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## »» DATA SHEET

(DOC No. HX8353-E-DS )

### »» HX8353-E

132RGB x 162 dots, 262K color,  
with Internal GRAM,  
TFT Mobile Single Chip Driver  
*Version 0.1 April, 2012*

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## 1. General Description

This manual is describes the Himax's HX8353-E 132RGB\*162 dots resolution driving controller. The HX8353-E is designed to provide a single-chip solution that combined a gate driver, a source driver, power supply circuit, and internal graphics RAM for 262,144 colors to drive a TFT panel with 132RGB\*162 dots at maximum.

The HX8353-E can be operated in low-voltage condition to the interface and integrated internal boosters that produce the liquid crystal voltage, breeder resistance and the voltage follower circuit for liquid crystal driver. In addition, The HX8353-E also supports various functions to reduce the power consumption of a LCD system via software control.

The HX8353-E is suitable for any small portable battery-driven product and requiring long-term driving capabilities, such as small PDAs, digital cellular phones and bi-directional pagers.

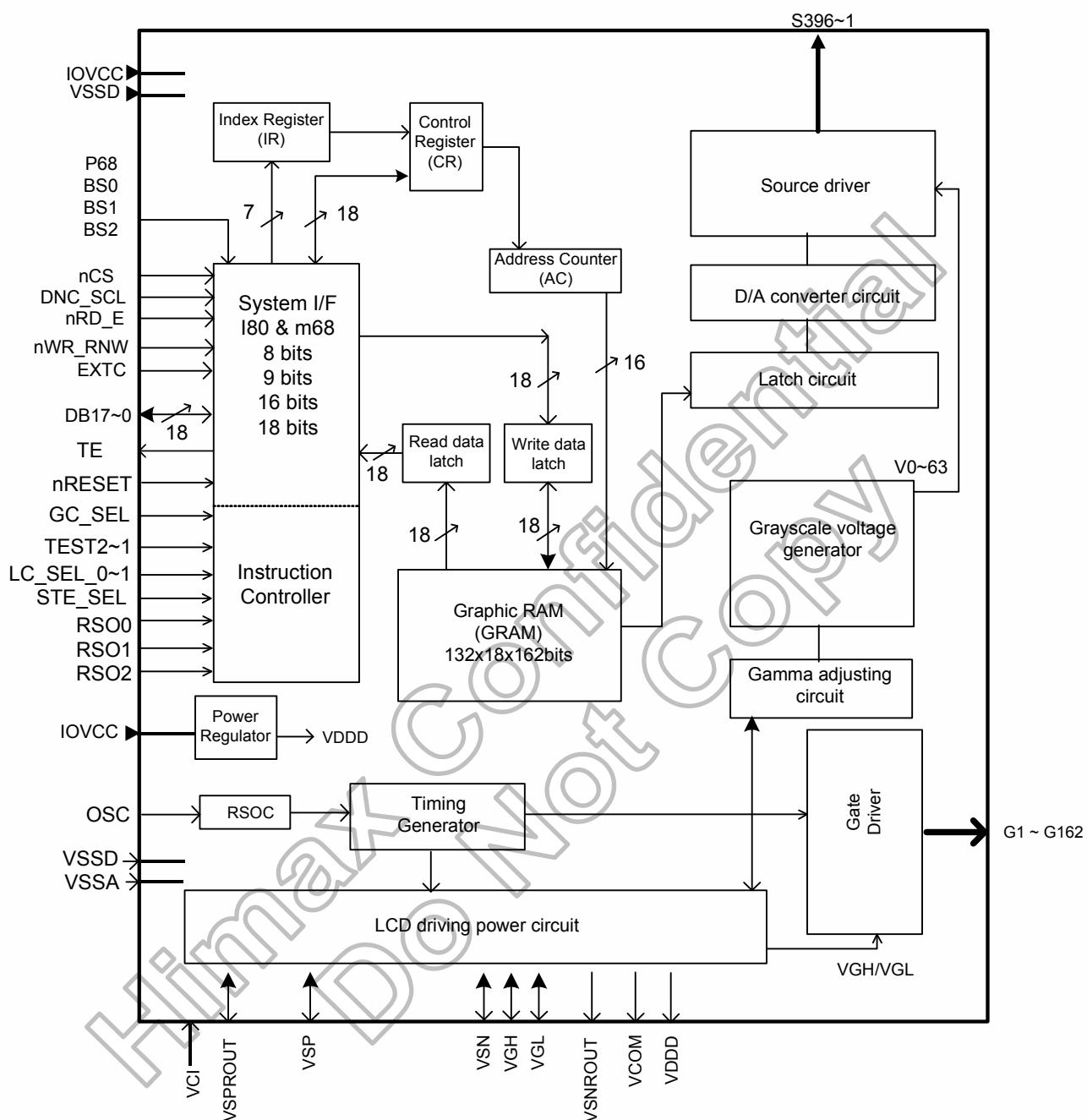
## 2. Features

- Single chip solution to drive a TFT panel
- 132RGB x 162-dot graphics display LCD controller/driver and 262,144 TFT colors
- Support resolution:
  - 132RGB x 162-dot: Display with 132 x 18-bits x 162 display RAM
  - 128RGB x 160-dot
    - Type 1: Display with 128 x 18-bits x 160 display RAM
    - Type 2: Display with 132 x 18-bits x 162 display RAM
  - 128RGB x 128-dot
  - 120RGB x 160-dot
  - 96RGB x 68-dot: Display with 96 x 18-bits x 68 display RAM
  - 96RGB x 64-dot
- Internal operation circuit of liquid crystal display:
  - Source channel: 396ch (132RGB)
  - Gate line: 162 Gate output
- Display mode (Color modes):
  - Full colors
    - 262k colors (18bit 6(R):6(G):6(B))
  - Reduce color mode:
    - 65k colors (16bit 5(R):6(G):5(B))
    - 4k colors (12bit 4(R):4(G):4(B))
    - 8 colors (Idle mode on): 8 colors (3 bit binary mode)
- Internal graphics RAM capacity: 132 x 162 x 18-bit = 0.38M bit:
- Support interface mode:
  - I80 System interface: 8-/9-/16-/18-bits bus
  - M68 System interface: 8-/9-/16- /18-bits bus
  - 3-/4- Wires Serial Data Transfer Interface
- Display features
  - Area scrolling
  - Partial display mode
  - Software programmable color depth mode
- On chip features:
  - DC/DC converter
  - OTP to store initialization register setting and MTP (Multi-time-programming)

non-volatile memory to store for VCOM setting

- Oscillator for display clock generation
- 1-dot/2-dot/4-dot inversion, column inversion
- Support default value for factory use
- Low-power consumption architecture supports:
  - Logic supply voltage range for IOVCC to VSSD: 1.65 to 3.3V
  - Analog supply voltage range for VCI to VSSA: 2.5 to 3.3V
- Output voltage range:
  - VSP = 5.0V (VCI=2.8V) for dual pump (Power supply for driver circuit range)
  - VSN = -5.0 V for dual pump (Power supply for driver circuit range)
  - VSPROUT =3.3V to 4.6V (Positive Source output voltage range)
  - VSNROUT = -3.3V to -4.6V (Negative Source output voltage range)
  - VGH = +9.0 to +15V (Positive Gate output voltage range)
  - VGL = -6.0 to -12.5V (Negative Gate output voltage range)
  - VCOM=-2.5V to 0V
- Low power consumption, suitable for battery operated systems
- Suitable for all brand LCM module
- Command set:
  - 128RGB x 160-dot
  - 132RGB x 162-dot
  - 120RGB x 160-dot
  - 96RGB x 68-dot
  - 96RGB x 64-dot
- Himax defined command set
- CMOS compatible inputs
- Optimized layout for COG assembly
- Temperature range: -30°C ~ 80°C

### 3. Block Diagram



## 4. Pin Description

### 4.1 Pin description

| Input Part                          |     |            |                |   |                                   |                                   |     |                                    |  |
|-------------------------------------|-----|------------|----------------|---|-----------------------------------|-----------------------------------|-----|------------------------------------|--|
| Signals                             | I/O | Pin Number | Connected with | Description   |                                   |                                   |     |                                    |  |
| P68, BS2,BS1,BS0                    | I   | 4          | VSSD/<br>IOVCC | Select the MPU interface mode as listed below   |                                   |                                   |     |                                    |  |
|                                     |     |            |                | P68   | BS2                               | BS1                               | BS0 | Interface mode                     | DB pins                                      |
|                                     |     |            |                | 0   | 1                                 | 0                                 | 0   | 8-bit bus interface,<br>80-system  | DB17-DB8:Unused<br>DB7-DB0: Data             |
|                                     |     |            |                | 0   | 1                                 | 0                                 | 1   | 16-bit bus interface,<br>80-system | DB17-DB16:Unused<br>DB15-DB0: Data           |
|                                     |     |            |                | 0   | 1                                 | 1                                 | 0   | 9-bit bus interface,<br>80-system  | DB17-DB9:Unused<br>DB8-DB0: Data             |
|                                     |     |            |                | 0   | 1                                 | 1                                 | 1   | 18-bit bus interface,<br>80-system | DB17-DB0: Data                               |
|                                     |     |            |                | 1   | 1                                 | 0                                 | 0   | 8-bit bus interface,<br>68-system  | DB17-DB8:Unused<br>DB7-DB0: Data             |
|                                     |     |            |                | 1   | 1                                 | 0                                 | 1   | 16-bit bus interface,<br>68-system | DB17-DB16:Unused<br>DB15-DB0: Data           |
|                                     |     |            |                | 1   | 1                                 | 1                                 | 0   | 9-bit bus interface,<br>68-system  | DB17-DB9:Unused<br>DB8-DB0: Data             |
|                                     |     |            |                | 1   | 1                                 | 1                                 | 1   | 18-bit bus interface,<br>68-system | DB17-DB0: Data                               |
|                                     |     |            |                | X   | 0                                 | X                                 | X   | 3-/4-wire serial<br>interface      | DB17-DB0:Unused<br>SDA: Data<br>input/output |
| Must be connected to VSSD or IOVCC. |     |            |                |   |                                   |                                   |     |                                    |  |
| SPI_SEL                             | I   | 1          | VSSD/<br>IOVCC | Interface format select pin   |                                   |                                   |     |                                    |  |
|                                     |     |            |                | SPI_SEL   |                                   | Serial Interface Format Selection |     |                                    |  |
|                                     |     |            |                | 0   | 3-wire serial interface (default) |                                   |     |                                    |  |
|                                     |     |            |                | 1   | 4-wire serial interface           |                                   |     |                                    |  |
| If not used, connect it to VSSD.    |     |            |                |   |                                   |                                   |     |                                    |  |
| NCS                                 | I   | 1          | MPU            | Chip select signal.<br>Low: chip can be accessed;<br>High: chip cannot be accessed.   |                                   |                                   |     |                                    |  |
| DNC_SCL                             | I   | 1          | MPU            | The signal for command or parameter select under parallel mode(i.e.<br>Not serial interface):<br>Low: command. High: parameter.<br>When under serial interface, it servers as SCL.  |                                   |                                   |     |                                    |  |
| NRD_E                               | I   | 1          | MPU            | I80 system: Serves as a read signal and read data at the low level.<br>M68 system: 0: Read/Write disable, 1: Read/Write enable.<br>If not used, connected to IOVCC.   |                                   |                                   |     |                                    |  |
| NWR_RNW                             | I   | 1          | MPU            | I80 system: Serves as a write signal and writes data at the rising<br>edge.<br>M68 system: 0: Write, 1: Read.<br>4-wire SPI interface: 0: Command, 1: Data.<br>If not used, connected to IOVCC.                           |                                   |                                   |     |                                    |  |
| EXTC                                | I   | 1          | VSSD/<br>IOVCC | Extended command set enable.<br>Low (VSSD): extended command set is discarded<br>High (IOVCC): extended command set is accepted<br>If not used, let it open or connected to VSSD.(weak pull low)                          |                                   |                                   |     |                                    |  |
| STE_SEL                             | I   | 1          | VSSD/<br>IOVCC | This Pin is only valid for RSO[2:0]=3'b000.<br>Low (VSSD): Scrolling function enable and TE lines (162 lines)<br>High (IOVCC): Scrolling function disable and TE lines (160 lines)<br>Must be connected to VSSD or IOVCC. |                                   |                                   |     |                                    |  |
| GC_SEL                              | I   | 1          | VSSD/<br>IOVCC | This signal is used to select gamma curve order.<br>Low (VSSD): GC0(1.0), GC1(2.5), GC2(2.2), GC3(1.8)<br>High (IOVCC): GC0(2.2), GC1(1.8), GC2(2.5), GC3(1.0)<br>Must be connected to VSSD or IOVCC.                     |                                   |                                   |     |                                    |  |

| Input Part  |     |            |                      |   |  |   |  |  |  |
|---|-----|------------|----------------------|---|--|---|--|--|--|
| Signals   | I/O | Pin Number | Connected with       | Description   |  |   |  |  |  |
| RSO0~2  | I   | 3          | VSSD/<br>IOVCC       | Resolution selection pins. RSO[2:0] is used for selecting resolution. Must be connected to VSSD or IOVCC. |  |   |  |  |  |
|   |     |            |                      | RSO2  | RSO1   | RSO0  |  |  |  |
|   |     |            |                      | 0   | 0  | 0   |  |  |  |
|   |     |            |                      | 0   | 0  | 1   |  |  |  |
|   |     |            |                      | 0   | 1  | 0   |  |  |  |
|   |     |            |                      | 0   | 1  | 1   |  |  |  |
|   |     |            |                      | 1   | 0  | 0   |  |  |  |
|   |     |            |                      | 1   | 0  | 1   |  |  |  |
|   |     |            |                      | 1   | 1  | 0   |  |  |  |
|   |     |            |                      | 1   | 1  | 1   |  |  |  |
| GRAM resolution (Size): 132RGBX162<br>Display resolution:<br>Type1 :132RGBx162 (S1~S396 and G1~G162)<br>Type2 :128RGBx160 (S7~S390 and G2~G161) |     |            |                      |   |  |   |  |  |  |
| GRAM resolution (Size): 128RGBX128<br>Display resolution:<br>128RGBx128 (S7~S390 and G2~G129)   |     |            |                      |   |  |   |  |  |  |
| GRAM resolution (Size): 120RGBX160<br>Display resolution:<br>120RGBx160 (S7~S366, G2~G161)  |     |            |                      |   |  |   |  |  |  |
| GRAM resolution (Size): 128RGBX160<br>Display resolution:<br>128RGBx160 (S7~S390 and G2~G161)   |     |            |                      |   |  |   |  |  |  |
| GRAM resolution: 96RGBx68<br>Display resolution:<br>96RGBx68 (S55~S342, G1~G68)   |     |            |                      |   |  |   |  |  |  |
| GRAM resolution: 96RGBx64<br>Display resolution:<br>96RGBx64 (S55~S342, G1~G64)   |     |            |                      |   |  |   |  |  |  |
| Setting disable   |     |            |                      |   |  |   |  |  |  |
| Setting disable   |     |            |                      |   |  |   |  |  |  |
| NRESET  | I   | 1          | MPU or reset circuit | Reset pin. Setting this pin low initializes the LSI. Must be reset after power is supplied.               |  |   |  |  |  |
| SS_PANEL  | I   | 1          | VSSD/<br>IOVCC       | Input pin to select the source driver scan direction on panel module. Must be connected to VSSD or IOVCC. |  |   |  |  |  |
|   |     |            |                      | SS_PANEL  | Module source output direction                       |   |  |  |  |
|   |     |            |                      | RSO[2:0]<br>=3'b100,<br>3'b101  | RSO[2:0]<br>=3'b010                                  | RSO[2:0]<br>=3'b000<br>(type2),<br>3'b001, 3'b011 |  |  |  |
|   |     |            |                      | 0   | S55 -> S342  | S7 -> S366  |  |  |  |
|   |     |            |                      | 1   | S342 -> S55  | S366 -> S7  |  |  |  |
|   |     |            |                      |   | S390 -> S7   | S396 -> S1  |  |  |  |
| Input pin to select the Gate driver scan direction on panel module. Must be connected to VSSD or IOVCC.   |     |            |                      |   |  |   |  |  |  |
| GS_PANEL  | I   | 1          | VSSD/<br>IOVCC       | Module Gate output direction  |  |   |  |  |  |
|   |     |            |                      | GS_PA<br>NEL  | RSO[2:0]<br>=3'b101                                  | RSO[2:0]<br>=3'b100                               |  |  |  |
|   |     |            |                      |   | RSO[2:0]<br>=3'b000<br>(type2),<br>3'b010,<br>3'b011 | RSO[2:0]<br>=3'b001                               |  |  |  |
|   |     |            |                      | 0   | G1 -> G64  | G1 -> G68   |  |  |  |
|   |     |            |                      | 1   | G64 -> G1  | G68 -> G1   |  |  |  |
|   |     |            |                      |   | G161 -> G2   | G129 -> G2  |  |  |  |
|   |     |            |                      |   |  | G162 -> G1  |  |  |  |
| Input pin to select the display reversion. Must be connected to VSSD or IOVCC.  |     |            |                      |   |  |   |  |  |  |
| REV_PANEL   | I   | 1          | VSSD/<br>IOVCC       | REV_PANEL   |  | Mapping data                                      |  |  |  |
|   |     |            |                      | 0   | "0" to maximum pixel voltage for normal white panel  |   |  |  |  |
|   |     |            |                      | 1   | "0" to minimum pixel voltage for normal black panel  |   |  |  |  |

| Input Part |     |            |                         |   |
|------------|-----|------------|-------------------------|---|
| Signals    | I/O | Pin Number | Connected with          | Description   |
| BGR_PANEL  | I   | 1          | VSSD/<br>IOVCC          | Input pin to select the color mapping. Must be connected to VSSD or IOVCC.                  |
|            |     |            |                         | <b>BGR_PANEL</b>  |
|            |     |            |                         | Color mapping<br>0 S1、S2、S3 filter order = R → G → B<br>1 S1、S2、S3 filter order = B → G → R |
| TEST2~1    | I   | 2          | VSSD                    | Test pins. Let it open or connected to VSSD. (Internal pull low)                            |
| OSC        | I   | 1          | Open or Connect to VSSD | Oscillator input for test purpose.<br>If not used, please let it open.                      |

| Output Part |     |            |                       |  |
|-------------|-----|------------|-----------------------|--|
| Signals     | I/O | Pin Number | Connected with        | Description  |
| S1~396      | O   | 396        | LCD                   | Output voltages applied to the liquid crystal.<br>SS=0, ram address "0000" is output from S1.<br>SS=1, ram address "0000" is output from S396.<br>S1,S2,S3 ='R','G','B' (SS=0, BGR=0). |
| G1~162      | O   | 162        | LCD                   | Output signals from gate lines.<br>VGH: the level to select the gate lines<br>VGL: the level not to select the gate lines  |
| VCOM        | O   | 3          | TFT common electrode  | The power supply of common voltage in TFT driving. Connect this pin to the common electrode in TFT panel.  |
| VSPROUT     | O   | 3          | Open                  | Positive gamma reference voltage.  |
| VSNROUT     | O   | 3          | Open                  | Negative gamma reference voltage.  |
| VSP         | O   | 5          | Stabilizing capacitor | An output from the step-up circuit1.<br>Connect to a stabilizing capacitor between VSSA and VSP.   |
| VSN         | O   | 3          | Stabilizing capacitor | An output from the step-up circuit3.<br>Connect to a stabilizing capacitor between VSSA and VSN.   |
| VGH         | O   | 3          | Open                  | A positive power output from the step-up circuit 2 for the gate line drive circuit.  |
| VGL         | O   | 3          | Open                  | A positive power output from the step-up circuit 2 for the gate line drive circuit.  |
| TE          | O   | 1          | MPU or open           | A frame start pulse output (amplitude: IOVCC-VSSD). Use when writing data to RAM in synchronization with FLM. When FLM is not used, disconnect it                                      |
| VTESTOUT    | O   | 2          | Open                  | A test pin. Disconnect it.   |
| VDDD        | O   | 3          | Open                  | Output for internal logic voltage. Let it open.  |
| VBGP        | O   | 3          | Open                  | Reference voltage for power circuit. Let it open.  |
| TS7~0       | O   | 8          | Open                  | Test pins. Let these pins open.  |

**Input/Output Part**

| <b>Signals</b>       | <b>I/O</b> | <b>Pin Number</b> | <b>Connected with</b> | <b>Description</b>  |
|----------------------|------------|-------------------|-----------------------|---|
| DB0_SDA<br>DB1~17    | I/O        | 18                | MPU                   | <p>When Operates in system interface mode, it is used like an 18-bit bi-directional data bus.<br/>           8-bit bus: use DB7-DB0<br/>           9-bit bus: use DB8-DB0<br/>           16-bit bus: use DB15-DB0<br/>           18-bit bus: use DB17-DB0</p> <p>For serial interface, this pin (SDA) is for serial data pin when operate on serial data transfer interface mode of Command-parameter Interface mode. Data would be latched on the rising edge of the SCL signal.</p> <p>Let unused data pins open or pulled Gnd or pulled IOVCC.</p> |
| DUMMY_C1<br>DUMMY_C2 | I/O        | 8,18              | Open                  | Dummy pads. Disconnect them.  |
| DUMMY1 ~ 25          | -          | 25                | Open                  | Dummy pads. Disconnect them.  |
| DUMMYR1~R2           | -          | 2                 | -                     | Dummy pads. Available for measuring the COG contact resistance. DUMMYR1 and DUMMYR2 are short-circuited within the chip.  |
| LC_SEL1~0            | -          | 2                 | -                     | Dummy pin, let it open or pull up/down.   |

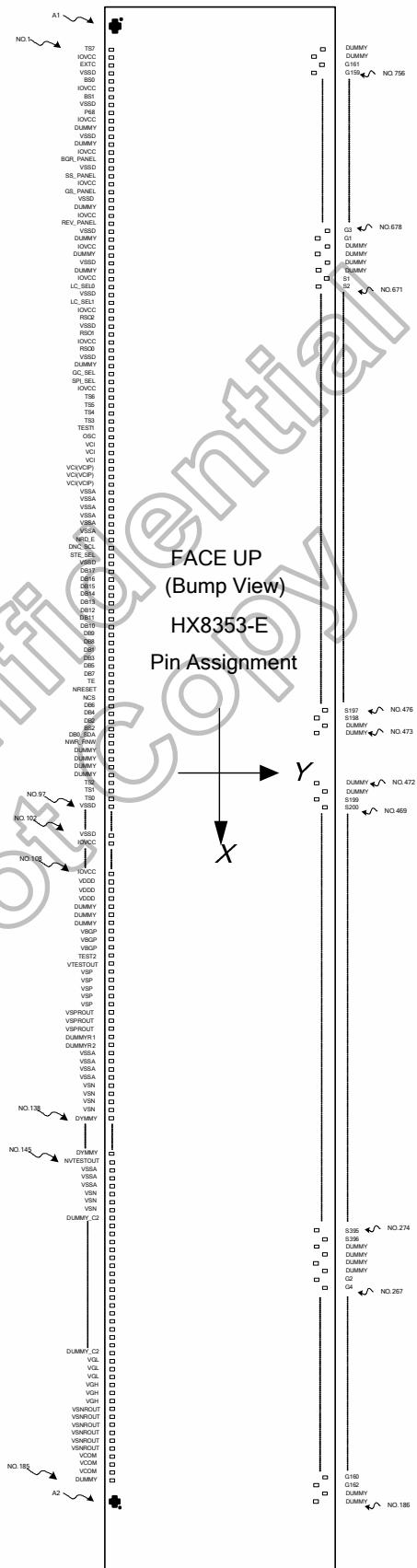
**Power Part**

| <b>Signals</b> | <b>I/O</b> | <b>Pin Number</b> | <b>Connected with</b> | <b>Description</b>  |
|----------------|------------|-------------------|-----------------------|---|
| IOVCC          | P          | 17                | Power supply          | Power supply for interface pin. IOVCC = 1.65 ~3.3 V.  |
| VSSD           | P          | 17                | Power supply          | Ground for the logic side. VSSD = 0V  |
| VSSA           | P          | 9                 | Power supply          | Analog ground. VSSA = 0V. When using the COG method, connect to VSSD on the FPC to prevent noise. |
| VCI            | P          | 6                 | Power supply          | A power supply for the analog circuit. VCI = 2.5 ~ 3.3V   |

## 4.2 Pin assignment

Chip size : 10100um x 655um  
(Include Seal-ring and Scribe line)  
Chip thickness : 250um(typ.)/350um  
Pad coordinate : PAD center  
Coordinate Origin : Chip Center  
Au Bump Size  
Bump height tolerance +/- 3um  
Bump size tolerance :  
Output bump width : 16 +/- 2um  
Output bump length : 98 +/- 3um  
Input bump width : 35/40 +/- 3um  
Input bump length : 90 +/- 3um

Numbers in the figure corresponds to  
pad coordinate numbers  
Alignment Mark  
Arrangement : Two places  
A1 : Coordinate(X,Y)=(-4841,-220)  
A2 : Coordinate(X,Y)=(4841,-220)



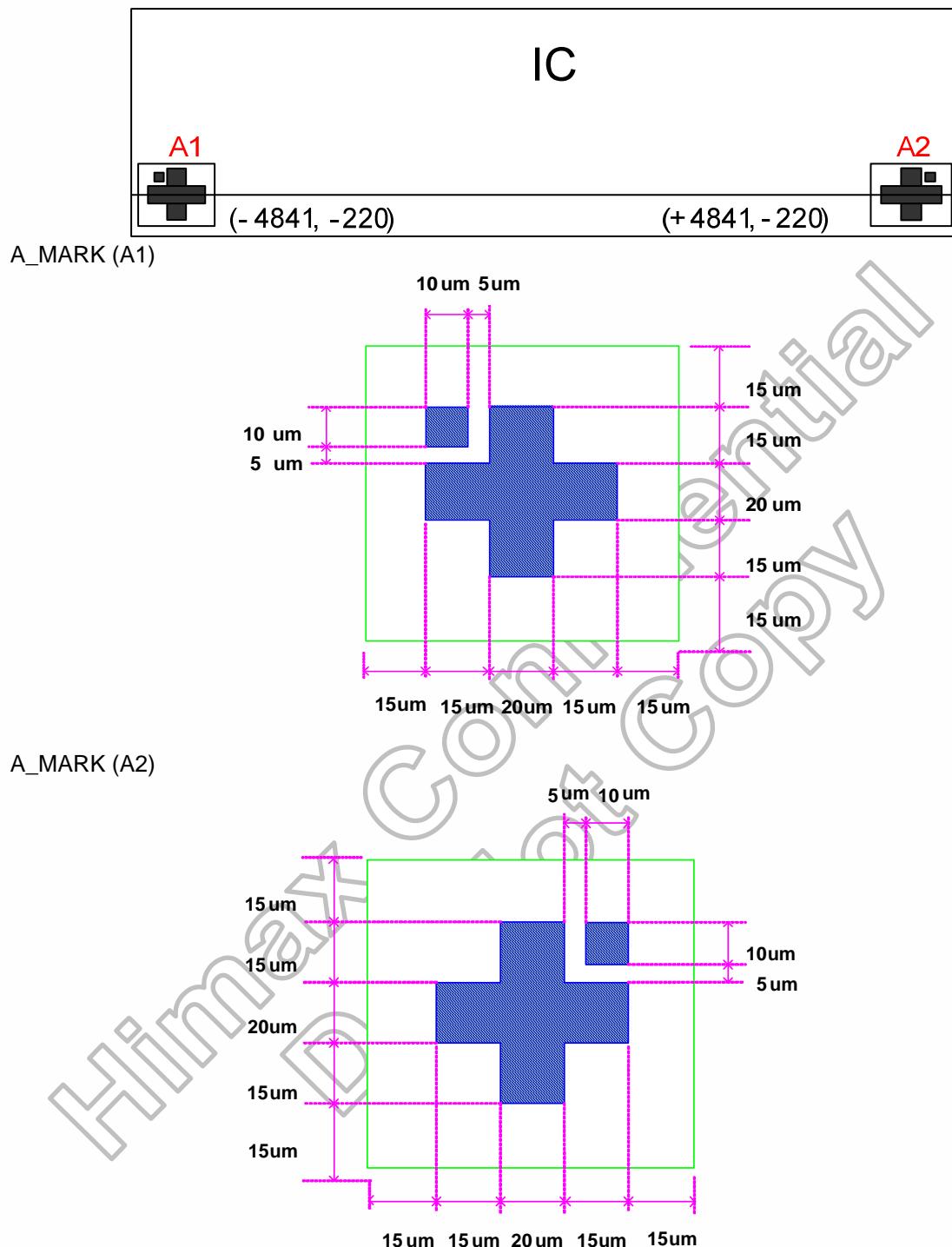
### 4.3 PAD coordinates

| No. | Name      | X     | Y    | No. | Name     | X     | Y    | No. | Name      | X    | Y    | No. | Name  | X    | Y   |
|-----|-----------|-------|------|-----|----------|-------|------|-----|-----------|------|------|-----|-------|------|-----|
| 1   | TS7       | -4750 | -231 | 71  | DB13     | -1150 | -231 | 141 | DUMMY     | 2550 | -231 | 211 | G116  | 4372 | 227 |
| 2   | IOVCC     | -4700 | -231 | 72  | DB12     | -1090 | -231 | 142 | DUMMY     | 2600 | -231 | 212 | G114  | 4356 | 110 |
| 3   | EXTC      | -4650 | -231 | 73  | DB11     | -1030 | -231 | 143 | DUMMY     | 2650 | -231 | 213 | G112  | 4340 | 227 |
| 4   | VSSD      | -4600 | -231 | 74  | DB10     | -970  | -231 | 144 | DUMMY     | 2700 | -231 | 214 | G110  | 4324 | 110 |
| 5   | BS0       | -4550 | -231 | 75  | DB9      | -910  | -231 | 145 | NVTESTOUT | 2750 | -231 | 215 | G108  | 4308 | 227 |
| 6   | IOVCC     | -4500 | -231 | 76  | DB8      | -850  | -231 | 146 | VSSA      | 2800 | -231 | 216 | G106  | 4292 | 110 |
| 7   | BS1       | -4450 | -231 | 77  | DB1      | -790  | -231 | 147 | VSSA      | 2850 | -231 | 217 | G104  | 4276 | 227 |
| 8   | VSSD      | -4400 | -231 | 78  | DB3      | -730  | -231 | 148 | VSSA      | 2900 | -231 | 218 | G102  | 4260 | 110 |
| 9   | P68       | -4350 | -231 | 79  | DB5      | -670  | -231 | 149 | VSN       | 2950 | -231 | 219 | G100  | 4244 | 227 |
| 10  | IOVCC     | -4300 | -231 | 80  | DB7      | -610  | -231 | 150 | VSN       | 3000 | -231 | 220 | G98   | 4228 | 110 |
| 11  | DUMMY     | -4250 | -231 | 81  | TE       | -550  | -231 | 151 | VSN       | 3050 | -231 | 221 | G96   | 4212 | 227 |
| 12  | VSSD      | -4200 | -231 | 82  | NRESET   | -490  | -231 | 152 | DUMMY_C2  | 3100 | -231 | 222 | G94   | 4196 | 110 |
| 13  | DUMMY     | -4150 | -231 | 83  | NCS      | -430  | -231 | 153 | DUMMY_C2  | 3150 | -231 | 223 | G92   | 4180 | 227 |
| 14  | IOVCC     | -4100 | -231 | 84  | DB6      | -370  | -231 | 154 | DUMMY_C2  | 3200 | -231 | 224 | G90   | 4164 | 110 |
| 15  | BGR_PANEL | -4050 | -231 | 85  | DB4      | -310  | -231 | 155 | DUMMY_C2  | 3250 | -231 | 225 | G88   | 4148 | 227 |
| 16  | VSSD      | -4000 | -231 | 86  | DB2      | -250  | -231 | 156 | DUMMY_C2  | 3300 | -231 | 226 | G86   | 4132 | 110 |
| 17  | SS_PANEL  | -3950 | -231 | 87  | BS2      | -190  | -231 | 157 | DUMMY_C2  | 3350 | -231 | 227 | G84   | 4116 | 227 |
| 18  | IOVCC     | -3900 | -231 | 88  | DB0_SDA  | -130  | -231 | 158 | DUMMY_C2  | 3400 | -231 | 228 | G82   | 4100 | 110 |
| 19  | GS_PANEL  | -3850 | -231 | 89  | NWR_RNW  | -70   | -231 | 159 | DUMMY_C2  | 3450 | -231 | 229 | G80   | 4084 | 227 |
| 20  | VSSD      | -3800 | -231 | 90  | DUMMY    | 0     | -231 | 160 | DUMMY_C2  | 3500 | -231 | 230 | G78   | 4068 | 110 |
| 21  | DUMMY     | -3750 | -231 | 91  | DUMMY    | 50    | -231 | 161 | DUMMY_C2  | 3550 | -231 | 231 | G76   | 4052 | 227 |
| 22  | IOVCC     | -3700 | -231 | 92  | DUMMY    | 100   | -231 | 162 | DUMMY_C2  | 3600 | -231 | 232 | G74   | 4036 | 110 |
| 23  | REV_PANEL | -3650 | -231 | 93  | DUMMY    | 150   | -231 | 163 | DUMMY_C2  | 3650 | -231 | 233 | G72   | 4020 | 227 |
| 24  | VSSD      | -3600 | -231 | 94  | TS2      | 200   | -231 | 164 | DUMMY_C2  | 3700 | -231 | 234 | G70   | 4004 | 110 |
| 25  | DUMMY     | -3550 | -231 | 95  | TS1      | 250   | -231 | 165 | DUMMY_C2  | 3750 | -231 | 235 | G68   | 3988 | 227 |
| 26  | IOVCC     | -3500 | -231 | 96  | TS0      | 300   | -231 | 166 | DUMMY_C2  | 3800 | -231 | 236 | G66   | 3972 | 110 |
| 27  | DUMMY     | -3450 | -231 | 97  | VSSD     | 350   | -231 | 167 | DUMMY_C2  | 3850 | -231 | 237 | G64   | 3956 | 227 |
| 28  | VSSD      | -3400 | -231 | 98  | VSSD     | 400   | -231 | 168 | DUMMY_C2  | 3900 | -231 | 238 | G62   | 3940 | 110 |
| 29  | DUMMY     | -3350 | -231 | 99  | VSSD     | 450   | -231 | 169 | DUMMY_C2  | 3950 | -231 | 239 | G60   | 3924 | 227 |
| 30  | IOVCC     | -3300 | -231 | 100 | VSSD     | 500   | -231 | 170 | VGL       | 4000 | -231 | 240 | G58   | 3908 | 110 |
| 31  | LC_SEL0   | -3250 | -231 | 101 | VSSD     | 550   | -231 | 171 | VGL       | 4050 | -231 | 241 | G56   | 3892 | 227 |
| 32  | VSSD      | -3200 | -231 | 102 | VSSD     | 600   | -231 | 172 | VGL       | 4100 | -231 | 242 | G54   | 3876 | 110 |
| 33  | LC_SEL1   | -3150 | -231 | 103 | IOVCC    | 650   | -231 | 173 | VGH       | 4150 | -231 | 243 | G52   | 3860 | 227 |
| 34  | IOVCC     | -3100 | -231 | 104 | IOVCC    | 700   | -231 | 174 | VGH       | 4200 | -231 | 244 | G50   | 3844 | 110 |
| 35  | RS02      | -3050 | -231 | 105 | IOVCC    | 750   | -231 | 175 | VGH       | 4250 | -231 | 245 | G48   | 3828 | 227 |
| 36  | VSSD      | -3000 | -231 | 106 | IOVCC    | 800   | -231 | 176 | VSNROUT   | 4300 | -231 | 246 | G46   | 3812 | 110 |
| 37  | RS01      | -2950 | -231 | 107 | IOVCC    | 850   | -231 | 177 | VSNROUT   | 4350 | -231 | 247 | G44   | 3796 | 227 |
| 38  | IOVCC     | -2900 | -231 | 108 | IOVCC    | 900   | -231 | 178 | VSNROUT   | 4400 | -231 | 248 | G42   | 3780 | 110 |
| 39  | RS00      | -2850 | -231 | 109 | VDDD     | 950   | -231 | 179 | VSNROUT   | 4450 | -231 | 249 | G40   | 3764 | 227 |
| 40  | VSSD      | -2800 | -231 | 110 | VDDD     | 1000  | -231 | 180 | VSNROUT   | 4500 | -231 | 250 | G38   | 3748 | 110 |
| 41  | DUMMY     | -2750 | -231 | 111 | VDDD     | 1050  | -231 | 181 | VSNROUT   | 4550 | -231 | 251 | G36   | 3732 | 227 |
| 42  | GC_SEL    | -2700 | -231 | 112 | DUMMY    | 1100  | -231 | 182 | VCOM      | 4600 | -231 | 252 | G34   | 3716 | 110 |
| 43  | SPI_SEL   | -2650 | -231 | 113 | DUMMY    | 1150  | -231 | 183 | VCOM      | 4650 | -231 | 253 | G32   | 3700 | 227 |
| 44  | IOVCC     | -2600 | -231 | 114 | DUMMY    | 1200  | -231 | 184 | VCOM      | 4700 | -231 | 254 | G30   | 3684 | 110 |
| 45  | TS6       | -2550 | -231 | 115 | VBGP     | 1250  | -231 | 185 | DUMMY     | 4750 | -231 | 255 | G28   | 3668 | 227 |
| 46  | TS5       | -2500 | -231 | 116 | VBGP     | 1300  | -231 | 186 | DUMMY     | 4772 | 110  | 256 | G26   | 3652 | 110 |
| 47  | TS4       | -2450 | -231 | 117 | VBGP     | 1350  | -231 | 187 | DUMMY     | 4756 | 227  | 257 | G24   | 3636 | 227 |
| 48  | TS3       | -2400 | -231 | 118 | TEST2    | 1400  | -231 | 188 | G162      | 4740 | 110  | 258 | G22   | 3620 | 110 |
| 49  | TEST1     | -2350 | -231 | 119 | VTESTOUT | 1450  | -231 | 189 | G160      | 4724 | 227  | 259 | G20   | 3604 | 227 |
| 50  | OSC       | -2300 | -231 | 120 | VSP      | 1500  | -231 | 190 | G158      | 4708 | 110  | 260 | G18   | 3588 | 110 |
| 51  | VCI       | -2250 | -231 | 121 | VSP      | 1550  | -231 | 191 | G156      | 4692 | 227  | 261 | G16   | 3572 | 227 |
| 52  | VCI       | -2200 | -231 | 122 | VSP      | 1600  | -231 | 192 | G154      | 4676 | 110  | 262 | G14   | 3556 | 110 |
| 53  | VCI       | -2150 | -231 | 123 | VSP      | 1650  | -231 | 193 | G152      | 4660 | 227  | 263 | G12   | 3540 | 227 |
| 54  | VCI       | -2100 | -231 | 124 | VSP      | 1700  | -231 | 194 | G150      | 4644 | 110  | 264 | G10   | 3524 | 110 |
| 55  | VCI       | -2050 | -231 | 125 | VSPROUT  | 1750  | -231 | 195 | G148      | 4628 | 227  | 265 | G8    | 3508 | 227 |
| 56  | VCI       | -2000 | -231 | 126 | VSPROUT  | 1800  | -231 | 196 | G146      | 4612 | 110  | 266 | G6    | 3492 | 110 |
| 57  | VSSA      | -1950 | -231 | 127 | VSPROUT  | 1850  | -231 | 197 | G144      | 4596 | 227  | 267 | G4    | 3476 | 227 |
| 58  | VSSA      | -1900 | -231 | 128 | DUMMYR1  | 1900  | -231 | 198 | G142      | 4580 | 110  | 268 | G2    | 3460 | 110 |
| 59  | VSSA      | -1850 | -231 | 129 | DUMMYR2  | 1950  | -231 | 199 | G140      | 4564 | 227  | 269 | DUMMY | 3444 | 227 |
| 60  | VSSA      | -1800 | -231 | 130 | VSSA     | 2000  | -231 | 200 | G138      | 4548 | 110  | 270 | DUMMY | 3428 | 110 |
| 61  | VSSA      | -1750 | -231 | 131 | VSSA     | 2050  | -231 | 201 | G136      | 4532 | 227  | 271 | DUMMY | 3412 | 227 |
| 62  | VSSA      | -1700 | -231 | 132 | VSSA     | 2100  | -231 | 202 | G134      | 4516 | 110  | 272 | DUMMY | 3396 | 110 |
| 63  | NRD_E     | -1630 | -231 | 133 | VSSA     | 2150  | -231 | 203 | G132      | 4500 | 227  | 273 | S396  | 3380 | 227 |
| 64  | DNC_SCL   | -1570 | -231 | 134 | VSN      | 2200  | -231 | 204 | G130      | 4484 | 110  | 274 | S395  | 3364 | 110 |
| 65  | STE_SEL   | -1510 | -231 | 135 | VSN      | 2250  | -231 | 205 | G128      | 4468 | 227  | 275 | S394  | 3348 | 227 |
| 66  | VSSD      | -1450 | -231 | 136 | VSN      | 2300  | -231 | 206 | G126      | 4452 | 110  | 276 | S393  | 3332 | 110 |
| 67  | DB17      | -1390 | -231 | 137 | VSN      | 2350  | -231 | 207 | G124      | 4436 | 227  | 277 | S392  | 3316 | 227 |
| 68  | DB16      | -1330 | -231 | 138 | DUMMY    | 2400  | -231 | 208 | G122      | 4420 | 110  | 278 | S391  | 3300 | 110 |
| 69  | DB15      | -1270 | -231 | 139 | DUMMY    | 2450  | -231 | 209 | G120      | 4404 | 227  | 279 | S390  | 3284 | 227 |
| 70  | DB14      | -1210 | -231 | 140 | DUMMY    | 2500  | -231 | 210 | G118      | 4388 | 110  | 280 | S389  | 3268 | 110 |

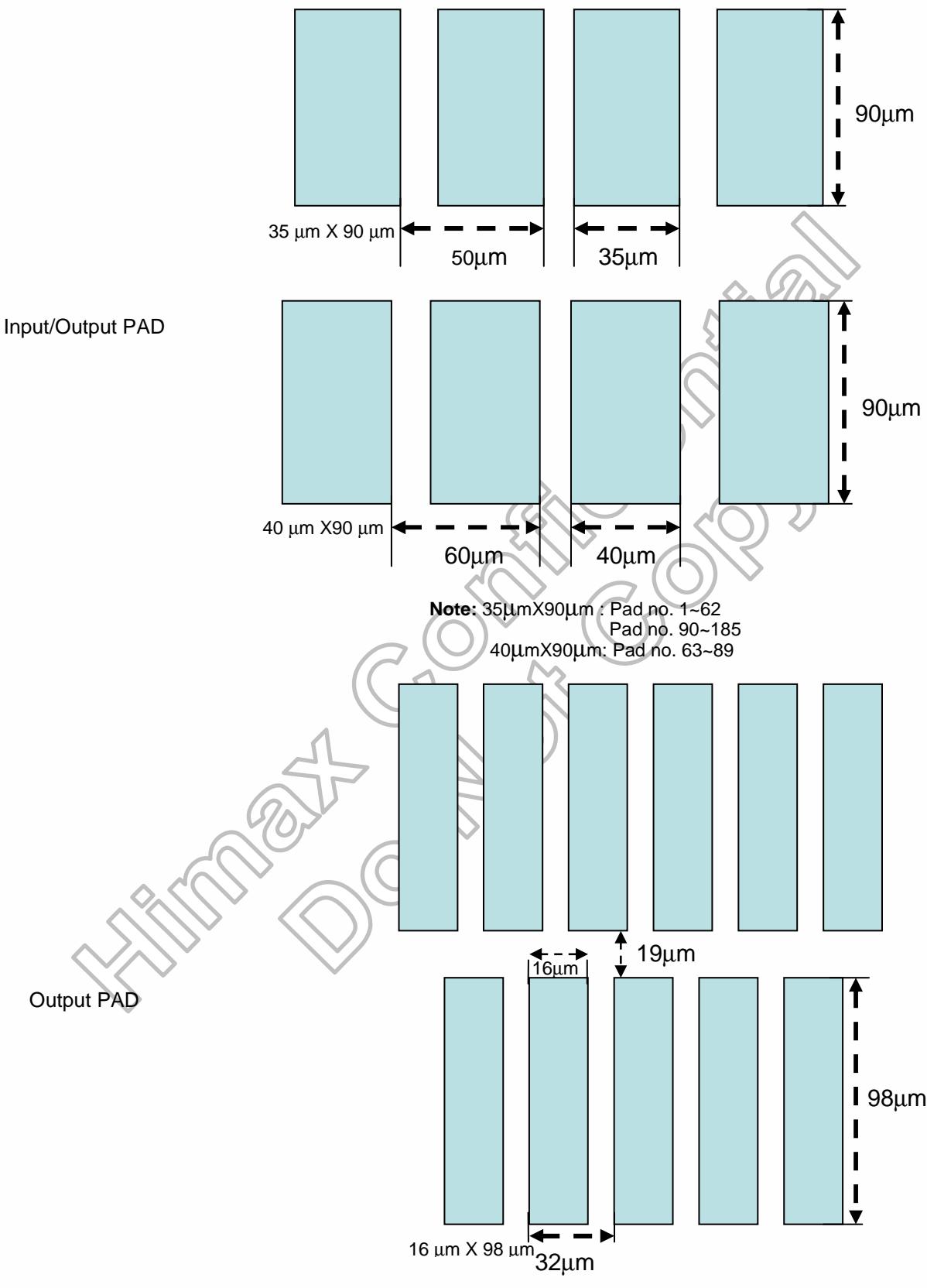
| No. | Name  | X    | Y   |
|-----|-------|------|-----|
| 281 | S388  | 3252 | 227 |
| 282 | S387  | 3236 | 110 |
| 283 | S386  | 3220 | 227 |
| 284 | S385  | 3204 | 110 |
| 285 | S384  | 3188 | 227 |
| 286 | S383  | 3172 | 110 |
| 287 | S382  | 3156 | 227 |
| 288 | S381  | 3140 | 110 |
| 289 | S380  | 3124 | 227 |
| 290 | S379  | 3108 | 110 |
| 291 | S378  | 3092 | 227 |
| 292 | S377  | 3076 | 110 |
| 293 | S376  | 3060 | 227 |
| 294 | S375  | 3044 | 110 |
| 295 | S374  | 3028 | 227 |
| 296 | S373  | 3012 | 110 |
| 297 | S372  | 2996 | 227 |
| 298 | S371  | 2980 | 110 |
| 299 | S370  | 2964 | 227 |
| 300 | S369  | 2948 | 110 |
| 301 | S368  | 2932 | 227 |
| 302 | S367  | 2916 | 110 |
| 303 | S366  | 2900 | 227 |
| 304 | S365  | 2884 | 110 |
| 305 | S364  | 2868 | 227 |
| 306 | S363  | 2852 | 110 |
| 307 | S362  | 2836 | 227 |
| 308 | S361  | 2820 | 110 |
| 309 | S360  | 2804 | 227 |
| 310 | S359  | 2788 | 110 |
| 311 | S358  | 2772 | 227 |
| 312 | S357  | 2756 | 110 |
| 313 | S356  | 2740 | 227 |
| 314 | S355  | 2724 | 110 |
| 315 | S354  | 2708 | 227 |
| 316 | S353  | 2692 | 110 |
| 317 | S352  | 2676 | 227 |
| 318 | S351  | 2660 | 110 |
| 319 | S350  | 2644 | 227 |
| 320 | S349  | 2628 | 110 |
| 321 | S348  | 2612 | 227 |
| 322 | S347  | 2596 | 110 |
| 323 | S346  | 2580 | 227 |
| 324 | S345  | 2564 | 110 |
| 325 | S344  | 2548 | 227 |
| 326 | S343  | 2532 | 110 |
| 327 | S342  | 2516 | 227 |
| 328 | S341  | 2500 | 110 |
| 329 | S340  | 2484 | 227 |
| 330 | S339  | 2468 | 110 |
| 331 | S338  | 2452 | 227 |
| 332 | S337  | 2436 | 110 |
| 333 | S336  | 2420 | 227 |
| 334 | S335  | 2404 | 110 |
| 335 | S334  | 2388 | 227 |
| 336 | S333  | 2372 | 110 |
| 337 | S332  | 2356 | 227 |
| 338 | S331  | 2340 | 110 |
| 339 | S330  | 2324 | 227 |
| 340 | S329  | 2308 | 110 |
| 341 | S328  | 2292 | 227 |
| 342 | S327  | 2276 | 110 |
| 343 | S326  | 2260 | 227 |
| 344 | S325  | 2244 | 110 |
| 345 | S324  | 2228 | 227 |
| 346 | S323  | 2212 | 110 |
| 347 | S322  | 2196 | 227 |
| 348 | S321  | 2180 | 110 |
| 349 | S320  | 2164 | 227 |
| 350 | S319  | 2148 | 110 |
| 351 | S318  | 2132 | 227 |
| 352 | S317  | 2116 | 110 |
| 353 | S316  | 2100 | 227 |
| 354 | S315  | 2084 | 110 |
| 355 | S314  | 2068 | 227 |
| 356 | S313  | 2052 | 110 |
| 357 | S312  | 2036 | 227 |
| 358 | S311  | 2020 | 110 |
| 359 | S310  | 2004 | 227 |
| 360 | S309  | 1988 | 110 |
| 361 | S308  | 1972 | 227 |
| 362 | S307  | 1956 | 110 |
| 363 | S306  | 1940 | 227 |
| 364 | S305  | 1924 | 110 |
| 365 | S304  | 1908 | 227 |
| 366 | S303  | 1892 | 110 |
| 367 | S302  | 1876 | 227 |
| 368 | S301  | 1860 | 110 |
| 369 | S300  | 1844 | 227 |
| 370 | S299  | 1828 | 110 |
| 371 | S298  | 1812 | 227 |
| 372 | S297  | 1796 | 110 |
| 373 | S296  | 1780 | 227 |
| 374 | S295  | 1764 | 110 |
| 375 | S294  | 1748 | 227 |
| 376 | S293  | 1732 | 110 |
| 377 | S292  | 1716 | 227 |
| 378 | S291  | 1700 | 110 |
| 379 | S290  | 1684 | 227 |
| 380 | S289  | 1668 | 110 |
| 381 | S288  | 1652 | 227 |
| 382 | S287  | 1636 | 110 |
| 383 | S286  | 1620 | 227 |
| 384 | S285  | 1604 | 110 |
| 385 | S284  | 1588 | 227 |
| 386 | S283  | 1572 | 110 |
| 387 | S282  | 1556 | 227 |
| 388 | S281  | 1540 | 110 |
| 389 | S280  | 1524 | 227 |
| 390 | S279  | 1508 | 110 |
| 391 | S278  | 1492 | 227 |
| 392 | S277  | 1476 | 110 |
| 393 | S276  | 1460 | 227 |
| 394 | S275  | 1444 | 110 |
| 395 | S274  | 1428 | 227 |
| 396 | S273  | 1412 | 110 |
| 397 | S272  | 1396 | 227 |
| 398 | S271  | 1380 | 110 |
| 399 | S270  | 1364 | 227 |
| 400 | S269  | 1348 | 110 |
| 401 | S268  | 1332 | 227 |
| 402 | S267  | 1316 | 110 |
| 403 | S266  | 1300 | 227 |
| 404 | S265  | 1284 | 110 |
| 405 | S264  | 1268 | 227 |
| 406 | S263  | 1252 | 110 |
| 407 | S262  | 1236 | 227 |
| 408 | S261  | 1220 | 110 |
| 409 | S260  | 1204 | 227 |
| 410 | S259  | 1188 | 110 |
| 411 | S258  | 1172 | 227 |
| 412 | S257  | 1156 | 110 |
| 413 | S256  | 1140 | 227 |
| 414 | S255  | 1124 | 110 |
| 415 | S254  | 1108 | 227 |
| 416 | S253  | 1092 | 110 |
| 417 | S252  | 1076 | 227 |
| 418 | S251  | 1060 | 110 |
| 419 | S250  | 1044 | 227 |
| 420 | S249  | 1028 | 110 |
| 421 | S248  | 1012 | 227 |
| 422 | S247  | 996  | 110 |
| 423 | S246  | 980  | 227 |
| 424 | S245  | 964  | 110 |
| 425 | S244  | 948  | 227 |
| 426 | S243  | 932  | 110 |
| 427 | S242  | 916  | 227 |
| 428 | S241  | 900  | 110 |
| 429 | S240  | 884  | 227 |
| 430 | S239  | 868  | 110 |
| 431 | S238  | 852  | 227 |
| 432 | S237  | 836  | 110 |
| 433 | S236  | 820  | 227 |
| 434 | S235  | 804  | 110 |
| 435 | S234  | 788  | 227 |
| 436 | S233  | 772  | 110 |
| 437 | S232  | 756  | 227 |
| 438 | S231  | 740  | 110 |
| 439 | S230  | 724  | 227 |
| 440 | S229  | 708  | 110 |
| 441 | S228  | 692  | 227 |
| 442 | S227  | 676  | 110 |
| 443 | S226  | 660  | 227 |
| 444 | S225  | 644  | 110 |
| 445 | S224  | 628  | 227 |
| 446 | S223  | 612  | 110 |
| 447 | S222  | 596  | 227 |
| 448 | S221  | 580  | 110 |
| 449 | S220  | 564  | 227 |
| 450 | S219  | 548  | 110 |
| 451 | S218  | 532  | 227 |
| 452 | S217  | 516  | 110 |
| 453 | S216  | 500  | 227 |
| 454 | S215  | 484  | 110 |
| 455 | S214  | 468  | 227 |
| 456 | S213  | 452  | 110 |
| 457 | S212  | 436  | 227 |
| 458 | S211  | 420  | 110 |
| 459 | S210  | 404  | 227 |
| 460 | S209  | 388  | 110 |
| 461 | S208  | 372  | 227 |
| 462 | S207  | 356  | 110 |
| 463 | S206  | 340  | 227 |
| 464 | S205  | 324  | 110 |
| 465 | S204  | 308  | 227 |
| 466 | S203  | 292  | 110 |
| 467 | S202  | 276  | 227 |
| 468 | S201  | 260  | 110 |
| 469 | S200  | 244  | 227 |
| 470 | S199  | 228  | 110 |
| 471 | DUMMY | 212  | 227 |
| 472 | DUMMY | 196  | 110 |
| 473 | DUMMY | -196 | 110 |
| 474 | DUMMY | -212 | 227 |
| 475 | S198  | -228 | 110 |
| 476 | S197  | -244 | 227 |
| 477 | S196  | -260 | 110 |
| 478 | S195  | -276 | 227 |
| 479 | S194  | -292 | 110 |
| 480 | S193  | -308 | 227 |
| 481 | S192  | -324 | 110 |
| 482 | S191  | -340 | 227 |
| 483 | S190  | -356 | 110 |
| 484 | S189  | -372 | 227 |
| 485 | S188  | -388 | 110 |
| 486 | S187  | -404 | 227 |
| 487 | S186  | -420 | 110 |
| 488 | S185  | -436 | 227 |
| 489 | S184  | -452 | 110 |
| 490 | S183  | -468 | 227 |

| No.            | Name  | X     | Y    |
|----------------|-------|-------|------|
| 561            | S112  | -1604 | 110  |
| 562            | S111  | -1620 | 227  |
| 563            | S110  | -1636 | 110  |
| 564            | S109  | -1652 | 227  |
| 565            | S108  | -1668 | 110  |
| 566            | S107  | -1684 | 227  |
| 567            | S106  | -1700 | 110  |
| 568            | S105  | -1716 | 227  |
| 569            | S104  | -1732 | 110  |
| 570            | S103  | -1748 | 227  |
| 571            | S102  | -1764 | 110  |
| 572            | S101  | -1780 | 227  |
| 573            | S100  | -1796 | 110  |
| 574            | S99   | -1812 | 227  |
| 575            | S98   | -1828 | 110  |
| 576            | S97   | -1844 | 227  |
| 577            | S96   | -1860 | 110  |
| 578            | S95   | -1876 | 227  |
| 579            | S94   | -1892 | 110  |
| 580            | S93   | -1908 | 227  |
| 581            | S92   | -1924 | 110  |
| 582            | S91   | -1940 | 227  |
| 583            | S90   | -1956 | 110  |
| 584            | S89   | -1972 | 227  |
| 585            | S88   | -1988 | 110  |
| 586            | S87   | -2004 | 227  |
| 587            | S86   | -2020 | 110  |
| 588            | S85   | -2036 | 227  |
| 589            | S84   | -2052 | 110  |
| 590            | S83   | -2068 | 227  |
| 591            | S82   | -2084 | 110  |
| 592            | S81   | -2100 | 227  |
| 593            | S80   | -2116 | 110  |
| 594            | S79   | -2132 | 227  |
| 595            | S78   | -2148 | 110  |
| 596            | S77   | -2164 | 227  |
| 597            | S76   | -2180 | 110  |
| 598            | S75   | -2196 | 227  |
| 599            | S74   | -2212 | 110  |
| 600            | S73   | -2228 | 227  |
| 601            | S72   | -2244 | 110  |
| 602            | S71   | -2260 | 227  |
| 603            | S70   | -2276 | 110  |
| 604            | S69   | -2292 | 227  |
| 605            | S68   | -2308 | 110  |
| 606            | S67   | -2324 | 227  |
| 607            | S66   | -2340 | 110  |
| 608            | S65   | -2356 | 227  |
| 609            | S64   | -2372 | 110  |
| 610            | S63   | -2388 | 227  |
| 611            | S62   | -2404 | 110  |
| 612            | S61   | -2420 | 227  |
| 613            | S60   | -2436 | 110  |
| 614            | S59   | -2452 | 227  |
| 615            | S58   | -2468 | 110  |
| 616            | S57   | -2484 | 227  |
| 617            | S56   | -2500 | 110  |
| 618            | S55   | -2516 | 227  |
| 619            | S54   | -2532 | 110  |
| 620            | S53   | -2548 | 227  |
| 621            | S52   | -2564 | 110  |
| 622            | S51   | -2580 | 227  |
| 623            | S50   | -2596 | 110  |
| 624            | S49   | -2612 | 227  |
| 625            | S48   | -2628 | 110  |
| 626            | S47   | -2644 | 227  |
| 627            | S46   | -2660 | 110  |
| 628            | S45   | -2676 | 227  |
| 629            | S44   | -2692 | 110  |
| 630            | S43   | -2708 | 227  |
| 631            | S42   | -2724 | 110  |
| 632            | S41   | -2740 | 227  |
| 633            | S40   | -2756 | 110  |
| 634            | S39   | -2772 | 227  |
| 635            | S38   | -2788 | 110  |
| 636            | S37   | -2804 | 227  |
| 637            | S36   | -2820 | 110  |
| 638            | S35   | -2836 | 227  |
| 639            | S34   | -2852 | 110  |
| 640            | S33   | -2868 | 227  |
| 641            | S32   | -2884 | 110  |
| 642            | S31   | -2900 | 227  |
| 643            | S30   | -2916 | 110  |
| 644            | S29   | -2932 | 227  |
| 645            | S28   | -2948 | 110  |
| 646            | S27   | -2964 | 227  |
| 647            | S26   | -2980 | 110  |
| 648            | S25   | -2996 | 227  |
| 649            | S24   | -3012 | 110  |
| 650            | S23   | -3028 | 227  |
| 651            | S22   | -3044 | 110  |
| 652            | S21   | -3060 | 227  |
| 653            | S20   | -3076 | 110  |
| 654            | S19   | -3092 | 227  |
| 655            | S18   | -3108 | 110  |
| 656            | S17   | -3124 | 227  |
| 657            | S16   | -3140 | 110  |
| 658            | S15   | -3156 | 227  |
| 659            | S14   | -3172 | 110  |
| 660            | S13   | -3188 | 227  |
| 661            | S12   | -3204 | 110  |
| 662            | S11   | -3220 | 227  |
| 663            | S10   | -3236 | 110  |
| 664            | S9    | -3252 | 227  |
| 665            | S8    | -3268 | 110  |
| 666            | S7    | -3284 | 227  |
| 667            | S6    | -3300 | 110  |
| 668            | S5    | -3316 | 227  |
| 669            | S4    | -3332 | 110  |
| 670            | S3    | -3348 | 227  |
| 671            | S2    | -3364 | 110  |
| 672            | S1    | -3380 | 227  |
| 673            | DUMMY | -3396 | 110  |
| 674            | DUMMY | -3412 | 227  |
| 675            | DUMMY | -3428 | 110  |
| 676            | DUMMY | -3444 | 227  |
| 677            | G1    | -3460 | 110  |
| 678            | G3    | -3476 | 227  |
| 679            | G5    | -3492 | 110  |
| 680            | G7    | -3508 | 227  |
| 681            | G9    | -3524 | 110  |
| 682            | G11   | -3540 | 227  |
| 683            | G13   | -3556 | 110  |
| 684            | G15   | -3572 | 227  |
| 685            | G17   | -3588 | 110  |
| 686            | G19   | -3604 | 227  |
| 687            | G21   | -3620 | 110  |
| 688            | G23   | -3636 | 227  |
| 689            | G25   | -3652 | 110  |
| 690            | G27   | -3668 | 227  |
| 691            | G29   | -3684 | 110  |
| 692            | G31   | -3700 | 227  |
| 693            | G33   | -3716 | 110  |
| 694            | G35   | -3732 | 227  |
| 695            | G37   | -3748 | 110  |
| 696            | G39   | -3764 | 227  |
| 697            | G41   | -3780 | 110  |
| 698            | G43   | -3796 | 227  |
| 699            | G45   | -3812 | 110  |
| 700            | G47   | -3828 | 227  |
| 701            | G49   | -3844 | 110  |
| 702            | G51   | -3860 | 227  |
| 703            | G53   | -3876 | 110  |
| 704            | G55   | -3892 | 227  |
| 705            | G57   | -3908 | 110  |
| 706            | G59   | -3924 | 227  |
| 707            | G61   | -3940 | 110  |
| 708            | G63   | -3956 | 227  |
| 709            | G65   | -3972 | 110  |
| 710            | G67   | -3988 | 227  |
| 711            | G69   | -4004 | 110  |
| 712            | G71   | -4020 | 227  |
| 713            | G73   | -4036 | 110  |
| 714            | G75   | -4052 | 227  |
| 715            | G77   | -4068 | 110  |
| 716            | G79   | -4084 | 227  |
| 717            | G81   | -4100 | 110  |
| 718            | G83   | -4116 | 227  |
| 719            | G85   | -4132 | 110  |
| 720            | G87   | -4148 | 227  |
| 721            | G89   | -4164 | 110  |
| 722            | G91   | -4180 | 227  |
| 723            | G93   | -4196 | 110  |
| 724            | G95   | -4212 | 227  |
| 725            | G97   | -4228 | 110  |
| 726            | G99   | -4244 | 227  |
| 727            | G101  | -4260 | 110  |
| 728            | G103  | -4276 | 227  |
| 729            | G105  | -4292 | 110  |
| 730            | G107  | -4308 | 227  |
| 731            | G109  | -4324 | 110  |
| 732            | G111  | -4340 | 227  |
| 733            | G113  | -4356 | 110  |
| 734            | G115  | -4372 | 227  |
| 735            | G117  | -4388 | 110  |
| 736            | G119  | -4404 | 227  |
| 737            | G121  | -4420 | 110  |
| 738            | G123  | -4436 | 227  |
| 739            | G125  | -4452 | 110  |
| 740            | G127  | -4468 | 227  |
| Alignment mark |       | X     | Y    |
| A1             |       | -4841 | -220 |
| A2             |       | 4841  | -220 |

#### 4.4 Alignment mark



#### 4.5 Bump size



## 5. Interface

### 5.1 System interface

The HX8353-E supports parallel 80-system and 68-system 18-/16-/9-/8-bits bus interface mode and 3-/4-wires serial interface mode. When NCS = "L", the parallel and serial bus system interface of the HX8353-E become active and data transfer through the interface circuit is available. The DNC\_SCL pin specifies whether the system interface circuit access is to the register command or to the GRAM. The input bus width format of system interface circuit is selected by external pins BS2-0. For selecting the format of input bus, please refer to Table 5.1 and Table 5.2.

The HX8353-E includes command code and the following parameter and GRAM data. The command code can be written through data bus by setting DNC\_SCL=0. Then the command or GRAM data can be written to register at which that index pointer pointed by setting DNC\_SCL=1.

Furthermore, there are two 18-bit bus control registers used to temporarily store the data written to or read from the GRAM. When the data is written into the GRAM from the MPU, it is first written into the write-data latch and then automatically written into the GRAM by internal operation. Data is read through the read-data latch when reading from the GRAM. Therefore, the first read data operation is invalid and the following read data operations are valid.

| SPI_SEL | P68 | BS2 | BS1 | BS0 | Interface                    |
|---------|-----|-----|-----|-----|------------------------------|
| x       | 0   | 1   | 0   | 0   | 80-system 8-bit Parallel     |
| x       | 0   | 1   | 0   | 1   | 80-system 16-bit Parallel    |
| x       | 0   | 1   | 1   | 0   | 80-system 9-bit Parallel     |
| x       | 0   | 1   | 1   | 1   | 80-system 18-bit Parallel    |
| x       | 1   | 1   | 0   | 0   | 68-system 8-bit Parallel     |
| x       | 1   | 1   | 0   | 1   | 68-system 16-bit Parallel    |
| x       | 1   | 1   | 1   | 0   | 68-system 9-bit Parallel     |
| x       | 1   | 1   | 1   | 1   | 68-system 18-bit Parallel    |
| 0       | x   | 0   | x   | x   | 3 wire serial Interface only |
| 1       | x   | 0   | x   | x   | 4 wire serial Interface only |

Table 5.1 Interface selection

| Interface                 | NRD_E | NWR_RNW | DNC_SCL | DB17 – DB0        |          |
|---------------------------|-------|---------|---------|-------------------|----------|
|                           |       |         |         | Command/Parameter | GRAM     |
| 80-system 8-bit Parallel  | NRD   | NWR     | DNC     | DB7-DB0           | DB7-DB0  |
| 80-system 9-bit Parallel  | NRD   | NWR     | DNC     | DB7-DB0           | DB8-DB0  |
| 80-system 16-bit Parallel | NRD   | NWR     | DNC     | DB7-DB0           | DB15-DB0 |
| 80-system 18-bit Parallel | NRD   | NWR     | DNC     | DB7-DB0           | DB17-DB0 |
| 3 wire serial Interface   | -     | -       | SCL     | DB0 as SDA        |          |
| 68-system 8-bit Parallel  | E     | RW      | DNC     | DB7-DB0           | DB7-DB0  |
| 68-system 9-bit Parallel  | E     | RW      | DNC     | DB7-DB0           | DB8-DB0  |
| 68-system 16-bit Parallel | E     | RW      | DNC     | DB7-DB0           | DB15-DB0 |
| 68-system 18-bit Parallel | E     | RW      | DNC     | DB7-DB0           | DB17-DB0 |
| 4 wire serial Interface   | -     | DNC     | SCL     | DB0 as SDA        |          |

Table 5.2 Interface mode selection

### 5.1.1 Parallel bus system interface

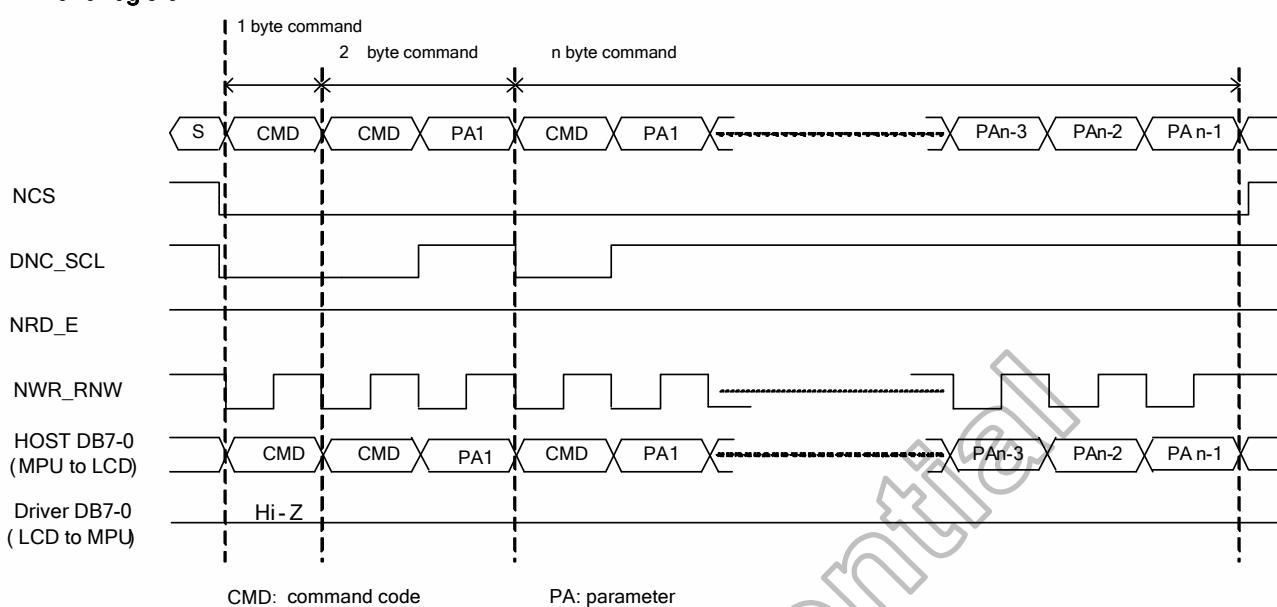
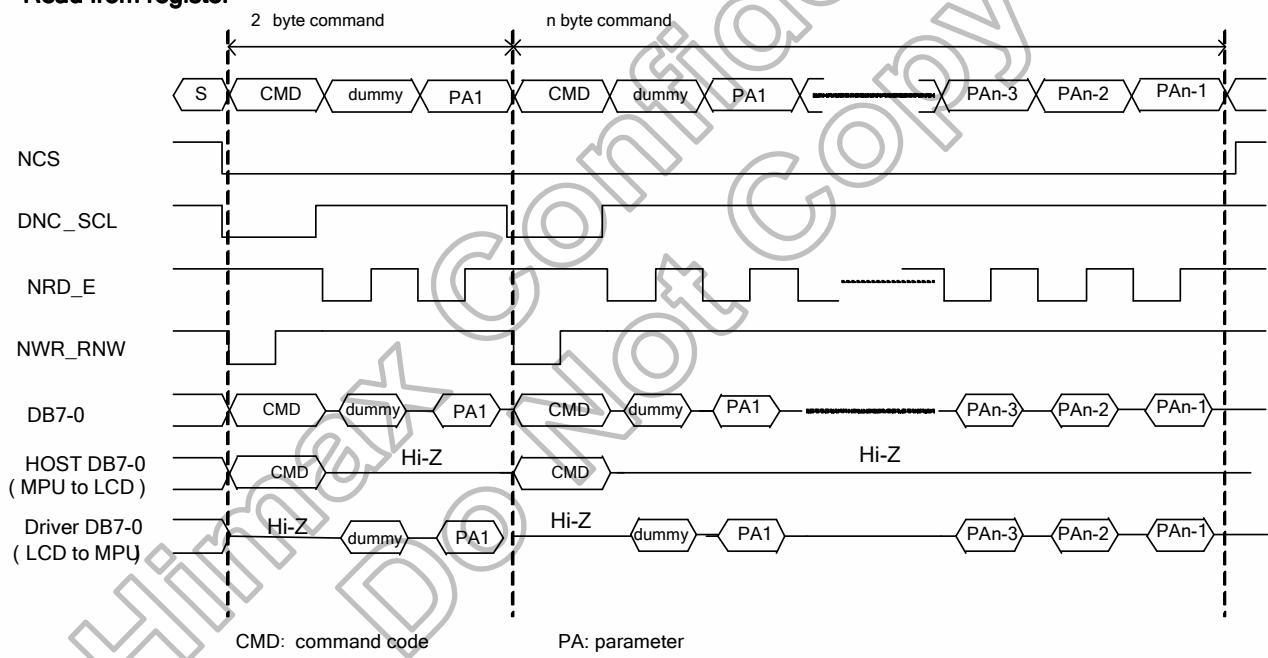
The input / output data from data pins (DB17-0) and signal operation of the I80/M68 series parallel bus interface as listed in Table 5.3 and Table 5.4.

| Operations                                      | NWR_RNW | NRD_E | DNC_SCL |
|---|---------|-------|---------|
| Writes command code                             | 0       | 1     | 0       |
| Reads internal status                           | 1       | 0     | 0       |
| Writes parameter into command or data into GRAM | 0       | 1     | 1       |
| Reads parameter from command or data from GRAM  | 1       | 0     | 1       |

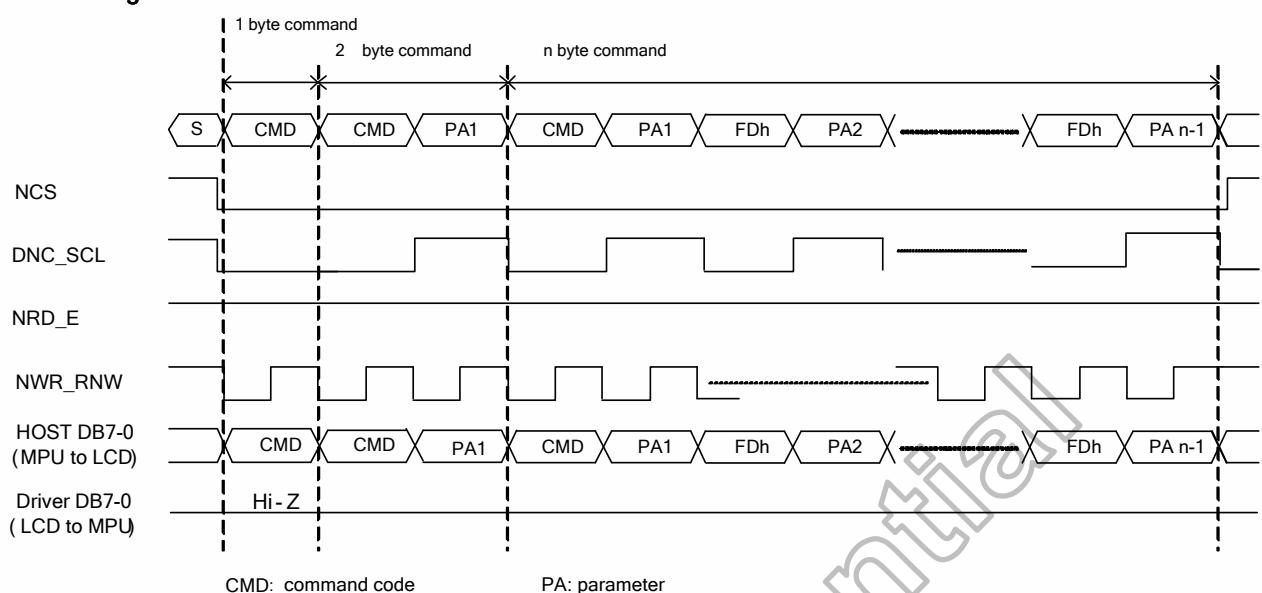
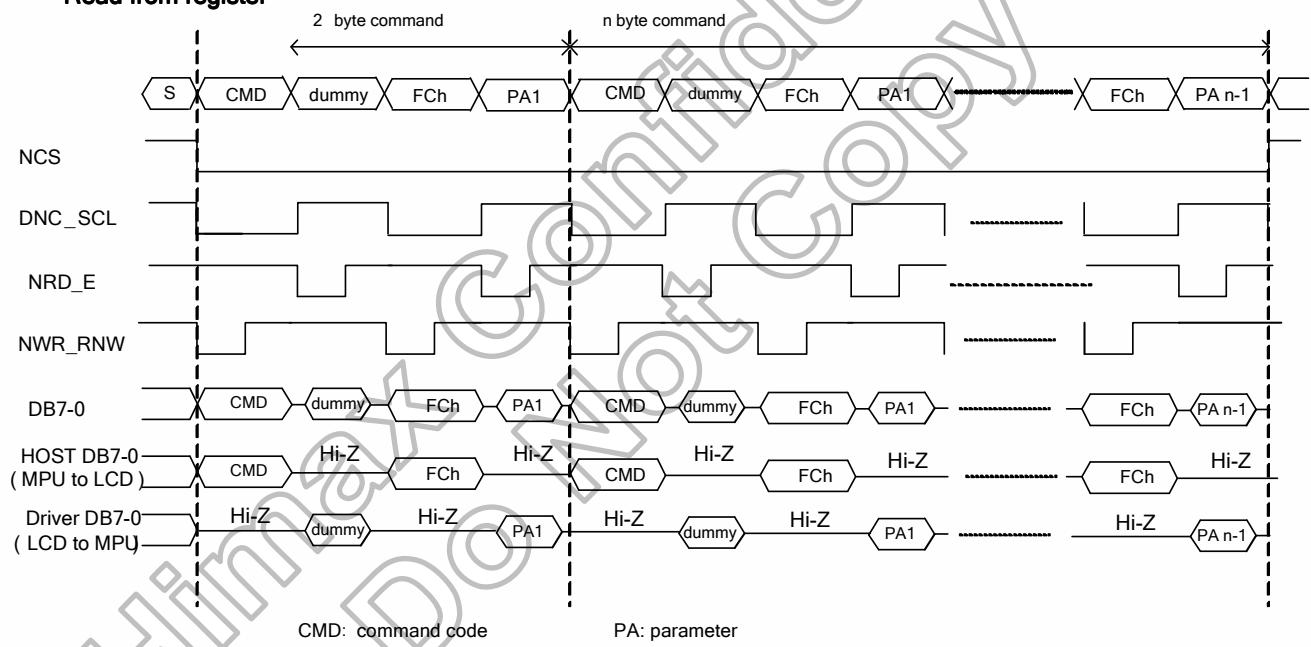
Table 5.3 Data pin function for I80 series CPU

| Operations                                      | NWR_RNW | NRD_E | DNC_SCL |
|---|---------|-------|---------|
| Writes command code                             | 0       | 1     | 0       |
| Reads internal status                           | 1       | 1     | 0       |
| Writes parameter into command or data into GRAM | 0       | 1     | 1       |
| Reads parameter from command or data from GRAM  | 1       | 1     | 1       |

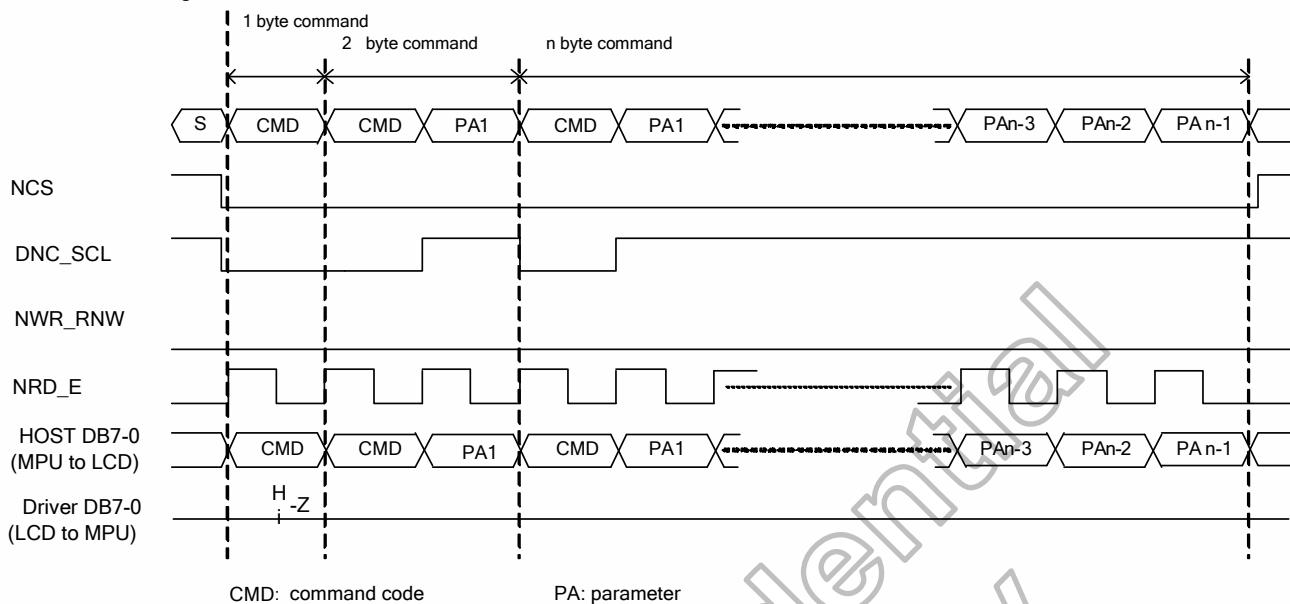
Table 5.4 Data pin function for M68 series CPU

**Write to register****Read from register**

**Figure 5.1 Register read/write timing in parallel bus system interface (for I80 series MPU)-1**

**Write to register****Read from register****Figure 5.2 Register read/write timing in parallel bus system interface (for I80 series MPU)-2**

## Write to register



## Read from register

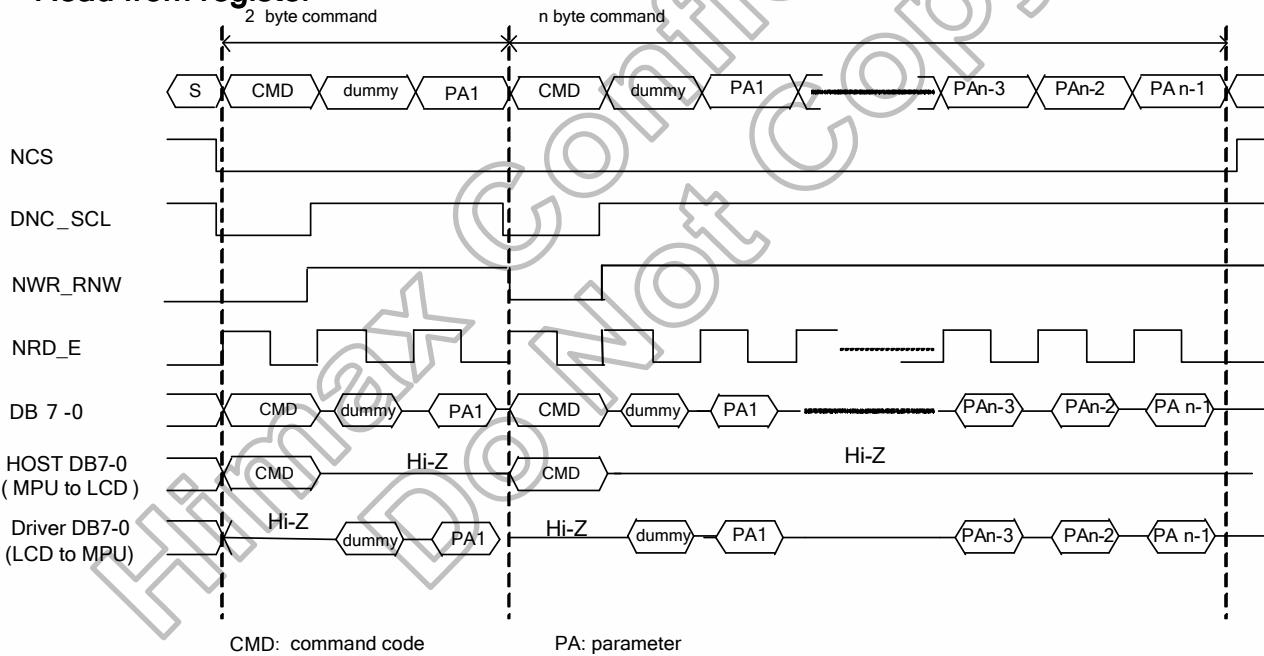
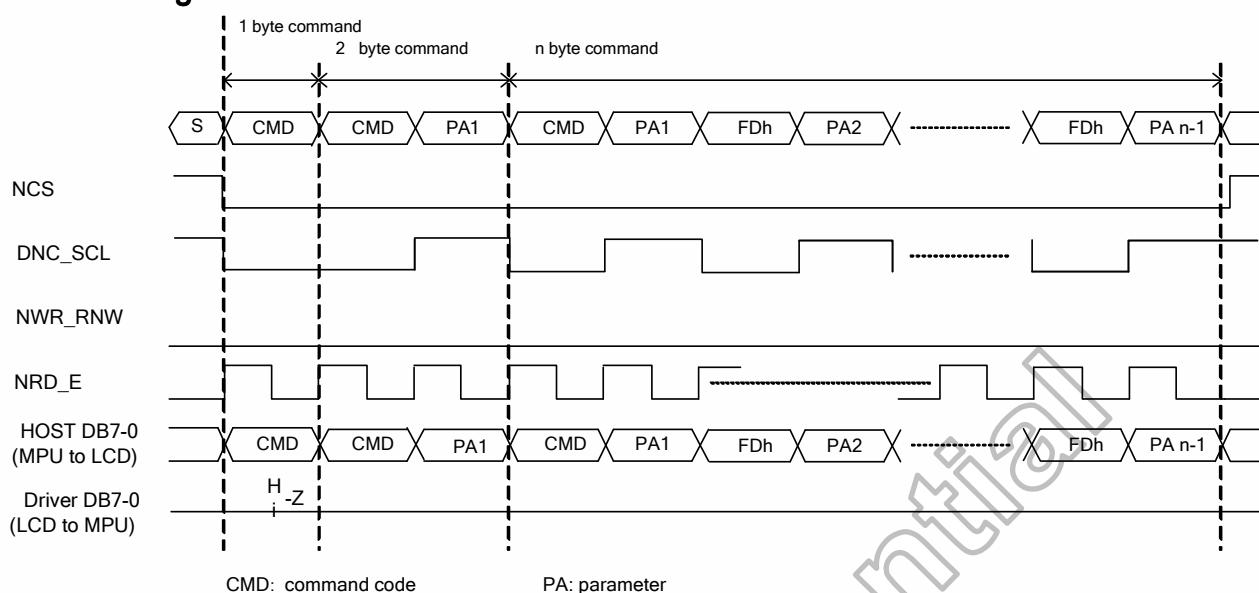


Figure 5.3 Register read/write timing in parallel bus system interface (for M68 series MPU)-1

## Write to register



## Read from register

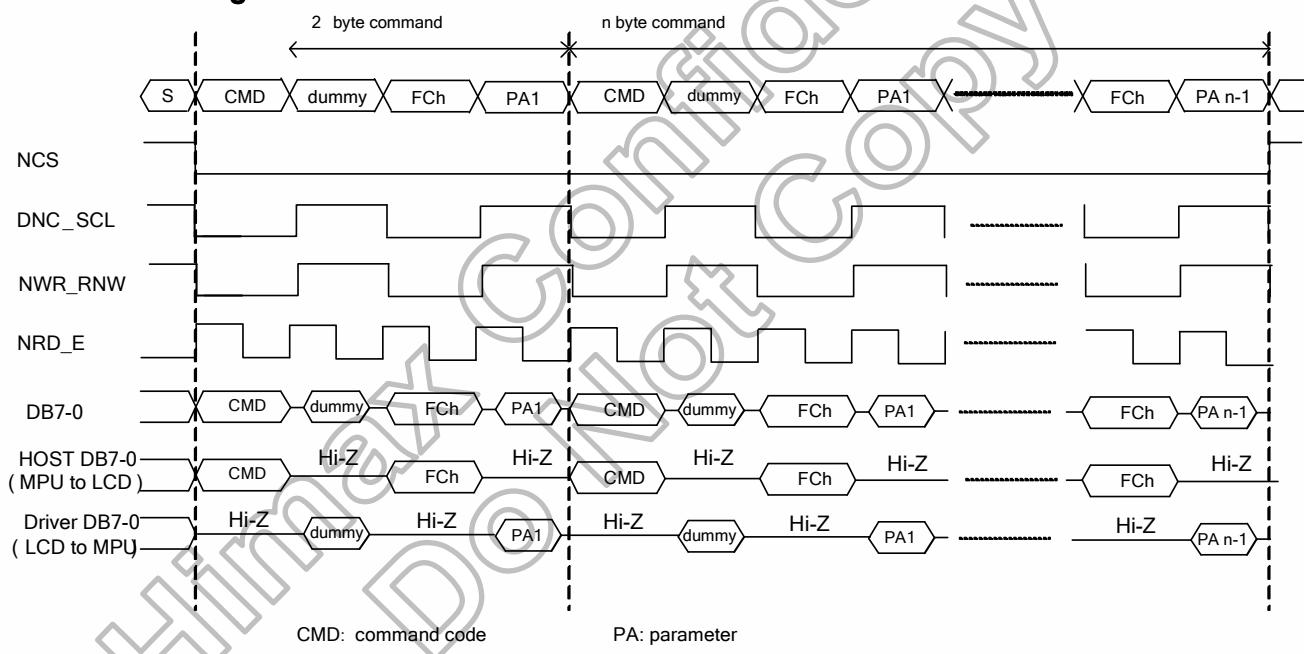
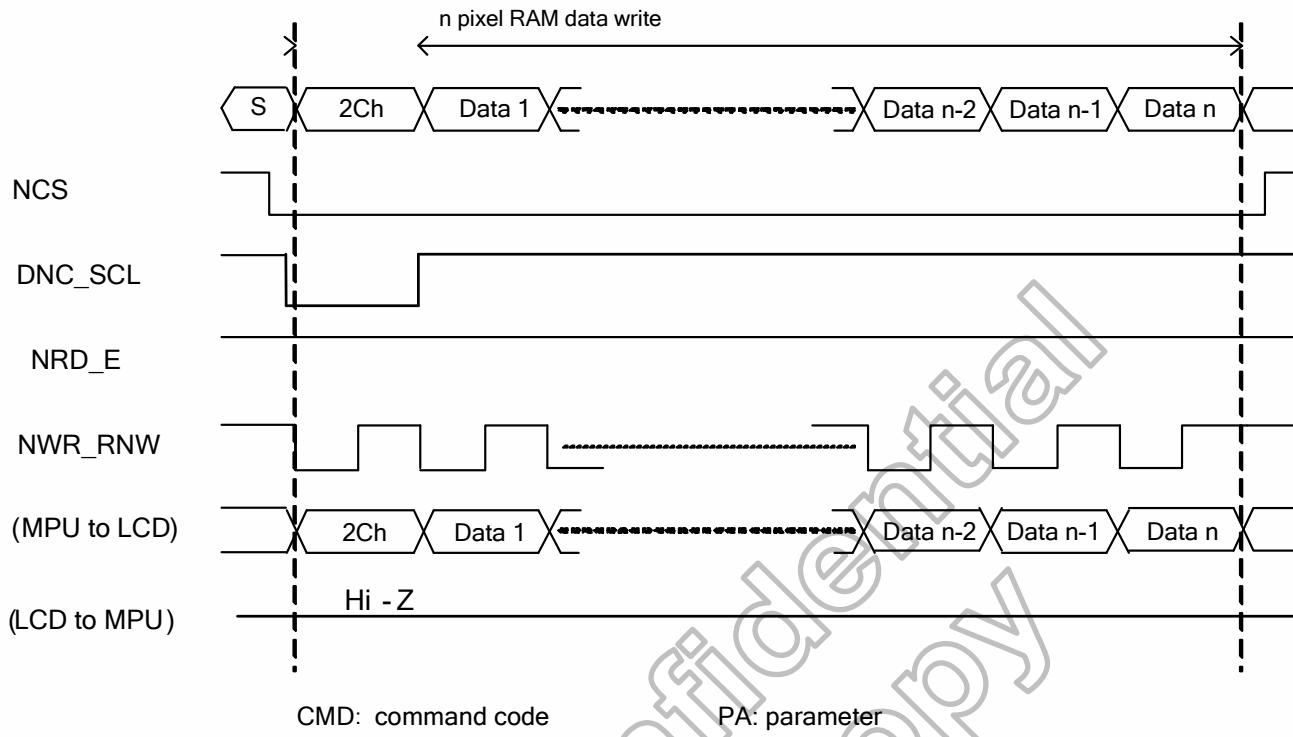
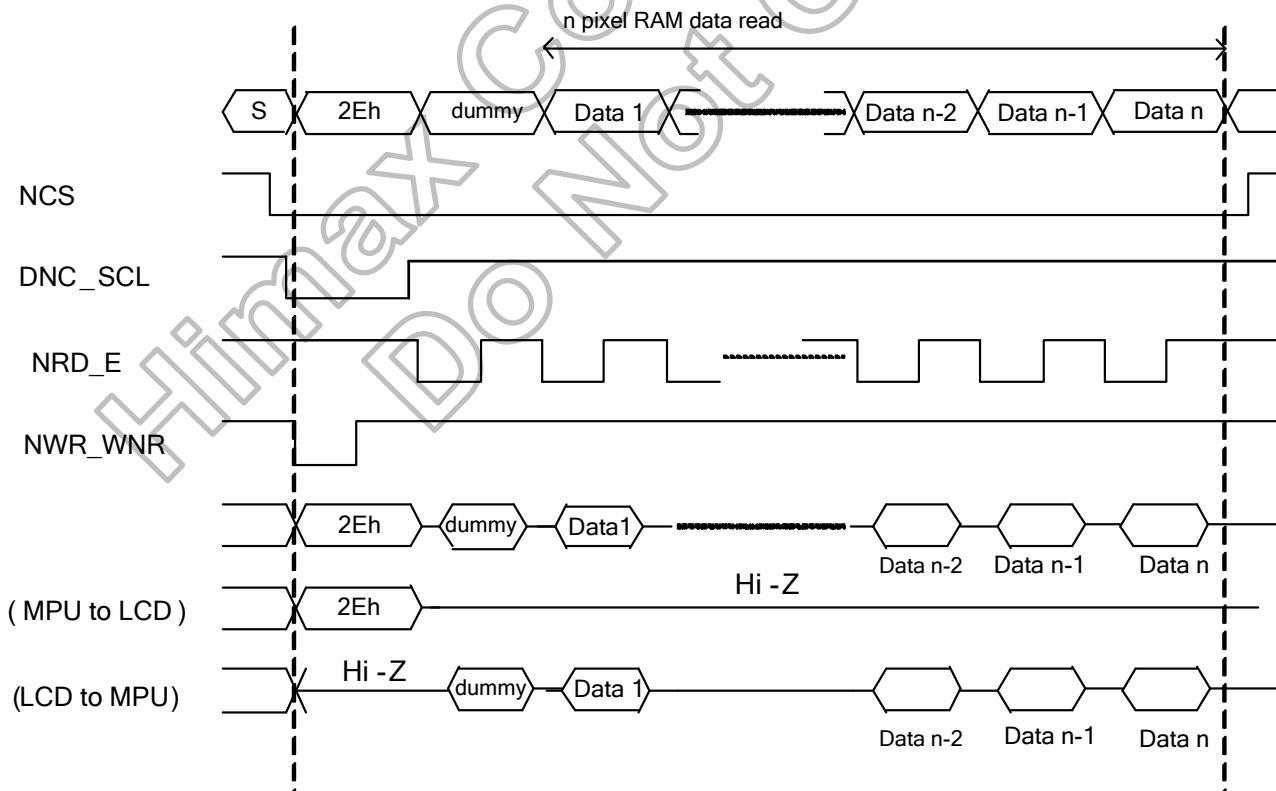
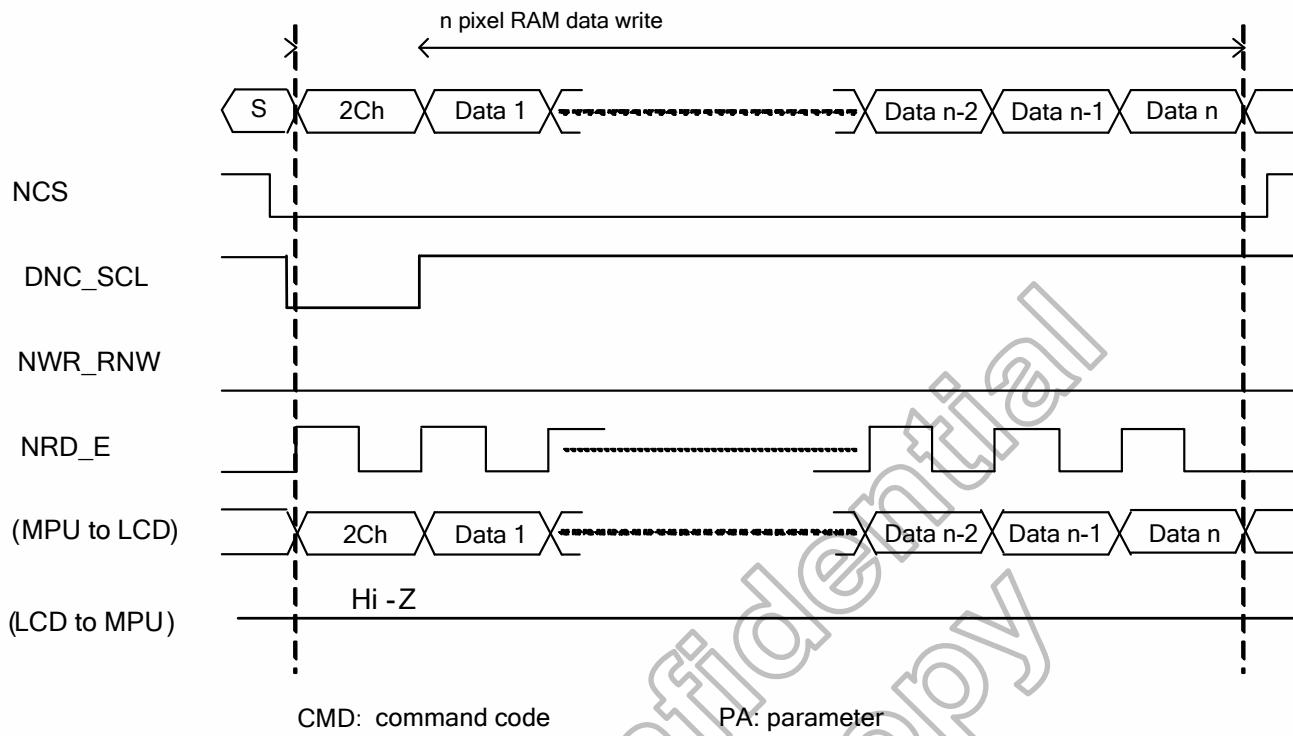
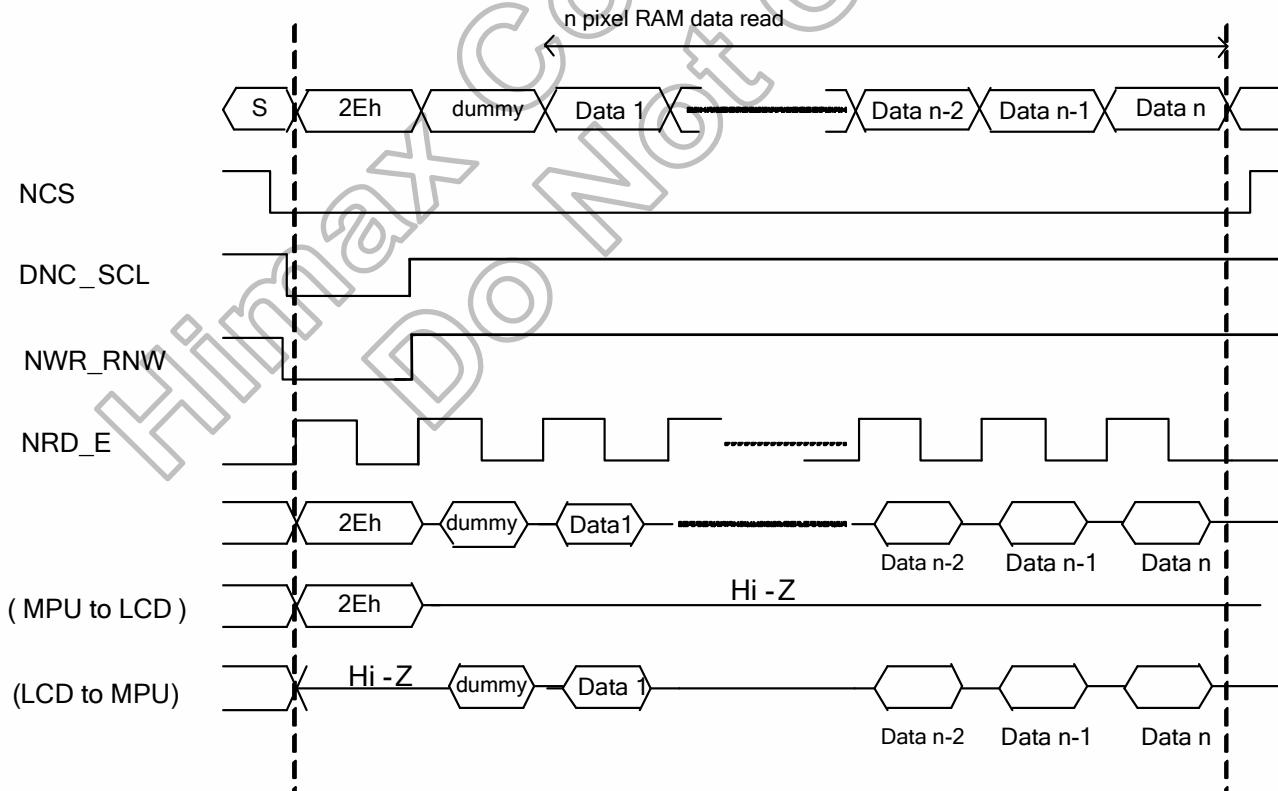


Figure 5.4 Register read/write timing in parallel bus system interface (for M68 series MPU)-2

**Write to GRAM****Read from GRAM****Figure 5.5 GRAM read/write timing in parallel bus system interface (for I80 series MPU)**

**Write to GRAM****Read from GRAM****Figure 5.6 GRAM read/write timing in parallel bus system interface (for M68 series MPU)**

### 5.1.2 MCU data color coding

#### MCU Data Color Coding for RAM data **Write**

- Parallel 8-Bit Bus Interface (BS2,BS1,BS0="100")

| Register Command | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Command                         |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|---------------------------------|
|                  | x   | x   | x   | x   | x   | x   | x   | x   | x  | x  | 0  | 0  | 1  | 0  | 1  | 1  | 0  | 0  | 2CH                             |
| <b>3AH</b>       | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Color                           |
| 03h              | x   | x   | x   | x   | x   | x   | x   | x   | x  | x  | R3 | R2 | R1 | R0 | G3 | G2 | G1 | G0 | 4K-Color<br>(2-pixel/ 3-bytes)  |
|                  | x   | x   | x   | x   | x   | x   | x   | x   | x  | x  | B3 | B2 | B1 | B0 | R3 | R2 | R1 | R0 |                                 |
| 05h              | x   | x   | x   | x   | x   | x   | x   | x   | x  | x  | G3 | G2 | G1 | G0 | B3 | B2 | B1 | B0 | 65K-Color<br>(1-pixel/ 2-bytes) |
|                  | x   | x   | x   | x   | x   | x   | x   | x   | x  | x  | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G0                              |
| 06h              | x   | x   | x   | x   | x   | x   | x   | x   | x  | x  | R5 | R4 | R3 | R2 | R1 | R0 | x  | x  | 262K-Color<br>(2-pixel/ 3bytes) |
|                  | x   | x   | x   | x   | x   | x   | x   | x   | x  | x  | G5 | G4 | G3 | G2 | G1 | G0 | x  | x  |                                 |
|                  | x   | x   | x   | x   | x   | x   | x   | x   | x  | x  | B5 | B4 | B3 | B2 | B1 | B0 | x  | x  |                                 |

Table 5.5 8-bit parallel interface GRAM write table

- Parallel 16-Bit Bus Interface (BS2,BS1,BS0="101")

| Register Command | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Command                         |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|---------------------------------|
|                  | x   | x   | x   | x   | x   | x   | x   | x   | x  | x  | 0  | 0  | 1  | 0  | 1  | 1  | 0  | 0  | 2CH                             |
| <b>3AH</b>       | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Color                           |
| 03h              | x   | x   | x   | x   | x   | x   | R3  | R2  | R1 | R0 | G3 | G2 | G1 | G0 | B3 | B2 | B1 | B0 | 4K-Color                        |
| 05h              | x   | x   | R4  | R3  | R2  | R1  | R0  | G5  | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | 65K-Color                       |
| 06h              | x   | x   | R5  | R4  | R3  | R2  | R1  | R0  | x  | x  | G5 | G4 | G3 | G2 | G1 | G0 | x  | x  | 262K-Color<br>(2-pixel/ 3bytes) |
|                  | x   | x   | B5  | B4  | B3  | B2  | B1  | B0  | x  | x  | R5 | R4 | R3 | R2 | R1 | R0 | x  | x  |                                 |
|                  | x   | x   | G5  | G4  | G3  | G2  | G1  | G0  | x  | x  | B5 | B4 | B3 | B2 | B1 | B0 | x  | x  |                                 |

Table 5.6 16-bit parallel interface GRAM write table

- Parallel 9-Bit Bus Interface (BS2,BS1,BS0="110")

| Register Command | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Register                        |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|---------------------------------|
|                  | x   | x   | x   | x   | x   | x   | x   | x   | x  | x  | 0  | 0  | 1  | 0  | 1  | 1  | 0  | 0  | 2CH                             |
| <b>3AH</b>       | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Color                           |
| 06h              | x   | x   | x   | x   | x   | x   | x   | x   | x  | R5 | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | 262K-Color<br>(1-pixel/ 2bytes) |

Table 5.7 9-bit parallel interface GRAM write table

- Parallel 18-Bit Bus Interface (BS2,BS1,BS0="111")

| Register Command | DB17 | DB16 | DB15 | DB14 | DB13 | DB12 | DB11 | DB10 | DB9 | DB8 | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Register   |
|------------------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------|
|                  | x    | x    | x    | x    | x    | x    | x    | x    | x   | x   | 0   | 0   | 1   | 0   | 1   | 1   | 0   | 0   | 2CH        |
| <b>3AH</b>       | DB17 | DB16 | DB15 | DB14 | DB13 | DB12 | DB11 | DB10 | DB9 | DB8 | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Color      |
| 06h              | R5   | R4   | R3   | R2   | R1   | R0   | G5   | G4   | G3  | G2  | G1  | G0  | B5  | B4  | B3  | B2  | B1  | B0  | 262K-Color |

Table 5.8 18-bit parallel interface GRAM write table

## 8-bit bus interface

The I80-system 8-bit parallel bus interface can be used by setting external pins "P68, BS2, BS1, BS0" pins to "0100". And the M68-system 8-bit parallel bus interface can be used by setting "P68, BS2, BS1, and BS0" pins to "1100". Figure 5.7 is the example of interface with I80/M68 microcomputer system interface and Figure 5.8 ~Figure 5.10 is bit format per pixel color order.

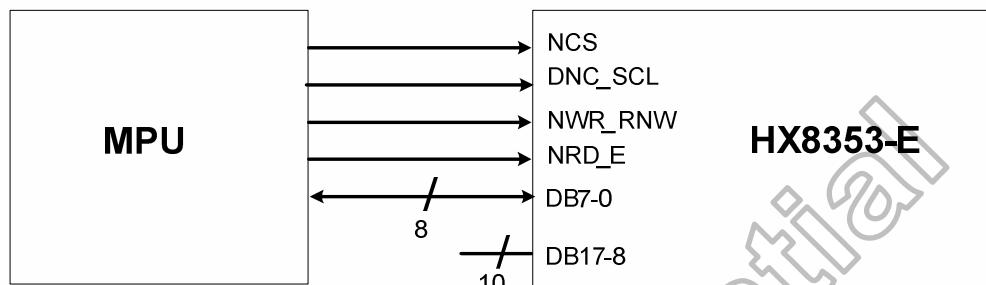


Figure 5.7 Example of 80- / 68- system 8-bit bus interface

| 262k Color Data | DNC_SCL | DB7                     | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | GRAM Write           |
|-----------------|---------|-------------------------|-----|-----|-----|-----|-----|-----|-----|----------------------|
| MEMWR           | 0       | GRAM Write command code |     |     |     |     |     |     |     | -                    |
| 1st write       | 1       | R15                     | R14 | R13 | R12 | R11 | R10 | x   | x   | -                    |
| 2nd write       | 1       | G15                     | G14 | G13 | G12 | G11 | G10 | x   | x   | -                    |
| 3rd write       | 1       | B15                     | B14 | B13 | B12 | B11 | B10 | x   | x   | 1st pixel (R1/G1/B1) |
| 4th write       | 1       | R25                     | R24 | R23 | R22 | R21 | R20 | x   | x   | -                    |
| 5th write       | 1       | G25                     | G24 | G23 | G22 | G21 | G20 | x   | x   | -                    |
| 6th write       | 1       | B25                     | B24 | B23 | B22 | B21 | B20 | x   | x   | 2nd pixel (R2/G2/B2) |

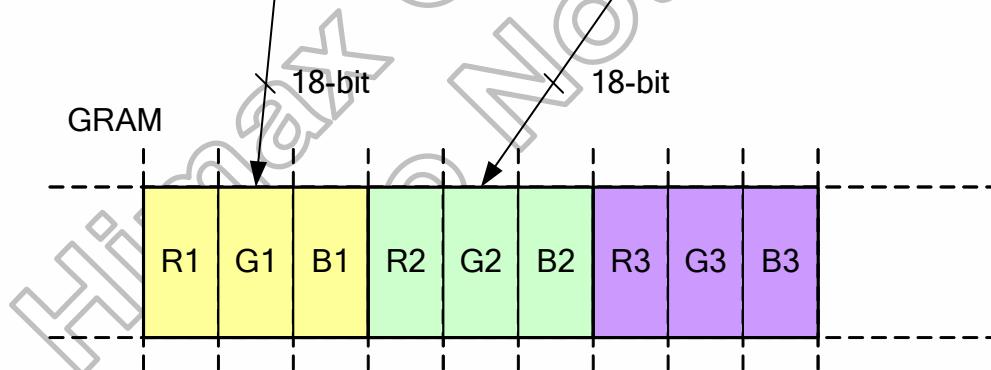
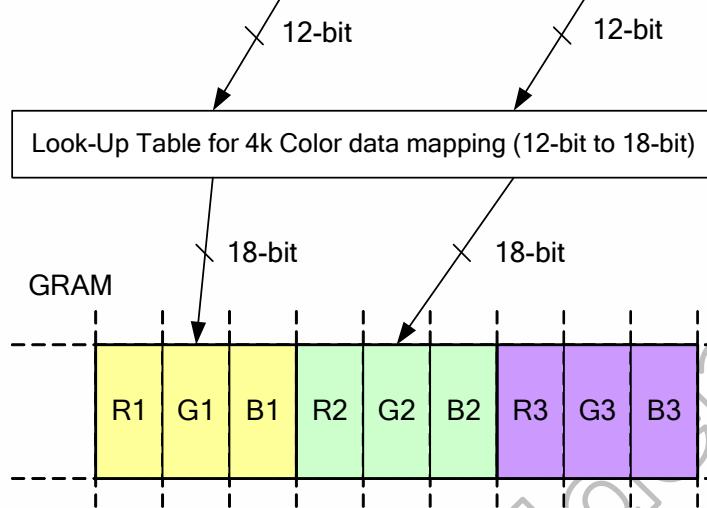


Figure 5.8 Write data for RGB 6-6-6-bit input

| 4k Color Data | DNC_SCL | DB7                     | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | GRAM Write           |
|---------------|---------|-------------------------|-----|-----|-----|-----|-----|-----|-----|----------------------|
| MEMWR         | 0       | GRAM Write command code |     |     |     |     |     |     |     | -                    |
| 1st write     | 1       | R13                     | R12 | R11 | R10 | G13 | G12 | G11 | G10 | -                    |
| 2nd write     | 1       | B13                     | B12 | B11 | B10 | R23 | R22 | R21 | R20 | 1st pixel (R1/G1/B1) |
| 3rd write     | 1       | G23                     | G22 | G21 | G20 | B23 | B22 | B21 | B20 | 2nd pixel (R2/G2/B2) |



| 4k Color Data | DNC_SCL | DB7                     | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | GRAM Write           |
|---------------|---------|-------------------------|-----|-----|-----|-----|-----|-----|-----|----------------------|
| MEMWR         | 0       | GRAM Write command code |     |     |     |     |     |     |     | -                    |
| 1st write     | 1       | R13                     | R12 | R11 | R10 | G13 | G12 | G11 | G10 | -                    |
| 2nd write     | 1       | B13                     | B12 | B11 | B10 | R23 | R22 | R21 | R20 | 1st pixel (R1/G1/B1) |
| MEMWR         | 0       | The other command       |     |     |     |     |     |     |     | -                    |
| MEMWR         | 0       | GRAM Write command code |     |     |     |     |     |     |     | -                    |
| 1st write     | 1       | R23                     | R22 | R21 | R20 | G23 | G22 | G21 | G20 | -                    |
| 2nd write     | 1       | B23                     | B22 | B21 | B20 | R33 | R32 | R31 | R30 | 2nd pixel (R2/G2/B2) |
| 3rd write     | 1       | G33                     | G32 | G31 | G30 | B33 | B32 | B31 | B30 | 3rd pixel (R3/G3/B3) |

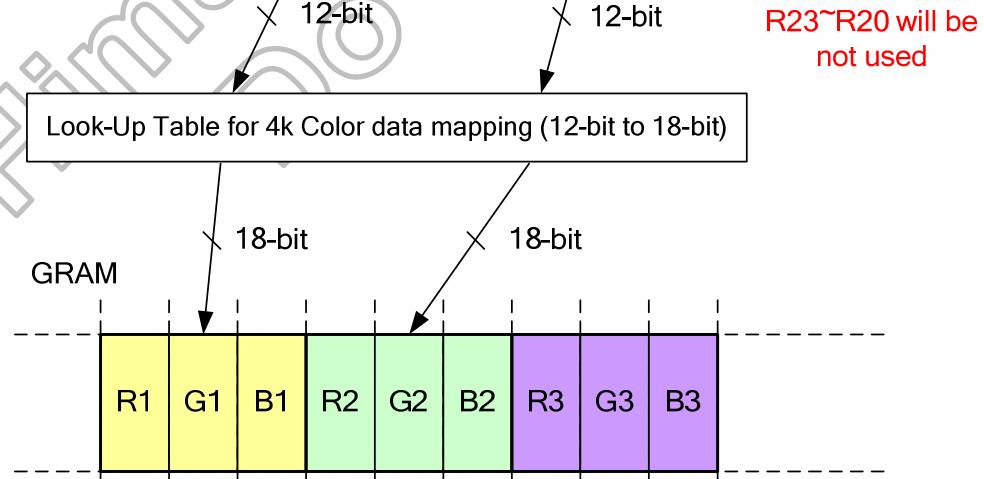


Figure 5.9 Write data for RGB 4-4-4-bit input

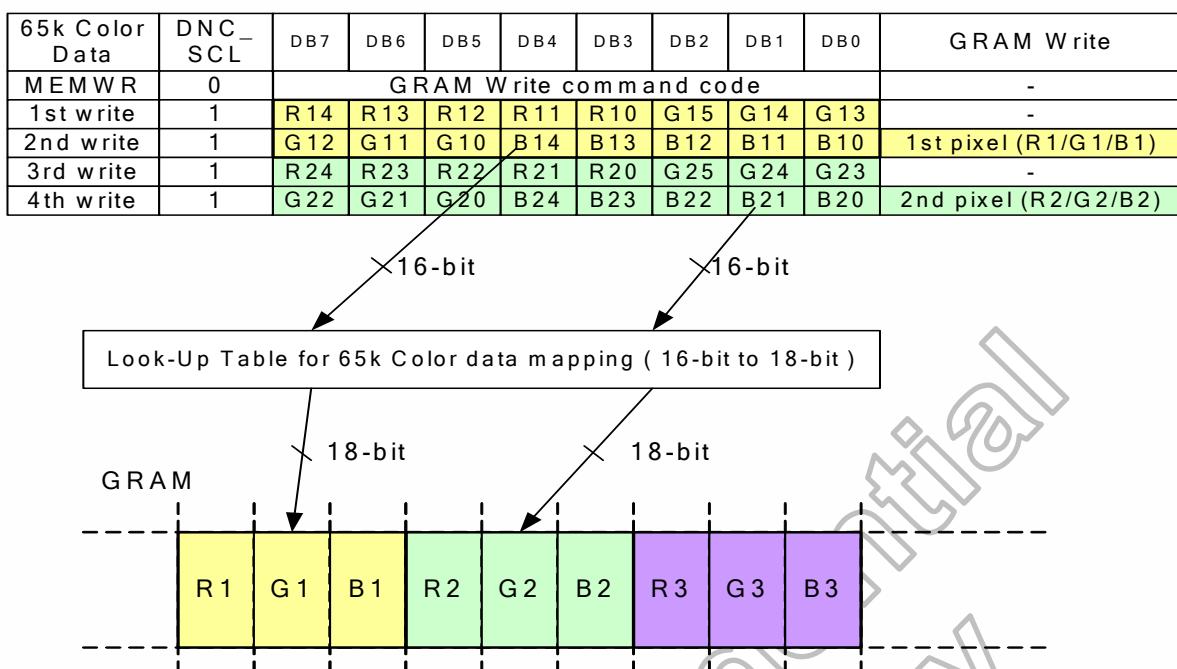
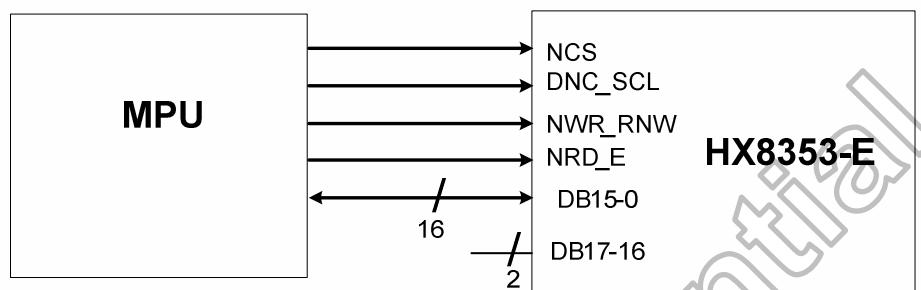


Figure 5.10 Write data for RGB 5-6-5-bit input

## 16-bit parallel bus system interface

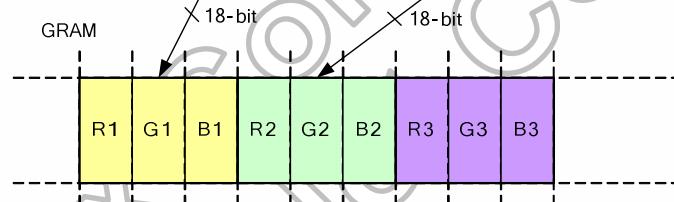
The I80-system 16-bit parallel bus interface in command-parameter interface mode can be used by setting external pins “P68, BS2, BS1, BS0” pins to “0101”. And the M68-system 16-bit parallel bus interface in MPU interface mode can be used by setting “P68, BS2, BS1” pins to “1101”. The Figure 5.11 is the example of interface with I80/M68 microcomputer system interface. There are three types of data format to write display data at 18-bit bus Interface. See Figure 5.12 ~ Figure 5.14.



**Figure 5.11 Example of I80- / M68- system 16-bit parallel bus interface**

|            | DNC_SCL | DB15 | DB14 | DB13 | DB12 | DB11 | DB10 | DB9 | DB8 | DB7                           | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | GRAM Write           |
|------------|---------|------|------|------|------|------|------|-----|-----|-------------------------------|-----|-----|-----|-----|-----|-----|-----|----------------------|
| MEMWR      | 0       | x    | x    | x    | x    | x    | x    | x   | x   | GRAM Write command code (2Ch) |     |     |     |     |     |     |     | -                    |
| 1 st write | 1       | R15  | R14  | R13  | R12  | R11  | R10  | x   | x   | G15                           | G14 | G13 | G12 | G11 | G10 | x   | x   | -                    |
| 2 nd write | 1       | B15  | B14  | B13  | B12  | B11  | B10  | x   | x   | R25                           | R24 | R23 | R22 | R21 | R20 | x   | x   | 1st pixel (R1/G1/B1) |
| 3 rd write | 1       | G25  | G24  | G23  | G22  | G21  | G20  | x   | x   | B25                           | B24 | B23 | B22 | B21 | B20 | x   | x   | 2nd pixel (R2/G2/B2) |

X : Don't care



**Figure 5.12 GRAM write data for RGB 6-6-6-(262k colors) bit input**

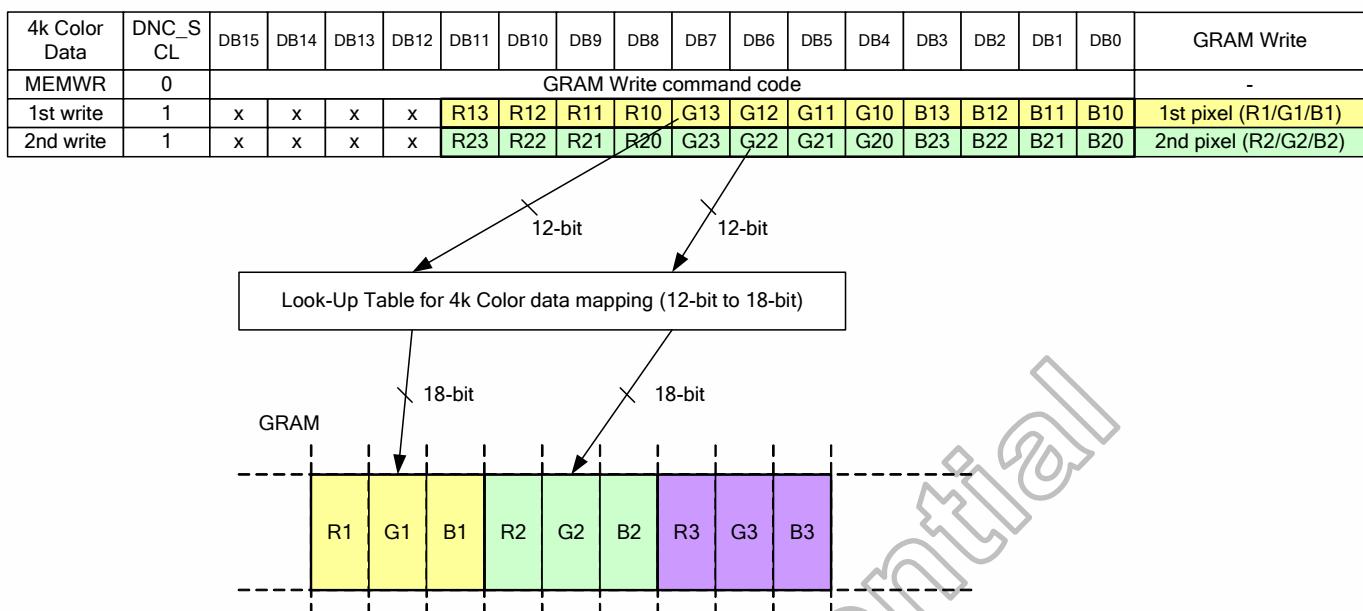


Figure 5.13 Write data for RGB 4-4-4 (4k colors) bit input on 16-bit parallel interface

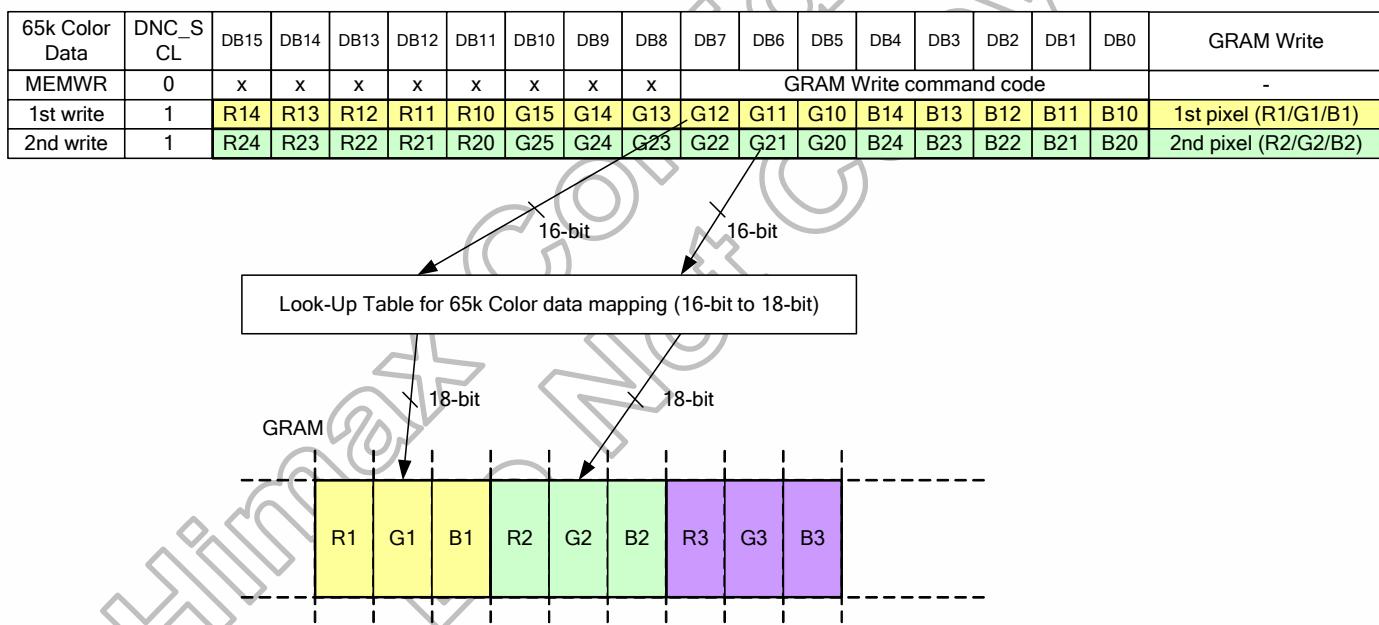
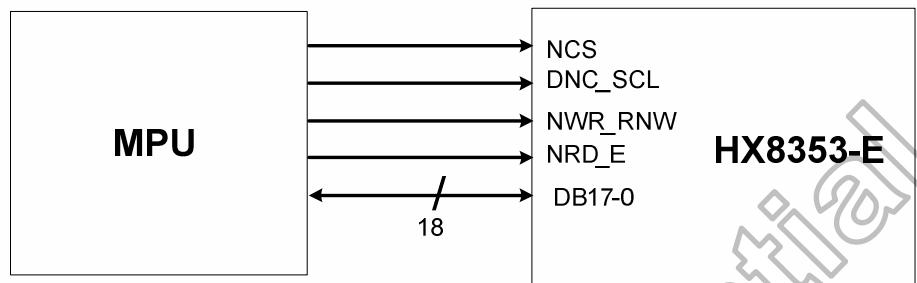


Figure 5.14 Write data for RGB 5-6-5 (65k colors) bit input on 16-bit parallel interface

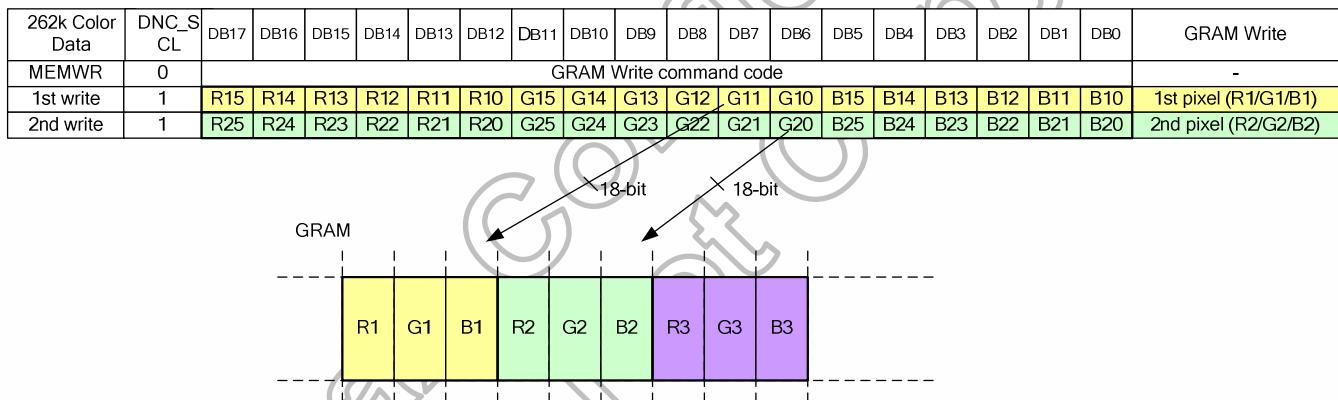
### 18-bit parallel bus system interface

The I80-system 18-bit parallel bus interface in MPU interface mode can be used by setting external pins “P68, BS2, BS1, BS0” pins to “0111”. And the M68-system 18-bit parallel bus interface in MPU interface mode can be used by setting “P68, BS2, BS1, BS0” pins to “1111”. The Figure5.15 is the example of interface with I80/M68 microcomputer system interface.



**Figure 5.15 Example of I80- / M68- system 18-bit parallel bus interface**

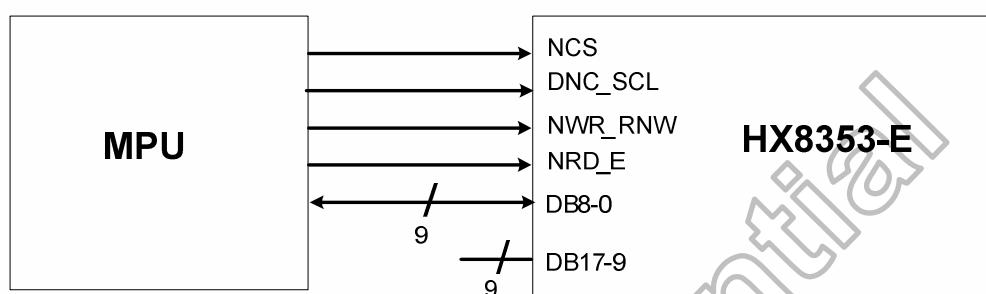
There is one type of data format to write display data at 18-bit bus Interface. See Figure 5.16.



**Figure 5.16 Write data for RGB 6-6-6(262k colors) bit input in 18-bit parallel interface**

### 9-bit bus interface

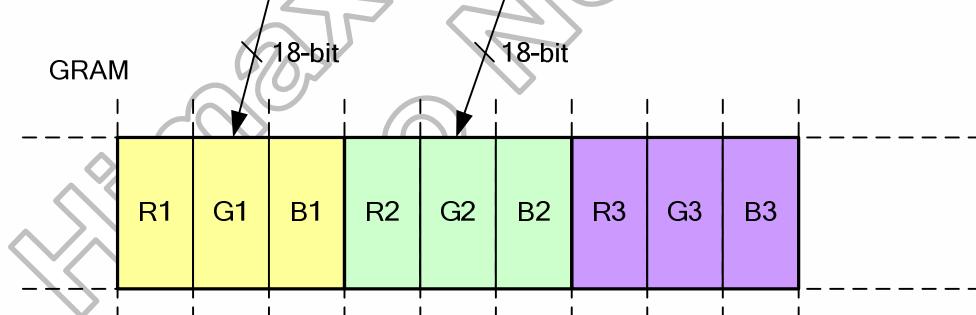
The I80-system 9-bit parallel bus interface in MPU interface mode can be used by setting external pins “P68, BS2, BS1, BS0” pins to “0110”. And the M68-system 9-bit parallel bus interface in MPU interface mode can be used by setting “P68, BS2, BS1, BS0” pins to “1110”. The Figure5.17 is the example of interface with I80/M68 microcomputer system interface.



**Figure 5.17 Example of 80- / 68- system 9-bit bus interface**

There is one type of data format to write display data at 9-bit bus Interface. See Figure 5.18.

| 262k Color Data | DNC_S CL | DB8 | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | GRAM Write           |
|-----------------|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------------------|
| MEMWR           | 0        |     |     |     |     |     |     |     |     |     | -                    |
| 1st write       | 1        | R15 | R14 | R13 | R12 | R11 | R10 | G15 | G14 | G13 | -                    |
| 2nd write       | 1        | G12 | G11 | G10 | B15 | B14 | B13 | B12 | B11 | B10 | 1st pixel (R1/G1/B1) |
| 3rd write       | 1        | R25 | R24 | R23 | R22 | R21 | R20 | G25 | G24 | G23 | -                    |
| 4th write       | 1        | G22 | G21 | G20 | B25 | B24 | B23 | B22 | B21 | B20 | 2nd pixel (R2/G2/B2) |



**Figure 5.18 Write data for RGB 6-6-6-bit (262k colors) input in 9-bit parallel interface**

### MCU Data Color Coding for RAM data Read

- Parallel 8-Bit Bus Interface (BS2,BS1,BS0="100")

| Register Command | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Command                      |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|------------------------------|
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 0  | 2EH                          |
| Read Data Format | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Color                        |
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | Dummy Read                   |
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | R5 | R4 | R3 | R2 | R1 | R0 | X  | X  | 262K-Color (1-pixel/ 3bytes) |
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | G5 | G4 | G3 | G2 | G1 | G0 | X  | X  |                              |
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | B5 | B4 | B3 | B2 | B1 | B0 | X  | X  |                              |

Table 5.9 8-bit parallel interface GRAM read table

- Parallel 16-Bit Bus Interface (BS2,BS1,BS0="101")

| Register Command | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Command                      |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|------------------------------|
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 0  | 2EH                          |
| Read Data Format | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Color                        |
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | Dummy Read                   |
|                  | X   | X   | R5  | R4  | R3  | R2  | R1  | R0  | X  | X  | G5 | G4 | G3 | G2 | G1 | G0 | X  | X  | 262K-Color (2-pixel/ 3bytes) |
|                  | X   | X   | B5  | B4  | B3  | B2  | B1  | B0  | X  | X  | R5 | R4 | R3 | R2 | R1 | R0 | X  | X  |                              |
|                  | X   | X   | G5  | G4  | G3  | G2  | G1  | G0  | X  | X  | B5 | B4 | B3 | B2 | B1 | B0 | X  | X  |                              |

Table 5.10 16-bit parallel interface GRAM read table

- Parallel 9-Bit Bus Interface (BS2,BS1,BS0="110")

| Register Command | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Register   |                              |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|------------|------------------------------|
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 0  | 2EH        |                              |
| Read Data Format | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Color      |                              |
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | Dummy Read |                              |
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | R5 | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3         | 262K-Color (1-pixel/ 2bytes) |
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0         |                              |
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | B5 | B4 | B3 | B2 | B1 | B0 | X  | X  |            |                              |

Table 5.11 9-bit parallel interface GRAM read table

- Parallel 18-Bit Bus Interface (BS2,BS1,BS0="111")

| Register Command | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Register   |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|------------|
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 0  | 2EH        |
| Read Data Format | D17 | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Color      |
|                  | X   | X   | X   | X   | X   | X   | X   | X   | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | Dummy Read |
|                  | R5  | R4  | R3  | R2  | R1  | R0  | G5  | G4  | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 | 262K-Color |
|                  |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |            |
|                  |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |            |

Table 5.12 18-bit parallel interface GRAM read table

### 5.1.3 Serial Interface

The HX8353-E supports serial data transfer interface. The interface selection by setting BS2=0 for serial interface mode. The 3-wires serial bus and 4-wires serial bus is select by SPI\_SEL pin. When SPI\_SEL pin is low (VSSD), it is selected by 3-wires serial bus and use: chip select line (NCS), serial input/output data (SDA), and the serial transfer clock line (DNC\_SCL). When SPI\_SEL pin is high (IOVCC), it is selected by 4-wires serial bus and use: chip select line (NCS), serial input/output data (SDA), and the serial transfer clock line (DNC\_SCL) and the command or data transfer signal (NWR\_RNW).

#### Serial data write mode

The 3-wires serial data packet contains a control bit DNC and a transmission byte, and in 4-wires serial case data packet contains just transmission byte and control bit DNC is transferred by NWR\_RNW pin. If NWR\_RNW is low, the transmission byte is command byte. If NWR\_RNW is high, the transmission byte is stored to command register or GRAM. The MSB is transmitted first. The serial interface is initialized when NCS is high. In this state, DNC\_SCL clock pulse or SDA data have no effect. A falling edge on NCS enables the serial interface and indicates the start of data transmission.

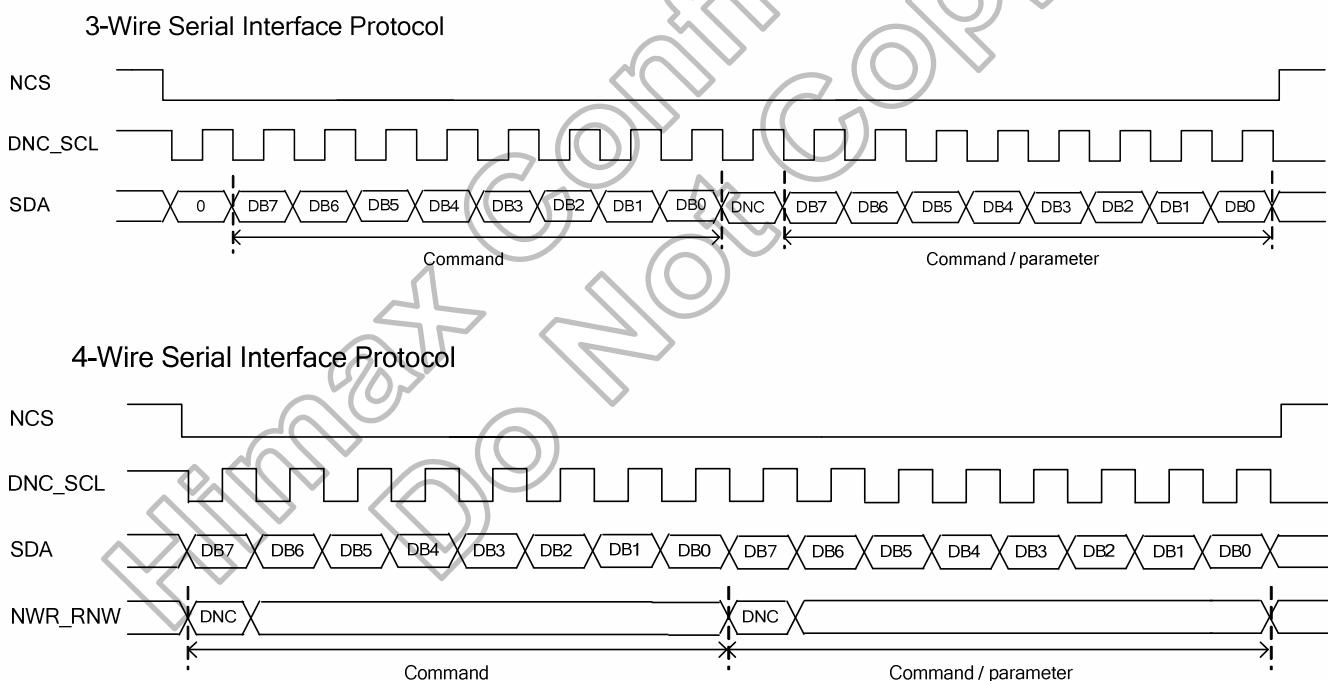
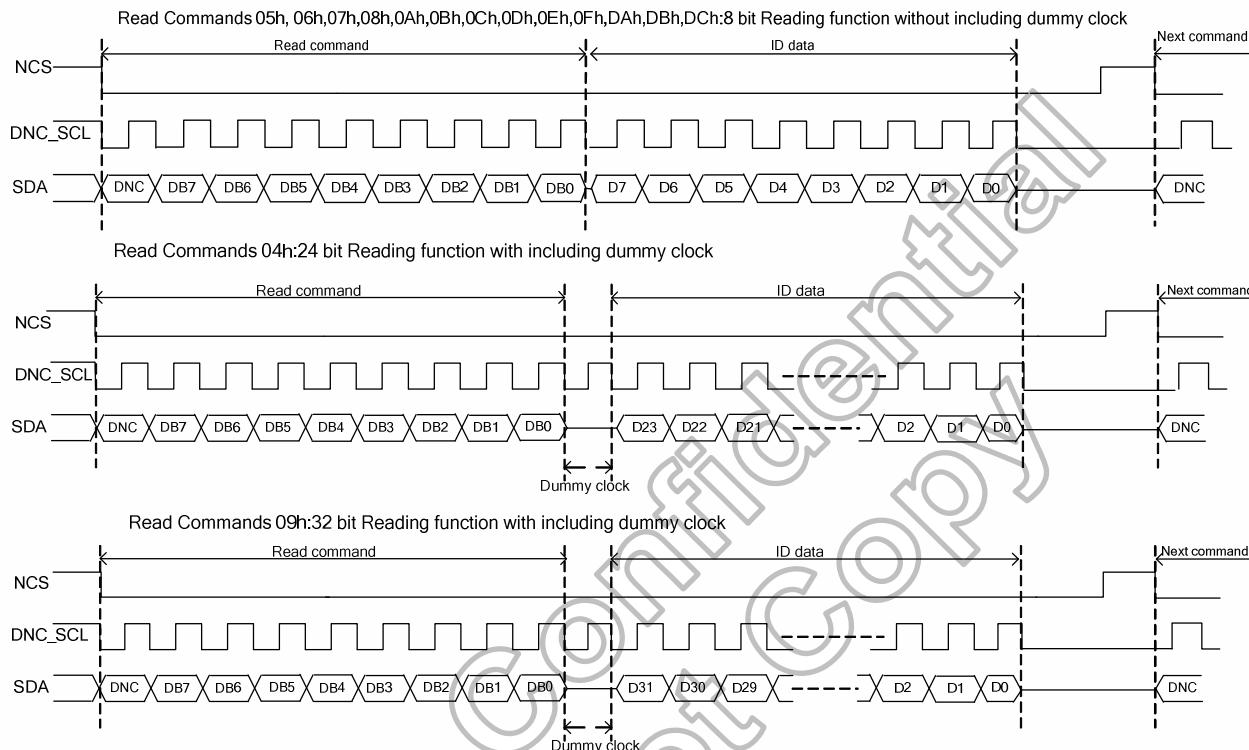


Figure 5.19 Serial interface protocol 3-/4- wire, write mode

## Serial data read mode

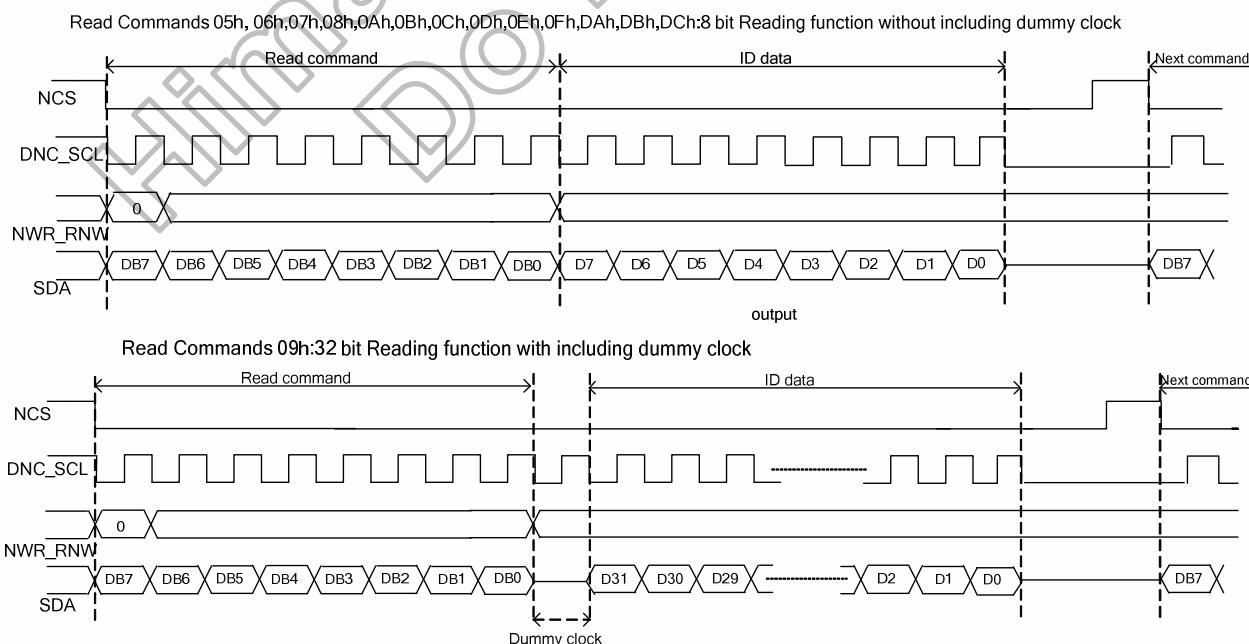
The microcontroller first has to send a command and then the following byte is transmitted in the opposite direction. The read mode has three type command data transmitted (8- / 24- / 32-bit) is according command code.

### 3-Wire Serial Interface Protocol



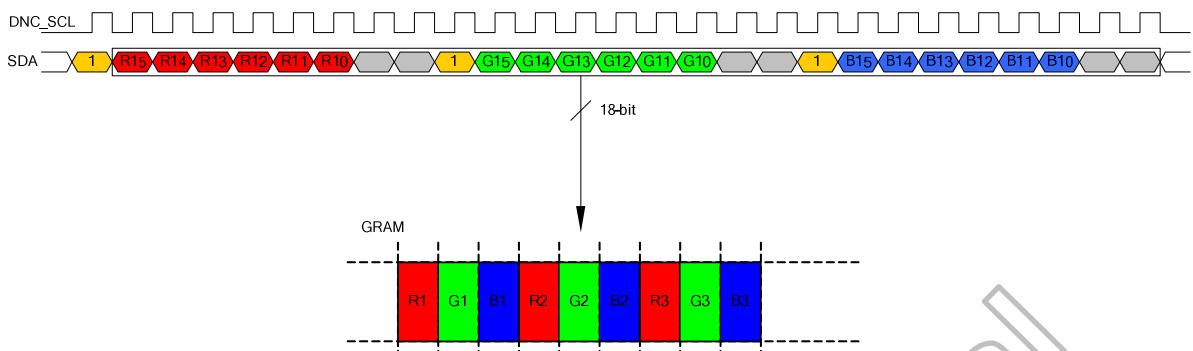
**Figure 5.20 3-wire serial interface protocol, read mode**

### 4-Wire Serial Interface Protocol

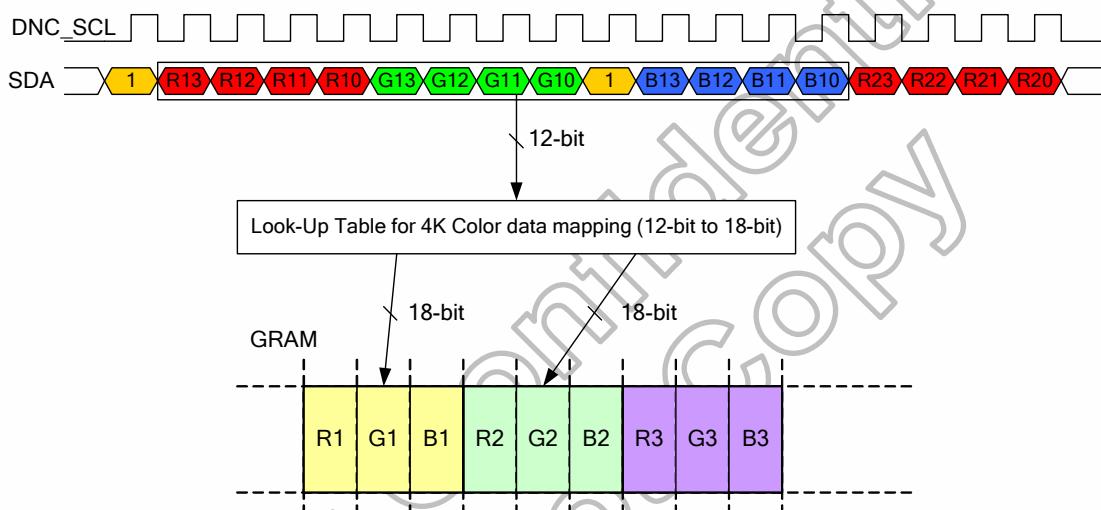


**Figure 5.21 4-wire serial interface protocol, read mode**

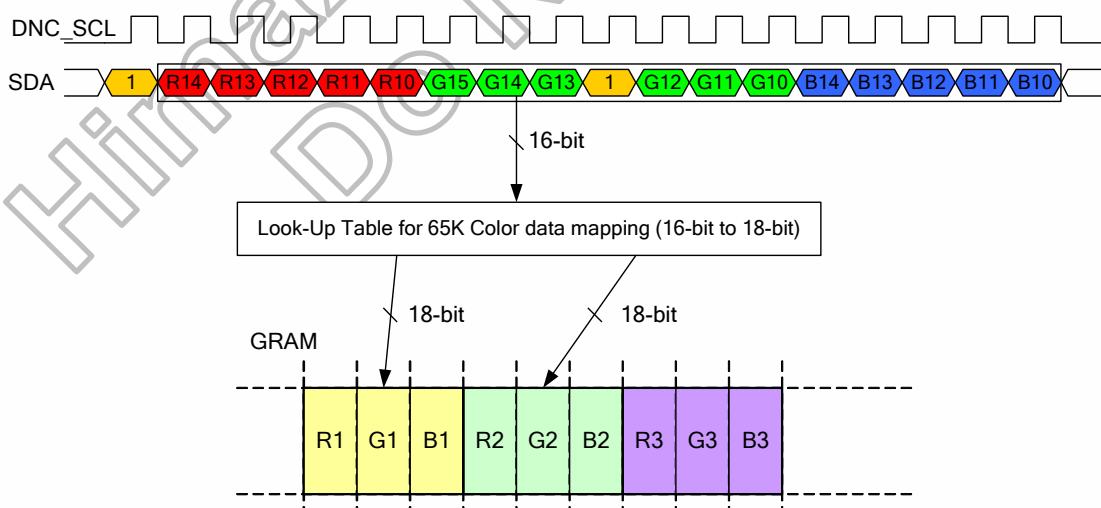
The data format that write display data to SRAM at Serial data bus Interface is shown as Figure5. 22 ~ Figure5. 27.



**Figure 5.22 3-wire serial write data for RGB (6-6-6) bit input**



**Figure 5.23 3-wire serial write data for RGB 4-4-4-bit input**



**Figure 5.24 3-wire serial write data for RGB 5-6-5-bit input**

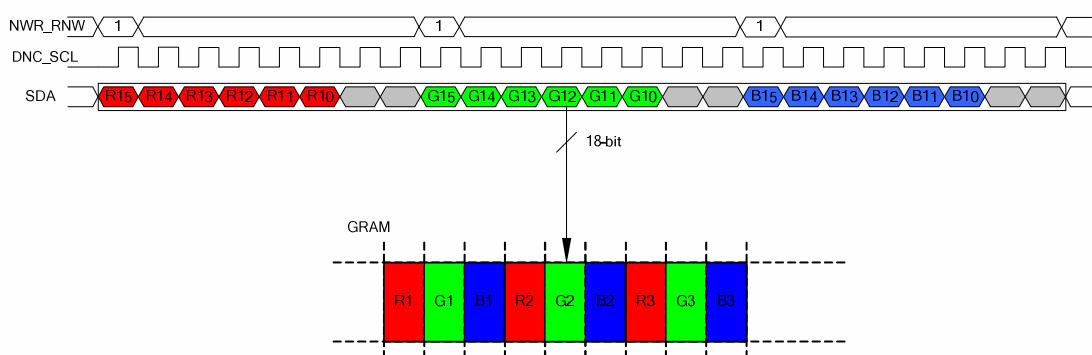


Figure 5.25 4-wire serial write data for RGB (6-6-6) bit input

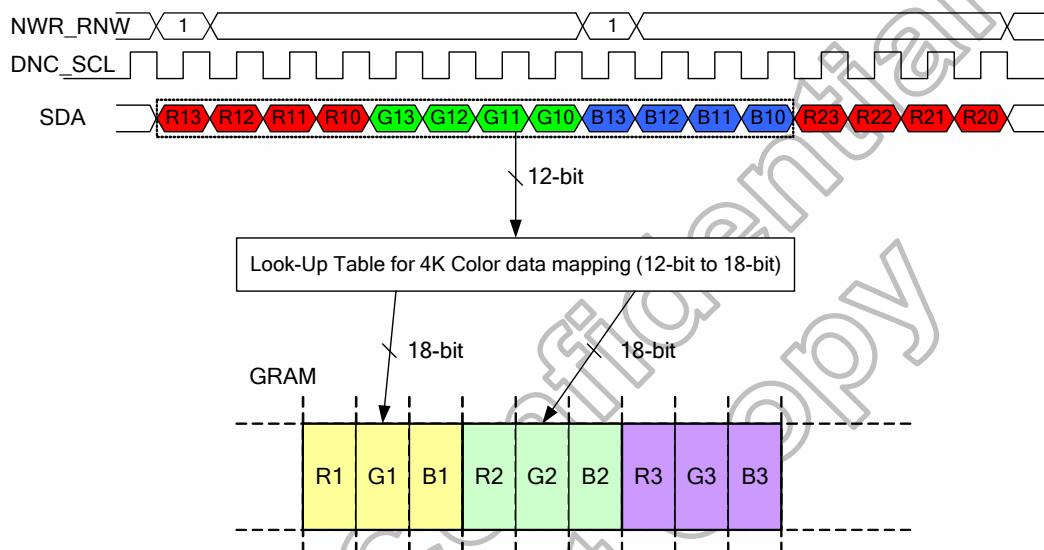


Figure 5.26 4-wire serial write data for RGB 4-4-4-bit input

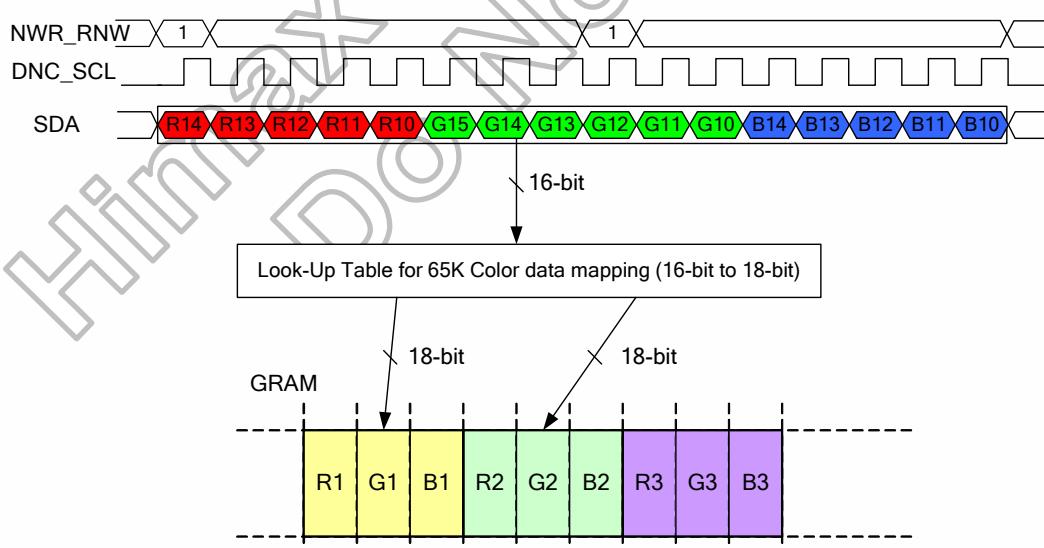
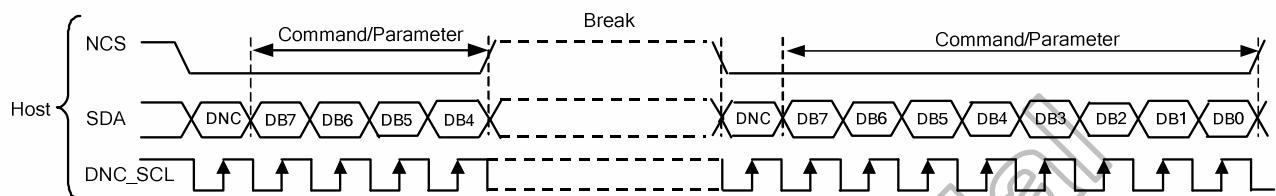


Figure 5.27 4-wire serial write data for RGB 5-6-5-bit input

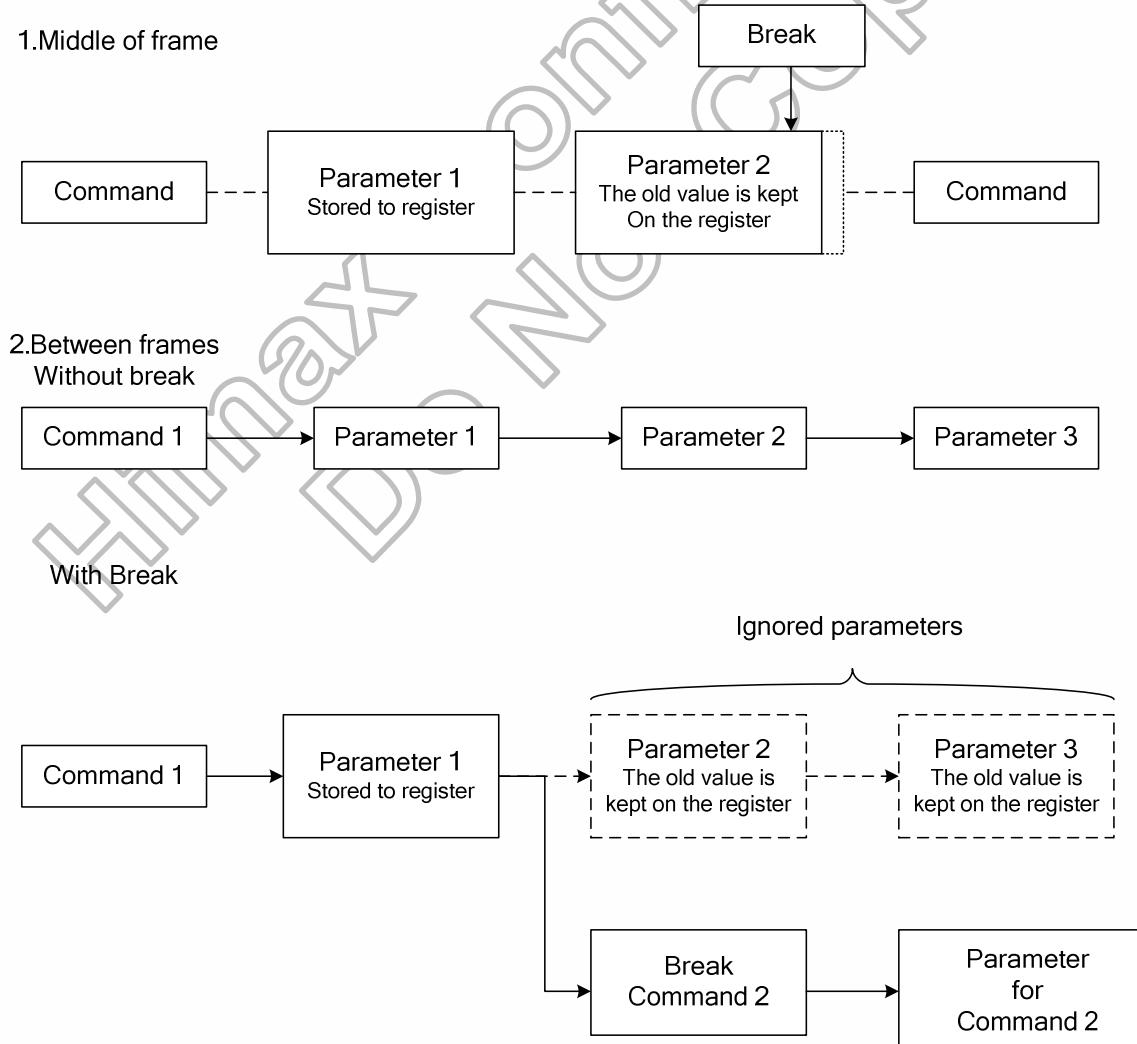
### 5.1.4 Display module data transfer recovery

If there is a break on data transmission when transmitting a command before a whole byte has been completed, then the display module will reset the interface so that it will be ready to receive the same byte re-transmitted when the chip select line (NCS) is next activated. See the following figure.



**Figure 5.28 Display module data transfer recovery**

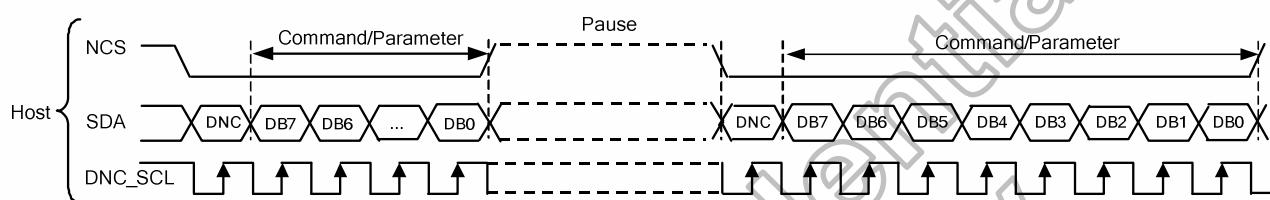
If 1 or more parameter command is being sent and a break occurs while sending any parameter before the last one and if the host then sends a new command rather than re-transmitting the parameter that was interrupted, then the parameters that were successfully sent are stored and the parameter where the break occurred is rejected. The interface is ready to receive next byte as shown:



### 5.1.5 Display module data transfer pause

It will be possible when transferring a Command, Frame Memory Data or Multiple Parameter Data to invoke a pause in the data transmission. If the Chip Select Line is released after a whole byte of a Frame Memory Data or Multiple Parameter Data has been completed, then the Display Module will wait and continue the Frame Memory Data or Parameter Data Transmission from the point where it was paused. If the Chip Select Line is released after a whole byte of a command has been completed, then the Display Module will receive either the command's parameters (if appropriate) or a new command when the Chip Select Line is next enabled as shown below:

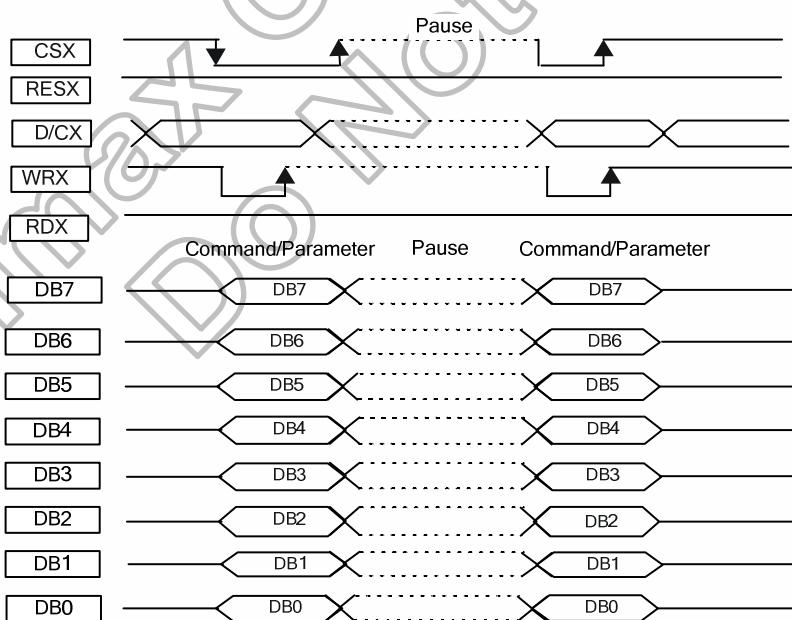
#### Serial interface pause



This applies to the following 4 conditions:

- Command-Pause-Command
- Command-Pause-Parameter
- Parameter-Pause-Command
- Parameter-Pause-Parameter

#### Parallel interface pause



This applies to the following 4 conditions:

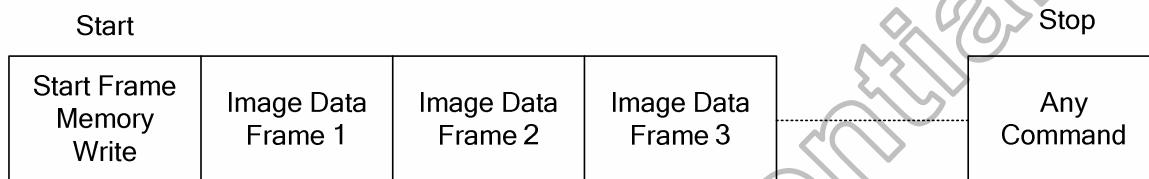
- Command-Pause-Command
- Command-Pause-Parameter
- Parameter-Pause-Command
- Parameter-Pause-Parameter

### 5.1.6 Display module data transfer modes

The Module has three colour modes for transferring data to the display RAM. These are 12-bit colour per pixel, 16-bit colour per pixel and 18-bit colour per pixel. The data format is described for each interface. Data can be downloaded to the Frame Memory by 2 methods.

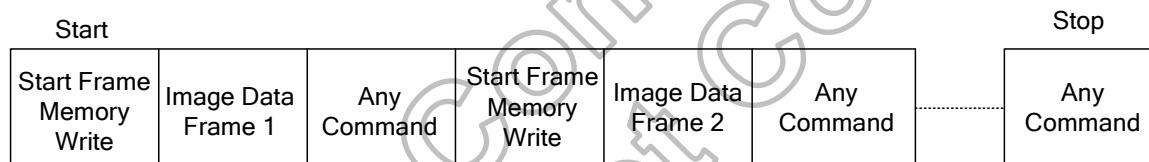
#### Method 1:

The Image data is sent to the Frame Memory in successive Frame writes, each time the Frame Memory is filled, the Frame Memory pointer is reset to the start point and the next Frame is written.



#### Method 2:

Image Data is sent and at the end of each Frame Memory download, a command is sent to stop Frame Memory Write. Then Start Memory Write command is sent, and a new Frame is downloaded.



**Note:** (1) These apply to all Data Transfer Colour modes on both Serial and Parallel interfaces.

(2) The Frame Memory can contain both odd and even number of pixels for both Methods. Only complete pixel data will be stored in the Frame Memory.

## 5.2 Color depth conversion

| R input (4bit)<br>12 bit/pixel -mode<br>4,096 colors | R input (5 bit)<br>16 bit/pixel -mode<br>65,536 colors | R output (6bit)<br>18 bit/pixel -mode<br>262,144 colors | RGBSET Parameter |
|--|--|---|------------------|
| 0000   | 00000  | R005 R004 R003 R002 R001 R000                           | 1                |
| 0001   | 00001  | R015 R014 R013 R012 R011 R010                           | 2                |
| 0010   | 00010  | R025 R024 R023 R022 R021 R020                           | 3                |
| 0011   | 00011  | R035 R034 R033 R032 R031 R030                           | 4                |
| 0100   | 00100  | R045 R044 R043 R042 R041 R040                           | 5                |
| 0101   | 00101  | R055 R054 R053 R052 R051 R050                           | 6                |
| 0110   | 00110  | R065 R064 R063 R062 R061 R060                           | 7                |
| 0111   | 00111  | R075 R074 R073 R072 R071 R070                           | 8                |
| 1000   | 01000  | R085 R084 R083 R082 R081 R080                           | 9                |
| 1001   | 01001  | R095 R094 R093 R092 R091 R090                           | 10               |
| 1010   | 01010  | R105 R104 R103 R102 R101 R100                           | 11               |
| 1011   | 01011  | R115 R114 R113 R112 R111 R110                           | 12               |
| 1100   | 01100  | R125 R124 R123 R122 R121 R120                           | 13               |
| 1101   | 01101  | R135 R134 R133 R132 R131 R130                           | 14               |
| 1110   | 01110  | R145 R144 R143 R142 R141 R140                           | 15               |
| 1111   | 01111  | R155 R154 R153 R152 R151 R150                           | 16               |
| No Input   | 10000  | R165 R164 R163 R162 R161 R160                           | 17               |
| No Input   | 10001  | R175 R174 R173 R172 R171 R170                           | 18               |
| No Input   | 10010  | R185 R184 R183 R182 R181 R180                           | 19               |
| No Input   | 10011  | R195 R194 R193 R192 R191 R190                           | 20               |
| No Input   | 10100  | R205 R204 R203 R202 R201 R200                           | 21               |
| No Input   | 10101  | R215 R214 R213 R212 R211 R210                           | 22               |
| No Input   | 10110  | R225 R224 R223 R222 R221 R220                           | 23               |
| No Input   | 10111  | R235 R234 R233 R232 R231 R230                           | 24               |
| No Input   | 11000  | R245 R244 R243 R242 R241 R240                           | 25               |
| No Input   | 11001  | R255 R254 R253 R252 R251 R250                           | 26               |
| No Input   | 11010  | R265 R264 R263 R262 R261 R260                           | 27               |
| No Input   | 11011  | R275 R274 R273 R272 R271 R270                           | 28               |
| No Input   | 11100  | R285 R284 R283 R282 R281 R280                           | 29               |
| No Input   | 11101  | R295 R294 R293 R292 R291 R290                           | 30               |
| No Input   | 11110  | R305 R304 R303 R302 R301 R300                           | 31               |
| No Input   | 11111  | R315 R314 R313 R312 R311 R310                           | 32               |

| G input (4bit)<br>12 bit/pixel -mode<br>4,096 colors | G input (6 bit)<br>16 bit/pixel -mode<br>65,536 colors | G output (6bit)<br>18 bit/pixel -mode<br>262,144 colors | RGBSET Parameter |
|--|--|---|------------------|
| 0000   | 000000   | G005 G004 G003 G002 G001 G000                           | 33               |
| 0001   | 000001   | G015 G014 G013 G012 G011 G010                           | 34               |
| 0010   | 000010   | G025 G024 G023 G022 G021 G020                           | 35               |
| 0011   | 000011   | G035 G034 G033 G032 G031 G030                           | 36               |
| 0100   | 000100   | G045 G044 G043 G042 G041 G040                           | 37               |
| 0101   | 000101   | G055 G054 G053 G052 G051 G050                           | 38               |
| 0110   | 000110   | G065 G064 G063 G062 G061 G060                           | 39               |
| 0111   | 000111   | G075 G074 G073 G072 G071 G070                           | 40               |
| 1000   | 001000   | G085 G084 G083 G082 G081 G080                           | 41               |
| 1001   | 001001   | G095 G094 G093 G092 G091 G090                           | 42               |
| 1010   | 001010   | G105 G104 G103 G102 G101 G100                           | 43               |
| 1011   | 001011   | G115 G114 G113 G112 G111 G110                           | 44               |
| 1100   | 001100   | G125 G124 G123 G122 G121 G120                           | 45               |
| 1101   | 001101   | G135 G134 G133 G132 G131 G130                           | 46               |
| 1110   | 001110   | G145 G144 G143 G142 G141 G140                           | 47               |
| 1111   | 001111   | G155 G154 G153 G152 G151 G150                           | 48               |
| No Input   | 010000   | G165 G164 G163 G162 G161 G160                           | 49               |
| No Input   | 010001   | G175 G174 G173 G172 G171 G170                           | 50               |
| No Input   | 010010   | G185 G184 G183 G182 G181 G180                           | 51               |
| No Input   | 010011   | G195 G194 G193 G192 G191 G190                           | 52               |
| No Input   | 010100   | G205 G204 G203 G202 G201 G200                           | 53               |
| No Input   | 010101   | G215 G214 G213 G212 G211 G210                           | 54               |
| No Input   | 010110   | G225 G224 G223 G222 G221 G220                           | 55               |
| No Input   | 010111   | G235 G234 G233 G232 G231 G230                           | 56               |
| No Input   | 011000   | G245 G244 G243 G242 G241 G240                           | 57               |
| No Input   | 011001   | G255 G254 G253 G252 G251 G250                           | 58               |
| No Input   | 011010   | G265 G264 G263 G262 G261 G260                           | 59               |
| No Input   | 011011   | G275 G274 G273 G272 G271 G270                           | 60               |
| No Input   | 011100   | G285 G284 G283 G282 G281 G280                           | 61               |
| No Input   | 011101   | G295 G294 G293 G292 G291 G290                           | 62               |
| No Input   | 011110   | G305 G304 G303 G302 G301 G300                           | 63               |
| No Input   | 011111   | G315 G314 G313 G312 G311 G310                           | 64               |

| G input (4bit)<br>12 bit/pixel -mode<br>4,096 colors | G input (6 bit)<br>16 bit/pixel -mode<br>65,536 colors | G output (6bit)<br>18 bit/pixel -mode<br>262,144 colors | RGBSET Parameter |
|--|--|---|------------------|
| No Input   | 100000   | G325 G324 G323 G322 G321 G320                           | 65               |
| No Input   | 100001   | G335 G334 G333 G332 G331 G330                           | 66               |
| No Input   | 100010   | G345 G344 G343 G342 G341 G340                           | 67               |
| No Input   | 100011   | G355 G354 G353 G352 G351 G350                           | 68               |
| No Input   | 100100   | G365 G364 G363 G362 G361 G360                           | 69               |
| No Input   | 100101   | G375 G374 G373 G372 G371 G370                           | 70               |
| No Input   | 100110   | G385 G384 G383 G382 G381 G380                           | 71               |
| No Input   | 100111   | G395 G394 G393 G392 G391 G390                           | 72               |
| No Input   | 101000   | G405 G404 G403 G402 G401 G400                           | 73               |
| No Input   | 101001   | G415 G414 G413 G412 G411 G410                           | 74               |
| No Input   | 101010   | G425 G424 G423 G422 G421 G420                           | 75               |
| No Input   | 101011   | G435 G434 G433 G432 G431 G430                           | 76               |
| No Input   | 101100   | G445 G444 G443 G442 G441 G440                           | 77               |
| No Input   | 101101   | G455 G454 G453 G452 G451 G450                           | 78               |
| No Input   | 101110   | G465 G464 G463 G462 G461 G460                           | 79               |
| No Input   | 101111   | G475 G474 G473 G472 G471 G470                           | 80               |
| No Input   | 110000   | G485 G484 G483 G482 G481 G480                           | 81               |
| No Input   | 110001   | G495 G494 G493 G492 G491 G490                           | 82               |
| No Input   | 110010   | G505 G504 G503 G502 G501 G500                           | 83               |
| No Input   | 110011   | G515 G514 G513 G512 G511 G510                           | 84               |
| No Input   | 110100   | G525 G524 G523 G522 G521 G520                           | 85               |
| No Input   | 110101   | G535 G534 G533 G532 G531 G530                           | 86               |
| No Input   | 110110   | G545 G544 G543 G542 G541 G540                           | 87               |
| No Input   | 110111   | G555 G554 G553 G552 G551 G550                           | 88               |
| No Input   | 111000   | G565 G564 G563 G562 G561 G560                           | 89               |
| No Input   | 111001   | G575 G574 G573 G572 G571 G570                           | 90               |
| No Input   | 111010   | G585 G584 G583 G582 G581 G580                           | 91               |
| No Input   | 111011   | G595 G594 G593 G592 G591 G590                           | 92               |
| No Input   | 111100   | G605 G604 G603 G602 G601 G600                           | 93               |
| No Input   | 111101   | G615 G614 G613 G612 G611 G610                           | 94               |
| No Input   | 111110   | G625 G624 G623 G622 G621 G620                           | 95               |
| No Input   | 111111   | G635 G634 G533 G632 G631 G630                           | 96               |

| B input (4bit)<br>12 bit/pixel -mode<br>4,096 colors | B input (5 bit)<br>16 bit/pixel -mode<br>65,536 colors | B output (6bit)<br>18 bit/pixel -mode<br>262,144 colors | RGBSET Parameter |
|--|--|---|------------------|
| 0000   | 00000  | B005 B004 B003 B002 B001 B000                           | 97               |
| 0001   | 00001  | B015 B014 B013 B012 B011 B010                           | 98               |
| 0010   | 00010  | B025 B024 B023 B022 B021 B020                           | 99               |
| 0011   | 00011  | B035 B034 B033 B032 B031 B030                           | 100              |
| 0100   | 00100  | B045 B044 B043 B042 B041 B040                           | 101              |
| 0101   | 00101  | B055 B054 B053 B052 B051 B050                           | 102              |
| 0110   | 00110  | B065 B064 B063 B062 B061 B060                           | 103              |
| 0111   | 00111  | B075 B074 B073 B072 B071 B070                           | 104              |
| 1000   | 01000  | B085 B084 B083 B082 B081 B080                           | 105              |
| 1001   | 01001  | B095 B094 B093 B092 B091 B090                           | 106              |
| 1010   | 01010  | B105 B104 B103 B102 B101 B100                           | 107              |
| 1011   | 01011  | B115 B114 B113 B112 B111 B110                           | 108              |
| 1100   | 01100  | B125 B124 B123 B122 B121 B120                           | 109              |
| 1101   | 01101  | B135 B134 B133 B132 B131 B130                           | 110              |
| 1110   | 01110  | B145 B144 B143 B142 B141 B140                           | 111              |
| 1111   | 01111  | B155 B154 B153 B152 B151 B150                           | 112              |
| No Input   | 10000  | B165 B164 B163 B162 B161 B160                           | 113              |
| No Input   | 10001  | B175 B174 B173 B172 B171 B170                           | 114              |
| No Input   | 10010  | B185 B184 B183 B182 B181 B180                           | 115              |
| No Input   | 10011  | B195 B194 B193 B192 B191 B190                           | 116              |
| No Input   | 10100  | B205 B204 B203 B202 B201 B200                           | 117              |
| No Input   | 10101  | B215 B214 B213 B212 B211 B210                           | 118              |
| No Input   | 10110  | B225 B224 B223 B222 B221 B220                           | 119              |
| No Input   | 10111  | B235 B234 B233 B232 B231 B230                           | 120              |
| No Input   | 11000  | B245 B244 B243 B242 B241 B240                           | 121              |
| No Input   | 11001  | B255 B254 B253 B252 B251 B250                           | 122              |
| No Input   | 11010  | B265 B264 B263 B262 B261 B260                           | 123              |
| No Input   | 11011  | B275 B274 B273 B272 B271 B270                           | 124              |
| No Input   | 11100  | B285 B284 B283 B282 B281 B280                           | 125              |
| No Input   | 11101  | B295 B294 B293 B292 B291 B290                           | 126              |
| No Input   | 11110  | B305 B304 B303 B302 B301 B300                           | 127              |
| No Input   | 11111  | B315 B314 B313 B312 B311 B310                           | 128              |

## 6. Display Data GRAM

The display data RAM stores display dots and consists of 384,912 bits (132x18x162 bits). There is no restriction on access to the RAM even when the display data on the same address is loaded to DAC. There will be no abnormal visible effect on the display when there is a simultaneous Panel Read and Interface Read or Write to the same location of the Frame Memory.

### 6.1 Display data GRAM mapping

Every pixel (18-bit) data in GRAM is located by a (Page, Column) address (Y, X). By specifying the arbitrary window address **CASET's SC, EC** and **PASET's SP, EP**, it is possible to access the GRAM by setting RAMWR or RAMRD commands from start positions of the window address.

|       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0000H | 0001H | 0002H | 0003H | ----- | 0080H | 0081H | 0082H | 0083H |
| 0100H | 0101H | 0102H | 0103H | ----- | 0180H | 0181H | 0182H | 0183H |
| 0200H | 0201H | 0202H | 0203H | ----- | 0280H | 0281H | 0282H | 0283H |
| 0300H | 0301H | 0302H | 0303H | ----- | 0380H | 0381H | 0382H | 0383H |
| 0400H | 0401H | 0402H | 0403H | ----- | 0480H | 0481H | 0482H | 0483H |
| 0500H | 0501H | 0502H | 0503H | ----- | 0580H | 0581H | 0582H | 0583H |
|       |       |       |       | ----- |       |       |       |       |
| 9C00H | 9C01H | 9C02H | 9C03H | ----- | 9C80H | 9C81H | 9C82H | 9C83H |
| 9D00H | 9D01H | 9D02H | 9D03H | ----- | 9D80H | 9D81H | 9D82H | 9D83H |
| 9E00H | 9E01H | 9E02H | 9E03H | ----- | 9E80H | 9E81H | 9E82H | 9E83H |
| 9F00H | 9F01H | 9F02H | 9F03H | ----- | 9F80H | 9F81H | 9F82H | 9F83H |
| A000H | A001H | A002H | A003H | ----- | A080H | A081H | A082H | A083H |
| A100H | A101H | A102H | A103H | ----- | A180H | A181H | A182H | A183H |

Table 6.1 GRAM address for display panel position

### 6.2 Address counter (AC) of GRAM

The HX8353-E contains an address counter (AC) which assigns address for writing/reading pixel data to/from GRAM. The address pointers set the position of GRAM. Every time when a pixel data is written into the GRAM, the X address or Y address of AC will be automatically increased by 1 (or decreased by 1), which is decided by the register (**MADTCL's MV(B5), MX(B6)** and **MY(B7)** bits) setting.

To simplify the address control of GRAM access, the window address function allows for writing data only to a window area of GRAM specified by registers. After data being written to the GRAM, the AC will be increased or decreased within setting window address-range which is specified by the **CASET** (start: **SC**, end: **EC**) and the **PASET** (start: **SP**, end: **EP**). Therefore, the data can be written consecutively without thinking a data wrap by those bit function.

### 6.2.1 System interface to GRAM write direction

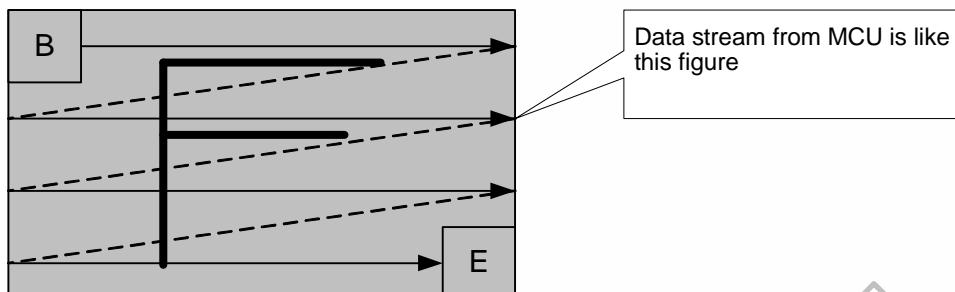


Figure 6.1 Image data sending order from host

The data is written in the order illustrated above. The counter which dictates where in the physical memory the data is to be written is controlled by **MADTCL's MV(B5), MX(B6) and MY(B7)** bits setting

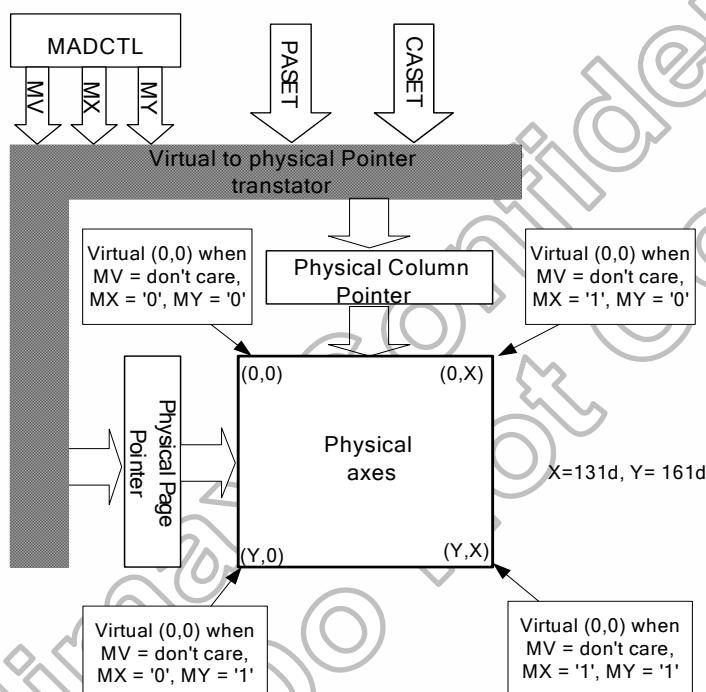


Figure 6.2 Image data writing control

| MV | MX | MY | CASET                                   | PASET                                   |
|----|----|----|---|---|
| 0  | 0  | 0  | Direct to Physical Column Pointer       | Direct to Physical Page Pointer         |
| 0  | 0  | 1  | Direct to Physical Column Pointer       | Direct to (Y - Physical Page Pointer)   |
| 0  | 1  | 0  | Direct to (X-Physical Column Pointer)   | Direct to Physical Page Pointer         |
| 0  | 1  | 1  | Direct to (X - Physical Column Pointer) | Direct to (Y - Physical Page Pointer)   |
| 1  | 0  | 0  | Direct to Physical Page Pointer         | Direct to Physical Column Pointer       |
| 1  | 0  | 1  | Direct to (Y - Physical Page Pointer)   | Direct to Physical Column Pointer       |
| 1  | 1  | 0  | Direct to Physical Page Pointer         | Direct to (X-Physical Column Pointer)   |
| 1  | 1  | 1  | Direct to (Y - Physical Page Pointer)   | Direct to (X - Physical Column Pointer) |

Table 6.2 CASET and PASET control for physical column/page pointers

For each image orientation, the controls for the column and page counters apply as below:

| Condition   | Column Counter           | Page Counter           |
|---|--------------------------|------------------------|
| When RAMWR/RAMRD command is accepted.                 | Return to "Start Column" | Return to "Start Page" |
| Complete Pixel Pair Write/Read action                 | Increment by 1           | No change              |
| The Column counter value is larger than "End column." | Return to "Start Column" | Increment by 1         |
| The Page counter value is larger than "End page".     | Return to "Start Column" | Return to "Start Page" |

**Note:** Data is always written to the Frame Memory in the same order, regardless of the Memory Write Direction set by MADCTL bits B7, B6 and B5.

**Table 6.3 Rules for updating GRAM order**

The following figure depicts the GRAM address update method with MV, MX and MY bit setting.

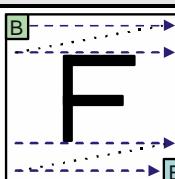
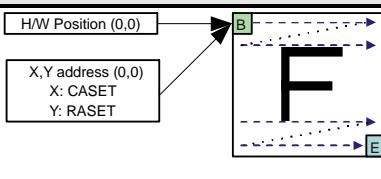
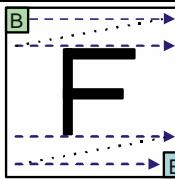
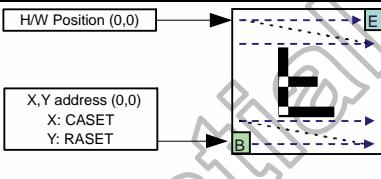
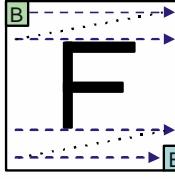
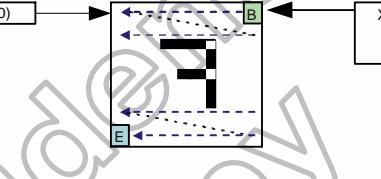
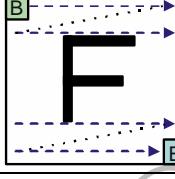
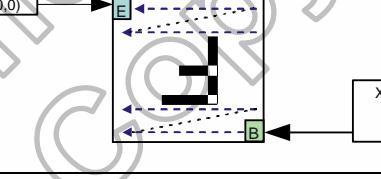
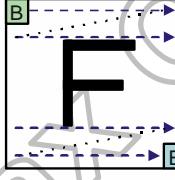
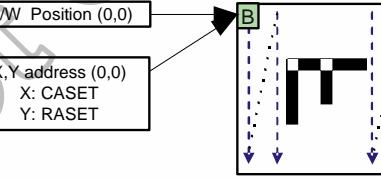
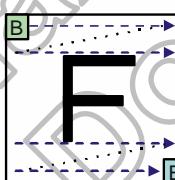
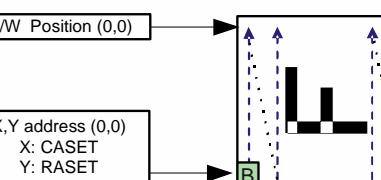
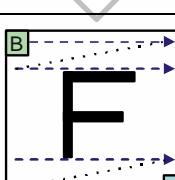
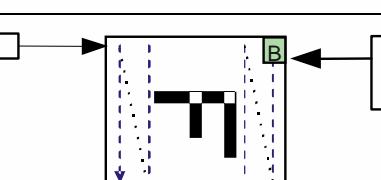
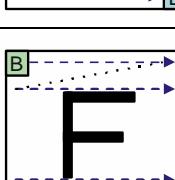
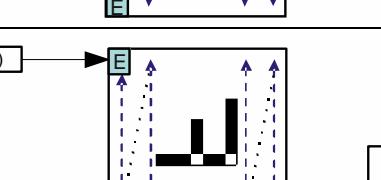
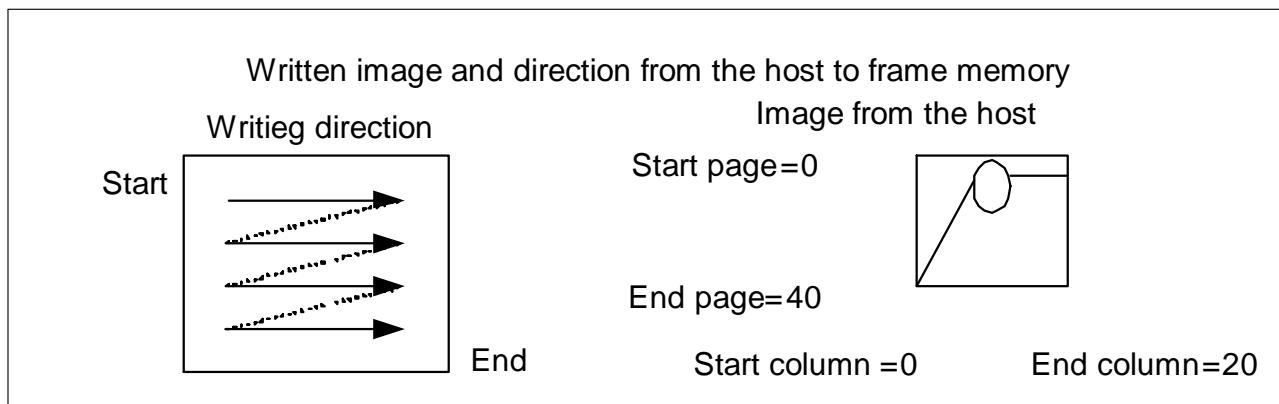
| Display Data Direction         | MADCTR parameter |    |    | Image in the Host   | Image in the Driver (GRAM)   |  |
|--------------------------------|------------------|----|----|---|--|--|
|                                | MV               | MX | MY |   |  |  |
| Normal                         | 0                | 0  | 0  |    |    | <p>H/W Position (0,0) → B → E</p> <p>X,Y address (0,0)<br/>X: CASET<br/>Y: RASET</p> |
| Y-Invert                       | 0                | 0  | 1  |    |    | <p>H/W Position (0,0) → B → E</p> <p>X,Y address (0,0)<br/>X: CASET<br/>Y: RASET</p> |
| X-Invert                       | 0                | 1  | 0  |    |    | <p>H/W Position (0,0) → B → E</p> <p>X,Y address (0,0)<br/>X: CASET<br/>Y: RASET</p> |
| X-Invert Y-Invert              | 0                | 1  | 1  |   |   | <p>H/W Position (0,0) → E → B</p> <p>X,Y address (0,0)<br/>X: CASET<br/>Y: RASET</p> |
| X-Y Exchange                   | 1                | 0  | 0  |  |  | <p>H/W Position (0,0) → B → E</p> <p>X,Y address (0,0)<br/>X: CASET<br/>Y: RASET</p> |
| X-Y Exchange X-invert          | 1                | 0  | 1  |  |  | <p>H/W Position (0,0) → B → E</p> <p>X,Y address (0,0)<br/>X: CASET<br/>Y: RASET</p> |
| X-Y Exchange Y-invert          | 1                | 1  | 0  |  |  | <p>H/W Position (0,0) → B → E</p> <p>X,Y address (0,0)<br/>X: CASET<br/>Y: RASET</p> |
| X-Y Exchange X-invert Y-invert | 1                | 1  | 1  |  |  | <p>H/W Position (0,0) → E → B</p> <p>X,Y address (0,0)<br/>X: CASET<br/>Y: RASET</p> |

Table 6.4 Address direction settings

### Example for rotation with MY, MX and MV

This example is using following values: start page=0, end page=40, start column=0 and end column=20=> commands: page address set (0, 40) and column address set (0, 20). The sent figure is as follows and its sending order is as follows.



### Image position on the frame memory with MY = 0/1, MX = 0/1, MV = 0/1

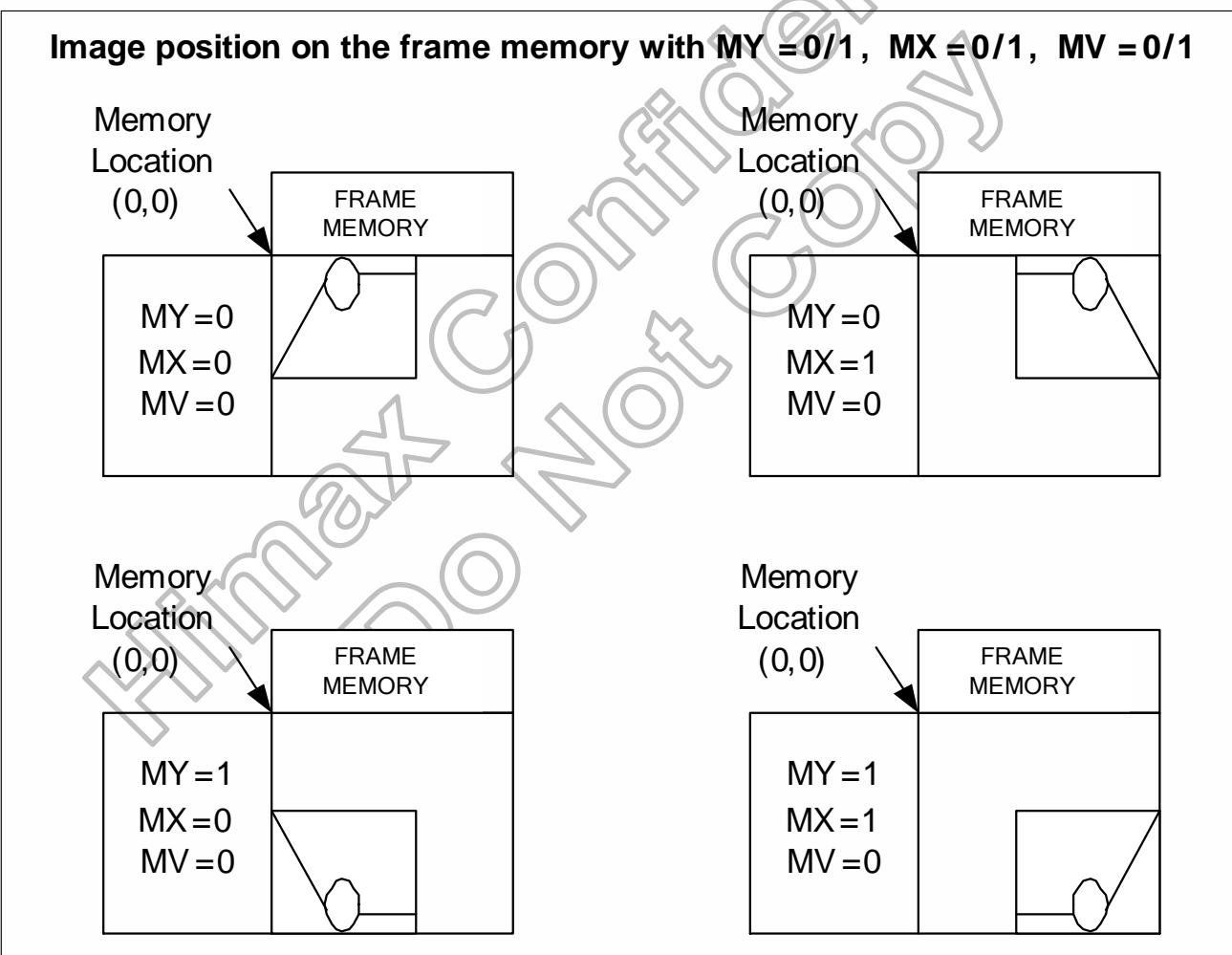
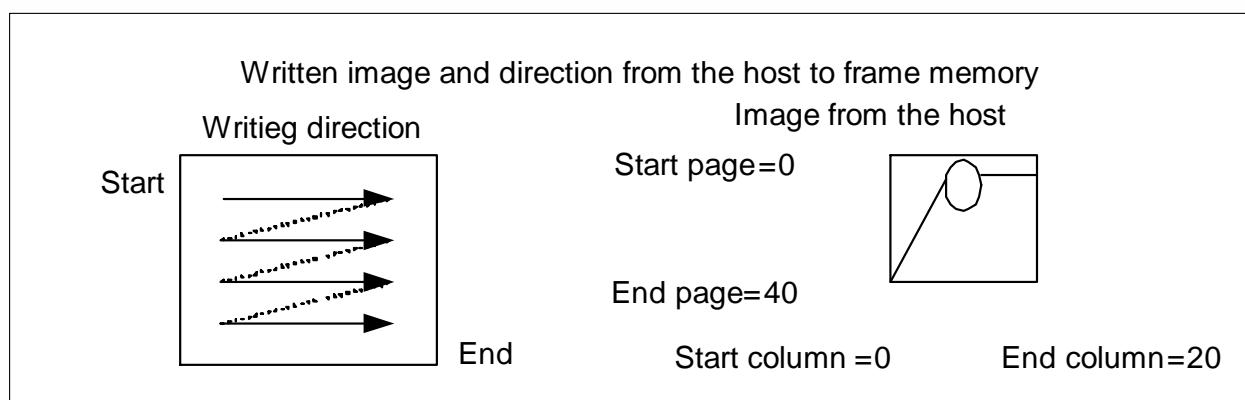


Figure 6.3 Example for rotation with MY, MX and MV – 1



### Image position on the frame memory with $MY = 0/1$ , $MX = 0/1$ , $MV = 0/1$

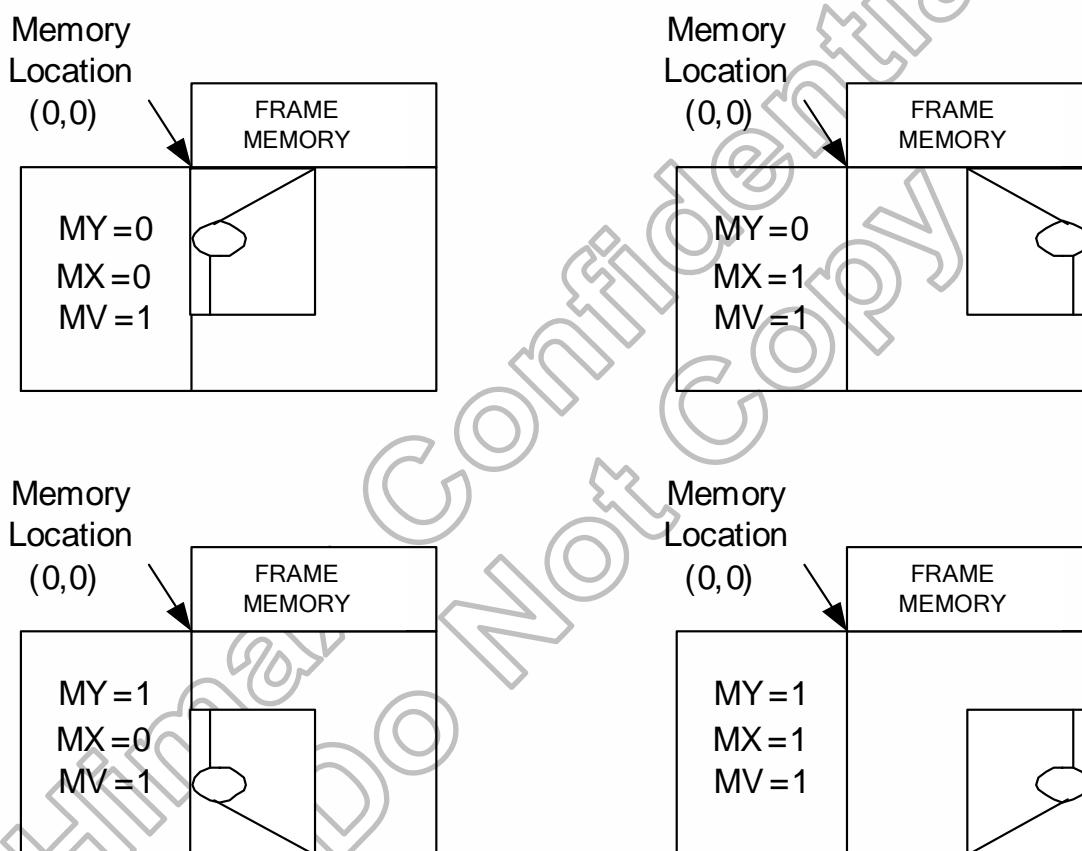
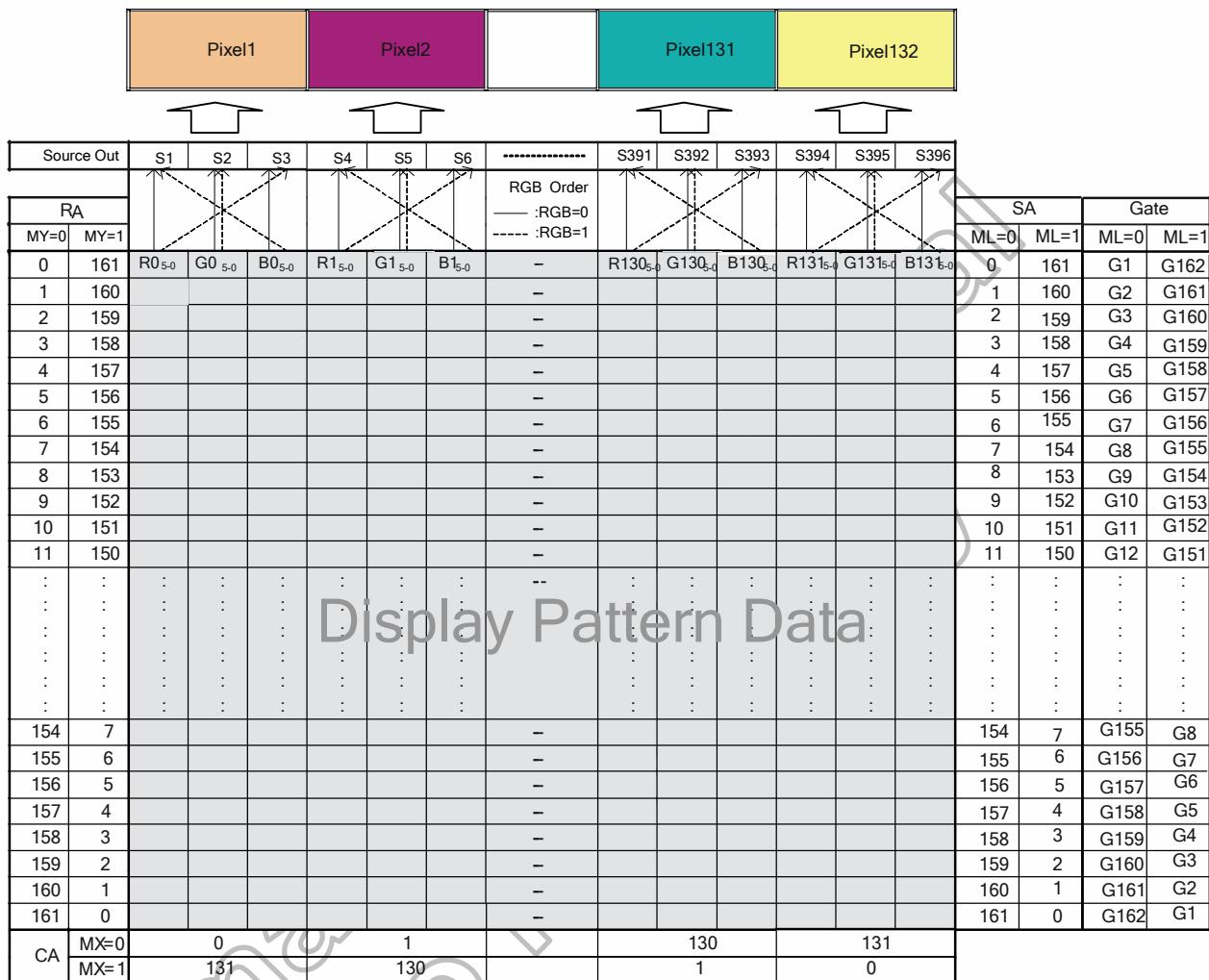


Figure 6.4 Example for rotation with  $MY$ ,  $MX$  and  $MV$  – 2

### 6.3 Source, gate and memory map

#### 6.3.1 When using 132 x 162 GRAM resolution, display resolution 132RGB x 162 (RSO[2:0]=3'b000 & STE\_SEL=0)



The table illustrates the memory mapping for the HX8353-E chip. The top row shows the display resolution (132RGB x 162) with individual pixels labeled Pixel1 through Pixel132. Below this is a detailed memory map:

| Source Out | S1   | S2                | S3                | S4                | S5                | S6                | -----             | S391     | S392                | S393                | S394                | S395                | S396                |                     |   |      |    |
|------------|------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|----------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---|------|----|
|            | RA   |                   |                   |                   |                   |                   | RGB Order         |          |                     |                     |                     |                     |                     |                     |   |      |    |
| MY=0       | MY=1 |                   |                   |                   |                   |                   |                   | — :RGB=0 |                     |                     |                     |                     |                     |                     |   |      |    |
| 0          | 161  | R0 <sub>5-0</sub> | G0 <sub>5-0</sub> | B0 <sub>5-0</sub> | R1 <sub>5-0</sub> | G1 <sub>5-0</sub> | B1 <sub>5-0</sub> | —        | R130 <sub>5-0</sub> | G130 <sub>5-0</sub> | B130 <sub>5-0</sub> | R131 <sub>5-0</sub> | G131 <sub>5-0</sub> | B131 <sub>5-0</sub> |   |      |    |
| 1          | 160  |                   |                   |                   |                   |                   |                   | —        |                     |                     |                     |                     |                     |                     |   |      |    |
| 2          | 159  |                   |                   |                   |                   |                   |                   | —        |                     |                     |                     |                     |                     |                     |   |      |    |
| 3          | 158  |                   |                   |                   |                   |                   |                   | —        |                     |                     |                     |                     |                     |                     |   |      |    |
| 4          | 157  |                   |                   |                   |                   |                   |                   | —        |                     |                     |                     |                     |                     |                     |   |      |    |
| 5          | 156  |                   |                   |                   |                   |                   |                   | —        |                     |                     |                     |                     |                     |                     |   |      |    |
| 6          | 155  |                   |                   |                   |                   |                   |                   | —        |                     |                     |                     |                     |                     |                     |   |      |    |
| 7          | 154  |                   |                   |                   |                   |                   |                   | —        |                     |                     |                     |                     |                     |                     |   |      |    |
| 8          | 153  |                   |                   |                   |                   |                   |                   | —        |                     |                     |                     |                     |                     |                     |   |      |    |
| 9          | 152  |                   |                   |                   |                   |                   |                   | —        |                     |                     |                     |                     |                     |                     |   |      |    |
| 10         | 151  |                   |                   |                   |                   |                   |                   | —        |                     |                     |                     |                     |                     |                     |   |      |    |
| 11         | 150  |                   |                   |                   |                   |                   |                   | —        |                     |                     |                     |                     |                     |                     |   |      |    |
| :          | :    | :                 | :                 | :                 | :                 | :                 | —                 | :        | :                   | :                   | :                   | :                   | :                   | :                   |   |      |    |
| :          | :    | :                 | :                 | :                 | :                 | :                 | —                 | :        | :                   | :                   | :                   | :                   | :                   | :                   |   |      |    |
| :          | :    | :                 | :                 | :                 | :                 | :                 | —                 | :        | :                   | :                   | :                   | :                   | :                   | :                   |   |      |    |
| :          | :    | :                 | :                 | :                 | :                 | :                 | —                 | :        | :                   | :                   | :                   | :                   | :                   | :                   |   |      |    |
| :          | :    | :                 | :                 | :                 | :                 | :                 | —                 | :        | :                   | :                   | :                   | :                   | :                   | :                   |   |      |    |
| 154        | 7    |                   |                   |                   |                   |                   | —                 |          |                     |                     |                     |                     |                     | 154                 | 7 | G155 | G8 |
| 155        | 6    |                   |                   |                   |                   |                   | —                 |          |                     |                     |                     |                     |                     | 155                 | 6 | G156 | G7 |
| 156        | 5    |                   |                   |                   |                   |                   | —                 |          |                     |                     |                     |                     |                     | 156                 | 5 | G157 | G6 |
| 157        | 4    |                   |                   |                   |                   |                   | —                 |          |                     |                     |                     |                     |                     | 157                 | 4 | G158 | G5 |
| 158        | 3    |                   |                   |                   |                   |                   | —                 |          |                     |                     |                     |                     |                     | 158                 | 3 | G159 | G4 |
| 159        | 2    |                   |                   |                   |                   |                   | —                 |          |                     |                     |                     |                     |                     | 159                 | 2 | G160 | G3 |
| 160        | 1    |                   |                   |                   |                   |                   | —                 |          |                     |                     |                     |                     |                     | 160                 | 1 | G161 | G2 |
| 161        | 0    |                   |                   |                   |                   |                   | —                 |          |                     |                     |                     |                     |                     | 161                 | 0 | G162 | G1 |
| CA         | MX=0 | 0                 |                   | 1                 |                   |                   |                   | 130      |                     | 131                 |                     |                     |                     |                     |   |      |    |
|            | MX=1 | 131               |                   | 130               |                   |                   |                   | 1        |                     | 0                   |                     |                     |                     |                     |   |      |    |

**Note:** RA = Row Address,  
 CA = Column Address,  
 SA = Scan Address,  
 MX = Mirror X-axis (Column address direction parameter), DB6 parameter of MADCTL command  
 MY = Mirror Y-axis (Row address direction parameter), DB7 parameter of MADCTL command  
 ML = Scan direction parameter, DB4 parameter of MADCTL command  
 RGB= Red, Green and Blue pixel position change, DB3 parameter of MADCTL command

Figure 6.5 Memory map, 132 x 162 GRAM resolution, display resolution 132RGB x 162

### 6.3.2 When using 132 x 162 GRAM resolution, display resolution 128RGB x 160 (RSO[2:0]=3'b000 & STE\_SEL=1)

| Pixel1 Pixel2 Pixel127 Pixel128 |      |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     |                     |                     |
|---------------------------------|------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Source Out                      | S7   | S8                | S9                | S10               | S11               | S12               | -----             | S385 | S386                | S387                | S388                | S389                | S390                |                     |
| RA                              |      |                   |                   |                   |                   |                   | RGB Order         |      |                     |                     |                     |                     |                     |                     |
| MY=0                            |      |                   |                   |                   |                   |                   | — :RGB=0          |      |                     |                     |                     |                     |                     |                     |
| MY=1                            |      |                   |                   |                   |                   |                   | --- :RGB=1        |      |                     |                     |                     |                     |                     |                     |
| 0                               | 161  | R0 <sub>5:0</sub> | G0 <sub>5:0</sub> | B0 <sub>5:0</sub> | R1 <sub>5:0</sub> | G1 <sub>5:0</sub> | B1 <sub>5:0</sub> | —    | R126 <sub>5:0</sub> | G126 <sub>5:0</sub> | B126 <sub>5:0</sub> | R127 <sub>5:0</sub> | G127 <sub>5:0</sub> | B127 <sub>5:0</sub> |
| 1                               | 160  |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     |                     |
| 2                               | 159  |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     |                     |
| 3                               | 158  |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     |                     |
| 4                               | 157  |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     |                     |
| 5                               | 156  |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     |                     |
| 6                               | 155  |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     |                     |
| 7                               | 154  |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 7 154 G8 G155       |
| 8                               | 153  |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 8 153 G9 G154       |
| 9                               | 152  |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 9 152 G10 G153      |
| 10                              | 151  |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 10 151 G11 G152     |
| 11                              | 150  |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 11 150 G12 G151     |
| :                               | :    | :                 | :                 | :                 | :                 | :                 | —                 | :    | :                   | :                   | :                   | :                   | :                   | :                   |
| :                               | :    | :                 | :                 | :                 | :                 | :                 | —                 | :    | :                   | :                   | :                   | :                   | :                   | :                   |
| :                               | :    | :                 | :                 | :                 | :                 | :                 | —                 | :    | :                   | :                   | :                   | :                   | :                   | :                   |
| :                               | :    | :                 | :                 | :                 | :                 | :                 | —                 | :    | :                   | :                   | :                   | :                   | :                   | :                   |
| :                               | :    | :                 | :                 | :                 | :                 | :                 | —                 | :    | :                   | :                   | :                   | :                   | :                   | :                   |
| 154                             | 7    |                   |                   |                   |                   |                   | —                 |      |                     |                     |                     |                     |                     | 154 7 G155 G8       |
| 155                             | 6    |                   |                   |                   |                   |                   | —                 |      |                     |                     |                     |                     |                     | 155 6 G156 G7       |
| 156                             | 5    |                   |                   |                   |                   |                   | —                 |      |                     |                     |                     |                     |                     | 156 5 G157 G6       |
| 157                             | 4    |                   |                   |                   |                   |                   | —                 |      |                     |                     |                     |                     |                     | 157 4 G158 G5       |
| 158                             | 3    |                   |                   |                   |                   |                   | —                 |      |                     |                     |                     |                     |                     | 158 3 G159 G4       |
| 159                             | 2    |                   |                   |                   |                   |                   | —                 |      |                     |                     |                     |                     |                     | 159 2 G160 G3       |
| 160                             | 1    |                   |                   |                   |                   |                   | —                 |      |                     |                     |                     |                     |                     | 160 1 G161 G2       |
| 161                             | 0    |                   |                   |                   |                   |                   | —                 |      |                     |                     |                     |                     |                     | 161 0 -- --         |
| CA                              | MX=0 | 0                 | 1                 | 126               | 126               | 127               | 127               |      |                     |                     |                     |                     |                     |                     |
|                                 | MX=1 | 127               | 126               | 1                 | 0                 |                   |                   |      |                     |                     |                     |                     |                     |                     |

**Note:** RA = Row Address,  
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 SA = Scan Address,  
 MX = Mirror X-axis (Column address direction parameter), DB6 parameter of MADCTL command  
 MY = Mirror Y-axis (Row address direction parameter), DB7 parameter of MADCTL command  
 ML = Scan direction parameter, DB4 parameter of MADCTL command  
 RGB= Red, Green and Blue pixel position change, DB3 parameter of MADCTL command

Figure 6.6 Memory map, 132 x 162 GRAM resolution, display resolution 128RGB x 160

### 6.3.3 When using 128 x 128 GRAM resolution, display resolution 128RGB x 128 (RSO[2:0]=3'b001)

Pixel1      Pixel2           Pixel127      Pixel128



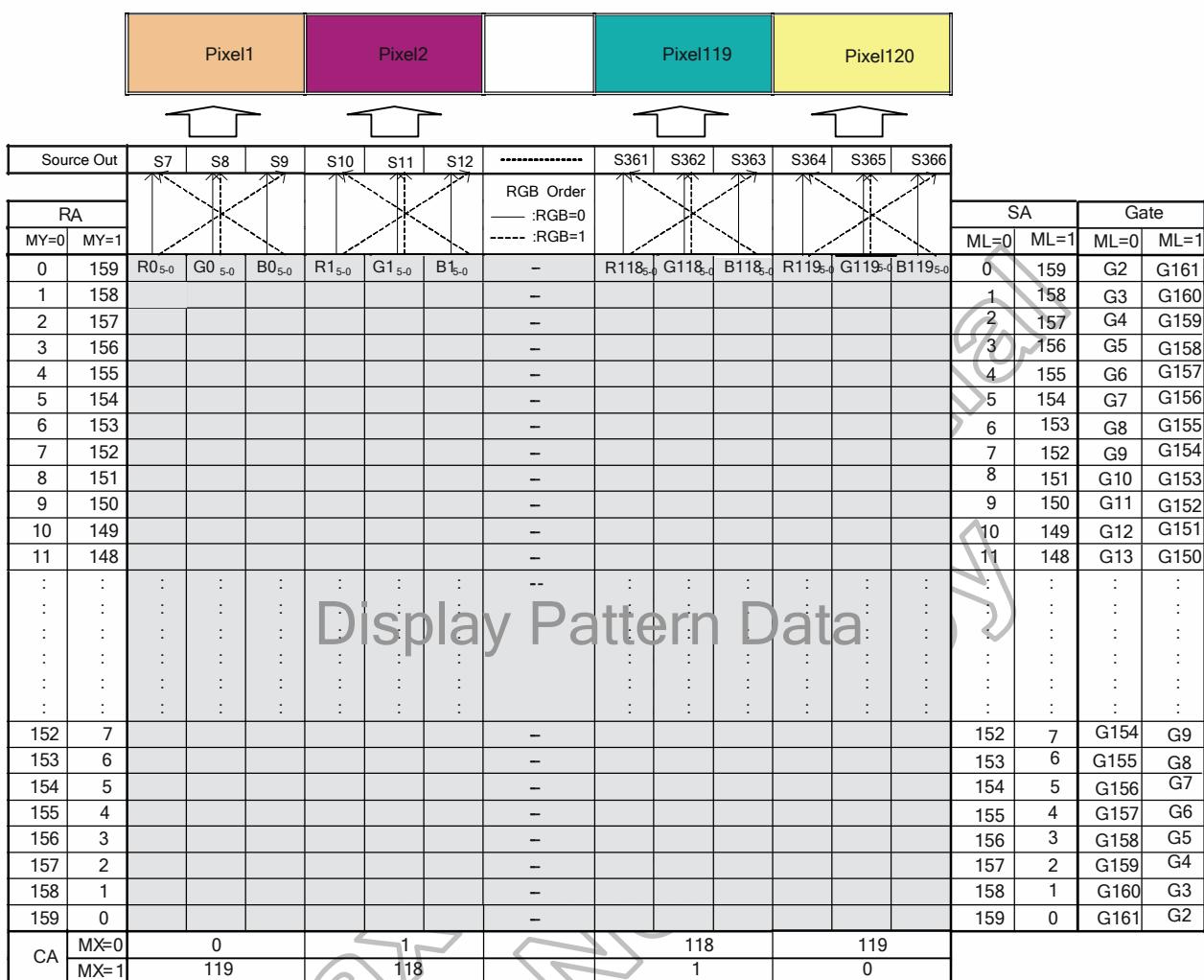
| Source Out | S7   | S8  | S9                | S10               | S11               | S12               | -----             | S385              | S386 | S387                | S388                | S389                | S390                | SA                  | Gate |      |      |      |
|------------|------|-----|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|---------------------|---------------------|---------------------|---------------------|---------------------|------|------|------|------|
| RA         |      |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | ML=0                | ML=1 | ML=0 | ML=1 |      |
| MY=0       | 0    | 127 | R0 <sub>5:0</sub> | G0 <sub>5:0</sub> | B0 <sub>5:0</sub> | R1 <sub>5:0</sub> | G1 <sub>5:0</sub> | B1 <sub>5:0</sub> | -    | R126 <sub>5:0</sub> | G126 <sub>5:0</sub> | B126 <sub>5:0</sub> | R127 <sub>5:0</sub> | G127 <sub>5:0</sub> | 0    | 127  | G2   | G129 |
| MY=1       | 1    | 126 |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 1                   | 126  | G3   | G128 |      |
| 0          | 125  |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 2                   | 125  | G4   | G127 |      |
| 3          | 124  |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 3                   | 124  | G5   | G126 |      |
| 4          | 123  |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 4                   | 123  | G6   | G125 |      |
| 5          | 122  |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 5                   | 122  | G7   | G124 |      |
| 6          | 121  |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 6                   | 121  | G8   | G123 |      |
| 7          | 120  |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 7                   | 120  | G9   | G122 |      |
| 8          | 119  |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 8                   | 119  | G10  | G121 |      |
| 9          | 118  |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 9                   | 118  | G11  | G120 |      |
| 10         | 117  |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 10                  | 117  | G12  | G119 |      |
| 11         | 116  |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 11                  | 116  | G13  | G118 |      |
| :          | :    | :   | :                 | :                 | :                 | :                 |                   | :                 | :    | :                   | :                   | :                   |                     | :                   | :    | :    | :    |      |
| :          | :    | :   | :                 | :                 | :                 | :                 |                   | :                 | :    | :                   | :                   | :                   |                     | :                   | :    | :    | :    |      |
| :          | :    | :   | :                 | :                 | :                 | :                 |                   | :                 | :    | :                   | :                   | :                   |                     | :                   | :    | :    | :    |      |
| :          | :    | :   | :                 | :                 | :                 | :                 |                   | :                 | :    | :                   | :                   | :                   |                     | :                   | :    | :    | :    |      |
| :          | :    | :   | :                 | :                 | :                 | :                 |                   | :                 | :    | :                   | :                   | :                   |                     | :                   | :    | :    | :    |      |
| 120        | 7    |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 120                 | 7    | G122 | G9   |      |
| 121        | 6    |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 121                 | 6    | G123 | G8   |      |
| 122        | 5    |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 122                 | 5    | G124 | G7   |      |
| 123        | 4    |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 123                 | 4    | G125 | G6   |      |
| 124        | 3    |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 124                 | 3    | G126 | G5   |      |
| 125        | 2    |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 125                 | 2    | G127 | G4   |      |
| 126        | 1    |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 126                 | 1    | G128 | G3   |      |
| 127        | 0    |     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | 127                 | 0    | G129 | G2   |      |
| CA         | MX=0 | 0   | 1                 |                   |                   |                   |                   |                   |      | 126                 | 127                 |                     |                     |                     |      |      |      |      |
|            | MX=1 | 127 | 126               |                   |                   |                   |                   |                   |      | 1                   | 0                   |                     |                     |                     |      |      |      |      |

**Note:** RA = Row Address,  
 CA = Column Address,  
 SA = Scan Address,  
 MX = Mirror X-axis (Column address direction parameter), DB6 parameter of MADCTL command  
 MY = Mirror Y-axis (Row address direction parameter), DB7 parameter of MADCTL command  
 ML = Scan direction parameter, DB4 parameter of MADCTL command  
 RGB= Red, Green and Blue pixel position change, DB3 parameter of MADCTL command

Figure 6.7 Memory map, 128 x 128 GRAM resolution, display resolution 128RGB x 128

### 6.3.4 When using 120 x 160 GRAM resolution, display resolution 120RGB x 160 (RSO[2:0]=3'b010)

Pixel1      Pixel2           Pixel119      Pixel120



**Source Out**

|           | S7                                  | S8                | S9                | S10               | S11               | S12               | -----             | S361 | S362                | S363                | S364                | S365                | S366                |                     |      |      |      |      |
|-----------|-------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|------|------|------|------|
| <b>RA</b> | RGB Order<br>— :RGB=0<br>- - :RGB=1 |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | <b>SA</b>           | <b>Gate</b>         |      |      |      |      |
| MY=0      |                                     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | MY=1                | ML=0                | ML=1 | ML=0 | ML=1 |      |
| 0         | 159                                 | R0 <sub>5:0</sub> | G0 <sub>5:0</sub> | B0 <sub>5:0</sub> | R1 <sub>5:0</sub> | G1 <sub>5:0</sub> | B1 <sub>5:0</sub> | -    | R118 <sub>5:0</sub> | G118 <sub>5:0</sub> | B118 <sub>5:0</sub> | R119 <sub>5:0</sub> | G119 <sub>5:0</sub> | B119 <sub>5:0</sub> | 0    | 159  | G2   | G161 |
| 1         | 158                                 |                   |                   |                   |                   |                   |                   | -    |                     |                     |                     |                     |                     |                     | 1    | 158  | G3   | G160 |
| 2         | 157                                 |                   |                   |                   |                   |                   |                   | -    |                     |                     |                     |                     |                     |                     | 2    | 157  | G4   | G159 |
| 3         | 156                                 |                   |                   |                   |                   |                   |                   | -    |                     |                     |                     |                     |                     |                     | 3    | 156  | G5   | G158 |
| 4         | 155                                 |                   |                   |                   |                   |                   |                   | -    |                     |                     |                     |                     |                     |                     | 4    | 155  | G6   | G157 |
| 5         | 154                                 |                   |                   |                   |                   |                   |                   | -    |                     |                     |                     |                     |                     |                     | 5    | 154  | G7   | G156 |
| 6         | 153                                 |                   |                   |                   |                   |                   |                   | -    |                     |                     |                     |                     |                     |                     | 6    | 153  | G8   | G155 |
| 7         | 152                                 |                   |                   |                   |                   |                   |                   | -    |                     |                     |                     |                     |                     |                     | 7    | 152  | G9   | G154 |
| 8         | 151                                 |                   |                   |                   |                   |                   |                   | -    |                     |                     |                     |                     |                     |                     | 8    | 151  | G10  | G153 |
| 9         | 150                                 |                   |                   |                   |                   |                   |                   | -    |                     |                     |                     |                     |                     |                     | 9    | 150  | G11  | G152 |
| 10        | 149                                 |                   |                   |                   |                   |                   |                   | -    |                     |                     |                     |                     |                     |                     | 10   | 149  | G12  | G151 |
| 11        | 148                                 |                   |                   |                   |                   |                   |                   | -    |                     |                     |                     |                     |                     |                     | 11   | 148  | G13  | G150 |
| :         | :                                   | :                 | :                 | :                 | :                 | :                 | -                 | :    | :                   | :                   | :                   | :                   | :                   | :                   | :    | :    | :    | :    |
| :         | :                                   | :                 | :                 | :                 | :                 | :                 | -                 | :    | :                   | :                   | :                   | :                   | :                   | :                   | :    | :    | :    | :    |
| :         | :                                   | :                 | :                 | :                 | :                 | :                 | -                 | :    | :                   | :                   | :                   | :                   | :                   | :                   | :    | :    | :    | :    |
| :         | :                                   | :                 | :                 | :                 | :                 | :                 | -                 | :    | :                   | :                   | :                   | :                   | :                   | :                   | :    | :    | :    | :    |
| :         | :                                   | :                 | :                 | :                 | :                 | :                 | -                 | :    | :                   | :                   | :                   | :                   | :                   | :                   | :    | :    | :    | :    |
| 152       | 7                                   |                   |                   |                   |                   |                   | -                 |      |                     |                     |                     |                     |                     |                     | 152  | 7    | G154 | G9   |
| 153       | 6                                   |                   |                   |                   |                   |                   | -                 |      |                     |                     |                     |                     |                     |                     | 153  | 6    | G155 | G8   |
| 154       | 5                                   |                   |                   |                   |                   |                   | -                 |      |                     |                     |                     |                     |                     |                     | 154  | 5    | G156 | G7   |
| 155       | 4                                   |                   |                   |                   |                   |                   | -                 |      |                     |                     |                     |                     |                     |                     | 155  | 4    | G157 | G6   |
| 156       | 3                                   |                   |                   |                   |                   |                   | -                 |      |                     |                     |                     |                     |                     |                     | 156  | 3    | G158 | G5   |
| 157       | 2                                   |                   |                   |                   |                   |                   | -                 |      |                     |                     |                     |                     |                     |                     | 157  | 2    | G159 | G4   |
| 158       | 1                                   |                   |                   |                   |                   |                   | -                 |      |                     |                     |                     |                     |                     |                     | 158  | 1    | G160 | G3   |
| 159       | 0                                   |                   |                   |                   |                   |                   | -                 |      |                     |                     |                     |                     |                     |                     | 159  | 0    | G161 | G2   |
| <b>CA</b> | MX=0                                | 0                 | 1                 |                   |                   |                   |                   | 118  |                     | 119                 |                     |                     |                     |                     |      |      |      |      |
|           | MX=1                                | 119               | 118               |                   |                   |                   |                   | 1    |                     | 0                   |                     |                     |                     |                     |      |      |      |      |

**Note:** RA = Row Address,  
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 MX = Mirror X-axis (Column address direction parameter), DB6 parameter of MADCTL command  
 MY = Mirror Y-axis (Row address direction parameter), DB7 parameter of MADCTL command  
 ML = Scan direction parameter, DB4 parameter of MADCTL command  
 RGB= Red, Green and Blue pixel position change, DB3 parameter of MADCTL command

**Figure 6.8 Memory map, 120 x 160 GRAM resolution, display resolution 120RGB x 160**

### 6.3.5 When using 128 x 160 GRAM resolution, display resolution 128RGB x 160 (RSO[2:0]=3'b011)

Display Pattern Data

| Pixel Layout |                                     |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     |                     |                     |      |      |      |      |
|--------------|-------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|------|------|------|------|
| Source Out   | S7                                  | S8                | S9                | S10               | S11               | S12               | -----             | S385 | S386                | S387                | S388                | S389                | S390                |                     |      |      |      |      |
| RA           | RGB Order<br>— :RGB=0<br>--- :RGB=1 |                   |                   |                   |                   |                   |                   |      |                     |                     |                     |                     | SA                  | Gate                |      |      |      |      |
| MY=0         | MY=1                                | R0 <sub>5:0</sub> | G0 <sub>5:0</sub> | B0 <sub>5:0</sub> | R1 <sub>5:0</sub> | G1 <sub>5:0</sub> | B1 <sub>5:0</sub> | —    | R126 <sub>5:0</sub> | G126 <sub>5:0</sub> | B126 <sub>5:0</sub> | R127 <sub>5:0</sub> | G127 <sub>5:0</sub> | B127 <sub>5:0</sub> | ML=0 | ML=1 | ML=0 | ML=1 |
| 0            | 159                                 |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 0                   | 159  | G2   | G161 |      |
| 1            | 158                                 |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 1                   | 158  | G3   | G160 |      |
| 2            | 157                                 |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 2                   | 157  | G4   | G159 |      |
| 3            | 156                                 |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 3                   | 156  | G5   | G158 |      |
| 4            | 155                                 |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 4                   | 155  | G6   | G157 |      |
| 5            | 154                                 |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 5                   | 154  | G7   | G156 |      |
| 6            | 153                                 |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 6                   | 153  | G8   | G155 |      |
| 7            | 152                                 |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 7                   | 152  | G9   | G154 |      |
| 8            | 151                                 |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 8                   | 151  | G10  | G153 |      |
| 9            | 150                                 |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 9                   | 150  | G11  | G152 |      |
| 10           | 149                                 |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 10                  | 149  | G12  | G151 |      |
| 11           | 148                                 |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 11                  | 148  | G13  | G150 |      |
| :            | :                                   | :                 | :                 | :                 | :                 | :                 | —                 | :    | :                   | :                   | :                   | :                   | :                   | :                   | :    | :    | :    |      |
| :            | :                                   | :                 | :                 | :                 | :                 | :                 | —                 | :    | :                   | :                   | :                   | :                   | :                   | :                   | :    | :    | :    |      |
| :            | :                                   | :                 | :                 | :                 | :                 | :                 | —                 | :    | :                   | :                   | :                   | :                   | :                   | :                   | :    | :    | :    |      |
| :            | :                                   | :                 | :                 | :                 | :                 | :                 | —                 | :    | :                   | :                   | :                   | :                   | :                   | :                   | :    | :    | :    |      |
| :            | :                                   | :                 | :                 | :                 | :                 | :                 | —                 | :    | :                   | :                   | :                   | :                   | :                   | :                   | :    | :    | :    |      |
| 152          | 7                                   |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 152                 | 7    | G154 | G9   |      |
| 153          | 6                                   |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 153                 | 6    | G155 | G8   |      |
| 154          | 5                                   |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 154                 | 5    | G156 | G7   |      |
| 155          | 4                                   |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 155                 | 4    | G157 | G6   |      |
| 156          | 3                                   |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 156                 | 3    | G158 | G5   |      |
| 157          | 2                                   |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 157                 | 2    | G159 | G4   |      |
| 158          | 1                                   |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 158                 | 1    | G160 | G3   |      |
| 159          | 0                                   |                   |                   |                   |                   |                   |                   | —    |                     |                     |                     |                     |                     | 159                 | 0    | G161 | G2   |      |
| CA           | MX=0                                | 0                 |                   | 1                 |                   |                   |                   | 126  |                     | 127                 |                     |                     |                     |                     |      |      |      |      |
| CA           | MX=1                                | 127               |                   | 126               |                   |                   |                   | 1    |                     | 0                   |                     |                     |                     |                     |      |      |      |      |

**Note:** RA = Row Address,  
 CA = Column Address,  
 SA = Scan Address,  
 MX = Mirror X-axis (Column address direction parameter), DB6 parameter of MADCTL command  
 MY = Mirror Y-axis (Row address direction parameter), DB7 parameter of MADCTL command  
 ML = Scan direction parameter, DB4 parameter of MADCTL command  
 RGB= Red, Green and Blue pixel position change, DB3 parameter of MADCTL command

Figure 6.9 Memory map, 128 x 160 GRAM resolution, display resolution 128RGB x 160

### 6.3.6 When using 96 x 68 GRAM resolution, display resolution 96RGB x 68 (RSO[2:0]=3'b100)

Pixel1      Pixel2      Pixel95      Pixel 96



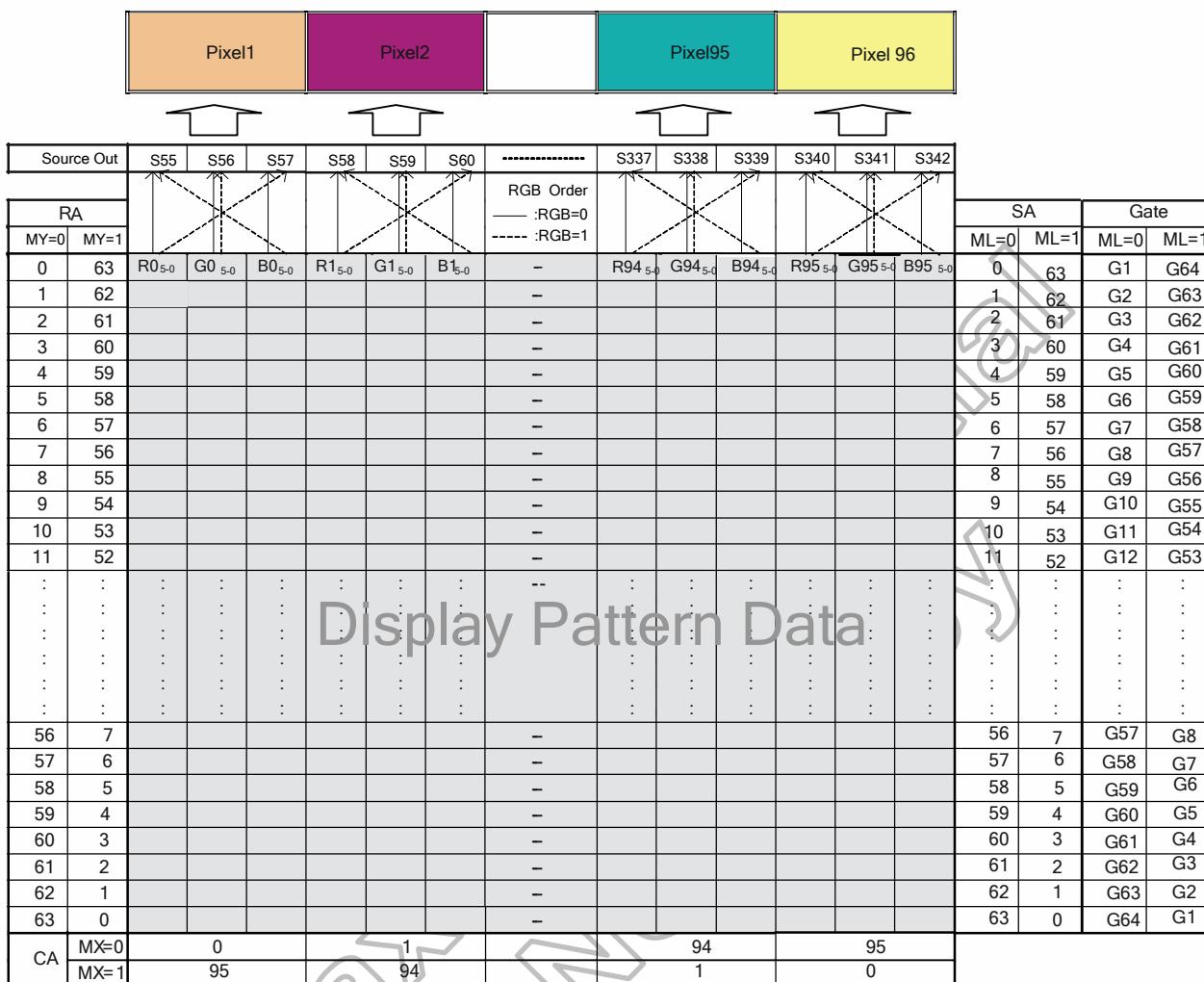
| Source Out | S55  | S56 | S57               | S58               | S59               | S60               | -----             | S337              | S338 | S339               | S340               | S341               | S342               | SA                 | Gate               |      |      |     |     |
|------------|------|-----|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|------|------|-----|-----|
| RA         |      |     |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    | ML=0               | ML=1               | ML=0 | ML=1 |     |     |
| MY=0       | 0    | 67  | R0 <sub>5:0</sub> | G0 <sub>5:0</sub> | B0 <sub>5:0</sub> | R1 <sub>5:0</sub> | G1 <sub>5:0</sub> | B1 <sub>5:0</sub> | -    | R94 <sub>5:0</sub> | G94 <sub>5:0</sub> | B94 <sub>5:0</sub> | R95 <sub>5:0</sub> | G95 <sub>5:0</sub> | B95 <sub>5:0</sub> | 0    | 67   | G1  | G68 |
| MY=1       | 1    | 66  |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 1                  | 66   | G2   | G67 |     |
|            | 2    | 65  |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 2                  | 65   | G3   | G66 |     |
|            | 3    | 64  |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 3                  | 64   | G4   | G65 |     |
|            | 4    | 63  |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 4                  | 63   | G5   | G64 |     |
|            | 5    | 62  |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 5                  | 62   | G6   | G63 |     |
|            | 6    | 61  |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 6                  | 61   | G7   | G62 |     |
|            | 7    | 60  |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 7                  | 60   | G8   | G61 |     |
|            | 8    | 59  |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 8                  | 59   | G9   | G60 |     |
|            | 9    | 58  |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 9                  | 58   | G10  | G59 |     |
|            | 10   | 57  |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 10                 | 57   | G11  | G58 |     |
|            | 11   | 56  |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 11                 | 56   | G12  | G57 |     |
| ⋮          | ⋮    | ⋮   | ⋮                 | ⋮                 | ⋮                 | ⋮                 | ⋮                 | ⋮                 | ⋮    | ⋮                  | ⋮                  | ⋮                  | ⋮                  | ⋮                  | ⋮                  | ⋮    | ⋮    | ⋮   |     |
| 60         | 7    |     |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 60                 | 7    | G61  | G8  |     |
| 61         | 6    |     |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 61                 | 6    | G62  | G7  |     |
| 62         | 5    |     |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 62                 | 5    | G63  | G6  |     |
| 63         | 4    |     |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 63                 | 4    | G64  | G5  |     |
| 64         | 3    |     |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 64                 | 3    | G65  | G4  |     |
| 65         | 2    |     |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 65                 | 2    | G66  | G3  |     |
| 66         | 1    |     |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 66                 | 1    | G67  | G2  |     |
| 67         | 0    |     |                   |                   |                   |                   |                   |                   |      |                    |                    |                    |                    |                    | 67                 | 0    | G68  | G1  |     |
| CA         | MX=0 | 0   | 1                 |                   |                   |                   |                   |                   | 94   |                    | 95                 |                    |                    |                    |                    |      |      |     |     |
|            | MX=1 | 95  | 94                |                   |                   |                   |                   |                   | 1    |                    | 0                  |                    |                    |                    |                    |      |      |     |     |

**Note:** RA = Row Address,  
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 MX = Mirror X-axis (Column address direction parameter), DB6 parameter of MADCTL command  
 MY = Mirror Y-axis (Row address direction parameter), DB7 parameter of MADCTL command  
 ML = Scan direction parameter, DB4 parameter of MADCTL command  
 RGB= Red, Green and Blue pixel position change, DB3 parameter of MADCTL command

**Figure 6.10 Memory map, 96 x 68 GRAM resolution, display resolution 96RGB x 68**

### 6.3.7 When using 96 x 64 GRAM resolution, display resolution 96RGB x 64 (RSO[2:0]=3'b101)

Pixel1      Pixel2      Pixel95      Pixel 96



|      |      | Pixel1            |                   |                   |                   |                   |                   | Pixel2 |  |  |  |  |  | Pixel95            |                    |                    |                    |                    |                    | Pixel 96 |    |     |     |   |   |  |
|------|------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------|--|--|--|--|--|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|----------|----|-----|-----|---|---|--|
|      |      | S55               | S56               | S57               | S58               | S59               | S60               |        |  |  |  |  |  | S337               | S338               | S339               | S340               | S341               | S342               |          |    |     |     |   |   |  |
| RA   |      |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  | RGB Order          |                    |                    |                    |                    |                    |          |    |     |     |   |   |  |
| MY=0 |      |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  | --- :RGB=0         |                    |                    |                    |                    |                    |          |    |     |     |   |   |  |
| MY=1 |      |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  | ---- :RGB=1        |                    |                    |                    |                    |                    |          |    |     |     |   |   |  |
| 0    | 63   | R0 <sub>5:0</sub> | G0 <sub>5:0</sub> | B0 <sub>5:0</sub> | R1 <sub>5:0</sub> | G1 <sub>5:0</sub> | B1 <sub>5:0</sub> |        |  |  |  |  |  | R94 <sub>5:0</sub> | G94 <sub>5:0</sub> | B94 <sub>5:0</sub> | R95 <sub>5:0</sub> | G95 <sub>5:0</sub> | B95 <sub>5:0</sub> | 0        | 63 | G1  | G64 |   |   |  |
| 1    | 62   |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 1        | 62 | G2  | G63 |   |   |  |
| 2    | 61   |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 2        | 61 | G3  | G62 |   |   |  |
| 3    | 60   |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 3        | 60 | G4  | G61 |   |   |  |
| 4    | 59   |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 4        | 59 | G5  | G60 |   |   |  |
| 5    | 58   |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 5        | 58 | G6  | G59 |   |   |  |
| 6    | 57   |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 6        | 57 | G7  | G58 |   |   |  |
| 7    | 56   |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 7        | 56 | G8  | G57 |   |   |  |
| 8    | 55   |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 8        | 55 | G9  | G56 |   |   |  |
| 9    | 54   |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 9        | 54 | G10 | G55 |   |   |  |
| 10   | 53   |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 10       | 53 | G11 | G54 |   |   |  |
| 11   | 52   |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 11       | 52 | G12 | G53 |   |   |  |
| :    | :    | :                 | :                 | :                 | :                 | :                 | :                 |        |  |  |  |  |  | :                  | :                  | :                  | :                  | :                  | :                  | :        | :  | :   | :   | : | : |  |
| 56   | 7    |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 56       | 7  | G57 | G8  |   |   |  |
| 57   | 6    |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 57       | 6  | G58 | G7  |   |   |  |
| 58   | 5    |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 58       | 5  | G59 | G6  |   |   |  |
| 59   | 4    |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 59       | 4  | G60 | G5  |   |   |  |
| 60   | 3    |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 60       | 3  | G61 | G4  |   |   |  |
| 61   | 2    |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 61       | 2  | G62 | G3  |   |   |  |
| 62   | 1    |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 62       | 1  | G63 | G2  |   |   |  |
| 63   | 0    |                   |                   |                   |                   |                   |                   |        |  |  |  |  |  |                    |                    |                    |                    |                    |                    | 63       | 0  | G64 | G1  |   |   |  |
| CA   | MX=0 | 0                 |                   |                   |                   |                   |                   | 1      |  |  |  |  |  | 94                 |                    |                    |                    |                    |                    | 95       |    |     |     |   |   |  |
|      | MX=1 | 95                |                   |                   |                   |                   |                   | 94     |  |  |  |  |  | 1                  |                    |                    |                    |                    |                    | 0        |    |     |     |   |   |  |

**Note:** RA = Row Address,  
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 MX = Mirror X-axis (Column address direction parameter), DB6 parameter of MADCTL command  
 MY = Mirror Y-axis (Row address direction parameter), DB7 parameter of MADCTL command  
 ML = Scan direction parameter, DB4 parameter of MADCTL command  
 RGB= Red, Green and Blue pixel position change, DB3 parameter of MADCTL command

**Figure 6.11 Memory map, 96 x 64 GRAM resolution, display resolution 96RGB x 64**

### 6.3.8 Normal display on or partial display on

The HX8353-E has an internal GRAM that store 48,114 bytes pattern data, where one pixel is expressed by 18 bits.

#### 6.3.8.1 132X162 GRAM resolution (size) (display resolution 132RGB x 162 (RSO[2:0]=3'b000 & STE\_SEL=0)

##### (a) Normal display on

In this mode, contents of the frame memory within an area where column pointer is 00h to 83h and page pointer is 00h to A1h is displayed. To display a dot on leftmost top corner, store the dot data at (column pointer, row pointer) = (0, 0).

| GRAM | 00h               | 01h               | 02h               | 03h               | ----- | 80h               | 81h               | 82h               | 83h               |
|------|-------------------|-------------------|-------------------|-------------------|-------|-------------------|-------------------|-------------------|-------------------|
|      | DB--DB<br>17 ---0 | DB--DB<br>17 ---0 | DB--DB<br>17 ---0 | DB--DB<br>17 ---0 | ----- | DB--DB<br>17 ---0 | DB--DB<br>17 ---0 | DB--DB<br>17 ---0 | DB--DB<br>17 ---0 |
| 00h  | 0000H             | 0001H             | 0002H             | 0003H             | ----- | 0080H             | 0081H             | 0082H             | 0083H             |
| 01h  | 0100H             | 0101H             | 0102H             | 0103H             | ----- | 0180H             | 0181H             | 0182H             | 0183H             |
| 02h  | 0200H             | 0201H             | 0202H             | 0203H             | ----- | 0280H             | 0281H             | 0282H             | 0283H             |
| 03h  | 0300H             | 0301H             | 0302H             | 0303H             | ----- | 0380H             | 0381H             | 0382H             | 0383H             |
| 04h  | 0400H             | 0401H             | 0402H             | 0403H             | ----- | 0480H             | 0481H             | 0482H             | 0483H             |
| 05h  | 0500H             | 0501H             | 0502H             | 0503H             | ----- | 0580H             | 0581H             | 0582H             | 0583H             |
|      |                   |                   |                   |                   | ----- |                   |                   |                   |                   |
| 9Ch  | 9C00H             | 9C01H             | 9C02H             | 9C03H             | ----- | 9C80H             | 9C81H             | 9C82H             | 9C83H             |
| 9Dh  | 9D00H             | 9D01H             | 9D02H             | 9D03H             | ----- | 9D80H             | 9D81H             | 9D82H             | 9D83H             |
| 9Eh  | 9E00H             | 9E01H             | 9E02H             | 9E03H             | ----- | 9E80H             | 9E81H             | 9E82H             | 9E83H             |
| 9Fh  | 9F00H             | 9F01H             | 9F02H             | 9F03H             | ----- | 9F80H             | 9F81H             | 9F82H             | 9F83H             |
| A0h  | A000H             | A001H             | A002H             | A003H             | ----- | A080H             | A081H             | A082H             | A083H             |
| A1h  | A100H             | A101H             | A102H             | A103H             | ----- | A180H             | A181H             | A182H             | A183H             |

| LCD panel S/G pins | S1    | S2    | S3    | ----- | S4    | S5    | S6    |
|--------------------|-------|-------|-------|-------|-------|-------|-------|
| G1                 | 0000H | ----- | ----- | ----- | 0083H | ----- | ----- |
| G2                 | 0100H | ----- | ----- | ----- | 0183H | ----- | ----- |
| G3                 | 0200H | ----- | ----- | ----- | 0283H | ----- | ----- |
| G4                 | 0300H | ----- | ----- | ----- | 0383H | ----- | ----- |
| G5                 | 0400H | ----- | ----- | ----- | 0483H | ----- | ----- |
| G6                 | 0500H | ----- | ----- | ----- | 0583H | ----- | ----- |
|                    |       |       |       | ----- |       |       |       |
| G157               | 9C00H | ----- | ----- | ----- | 9C83H | ----- | ----- |
| G158               | 9D00H | ----- | ----- | ----- | 9D83H | ----- | ----- |
| G159               | 9E00H | ----- | ----- | ----- | 9E83H | ----- | ----- |
| G160               | 9F00H | ----- | ----- | ----- | 9F83H | ----- | ----- |
| G161               | A000H | ----- | ----- | ----- | A083H | ----- | ----- |
| G162               | A100H | ----- | ----- | ----- | A183H | ----- | ----- |

Table 6.5 132X162 GRAM resolution

**(b) Partial display on**

PSL[15:0]=02h, PEL[15:0]=9Fh, ML=0.

| GRAM | 00h                | 01h                | 02h                | 03h                | ----- | 80h                | 81h                | 82h                | 83h                |
|------|--------------------|--------------------|--------------------|--------------------|-------|--------------------|--------------------|--------------------|--------------------|
|      | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | ----- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 |
| 00h  | 0000H              | 0001H              | 0002H              | 0003H              | ----- | 0080H              | 0081H              | 0082H              | 0083H              |
| 01h  | 0100H              | 0101H              | 0102H              | 0103H              | ----- | 0180H              | 0181H              | 0182H              | 0183H              |
| 02h  | 0200H              | 0201H              | 0202H              | 0203H              | ----- | 0280H              | 0281H              | 0282H              | 0283H              |
| 03h  | 0300H              | 0301H              | 0302H              | 0303H              | ----- | 0380H              | 0381H              | 0382H              | 0383H              |
| 04h  | 0400H              | 0401H              | 0402H              | 0403H              | ----- | 0480H              | 0481H              | 0482H              | 0483H              |
| 05h  | 0500H              | 0501H              | 0502H              | 0503H              | ----- | 0580H              | 0581H              | 0582H              | 0583H              |
|      |                    |                    |                    |                    | ----- |                    |                    |                    |                    |
| 9Ch  | 9C00H              | 9C01H              | 9C02H              | 9C03H              | ----- | 9C80H              | 9C81H              | 9C82H              | 9C83H              |
| 9Dh  | 9D00H              | 9D01H              | 9D02H              | 9D03H              | ----- | 9D80H              | 9D81H              | 9D82H              | 9D83H              |
| 9Eh  | 9E00H              | 9E01H              | 9E02H              | 9E03H              | ----- | 9E80H              | 9E81H              | 9E82H              | 9E83H              |
| 9Fh  | 9F00H              | 9F01H              | 9F02H              | 9F03H              | ----- | 9F80H              | 9F81H              | 9F82H              | 9F83H              |
| A0h  | A000H              | A001H              | A002H              | A003H              | ----- | A080H              | A081H              | A082H              | A083H              |
| A1h  | A100H              | A101H              | A102H              | A103H              | ----- | A180H              | A181H              | A182H              | A183H              |

| LCD panel S/G pins | S1    | S2 | S3 | ----- | S394  | S395 | S396 |
|--------------------|-------|----|----|-------|-------|------|------|
| G1                 | 0000H |    |    | ----- | 0083H |      |      |
| G2                 | 0100H |    |    | ----- | 0183H |      |      |
| G3                 | 0200H |    |    | ----- | 0283H |      |      |
| G4                 | 0300H |    |    | ----- | 0383H |      |      |
| G5                 | 0400H |    |    | ----- | 0483H |      |      |
| G6                 | 0500H |    |    | ----- | 0583H |      |      |
|                    |       |    |    | ----- |       |      |      |
| G157               | 9C00H |    |    | ----- | 9C83H |      |      |
| G158               | 9D00H |    |    | ----- | 9D83H |      |      |
| G159               | 9E00H |    |    | ----- | 9E83H |      |      |
| G160               | 9F00H |    |    | ----- | 9F83H |      |      |
| G161               | A000H |    |    | ----- | A083H |      |      |
| G162               | A100H |    |    | ----- | A183H |      |      |

Table 6.6 Partial area of 132X162 GRAM resolution

### 6.3.8.2 132X162 GRAM resolution (size) (display resolution 128RGB x 160 (RSO[2:0]=3'b000 & STE\_SEL=1)

#### (a) Normal display on

In this mode, contents of the frame memory within an area where column pointer is 00h to 83h and page pointer is 00h to A1h is displayed. To display a dot on leftmost top corner, store the dot data at (column pointer, row pointer) = (0, 0).

| GRAM | 00h                | 01h                | 02h                | 03h                | ----- | 80h                | 81h                | 82h                | 83h                |
|------|--------------------|--------------------|--------------------|--------------------|-------|--------------------|--------------------|--------------------|--------------------|
|      | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | ----- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 |
| 00h  | 0000H              | 0001H              | 0002H              | 0003H              | ----- | 0080H              | 0081H              | 0082H              | 0083H              |
| 01h  | 0100H              | 0101H              | 0102H              | 0103H              | ----- | 0180H              | 0181H              | 0182H              | 0183H              |
| 02h  | 0200H              | 0201H              | 0202H              | 0203H              | ----- | 0280H              | 0281H              | 0282H              | 0283H              |
| 03h  | 0300H              | 0301H              | 0302H              | 0303H              | ----- | 0380H              | 0381H              | 0382H              | 0383H              |
| 04h  | 0400H              | 0401H              | 0402H              | 0403H              | ----- | 0480H              | 0481H              | 0482H              | 0483H              |
| 05h  | 0500H              | 0501H              | 0502H              | 0503H              | ----- | 0580H              | 0581H              | 0582H              | 0583H              |
|      |                    |                    |                    |                    | ----- |                    |                    |                    |                    |
| 9Ch  | 9C00H              | 9C01H              | 9C02H              | 9C03H              | ----- | 9C80H              | 9C81H              | 9C82H              | 9C83H              |
| 9Dh  | 9D00H              | 9D01H              | 9D02H              | 9D03H              | ----- | 9D80H              | 9D81H              | 9D82H              | 9D83H              |
| 9Eh  | 9E00H              | 9E01H              | 9E02H              | 9E03H              | ----- | 9E80H              | 9E81H              | 9E82H              | 9E83H              |
| 9Fh  | 9F00H              | 9F01H              | 9F02H              | 9F03H              | ----- | 9F80H              | 9F81H              | 9F82H              | 9F83H              |
| A0h  | A000H              | A001H              | A002H              | A003H              | ----- | A080H              | A081H              | A082H              | A083H              |
| A1h  | A100H              | A101H              | A102H              | A103H              | ----- | A180H              | A181H              | A182H              | A183H              |

| LCD panel S/G pins | S     | S | S | ----- | S     | S | S |
|--------------------|-------|---|---|-------|-------|---|---|
| G2                 | 0102H |   |   | ----- | 0181H |   |   |
| G3                 | 0202H |   |   | ----- | 0281H |   |   |
| G4                 | 0302H |   |   | ----- | 0381H |   |   |
| G5                 | 0402H |   |   | ----- | 0481H |   |   |
| G6                 | 0502H |   |   | ----- | 0581H |   |   |
| G7                 | 0602H |   |   | ----- | 0681H |   |   |
|                    |       |   |   | ----- |       |   |   |
| G158               | 9D02H |   |   | ----- | 9D81H |   |   |
| G159               | 9E02H |   |   | ----- | 9E81H |   |   |
| G160               | 9F02H |   |   | ----- | 9F81H |   |   |
| G161               | A002H |   |   | ----- | A081H |   |   |

Table 6.7 132X162 GRAM resolution and 128X160 display resolution

**(b) Partial display on**

PSL[15:0]=03h, PEL[15:0]=9Eh, ML=0.

| GRAM       | 00h                | 01h                | 02h                | 03h                | ----- | 80h                | 81h                | 82h                | 83h                |
|------------|--------------------|--------------------|--------------------|--------------------|-------|--------------------|--------------------|--------------------|--------------------|
|            | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | ----- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 |
| <b>00h</b> | 0000H              | 0001H              | 0002H              | 0003H              | ----- | 0080H              | 0081H              | 0082H              | 0083H              |
| <b>01h</b> | 0100H              | 0101H              | 0102H              | 0103H              | ----- | 0180H              | 0181H              | 0182H              | 0183H              |
| <b>02h</b> | 0200H              | 0201H              | 0202H              | 0203H              | ----- | 0280H              | 0281H              | 0282H              | 0283H              |
| <b>03h</b> | 0300H              | 0301H              | 0302H              | 0303H              | ----- | 0380H              | 0381H              | 0382H              | 0383H              |
| <b>04h</b> | 0400H              | 0401H              | 0402H              | 0403H              | ----- | 0480H              | 0481H              | 0482H              | 0483H              |
| <b>05h</b> | 0500H              | 0501H              | 0502H              | 0503H              | ----- | 0580H              | 0581H              | 0582H              | 0583H              |
|            |                    |                    |                    |                    | ----- |                    |                    |                    |                    |
| <b>9Ch</b> | 9C00H              | 9C01H              | 9C02H              | 9C03H              | ----- | 9C80H              | 9C81H              | 9C82H              | 9C83H              |
| <b>9Dh</b> | 9D00H              | 9D01H              | 9D02H              | 9D03H              | ----- | 9D80H              | 9D81H              | 9D82H              | 9D83H              |
| <b>9Eh</b> | 9E00H              | 9E01H              | 9E02H              | 9E03H              | ----- | 9E80H              | 9E81H              | 9E82H              | 9E83H              |
| <b>9Fh</b> | 9F00H              | 9F01H              | 9F02H              | 9F03H              | ----- | 9F80H              | 9F81H              | 9F82H              | 9F83H              |
| <b>A0h</b> | A000H              | A001H              | A002H              | A003H              | ----- | A080H              | A081H              | A082H              | A083H              |
| <b>A1h</b> | A100H              | A101H              | A102H              | A103H              | ----- | A180H              | A181H              | A182H              | A183H              |

| LCD panel S/G pins       |             | S     | S     | S     | ----- | S     | S     | S     |
|--------------------------|-------------|-------|-------|-------|-------|-------|-------|-------|
| Non-display area 2 lines | <b>G2</b>   | 0102H | ----- | ----- | ----- | ----- | 0181H | ----- |
|                          | <b>G3</b>   | 0202H | ----- | ----- | ----- | ----- | 0281H | ----- |
|                          | <b>G4</b>   | 0302H | ----- | ----- | ----- | ----- | 0381H | ----- |
|                          | <b>G5</b>   | 0402H | ----- | ----- | ----- | ----- | 0481H | ----- |
|                          | <b>G6</b>   | 0502H | ----- | ----- | ----- | ----- | 0581H | ----- |
|                          | <b>G7</b>   | 0602H | ----- | ----- | ----- | ----- | 0681H | ----- |
|                          |             |       | ----- | ----- | ----- |       |       |       |
| Display area 156 lines   | <b>G158</b> | 9D02H | ----- | ----- | ----- | ----- | 9D81H | ----- |
|                          | <b>G159</b> | 9E02H | ----- | ----- | ----- | ----- | 9E81H | ----- |
|                          | <b>G160</b> | 9F02H | ----- | ----- | ----- | ----- | 9F81H | ----- |
|                          | <b>G161</b> | A002H | ----- | ----- | ----- | ----- | A081H | ----- |
|                          |             |       | ----- | ----- | ----- |       |       |       |
| Non-display area 2 lines |             |       |       |       |       |       |       |       |

Table 6.8 Partial area of 132X162 GRAM resolution and 128X160 display resolution

### 6.3.8.3 128X128 GRAM resolution (size) (display resolution 128RGB x 128 → RSO[2:0]=3'b001)

#### (a) Normal display on

In this mode, contents of the frame memory within an area where column pointer is 00h to 7Fh and page pointer is 00h to 7Fh is displayed. To display a dot on leftmost top corner, store the dot data at (column pointer, row pointer) = (0, 0).

| GRAM | 00h                | 01h                | 02h                | 03h                | ----- | 7Fh                | ----- | 81h                | 82h                | 83h                |
|------|--------------------|--------------------|--------------------|--------------------|-------|--------------------|-------|--------------------|--------------------|--------------------|
|      | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | ----- | DB---DB<br>17 ---0 | ----- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 |
| 00h  | 0000H              | 0001H              | 0002H              | 0003H              | ----- | 007FH              | ----- | 0081H              | 0082H              | 0083H              |
| 01h  | 0100H              | 0101H              | 0102H              | 0103H              | ----- | 017FH              | ----- | 0181H              | 0182H              | 0183H              |
| 02h  | 0200H              | 0201H              | 0202H              | 0203H              | ----- | 027FH              | ----- | 0281H              | 0282H              | 0283H              |
| 03h  | 0300H              | 0301H              | 0302H              | 0303H              | ----- | 037FH              | ----- | 0381H              | 0382H              | 0383H              |
| 04h  | 0400H              | 0401H              | 0402H              | 0403H              | ----- | 047FH              | ----- | 0481H              | 0482H              | 0483H              |
| 05h  | 0500H              | 0501H              | 0502H              | 0503H              | ----- | 057FH              | ----- | 0581H              | 0582H              | 0583H              |
|      |                    |                    |                    |                    | ----- |                    | ----- |                    |                    |                    |
| 7Eh  | 7E00H              | 7E01H              | 7E02H              | 7E03H              | ----- | 7E7FH              | ----- | 7E81H              | 7E82H              | 7E83H              |
| 7Fh  | 7F00H              | 7F01H              | 7F02H              | 7F03H              | ----- | 7E7FH              | ----- | 7F81H              | 7F82H              | 7F83H              |
|      |                    |                    |                    |                    | ----- |                    | ----- |                    |                    |                    |
| 9Ch  | 9C00H              | 9C01H              | 9C02H              | 9C03H              | ----- | 9C7FH              | ----- | 9C81H              | 9C82H              | 9C83H              |
| 9Dh  | 9D00H              | 9D01H              | 9D02H              | 9D03H              | ----- | 9D7FH              | ----- | 9D81H              | 9D82H              | 9D83H              |
| 9Eh  | 9E00H              | 9E01H              | 9E02H              | 9E03H              | ----- | 9E7FH              | ----- | 9E81H              | 9E82H              | 9E83H              |
| 9Fh  | 9F00H              | 9F01H              | 9F02H              | 9F03H              | ----- | 9F7FH              | ----- | 9F81H              | 9F82H              | 9F83H              |
| A0h  | A000H              | A001H              | A002H              | A003H              | ----- | A07FH              | ----- | A081H              | A082H              | A083H              |
| A1h  | A100H              | A101H              | A102H              | A103H              | ----- | A17FH              | ----- | A181H              | A182H              | A183H              |

| LCD panel S/G pins | 7S    | 8S | S9 | ----- | 88S | 88S   | S39S |
|--------------------|-------|----|----|-------|-----|-------|------|
| G2                 | 0000H |    |    | ----- |     | 007FH |      |
| G3                 | 0100H |    |    | ----- |     | 017FH |      |
| G4                 | 0200H |    |    | ----- |     | 027FH |      |
| G5                 | 0300H |    |    | ----- |     | 037FH |      |
| G6                 | 0400H |    |    | ----- |     | 047FH |      |
| G7                 | 0500H |    |    | ----- |     | 057FH |      |
|                    |       |    |    | ----- |     |       |      |
| G126               | 7C00H |    |    | ----- |     | 7C7FH |      |
| G127               | 7D00H |    |    | ----- |     | 7D7FH |      |
| G128               | 7E00H |    |    | ----- |     | 7E7FH |      |
| G129               | 7F00H |    |    | ----- |     | 7F7FH |      |

Table 6.9 128X128 GRAM resolution

**(b) Partial display on**

PSL[15:0]=02h, PEL[15:0]=7Dh, ML=0.

| GRAM | 00h                | 01h                | 02h                | 03h                | ----- | 7Fh                | ----- | 81h                | 82h                | 83h                |
|------|--------------------|--------------------|--------------------|--------------------|-------|--------------------|-------|--------------------|--------------------|--------------------|
|      | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | ----- | DB---DB<br>17 ---0 | ----- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 |
| 00h  | 0000H              | 0001H              | 0002H              | 0003H              | ----- | 007FH              | ----- | 0081H              | 0082H              | 0083H              |
| 01h  | 0100H              | 0101H              | 0102H              | 0103H              | ----- | 017FH              | ----- | 0181H              | 0182H              | 0183H              |
| 02h  | 0200H              | 0201H              | 0202H              | 0203H              | ----- | 027FH              | ----- | 0281H              | 0282H              | 0283H              |
| 03h  | 0300H              | 0301H              | 0302H              | 0303H              | ----- | 037FH              | ----- | 0381H              | 0382H              | 0383H              |
| 04h  | 0400H              | 0401H              | 0402H              | 0403H              | ----- | 047FH              | ----- | 0481H              | 0482H              | 0483H              |
| 05h  | 0500H              | 0501H              | 0502H              | 0503H              | ----- | 057FH              | ----- | 0581H              | 0582H              | 0583H              |
|      |                    |                    |                    |                    | ----- |                    | ----- |                    |                    |                    |
| 7Eh  | 7E00H              | 7E01H              | 7E02H              | 7E03H              | ----- | 7E7FH              | ----- | 7E81H              | 7E82H              | 7E83H              |
| 7Fh  | 7F00H              | 7F01H              | 7F02H              | 7F03H              | ----- | 7E7FH              | ----- | 7F81H              | 7F82H              | 7F83H              |
|      |                    |                    |                    |                    | ----- |                    | ----- |                    |                    |                    |
| 9Ch  | 9C00H              | 9C01H              | 9C02H              | 9C03H              | ----- | 9C7FH              | ----- | 9C81H              | 9C82H              | 9C83H              |
| 9Dh  | 9D00H              | 9D01H              | 9D02H              | 9D03H              | ----- | 9D7FH              | ----- | 9D81H              | 9D82H              | 9D83H              |
| 9Eh  | 9E00H              | 9E01H              | 9E02H              | 9E03H              | ----- | 9E7FH              | ----- | 9E81H              | 9E82H              | 9E83H              |
| 9Fh  | 9F00H              | 9F01H              | 9F02H              | 9F03H              | ----- | 9F7FH              | ----- | 9F81H              | 9F82H              | 9F83H              |
| A0h  | A000H              | A001H              | A002H              | A003H              | ----- | A07FH              | ----- | A081H              | A082H              | A083H              |
| A1h  | A100H              | A101H              | A102H              | A103H              | ----- | A17FH              | ----- | A181H              | A182H              | A183H              |

| LCD panel S/G pins | S <sub>7</sub> | S <sub>8</sub> | S <sub>9</sub> | ----- | S <sub>367</sub> | S <sub>389</sub> | S <sub>390</sub> |
|--------------------|----------------|----------------|----------------|-------|------------------|------------------|------------------|
| G2                 | 0000H          |                |                | ----- | 007FH            |                  |                  |
| G3                 | 0100H          |                |                | ----- | 017FH            |                  |                  |
| G4                 | 0200H          |                |                | ----- | 027FH            |                  |                  |
| G5                 | 0300H          |                |                | ----- | 037FH            |                  |                  |
| G6                 | 0400H          |                |                | ----- | 047FH            |                  |                  |
| G7                 | 0500H          |                |                | ----- | 057FH            |                  |                  |
|                    |                |                |                | ----- |                  |                  |                  |
| G126               | 7C00H          |                |                | ----- | 7C7FH            |                  |                  |
| G127               | 7D00H          |                |                | ----- | 7D7FH            |                  |                  |
| G128               | 7E00H          |                |                | ----- | 7E7FH            |                  |                  |
| G129               | 7F00H          |                |                | ----- | 7F7FH            |                  |                  |

Table 6.10 Partial area of 128X128 GRAM resolution

### 6.3.8.4 120X160 GRAM resolution (size) (display resolution 120RGB x 160 → RSO[2:0]=3'b010)

#### (a) Normal display on

In this mode, contents of the frame memory within an area where column pointer is 00h to 77h and page pointer is 00h to 9Fh is displayed. To display a dot on leftmost top corner, store the dot data at (column pointer, row pointer) = (0, 0).

| GRAM | 00h                | 01h                | 02h                | 03h                | ----- | 77h                | ----- | 81h                | 82h                | 83h                |
|------|--------------------|--------------------|--------------------|--------------------|-------|--------------------|-------|--------------------|--------------------|--------------------|
|      | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | ----- | DB---DB<br>17 ---0 | ----- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 |
| 00h  | 0000H              | 0001H              | 0002H              | 0003H              | ----- | 0077H              | ----- | 0081H              | 0082H              | 0083H              |
| 01h  | 0100H              | 0101H              | 0102H              | 0103H              | ----- | 0177H              | ----- | 0181H              | 0182H              | 0183H              |
| 02h  | 0200H              | 0201H              | 0202H              | 0203H              | ----- | 0277H              | ----- | 0281H              | 0282H              | 0283H              |
| 03h  | 0300H              | 0301H              | 0302H              | 0303H              | ----- | 0377H              | ----- | 0381H              | 0382H              | 0383H              |
| 04h  | 0400H              | 0401H              | 0402H              | 0403H              | ----- | 0477H              | ----- | 0481H              | 0482H              | 0483H              |
| 05h  | 0500H              | 0501H              | 0502H              | 0503H              | ----- | 0577H              | ----- | 0581H              | 0582H              | 0583H              |
|      |                    |                    |                    |                    | ----- |                    | ----- |                    |                    |                    |
| 9Ch  | 9C00H              | 9C01H              | 9C02H              | 9C03H              | ----- | 9C77H              | ----- | 9C81H              | 9C82H              | 9C83H              |
| 9Dh  | 9D00H              | 9D01H              | 9D02H              | 9D03H              | ----- | 9D77H              | ----- | 9D81H              | 9D82H              | 9D83H              |
| 9Eh  | 9E00H              | 9E01H              | 9E02H              | 9E03H              | ----- | 9E77H              | ----- | 9E81H              | 9E82H              | 9E83H              |
| 9Fh  | 9F00H              | 9F01H              | 9F02H              | 9F03H              | ----- | 9F77H              | ----- | 9F81H              | 9F82H              | 9F83H              |
| A0h  | A000H              | A001H              | A002H              | A003H              | ----- | A077H              | ----- | A081H              | A082H              | A083H              |
| A1h  | A100H              | A101H              | A102H              | A103H              | ----- | A177H              | ----- | A181H              | A182H              | A183H              |

| LCD panel S/G pins | S7    | S8 | S9 | ----- | ----- | S364  | S365 | S366 |
|--------------------|-------|----|----|-------|-------|-------|------|------|
| G2                 | 0000H |    |    | ----- |       | 0077H |      |      |
| G3                 | 0100H |    |    | ----- |       | 0177H |      |      |
| G4                 | 0200H |    |    | ----- |       | 0277H |      |      |
| G5                 | 0300H |    |    | ----- |       | 0377H |      |      |
| G6                 | 0400H |    |    | ----- |       | 0477H |      |      |
| G7                 | 0500H |    |    | ----- |       | 0577H |      |      |
|                    |       |    |    | ----- |       |       |      |      |
| G158               | 9C00H |    |    | ----- |       | 9C77H |      |      |
| G159               | 9D00H |    |    | ----- |       | 9D77H |      |      |
| G160               | 9E00H |    |    | ----- |       | 9E77H |      |      |
| G161               | 9F00H |    |    | ----- |       | 9F77H |      |      |

Table 6.11 120X160 GRAM resolution

**(b) Partial display on**

PSL[15:0]=02h, PEL[15:0]=9Dh, ML=0.

| GRAM | 00h                | 01h                | 02h                | 03h                | ----- | 77h                | ----- | 81h                | 82h                | 83h                |
|------|--------------------|--------------------|--------------------|--------------------|-------|--------------------|-------|--------------------|--------------------|--------------------|
|      | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | ----- | DB---DB<br>17 ---0 | ----- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 |
| 00h  | 0000H              | 0001H              | 0002H              | 0003H              | ----- | 0077H              | ----- | 0081H              | 0082H              | 0083H              |
| 01h  | 0100H              | 0101H              | 0102H              | 0103H              | ----- | 0177H              | ----- | 0181H              | 0182H              | 0183H              |
| 02h  | 0200H              | 0201H              | 0202H              | 0203H              | ----- | 0277H              | ----- | 0281H              | 0282H              | 0283H              |
| 03h  | 0300H              | 0301H              | 0302H              | 0303H              | ----- | 0377H              | ----- | 0381H              | 0382H              | 0383H              |
| 04h  | 0400H              | 0401H              | 0402H              | 0403H              | ----- | 0477H              | ----- | 0481H              | 0482H              | 0483H              |
| 05h  | 0500H              | 0501H              | 0502H              | 0503H              | ----- | 0577H              | ----- | 0581H              | 0582H              | 0583H              |
|      |                    |                    |                    |                    | ----- |                    | ----- |                    |                    |                    |
| 9Ch  | 9C00H              | 9C01H              | 9C02H              | 9C03H              | ----- | 9C77H              | ----- | 9C81H              | 9C82H              | 9C83H              |
| 9Dh  | 9D00H              | 9D01H              | 9D02H              | 9D03H              | ----- | 9D77H              | ----- | 9D81H              | 9D82H              | 9D83H              |
| 9Eh  | 9E00H              | 9E01H              | 9E02H              | 9E03H              | ----- | 9E77H              | ----- | 9E81H              | 9E82H              | 9E83H              |
| 9Fh  | 9F00H              | 9F01H              | 9F02H              | 9F03H              | ----- | 9F77H              | ----- | 9F81H              | 9F82H              | 9F83H              |
| A0h  | A000H              | A001H              | A002H              | A003H              | ----- | A077H              | ----- | A081H              | A082H              | A083H              |
| A1h  | A100H              | A101H              | A102H              | A103H              | ----- | A177H              | ----- | A181H              | A182H              | A183H              |

| LCD panel S/G pins       |      | S7    | S8    | S9    | ----- | S364  | S365  | S366  |
|--------------------------|------|-------|-------|-------|-------|-------|-------|-------|
| Non-display area 2 lines | G2   | 0000H | ----- | ----- | ----- | 0077H | ----- | ----- |
|                          | G3   | 0100H | ----- | ----- | ----- | 0177H | ----- | ----- |
|                          | G4   | 0200H | ----- | ----- | ----- | 0277H | ----- | ----- |
|                          | G5   | 0300H | ----- | ----- | ----- | 0377H | ----- | ----- |
|                          | G6   | 0400H | ----- | ----- | ----- | 0477H | ----- | ----- |
|                          | G7   | 0500H | ----- | ----- | ----- | 0577H | ----- | ----- |
|                          |      |       |       |       | ----- |       |       |       |
| Display area 156 lines   | G158 | 9C00H | ----- | ----- | ----- | 9C77H | ----- | ----- |
|                          | G159 | 9D00H | ----- | ----- | ----- | 9D77H | ----- | ----- |
|                          | G160 | 9E00H | ----- | ----- | ----- | 9E77H | ----- | ----- |
|                          | G161 | 9F00H | ----- | ----- | ----- | 9F77H | ----- | ----- |
|                          |      |       |       |       | ----- |       |       |       |
| Non-display area 2 lines | G158 | 9C00H | ----- | ----- | ----- | 9C77H | ----- | ----- |
|                          | G159 | 9D00H | ----- | ----- | ----- | 9D77H | ----- | ----- |

Table 6.12 Partial area of 120X160 GRAM resolution

### 6.3.8.5 128X160 GRAM resolution (size) (display resolution 128RGB x 160 (RSO[2:0]=3'b011)

#### (a) Normal display on

In this mode, contents of the frame memory within an area where column pointer is 00h to 7Fh and page pointer is 00h to 9Fh is displayed. To display a dot on leftmost top corner, store the dot data at (column pointer, row pointer) = (0, 0).

| GRAM | 00h                | 01h                | 02h                | 03h                | ----- | 7Fh                | 80h                | 81h                | 82h                | 83h                |
|------|--------------------|--------------------|--------------------|--------------------|-------|--------------------|--------------------|--------------------|--------------------|--------------------|
|      | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | ----- | DB---DB<br>17 ---0 |
| 00h  | 0000H              | 0001H              | 0002H              | 0003H              | ----- | 007FH              | 0080H              | 0081H              | 0082H              | 0083H              |
| 01h  | 0100H              | 0101H              | 0102H              | 0103H              | ----- | 017FH              | 0180H              | 0181H              | 0182H              | 0183H              |
| 02h  | 0200H              | 0201H              | 0202H              | 0203H              | ----- | 027FH              | 0280H              | 0281H              | 0282H              | 0283H              |
| 03h  | 0300H              | 0301H              | 0302H              | 0303H              | ----- | 037FH              | 0380H              | 0381H              | 0382H              | 0383H              |
| 04h  | 0400H              | 0401H              | 0402H              | 0403H              | ----- | 047FH              | 0480H              | 0481H              | 0482H              | 0483H              |
| 05h  | 0500H              | 0501H              | 0502H              | 0503H              | ----- | 057FH              | 0580H              | 0581H              | 0582H              | 0583H              |
|      |                    |                    |                    |                    | ----- |                    |                    |                    |                    |                    |
| 9Ch  | 9C00H              | 9C01H              | 9C02H              | 9C03H              | ----- | 9C7FH              | 9C80H              | 9C81H              | 9C82H              | 9C83H              |
| 9Dh  | 9D00H              | 9D01H              | 9D02H              | 9D03H              | ----- | 9D7FH              | 9D80H              | 9D81H              | 9D82H              | 9D83H              |
| 9Eh  | 9E00H              | 9E01H              | 9E02H              | 9E03H              | ----- | 9E7FH              | 9E80H              | 9E81H              | 9E82H              | 9E83H              |
| 9Fh  | 9F00H              | 9F01H              | 9F02H              | 9F03H              | ----- | 9F7FH              | 9F80H              | 9F81H              | 9F82H              | 9F83H              |
| A0h  | A000H              | A001H              | A002H              | A003H              | ----- | A07FH              | A080H              | A081H              | A082H              | A083H              |
| A1h  | A100H              | A101H              | A102H              | A103H              | ----- | A17FH              | A180H              | A181H              | A182H              | A183H              |

| LCD panel S/G pins | S7    | S8    | S9    | ----- | S88   | S89   | S90   |
|--------------------|-------|-------|-------|-------|-------|-------|-------|
| G2                 | 0000H | ----- | ----- | ----- | 007FH | ----- | ----- |
| G3                 | 0100H | ----- | ----- | ----- | 017FH | ----- | ----- |
| G4                 | 0200H | ----- | ----- | ----- | 027FH | ----- | ----- |
| G5                 | 0300H | ----- | ----- | ----- | 037FH | ----- | ----- |
| G6                 | 0400H | ----- | ----- | ----- | 047FH | ----- | ----- |
| G7                 | 0500H | ----- | ----- | ----- | 057FH | ----- | ----- |
|                    |       | ----- | ----- | ----- |       | ----- | ----- |
| G158               | 9C00H | ----- | ----- | ----- | 9C7FH | ----- | ----- |
| G159               | 9D00H | ----- | ----- | ----- | 9D7FH | ----- | ----- |
| G160               | 9E00H | ----- | ----- | ----- | 9E7FH | ----- | ----- |
| G161               | 9F00H | ----- | ----- | ----- | 9F7FH | ----- | ----- |

Table 6.13 128X160 GRAM resolution

**(b) Partial display on**

PSL[15:0]=02h, PEL[15:0]=9Dh, ML=0.

| GRAM | 00h                | 01h                | 02h                | 03h                | ----- | 7Fh                | 80h                | 81h                | 82h                | 83h                |
|------|--------------------|--------------------|--------------------|--------------------|-------|--------------------|--------------------|--------------------|--------------------|--------------------|
|      | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | ----- | DB---DB<br>17 ---0 |
| 00h  | 0000H              | 0001H              | 0002H              | 0003H              | ----- | 007FH              | 0080H              | 0081H              | 0082H              | 0083H              |
| 01h  | 0100H              | 0101H              | 0102H              | 0103H              | ----- | 017FH              | 0180H              | 0181H              | 0182H              | 0183H              |
| 02h  | 0200H              | 0201H              | 0202H              | 0203H              | ----- | 027FH              | 0280H              | 0281H              | 0282H              | 0283H              |
| 03h  | 0300H              | 0301H              | 0302H              | 0303H              | ----- | 037FH              | 0380H              | 0381H              | 0382H              | 0383H              |
| 04h  | 0400H              | 0401H              | 0402H              | 0403H              | ----- | 047FH              | 0480H              | 0481H              | 0482H              | 0483H              |
| 05h  | 0500H              | 0501H              | 0502H              | 0503H              | ----- | 057FH              | 0580H              | 0581H              | 0582H              | 0583H              |
|      |                    |                    |                    |                    | ----- |                    |                    |                    |                    |                    |
| 9Ch  | 9C00H              | 9C01H              | 9C02H              | 9C03H              | ----- | 9C7FH              | 9C80H              | 9C81H              | 9C82H              | 9C83H              |
| 9Dh  | 9D00H              | 9D01H              | 9D02H              | 9D03H              | ----- | 9D7FH              | 9D80H              | 9D81H              | 9D82H              | 9D83H              |
| 9Eh  | 9E00H              | 9E01H              | 9E02H              | 9E03H              | ----- | 9E7FH              | 9E80H              | 9E81H              | 9E82H              | 9E83H              |
| 9Fh  | 9F00H              | 9F01H              | 9F02H              | 9F03H              | ----- | 9F7FH              | 9F80H              | 9F81H              | 9F82H              | 9F83H              |
| A0h  | A000H              | A001H              | A002H              | A003H              | ----- | A07FH              | A080H              | A081H              | A082H              | A083H              |
| A1h  | A100H              | A101H              | A102H              | A103H              | ----- | A17FH              | A180H              | A181H              | A182H              | A183H              |

| LCD panel S/G pins |       | S <sub>7</sub> | S <sub>8</sub> | S <sub>9</sub> | S <sub>388</sub> | S <sub>389</sub> | S <sub>390</sub> |
|--------------------|-------|----------------|----------------|----------------|------------------|------------------|------------------|
| G2                 | 0000H |                |                | -----          |                  | 007FH            |                  |
| G3                 | 0100H |                |                | -----          |                  | 017FH            |                  |
| G4                 | 0200H |                |                | -----          |                  | 027FH            |                  |
| G5                 | 0300H |                |                | -----          |                  | 037FH            |                  |
| G6                 | 0400H |                |                | -----          |                  | 047FH            |                  |
| G7                 | 0500H |                |                | -----          |                  | 057FH            |                  |
|                    |       |                |                | -----          |                  |                  |                  |
| G158               | 9C00H |                |                | -----          |                  | 9C7FH            |                  |
| G159               | 9D00H |                |                | -----          |                  | 9D7FH            |                  |
| G160               | 9E00H |                |                | -----          |                  | 9E7FH            |                  |
| G161               | 9F00H |                |                | -----          |                  | 9F7FH            |                  |

Table 6.14 Partial area of 128X160 GRAM resolution

### 6.3.8.6 96x68 Resolution (RSO[2:0]=3'b100)

#### (a) Normal display on

In this mode, contents of the frame memory within an area where column pointer is 00h to 5Fh and page pointer is 00h to 43h is displayed. To display a dot on leftmost top corner, store the dot data at (column pointer, row pointer) = (0, 0).

| GRAM       | 00h                | 01h                | 02h                | 03h                | -- | 5Dh                | 5Eh                | 5Fh                | -- | 80h                | 81h                | 82h                | 83h                |
|------------|--------------------|--------------------|--------------------|--------------------|----|--------------------|--------------------|--------------------|----|--------------------|--------------------|--------------------|--------------------|
|            | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | -- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | -- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 |
| <b>00h</b> | 0000H              | 0001H              | 0002H              | 0003H              | -- | 005DH              | 005EH              | 005FH              | -- | 0080H              | 0081H              | 0082H              | 0083H              |
| <b>01h</b> | 0100H              | 0101H              | 0102H              | 0103H              | -- | 015DH              | 015EH              | 015FH              | -- | 0180H              | 0181H              | 0182H              | 0183H              |
| <b>02h</b> | 0200H              | 0201H              | 0202H              | 0203H              | -- | 025DH              | 025EH              | 025FH              | -- | 0280H              | 0281H              | 0282H              | 0283H              |
| <b>03h</b> | 0300H              | 0301H              | 0302H              | 0303H              | -- | 035DH              | 035EH              | 035FH              | -- | 0380H              | 0381H              | 0382H              | 0383H              |
| <b>04h</b> | 0400H              | 0401H              | 0402H              | 0403H              | -- | 045DH              | 045EH              | 045FH              | -- | 0480H              | 0481H              | 0482H              | 0483H              |
| <b>05h</b> | 0500H              | 0501H              | 0502H              | 0503H              | -- | 055DH              | 055EH              | 055FH              | -- | 0580H              | 0581H              | 0582H              | 0583H              |
| ---        | ---                | ---                | ---                | ---                | -- | ---                | ---                | ---                | -- | ---                | ---                | ---                | ---                |
| <b>41h</b> | 4100H              | 4101H              | 4102H              | 4103H              | -- | 415DH              | 415EH              | 415FH              | -- | 4180H              | 4181H              | 4182H              | 4183H              |
| <b>42h</b> | 4200H              | 4201H              | 4202H              | 4203H              | -- | 425DH              | 425EH              | 425FH              | -- | 4280H              | 4281H              | 4282H              | 4283H              |
| <b>43h</b> | 4300H              | 4301H              | 4302H              | 4303H              | -- | 435DH              | 435EH              | 435FH              | -- | 4380H              | 4381H              | 4382H              | 4383H              |
| ---        | ---                | ---                | ---                | ---                | -- | ---                | ---                | ---                | -- | ---                | ---                | ---                | ---                |
| <b>9Ch</b> | 9C00H              | 9C01H              | 9C02H              | 9C03H              | -- | 9C5DH              | 9C5EH              | 9C5FH              | -- | 9C80H              | 9C81H              | 9C82H              | 9C83H              |
| <b>9Dh</b> | 9D00H              | 9D01H              | 9D02H              | 9D03H              | -- | 9D5DH              | 9D5EH              | 9D5FH              | -- | 9D80H              | 9D81H              | 9D82H              | 9D83H              |
| <b>9Eh</b> | 9E00H              | 9E01H              | 9E02H              | 9E03H              | -- | 9E5DH              | 9E5EH              | 9E5FH              | -- | 9E80H              | 9E81H              | 9E82H              | 9E83H              |
| <b>9Fh</b> | 9F00H              | 9F01H              | 9F02H              | 9F03H              | -- | 9F5DH              | 9F5EH              | 9F5FH              | -- | 9F80H              | 9F81H              | 9F82H              | 9F83H              |
| <b>A0h</b> | A000H              | A001H              | A002H              | A003H              | -- | A05DH              | A05EH              | A05FH              | -- | A080H              | A081H              | A082H              | A083H              |
| <b>A1h</b> | A100H              | A101H              | A102H              | A103H              | -- | A15DH              | A15EH              | A15FH              | -- | A180H              | A181H              | A182H              | A183H              |

| LCD panel S/G pins | S55   | S56   | S57   | S340  | S341 | S342 |
|--------------------|-------|-------|-------|-------|------|------|
| <b>G1</b>          | 0000H | ----- | ----- | 005FH |      |      |
| <b>G2</b>          | 0100H | ----- | ----- | 015FH |      |      |
| <b>G3</b>          | 0200H | ----- | ----- | 025FH |      |      |
| <b>G4</b>          | 0300H | ----- | ----- | 035FH |      |      |
| <b>G5</b>          | 0400H | ----- | ----- | 045FH |      |      |
| <b>G6</b>          | 0500H | ----- | ----- | 055FH |      |      |
| ---                | ---   | ---   | ---   | ---   | ---  | ---  |
| <b>G67</b>         | 4200H | ----- | ----- | 425FH |      |      |
| <b>G68</b>         | 4300H | ----- | ----- | 435FH |      |      |

Table 6.15 96X68 GRAM resolution

**(b) Partial display on**

PSL[15:0]=02, PEL[15:0]=41, ML=0.

| GRAM | 00h                | 01h                | 02h                | 03h                | -- | 5Dh                | 5Eh                | 5Fh                | -- | 80h                | 81h                | 82h                | 83h                |
|------|--------------------|--------------------|--------------------|--------------------|----|--------------------|--------------------|--------------------|----|--------------------|--------------------|--------------------|--------------------|
|      | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | -- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | -- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 |
| 00h  | 0000H              | 0001H              | 0002H              | 0003H              | -- | 005DH              | 005EH              | 005FH              | -- | 0080H              | 0081H              | 0082H              | 0083H              |
| 01h  | 0100H              | 0101H              | 0102H              | 0103H              | -- | 015DH              | 015EH              | 015FH              | -- | 0180H              | 0181H              | 0182H              | 0183H              |
| 02h  | 0200H              | 0201H              | 0202H              | 0203H              | -- | 025DH              | 025EH              | 025FH              | -- | 0280H              | 0281H              | 0282H              | 0283H              |
| 03h  | 0300H              | 0301H              | 0302H              | 0303H              | -- | 035DH              | 035EH              | 035FH              | -- | 0380H              | 0381H              | 0382H              | 0383H              |
| 04h  | 0400H              | 0401H              | 0402H              | 0403H              | -- | 045DH              | 045EH              | 045FH              | -- | 0480H              | 0481H              | 0482H              | 0483H              |
| 05h  | 0500H              | 0501H              | 0502H              | 0503H              | -- | 055DH              | 055EH              | 055FH              | -- | 0580H              | 0581H              | 0582H              | 0583H              |
|      |                    |                    |                    |                    | -- |                    |                    |                    | -- |                    |                    |                    |                    |
| 41h  | 4100H              | 4101H              | 4102H              | 4103H              | -- | 415DH              | 415EH              | 415FH              | -- | 4180H              | 4181H              | 4182H              | 4183H              |
| 42h  | 4200H              | 4201H              | 4202H              | 4203H              | -- | 425DH              | 425EH              | 425FH              | -- | 4280H              | 4281H              | 4282H              | 4283H              |
| 43h  | 4300H              | 4301H              | 4302H              | 4303H              | -- | 435DH              | 435EH              | 435FH              | -- | 4380H              | 4381H              | 4382H              | 4383H              |
|      |                    |                    |                    |                    | -- |                    |                    |                    | -- |                    |                    |                    |                    |
| 9Ch  | 9C00H              | 9C01H              | 9C02H              | 9C03H              | -- | 9C5DH              | 9C5EH              | 9C5FH              | -- | 9C80H              | 9C81H              | 9C82H              | 9C83H              |
| 9Dh  | 9D00H              | 9D01H              | 9D02H              | 9D03H              | -- | 9D5DH              | 9D5EH              | 9D5FH              | -- | 9D80H              | 9D81H              | 9D82H              | 9D83H              |
| 9Eh  | 9E00H              | 9E01H              | 9E02H              | 9E03H              | -- | 9E5DH              | 9E5EH              | 9E5FH              | -- | 9E80H              | 9E81H              | 9E82H              | 9E83H              |
| 9Fh  | 9F00H              | 9F01H              | 9F02H              | 9F03H              | -- | 9F5DH              | 9F5EH              | 9F5FH              | -- | 9F80H              | 9F81H              | 9F82H              | 9F83H              |
| A0h  | A000H              | A001H              | A002H              | A003H              | -- | A05DH              | A05EH              | A05FH              | -- | A080H              | A081H              | A082H              | A083H              |
| A1h  | A100H              | A101H              | A102H              | A103H              | -- | A15DH              | A15EH              | A15FH              | -- | A180H              | A181H              | A182H              | A183H              |

| LCD panel S/G pins | G1  | 0000H | ----- | 005FH | S342 |
|--------------------|-----|-------|-------|-------|------|
|                    | G2  | 0100H | ----- | 015FH | S341 |
|                    | G3  | 0200H | ----- | 025FH | S340 |
|                    | G4  | 0300H | ----- | 035FH |      |
|                    | G5  | 0400H | ----- | 045FH |      |
|                    | G6  | 0500H | ----- | 055FH |      |
|                    |     |       |       |       |      |
|                    | G66 | 4100H | ----- | 415FH |      |
|                    | G67 | 4200H | ----- | 425FH |      |
|                    | G68 | 4300H | ----- | 435FH |      |

Table 6.16 Partial area of 96X68 GRAM resolution

### 6.3.8.7 96x64 resolution (RSO[2:0]=3'b101)

#### (a) Normal display on

In this mode, contents of the frame memory within an area where column pointer is 00h to 5Fh and page pointer is 00h to 43h is displayed. To display a dot on leftmost top corner, store the dot data at (column pointer, row pointer) = (0, 0).

| GRAM       | 00h                | 01h                | 02h                | 03h                | -- | 5Dh                | 5Eh                | 5Fh                | -- | 80h                | 81h                | 82h                | 83h                |
|------------|--------------------|--------------------|--------------------|--------------------|----|--------------------|--------------------|--------------------|----|--------------------|--------------------|--------------------|--------------------|
|            | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | -- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | -- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 |
| <b>00h</b> | 0000H              | 0001H              | 0002H              | 0003H              | -- | 005DH              | 005EH              | 005FH              | -- | 0080H              | 0081H              | 0082H              | 0083H              |
| <b>01h</b> | 0100H              | 0101H              | 0102H              | 0103H              | -- | 015DH              | 015EH              | 015FH              | -- | 0180H              | 0181H              | 0182H              | 0183H              |
| <b>02h</b> | 0200H              | 0201H              | 0202H              | 0203H              | -- | 025DH              | 025EH              | 025FH              | -- | 0280H              | 0281H              | 0282H              | 0283H              |
| <b>03h</b> | 0300H              | 0301H              | 0302H              | 0303H              | -- | 035DH              | 035EH              | 035FH              | -- | 0380H              | 0381H              | 0382H              | 0383H              |
| <b>04h</b> | 0400H              | 0401H              | 0402H              | 0403H              | -- | 045DH              | 045EH              | 045FH              | -- | 0480H              | 0481H              | 0482H              | 0483H              |
| <b>05h</b> | 0500H              | 0501H              | 0502H              | 0503H              | -- | 055DH              | 055EH              | 055FH              | -- | 0580H              | 0581H              | 0582H              | 0583H              |
| ---        | ---                | ---                | ---                | ---                | -- | ---                | ---                | ---                | -- | ---                | ---                | ---                | ---                |
| <b>3Fh</b> | 3F00H              | 3F01H              | 3F02H              | 3F03H              | -- | 3F5DH              | 3F5EH              | 3F5FH              | -- | 3F80H              | 3F81H              | 3F82H              | 3F83H              |
| <b>40h</b> | 4000H              | 4001H              | 4002H              | 4003H              | -- | 405DH              | 405EH              | 405FH              | -- | 4080H              | 4081H              | 4082H              | 4083H              |
| <b>41h</b> | 4100H              | 4101H              | 4102H              | 4103H              | -- | 415DH              | 415EH              | 415FH              | -- | 4180H              | 4181H              | 4182H              | 4183H              |
| ---        | ---                | ---                | ---                | ---                | -- | ---                | ---                | ---                | -- | ---                | ---                | ---                | ---                |
| <b>9Ch</b> | 9C00H              | 9C01H              | 9C02H              | 9C03H              | -- | 9C5DH              | 9C5EH              | 9C5FH              | -- | 9C80H              | 9C81H              | 9C82H              | 9C83H              |
| <b>9Dh</b> | 9D00H              | 9D01H              | 9D02H              | 9D03H              | -- | 9D5DH              | 9D5EH              | 9D5FH              | -- | 9D80H              | 9D81H              | 9D82H              | 9D83H              |
| <b>9Eh</b> | 9E00H              | 9E01H              | 9E02H              | 9E03H              | -- | 9E5DH              | 9E5EH              | 9E5FH              | -- | 9E80H              | 9E81H              | 9E82H              | 9E83H              |
| <b>9Fh</b> | 9F00H              | 9F01H              | 9F02H              | 9F03H              | -- | 9F5DH              | 9F5EH              | 9F5FH              | -- | 9F80H              | 9F81H              | 9F82H              | 9F83H              |
| <b>A0h</b> | A000H              | A001H              | A002H              | A003H              | -- | A05DH              | A05EH              | A05FH              | -- | A080H              | A081H              | A082H              | A083H              |
| <b>A1h</b> | A100H              | A101H              | A102H              | A103H              | -- | A15DH              | A15EH              | A15FH              | -- | A180H              | A181H              | A182H              | A183H              |

| LCD panel S/G pins | S55   | S56   | S57   | S340  | S341 | S342 |
|--------------------|-------|-------|-------|-------|------|------|
| <b>G1</b>          | 0000H | ----- | ----- | 005FH |      |      |
| <b>G2</b>          | 0100H | ----- | ----- | 015FH |      |      |
| <b>G3</b>          | 0200H | ----- | ----- | 025FH |      |      |
| <b>G4</b>          | 0300H | ----- | ----- | 035FH |      |      |
| <b>G5</b>          | 0400H | ----- | ----- | 045FH |      |      |
| <b>G6</b>          | 0500H | ----- | ----- | 055FH |      |      |
| ---                | ---   | ---   | ---   | ---   | ---  | ---  |
| <b>G63</b>         | 3E00H | ----- | ----- | 3E5FH |      |      |
| <b>G64</b>         | 3F00H | ----- | ----- | 3F5FH |      |      |

Table 6.17 96X64 GRAM resolution

**(b) Partial display on**

PSL[15:0]=02, PEL[15:0]=3D, ML=0.

| GRAM | 00h                | 01h                | 02h                | 03h                | -- | 5Dh                | 5Eh                | 5Fh                | -- | 80h                | 81h                | 82h                | 83h                |
|------|--------------------|--------------------|--------------------|--------------------|----|--------------------|--------------------|--------------------|----|--------------------|--------------------|--------------------|--------------------|
|      | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | -- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | -- | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 | DB---DB<br>17 ---0 |
| 00h  | 0000H              | 0001H              | 0002H              | 0003H              | -- | 005DH              | 005EH              | 005FH              | -- | 0080H              | 0081H              | 0082H              | 0083H              |
| 01h  | 0100H              | 0101H              | 0102H              | 0103H              | -- | 015DH              | 015EH              | 015FH              | -- | 0180H              | 0181H              | 0182H              | 0183H              |
| 02h  | 0200H              | 0201H              | 0202H              | 0203H              | -- | 025DH              | 025EH              | 025FH              | -- | 0280H              | 0281H              | 0282H              | 0283H              |
| 03h  | 0300H              | 0301H              | 0302H              | 0303H              | -- | 035DH              | 035EH              | 035FH              | -- | 0380H              | 0381H              | 0382H              | 0383H              |
| 04h  | 0400H              | 0401H              | 0402H              | 0403H              | -- | 045DH              | 045EH              | 045FH              | -- | 0480H              | 0481H              | 0482H              | 0483H              |
| 05h  | 0500H              | 0501H              | 0502H              | 0503H              | -- | 055DH              | 055EH              | 055FH              | -- | 0580H              | 0581H              | 0582H              | 0583H              |
| ---  | ---                | ---                | ---                | ---                | -- | ---                | ---                | ---                | -- | ---                | ---                | ---                | ---                |
| 3Fh  | 3F00H              | 3F01H              | 3F02H              | 3F03H              | -- | 3F5DH              | 3F5EH              | 3F5FH              | -- | 3F80H              | 3F81H              | 3F82H              | 3F83H              |
| 40h  | 4000H              | 4001H              | 4002H              | 4003H              | -- | 405DH              | 405EH              | 405FH              | -- | 4080H              | 4081H              | 4082H              | 4083H              |
| 41h  | 4100H              | 4101H              | 4102H              | 4103H              | -- | 415DH              | 415EH              | 415FH              | -- | 4180H              | 4181H              | 4182H              | 4183H              |
| ---  | ---                | ---                | ---                | ---                | -- | ---                | ---                | ---                | -- | ---                | ---                | ---                | ---                |
| 9Ch  | 9C00H              | 9C01H              | 9C02H              | 9C03H              | -- | 9C5DH              | 9C5EH              | 9C5FH              | -- | 9C80H              | 9C81H              | 9C82H              | 9C83H              |
| 9Dh  | 9D00H              | 9D01H              | 9D02H              | 9D03H              | -- | 9D5DH              | 9D5EH              | 9D5FH              | -- | 9D80H              | 9D81H              | 9D82H              | 9D83H              |
| 9Eh  | 9E00H              | 9E01H              | 9E02H              | 9E03H              | -- | 9E5DH              | 9E5EH              | 9E5FH              | -- | 9E80H              | 9E81H              | 9E82H              | 9E83H              |
| 9Fh  | 9F00H              | 9F01H              | 9F02H              | 9F03H              | -- | 9F5DH              | 9F5EH              | 9F5FH              | -- | 9F80H              | 9F81H              | 9F82H              | 9F83H              |
| A0h  | A000H              | A001H              | A002H              | A003H              | -- | A05DH              | A05EH              | A05FH              | -- | A080H              | A081H              | A082H              | A083H              |
| A1h  | A100H              | A101H              | A102H              | A103H              | -- | A15DH              | A15EH              | A15FH              | -- | A180H              | A181H              | A182H              | A183H              |

| LCD panel S/G pins |       | S55   | S56 | S57 | S340  | S341 | S342 |
|--------------------|-------|-------|-----|-----|-------|------|------|
| G1                 | 0000H | ----- |     |     | 005FH |      |      |
| G2                 | 0100H | ----- |     |     | 015FH |      |      |
| G3                 | 0200H | ----- |     |     | 025FH |      |      |
| G4                 | 0300H | ----- |     |     | 035FH |      |      |
| G5                 | 0400H | ----- |     |     | 045FH |      |      |
| G6                 | 0500H | ----- |     |     | 055FH |      |      |
| ---                | ---   | ---   | --- | --- | ---   | ---  | ---  |
| G63                | 3E00H | ----- |     |     | 3E5FH |      |      |
| G64                | 3F00H | ----- |     |     | 3F5FH |      |      |

Table 6.18 Partial area of 96X64 GRAM resolution

## 6.4 Vertical scrolling display

The vertical scrolling display is specified by SCRLAR instruction (R33h) and VSCSAD instruction (R37h). The Vertical scrolling is only enable when using 132 x 162 GRAM resolution, display resolution 132RGB x 162 (RSO[2:0]=3'b000 & STE\_SEL=0) and display resolution 128RGB x 160 (RSO[2:0]=3'b011)

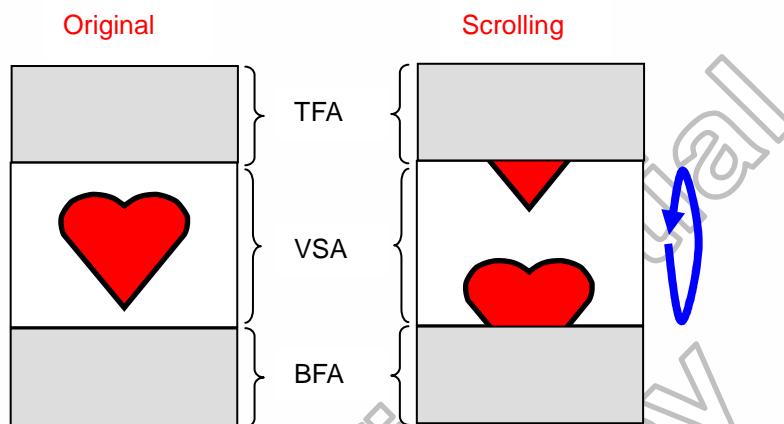


Figure 6.12 Vertical scrolling display

When RSO[2:0]=3'b000(132RGB x 162) and Vertical Scrolling Definition Parameters (TFA+VSA+BFA)=162 (other setting is prohibited). In this case, scrolling is applied as shown below.

**Example 1: RSO=3'b000(132RGB x 162), TFA =3, VSA=157, BFA=2, VSP=4, MADCTR(ML)=0: Scrolling**

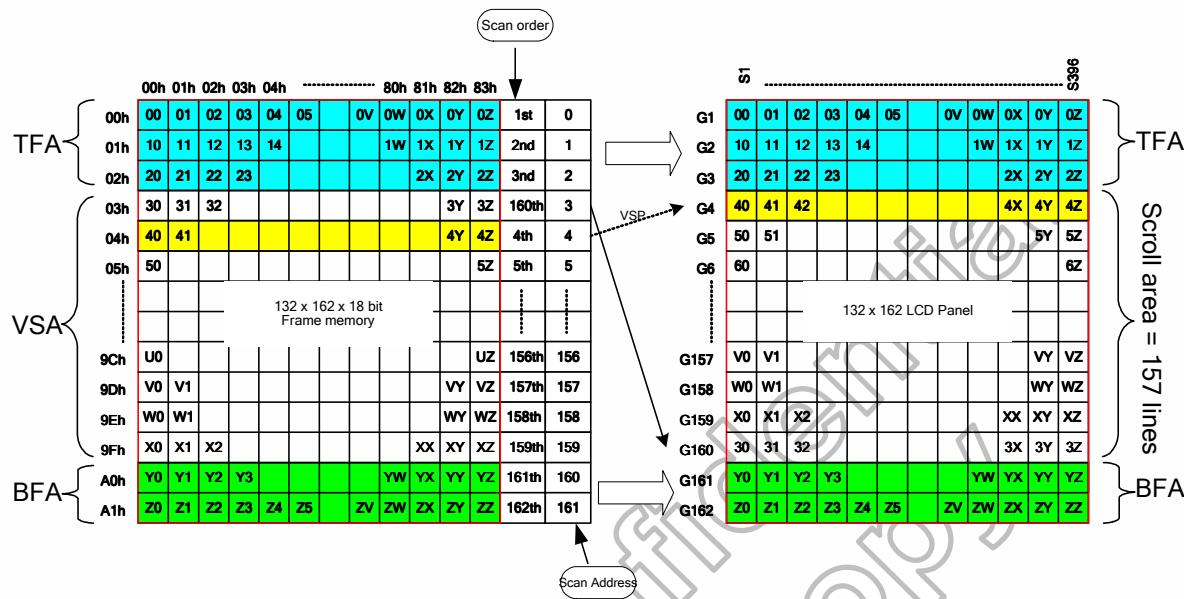


Figure 6.13 Example1 of scrolling

**Example 2: RSO=3'b000(132RGB x 162), TFA =3, VSA=157, BFA=2, VSP=4, MADCTR (ML)=1: Scrolling (TFA and BFA are exchanged)**

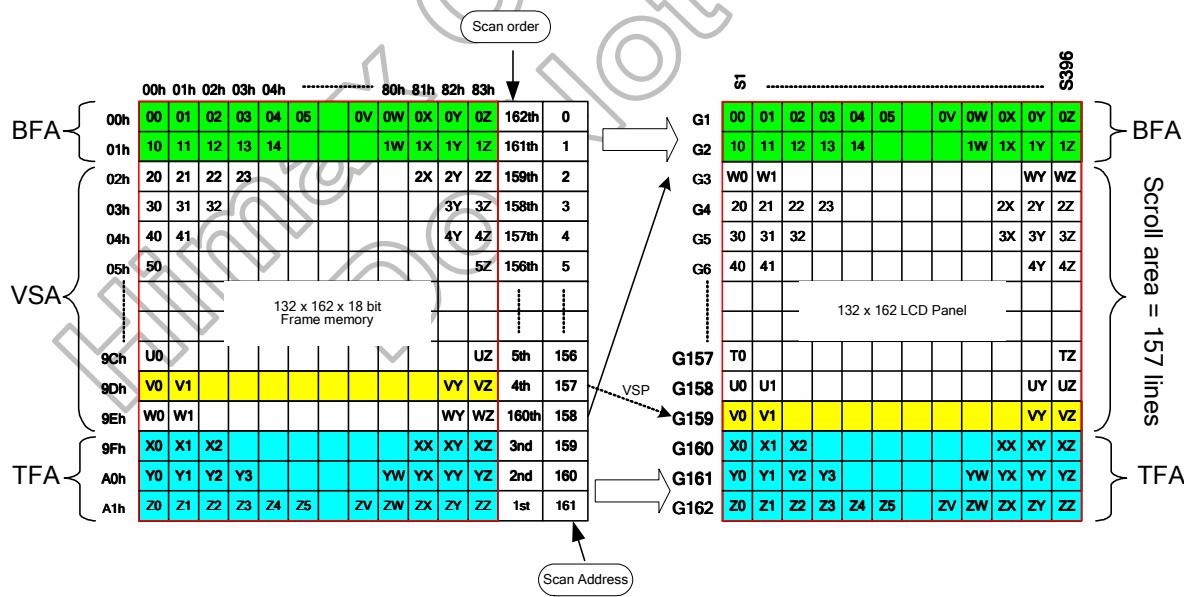


Figure 6.14 Example2 of scrolling

## 7. Functional Description

### 7.1 Internal Oscillator

The HX8353-E can oscillate an internal R-C oscillator for internal operation. Because the tolerance of internal oscillator frequency is  $\pm 5\%$ , it can be adjusted by the **RADJ[3:0]** bits for initial 6MHz internal clock generation. With other dividers setting, the 6MHz internal clock can be used to generate clock for other part of the chip using.

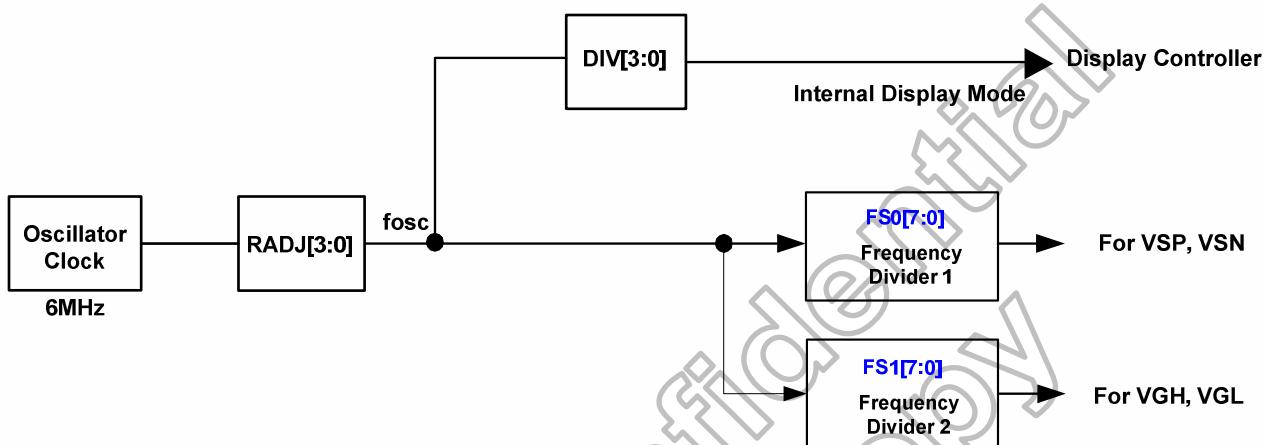


Figure 7.1 HX8353-E internal clock circuit

## 7.2 Gamma characteristic correction function

The HX8353-E incorporates gamma adjustment function for the 262,144-color display (64 grayscale for each R, G, B color). Gamma adjustment operation is implemented by deciding the 8 grayscale levels firstly in gamma adjustment control registers to match the LCD panel. These registers are available for both polarities.

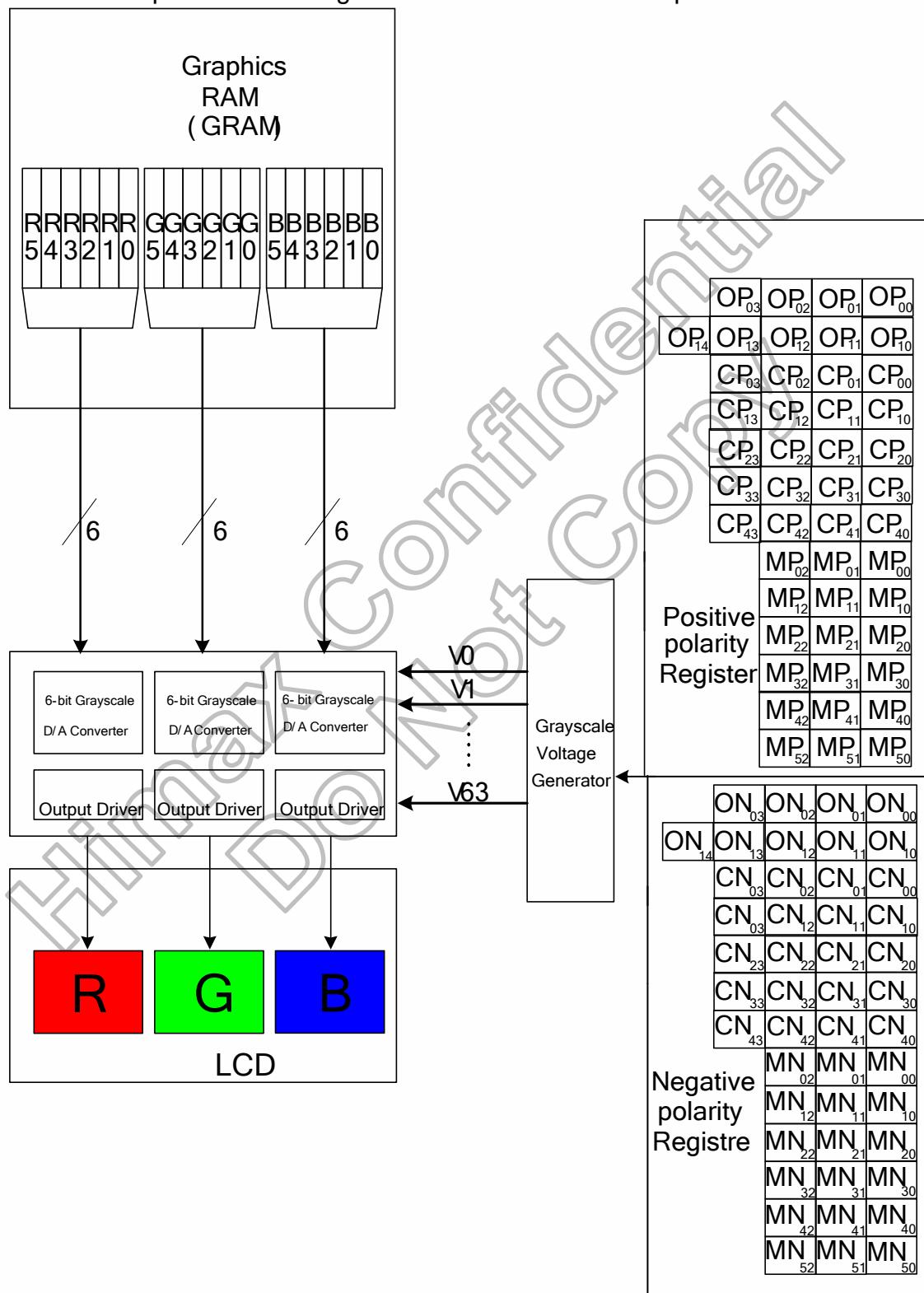
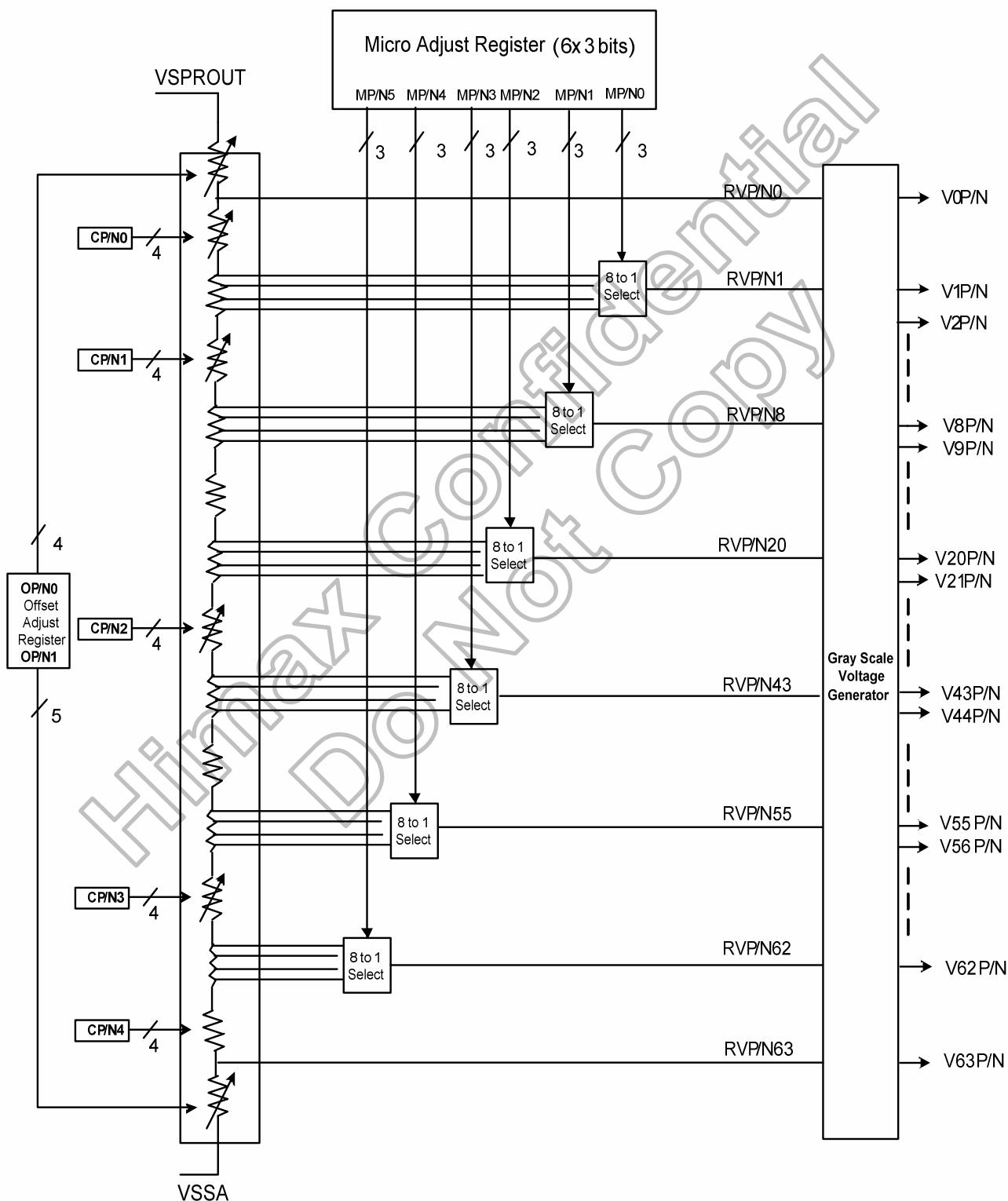


Figure 7.2 Grayscale control

### 7.2.1 Structure of grayscale voltage generator

Eight reference gamma voltages  $VgP/N(0, 1, 8, 20, 43, 55, 62, 63)$  for positive and negative polarity are specified by the center adjustment, the micro adjustment and the offset adjustment registers firstly. With those eight voltage injected into specified node of grayscale voltage generator, totally 64 grayscale voltages (V0-V63) can be generated from grayscale amplifier for LCD panel.



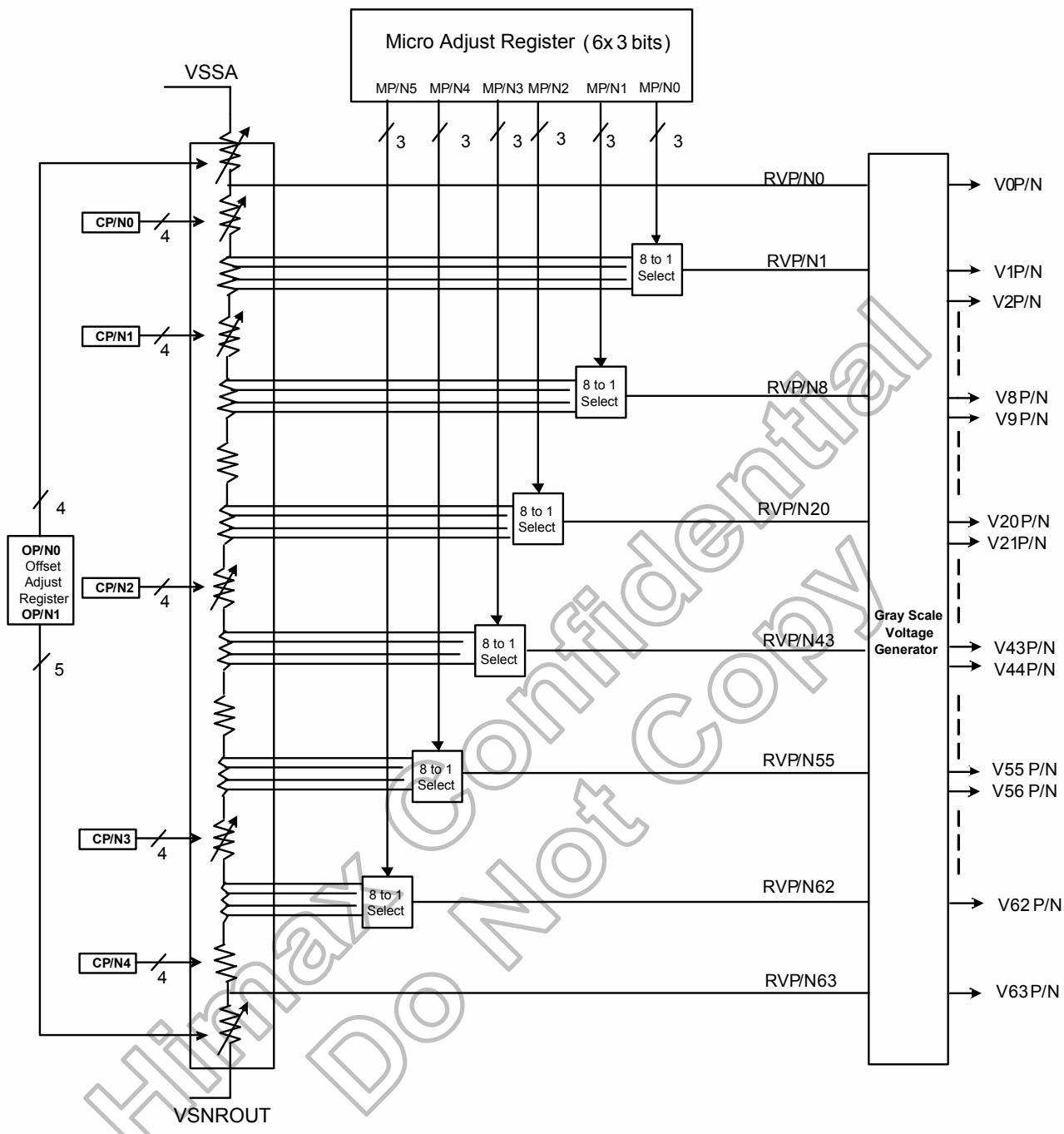


Figure 7.3 Structure of grayscale voltage Positive and Negative Generator

### 7.2.2 Gamma-characteristics adjustment register

This HX8353-E has register groups for specifying a series grayscale voltage that meets the Gamma-characteristics for the LCD panel. These registers are divided into two groups, which correspond to the gradient, amplitude, and macro adjustment of the voltage for the grayscale characteristics. The polarity of each register can be specified independently. (R, G, and B are common.)

### 7.2.2.1 Offset adjustment registers 0/1

The offset adjustment variable registers are used to adjust the amplitude of the grayscale voltage. This function is implemented by controlling these variable resistors in the top and bottom of the gamma resister stream for reference gamma voltage generation. These registers are available for both positive and negative polarities

### 7.2.2.2 Gamma center adjustment registers

The gamma center adjustment registers are used to adjust the reference gamma voltage in the middle level of grayscale without changing the dynamic range. This function is implemented by controlling these variable resistors in center of the gamma resister stream for reference gamma voltage generation. These registers are available for both positive and negative polarities.

### 7.2.2.3 Gamma macro adjustment registers

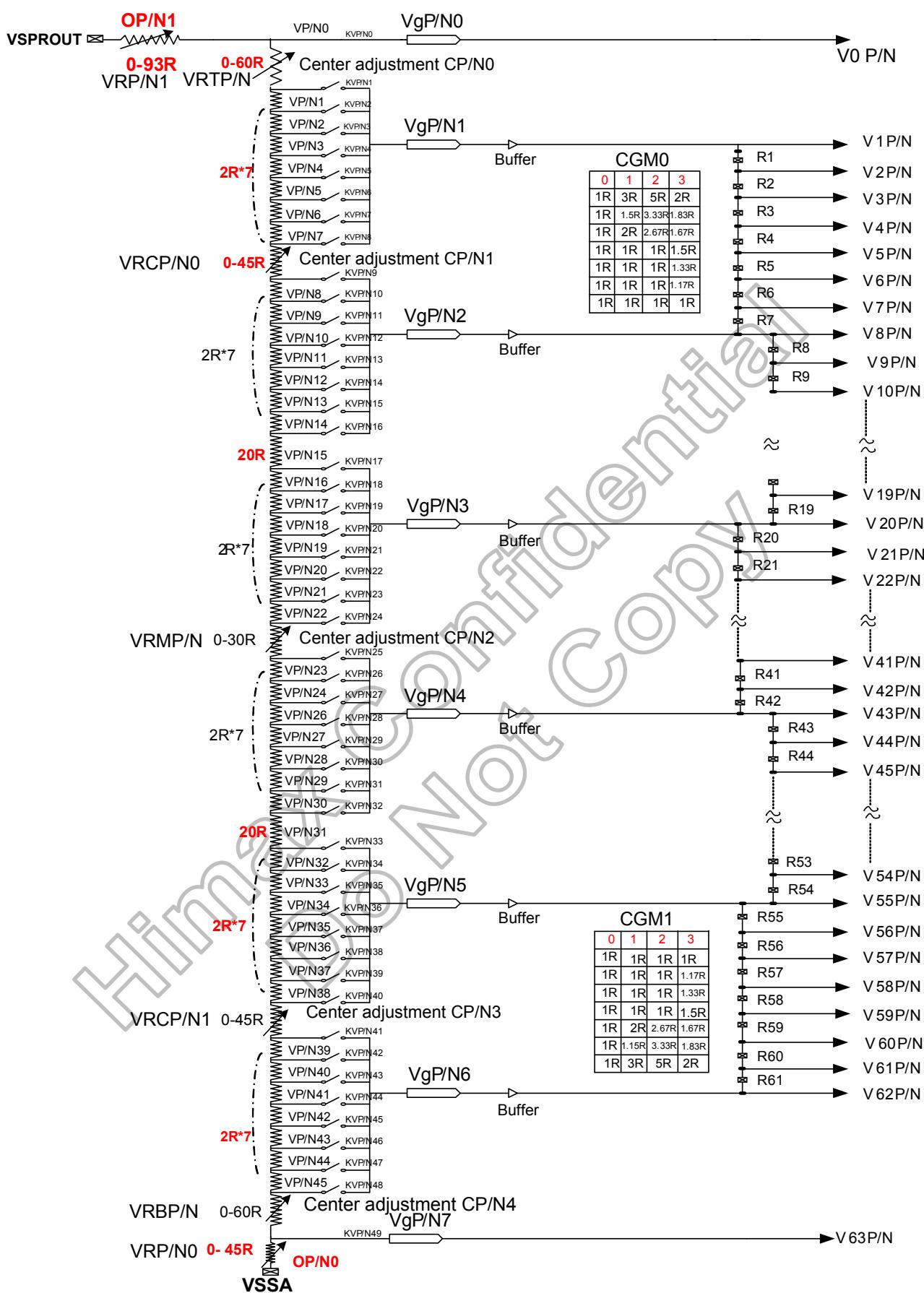
The gamma macro adjustment registers can be used for fine adjustment of the reference gamma voltage. This function is implemented by controlling the 8-to-1 selectors (MP/N0~5), each of which has 8 inputs and generate one reference voltage output (RVP/N 0, 1, 8, 20, 44, 56, 63, 64). These registers are available for both positive and negative polarities.

| Register Groups   | Positive Polarity | Description   |
|-------------------|-------------------|---|
| Center Adjustment | CP/N0 3-0         | Variable resistor (VRTP/N) for center adjustment          |
|                   | CP/N1 3-0         | Variable resistor (VRCP/N0)for center adjustment          |
|                   | CP/N2 3-0         | Variable resistor (VRMP/N) for center adjustment          |
|                   | CP/N3 3-0         | Variable resistor (VRCP/N1)for center adjustment          |
|                   | CP/N4 3-0         | Variable resistor (VRBP/N)for center adjustment           |
| Macro Adjustment  | MP/N0 2-0         | 8-to-1 selector (reference voltage level of grayscale 1)  |
|                   | MP/N1 2-0         | 8-to-1 selector (reference voltage level of grayscale 8)  |
|                   | MP/N2 2-0         | 8-to-1 selector (reference voltage level of grayscale 20) |
|                   | MP/N3 2-0         | 8-to-1 selector (reference voltage level of grayscale 43) |
|                   | MP/N4 2-0         | 8-to-1 selector (reference voltage level of grayscale 55) |
|                   | MP/N5 2-0         | 8-to-1 selector (reference voltage level of grayscale 62) |
| Offset Adjustment | OP/N0 3-0         | Variable resistor (VRP/N0)for offset adjustment           |
|                   | OP/N1 4-0         | Variable resistor (VRP/N1)for offset adjustment           |

Table 7.1 Gamma-adjustment registers

### 7.2.3 Gamma resister stream and 8 to 1 selector

The block consists of two gamma resister streams, one is for positive polarity and the other is for negative polarity, each one includes eight gamma reference voltages ( $Vg(P/N)0, 1, 8, 20, 43, 55, 62, 63$ ).



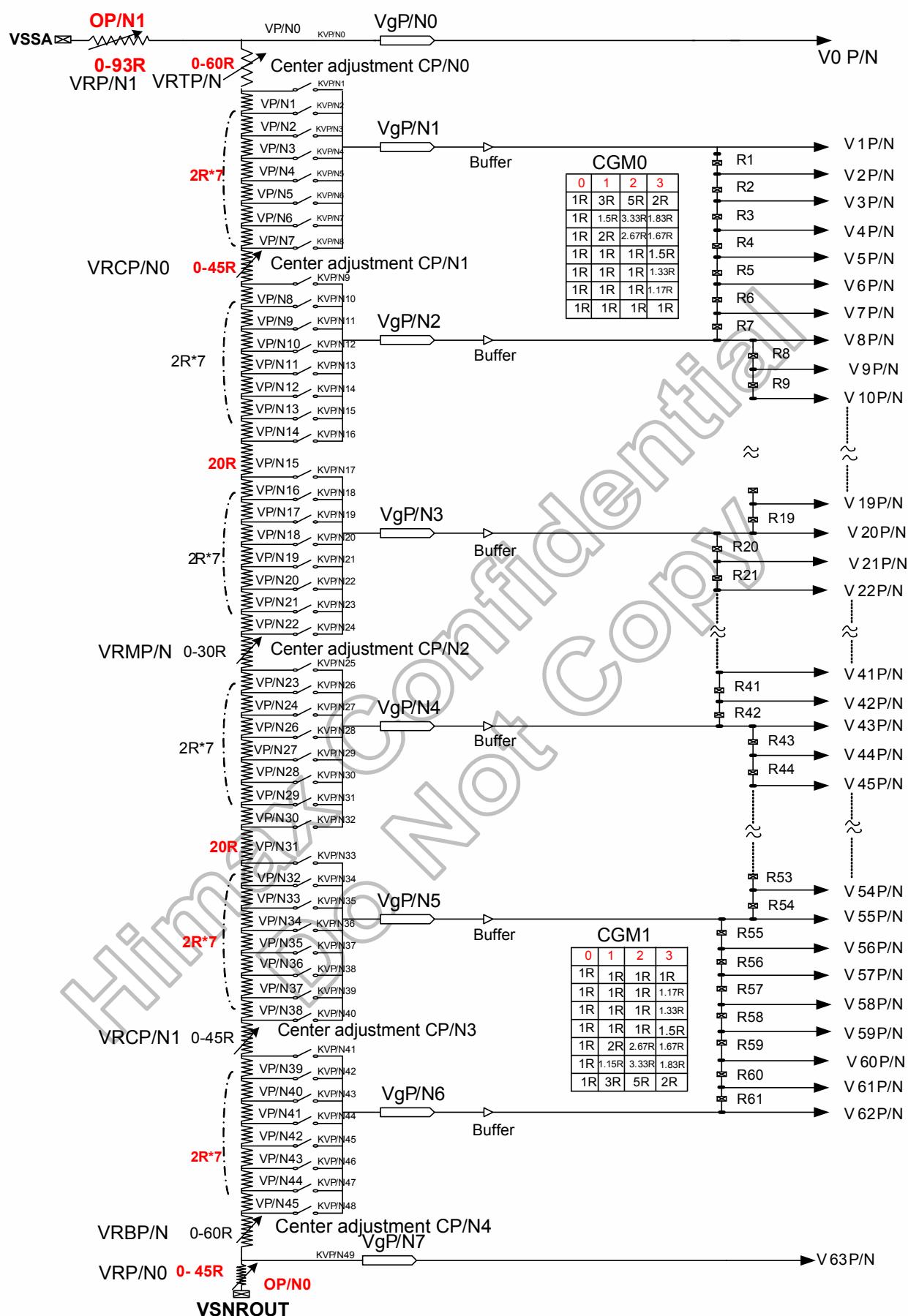


Figure 7.4 Gamma resistor stream and Positive &amp; Negative gamma reference voltage

### 7.2.4 Variable resistor

There are two types of variable resistors, one is for center adjustment and the other is for offset adjustment. The resistances are decided by setting values in the center adjustment, offset adjustment registers. Their relationship is shown as below.

| Value in Register<br>OP/N0 3-0 | Resistance<br>VRP/N0 | Value in Register<br>OP/N1 4-0 | Resistance<br>VRP/N1 |
|--------------------------------|----------------------|--------------------------------|----------------------|
| 0000                           | 0R                   | 00000                          | 0R                   |
| 0001                           | 3R                   | 00001                          | 3R                   |
| 0010                           | 6R                   | 00010                          | 6R                   |
| •                              |                      | •                              |                      |
| 1101                           | 39R                  | 11101                          | 87R                  |
| 1110                           | 42R                  | 11110                          | 90R                  |
| 1111                           | 45R                  | 11111                          | 93R                  |

Table 7.2 Offset adjustment

| Value in Register<br>CP/N0 3-0 | Resistance<br>VRTP/N | Value in Register<br>CP/N4 3-0 | Resistance<br>VRBP/N | Value in Register<br>CP/N2 3-0 | Resistance<br>VRMP/N0 |
|--------------------------------|----------------------|--------------------------------|----------------------|--------------------------------|-----------------------|
| 0000                           | 0R                   | 0000                           | 0R                   | 0000                           | 0R                    |
| 0001                           | 4R                   | 0001                           | 4R                   | 0001                           | 2R                    |
| 0010                           | 8R                   | 0010                           | 8R                   | 0010                           | 4R                    |
| •                              |                      | •                              | •                    | •                              | •                     |
| •                              |                      | •                              | •                    | •                              | •                     |
| 1100                           |                      | 1100                           | 48R                  | 1100                           | 24R                   |
| 1101                           | 52R                  | 1101                           | 52R                  | 1101                           | 26R                   |
| 1110                           | 56R                  | 1110                           | 56R                  | 1110                           | 28R                   |
| 1111                           | 60R                  | 1111                           | 60R                  | 1111                           | 30R                   |

| Value in Register<br>CP/N3 3-0 | Resistance<br>VRCP/N1 | Value in Register<br>CP/N1 3-0 | Resistance<br>VRCP/N0 |
|--------------------------------|-----------------------|--------------------------------|-----------------------|
| 0000                           | 0R                    | 0000                           | 0R                    |
| 0001                           | 3R                    | 0001                           | 3R                    |
| 0010                           | 6R                    | 0010                           | 6R                    |
| •                              | •                     | •                              | •                     |
| •                              | •                     | •                              | •                     |
| 1100                           | 36R                   | 1100                           | 36R                   |
| 1101                           | 39R                   | 1101                           | 39R                   |
| 1110                           | 42R                   | 1110                           | 42R                   |
| 1111                           | 45R                   | 1111                           | 45R                   |

Table 7.3 Center adjustment

**8 to 1 selector**

The 8 to 1 selector has eight input voltages generated by gamma resister stream, and outputs one reference voltages selected from inputs for gamma reference voltage generation by setting value in macro adjustment register. There are six 8 to 1 selectors and the relationship is shown as below.

| Value in Register | Voltage level |           |           |           |           |           |
|-------------------|---------------|-----------|-----------|-----------|-----------|-----------|
|                   | Vg(P/N) 1     | Vg(P/N) 2 | Vg(P/N) 3 | Vg(P/N) 4 | Vg(P/N) 5 | Vg(P/N) 6 |
| 000               | VP(N)1        | VP(N)9    | VP(N)17   | VP(N)25   | VP(N)33   | VP(N)41   |
| 001               | VP(N)2        | VP(N)10   | VP(N)18   | VP(N)26   | VP(N)34   | VP(N)42   |
| 010               | VP(N)3        | VP(N)11   | VP(N)19   | VP(N)27   | VP(N)35   | VP(N)43   |
| 011               | VP(N)4        | VP(N)12   | VP(N)20   | VP(N)28   | VP(N)36   | VP(N)44   |
| 100               | VP(N)5        | VP(N)13   | VP(N)21   | VP(N)29   | VP(N)37   | VP(N)45   |
| 101               | VP(N)6        | VP(N)14   | VP(N)22   | VP(N)30   | VP(N)38   | VP(N)46   |
| 110               | VP(N)7        | VP(N)15   | VP(N)23   | VP(N)31   | VP(N)39   | VP(N)47   |
| 111               | VP(N)8        | VP(N)16   | VP(N)24   | VP(N)32   | VP(N)40   | VP(N)48   |

Table 7.4 Output voltage of 8 to 1 selector

The grayscale levels are determined by the following formulas.

| Reference Voltage |               | Formula   |
|-------------------|---------------|---|
| VgP/N0            | -             | VSPROUT-VD*VRP/N1 /sumRP/N  |
| VgP1/VgN7         | MP/N0 2-0=000 | VSPROUT -VD((VRP/N1+VRTP/N) /sumRP/N  |
|                   | MP/N0 2-0=001 | VSPROUT -VD((VRP/N1+ VRTP/N +2R) /sumRP/N                                   |
|                   | MP/N0 2-0=010 | VSPROUT -VD((VRP/N1+ VRTP/N +4R) /sumRP/N                                   |
|                   | MP/N0 2-0=011 | VSPROUT -VD((VRP/N1+ VRTP/N +6R) /sumRP/N                                   |
|                   | MP/N0 2-0=100 | VSPROUT -VD((VRP/N1+ VRTP/N +8R) /sumRP/N                                   |
|                   | MP/N0 2-0=101 | VSPROUT -VD((VRP/N1+ VRTP/N +10R) /sumRP/N                                  |
|                   | MP/N0 2-0=110 | VSPROUT -VD((VRP/N1+ VRTP/N +12R) /sumRP/N                                  |
|                   | MP/N0 2-0=111 | VSPROUT -VD((VRP/N1+ VRTP/N +14R) /sumRP/N                                  |
| VgP2/VgN2         | MP/N1 2-0=000 | VSPROUT -VD((VRP/N1+ VRTP/N +14R+VRCP/N0) /sumRP/N                          |
|                   | MP/N1 2-0=001 | VSPROUT -VD((VRP/N1+ VRTP/N +16R+VRCP/N0) /sumRP/N                          |
|                   | MP/N1 2-0=010 | VSPROUT -VD((VRP/N1+ VRTP/N +18R+VRCP/N0) /sumRP/N                          |
|                   | MP/N1 2-0=011 | VSPROUT -VD((VRP/N1+ VRTP/N +20R+VRCP/N0) /sumRP/N                          |
|                   | MP/N1 2-0=100 | VSPROUT -VD((VRP/N1+ VRTP/N +22R+VRCP/N0) /sumRP/N                          |
|                   | MP/N1 2-0=101 | VSPROUT -VD((VRP/N1+ VRTP/N +24R+VRCP/N0) /sumRP/N                          |
|                   | MP/N1 2-0=110 | VSPROUT -VD((VRP/N1+ VRTP/N +26R+VRCP/N0) /sumRP/N                          |
|                   | MP/N1 2-0=111 | VSPROUT -VD((VRP/N1+ VRTP/N +28R+VRCP/N0) /sumRP/N                          |
| VgP3/VgN3         | MP/N2 2-0=000 | VSPROUT -VD((VRP/N1+ VRTP/N+48R+VRCP/N0) /sumRP/N                           |
|                   | MP/N2 2-0=001 | VSPROUT -VD((VRP/N1+ VRTP/N+50R+VRCP/N0) /sumRP/N                           |
|                   | MP/N2 2-0=010 | VSPROUT -VD((VRP/N1+ VRTP/N+52R+VRCP/N0) /sumRP/N                           |
|                   | MP/N2 2-0=011 | VSPROUT -VD((VRP/N1+ VRTP/N+54R+VRCP/N0) /sumRP/N                           |
|                   | MP/N2 2-0=100 | VSPROUT -VD((VRP/N1+ VRTP/N+56R+VRCP/N0) /sumRP/N                           |
|                   | MP/N2 2-0=101 | VSPROUT -VD((VRP/N1+ VRTP/N+58R+VRCP/N0) /sumRP/N                           |
|                   | MP/N2 2-0=110 | VSPROUT -VD((VRP/N1+ VRTP/N+60R+VRCP/N0) /sumRP/N                           |
|                   | MP/N2 2-0=111 | VSPROUT -VD((VRP/N1+ VRTP/N+62R+VRCP/N0) /sumRP/N                           |
| VgP4/VgN4         | MP/N3 2-0=000 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +62R+VRCP/N0) /sumRP/N                  |
|                   | MP/N3 2-0=001 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +64R+VRCP/N0) /sumRP/N                  |
|                   | MP/N3 2-0=010 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +66R+VRCP/N0) /sumRP/N                  |
|                   | MP/N3 2-0=011 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +68R+VRCP/N0) /sumRP/N                  |
|                   | MP/N3 2-0=100 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +70R+VRCP/N0) /sumRP/N                  |
|                   | MP/N3 2-0=101 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +72R+VRCP/N0) /sumRP/N                  |
|                   | MP/N3 2-0=110 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +74R+VRCP/N0) /sumRP/N                  |
|                   | MP/N3 2-0=111 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +76R+VRCP/N0) /sumRP/N                  |
| VgP5/VgN5         | MP/N4 2-0=000 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +96R+VRCP/N0) /sumRP/N                  |
|                   | MP/N4 2-0=001 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +98R+VRCP/N0) /sumRP/N                  |
|                   | MP/N4 2-0=010 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +100R+VRCP/N0) /sumRP/N                 |
|                   | MP/N4 2-0=011 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +102R+VRCP/N0) /sumRP/N                 |
|                   | MP/N4 2-0=100 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +104R+VRCP/N0) /sumRP/N                 |
|                   | MP/N4 2-0=101 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +106R+VRCP/N0) /sumRP/N                 |
|                   | MP/N4 2-0=110 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +108R+VRCP/N0) /sumRP/N                 |
|                   | MP/N4 2-0=111 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +110R+VRCP/N0) /sumRP/N                 |
| VgP6/VgN6         | MP/N5 2-0=000 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N+110R+VRCP/N0 +VRCP/N1) /sumRP/N         |
|                   | MP/N5 2-0=001 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +112R+VRCP/N0+VRCP/N1) /sumRP/N         |
|                   | MP/N5 2-0=010 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +114R+VRCP/N0+VRCP/N1) /sumRP/N         |
|                   | MP/N5 2-0=011 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +116R+VRCP/N0+VRCP/N1) /sumRP/N         |
|                   | MP/N5 2-0=100 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +118R+VRCP/N0+VRCP/N1) /sumRP/N         |
|                   | MP/N5 2-0=101 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +120R+VRCP/N0+VRCP/N1) /sumRP/N         |
|                   | MP/N5 2-0=110 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +122R+VRCP/N0+VRCP/N1) /sumRP/N         |
|                   | MP/N5 2-0=111 | VSPROUT -VD((VRP/N1+ VRTP/N+ VRMP/N +124R+VRCP/N0+VRCP/N1) /sumRP/N         |
| VgP7/VgN7         | -             | VSPROUT -VD((VRP/N1+ VRBP/N+ VRTP/N+ VRMP/N +104R+VRCP/N0+VRCP/N1) /sumRP/N |

SumRP=124R+VRP0+ VRP1+ VRTP+ VRCP0+VRMP+VRCP1+VRBP

SumRN=124R+ VRN0+ VRN1+ VRTN+ VRCN0+VRMN+VRCN1+VRBN

VD=(VSPROUT-VSSA)

Table 7.5 Voltage calculation formula

| Grayscale Voltage | Formula                        | Grayscale Voltage | Formula                        |
|-------------------|--------------------------------|-------------------|--------------------------------|
| V0P/V63N          | VgP/N0                         | V32P/V31N         | VgP/N4+(VgP/N3-VgP/N4)*(11/23) |
| V1P/V62N          | VgP/N1                         | V33P/V30N         | VgP/N4+(VgP/N3-VgP/N4)*(10/23) |
| V2P/V61N          | VgP/N2+(VgP/N1-VgP/N2)*CT1     | V34P/V29N         | VgP/N4+(VgP/N3-VgP/N4)*(9/23)  |
| V3P/V60N          | VgP/N2+(VgP/N1-VgP/N2)*CT2     | V35P/V28N         | VgP/N4+(VgP/N3-VgP/N4)*(8/23)  |
| V4P/V59N          | VgP/N2+(VgP/N1-VgP/N2)*CT3     | V36P/V27N         | VgP/N4+(VgP/N3-VgP/N4)*(7/23)  |
| V5P/V58N          | VgP/N2+(VgP/N1-VgP/N2)*CT4     | V37P/V26N         | VgP/N4+(VgP/N3-VgP/N4)*(6/23)  |
| V6P/V57N          | VgP/N2+(VgP/N1-VgP/N2)*CT5     | V38P/V25N         | VgP/N4+(VgP/N3-VgP/N4)*(5/23)  |
| V7P/V56N          | VgP/N2+(VgP/N1-VgP/N2)*CT6     | V39P/V24N         | VgP/N4+(VgP/N3-VgP/N4)*(4/23)  |
| V8P/V55N          | VgP/N2                         | V40P/V23N         | VgP/N4+(VgP/N3-VgP/N4)*(3/23)  |
| V9P/V54N          | VgP/N3+(VgP/N2-VgP/N3)*(22/24) | V41P/V22N         | VgP/N4+(VgP/N3-VgP/N4)*(2/23)  |
| V10P/V53N         | VgP/N3+(VgP/N2-VgP/N3)*(20/24) | V42P/V21N         | VgP/N4+(VgP/N3-VgP/N4)*(1/23)  |
| V11P/V52N         | VgP/N3+(VgP/N2-VgP/N3)*(18/24) | V43P/V20N         | VgP/N4                         |
| V12P/V51N         | VgP/N3+(VgP/N2-VgP/N3)*(16/24) | V44P/V19N         | VgP/N5+(VgP/N4-VgP/N5)*(22/24) |
| V13P/V50N         | VgP/N3+(VgP/N2-VgP/N3)*(14/24) | V45P/V18N         | VgP/N5+(VgP/N4-VgP/N5)*(20/24) |
| V14P/V49N         | VgP/N3+(VgP/N2-VgP/N3)*(12/24) | V46P/V17N         | VgP/N5+(VgP/N4-VgP/N5)*(18/24) |
| V15P/V48N         | VgP/N3+(VgP/N2-VgP/N3)*(10/24) | V47P/V16N         | VgP/N5+(VgP/N4-VgP/N5)*(16/24) |
| V16P/V47N         | VgP/N3+(VgP/N2-VgP/N3)*(8/24)  | V48P/V15N         | VgP/N5+(VgP/N4-VgP/N5)*(14/24) |
| V17P/V46N         | VgP/N3+(VgP/N2-VgP/N3)*(6/24)  | V49P/V14N         | VgP/N5+(VgP/N4-VgP/N5)*(12/24) |
| V18P/V45N         | VgP/N3+(VgP/N2-VgP/N3)*(4/24)  | V50P/V13N         | VgP/N5+(VgP/N4-VgP/N5)*(10/24) |
| V19P/V44N         | VgP/N3+(VgP/N2-VgP/N3)*(2/24)  | V51P/V12N         | VgP/N5+(VgP/N4-VgP/N5)*(8/24)  |
| V20P/V43N         | VgP/N3                         | V52P/V11N         | VgP/N5+(VgP/N4-VgP/N5)*(6/24)  |
| V21P/V42N         | VgP/N4+(VgP/N3-VgP/N4)*(22/23) | V53P/V10N         | VgP/N5+(VgP/N4-VgP/N5)*(4/24)  |
| V22P/V41N         | VgP/N4+(VgP/N3-VgP/N4)*(21/23) | V54P/V9N          | VgP/N5+(VgP/N4-VgP/N5)*(2/24)  |
| V23P/V40N         | VgP/N4+(VgP/N3-VgP/N4)*(20/23) | V55P/V8N          | VgP/N5                         |
| V24P/V39N         | VgP/N4+(VgP/N3-VgP/N4)*(19/23) | V56P/V7N          | VgP/N6+(VgP/N5-VgP/N6)*CB1     |
| V25P/V38N         | VgP/N4+(VgP/N3-VgP/N4)*(18/23) | V57P/V6N          | VgP/N6+(VgP/N5-VgP/N6)*CB2     |
| V26P/V37N         | VgP/N4+(VgP/N3-VgP/N4)*(17/23) | V58P/V5N          | VgP/N6+(VgP/N5-VgP/N6)*CB3     |
| V27P/V36N         | VgP/N4+(VgP/N3-VgP/N4)*(16/23) | V59P/V4N          | VgP/N6+(VgP/N5-VgP/N6)*CB4     |
| V28P/V35N         | VgP/N4+(VgP/N3-VgP/N4)*(15/23) | V60P/V3N          | VgP/N6+(VgP/N5-VgP/N6)*CB5     |
| V29P/V34N         | VgP/N4+(VgP/N3-VgP/N4)*(14/23) | V61P/V2N          | VgP/N6+(VgP/N5-VgP/N6)*CB6     |
| V30P/V33N         | VgP/N4+(VgP/N3-VgP/N4)*(13/23) | V62P/V1N          | VgP/N6                         |
| V31P/V32N         | VgP/N4+(VgP/N3-VgP/N4)*(12/23) | V63P/V0N          | VgP/N7                         |

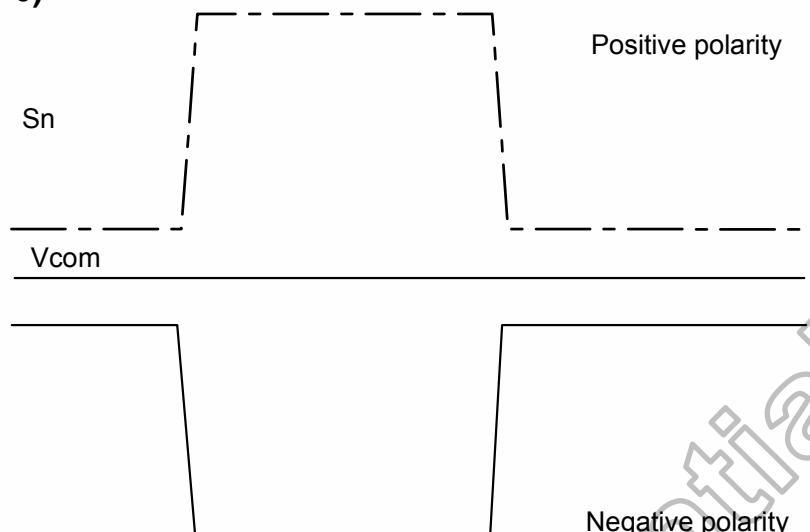
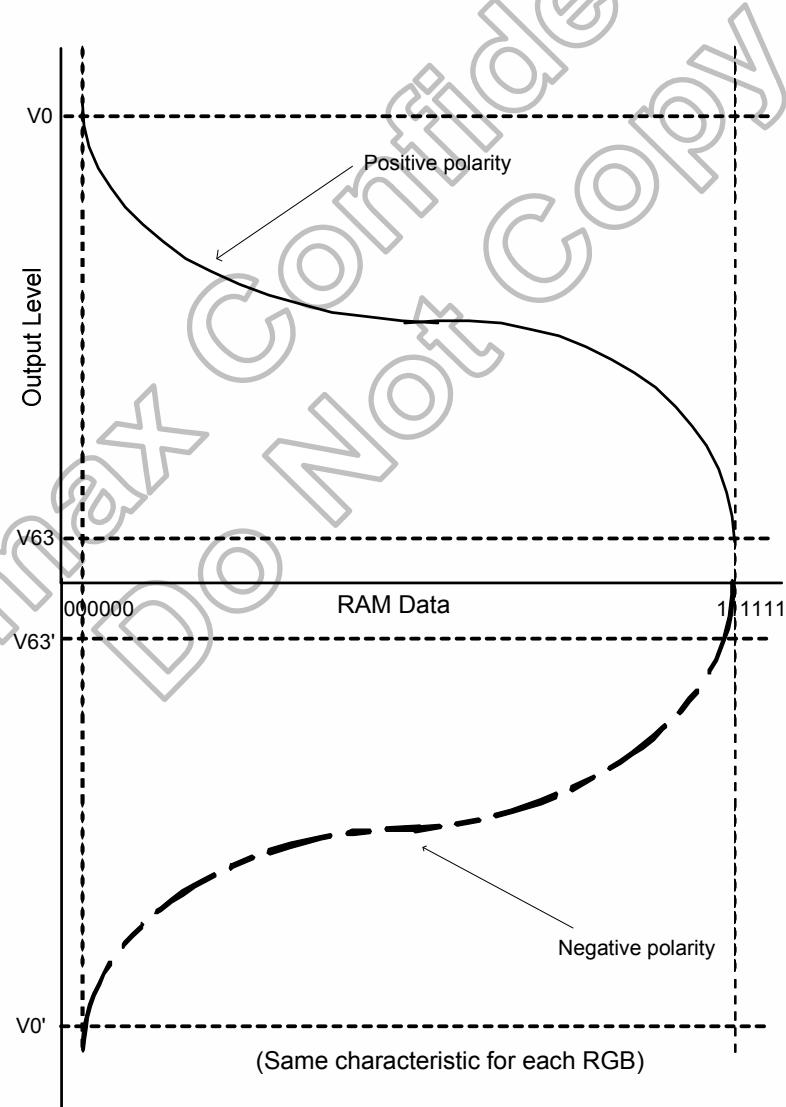
Table 7.6 Voltage calculation formula of grayscale voltage

| CGM0[1:0] | “00” | “01”     | “10”    | “11”      |
|-----------|------|----------|---------|-----------|
| CT1       | 6/7  | 7.5/10.5 | 10/15   | 8.5/10.5  |
| CT2       | 5/7  | 6/10.5   | 6.67/15 | 6.67/10.5 |
| CT3       | 4/7  | 4/10.5   | 4/15    | 5.0/10.5  |
| CT4       | 3/7  | 3/10.5   | 3/15    | 3.5/10.5  |
| CT5       | 2/7  | 2/10.5   | 2/15    | 2.17/10.5 |
| CT6       | 1/7  | 1/10.5   | 1/15    | 1/10.5    |

| CGM1[1:0] | “00” | “01”     | “10”    | “11”      |
|-----------|------|----------|---------|-----------|
| CB1       | 6/7  | 9.5/10.5 | 14/15   | 9.5/10.5  |
| CB2       | 5/7  | 8.5/10.5 | 13/15   | 8.33/10.5 |
| CB3       | 4/7  | 7.5/10.5 | 12/15   | 7.0/10.5  |
| CB4       | 3/7  | 6.5/10.5 | 11/15   | 5.5/10.5  |
| CB5       | 2/7  | 4.5/10.5 | 8.33/15 | 3.83/10.5 |
| CB6       | 1/7  | 3.0/10.5 | 5/15    | 2.0/10.5  |

Note: Negative gamma don't have CGM0/CGM1 setting, the ratio V2~V7 and V56~V61 is automatically mapping from positive side.

Table 7.7 Voltage calculation formula of grayscale voltage V2~V7 and V56~V61

**Relationship between GRAM Data and Output Level (“Normally White Panel”,  
GRAM data=0)**

**Figure 7.5 Relationship between source output and VCOM**

**Figure 7.6 Relationship between GRAM data and output level (normal white panel REV\_Panel=“0”)**

### Four-characteristic gamma curve selection

There are four kind of Gamma Curve is selected by GAMSET command. The parameter GC[7:0] is stored in internal register and used to select one set of gamma correction register.

**GC\_SEL="L":**

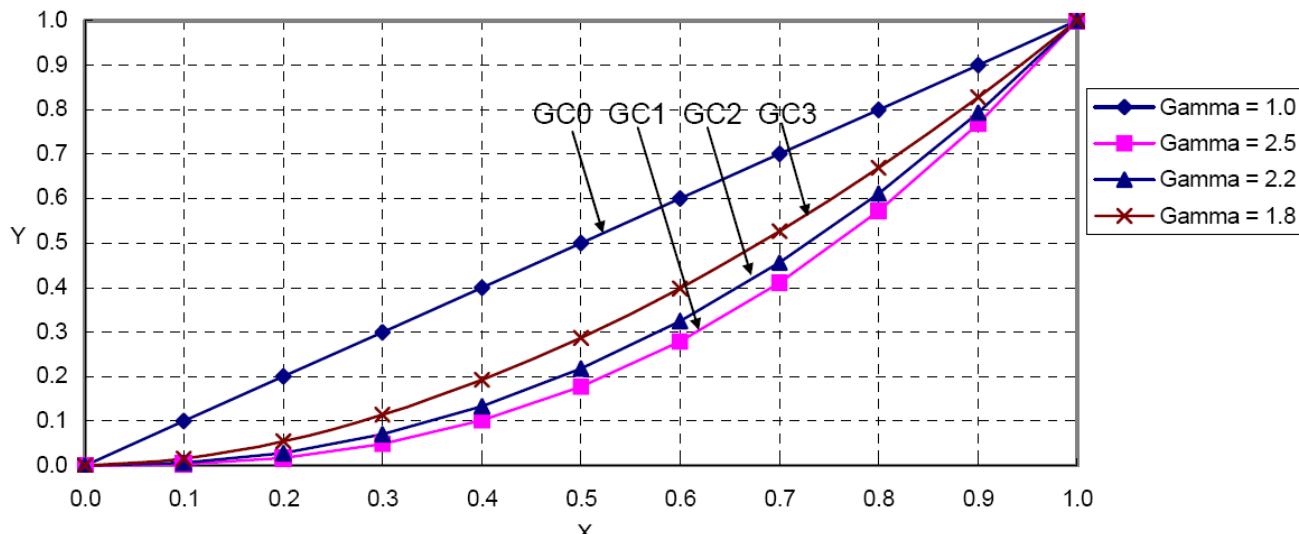


Figure 7.7 Gamma curve according to GC0 to GC3 bit (GC\_SEL="L")

**GC\_SEL="H":**

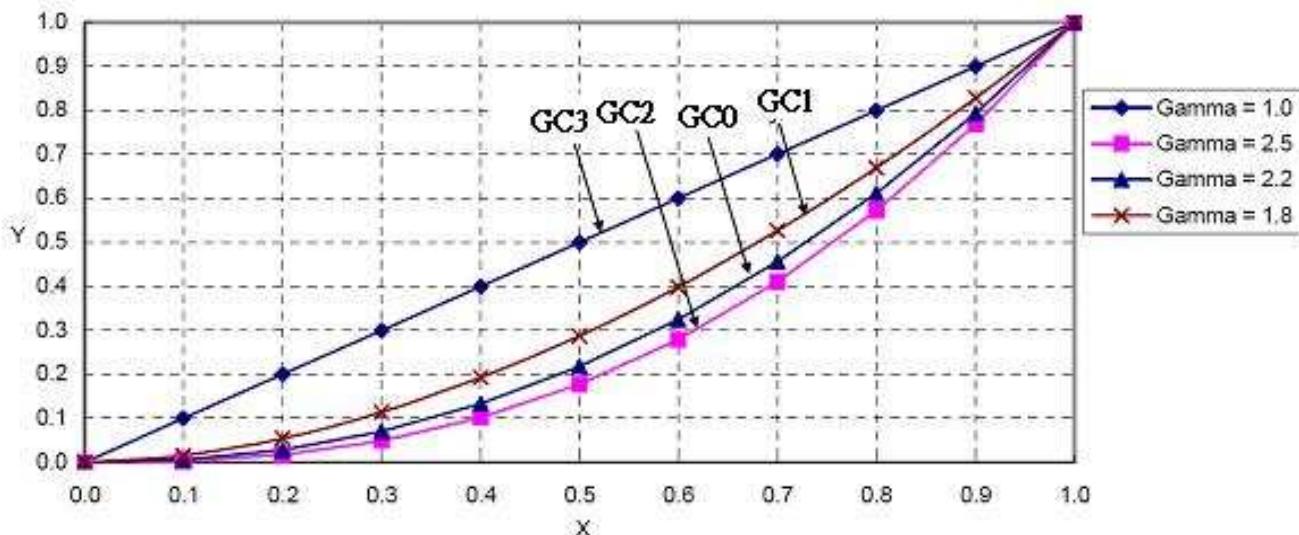


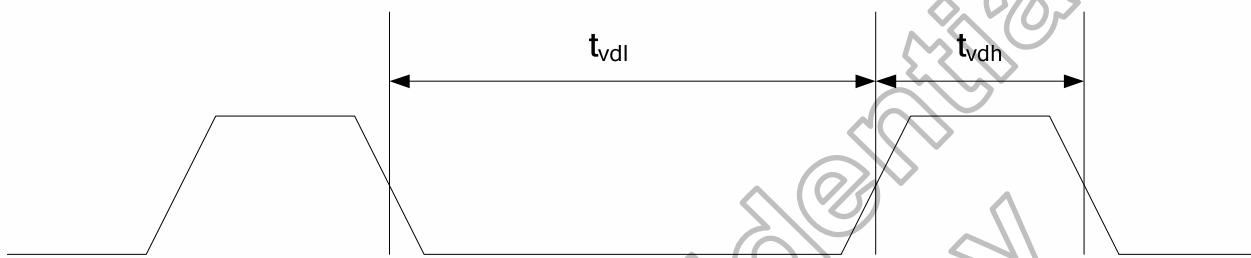
Figure 7.8 Gamma curve according to GC0 to GC3 bit (GC\_SEL="H")

## 7.3 Tearing effect output line

The Tearing Effect output line supplies to the MPU a Panel synchronization signal. This signal can be enabled or disabled by the Tearing Effect Line off & on commands. The mode of the Tearing Effect signal is defined by the parameter of the Tearing Effect Line On command. The signal can be used by the MPU to synchronize Frame Memory Writing when displaying video images.

### 7.3.1 Tearing effect line modes

**Mode 1:** The Tearing Effect Output signal consists of V-Blanking Information only:



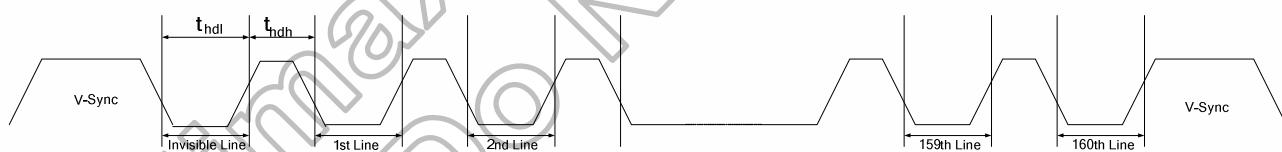
$t_{vdh}$  = The LCD display is not updated from the Frame Memory

$t_{vdl}$  = The LCD display is updated from the Frame Memory (except Invisible Line – see below)

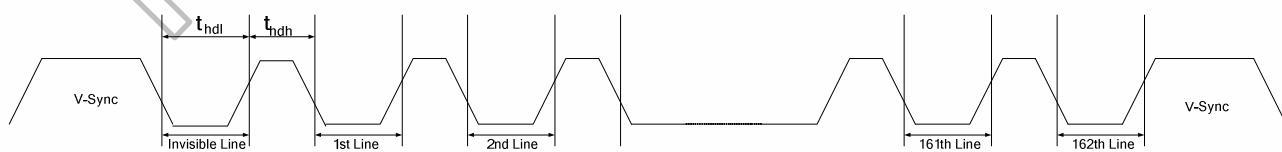
Figure 7.9 TE mode 1 output

**Mode 2:** The Tearing Effect Output signal consists of V-Blanking and H-Blanking Information, there is one V-sync and N H-sync pulses per field on different resolution.

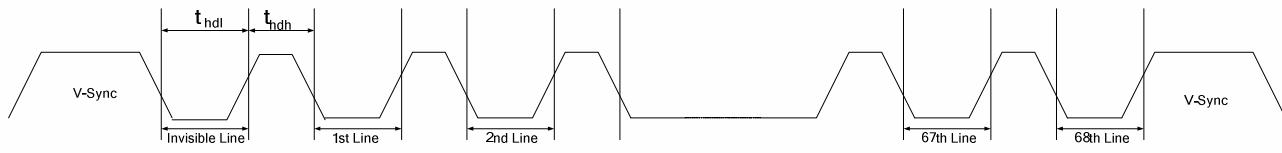
128RGBx160: N=160



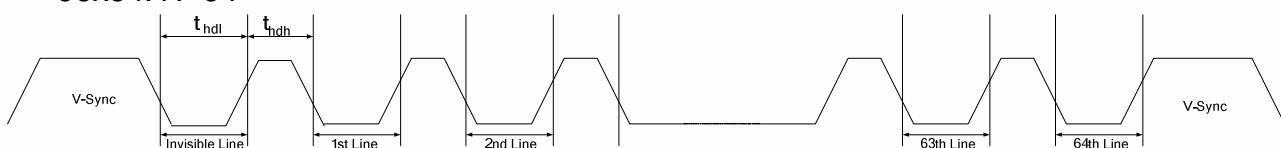
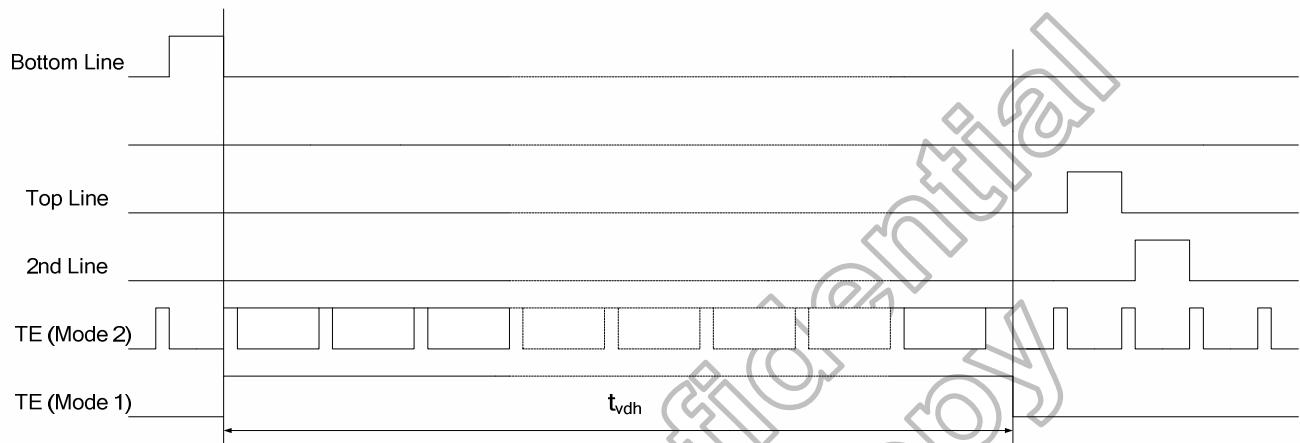
132RGBx162: N=162



96x68: N=68

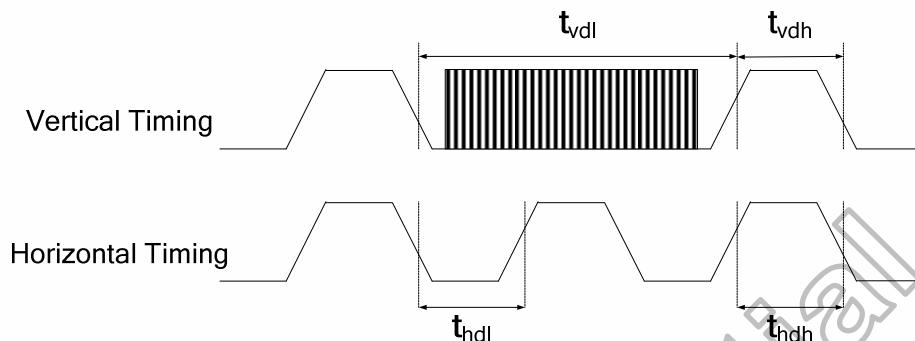


96x64: N=64

**Figure 7.10 TE mode 2 output** $t_{hdh}$ = The LCD display is not updated from the Frame Memory $t_{hdl}$ = The LCD display is updated from the Frame Memory (except Invisible Line – see above.)**Note:** During Sleep In Mode, the Tearing Output Pin is active Low.**Figure 7.11 TE output waveform**

### 7.3.2 Tearing effect line timing

The Tearing Effect signal is described below.



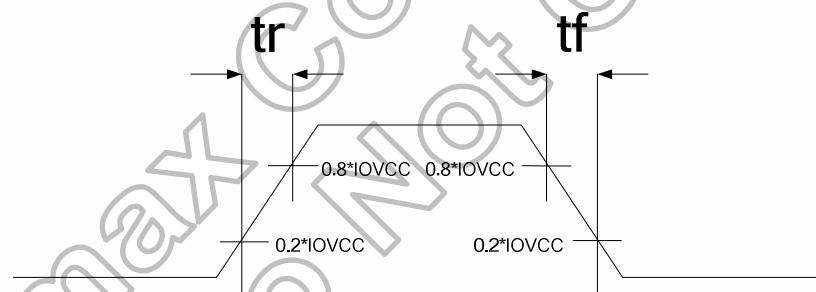
**Figure 7.12 Waveform of tearing effect signal**

Idle Mode Off (Frame Rate=60Hz)

| Symbol | Parameter                       | Min. | Max. | Unit | Description |
|--------|---------------------------------|------|------|------|-------------|
| tvdl   | Vertical Timing Low Duration    | TBD  | -    | ms   | -           |
| tvdh   | Vertical Timing High Duration   | 1000 | -    | μs   | -           |
| thdl   | Horizontal Timing Low Duration  | TBD  | -    | μs   | -           |
| thdh   | Horizontal Timing High Duration | TBD  | 500  | μs   | -           |

**Table 7.8 AC characteristics of tearing effect signal**

The signal's rise and fall times ( $tf$ ,  $tr$ ) are stipulated to be equal to or less than 15ns.



**Figure 7.13 Timing of tearing effect signal**

The Tearing Effect Output Line is fed back to the MPU and should be used as shown below to avoid Tearing Effect:

### 7.3.3 Example 1: MPU write is faster than panel read

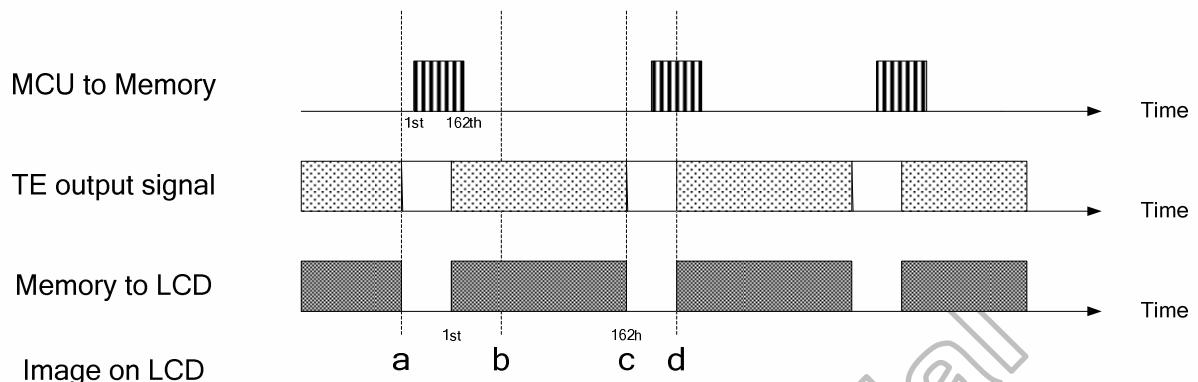


Figure 7.14 Timing of MPU write is faster than panel read

Data write to frame memory is now synchronized to the panel scan. It should be written during the vertical sync pulse of the tearing effect output line. This ensures that data is always written ahead of the panel scan and each panel frame refresh has a complete new image:

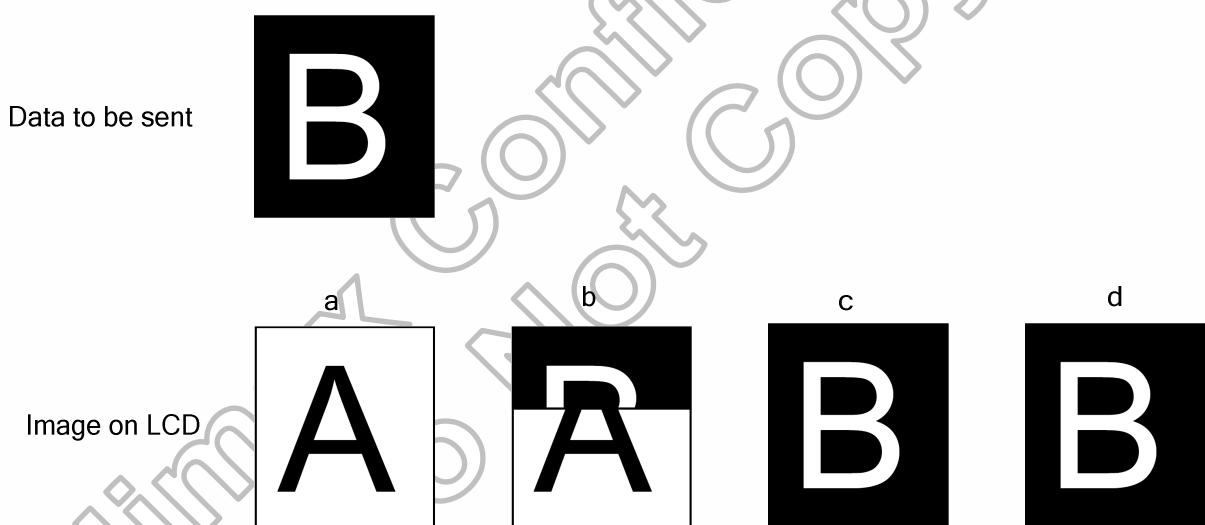
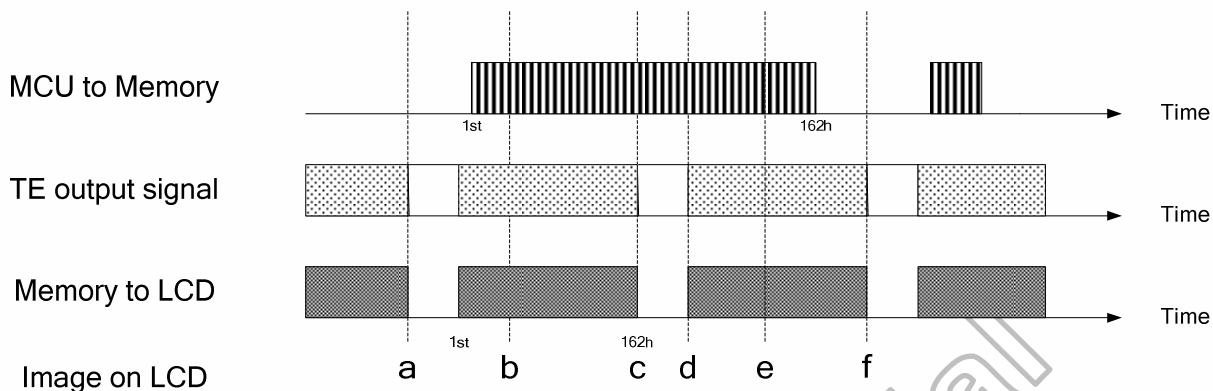


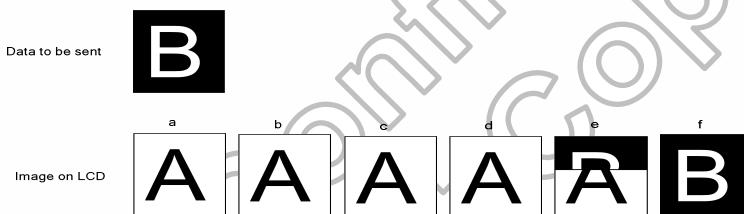
Figure 7.15 Display of MPU write is faster than panel read

### 7.3.4 Example 2: MPU write is slower than panel read



**Figure 7.16 Timing of MPU write is slower than panel read**

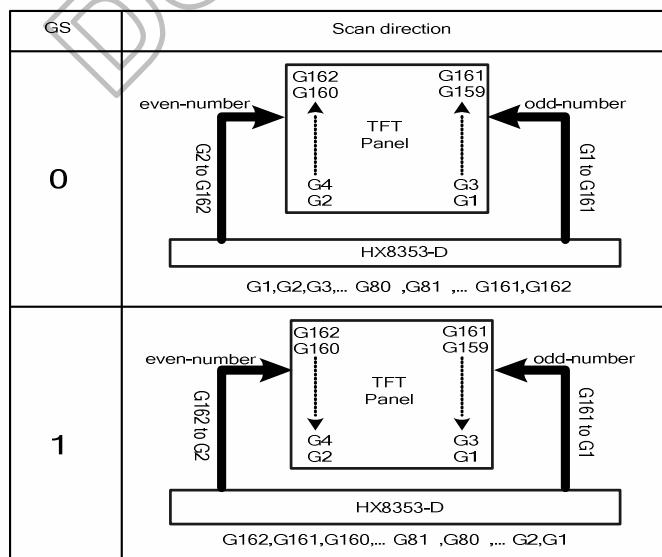
The MPU to frame memory write begins just after panel read has commenced i.e. after one horizontal sync pulse of the tearing effect output line. This allows time for the image to download behind the panel read pointer and finishing download during the subsequent frame before the read pointer “catches” the MPU to frame memory write position.



**Figure 7.17 Display of MPU write is slower than panel read**

### 7.4 Scan Mode Setting

HX8353-E can set internal register GS\_PANEL bit to determine the pin assignment of gate. The GS\_PANEL setting allows changing the shift direction of gate outputs by connecting LCD panel with the HX8353-E.



**Figure 7.18 Gate Scan Mode**

## 7.5 LCD power generation circuit

### 7.5.1 Power supply circuit

The power circuit of HX8353-E is used to generate supply voltages for LCD panel driving.

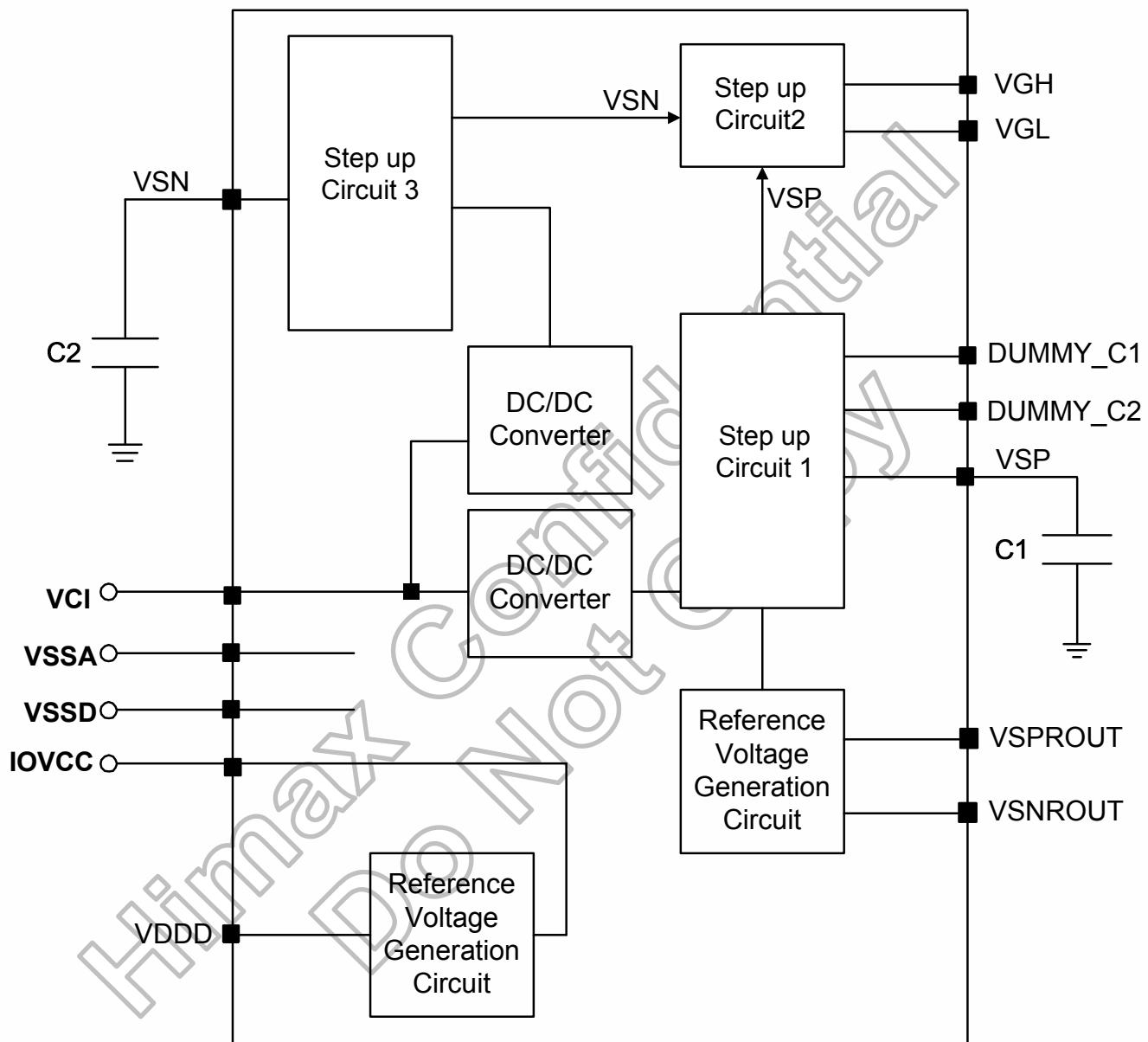


Figure 7.19 Block diagram of HX8353-E power circuit

#### Specification of Connected Passive Component

| Capacitor | Recommended voltage | Capacity                      |
|-----------|---------------------|-------------------------------|
| C1 (VSP)  | 10V                 | 1 $\mu$ F (B characteristics) |
| C2 (VSN)  | 10V                 | 1 $\mu$ F (B characteristics) |

Table 7.9 The adoptability of Capacitor

### 7.5.2 LCD power generation scheme

The boost voltage generated is shown as below.

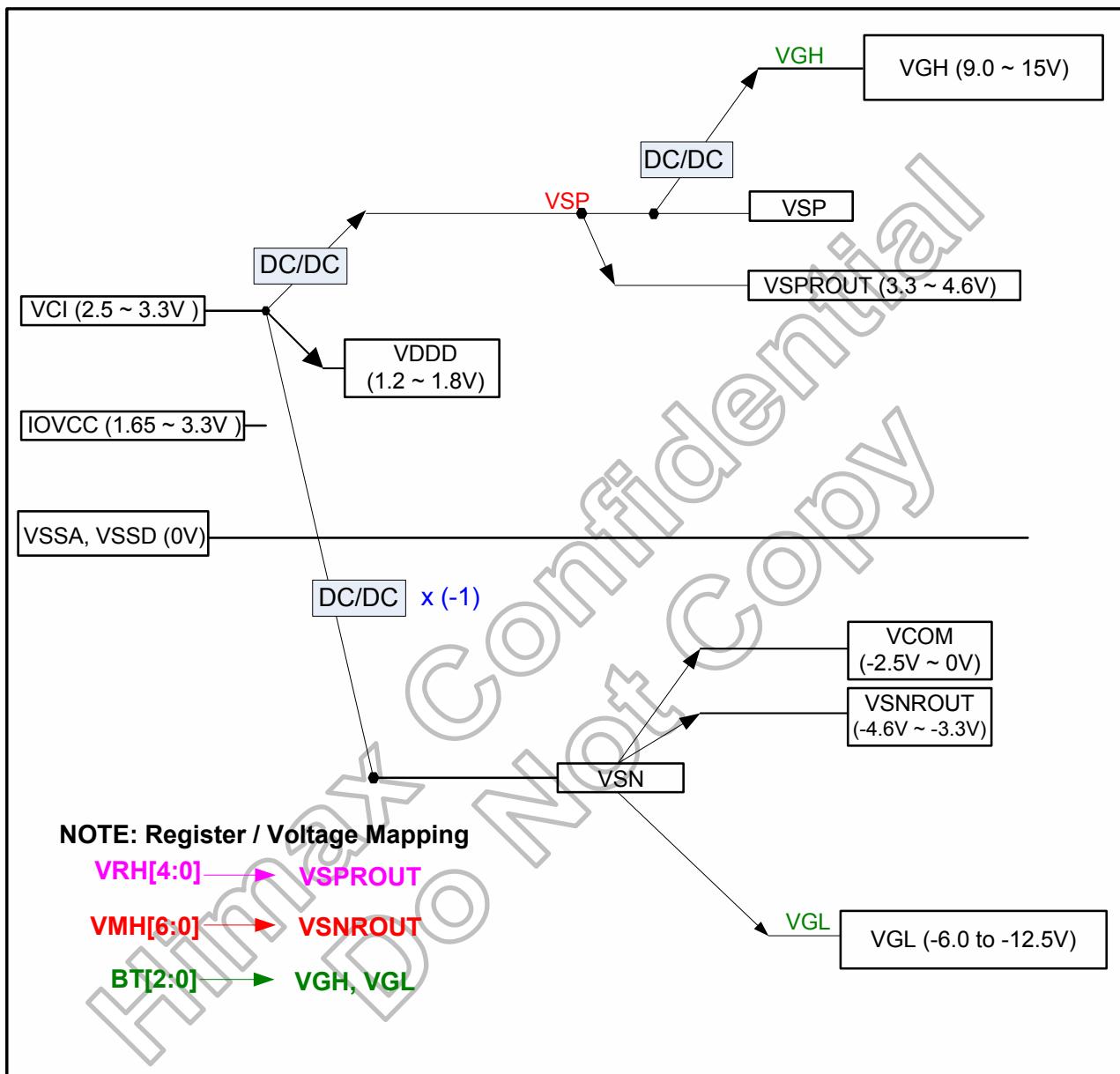


Figure 7.20 LCD power generation scheme

## 7.6 Power function

### 7.6.1 Power on/off sequence

Power source IOVCC, VCI can be applied and powered down in any order. IOVCC, VCI can be powered down in any order.

During power off, if LCD is in the Sleep Out mode, IOVCC, VCI must be powered down minimum 120msec after NRESET has been released.

During power off, if LCD is in the Sleep In mode, IOVCC, VCI can be powered down minimum 0msec after NRESET has been released.

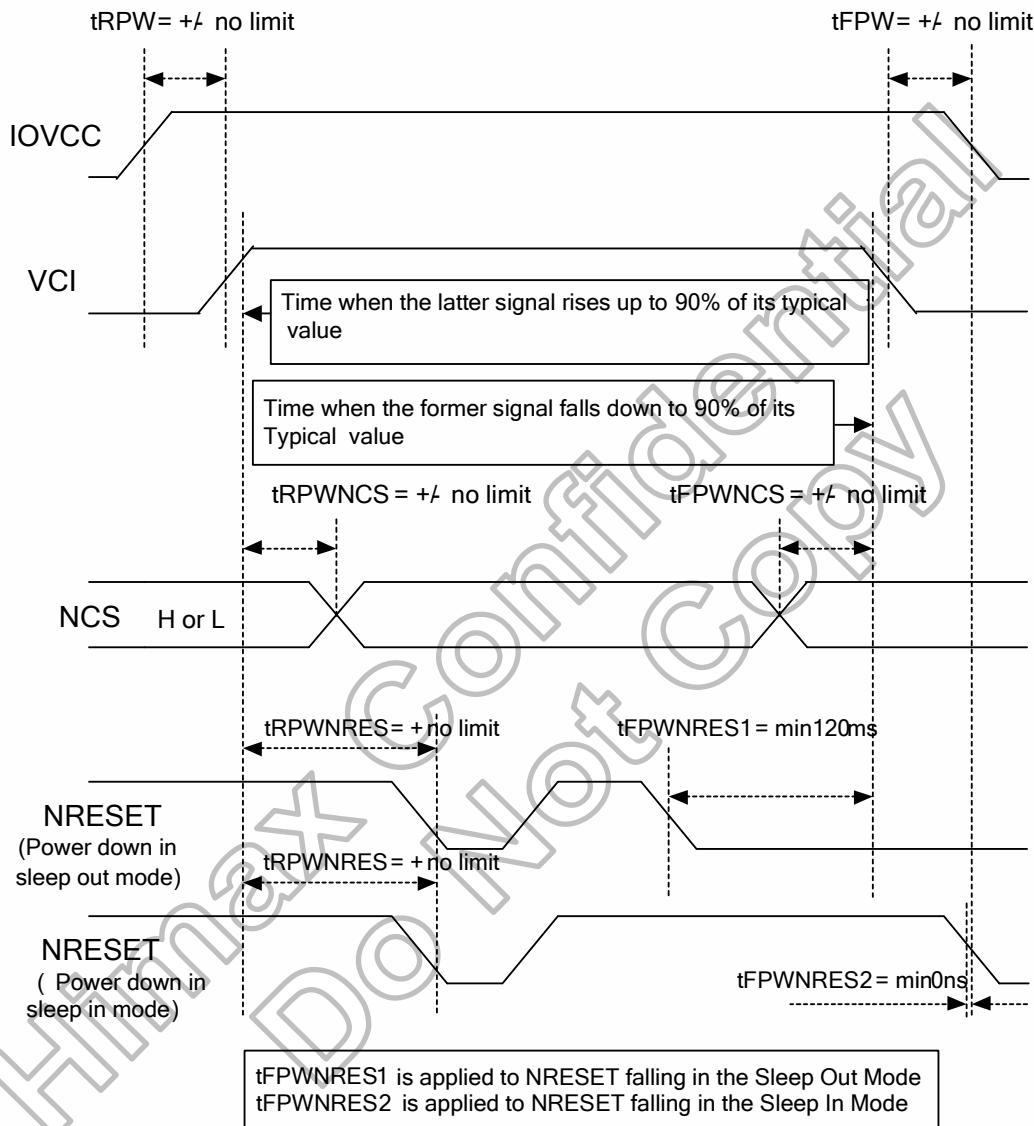
NCS can be applied at any timing or can be permanently grounded. NRESET has priority over NCS.

- Note:** (1) There will be no damage to the display module if the power sequences are not met.  
(2) There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.  
(3) There will be no abnormal visible effects on the display between end of Power on Sequence and before receiving Sleep Out command. Also between receiving Sleep In command and Power Off Sequence.  
(4) If NRESET line is not held stable by host during Power on Sequence as defined in Sections 7.5.1.1 and 7.5.1.2, then it will be necessary to apply a Hardware Reset (NRESET) after Host Power on Sequence to ensure correct operation. Otherwise correct function is not guaranteed.

If NRESET line is not held stable by host during Power on Sequence as defined in Sections 7.5.1.1 and 7.5.1.2, then it will be necessary to apply a Hardware Reset (NRESET) after Host Power on Sequence is complete to ensure correct operation, otherwise correct functionality is not guaranteed. The power on/off sequence is illustrated as below.

### 7.6.1.1 Case 1 – NRESET line is held high or unstable by host at power on

If NRESET line is held high or unstable by the host during Power On, then a Hardware Reset must be applied after both IOVCC, VCI have been applied, otherwise correct functionality is not guaranteed. There is no timing restriction upon this hardware reset.

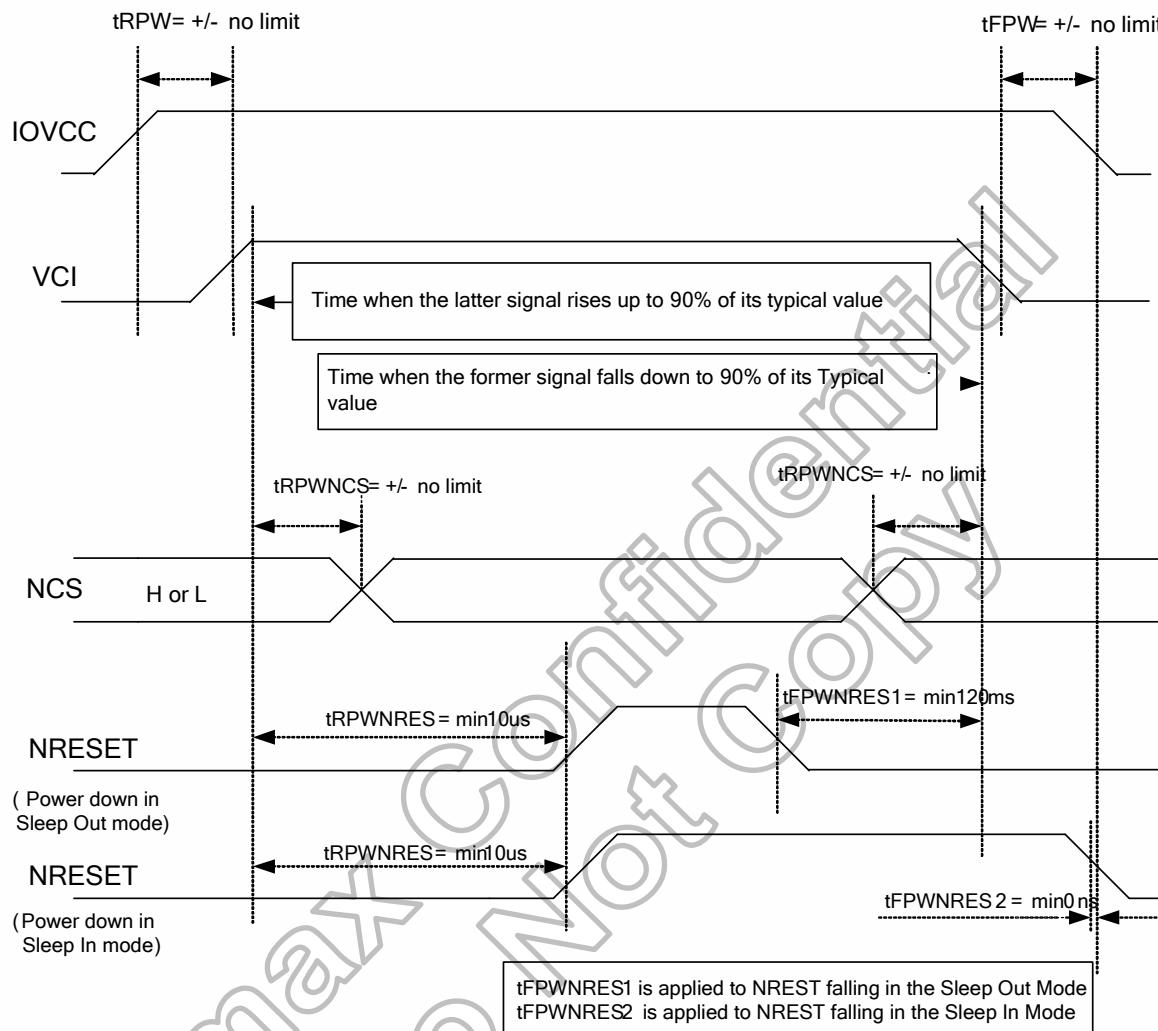


**Note:** Unless otherwise specified, timings herein show cross point at 50% of signal/power level.

**Figure 7.21 Case 1 – NRESET line is held high or unstable by host at power on**

### 7.6.1.2 Case 2 – NRESET line is held low by host at power on

If NRESET line is held Low (and stable) by the host during Power On, then the NRESET must be held low for minimum 10 $\mu$ sec after VCI have been applied.



**Figure 7.22 NRESET Line is Held Low by Host at Power On**

## 7.6.2 Power levels definition

### 7.6.2.1 General definition for power levels on system interface

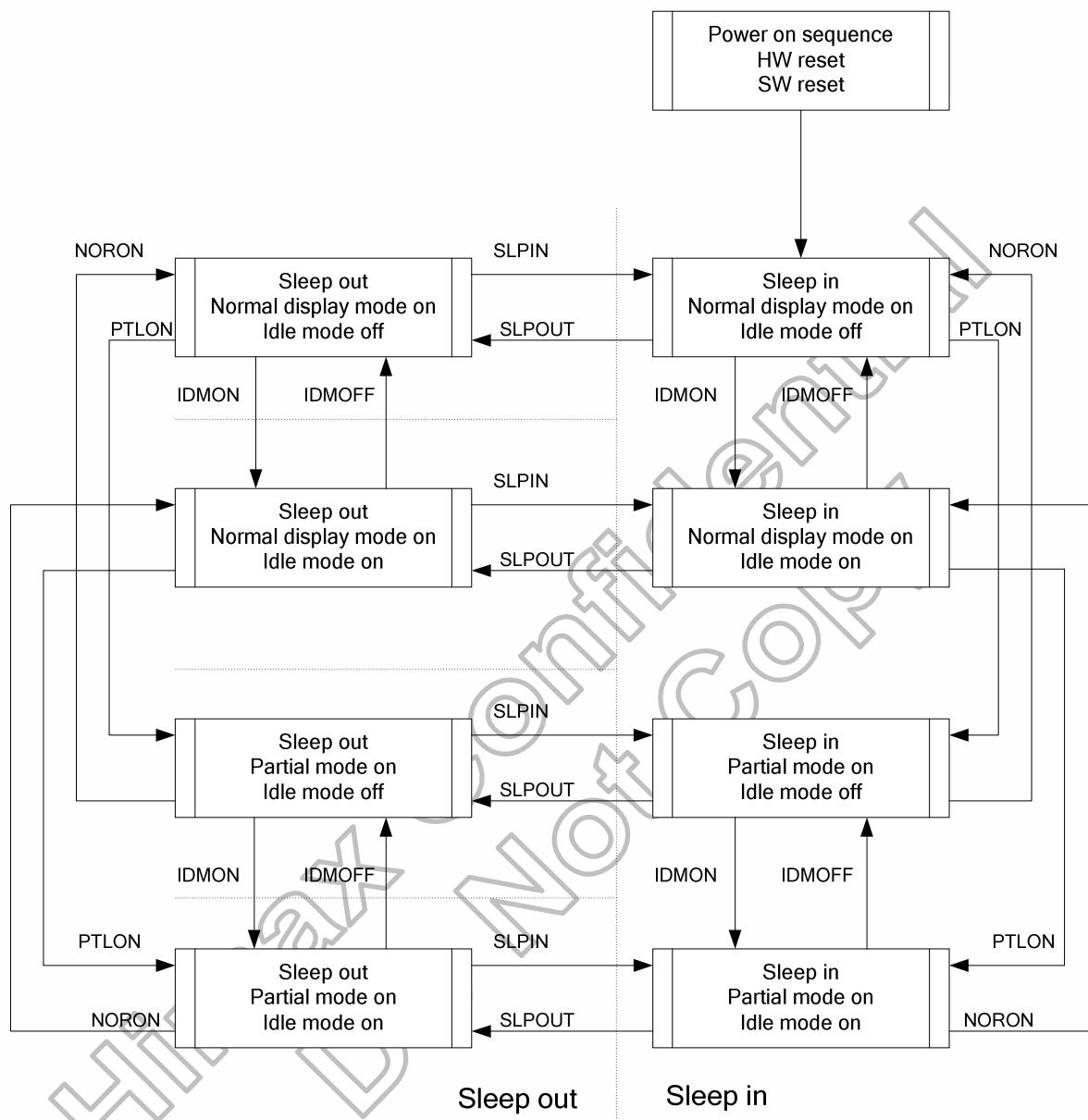


Figure 7.23 Power flow chart for different power modes

### 7.6.3 Deep standby mode set up flow

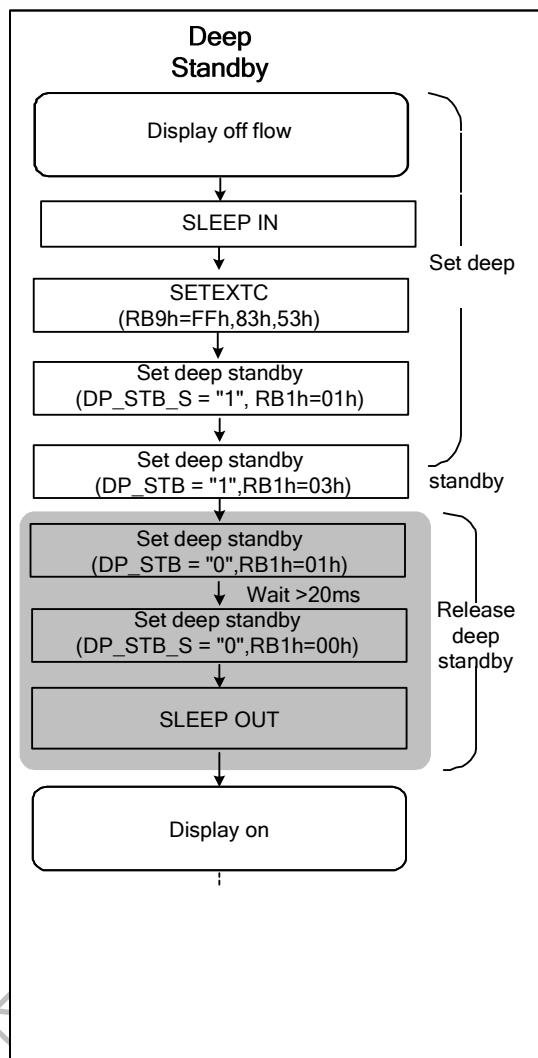


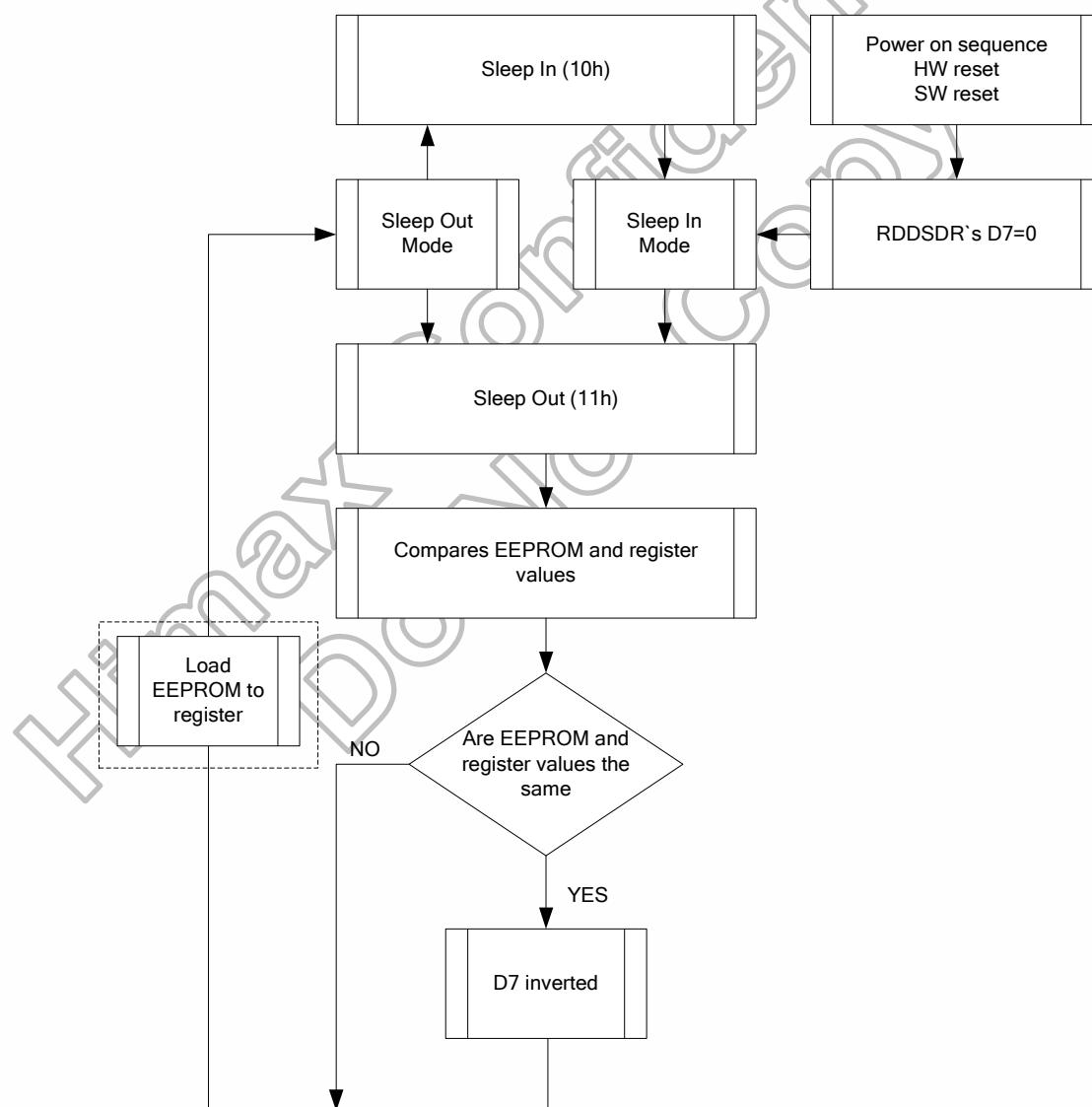
Figure 7.24 Deep standby mode setting flow

## 7.7 Sleep out – command and self-diagnostic functions of display module

### 7.7.1 Register loading detection

Sleep Out-command (See section 8.2.12 “Sleep Out (11h)”) is a trigger for an internal function of the display module, which indicates, if the display module loading function of factory default values from EEPROM (or similar device) to registers of the display controller is working properly.

There are compared factory values of the EEPROM and register values of the display controller by the display controller. If those both values (EEPROM and register values) are the same, there is an inverted (=increased by 1) bit, which is defined in section 8.2.10 “Read Display Self-Diagnostic Result (0Fh)” (=RDDSDR) (The bit used for this command is D7). If those both values are not the same, this bit (D7) is not inverted (=increased by 1). The flow chart for this internal function is shown as below.



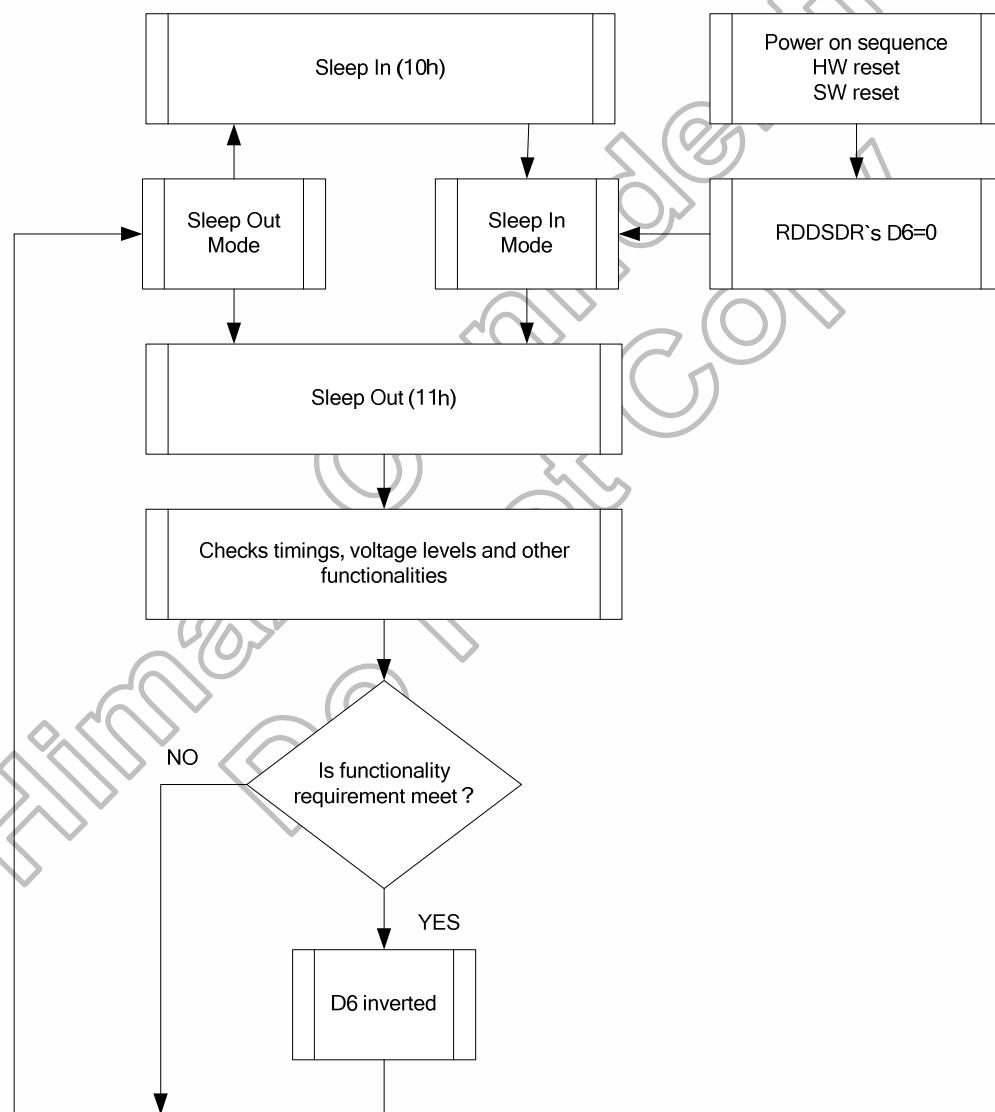
**Note:** There is not compared and loaded register values, which can be changed by User (User area commands: 00h to AFh and DAh to DDh), by the display module.

Figure 7.25 RDDSDR register loading detection flow

### 7.7.2 Functionality detection

Sleep Out-command (See section 8.2.12 “Sleep Out (11h)”) is a trigger for an internal function of the display module, which indicates, if the display module is still running and meets functionality requirements.

The internal function (= the display controller) is comparing, if the display module is still meeting functionality requirements (e.g. booster voltage levels, timings, etc.) If functionality requirement is met, there is an inverted (= increased by 1) bit, which defined in section 8.2.10 “Read Display Self-Diagnostic Result (0Fh)” (= RDDSDR) (The used bit of this command is D6). If functionality requirement is not same, this bit (D6) is not inverted (= increased by 1). The flow chart for this internal function is shown as below.



**Note:** There is needed 120msec after Sleep Out -command, when there is changing from Sleep In -mode to Sleep Out -mode, before there is possible to check if User's functionality requirements are met and a value of RDDSDR's D6 is valid. Otherwise, there is 5msec delay for D6's value, when Sleep Out -command is sent in Sleep Out -mode.

**Figure 7.26 Functionality detection flow**

## 7.8 Input / output pin state

### 7.8.1 Output pins

| Output or Bi-directional pins  | After Power On    | After Hardware Reset | After Software Reset |
|--------------------------------|-------------------|----------------------|----------------------|
| TE                             | Low               | Low                  | Low                  |
| DB17 to DB0<br>(Output driver) | High-Z (Inactive) | High-Z (Inactive)    | High-Z (Inactive)    |
| VTESTOUT<br>NVTESTOUT          | Low               | Low                  | Low                  |

Table 7.10 Characteristics of output pins

### 7.8.2 Input pins

| Input pins          | During Power On Process | After Power On | After Hardware Reset | After Software Reset | During Power Off Process |
|---------------------|-------------------------|----------------|----------------------|----------------------|--------------------------|
| NRESET              | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| NCS                 | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| SPI_SEL             | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| GC_SEL              | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| LC_SEL0, LC_SEL1    | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| DNC_SCL             | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| NWR_RNW             | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| NRD_E               | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| DB17 to DB0         | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| OSC,P68,BS1,BS2,BS0 | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| EXTC                | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| TEST1               | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| TEST2               | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| RSO0                | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| RSO1                | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |
| RSO2                | Input valid             | Input valid    | Input valid          | Input valid          | Input valid              |

Table 7.11 Characteristics of input pins

## 8. Command Set

### 8.1 Command set list

| (Hex) | Operation Code | DNC | NWR | NRD | D7  | D6  | D5  | D4  | D3       | D2  | D1  | D0  | Function                                |
|-------|----------------|-----|-----|-----|-----|-----|-----|-----|----------|-----|-----|-----|---|
| 00    | NOP            | 0   | ↑   | 1   | 0   | 0   | 0   | 0   | 0        | 0   | 0   | 0   | No operation                            |
| 01    | SWRESET        | 0   | ↑   | 1   | 0   | 0   | 0   | 0   | 0        | 0   | 0   | 1   | Software reset                          |
| 04    | RDDIDIF        | 0   | ↑   | 1   | 0   | 0   | 0   | 0   | 0        | 1   | 0   | 0   | Read display identification information |
|       |                | 1   | 1   | ↑   | -   | -   | -   | -   | -        | -   | -   | -   | Dummy read                              |
|       |                | 1   | 1   | ↑   |     |     |     |     | ID1[7:0] |     |     |     | ID1 read                                |
|       |                | 1   | 1   | ↑   |     |     |     |     | ID2[7:0] |     |     |     | ID2 read                                |
|       |                | 1   | 1   | ↑   |     |     |     |     | ID3[7:0] |     |     |     | ID3 read                                |
| 09    | RDDST          | 0   | ↑   | 1   | 0   | 0   | 0   | 0   | 1        | 0   | 0   | 1   | Read display status                     |
|       |                | 1   | 1   | ↑   | -   | -   | -   | -   | -        | -   | -   | -   | Dummy read                              |
|       |                | 1   | 1   | ↑   | D31 | D30 | D29 | D28 | D27      | D26 | D25 | 0   |   |
|       |                | 1   | 1   | ↑   | 0   | D22 | D21 | D20 | D19      | D18 | D17 | D16 |   |
|       |                | 1   | 1   | ↑   | D15 | 0   | D13 | 0   | 0        | D10 | D9  | D8  |   |
|       |                | 1   | 1   | ↑   | D7  | D6  | D5  | 0   | 0        | 0   | 0   | 0   |   |
| 0A    | RDDPM          | 0   | ↑   | 1   | 0   | 0   | 0   | 0   | 1        | 0   | 1   | 0   | Read display power mode                 |
|       |                | 1   | 1   | ↑   | -   | -   | -   | -   | -        | -   | -   | -   | Dummy read                              |
|       |                | 1   | 1   | ↑   | D7  | D6  | D5  | D4  | D3       | D2  | 0   | 0   |   |
| 0B    | RDDMADCTL      | 0   | ↑   | 1   | 0   | 0   | 0   | 0   | 1        | 0   | 1   | 1   | Read display MADCTL                     |
|       |                | 1   | 1   | ↑   | -   | -   | -   | -   | -        | -   | -   | -   | Dummy read                              |
|       |                | 1   | 1   | ↑   | D7  | D6  | D5  | D4  | D3       | D2  | 0   | 0   |   |
| 0C    | RDDCOLM OD     | 0   | ↑   | 1   | 0   | 0   | 0   | 0   | 1        | 1   | 0   | 0   | Read display pixel format               |
|       |                | 1   | 1   | ↑   | -   | -   | -   | -   | -        | -   | -   | -   | Dummy read                              |
|       |                | 1   | 1   | ↑   | 0   | 0   | 0   | 0   | 0        | D2  | D1  | D0  |   |
| 0D    | RDDIM          | 0   | ↑   | 1   | 0   | 0   | 0   | 0   | 1        | 1   | 0   | 1   | Read display image mode                 |
|       |                | 1   | 1   | ↑   | -   | -   | -   | -   | -        | -   | -   | -   | Dummy read                              |
|       |                | 1   | 1   | ↑   | D7  | 0   | D5  | 0   | 0        | D2  | D1  | D0  |   |
| 0E    | RDDSM          | 0   | ↑   | 1   | 0   | 0   | 0   | 0   | 1        | 1   | 1   | 0   | Read display signal mode                |
|       |                | 1   | 1   | ↑   | -   | -   | -   | -   | -        | -   | -   | -   | Dummy read                              |
|       |                | 1   | 1   | ↑   | D7  | D6  | 0   | 0   | 0        | 0   | 0   | 0   |   |
| 0F    | RDDSDR         | 0   | ↑   | 1   | 0   | 0   | 0   | 0   | 1        | 1   | 1   | 1   | Read display self-diagnostic result     |
|       |                | 1   | 1   | ↑   | -   | -   | -   | -   | -        | -   | -   | -   | Dummy read                              |
|       |                | 1   | 1   | ↑   | D7  | D6  | D5  | D4  | 0        | 0   | 0   | 0   |   |
| 10    | SLPIN          | 0   | ↑   | 1   | 0   | 0   | 0   | 1   | 0        | 0   | 0   | 0   | Sleep in and charge-pump off            |
| 11    | SLPOUT         | 0   | ↑   | 1   | 0   | 0   | 0   | 1   | 0        | 0   | 0   | 1   | Sleep out and charge-pump on            |
| 12    | PTLON          | 0   | ↑   | 1   | 0   | 0   | 0   | 1   | 0        | 0   | 1   | 0   | Partial mode on                         |
| 13    | NORON          | 0   | ↑   | 1   | 0   | 0   | 0   | 1   | 0        | 0   | 1   | 1   | Normal display mode on                  |
| 20    | INVOFF         | 0   | ↑   | 1   | 0   | 0   | 1   | 0   | 0        | 0   | 0   | 0   | Display inversion off                   |
| 21    | INVON          | 0   | ↑   | 1   | 0   | 0   | 1   | 0   | 0        | 0   | 0   | 1   | Display inversion on                    |

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| (Hex) | Operation Code | DNC | NWR | NRD | D7    | D6    | D5    | D4    | D3    | D2    | D1   | D0   | Function                      |
|-------|----------------|-----|-----|-----|-------|-------|-------|-------|-------|-------|------|------|-------------------------------|
| 26    | GAMSET         | 0   | ↑   | 1   | 0     | 0     | 1     | 0     | 0     | 1     | 1    | 0    | Gamma set                     |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | GC[7:0]                       |
| 28    | DISPOFF        | 0   | ↑   | 1   | 0     | 0     | 1     | 0     | 1     | 0     | 0    | 0    | Display off                   |
| 29    | DISPON         | 0   | ↑   | 1   | 0     | 0     | 1     | 0     | 1     | 0     | 0    | 1    | Display on                    |
| 2A    | CASET          | 0   | ↑   | 1   | 0     | 0     | 1     | 0     | 1     | 0     | 1    | 0    | Column setting                |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | Column address start          |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | Column address start          |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | Column address end            |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | Column address end            |
| 2B    | PASET          | 0   | ↑   | 1   | 0     | 0     | 1     | 0     | 1     | 0     | 1    | 1    | Row address set               |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | Row address start             |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | Row address start             |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | Row address end               |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | Row address end               |
| 2C    | RAMWR          | 0   | ↑   | 1   | 0     | 0     | 1     | 0     | 1     | 1     | 0    | 0    | Memory write                  |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | Write GRAM data               |
| 2D    | RGBSET         | 0   | ↑   | 1   | 0     | 0     | 1     | 0     | 1     | 1     | 0    | 1    | LUT parameter                 |
|       |                | 1   | ↑   | 1   | -     | -     | R005  | R004  | R003  | R002  | R001 | R000 | Red tone                      |
|       |                |     |     | :   | :     | :     | :     | :     | :     | :     | :    | :    |                               |
|       |                | 1   | ↑   | 1   | -     | -     | Rnn5  | Rnn4  | Rnn3  | Rnn2  | Rnn1 | Rnn0 | Red tone                      |
|       |                | 1   | ↑   | 1   | :     | :     | :     | :     | :     | :     | :    | :    |                               |
|       |                | 1   | ↑   | 1   | -     | -     | R315  | R314  | R313  | R312  | R311 | R310 | Red tone                      |
|       |                | 1   | ↑   | 1   | -     | -     | G005  | G004  | G003  | G002  | G001 | G000 | Green tone                    |
|       |                | 1   | ↑   | 1   | :     | :     | :     | :     | :     | :     | :    | :    |                               |
|       |                | 1   | ↑   | 1   | -     | -     | G635  | G634  | G633  | G632  | G631 | G630 | Green tone                    |
|       |                | 1   | ↑   | 1   | -     | -     | B005  | B004  | B003  | B002  | B001 | B000 | Blue tone                     |
|       |                | 1   | ↑   | 1   | :     | :     | :     | :     | :     | :     | :    | :    |                               |
|       |                | 1   | ↑   | 1   | -     | -     | Bnn5  | Bnn4  | Bnn3  | Bnn2  | Bnn1 | Bnn0 | Blue tone                     |
|       |                | 1   | ↑   | 1   | :     | :     | :     | :     | :     | :     | :    | :    |                               |
|       |                | 1   | ↑   | 1   | -     | -     | B315  | B314  | B313  | B312  | B311 | B310 | Blue tone                     |
|       |                |     |     |     |       |       |       |       |       |       |      |      |                               |
| 2E    | RAMRD          | 0   | ↑   | 1   | 0     | 0     | 1     | 0     | 1     | 1     | 1    | 0    | Memory read                   |
|       |                | 1   | ↑   | 1   | -     | -     | -     | -     | -     | -     | -    | -    | Dummy read                    |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | Read GRAM data                |
| 30    | PLTAR          | 0   | ↑   | 1   | 0     | 0     | 1     | 1     | 0     | 0     | 0    | 0    | Partial start end address set |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | Start row                     |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | Start row                     |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | End row                       |
|       |                | 1   | ↑   | 1   |       |       |       |       |       |       |      |      | End row                       |
| 33    | VSCRDEF        | 0   | ↑   | 1   | 0     | 0     | 1     | 1     | 0     | 0     | 1    | 1    |                               |
|       |                | 1   | ↑   | 1   | TFA15 | TFA14 | TFA13 | TFA12 | TFA11 | TFA10 | TFA9 | TFA8 |                               |
|       |                | 1   | ↑   | 1   | TFA7  | TFA6  | TFA5  | TFA4  | TFA3  | TFA2  | TFA1 | TFA0 |                               |
|       |                | 1   | ↑   | 1   | VSA15 | VSA14 | VSA13 | VSA12 | VSA11 | VSA10 | VSA9 | VSA8 |                               |
|       |                | 1   | ↑   | 1   | VSA7  | VSA6  | VSA5  | VSA4  | VSA3  | VSA2  | VSA1 | VSA0 |                               |
|       |                | 1   | ↑   | 1   | BFA15 | BFA14 | BFA13 | BFA12 | BFA11 | BFA10 | BFA9 | BFA8 |                               |
|       |                | 1   | ↑   | 1   | BFA7  | BFA6  | BFA5  | BFA4  | BFA3  | BFA2  | BFA1 | BFA0 |                               |
| 34    | TEOFF          | 0   | ↑   | 1   | 0     | 0     | 1     | 1     | 0     | 1     | 0    | 0    | Tear effect Off               |
| 35    | TEON           | 0   | ↑   | 1   | 0     | 0     | 1     | 1     | 0     | 1     | 0    | 1    |                               |
|       |                | 1   | ↑   | 1   | -     | -     | -     | -     | -     | -     | -    | -    | TEMODE                        |

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Vertical Scrolling Definition

| (Hex) | Operation Code | DNC | NWR | NRD | D7                         | D6                              | D5     | D4     | D3     | D2     | D1   | D0   | Function                         |
|-------|----------------|-----|-----|-----|----------------------------|---------------------------------|--------|--------|--------|--------|------|------|----------------------------------|
| 36    | MADCTL         | 0   | ↑   | 1   | 0                          | 0                               | 1      | 1      | 0      | 1      | 1    | 0    | Memory access control            |
|       |                | 1   | ↑   | 1   | MY                         | MX                              | MV     | ML     | BGR    | SS     | 0    | 0    |                                  |
| 37    | VSCRSADD       | 0   | ↑   | 1   | 0                          | 0                               | 1      | 1      | 0      | 1      | 1    | 1    | Vertical scrolling start address |
|       |                | 1   | ↑   | 1   | VSP 15                     | VSP 14                          | VSP 13 | VSP 12 | VSP 11 | VSP 10 | VSP9 | VSP8 |                                  |
|       |                | 1   | ↑   | 1   | VSP7                       | VSP6                            | VSP5   | VSP4   | VSP3   | VSP2   | VSP1 | VSP0 |                                  |
| 38    | IDMOFF         | 0   | ↑   | 1   | 0                          | 0                               | 1      | 1      | 1      | 0      | 0    | 0    | Idle mode off                    |
| 39    | IDMON          | 0   | ↑   | 1   | 0                          | 0                               | 1      | 1      | 1      | 0      | 0    | 1    | Idle mode on                     |
| 3A    | COLMOD         | 0   | ↑   | 1   | 0                          | 0                               | 1      | 1      | 1      | 0      | 1    | 0    | Interface pixel format           |
|       |                | 1   | ↑   | 1   | 0                          | 0                               | 0      | 0      | 0      | D2     | D1   | D0   |                                  |
| DA    | RDID1          | 0   | ↑   | 1   | 1                          | 1                               | 0      | 1      | 1      | 0      | 1    | 0    | Read ID1                         |
|       |                | 1   | 1   | ↑   | -                          | -                               | -      | -      | -      | -      | -    | -    | Dummy read                       |
|       |                | 1   | 1   | ↑   | module's manufacturer[7:0] |                                 |        |        |        |        |      |      |                                  |
| DB    | RDID2          | 0   | ↑   | 1   | 1                          | 1                               | 0      | 1      | 1      | 0      | 1    | 1    | Read ID2                         |
|       |                | 1   | 1   | ↑   | -                          | -                               | -      | -      | -      | -      | -    | -    | Dummy read                       |
|       |                | 1   | 1   | ↑   | 1                          | LCD module/driver version [6:0] |        |        |        |        |      |      |                                  |
| DC    | RDID3          | 0   | ↑   | 1   | 1                          | 1                               | 0      | 1      | 1      | 1      | 0    | 0    | Read ID3                         |
|       |                | 1   | 1   | ↑   | -                          | -                               | -      | -      | -      | -      | -    | -    | Dummy read                       |
|       |                | 1   | 1   | ↑   | LCD module/driver ID[7:0]  |                                 |        |        |        |        |      |      |                                  |

Table 8.1 System interface command set

## Extended command set

| (Hex) | Operation Code | DNC | NWR | NRD | D15-8 | D7                       | D6                        | D5             | D4                   | D3                  | D2                     | D1                         | D0                  | Function                |  |  |  |  |  |
|-------|----------------|-----|-----|-----|-------|--------------------------|---------------------------|----------------|----------------------|---------------------|------------------------|----------------------------|---------------------|-------------------------|--|--|--|--|--|
| B0    | SETOSC         | 0   | ↑   | 1   | -     | 1                        | 0                         | 1              | 1                    | 0                   | 0                      | 0                          | 0                   | Set internal oscillator |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | I_RADJ[3:0](0011)        |                           |                | N_RADJ[3:0] (0100)   |                     |                        |                            |                     |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | -                         | -              | -                    | -                   | -                      | -                          | OSC_EN (0)          |                         |  |  |  |  |  |
| B1    | SETPWCTR       | 0   | ↑   | 1   | -     | 1                        | 0                         | 1              | 1                    | 0                   | 0                      | 0                          | 1                   | Set power control       |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | -                         | -              | -                    | -                   | -                      | -                          | DP_S_TB (0)         |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | -                         | -              | -                    | -                   | -                      | -                          | DP_S_TB_S (0)       |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | -                         | -              | -                    | -                   | -                      | -                          | BT[2:0](000)        |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | -                         | -              | -                    | -                   | -                      | -                          | VRH[5:0](01_1010)   |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | -                         | -              | -                    | -                   | -                      | -                          | NVRH[5:0](01_1010)  |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | -                         | -              | -                    | -                   | -                      | -                          | AP[2:0](011)        |                         |  |  |  |  |  |
| B2    | SETDISPLAY     | 0   | ↑   | 1   | -     | 1                        | 0                         | 1              | 1                    | 0                   | 0                      | 1                          | 0                   | Set display control     |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | PT[1:0] (10)             |                           | -              | -                    | -                   | -                      | -                          | ISC[3:0] (0001)     |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | PTG (1)                  |                           | -              | -                    | -                   | -                      | -                          | REF (1)             |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | -                         | GON (1)        | DTE (0)              | D[1:0] (00)         |                        | -                          | -                   |                         |  |  |  |  |  |
| B4    | SETCYC         | 0   | ↑   | 1   | -     | 1                        | 0                         | 1              | 1                    | 0                   | 1                      | 0                          | 0                   | Set display cycle       |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | -                         | I_NW[1:0](01)  | -                    | -                   | N_NW[1:0](01)          |                            |                     |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | -                         | -              | -                    | N_RTN[3:0] (1000)   |                        |                            |                     |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | -                         | -              | -                    | -                   | -                      | -                          | N_DIV[1:0](00)      |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | N_DUM[7:0] (0000_1100)   |                           |                |                      |                     | I_DUM[7:0] (0000_1100) |                            |                     |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | GDON[7:0] (0000_1101)    |                           |                |                      |                     | GDOF[7:0] (0101_0011)  |                            |                     |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | L_BASE[7:0] (0101_1001)  |                           |                |                      |                     | NVREF[3:0] (0111)      |                            |                     |                         |  |  |  |  |  |
| B5    | SETBGP         | 0   | ↑   | 1   | -     | 1                        | 0                         | 1              | 1                    | 0                   | 1                      | 0                          | 1                   | Set BGP voltage         |  |  |  |  |  |
|       |                |     |     |     |       | VREF[3:0] (0111)         |                           |                | VVDHS_SEL[2:0] (011) |                     |                        | VVDHS_SEL[2:0] (011)       |                     |                         |  |  |  |  |  |
|       |                |     |     |     |       | FBOF F(0)                | VNVDHS_SEL[2:0] (011)     |                | -                    | VCM_TIMES[2:0](000) |                        |                            | VCM_TIMES[2:0](000) |                         |  |  |  |  |  |
| B6    | SETVCOM        | 0   | ↑   | 1   | -     | 1                        | 0                         | 1              | 1                    | 0                   | 1                      | 1                          | 0                   | Set VCOM voltage        |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | VCOM[6:0] (100_1011)      |                |                      |                     |                        | EXTC1[7:0] (0000_0000)     |                     |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | -                         | -              | -                    | -                   | -                      | EXTC2[7:0] (0000_0000)     |                     |                         |  |  |  |  |  |
| B9    | SETEXTC        | 0   | ↑   | 1   | -     | 1                        | 0                         | 1              | 1                    | 1                   | 0                      | 0                          | 1                   | Enter extension command |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | EXTC3[7:0] (0000_0000)    |                |                      |                     |                        | OTP_KEY[7:0] (0000_0000)   |                     |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | -                        | OTP_MASK[7:0] (0000_0000) |                |                      |                     |                        | OTP_INDEX[7:0] (0000_0000) |                     |                         |  |  |  |  |  |
| BB    | SETOTP         | 0   | ↑   | 1   | -     | 1                        | 0                         | 1              | 1                    | 1                   | 0                      | 1                          | 1                   | Set OTP                 |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | OTP_PTM [1:0] (00)       |                           |                |                      |                     | VPP_SEL (0)            |                            |                     | OTP_PROG (0)            |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | LOAD<br>DISAB<br>LE (0)  | VPP<br>ENAB<br>LE (0)     | OTP<br>POR (0) | OTP<br>PWE (0)       | OTP_PTM [1:0] (00)  |                        | VPP_SEL (0)                |                     | OTP_PROG (0)            |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | ↑     | OTPDOUT[7:0] (1111_1111) |                           |                |                      |                     |                        |                            |                     |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | ↑     | GENON[7:0](8'h10)        |                           |                |                      |                     |                        |                            |                     |                         |  |  |  |  |  |
| C0    | SETSTBA        | 0   | ↑   | 1   | -     | 1                        | 1                         | 0              | 0                    | 0                   | 0                      | 0                          | 0                   | Set Source option       |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | N_OPON[7:0](8'h20)       |                           |                |                      |                     | I_OPON[7:0](8'h10)     |                            |                     |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | STBA[15:8](8'h0C)        |                           |                |                      |                     | STBA[7:0](8'hC7)       |                            |                     |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | GENON[7:0](8'h10)        |                           |                |                      |                     | GENON[7:0](8'h10)      |                            |                     |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | STBA[15:8](8'h0C)        |                           |                |                      |                     | STBA[7:0](8'hC7)       |                            |                     |                         |  |  |  |  |  |
|       |                | 1   | ↑   | 1   | -     | GENON[7:0](8'h10)        |                           |                |                      |                     | GENON[7:0](8'h10)      |                            |                     |                         |  |  |  |  |  |

|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  | -                   | -                   | -                    | OTPS<br>1B (1)                |          |                              |
|-------|-------------------|-----|-----|-----|-------|----|-----------------|-----------------------------|----|---------------------|---------------------|----------------------|-------------------------------|----------|------------------------------|
| C3    | SETID             | 0   | ↑   | 1   | -     | 1  | 1               | 0                           | 0  | 0                   | 0                   | 0                    | 1                             | 1        | Set ID                       |
|       |                   | 1   | ↑   | 1   | -     |    |                 | ID1[7:0] (0000_0000)        |    |                     |                     |                      |                               |          |                              |
|       |                   | 1   | ↑   | 1   | -     |    |                 | ID2[7:0] (0000_0000)        |    |                     |                     |                      |                               |          |                              |
|       |                   | 1   | ↑   | 1   | -     |    |                 | ID3[7:0] (0000_0000)        |    |                     |                     |                      |                               |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  | -                   | -                   | ID_TIMES[2:0] (000)  |                               |          |                              |
| CC    | SETPANEL          | 0   | ↑   | 1   | -     | 1  | 1               | 0                           | 0  | 1                   | 1                   | 0                    | 0                             |          | Set Panel<br>characteristics |
|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  | SS_P<br>ANEL<br>(0) | GS_P<br>ANEL<br>(0) | REV_<br>PANE<br>L(0) | BGR_<br>PANE<br>L(0)          |          |                              |
| D0    | GETHID            | 0   | 1   | ↑   |       | 1  | 1               | 0                           | 1  | 0                   | 0                   | 0                    | 0                             |          | Read Himax internal<br>ID    |
|       |                   | 1   | 1   | ↑   |       |    |                 | ID_VERSION[7:0] (1000_0101) |    |                     |                     |                      |                               |          |                              |
| (Hex) | Operation<br>Code | DNC | NWR | NRD | D15-8 | D7 | D6              | D5                          | D4 | D3                  | D2                  | D1                   | D0                            | Function |                              |
| E0    | SETGAMMA          | 0   | ↑   | 1   | -     | 1  | 1               | 1                           | 0  | 0                   | 0                   | 0                    | 0                             |          | Set Gamma                    |
|       |                   | 1   | ↑   | 1   | -     | -  |                 | MP1[2:0] (000)              |    | -                   |                     |                      | MP0[2:0] (000)                |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  |                 | MP3[2:0] (110)              |    | -                   |                     |                      | MP2[2:0] (000)                |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  |                 | MP5[2:0] (011)              |    | -                   |                     |                      | MP4[2:0] (000)                |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  |                     |                     |                      | CP0[3:0] (0110)               |          |                              |
|       |                   | 1   | ↑   | 1   | -     |    | CP2[3:0] (1000) |                             |    |                     |                     |                      | CP1[3:0] (1100)               |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  |                     |                     |                      | CP3[3:0] (0010)               |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  |                     |                     |                      | CP4[3:0] (0100)               |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  |                     |                     |                      | OP0[3:0] (1111)               |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  |                     |                     |                      | OP1[4:0] (0_0110)             |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  |                     |                     |                      | CGM1[1:0] (11) CGM0[1:0] (10) |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  |                 | MN1[2:0] (111)              |    | -                   |                     |                      | MN0[2:0] (100)                |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  |                 | MN3[2:0] (111)              |    | -                   |                     |                      | MN2[2:0] (001)                |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  |                 | MN5[2:0] (111)              |    | -                   |                     |                      | MN4[2:0] (111)                |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  |                     |                     |                      | CN0[3:0] (0100)               |          |                              |
|       |                   | 1   | ↑   | 1   | -     |    | CN2[3:0] (1000) |                             |    |                     |                     |                      | CN1[3:0] (0010)               |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  |                     |                     |                      | CN3[3:0] (1100)               |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  |                     |                     |                      | CN4[3:0] (0110)               |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  |                     |                     |                      | ON0[3:0] (0011)               |          |                              |
|       |                   | 1   | ↑   | 1   | -     | -  | -               | -                           | -  |                     |                     |                      | ON1[4:0] (1_1110)             |          |                              |
| FE    | SET_SPI_RD<br>EN  | 0   | ↑   | 1   | -     | 1  | 1               | 1                           | 1  | 1                   | 1                   | 1                    | 1                             | 0        | SPI READ EN                  |
|       |                   | 1   | ↑   | 1   | -     | A7 | A6              | A5                          | A4 | A3                  | A2                  | A1                   | A0                            |          | Set SPI Read<br>address      |
| FF    | GET_SPI_RD<br>EN  | 0   | ↑   | 1   | -     | 1  | 1               | 1                           | 1  | 1                   | 1                   | 1                    | 1                             | 1        | SPI READ EN                  |
|       |                   | 1   | 1   | ↑   | -     |    |                 |                             |    |                     |                     |                      |                               |          | Get FE A[7:0]<br>parameter   |
|       |                   | 1   | 1   | ↑   | -     |    |                 |                             |    |                     |                     |                      |                               |          | Get FE A[7:0]<br>parameter   |
|       |                   | 1   | 1   | ↑   | -     |    |                 |                             |    |                     |                     |                      |                               |          | Get FE A[7:0]<br>parameter   |
|       |                   | 1   | 1   | ↑   | -     |    |                 |                             |    |                     |                     |                      |                               |          | Get FE A[7:0]<br>parameter   |

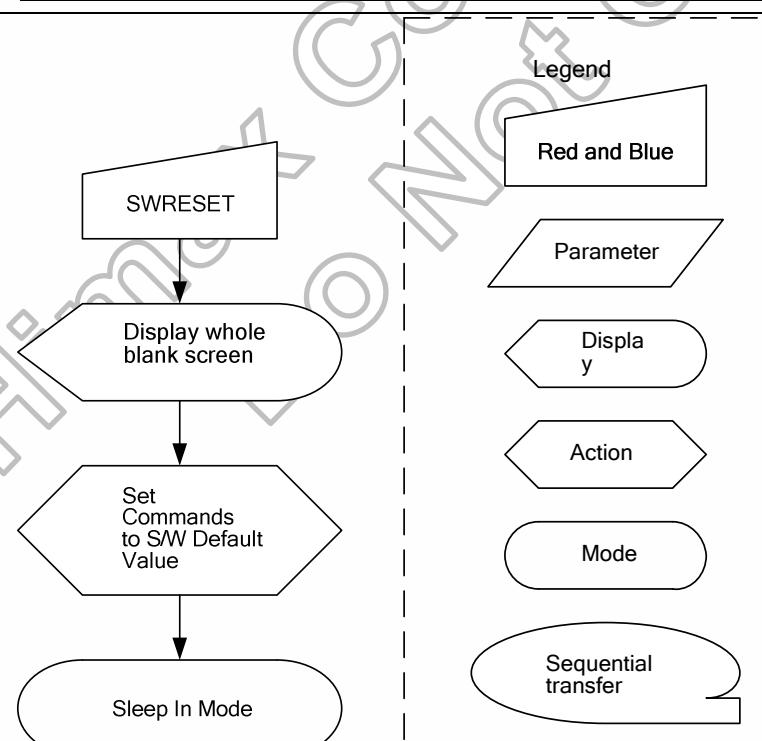
Table 8.2 System Interface In-House Command Set

## 8.2 Command description

### 8.2.1 NOP

|                       |  |     |               |       |    |    |    |    |    |    |    |    |     |  |  |  |
|-----------------------|--|-----|---------------|-------|----|----|----|----|----|----|----|----|-----|--|--|--|
| <b>00 H</b>           | NOP (No Operation)   |     |               |       |    |    |    |    |    |    |    |    |     |  |  |  |
|                       | DNC  | NWR | NRD           | D17-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |  |  |  |
| Command               | 0  | ↑   | 1             | -     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 00  |  |  |  |
| Parameter             | NO PARAMETER   |     |               |       |    |    |    |    |    |    |    |    |     |  |  |  |
| Description           | This command is an empty command; it does not have any effect on the display module. However it can be used to terminate Frame Memory Write as described in RAMWR (Memory Write) or RAMRD (Memory Read) command. |     |               |       |    |    |    |    |    |    |    |    |     |  |  |  |
| Restriction           |  |     |               |       |    |    |    |    |    |    |    |    |     |  |  |  |
| Register Availability | Status   |     | Availability  |       |    |    |    |    |    |    |    |    |     |  |  |  |
|                       | Normal Mode On, Idle Mode Off, Sleep Out   |     | Yes           |       |    |    |    |    |    |    |    |    |     |  |  |  |
|                       | Normal Mode On, Idle Mode On, Sleep Out  |     | Yes           |       |    |    |    |    |    |    |    |    |     |  |  |  |
|                       | Partial Mode On, Idle Mode Off, Sleep Out  |     | Yes           |       |    |    |    |    |    |    |    |    |     |  |  |  |
|                       | Partial Mode On, Idle Mode On, Sleep Out   |     | Yes           |       |    |    |    |    |    |    |    |    |     |  |  |  |
|                       | Sleep In or Booster Off  |     | Yes           |       |    |    |    |    |    |    |    |    |     |  |  |  |
| Default               | Status   |     | Default Value |       |    |    |    |    |    |    |    |    |     |  |  |  |
|                       | Power On Sequence  |     | N/A           |       |    |    |    |    |    |    |    |    |     |  |  |  |
|                       | S/W Reset  |     | N/A           |       |    |    |    |    |    |    |    |    |     |  |  |  |
|                       | H/W Reset  |     | N/A           |       |    |    |    |    |    |    |    |    |     |  |  |  |
| Flow Chart            | -  |     |               |       |    |    |    |    |    |    |    |    |     |  |  |  |

### 8.2.2 Software reset (01h)

| <b>01 H</b>                               | SWRESET (Software Reset)  |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
|---|---|-----|-----|-------|----|----|----|----|----|----|----|----|-----|--------|---------------|--|-----|---|-----|---|-----|--|-----|-------------------------|-----|
|   | DNC   | NWR | NRD | D17-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |        |               |  |     |   |     |   |     |  |     |                         |     |
| Command                                   | 0   | ↑   | 1   | -     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 01  |        |               |  |     |   |     |   |     |  |     |                         |     |
| Parameter                                 | NO PARAMETER  |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Description                               | <p>When the Software Reset command is written, it causes a software reset. It resets the commands and parameters to their S/W Reset default values. (See default tables in each command description.)</p> <p>The display is blank immediately.</p> <p>Note: The GRAM contents are unaffected by this command.</p>   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Restriction                               | <p>It will be necessary to wait 5m sec before sending new command following software reset. The display module loads all display suppliers' factory default values to the registers during this 5m sec.</p> <p>If SW Reset is applied during Sleep Out mode, it will be necessary to wait 120m sec before sending Sleep Out command.</p> <p>SW Reset command cannot be sent during Sleep Out sequence.</p>  |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table> |     |     |       |    |    |    |    |    |    |    |    |     | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes | Normal Mode On, Idle Mode On, Sleep Out | Yes | Partial Mode On, Idle Mode Off, Sleep Out | Yes | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>N/A</td> </tr> <tr> <td>S/W Reset</td> <td>N/A</td> </tr> <tr> <td>H/W Reset</td> <td>N/A</td> </tr> </tbody> </table>  |     |     |       |    |    |    |    |    |    |    |    |     | Status | Default Value | Power On Sequence                        | N/A | S/W Reset                               | N/A | H/W Reset                                 | N/A |  |     |                         |     |
| Status                                    | Default Value   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Power On Sequence                         | N/A   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| S/W Reset                                 | N/A   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| H/W Reset                                 | N/A   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Flow Chart                                |  <pre> graph TD     SWRESET[SWRESET] --&gt; Blank[Display whole blank screen]     Blank --&gt; Default[Set Commands to S/W Default Value]     Default --&gt; SleepIn[Sleep In Mode]     </pre> <p><b>Legend:</b></p> <ul style="list-style-type: none"> <li>Red and Blue</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>          |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |     |   |     |   |     |  |     |                         |     |

### 8.2.3 Read display identification information (04h)

| <b>04 H</b>                               |  | RDDIDIF (Read Display Identification Information) |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
|---|--|---|-----|-------|------|------|------|------|------|------|------|------|-----|--|------------------------|---------------|--|-----------------|---|-----------------|---|-----------------|--|-----|-------------------------|-----|-----|---|---|-----|---|---|-----|---|---|
|   | DNC  | NWR   | NRD | D17-8 | D7   | D6   | D5   | D4   | D3   | D2   | D1   | D0   | HEX |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Command                                   | 0  | ↑   | 1   | -     | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 04  |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 1st parameter                             | 1  | 1   | ↑   | -     | -    | -    | -    | -    | -    | -    | -    | -    | -   |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 2 <sup>nd</sup> parameter                 | 1  | 1   | ↑   | -     | ID17 | ID16 | ID15 | ID14 | ID13 | ID12 | ID11 | ID10 | -   |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 3 <sup>rd</sup> parameter                 | 1  | 1   | ↑   | -     | ID27 | ID26 | ID25 | ID24 | ID23 | ID22 | ID21 | ID20 | -   |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 4 <sup>th</sup> parameter                 | 1  | 1   | ↑   | -     | ID37 | ID36 | ID35 | ID34 | ID33 | ID32 | ID31 | ID30 | -   |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Description                               | <p>This read byte returns 24-bit display identification information.<br/>           The 1st Parameter is dummy read. The 2<sup>nd</sup> ~ 4th Parameter identifies the LCD module's manufacturer.<br/>           It is defined by display supplier and it changes each time a revision is made to the display, material or construction specifications. See Table:</p> <table border="1"> <thead> <tr> <th>ID Byte Value ID2[7:0]</th> <th>Version</th> <th>Changes</th> </tr> </thead> <tbody> <tr> <td>80h</td> <td>-</td> <td>-</td> </tr> <tr> <td>81h</td> <td>-</td> <td>-</td> </tr> <tr> <td>82h</td> <td>-</td> <td>-</td> </tr> <tr> <td>83h</td> <td>-</td> <td>-</td> </tr> <tr> <td>84h</td> <td>-</td> <td>-</td> </tr> <tr> <td>85h</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>The 4th parameter identifies the LCD module/driver.</p> |   |     |       |      |      |      |      |      |      |      |      |     |  | ID Byte Value ID2[7:0] | Version       | Changes                                  | 80h             | -                                       | -               | 81h                                       | -               | -  | 82h | -                       | -   | 83h | - | - | 84h | - | - | 85h | - | - |
| ID Byte Value ID2[7:0]                    | Version  | Changes   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 80h                                       | -  | -   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 81h                                       | -  | -   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 82h                                       | -  | -   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 83h                                       | -  | -   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 84h                                       | -  | -   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 85h                                       | -  | -   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Restriction                               | -  |   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table>  |   |     |       |      |      |      |      |      |      |      |      |     |  | Status                 | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes             | Normal Mode On, Idle Mode On, Sleep Out | Yes             | Partial Mode On, Idle Mode Off, Sleep Out | Yes             | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |     |   |   |     |   |   |     |   |   |
| Status                                    | Availability   |   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes  |   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes  |   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes  |   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes  |   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Sleep In or Booster Off                   | Yes  |   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>See Description</td> </tr> <tr> <td>S/W Reset</td> <td>See Description</td> </tr> <tr> <td>H/W Reset</td> <td>See Description</td> </tr> </tbody> </table>   |   |     |       |      |      |      |      |      |      |      |      |     |  | Status                 | Default Value | Power On Sequence                        | See Description | S/W Reset                               | See Description | H/W Reset                                 | See Description |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Status                                    | Default Value  |   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Power On Sequence                         | See Description  |   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| S/W Reset                                 | See Description  |   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| H/W Reset                                 | See Description  |   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Flow Chart                                | <pre> graph TD     subgraph "Serial I/F Mode"         RDDID_S[RDDID (04h)] --&gt; DC[Dummy Clock]         DC --&gt; S1[Send ID1[7:0]]         S1 --&gt; S2[Send ID2[7:0]]         S2 --&gt; S3[Send ID3[7:0]]     end     subgraph "Parallel I/F Mode"         RDDID_P[RDDID (04h)] --&gt; DR[Dummy Read]         DR --&gt; S1[Send ID1[7:0]]         S1 --&gt; S2[Send ID2[7:0]]         S2 --&gt; S3[Send ID3[7:0]]     end     legend         Legend --- Command         Legend --- Parameter         Legend --- Display         Legend --- Action         Legend --- Mode         Legend --- Sequential transfer     </pre>  |   |     |       |      |      |      |      |      |      |      |      |     |  |                        |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |

### 8.2.4 Read display status (09h)

| 09 H                      |   | RDDST (Read Display Status)               |     |       |     |     |     |     |     |     |     |            |     |  |
|---------------------------|---|---|-----|-------|-----|-----|-----|-----|-----|-----|-----|------------|-----|--|
|                           | DNC   | NWR                                       | NRD | D17-8 | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0         | HEX |  |
| Command                   | 0   | ↑   | 1   | -     | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 1          | 09  |  |
| 1 <sup>st</sup> parameter | 1   | 1   | ↑   | -     | -   | -   | -   | -   | -   | -   | -   | -          | -   |  |
| 2 <sup>nd</sup> parameter | 1   | 1   | ↑   | -     | D31 | D30 | D29 | D28 | D27 | D26 | D25 | 0          | -   |  |
| 3 <sup>rd</sup> parameter | 1   | 1   | ↑   | -     | 0   | D22 | D21 | D20 | D19 | D18 | D17 | D16        | -   |  |
| 4 <sup>th</sup> parameter | 1   | 1   | ↑   | -     | D15 | 0   | D13 | 0   | 0   | D10 | D9  | D8         | -   |  |
| 5 <sup>th</sup> parameter | 1   | 1   | ↑   | -     | D7  | D6  | D5  | D4  | D3  | D2  | D1  | 0          | -   |  |
| Description               | This command indicates the current status of the display as described in the table below: |   |     |       |     |     |     |     |     |     |     |            |     |  |
|                           | Bit   | Description                               |     |       |     |     |     |     |     |     |     | Comment    |     |  |
|                           | D31   | Booster Voltage Status                    |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D30   | Page Address Order (MY)                   |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D29   | Column Address Order (MX)                 |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D28   | Page/Column Order (MV)                    |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D27   | Line Address Order (ML)                   |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D26   | RGB/BGR Order                             |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D25   | Display Data Latch Order                  |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D24   | Switching between Segment outputs and RAM |     |       |     |     |     |     |     |     |     | Set to '0' |     |  |
|                           | D23   | Switching between Common outputs and RAM  |     |       |     |     |     |     |     |     |     | Set to '0' |     |  |
|                           | D22   |   |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D21   | Interface Color Pixel Format Definition   |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D20   |   |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D19   | Idle Mode On/Off                          |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D18   | Partial Mode On/Off                       |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D17   | Sleep In/Out                              |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D16   | Display Normal Mode On/Off                |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D15   | Vertical Scrolling Status                 |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D14   | Horizontal Scrolling Status               |     |       |     |     |     |     |     |     |     | Set to '0' |     |  |
|                           | D13   | Inversion Status                          |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D12   | All Pixels On                             |     |       |     |     |     |     |     |     |     | Set to '0' |     |  |
|                           | D11   | All Pixels Off                            |     |       |     |     |     |     |     |     |     | Set to '0' |     |  |
|                           | D10   | Display On/Off                            |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D9  | Tearing Effect Line On/Off                |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D8  |   |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D7  | Gamma Curve Selection                     |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D6  |   |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D5  | Tearing Effect Output Line Mode           |     |       |     |     |     |     |     |     |     | -          |     |  |
|                           | D4  | Horizontal Sync. (HS, RGB I/F)            |     |       |     |     |     |     |     |     |     | Set to '0' |     |  |
|                           | D3  | Vertical Sync. (VS,RGB I/F)               |     |       |     |     |     |     |     |     |     | Set to '0' |     |  |
|                           | D2  | Pixel Clock (DOTCLK,RGB I/F))             |     |       |     |     |     |     |     |     |     | Set to '0' |     |  |
|                           | D1  | Data Enable (DE,RGB I/F)                  |     |       |     |     |     |     |     |     |     | Set to '0' |     |  |
|                           | D0  | Parity Error                              |     |       |     |     |     |     |     |     |     | Set to '0' |     |  |

Bit Values are explained overleaf.

Bit D31 – Booster Voltage Status  
 '0' = Booster Off or has a fault.  
 '1' = Booster On and working OK.

Bit D30 – Page Address Order  
 '0' = Top to Bottom (When MADCTL B7(MY) = '0').  
 '1' = Bottom to Top (When MADCTL B7(MY) = '1').

Bit D29 – Column Address Order  
 '0' = Left to Right (When MADCTL B6(MX) = '0').  
 '1' = Right to Left (When MADCTL B6(MX) = '1').

Bit D28 –Page / Column Order  
 '0' = Normal Mode (When MADCTL B5(MV) = '0').

'1' = Reverse Mode (When MADCTL B5(MV) = '1').  
 Bit D27 – Line Address Order  
 '0' = LCD Refresh Top to Bottom (When MADCTL B4(ML) = '0').  
 '1' = LCD Refresh Bottom to Top (When MADCTL B4(ML) = '1').  
 Bit D26 – RGB/BGR Order  
 '0' = RGB (When MADCTL B3 = '0').  
 '1' = BGR (When MADCTL B3 = '1').  
 Bit D25 – Display Data Latch Order  
 '0' = LCD Refresh Left to Right (When MADCTL B2 = '0').  
 '1' = LCD Refresh Right to Left (When MADCTL B2 = '1').

Note : For bits D27, D26 and D25 also refer to 8.3.29 Memory Access Control (R36h)  
 Bit D24 – Switching Between Segment Outputs and RAM

This bit is not applicable for this project, so it is set to '0'.

Bit D23 – Switching Between Common Outputs and RAM  
 This bit is not applicable for this project, so it is set to '0'.

Bits D22, D21, D20 – Interface Color Pixel Format Definition

| Interface Format | D22 | D21 | D20 |
|------------------|-----|-----|-----|
| Not Defined      | 0   | 0   | 0   |
| Not Defined      | 0   | 0   | 1   |
| Not Defined      | 0   | 1   | 0   |
| 12 bit/pixel     | 0   | 1   | 1   |
| Not Defined      | 1   | 0   | 0   |
| 16 bit/pixel     | 1   | 0   | 1   |
| 18 bit/pixel     | 1   | 1   | 0   |
| Not Defined      | 1   | 1   | 1   |

Bit D19 – Idle Mode On/Off

'0' = Idle Mode Off.

'1' = Idle Mode On.

Bit D18 – Partial Mode On/Off

'0' = Partial Mode Off.

'1' = Partial Mode On.

Bit D17 – Sleep In/Out

'0' = Sleep In Mode.

'1' = Sleep Out Mode.

Bit D16 – Display Normal Mode On/Off

'0' = Display Normal Mode Off.

'1' = Display Normal Mode On.

Bit D15 – Vertical Scrolling On/Off

'0' = Vertical Scrolling is Off.

'1' = Vertical Scrolling is On.

Bit D14 – Horizontal Scrolling Status

This bit is not applicable for this project, so it is set to '0'.

Bit D13 – Inversion On/Off

'0' = Inversion is Off.

'1' = Inversion is On.

Bit D12 – All Pixels On

This bit is not applicable for this project, so it is set to '0'.

Bit D11 – All Pixels Off

This bit is not applicable for this project, so it is set to '0'.

Bit D10 – Display On/Off

'0' = Display is Off.

'1' = Display is On.

Bit D9 – Tearing Effect Line On/Off

'0' = Tearing Effect Line Off.

'1' = Tearing Effect On.

**Bits D8, D7, D6 – Gamma Curve Selection**

| Gamma Curve Selected | B8 | B7 | B6 | Gamma Set (26h) Parameter |
|----------------------|----|----|----|---------------------------|
| Gamma Curve 1        | 0  | 0  | 0  | GC0                       |
| Gamma Curve 2        | 0  | 0  | 1  | GC1                       |
| Gamma Curve 3        | 0  | 1  | 0  | GC2                       |
| Gamma Curve 4        | 0  | 1  | 1  | GC3                       |
| Not Defined          | 1  | 0  | 0  | Not Defined               |
| Not Defined          | 1  | 0  | 1  | Not Defined               |
| Not Defined          | 1  | 1  | 0  | Not Defined               |
| Not Defined          | 1  | 1  | 1  | Not Defined               |

Bit D5 – Tearing Effect Line Output Mode.

‘0’ = Mode 1, V-Blanking only.

‘1’ = Mode 2, both H-Blanking and V-Blanking.

Bit D4 – Horizontal Sync. (HS) RGB I/F On/Off, Note

This bit is not applicable for this project, so it is set to ‘0’.

Bit D3 – Vertical Sync. (VS) RGB I/F On/Off, Note

This bit is not applicable for this project, so it is set to ‘0’.

Bit D2 – Pixel Clock (DOTCLK) RGB I/F On/Off, Note

This bit is not applicable for this project, so it is set to ‘0’.

Bit D1 – Data Enable (DE) RGB I/F On/Off, Note

This bit is not applicable for this project, so it is set to ‘0’.

Bit D0 – Parity Error

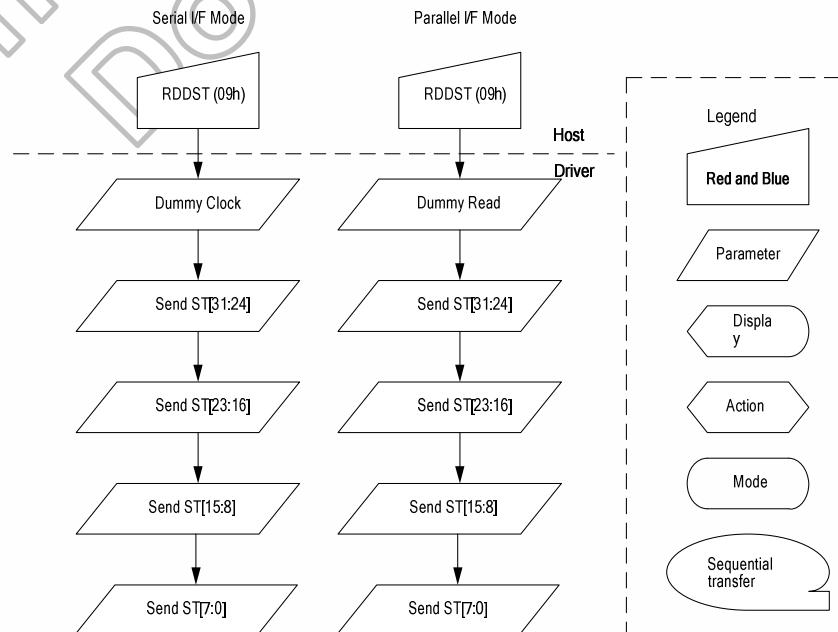
This bit is not applicable for this project, so it is set to ‘0’.

**Restriction**

| Status                                    | Availability |
|---|--------------|
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes          |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes          |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes          |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes          |
| Sleep In or Booster Off                   | Yes          |

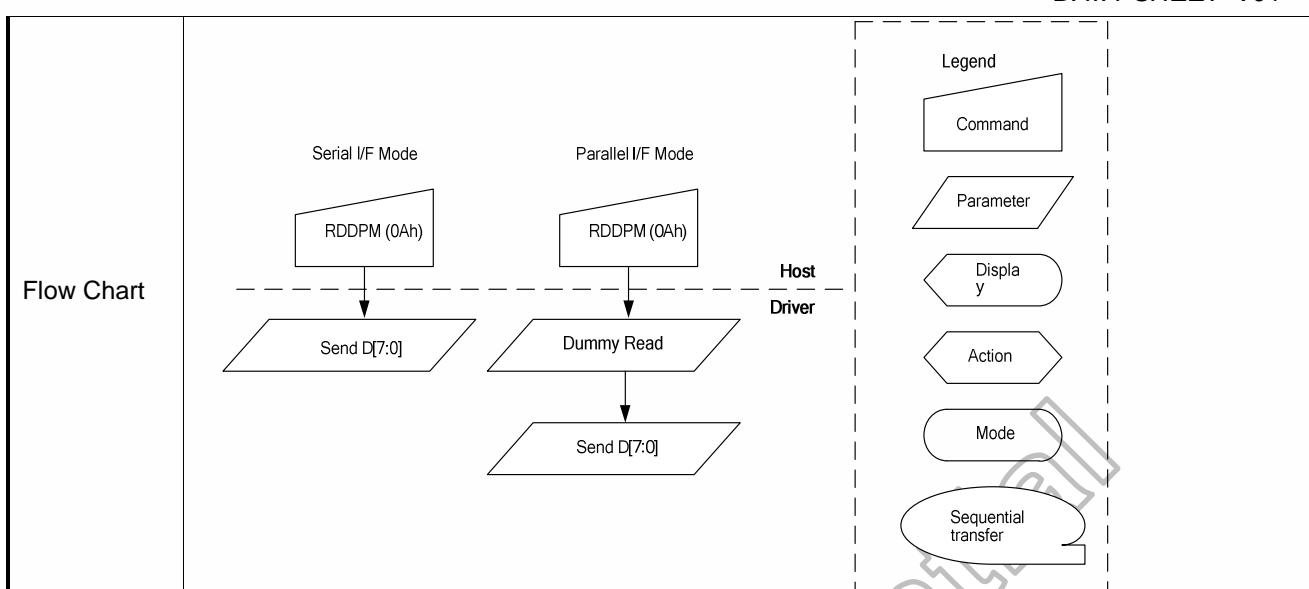
**Default**

| Status            | Default Value   |
|-------------------|-----------------|
| Power On Sequence | See Description |
| S/W Reset         | See Description |
| H/W Reset         | See Description |

**Flow Chart**

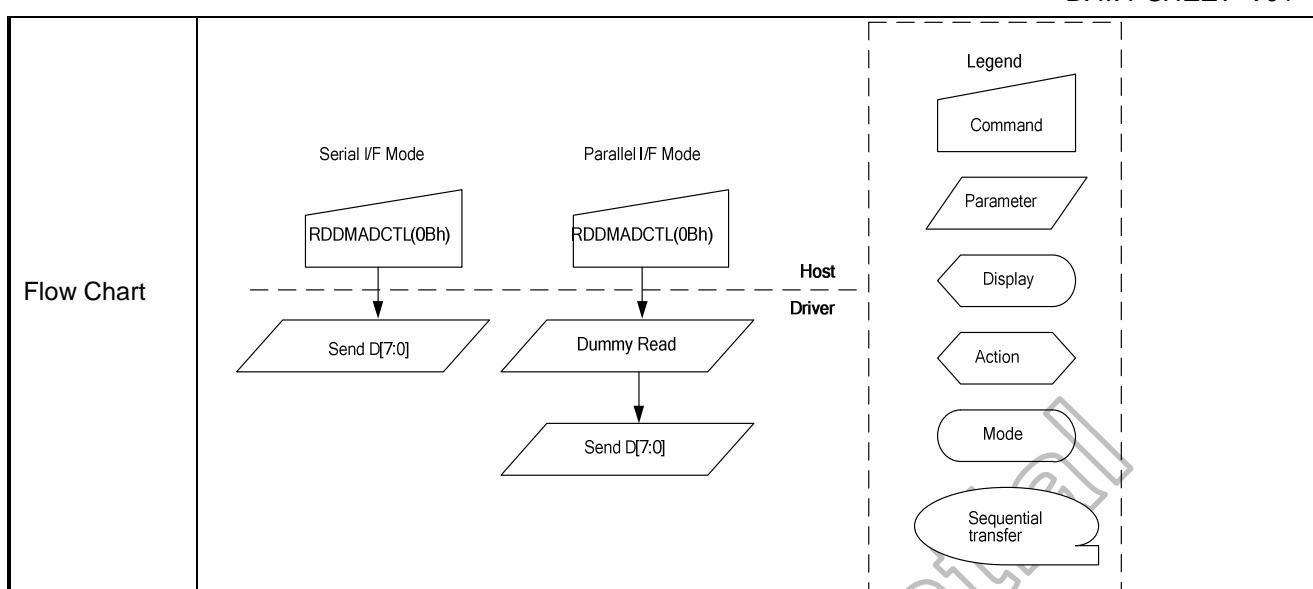
### 8.2.5 Read display power mode (0Ah)

| <b>0A H</b>                               |  | RDDPM (Read Display Power Mode) |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
|---|--|---------------------------------|-----|-------|----|----|----|----|----|----|----|----|-----|--|--------|---------------|--|-----|---|-----|---|------------------|--|-----|-------------------------|-----|----|--------------|---|----|----------------------------|---|----|----------------|---|----|-------------|------------|----|-------------|------------|
|   | DNC  | NWR                             | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| Command                                   | 0  | ↑                               | 1   | -     | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 0  | 0A  |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| 1 <sup>st</sup> parameter                 | 1  | 1                               | ↑   | -     | -  | -  | -  | -  | -  | -  | -  | -  | -   |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| 2 <sup>nd</sup> parameter                 | 1  | 1                               | ↑   | -     | D7 | D6 | D5 | D4 | D3 | D2 | 0  | 0  | xx  |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| Description                               | This command indicates the current status of the display as described in the table below:<br><table border="1"> <thead> <tr> <th>Bit</th><th>Description</th><th>Comment</th></tr> </thead> <tbody> <tr> <td>D7</td><td>Booster Voltage Status</td><td>-</td></tr> <tr> <td>D6</td><td>Idle Mode On/Off</td><td>-</td></tr> <tr> <td>D5</td><td>Partial Mode On/Off</td><td>-</td></tr> <tr> <td>D4</td><td>Sleep In/Out</td><td>-</td></tr> <tr> <td>D3</td><td>Display Normal Mode On/Off</td><td>-</td></tr> <tr> <td>D2</td><td>Display On/Off</td><td>-</td></tr> <tr> <td>D1</td><td>Not Defined</td><td>Set to '0'</td></tr> <tr> <td>D0</td><td>Not Defined</td><td>Set to '0'</td></tr> </tbody> </table> Bit D7 – Booster Voltage Status<br>'0' = Booster Off or has a fault.<br>'1' = Booster On and working OK (Meets display supplier's optical requirements).<br>Bit D6 – Idle Mode On/Off<br>'0' = Idle Mode Off.<br>'1' = Idle Mode On.<br>Bit D5 – Partial Display Mode On/Off<br>'0' = Partial Mode Off.<br>'1' = Partial Mode On.<br>Bit D4 – Sleep In/Out<br>'0' = Sleep In Mode.<br>'1' = Sleep Out Mode.<br>Bit D3 – Normal Display Mode On/Off<br>'0' = Display Normal Mode Off.<br>'1' = Display Normal Mode On.<br>Bit D2 – Display On/Off<br>'0' = Display is Off.<br>'1' = Display is On.<br>Bit D1 – Not Defined<br>This bit is not applicable for this project, so it is set to '0'.<br>Bit D0 – Not Defined<br>This bit is not applicable for this project, so it is set to '0'. |                                 |     |       |    |    |    |    |    |    |    |    |     |  | Bit    | Description   | Comment                                  | D7  | Booster Voltage Status                  | -   | D6  | Idle Mode On/Off | -  | D5  | Partial Mode On/Off     | -   | D4 | Sleep In/Out | - | D3 | Display Normal Mode On/Off | - | D2 | Display On/Off | - | D1 | Not Defined | Set to '0' | D0 | Not Defined | Set to '0' |
| Bit                                       | Description  | Comment                         |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| D7  | Booster Voltage Status   | -                               |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| D6  | Idle Mode On/Off   | -                               |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| D5  | Partial Mode On/Off  | -                               |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| D4  | Sleep In/Out   | -                               |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| D3  | Display Normal Mode On/Off   | -                               |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| D2  | Display On/Off   | -                               |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| D1  | Not Defined  | Set to '0'                      |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| D0  | Not Defined  | Set to '0'                      |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| Restrictions                              | -  |                                 |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th><th>Availability</th></tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Sleep In or Booster Off</td><td>Yes</td></tr> </tbody> </table>  |                                 |     |       |    |    |    |    |    |    |    |    |     |  | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes | Normal Mode On, Idle Mode On, Sleep Out | Yes | Partial Mode On, Idle Mode Off, Sleep Out | Yes              | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| Status                                    | Availability   |                                 |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes  |                                 |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes  |                                 |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes  |                                 |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes  |                                 |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| Sleep In or Booster Off                   | Yes  |                                 |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th><th>Default Value</th></tr> </thead> <tbody> <tr> <td>Power On Sequence</td><td>08h</td></tr> <tr> <td>S/W Reset</td><td>08h</td></tr> <tr> <td>H/W Reset</td><td>08h</td></tr> </tbody> </table>   |                                 |     |       |    |    |    |    |    |    |    |    |     |  | Status | Default Value | Power On Sequence                        | 08h | S/W Reset                               | 08h | H/W Reset                                 | 08h              |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| Status                                    | Default Value  |                                 |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| Power On Sequence                         | 08h  |                                 |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| S/W Reset                                 | 08h  |                                 |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |
| H/W Reset                                 | 08h  |                                 |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |                  |  |     |                         |     |    |              |   |    |                            |   |    |                |   |    |             |            |    |             |            |



### 8.2.6 Read display MADCTL (0Bh)

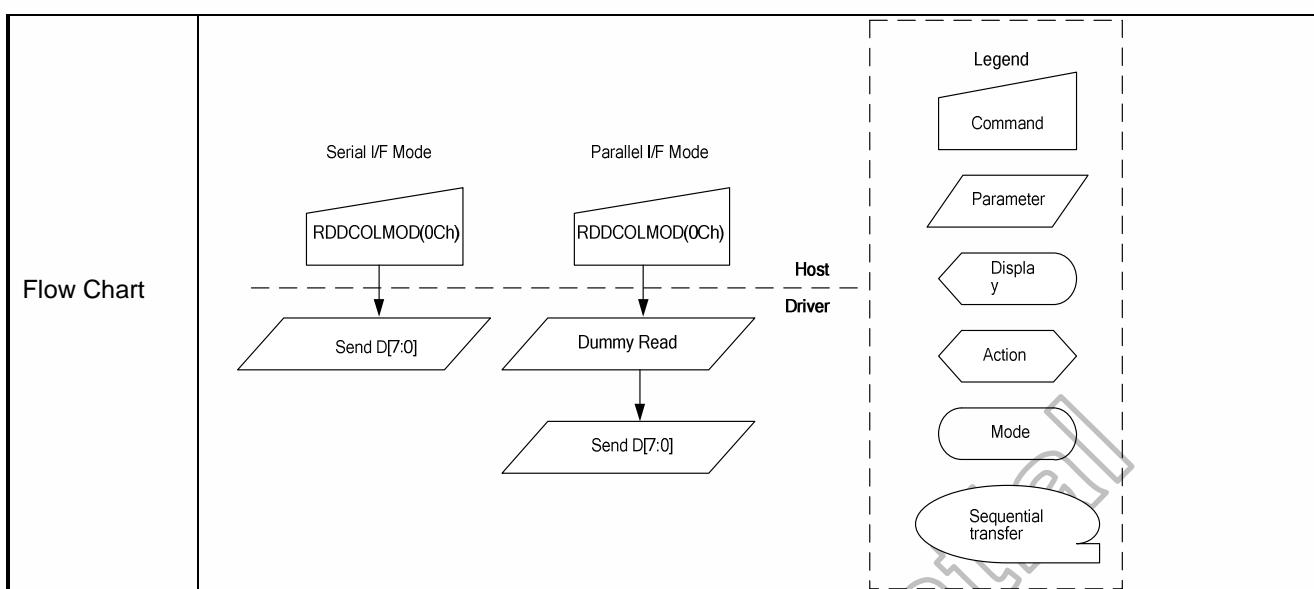
| <b>0B H</b>  |   | RDDMADCTL (Read Display MADCTL) |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
|--|---|---------------------------------|-----|-------|----|----|----|----|----|----|----|----|-----|--------|---------------|-------------------|--|-----------|---|-----------|---|----------------------|--|-----|-------------------------|-----|----|--------------------|---|----|---------------|---|----|--------------------------|---|----|---|------------|----|--|
|  | DNC   | NWR                             | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Command  | 0   | ↑                               | 1   | -     | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 0B  |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| 1 <sup>st</sup> parameter  | 1   | 1                               | ↑   | -     | -  | -  | -  | -  | -  | -  | -  | -  | -   |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| 2 <sup>nd</sup> parameter  | 1   | 1                               | ↑   | -     | D7 | D6 | D5 | D4 | D3 | D2 | 0  | 0  | xx  |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Description  | This command indicates the current status of the display as described in the table below:   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
|  | <table border="1"> <thead> <tr> <th>Bit</th><th>Description</th><th>Comment</th></tr> </thead> <tbody> <tr> <td>D7</td><td>Page Address Order</td><td>-</td></tr> <tr> <td>D6</td><td>Column Address Order</td><td>-</td></tr> <tr> <td>D5</td><td>Page/Column Order</td><td>-</td></tr> <tr> <td>D4</td><td>Line Address Order</td><td>-</td></tr> <tr> <td>D3</td><td>RGB/BGR Order</td><td>-</td></tr> <tr> <td>D2</td><td>Display Data Latch Order</td><td>-</td></tr> <tr> <td>D1</td><td>Switching between Segment outputs and RAM</td><td>Set to '0'</td></tr> <tr> <td>D0</td><td>Switching between Common outputs and RAM</td><td>Set to '0'</td></tr> </tbody> </table> |                                 |     |       |    |    |    |    |    |    |    |    |     |        | Bit           | Description       | Comment                                  | D7        | Page Address Order                      | -         | D6  | Column Address Order | -  | D5  | Page/Column Order       | -   | D4 | Line Address Order | - | D3 | RGB/BGR Order | - | D2 | Display Data Latch Order | - | D1 | Switching between Segment outputs and RAM | Set to '0' | D0 | Switching between Common outputs and RAM |
| Bit  | Description   | Comment                         |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| D7   | Page Address Order  | -                               |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| D6   | Column Address Order  | -                               |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| D5   | Page/Column Order   | -                               |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| D4   | Line Address Order  | -                               |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| D3   | RGB/BGR Order   | -                               |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| D2   | Display Data Latch Order  | -                               |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| D1   | Switching between Segment outputs and RAM   | Set to '0'                      |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| D0   | Switching between Common outputs and RAM  | Set to '0'                      |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Bit D7 – Page Address Order<br>'0' = Top to Bottom (When MADCTL B7(MY) = '0').<br>'1' = Bottom to Top (When MADCTL B7(MY) = '1').  |   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Bit D6 – Column Address Order<br>'0' = Left to Right (When MADCTL B6(MX) = '0').<br>'1' = Right to Left (When MADCTL B6(MX) = '1').  |   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Bit D5 – Page / Column Order<br>'0' = Normal Mode (When MADCTL B5(MV) = '0').<br>'1' = Reverse Mode (When MADCTL B5(MV) = '1').  |   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Bit D4 – Line Address Order<br>'0' = LCD Refresh Top to Bottom (When MADCTL B4(ML) = '0').<br>'1' = LCD Refresh Bottom to Top (When MADCTL B4(ML) = '1').  |   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Bit D3 – RGB/BGR Order<br>'0' = RGB (When MADCTL B3 = '0').<br>'1' = BGR (When MADCTL B3 = '1').   |   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Note: For bits D4, D3 and D2 also refer to 8.2.29 Memory Access Control (R36h)   |   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Bit D2 – Display Data Latch Order<br>Display Data Latch Data Order<br>'0' = LCD Refresh Left to Right (When MADCTL B2='0').<br>'1' = LCD Refresh Right to Left (When MADCTL B2='1').   |   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Bit D1 – Switching Between Segment Outputs and RAM<br>This bit is not applicable for this project, so it is set to '0'.  |   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Bit D0 – Switching Between Common Outputs and RAM<br>This bit is not applicable for this project, so it is set to '0'.   |   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Restrictions   | -   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Register Availability  | <table border="1"> <thead> <tr> <th>Status</th><th>Availability</th></tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Sleep In or Booster Off</td><td>Yes</td></tr> </tbody> </table>   |                                 |     |       |    |    |    |    |    |    |    |    |     |        | Status        | Availability      | Normal Mode On, Idle Mode Off, Sleep Out | Yes       | Normal Mode On, Idle Mode On, Sleep Out | Yes       | Partial Mode On, Idle Mode Off, Sleep Out | Yes                  | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Status   | Availability  |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Normal Mode On, Idle Mode Off, Sleep Out   | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Normal Mode On, Idle Mode On, Sleep Out  | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Partial Mode On, Idle Mode Off, Sleep Out  | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Partial Mode On, Idle Mode On, Sleep Out   | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Sleep In or Booster Off  | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| <table border="1"> <thead> <tr> <th>Status</th><th>Default Value</th></tr> </thead> <tbody> <tr> <td>Power On Sequence</td><td>00h</td></tr> <tr> <td>S/W Reset</td><td>No Change</td></tr> <tr> <td>H/W Reset</td><td>00h</td></tr> </tbody> </table> |   |                                 |     |       |    |    |    |    |    |    |    |    |     | Status | Default Value | Power On Sequence | 00h                                      | S/W Reset | No Change                               | H/W Reset | 00h                                       |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Status   | Default Value   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| Power On Sequence  | 00h   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| S/W Reset  | No Change   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |
| H/W Reset  | 00h   |                                 |     |       |    |    |    |    |    |    |    |    |     |        |               |                   |  |           |   |           |   |                      |  |     |                         |     |    |                    |   |    |               |   |    |                          |   |    |   |            |    |  |



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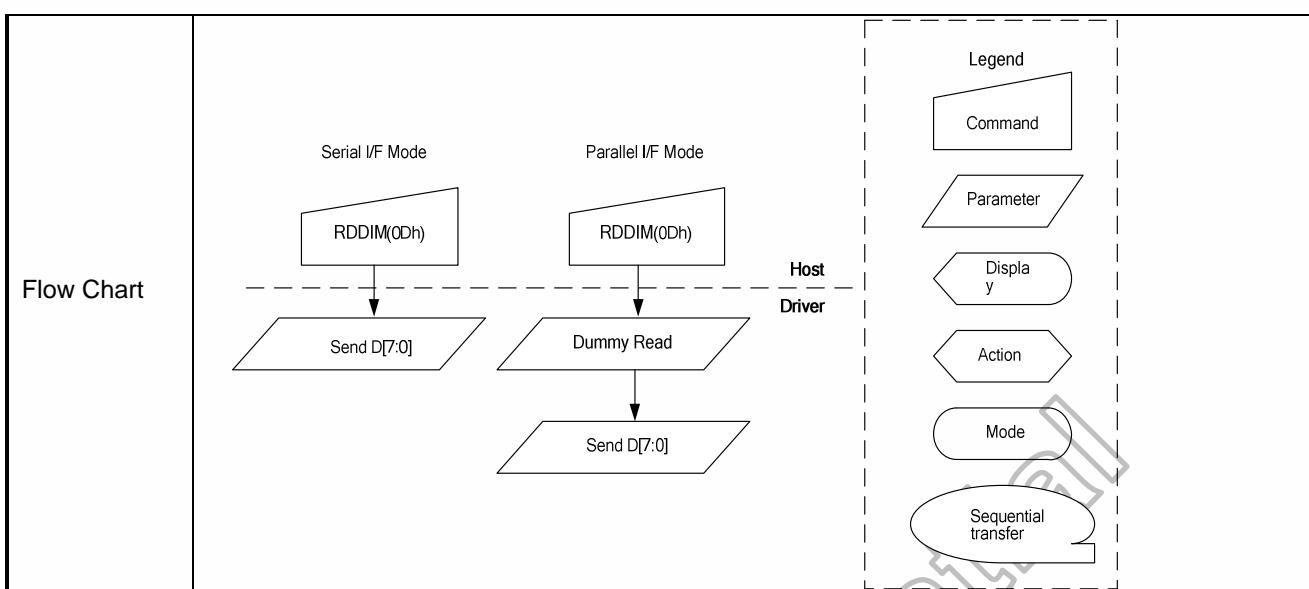
### 8.2.7 Read display pixel format (0Ch)

| 0C H  |   | RDDCOLMOD (Read Display COLMOD) |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
|---|---|---------------------------------|-----|-------|----|----|----|----|----|----|----|----|-----|-------------------------------|---------------|-------------------|--|-------------|---|------------|---|-------------|--|------------|----|-------------|----|-------------------------------|------------|-------------|---|----|---|-------------|---|---|---|--------------|---|---|---|--------------|---|---|---|-------------|---|---|---|
|   | DNC   | NWR                             | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Command   | 0   | ↑                               | 1   | -     | 0  | 0  | 0  | 0  | 1  | 1  | 0  | 0  | 0C  |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| 1 <sup>st</sup> parameter   | 1   | 1                               | ↑   | -     | -  | -  | -  | -  | -  | -  | -  | -  | -   |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| 2 <sup>nd</sup> parameter   | 1   | 1                               | ↑   | -     | 0  | D6 | D5 | D4 | 0  | D2 | D1 | D0 | xx  |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Description   | This command indicates the current status of the display as described in the table below:<br><table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td>D7</td> <td rowspan="4">RGB Interface Color Format</td> <td>Set to '0'</td> </tr> <tr> <td>D6</td> <td>Set to '0'</td> </tr> <tr> <td>D5</td> <td>Set to '0'</td> </tr> <tr> <td>D4</td> <td>Set to '0'</td> </tr> <tr> <td>D3</td> <td rowspan="4">System Interface Color Format</td> <td>Set to '0'</td> </tr> <tr> <td>D2</td> <td>-</td> </tr> <tr> <td>D1</td> <td>-</td> </tr> <tr> <td>D0</td> <td>-</td> </tr> </tbody> </table> Bit D7 – RGB Interface Color Format Selection<br>This bit is not applicable for this project, so it is set to '0'.<br>Bits D6, D5, D4 – RGB Interface Color Pixel Format Definition<br>These bits are not applicable for this project, so they are set to '0's.<br>Bit D3 – System Interface Color Format Selection<br>This bit is not applicable for this project, so it is set to '0'.<br>Bit D2, D1, D0 – Control Interface Color Pixel Format Definition.<br>See section "8.2.33 Interface Pixel Format (R3Ah)". |                                 |     |       |    |    |    |    |    |    |    |    |     |                               | Bit           | Description       | Comment                                  | D7          | RGB Interface Color Format              | Set to '0' | D6  | Set to '0'  | D5                                       | Set to '0' | D4 | Set to '0'  | D3 | System Interface Color Format | Set to '0' | D2          | - | D1 | - | D0          | - |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Bit   | Description   | Comment                         |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| D7  | RGB Interface Color Format  | Set to '0'                      |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| D6  |   | Set to '0'                      |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| D5  |   | Set to '0'                      |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| D4  |   | Set to '0'                      |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| D3  | System Interface Color Format   | Set to '0'                      |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| D2  |   | -                               |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| D1  |   | -                               |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| D0  |   | -                               |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| <table border="1"> <thead> <tr> <th>System Interface Color Format</th> <th>D2</th> <th>D1</th> <th>D0</th> </tr> </thead> <tbody> <tr> <td>Not Defined</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Not Defined</td> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>Not Defined</td> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>Not Defined</td> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>Not Defined</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>16 bit/pixel</td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>18 bit/pixel</td> <td>1</td> <td>1</td> <td>0</td> </tr> <tr> <td>Not Defined</td> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table> |   |                                 |     |       |    |    |    |    |    |    |    |    |     | System Interface Color Format | D2            | D1                | D0                                       | Not Defined | 0                                       | 0          | 0   | Not Defined | 0  | 0          | 1  | Not Defined | 0  | 1                             | 0          | Not Defined | 0 | 1  | 1 | Not Defined | 1 | 0 | 0 | 16 bit/pixel | 1 | 0 | 1 | 18 bit/pixel | 1 | 1 | 0 | Not Defined | 1 | 1 | 1 |
| System Interface Color Format   | D2  | D1                              | D0  |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Not Defined   | 0   | 0                               | 0   |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Not Defined   | 0   | 0                               | 1   |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Not Defined   | 0   | 1                               | 0   |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Not Defined   | 0   | 1                               | 1   |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Not Defined   | 1   | 0                               | 0   |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| 16 bit/pixel  | 1   | 0                               | 1   |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| 18 bit/pixel  | 1   | 1                               | 0   |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Not Defined   | 1   | 1                               | 1   |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| -   |   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| -   |   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Register Availability   | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> </tbody> </table>  |                                 |     |       |    |    |    |    |    |    |    |    |     |                               | Status        | Availability      | Normal Mode On, Idle Mode Off, Sleep Out | Yes         | Normal Mode On, Idle Mode On, Sleep Out | Yes        | Partial Mode On, Idle Mode Off, Sleep Out | Yes         | Partial Mode On, Idle Mode On, Sleep Out | Yes        |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Status  | Availability  |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Partial Mode On, Idle Mode Off, Sleep Out   | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
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| Status  | Default Value   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Power On Sequence   | 18-bit/pixel  |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| S/W Reset   | No Change   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| H/W Reset   | 18-bit/pixel  |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
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| Status  | Default Value   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Power On Sequence   | 18-bit/pixel  |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| S/W Reset   | No Change   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| H/W Reset   | 18-bit/pixel  |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
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| Status  | Default Value   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Power On Sequence   | 18-bit/pixel  |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| S/W Reset   | No Change   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| H/W Reset   | 18-bit/pixel  |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
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| Status  | Default Value   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Power On Sequence   | 18-bit/pixel  |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| S/W Reset   | No Change   |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| H/W Reset   | 18-bit/pixel  |                                 |     |       |    |    |    |    |    |    |    |    |     |                               |               |                   |  |             |   |            |   |             |  |            |    |             |    |                               |            |             |   |    |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |



### 8.2.8 Read display image mode (0Dh)

| 0D H                                      | RDDIM (Read Display Image Mode)   |     |     |                            |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
|---|---|-----|-----|----------------------------|----|----|----|----|----|----|----|----|-----|----------------------|---------------|--|-----|---|---------------|---|-----|--|-----|-------------------------|-----|---|---|-----|---------------|---|---|---|-----|---------------|---|---|---|-----|-------------|---|---|---|-------------|-------------|---|---|---|-------------|-------------|---|---|---|-------------|-------------|---|---|---|-------------|
|   | DNC   | NWR | NRD | D15-8                      | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Command                                   | 0   | ↑   | 1   | -                          | 0  | 0  | 0  | 0  | 1  | 1  | 0  | 1  | 0D  |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| 1 <sup>st</sup> parameter                 | 1   | 1   | ↑   | -                          | -  | -  | -  | -  | -  | -  | -  | -  | -   |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| 2 <sup>nd</sup> parameter                 | 1   | 1   | ↑   | -                          | D7 | 0  | D5 | 0  | 0  | D2 | D1 | D0 | xx  |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Description                               | <p>This command indicates the current status of the display as described in the table below:</p> <p>Bit D7 – Vertical Scrolling On/Off<br/>         '0' = Vertical Scrolling is Off.<br/>         '1' = Vertical Scrolling is On.</p> <p>Bit D6 – Horizontal Scrolling Status<br/>         This bit is not applicable for this project, so it is set to '0'</p> <p>Bit D5 – Inversion On/Off<br/>         '0' = Inversion is Off.<br/>         '1' = Inversion is On.</p> <p>Bit D4 – All Pixels On<br/>         This bit is not applicable for this project, so it is set to '0'</p> <p>Bit D3 – All Pixels Off<br/>         This bit is not applicable for this project, so it is set to '0'</p> <p>Bits D2, D1, D0 – Gamma Curve Selection</p> <table border="1"> <thead> <tr> <th>Gamma Curve Selected</th><th>D2</th><th>D1</th><th>D0</th><th>Gamma Set (R26h) Parameter</th></tr> </thead> <tbody> <tr> <td>Gamma Curve 1</td><td>0</td><td>0</td><td>0</td><td>GC0</td></tr> <tr> <td>Gamma Curve 2</td><td>0</td><td>0</td><td>1</td><td>GC1</td></tr> <tr> <td>Gamma Curve 3</td><td>0</td><td>1</td><td>0</td><td>GC2</td></tr> <tr> <td>Gamma Curve 4</td><td>0</td><td>1</td><td>1</td><td>GC3</td></tr> <tr> <td>Not Defined</td><td>1</td><td>0</td><td>0</td><td>Not Defined</td></tr> <tr> <td>Not Defined</td><td>1</td><td>0</td><td>1</td><td>Not Defined</td></tr> <tr> <td>Not Defined</td><td>1</td><td>1</td><td>0</td><td>Not Defined</td></tr> <tr> <td>Not Defined</td><td>1</td><td>1</td><td>1</td><td>Not Defined</td></tr> </tbody> </table> |     |     |                            |    |    |    |    |    |    |    |    |     | Gamma Curve Selected | D2            | D1                                       | D0  | Gamma Set (R26h) Parameter              | Gamma Curve 1 | 0   | 0   | 0  | GC0 | Gamma Curve 2           | 0   | 0 | 1 | GC1 | Gamma Curve 3 | 0 | 1 | 0 | GC2 | Gamma Curve 4 | 0 | 1 | 1 | GC3 | Not Defined | 1 | 0 | 0 | Not Defined | Not Defined | 1 | 0 | 1 | Not Defined | Not Defined | 1 | 1 | 0 | Not Defined | Not Defined | 1 | 1 | 1 | Not Defined |
| Gamma Curve Selected                      | D2  | D1  | D0  | Gamma Set (R26h) Parameter |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Gamma Curve 1                             | 0   | 0   | 0   | GC0                        |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Gamma Curve 2                             | 0   | 0   | 1   | GC1                        |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Gamma Curve 3                             | 0   | 1   | 0   | GC2                        |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Gamma Curve 4                             | 0   | 1   | 1   | GC3                        |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Not Defined                               | 1   | 0   | 0   | Not Defined                |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Not Defined                               | 1   | 0   | 1   | Not Defined                |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Not Defined                               | 1   | 1   | 0   | Not Defined                |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Not Defined                               | 1   | 1   | 1   | Not Defined                |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Restrictions                              | -   |     |     |                            |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th><th>Availability</th></tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Sleep In or Booster Off</td><td>Yes</td></tr> </tbody> </table>   |     |     |                            |    |    |    |    |    |    |    |    |     | Status               | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes | Normal Mode On, Idle Mode On, Sleep Out | Yes           | Partial Mode On, Idle Mode Off, Sleep Out | Yes | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Status                                    | Availability  |     |     |                            |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |     |     |                            |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |     |     |                            |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |     |     |                            |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |     |     |                            |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Sleep In or Booster Off                   | Yes   |     |     |                            |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th><th>Default Value</th></tr> </thead> <tbody> <tr> <td>Power On Sequence</td><td>00h</td></tr> <tr> <td>S/W Reset</td><td>00h</td></tr> <tr> <td>H/W Reset</td><td>00h</td></tr> </tbody> </table>  |     |     |                            |    |    |    |    |    |    |    |    |     | Status               | Default Value | Power On Sequence                        | 00h | S/W Reset                               | 00h           | H/W Reset                                 | 00h |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Status                                    | Default Value   |     |     |                            |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| Power On Sequence                         | 00h   |     |     |                            |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| S/W Reset                                 | 00h   |     |     |                            |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |
| H/W Reset                                 | 00h   |     |     |                            |    |    |    |    |    |    |    |    |     |                      |               |  |     |   |               |   |     |  |     |                         |     |   |   |     |               |   |   |   |     |               |   |   |   |     |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |             |   |   |   |             |



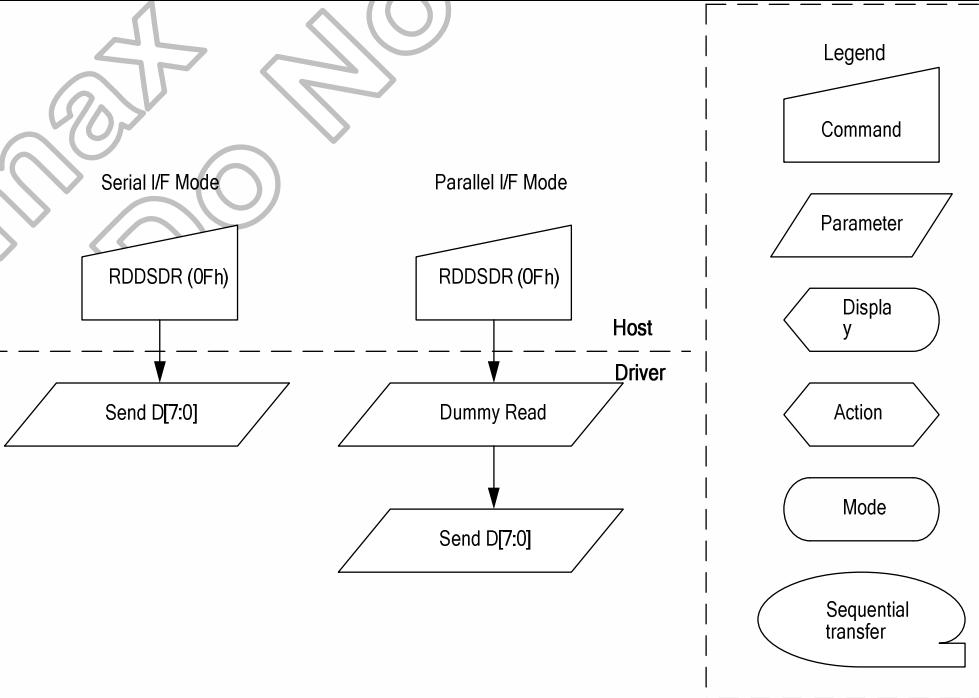
### **8.2.9 Read display signal mode (0Eh)**

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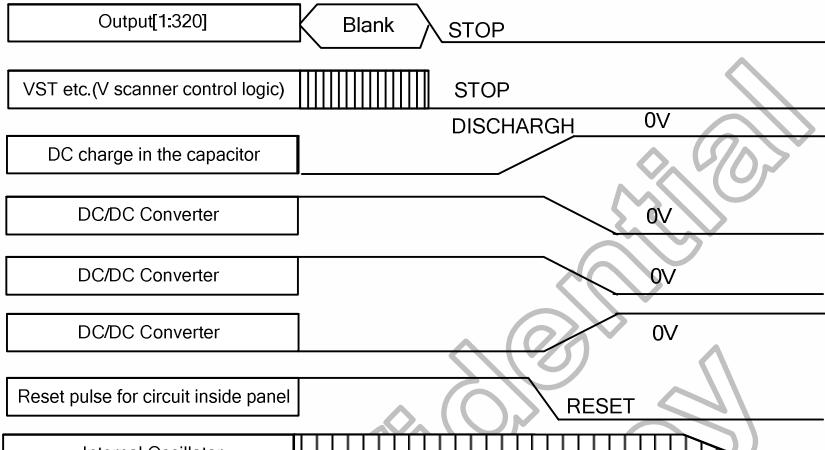
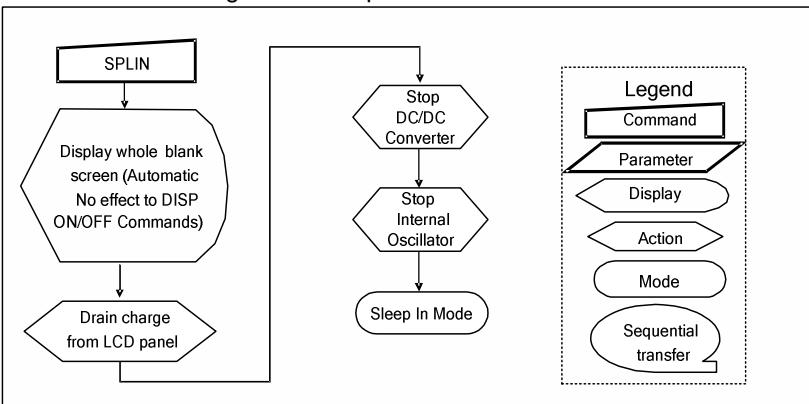
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-P.123-  
April, 2012

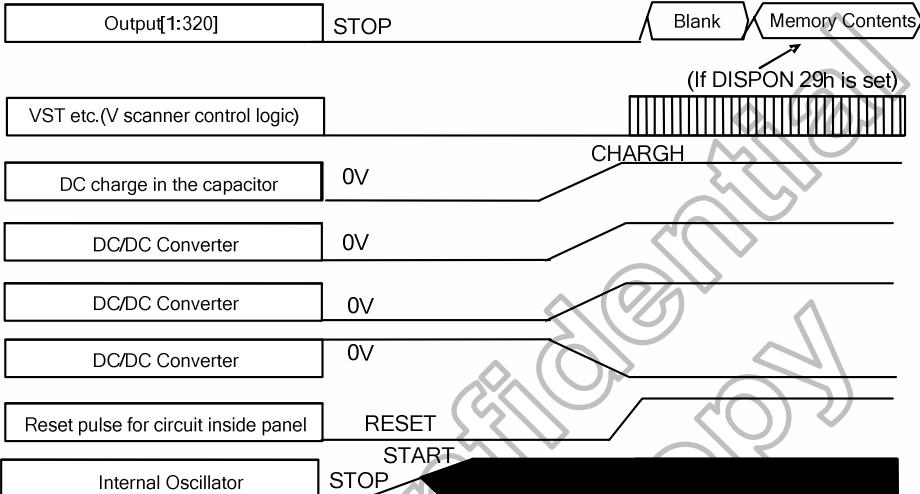
### 8.2.10 Read display self-diagnostic result (0Fh)

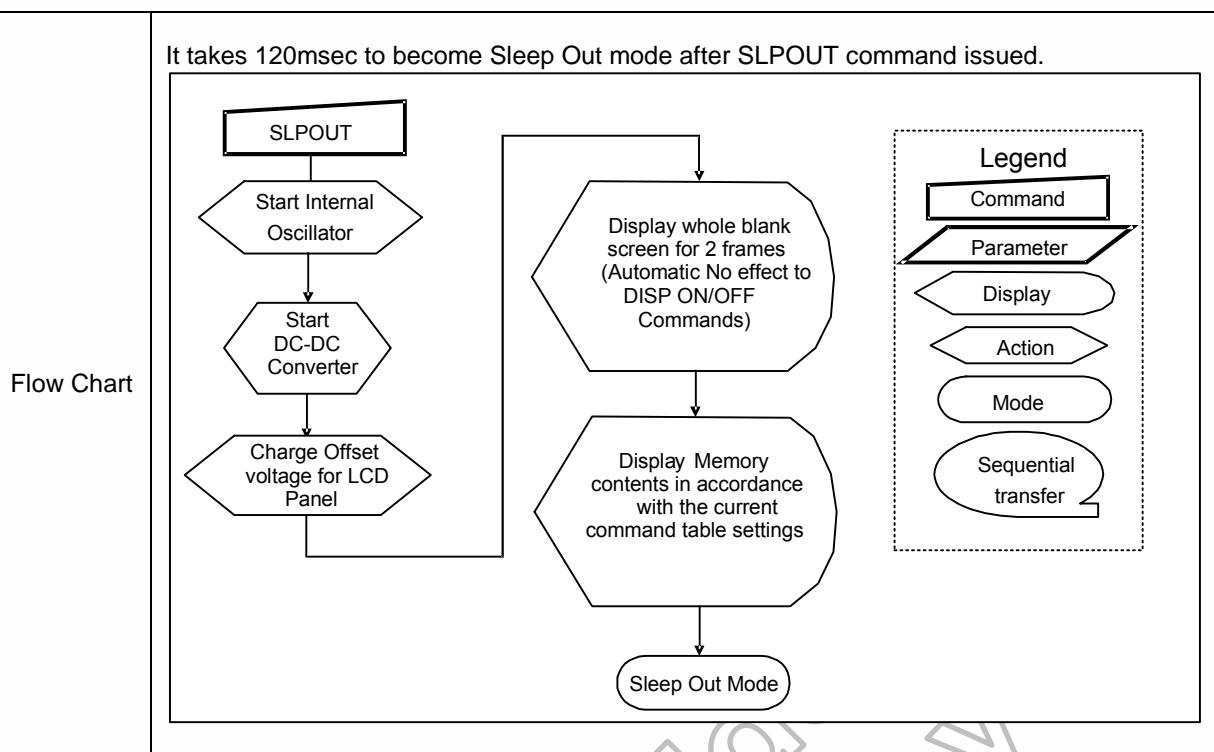
| 0F H RDDSDR (Read Display Self-Diagnostic Result) |  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |
|---|--|-----|-----|-------|----|----|----|----|----|----|----|----|-----|--|--------|---------------|--|-----|---|-----|---|-----|--|-----|-------------------------|-----|
|   | DNC  | NWR | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| Command   | 0  | ↑   | 1   | -     | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 0F  |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| 1 <sup>st</sup> parameter                         | 1  | 1   | ↑   | -     | -  | -  | -  | -  | -  | -  | -  | -  | -   |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| 2 <sup>nd</sup> parameter                         | 1  | 1   | ↑   | -     | D7 | D6 | D5 | D4 | 0  | 0  | 0  | 0  | -   |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| Description                                       | This command indicates the status of the display self-diagnostic results after Sleep Out -command as described in the table below:<br>Bit D7 – Register Loading Detection<br>See section 7.6.1.<br>Bit D6 – Functionality Detection<br>See section 7.6.2.<br>Bit D5 – Chip Attachment Detection<br>Set bit D5 to '0', if this function is not implemented.<br>Bit D4 – Display Glass Break Detection<br>Set bit D4 to '0', if this function is not implemented.<br>Bits D3, D2, D1 and D0 are for future use and are set to '0'. |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| Restrictions                                      | -  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| Register Availability                             | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table>  |     |     |       |    |    |    |    |    |    |    |    |     |  | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes | Normal Mode On, Idle Mode On, Sleep Out | Yes | Partial Mode On, Idle Mode Off, Sleep Out | Yes | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status  | Availability   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out          | Yes  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out           | Yes  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out         | Yes  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out          | Yes  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| Sleep In or Booster Off                           | Yes  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| Default   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>   |     |     |       |    |    |    |    |    |    |    |    |     |  | Status | Default Value | Power On Sequence                        | 00h | S/W Reset                               | 00h | H/W Reset                                 | 00h |  |     |                         |     |
| Status  | Default Value  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| Power On Sequence                                 | 00h  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| S/W Reset   | 00h  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| H/W Reset   | 00h  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |
| Flow Chart  |  <pre> graph TD     RDDSDR[RDDSDR (0Fh)] --&gt; SendD1[Send D[7:0]]     RDDSDR[RDDSDR (0Fh)] --&gt; DummyRead[Dummy Read]     SendD1 --&gt; SendD2[Send D[7:0]]     DummyRead --&gt; SendD2[Send D[7:0]]   </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |     |   |     |   |     |  |     |                         |     |

### 8.2.11 Sleep in (10h)

| <b>10 H</b>                               | SLPIN (Sleep In)  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
|---|---|-----|-----|-------|----|----|----|----|----|----|----|----|-----|--|--------|---------------|--|---------------|---|---------------|---|---------------|--|-----|-------------------------|-----|
|   | DNC   | NWR | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Command                                   | 0   | ↑   | 1   | -     | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 10  |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Parameter                                 | NO PARAMETER  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Description                               | <p>This command causes the LCD module to enter the minimum power consumption mode. In this mode the DC/DC converter is stopped, Internal oscillator is stopped, and panel scanning is stopped.</p>  <p>MCU interface and memory are still working and the memory keeps its contents.</p>  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Restriction                               | <p>This command has no effect when module is already in sleep in mode. Sleep In Mode can only be left by the Sleep Out Command (11h). It will be necessary to wait 5msec before sending next command, this is to allow time for the supply voltages and clock circuits to stabilize. It will be necessary to wait 120msec after sending Sleep Out command (when in Sleep In Mode) before Sleep In command can be sent.</p>  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table> |     |     |       |    |    |    |    |    |    |    |    |     |  | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes           | Normal Mode On, Idle Mode On, Sleep Out | Yes           | Partial Mode On, Idle Mode Off, Sleep Out | Yes           | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Sleep In Mode</td> </tr> <tr> <td>S/W Reset</td> <td>Sleep In Mode</td> </tr> <tr> <td>H/W Reset</td> <td>Sleep In Mode</td> </tr> </tbody> </table>  |     |     |       |    |    |    |    |    |    |    |    |     |  | Status | Default Value | Power On Sequence                        | Sleep In Mode | S/W Reset                               | Sleep In Mode | H/W Reset                                 | Sleep In Mode |  |     |                         |     |
| Status                                    | Default Value   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Power On Sequence                         | Sleep In Mode   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| S/W Reset                                 | Sleep In Mode   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| H/W Reset                                 | Sleep In Mode   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Flow Chart                                | <p>It takes 120msec to get into Sleep In mode after SLPIN command issued.</p>   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |

### 8.2.12 Sleep out (11h)

| <b>11 H</b>                               | SLPOUT (Sleep Out)  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
|---|---|-----|-----|-------|----|----|----|----|----|----|----|----|-----|--|--------|---------------|--|---------------|---|---------------|---|---------------|--|-----|-------------------------|-----|
|   | DNC   | NWR | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Command                                   | 0   | ↑   | 1   | -     | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 1  | 11  |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Parameter                                 | NO PARAMETER  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Description                               | <p>This command turns off sleep mode.<br/>In this mode the DC/DC converter is enabled, Internal oscillator is started, and panel scanning is started.</p>  <p>The timing diagram illustrates the state of various signals during the transition from Sleep Mode to Sleep Out Mode. It shows the following sequence of events:</p> <ul style="list-style-type: none"> <li><b>Output[1:320]:</b> Changes from STOP to Blank (high) when DISPON 29h is set.</li> <li><b>VST etc.(V scanner control logic):</b> Changes from low to high.</li> <li><b>DC charge in the capacitor:</b> Changes from 0V to high.</li> <li><b>DC/DC Converter:</b> Changes from 0V to high.</li> <li><b>Internal Oscillator:</b> Changes from STOP to START.</li> <li><b>CHARGH:</b> Changes from low to high.</li> <li><b>Reset pulse for circuit inside panel:</b> Changes from low to high.</li> </ul> |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Restriction                               | <p>This command has no effect when module is already in sleep out mode. Sleep Out Mode can only be left by the Sleep In Command (10h).<br/>It will be necessary to wait 5msec before sending next command, this is to allow time for the supply voltages and clock circuits to stabilize.<br/>The display module loads all display suppliers' factory default values to the registers during this 5msec and there cannot be any abnormal visual effect on the display image. If factory default and register values are same when this load is done and when the display module is already Sleep Out -mode.<br/>The display module is doing self-diagnostic functions during this 5msec.<br/>It will be necessary to wait 120msec after sending Sleep In command (when in Sleep Out mode) before Sleep Out command can be sent.</p>   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table>   |     |     |       |    |    |    |    |    |    |    |    |     |  | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes           | Normal Mode On, Idle Mode On, Sleep Out | Yes           | Partial Mode On, Idle Mode Off, Sleep Out | Yes           | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Sleep In Mode</td> </tr> <tr> <td>S/W Reset</td> <td>Sleep In Mode</td> </tr> <tr> <td>H/W Reset</td> <td>Sleep In Mode</td> </tr> </tbody> </table>  |     |     |       |    |    |    |    |    |    |    |    |     |  | Status | Default Value | Power On Sequence                        | Sleep In Mode | S/W Reset                               | Sleep In Mode | H/W Reset                                 | Sleep In Mode |  |     |                         |     |
| Status                                    | Default Value   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| Power On Sequence                         | Sleep In Mode   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| S/W Reset                                 | Sleep In Mode   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |
| H/W Reset                                 | Sleep In Mode   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |               |   |               |   |               |  |     |                         |     |



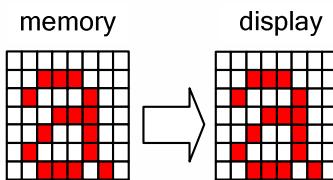
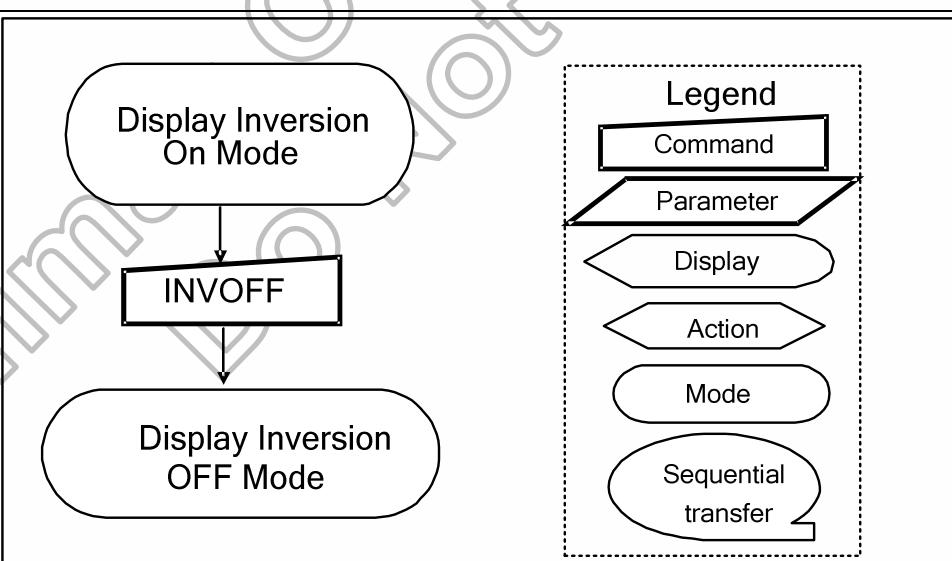
### 8.2.13 Partial mode on (12h)

| 12 H                                      |   | PTLON (Partial Mode On) |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
|---|---|-------------------------|-----|-----|-------|----|----|----|----|----|----|----|----|--------|---------------|--|------------------------|---|------------------------|---|------------------------|--|-----|-------------------------|-----|--|
|   |   | DNC                     | NWR | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX    |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| Command                                   |   | 0                       | ↑   | 1   | -     | 0  | 0  | 0  | 1  | 0  | 0  | 1  | 0  | 12     |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| Parameter                                 | NO PARAMETER  |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| Description                               | This command turns on partial mode. The partial mode window is described by the Partial Area command (30H). To leave Partial mode, the Normal Display Mode On command (13H) should be written.<br>See also section 6.3.8  |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| Restrictions                              | This command has no effect when Partial mode is active.   |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table> |                         |     |     |       |    |    |    |    |    |    |    |    | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes                    | Normal Mode On, Idle Mode On, Sleep Out | Yes                    | Partial Mode On, Idle Mode Off, Sleep Out | Yes                    | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |  |
| Status                                    | Availability  |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| Sleep In or Booster Off                   | Yes   |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Normal Display Mode On</td> </tr> <tr> <td>S/W Reset</td> <td>Normal Display Mode On</td> </tr> <tr> <td>H/W Reset</td> <td>Normal Display Mode On</td> </tr> </tbody> </table>   |                         |     |     |       |    |    |    |    |    |    |    |    | Status | Default Value | Power On Sequence                        | Normal Display Mode On | S/W Reset                               | Normal Display Mode On | H/W Reset                                 | Normal Display Mode On |  |     |                         |     |  |
| Status                                    | Default Value   |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| Power On Sequence                         | Normal Display Mode On  |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| S/W Reset                                 | Normal Display Mode On  |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| H/W Reset                                 | Normal Display Mode On  |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |
| Flow Chart                                | See Partial Area (30h)  |                         |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                        |   |                        |   |                        |  |     |                         |     |  |

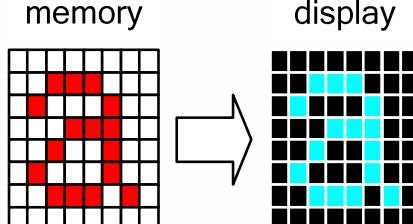
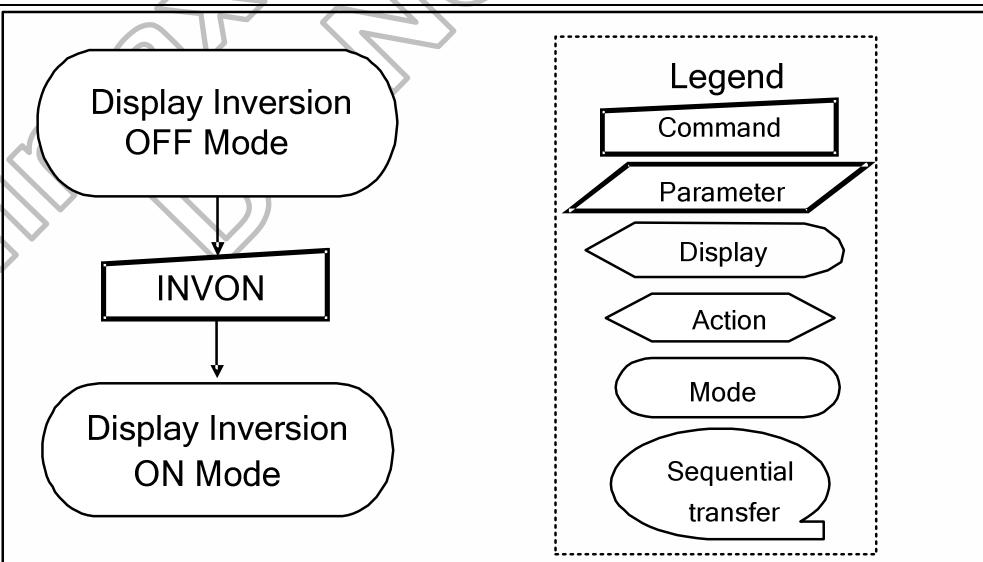
### 8.2.14 Normal display mode on (13h)

| <b>13 H</b>                               | NORON (Normal Display Mode On)  |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
|---|---|-----|-----|-------|----|----|----|----|----|----|----|----|-----|--------|---------------|--|------------------------|---|------------------------|---|------------------------|--|-----|-------------------------|-----|
|   | DNC   | NWR | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| Command                                   | 0   | ↑   | 1   | -     | 0  | 0  | 0  | 1  | 0  | 0  | 1  | 1  | 13  |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| Parameter                                 | NO PARAMETER  |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| Description                               | This command returns the display to normal mode. Normal display mode on means Partial mode off, Scroll mode Off.<br>See also section 6.2.1.   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| Restriction                               | This command has no effect when Normal mode is active.  |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table> |     |     |       |    |    |    |    |    |    |    |    |     | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes                    | Normal Mode On, Idle Mode On, Sleep Out | Yes                    | Partial Mode On, Idle Mode Off, Sleep Out | Yes                    | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Normal Display Mode On</td> </tr> <tr> <td>S/W Reset</td> <td>Normal Display Mode On</td> </tr> <tr> <td>H/W Reset</td> <td>Normal Display Mode On</td> </tr> </tbody> </table>   |     |     |       |    |    |    |    |    |    |    |    |     | Status | Default Value | Power On Sequence                        | Normal Display Mode On | S/W Reset                               | Normal Display Mode On | H/W Reset                                 | Normal Display Mode On |  |     |                         |     |
| Status                                    | Default Value   |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| Power On Sequence                         | Normal Display Mode On  |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| S/W Reset                                 | Normal Display Mode On  |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| H/W Reset                                 | Normal Display Mode On  |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |
| Flow Chart                                | See Partial Area and Vertical Scrolling Definition Descriptions for details of when to use this command.  |     |     |       |    |    |    |    |    |    |    |    |     |        |               |  |                        |   |                        |   |                        |  |     |                         |     |

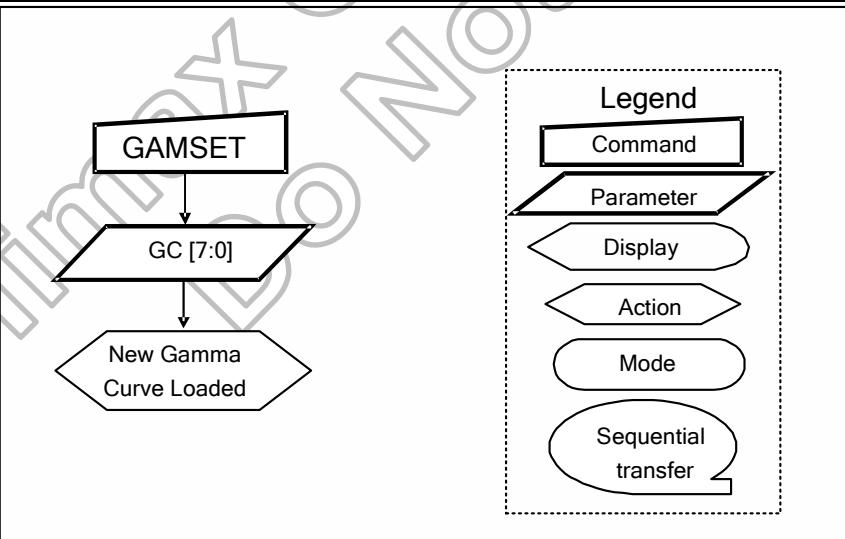
### 8.2.15 Display inversion off (20h)

| <b>20 H</b>                               | INVOFF (Display Inversion Off)  |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
|---|---|-----|-----|-------|----|----|----|----|----|----|----|----|-----|----|--------|---------------|--|-----------------------|---|-----------------------|---|-----------------------|--|-----|-------------------------|-----|
|   | DNC   | NRD | NWR | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Command                                   | 0   | 1   | ↑   | -     | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0   | 20 |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Parameter                                 | NO PARAMETER  |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Description                               | <p>This command is used to recover from display inversion mode.<br/> This command makes no change of contents of frame memory.<br/> This command does not change any other status.</p> <p>(Example)</p>   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Restriction                               | -   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table> |     |     |       |    |    |    |    |    |    |    |    |     |    | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes                   | Normal Mode On, Idle Mode On, Sleep Out | Yes                   | Partial Mode On, Idle Mode Off, Sleep Out | Yes                   | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Display Inversion Off</td> </tr> <tr> <td>S/W Reset</td> <td>Display Inversion Off</td> </tr> <tr> <td>H/W Reset</td> <td>Display Inversion Off</td> </tr> </tbody> </table>  |     |     |       |    |    |    |    |    |    |    |    |     |    | Status | Default Value | Power On Sequence                        | Display Inversion Off | S/W Reset                               | Display Inversion Off | H/W Reset                                 | Display Inversion Off |  |     |                         |     |
| Status                                    | Default Value   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Power On Sequence                         | Display Inversion Off   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| S/W Reset                                 | Display Inversion Off   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| H/W Reset                                 | Display Inversion Off   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Flow Chart                                |  <pre> graph TD     A([Display Inversion On Mode]) --&gt; B[INVOFF]     B --&gt; C([Display Inversion OFF Mode])     </pre> <p><b>Legend:</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>  |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |                       |   |                       |   |                       |  |     |                         |     |

### 8.2.16 Display inversion on (21h)

| <b>21 H</b>                               | INVON (Display Inversion On)  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
|---|---|-----|-----|-------|----|----|----|----|----|----|----|----|-----|--|--------|---------------|--|-----------------------|---|-----------------------|---|-----------------------|--|-----|-------------------------|-----|
|   | DNC   | NRD | NWR | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Command                                   | 0   | 1   | ↑   | -     | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 1  | 21  |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Parameter                                 | NO PARAMETER  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Description                               | <p>This command is used to enter into display inversion mode.<br/>           This command makes no change of contents of frame memory. Every bit is inverted from the frame memory to the display.<br/>           This command does not change any other status.</p> <p style="text-align: center;">(Example)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <span>memory</span>  <span>display</span> </div>   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Restriction                               |   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Register Availability                     | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Status</th> <th style="text-align: center;">Availability</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Normal Mode On, Idle Mode Off, Sleep Out</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td style="text-align: center;">Normal Mode On, Idle Mode On, Sleep Out</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td style="text-align: center;">Partial Mode On, Idle Mode Off, Sleep Out</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td style="text-align: center;">Partial Mode On, Idle Mode On, Sleep Out</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td style="text-align: center;">Sleep In or Booster Off</td> <td style="text-align: center;">Yes</td> </tr> </tbody> </table> |     |     |       |    |    |    |    |    |    |    |    |     |  | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes                   | Normal Mode On, Idle Mode On, Sleep Out | Yes                   | Partial Mode On, Idle Mode Off, Sleep Out | Yes                   | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Default                                   | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Status</th> <th style="text-align: center;">Default Value</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Power On Sequence</td> <td style="text-align: center;">Display Inversion Off</td> </tr> <tr> <td style="text-align: center;">S/W Reset</td> <td style="text-align: center;">Display Inversion Off</td> </tr> <tr> <td style="text-align: center;">H/W Reset</td> <td style="text-align: center;">Display Inversion Off</td> </tr> </tbody> </table>  |     |     |       |    |    |    |    |    |    |    |    |     |  | Status | Default Value | Power On Sequence                        | Display Inversion Off | S/W Reset                               | Display Inversion Off | H/W Reset                                 | Display Inversion Off |  |     |                         |     |
| Status                                    | Default Value   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Power On Sequence                         | Display Inversion Off   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| S/W Reset                                 | Display Inversion Off   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| H/W Reset                                 | Display Inversion Off   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |
| Flow Chart                                |  <pre> graph TD     A([Display Inversion OFF Mode]) --&gt; B[INVON]     B --&gt; C([Display Inversion ON Mode])     </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |                       |   |                       |   |                       |  |     |                         |     |

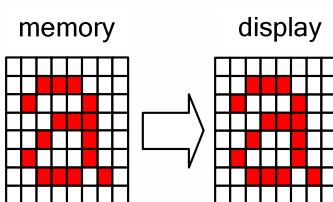
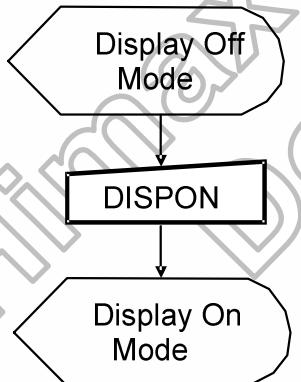
### 8.2.17 Gamma set (26h)

| 26 H                                      |   | GAMSET (Gamma Set) |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
|---|---|--------------------|-----|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|---------------|--|-----|---|---------------|---|-----|--|-----|-------------------------|---------------|-----|-----|---------------|
|   | DNC   | NWR                | NRD | D15-8 | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | HEX |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| Command                                   | 0   | ↑                  | 1   | -     | 0   | 0   | 1   | 0   | 0   | 1   | 1   | 0   | 26  |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| Parameter                                 | 1   | ↑                  | 1   | -     | GC7 | GC6 | GC5 | GC4 | GC3 | GC2 | GC1 | GC0 | -   |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| Description                               | <p>This command is used to select the desired Gamma curve for the current display. A maximum of 4 fixed gamma curves can be selected. The curve is selected by setting the appropriate bit in the parameter as described in the table:</p> <table border="1"> <thead> <tr> <th>GC[7..0]</th><th>Parameter</th><th>Curve Selected</th></tr> </thead> <tbody> <tr> <td>01h</td><td>GC0</td><td>Gamma Curve 1</td></tr> <tr> <td>02h</td><td>GC1</td><td>Gamma Curve 2</td></tr> <tr> <td>04h</td><td>GC2</td><td>Gamma Curve 3</td></tr> <tr> <td>08h</td><td>GC3</td><td>Gamma Curve 4</td></tr> </tbody> </table> <p><b>Note:</b> All other values are undefined.</p> |                    |     |       |     |     |     |     |     |     |     |     |     | GC[7..0] | Parameter     | Curve Selected                           | 01h | GC0                                     | Gamma Curve 1 | 02h                                       | GC1 | Gamma Curve 2                            | 04h | GC2                     | Gamma Curve 3 | 08h | GC3 | Gamma Curve 4 |
| GC[7..0]                                  | Parameter   | Curve Selected     |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| 01h                                       | GC0   | Gamma Curve 1      |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| 02h                                       | GC1   | Gamma Curve 2      |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| 04h                                       | GC2   | Gamma Curve 3      |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| 08h                                       | GC3   | Gamma Curve 4      |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| Restriction                               | Values of GC[7..0] not shown in table above are invalid and will not change the Current selected Gamma curve until valid value is received.   |                    |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th><th>Availability</th></tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Sleep In or Booster Off</td><td>Yes</td></tr> </tbody> </table>   |                    |     |       |     |     |     |     |     |     |     |     |     | Status   | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes | Normal Mode On, Idle Mode On, Sleep Out | Yes           | Partial Mode On, Idle Mode Off, Sleep Out | Yes | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes           |     |     |               |
| Status                                    | Availability  |                    |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |                    |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |                    |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |                    |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |                    |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| Sleep In or Booster Off                   | Yes   |                    |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th><th>Default Value</th></tr> </thead> <tbody> <tr> <td>Power On Sequence</td><td>01h</td></tr> <tr> <td>S/W Reset</td><td>01h</td></tr> <tr> <td>H/W Reset</td><td>01h</td></tr> </tbody> </table>  |                    |     |       |     |     |     |     |     |     |     |     |     | Status   | Default Value | Power On Sequence                        | 01h | S/W Reset                               | 01h           | H/W Reset                                 | 01h |  |     |                         |               |     |     |               |
| Status                                    | Default Value   |                    |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| Power On Sequence                         | 01h   |                    |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| S/W Reset                                 | 01h   |                    |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| H/W Reset                                 | 01h   |                    |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |
| Flow Chart                                |  <pre> graph TD     GAMSET[GAMSET] --&gt; GC[GC 7:0]     GC --&gt; NewGamma[New Gamma Curve Loaded]     </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>  |                    |     |       |     |     |     |     |     |     |     |     |     |          |               |  |     |   |               |   |     |  |     |                         |               |     |     |               |

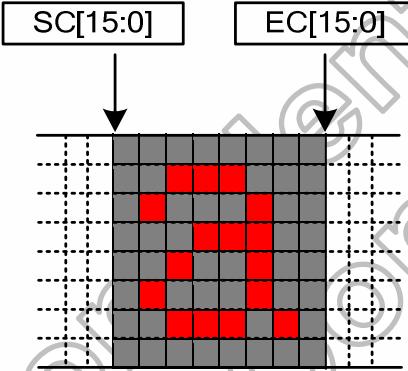
### 8.2.18 Display off (28h)

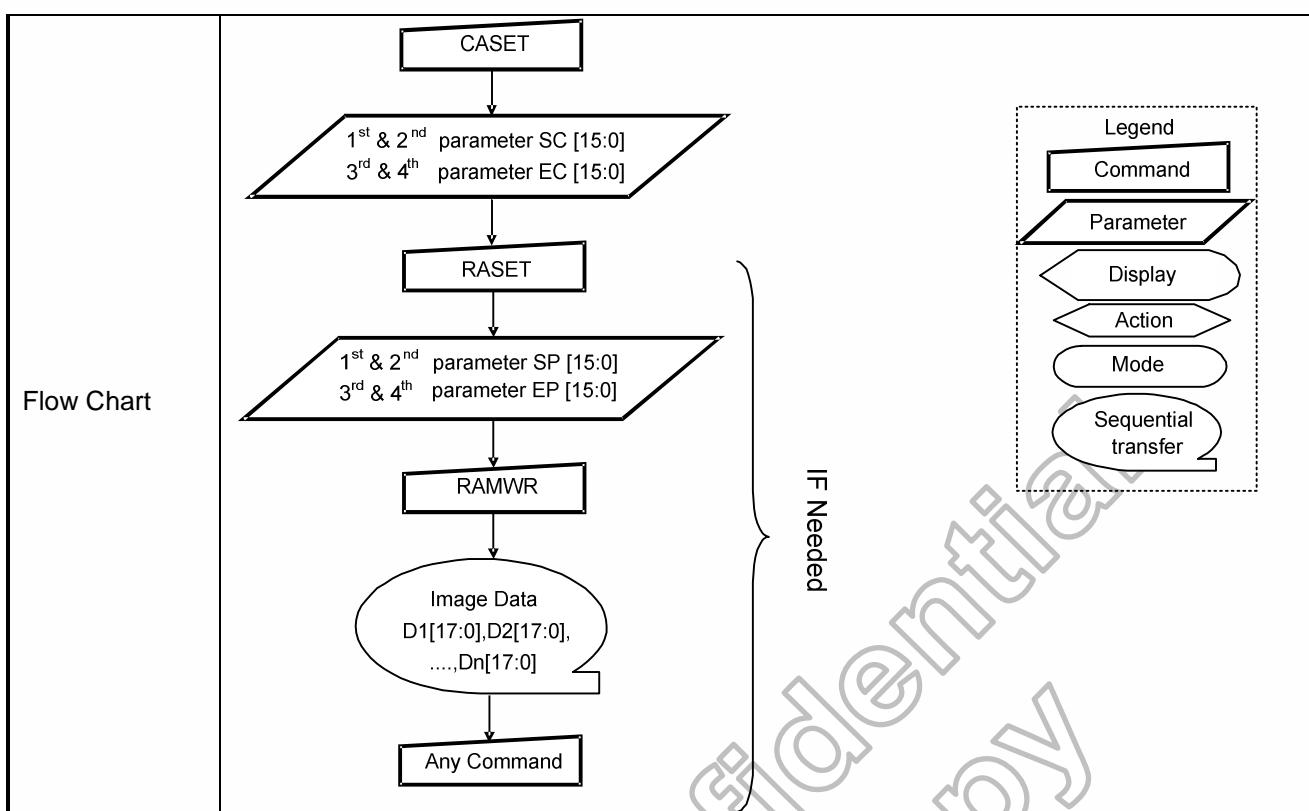
| <b>28 H</b>                               | DISPOFF (Display Off)   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
|---|---|-----|-----|-------|----|----|----|----|----|----|----|----|-----|----|--------|---------------|--|-------------|---|-------------|---|-------------|--|-----|-------------------------|-----|
|   | DNC   | NWR | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| Command                                   | 0   | ↑   | 1   | -     | 0  | 0  | 1  | 0  | 1  | 0  | 0  | 0  | 0   | 28 |        |               |  |             |   |             |   |             |  |     |                         |     |
| Parameter                                 | NO PARAMETER  |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| Description                               | <p>This command is used to enter into DISPLAY OFF mode. In this mode, the output from Frame Memory is disabled and blank page inserted.</p> <p>This command makes no change of contents of frame memory.</p> <p>This command does not change any other status.</p> <p>There will be no abnormal visible effect on the display.</p> <p style="text-align: center;">(Example)</p>   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| Restriction                               | This command has no effect when module is already in display off mode.  |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table> |     |     |       |    |    |    |    |    |    |    |    |     |    | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes         | Normal Mode On, Idle Mode On, Sleep Out | Yes         | Partial Mode On, Idle Mode Off, Sleep Out | Yes         | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Display Off</td> </tr> <tr> <td>S/W Reset</td> <td>Display Off</td> </tr> <tr> <td>H/W Reset</td> <td>Display Off</td> </tr> </tbody> </table>  |     |     |       |    |    |    |    |    |    |    |    |     |    | Status | Default Value | Power On Sequence                        | Display Off | S/W Reset                               | Display Off | H/W Reset                                 | Display Off |  |     |                         |     |
| Status                                    | Default Value   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| Power On Sequence                         | Display Off   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| S/W Reset                                 | Display Off   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| H/W Reset                                 | Display Off   |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |
| Flow Chart                                | <pre> graph TD     A([Display On Mode]) --&gt; B[DISPOFF]     B --&gt; C([Display Off Mode])     </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> </ul>  |     |     |       |    |    |    |    |    |    |    |    |     |    |        |               |  |             |   |             |   |             |  |     |                         |     |

### 8.2.19 Display on (29h)

| <b>29 H</b>                               | DISPON (Display On)   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
|---|---|-----|-----|-------|----|----|----|----|----|----|----|----|-----|--|--------|---------------|--|-------------|---|-------------|---|-------------|--|-----|-------------------------|-----|
|   | DNC   | NWR | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| Command                                   | 0   | ↑   | 1   | -     | 0  | 0  | 1  | 0  | 1  | 0  | 0  | 1  | 29  |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| Parameter                                 | NO PARAMETER  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| Description                               | <p>This command is used to recover from DISPLAY OFF mode. Output from the Frame Memory is enabled.</p> <p>This command makes no change of contents of frame memory.</p> <p>This command does not change any other status.</p> <p style="text-align: center;">(Example)</p> <div style="text-align: center; margin-left: 100px;">  </div>  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| Restriction                               | This command has no effect when module is already in display on mode.   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| Register Availability                     | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Status</th> <th style="text-align: center;">Availability</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Normal Mode On, Idle Mode Off, Sleep Out</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td style="text-align: center;">Normal Mode On, Idle Mode On, Sleep Out</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td style="text-align: center;">Partial Mode On, Idle Mode Off, Sleep Out</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td style="text-align: center;">Partial Mode On, Idle Mode On, Sleep Out</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td style="text-align: center;">Sleep In or Booster Off</td> <td style="text-align: center;">Yes</td> </tr> </tbody> </table> |     |     |       |    |    |    |    |    |    |    |    |     |  | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes         | Normal Mode On, Idle Mode On, Sleep Out | Yes         | Partial Mode On, Idle Mode Off, Sleep Out | Yes         | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| Default                                   | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Status</th> <th style="text-align: center;">Default Value</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Power On Sequence</td> <td style="text-align: center;">Display Off</td> </tr> <tr> <td style="text-align: center;">S/W Reset</td> <td style="text-align: center;">Display Off</td> </tr> <tr> <td style="text-align: center;">H/W Reset</td> <td style="text-align: center;">Display Off</td> </tr> </tbody> </table>  |     |     |       |    |    |    |    |    |    |    |    |     |  | Status | Default Value | Power On Sequence                        | Display Off | S/W Reset                               | Display Off | H/W Reset                                 | Display Off |  |     |                         |     |
| Status                                    | Default Value   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| Power On Sequence                         | Display Off   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| S/W Reset                                 | Display Off   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| H/W Reset                                 | Display Off   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |
| Flow Chart                                |  <div style="border: 1px dashed black; padding: 5px; margin-top: 10px;"> <b>Legend</b> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul> </div>   |     |     |       |    |    |    |    |    |    |    |    |     |  |        |               |  |             |   |             |   |             |  |     |                         |     |

### 8.2.20 Column address set (2Ah)

| 2A H  |  | CASET (Column Address Set) |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
|---|--|----------------------------|-----|-----|-------|------|------|------|------|------|-----|-----|----|------|--------|---------------|--|--|----------------|----------------|---|---------------------------------------|----------------|---|----------------|-----------|--|----------------|--|-------------------------|-----|--|
|   |  | DNC                        | NWR | NRD | D15-8 | D7   | D6   | D5   | D4   | D3   | D2  | D1  | D0 | HEX  |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| Command   | 0  | ↑                          | 1   | -   | 0     | 0    | 1    | 0    | 1    | 0    | 1   | 0   | 0  | 2A   |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| 1st parameter   | 1  | ↑                          | 1   | -   | SC15  | SC14 | SC13 | SC12 | SC11 | SC10 | SC9 | SC8 |    | Note |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| 2nd parameter   | 1  | ↑                          | 1   | -   | SC7   | SC6  | SC5  | SC4  | SC3  | SC2  | SC1 | SC0 |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| 3rd parameter   | 1  | ↑                          | 1   | -   | EC15  | EC14 | EC13 | EC12 | EC11 | EC10 | EC9 | EC8 |    | Note |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| 4th parameter   | 1  | ↑                          | 1   | -   | EC7   | EC6  | EC5  | EC4  | EC3  | EC2  | EC1 | EC0 |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| Description   | This command is used to define area of frame memory where MCU can access.<br>This command makes no change on the other driver status.<br>The values of SC[15:0] and EC[15:0] are referred when RAMWR command comes. Each value represents one column line in the Frame Memory.   |                            |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| (Example)   |  |                            |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
|  |  |                            |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| Restriction   | SC[15:0] always must be equal to or less than EC[15:0]<br><b>Note:</b> When SC[15:0] or EC[15:0] is greater than maximum address like below, data out of range will be ignored<br>0000h<=SC[15:0]<=EC[15:0] <=0083h ,when MADCTL's B5=0<br>0000h<=SC[15:0]<=EC[15:0] <=00A1h ,when MADCTL's B5=1   |                            |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| Register Availability   | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Status</th> <th colspan="2" style="text-align: center;">Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td colspan="2" style="text-align: center;">Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td colspan="2" style="text-align: center;">Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td colspan="2" style="text-align: center;">Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td colspan="2" style="text-align: center;">Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td colspan="2" style="text-align: center;">Yes</td> </tr> </tbody> </table>  |                            |     |     |       |      |      |      |      |      |     |     |    |      | Status | Availability  |  | Normal Mode On, Idle Mode Off, Sleep Out | Yes            |                | Normal Mode On, Idle Mode On, Sleep Out | Yes                                   |                | Partial Mode On, Idle Mode Off, Sleep Out | Yes            |           | Partial Mode On, Idle Mode On, Sleep Out | Yes            |  | Sleep In or Booster Off | Yes |  |
| Status  | Availability   |                            |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes  |                            |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes  |                            |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| Partial Mode On, Idle Mode Off, Sleep Out   | Yes  |                            |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes  |                            |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| Sleep In or Booster Off   | Yes  |                            |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| Default   | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Status</th> <th colspan="2" style="text-align: center;">Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td style="text-align: center;">SC[15:0]=0000h</td> <td style="text-align: center;">EC[15:0]=0083h</td> </tr> <tr> <td rowspan="2" style="text-align: center; vertical-align: middle;">S/W Reset</td> <td style="text-align: center;">When MADCTL's B5=0:<br/>SC[15:0]=0000h</td> <td style="text-align: center;">EC[15:0]=0083h</td> </tr> <tr> <td style="text-align: center;">When MADCTL's B5=1:<br/>SC[15:0]=0000h</td> <td style="text-align: center;">EC[15:0]=00A1h</td> </tr> <tr> <td>H/W Reset</td> <td style="text-align: center;">SC[15:0]=0000h</td> <td style="text-align: center;">EC[15:0]=0083h</td> </tr> </tbody> </table> |                            |     |     |       |      |      |      |      |      |     |     |    |      | Status | Default Value |  | Power On Sequence                        | SC[15:0]=0000h | EC[15:0]=0083h | S/W Reset                               | When MADCTL's B5=0:<br>SC[15:0]=0000h | EC[15:0]=0083h | When MADCTL's B5=1:<br>SC[15:0]=0000h     | EC[15:0]=00A1h | H/W Reset | SC[15:0]=0000h                           | EC[15:0]=0083h |  |                         |     |  |
| Status  | Default Value  |                            |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| Power On Sequence   | SC[15:0]=0000h   | EC[15:0]=0083h             |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| S/W Reset   | When MADCTL's B5=0:<br>SC[15:0]=0000h  | EC[15:0]=0083h             |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
|   | When MADCTL's B5=1:<br>SC[15:0]=0000h  | EC[15:0]=00A1h             |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |
| H/W Reset   | SC[15:0]=0000h   | EC[15:0]=0083h             |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |  |                |                |   |                                       |                |   |                |           |  |                |  |                         |     |  |



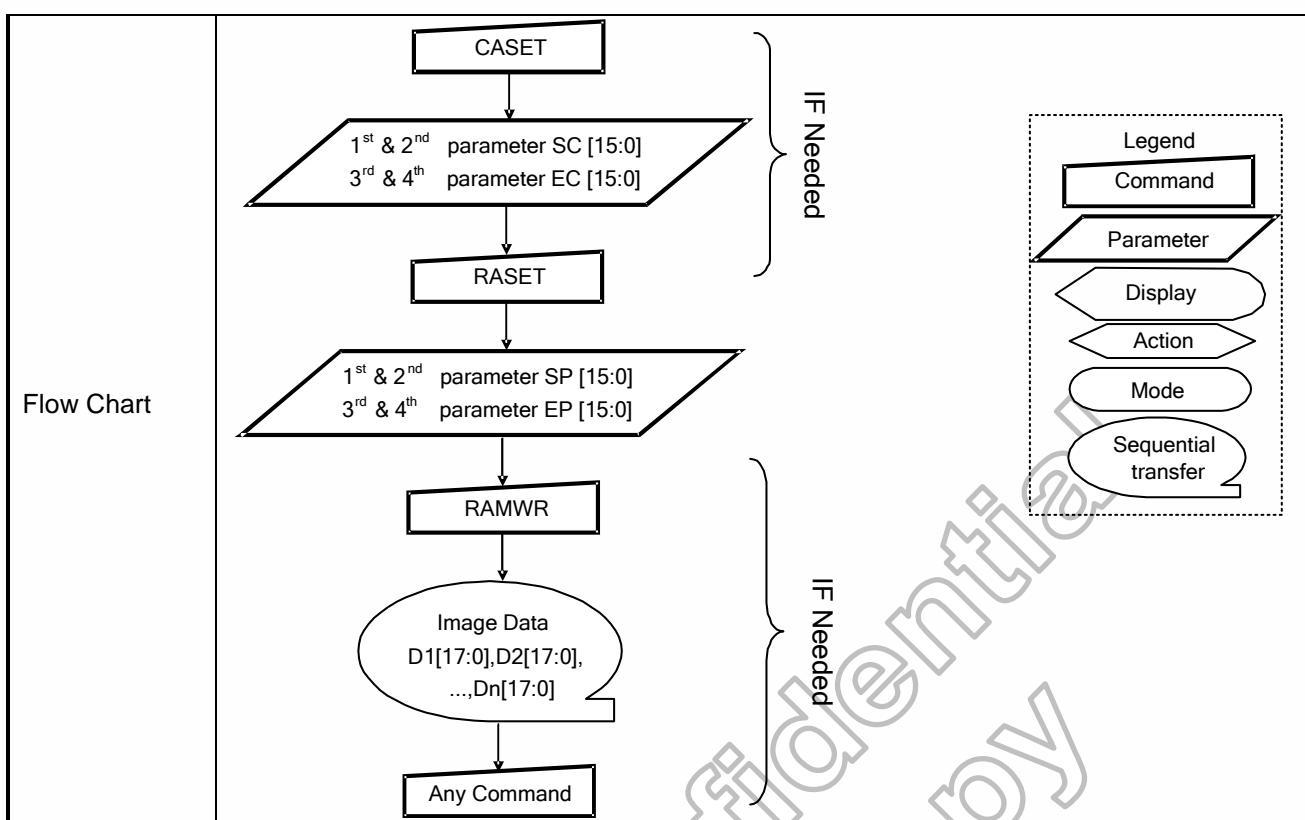
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-P.136-  
April, 2012

### 8.2.21 Page address set (2Bh)

| 2B H                                      |   | PASET (Page Address Set) |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
|---|---|--------------------------|-----|-----|-------|------|------|------|------|------|-----|-----|----|------|--------|---------------|--|-------------------|---|----------------|---|----------------|--|----------------|-------------------------|----------------|----------------|-----------|----------------|----------------|
|   |   | DNC                      | NWR | NRD | D15-8 | D7   | D6   | D5   | D4   | D3   | D2  | D1  | D0 | HEX  |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| Command                                   | 0   | ↑                        | 1   | -   | 0     | 0    | 1    | 0    | 1    | 0    | 1   | 1   | 1  | 2B   |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| 1st parameter                             | 1   | ↑                        | 1   | -   | SP15  | SP14 | SP13 | SP12 | SP11 | SP10 | SP9 | SP8 |    | Note |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| 2nd parameter                             | 1   | ↑                        | 1   | -   | SP7   | SP6  | SP5  | SP4  | SP3  | SP2  | SP1 | SP0 |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| 3rd parameter                             | 1   | ↑                        | 1   | -   | EP15  | EP14 | EP13 | EP12 | EP11 | EP10 | EP9 | EP8 |    | Note |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| 4th parameter                             | 1   | ↑                        | 1   | -   | EP7   | EP6  | EP5  | EP4  | EP3  | EP2  | EP1 | EP0 |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| Description                               | This command is used to define area of frame memory where MCU can access.<br>This command makes no change on the other driver status.<br>The values of SP[15:0] and EP[15:0] are referred when RAMWR command comes.<br>Each value represents one Page line in the Frame Memory.<br>(Example)  |                          |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| Restriction                               | SP[15:0] always must be equal to or less than EP[15:0]<br><b>Note:</b> When SP[15:0] or EP[15:0] is greater than maximum row address like below, data of out of range will be ignored<br>0000h<=SP[15:0]<=EP[15:0]<=00A1h (When MADCTL's B5=0)<br>0000h<=SP[15:0]<=EP[15:0]<=0083h (When MADCTL's B5=1)   |                          |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table>                                 |                          |     |     |       |      |      |      |      |      |     |     |    |      | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes               | Normal Mode On, Idle Mode On, Sleep Out | Yes            | Partial Mode On, Idle Mode Off, Sleep Out | Yes            | Partial Mode On, Idle Mode On, Sleep Out | Yes            | Sleep In or Booster Off | Yes            |                |           |                |                |
| Status                                    | Availability  |                          |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |                          |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |                          |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |                          |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |                          |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| Sleep In or Booster Off                   | Yes   |                          |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th colspan="2">Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>SP[15:0]=0000h</td> <td>EP[15:0]=00A1h</td> </tr> <tr> <td rowspan="3">S/W Reset</td> <td>SP[15:0]=0000h</td> <td>EP[15:0]=00A1h</td> </tr> <tr> <td>SP[15:0]=0000h</td> <td>EP[15:0]=0083h</td> </tr> <tr> <td>SP[15:0]=0000h</td> <td>EP[15:0]=00A1h</td> </tr> <tr> <td>H/W Reset</td> <td>SP[15:0]=0000h</td> <td>EP[15:0]=00A1h</td> </tr> </tbody> </table> |                          |     |     |       |      |      |      |      |      |     |     |    |      | Status | Default Value |  | Power On Sequence | SP[15:0]=0000h                          | EP[15:0]=00A1h | S/W Reset                                 | SP[15:0]=0000h | EP[15:0]=00A1h                           | SP[15:0]=0000h | EP[15:0]=0083h          | SP[15:0]=0000h | EP[15:0]=00A1h | H/W Reset | SP[15:0]=0000h | EP[15:0]=00A1h |
| Status                                    | Default Value   |                          |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| Power On Sequence                         | SP[15:0]=0000h  | EP[15:0]=00A1h           |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| S/W Reset                                 | SP[15:0]=0000h  | EP[15:0]=00A1h           |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
|   | SP[15:0]=0000h  | EP[15:0]=0083h           |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
|   | SP[15:0]=0000h  | EP[15:0]=00A1h           |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |
| H/W Reset                                 | SP[15:0]=0000h  | EP[15:0]=00A1h           |     |     |       |      |      |      |      |      |     |     |    |      |        |               |  |                   |   |                |   |                |  |                |                         |                |                |           |                |                |



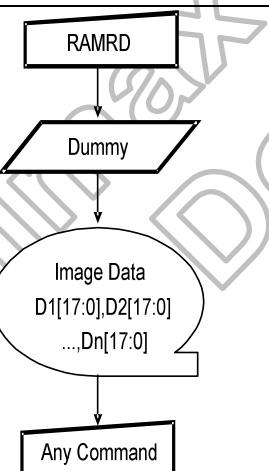
### 8.2.22 Memory write (2Ch)

| 2C H                                      |   | RAMWR (Memory Write) |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
|---|---|----------------------|-----|-----|-------|----|----|----|----|----------|----|----|----|--------|---------------|--|------------------------------------|---|-----------------------------------|---|-----------------------------------|--|-----|-------------------------|-----|
|   |   | DNC                  | NWR | NRD | D15-8 | D7 | D6 | D5 | D4 | D3       | D2 | D1 | D0 | HEX    |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Command                                   |   | 0                    | ↑   | 1   | -     | 0  | 0  | 1  | 0  | 1        | 1  | 0  | 0  | 2C     |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| 1st parameter                             |   | 1                    | ↑   | 1   |       |    |    |    |    | D1[15:0] |    |    |    | 00..FF |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| :   |   | 1                    | ↑   | 1   |       |    |    |    |    | Dx[15:0] |    |    |    | 00..FF |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| nth parameter                             |   | 1                    | ↑   | 1   |       |    |    |    |    | Dn[15:0] |    |    |    | 00..FF |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Description                               | This command is used to transfer data from MCU to frame memory.<br>This command makes no change to the other driver status.<br>When this command is accepted, the column register and the page register are reset to the Start Column/Start Page positions.<br>The Start Column/Start Page positions are different in accordance with MADCTL setting.<br>(See 6.2)<br>Then D[7:0] is stored in frame memory and the column register and the page register incremented.<br>Sending any other command can stop frame Write. |                      |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Restriction                               | In all color modes, there is no restriction on length of parameters.  |                      |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table>   |                      |     |     |       |    |    |    |    |          |    |    |    | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes                                | Normal Mode On, Idle Mode On, Sleep Out | Yes                               | Partial Mode On, Idle Mode Off, Sleep Out | Yes                               | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |                      |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |                      |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |                      |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |                      |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |                      |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |                      |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Contents of memory is set randomly</td> </tr> <tr> <td>S/W Reset</td> <td>Contents of memory is not cleared</td> </tr> <tr> <td>H/W Reset</td> <td>Contents of memory is not cleared</td> </tr> </tbody> </table>   |                      |     |     |       |    |    |    |    |          |    |    |    | Status | Default Value | Power On Sequence                        | Contents of memory is set randomly | S/W Reset                               | Contents of memory is not cleared | H/W Reset                                 | Contents of memory is not cleared |  |     |                         |     |
| Status                                    | Default Value   |                      |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Power On Sequence                         | Contents of memory is set randomly  |                      |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| S/W Reset                                 | Contents of memory is not cleared   |                      |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| H/W Reset                                 | Contents of memory is not cleared   |                      |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Flow Chart                                | <pre> graph TD     RAMWR[RAMWR] --&gt; ImageData((Image Data<br/>D1[17:0], D2[17:0],<br/>..., Dn[17:0]))     ImageData --&gt; AnyCommand[Any Command]     style ImageData fill:none,stroke:none     style AnyCommand fill:none,stroke:none     subgraph Legend [Legend]         Parameter[Parameter]         Display[Display]         SequentialTransfer[Sequential transfer]     end   </pre>  |                      |     |     |       |    |    |    |    |          |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |

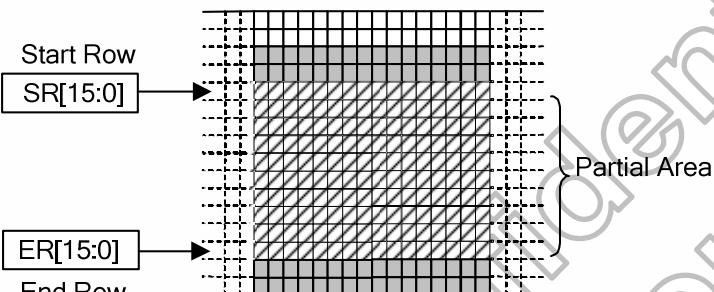
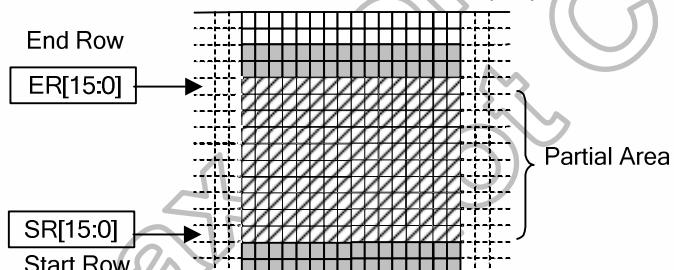
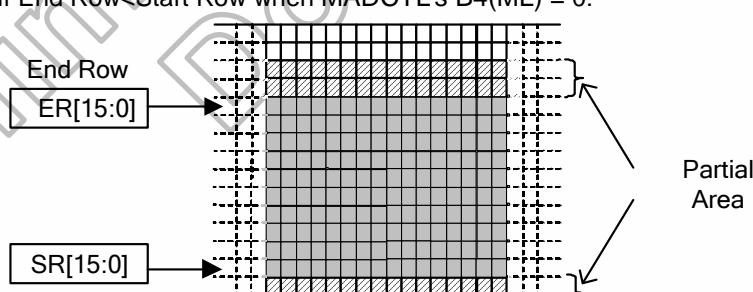
### 8.2.23 Color set (2Dh)

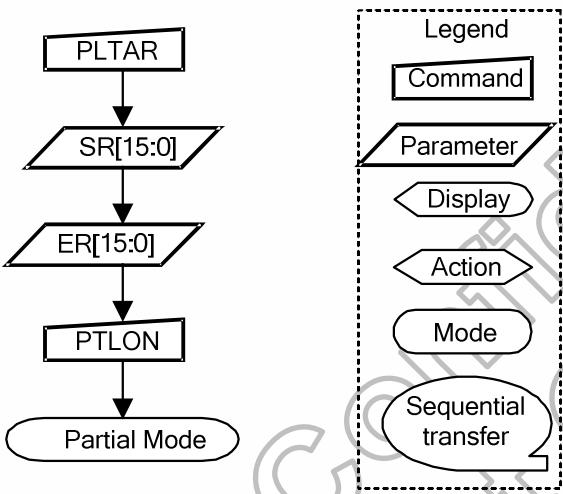
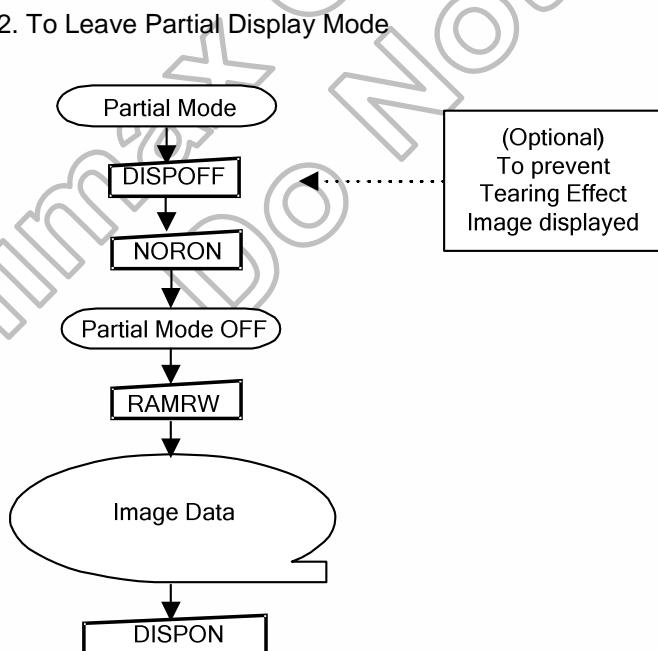
| 2D H                                      |   | RGBSET (Color Set) |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |
|---|---|--------------------|-----|-----|-----|-----|------|------|------|------|------|------|--------|--------|---------------|--|---------------|---|---|---|---------------|--|-----|-------------------------|-----|
|   |   | DNC                | NRD | NWR | DB7 | DB6 | DB5  | DB4  | DB3  | DB2  | DB1  | DB0  | HEX    |        |               |  |               |   |   |   |               |  |     |                         |     |
| Command                                   |   | 0                  | 1   | ↑   | 0   | 0   | 1    | 0    | 1    | 1    | 0    | 1    | 2D     |        |               |  |               |   |   |   |               |  |     |                         |     |
| 1st parameter                             |   | 1                  | 1   | ↑   | X   | X   | R005 | R004 | R003 | R002 | R001 | R000 | 00..FF |        |               |  |               |   |   |   |               |  |     |                         |     |
| :   |   | 1                  | 1   | ↑   | X   | X   | Rnn5 | Rnn4 | Rnn3 | Rnn2 | Rnn1 | Rnn0 | 00..FF |        |               |  |               |   |   |   |               |  |     |                         |     |
| 32 <sup>th</sup> parameter                |   | 1                  | 1   | ↑   | X   | X   | R315 | R314 | R313 | R312 | R311 | R310 | 00..FF |        |               |  |               |   |   |   |               |  |     |                         |     |
| 33rd parameter                            |   | 1                  | 1   | ↑   | X   | X   | G005 | G004 | G003 | G002 | G001 | G000 | 00..FF |        |               |  |               |   |   |   |               |  |     |                         |     |
| :   |   | 1                  | 1   | ↑   | X   | X   | Gnn5 | Gnn4 | Gnn3 | Gnn2 | Gnn1 | Gnn0 | 00..FF |        |               |  |               |   |   |   |               |  |     |                         |     |
| 96 <sup>th</sup> parameter                |   | 1                  | 1   | ↑   | X   | X   | G635 | G634 | G633 | G632 | G631 | G630 | 00..FF |        |               |  |               |   |   |   |               |  |     |                         |     |
| 97 <sup>th</sup> parameter                |   | 1                  | 1   | ↑   | X   | X   | B005 | B004 | B003 | B002 | B001 | B000 | 00..FF |        |               |  |               |   |   |   |               |  |     |                         |     |
| :   |   | 1                  | 1   | ↑   | X   | X   | Bnn5 | Bnn4 | Bnn3 | Bnn2 | Bnn1 | Bnn0 | 00..FF |        |               |  |               |   |   |   |               |  |     |                         |     |
| 128th parameter                           |   | 1                  | 1   | ↑   | X   | X   | B315 | B314 | B313 | B312 | B311 | B310 | 00..FF |        |               |  |               |   |   |   |               |  |     |                         |     |
| Description                               | This command is used to define the LUT for 12bit-to-18bit/16bit-to-18bit color depth conversions. (See also section 5.2) 128 bytes must be written to the LUT regardless of the color mode. This command has no effect on other commands/parameters and Contents of frame memory. Visible change takes effect next time the Frame Memory is written to.   |                    |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |
| Restriction                               | -   |                    |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Sleep In or Booster Off</td><td>Yes</td></tr> </tbody> </table>     |                    |     |     |     |     |      |      |      |      |      |      |        | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes           | Normal Mode On, Idle Mode On, Sleep Out | Yes                                     | Partial Mode On, Idle Mode Off, Sleep Out | Yes           | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |                    |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |                    |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |                    |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |                    |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |                    |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |                    |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td><td>Random values</td></tr> <tr> <td>S/W Reset</td><td>Contents of the look-up table protected</td></tr> <tr> <td>H/W Reset</td><td>Random values</td></tr> </tbody> </table>  |                    |     |     |     |     |      |      |      |      |      |      |        | Status | Default Value | Power On Sequence                        | Random values | S/W Reset                               | Contents of the look-up table protected | H/W Reset                                 | Random values |  |     |                         |     |
| Status                                    | Default Value   |                    |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |
| Power On Sequence                         | Random values   |                    |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |
| S/W Reset                                 | Contents of the look-up table protected   |                    |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |
| H/W Reset                                 | Random values   |                    |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |
| Flow Chart                                | <pre> graph TD     RGBSET[RGBSET] --&gt; P1[1st parameter R00[7:0]]     P1 --&gt; P2[32th parameter R31[7:0]]     P2 --&gt; P3[33th parameter G00[7:0]]     P3 --&gt; P4[96th parameter G63[7:0]]     P4 --&gt; P5[97th parameter B00[7:0]]     P5 --&gt; P6[128th parameter B31[7:0]]     </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul> |                    |     |     |     |     |      |      |      |      |      |      |        |        |               |  |               |   |   |   |               |  |     |                         |     |

### 8.2.24 Memory read (2Eh)

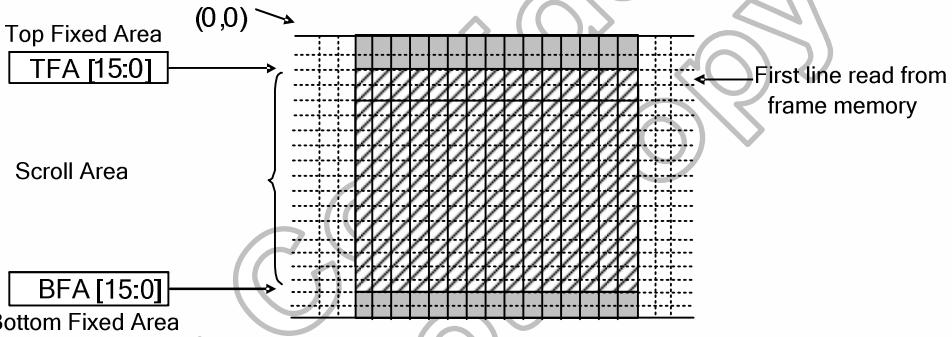
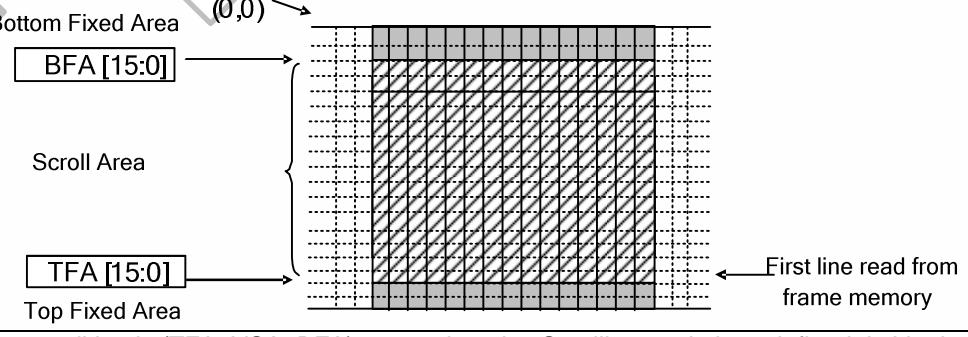
| 2E H                                      |  | RAMRD (Memory Read) |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
|---|--|---------------------|-----|-----|-------|----|----|----|----|----|----|----|----|--------|---------------|--|------------------------------------|---|-----------------------------------|---|-----------------------------------|--|-----|-------------------------|-----|
|   |  | DNC                 | NWR | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX    |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Command                                   |  | 0                   | ↑   | 1   | -     | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 0  | 2E     |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| 1st parameter                             |  | 1                   | ↑   | 1   | -     | -  | -  | -  | -  | -  | -  | -  | -  | -      |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| 2nd parameter                             |  | 1                   | ↑   | 1   |       |    |    |    |    |    |    |    |    | 00..FF |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| :   |  | 1                   | ↑   | 1   |       |    |    |    |    |    |    |    |    | 00..FF |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| (n+1)th parameter                         |  | 1                   | ↑   | 1   |       |    |    |    |    |    |    |    |    | 00..FF |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Description                               | This command is used to transfer data from frame memory to MCU. This command makes no change to the other driver status.<br>When this command is accepted, the column register and the page register are reset to the Start Column/Start Page positions.<br>The Start Column/Start Page positions are different in accordance with MADCTL setting.<br>(See 6.2)<br>Then D[7:0] is read back from the frame memory and the column register and the page register incremented<br>Frame Read can be stopped by sending any other command. |                     |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Restriction                               | -  |                     |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table>  |                     |     |     |       |    |    |    |    |    |    |    |    | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes                                | Normal Mode On, Idle Mode On, Sleep Out | Yes                               | Partial Mode On, Idle Mode Off, Sleep Out | Yes                               | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability   |                     |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes  |                     |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes  |                     |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes  |                     |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes  |                     |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Sleep In or Booster Off                   | Yes  |                     |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Contents of memory is set randomly</td> </tr> <tr> <td>S/W Reset</td> <td>Contents of memory is not cleared</td> </tr> <tr> <td>H/W Reset</td> <td>Contents of memory is not cleared</td> </tr> </tbody> </table>  |                     |     |     |       |    |    |    |    |    |    |    |    | Status | Default Value | Power On Sequence                        | Contents of memory is set randomly | S/W Reset                               | Contents of memory is not cleared | H/W Reset                                 | Contents of memory is not cleared |  |     |                         |     |
| Status                                    | Default Value  |                     |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Power On Sequence                         | Contents of memory is set randomly   |                     |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| S/W Reset                                 | Contents of memory is not cleared  |                     |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| H/W Reset                                 | Contents of memory is not cleared  |                     |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |
| Flow Chart                                |  <div style="border: 1px dashed black; padding: 5px; margin-top: 10px;"> <b>Legend</b> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul> </div>  |                     |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                                    |   |                                   |   |                                   |  |     |                         |     |

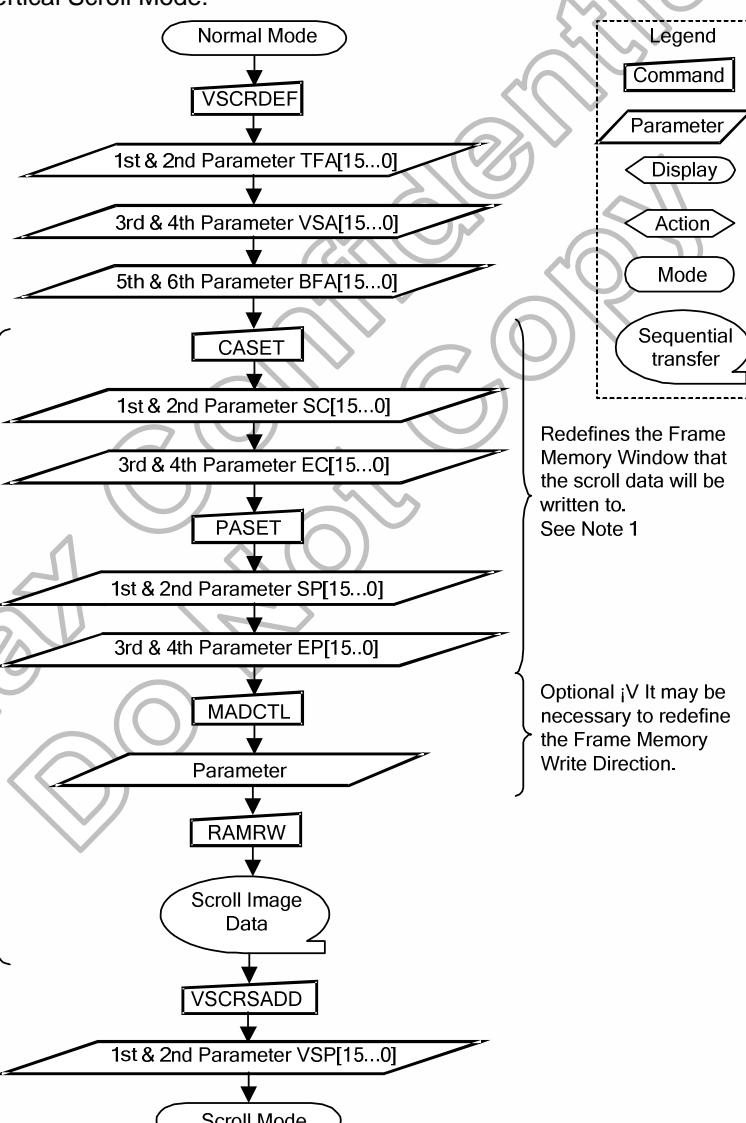
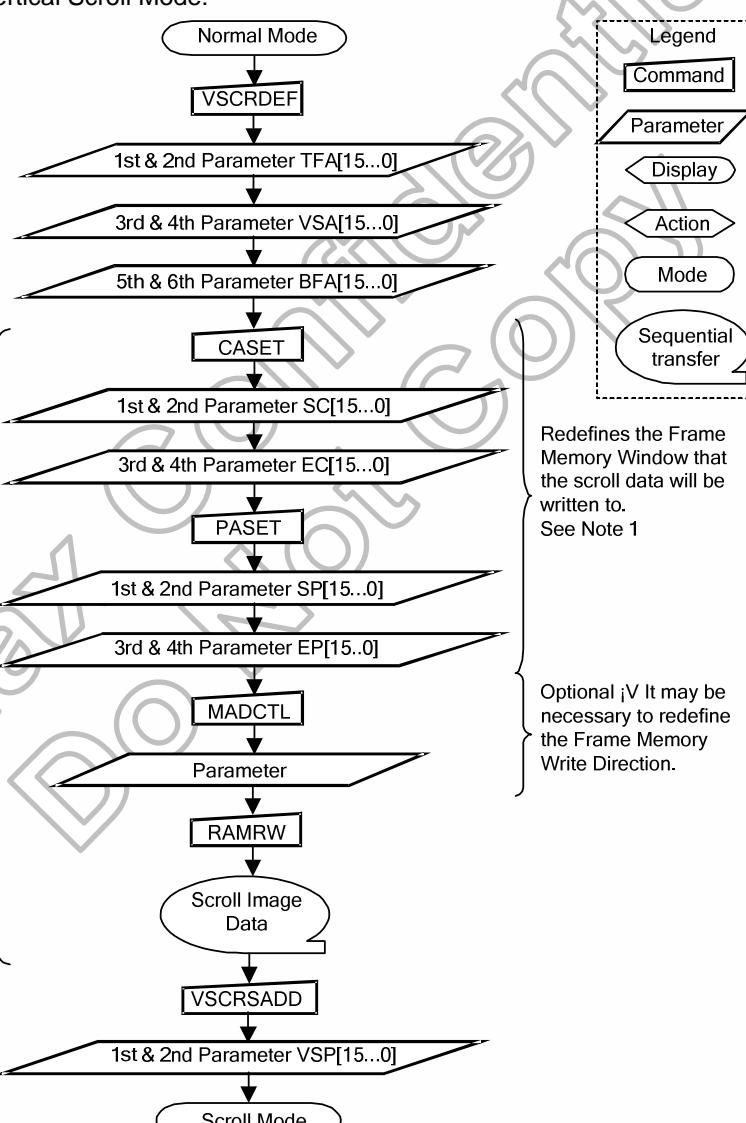
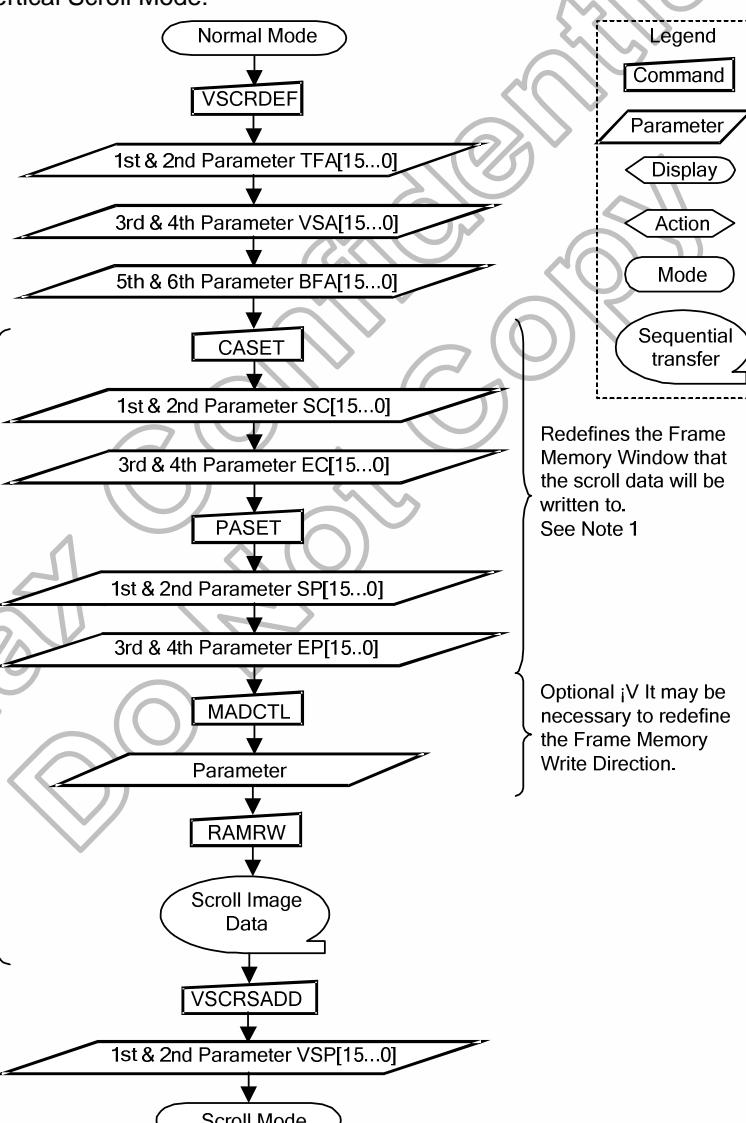
### 8.2.25 Partial area (30h)

| 30 H          |   | PLTAR (Partial Area) |     |     |       |      |      |      |      |      |     |     |       |     |
|---------------|---|----------------------|-----|-----|-------|------|------|------|------|------|-----|-----|-------|-----|
|               |   | DNC                  | NWR | NRD | D15-8 | D7   | D6   | D5   | D4   | D3   | D2  | D1  | D0    | HEX |
| Command       |   | 0                    | ↑   | 1   | -     | 0    | 0    | 1    | 1    | 0    | 0   | 0   | 0     | 30  |
| 1st parameter | 1   | ↑                    | 1   | -   | SR15  | SR14 | SR13 | SR12 | SR11 | SR10 | SR9 | SR8 | 0000: |     |
| 2nd parameter | 1   | ↑                    | 1   | -   | SR7   | SR6  | SR5  | SR4  | SR3  | SR2  | SR1 | SR0 | 013F  |     |
| 3rd parameter | 1   | ↑                    | 1   | -   | ER15  | ER14 | ER13 | ER12 | ER11 | ER10 | ER9 | ER8 | 0000: |     |
| 4th parameter | 1   | ↑                    | 1   | -   | ER7   | ER6  | ER5  | ER4  | ER3  | ER2  | ER1 | ER0 | 013F  |     |
| Description   | <p>This command defines the partial mode's display area. There are 4 parameters associated with this command, the first defines the Start Row (SR) and the second the End Row (ER), as illustrated in the figures below. SR and ER refer to the Frame Memory Line Pointer.</p> <p>If End Row &gt; Start Row when MADCTL B4(ML) = 0:</p>  <p>If End Row &gt; Start Row when MADCTL B4(ML) = 1:</p>  <p>If End Row &lt; Start Row when MADCTL's B4(ML) = 0:</p>  <p>If End Row = Start Row then the Partial Area will be one row deep.</p> |                      |     |     |       |      |      |      |      |      |     |     |       |     |
| Restriction   | SR[15:0] and ER[15:0] cannot be exceeding than 00A1h.   |                      |     |     |       |      |      |      |      |      |     |     |       |     |

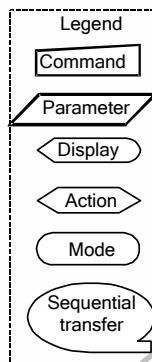
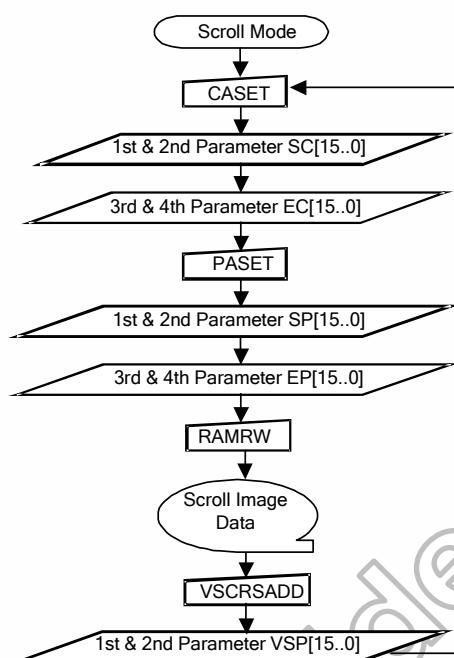
|                       |   |                |                |
|-----------------------|---|----------------|----------------|
| Register Availability | Status  | Availability   |                |
|                       | Normal Mode On, Idle Mode Off, Sleep Out  | Yes            |                |
|                       | Normal Mode On, Idle Mode On, Sleep Out   | Yes            |                |
|                       | Partial Mode On, Idle Mode Off, Sleep Out   | Yes            |                |
|                       | Partial Mode On, Idle Mode On, Sleep Out  | Yes            |                |
|                       | Sleep In or Booster Off   | Yes            |                |
| Default               | Status  | Default Value  |                |
|                       | Power On Sequence   | SR[15:0]=0000h | ER[15:0]=00A1h |
|                       | S/W Reset   | SR[15:0]=0000h | ER[15:0]=00A1h |
|                       | H/W Reset   | SR[15:0]=0000h | ER[15:0]=00A1h |
| Flow Chart            | <p>1. To Enter Partial Display Mode:</p>  <pre> graph TD     PLTAR[PLTAR] --&gt; SR15_0[/SR[15:0]/]     SR15_0 --&gt; ER15_0[/ER[15:0]/]     ER15_0 --&gt; PTLON[PTLON]     PTLON --&gt; PartialMode([Partial Mode])     </pre> <p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul> <p>2. To Leave Partial Display Mode</p>  <pre> graph TD     PartialMode([Partial Mode]) --&gt; DISPOFF[DISPOFF]     DISPOFF --&gt; NORON[NORON]     NORON --&gt; PartialModeOFF([Partial Mode OFF])     PartialModeOFF --&gt; RAMRW[RAMRW]     RAMRW --&gt; ImageData([Image Data])     ImageData --&gt; DISPON[DISPON]     </pre> <p>(Optional)<br/>To prevent<br/>Tearing Effect<br/>Image displayed</p> |                |                |

### 8.2.26 Vertical scrolling definition (33h)

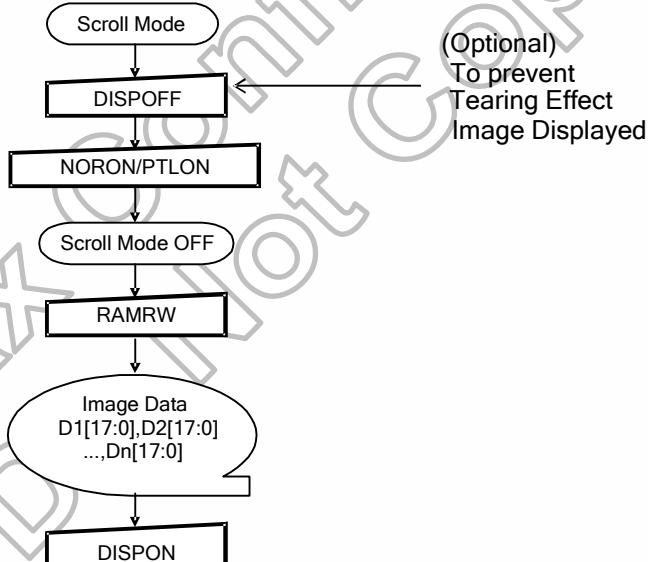
| 33 H                      |  | VSCRDEF (Vertical Scrolling Definition) |     |       |        |        |        |        |        |        |       |       |       |  |
|---------------------------|--|---|-----|-------|--------|--------|--------|--------|--------|--------|-------|-------|-------|--|
|                           | DNC  | NWR                                     | NRD | D15-8 | D7     | D6     | D5     | D4     | D3     | D2     | D1    | D0    | HEX   |  |
| Command                   | 0  | ↑                                       | 1   | -     | 0      | 0      | 1      | 1      | 0      | 0      | 1     | 1     | 33    |  |
| 1st parameter             | 1  | ↑                                       | 1   | -     | TFA 15 | TFA 14 | TFA 13 | TFA 12 | TFA 11 | TFA 10 | TFA 9 | TFA 8 | 0000: |  |
| 2nd parameter             | 1  | ↑                                       | 1   | -     | TFA 7  | TFA 6  | TFA 5  | TFA 4  | TFA 3  | TFA 2  | TFA 1 | TFA 0 | 00A2  |  |
| 3rd parameter             | 1  | ↑                                       | 1   | -     | VSA 15 | VSA 14 | VSA 13 | VSA 12 | VSA 11 | VSA 10 | VSA 9 | VSA 8 | 0000: |  |
| 4th parameter             | 1  | ↑                                       | 1   | -     | VSA 7  | VSA 6  | VSA 5  | VSA 4  | VSA 3  | VSA 2  | VSA 1 | VSA 0 | 00A2  |  |
| 5 <sup>th</sup> parameter | 1  | ↑                                       | 1   | -     | BFA 15 | BFA 14 | BFA 13 | BFA 12 | BFA 11 | BFA 10 | BFA 9 | BFA 8 | 0000: |  |
| 6 <sup>th</sup> parameter | 1  | ↑                                       | 1   | -     | BFA 7  | BFA 6  | BFA 5  | BFA 4  | BFA 3  | BFA 2  | BFA 1 | BFA 0 | 00A2  |  |
| Description               | <p>This command defines the Vertical Scrolling Area of the display. When MADCTL B4=0, the 1<sup>st</sup> &amp; 2<sup>nd</sup> parameter TFA[15:0] describes the Top Fixed Area (in No. of lines from top of the Frame Memory and Display). The 3<sup>rd</sup> &amp; 4<sup>th</sup> parameter VSA[15:0] describes the height of the Vertical Scrolling Area (in No. of lines of the Frame Memory [not the display] from the Vertical Scrolling Start Address). The first line read from Frame Memory appears immediately after the bottom most line of the Top Fixed Area. The 5<sup>th</sup> &amp; 6<sup>th</sup> parameter BFA[15:0] describes the Bottom Fixed Area (in No. of lines from Bottom of the Frame Memory and Display). TFA, VSA and BFA refer to the Frame Memory Line Pointer.</p>  <p>The diagram illustrates the frame memory grid. The origin (0,0) is at the top-left. A bracket labeled 'Top Fixed Area' covers the top portion of the grid. An arrow labeled 'TFA [15:0]' points to this area. Below it is a large central area labeled 'Scroll Area'. At the bottom, another bracket labeled 'Bottom Fixed Area' covers the bottom portion of the grid. An arrow labeled 'BFA [15:0]' points to this area. A horizontal arrow labeled 'First line read from frame memory' points to the start of the scroll area.</p> <p>When MADCTL B4=1</p> <p>The 1<sup>st</sup> &amp; 2<sup>nd</sup> parameter TFA[15:0] describes the Top Fixed Area (in No. of lines from bottom of the Frame Memory and Display). The 3<sup>rd</sup> &amp; 4<sup>th</sup> parameter VSA[15:0] describes the height of the Vertical Scrolling Area (in No. of lines of the Frame Memory [not the display] from the Vertical Scrolling Start Address). The first line read from Frame Memory appears immediately after the top most line of the Top Fixed Area. The 5<sup>th</sup> &amp; 6<sup>th</sup> parameter BFA[15:0] describes the Bottom Fixed Area (in No. of lines from Top of the Frame Memory and Display).</p>  <p>The diagram illustrates the frame memory grid. The origin (0,0) is at the top-left. A bracket labeled 'Bottom Fixed Area' covers the bottom portion of the grid. An arrow labeled 'BFA [15:0]' points to this area. Below it is a large central area labeled 'Scroll Area'. At the top, another bracket labeled 'Top Fixed Area' covers the top portion of the grid. An arrow labeled 'TFA [15:0]' points to this area. A horizontal arrow labeled 'First line read from frame memory' points to the start of the scroll area.</p> |   |     |       |        |        |        |        |        |        |       |       |       |  |
| Restriction               | The condition is (TFA+VSA+BFA)=162, otherwise Scrolling mode is undefined. In Vertical Scroll Mode, MADCTL B5 should be set to '0' – this only affects the Frame Memory Write.   |   |     |       |        |        |        |        |        |        |       |       |       |  |

| Register Availability   | <table border="1"> <thead> <tr> <th>Status</th><th>Availability</th></tr> </thead> <tbody> <tr><td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr><td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr><td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr><td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr><td>Sleep In or Booster Off</td><td>Yes</td></tr> </tbody> </table> |        | Status        | Availability      | Normal Mode On, Idle Mode Off, Sleep Out | Yes       | Normal Mode On, Idle Mode On, Sleep Out | Yes       | Partial Mode On, Idle Mode Off, Sleep Out | Yes | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
|---|--|--------|---------------|-------------------|--|-----------|---|-----------|---|-----|--|-----|-------------------------|-----|
| Status  | Availability   |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes  |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes  |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out   | Yes  |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes  |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Sleep In or Booster Off   | Yes  |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| <table border="1"> <thead> <tr> <th>Status</th><th>Default Value</th></tr> </thead> <tbody> <tr><td>Power On Sequence</td><td>TFA[15:0]=0000</td></tr> <tr><td>S/W Reset</td><td>TFA[15:0]=0000</td></tr> <tr><td>H/W Reset</td><td>TFA[15:0]=0000</td></tr> <tr><td></td><td>VSA[15:0]=00A2h</td></tr> <tr><td></td><td>BFA[15:0]=0000</td></tr> </tbody> </table> |  | Status | Default Value | Power On Sequence | TFA[15:0]=0000                           | S/W Reset | TFA[15:0]=0000                          | H/W Reset | TFA[15:0]=0000                            |     | VSA[15:0]=00A2h                          |     | BFA[15:0]=0000          |     |
| Status  | Default Value  |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Power On Sequence   | TFA[15:0]=0000   |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| S/W Reset   | TFA[15:0]=0000   |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| H/W Reset   | TFA[15:0]=0000   |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
|   | VSA[15:0]=00A2h  |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
|   | BFA[15:0]=0000   |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| <p>1. To enter Vertical Scroll Mode:</p>  <p>Only required for nonrolling scrolling</p>  |  |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| <p>1. To enter Vertical Scroll Mode:</p>  <p>Only required for nonrolling scrolling</p>  |  |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| <p>1. To enter Vertical Scroll Mode:</p>  <p>Only required for nonrolling scrolling</p>  |  |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| <p><b>Note:</b> The Frame Memory Window size must be defined correctly otherwise undesirable image will be displayed.</p>   |  |        |               |                   |  |           |   |           |   |     |  |     |                         |     |

## 2. Continuous Scroll:



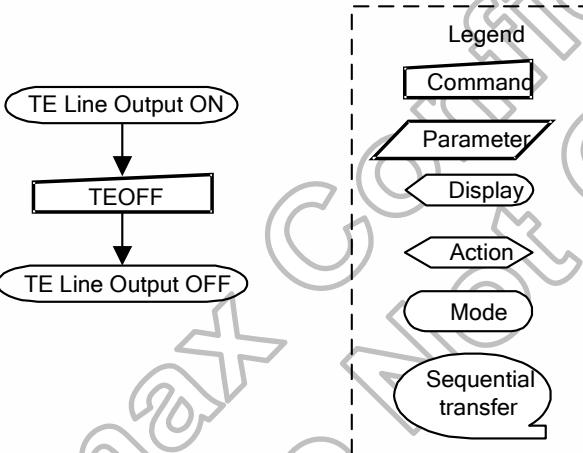
## 3. To Leave Vertical Scroll Mode:



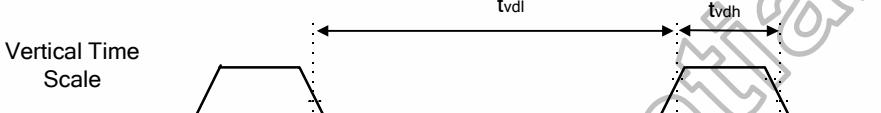
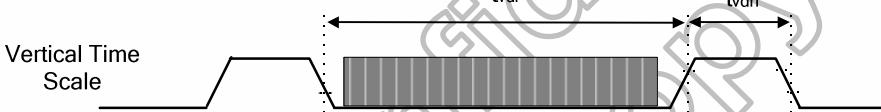
(Optional)  
To prevent  
Tearing Effect  
Image Displayed

**Note:** Scroll Mode can be left by both the Normal Display Mode On (13h) and Partial Mode On (12h) commands.

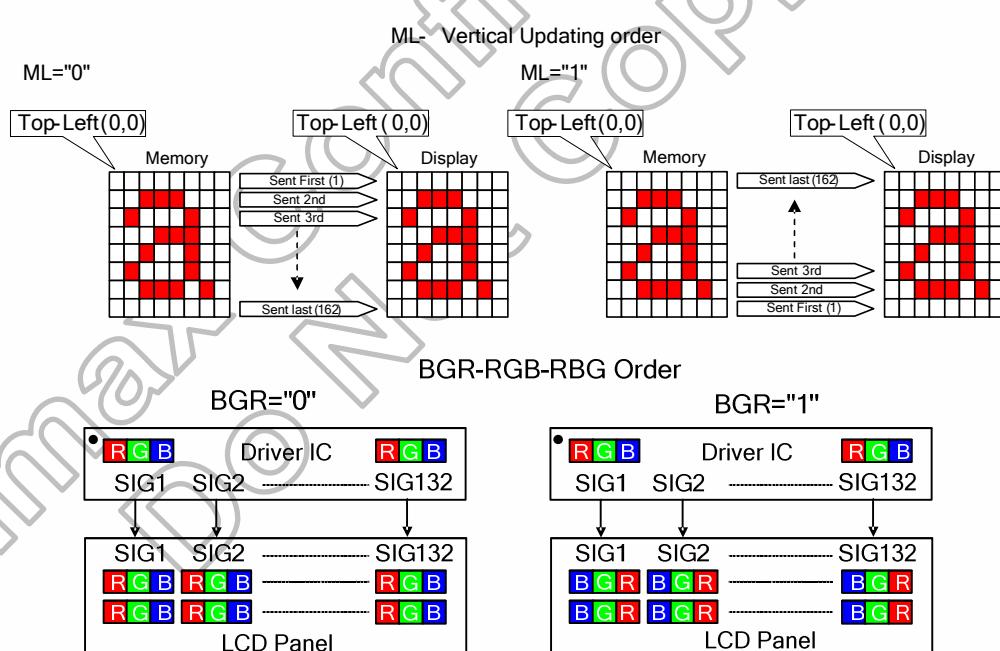
### 8.2.27 Tearing effect line off (34h)

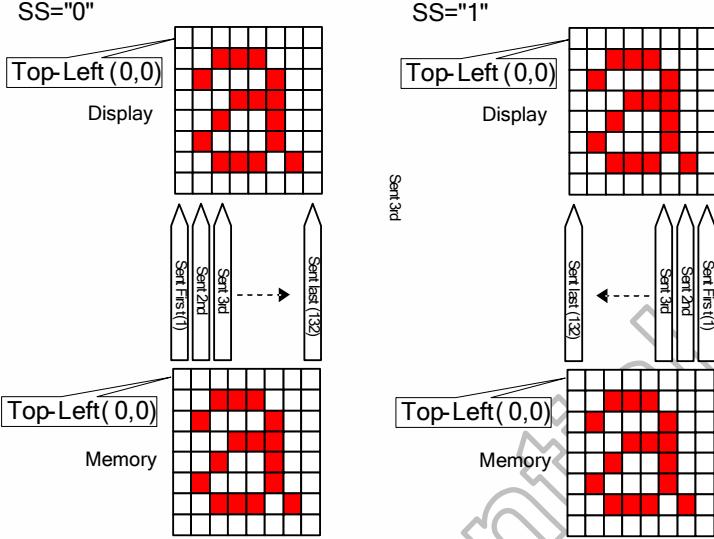
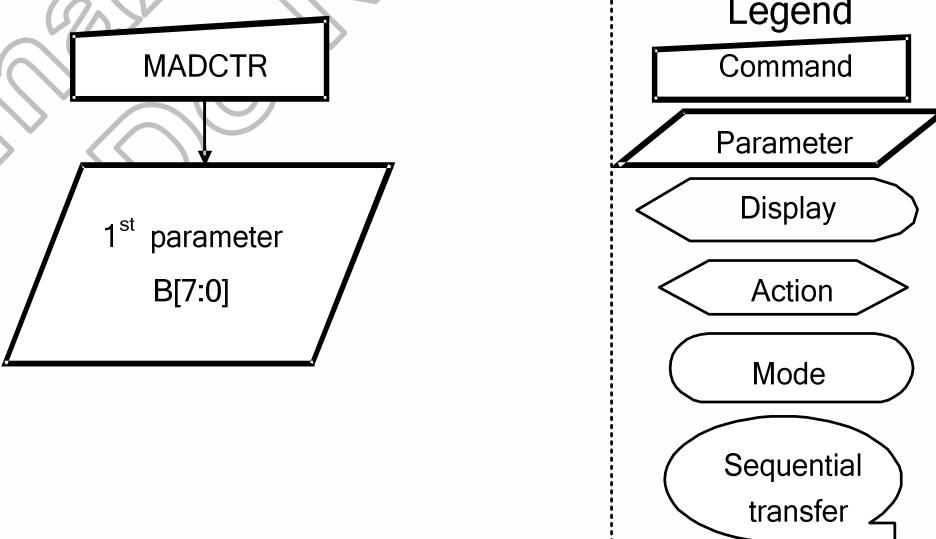
| 34 H                                      |   | TEOFF (Tearing Effect Line OFF) |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
|---|---|---------------------------------|-----|-----|-------|----|----|----|----|----|----|----|----|--------|---------------|--|--------------------|---|--------------------|---|--------------------|--|-----|-------------------------|-----|
|   |   | DNC                             | NWR | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX    |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Command                                   | 0   | ↑                               | 1   | -   | 0     | 0  | 1  | 1  | 0  | 1  | 0  | 0  | 0  | 34     |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Parameter                                 | No Parameter  |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Description                               | This command is used to turn OFF the Tearing Effect output signal from the TE signal line.  |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Restriction                               | This command has no effect when Tearing Effect output is already OFF.   |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table> |                                 |     |     |       |    |    |    |    |    |    |    |    | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes                | Normal Mode On, Idle Mode On, Sleep Out | Yes                | Partial Mode On, Idle Mode Off, Sleep Out | Yes                | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Tearing Effect Off</td> </tr> <tr> <td>S/W Reset</td> <td>Tearing Effect Off</td> </tr> <tr> <td>H/W Reset</td> <td>Tearing Effect Off</td> </tr> </tbody> </table>   |                                 |     |     |       |    |    |    |    |    |    |    |    | Status | Default Value | Power On Sequence                        | Tearing Effect Off | S/W Reset                               | Tearing Effect Off | H/W Reset                                 | Tearing Effect Off |  |     |                         |     |
| Status                                    | Default Value   |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Power On Sequence                         | Tearing Effect Off  |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| S/W Reset                                 | Tearing Effect Off  |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| H/W Reset                                 | Tearing Effect Off  |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Flow Chart                                |  <pre> graph TD     A([TE Line Output ON]) --&gt; B[TEOFF]     B --&gt; C([TE Line Output OFF])     </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>  |                                 |     |     |       |    |    |    |    |    |    |    |    |        |               |  |                    |   |                    |   |                    |  |     |                         |     |

### 8.2.28 Tearing effect line on (35h)

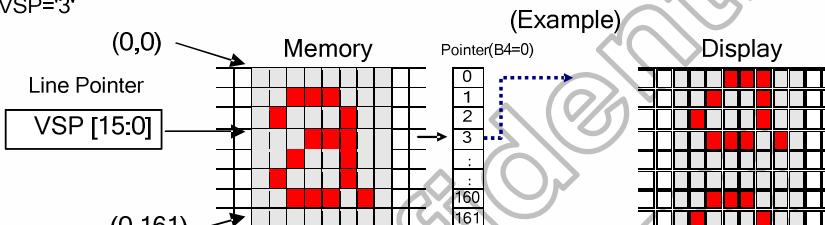
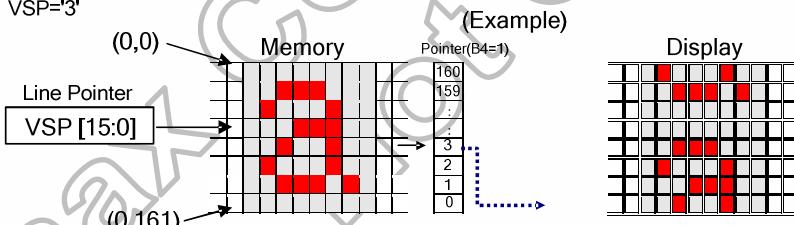
| 35 H                                      | TEON (Tearing Effect Line ON)   |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
|---|---|-----|-----|-------|----|----|----|----|----|----|----|--------|-----|--------|---------------|--|--------------------|---|--------------------|---|--------------------|--|-----|-------------------------|-----|
|   | DNC   | NWR | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0     | HEX |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Command                                   | 0   | ↑   | 1   | -     | 0  | 0  | 1  | 1  | 0  | 1  | 0  | 1      | 35  |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| 1stparameter                              | 0   | ↑   | 1   | -     | -  | -  | -  | -  | -  | -  | -  | TEMODE | -   |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Description                               | <p>This command is used to turn ON the Tearing Effect output signal from the TE signal line. This output is not affected by changing MADCTL bit B4.</p> <p>The Tearing Effect Line On has one parameter which describes the mode of the Tearing Effect Output Line. (X=Don't Care).</p> <p>When TEMODE=0:</p> <p>The Tearing Effect Output line consists of V-Blanking information only:</p>  <p>When TEMODE=1:</p> <p>The Tearing Effect Output Line consists of both V-Blanking and H-Blanking information:</p>  <p><b>Note:</b> During Sleep In Mode with Tearing Effect Line On, Tearing Effect Output pin will be active Low.</p> |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Restriction                               | This command has no effect when Tearing Effect output is already ON.  |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table>   |     |     |       |    |    |    |    |    |    |    |        |     | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes                | Normal Mode On, Idle Mode On, Sleep Out | Yes                | Partial Mode On, Idle Mode Off, Sleep Out | Yes                | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Tearing Effect Off</td> </tr> <tr> <td>S/W Reset</td> <td>Tearing Effect Off</td> </tr> <tr> <td>H/W Reset</td> <td>Tearing Effect Off</td> </tr> </tbody> </table>   |     |     |       |    |    |    |    |    |    |    |        |     | Status | Default Value | Power On Sequence                        | Tearing Effect Off | S/W Reset                               | Tearing Effect Off | H/W Reset                                 | Tearing Effect Off |  |     |                         |     |
| Status                                    | Default Value   |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Power On Sequence                         | Tearing Effect Off  |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| S/W Reset                                 | Tearing Effect Off  |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| H/W Reset                                 | Tearing Effect Off  |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |
| Flow Chart                                | <pre> graph TD     A([TE Line Output OFF]) --&gt; B[TEON]     B --&gt; C{M}     C --&gt; D([TE Line Output ON])     style C fill:none,stroke:none     style D fill:none,stroke:none     %% Legend     %% Command: rectangle     %% Parameter: rectangle     %% Display: left-pointing arrow     %% Action: right-pointing arrow     %% Mode: oval     %% Sequential transfer: oval with arrow   </pre>  |     |     |       |    |    |    |    |    |    |    |        |     |        |               |  |                    |   |                    |   |                    |  |     |                         |     |

### 8.2.29 Memory access control (36h)

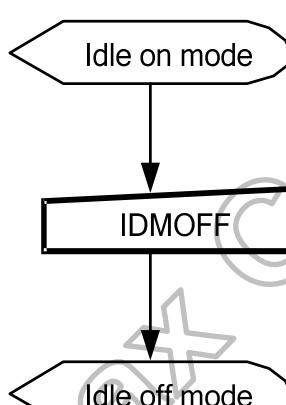
| <b>36 H</b>   | MADCTL (Memory Access Control)   |  |     |       |    |    |    |    |     |    |    |    |     |     |      |             |    |                    |  |    |                      |  |    |                       |  |    |                |  |      |               |  |    |                  |  |
|---------------|--|--|-----|-------|----|----|----|----|-----|----|----|----|-----|-----|------|-------------|----|--------------------|--|----|----------------------|--|----|-----------------------|--|----|----------------|--|------|---------------|--|----|------------------|--|
|               | DNC  | NWR  | NRD | D15-8 | D7 | D6 | D5 | D4 | D3  | D2 | D1 | D0 | HEX |     |      |             |    |                    |  |    |                      |  |    |                       |  |    |                |  |      |               |  |    |                  |  |
| Command       | 0  | ↑  | 1   | -     | 0  | 0  | 1  | 1  | 0   | 1  | 1  | 0  | 36  |     |      |             |    |                    |  |    |                      |  |    |                       |  |    |                |  |      |               |  |    |                  |  |
| 1st parameter | 1  | ↑  | 1   | -     | MY | MX | MV | ML | BGR | SS | -  | -  | -   |     |      |             |    |                    |  |    |                      |  |    |                       |  |    |                |  |      |               |  |    |                  |  |
|               | This command defines read/write scanning direction of frame memory.<br>This command makes no change on the other driver status.<br>Bit Assignment  |  |     |       |    |    |    |    |     |    |    |    |     |     |      |             |    |                    |  |    |                      |  |    |                       |  |    |                |  |      |               |  |    |                  |  |
|               | <table border="1"> <thead> <tr> <th>Bit</th> <th>Name</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>MY</td> <td>PAGE ADDRESS ORDER</td> <td>These 3 bits controls MCU to memory write/read direction. See Section 6.2.1 "MCU to memory write/read direction"</td> </tr> <tr> <td>MX</td> <td>COLUMN ADDRESS ORDER</td> <td></td> </tr> <tr> <td>MV</td> <td>PAGE/COLUMN SELECTION</td> <td></td> </tr> <tr> <td>ML</td> <td>Vertical ORDER</td> <td>LCD vertical refresh direction control</td> </tr> <tr> <td>BG R</td> <td>RGB-BGR ORDER</td> <td>Color selector switch control (0=RGB color filter panel, 1=BGR color filter panel)</td> </tr> <tr> <td>SS</td> <td>Horizontal ORDER</td> <td>LCD horizontal refresh direction control</td> </tr> </tbody> </table> |  |     |       |    |    |    |    |     |    |    |    |     | Bit | Name | Description | MY | PAGE ADDRESS ORDER | These 3 bits controls MCU to memory write/read direction. See Section 6.2.1 "MCU to memory write/read direction" | MX | COLUMN ADDRESS ORDER |  | MV | PAGE/COLUMN SELECTION |  | ML | Vertical ORDER | LCD vertical refresh direction control | BG R | RGB-BGR ORDER | Color selector switch control (0=RGB color filter panel, 1=BGR color filter panel) | SS | Horizontal ORDER | LCD horizontal refresh direction control |
| Bit           | Name   | Description  |     |       |    |    |    |    |     |    |    |    |     |     |      |             |    |                    |  |    |                      |  |    |                       |  |    |                |  |      |               |  |    |                  |  |
| MY            | PAGE ADDRESS ORDER   | These 3 bits controls MCU to memory write/read direction. See Section 6.2.1 "MCU to memory write/read direction" |     |       |    |    |    |    |     |    |    |    |     |     |      |             |    |                    |  |    |                      |  |    |                       |  |    |                |  |      |               |  |    |                  |  |
| MX            | COLUMN ADDRESS ORDER   |  |     |       |    |    |    |    |     |    |    |    |     |     |      |             |    |                    |  |    |                      |  |    |                       |  |    |                |  |      |               |  |    |                  |  |
| MV            | PAGE/COLUMN SELECTION  |  |     |       |    |    |    |    |     |    |    |    |     |     |      |             |    |                    |  |    |                      |  |    |                       |  |    |                |  |      |               |  |    |                  |  |
| ML            | Vertical ORDER   | LCD vertical refresh direction control   |     |       |    |    |    |    |     |    |    |    |     |     |      |             |    |                    |  |    |                      |  |    |                       |  |    |                |  |      |               |  |    |                  |  |
| BG R          | RGB-BGR ORDER  | Color selector switch control (0=RGB color filter panel, 1=BGR color filter panel)                               |     |       |    |    |    |    |     |    |    |    |     |     |      |             |    |                    |  |    |                      |  |    |                       |  |    |                |  |      |               |  |    |                  |  |
| SS            | Horizontal ORDER   | LCD horizontal refresh direction control   |     |       |    |    |    |    |     |    |    |    |     |     |      |             |    |                    |  |    |                      |  |    |                       |  |    |                |  |      |               |  |    |                  |  |
| Description   |   |  |     |       |    |    |    |    |     |    |    |    |     |     |      |             |    |                    |  |    |                      |  |    |                       |  |    |                |  |      |               |  |    |                  |  |

|   | <p><b>SS- Horizontal Updating order</b></p>  <p><b>Note:</b> Top-Left (0,0) means a physical memory location.</p>  |        |               |  |     |   |           |   |     |  |     |                         |     |
|---|--|--------|---------------|--|-----|---|-----------|---|-----|--|-----|-------------------------|-----|
| Restriction                               | D1 and D0 are set to '00' internally. D2 is implemented if the LCD is updating pixel-by pixel. D2 is set to '0' internally if the LCD is updating line-by-line.  |        |               |  |     |   |           |   |     |  |     |                         |     |
| Register Availability                     | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Status</th><th style="text-align: center;">Availability</th></tr> </thead> <tbody> <tr> <td style="text-align: center;">Normal Mode On, Idle Mode Off, Sleep Out</td><td style="text-align: center;">Yes</td></tr> <tr> <td style="text-align: center;">Normal Mode On, Idle Mode On, Sleep Out</td><td style="text-align: center;">Yes</td></tr> <tr> <td style="text-align: center;">Partial Mode On, Idle Mode Off, Sleep Out</td><td style="text-align: center;">Yes</td></tr> <tr> <td style="text-align: center;">Partial Mode On, Idle Mode On, Sleep Out</td><td style="text-align: center;">Yes</td></tr> <tr> <td style="text-align: center;">Sleep In or Booster Off</td><td style="text-align: center;">Yes</td></tr> </tbody> </table>  | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes | Normal Mode On, Idle Mode On, Sleep Out | Yes       | Partial Mode On, Idle Mode Off, Sleep Out | Yes | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability   |        |               |  |     |   |           |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes  |        |               |  |     |   |           |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes  |        |               |  |     |   |           |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes  |        |               |  |     |   |           |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes  |        |               |  |     |   |           |   |     |  |     |                         |     |
| Sleep In or Booster Off                   | Yes  |        |               |  |     |   |           |   |     |  |     |                         |     |
| Default                                   | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Status</th><th style="text-align: center;">Default Value</th></tr> </thead> <tbody> <tr> <td style="text-align: center;">Power On Sequence</td><td style="text-align: center;">00h</td></tr> <tr> <td style="text-align: center;">S/W Reset</td><td style="text-align: center;">No Change</td></tr> <tr> <td style="text-align: center;">H/W Reset</td><td style="text-align: center;">00h</td></tr> </tbody> </table>   | Status | Default Value | Power On Sequence                        | 00h | S/W Reset                               | No Change | H/W Reset                                 | 00h |  |     |                         |     |
| Status                                    | Default Value  |        |               |  |     |   |           |   |     |  |     |                         |     |
| Power On Sequence                         | 00h  |        |               |  |     |   |           |   |     |  |     |                         |     |
| S/W Reset                                 | No Change  |        |               |  |     |   |           |   |     |  |     |                         |     |
| H/W Reset                                 | 00h  |        |               |  |     |   |           |   |     |  |     |                         |     |
| Flow Chart                                |  <pre> graph TD     MADCTR[MADCTR] --&gt; B["1<sup>st</sup> parameter<br/>B[7:0]"] </pre> <div style="border: 1px dashed black; padding: 5px; margin-top: 10px;"> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li><span style="border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> Command</li> <li><span style="border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> Parameter</li> <li><span style="border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> Display</li> <li><span style="border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> Action</li> <li><span style="border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> Mode</li> <li><span style="border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> Sequential transfer</li> </ul> </div> |        |               |  |     |   |           |   |     |  |     |                         |     |

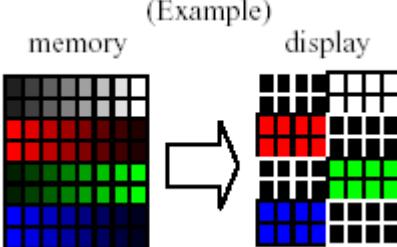
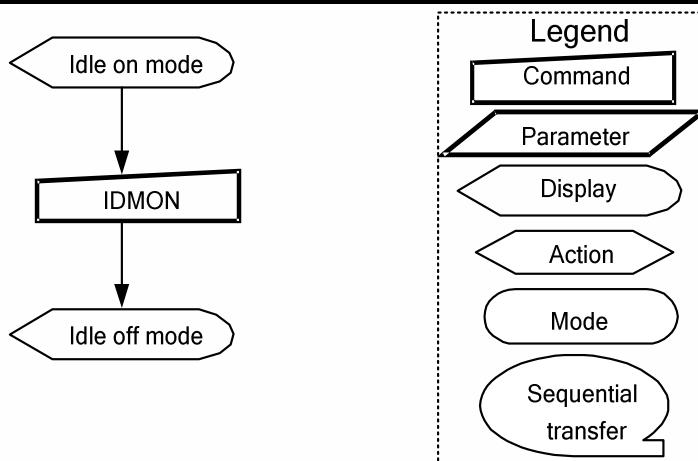
### 8.2.30 Vertical scrolling start address (37h)

| 37 H                                      |               | VSCRSADD (Vertical Scrolling Start Address)   |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |
|---|---------------|---|-----|-----|--------|--------|--------|--------|--------|--------|-------|-------|-----|-----|--------|---------------|--|-----|---|-----|---|-----|--|-----|-------------------------|-----|
|   |               | DNC   | NRD | NWR | D15-8  | D7     | D6     | D5     | D4     | D3     | D2    | D1    | D0  | HEX |        |               |  |     |   |     |   |     |  |     |                         |     |
| Command                                   |               | 0   | 1   | ↑   | -      | 0      | 0      | 1      | 1      | 0      | 1     | 1     | 1   | 37  |        |               |  |     |   |     |   |     |  |     |                         |     |
| 1 <sup>st</sup> parameter                 | 1             | 1   | ↑   | -   | VSP 15 | VSP 14 | VSP 13 | VSP 12 | VSP 11 | VSP 10 | VSP 9 | VSP 8 | 01. |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| 2 <sup>nd</sup> parameter                 | 1             | 1   | ↑   | -   | VSP 7  | VSP 6  | VSP 5  | VSP 4  | VSP 3  | VSP 2  | VSP 1 | VSP 0 | 3F  |     |        |               |  |     |   |     |   |     |  |     |                         |     |
|   |               | This command is used together with Vertical Scrolling Definition (33h). These two commands describe the scrolling area and the scrolling mode. The Vertical Scrolling Start Address command has one parameter which describes the address of the line in the Frame Memory that will be written as the first line after the last line of the Top Fixed Area on the display as illustrated below:<br><br>When MADCTL B4='0'<br>Example:<br>When Top Fixed Area = Bottom Fixed Area = 00, Vertical Scrolling Area = 162 and<br>VSP='3'<br><br><br>When MADCTL B4=1<br>Example:<br>When Top Fixed Area = Bottom Fixed Area = 00, Vertical Scrolling Area = 162 and<br>VSP='3'<br><br><br>When new Pointer position and Picture Data are sent, the result on the display will happen at the next Panel Scan to avoid tearing effect.<br>VSP refers to the Frame Memory line Pointer. |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Restriction                               |               | Since the value of the Vertical Scrolling Start Address is absolute (with reference to the Frame Memory), it must not enter the fixed area (defined by Vertical Scrolling Definition (33h) – otherwise undesirable image will be displayed on the Panel).   |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Register Availability                     |               | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table>   |     |     |        |        |        |        |        |        |       |       |     |     | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes | Normal Mode On, Idle Mode On, Sleep Out | Yes | Partial Mode On, Idle Mode Off, Sleep Out | Yes | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |   |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes           |   |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes           |   |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes           |   |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes           |   |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Sleep In or Booster Off                   | Yes           |   |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Default                                   |               | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>00h</td> </tr> <tr> <td>S/W Reset</td> <td>00h</td> </tr> <tr> <td>H/W Reset</td> <td>00h</td> </tr> </tbody> </table>  |     |     |        |        |        |        |        |        |       |       |     |     | Status | Default Value | Power On Sequence                        | 00h | S/W Reset                               | 00h | H/W Reset                                 | 00h |  |     |                         |     |
| Status                                    | Default Value |   |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Power On Sequence                         | 00h           |   |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| S/W Reset                                 | 00h           |   |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| H/W Reset                                 | 00h           |   |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |
| Flow Chart                                |               | See Vertical Scrolling Definition (33h) description.  |     |     |        |        |        |        |        |        |       |       |     |     |        |               |  |     |   |     |   |     |  |     |                         |     |

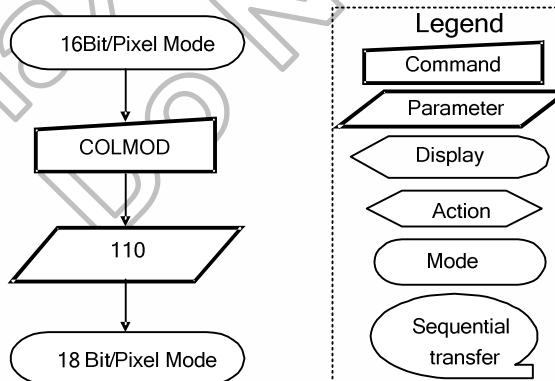
### 8.2.31 Idle mode off (38h)

| <b>38 H</b>                               | IDMOFF (Idle Mode Off)  |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
|---|---|-----|-----|-------|----|----|----|----|----|----|----|----|---|-----------|--------|---------------|--|---------------|---|---------------|---|---------------|--|-----|-------------------------|-----|
| Command                                   | DNC   | NWR | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | 0 | HEX<br>38 |        |               |  |               |   |               |   |               |  |     |                         |     |
| Parameter                                 | NO PARAMETER  |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
| Description                               | This command is used to recover from Idle mode on.<br>In the idle off mode, LCD can display maximum 262,144 colors.   |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
| Restriction                               | 1. This command has no effect when module is already in idle off mode.<br>2. RGB I/F enable, this command is working as a NOP (00h) command.  |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table> |     |     |       |    |    |    |    |    |    |    |    |   |           | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes           | Normal Mode On, Idle Mode On, Sleep Out | Yes           | Partial Mode On, Idle Mode Off, Sleep Out | Yes           | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>Idle Mode Off</td> </tr> <tr> <td>S/W Reset</td> <td>Idle Mode Off</td> </tr> <tr> <td>H/W Reset</td> <td>Idle Mode Off</td> </tr> </tbody> </table>  |     |     |       |    |    |    |    |    |    |    |    |   |           | Status | Default Value | Power On Sequence                        | Idle Mode Off | S/W Reset                               | Idle Mode Off | H/W Reset                                 | Idle Mode Off |  |     |                         |     |
| Status                                    | Default Value   |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
| Power On Sequence                         | Idle Mode Off   |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
| S/W Reset                                 | Idle Mode Off   |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
| H/W Reset                                 | Idle Mode Off   |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |
| Flow Chart                                |  <pre> graph TD     A([Idle on mode]) --&gt; B[IDMOFF]     B --&gt; C([Idle off mode])   </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>   |     |     |       |    |    |    |    |    |    |    |    |   |           |        |               |  |               |   |               |   |               |  |     |                         |     |

### 8.2.32 Idle mode on (39h)

| <b>39 H</b>                               | IDMON (Idle Mode On)   |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
|---|--|---|---|-------|----|----|----|----|----|----|----|----|-----|--|--------|---|---|---|---|---------------|---|---------------|--|--------|-------------------------|--------|-----|--------|--------|--------|---------|--------|--------|--------|-------|--------|--------|--------|------|--------|--------|--------|--------|--------|--------|--------|-------|--------|--------|--------|
| Command                                   | DNC  | NWR   | NRD   | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Parameter                                 | 0  | ↑   | 1   | -     | 0  | 0  | 1  | 1  | 1  | 0  | 0  | 1  | 39  |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Description                               | <p>This command is used to enter into Idle mode on.</p> <p>In the idle on mode, color expression is reduced. The primary and the secondary colors using MSB of each R, G and B in the Frame Memory, 8 color depth data is displayed.</p> <p>(Example)</p>    |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Memory contents vs. Display Color         | <table border="1"> <thead> <tr> <th></th> <th>R<sub>5</sub> R<sub>4</sub> R<sub>3</sub> R<sub>2</sub> R<sub>1</sub> R<sub>0</sub></th> <th>G<sub>5</sub> G<sub>4</sub> G<sub>3</sub> G<sub>2</sub> G<sub>1</sub> G<sub>0</sub></th> <th>B<sub>5</sub> B<sub>4</sub> B<sub>3</sub> B<sub>2</sub> B<sub>1</sub> B<sub>0</sub></th> </tr> </thead> <tbody> <tr> <td>Black</td><td>0XXXXX</td><td>0XXXXX</td><td>0XXXXX</td></tr> <tr> <td>Blue</td><td>0XXXXX</td><td>0XXXXX</td><td>1XXXXX</td></tr> <tr> <td>Red</td><td>1XXXXX</td><td>0XXXXX</td><td>0XXXXX</td></tr> <tr> <td>Magenta</td><td>1XXXXX</td><td>0XXXXX</td><td>1XXXXX</td></tr> <tr> <td>Green</td><td>0XXXXX</td><td>1XXXXX</td><td>0XXXXX</td></tr> <tr> <td>Cyan</td><td>0XXXXX</td><td>1XXXXX</td><td>1XXXXX</td></tr> <tr> <td>Yellow</td><td>1XXXXX</td><td>1XXXXX</td><td>0XXXXX</td></tr> <tr> <td>White</td><td>1XXXXX</td><td>1XXXXX</td><td>1XXXXX</td></tr> </tbody> </table> |   |   |       |    |    |    |    |    |    |    |    |     |  |        | R <sub>5</sub> R <sub>4</sub> R <sub>3</sub> R <sub>2</sub> R <sub>1</sub> R <sub>0</sub> | G <sub>5</sub> G <sub>4</sub> G <sub>3</sub> G <sub>2</sub> G <sub>1</sub> G <sub>0</sub> | B <sub>5</sub> B <sub>4</sub> B <sub>3</sub> B <sub>2</sub> B <sub>1</sub> B <sub>0</sub> | Black                                   | 0XXXXX        | 0XXXXX                                    | 0XXXXX        | Blue                                     | 0XXXXX | 0XXXXX                  | 1XXXXX | Red | 1XXXXX | 0XXXXX | 0XXXXX | Magenta | 1XXXXX | 0XXXXX | 1XXXXX | Green | 0XXXXX | 1XXXXX | 0XXXXX | Cyan | 0XXXXX | 1XXXXX | 1XXXXX | Yellow | 1XXXXX | 1XXXXX | 0XXXXX | White | 1XXXXX | 1XXXXX | 1XXXXX |
|   | R <sub>5</sub> R <sub>4</sub> R <sub>3</sub> R <sub>2</sub> R <sub>1</sub> R <sub>0</sub>  | G <sub>5</sub> G <sub>4</sub> G <sub>3</sub> G <sub>2</sub> G <sub>1</sub> G <sub>0</sub> | B <sub>5</sub> B <sub>4</sub> B <sub>3</sub> B <sub>2</sub> B <sub>1</sub> B <sub>0</sub> |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Black                                     | 0XXXXX   | 0XXXXX  | 0XXXXX  |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Blue                                      | 0XXXXX   | 0XXXXX  | 1XXXXX  |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Red                                       | 1XXXXX   | 0XXXXX  | 0XXXXX  |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Magenta                                   | 1XXXXX   | 0XXXXX  | 1XXXXX  |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Green                                     | 0XXXXX   | 1XXXXX  | 0XXXXX  |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Cyan                                      | 0XXXXX   | 1XXXXX  | 1XXXXX  |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Yellow                                    | 1XXXXX   | 1XXXXX  | 0XXXXX  |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| White                                     | 1XXXXX   | 1XXXXX  | 1XXXXX  |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Restriction                               | This command has no effect when module is already in idle off mode.  |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Sleep In or Booster Off</td><td>Yes</td></tr> </tbody> </table>  |   |   |       |    |    |    |    |    |    |    |    |     |  | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out  | Yes   | Normal Mode On, Idle Mode On, Sleep Out | Yes           | Partial Mode On, Idle Mode Off, Sleep Out | Yes           | Partial Mode On, Idle Mode On, Sleep Out | Yes    | Sleep In or Booster Off | Yes    |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Status                                    | Availability   |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes  |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes  |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes  |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes  |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Sleep In or Booster Off                   | Yes  |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td><td>Idle Mode Off</td></tr> <tr> <td>S/W Reset</td><td>Idle Mode Off</td></tr> <tr> <td>H/W Reset</td><td>Idle Mode Off</td></tr> </tbody> </table>   |   |   |       |    |    |    |    |    |    |    |    |     |  | Status | Default Value   | Power On Sequence   | Idle Mode Off   | S/W Reset                               | Idle Mode Off | H/W Reset                                 | Idle Mode Off |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Status                                    | Default Value  |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Power On Sequence                         | Idle Mode Off  |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| S/W Reset                                 | Idle Mode Off  |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| H/W Reset                                 | Idle Mode Off  |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |
| Flow Chart                                |  <pre> graph TD     A([Idle on mode]) --&gt; B[IDMON]     B --&gt; C([Idle off mode])     </pre> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>   |   |   |       |    |    |    |    |    |    |    |    |     |  |        |   |   |   |   |               |   |               |  |        |                         |        |     |        |        |        |         |        |        |        |       |        |        |        |      |        |        |        |        |        |        |        |       |        |        |        |

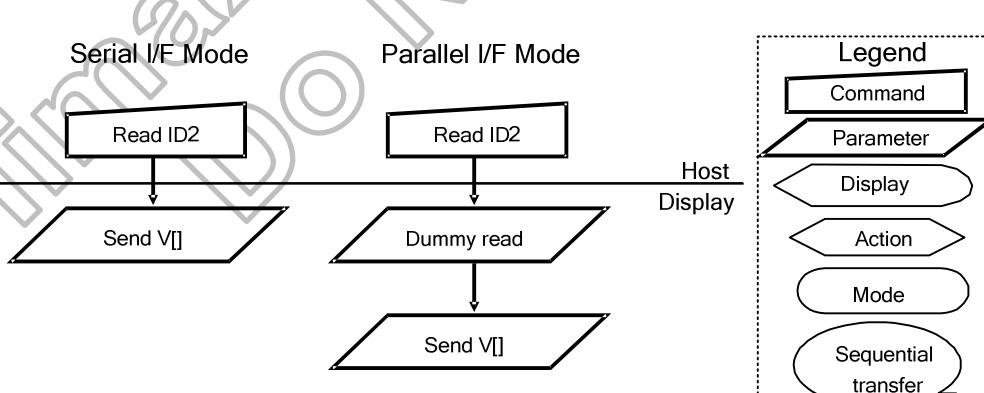
### 8.2.33 Interface pixel format (3Ah)

| 3A H                                      |   | COLMOD (Interface Pixel Format) |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
|---|---|---------------------------------|-----|-------|----|----|----|----|----|----|----|----|-----|---------------------|------------------|---------------|--|--------------|---|-----------|---|--------------|--|-----|-------------------------|-----|-------------|---|---|---|--------------|---|---|---|-------------|---|---|---|--------------|---|---|---|--------------|---|---|---|-------------|---|---|---|
|   | DNC   | NWR                             | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Command                                   | 0   | ↑                               | 1   | -     | 0  | 0  | 1  | 1  | 1  | 0  | 1  | 0  | 3A  |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| 1 <sup>st</sup> parameter                 | 1   | ↑                               | 1   | -     | -  | -  | -  | -  | -  | -  | D2 | D1 | D0  | 011,<br>101,<br>110 |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Description                               | This command is used to define the format of RGB picture data, which is to be transfer via the system interface. The formats are shown in the table:  |                                 |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
|   | <table border="1"> <thead> <tr> <th>Interface Format</th> <th>D2</th> <th>D1</th> <th>D0</th> </tr> </thead> <tbody> <tr> <td>Not Defined</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Not Defined</td> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>Not Defined</td> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>12 Bit/Pixel</td> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>Not Defined</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>16 Bit/Pixel</td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>18 Bit/Pixel</td> <td>1</td> <td>1</td> <td>0</td> </tr> <tr> <td>Not Defined</td> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table> |                                 |     |       |    |    |    |    |    |    |    |    |     |                     | Interface Format | D2            | D1                                       | D0           | Not Defined                             | 0         | 0   | 0            | Not Defined                              | 0   | 0                       | 1   | Not Defined | 0 | 1 | 0 | 12 Bit/Pixel | 0 | 1 | 1 | Not Defined | 1 | 0 | 0 | 16 Bit/Pixel | 1 | 0 | 1 | 18 Bit/Pixel | 1 | 1 | 0 | Not Defined | 1 | 1 | 1 |
| Interface Format                          | D2  | D1                              | D0  |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Not Defined                               | 0   | 0                               | 0   |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Not Defined                               | 0   | 0                               | 1   |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Not Defined                               | 0   | 1                               | 0   |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| 12 Bit/Pixel                              | 0   | 1                               | 1   |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Not Defined                               | 1   | 0                               | 0   |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| 16 Bit/Pixel                              | 1   | 0                               | 1   |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| 18 Bit/Pixel                              | 1   | 1                               | 0   |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Not Defined                               | 1   | 1                               | 1   |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Restriction                               | -   |                                 |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table>   |                                 |     |       |    |    |    |    |    |    |    |    |     |                     | Status           | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes          | Normal Mode On, Idle Mode On, Sleep Out | Yes       | Partial Mode On, Idle Mode Off, Sleep Out | Yes          | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Status                                    | Availability  |                                 |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Sleep In or Booster Off                   | Yes   |                                 |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>18-bit/pixel</td> </tr> <tr> <td>S/W Reset</td> <td>No Change</td> </tr> <tr> <td>H/W Reset</td> <td>18-bit/pixel</td> </tr> </tbody> </table>  |                                 |     |       |    |    |    |    |    |    |    |    |     |                     | Status           | Default Value | Power On Sequence                        | 18-bit/pixel | S/W Reset                               | No Change | H/W Reset                                 | 18-bit/pixel |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Status                                    | Default Value   |                                 |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Power On Sequence                         | 18-bit/pixel  |                                 |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| S/W Reset                                 | No Change   |                                 |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| H/W Reset                                 | 18-bit/pixel  |                                 |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |
| Flow Chart                                | <p>Example:</p>  <pre> graph TD     A[16Bit/Pixel Mode] --&gt; B[COLMOD]     B --&gt; C[110]     C --&gt; D[18 Bit/Pixel Mode]     style C fill:none,stroke:none     </pre> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>   |                                 |     |       |    |    |    |    |    |    |    |    |     |                     |                  |               |  |              |   |           |   |              |  |     |                         |     |             |   |   |   |              |   |   |   |             |   |   |   |              |   |   |   |              |   |   |   |             |   |   |   |

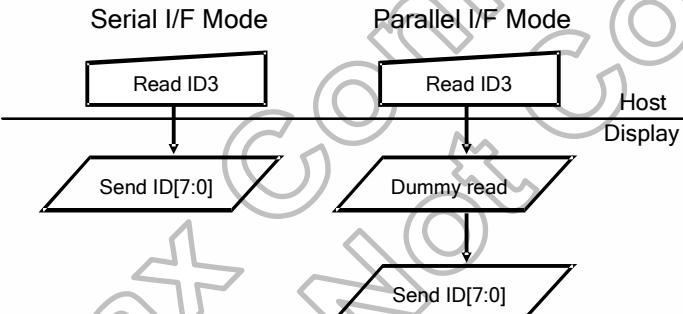
### 8.2.34 Read ID1 (DAh)

| DA H                                      | RDID1 (Read ID1)  |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |
|---|---|-----|-----|-------|------------------------------|----|----|----|----|----|----|----|-----|--------|---------------|--|-------|---|-------|---|-------|--|-----|-------------------------|-----|
|   | DNC   | NWR | NRD | D15-8 | D7                           | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |        |               |  |       |   |       |   |       |  |     |                         |     |
| Command                                   | 0   | ↑   | 1   | -     | 1                            | 1  | 0  | 1  | 1  | 0  | 1  | 0  | DA  |        |               |  |       |   |       |   |       |  |     |                         |     |
| 1 <sup>st</sup> parameter                 | 1   | 1   | ↑   | -     | -                            | -  | -  | -  | -  | -  | -  | -  | -   |        |               |  |       |   |       |   |       |  |     |                         |     |
| 2 <sup>nd</sup> parameter                 | 1   | 1   | ↑   | -     | module's manufacturer m[7:0] |    |    |    |    |    |    |    | -   |        |               |  |       |   |       |   |       |  |     |                         |     |
| Description                               | This read byte identifies the LCD module's manufacturer.  |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |
| Restriction                               | -   |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table> |     |     |       |                              |    |    |    |    |    |    |    |     | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes   | Normal Mode On, Idle Mode On, Sleep Out | Yes   | Partial Mode On, Idle Mode Off, Sleep Out | Yes   | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>xxHEX</td> </tr> <tr> <td>S/W Reset</td> <td>xxHEX</td> </tr> <tr> <td>H/W Reset</td> <td>xxHEX</td> </tr> </tbody> </table>  |     |     |       |                              |    |    |    |    |    |    |    |     | Status | Default Value | Power On Sequence                        | xxHEX | S/W Reset                               | xxHEX | H/W Reset                                 | xxHEX |  |     |                         |     |
| Status                                    | Default Value   |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |
| Power On Sequence                         | xxHEX   |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |
| S/W Reset                                 | xxHEX   |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |
| H/W Reset                                 | xxHEX   |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |
| Flow Chart                                | <p>Serial I/F Mode</p> <pre> graph TD     Start1[Read ID1] --&gt; Send1[/Send m[7:0]/]     Start2[Read ID1] --&gt; Dummy[/Dummy read/]     Dummy --&gt; Send2[/Send m[7:0]/]     </pre> <p>Parallel I/F Mode</p> <p>Host Display</p> <p>Legend:</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul>  |     |     |       |                              |    |    |    |    |    |    |    |     |        |               |  |       |   |       |   |       |  |     |                         |     |

### 8.2.35 Read ID2 (DBh)

| DB H                                      | RDID2 (Read ID2)  |         |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
|---|---|---------|-----|-------|----|----|----|----|----|----|----|----|-----|----|----------------------|---------------|--|-----------------|---|-----------------|---|-----------------|--|-----|-------------------------|-----|-----|---|---|-----|---|---|-----|---|---|
|   | DNC   | NWR     | NRD | D15-8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Command                                   | 0   | ↑       | 1   | -     | 1  | 1  | 0  | 1  | 1  | 0  | 1  | 1  | 1   | DB |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 1 <sup>st</sup> parameter                 | 1   | 1       | ↑   | -     | -  | -  | -  | -  | -  | -  | -  | -  | -   | -  |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 2 <sup>nd</sup> parameter                 | 1   | 1       | ↑   | -     | 1  | V6 | V5 | V4 | V3 | V2 | V1 | V0 | -   | -  |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Description                               | <p>This read byte is used to track the LCD module/driver version. It is defined by display supplier and changes each time a revision is made to the display, material or construction specifications. See the following table.</p> <table border="1"> <thead> <tr> <th>ID Byte Value V[7:0]</th> <th>Version</th> <th>Changes</th> </tr> </thead> <tbody> <tr> <td>80h</td><td>-</td><td>-</td></tr> <tr> <td>81h</td><td>-</td><td>-</td></tr> <tr> <td>82h</td><td>-</td><td>-</td></tr> <tr> <td>83h</td><td>-</td><td>-</td></tr> <tr> <td>84h</td><td>-</td><td>-</td></tr> <tr> <td>85h</td><td>-</td><td>-</td></tr> </tbody> </table> |         |     |       |    |    |    |    |    |    |    |    |     |    | ID Byte Value V[7:0] | Version       | Changes                                  | 80h             | -                                       | -               | 81h                                       | -               | -  | 82h | -                       | -   | 83h | - | - | 84h | - | - | 85h | - | - |
| ID Byte Value V[7:0]                      | Version   | Changes |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 80h                                       | -   | -       |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 81h                                       | -   | -       |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 82h                                       | -   | -       |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 83h                                       | -   | -       |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 84h                                       | -   | -       |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| 85h                                       | -   | -       |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Restrictions                              |   |         |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr> <td>Sleep In or Booster Off</td><td>Yes</td></tr> </tbody> </table>   |         |     |       |    |    |    |    |    |    |    |    |     |    | Status               | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes             | Normal Mode On, Idle Mode On, Sleep Out | Yes             | Partial Mode On, Idle Mode Off, Sleep Out | Yes             | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |     |   |   |     |   |   |     |   |   |
| Status                                    | Availability  |         |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |         |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |         |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |         |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |         |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Sleep In or Booster Off                   | Yes   |         |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td><td>See Description</td></tr> <tr> <td>S/W Reset</td><td>See Description</td></tr> <tr> <td>H/W Reset</td><td>See Description</td></tr> </tbody> </table>  |         |     |       |    |    |    |    |    |    |    |    |     |    | Status               | Default Value | Power On Sequence                        | See Description | S/W Reset                               | See Description | H/W Reset                                 | See Description |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Status                                    | Default Value   |         |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Power On Sequence                         | See Description   |         |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| S/W Reset                                 | See Description   |         |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| H/W Reset                                 | See Description   |         |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |
| Flow Chart                                |  <p>Serial I/F Mode</p> <p>Parallel I/F Mode</p> <p>Host Display</p> <p>Legend</p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul> <pre> graph TD     Start(( )) -- "Read ID2" --&gt; SendV1[/Send V[]/]     Start(( )) -- "Read ID2" --&gt; SendV2[/Send V[]/]     SendV1 --&gt; End1[/Send V[]/]     SendV2 --&gt; Dummy[Dummy read]     Dummy --&gt; End2[/Send V[]/]   </pre>  |         |     |       |    |    |    |    |    |    |    |    |     |    |                      |               |  |                 |   |                 |   |                 |  |     |                         |     |     |   |   |     |   |   |     |   |   |

### 8.2.36 Read ID3 (DCh)

| DC H                                      | RDID3 (Read ID3)   |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |
|---|--|-----|-----|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--------|---------------|--|-------|---|-------|---|-------|--|-----|-------------------------|-----|
|   | DN C   | NWR | NRD | D15-8 | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | HEX |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| Command                                   | 0  | ↑   | 1   | -     | 1   | 1   | 0   | 1   | 1   | 1   | 0   | 0   | DC  |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| 1 <sup>st</sup> parameter                 | 1  | 1   | ↑   | -     | -   | -   | -   | -   | -   | -   | -   | -   | -   |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| 2 <sup>nd</sup> parameter                 | 1  | 1   | ↑   | -     | ID7 | ID6 | ID5 | ID4 | ID3 | ID2 | ID1 | ID0 | -   |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| Description                               | This read byte identifies the LCD module/driver.   |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| Restrictions                              |  |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table>  |     |     |       |     |     |     |     |     |     |     |     |     |  | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes   | Normal Mode On, Idle Mode On, Sleep Out | Yes   | Partial Mode On, Idle Mode Off, Sleep Out | Yes   | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability   |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes  |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes  |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes  |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes  |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| Sleep In or Booster Off                   | Yes  |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>xxHEX</td> </tr> <tr> <td>S/W Reset</td> <td>xxHEX</td> </tr> <tr> <td>H/W Reset</td> <td>xxHEX</td> </tr> </tbody> </table>   |     |     |       |     |     |     |     |     |     |     |     |     |  | Status | Default Value | Power On Sequence                        | xxHEX | S/W Reset                               | xxHEX | H/W Reset                                 | xxHEX |  |     |                         |     |
| Status                                    | Default Value  |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| Power On Sequence                         | xxHEX  |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| S/W Reset                                 | xxHEX  |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| H/W Reset                                 | xxHEX  |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |
| Flow Chart                                |  <pre> graph TD     Start[Read ID3] --&gt; Send1[/Send ID[7:0]/]     Start[Read ID3] --&gt; Parallel[Parallel I/F Mode]     Parallel --&gt; Dummy1[/Dummy read/]     Parallel --&gt; Send2[/Send ID[7:0]/]     Serial[Serial I/F Mode] --&gt; Send1     Parallel --&gt; Send1     Parallel --&gt; Dummy1     Parallel --&gt; Send2     </pre> <p>The flowchart illustrates the sequence of commands for reading ID3. It branches into two main paths based on the interface mode: Serial I/F Mode and Parallel I/F Mode. Both paths start with a 'Read ID3' command. In Serial I/F Mode, the next step is to send the 8-bit ID value. In Parallel I/F Mode, after the 'Read ID3' command, there is a 'Dummy read' step followed by the sending of the 8-bit ID value.</p> <p><b>Legend:</b></p> <ul style="list-style-type: none"> <li>Command</li> <li>Parameter</li> <li>Display</li> <li>Action</li> <li>Mode</li> <li>Sequential transfer</li> </ul> |     |     |       |     |     |     |     |     |     |     |     |     |  |        |               |  |       |   |       |   |       |  |     |                         |     |

### 8.2.37 SETOSC: set internal oscillator (B0h)

| <b>B0 H</b>                               |  | SETOSC( Set Internal Oscillator) |       |                               |                    |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
|---|--|----------------------------------|-------|-------------------------------|--------------------|----|----|----|-------------|----|----|--------|-----|--------|---------------|--|--|---|----------------------------|---|--|--|-----|-------------------------|------|---|---|---|---|------------|------|---|---|---|---|------------|------|---|---|---|---|------------|------|---|---|---|---|-------------|------|---|---|---|---|-------------|------|---|---|---|---|-------------|------|---|---|---|---|-------------|------|---|---|---|---|-------------|------|---|---|---|---|-------------|------|---|---|---|---|-------------|------|---|---|---|---|-------------|------|---|---|---|---|-------------|-------|---|---|---|---|-------------|-------|---|---|---|---|-------------|-------|---|---|---|---|-------------|-------|
|   | DNC  | NWR                              | NRD   | D17-8                         | D7                 | D6 | D5 | D4 | D3          | D2 | D1 | D0     | HEX |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Command                                   | 0  | ↑                                | 1     | -                             | 1                  | 0  | 1  | 1  | 0           | 0  | 0  | 0      | B0  |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 1 <sup>st</sup> parameter                 | 1  | ↑                                | 1     | -                             | I_RADJ[3:0]        |    |    |    | N_RADJ[3:0] |    |    |        | 34  |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 2 <sup>nd</sup> parameter                 | 1  | ↑                                | 1     | -                             | -                  | -  | -  | -  | -           | -  | -  | OSC_EN | 00  |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Description                               | <p>These command is used to set internal oscillator related setting<br/> <b>OSC_EN:</b> Enable internal oscillator, OSC_EN = '1', internal oscillator start to oscillate.<br/> OSC_EN = '0', internal oscillator stop.<br/> <b>N_RADJ[3:0]:</b> Internal oscillator frequency adjusts in Normal / Partial mode.<br/> <b>I_RADJ[3:0]:</b> Internal oscillator frequency adjusts in Idle(8-color) / Partial Idle mode.</p> <p>For details, please refer to "7.1 Internal Oscillator" section.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>RADJ3</th><th>RADJ2</th><th>RADJ1</th><th>RADJ0</th><th>Internal Oscillator Frequency</th><th>Display Frame rate</th></tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>50% x 6MHz</td><td>30Hz</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>1</td><td>67% x 6MHz</td><td>40Hz</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>0</td><td>75% x 6MHz</td><td>45Hz</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>1</td><td>83% x 6MHz</td><td>50Hz</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>0</td><td>100% x 6MHz</td><td>60Hz</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>1</td><td>108% x 6MHz</td><td>65Hz</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>0</td><td>117% x 6MHz</td><td>70Hz</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>1</td><td>125% x 6MHz</td><td>75Hz</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td><td>100% x 6MHz</td><td>60Hz</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>1</td><td>125% x 6MHz</td><td>75Hz</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>0</td><td>141% x 6MHz</td><td>85Hz</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>1</td><td>158% x 6MHz</td><td>95Hz</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>0</td><td>183% x 6MHz</td><td>110Hz</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>1</td><td>191% x 6MHz</td><td>115Hz</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>0</td><td>200% x 6MHz</td><td>120Hz</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>217% x 6MHz</td><td>130Hz</td></tr> </tbody> </table> |                                  |       |                               |                    |    |    |    |             |    |    |        |     | RADJ3  | RADJ2         | RADJ1                                    | RADJ0  | Internal Oscillator Frequency           | Display Frame rate         | 0   | 0  | 0  | 0   | 50% x 6MHz              | 30Hz | 0 | 0 | 0 | 1 | 67% x 6MHz | 40Hz | 0 | 0 | 1 | 0 | 75% x 6MHz | 45Hz | 0 | 0 | 1 | 1 | 83% x 6MHz | 50Hz | 0 | 1 | 0 | 0 | 100% x 6MHz | 60Hz | 0 | 1 | 0 | 1 | 108% x 6MHz | 65Hz | 0 | 1 | 1 | 0 | 117% x 6MHz | 70Hz | 0 | 1 | 1 | 1 | 125% x 6MHz | 75Hz | 1 | 0 | 0 | 0 | 100% x 6MHz | 60Hz | 1 | 0 | 0 | 1 | 125% x 6MHz | 75Hz | 1 | 0 | 1 | 0 | 141% x 6MHz | 85Hz | 1 | 0 | 1 | 1 | 158% x 6MHz | 95Hz | 1 | 1 | 0 | 0 | 183% x 6MHz | 110Hz | 1 | 1 | 0 | 1 | 191% x 6MHz | 115Hz | 1 | 1 | 1 | 0 | 200% x 6MHz | 120Hz | 1 | 1 | 1 | 1 | 217% x 6MHz | 130Hz |
| RADJ3                                     | RADJ2  | RADJ1                            | RADJ0 | Internal Oscillator Frequency | Display Frame rate |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 0   | 0  | 0                                | 0     | 50% x 6MHz                    | 30Hz               |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 0   | 0  | 0                                | 1     | 67% x 6MHz                    | 40Hz               |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 0   | 0  | 1                                | 0     | 75% x 6MHz                    | 45Hz               |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 0   | 0  | 1                                | 1     | 83% x 6MHz                    | 50Hz               |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 0   | 1  | 0                                | 0     | 100% x 6MHz                   | 60Hz               |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 0   | 1  | 0                                | 1     | 108% x 6MHz                   | 65Hz               |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 0   | 1  | 1                                | 0     | 117% x 6MHz                   | 70Hz               |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 0   | 1  | 1                                | 1     | 125% x 6MHz                   | 75Hz               |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 1   | 0  | 0                                | 0     | 100% x 6MHz                   | 60Hz               |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 1   | 0  | 0                                | 1     | 125% x 6MHz                   | 75Hz               |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 1   | 0  | 1                                | 0     | 141% x 6MHz                   | 85Hz               |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 1   | 0  | 1                                | 1     | 158% x 6MHz                   | 95Hz               |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 1   | 1  | 0                                | 0     | 183% x 6MHz                   | 110Hz              |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 1   | 1  | 0                                | 1     | 191% x 6MHz                   | 115Hz              |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 1   | 1  | 1                                | 0     | 200% x 6MHz                   | 120Hz              |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| 1   | 1  | 1                                | 1     | 217% x 6MHz                   | 130Hz              |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Restrictions                              | If EXTC is high or enable SETEXTC command (even EXTC = low) can enable this command  |                                  |       |                               |                    |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Register Availability                     | <table border="1" style="width: 100%;"> <thead> <tr> <th>Status</th><th>Availability</th></tr> </thead> <tbody> <tr><td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr><td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr><td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr><td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr><td>Sleep In or Booster Off</td><td>Yes</td></tr> </tbody> </table>  |                                  |       |                               |                    |    |    |    |             |    |    |        |     | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes  | Normal Mode On, Idle Mode On, Sleep Out | Yes                        | Partial Mode On, Idle Mode Off, Sleep Out | Yes  | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes  |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Status                                    | Availability   |                                  |       |                               |                    |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes  |                                  |       |                               |                    |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes  |                                  |       |                               |                    |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes  |                                  |       |                               |                    |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes  |                                  |       |                               |                    |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Sleep In or Booster Off                   | Yes  |                                  |       |                               |                    |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Default                                   | <table border="1" style="width: 100%;"> <thead> <tr> <th>Status</th><th>Default Value</th></tr> </thead> <tbody> <tr><td>Power On Sequence</td><td>OSC_EN=0, N_RADJ[2:0]=4'b0100,<br/>I_RADJ[2:0]=4'b0011.</td></tr> <tr><td>S/W Reset</td><td>OSC_EN=0, others no change</td></tr> <tr><td>H/W Reset</td><td>OSC_EN=0, N_RADJ[2:0]=4'b0100,<br/>I_RADJ[2:0]=4'b0011.</td></tr> </tbody> </table>  |                                  |       |                               |                    |    |    |    |             |    |    |        |     | Status | Default Value | Power On Sequence                        | OSC_EN=0, N_RADJ[2:0]=4'b0100,<br>I_RADJ[2:0]=4'b0011. | S/W Reset                               | OSC_EN=0, others no change | H/W Reset                                 | OSC_EN=0, N_RADJ[2:0]=4'b0100,<br>I_RADJ[2:0]=4'b0011. |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Status                                    | Default Value  |                                  |       |                               |                    |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Power On Sequence                         | OSC_EN=0, N_RADJ[2:0]=4'b0100,<br>I_RADJ[2:0]=4'b0011.   |                                  |       |                               |                    |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| S/W Reset                                 | OSC_EN=0, others no change   |                                  |       |                               |                    |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| H/W Reset                                 | OSC_EN=0, N_RADJ[2:0]=4'b0100,<br>I_RADJ[2:0]=4'b0011.   |                                  |       |                               |                    |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |
| Flow Chart                                | -  |                                  |       |                               |                    |    |    |    |             |    |    |        |     |        |               |  |  |   |                            |   |  |  |     |                         |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |            |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |      |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |   |   |   |   |             |       |

### 8.2.38 SETPOWER: set power (B1h)

| <b>B1 H</b>               |     | SETPOWER (Set Power ) |     |       |          |    |           |    |    |    |         |          |      |    |
|---------------------------|-----|-----------------------|-----|-------|----------|----|-----------|----|----|----|---------|----------|------|----|
|                           | DNC | NWR                   | NRD | D17-8 | D7       | D6 | D5        | D4 | D3 | D2 | D1      | D0       | HE X |    |
| Command                   | 0   | ↑                     | 1   | -     | 1        | 0  | 1         | 1  | 0  | 0  | 0       | 1        |      | B1 |
| 1 <sup>st</sup> parameter | 1   | ↑                     | 1   | -     | -        | -  | -         | -  | -  | -  | DP_STB  | DP_STB_S |      | 00 |
| 2 <sup>nd</sup> parameter | 1   | ↑                     | 1   | -     | -        | -  | -         | -  | -  | -  | BT[2:0] |          |      | 00 |
| 3 <sup>rd</sup> parameter | 1   | ↑                     | 1   | -     | -        | -  | VRH[5:0]  |    |    |    |         |          |      | 1A |
| 4 <sup>th</sup> parameter | 1   | ↑                     | 1   | -     | -        | -  | NVRH[5:0] |    |    |    |         |          |      | 1A |
| 5 <sup>th</sup> parameter | 1   | ↑                     | 1   | -     | -        | -  | -         | -  | -  | -  | AP[2:0] |          |      | 03 |
| 6 <sup>th</sup> parameter | 1   | ↑                     | 1   | -     | FS0[7:0] |    |           |    |    |    |         |          |      | 01 |
| 7 <sup>th</sup> parameter | 1   | ↑                     | 1   | -     | FS1[7:0] |    |           |    |    |    |         |          |      | 11 |

**DP\_STB, DP\_STB\_S :** These two bits can let the driver into the deep standby mode. And when into deep standby, all display operation stops, including the internal R-C oscillator. In the deep standby mode, the GRAM data and register content are not retained.

**BT[2:0]:** Switch the output factor of step-up circuit 2 for VGH and VGL voltage generation. The LCD drive voltage level can be selected according to the characteristic of liquid crystal which panel used. Lower amplification of the step-up circuit consumes less current and then the power consumption can be reduced.

| BT2 | BT1 | BT0 | VSP  | VSN   | VGH   | VGL    |
|-----|-----|-----|------|-------|-------|--------|
| 0   | 0   | 0   | 5.0V | -5.0V | 14.8V | -12.5V |
| 0   | 0   | 1   | 5.0V | -5.0V | 14.8V | -10.1V |
| 0   | 1   | 0   | 5.0V | -5.0V | 14.8V | -7.5V  |
| 0   | 1   | 1   | 5.0V | -5.0V | 12.5V | -12.5V |
| 1   | 0   | 0   | 5.0V | -5.0V | 12.5V | -10.1V |
| 1   | 0   | 1   | 5.0V | -5.0V | 12.5V | -7.5V  |
| 1   | 1   | 0   | 5.0V | -5.0V | 10.0V | -10.1V |
| 1   | 1   | 1   | 5.0V | -5.0V | 10.0V | -7.5V  |

**Note:** When VCI = 2.8V, TRI=0, @ IVGH=50uA, IVGL=-50uA

**VRH[5:0]:** Specify the VSPROUT voltage adjusting. VSPROUT voltage is for gamma voltage setting. VSPROUT=Decimal(VRH[5:0])x0.05+3.3. The default value is 1Bh(27x0.05+3.3=4.65V)

| VRH5 | VRH4 | VRH3 | VRH2 | VRH1 | VRH0 | VSPROUT (TRI=0)  |
|------|------|------|------|------|------|--|
| 0    | 0    | 0    | 0    | 0    | 0    | 3.30   |
| 0    | 0    | 0    | 0    | 0    | 1    | 3.35   |
| 0    | 0    | 0    | 0    | 1    | 0    | 3.40   |
| 0    | 0    | 0    | 0    | 1    | 1    | 3.45   |
| 0    | 0    | 0    | 1    | 0    | 0    | 3.50   |
| 0    | 0    | 0    | 1    | 0    | 1    | 3.55   |
| 0    | 0    | 0    | 1    | 1    | 0    | 3.60   |
| 0    | 0    | 0    | 1    | 1    | 1    | 3.65   |
| :    | :    | :    | :    | :    | :    | :  |
| 0    | 1    | 1    | 0    | 0    | 1    | 4.55   |
| 0    | 1    | 1    | 0    | 1    | 0    | 4.6  |
| 0    | 1    | 1    | 0    | 1    | 1    | STOP   |
| 0    | 1    | 1    | 1    | 0    | 0    | STOP   |
| :    | :    | :    | :    | :    | :    | :  |
| 1    | 1    | 1    | 1    | 0    | 1    | STOP   |
| 1    | 1    | 1    | 1    | 1    | 0    | STOP   |
| 1    | 1    | 1    | 1    | 1    | 1    | Internal circuit operations stop. The gamma voltage can be adjusted from external VSPROUT input. |

**Note :** Please make sure VSPROUT=VSP-0.2V

**NVRH[5:0]:** Specify the VSNR voltage adjusting. VSNR voltage is for gamma voltage setting. VSNR=Decimal(-3.3-nVRH[5:0])x0.05. The default value is 1Bh (-3.3-27x0.05= -4.65V)

| NVRH5 | NVRH4 | NVRH3 | NVRH2 | NVRH1 | NVRH0 | VSNROUT (TRI=0)   |
|-------|-------|-------|-------|-------|-------|---|
| 0     | 0     | 0     | 0     | 0     | 0     | -3.30   |
| 0     | 0     | 0     | 0     | 0     | 1     | -3.35   |
| 0     | 0     | 0     | 0     | 1     | 0     | -3.40   |
| 0     | 0     | 0     | 0     | 1     | 1     | -3.45   |
| 0     | 0     | 0     | 1     | 0     | 0     | -3.50   |
| 0     | 0     | 0     | 1     | 0     | 1     | -3.55   |
| 0     | 0     | 0     | 1     | 1     | 0     | -3.60   |
| 0     | 0     | 0     | 1     | 1     | 1     | -3.65   |
| :     | :     | :     | :     | :     | :     | :   |
| 0     | 1     | 1     | 0     | 0     | 1     | -4.55   |
| 0     | 1     | 1     | 0     | 1     | 0     | -4.6  |
| 0     | 1     | 1     | 0     | 1     | 1     | STOP  |
| 0     | 1     | 1     | 1     | 0     | 0     | STOP  |
| :     | :     | :     | :     | :     | :     | :   |
| 1     | 1     | 1     | 1     | 0     | 1     | STOP  |
| 1     | 1     | 1     | 1     | 1     | 0     | STOP  |
| 1     | 1     | 1     | 1     | 1     | 1     | Internal circuit operations stop. The gamma voltage can be adjusted from external VSNR input. |

**Note :** Please make sure VSNR=VSN+0.2V

**AP[2:0]:** Adjust the amount of current driving for the operational amplifier in the power supply circuit. When the amount of fixed current is increased, the LCD driving capacity and the display quality are high, but the current consumption is increased. Adjust the fixed current by considering both the display quality and the current consumption.

| AP2 | AP1 | AP0 | Constant Current of Operational Amplifier    |
|-----|-----|-----|--|
| 0   | 0   | 0   | Operation of the operational amplifier stops |
| 0   | 0   | 1   | Small  |
| 0   | 1   | 0   | Small  |
| 0   | 1   | 1   | Small  |
| 1   | 0   | 0   | Medium                                       |
| 1   | 0   | 1   | Medium High                                  |
| 1   | 1   | 0   | Large  |
| 1   | 1   | 1   | Small  |

**FS0[7:0]:** Set the operating frequency for VSP and VSN voltage generation.

| FS07 | FS06 | FS05 | FS04 | FS03 | FS02 | FS01 | FS00 | Operation Frequency for VSP and VSN |
|------|------|------|------|------|------|------|------|-------------------------------------|
| 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | fosc/1                              |
| 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | fosc/1                              |
| 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | fosc/2                              |
| 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | fosc/3                              |
| :    | :    | :    | :    | :    | :    | :    | :    | :                                   |
| 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | fosc/254                            |
| 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | fosc/255                            |

**FS1[7:0]:** Set the operating frequency for VGH and VGL voltage generation.

| FS17 | FS16 | FS15 | FS14 | FS13 | FS12 | FS11 | FS10 | Operation Frequency for VGH and VGL |
|------|------|------|------|------|------|------|------|-------------------------------------|
| 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | fosc/1                              |
| 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | fosc/1                              |
| 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | fosc/2                              |
| 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | fosc/3                              |
| :    | :    | :    | :    | :    | :    | :    | :    | :                                   |
| 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | fosc/254                            |
| 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | fosc/255                            |

**Note:** Ensure that the operation frequency of FS1  $\geq$  FS0.

|                       |   |   |
|-----------------------|---|---|
| Restrictions          | If EXTC is high or enable SETEXTC command (even EXTC = low) can enable this command |   |
| Register Availability | Status  | Availability  |
|                       | Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |
|                       | Normal Mode On, Idle Mode On, Sleep Out   | Yes   |
|                       | Partial Mode On, Idle Mode Off, Sleep Out   | Yes   |
|                       | Partial Mode On, Idle Mode On, Sleep Out  | Yes   |
|                       | Sleep In or Booster Off   | Yes   |
| Default               | Status  | Default Value   |
|                       | Power On Sequence   | DP_STB=0, DP_STB_S=0, BT[2:0]=100, VRH[5:0]=6'h1B, NVRH[5:0]=6'h1B, AP[2:0]=011, FS0[7:0]=8'h40, FS1[7:0]=8'h08, GASEN=1, VCOMG=0, PON=0, DK=1, XDK=0, TRI=0, STB=1 |
|                       | S/W Reset   | VCOMG=0, PON=0, DK=1, STB=1, othes no change  |
| Flow Chart            | H/W Reset   | DP_STB=0, DP_STB_S=0, BT[2:0]=100, VRH[5:0]=6'h1B, NVRH[5:0]=6'h1B, AP[2:0]=011, FS0[7:0]=8'h40, FS1[7:0]=8'h08, GASEN=1, VCOMG=0, PON=0, DK=1, XDK=0, TRI=0, STB=1 |
|                       | -   |   |

### 8.2.39 SETDISPLAY: set display related register (B2h)

| B2H   | SETDISPLAY( Set Display Control )  |                             |                             |                             |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
|---|--|-----------------------------|-----------------------------|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-----|------|----------------------------------|-----|---------------------|-----------------------------|-----------------------------|--------------|---|------|--------------|------|---|----------------------------|------|-----------|-----------|--------------|---|------------------|---------|---------|---|---|---------|---------|---------|--|----------|----------|-------------|--|--|-------------|--|--|-------------|--|--|-----------------------------|------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-----|------|-----------------------------|------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--|--|
|   | DNC  | NWR                         | NRD                         | D17-8                       | D7          | D6          | D5          | D4          | D3          | D2          | D1          | D0  | HEX  |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| Command   | 0  | ↑                           | 1                           | -                           | 1           | 0           | 1           | 1           | 0           | 0           | 1           | 0   | B2   |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| 1 <sup>st</sup> parameter   | 1  | ↑                           | 1                           | -                           | -           | -           | -           | -           | ISC[3:0]    |             |             | 01  |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| 2 <sup>nd</sup> parameter   | 1  | ↑                           | 1                           | -                           | PT[1:0]     |             | -           | -           | -           | -           | PTG         | REF | 83   |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| 3 <sup>rd</sup> parameter   | 1  | ↑                           | 1                           | -                           | -           | -           | GON         | DTE         | D[1:0]      |             | -           | -   | 20   |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
|   | This command is used to set display related register   |                             |                             |                             |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
|   | <p><b>D[1:0]:</b> When D1 = '1', display is on; when D1 = '0', display is off. When display is off, the display data is retained in the GRAM and the entire source outputs are set to the VSSD level.</p> <p>When D[1:0]= '01', the internal display of the HX8353-E is performed although the actual display is off. When D[1:0]= '00', the internal display operation halts and the display is off.</p> <table border="1"> <thead> <tr> <th>D1</th> <th>D0</th> <th>Source Output</th> <th>Internal Display Operations</th> <th>Gate-Driver Control Signals</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>VSSD</td> <td>Halt</td> <td>Halt</td> </tr> <tr> <td>0</td> <td>1</td> <td>VSSD</td> <td>Operate</td> <td>Operate</td> </tr> <tr> <td>1</td> <td>0</td> <td>=PT(0,0)</td> <td>Operate</td> <td>Operate</td> </tr> <tr> <td>1</td> <td>1</td> <td>Display</td> <td>Operate</td> <td>Operate</td> </tr> </tbody> </table>   |                             |                             |                             |             |             |             |             |             |             |             |     |      | D1                               | D0  | Source Output       | Internal Display Operations | Gate-Driver Control Signals | 0            | 0 | VSSD | Halt         | Halt | 0 | 1                          | VSSD | Operate   | Operate   | 1            | 0 | =PT(0,0)         | Operate | Operate | 1 | 1 | Display | Operate | Operate |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| D1  | D0   | Source Output               | Internal Display Operations | Gate-Driver Control Signals |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| 0   | 0  | VSSD                        | Halt                        | Halt                        |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| 0   | 1  | VSSD                        | Operate                     | Operate                     |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| 1   | 0  | =PT(0,0)                    | Operate                     | Operate                     |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| 1   | 1  | Display                     | Operate                     | Operate                     |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
|   | <b>GON, DTE:</b>   |                             |                             |                             |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
|   | <table border="1"> <thead> <tr> <th>GON</th> <th>DTE</th> <th>Gate Output</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>x</td> <td>Fixed to VGH</td> </tr> <tr> <td>1</td> <td>0</td> <td>Fixed to VGL</td> </tr> <tr> <td>1</td> <td>1</td> <td>Normal Operation (VGH/VGL)</td> </tr> </tbody> </table>   |                             |                             |                             |             |             |             |             |             |             |             |     |      | GON                              | DTE | Gate Output         | 0                           | x                           | Fixed to VGH | 1 | 0    | Fixed to VGL | 1    | 1 | Normal Operation (VGH/VGL) |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| GON   | DTE  | Gate Output                 |                             |                             |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| 0   | x  | Fixed to VGH                |                             |                             |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| 1   | 0  | Fixed to VGL                |                             |                             |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| 1   | 1  | Normal Operation (VGH/VGL)  |                             |                             |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
|   | <b>PT[1:0] :</b> Specify the Non-display area source output in partial display mode.   |                             |                             |                             |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| Description   | <table border="1"> <thead> <tr> <th colspan="2"></th> <th colspan="11">Source Output Level</th> </tr> <tr> <th rowspan="3">REV_Panel</th> <th rowspan="3">GRAM Data</th> <th colspan="2">Display area</th> <th colspan="9">Non-display Area</th> </tr> <tr> <th>Positive</th> <th>Negative</th> <th colspan="3">PT1-0=(0,*)</th> <th colspan="3">PT1-0=(1,0)</th> <th colspan="3">PT1-0=(1,1)</th> </tr> </thead> <tbody> <tr> <td>1<br/>(Normally Black Panel)</td> <td>18'h00000<br/>18'h3FFFF</td> <td>V63P<br/>V0P</td> <td>V0N<br/>V63N</td> <td>V63P<br/>V0P</td> <td>V0N<br/>V63N</td> <td>V63P<br/>V0P</td> <td>V0N<br/>V63N</td> <td>V63P<br/>V0P</td> <td>V0N<br/>V63N</td> <td>GND</td> <td>Hi-z</td> </tr> <tr> <td>0<br/>(Normally White Panel)</td> <td>18'h00000<br/>18'h3FFFF</td> <td>V63P<br/>V0P</td> <td>V0N<br/>V63N</td> <td>V63P<br/>V0P</td> <td>V0N<br/>V63N</td> <td>V63P<br/>V0P</td> <td>V0N<br/>V63N</td> <td>V63P<br/>V0P</td> <td>V0N<br/>V63N</td> <td></td> <td></td> </tr> </tbody> </table> |                             |                             |                             |             |             |             |             |             |             |             |     |      |                                  |     | Source Output Level |                             |                             |              |   |      |              |      |   |                            |      | REV_Panel | GRAM Data | Display area |   | Non-display Area |         |         |   |   |         |         |         |  | Positive | Negative | PT1-0=(0,*) |  |  | PT1-0=(1,0) |  |  | PT1-0=(1,1) |  |  | 1<br>(Normally Black Panel) | 18'h00000<br>18'h3FFFF | V63P<br>V0P | V0N<br>V63N | V63P<br>V0P | V0N<br>V63N | V63P<br>V0P | V0N<br>V63N | V63P<br>V0P | V0N<br>V63N | GND | Hi-z | 0<br>(Normally White Panel) | 18'h00000<br>18'h3FFFF | V63P<br>V0P | V0N<br>V63N | V63P<br>V0P | V0N<br>V63N | V63P<br>V0P | V0N<br>V63N | V63P<br>V0P | V0N<br>V63N |  |  |
|   |  | Source Output Level         |                             |                             |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| REV_Panel   | GRAM Data  | Display area                |                             | Non-display Area            |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
|   |  | Positive                    | Negative                    | PT1-0=(0,*)                 |             |             | PT1-0=(1,0) |             |             | PT1-0=(1,1) |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
|   |  | 1<br>(Normally Black Panel) | 18'h00000<br>18'h3FFFF      | V63P<br>V0P                 | V0N<br>V63N | V63P<br>V0P | V0N<br>V63N | V63P<br>V0P | V0N<br>V63N | V63P<br>V0P | V0N<br>V63N | GND | Hi-z |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| 0<br>(Normally White Panel)   | 18'h00000<br>18'h3FFFF   | V63P<br>V0P                 | V0N<br>V63N                 | V63P<br>V0P                 | V0N<br>V63N | V63P<br>V0P | V0N<br>V63N | V63P<br>V0P | V0N<br>V63N |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| <p><b>REF:</b> Refresh display in non-display area in Partial mode enable bit.</p> <p>REF = '0': Refresh display operation is disabling.</p> <p>REF = '1': Refresh display operation is enable.</p> <p><b>PTG:</b> Specify the scan mode of gate driver in non-display area.</p> <table border="1"> <thead> <tr> <th>PTG</th> <th>Gate Outputs in Non-display Area</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Normal Drive</td> </tr> <tr> <td>1</td> <td>Fixed VGL</td> </tr> </tbody> </table> |  |                             |                             |                             |             |             |             |             |             |             |             |     | PTG  | Gate Outputs in Non-display Area | 0   | Normal Drive        | 1                           | Fixed VGL                   |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| PTG   | Gate Outputs in Non-display Area   |                             |                             |                             |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| 0   | Normal Drive   |                             |                             |                             |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |
| 1   | Fixed VGL  |                             |                             |                             |             |             |             |             |             |             |             |     |      |                                  |     |                     |                             |                             |              |   |      |              |      |   |                            |      |           |           |              |   |                  |         |         |   |   |         |         |         |  |          |          |             |  |  |             |  |  |             |  |  |                             |                        |             |             |             |             |             |             |             |             |     |      |                             |                        |             |             |             |             |             |             |             |             |  |  |

**ISC[3:0]:** Specify the scan cycle of gate driver when REF = '1' in non-display area. Then scan cycle is set to Decimal(ISC[3:0])x4+1. The polarity is inverted every scan cycle.

| ISC3 | ISC2 | ISC1 | ISC0 | Scan Cycle        | f <sub>FLM</sub> = 60Hz |
|------|------|------|------|-------------------|-------------------------|
| 0    | 0    | 0    | 0    | 1 frame           | 17ms                    |
| 0    | 0    | 0    | 1    | 5 frames          | 83ms                    |
| 0    | 0    | 1    | 0    | 9 frames          | 150ms                   |
| 0    | 0    | 1    | 1    | 13 frames         | 217ms                   |
| 0    | 1    | 0    | 0    | 17 frames         | 283ms                   |
| 0    | 1    | 0    | 1    | 21 frames         | 350ms                   |
| 0    | 1    | 1    | 0    | 25 frames         | 417ms                   |
| 0    | 1    | 1    | 1    | 29 frames         | 483ms                   |
| 1    | 0    | 0    | 0    | 33 frames         | 550ms                   |
| 1    | 0    | 0    | 1    | 37 frames         | 616ms                   |
| 1    | 0    | 1    | 0    | 41 frames         | 683ms                   |
| 1    | 0    | 1    | 1    | 45 frames         | 750ms                   |
| 1    | 1    | 0    | 0    | 49 frames         | 816ms                   |
| 1    | 1    | 0    | 1    | 53 frames         | 883ms                   |
| 1    | 1    | 1    | 0    | 57 frames         | 950ms                   |
| 1    | 1    | 1    | 1    | Setting inhibited |                         |

**Restrictions** If EXTC is high or enable SETEXTC command (even EXTC = low) can enable this command

| Register Availability | Status                                    | Availability |
|-----------------------|---|--------------|
|                       | Normal Mode On, Idle Mode Off, Sleep Out  | Yes          |
|                       | Normal Mode On, Idle Mode On, Sleep Out   | Yes          |
|                       | Partial Mode On, Idle Mode Off, Sleep Out | Yes          |
|                       | Partial Mode On, Idle Mode On, Sleep Out  | Yes          |
|                       | Sleep In or Booster Off                   | Yes          |

| Default | Status            | Default Value   |
|---------|-------------------|---|
|         | Power On Sequence | D[1:0]=2'b00, GON=1, DTE=0, PT[1:0]=2'b10, REF=1, PTG=1, ISC[3:0]=4'b0001, NL[5:0]=6'h27, SCN[6:0]=7'h00. |
|         | S/W Reset         | D[1:0]=2'b00, GON=1, DTE=0, others no change  |
|         | H/W Reset         | D[1:0]=2'b00, GON=1, DTE=0, PT[1:0]=2'b10, REF=1, PTG=1, ISC[3:0]=4'b0001, NL[5:0]=6'h27, SCN[6:0]=7'h00. |

**Flow Chart** -

### 8.2.40 SETCYC: set display cycle register (B4h)

| B4 H                      | SETCYC ( Set display cycle ) |     |     |       |    |    |           |    |             |            |    |            |     |
|---------------------------|------------------------------|-----|-----|-------|----|----|-----------|----|-------------|------------|----|------------|-----|
|                           | DNC                          | NWR | NRD | D17-8 | D7 | D6 | D5        | D4 | D3          | D2         | D1 | D0         | HEX |
| Command                   | 0                            | ↑   | 1   | -     | 1  | 0  | 1         | 1  | 0           | 1          | 0  | 0          | B4  |
| 1 <sup>st</sup> parameter | 1                            | ↑   | 1   | -     | -  | -  | I_NW[1:0] | -  | -           | N_NW[1:0]  | -  | -          | 11  |
| 2 <sup>nd</sup> parameter | 1                            | ↑   | 1   | -     | -  | -  | -         | -  | -           | N_RTN[3:0] | -  | -          | 08  |
| 3 <sup>rd</sup> parameter | 1                            | ↑   | 1   | -     | -  | -  | -         | -  | -           | -          | -  | N_DIV[3:0] | 00  |
| 4 <sup>th</sup> parameter | 1                            | ↑   | 1   | -     | -  | -  | -         | -  | N_DUM[7:0]  | -          | -  | -          | 0C  |
| 5 <sup>th</sup> parameter | 1                            | ↑   | 1   | -     | -  | -  | -         | -  | I_DUM[7:0]  | -          | -  | -          | 0C  |
| 6 <sup>th</sup> parameter | 1                            | ↑   | 1   | -     | -  | -  | -         | -  | GDON[7:0]   | -          | -  | -          | 0D  |
| 7 <sup>th</sup> parameter | 1                            | ↑   | 1   | -     | -  | -  | -         | -  | GDOF[7:0]   | -          | -  | -          | 53  |
| 8 <sup>th</sup> parameter | 1                            | ↑   | 1   | -     | -  | -  | -         | -  | L_BASE[7:0] | -          | -  | -          | 59  |

**N\_NW[2:0]:** Specify LCD driving inversion type in Normal/ Partial mode.

**I\_NW[2:0]:** Specify LCD driving inversion type in Idle / Partial Idle mode.

| NW[1:0] | LCD driving Inversion Type |
|---------|----------------------------|
| 00      | Column inversion           |
| 01      | 1-dot inversion            |
| 10      | 2-dot inversion            |
| 11      | 4-dot inversion            |

**N\_RTN[3:0]:** Specify clock number of one line period in Normal / Partial mode for internal operation.

Clock cycles=1/internal operation clock frequency(fosc)

| RTN[3:0] | Clock number per Line |
|----------|-----------------------|
| 4'b0000  | 89                    |
| 4'b0001  | 90                    |
| 4'b0010  | 91                    |
| 4'b0011  | 92                    |
| 4'b0100  | 93                    |
| 4'b0101  | 94                    |
| 4'b0110  | 95                    |
| 4'b0111  | 96                    |
| 4'b1000  | 97                    |
| :        | :                     |
| 4'b1110  | 103                   |
| 4'b1111  | 104                   |

**N\_DIV[3:0]:** Specify the division ratio of internal clocks IN Normal / Partial mode for internal operation. When used internal clock for the display operation, frame frequency can be adjusted with the N\_RTN[3:0] bits (1H period clock cycle), N\_DIV[3:0], and N\_DUM[7:0] bits.

| DIV1 | DIV0 | Internal Display Operation Clock Frequency |
|------|------|--|
| 0    | 0    | fosc / 6                                   |
| 0    | 1    | fosc / 12                                  |
| 1    | 0    | fosc / 24                                  |
| 1    | 1    | fosc / 48                                  |

Note : fosc = R-C oscillation frequency

- N\_DUM[7:0]**: Specify dummy line number in blanking area of one frame in Normal / Partial mode for internal operation.
- I\_DUM[7:0]**: Specify dummy line number in blanking area of one frame in Idle (8-color) / Partial Idle mode for internal operation.

| DUM[7:0] | Line number in blanking period |
|----------|--------------------------------|
| 000d     | Setting Inhibited              |
| 001d     | Setting Inhibited              |
| 002d     | 2                              |
| 003d     | 3                              |
| 004d     | 4                              |
| :        | :                              |
| 190d     | 190                            |
| others   | Setting Inhibited              |

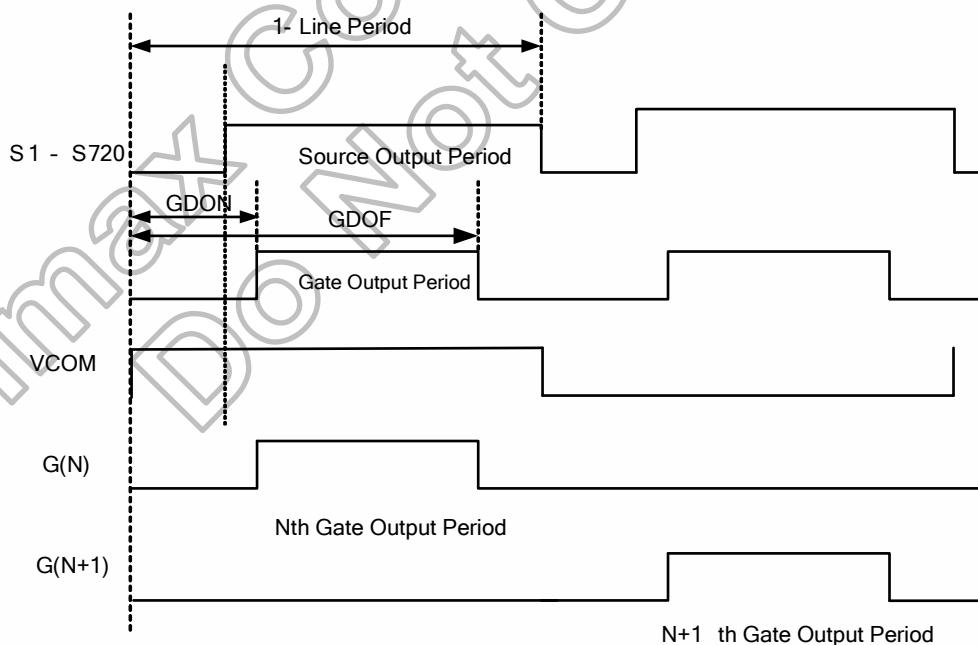
#### Formula for the Frame Frequency during internal display mode:

$$\text{Frame frequency} = \text{fosc} / (\text{RTN} \times \text{DIV} \times (162+\text{DUM})) \text{ [Hz]}$$

Fosc : RC oscillation frequency

**GDON[7:0]**: Specify the valid gate output start time in 1-line driving period. The period time value is defined as SYSCLK number in internal clock display mode. The period time value is defined as DOTCLK number in 18/16-bit bus width RGB display mode and is defined as DOTCLK/3 number in 6-bit bus width RGB display mode. (Please note that the setting "00h", "01h", "02h" is inhibited).

**GDOF[7:0]**: Specify the gate output end time in 1-line driving period. The period time value is defined as SYSCLK number in internal clock display mode. The period time value is defined as DOTCLK number in 18/16-bit bus width RGB display mode and is defined as DOTCLK/3 number in 6-bit bus width RGB display mode. (Please note that the  $\text{GDON}[7:0] + 1 \leq \text{GDOF}[7:0] \leq \text{RTN}-1$ ).



**L\_BASE[7:0]**: Basic line clock number. Internal line clock= $\text{L}_\text{BASE}[7:0] + \text{RTN}[3:0]$ .

**Restrictions** If EXTC is high or enable SETEXTC command (even EXTC = low) can enable this command

| Status                                    | Availability |
|---|--------------|
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes          |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes          |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes          |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes          |
| Sleep In or Booster Off                   | Yes          |

|            | Status            | Default Value  |
|------------|-------------------|--|
| Default    | Power On Sequence | I_NW[2:0]=3'b001, N_NW[2:0]=3'b001,<br>I_RTN[3:0]=4'b0000, N_RTN[3:0]=4'b0000,<br>N_DUM[7:0]=8'b00001100, I_DUM[7:0]=8'b00001100,<br>GDON[7:0]=8'b00001101, GDOF[7:0]=8'b01110000, |
|            | S/W Reset         | No change  |
|            | H/W Reset         | I_NW[2:0]=3'b001, N_NW[2:0]=3'b001,<br>I_RTN[3:0]=4'b0000, N_RTN[3:0]=4'b0000,<br>N_DUM[7:0]=8'b00001100, I_DUM[7:0]=8'b00001100,<br>GDON[7:0]=8'b00001101, GDOF[7:0]=8'b01110000, |
| Flow Chart | -                 |  |

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### 8.2.41 SETBGP: set internal reference voltage register (B5h)

| B5 H                      | SETBGP ( Set Reference Voltage) |     |     |       |            |                 |    |    |                |    |    |    |     |
|---------------------------|---------------------------------|-----|-----|-------|------------|-----------------|----|----|----------------|----|----|----|-----|
|                           | DNC                             | NWR | NRD | D17-8 | D7         | D6              | D5 | D4 | D3             | D2 | D1 | D0 | HEX |
| Command                   | 0                               | ↑   | 1   | -     | 1          | 0               | 1  | 1  | 0              | 1  | 0  | 1  | B5  |
| 1 <sup>st</sup> parameter | 1                               | ↑   | 1   | -     | NVREF[3:0] |                 |    |    | VREF[3:0]      |    |    |    | 77  |
| 2 <sup>nd</sup> parameter | 1                               | ↑   | 1   | -     | FBOFF      | VNVDHS_SEL[2:0] |    |    | VVDHS_SEL[2:0] |    |    | 33 |     |

This command is used to set internal reference Voltage.

**VREF[3:0]:** Positive reference voltage setting.

**NVREF[3:0]:** Negative reference voltage setting.

| VREF[3:0]/NVREF[3:0] | VREF voltage | NVREF voltage |
|----------------------|--------------|---------------|
| 4'b0000              | 4.1V         | -4.1V         |
| 4'b0001              | 4.2V         | -4.2V         |
| 4'b0010              | 4.3V         | -4.3V         |
| 4'b0011              | 4.4V         | -4.4V         |
| 4'b0100              | 4.45V        | -4.45V        |
| 4'b0101              | 4.5V         | -4.5V         |
| 4'b0110              | 4.55V        | -4.55V        |
| 4'b0111              | 4.6V         | -4.6V         |
| 4'b1000              | 4.65V        | -4.65V        |
| 4'b1001              | 4.7V         | -4.7V         |
| 4'b1010              | 4.75V        | -4.75V        |
| 4'b1011              | 4.8V         | -4.8V         |
| 4'b1100              | 4.85V        | -4.85V        |
| 4'b1101              | 4.9V         | -4.9V         |
| 4'b1110              | 4.95V        | -4.95V        |
| 4'b1111              | 5V           | -5V           |

Note: Ensure that VSP - 0.1  $\geq$  VREF and VSN + 0.1  $\leq$  NVREF.

**VVDHS\_SEL[2:0]:** VSP voltage setting

**VNVDHS\_SEL[2:0]:** VSN voltage setting

| VVDHS_SEL [2:0]/VNVDHS [2:0] | VSP voltage | VSN voltage |
|------------------------------|-------------|-------------|
| 4'b000                       | 4.463V      | -4.39V      |
| 4'b001                       | 4.539V      | -4.479V     |
| 4'b010                       | 4.617V      | -4.57V      |
| 4'b011                       | 4.699V      | -4.659V     |
| 4'b100                       | 4.782V      | -4.747V     |
| 4'b101                       | 4.867V      | -4.825V     |
| 4'b110                       | 4.954V      | -4.866V     |

|  |   |   |   |
|--|---|---|---|
|  | 4'b111                                    | 5.019V  | -4.867V   |
| <b>FBOFF:</b> Internal used, not open. |   |   |   |
| Restrictions                           | Must enable SETEXTC command               |   |   |
| Register Availability                  | Status                                    |   | Availability  |
|  | Normal Mode On, Idle Mode Off, Sleep Out  |   | Yes   |
|  | Normal Mode On, Idle Mode On, Sleep Out   |   | Yes   |
|  | Partial Mode On, Idle Mode Off, Sleep Out |   | Yes   |
|  | Partial Mode On, Idle Mode On, Sleep Out  |   | Yes   |
|  | Sleep In or Booster Off                   |   | Yes   |
| Default                                | Status                                    |   | Default Value   |
|  | Power On Sequence                         |   | NVREF[3:0]=0111, VREF[3:0]=0111,<br>VNVDHS_SEL[2:0]=011, VVDHS_SEL[2:0]=011,<br>FBOFF=0 |
|  | S/W Reset                                 |   | No change   |
| H/W Reset                              |   | NVREF[3:0]=0111, VREF[3:0]=0111,<br>VNVDHS_SEL[2:0]=011, VVDHS_SEL[2:0]=011,<br>FBOFF=0 |   |
| Flow Chart                             | -   |   |   |

### 8.2.42 SETCOM: set VCOM voltage related register (B6h)

| <b>B6 H</b>               |  | SETCOM ( Set VCOM Voltage) |   |       |                   |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
|---------------------------|--|----------------------------|---|-------|-------------------|----|--|----|-----------|----|----------------|----|-----|-----------|--|--|--|--|--|--|--------------|---|---|---|---|---|---|---|--------|---|---|---|---|---|---|---|--------|---|---|---|---|---|---|---|--------|---|---|---|---|---|---|---|--------|---|---|---|---|---|---|---|--------|---|--|--|--|--|--|--|---|---|--|--|--|--|--|--|---|---|---|---|---|---|---|---|--------|---|---|---|---|---|---|---|--------|---|---|---|---|---|---|---|--------|---|---|---|---|---|---|---|------|---|---|---|---|---|---|---|------|---|---|---|---|---|---|---|------|----------------|---------------------------|--------|----------------|-------|--------|--------|---------|--------|---------|--------|---------|
|                           | DNC  | NWR                        | NRD                                       | D17-8 | D7                | D6 | D5   | D4 | D3        | D2 | D1             | D0 | HEX |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| Command                   | 0  | ↑                          | 1   | -     | 1                 | 0  | 1  | 1  | 0         | 1  | 1              | 0  | B6  |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 1 <sup>st</sup> parameter | 1  | ↑                          | 1   | -     | -                 |    |  |    | VCOM[6:0] |    |                |    | 4B  |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 2 <sup>nd</sup> parameter | 1  | ↑                          | 1   | -     | -                 | -  | -  | -  | -         | -  | VCM_TIMES[2:0] |    | 00  |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| Description               | This command is used to set VCOM Voltage.<br><br><b>VCOM[6:0]:</b> DC VCOM voltage setting.<br><br><table border="1"> <thead> <tr> <th colspan="7">VCOM[6:0]</th> <th>VCOM Voltage</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>-2.500</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>-2.480</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>-2.460</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>-2.440</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>-2.420</td></tr> <tr><td colspan="7">:</td><td>:</td></tr> <tr><td colspan="7">:</td><td>:</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>-0.060</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>-0.040</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>-0.020</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>VSSA</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>VSSA</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>VSSA</td></tr> </tbody> </table><br><b>VCM_OTP_TIMES[2:0]:</b> Read VCOM OTP programmed times.<br><br><table border="1"> <thead> <tr> <th>VCM_TIMES[2:0]</th> <th>VCOM OTP programmed times</th> </tr> </thead> <tbody> <tr><td>3'b000</td><td>Not programmed</td></tr> <tr><td>3b001</td><td>1 time</td></tr> <tr><td>3'b010</td><td>2 times</td></tr> <tr><td>3'b011</td><td>3 times</td></tr> <tr><td>3'b100</td><td>4 times</td></tr> </tbody> </table> |                            |   |       |                   |    |  |    |           |    |                |    |     | VCOM[6:0] |  |  |  |  |  |  | VCOM Voltage | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -2.500 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | -2.480 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -2.460 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | -2.440 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | -2.420 | : |  |  |  |  |  |  | : | : |  |  |  |  |  |  | : | 1 | 1 | 1 | 1 | 0 | 1 | 0 | -0.060 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | -0.040 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | -0.020 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | VSSA | 1 | 1 | 1 | 1 | 1 | 1 | 0 | VSSA | 1 | 1 | 1 | 1 | 1 | 1 | 1 | VSSA | VCM_TIMES[2:0] | VCOM OTP programmed times | 3'b000 | Not programmed | 3b001 | 1 time | 3'b010 | 2 times | 3'b011 | 3 times | 3'b100 | 4 times |
| VCOM[6:0]                 |  |                            |   |       |                   |    | VCOM Voltage                                   |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 0                         | 0  | 0                          | 0   | 0     | 0                 | 0  | -2.500   |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 0                         | 0  | 0                          | 0   | 0     | 0                 | 1  | -2.480   |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 0                         | 0  | 0                          | 0   | 0     | 1                 | 0  | -2.460   |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 0                         | 0  | 0                          | 0   | 0     | 1                 | 1  | -2.440   |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 0                         | 0  | 0                          | 0   | 1     | 0                 | 0  | -2.420   |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| :                         |  |                            |   |       |                   |    | :  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| :                         |  |                            |   |       |                   |    | :  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 1                         | 1  | 1                          | 1   | 0     | 1                 | 0  | -0.060   |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 1                         | 1  | 1                          | 1   | 0     | 1                 | 1  | -0.040   |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 1                         | 1  | 1                          | 1   | 1     | 0                 | 0  | -0.020   |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 1                         | 1  | 1                          | 1   | 1     | 1                 | 0  | VSSA   |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 1                         | 1  | 1                          | 1   | 1     | 1                 | 0  | VSSA   |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 1                         | 1  | 1                          | 1   | 1     | 1                 | 1  | VSSA   |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| VCM_TIMES[2:0]            | VCOM OTP programmed times  |                            |   |       |                   |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 3'b000                    | Not programmed   |                            |   |       |                   |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 3b001                     | 1 time   |                            |   |       |                   |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 3'b010                    | 2 times  |                            |   |       |                   |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 3'b011                    | 3 times  |                            |   |       |                   |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| 3'b100                    | 4 times  |                            |   |       |                   |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| Restrictions              | If EXTC is high or enable SETEXTC command (even EXTC = low) can enable this command  |                            |   |       |                   |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| Register Availability     |  |                            | Status                                    |       | Availability      |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
|                           |  |                            | Normal Mode On, Idle Mode Off, Sleep Out  |       | Yes               |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
|                           |  |                            | Normal Mode On, Idle Mode On, Sleep Out   |       | Yes               |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
|                           |  |                            | Partial Mode On, Idle Mode Off, Sleep Out |       | Yes               |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
|                           |  |                            | Partial Mode On, Idle Mode On, Sleep Out  |       | Yes               |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| Default                   |  |                            | Sleep In or Booster Off                   |       | Yes               |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
|                           |  |                            |   |       | Status            |    | Default Value                                  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
|                           |  |                            |   |       | Power On Sequence |    | VCOM[6:0]=8'h4B,<br>VCOM_OTP_TIMES[2:0]=3'b000 |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
|                           |  |                            |   |       | S/W Reset         |    | No change                                      |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |
| Flow Chart                | -  |                            |   |       |                   |    |  |    |           |    |                |    |     |           |  |  |  |  |  |  |              |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |  |  |  |  |  |  |   |   |  |  |  |  |  |  |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |      |                |                           |        |                |       |        |        |         |        |         |        |         |

### 8.2.43 SETEXTC: enable extension command (B9h)

| B9 H      SETEXTC ( Set Extended Command Set)                   |   |     |     |       |   |    |    |              |            |    |    |    |     |  |  |  |  |  |  |
|---|---|-----|-----|-------|---|----|----|--------------|------------|----|----|----|-----|--|--|--|--|--|--|
|   | DNC                                       | NWR | NRD | D17-8 | D7  | D6 | D5 | D4           | D3         | D2 | D1 | D0 | HEX |  |  |  |  |  |  |
| Command   | 0   | ↑   | 1   | -     | 1   | 0  | 1  | 1            | 1          | 0  | 0  | 1  | B9  |  |  |  |  |  |  |
| 1 <sup>st</sup> parameter                                       | 1   | ↑   | 1   | -     |   |    |    |              | EXTC1[7:0] |    |    |    | 00  |  |  |  |  |  |  |
| 2 <sup>nd</sup> parameter                                       | 1   | ↑   | 1   | -     |   |    |    |              | EXTC2[7:0] |    |    |    | 00  |  |  |  |  |  |  |
| 3 <sup>rd</sup> parameter                                       | 1   | ↑   | 1   | -     |   |    |    |              | EXTC3[7:0] |    |    |    | 00  |  |  |  |  |  |  |
| This command is used to set extended command set access enable. |   |     |     |       |   |    |    |              |            |    |    |    |     |  |  |  |  |  |  |
| Description   | Extend cmd                                |     |     |       | Command description   |    |    |              |            |    |    |    |     |  |  |  |  |  |  |
|   | Enable                                    |     |     |       | After command (B9h), must write 3 parameters (FFh,83h,53h) by order                                       |    |    |              |            |    |    |    |     |  |  |  |  |  |  |
|   | Disable(default)                          |     |     |       | After command(B9h), write 3 parameters (xxh,xxh,xxh) any value is all right, but can not be (FFh,83h,53h) |    |    |              |            |    |    |    |     |  |  |  |  |  |  |
| Restrictions  | -   |     |     |       |   |    |    |              |            |    |    |    |     |  |  |  |  |  |  |
| Register Availability   | Status                                    |     |     |       |   |    |    | Availability |            |    |    |    |     |  |  |  |  |  |  |
|   | Normal Mode On, Idle Mode Off, Sleep Out  |     |     |       |   |    |    | Yes          |            |    |    |    |     |  |  |  |  |  |  |
|   | Normal Mode On, Idle Mode On, Sleep Out   |     |     |       |   |    |    | Yes          |            |    |    |    |     |  |  |  |  |  |  |
|   | Partial Mode On, Idle Mode Off, Sleep Out |     |     |       |   |    |    | Yes          |            |    |    |    |     |  |  |  |  |  |  |
|   | Partial Mode On, Idle Mode On, Sleep Out  |     |     |       |   |    |    | Yes          |            |    |    |    |     |  |  |  |  |  |  |
| Default   | Sleep In or Booster Off                   |     |     |       |   |    |    | Yes          |            |    |    |    |     |  |  |  |  |  |  |
|   | Status                                    |     |     |       | Default Value   |    |    |              |            |    |    |    |     |  |  |  |  |  |  |
|   | Power On Sequence                         |     |     |       | EXTC1[7:0]=8'h00, EXTC2[7:0]=8'h00, EXTC3[7:0]=8'h00  |    |    |              |            |    |    |    |     |  |  |  |  |  |  |
|   | S/W Reset                                 |     |     |       | No change   |    |    |              |            |    |    |    |     |  |  |  |  |  |  |
| Flow Chart  |   | -   |     |       |   |    |    |              |            |    |    |    |     |  |  |  |  |  |  |

### 8.2.44 SETOTP: set OTP setting (BBh)

| BB H                                      | SETOTP ( Set OTP related setting)   |  |  |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |
|---|---|--|--|-------|----------------|--------|---------|---------|---------------|---------|----------|----|-----|--------|--------------|--|-----|---|-----|---|-----|--|-----|-------------------------|-----|
|   | DNC   | NWR  | NRD  | D17-8 | D7             | D6     | D5      | D4      | D3            | D2      | D1       | D0 | HEX |        |              |  |     |   |     |   |     |  |     |                         |     |
| Command                                   | 0   | ↑  | 1  | -     | 1              | 0      | 1       | 1       | 1             | 0       | 1        | 1  | BB  |        |              |  |     |   |     |   |     |  |     |                         |     |
| 1 <sup>st</sup> parameter                 | 1   | ↑  | 1  | -     | OTP_KEY[7:0]   |        |         |         |               |         |          |    | 00  |        |              |  |     |   |     |   |     |  |     |                         |     |
| 2 <sup>nd</sup> parameter                 | 1   | ↑  | 1  | -     | OTP_MASK[7:0]  |        |         |         |               |         |          |    | 00  |        |              |  |     |   |     |   |     |  |     |                         |     |
| 3 <sup>rd</sup> parameter                 | 1   | ↑  | 1  | -     | OTP_INDEX[7:0] |        |         |         |               |         |          |    | 00  |        |              |  |     |   |     |   |     |  |     |                         |     |
| 4 <sup>th</sup> parameter                 | 1   | ↑  | 1  | -     | LOA_D_DI_SABLE | VPP_EN | OTP_POR | OTP_PWE | OTP_PTMM[1:0] | VPP_SEL | OTP_PROG |    | 00  |        |              |  |     |   |     |   |     |  |     |                         |     |
| 5 <sup>th</sup> parameter                 | 1   | 1  | ↑  | -     | OTPDOUT[7:0]   |        |         |         |               |         |          |    | FF  |        |              |  |     |   |     |   |     |  |     |                         |     |
| Description                               | <p>This command is used to set the OTP related setting.</p> <p><b>OTP_KEY[7:0]:</b> "AAh" OTP register access enable and other registers access disable.<br/>"55h" OTP register access disable and other registers access enable.</p> <p><b>OTP_MASK[7:0]:</b> Bit programming mask. If "1", means don't programming this bit.</p> <p><b>OTP_INDEX[7:0]:</b> Set index of OTP to be programmed.</p> <p><b>LOAD_DIS:</b> When written to "1", OTP load disable.</p> <p><b>VPP_EN:</b> When written to "1", OTP power OP is enable.</p> <p><b>OTP_POR:</b> for OTP read control. When set to from "0" to "1", OTP data can be read the related OTP index at OTP_DOUT[7:0].</p> <p><b>OTP_PROG :</b> When this bit set to "1", it will programmed to the setting OTP index from related register value.</p> <p><b>OTP_PWE :</b> Internal use, not open.</p> <p><b>OTP_PTMM[1:0] :</b> Internal use, not open.</p> <p><b>VPP_SEL :</b> When set to '1', VPP input voltage is fed to OTP.</p> <p><b>OTP_DOUT[7:0] :</b> OTP read data.</p> |  |  |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |
| Restrictions                              | If EXTC is high or enable SETEXTC command (even EXTC = low) can enable this command   |  |  |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table>   |  |  |       |                |        |         |         |               |         |          |    |     | Status | Availability | Normal Mode On, Idle Mode Off, Sleep Out | Yes | Normal Mode On, Idle Mode On, Sleep Out | Yes | Partial Mode On, Idle Mode Off, Sleep Out | Yes | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |  |  |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |  |  |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |  |  |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |  |  |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |  |  |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |  |  |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |
| Default                                   | Status  |  | Default Value  |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |
|   | Power On Sequence   |  | OTP_MASK[7:0]=8'h00, OTP_INDEX[7:0]=8'h00,<br>OTP_LOAD_DISABLE=0, DCCLK_DISABLE=0, OTP_POR=0,<br>OTP_PWE=0, OTP_EN=0, OTPTEST_EN=0, VPP_SEL=0,<br>OTP_PROG=0, OTP_PTMM[1:0]=2'b00,<br>OTP_VRADJ[1:0]=2'b00 |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |
|   | S/W Reset   |  | OTP_MASK[7:0]=8'h00, OTP_INDEX[7:0]=8'h00,<br>OTP_LOAD_DISABLE=0, DCCLK_DISABLE=0, OTP_POR=0,<br>OTP_PWE=0, OTP_EN=0, OTPTEST_EN=0, VPP_SEL=0,<br>OTP_PROG=0, OTP_PTMM[1:0]=2'b00,<br>OTP_VRADJ[1:0]=2'b00 |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |
| H/W Reset                                 |   | OTP_MASK[7:0]=8'h00, OTP_INDEX[7:0]=8'h00,<br>OTP_LOAD_DISABLE=0, DCCLK_DISABLE=0, OTP_POR=0,<br>OTP_PWE=0, OTP_EN=0, OTPTEST_EN=0, VPP_SEL=0,<br>OTP_PROG=0, OTP_PTMM[1:0]=2'b00,<br>OTP_VRADJ[1:0]=2'b00 |  |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |
| Flow Chart                                | -   |  |  |       |                |        |         |         |               |         |          |    |     |        |              |  |     |   |     |   |     |  |     |                         |     |

### 8.2.45 SETSTBA: set Source option related register (C0h)

| C0 H                      | SETSTBA ( Set Source Option)  |        |        |                       |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
|---------------------------|---|--------|--------|-----------------------|-----------------------|----|----|----|----|----|----|----|-----------|---------------------------|---------------------|--------|-------------------|--------|-----------------------|-------|---------------|---|---|-------|-----------------|---|---|---|---|---|----|---|---|---|---|---|----|---|---|---|---|---|----|---|---|---|---|---|----|---|---|---|---|---|----|---|---|---|---|---|----|---|---|---|---|---|----|---|---|---|---|---|----|-------|-------|-------|-------|-----------------------|---|---|---|---|-------|---|---|---|---|--------------|---|---|---|---|--------|---|---|---|---|--------------|---|---|---|---|-------|
|                           | DNC   | NWR    | NRD    | D17-8                 | D7                    | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX       |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| Command                   | 0   | ↑      | 1      | -                     | 1                     | 1  | 0  | 0  | 0  | 0  | 0  | 0  | C0        |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 1 <sup>st</sup> parameter | 1   | ↑      | 1      | -                     | N_OPON[7:0]           |    |    |    |    |    |    |    | 20        |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 2 <sup>nd</sup> parameter | 1   | ↑      | 1      | -                     | I_OPON[7:0]           |    |    |    |    |    |    |    | 10        |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 3 <sup>rd</sup> parameter | 1   | ↑      | 1      | -                     | STBA[15:8]            |    |    |    |    |    |    |    | 0C        |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 4 <sup>th</sup> parameter | 1   | ↑      | 1      | -                     | STBA[7:0]             |    |    |    |    |    |    |    | C7        |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 5 <sup>th</sup> parameter | 1   | ↑      | 1      | -                     | GENON[7:0]            |    |    |    |    |    |    |    | 10        |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 6 <sup>th</sup> parameter | 1   | ↑      | 1      | -                     | -                     | -  | -  | -  | -  | -  | -  | -  | OTPS1B 00 |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| Description               | This command is used to set source related setting.<br><b>N_OPON[7:0]:</b> Source OP on period control on Normal/Partial mode setting. The period time is defined as SYSCLK number in internal clock display mode.<br><b>I_OPON[7:0]:</b> Source OP on period control on Idle/Idle Partial mode setting. The period time is defined as SYSCLK number in internal clock display mode.<br><br>Clock cycle=1/internal operation clock frequency(fosc)  |        |        |                       |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
|                           | <table border="1"> <thead> <tr> <th>N_OPON[7:0] / I_OPON[7:0]</th> <th>Source OP on Period</th> </tr> </thead> <tbody> <tr> <td>8'h00</td> <td>Setting Inhabited</td> </tr> <tr> <td>8'h01</td> <td>1 clock cycle</td> </tr> <tr> <td>8'h02</td> <td>2 clock cycle</td> </tr> <tr> <td>:</td> <td>:</td> </tr> <tr> <td>8'hFF</td> <td>255 clock cycle</td> </tr> </tbody> </table><br><b>STBA[14:6]:</b> Source Bias current setting. The driving ability= Driving Level1 x Driving Level2.<br><b>STBA[4:2] , STBA[1:0]:</b> Gamma Bias current setting. The driving ability= Driving Level1 x Driving Level2.<br><b>STBA15, STBA5:</b> Not used.  |        |        |                       |                       |    |    |    |    |    |    |    |           | N_OPON[7:0] / I_OPON[7:0] | Source OP on Period | 8'h00  | Setting Inhabited | 8'h01  | 1 clock cycle         | 8'h02 | 2 clock cycle | : | : | 8'hFF | 255 clock cycle |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| N_OPON[7:0] / I_OPON[7:0] | Source OP on Period   |        |        |                       |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 8'h00                     | Setting Inhabited   |        |        |                       |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 8'h01                     | 1 clock cycle   |        |        |                       |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 8'h02                     | 2 clock cycle   |        |        |                       |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| :                         | :   |        |        |                       |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 8'hFF                     | 255 clock cycle   |        |        |                       |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
|                           | <table border="1"> <thead> <tr> <th>STBA14</th> <th>STBA13</th> <th>STBA12</th> <th>STBA11</th> <th>STBA10</th> <th>Source Driving Level1</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>1x</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>2x</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>3x</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>4x</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>5x</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> <td>6x</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>1</td> <td>0</td> <td>7x</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> <td>8x</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>0</td> <td>9x</td> </tr> </tbody> </table><br><table border="1"> <thead> <tr> <th>STBA9</th> <th>STBA8</th> <th>STBA7</th> <th>STBA6</th> <th>Source Driving Level2</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>Small</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>Middle Small</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>Middle</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>Middle Large</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>0</td> <td>Large</td> </tr> </tbody> </table> |        |        |                       |                       |    |    |    |    |    |    |    |           | STBA14                    | STBA13              | STBA12 | STBA11            | STBA10 | Source Driving Level1 | 0     | 0             | 0 | 1 | 1     | 1x              | 0 | 0 | 0 | 0 | 0 | 2x | 0 | 0 | 0 | 1 | 0 | 3x | 0 | 0 | 1 | 0 | 0 | 4x | 0 | 0 | 1 | 1 | 0 | 5x | 0 | 1 | 1 | 0 | 0 | 6x | 0 | 1 | 1 | 1 | 0 | 7x | 1 | 1 | 1 | 0 | 0 | 8x | 1 | 1 | 1 | 1 | 0 | 9x | STBA9 | STBA8 | STBA7 | STBA6 | Source Driving Level2 | 0 | 0 | 1 | 1 | Small | 0 | 0 | 1 | 0 | Middle Small | 0 | 0 | 0 | 0 | Middle | 0 | 1 | 0 | 0 | Middle Large | 1 | 1 | 0 | 0 | Large |
| STBA14                    | STBA13  | STBA12 | STBA11 | STBA10                | Source Driving Level1 |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 0                         | 0   | 0      | 1      | 1                     | 1x                    |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 0                         | 0   | 0      | 0      | 0                     | 2x                    |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 0                         | 0   | 0      | 1      | 0                     | 3x                    |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 0                         | 0   | 1      | 0      | 0                     | 4x                    |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 0                         | 0   | 1      | 1      | 0                     | 5x                    |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 0                         | 1   | 1      | 0      | 0                     | 6x                    |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 0                         | 1   | 1      | 1      | 0                     | 7x                    |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 1                         | 1   | 1      | 0      | 0                     | 8x                    |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 1                         | 1   | 1      | 1      | 0                     | 9x                    |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| STBA9                     | STBA8   | STBA7  | STBA6  | Source Driving Level2 |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 0                         | 0   | 1      | 1      | Small                 |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 0                         | 0   | 1      | 0      | Middle Small          |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 0                         | 0   | 0      | 0      | Middle                |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 0                         | 1   | 0      | 0      | Middle Large          |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |
| 1                         | 1   | 0      | 0      | Large                 |                       |    |    |    |    |    |    |    |           |                           |                     |        |                   |        |                       |       |               |   |   |       |                 |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |   |   |   |   |   |    |       |       |       |       |                       |   |   |   |   |       |   |   |   |   |              |   |   |   |   |        |   |   |   |   |              |   |   |   |   |       |

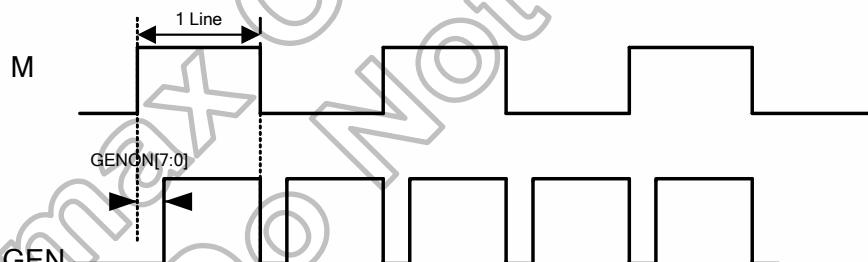
| <b>STBA4</b> | <b>STBA3</b> | <b>STBA2</b> | <b>Gamma Driving Level1</b> |
|--------------|--------------|--------------|-----------------------------|
| 0            | 0            | 1            | 1x                          |
| 0            | 0            | 0            | 2x                          |
| 0            | 1            | 1            | 3x                          |
| 0            | 1            | 0            | 4x                          |
| 1            | 0            | 1            | 5x                          |
| 1            | 0            | 0            | 6x                          |
| 1            | 1            | 1            | 7x                          |
| 1            | 1            | 0            | 8x                          |

| <b>STBA1</b> | <b>STBA0</b> | <b>Gamma Driving Level2</b> |
|--------------|--------------|-----------------------------|
| 0            | 0            | Small                       |
| 0            | 1            | Middle Small                |
| 1            | 0            | Middle                      |
| 1            | 1            | Large                       |

**GENON[7:0]:** Gamma OP on period control. The period time is defined as SYSCLK number in internal clock display mode.

Clock cycle=1/internal operation clock frequency(fosc)

| <b>GENON[7:0]</b> | <b>Gamma OP on Period</b> |
|-------------------|---------------------------|
| 8'h00             | 0 clock cycle             |
| 8'h01             | 1 clock cycle             |
| 8'h02             | 2 clock cycle             |
| :                 | :                         |
| 8'hFF             | 255 clock cycle           |



**OTPS1B:** Internal used, not open.

| Restrictions                              | Must enable SETEXTC command  |        |              |  |     |   |     |   |     |  |     |                         |     |
|---|--|--------|--------------|--|-----|---|-----|---|-----|--|-----|-------------------------|-----|
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr><td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr><td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr><td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td></tr> <tr><td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td></tr> <tr><td>Sleep In or Booster Off</td><td>Yes</td></tr> </tbody> </table> | Status | Availability | Normal Mode On, Idle Mode Off, Sleep Out | Yes | Normal Mode On, Idle Mode On, Sleep Out | Yes | Partial Mode On, Idle Mode Off, Sleep Out | Yes | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability   |        |              |  |     |   |     |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes  |        |              |  |     |   |     |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes  |        |              |  |     |   |     |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes  |        |              |  |     |   |     |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes  |        |              |  |     |   |     |   |     |  |     |                         |     |
| Sleep In or Booster Off                   | Yes  |        |              |  |     |   |     |   |     |  |     |                         |     |

|            | Status            | Default Value   |
|------------|-------------------|---|
| Default    | Power On Sequence | N_OPON[7:0]=8'h20, I_OPON[7:0]=8'h10,<br>STBA[15:8]=8'h0C, STBA[7:0]=8'hC7,<br>GENON[7:0]=8'h10 |
|            | S/W Reset         | No change   |
|            | H/W Reset         | N_OPON[7:0]=8'h20, I_OPON[7:0]=8'h10,<br>STBA[15:8]=8'h0C, STBA[7:0]=8'hC7,<br>GENON[7:0]=8'h10 |
| Flow Chart | -                 |   |

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### 8.2.46 SETTID: set ID (C3h)

| C3 H  | SETID ( Set ID)   |                         |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|-------------------------|-----|-------|----|----|----|----|----------|---------------|----|----|-----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
|   | DNC   | NWR                     | NRD | D17-8 | D7 | D6 | D5 | D4 | D3       | D2            | D1 | D0 | HEX |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Command   | 0   | ↑                       | 1   | -     | 1  | 1  | 0  | 0  | 0        | 0             | 1  | 1  | C3  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 <sup>st</sup> parameter                               | 1   | ↑                       | 1   | -     |    |    |    |    | ID1[7:0] |               |    |    | 00  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 <sup>nd</sup> parameter                               | 1   | ↑                       | 1   | -     |    |    |    |    | ID2[7:0] |               |    |    | 00  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 <sup>rd</sup> parameter                               | 1   | ↑                       | 1   | -     |    |    |    |    | ID3[7:0] |               |    |    | 00  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 <sup>th</sup> parameter                               |   |                         |     |       | -  | -  | -  | -  | -        | ID_TIMES[2:0] |    |    | 00  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| This command is used to set ID.                         |   |                         |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>ID OTP TIMES[2:0]:</b> Read ID OTP programmed times. |   |                         |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Description   | ID_TIMES[2:0]   | ID OTP programmed times |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 3'b000  | Not programmed          |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 3'b001  | 1 time                  |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 3'b010  | 2 times                 |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 3'b011  | 3 times                 |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   | 3'b100  | 4 times                 |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Restrictions  | If EXTC is high or enable SETEXTC command (even EXTC = low) can enable this command |                         |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Register Availability                                   | Status  | Availability            |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   | Normal Mode On, Idle Mode Off, Sleep Out  | Yes                     |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   | Normal Mode On, Idle Mode On, Sleep Out   | Yes                     |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   | Partial Mode On, Idle Mode Off, Sleep Out   | Yes                     |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   | Partial Mode On, Idle Mode On, Sleep Out  | Yes                     |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Default   | Sleep In or Booster Off   | Yes                     |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   | Status  | Default Value           |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   | Power On Sequence   | OTP value               |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   | S/W Reset   | No Change               |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Flow Chart  |   |                         |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| -   |   |                         |     |       |    |    |    |    |          |               |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

### 8.2.47 SETPANEL: set panel characteristic (CCh)

| CCH                                       | SETPANEL( Set Panel Characteristic Register)  |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |
|---|---|-----|-----|-------|----|----|----|----|--------------|--------------|---------------|---------------|-----|--|--------|---------------|--|---|---|-----------|---|---|--|-----|-------------------------|-----|
|   | DNC   | NWR | NRD | D17-8 | D7 | D6 | D5 | D4 | D3           | D2           | D1            | D0            | HEX |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| Command                                   | 0   | ↑   | 1   | -     | 1  | 1  | 0  | 0  | 1            | 1            | 0             | 0             | CC  |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| 1 <sup>st</sup> parameter                 | 1   | ↑   | 1   | -     | -  | -  | -  | -  | SS_PAN<br>EL | GS_P<br>ANEL | REV_P<br>ANEL | BGR_P<br>ANEL | 00  |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| Description                               | <p>This command is used to set Panel characteristic related register</p> <p><b>REV_PANEL:</b> The source output data polarity selected.<br/>           '0': normally white panel.<br/>           '1': normally black panel.</p> <p><b>BGR_PANEL:</b> The color filter order direction selected.<br/>           '0': S1:S2:S3='R':'G':'B'<br/>           '1': S1:S2:S3='B':'G':'R'</p> <p><b>GS_PANEL:</b> The gate driver output shift direction selected.<br/>           '0': G1→G320<br/>           '1': G320→G1</p> <p><b>SS_PANEL:</b> The source driver output shift direction selected.<br/>           '0': S720→S1<br/>           '1': S1→S720</p> |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| Restrictions                              | If EXTC is high or enable SETEXTC command (even EXTC = low) can enable this command   |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table>   |     |     |       |    |    |    |    |              |              |               |               |     |  | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes   | Normal Mode On, Idle Mode On, Sleep Out | Yes       | Partial Mode On, Idle Mode Off, Sleep Out | Yes   | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>SS_PANEL=0, GS_PANEL=0,<br/>REV_PANEL=0, BGR_PANEL=0</td> </tr> <tr> <td>S/W Reset</td> <td>No change</td> </tr> <tr> <td>H/W Reset</td> <td>SS_PANEL=0, GS_PANEL=0,<br/>REV_PANEL=0, BGR_PANEL=0</td> </tr> </tbody> </table>  |     |     |       |    |    |    |    |              |              |               |               |     |  | Status | Default Value | Power On Sequence                        | SS_PANEL=0, GS_PANEL=0,<br>REV_PANEL=0, BGR_PANEL=0 | S/W Reset                               | No change | H/W Reset                                 | SS_PANEL=0, GS_PANEL=0,<br>REV_PANEL=0, BGR_PANEL=0 |  |     |                         |     |
| Status                                    | Default Value   |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| Power On Sequence                         | SS_PANEL=0, GS_PANEL=0,<br>REV_PANEL=0, BGR_PANEL=0   |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| S/W Reset                                 | No change   |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| H/W Reset                                 | SS_PANEL=0, GS_PANEL=0,<br>REV_PANEL=0, BGR_PANEL=0   |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |
| Flow Chart                                | -   |     |     |       |    |    |    |    |              |              |               |               |     |  |        |               |  |   |   |           |   |   |  |     |                         |     |

### 8.2.48 GETHID: Read Himax Internal ID (D0h)

| D0H GETHID (Read Himax Internal ID)   |  |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
|---|--|-----|-----|-------|-----------------------------|----|----|----|----|----|----|----|--------|---------------|-------------------|--|-----------|---|-----------|---|-----|--|-----|-------------------------|-----|
|   | DNC  | NWR | NRD | D17-8 | D7                          | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX    |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Command   | 0  | ↑   | 1   | -     | 0                           | 1  | 0  | 1  | 0  | 0  | 1  | 1  | D0     |               |                   |  |           |   |           |   |     |  |     |                         |     |
| 1 <sup>st</sup> parameter   | 1  | ↑   | 1   | -     | ID_VERSION[7:0] (0101_0011) |    |    |    |    |    |    |    | 53     |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Description   | This command is used to Read Himax Internal ID   |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Restrictions  | If EXTC is high or enable SETEXTC command (even EXTC = low) can enable this command  |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Register Availability   | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td><td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td><td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td><td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td><td>Yes</td> </tr> </tbody> </table> |     |     |       |                             |    |    |    |    |    |    |    |        | Status        | Availability      | Normal Mode On, Idle Mode Off, Sleep Out | Yes       | Normal Mode On, Idle Mode On, Sleep Out | Yes       | Partial Mode On, Idle Mode Off, Sleep Out | Yes | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status  | Availability   |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes  |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes  |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out   | Yes  |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes  |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Sleep In or Booster Off   | Yes  |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td><td>ID_VERSION[7:0]=53h</td> </tr> <tr> <td>S/W Reset</td><td>ID_VERSION[7:0]=53h</td> </tr> <tr> <td>H/W Reset</td><td>ID_VERSION[7:0]=53h</td> </tr> </tbody> </table> |  |     |     |       |                             |    |    |    |    |    |    |    | Status | Default Value | Power On Sequence | ID_VERSION[7:0]=53h                      | S/W Reset | ID_VERSION[7:0]=53h                     | H/W Reset | ID_VERSION[7:0]=53h                       |     |  |     |                         |     |
| Status  | Default Value  |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Power On Sequence   | ID_VERSION[7:0]=53h  |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| S/W Reset   | ID_VERSION[7:0]=53h  |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| H/W Reset   | ID_VERSION[7:0]=53h  |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |
| Flow Chart  | -  |     |     |       |                             |    |    |    |    |    |    |    |        |               |                   |  |           |   |           |   |     |  |     |                         |     |

### 8.2.49 SETGAMMA: set gamma curve (E0h)

| <b>E0H</b>                                |   | SETGAMMA ( Set Gamma Curve Related Setting) |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |
|---|---|---|-----|-------|----------|----------|----|----|-----------|----------|-----------|----|-----|--|--------|---------------|--|-----------|---|-----------|---|-----------|--|-----|-------------------------|-----|
|   | DNC   | NWR   | NRD | D17-8 | D7       | D6       | D5 | D4 | D3        | D2       | D1        | D0 | HEX |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| Command                                   | 0   | ↑   | 1   | -     | 1        | 1        | 1  | 0  | 0         | 0        | 0         | 0  | E0  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 1 <sup>st</sup> parameter                 | 1   | ↑   | 1   | -     | -        | MP1[2:0] |    |    | -         | MP0[2:0] |           |    | 00  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 2 <sup>nd</sup> parameter                 | 1   | ↑   | 1   | -     | -        | MP3[2:0] |    |    | -         | MP2[2:0] |           |    | 60  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 3 <sup>rd</sup> parameter                 | 1   | ↑   | 1   | -     | -        | MP5[2:0] |    |    | -         | MP4[2:0] |           |    | 30  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 4 <sup>th</sup> parameter                 | 1   | ↑   | 1   | -     | -        | -        | -  | -  | CP0[3:0]  |          |           | -  | 06  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 5 <sup>th</sup> parameter                 | 1   | ↑   | 1   | -     | CP2[3:0] |          |    |    | CP1[3:0]  |          |           | -  | 8C  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 6 <sup>th</sup> parameter                 | 1   | ↑   | 1   | -     | -        | -        | -  | -  | CP3[3:0]  |          |           | -  | 02  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 7 <sup>th</sup> parameter                 | 1   | ↑   | 1   | -     | -        | -        | -  | -  | CP4[3:0]  |          |           | -  | 04  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 8 <sup>th</sup> parameter                 | 1   | ↑   | 1   | -     | -        | -        | -  | -  | OP0[3:0]  |          |           | -  | 0F  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 9 <sup>th</sup> parameter                 | 1   | ↑   | 1   | -     | -        | -        | -  | -  | OP1[4:0]  |          |           | -  | 06  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 10 <sup>th</sup> parameter                | 1   | ↑   | 1   | -     | -        | -        | -  | -  | CGM1[1:0] |          | CGM0[1:0] |    | 0E  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 11 <sup>th</sup> parameter                | 1   | ↑   | 1   | -     | -        | MN1[2:0] |    |    | -         | MN0[2:0] |           |    | 74  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 12 <sup>th</sup> parameter                | 1   | ↑   | 1   | -     | -        | MN3[2:0] |    |    | -         | MN2[2:0] |           |    | 71  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 13 <sup>th</sup> parameter                | 1   | ↑   | 1   | -     | -        | MN5[2:0] |    |    | -         | MN4[2:0] |           |    | 77  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 14 <sup>th</sup> parameter                | 1   | ↑   | 1   | -     | -        | -        | -  | -  | CN0[3:0]  |          |           | -  | 04  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 15 <sup>th</sup> parameter                | 1   | ↑   | 1   | -     | CN2[3:0] |          |    |    | CN1[3:0]  |          |           | -  | 82  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 16 <sup>th</sup> parameter                | 1   | ↑   | 1   | -     | -        | -        | -  | -  | CN3[3:0]  |          |           | -  | 0C  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 17 <sup>th</sup> parameter                | 1   | ↑   | 1   | -     | -        | -        | -  | -  | CN4[3:0]  |          |           | -  | 06  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 18 <sup>th</sup> parameter                | 1   | ↑   | 1   | -     | -        | -        | -  | -  | ON0[3:0]  |          |           | -  | 03  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| 19 <sup>th</sup> parameter                | 1   | ↑   | 1   | -     | -        | -        | -  | -  | ON1[4:0]  |          |           | -  | 1E  |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| Description                               | This command is used for Gamma Curve related Setting.<br>For details, please refer to Section 7.2.  |   |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| Restrictions                              | If EXTC is high or enable SETEXTC command (even EXTC = low) can enable this command   |   |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| Register Availability                     | <table border="1"> <thead> <tr> <th>Status</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>Normal Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Normal Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode Off, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Partial Mode On, Idle Mode On, Sleep Out</td> <td>Yes</td> </tr> <tr> <td>Sleep In or Booster Off</td> <td>Yes</td> </tr> </tbody> </table> |   |     |       |          |          |    |    |           |          |           |    |     |  | Status | Availability  | Normal Mode On, Idle Mode Off, Sleep Out | Yes       | Normal Mode On, Idle Mode On, Sleep Out | Yes       | Partial Mode On, Idle Mode Off, Sleep Out | Yes       | Partial Mode On, Idle Mode On, Sleep Out | Yes | Sleep In or Booster Off | Yes |
| Status                                    | Availability  |   |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| Normal Mode On, Idle Mode Off, Sleep Out  | Yes   |   |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| Normal Mode On, Idle Mode On, Sleep Out   | Yes   |   |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| Partial Mode On, Idle Mode Off, Sleep Out | Yes   |   |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| Partial Mode On, Idle Mode On, Sleep Out  | Yes   |   |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| Sleep In or Booster Off                   | Yes   |   |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| Default                                   | <table border="1"> <thead> <tr> <th>Status</th> <th>Default Value</th> </tr> </thead> <tbody> <tr> <td>Power On Sequence</td> <td>GC0 value</td> </tr> <tr> <td>S/W Reset</td> <td>No change</td> </tr> <tr> <td>H/W Reset</td> <td>GC0 value</td> </tr> </tbody> </table>  |   |     |       |          |          |    |    |           |          |           |    |     |  | Status | Default Value | Power On Sequence                        | GC0 value | S/W Reset                               | No change | H/W Reset                                 | GC0 value |  |     |                         |     |
| Status                                    | Default Value   |   |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| Power On Sequence                         | GC0 value   |   |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| S/W Reset                                 | No change   |   |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| H/W Reset                                 | GC0 value   |   |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |
| Flow Chart                                | -   |   |     |       |          |          |    |    |           |          |           |    |     |  |        |               |  |           |   |           |   |           |  |     |                         |     |

### 8.2.50 SET SPI READ: Set SPI read address (FEh)

| FEH                       | SET SPI READ (Set SPI read address)   |     |     |       |    |    |               |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---------------------------|---|-----|-----|-------|----|----|---------------|----|----|----|----|----|-----|--|--|--|--|--|--|--|--|--|--|--|--|--|
|                           | DNC   | NWR | NRD | D17-8 | D7 | D6 | D5            | D4 | D3 | D2 | D1 | D0 | HEX |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Command                   | 0   | ↑   | 1   | -     | 1  | 1  | 1             | 1  | 1  | 1  | 1  | 0  | FE  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 <sup>st</sup> parameter | 1   | ↑   | 1   | -     | A7 | A6 | A5            | A4 | A3 | A2 | A1 | A0 | -   |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Description               | This command is used to set SPI-4W read address                                     |     |     |       |    |    |               |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Restrictions              | If EXTC is high or enable SETEXTC command (even EXTC = low) can enable this command |     |     |       |    |    |               |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Register Availability     | Status  |     |     |       |    |    | Availability  |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                           | Normal Mode On, Idle Mode Off, Sleep Out  |     |     |       |    |    | Yes           |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                           | Normal Mode On, Idle Mode On, Sleep Out   |     |     |       |    |    | Yes           |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                           | Partial Mode On, Idle Mode Off, Sleep Out   |     |     |       |    |    | Yes           |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                           | Partial Mode On, Idle Mode On, Sleep Out  |     |     |       |    |    | Yes           |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Default                   | Sleep In or Booster Off   |     |     |       |    |    | Yes           |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                           | Status  |     |     |       |    |    | Default Value |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                           | Power On Sequence   |     |     |       |    |    | No change     |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                           | S/W Reset   |     |     |       |    |    | No change     |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Flow Chart                |   |     |     |       |    |    |               |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
| -                         |   |     |     |       |    |    |               |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |

### 8.2.51 GET SPI READ: Get SPI read address (FFh)

| FFH                       | GET SPI READ (Get SPI read address)   |     |     |               |    |    |    |    |    |    |    |    |     |
|---------------------------|---|-----|-----|---------------|----|----|----|----|----|----|----|----|-----|
|                           | DNC   | NWR | NRD | D17-8         | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | HEX |
| Command                   | 0   | ↑   | 1   | -             | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | FF  |
| 1 <sup>st</sup> parameter | 1   | ↑   | 1   | -             |    |    |    |    |    |    |    |    | -   |
| 2 <sup>nd</sup> parameter | 1   | ↑   | 1   | -             |    |    |    |    |    |    |    |    | -   |
| 3 <sup>rd</sup> parameter | 1   | ↑   | 1   | -             |    |    |    |    |    |    |    |    | -   |
| 4 <sup>th</sup> parameter | 1   | ↑   | 1   | -             |    |    |    |    |    |    |    |    | -   |
| 5 <sup>th</sup> parameter | 1   | ↑   | 1   | -             |    |    |    |    |    |    |    |    | -   |
| Description               | This command is used to get the SPI-4W read address index's parameters.             |     |     |               |    |    |    |    |    |    |    |    |     |
| Restrictions              | If EXTC is high or enable SETEXTC command (even EXTC = low) can enable this command |     |     |               |    |    |    |    |    |    |    |    |     |
| Register Availability     | Status  |     |     | Availability  |    |    |    |    |    |    |    |    |     |
|                           | Normal Mode On, Idle Mode Off, Sleep Out  |     |     | Yes           |    |    |    |    |    |    |    |    |     |
|                           | Normal Mode On, Idle Mode On, Sleep Out   |     |     | Yes           |    |    |    |    |    |    |    |    |     |
|                           | Partial Mode On, Idle Mode Off, Sleep Out   |     |     | Yes           |    |    |    |    |    |    |    |    |     |
|                           | Partial Mode On, Idle Mode On, Sleep Out  |     |     | Yes           |    |    |    |    |    |    |    |    |     |
|                           | Sleep In or Booster Off   |     |     | Yes           |    |    |    |    |    |    |    |    |     |
| Default                   | Status  |     |     | Default Value |    |    |    |    |    |    |    |    |     |
|                           | Power On Sequence   |     |     | No change     |    |    |    |    |    |    |    |    |     |
|                           | S/W Reset   |     |     | No change     |    |    |    |    |    |    |    |    |     |
|                           | H/W Reset   |     |     | No change     |    |    |    |    |    |    |    |    |     |
| Flow Chart                | -   |     |     |               |    |    |    |    |    |    |    |    |     |

## 9. Layout Recommendation

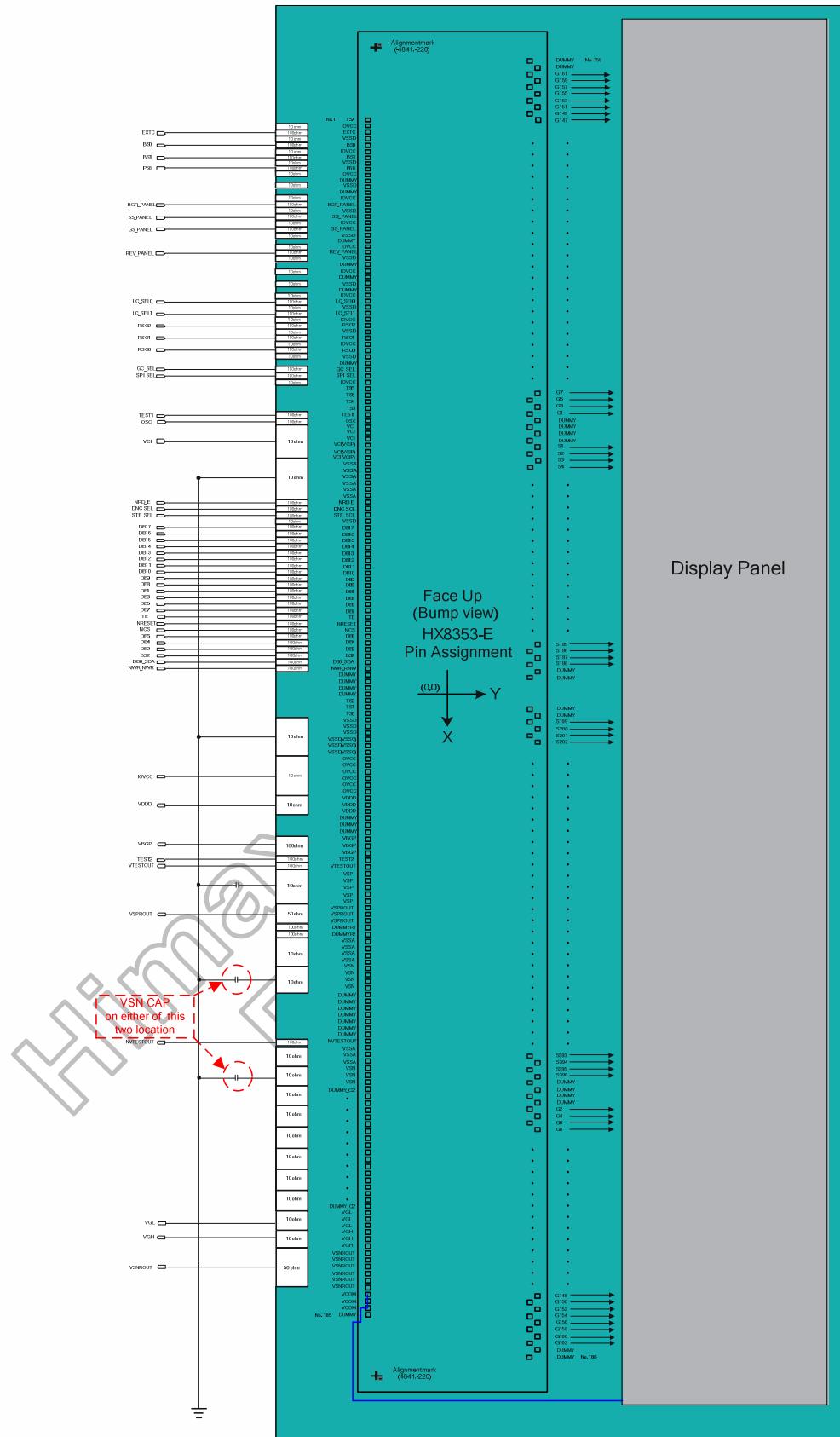


Figure 9.1 Layout recommendation of HX8353-E

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## Maximum layout resistance

| Name                            | Type                 | Maximum Series Resistance | Unit |
|---------------------------------|----------------------|---------------------------|------|
| IOVCC                           | Power supply         | 10                        | Ω    |
| VCI                             | Power supply         | 10                        | Ω    |
| VSSA                            | Power supply         | 10                        | Ω    |
| VSSD                            | Power supply         | 10                        | Ω    |
| OSC                             | Input                | 100                       | Ω    |
| IM[3:0], IFSEL                  | Input                | 100                       | Ω    |
| NRD, NWR_SCL, DNC_SCL, NCS, SDA | Input                | 100                       | Ω    |
| NRESET                          | Input                | 100                       | Ω    |
| TE, CABC_PWM_OUT, BC_CTRL       | Output               | 100                       | Ω    |
| DB[17:0],                       | I/O                  | 100                       | Ω    |
| DOTCLK, DE, VSYNC, HSYNC        | Input                | 100                       | Ω    |
| VGH                             | Output               | 10                        | Ω    |
| VGL                             | Output               | 10                        | Ω    |
| VSN                             | Capacitor connection | 10                        | Ω    |
| VSP                             | Capacitor connection | 10                        | Ω    |
| VDDD                            | Output               | 10                        | Ω    |
| VSPROUT, VSNROUT                | Output               | 50                        | Ω    |
| DUMMY_C1, DUMMY_C2              | Dummy                | 10                        | Ω    |
| TEST[2:1]                       | Input                | 100                       | Ω    |
| TEST[10:3]                      | Output               | 100                       | Ω    |
| VCOM, DUMMY1~24                 | Dummy                | 100                       | Ω    |
| VTEST, NVTEST                   | Test Pin             | 100                       | Ω    |

Table 9.1 Maximum layout resistance

## 10. OTP Programming

| INDEX | D7                | D6               | D5   | D4   | D3                  | D2               | D1               | D0         |  |  |  |  |  |
|-------|-------------------|------------------|------|------|---------------------|------------------|------------------|------------|--|--|--|--|--|
| 0     |                   |                  |      |      | ID1 [7:0]           |                  |                  |            |  |  |  |  |  |
| 1     |                   |                  |      |      | ID2 [7:0]           |                  |                  |            |  |  |  |  |  |
| 2     |                   |                  |      |      | ID3 [7:0]           |                  |                  |            |  |  |  |  |  |
| 3     |                   |                  |      |      | ID1 [7:0]           |                  |                  |            |  |  |  |  |  |
| 4     |                   |                  |      |      | ID2 [7:0]           |                  |                  |            |  |  |  |  |  |
| 5     |                   |                  |      |      | ID3 [7:0]           |                  |                  |            |  |  |  |  |  |
| 6     |                   |                  |      |      | ID1 [7:0]           |                  |                  |            |  |  |  |  |  |
| 7     |                   |                  |      |      | ID2 [7:0]           |                  |                  |            |  |  |  |  |  |
| 8     |                   |                  |      |      | ID3 [7:0]           |                  |                  |            |  |  |  |  |  |
| 9     |                   |                  |      |      | ID1 [7:0]           |                  |                  |            |  |  |  |  |  |
| A     |                   |                  |      |      | ID2 [7:0]           |                  |                  |            |  |  |  |  |  |
| B     |                   |                  |      |      | ID3 [7:0]           |                  |                  |            |  |  |  |  |  |
| 18    | *                 | *                | *    | *    | nValid_ID4          | nValid_ID3       | nValid_ID2       | nValid_ID1 |  |  |  |  |  |
| 19    | nValid_VCMC1      |                  |      |      | VCMC[6:0]           |                  |                  |            |  |  |  |  |  |
| 1A    | nValid_VCMC2      |                  |      |      | VCMC[6:0]           |                  |                  |            |  |  |  |  |  |
| 1B    | nValid_VCMC3      |                  |      |      | VCMC[6:0]           |                  |                  |            |  |  |  |  |  |
| 1C    | nValid_VCMC4      |                  |      |      | VCMC[6:0]           |                  |                  |            |  |  |  |  |  |
| 1D    | nValid_PANEL      | 1'b1             | 1'b1 | 1'b1 | SS_PANEL            | GS_PANEL         | REV_PANEL        | BGR_PANEL  |  |  |  |  |  |
| 20    | nValid_Gamma      | MP1[2:0](3'b010) |      |      | *                   | MP0[2:0](3'b000) |                  |            |  |  |  |  |  |
| 21    | *                 | MP3[2:0](3'b111) |      |      | *                   | MP2[2:0](3'b100) |                  |            |  |  |  |  |  |
| 22    | *                 | MP5[2:0](3'b000) |      |      | *                   | MP4[2:0](3'b000) |                  |            |  |  |  |  |  |
| 23    | *                 | *                |      |      | CP0[3:0](4'b0000)   |                  |                  |            |  |  |  |  |  |
| 24    | CP2[3:0](4'b0111) |                  |      |      | CP1[3:0](4'b0100)   |                  |                  |            |  |  |  |  |  |
| 25    | *                 | *                | *    | *    | CP3[3:0](4'b0010)   |                  |                  |            |  |  |  |  |  |
| 26    | *                 | *                | *    | *    | CP4[3:0](4'b1001)   |                  |                  |            |  |  |  |  |  |
| 27    | *                 | *                | *    | *    | OP0[3:0](4'b1010)   |                  |                  |            |  |  |  |  |  |
| 28    | *                 | *                | *    |      | OP1[4:0](5'b0_0001) |                  |                  |            |  |  |  |  |  |
| 29    | *                 | *                | *    | *    | CGM1[1:0](2'b00)    |                  | CGM0[1:0](2'b00) |            |  |  |  |  |  |
| 2A    | *                 | MN1[2:0](3'b111) |      |      | *                   | MN0[2:0](3'b110) |                  |            |  |  |  |  |  |
| 2B    | *                 | MN3[2:0](3'b010) |      |      | *                   | MN2[2:0](3'b000) |                  |            |  |  |  |  |  |
| 2C    | *                 | MN5[2:0](3'b111) |      |      | *                   | MN4[2:0](3'b011) |                  |            |  |  |  |  |  |
| 2D    | *                 | *                |      |      | CN0[3:0](4'b1000)   |                  |                  |            |  |  |  |  |  |
| 2E    | CN2[3:0](4'b0110) |                  |      |      | CN1[3:0](4'b0001)   |                  |                  |            |  |  |  |  |  |
| 2F    | *                 | *                | *    | *    | CN3[3:0](4'b0010)   |                  |                  |            |  |  |  |  |  |
| 30    | *                 | *                | *    | *    | CN4[3:0](4'b0000)   |                  |                  |            |  |  |  |  |  |
| 31    | *                 | *                | *    | *    | ON0[3:0](4'b1000)   |                  |                  |            |  |  |  |  |  |
| 32    | *                 | *                | *    |      | ON1[4:0](5'b0_0010) |                  |                  |            |  |  |  |  |  |

Table 10.1 OTP address mapping

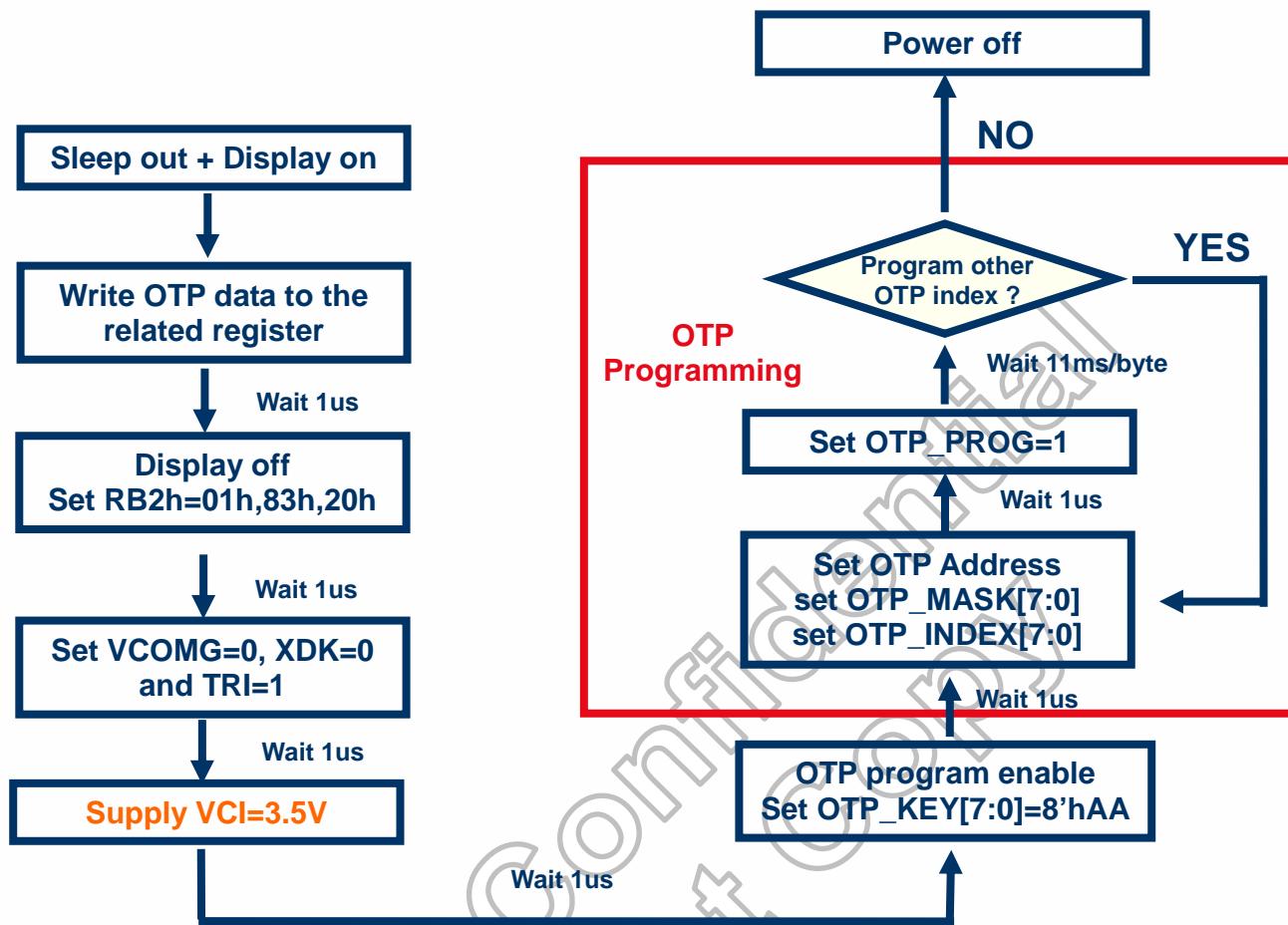
**Note:** (1) The same color means the same VALID bit controlled. When OTP Index programmed, the related VALID bit will be programmed to "0" automatically. If the VALID bit programmed to "0", the OTP value will be reload to related register after HW reset or SLPOUT command.

(2) If want to program ID1~ID3, it just need to program Index 00h (ID2 and ID3 will be programmed automatically). If ID had be programmed, it also need to program Index 00h when second to eighth times programming (it will be programmed to corresponding Index automatically).

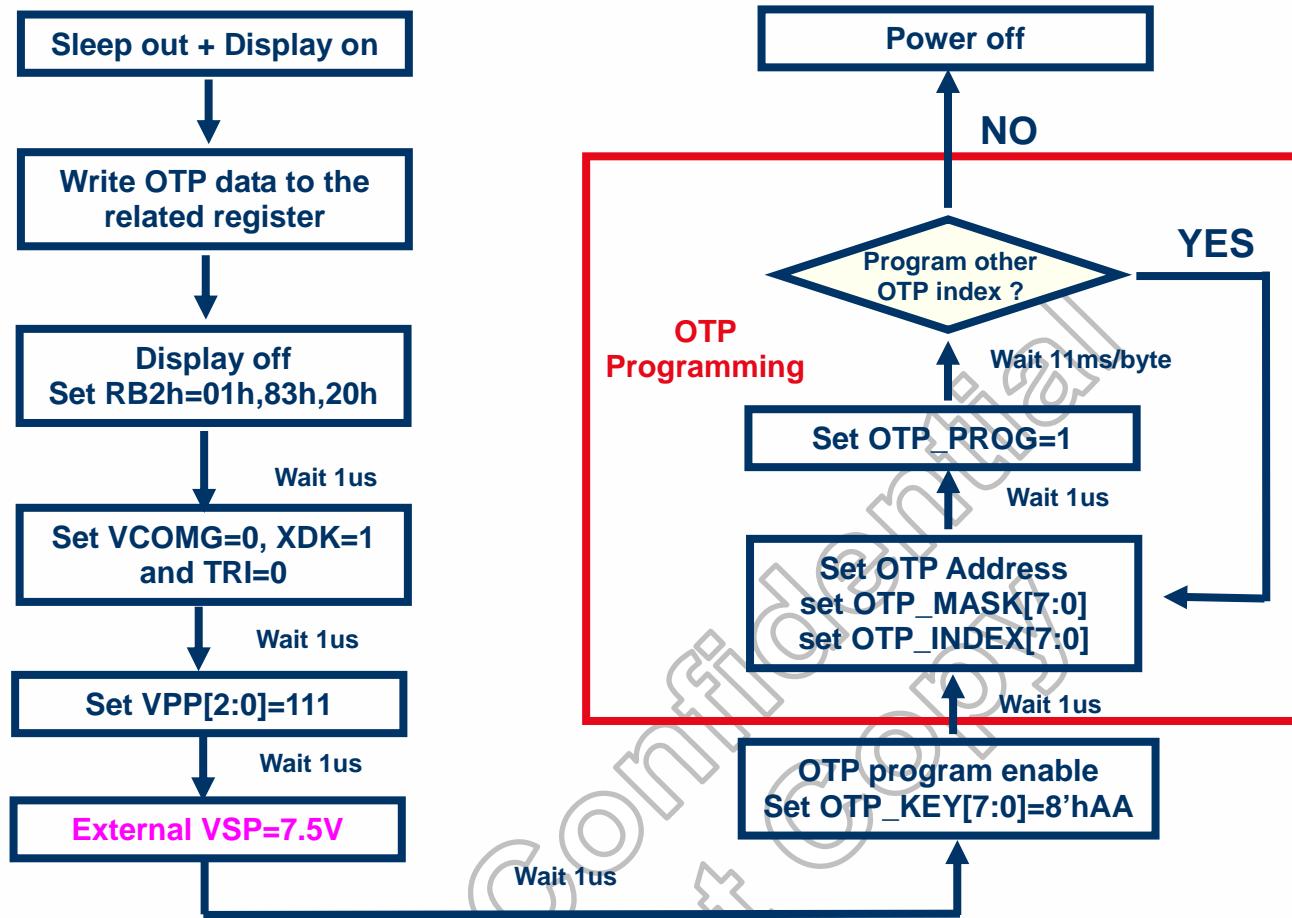
(3) If want to program VCOM, it just need to program Index 19h. If VCOM had be programmed, it also need to program Index 19h when second to eighth times programming (it will be programmed to corresponding Index automatically).

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### 10.1 Programming flow (**Internal** OTP power programming sequence)



## 10.2 Programming flow ( External OTP power programming sequence )



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## 11. Electrical Characteristic

### 11.1 Absolute maximum ratings

| Item                   | Symbol          | Unit | Value             | Note                     |
|------------------------|-----------------|------|-------------------|--------------------------|
| Power Supply Voltage 1 | IOVCC~VSSD      | V    | -0.3 to +4.6      | Note <sup>(1),(2)</sup>  |
| Power Supply Voltage 2 | VCI ~ VSSA      | V    | -0.3 to +4.6      | Note <sup>(3)</sup>      |
| Power Supply Voltage 3 | VSP ~ VSSA      | V    | -0.3 to +6.6      | Note <sup>(4)</sup>      |
| Power Supply Voltage 4 | VSSA ~ VSN      | V    | -0.3 to +4.6      | Note <sup>(5)</sup>      |
| Power Supply Voltage 5 | VSP ~ VSN       | V    | -0.3 to +9        | Note <sup>(6)</sup>      |
| Power Supply Voltage 6 | VGH ~ VSSA      | V    | -0.3 to +18.5     | Note <sup>(7)</sup>      |
| Power Supply Voltage 7 | VSSA ~ VGL      | V    | -16.5 to 0        | Note <sup>(8)</sup>      |
| Logic Input Voltage    | V <sub>IN</sub> | V    | -0.3 to IOVCC+0.5 | -                        |
| Logic Output Voltage   | Vo              | V    | -0.3 to IOVCC+0.5 | -                        |
| Operating Temperature  | Topr            | °C   | -30 to +80        | Note <sup>(9),(10)</sup> |
| Storage Temperature    | Tstg            | °C   | -55 to +110       | Note <sup>(9),(10)</sup> |

**Note:** (1) IOVCC, VSSD must be maintained.

(2) To make sure IOVCC ≥ VSSD.

(3) To make sure VCI ≥ VSSA.

(4) To make sure VSP ≥ VSSA.

(5) To make sure VSSA ≥ VSN.

(6) To make sure VSP ≥ VSN.

(7) To make sure VGH ≥ VSSA.

(8) To make sure VSSA ≥ VGL

VGH +|VGL| < 32V

(9) For die and wafer products, specified up to +80°C.

(10) This temperature specifications apply to the TCP package.

**Table 11.1 Absolute maximum ratings**

### 11.2 ESD protection level

| Mode             | Test Condition   | Protection Level | Standard                      |
|------------------|------------------|------------------|-------------------------------|
| Human Body Model | C=100pF, R=1.5kΩ | ±2.0KV           | MIL-STD-883F<br>Method 3015.7 |
| Machine Model    | C=200pF, R=0.0Ω  | ±200V            | EIA/JEDEC<br>JESD22-A115A     |

**Table 11.2 ESD protection level**

### 11.3 DC characteristics

| Parameter  | Symbol  | Conditions   | Spec.     |        |           | Unit |
|--|---------|--|-----------|--------|-----------|------|
|  |         |  | Min.      | Typ.   | Max.      |      |
| <b>Power &amp; Operating Voltages</b>                  |         |  |           |        |           |      |
| IO Operating voltage                                   | IOVCC   | I/O supply voltage   | 1.65      | 1.8    | 3.3       | V    |
| Driver Operating voltage                               | VCI     | Operation voltage  | 2.5       | 2.8    | 3.3       |      |
| Source Drive Voltage                                   | VSPROUT | Dual Pump  | 3.3       | 4.65   | 4.8       |      |
| Gate Drive High Voltage                                | VGH     | VCI=2.8 Dual Pump<br>(Typ:BT=001)                                  | -         | -      | -         |      |
|  |         | IVGH=80µA  | TBD       | TBD    | TBD       |      |
|  |         | IVGH=70µA  | TBD       | TBD    | TBD       |      |
|  |         | IVGH=60µA  | TBD       | TBD    | TBD       |      |
|  |         | IVGH=50µA  | TBD       | TBD    | TBD       |      |
|  |         | IVGH=40µA  | TBD       | TBD    | TBD       |      |
| Gate Drive Low Voltage                                 | VGL     | VCI=2.8 Dual Pump<br>(Typ:BT=001)                                  | -         | -      | -         |      |
|  |         | IVGL=-80µA   | TBD       | TBD    | TBD       |      |
|  |         | IVGL=-70µA   | TBD       | TBD    | TBD       |      |
|  |         | IVGL=-60µA   | TBD       | TBD    | TBD       |      |
|  |         | IVGL=-50µA   | TBD       | TBD    | TBD       |      |
|  |         | IVGL=-40µA   | TBD       | TBD    | TBD       |      |
| Drive Supply Voltage                                   | VGH-VGL | -  | -         | -      | 30        |      |
| <b>Input / Output</b>                                  |         |  |           |        |           |      |
| High level input voltage                               | VIH     | -  | 0.7*IOVCC | -      | IOVCC     | V    |
| Low level input voltage                                | VIL     | -  | VSSD      | -      | 0.3*IOVCC |      |
| High level output voltage                              | VOH     | IOH = -1.0mA   | 0.8*IOVCC | -      | IOVCC     |      |
| Low level output voltage                               | VOL     | IOL = +1.0mA   | VSSD      | -      | 0.2*IOVCC |      |
| Input leakage current                                  | IIL     | -  | -1        | -      | 1         | µA   |
| Oscillator frequency                                   | fOSC    | Frame rate at 60hz, default Vs and Hs setting T <sub>A</sub> =25°C | 5.7       | 6      | 6.3       | MHz  |
| <b>Booster (VCI=2.8V)</b>                              |         |  |           |        |           |      |
| VSP boost voltage1                                     | VSP     | Dual Pump IVSP=1mA   | 4.8       | 5.0    | 5.2       | V    |
| VSN boost voltage                                      | VSN     | Dual Pump IVSN=-1mA  | -5.2      | -5.0   | -4.8      |      |
| <b>VCOM Generator (VCI=2.8V)</b>                       |         |  |           |        |           |      |
| VCOM amplitude   | VCOM    | No load, Dual Pump   | -2.5      | -      | 0         | V    |
| <b>Source Driver (Typ:T<sub>A</sub>=25°C VCI=2.8V)</b> |         |  |           |        |           |      |
| Output voltage deviation (mean value)                  | DVOS    | VSSD+1.0 ~ VSPROUT-1.0   | -         | +/- 10 | +/- 20    | mV   |
|  |         | VSSD+0.1V ~ VSSD+1.0 VSPROUT-1.0 ~ VSPROUT-0.1V                    | -         | +/- 30 | +/- 50    | mV   |
| Output voltage range                                   | VOS     | -  | 0.1       | -      | VSP-0.1   | V    |
| Output offset voltage                                  | Voff    | -  | -         | +/-30  | +/-50     | mV   |

### 11.3.1 Current consumption

| Host I/F                  | Mode of operation  | Frame Frequency | Inversion Mode | Image  | Memory Data Access Control (MY:MX:MV) | Current consumption |            |            |            |  |
|---------------------------|--|-----------------|----------------|--|---------------------------------------|---------------------|------------|------------|------------|--|
|                           |  |                 |                |  |                                       | Typical             |            | Worst case |            |  |
|                           |  |                 |                |  |                                       | VCI (mA)            | IOVCC (uA) | VCI (mA)   | IOVCC (uA) |  |
| Host interface NOT active | <ul style="list-style-type: none"> <li>- Normal Mode On</li> <li>- Partial Mode Off</li> <li>- Idle Mode Off</li> <li>- Sleep Out Mode</li> </ul>            | 60Hz            | 1-line         | Black  | X;X;X                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           |  |                 | 1-line         | 1x1 checker board                            | X;X;X                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           |  |                 | 1-line         | 4x4 checker board                            | X;X;X                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           |  |                 | 1-line         | Grayscale Top to Bottom                      | X;X;X                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           |  |                 | 1-line         | 20B80W                                       | X;X;X                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           | <ul style="list-style-type: none"> <li>- Normal Mode On</li> <li>- Partial Mode Off</li> <li>- Idle Mode On</li> <li>- Sleep Out Mode</li> </ul>             |                 | 60Hz           | 1-line                                       | 20B80W                                | X;X;X               | TBD        | TBD        | TBD        |  |
|                           |  |                 | 60Hz           | 1-line                                       | Grey Levels                           | X;X;X               | TBD        | TBD        | TBD        |  |
|                           | <ul style="list-style-type: none"> <li>- Normal Mode Off</li> <li>- Partial Mode On (32 lines)</li> <li>- Idle Mode Off</li> <li>- Sleep Out Mode</li> </ul> |                 | 60Hz           | 1-line                                       | 8x8 checker board                     | X;X;X               | TBD        | TBD        | TBD        |  |
|                           |  |                 | 60Hz           | 1-line                                       | Worst pattern                         | X;X;X               | TBD        | TBD        | TBD        |  |
|                           | - Sleep In Mode  | N/A             | N/A            | N/A  | X;X;X                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           | - Deep Sleep In Mode   | N/A             | N/A            | N/A  | X;X;X                                 | TBD                 | TBD        | TBD        | TBD        |  |
| Host interface active     | <ul style="list-style-type: none"> <li>- Normal Mode On</li> <li>- Partial Mode Off</li> <li>- Idle Mode Off</li> <li>- Sleep Out Mode</li> </ul>            | 60Hz            | 1-line         | 262k Colors Worst pattern CPU Access @ 15fps | 0;0;0                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           |  |                 |                |  | 0;0;1                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           |  |                 |                |  | 0;1;0                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           |  |                 |                |  | 0;1;1                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           |  |                 |                |  | 1;0;0                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           |  |                 |                |  | 1;0;1                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           |  |                 |                |  | 1;1;0                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           |  |                 |                |  | 1;1;1                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           |  |                 |                | 262k Colors Worst pattern CPU Access @ 25fps | 0;0;0                                 | TBD                 | TBD        | TBD        | TBD        |  |
|                           |  |                 |                |  | 0;0;1                                 | TBD                 | TBD        | TBD        | TBD        |  |

Table 11.3 Current consumption

Typical Case:

TA = 25°C

IOVCC=1.8V

VCI = 2.8V

Worst Case:

TA = -30 to 80°C

IOVCC = 1.65V to 1.95V

VCI = 2.5V to 3.3V

Includes Process Variance.

## 11.4 AC characteristics

### 11.4.1 Parallel interface characteristics (8080-series MPU)

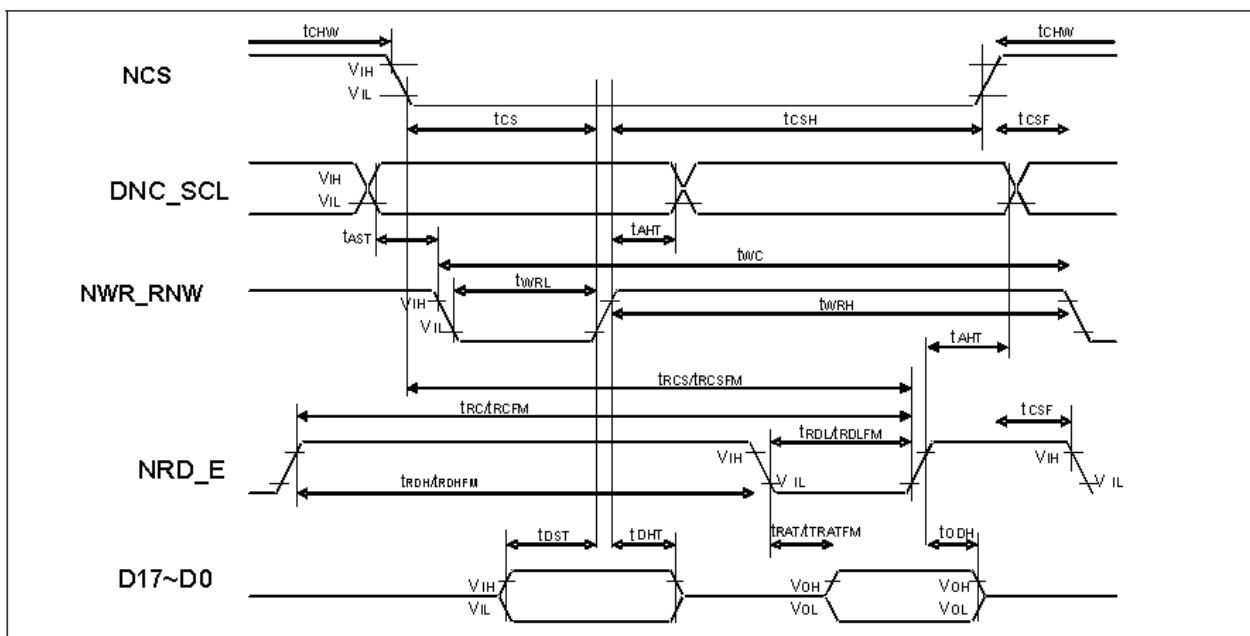


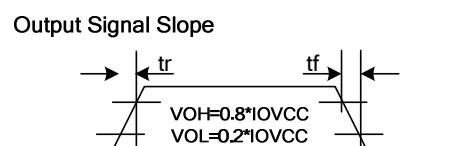
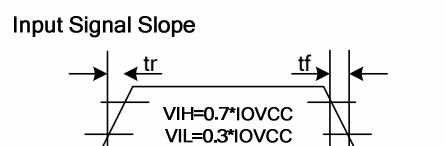
Figure 11.1 Parallel interface characteristics (8080-series MPU)

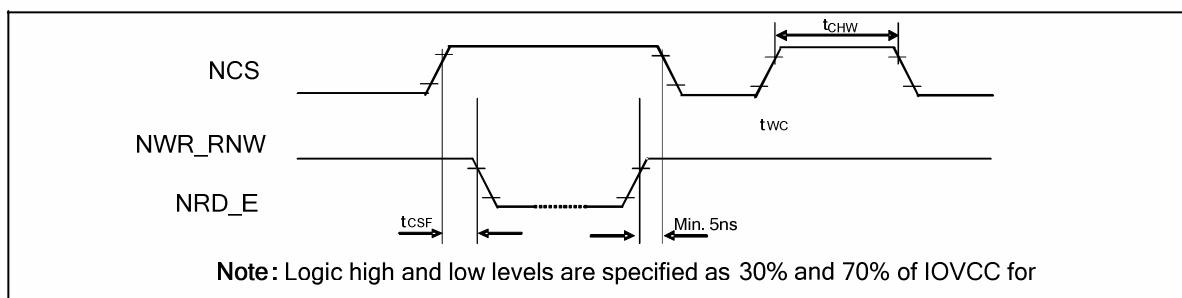
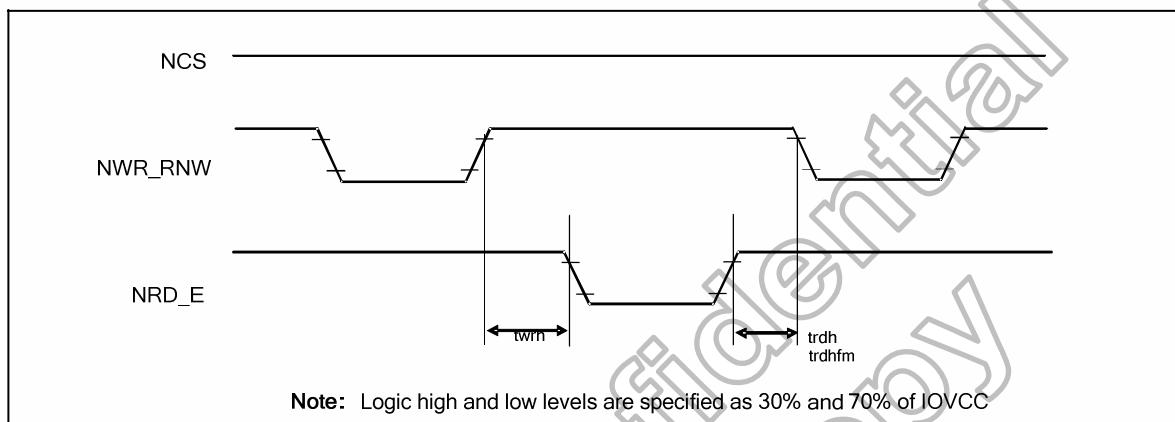
(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3 V, TA = -30 to 70°C)

| Signal     | Symbol | Parameter                          | Min. | Max. | Unit | Description                 |
|------------|--------|------------------------------------|------|------|------|-----------------------------|
| DNC_SCL    | tAST   | Address setup time                 | 0    | -    | ns   | -                           |
|            | taHTT  | Address hold time (Write/Read)     | 10   | -    | ns   | -                           |
| NCS        | tCHW   | Chip select "H" pulse width        | 0    | -    | ns   | -                           |
|            | tcs    | Chip select setup time (Write)     | 15   | -    | ns   | -                           |
|            | trCS   | Chip select setup time (Read ID)   | 45   | -    | ns   | -                           |
|            | trCSFM | Chip select setup time (Read FM)   | 355  | -    | ns   | -                           |
|            | tCSF   | Chip select wait time (Write/Read) | 10   | -    | ns   | -                           |
|            | tCSH   | Chip select hold time              | 10   | -    | ns   | -                           |
| NWR_SCL    | tWC    | Write cycle                        | 66   | -    | ns   | -                           |
|            | tWRH   | Control pulse "H" duration         | 15   | -    | ns   | -                           |
|            | tWRWL  | Control pulse "L" duration         | 15   | -    | ns   | -                           |
| NRD_E (ID) | trC    | Read cycle (ID)                    | 160  | -    | ns   | -                           |
|            | trDH   | Control pulse "H" duration (ID)    | 90   | -    | ns   | When read ID data           |
|            | trDL   | Control pulse "L" duration (ID)    | 45   | -    | ns   | -                           |
| NRD_E (FM) | trCFM  | Read cycle (FM)                    | 450  | -    | ns   | -                           |
|            | trDHFM | Control pulse "H" duration (FM)    | 90   | -    | ns   | When read from frame memory |
|            | trDLFM | Control pulse "L" duration (FM)    | 355  | -    | ns   | -                           |
| D17 to D0  | tdST   | Data setup time                    | 10   | -    | ns   | For maximum CL=30pF         |
|            | tdHT   | Data hold time                     | 10   | -    | ns   | For minimum CL=8pF          |
|            | trAT   | Read access time (ID)              | -    | 40   | ns   | -                           |
|            | trATFM | Read access time (FM)              | -    | 340  | ns   | -                           |
|            | tODH   | Output disable time                | 20   | 80   | ns   | -                           |

Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.

Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.



**Figure 11.2 Chip select timing****Figure 11.3 Write to read and read to write timing**

### 11.4.2 Serial interface characteristics

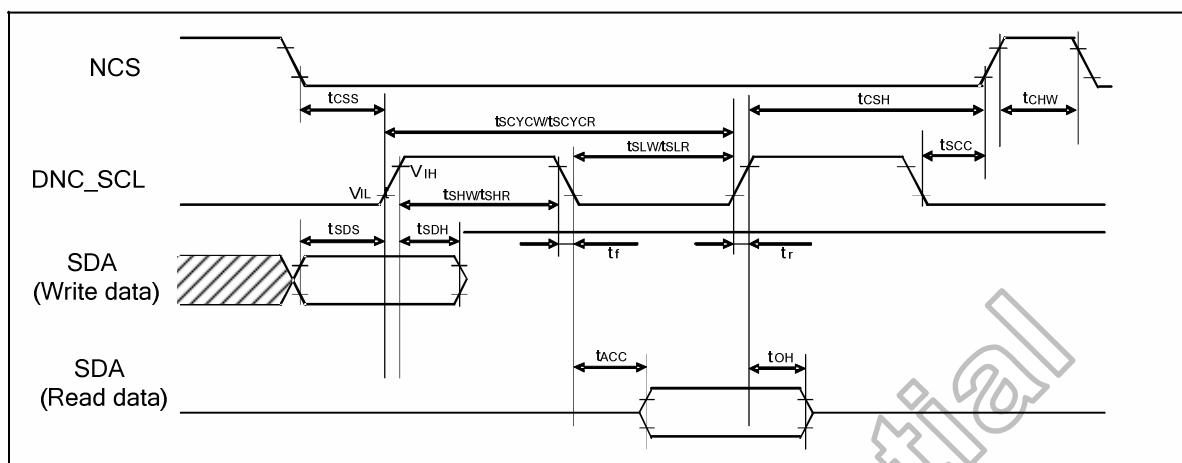


Figure 11.4 Serial interface characteristics

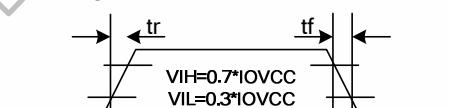
(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3 V, T<sub>A</sub>= -30 to 70° C)

| Parameter                       | Symbol | Conditions                                    | Min. | Typ. | Max. | Unit |
|---------------------------------|--------|---|------|------|------|------|
| Serial clock cycle (Write)      | tSCYCw |   | 40   | -    | -    |      |
| DNC_SCL "H" pulse width (Write) | tSHW   | DNC_SCL                                       | 16   | -    | -    | ns   |
| DNC_SCL "L" pulse width (Write) | tSLW   |   | 16   | -    | -    |      |
| Data setup time (Write)         | tSDS   | SDA   | 16   | -    | -    | ns   |
| Data hold time (Write)          | tSDH   |   | 16   | -    | -    | ns   |
| Serial clock cycle (Read)       | tSCYCR |   | 150  | -    | -    |      |
| DNC_SCL "H" pulse width (Read)  | tSHR   | DNC_SCL                                       | 60   | -    | -    | ns   |
| DNC_SCL "L" pulse width (Read)  | tSLR   |   | 60   | -    | -    |      |
| Access Time                     | tACC   | SDI for maximum CL=30pF<br>For minimum CL=8pF | 10   | -    | 50   | ns   |
| Output disable time             | tOH    | SDO For maximum CL=30pF<br>For minimum CL=8pF | 15   | -    | 50   | ns   |
| DNC_SCL to Chip select          | tSCC   | DNC_SCL, NCS                                  | 15   | -    | -    | ns   |
| NCS "H" pulse width             | tCHW   | NCS   | 40   | -    | -    | ns   |
| Chip select setup time          | tCSS   |   | 60   | -    | -    | ns   |
| Chip select hold time           | tCSH   | NCS   | 65   | -    | -    | ns   |

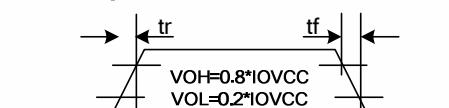
Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.

Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

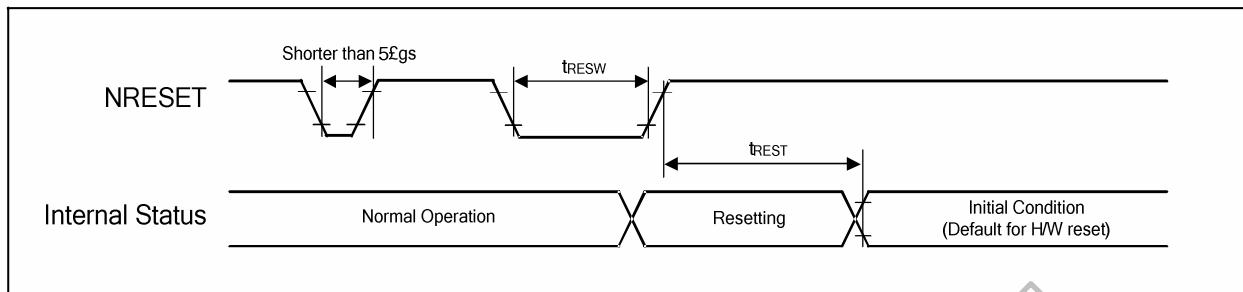
Input Signal Slope



Output Signal Slope



### 11.4.3 Reset input timing



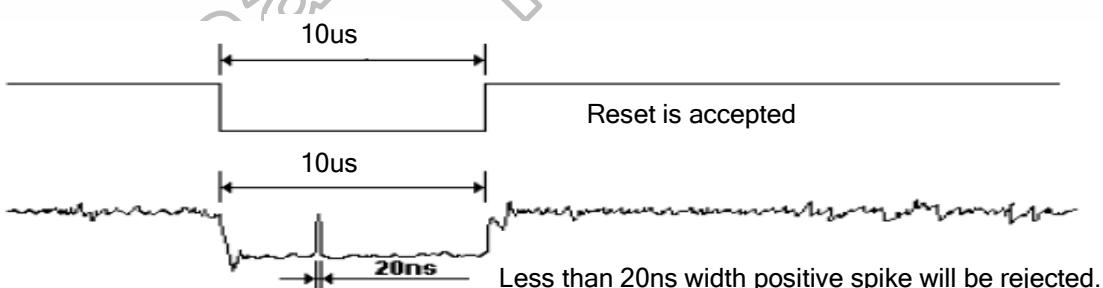
**Figure 11.5 Reset input timing**

| <b>Symbol</b> | <b>Parameter</b>                     | <b>Related Pins</b> | <b>Spec.</b> |             |             | <b>Note</b>                              | <b>Unit</b> |
|---------------|--------------------------------------|---------------------|--------------|-------------|-------------|--|-------------|
|               |                                      |                     | <b>Min.</b>  | <b>Typ.</b> | <b>Max.</b> |  |             |
| tRESW         | Reset low pulse width <sup>(1)</sup> | NRESET              | 10           | -           | -           | -  | $\mu$ s     |
| tREST         | Reset complete time <sup>(2)</sup>   | -                   | -            | 5           | -           | When reset applied during Sleep Out mode | ms          |
|               |                                      | -                   | -            | 120         | -           | When reset applied during Sleep In mode  | ms          |

**Note:** (1) Spike due to an electrostatic discharge on !RES line does not cause irregular system reset according to the following table.

| <b>NRESET Pulse</b>              | <b>Action</b>  |
|----------------------------------|----------------|
| Shorter than 5 $\mu$ s           | Reset Rejected |
| Longer than 10 $\mu$ s           | Reset          |
| Between 5 $\mu$ s and 10 $\mu$ s | Reset Start    |

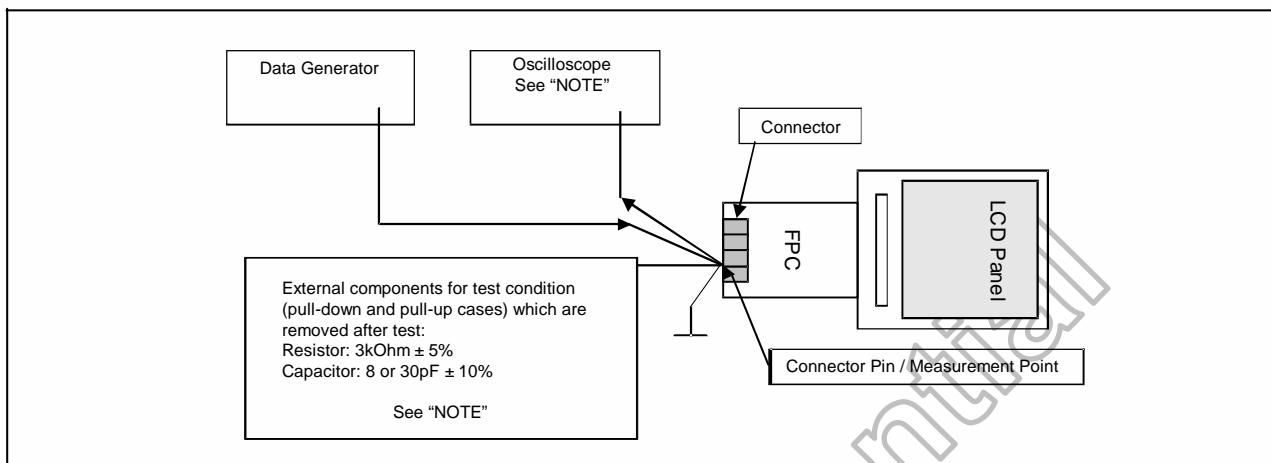
- (2) During the resetting period, the display will be blanked (The display is entering blanking sequence, which Maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode) and then return to Default condition for H/W reset.
- (3) During Reset Complete Time, ID2 and VCOMOF value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 5ms after a rising edge of NRESET.
- (4) Spike Rejection also applies during a valid reset pulse as shown as below:



- (5) It is necessary to wait 5msec after releasing NRESET before sending commands. Also Sleep Out command cannot be sent for 120msec.

## 11.5 tACC, tOH Measurement Condition

### Measurement condition set-up



**Note:** Capacitances and resistances of the oscilloscope's probe must be included externals components in these measurements

Figure 11.6 tACC and tOH measurement condition set-up

### Minimum value measurement

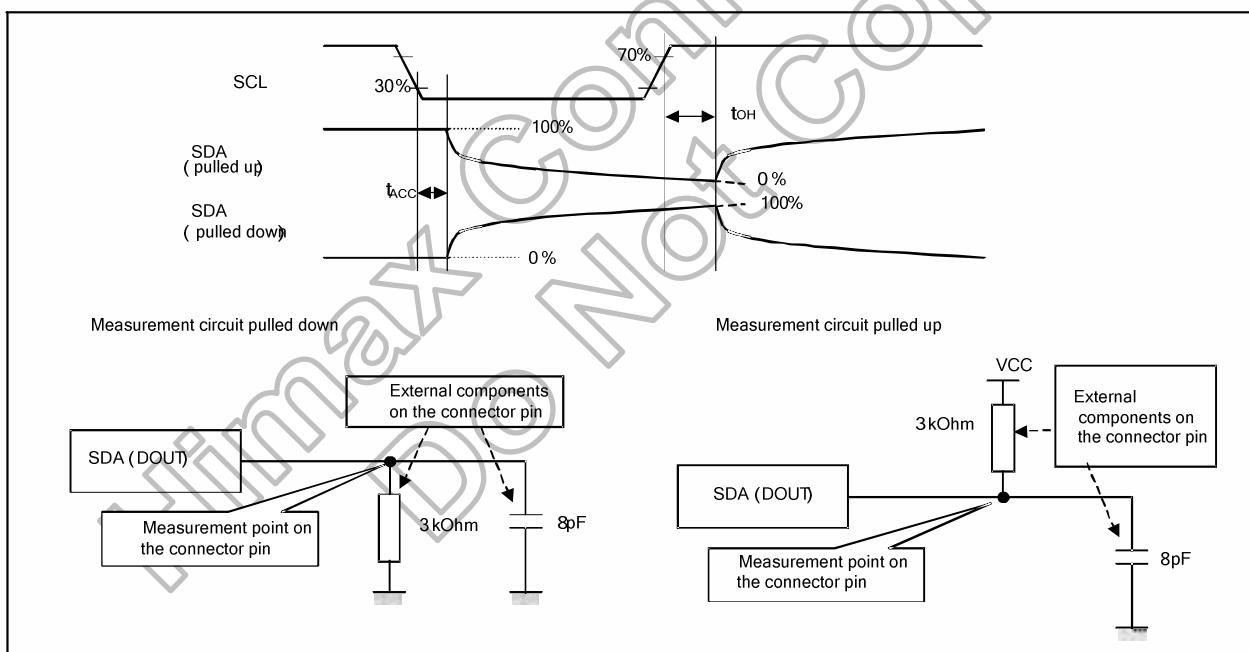
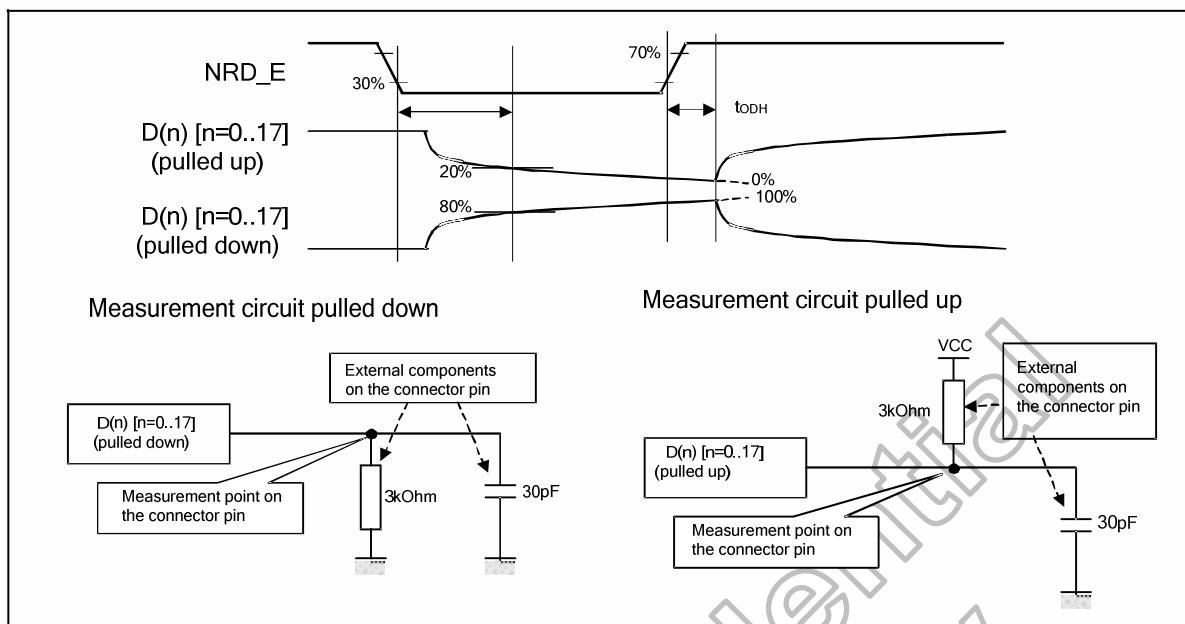


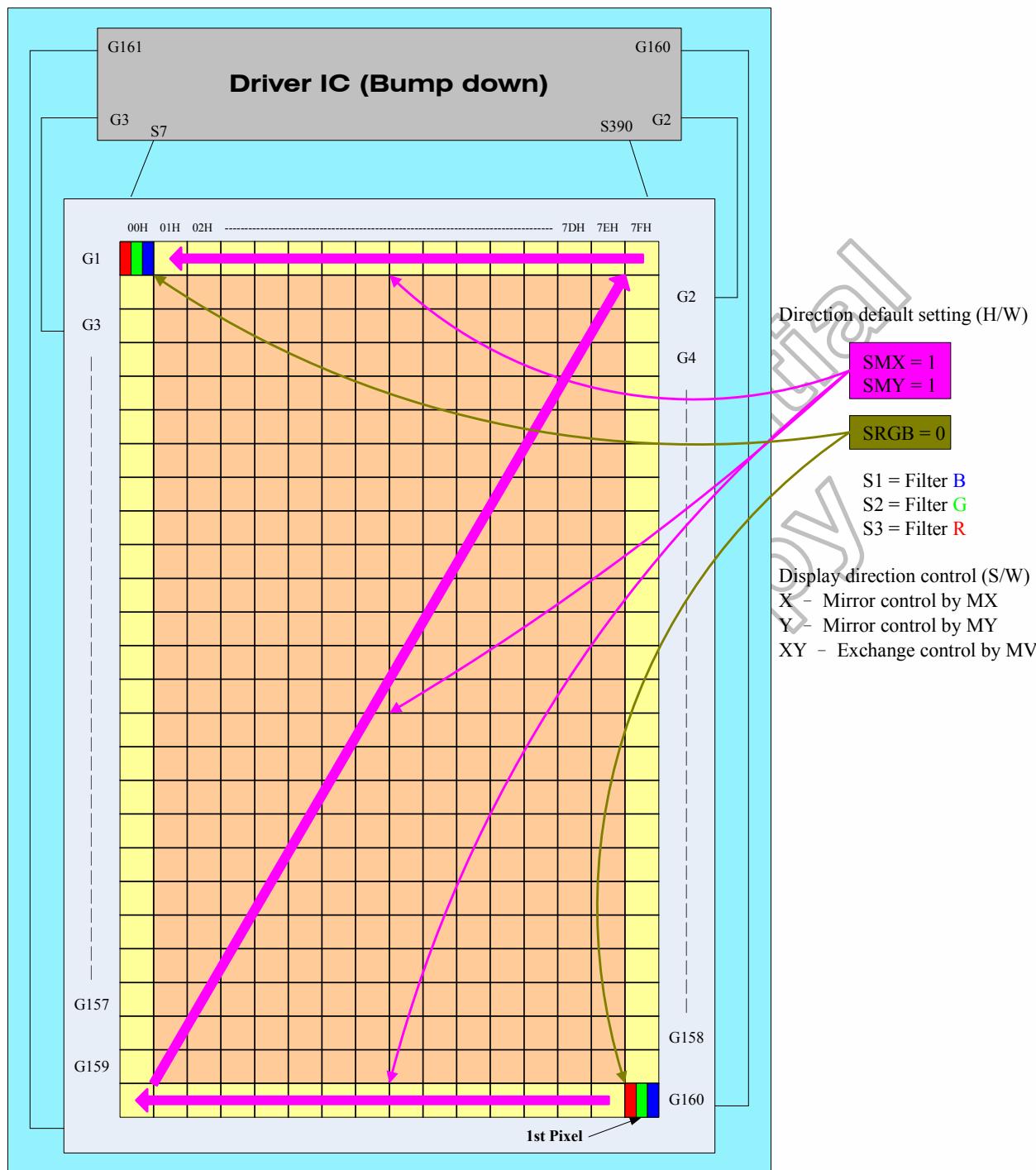
Figure 11.7 tACC and tOH minimum value measurement

## Maximum value measurement

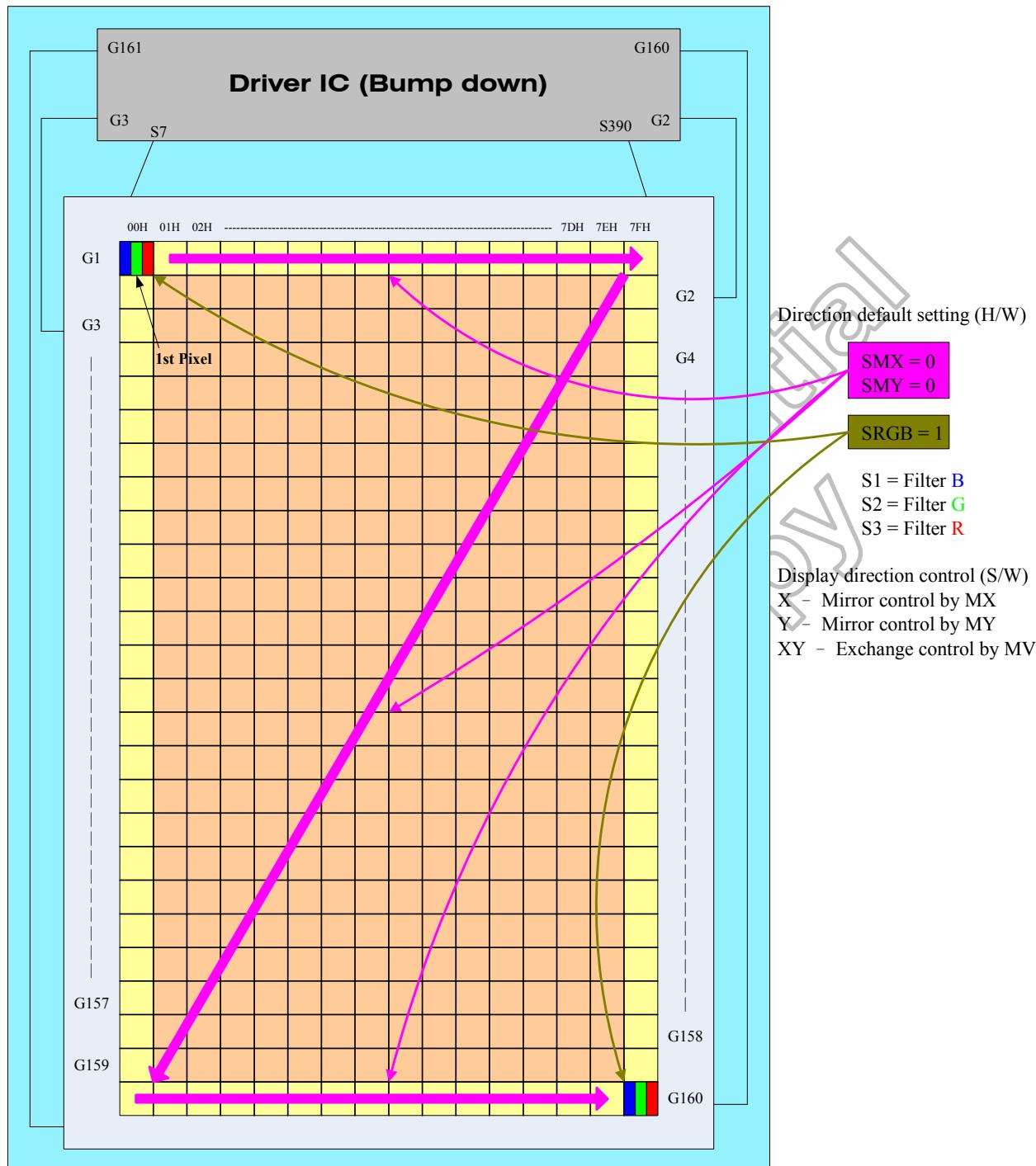


**Figure 11.8 tACC and tOH maximum value measurement**

**11.6 1<sup>st</sup> Pixel is at right-bottom of the panel & RGB filter order = RGB**



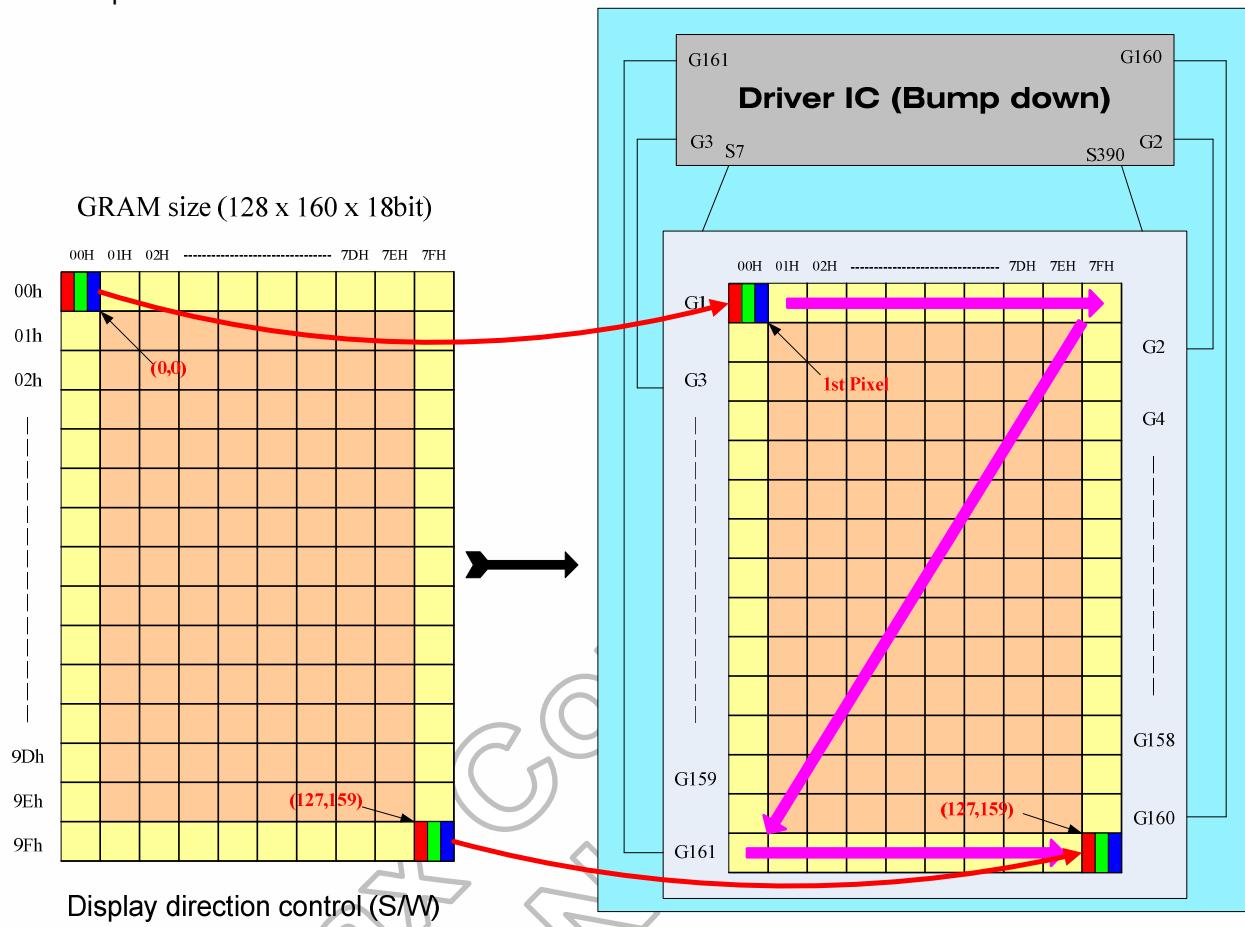
### 11.7 1<sup>st</sup> Pixel is at left-top of the panel & RGB filter order = **BGR**



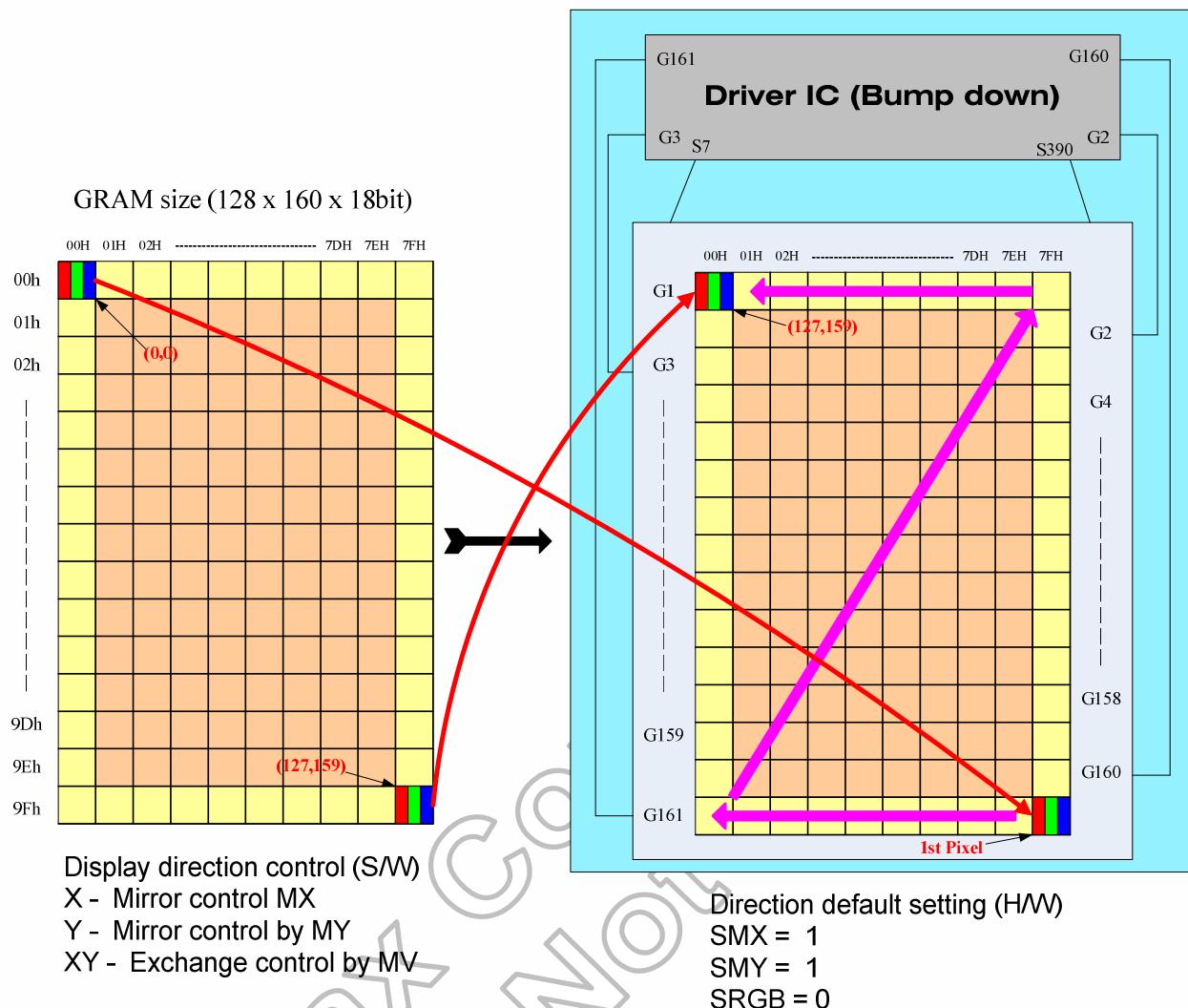
## 11.8 Application of connection with Different resolution

Case 1 of resolution (128RGB x 160) (RSO[2:0] = 011) RAM size = 128 x 160 x 18-bits (Used)  
Display size = 128RGB x 160

Example for SMX = SMY = 0

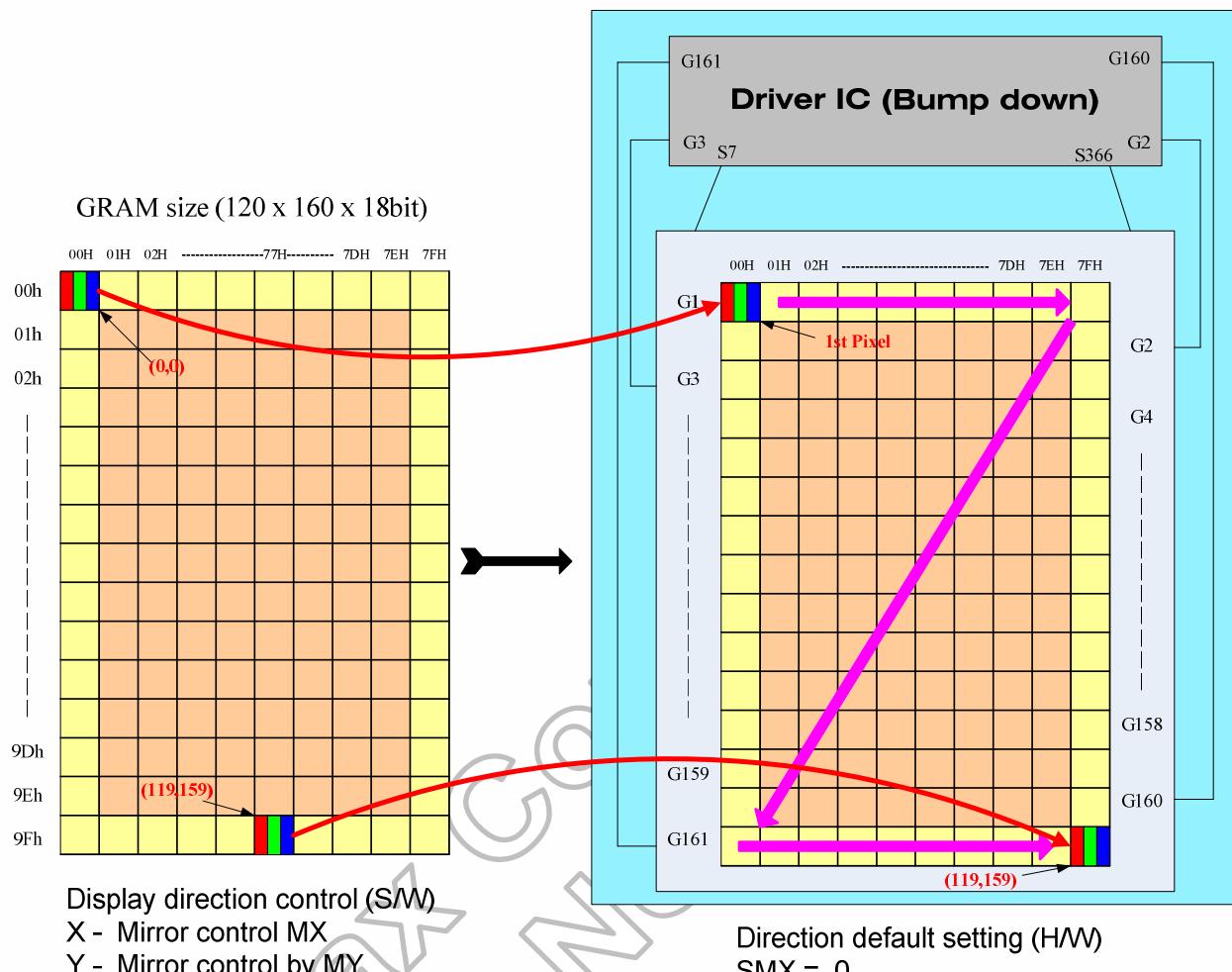


Example for SMX = SMY = 1

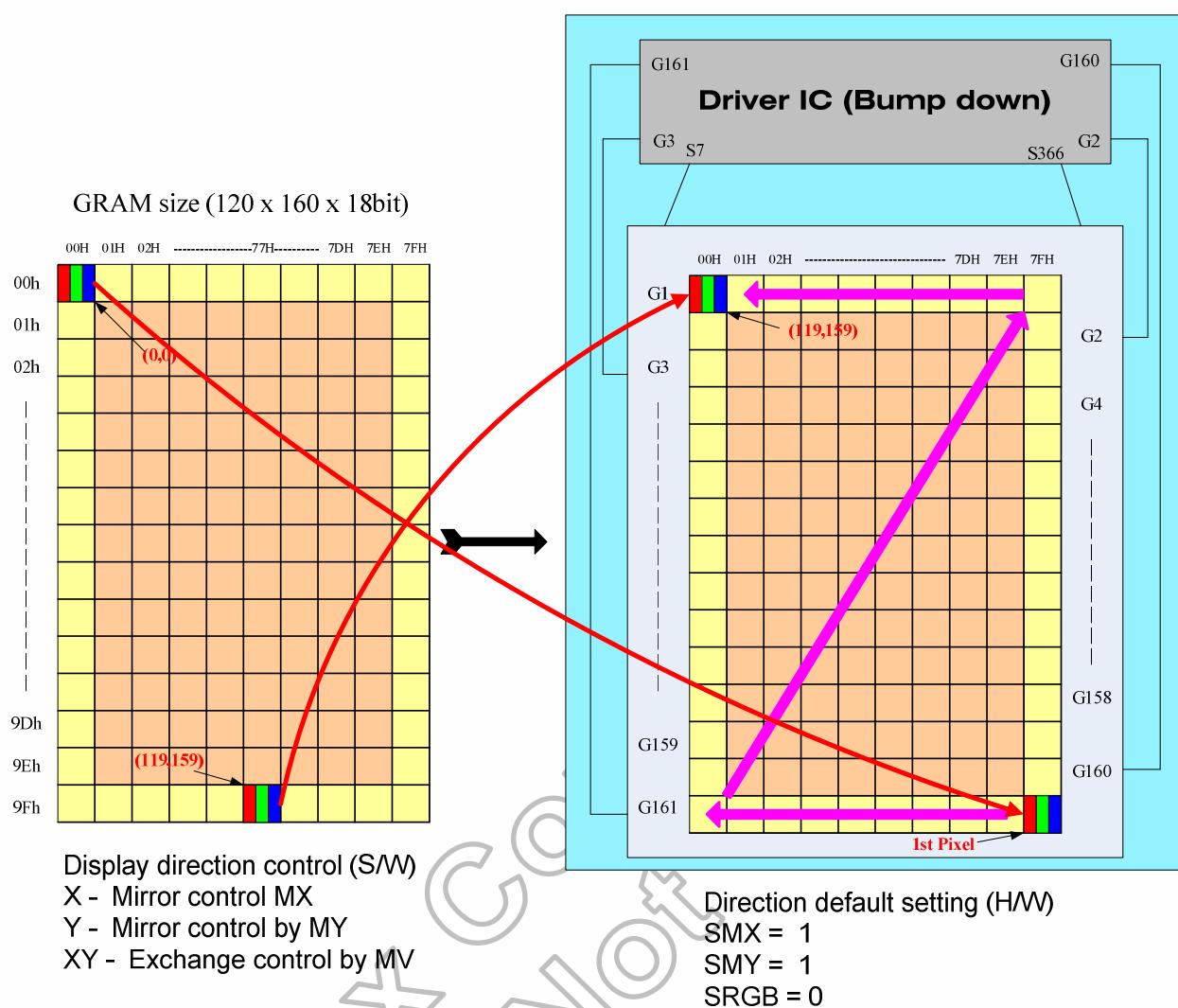


Case 2 of resolution (120RGB x 160) (RSO[2:0] = 010) RAM size = 120 x 160 x 18-bits (Used)  
Display size = 120RGB x 160

Example for SMX = SMY = 0

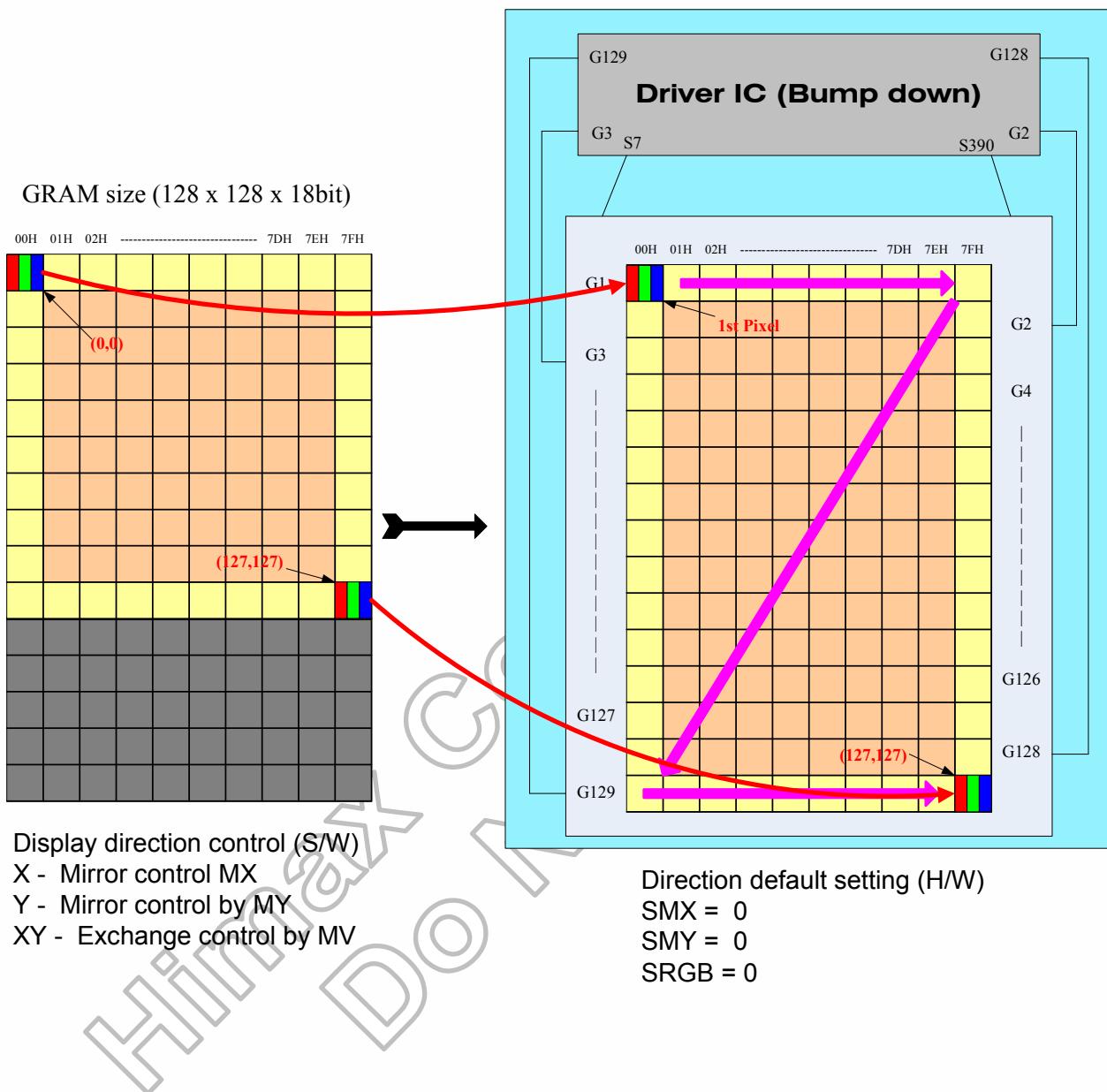


Example for SMX = SMY = 1

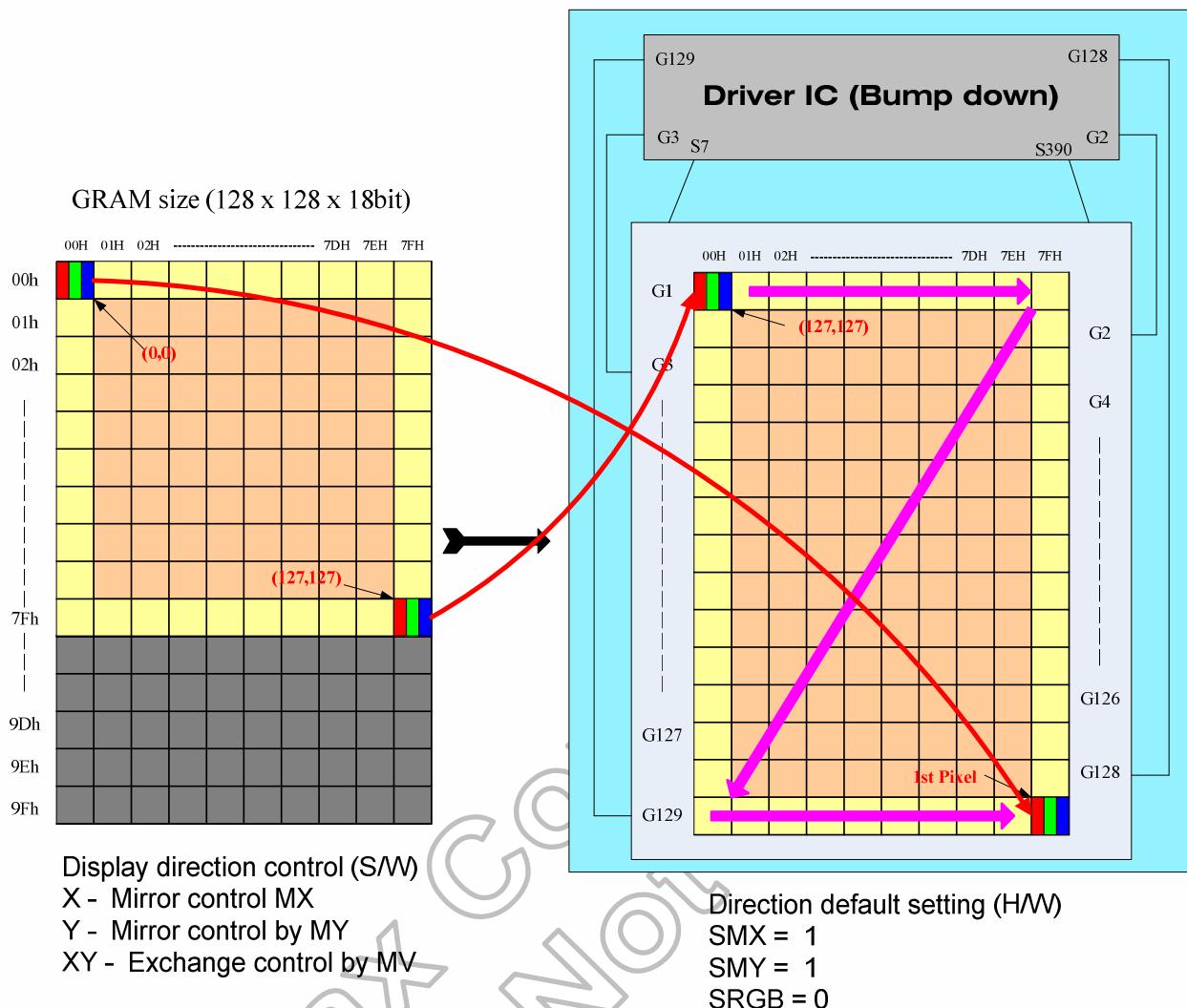


Case 3 of resolution (128RGB x 128) (RSO[2:0] = 001) RAM size = 128 x 128 x 18-bits (Used)  
Display size = 128RGB x 128

Example for SMX = SMY = 0

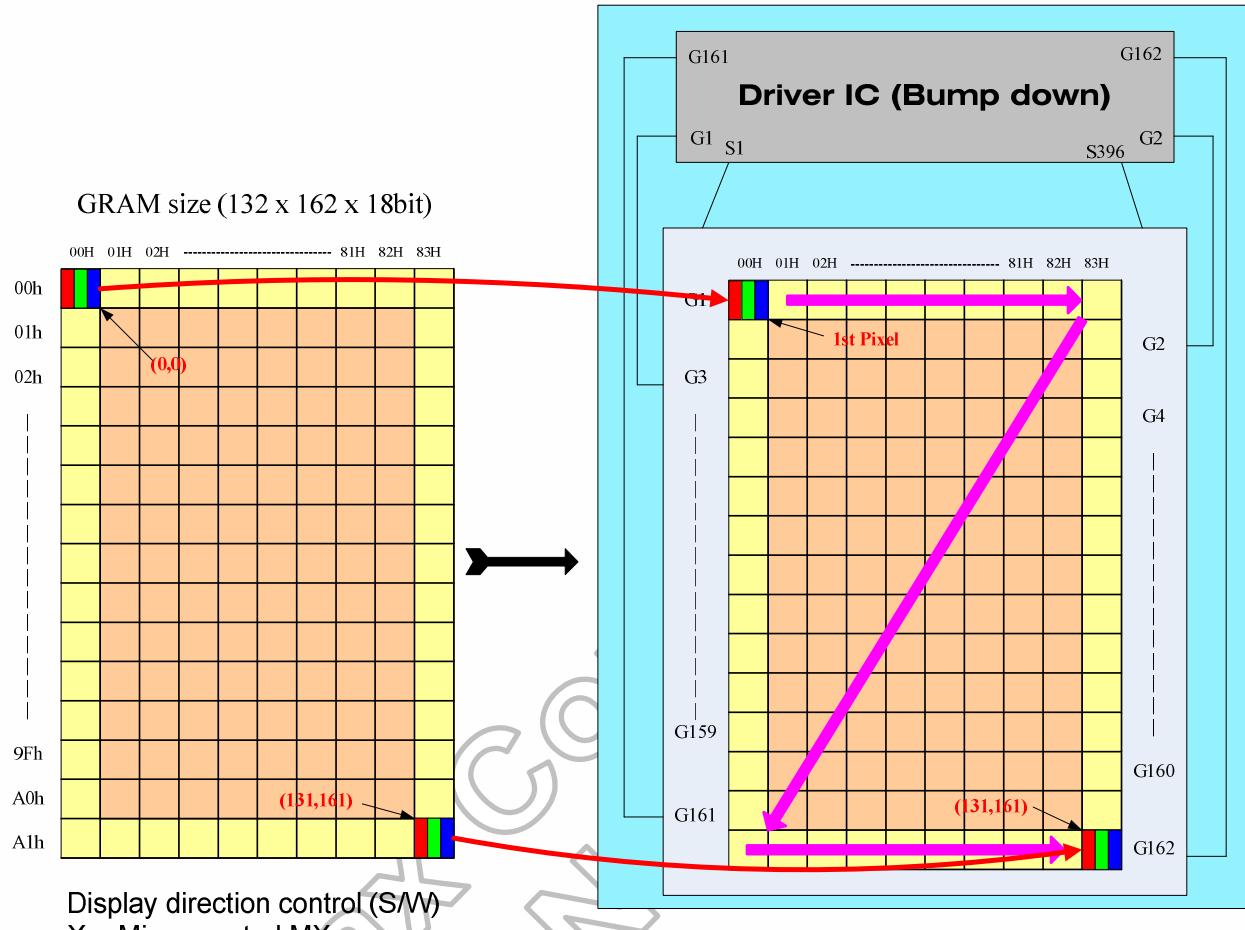


Example for SMX = SMY = 1

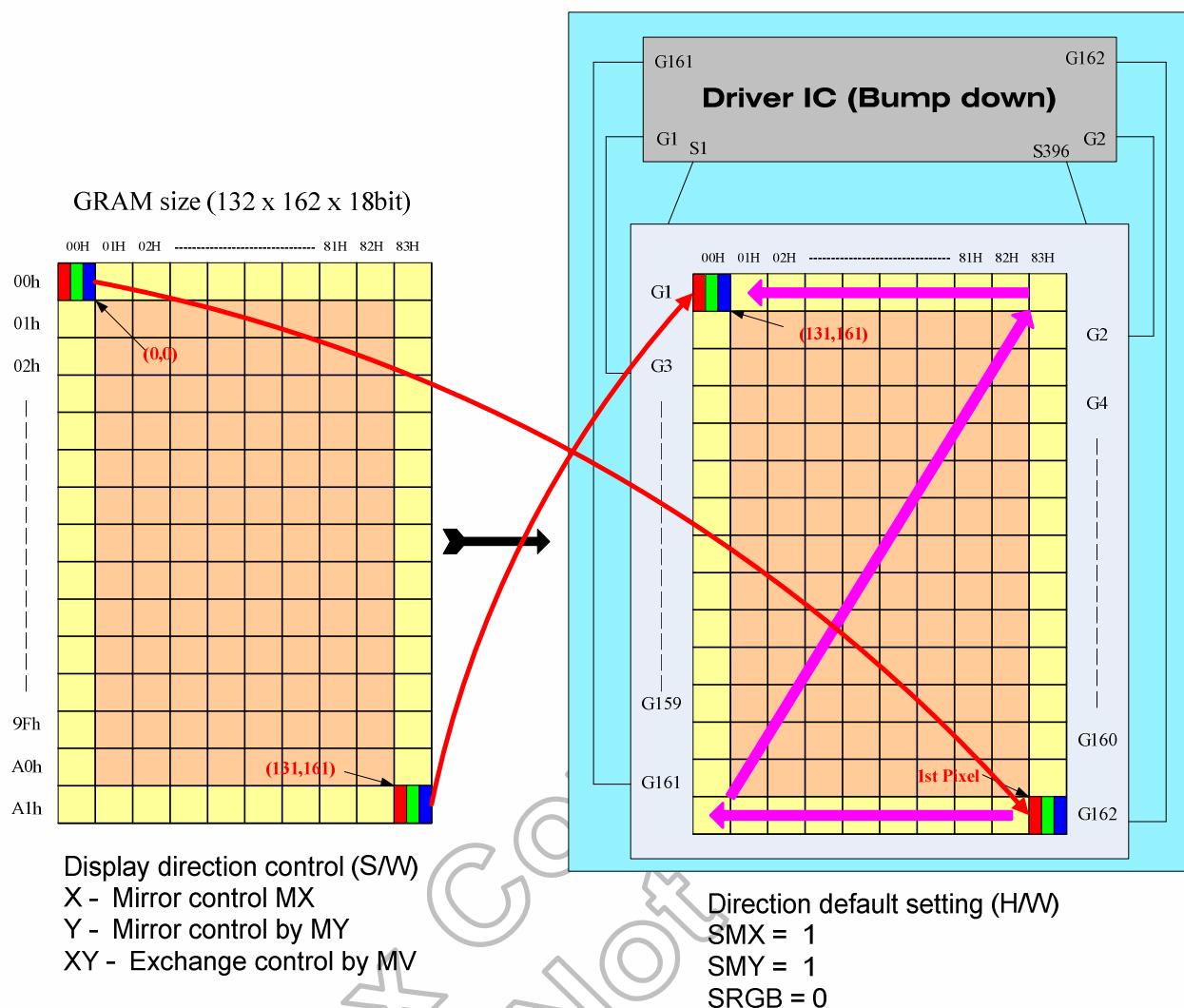


Case 4 of resolution (132RGB x 162) (RSO[2:0] = 000) RAM size = 132 x 162 x 18-bits (Used)  
 Display size = 132RGB x 162 ~ Type 1  
 (P.S : STE\_SEL = 0 → Type1 ; STE\_SEL = 1 → Type 2)

Example for SMX = SMY = 0



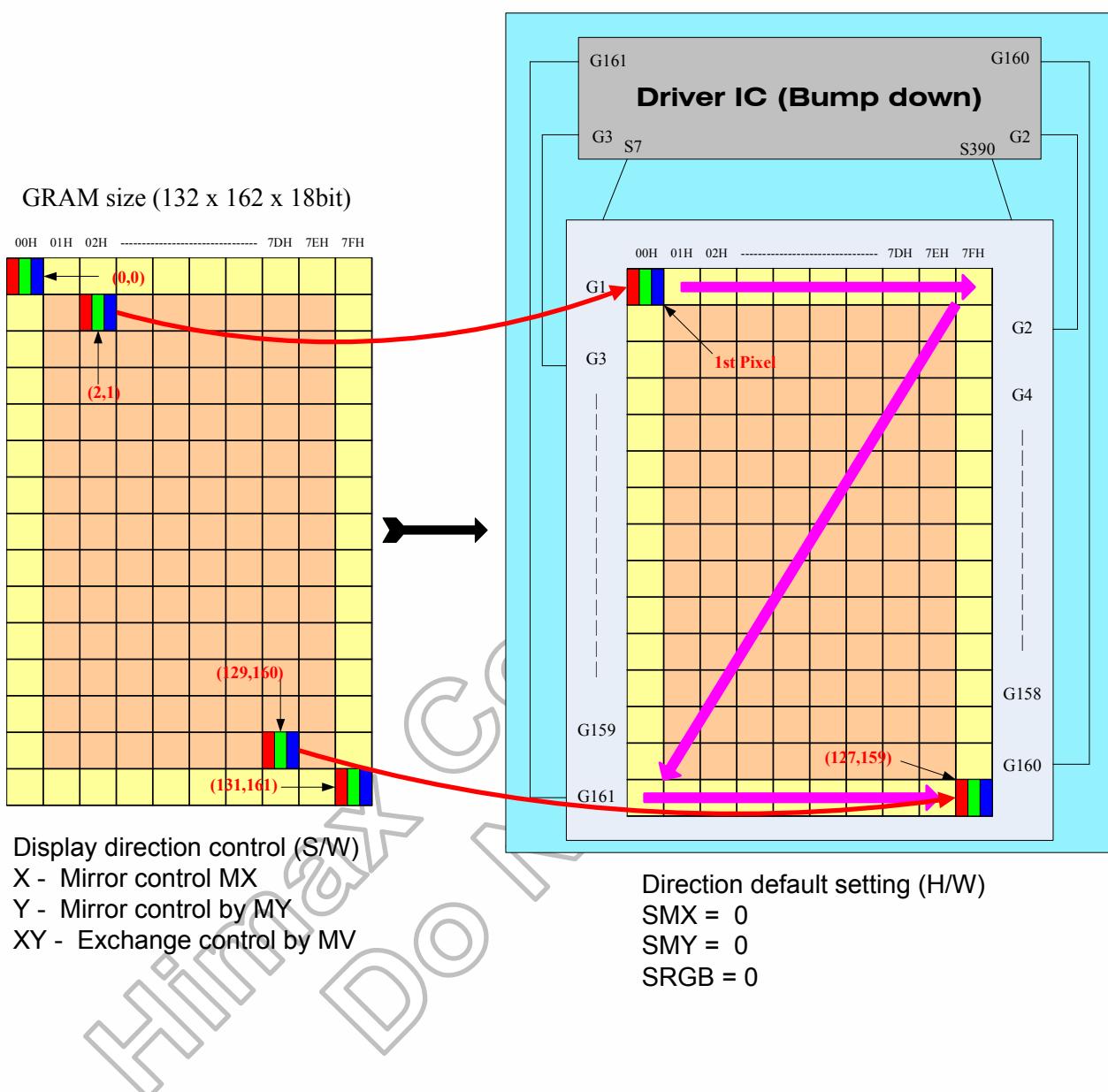
Example for SMX = SMY = 1



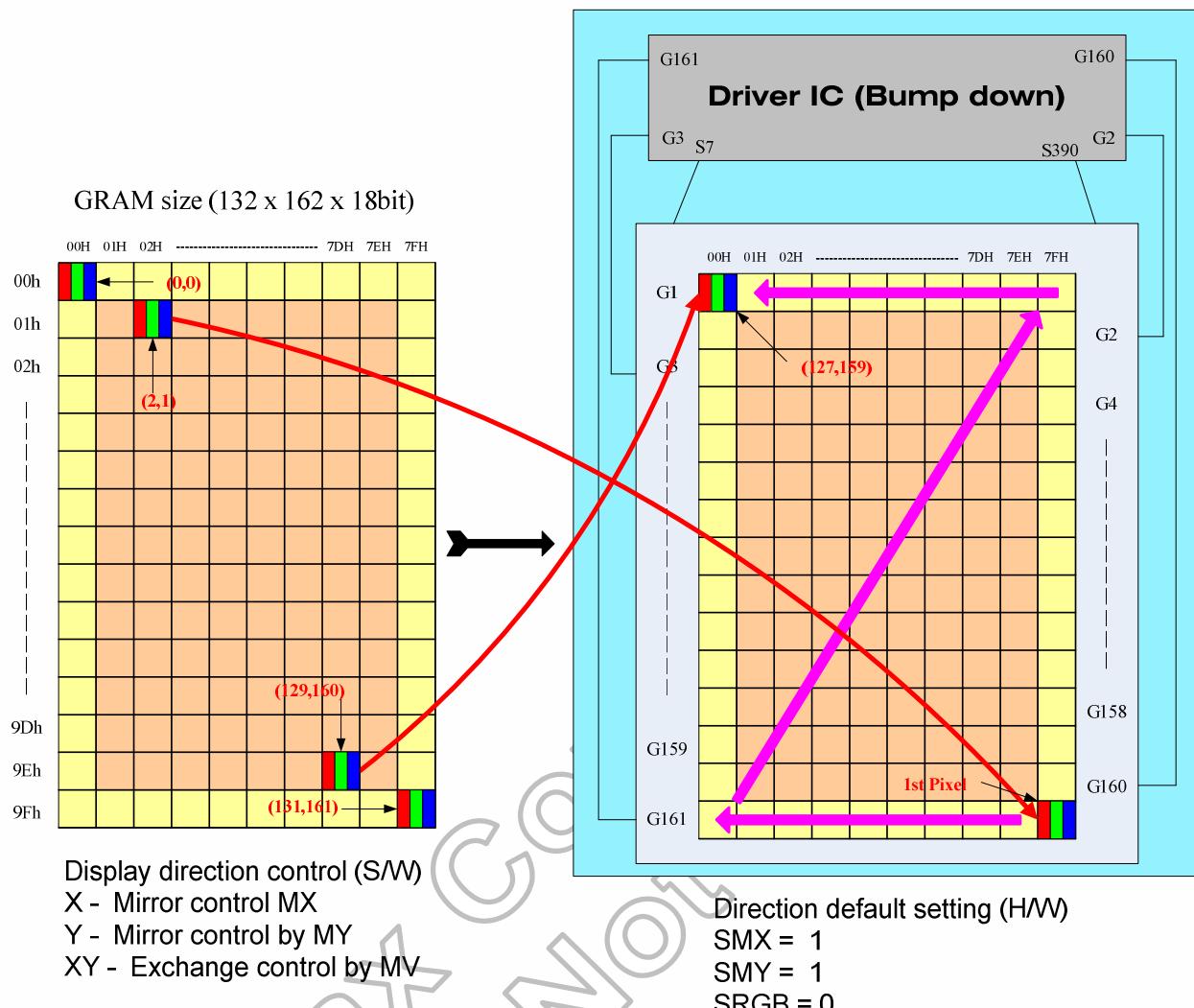
Display size = 132RGB x 162 ~ Type 2

(P.S : STE\_SEL = 0 → Type1 ; STE\_SEL = 1 → Type 2)

Example for SMX = SMY = 0

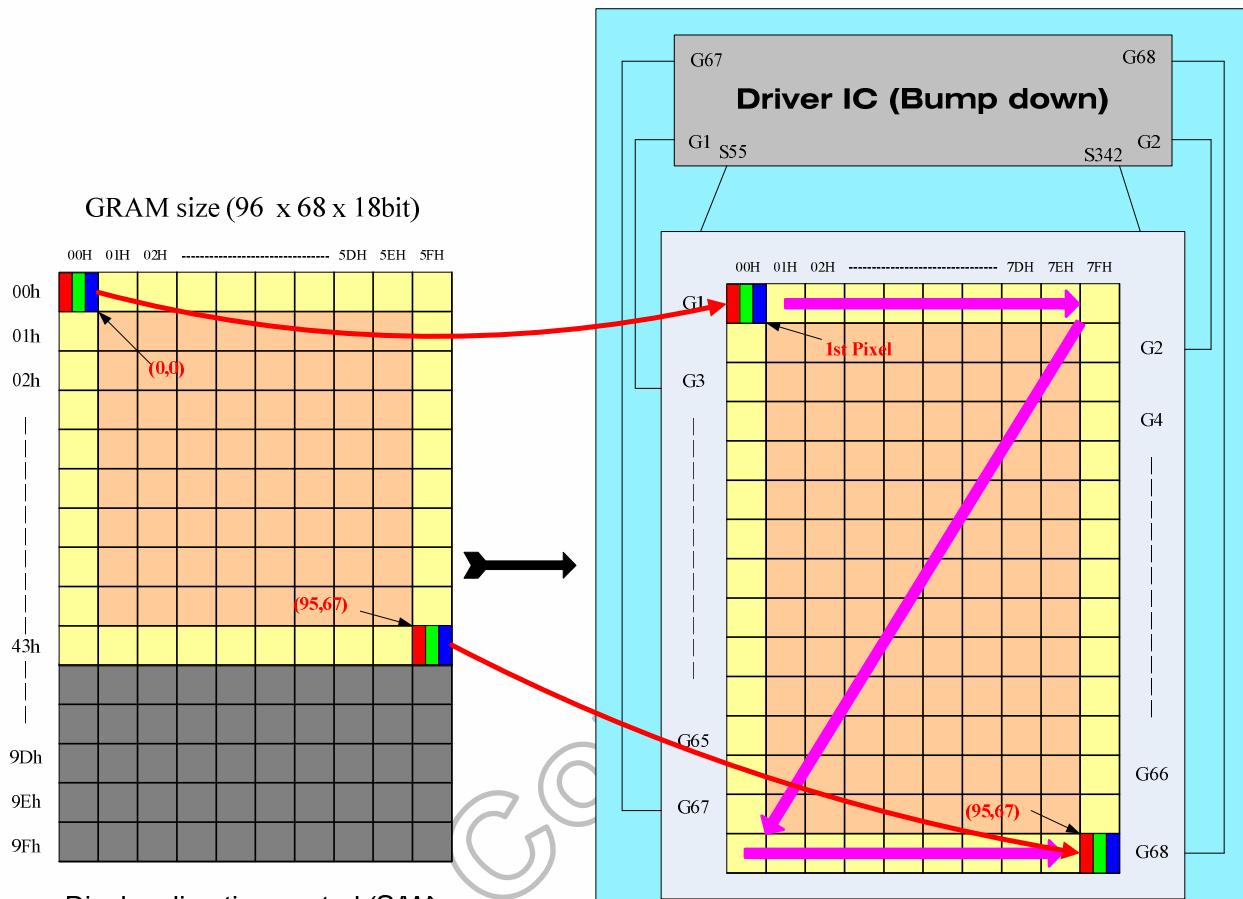


Example for SMX = SMY = 0

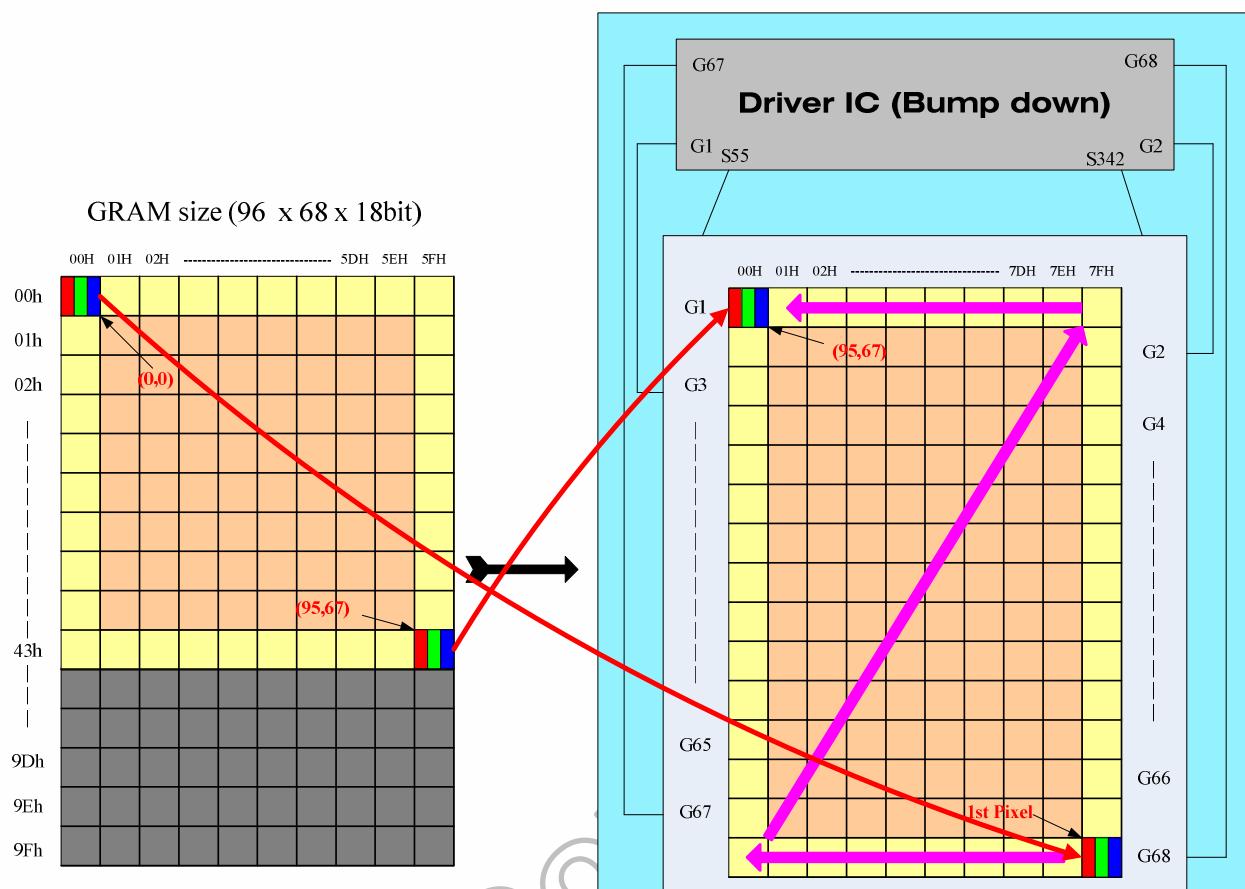


Case 5 of resolution (96RGB x 68) (RSO[2:0] = 100) RAM size = 96 x 68 x 18-bits (Used)  
Display size = 96RGB x 68

Example for SMX = SMY = 0

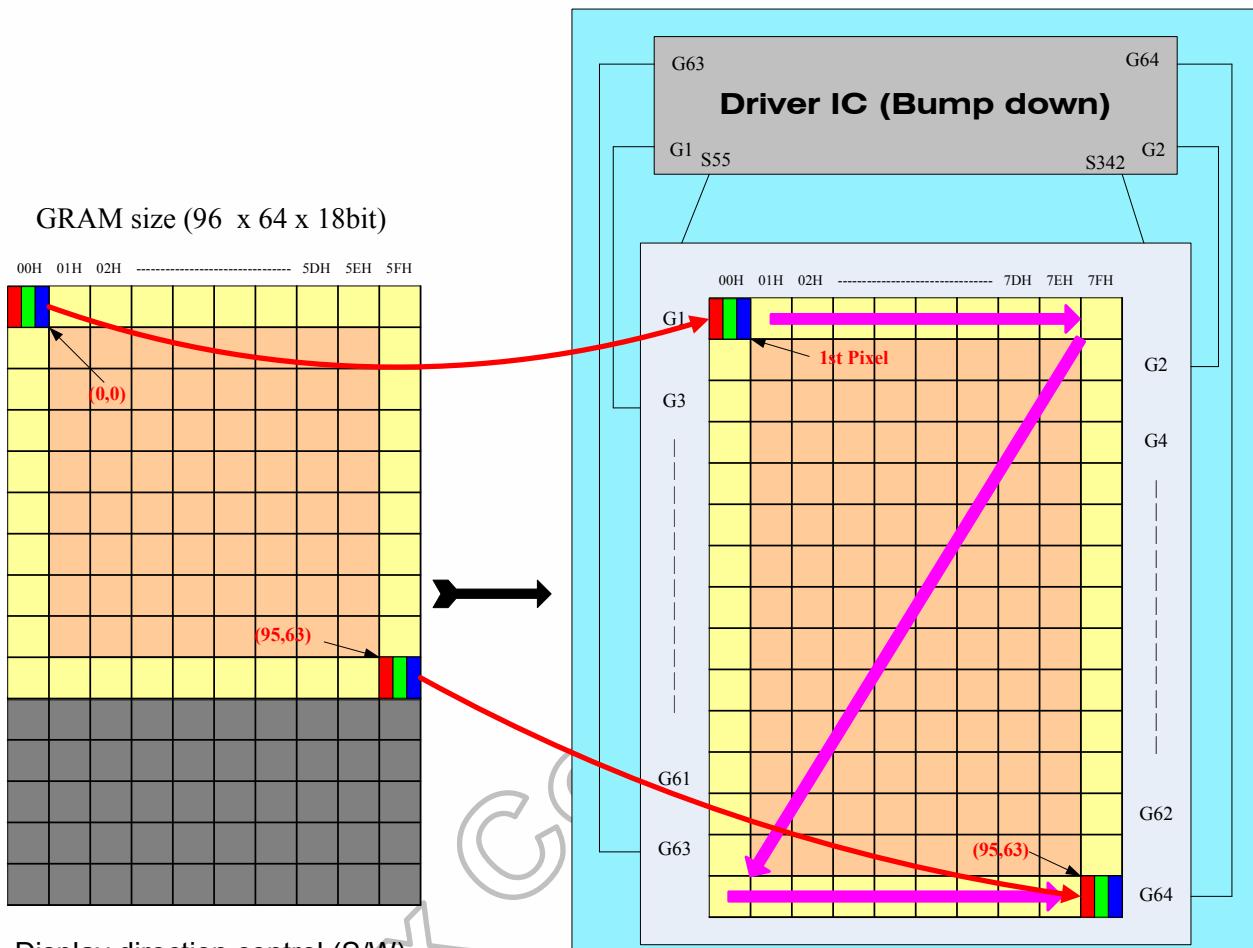


Example for SMX = SMY = 1



Case 6 of resolution (96RGB x 64) (RSO[2:0] = 101) RAM size = 96 x 64 x 18-bits (Used)  
Display size = 96RGB x 64

Example for SMX = SMY = 0



Display direction control (S/W)

X - Mirror control MX

Y - Mirror control by MY

XY - Exchange control by MV

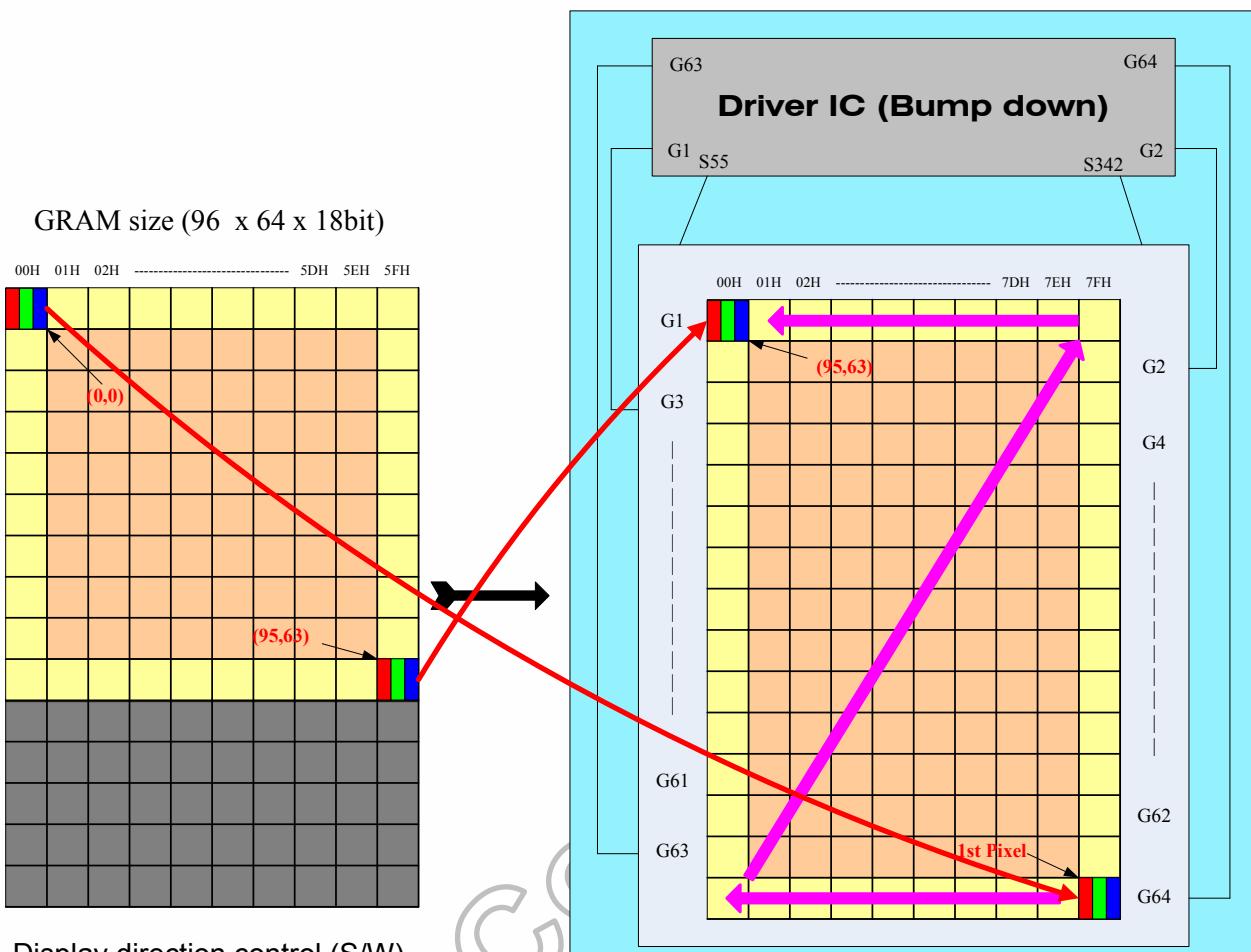
Direction default setting (H/W)

SMX = 0

SMY = 0

SRGB = 0

Example for  $SMX = SMY = 1$



### Display direction control (S/W)

#### X - Mirror control MX

Y - Mirror control by MY

XY - Exchange control by MV

#### Direction default setting (H/W)

SMX = 1

**SMX = 1**

SMT = 1  
SRGB = 0

## 12. Ordering Information

| Part No.                            | Package  |
|-------------------------------------|--|
| <b>HX8353-E000 PD<sub>xxx</sub></b> | PD : mean COG<br>xxx : mean chip thickness (μm), (default: 250 μm) |

## 13. Revision History

| Version | Date       | Description of Changes   |
|---------|------------|--|
| 01      | 2010-11-23 | New setup  |
|         | 2010/12/31 | Modify PAD coordinates   |
|         | 2011/2/17  | Update register and OTP flow   |
|         | 2011/9/30  | <ol style="list-style-type: none"> <li>1. Page 172 modify Read Himax Internal ID=53h</li> <li>2. cover page preliminary version 01 delete "preliminary"</li> </ol>   |
| 01.02   | 2011/11/15 | <ol style="list-style-type: none"> <li>1. Add reg C0h SETSTBA &amp; B5h SETBGP define</li> <li>2. Page 13 delete bump height</li> <li>3. Page 158 modify reg B0h RADJ[3:0] table</li> <li>4. Page 12 add LC_SEL1~0 pin define</li> </ol> |
| 01.03   | 2012/04/17 | Page 181 pad 114 is modified from nvtestout to dummy   |