

**Specification**

For

LCD Module

**CFAF240400DT**

<b>MODULE:</b>	<b>CFAF240400DT</b>
<b>CUSTOMER:</b>	

REV	DESCRIPTION	DATE
1	FIRST ISSUE	2009-5-6

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## Revision History

Data	Rev. No.	Page	Summary
2009-5-6	1	16	FIRST ISSUE
2010-11-08	2	16	Changed pin table to reflect pin 33 as IM0, 9 as IM1, and 10 as IM2

PRELIMINARY

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## General Description

### \* Description

This is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching devices. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit ,back-light unit. The resolution of a 3.0" TFT-LCD contains 240 x 400 pixels, and can display up to 262K colors.

### \* Features

- Low Input Voltage : VCC : 2.8V
- Display Colors of TFT LCD : 262K colors
- CPU Interface : 8080 parallel 8 bit/16bit/18bit
- Internal Power Supply Circuit.

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	38.88(H) *64.80(V) (3.0 inch )	mm	-
Driver element	a-Si TFT active matrix	-	-
Display colors	262K	colors	-
Number of pixels	240(RGB) *400	dots	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.162(H) *0.162 (V)	mm	-
Viewing angle	12	o'clock	-
Drive IC	SPFD5420A	-	-
Display mode	Transmissive/ Normally White	-	-
Operating temperature	-20~+70℃	-	-
Storage temperature	-30~+80℃	-	-

### ● Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	45.04	-	mm	-
	Vertical(V)	-	77.00	-	mm	-
	Depth(D)	-	2.6	-	mm	-
Weight		-	TBD	-	g	-

## 1. Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (1).

Measuring equipment: LCD-7200, BM-5A, BM-7, PR-650, EZ-Contrast

ITEM	SYMBOL	CONDITION	Min.	TYP.	Max.
Color Filter Chromaticity (Note.1)	White	x	(0.283)	(0.303)	(0.323)
		y	(0.322)	(0.342)	(0.362)
		Y	(27.7)	(31.7)	(35.7)
	Red	x	(0.633)	(0.653)	(0.673)
		y	(0.311)	(0.331)	(0.351)
		Y	(14.9)	(17.9)	(20.9)
	Green	x	(0.290)	(0.310)	(0.330)
		y	(0.554)	(0.574)	(0.594)
		Y	(57.3)	(61.3)	(65.3)
	Blue	x	(0.115)	(0.135)	(0.155)
		y	(0.115)	(0.135)	(0.155)
		Y	(12.8)	(15.8)	(18.8)

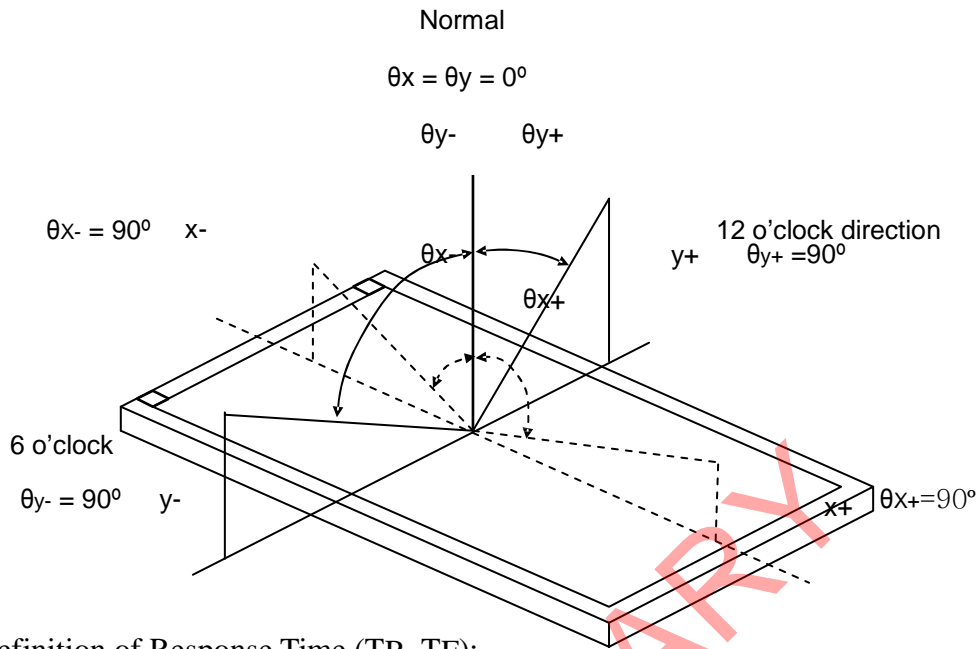
Measuring equipment : BM-7

Note (1) If product is exposed to high temperatures for extended time, there is a possibility of the polarizer film damage which could degrade the optical characteristics.

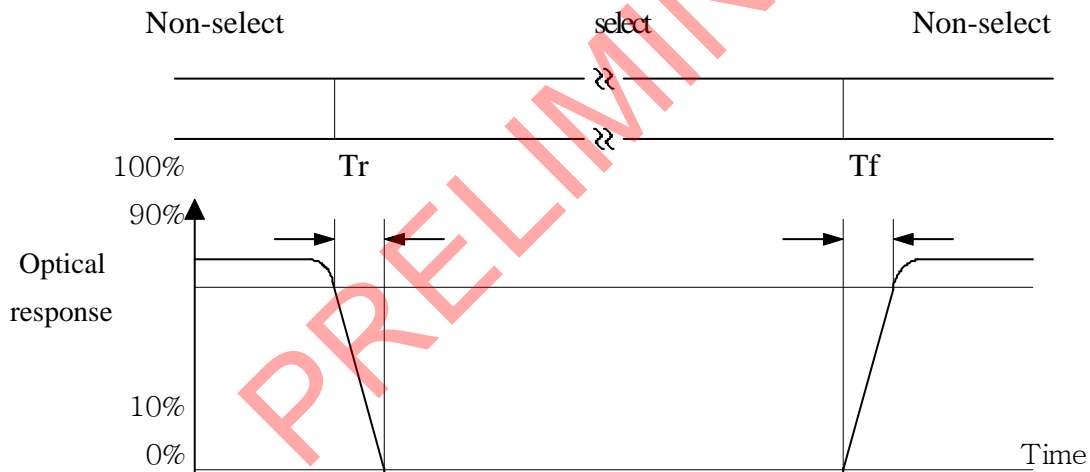
Note (2) Definition of Contrast Ratio (CR):

$$CR = \frac{\text{Luminance ( brightness ) all pixels "White"}}{\text{Luminance ( brightness ) all pixels "dark"}}$$

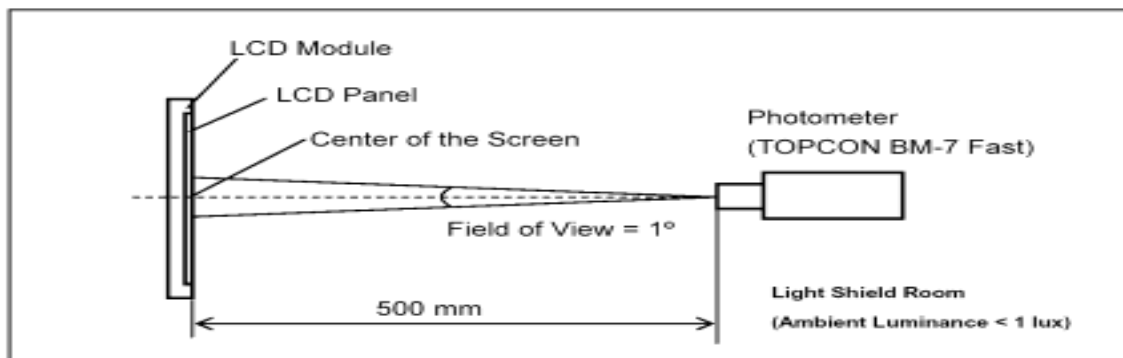
Note (3). Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):



Note (4) Definition of Response Time (TR, TF):



Note (5) Measurement Set-Up: Measure after lighting Backlight for 30 minutes in a windless room.



## 2. Electrical Characteristics

### 2.1 ABSOLUTE MAXIMUM RATING(Ta=25 VSS=0V)

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Supply voltage for Logic	V <sub>CC</sub>	2.7	2.8	+ 3.3	V	-
Logic signal input voltage	V <sub>IN</sub>	-0.3	-	V <sub>DDI</sub> + 0.3	V	-
Operating temperature	T <sub>OP</sub>	-20	-	+70	°C	1,2
Storage temperature	T <sub>ST</sub>	-30	-	+80	°C	1,2

Note1: Background color changes slightly depending on ambient temperature.  
This phenomenon is reversible. Ta70°C: 75%RH max

Ta>70°C: absolute humidity must be lower than the humidity of 75%RH at 70°C

Note2: Ta at -30°C will be <48hrs, at 80°C will be <120hrs

### 2.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Supply voltage for Logic	V <sub>CC</sub>	2.7	2.8	3.3	V	-
Current consumption	I <sub>CC</sub> + I <sub>CI</sub>	-	8		mA	-
Level input voltage	V <sub>IH</sub>	0.7V <sub>DDI</sub>	-	V <sub>DDI</sub>	V	-
	V <sub>IL</sub>	V <sub>SS</sub>	-	0.3V <sub>DDI</sub>	V	-
Level output voltage	V <sub>OH</sub>	V <sub>SS</sub>	-	V <sub>DDI</sub>	V	-
	V <sub>OL</sub>	V <sub>SS</sub>	-	0.2V <sub>DDI</sub>	V	-

### 2.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 4chips White LED in parallel

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I <sub>F</sub>	-	60	-	mA	
Forward Voltage	V <sub>F</sub>	-	3.2	-	V	-
Luminance	L <sub>V</sub>	--	TBD	-	cd/m <sup>2</sup>	-
Uniformity	A <sub>Vg</sub>	80	-	-	%	-

### 3. Input terminal Pin Assignment

#### 3.1 Input signal & Power

Pin NO.	Symbol	Function
1	GND	System ground
2	NC	NC
3-6	LEDK4- LEDK1	LED Cathode K4-K1
7	LEDA	LED Anode
8	RESET	This signal will reset the device and it must be applied to properly
9	IM1	Connect to MCU IM1
10	IM2	Connect to MCU IM2
11-28	DB17-D B00	MCU parallel interface data busDB17-DB00.
29	RD	Read enable in 8080 MCU parallel interface.
30	WR	Write enable in 8080 MCU parallel interface.
31	RS	Display data/command selection pin in MCU interface. RS='1': display data or parameter. RS='0': command data.
32	CS	Chip selection pin ("Low" is enable) signal
33	IM0	Connect to MCU IM0
34	XL	NC
35	YD	NC
36	XR	NC
37	YU	NC
38	VDD	Power supply
39	GND	System ground



### 3.2 Input Signal, Basic Display Colors and Gray scale of Each Colors

COLOR	Display	RED					GREEN					BLUE					GRAY SCALE LEVEL			
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2		B3	B4	B5
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	-
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	DARK ↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R60
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R61
	LIGHT ↓	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R62
RED	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R63	
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK ↑	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	G1
		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G60
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	G61
	LIGHT ↓	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	G62
GREEN	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	G63	
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	B1
		0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	B2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B60
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	B61
	LIGHT ↓	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B62
BLUE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	B63	

Note) Defintion of Gray :

Rn: Red Gray, Gn : Green Gray, Bn: Blue Gray (n = Gray level)

Input Signal : 0 = Low level voltage , 1 = High level vottage

## 4. Operating Principle & Methods

4.1 Please refer to SPFD5420A datasheet for more details.

### 80-System Interface Timing Characteristics

**Table 13-4** Normal write operation (HWM=0), IOVCC=1.65V~3.60V

Item	Symbol	Unit	Min.	Typ.	Max.	
Bus cycle time	Write	tCYCW	ns	150	-	-
	Read	tCYCR	ns	450	-	-
Write low-level pulse width	PWLW	ns	55	-	-	
Read low-level pulse width	PWLR	ns	170	-	-	
Write high-level pulse width	PWHW	ns	70	-	-	
Read high-level pulse width	PWHR	ns	250	-	-	
Write/Read rise/ fall time	tWRr, WRf	ns	-	-	10	
Setup time	Write (RS to CS*,WR*)	tAS	ns	0	-	-
	Read (RS to CS*, RD*)		ns	10	-	-
Address Hold Time	tAH	ns	2	-	-	
Write data setup time	tDSW	ns	25	-	-	
Write data hold time	tH	ns	10	-	-	
Read data delay time	tDDR	ns	-	-	150	
Read data hold time	tDHR	ns	5	-	-	

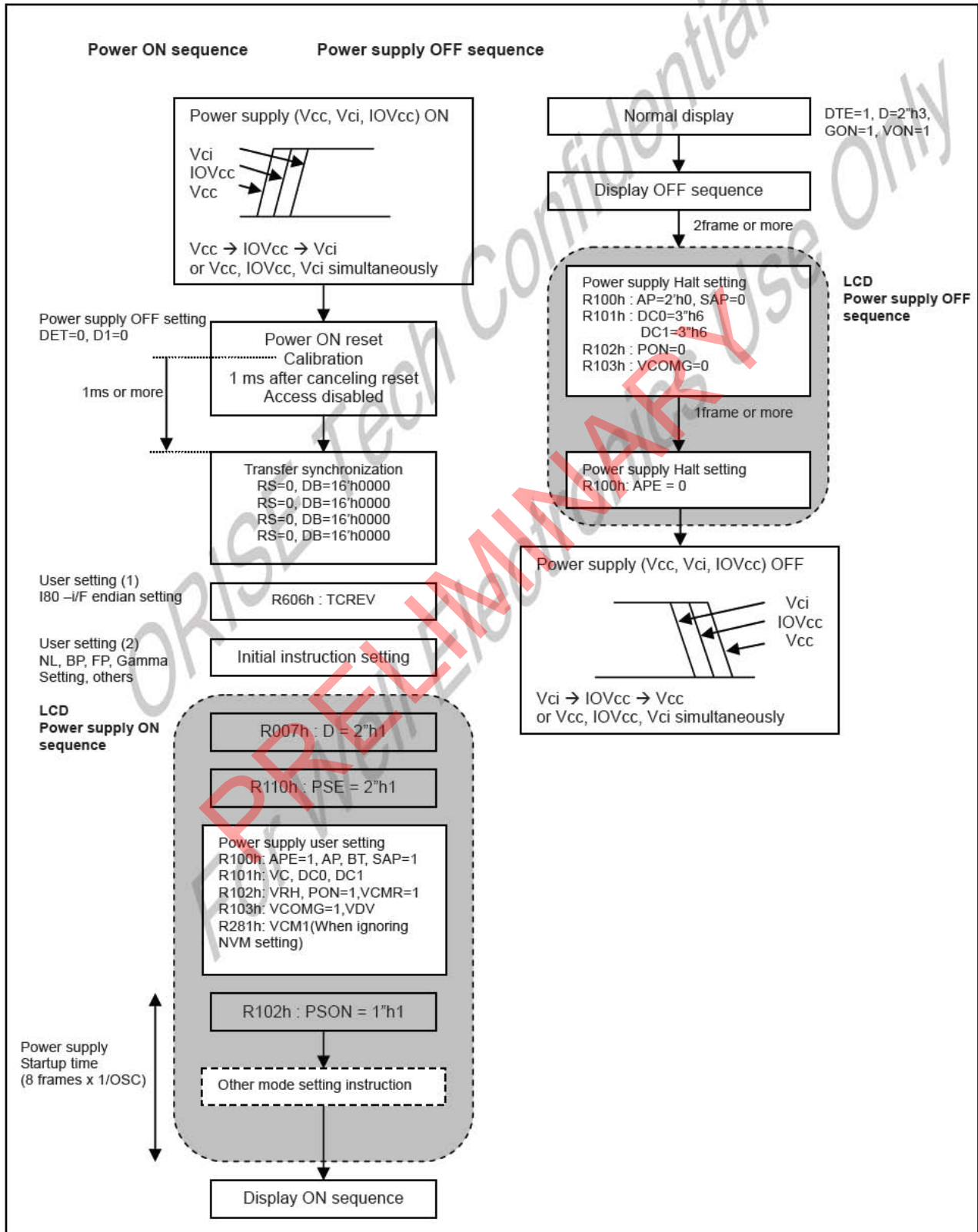
Figure 4.1 80 SYSTEM BUS TIMING

### 4.2 RESET TIMING

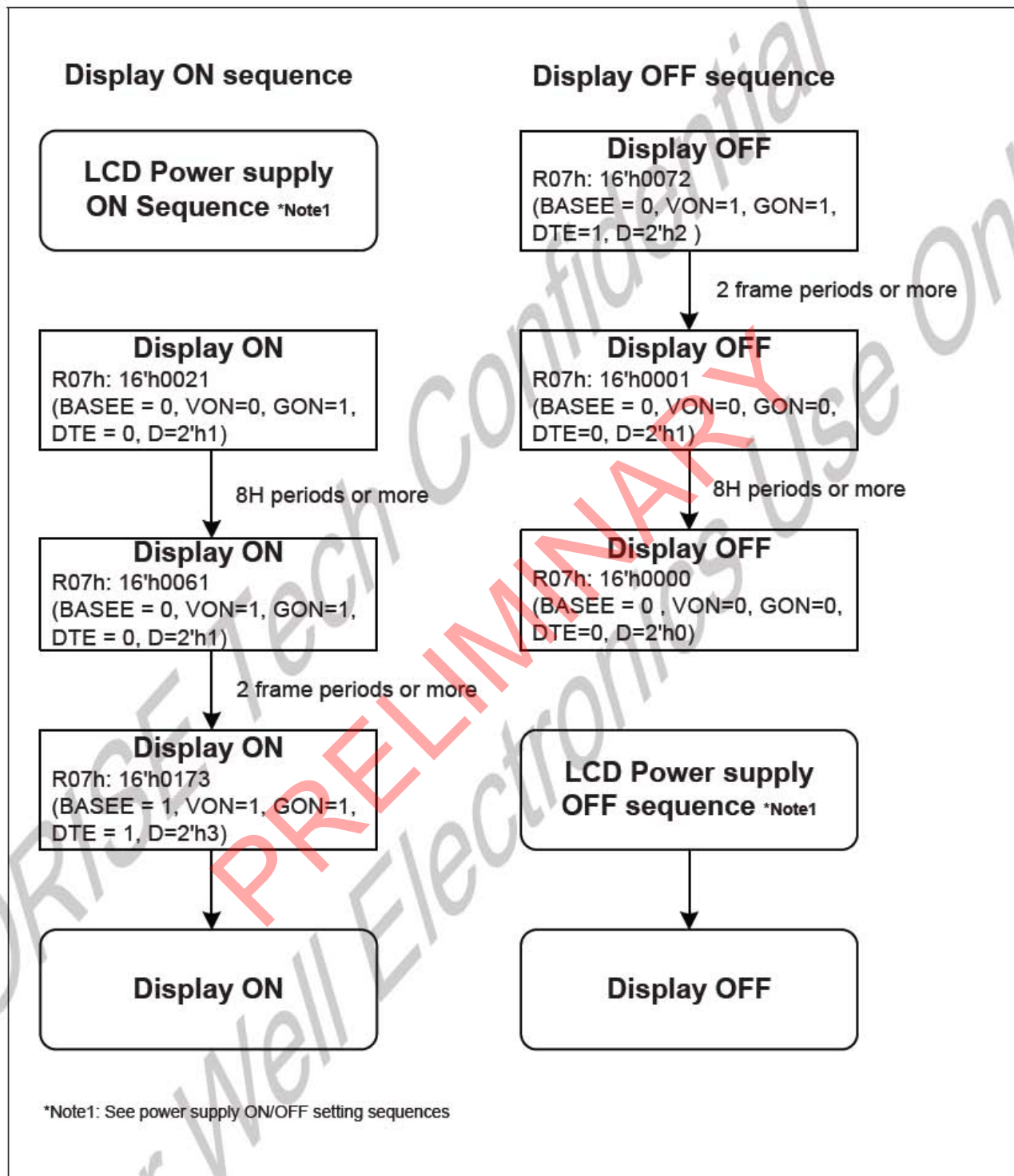
Item	Symbol	Unit	Min.	Typ.	Max.
Reset low-level width	tRES	ms	1	-	-
Reset rise time	trRES	μs	-	-	10

## 5. Operation Sequence:

### 5.1 Power On/Off Sequence



## 5.2 Display On/Off Sequence



## 6. Reliability Test Result

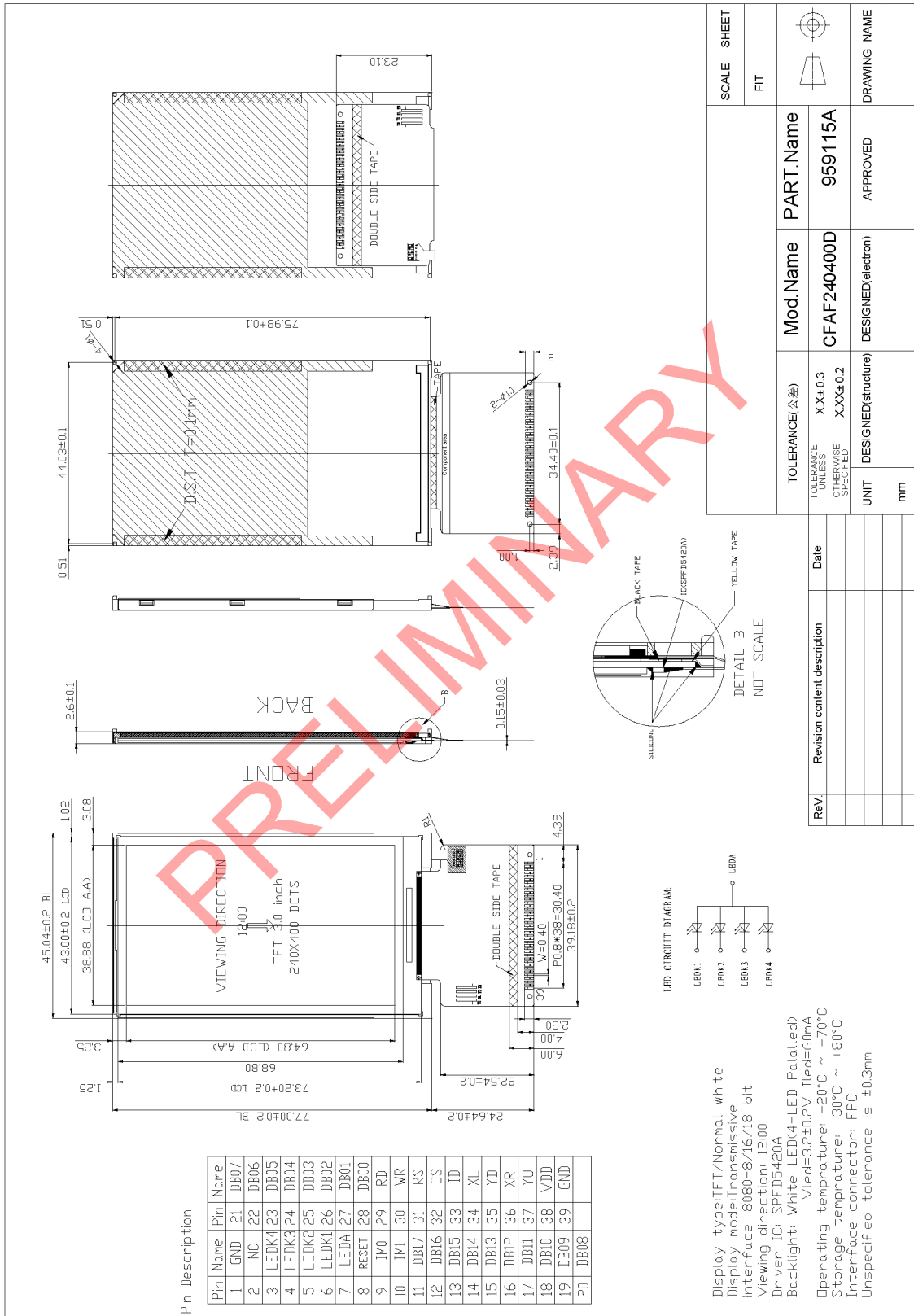
### 6.1 Condition

Item	Condition	Sample Size	Test Result	Note
Low Temperature Operating Life test	-20°C, 96HR	5ea	TBD	-
Thermal Humidity Operating Life test	60°C, 90%RH, 96HR	10ea	TBD	-
Temperature Cycle ON/OFF test	-20°C ↔ 70°C, ON/OFF, 20CYC	5ea	TBD	(1)
High Temperature Storage test	80°C, 96HR	5ea	TBD	-
Low Temperature Storage test	- 30°C, 96HR	5ea	TBD	-
Thermal Shock test	(-20°C ↔ 70°C) <sup>8CYC</sup>	5ea	TBD	(2)
ESD CDM	Contact	+/-4kV, 5 times	5ea	TBD
	Air	+/-8kV, 5 times	5ea	TBD
Box Vibration Test	Acceleration:1.5G, Vibration width : 3 mm Sweep range : 5-55 Hz Vibration direction : X, Y, Z axis 120 cyc	1box	TBD	
Box Drop Test	1 Corner 3 Edges 6 faces, 66cm(MEDIUM BOX)	1box	TBD	-

Note (1) ON Time over 10 seconds, OFF Time under 10 seconds

(2)

STEP Order	Temperature	Humidity	Time	Test	Note
1	+ 25 °C	65 %	3 Hr	Function Test	① Temperature : within 3 °C  below 1 °C/min
2	- 20 °C	0 %	12 Hr	Auto Test	
3	+ 25°C	65 %	1 Hr	Function Test	
4	+ 70 °C	90 %	12 Hr	Auto Test	
5	+ 25 °C	65 %	1 Hr	Function Test	
6	- 20 °C	0 %	12 Hr	Auto Test	
7	+ 70 °C	95 %	12 Hr	Auto Test	
8	+ 25 °C	65 %	3 Hr	Final Test	



## 8. Packing

TBD

## 9. Cautions and Handling Precautions

### 9.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.

Do not warp or twist the module during assembly work.

(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(3) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface.

(4) Do not allow drops of water or chemicals to remain on the display surface.

If you have the droplets for a long time, staining and discoloration may occur.

(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.

Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static, it may cause damage to the CMOS ICs.

(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(12) Pins of I/F connector shall not be touched directly with bare hands.

(13) Do not connect, disconnect the module in the "Power ON" condition.

(14) Power supply should always be turned on/off by the item 5.1 Power On Sequence & 5.2 Power Off Sequence

## 9.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.

It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%

(2) Do not store the TFT-LCD module in direct sunlight.

(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.

(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module. In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

PRELIMINARY