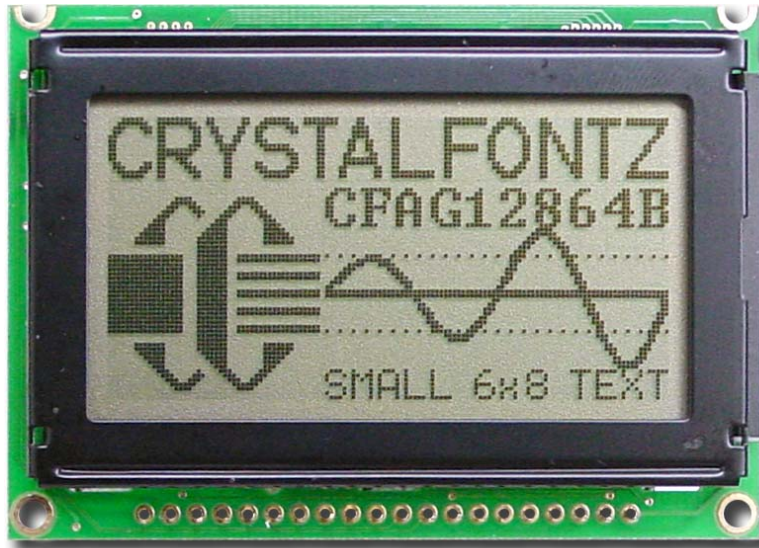




# Crystalfontz America, Incorporated

## GRAPHIC LCD MODULE SPECIFICATIONS



Crystalfontz Model Number	CFAG12864B-TFH-V
Hardware Version	Revision "A", September 2005
Data Sheet Version	Revision 1.0, December 2006
Product Pages	<a href="http://www.crystalfontz.com/products/12864b">www.crystalfontz.com/products/12864b</a>
Customer Name	
Customer Part Number	

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2005/09/01	Current Hardware Version: vA

DATA SHEET	
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The information in this publication is deemed accurate but is not guaranteed.

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## MAIN FEATURES

- ❑ 128 x 64 dots graphic LCD module has a large display area in a compact 75.0 (W) x 52.7 (H) x 8.9 (D) millimeter package (2.95" (W) x 2.07" (H) x .35" (D)).
- ❑ White edge LED backlit with FSTN, positive transreflective mode LCD. Displays dark dots on an illuminated light background.
- ❑ Sunlight readable.
- ❑ Built-in controllers Samsung PN S6B0107B (formerly Samsung PN KS0107B, see [APPENDIX C: SAMSUNG S6B0107 64 CH COMMON DRIVER \(Pg. 28\)](#)) and Samsung S6B0108B (formerly Samsung PN KS0108B, see [APPENDIX D: SAMSUNG S6B0108 64 CH SEGMENT DRIVER \(Pg. 29\)](#)).
- ❑ 8-bit parallel interface.
- ❑ Wide temperature operation: -20°C to +70°C.
- ❑ RoHS compliant.

## MODULE CLASSIFICATION INFORMATION

CFA  
 G  
 128  
 64  
 B - T F H - V<sup>\*</sup>  
1  
2  
3  
4  
5  
6  
7  
8  
9

<b>1</b>	Brand	CrystalFontz America, Inc.
<b>2</b>	Display Type	G – Graphic
<b>3</b>	Number of Dots (Width)	128 dots
<b>4</b>	Number of Dots (Height)	64 dots
<b>5</b>	Model Identifier	B
<b>6</b>	Backlight Type & Color	T – LED, white
<b>7</b>	Fluid Type, Image (positive or negative), & LCD Glass Color	F – FSTN, positive, light
<b>8</b>	Polarizer Film Type, Wide Temperature (WT) Range, & View Angle (O’Clock)	H – Transflective, WT, 6:00 <sup>1</sup>
<b>9</b>	Special Code	V – Built-in negative voltage generator (on the board) * – May have additional manufacturer's codes at this location.
<sup>1</sup> For more information on View Angle, see <a href="#">Definition of 6 O’Clock and 12:00 O’Clock Viewing Angles (Pg. 15)</a> .		



## ORDERING INFORMATION

PART NUMBER	BUILT-IN NEGATIVE VOLTAGE GENERATOR	FLUID	LCD GLASS COLOR	IMAGE	POLARIZER FILM	BACKLIGHT
CFAG12864B-TFH-V	Yes	FSTN	light	positive	transflective	white edge LEDs
<i>Additional variant (same form factor, different LCD mode or backlight):</i>						
CFAG12864B-TMI-V	Yes	STN	blue	negative	transmissive	white edge LEDs
CFAG12864B-WGH-N	No	STN	light	positive	transflective	white EL lamp
CFAG12864B-WGH-V	Yes	STN	light	positive	transflective	white EL lamp
CFAG12864B-YYH-N	No	STN	yellow-green	positive	transflective	yellow-green edge LEDs
CFAG12864B-YYH-V	Yes	STN	yellow-green	positive	transflective	yellow-green edge LEDs

## MECHANICAL SPECIFICATIONS

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### PHYSICAL CHARACTERISTICS

ITEM	SIZE
Number of Dots	128 x 264 dots
Module Dimensions	75.0 (W) x 52.7 (H) x 8.9 (D) mm
Viewing Area	60.0 (W) x 32.6 (H) mm
Active Area	55.0 (W) x 27.48 (H) mm
Dot Size	.39 (W) x .39 (H) mm
Dot Pitch	.43 (W) x .43 (H) mm
Weight	36 grams (typical)



# MODULE OUTLINE DRAWING

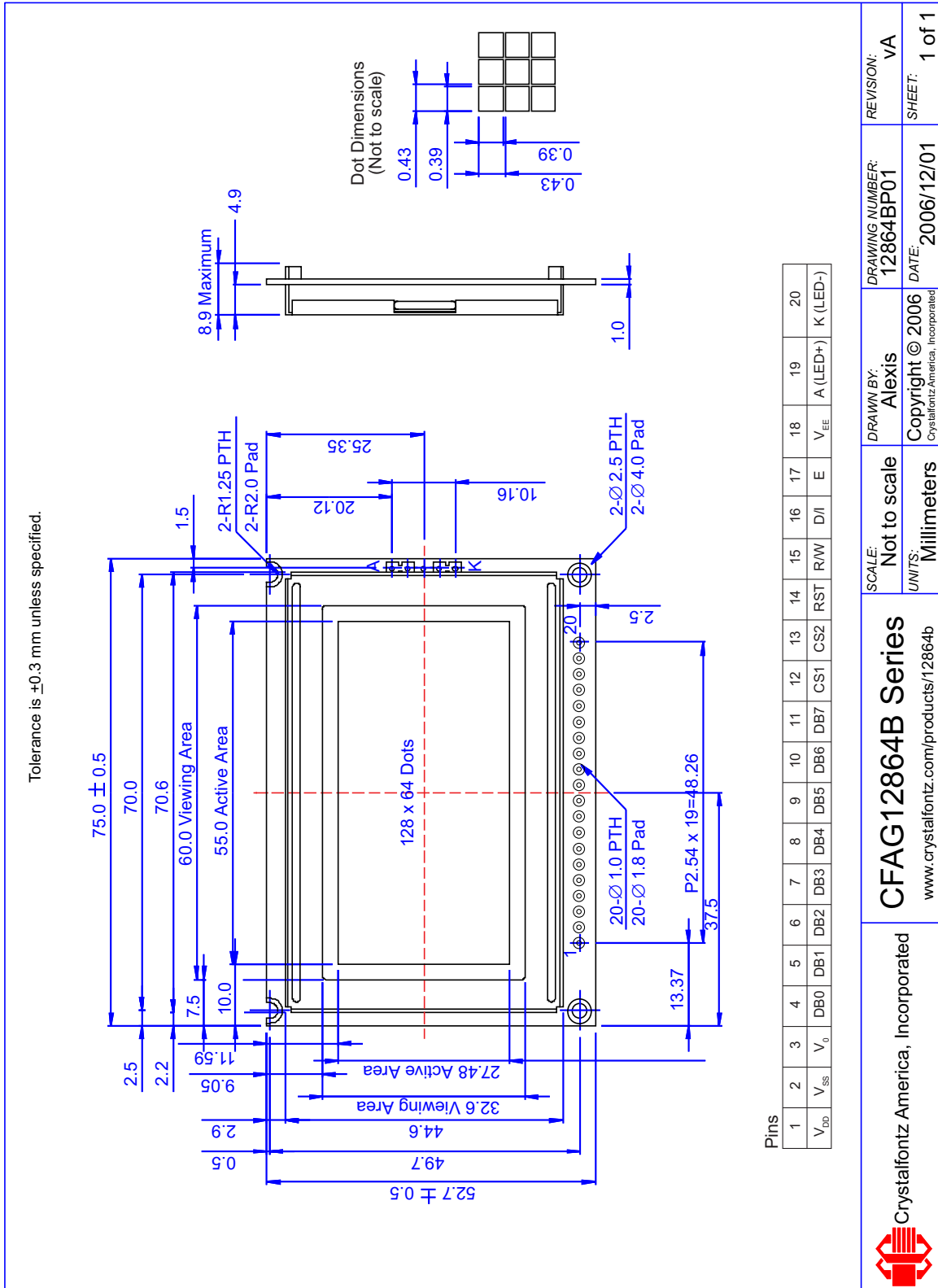
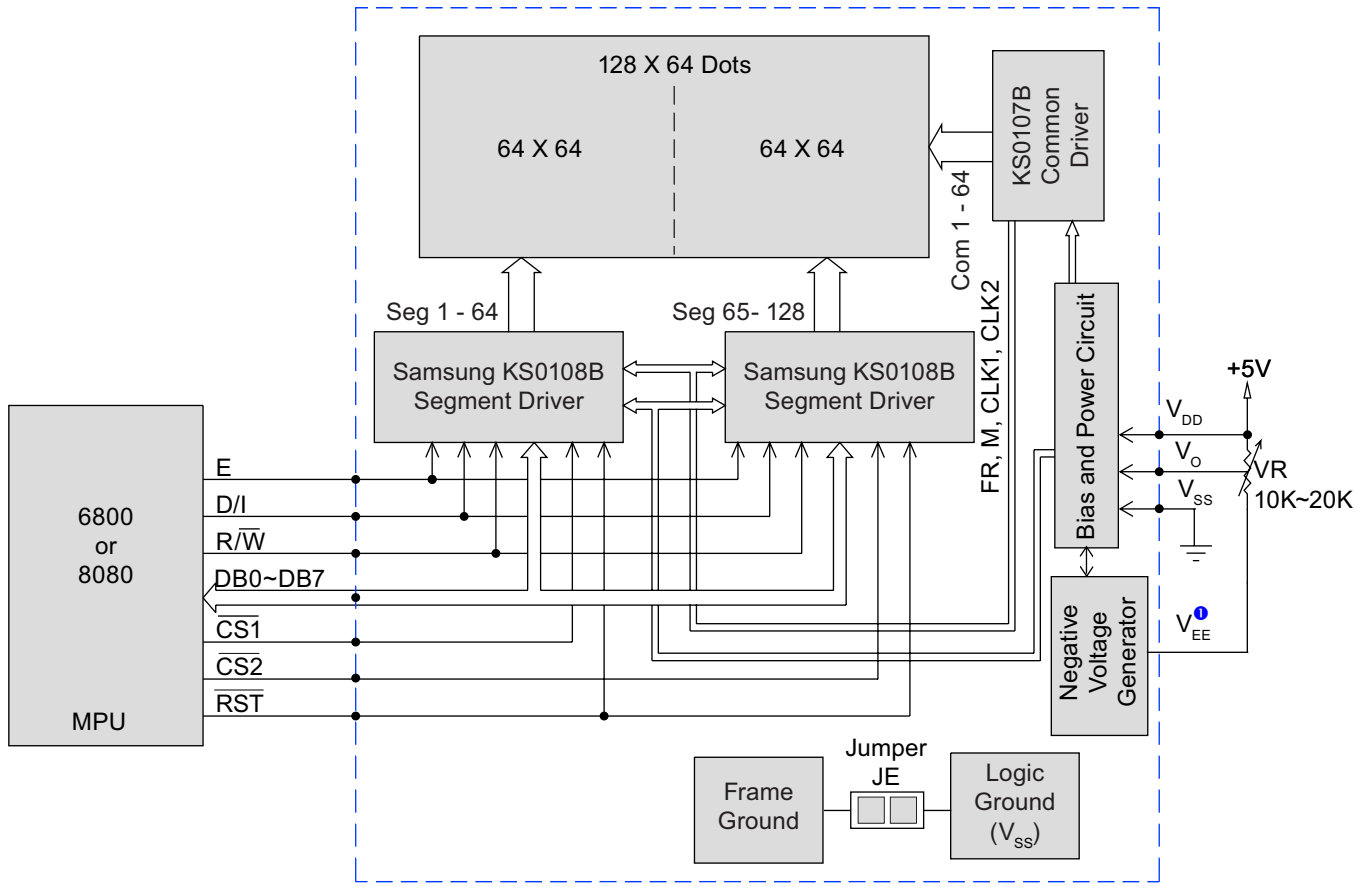


Figure 1. Module Outline Drawing



# ELECTRICAL SPECIFICATIONS

## SYSTEM BLOCK DIAGRAM



<sup>1</sup>V<sub>EE</sub> = output pin of on-board negative voltage generator

Figure 2. System Block Diagram





## FRAME GROUND

Frame Ground (shown in the System Block Diagram above) is a trace that connects some of the bezel tabs. To connect Frame Ground to the Logic Ground ( $V_{SS}$ , Pin 2), use an "0805" package 0 ohm resistor to close jumper **JE**.

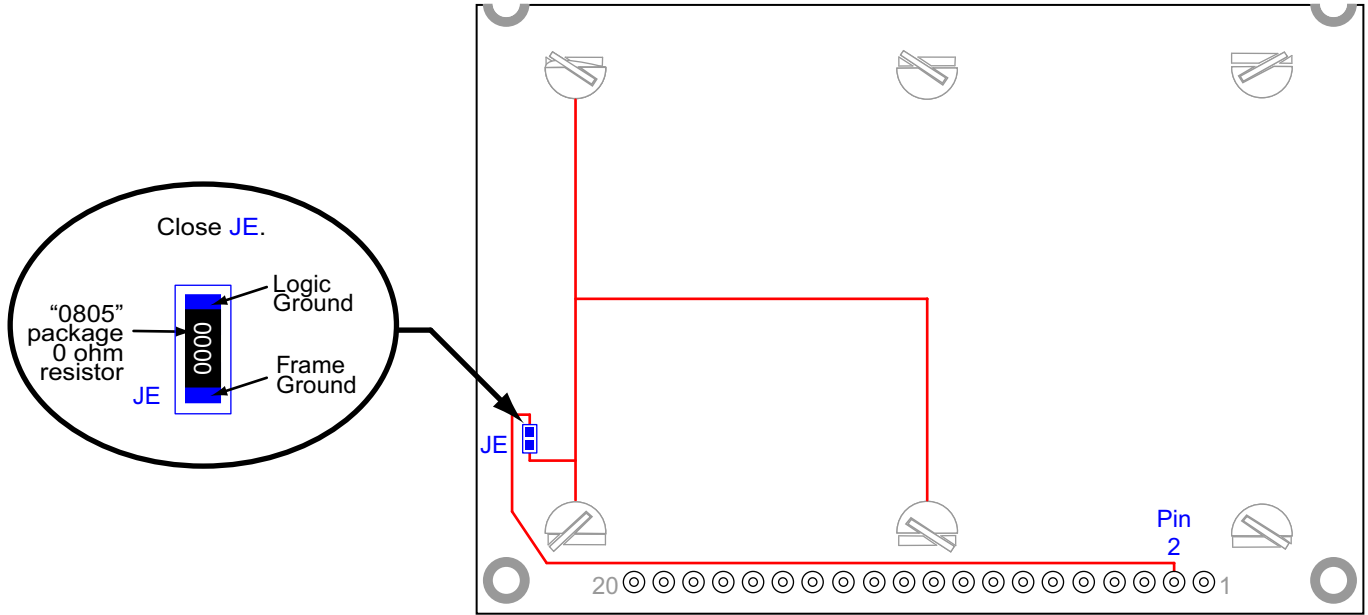


Figure 3. Frame Ground (Back View of Module)



## DRIVING METHOD

DRIVING METHOD	SPECIFICATION
Duty	1/64
Bias	1/9

## ABSOLUTE MAXIMUM RATINGS

ABSOLUTE MAXIMUM RATINGS	SYMBOL	MINIMUM	MAXIMUM
Operating Temperature	$T_{OP}$	-20°C	+70°C
Storage Temperature*	$T_{ST}$	-30°C	+80°C
Input Voltage	$V_I$	0	$V_{DD}$
Supply Voltage for Logic	$V_{DD}$	0	6.7v
Supply Voltage for LCD	$V_{DD}-V_O$		16.0v

*\*Note: Prolonged exposure at temperatures outside of this range may cause permanent damage to the module.*

## DC CHARACTERISTICS

DC CHARACTERISTICS*	SYMBOL	MINIMUM	TYPICAL	MAXIMUM
Supply voltage for driving LCD	$V_{DD} - V_O$			+9.8v
			$T_A = -20^\circ\text{C}$	
			$T_A = +25^\circ\text{C}$	+8.0v
		+7.6v		
Logic Voltage	$V_{DD}$	+4.5v	+5.0v	+5.5v
Input High Voltage	$V_{IH}$	3.5v		$V_{DD}$
Input Low Voltage	$V_{IL}$	0 ( $V_{SS}$ )		+0.8v
Supply Current (Logic only, not including backlight)	$I_{DD}$	1.5 mA		4.0 mA

*\*For more information, see [DC Characteristics on page 12 of Appendix D, S6B0108 64 CH Segment Driver for Dot Matrix LCD.](#)*



## INTERFACE PIN FUNCTIONS

PIN	SIGNAL	LEVEL	DIRECTION	DESCRIPTION
1	$V_{DD}$	+5.0v	–	Supply voltage for logic
2	$V_{SS}$	0v	–	Ground
3	$V_O$	variable	–	Supply voltage for driving LCD $V_O = -3.0v$ typical at $V_{DD} = +5v$ which gives $V_{LCD} = (V_{DD} - V_O) = 8v$
4	DB0	H/L	I/O	Data bit 0
5	DB1	H/L	I/O	Data bit 1
6	DB2	H/L	I/O	Data bit 2
7	DB3	H/L	I/O	Data bit 3
8	DB4	H/L	I/O	Data bit 4
9	DB5	H/L	I/O	Data bit 5
10	DB6	H/L	I/O	Data bit 6
11	DB7	H/L	I/O	Data bit 7
12	$\overline{CS1}$	L	I	Chip select for controller #1 Columns 1 to 64 Chip select for controller #2 Columns 65 to 128
13	$\overline{CS2}$	L	I	Select Column 65 to Column 128
14	$\overline{RST}$	L	I	Controller reset signal
15	$R/\overline{W}$	H/L		Read/write selection input H: read (MPU←module) L: write (MPU→module)

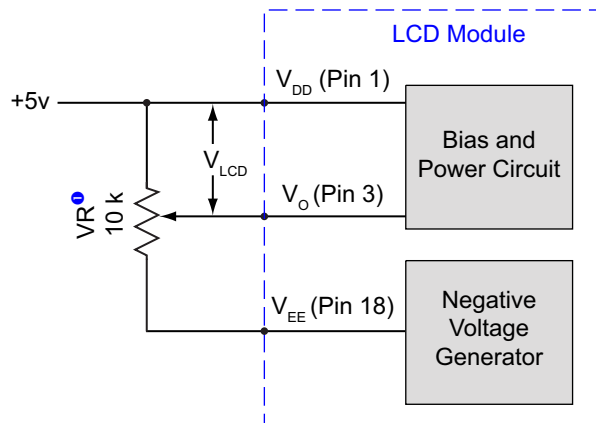


PIN	SIGNAL	LEVEL	DIRECTION	DESCRIPTION
16	D/I	H/L	I	H: Data L: Instruction
17	E	H, H→L	I	Read/write enable signal H: read data is enabled by a high level H→L: write data is latched on the falling edge
18	V <sub>EE</sub>	-5v	O	Negative voltage output
19	A (LED+)			Supply voltage for LED "A" (anode) or "+" of LED backlight
20	K (LED+)			Supply voltage for LED "K" (cathode or kathode for German and original Greek spelling) or "-" of LED backlight

For Backlight connections, please refer to [LED BACKLIGHT \(Pg. 15\)](#).

## TYPICAL V<sub>O</sub> CONNECTIONS FOR DISPLAY CONTRAST

Adjust V<sub>O</sub> to -3.0v (V<sub>LCD</sub> = 8.0v) as an initial setting. When the module is operational, readjust V<sub>O</sub> for optimal display appearance.



• Use external control to adjust for optimal display appearance.

Figure 4. Typical V<sub>O</sub> Connections for Display Contrast

## SAMSUNG S6B0107/S6B0108 CONTROLLERS (FORMERLY KS0107B/ KS0108B)

The CFAG12864B-TFH-V uses two Samsung controllers: S6B0107 64 channel common driver and a S6B0108 64 channel segment driver. The previous part number for the Samsung S6B0107 driver was "KS0107B". The previous part number for the Samsung S6B0108 driver was "KS6B108".



For your reference, the most recent versions (July 2001) of the Samsung driver specifications are included as appendixes in this Data Sheet: Samsung S6B0107 64CH Common Driver for Dot Matrix LCD and S6B0108 64CH Segment Driver For Dot Matrix LCD.

Here are links to some of the commonly used sections:

- For DC characteristics, see [page 13 of Appendix B, "DC Characteristics"](#).
- For functional description, see [page 17 of Appendix B, "Functional Description"](#).
- For MPU interface timing characteristics (read and write), see [page 15 of Appendix C, "MPU Interface"](#).
- For display control instruction, see [page 21 of Appendix C, "Display Control Instruction"](#).

## OPTICAL SPECIFICATIONS

ITEM	SYMBOL	CONDITION	MINIMUM	TYPICAL	MAXIMUM
View Angle (Vertical, Horizontal)	(V) $\theta$	CR $\geq$ 2	30°		60°
	(H) $\phi$	CR $\geq$ 2	-45°		+45°
Contrast Ratio	CR			5	
LCD Response Time*	T rise	Ta = 25°C		200 ms	300 ms
	T fall	Ta = 25°C		200 ms	300 ms
*Response Time: The amount of time it takes a liquid crystal cell to go from active to inactive or back again.					

## TEST CONDITIONS AND DEFINITIONS FOR OPTICAL CHARACTERISTICS

### Test Conditions

- Operating Voltage (V<sub>LCD</sub>): V<sub>OP</sub>
- Viewing Angle
  - Vertical (V) $\theta$ : 0°
  - Horizontal (H) $\phi$ : 0°
- Frame Frequency: 64 Hz (nominal)
- Driving Waveform: 1/64 Duty, 1/9 Bias
- Ambient Temperature (Ta): 25°C



## Definition Operation Voltage ( $V_{op}$ )

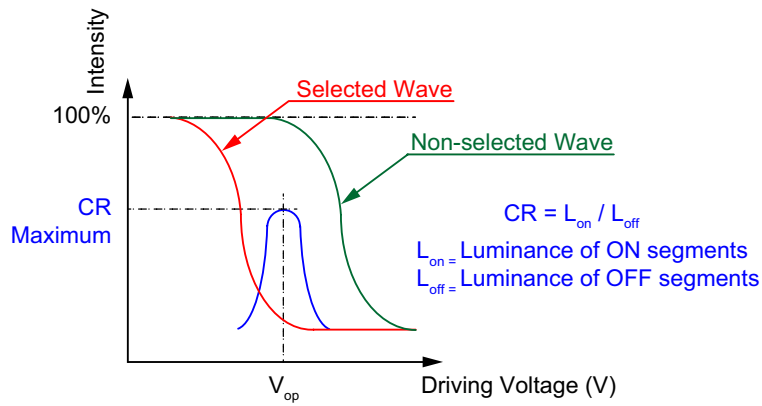


Figure 5. Definition of Operation Voltage ( $V_{OP}$ )

## Definition of Response Time ( $T_r$ , $T_f$ )

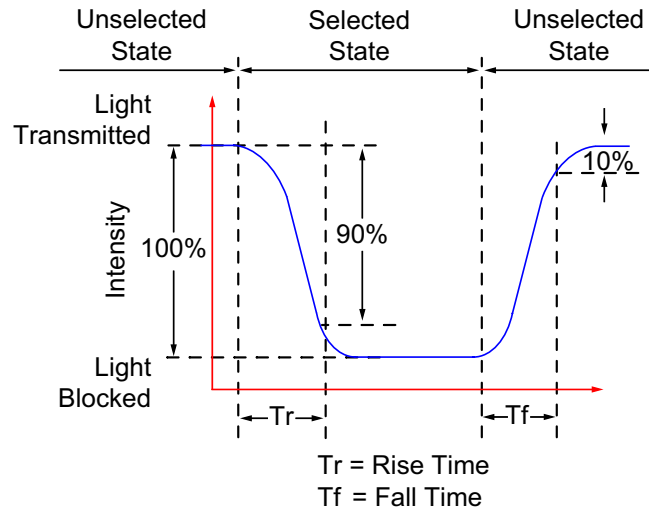


Figure 6. Definition of Response Time ( $T_r$ ,  $T_f$ )



### Definition of Vertical and Horizontal Viewing Angles (CR>2)

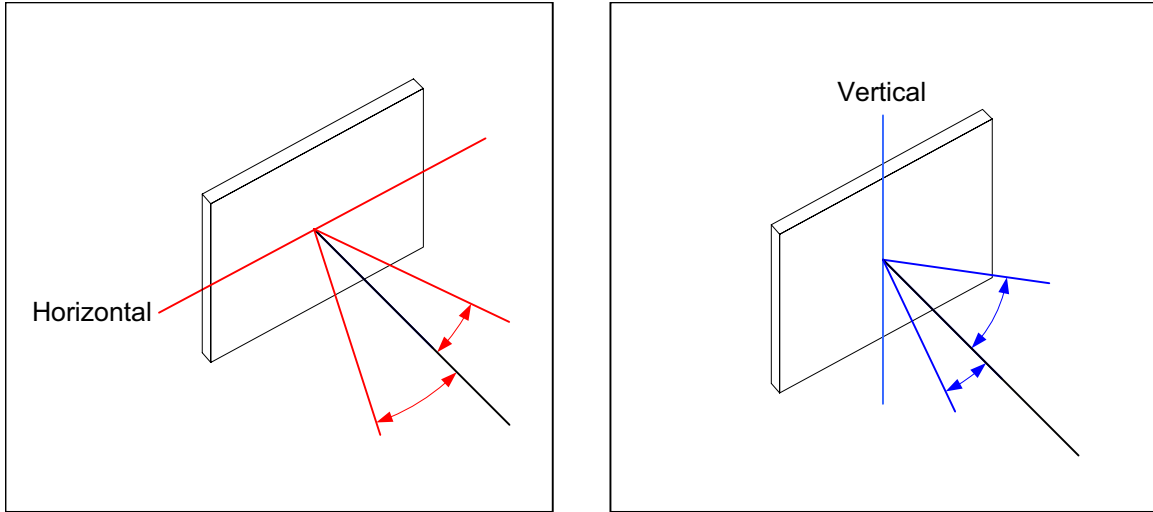


Figure 7. Definition of Horizontal and Vertical Viewing Angles (CR>2)

### Definition of 6 O’Clock and 12:00 O’Clock Viewing Angles

A 6:00 o’clock viewing angle is a bottom viewing angle like what you would see when looking at a cell phone or calculator. A 12:00 o’clock viewing angle is a top viewing angle like what you would see when looking at the gauges in a golf cart or airplane.

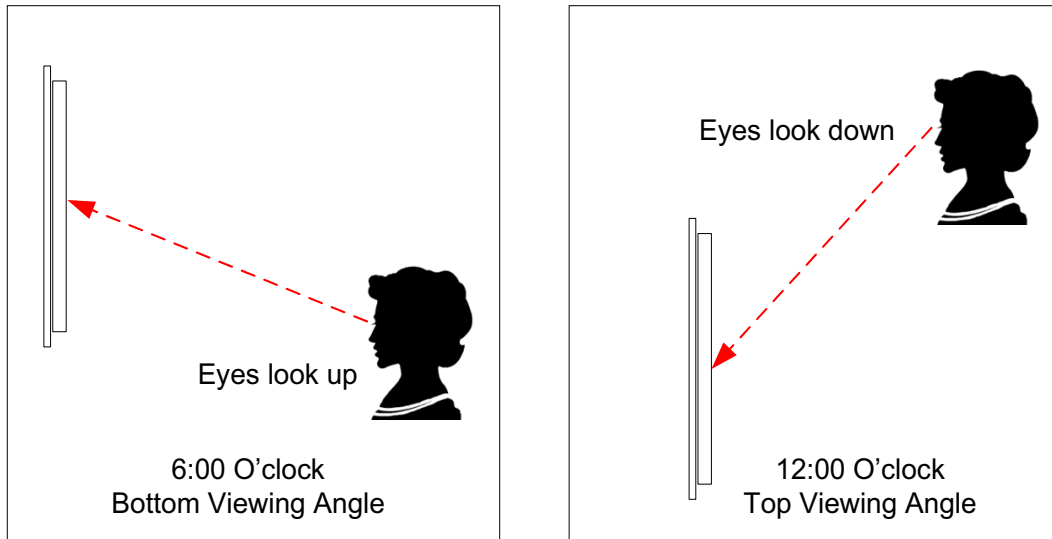


Figure 8. 6:00 O’Clock and 12:00 O’Clock Viewing Angles

## LED BACKLIGHT

You can connect the CFAG12864B-TFH-V backlight by one of these two methods:

- Solder leads from your PCB’s circuit to the “A” and “K” connectors on the right edge of the display (glass facing up).
- Make connections to your PCB using Pins 19 (A (LED+)) and 20 (K (LED+)) on the display module’s connector.































































































































































