



# PACIFIC DISPLAY DEVICES

## LCD Component Data Sheet

**Model Number: 128160-C20**

**128 x BGR x 160 Dot  
CSTN Color Graphic LCD Assembly  
With Embedded S6B33B2A01 Graphic Controller with  
16 Bit Color Depth (64K Colors)  
White LED Backlight Assembly  
Transmissive and Transflective Rear Polarizer Options**

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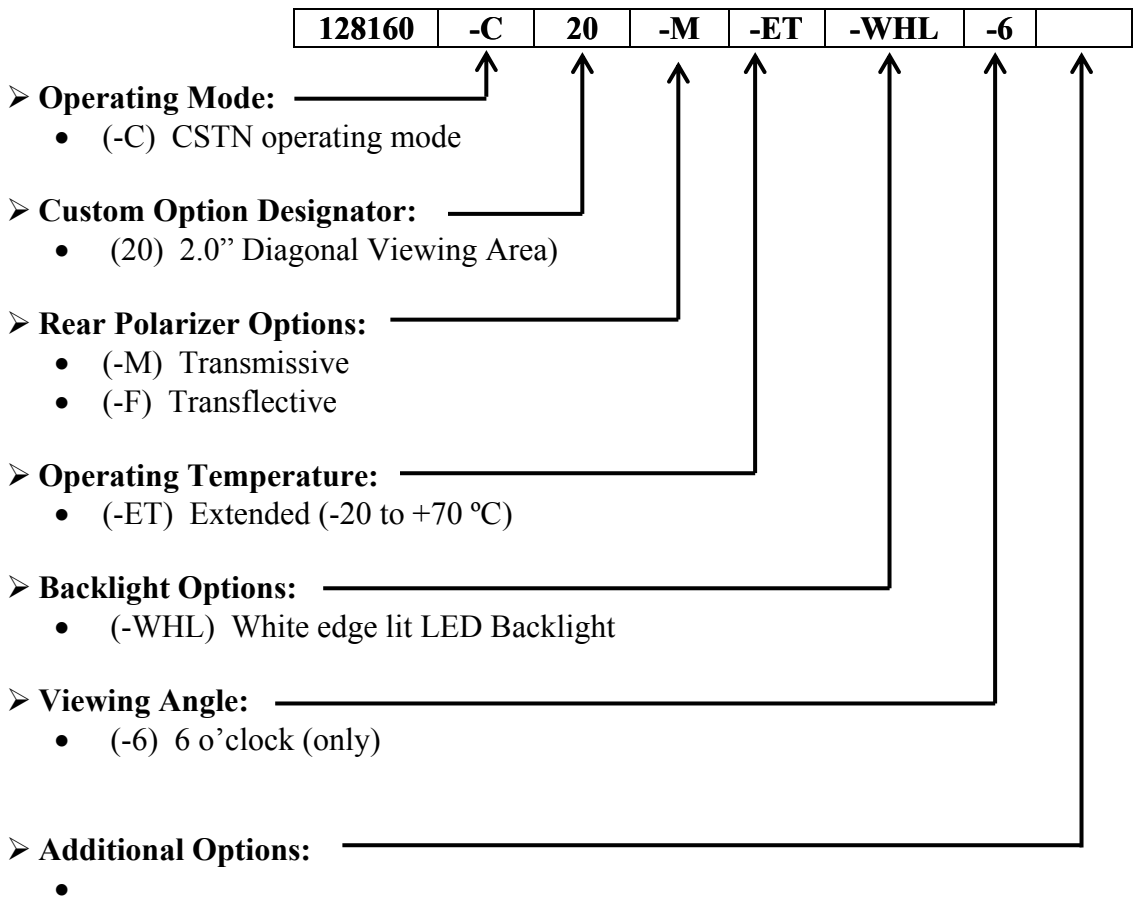
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**1. GENERAL INFORMATION**

**1.1 Product Overview**

- 128 x 3 (BGR) x 160 dot matrix LCD w/ Integrated Controller
- 2.0” Diagonal Viewing Area
- CSTN (Color Super Twisted Nematic) Technology
- Solid State White LEDs used for the Backlight
- Transmissive and Transflective Rear Polarizer Options
- Samsung S6B33B2A01 Controller / Driver IC
- Multiplex drive: 1/160 duty
- LCD Bias: 1/5
- LCD Module Service Life: 100,000 hours minimum (Exclusive of backlight)

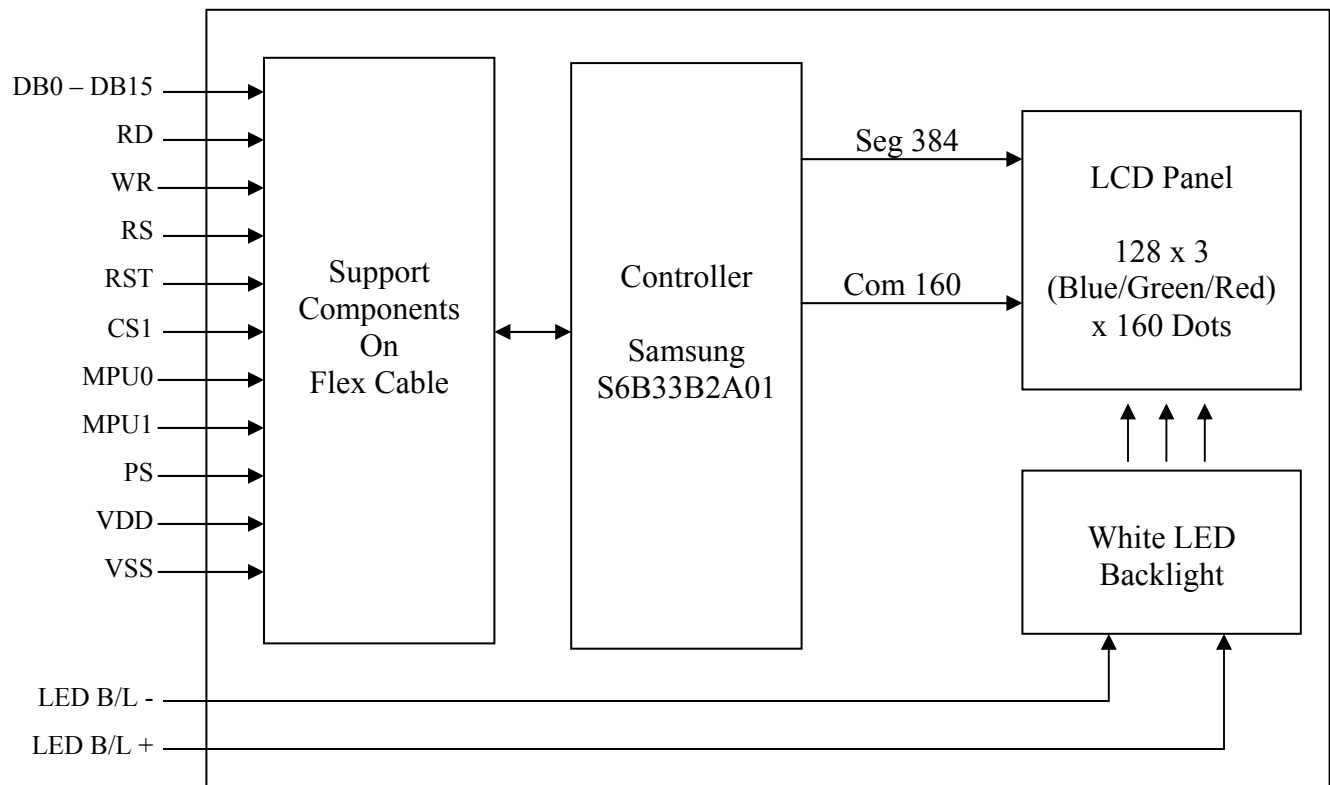
**1.2 Part Options and Numbering System**



### 1.3 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply voltage for Logic	$V_{DD}-V_{SS}$	-0.3	+4.0	V
Supply voltage for LCD (internal)	$V_{LCD}-V_{SS}$	0	+22.0	V
Input voltage	$V_I$	-0.3	$V_{DD}+0.3$	V
Extended Operating temperature	TOP (-ET)	-20	70	°C
Extended Storage temperature	TST (-ET)	-30	80	°C
Soldering Temp	Tsolder	260		°C

### 1.4 Module Block Diagram



## 1.5 Mechanical Characteristics

Item	Contents	Unit
Module size (W×H×T)	38.50 x 49.50 x 3.55	mm
Viewing area (W×H)	34.50 x 38.90	mm
Active area (W×H)	30.323 x 35.987	mm
Number of dots	128 x 3 (BGR) x 160	dots
Dot size (W×H)	0.227 x 0.217	mm
Dot pitch (W×H)	0.237 x 0.225	mm

## 1.6 Input Signal Function

### Graphic Display Logic and Supply Voltages

Pin No.	Symbol	Level	Description
1	VSS	---	Ground (0V)
2	VDD	---	Power supply for Logic circuit (+)
3	DB15	H/L	Display data Bits DB0-D15
4	DB14	H/L	
5	DB13	H/L	
6	DB12	H/L	
7	DB11	H/L	
8	DB10	H/L	
9	DB9	H/L	
10	DB8	H/L	
11	DB7	H/L	
12	DB6	H/L	
13	DB5	H/L	
14	DB4	H/L	
15	DB3	H/L	
16	DB2	H/L	
17	DB1	H/L	
18	DB0	H/L	
19	RDB - E	L	Read – Write execution control pin (MPU I/F Selectable)
20	WRB – R/W	L	Read / Write – Execution control pin (MPU I/F Selectable)
21	D/I - RS	L	Data / Instruction - Register Select input Pin
22	/Reset	L	Reset: Active Low
23	/CS1B	L	Must be Low to read data from or write data to module
24	MPU0	---	MPU Interface select 0
25	MPU1	---	MPU Interface select 1
26	PS	H/L	MPU Parallel / Serial Interface Select

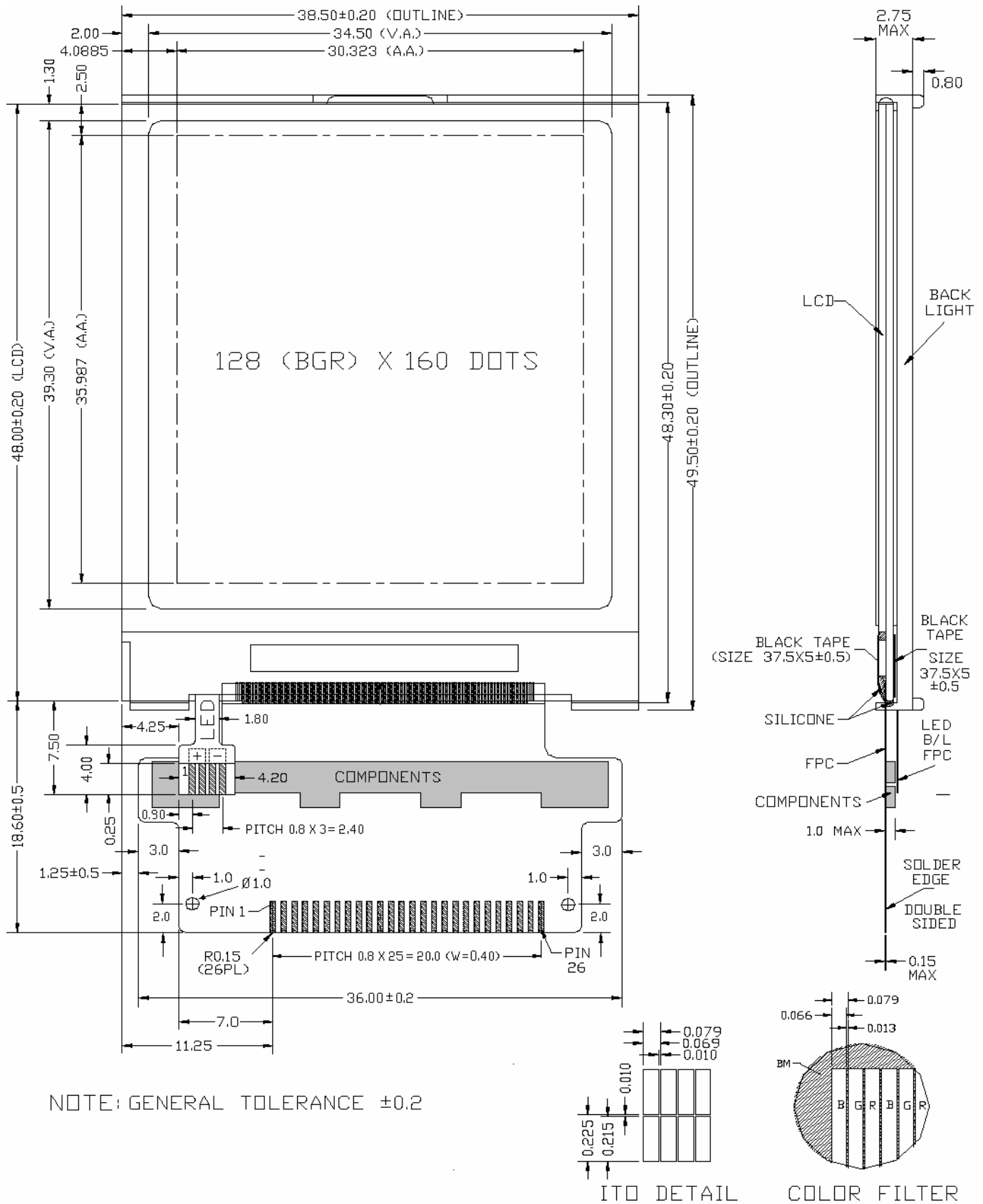
Interface connector: 26 conductor flat cable – Solder mount

### Backlight Interconnection

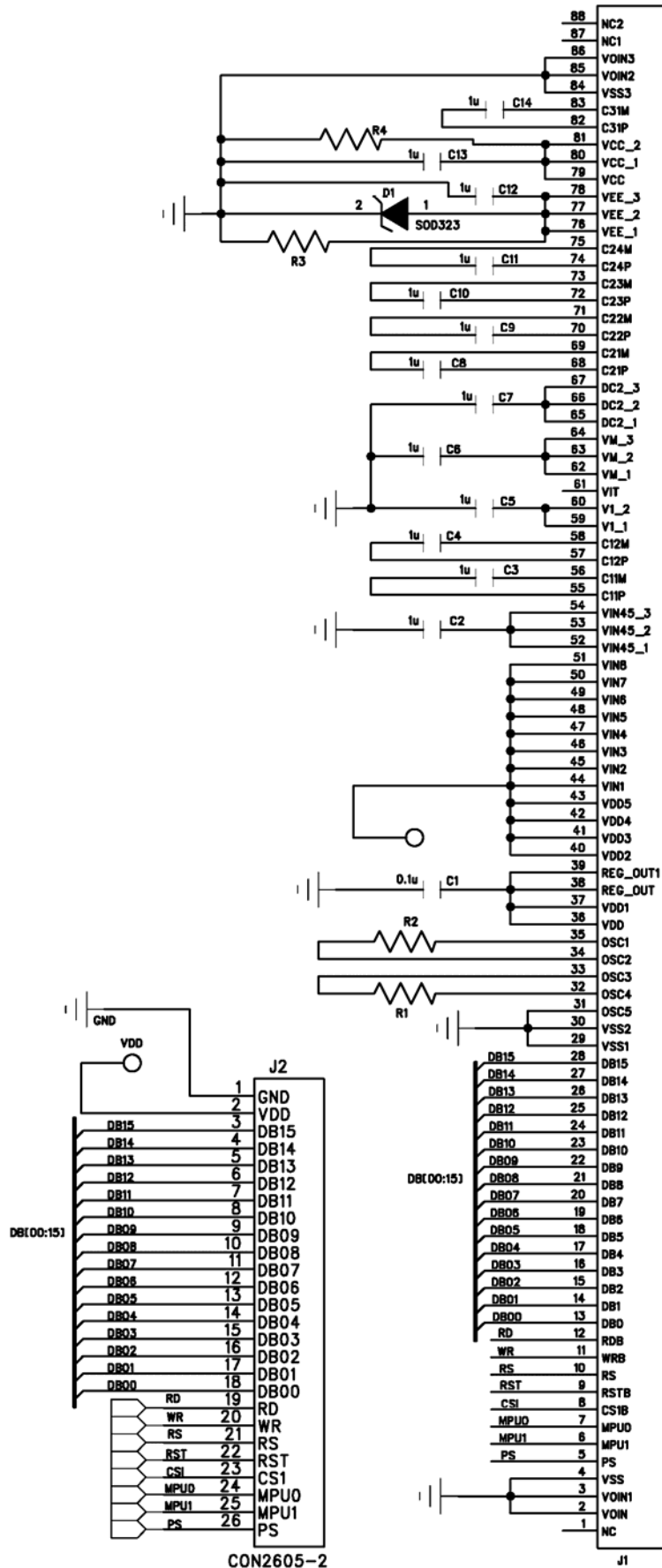
Pin No.	Symbol	Level	Description
1	LED (+)	---	Backlight LED Power (Anode +)
2	LED (+)	---	Backlight LED Power (Anode +)
3	LED (-)	---	Backlight LED Power (Cathode -)
4	LED (-)	---	Backlight LED Power (Cathode -)

Interface connector: 4 conductor flat cable – Solder mount

1.7 LCM Dimensions



1.8 LCM Tab Schematic



## 2. ELECTRICAL / OPTICAL CHARACTERISTICS

### 2.1 DC Electrical Characteristics ( $V_{SS} = 0V$ , $T_a = 25^\circ C$ )

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Notes
Supply Voltage for Module	$V_{DD}$	25°C	2.4	2.8	3.3	V	---
Supply Current for Module	$I_{DD}$	25°C	---	---	1.5	mA	---
LCD Operating voltage	$V_{LCD}$	25°C	---	10	---	V	1
Input voltage 'H' level	$V_{IH}$	25°C	$0.7 V_{DD}$	---	$V_{DD} + 0.5$	V	2
Input voltage 'L' level	$V_{IL}$	25°C	0	---	$0.3 V_{DD}$	V	2

#### Notes:

(1)  $V_{LCD}$ , is generated internally on the display controller / driver chip and the values listed in this table are for reference only. The capacitors to support the on chip voltage generator are located on the flex cable.

(2) Logic input voltage level cannot exceed  $V_{DD} + 0.5V$  without risking potential damage of the part.

### 2.2 AC Electrical Characteristics

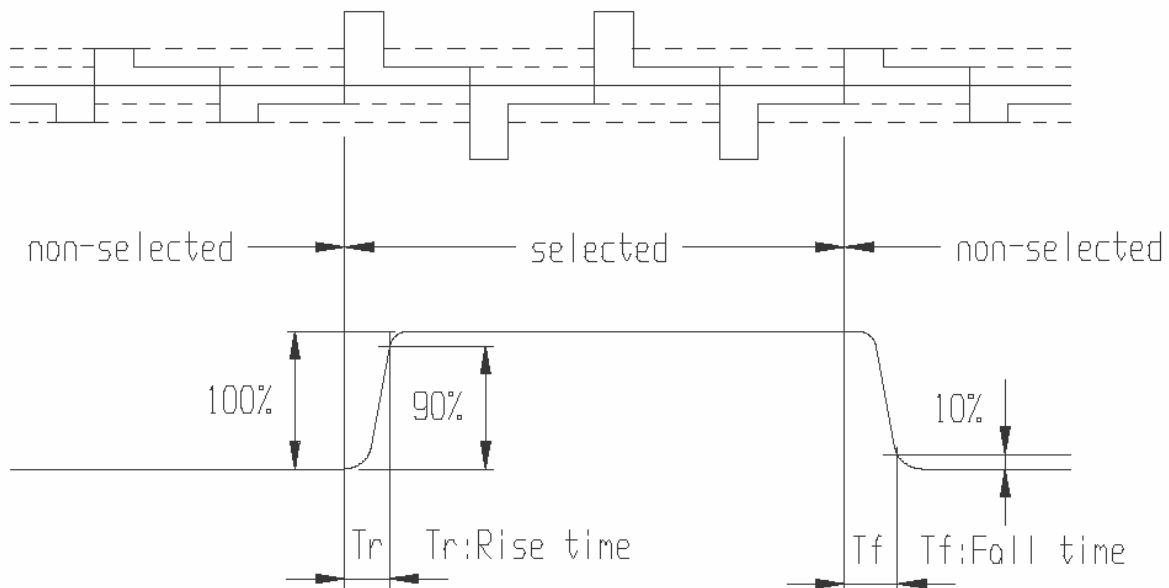
Please reference the following Samsung Data Sheet, It is available on the Pacific Display Devices web site:

- Samsung S6B33B2A01 Controller / Segment Driver ICs

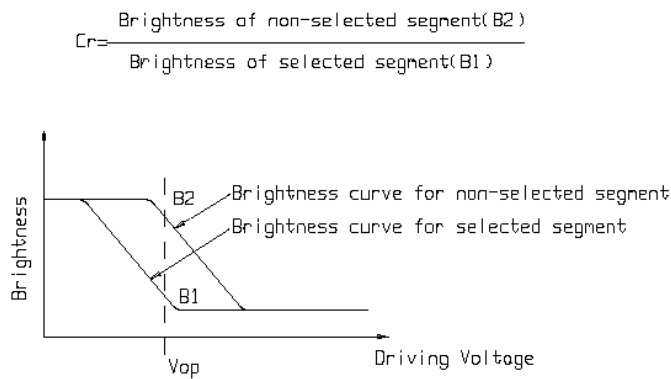
2.3 Optical Characteristics (V<sub>OP</sub> = 2.5V ±5%, Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Remarks	Note
Response time	Tr	---	156	---	ms	--	1
	Tf	---	166	---		--	1
Driving Voltage	V <sub>LCD</sub>	---	10	---	Volts	--	--
Contrast ratio	Cr	---	7	---		--	2
Viewing Angle Range	Cr≥10	---	26	---	degrees	φ = 90°	3
		---	24	---		φ = 270°	3
		---	0	---		φ = 0°	3
		---	37	---		φ = 180°	3
Color of CIE Coordinate (Reflective Mode)	Red	x	0.42	0.47	0.52		
		y	0.29	0.34	0.39		
	Green	x	0.26	0.31	0.36		
		y	0.46	0.51	0.56		
	Blue	x	0.13	0.18	0.23		
		y	0.13	0.18	0.23		

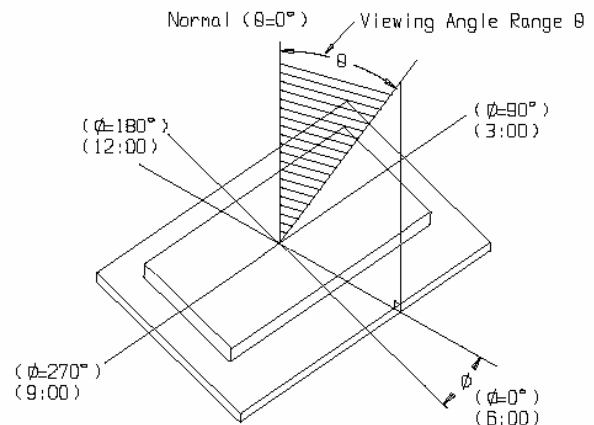
Note1: Definition of response time.



Note2: Definition of contrast ratio Cr.



Note3: Definition of viewing angle range “θ”.



## 2.4 LED Backlight Characteristics

### ■ White Edge Lit LED (-WHL) Operating Characteristics

#### Electrical Characteristics

Item	Symbol	Conditions	Standard			Unit
			Min.	Typ.	Max.	
Forward voltage	$V_f$	Ta= 25 °C	9.6	9.8	10.0	VDC
Forward Current	$I_f$	Ta= 25 °C	---	15	20	mA
Reverse voltage	$V_r$	Ta= 25 °C	---	---	5.0	VDC

#### Optical Brightness

Item	Conditions	Standard			Unit
		Min.	Typ.	Max.	
Display Intensity	Ta= 25 °C	126	140	---	Cd/m <sup>2</sup>
Backlight Brightness (before LCD)	Ta= 25 °C	2520	2800	---	Cd/m <sup>2</sup>

#### Absolute Maximum Ratings

Item	Symbol	Conditions	Standard			Unit
			Min.	Typ.	Max.	
Max Forward Current (Average)	$I_{FM}$	Ta= 25 °C	---	---	25	mA
Max Forward Current (Peak*)	$I_{FP}$	Ta= 25 °C	---	---	60	mA
Reverse voltage	$V_r$	Ta= 25 °C	---	---	5.0	VDC

\*Peak: 1ms pulse / 10% duty cycle, current de-rating -0.36ma / °C above 25°C

#### Lifetime Characteristics

Item	Conditions	Standard		Unit
		Min.	Max.	
Life	Ta = 25 °C $I_f = 15mA$	20,000	---	hrs

**Note:** White LED backlight consists of 3 White LEDs in a series configuration.

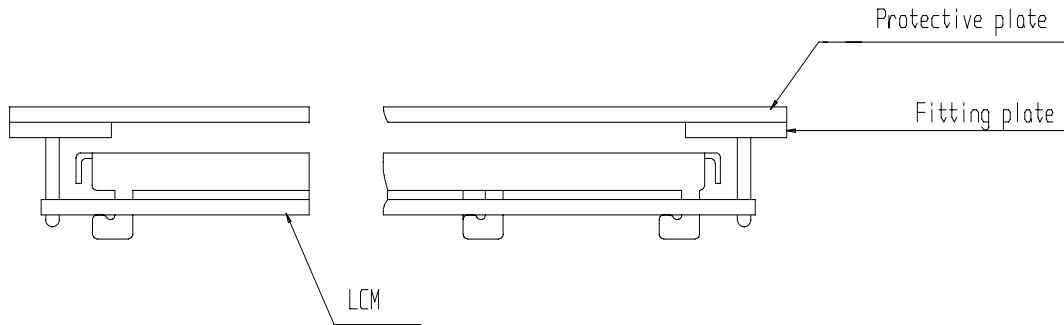


## 5. PRECAUTIONS FOR USING LCD MODULES

### Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

- 1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



- 2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be  $\pm 0.1$  mm.

### Precaution for Handling LCD Modules

Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- 1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.
- 2) Do not alter, modify or change the shape of the tab on the metal frame.
- 3) Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- 4) Do not damage or modify the pattern writing on the printed circuit board.
- 5) Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- 6) Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- 7) Do not drop, bend or twist LCM.

### Electro-Static Discharge Control

Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.

- 1) Make certain that you are grounded when handling LCM.
- 2) Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.
- 3) When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.
- 4) When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
- 5) As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.
- 6) To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.

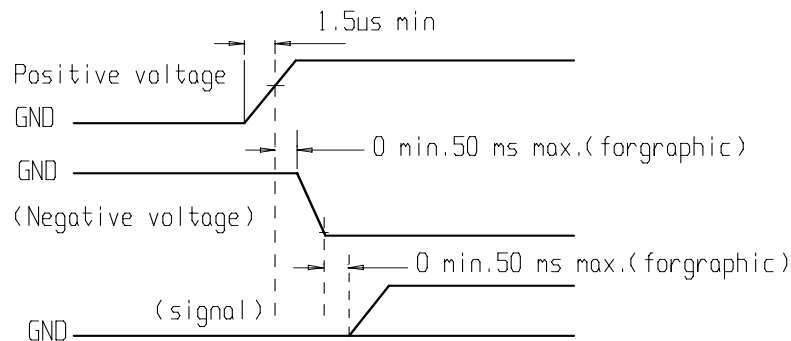
### Precaution for soldering to the LCM

- 1) Observe the following when soldering lead wire, connector cable and etc. to the LCM.
  - a) Soldering iron temperature :  $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$ .
  - b) Soldering time : 3-4 sec.
- 2) Solder : eutectic solder.

- 3) If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.
- 4) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.
- 5) When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

### **Precautions for Operation**

- 1) Viewing angle varies with the change of liquid crystal driving voltage ( $V_{LCD}$ ). Adjust  $V_{LCD}$  to show the best contrast.
- 2) Driving the LCD in the voltage above the limit shortens its life.
- 3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.
- 4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
- 5) Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, it must be used under the relative condition of  $40^{\circ}\text{C}$  , 50% RH.
- 6) When turning the power on, input each signal after the positive/negative voltage becomes stable.



### **Safety**

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

### **Handling**

- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it or impact.
- If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents :
  - Isopropyl alcohol
  - Ethyl alcohol
- Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
  - Water
  - Ketone
  - Aromatic solvents
- Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
- Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
- Do not attempt to disassemble or process the LCD module.
- NC terminal should be open. Do not connect anything.

- If the logic circuit power is off, do not apply the input signals.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  - Be sure to ground the body when handling the LCD modules.
  - Tools required for assembling, such as soldering irons, must be properly grounded.
  - To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
  - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

### **Storage**

- When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps
- Store the module in a dark place where the temperature is  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$  and the humidity below 65% RH.
- Do not store the module near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the module (including accessories).

### **Cleaning**

- Do not wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- Wipe the module gently with soft cloth soaked with a petroleum benzene.
- Do not use ketonic solvents (ketone and acetone) or aromatic solvents (toluene and xylene), as they may damage the polarizing plate.

### **Others:**

- Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.
  - Exposed area of the printed circuit board.
  - Terminal electrode sections.