TFT Product Specification

◇ TENTATIVE SPECIFICATION

◆ APPROVED SPECIFICATION

Part Number #REV: FLC-121GML5000SA1#00

Description: TFT 12.1'' 1024*768 Full View One Channel LVDS 1000CD + Led Cable

Customer Name:	
Signature:	**Date:**

PREPARED BY	**REVIEWED BY**
Sarah Chen	*David*

Revision History

Version	Date	Page	Description	Note
V1.0	2022/04/08		First Edition	
V1.1	2022/08/10		Update Backlight connector	P7

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1. GENERAL DESCRIPTION

1.1 Description

12.1" is a Color Active Matrix Liquid Crystal Display Module composed of a TFT LCD panel and LED backlight system. The screen format is intended to support the XGA, 1024x768 screen and 262K / 16.2 M colors.

1.2 Product Summary

The following items are summary on the table under Ta=25 °C condition:

No.	Item	Specification	Unit
1	Display Size	12.1"	Inch
2	Pixel Number	1024 (H) x 3(RGB)x 768 (V)	Pixels
3	Outline Dimension	260.5(W)×204(H)×8.4(D, max)	mm
4	Active Area	245.76 (H) x 184.32 (V)	mm
5	Display Colors	262K /16.2M	- -
6	Pixel Arrangement	RGB vertical stripe	- -
7	Display Mode	Full View / Normally Black	- -
8	Electrical Interface	LVDS	- -
9	Surface Treatment	Anti-Glare, 3H	- -
10	Brightness	1000 (Typ.)	cd/m2
11	Contrast Ratio	1000 (Typ.)	- -
12	Total Power Consumption (Typ)	Total 10.13 (Vcc line: 1.49W; LED line: 8.64W)	W

2. ABSOLUTE MAXIMUM RATING

2.1 Electrical Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max		
Power supply voltage	Vcc	-0.3	-	4.0	V	(1)
LED Current	I LED	--	--	600	mA	Duty=100% (1)(2)

Note (1) Permanent damage to the device may occur if max values are exceeded.

Function operation should be restricted to the conditions described under normal operating conditions.

(2) Specified values are for input pin of LED light bar at Ta-25± 2°C

2.2 Environment Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max.		
Operating Temperature	Top	-30		85	°C	Note(1)(2)
Storage Temperature	Tstg	-40		90	°C	

Note (1) : Max O.T. LCD surface Temperature

Note(2) : Permanent damage to the device may occur if exceed maximum values

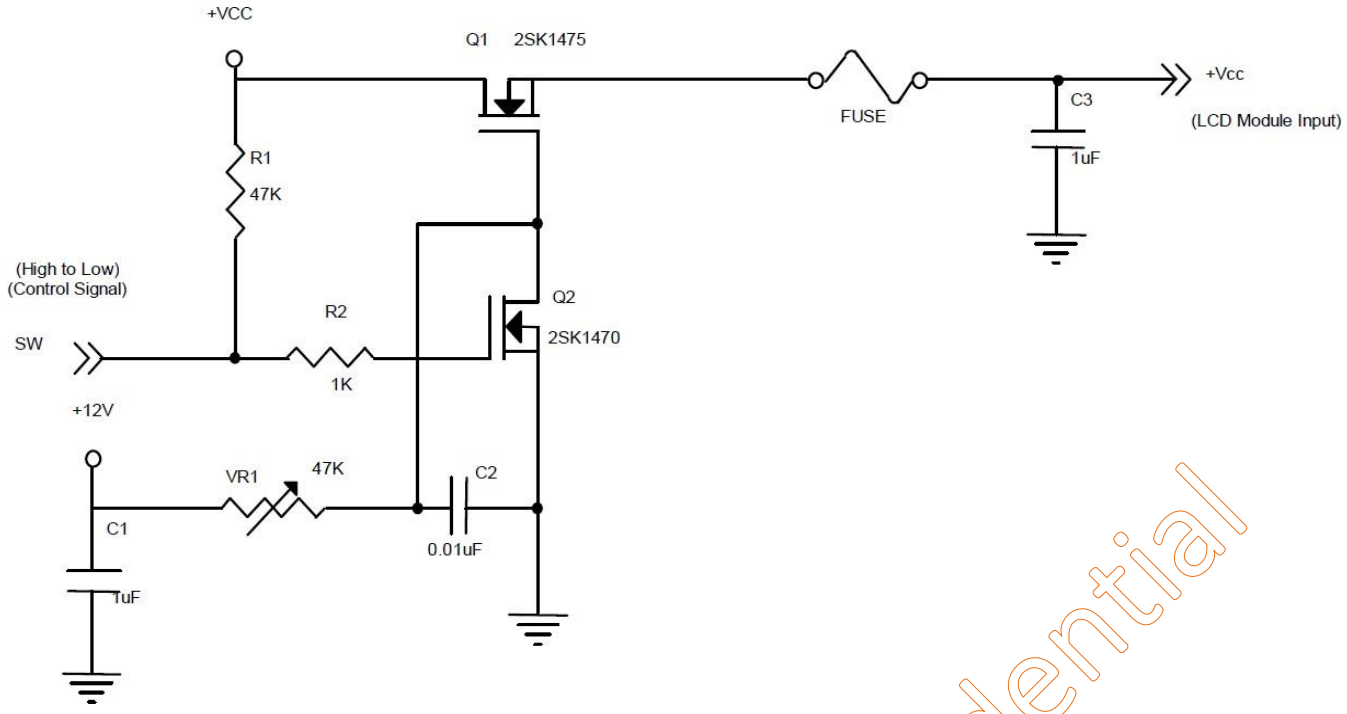
3. ELECTRICAL CHARACTERISTICS

3.1 LCM

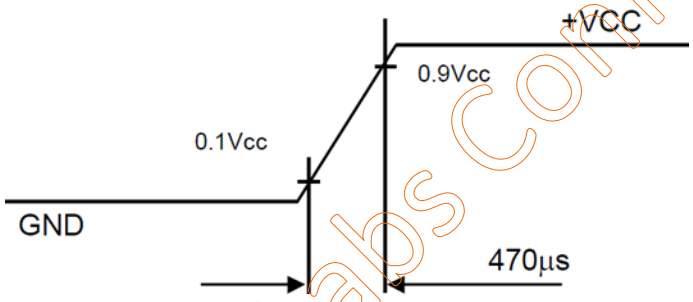
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VCC	3.0	3.3	3.6	V	(1) Vcc=3.3v
Rush Current		IRUSH	-	--	4.0	A	(2)
Power Supply Current	White		--	370	450	mA	(3) Vcc=3.3v
	Black		--	300	380	mA	
Power Consumption		PLC	--	1.22	1.49	W	
LVDS differential input voltage		Vid	100	--	600	mV	
LVDS common input voltage		Vicm	0.7	--	1.6	V	

Note (1) The assembly should be always operated within above ranges. Ta = 25 ± 2 ºC

Note (2) Measurement Conditions:

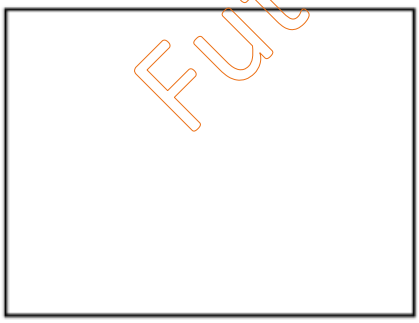


Vcc rising time is 470µs



Note (3) The specified power supply current is under the conditions at Vcc = 3.3V or 5V, Ta = 25 ± 2ºC, fv = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern

Active Area

3.2 Backlight Unit

Parameter guideline for LED driving is under stable conditions at 25℃ (Room Temperature):

Parameter	Min.	Typ.	Max.	Unit	Note
LED voltage (VL)		36		V	(2)
LED current (IL-channel)		250		mA	(2)
LED Power (PL)		8.64		W	
LED life Time (Typical)	--	50,000	--	Hrs	(1)

Note 1: The "LED lift time" is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25℃ and typical LED Current at 330 mA (Long lifetime mode).

Note 2: The variance of LED Light Bar power consumption is ±10%. Calculator value for reference (IL × VL = PLED)

3.2.1 LED Light bar connector

Recommended connector: BHSR-02VS-1 manufactured by JST

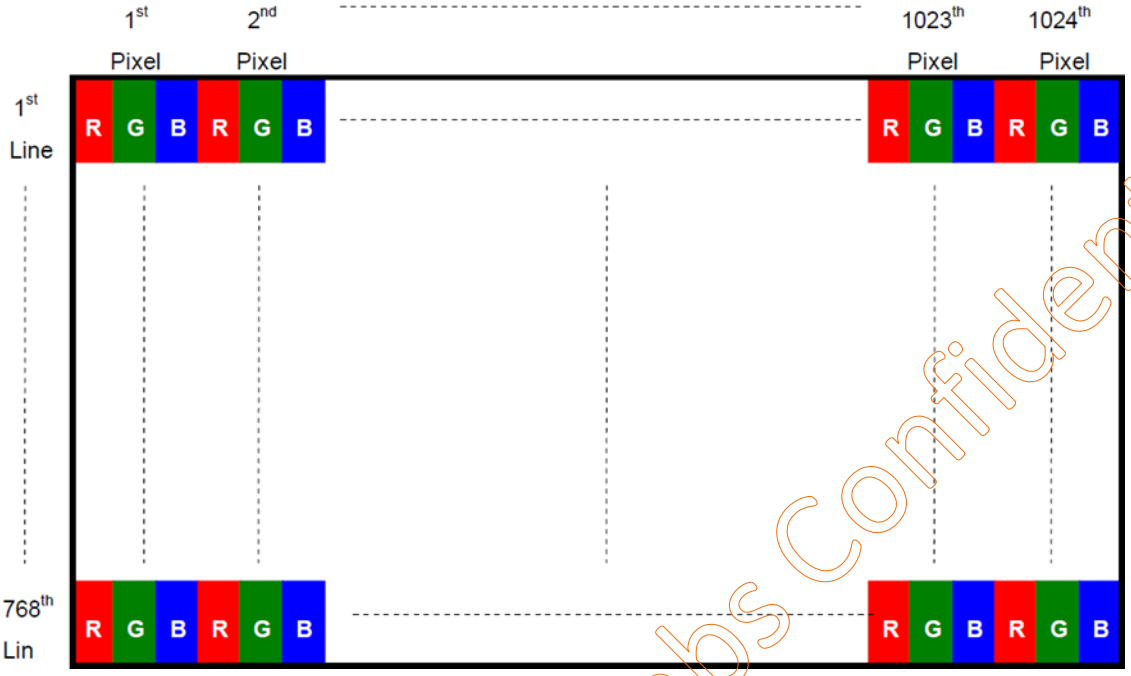
Pin No	Symbol	I/O	Description	Remark
1	VLED+	P	Backlight LED anode	
2	VLED-	P	Backlight LED cathode	

4. SIGNAL CHARACTERISTICS

4.1 Signal Interface Characteristic

1. Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.



4.2 Interface Timing

4.2.1 Timing Characteristics:

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	Fc	57.7	65	73.6	MHZ	
Vertical Display Term	Total	Tv	774	806	838	Th	Tv=Tvd+Tvb
	Display	Tvd	-	768	-	Th	--
	Blank	Tvb	6	38	80	Th	--
Horizontal Display Term	Total	Th	1240	1344	1464	Tc	Th=Thd+Thb
	Display	Thd	-	1024	-	Tc	--
	Blank	Thb	216	320	440	Tc	--

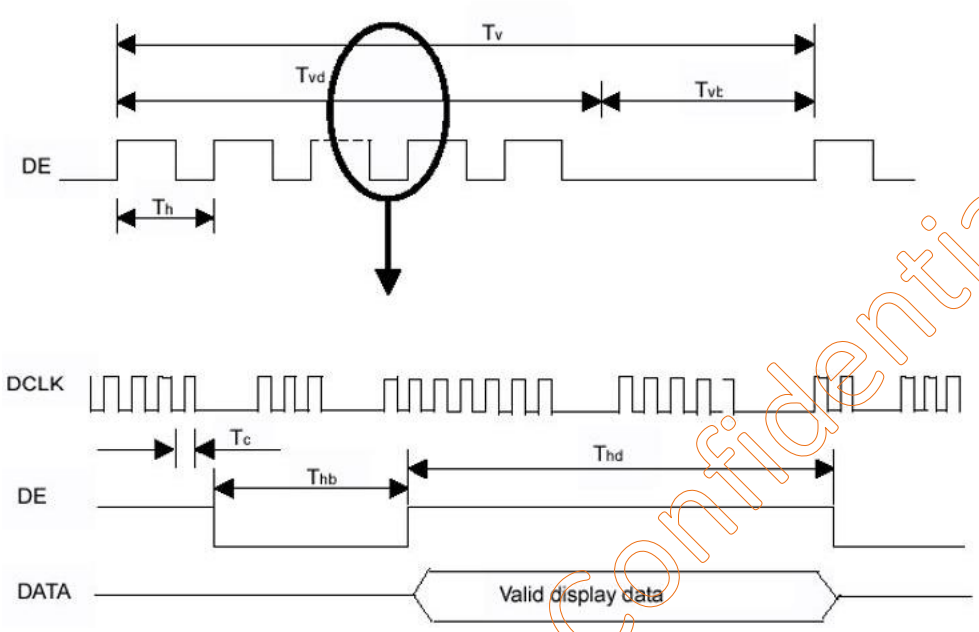
Note (1) Since this assembly is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level.

Otherwise, this assembly would operate abnormally.

Note (2) Frame rate is 60Hz

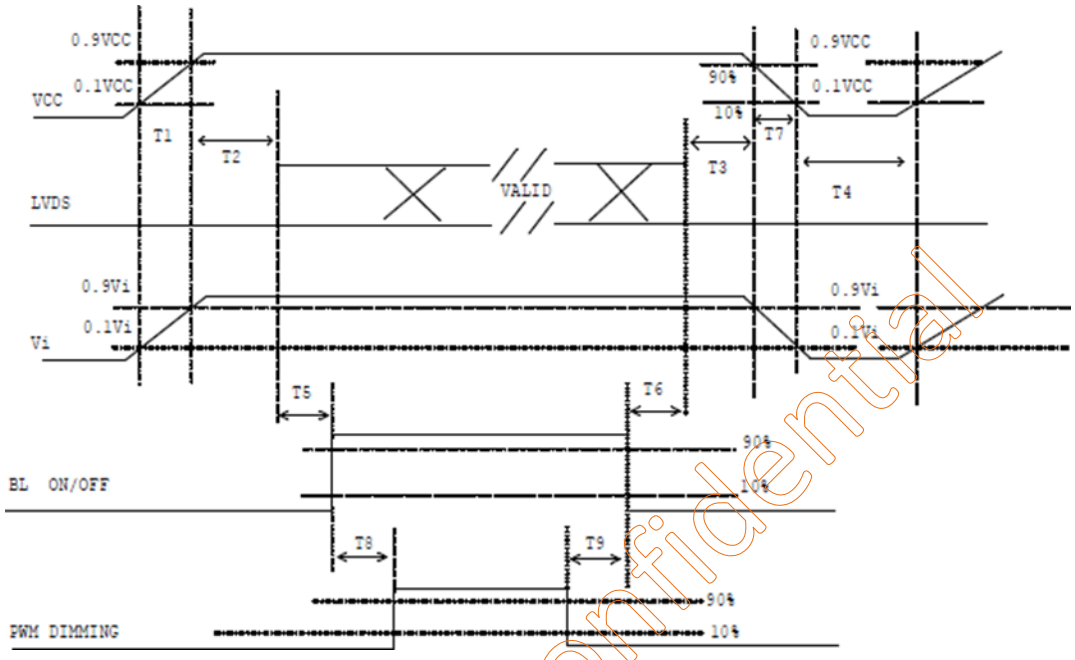
Note (3) The Tv(Tvd+Tvb) must be integer, otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM



4.3 Power ON/OFF Sequence

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below.



Timing specifications:

Parameter	Value			Units
	Min	Typ	Max	ms
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	500	-		ms
T5	200	-		ms
T6	200	-		ms
T7	5	-	300	ms
T8	10	-		ms
T9	10	-		ms

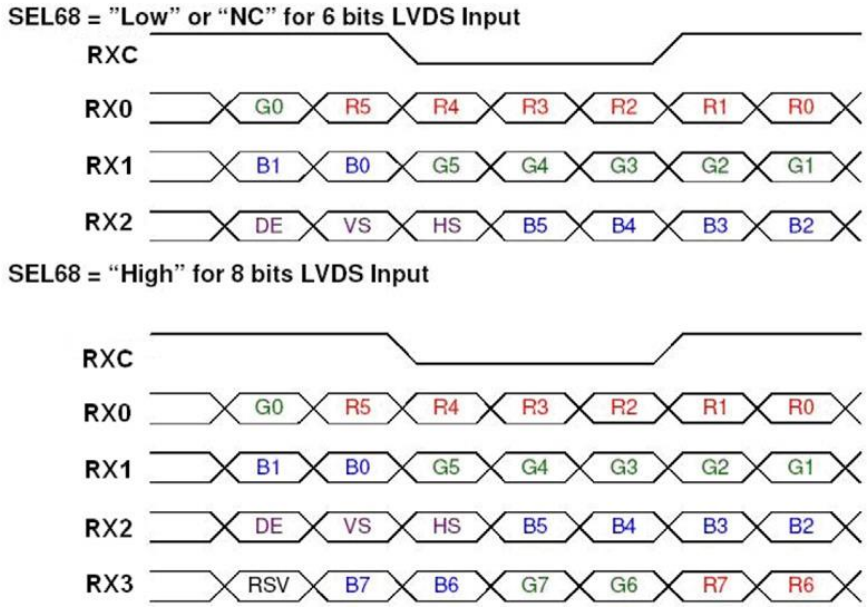
Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0V.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid.

The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

4.4 The Input Data Format



Note (1) R/G/B data 7: MSB, R/G/B data 0: LSB

Note (2) Please follow PSWG

Signal Name	Description	Remark
R7	Red Data 7 (MSB)	Red-pixel Data
R6	Red Data 6	Each red pixel's brightness data consists of these
R5	Red Data 5	8 bits pixel data.
R4	Red Data 4	
R3	Red Data 3	
R2	Red Data 2	
R1	Red Data 1	
R0	Red Data 0 (LSB)	
G7	Green Data 7 (MSB)	Green-pixel Data
G6	GreenData 6	Each green pixel's brightness data consists of these
G5	GreenData 5	8 bits pixel data.
G4	GreenData 4	
G3	GreenData 3	
G2	GreenData 2	
G1	GreenData 1	
G0	GreenData 0 (LSB)	
B7	Blue Data 7 (MSB)	Blue-pixel Data
B6	Blue Data 6	Each blue pixel's brightness data consists of these
B5	Blue Data 5	8 bits pixel data.
B4	Blue Data 4	
B3	Blue Data 3	
B2	Blue Data 2	
B1	Blue Data 1	
B0	Blue Data 0 (LSB)	
RXCLKIN+ RXCLKIN-	LVDS Clock Input	
DE	Display Enable	
VS	Vertical Sync	
HS	Horizontal Sync	

Note (3) Output signals from any system shall be low or Hi-Z state when VCC is off.

4.5 Scanning Direction

The following figures show the image see from the front view.

The arrow indicates the direction of scan

Fig.1 Normal Scan

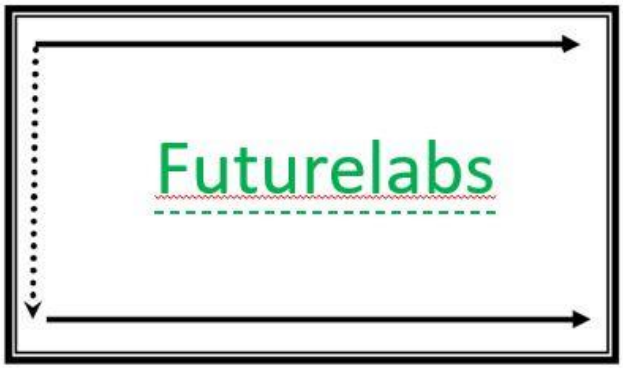


Fig.2 Reverse Scan

Fig.3 Reverse Scan

Fig.4 Reverse Scan

Fig. 1 Normal scan (pin 17, reLR=Low or NC, pin 18, reUD= Low or NC)

Fig. 2 Normal scan (pin 17, reLR=High, pin 18, reUD= Low or NC)

Fig. 3 Normal scan (pin 17, reLR=Low or NC, pin 18, reUD= High)

Fig. 4 Normal scan (pin 17, reLR=High, pin 18, reUD= High)

5. INTERFACE PIN DESCRIPTION

5.1 LCM Connector PIN Assignment

N O	Symbol	Description	Note
1	RX3+	Positive LVDS differential data input. CH3	-
2	RX3-	Negative LVDS differential data input. CH3	-
3	NC	Not connection	-
4	SEL68	LVDS 6/8 bit select function control, Low or NC-> 6 bit Input Mode High-> 8 bit Input Mode	Note (3)
5	GND	Ground	-
6	RXC+	Positive Clock differential clock input	-
7	RXC-	Negative Clock differential clock input	
8	GND	Ground	
9	RX2+	Positive LVDS differential data input. CH2	-
10	RX2-	Negative LVDS differential data input. CH2	-
11	GND	Ground	
12	RX1+	Positive LVDS differential data input. CH1	
13	RX1-	Negative LVDS differential data input. CH1	
14	GND	Ground	-
15	RX0+	Positive LVDS differential data input. CH0	-
16	RX0-	Negative LVDS differential data input. CH0	-
17	re LR	Horizontal Reverse Scan Control, Low or NC-> Normal Mode. High-> Horizontal Reverse Scan	Note (3)
18	re UD	Vertical Reverse Scan Control, Low or NC-> Normal Mode. High-> Vertical Reverse Scan	Note (3)
19	VCC	Power supply	-
20	VCC	Power supply	

Note (1) Connector Part No.: STARCONN 076B20-0048RA-G4 or JAE FI-SEB20P-HFE or equivalent.

Note (2) User's connector Part No: JAE FI-SE20ME or equivalent.

Note (3) "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connected".

5.2 Color Data Input Assignment

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color.

The higher the binary input, the brighter the color.

The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	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
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	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	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color.

The higher the binary input, the brighter the color.

The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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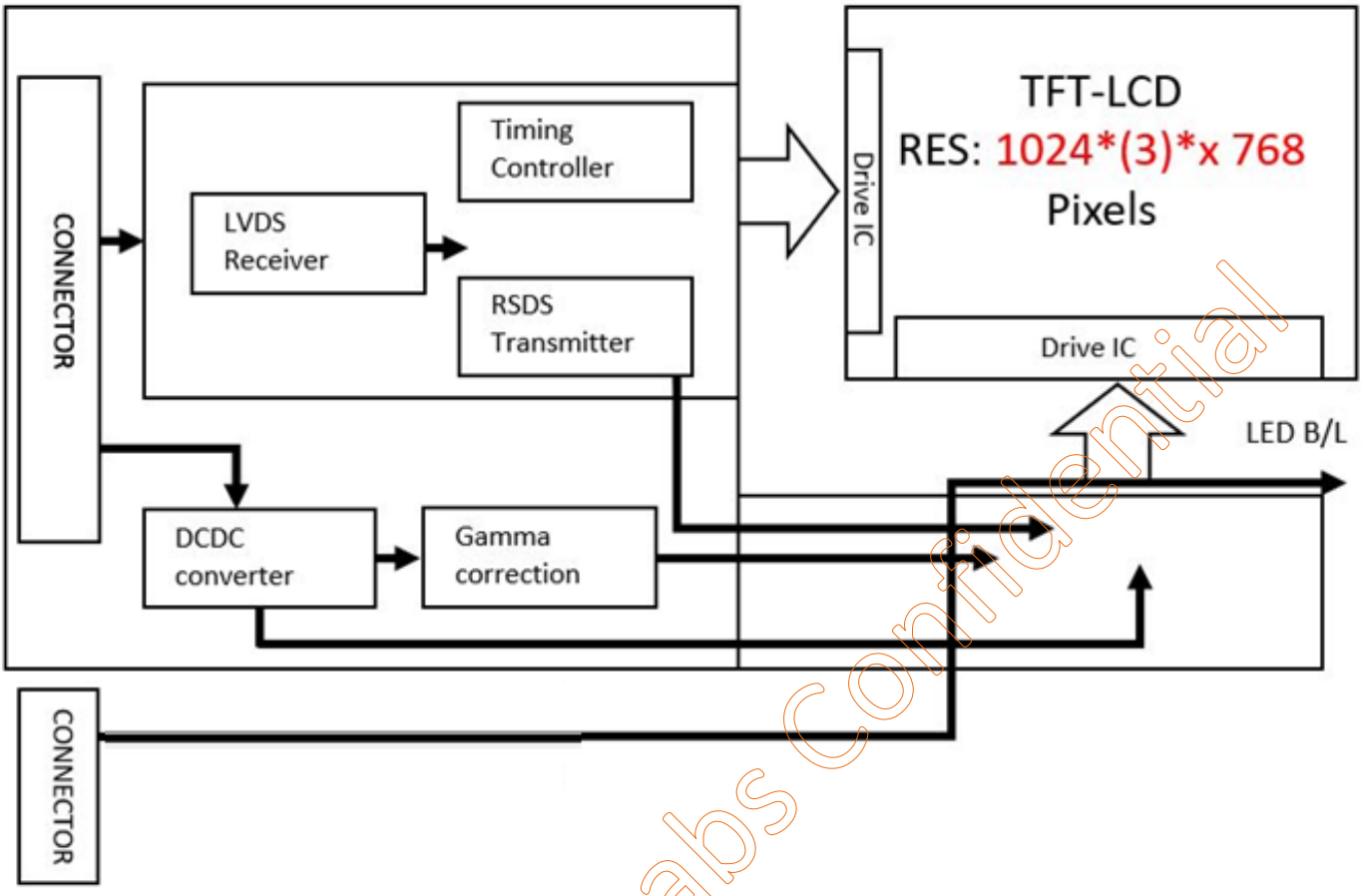
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/ Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

6. BLOCK DIAGRAM

The following diagram shows the functional block of the TFT module:



7. OPTICAL CHARACTERISTIC

The optical characteristics are measured under stable conditions at room temperature.

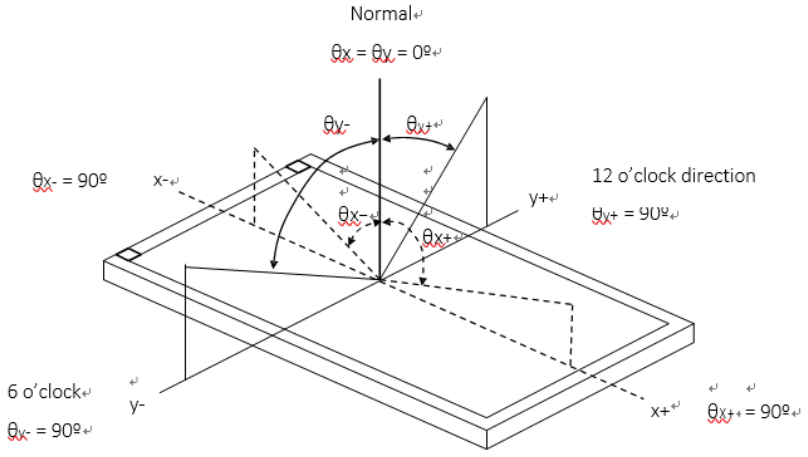
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_X=0°, θ_Y =0° Viewing angle at normal direction	-	1000		-	(2)(5)
Response Time		T_R		-	13	-	ms	(3)
		T_F		-	12	-	ms	
Center Luminance of White		LC		800	1000	-	cd/m2	(4)(5)
White Variation		δW		70	75	--	%	(5)(6)
Chromaticity	Red	Rx		Typ. -0.05	0.652	Typ. +0.05	-	(1) (5)
		Ry			0.338		-	
	Green	Gx			0.324		-	
		Gy			0.604		-	
	Blue	Bx			0.153		-	
		By			0.048		-	
	White	Wx			0.310		-	
		Wy			0.329		-	
Viewing Angle	Horizontal	θ_X+	CR=10	170	178	-	Deg.	(1)(5)
		θ_X-		170	178	-		
	Vertical	θ_Y+		170	178	-		
		θ_Y-		170	178	-		

The following optical specifications shall be measured in a darkroom or equivalent state (ambient luminance <2 lux, and at room temperature).

The room temperature is 25°C±2°C.

Note 1: Definition of Viewing Angle

Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or the vertical clock direction with respect to the optical axis which is normal to the LCD surface

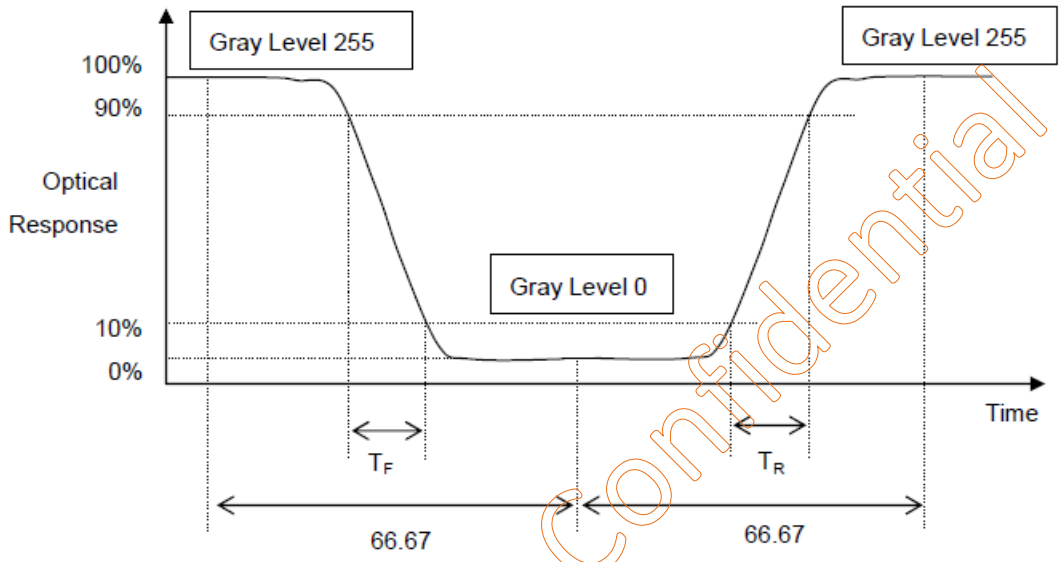


Note 2: Definition of Contrast Ratio (CR)

Measure the viewing angle of Θ= 0 and at the center of the LCD surface. Luminance with all pixels in white state divide by Luminance with all pixels in Black state

Note 3 Definition of Response Time:

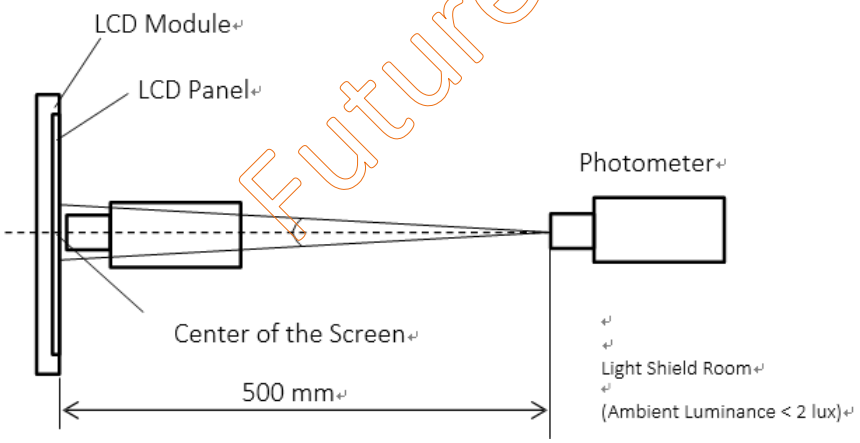
The response time is set initially by defining the "Rising Time (T_R)" and the "Falling Time (T_F)" respectively. Please refer the figure to the followings:



Note 4: Definition of Brightness (L)

Measure the center area of the panel and the viewing angle of the θx=θy =0°

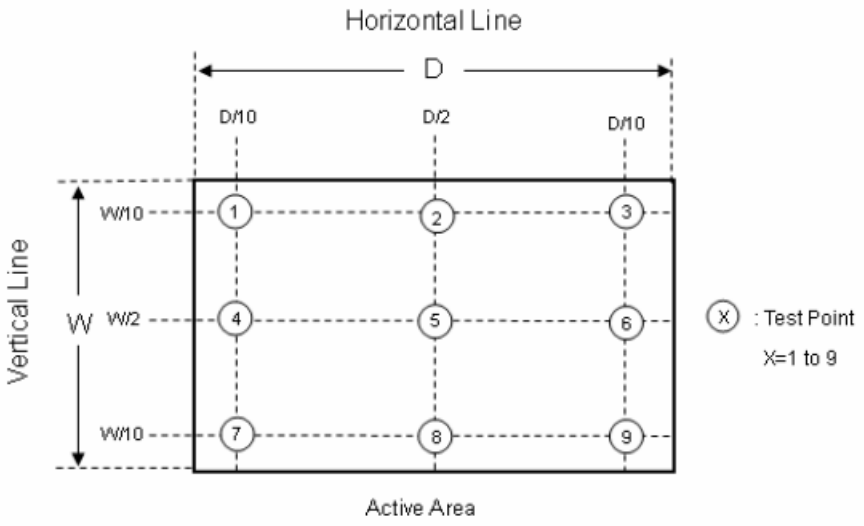
Note 5: The method of optical measurement:



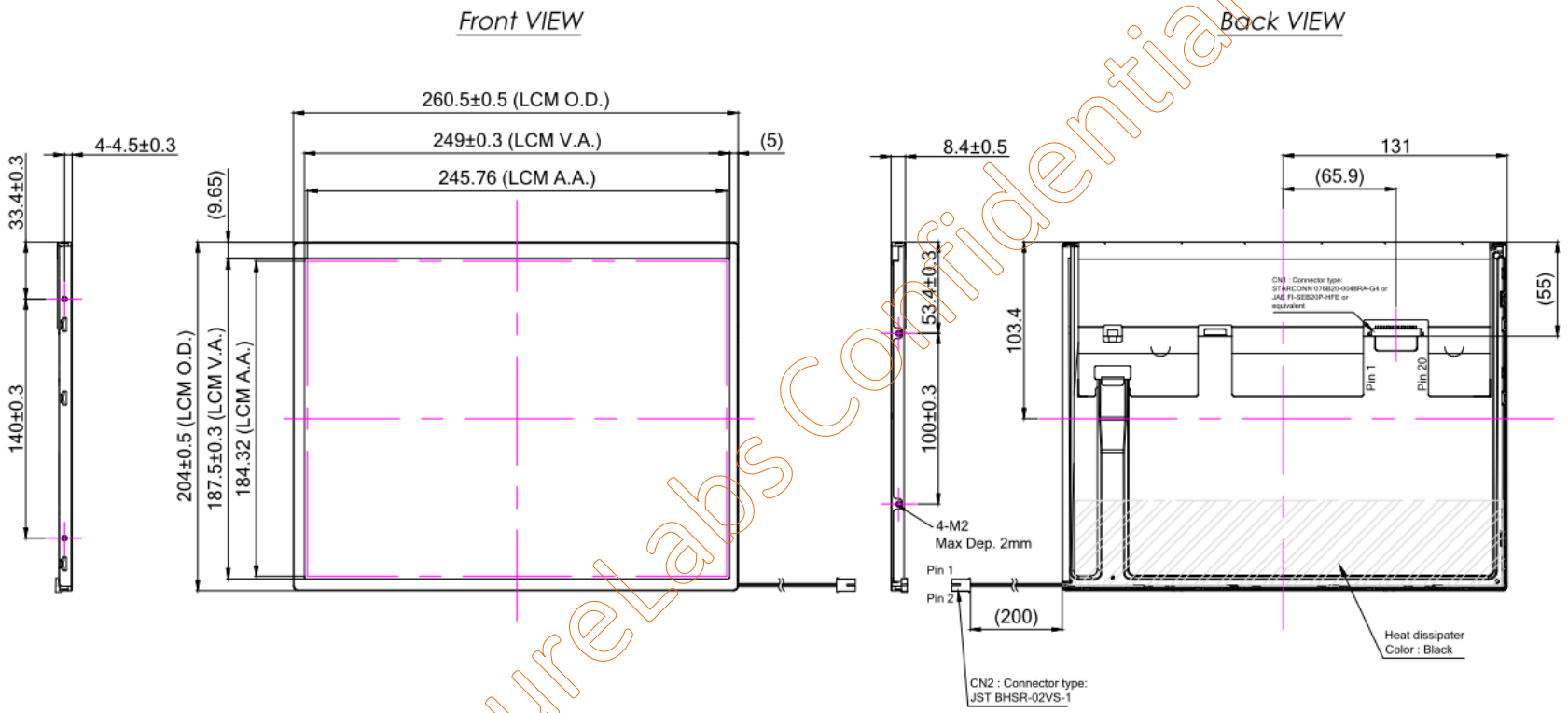
Note 6: Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

δW = Maximum [L (1), L (2), L (3), L (4)~ L (9)] / Minimum [L (1), L (2), L (3), L (4)~ L (9)]



8. DIMENSION AND DRAWING



CN2: Pin Define	
Pin 01	VLED+
Pin 02	VLED-

CN1 Pin Define			
PIN	SYMBOL	PIN	SYMBOL
1	RX3+	11	GND
2	RX3-	12	RX1+
3	NC	13	RX1-
4	SEL68	14	GND
5	GND	15	RX0+
6	RXC+	16	RX0-
7	RXC-	17	LR
8	GND	18	UD
9	RX2+	19	VCC
10	RX2-	20	VCC

Customer Approval	Part Number #Rev	FLC-121GML5000SA1	#00

NOTES:
1. General tolerance are ±0.5mm

9. PRECAUTION AND PRODUCT HANDLING

- Do not apply the external force such as bending or twisting to the LCD panel and backlight during assembly.
- Do not insert and plug out the input connector while the LCD panel is operating.
- Do not take apart the panel or frame from LCD module assembly or insert anything into the backlight unit.
- Do not keep the same pattern in a long period of time, it may cause image sticking on LCD panel. Can use shuffle content periodically if fixed pattern is displayed on the screen.
- Do not touch the display area with bare hands, this will stain the display area.
- Pay attention to handle lead wire of backlight, that is not tugged in connect with LED driver.
- Do not change variable resistance settings in LCD panel, it may cause not satisfy of LCD characteristics specification.
- The surface of LCD panel's polarizer is very soft and easily scratched, please use a very soft dry cloth without chemicals for cleaning.
- To avoid the static electricity to damage the CMOS LSI, the operator should be grounded when in contact with the LCD panel, and also to all electrical equipment.
- Need to follow the correct power frequency when LCD panel is connecting and operating, this can avoid damage to CMOS LSI during latch-up.
- Need to store the LCD panel indoor without the exposure of sunlight where the temperature is 25°C ± 5°C and the humidity is below 60% RH.