



RAYSTAR

RAYSTAR Optronics, Inc.  
曜凌光電股份有限公司



# 曜凌光電股份有限公司 Raystar Optronics, Inc.

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## RFM1040F-AIW-LNN

### SPECIFICATION

CUSTOMER:

<b>APPROVED BY</b>	
<b>PCB VERSION</b>	
<b>DATE</b>	

FOR CUSTOMER USE ONLY

<b>SALES BY</b>	<b>APPROVED BY</b>	<b>CHECKED BY</b>	<b>PREPARED BY</b>

Release DATE:

TFT Display Inspection Specification: <https://www.raystar-optronics.com/download/products.htm>  
Precaution in use of TFT module: <https://www.raystar-optronics.com/download/declaration.htm>

## Revision History

VERSION	DATE	REVISED PAGE NO.	Note
0	2017/10/25		First issue

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## 2.Summary

The RF104F is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. It is composed of a TFT LCD panel, a timing controller, voltage reference, common voltage, column driver, and row driver circuit. This TFT LCD has a 10.4-inch diagonally measured active display area with XGA resolution (1,024 horizontal by 768 vertical pixels array).

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### 3. General Specifications

- Size: 10.4 inch
- Dot Matrix: 1024 x R.G.B. x 768 dots
- Module dimension: 236.0\*176.9\*5.7 mm
- Active area: 211.2 \*158.4 mm
- Dot pitch: 0.20625 x 0.20625 mm
- LCD type: TFT, Normally White, Transmissive
- Gray scale inversion direction: 6 o'clock
- Backlight Type: LED ,Normally White
- Interface: LVDS
- With /Without TP: Without TP
- Surface: Anti-Glare

\*Color tone slight changed by temperature and driving voltage.



## 4.Interface

### 4.1. Signal Connector Type

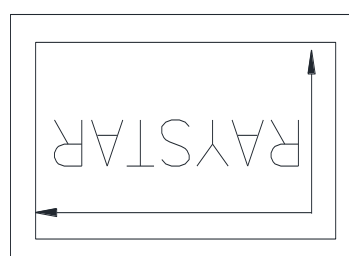
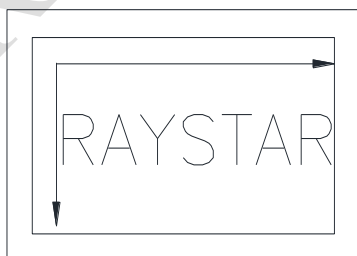
Item	Description
Type/Part Number	MSB24013P20HA (Manufacture by STM)
Mating Receptacle / Type (Reference)	P24013P20 or compatible

### Signal Connector Pin Assignment

Pin No.	Symbol	Description	Note
1	VDD	Power Supply, 3.3V (typical)	-
2	VDD	Power Supply, 3.3V (typical)	-
3	VSS	Ground	-
4	REV	Reverse Scan selection {High:2.5(min), 3.3(typ),3.6(max); Low: 0.5(max)}	(1)
5	Rin1-	-LVDS differential data input (R0-R5,G0)	-
6	Rin1+	+LVDS differential data input (R0-R5,G0)	-
7	VSS	Ground	-
8	Rin2-	-LVDS differential data input (G1-G5,B0-B1)	-
9	Rin2+	+LVDS differential data input (G1-G5,B0-B1)	-
10	VSS	Ground	-
11	Rin3-	-LVDS differential data input (B2-B5,HS,VS,DE)	-
12	Rin3+	+LVDS differential data input (B2-B5,HS,VS,DE)	-
13	VSS	Ground	-
14	ClkIN-	-LVDS differential clock input	-
15	ClkIN+	+LVDS differential clock input	-
16	GND	Ground	-
17	Rin4-	-LVDS differential data input (R6-R7,G6-G7,B6-B7)	-
18	Rin4+	+VDS differential data input (R6-R7,G6-G7,B6-B7)	-
19	SEL68	6/8 bits LVDS data input selection(H:8bits L/NC:6bits)	-
20	Bist	Internal use	-

Note (1) REV = LOW/NC

(2) REV = High



## 4.2. LVDS Receiver

Signal Electrical Characteristics For LVDS Receiver

The built-in LVDS receiver is compatible with (ANSI/TIA/TIA-644 ) standard.

Table 8 LVDS Receiver Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential Input High Threshold	$V_{th}$	-	-	+100	mV	$V_{CM} = +1.2V$
Differential Input Low Threshold	$V_{tl}$	-100	-	-	mV	$V_{CM} = +1.2V$
Magnitude Differential Input	$ V_{ID} $	200	-	600	mV	-
Common Mode Voltage	$V_{CM}$	1.0	1.2	1.4	V	$V_{th} - V_{tl} = 200\text{ mV}$
Common Mode Voltage Offset	$\Delta V_{CM}$	-50	-	+50	mV	$V_{th} - V_{tl} = 200\text{ mV}$

Note:(1) Input signals shall be low or Hi- resistance state when VDD is off.

(2) All electrical characteristics for LVDS signal are defined and shall be measured at the interface connector of LCD

Figure 1 Voltage Definitions

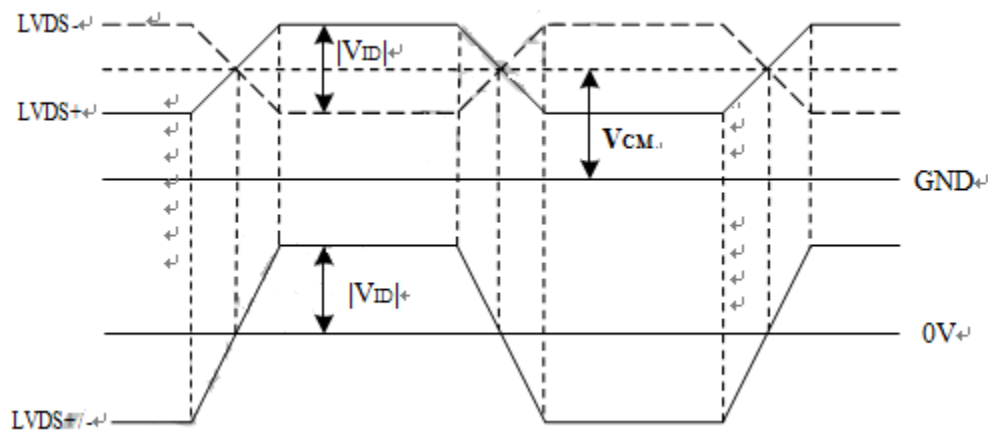


Figure 2 Measurement System

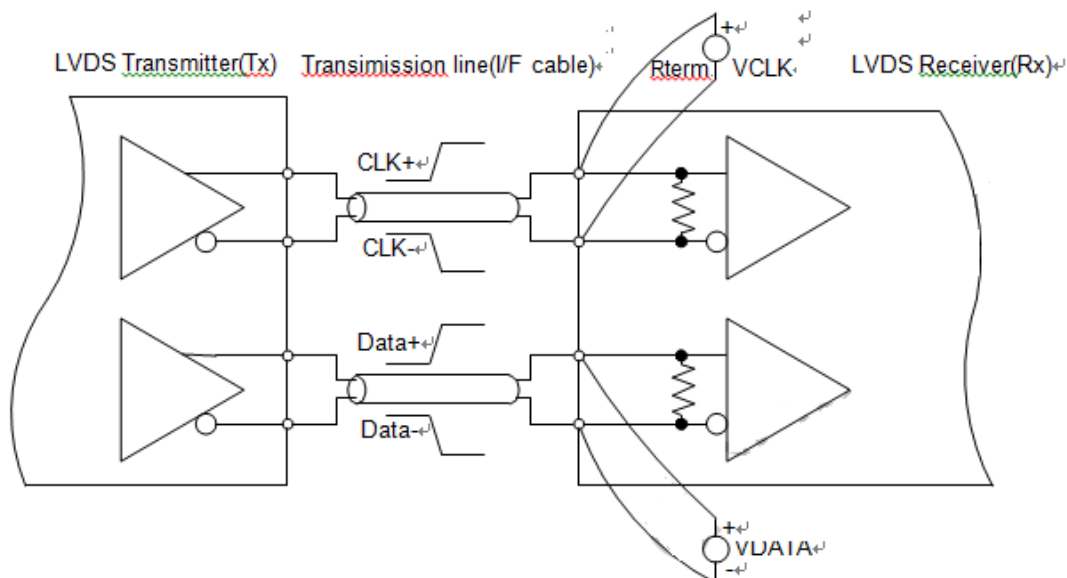


Figure 3 Data Mapping (6 Bit)

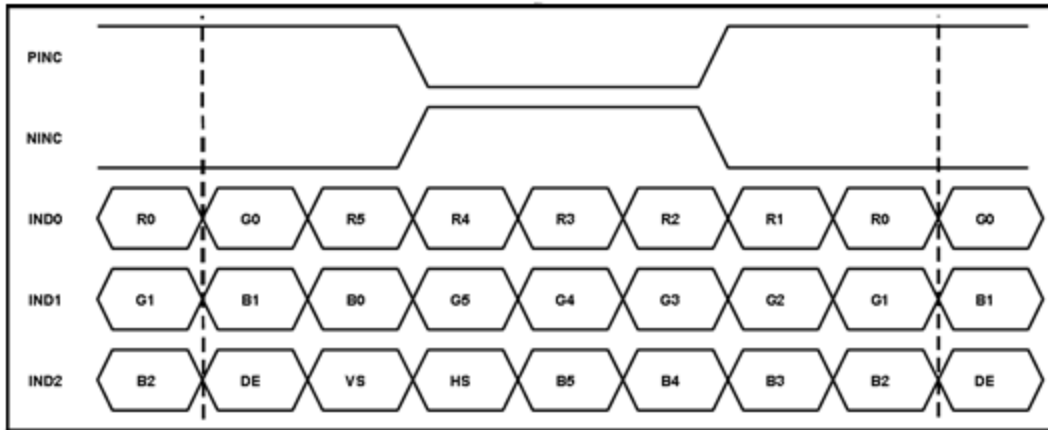
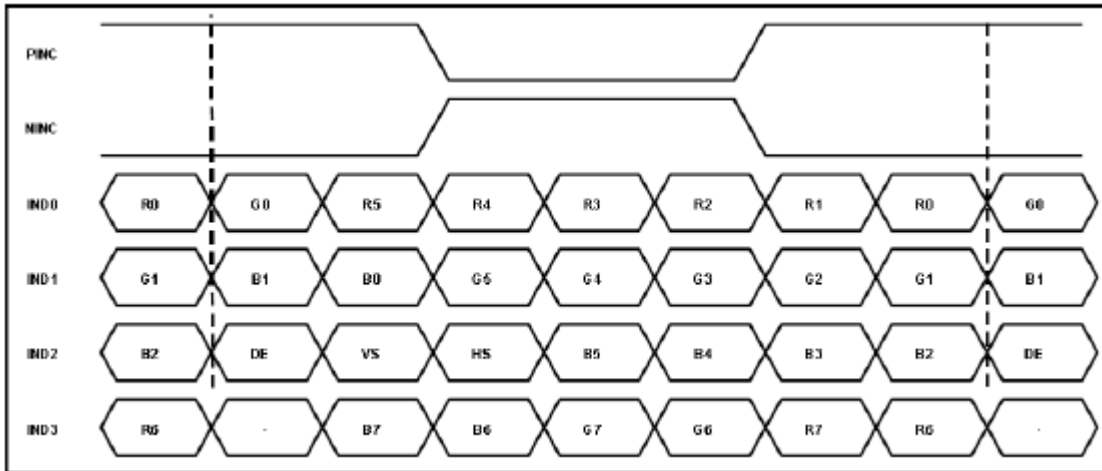


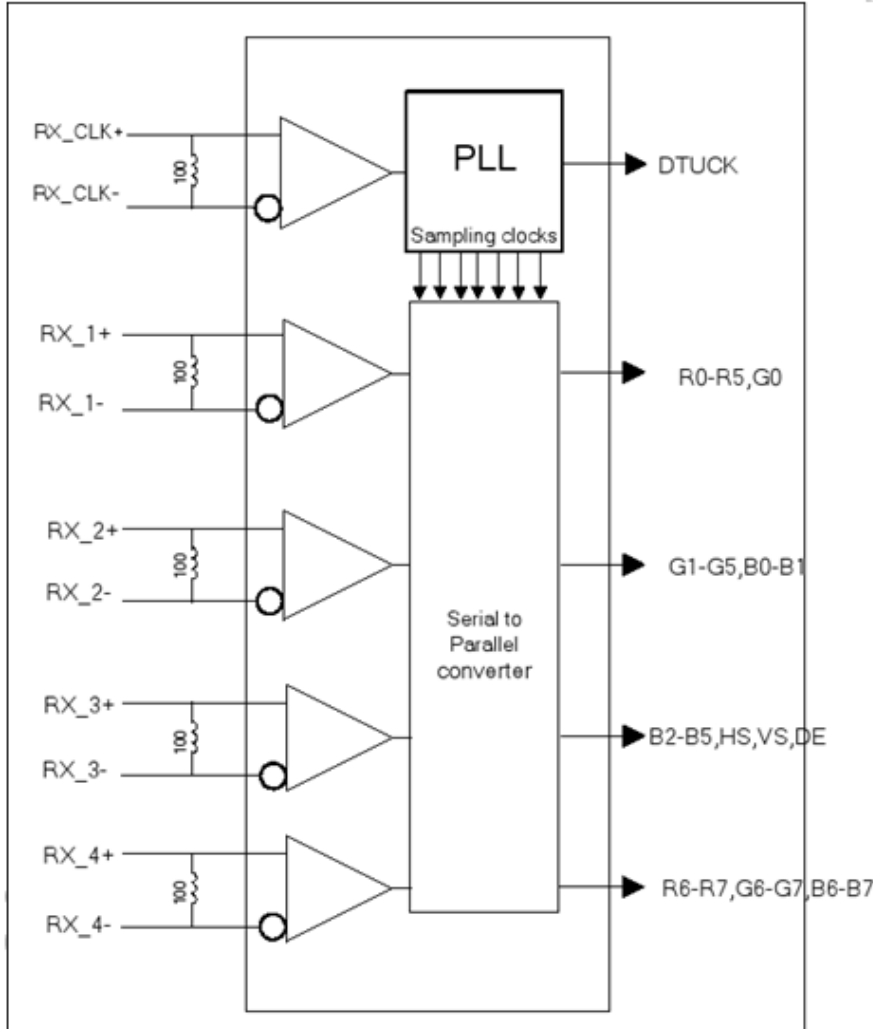
Figure 4 Data Mapping (8 Bit)



**LVDS Receiver Internal Circuit**

Figure 4 LVDS Receiver Internal Circuit shows the internal block diagram of the LVDS receiver. This LCD module equips termination resistors for LVDS link.

**Figure 5 LVDS Receiver Internal Circuit**



**4.3. Backlight Connector Type**

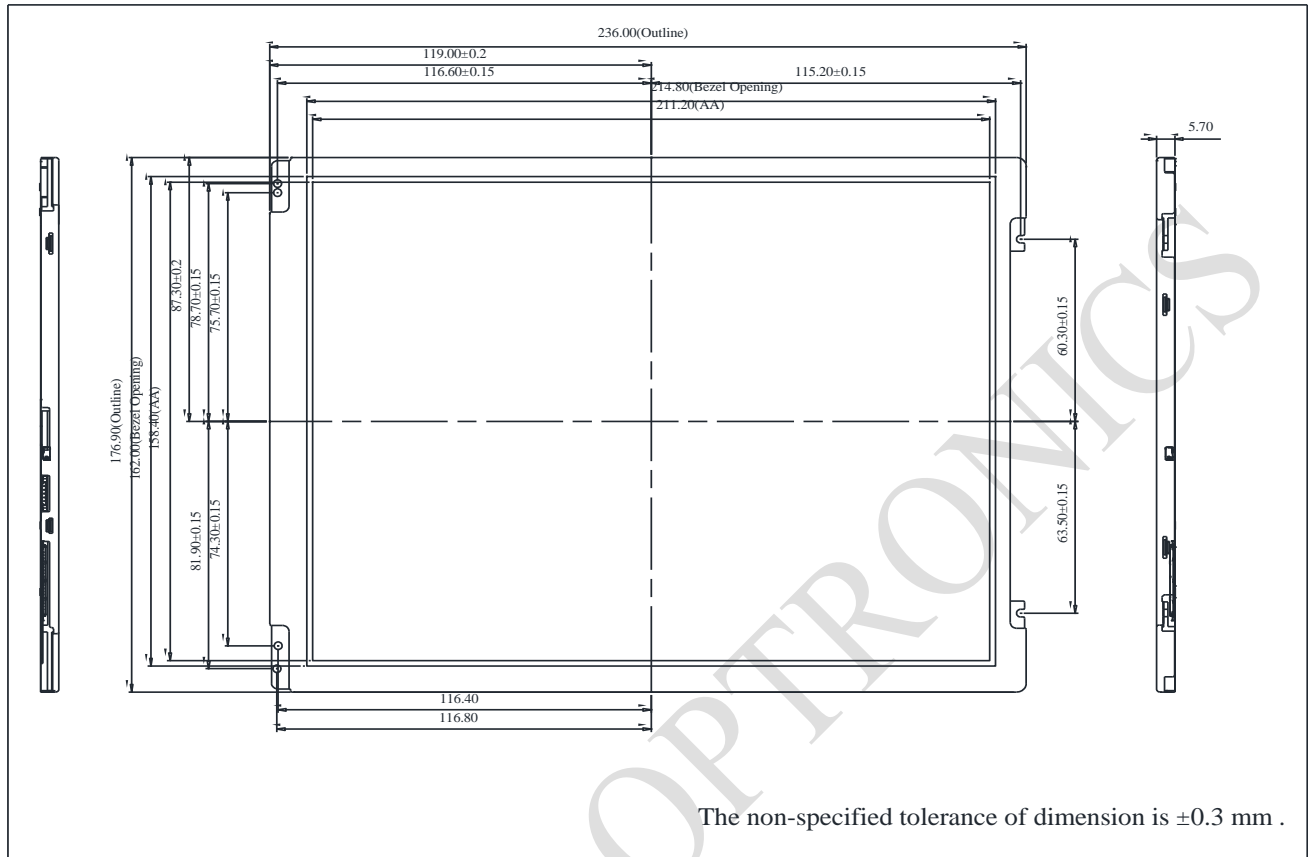
Item	Description
Type	MSB24038P5A (Manufacture by STM)
Mating Receptacle / Type (Reference)	P24038P5

**Backlight Connector Pin Assignment**

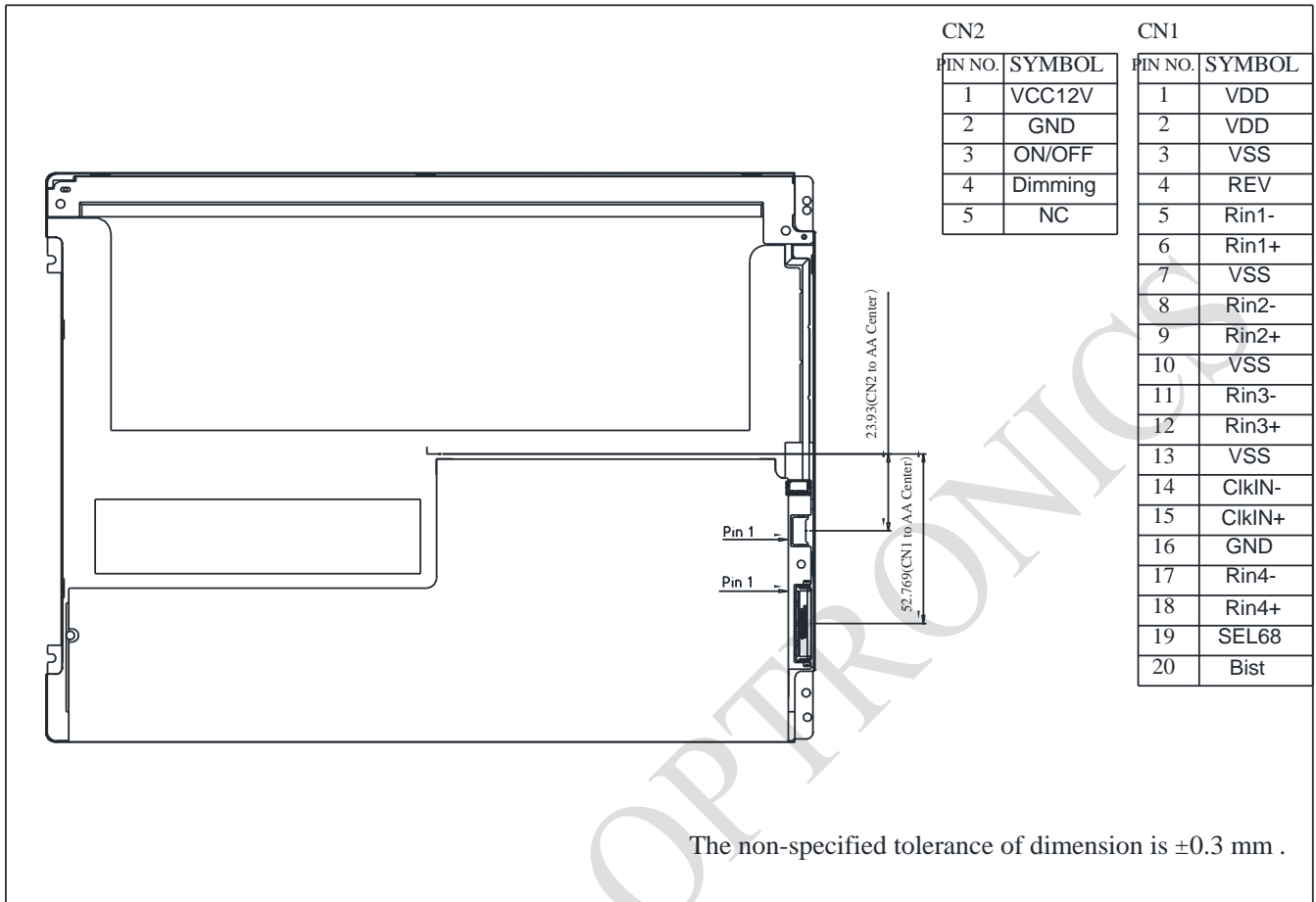
Pin No.	Symbol	Signal name
1	VCC	12V
2	GND	GND
3	ON/OFF	5V-ON,0V-OFF
4	Dimming	PWM Dimming or Analog Dimming
5	NC	NC

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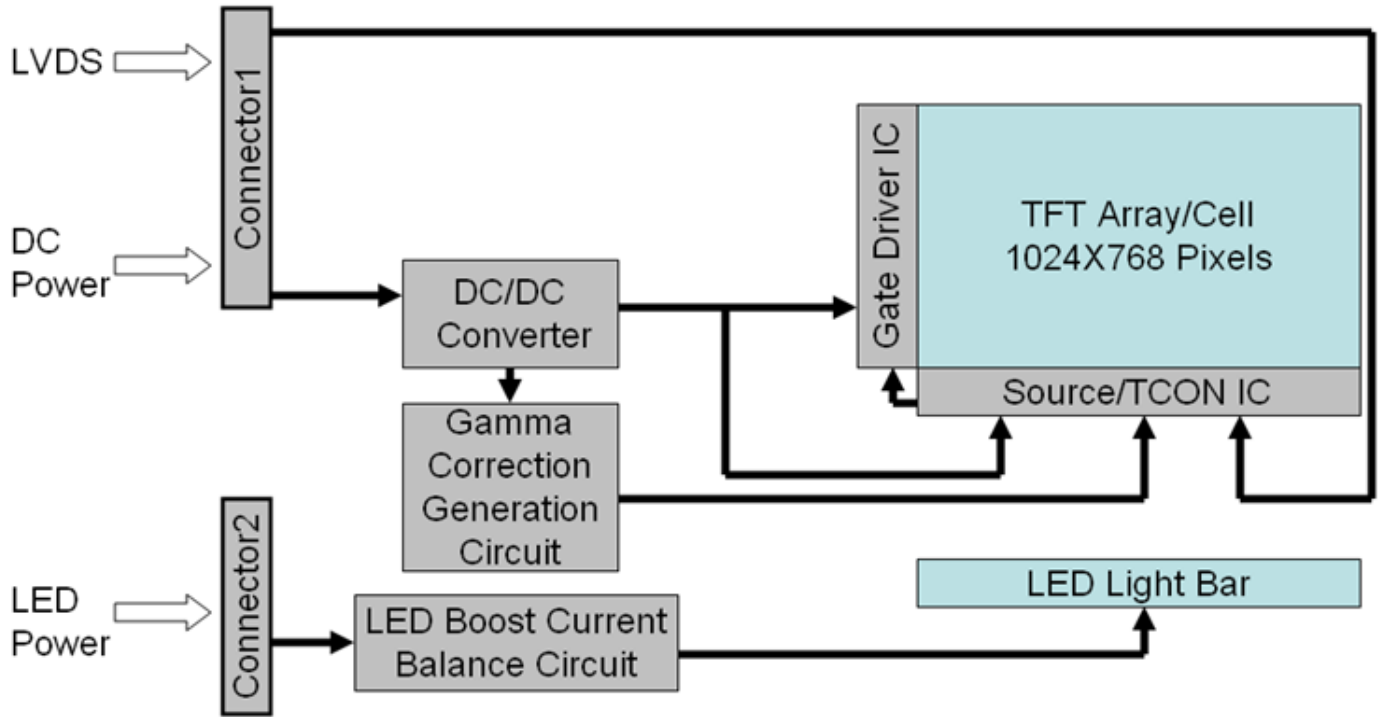
# 5. Contour Drawing



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## 6. Block Diagram



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## 7. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	TOP	-20	–	+70	□
Storage Temperature	TST	-30	–	+80	□

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

- Temp. □60□, 90% RH MAX. Temp. >60□, Absolute humidity shall be less than 90% RH at 60□

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## 8. Electrical Characteristics

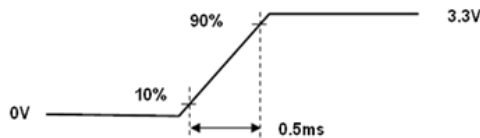
8.1. Input power specifications are as follows.

Table 1 Power Consumption

Item	Symbol	Min.	Typ.	Max.	Units	Note
LCD Drive Voltage (Logic)	VDD	3.0	3.3	3.6	V	(2), (4)
VDD Current	IDD	-	TBD	(0.25)	A	(3),(4)
VDD Power Consumption	PDD	-	-	(0.84)	W	
Rush Current	Irush	-	-	1.5	A	(1),(4)
Allowable Logic/LCD Drive Ripple Voltage	VDDrp	-	-	(200)	mV	(4)

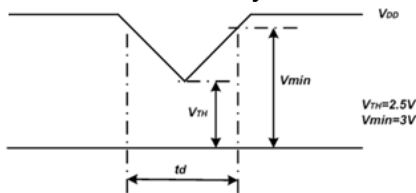
Note (1) Measure Condition

Figure 15 VDD Rising Time



Note (2) VDD Power Dip Condition

If  $V_{TH} < VDD \leq V_{min}$ , then  $t_d \leq 10ms$ ; when the voltage return to normal our panel must revive automatically



Note (3) Frame Rate=60Hz, VDD=3.3V, DC Current.

Note (4) Operating temperature 25°C, humidity 55%RH.

### Power ON/OFF Sequence

VDD power on/off sequence is as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi- resistance state or low level when VDD is off.

Figure 17 Power Sequence

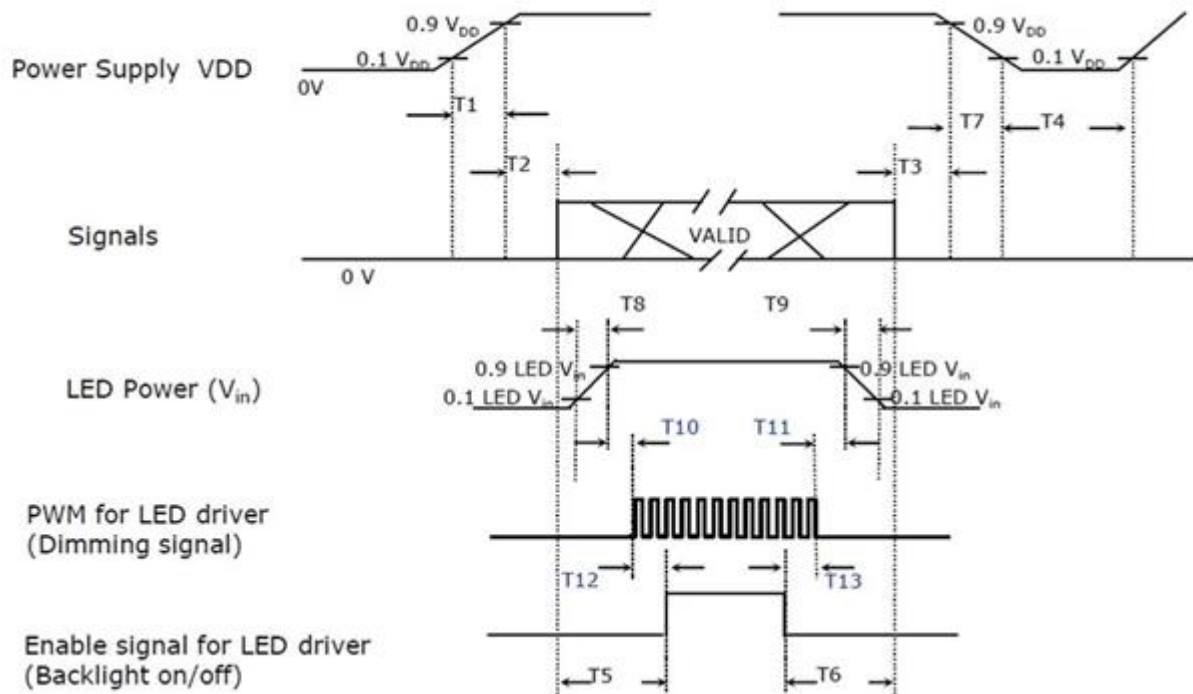


Table 2 Power Sequencing Requirements

Power ON/OFF Sequence					
Items	Symbol	MIN	TYP	MAX	Unit
VDD rising time from 10% to 90%	T1	0.5	-	10	ms
Delay from VDD to valid data at power ON	T2	30	-	50	ms
Delay from valid data OFF to VDD OFF at power OFF	T3	0	-	50	ms
VDD OFF time for windows restart	T4	500	-	-	ms
Delay from valid data to B/L enable at power ON	T5	200	-	-	ms
Delay from valid data off to B/L disable at power Off	T6	200	-	-	ms
VDD falling time from 90% to 10%	T7	0.5	-	10	ms
LED V <sub>in</sub> rising time from 10% to 90%	T8	0.5	-	10	ms
LED V <sub>in</sub> falling time from 90% to 10%	T9	0.5	-	10	ms
Delay from LED driver V <sub>in</sub> rising time 90% to PWM ON	T10	0	-	-	ms
Delay from PWM Off to LED driver V <sub>in</sub> falling time 10%, Must keep rule	T11	0	-	-	ms
Delay from PWM ON to B/L Enable ON, Must keep rule	T12	0	-	-	ms
Delay from B/L Enable Off to PWM Off	T13	0	-	-	ms

## 8.2. Parameter Guideline Of LED Backlight

Table 3 Parameter Guideline for LED Backlight

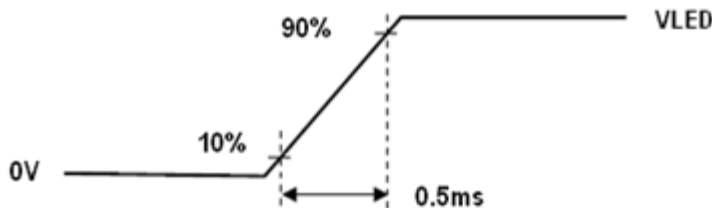
Item	Symbol	Min.	Typ.	Max.	Units	Note	
LED Input Voltage	V_LED	10.8	12	12.6	V	(2),(3)	
LED Power Consumption	P_LED	-	-	(2.88)	W	(2),(3)	
LED Forward Voltage	V <sub>F</sub>	2.8	3.2	3.6	V	(2)	
LED Forward Current	I <sub>F</sub>	-	20	30	mA		
PWM Signal Voltage	VPW M_EN	High	4.5	5	5.5		V
		Low	0	-	0.4		
LED Enable Voltage	VLED_EN	High	2.0	5	5.5	V	
		Low	0	-	0.4		
Input PWM Frequency	FPWM	100	-	1K	Hz		
LED Life Time	LT	30,000	-	-	Hours	(1)(2)	
Duty Ratio	PWM	5	-	100	%	(2)	

Note (1) The LED life time define as the estimated time to 50% degradation of initial luminous.

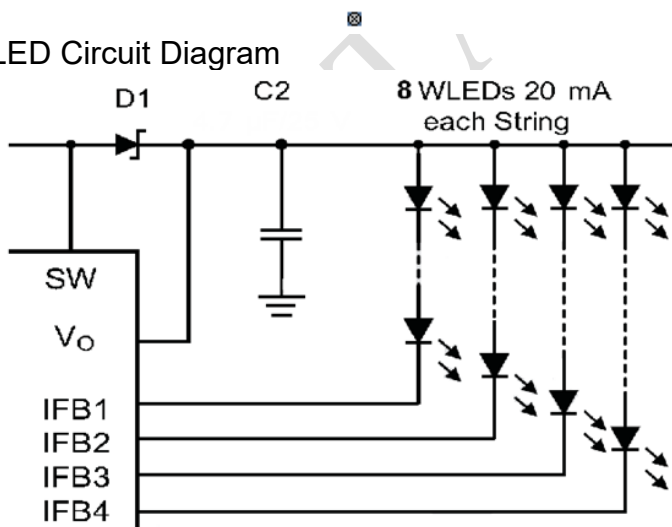
Note (2) Operating temperature 25°C, humidity 55%RH.

Note (3) A higher LED power supply voltage will result in better power efficiency. Keep the V\_LED between 12V and 12.6V is strongly recommended.

Figure 8 LED Rush Current Measure Condition



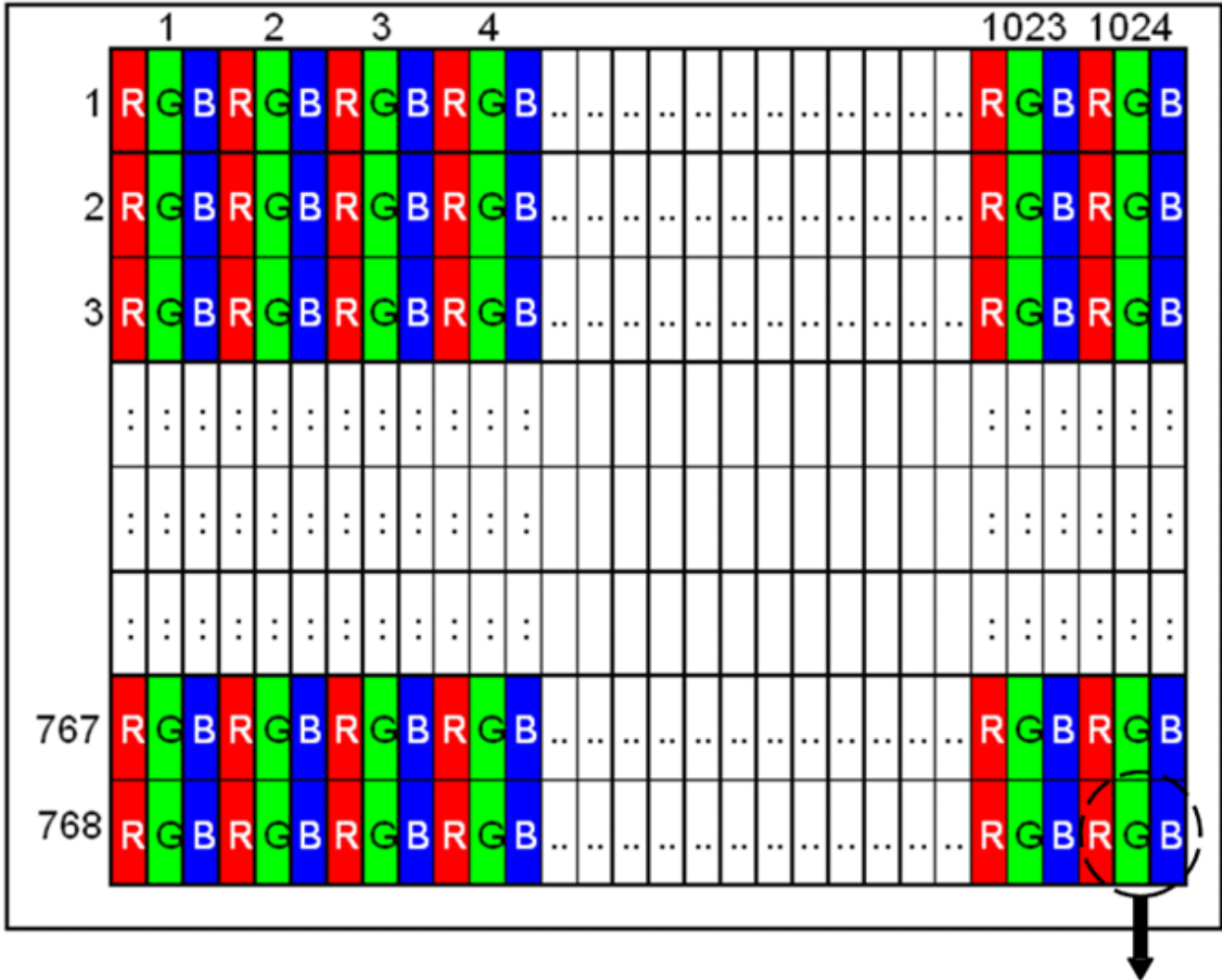
LED Circuit Diagram



## 9.Pixel Format Image

Figure 1 shows the relationship of the input signals and LCD pixel format image.

Figure 1 Pixel Format



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## 10. Interface Timings

### 10.1. Timing Characteristics

Synchronization method should be DE mode.

Table 1 Interface Timings

Parameter	Symbol	Unit	Min.	Typ.	Max.
LVDS Clock Frequency	Fclk	MHz	(52)	(65)	(71)
H Total Time	HT	Clocks	(1,114)	(1,344)	(1,400)
H Active Time	HA	Clocks	1,024	1,024	1,024
H Blanking Time	HBL	Clocks	(90)	(320)	(376)
V Total Time	VT	Lines	(778)	(806)	(845)
V Active Time	VA	Lines	768	768	768
V Blanking Time	VBL	Lines	(10)	(38)	(77)
Frame Rate	Vsync	Hz	55	60	65

Note: H Blanking Time and V Blanking Time can not be changed at every frame.

## 11. Optical Characteristics

Item	Symbol	Condition.	Min	Typ.	Max.	Unit	Remark	
Response time	$T_r$	$\theta=0^\circ \cdot \phi=0^\circ$	-	16	-	.ms	Note 3,5	
	$T_f$							
Contrast ratio	CR	At optimized viewing angle	720	900	-	-	Note 4,5	
Color Chromaticity	White	$W_x$	$\theta=0^\circ \cdot \phi=0^\circ$	0.26	0.31	0.36	Note 2,6,7	
		$W_y$		0.28	0.33	0.38		
Viewing angle	Hor.	$\theta_R$	CR $\geq 10$	70	75	-	Deg.	Note 1
		$\theta_L$		70	75	-		
	Ver.	$\phi_T$		70	75	-		
		$\phi_B$		70	75	-		
Brightness	-	-	300	350	-	cd/m <sup>2</sup>	Center of display	

$T_a=25\pm 2^\circ\text{C}$ ,

Note 1: Definition of viewing angle range

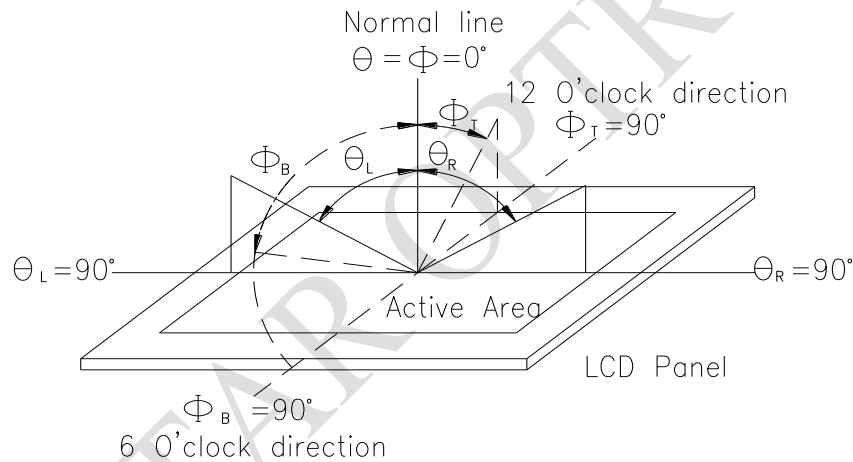


Fig.11.1. Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7 or BM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

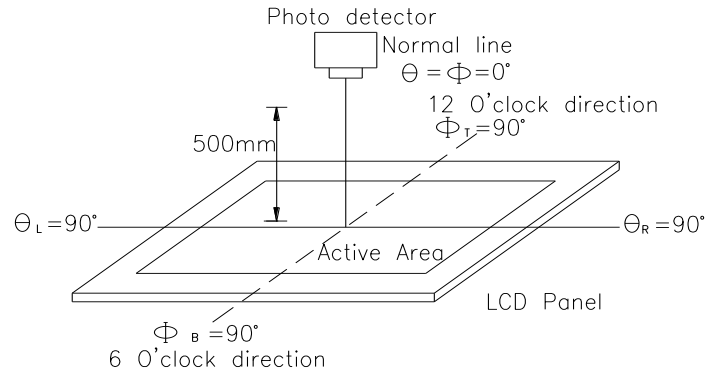
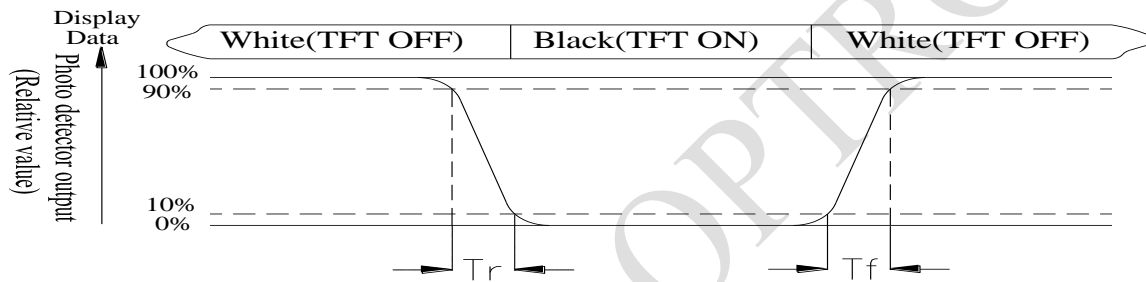


Fig. 11.2. Optical measurement system setup

Note 3: Definition of Response time:

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time,  $T_r$ , is the time between photo detector output intensity changed from 90% to 10%. And fall time,  $T_f$ , is the time between photo detector output intensity changed from 10% to 90%



Note 4: Definition of contrast ratio:

The contrast ratio is defined as the following expression.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5: White  $V_i = V_{i50} \pm 1.5V$

Black  $V_i = V_{i50} \pm 2.0V$

"±" means that the analog input signal swings in phase with VCOM signal.

"±" means that the analog input signal swings out of phase with VCOM signal.

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 6: Definition of color chromaticity (CIE 1931)

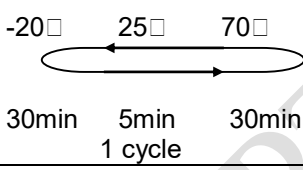
Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.



## 12. Reliability

Content of Reliability Test (Wide temperature,  $-20^{\circ}\text{C}\sim 70^{\circ}\text{C}$ )

Environmental Test			
Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	$80^{\circ}\text{C}$ 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	$-30^{\circ}\text{C}$ 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	$70^{\circ}\text{C}$ 200hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	$-20^{\circ}\text{C}$ 200hrs	1
High Temperature/Humidity Operation	The module should be allowed to stand at $60^{\circ}\text{C}, 90\% \text{RH}$ max	$60^{\circ}\text{C}, 90\% \text{RH}$ 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation  	$-20^{\circ}\text{C}/70^{\circ}\text{C}$ 10 cycles	—
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS= $\pm 600\text{V}$ (contact) , $\pm 800\text{V}$ (air), RS=330 $\Omega$ CS=150pF 10 times	—

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

**LCM Sample Estimate Feedback Sheet**

**Module Number :** \_\_\_\_\_

**1 、 Panel Specification :**

1. Panel Type :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2. View Direction :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3. Numbers of Dots :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4. View Area :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5. Active Area :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
6. Operating Temperature :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
7. Storage Temperature :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
8. Others :	_____	

**2 、 Mechanical Specification :**

1. PCB Size :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2. Frame Size :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3. Material of Frame :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4. Connector Position :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5. Fix Hole Position :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
6. Backlight Position :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
7. Thickness of PCB :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
8. Height of Frame to PCB :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
9. Height of Module :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
10. Others :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____

**3 、 Relative Hole Size :**

1. Pitch of Connector :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2. Hole size of Connector :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3. Mounting Hole size :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4. Mounting Hole Type :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5. Others :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____

**4 、 Backlight Specification :**

1. B/L Type :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2. B/L Color :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3. B/L Driving Voltage (Reference for LED Type) :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4. B/L Driving Current :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5. Brightness of B/L :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
6. B/L Solder Method :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
7. Others :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____

>> Go to page 2 <<

Module Number : \_\_\_\_\_

**5、Electronic Characteristics of Module :**

1.Input Voltage :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2.Supply Current :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3.Driving Voltage for LCD :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4.Contrast for LCD :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5.B/L Driving Method :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
6.Negative Voltage Output :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
7.Interface Function :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
8.LCD Uniformity :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
9.ESD test :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
10.Others :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____

**6、Summary :**

Sales signature : \_\_\_\_\_

Customer Signature : \_\_\_\_\_

Date : / /