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# Datasheet

## Tianma

**P0650VGF1MA00**

TI-01-018



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## 1 General Specifications

Feature		Spec
<b>Display Spec.</b>	Size	6.5 inch
	Resolution	640(RGB) x 480
	Technology Type	a-Si TFT
	Pixel Pitch (mm)	0.207 (H) x 0.207(V)
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	SFT, Normally black
	Surface Treatment	AG
	Viewing Direction	ALL
<b>Mechanical Characteristics</b>	LCM (W x H x D) (mm)	154.00x 121.00 x 7.10
	Active Area(mm)	132.48×99.36
	With /Without TSP	Without Touch Screen
	Weight (g)	TBD
	Matching Connection Type	CN1:FI-S20S CN2:SHLP-06V-S-B
<b>Electrical Characteristics</b>	Interface	Single LVDS
	Color Depth	16.7M

Note 1: Requirements on Environmental Protection: Q/S0002

Note 2: LCM weight tolerance: +/- 5%

## 2 Input/Output Terminals

### 2.1 CN1(LCD)

Connector type:FI-SE20P-HFE (JAE)  
Matching connector: FI-S20S

PIN	Symbol	I/O	Description	Remark
1	VCC	P	Power supply(+3.3V)	
2	VCC	P	Power supply(+3.3V)	
3	GND	P	Ground	
4	GND	P	Ground	
5	Link 0-	I	- LVDS differential data input(R0~R5,G0)	
6	Link 0+	I	+ LVDS differential data input(R0~R5,G0)	
7	GND	P	Ground	
8	Link 1-	I	- LVDS differential data input(G1~G5,B0~B1)	
9	Link 1+	I	+ LVDS differential data input(G1~G5,B0~B1)	
10	GND	P	Ground	
11	Link 2-	I	- LVDS differential data input (B2~B5,-,-,DE)	
12	Link 2+	I	+ LVDS differential data input (B2~B5,-,-,DE)	
13	GND	P	Ground	
14	CLKIN-	I	- LVDS differential data input	
15	CLKIN+	I	+ LVDS differential data input	
16	GND	P	Ground	
17	Link 3-	I	- LVDS differential data input(R6~R7,G6~G7,B6~B7)	
18	Link 3+	I	+ LVDS differential data input(R6~R7,G6~G7,B6~B7)	
19	Mode	I	L: 6bit H: 8bit	
20	SC	I	Display direction selection	

I---Input, O---Output, P--- Power/Ground

Table 2.1 terminal pin assignments

Note 1: Scan direction is shown as below(PCB at down side):



SC=0

SC=1

2.2 CN2(Backlight)

Connector type: JST SM06B-SHLS-TF(LF)(SN)  
 Matching connector:SHLP-06V-S-B

No	Symbol	I/O	Description	Remark
1	NC	-	No connection	
2	NC	-	No connection	
3	LED C1	P	LED cathode 1	
4	LED A1	P	LED anode 1	
5	LED A2	P	LED anode 2	
6	LED C2	P	LED cathode 2	

Table2.2 Backlight pin assignment

3 Absolute Maximum Ratings

Ta = 25°C

Item	Symbol	Min	Max	Unit	Remark
Power Voltage for LCD	VCC	-0.5	5.0	V	Note1
Input voltage for LCD	Vin	-0.5	5.0	V	
Operating Temperature	TOPR	-30	+80	°C	Note2
Storage Temperature	TSTG	-40	+90	°C	
Relative Humidity Note2	RH	--	≤95	%	Ta≤40°C
		--	≤85	%	40°C < Ta ≤ 50°C
		--	≤55	%	50°C < Ta ≤ 60°C
		--	≤36	%	60°C < Ta ≤ 70°C
		--	≤24	%	70°C < Ta ≤ 80°C
Absolute Humidity	AH	--	≤70	g/m <sup>3</sup>	Ta > 70°C

Table 3.1 absolute maximum rating

Note1: V<sub>IN</sub> represents Mode,SC,LVDS data etc..

Note2: Ta means the ambient temperature.

It is necessary to limit the relative humidity to the specified temperature range.  
 Condensation on the module is not allowed.

## 4 Electrical Characteristics

### 4.1 Recommended Operating Condition

VCC=3.3V, GND=0V, Ta = 25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Power supply Voltage	VCC	3.00	3.30	3.60	V	
Power supply ripple	Vp-p	-	-	100	mV	
Power supply current	IDD	-	TBD	-	mA	
Power consumption	P	-	TBD	-	mW	Note1
Input voltage threshold	Low level	VIL	0	-	0.3VCC	V
	High level	VIH	0.7VCC	-	VCC	V
Inrush current	Irush	-	-	1.5	A	Note2

Table 4.1 LCD module electrical characteristics

Note1: To test the current dissipation, using the “white” testing pattern.

**Vcc rising time is 470μs**

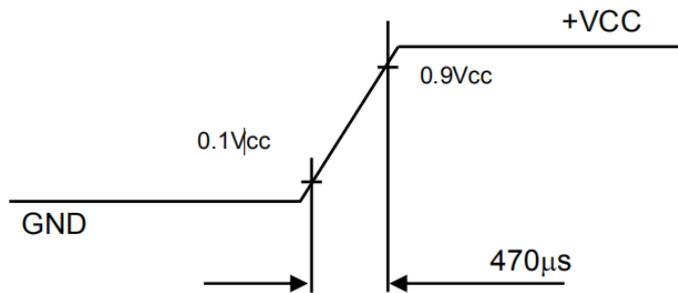


Figure4.1 Inrush current test condition

**4.2 Backlight Unit Driving Condition**

Ta = 25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	$I_F$	-	180	200	mA	12 LEDs (6 LED Serial, 2 LED Parallel)
Forward Current Voltage	$V_F$	-	18.6	20.4	V	
Backlight Power Consumption	$W_{BL}$	-	3348	-	mW	
Operating Life Time	--	-	100000	-	hrs	Note

**Table 4.2 Backlight Unit Driving Condition**

Note1: The LED driving condition is defined for total LED module.

Note2: Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

Note3: Optical performance should be evaluated at Ta=25°C only If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

Note4: The LED driving condition is defined for each LED module.

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4.3 BLOCK DIAGRAM

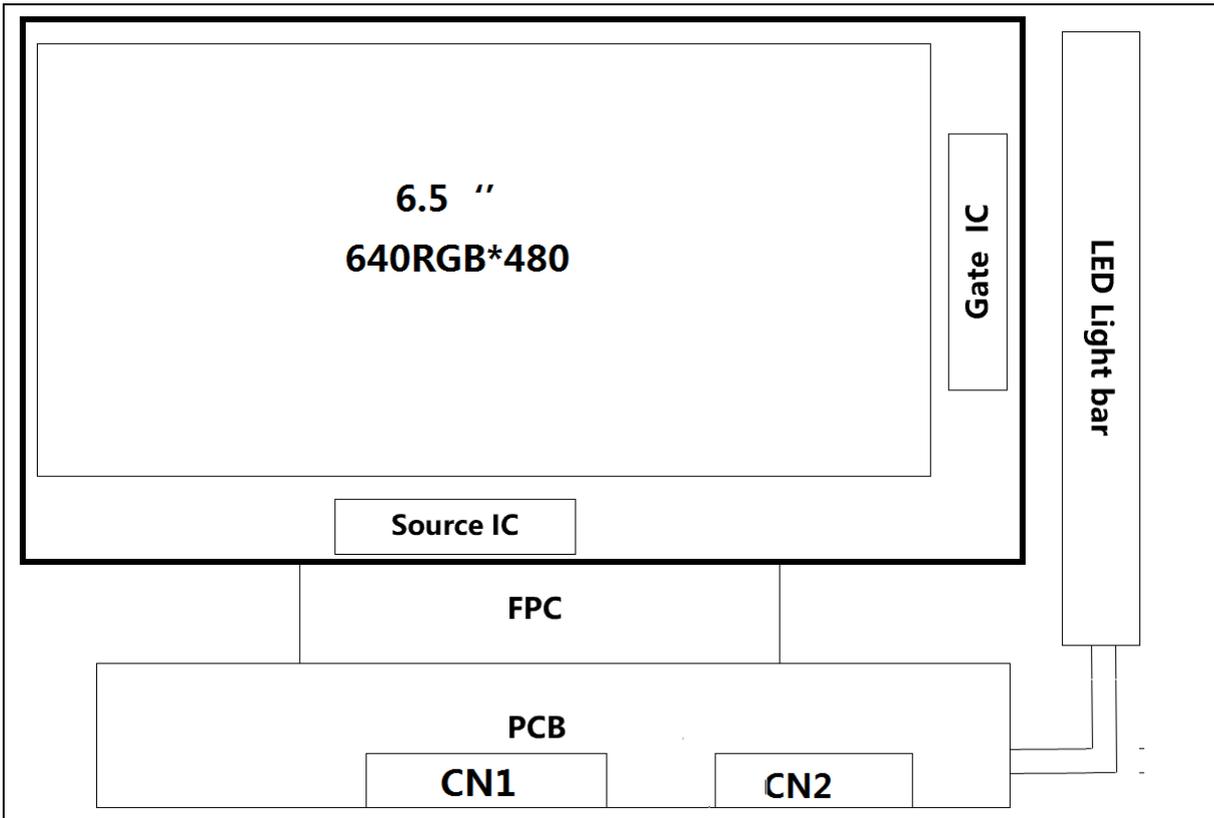


Figure4.3 Block diagram

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## 5 Timing Chart

### 5.1 Input Timing

VCC=3.3V, GND=0V, Ta=25°C

Parameter	Symbol	Min	Typ	Max	Unit	Remark
CLK frequency	F <sub>dclk</sub>	19.7	20.7	47.2	MHz	
Horizontal blanking time	t <sub>HBT</sub>	26	34	506	t <sub>clk</sub>	
Horizontal display area	t <sub>HD</sub>	-	640	-	t <sub>clk</sub>	
Horizontal period	t <sub>H</sub>	666	674	1146	t <sub>clk</sub>	
Vertical blanking time	t <sub>VBT</sub>	13	32	206	t <sub>H</sub>	
Vertical display area	t <sub>VD</sub>	-	480	-	t <sub>H</sub>	
Vertical period	t <sub>V</sub>	493	512	686	t <sub>H</sub>	
Frame Rate	F	-	60	-	HZ	

Note: DE mode, HSYNC&VSYNC is unnecessary.

Table 5.1 Timing table

### 5.2 Timing Diagram

#### Horizontal input timing

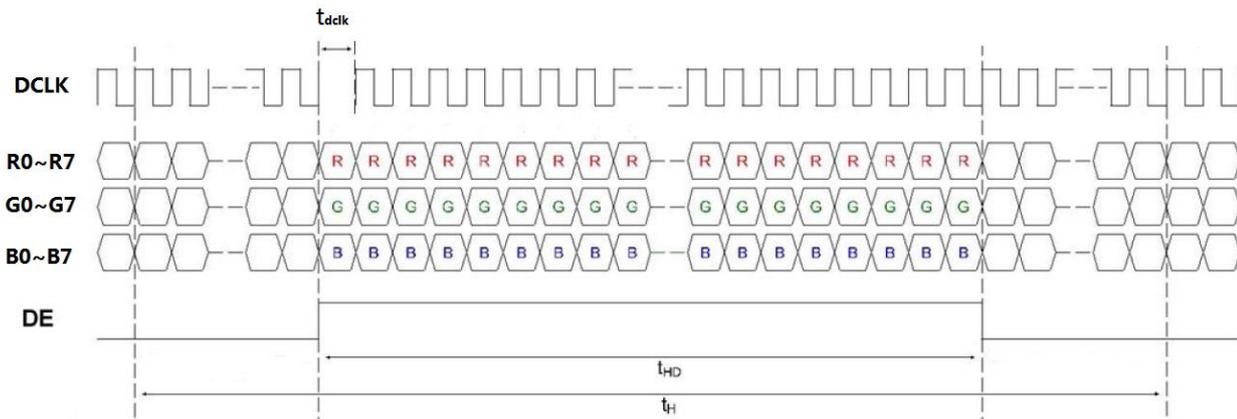


Figure 5.2.1 Horizontal input timing

#### Vertical input timing

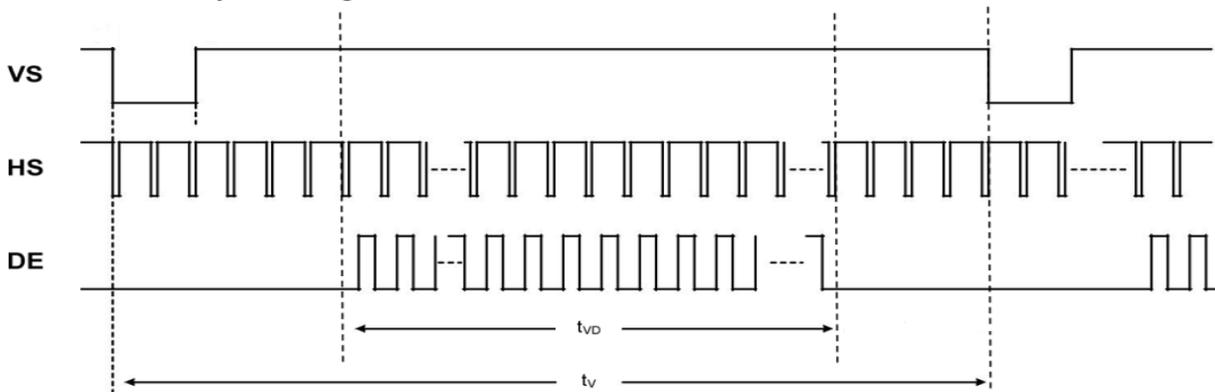


Figure 5.2.2 Vertical input timing

Note: HS/VS waveform is for reference only.

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5.3 LVDS data mapping

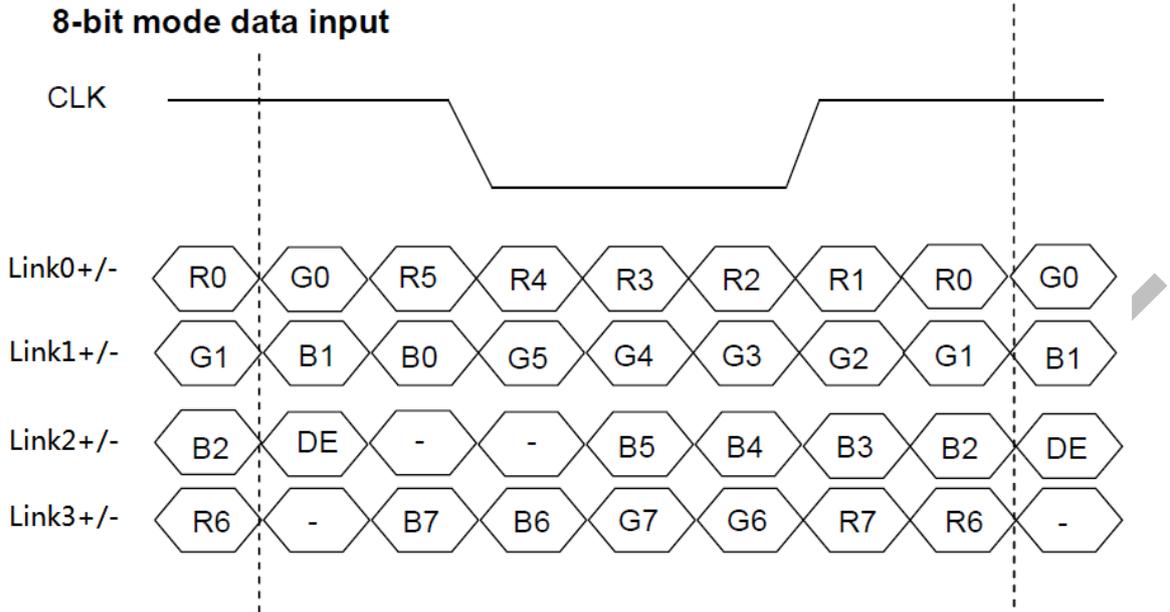


Figure 5.3.1 LVDS 8bit(Mode=H)

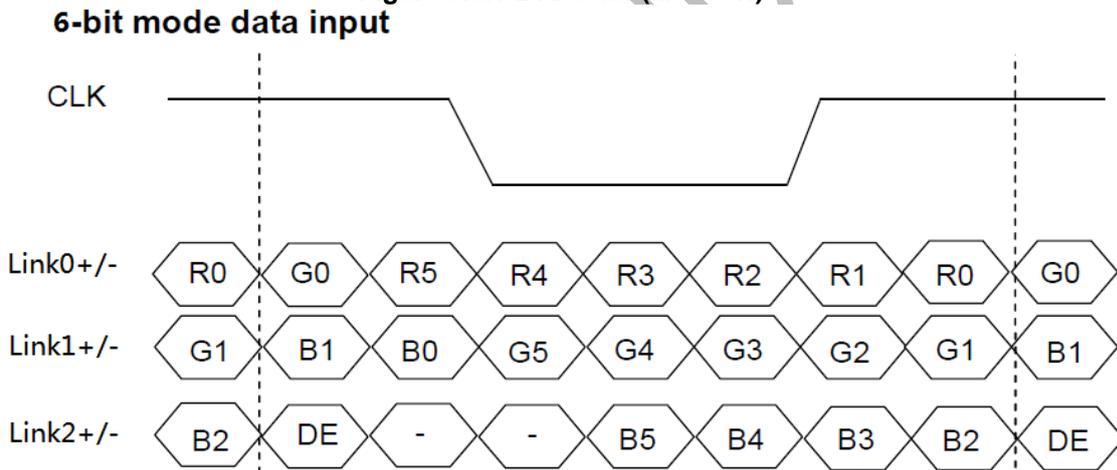
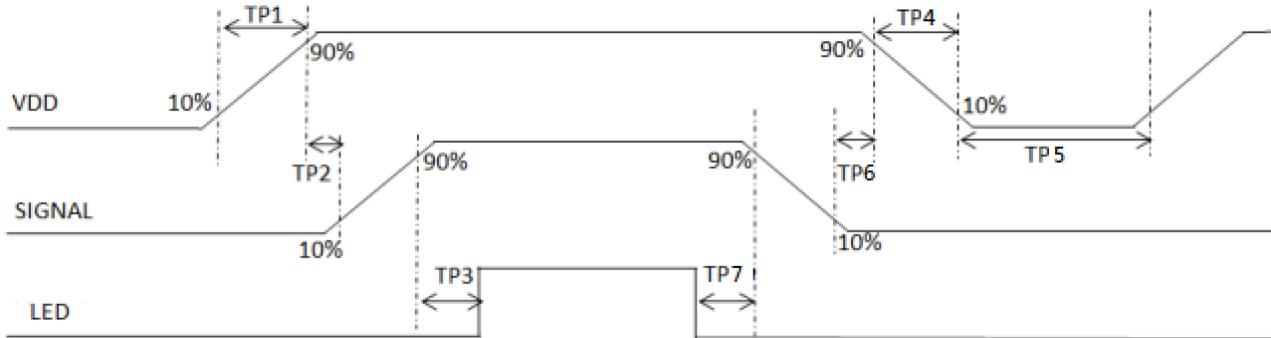


Figure 5.3.2 LVDS 6bit(Mode=L)

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**5.4 POWER ON/OFF SEQUENCE**

Item	Symbol	Min	Typ	Max	Unit	Remark
VCC on to VCC stable	TP1	0.5	-	3	ms	
VCC stable to signal on	TP2	1	-	-	ms	
Signal on to LED on	TP3	200	-	-	ms	
VDD off time	TP4	0	-	10	ms	
VDD off to next VDD on	TP5	500	-	-	ms	
Signal off before VDD off	TP6	1	-	-	ms	
LED off before signal off	TP7	200	-	-	ms	

**Table 5.4 Power on/off sequence**

**Figure 5.4 Power on/off sequence**

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## 6 Optical Characteristics

 $T_a=25^{\circ}\text{C}$ 

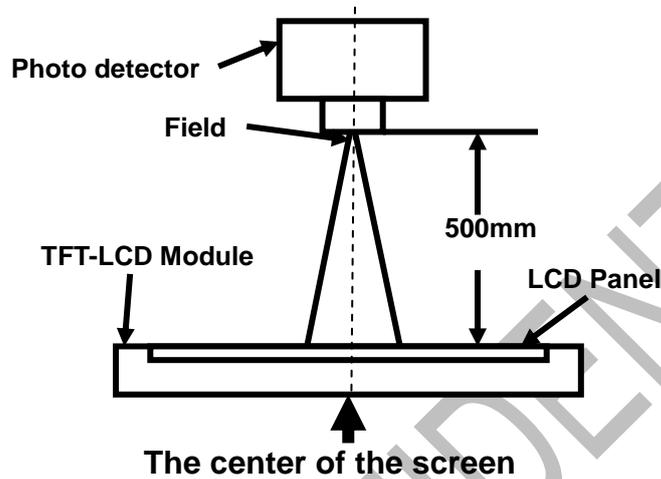
Item	Symbol	Condition	Min	Typ	Max	Unit	Remark	
View Angles	$\theta T$	$CR \geq 10$	75	85	-	Degree	Note 2	
	$\theta B$		75	85	-			
	$\theta L$		75	85	-			
	$\theta R$		75	85	-			
Contrast Ratio	CR	$\theta=0^{\circ}$	700	900	-		Note1 Note3	
Response Time	$T_{ON}$	$25^{\circ}\text{C}$	-	30	35	ms	Note1 Note4	
	$T_{OFF}$							
Chromaticity	White	Backlight is on	x	0.263	0.313	0.363		Note1 Note5
			y	0.279	0.329	0.379		
	Red		x	-	-	-		
			y	-	-	-		
	Green		x	-	-	-		
			y	-	-	-		
	Blue		x	-	-	-		
			y	-	-	-		
Uniformity	U		75	80	-	%	Note1 Note6	
NTSC			65	70	-	%	Note 5	
Luminance (Without TP)	L		900	1200	-	$\text{cd}/\text{m}^2$	Note1 Note7	

Test Conditions:

- $I_f=180\text{ mA}$ , and the ambient temperature is  $25\pm 2^{\circ}\text{C}$ . humidity is  $65\pm 7\%$
- The test systems refer to Note 1 and Note 2.

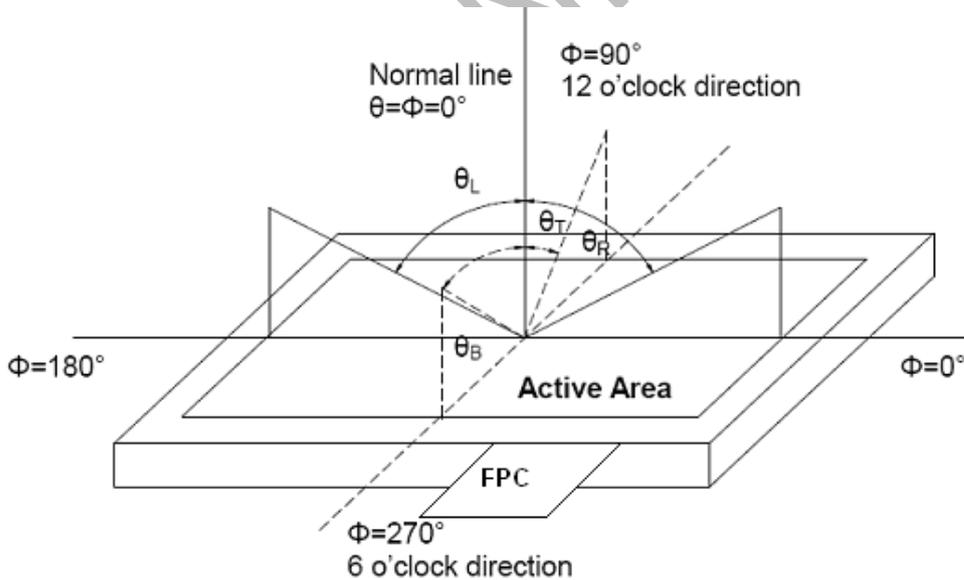
Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).



Note 3: Definition of contrast ratio

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

“White state “: The state is that the LCD should drive by  $V_{white}$ .

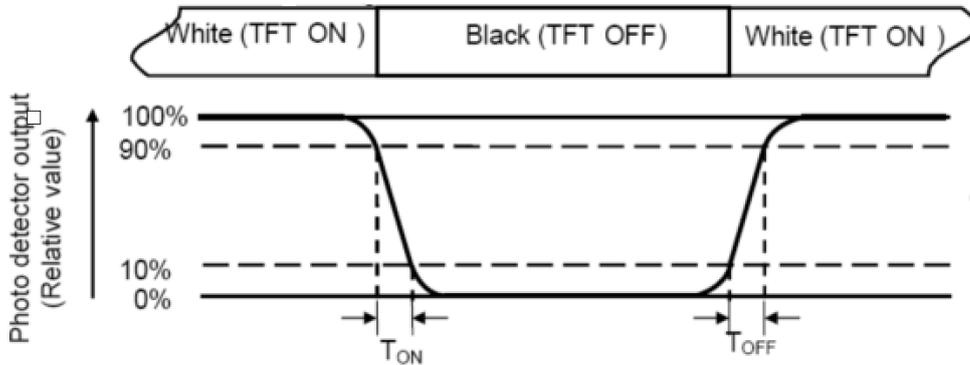
“Black state”: The state is that the LCD should drive by  $V_{black}$ .

$V_{white}$ : To be determined     $V_{black}$ : To be determined.

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Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time ( $T_{ON}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{OFF}$ ) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

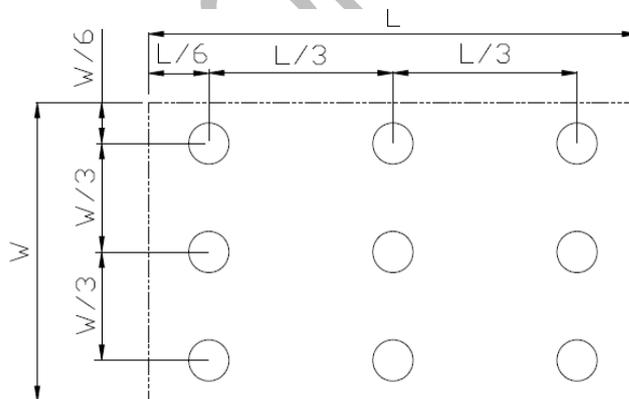
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = L_{\min} / L_{\max}$$

L-----Active area length W----- Active area width



$L_{\max}$ : The measured Maximum luminance of all measurement position.

$L_{\min}$ : The measured Minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

## 7 Environmental / Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ta = +80℃, 500 hours	IEC60068-2-1 GB2423.2
2	Low Temperature Operation	Ta = -30℃, 500 hours	IEC60068-2-1 GB2423.1
3	High Temperature Storage	Ta = +90℃, 500 hours	IEC60068-2-1 GB2423.2
4	Low Temperature Storage	Ta = -40℃, 500 hours	IEC60068-2-1 GB2423.1
5	High Temperature and Humidity Operation	Ta = +60℃, 90% RH max,500hours	IEC60068-2-78 GB/T2423.3
6	Thermal Shock (non-operation)	-30℃ 30 min~+80℃ 30 min, Change time:5min, 100 Cycle	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22
7	ESD	C=150pF,R=330Ω,5point/panel Air:±15Kv,5times; Contact:±8Kv,5times (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa)	IEC61000-4-2 GB/T17626.2
8	Vibration Test (non-operation)	vibration level :9.8m/s <sup>2</sup> (1G) waveform: sinusoidal Frequency range: 5 to 500Hz Frequency sweep rate:0.5 octave/min Duration : one sweep from 5 to 500Hz in each of three mutually perpendicular axis(each x,y,z axis: 1hour, total 3 hours )	GB/T 2423.10-2008 ; GB/T 2423.56-2006
9	Shock Test	Shock level:1470m/s <sup>2</sup> (150G) Waveform:half sinusoidal wave,2ms Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs	GB/T 2423.5-1995
10	Package Drop Test	Height:60cm, 1corner,3edges,6surfaces	GB/T 4857.5-1992
11	Package Vibration	Frequency : 5-20-200HZ , PSD : 0.01-0.01-0.001 Total:0.781g <sup>2</sup> /HZ,x/y/z axis per 30min )	GB/T 4857.23-2012

Note1: Ta is the ambient temperature of samples.

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# 8 Mechanical Drawing

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
1												REV	IPC/C NUMBER	DESCRIPTION	DATE
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## 9 Packing drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM	P0650VGF1MA00	154.00x 121.00 x 7.10	TBD	TBD	
2						
3						
4						
5						
6						
7	Total weight	TBD±5% Kg				

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## 10 Precautions for Use of LCD Modules

### 10.1 Handling Precautions

11.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

11.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

11.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

11.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

11.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water ,Ketone ,Aromatic solvents

11.1.6 Do not attempt to disassemble the LCD Module.

11.1.7 If the logic circuit power is off, do not apply the input signals.

11.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

11.1.8.1 Be sure to ground the body when handling the LCD Modules.

11.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

11.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

11.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

### 10.2 Storage precautions

11.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

11.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0°C ~ 40°C      Relatively humidity: ≤80%

11.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

### 10.3 Transportation Precautions

11.3.1 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

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