

Display Elektronik GmbH

# DATA SHEET

*TFT MODULE*

**DEM 1280800E VMX-PW-N**  
**(C-TOUCH)**  
**10,1“ TFT**

Product Specification

Version: 0

13.12.2024



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**\* Description**

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, capacitance touch panel, backlight unit. The resolution of a 10.1' TFT-LCD contains 1280x800 pixels, and can display up to 16.7 Million colors.

**\* Features**

General Information Items	Specification	Unit	Note
	Main Panel		
Display Area(AA)	216.96 x 135.60 (10.1 Inch)	mm	-
Driver Element	TFT Active Matrix	-	-
Display Colors	16.7 Million	colors	-
Number of Pixels	1280 x RGB x 800	dots	-
Pixel Arrangement	RGB Vertical Stripe	-	-
Pixel Pitch	0.1692 x 0.1692	mm	-
Viewing Angle	ALL	o'clock	-
Controller IC	EK79202D_A	-	-
LCM Interface	8-BIT-LVDS	-	-
Display Mode	IPS, Transmissive / Normally Black	-	-
Operating Temperature	-30 ~ +85	°C	-
Storage Temperature	-40 ~ +85	°C	-
Module Bonding Technology	Optical bonding between LCM and CTP	-	-

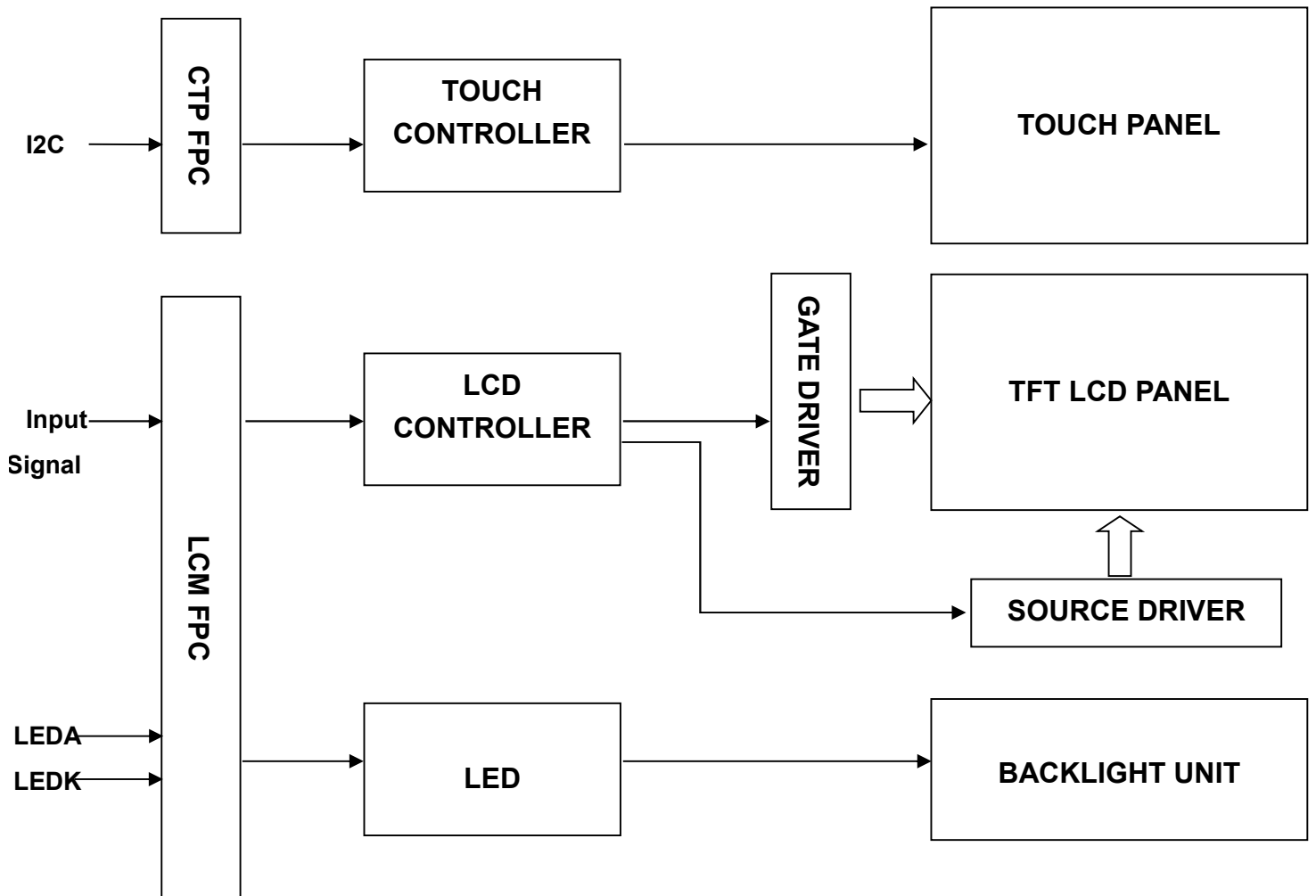
**\*C-TP Features**

General Information Items	Specification	Unit	Note
	Main Panel		
Resolution	1280(H)*800(V)	-	-
Structure	G+G	-	-
Controller IC	FT5626NEM	-	-
Interface	I2C	-	-
Touch Mode	Ten points	-	-
Logic Level	3.3	V	-

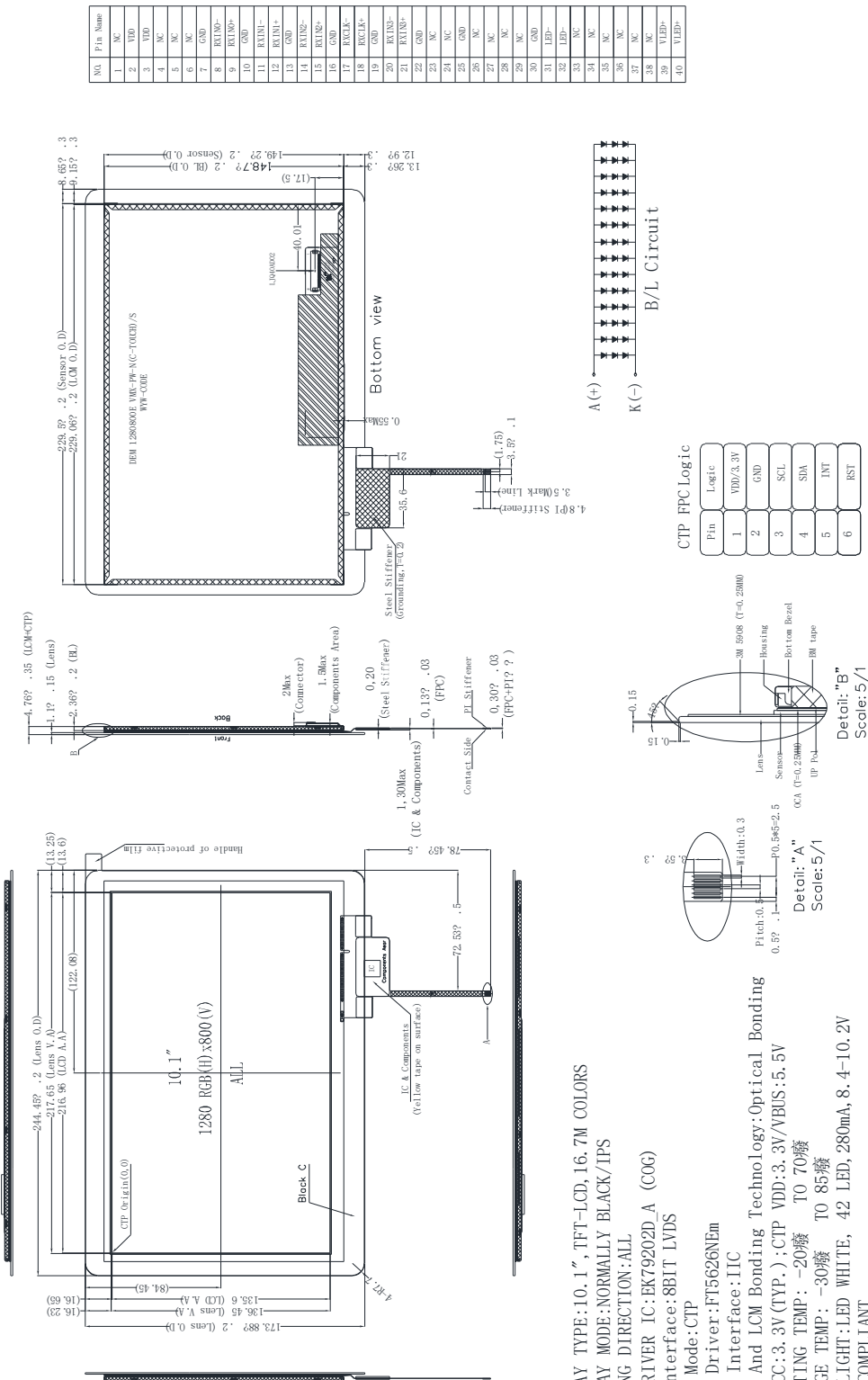
\* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	-	244.45	-	mm	-
	Vertical(V)	-	173.88	-	mm	-
	Depth(D)	-	4.76	-	mm	-
Weight		-	393	-	g	-

1. Block Diagram



2. Outline Dimension



- NOTE:
1. DISPLAY TYPE: 10.1", TFT-LCD, 16.7M COLORS
  2. DISPLAY MODE: NORMALLY BLACK/IPS
  3. VIEWING DIRECTION: ALL
  4. LCM DRIVER IC: EK79202D A (COG)
  5. Touch Mode: CTP  
 Touch Driver: FT5626Nem  
 Touch Interface: IIC
  6. VDD/VCC: 3.3V (TYP.); CTP VDD: 3.3V/VBUS: 5.5V
  7. OPERATING TEMP: -20°C TO 70°C  
 STORAGE TEMP: -30°C TO 85°C
  8. BACK LIGHT: LED WHITE, 42 LED, 280mA, 8.4-10.2V
  9. RoHS COMPLIANT.

### 3. Input terminal Pin Assignment

#### 3.1 TFT

40pin connector is used for the module electronics interface.

The recommended model is Molex\_505110-4096 manufactured by Molex.

NO.	SYMBOL	DISCRIPTION	I/O
1	NC	--	--
2	VDD	A power supply for analog circuit. VDD=3.3V;	P
3	VDD		
4	NC	--	--
5	NC	--	--
6	NC	--	--
7	GND	Ground	P
8	RXIN0-	-LVDS Differential Data Input	I
9	RXIN0+	+LVDS Differential Data Input	I
10	GND	Ground	P
11	RXIN1-	-LVDS Differential Data Input	I
12	RXIN1+	+LVDS Differential Data Input	I
13	GND	Ground	P
14	RXIN2-	-LVDS Differential Data Input	I
15	RXIN2+	+LVDS Differential Data Input	I
16	GND	Ground	P
17	RXCLK-	-LVDS Differential Clock Input	I
18	RXCLK+	+LVDS Differential Clock Input	I
19	GND	Ground	P
20	RXIN3-	-LVDS Differential Data Input	I
21	RXIN3+	+LVDS Differential Data Input	I
22	GND	Ground	P
23	NC	--	--
24	NC	--	--
25	GND	Ground	P
26	NC	--	--
27	NC	--	--
28	NC	--	--
29	NC	--	--
30	NC	--	--

31	LED-	LED Cathode	P
32	LED-	LED Cathode	P
33	NC	--	--
34	NC	--	--
35	NC	--	--
36	NC	--	--
37	NC	--	--
38	NC	--	--
39	LED+	LED Anode	P
40	LED+	LED Anode	P

**3.2 C-TP**

NO.	SYMBOL	DISCRIPTION	I/O
1	VDD/3.3V	Supply voltage. (I2C Interface select)	P
2	GND	Ground. (I2C Interface select)	P
3	SCL	I2C clock input. (I2C Interface select)	I
4	SDA	I2C data input and output(I2C Interface select)	I/O
5	INT	External interrupt to the host. (I2C Interface select)	I
6	RST	External Reset, Low is active. (I2C Interface select)	I



## 4. LCD Optical Characteristics

### 4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	$\Theta=0$	800	1000	--		CA-310
Response Time	Rising	$T_{R+T_F}$	Normal viewing angle	--	25	35	msec	*
	Falling							*
Uniformity		S(%)		42	45	--	%	*
Color Filter Chromaticity ((CIE 1931))	White	$W_X$	-0.04	-0.04	0.3185	+0.04		CA-310
		$W_Y$			0.3434			
	Red	$R_X$			0.5916			
		$R_Y$			0.3594			
	Green	$G_X$			0.3624			
		$G_Y$			0.5525			
	Blue	$B_X$			0.1484			
		$B_Y$			0.1084			
Viewing Angle	Hor.	$\Theta_L$	CR>10	70	80	--		*
		$\Theta_R$		70	80	--		
	Ver.	$\Theta_U$		70	80	--		
		$\Theta_D$		70	80	--		
Option View Direction		ALL						

\* The data comes from the LCD specification.

### Measuring Condition

Measuring surrounding: dark room

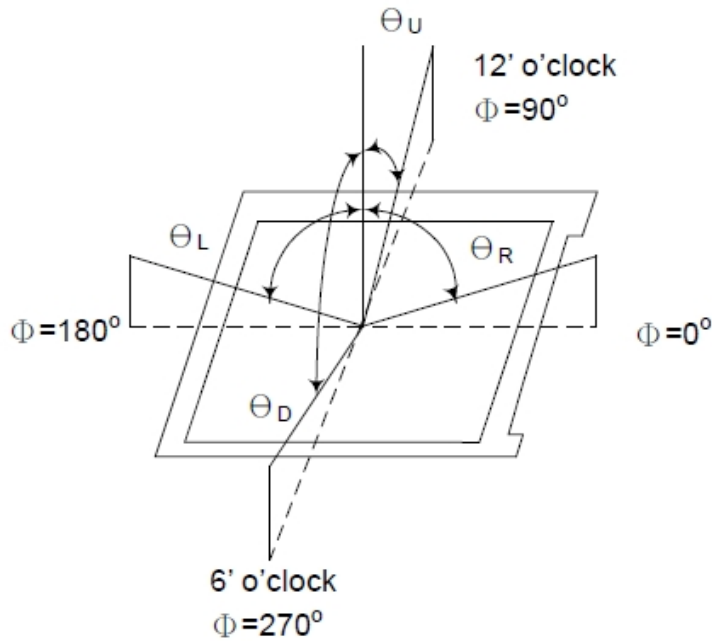
Ambient temperature: 25°C±2°C

15min. warm-up time.

### Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

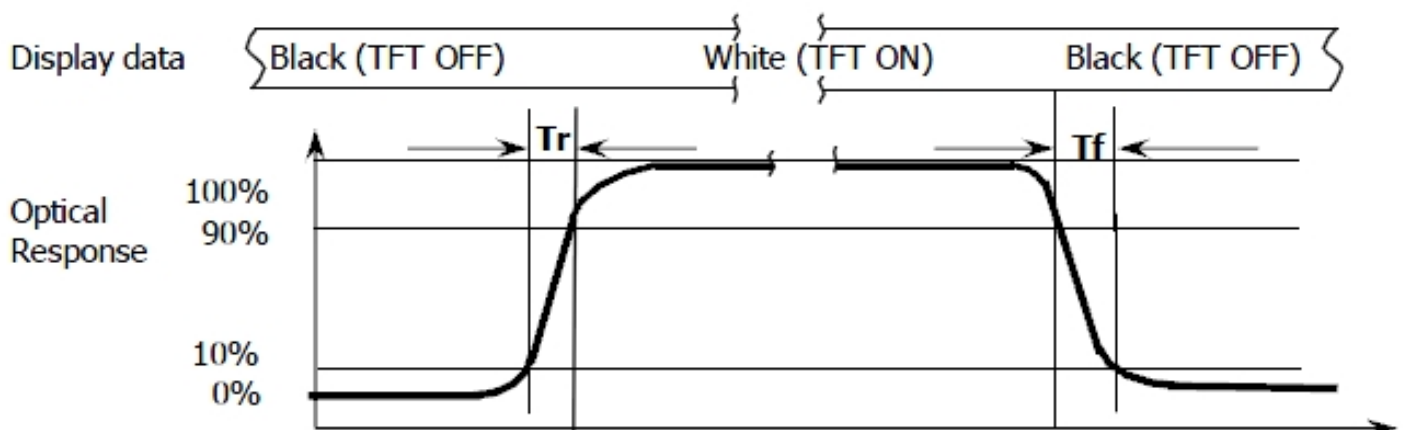
Note (1): Definition of Viewing Angle:



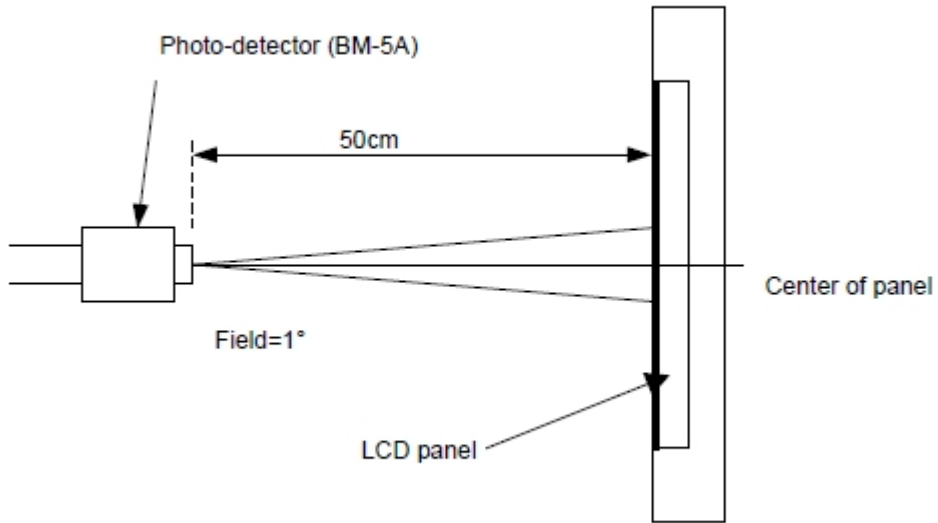
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3): Response Time



Note (4): Definition of optical measurement setup



## 5. Electrical Characteristics

### 5.1 Absolute Maximum Ratings

Characteristics	Symbol	Min.	Max.	Unit	Note
Digital Supply Voltage	V <sub>DD</sub>	-0.5	4	V	Note1
Operating Temperature	T <sub>OP</sub>	-30	+85	°C	-
Storage Temperature	T <sub>ST</sub>	-40	+85	°C	-

NOTE1: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

### 5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	V <sub>DD</sub>	-	3.3	-	V	-
Normal Mode Current	I <sub>DD</sub>	--	170	340	mA	-
Level Input Voltage	V <sub>IH</sub>	0.8*V <sub>DD</sub>	--	V <sub>DD</sub>	V	-
	V <sub>IL</sub>	GND	--	0.2*V <sub>DD</sub>	V	-

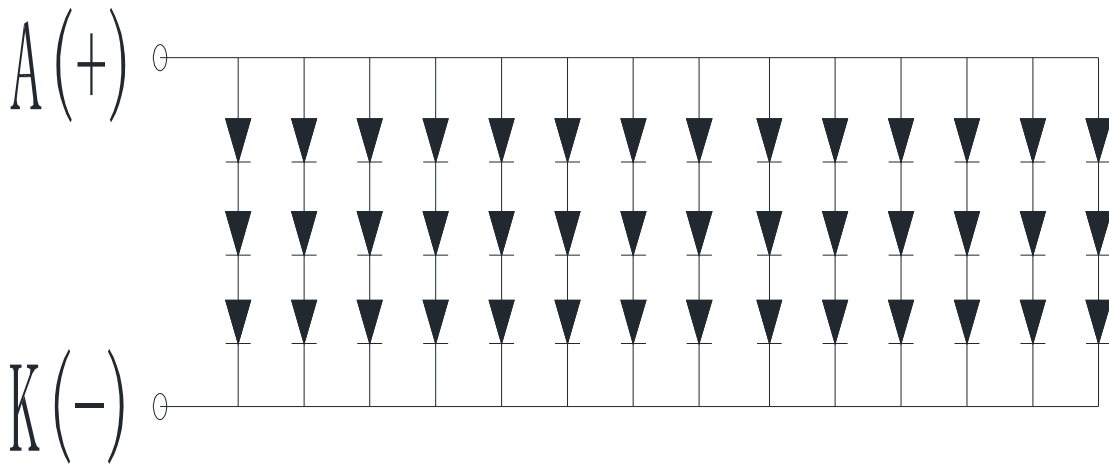
**5.3 LED Backlight Characteristics**

The backlight system is edge-lighting type with 42 chips LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	$I_F$	--	280	--	mA	-
Forward Voltage	$V_F$	--	9.6	--	V	-
LCM Luminance	LV	480	530	--	cd/m2	-
LED Lifetime	Hr	50000	--	--	Hour	Note 1,2
Uniformity	Avg	70	80	--	%	Note3

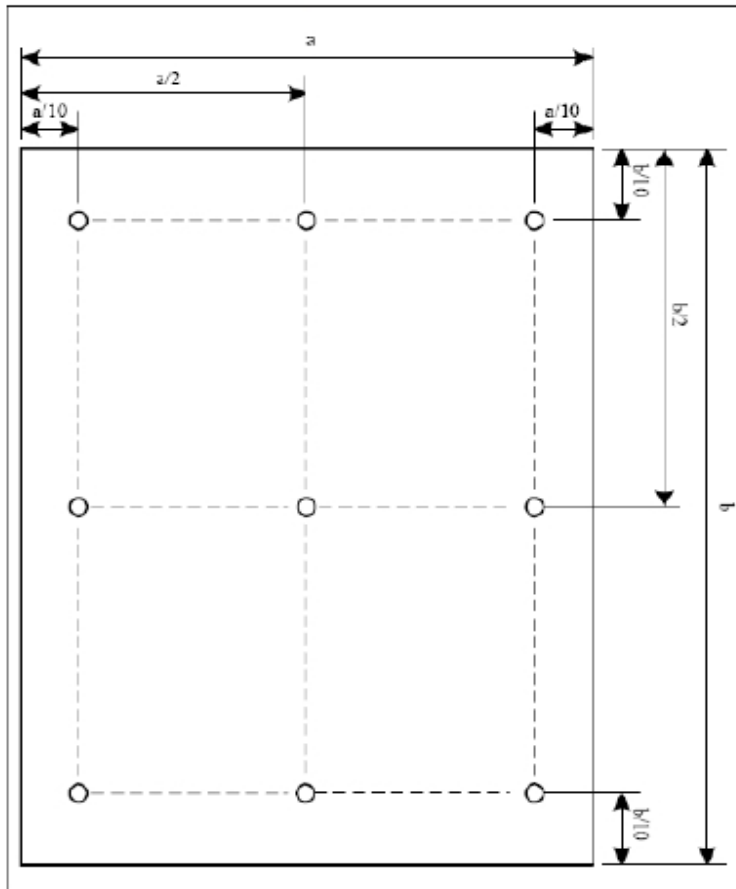
Note1: LED Lifetime (Hr) can be defined as the time in which it continues to operate under the condition:  $T_a=25^{\circ}C\pm 3^{\circ}C$ , typical IL value indicated in the above table until the brightness becomes less than 50%.

Note 2: The "LED Lifetime" is defined as the module brightness decrease to 50% original brightness at  $T_a=25^{\circ}C$  and  $I_L=280mA$ . The LED lifetime could be decreased if operating  $I_L$  is larger than 280mA. The constant current driving method is suggested.



B/L Circuit ( $I_f=280mA, V_f=8.4\sim 10.2V$ )

Note (3) Luminance Uniformity of these 9 points is defined as below:



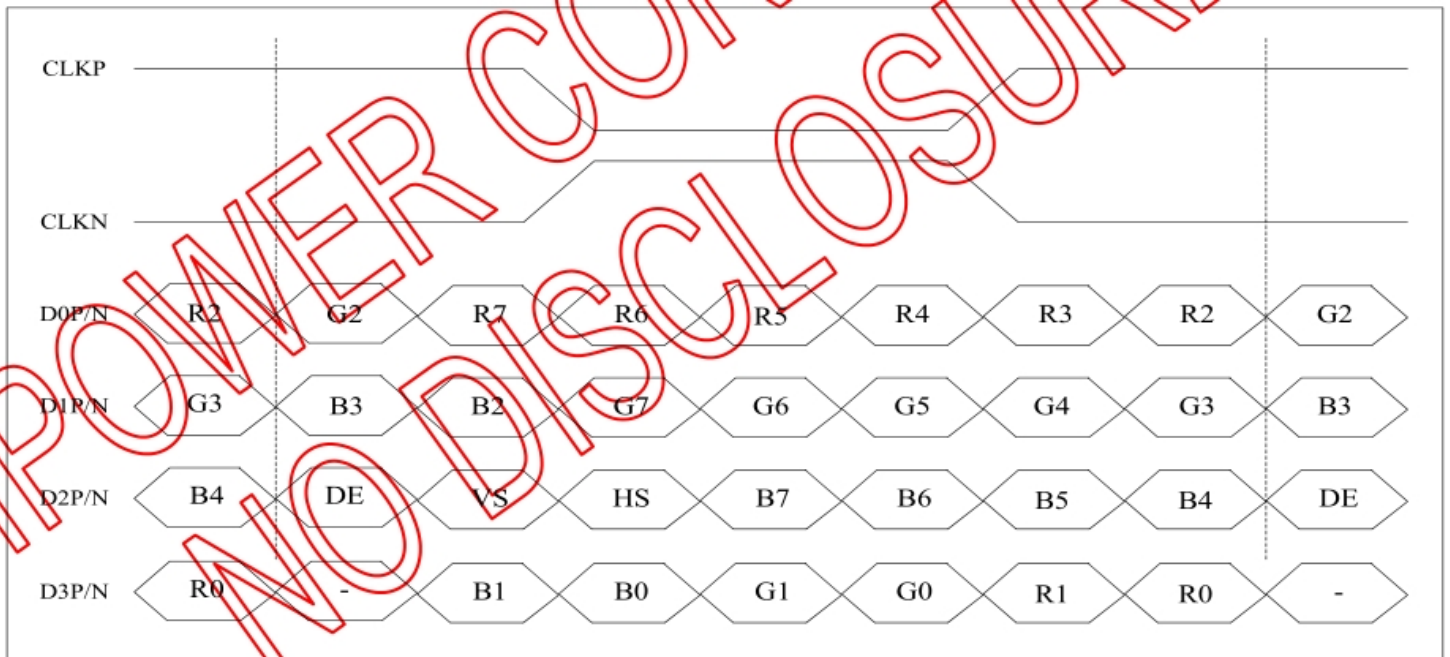
$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

6. Video Interface and Timing Table

6.1 LVDS interface

6.1.1 Data input format for LVDS



8-bit LVDS input (LVBIT=H, LVFMT=L)

**6.1.2 LVDS Input Timing Table**

**For 1280xRGBx800**

Parameter		Symbol	Value			Unit
			Min.	Typ.	Max.	
DCLK frequency @Frame rate=60Hz (LVDS)		F <sub>DCLK</sub>	66.3	72.4	78.9	MHz
HSYNC period time		T <sub>H</sub>	1380	1440	1500	DCLK
Horizontal display area		T <sub>HD</sub>	1280			DCLK
HSYNC pulse width	Min.	T <sub>HPW</sub>	2			
	Typ.		-			
	Max.		40			
HSYNC back porch(with pulse width)		T <sub>HBP</sub>	88	88	88	DCLK
HSYNC front porch		T <sub>HFP</sub>	12	72	132	DCLK
VSYNC period time		T <sub>V</sub>	824	838	872	H
Vertical display area		T <sub>VD</sub>	800			H
VSYNC pulse width	Min.	T <sub>VPW</sub>	2			H
	Typ.		-			
	Max.		20			
VSYNC back porch(with pulse width)		T <sub>VBP</sub>	23	23	23	H
VSYNC front porch		T <sub>VFP</sub>	1	15	49	H



## 7. C-TP Specification

### 7.1 Electrical Characteristics

#### 7.1.1 Absolute Maximum Rating

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	-0.3	3.6	V	1,2
Operating Temperature	T <sub>OP</sub>	-30	+85	°C	1
Storage Temperature	T <sub>ST</sub>	-40	+85	°C	1

#### NOTES:

1. If used beyond the absolute maximum ratings, FT5X26 may be permanently damaged. It is strongly recommended that the device be used within the electrical characteristics in normal operations. If exposed to the condition not within the electrical characteristics, it may affect the reliability of the device.
2. Make sure VDDA(high)≥VSSA (low)
3. Make sure VDD (high)≥VSS (low).

#### 7.1.2 DC Electrical Characteristics

**Table 3-2 DC Characteristics**

Item	Symbol	Unit	Test Condition	Min.	Typ.	Max.	Note
Input high-level voltage	V <sub>IH</sub>	V		0.7 x IOVCC	--	IOVCC	
Input low-level voltage	V <sub>IL</sub>	V		-0.3	--	0.3 x IOVCC	
Output high-level voltage	V <sub>OH</sub>	V	I <sub>OH</sub> =-0.1mA	0.7 x IOVCC	--	--	
Output low-level voltage	V <sub>OL</sub>	V	I <sub>OH</sub> =0.1mA	--	--	0.3 x IOVCC	
I/O leakage current	I <sub>LI</sub>	uA	V <sub>in</sub> =0~VDD3	-1	--	1	
Current consumption (Normal operation mode)	I <sub>opr</sub>	mA	VDD3 = 3V T <sub>a</sub> =25°C MCLK=24MHz	--	15.6	--	
Current consumption (Monitor mode)	I <sub>mon</sub>	mA	VDD3 = 3V T <sub>a</sub> =25°C MCLK=24MHz	--	0.54	--	
Current consumption (Sleep mode)	I <sub>slp</sub>	uA	VDD3 = 3V T <sub>a</sub> =25°C MCLK=24MHz	--	37	--	
Step-up output voltage	VDD5	V	VDD3= 2.8V		0.25		
Power Supply voltage	VDD3	V		2.7	--	3.6	

Notes: This sample data is intended for design guidance only. Values shown are typical for a 40Tx × 27Rx sensor configured at 80 Hz report rate. Actual current will depend on the particular sensor design and firmware options.

**7.1.3 AC Characteristics**

**AC Characteristics of Oscillators**

Item	Symbol	Unit	Test Condition	Min.	Typ.	Max.	Note
OSC clock 1	fosc1	MHz	VDD3 = 2.8V; Ta=25°C	49	50	51	

**Table 3-3 AC Characteristics of TX & RX**

Item	Symbol	Test Condition	Min	Typ	Max	Unit	Note
TX acceptable clock	ftx		50	150	400	KHz	
TX output rise time	Ttxr		--	210	--	nS	
TX output fall time	Ttxf		--	210	--	nS	
RX input voltage	Trxi		1.2	--	1.6	V	

7.1.4 I/O Ports Circuits

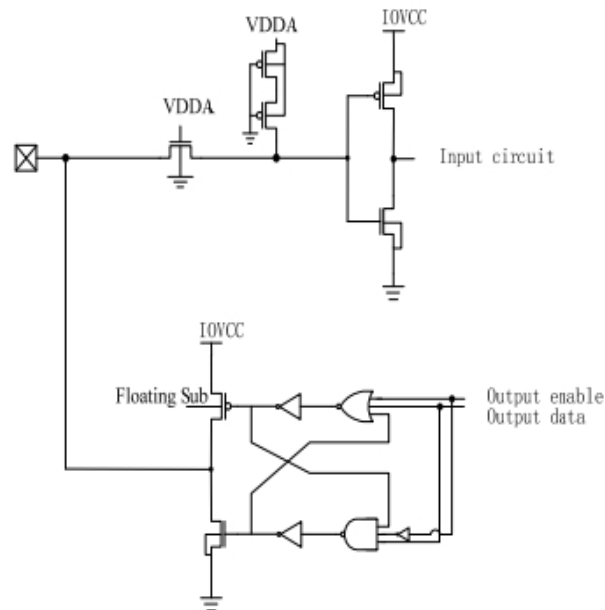


Figure 3-1 General Purpose In/Out Port Circuit.

The input/output property can be configured via firmware setting. The firmware can also control its output behavior as push-pull or as open-drain that SDA of I2C interface is required.

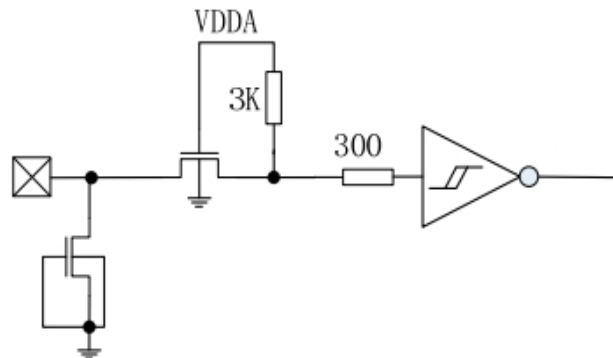


Figure 3-2 Reset Input Port Circuits

7.1.5 POWER ON/Reset Sequence

Reset should be pulled down to be low before powering on and powering down. I2C/SPI shouldn't be used by other devices during Reset time after IOVCC powering on ( $T_{prt}$ ). INT signal will be sent to the host after initializing all parameters and then start to report points to the host. If Power is down, the voltage of supply must be below 0.3V and  $T_{pdt}$  is more than 5ms.

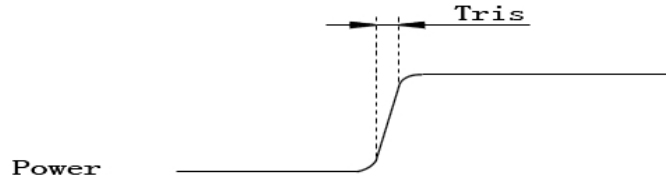


Figure 3-7 Power on time

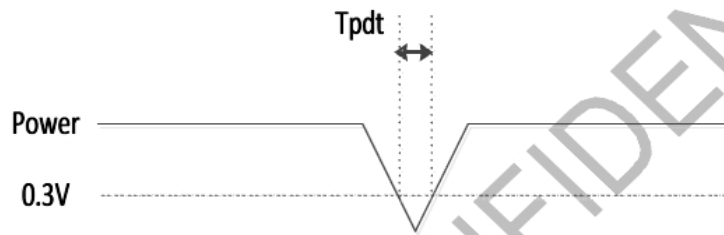


Figure 3-8 Power Cycle requirement

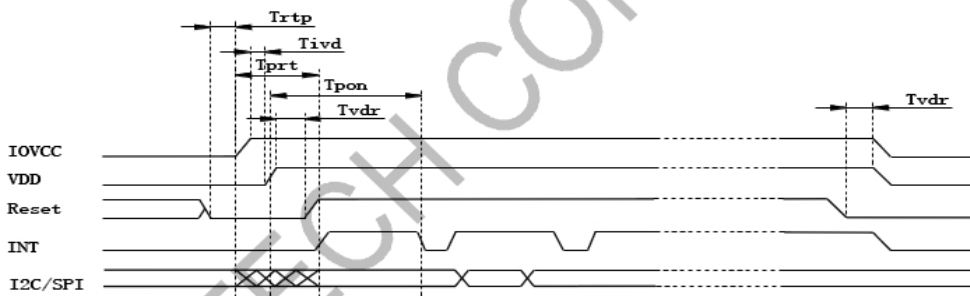


Figure 3-9 Power on / down Sequence

Reset time must be enough to guarantee reliable reset. The time of starting to report point after resetting approach to the time of starting to report point after powering on.

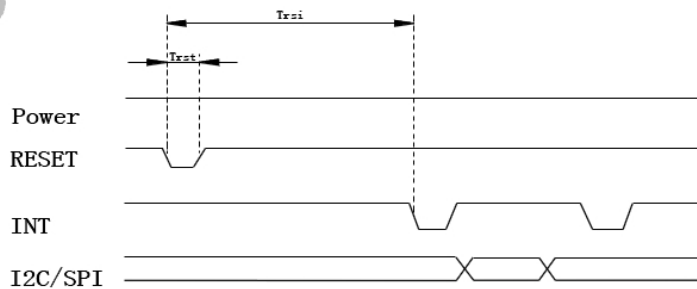
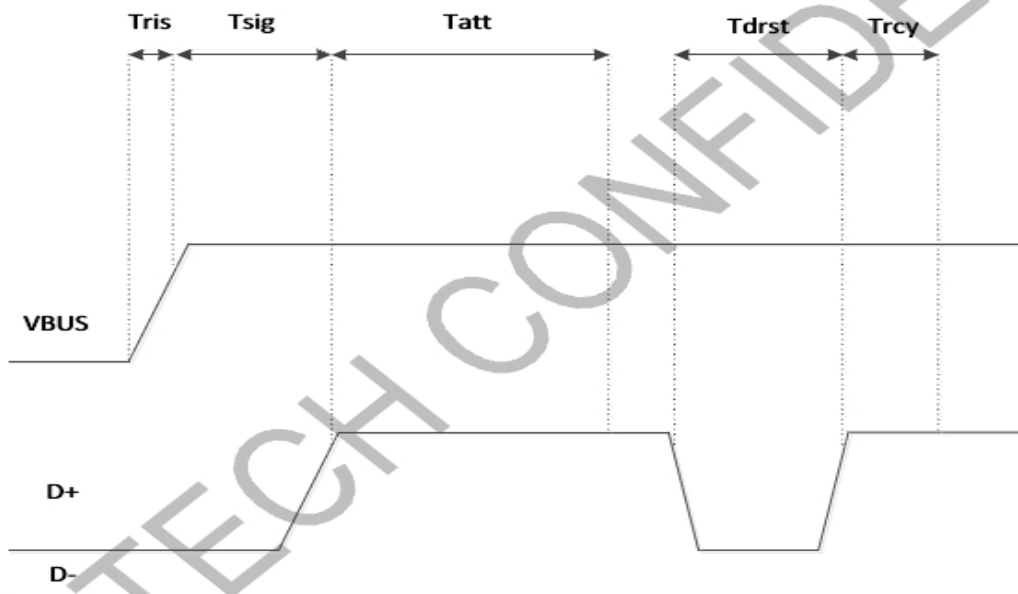


Figure 3-10 Reset Sequence

**Table 3-6 Power on/Reset Sequence Parameters**

Parameter	Description	Min	Max	Units
Tris	Rise time from 0.1VDD to 0.9VDD	--	5	ms
Tpdt	Time of the voltage of supply being below 0.3V	5	--	ms
Trtp	Time of resetting to be low before powering on	100	--	$\mu$ s
Tivd	Delay time of VDD powering on after IOVCC powering on	10	--	$\mu$ s
Tprt	Reset time after IOVCC powering on	$2Tris+Tivd+Tvdr$	--	ms
Tpon	Time of starting to report point after powering on	400	--	ms
Tvdr	Reset time after VDD powering on	1	--	ms
Trsi	Time of starting to report point after resetting	400	--	ms
Trst	Reset time	1	--	ms



**Figure 3-11 Power on / down Sequence**

**Table 3-7 USB Power on/Reset Sequence Parameters**

Parameter	Description	Min	Max	Units
Tris	Rise time from 0.1VDD to 0.9VDD	--	5	ms
Tsig	Time required for the device internal power rail to stabilize and for D+ or D- to reach VIH (min)	100	--	ms
Tatt	Time ensures that the electrical and mechanical connection is stable before software attempts to reset the attached device	100	--	ms
Tdrst	Time hubs drive reset to a device	10	--	ms
Trcy	The USB System Software guarantees a minimum of 10 ms for reset recovery	10	--	ms

## 7.2 Serial Interface

FT5X26 supports the I2C OR USB interfaces, which can be used by a host processor or other devices.

### 7.2.1 I2C

The I2C is always configured in the Slave mode. The data transfer format is shown in Figure 2-4.

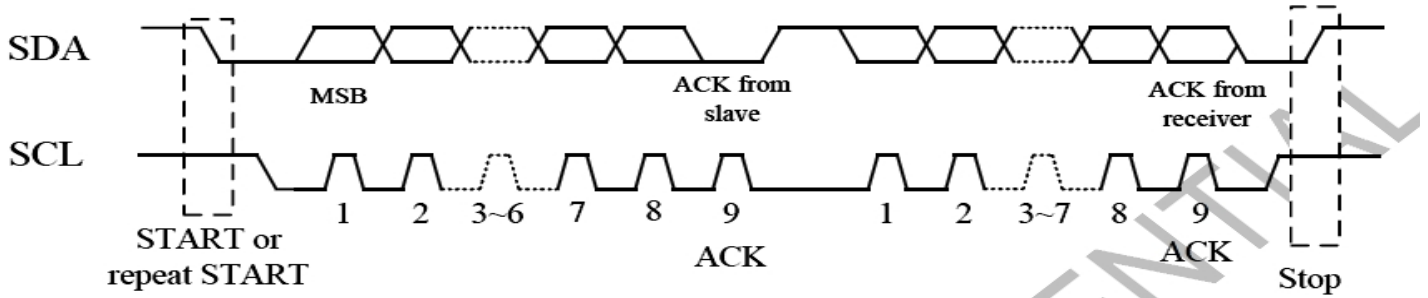


Figure 2-4 I2C Serial Data Transfer Format

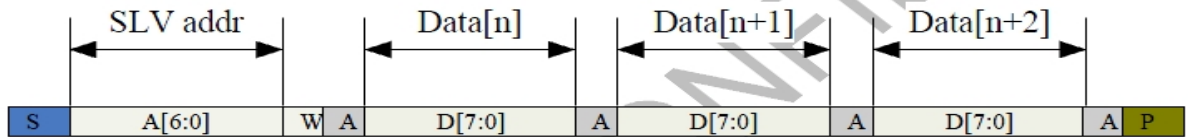


Figure 2-5 I2C master write, slave read

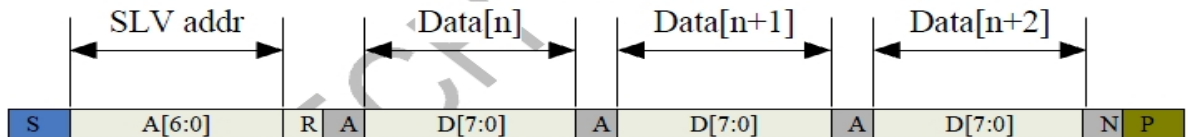


Figure 2-6 I2C master read, slave write

Table 2-1 lists the meanings of the symbols used in the above figures.

**Table 2-1 Mnemonics Description**

Mnemonics	Description
S	I2C Start or I2C Restart
A[6:0]	Slave address
R/W	READ/WRITE bit, '1' for read, '0' for write
A(N)	ACK(NACK) bit
P	STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet)

I2C Interface Timing Characteristics is shown in Table 2-2.

**Table 2-2 I2C Timing Characteristics**

Parameter	Min	Max	Unit
SCL frequency	10	400	KHz
Bus free time between a STOP and START condition	4.7	\	us
Hold time (repeated) START condition	4.0	\	us
Data setup time	250	\	ns
Setup time for a repeated START condition	4.7	\	us
Setup Time for STOP condition	4.0	\	us

### 8. LCD Module Out-Going Quality Level

#### 8.1 VISUAL & FUNCTION INSPECTION STANDARD

##### 8.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

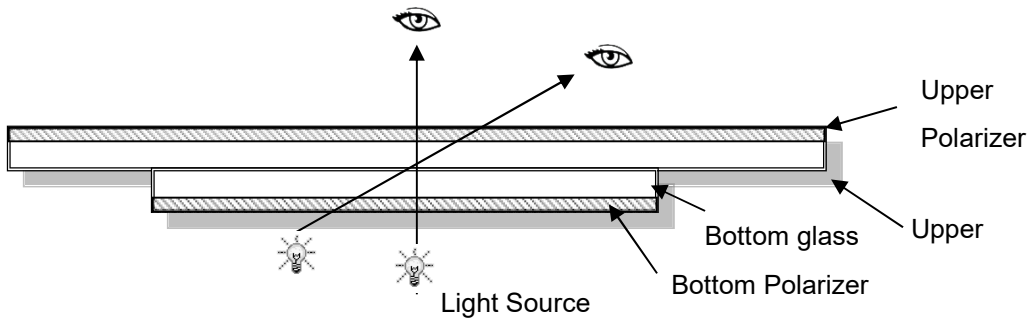
Temperature: 25°C±5°C

Humidity: 65%±10%RH

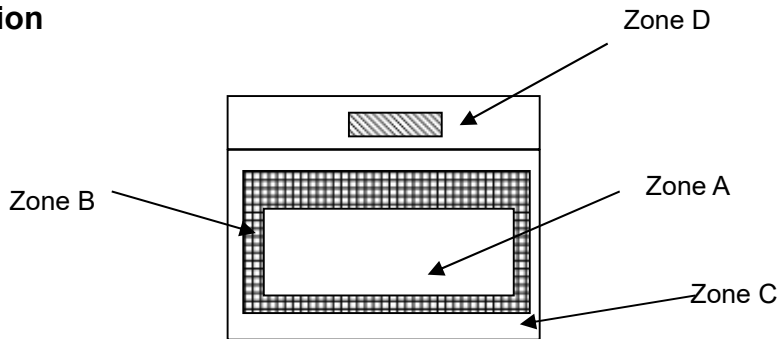
Viewing Angle: Normal Viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance: 30-50cm



##### 8.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C Cover (Zone A+Zone B) which can not be seen after assembly by customer)

Zone D : IC Bonding Area

Note:

As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer



**8.1.3 Sampling Plan**

According to GB/T 2828-2012; ,Normal Inspection, Class II

AQL:

Major defect	Minor defect
0.65	1.5

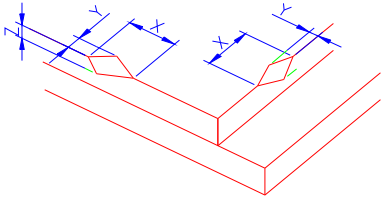
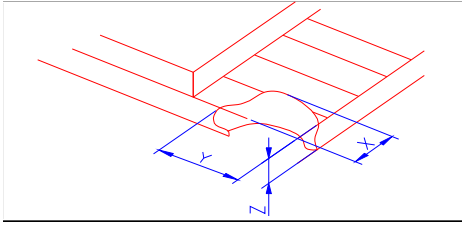
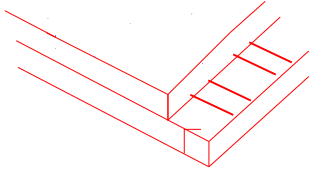
LCD: Liquid Crystal Display, LCM: Liquid Crystal Module, CTP: Capacitive Touch Panel

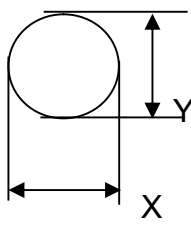
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc	Major
2	Missing	Missing components and etc	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed,deformation and etc	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot/Line defect	Light dot,Dim spot,(Note1) Polarizer Air Bubble, Polarizer accidented spot and etc	
6	Soldering appearance	Good soldering , Peeling off is not allowed and etc	
7	LCD/Polarizer/CTP	Black/White spot/line, scratch, crack, etc.	



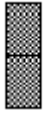
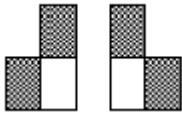
Note1:


- a) Light dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
- b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

**8.1.4 Criteria (Visual)**

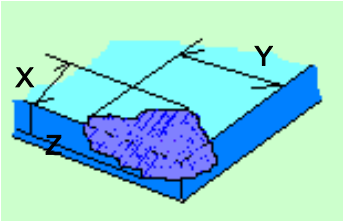
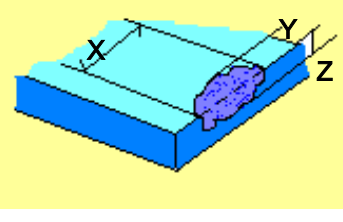
Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of ITO, T: Height of LCD	(1) The edge of LCD broken	 <table border="1" data-bbox="751 618 1452 768"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td>&lt;Inner border line of the seal</td> <td>≤T</td> </tr> </tbody> </table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
X	Y	Z						
≤3.0mm	<Inner border line of the seal	≤T						
	(2)LCD corner broken	 <table border="1" data-bbox="831 1075 1370 1176"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td>≤L</td> <td>≤T</td> </tr> </tbody> </table>	X	Y	Z	≤3.0mm	≤L	≤T
X	Y	Z						
≤3.0mm	≤L	≤T						
	(3) LCD crack	 <p style="text-align: center;">Crack Not allowed</p>						

2.0	Spot defect	<p>① light dot ( black/white spot , pinhole, stain, etc. )</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><math>\Phi \leq 0.15</math></td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;"><math>0.15 &lt; \Phi \leq 0.25</math></td> <td colspan="3" style="text-align: center;">3(distance <math>\geq 10</math>mm)</td> </tr> <tr> <td style="text-align: center;"><math>0.25 &lt; \Phi \leq 0.4</math></td> <td colspan="3" style="text-align: center;">2(distance <math>\geq 10</math>mm)</td> </tr> <tr> <td style="text-align: center;"><math>\Phi &gt; 0.4</math></td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table> <p>② Dim spot ( light leakage, dent, dark spot, etc )</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><math>\Phi \leq 0.15</math></td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;"><math>0.15 &lt; \Phi \leq 0.25</math></td> <td colspan="3" style="text-align: center;">3( distance <math>\geq 10</math>mm)</td> </tr> <tr> <td style="text-align: center;"><math>0.25 &lt; \Phi \leq 0.4</math></td> <td colspan="3" style="text-align: center;">2( distance <math>\geq 10</math>mm)</td> </tr> <tr> <td style="text-align: center;"><math>\Phi &gt; 0.4</math></td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table> <p>③ Polarizer accidented spot</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><math>\Phi \leq 0.2</math></td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;"><math>0.2 &lt; \Phi \leq 0.5</math></td> <td colspan="3" style="text-align: center;">2( distance <math>\geq 10</math>mm)</td> </tr> <tr> <td style="text-align: center;"><math>\Phi &gt; 0.5</math></td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table> <p>④ Polarizer Bubble</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><math>\Phi \leq 0.2</math></td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;"><math>0.2 &lt; \Phi \leq 0.4</math></td> <td colspan="3" style="text-align: center;">2(distance <math>\geq 10</math>mm)</td> </tr> <tr> <td style="text-align: center;"><math>\Phi &gt; 0.4</math></td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.15$	Ignore			$0.15 < \Phi \leq 0.25$	3(distance $\geq 10$ mm)			$0.25 < \Phi \leq 0.4$	2(distance $\geq 10$ mm)			$\Phi > 0.4$	0			Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.15$	Ignore			$0.15 < \Phi \leq 0.25$	3( distance $\geq 10$ mm)			$0.25 < \Phi \leq 0.4$	2( distance $\geq 10$ mm)			$\Phi > 0.4$	0			Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore			$0.2 < \Phi \leq 0.5$	2( distance $\geq 10$ mm)			$\Phi > 0.5$	0			Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore			$0.2 < \Phi \leq 0.4$	2(distance $\geq 10$ mm)			$\Phi > 0.4$	0		
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3.0	LCD Pixel defect	<p>Pixel bad points</p> <table border="1"> <thead> <tr> <th data-bbox="523 293 715 344">Item</th> <th data-bbox="715 293 1230 344">Zone A</th> <th data-bbox="1230 293 1481 344">Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td data-bbox="523 344 715 506" rowspan="3">Bright dot</td> <td data-bbox="715 344 1230 400">Random</td> <td data-bbox="1230 344 1481 400">N≤2</td> </tr> <tr> <td data-bbox="715 400 1230 456">2 dots adjacent</td> <td data-bbox="1230 400 1481 456">N≤0</td> </tr> <tr> <td data-bbox="715 456 1230 506">3 dots adjacent</td> <td data-bbox="1230 456 1481 506">N≤0</td> </tr> <tr> <td data-bbox="523 506 715 674" rowspan="3">Dark dot</td> <td data-bbox="715 506 1230 562">Random</td> <td data-bbox="1230 506 1481 562">N≤3</td> </tr> <tr> <td data-bbox="715 562 1230 618">2 dots adjacent</td> <td data-bbox="1230 562 1481 618">N≤0</td> </tr> <tr> <td data-bbox="715 618 1230 674">3 dots adjacent</td> <td data-bbox="1230 618 1481 674">N≤0</td> </tr> <tr> <td data-bbox="523 674 715 983">Distance</td> <td data-bbox="715 674 1230 983">                     1. Minimum Distance Between Bright dots.                      2. Minimum Distance Between dark dots                      3. Minimum Distance Between dark and bright dot.                 </td> <td data-bbox="1230 674 1481 983">5mm</td> </tr> <tr> <td colspan="2" data-bbox="523 983 1230 1039">Total bright and dark dot</td> <td data-bbox="1230 983 1481 1039">N≤4</td> </tr> </tbody> </table> <p>Note:</p> <p>A) Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.</p> <p>B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.</p> <p>C) 2 dot adjacent = 1 pair = 2 dots</p> <p>Picture:</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>2 dot adjacent</p> </div> <div style="text-align: center;">  <p>2 dot adjacent</p> </div> <div style="text-align: center;">  <p>2 dot adjacent (vertical)</p> </div> <div style="text-align: center;">  <p>2 dot adjacent (slant)</p> </div> </div>	Item	Zone A	Acceptable Qty	Bright dot	Random	N≤2	2 dots adjacent	N≤0	3 dots adjacent	N≤0	Dark dot	Random	N≤3	2 dots adjacent	N≤0	3 dots adjacent	N≤0	Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm	Total bright and dark dot		N≤4
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Total bright and dark dot		N≤4																							

4.0	Line defect (LCD /Polarizer backlight black/white line, scratch, stain)  W: width, L : length  N : Count	<table border="1"> <thead> <tr> <th rowspan="2">Width(mm)</th> <th rowspan="2">Length(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.05</math></td> <td>Ignore</td> <td colspan="3">Ignore</td> </tr> <tr> <td><math>0.05 &lt; W \leq 0.06</math></td> <td><math>L \leq 5.0</math></td> <td colspan="3">N<math>\leq</math>3</td> </tr> <tr> <td><math>0.06 &lt; W \leq 0.08</math></td> <td><math>L \leq 4.0</math></td> <td colspan="3">N<math>\leq</math>2</td> </tr> <tr> <td><math>W &gt; 0.08</math></td> <td colspan="4">Define as spot defect</td> </tr> </tbody> </table>	Width(mm)	Length(mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.05$	Ignore	Ignore			$0.05 < W \leq 0.06$	$L \leq 5.0$	N $\leq$ 3			$0.06 < W \leq 0.08$	$L \leq 4.0$	N $\leq$ 2			$W > 0.08$	Define as spot defect			
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$0.06 < W \leq 0.08$	$L \leq 4.0$	N $\leq$ 2																												
$W > 0.08$	Define as spot defect																													
5.0	Electronic Components SMT.	Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite																												
6.0	Display color& Brightness.	1. Color: Measuring the color coordinates, The measurement standard according to the datasheet or samples. 2. Brightness: Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.																												
7.0	LCD Mura/Waving/ Hot spot	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.																												

8.0	CTP Related	CTP Cover sensor accidented black/white spot	<table border="1"> <thead> <tr> <th rowspan="2">Size <math>\Phi</math>(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.15</math></td> <td colspan="3">Ignore</td> </tr> <tr> <td><math>0.15 &lt; \Phi \leq 0.25</math></td> <td colspan="3">1 ( distance <math>\geq 10mm</math> )</td> </tr> <tr> <td><math>0.25 &lt; \Phi \leq 0.35</math></td> <td colspan="3">2 ( distance <math>\geq 10mm</math> )</td> </tr> <tr> <td><math>\Phi &gt; 0.35</math></td> <td colspan="3">0</td> </tr> </tbody> </table>	Size $\Phi$ (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.15$	Ignore			$0.15 < \Phi \leq 0.25$	1 ( distance $\geq 10mm$ )			$0.25 < \Phi \leq 0.35$	2 ( distance $\geq 10mm$ )			$\Phi > 0.35$	0							
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		CTP Cover scratch	<table border="1"> <thead> <tr> <th rowspan="2">Width(mm)</th> <th rowspan="2">Ignore(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.05</math></td> <td>Ignore</td> <td colspan="3">Ignore</td> </tr> <tr> <td><math>0.05 &lt; W \leq 0.06</math></td> <td><math>L \leq 4.0</math></td> <td colspan="3">N<math>\leq</math>3</td> </tr> <tr> <td><math>0.06 &lt; W \leq 0.08</math></td> <td><math>L \leq 3.0</math></td> <td colspan="3">N<math>\leq</math>2</td> </tr> <tr> <td><math>0.08 &lt; W</math></td> <td colspan="4">Define as spot defect</td> </tr> </tbody> </table>	Width(mm)	Ignore(mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.05$	Ignore	Ignore			$0.05 < W \leq 0.06$	$L \leq 4.0$	N $\leq$ 3			$0.06 < W \leq 0.08$	$L \leq 3.0$	N $\leq$ 2			$0.08 < W$	Define as spot defect			
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		CTP Cover Pinhole/ Lack of ink	<table border="1"> <thead> <tr> <th>Zone Size (mm)</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.2</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.2 &lt; \Phi \leq 0.3</math></td> <td>4 (distance <math>\geq 10</math>mm)</td> </tr> <tr> <td><math>0.3 &lt; \Phi \leq 0.4</math></td> <td>2 (distance <math>\geq 10</math>mm)</td> </tr> <tr> <td><math>\Phi &gt; 0.4</math></td> <td>0</td> </tr> </tbody> </table>	Zone Size (mm)	Acceptable Qty	$\Phi \leq 0.2$	Ignore	$0.2 < \Phi \leq 0.3$	4 (distance $\geq 10$ mm)	$0.3 < \Phi \leq 0.4$	2 (distance $\geq 10$ mm)	$\Phi > 0.4$	0							
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		CTP Bonding bubble/ accidented spot	<table border="1"> <thead> <tr> <th rowspan="2">Size <math>\Phi</math>(mm)</th> <th colspan="2">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.1</math></td> <td colspan="2">Ignore</td> </tr> <tr> <td><math>0.1 &lt; \Phi \leq 0.2</math></td> <td colspan="2">2 (distance <math>\geq 10</math>mm)</td> </tr> <tr> <td><math>0.2 &lt; \Phi \leq 0.3</math></td> <td colspan="2">2 (distance <math>\geq 10</math>mm)</td> </tr> <tr> <td><math>\Phi &gt; 0.3</math></td> <td colspan="2">0</td> </tr> </tbody> </table>	Size $\Phi$ (mm)	Acceptable Qty		A	B	$\Phi \leq 0.1$	Ignore		$0.1 < \Phi \leq 0.2$	2 (distance $\geq 10$ mm)		$0.2 < \Phi \leq 0.3$	2 (distance $\geq 10$ mm)		$\Phi > 0.3$	0	
Size $\Phi$ (mm)	Acceptable Qty																			
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$\Phi > 0.3$	0																			
		Assembly deflection	beyond the edge of backlight $\leq 0.2$ mm																	
		CTP cover broken  X : length  Y : width  Z : height	<table border="1"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td><math>X \leq 0.5</math>mm</td> <td><math>Y \leq 0.5</math>mm</td> <td><math>Z &lt; \text{cover thickness } s</math></td> </tr> </tbody> </table> <p>Circuitry broken is not allowed.</p> 	X	Y	Z	$X \leq 0.5$ mm	$Y \leq 0.5$ mm	$Z < \text{cover thickness } s$											
X	Y	Z																		
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X	Y	Z																		
$X \leq 0.3$ mm	$Y \leq 0.3$ mm	$Z < \text{cover thickness}$																		

Criteria ( functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	CTP no function	Not allowed

**9. Reliability Test Result**

Remark:

Item	Condition	Inspection after test
High Temperature Operating	85°C,96H	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1. Air bubble in the LCD; 2. Non-display; 3. Missing segments/line; 4. Glass crack; 5. Current IDD is twice higher than initial value.
Low Temperature Operating	-30°C, 96HR	
High Temperature Storage	85°C, 96HR	
Low Temperature Storage	-40°C, 96HR	
High Temperature & High	+60°C, 90% RH ,96 hours.	
Thermal Shock (Non-operation)	-30°C,30 min ↔ +85°C,30 min, Change time: 5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±6kV, 5times; Contact:±4kV, 5 times; (Environment: 15°C~35°C, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80cm(MEDIUM BOX)	

1. The test samples should be applied to only one test item.
2. Sample size for each test item is 5~10pcs.
3. For Damp Proof Test, Pure water (Resistance > 10MΩ) should be used.
4. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
5. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.



## **10. Cautions and Handling Precautions**

### **10.1 Handling and Operating the Module**

- (1) When the module is assembled, it should be attached to the system firmly.  
Do not warp or twist the module during assembly work.
- (2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
- (3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
- (4) Do not allow drops of water or chemicals to remain on the display surface.  
If you have the droplets for a long time, staining and discoloration may occur.
- (5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.  
Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static; it may cause damage to the CMOS ICs.
- (9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (10) Do not disassemble the module.
- (11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (12) Pins of I/F connector shall not be touched directly with bare hands.
- (13) Do not connect, disconnect the module in the "Power ON" condition.
- (14) Power supply should always be turned on/off by the item 6.1 Power On Sequence & 6.2 Power Off Sequence

### **10.2 Storage and Transportation.**

- (1) Do not leave the panel in high temperature, and high humidity for a long time.  
It is highly recommended to store the module with temperature from 0°C to 35°C and relative humidity of less than 70%
- (2) Do not store the TFT-LCD module in direct sunlight.
- (3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
- (4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.  
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
- (5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.