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TFT Module Specification

MODEL: 13-101XIEBCAC0-S

< ◇ > PRELIMINARY SPECIFICATION
< ◆ > APPROVAL SPECIFICATION

CUSTOMER
APPROVED BY
DATE:

DESIGNED	CHECKED	APPROVED
RD 2020.04.23 趙長慶	PM 2020.04.23 呂家祥	批准 2020.04.23 PM

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RECORD OF REVISION

Version	Revised Date	Page	Content
V1.0	2019/09/04	--	First Issued
V1.1	2020/04/23	5	Update LCM drawing→ Add PCT CN2,CN3 location

TABLE OF CONTENTS

1. GENERAL DESCRIPTION

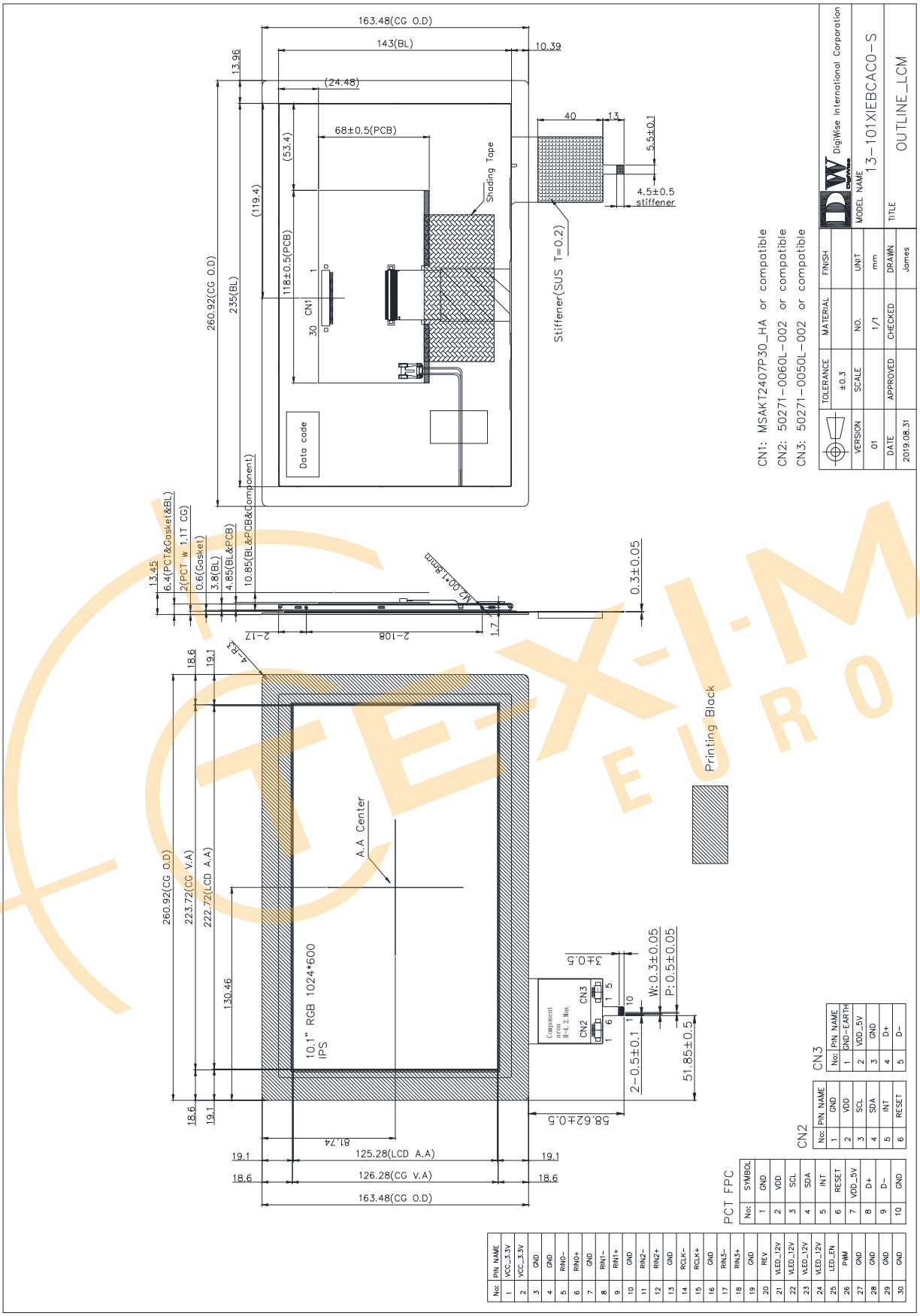
1.1 Description

The specification is model 13-101XIEBCAC0-S is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit, a backlight system, a projected capacitive touch panel. This TFT LCD has a 10.1 (16:9) inch diagonally measured active display area with WSGA (1024 horizontal by 600 vertical pixels) resolution.

1.2 Features:

No.	Item	Specification	Unit
1	Panel Size	10.1”	Inch
2	Number of Pixels	1024 (W) x RGB x 600 (H)	Pixels
3	Active Area	222.72 (W) × 125.28 (H)	mm
4	Pixel Pitch	0.2175 (W) x 0.2088 (H)	mm
5	Outline Dimension	260.92 (W) × 163.48 (H) × 13.85 (T)	mm
6	Number of Colors	16.7M	- -
7	Display Mode	IPS / Normally Black / Transmissive	- -
8	Viewing Direction	Free direction	- -
9	Display Format	RGB vertical stripe	- -
10	Surface Treatment	Clear (7H)	- -
11	Contrast Ratio	600 (Typ.)	- -
12	Luminance (cd/m^2)	850 (Typ.)	cd/m2
13	Interface	LVDS 8 bit Interface	- -
14	Backlight	White LED	- -
15	Operation Temperature	-20 ~ 70	°C
16	Storage Temperature	-30 ~ 80	°C
17	Weight	TBD	g

2. MECHANICAL SPECIFICATION



3. PIN DESCRIPTION

3.1 TFT LCD Module (Connector Part No: MSAKT2407P30_HA or equivalent)

Pin No.	Symbol	I/O	Function	Note
1	VCC	P	Power Supply Logic voltage +3.3V	
2	VCC	P	Power Supply Logic voltage +3.3V	
3	GND	P	Ground	
4	GND	P	Ground	
5	RIN0-	I	Negative LVDS differential data input	
6	RIN0+	I	Positive LVDS differential data input	
7	GND	P	Ground	
8	RIN1-	I	Negative LVDS differential data input	
9	RIN1+	I	Positive LVDS differential data input	
10	GND	P	Ground	
11	RIN2-	I	Negative LVDS differential data input	
12	RIN2+	I	Positive LVDS differential data input	
13	GND	P	Ground	
14	RCLK-	I	Negative LVDS differential clock input	
15	RCLK+	I	Positive LVDS differential clock input	
16	GND	P	Ground	
17	RIN3-	I	Negative LVDS differential data input	
18	RIN3+	I	Positive LVDS differential data input	
19	GND	P	Ground	
20	REV	I	Select horizontal and vertical scanning direction (Normal: Low, Reverse: High)	
21	VLED_12V	P	Power Supply LED voltage +12V	
22	VLED_12V	P	Power Supply LED voltage +12V	
23	VLED_12V	P	Power Supply LED voltage +12V	
24	VLED_12V	P	Power Supply LED voltage +12V	
25	LED_EN	I	Back-light On/Off control	
26	PWM	I	Back-light Dimming control	
27	GND	P	Ground	
28	GND	P	Ground	
29	GND	P	Ground	
30	GND	P	Ground	

4. ABSOLUTE MAXIMUM RATINGS

4.1 Electrical Absolute Rating

4.1.1 TFT LCD Module

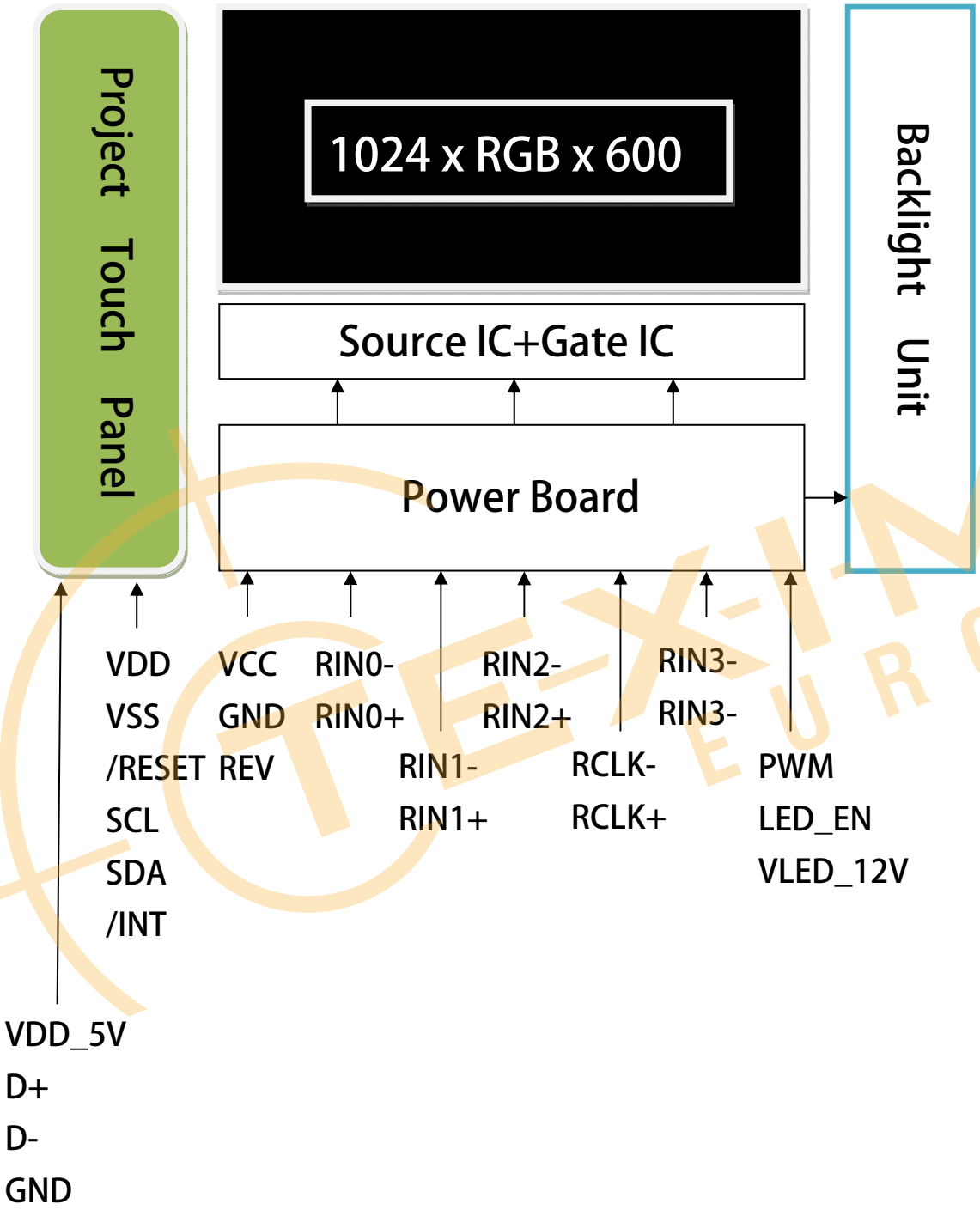
Item	Symbol	Values		Unit	Note
		Min	Max.		
Power supply voltage	VCC	-0.3	3.9	V	
	VLED_12V	11	13	V	

4.1.2 Environment Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max.		
Operating Temperature	Topa	-20		70	°C	Ambient temperature
Storage Temperature	Tstg	-30		80	°C	

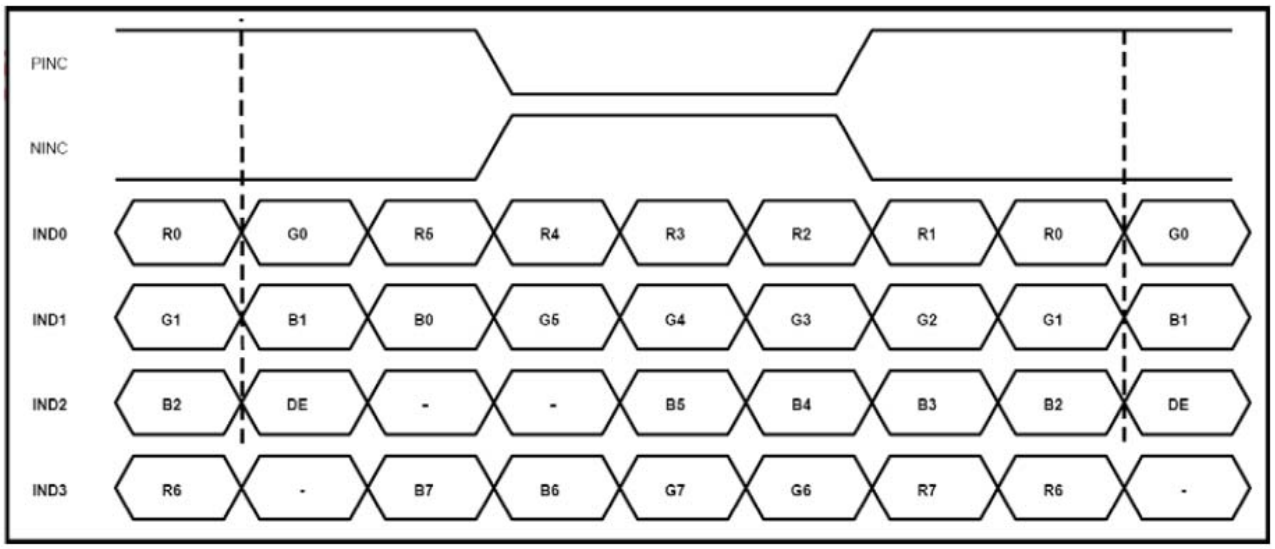
5. BLOCK DIAGRAM

5.1 TFT LCD Module



6. Relationship Between Displayed Color and Input

6.1 Data Mapping



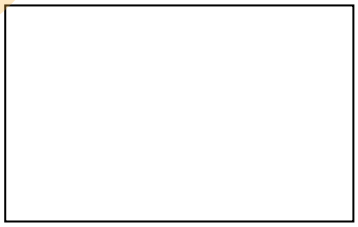
8bit LVDS input

7. ELECTRICAL CHARACTERISTICS

7.1 TFT LCD Module

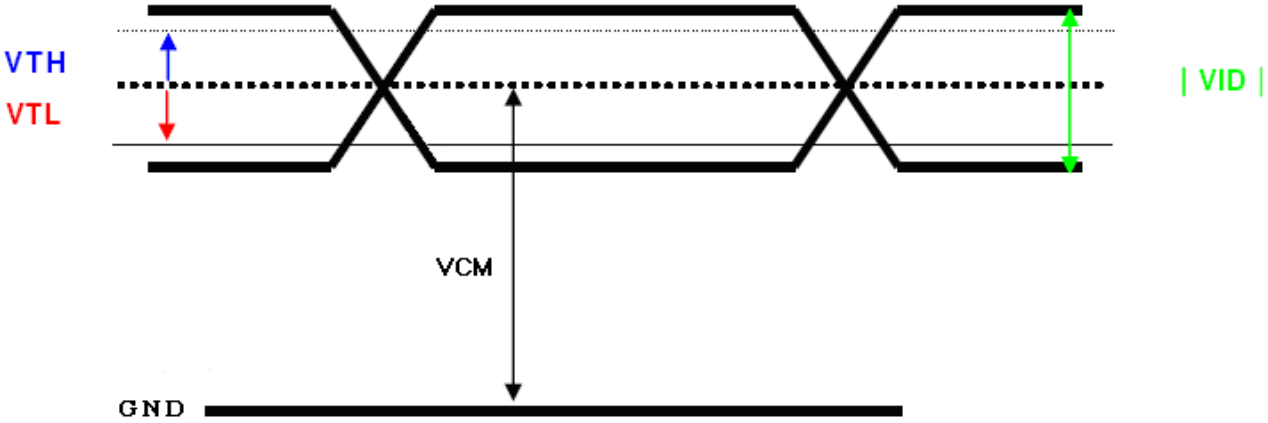
Item	Symbol	Values			Unit	Note
		Min	Typ.	Max.		
Supply Voltage	VCC	3.0	3.3	3.6	V	
	VLED_12V	-	12	-	V	
Differential Input High Threshold	RxVTH	-	-	+100	mV	RxVCM=+1.2V
Differential Input Low Threshold	RxVTL	-100	-	-	mV	RxVCM=+1.2V
Magnitude differential Input Voltage	|VID|	200	-	600	mV	(1)
Common Mode Voltage	RxVCM	0.7	-	1.6	V	
PWM frequency	-	100	-	10K	Hz	
PWM Duty ratio	-	17	-	100	%	
LED_EN Threshold Voltage	VIH	2	-	-	V	
	VIL	-	-	0.5	V	
Supply Current	ICC	-	155	180	mA	
	ILED	-	460	550	mA	
LED life time	-	-	50000	-	Hr	(2)

Note 1: frame = 60Hz, Ta=25°C, Display pattern: White pattern



Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25℃ 60% RH.

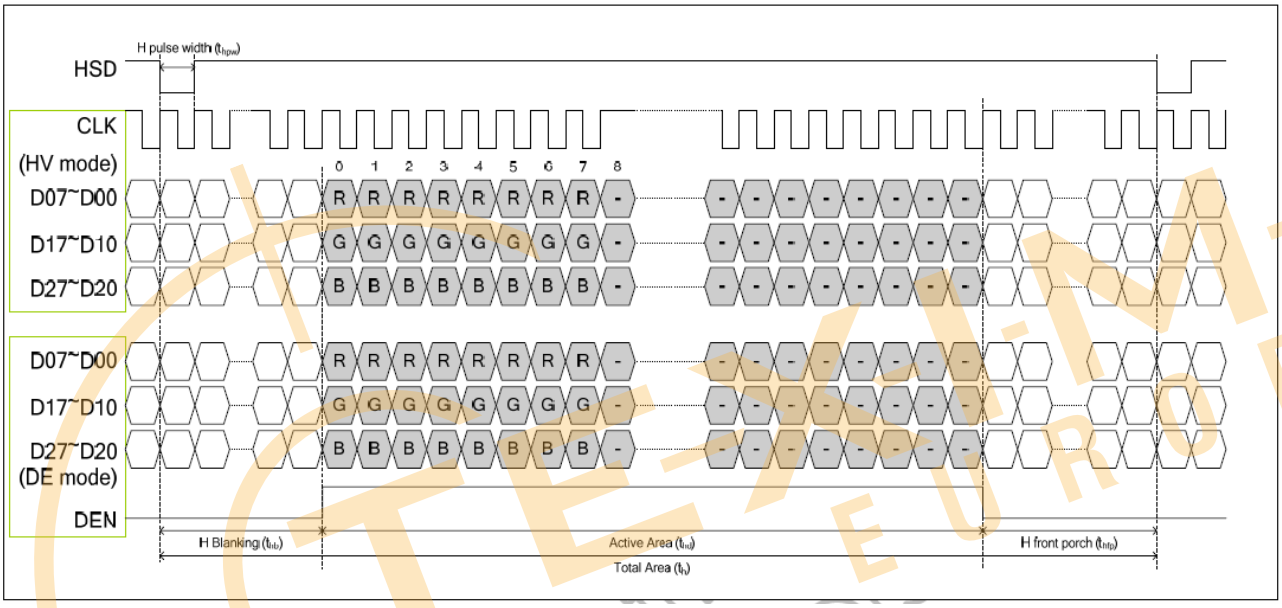
Note 3:

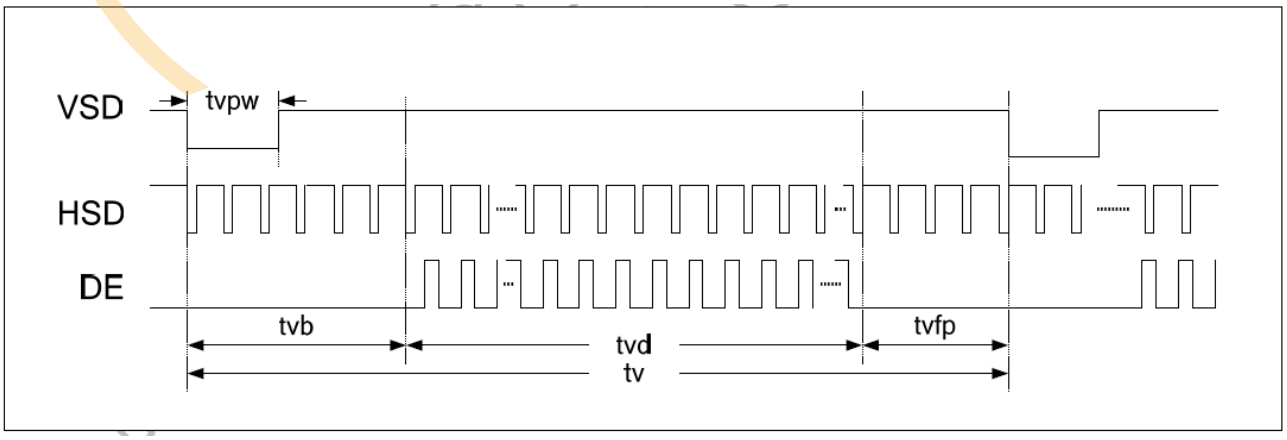


7.2 INTERFACE SPECIFICATIONS

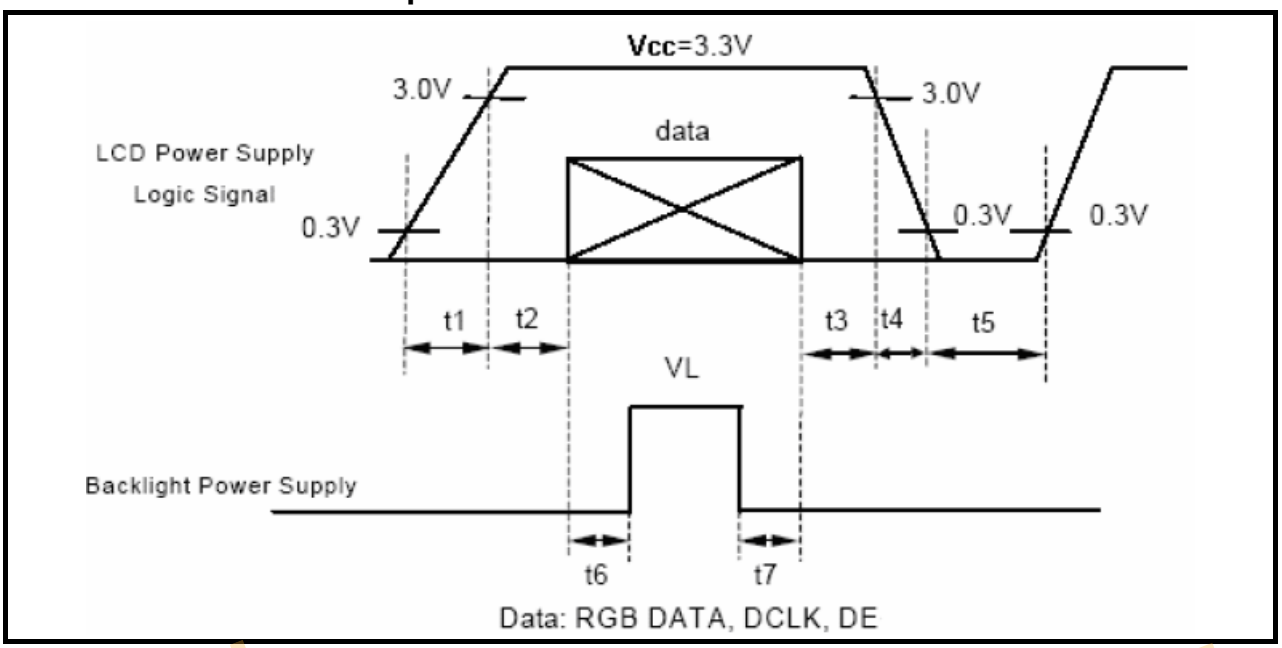
7.2.1 DE mode Input signal characteristics

Signal	Parameter	Symbol	Min.	Typ.	Max.	Unit.	Note
DCLK	DCLK Frequency	fclk	45	51.2	57	MHz	
Horizontal	Horizontal display area	thd	-	1024	-	DCLK	
	HSD period time	th	1324	1344	1364	DCLK	
	HSD Blanking	thb+thfb	300	320	340	DCLK	
Vertical	Vertical display area	tvd	-	600	-	th	
	VSD period time	tv	625	635	645	th	
	VSD pulse width	tvb+tvfb	25	35	45	th	





7.3 Power On / Off Sequence



t1 ≤10ms : 1 sec≤ t5

50ms≤ t2 : 200ms ≤t6

0<t3 ≤50ms: 200ms≤ t7

0<t4 ≤10ms

8. POROJECTED CAPACITIVE TOUCH PANEL SPECIFICATION

8.1 Main Feature

Item	Specification	Unit
Screen Size	10.1 inches	Diagonal
Type	Transparent Type Projected Capacitive Touch Panel	
Input Mode	Human's Finger	
Interface	I2C or USB	
Touch number	10 points	
Cover glass pencil-hardness	7H	
Response time	≤ 25ms	ms
IC solution	ILI2511	

8.2 Pin Assignments and Definitions

Item	Name	I/O	Unit
1	GND	P	Ground
2	VDD	P	Power supply for I2C
3	SCL	I	I2C clock
4	SDA	I/O	I2C data
5	INT	O	Interrupt signal to inform the host processor that touch data is ready for read
6	RESET	I	External low signal reset the chip.
7	VDD_5V	P	Power supply for USB I/F
8	D+	I/O	USB interface
9	D-	I/O	USB interface
10	GND	P	Ground

(CN2)

Item	Name	I/O	Unit
1	GND	P	Ground
2	VDD	P	Power supply for I2C
3	SCL	I	I2C clock
4	SDA	I/O	I2C data
5	INT	O	Interrupt signal to inform the host processor that touch data is ready for read
6	RESET	I	External low signal reset the chip.

(CN3)

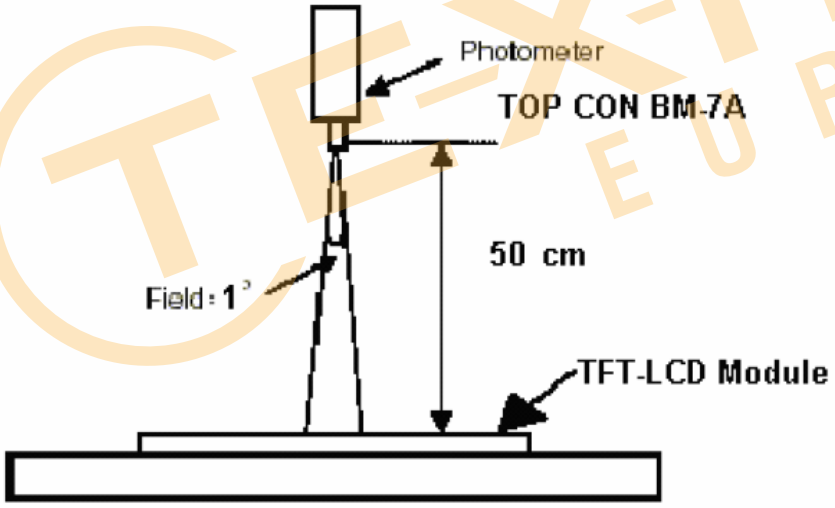
Item	Name	I/O	Unit
1	GND_EARTH	P	Ground
2	VDD_5V	P	Power supply for USB
3	GND	P	Ground
4	D+	I/O	USB interface
5	D-	I/O	USB interface

9. OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Brightness		--	Note1, Note 3, ($\theta = 0^\circ$, Normal Viewing Angle)	680	850	--	cd/m2
Uniformity		B-uni		70	75	-	%
Contrast Ratio		CR		500	600	--	--
Response Time		Tr+Tf		--	40	--	ms
Color Chromaticity	White	Wx		0.260	0.310	0.360	--
		Wy		0.280	0.330	0.380	--
View angle	Horizontal	θ x+	Center CR≥10	70	85	--	
		θ x-		70	85	--	
	Vertical	θ Y+		70	85	--	
		θ Y-		70	85	--	

Note：The following optical specifications shall be measured in a darkroom or equivalent state(ambient luminance ≤1 lux, and at room temperature). The operation temperature is 25°C±2°C. The measurement method is shown in Note1.

Note 1: The method of optical measurement:

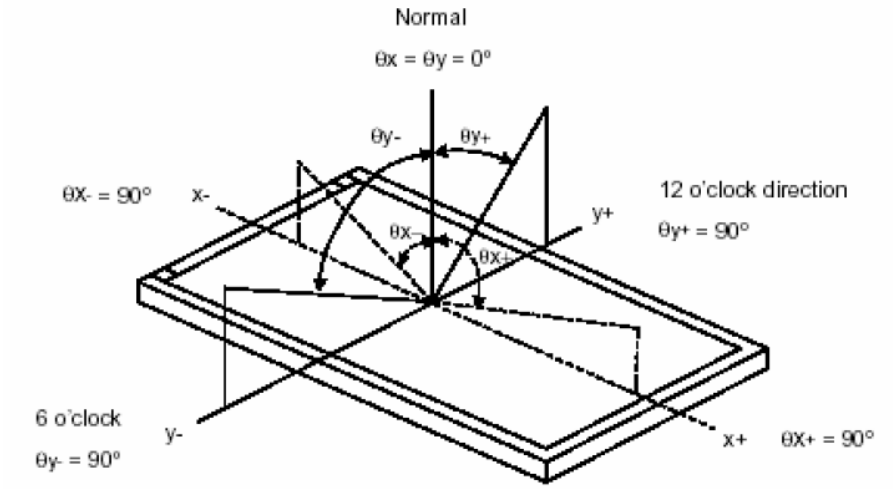


Note 2: Measured at the center area of the panel and at the viewing angle of the θ x= θ y =0°

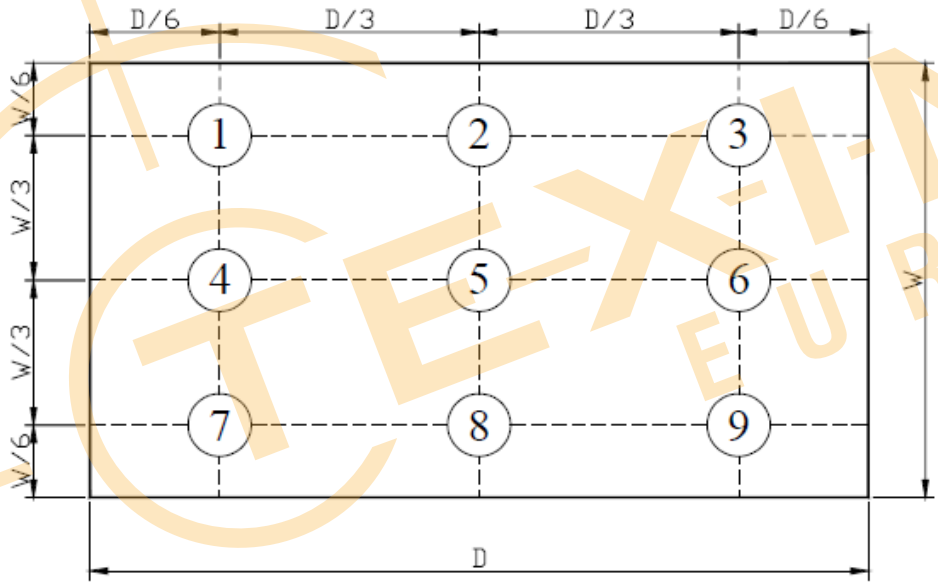
Note 3: Definition of Contrast Ratio (CR):

CR = Luminance with all pixels in white state ÷ Luminance with all pixels in Black state

Note 4: Definition of Viewing Angle:



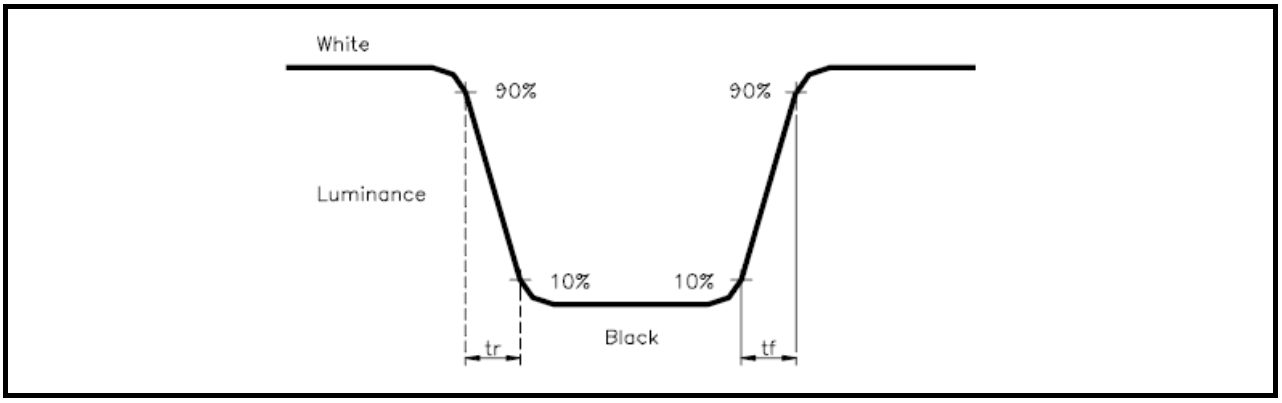
Note 5: Definition of Brightness Uniformity (B-uni):



B-uni ＝(Minimum luminance of 9 points÷Maximum luminance of 9points)X100%

Note 6: Definition of Response Time:

The Response Time is set initially by defining the “Rising Time (Tr)” and the “Falling Time (Tf)” respectively. Tr and Tf are defined as following figure



Note 7: Definition of Chromaticity:

The color coordinates (Wx,Wy),(Rx,Ry),(Gx,Gy),and (Bx,By) are obtained with all pixels in the viewing field at white, red, green, and blue states, respectively.

10. RELIABILITY

10.1 Test Condition

10.1.1 Temperature and Humidity(Ambient Temperature)

Temperature : 25 ± 5°C

Humidity : 65 ± 5%

10.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

10.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

10.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

10.2 TESTS

No.	ITEM	CONDITION CRITERION
1	High Temperature Storage	80°C, 240 hrs
2	Low Temperature Storage	-30°C, 240 hrs
3	High Temperature Operating	70°C, 240 hrs
4	Low Temperature Operating	-20°C, 240 hrs
5	High Temperature/Humidity Non-Operating	60°C, 90%RH, 240 hrs
6	Temperature Shock Non-Operating	-30°C ←→ 80°C (0.5hr each), 25 cycles
7	Vibration Test Non-Operating	Frequency:0 ~ 55 Hz Amplitude:1.5 mm Sweep Time:11min Test Period:6 Cycles for each Direction of X,Y,Z
8	Electro-static Discharge Non-Operating	150pF,330Ω Air:± 8KV;Contact: ±6KV 10 times/point;4 points/panel face

Note1: The test sample have recovery time for 24 hours at room temperature before the function check. In the standard conditions, there is no any touch panel function NG issue occurred.

10.3 JUDGMENT STANDARD

The judgment of the above test should be made as follow:

Pass: Normal display image with no obvious non-uniformity and no line defect. Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defects.

10.4 INCOMING INSPECTION STANDARDS

<table>
<tr><th>No.</th><th>Parameter</th><th>Criteria</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Operating</td><td>
Display function: No Display malfunction (Major)
Contrast ratio (Black, White):
Does not meet specified range in the spec. (Major) (Note:3)
Line Defect: No obvious Vertical and Horizontal line defect in bright, dark and colored. (Major) (Note:1)
Point Defect : Active area ≤ 5 dots (Minor) (Note:1)
<table>
<tr><th rowspan="2">Item</th><th>Acceptable number</th><th rowspan="2">Total</th></tr>
<tr><th>Active Area</th></tr>
<tr><td>Bright</td><td>2</td><td rowspan="2">5</td></tr>
<tr><td>Dark</td><td>4</td></tr>
</table>
</td></tr>
<tr><td>
Non-uniformity: Visible through 5%ND filter. (Minor)
Foreign material in Black or White spots shape (W>1/4L)
<table>
<tr><th>Zone / Dimension</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>D> 0.5</td><td>0</td><td rowspan="3">Minor</td><td rowspan="3">1.5</td></tr>
<tr><td>0.3 < D ≤ 0.5</td><td>5</td></tr>
<tr><td>D ≤ 0.3</td><td>*</td></tr>
</table>
D = (Long + Short) / 2 ＊ : Disregard
Foreign Material in Line or spiral shape (W≤1/4L) (Note: 4)
<table>
<tr><th>L (mm) / Zone W(mm)</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>L >5</td><td>W>0.1</td><td>0</td><td rowspan="3">Minor</td><td rowspan="3">1.5</td></tr>
<tr><td>0.5 < L ≤ 5</td><td>0.03 < W≤0.1</td><td>5</td></tr>
<tr><td>L ≤0.5</td><td>W≤0.03</td><td>*</td></tr>
</table>
L : Length W : Width ＊ : Disregard
</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">External Inspection (non-operating)</td><td>
Dimension: Outline (Major)
Bezel appearance: uneven (Minor)
Scratch on the polarize: (Note:2)
<table>
<tr><th>L (mm) / Zone W(mm)</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>--</td><td>W>0.1</td><td>0</td><td rowspan="2">Minor</td><td rowspan="2">1.5</td></tr>
<tr><td>L ≤ 3</td><td>W≤0.1</td><td>3</td></tr>
</table>
L : Length W : Width ＊ : Disregard
</td></tr>
<tr><td>
Dent or bubble on the polarize (Note:2)
<table>
<tr><th>Zone / Dimension</th><th>Acceptable number</th><th>Class Of Defects</th><th>AQL Level</th></tr>
<tr><td>D≤0.3</td><td>*</td><td rowspan="2">Minor</td><td rowspan="2">1.5</td></tr>
<tr><td>D≤0.5</td><td>3</td></tr>
</table>
D = (Long + Short) / 2 ＊ : Disregard
</td></tr>
</table>

Class of defects	**Major**	AQL 0.65%	**Definition** It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function.
	Minor	AQL 1.5%	It is a defect that will not result in functioning problem with deviation classified.

Note1:

(a)Bright point defect is defined as point defect of R,G,B with area >1/2 pixel respectively

(b)Dark point defect is defined as visible in full white pattern.

(c)Definition of distribution of point defect is as follows:

-minimum separation between dark point defects should be larger than 5mm.

-minimum separation between bright point defects should be larger than 5mm.

(d)Definition of joined bright point defect and joined dark point defect are as follows:

-Two or more joined bright point defects must be nil.

-Three joined dark point defects must be nil.

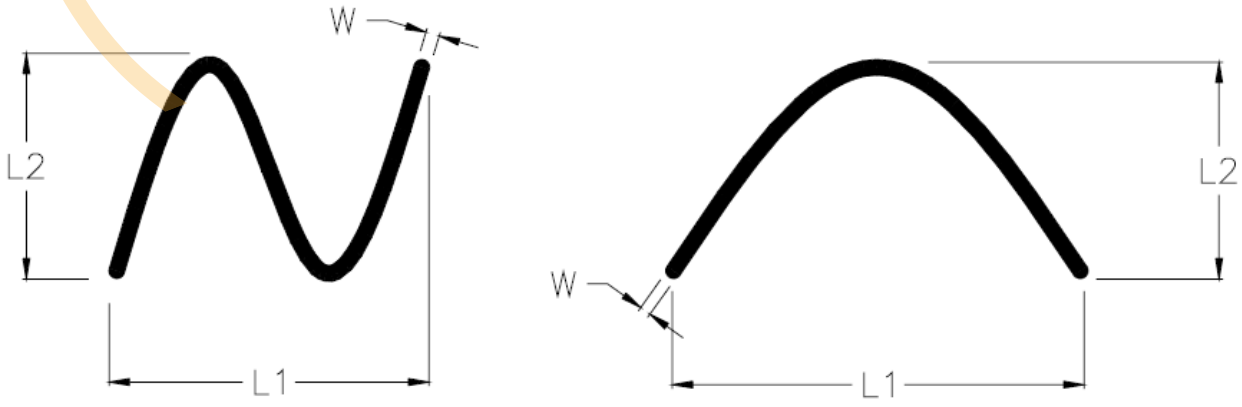
-Coupling of one dark and one bright point in junction is counted as one dark and bright spot with 1 pair maximum.

-Two Joined dark point is counted as two dark points with 2 pair maximum.

Note2: The external inspection should be conducted at the distance 30± 5cm between the eyes of inspector and the panel.

Note3: Luminance measurement for contrast ratio is at the distance 50± 5cm between the detective head and the panel with ambient luminance less than 1 lux. Contrast ratio is obtained at optimum view angle.

Note4: W-Width in mm , L-length of Max.(L1,L2) in mm.



10.5 Sampling Condition

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.

Lot size: Quantity of shipment lot per model.

Sampling type: normal inspection, single sampling

Sampling table: MIL-STD-105E

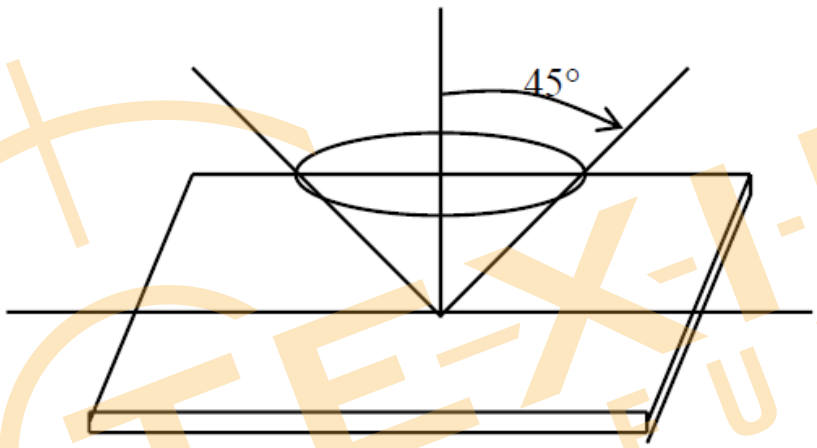
Inspection level: Level II

10.6 Inspection conditions

The LCD shall be inspected under 40W white fluorescent light.

$\theta \leq 45^{\circ}$ inspection under non-operating condition.

$\theta \leq 5^{\circ}$ inspection under operating condition



11. PRECAUTION RELATING PRODUCT HANDLING

11.1 SAFETY

11.1.1 If the LCD panel breaks , be careful not to get the liquid crystal to touch your skin.

11.1.2 If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.

11.2 HANDLING

11.2.1 Avoid any strong mechanical shock which can break the glass.

11.2.2 Avoid static electricity which can damage the CMOS LSI—When working with the module, be sure to ground your body and any electrical equipment you may be using.

11.2.3 Do not remove the panel or frame from the module.

11.2.4 The polarizing plate of the display is very fragile. So , please handle it very carefully, Do not touch, push or rub the exposed polarizing with anything harder than an HB pencil lead (glass , tweezers , etc.)

11.2.5 Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.

11.2.6 Do not touch the display area with bare hands , this will stain the display area.

11.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.

11.2.8 To control temperature and time of soldering is 280 ± 10°C and 3-5 sec.

11.2.9 To avoid liquid (include organic solvent) stained on LCM.

11.3 STORAGE

11.3.1 Store the panel or module in a dark place where the temperature is 25°C ± 5°C and the humidity is below 65% RH.

11.3.2 Do not place the module near organics solvents or corrosive gases.

11.3.3 Do not crush, shake, or jolt the module.