

KOE

JDI Group

Kaohsiung Opto-Electronics Inc.

FOR MESSRS : _____

DATE : Jul. 11th ,2017

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

TX26D19VM2BPA

Contents

No.	ITEM	SHEET No.	PAGE
1	COVER	7B64PS 2701-TX26D19VM2BPA-4	1-1/1
2	RECORD OF REVISION	7B64PS 2702-TX26D19VM2BPA-4	2-1/1
3	GENERAL DATA	7B64PS 2703-TX26D19VM2BPA-4	3-1/1
4	ABSOLUTE MAXIMUM RATINGS	7B64PS 2704-TX26D19VM2BPA-4	4-1/1
5	ELECTRICAL CHARACTERISTICS	7B64PS 2705-TX26D19VM2BPA-4	5-1/2~2/2
6	OPTICAL CHARACTERISTICS	7B64PS 2706-TX26D19VM2BPA-4	6-1/2~2/2
7	BLOCK DIAGRAM	7B64PS 2707-TX26D19VM2BPA-4	7-1/1
8	RELIABILITY TESTS	7B64PS 2708-TX26D19VM2BPA-4	8-1/1
9	LCD INTERFACE	7B64PS 2709-TX26D19VM2BPA-4	9-1/7~7/7
10	OUTLINE DIMENSIONS	7B64PS 2710-TX26D19VM2BPA-4	10-1/2~2/2
11	TOUCH PANEL	7B64PS 2711-TX26D19VM2BPA-4	11-1/2~2/2
12	APPEARANCE STANDARD	7B64PS 2712-TX26D19VM2BPA-4	12-1/4~4/4
13	PRECAUTIONS	7B64PS 2713-TX26D19VM2BPA-4	13-1/2~2/2
14	DESIGNATION OF LOT MARK	7B64PS 2714-TX26D19VM2BPA-4	14-1/1

ACCEPTED BY: _____

PROPOSED BY: Oblack Tsai

2. RECORD OF REVISION

DATE	SHEET No.	SUMMARY																
Feb. 11,'14	7B64PS 2709- TX26D19VM2BPA-2 Page 9-2/7	Changed: 9.3 LVDS DATA FORMAT																
Apr. 16,'14	7B64PS-2711- TX26D19VM2BPA-3 Page 11-1/2	11.2 ELECTRICAL CHARACTERISTICS Revised : <table border="1" style="margin-left: 40px;"> <thead> <tr> <th colspan="2">Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Resistance Between Terminal</td> <td>X1-X2</td> <td>250~900Ω</td> </tr> <tr> <td>Y1-Y2</td> <td>210~600Ω</td> </tr> </tbody> </table> <p style="text-align: center;">↓</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th colspan="2">Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Resistance Between Terminal</td> <td>X1-X2</td> <td>330~1100Ω</td> </tr> <tr> <td>Y1-Y2</td> <td>210~600Ω</td> </tr> </tbody> </table>	Item		Specification	Resistance Between Terminal	X1-X2	250~900Ω	Y1-Y2	210~600Ω	Item		Specification	Resistance Between Terminal	X1-X2	330~1100Ω	Y1-Y2	210~600Ω
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Resistance Between Terminal	X1-X2	330~1100Ω																
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7B64PS-2711- TX26D19VM2BPA-3 Page 11-2/2	11.4 OPTICAL CHARACTERISTICS Revised : <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Transmittance</td> <td>78% min.</td> </tr> </tbody> </table> <p style="text-align: center;">↓</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Transmittance</td> <td>77% min.</td> </tr> </tbody> </table>	Item	Specification	Transmittance	78% min.	Item	Specification	Transmittance	77% min.									
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7B64PS-2713- TX26D19VM2BPA-3 Page 13-1/2	13. PRECAUTIONS Added : 13.1 PRECAUTIONS of MOUNTING																	
Jul. 11,'17	7B64PS-2710- TX26D19VM2BPA-4 Page 10-1/2	10.1 FRONT VIEW Revised : All Page																
	7B64PS-2711- TX26D19VM2BPA-4 Page 11-1/2~2/2	11.2 ELECTRICAL CHARACTERISTICS Revised : <table border="1" style="margin-left: 40px;"> <thead> <tr> <th colspan="2">Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Resistance Between Terminal</td> <td>X1-X2</td> <td>330~1100Ω</td> </tr> <tr> <td>Y1-Y2</td> <td>210~600Ω</td> </tr> </tbody> </table> <p style="text-align: center;">↓</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th colspan="2">Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Resistance Between Terminal</td> <td>X1-X2</td> <td>310~1400Ω</td> </tr> <tr> <td>Y1-Y2</td> <td>100~800Ω</td> </tr> </tbody> </table> 11.3 MECHANICAL CHARACTERISTICS Revised : Surface Hardness JIS K 5400 → JIS K5600-5-4	Item		Specification	Resistance Between Terminal	X1-X2	330~1100Ω	Y1-Y2	210~600Ω	Item		Specification	Resistance Between Terminal	X1-X2	310~1400Ω	Y1-Y2	100~800Ω
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3. GENERAL DATA

3.1 DISPLAY FEATURES

This module is a 10.4" SVGA of 4:3 format amorphous silicon TFT. The pixel format is vertical stripe and sub pixels are arranged as R(red), G(green), B(blue) sequentially. This display is RoHS compliant, and COG (chip on glass) technology and LED backlight are applied on this display.

Part Name	TX26D19VM2BPA
Module Dimensions	243.0(W) mm x 185.1(H) mm x 12.0max.(D) mm
LCD Active Area	211.2(W) mm x 158.4(H) mm
Dot Pitch	0.088(W) mm x 3(R, G, B)(W) x 0.264(H) mm
Resolution	800 x 3(RGB)(W) x 600(H) Dots
Color Pixel Arrangement	R, G, B Vertical Stripe
LCD Type	Transmissive Color TFT; Normally White
Display Type	Active Matrix
Number of Colors	16.7M Colors (8-bit RGB)
Backlight	Light Emitting Diode (LED)
Weight	550 g
Interface	LVDS; 20 pins
Power Supply Voltage	3.3V for LCD ; 12.0V for Backlight
Power Consumption	1.29W for LCD ; 3.46W for Backlight
Viewing Direction	12 O'clock (without image inversion and least brightness change) 6 O'clock (contrast peak located at)

4. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Remarks
Supply Voltage	V_{DD}	0	5.0	V	-
Input Voltage of Logic	V_I	-0.3	$V_{DD}+0.3$	V	Note 1
Operating Temperature	T_{op}	-20	70	°C	Note 2
Storage Temperature	T_{st}	-30	80	°C	Note 2
Backlight Input Voltage	V_{LED}	-	14.4	V	-

Note 1: It shall be applied to pixel data signal and clock signal.

Note 2: The maximum rating is defined as above based on the chamber temperature, which might be different from ambient temperature after assembling the panel into the application. Moreover, some temperature-related phenomenon as below needed to be noticed:

- Background color, contrast and response time would be different in temperatures other than 25°C.
- Operating under high temperature will shorten LED lifetime.

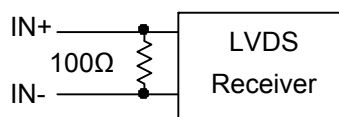
5. ELECTRICAL CHARACTERISTICS

5.1 LCD CHARACTERISTICS

$T_a = 25\text{ }^\circ\text{C}$, $V_{SS} = 0\text{V}$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	-	3.0	3.3	3.6	V	-
Input Voltage of Logic	V_I	"H" level	-	-	+100	mV	Note 1
		"L" level	-100	-	-		
Power Supply Current	I_{DD}	$V_{DD}-V_{SS} = 3.3\text{V}$	-	390	470	mA	Note 2,3
Frame Frequency	f_{Frame}	-	-	60	66	Hz	-
CLK Frequency	f_{CLK}	-	32.3	40	50	MHz	

Note 1: VCM 1.2V is common mode voltage of LVDS transmitter and receiver. The input terminal of LVDS receiver is terminated with 100Ω .



Note 2: An all black check pattern is used when measuring I_{DD} , f_{Frame} is set to 60Hz.

Note 3: 1.0A fuse is applied in the module for I_{DD} . For display activation and protection purpose, power supply is recommended larger than 2.5A to start the display and break fuse once any short circuit occurred.

5.2 BACKLIGHT CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
LED Input Voltage	V_{LED}	Backlight Unit	11.5	12.0	12.5	V	Note 1
LED Forward Current	I_{LED}	Backlight Unit	-	288	-	mA	
LED Lifetime	-	$I_{LED}=288\text{ mA}$	-	50K	-	hrs	Note 2,3

Note 1: Fig. 5.1 shows the LED backlight circuit. V_{LED} and I_{LED} is many-to-one relationship, the above V_{LED} range is defined to obtain 288mA and the R is 243Ω.

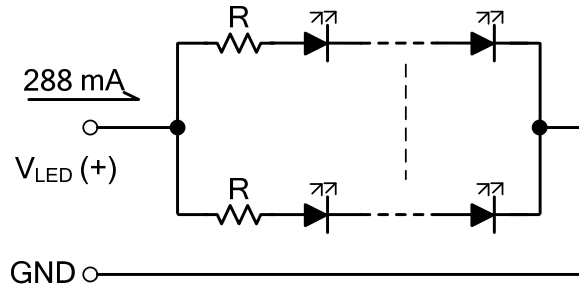


Fig. 5.1

Note 2: The estimated lifetime is specified as the time to reduce 50% brightness by applying 288 mA at 25°C.

Note 3: By applying different I_{LED} , the estimated brightness and LED lifetime curves are shown as Fig 5.2 and Fig 5.3 for various environment uses. Do not apply I_{LED} over 480 mA for the rating concern of power consumption.

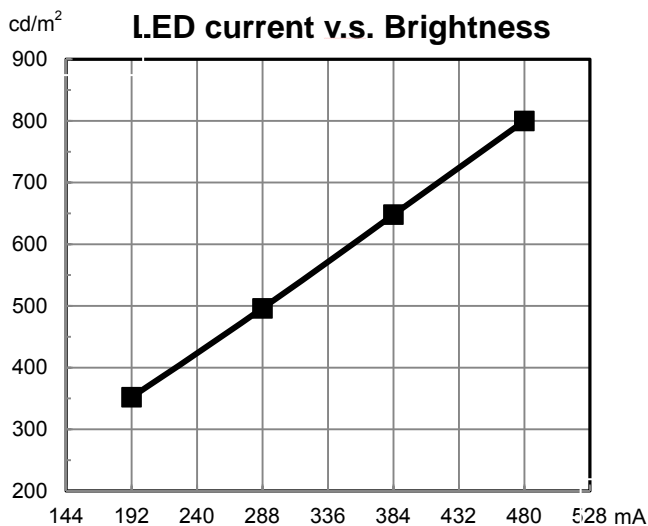


Fig 5.2

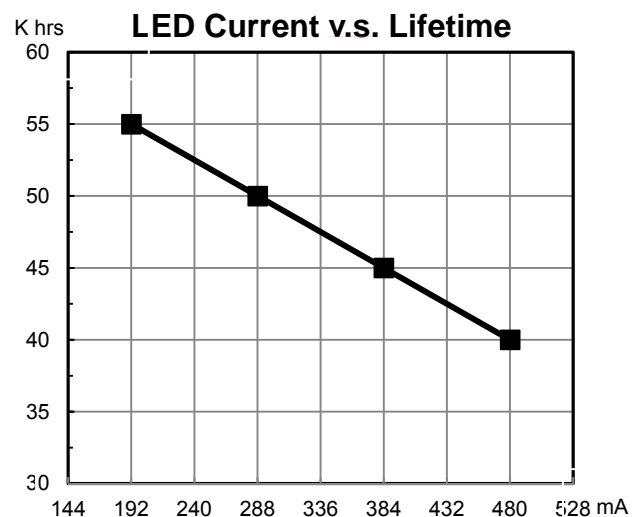


Fig 5.3

6. OPTICAL CHARACTERISTICS

The optical characteristics are measured based on the conditions as below:

- Supplying the signals and voltages defined in the section of electrical characteristics.
- The backlight unit needs to be turned on for 30 minutes.
- The ambient temperature is 25 °C .
- In the dark room less than 100 lx, the equipment has been set for the measurements as shown in Fig 6.1.

$$T_a = 25\text{ }^\circ\text{C}, f_{Frame} = 60\text{ Hz}, V_{DD} = 3.3\text{V}$$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks	
Brightness of White	-	$\phi = 0^\circ, \theta = 0^\circ,$ $I_{LED} = 288\text{ mA}$	350	450	-	cd/m ²	Note 1	
Brightness Uniformity	-		70	-	-	%	Note 2	
Contrast Ratio	CR		500	800	-	-	Note 3	
Response Time	Rise + Fall	$\phi = 0^\circ, \theta = 0^\circ$	-	20	-	ms	Note 4	
NTSC Ratio	-	$\phi = 0^\circ, \theta = 0^\circ$	-	50	-	%	-	
Viewing Angle	θ_x	$\phi = 0^\circ, CR \geq 10$	-	80	-	Degree	Note 5	
	$\theta_{x'}$	$\phi = 180^\circ, CR \geq 10$	-	80	-			
	θ_y	$\phi = 90^\circ, CR \geq 10$	-	50	-			
	$\theta_{y'}$	$\phi = 270^\circ, CR \geq 10$	-	80	-			
Color Chromaticity	Red	X	$\phi = 0^\circ, \theta = 0^\circ$	0.53	0.58	0.63	-	Note 6
		Y		0.28	0.33	0.38		
	Green	X		0.30	0.35	0.40		
		Y		0.55	0.60	0.65		
	Blue	X		0.10	0.15	0.20		
		Y		0.08	0.13	0.18		
	White	X		0.23	0.28	0.33		
		Y		0.27	0.32	0.37		

Note 1: The brightness is measured from the panel center point, P5 in Fig. 6.2, for the typical value.

Note 2: The brightness uniformity is calculated by the equation as below:

$$\text{Brightness uniformity} = \frac{\text{Min. Brightness}}{\text{Max. Brightness}} \times 100\%$$

which is based on the brightness values of the 9 points in active area measured by BM-5 as shown in Fig. 6.2.

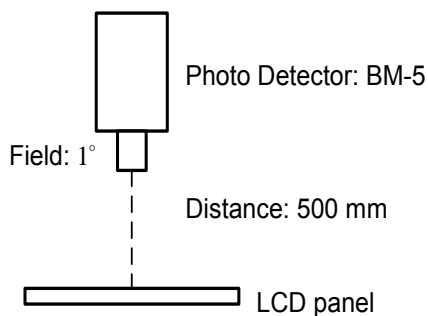


Fig 6.1

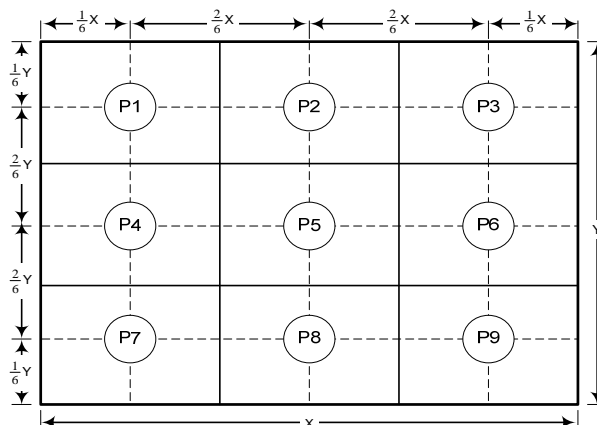


Fig 6.2

Note 3: The Contrast ratio is measured from the center point of the panel, P5, and defined as the following equation:

$$CR = \frac{\text{Brightness of White}}{\text{Brightness of Black}}$$

Note 4: The definition of response time is shown in Fig. 6.3. The rising time is the period from 90% brightness to 10% brightness when the data is from white to black. Oppositely, Falling time is the period from 90% brightness falling to 10% brightness.

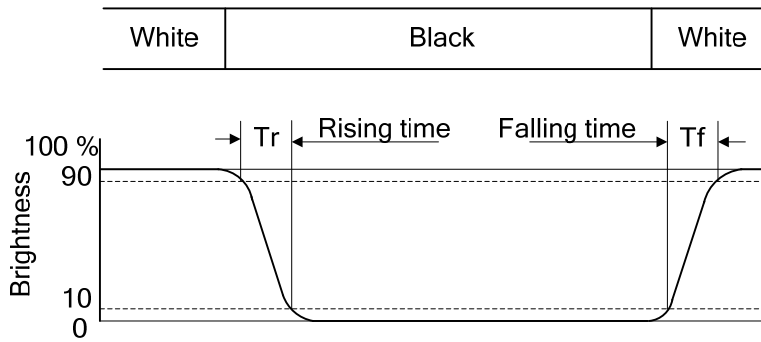


Fig. 6.3

Note 5: The definition of viewing angle is shown in Fig. 6.4. Angle ϕ is used to represent viewing directions, for instance, $\phi = 270^\circ$ means 6 o'clock, and $\phi = 0^\circ$ means 3 o'clock. Moreover, angle θ is used to represent viewing angles from axis Z toward plane XY.

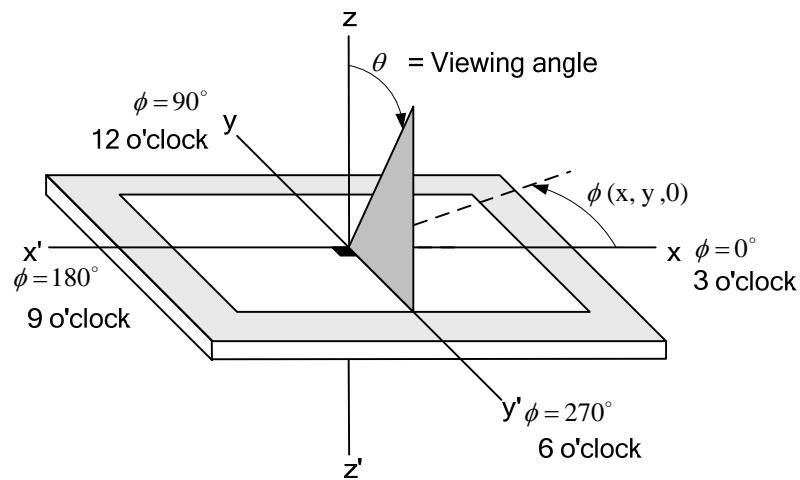
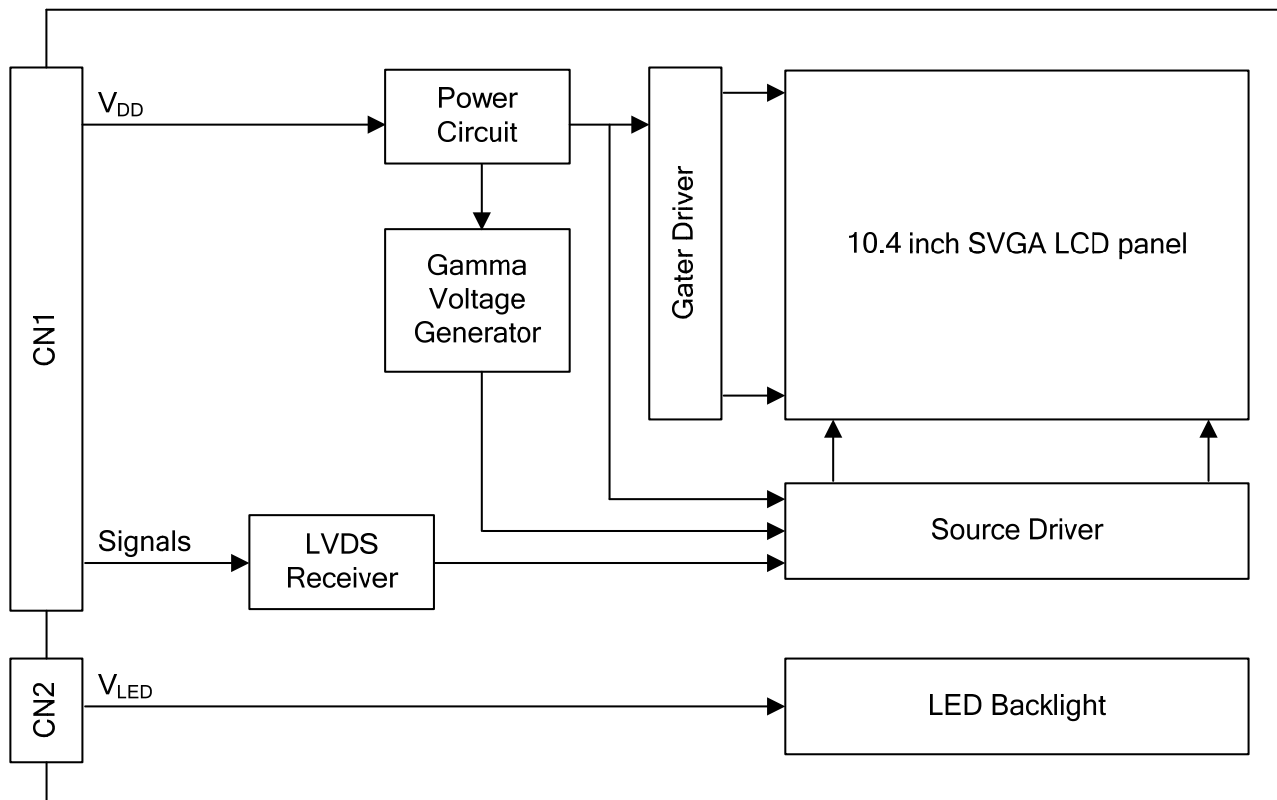


Fig. 6.4

Note 6: The color chromaticity is measured from the center point of the panel, P5, as shown in Fig. 6.2.

7. BLOCK DIAGRAM



Note : Signals are CLK and pixel data pairs.

8. RELIABILITY TESTS

Test Item	Condition	
High Temperature	1) Operating 2) 70°C	240 hrs
Low Temperature	1) Operating 2) -20°C	240 hrs
High Temperature	1) Storage 2) 80°C	240 hrs
Low Temperature	1) Storage 2) -30°C	240 hrs
Heat Cycle	1) Operating 2) -20°C~70°C 3) 3hrs~1hr~3hrs	240 hrs
Thermal Shock	1) Non-Operating 2) -35°C ↔ 85°C 3) 0.5 hr ↔ 0.5 hr	240 hrs
High Temperature & Humidity	1) Operating 2) 40°C & 85%RH 3) Without condensation	240 hrs (Note3)
Vibration	1) Non-Operating 2) 20~200 Hz 3) 2G 4) X, Y, and Z directions	1 hr for each direction
Mechanical Shock	1) Non-Operating 2) 10 ms 3) 50G 4) ±X, ±Y and ±Z directions	Once for each direction
ESD	1) Operating 2) Tip: 150 pF, 330 Ω 3) Air discharge for glass: ± 8KV 4) Contact discharge for metal frame: ± 8KV	1) Glass: 9 points 2) Metal frame: 8 points (Note4)

Note 1: Display functionalities are inspected under the conditions defined in the specification after the reliability tests.

Note 2: The display is not guaranteed for use in corrosive gas environments.

Note 3: Under the condition of high temperature & humidity, if the temperature is higher than 40°C, the humidity needs to be reduced as Fig. 8.1 shown.

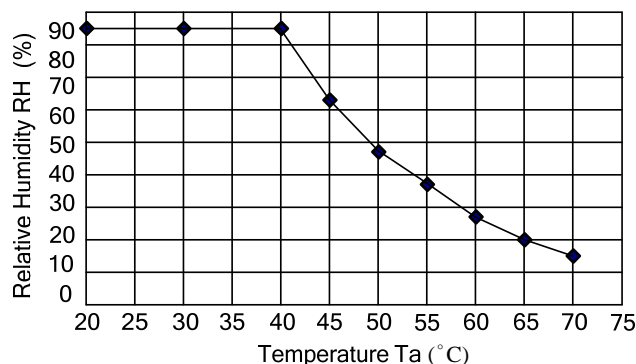


Fig. 8.1

Note 4: All pins of LCD interface (CN1) have been tested by ± 100V contact discharge of ESD under non-operating condition.

9. LCD INTERFACE

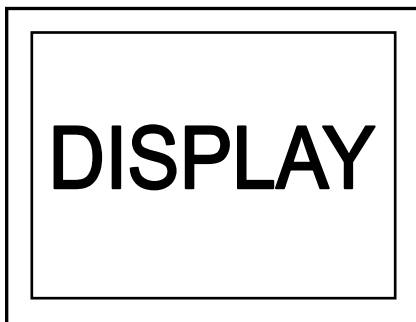
9.1 INTERFACE PIN CONNECTIONS

The display interface connector is FI-SEB20P-HF13E-E1500 made by JAE and more details of the connector are shown in the section of outline dimension.

Pin assignment of LCD interface is as below:

Pin No.	Signal	Signal	Pin No.	Signal	Signal
1	V _{DD}	Power Supply for Logic	11	IN2-	B2~B5, DE
2	SD	Scan Direction Control (Note 1)	12	IN2+	
3	V _{SS}	GND	13	V _{SS}	GND
4	V _{SS}				
5	IN0-	R0~R5, G0	14	CLK IN-	Pixel Clock
6	IN0+		15	CLK IN+	
7	V _{SS}	GND	16	NC	No Connection
8	IN1-	G1~G5, B0~B1	17	IN3-	R6~R7, G6~G7, B6~B7
9	IN1+		18	IN3+	
10	V _{SS}	GND	19	NC	No Connection
			20	NC	No Connection

Note 1: Scan direction is available to be switched as below.



SD : High or Open (Default)

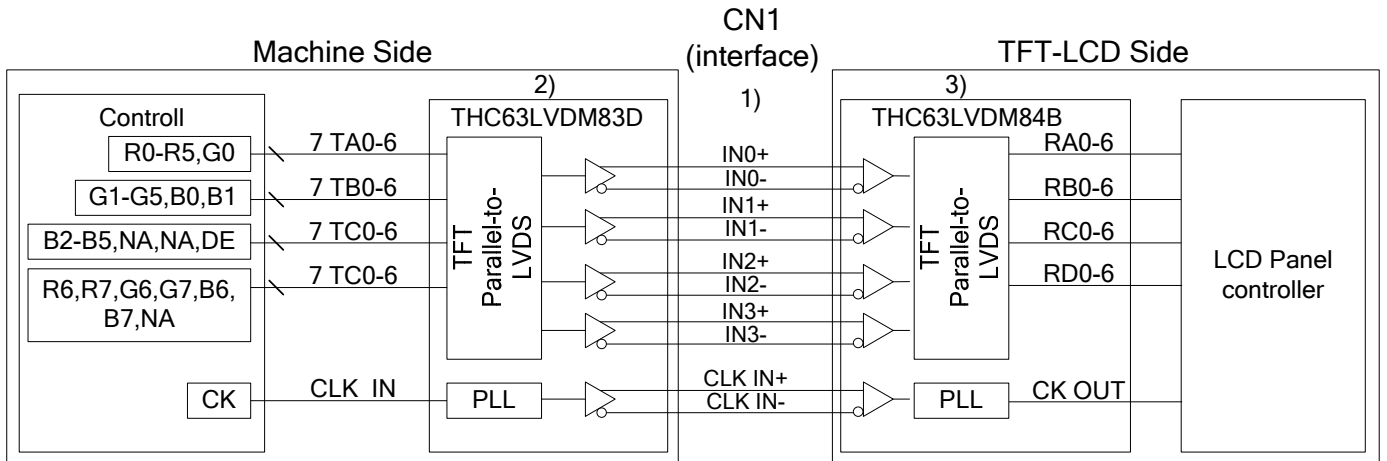


SD : Low

The backlight interface connector is SM08B-SRSS-TB made by JST, and pin assignment of backlight is as below:

Pin No.	Signal	Level	Function
1~3	V _{LED+}	-	Power Supply for LED (12V)
4~5	NC	-	No Connection
6~8	V _{LED-}	-	GND

9.2 LVDS INTERFACE

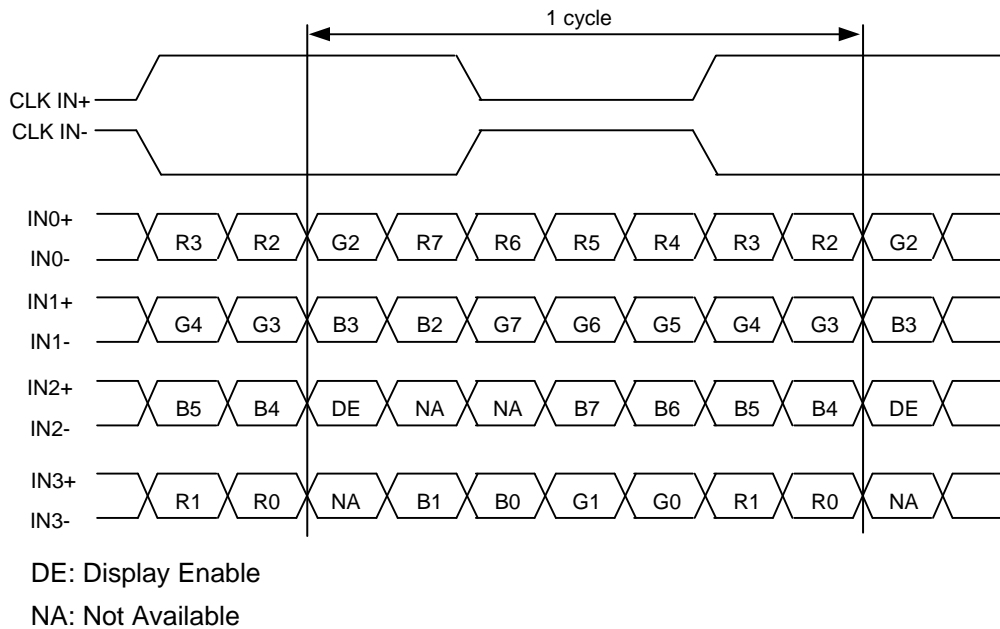


Note 1: LVDS cable impedance should be 100 ohms per signal line when each 2-lines (+,-) is used in differential mode.

Note 2: The recommended transmitter, THC63LVDM83R, is made by Thine or equivalent, which is not contained in the module.

Note 3: The receiver built-in the module is THC63LVDM84B made by Thine.

9.3 LVDS DATA FORMAT



9.4 TIMING CHART

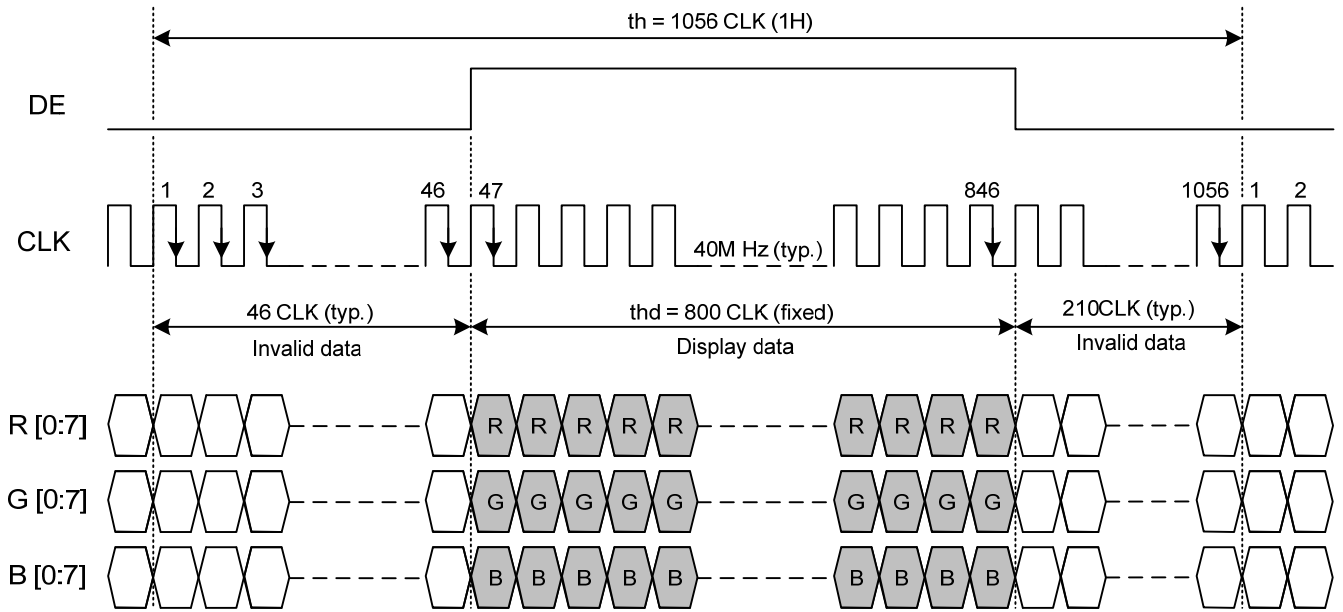


Fig. 9.1 Horizontal Timing

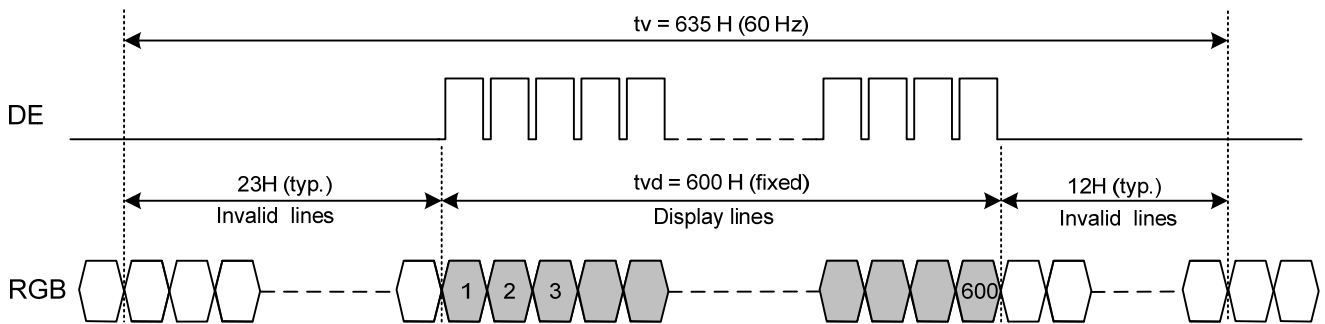


Fig. 9.2 Vertical Timing

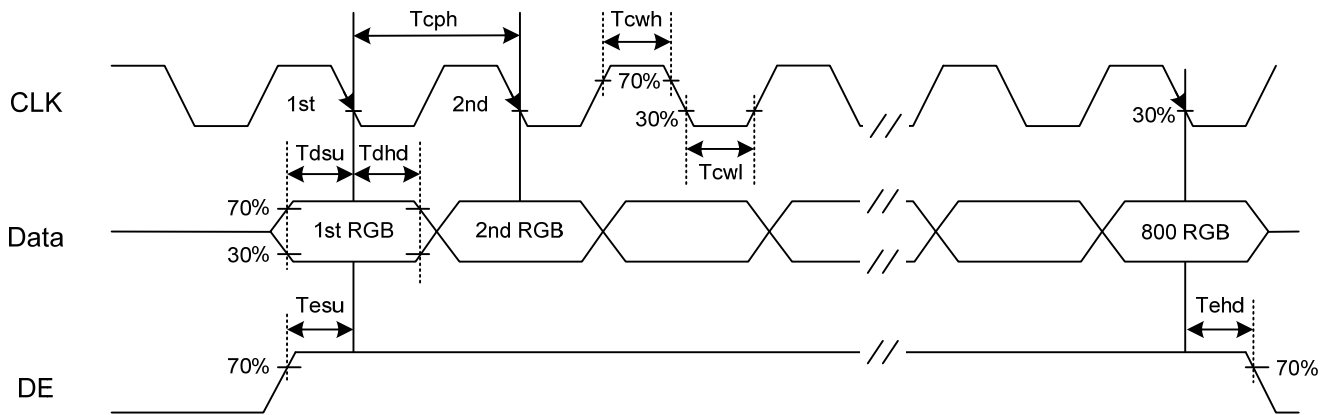


Fig. 9.3 Setup & Hold Time

9.5 TIME TABLE

The column of timing sets including minimum, typical, and maximum as below are based on the best optical performance, frame frequency (Vsync) = 60 Hz to define. If 60 Hz is not the aim to set, less than 66 Hz for Vsync is recommended to apply for better performance by other parameter combination as the definitions in section 5.1.

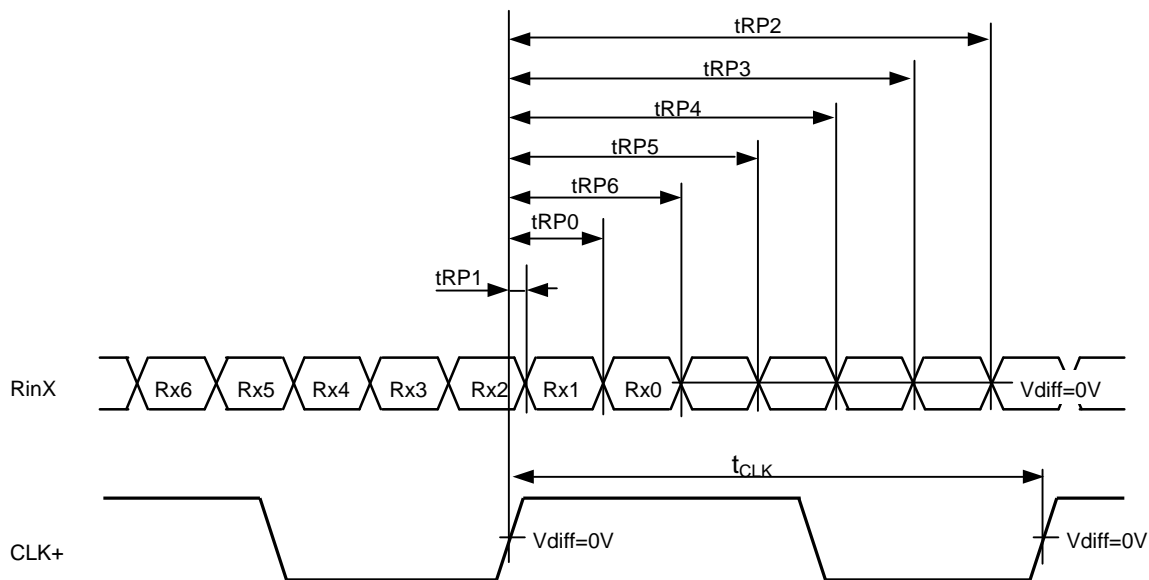
A. Horizontal and Vertical Timing

Item		Symbol	Min.	Typ.	Max.	Unit
Horizontal	CLK Frequency	fclk	32.3	40	50	M Hz
	Display Data	thd	800			CLK
	Cycle Time	th	862	1056	1200	
Vertical	Display Data	tvd	600			H
	Cycle Time	tv	624	635	700	

B. Setup and Hold Time

Item		Symbol	Min.	Typ.	Max.	Unit
CLK	Duty	Tcwh	40	50	60	%
	Cycle Time	Tcph	20	25	-	ns
Data	Setup Time	Tdsu	8	-	-	
	Hold Time	Tdhd	8	-	-	
DE	Setup Time	Tesu	8	-	-	
	Hold Time	Tehd	8	-	-	

9.6 LVDS RECEIVER TIMING



$$RinX = (RinX+) - (RinX-) \quad (X=0, 1, 2, 3)$$

	Item	Symbol	Min.	Typ.	Max.	Unit
CLK	Cycle frequency	$1/t_{CLK}$	32.3	40	50	MHz
RinX (X=0,1,2,3)	0 data position	t_{RP0}	$1/7 * t_{CLK} - 0.4$	$1/7 * t_{CLK}$	$1/7 * t_{CLK} + 0.4$	ns
	1st data position	t_{RP1}	-0.4	0	+0.4	
	2nd data position	t_{RP2}	$6/7 * t_{CLK} - 0.4$	$6/7 * t_{CLK}$	$6/7 * t_{CLK} + 0.4$	
	3rd data position	t_{RP3}	$5/7 * t_{CLK} - 0.4$	$5/7 * t_{CLK}$	$5/7 * t_{CLK} + 0.4$	
	4th data position	t_{RP4}	$4/7 * t_{CLK} - 0.4$	$4/7 * t_{CLK}$	$4/7 * t_{CLK} + 0.4$	
	5th data position	t_{RP5}	$3/7 * t_{CLK} - 0.4$	$3/7 * t_{CLK}$	$3/7 * t_{CLK} + 0.4$	
	6th data position	t_{RP6}	$2/7 * t_{CLK} - 0.4$	$2/7 * t_{CLK}$	$2/7 * t_{CLK} + 0.4$	

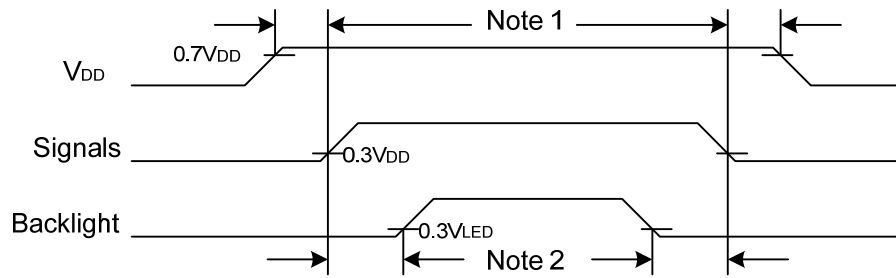
9.7 DATA INPUT for DISPLAY COLOR

Input color		Red Data								Green Data								Blue Data							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
		MSB				LSB				MSB				LSB				MSB				LSB			
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	

Note 1: Definition of gray scale : Color(n) Number in parenthesis indicates gray scale level. Larger number corresponds to brighter level.

Note 2: Data Signal : 1 : High, 0 : Low

9.8 POWER SEQUENCE

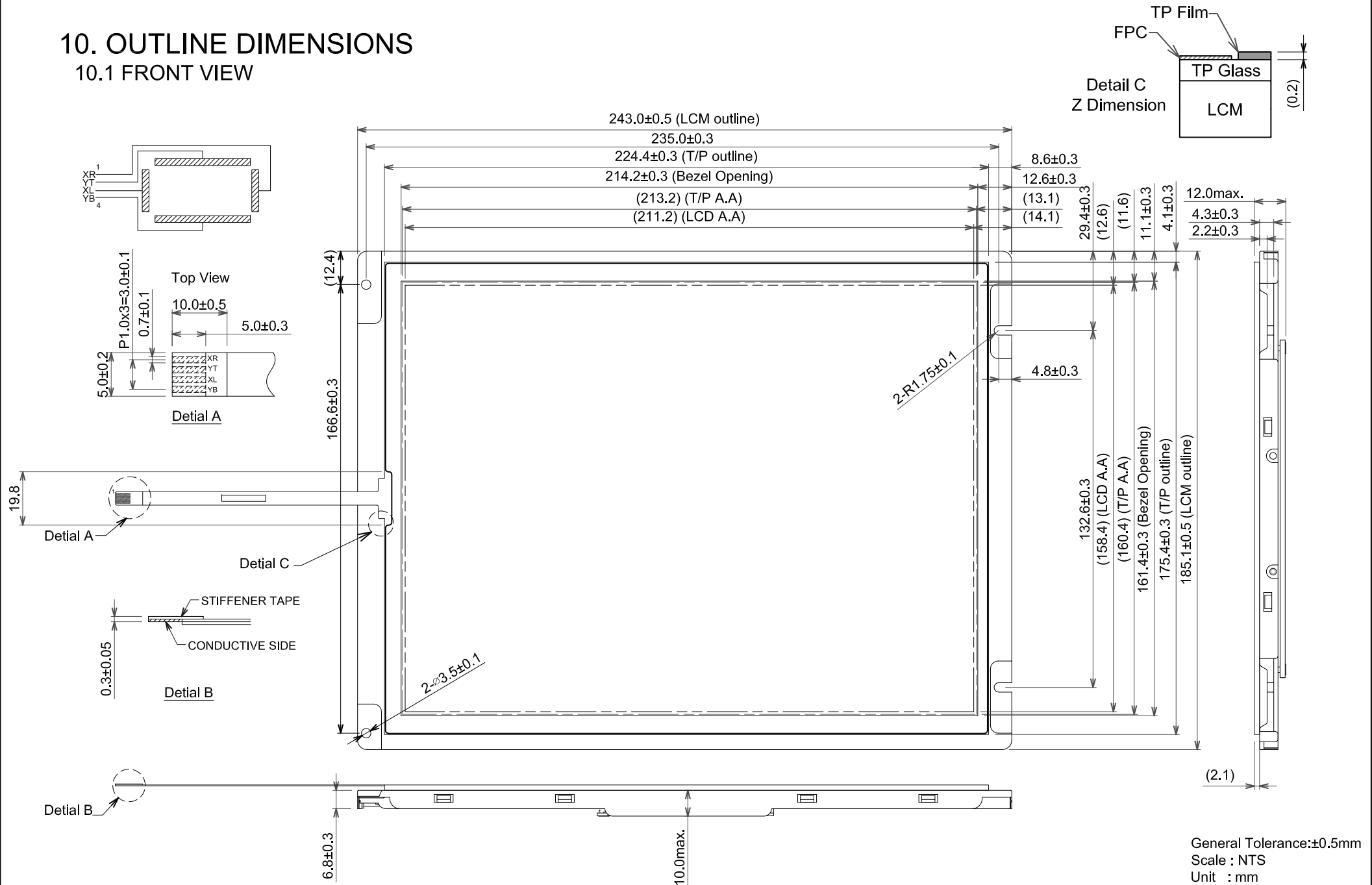


Note 1: In order to avoid any damages, V_{DD} has to be applied before all other signals. The opposite is true for power off where V_{DD} has to be remained on until all other signals have been switch off. The recommended time period is 1 second. Hot plugging might cause display damage due to incorrect power sequence, please pay attention on interface connecting before power on.

Note 2: In order to avoid showing uncompleted patterns in transient state. It is recommended that switching the backlight on is delayed for 1 second after the signals have been applied. The opposite is true for power off where the backlight has to be switched off 1 second before the signals are removed.

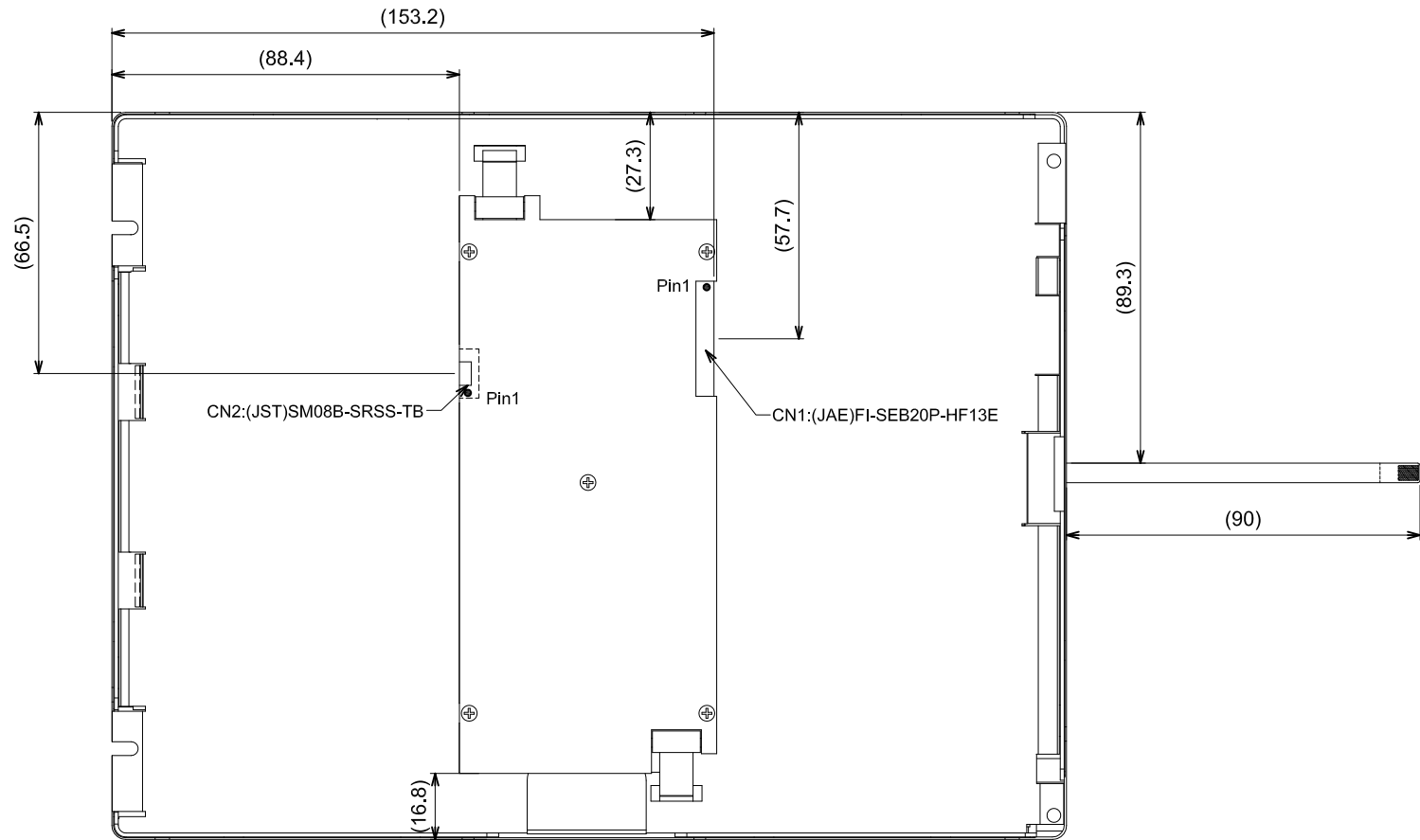
10. OUTLINE DIMENSIONS

10.1 FRONT VIEW



General Tolerance:±0.5mm
 Scale : NTS
 Unit : mm

10.2 REAR VIEW



General Tolerance:±0.5mm
 Scale : NTS
 Unit : mm

11. TOUCH PANEL

The type of touch panel used on this display is resistive, analog, 4-wire and film on glass, and more characteristics are shown as below:

11.1 OPERATING CONDITIONS

Item	Specification	Remarks
Operating Voltage	5VDC	-

11.2 ELECTRICAL CHARACTERISTICS

Item	Specification	Remarks
Resistance Between Terminal	X1-X2	310~1400Ω
	Y1-Y2	100~800Ω
Insulation Resistance	X-Y	20MΩ min. At 25V DC
Linearity	X	±1.5% max.
	Y	±1.5% max.
Chattering	10ms max.	-

Note 1: The test conditions and equipments of linearity are as below:

- Material of pen: poly-acetal resin
- End shape: R 0.8 mm
- Test force: 150 g
- Pitch: 10 mm
- Test area is shown in Fig. 11.1

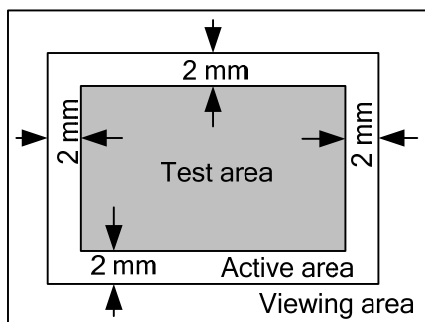


Fig. 11.1

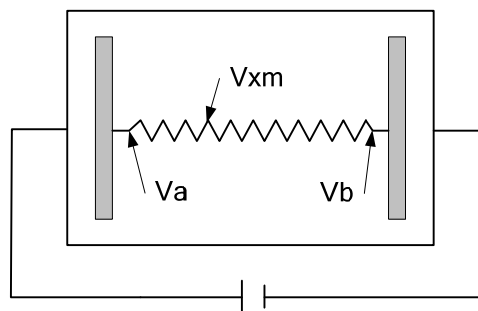


Fig. 11.2

As shown in Fig. 11.2, applying voltage meter to measure Va, Vb and Vxm, where Va is the maximum voltage in the active area; Vb is the minimum voltage in the active area; Vxm is the measured voltage of point x selected by random. Afterwards, the linearity can be calculated by following equation:

$$Linearity = \frac{|V_{xi} - V_{xm}|}{V_a - V_b} \times 100\%$$

where Vxi is the idea voltage of point x.

The method to measure the linearity of Y-axis is the same as above.

11.3 MECHANICAL CHARACTERISTICS

Item	Specification	Remarks
Pen Input Pressure	1.2N max.	R0.8, Polyacetal Pen
Finger	1.2N max.	R8.0, Silicon Rubber
Surface Hardness	3H min.	JIS K5600-5-4

11.4 OPTICAL CHARACTERISTICS

Item	Specification	Remarks
Transmittance	77% min.	-

11.5 SAFETY AND ATTENTIONS

- 1) Do not put heavy shock or stress on the touch panel.
- 2) Please use soft cloth or absorbent cotton with ethanol to clean the touch panel by gently wiping. Moreover, please wipe it by horizontal or vertical direction instead of circling to prevent leaving scars on the touch panel's surface.
- 3) Do not use any harmful chemicals such as acetone, toluene, and isopropyl alcohol to clean the display's surface.
- 4) UV protection is recommended to avoid the possibility of performance degrading when touch panel is likely applied under UV environment for a long period of time.

12. APPEARANCE STANDARD

The appearance inspection is performed in a room around 500~1000 lx based on the conditions as below:

- The distance between inspector's eyes and display is 30 cm.
- The viewing zone is defined with angle θ shown in Fig. 12.1 The inspection should be performed within 45° when display is shut down. The inspection should be performed within 5° when display is power on.

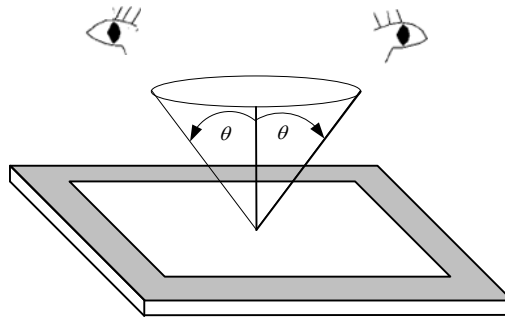


Fig. 12.1

12.1 THE DEFINITION OF LCD ZONE

LCD panel is divided into 2 areas as shown in Fig.12.2 for appearance specification in next section. A zone is the LCD active area (dot area); B zone is the area, between A zone and metal frame.

In terms of housing design, B zone is the recommended window area customers' housing should be located in.

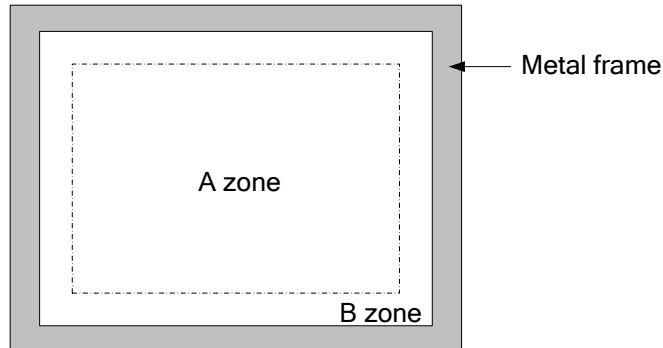


Fig. 12.2

12.2 LCD APPEARANCE SPECIFICATION

The specification as below is defined as the amount of unexpected phenomenon or material in different zones of LCD panel. The definitions of length, width and average diameter using in the table are shown in Fig. 12.3 and Fig. 12.4.

Item	Criteria				Applied zone	
	Length (mm)	Width (mm)	Maximum number	Minimum space		
Scratches	Ignored	$W \leq 0.02$	Ignored	-	A,B	
	$L \leq 40$	$0.02 < W \leq 0.04$	10	-		
	$L \leq 20$	$W \leq 0.04$	10	-		
	Serious one is not allowed					
Dent	Serious one is not allowed				A	
Wrinkles in polarizer	Serious one is not allowed				A	
Bubbles on polarizer	Average diameter (mm)		Maximum number		A	
	$D \leq 0.3$		Ignored			
	$0.3 < D \leq 0.5$		10			
	$0.5 < D \leq 1.0$		5			
	$1.0 < D$		none			
1) Stains 2) Foreign Materials 3) Dark Spot	Filamentous (Line shape)				A,B	
	Length (mm)	Width (mm)	Maximum number			
	L : Ignored	$W \leq 0.06$	Ignored			
	$L \leq 1.0$	$0.06 < W$	Ignored			
	$1.0 < L$		(See Dot shape)			
	Round (Dot shape)				A,B	
	Average diameter (mm)	Maximum number	Minimum Space			
	$D \leq 0.45$	Ignored	-			
	$0.45 < D \leq 0.7$	5	-			
	$0.7 < D$	none	-			
Those wiped out easily are acceptable						
Dot-Defect	Type		Maximum number		A (Note 1)	
	Bright dot-defect	1 dot		4		
		2 adjacent dot		2		
		3 adjacent dot or above		Not allowed		
		Density		$2/\phi 20\text{mm}$		
		In total		6		
	Dark dot-defect	1 dot		5		
		2 adjacent dot		2		
		3 adjacent dot or above		Not allowed		
		Density		$3/\phi 20\text{mm}$		
		In total		5		
In total		11				

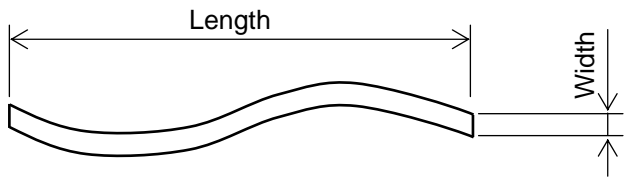
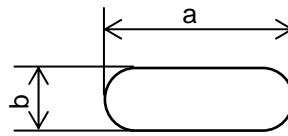


Fig 12.3

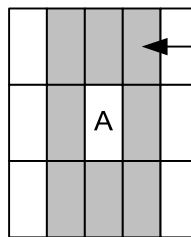


$$\text{Average diameter} = \frac{a+b}{2}$$

Fig 12.4

Note 1: The definitions of dot defect are as below:

- The defect area of the dot must be bigger than half of a dot.
- For bright dot-defect, showing black pattern, the dot's brightness must be over 30% brighter than others.
- For dark dot-defect, showing white pattern, the dot's brightness must be under 70% darker than others.
- The definition of 1-dot-defect is the defect-dot, which is isolated and no adjacent defect-dot.
- The definition of adjacent dot is shown as Fig. 12.5.
- The Density of dot defect is defined in the area within diameter $\phi = 20\text{mm}$.



The dots colored gray are adjacent to defect-dot A.

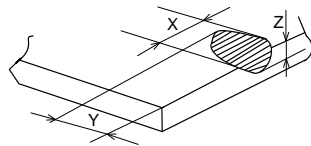
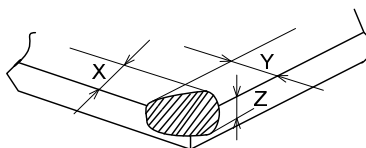
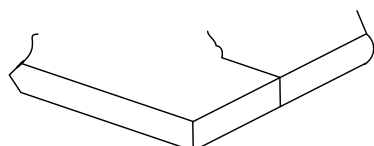
Fig. 12.5

12.3 TOUCH PANEL APPEARANCE SPECIFICATION

The specification as below is defined by the amount of unexpected material in different zones of touch panel.

Item	Criteria			Applied zone
Scratches	Width (mm)	Length (mm)	Maximum number	A
	$W > 0.1$	$L \geq 10$	Not allowed	
	$0.10 \geq W > 0.05$	$10 > L$	4 pcs max.	
	$0.05 \geq W$	$10 > L$	Ignored	
Foreign Materials	Filamentous (Line shape)			A
	Width (mm)	Length (mm)	Maximum number	
	$W > 0.05$	$3 < L$	Not allowed	
	$0.05 \geq W$	$3 \geq L$	Ignored	
	Round (Dot shape)			A
	Average diameter (mm)		Maximum number	
	$D > 0.35$		Not allowed	
	$0.35 \geq D > 0.25$		6 pcs max.	
$0.25 > D$		Ignored		

The limitation of glass flaw occurred on touch panel is defined in the table as below.

Item	Specifications	
Edge flaw		$X \leq 5.0 \text{ mm}$ $Y \leq 3.0 \text{ mm}$ $Z \leq \text{Thickness}$
Corner flaw		$X \leq 3.0 \text{ mm}$ $Y \leq 3.0 \text{ mm}$ $Z \leq \text{Thickness}$
Progressive flaw		Not allowed

13. PRECAUTIONS

13.1 PRECAUTIONS of MOUNTING

1) Please refer to Fig. 13.1 for housing the display with touch panel into applications. The Fig. 13.1 shows some points as below:

- The cushion needs to be designed between housing and touch panel in order to avoid unexpected pressure to cause any wrong reactions, and the cushion should be located in the insulated area.
- The housing should not cover the active area of touch panel as the figure shown.

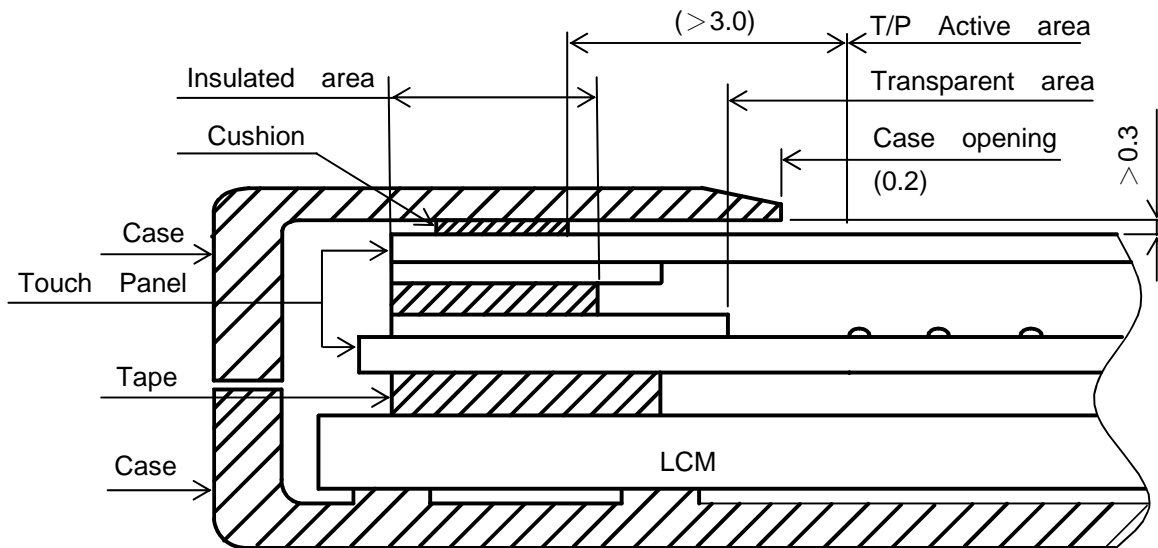


Fig 13.1

13.2 PRECAUTIONS of ESD

- 1) Before handling the display, please ensure your body has been connected to ground to avoid any damages by ESD. Also, do not touch display's interface directly when assembling.
- 2) Please remove the protection film very slowly before turning on the display to avoid generating ESD.

13.3 PRECAUTIONS of HANDLING

- 1) In order to keep the appearance of display in good condition, please do not rub any surfaces of the displays by sharp tools harder than 3H, especially touch panel, metal frame and polarizer.
- 2) Please do not pile the displays in order to avoid any scars leaving on the display. In order to avoid any injuries, please pay more attention for the edges of glasses and metal frame, and wear finger cots to protect yourself and the display before working on it.
- 3) Touching the display area or the terminal pins with bare hand is prohibited. This is because it will stain the display area and cause poor insulation between terminal pins, and might affect display's electrical characteristics furthermore.
- 4) Do not use any harmful chemicals such as acetone, toluene, and isopropyl alcohol to clean display's surfaces.
- 5) Please use soft cloth or absorbent cotton with ethanol to clean the display by gently wiping. Moreover, when wiping the display, please wipe it by horizontal or vertical direction instead of circling to prevent leaving scars on the display's surface, especially polarizer.

- 6) Please wipe any unknown liquids immediately such as saliva, water or dew on the display to avoid color fading or any permanently damages.
- 7) Maximum pressure to the surface of the display must be less than 1.96×10^4 Pa. If the area of adding pressure is less than 1 cm^2 , the maximum pressure must be less than 1.96N.

13.4 PRECAUTIONS OF OPERATING

- 1) Please input signals and voltages to the displays according to the values defined in the section of electrical characteristics to obtain the best performance. Any voltages over than absolute maximum rating will cause permanent damages to this display. Also, any timing of the signals out of this specification would cause unexpected performance.
- 2) When the display is operating at significant low temperature, the response time will be slower than it at 25°C . In high temperature, the color will be slightly dark and blue compared to original pattern. However, these are temperature-related phenomenon of LCD and it will not cause permanent damages to the display when used within the operating temperature.
- 3) The use of screen saver or sleep mode is recommended when static images are likely for long periods of time. This is to avoid the possibility of image sticking.
- 4) Spike noise can cause malfunction of the circuit. The recommended limitation of spike noise is no bigger than $\pm 100 \text{ mV}$.

13.5 PRECAUTIONS of STORAGE

If the displays are going to be stored for years, please be aware the following notices.

- 1) Please store the displays in a dark room to avoid any damages from sunlight and other sources of UV light.
- 2) The recommended long term storage temperature is between $10^\circ\text{C} \sim 35^\circ\text{C}$ and 55%~75% humidity to avoid causing bubbles between polarizer and LCD glasses, and polarizer peeling from LCD glasses.
- 3) It would be better to keep the displays in the container, which is shipped from KOE, and do not unpack it.
- 4) Please do not stick any labels on the display surface for a long time, especially on the polarizer.

14. DESIGNATION of LOT MARK

1) The lot mark is showing in Fig.14.1. First 4 digits are used to represent production lot, T represented made in Taiwan, and the last 6 digits are the serial number.

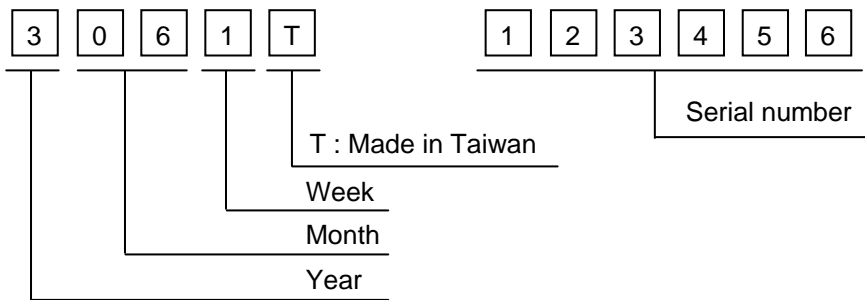


Fig. 14.1

2) The tables as below are showing what the first 4 digits of lot mark are shorted for.

Year	Mark
2014	4
2015	5
2016	6
2017	7
2018	8

Month	Mark	Month	Mark
1	01	7	07
2	02	8	08
3	03	9	09
4	04	10	10
5	05	11	11
6	06	12	12

Week (Days)	Mark
1~7	1
8~14	2
15~21	3
22~28	4
29~31	5

3) Except letters I and O, revision number will be shown on lot mark and following letters A to Z.

4) The location of the lot mark is on the back of the display shown in Fig. 14.2



Fig. 14.2