Doc. Number :

☐ Tentative Specification
☐ Preliminary Specification
■ Approval Specification

MODEL NO.: M220ZGE
SUFFIX: L20

Customer: Common

APPROVED BY **SIGNATURE**

Name / Title
Note
Product Version C8

Please return 1 copy for your confirmation with your signature and comments.

Approved By	Checked By	Prepared By
陳立錚	徐煥效	劉燕燕

CONTENTS

1. GENERAL DESCRIPTION 5
1.1 OVERVIEW 5
1.2 GENERAL SPECIFICATI0NS 5
2. MECHANICAL SPECIFICATIONS 6
3. ABSOLUTE MAXIMUM RATINGS 6
3.1 ABSOLUTE RATINGS OF ENVIRONMENT 6
3.2 ELECTRICAL ABSOLUTE RATINGS 7
3.2.1 TFT LCD MODULE 7
3.2.2 BACKLIGHT UNIT 7
4. ELECTRICAL SPECIFICATIONS 8
4.1 FUNCTION BLOCK DIAGRAM 8
4.2. INTERFACE CONNECTIONS 9
4.3 ELECTRICAL CHARACTERISTICS 11
4.3.1 LCD ELETRONICS SPECIFICATION 11
4.3.2 VCC POWER DIP CONDITION 13
4.3.3 BACKLIGHT UNIT 13
4.3.4 LIGHTBAR CONNECTOR PIN ASSIGNMENT 14
4.4 LVDS INPUT SIGNAL SPECIFICATIONS 16
4.4.1 LVDS DATA MAPPING TABLE 16
4.4.2 COLOR DATA INPUT ASSIGNMENT 17
4.5 DISPLAY TIMING SPECIFICATIONS 18
4.6 POWER ON/OFF SEQUENCE 20
5. OPTICAL CHARACTERISTICS 21
5.1 TEST CONDITIONS 21
5.2 OPTICAL SPECIFICATIONS 21
6. RELIABILITY TEST ITEM 24
7. MECHANICAL STRENGTH CHARACTERISTICS 25
7.1 MECHANICAL STRENGTH SPECIFICATIONS 25
7.2 TEST CONDITIONS 25
7.3 DEFINITION OF TEST POINTS 25
8. PACKING 26
8.1 PACKING SPECIFICATIONS 26
8.2 PACKING METHOD 26
8.3 PALLET 27
8.4 UN-PACKING METHOD 28

9. INX MODULE LABEL 29
10. PRECAUTIONS 30
10.1 ASSEMBLY AND HANDLING PRECAUTIONS 30
10.2 STORAGE PRECAUTIONS 30
10.3 OPERATION PRECAUTIONS 31
10.4 SAFETY PRECAUTIONS 31
10.5 SAFETY STANDARDS 31
10.6 OTHER 31
Appendix 1. SYSTEM COVER DESIGN NOTICE 32
Appendix 2. OUTLINE DRAWING 35

REVISION HISTORY

<table>
<tr><th>Version</th><th>Date</th><th>Page</th><th>Description</th></tr>
<tr><td>3.0</td><td>04.02.2019</td><td>All</td><td>Spec Ver.3.0(C8) was first issued.</td></tr>
<tr><td>3.1</td><td>08.01.2019</td><td>21</td><td>Color Chromaticity(CIE 1931)
Before:
<table>
<tr><th colspan="2">Item</th><th>Symbol</th><th>Condition</th><th>Min.</th><th>Typ.</th><th>Max.</th><th>Unit</th><th>Note</th></tr>
<tr><td rowspan="8">Color Chromaticity (CIE 1931)</td><td rowspan="2">Red</td><td>Rx</td><td rowspan="8">θx=0°, θY =0°
CS-2000
R=G=B=255
Gray scale</td><td rowspan="8">Typ – 0.03</td><td>0.645</td><td rowspan="8">Typ + 0.03</td><td rowspan="8">-</td><td rowspan="8">(1), (5)</td></tr>
<tr><td>Ry</td><td>0.342</td></tr>
<tr><td rowspan="2">Green</td><td>Gx</td><td>0.309</td></tr>
<tr><td>Gy</td><td>0.634</td></tr>
<tr><td rowspan="2">Blue</td><td>Bx</td><td>0.151</td></tr>
<tr><td>By</td><td>0.059</td></tr>
<tr><td rowspan="2">White</td><td>Wx</td><td>0.313</td></tr>
<tr><td>Wy</td><td>0.329</td></tr>
</table>
After:
<table>
<tr><th colspan="2">Item</th><th>Symbol</th><th>Condition</th><th>Min.</th><th>Typ.</th><th>Max.</th><th>Unit</th><th>Note</th></tr>
<tr><td rowspan="8">Color Chromaticity (CIE 1931)</td><td rowspan="2">Red</td><td>Rx</td><td rowspan="8">θx=0°, θY =0°
CS-2000
R=G=B=255
Gray scale</td><td rowspan="8">Typ – 0.03</td><td>0.640</td><td rowspan="8">Typ + 0.03</td><td rowspan="8">-</td><td rowspan="8">(1), (5)</td></tr>
<tr><td>Ry</td><td>0.342</td></tr>
<tr><td rowspan="2">Green</td><td>Gx</td><td>0.320</td></tr>
<tr><td>Gy</td><td>0.628</td></tr>
<tr><td rowspan="2">Blue</td><td>Bx</td><td>0.155</td></tr>
<tr><td>By</td><td>0.056</td></tr>
<tr><td rowspan="2">White</td><td>Wx</td><td>0.313</td></tr>
<tr><td>Wy</td><td>0.329</td></tr>
</table></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

1. GENERAL DESCRIPTION

1.1 OVERVIEW

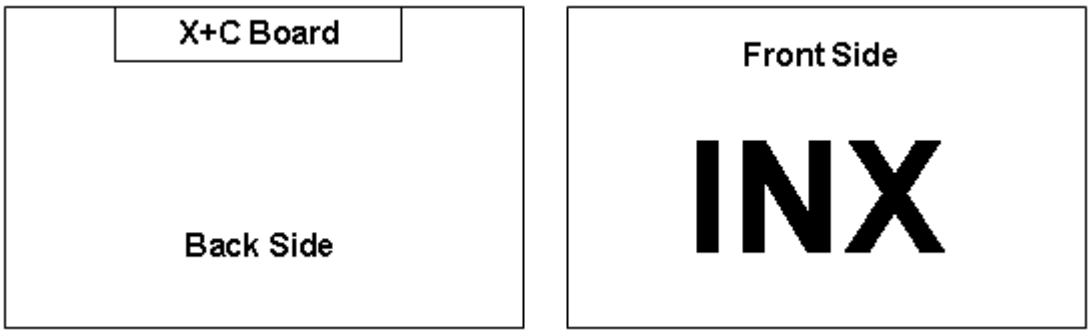
The M220ZGE-L20 model is a 22 inch wide TFT-LCD slimming MNT module with a WLED light bar Backlight Unit and a 30-pin 2ch-LVDS interface. This module supports 1680 x 1050 WSXGA$^+$ (16:10 wide screen) mode and displays up to 16.7 millions colors. The converter module for the Backlight Unit is not built in.

1.2 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Screen Size	22	inch	
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	1680 x R.G.B. x 1050	pixel	-
Pixel Pitch	0.282(H) x 0.282(V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7M(6bit+FRC)	color	-
Transmissive Mode	Normally White	-	-
Surface Treatment	Hard coating (3H), AG (Haze 25%)	-	-
Luminance, White	250 (typical)	Cd/m2	
Color Gamut	72% of NTSC(Typ.)	-	-
Display Orientation	Signal input with “ INX”		(2)
RoHS,Halogen Free &TCO 8.0	RoHS, Halogen Free TCO8.0 compliance	-	-
Power Consumption	Total 12.94W (Max.) @ cell 6W (Max.), BL 6.94W (Max.)		(1)

Note (1) The specified power consumption : Total= cell (reference 4.3.1)+BL (reference 4.3.3)

Note (2)



2. MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	493.2	493.7	494.2	mm	(1)
	Vertical (V)	319.6	320.1	320.6	mm	
	Thickness (T)	10.5	11	11.5	mm	
Bezel Area	Horizontal	477.4	477.7	478	mm	
	Vertical	299.8	300.1	300.4	mm	
Active Area	Horizontal	-	473.76	-	mm	
	Vertical	-	296.1	-	mm	
Weight		1767	1860	1953	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	TST	-20	+60	ºC	(1)
Operating Ambient Temperature	TOP	0	+50	ºC	(1), (2)

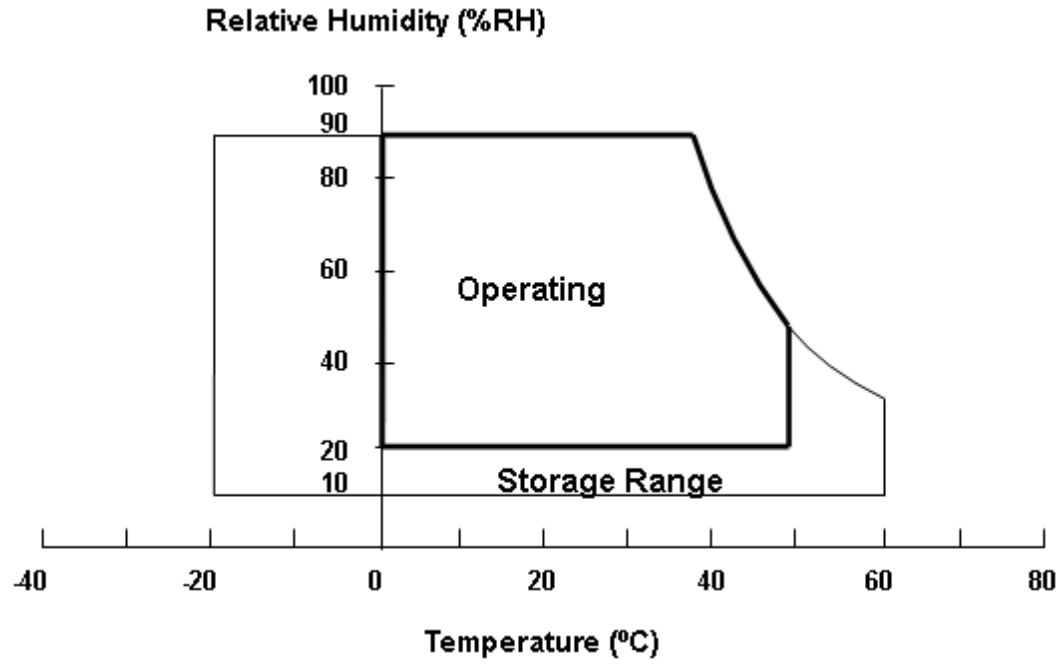
Note (1)

(a) 90 %RH Max..

(b) Wet-bulb temperature should be 39 ºC Max..

(c) No condensation.

Note (2) Panel surface temperature should be 0℃ min. and 65℃ max under Vcc=5.0V, fr =60Hz, typical LED string current, 25℃ ambient temperature, and no humidity control . Any condition of ambient operating temperature ,the surface of active area should be keeping not higher than 65℃.



3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCCS	-0.3	6	V	(1)
Logic Input Voltage	VIN	-0.3	3.6	V	

3.2.2 BACKLIGHT UNIT

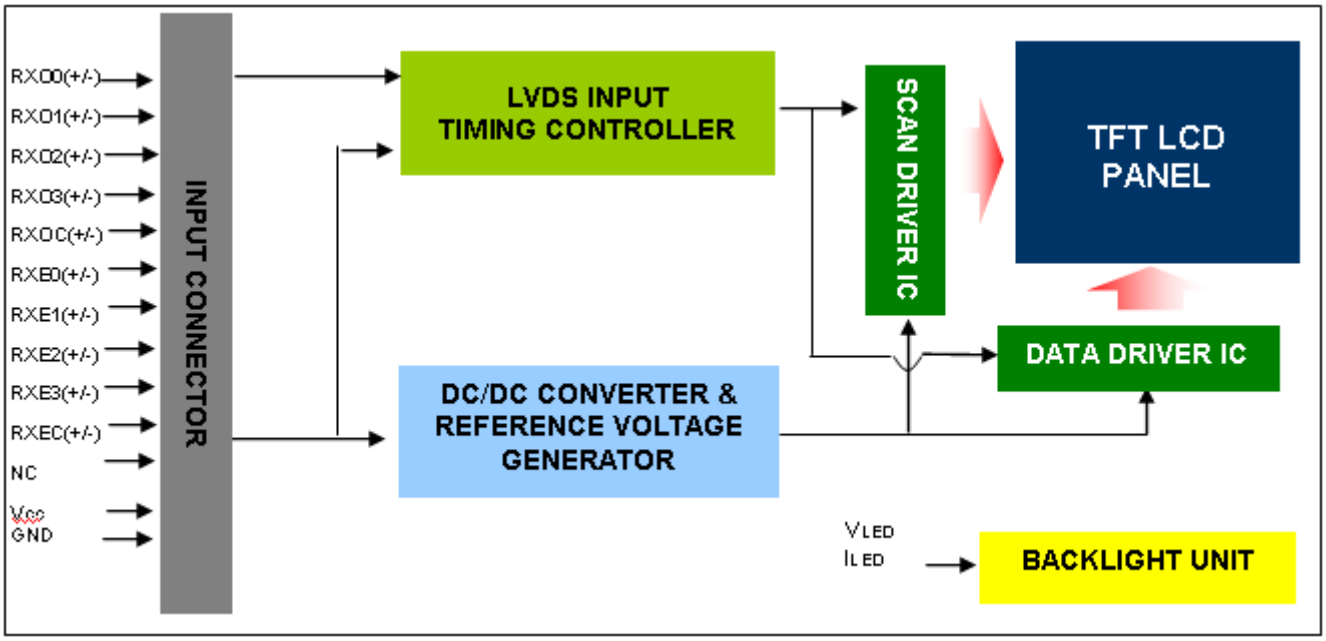
Item	Symbol	Value			Unit	Note
		Min.	Typ	Max.		
LED Forward Current Per Input Pin	I_F	38.5	40	42.5	mA	(1), (2) Duty=100%
LED Pulse Forward Current Per Input Pin	I_P	---	---	470	mA	(1), (2) Pulse Width≦10msec. and Duty≦30%

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for input pin of LED light bar at Ta=25±2 ℃ (Refer to 4.3.3 and 4.3.4 for further information).

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM



4.2. INTERFACE CONNECTIONS

PIN ASSIGNMENT

Pin	Name	Description
1	RXO0-	Negative LVDS differential data input. Channel O0 (odd)
2	RXO0+	Positive LVDS differential data input. Channel O0 (odd)
3	RXO1-	Negative LVDS differential data input. Channel O1 (odd)
4	RXO1+	Positive LVDS differential data input. Channel O1 (odd)
5	RXO2-	Negative LVDS differential data input. Channel O2 (odd)
6	RXO2+	Positive LVDS differential data input. Channel O2 (odd)
7	GND	Ground
8	RXOC-	Negative LVDS differential clock input. (odd)
9	RXOC+	Positive LVDS differential clock input. (odd)
10	RXO3-	Negative LVDS differential data input. Channel O3(odd)
11	RXO3+	Positive LVDS differential data input. Channel O3 (odd)
12	RXE0-	Negative LVDS differential data input. Channel E0 (even)
13	RXE0+	Positive LVDS differential data input. Channel E0 (even)
14	GND	Ground
15	RXE1-	Negative LVDS differential data input. Channel E1 (even)
16	RXE1+	Positive LVDS differential data input. Channel E1 (even)
17	GND	Ground
18	RXE2-	Negative LVDS differential data input. Channel E2 (even)
19	RXE2+	Positive LVDS differential data input. Channel E2 (even)
20	RXEC-	Negative LVDS differential clock input. (even)
21	RXEC+	Positive LVDS differential clock input. (even)
22	RXE3-	Negative LVDS differential data input. Channel E3 (even)
23	RXE3+	Positive LVDS differential data input. Channel E3 (even)
24	GND	Ground
25	NC	For LCD internal use only, Do not connect
26	NC	For LCD internal use only, Do not connect
27	NC	For LCD internal use only, Do not connect
28	Vcc	+5.0V power supply
29	Vcc	+5.0V power supply
30	Vcc	+5.0V power supply

Note (1) Connector Part No.:

Foxconn GS23301-0321R-7H or equivalent

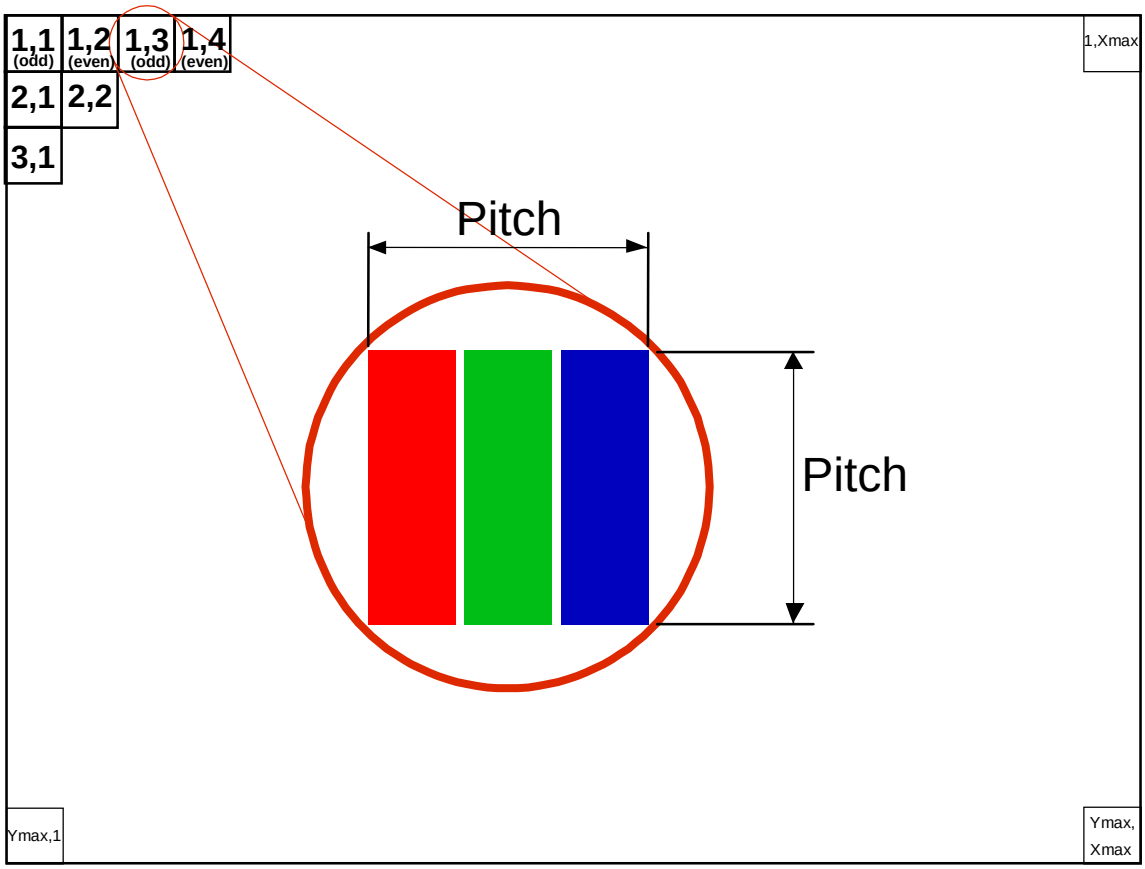
Note (2) User's connector Part No:

Mating Wire Cable Connector Part No.: FI-X30H(JAE) or FI-X30HL(JAE)

Mating FFC Cable Connector Part No.: 217007-013001 (P-TWO) or JF05X030-1 (JAE).

Note (3) The first pixel is odd.

Note (4) Input signal of even and odd clock should be the same timing.



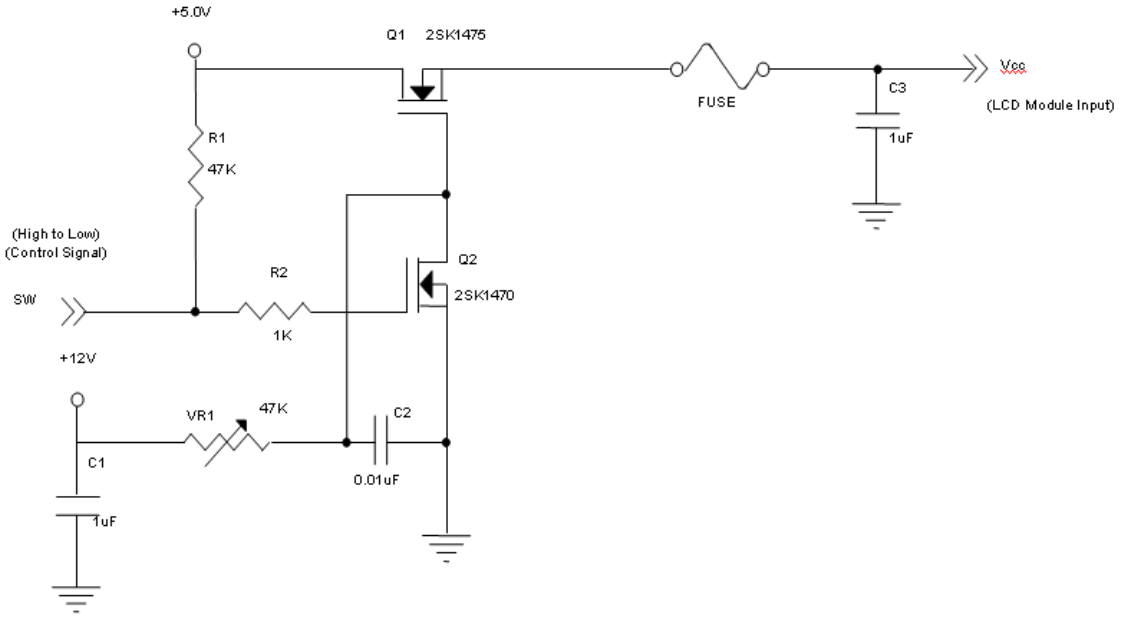
4.3 ELECTRICAL CHARACTERISTICS

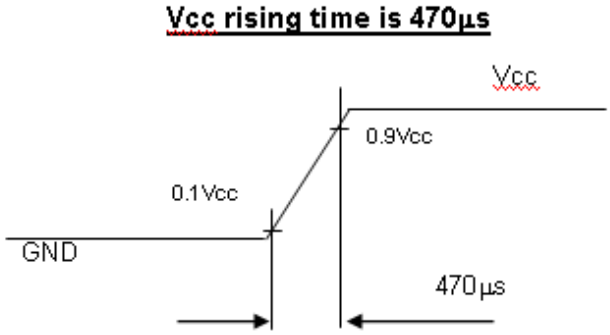
4.3.1 LCD ELETRONICS SPECIFICATION

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	4.5	5.0	5.5	V	-
Ripple Voltage		V_{RP}	-	--	300	mV	-
Rush Current		I_{RUSH}	-	--	3	A	(2)
Power Supply Current	White	-	-	0.36	0.52	A	(3)a
	Black	-	-	0.65	1.2	A	(3)b
	Vertical Stripe	-	-	0.4	0.6	A	(3)c
Power Consumption		PLCD	-	3.25	6	Watt	(4)(6)
LVDS differential input voltage		Vid	100	-	600	mV	
LVDS common input voltage		Vic	1.0	1.2	1.4	V	
Logic High Input Voltage		VIH	2.0	-	-	V	
Logic Low Input Voltage		VIL	-	-	0.8	V	

Note (1) The ambient temperature is Ta = 25 ± 2 ºC.

Note (2) Measurement Conditions:





Note (3) The specified power supply current is under the conditions at Vcc = 5.0 V, Ta = 25 ± 2 ºC, Fr = 60Hz, whereas a power dissipation check pattern below is displayed.

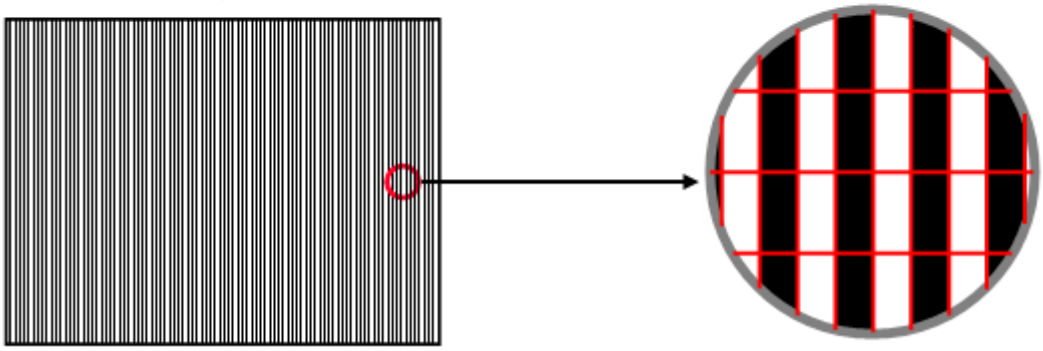
a. White Pattern

Active Area

b. Black Pattern

Active Area

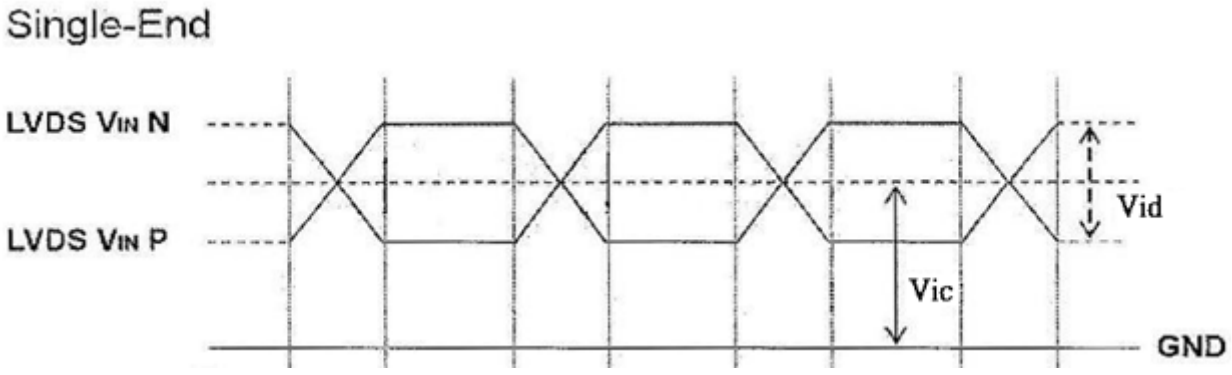
c. Vertical Stripe Pattern



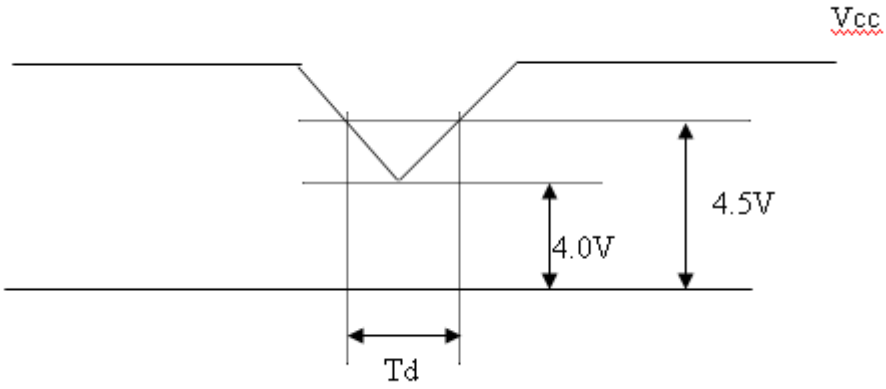
Active Area

Note (4) The power consumption is specified at the pattern with the maximum current.

Note (5) VID waveform condition



4.3.2 VCC POWER DIP CONDITION



4.3.3 BACKLIGHT UNIT

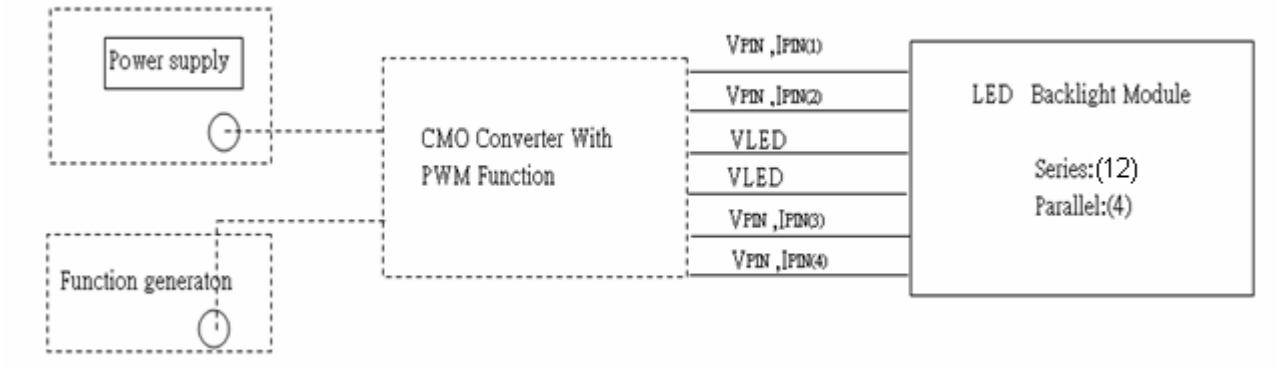
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Input Voltage Per Input Pin	VPIN	35	39.2	43.4	V	(1), Duty=100%, IPIN=40mA
LED Light Bar Current Per Input Pin	IPIN	38.5	40	42.5	mA	(1), (2) Duty=100%
LED Life Time	LLED	40000			Hrs	(3)
Power Consumption	PBL	--	6.27	6.94	W	(1) Duty=100%, IPIN=40mA

Note (1) LED light bar input voltage and current are measured by utilizing a true RMS multimeter as shown below:

Note (2) PBL = IPIN × VPIN × 4 input pins ,

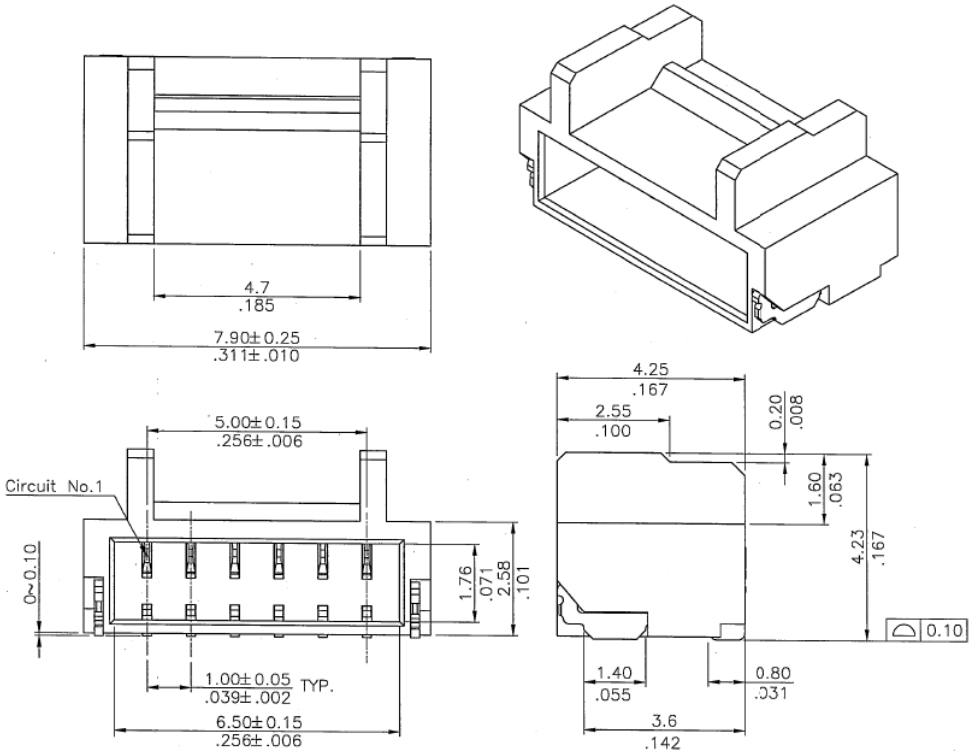
Note (3) The lifetime of LED is defined as the time when LED packages continue to operate under the conditions at Ta = 25 ±2 ℃ and I= 40mA per chip until the brightness becomes ≦ 50% of its original value.

Note (4) The module must be operated with constant driving current.



4.3.4 LIGHTBAR CONNECTOR PIN ASSIGNMENT

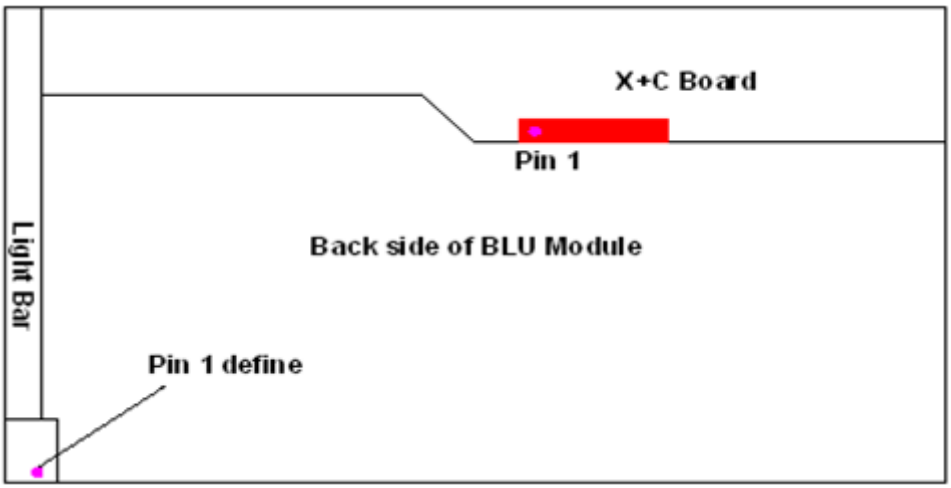
Connector: WM13-406-063N (FCN)



Other equivalents please refer to individual drawing

CN1

Pin number	Description
1	Cathode of LED string1
2	Cathode of LED string2
3	VLED
4	VLED
5	Cathode of LED string3
6	Cathode of LED string4



4.4 LVDS INPUT SIGNAL SPECIFICATIONS

4.4.1 LVDS DATA MAPPING TABLE

LVDS Channel O0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	OG0	OR5	OR4	OR3	OR2	OR1	OR0
LVDS Channel O1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	OB1	OB0	OG5	OG4	OG3	OG2	OG1
LVDS Channel O2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	OB5	OB4	OB3	OB2
LVDS Channel O3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	OB7	OB6	OG7	OG6	OR7	OR6
LVDS Channel E0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	EG0	ER5	ER4	ER3	ER2	ER1	ER0
LVDS Channel E1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	EB1	EB0	EG5	EG4	EG3	EG2	EG1
LVDS Channel E2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	EB5	EB4	EB3	EB2
LVDS Channel E3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	EB7	EB6	EG7	EG6	ER7	ER6

4.4.2 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	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	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	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	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
Gray Scale Of Red	Red(0) / Dark	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
Gray Scale Of Green	Green(0) / Dark	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	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	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	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	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
Gray Scale Of Blue	Blue(0) / Dark	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	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	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	0	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

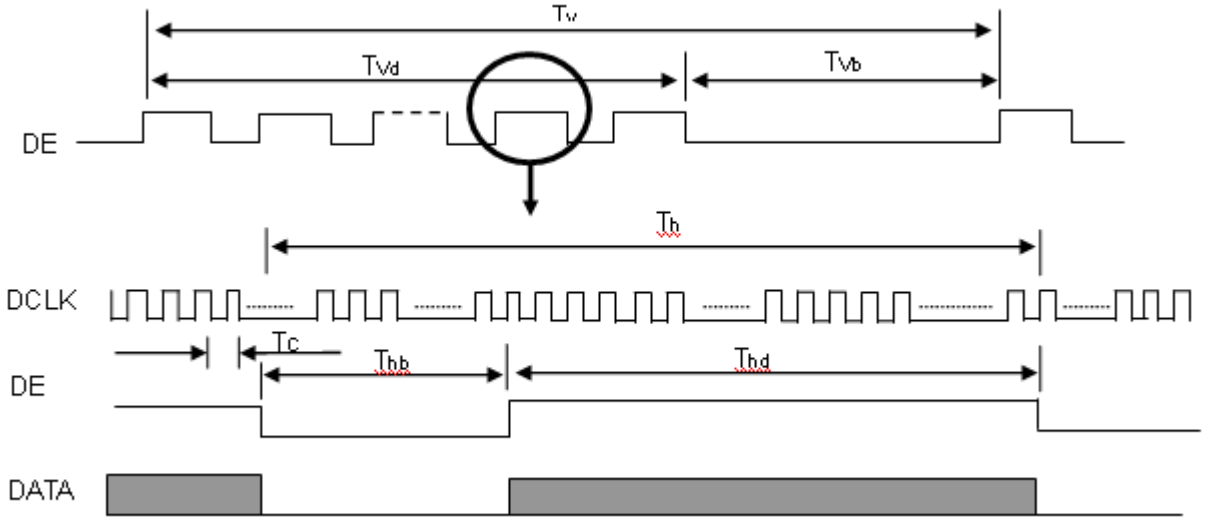
4.5 DISPLAY TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

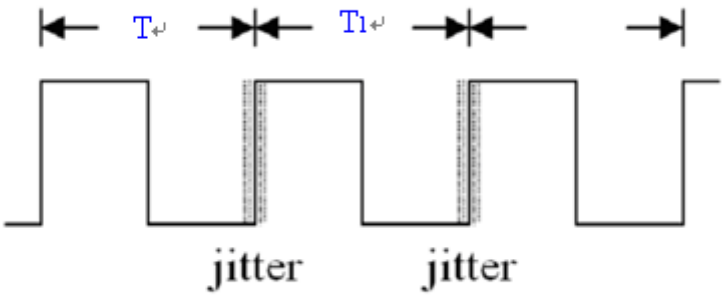
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	49	60	81	MHz	-
	Period	Tc	13	16.7	20	ns	
	Input cycle to cycle jitter	T_{rcl}	-0.02*Tc	-	0.02*Tc	ps	(1)
	Input Clock to data skew	TLVCCS	-0.02*Tc		0.02*Tc	ns	(2)
	Spread spectrum modulation range	F_{clkin_mod}	0.97*Fc	-	1.03*Fc	MHz	(3)
	Spread spectrum modulation frequency	F_{SSM}	-	-	100	KHz	
Vertical Display Term	Frame Rate	Fr	49	60	77	Hz	Tv=Tvd+Tvb
	Total	Tv	1077	1080	1216	Th	-
	Active Display	Tvd	1050	1050	1050	Th	-
	Blank	Tvb	Tv-Tvd	30	Tv-Tvd	Th	-
Horizontal Display Term	Total	Th	910	920	929	Tc	Th=Thd+Thb
	Active Display	Thd	840	840	840	Tc	-
	Blank	Thb	Th-Thd	80	Th-Thd	Tc	-

Note: Because this module is operated by DE only mode, Hsync and Vsync input signals are ignored.

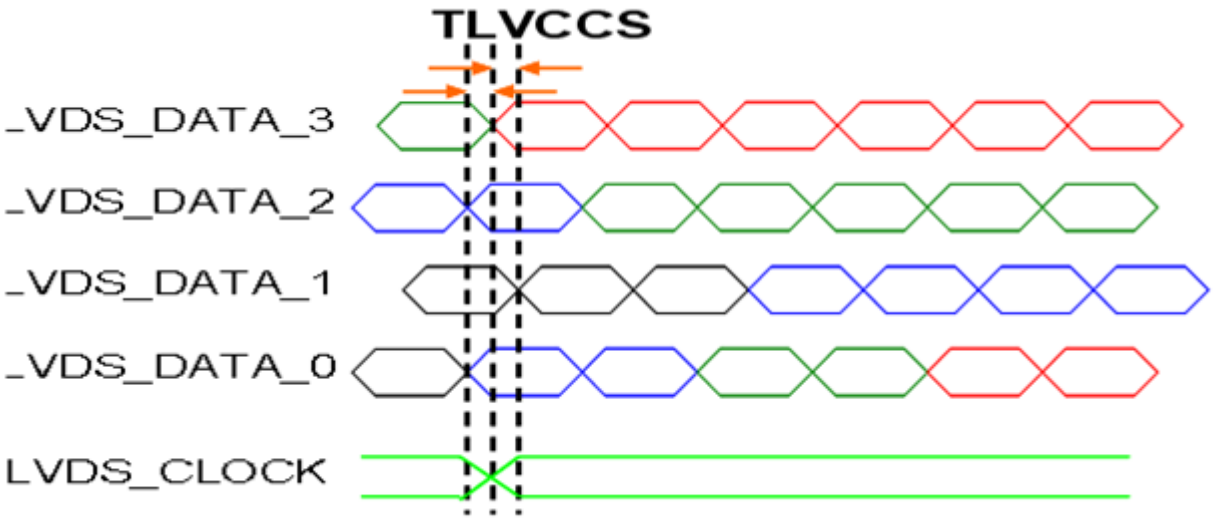
INPUT SIGNAL TIMING DIAGRAM



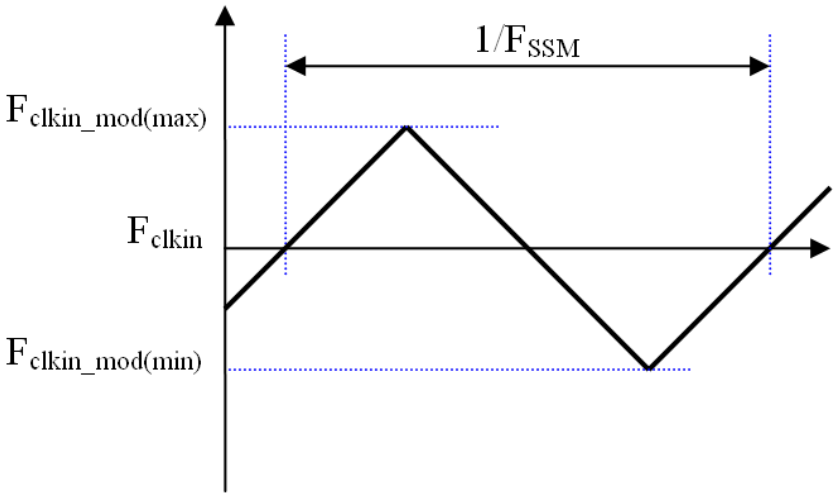
Note (1) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T_1 – TI



Note (2) Input Clock to data skew is defined as below figures.



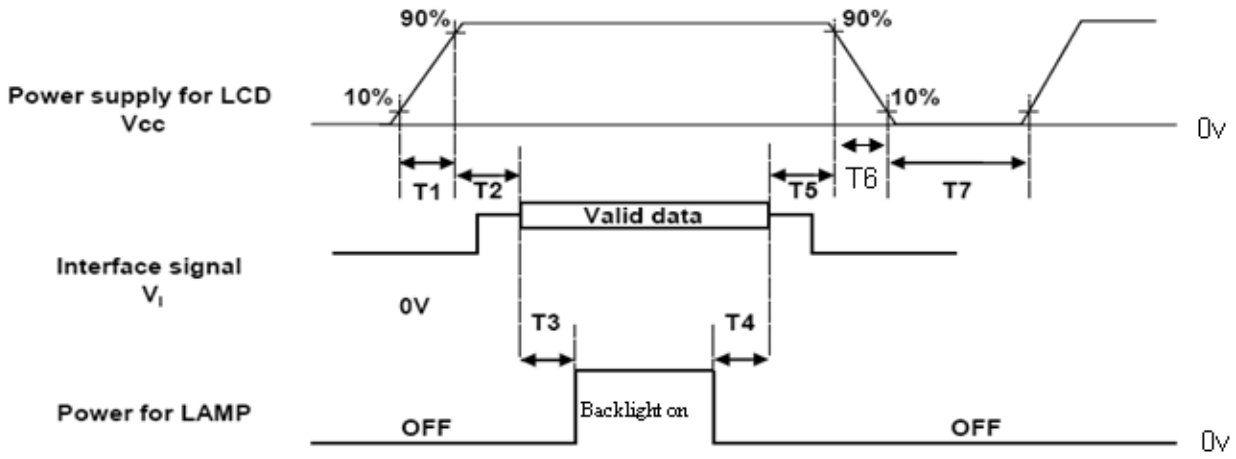
Note (3) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note(4) The DCLK range at last line of V-blank should be set in 0 to Hdisplay/2

4.6 POWER ON/OFF SEQUENCE

The power sequence specifications are shown as the following table and diagram**.**



Timing Specifications:

Parameters	Values			Units
	Min	Typ.	Max	
T1	0.5		10	ms
T2	0	30	50	ms
T3	200	250		ms
T4	100	250		ms
T5	0	20	50	ms
T6	0.5		100	ms
T7	1000			ms

Note (1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.

Note (2) When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become abnormal screen.

Note (3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

Note (6) INX won’ t take any responsibility for the products which are damaged by the customers not following the Power Sequence.

Note (7) There might be slight electronic noise when LCD is turned off (even backlight unit is also off). To avoid this symptom, we suggest "Vcc falling timing" to follow "t6 spec".

5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

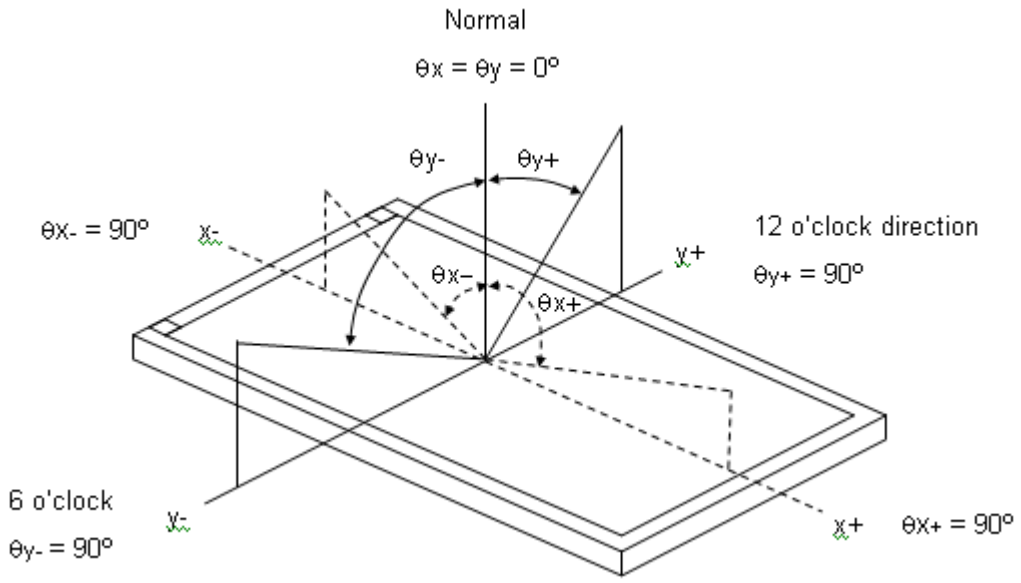
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	5	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current Per Input Pin	I_{PIN}	40 ± 1.5	mA_{DC}
PWM Duty Ratio	D	100	%
LED Light Bar Test Converter	INX TEST01001 T2-D1		

5.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 5.2. The following items should be measured under the test conditions described in 5.1 and stable environment shown in Note (5).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	Rx	θ_x=0°, θ_Y =0° CS-2000 R=G=B=255 Gray scale	Typ – 0.03	0.640	Typ + 0.03	-	(1), (5)
		Ry			0.342			
	Green	Gx			0.320			
		Gy			0.628			
	Blue	Bx			0.155			
		By			0.056			
	White	Wx			0.313			
		Wy			0.329			
Center Luminance of White (Center of Screen)		L_C		200	250	-	cd/m^2	(4), (5)
Contrast Ratio		CR		700	1000	-	-	(2), (5)
Response Time		T_R	θ_x=0°, θ_Y =0°	-	1.3	2.2	ms	(3)
		T_F		-	3.7	5.8		
White Variation		δW	θ_x=0°, θ_Y =0°	75	80		-	(5), (6)
Viewing Angle	Horizontal	θx- + θx+	CR ≧ 10	150	170	-	Deg.	(1), (5)
	Vertical	θy- + θy+		140	160	-		
Viewing Angle	Horizontal	θx- + θx+	CR ≧ 5	160	178	---	Deg.	(1), (5)
	Vertical	θy- + θy+		150	170	---		

Note (1) Definition of Viewing Angle (θx, θy):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

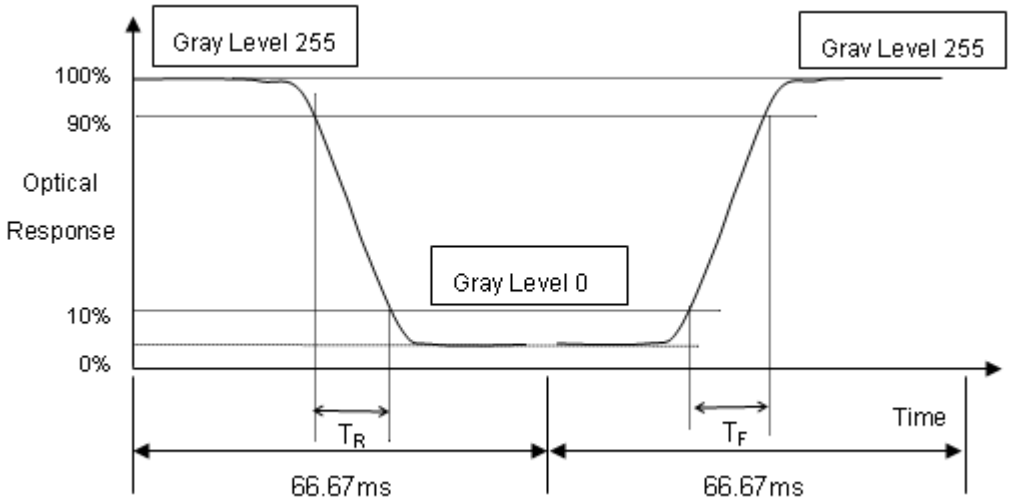
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R, T_F):



Note (4) Definition of Luminance of White (L_C):

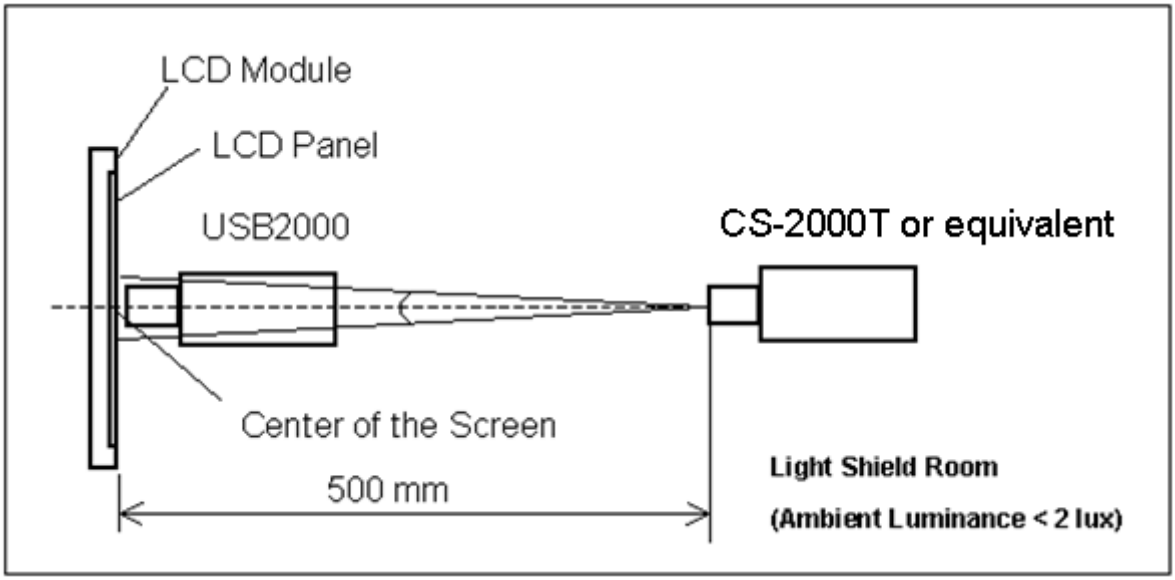
Measure the luminance of gray level 255 at center point

L_C = L (5)

L (x) is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

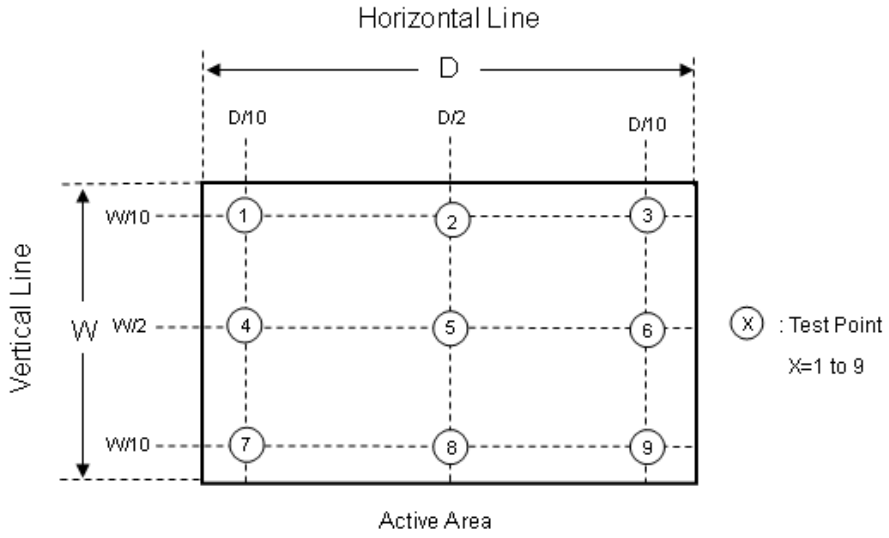
The LCD module should be stabilized at given temperature for 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.



Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 9 points

δW = (Minimum [L (1) ~ L (9)] / Maximum [L (1) ~ L (9)]) *100%



6. RELIABILITY TEST ITEM

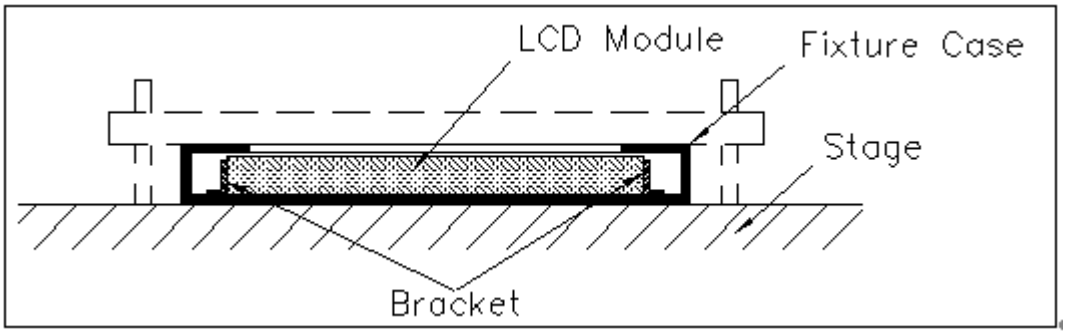
Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50℃ , 80%RH, 240hours	(1)(2)
High Temperature Operation (HTO)	Ta= 50℃ , 240hours	(1)(2)
Low Temperature Operation (LTO)	Ta= 0℃ , 240hours	(1)(2)
High Temperature Storage (HTS)	Ta= 60℃ , 240hours	(1)(2)
Low Temperature Storage (LTS)	Ta= -20℃ , 240hours	(1)(2)
Vibration Test (Non-operation)	Acceleration: 1.5 G Wave:Sine Frequency: 10 - 300 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	(3)
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 11 ms Direction : ± X, ± Y, ± Z.(one time for each Axis)	(3)
Thermal Shock Test (TST)	-20℃/30min , 60℃ / 30min , 100 cycles	(1)(2)
On/Off Test	25℃ ,On/10sec , Off /10sec , 30,000 cycles	(1)
ESD (Electro Static Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω)	(1)
	Air Discharge: ± 15KV, 150pF(330Ω)	(1)
Altitude Test	Operation:16,404 ft / 24hours Non-Operation:30,000 ft / 24hours	(1)(2)

Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:



7. MECHANICAL STRENGTH CHARACTERISTICS

7.1 MECHANICAL STRENGTH SPECIFICATIONS

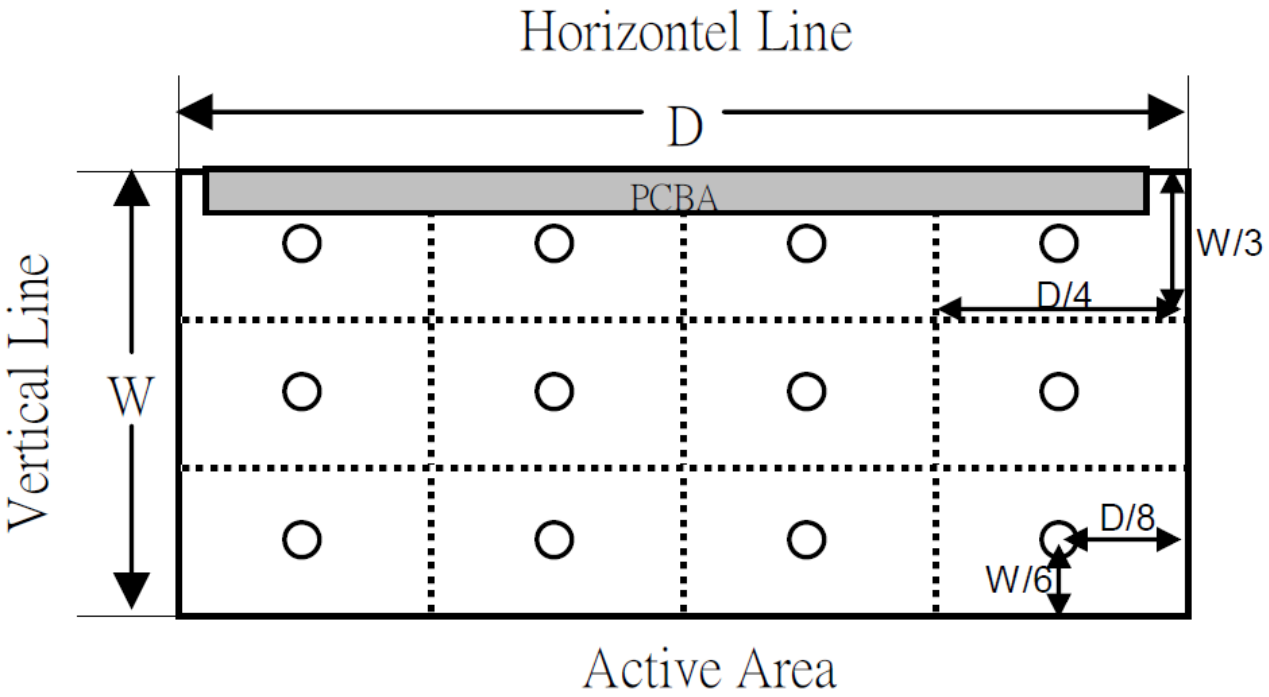
Item	Condition	Min	Unit	Note
Mechanical Strength	128th Gray Pattern	0.6	Kgf	

7.2 TEST CONDITIONS

Items	Description
Test Condition	1. Ambient Illumination : 10~15 lux 2. Test Pattern : 128 Gray 3. Distance of the judgment : 30cm from the surface of module 4. Viewing angle of the judgment : Front
Gage Information	1. Push pull guage a. Model name : HF-50, maker : ALGOL b. Shape of gage tip - Diameter : 2mm - Thickness : 2mm
Definition of Minimum force	To measure minimum force when operator detects any white spot and light leakage that have occurred while operator presses on back side of module with push pull gage.

7.3 DEFINITION OF TEST POINTS

Measure the minimum force of test points at 128th Gray pattern. The test points at back side of module area is showing as below (If the test points on the PCBA or TP board, these points are not included).



8. PACKING

8.1 PACKING SPECIFICATIONS

(1) 11 LCD modules / 1 Box

(2) Box dimensions: 567(L) X 278 (W) X 417 (H) mm

(3) Weight: approximately: 22.8 Kg (11 modules per box)

8.2 PACKING METHOD

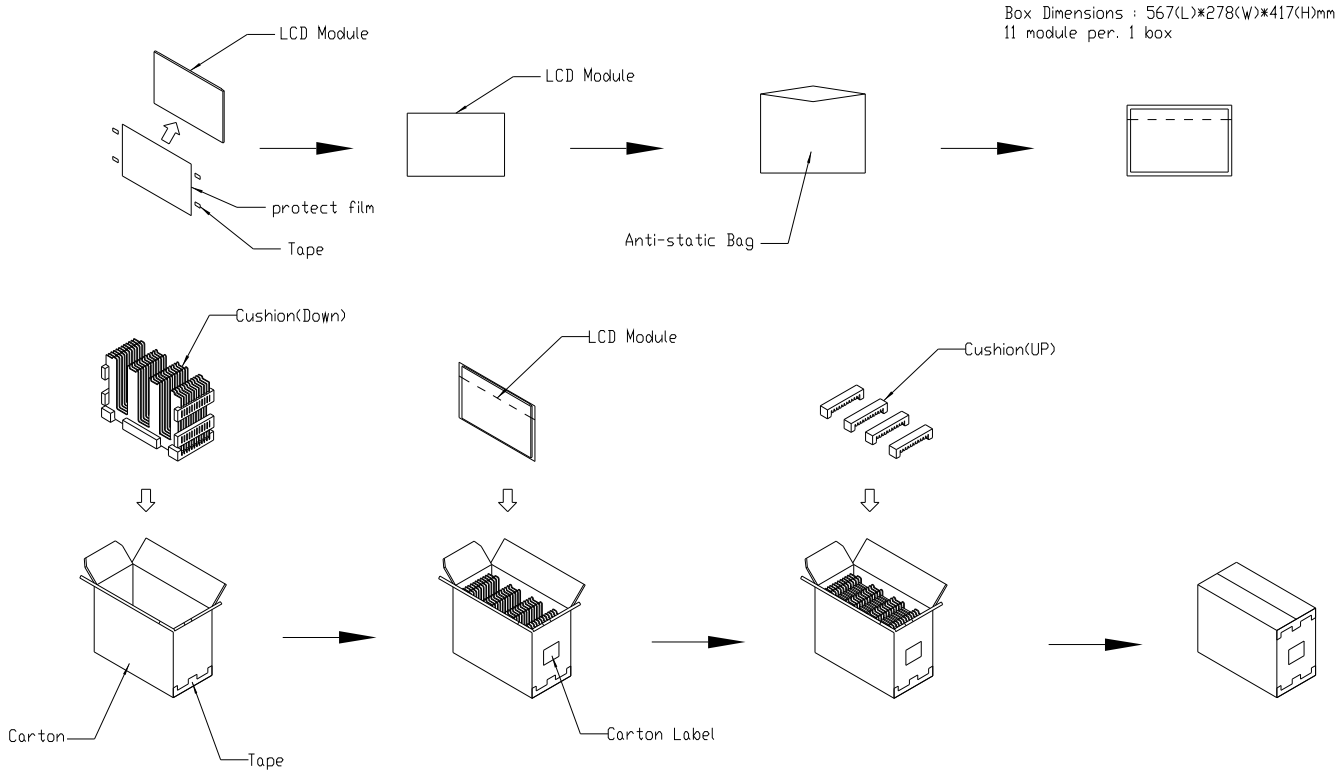
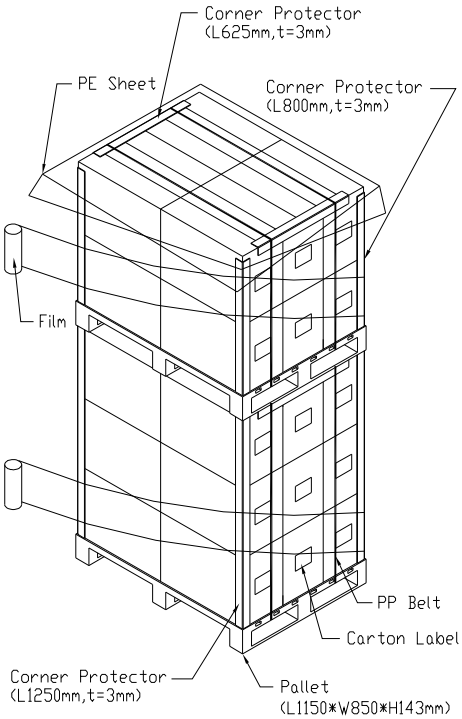


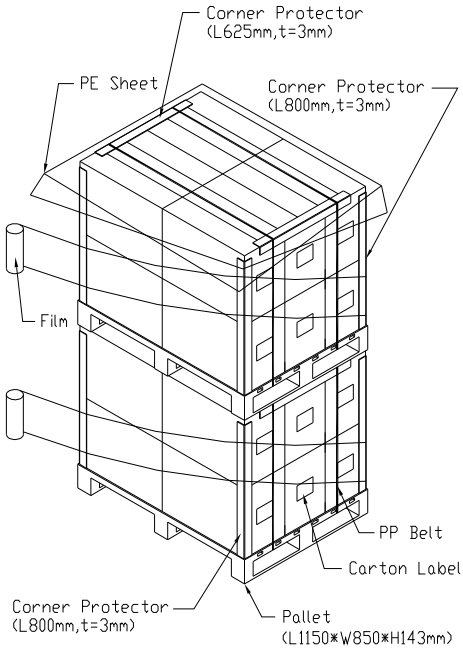
Figure. 8-1 Packing method

8.3 PALLET

Sea / Land Transportation
(40ft HQ Container)



Sea / Land Transportation
(40ft Container)



Air Transportation

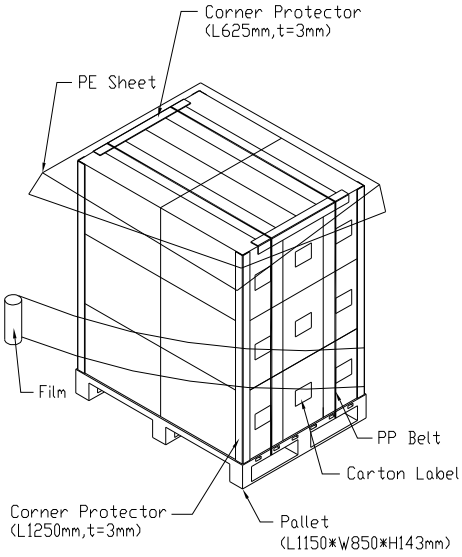


Figure. 8-2 Packing method

8.4 UN-PACKING METHOD

UN-packaging method is shown as following figures.

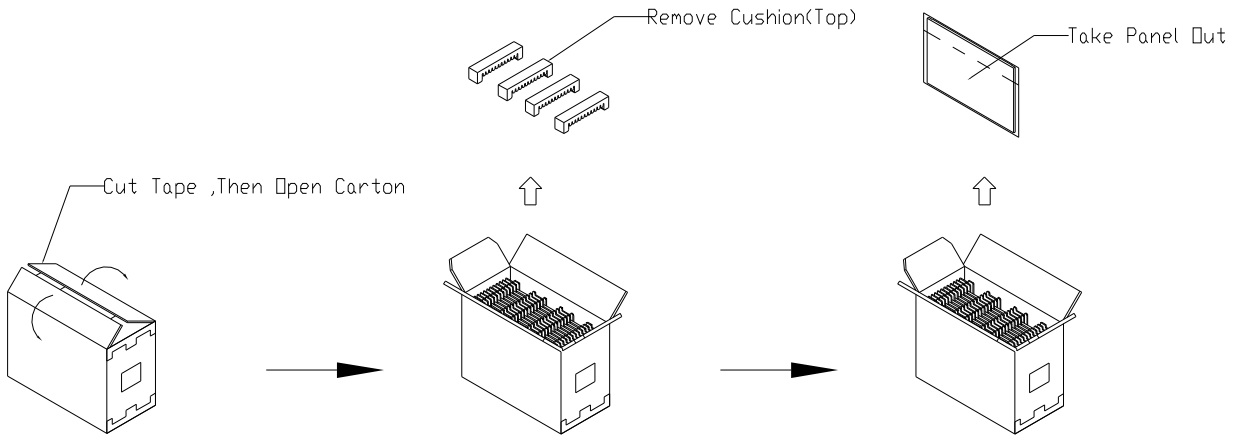
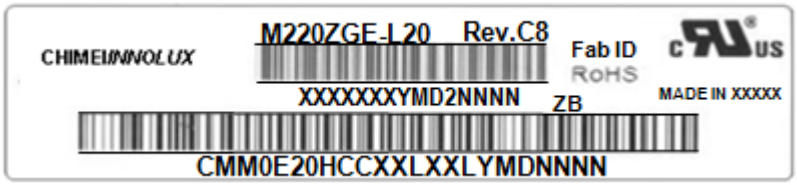


Figure. 8-3 Un-packing method

9. INX MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: M220ZGE-L20

(b) Revision: Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.

(c) INX barcode definition:

Serial ID: XX-XX-X-XX-YMD-L-NNNN

Code	Meaning	Description
XX	INX internal use	-
XX	Revision	Cover all the change
X	INX internal use	-
XX	INX internal use	-
YMD	Year, month, day	Year: 0~9, 2001=1, 2002=2, 2003=3…2010=0, 2011=1, 2012=2… Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U.
L	Product line #	Line 1=1, Line 2=2, Line 3=3, …
NNNN	Serial number	Manufacturing sequence of product

(d) Customer's barcode definition:

Serial ID: CM-M0E20-X-X-X-XX-L-XX-L-YMD-NNNN

Code	Meaning	Description
CM	Supplier code	INX=CM
M0E20	Model number	M220ZGE-L20= M0E20
X	Revision code	Non ZBD: 1,2,~,8,9 / ZBD: A~Z
X	Source driver IC code	Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatek=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M, ILITEK=Q, Fiti=Y, None IC =Z
X	Gate driver IC code	
XX	Cell location	Tainan Taiwan=TN, Ningbo China=CN, Hsinchu Taiwan=SC
L	Cell line #	1,2,~,9,A,B,~,Y,Z
XX	Module location	Tainan, Taiwan=TN ; Ningbo China=NP ; Shenzhen China=SH ; Nanhai China=NH
L	Module line #	1,2,~,9,A,B,~,Y,Z
YMD	Year, month, day	Year: 0~9, 2001=1, 2002=2, 2003=3…2010=0, 2011=1, 2012=2… Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, T, U, V
NNNN	Serial number	By LCD supplier

(e) FAB ID(UL Factory ID):

Region	Factory ID
TWINX	GEMN
NBCMI	LEOO
NBCME	CANO
NHCMI	CAPG

10. PRECAUTIONS

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the module during assembly.

(2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.

(4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.

(5) Do not pull the I/F connector in or out while the module is operating.

(6) Do not disassemble the module.

(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.

(9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(10)When ambient temperature is lower than 10ºC may reduce the display quality. For example, the response time will become slowly.

(11) While touching the panel surface under the patterns with higher grey levels, a shadow or mura phenomenon would be seen. This phenomenon is totally recoverable by switching the patterns to lower grey levels. It is a product feature.

10.2 STORAGE PRECAUTIONS

(1) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0℃ to 35℃ and relative humidity of less than 90%

(2) Do not store the TFT – LCD module in direct sunlight

(3) The module should be stored in dark place. It is prohibited to apply sunlight or fluorescent light in storing

10.3 OPERATION PRECAUTIONS

(1) The LCD product should be operated under normal condition.

Normal condition is defined as below :

Temperature : 20±15℃

Humidity: 65±20%

Display pattern : continually changing pattern(Not stationary)

(2) If the product will be used in extreme conditions such as high temperature ,high humidity, high altitude ,display pattern or operation time etc…It is strongly recommended to contact INX for application engineering advice . Otherwise , Its reliability and function may not be guaranteed.

10.4 SAFETY PRECAUTIONS

(1) 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, skin or clothes, it has to be washed away thoroughly with soap.

(2) After the module's end of life, it is not harmful in case of normal operation and storage.

10.5 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:

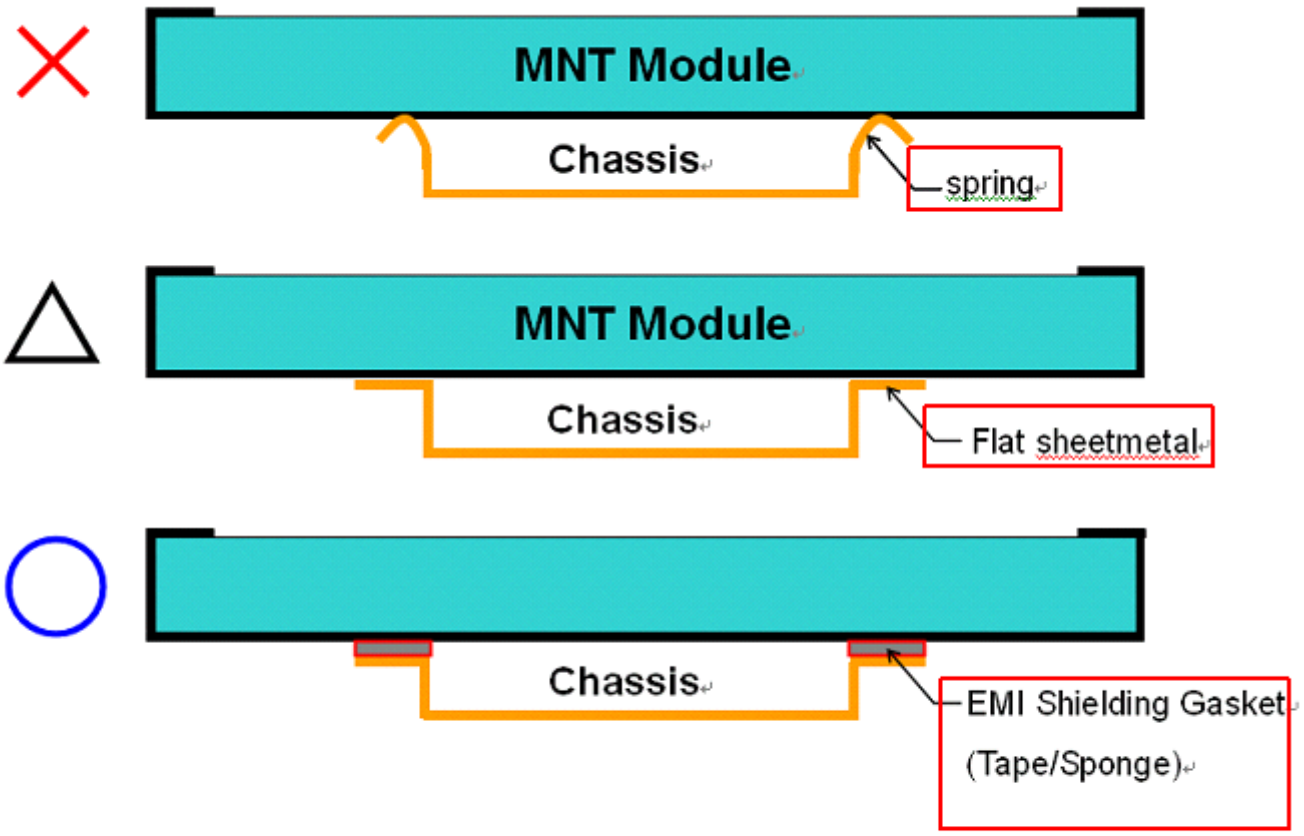
(1) UL60950-1 or updated standard.

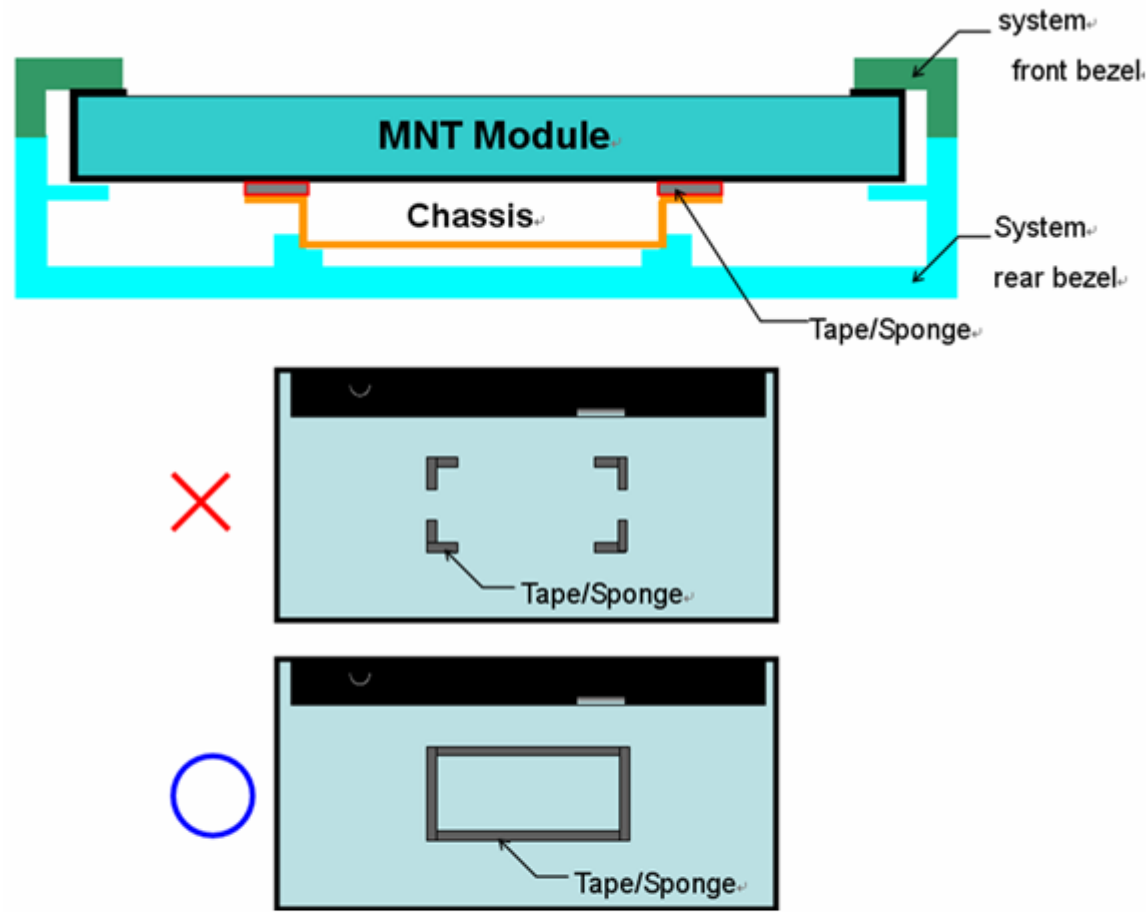
(2) IEC60950-1 or updated standard.

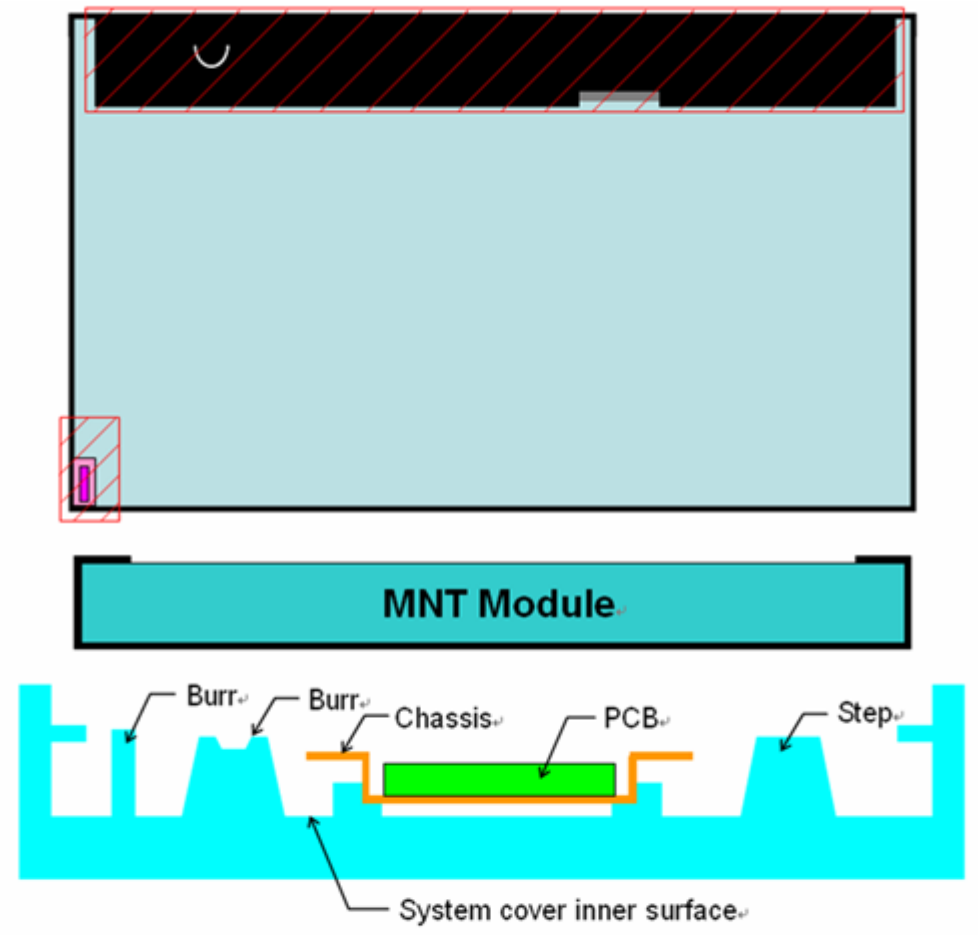
10.6 OTHER

When fixed patterns are displayed for a long time, remnant image is likely to occur.

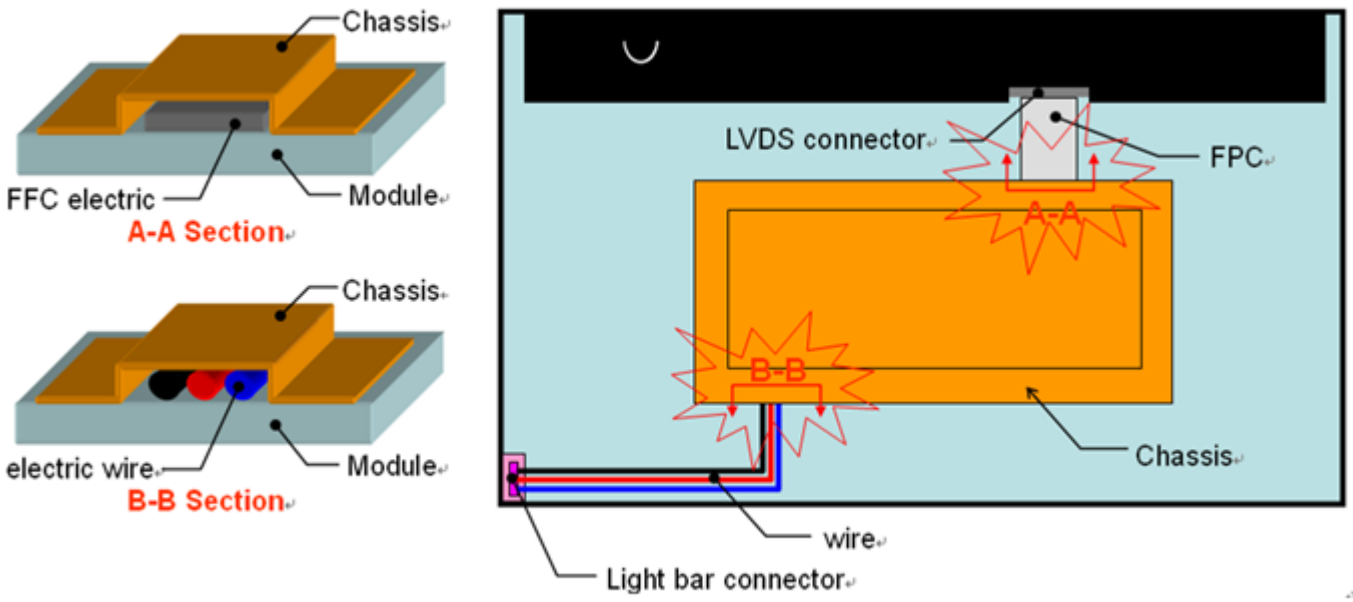
Appendix 1. SYSTEM COVER DESIGN NOTICE

1.	Set Chassis and MNT Module touching Mode
	
Definition	a) To prevent from abnormal display & white spot after Mechanical test, it is not recommended to used spring type chassis. b) We suggest the contact mode between Chassis and Module rear cover is Tape/Sponge, second is Flat sheetmetal type chassis (Don't interference from flat sheetmetal of chassis to rear cover of Module).

2	Tape/sponge design on system inner surface
	
Definition	a) To prevent from abnormal display & white spot after Mechanical test, We suggest using Tape/Sponge as medium between chassis and Module rear cover could reduce the occurrence of white spot. b) When using the Tape/Sponge, suggest it be lay over between set chassis and module rear cover. it is not recommended to add tape/sponge in separate location. Since each tape/sponge may act as pressure concentration location.

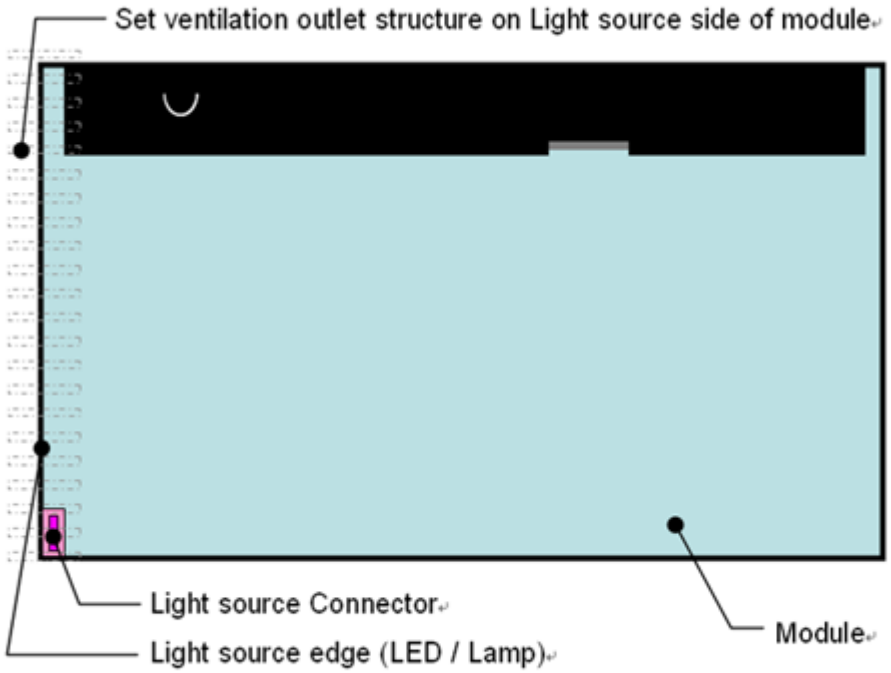
3	System inner surface examination
	
Definition	a). Burr at logo edge, step, protrusion or PCB board will easily cause white spot. b). Keeping flat surface underneath module is recommended. c). The area ( ) on Module PCBA and Light bar connector should keep at least 1mm gap to any structure with System cover inner surface.

4	The overlapping part on System's Chassis and electric wire needs gap structure.



Definition	The overlapping part on System's Chassis and electric wire (FPC、FFC and wire) needs gap structure to avoid display of white spot by pressing overlapping part cause interference.

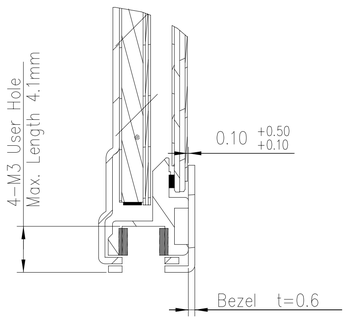
5	System cover's ventilation outlet structure



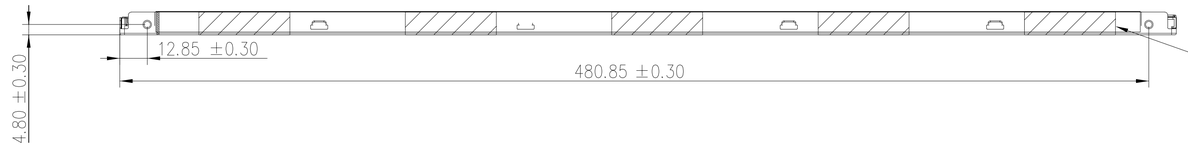
Definition	To prevent from abnormal display of light leakage, We suggest to set ventilation outlet structure on side of Module Light bar in system cover inner surface.

Appendix 2. OUTLINE DRAWING

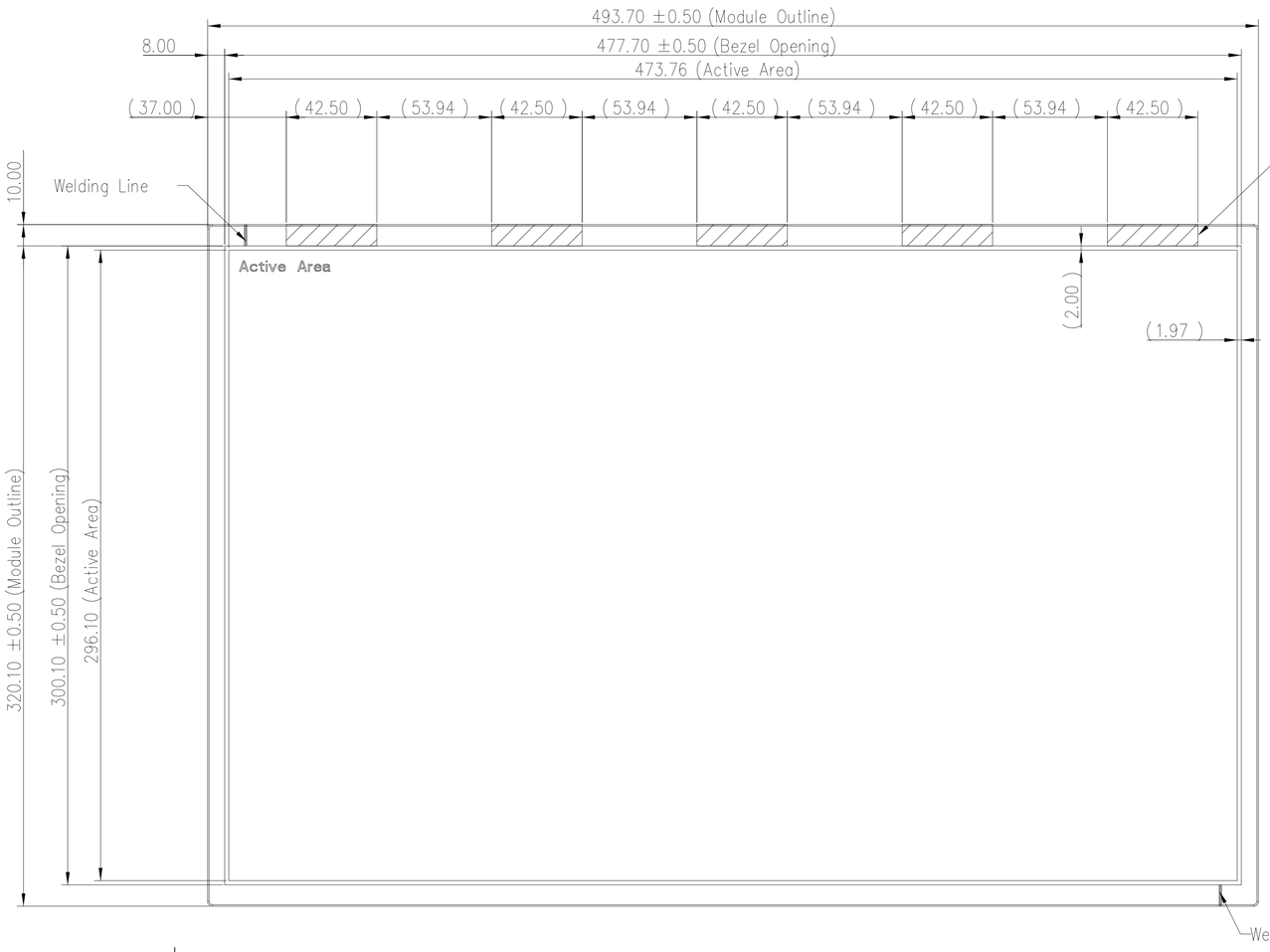
REV	EC NUMBER	DESCRIPTION	DATE
A		First Release	2019/02/08

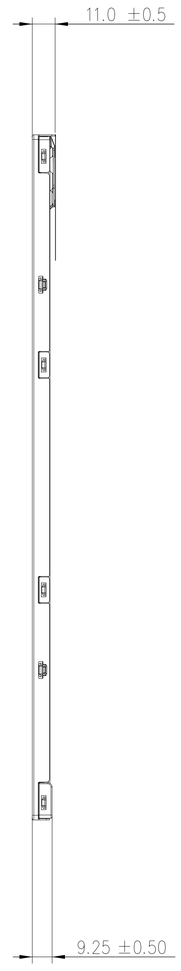


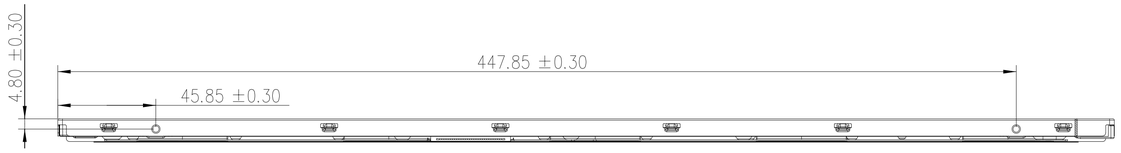
DETAIL A
SCALE 5:1



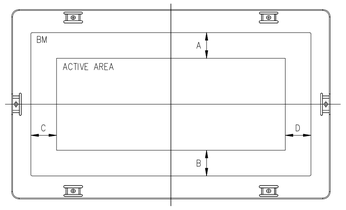
DATA COF Position x5, Don't Touch!!!
SI mechanical structure should not touch the positions of Data COF







NOTE:
1.LVDS INPUT CONNECTOR SPECIFICATION :
Foxconn GS23301-0321R-7H or equivalent
2.LED CONNECTOR SPECIFICATION:
FCN WM13-406-063N or equivalent
3.THE DIMENSION EXCLUDES DEFORMATION
4.TOLERANCE WITHOUT NOTICED TO BE ±0.5MM
5.TORQUE OF M3 USER HOLE SHOULD BE WITHIN 5 kgf-cm AND JUST RESCREW 10 TIMES
6. Display area position tolerance : |A-B| <= 1& |C-D| <=1



BM WIDTH VARIATION : |A-B|,|C-D|≤1.0 (MAX.)
FIG.1

CRITICAL DIMENSION	CONTROL DIMENSION	DATE	SCALE 1/1
APPROVED	YS Shiu	DRAWING NUMBER or PAGE NUMBER	
CHECKED	Aiden Wan	PART DESCRIPTION	module_M220ZGE-L20
DESIGNED	Youlin Huang	INNOLUX	

REV	EC NUMBER	DESCRIPTION	DATE
A		First Release	2019/02/08

149.7±1.0(connector 1st function pin position)

Don't Touch COF Area

53.93

192.92

Don't Touch 勿碰觸 請勿碰觸

LVDS Connector (30pin)
Foxconn GS23301-0321R-7H

Heigh 7.70 ±0.5

Height 8.30 ±0.5

Height 8.30 ±0.5

92.00±0.20

(87.20)

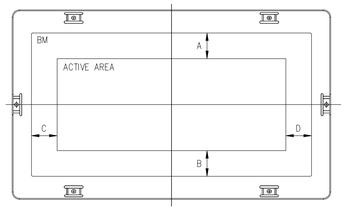
(149.00)

62.00±0.20

Heigh 9.25 ±0.5

Light Bar Connector(6pin)
FCN WM13-406-063N

NOTE:
1.LVDS INPUT CONNECTOR SPECIFICATION :
Foxconn GS23301-0321R-7H or equivalent
2.LED CONNECTOR SPECIFICATION:
FCN WM13-406-063N or equivalent
3.THE DIMENSION EXCLUDES DEFORMATION
4.TOLERANCE WITHOUT NOTICED TO BE ±0.5MM
5.TORQUE OF M3 USER HOLE SHOULD BE WITHIN 5 kgf-cm
AND JUST RESCREW 10 TIMES
6. Display area position tolerance : |A-B| <= 1& |C-D| <=1



BM WIDTH VARIATION : |A-B|,|C-D|≤1.0 (MAX.)
FIG.1

APPROVED	YS Shiu	PART NUMBER	2N112228
CHECKED	Alden Wan	model	M220ZGE-L20
DESIGNED	Youlin Huang		

INNOLUX