

# TFT LCD Preliminary Specifications

Model No. : M220Z2-L02

Customer : \_\_\_\_\_

Approved by : \_\_\_\_\_

Note :

記錄	工作	審核	角色	投票
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**REVISION HISTORY**

Version	Date	Section	Description
Ver. 1.0	Jul,09 '08	-	M220Z2-L02 RGB BLU Module Preliminary Specifications was first issued.

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

The M220Z2-L02 model is a 22 inch wide TFT-LCD module with 4pcs LED light-bar Backlight unit and LVDS interface. This module supports 1680 x 1050 WSXGA+ mode and displays up to 16.7 millions colors. The Converter module for the Backlight Unit is built in.

### 1.2 FEATURES

- 22" wide WSXGA+ TFT LCD Panel
- TN Mode Liquid Crystal
- Super Wide Viewing Angle
- High Color saturation
- High Brightness & Contrast Ratio
- High Brightness & Contrast Angular Dependent
- Fast LC Response Time
- LVDS (Low Voltage Differential Signaling) interface
- RGB LED Backlight

### 1.3 APPLICATION

- Workstation & desktop monitor
- Display terminals for AV application

### 1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Diagonal size	558.68	mm	
Active Area	473.76x296.1	mm	(1)
Bezel Opening Area	477.7 (H) x 300.1 (V)	mm	
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	16.7 millions	color	-
Transmissive Mode	Normally White	-	-
Color saturation	104%NTSC	-	-
Surface Treatment	Hard coating (3H), AG (Haze 25%)	-	-

### 1.5 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	
	Depth(D)	--	21.42	21.92	mm	
Weight			2498	g		
I/F connector mounting position	The mounting inclination of the connector makes the screen center within $\pm 0.5$ mm as the horizontal.					

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

## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T <sub>ST</sub>	-20	+60	°C	(1)
Operating Ambient Temperature	T <sub>OP</sub>	0	+50	°C	(1), (2)
Shock (Non-Operating)	S <sub>NOP</sub>	-	50	G	(3), (5)
Vibration (Non-Operating)	V <sub>NOP</sub>	-	1	G	(4), (5)
LCD Cell Life Time	L <sub>CELL</sub>	50,000	-	Hrs	MTBF based

Note (1) Temperature and relative humidity range is shown in the figure below.

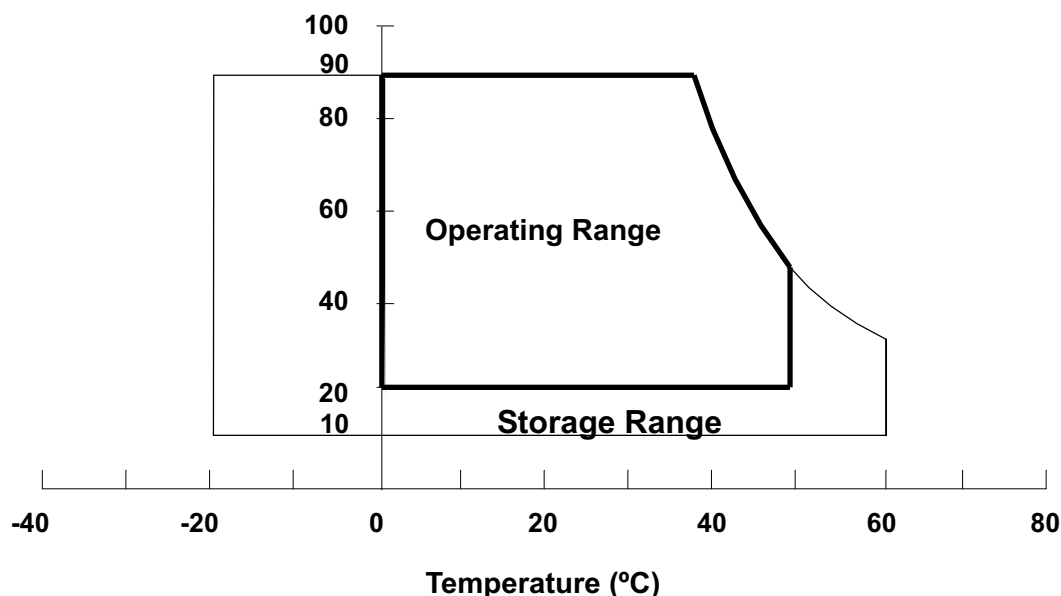
(a) 90% RH Max. ( $T_a \leq 40$  °C).

(b) Wet-bulb temperature should be 39 °C Max. ( $T_a > 40$  °C).

(c) No condensation.

Note (2) The temperature of panel surface should be 0 °C Min. and 60 °C Max.

**Relative Humidity (%RH)**



Note (3) 11 ms, half-sine wave, 1 time for  $\pm X$ ,  $\pm Y$ ,  $\pm Z$ .

Note (4) 10 ~ 300 Hz, sweep rate 10 min / cycle, 30 min for X,Y,Z axis

Note (5) Upon the Vibration and Shock tests, the fixture used to hold the module must be firm and rigid enough to prevent the module from twisting or bending by the fixture.

## 2.2 ELECTRICAL ABSOLUTE RATINGS

### 2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V <sub>CC</sub>	-0.3	+6	V	(1), (2)
Logic Input Voltage	V <sub>IN</sub>	-0.3	+4.3	V	

### 2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Converter Voltage	V <sub>in</sub>	21.6	26.4	V	(1), (3)
Converter Current	I <sub>in</sub>	-	1.9	A	(1), (3)

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) Testing Environment Temperature = 25°C , Duty Ratio=1/10, Pulse Width=0.1ms.

Note (3) Specified values are for LED (Refer to 3.2 for further information).

### 3. ELECTRICAL CHARACTERISTICS

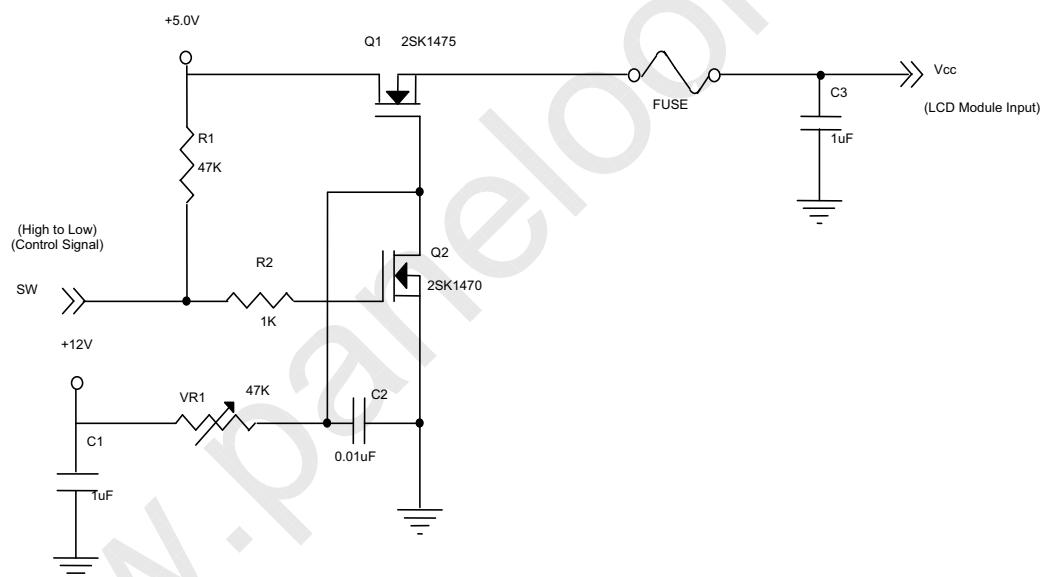
#### 3.1 TFT LCD MODULE

 $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ 

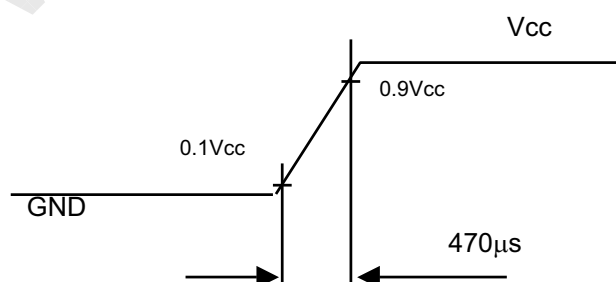
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V <sub>CC</sub>	4.5	5.0	5.5	V	-
Ripple Voltage	V <sub>RP</sub>	-	--	100	mV	-
Rush Current	I <sub>RUSH</sub>	-	--	(3)	A	(2)
Power Supply Current	White	-	530	(819)	mA	(3)a
	Black	-	900	(1521)	mA	(3)b
	Vertical Stripe	-	850	(1400)	mA	(3)c
LVDS differential input voltage	V <sub>id</sub>	200	-	600	mV	
LVDS common input voltage	V <sub>ic</sub>	--	1.2	--	V	

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:

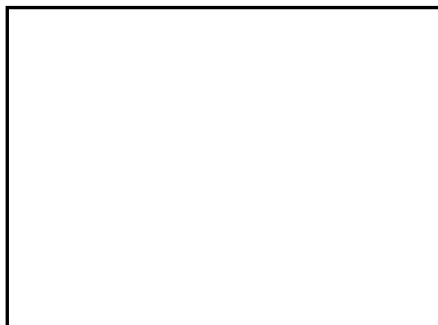


**V<sub>CC</sub> rising time is 470μs**



Note (3) The specified power supply current is under the conditions at  $V_{cc} = 5.0\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^\circ\text{C}$ ,  $f_v = 60\text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern



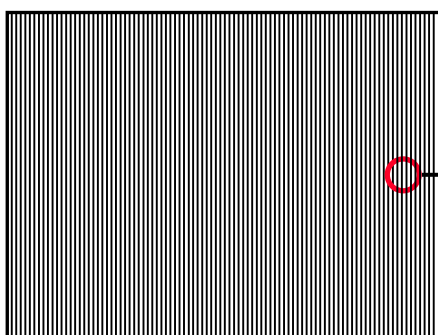
Active Area

b. Black Pattern

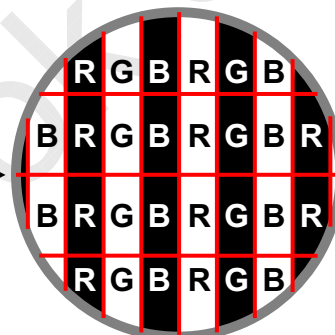


Active Area

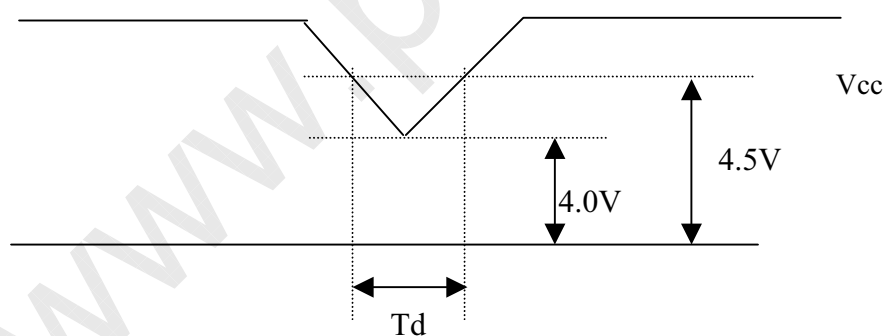
c. Vertical Stripe Pattern



Active Area



### 3.1.1 Vcc Power Dip Condition:



Dip condition:  $4.0\text{ V} \leq V_{cc} \leq 4.5\text{ V}$ ,  $T_d \leq 20\text{ ms}$

## 3.2 BACKLIGHT UNIT

Ta = 25 ± 2 °C

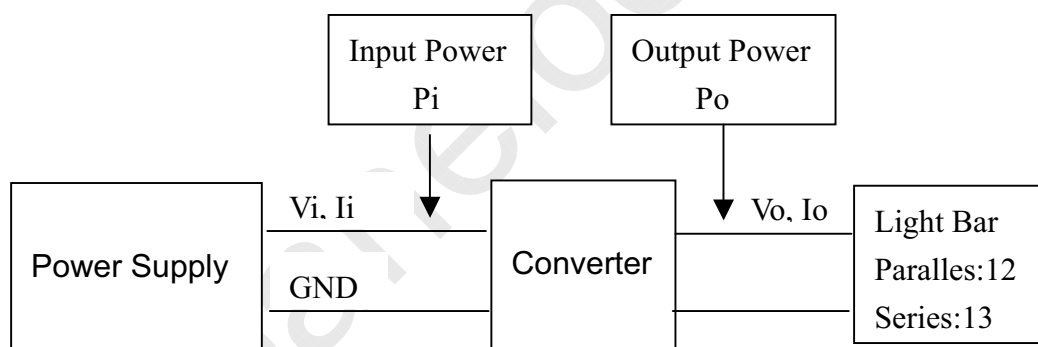
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Light bar Red LED Input Voltage	R <sub>Out</sub>	---	29	37	V <sub>DC</sub>	(Duty 100%)
Light bar Red LED Lamp Current	I <sub>R</sub>	--	300	--	mA <sub>DC</sub>	(Duty 100%)
Light bar Green LED Input Voltage	G <sub>Out</sub>	---	48	52	V <sub>DC</sub>	(Duty 100%)
Light bar Green LED Lamp Current	I <sub>G</sub>	--	300	--	mA <sub>DC</sub>	(Duty 100%)
Light bar Blue LED Input Voltage	B <sub>Out</sub>	---	43	47	V <sub>DC</sub>	(Duty 100%)
Light bar Blue LED Lamp Current	I <sub>B</sub>	--	240	--	mA <sub>DC</sub>	(Duty 100%)
LED Life Time	L <sub>BL</sub>	30000	---	---	Hrs	(2)
Power Consumption	P <sub>O</sub>	---	33.42	---	W	(3)

Note (1) LED current is measured by utilizing a high frequency current meter as shown below:

Note (2) The lifetime of LED is defined as the time when it continues to operate under the conditions at

Ta = 25 ± 2 °C and I = 60 mA(Per EA) until the brightness  $\leq$  50% of its original value.

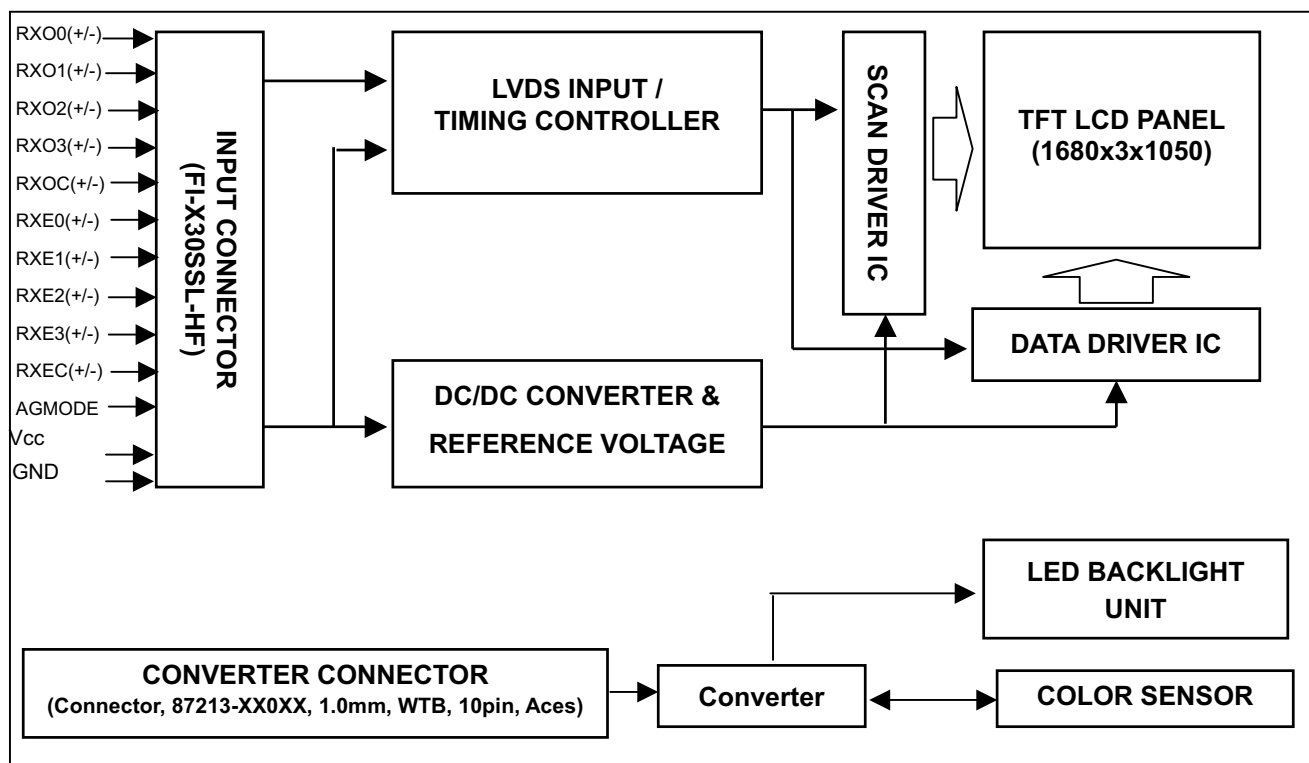
Note (3)  $P_O = I_R \times R_{out} + I_G \times G_{out} + I_B \times B_{out}$



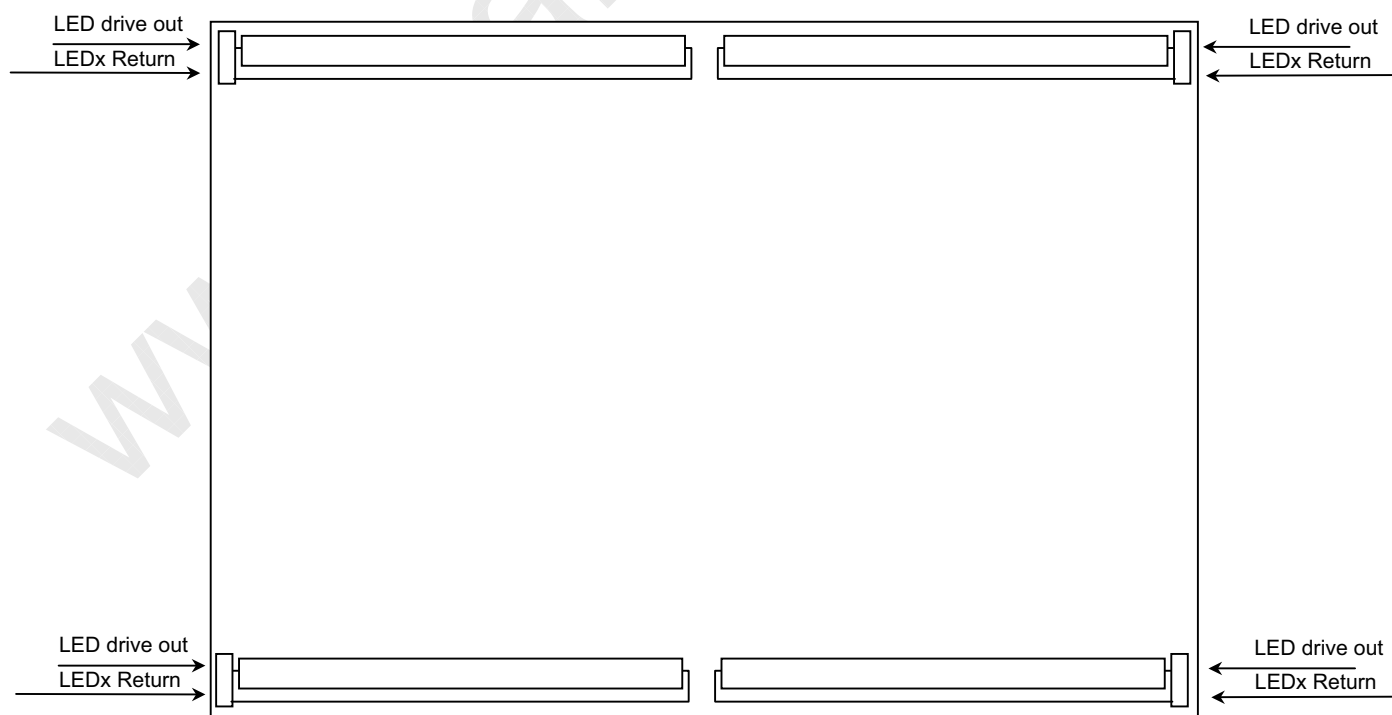
Ta = 25 ± 2 °C

## 4. BLOCK DIAGRAM

### 4.1 TFT LCD MODULE



### 4.2 BACKLIGHT UNIT



## 5. INPUT TERMINAL PIN ASSIGNMENT

### 5.1 TFT LCD MODULE

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	Not connection, this pin should be open.
26	AGMODE	AGMODE should be tied to ground or open.
27	VCC	+5.0V power supply
28	VCC	+5.0V power supply
29	VCC	+5.0V power supply
30	VCC	+5.0V power supply

Note (1) Connector Part No.: 093G30-B0001A(STARCONN) or FI-X30SSL-HF(JAE) or EQUIVALENT.

Note (2) The first pixel is odd.

Note (3) Input signal of even and odd clock should be the same timing.

## 5.2 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

## 5.3 BACKLIGHT UNIT(Converter connector pin)

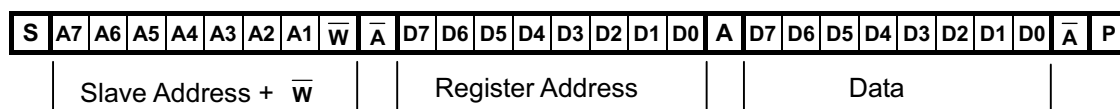
Pin	Symbol	Description	Remark
1	$V_{in}$	Converter input voltage	24V
2	$V_{in}$	Converter input voltage	24V
3	$V_{in}$	Converter input voltage	24V
4	5V	MCU input voltage	5V
5	$V_{GND}$	Converter ground	Ground
6	$V_{GND}$	Converter ground	Ground
7	$V_{GND}$	Converter ground	Ground
8	EN	Enable pin	3.3V
9	SCL	I2C clock pin	
10	SDA	I2C bi-directional data pin	

Note (1) Connector Part No.: SM10B-SRSS-TB (JST), 87213-1000G(ACES) or equivalent

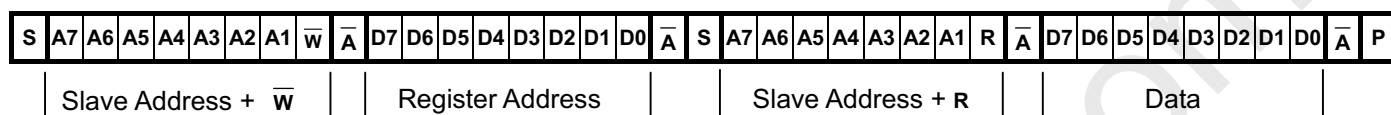
Note (2) User's connector Part No.: SHR-10V-S-B (JST), 87214-1000 (ACES) or equivalent

5.4 CONVERTER DATA TRANSFER( via I<sup>2</sup>C interface) :5.4.1 I<sup>2</sup>C Format

Byte Write:



Byte Read:



Slave Address : 38H

 $\bar{W}$  : Write (0)

R : Read (1)

S : I<sup>2</sup>C Start Bit

A : Acknowledge

 $\bar{A}$  : Not AcknowledgeI<sup>2</sup>C SCL clock frequency : 100KHz

## 5.4.2 Register Table

Symbol	Register	Definition	R/W	Default	Note
CTRL	01	Bit[7] Reserved Bit[6] Reserved Bit[5] Reserved Bit[4] Reserved Bit[3] 1: Open loop, 0: Close loop Bit[2] 1: PWM enable, 0: PWM disable Bit[1] 1: HW Reset (Avago power restart) 0: Reset finished Bit[0] 1: SW Reset, 0: Reset finished	R/W	00H	
BRIGHT	02	Brightness Value	R/W	FFH	00H ~ FFH
CT	03	Color Temperature Value, (CT*100) °K	R/W	41H	6500 °K(Kelvin)
CTXL	04	Color temperature CIE X [7:0]	R/W	01H	10 bits
CTXH	05	Color temperature CIE X [9:8]	R/W	39H	X = 313
CTYL	06	Color temperature CIE Y [7:0]	R/W	01H	10 bits
CTYH	07	Color temperature CIE Y [9:8]	R/W	49H	Y = 329
NITSL	08	Brightness Display [7:0]	R		
NITSH	09	Brightness Display [15:8]	R		



**Preliminary**

### 5.5 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	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
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	1	0	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	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Green(253)	0	0	0	0	0	0	0	1	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	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	1	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	1	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	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	1

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

## 6. INTERFACE TIMING

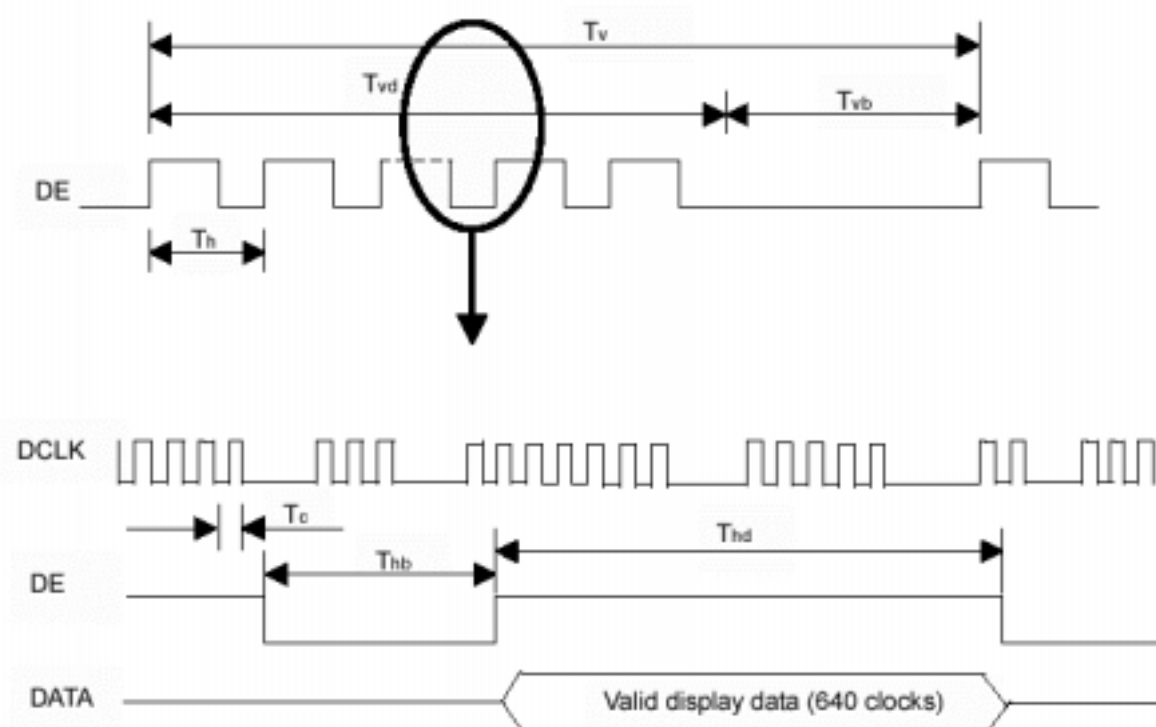
### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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	50	59.5	82	MHz	-
	Period	Tc	13.4	16.8	-	ns	-
	High Time	Tch	-	4/7	-	Tc	-
	Low Time	Tcl	-	3/7	-	Tc	-
LVDS Data	Setup Time	Tlvs	600	-	-	ps	-
	Hold Time	Tlvh	600	-	-	ps	-
Vertical Active Display Term	Frame Rate	Fr	50	60	76	Hz	Tv=Tvd+Tvb
	Total	Tv	1060	1080	1195	Th	-
	Display	Tvd	1050	1050	1050	Th	-
	Blank	Tvb	Tv-Tvd	30	Tv-Tvd	Th	-
Horizontal Active Display Term	Total	Th	890	920	1000	Tc	Th=Thd+Thb
	Display	Thd	840	840	840	Tc	-
	Blank	Thb	Th-Thd	80	Th-Thd	Tc	-

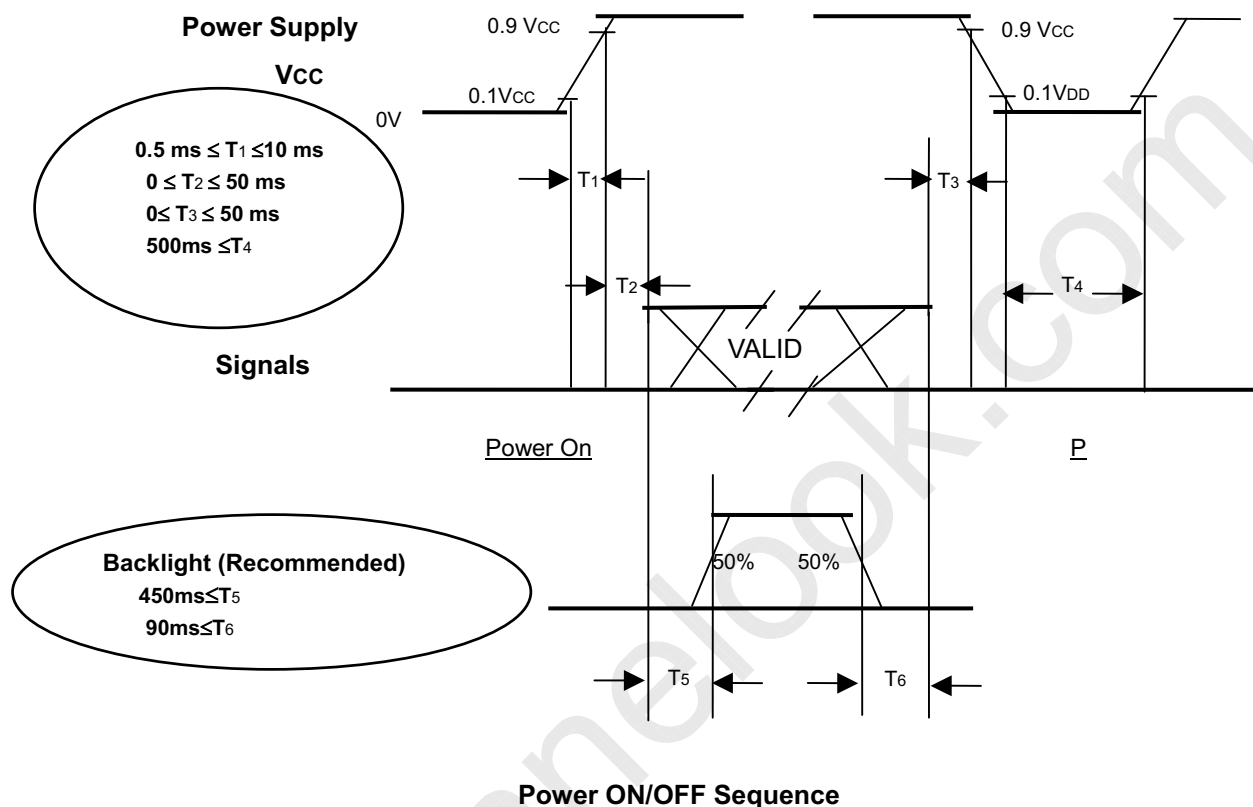
Note : (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

### INPUT SIGNAL TIMING DIAGRAM



## 6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the conditions shown in the following diagram.



### Note.

- (1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.
- (2) Please apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation of the LCD turns off, the display may, instantly, function abnormally.
- (3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.
- (4) T4 should be measured after the module has been fully discharged between power on/off periods.
- (5) Interface signal shall not be kept at high impedance when the power is on.

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

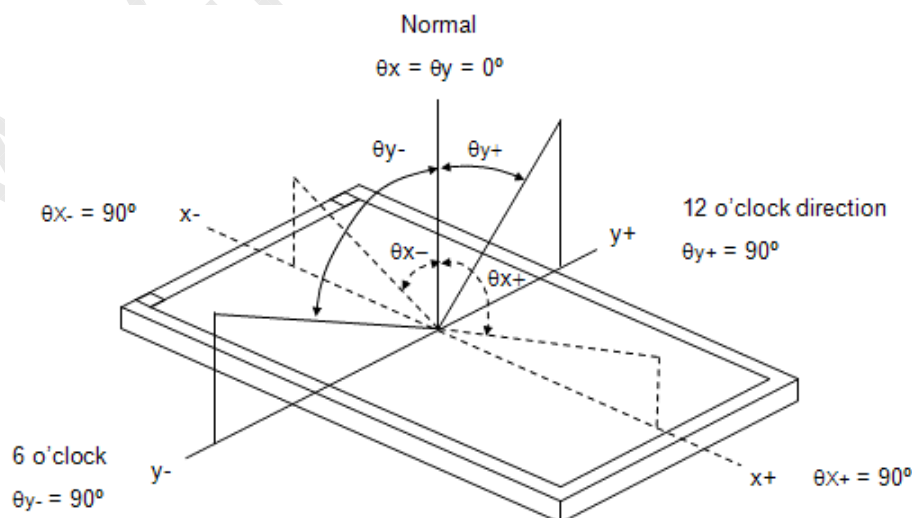
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V <sub>CC</sub>	5.0	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current	-	-	-

### 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (5).

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Color Chromaticity	Red	$\theta_x=0^\circ, \theta_y=0^\circ$ CS-1000T R=G=B=255 Grayscale	Typ - 0.03	0.693	Typ + 0.03		(1), (5)	
				Ry				0.296
	Green			Gx				0.164
				Gy				0.693
	Blue			Bx				0.148
				By				0.083
	White			Wx				0.313
				Wy				0.329
	Center Luminance of White			L <sub>C</sub>				
Contrast Ratio	CR		700	1000	---	-	(2), (6)	
Response Time	T <sub>R</sub>	$\theta_x=0^\circ, \theta_y=0^\circ$	---	1.3	6.3	ms	(3)	
	T <sub>F</sub>			3.7	8.7			
White Variation	δW	$\theta_x=0^\circ, \theta_y=0^\circ$	---	1.3	1.5	-	(5), (6)	
Viewing Angle	Horizontal	CR>10	75	85	---	Deg.	(1), (5)	
				$\theta_{x-}$				85
	Vertical			$\theta_{y+}$				70
				$\theta_{y-}$				70

Note (1) Definition of Viewing Angle ( $\theta_x, \theta_y$ ):



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

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

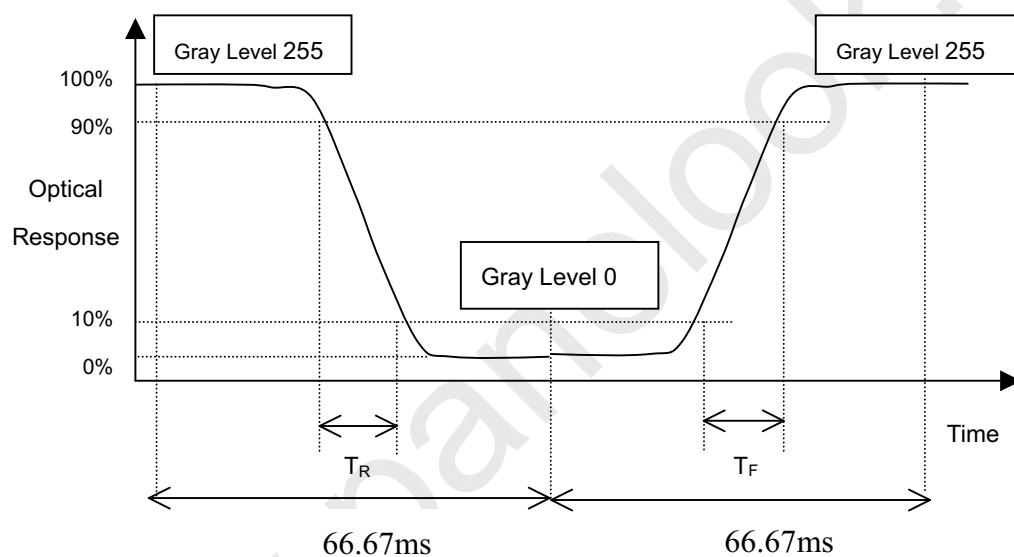
L<sub>255</sub>: Luminance of gray level 255

L<sub>0</sub>: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

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 ( $L_C$ ):

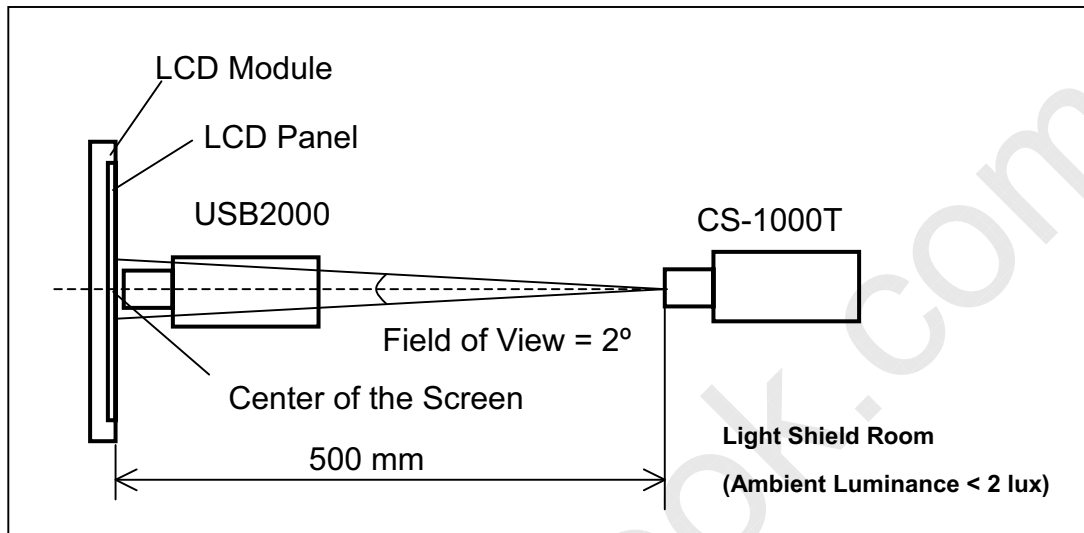
Measure the luminance of gray level 255 at center point

$$L_C = L (5)$$

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

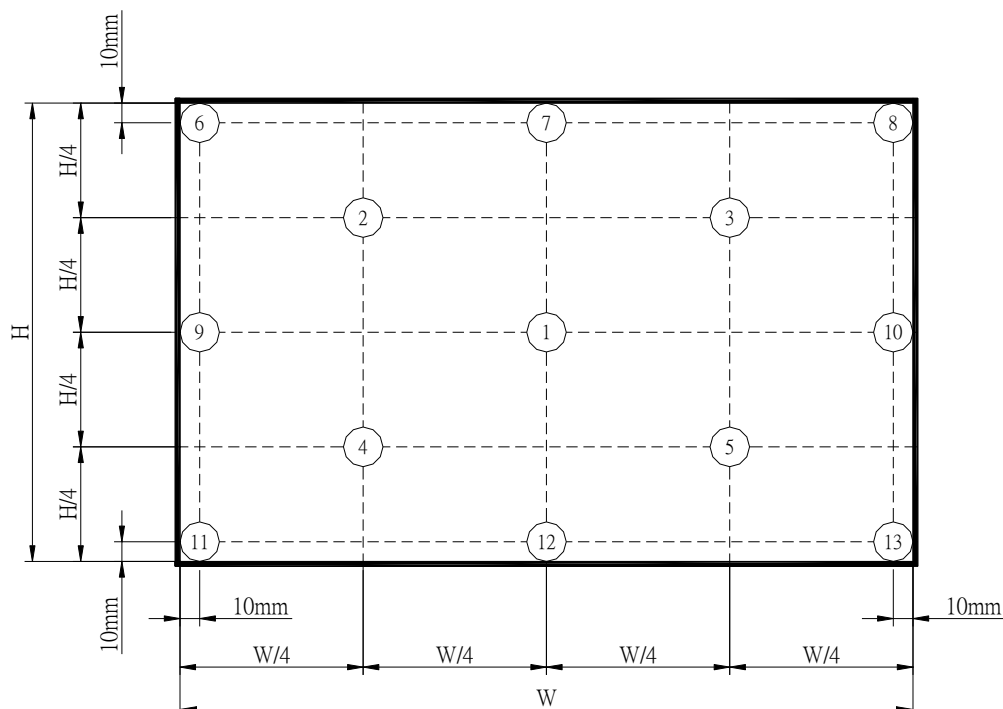
**Note (5) Measurement Setup:**

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 ( $\delta W$ ):**

Measure the luminance of gray level 255 at 13 points

$$\delta W = \text{Maximum [L (1) ~ L (13)]} / \text{Minimum [L (1) ~ L (13)]}$$



## 8. PACKAGING

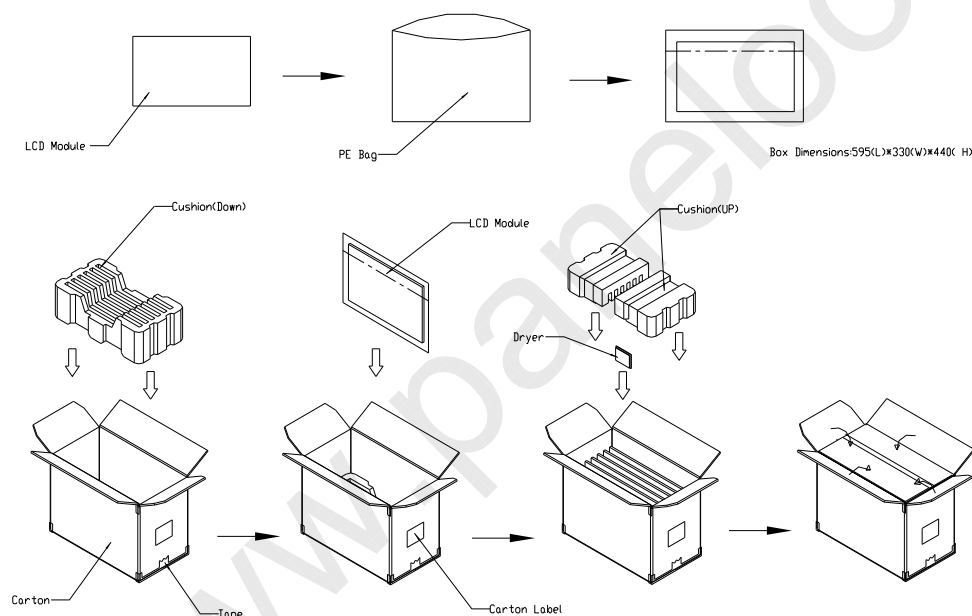
### 8.1 PACKING SPECIFICATIONS

- (1) 6 LCD modules / 1 Box
- (2) Box dimensions: 595(L) X 330 (W) X 440 (H) mm
- (3) Weight: 16.50 Kg (6 modules per box)

### 8.2 PACKING METHOD

- (1) Carton Packing should have no failure in the following reliability test items.

Test Item	Test Conditions	Note
Vibration	ISTA STANDARD Random, Frequency Range: 1 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Non Operation
Dropping Test	1 Angle, 3 Edge, 6 Face, 60cm	Non Operation



**Figure. 8-1 Packing method**

For ocean shipping

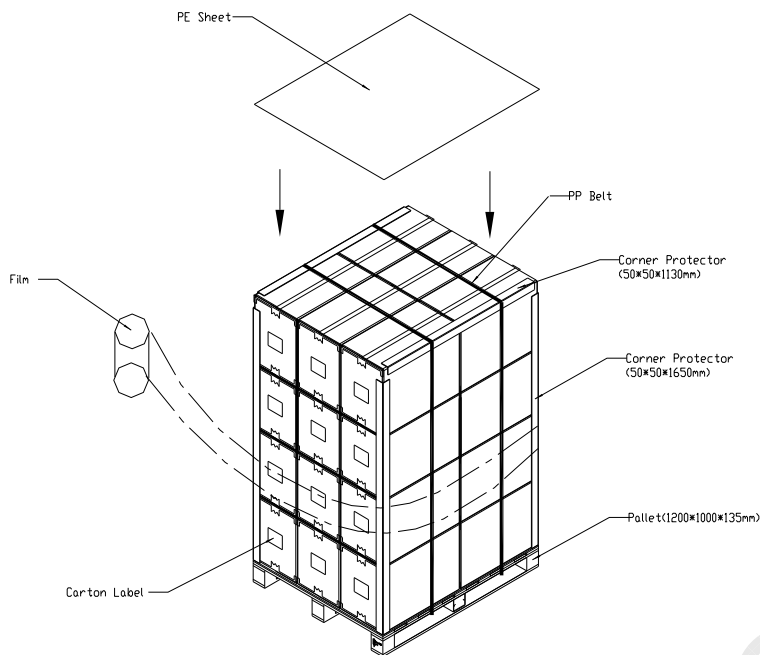


Figure. 8-2 Packing method

For air transport

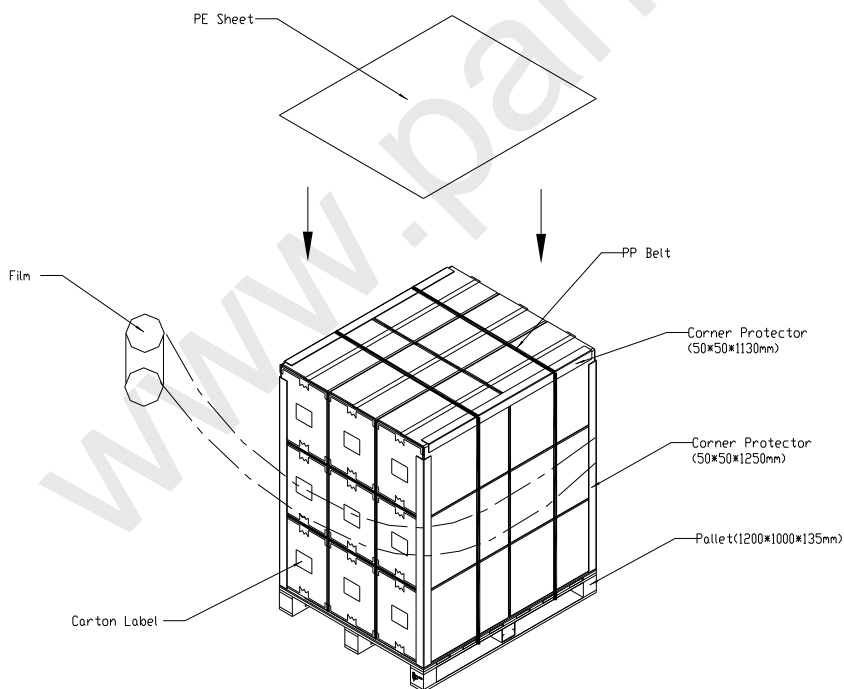


Figure. 8-3 Packing method

## 9. DEFINITION OF LABELS

### 9.1 CMO MODULE LABEL

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



- (a) Model Name: M220Z2-L02
- (b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.
- (c) CMO barcode definition:

Serial ID: XX-XX-X-XX-XXX-X-XXXX

Code	Meaning	Description
XX	CMO internal use	-
XX	Revision	Cover all the change
X	CMO internal use	-
XX	CMO internal use	-
XXX	Year, month, day	Year: 2001=1, 2002=2, 2003=3, 2004=4... 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.
X	Product line #	Line 1=1, Line 2=2, Line 3=3, ...
XXXX	Serial number	Manufacturing sequence of product

- (d) Customer's barcode definition:

Serial ID: CM-22Z22-X-X-X-XX-L-XX-L-YMD-NNNN

Code	Meaning	Description
CM	Supplier code	CMO=CM
22Z22	Model number	M220Z2-L02=22Z22
X	Revision code	Non ZBD: 0~9, 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, Novatec=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M
X	Gate driver IC code	
XX	Cell location	Tainan, Taiwan=TN
L	Cell line #	1~12=0~C
XX	Module location	Tainan, Taiwan=TN
L	Module line #	1~12=0~C
YMD	Year, month, day	Year: 2001=1, 2002=2, 2003=3, 2004=4... 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

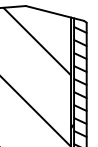
## 10. PRECAUTIONS

### 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 10°C may reduce the display quality. For example, the response time will become slowly.

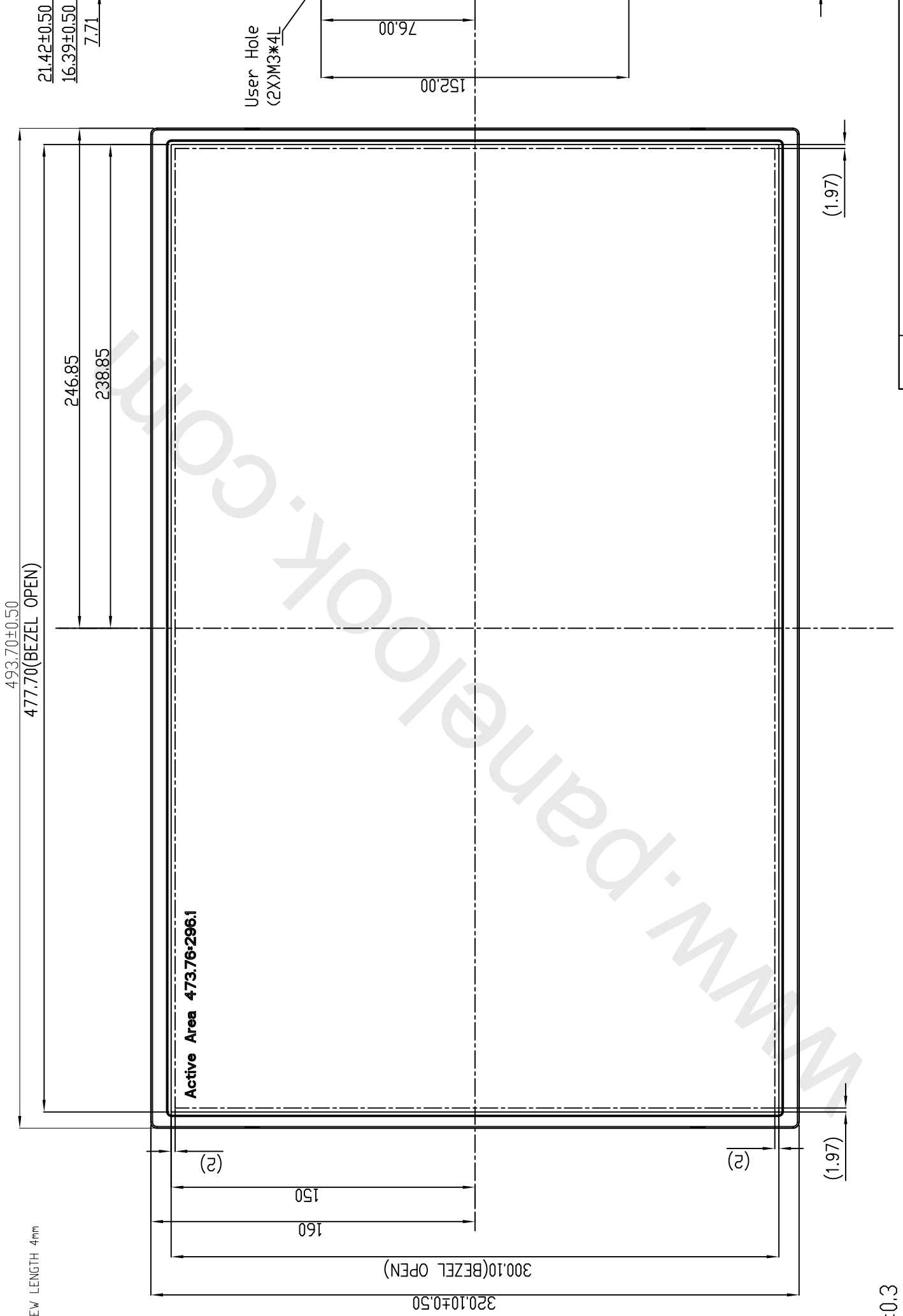
### 10.2 SAFETY PRECAUTIONS

- (1) Do not disassemble the module or insert anything into the Backlight unit.
- (2) 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.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.



USER HOLE MAX SCREW LENGTH 4mm

A-A  
5:1

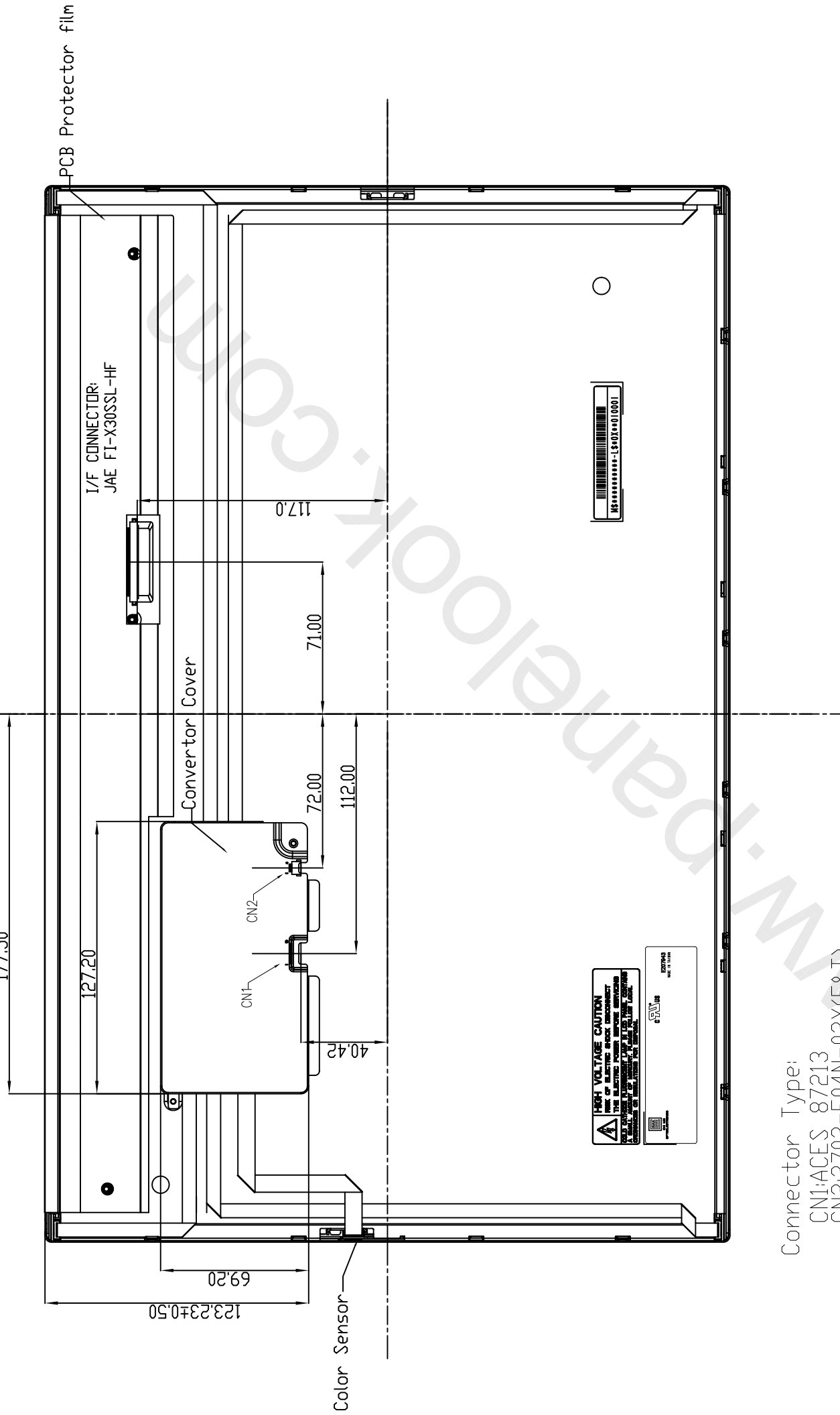


TOLERANCE:  $\pm 0.3$   
FOR SIDE MOUNT SCREWS:  
(X)

TITLE ISM\_ASSY\_M220Z2-L02

Approved TBD

Drawing No. TBD



Connector Type:  
 CN1:ACES 87213  
 CN2:3703-E04N-03X(E&T)

TITLE	ISM_ASSY_M220Z2-L02	Approved	TRD	Drawing No.	TRD
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