TFT LCD Tentative Specification

MODEL NO.: G154I1-LE1

Customer: _____

Approved by: _____

Note:

Liquid Crystal Display Division	
QRA Division.	OA Head Division.
Approval	Approval

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REVISION HISTORY

Version	Date	Section	Description
0.0	5th,Aug,2010	All	G154I1-LE1 Tentative Spec. was first issued

1. GENERAL DESCRIPTION

1.1 OVERVIEW

The G154I1-LE1 model is a 15.4" TFT-LCD module with a white LED Backlight Unit and a 30-pin 1ch-LVDS interface. This module supports 1280 x 800 WXGA mode and displays 262k/16.2M colors. The converter for the Backlight Unit is built in.

1.2 FEATURES

- WXGA (1280 x 800 pixels) resolution
- Wide operating temperature
- DE (Data Enable) mode
- LVDS (Low Voltage Differential Signaling) interface
- RoHS Compliance
- LED Light Bar Replaceable
- Reverse Scan

1.3 APPLICATION

- TFT LCD Monitor
- Industrial Application
- Amusement

1.4 GENERAL SPECIFICATIONS

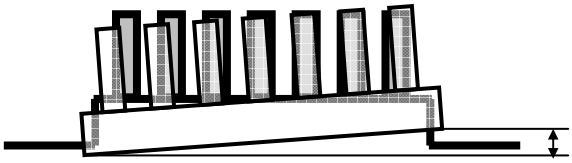
Item	Specification	Unit	Note
Diagonal Size	15.4	inch	(1)
Active Area	331.2(H) x 207.0(V)	mm	
Bezel Opening Area	334.5 x 210.3	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1280 x R.G.B. x 800	pixel	-
Pixel Pitch	0.259(H) x 0.259(V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262k/16.2M	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	AG, 3H	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	351.5	352	352.5	mm	(1)
	Vertical (V)	229.5	230	230.5	mm	
	Depth (D)	8.5	9	9.5	mm	
Weight			TBD	TBD	g	-
I/F connector mounting position		The mounting inclination of the connector makes the screen center within ±0.5mm as the horizontal.			-	(2)

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

(2) Connector mounting position



2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

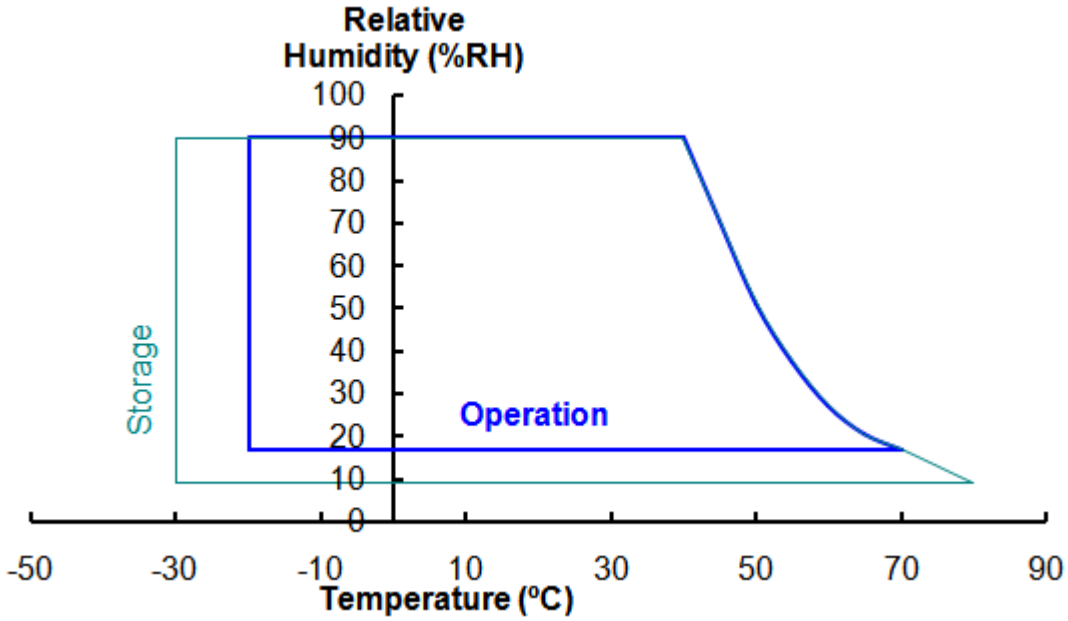
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Operating Ambient Temperature	T_{OP}	-20	+70	ºC	
Storage Temperature	T_{ST}	-30	+80	ºC	

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

(a) 90 %RH Max. (Ta ≦ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.



2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	Vcc+0.3	V	(1)

2.2.2 BACKLIGHT UNIT

Item	Value			Unit	Note
	Min	Typ.	Max.		
LED Light Bar Input voltage	-	28	-	V_{DC}	(1), (2)
LED Light Bar Input Current	-	320	-	mA_{DC}	

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 LED (Refer to Section 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

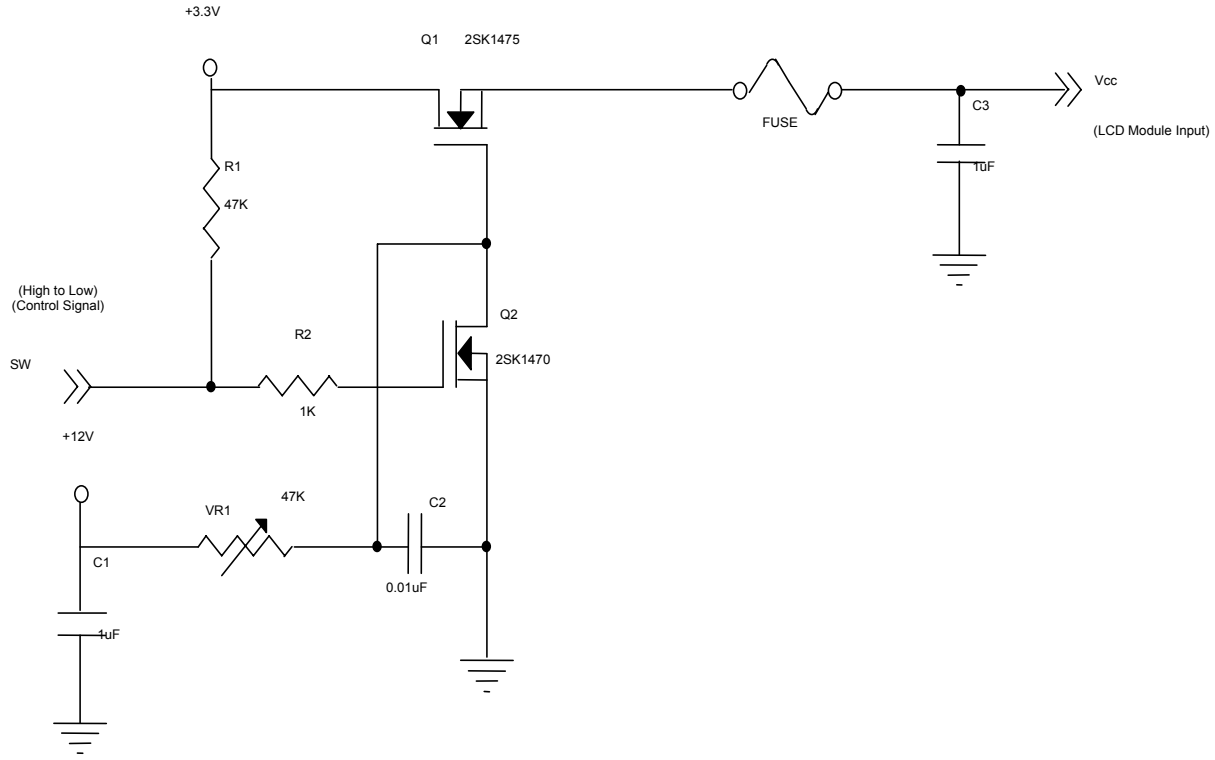
3.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

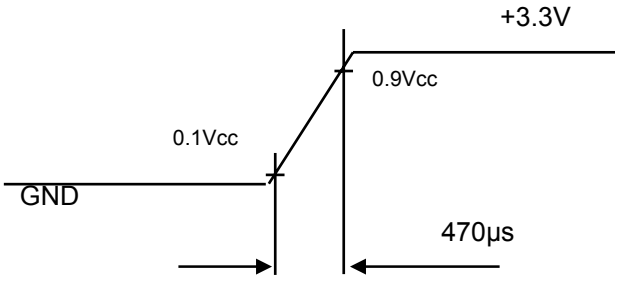
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	at Vcc=3.3V
Ripple Voltage		V_{RP}	-	50		mV	-
Rush Current		I_{RUSH}	-	-	1.5	A	(2)
Initial Stage Current		I_{IS}	-	-	1.0	A	(2)
Power Supply Current	White	Icc	-	TBD	TBD	mA	(3)a, at Vcc=3.3V
	Black		-	TBD	TBD	A	(3)b, at Vcc=3.3V
LVDS Differential Input High Threshold		VTH(LVDS)	-	-	+100	mV	(5), VCM=1.2V
LVDS Differential Input Low Threshold		VTL(LVDS)	-100	-	-	mV	(5) VCM=1.2V
LVDS Common Mode Voltage		VCM	1.125	-	1.375	V	(5)
LVDS Differential Input Voltage		|VID|	100	-	600	mV	(5)
Terminating Resistor		RT	-	100	-	Ohm	
Power per EBL WG		PEBL	-	2.68	-	W	(4)

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

Note (2) Measurement Conditions:

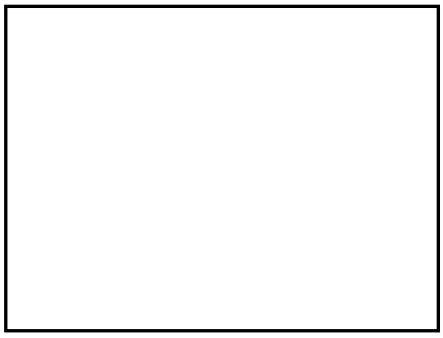


VCC rising time is 470us



Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

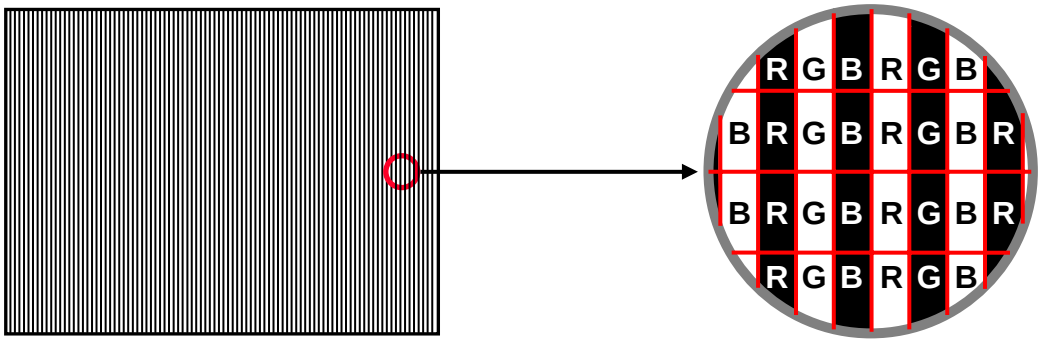


Active Area

b. Black Pattern

Active Area

c. Vertical Stripe Pattern



Active Area

3.2 BACKLIGHT UNIT

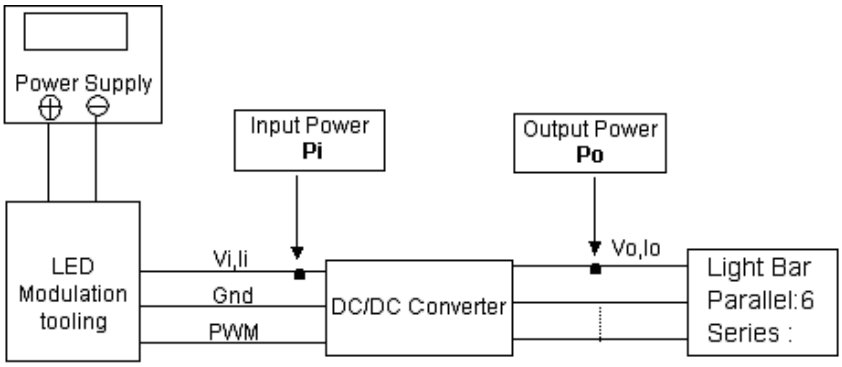
Ta = 25 ± 2 ºC

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Power Supply Voltage		V_i	10.8	12.0	13.2	V	(Duty 100%)
Converter Power Supply Current		I_i		TBD		A	@ Vi = 12V (Duty 100%)
LED Power Consumption		P_{LED}	---	7.56	---	W	@ Vi = 12V (Duty 100%)
EN Control Level	Backlight on	BLU_EN	2.0	---	3.3	V	
	Backlight off		0	---	0.8	V	
PWM Control Level	PWM High Level	BLU_ADJ	2.0	---	3.3	V	
	PWM Low Level		0	---	0.15	V	
PWM Control Duty Ratio			20		100	%	
PWM Control Frequency		f_{PWM}	190	200	210	Hz	
LED Life Time		L_L	50,000			Hrs	(1)

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

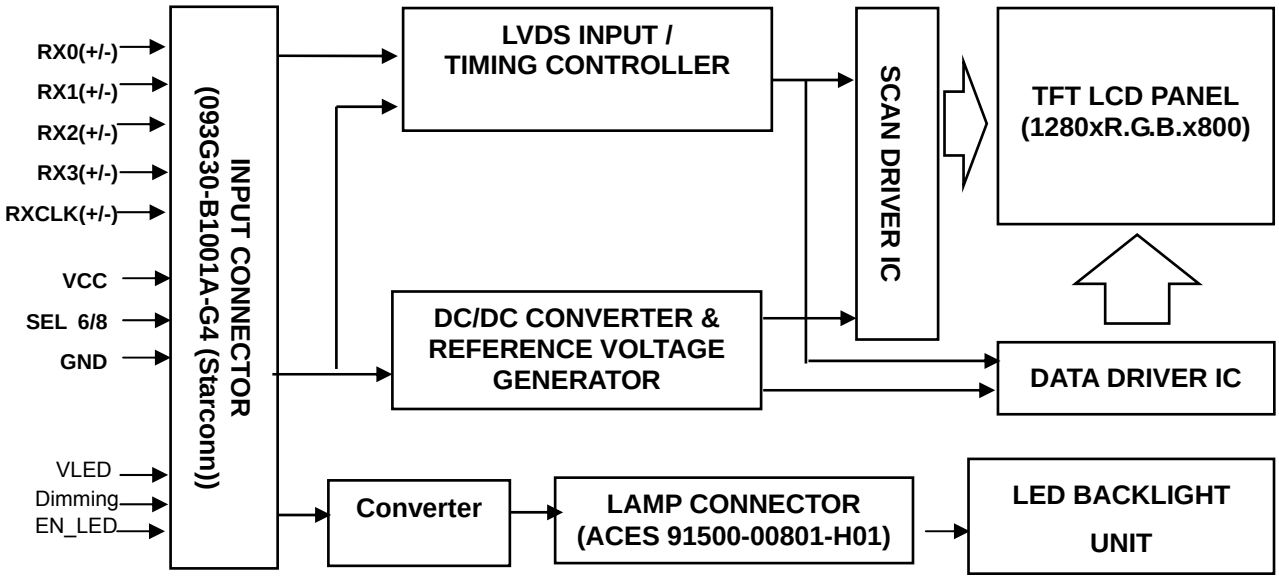
Note (2) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ±2 ℃ and I_{LED} = 80mA_{DC}(LED forward current) until the brightness becomes ≦ 50% of its original value. Operating LED under high temperature environment will reduce life time and lead to color shift.

Note (3) $P_L = I_o \times V_o$



4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Name	Description	Remark
1	12V	LED Power supply	LED converter power
2	12V	LED Power supply	
3	12V	LED Power supply	
4	12V	LED Power supply	
5	ENLED	Enable Pin	
6	Dimming	Backlight Adjust	
7	GND	Ground	
8	GND	Ground	
9	VCC	Power supply +3.3V	System power
10	VCC	Power supply +3.3V	
11	GND	Ground	
12	GND	Ground	
13	RX0-	Differential Data Input, CH0 (Negative)	
14	RX0+	Differential Data Input, CH0 (Positive)	
15	GND	Ground	
16	RX1-	Differential Data Input, CH1 (Negative)	
17	RX1+	Differential Data Input , CH1 (Positive)	
18	GND	Ground	
19	RX2-	Differential Data Input , CH2 (Negative)	B2~B5, DE, Hsync, Vsync
20	RX2+	Differential Data Input , CH2 (Positive)	
21	GND	Ground	
22	RXCLK-	Differential Clock Input (Negative)	LVDS Level Clock
23	RXCLK+	Differential Clock Input (Positive)	
24	GND	Ground	
25	RX3-	Differential Data Input, CH3 (Negative)	
26	RX3+	Differential Data Input, CH3 (Positive)	
27	GND	Ground	
28	SEL6/8	LVDS 6/8 bit select function control, Low or NC → 6 bit Input Mode High → 8bit Input Mode	(2)
29	Reverse	+3.3VReverse, GND/NC No Reverse	
30	GND	Ground	

Note (1) Connector Part No.: STARCONN 093G30-B1001A-G4 or equivalent.

Note (2) “Low” stands for 0V. “High” stands for 3.3V. “NC” stands for “No Connected”.

5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-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					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
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
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	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
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	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
	Blue(1)	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	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

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

6. INTERFACE TIMING

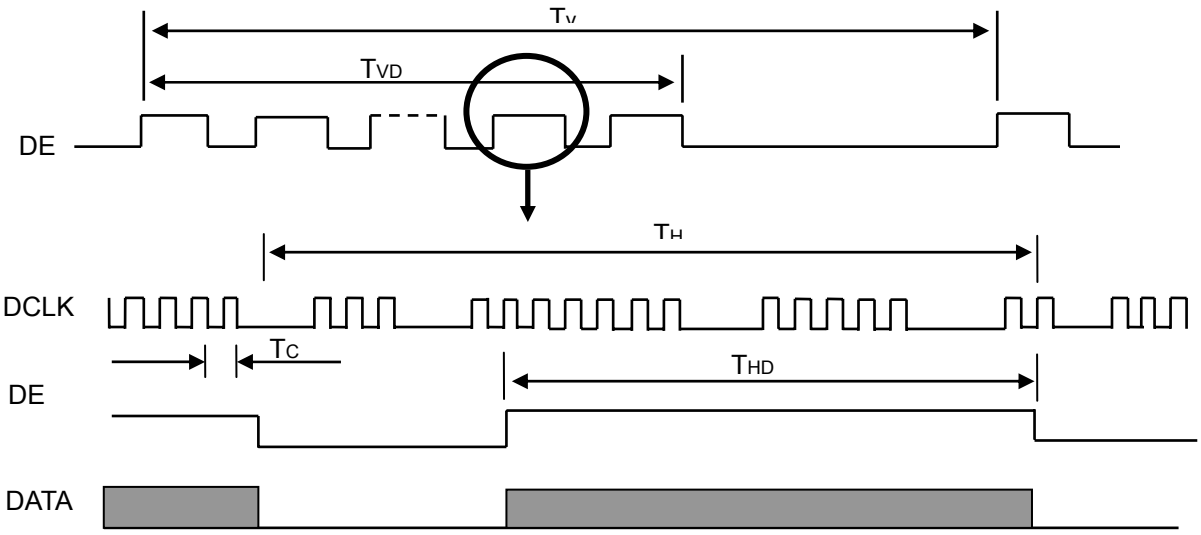
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	67.45	71	74.55	MHz	-
DE	Vertical Total Time	TV	810	823	1000	TH	-
	Vertical Addressing Time	TVD	800	800	800	TH	-
	Horizontal Total Time	TH	1360	1440	1600	Tc	-
	Horizontal Addressing Time	THD	1280	1280	1280	Tc	-

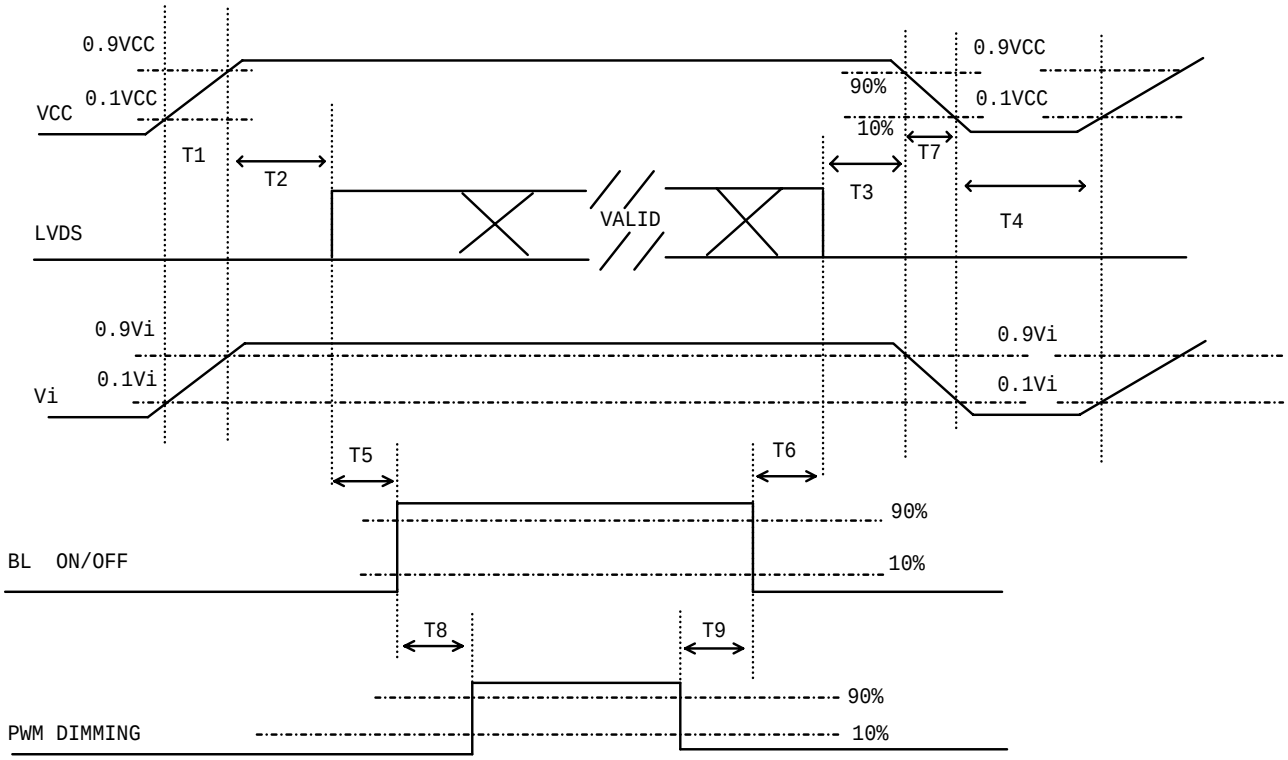
Note：(1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below.



Power ON/OFF sequence

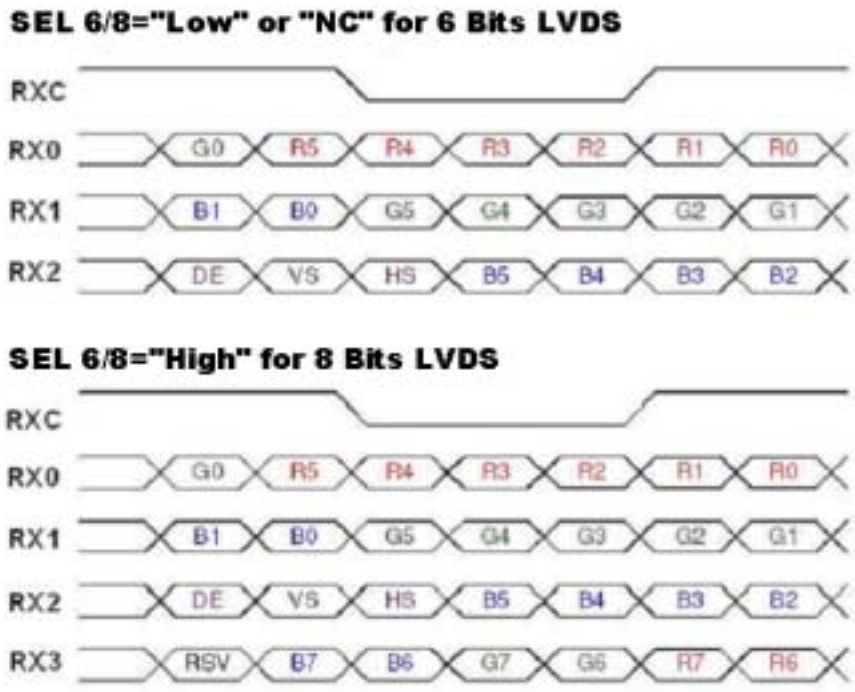
Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0 V.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

Parameter	Value			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	500	-	-	ms
T5	200	-	-	ms
T6	20	-	-	ms
T7	5	-	300	ms
T8	10	-	-	ms
T9	10	-	-	ms

6.3 The Input Data Format



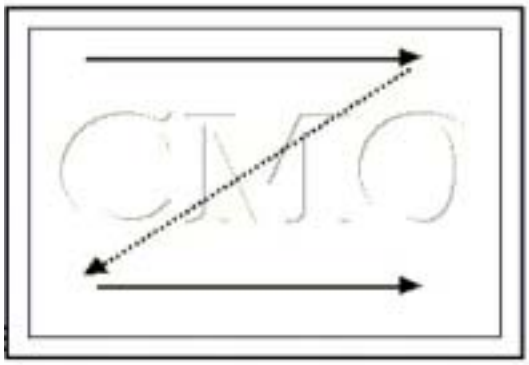
Note (1) R/G/B data 7: MSB, R/G/B data 0: LSB

Note (2) Please follow PSWG

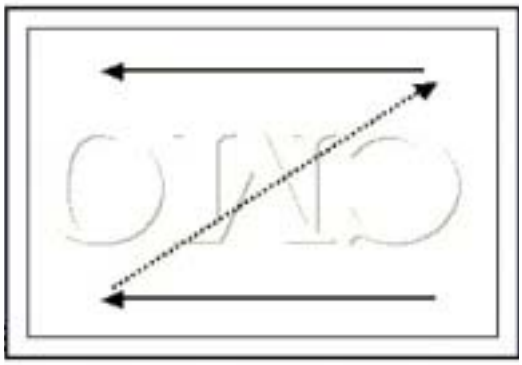
Signal Name	Description	Remark
R7 R6 R5 R4 R3 R2 R1 R0	Red Data 7 (MSB) Red Data 6 Red Data 5 Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0 (LSB)	Red-pixel Data Each red pixel's brightness data consists of these 8 bits pixel data.
G7 G6 G5 G4 G3 G2 G1 G0	Green Data 7 (MSB) GreenData 6 GreenData 5 GreenData 4 GreenData 3 GreenData 2 GreenData 1 GreenData 0 (LSB)	Green-pixel Data Each green pixel's brightness data consists of these 8 bits pixel data.
B7 B6 B5 B4 B3 B2 B1 B0	Blue Data 7 (MSB) Blue Data 6 Blue Data 5 Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0 (LSB)	Blue-pixel Data Each blue pixel's brightness data consists of these 8 bits pixel data.
RXCLKIN+ RXCLKIN-	LVDS Clock Input	
DE	Display Enable	
VS	Vertical Sync	
HS	Horizontal Sync	

6.4 Scanning Direction

The following figures show the image see from the front view. The arrow indicates the direction of scan.



Reverse = GND/NC : normal display (default)



Reverse = High : display with 180 degree rotation

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

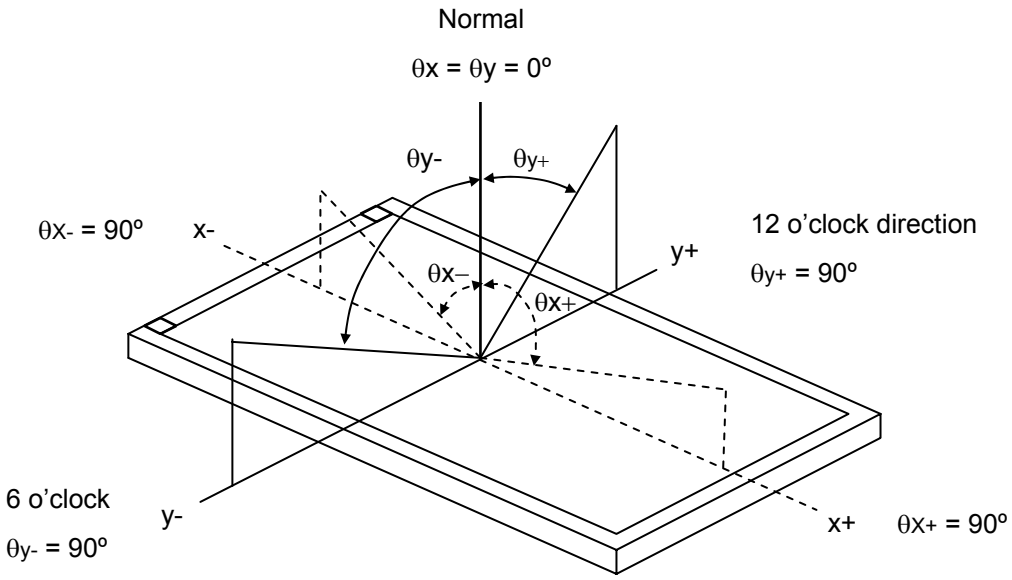
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Converter PWM duty		100%	

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	Rx	θ_x=0°, θ_Y =0° CS-1000	Typ - 0.05	TBD	Typ + 0.05	-	(1), (5)
		Ry			TBD		-	
	Green	Gx			TBD		-	
		Gy			TBD		-	
	Blue	Bx			TBD		-	
		By			TBD		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
Center Luminance of White		L_C		350	450	-	-	(4), (5)
Contrast Ratio		CR		500	700	-	-	(2), (5)
Response Time		T_R	θ_x=0°, θ_Y =0°	-	5	10	ms	(3)
		T_F		-	11	16	ms	
White Variation		δW	θ_x=0°, θ_Y =0°	-	1.25	1.4	-	(5), (6)
Viewing Angle	Horizontal	θ_x+	CR≥10	70	80	-	Deg.	(1), (5)
		θ_x-		70	80	-		
	Vertical	θ_Y+		60	70	-		
		θ_Y-		60	70	-		

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) = L63 / L0

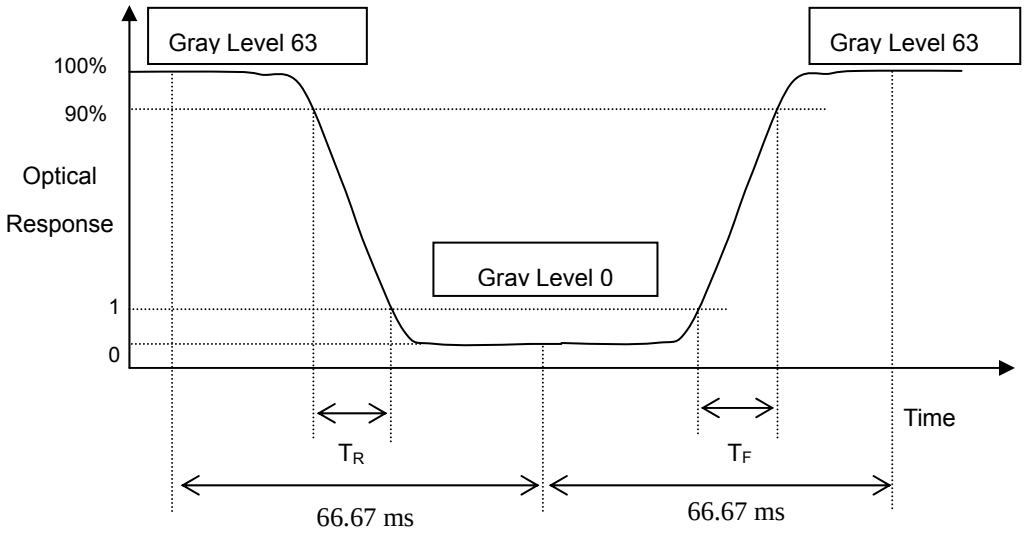
L63: Luminance of gray level 63

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) and measurement method:



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

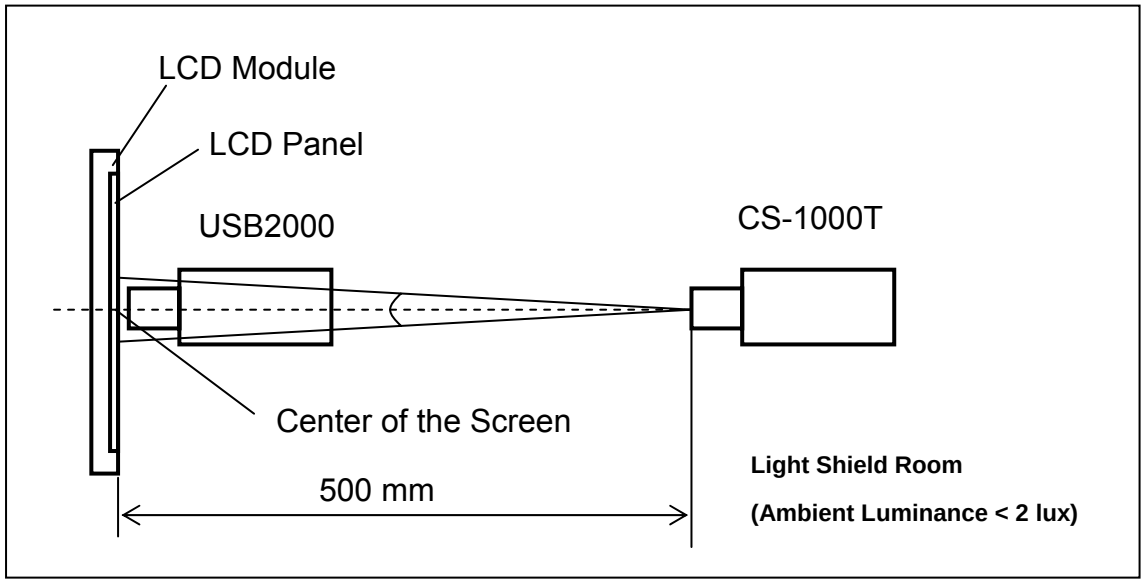
Measure the luminance of gray level 63 at center point

$L_C = L (5)$

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

Note (5) Measurement Setup:

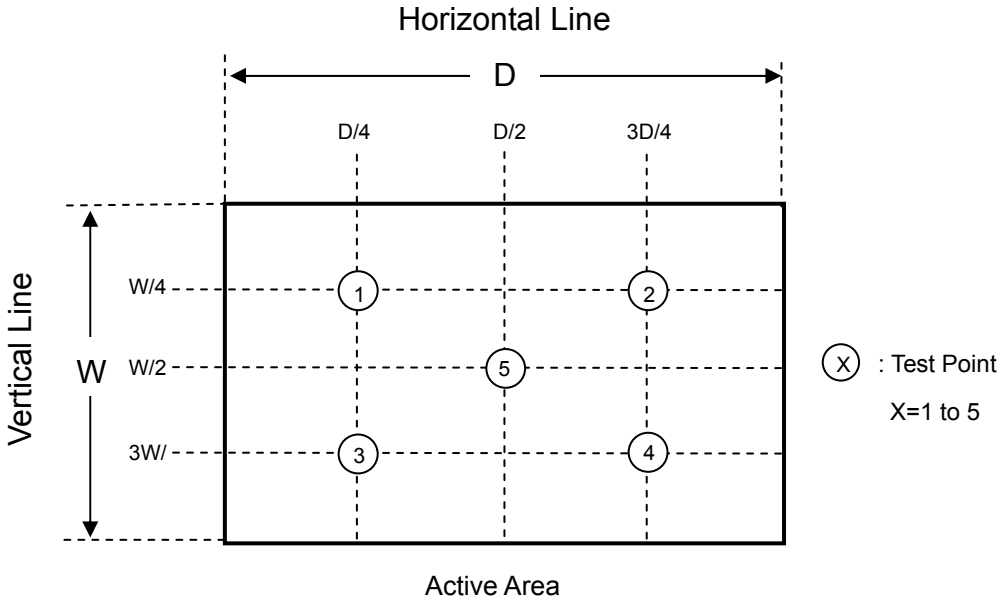
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



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

Measure the luminance of gray level 63 at 5 points

$$\delta W = \frac{\text{Maximum [L (1), L (2), L (3), L (4), L (5)]}}{\text{Minimum [L (1), L (2), L (3), L (4), L (5)]}}$$



8. Reliability Test Criteria

Test Item	Test Condition	Note
High Temperature Storage Test	80ºC, 240 hours	(1)(2)(4)
Low Temperature Storage Test	-30ºC, 240 hours	
Thermal Shock Storage Test	-30ºC, 0.5hour←→80℃, 0.5hour; 1hour/cycle,100cycles	
High Temperature Operation Test	70ºC, 240 hours	
Low Temperature Operation Test	-20ºC, 240 hours	
High Temperature & High Humidity Operation Test	60ºC, 90%RH, 240hours	
Shock (Non-Operating)	50G, 2ms, half sine wave, 1 time for ± X, ± Y, ± Z.	(3)(4)
Vibration (Non-Operating)	1.5G, 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z	(3)(4)

Note (1) There should be no condensation on the surface of panel during test.

Note (2) Temperature of panel display surface area should be 85 ºC Max.

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.

Note (4) In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before reliability test.

9. PACKAGING

9.1 PACKING SPECIFICATIONS

(1) 13pcs LCD modules / 1 Box

(2) Box dimensions: 465(L) X 362 (W) X 314 (H) mm

(3) Weight: approximately 11 Kg (13 modules per box)

9.2 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: 2 – 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, 61 cm	Non Operation

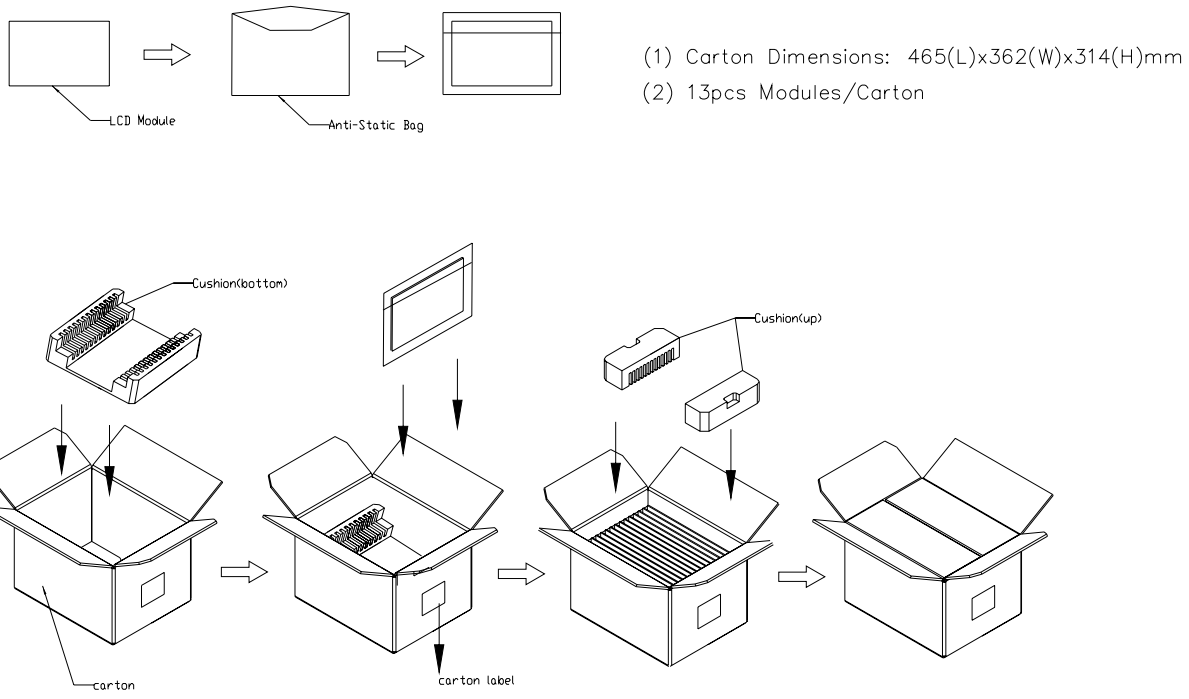
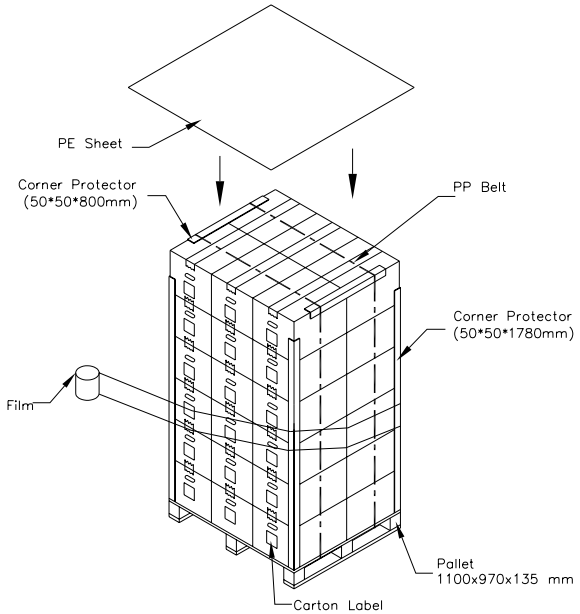


Figure. 9-1 Packing method

Sea / Land Transportation (40ft Container)



Air Transportation

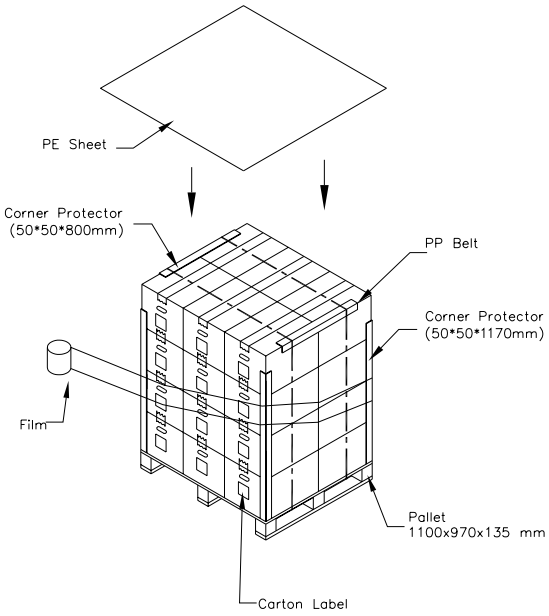
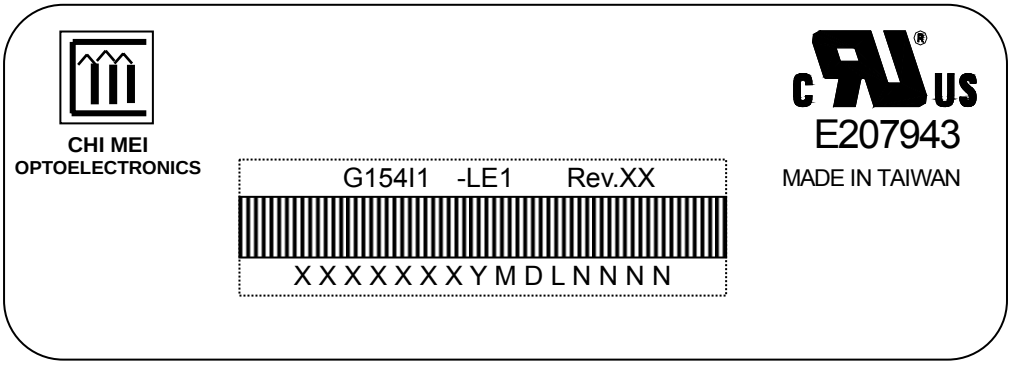


Figure. 9-2 Packing method

10. DEFINITION OF LABELS

10.1 CMO MODULE LABEL

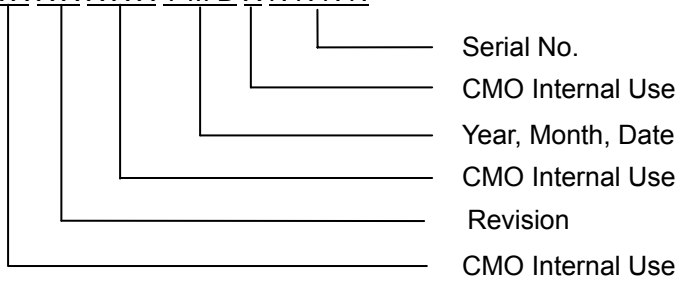
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: G154I1 -LE1

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

(c) Serial ID: X X X X X X X Y M D X N N N N



Serial ID includes the information as below:

(a) Manufactured Date: Year: 0~9, for 2010~2019

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

11. PRECAUTIONS

11.1 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, and the starting voltage of CCFL will be higher than room temperature.

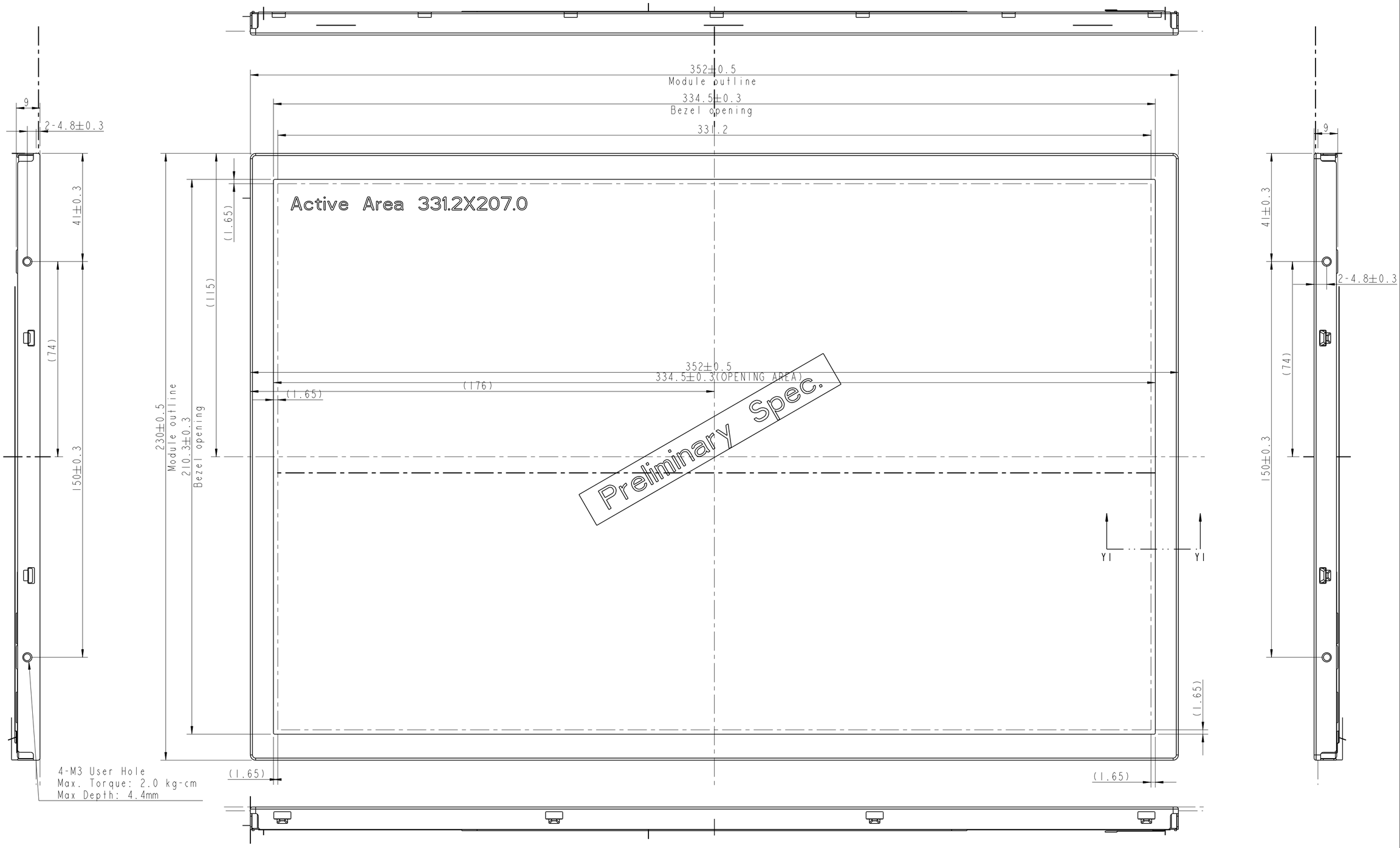
(11) Do not keep same pattern in a long period of time. It may cause image sticking on LCD.

11.2 SAFETY PRECAUTIONS

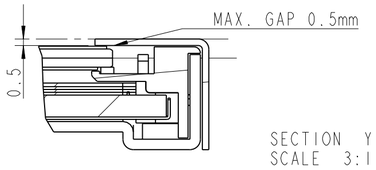
(1) Do not disassemble the module or insert anything into the Backlight unit.

(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.



NOTES:
1.OUTLINE TOLERANCE:±0.5mm.
2.I/F CONNECTOR SPEC: FI-SE20P-HFE (JAE) OR EQUIVALENT.
3.LAMP CONNECTOR: YEONHO_LOCKING_TYPE 35001HS-02L OR EQUIVALENT.
4.SIDE MOUNT HOLE TORQUE : 5Kgf-cm (MAX.).



SECTION Y1-Y1
SCALE 3:1

Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark

TITLE	ASSY_MODULE_G15411_LE1					2D REV.	1.0
						3D REV.	1.2+
Approved	SY_F	Drawing No.	***				
Checked	CCY	Part No.	***				
Drawer	Eason_Tseng	Material	***		Sheet	1 / 2	A2
Designer	Eason_Tseng	Date	26-Jul.-2010	Scale	1:1	Unit:mm	

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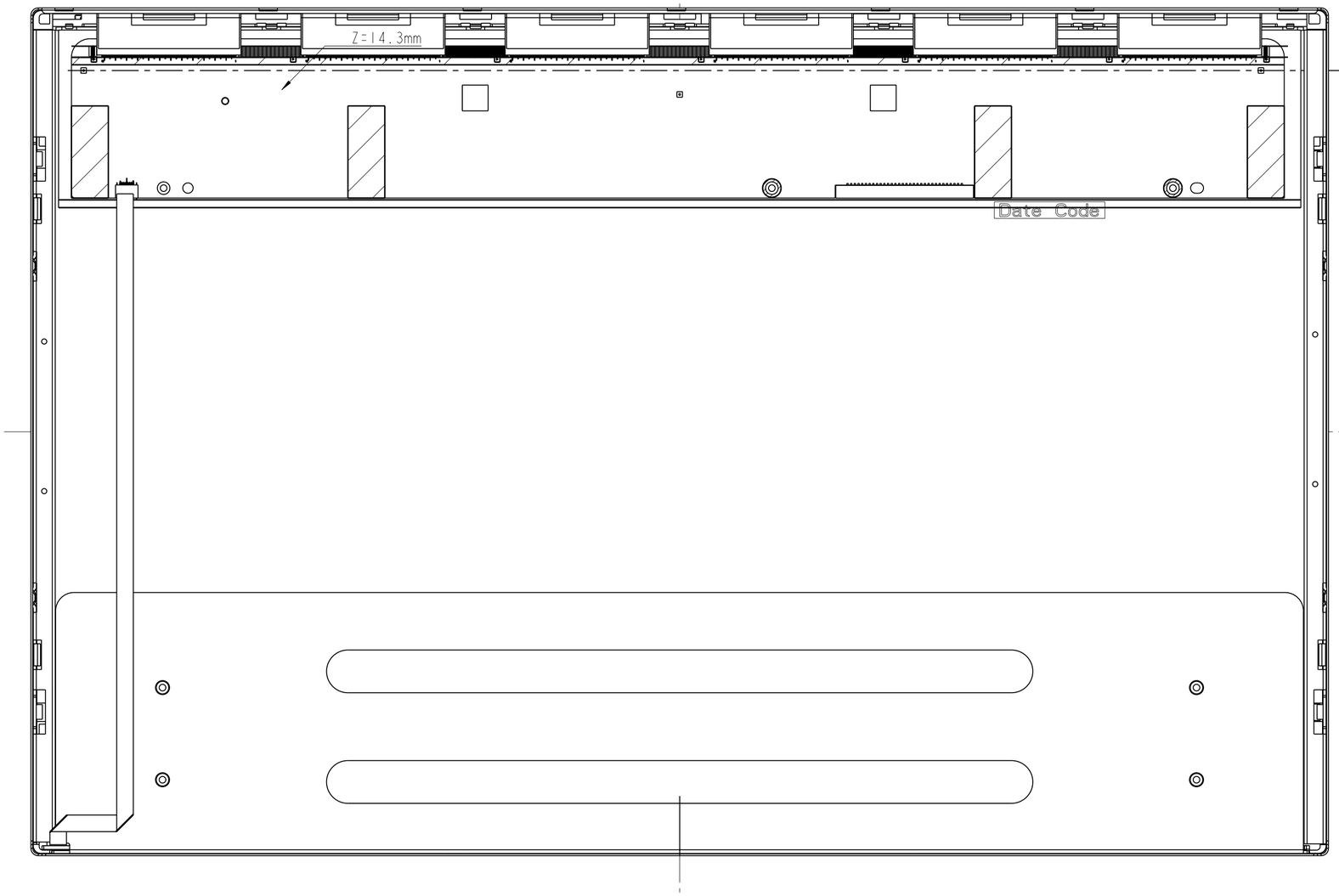

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				3D REV.	1.2+
Approved	SY_F	Drawing No.	***		
Checked	CCY	Part No.	***		
Drawer	Eason_Tseng	Material	***	Sheet	2 / 2 A2
Designer	Eason_Tseng	Date	26-Jul.-2010	Scale 1:1	Unit:mm

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