

1. GENERAL DESCRIPTION

1.1 OVERVIEW

G150X1-L03-V508 is a 15.0" TFT Liquid Crystal Display module with an LED Backlight unit and 20 pins LVDS interface. This module supports 1024 x 768 XGA mode and can display 16.2M colors.

The PSWG is to establish a set of displays with standard mechanical dimensions and select electrical interface requirements for an industry standard 15.0" XGA LCD panel and the inverter module for Backlight is not built in.

1.2 FEATURES

- XGA (1024 x 768 pixels) resolution
- DE(Data Enable) only mode
- LVDS Interface with 1pixel/clock
- PSWG (Panel Standardization Working Group)
- Wide operating temperature.

- optimized Sunlight Readability

1.3 APPLICATION

- TFT LCD Monitor
- TFT LCD TV
- Industrial Application
- Amusement
- Vehicle

1.4 GENERAL SPECIFICATIONS

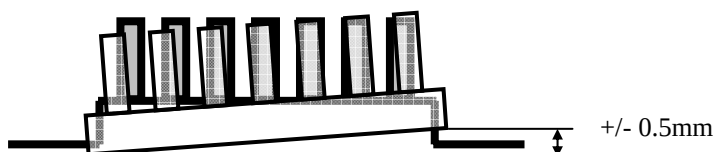
Item	Specification	Unit	Note
Active Area	304.128 (H) x 228.096(V) (15.0" diagonal)	mm	(1)
Bezel Opening Area	307.4(H) x 231.3(V)	mm	
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	1024 x R.G.B x 768	pixel	-
Pixel Pitch	0.297(H) x 0.297(W)	mm	-
Pixel Arrangement	RGB vertical Stripe	-	-
Display Colors	16.2M	color	-
Display Mode	Normally White	-	-
Surface Treatment	Hard coating (3H), Glare	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	326	326.5	327	mm	(1)
	Vertical(V)	253	253.5	254	mm	
	Depth(D)	13.35	13.85	14.35	mm	(1)(2)
Weight			970	1000	g	-

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

Note (2) The depth is without connector.



2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Operating Ambient Temperature	T _{OP}	-30	+80	°C	
Storage Temperature	T _{ST}	-40	+85	°C	

Test Item	Test Condition	Note
High Temperature Storage Test	85°C, 240 hours	(1) (2)
Low Temperature Storage Test	-40°C, 240 hours	
Thermal Shock Storage Test	-30°C, 0.5hour $\longleftrightarrow$ 80°C, 0.5hour, 1hour/cycle, 100cycles	
High Temperature Operation Test	80°C, 240 hours	
Low Temperature Operation Test	-30°C, 240 hours	
High Temperature & High Humidity Operation Test	60°C, 90%RH, 240hours	
Shock (Non-Operating)	50G, 11ms, half sine wave, 1 time for $\pm X$, $\pm Y$, $\pm Z$.	(3)
Vibration (Non-Operating)	1.5G, 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z	(3)

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

Note (2) Temperature of panel display surface area should be 90 °C 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 the reliability test

2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V _{DD}	-0.3	4.0	V	

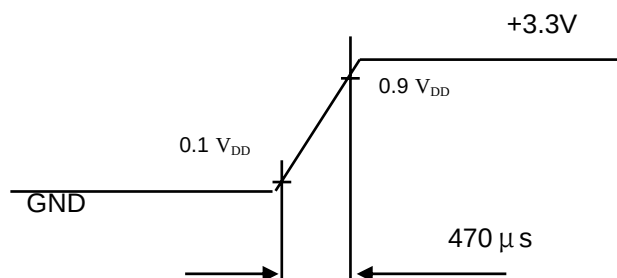
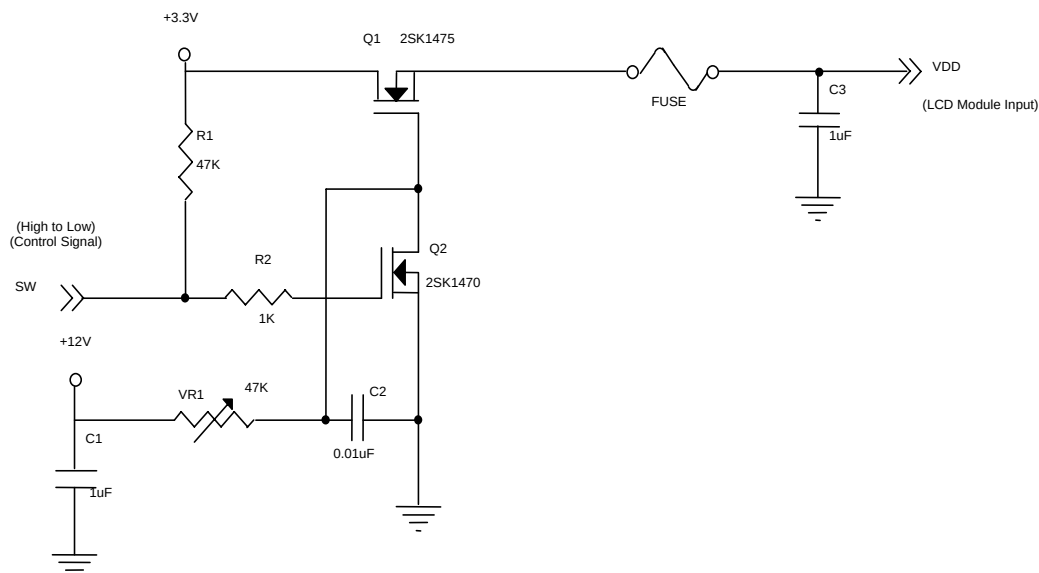
3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE⁽¹⁾

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V	-
Ripple Voltage	V_{RP}	-	-	100	mVp-p	
Rush Current	I_{RUSH}	-	-	2.0	A	(2)
Power Supply Current	White	-	500		mA	(3)a
	Black	-	750		mA	(3)b
Differential Input Voltage for LVDS Receiver Threshold	"H" Level	-	-	100	mV	-
	"L" Level	-100	-	-	mV	-
Terminating Resistor	R_T		100	-	Ohm	-

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

Note (2) Measurement Conditions:



Note (3) The specified power supply current is under the conditions at $V_{DD} = 3.3V$, $T_a = 25 \pm 2 \text{ }^{\circ}C$, DC Current and $f_v = 60 \text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



Active Area

3.2. Backlight Specifications

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

ITEM	SYMBOL	MIN	TYP.	MAX.	UNIT	Remarks
LED Forward Voltage	VL	--	8.69	9.59	V	*1), IL = 820mA
LED Forward Current	IL	--	--	820	mA	*2)
Power Consumption	WL	--	7.12	--	W	IL = 820mA
Backlight Lifetime	BL	--	50,000	--	h	*3), *4), IL = 820mA

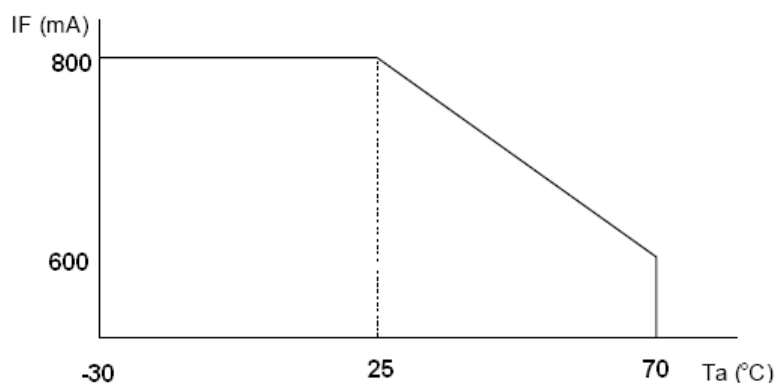
*1) VL is specified as the sum of the white LED forward voltages.

*2) LEDs are best driven using a constant current source. To avoid chromaticity shifts while dimming pulse-width modulation (PWM) techniques may be employed (0-100% duty cycle). IL is the current into one backlight connector (rail).

*3) Backlight lifetime is defined as the time when the brightness becomes 50% of the initial value.

*4) The lifetime of the backlight depends on the ambient temperature. The lifetime will decrease under high temperature unless LED forward current is reduced accordingly.

*5) LED forward current derating curve:

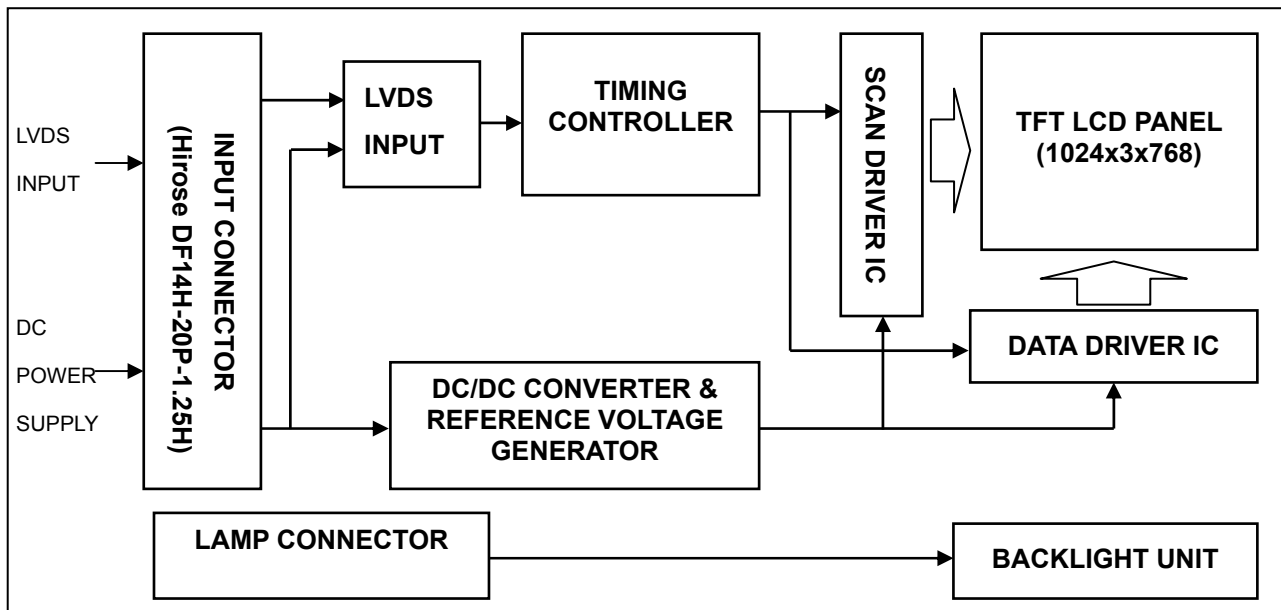


*5) Recommended backlight power supply:

PART NUMBER	MANUFACTURER
CCBR-2-800	Apollo Display Technologies, LLC.

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin No.	Symbol	Function	Polarity	Note
1	VDD	Power Supply +3.3V(typical)		
2	VDD	Power Supply +3.3V(typical)		
3	GND	Ground		
4	GND	Ground		
5	RX0-	LVDS Differential Data Input	Negative	
6	RX0+	LVDS Differential Data Input	Positive	
7	GND	Ground		
8	RX1-	LVDS Differential Data Input	Negative	
9	RX1+	LVDS Differential Data Input	Positive	
10	GND	Ground		
11	RX2-	LVDS Differential Data Input	Negative	
12	RX2+	LVDS Differential Data Input	Positive	
13	GND	Ground		
14	RXCLK-	LVDS Differential Data Input	Negative	
15	RXCLK+	LVDS Differential Data Input	Positive	
16	GND	Ground		
17	RX3-	LVDS Differential Data Input	Negative	
18	RX3+	LVDS Differential Data Input	Positive	
19	GND	Ground		
20	NC	tied to ground		

(1)Connector Part No.: [Hirose] DF14H-20P-1.25H

(2)Matching socket Part No.: [Hirose] DF14-20S-1.25C

5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Color
1	HV	Voltage	Red
2	LV	Ground	Black

Note (1) Connector Part No.: 22-01-3027 (Molex)

Note (2) Matching Connector Part No.: 22-05-3021 (Molex)

Note (3) : VL = HV - LV

5.3 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	R7	R6	G5	G4	G3	G2	G1	G0	R7	R6	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	1	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(252)	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(252)	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(252)	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(252)	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(252)	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(252)	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	1	0	0
	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Blue(252)	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(252)	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(252)	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

6. INTERFACE TIMING

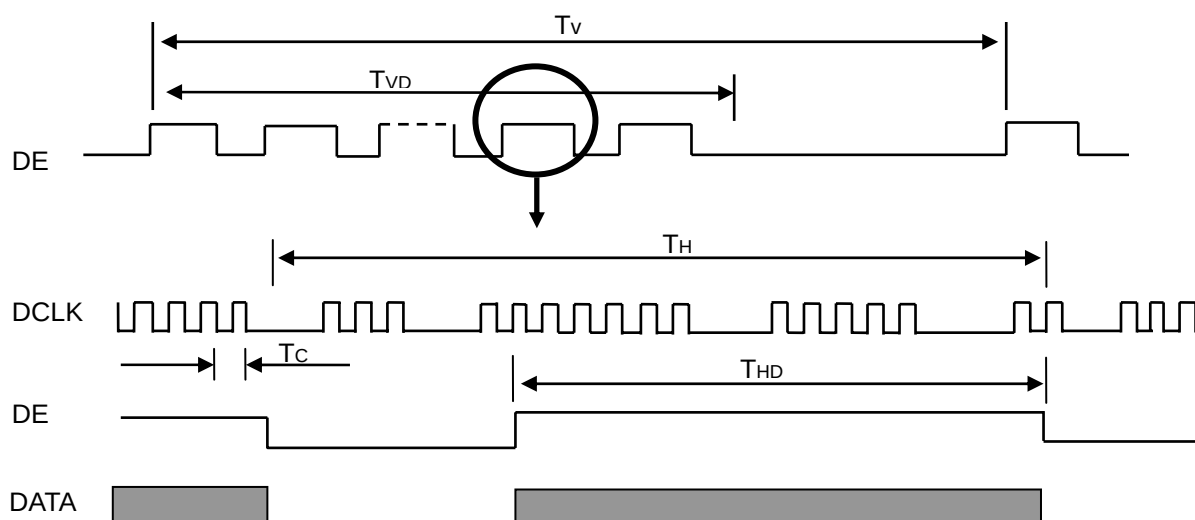
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

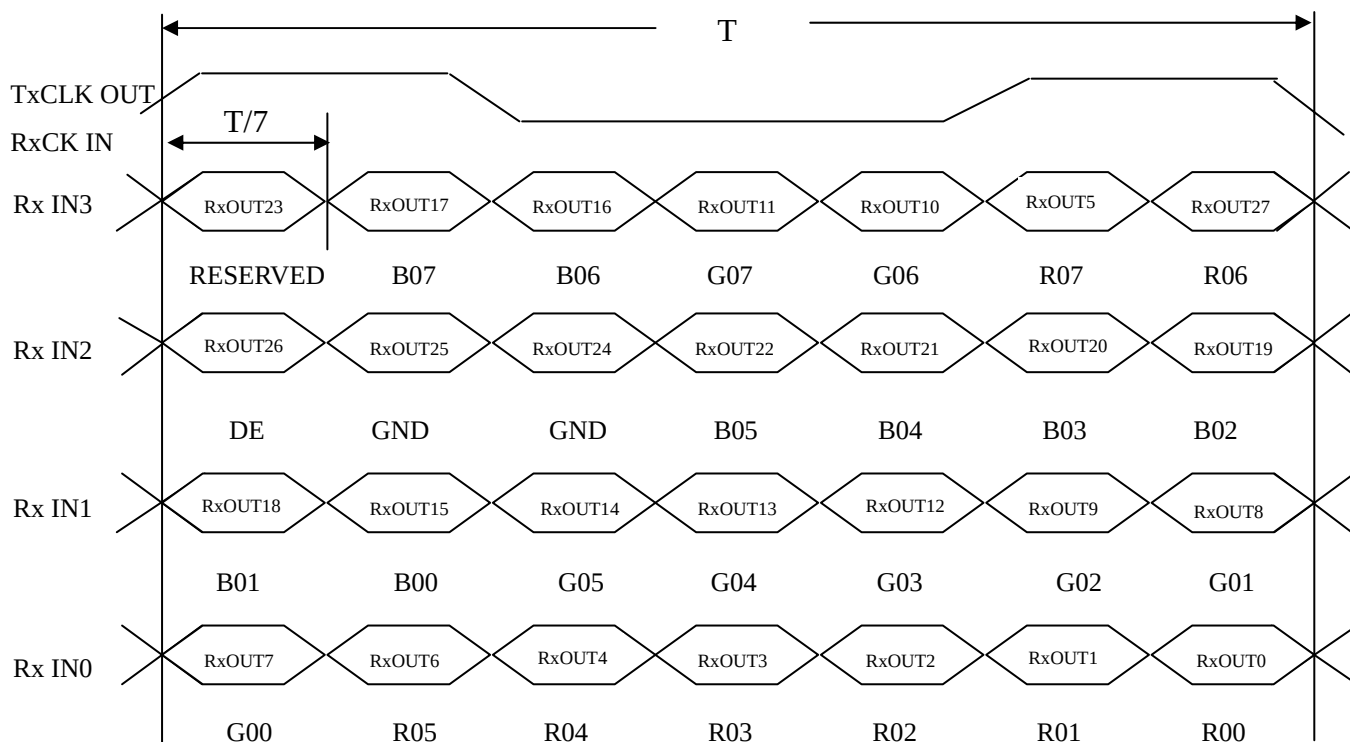
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Pixel Clock	$1/T_C$	-	65	80	MHz	-
DE	Vertical Total Time	T_V	780	806	1200	T_H	-
	Vertical Address Time	T_{VD}	768	768	768	T_H	-
	Horizontal Total Time	T_H	1140	1344	1600	T_C	-
	Horizontal Address Time	T_{HD}	1024	1024	1024	T_C	-

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.

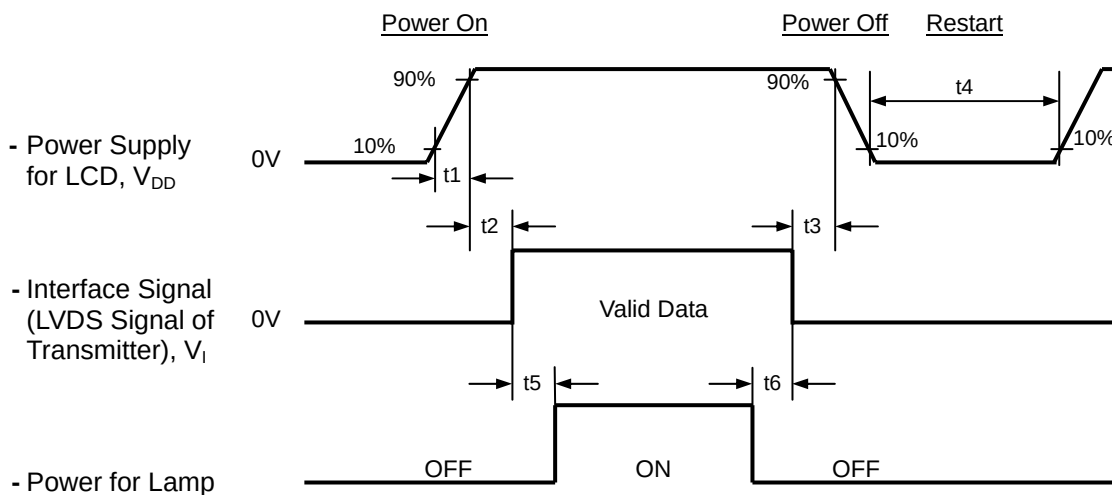
INPUT SIGNAL TIMING DIAGRAM



TIMING DIAGRAM of LVDS



6.2 POWER ON/OFF SEQUENCE



Timing Specifications:

$$0.5 < t1 \leq 10 \text{ msec}$$

$$0 < t2 \leq 50 \text{ msec}$$

$$0 < t3 \leq 50 \text{ msec}$$

$$t4 \geq 500 \text{ msec}$$

$$t5 \geq 200 \text{ msec}$$

$$t6 \geq 200 \text{ msec}$$

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 V_{DD} to 0 V.

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

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

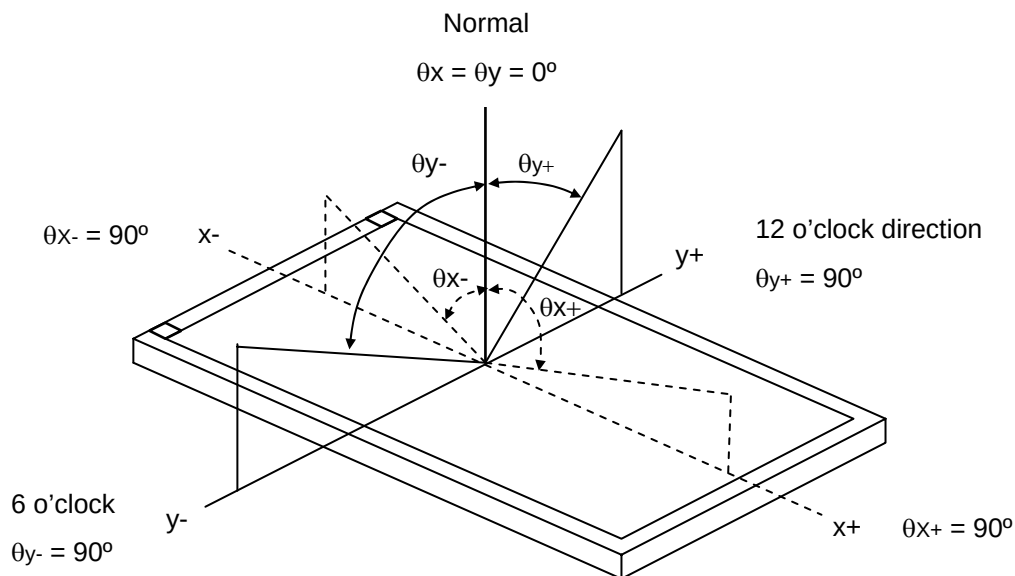
Item	Symbol	Value	Unit
Ambient Temperature	T _a	25±2	°C
Ambient Humidity	H _a	50±10	%RH
Supply Voltage	V _{DD}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Rail Current	I _L	820	mA
LED Driver	CCBR - 2 - 800		

The measurement methods of optical characteristics are shown in Section 7.2. The following items should be measured under the test conditions described in Section 7.1 and stable environment shown in Note (4).

7.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing Normal Angle	480	700		-	(2), (4)
Response Time		T _R		-	8	13	ms	(3)
		T _F		-	17	22	ms	
Luminance of White (Center point)		L		800	1000	-	cd/m	(4),(5)
White Variation		δW		-	1.25	1.4	-	(4),(5)
Color Chromaticity	Red	R _x		Typ+ 0.03	0.617	Typ+ 0.03	-	(1), (4)
		R _y			0.345		-	
	Green	G _x			0.315		-	
		G _y			0.575		-	
	Blue	B _x			0.145		-	
		B _y			0.110		-	
	White	W _x			0.313		-	
		W _y			0.329		-	
Viewing Angle	Horizontal	θ _x +	CR≥10	70	80	-	Deg.	
		θ _x -		70	80	-		
	Vertical	θ _Y +		70	80	-		
		θ _Y -		70	80	-		
Contrast Ratio in daylight		CR	Sun lamp	50	70			(6)

Note (1) Definition of Viewing Angle (θ_x , θ_y):



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

The contrast ratio can be calculated by the following expression.

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

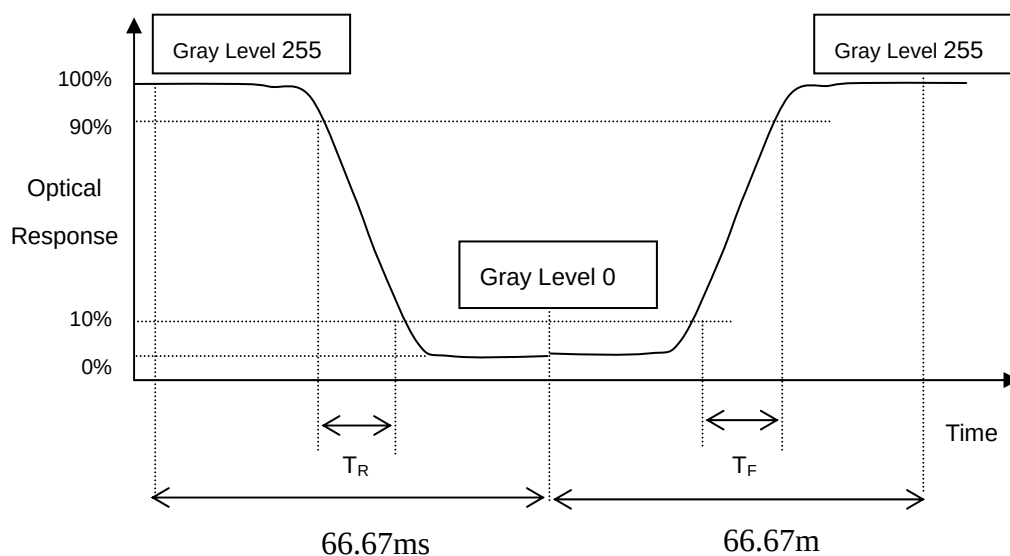
L_{255} : Luminance of gray level 255

L_0 : Luminance of gray level 0

$$\text{CR} = \text{CR} (1)$$

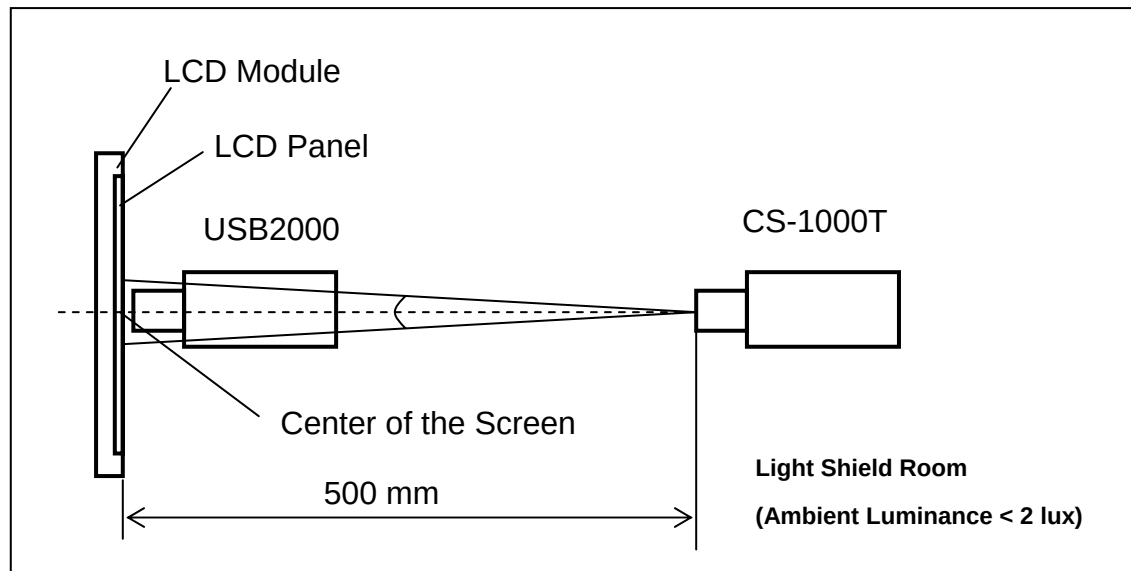
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

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



Note (4) Measurement Setup:

The LCD module should be stabilized at given temperature for 15 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



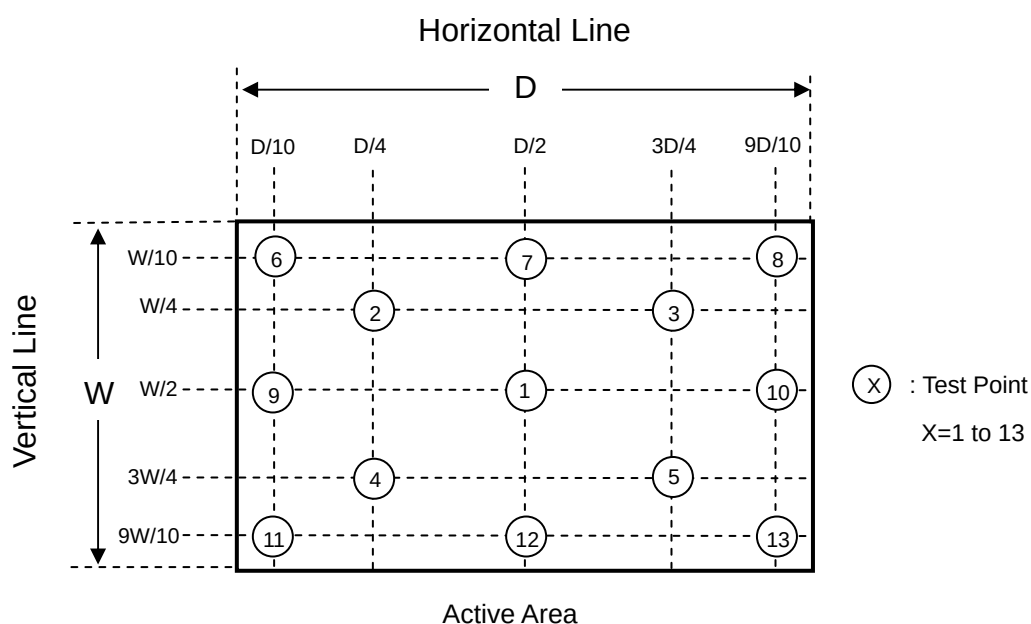
Note (5) Definition of luminance measured points:

Measure the luminance of gray level 255 at point L(1)

Definition of White Variation (δW):

Measure the luminance of gray level 255 at 9 points

$$\delta W = \frac{\text{Maximum [L (1), L (6), L (7), L (8), L (9), L (10), L (11), L (12), L (13)]}}{\text{Minimum [L (1), L (6), L (7), L (8), L (9), L (10), L (11), L (12), L (13)]}}$$

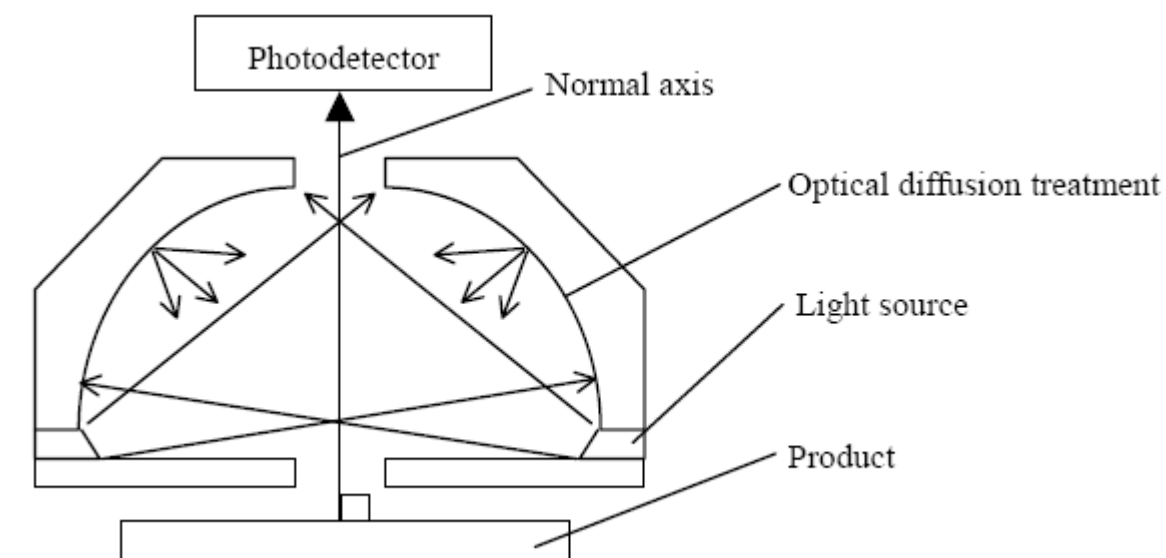


Note (6) Contrast Ratio in daylight:

Measuring method:

Sun lamp:10000 Lux

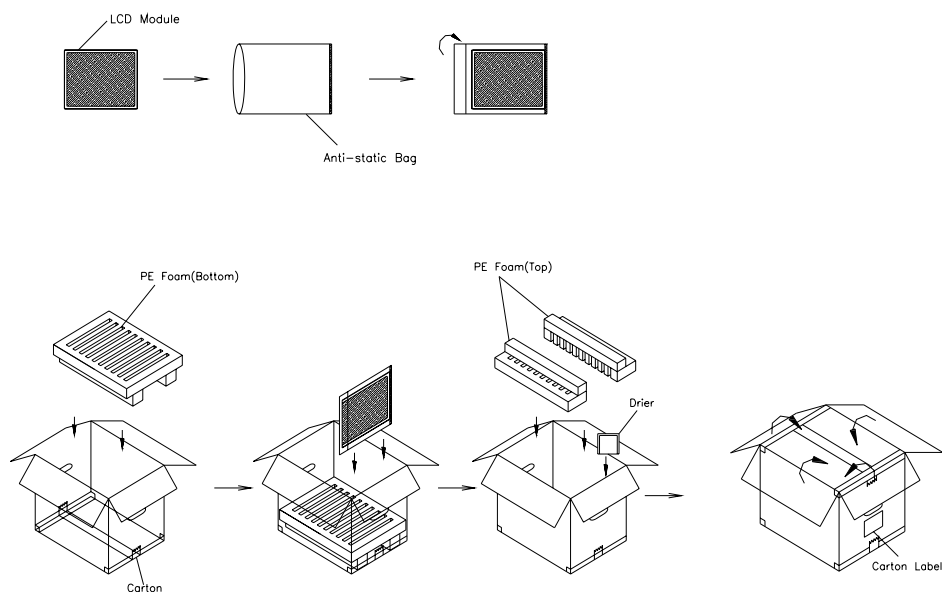
Contrast Ratio in daylight=Luminance of white screen/ Luminance of black screen



8. PACKAGING

8.1 PACKING SPECIFICATIONS

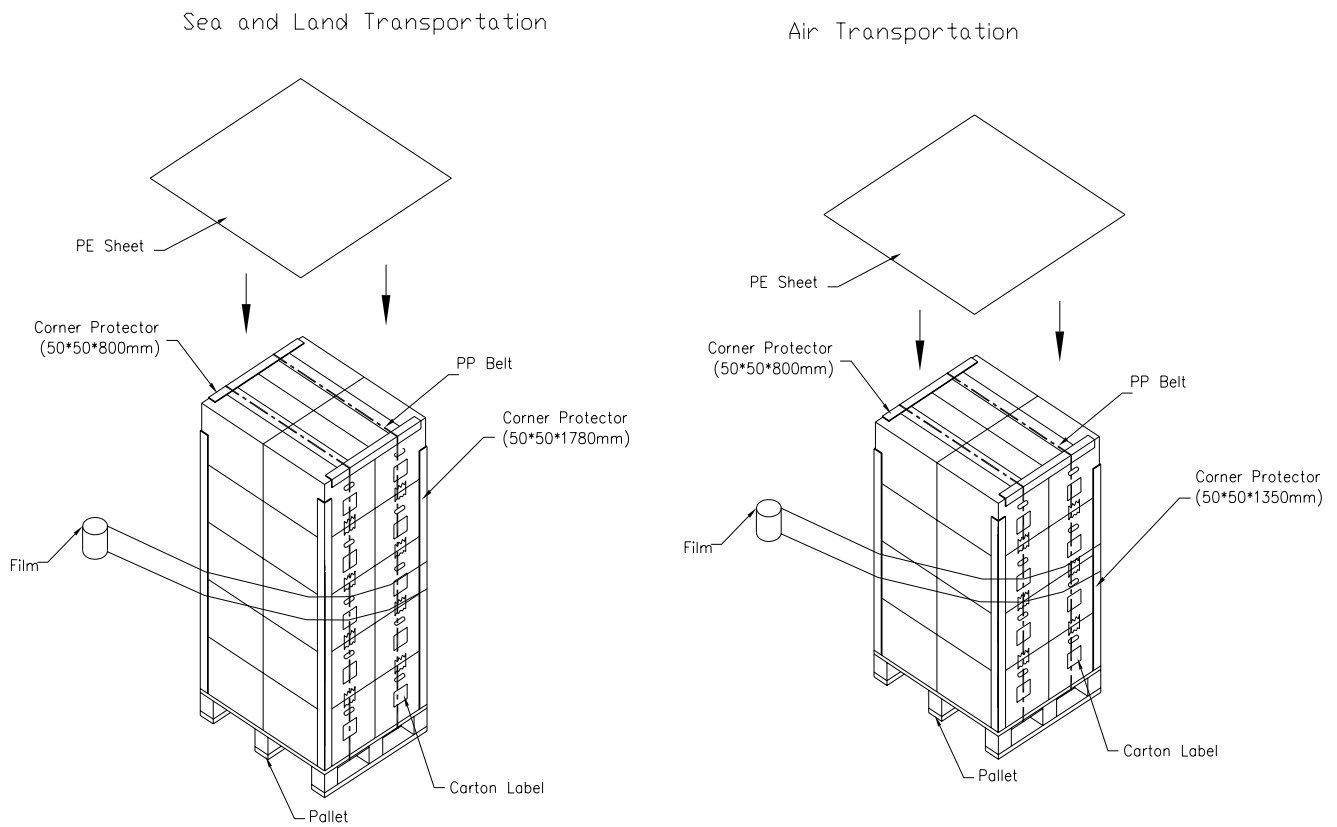
- (1) 10 LCD modules / 1 Box
- (2) Box dimensions : 511(L) X 420(W) X 360(H) mm
- (3) Weight : approximately 13Kg (10 modules per box)



- (1) 10 modules/1 box
- (2) Carton dimensions : 511(L)x420(W)x360(H)mm
- (3) Weight : approximately 12.7kg(10 modules per box).

Figures 8-1

8.2 PACKING Method

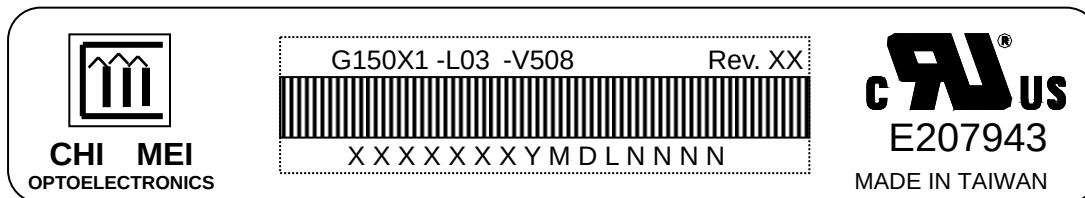


Figures 8-2

9. DEFINITION OF LABELS

9.1 CMO MODULE LABEL

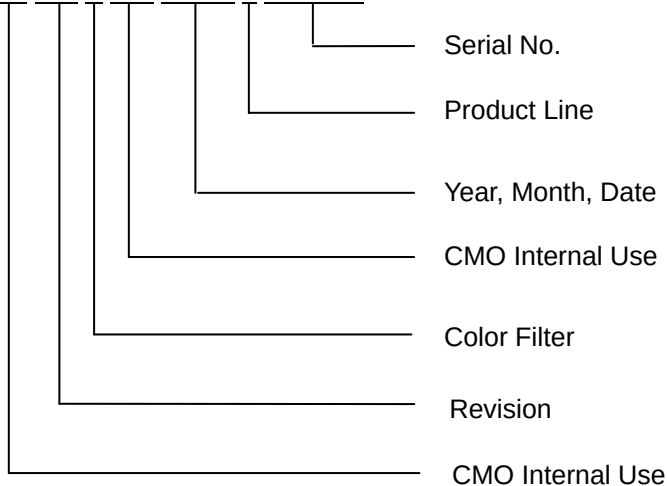
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: G150X1 –L01

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

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



Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2000~2009

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

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

(b) Revision Code: cover all the change

(c) Color Filter: 0 ->CMO, 2 -> Toppan

(d) Serial No.: Manufacturing sequence of product

(e) Product Line: 1 -> Line1, 2 -> Line 2, ...etc.

10. PRECAUTIONS

10.1 HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module.
- (10) Do not pull the lamp wire.
- (11) Pins of I/F connector should not be touched directly with bare hands.
- (12) Do not keep same pattern in a long period of time. It may cause image sticking on LCD.

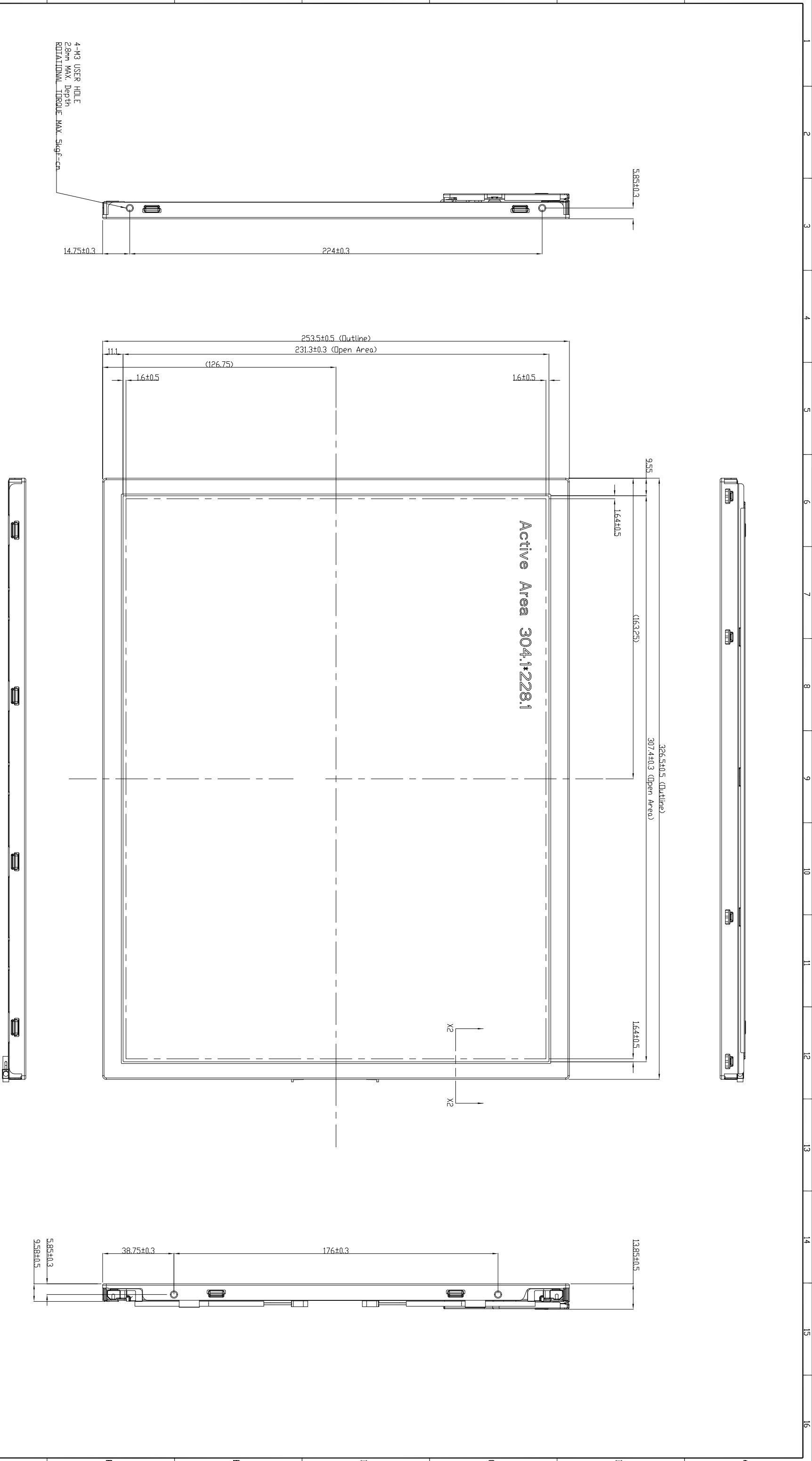
10.2 STORAGE PRECAUTIONS

- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

10.3 OPERATION PRECAUTIONS

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

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

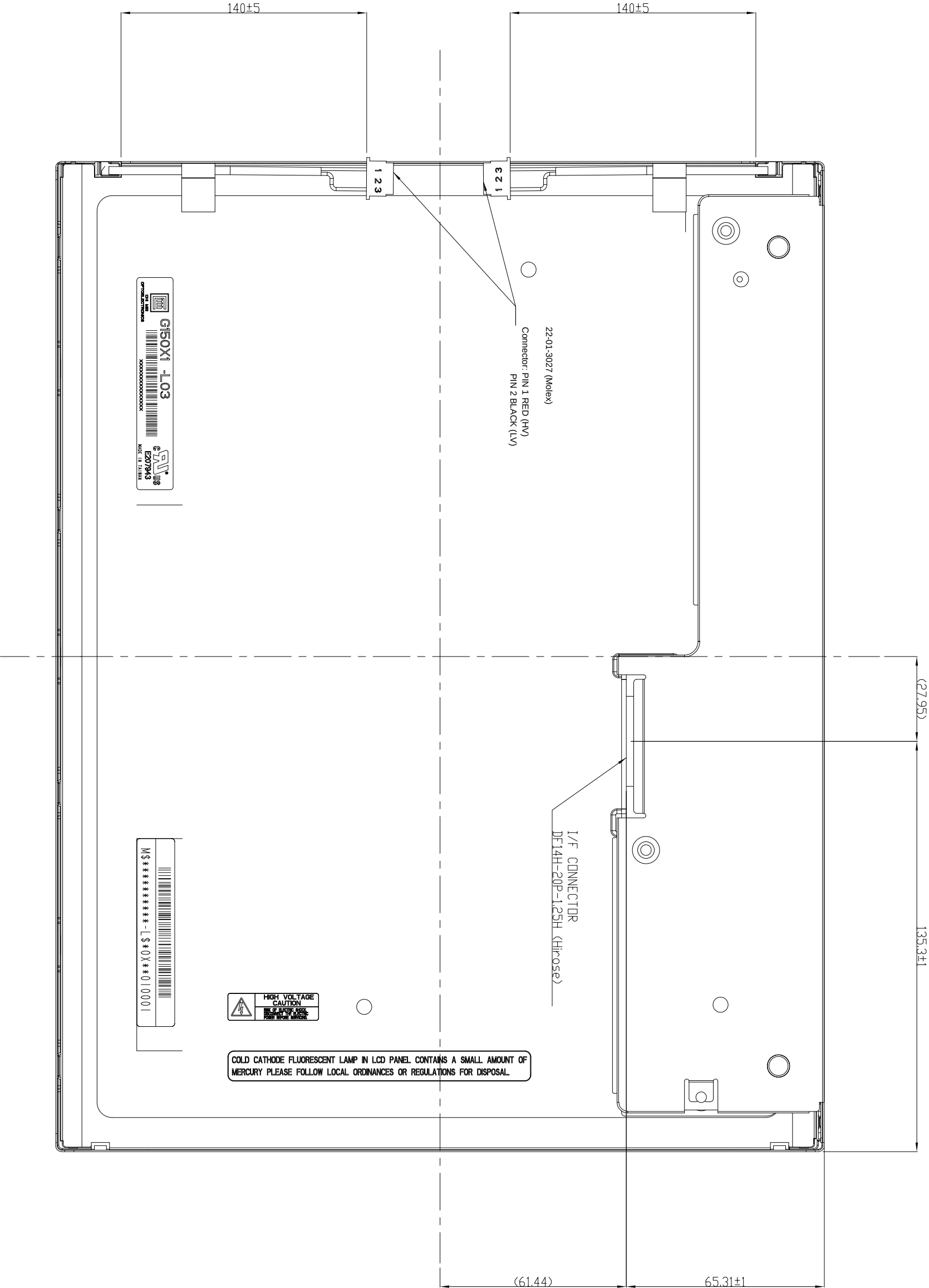


NOTE:
1. OUTLINE TOLERANCE±0.5mm,
2. I/F CONNECTOR: DJ14H-20P-1.25H (Hirose)
3. LAMP CONNECTOR: BHR-03VS-1 (JST)

Work	Description	Date	Changed_By	Approved_By	ECN No.	Remark
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TITLE	ASSY MODULE_GIS0X1-L03			2D REV/A
Approved	TIGER CHANG	Drawing No.	GIS01002A	3D REV/HS+
Checked	JANNA PAN	Part No.	1B0	
Drawer	TIBIRAS WANG	Material	1B0	
Designer	TIBIRAS WANG	Date	10-Dec-2007	Scale 1:1
		Sheet	1 / 2	Unit:mm

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TITLE ASSY_MODULE E_GI50X1-L03		2D REV.1 B	
Approved TIGER CHANG		3D REV.1.15+	
Checked	AMDNA PAN	Part No.	TBD
Drawer	TDBIAS WANG	Material	TBD
Designer	TDBIAS WANG	Date	10-Dec-2007
		Scale	1:1
		Sheet	2 / 2
		Unit/mm	A2

NOTE:
1.DUTLINE TOLERANCE:±0.5mm,
2.I/F CONNECTOR: DF14H-20P-1.25H (Hirose)
3.LAMP CONNECTOR: BHR-03VS-1 (JST)

Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark
1						