TFT LCD Approval Specification

MODEL NO.: V190C1 - L01

Customer: _____

Approved by: _____

Note:

LCD TV Head Division	
AVP	郭振隆

QRA Dept.	TVHD / PDD		
	DDIII	DDII	DDI
Approval	Approval	Approval	Approval
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LCD TV Marketing and Product Management Division	
Product Manager	廖曉菁

- CONTENTS -

REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 2.0	Jan .18,'06	All	All	Approval Specification was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

V190C1-L01 is a 19" TFT Liquid Crystal Display module with 4 CCFL Backlight units and 30 pins 2ch-LVDS interface. This module supports 1440 x 900 WXGA+ mode and can display 16.2M colors. The inverter module for Backlight is not built in.

1.2 FEATURES

- Wide viewing angle.
- High contrast ratio
- Super fast response time
- High color saturation
- WXGA+ (1440 x 900 pixels) resolution
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- RoHS Compliance

1.3 APPLICATION

- TFT LCD TV
- TFT LCD Multi Function Monitor

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	410.4 (H) x 256.5 (V)	mm	(1)
Bezel Opening Area	414.36 x 260.45	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1440 x R.G.B. x 900	pixel	-
Pixel Pitch (Sub Pixel)	0.285 (H) x 0.285 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.2M	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Anti-glare (Haze 25)		

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	426.7	427.2	427.7	mm	(1)
	Vertical(V)	276.9	277.4	277.9	mm	
	Depth(D)	16.5	17	17.5	mm	
Weight		2300	2400	2500	g	-

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

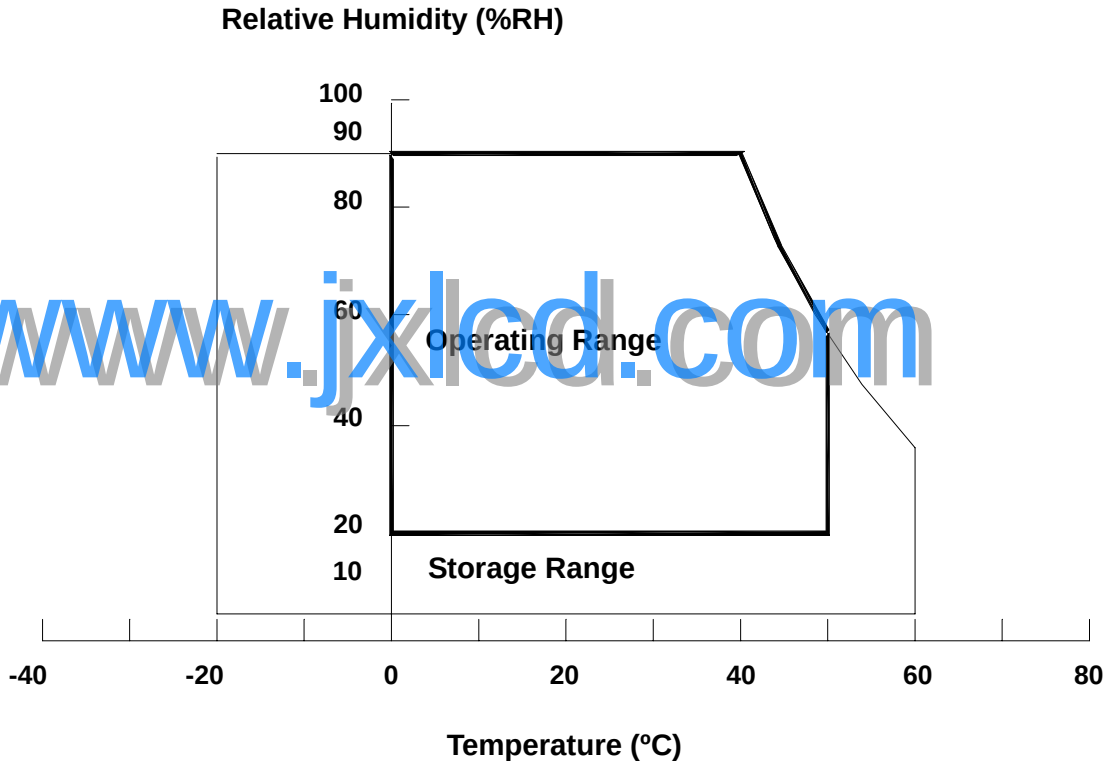
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2)
Shock (Non-Operating)	S_{NOP}	-	50	G	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1	G	(4), (5)

Note (1) 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.



Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 60 ºC with LCD module alone in a temperature controlled chamber. Thermal management should be considered in your product design to prevent the surface temperature of display area from being over 60 ºC. The range of operating temperature may degrade in case of improper thermal management in your product design.

Note (3) 11 ms, half sine wave, 1 time for ± X, ± Y, ± Z.

Note (4) 10 ~ 500 Hz, 10 min, 1 time each X, Y, Z.

Note (5) 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.

2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	+6.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	4.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_L	-	2.5K	V_{RMS}	(1), (2), I_L = 7.0mA
Lamp Current	I_L	-	7.5	mA_{RMS}	(1), (2)
Lamp Frequency	F_L	-	80	KHz	

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 lamp (Refer to Section 3.2 for further information).

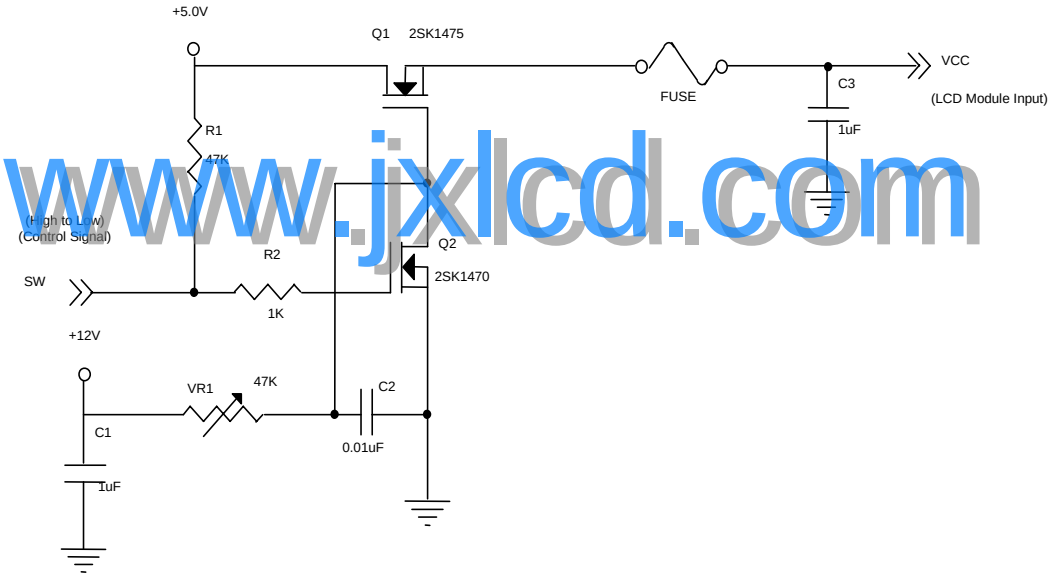
3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

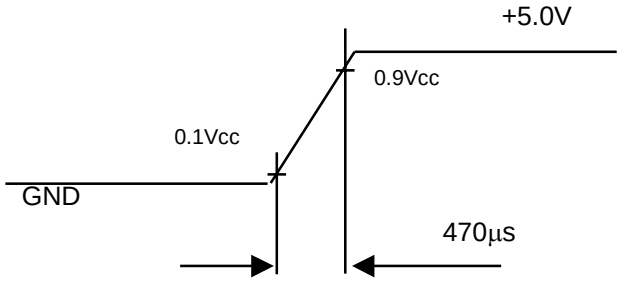
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	4.5	5.0	5.5	V	(1)
Power Supply Ripple Voltage		V_{RP}	-	-	100	mV	
Rush Current		I_{RUSH}	-	1.6	3	A	(2)
Power Supply Current	White	I_{CC}	-	0.5	-	A	(3)
	Black		-	0.7	0.82	A	
	Vertical Stripe		-	0.7	-	A	
LVDS Interface	Differential Input High Threshold Voltage	V_{LVTH}	-	-	+100	mV	
	Differential Input Low Threshold Voltage	V_{LVTL}	-100	-	-	mV	
	Common Input Voltage	V_{LVC}	1.125	1.25	1.375	V	
	Terminating Resistor	R_T		100		ohm	
CMOS interface	Input High Threshold Voltage	V_{IH}	2.7	-	3.3	V	
	Input Low Threshold Voltage	V_{IL}	0	-	0.7	V	

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

Note (2) Measurement Conditions:



Vcc rising time is 470µs



Note (3) The specified power supply current is under the conditions at V_{CC} =5V, Ta = 25 ± 2 ºC, DC Current and f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

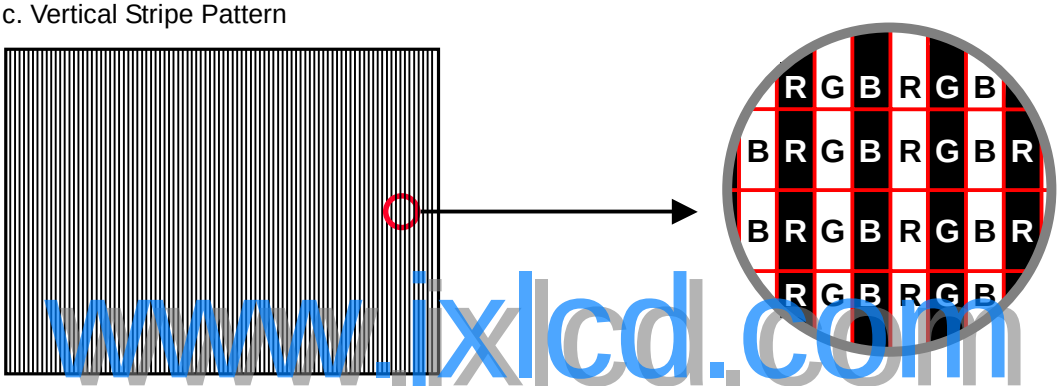
a. White Pattern

Active Area

b. Black Pattern

Active Area

c. Vertical Stripe Pattern



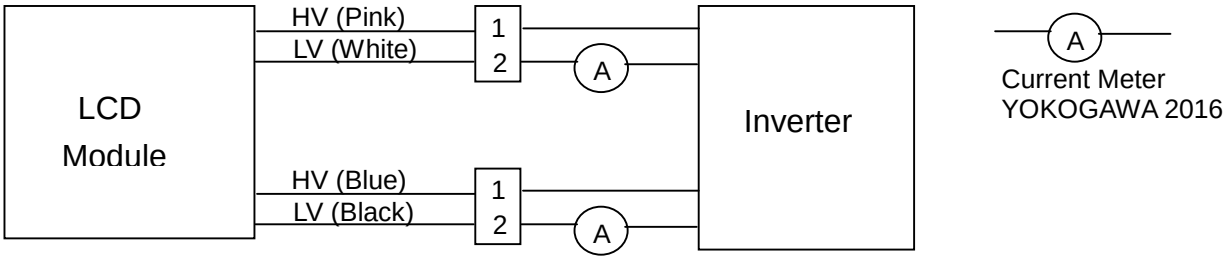
Active Area

3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	697	775	853	V_{RMS}	I_L = 7.0 mA
Lamp Current	I_L	6.5	7.0	7.5	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S	---	---	1500(25℃)	V_{RMS}	(2)
		---	---	1710(0℃)	V_{RMS}	(2)
Operating Frequency	F_L	40	---	80	KHz	(3)
Lamp Life Time	L_{BL}	40000	---	---	Hrs	(5)
Power Consumption	P_L	---	27	---	W	(4), I_L = 7.0 mA

Note (1) Lamp current is measured by utilizing high frequency current meters as shown below:



Note (2) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may produce interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) $P_L = I_L \times V_L \times$ 4 CCFLs

Note (5) The lifetime of lamp can be defined as the time in which it continues to operate under the condition **Ta = 25 ±2 °C and I_L = 7.0 mA rms** until one of the following events occurs:

(a) When the brightness becomes or lower than 50% of its original value.

(b) When the effective ignition length becomes or lower than 80% of its original value. (Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid producing too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

The output of the inverter must have symmetrical (negative and positive) voltage waveform and symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the

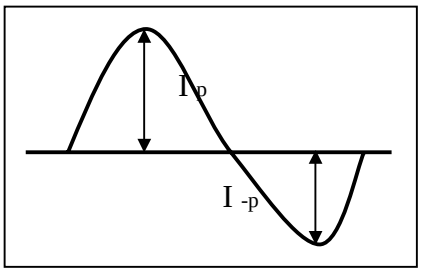
inverter which has unsymmetrical voltage and unsymmetrical current and spike wave. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

a. The asymmetry rate of the inverter waveform should be 10% below;

b. The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$;

c. The ideal sine wave form shall be symmetric in positive and negative polarities.



* Asymmetry rate:

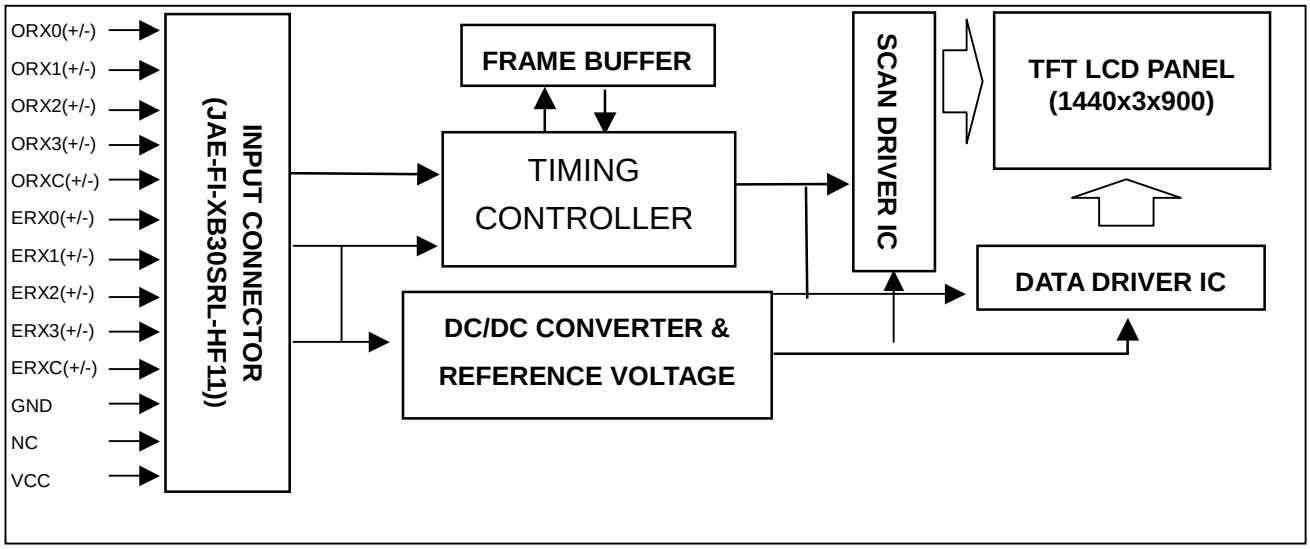
$$| I_p - I_{-p} | / I_{rms} * 100\%$$

* Distortion rate

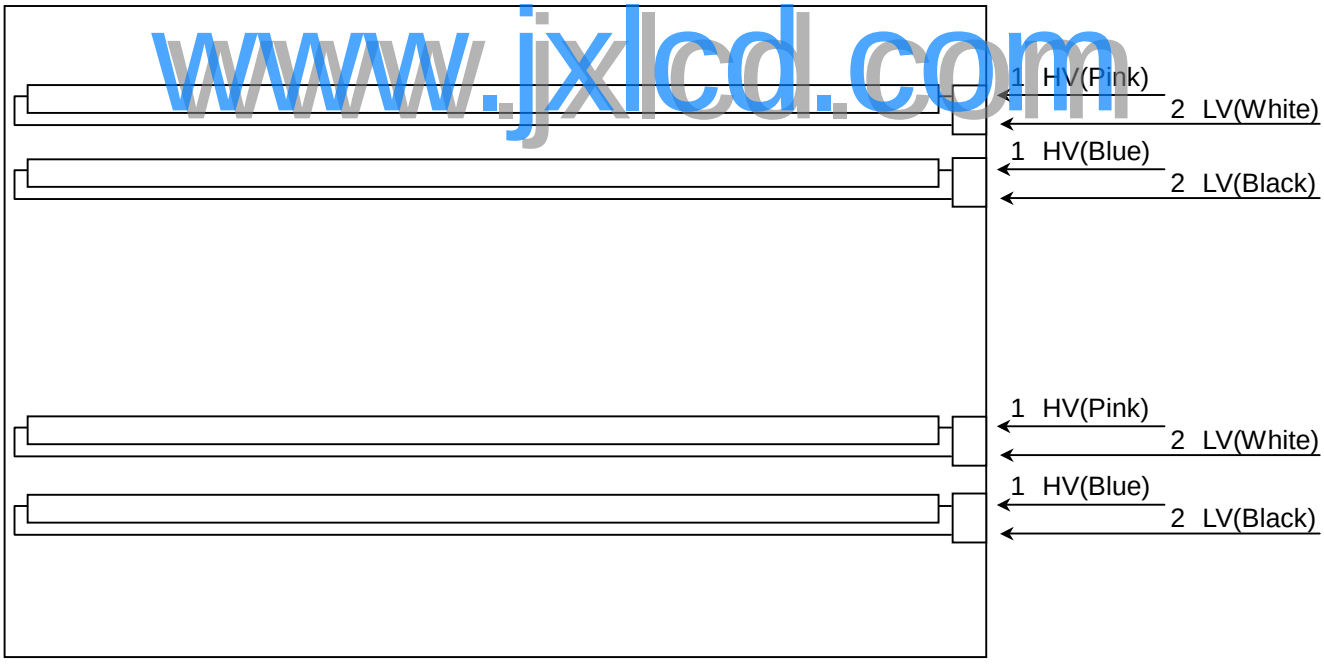
$$I_p \text{ (or } I_{-p}) / I_{rms}$$

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

CNF1 Connector Pin Assignment

Pin No.	Name	Description	Note
1	ORX0-	Negative transmission data of Odd pixel 0.	
2	ORX0+	Positive transmission data of Odd pixel 0.	
3	ORX1-	Negative transmission data of Odd pixel 1.	
4	ORX1+	Positive transmission data of Odd pixel 1.	
5	ORX2-	Negative transmission data of Odd pixel 2.	
6	ORX2+	Positive transmission data of Odd pixel 2.	
7	GND	Ground	
8	OCLK-	Negative of Odd clock.	
9	OCLK +	Positive of Odd clock.	
10	ORX3-	Negative transmission data of Odd pixel 3.	
11	ORX3+	Positive transmission data of Odd pixel 3.	
12	ERX0-	Negative transmission data of Even pixel 0.	
13	ERX0+	Positive transmission data of Even pixel 0.	
14	GND	Ground	
15	ERX1-	Negative transmission data of Even pixel 1.	
16	ERX1+	Positive transmission data of Even pixel 1.	
17	GND	Ground	
18	ERX2-	Negative transmission data of Even pixel 2.	
19	ERX2+	Positive transmission data of Even pixel 2.	
20	ECLK-	Negative of Even clock.	
21	ECLK+	Positive of Even clock.	
22	ERX3-	Negative transmission data of Even pixel 3.	
23	ERX3+	Positive transmission data of Even pixel 3.	
24	GND	Ground	
25	NC	Not connection.	(4)
26	NC	Not connection.	
27	NC	Not connection.	
28	VCC	+5.0V power supply	
29	VCC	+5.0V power supply	
30	VCC	+5.0V power supply	

Note (1) Connector Part No.: JAE-FI-XB30SRL-HF11 or equivalent.

Note (2) The first pixel is odd.

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

Note (4) Reserved for internal use. Left it open.

5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Remark
1	HV	High Voltage	Pink
2	LV	Low Voltage	White

1	HV	High Voltage	Blue
2	LV	Low Voltage	Black

Note (1) Connector Part No.: BHSR-02VS-1 (JST) or equivalent

Note (2) Matching Connector Part No.: SM02B-BHSS-1-TB (JST) or equivalent

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	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
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	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
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	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
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	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

5.4 LVDS INTERFACE

	SIGNAL	TRANSMITTER THC63LVDM83A		INTERFACE CONNECTOR		RECEIVER THC63LVDF84A		TFT CONTROL INPUT
		PIN	INPUT	Host	TFT-LCD	PIN	OUTPUT	
24bit	R0	51	TxIN0			27	Rx OUT0	R0
	R1	52	TxIN1			29	Rx OUT1	R1
	R2	54	TxIN2	TA OUT0+	Rx 0+	30	Rx OUT2	R2
	R3	55	TxIN3			32	Rx OUT3	R3
	R4	56	TxIN4			33	Rx OUT4	R4
	R5	3	TxIN6	TA OUT0-	Rx 0-	35	Rx OUT6	R5
	G0	4	TxIN7			37	Rx OUT7	G0
	G1	6	TxIN8			38	Rx OUT8	G1
	G2	7	TxIN9			39	Rx OUT9	G2
	G3	11	TxIN12	TA OUT1+	Rx 1+	43	Rx OUT12	G3
	G4	12	TxIN13			45	Rx OUT13	G4
	G5	14	TxIN14			46	Rx OUT14	G5
	B0	15	TxIN15	TA OUT1-	Rx 1-	47	Rx OUT15	B0
	B1	19	TxIN18			51	Rx OUT18	B1
	B2	20	TxIN19			53	Rx OUT19	B2
	B3	22	TxIN20			54	Rx OUT20	B3
	B4	23	TxIN21	TA OUT2+	Rx 2+	55	Rx OUT21	B4
	B5	24	TxIN22			1	Rx OUT22	B5
	DE	30	TxIN26			6	Rx OUT26	DE
	R6	50	TxIN27	TA OUT2-	Rx 2-	7	Rx OUT27	R6
	R7	2	TxIN5			34	Rx OUT5	R7
	G6	8	TxIN10			41	Rx OUT10	G6
	G7	10	TxIN11			42	Rx OUT11	G7
	B6	16	TxIN16	TA OUT3+	Rx 3+	49	Rx OUT16	B6
	B7	18	TxIN17			50	Rx OUT17	B7
	RSVD 1	25	TxIN23			2	Rx OUT23	Not connect
	RSVD 2	27	TxIN24	TA OUT3-	Rx 3-	3	Rx OUT24	Not connect
	RSVD 3	28	TxIN25			5	Rx OUT25	Not connect
	DCLK	31	TxCLK IN	TxCLK OUT+ TxCLK OUT-	RxCLK IN+ RxCLK IN-	26	RxCLK OUT	DCLK

R0~R7: Pixel R Data (7; MSB, 0; LSB)

G0~G7: Pixel G Data (7; MSB, 0; LSB)

B0~B7: Pixel B Data (7; MSB, 0; LSB)

DE : Data enable signal

DCLK : Data clock signal

Notes (1) RSVD(reserved)pins on the transmitter shall be “H” or “L”.

6. INTERFACE TIMING

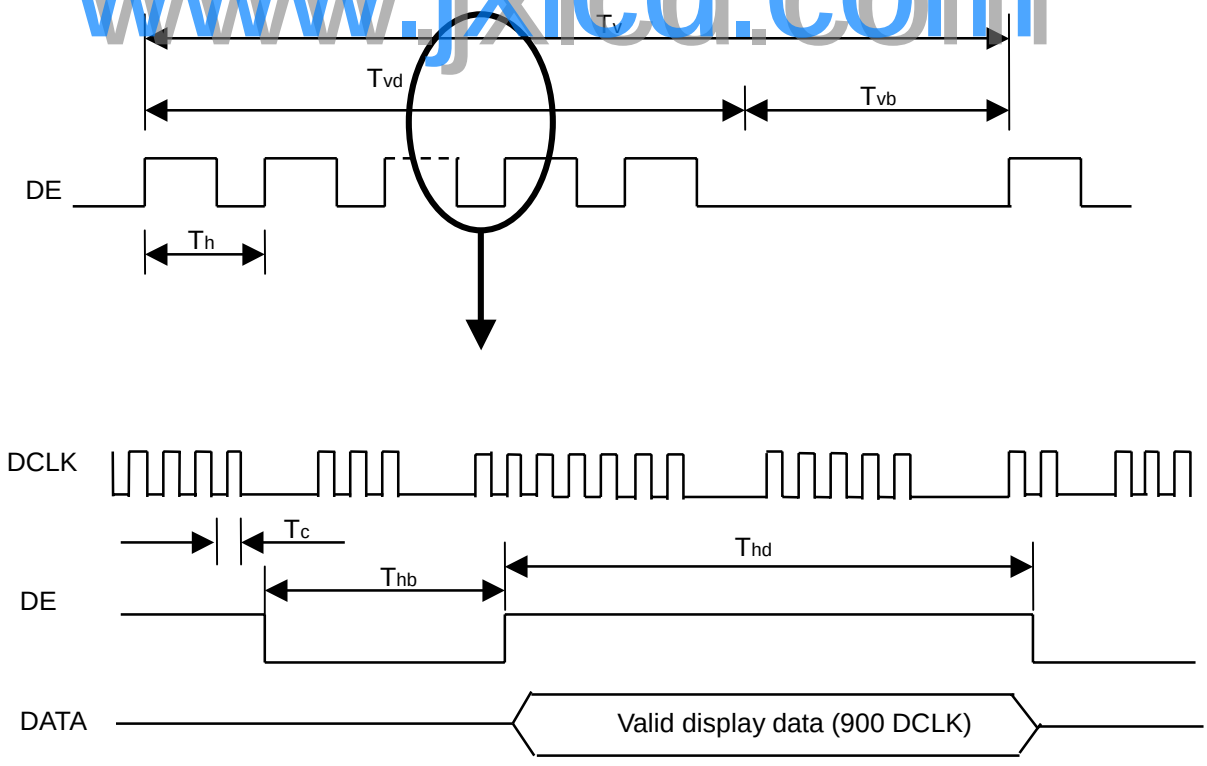
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

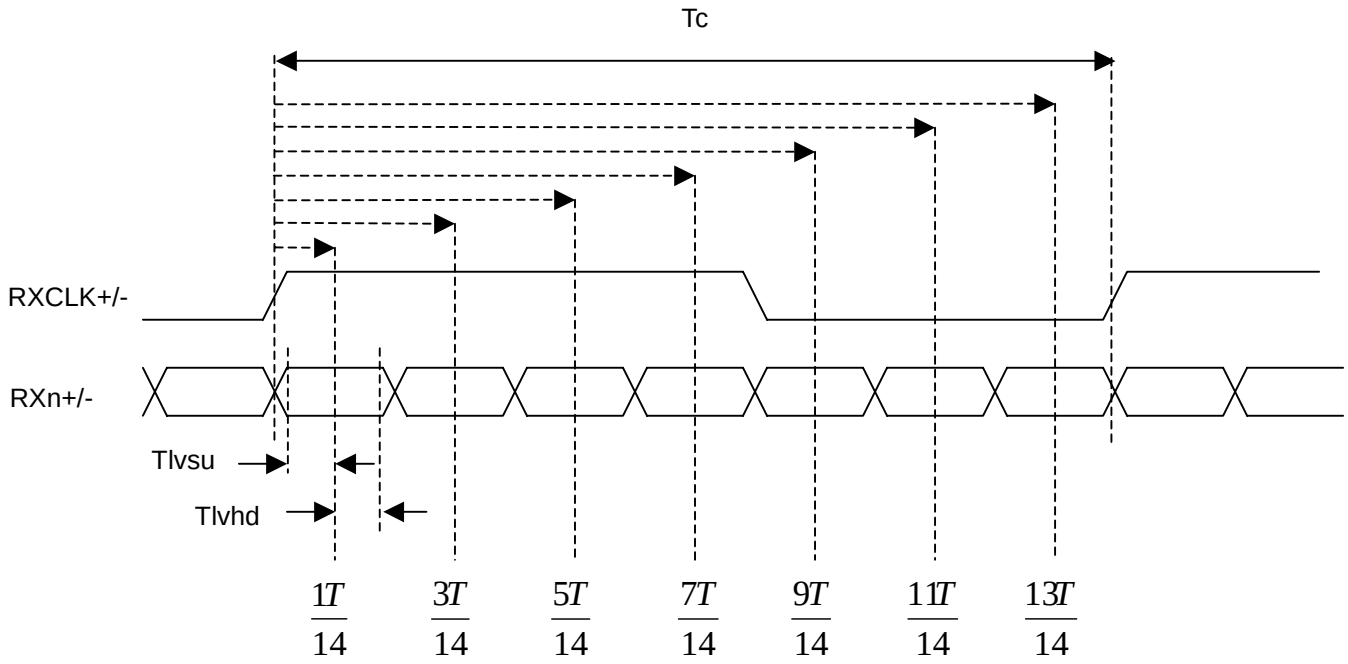
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	1/Tc	-	44	56	MHz	-
	Input cycle to cycle Jitter	Tc	-	-	200	ps	-
LVDS Receiver Data	Setup Time	Tlvs	600	-	-	ps	-
	Hold Time	Tlvh	600	-	-	ps	-
Vertical Active Display Term	Frame Rate	Fr	-	60	75	Hz	Tv=Tvd+Tvb
	Total	Tv	907	926	1050	Th	-
	Display	Tvd	900	900	900	Th	-
	Blank	Tvb	7	26	105	Th	-
Horizontal Active Display Term	Total	Th	750	800	960	Tc	Th=Thd+Thb
	Display	Thd	720	720	720	Tc	-
	Blank	Thb	30	80	240	Tc	-

Note : Since this module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM

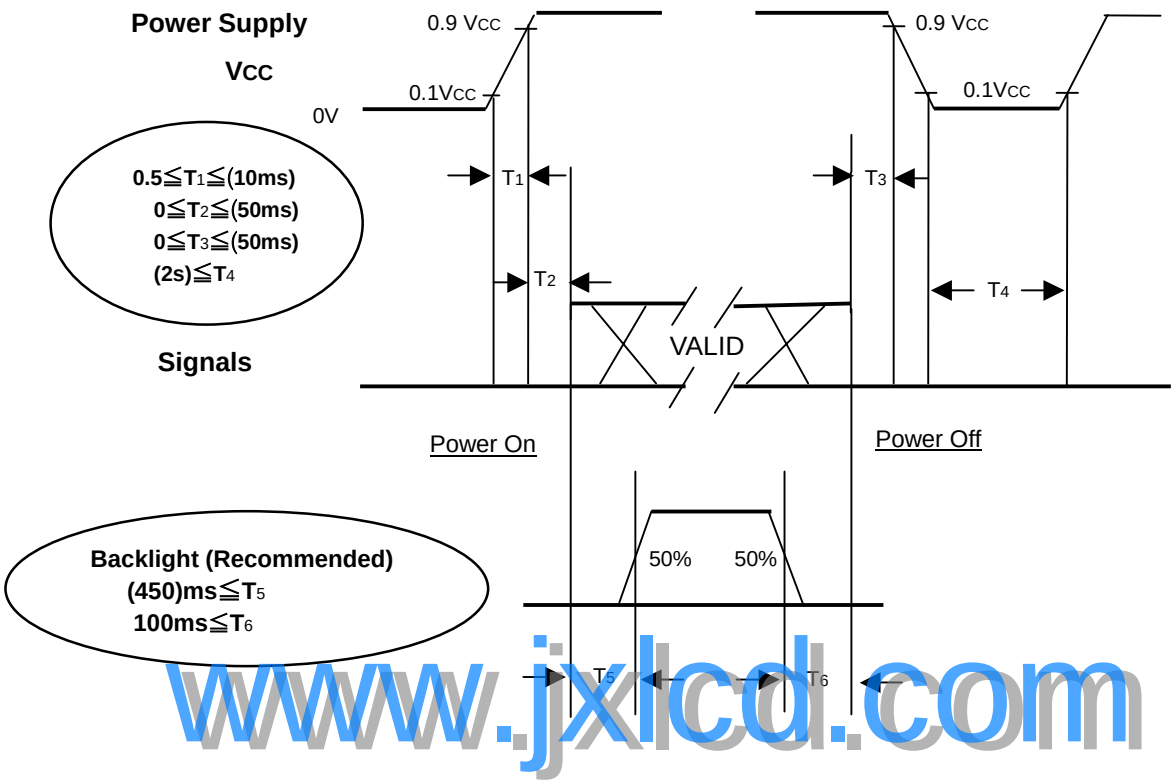


LVDS RECEIVER INTERFACE TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

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



Power ON/OFF Sequence

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

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of Vcc is in off level, please keep the level of input signals on the low or 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.

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}	5.0	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current	I_L	7.0	mA
Inverter Operating Frequency	F_L	61	KHz
Inverter	SUMIDA H05-5307		

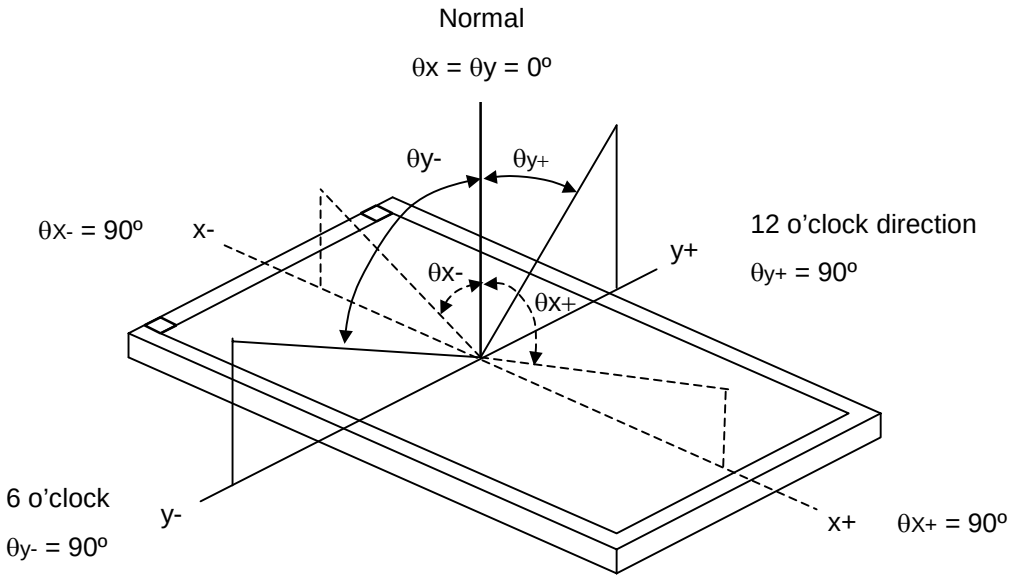
7.2 OPTICAL SPECIFICATIONS

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-1000T	Typ – 0.03	0.636	Typ + 0.03		(1)
		Ry			0.348			
	Green	Gx			0.289			
		Gy			0.587			
	Blue	Bx			0.143			
		By			0.079			
	White	Wx			0.313			
		Wy			0.329			
Center Luminance of White		L_C		330	400	---	cd/m^2	(4)
Contrast Ratio		CR		350	500	---	-	(2)
Response Time		T_R	θ_x=0°, θ_Y =0°	---	2	7	ms	(3)
		T_F		---	6	11	ms	
White Variation		δW	θ_x=0°, θ_Y =0°	---	1.2	1.5	-	(6)
Viewing Angle	Horizontal	θ_x+	CR ≧ 10	70	80	---	Deg.	(1)
		θ_x-		70	80	---		
	Vertical	θ_Y+		65	75	---		
		θ_Y-		50	60	---		

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

Viewing angles are measured by EZ-Contrast 160R (Eldim)



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

The contrast ratio can be calculated by the following expression.

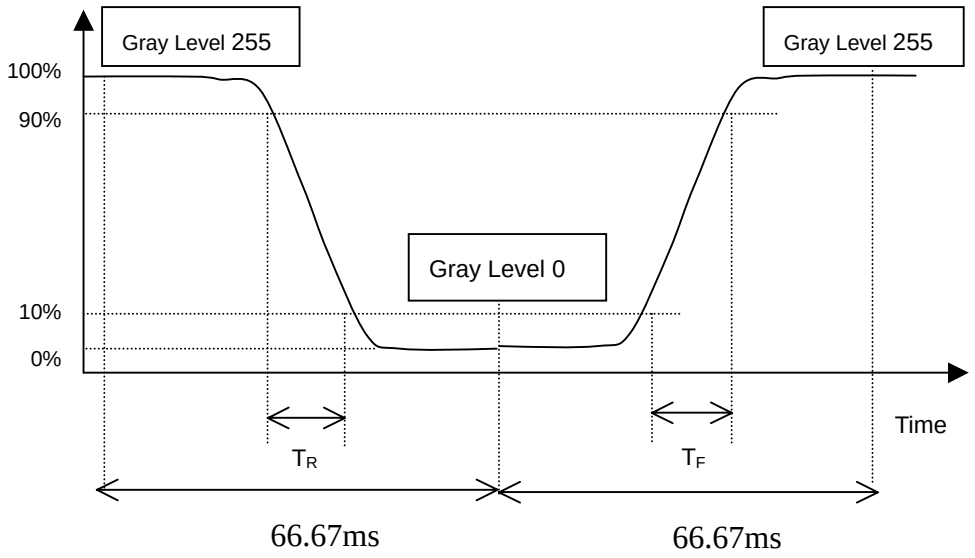
Contrast Ratio (CR) = L255 / L0

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5), where 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):

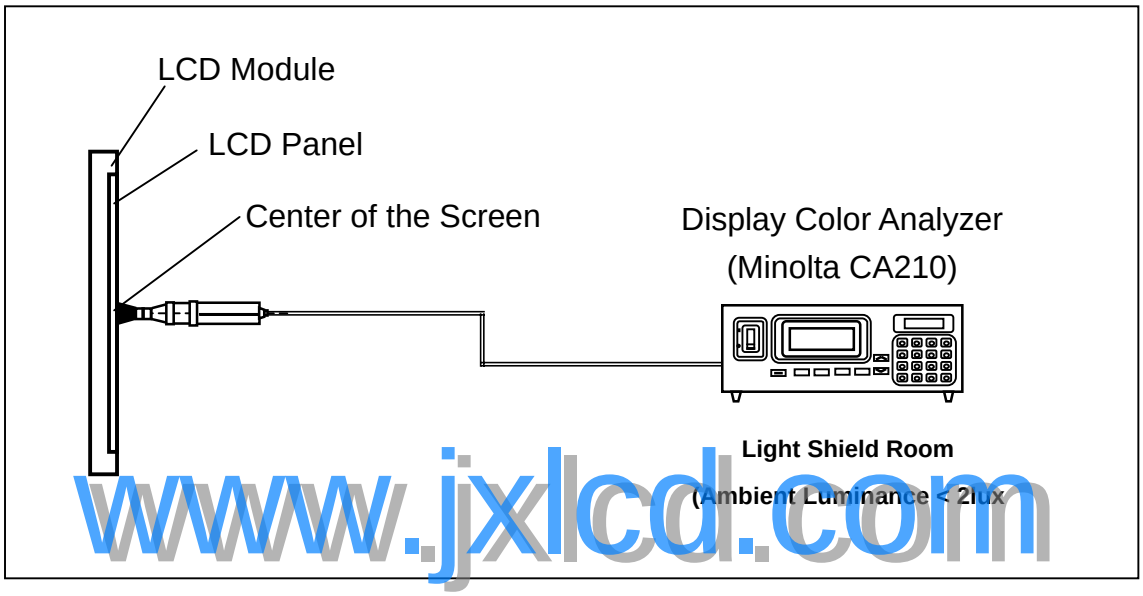
Measure the luminance of gray level 255 at center point

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 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.

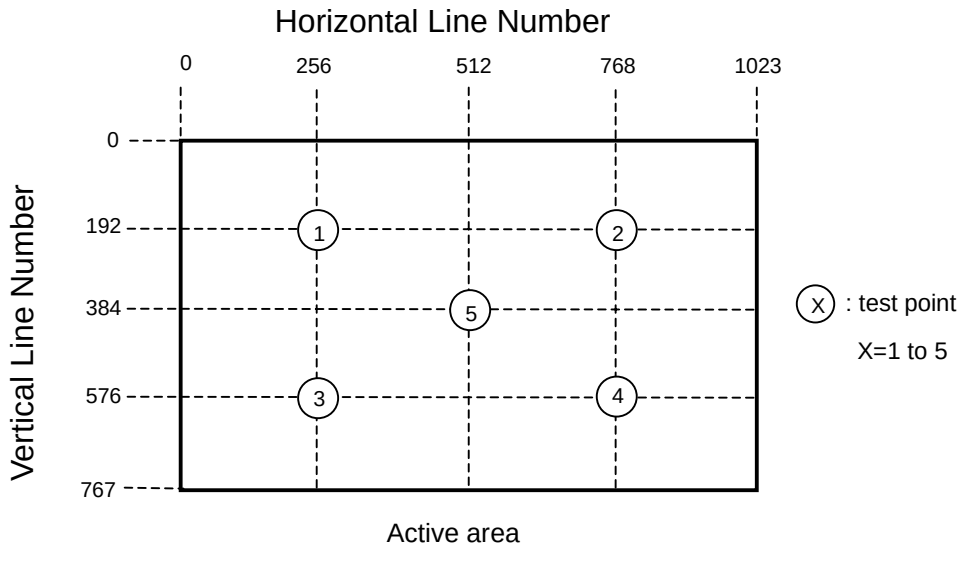


Note (6)

Definition of White Uniformity (δW):

Measure the luminance of gray level 255 at 5 points

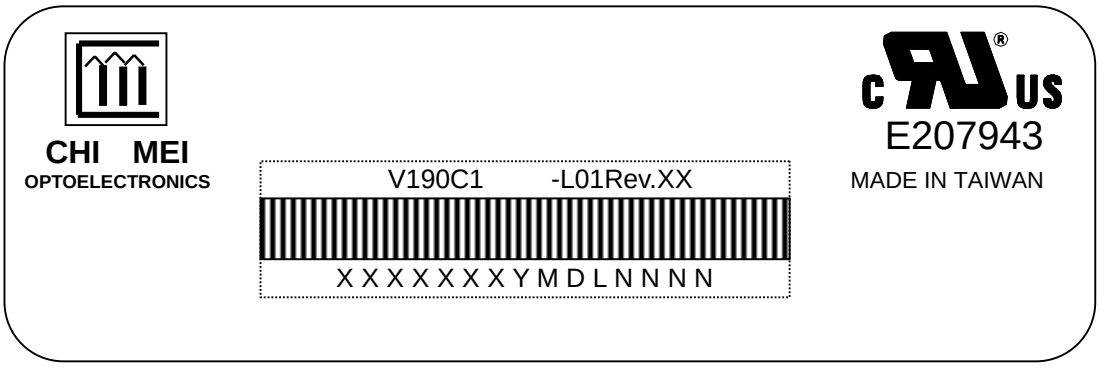
δW = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)] * 100%



8.DEFINTION OF LABELS

8.1 CMO MODULE LABEL

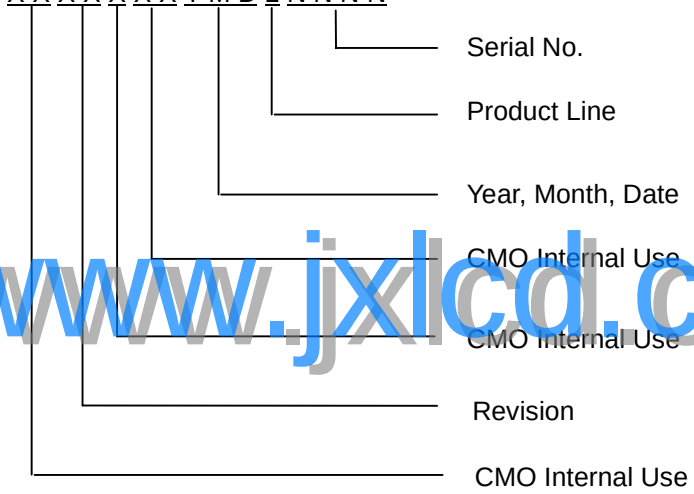
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: V190C1-L01

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

(c) Serial ID: X 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: 0~9, for 2000~2009

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

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

9.PACKAGING

9.1 PACKING SPECIFICATIONS

(1) 5 LCD modules / 1 Box

(2) Box dimensions: 545(L) X 320 (W) X 360 (H) mm

(3) Weight: approximately 13.87 Kg (5 modules per box)

9.2 PACKING METHOD

Figures 9-1and 9-2 are the packing method.

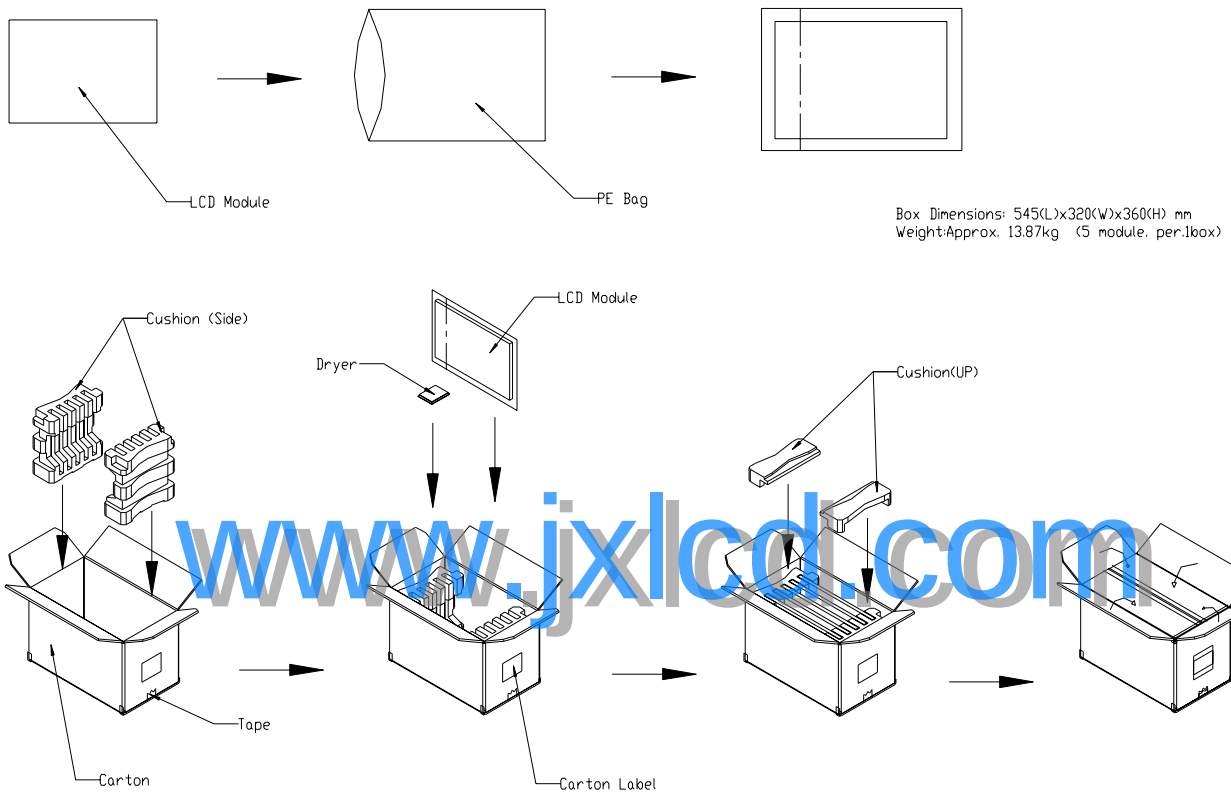
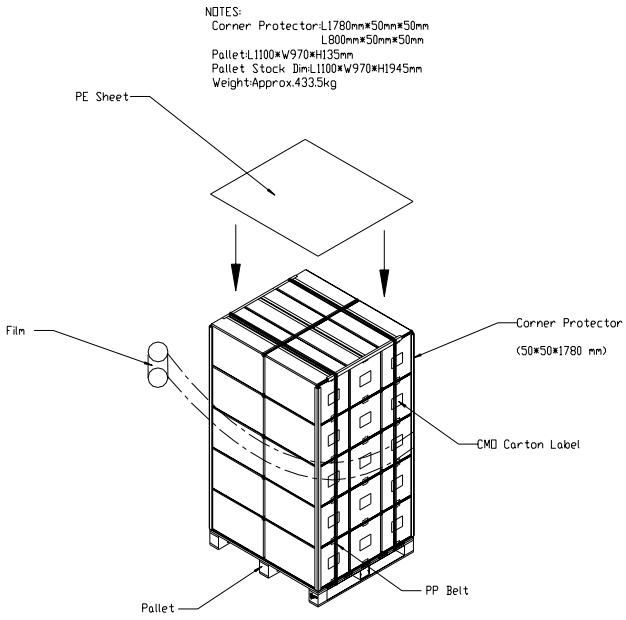


Figure. 9-1 Packing method

For ocean shipping



For air transport

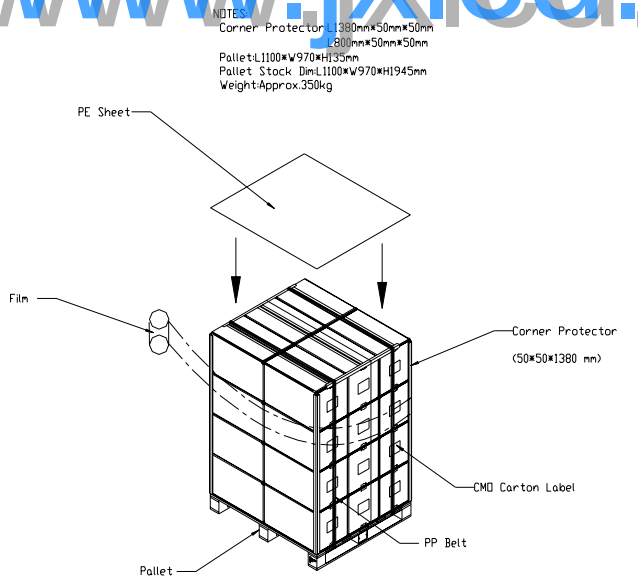


Figure. 9-2Packing method

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) It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.

(4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.

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

(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) Moisture can easily penetrate into LCD module and may cause the damage during operation.

(9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.

(10) When ambient temperature is lower than 10ºC, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

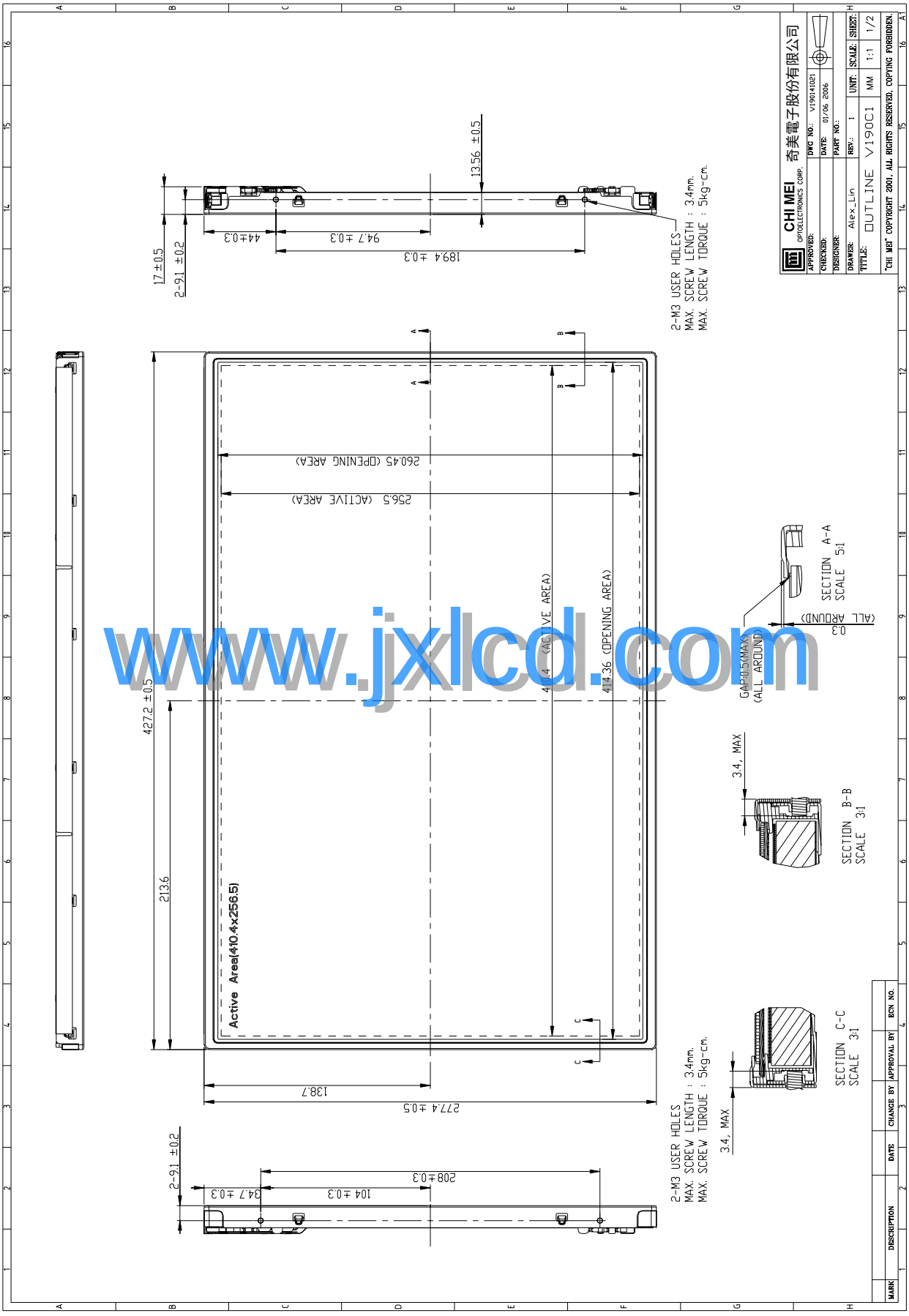
10.2 SAFETY PRECAUTIONS

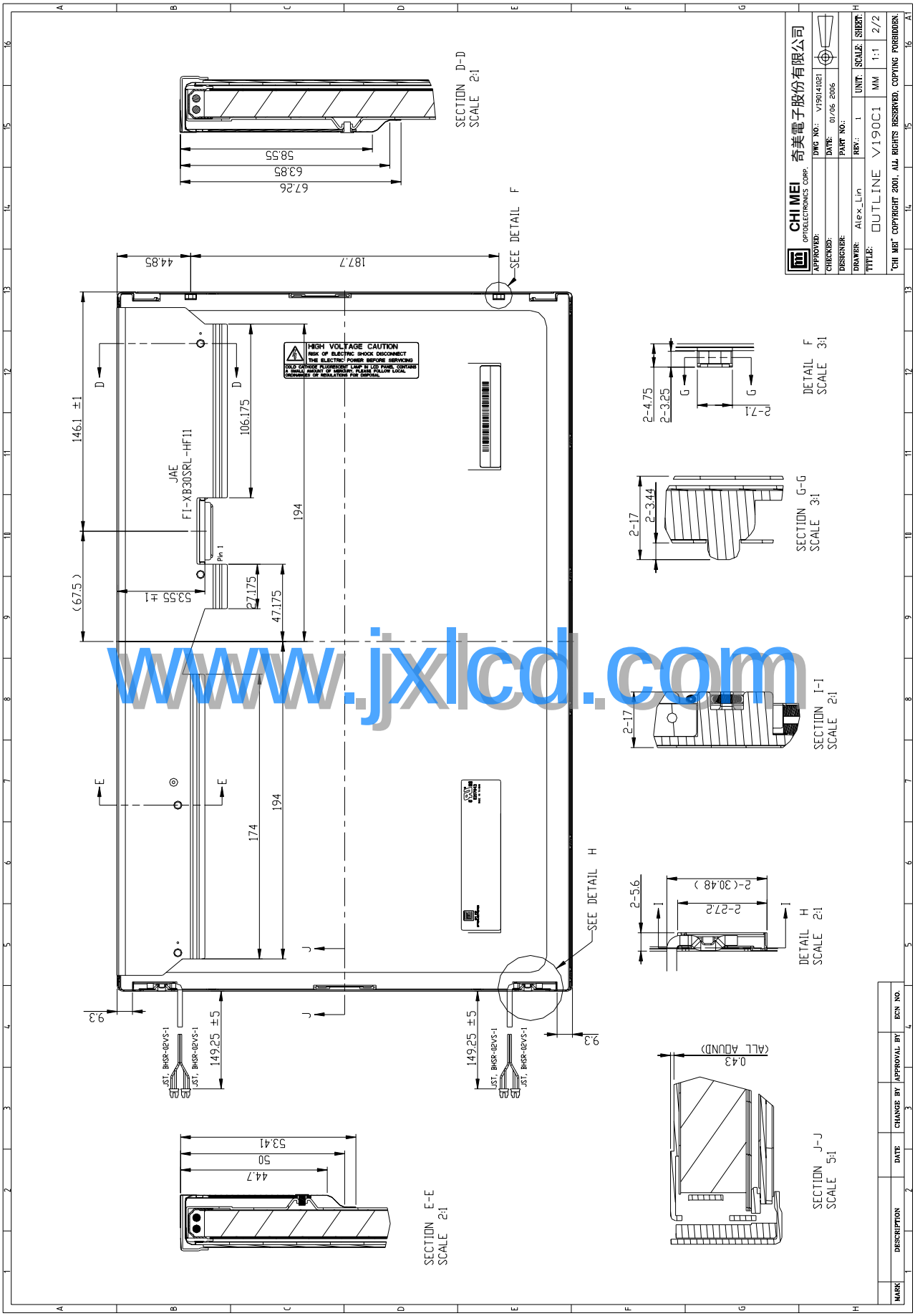
(1) The startup voltage of a Backlight is approximately 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the Backlight unit.

(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.

11. MECHANICAL CHARACTERISTIC




SECTION D-D
SCALE 2:1
SEE DETAIL F
SEE DETAIL H
DETAIL F
SCALE 3:1
SECTION G-G
SCALE 3:1
SECTION I-I
SCALE 2:1
DETAIL H
SCALE 2:1
SECTION J-J
SCALE 5:1
SECTION E-E
SCALE 2:1
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