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TFT LCD Preliminary Specification

MODEL NO.: HC315BH-D04

Customer: _____

Approved by: _____

Note:

Approved By		Date:
Reviewed By		Date:
Prepared By		Date:

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CONTENT

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DESCRIPTION

The following specifications are applied to the following Hisense module.

Product Name: HC315BH-D04

General Specifications

Effective Display Area	:(H)697.6845×(V)392.256	(mm)
Number of Pixels	:(H)1366×R.G.B×(V)768	(Pixels)
Pixel Pitch	:(H)0.17025×(V)0.51075	(mm)
Color Pixel Arrangement	: R+G+B Vertical Stripe	
Display Mode	: Transmissive Mode Normally Black Mode	
Top polarizer Type	: Anti-Glare	
Number of Colors	: 16.7M	(colors)
Viewing Angle Range	: +88/-88(H), +88/-88(V) Typ.	
Back Light	: 6 CCFL	
Color Chromaticity	: R=0.642, 0.332 G=0.277, 0.598 B=0.145, 0.066 W=0.285, 0.293	
External Dimensions	: (H)760.0×(V)450.0×(D)32.5	(mm)
Weight	: 6.3	(Kg)

1. ABSOLUTE MAXIMUM RATINGS

1.1 Environment Absolute Maximum Ratings

The following items are maximum values which, if exceeded, may cause faulty operation or damage to the LCD module.

TFT Module

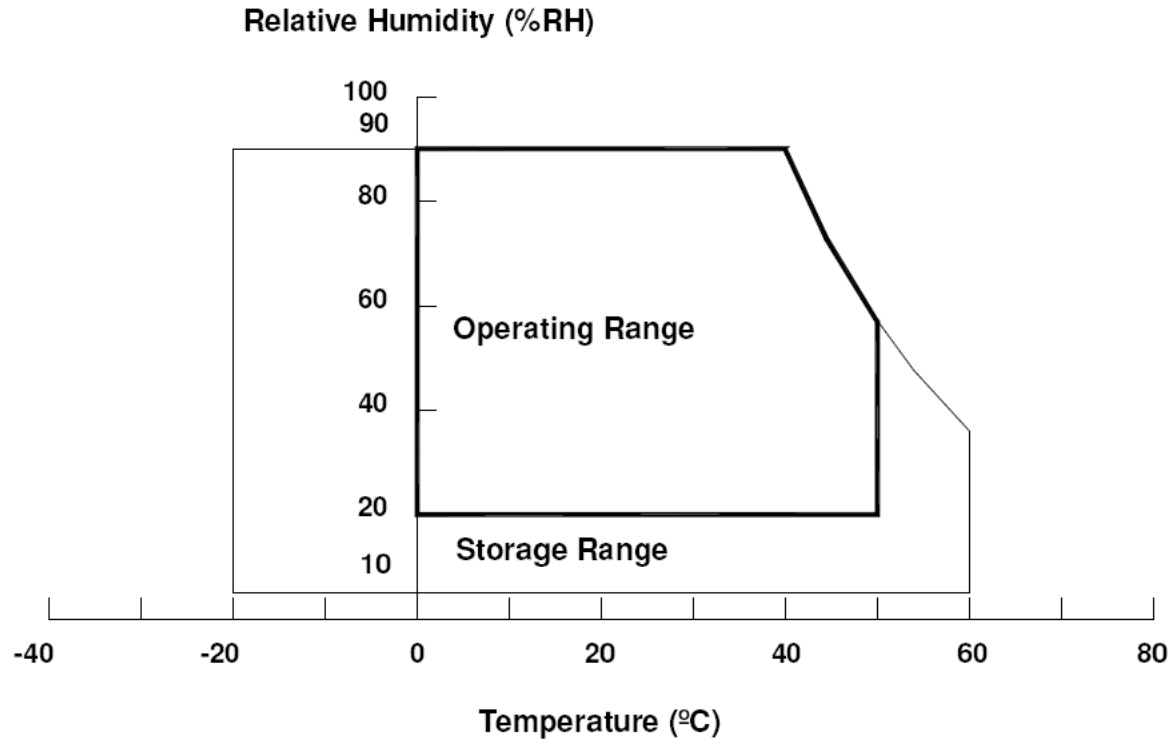
Parameter	Symbol	Value		Unit	Note
		Min.	Max.		
Operating Temperature	T_{OP}	0	50	℃	(1),(2),(3)
Storage Temperature	T_{ST}	-20	60	℃	(1),(3)
Altitude Operating	A_{OP}	0	5000	M	(3)
Vibration (Non-Operating)	A_{ST}	0	12000	M	(3)

Notes : 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.



2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65 ºC with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 ºC.

The range of operating temperature may degrade in case of improper thermal management in final product design.

3) The rating of environment is base on LCD module. Leave LCD cell alone, this environment condition can't be guaranteed. Except LCD cell, the customer has to consider the ability of other parts of LCD module and LCD module process.

1.2 BACKLIGHT UNIT

1.2.1 TFT LCD MODULE

ITEM	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V_{CC}	-0.3	13.0	V	(1)

1.2.2 BACKLIGHT UNIT

ITEM	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	Vw	-	3000	V_{RMS}	
Power Supply Voltage	V_{BL}	0	30	V	(1)
Control Signal Level		-0.3	7	V	(1),(3)

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under normal operating conditions.

Note (2) No moisture condensation or freezing.

Note (3) The control signals includes Backlight On/Off Control, I_PWM Control, E_PWM Control and ERR signal for inverter status output.

2. INITIAL OPTICAL CHARACTERISTICS

The following optical characteristics are measured under stable conditions. It takes about 30 minutes to reach stable conditions. The measuring point is the center of display area unless otherwise noted. The optical characteristics should be measured in a dark room or equivalent state.

Measuring equipment：SR-3 and LIPS

Ambient Temperature=25±2°C, V_{LCD}=12.0V, f_V=60Hz, Dclk=74.25MHz V_{BR_A}=1.65V, $EXTV_{BR\_B}$=100%

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	x	θx=0°, θy=0° viewing angle at normal direction	Typ.-0.03	0.652	Typ.+0.03	-	(1),(5)
		y			0.332			
	Green	x			0.277			
		y			0.598			
	Blue	x			0.145			
		y			0.066			
	white	x			0.285			
		y			0.293			
Center Transmittance		T%	θx=0°, θy=0°	-	5.8		%	(1),(7)
Contrast Ratio		CR		2000	3000		-	(1),(3)
Response Time		Gray to gray average	θx=0°, θy=0° with Module@60Hz	-	6.5	12	ms	(4)
White Variation		δW	θx=0°, θy=0°			1.5	-	(1),(6)
Viewing Angle	Horizontal	θ_X^+	CR≧20	80	88	-	Deg.	(1),(2)
		θ_X^-		80	88	-		
	Vertical	θ_Y^+		80	88	-		
		θ_Y^-		80	88	-		

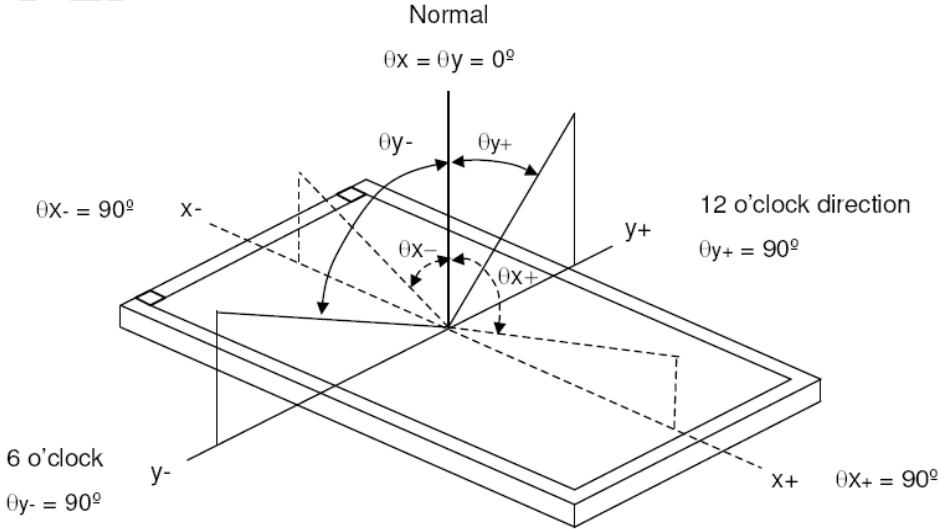
Note (1) Driving voltages are based on suitable gamma voltages.

The calculated method is as following:

1. Measure module's and backlight's spectrum. White and R, G, B are with signal input.
2. Calculate cell's spectrum.

Note (2) Definition of Viewing Angle (θx, θy):

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



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Note (3) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

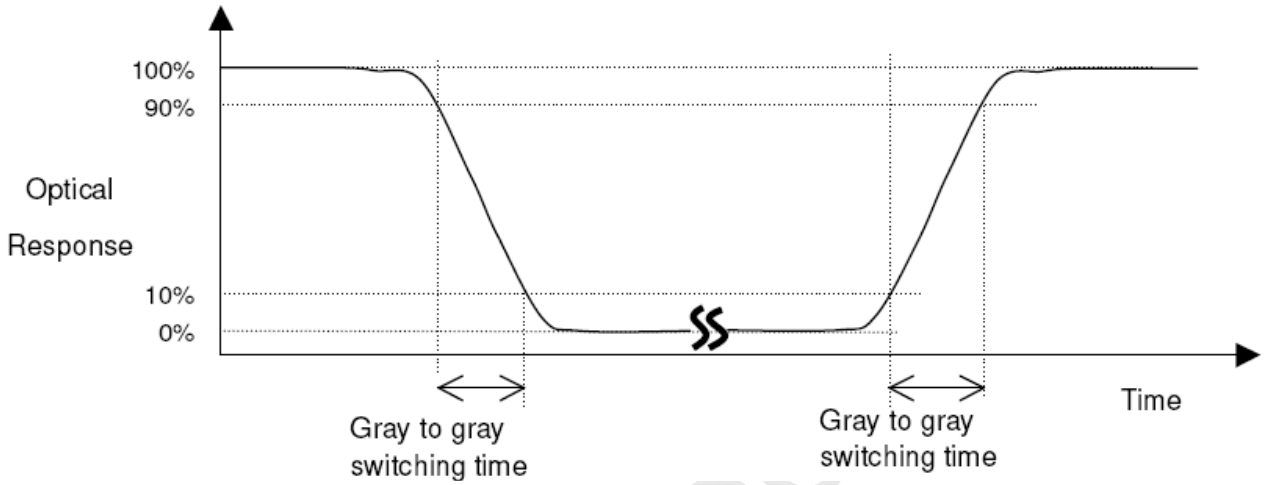
Contrast Ratio (CR) = L255 / L0

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 the figure in Note (6).

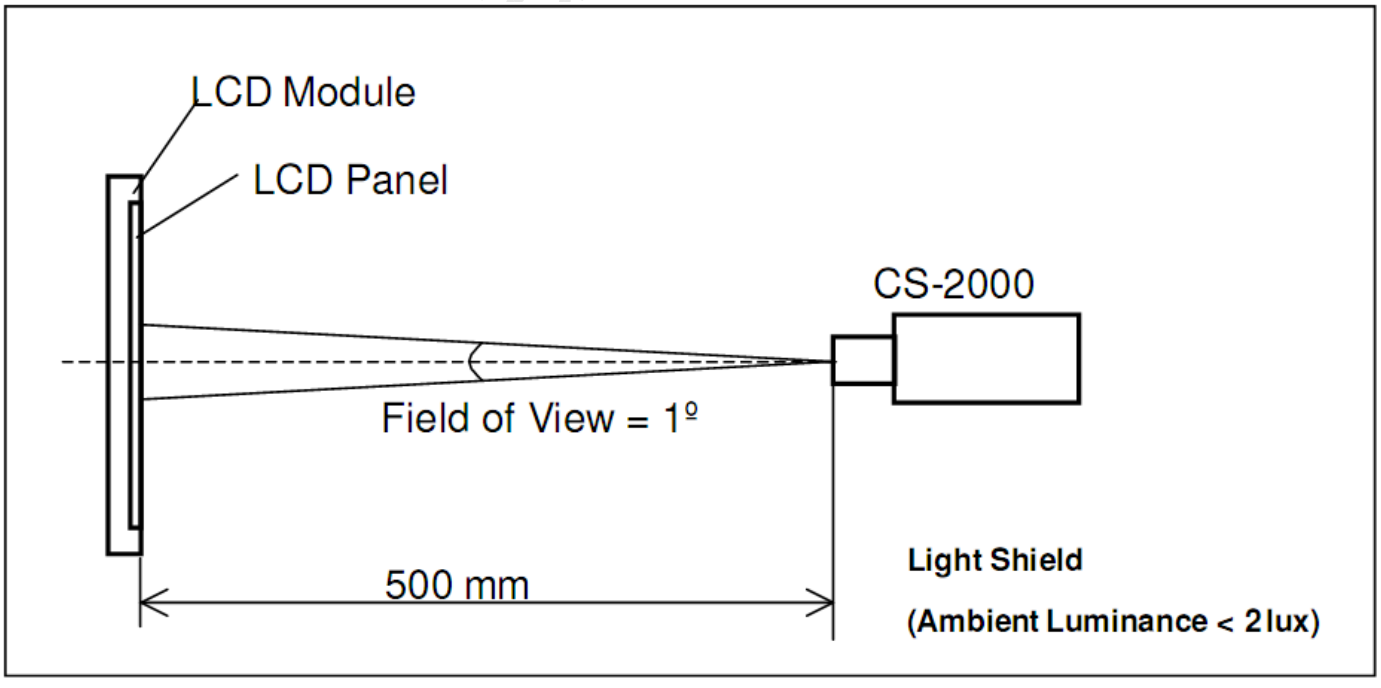
Note (4) Definition of Gray to Gray Switching Time:



The driving signal means the signal of gray level 0, 123, 168, 202, 230, 255. Gray to gray average time means the average switching time of gray level 0, 123, 168, 202, 230, 255 to each other.

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 60 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 60 minutes in a windless room.



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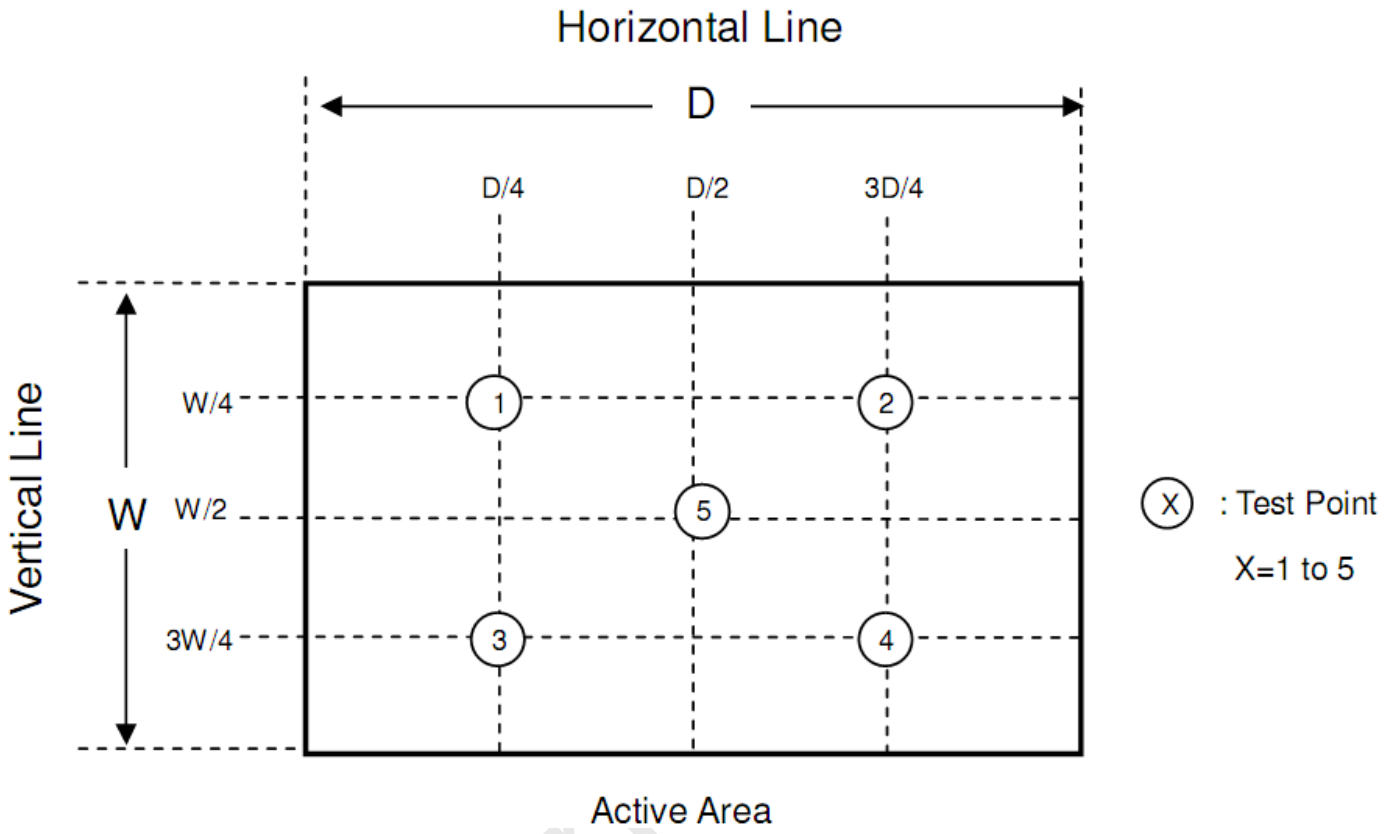
Note (6) Definition of White Variation (δW):

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)]

where L (X) is corresponding to the luminance of the point X at the figure below.



Note (7) Definition of Transmittance (T%):

Module is without signal input.

$$\text{Transmittance} = \frac{\text{Luminance of LCD module}}{\text{Luminance of backlight}} * 100\%$$

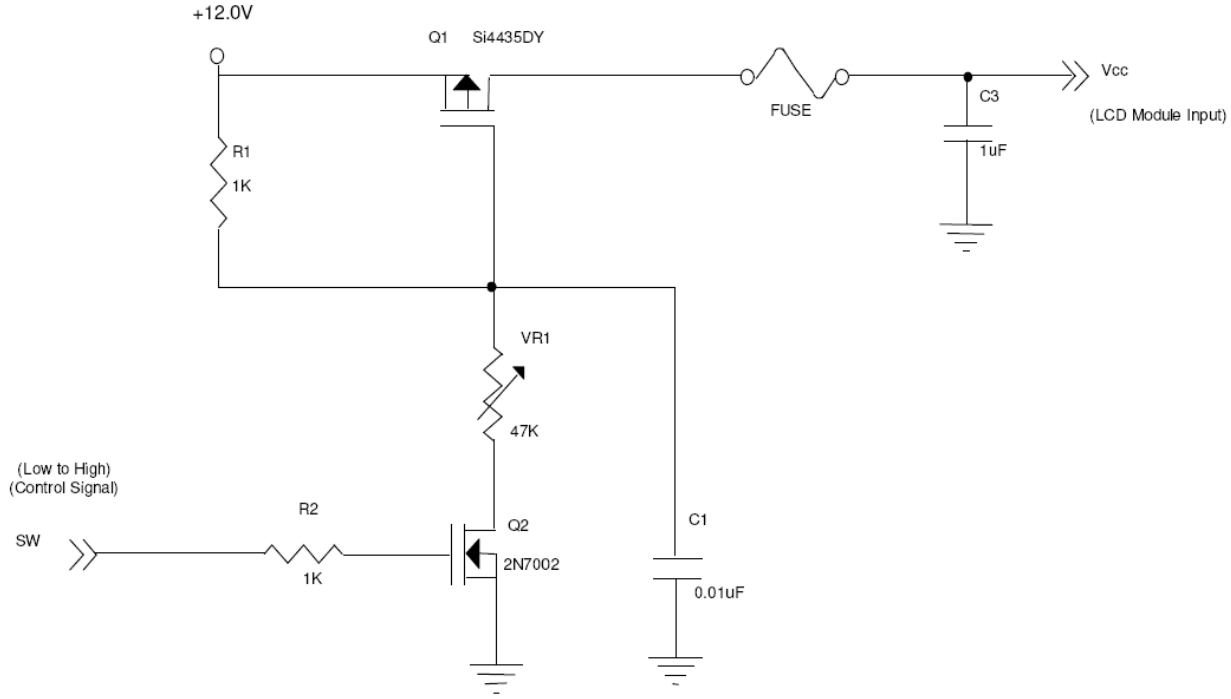
3. ELECTRICAL CHARACTERISTICS

3.1 TFT-LCD Module

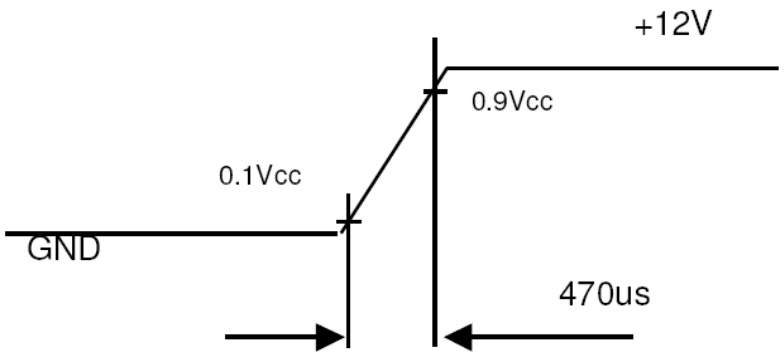
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	11.4	12.0	12.6	V	(1)
Rush Current		I_{RUSH}	-	-	3.4	A	(2)
Power Supply Current	White	I_{CC}	-	0.45	0.52	A	(3)
	Black		-	0.33	-	A	
	Vertical Stripe		-	0.45	-	A	
LVDS Interface	Differential input High Threshold Voltage	V_{LVTH}	-	-	+100	mV	
	Differential input Low Threshold Voltage	V_{LVTL}	-100	-	-	mV	
	Common input Voltage	V_{CM}	1.0	1.2	1.4	V	
	Terminating Resistor	R_T	-	100	-	ohm	
	Differential input voltage	$\|V_{ID}\|$	200	-	600	mV	
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 470us



Note (3) The specified power supply current is under the conditions at Vcc =12V, Ta = 25 ± 2 ºC, fv = 60 Hz, where as a power dissipation check pattern below is displayed.

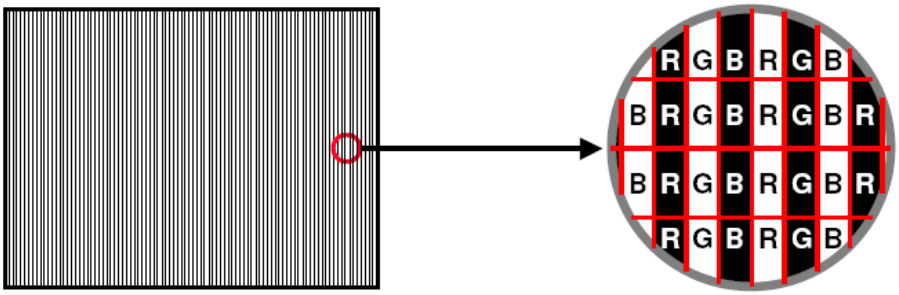
a. White Pattern

Active Area

b. Black Pattern

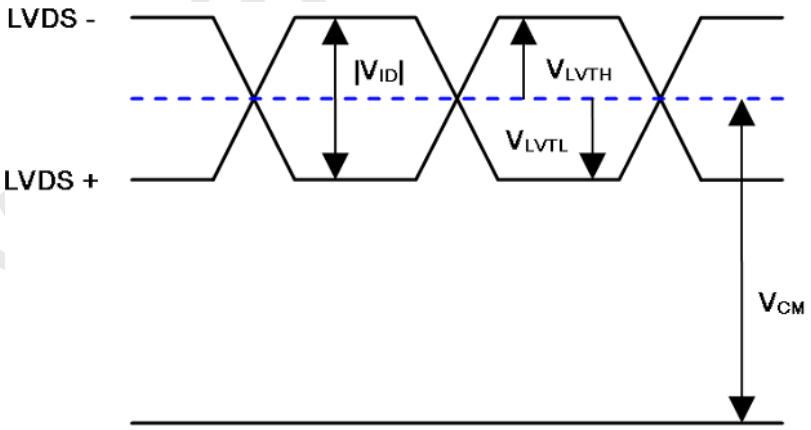
Active Area

c. Vertical Stripe Pattern



Active Area

Note (4) The LVDS input characteristics are as follows:



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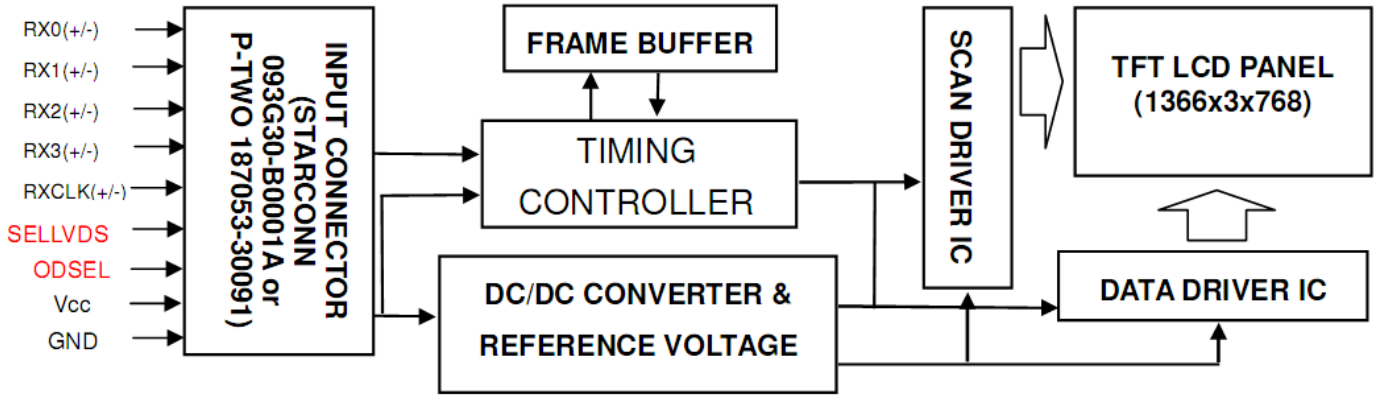
4. BLOCK DIAGRAM

4.1 TFT Module



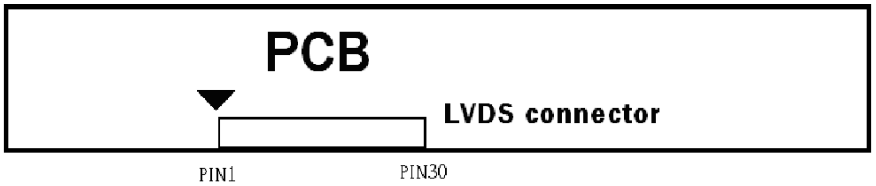
5. INTERFACE PIN ASSIGNMENT

5.1 TFT-LCD MODULE

CNF1 Connector Pin Assignment

Pin No.	Symbol	Description	Note
1	VCC	Power supply: +12V	
2	VCC	Power supply: +12V	
3	VCC	Power supply: +12V	
4	VCC	Power supply: +12V	
5	GND	Ground	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	SELLVDS	Select LVDS data format	(2)
10	ODSEL	Overdrive Lookup Table Selection	(3)
11	GND	Ground	
12	RX0-	Negative transmission data of pixel 0	
13	RX0+	Positive transmission data of pixel 0	
14	GND	Ground	
15	RX1-	Negative transmission data of pixel 1	
16	RX1+	Positive transmission data of pixel 1	
17	GND	Ground	
18	RX2-	Negative transmission data of pixel 2	
19	RX2+	Positive transmission data of pixel 2	
20	GND	Ground	
21	RXCLK-	Negative of clock	
22	RXCLK+	Positive of clock	
23	GND	Ground	
24	RX3-	Negative transmission data of pixel 3	
25	RX3+	Positive transmission data of pixel 3	
26	GND	Ground	
27	TST_AGE	Aging Mode	(4)
28	NC	No connection	(5)
29	GND	Ground	
30	GND	Ground	

Note (1) Connector type: STARCONN 093G30-B0001A or P-TWO 187053-30091or compatible LVDS connector pin orderdefined as follows



Note (2) Low = Open or connect to GND: VESA Format, High = Connect to +3.3V: JEIDA Format. Please refer to 5.5 LVDS INTERFACE

Note (3) Overdrive lookup table selection. The Overdrive lookup table should be selected in accordance to the frame rate to optimize image quality.

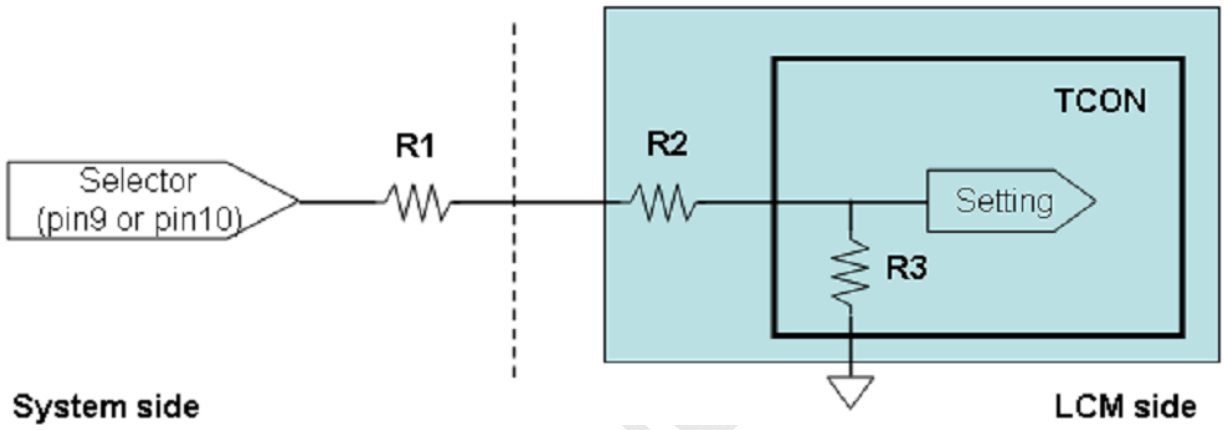
Low = Open or connect to GND, High = Connect to +3.3V

ODSEL	Note
L or Open	Lookup table was optimized for 60 Hz frame rate
H	Lookup table was optimized for 50 Hz frame rate

Note (4) Ground or OPEN: Disable, High: Enable.

Note (5) Reserved for internal use. Left it open.

Note (6) LVDS signal pin connected to the LCM side has the following diagram. R1 in the system side should be less than 1K Ohm. (R1 < 1K Ohm)



5.2 RELATIONSHIP BETWEEN DISPLAY COLORS AND INPUT SIGNALS

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

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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. Signal Timing Specifications

The following table shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timing should be satisfied with the following specification for normal operation.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	1/Tc	60	76	82	MHz	
	Input cycle to cycle jitter	Trcl	-	-	200	ps	(3)
	Spread spectrum modulation range	F_{clkin_mod}	F_{clkin}-2%	-	F_{clkin}+2%	MHz	(4)
	Spread spectrum modulation frequency	F_{SSM}			200	KHz	
LVDS Receiver Data	Setup Time	Tlvsu	600	-	-	ps	(5)
	Hold Time	Tlvhd	600	-	-	ps	
Vertical Active Display Term	Frame Rate	Fr5	47	50	53	Hz	(2)
		Fr6	57	60	63	Hz	
	Total	Tv	778	806	888	Th	Tv=Tvd+Tvb
	Display	Tvd	768	768	768	Th	-
	Blank	Tvb	10	38	120	Th	-
Horizontal Active Display Term	Total	Th	1442	1560	1936	Tc	Th=Thd+Thb
	Display	Thd	1366	1366	1366	Tc	-
	Blank	Thb	76	194	570	Tc	-

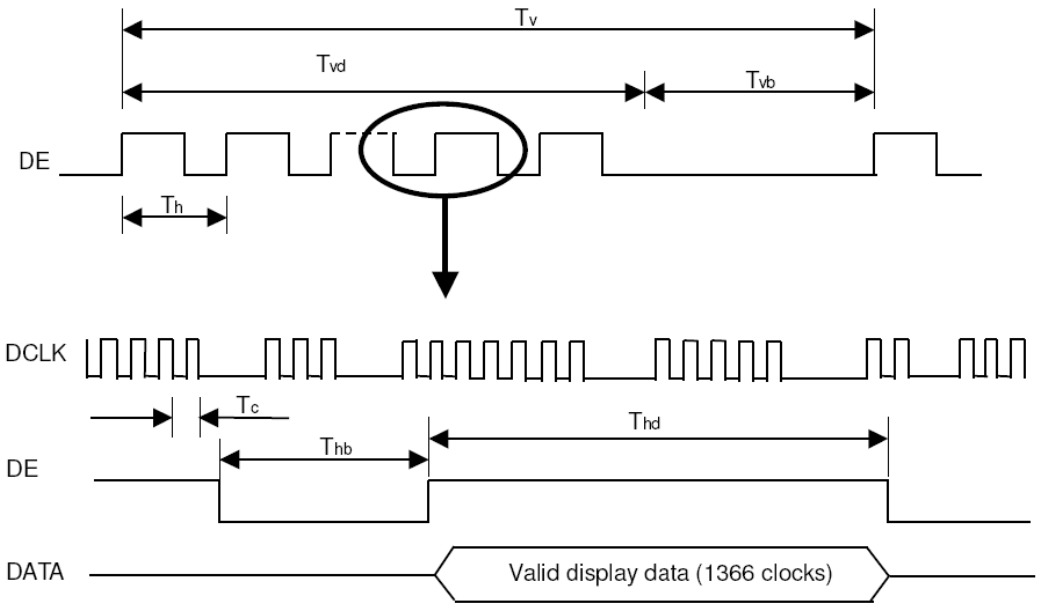
Note (1) Please make sure the range of pixel clock has follow the below equation:

Fclkin(max) ≥ Fr6× Tv × Th

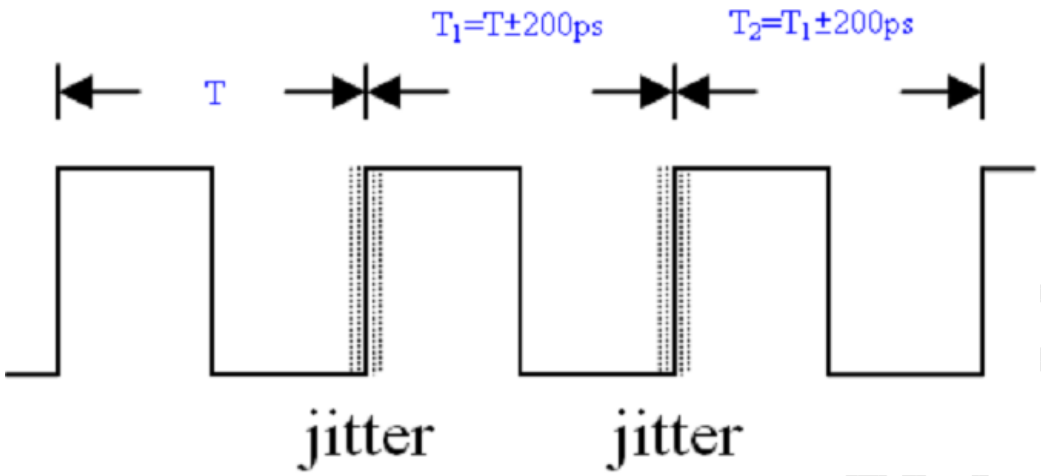
Fr5 × Tv × Th ≥ Fclkin(min)

Note(2) This mode is operated in DE only mode and please follow the input signal timing diagram below:

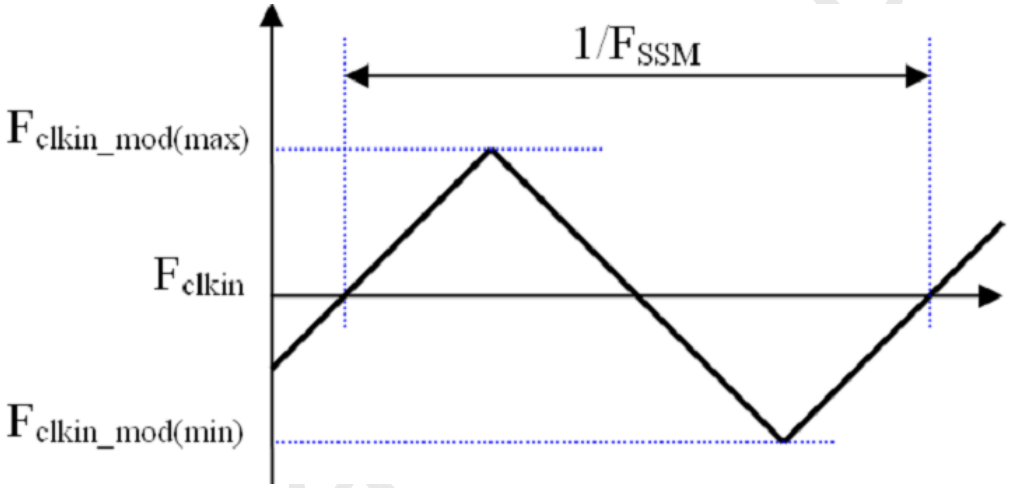
INPUT SIGNAL TIMING DIAGRAM



Note (3) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = |T1 – T|

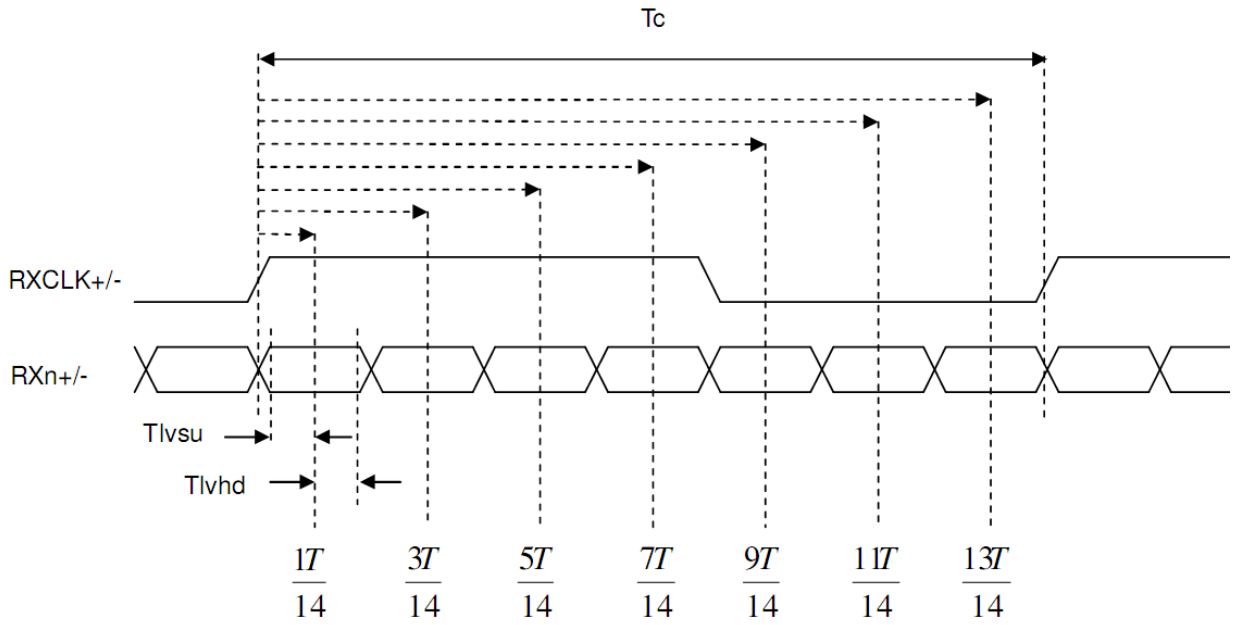


Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (5) The LVDS timing diagram and setup/hold time is defined and showing as the following figures.

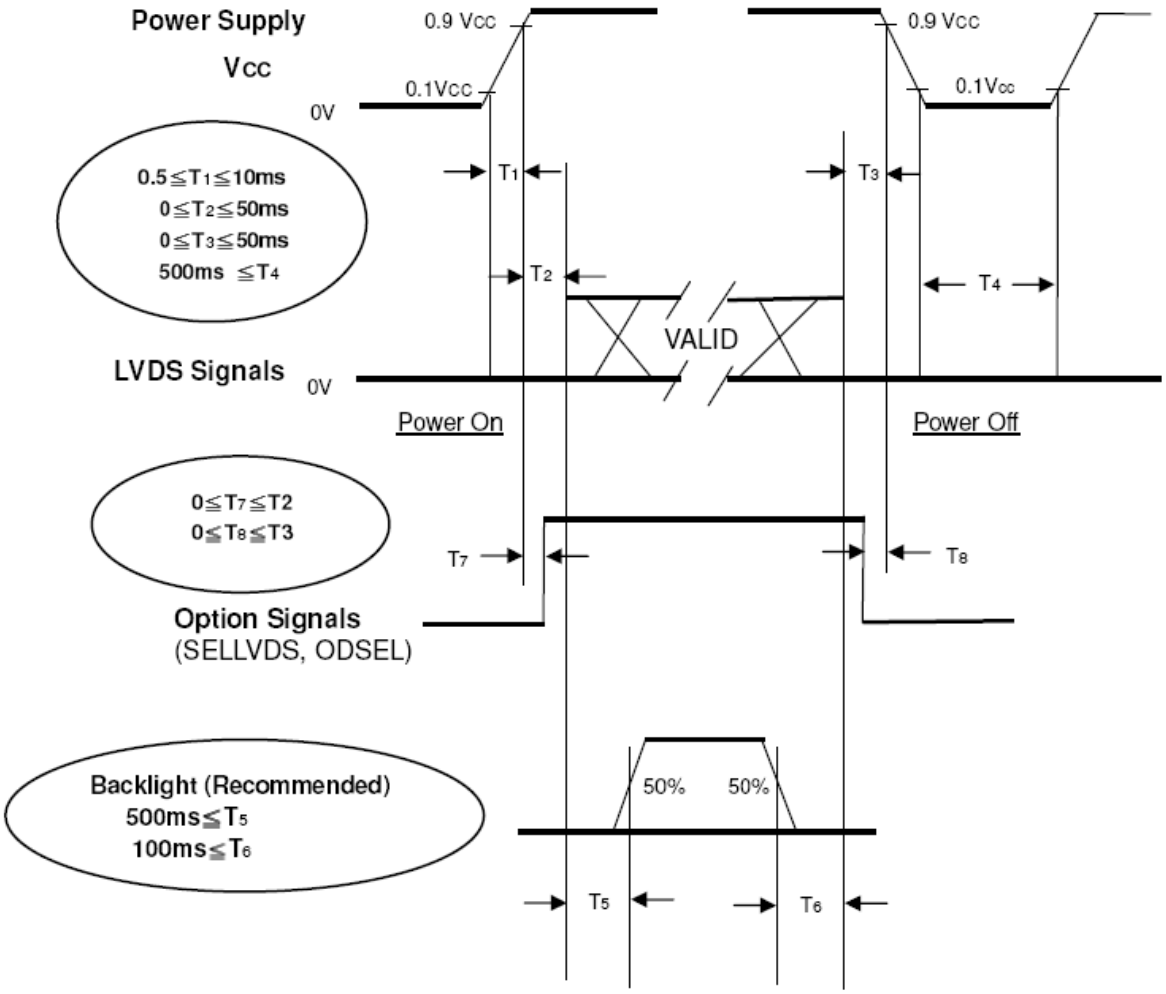
LVDS RECEIVER INTERFACE TIMING DIAGRAM



5.5. Power On/Off Sequence

(Ta = 25 ± 2 ºC)

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. If T2<0, that maybe cause electrical overstress failures.

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.

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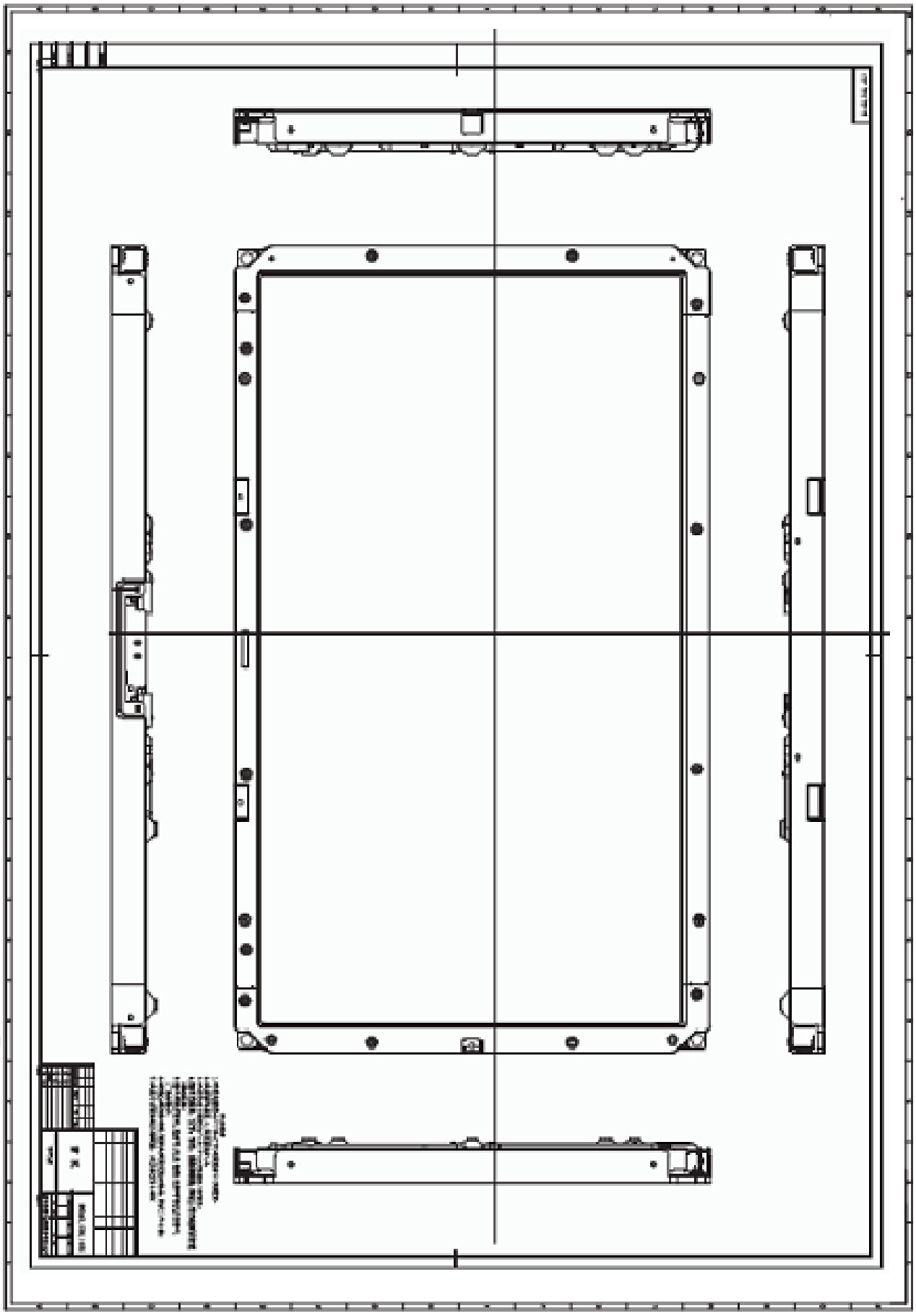
6. MECHANICAL CHARACTERISTICS



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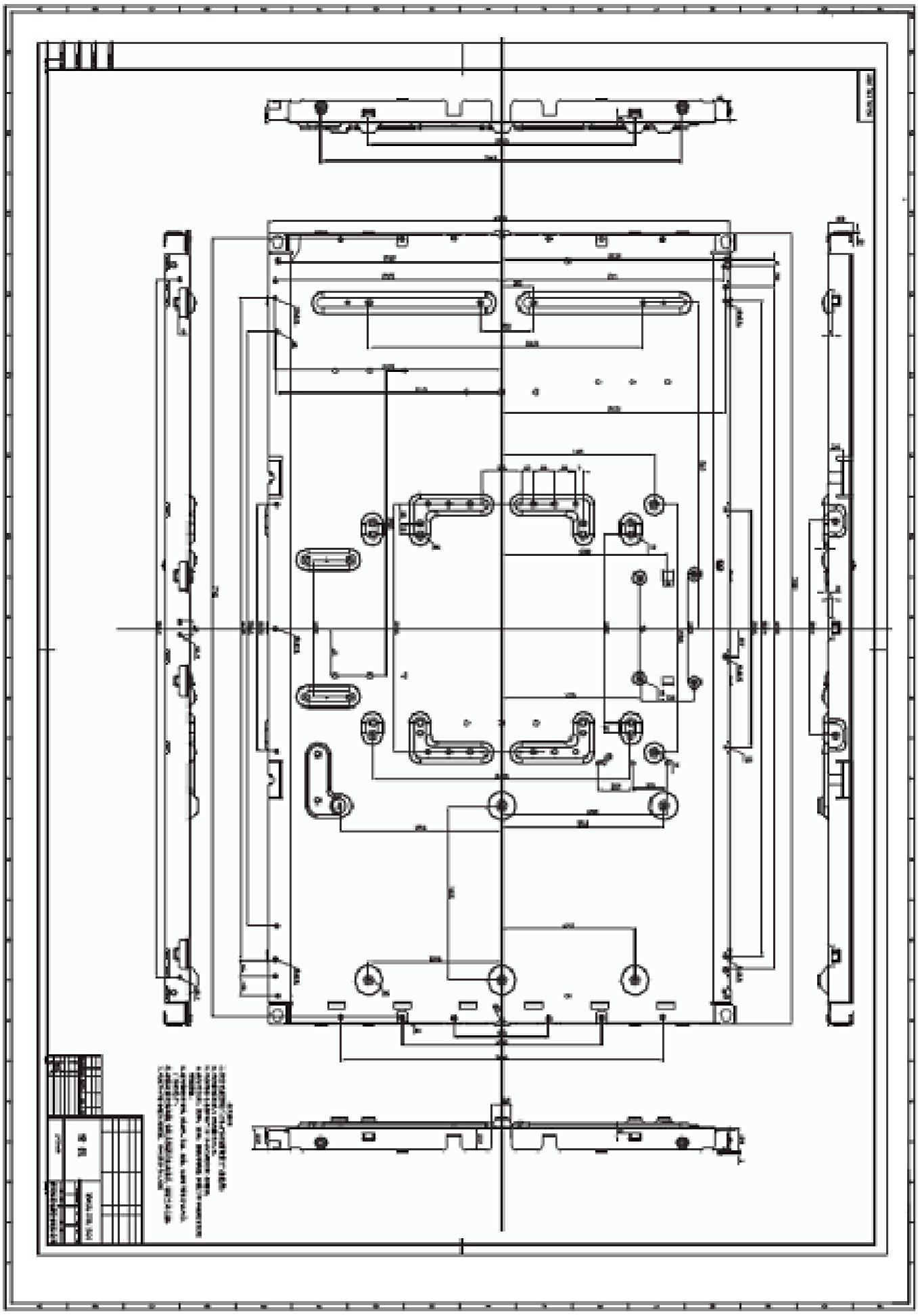

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7. PACKAGING

7.1 PACKAGING SPECIFICATION

(1) 5 LCD TV modules / 1 Box
(2) Box dimensions : 826(L)x376(W)x540(H)mm
(3) Weight : approximately 50Kg (5 modules per box)

7.2 PACKAGING METHOD

Figures 7-1 and 7-2 are the packing method

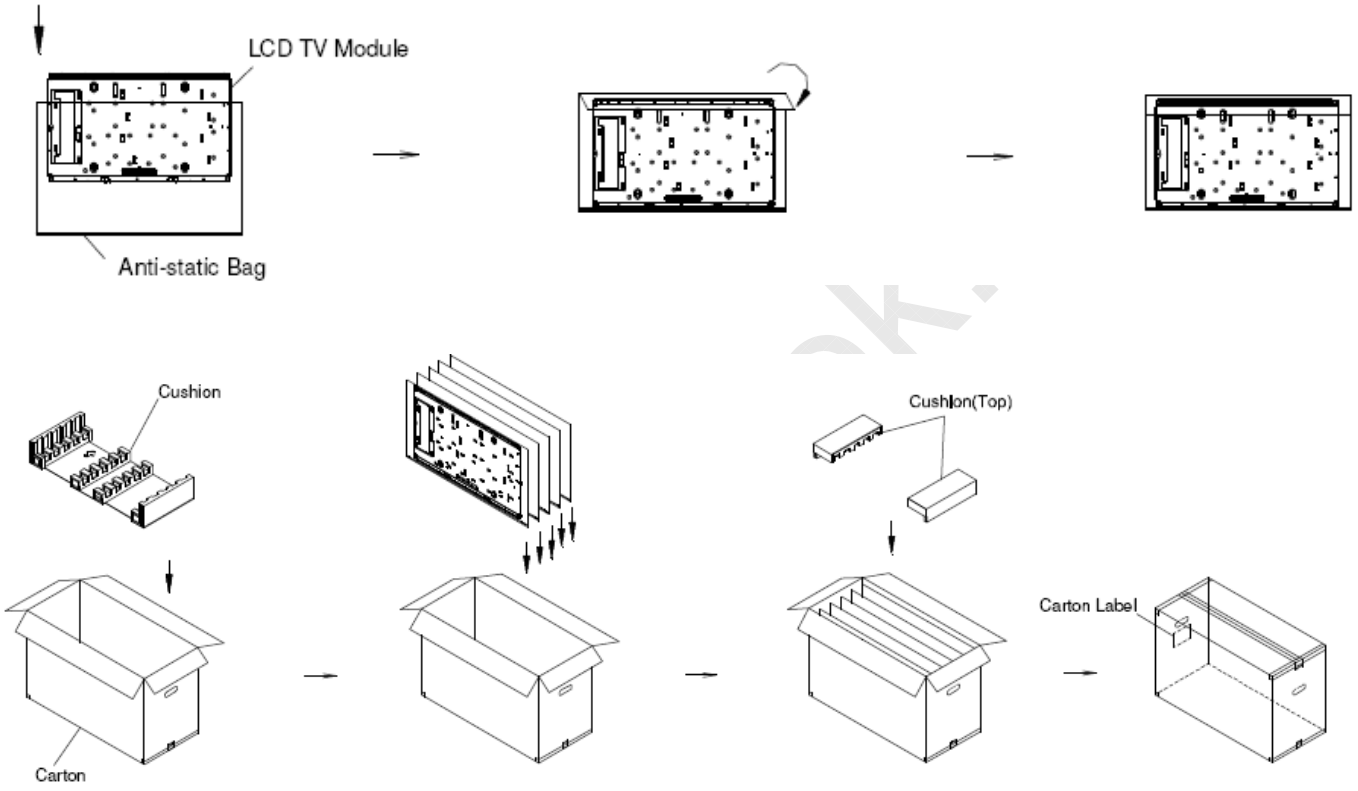

Figure.7-1 packing method

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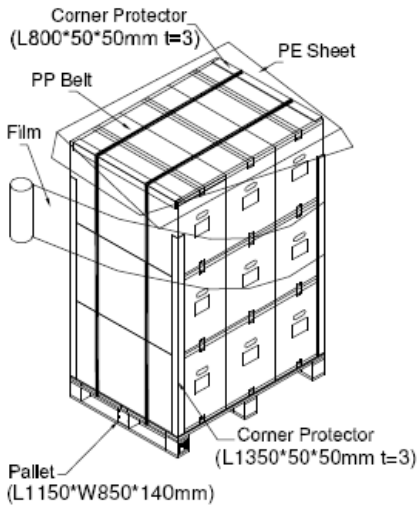
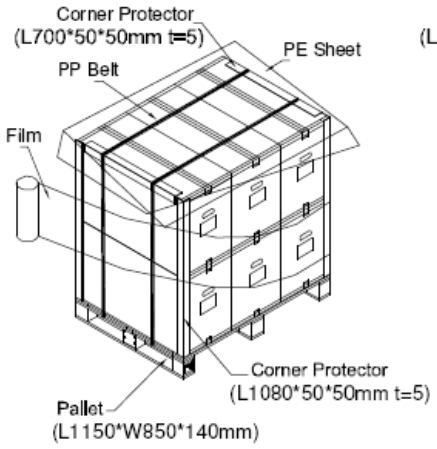
Sea / Land Transportation
(40ft Container)
Gross:298kg



Air Transportation
Gross:204kg



Sea / Land Transportation
(40ft HQ Container)
Gross:408kg

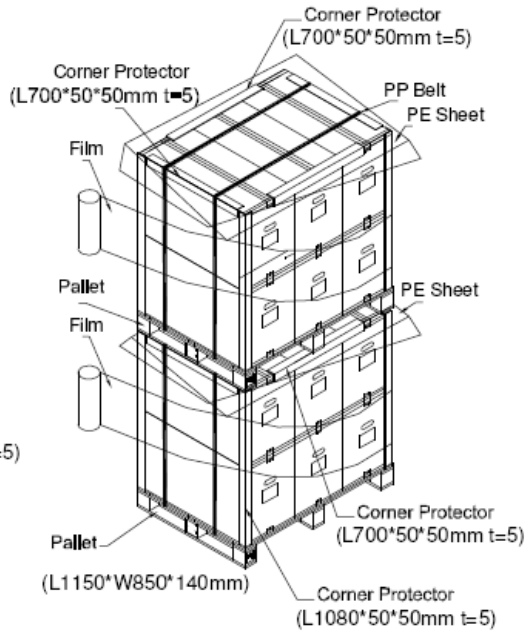


Figure.7-2 packing method

8. PRECAUTIONS

8.1 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.

8.2 SAFETY PRECAUTIONS

1) The startup voltage of a backlight is over 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.

8.3 STORAGE PRECAUTIONS

When storing modules as spares for a long time, the following precaution is necessary. 1) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35℃at normal humidity without condensation.

2) The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.