



TFT LCD Approval Specification

MODEL NO.: V470H2 – P03

Customer: _____

Approved by: _____

Note:

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REVISION HISTORY

[illegible]

1. GENERAL DESCRIPTION

1.1 OVERVIEW

V470H2-P03 is a 47" TFT Liquid Crystal Display module with driver ICs and 2ch-LVDS interface. This product supports 1920 x 1080 Full HDTV format and can display 16.7M colors (8-bit/color). The backlight unit is not built-in.

1.2 FEATURES

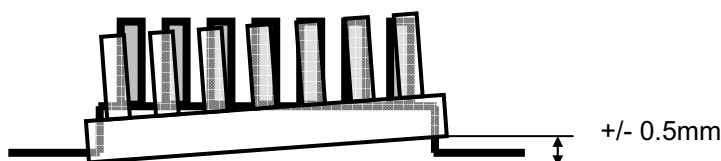
CHARACTERISTICS ITEMS	SPECIFICATIONS
Screen Diagonal [in]	47"
Pixels [lines]	1920 × 1080
Active Area [mm]	1039.68 (H) x584.82 (V) (47" diagonal)
Sub-Pixel Pitch [mm]	0.5405(V) ×0.1805(H)
Pixel Arrangement	RGB vertical stripe
Weight [g]	2560
Physical Size [mm]	1059.78(W) × 605.87(H) × 1.80(D) Typ.
Display Mode	Transmissive mode / Normally black
Contrast Ratio	4000:1 Typ. (Typical value measure at CMO's module)
Glass thickness (Array / CF) [mm]	0.7 / 0.7
Viewing Angle (CR>20)	+88/-88(H), +88/-88(V) Typ. (CR ≥ 20) (Typical value measure at CMO's module)
Color Chromaticity	R = (0.641, 0.332) G = (0.272, 0.598) B = (0.151, 0.0667) W= (0.290, 0.295) * Please refer to "color chromaticity" on p.14
Cell Transparency [%]	4.6%
Polarizer Surface Treatment	Anti-Glare coating (Haze 11%), Hard coating (3H)

1.3 MECHANICAL SPECIFICATIONS

Item	Min.	Typ.	Max.	Unit	Note
Weight	2510	2560	2610	g	-
I/F connector mounting position	The mounting inclination of the connector makes the screen center within $\pm 0.5\text{mm}$ as the horizontal.				(2)

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

Note (2) Connector mounting position





2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT (BASE ON CMO MODULE V470H2-P03)

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	TST	-20	+60	°C	(1)
Operating Ambient Temperature	TOP	0	50	°C	(1), (2)
Shock (Non-Operating)	SNOP	-	50	G	(3), (5)
Vibration (Non-Operating)	VNOP	-	1.0	G	(4), (5)

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

(a) 90 %RH Max. ($T_a \leq 40\text{ }^{\circ}\text{C}$).

(b) Wet-bulb temperature should be 39 °C Max. ($T_a > 40\text{ }^{\circ}\text{C}$).

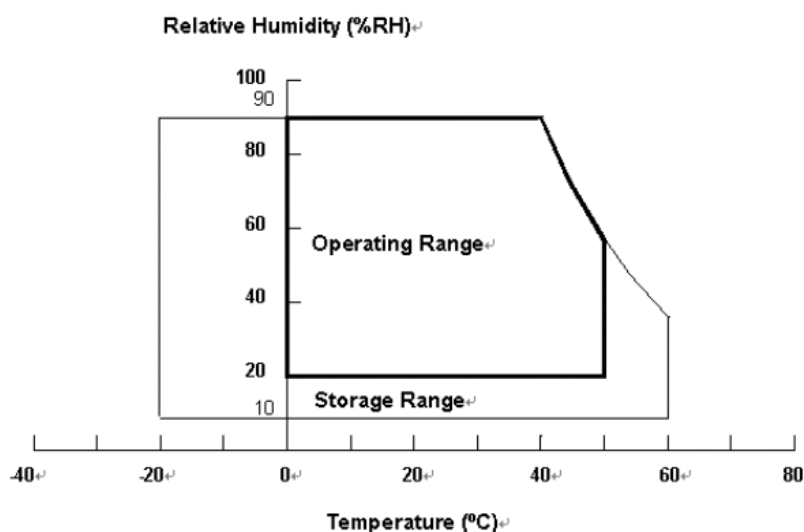
(c) No condensation.

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 65 °C 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 °C. The range of operating temperature may degrade in case of improper thermal management in final product design.

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

Note (4) 10 ~ 200 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 PACKAGE STORAGE

Storage condition: With shipping package.

Storage temperature rang: $25\pm 5^{\circ}\text{C}$

Storage humidity range: $50\pm 10\%\text{RH}$

Shelf life: a month

2.3 ELECTRICAL ABSOLUTE RATINGS

2.3.1 ELECTRICAL ABSOLUTE RATINGS

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCC	-0.3	13.5	V	(1)
Logic Input Voltage	VIN	-0.3	3.6	V	

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.

3. ELECTRICAL CHARACTERISTICS**3.1 TFT LCD MODULE**

(Ta = 25 ± 2 °C)

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V _{CC}	10.8	12	13.2	V	(1)
Rush Current		I _{RUSH}	—	—	4.4	A	(2)
Power Supply Current	White Pattern	—	—	0.48	—	A	(3)
	Horizontal Stripe	—	—	1.2	1.4	A	
	Black Pattern	—	—	0.51	—	A	
LVDS interface	Differential Input High Threshold Voltage	V _{LVTH}	+100	—	—	mV	(4)
	Differential Input Low Threshold Voltage	V _{LVTL}	—	—	-100	mV	
	Common Input Voltage	V _{CM}	1.0	1.2	1.4	V	
	Differential input voltage	V _{ID}	200	—	600	mV	
	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 the above ranges.

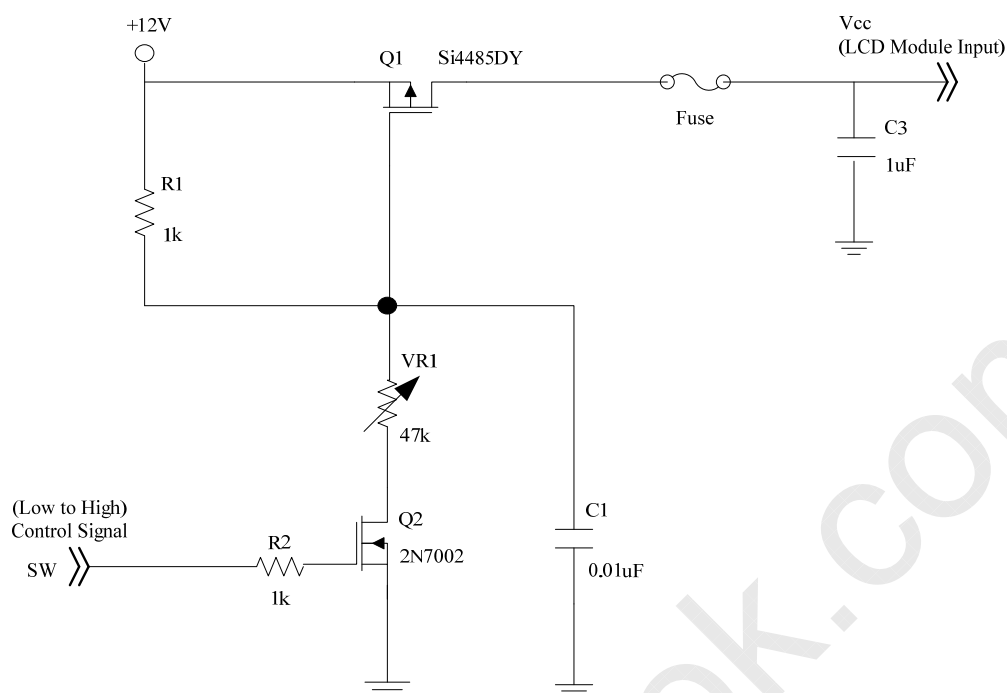
Note (2) Measurement condition:



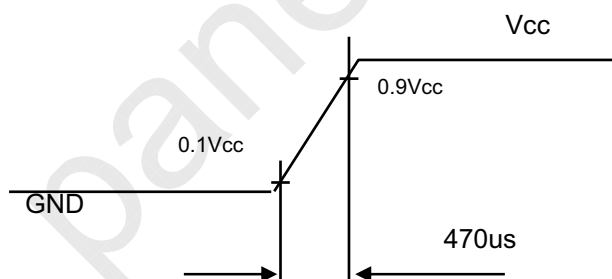
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Vcc rising time is 470us



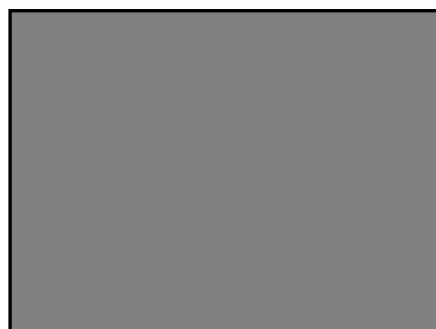
Note (3) The specified power supply current is under the conditions at $V_{CC} = 12\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



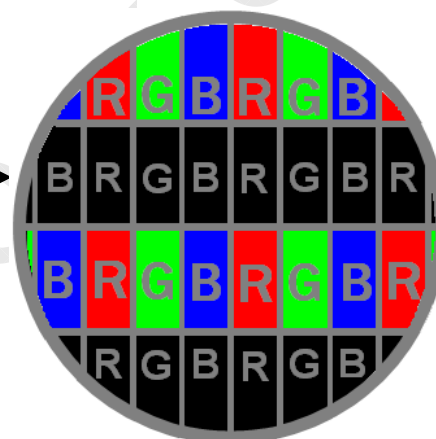
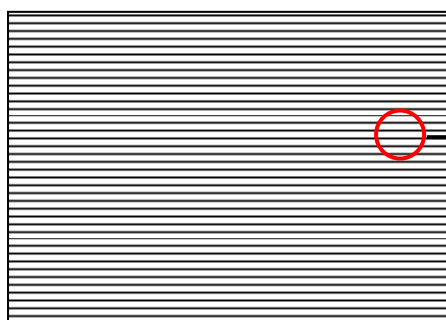
Active Area

b. Black Pattern

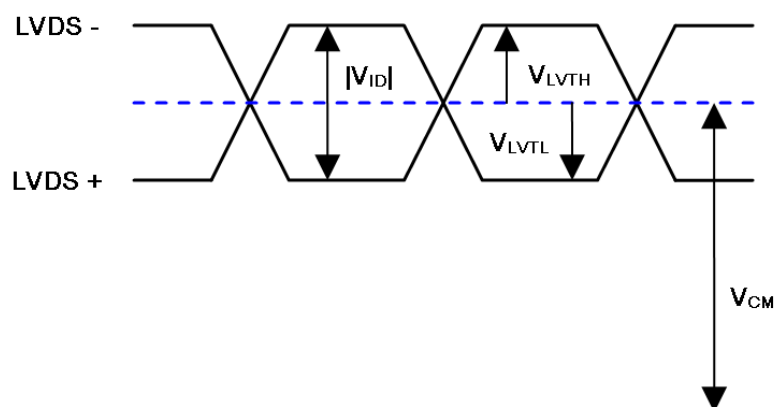


Active Area

c. Horizontal Pattern

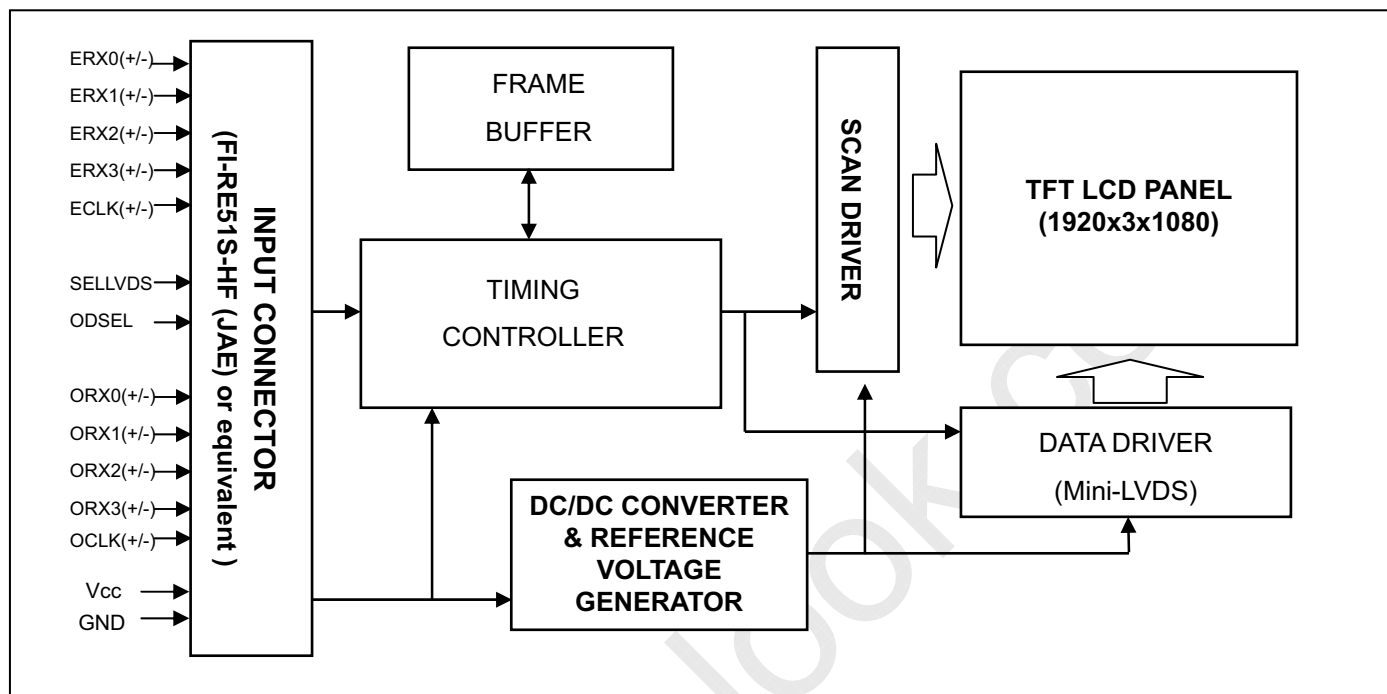


Note (4) The LVDS input characteristics are as follows:



4. BLOCK DIAGRAM OF INTERFACE

4.1 TFT LCD MODULE

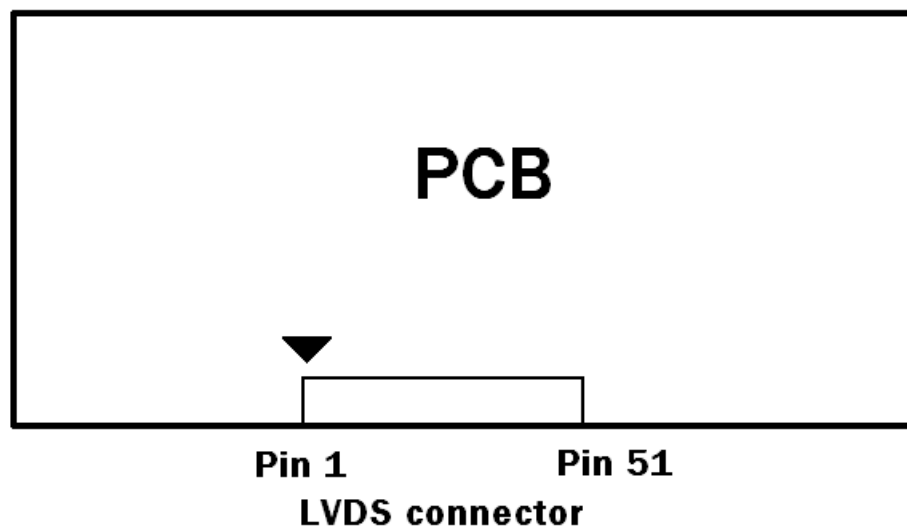


5. INPUT TERMINAL PIN ASSIGNMENT**5.1 TFT LCD Module Input**

Pin	Name	Description	Note
1	GND	Ground	
2	N.C.	No Connection	(2)
3	N.C.	No Connection	
4	N.C.	No Connection	
5	N.C.	No Connection	
6	N.C.	No Connection	
7	SELLVDS	LVDS data format Selection	(3)(5)
8	N.C.	No Connection	(2)
9	ODSEL	Overdrive Lookup Table Selection	(4)(6)
10	N.C.	No Connection	(2)
11	GND	Ground	
12	ERX0-	Even pixel Negative LVDS differential data input. Channel 0	(7)
13	ERX0+	Even pixel Positive LVDS differential data input. Channel 0	(7)
14	ERX1-	Even pixel Negative LVDS differential data input. Channel 1	(7)
15	ERX1+	Even pixel Positive LVDS differential data input. Channel 1	(7)
16	ERX2-	Even pixel Negative LVDS differential data input. Channel 2	(7)
17	ERX2+	Even pixel Positive LVDS differential data input. Channel 2	(7)
18	GND	Ground	
19	ECLK-	Even pixel Negative LVDS differential clock input.	(7)
20	ECLK+	Even pixel Positive LVDS differential clock input.	(7)
21	GND	Ground	
22	ERX3-	Even pixel Negative LVDS differential data input. Channel 3	(7)
23	ERX3+	Even pixel Positive LVDS differential data input. Channel 3	(7)
24	N.C.	No Connection	(2)
25	N.C.	No Connection	(2)
26	GND	Ground	
27	GND	Ground	
28	ORX0-	Odd pixel Negative LVDS differential data input. Channel 0	(7)
29	ORX0+	Odd pixel Positive LVDS differential data input. Channel 0	(7)
30	ORX1-	Odd pixel Negative LVDS differential data input. Channel 1	(7)
31	ORX1+	Odd pixel Positive LVDS differential data input. Channel 1	(7)
32	ORX2-	Odd pixel Negative LVDS differential data input. Channel 2	(7)
33	ORX2+	Odd pixel Positive LVDS differential data input. Channel 2	(7)
34	GND	Ground	
35	OCLK-	Odd pixel Negative LVDS differential clock input	(7)
36	OCLK+	Odd pixel Positive LVDS differential clock input	(7)
37	GND	Ground	
38	ORX3-	Odd pixel Negative LVDS differential data input. Channel 3	(7)
39	ORX3+	Odd pixel Positive LVDS differential data input. Channel 3	(7)
40	N.C.	No Connection	(2)
41	N.C.	No Connection	(2)
42	GND	Ground	
43	GND	Ground	
44	GND	Ground	
45	GND	Ground	
46	GND	Ground	
47	N.C.	No Connection	(2)
48	VCC	Power input (+12V)	

49	VCC	Power input (+12V)	
50	VCC	Power input (+12V)	
51	VCC	Power input (+12V)	

Note (1) LVDS connector pin order defined as follows



Note (2) Reserved for internal use. Please leave it open.

Note (3) Low = Open or connect to GND: VESA Format, High = Connect to +3.3V: JEIDA Format.

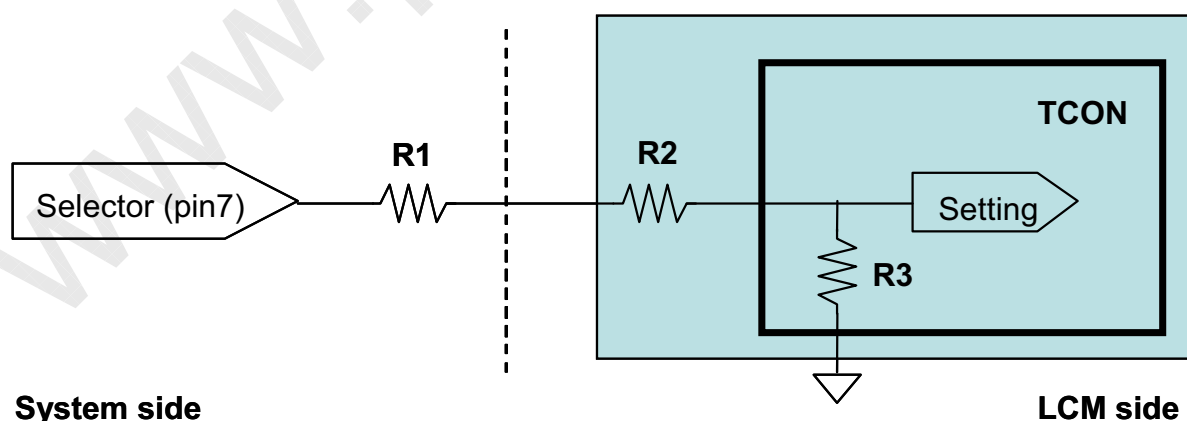
Note (4) Overdrive lookup table selection. The overdrive lookup table should be selected in accordance with the frame rate to optimize image quality.

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.

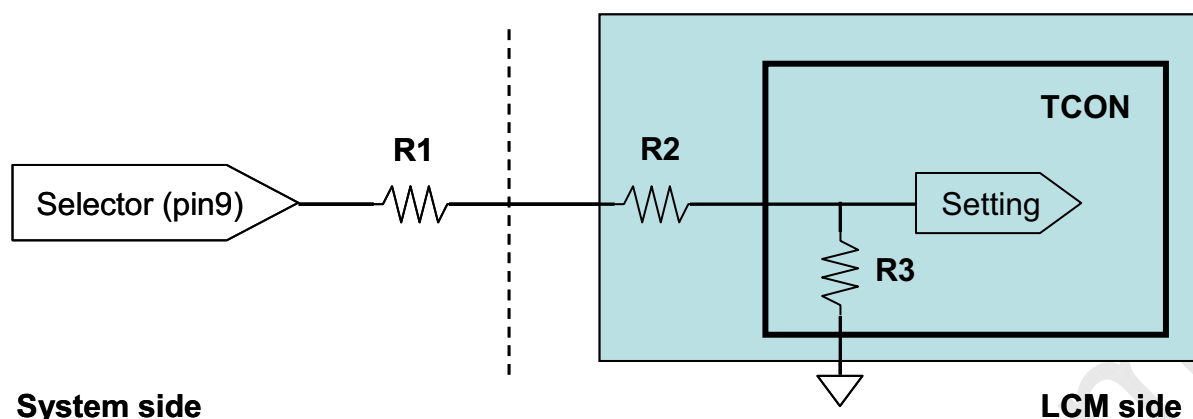
Note (5) LVDS signal pin connected to the LCM side has the following diagram.

R1 in the system side should be less than 1K Ohm. ($R1 < 1K \text{ Ohm}$)

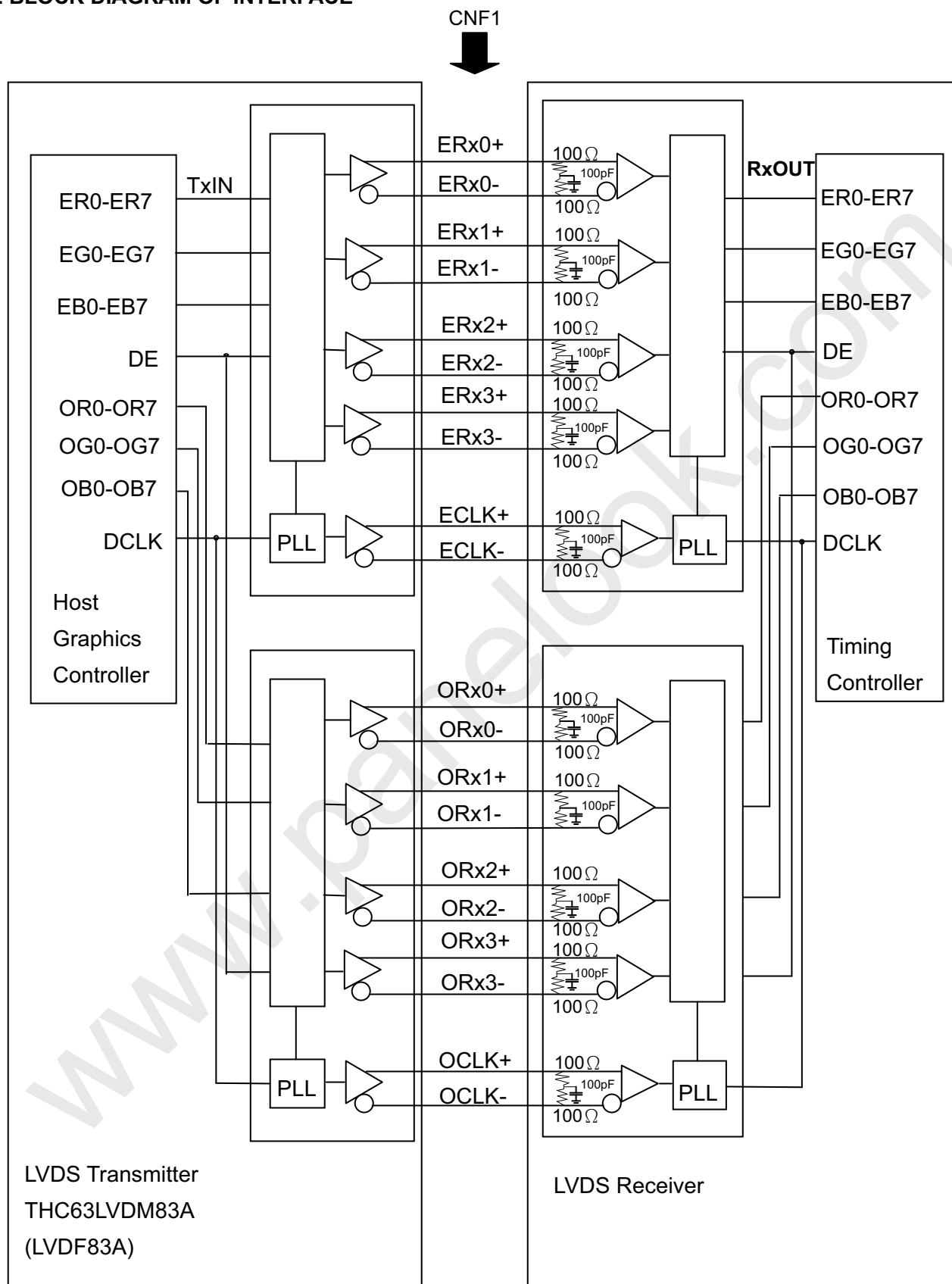


Note (6) ODSEL signal pin connected to the LCM side has the following diagram.

R1 in the system side should be less than 1K Ohm. ($R1 < 1K \text{ Ohm}$)

**System side****LCM side**

Notes (7) Two pixel data send into the module for every clock cycle. The first pixel of the frame is odd pixel and the second pixel is even pixel.

5.2 BLOCK DIAGRAM OF INTERFACE

ER0~ER7 : Even pixel R data

EG0~EG7 : Even pixel G data

EB0~EB7 : Even pixel B data

OR0~OR7 : Odd pixel R data

OG0~OG7 : Odd pixel G data

OB0~OB7 : Odd pixel B data

DE : Data enable signal

DCLK : Data clock signal

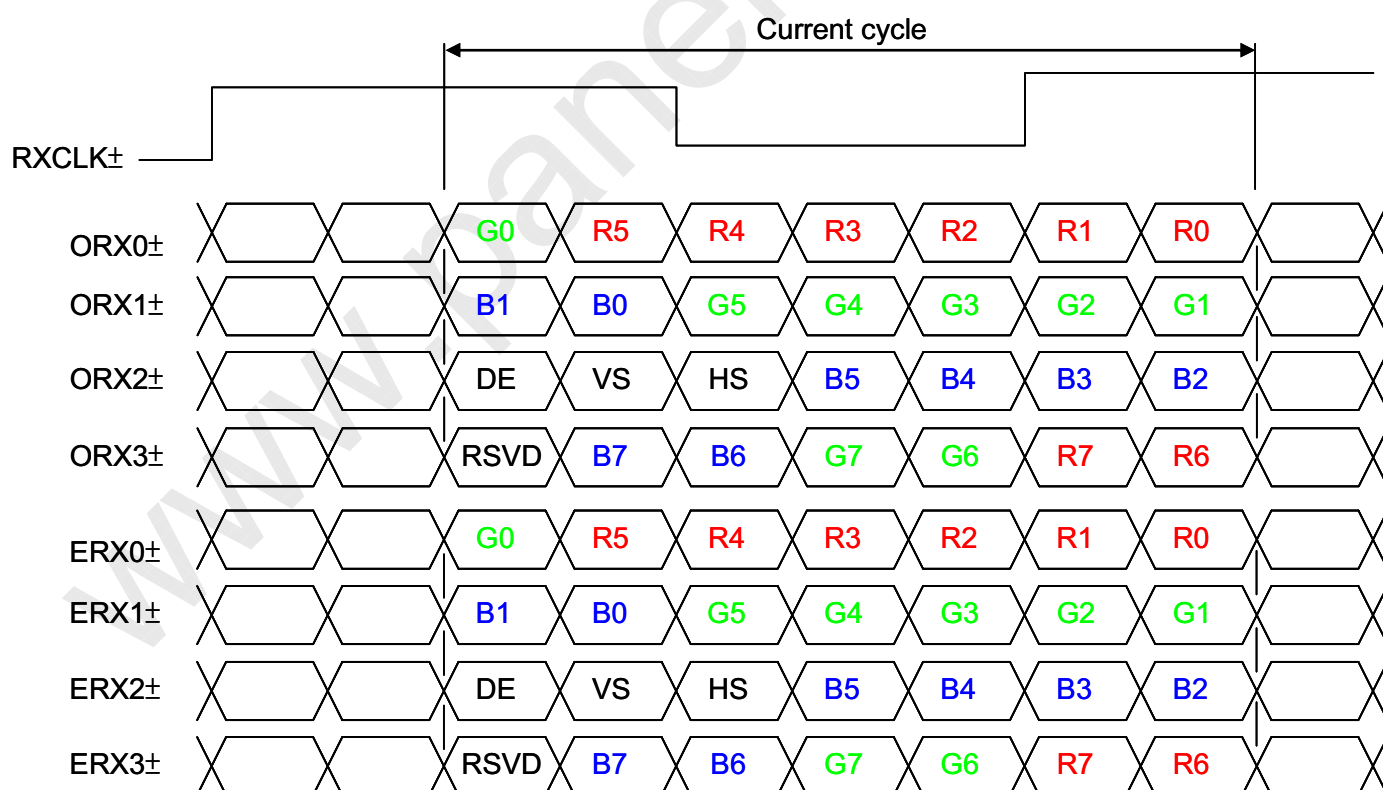
Notes (1) The system must have the transmitter to drive the module.

Notes (2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

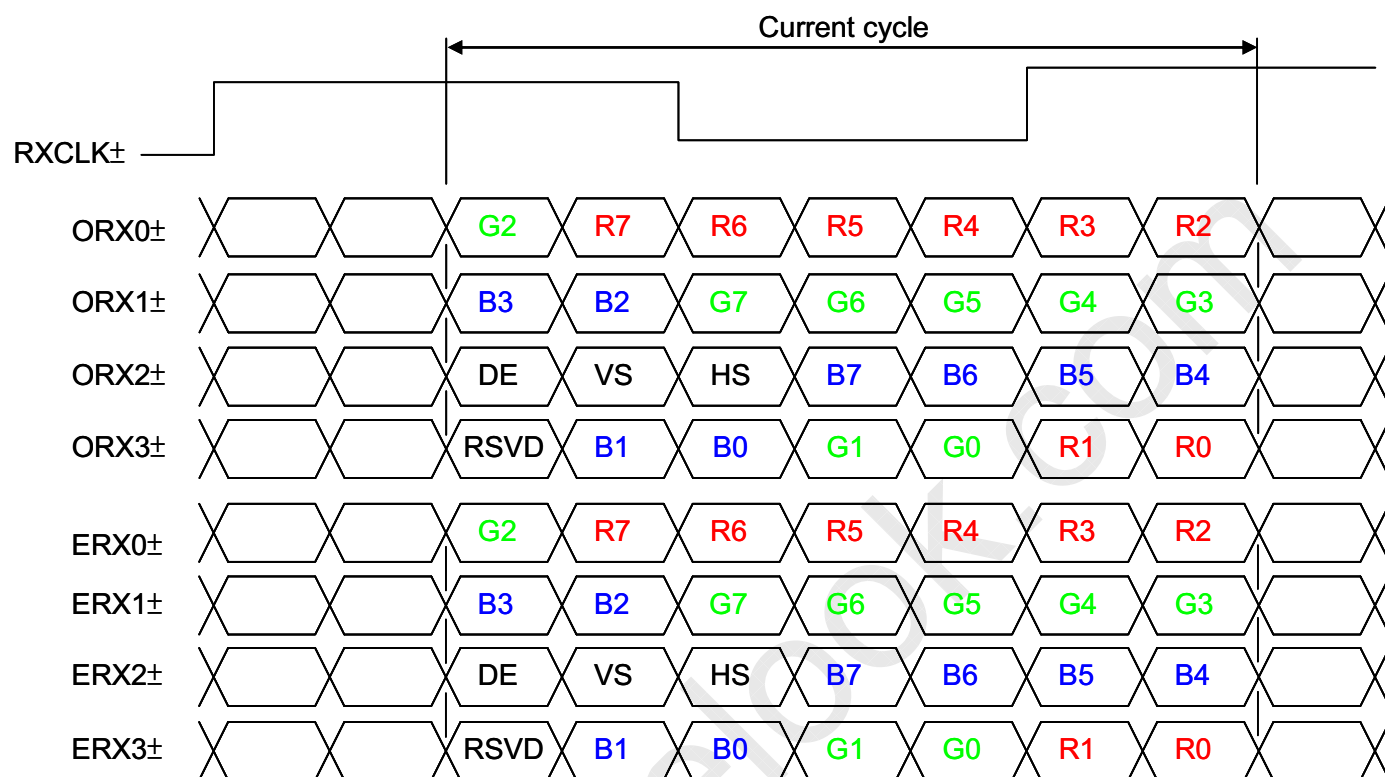
Notes (3) Two pixel data send into the module for every clock cycle. The first pixel of the frame is odd pixel and the second pixel is even pixel.

5.3 LVDS INTERFACE

VESA LVDS format : (SELLVDS pin=L or OPEN)



JEDIA LVDS format : (SELLVDS pin=H)



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

(Ta = 25 ± 2 °C)

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	$F_{\text{clkin}} (=1/T_c)$	60	74.25	80	MHz	
	Input cycle to cycle jitter	T_{rcl}	-200	—	200	ps	(3)
	Spread spectrum modulation range	$F_{\text{clkin_mod}}$	$F_{\text{clkin}}-2\%$	—	$F_{\text{clkin}}+2\%$	MHz	(4)
	Spread spectrum modulation frequency	F_{SSM}			200	KHz	
LVDS Receiver Data	Setup Time	T_{lvsu}	600	—	—	ps	(5)
	Hold Time	T_{lvhd}	600	—	—	ps	
Vertical Active Display Term	Frame Rate	F_{r5}	47	50	53	Hz	(6)
		F_{r6}	57	60	63	Hz	
	Total	T_v	1115	1125	1135	Th	$T_v = T_{\text{vd}} + T_{\text{vb}}$
	Display	T_{vd}	1080	1080	1080	Th	—
	Blank	T_{vb}	35	45	55	Th	—
Horizontal Active Display Term	Total	T_h	1050	1100	1150	Tc	$T_h = T_{\text{hd}} + T_{\text{hb}}$
	Display	T_{hd}	960	960	960	Tc	—
	Blank	T_{hb}	90	140	190	Tc	—

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

$$F_{\text{clkin(max)}} \geq F_{\text{r6}} \times T_v \times T_h$$

$$F_{\text{r5}} \times T_v \times T_h \geq F_{\text{clkin(min)}}$$

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



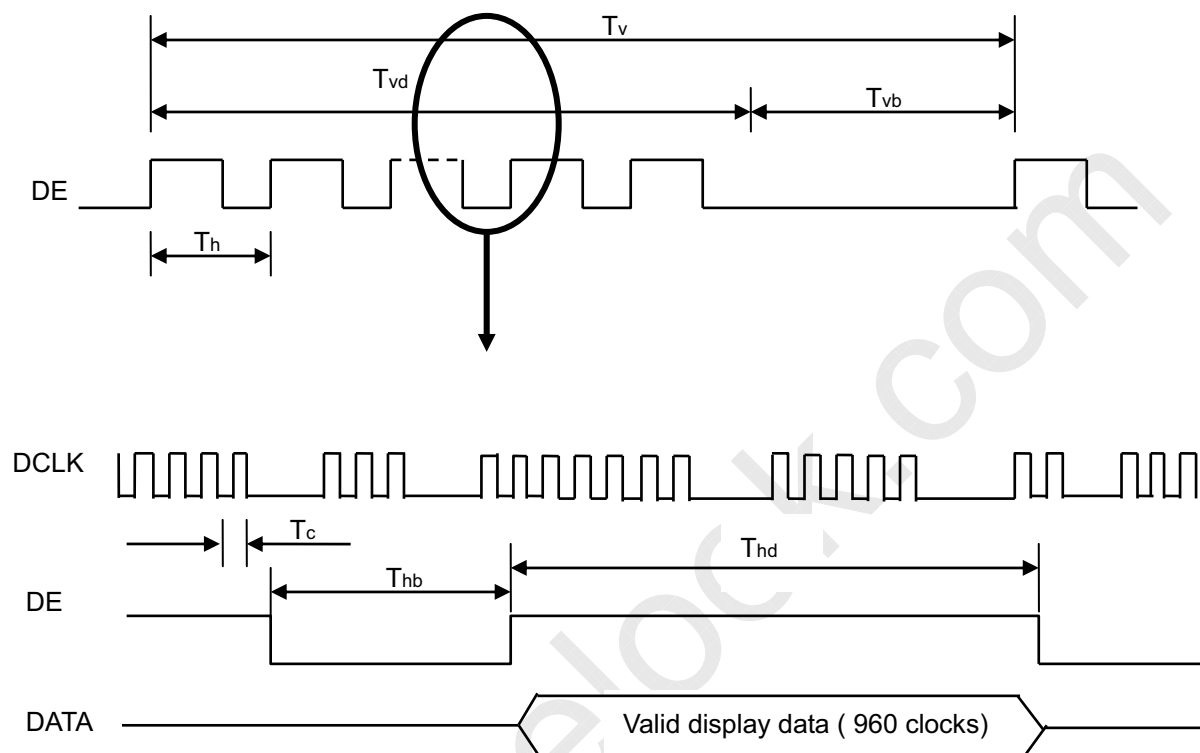
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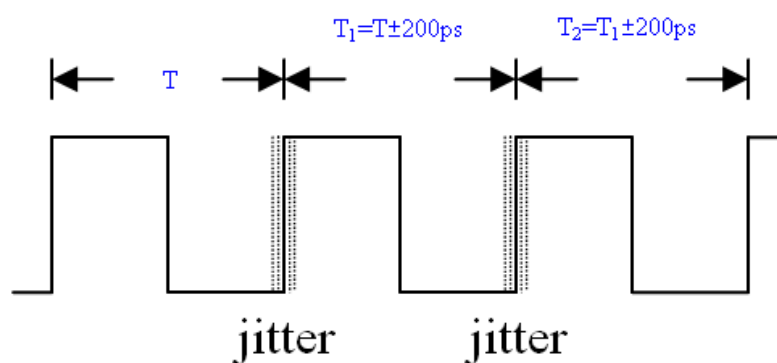
Model No.: V470H2-P03

Approval

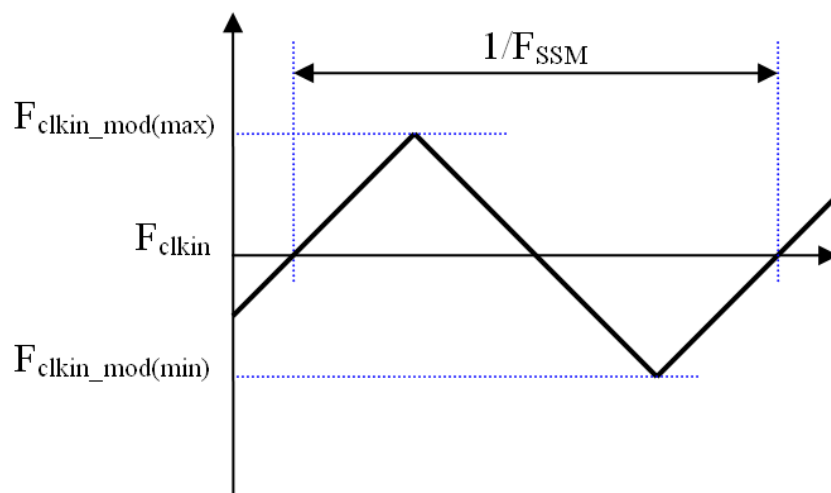
INPUT SIGNAL TIMING DIAGRAM



Note (3) The input clock cycle-to-cycle jitter is defined as below figures. $Trcl = |T_1 - T_1|$

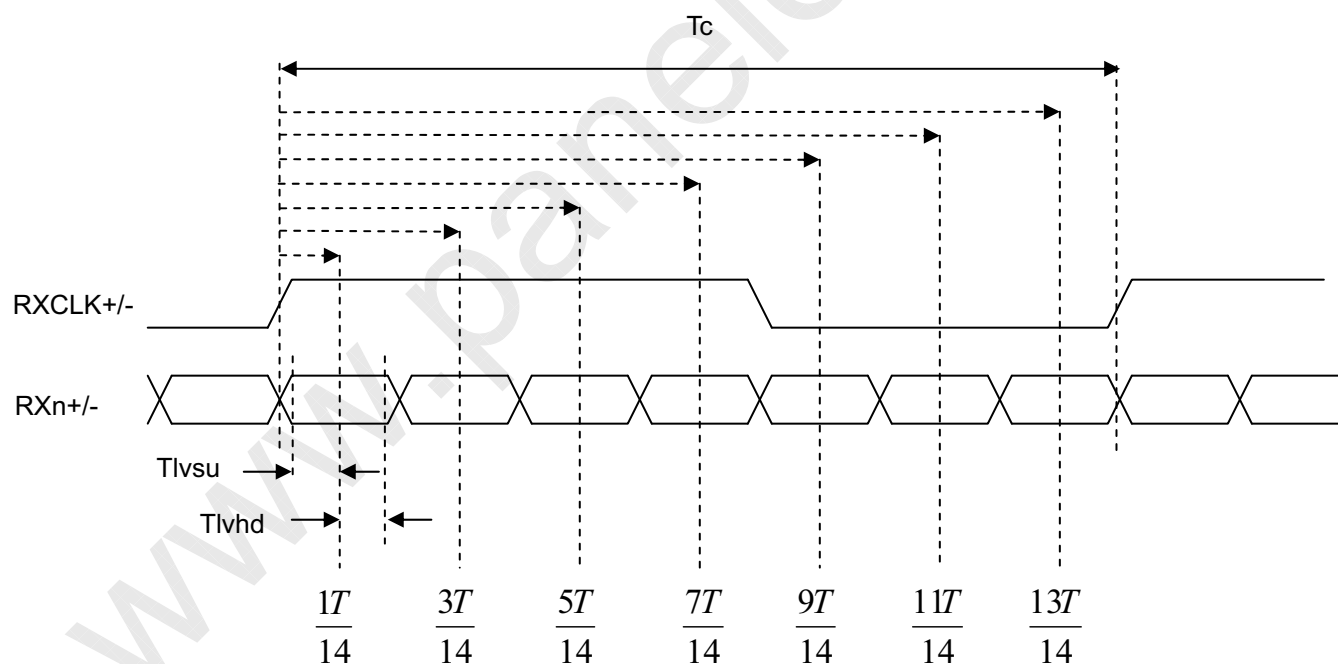


Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



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

LVDS RECEIVER INTERFACE TIMING DIAGRAM

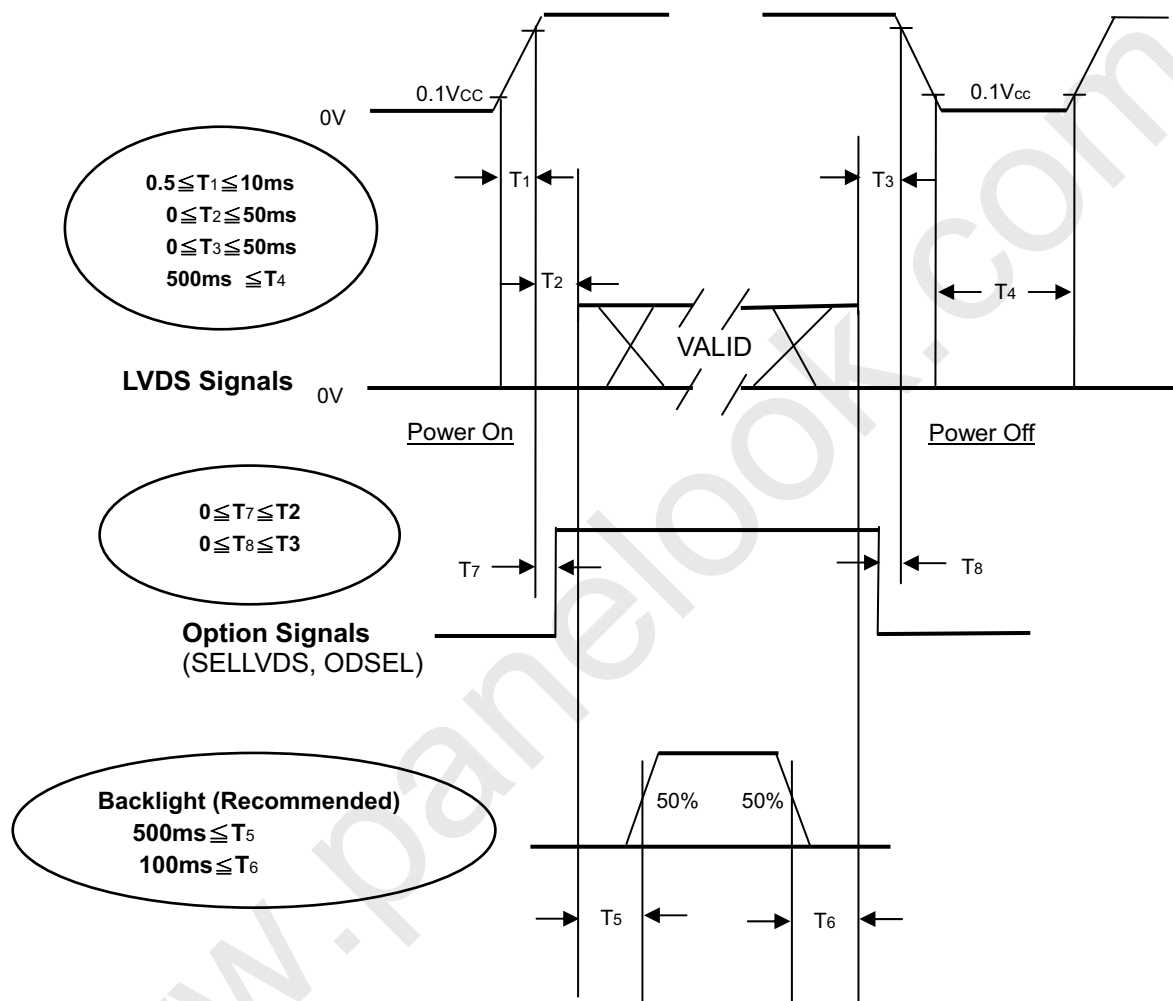


Note (6) : (ODSEL) = H/L or open for 50/60Hz frame rate. Please refer to 5.1 for detail information

6.2 POWER ON/OFF SEQUENCE

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

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow 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 V_{CC}.

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 V_{CC} is in off level, please keep the level of input signals on the low or high impedance. If $T_2 < 0$, that maybe cause electrical overstress failure.

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}	12	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current	I _L	9.3±0.5	mA
Oscillating Frequency (Inverter)	F _W	40±3	KHz
Vertical Frame Rate	Fr	60	Hz

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 (7).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	Rcx	$\theta_x=0^\circ, \theta_Y=0^\circ$ CS-1000T Standard light source “C”	-	(0.641)	-	-	(1),(6)
		Rcy			(0.332)		-	
	Green	Gcx			(0.272)		-	
		Gcy			(0.598)		-	
	Blue	Bcx			(0.151)		-	
		Bcy			0.067)		-	
	White	Wcx			(0.290)		-	
		Wcy			(0.295)		-	
Center Transmittance		T%	$\theta_x=0^\circ, \theta_Y=0^\circ$	-	(4.6)		-	(2), (8)
Contrast Ratio		CR	With CMO Module	(3000)	(4000)		-	(2), (4)
Response Time		Gray to gray	$\theta_x=0^\circ, \theta_Y=0^\circ$ With CMO Module @60Hz	-	(6.5)	-		(5)
White Variation		δW	$\theta_x=0^\circ, \theta_Y=0^\circ$ With CMO Module	-	-	(1.3)		(2), (7)
Viewing Angle	Horizontal	θ_x+	CR $\geq$ 20 With CMO Module	(80)	(88)	-	Deg.	(2), (3)
		θ_x-		(80)	(88)	-		
	Vertical	θ_Y+		(80)	(88)	-		
		θ_Y-		(80)	(88)	-		

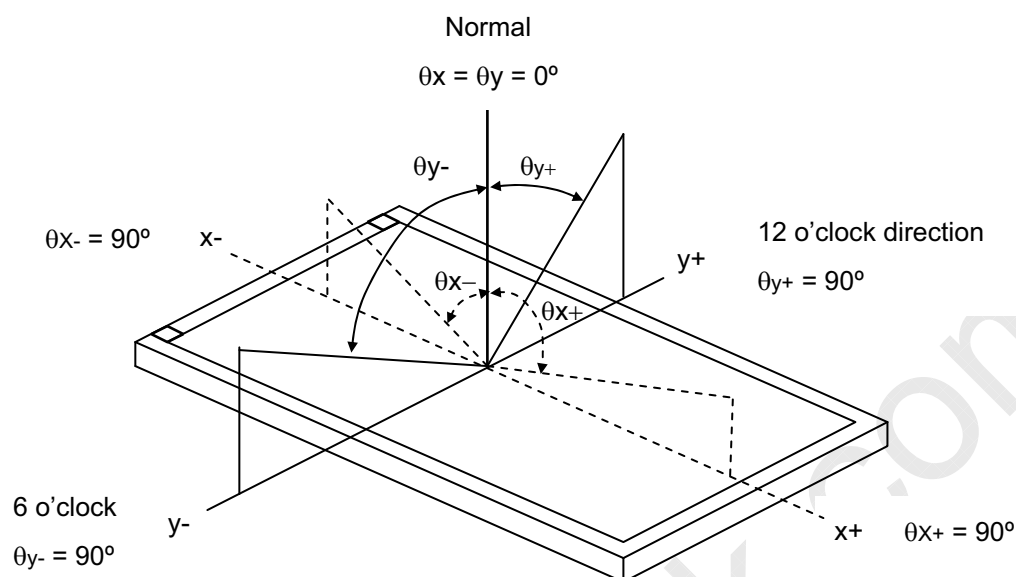
Note (0) Light source is the standard light source "C" which is defined by CIE and driving voltage are based on suitable gamma voltages. The calculating method is as following :

1. Measure Module's and BLU's spectrum. White is without signal input and R,G,B are with signal input. BLU(for V470H2-L03) is supplied by CMO.
2. Calculate cell's spectrum.
3. Calculate cell's chromaticity by using the spectrum of standard light source "C".

Note (2) Light source is the BLU which is supplied by CMO and driving voltages are based on suitable gamma voltages.

Note (3) Definition of Viewing Angle (θ_x, θ_y):

Viewing angles are measured by Conoscope Cono-80

**Note (4) Definition of Contrast Ratio (CR):**

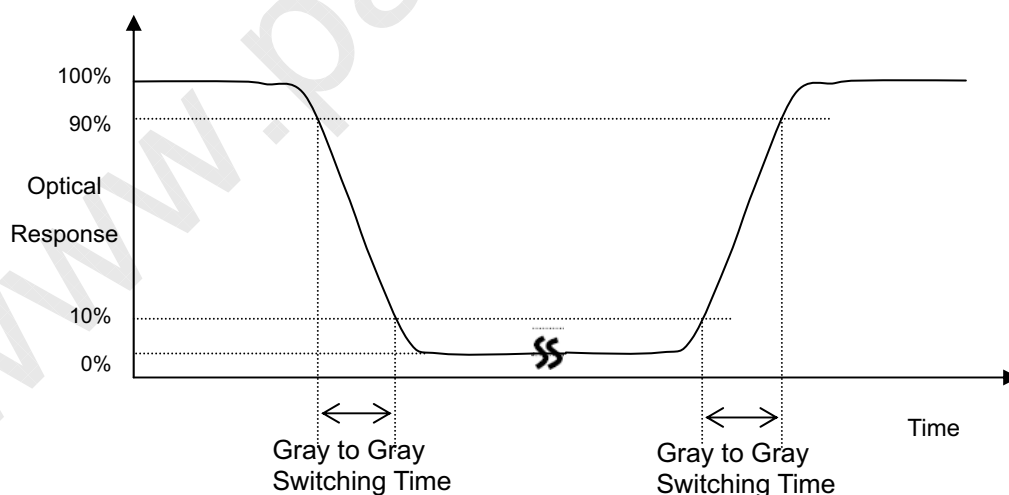
The contrast ratio can be calculated by the following expression.

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

L255: Luminance of gray level 255

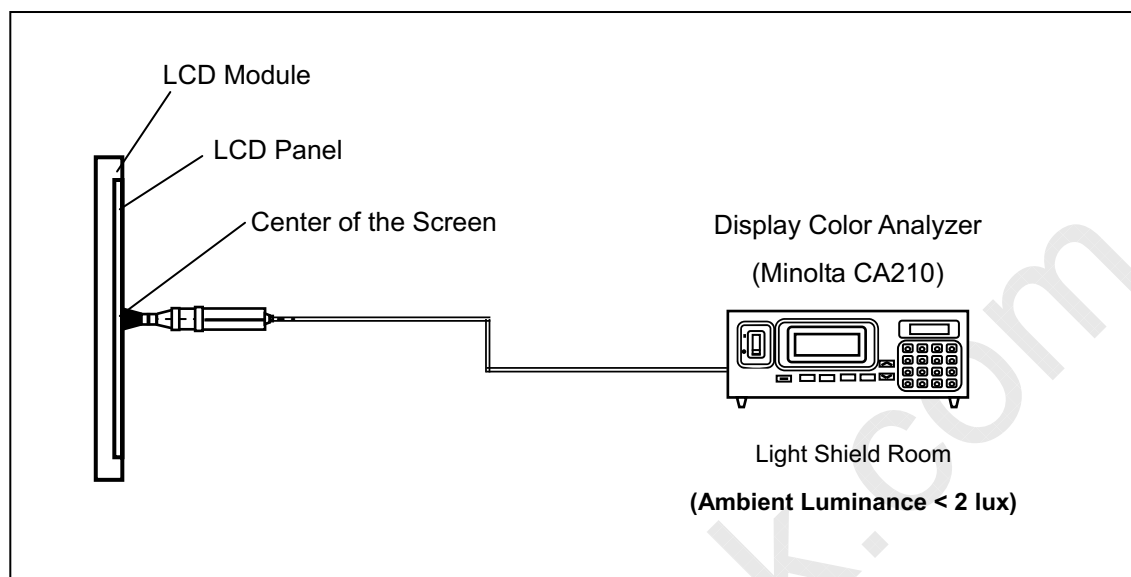
L 0: Luminance of gray level 0

CR = CR (1), where CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (8).

Note (5) Definition of Gray to Gray Switching Time:**Note (6) Measurement Setup:**

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed

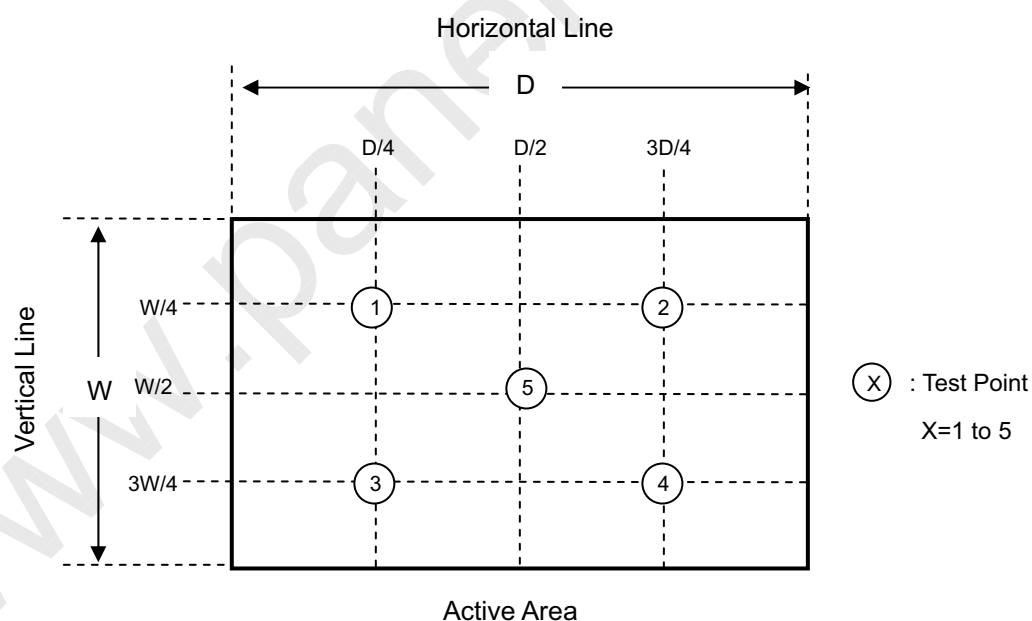
after lighting backlight for 1 hour in a windless room.



Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

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



Note (8) Definition of Transmittance (T%):

Module is without signal input.

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

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] When storing modules as spares for a long time, the following precaution is necessary.
 - [9.1] 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°C at normal humidity without condensation.
 - [9.2] The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.
- [10] When ambient temperature is lower than 10°C, 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 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.

9. DEFINITION OF LABELS

9.1 OPEN CELL LABEL

The barcode nameplate is pasted on each open cell as illustration for CMO internal control.

V470H2-P03



9.2 CARTON LABEL

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

A template for a carton label. It includes the CHI MEI OPTOELECTRONICS logo and name in the top left, and "RoHS" in the top right. Below these are four horizontal lines for text entry, labeled "PO.NO.", "Part ID.", "Model Name", and "Carton ID.". The "Quantities" field is located to the right of the "Carton ID." line. The entire label is enclosed in a rectangular border with a dark blue footer bar.

- (a) Model Name: V470H2-P03
- (b) Carton ID: CMO internal control
- (c) Quantities: 8 pcs

10. Packing

10.1 packing specifications

- (1) 8 LCD TV Panels / 1 Box
- (2) Box dimensions : 1238 (L) X 842 (W) X 240(H)
- (3) Weight : approximately 38Kg (8 panels per box)

10.2 packing Method

Figures 10-1 and 10-2 are the packing method

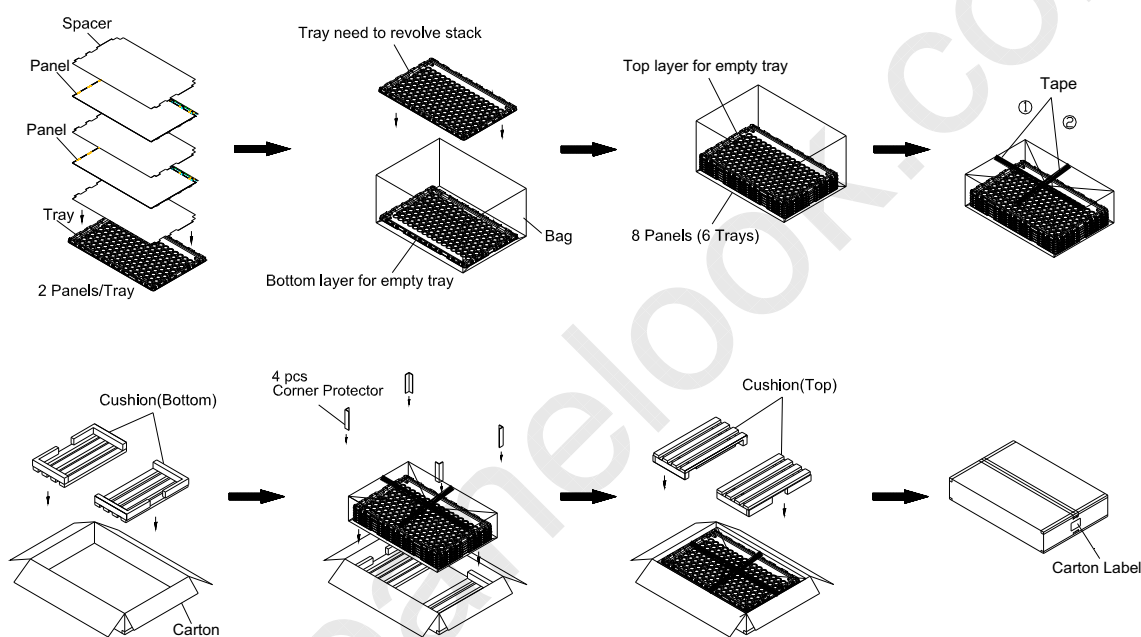
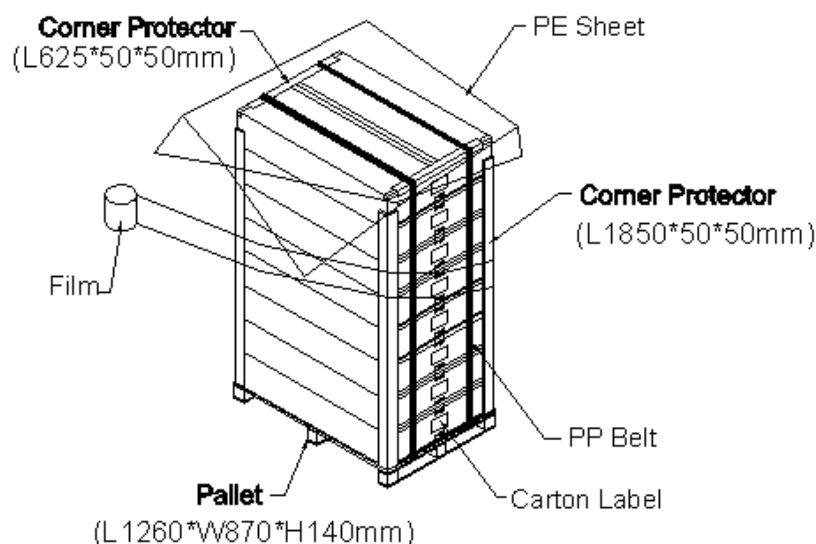


Figure.10-1 packing method

Figure.9-1 packing method

Sea & Land Transportation

Gross: 319kg



Air Transportation

Figure.10-2 packing method

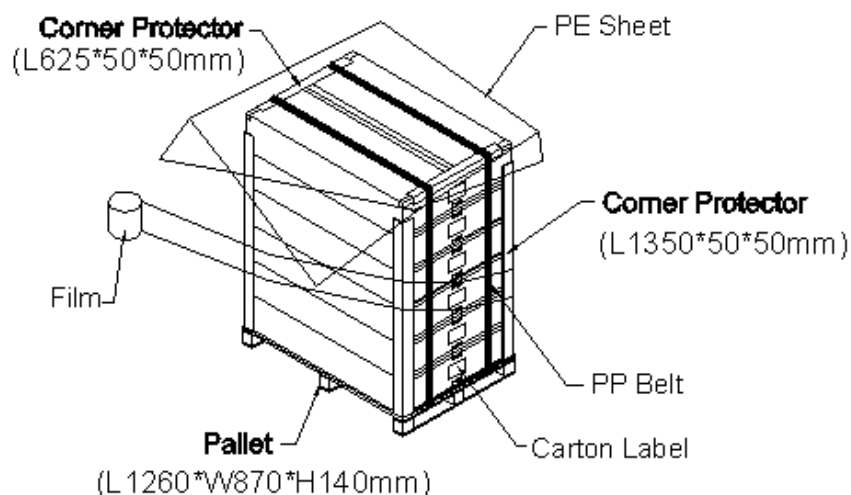


Figure.9-2 packing method

11. MECHANICAL CHARACTERISTICS