TFT LCD Approval Specification

MODEL NO.: V216B1 – P04

Customer: _____

Approved by:_____

Note:

Approved By	TV Product Marketing & Management Div
	Chao-Chun Chung

- CONTENTS -

REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 2.0	Feb. 9th, '09	All	All	Approval Specification was first issued.
Ver 2.1	Nov. 26, '09	4	1.2	Modified CMO module (V216B1-L01 → V216B1-L02)
		15	7.2	Modified CMO module (V216B1-L01 → V216B1-L02).
		16	7.2	Modified Optical Specifications Note (0).
		16	7.2	Modified Optical Specifications Note (1).
		17	7.2	Modified Optical Specifications Note (6).
Ver 2.2	Apr. 14, '10	23	11	Modified Drawing.
		5	2.1	Delete Altitude Operating& Altitude Storage

1. GENERAL DESCRIPTION

1.1 OVERVIEW

V216B1- P04 is a 21.6-inch wide TFT LCD cell with driver ICs and a 30-pin 1-ch LVDS interface. The product supports 1366 x 768 (16.9 wide screen) mode and displays up to 16.7 (6-bit+Hi-FRC colors) millions colors. The backlight unit is not built in.

1.2 CHARACTERISTICS

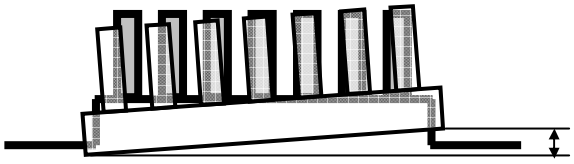
CHARACTERISTICS ITEMS	SPECIFICATIONS
Screen Diagonal [in]	21.6
Pixels [lines]	1366 x R.G.B. x 768
Active Area [mm]	477.417 (H) x 268.416 (V) (21.6" diagonal)
Sub -Pixel Pitch [mm]	0.1165 (H) x 0.3495 (V)
Pixel Arrangement	RGB vertical stripe
Weight [g]	Typ. 606
Physical Size [mm]	488.917(W) x 279.916(H) x 2.0(D) Typ.
Display Mode	TN / Normally White
Contrast Ratio	800:1 Typ. (Typical value measured at CMO's module: V216B1-L02)
Glass thickness (Array/CF) [mm]	0.7 / 0.7
Viewing Angle (CR>10)	+85 / -85(H), +80 / -80(V) Typ. (Typical value measured at CMO's module: V216B1-L02)
Color Chromaticity	R=(0.644, 0.331) G=(0.273,0.588) B=(0.151,0.061) W=(0.285,0.293) *Please refer to "color chromaticity" on p.15 (Typical value measured at CMO's module: V216B1-L02)
Cell Transparency [%]	7.25%Typ. (Typical value measured at CMO's module: V216B1-L02)
Polarizer (CF side)	Anti-glare coating, Hardness: 3H 484.4(H) x 275.8(W)
Polarizer (TFT side)	484.4(H) x 275.8(W)

1.3 MECHANICAL SPECIFICATIONS

Item	Min.	Typ.	Max.	Unit	Note
Weight	-	595	-	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 (BASED ON CMO MODULE V216B1-L02)

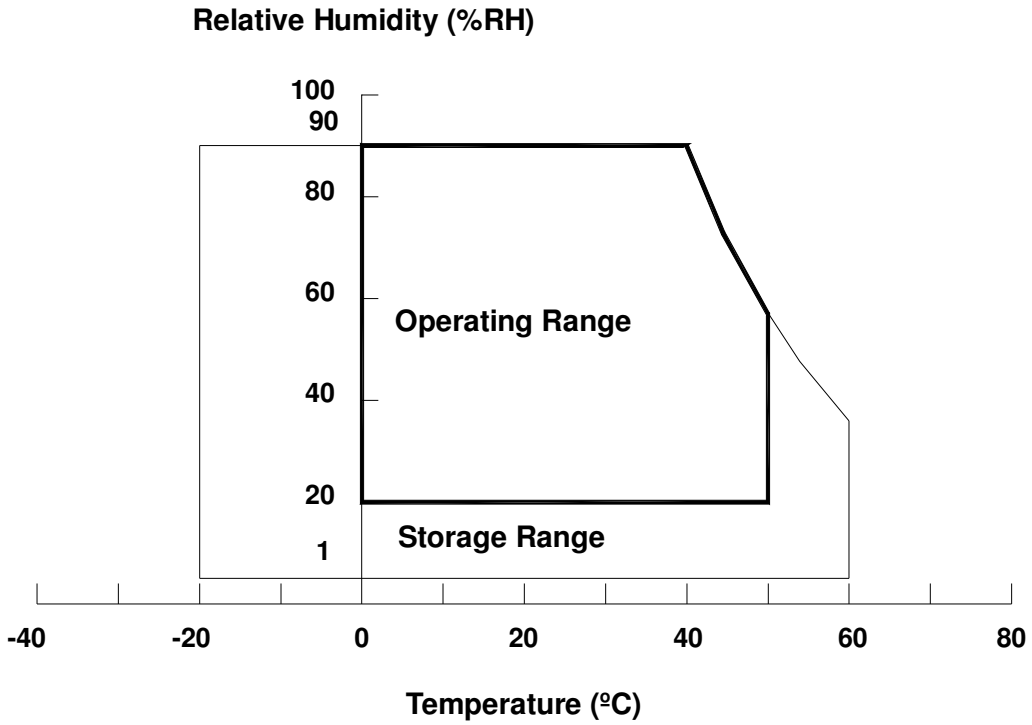
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1), (3)
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2), (3)

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) 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 your 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 your product design.

Note (3) Rating of environment is based on LCD module. Leave LCD cell alone; this environment condition can't be guaranteed. Except LCD cell, customers have to consider the ability of other parts of LCD module and LCD module process.

2.2 ABSOLUTE RATINGS OF ENVIRONMENT (OPEN CELL)

Storage condition: With shipping package.

Storage temperature range: 25±5 ℃

Storage humidity range: 50±10%RH

Shelf life: a month

2.3 ELECTRICAL ABSOLUTE RATINGS

2.3.1 ELECTRICAL ABSOLUTE RATINGS (OPEN CELL)

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	6.0	V	-
Input Signal Voltage	V_{IN}	-0.3	3.6	V	

3. ELECTRICAL CHARACTERISTICS

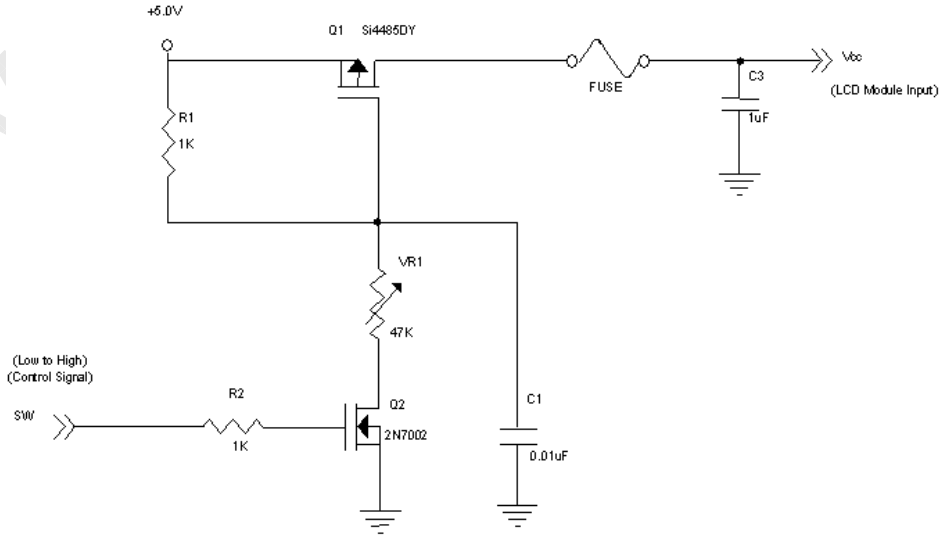
3.1 TFT LCD OPEN CELL

Ta = 25 ± 2 ºC

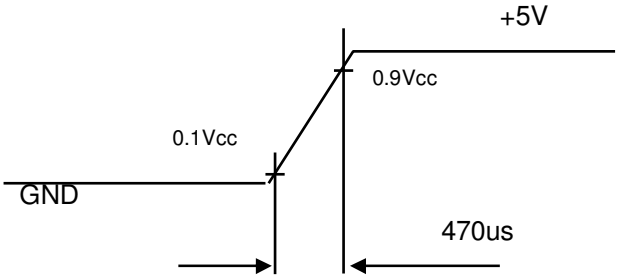
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	4.5	5.0	5.5	V	(1)
Power Supply Ripple Voltage		V_{RP}	-	-	150	mV	-
Rush Current		I_{RUSH}	-	-	3.0	A	(2)
Power Supply Current	White	I_{CC}	-	0.50	-	A	(3)
	Black		-	0.85	0.95	A	
	Vertical Stripe		-	0.75	-	A	
LVDS Interface	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:

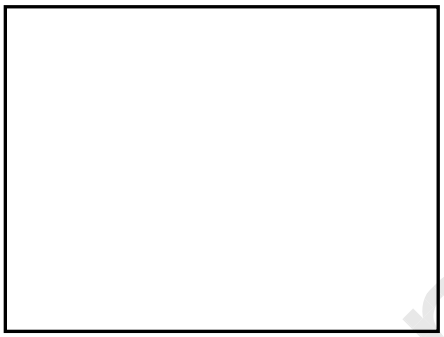


Vcc rising time is 470us



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

a. White Pattern

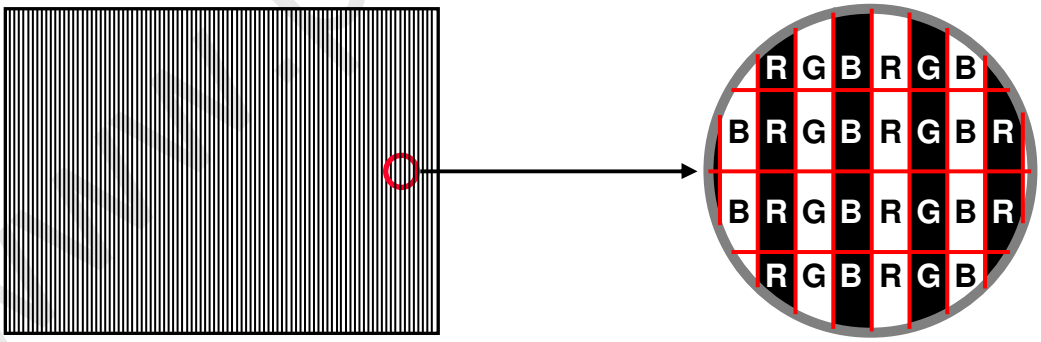


Active Area

b. Black Pattern

Active Area

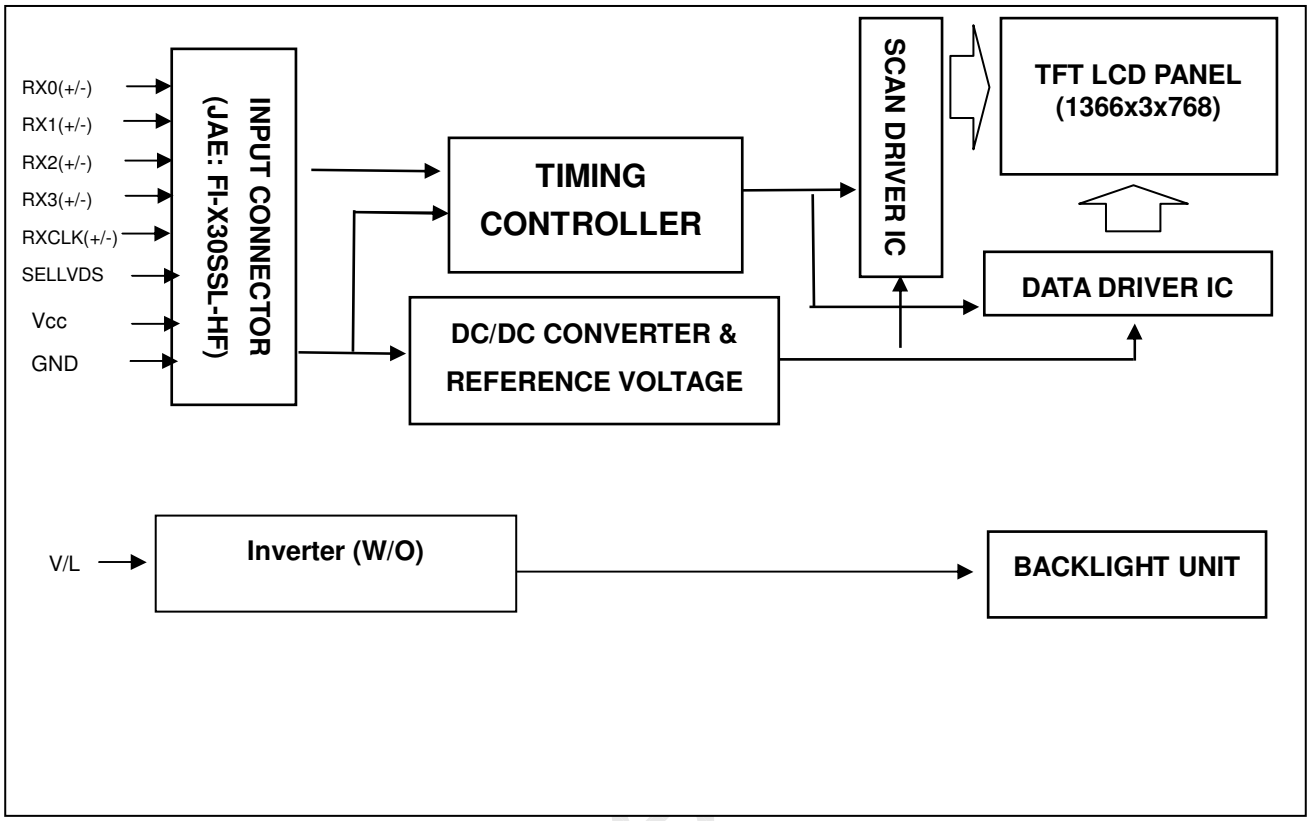
c. Vertical Stripe Pattern



Active Area

4. BLOCK DIAGRAM

4.1 TFT LCD OPEN CELL



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

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

Note (1) Connector part no.: JAE: FI-X30SSL-HF (LCDS) or compatible

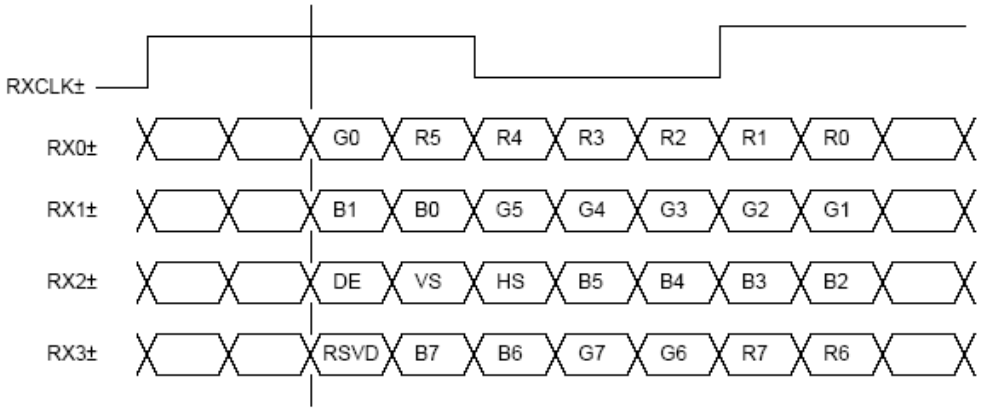
Note (2) Reserved for CMO internal use, please leave it open.

Note (3) Low: JEIDA data format, High/open: VESA data format

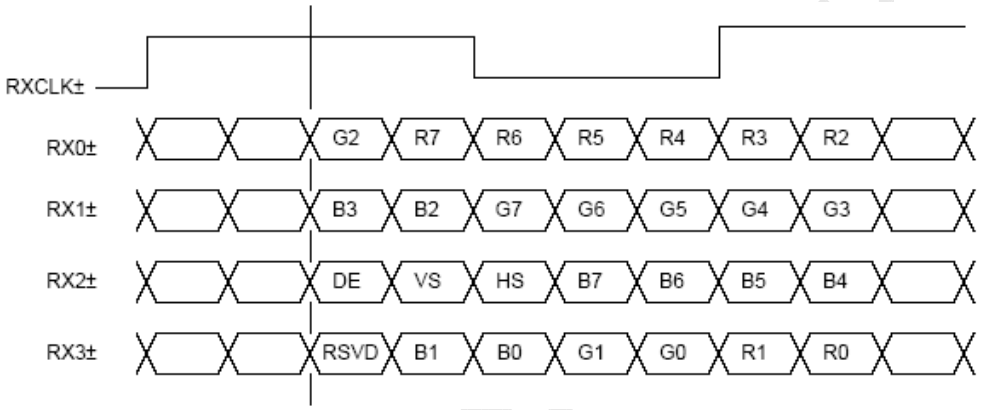
Note (4) Logic level voltage definition: Low: 0V, High: 3.3V

5.2 LVDS DATA MAPPING TABLE

SELLVDS = H or Open (VESA)



SELLVDS = L (JEIDA)



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

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

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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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

6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

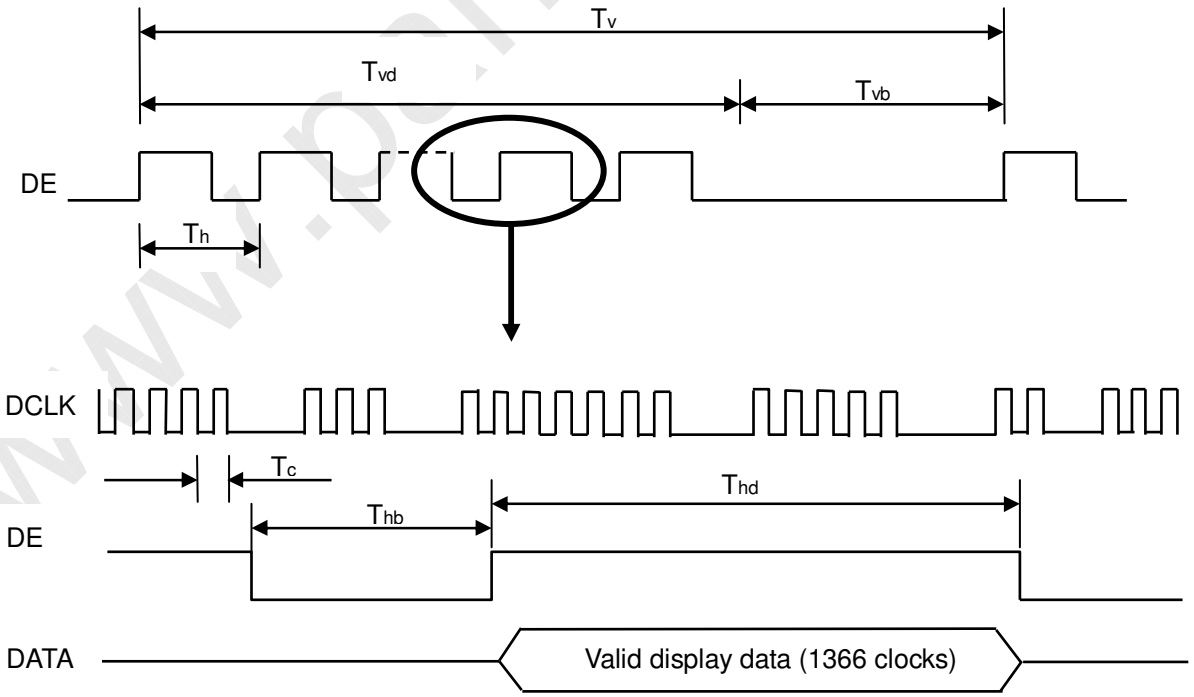
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	1/Tc	60	76	82	MHz	-
	Input cycle to cycle Jitter	Trcl	-	-	200	ps	-
LVDS Receiver Data	Setup Time	Tlvsu	600	-	-	ps	-
	Hold Time	Tlvhd	600	-	-	ps	-
Vertical Active Display Term	Frame Rate	Fr	47	50	53	Hz	-
			57	60	63		-
	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	-

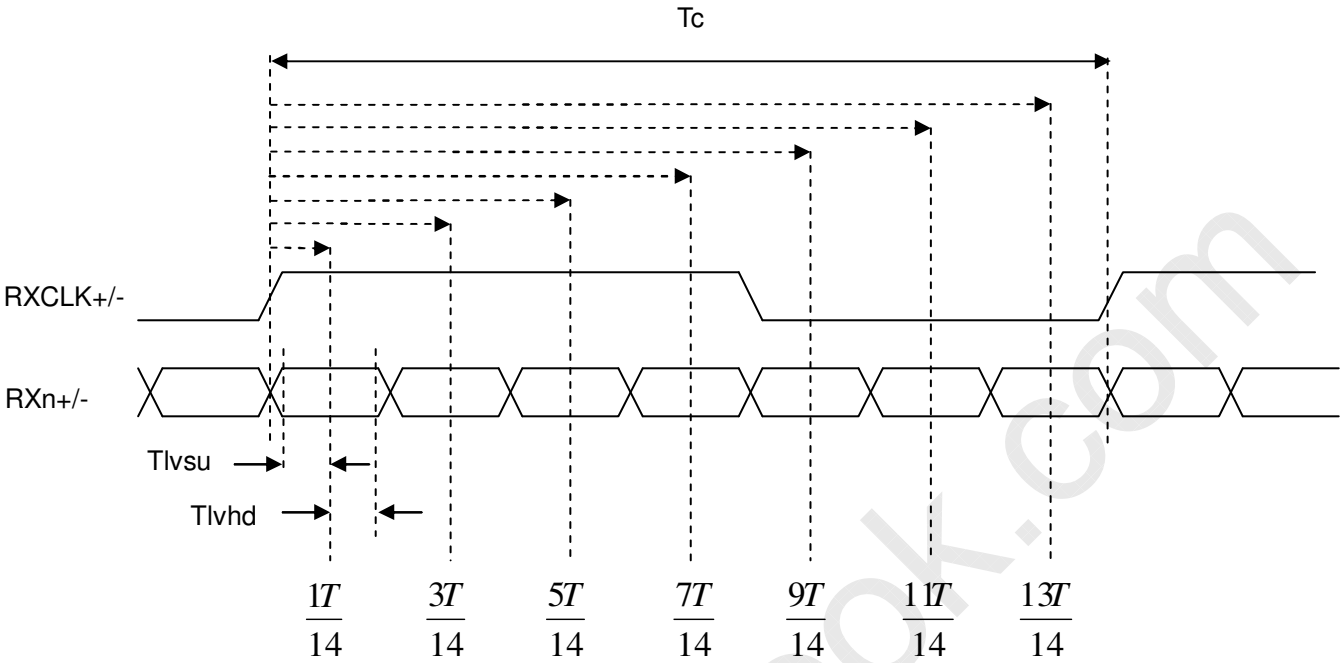
Note (1) Since this module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would operate abnormally.

Note (2) Please refer to 5.1 for detail information.

INPUT SIGNAL TIMING DIAGRAM

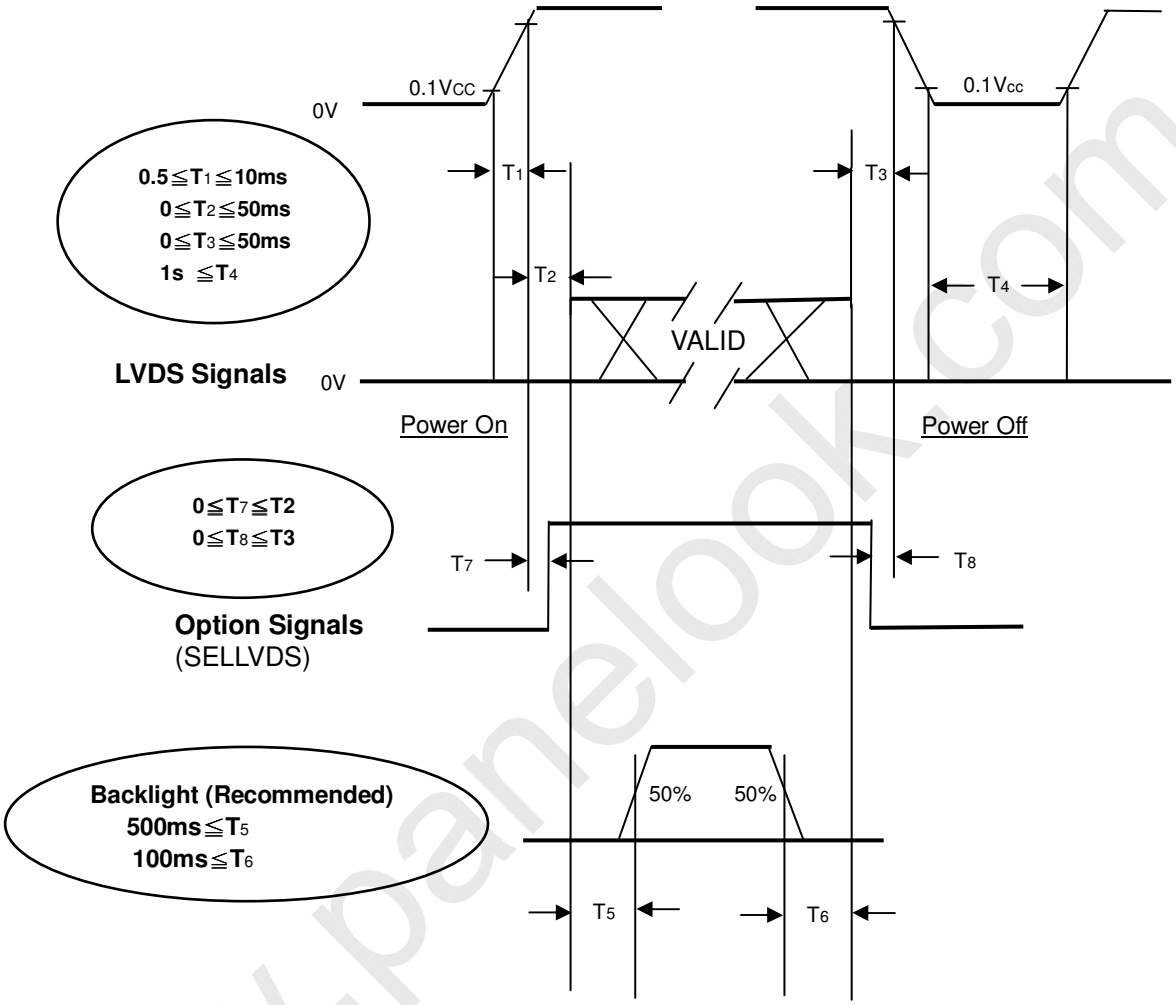


LVDS RECEIVER INTERFACE TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, 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 may 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}	5.0	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	7.0	mA
Inverter Driving Frequency	F_L	50	KHz
Dimming Frequency	F_B	160 (type)	Hz
Minimum Duty Ratio	D_{MIN}	20	%
Maximum Duty Ratio	D_{MAX}	100	%
Inverter	Ampower (27-D024817)		

7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown as below. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

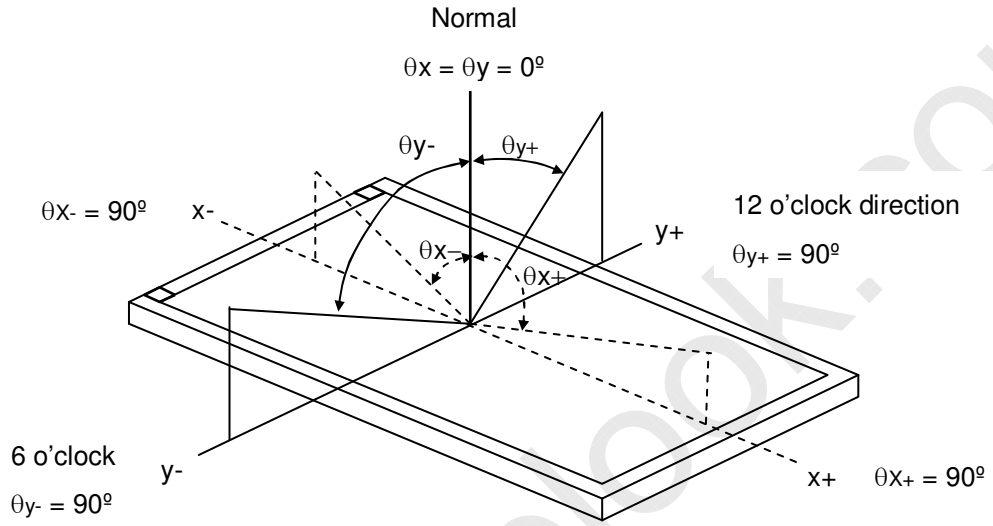
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_x=0°, θ_Y =0° Viewing Angle at Normal Direction With CMO's module: V216B1-L02	600	800	-	-	(2)
Response Time		T_R		-	1.3	2.2	ms	(3)
		T_F		-	3.7	5.8		
Center Transmittance		T%		-	7.25	-	%	(4)
White Variation		δW		-	-	1.3	-	(7)
Cross Talk		CT		-	-	4	%	(5)
Color Chromaticity	Red	Rx		Typ. -0.03	0.644	Typ. +0.03	-	(0),(6)
		Ry			0.331		-	
	Green	Gx			0.273		-	
		Gy			0.588		-	
	Blue	Bx			0.151		-	
		By			0.061		-	
	White	Wx			0.285		-	
		Wy			0.293		-	
	Color Gamut	CG		-	72	-	%	NTSC Ratio
Viewing Angle	Horizontal	θ_x+	CR≥10 With CMO's module: V216B1-L02	75	85	-	Deg.	(1)
		θ_x-		75	85	-		
	Vertical	θ_Y+		70	80	-		
		θ_Y-		70	80	-		

Note (0) Light source is CMO's BLU and driving voltages are based on suitable gamma voltages. The calculated method is as follows,

1. Measure Module's and BLU's spectrum. White is without signal input and R, G, B are with signal input. BLU (for V216B1-L02) is supplied by CMO.
2. Calculate cell's spectrum.

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

Viewing angles are measured by Autronic Conoscope Cono-80.



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

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

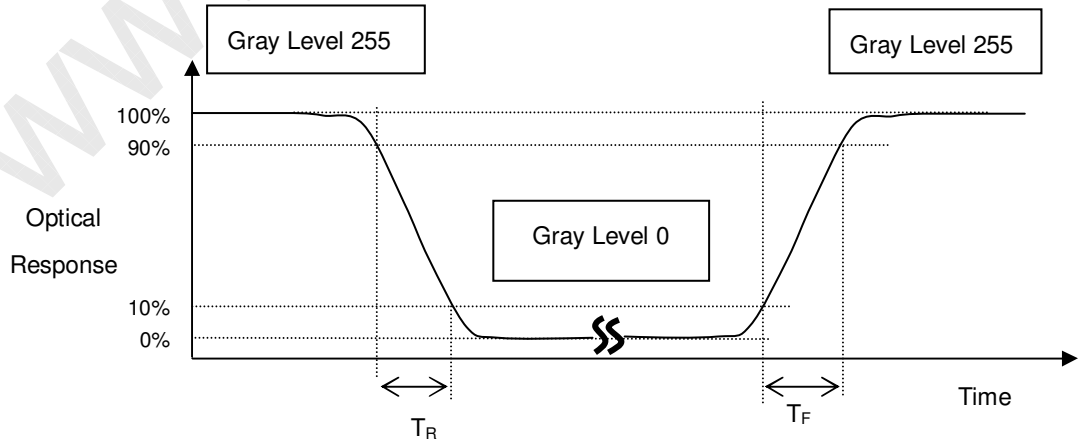
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5),

CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (7).

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



Note (4) Definition of Transmittance (T%):

Module is without signal input.

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

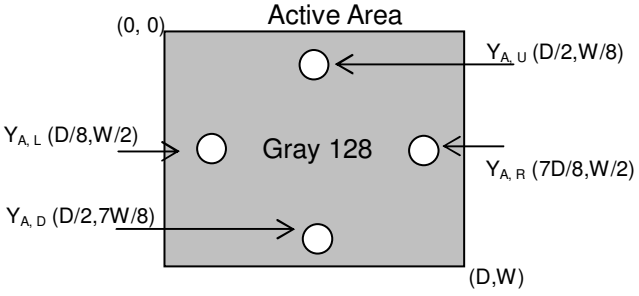
Note (5) Definition of Cross Talk (CT):

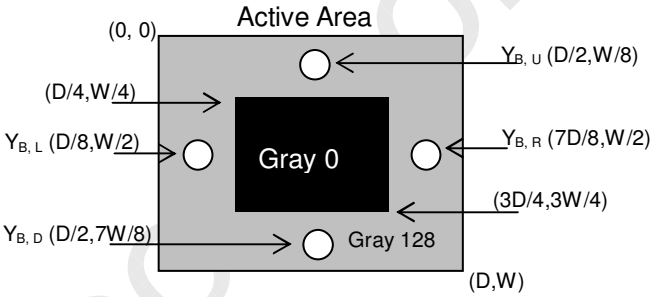
$CT = | Y_B - Y_A | / Y_A \times 100\ (\%)$

Where:

Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

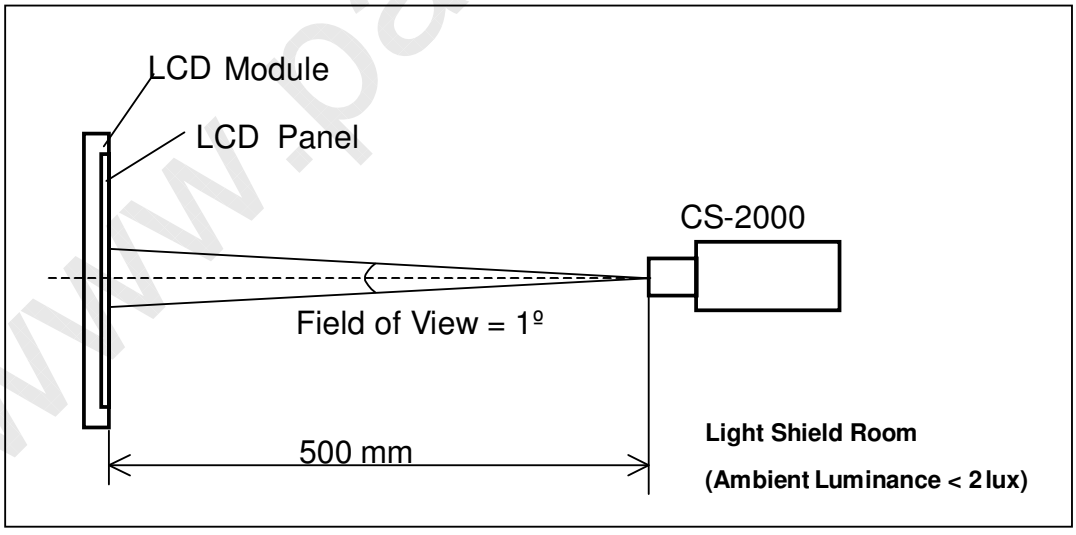
Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)





Note (6) Measurement Setup:

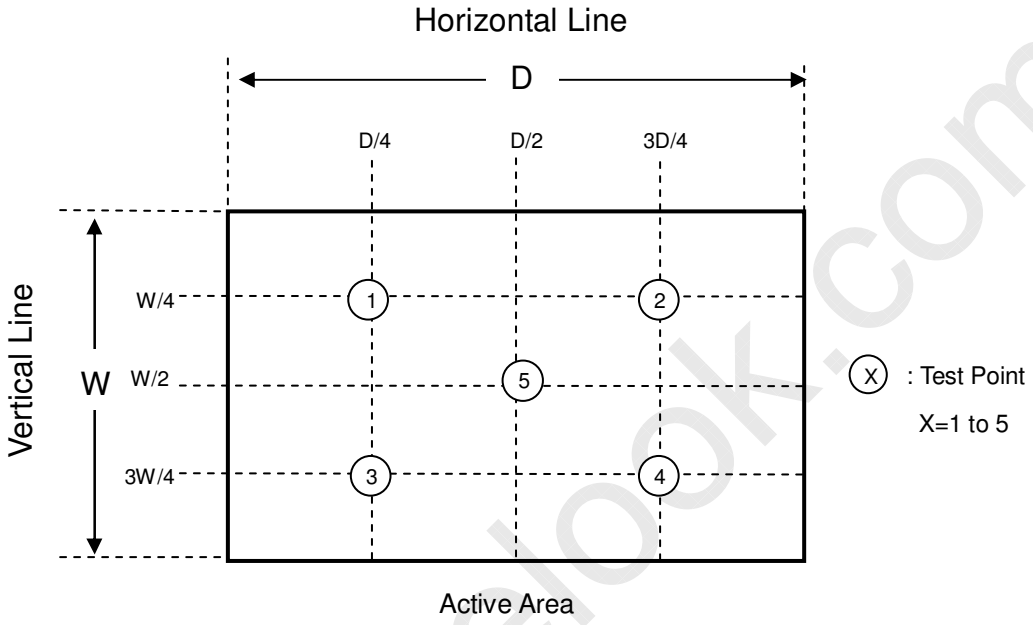
The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.



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

Measure the luminance of gray level 255 at 5 points

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

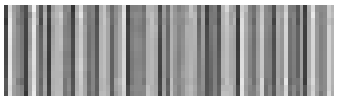


8. DEFINITION OF LABELS

8.1 OPEN CELL LABEL

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

V216B1-P04



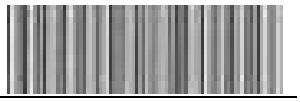
XXXXXXXXXXXX

8.2 CARTON LABEL

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

P.O. NO.: _____

Parts ID.: _____

Carton ID.  Quantities: 27

XXXXXXXXXXXXX

Made in XXXX

(a) Model Name: V216B1-P04

(b) Carton ID: CMO internal control

(c) Quantities: 27

(d) Production Location: XXXX, for example: TAIWAN or CHINA

9. Packaging

9.1 Packing Specifications

(1) 27 LCD TV Panels / 1 Box

(2) Box dimensions: 640(L) x 490(W) x 320(H) mm

(3) Weight: Approx. 24.2Kg

9.2 Packing Method

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

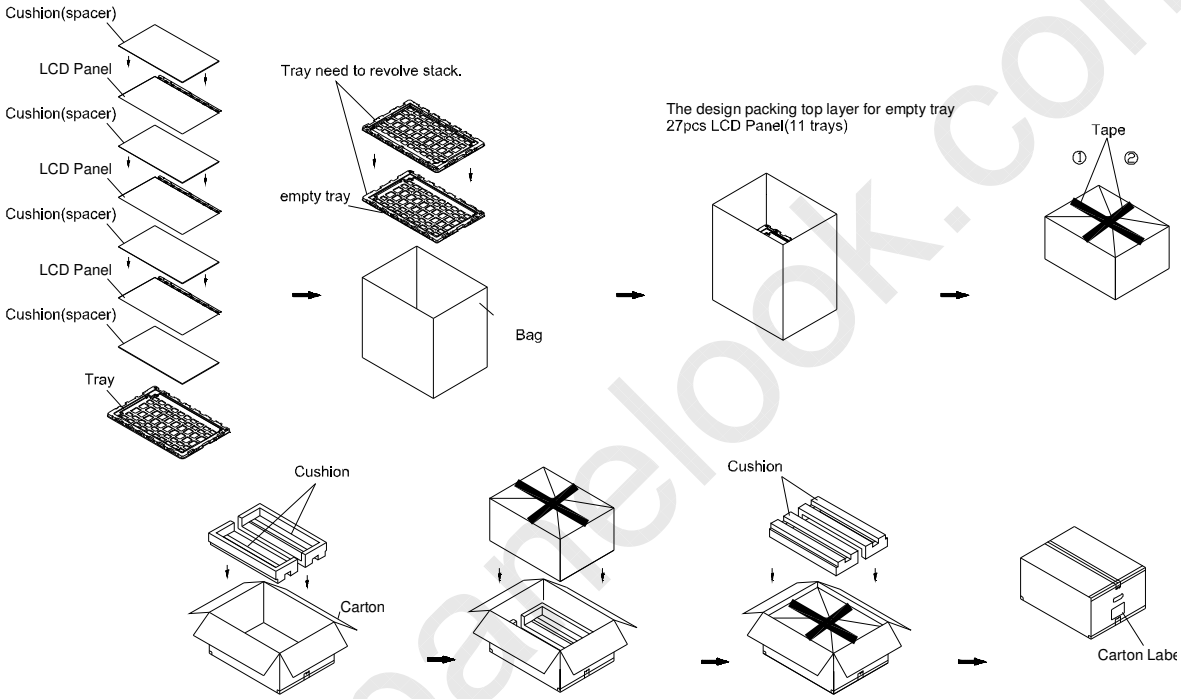
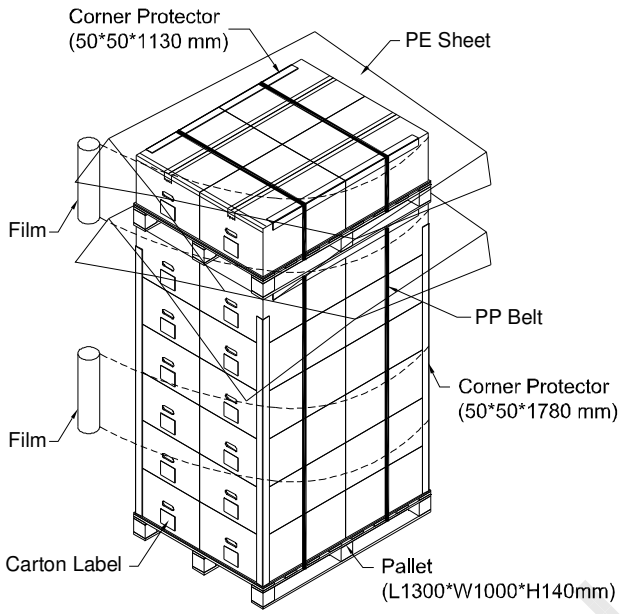
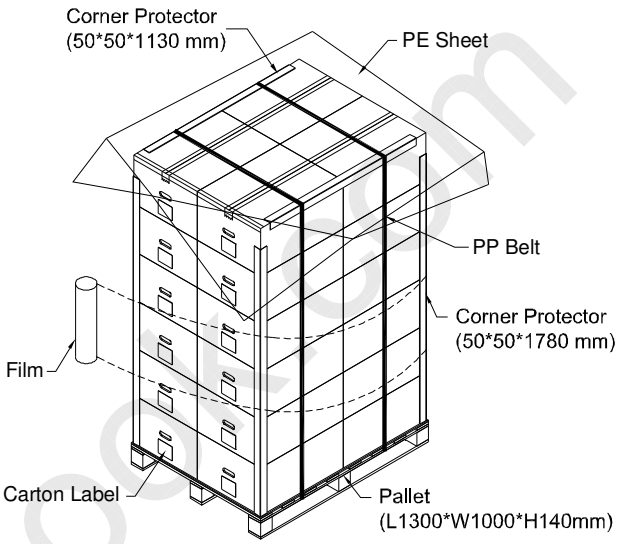


Figure.9-1 Packing Method

Sea / Land Transportation
(40ft HQ Container)



Sea / Land Transportation



Air Transportation

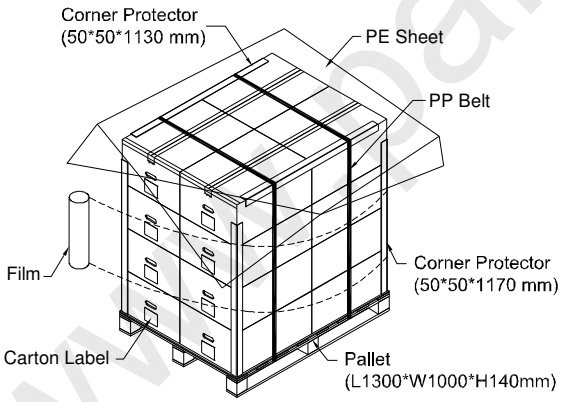


Figure.9-2 Packing Method

10. PRECAUTIONS

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the product during assembly.

(2) To assemble backlight 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 is not permitted to have pressure or impulse on the module because the LCD panel will be damaged.

(4) Always follow the correct power sequence when the product is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.

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

(6) Use a soft dry cloth without chemicals for cleaning because the surface of polarizer is very soft and easily scratched.

(7) It is dangerous that moisture comes into or contacts the product because moisture may damage the product when it is operating.

(8) High temperature or humidity may reduce the performance of module. Please store this product within the specified storage conditions.

(9) When ambient temperature is lower than 10ºC, it may reduce the display quality. For example, the response time will become slowly.

10.2 SAFETY PRECAUTIONS

(1) If the liquid crystal material leaks from the panel, it should be kept away from eyes or mouths. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

(2) After the product's end of life, it is not harmful in case of normal operation and storage.

11. Mechanical Drawing