

## TFT LCD Approval Specification

# MODEL NO.:V156B1 - L01

Customer: \_\_\_\_\_

Approved by: \_\_\_\_\_

Note:

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## REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 2.0	Dec. 05,'07	All	All	Approval Specification was first issued.
Ver 2.0	Dec. 05,'07	All	All	RoHS Compliance.
Ver 2.1	Jan. 21,'08	24	9.2	Figure.9-1 packing method for Anti-Static bag.

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

V156B1- L01 is a 15.6" TFT Liquid Crystal Display module with 4-CCFL Backlight unit and 1ch-LVDS interface. This module supports 1366 x 768 WXGA format and can display true 16.2M colors (6-bits+FRC). The inverter module for backlight is not built-in.

### 1.2 FEATURES

- High brightness (500nits)
- High contrast ratio (1200:1)
- Fast response time (Gray to gray average 7.5 ms)
- High color saturation NTSC 72%
- WXGA (1366 x 768 pixels) resolution
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Ultra wide viewing angle: 176(H)/176(V) (CR>20) Super MVA technology

### 1.3 APPLICATION

- TFT LCD TVs

### 1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	344.232 (H) x 193.536 (V) (15.6" diagonal)	mm	(1)
Bezel Opening Area	347.83 (H) x 197.14 (V)	mm	
Driver Element	a-si TFT active matrix	-	
Pixel Number	1366 x R.G.B. x 768	pixel	
Pixel Pitch (Sub Pixel)	0.084 (H) x 0.252 (V)	mm	
Pixel Arrangement	RGB vertical stripe	-	
Display Colors	16.2M	color	
Display Operation Mode	Transmissive mode / Normally black	-	
Surface Treatment	Anti-Glare coating , Hard coating: 3H	-	

### 1.5 MECHANICAL SPECIFICATIONS

Item	Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	363.2	363.8	364.4	mm
	Vertical(V)	215.32	215.92	216.52	mm
	Depth(D)	26.57	27.57	28.57	mm
	Depth(D)	35.1	36.1	37.1	mm
Weight		1440		g	

## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T <sub>ST</sub>	-20	+60	°C	(1)
Operating Ambient Temperature	T <sub>OP</sub>	0	+50	°C	(1), (2)
Shock (Non-Operating)	S <sub>NOP</sub>	-	50	G	(3), (5)
Vibration (Non-Operating)	V <sub>NOP</sub>	-	1.0	G	(4), (5)

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

(a) 90 %RH Max. (Ta ≤ 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

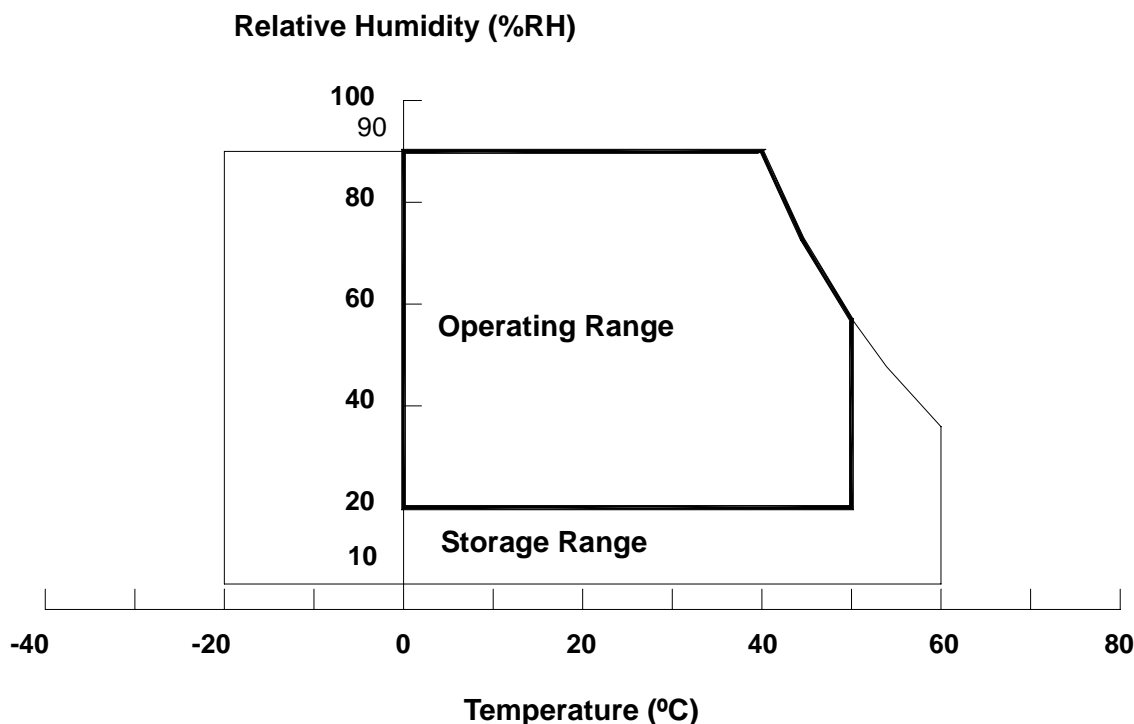
(c) No condensation.

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 ± X, ± Y, ± 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

When storing modules as spares for a long time, the following precaution is necessary.

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

## 2.3 ELECTRICAL ABSOLUTE RATINGS

### 2.3.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V <sub>CC</sub>	-0.3	6.0	V	(1)
Input Signal Voltage	V <sub>IN</sub>	-0.3	2.7	V	

### 2.3.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V <sub>W</sub>	-	3000	V <sub>RMS</sub>	
Power Supply Voltage	V <sub>BL</sub>	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, Internal PWM Control.

### 3. ELECTRICAL CHARACTERISTICS

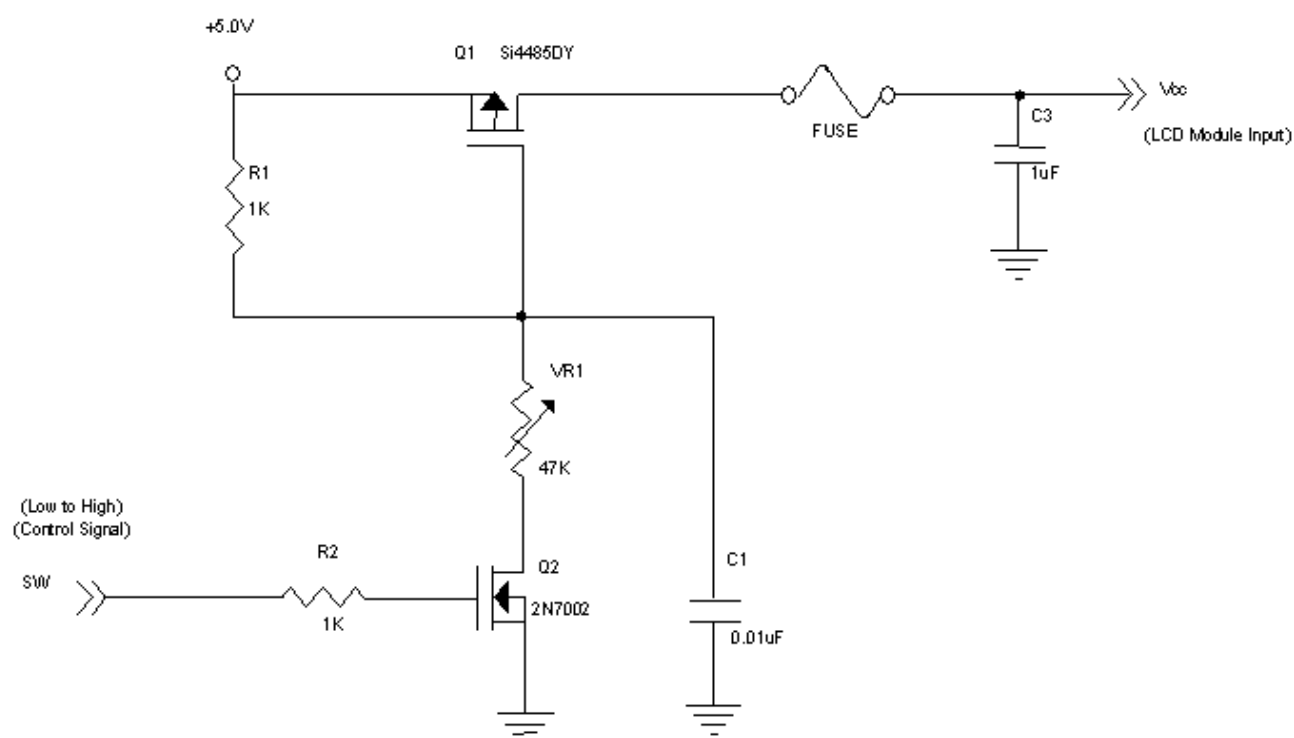
#### 3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

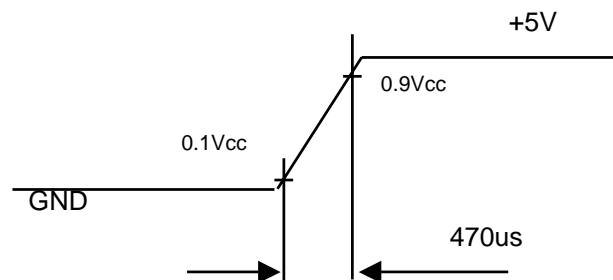
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V <sub>CC</sub>	4.5	5.0	5.5	V	(1)
Power Supply Ripple Voltage		V <sub>RP</sub>	-	-	150	mV	
Rush Current		I <sub>RUSH</sub>	-	-	2.5	A	(2)
Power Supply Current	White	I <sub>CC</sub>	-	1.00	1.25	A	(3)
	Black		-	0.67	0.74	A	
	Vertical Stripe		-	0.97	1.07	A	
LVDS Interface	Differential Input High Threshold Voltage	V <sub>LVTH</sub>	-	-	+100	mV	
	Differential Input Low Threshold Voltage	V <sub>LVTL</sub>	-100	-	-	mV	
	Common Input Voltage	V <sub>LVC</sub>	1.125	1.25	1.375	V	
	Terminating Resistor	R <sub>T</sub>	-	100	-	ohm	
CMOS interface	Input High Threshold Voltage	V <sub>IH</sub>	1.9	-	2.5	V	
	Input Low Threshold Voltage	V <sub>IL</sub>	0	-	0.7	V	

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

Note (2) Measurement Conditions:

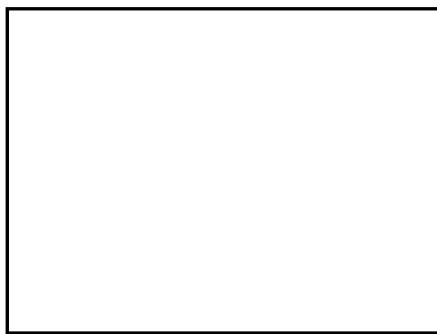


**Vcc rising time is 470us**



Note (3) The specified power supply current is under the conditions at  $V_{cc} = 5\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ ,  $f_v = 60\text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern



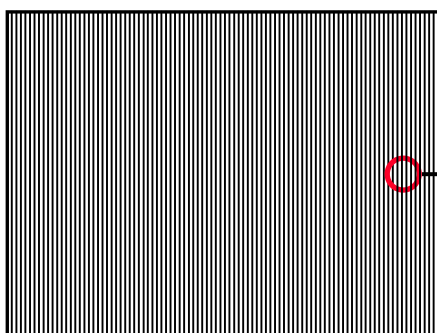
Active Area

b. Black Pattern

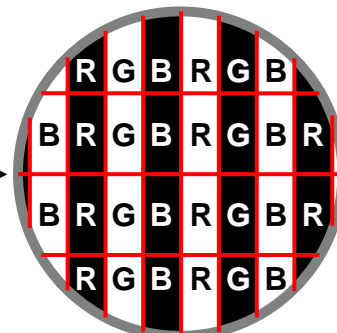


Active Area

c. Vertical Stripe Pattern



Active Area



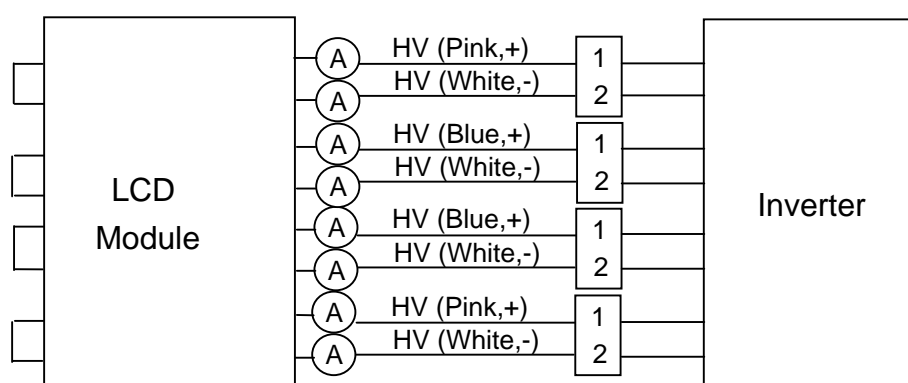


### 3.3 BACKLIGHT INVERTER UNIT

#### 3.2.1 CCFL (Cold Cathode Fluorescent Lamp) CHARACTERISTICS ( $T_a = 25 \pm 2^\circ\text{C}$ )

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Voltage	$V_W$	-	1230	-	$V_{RMS}$	$I_L = 6.5\text{mA}$
Lamp Current	$I_L$	6.0	6.5	7.0	$\text{mA}_{RMS}$	(1)
Lamp Starting Voltage	$V_S$	-	-	1750	$V_{RMS}$	(2), $T_a = 0^\circ\text{C}$
		-	-	1620	$V_{RMS}$	(2), $T_a = 25^\circ\text{C}$
Operating Frequency	$F_O$	40	-	70	KHz	(3)
Lamp Life Time	$L_{BL}$	50,000	60,000	-	Hrs	(4)

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



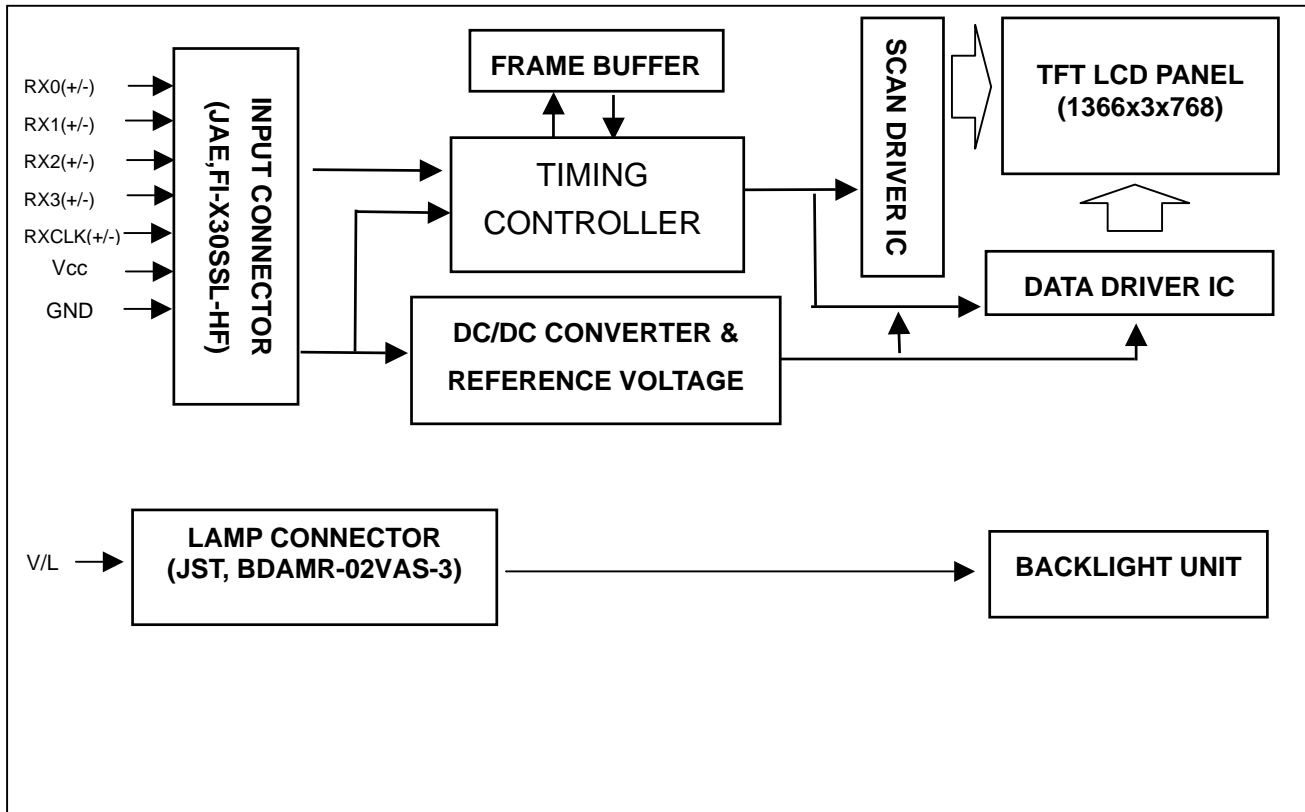
Note (2) The lamp starting voltage  $V_S$  should be applied to the lamp for more than 1 second under starting up duration. Otherwise the lamp could not be lighted on completed.

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) The life time of a lamp is defined as when the brightness is larger than 50% of its original value and the effective discharge length is longer than 80% of its original length (Effective discharge length is defined as an area that has equal to or more than 70% brightness compared to the brightness at the center point.) as the time in which it continues to operate under the condition  $T_a = 25 \pm 2$  and  $I_L = 6.0 \sim 7.0\text{mA}_{RMS}$ .

## 4. BLOCK DIAGRAM

### 4.1 TFT LCD MODULE



## 5. INTERFACE PIN CONNECTION

### 5.1 TFT LCD MODULE

#### CNF1 Connector Pin Assignment

Pin No.	Symbol	Description	Note
1	ODSEL	Overdrive Lookup Table Selection	(2)
2	NC	No Connection	(3)
3	NC	No Connection	
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	(3)
21	SELLEVDS	Select LVDS data format	(4)
22	NC	No Connection	(3)
23	GND	Ground	
24	GND	Ground	
25	GND	Ground	
26	VIN	Power supply: +5V	
27	VIN	Power supply: +5V	
28	VIN	Power supply: +5V	
29	VIN	Power supply: +5V	
30	VIN	Power supply: +5V	

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

Note (2) Low/OPEN: OD LUT optimized for 60Hz frame rate. High: OD LUT optimized for 50Hz frame rate

ODSEL	Note
L / open	Lookup table optimized for 60 Hz frame rate.
H	Lookup table optimized for 50 Hz frame rate.

Note (3) Reserved for CMO internal use, please leave it open

Note (4) Low/OPEN: NS/VESA data format. High: JEIDA data format

Note (5) Please refer to 5.4 LVDS INTERFACE for LVDS data mapping

Note (6) Logic level voltage definition: Low: 0V, High: 2.5V

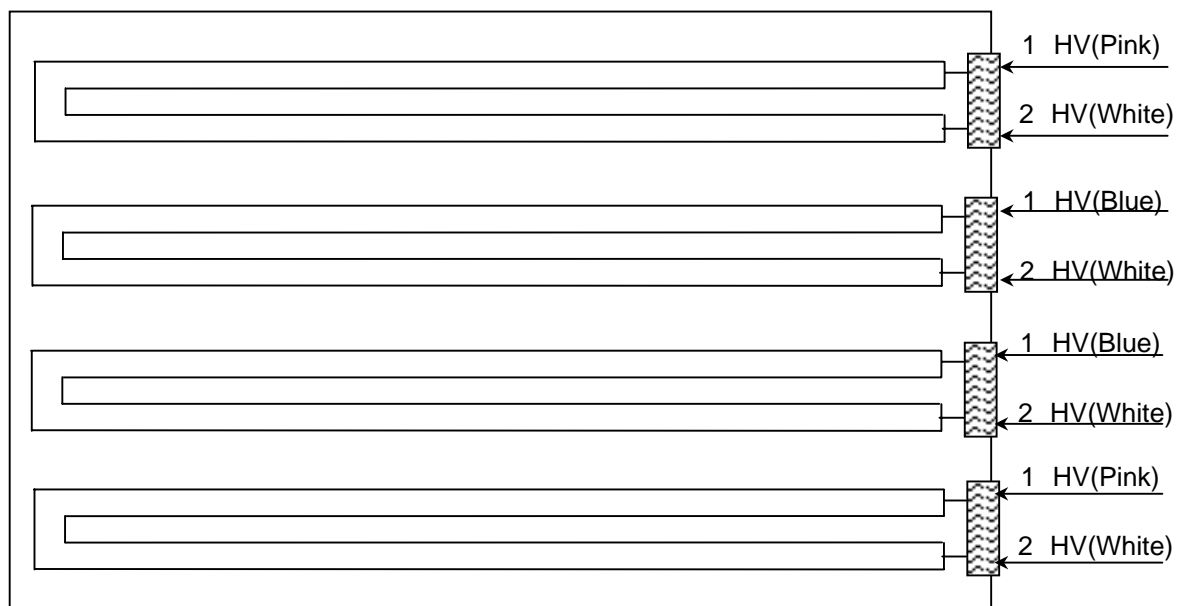
## 5.2 BACKLIGHT UNIT

The pin configuration for the housing and leader wire is shown in the table below.

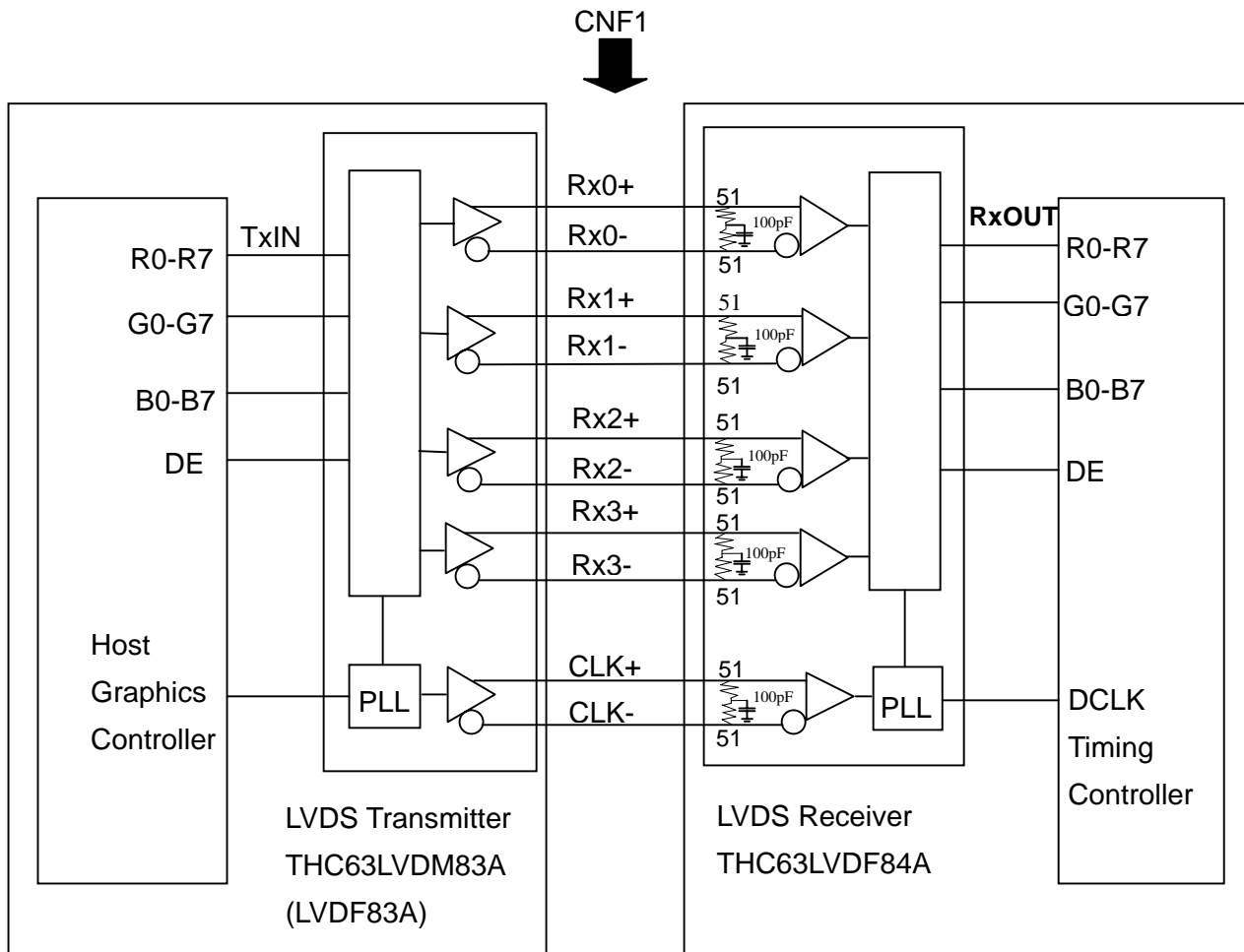
CN3-CN6 (Housing): BDAMR-02VAS-3 (JST)

Pin No.	Symbol	Description	Wire Color
1	HV	High Voltage	Pink
2	HV	High Voltage	White

Note (1) The backlight interface housing for high voltage side is a model BDAMR-02VAS-3, manufactured by JST.



### 5.3 BLOCK DIAGRAM OF INTERFACE



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) The system must have the transmitter to drive the module.

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

## 5.4 LVDS INTERFACE

	SIGNAL		TRANSMITTER THC63LVDM83A		INTERFACE CONNECTOR		RECEIVER THC63LVDF84A		TFT CONTROL INPUT	
	SELLVDS =L or OPEN	SELLVDS =H	PIN	INPUT	Host	TFT-LCD	PIN	OUTPUT	SELLVDS =L or OPEN	SELLVDS =H
24 bit	R0	R2	51	TxIN0	TA OUT0+	Rx 0+	27	Rx OUT0	R0	R2
	R1	R3	52	TxIN1			29	Rx OUT1	R1	R3
	R2	R4	54	TxIN2			30	Rx OUT2	R2	R4
	R3	R5	55	TxIN3			32	Rx OUT3	R3	R5
	R4	R6	56	TxIN4	TA OUT0-	Rx 0-	33	Rx OUT4	R4	R6
	R5	R7	3	TxIN6			35	Rx OUT6	R5	R7
	G0	G2	4	TxIN7			37	Rx OUT7	G0	G2
	G1	G3	6	TxIN8			38	Rx OUT8	G1	G3
	G2	G4	7	TxIN9	TA OUT1+	Rx 1+	39	Rx OUT9	G2	G4
	G3	G5	11	TxIN12			43	Rx OUT12	G3	G5
	G4	G6	12	TxIN13			45	Rx OUT13	G4	G6
	G5	G7	14	TxIN14			46	Rx OUT14	G5	G7
	B0	B2	15	TxIN15	TA OUT1-	Rx 1-	47	Rx OUT15	B0	B2
	B1	B3	19	TxIN18			51	Rx OUT18	B1	B3
	B2	B4	20	TxIN19			53	Rx OUT19	B2	B4
	B3	B5	22	TxIN20			54	Rx OUT20	B3	B5
	B4	B6	23	TxIN21	TA OUT2+	Rx 2+	55	Rx OUT21	B4	B6
	B5	B7	24	TxIN22			1	Rx OUT22	B5	B7
	DE	DE	30	TxIN26			6	Rx OUT26	DE	DE
	R6	R0	50	TxIN27	TA OUT2-	Rx 2-	7	Rx OUT27	R6	R0
	R7	R1	2	TxIN5			34	Rx OUT5	R7	R1
	G6	G0	8	TxIN10			41	Rx OUT10	G6	G0
	G7	G1	10	TxIN11			42	Rx OUT11	G7	G1
	B6	B0	16	TxIN16	TA OUT3+	Rx 3+	49	Rx OUT16	B6	B0
	B7	B1	18	TxIN17			50	Rx OUT17	B7	B1
	RSVD 1	RSVD 1	25	TxIN23			2	Rx OUT23	NC	NC
	RSVD 2	RSVD 2	27	TxIN24	TA OUT3-	Rx 3-	3	Rx OUT24	NC	NC
	RSVD 3	RSVD 3	28	TxIN25			5	Rx OUT25	NC	NC
DCLK			31	TxCLK IN	TxCLK OUT+	RxCLK IN+	26	RxCLK OUT	DCLK	
					TxCLK OUT-	RxCLK IN-				

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

Notes(1) RSVD(reserved)pins on the transmitter shall be "H" or( "L" or OPEN)

## 5.5 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	0	0	0	0	0	0	0	0			
	Blue	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			
	Magenta	1	1	1	1	1	1	1	1	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	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			
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			
	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			
	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			
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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			
	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			
	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			
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			
	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			
	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			
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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			
	Green(254)	0	0	0	0	0	0	0	0	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	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			
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1			
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0			
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	Blue(253)	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	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	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

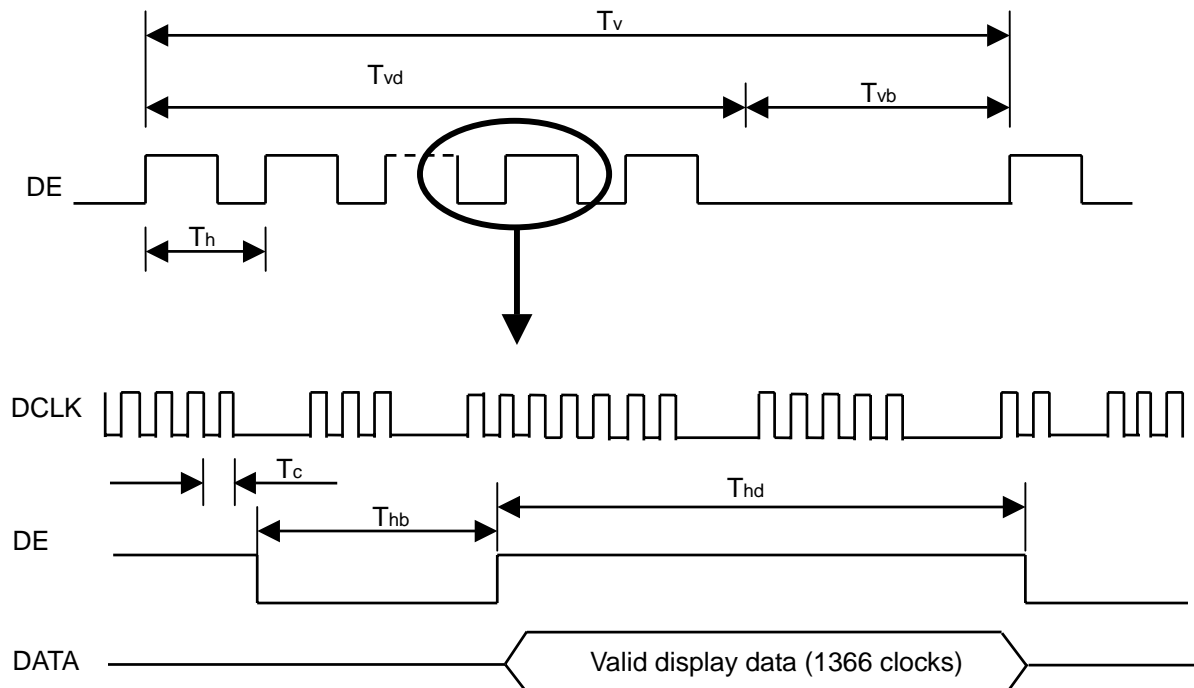
The input signal timing specifications are shown as the following table and timing diagram.

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	Fr5	47	50	53	Hz	
		Fr6	57	60	63	Hz	
	Total	Tv	778	806	888	Th	$T_v = T_{vd} + T_{vb}$
	Display	Tvd	768	768	768	Th	-
	Blank	Tvb	10	38	120	Th	-
Horizontal Active Display Term	Total	Th	1442	1560	1936	Tc	$T_h = T_{hd} + T_{hb}$
	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.

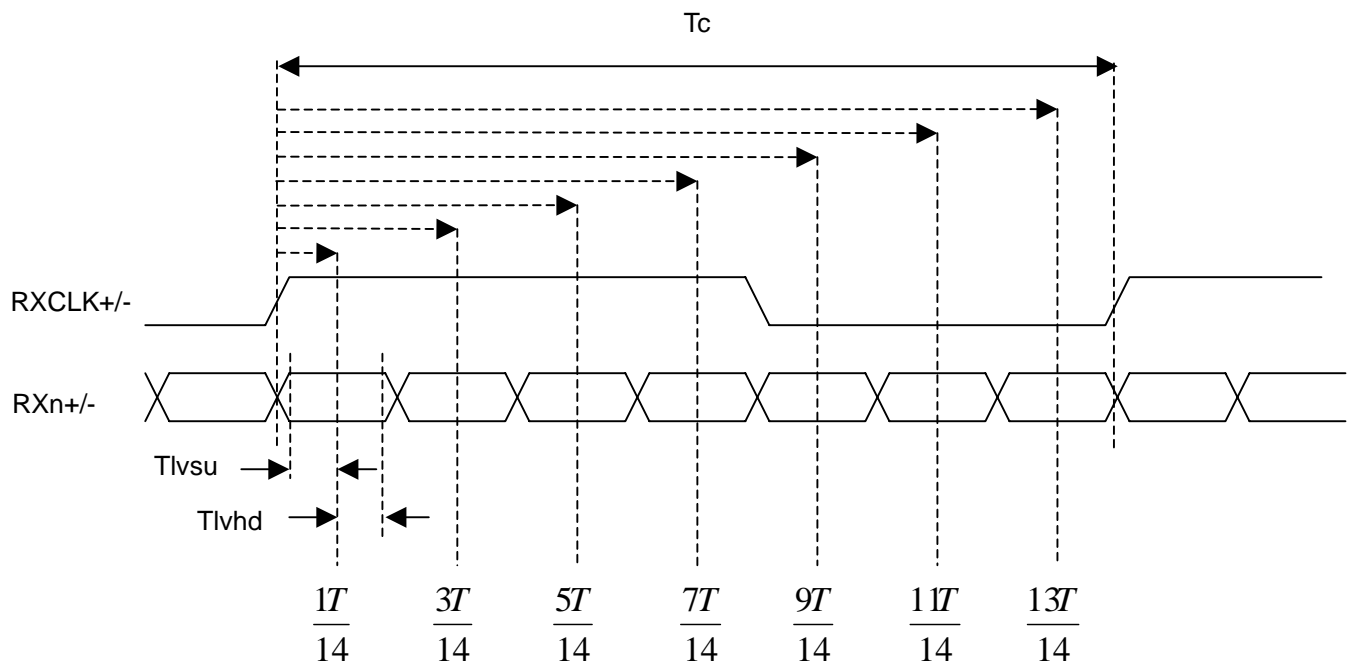
(2) Please refer to 5.1 for detail information.

#### INPUT SIGNAL TIMING DIAGRAM



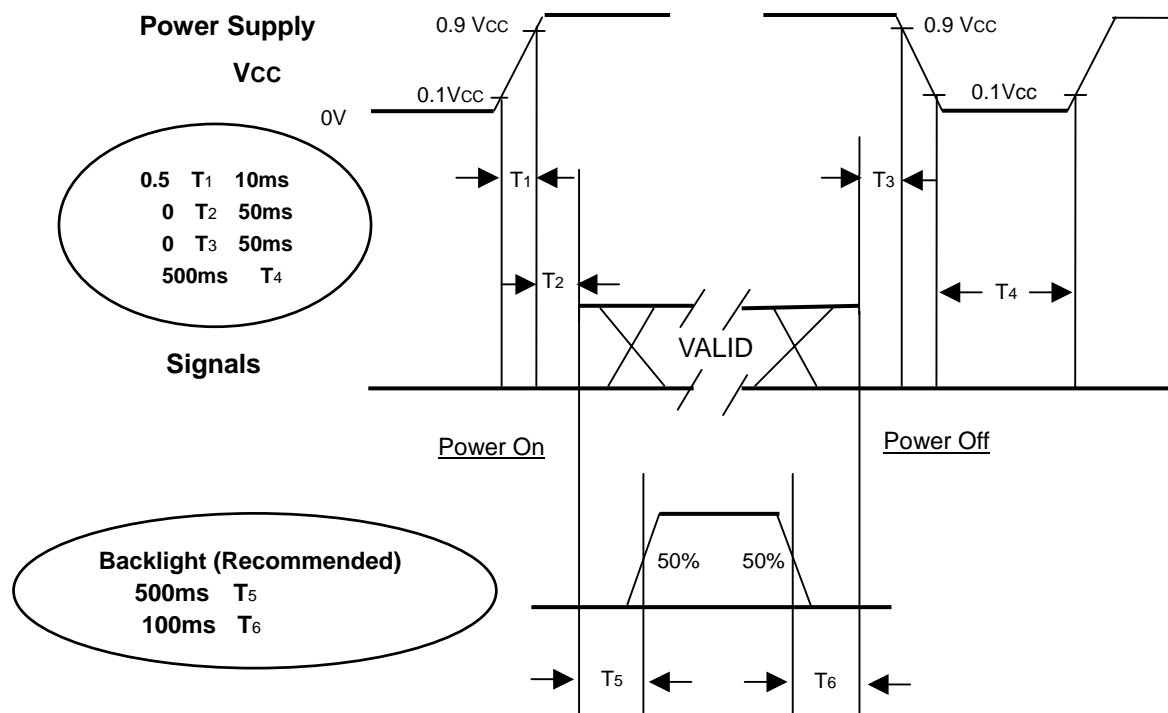


**LVDS RECEIVER INTERFACE TIMING DIAGRAM**



## 6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, 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 <sub>CC</sub>	5.0	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current	I <sub>L</sub>	6.5	mA
Frame Rate	Fr	60	Hz

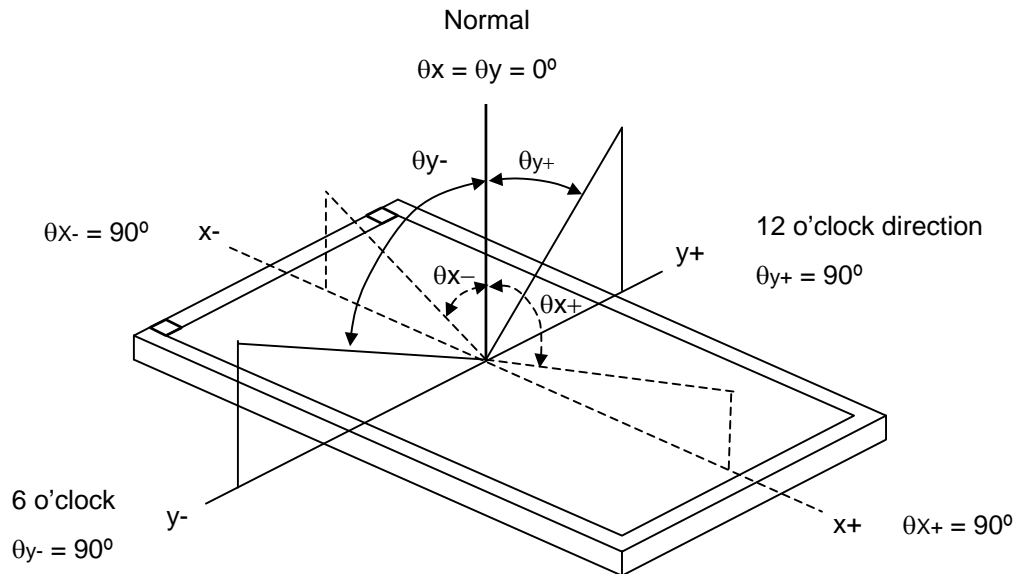
### 7.2 OPTICAL SPECIFICATIONS

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 (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing Angle at Normal Direction	1000	1200	-	-	(2)
Response Time		Gray to Gray			7.5	12	ms	(3)
Center Luminance of White		L <sub>C</sub>		420	500	-	cd/m <sup>2</sup>	(4)
Average Luminance of White		L <sub>AVE</sub>		420	480	-	cd/m <sup>2</sup>	(4)
White Variation		δW			-	1.3	-	(7)
Cross Talk		CT			-	4.0	%	(5)
Color Chromaticity	Red	Rx		Typ -0.03	0.636	Typ +0.03	-	(6)
		Ry			0.332		-	
	Green	Gx			0.267		-	
		Gy			0.595		-	
	Blue	Bx			0.150		-	
		By			0.062		-	
	White	Wx			0.280		-	
		Wy			0.290		-	
	Color Gamut		CG	68	72		%	NTSC Ratio
Viewing Angle	Horizontal	θ <sub>x+</sub>	CR≥20	80	88	-	Deg.	(1)
		θ <sub>x-</sub>		80	88	-		
	Vertical	θ <sub>y+</sub>		80	88	-		
		θ <sub>y-</sub>		80	88	-		

Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):

Viewing angles are measured by Eldim EZ-Contrast 160R



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

The contrast ratio can be calculated by the following expression.

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

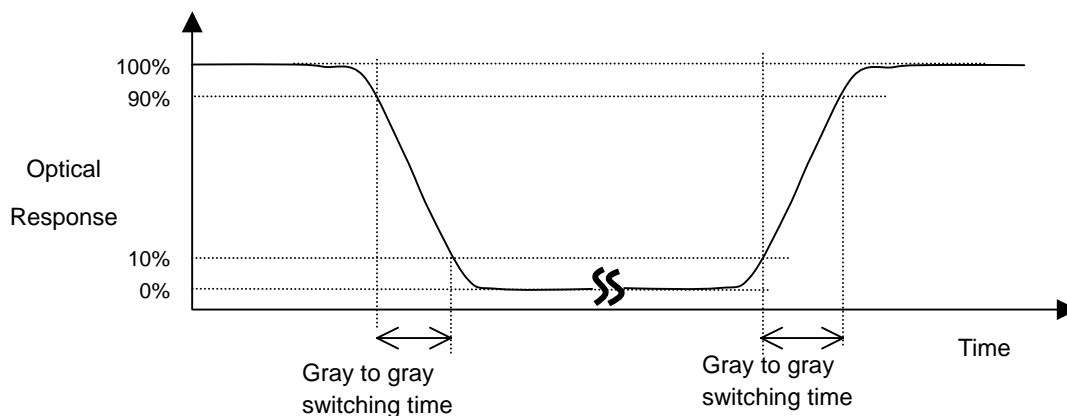
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

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

Note (3) Definition of Gray to Gray Switching Time :



The driving signal means the signal of gray level 0, 63, 127, 191, 255.

Gray to gray average time means the average switching time of gray level 0 ,63,127,191,255 to each other ..

Note (4) Definition of Luminance of White ( $L_C$ ,  $L_{AVE}$ ):

Measure the luminance of gray level 255 at center point and 5 points

$$L_C = L(5)$$

$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$$

$L(x)$  is corresponding to the luminance of the point X at the figure in Note (7).

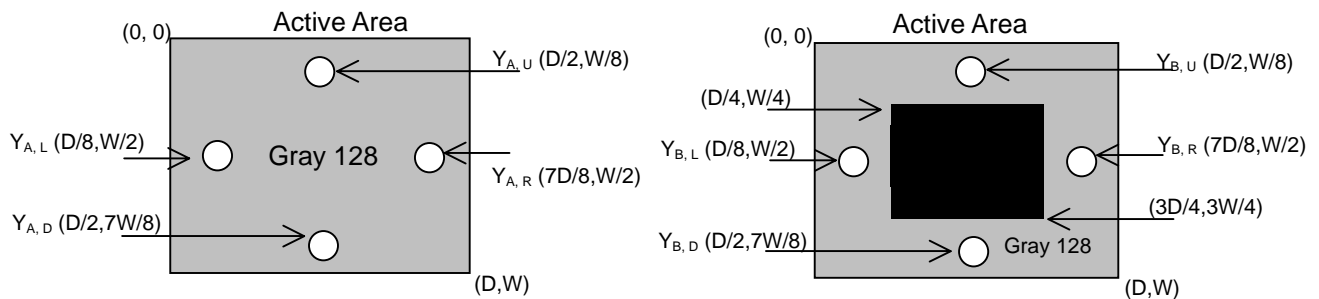
Note (5) Definition of Cross Talk (CT):

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

Where:

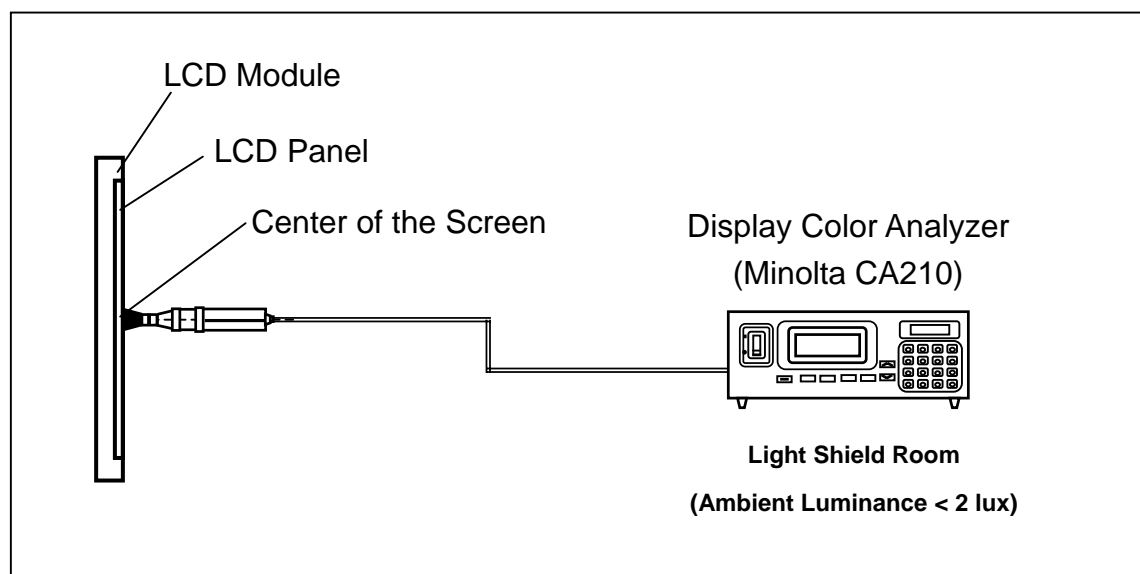
$Y_A$  = Luminance of measured location without gray level 0 pattern ( $\text{cd/m}^2$ )

$Y_B$  = Luminance of measured location with gray level 0 pattern ( $\text{cd/m}^2$ )



Note (6) Measurement Setup:

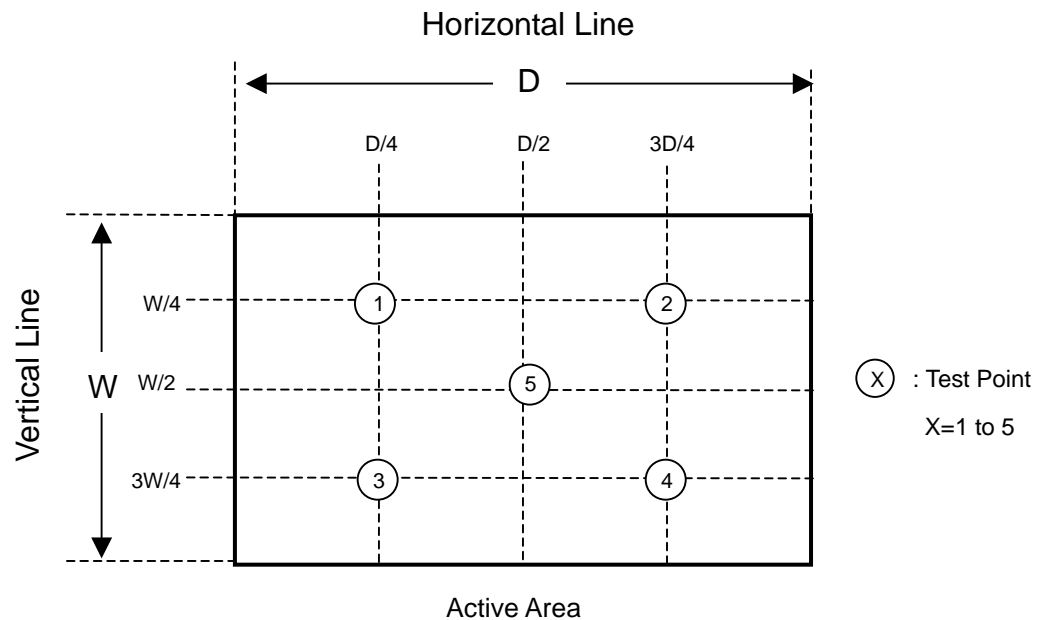
The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.



Note (7) Definition of White Variation ( $\delta W$ ):

Measure the luminance of gray level 255 at 5 points

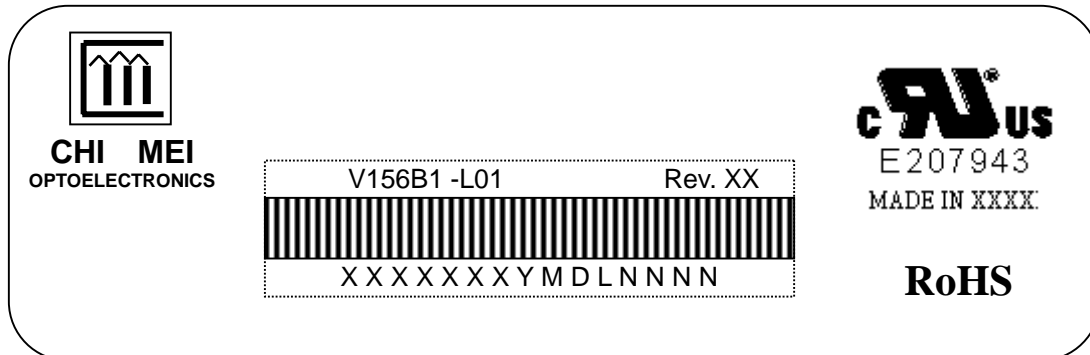
$$\delta W = \text{Maximum} [L(1), L(2), L(3), L(4), L(5)] / \text{Minimum} [L(1), L(2), L(3), L(4), L(5)]$$



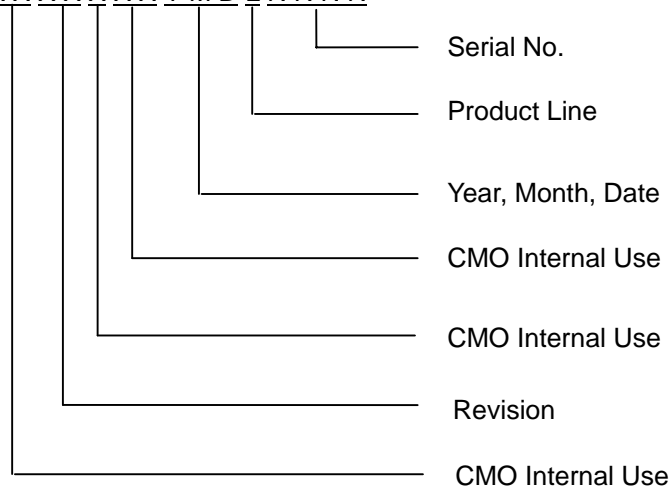
## 8. DEFINITION OF LABELS

### 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: V156B1-L01  
(b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.  
(c) Serial ID: X X X X X X Y M D L N N N N



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

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 1<sup>st</sup> to 31<sup>st</sup>, 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) 10 LCD TV modules / 1 Box
- (2) Box dimensions : 676(L)x468(W)x318(H)mm
- (3) Weight : approximately 17Kg

### 9.2 PACKING METHOD

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

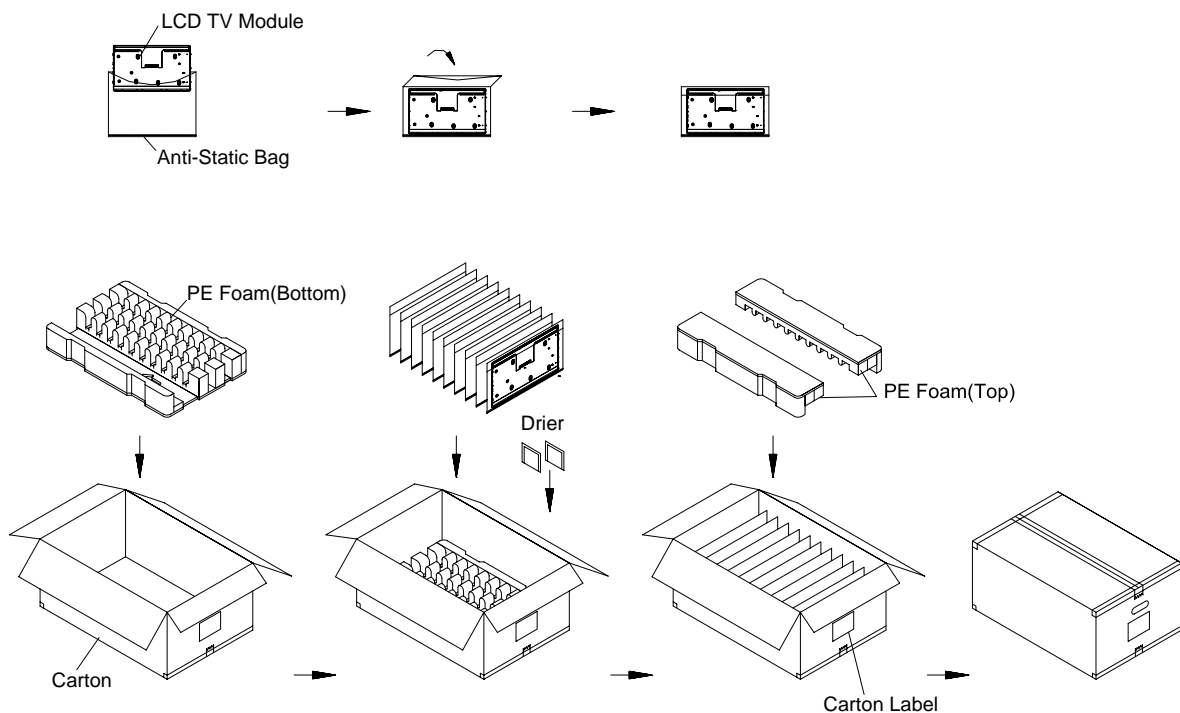
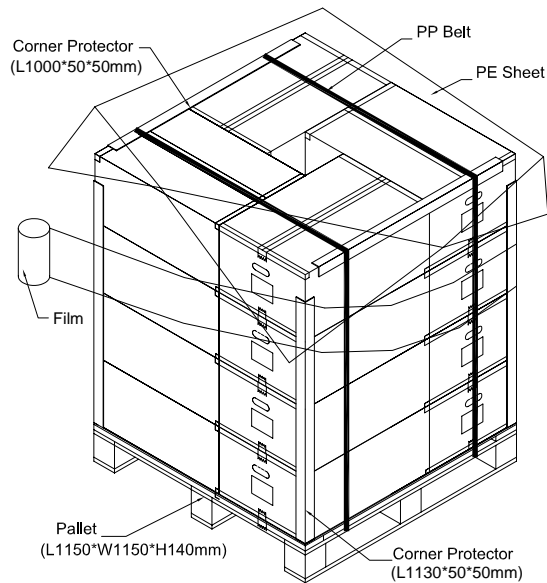


Figure.9-1 packing method



### Air Transportation



### Sea / Land Transportation

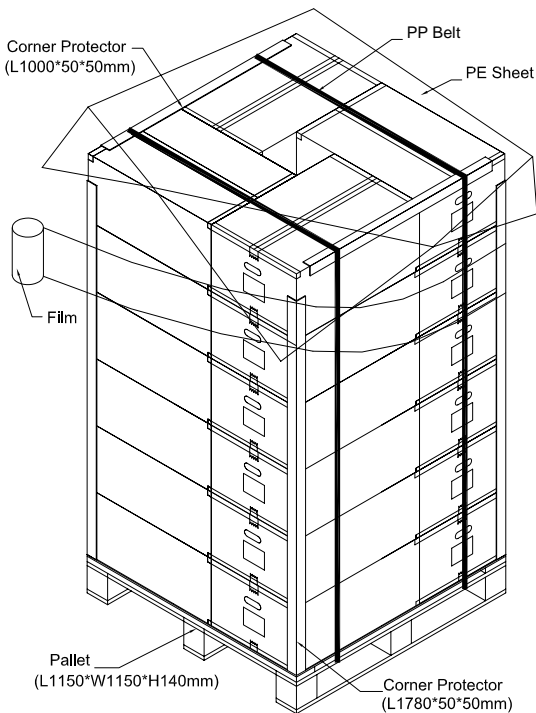


Figure.9-2 packing method

## 10. PRECAUTIONS

### 10.1 ASSEMBLY AND HANDLING PRECAUTIONS

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

### 10.2 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.

### 10.3 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:

Regulatory	Item	Standard
Information Technology equipment	UL	UL 60950-1 ; 2006
	cUL	CAN/CSA C22.2 No.60950-1-03 ; 2006
	CB	IEC 60950-1:2001
Audio/Video Apparatus	UL	UL 60065 ; 2006
	cUL	CAN/CSA C22.2 No.60065-03 ; 2006
	CB	IEC 60065:2001



