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Datasheet

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G154I1-LE1-V549D

15.4" High Brightness TFT Display

CH-03-039R1.1

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Revision History

Version and Date	Page	description
1.0 2013/03/07	All	Preliminary Edition

1. General Description

1.1 Overview

The G154I1-LE1-V549D model is a 15.4" TFT-LCD module with a white LED Backlight Unit and a 30-pin 1ch-LVDS interface. This module supports 1280 x 800 WXGA mode and displays 262k/16.2M colors.

1.2 Features

- WXGA (1280 x 800 pixels) resolution
- Wide operating temperature
- DE (Data Enable) mode
- LVDS (Low Voltage Differential Signaling) interface
- RoHS Compliance
- LED Light Bar Replaceable
- Reverse Scan

1.3 Applikation

- TFT LCD Monitor
- Industrial Application
- Amusement

1.4 General Specification

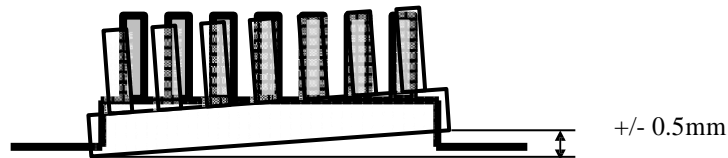
Item	Specification	Unit	Note
Diagonal Size	15.4	inch	(1)
Active Area	331.2(H) x 207.0(V)	mm	
Bezel Opening Area	334.5 x 210.3	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1280 x R.G.B. x 800	pixel	-
Pixel Pitch	0.259(H) x 0.259(V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262k/16.2M	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	AG, 3H	-	-

1.5 Mechanical Specifications

Item	Min.	Typ.	Max.	Unit	Note	
Module Size	Horizontal (H)	351.5	352	352.5	mm	(1)
	Vertical (V)	229.5	230	230.5	mm	
	Depth (D)	8.5	9	9.5	mm	
Weight		880		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.

(2) Connector mounting position



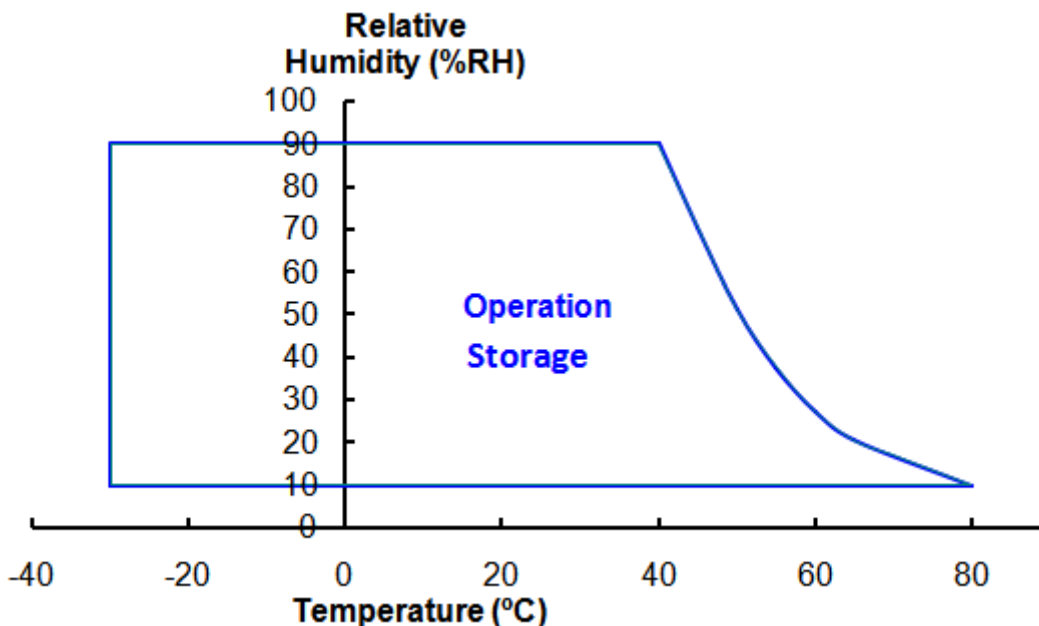
2. Absolute Maximum Ratings

2.1 Absolute Ratings of Environment

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Operating Ambient Temperature	T_{OP}	-30	+80	$^{\circ}\text{C}$	
Storage Temperature	T_{ST}	-30	+80	$^{\circ}\text{C}$	

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

- (a) 90 %RH Max. ($T_a \leq 40^{\circ}\text{C}$).
- (b) Wet-bulb temperature should be 39 $^{\circ}\text{C}$ Max. ($T_a > 40^{\circ}\text{C}$).
- (c) No condensation.



2.2 Electrical Absolute Ratings TFT LCD Module

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V _{CC}	-0.3	4.0	V	(1)
Logic Input Voltage	V _{IN}	-0.3	V _{CC} +0.3	V	(1)

3. Electrical Characteristics

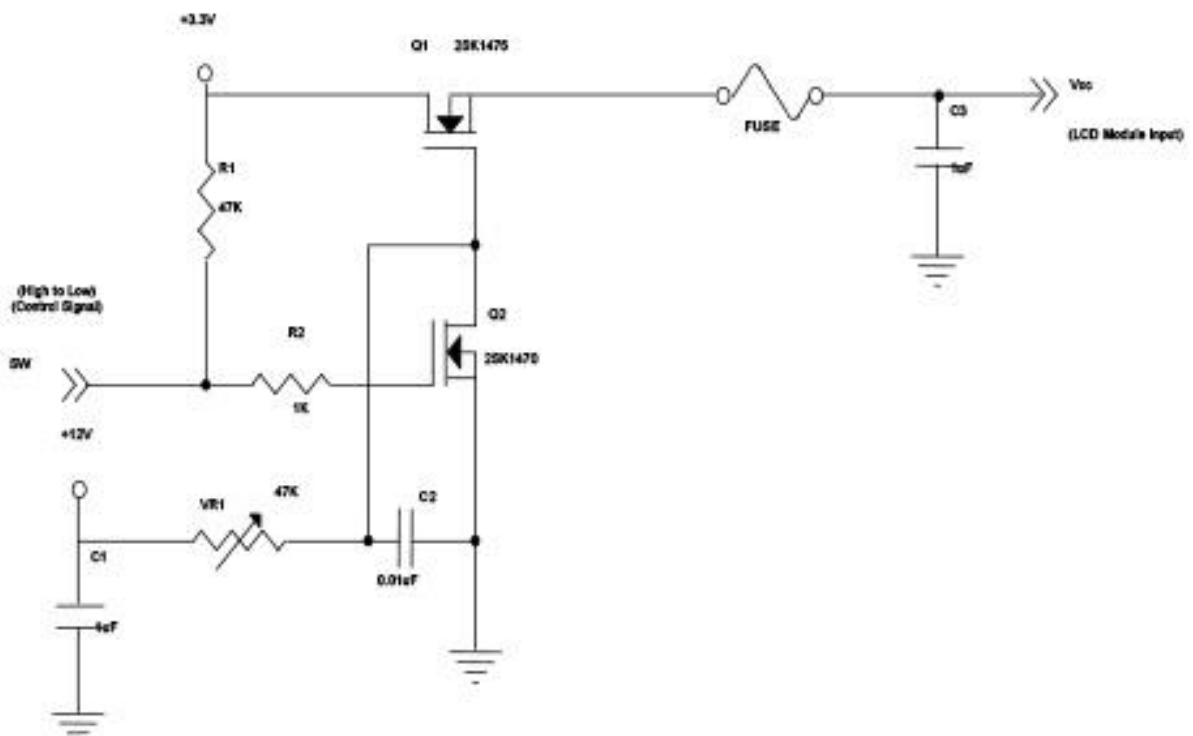
3.1 TFT LCD MODULE

T_a = 25 ± 2 °C

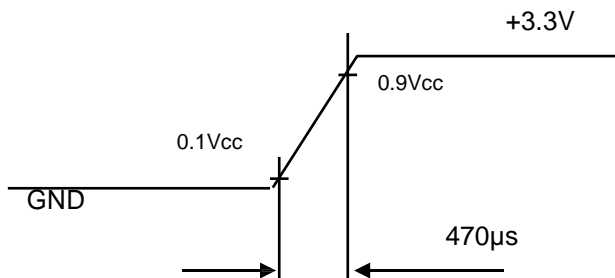
Parameter	Symbol	Value			Unit	Note	
		Min.	Typ.	Max.			
Power Supply Voltage	V _{CC}	3.0	3.3	3.6	V	at V _{CC} =3.3V	
Ripple Voltage	V _{RP}	-	50		mV	-	
Rush Current	I _{RUSH}	-	-	1.5	A	(2)	
Initial Stage Current	I _{IS}	-	-	1.0	A	(2)	
Power Supply Current	White	I _{CC}	-	400	500	mA	(3)a, at V _{CC} =3.3V
	Black		-	550	650	mA	(3)b, at V _{CC} =3.3V
LVDS Differential Input High Threshold	V _{TH} (LVDS)	-	-	+100	mV	V _{CM} =1.2V	
LVDS Differential Input Low Threshold	V _{TL} (LVDS)	-100	-	-	mV	V _{CM} =1.2V	
LVDS Common Mode Voltage	V _{CM}	1.125	-	1.375	V		
LVDS Differential Input Voltage	|V _{ID}|	100	-	600	mV		
Terminating Resistor	R _T	-	100	-	Ohm		

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

Note (2) Measurement Conditions:

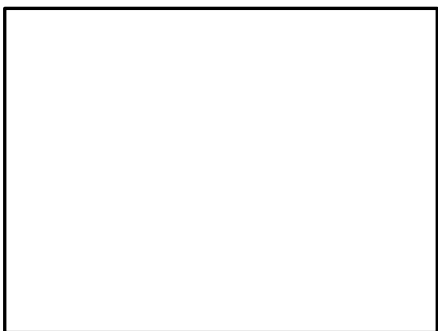


VCC rising time is 470us



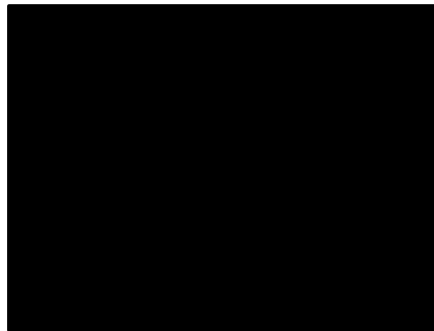
Note (3) The specified power supply current is under the conditions at V_{cc} = 3.3 V, T_a = 25 ± 2 °C, f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



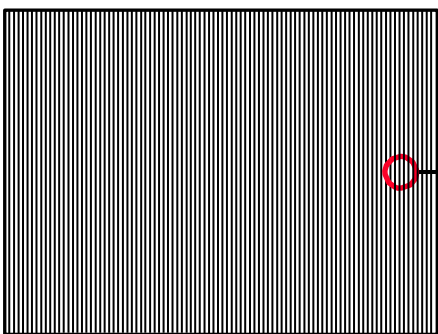
Active Area

b. Black Pattern

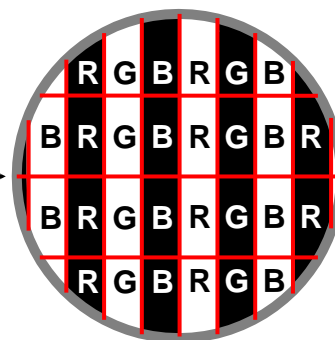


Active Area

c. Vertical Stripe Pattern



Active Area



3.2. Backlight Unit

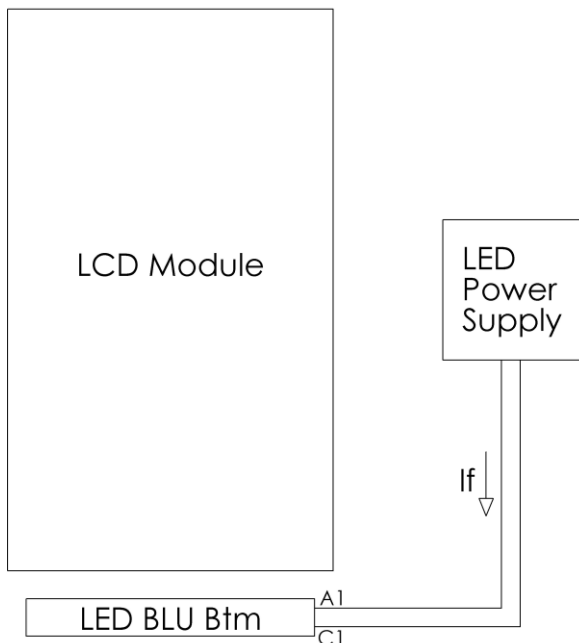
Apollo LED Backlight Unit (BLU)		140000-0					$T_a = 25 \pm 2^\circ\text{C}$	
Parameter	Symbol	Min.	Typ.	Max.	Unit	Note		
BLU Input Voltage	V_f	7.4	8.45	8.5	V_{DC}	4,6		
BLU Forward Current	I_f	-	1400	1430	mA_{DC}	2,3,5		
BLU Power Consumption	P_{LED}	-	11.8	12.2	W	1,2		
BLU Lifetime	L_L	-	100,000	-	Hrs	1		

Notes:

- (1) The lifetime of the LED BLU is defined as the number of hours it continues to operate at $T_a = 25 \pm 2^\circ\text{C}$ and $I_f = 1400\text{mA}_{DC}$ until the luminance is 50% of its original value. Operating the BLU at $T_a > 25 \pm 2^\circ\text{C}$ or applying power $> 12.3\text{W}$ will reduce the lifetime and cause color shifting.
- (2) Specified values are for a single LED BLU connector, this module contains one BLU connector.
- (3) Specified current equals input to a single LED BLU connector at 100% duty cycle.
- (4) Specified voltage is input to LED BLU at typical and maximum current values & 100% duty cycle.
- (5) It is recommended to dim LED BLU using PWM and to synchronize PWM with frame frequency.
- (6) $V_f = \Delta_{BLU1}^{BLU1} (V_A - V_C)$

Connector Name	LED BLU Connector
Connector Quantity	1
Connector Manufacturer | P/N	Molex | 22-01-3027
Connector Mate	Molex | 22-05-3021
BLU Wire Length	10"

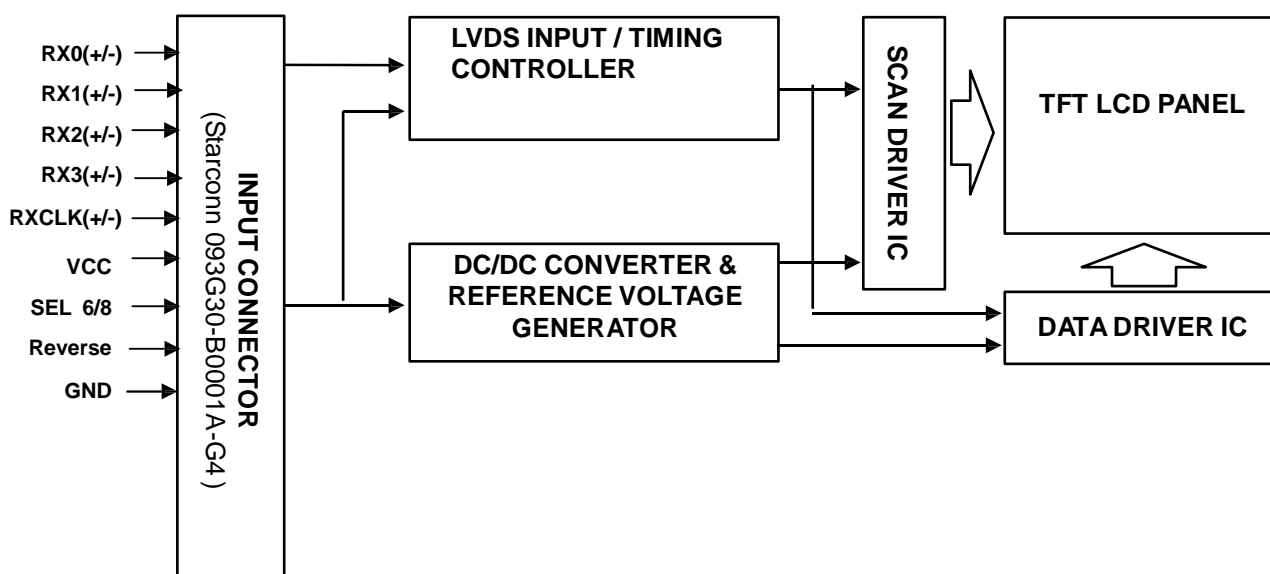
LED BLU CONN PIN ASSIGNMENT			
Pin	Name	Description	Color
1	LED+	Anode	Red
2	LED-	Cathode	Black



Recommended backlight power supply

PART NUMBER	MANUFACTURER
SmartLED: IN-50-012 – 700mA x 2 Channel, Analog Dimming IN-51-012 – 700mA x 2 Channel, PWM Dimming Cable CBL-390A	Apollo Display Technologies Corp.

4. Block Diagram TFT LCD Module



5. Input Terminal Pin Assignment

5.1 TFT LCD Module

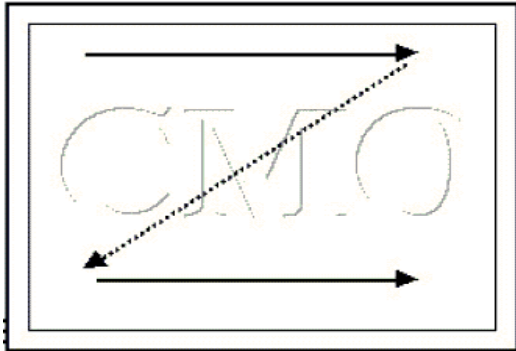
Pin	Name	Description	Remark
1	NC	Do not connect	
2	NC	Do not connect	
3	NC	Do not connect	
4	NC	Do not connect	
5	NC	Do not connect	
6	NC	Do not connect	
7	GND	Ground	
8	GND	Ground	
9	VCC	Power supply +3.3V	System power
10	VCC	Power supply +3.3V	
11	GND	Ground	
12	GND	Ground	
13	RX0-	Differential Data Input, CH0 (Negative)	
14	RX0+	Differential Data Input, CH0 (Positive)	
15	GND	Ground	
16	RX1-	Differential Data Input, CH1 (Negative)	
17	RX1+	Differential Data Input , CH1 (Positive)	
18	GND	Ground	
19	RX2-	Differential Data Input , CH2 (Negative)	
20	RX2+	Differential Data Input , CH2 (Positive)	
21	GND	Ground	
22	RXCLK-	Differential Clock Input (Negative)	
23	RXCLK+	Differential Clock Input (Positive)	
24	GND	Ground	
25	RX3-	Differential Data Input, CH3 (Negative)	
26	RX3+	Differential Data Input, CH3 (Positive)	
27	GND	Ground	
28	SEL6/8	LVDS 6/8 bit select function control, Low or NC -7 6 bit Input Mode High -7 8bit Input Mode	(2)
29	Reverse	Scanning direction control	(2)
		Low or NC -7 normal display (default)	
		High -7 display with 180 degree rotation	
30	GND	Ground	

Note (1) Connector Part No.: STARCONN 093G30-B1001A-G4 or equivalent.

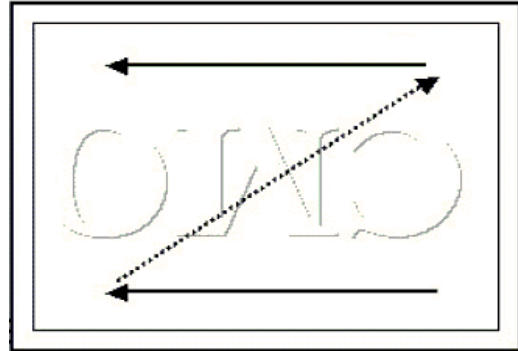
Note (2) "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connected".

5.2 Scanning Direction

The following figures are seen from front view and the arrow shows the direction of scan.



Reverse = GND/NC : normal display (default) rotation



Reverse = High : display with 180 degree rotation

5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6/8-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.

5.3.1 For 6-Bits

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
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
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	.	.	.	.	.	.	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(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	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
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	.	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(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	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
	Blue(1)	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	1	0
	.	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(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

5.3.2 For 8-Bits

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
	.	.	.	.	.	.	.	.	0	0	0	0	0	0	0	0	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(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	1	0	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
	.	0	0	0	0	0	0	0	0	.	.	.	.	.	.	.	0	0	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(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
	.	0	0	0	0	0	0	0	0	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(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

6. Interface Timing

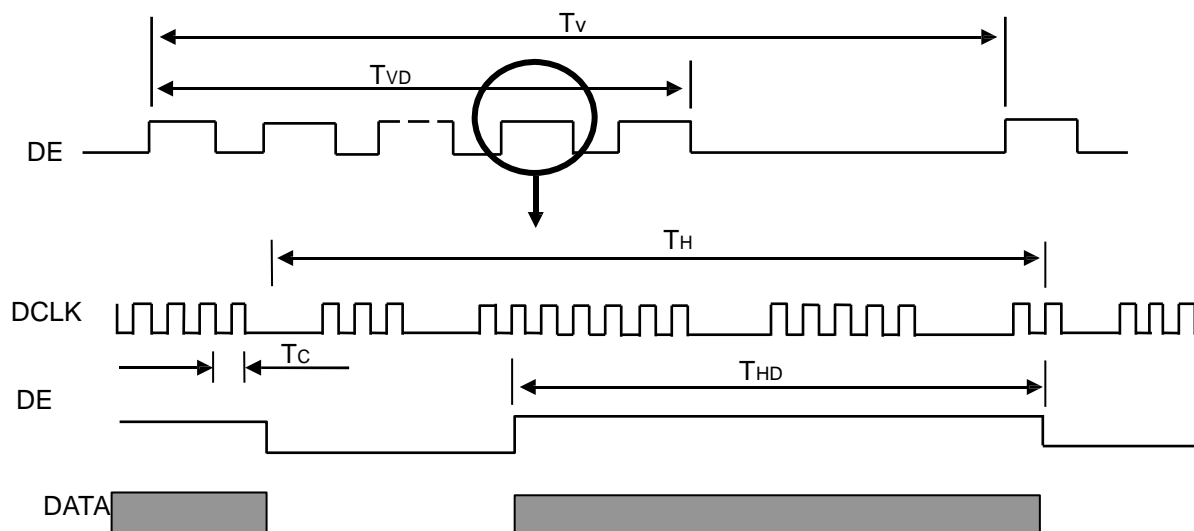
6.1 Input Signal Timing Specifications

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

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	67.45	71	74.55	MHz	-
DE	Vertical Total Time	TV	810	823	1000	TH	-
	Vertical Addressing Time	TVD	800	800	800	TH	-
	Horizontal Total Time	TH	1360	1440	1600	Tc	-
	Horizontal Addressing Time	THD	1280	1280	1280	Tc	-

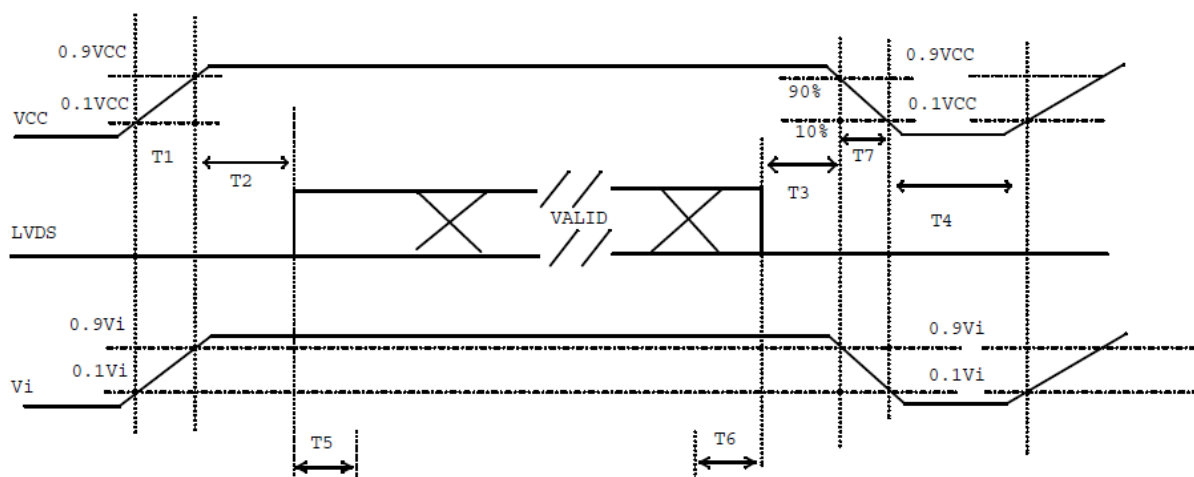
Note: (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM



6.2 Power ON/OFF Sequence

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



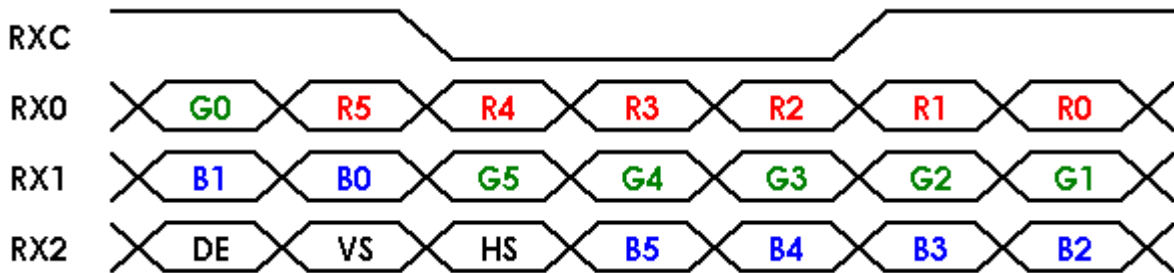
Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0 V.

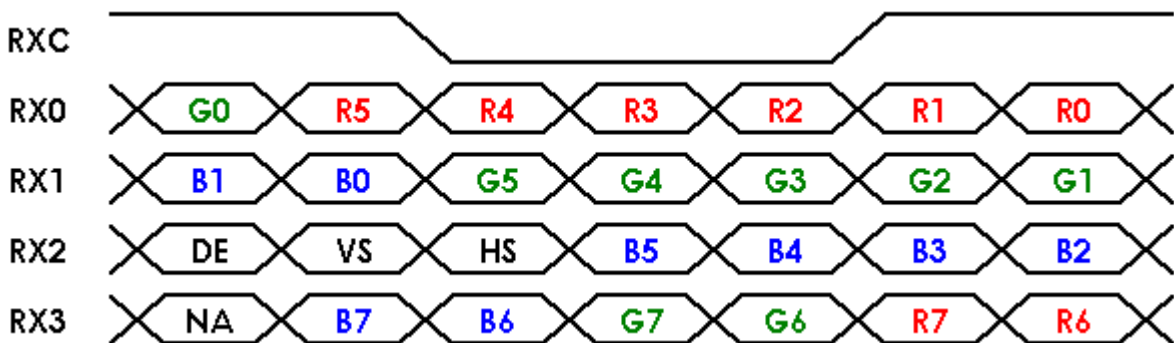
Parameter	Value			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	500	-	-	ms
T5	200	-	-	ms
T6	20	-	-	ms

6.3 The Input Data Format

SEL 6/8 = "LOW" or "NC" for 6 Bits LVDS.



SEL 6/8 = "High" for 8 Bits LVDS.



Note (1) R/G/B data 7: MSB, R/G/B data 0: LSB

Note (2) Please follow PSWG

Signal Name	Description	Remark
R7	Red Data 7 (MSB)	Red-pixel Data Each red pixel's brightness data consists of these 8 bits pixel data.
R6	Red Data 6	
R5	Red Data 5	
R4	Red Data 4	
R3	Red Data 3	
R2	Red Data 2	
R1	Red Data 1	
R0	Red Data 0 (LSB)	
G7	Green Data 7 (MSB)	Green-pixel Data Each green pixel's brightness data consists of these 8 bits pixel data.
G6	GreenData 6	
G5	GreenData 5	
G4	GreenData 4	
G3	GreenData 3	
G2	GreenData 2	
G1	GreenData 1	
G0	GreenData 0 (LSB)	
B7	Blue Data 7 (MSB)	Blue-pixel Data Each blue pixel's brightness data consists of these 8 bits pixel data.
B6	Blue Data 6	
B5	Blue Data 5	
B4	Blue Data 4	
B3	Blue Data 3	
B2	Blue Data 2	
B1	Blue Data 1	
B0	Blue Data 0 (LSB)	
RXCLKIN+ RXCLKIN-	LVDS Clock Input	
DE	Display Enable	
VS	Vertical Sync	
HS	Horizontal Sync	

7. Optical Characteristics

7.1 Test Conditions

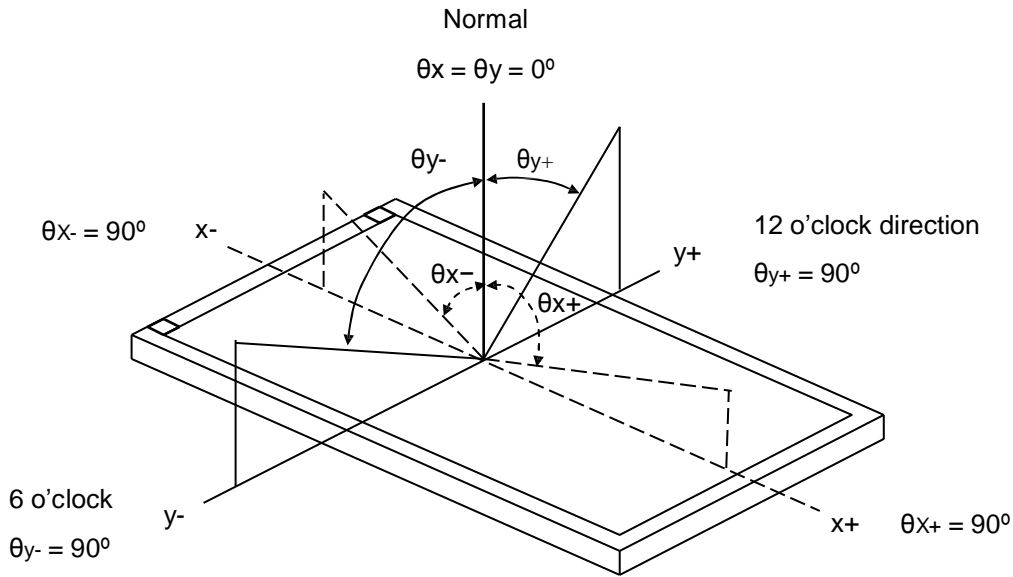
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		

7.2 Optical Specifications

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (5).

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Color Chromaticity	Red	R _x	Typ - 0.05	0.601	Typ + 0.05	-	(1), (5)	
		R _y		0.340		-		
	Green	G _x		0.332		-		
		G _y		0.583		-		
	Blue	B _x		0.149		-		
		B _y		0.087		-		
	White	W _x		0.313		-		
		W _y		0.329		-		
Center Luminance of White	L _C		880	925	-	-	(4), (5)	
Contrast Ratio	CR		500	700	-	-	(2), (5)	
Response Time	T _R	θ _x =0°, θ _y =0°	-	5	10	ms	(3)	
	T _F		-	11	16	ms		
White Variation	δW	θ _x =0°, θ _y =0°	-	1.25	1.4	-	(5), (6)	
Viewing Angle	Horizontal	θ _{x+}	CR≥10	70	80	-	Deg.	(1), (5)
		θ _{x-}		70	80	-		
	Vertical	θ _{y+}		60	70	-		
		θ _{y-}		60	70	-		

Note (1) Definition of Viewing Angle (θ_x, θ_y):



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

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

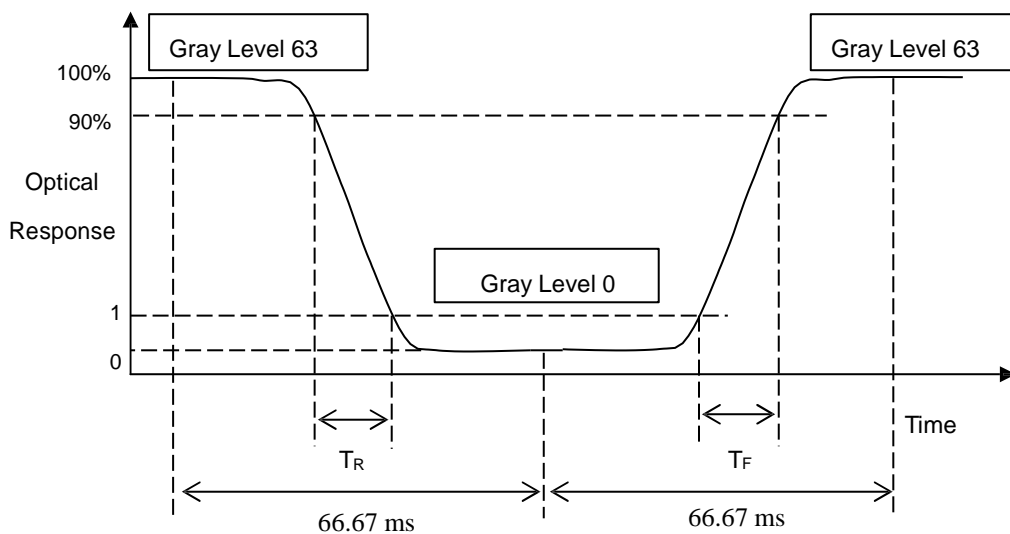
L63: Luminance of gray level 63

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 Figure in Note (6).

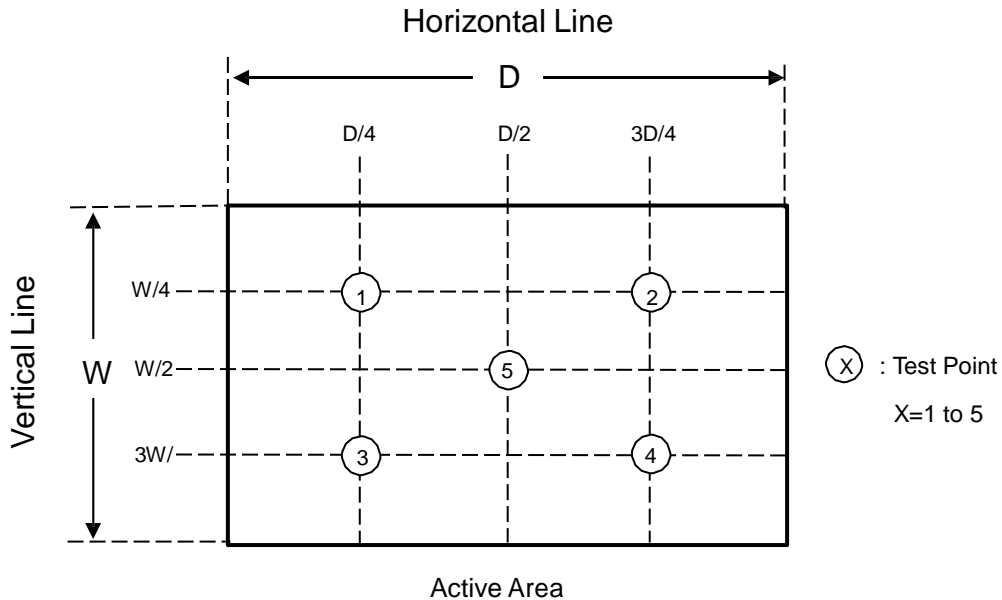
Note (3) Definition of Response Time (T_R, T_F) and measurement method:



Note (4) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

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



8. Reliability Test Criteria

Test Item	Test Condition	Note
High Temperature Storage Test	80°C, 240 hours	(1)(2)(4)
Low Temperature Storage Test	-30°C, 240 hours	
Thermal Shock Storage Test	-30°C, 0.5hour ↔ 80°C, 0.5hour; 1hour/cycle, 100cycles	
High Temperature Operation Test	80°C, 240 hours	
Low Temperature Operation Test	-30°C, 240 hours	
High Temperature & High Humidity Operation Test	60°C, 90%RH, 240hours	
Shock (Non-Operating)	50G, 11ms, half sine wave, 1 time for ± X, ± Y, ± Z.		(3)(4)
Vibration (Non-Operating)	1.5G, 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z	(3)(4)

Note (1) There should be no condensation on the surface of panel during test.

Note (2) Temperature of panel display surface area should be 80 °C Max.

Note (3) 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.

Note (4) In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before reliability test.

9. Packaging

9.1 Packing Specifications

- (1) 13pcs LCD modules / 1 Box
- (2) Box dimensions: 465(L) X 362 (W) X 314 (H) mm
- (3) Weight: approximately 11 Kg (13 modules per box)

9.2 Packing Method

(1) Carton Packing should have no failure in the following reliability test items.

Test Item	Test Conditions	Note
Vibration	ISTA STANDARD Random, Frequency Range: 2 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Non Operation
Dropping Test	1 Angle, 3 Edge, 6 Face, 61 cm	Non Operation

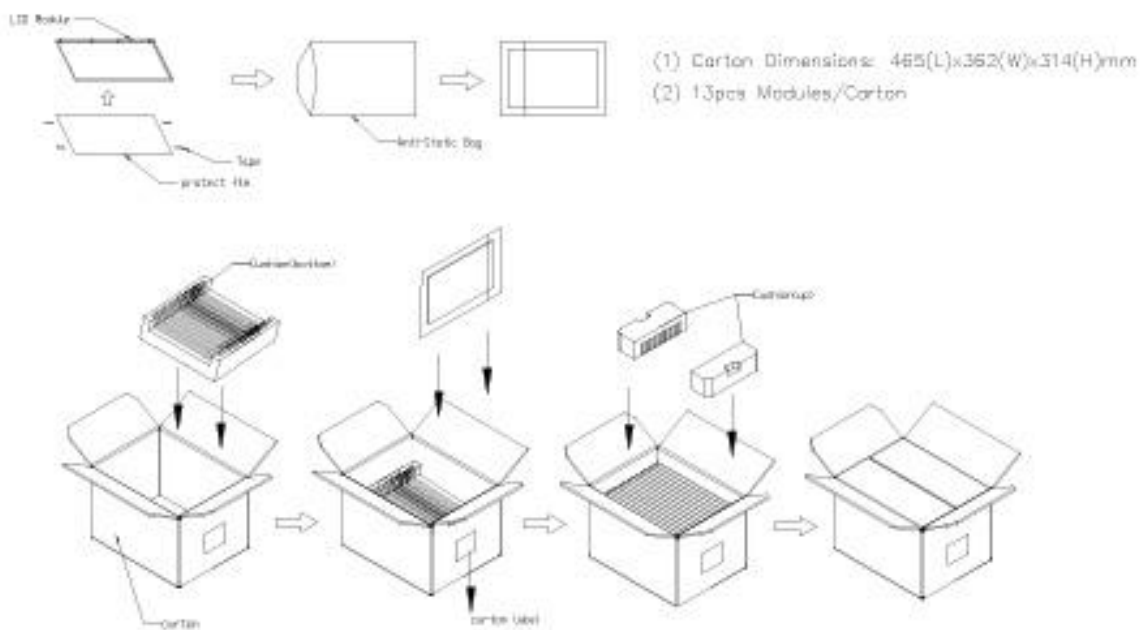


Figure. 9-1 Packing method

Sea / Land Transportation (40ft Container)

Air Transportation

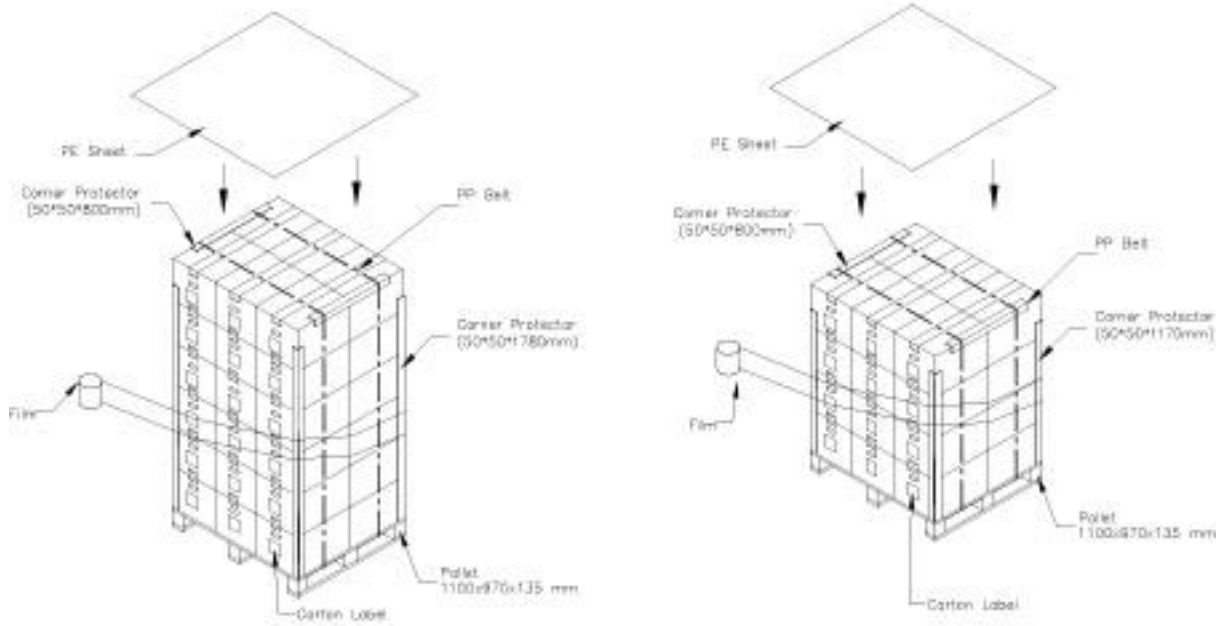
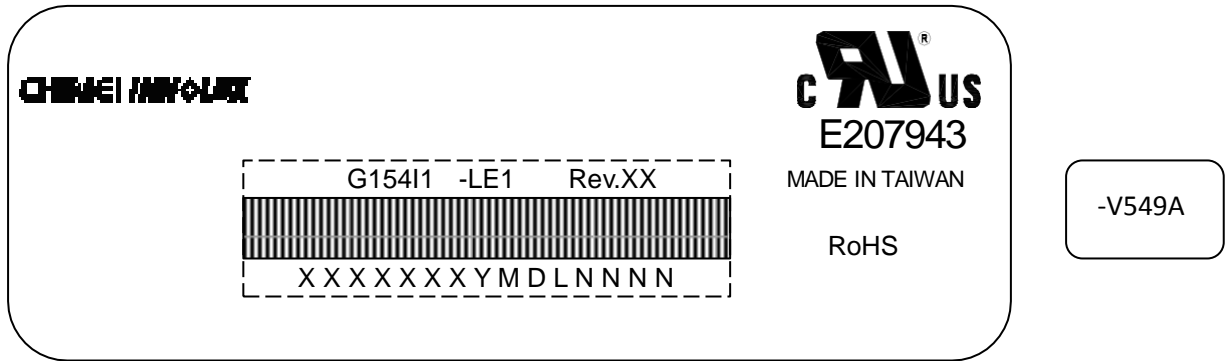


Figure. 9-2 Packing method

10. Definition of Labels

10.1 Module Label

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



- (a) Model Name: G154I1-LE1-V549D
- (b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.

11. Precautions

11.1 Assembly and Handling Precautions

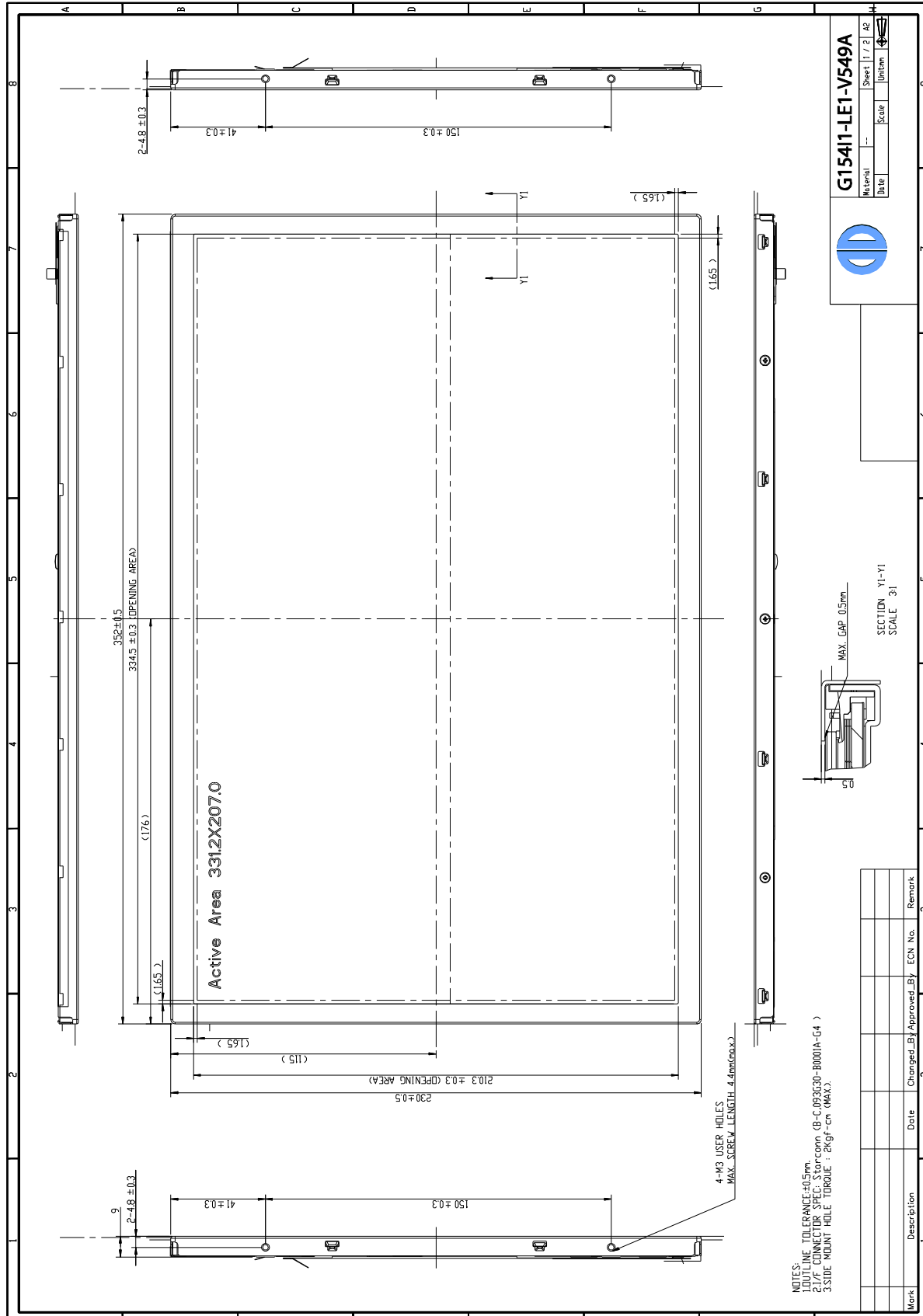
- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.
- (4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- (5) Do not pull the I/F connector in or out while the module is operating. (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) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
- (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (10) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.
- (11) Do not keep same pattern in a long period of time. It may cause image sticking on LCD.

11.2 SAFETY PRECAUTIONS

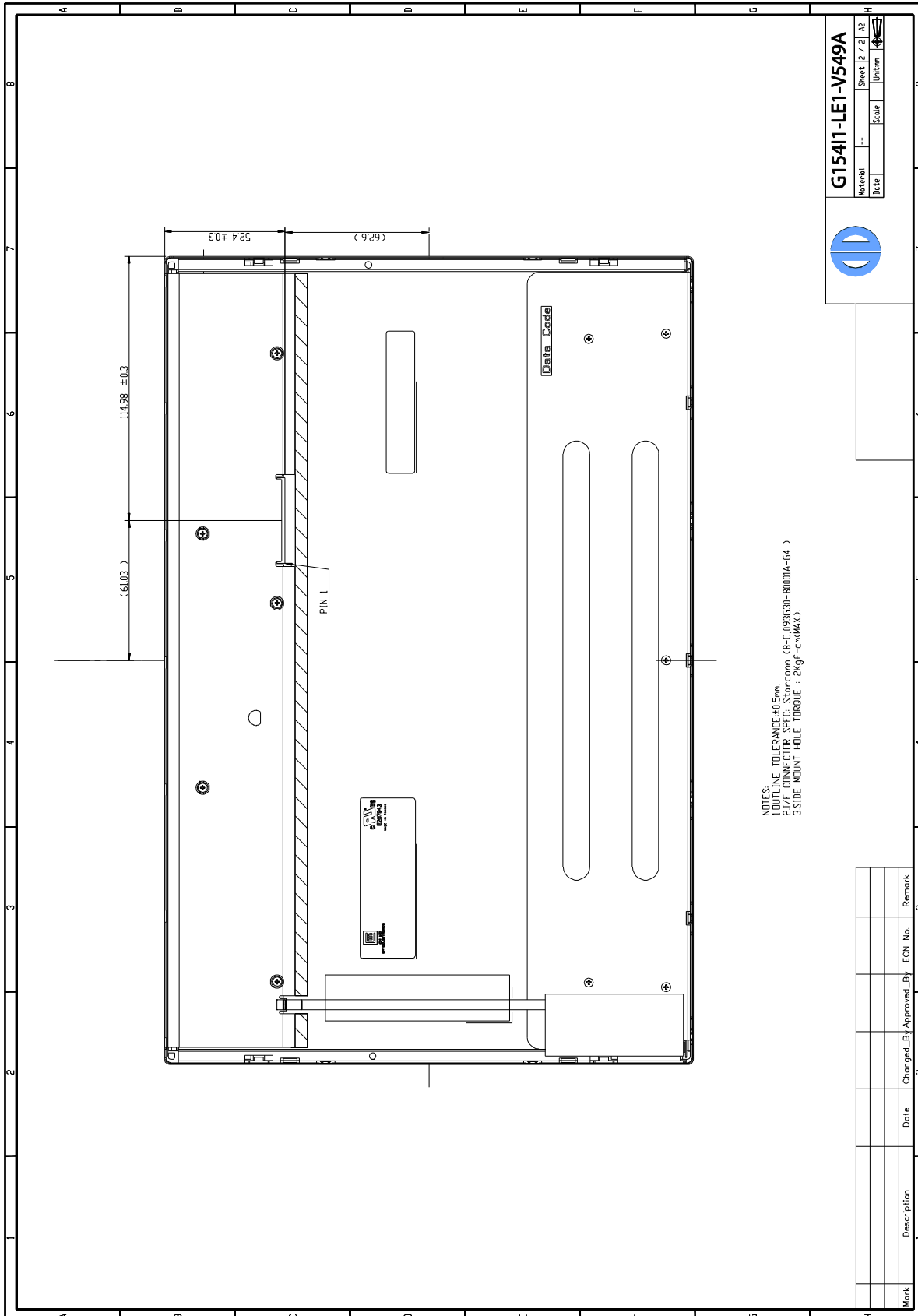
- (1) Do not disassemble the module or insert anything into the Backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

12. Mechanical Characteristics

12.1 LCM Outline Dimensions (Front View)



12.2 LCM Outline Dimensions (Rear View)



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