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InnoLux

G104X1-T03

CH-01-026 (Rev.C1, until Version 2.2)
CH-01-026R1.1 (Rev. C2)
CH-01-026R1.2 (Rev. C3)
CH-01-026R1.3 (Rev. C4)

Doc. Number:

☐ Tentative Specification
☐ Preliminary Specification
■ Approval Specification

MODEL NO.: G104V1
SUFFIX: T03

Customer:

APPROVED BY   **SIGNATURE**

Name / Title
Note

Please return 1 copy for your confirmation with your signature and comments.

Approved By	Checked By	Prepared By
許君述	林秋森	許秝茵

CONTENTS

REVISION HISTORY

Version	Date	Section	Description
3.0	8 Jan, 2017	All	G104V1-T03 Approval Spec was first issued.
3.1	Feb 07, 2018	10.1	Modified INX MODULE LABEL
3.2	Nov 23, 2018	12	Updated outline drawing (front & panel gap 0.3mm to 0.5mm)

1. GENERAL DESCRIPTION

1.1 OVERVIEW

The G104V1-T03 model is a IAV 10.4" TFT-LCD module with white LED Backlight Unit and a 31-pin and 1ch TTL interface. This module supports 640 x 480 VGA mode and display 262,144 colors. The converter for the LED Backlight Unit is built in.

1.2 FEATURES

- Wide viewing angle
- High contrast ratio
- VGA (640 x 480 pixels) resolution
- Wide operating temperature
- DE (Data Enable) mode
- CMOS/TTL (Transistor-Transistor Logic) interface
- Reversible-scan direction
- RoHS Compliance
- LED Light Bar Replaceable

1.3 APPLICATION

- TFT LCD Monitor
- Industrial Application
- Amusement

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Diagonal Size	10.4	inch	
Active Area	211.2(H) x 158.4(V)	mm	(1)
Bezel Opening Area	215.4(H) x 161.8(V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	640 x R.G.B. x 480	pixel	-
Pixel Pitch	0.33(H) x 0.33(V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally black	-	-
Surface Treatment	Hard coating (3H), Anti-glare (Haze 25%)	-	-
Module Power Consumption	7.38	W	Typ.

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	225	225.5	226	mm	(1)
	Vertical (V)	175.8	176.3	176.8	Mm	
	Depth (D)	8.84(7.31)	9.34(7.81)	9.84(8.31)	Mm	
Weight		345	395	445	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. Module

depth 7.8mm does not include TTL connector, with TTL connector is 9.34mm (typical).

(2) Connector mounting position

+/- 0.5mm
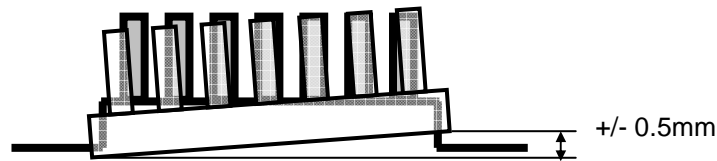
2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Operating Ambient Temperature	T_{OP}	-30	+80	ºC	(1)
Storage Temperature	T_{ST}	-30	+80	ºC	(1)

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

      (a)   90 %RH Max. (Ta $\leqq$ 40 ºC).

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

      (c)   No condensation.
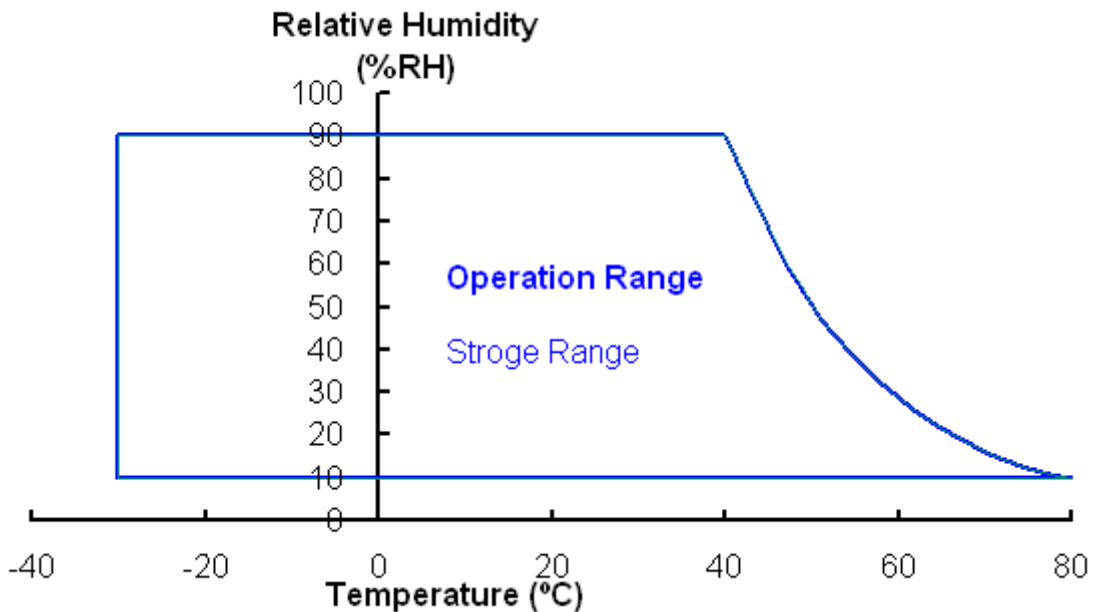
2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCC	-0.3	7	V	(1)

2.2.2 LED CONVERTER

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Converter Voltage	V_i	-0.3	18	V	(1) , (2)
Enable Voltage	EN	---	5.5	V	
Backlight Adjust	ADJ	---	5.5	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.

Note (2) Specified values are for LED (Refer to 3.2 for further information).

3. ELECTRICAL SPECIFICATIONS

3.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VCC	3.0	3.3	3.6	V	at VCC=3.3V
			4.75	5.0	5.25	V	at VCC=5.0V
Power Supply Current	White	---	390	490	540	mA	(3)a, at VCC=3.3V, 60Hz
			290	390	440	mA	(3)a, at VCC=5.0V, 60Hz
	Black		370	470	520	mA	(3)b, at VCC=3.3V, 60Hz
			280	380	430	mA	(3)b, at VCC=5.0V, 60Hz
Power Consumption		P_L	---	1.617	---	W	VCC=3.3V, 60Hz
Logic input voltage		V_{IH}	$0.7V_{CC}$	-	V_{CC}	V	
		V_{IL}	0	-	$0.3V_{CC}$	V	

Note (1) The module is recommended to operate within specification ranges listed above for normal function.

Note (2) Measurement Conditions:
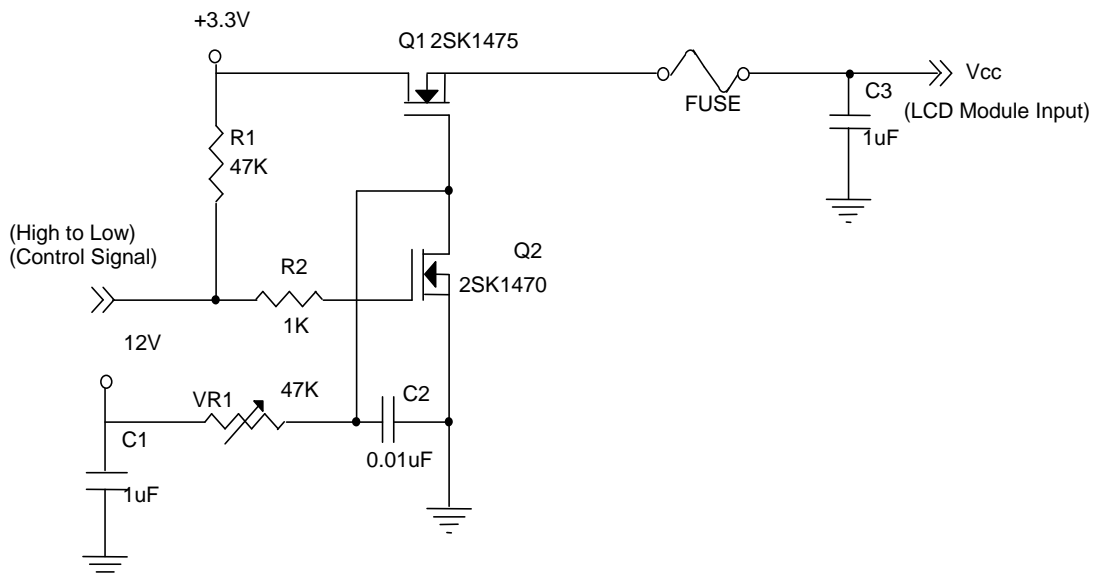
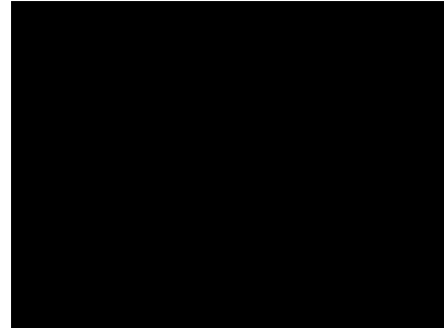**Vcc rising time is 470μs**
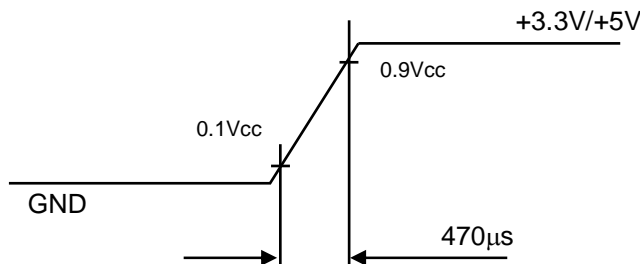
Note (3) The specified power supply current is under the conditions at Ta = 25 ± 2 ℃, f_v = 60 Hz, where as a power dissipation check pattern below is displayed.

a. White Pattern

Active Area
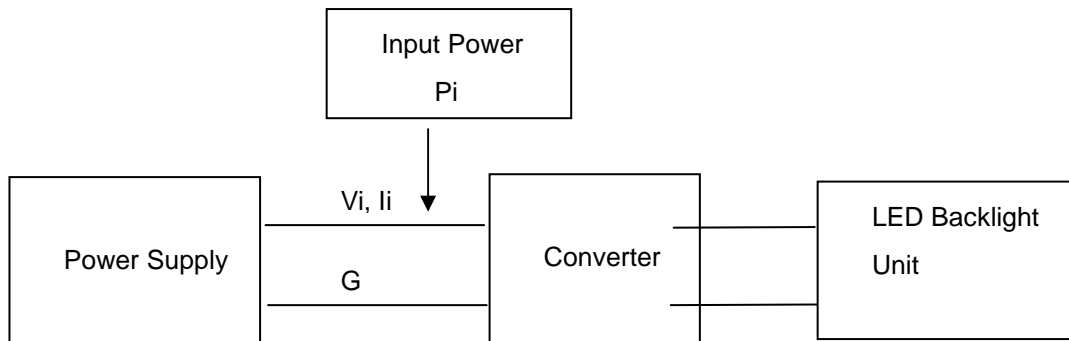
b. Black Pattern

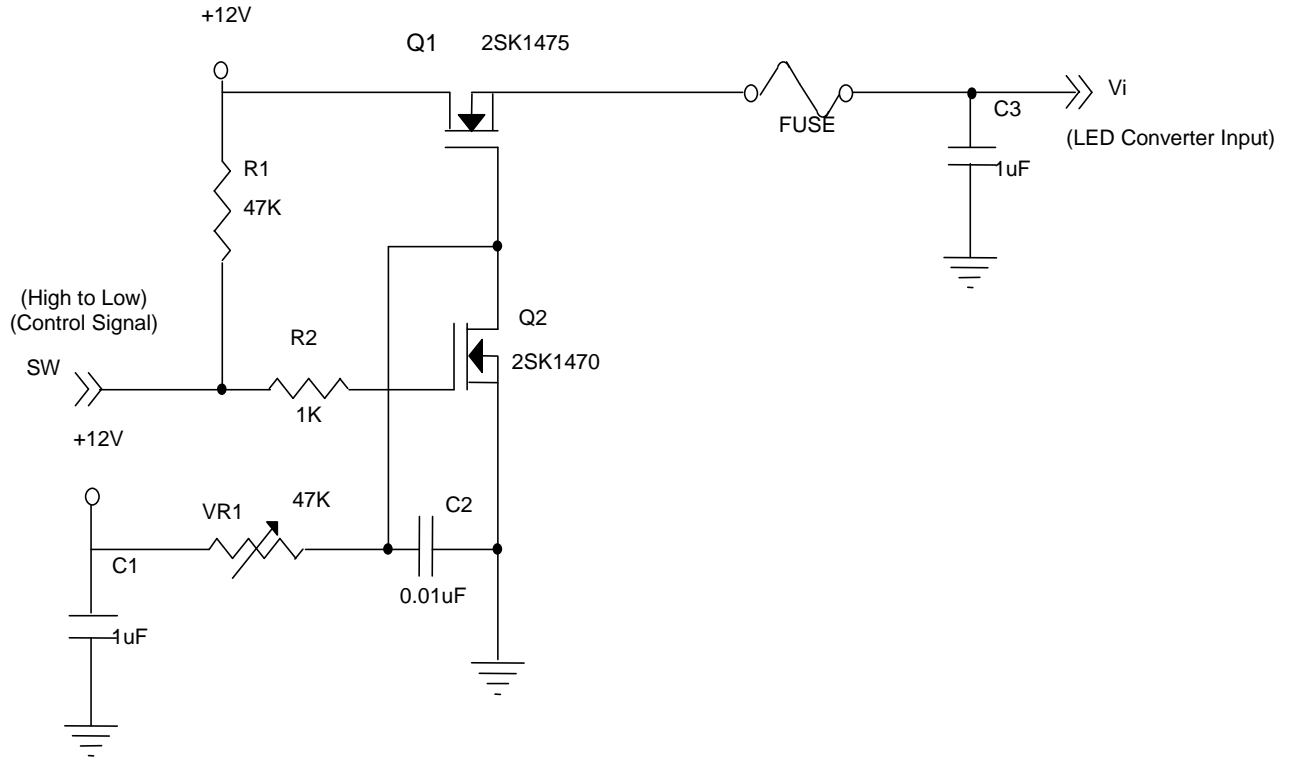Active Area

3.2 LED CONVERTER

Ta = 25 ± 2 ºC

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Power Supply Voltage		V_i	10.8	12.0	12.6	V	(Duty 100%)
Converter Power Supply Current		I_i	---	0.48	---	A	(1) Vi = 12V (Duty 100%)
Converter Power Consumption		Pi	---	5.76	---	W	(1) Vi = 12V (Duty 100%)
EN Control Level	Backlight on		2.0	3.3	5.0	V	
	Backlight off		0	---	0.8	V	
PWM Control Level	PWM High Level		2.0	3.3	5.0	V	
	PWM Low Level		0	---	0.8	V	
PWM Control Duty Ratio			20		100	%	
PWM Control Frequency		f_{PWM}	190	200	20K	Hz	
LED Life Time		L_L	50,000			Hrs	(2)

Note (1) LED current is measured by utilizing a high frequency current meter as shown below:
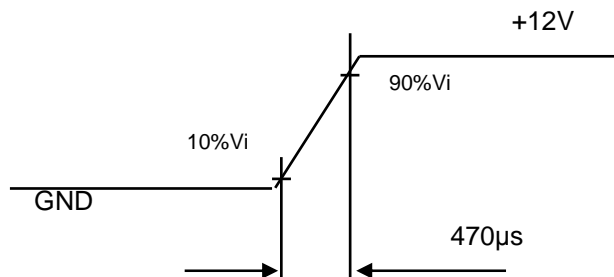
Note (2) The lifetime of LED is defined as the time when it continues to operate under the conditions at   Ta

= 25 ±2 ℃ and I_{LED} = 70mA$_{DC}$ (LED forward current) until the brightness becomes ≦ 50% of its

original value. And minimum LED lifetime is estimated and provided by Nichia in Japan.

Operating LED under high temperature environment will reduce life time and lead to color shift.

```
                    ┌─────────────────┐
                    │   Input Power   │
                    │       Pi        │
                    └─────────────────┘
                             │
                             ▼
┌──────────────┐    Vi, Ii     ┌──────────────┐         ┌──────────────┐
│              │ ───────────── │              │ ─────── │ LED Backlight │
│ Power Supply │               │  Converter   │         │     Unit     │
│              │ ───────────── │              │ ─────── │              │
└──────────────┘      G        └──────────────┘         └──────────────┘
```

+12V

Q1   2SK1475

R1
47K

(High to Low)
(Control Signal)

SW

+12V

R2

1K

Q2

2SK1470

FUSE

C3

1uF

Vi

(LED Converter Input)

VR1   47K

C1

1uF

C2

0.01uF

Vi   rising time is 470us

+12V

90%Vi

10%Vi

GND

470μs

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE
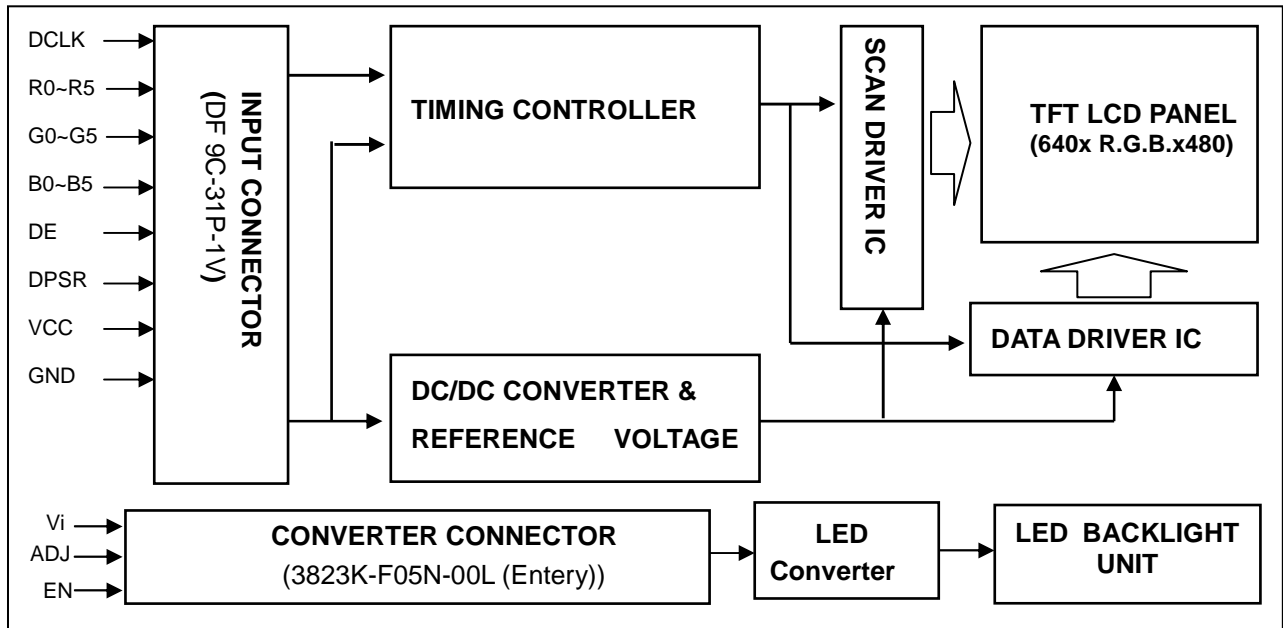
5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Name	Description
1	GND	Ground
2	DCLK	Dot clock
3	N.C.	N.C.
4	N.C.	N.C.
5	GND	Ground
6	R0	Red data (LSB)
7	R1	Red data
8	R2	Red data
9	R3	Red data
10	R4	Red data
11	R5	Red data (MSB)
12	GND	Ground
13	G0	Green data (LSB)
14	G1	Green data
15	G2	Green data
16	G3	Green data
17	G4	Green data
18	G5	Green data (MSB)
19	GND	Ground
20	B0	Blue data (LSB)
21	B1	Blue data
22	B2	Blue data
23	B3	Blue data
24	B4	Blue data
25	B5	Blue data (MSB)
26	GND	Ground
27	DE	Data enable signal
28	VCC	Power supply
29	VCC	Power supply
30	N.C.	Reserved, please keep it floating.
31	DPSR	Selection of scan direction

Note (1) Connector Part No.: DF 9C-31P-1V or equivalent.

5.2 BACKLIGHT UNIT (Converter connector pin)

Pin	Symbol	Description	Remark
1	V_i	Converter input voltage	12V
2	V_{GND}	Converter ground	Ground
3	EN	Enable pin	
4	ADJ	Backlight Adjust	PWM Dimming
5	NC	Not Connect	

Note (1)   Connector Part No.: 3823K-F05N-00L (Entery) or equivalent

Note (2)   User's connector Part No.: H208K-P05N-02B (Entery) or equivalent

5.3 COLOR DATA INPUT ASSIGNMENT

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

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
Dot Clock	Frequency	Fc	21	25.175	29	MHz	-
	Period	Tc	34.48	39.72	47.62	ns	
	High Time	TCIH	0.35 Tc	0.5 Tc	0.65 Tc	ns	
	Low Time	TCIL	0.35 Tc	0.5 Tc	0.65 Tc	ns	
Dot Data	Setup Time	Tlvs	8	-	-	ns	(4)
	Hold Time	Tlvh	12	-	-	ns	(4)
DE	Setup Time	TSTC	8	-	-	ns	(5)
	Hold Time	THTC	12	-	-	ns	(5)
Horizontal Active Display Term	Frame Rate	Fr	-	60	-	Hz	
	Total	Th	730	800	900	Th	Th=Thd+Thb
	Display	Thd	-	640	-	Th	-
	Blank	Thb	90	160	260	Th	-
Vertical Active Display Term	Total	Tv	485	525	576	Tc	Tv=Tvd+Tvb
	Display	Tvd	-	480	-	Tc	-
	Blank	Tvb	5	45	96	Tc	-

Note：(1)This module is operated by DE only mode

(2) Frame rate is 60Hz

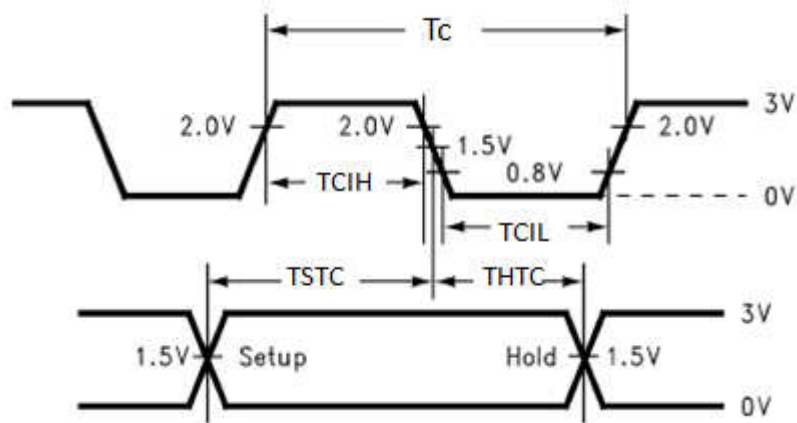(3) The Tv(Tvd+Tvb) must be integer, otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM
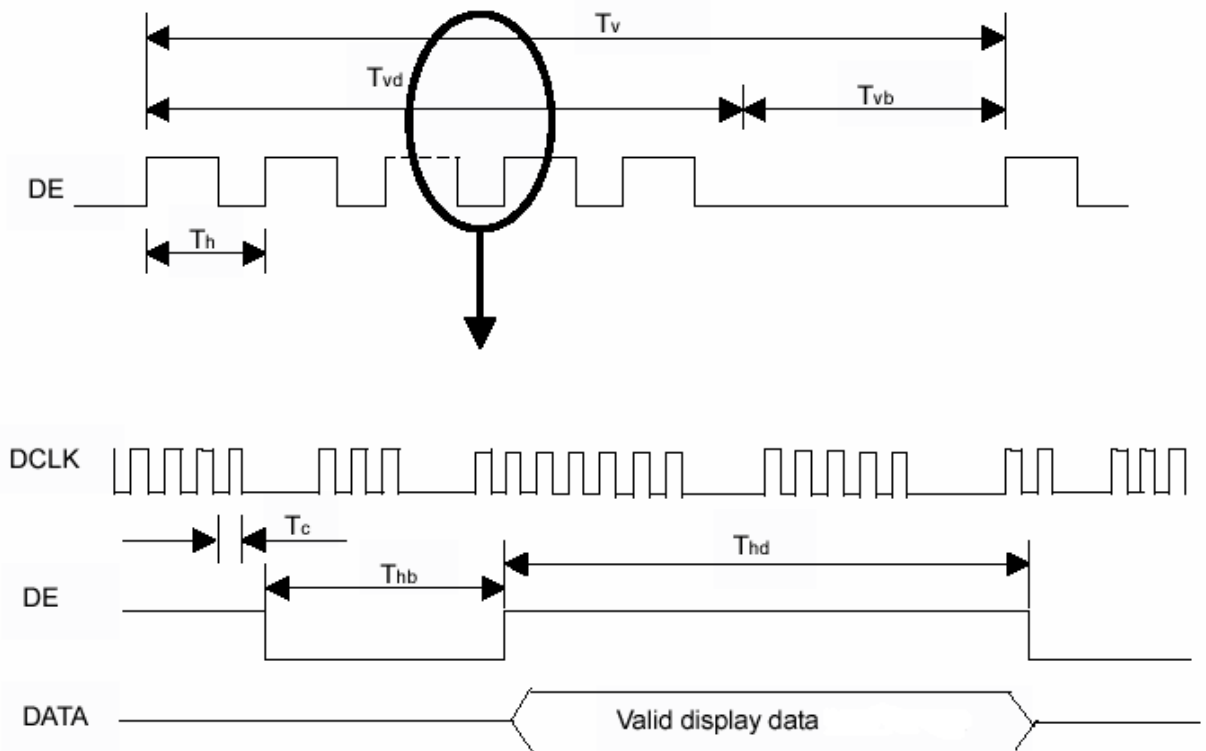
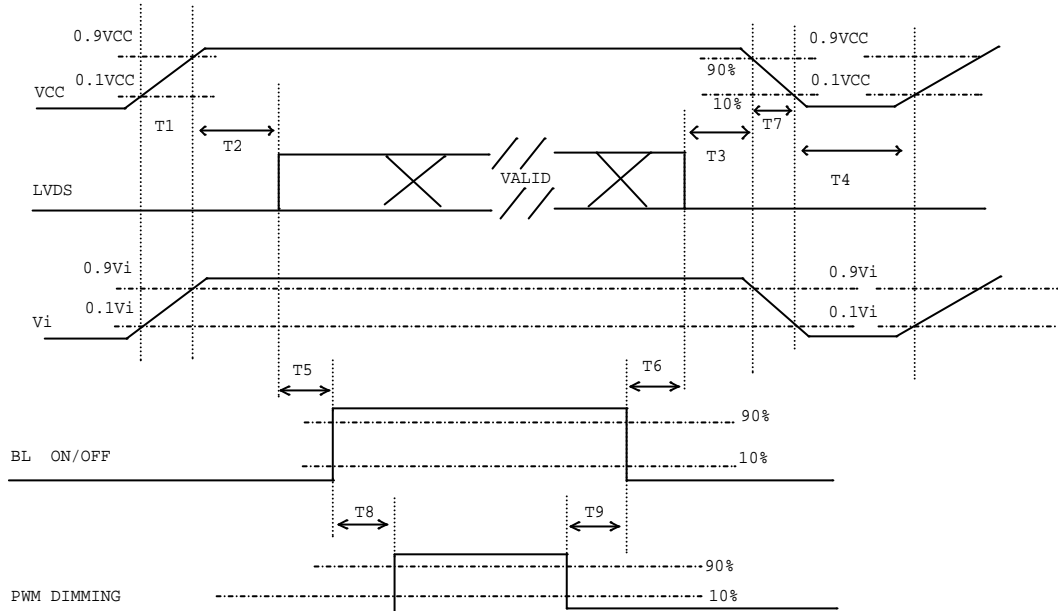(4) Clock and data setup/hold and high/low time input waveforms.
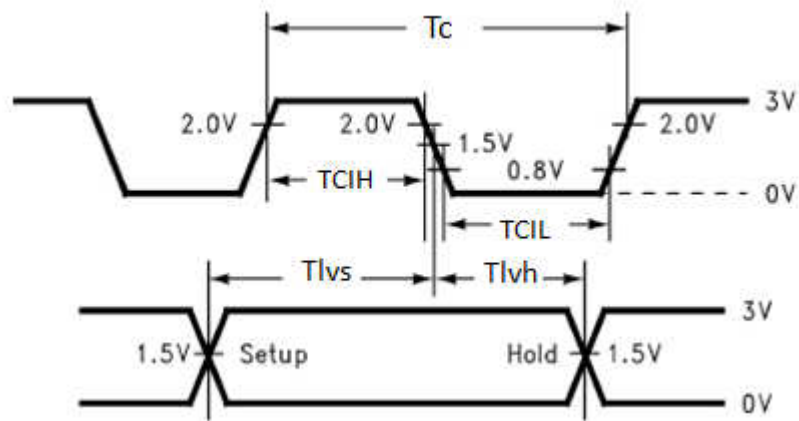
(5) Clock and DE setup/hold and high/low time input waveforms.

6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the conditions shown in the following diagram.

Power ON/OFF sequence

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.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

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
T7	5	-	300	ms
T8	10	-	-	ms
T9	10	-	-	ms

6.3 SCANNING DIRECTION

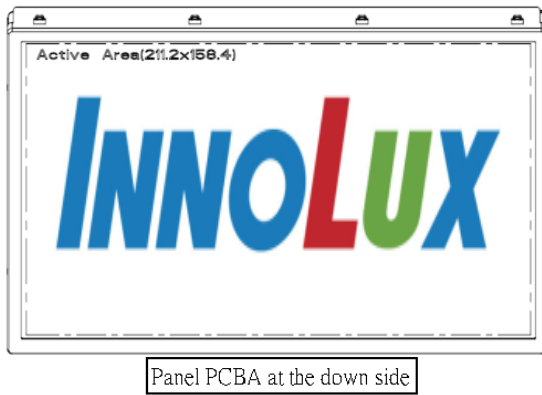The following figures show the image see from the front view. The arrow indicates the direction of scan.
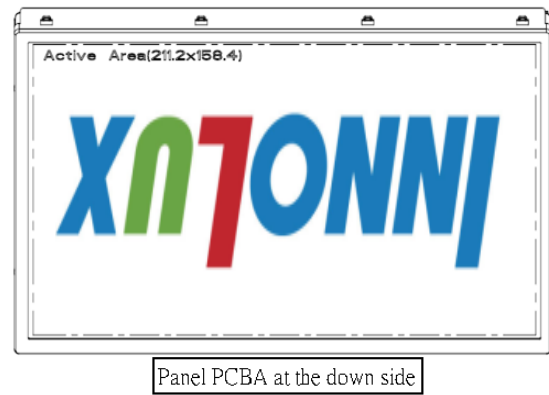

Figure1.Normal scan (DPSR : Low or Open)　　　Figure 2. Reverse scan (DPSR : High)

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITION

Item	Value	Unit
Ambient Temperature (Ta)	25±2	°C
Ambient Humidity (Ha)	50±10	%RH
Supply Voltage	According to typical value in "ELECTRICAL CHARACTERISTICS"	
Input Signal		
LED Light Bar Input Current Per Input Pin		

7.2 OPTICAL SPECIFICATION

The relative measurement methods of optical characteristics are shown in 7.2 and all items are measured at the center point of screen except white variation. 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	Rx	$\theta_x=0°$, $\theta_Y=0°$ CS-1000	Typ - 0.05	0.619	Typ + 0.05	-	(1), (5)
		Ry			0.357		-	
	Green	Gx			0.333		-	
		Gy			0.562		-	
	Blue	Bx			0.145		-	
		By			0.092		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
Center Luminance of White		L_C		450	500	-	-	(4), (5)
Contrast Ratio		CR		1000	1500	-	-	(2), (5)
Response Time		T_R	$\theta_x=0°$, $\theta_Y=0°$	-	14	19	ms	(3)
		T_F		-	9	14	ms	
White Variation		δW	$\theta_x=0°$, $\theta_Y=0°$	-	-	1.4	-	(5), (6)
Viewing Angle	Horizontal	θ_x+	CR≥10	80	88	-	Deg.	(1), (5)
		θ_x-		80	88	-		
	Vertical	θ_Y+		80	88	-		
		θ_Y-		80	88	-		

Note (1) Definition of Viewing Angle (θx, θy):
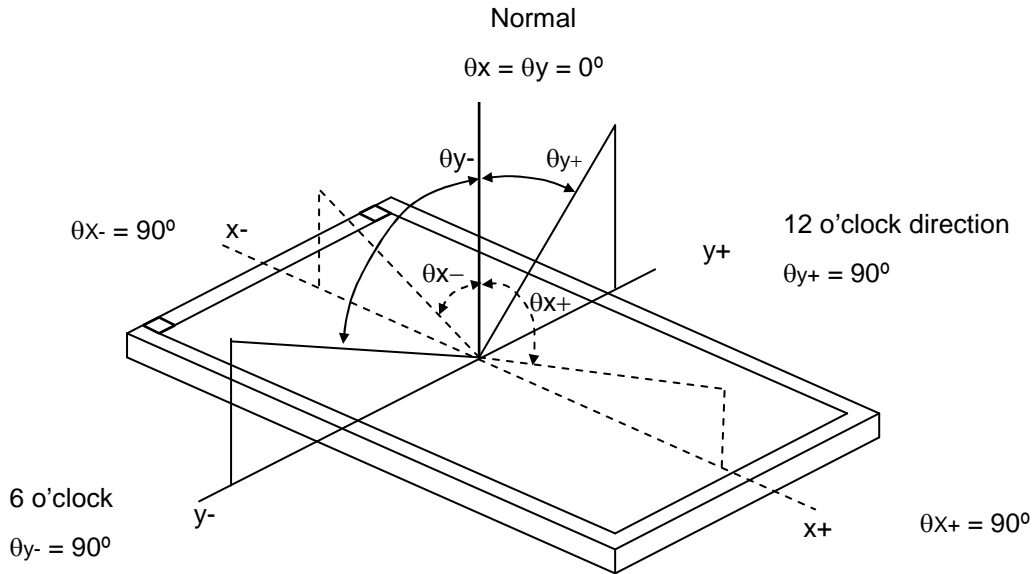
Note (2) Definition of Contrast Ratio, (CR):

The contrast ratio can be calculated by the following expression.
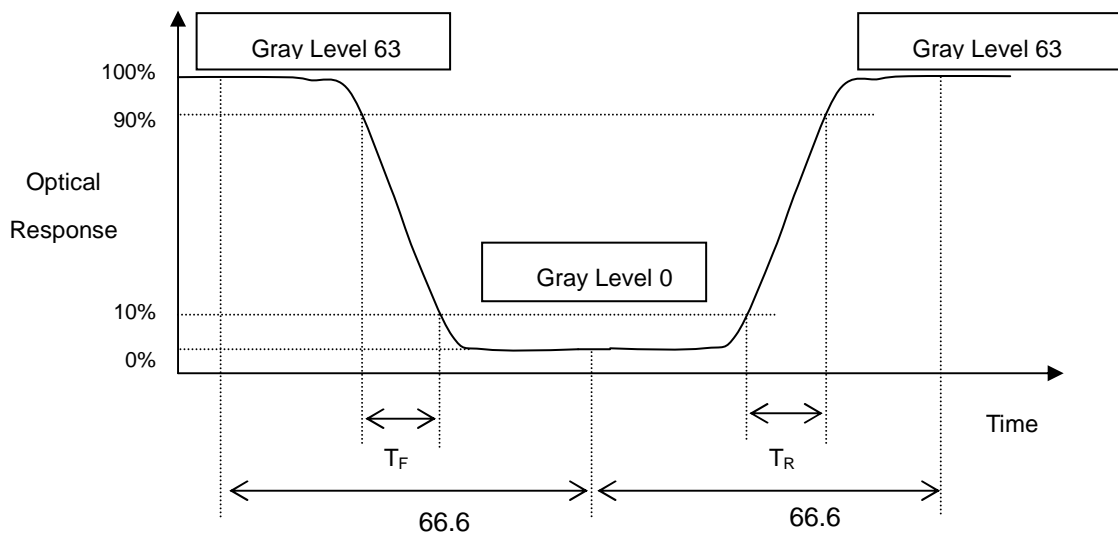
Contrast Ratio, CR = L63 / L0

L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = 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 Luminance of White (L_C):

Measure the luminance of gray level 63 at center point and 5 points

$L_C = L(5)$, where $L(X)$ is corresponding to the luminance of the point X at the figure in Note (6).

Note (5)   Measurement Setup:

The LCD assembly should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.
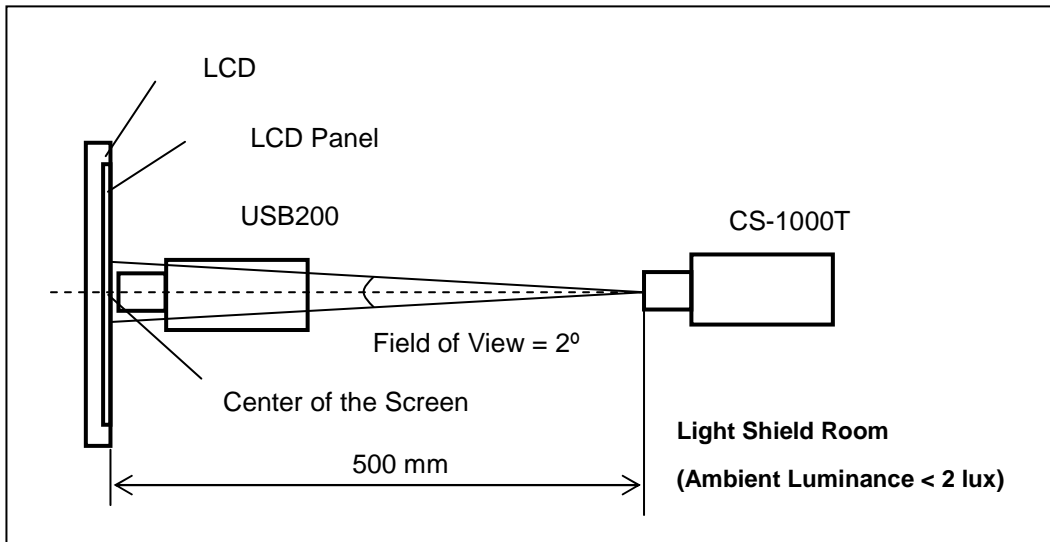
Note (6)   Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

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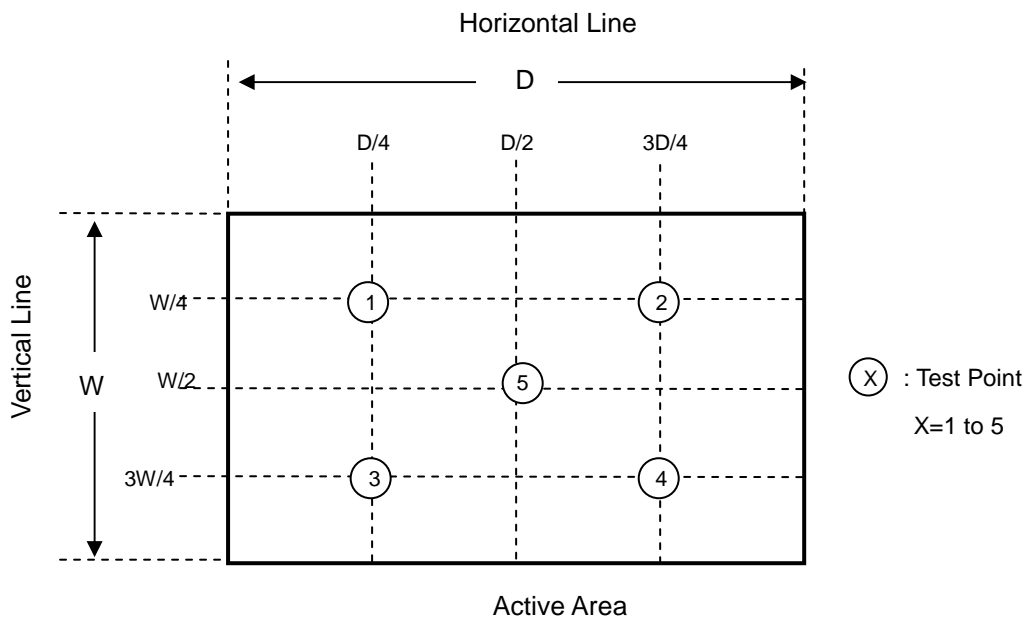
8. RELIABILITY TEST CRITERION

Test Item	Test Condition	Note
High Temperature Storage Test	80ºC, 240 hours	(1) (2) (4) (5)
Low Temperature Storage Test	-30ºC, 240 hours	
Thermal Shock Storage Test	-30ºC, 0.5hour←→80℃, 0.5hour; 100cycles, 1hour/cycle	
High Temperature Operation Test	80ºC, 240 hours	
Low Temperature Operation Test	-30ºC, 240 hours	
High Temperature & High Humidity Operation Test	60ºC, 90%RH, 240hours	(1) (2) (4) (6)
Shock (Non-Operating)	200G, 2ms, 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 85 ºC 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.

Note (5) Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note (6) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

9. PACKING

9.1 PCAKING SPECIFICATIONS

(1) 18pcs LCD modules / 1 Box

(2) Box dimensions: 465 (L) X 362 (W) X 314 (H) mm

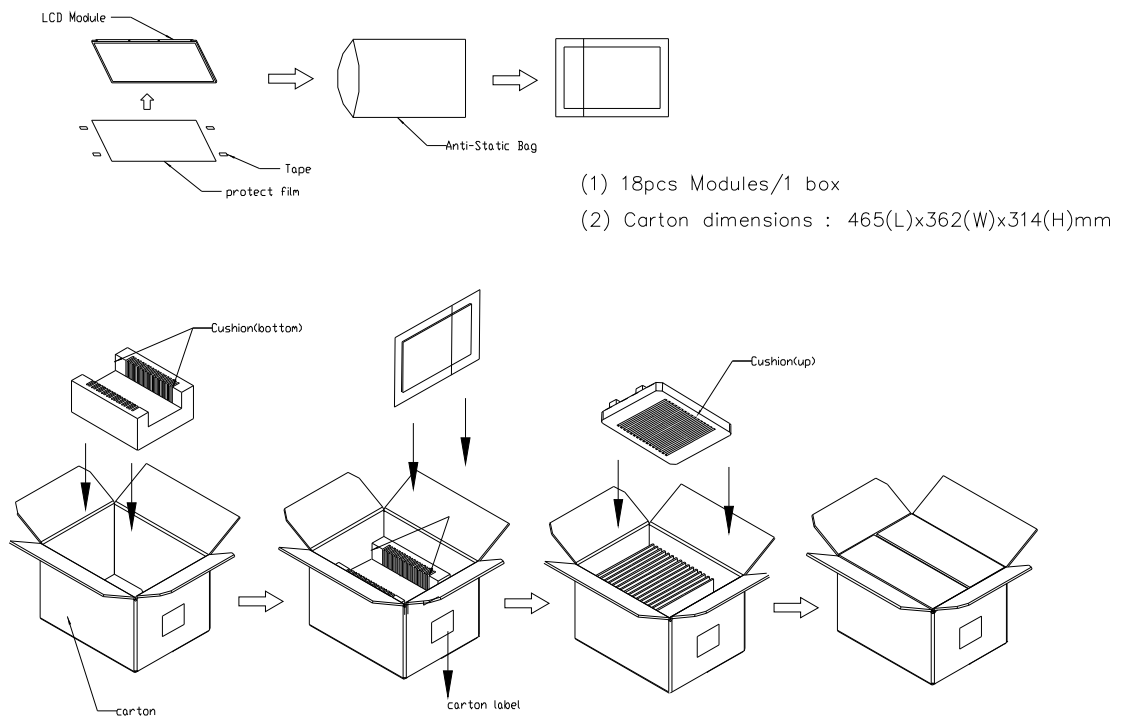(3) Weight: approximately 11.23Kg (18 modules per box)

9.2 PACKING METHOD

(1) 18pcs Modules/1 box
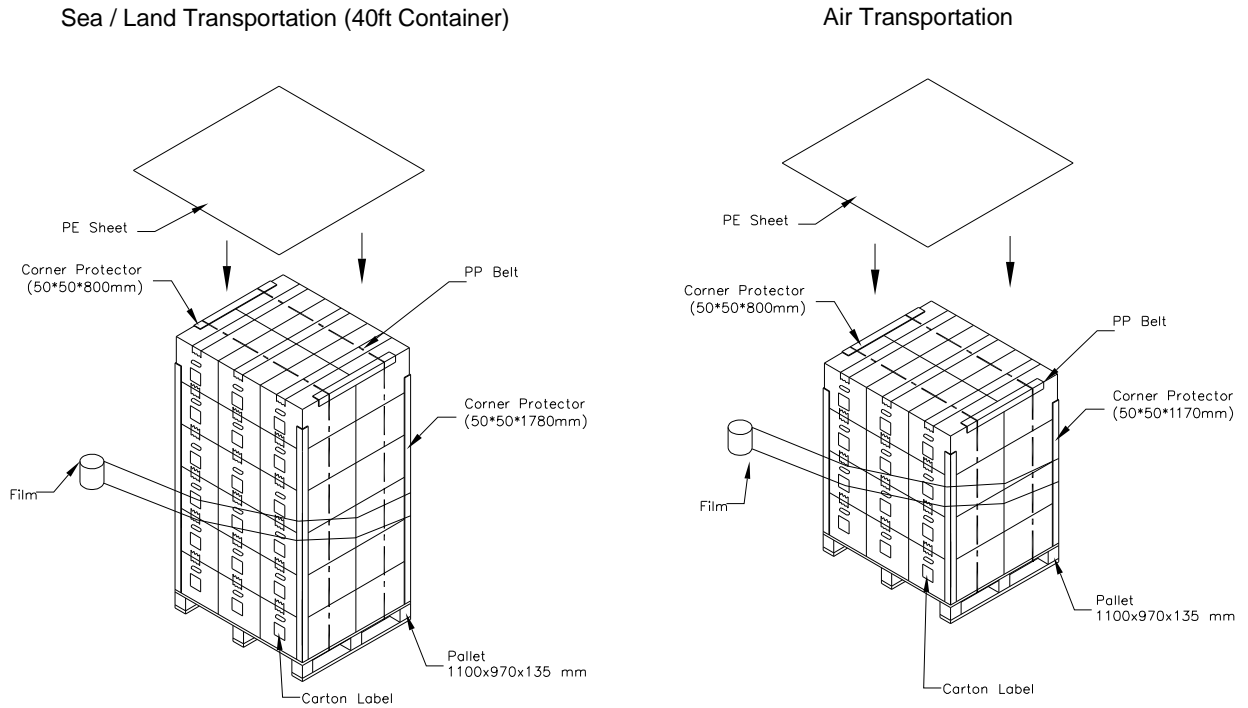
(2) Carton dimensions : 465(L)x362(W)x314(H)mm

Figure. 9-1 Packing method

Sea / Land Transportation (40ft Container)

Air Transportation

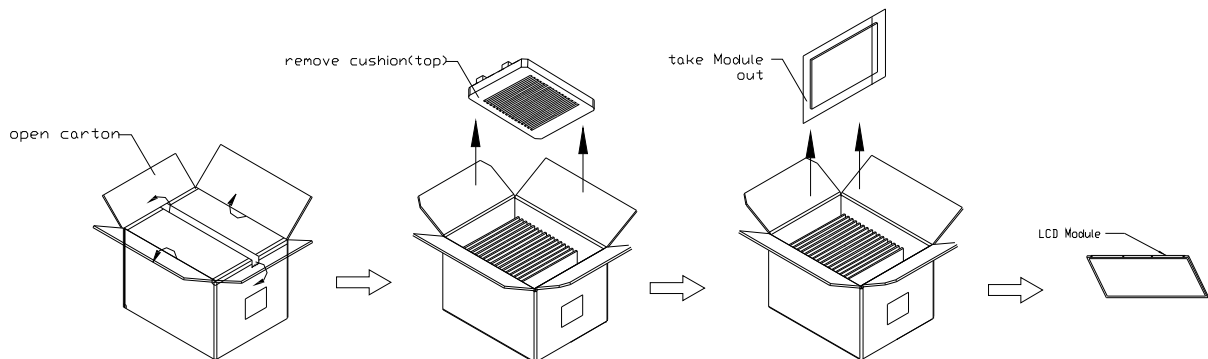**Figure. 9-2 Packing method**
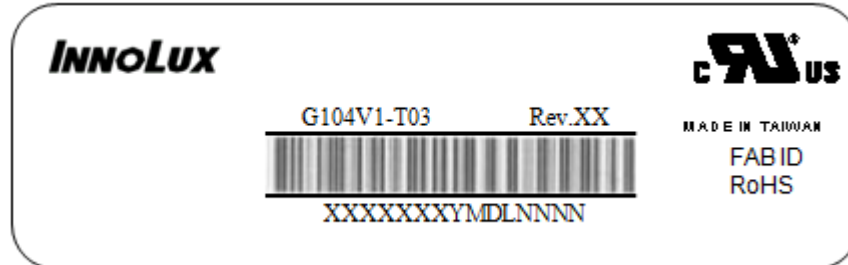
9.3 UN-PACKING METHOD

Figure. 9-3 UN-Packing method

10. DEFINITION OF LABEL

10.1 INX MODULE LABEL

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

(a)Model Name: G104V1-T03

(b)Revision: Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.

(c) Serial ID: XX-XX-X-XX-YMD-L-NNNN

Code	Meaning	Description
XX	INX internal use	-
XX	Revision	Cover all the change
X	INX internal use	-
XX	INX internal use	-
YMD	Year, month, day	Year: 0~9, 2001=1, 2002=2, 2003=3…2010=0, 2011=1, 2012=2… Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U.
L	Product line #	Line 1=1, Line 2=2, Line 3=3, …
NNNN	Serial number	Manufacturing sequence of product

(d) FAB ID(UL Factory ID):

Region	Factory ID
TWINX	GEMN
NBINX	LEOO
NBINX	VIRO
NHINX	CAPG

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 10ºC may reduce the display quality, the response time will become slowly.

(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

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