INNOLUX

PRODUCT SPECIFICATION

Doc. Number :

■ Tentative Target Specification

☐ Preliminary Specification

☐ Approval Specification

MODEL NO.: G070ACE
SUFFIX: L01

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

CONTENTS

REVISION HISTORY

Version	Date	Page	Description
0.0	Dec.27, 2018	All	Spec Ver. 1.0 was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

G070ACE-L01 is a 7” TFT Liquid Crystal Display module with WLED Backlight unit and 30 pins 1ch-LVDS interface. This module supports 800xRGBx480 AAS mode and can display 262k or 16.7M colors.

1.2 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Screen Size	7” real diagonal		
Driver Element	a-si TFT active matrix	-	-
Pixel Number	800 x R.G.B. x 480	pixel	-
Pixel Pitch	0.1905 (H) x 0.1905 (V)	mm	-
Pixel Arrangement	RGB stripe	-	-
Display Colors	16.7M / 262K	color	-
Transmissive Mode	Normally Black	-	-
Surface Treatment	AG type, 3H hard coating,	-	-
Luminance, White	(500)(Typ.)	Cd/m2	
Color Gamut	70 % of NTSC(Typ.)	-	-
Power Consumption	(Total 2.48 W (Typ) @ cell 0.48 W (Typ), BL 2.0 W (Typ))		

2. MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	169.5	170	170.5	mm	(1) (2)
	Vertical (V)	109.5	110	110.5	mm	
	Thickness (T)	5.5	6	6.5	mm	
Bezel Area	Horizontal	153.9	154.40	154.9	mm	
	Vertical	92.94	93.44	93.94	mm	
Active Area	Horizontal	-	152.4	-	mm	
	Vertical	-	91.44	-	mm	
Weight		173.66	182.8	191.94	g	

Note (1) Module Outline Size without User hold. (Based on 2D Drawing)

(2) Module Thickness Size without PCBA/Connector. (Based on 2D Drawing)

3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	Tst	-40	90	℃	(1), (2)
Operating Ambient Temperature	Top	-30	(85)	℃	(1), (2)

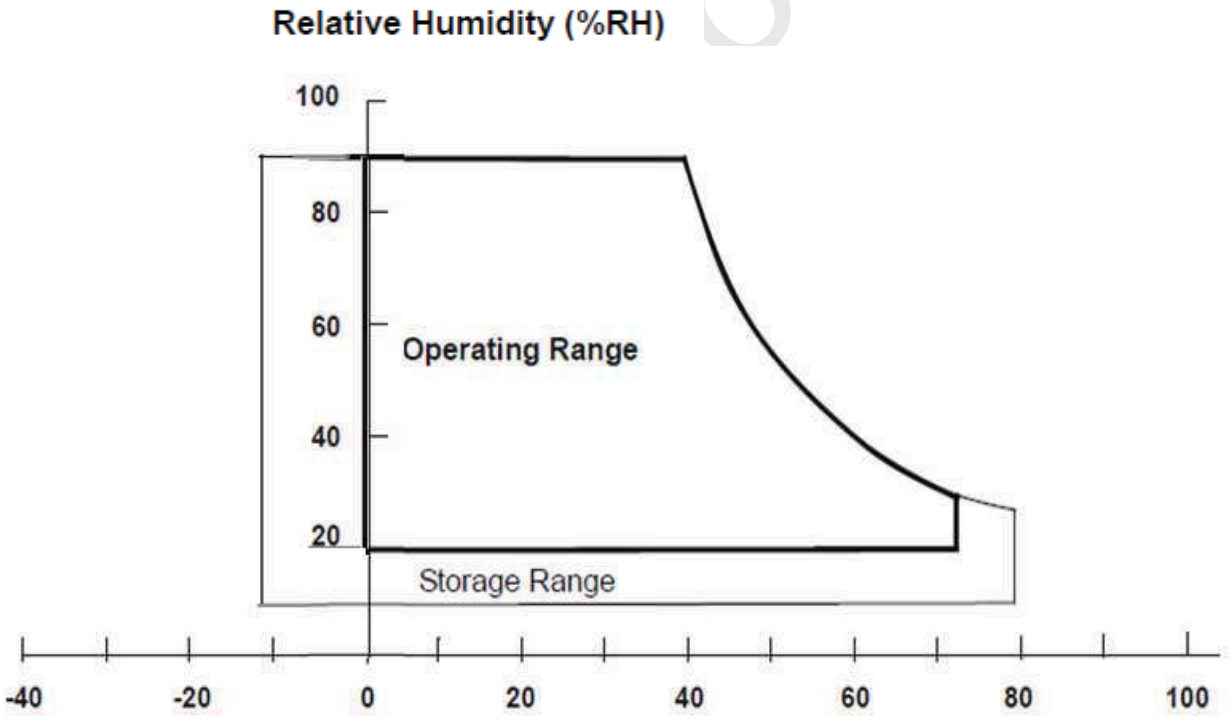
Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ≦ 40 ºC).

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

(c) No condensation.

(2) The absolute maximum rating values of this product are not allowed to be exceeded at any times. The module should not be used over the absolute maximum rating value. It will cause permanently unrecoverable function fail in such an condition



3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	3.6	V	(1)
Logic Input Voltage	V_{IN}	-0.3	3.6	V	

3.2.2 BACKLIGHT CONVERTER

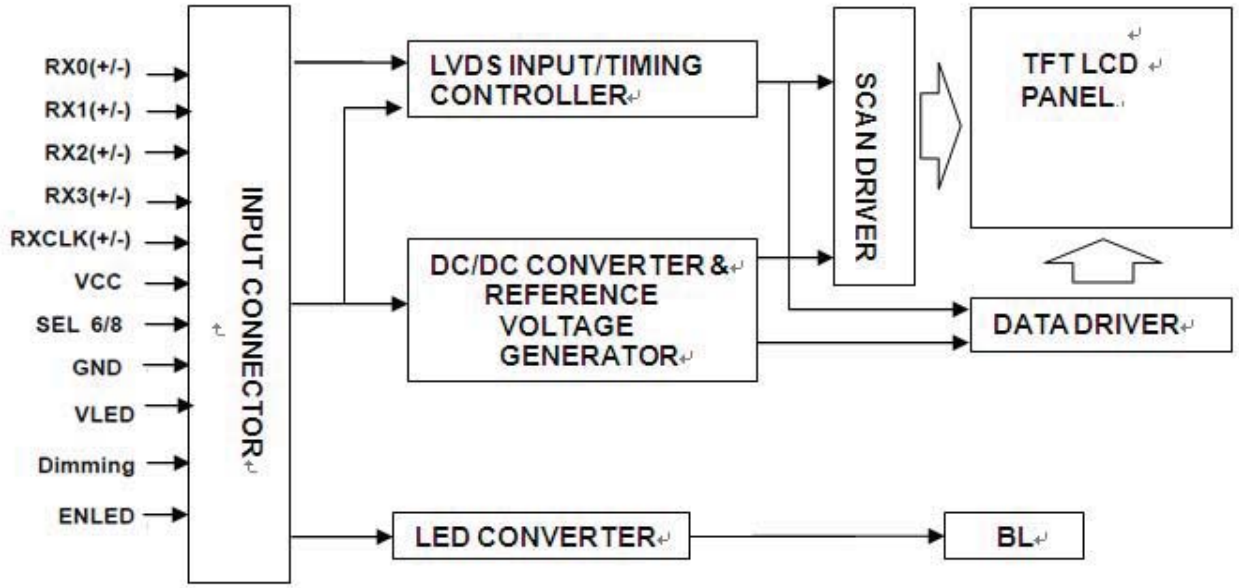
Item	Symbol	Value			Unit	Note
		Min.	Typ	Max.		
Converter Voltage	LED_V_{in}	0	12.0	18.0	V	(1), (2) Duty=100%
Enable Voltage	LED_EN	0	3.3 / 5	7	V	
Backlight Adjust	LED_PWM	0	3.3 / 5	7	V	(1), (2) Pulse Width≦10msec. and Duty≦10%

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 input pin of LED light bar at Ta=25±2 ℃ (Refer to 4.3.3 and 4.3.4 for further information)

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM



4.2. INTERFACE CONNECTIONS

PIN ASSIGNMENT

Pin No.	Symbol	Description	Note
1	12V	LED power	-
2	12V	LED power	-
3	12V	LED power	-
4	12V	LED power	-
5	ENLED	Enable pin	-
6	Dimming	Backlight Adjust	-
7	NC	No Conncetion (Reserve for INX test)	(3)
8	NC	No Conncetion (Reserve for INX test)	(3)
9	VCC	Power supply: +3.3V	-
10	VCC	Power supply: +3.3V	-
11	GND	Ground	-
12	GND	Ground	-
13	RX0-	Negative transmission data of pixel 0	-
14	RX0+	Positive transmission data of pixel 0	-
15	GND	Ground	-
16	RX1-	Negative transmission data of pixel 1	-
17	RX1+	Positive transmission data of pixel 1	-
18	GND	Ground	-
19	RX2-	Negative transmission data of pixel 2	-
20	RX2+	Positive transmission data of pixel 2	-
21	GND	Ground	-
22	RXCLK-	Negative of clock	-
23	RXCLK+	Positive of clock	-
24	GND	Ground	-
25	RX3-	Negative transmission data of pixel 3	-
26	RX3+	Positive transmission data of pixel 3	-
27	GND	Ground	-
28	SEL6/8	LVDS 6/8 bit select function control, Low → 6 bit Input Mode High or NC → 8bit Input Mode	(2)
29	GND	Ground	-
30	GND	Ground	-

Note (1) Connector Part No.: Starconn 093G30-B0001A-G4.

Note (2) “Low” stands for 0V. “High” stands for 3.3V

Note (3) Pin7, Pin8 input signals should be set to no connection or ground, this module would operate normally.

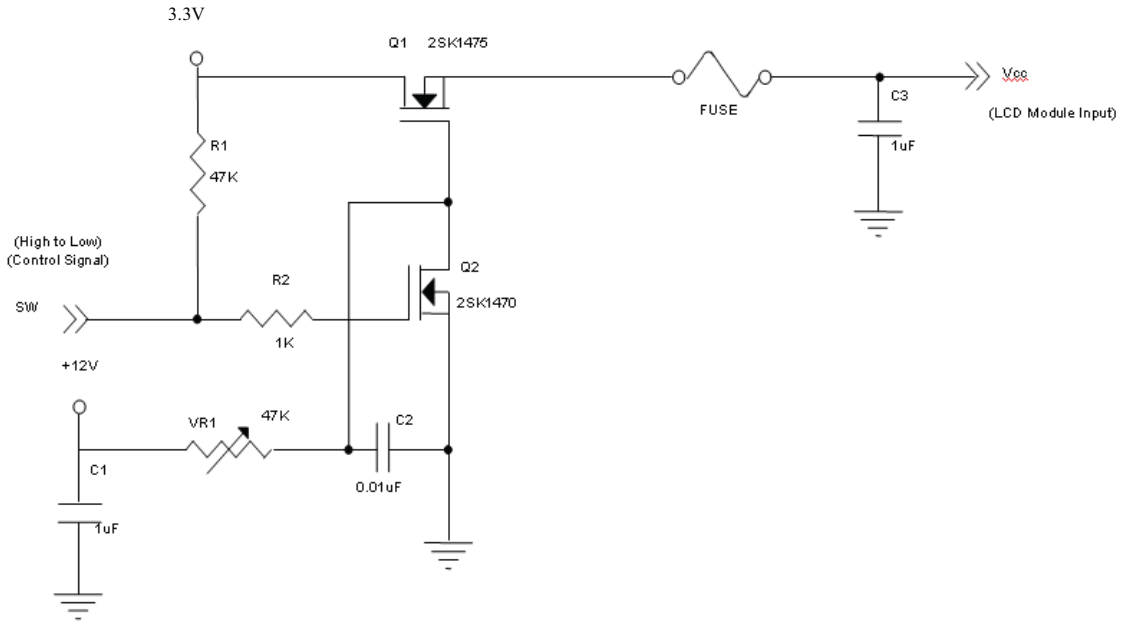
4.3 ELECTRICAL CHARACTERISTICS

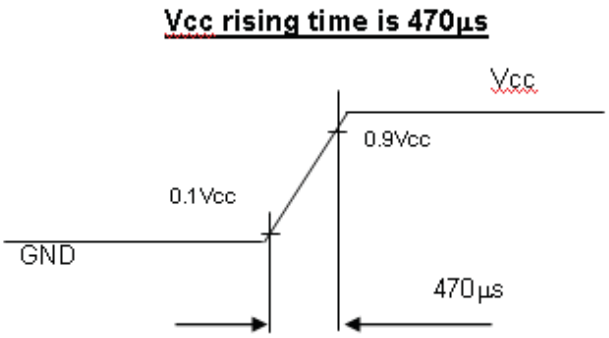
4.3.1 LCD ELETRONICS SPECIFICATION

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	-
Ripple Voltage		V_{RP}	-	-	100	mVp-p	-
Rush Current		I_{RUSH}	-	-	2	A	(2)
Power Supply Current	White	-	-	135	200	mA	(3)a
	Black	-	-	85	135	mA	(3)b
	Vertical Stripe	-	-	145	220	mA	(3)c
Power Consumption		PLCD	-	0.48	0.73	W	
LVDS differential input voltage		Vid	200	-	600	mV	
LVDS common input voltage		Vic	1.0	1.2	1.4	V	
LVDS terminating resistor		R_T	-	100	-	ohm	

Note (1) The ambient temperature is Ta = 25 ± 2 ℃.

Note (2) Measurement Conditions:





Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ℃, Fr = 60Hz, whereas a power dissipation check pattern below is displayed.

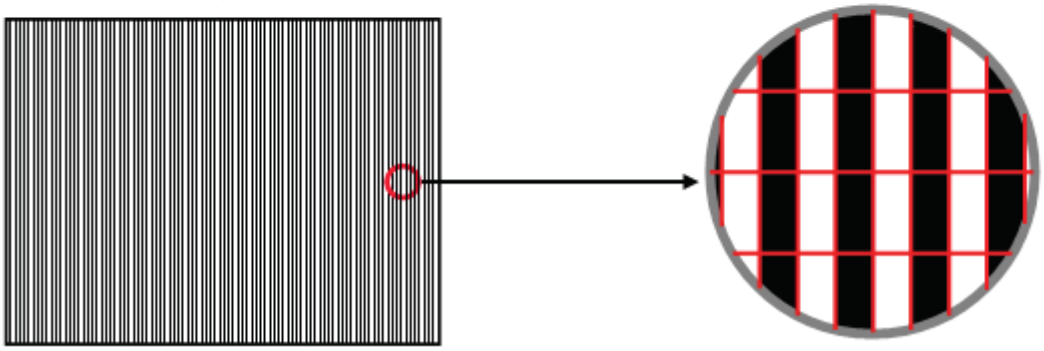
a. White Pattern

Active Area

b. Black Pattern

Active Area

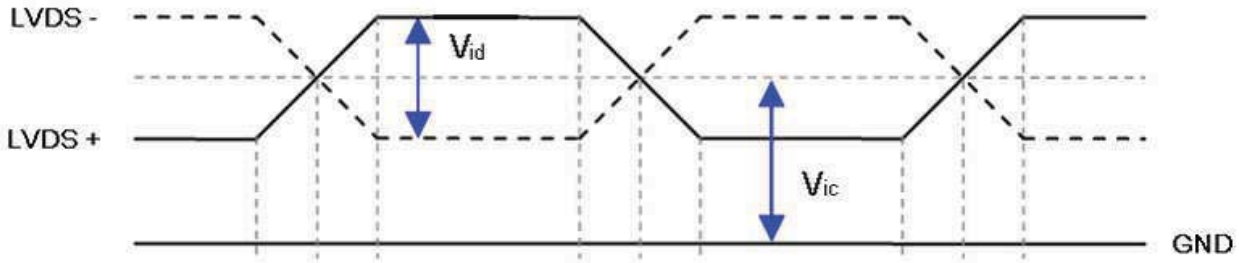
c. Vertical Stripe Pattern



Active Area

Note (4) The power consumption is specified at the pattern with the maximum current.

Note (5) VID waveform condition

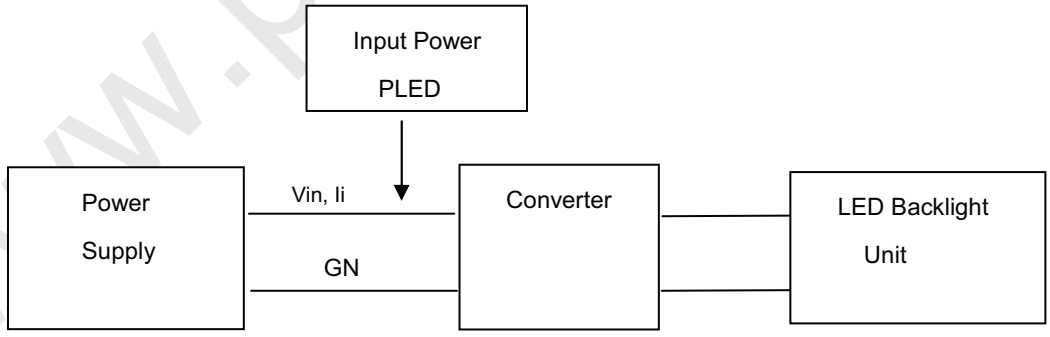


4.3.2 BACKLIGHT UNIT

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Power Supply Voltage		LED_Vin	10.8	12.0	13.2	V	
Converter Power Supply Current		Ii	0.1	0.17	2.0	A	@LED_Vin= 12V Duty=100%
Converter Input Rush Current		Iirsh		4.3		A	@LED_Vin rising = 1mS
Power Consumption		P_{LED}		2.0	2.3	W	@ LED_Vin = 12V Duty=100%
EN Control Level	Backlight on	LED_EN	2.0	3.3	5.0	V	
	Backlight off		0	-	0.15		
PWM Control Level	PWM High Level	LED_PWM	2.0	--	5.0	V	
	PWM Low Level		0	--	0.15		
PWM Control Duty Ratio			5	--	100	%	
PWM Control Frequency		f_{PWM}	190	200	300	Hz	
LED Life Time		L_L	(50,000)			Hrs	(2)

Note (1) LED light bar input voltage and current are measured by utilizing a true RMS multimeter as shown below:

Note (2) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at Ta = 25±2℃ and Duty 100% until the brightness becomes ≦ 50% of its original value. Operating LED under high temperature environment will reduce life time and lead to color shift.



4.4 LVDS INPUT SIGNAL SPECIFICATIONS

4.4.1 LVDS DATA MAPPING TABLE

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

4.5 DISPLAY TIMING SPECIFICATIONS

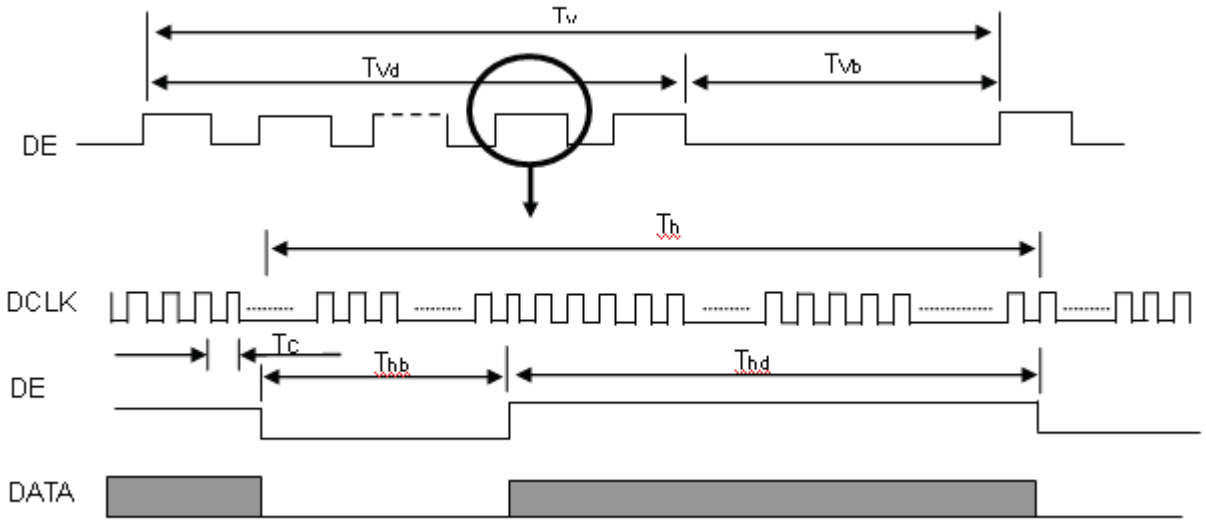
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	25.2	25.4	35.7	MHz	-
	Period	Tc		39.37		ns	
	Input cycle to cycle jitter	T_{rcl}	(-0.02*Tc)	-	(0.02*Tc)	ns	(3)
	Input clock to data skew	TLVCCS	(-0.02*Tc)	-	(0.02*Tc)	ns	(4)
	Spread spectrum modulation range	Fclkin_mod	(FC*98%)	-	(FC*102%)	MHz	(5)
	Spread spectrum modulation frequency	F_{SSM}	23	-	93	KHz	
Vertical Display Term	Frame Rate	Fr	-	60	-	Hz	Tv=Tvd+Tvb
	Total	Tv	488	490	611	Th	-
	Active Display	Tvd	480	480	480	Th	-
	Blank	Tvb	8	10	313	Th	-
Horizontal Display Term	Total	Th	860	864	974	Tc	Th=Thd+Thb
	Active Display	Thd	800	800	800	Tc	-
	Blank	Thb	60	64	174	Tc	-

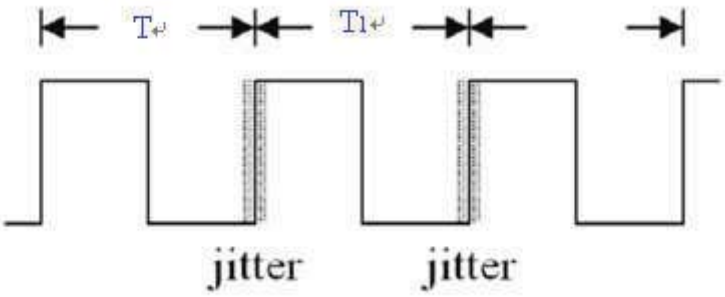
Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals are ignored.

Note (2) The Tv(Tvd+Tvb) must be integer, otherwise, this module would operate abnormally.

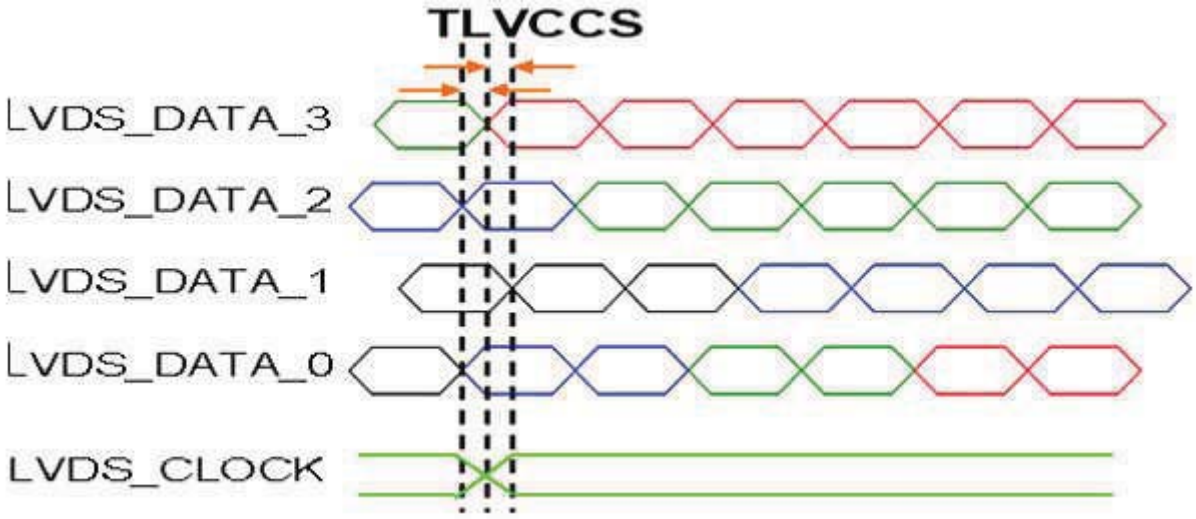
INPUT SIGNAL TIMING DIAGRAM



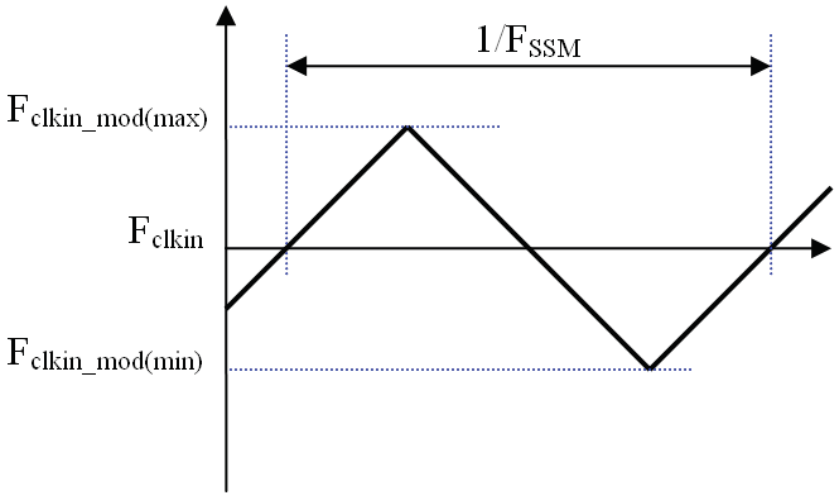
Note (3) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T_1 – TI



Note (4) Input Clock to data skew is defined as below figures.

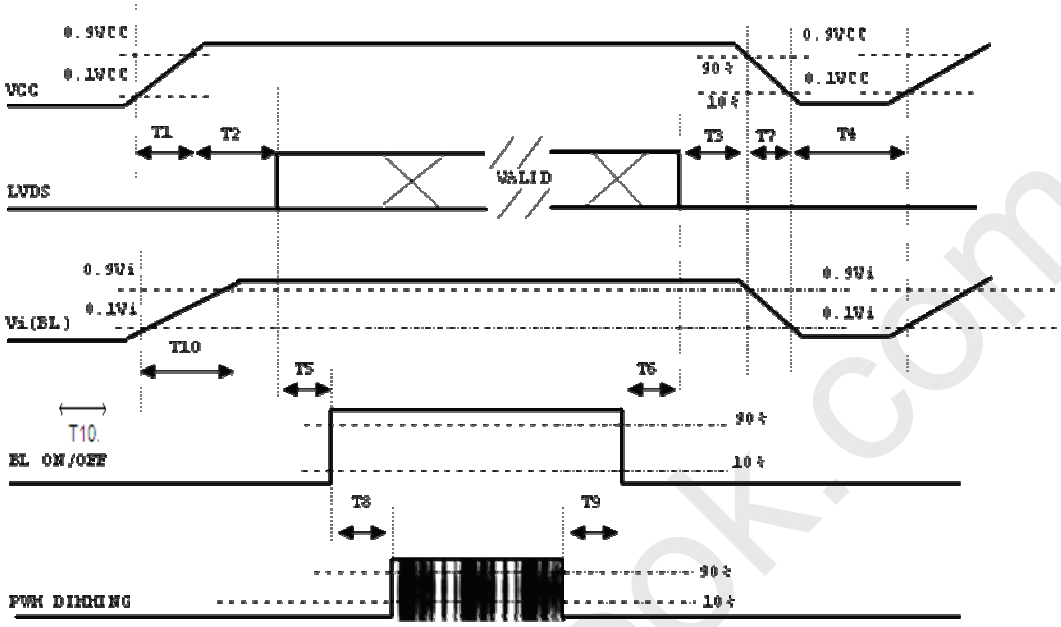


Note (5) The SSCG (Spread spectrum clock generator) is defined as below figures.



4.6 POWER ON/OFF SEQUENCE

The power sequence specifications are shown as the following table and diagram.



Timing Specifications:

Parameter	Value			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	500	-	-	ms
T5	450	-	-	ms
T6	200	-	-	ms
T7	10	-	100	ms
T8	10	-	-	ms
T9	10	-	-	ms
T10	20		50	

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.

5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

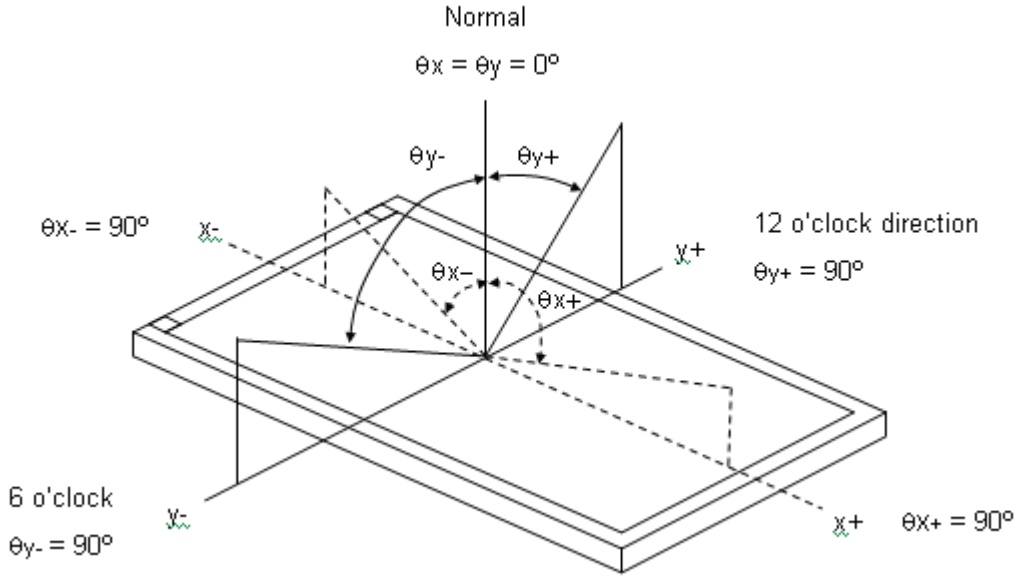
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	℃
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	According to typical value in "ELECTRICAL CHARACTERISTICS"		
Input Signal			
LED Light Bar Input Current Per Input Pin			

5.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 5.2 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 5.1 and stable environment shown in Note (5).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	Rx	θ_x=0°, θ_Y =0° CS-2000 R=G=B=255 Gray scale	Typ – 0.05	(0.625)	Typ + 0.05	-	(1), (5)
		Ry			(0.303)			
	Green	Gx			(0.307)			
		Gy			(0.630)			
	Blue	Bx			(0.150)			
		By			(0.050)			
	White	Wx			(0.313)			
		Wy			(0.315)			
Center Luminance of White		L_C		(360)	(500)	-	cd/m^2	(4), (5)
Contrast Ratio		CR		(600)	(800)	-	-	(2), (5)
Response Time		T_R	θ_x=0°, θ_Y =0°	-	(13)	-	ms	(3)
		T_F		-	(12)	-		
White Variation		W	θ_x=0°, θ_Y =0°	(70)	-	-	%	(5), (6)
Viewing Angle	Horizontal	θ_x+	CR ≧ 10	(80)	(89)	---	Deg.	(1), (5)
		θ_x-		(80)	(89)			
	Vertical	θ_Y+		(80)	(89)			
		θ_Y-		(80)	(89)	---		

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) = L255 / L0

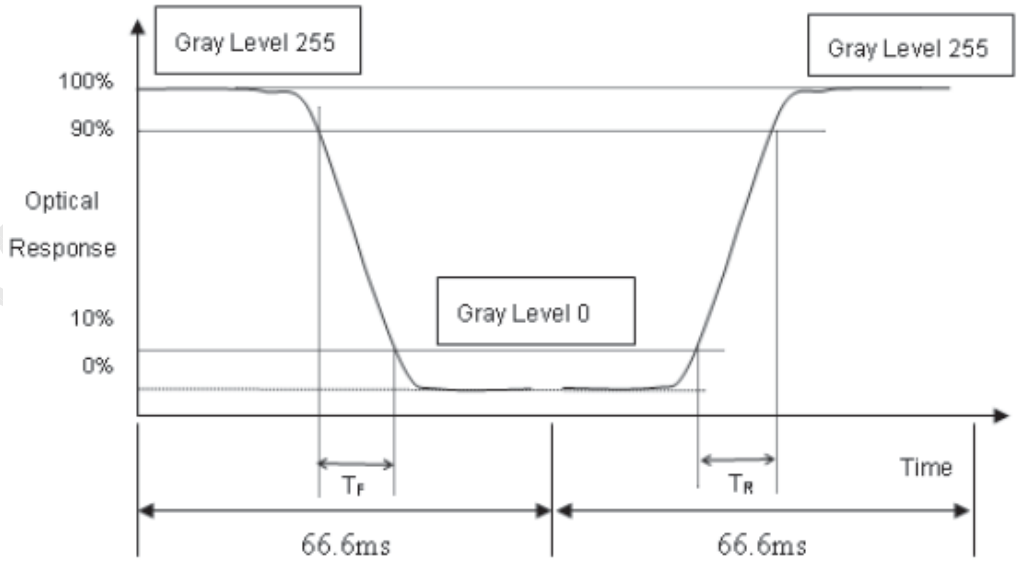
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

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



Note (4) Definition of Luminance of White (L_C):

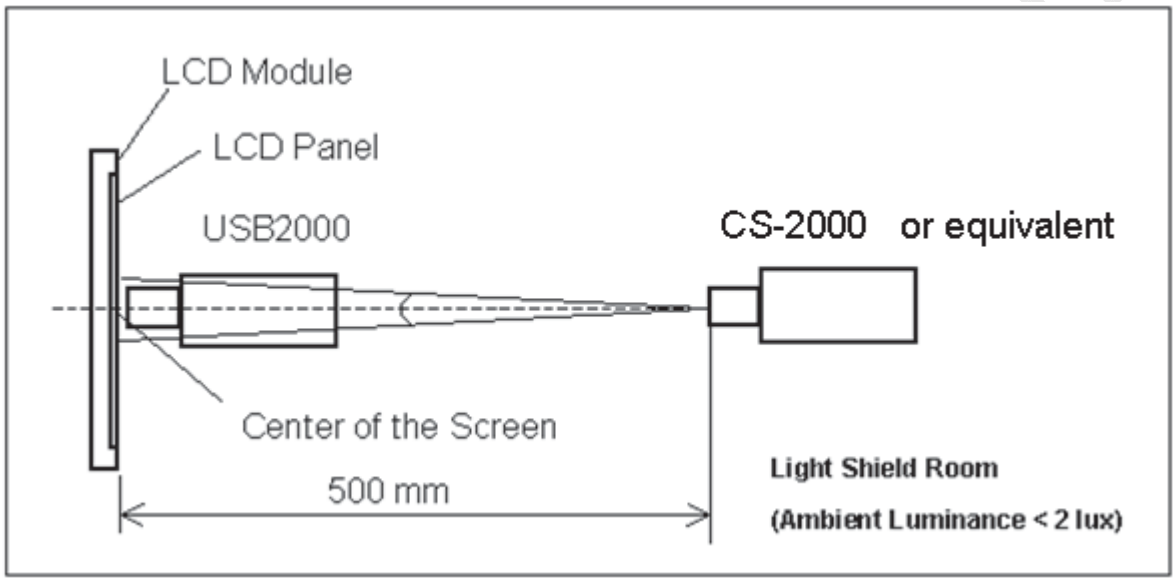
Measure the luminance of gray level 255 at center point

L_C = L (5)

L (x) is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

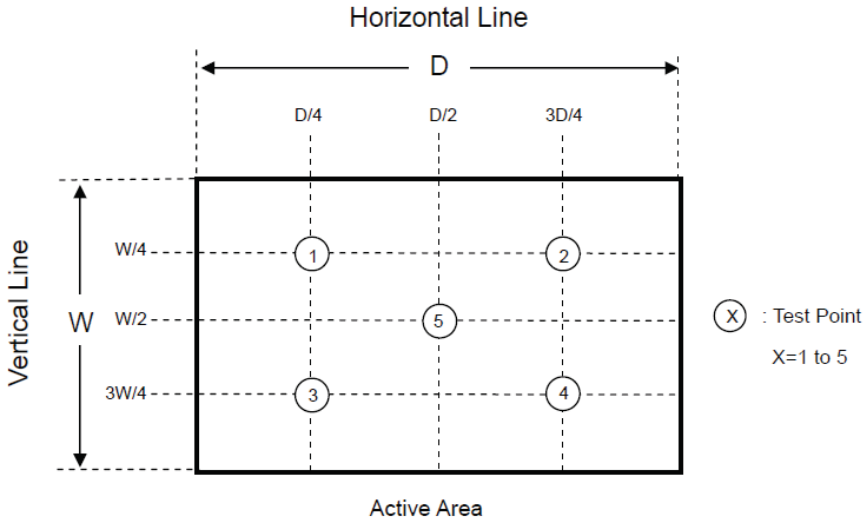
The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.



Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

δW = (Minimum [L (1) ~ L (5)] / Maximum [L (1) ~ L (5)]) *100%



6. RELIABILITY TEST ITEM

Test Item	Test Condition	Note
High Temperature Storage Test	90ºC, 240 hours	(1)(2) (4)(5)
Low Temperature Storage Test	-40ºC, 240 hours	
Thermal Shock Storage Test	-30ºC, 0.5hour←→80℃, 0.5hour; 1hour/cycle,100cycles	
High Temperature Operation Test	85ºC, 240 hours	
Low Temperature Operation Test	-30ºC, 240 hours	
High Temperature & High Humidity Operation Test	60ºC, 90%RH, 504hours	(1)(2) (4)(6)
Shock (Non-Operating)	50G, 11ms, half sine wave, 1 time for ± X, ± Y, ± Z.	(2)(3)
Vibration (Non-Operating)	1.5G, 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z	(2)(3)

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.

7. PACKING

7.1 PACKING SPECIFICATIONS

(1) 38 pcs LCD modules / 1 Box

(2) Box dimensions: 445 (L) X 370 (W) X 275 (H) mm

(3) Weight: approximately 8.3Kg (38modules per box)

7.2 PACKING METHOD

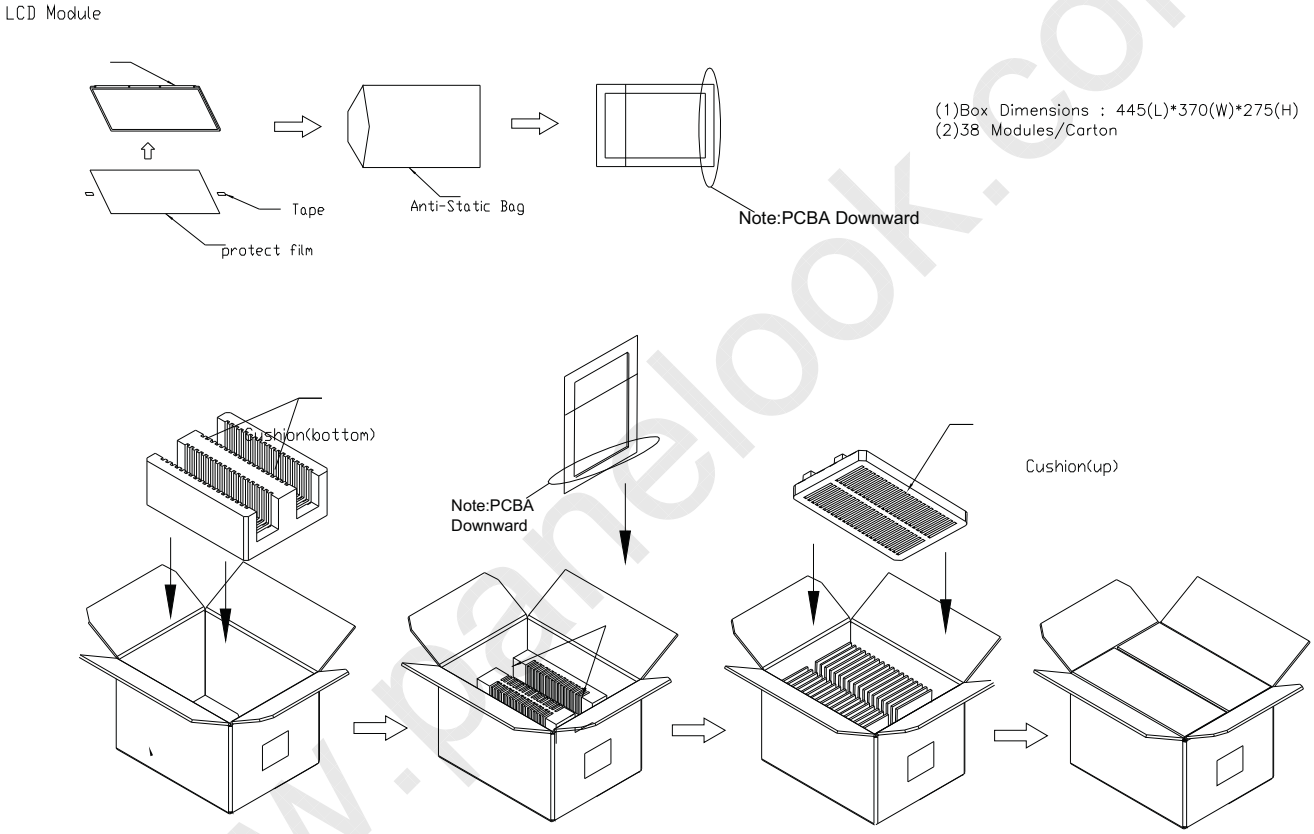


Figure. 7-1 Packing

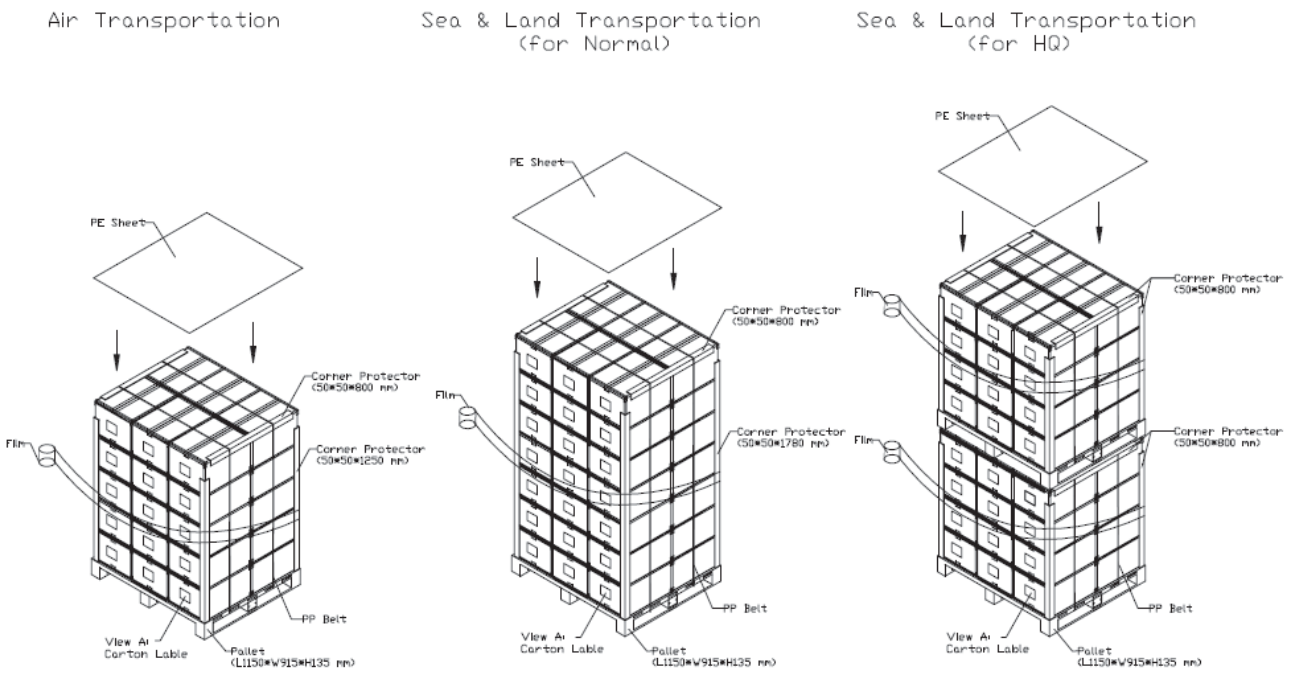


Figure. 7-2 Packing

7.3 UN-PACKING METHOD

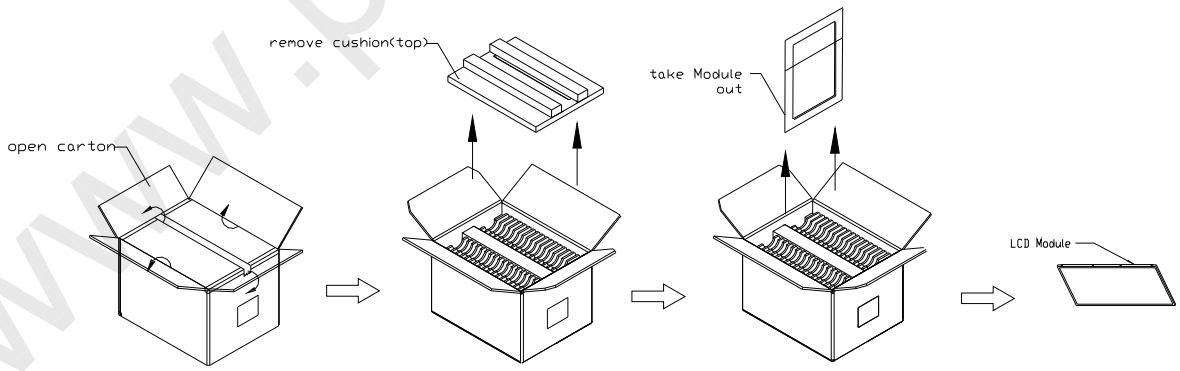
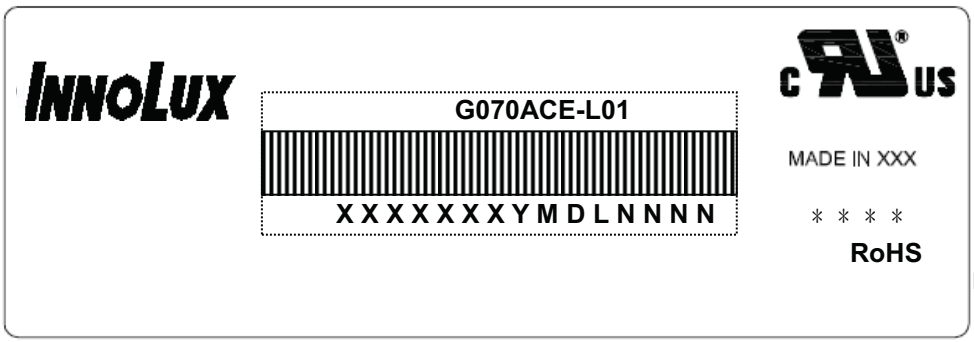


Figure. 7-3 UN-Packing

8. MODULE LABEL

8.1 INX MODULE LABEL

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

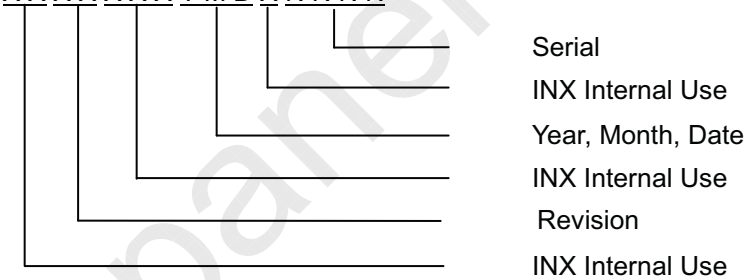


(a) Model Name: G070ACE-L01

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

(c) ＊ ＊ ＊ ＊ : Factory ID

(d) Serial ID: X X X X X X Y M D X N N N N



Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2011~2019

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

9. PRECAUTIONS

9.1 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℃ may reduce the display quality. For example, the response time will become slowly.

9.2 STORAGE PRECAUTIONS

(1) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0℃ to 35℃ and relative humidity of less than 70%

(2) Do not store the TFT – LCD module in direct sunlight

(3) The module should be stored in dark place. It is prohibited to apply sunlight or fluorescent light in storing

9.3 OPERATION PRECAUTIONS

(1) The LCD product should be operated under normal condition.

Normal condition is defined as below :

Temperature : 20±15℃

Humidity: 65±20%

Display pattern : continually changing pattern(Not stationary)

(2) If the product will be used in extreme conditions such as high temperature,high humidity,high altitude ,display pattern or operation time etc…It is strongly recommended to contact CMI for application engineering advice . Otherwise , Its reliability and function may not be guaranteed.

9.4 SAFETY PRECAUTIONS

(1) 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.

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

9.5 SAFETY STANDARDS

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

(1) UL60950-1 or updated standard.

(2) IEC60950-1 or updated standard.

9.6 OTHER

When fixed patterns are displayed for a long time, remnant image is likely to occur

1 MECHANICAL DESCRIPTION

1.1 Module drawing (2018-08-09)