Doc. Number :

☐ Tentative Specification
■ Preliminary Specification
☐ Approval Specification

MODEL NO.: G121ICE
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	Section	Description
Ver. 0.1	Apr.8,2019	All	Tentative Spec was first issued.
Ver. 1.0	Sep.2,2019	All	Preliminary Spec was first issued.
Ver. 1.1	Dec.27,2019	10	Update the Mechanical Characteristics.
Ver. 1.2	Feb.21,2020	1.2	Add Color Gamma and modify Power Consumption.
		2	Modify the Typ of weight.
		4.2	Add the description of Note(1).
		4.3.1	Modify the Typ and Max of Power Supply Current.
		4.3.2	Modify the note of LED Converter inrush current.
			Add the the Max of Input Power Consumption.
		5.2	Modify the Typ. of Viewing Angle.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

G121ICE-L01 is a 12.1" TFT Liquid Crystal Display module with LED Backlight unit LVDS interface. This module supports 1280 x 800 Wide-XGA AAS mode and can display 262k/16.7M colors . The LED converter for Backlight is built in control board.

1.2 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Screen Size	12.1" real diagonal		
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1280 x R.G.B. x 800	pixel	-
Pixel Pitch	0.204(H) x 0.204 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262k/16.7M	color	-
Transmissive Mode	Normally Black	-	-
Surface Treatment	AG type, 3H hard coating	-	-
Luminance, White	(600)	Cd/m2	
Color Gamma	72	%	NTSC
Power Consumption	11.35W (white pattern)	W	Typ. (2)

2. MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	277.5	278	278.5	mm	(1)
	Vertical (V)	183.5	184	184.5	mm	
	Thickness (T)	9.5	10	10.5	mm	
Bezel Area	Horizontal	263.82	264.12	264.42	mm	
	Vertical	165.9	166.2	166.5	mm	
Active Area	Horizontal	-	261.12	-	mm	
	Vertical	-	163.2	-	mm	
Weight		-	470	490-	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

(2) The Module Power Consumption is specified at 3.3V, white pattern and 100% duty for LED backlight.

3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	TST	(-30)	(85)	ºC	(1)
Operating Ambient Temperature	TOP	(-30)	(80)	ºC	(1), (2)

Note (1)

(a) 90 %RH Max. (Ta <= 40 ºC).

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

(c) No condensation.

3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 TFT LCD MODULE

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

3.2.2 BACKLIGHT UNIT

Item	Value			Unit	Note
	Min	Typ.	Max.		
LED Converter Input voltage	10.8	12.0	13.2	V_{DC}	(1), (2)
LED Converter Input Current	-	(0.8)	-	A_{DC}	

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 Section 3.2 for further information).

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM
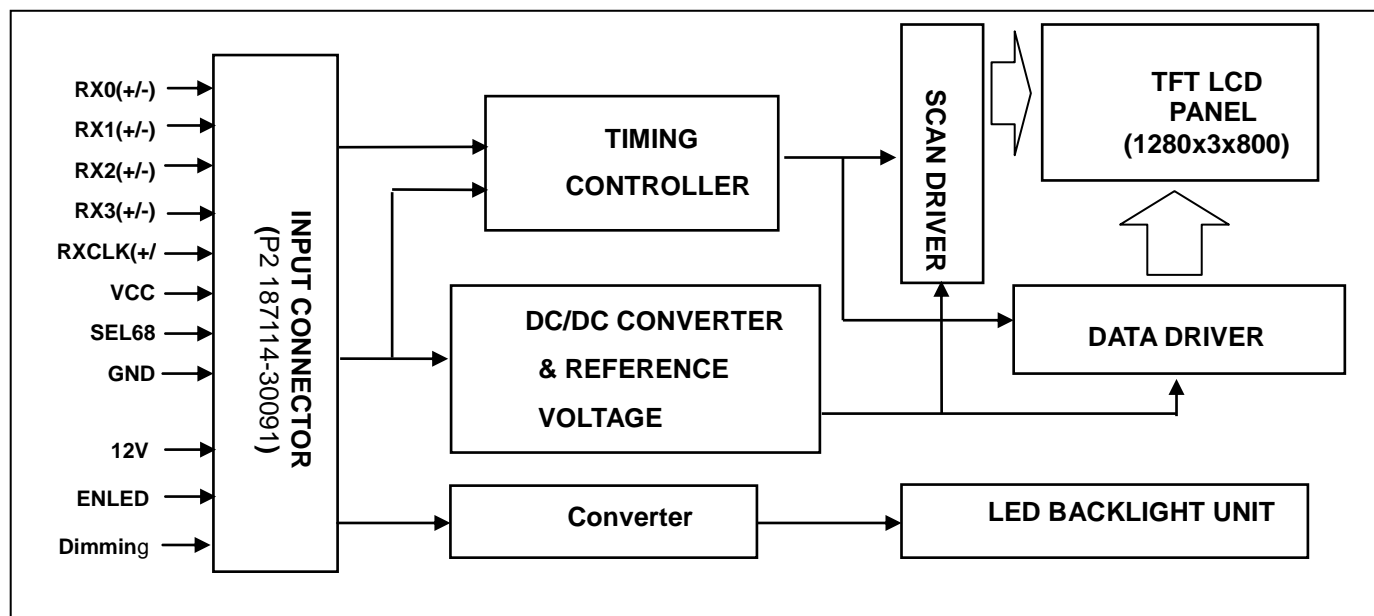
4.2. INTERFACE CONNECTIONS

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	(3)
6	Dimming	Backlight Adjust	(3)
7	NC	No Connection or Ground	-
8	NC	No Connection or Ground	-
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	-

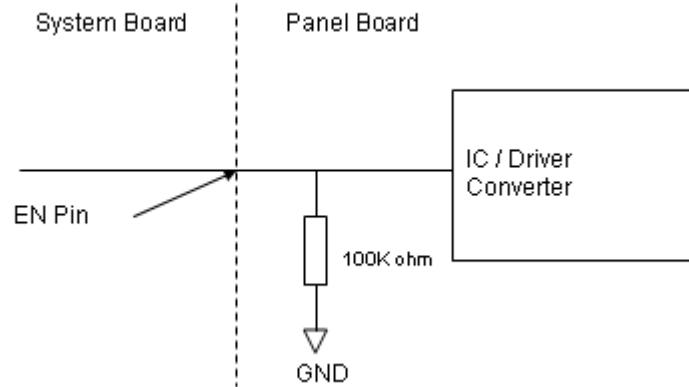| 16	RX1-	Negative transmission data of pixel 1	-
17	RX1+	Positive transmission data of pixel 1	-
18	GND	Ground	-
19	RX2-	Negative transmission data of pixel 2	-
20	RX2+	Positive transmission data of pixel 2	-
21	GND	Ground	-
22	RXCLK-	Negative of clock	-
23	RXCLK+	Positive of clock	-
24	GND	Ground	-
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 → 8bit Input Mode	(2) (3)
29	GND	Ground	-
30	NC	No Connection or Ground	-

Note (1)   Connector Part No.: P2 187114-30091

　　　　User's connector Part No.; JAE FI-X30HL or FI-X30HL-B or equivalent.

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

Note (3) ENLED(BLON), Dimming(E_PWM), SEL6/8 as shown below :

BLON Pin

System Board | Panel Board

EN Pin → IC / Driver Converter

100K ohm

GND

E_PWM Pin

System Board | Panel Board

Dimming Pin → IC / Driver Converter

500K ohm

GND

SEL6/8

System Board | Panel Board

Interface Voltage Level

$V_H > V_{IH}$

$V_L > V_{IL}$

IC / Driver System

1M Ohm

GND
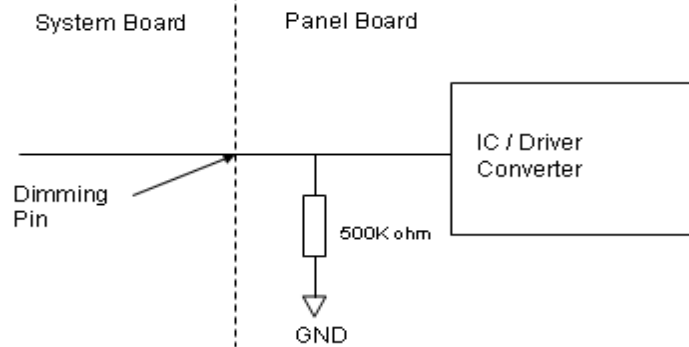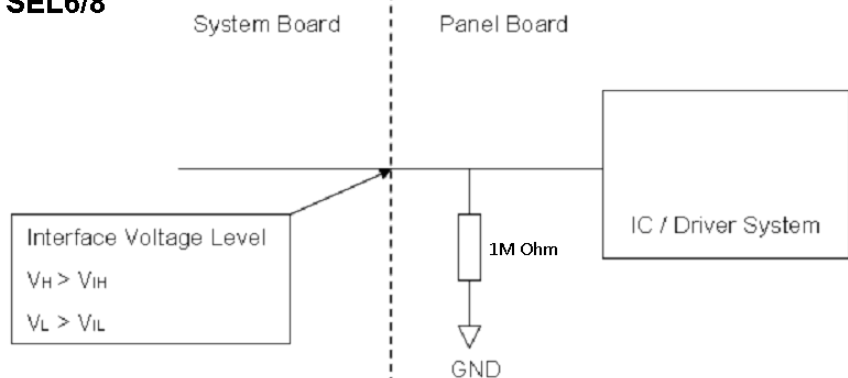
4.3 ELECTRICAL CHARACTERISTICS

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	-
Permissive 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	-	-	530	630	mA	(3)a
	Black	-	-	350	420	mA	(3)b
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:
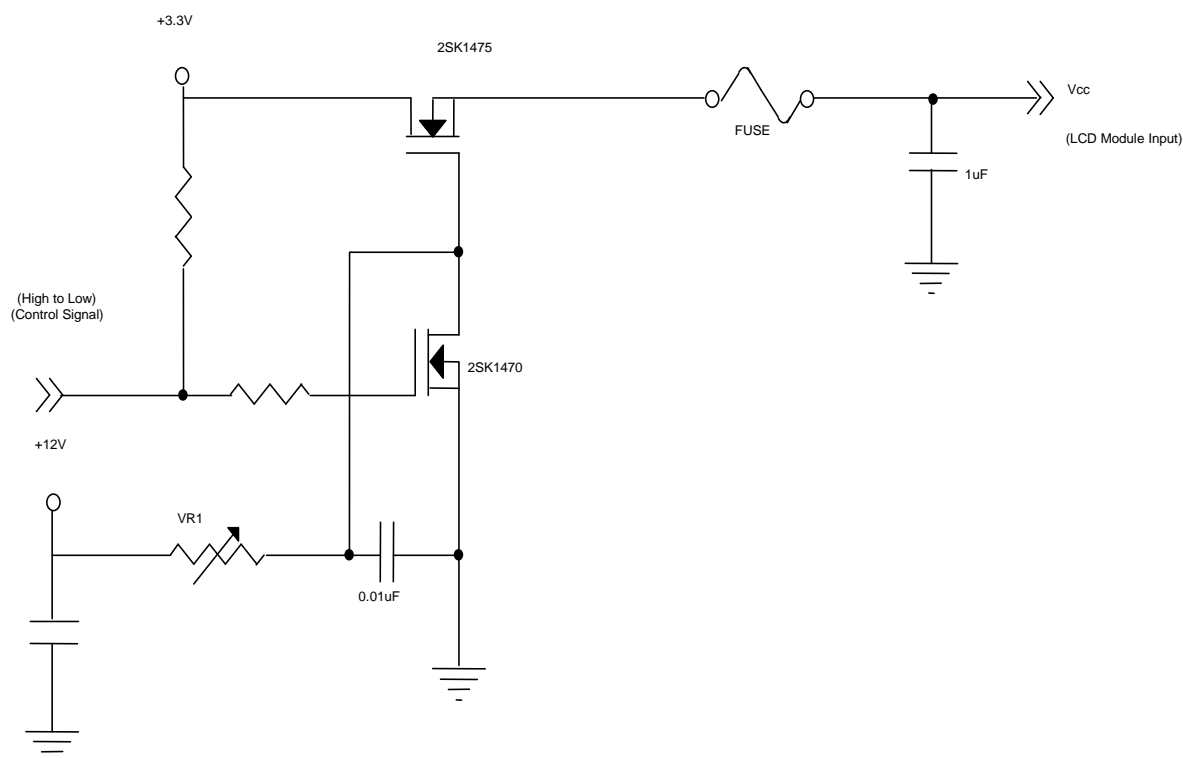
VCC rising time is 470us

+3.3V

0.9Vcc

0.1Vcc

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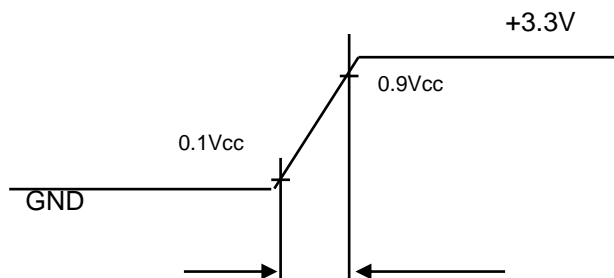
Note (3)The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz, whereas a power dissipation check pattern below is
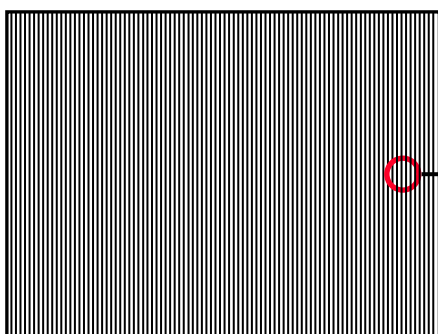
a. White Pattern

Active Area

b. Black Pattern
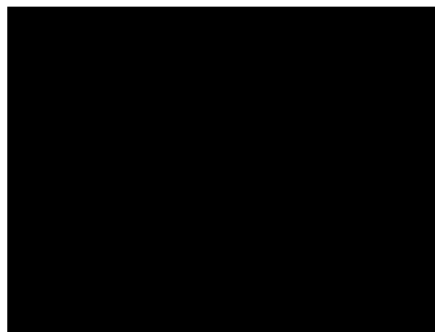
Active Area

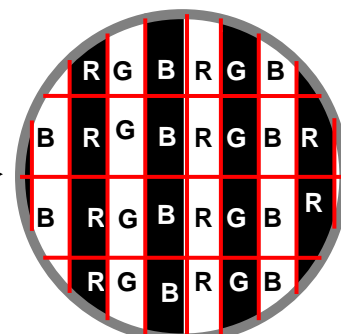c. Vertical Stripe Pattern

Active Area

4.3.2 BACKLIGHT UNIT

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
(LED Converter input voltage)		V_i	10.8	12.0	13.2	V_{DC}	(Duty 100%)
(LED Converter input ripple voltage)		Vi_{RP}	-	-	350	mV	
(LED Converter input current)		I_i	-	0.8	1.0	A_{DC}	@ Vi = 12V (Duty 100%)
(LED Converter inrush current)		Ii_{RUSH}	-	-	3.0	A	@ Vi rising time=20ms (Vi=12V)
Input Power Consumption		P_i	-	(9.6)	**12**	W	(1)
EN Control Level	Backlight on	ENLED (BLON)	2.5	3.3	5.0	V	
	Backlight off		0	---	0.3	V	
PWM Control Level	PWM High Level	Dimming (E_PWM)	2.5	---	5.0	V	
	PWM Low Level		0	---	0.15	V	
PWM Control Frequency		f_{PWM}	190	200	20k	Hz	(3)
PWM Noise Range		VNoise	-	-	0.1	V	
PWM Control Duty Ratio		-	5		100	%	(3), Suggestion @ 190Hz$\leq f_{PWM}$<1kHz
			20		100	%	(3), @ 1kHz$\leq f_{PWM} \leq$20kHz
LED Life Time		L_{BL}	50000	-	-	Hrs	(2)

Note (1)LED current is measured by utilizing a high frequency current meter as shown below:
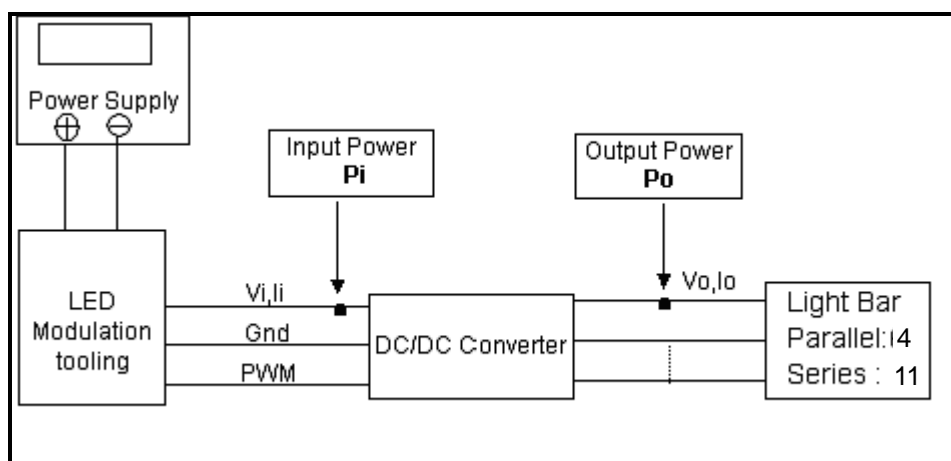
Note (2) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at Ta = 25 ±2 °C and Duty 100% until the brightness becomes $\leq$ 50% of its original value. Operating LED at high temperature condition will reduce life time and lead to color shift.

Note (3) At 190 ~1kHz PWM control frequency, duty ratio range is restricted from 5% to 100%.

　　　　1K ~20kHz PWM control frequency, duty ratio range is restricted from 20% to 100%.

If PWM control frequency is applied in the range from 1KHz to 20KHZ, The "non-linear" phenomenon on the Backlight Unit may be found. So It's a suggestion that PWM control frequency should be less than **1K**Hz.

4.4 LVDS INPUT SIGNAL SPECIFICATIONS

4.4.1 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.

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

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.

Color		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
		Red								**Green**								**Blue**							
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/ Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note: 0: Low Level Voltage, 1: High Level Voltage
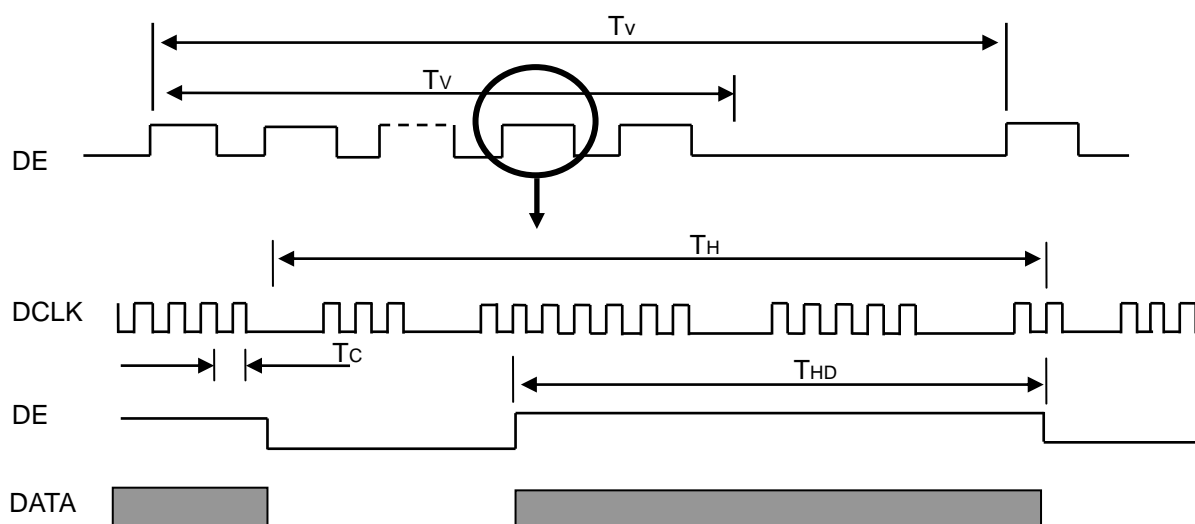
4.5 DISPLAY TIMING SPECIFICATIONS

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	66.1	71	74.7	MHz	-
	Period	Tc	13.4	14.1	15.1	ns	
	Input cycle to cycle jitter	T_{rcl}	---	---	200	ns	(a)
	Input Clock to data skew	TLVCCS	-0.02*Tc	---	0.02*Tc	ps	(b)
	Spread spectrum modulation range	F_{clkin_mod}	---	---	1.02*Fc	MHz	(c)
	Spread spectrum modulation frequency	F_{SSM}	---	---	200	KHz	
	High Time	T_{ch}	---	4/7	---	T_{ch}	
	Low Time	T_{cl}	---	3/7	---	T_{ch}	
Vertical Display Term	Frame Rate	Fr	---	60	---	Hz	Tv=Tvd+Tvb
	Total	Tv	810	823	830	Th	-
	Active Display	Tvd	800	800	800	Th	-
	Blank	Tvb	10	23	30	Th	-
Horizontal Display Term	Total	Th	1360	1440	1500	Tc	Th=Thd+Thb
	Active Display	Thd	1280	1280	1280	Tc	-
	Blank	Thb	80	160	220	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.

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

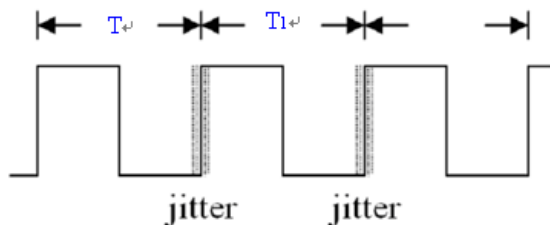## INPUT SIGNAL TIMING DIAGRAM

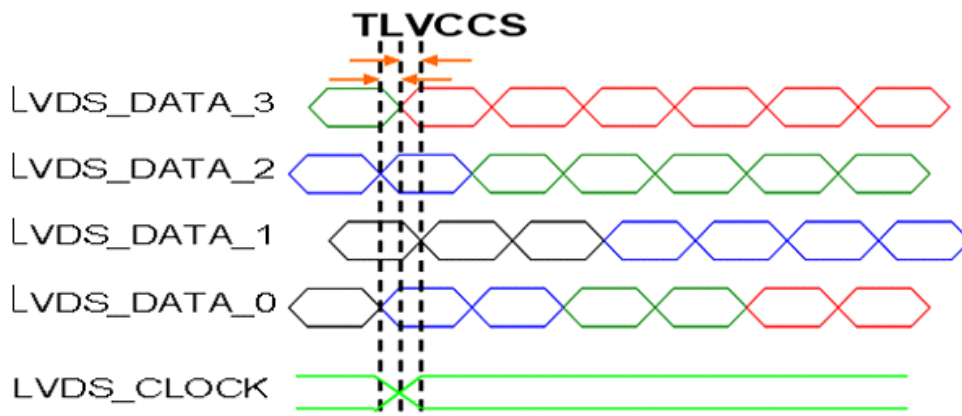**TIMING DIAGRAM of LVDS**

|							
Rx IN3	RxOUT23	RxOUT17	RxOUT16	RxOUT11	RxOUT10	RxOUT5	RxOUT27
	RESERVED	B07	B06	G07	G06	R07	R06
Rx IN2	RxOUT26	RxOUT25	RxOUT24	RxOUT22	RxOUT21	RxOUT20	RxOUT19
	DE	GND	GND	B05	B04	B03	B02
Rx IN1	RxOUT18	RxOUT15	RxOUT14	RxOUT13	RxOUT12	RxOUT9	RxOUT8
	B01	B00	G05	G04	G03	G02	G01
Rx IN0	RxOUT7	RxOUT6	RxOUT4	RxOUT3	RxOUT2	RxOUT1	RxOUT0
	G00	R05	R04	R03	R02	R01	R00

TxCLK OUT / RxCK IN — T, T/7

Note (a) The input clock cycle-to-cycle jitter is defined as below figures. $Trcl = | T_1 – T |$

T, T1, jitter, jitter

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

TLVCCS

LVDS_DATA_3
LVDS_DATA_2
LVDS_DATA_1
LVDS_DATA_0
LVDS_CLOCK

Note (c) The SSCG (Spread spectrum clock generator) is defined as below figures.
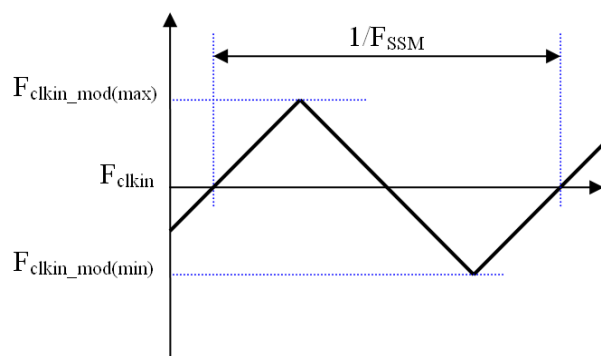
4.6 POWER ON/OFF SEQUENCE

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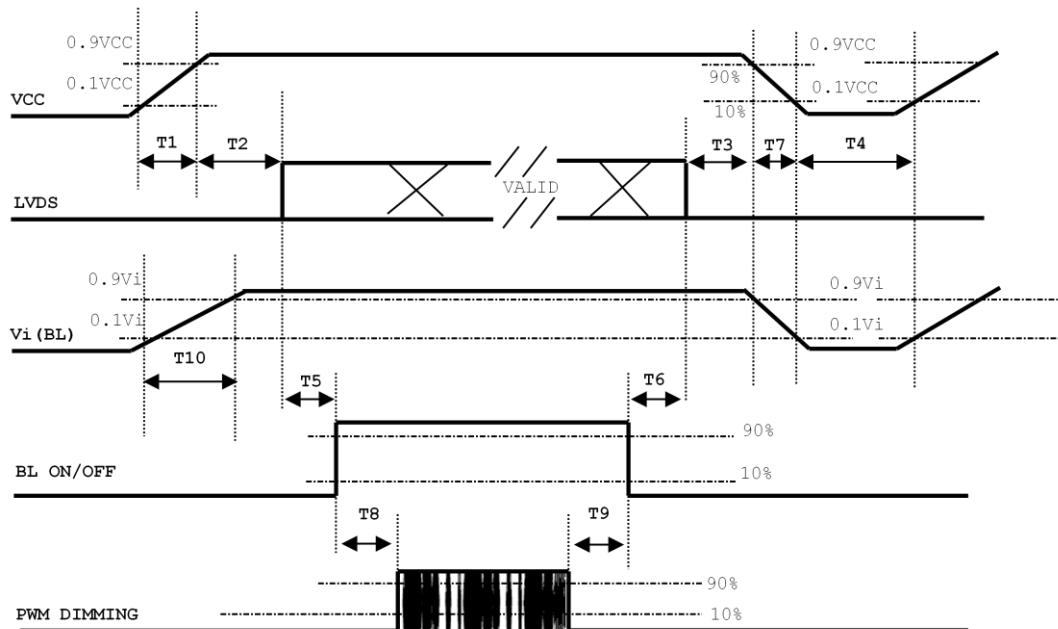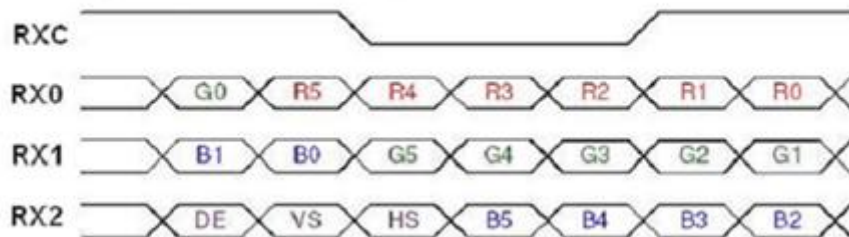

Note:

(1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.

(2) When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become abnormal screen.

(3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.

(4) T4 should be measured after the module has been fully discharged between power off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

(6) INX won't take any responsibility for the products which are damaged by the customers not following the Power Sequence.

(7) There might be slight electronic noise when LCD is turned off (even backlight unit is also off). To avoid this symptom, we suggest "Vcc falling timing" to follow "T7 spec".

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	ms

The Input Data Format

SEL 6/8="Low" for 6 Bits LVDS

RXC
RX0: G0, R5, R4, R3, R2, R1, R0
RX1: B1, B0, G5, G4, G3, G2, G1
RX2: DE, VS, HS, B5, B4, B3, B2

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

RXC
RX0: G0, R5, R4, R3, R2, R1, R0
RX1: B1, B0, G5, G4, G3, G2, G1
RX2: DE, VS, HS, B5, B4, B3, B2
RX3: RSV, B7, B6, G7, G6, R7, R6
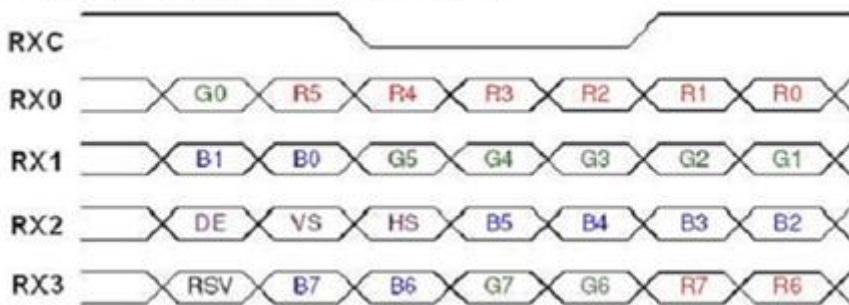
Note (1)   R/G/B data 7: MSB, R/G/B data 0: LSB

Note (2)   Please follow PSWG

Signal Name	Description	Remark
R7	Red Data 7 (MSB)	Red-pixel Data
R6	Red Data 6	Each red pixel's brightness data consists of these
R5	Red Data 5	8 bits pixel data.
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
G6	GreenData 6	Each green pixel's brightness data consists of these
G5	GreenData 5	8 bits pixel data.
G4	GreenData 4	
G3	GreenData 3	
G2	GreenData 2	
G1	GreenData 1	
G0	GreenData 0 (LSB)	
B7	Blue Data 7 (MSB)	Blue-pixel Data
B6	Blue Data 6	Each blue pixel's brightness data consists of these
B5	Blue Data 5	8 bits pixel data.
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	

5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

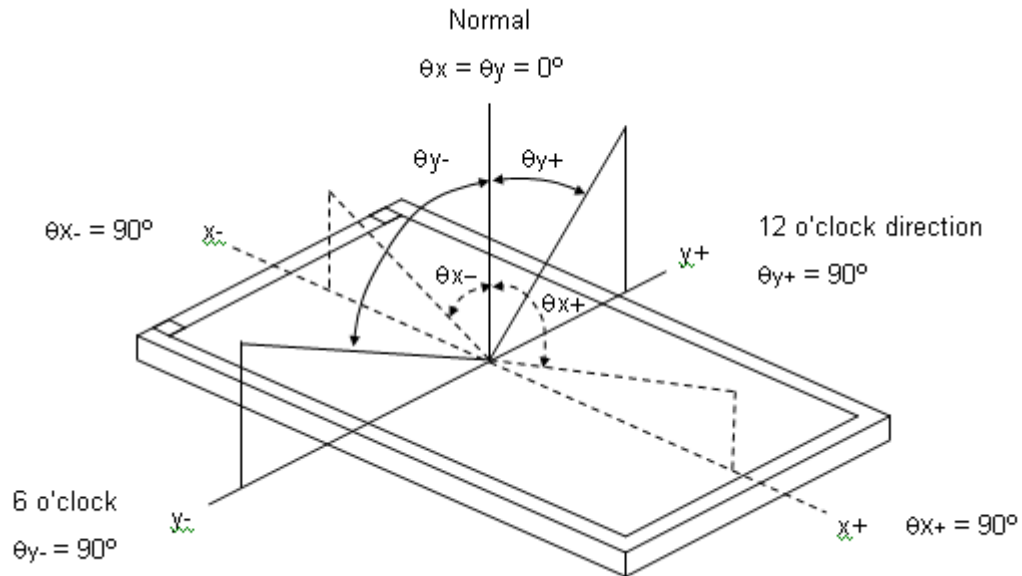| Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Convertor Voltage		According to typical value in "3. ELECTRICAL CHARACTERISTICS"	
Convertor Duty			

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).

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5.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 5.2. 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
Contrast Ratio			CR		800	1000	-	-	(2), (5)
Response Time			T_R		-	12	17	ms	(3)
			T_F		-	8	13	ms	
Luminance of White			L_c		480	600	-	cd/m^2	(4), (5)
White Variation			δW	$\theta_x=0°,\theta_Y=0°$ Viewing Normal Angle	-	1.25	1.4	-	(5), (6)
Color Chromaticity	Red	Rx				0.652		-	(1), (5)
		Ry				0.338		-	
	Green	Gx			Typ. - 0.05	0.326	Typ. + 0.05	-	
		Gy				0.608		-	
	Blue	Bx				0.150		-	
		By				0.053		-	
	White	Wx				0.313		-	
		Wy				0.329		-	
Viewing Angle	Horizontal	θ_x+		CR≥10	80	85	-	Deg.	(1), (5)
		θ_x-			80	85	-		
	Vertical	θ_Y+			80	85	-		
		θ_Y-			80	85	-		

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.
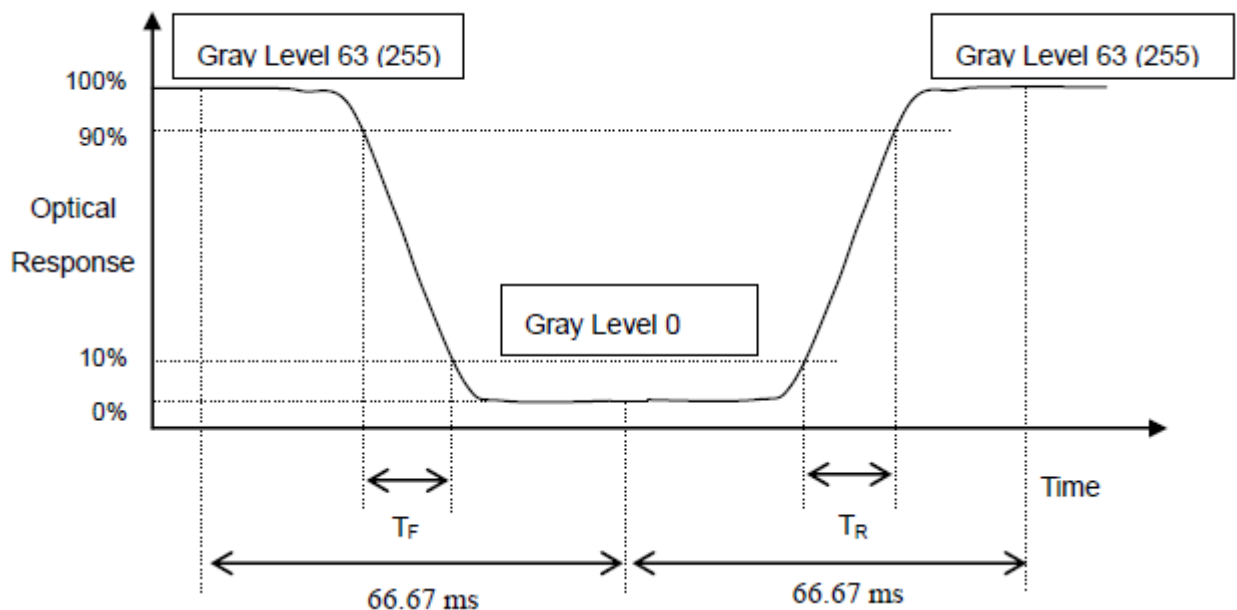
Contrast Ratio (CR) = L255 / L0

L63: 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):
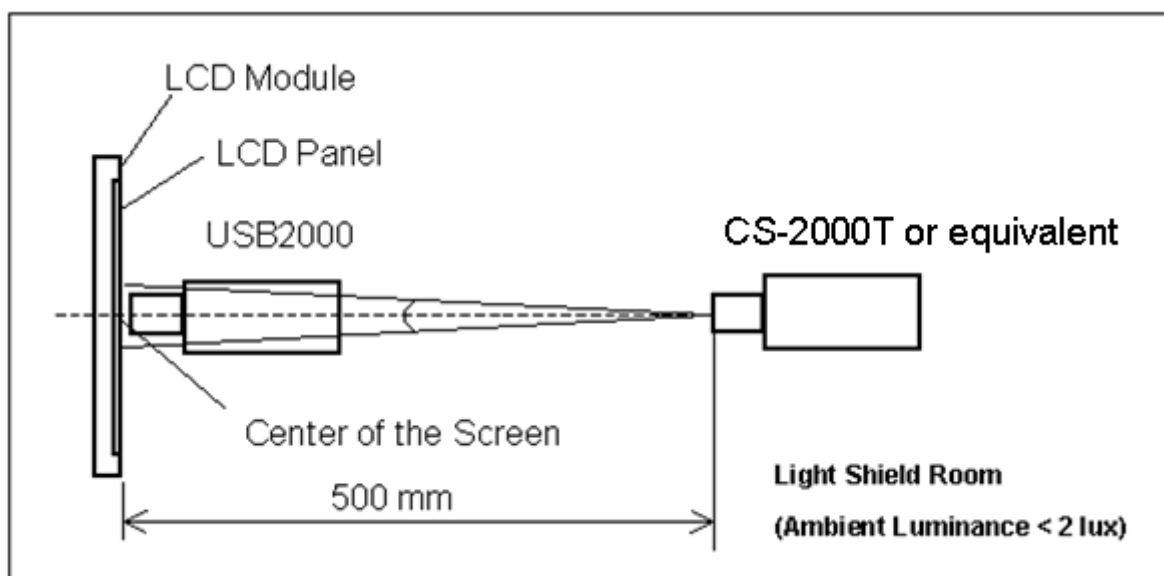
Note (4) Definition of Luminance of White (L_c):

Measure the luminance of gray level 255 at center points

$L_c = L (5)$

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 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.

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

Measure the luminance of gray level 255 at 5 points

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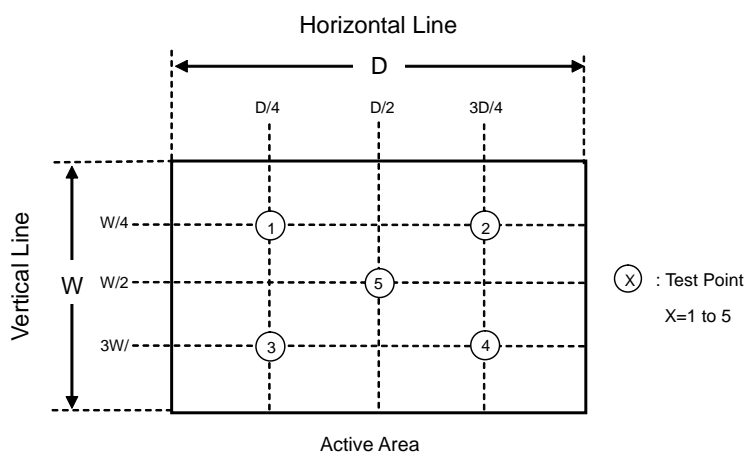
6. Reliability Test Criteria

Test Item	Test Condition	Note
High Temperature Storage Test	85ºC, 240 hours	(1),(2) (4),(5)
Low Temperature Storage Test	-30ºC, 240 hours	
Thermal Shock Storage Test	-30ºC, 0.5hour⟷85℃, 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.	(2)(3)
Vibration (Non-Operating)	1.5G / 10-500 Hz, Sine wave, 30 min/cycle, 1cycle for 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 90 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
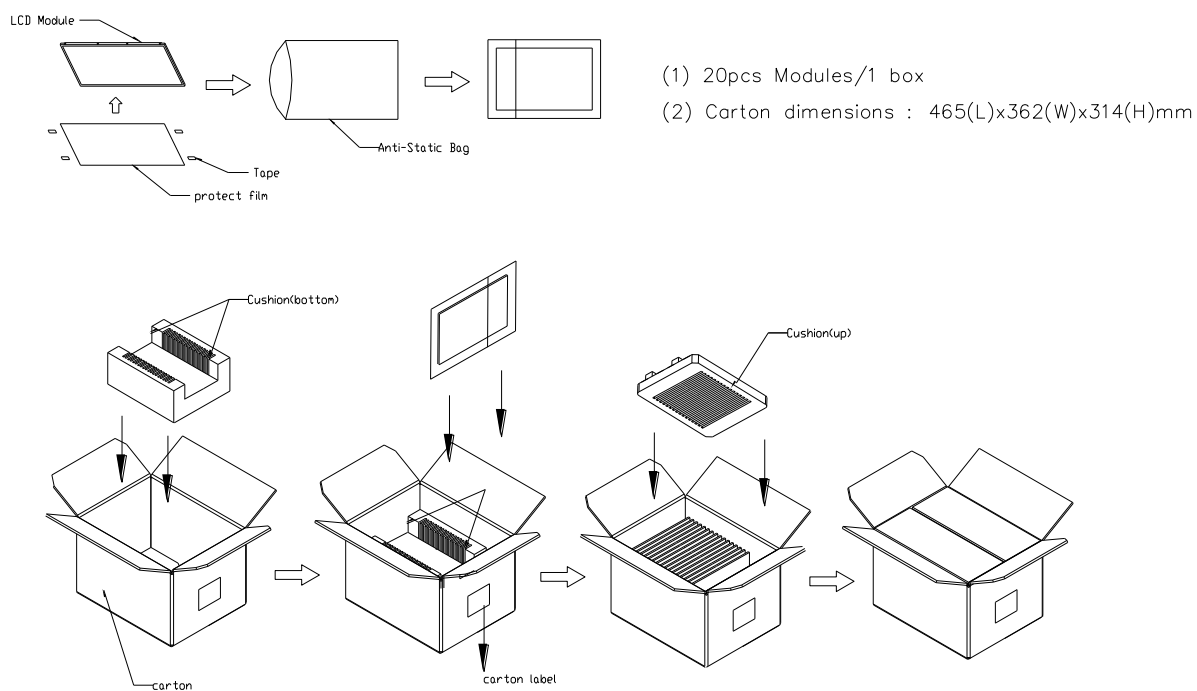
temperature.

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

temperature.

7. PACKAGING

7.1 PACKING SPECIFICATIONS

(1) 20pcs LCD modules / 1 Box

(2) Box dimensions: 465 (L) X 362 (W) X 314 (H) mm
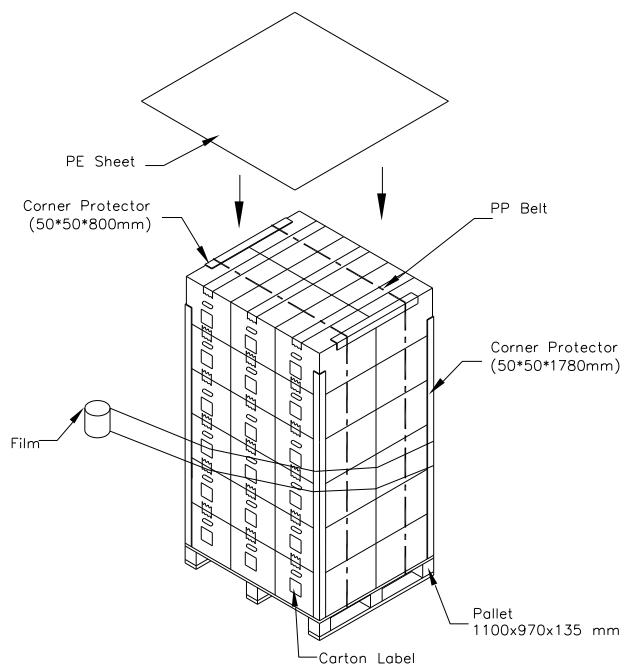
(3) Weight: approximately 17Kg (20 modules per box)

7.2 PACKING METHOD

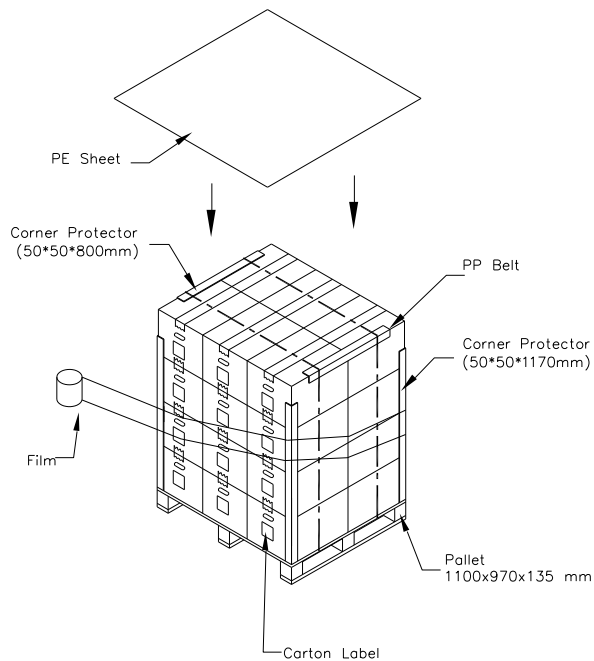(1) 20pcs Modules/1 box

(2) Carton dimensions : 465(L)x362(W)x314(H)mm

Figure. 7-1 Packing

Sea / Land Transportation (40ft Container)　　　　　　　　　Air Transportation

PE Sheet

Corner Protector
(50*50*800mm)

PP Belt

Corner Protector
(50*50*1780mm)

Film

Pallet
1100x970x135 mm

Carton Label

PE Sheet

Corner Protector
(50*50*800mm)

PP Belt

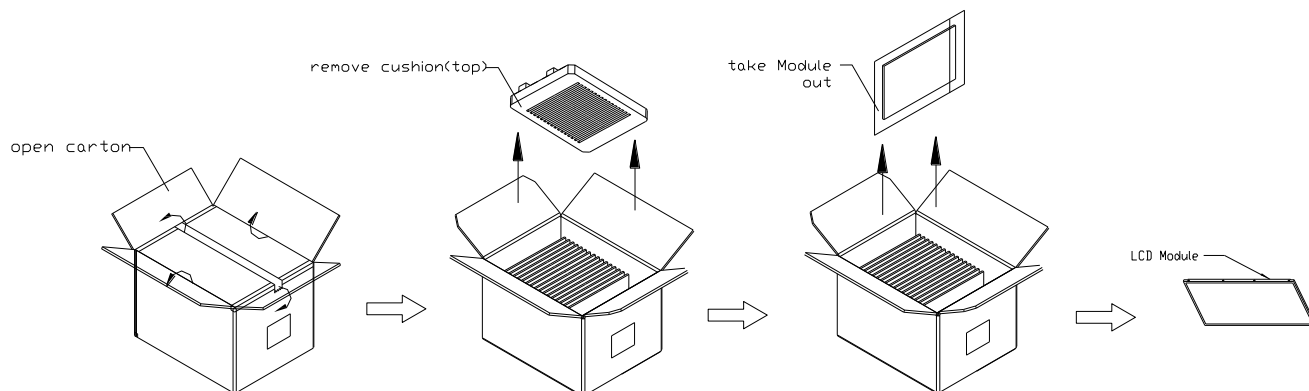Corner Protector
(50*50*1170mm)

Film

Pallet
1100x970x135 mm

Carton Label

Figure. 7-2 Packing

7.3 UN-PACKING METHOD

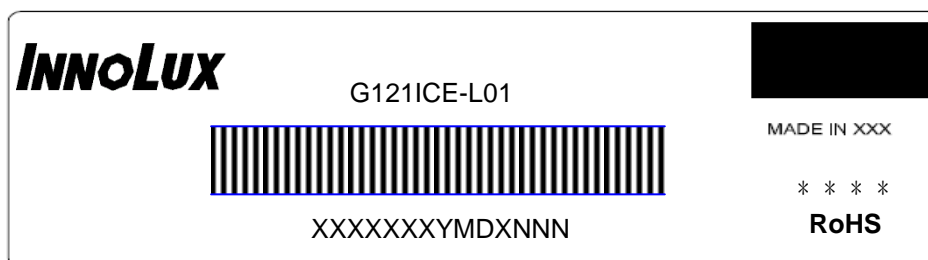
Figure. 7-3 UN-Packing

8. MODULE LABEL

8.1 MODULE LABEL

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

8.1 SN Label Definition

INX Barcode Definition
(a)Model Name: G121ICE-L01
(b)Revision: Rev. XX, for example: A1, B1, C1, C2 …etc.

(c)∗ ∗ ∗ ∗ : Factory ID

  "LEOO" for Ningbo NA

  "VIRO" for Ningbo NB,NC

  "COCKN" for Ningbo ND

  "GEMN" for Tainan LCM1,LCM4

(d)Serial ID: XX-XX-X-XX-YMD-X-NNNN

Code	Meaning	Description
XX	INX internal use	Model Code
XX	Revision	Cover all the change
X	INX internal use	Fab ID
XX	INX internal use	Dash Code
YMD	Year, month, day	Year: 2011=1, 2012=2, 2013=3, 2014=4… 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.
X	INX internal use	Grade Code
NNNN	Serial number	Manufacturing sequence of product

9. PRECAUTIONS

9.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.

(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.

(5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.

(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(9) Do not disassemble the module.

(10) Do not pull or fold the lamp wire.

(11) Pins of I/F connector should not be touched directly with bare hands.

9.2 STORAGE PRECAUTIONS

(1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.

(3) It may reduce the display quality if the ambient temperature is lower than 10 ºC. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

9.3 OPERATION PRECAUTIONS

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

(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

(3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with converter. Do not disassemble the module or insert anything into the Backlight unit.

9.4 OTHER PRECAUTIONS

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

10. MECHANICAL CHARACTERISTICS