InnoLux
群創光電

☐ Tentative Specification
☐ Preliminary Specification
■ Approval Specification

MODEL NO.: N116BCA
SUFFIX: EA1 Rev.C1

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
陳立錚	林秋森	許文進

CONTENTS

REVISION HISTORY

Version	Date	Page	Description
3.0	March.14, 2018	All	Spec Ver.3.0 was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

N116BCA-EA1 is a 11.6" (11.6" diagonal) TFT Liquid Crystal Display NB module with LED Backlight unit and 30 pins eDP interface. This module supports 1366 x 768 HD mode and can display 262,144 colors.

1.2 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Screen Size	11.6 diagonal		
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1366 x R.G.B. x 768	pixel	-
Pixel Pitch	0.1875 (H) x 0.1875 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally black	-	-
Surface Treatment	Hard coating (3H), Anti-Glare	-	-
Luminance, White	250(typ.)	Cd/m2	
Color Gamut	50%	NTSC	
Power Consumption	Total 2.362W (Max.) @ cell 0.538 W (Max.), BL 1.824 W (Max.)		(1)

SSC(Internally)	PSR	MBO	G-sync	NVSR
Not support	Not support	Not support	Not support	Not support

Note (1) The specified power consumption (with converter efficiency) is under the conditions at VCCS = 3.3 V, fv = 60 Hz, LED_VCCS = Typ, fPWM = 200 Hz, Duty=100% and Ta = 25 ± 2 ºC, whereas mosaic pattern is displayed.

2. MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	267.5	268	268.5	mm	Without bracket (1), (2)
	Vertical (V)	157.5	158	158.5	mm	
	Thickness (T)	-	2.78	3.0	mm	
Active Area	Horizontal	256.03	256.13	256.23	mm	
	Vertical	143.9	144	144.1-	mm	
Weight		-		200	g	

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

(2) Dimensions are measured by caliper.

2.1 CONNECTOR TYPE

Please refer appendix outline drawing for detail design.

Connector Part No.: IPEX-20455-030E-12

User's connector Part No: IPEX-20453-030T-03

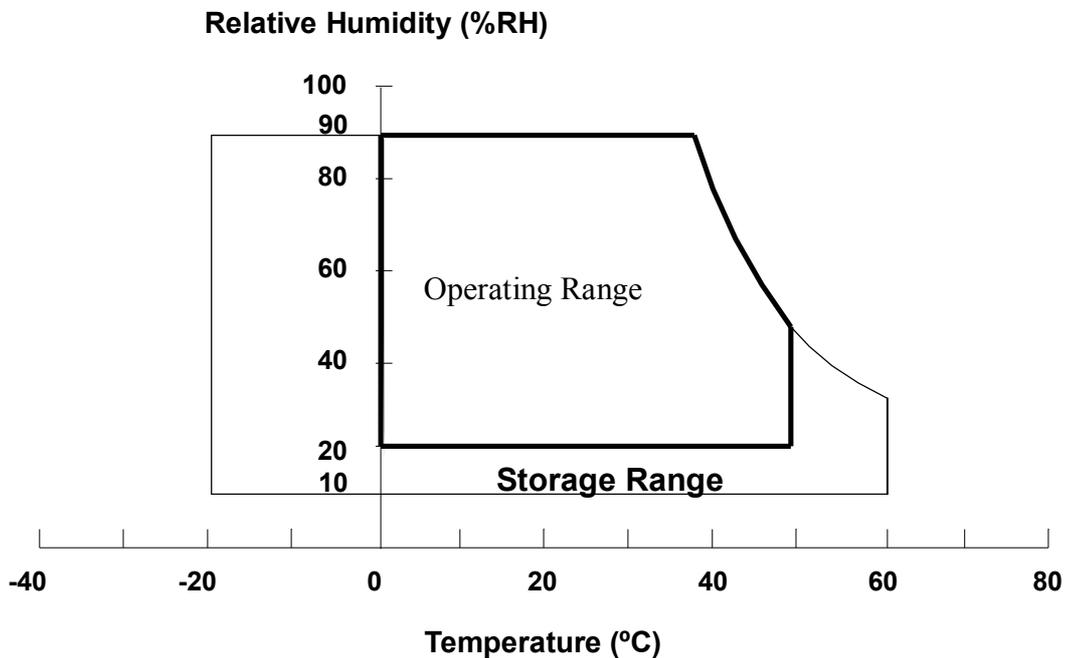## 3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	℃	(1)
Operating Ambient Temperature	T_{OP}	0	+50	℃	(1), (2)

Note (1)   (a) 90 %RH Max. (Ta < 40 ℃).

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

             (c) No condensation.

Note (2)   The temperature of panel surface should be 0 ℃ min. and 60 ℃ max.

**Relative Humidity (%RH)** vs **Temperature (ºC)** — Operating Range / Storage Range

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	+4.0	V	
Converter Input Voltage	LED_VCCS	-0.3	26	V	(1)
Converter Control Signal Voltage	LED_PWM,	-0.3	5	V	(1)
Converter Control Signal Voltage	LED_EN	-0.3	5	V	(1)

Note (1) Stresses beyond those listed in above "ELECTRICAL ABSOLUTE RATINGS" may cause permanent damage to the device. Normal operation should be restricted to the conditions described in "ELECTRICAL CHARACTERISTICS".

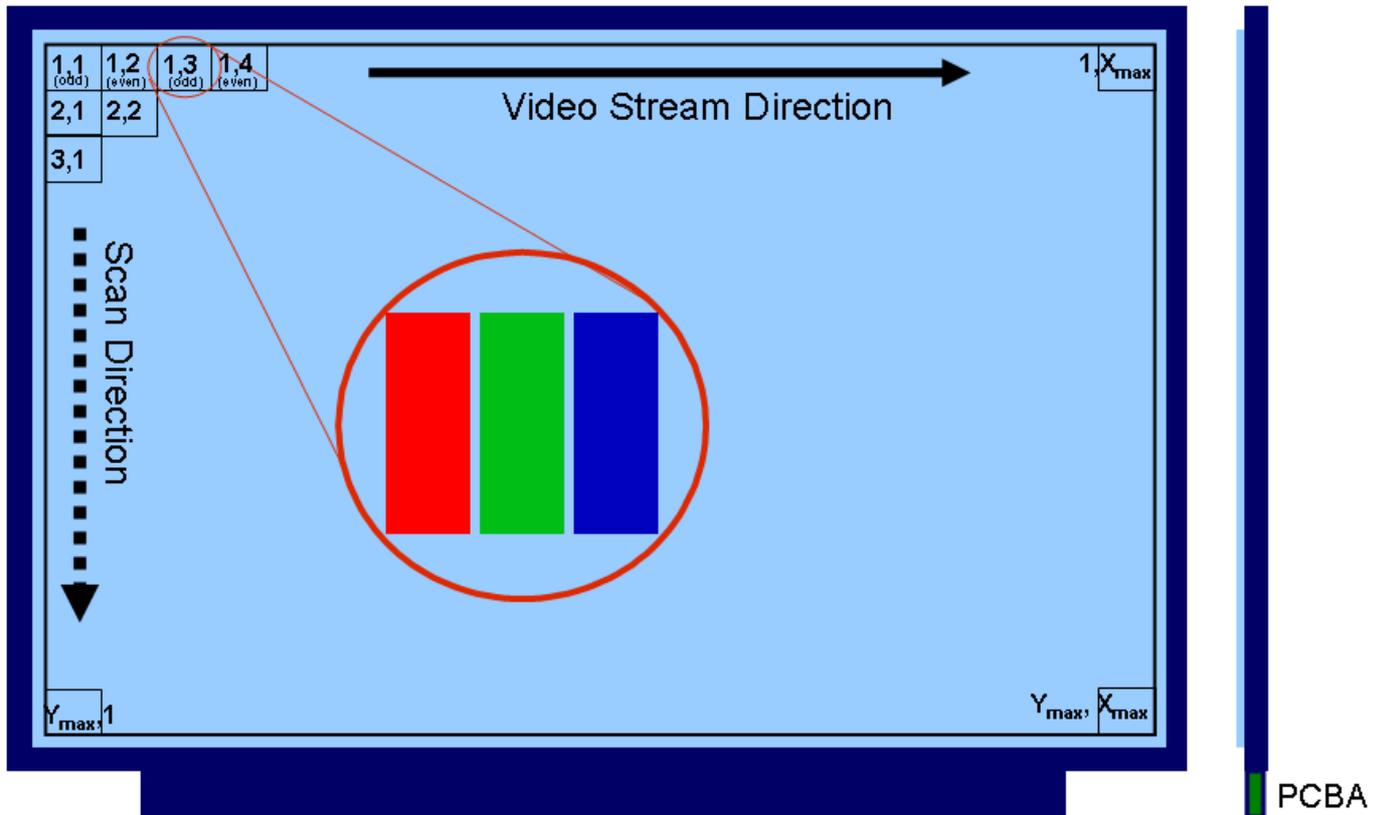# 4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM
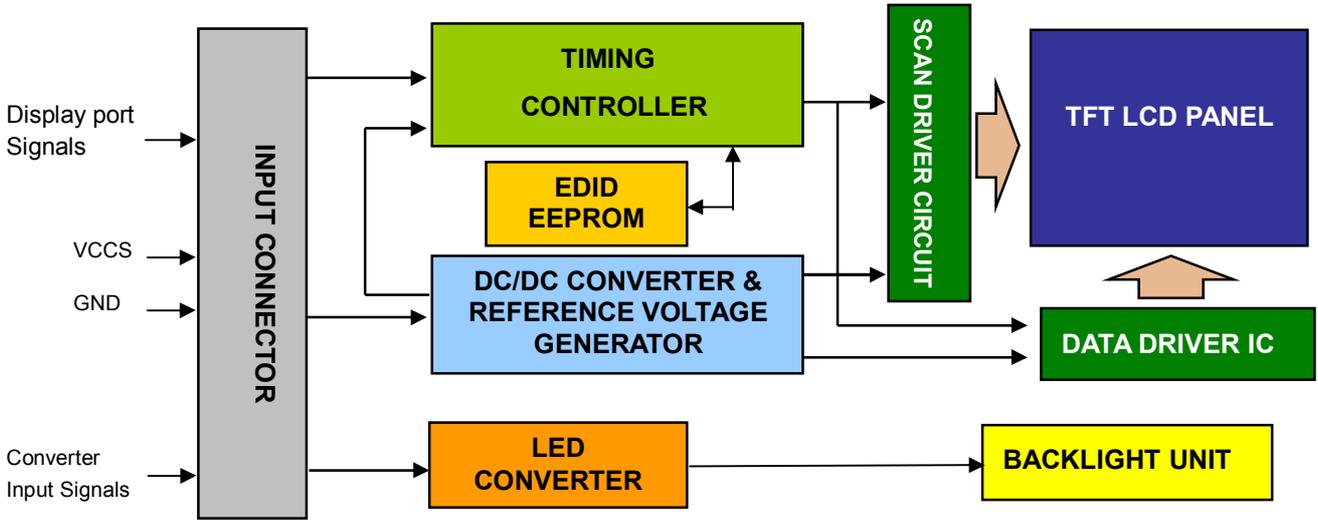
4.2. INTERFACE CONNECTIONS

PIN ASSIGNMENT

Pin	Symbol	Description	Remark
1	NC	No Connection (Reserved for LCD test)	
2	H_GND	High Speed Ground	
3	NC	No Connection (Reserved for ML1-)	
4	NC	No Connection (Reserved for ML1+)	
5	H_GND	High Speed Ground	
6	ML0-	Complement Signal-Lane 0	
7	ML0+	True Signal-Main Lane 0	
8	H_GND	High Speed Ground	
9	AUX+	True Signal-Auxiliary Channel	
10	AUX-	Complement Signal-Auxiliary Channel	
11	H_GND	High Speed Ground	
12	VCCS	Power Supply +3.3 V (typical)	
13	VCCS	Power Supply +3.3 V (typical)	
14	NC	No Connection (Reserved for LCD test)	
15	GND	Ground	
16	GND	Ground	
17	HPD	Hot Plug Detect	
18	BL_GND	BL Ground	
19	BL_GND	BL Ground	
20	BL_GND	BL Ground	
21	BL_GND	BL Ground	
22	LED_EN	BL_Enable Signal of LED Converter	
23	LED_PWM	PWM Dimming Control Signal of LED Converter	
24	NC	No Connection (Reserved for LCD test)	

25	NC	No Connection (Reserved for LCD test)	
26	LED_VCCS	BL Power	
27	LED_VCCS	BL Power	
28	LED_VCCS	BL Power	
29	LED_VCCS	BL Power	
30	NC	No Connection (Reserved for LCD test)	

Note (1) The first pixel is odd as shown in the following figure.

4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD ELETRONICS SPECIFICATION

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VCCS	3.0	3.3	3.6	V	(1)
Ripple Voltage		V_{RP}	-	50	-	mV	(1)
Inrush Current		I_{RUSH}	-	-	1.5	A	(1),(2)
Peak Current		I_{Peak}	-	-	1.5	A	(1),(2)
Power Supply Current	Mosaic	Icc		146	163	mA	(3)a
	White			141	158	mA	(3)
HPD	High Level		2.25	-	2.75	V	(5)
	Low Level		0	-	0.4	V	(5)
HPD Impedance		R_{HPD}	30K			ohm	(4)

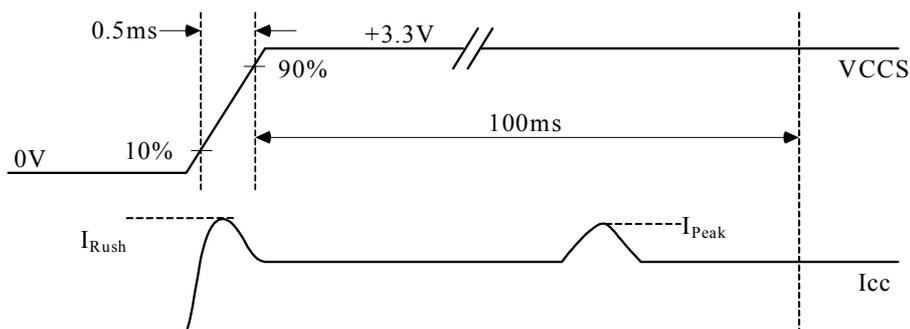Note (1) The ambient temperature is Ta = 25 ± 2 ºC.

Note (2) I_{RUSH}: the maximum current when VCCS is rising

I_{IS}: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: White
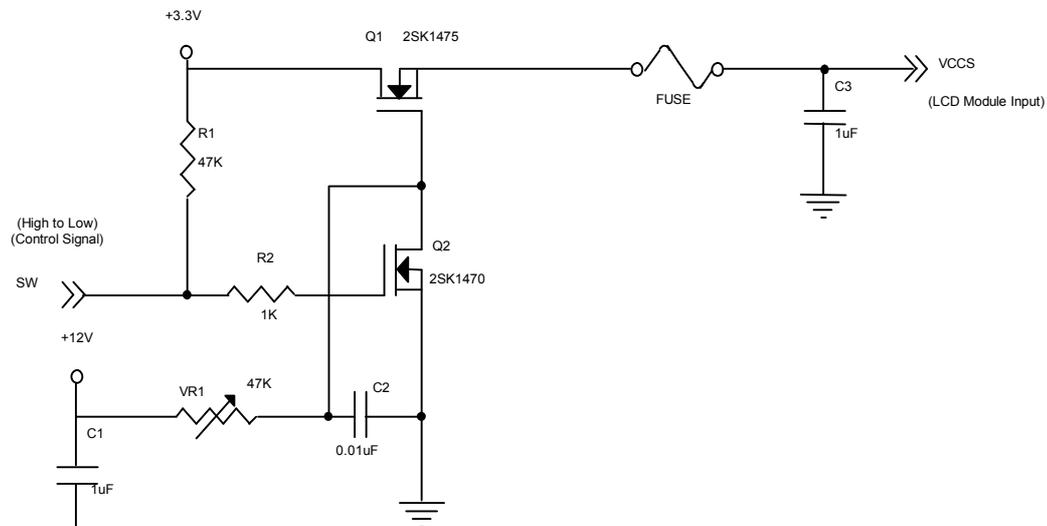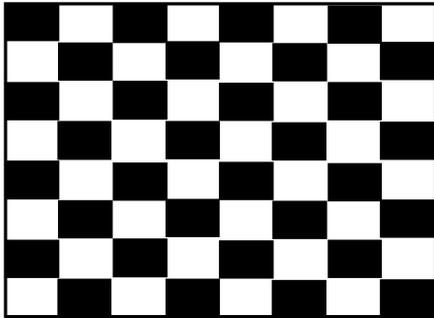

VCCS rising time is 0.5ms

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

a. Mosaic Pattern

Active Area

Note (4) The specified signals have equivalent impedances pull down to ground in the LCD module respectively. Customers should keep the input signal level requirement with the load of LCD module. Please refer to Note (4) of 4.3.2 LED CONVERTER SPECIFICATION to obtain more information.

Note (5) When a source detects a low-going HPD pulse, it must be regarded as a HPD event. Thus, the source must read the link / sink status field or receiver capability field of the DPCD and take corrective action.
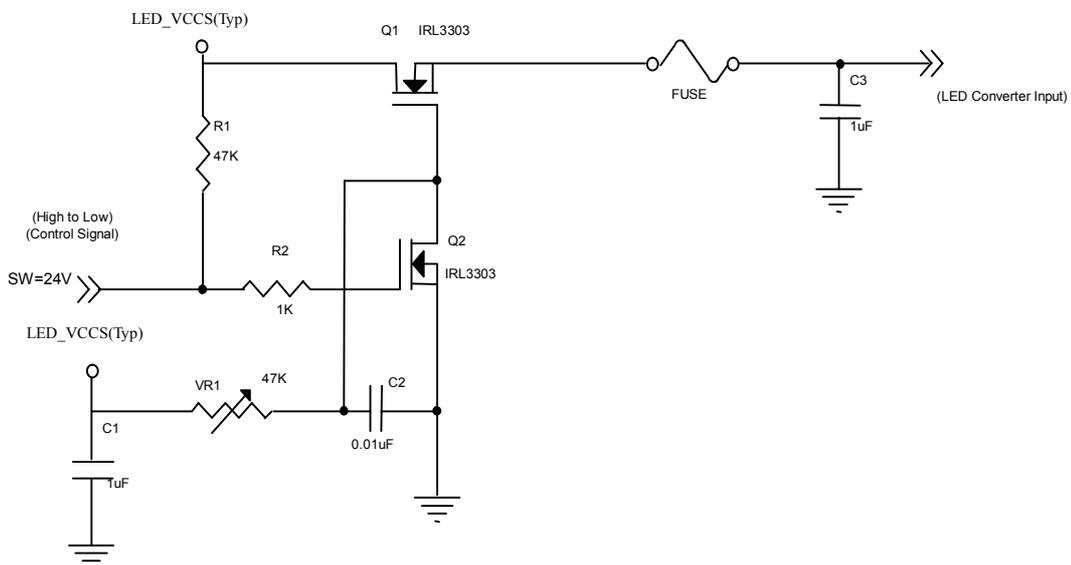
4.3.2 LED CONVERTER SPECIFICATION

| Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Input Power Supply Voltage		LED_Vccs	5.0	12.0	21.0	V	
Converter Inrush Current		ILED$_{RUSH}$	-	-	1.5	A	(1)
LED_EN Control Level	Backlight On		2.2	-	5.0	V	(4)
	Backlight Off		0	-	0.6	V	(4)
LED_EN Impedance		R$_{LED\_EN}$	30K	-	-	ohm	(4)
PWM Control Level	PWM High Level		2.2	-	5.0	V	(4)
	PWM Low Level		0	-	0.6	V	(4)
PWM Impedance		R$_{PWM}$	30K	-	-	ohm	(4)
PWM Control Duty Ratio			5	-	100	%	(5)
PWM Control Duty Resolution			0.2	-		%	
PWM Control Permissive Ripple Voltage		VPWM_pp	-	-	100	mV	
PWM Control Frequency		f$_{PWM}$	190	-	2K	Hz	(2)
LED Power Current LED_VCCS =Typ.		ILED	110	141	152	mA	(3)

Note (1) ILED$_{RUSH}$: the maximum current when LED_VCCS is rising,

ILED$_{IS}$: the maximum current of the first 100ms after power-on,

Measurement Conditions: Shown as the following figure. LED_VCCS = Typ, Ta = 25 ± 2 ℃, f$_{PWM}$ = 200 Hz, Duty=100%.

VLED rising time is 0.5ms
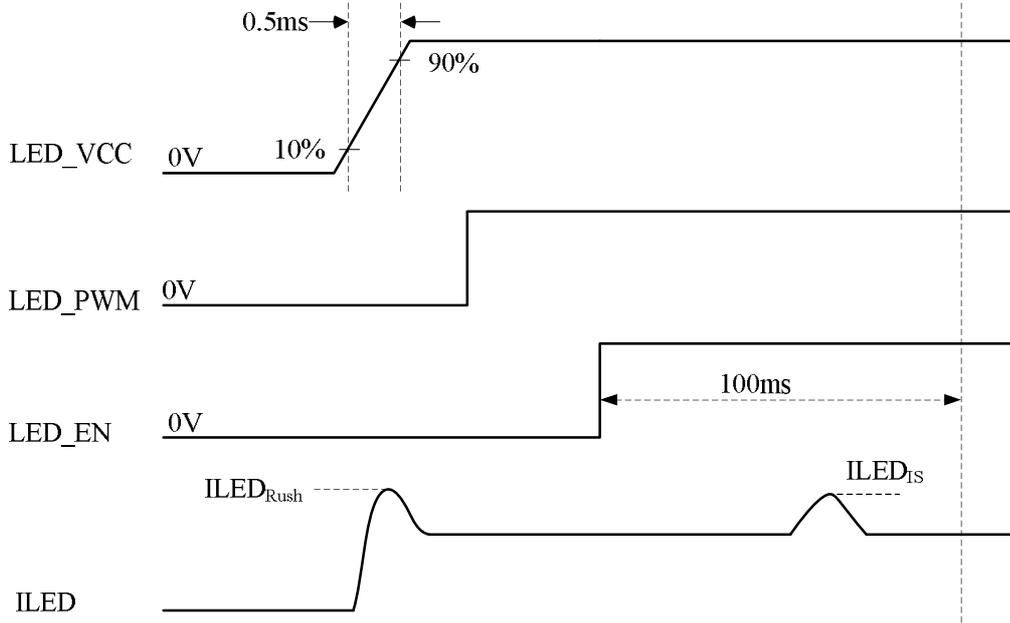
Note (2) If PWM control frequency is applied in the range less than 1KHz, the "waterfall" phenomenon on the screen may be found. To avoid the issue, it's a suggestion that PWM control frequency should follow the criterion as below.

PWM control frequency f_{PWM} should be in the range

$$(N + 0.33) * f \leq f_{PWM} \leq (N + 0.66) * f$$

$$N : \text{Integer} \quad (N \geq 3)$$

$$f : \text{Frame rate}$$

Note (3) The specified LED power supply current is under the conditions at "LED_VCCS = Typ.", Ta = 25 ± 2 °C, f_{PWM} = 200 Hz, Duty=100%.

Note (4) The specified signals have equivalent impedances pull down to ground in the LCD module respectively. Customers should keep the input signal level requirement with the load of LCD module. For example, the figure below describes the equivalent pull down impedance of LED_EN (If it exists). The rest pull down impedances of other signals (eg. HPD, PWM …) are in the same concept.
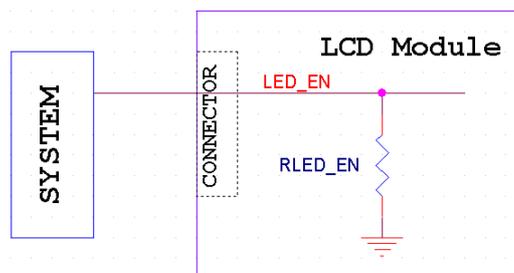

Note (5) If the cycle-to-cycle difference of PWM duty exceeds 0.1%, especially when the PWM duty is low, slight brightness change might be observed.

4.3.3 BACKLIGHT UNIT

Ta = 25 ± 2 ℃

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Power Supply Voltage	V_L	26	29	30	V	(1)(2)(Duty100%)
LED Light Bar Power Supply Current	I_L	--	48.6	--	mA	
Power Consumption	P_L	--	1.41	1.46	W	(3)
LED Life Time	L_{BL}	15000	-	-	Hrs	(4)

Note (1)   LED current is measured by utilizing a high frequency current meter as shown below :

V_L, I_L

LED
Light Bar
10s x 2p
r

Light Bar Feedback
Channels
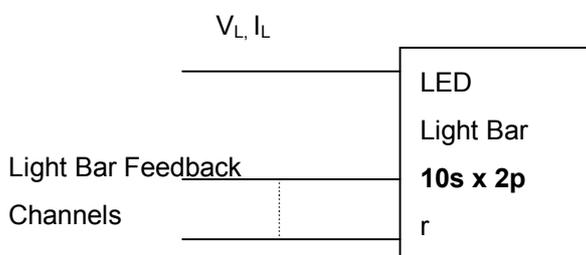
Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with
current balancing function to drive LED light-bar.

Note (3) $P_L = I_L \times V_L$ (Without LED converter transfer efficiency)

Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ±2 ℃
and I_L = 24.3mA (Per EA) until the brightness becomes $\leq$ 50% of its original value.

4.4 DISPLAY PORT INPUT SIGNAL TIMING SPECIFICATIONS

4.4.1 ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Differential Signal Common Mode Voltage(MainLink and AUX)	VCM	0		2	V	(1)(4)
AUX AC Coupling Capacitor	C_Aux_Source	75		200	nF	(2)
Main Link AC Coupling Capacitor	C_ML_Source	75		200	nF	(3)
DPCD Version (Address 00000h)	-		0x11h		-	(5)

Note (1)Display port interface related AC coupled signals should follow VESA DisplayPort Standard Version1. Revision 1a and VESA Embedded DisplayPort^{TM} Standard Version 1.2. There are many optional items described in eDP1.2. If some optional item is requested, please contact us. Mainlink eye diagram at TP3 needs to be measured on the sink side (LCD Panel). The spec of sink eye vertices at TP3 should follow VESA DisplayPort Standard Version1. Revision 1a and VESA Embedded DisplayPort^{TM} Standard Version 1.2.
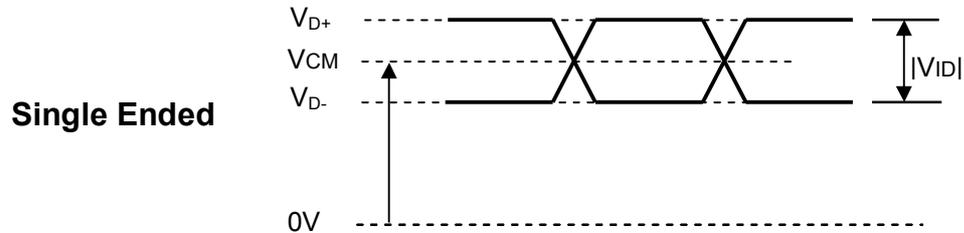
(2) Recommended eDP AUX Channel topology is as below and the AUX AC Coupling Capacitor (C_Aux_Source) should be placed on the source device.
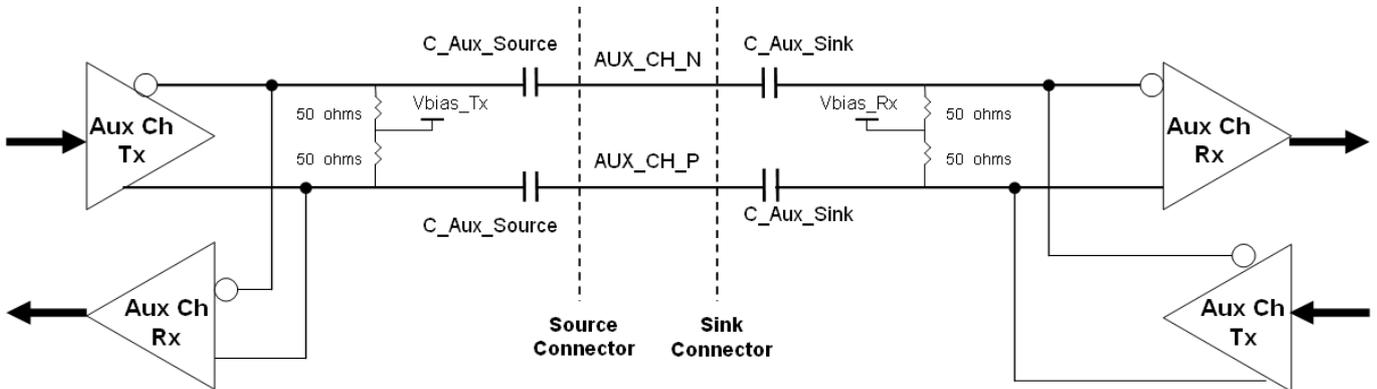
(3) Recommended Main Link Channel topology is as below and the Main Link AC Coupling Capacitor (C_ML_Source) should be placed on the source device.
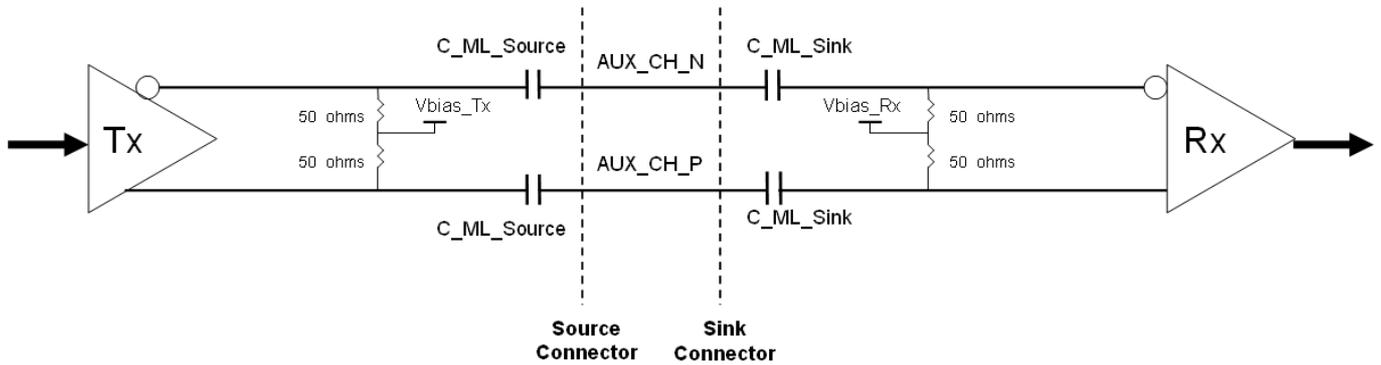
(4) The source device should pass the test criteria described in DisplayPortCompliance Test Specification (CTS) 1.1

(5) The DPCD revision number is specified at DPCD address 00000h, and its detail definition is listed as the following table according to the above documents about DP and eDP.

DPCD Address 00000h	DPCD revision number
0X10h	DPCD Rev.1.0
0X11h	DPCD Rev.1.1
0X12h	DPCD Rev.1.2

4.4.2 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
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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

4.5 DISPLAY TIMING SPECIFICATIONS

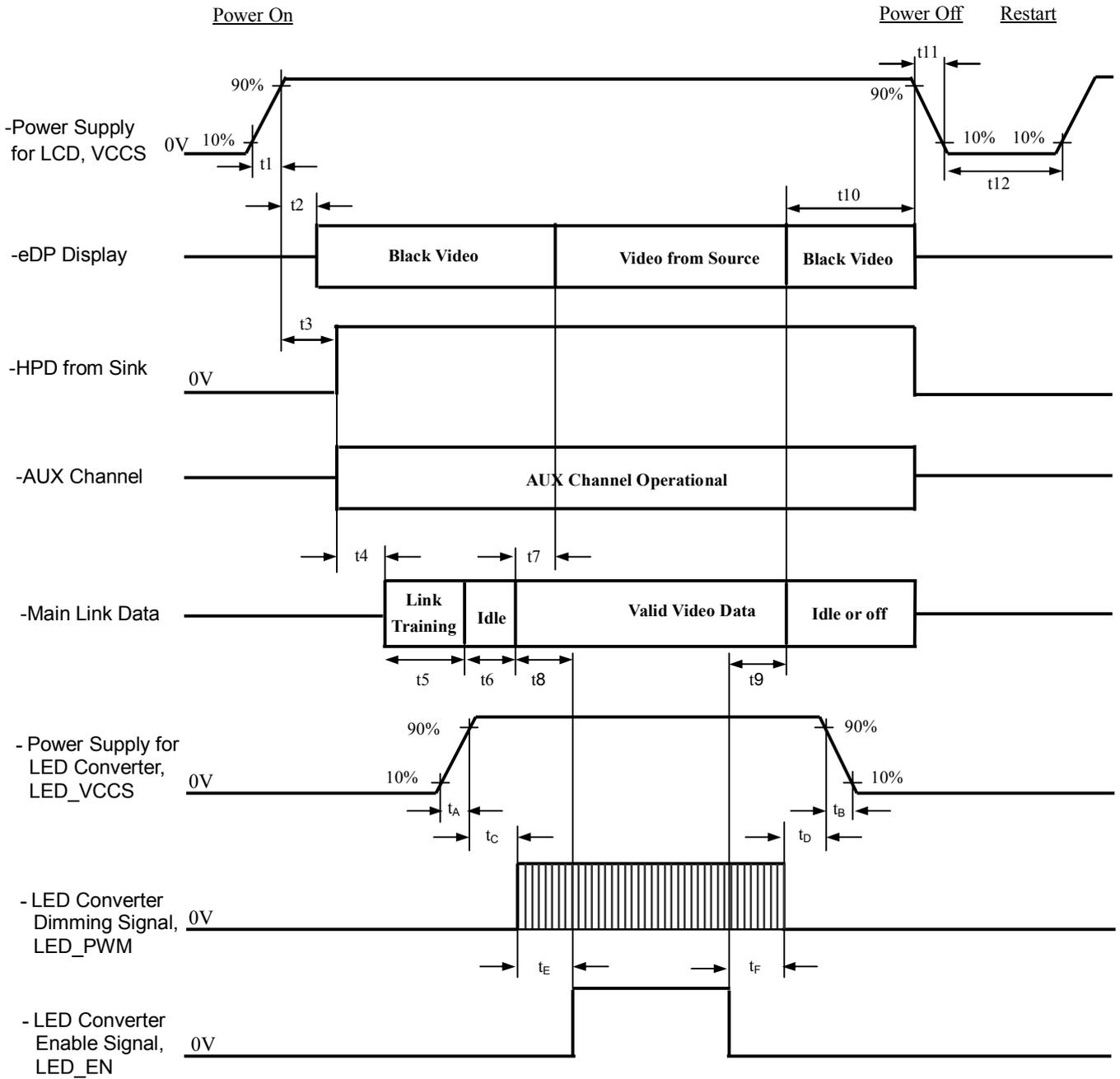The input signal timing specifications are shown as the following table and timing diagram.

Refresh Rate 60Hz

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	74.99	76.42	77.76	MHz	-
DE	Vertical Total Time	TV	790	800	804	TH	-
	Vertical Active Display Period	TVD	768	768	768	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	32	TV-TVD	TH	-
	Horizontal Total Time	TH	1582	1592	1612	Tc	-
	Horizontal Active Display Period	THD	1366	1366	1366	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	226	TH-THD	Tc	-

INPUT SIGNAL TIMING DIAGRAM
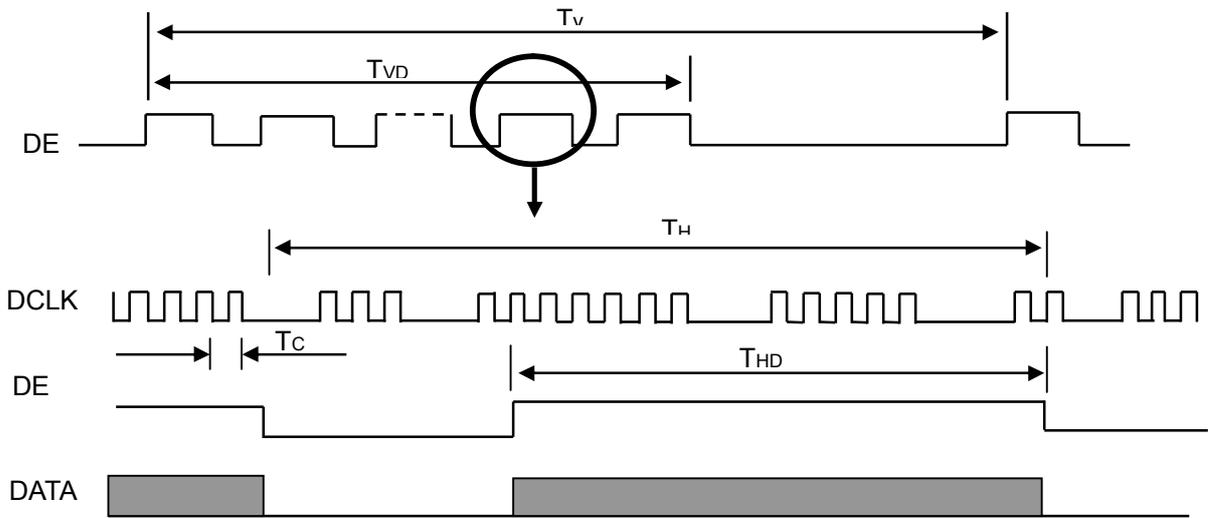
4.6 POWER ON/OFF SEQUENCE

Timing Specifications

Parameter	Description	Reqd. By	Value		Unit	Notes
			Min	Max		
t1	Power rail rise time, 10% to 90%	Source	0.5	10	ms	-
t2	Delay from LCD,VCCS to black video generation	Sink	0	200	ms	Automatic Black Video generation prevents display noise until valid video data is received from the Source (see Notes:2 and 3 below)
t3	Delay from LCD,VCCS to HPD high	Sink	0	200	ms	Sink AUX Channel must be operational upon HPD high (see Note:4 below)
t4	Delay from HPD high to link training initialization	Source	0	-	ms	Allows for Source to read Link capability and initialize
t5	Link training duration	Source	0	-	ms	Dependant on Source link training protocol
t6	Link idle	Source	0	-	ms	Min Accounts for required BS-Idle pattern. Max allows for Source frame synchronization
t7	Delay from valid video data from Source to video on display	Sink	0	50	ms	Max value allows for Sink to validate video data and timing. At the end of T7, Sink will indicate the detection of valid video data by setting the SINK_STATUS bit to logic 1 (DPCD 00205h, bit 0), and Sink will no longer generate automatic Black Video
t8	Delay from valid video data from Source to backlight on	Source	80	-	ms	Source must assure display video is stable *: Recommended by INX. To avoid garbage image.
t9	Delay from backlight off to end of valid video data	Source	50	-	ms	Source must assure backlight is no longer illuminated. At the end of T9, Sink will indicate the detection of no valid video data by setting the SINK_STATUS bit to logic 0 (DPCD 00205h, bit 0), and Sink will automatically display Black Video. (See Notes: 2 and 3 below) *: Recommended by INX. To avoid garbage image.
t10	Delay from end of valid video data from Source to power off	Source	0	500	ms	Black video will be displayed after receiving idle or off signals from Source
t11	VCCS power rail fall time, 90% to 10%	Source	0.5	10	ms	-

t12	VCCS Power off time	Source	500	-	ms	-
t_A	LED power rail rise time, 10% to 90%	Source	0.5	10	ms	-
t_B	LED power rail fall time, 90% to 10%	Source	0	10	ms	-
t_C	Delay from LED power rising to LED dimming signal	Source	1	-	ms	-
t_D	Delay from LED dimming signal to LED power falling	Source	1	-	ms	-
t_E	Delay from LED dimming signal to LED enable signal	Source	0	-	ms	-
t_F	Delay from LED enable signal to LED dimming signal	Source	0	-	ms	-

Note (1) Please don't plug or unplug the interface cable when system is turned on.

Note (2) The Sink must include the ability to automatically generate Black Video autonomously. The Sink must automatically enable Black Video under the following conditions:

- Upon LCDVCC power-on (within T2 max)

- When the "NoVideoStream_Flag" (VB-ID Bit 3) is received from the Source (at the end of T9)

Note (3) The Sink may implement the ability to disable the automatic Black Video function, as described in Note (2), above, for system development and debugging purposes.

Note (4) The Sink must support AUX Channel polling by the Source immediately following LCDVCC power-on without causing damage to the Sink device (the Source can re-try if the Sink is not ready). The Sink must be able to response to an AUX Channel transaction with the time specified within T3 max.
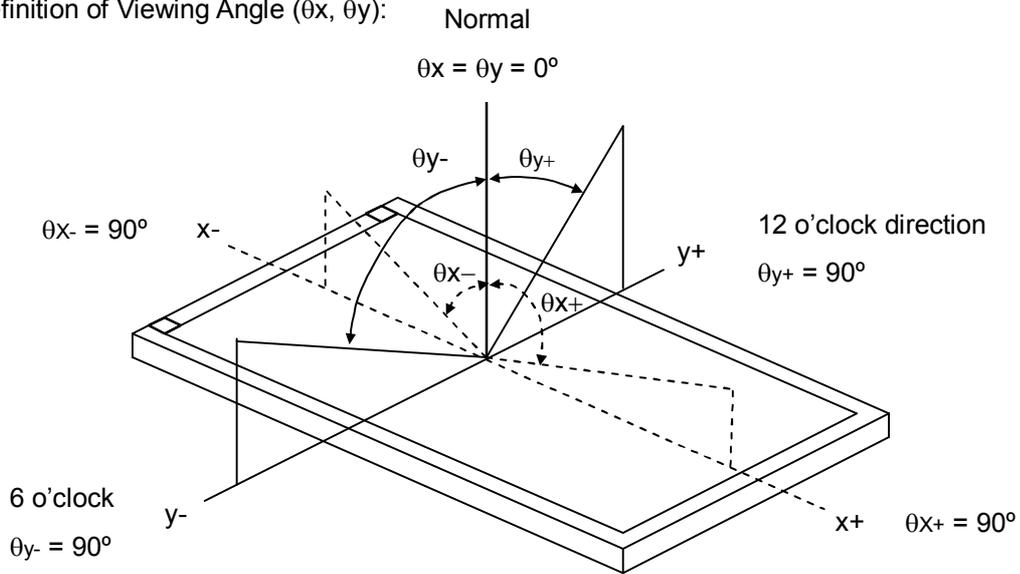
5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	^{o}C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current	I_L	48.6	mA

The measurement methods of optical characteristics are shown in Section 5.2. The following items should be measured under the test conditions described in Section 5.1 and stable environment shown in Note (5).

5.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR		600	800	-	-	(2), (5) ,(7)
Response Time		T_R		-	14	16	ms	(3) ,(7)
		T_F		-	11	14	ms	
Average Luminance of White		L_{AVE}		200	250	-	cd/m^2	(4), (6) ,(7)
Color Chromaticity	Red	Rx	θ_x=0°, θ_Y =0° Viewing Normal Angle	Typ – 0.03	0.595	Typ + 0.03	-	(1) ,(7)
		Ry			0.350		-	
	Green	Gx			0.325		-	
		Gy			0.565		-	
	Blue	Bx			0.153		-	
		By			0.112		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
Viewing Angle	Horizontal	θ_x+	CR≥10	80	89		Deg.	(1),(5) , (7)
		θ_x-		80	89	-		
	Vertical	θ_Y+		80	89	-		
		θ_Y-		80	89	-		
White Variation		δW_{5p}	θ_x=0°, θ_Y =0°		1.1	1.25		(5),(6) , (7)
		δW_{13p}			1.33	1.50		

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

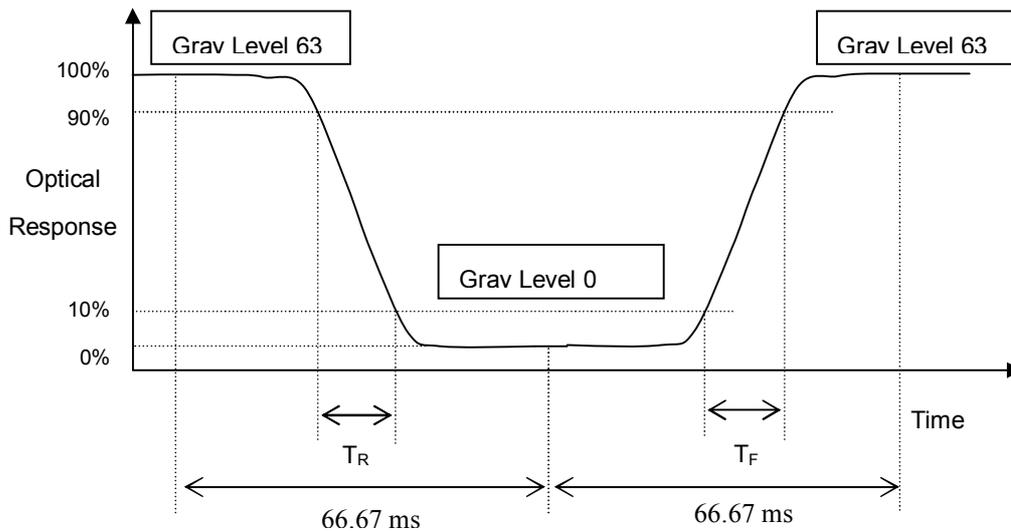L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = CR (1)

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):

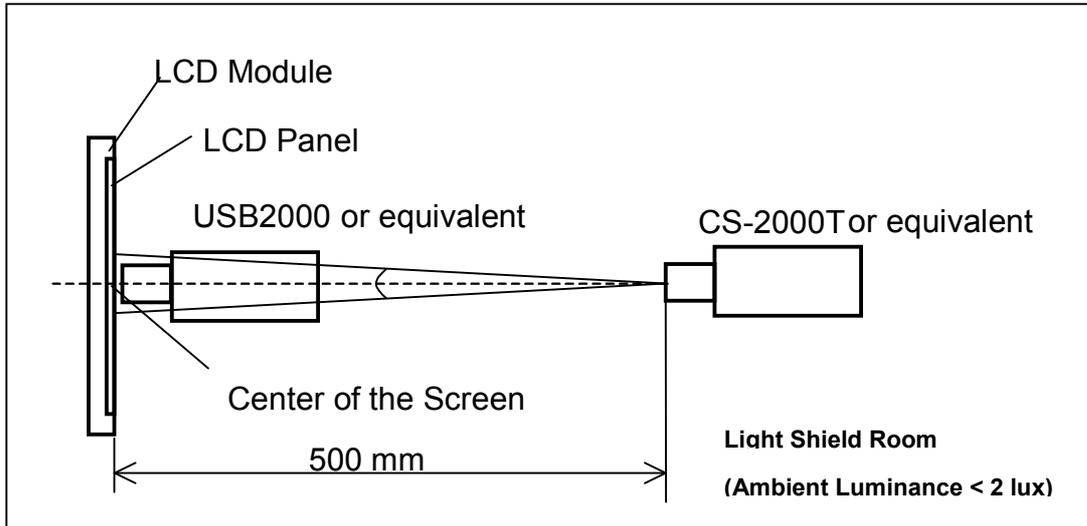

Note (4) Definition of Average Luminance of White (L_{AVE}):

Measure the luminance of gray level 63 at 5 points

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

L (x) is corresponding to the luminance of the point X at 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 63 at 5 points

δW_{5p} = {Maximum [L (1)~ L (5)] / Minimum [L (1)~ L (5)]}*100%

δW_{13p} = {Maximum [L (1)~ L (13)] / Minimum [L (1)~ L (13)]}*100%
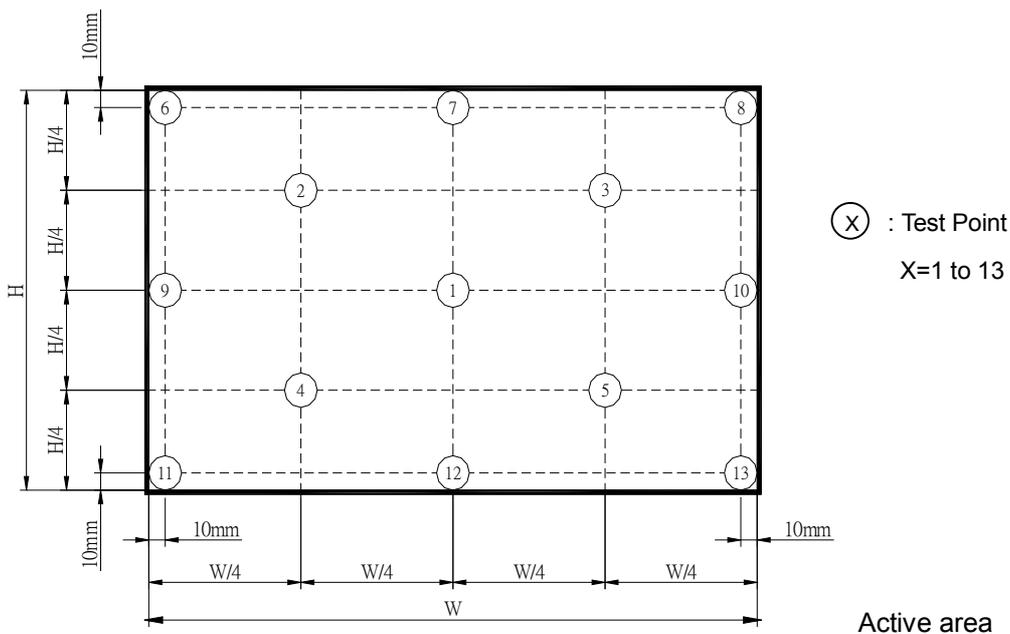
Note (7) The listed optical specifications refer to the initial value of manufacture, but the condition of the specifications after long-term operation will not be warranted.

6. RELIABILITY TEST ITEM

| Test Item	Test Condition	Note
High Temperature Storage Test	60ºC, 240 hours	(1) (2)
Low Temperature Storage Test	-20ºC, 240 hours	
Thermal Shock Storage Test	-20℃, 0.5hour←→60℃, 0.5hour; 100cycles, 1hour/cycle	
High Temperature Operation Test	50ºC, 240 hours	
Low Temperature Operation Test	0ºC, 240 hours	
High Temperature & High Humidity Operation Test	50ºC, RH 80%, 240hours	
ESD Test (Operation)	150pF, 330Ω, 1sec/cycle Condition 1 : Contact Discharge, ±8KV Condition 2 : Air Discharge, ±15KV	(1)
Shock (Non-Operating)	220G, 2ms, half sine wave,1 time for each direction of ±X,±Y,±Z	(1)(3)
Vibration (Non-Operating)	1.5G / 10-500 Hz, Sine wave, 30 min/cycle, 1cycle for each X, Y, Z	(1)(3)
Composite Non-Operation Test	Profile(a) : +25℃/ 50% R.H.(2hrs)-> transition(2hrs) -> -20℃/ No R.H.(12hrs) -> transition(4hrs) -> +43℃/ 80% R.H.(12hrs) -> transition(3hrs) -> +60℃/ 20% R.H.(12 Hrs) -> transition(2hrs) -> +25℃/ 50% R.H.(2hr) Profile (b) : Cycle 1 (54hrs) : +25℃/ 50% R.H.(2hrs) -> transition(3hrs) -> 41℃/ 90%R.H.(12hrs) -> transition(4hrs) -> +60℃/ 40% R.H.(12hrs) -> transition(5hrs) -> -20℃ / No R.H.(12hrs) -> transition(2hrs) -> +25℃/ 50% R.H.(2hr) Cycle 2 (54hrs) : +25℃/ 50% R.H.(2hrs) -> transition(3hrs) -> 41℃/ 90%R.H.(12hrs) -> transition(4hrs) -> +60℃/ 40% R.H.(12hrs) -> transition(5hrs) -> -20℃ / No R.H.(12hrs) -> transition(2hrs) -> +25℃/ 50% R.H.(2hr) Cycle 3 (54hrs) : +25℃/ 50% R.H.(2hrs) -> transition(3hrs) -> -20℃/ No R.H.(12hrs)-> transition(5hrs) -> +41℃/ 90% R.H.(12hrs) -> transition(4hrs) -> +60℃ / 40%R.H.(12 Hrs) -> transition(2hrs) -> +25℃/ 50% R.H.(2hr)	(1) (4)

Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

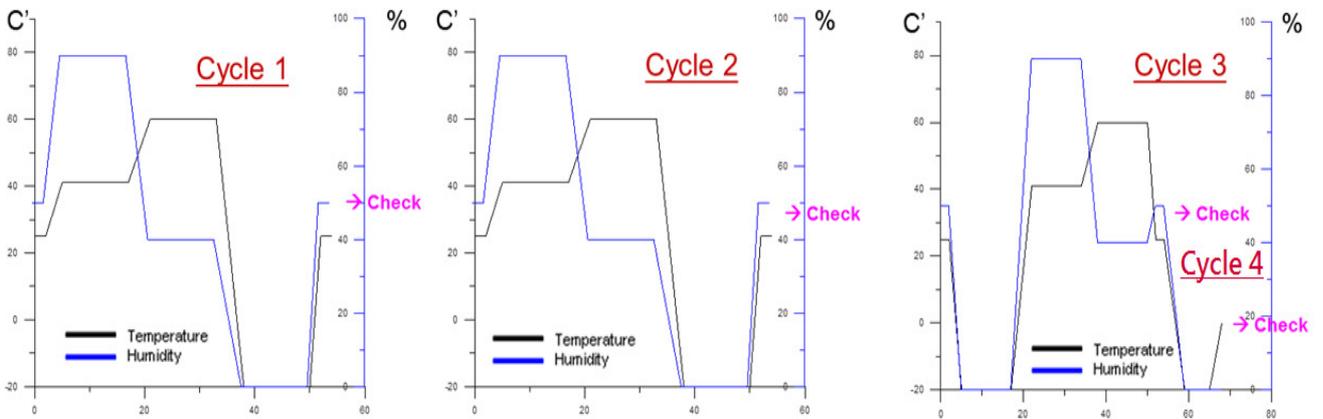Note (2) Evaluation should be tested after storage at room temperature for more than two hour

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) Judge by 3% ND filter after +25°C/ 50% R.H. 2hrs.
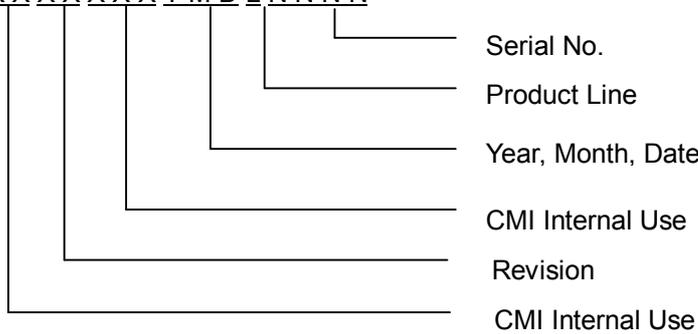
Profile(a):
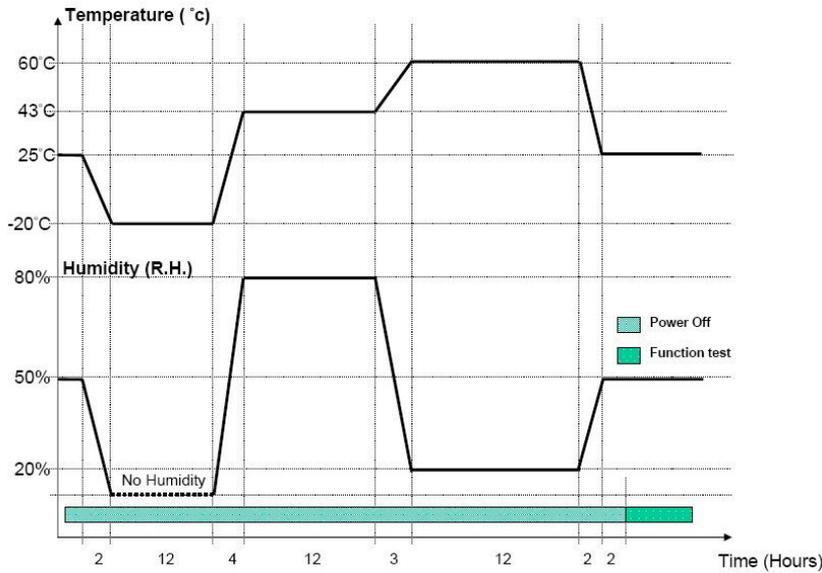
Profile (b) :

7. PACKING

7.1 MODULE LABEL

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

(a) Model Name: N116BCA – EA1

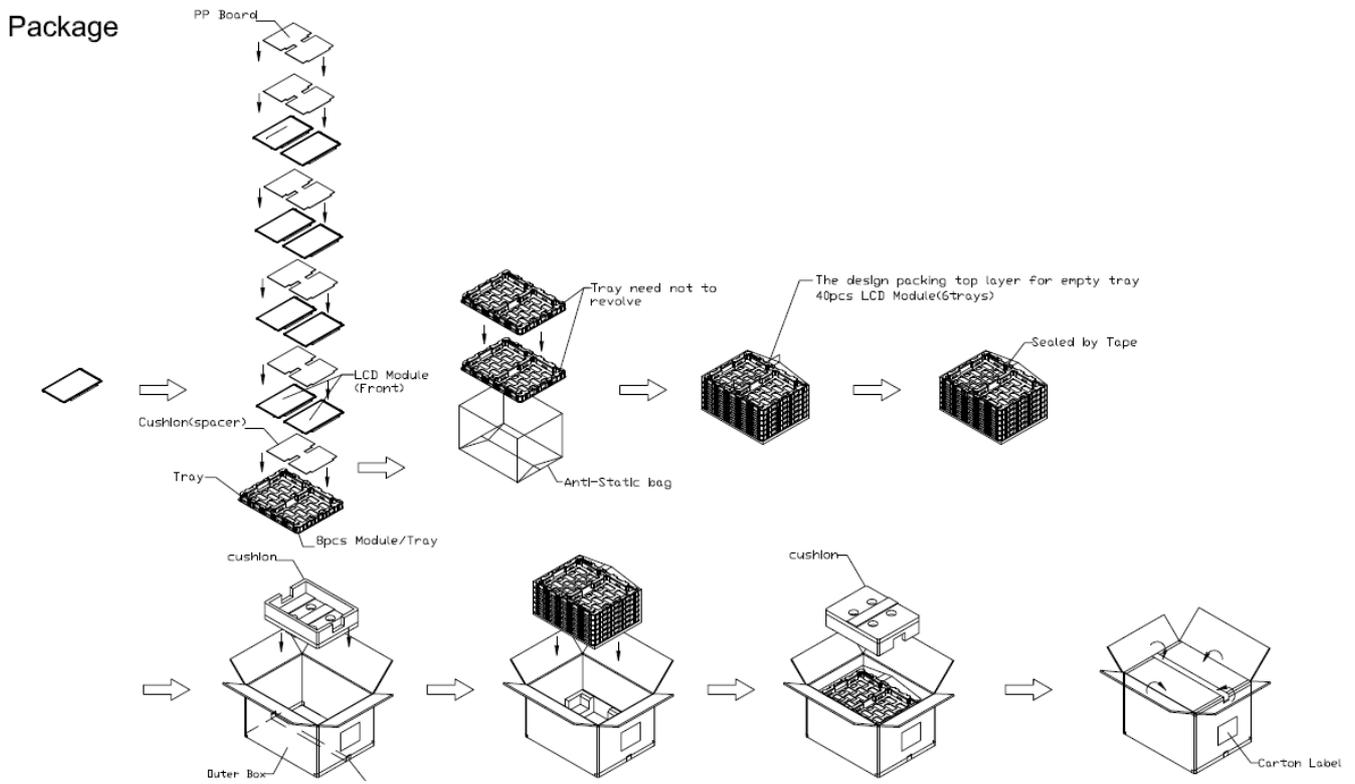(b) Revision: Rev. XX, for example: C1, C2 …etc.

(c) Serial ID: X X X X X X X Y M D L N N N N

```
                                        Serial No.

                                        Product Line

                                        Year, Month, Date

                                        CMI Internal Use

                                        Revision

                                        CMI Internal Use
```

(d) Production Location: MADE IN XXXX.

(e) UL Logo: XXXXX is UL factory ID. (XXXXX is a blank or a minimum of 4 or 5 English characters, only for INX internal used).

(f) Right side barcode for customer used.

Serial ID includes the information as below:

(a) Manufactured Date: Year: 0~9, for 2010~2019

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

(d) Product Line: 1 -> Line1, 2 -> Line 2, …etc.

7.2 CARTON

Package

PP Board

Cushion(spacer)

LCD Module (Front)

Tray

8pcs Module/Tray

Tray need not to revolve

Anti-Static bag

The design packing top layer for empty tray 40pcs LCD Module(6trays)

Sealed by Tape

cushion

Outer Box

cushion

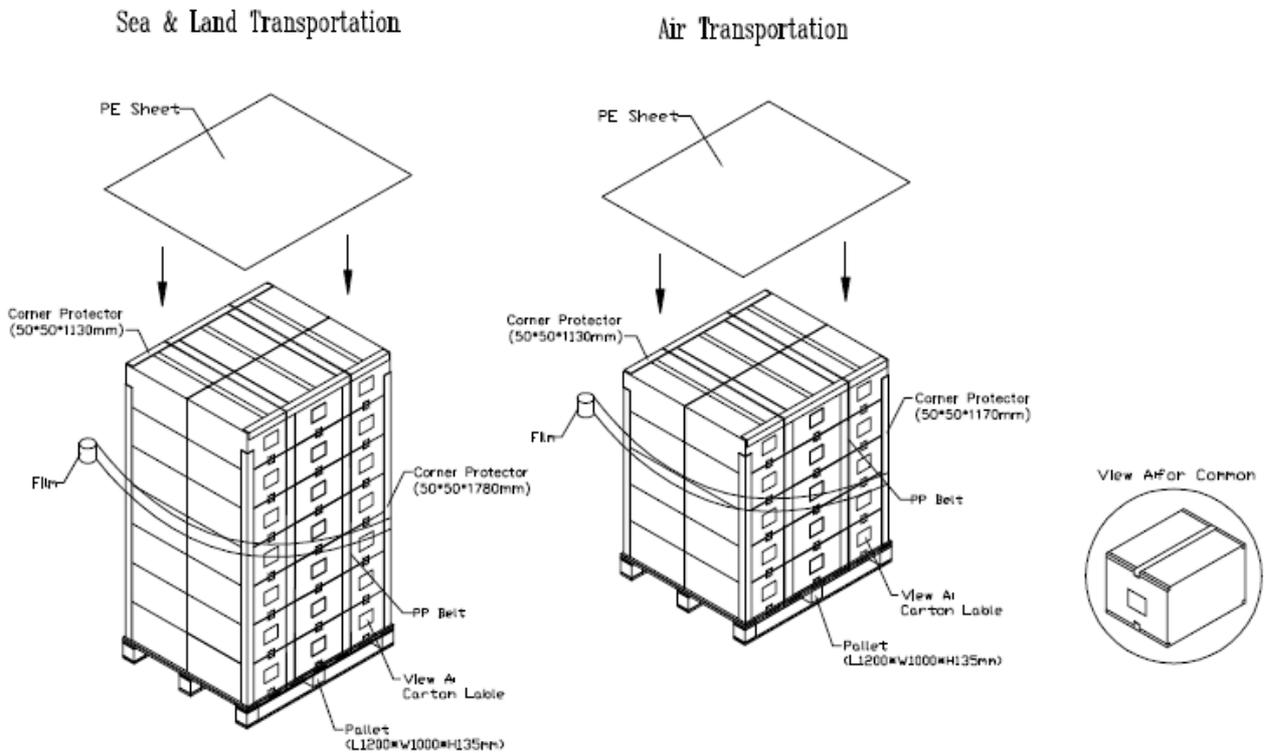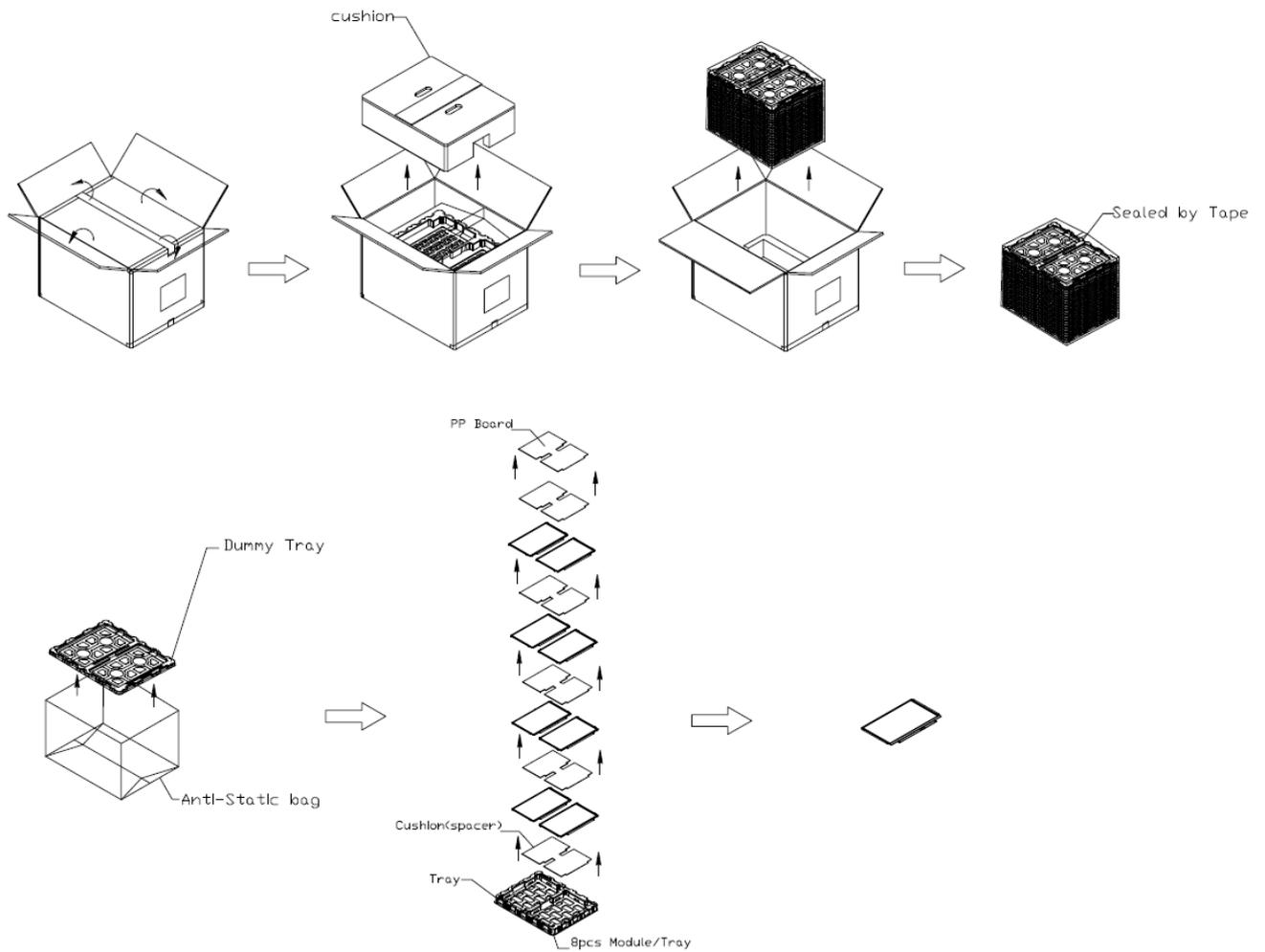Carton Label

Figure. 7-1 Packing method

7.3 PALLET

Figure. 7-2 Packing method

7.4 UN-PACK METHOD

Figure. 7-3 Packing method

8. PRECAUTIONS

8.1 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 LED wire.

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

8.2 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 LED will be higher than the room temperature.

(4) system parts must non-NH4+ / Low NH4+ to prevent LCD occured white spot symptom.

8.3 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 CMIS 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.

(4) IF system interfere with panel or twist panel while system operation. It may cause ripple or noise or other side effect. Please prevent such twist or interfere by system operation

(5) P-cover tape will bulge without external force due to the material character of P-cover tape. The tolerance of P-cover tape thickness will not exceed 2 mm from surface of polarizer and thickness of PCBA side can be reformed to normal thickness by external force

Appendix. EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPDI standards.
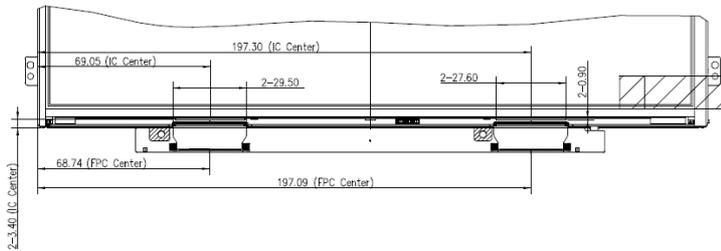
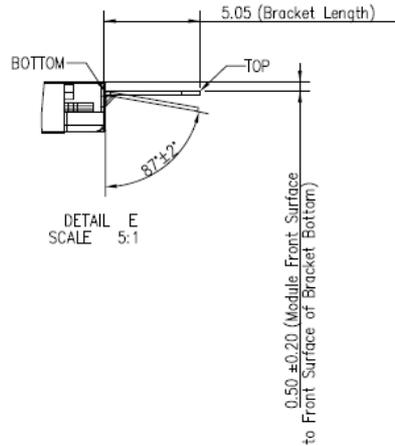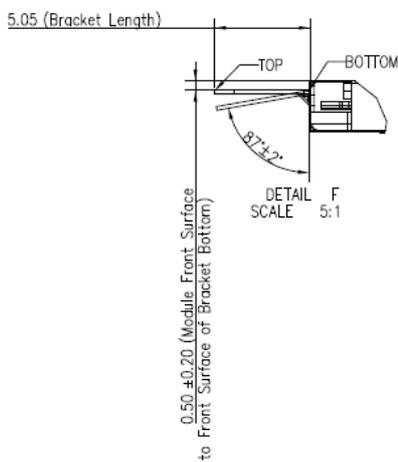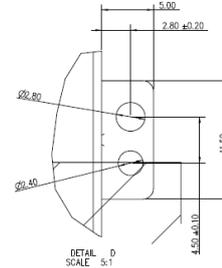| Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	00	Header	00	00000000
1	01	Header	FF	11111111
2	02	Header	FF	11111111
3	03	Header	FF	11111111
4	04	Header	FF	11111111
5	05	Header	FF	11111111
6	06	Header	FF	11111111
7	07	Header	00	00000000
8	08	EISA ID manufacturer name ("CMN")	0D	00001101
9	09	EISA ID manufacturer name	AE	10101110
10	0A	ID product code (LSB)	38	00111000
11	0B	ID product code (MSB)	11	00010001
12	0C	ID S/N (fixed "0")	00	00000000
13	0D	ID S/N (fixed "0")	00	00000000
14	0E	ID S/N (fixed "0")	00	00000000
15	0F	ID S/N (fixed "0")	00	00000000
16	10	Week of manufacture (fixed week code)	01	00000001
17	11	Year of manufacture (fixed year code)	1A	00011010
18	12	EDID structure version ("1")	01	00000001
19	13	EDID revision ("4")	04	00000100
20	14	Video I/P definition ("Digital")	95	10010101
21	15	Active area horizontal ("25.6125cm")	1A	00011010
22	16	Active area vertical ("14.4cm")	0E	00001110
23	17	Display Gamma (Gamma = "2.2")	78	01111000
24	18	Feature support ("RGB, Non-continous")	02	00000010
25	19	Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0	67	01100111
26	1A	Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0	75	01110101
27	1B	Rx=0.595	98	10011000
28	1C	Ry=0.35	59	01011001
29	1D	Gx=0.325	53	01010011
30	1E	Gy=0.565	90	10010000
31	1F	Bx=0.153	27	00100111
32	20	By=0.112	1C	00011100
33	21	Wx=0.313	50	01010000
34	22	Wy=0.329	54	01010100
35	23	Established timings 1	00	00000000
36	24	Established timings 2	00	00000000
37	25	Manufacturer's reserved timings	00	00000000
38	26	Standard timing ID # 1	01	00000001
39	27	Standard timing ID # 1	01	00000001
40	28	Standard timing ID # 2	01	00000001
41	29	Standard timing ID # 2	01	00000001

42	2A	Standard timing ID # 3	01	00000001
43	2B	Standard timing ID # 3	01	00000001
44	2C	Standard timing ID # 4	01	00000001
45	2D	Standard timing ID # 4	01	00000001
46	2E	Standard timing ID # 5	01	00000001
47	2F	Standard timing ID # 5	01	00000001
48	30	Standard timing ID # 6	01	00000001
49	31	Standard timing ID # 6	01	00000001
50	32	Standard timing ID # 7	01	00000001
51	33	Standard timing ID # 7	01	00000001
52	34	Standard timing ID # 8	01	00000001
53	35	Standard timing ID # 8	01	00000001
54	36	Detailed timing description # 1 Pixel clock ("76.42MHz")	DA	11011010
55	37	# 1 Pixel clock (hex LSB first)	1D	00011101
56	38	# 1 H active ("1366")	56	01010110
57	39	# 1 H blank ("226")	E2	11100010
58	3A	# 1 H active : H blank	50	01010000
59	3B	# 1 V active ("768")	00	00000000
60	3C	# 1 V blank ("32")	20	00100000
61	3D	# 1 V active : V blank	30	00110000
62	3E	# 1 H sync offset ("136")	88	10001000
63	3F	# 1 H sync pulse width ("30")	1E	00011110
64	40	# 1 V sync offset : V sync pulse width ("8 : 12")	8C	10001100
65	41	# 1 H sync offset : H sync pulse width : V sync offset : V sync width	00	00000000
66	42	# 1 H image size ("256 mm")	00	00000000
67	43	# 1 V image size ("144 mm")	90	10010000
68	44	# 1 H image size : V image size	10	00010000
69	45	# 1 H boarder ("0")	00	00000000
70	46	# 1 V boarder ("0")	00	00000000
71	47	# 1 Non-interlaced, Normal Display, Digital separate, Positive Hsync, Negative Vsync	18	00011000
72	48	Detailed timing description # 2	00	00000000
73	49	# 2 Flag	00	00000000
74	4A	# 2 Reserved	00	00000000
75	4B	# 2 ASCII string Model name	FE	11111110
76	4C	# 2 Flag	00	00000000
77	4D	# 2 Character of Model name ("N")	4E	01001110
78	4E	# 2 Character of Model name ("1")	31	00110001
79	4F	# 2 Character of Model name ("1")	31	00110001
80	50	# 2 Character of Model name ("6")	36	00110110
81	51	# 2 Character of Model name ("B")	42	01000010
82	52	# 2 Character of Model name ("C")	43	01000011
83	53	# 2 Character of Model name ("A")	41	01000001
84	54	# 2 Character of Model name ("-")	2D	00101101
85	55	# 2 Character of Model name ("E")	45	01000101
86	56	# 2 Character of Model name ("A")	41	01000001
87	57	# 2 Character of Model name ("1")	31	00110001

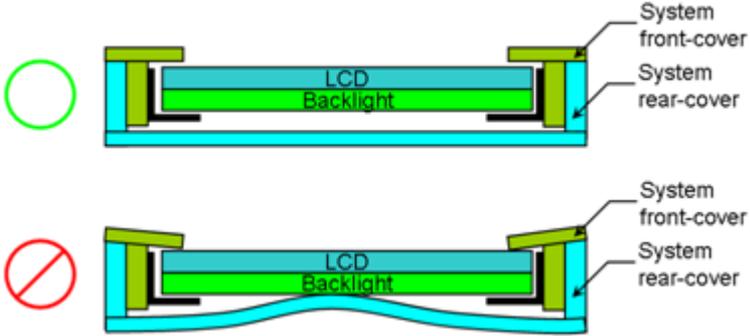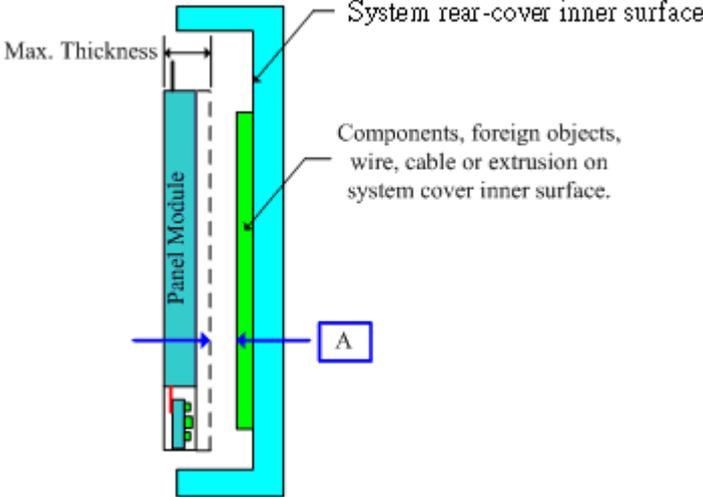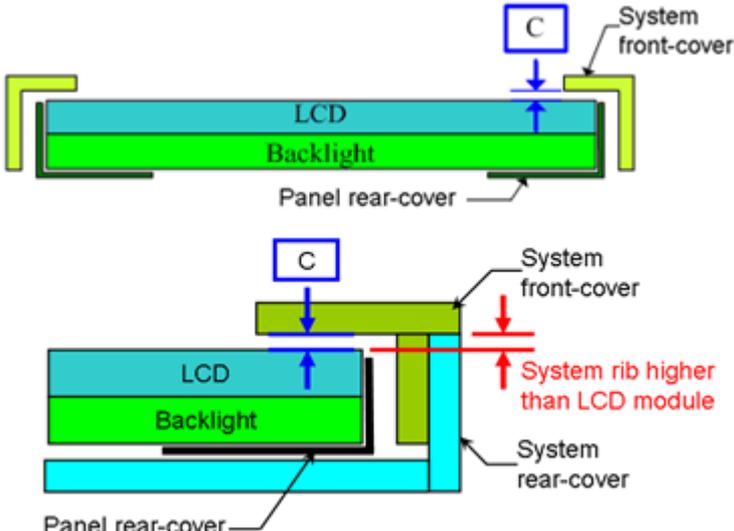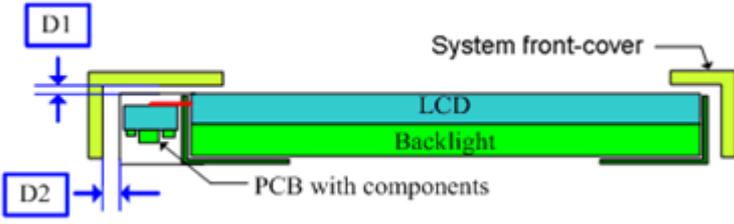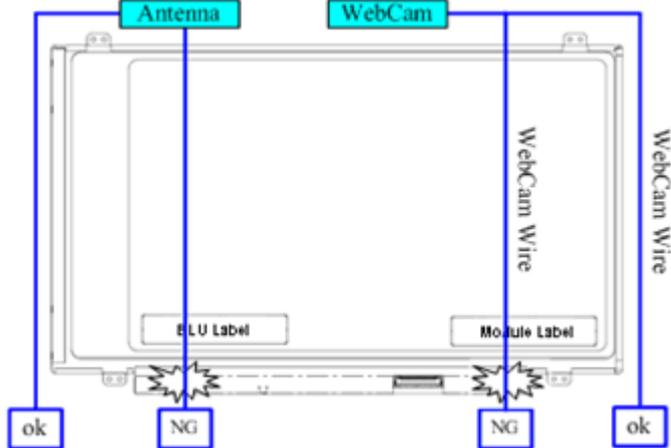| 88	58	# 2 New line character indicates end of ASCII string	0A	00001010
89	59	# 2 Padding with "Blank" character	20	00100000
90	5A	Detailed timing description # 3	00	00000000
91	5B	# 3 Flag	00	00000000
92	5C	# 3 Reserved	00	00000000
93	5D	# 3 ASCII string Vendor	FE	11111110
94	5E	# 3 Flag	00	00000000
95	5F	# 3 Character of string ("C")	43	01000011
96	60	# 3 Character of string ("M")	4D	01001101
97	61	# 3 Character of string ("N")	4E	01001110
98	62	# 3 New line character indicates end of ASCII string	0A	00001010
99	63	# 3 Padding with "Blank" character	20	00100000
100	64	# 3 Padding with "Blank" character	20	00100000
101	65	# 3 Padding with "Blank" character	20	00100000
102	66	# 3 Padding with "Blank" character	20	00100000
103	67	# 3 Padding with "Blank" character	20	00100000
104	68	# 3 Padding with "Blank" character	20	00100000
105	69	# 3 Padding with "Blank" character	20	00100000
106	6A	# 3 Padding with "Blank" character	20	00100000
107	6B	# 3 Padding with "Blank" character	20	00100000
108	6C	Detailed timing description # 4	00	00000000
109	6D	# 4 Flag	00	00000000
110	6E	# 4 Reserved	00	00000000
111	6F	# 4 ASCII string Model Name	FE	11111110
112	70	# 4 Flag	00	00000000
113	71	# 4 Character of Model name ("N")	4E	01001110
114	72	# 4 Character of Model name ("1")	31	00110001
115	73	# 4 Character of Model name ("1")	31	00110001
116	74	# 4 Character of Model name ("6")	36	00110110
117	75	# 4 Character of Model name ("B")	42	01000010
118	76	# 4 Character of Model name ("C")	43	01000011
119	77	# 4 Character of Model name ("A")	41	01000001
120	78	# 4 Character of Model name ("-")	2D	00101101
121	79	# 4 Character of Model name ("E")	45	01000101
122	7A	# 4 Character of Model name ("A")	41	01000001
123	7B	# 4 Character of Model name ("1")	31	00110001
124	7C	# 4 New line character indicates end of ASCII string	0A	00001010
125	7D	# 4 Padding with "Blank" character	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	D5	11010101

Appendix. OUTLINE DRAWING

DETAIL A
SCALE 5:1

DETAIL B
SCALE 5:1

DETAIL C
SCALE 5:1

DETAIL D
SCALE 5:1
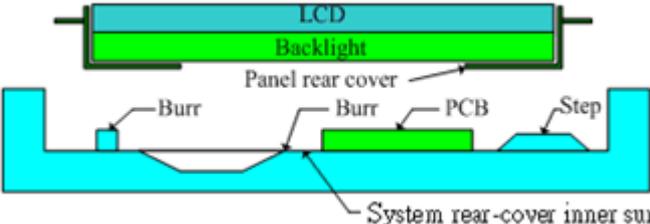

DETAIL F
SCALE 5:1

DETAIL E
SCALE 5:1

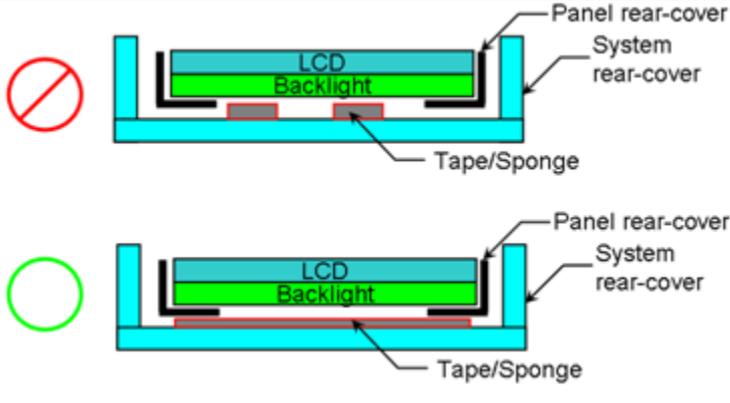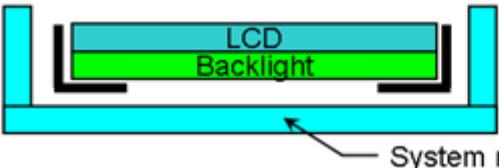DRIVER IC,FPC AND TCON LOCATION SEE NOTES FOR EXPLANATION
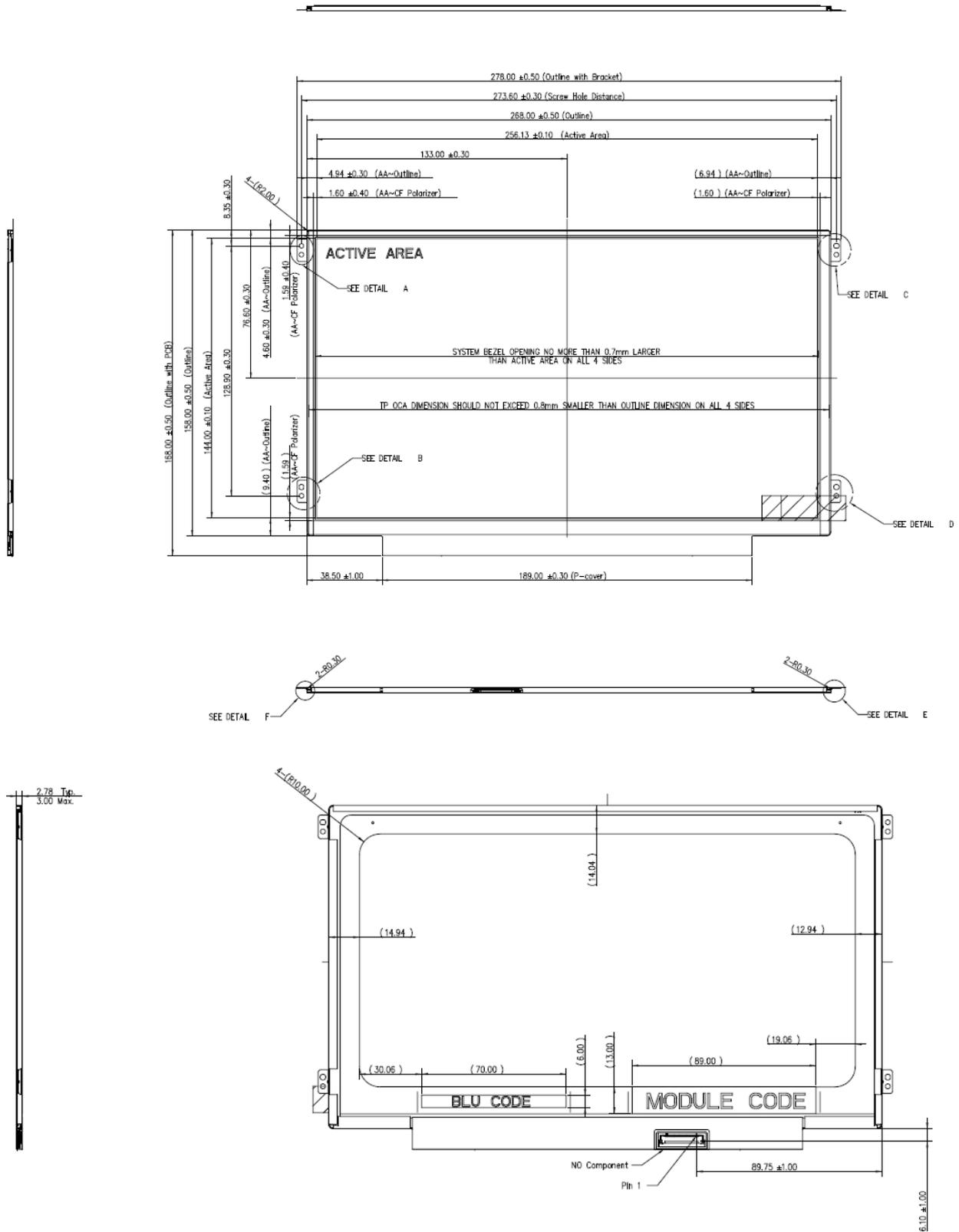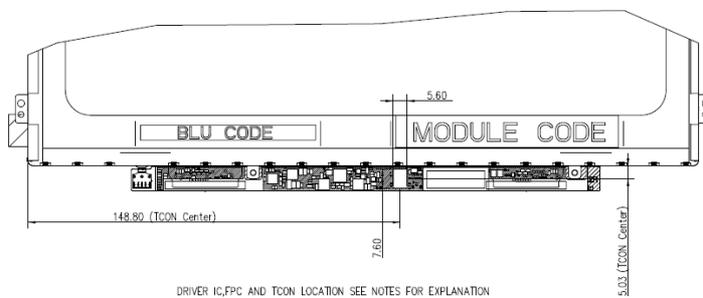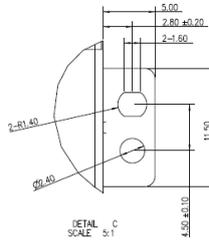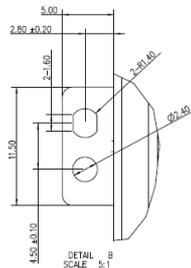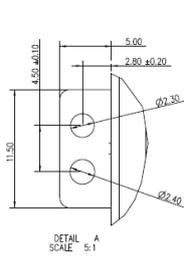
NOTES :
1. IN ORDER TO AVOID ABNORMAL DISPLAY, POOLING AND WHITE SPOT,
   NO OVERLAPPING IS SUGGESTED AT CABLES, ANTENNAS, CAMERA, WLAN, WAN OR
   FOREIGN OBJECTS OVER FPC, AND T-CON LOCATIONS.
2. EDP CONNECTOR IS MEASURED AT PIN1 AND ITS MATING LINE.
3. MODULE FLATNESS SPEC 0.5 mm MAX. (SPEC. WILL BE MODIFIED AFTER DVT CHECK).
4. "( )" MARKS THE REFERENCE DIMENSION.
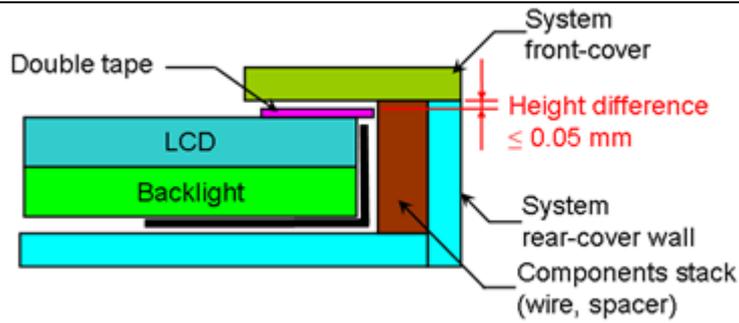
Appendix. SYSTEM COVER DESIGN GUIDANCE

0.	Permanent deformation of system cover after reliability test
Definition	System cover including front and rear cover may deform during reliability test. Permanent deformation of system front and rear cover after reliability test should not interfere with panel. Because it may cause issues such as pooling, abnormal display, white spot, and also cell crack. Note: If the interference can not be avoided, please feel free to contact INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.
1.	Design gap A between panel & any components on system rear-cover
Definition	Gap between panel's maximum thickness boundary & system's inner surface components such as wire, cable, extrusion is needed for preventing from backpack or pogo test fail. Because zero gap or interference may cause stress concentration. Issues such as pooling, abnormal display, white spot, and cell crack may occur. Maximum flatness of panel and system rear-cover should be taken into account for gap design. Note: If the interference can not be avoided, please feel free to contact INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.
2	Design gap B1 & B2 between panel & protrusions

Definition	Gap between panel & protrusions is needed to prevent shock test failure. Because protrusions with small gap may hit panel during the test. Issue such as cell crack, abnormal display may occur. The gap should be large enough to absorb the maximum displacement during the test. Note: If the interference can not be avoided, please feel free to contact INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.
3	**Design gap C between system front-cover & panel surface.**

Definition	Gap between system front-cover & panel surface is needed to prevent pooling or glass broken. Zero gap or interference such as burr and warpage from mold frame may cause pooling issue near system font-cover opening edge. This phenomenon is obvious during swing test, hinge test, knock test, or during pooling inspection procedure. To remain sufficient gap, design with system rib higher than maximum panel thickness is recommended. Note: If the interference can not be avoided, please feel free to contact INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.
4	**Design gap D1 & D2 between system front-cover & PCB Assembly.**

Definition	Same as point 2 and 3, but focus on PCBA side.
5	**Interference examination of antenna cable and WebCam wire**

Definition	Antenna cable or WebCam wire should not overlap with panel outline. Because issue such as abnormal display & white spot after backpack test, hinge test, twist test or pogo test may occur. Note: If the interference can not be avoided, please feel free to contact INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.
6	**Interference examination of antenna cable and Web Cam wire**
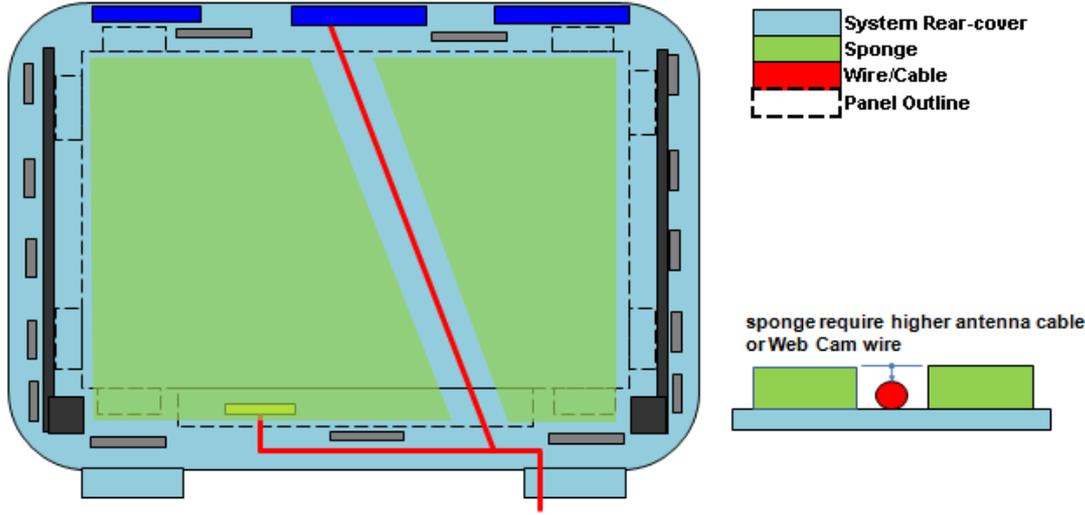
|	If the antenna cable or Web Cam wire must overlap with the panel outline, both sides of the antenna cable or Web Cam wire must have a sponge(Sponge material can not contain NH3) and sponge require higher antenna cable or Web Cam wire.(Antenna cable or Web Cam wire should not overlap with TCON,COF/FPC,Driver IC) Note: If the interference can not be avoided, please feel free to contact INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.
7	**System rear-cover inner surface examination**

Definition	Burr at logo edge, steps, protrusions or PCB board may cause stress concentration. White spot or glass broken issue may occur during reliability test.
8	**Tape/sponge design on system inner surface**

Definition	To prevent abnormal display & white spot after scuffing test, hinge test, pogo test, backpack test, tape/sponge should be well covered under panel rear-cover. Because tape/sponge in separate location may act as pressure concentration location.
9	**Material used for system rear-cover**

Definition	System rear-cover material with high rigidity is needed to resist deformation during scuffing test, hinge test, pogo test, or backpack test. Abnormal display, white spot, pooling issue may occur if low rigidity material is used. Pooling issue may occur because screw's boss positioning for module's bracket are deformed during open-close test. Solid structure design of system rear-cover may also influence the rigidity of system rear-cover. The deformation of system rear-cover should not caused interference.
10	**System base unit design near keyboard and mouse pad**
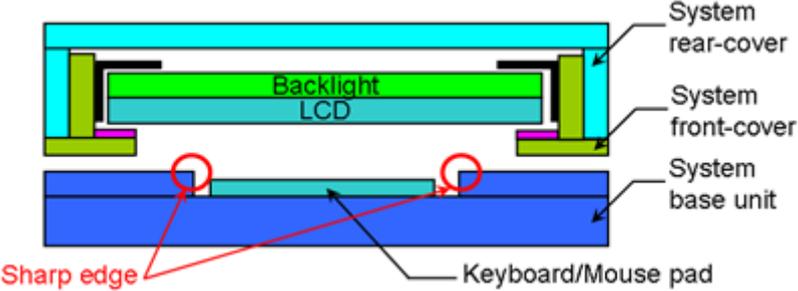
Definition	To prevent abnormal display & white spot after scuffing test, hinge test, pogo test, backpack test, sharp edge design in keyboard surface may damage panel during the test. We suggest to use slope edge design, or to reduce the thickness difference of keyboard/mouse pad from the nearby surface.

11	Screw boss height design

Definition	Screw boss height should be designed with respect to the height of bracket bottom surface to panel bottom surface + flatness change of panel itself. Because gap will exist between screw boss and bracket, if the screw boss height is smaller. As result while fastening screw, bracket will deformed and pooling issue may occur.

12	Assembly SOP examination for system front-cover with Hook design

Definition	To prevent panel crack during system front-cover assembly process with hook design, it is not recommended to press panel or any location that related directly to the panel.

13	Assembly SOP examination for system front-cover with Double tape design

Definition	To prevent panel crack during system front-cover assembly process with double tape design, it is only allowed to give slight pressure (MAX 3 Kgf/50mm2) with large contact area. This can help to distribute the stress and prevent stress concentration. We also suggest putting the system on a flat surface stage to prevent unequal stress distribution during the assembly.

14	System front-cover assembly reference with Double tape design

Definition	To prevent system front-cover peeling at double tape contact area, Height difference between system front-cover assembly reference such as wall or components stack (wire, spacer) and double tape top surface must be less than 0.05mm.
15	**Touch Application : TP and LCD Module Combination for White Line Prevention**
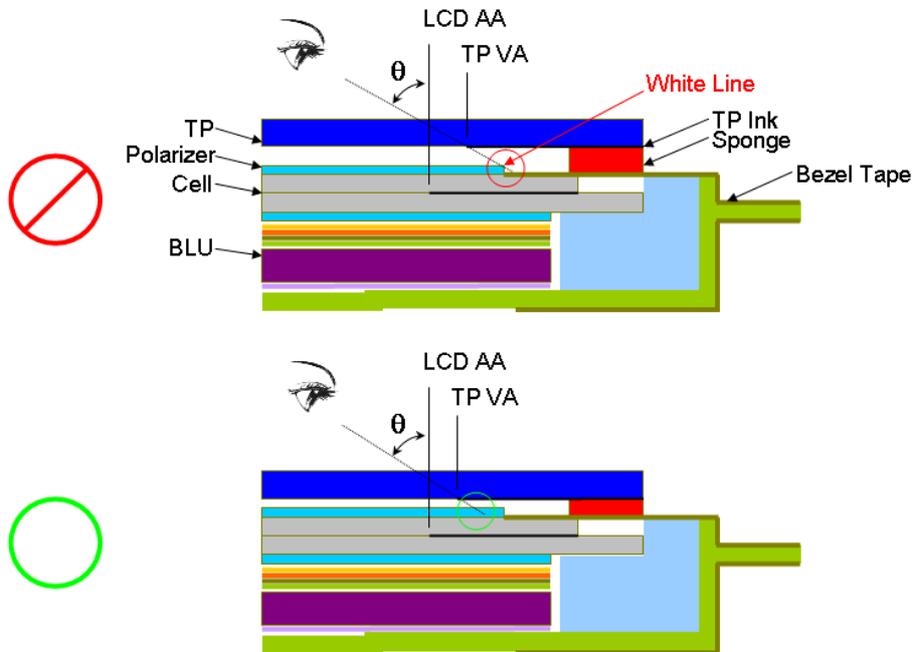
	Parameter consideration for White Line Issue :
1	TP VA to LCD AA distance
2	TP Assembly tolerance
3	TP Ink Printing tolerance
4	Sponge thickness and tolerance
5	Inspection/Viewing Angle specification
6	Polarizer edge to LCD AA distance and tolerance

Polarizer edge to LCD AA distance can be derived by "AA~Outline" – "CF Pol~Outline" with respect to INX 2D Outline Drawing on each side.
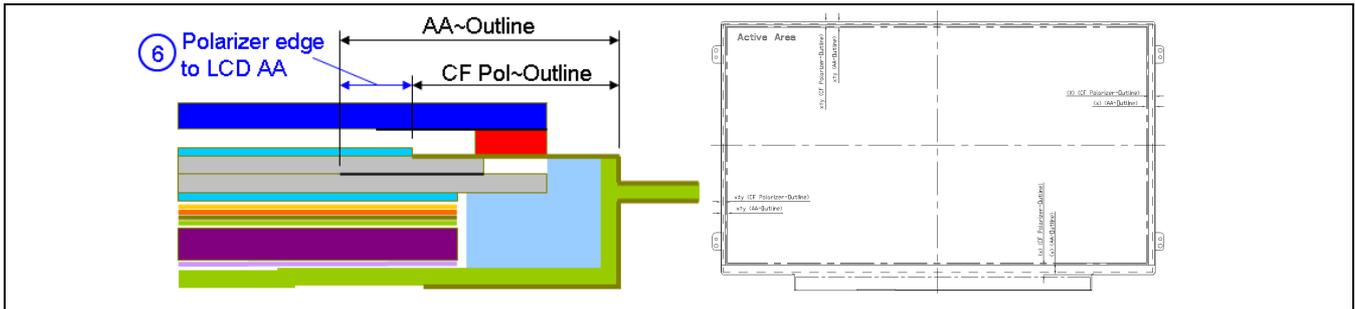
Definition	For using in Touch Application: to prevent White Line appears between TP and LCD module combination, the maximum inspection angle location must not fall onto LCD polarizer edge, otherwise light line near edge of polarizer will be appear. Parameters such as TP VA to LCD AA distance, TP assembly tolerance, TP Ink printing tolerance, Sponge thickness and tolerance, and Maximum Inspection/Viewing Angle, must be considered with respect to LCD module's Polarizer edge location and tolerance. This consideration must be taken at all four edges separately. The goal is to find parameters combination that allow maximum inspection angle falls inside polarizer black margin area. Note: Information for Polarizer edge location and its tolerance can be derived from INX 2D Outline Drawing ("AA ~Outline" - "CF Pol~Outline"). Note: Please feel free to contact INX FAE Engineer. By providing value of parameters above on each side, we can help to verify and pass the white line risk assessment for customer reference.
16	**Color of system front-cover material**
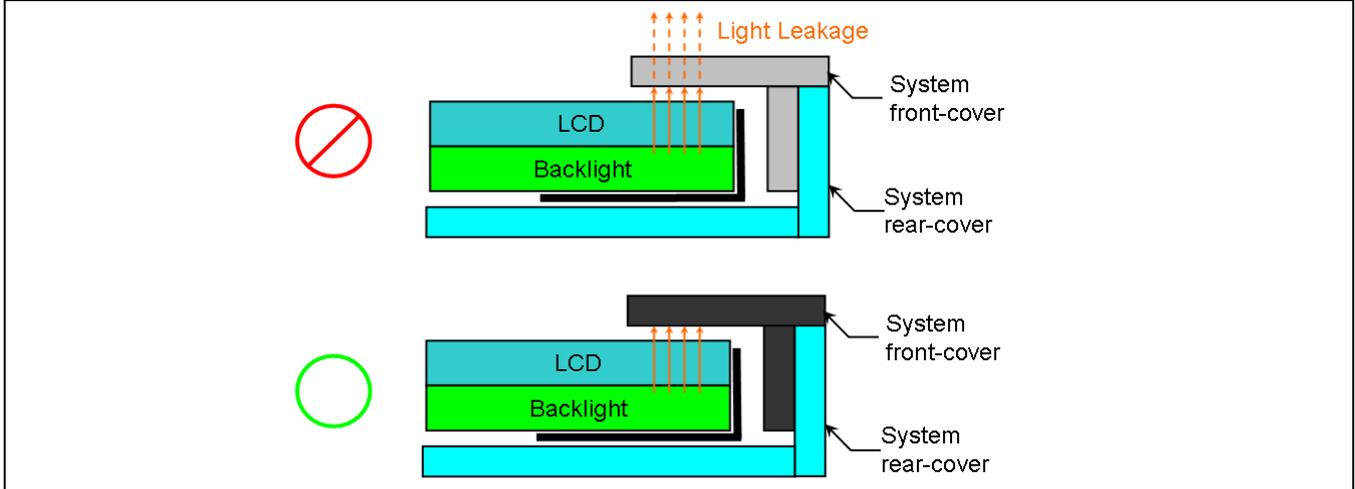
Definition	To prevent light leakage is seen at system front-cover due to material transparency, we suggest using dark color material (black) for system front-cover design.
17	**Inspection spec of gap E between system front-cover to LCD module surface**

Definition	To maintain gap E (gap of system front-cover to LCD module) in its inspection spec, especially at location with maximum LCD deformation (center of LCD length), we recommend adding spacer with design gap A smaller or equal to gap E. The allowable spacer mating location is on module metal frame outside LCD Active-Area. Note: If the interference can not be avoided, please feel free to contact INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.

Appendix. LCD MODULE HANDLING MANUAL

Purpose	・ **This SOP is prepared to prevent panel dysfunction possibility through incorrect handling procedure.** ・ **This manual provides guide in unpacking and handling steps.** ・ **Any person which may contact / related with panel, should follow guide stated in this manual to prevent panel loss.**
1.	**Unpacking**

Open carton   Remove EPE Cushion

Open plastic bag   Cut Adhesive Tape   Remove EPE Cushion

2.	**Panel Lifting**

Remove PET Cover

Remove PE Foam

Handle with care (see next page)

Finger Slot

Use slots at both sides for finger insertion.
Handle panel upward with care.

3.	Do and Don't

Do :
- Handle with both hands.
- Handle panel at left and right edge.

Don't :
- Lifting with one hand.
- Handle at PCBA side.

Don't :
- Stack panels.
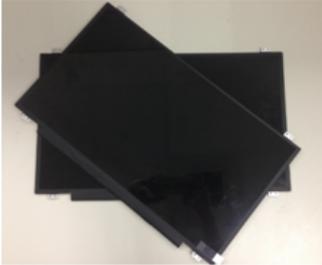
- Press panel.

Don't :
- Put foreign stuff onto panel

- Put foreign stuff under panel

Don't :
- Paste any material unto white reflector sheet

Don't :
- Pull / Push white reflector sheet

Don't :
• Hold at panel corner.

Don't :
- Twist panel.

Do :
- Hold panel at top edge while inserting connector.

Don't :
- Press white reflector sheet while inserting connector.

Do :

- Remove panel protector film starts from pull tape

Don't :

- Remove panel protector film From film another side.

Don't :

- Touch or Press PCBA Area.

InnoLux
群創光電

MODEL NO.: M315DJJ
SUFFIX: K31

Customer:

APPROVED BY   **SIGNATURE**

Name / Title
Note
Product Version C1

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

Approved By	Checked By	Prepared By
陳立錚	陳立錚	陳有成

CONTENTS

REVISION HISTORY

Version	Date	Page	Description
3.0	May.29, 2018	All	Spec Ver.3.0 was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

M315DJJ-K31 is a 31.5" TFT Liquid Crystal Display MNT module with WLED Backlight unit and 51 pins 8lane –V by1 interface. This module supports 3840 x 2160 UHD mode and can display up to 1.073G colors. The converter module for Backlight is not built in.

1.2 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Screen Size	31.5" real diagonal		
Driver Element	a-si TFT active matrix	-	-
Pixel Number	3840 x R.G.B. x 2160	pixel	-
Pixel Pitch	0.181 (H) x 0.181 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	1.073G	color	-
Transmissive Mode	Normally Black	-	-
Surface Treatment	AG type, 3H hard coating, Haze 25	-	-
Luminance, White	400	Cd/m2	-
Color Gamut	95% of NTSC(Typ.)	-	-
Display Orientation	Signal input with " INX"		(2)
Compliance	RoHS, Halogen Free TCO 7.0, VESA PCHDR-600 compliance		
Power Consumption	Total (91.92) W (Max.) @ cell 15.12 W (Max.), BL (76.8) W (Max.)		(1)

Note (1) The specified power consumption : Total= cell (reference 4.3.1)+BL (reference 4.3.3)

Note (2)

false
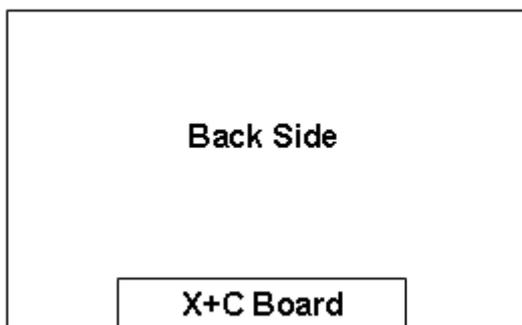
2. MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	716.4	717.4	718.4	mm	(1)
	Vertical (V)	412.85	413.85	414.85-	mm	
	Thickness (T)	16.9	17.9	18.9	mm	
Bezel Area	Horizontal	702.4	703.4	704.4	mm	
	Vertical	396.85	397.85	398.85	mm	
Active Area	Horizontal	-	698.4	-	mm	
	Vertical	-	392.85	-	mm	
Weight		-	3600	3650	g	

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

3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	TST	-20	60	ºC	(1)
Operating Ambient Temperature	TOP	0	50	ºC	(1), (2)

Note (1)

(a) 90 %RH Max.

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

(c) No condensation.

Note (2) Panel surface temperature should be 0℃ min. and 65℃ max under Vcc=5.0V, fr =60Hz, typical LED string current, 25℃ ambient temperature, and no humidity control . Any condition of ambient operating temperature ,the surface of active area should be keeping not higher than 65℃.

3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCCS	-0.3	13.5	V	(1)
Logic Input Voltage	V$_{IN}$	-0.3	3.6	V	

3.2.2 BACKLIGHT UNIT

Item	Symbol	Value			Unit	Note
		Min.	Typ	Max.		
LED Forward Current Per Input Pin	I$_F$	142.5	150	157.5	mA	(1), (2), (3),
LED Reverse Voltage Per Input Pin	V$_R$	24	30	32	V	
LED Pulse Forward Current Per Input Pin	I$_P$			500	mA	(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).

Note (3) Duty=60% for normal mode/ Duty=5%~100% for HDR mode

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM
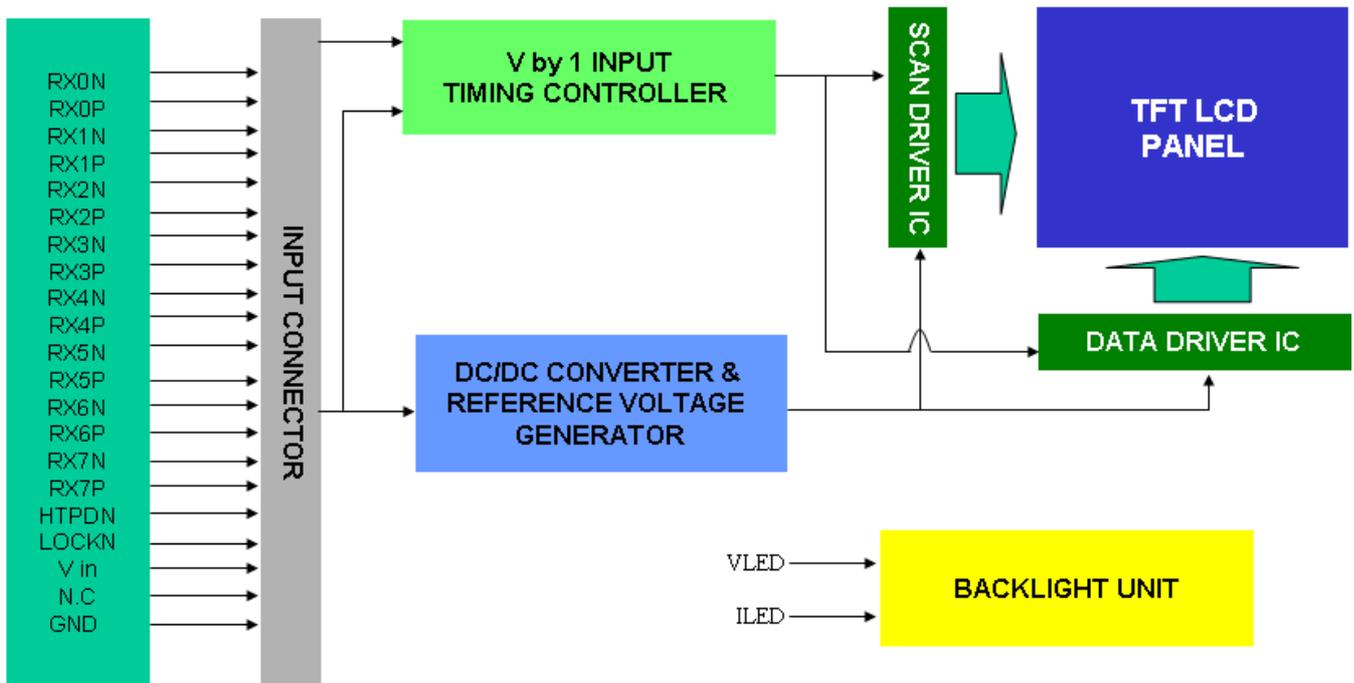
4.2. INTERFACE CONNECTIONS

PIN ASSIGNMENT

Pin	Name	Description	Note
1	Vin	Power input (+12V)	
2	Vin	Power input (+12V)	
3	Vin	Power input (+12V)	
4	Vin	Power input (+12V)	
5	Vin	Power input (+12V)	
6	Vin	Power input (+12V)	
7	Vin	Power input (+12V)	
8	Vin	Power input (+12V)	
9	N.C.	No Connection	(2)
10	GND	Ground	
11	GND	Ground	
12	GND.	Ground	
13	GND.	Ground	
14	GND.	Ground	
15	N.C.	No Connection	(2)
16	N.C.	No Connection	(2)
17	N.C.	No Connection	(2)
18	N.C	For internal use, no connection	
19	N.C	For internal use, no connection	
20	N.C.	No Connection	(2)
21	N.C.	No Connection	(2)
22	N.C.	No Connection	(2)
23	N.C.	No Connection	(2)

24	N.C.	No Connection	(2)
25	HTPDN	Hot plug detect output, Open drain.	
26	LOCKN	Lock detect output, Open drain.	
27	GND	Ground	
28	RX0N	1st Pixel Negative VbyOne differential data input in area A. Lan 0	(1)
29	RX0P	1st Pixel Positive VbyOne differential data input in area A. Lan 0	
30	GND	Ground	
31	RX1N	2nd Pixel Negative VbyOne differential data input in area A. Lan 1	(1)
32	RX1P	2nd Pixel Positive VbyOne differential data input in area A. Lan 1	
33	GND	Ground	
34	RX2N	3rd Pixel Negative VbyOne differential data input in area A. Lan 2	(1)
35	RX2P	3rd Pixel Positive VbyOne differential data input in area A. Lan 2	
36	GND	Ground	
37	RX3N	4th Pixel Negative VbyOne differential data input in area A. Lan 3	(1)
38	RX3P	4th Pixel Positive VbyOne differential data input in area A. Lan 3	
39	GND	Ground	
40	RX4N	5th Pixel Negative VbyOne differential data input in area A. Lan 4	(1)
41	RX4P	5th Pixel Positive VbyOne differential data input in area A. Lan 4	
42	GND	Ground	
43	RX5N	6th Pixel Negative VbyOne differential data input in area A. Lan 5	(1)
44	RX5P	6th Pixel Positive VbyOne differential data input in area A. Lan 5	
45	GND	Ground	
46	RX6N	7th Pixel Negative VbyOne differential data input in area A. Lan 6	(1)
47	RX6P	7th Pixel Positive VbyOne differential data input in area A. Lan 6	
48	GND	Ground	
Pin	Name	Description	Note
49	RX7N	8th Pixel Negative VbyOne differential data input in area A. Lan 7	(1)
50	RX7P	8th Pixel Positive VbyOne differential data input in area A. Lan 7	
51	GND	Ground	

Connector Information

Item	Description
Manufacturer	FCN/ P-TWO
Type part number	FCN: WF23-402-5133 P-TWO: 187059-51221
User's Mating housing part number	JAE: FI-RE51HL

*Notice: There would be compatible issues if not using the indicated connectors in the matching list.

Note (1) V-by-One$^{®}$ HS Data Mapping

Lan	Data Stream
Lan 0	1, 9, 17, ..., 3825, 3833
Lan 1	2, 10, 18, ..., 3826, 3834
Lan 2	3, 11, 19, ..., 3827, 3835
Lan 3	4, 12, 20, ..., 3828, 3836
Lan 4	5, 13, 21, ..., 3829, 3837
Lan 5	6, 14, 22, ..., 3830, 3838
Lan 6	7, 15, 23, ..., 3831, 3839
Lan 7	8, 16, 24, ..., 3832, 3840

Note (2) Reserved for internal use. Please leave it open.

Note (3) VbyOne HS connector pin order defined as following:
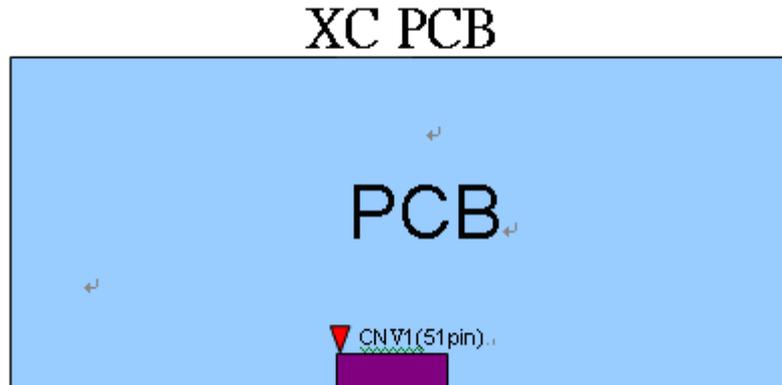
Note (4) V-by-One connector mating dimension range request is 0.93mm~1.0mm as below:
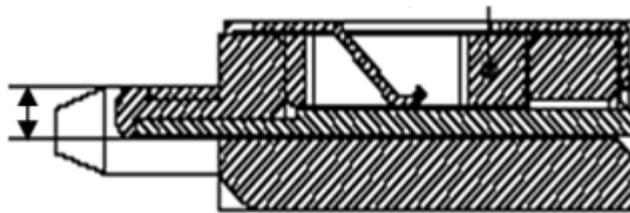
Note (5) The first pixel is odd.

Note (6) Input signal of even and odd clock should be the same timing
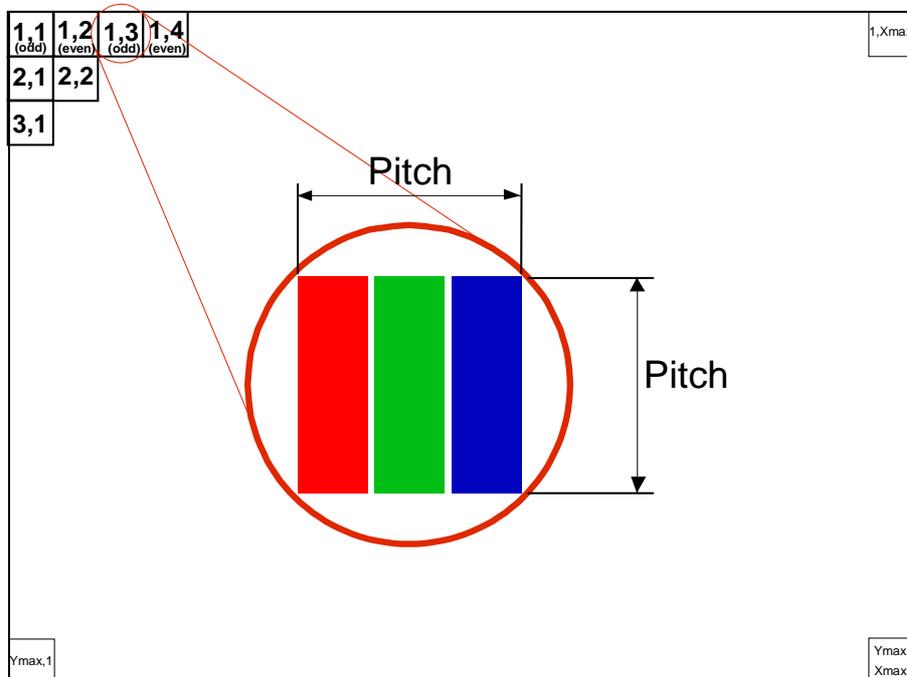
4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD ELETRONICS SPECIFICATION

(Ta = 25 ± 2 ºC)

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	10.8	12	13.2	V	(1)
Rush Current		I_{RUSH}	—	—	2.6	A	(2)
Power Consumption	White Pattern	P_T	—	8.78	9.52	W	(3)
	Black Pattern	P_T	—	8.18	8.86	W	
	Horizontal Stripe	P_T	—	15.12	16.38	W	
Power Supply Current	White Pattern	—	—	0.73	0.88	A	(3)
	Black Pattern	—	—	0.68	0.82	A	
	Horizontal Stripe	—	—	1.26	1.53	A	
VbyOne HS	Differential Input High Threshold Voltage	VLVTH	—	—	+50	mV	
	Differential Input Low Threshold Voltage	VLVTL	-50	—	—	mV	
	Differential Input Resistor	RRIN	80	100	120	ohm	
CMOS interface	Input High Threshold Voltage	VIH	2.7	—	3.3	V	
	Input Low Threshold Voltage	VIL	0	—	0.7	V	

Note (1) The module should be always operated within the above ranges. The ripple voltage should be controlled under 10 % of Vcc (Typ.)

Note (2) Measurement Conditions
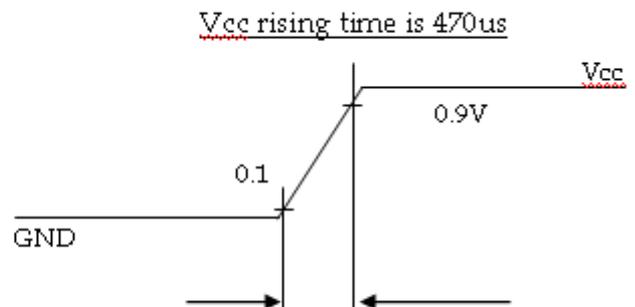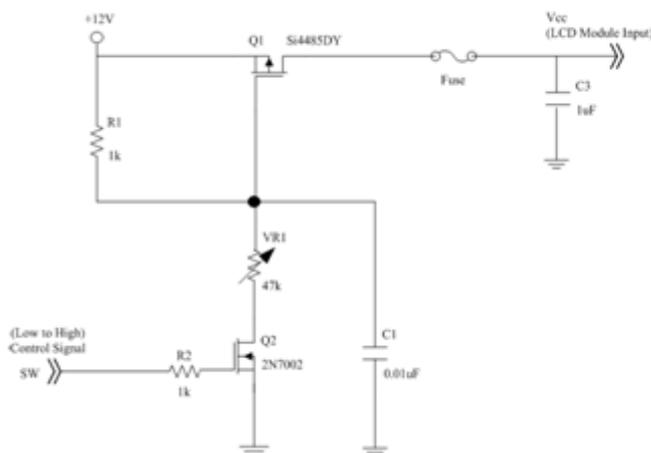
Note (3) The specified power supply current is under the conditions at Vcc = 12 V, Ta = 25 ± 2 ºC, Fr = 60Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

Active Area

b. Black Pattern

Active Area

c. Horizontal Pattern
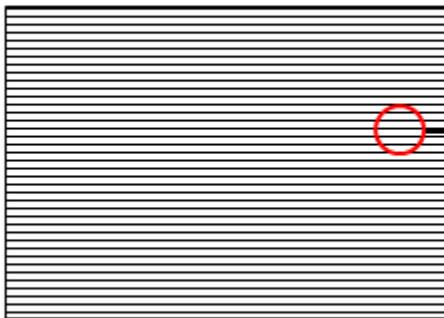
4.3.2 VCC POWER DIP CONDITION
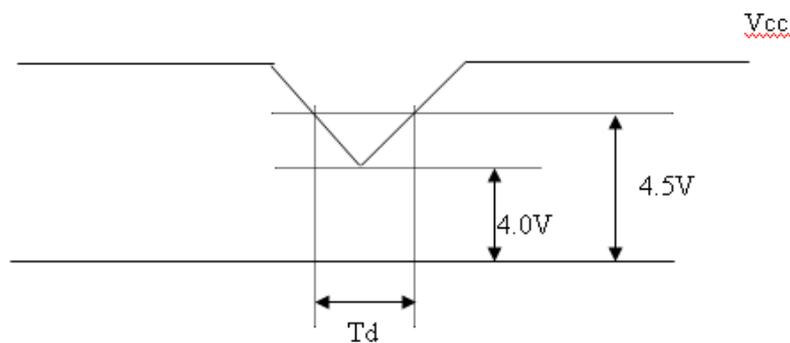
4.3.3 BACKLIGHT UNIT

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Input Voltage Per Input Pin	VPIN	24	30	32	V	(1), Duty=100%, IPIN=150mA
LED Light Bar Current Per Input Pin	IPIN	142.5	150	157.5	mA	(1), (2), (5)
LED Life Time	LLED	30000			Hrs	(3)
Power Consumption	PBL	---	72	76.8	W	(1) Duty=100%, IPIN=150mA

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

Note (2) PBL = IPIN × VPIN × (16) input pins ,

Note (3) The lifetime of LED is defined as the time when LED packages continue to operate under the conditions at Ta = 25 ±2 ℃ and I= (150)mA (per chip) until the brightness becomes ≦ 50% of its original value.

Note (4) The module must be operated with constant driving current.

Note (5) Duty=60% for normal mode/ Duty=5%~100% for HDR mode

4.3.4 LIGHTBAR CONNECTOR PIN ASSIGNMENT

Connector: FCN WM13-406-123N or CviLux CI1412M1HRM-NH.

CN1
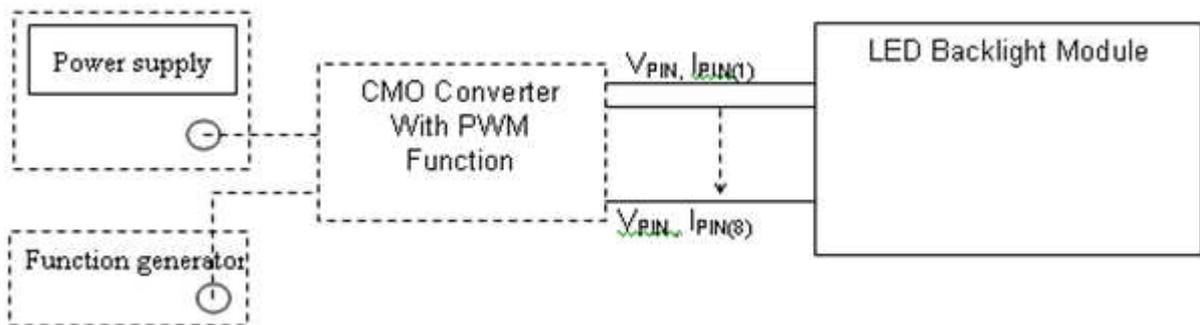
Pin number	Description
1	Cathode of LED string
2	Cathode of LED string
3	Cathode of LED string
4	Cathode of LED string
5	Not connection, this pin should be open
6	VLED
7	VLED
8	Not connection, this pin should be open
9	Cathode of LED string
10	Cathode of LED string
11	Cathode of LED string
12	Cathode of LED string

4.4 LVDS INPUT SIGNAL SPECIFICATIONS

4.4.1 V BY One ONE DATA MAPPING TABLE

Lan	Data Stream
Lan 0	1, 9, 17, ..., 3825, 3833
Lan 1	2, 10, 18, ..., 3826, 3834
Lan 2	3, 11, 19, ..., 3827, 3835
Lan 3	4, 12, 20, ..., 3828, 3836
Lan 4	5, 13, 21, ..., 3829, 3837
Lan 5	6, 14, 22, ..., 3830, 3838
Lan 6	7, 15, 23, ..., 3831, 3839
Lan 7	8, 16, 24, ..., 3832, 3840

4.4.2 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 10-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	Red										Green										BLUE									
		R9	R8	G7	G6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	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	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	1	1	0	0	0	0	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	0	0	1	1	1	1	1	1	1	1	1	1	0	0	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	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	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	1	1	0	0	0	0	0	0	0	0	0	0	1	1	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	1	1	1	1	0	0	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	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	0	0	0	0	0	0
	Red(1)	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
	Red(2)	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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(1021)	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1022)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	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	0	0	0	0	0	0
	Green(1)	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
	Green(2)	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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(1021)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
	Green(1022)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
	Green(1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	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	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	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	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(1021)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1
	Blue(1022)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0
	Blue(1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	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
V by One	Frequency	Fc	70	74.25	80	MHz	(1)
	Intra-Pair skew		-0.3	-	0.3	UI	(2)
	Inter-Pair skew		-5	-	5	UI	(3)
	Spread spectrum modulation range	Fclkin_mod	F_{clkin}-0.5%	-	F_{clkin}+0.5%	MHz	(4)
	Spread spectrum modulation frequency	F_{SSM}	-	-	30	KHz	
Vertical Display Term	Frame Rate	Fr	40	60	62.5	Hz	(5)(6)(7)
	Total	Tv	2200	2250	2790	Th	Tv=Tvd+Tvb
	Active Display	Tvd	2160	2160	2160	Th	-
	Blank	Tvb	40	90	630	Th	-
Horizontal Display Term	Total	Th	530	550	570	Tc	Th=Thd+Thb
	Active Display	Thd	480	480	480	Tc	-
	Blank	Thb	50	70	90	Tc	-

Note : In Free-sync mode, only guaranteed no functional failure, but don't guaranteed its quality of the optical and cosmetic performance.

Note (1) Please make sure the range of pixel clock has follow the below equation:

Fclkin(max) $\geqq$ Fr $\times$ Tv $\times$ Th

Fr $\times$ Tv $\times$ Th $\geqq$ Fclkin (min)

INPUT SIGNAL TIMING DIAGRAM
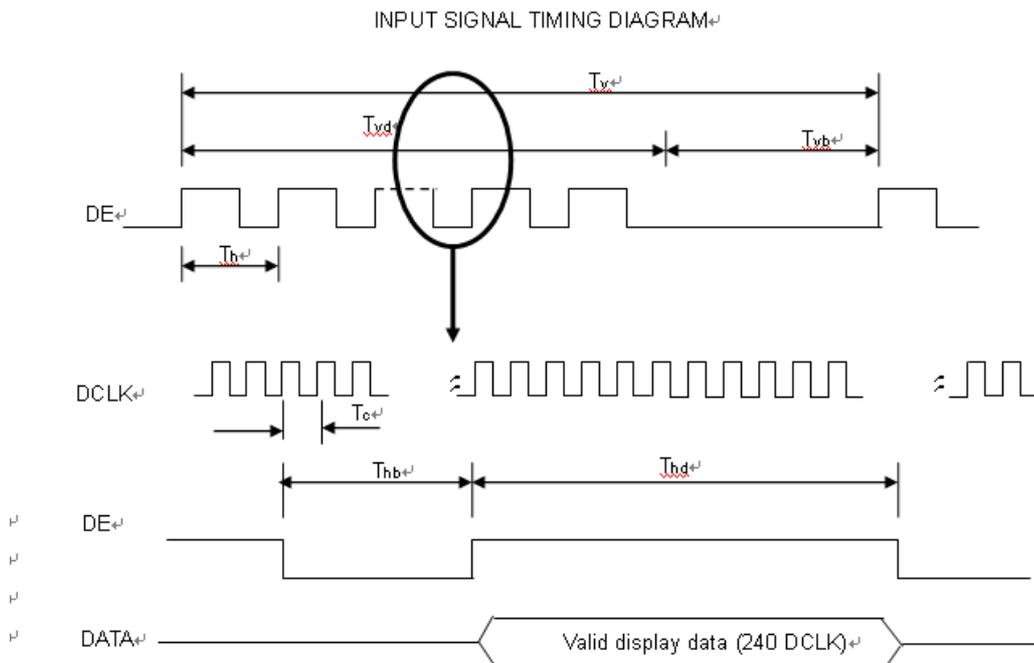
Note (2) V-by-One HS Intra-pair skew
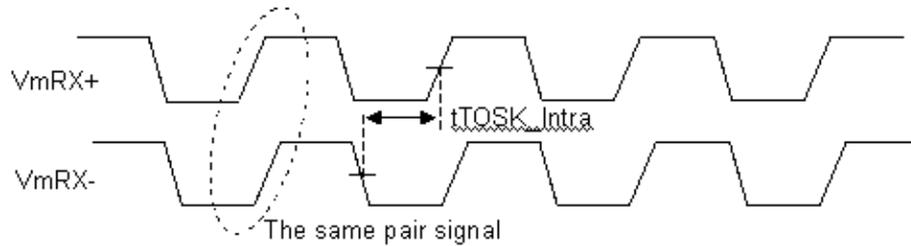
Note (3) V-by-One HS Inter-pair skew
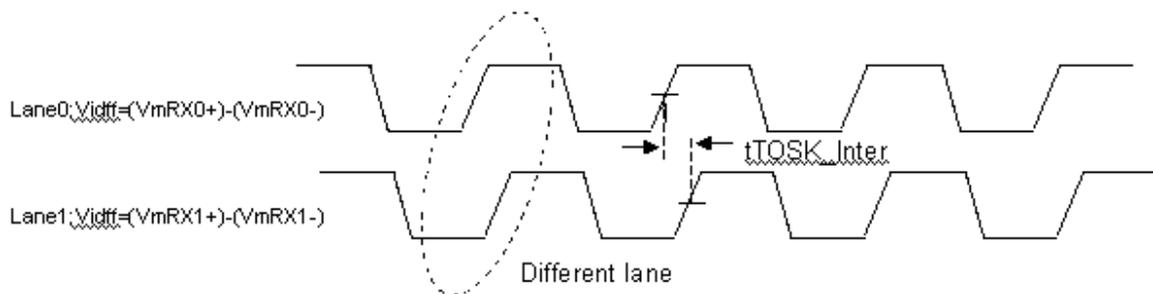
Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.
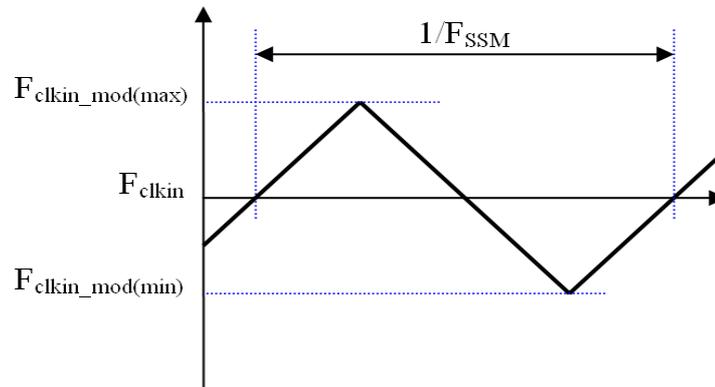
Note (5) The frame-to-frame jitter of the input frame rate is defined as the above figures. FRn = FRn-1 ± 0.5%.

Note (6) The setup of the frame rate jitter > 0.5% may result in the cosmetic LED backlight symptom and the electric function is affected.
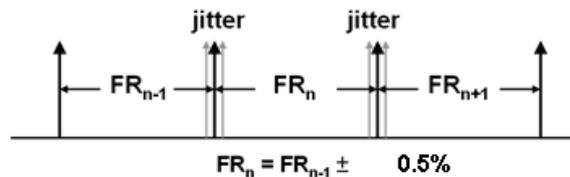
Note (7) In Free-sync mode, only guaranteed no functional failure, but don't guaranteed its quality of the optical and cosmetic performance.

4.6 V BY ONE INPUT SIGNAL TIMING DIAGRAM
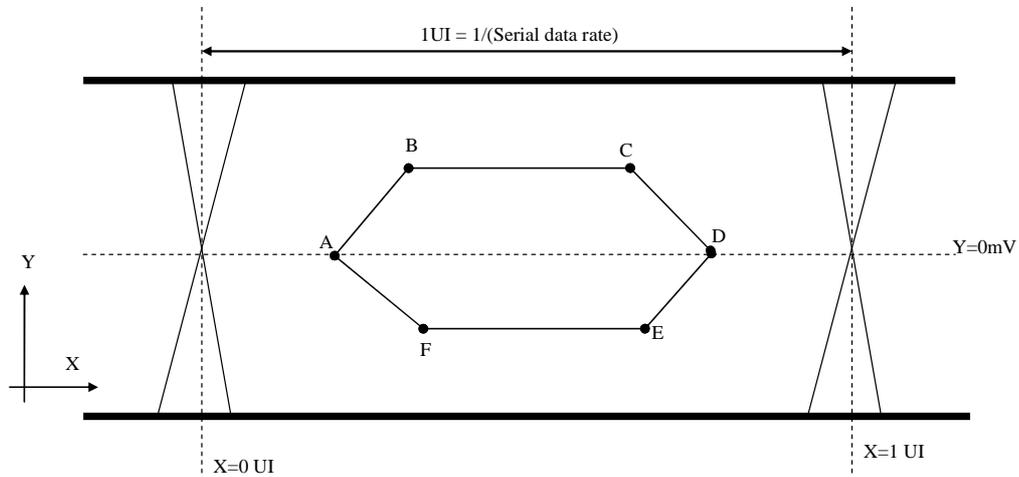
Table 1 Eye Mask Specification

	X [UI]	Y [mV]	Note
A	0.25	0	(1)
B	0.3	50	(1)
C	0.7	50	(1)
D	0.75	0	(1)
E	0.7	-50	(1)
F	0.3	-50	(1)

Note (1) Input levels of V-by-One HS signals are comes from "V-by-One HS Stander Ver.1.4"

4.7 BYTE LENGTH AND COLOR MAPPING OF V-BY-ONE HS

Packer input & Unpacker output		30bpp RGB (10bit)
Byte 0	D[0]	R[2]
	D[1]	R[3]
	D[2]	R[4]
	D[3]	R[5]
	D[4]	R[6]
	D[5]	R[7]
	D[6]	R[8]
	D[7]	R[9]
Byte 1	D[8]	G[2]
	D[9]	G[3]
	D[10]	G[4]
	D[11]	G[5]
	D[12]	G[6]
	D[13]	G[7]
	D[14]	G[8]
	D[15]	G[9]
Byte 2	D[16]	B[2]
	D[17]	B[3]
	D[18]	B[4]
	D[19]	B[5]
	D[20]	B[6]

	D[21]	B[7]
	D[22]	B[8]
	D[23]	B[9]
	D[24]	X
	D[25]	X
	D[26]	B[0]
Byte 3	D[27]	B[1]
	D[28]	G[0]
	D[29]	G[1]
	D[30]	R[0]
	D[31]	R[1]

4.8 POWER ON/OFF SEQUENCE (Ta = 25 ± 2 ºC)

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

0.9Vcc   0.9Vcc

0V   0.1Vcc   0.1Vcc

T1   T4

HTPDN

LOCKN

$0.5 \leqq T1 \leqq 10ms$
$0 \leqq T2$
$0 \leqq T3$
$500ms \leqq T4$
$10mS < T16$ (Recommended)

T16   T3   T2

CDR Traini   Valid Data

V-By-One Signals 0V

Power On   Power Off

Backlight (Recommended)
$500ms \leqq T5$
$100ms \leqq T6$

50%   50%

T5   T6

Vcc Dip
$T15 \leqq 10ms$

T15

Vcc
Vcc(typ.) x 0.85

0V
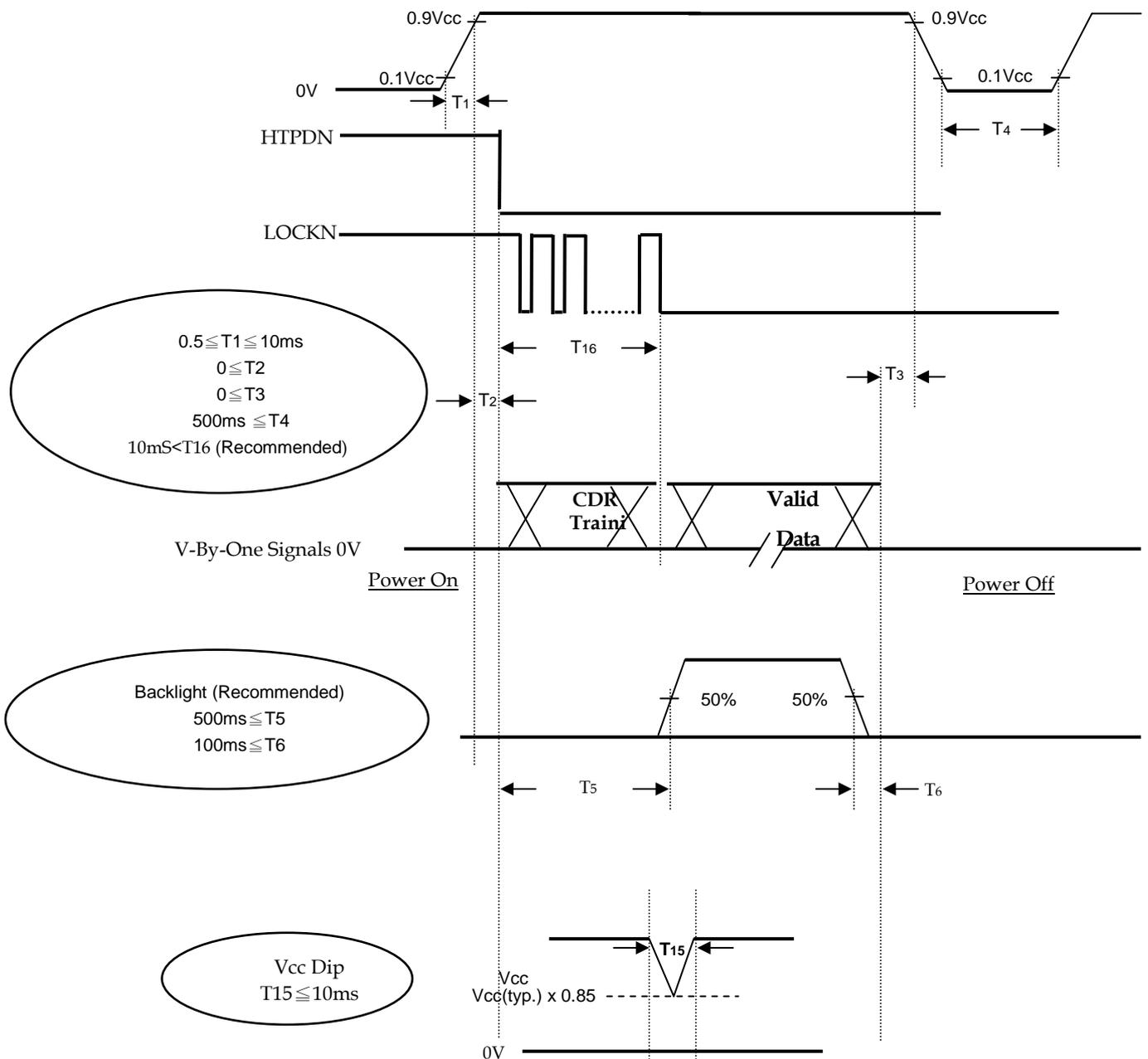
Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

Note (2) Apply the LED voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen..

Note (3) In case of Vcc is in off level, please keep the level of input signals on the low or high impedance. If T2<0,that maybe cause electrical overstress failure.

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

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

Note (6) Vcc must decay smoothly when power-off

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}	5	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current Per Input Pin	I_{PIN}	150 ± 1.2	mA_{DC}
PWM Duty Ratio for normal mode	D	60	%
PWM Duty Ratio for PCHDR peak mode	D	100	%
LED Light Bar Test Converter	INX 27-D041745		

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).

Normal mode

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	Rx	$\theta_x=0°$, $\theta_Y=0°$ CS-2000 R=G=B=255 Gray scale	Typ – 0.03	0.685	Typ + 0.03	-	(1), (5)
		Ry			0.310			
	Green	Gx			0.260			
		Gy			0.685			
	Blue	Bx			0.152			
		By			0.055			
	White	Wx			0.313			
		Wy			0.329			
Center Luminance of White (For normal mode)		L_C		350	400		cd/m²	(4), (5)
Contrast Ratio (normal mode)		CR		2000	3000		-	(2), (5)
Response Time		T_R	$\theta_x=0°$, $\theta_Y=0°$		15	20	ms	(3)
		T_F			5	10		
		GTG			9.5	20		
White Variation		W	$\theta_x=0°$, $\theta_Y=0°$			1.42	%	(5), (6)
Viewing Angle	Horizontal	θx- + θx+	CR ≧ 10	160	178		Deg.	(1), (5)
	Vertical	θy- + θy+		160	178			

PCHDR peak mode

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	Rx	$\theta_x=0°$, $\theta_Y=0°$ CS-2000 R=G=B=255 Gray scale	Typ – 0.03	0.685	Typ + 0.03	-	(1), (5)
		Ry			0.310			
	Green	Gx			0.260			
		Gy			0.685			
	Blue	Bx			0.152			
		By			0.055			
	White	Wx			0.313			
		Wy			0.329			
Center Luminance of White		Lc		600			cd/m²	(4), (5 Duty 100%
Contrast Ratio		CR		(6000)			-	(2), (5)

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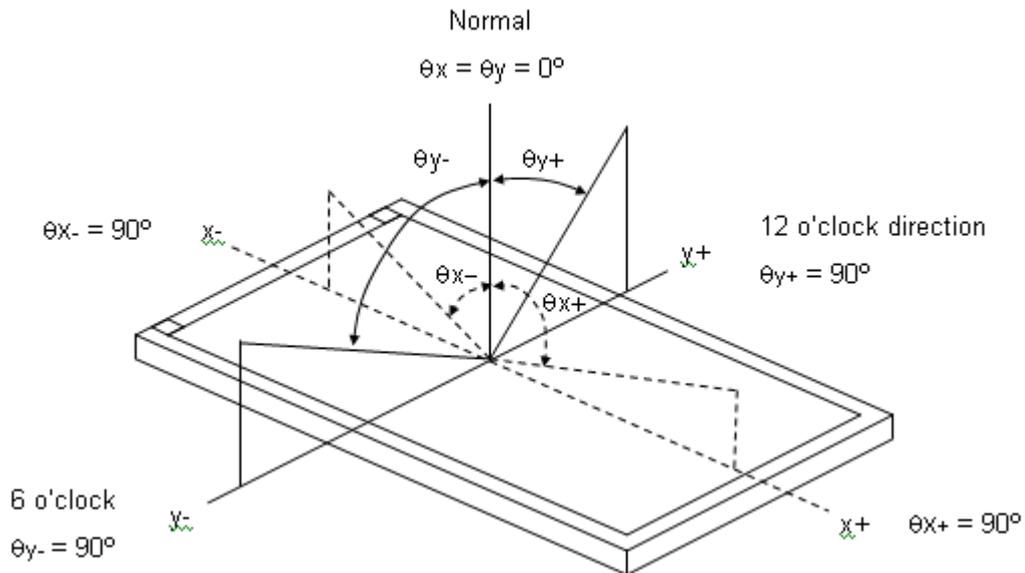
Note (2) Definition of Contrast Ratio (CR):

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 Gray-to-Gray Switching time：

-The TR is the rising-time means the transition time from "Full-Black (gray 0)" to "Full-White (gray 255)" and the TF is the falling-time means the transition time from "Full-White (gray 255)" to "Full-White (gray 0)" as the following figure.(Measured by TEKTRONIX TDS3054B):
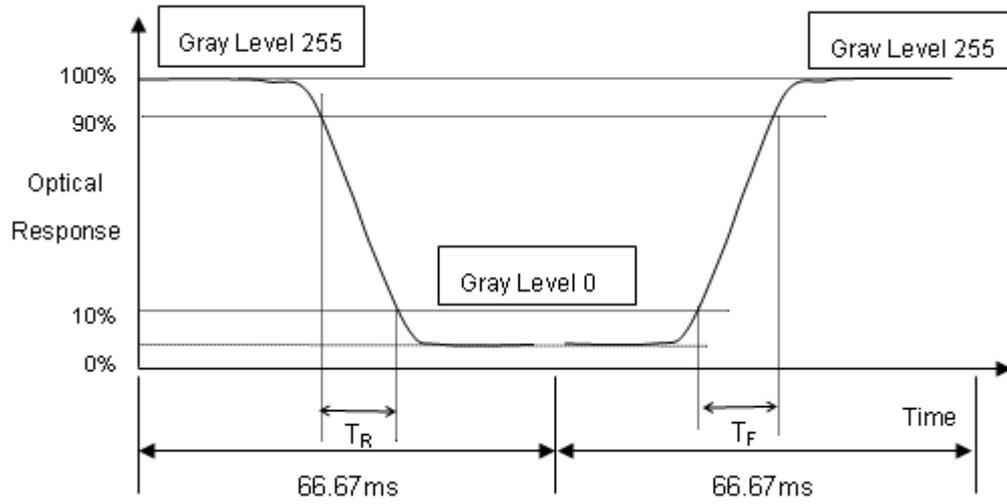
-The TGtG is the response time means the transition time from "Gray N" to "Gray M" (N,M=0~255)

- T_{GtG_AVE} is the total average of the T_{GtG} data (Measured by INX GTG instrument)

- The gray (N,M) stands for the (0,32,64,~255) as the following 9*9 table

Gaty to Gary	0	31	63	95	127	159	191	223	255
0									
31									
63									
95									
127									
159									
191									
223									
255									

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 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.
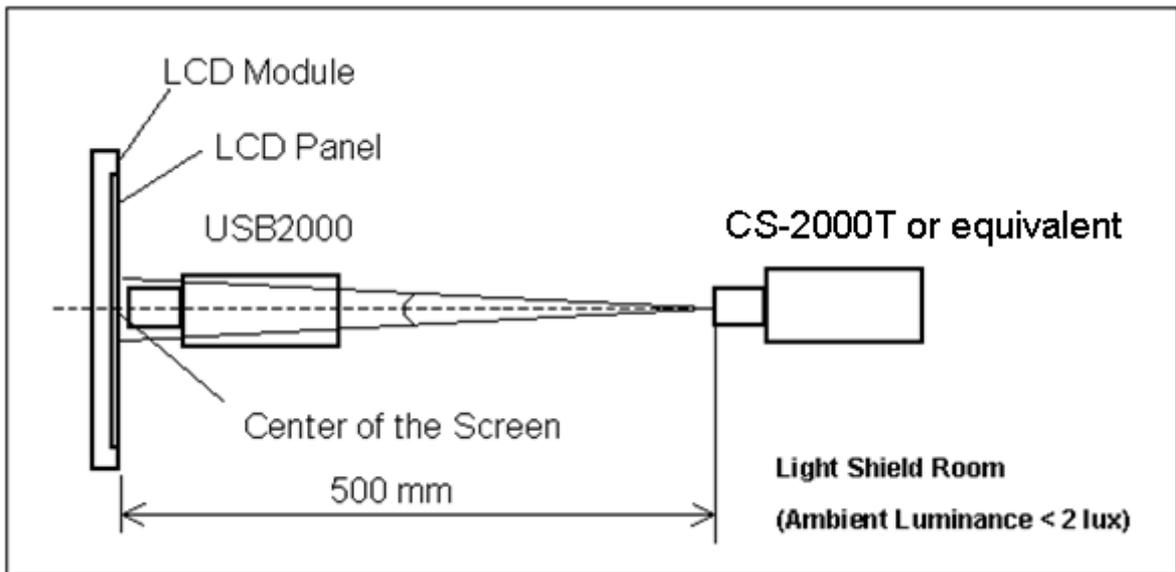
Note (6) Definition of White Variation (δW):

    Measure the luminance of gray level 255 at 9 points

    $\delta W = (\text{Minimum} [L (1) \sim L (9)] / \text{Maximum} [L (1) \sim L (9)]) *100\%$

6. RELIABILITY TEST ITEM

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50℃ , 80%RH, 240hours	
High Temperature Operation (HTO)	Ta= 50℃ , 240hours	
Low Temperature Operation (LTO)	Ta= 0℃ , 240hours	
High Temperature Storage (HTS)	Ta= 60℃ , 240hours	
Low Temperature Storage (LTS)	Ta= -20℃ , 240hours	
Vibration Test (Non-operation)	Acceleration: 1.5 G Wave: sine Frequency: 10 - 300 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 11 ms Direction : ± X, ± Y, ± Z.(one time for each Axis)	
Thermal Shock Test (TST)	-20℃/30min , 60℃ / 30min , 100 cycles	
On/Off Test	25℃ ,On/10sec , Off /10sec , 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω)	
	Air Discharge: ± 15KV, 150pF(330Ω)	
Altitude Test	Operation:10,000 ft / 24hours Non-Operation:30,000 ft / 24hours	

Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

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.

The fixing condition is shown as below:

7. MECHANICAL STRENGTH CHARACTERISTICS

7.1 MECHANICAL STRENGTH SPECIFICATIONS

Item	Condition	Min	Unit	Note
Mechanical Strength	128th Gray Pattern	0.6	Kgf	

7.2 TEST CONDITIONS

Items	Description
Test Condition	1. Ambient Illumination : 10~15 lux 2. Test Pattern : 128 Gray 3. Distance of the judgment : 30cm from the surface of module 4. Viewing angle of the judgment : Front

Gage Information	1. Push pull guage
	  a. Model name : HF-50, maker : ALGOL
	  b. Shape of gage tip
	    - Diameter : 2mm
	    - Thickness : 2mm

Definition of Minimum force	To measure minimum force when operator detects any white spot and light leakage that have occurred while operator presses on back side of module with push pull gage.

7.3 DEFINITION OF TEST POINTS

Measure the minimum force of test points at 128th Gray pattern. The test points at back side of module area is showing as below (except PCBA).
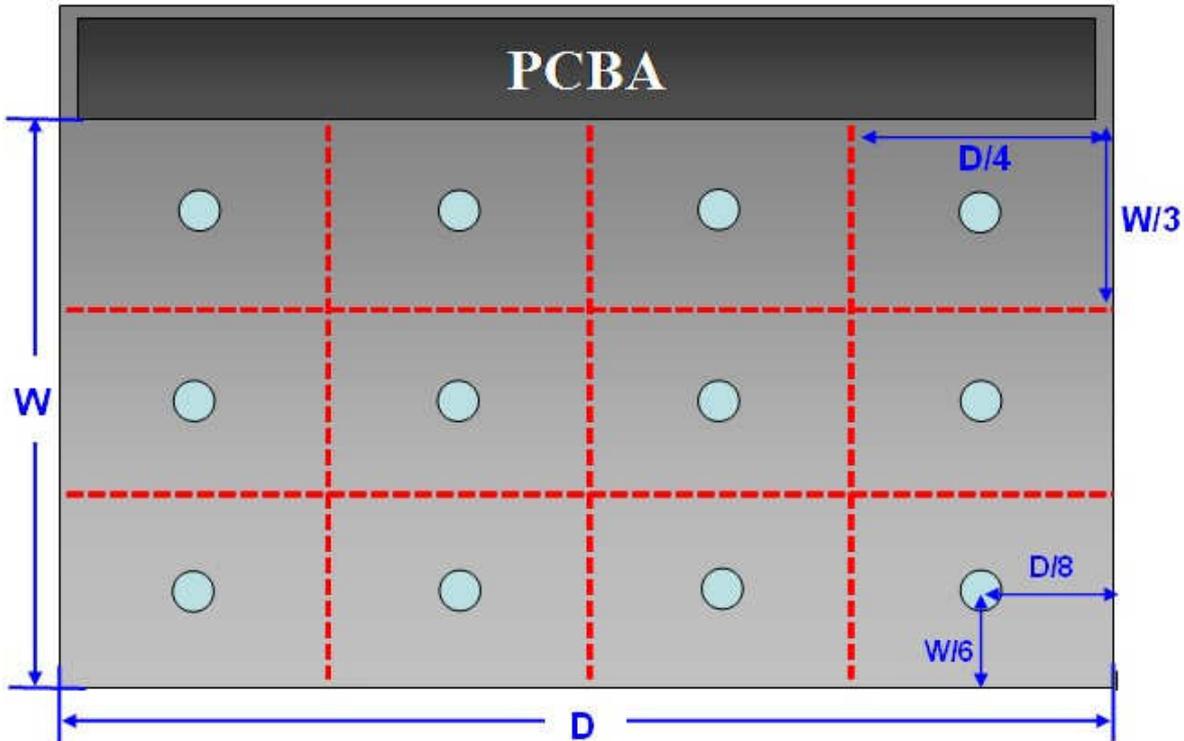
8. PACKING

8.1 PACKING SPECIFICATIONS

(1) 8 LCD modules / 1 Box

(2) Box dimensions: 826(L) X 376(W) X 540(H) mm

(3) Weight: approximately: (32)kg (8 modules per box)

8.2 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: 1 – 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 Corner , 3 Edge, 6 Face, 31cm	Non Operation
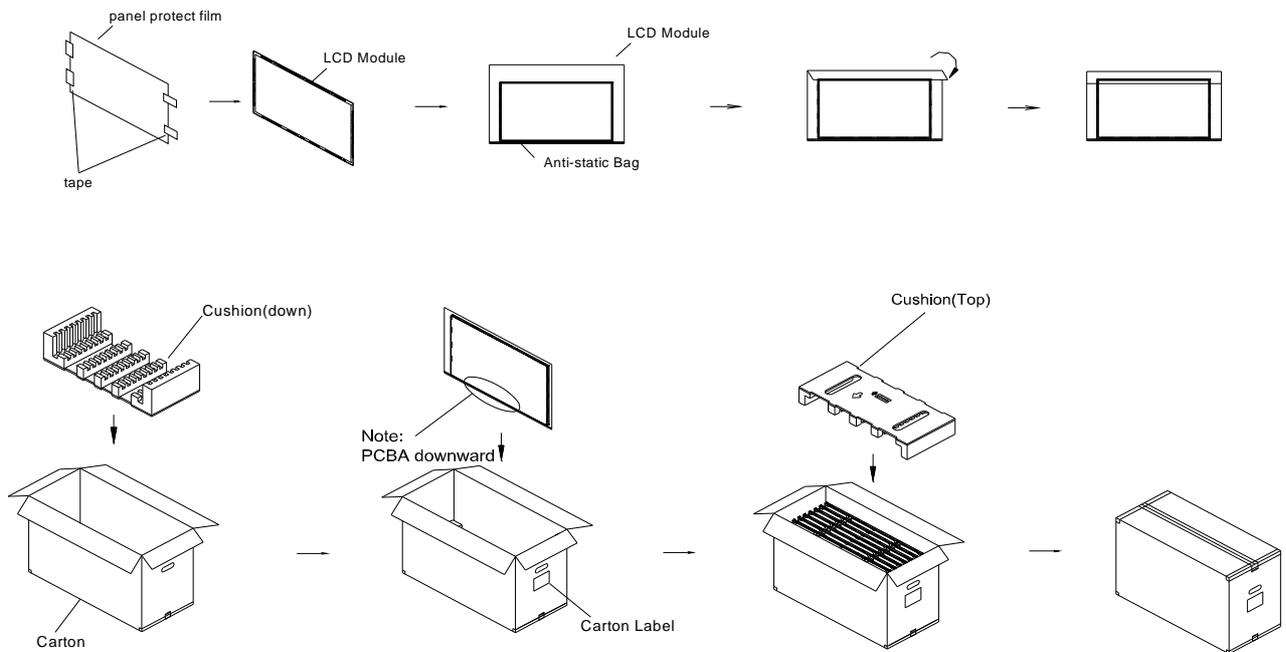
(1) Carton dimensions: 826(L)x376(W)x540(H)mm
(2) 8 modules / carton

Figure. 8-1 Packing method

8.3 PALLET

For ocean shipping

Air Transportation

2 Layer

Corner Protector
(L700*50*50mm ,t=7mm)

Corner Protector
(L1000*50*50mm ,t=7mm)

PP Belt

Corner Protector
(L1080*50*50mm ,t=7mm)

Pallet
(L1150*W850*140mm,田字型)
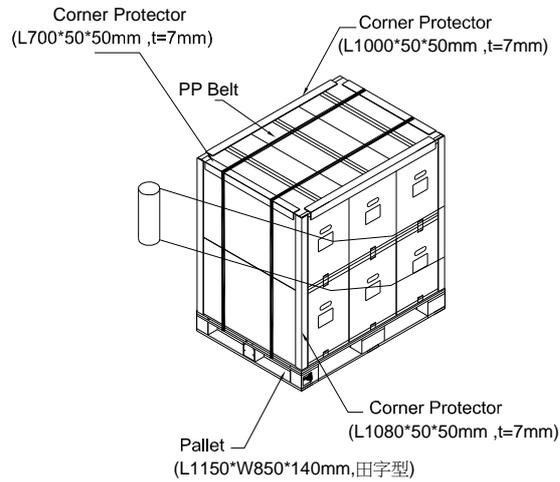
Sea / Land Transportation (40ft HQ Container)

3+2 Layer

Corner Protector
(L700*50*50mm ,t=7mm)

Corner Protector
(L1000*50*50mm ,t=7mm)

PP Belt

Corner Protector
(L1080*50*50mm ,t=7mm)

Pallet
(L1150*W850*140mm,田字型)
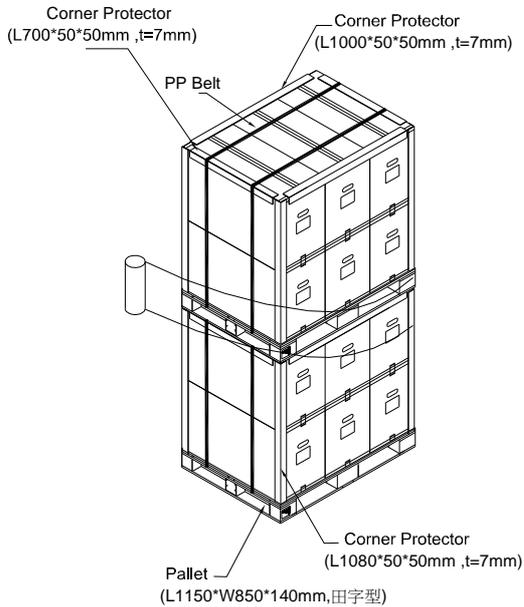
Sea / Land Transportation (40ft Container)

3 Layer
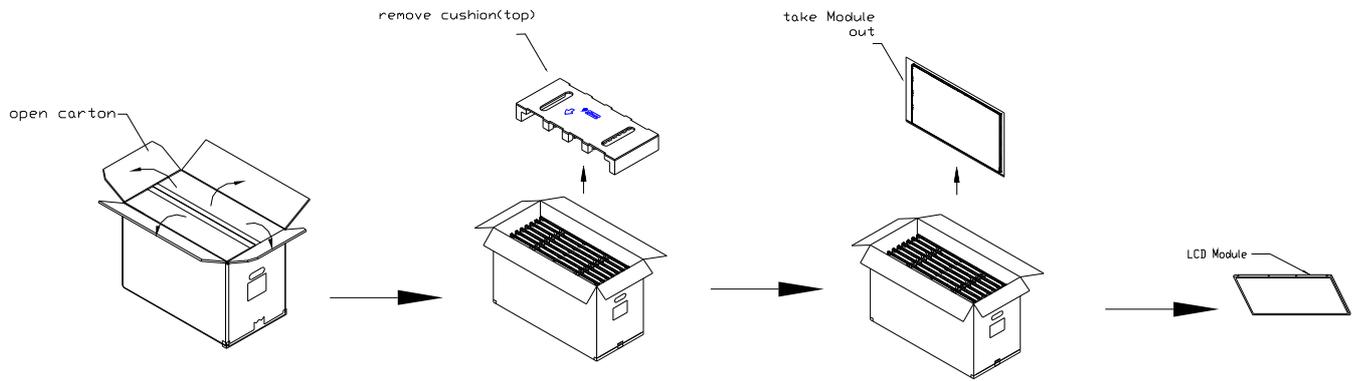
Corner Protector
(L800*50*50mm ,t=3mm)

PP Belt

Corner Protector
(L1350*50*50mm ,t=3mm)

Pallet
(L1150*W850*140mm,田字型)

Figure. 8-2 Packing method

8.4 UN-PACKING METHOD

Figure. 8-3 UN-Packing method

9. INX MODULE LABEL

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

(a) Model Name: M315DJJ-K31

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

(c) INX barcode definition:

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) Customer's barcode definition:

Serial ID: CM-V5J31-X-X-X-XX-L-XX-L-YMD-NNNN

Code	Meaning	Description
CM	Supplier code	INX=CM
N6E20	Model number	M315DJJ-K31= V5J31
X	Revision code	Non ZBD: 1,2,~,8,9 / ZBD: A~Z
X	Source driver IC code	Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatek=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M, ILITEK=Q, Fiti=Y, None IC =Z
X	Gate driver IC code	
XX	Cell location	Tainan Taiwan=TN, Ningbo China=CN, Hsinchu Taiwan=SC
L	Cell line #	1,2,~,9,A,B,~,Y,Z
XX	Module location	Tainan, Taiwan=TN ; Ningbo China=NP ; Shenzhen China=SH ; Nanhai China=NH
L	Module line #	1,2,~,9,A,B,~,Y,Z
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, ~, T, U, V
NNNN	Serial number	By LCD supplier

(e) FAB ID(UL Factory ID):

Region	Factory ID
TWINX	GEMN
NBINX	LEOO
NBINX	VIRO
NHINX	CAPG

10. PRECAUTIONS

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

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

(2) 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. For example, the response time will become slowly.

(11) While touching the panel surface under the patterns with higher grey levels, a shadow or mura phenomenon would be seen.This phenomenon is totally recoverable by switching the patterns to lower grey levels. It is a product feature.

10.2 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 90%

(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

10.3 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 INX for application engineering advice . Otherwise , Its reliability and function may not be guaranteed.

10.4 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.

10.5 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.

10.6 OTHER

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

Appendix 1. SYSTEM COVER DESIGN NOTICE

1.	Set Chassis and MNT Module touching Mode
✕	MNT Module / Chassis — spring
△	MNT Module / Chassis — Flat sheetmetal
○	Chassis — EMI Shielding Gasket (Tape/Sponge)
Definition	a) To prevent from abnormal display & white spot after Mechanical test, it is not recommended to used spring type chassis. b) We suggest the contact mode between Chassis and Module rear cover is Tape/Sponge, second is Flat sheetmetal type chassis (Don't interference from flat sheetmetal of chassis to rear cover of Module).

2	Tape/sponge design on system inner surface

Definition	a) To prevent from abnormal display & white spot after Mechanical test, We suggest using Tape/Sponge as medium between chassis and Module rear cover could reduce the occurrence of white spot. b) When using the Tape/Sponge, suggest it be lay over between set chassis and module rear cover. it is not recommended to add tape/sponge in separate location. Since each tape/sponge may act as pressure concentration location.

3	System inner surface examination

MNT Module

Burr — Burr — Chassis — PCB — Step

System cover inner surface

Definition	a). Burr at logo edge, step, protrusion or PCB board will easily cause white spot. b). Keeping flat surface underneath module is recommended. c). The area (▨) on Module PCBA and Light bar connector should keep at least 1mm gap to any structure with System cover inner surface.

4	The overlapping part on System's Chassis and electric wire needs gap structure.

Definition	The overlapping part on System's Chassis and electric wire (FPC、FFC and wire) needs gap structure to avoid display of white spot by pressing overlapping part cause interference.

Appendix 2. OUTLINE DRAWING

Doc. Number :

☐ Tentative Specification
☐ Preliminary Specification
■ Approval Specification

MODEL NO.: M220ZGE
SUFFIX: L20

Customer: Common

APPROVED BY   **SIGNATURE**

<u>Name / Title</u>
Note
Product Version C5

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

Approved By	Checked By	Prepared By
梁永祥	林秋森	邱詩容

CONTENTS

REVISION HISTORY

Version	Date	Page	Description
3.0	01.18.2016	All	Spec Ver.3.0 was first issued.
		P6	Modify Panel Weight of Min & Max **Before:** 2. MECHANICAL SPECIFICATIONS <table><tr><td>Item</td><td>Min.</td><td>Typ.</td><td>Max.</td><td>Unit</td></tr><tr><td>Weight</td><td>--</td><td>2100</td><td>2250</td><td>g</td></tr></table> **After:** 2. MECHANICAL SPECIFICATIONS <table><tr><td>Item</td><td>Min.</td><td>Typ.</td><td>Max.</td><td>Unit</td></tr><tr><td>Weight</td><td>1910</td><td>2100</td><td>2310</td><td>g</td></tr></table>
		P13	Backlight unit power consumption change to ES7.0 solution. **Before:** 4.3.3 BACKLIGHT UNIT <table><tr><td>Parameter</td><td>Symbol</td><td>Min.</td><td>Typ.</td><td>Max.</td><td>Unit</td><td>Note</td></tr><tr><td>LED Light Bar Input Voltage Per Input Pin</td><td>VPIN</td><td>---</td><td>37.2</td><td>40.8</td><td>V</td><td>(1), Duty=100%, IPIN=65mA</td></tr><tr><td>LED Light Bar Current Per Input Pin</td><td>IPIN</td><td>---</td><td>65</td><td>75</td><td>mA</td><td>(1), (2) Duty=100%</td></tr><tr><td>LED Life Time</td><td>LLED</td><td>40000</td><td></td><td></td><td>Hrs</td><td>(3)</td></tr><tr><td>Power Consumption</td><td>PBL</td><td>---</td><td>9.67</td><td>10.608</td><td>W</td><td>(1) Duty=100%, IPIN=65mA</td></tr></table> **After:** 4.3.3 BACKLIGHT UNIT <table><tr><td>Parameter</td><td>Symbol</td><td>Min.</td><td>Typ.</td><td>Max.</td><td>Unit</td><td>Note</td></tr><tr><td>LED Light Bar Input Voltage Per Input Pin</td><td>VPIN</td><td>31.2</td><td>33.6</td><td>36</td><td>V</td><td>(1), Duty=100%, IPIN=50mA</td></tr><tr><td>LED Light Bar Current Per Input Pin</td><td>IPIN</td><td>45</td><td>50</td><td>55</td><td>mA</td><td>(1), (2) Duty=100%</td></tr><tr><td>LED Life Time</td><td>LLED</td><td>40000</td><td></td><td></td><td>Hrs</td><td>(3)</td></tr><tr><td>Power Consumption</td><td>PBL</td><td>6.24</td><td>6.72</td><td>7.2</td><td>W</td><td>(1) Duty=100%, IPIN=50mA</td></tr></table>
3.1	02.16.2016	P13	Update 4.3.3 Note 2 PBL=IPIN*VPIN*(8)→PBL=IPIN*VPIN*(4)

1. GENERAL DESCRIPTION

1.1 OVERVIEW

The M220ZGE-L20 model is a 22 inch wide TFT-LCD slimming MNT module with a WLED light bar Backlight Unit and a 30-pin 2ch-LVDS interface. This module supports 1680 x 1050 WSXGA⁺ (16:10 wide screen) mode and displays up to 16.7 millions colors. The converter module for the Backlight Unit is not built in.

1.2 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Screen Size	22	inch	
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	1680 x R.G.B. x 1050	pixel	-
Pixel Pitch	0.282(H) x 0.282(V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7M(6bit+FRC)	color	-
Transmissive Mode	Normally White	-	-
Surface Treatment	Hard coating (3H), AG (Haze 25%)	-	-
Luminance, White	250 (typical)	Cd/m2	
Color Gamut	72% of NTSC(Typ.)	-	-
Display Orientation	Signal input with " INX"		(2)
RoHS,Halogen Free &TCO 7.0	RoHS, Halogen Free TCO 7.0 compliance	-	-
Power Consumption	Total 13.2W (Max.) @ cell 6W (Max.), BL 7.2W (Max.)		(1)

Note (1) The specified power consumption : Total= cell (reference 4.3.1)+BL (reference 4.3.3)

Note (2)
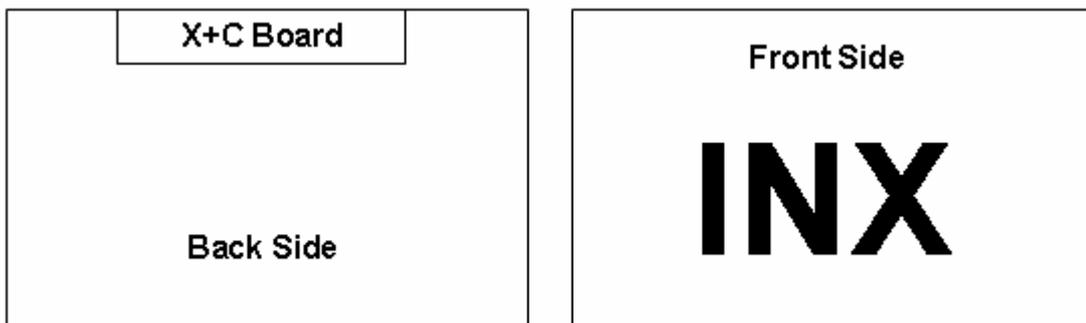
2. MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	493.2	493.7	494.2	mm	(1)
	Vertical (V)	319.6	320.1	320.6	mm	
	Thickness (T)	10.5	11	11.5	mm	
Bezel Area	Horizontal	477.4	477.7	478	mm	
	Vertical	299.8	300.1	300.4	mm	
Active Area	Horizontal	-	473.76	-	mm	
	Vertical	-	296.1	-	mm	
Weight		1910	2100	2310	g	

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

3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	TST	-20	+60	ºC	(1)
Operating Ambient Temperature	TOP	0	+50	ºC	(1), (2)

Note (1)

(a) 90 %RH Max..

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

(c) No condensation.

Note (2) Panel surface temperature should be 0℃ min. and 65℃ max under Vcc=5.0V, fr =60Hz, typical LED string current, 25℃ ambient temperature, and no humidity control . Any condition of ambient operating temperature ,the surface of active area should be keeping not higher than 65℃.

3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCCS	-0.3	6	V	(1)
Logic Input Voltage	VIN	-0.3	3.6	V	

3.2.2 BACKLIGHT UNIT

Item	Symbol	Value			Unit	Note
		Min.	Typ	Max.		
LED Forward Current Per Input Pin	I_F	45	50	55	mA	(1), (2) Duty=100%
LED Pulse Forward Current Per Input Pin	I_P	---	---	550	mA	(1), (2) Pulse Width≦10msec. and Duty≦30%

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
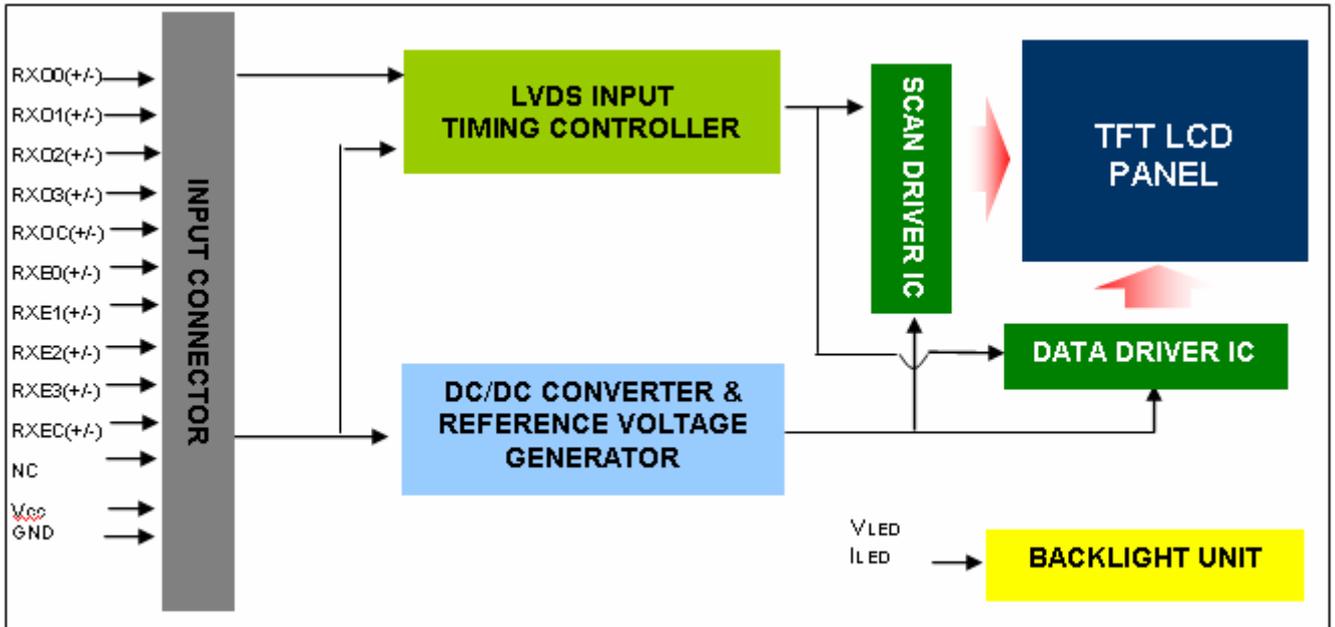
4.2. INTERFACE CONNECTIONS

PIN ASSIGNMENT

Pin	Name	Description
1	RXO0-	Negative LVDS differential data input. Channel O0 (odd)
2	RXO0+	Positive LVDS differential data input. Channel O0 (odd)
3	RXO1-	Negative LVDS differential data input. Channel O1 (odd)
4	RXO1+	Positive LVDS differential data input. Channel O1 (odd)
5	RXO2-	Negative LVDS differential data input. Channel O2 (odd)
6	RXO2+	Positive LVDS differential data input. Channel O2 (odd)
7	GND	Ground
8	RXOC-	Negative LVDS differential clock input. (odd)
9	RXOC+	Positive LVDS differential clock input. (odd)
10	RXO3-	Negative LVDS differential data input. Channel O3(odd)
11	RXO3+	Positive LVDS differential data input. Channel O3 (odd)
12	RXE0-	Negative LVDS differential data input. Channel E0 (even)
13	RXE0+	Positive LVDS differential data input. Channel E0 (even)
14	GND	Ground
15	RXE1-	Negative LVDS differential data input. Channel E1 (even)
16	RXE1+	Positive LVDS differential data input. Channel E1 (even)
17	GND	Ground
18	RXE2-	Negative LVDS differential data input. Channel E2 (even)
19	RXE2+	Positive LVDS differential data input. Channel E2 (even)
20	RXEC-	Negative LVDS differential clock input. (even)
21	RXEC+	Positive LVDS differential clock input. (even)
22	RXE3-	Negative LVDS differential data input. Channel E3 (even)
23	RXE3+	Positive LVDS differential data input. Channel E3 (even)
24	GND	Ground
25	NC	For LCD internal use only, Do not connect
26	NC	For LCD internal use only, Do not connect
27	NC	For LCD internal use only, Do not connect
28	Vcc	+5.0V power supply
29	Vcc	+5.0V power supply
30	Vcc	+5.0V power supply

Note (1) Connector Part No.:

Foxconn GS23301-0321R-7H or equivalent

Note (2) User's connector Part No:

Mating Wire Cable Connector Part No.: FI-X30H(JAE) or FI-X30HL(JAE)

Mating FFC Cable Connector Part No.: 217007-013001 (P-TWO) or JF05X030-1 (JAE).

Note (3) The first pixel is odd.

Note (4) Input signal of even and odd clock should be the same timing.
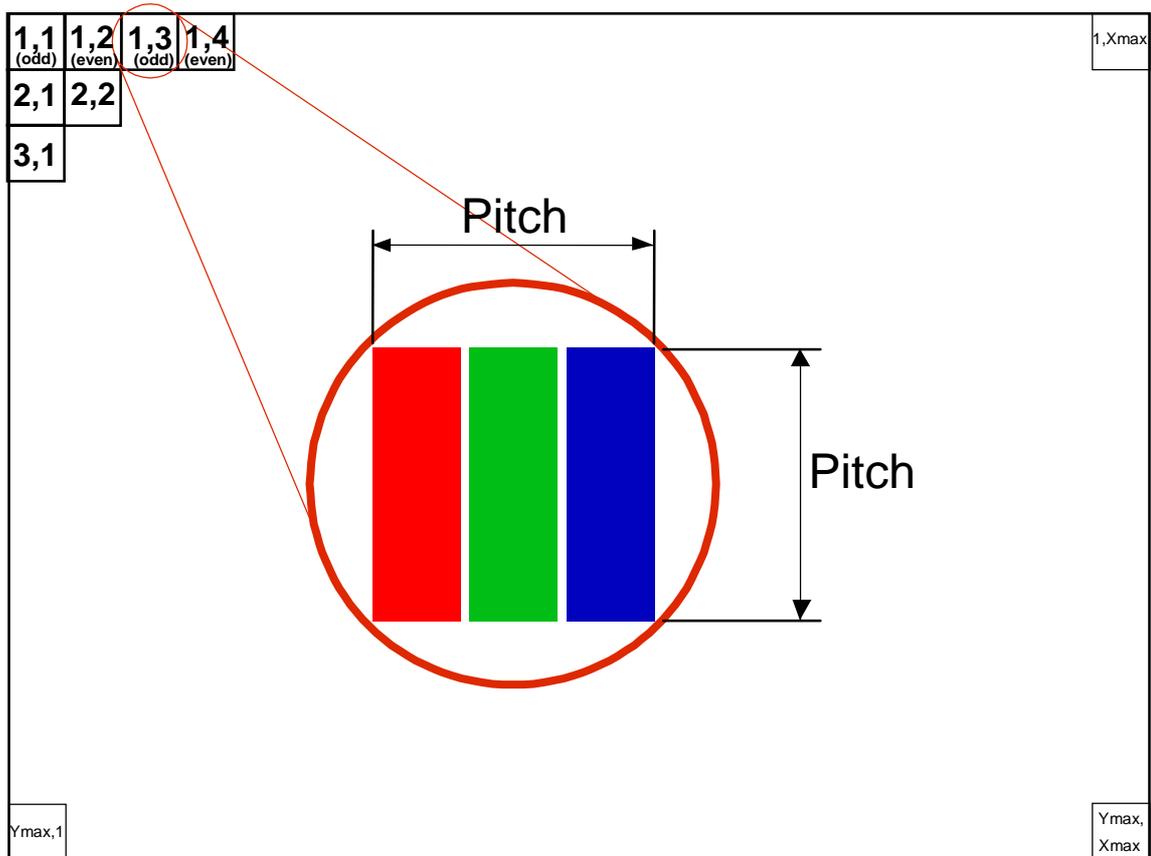
4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD ELETRONICS SPECIFICATION

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	4.5	5.0	5.5	V	-
Ripple Voltage		V$_{RP}$	-	--	300	mV	-
Rush Current		I$_{RUSH}$	-	--	3	A	(2)
Power Supply Current	White	-	-	0.36	0.52	A	(3)a
	Black	-	-	0.65	1.2	A	(3)b
	Vertical Stripe	-	-	0.4	0.6	A	(3)c
Power Consumption		PLCD	-	3.25	6	Watt	(4)(6)
LVDS differential input voltage		Vid	100	-	600	mV	
LVDS common input voltage		Vic	1.0-	1.2	1.4	V	
Logic High Input Voltage		VIH	2.0	-	-	V	
Logic Low Input Voltage		VIL	-	-	0.8	V	

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

Note (2) Measurement Conditions:
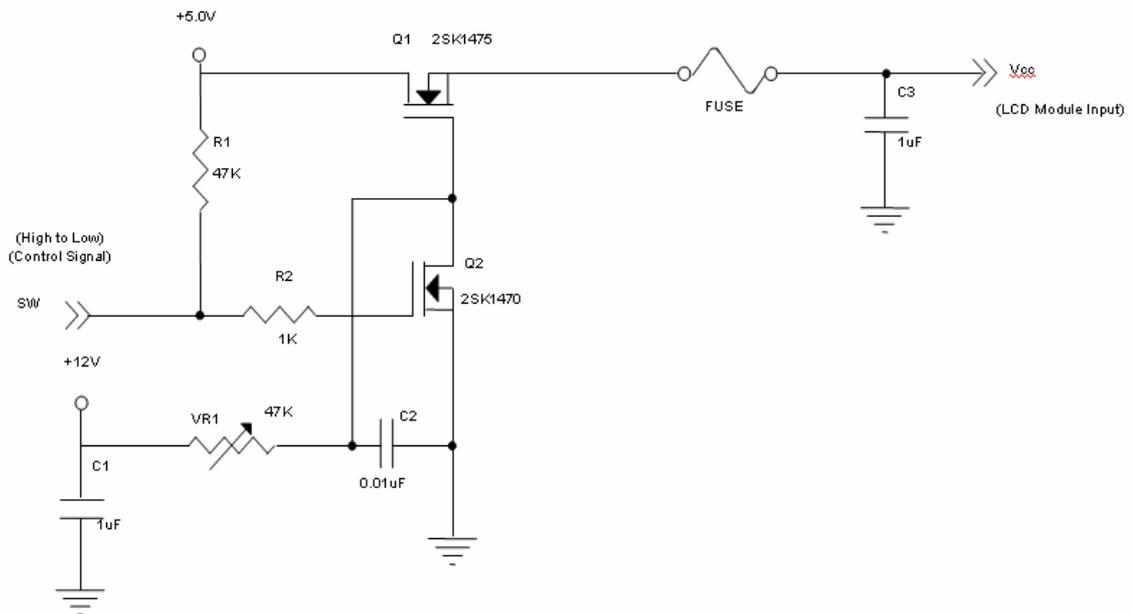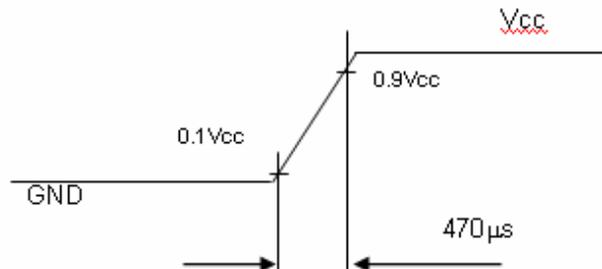
Vcc rising time is 470μs

Note (3) The specified power supply current is under the conditions at Vcc = 5.0 V, Ta = 25 ± 2 ºC, Fr = 60Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

Active Area

b. Black Pattern
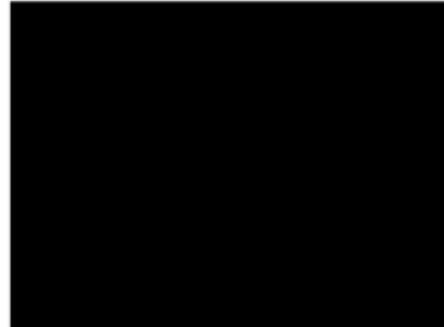
Active Area

c. Vertical Stripe Pattern
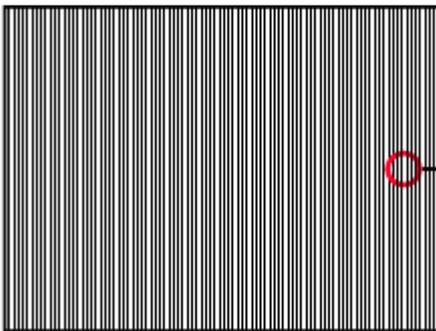
Active Area
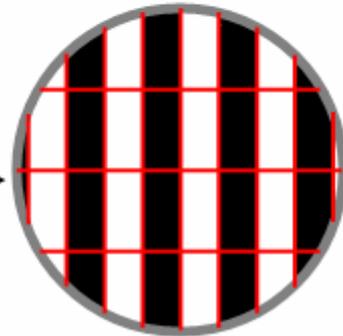
Note (4) The power consumption is specified at the pattern with the maximum current.

Note (5) VID waveform condition

Single-End

LVDS VIN N

LVDS VIN P

Vid

Vic

GND

4.3.2 VCC POWER DIP CONDITION

4.3.3 BACKLIGHT UNIT

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Input Voltage Per Input Pin	VPIN	31.2	33.6	36	V	(1), Duty=100%, IPIN=50mA
LED Light Bar Current Per Input Pin	IPIN	45	50	55	mA	(1), (2) Duty=100%
LED Life Time	LLED	40000			Hrs	(3)
Power Consumption	PBL	6.24	6.72	7.2	W	(1) Duty=100%, IPIN=50mA

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

Note (2) PBL = IPIN × VPIN × 4 input pins ,

Note (3) The lifetime of LED is defined as the time when LED packages continue to operate under the conditions at Ta = 25 ±2 ℃ and I= 150mA per chip until the brightness becomes ≦ 50% of its original value.

Note (4) The module must be operated with constant driving current.
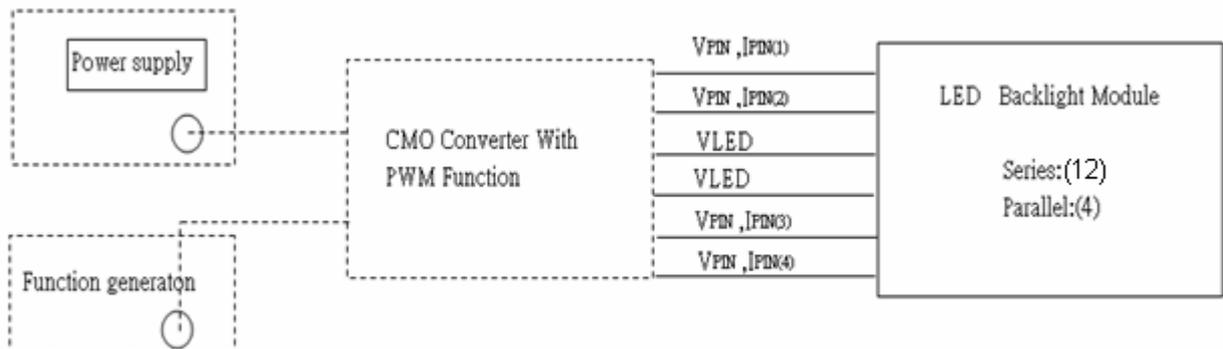
4.3.4 LIGHTBAR CONNECTOR PIN ASSIGNMENT

Connector: WM13-406-063N (FCN)
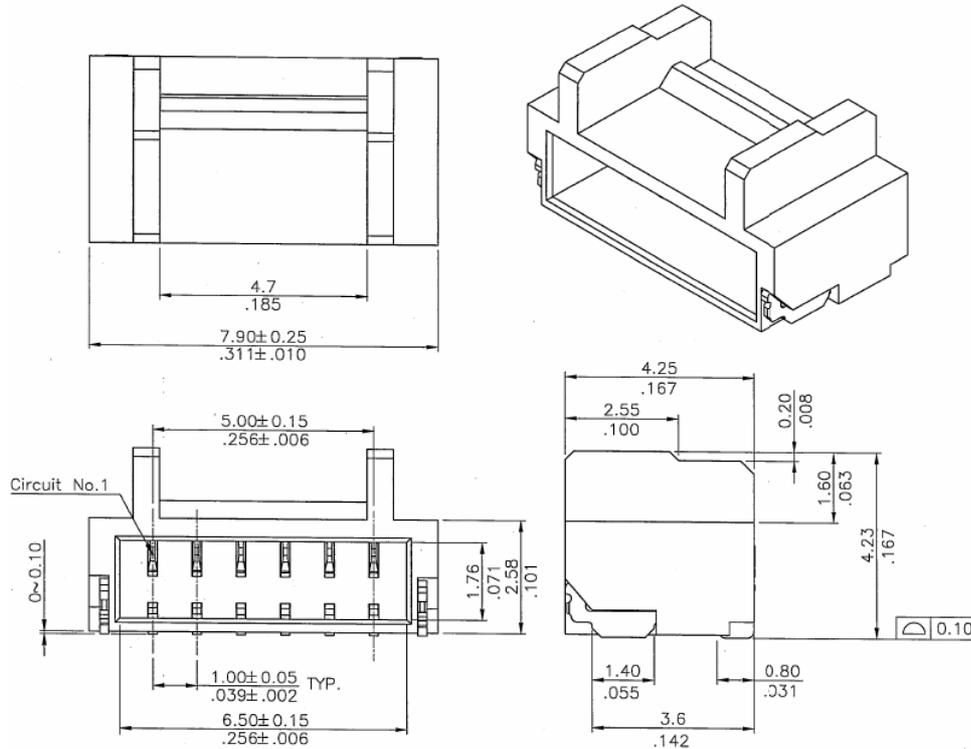
Other equivalents please refer to individual drawing

CN1

Pin number	Description
1	Cathode of LED string1
2	Cathode of LED string2
3	VLED
4	VLED
5	Cathode of LED string3
6	Cathode of LED string4
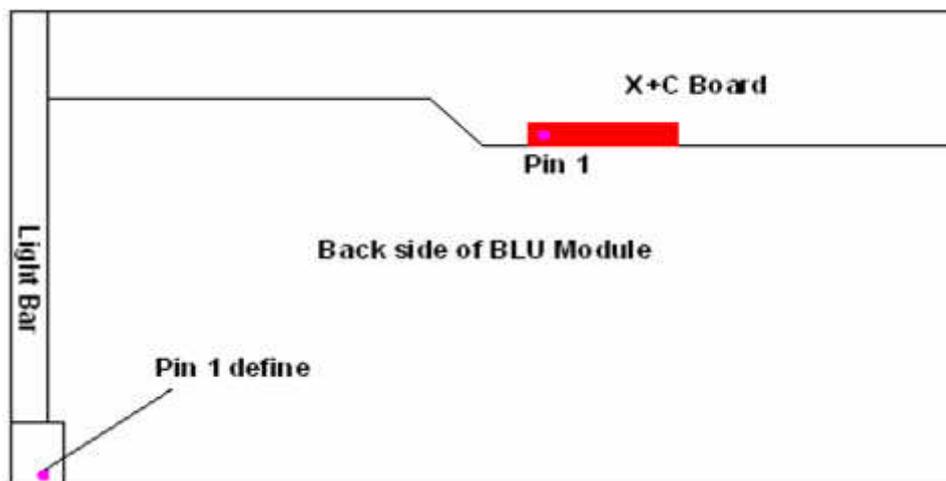
4.4 LVDS INPUT SIGNAL SPECIFICATIONS

4.4.1 LVDS DATA MAPPING TABLE

LVDS Channel O0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	OG0	OR5	OR4	OR3	OR2	OR1	OR0
LVDS Channel O1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	OB1	OB0	OG5	OG4	OG3	OG2	OG1
LVDS Channel O2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	OB5	OB4	OB3	OB2
LVDS Channel O3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	OB7	OB6	OG7	OG6	OR7	OR6
LVDS Channel E0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	EG0	ER5	ER4	ER3	ER2	ER1	ER0
LVDS Channel E1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	EB1	EB0	EG5	EG4	EG3	EG2	EG1
LVDS Channel E2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	EB5	EB4	EB3	EB2
LVDS Channel E3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	EB7	EB6	EG7	EG6	ER7	ER6

4.4.2 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	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 (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	49	60	81	MHz	-
	Period	Tc	13	16.7	20	ns	
	Input cycle to cycle jitter	T_{rcl}	-0.02*Tc	-	0.02*Tc	ps	(1)
	Input Clock to data skew	TLVCCS	-0.02*Tc		0.02*Tc	ns	(2)
	Spread spectrum modulation range	F_{clkin_mod}	0.97*Fc	-	1.03*Fc	MHz	(3)
	Spread spectrum modulation frequency	F_{SSM}	-	-	100	KHz	
Vertical Display Term	Frame Rate	Fr	49	60	77	Hz	Tv=Tvd+Tvb
	Total	Tv	1077	1080	1216	Th	-
	Active Display	Tvd	1050	1050	1050	Th	-
	Blank	Tvb	Tv-Tvd	30	Tv-Tvd	Th	-
Horizontal Display Term	Total	Th	910	920	929	Tc	Th=Thd+Thb
	Active Display	Thd	840	840	840	Tc	-
	Blank	Thb	Th-Thd	80	Th-Thd	Tc	-

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

INPUT SIGNAL TIMING DIAGRAM
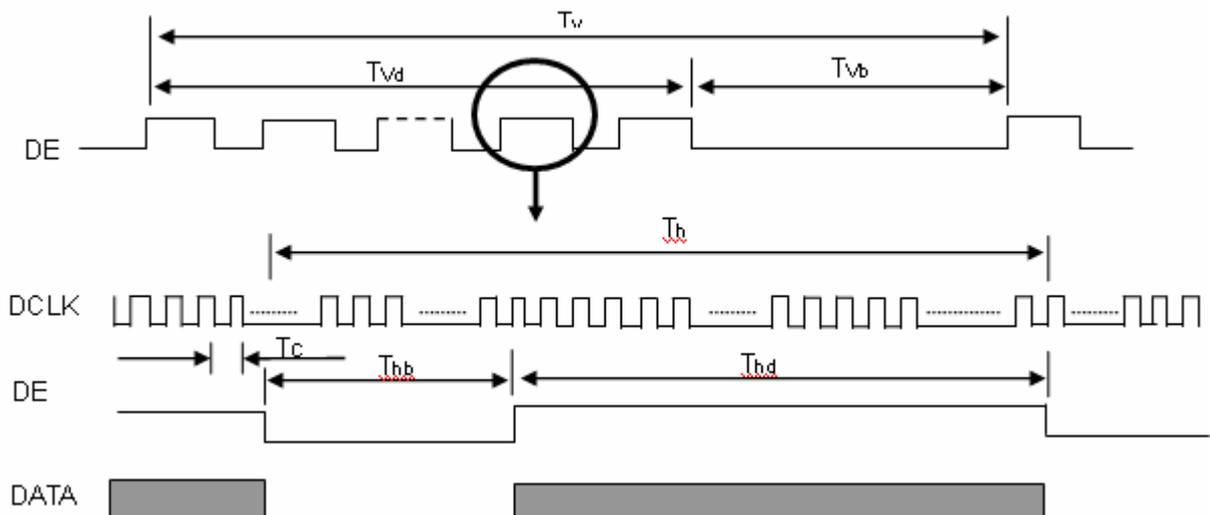
Note (1) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T_1 − TI
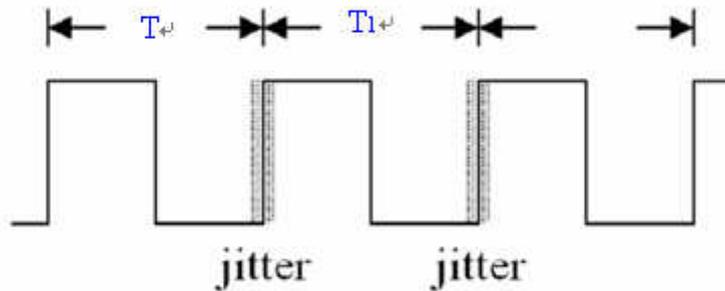
Note (2) Input Clock to data skew is defined as below figures.

Note (3) The SSCG (Spread spectrum clock generator) is defined as below figures.
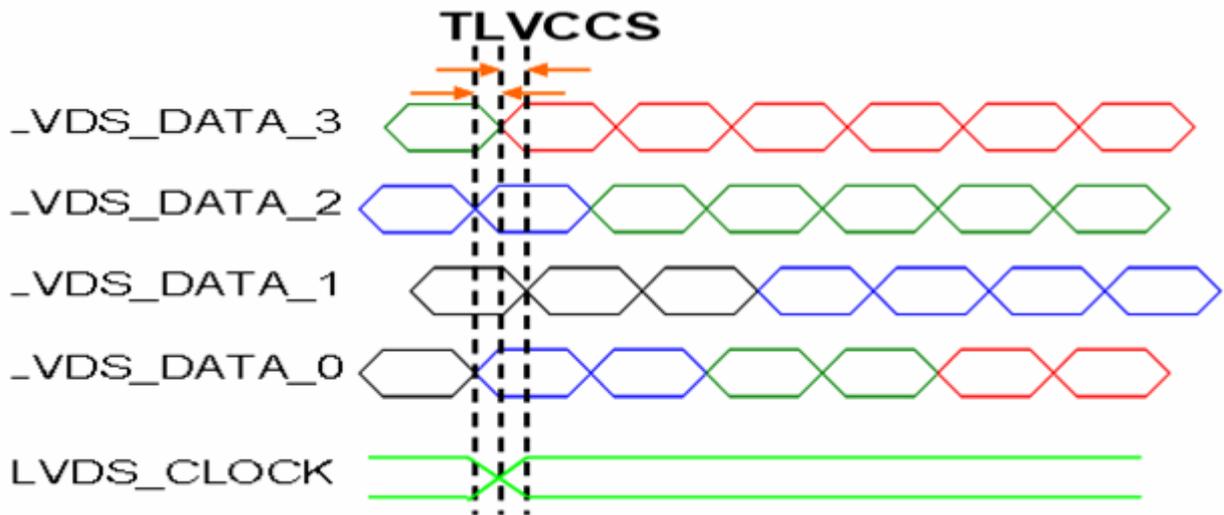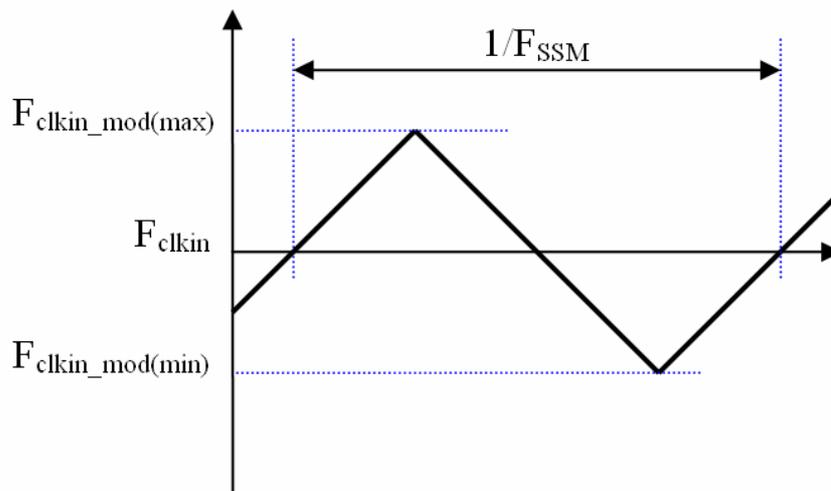

Note(4) The DCLK range at last line of V-blank should be set in 0 to Hdisplay/2

4.6 POWER ON/OFF SEQUENCE

The power sequence specifications are shown as the following table and diagram**.**
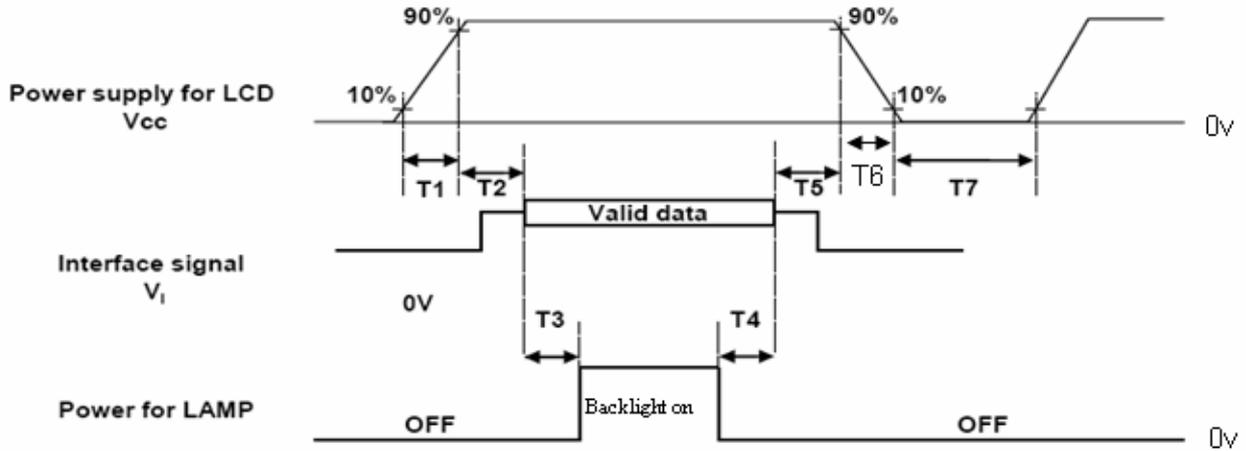
Timing Specifications:

Parameters	Values			Units
	Min	Typ.	Max	
T1	0.5		10	ms
T2	0	30	50	ms
T3	200	250		ms
T4	100	250		ms
T5	0	20	50	ms
T6	0.5		100	ms
T7	1000			ms

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

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

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

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

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

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

Note (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 "t6 spec".

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}	5	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current Per Input Pin	I_{PIN}	50 ± 1.5	mA_{DC}
PWM Duty Ratio	D	100	%
LED Light Bar Test Converter	INX TEST01001 T2-D1		

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
Color Chromaticity (CIE 1931)	Red	Rx	$\theta_x=0°$, $\theta_Y=0°$ CS-2000 R=G=B=255 Gray scale	Typ – 0.03	0.645	Typ + 0.03	-	(1), (5)
		Ry			0.342			
	Green	Gx			0.309			
		Gy			0.634			
	Blue	Bx			0.151			
		By			0.059			
	White	Wx			0.313			
		Wy			0.329			
Center Luminance of White (Center of Screen)		L_C		200	250	-	cd/m²	(4), (5)
Contrast Ratio		CR		700	1000	-	-	(2), (5)
Response Time		T_R	$\theta_x=0°$, $\theta_Y=0°$	-	1.3	2.2	ms	(3)
		T_F		-	3.7	5.8		
White Variation		δW	$\theta_x=0°$, $\theta_Y=0°$	75	80		-	(5), (6)
Viewing Angle	Horizontal	θx- + θx+	CR ≧ 10	150	170	-	Deg.	(1), (5)
	Vertical	θy- + θy+		140	160	-		
Viewing Angle	Horizontal	θx- + θx+	CR ≧ 5	160	178	---	Deg.	(1), (5)
	Vertical	θy- + θy+		150	170	---		

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 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.

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

Measure the luminance of gray level 255 at 9 points

δW = (Minimum [L (1) ~ L (9)] / Maximum [L (1) ~ L (9)]) *100%

6. RELIABILITY TEST ITEM

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50℃ , 80%RH, 240hours	
High Temperature Operation (HTO)	Ta= 50℃ , 240hours	
Low Temperature Operation (LTO)	Ta= 0℃ , 240hours	
High Temperature Storage (HTS)	Ta= 60℃ , 240hours	
Low Temperature Storage (LTS)	Ta= -20℃ , 240hours	
Vibration Test (Non-operation)	Acceleration: 1.5 G Wave:Sine Frequency: 10 - 300 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 11 ms Direction : ± X, ± Y, ± Z.(one time for each Axis)	
Thermal Shock Test (TST)	-20℃/30min , 60℃ / 30min , 100 cycles	
On/Off Test	25℃ ,On/10sec , Off /10sec , 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω)	
	Air Discharge: ± 15KV, 150pF(330Ω)	
Altitude Test	Operation:16,404 ft / 24hours Non-Operation:30,000 ft / 24hours	

Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

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.

The fixing condition is shown as below:

7. MECHANICAL STRENGTH CHARACTERISTICS

7.1 MECHANICAL STRENGTH SPECIFICATIONS

Item	Condition	Min	Unit	Note
Mechanical Strength	128th Gray Pattern	0.6	Kgf	

7.2 TEST CONDITIONS

Items	Description
Test Condition	1. Ambient Illumination : 10~15 lux 2. Test Pattern : 128 Gray 3. Distance of the judgment : 30cm from the surface of module 4. Viewing angle of the judgment : Front

Gage Information	1. Push pull guage
	  a. Model name : HF-50, maker : ALGOL
	  b. Shape of gage tip
	    - Diameter : 2mm
	    - Thickness : 2mm

Definition of Minimum force	To measure minimum force when operator detects any white spot and light leakage that have occurred while operator presses on back side of module with push pull gage.

7.3 DEFINITION OF TEST POINTS

Measure the minimum force of test points at 128th Gray pattern. The test points at back side of module area is showing as below (If the test points on the PCBA or TP board, these points are not included).
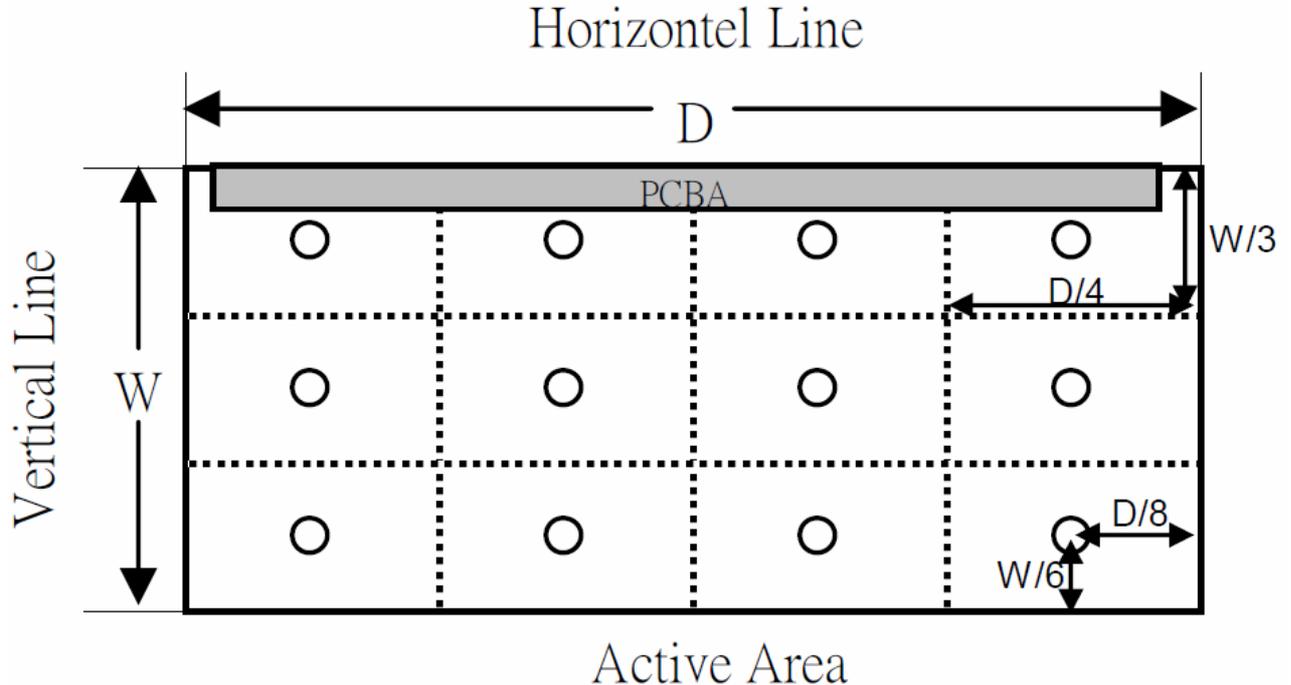
8. PACKING

8.1 PACKING SPECIFICATIONS

(1) 11 LCD modules / 1 Box

(2) Box dimensions: 567(L) X 278 (W) X 417 (H) mm

(3) Weight: approximately: (28.8) Kg (11 modules per box)

8.2 PACKING METHOD

Figure. 8-1 Packing method

8.3 PALLET

Sea / Land Transportation
(40ft HQ Container)

Sea / Land Transportation
(40ft Container)

Air Transportation
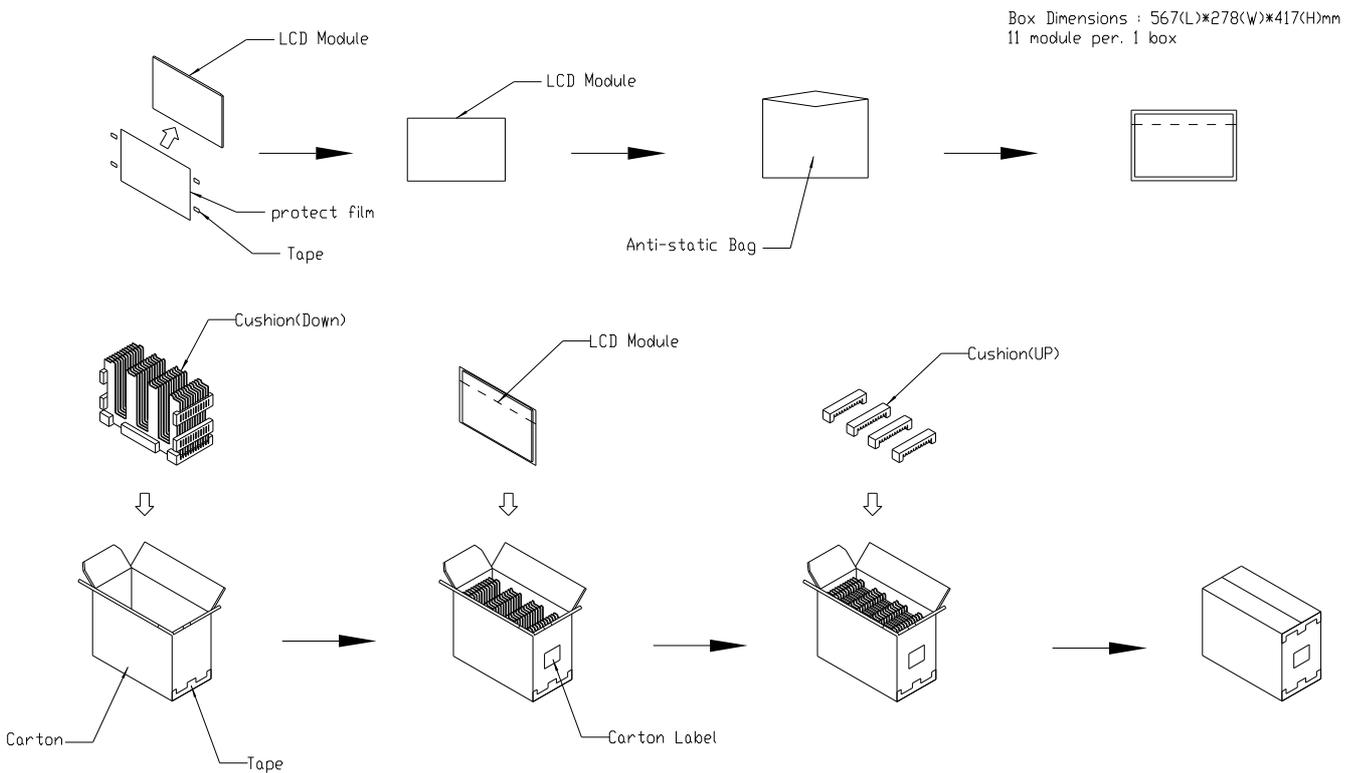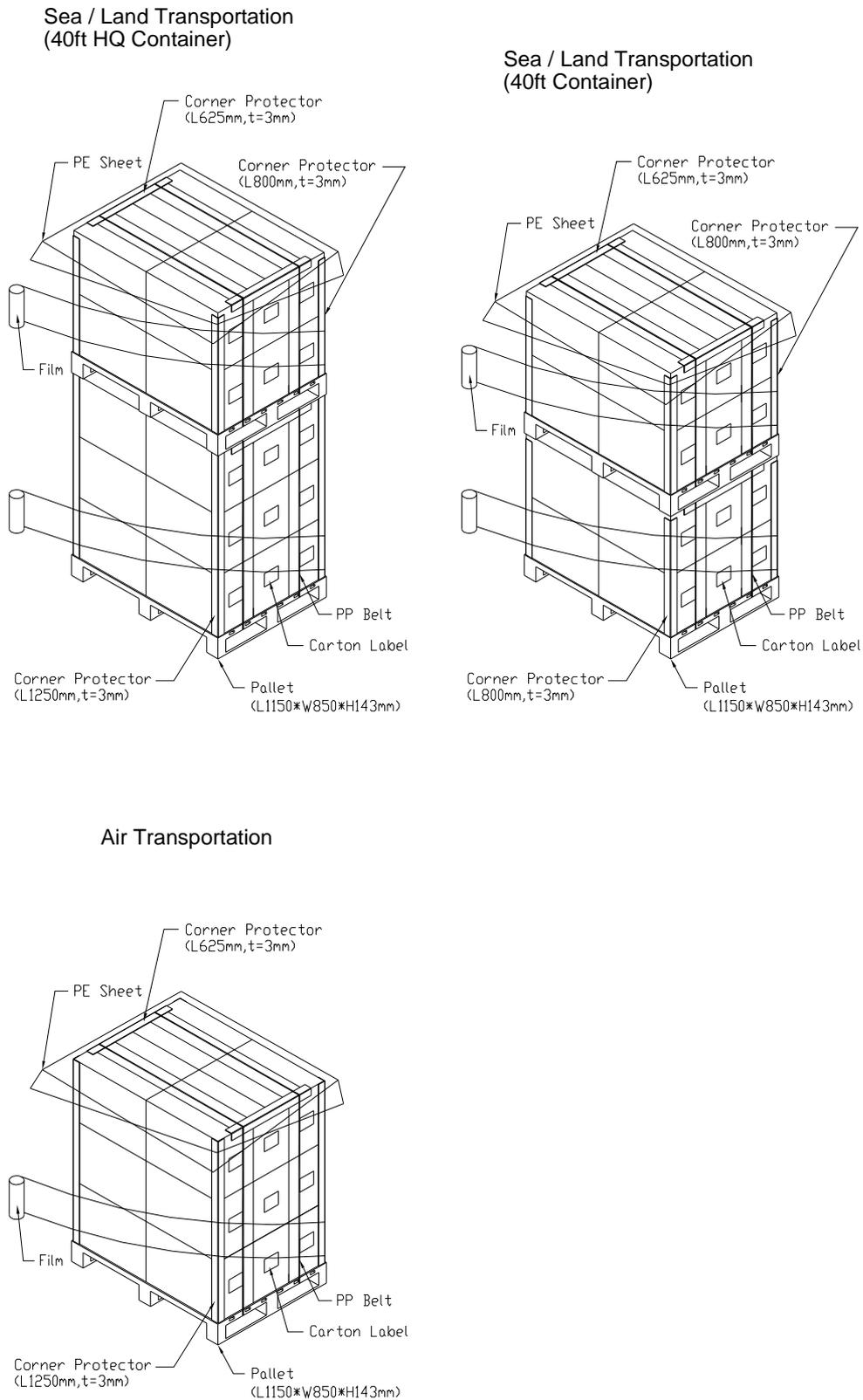
Figure. 8-2 Packing method

8.4 UN-PACKING METHOD

UN-packaging method is shown as following figures.
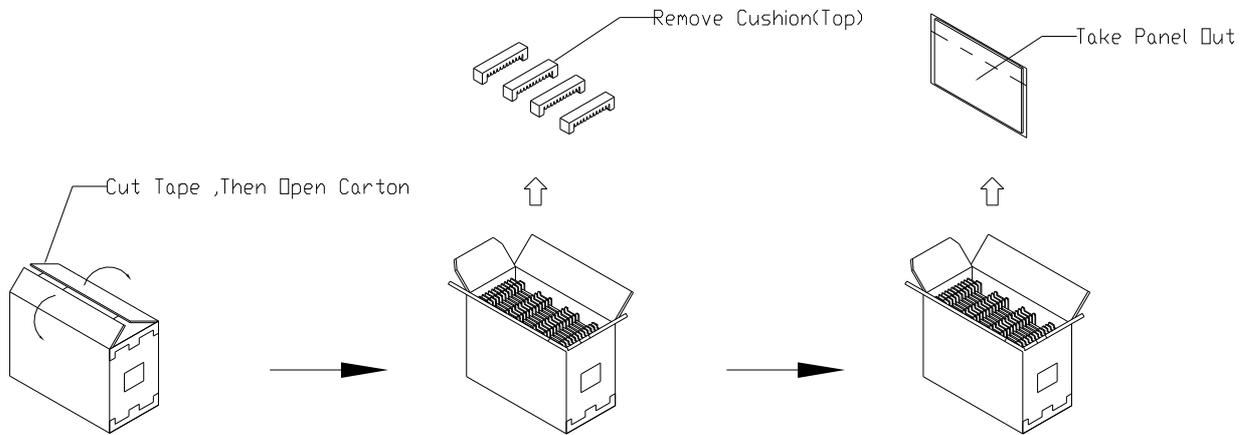
Figure. 8-3 Un-packing method

9. INX MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.
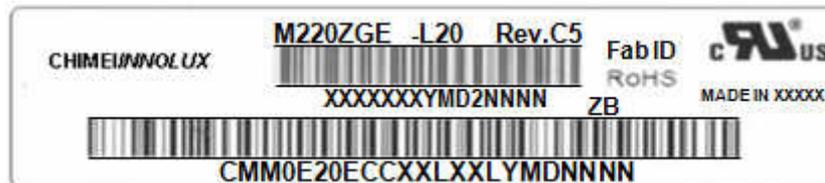
(a) Model Name: M220ZGE-L20

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

(c) INX barcode definition:

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) Customer's barcode definition:

Serial ID: CM-M0E20-X-X-X-XX-L-XX-L-YMD-NNNN

Code	Meaning	Description
CM	Supplier code	INX=CM
M0E20	Model number	M220ZGE-L20= M0E20
X	Revision code	Non ZBD: 1,2,~,8,9 / ZBD: A~Z
X	Source driver IC code	Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatek=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M, ILITEK=Q, Fiti=Y, None IC =Z
X	Gate driver IC code	
XX	Cell location	Tainan Taiwan=TN, Ningbo China=CN, Hsinchu Taiwan=SC
L	Cell line #	1,2,~,9,A,B,~,Y,Z
XX	Module location	Tainan, Taiwan=TN ; Ningbo China=NP ; Shenzhen China=SH ; Nanhai China=NH
L	Module line #	1,2,~,9,A,B,~,Y,Z
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, ~, T, U, V
NNNN	Serial number	By LCD supplier

(e) FAB ID(UL Factory ID):

Region	Factory ID
TWINX	GEMN
NBCMI	LEOO
NBCME	CANO
NHCMI	CAPG

10. PRECAUTIONS

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

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

(2) 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. For example, the response time will become slowly.

(11) While touching the panel surface under the patterns with higher grey levels, a shadow or mura phenomenon would be seen. This phenomenon is totally recoverable by switching the patterns to lower grey levels. It is a product feature.

10.2 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 90%

(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

10.3 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 INX for application

engineering advice . Otherwise , Its reliability and function may not be guaranteed.

10.4 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.

10.5 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.

10.6 OTHER

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

Appendix 1. SYSTEM COVER DESIGN NOTICE

1.	Set Chassis and MNT Module touching Mode
Definition	a) To prevent from abnormal display & white spot after Mechanical test, it is not recommended to used spring type chassis. b) We suggest the contact mode between Chassis and Module rear cover is Tape/Sponge, second is Flat sheetmetal type chassis (Don't interference from flat sheetmetal of chassis to rear cover of Module).

2	Tape/sponge design on system inner surface

	a) To prevent from abnormal display & white spot after Mechanical test, We suggest using Tape/Sponge as medium between chassis and Module rear cover could reduce the occurrence of white spot. b) When using the Tape/Sponge, suggest it be lay over between set chassis and module rear cover. it is not recommended to add tape/sponge in separate location. Since each tape/sponge may act as pressure concentration location.
Definition	

3	System inner surface examination

MNT Module

Burr — Burr — Chassis — PCB — Step

System cover inner surface

Definition	a). Burr at logo edge, step, protrusion or PCB board will easily cause white spot. b). Keeping flat surface underneath module is recommended. c). The area (▨) on Module PCBA and Light bar connector should keep at least 1mm gap to any structure with System cover inner surface.

4	The overlapping part on System's Chassis and electric wire needs gap structure.

Chassis
FFC electric — Module
A-A Section

Chassis
electric wire — Module
B-B Section

LVDS connector — FPC
A-A
B-B
Chassis
wire
Light bar connector

Definition	The overlapping part on System's Chassis and electric wire (FPC、FFC and wire) needs gap structure to avoid display of white spot by pressing overlapping part cause interference.

5	System cover's ventilation outlet structure

Set ventilation outlet structure on Light source side of module

Light source Connector
Light source edge (LED / Lamp)
Module

Definition	To prevent from abnormal display of light leakage, We suggest to set ventilation outlet structure on side of Module Light bar in system cover inner surface.

Appendix 2. OUTLINE DRAWING

Active Area

480.85±0.3

12.85±0.3

4.8±0.3

DATA COF POSITION
(SI mechanical structure should not
touch the positions of Data COF)

493.7±0.5(out size)

477.7(open area)

(246.85)

(36.99) (42.5) (53.94) (42.5) (53.94) (42.5) (53.94) (42.5) (53.94) (42.5)

DATA COF POSITION
(SI mechanical structure should not
touch the positions of Data COF)

1.97

11±0.5

150.05

300.1(open area)
320.1±0.5(out size)

1.97

4.1

Gap max. 0.5mm

4-M3 user hole
MAX. screw length 4.1mm

SECTION A-A
SCALE 5:1

447.85±0.3

45.85±0.3

4.8

Bezel Open

Active Area

NOTES:
1.outline tolerance:0.5mm
2.I/F connector SPEC:FOXCONN (GS23301-0321R-7H)
3.lightbar connector: FCN WM13-406-063N
4.side mount hole rotational torque must be MAX.6kgf-cm
5.display area position tolerance: IA-BK=1mm & IC-DK=1mm.

REV	EC NUMBER	DESCRIPTION	DATE
⚠	EA019998B	I/F connector type update	2012/06/01
⚠	EA014586G	Modify the hole of pet sheet	2014/05/29

				DATE	2014/05/29	SCALE	UNIT	
						1:1	mm	
APPROVED	JC.Young		PART NUMBER OF PCM NUMBER	INN0282653				C
CHECKED	Charin.Vang		PART DESCRIPTION	LCM_M220ZGE-L20		SHEET NUMBER		1of2
DESIGNED	Leiming.Tu		INNOLUX			SIZE		A1

REV	EC NUMBER	DESCRIPTION	DATE
⚠	EA0109988	I/F connector type update	2012/06/01
⚠	EA0145886	Modify the hole of prt sheet	2014/05/29

DATA COF POSITION
(SI mechanical structure should not
touch the positions of Data COF)

(39.43)

207.42±1(connector 1st function pin position)

(42.5) (53.94) (42.5) (36.99)

z=11

Don't Touch ✍ 請勿觸摸   Don't Touch ✍ 請勿觸摸   Don't Touch ✍ 請勿觸摸   Don't Touch ✍ 請勿觸摸   Don't Touch ✍ 請勿觸摸

33.79±1

(126.36)

z=7.7

z=8.3

149.7±1(connector 1st function pin position)

Module Mark

92±0.2   (87.25)   (148.95)

Backlight Mark

24±0.2   12.5±0.2   62±0.2

0.8   0.8   0.8   0.8

z=9.25

z=9.0

25.05±0.2   25.05±0.2

NOTES:
1.outline tolerance:0.5mm
⚠ 2.I/F connector SPEC:FOXCONN (GS23301-0321R-7H)
3.lightbar connector: FCN WM13-406-063N
4.side mount hole rotational torque must be MAX.6kgf-cm

									GENERAL LINEAR TOLERANCE			PRN DIMENSION		CONTROL DIMENSION	DATE	SCALE	UNIT	
															2014/05/29		mm	
															PART NUMBER or PIN NUMBER			DRAWN BY:
								APPROVED	JC.Young					INN0282653			C
								CHECKED	Charin.Vang					PART DESCRIPTION			SHEET NUMBER
								DESIGNED	Leining.Tu					LCM_M220ZGE-L20			2of2
														INNOLUX			A1

Doc. Number :

■ Tentative Specification
☐ Preliminary Specification
☐ Approval Specification

MODEL NO.: G156BGE
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
2.0	Feb.17, 2014	All	Spec Ver. 2.0 was first issued.
2.1	Jul., 8, 2014	7	4.2. INTERFACE CONNECTIONS Note(1) Added User Connector
		11	4.3.4 BACKLIGHT PIN ASSIGNMENT Added Note(2) User Connector
2.2	Feb.22, 2018	All	Transfer the manufacture side from TW to NGB. Spec update from Ver. 2.1 to Ver.2.2.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

G156BGE-L01 is a 15.6" TFT Liquid Crystal Display module with WLED Backlight unit and 30 pins 1ch-LVDS interface. This module supports 1366 x 768 WXGA mode and can display up to 16.7M colors. The converter module for Backlight is built in.

1.2 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Screen Size	15.6" real diagonal		
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1366 x R.G.B. x 768	pixel	-
Pixel Pitch	0.252 (H) x 0.252 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262K/16.7M	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	AG type, 3H hard coating,	-	-
Luminance, White	300	Cd/m2	
Color Gamut	65 % of NTSC(Typ.)	-	-
Power Consumption	(10.95)	W	

2. MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	363.3	363.8	364.3	mm	
	Vertical (V)	215.42	215.92	216.42	mm	
	Thickness (T)	16.35	16.85	17.35	mm	
Bezel Area	Horizontal	347.03	347.53	347.03	mm	
	Vertical	196.34	196.84	197.34	mm	
Active Area	Horizontal	-	344.232	-	mm	
	Vertical	-	193.536	-	mm	
Weight		-	1190	1250	g	

3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	TST	-20	60	℃	(1)
Operating Ambient Temperature	TOP	0	(60)	℃	(1), (2)

Note (1)

(a) 90 %RH Max. (Ta < 40 ℃).

(b) Wet-bulb temperature should be 39 ℃ Max. (Ta < 40 ℃).

(c) No condensation.

Note (2) The temperature of panel surface should be 0 ℃ min. and 60 ℃ max.

3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCCS	-0.3	6.0	V	(1)
Logic Input Voltage	VIN	-0.3	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)
Enable Voltage	LED_EN	0	3.3 / 5	7	V	Duty=100%
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	Name	Description
1	GND	Ground
2	NC	Not connection, this pin should be open.
3	NC	Not connection, this pin should be open.
4	GND	Ground
5	RX0-	Negative LVDS differential data input. Channel 0
6	RX0+	Positive LVDS differential data input. Channel 0
7	GND	Ground
8	RX1-	Negative LVDS differential data input. Channel 1
9	RX1+	Positive LVDS differential data input. Channel 1
10	GND	Ground
11	RX2-	Negative LVDS differential data input. Channel 2
12	RX2+	Positive LVDS differential data input. Channel 2
13	GND	Ground
14	RXCLK-	Negative LVDS differential clock input.
15	RXCLK+	Positive LVDS differential clock input.
16	GND	Ground
17	RX3-	Negative LVDS differential data input. Channel 3
18	RX3+	Positive LVDS differential data input. Channel 3
19	GND	Ground
20	NC	Not connection, this pin should be open.
21	NC	Not connection, this pin should be open.
22	NC	Not connection, this pin should be open.
23	GND	Ground
24	GND	Ground
25	GND	Ground
26	Vcc	+5V power supply
27	Vcc	+5V power supply
28	Vcc	+5V power supply
29	Vcc	+5V power supply
30	Vcc	+5V power supply

Note (1) Connector Part No.:187114-30091(P-TWO) or equivalent

 User's connector Part No.:FI-X30H(JAE)

Note (2) The first pixel is odd.

Note (3) Input signal of even and odd clock should be the same timing.

4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD ELETRONICS SPECIFICATION

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	(4.5)	(5)	(5.5)	V	-
Ripple Voltage		V$_{RP}$	-	-	(150)	mV	-
Rush Current		I$_{RUSH}$	-	-	(3)	A	(2)
Power Supply Current	White		-	(0.16)	(0.21)	A	(3)a
	Black		-	(0.22)	(0.27)	A	(3)b
	Vertical Stripe		- -	(0.27)	(0.32)	A	(3)c
Power Consumption		PLCD	-	(1.35)	(2.52)	Watt	(4)
LVDS differential input voltage		Vid	-	(1.35)	(1.60)	mV	
LVDS common input voltage		Vic	(200)	-	(600)	V	
Logic High Input Voltage		VIH	-	(1.2)	-	V	
Logic Low Input Voltage		VIL	(2.7)		(3.3)	V	

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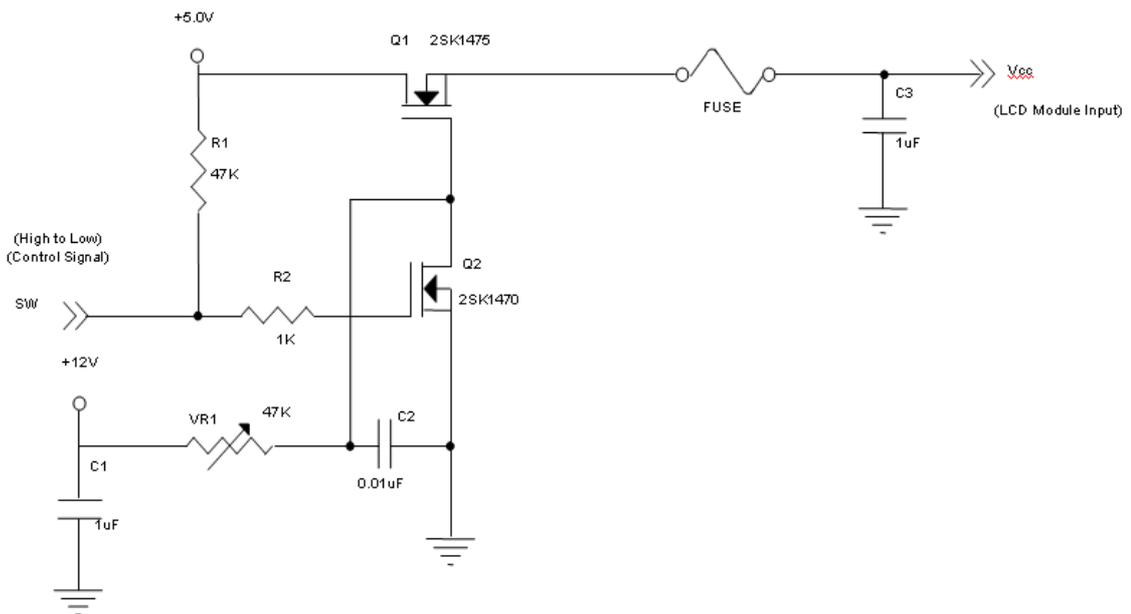
Note (2) Measurement Conditions:

Vcc rising time is 470μs

Note (3) The specified power supply current is under the conditions at Vcc = 5.0 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
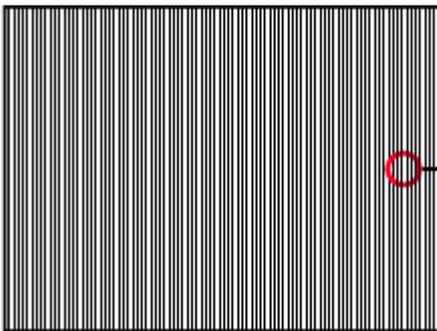
Active Area
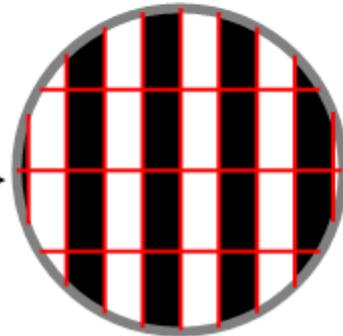
Note (4) The power consumption is specified at the pattern with the maximum current.

Note (5) VID waveform condition

4.3.2 Vcc Power Dip Condition
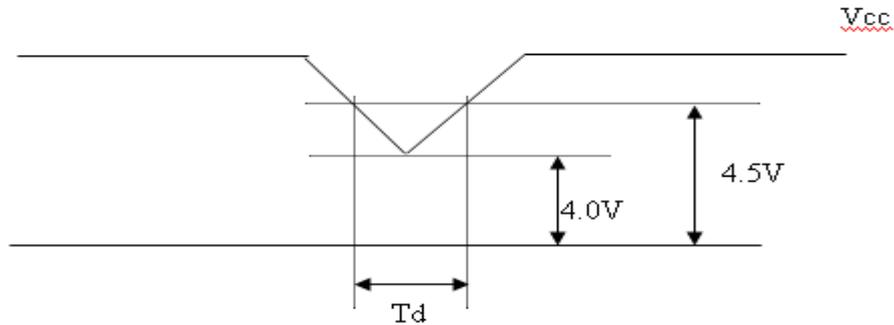
4.3.3 BACKLIGHT UNIT

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	(0.6)	(0.8)	(1)	A	@LED_Vin= 12V Duty=100%
Converter Input Rush Current		Iirsh			(3)	A	@LED_Vin rising = 1mS
Power Consumption		P_{LED}		(9.6)		W	@ LED_Vin = 12V Duty=100%
EN Control Level	Backlight on	LED_EN	(2.0)	(5)	(5.5)	V	
	Backlight off		(0)	(0)	(0.8)		
PWM Control Level	PWM High Level	LED_PWM	(2.0)	(3.3)	(5.0)	V	
	PWM Low Level		(0)	(0)	(0.15)		
PWM Control Duty Ratio			(10)	--	(100)	%	
PWM Control Frequency		f_{PWM}	(190)	(200)	(20k)	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 at high temperature condition will reduce life time and lead to color shift.

.
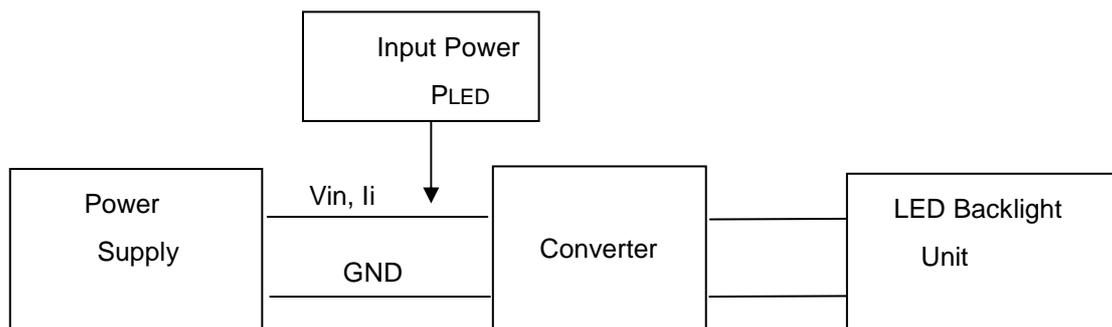
4.3.4 BACKLIGHT PIN ASSIGNMENT

Pin	Symbol	Description	Remark
1	V_i	Converter input voltage	12V
2	V_{GND}	Converter ground	Ground
3	EN	Enable pin	3.3 / 5 V
4	ADJ	Backlight Adjust	PWM Dimming (Hi: 3.3 / 5V_{DC}, Lo: 0V_{DC})
5	NC	Not Connect	

Note (1) Connector Part No.:CI4205M2HRP-NH,CVILUX

Note (2) User's connector Part No.:CI4205SL000(CVILUX)

4.4 LVDS INPUT SIGNAL SPECIFICATIONS

4.4.1 LVDS DATA MAPPING TABLE

LVDS Channel 0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	G0	R5	R4	R3	R2	R1	R0
LVDS Channel 1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	B1	B0	G5	G4	G3	G2	G1
LVDS Channel 2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	B5	B4	B3	B2
LVDS Channel 3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	B7	B6	G7	G6	R7	R6

4.4.2 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	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

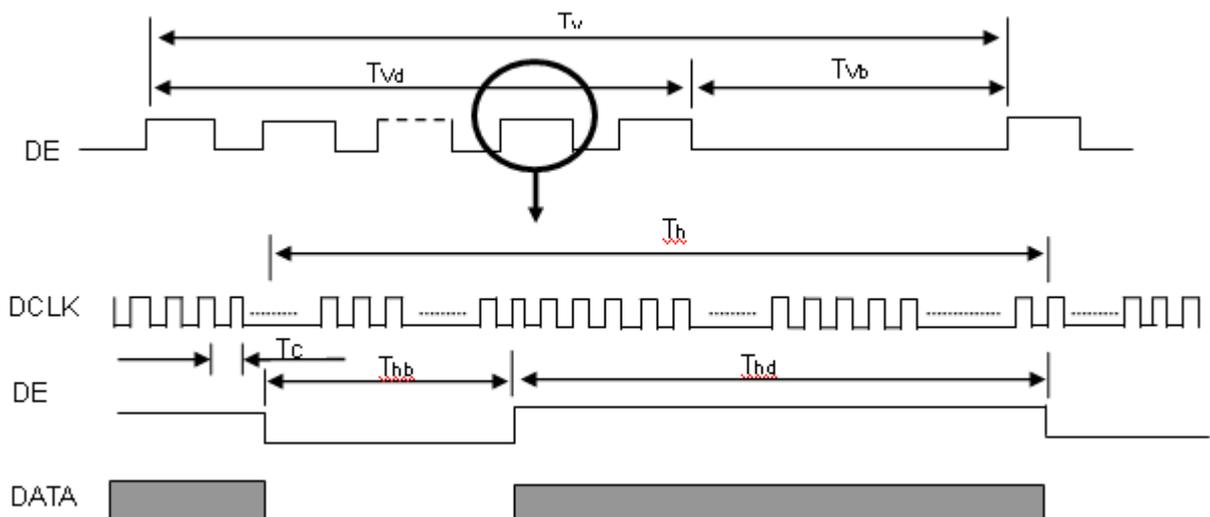Note (1) 0: Low Level Voltage, 1: High Level Voltage

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	(63)	(76)	(96)	MHz	-
	Period	Tc		(13)		ns	
	Input cycle to cycle jitter	T$_{rcl}$	(TC -200)		(TC +200)	ns	(1)
	Input Clock to data skew	TLVCCS			(400)	ps	(2)
	Spread spectrum modulation range	Fclkin_mod	(FC*97%)		(FC*103%)	MHz	(3)
	Spread spectrum modulation frequency	F$_{SSM}$			(200)	KHz	
Vertical Display Term	Frame Rate	Fr	(50)	(60)	(76)	Hz	Tv=Tvd+Tvb
	Total	Tv	(800)	(806)	(815)	Th	-
	Active Display	Tvd	(768)	(768)	(768)	Th	-
	Blank	Tvb	(32)	(38)	(47)	Th	-
Horizontal Display Term	Total	Th	(1500)	(1560)	(1570)	Tc	Th=Thd+Thb
	Active Display	Thd	(1366)	(1366)	(1366)	Tc	-
	Blank	Thb	(134)	(194)	(204)	Tc	-

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

INPUT SIGNAL TIMING DIAGRAM

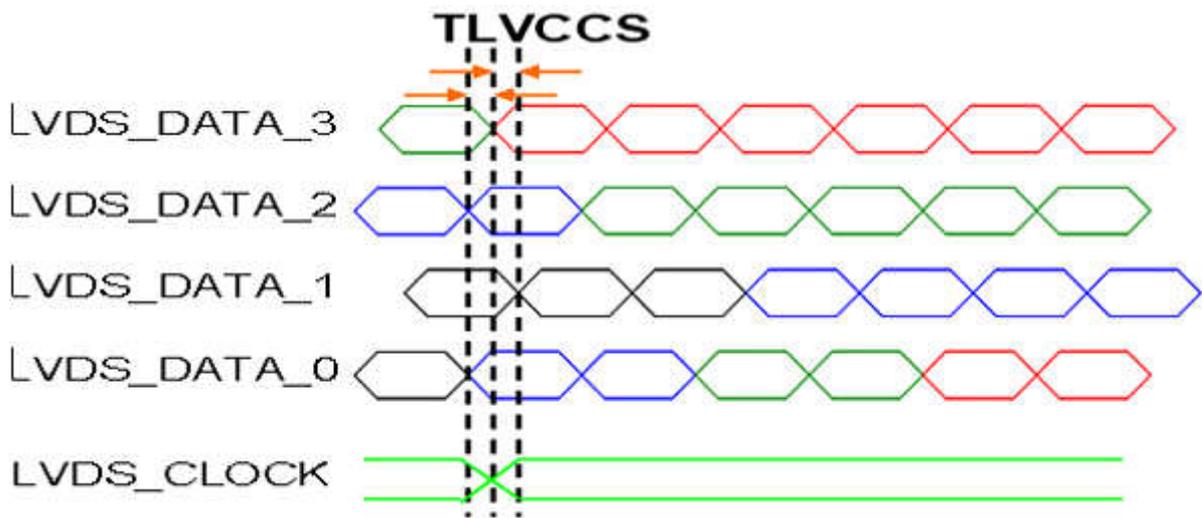Note (1) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T_1 – TI

Note (2) Input Clock to data skew is defined as below figures.

Note (3) The SSCG (Spread spectrum clock generator) is defined as below figures.
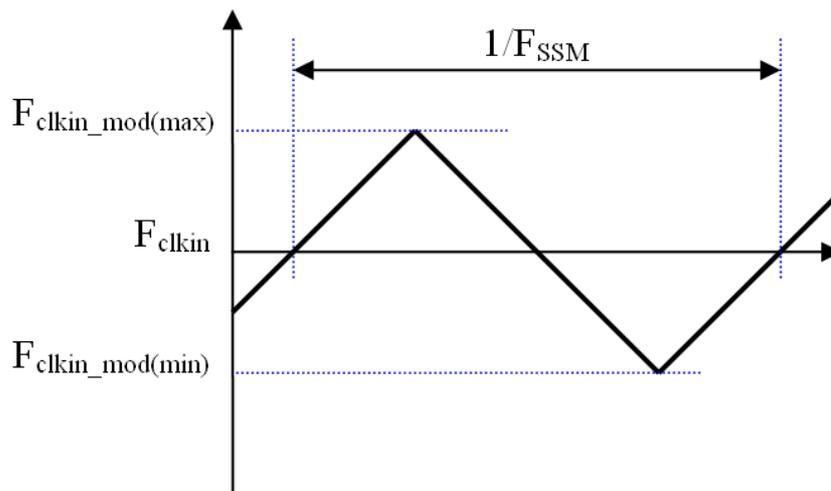
4.6 POWER ON/OFF SEQUENCE

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	200	-	-	ms
T6	20	-	-	ms
T7	5	-	300	ms
T8	10	-	-	ms
T9	10	-	-	ms

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 va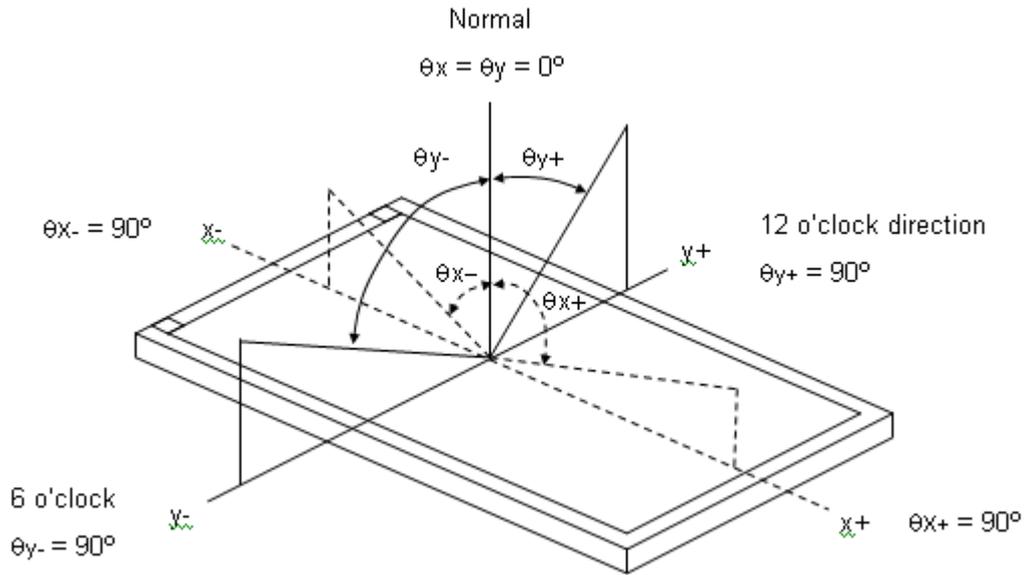riation. The following items should be measured under the test conditions described in 5.1 and stable environment shown in Note (5).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	Rx	$\theta_x=0°$, $\theta_Y=0°$ CS-2000 R=G=B=255 Gray scale	Typ – 0.045	(0.617)	Typ + 0.045	-	(1), (5)
		Ry			(0.340)			
	Green	Gx			(0.320)			
		Gy			(0.598)			
	Blue	Bx			(0.160)			
		By			(0.084)			
	White	Wx			(0.313)			
		Wy			(0.329)			
Center Luminance of White (Center of Screen)		L_C		240	300	-	cd/m^2	(4), (5)
Contrast Ratio		CR		400	500	-	-	(2), (5)
Response Time		T_R	$\theta_x=0°$, $\theta_Y=0°$	-	(3)	(8)	ms	(3)
		T_F		-	(7)	(13)		
White Variation		W	$\theta_x=0°$, $\theta_Y=0°$	(65)	-	-	%	(5), (6)
Viewing Angle	Horizontal	θx- + θx+	CR $\geqq$ 10	(140)	(160)	---	Deg.	(1), (5)
	Vertical	θy- + θy+		(140)	(160)	---		

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 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.

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

Measure the luminance of gray level 255 at 9 points

δW = (Minimum [L (1) ~ L (9)] / Maximum [L (1) ~ L (9)]) *100%

6. RELIABILITY TEST ITEM

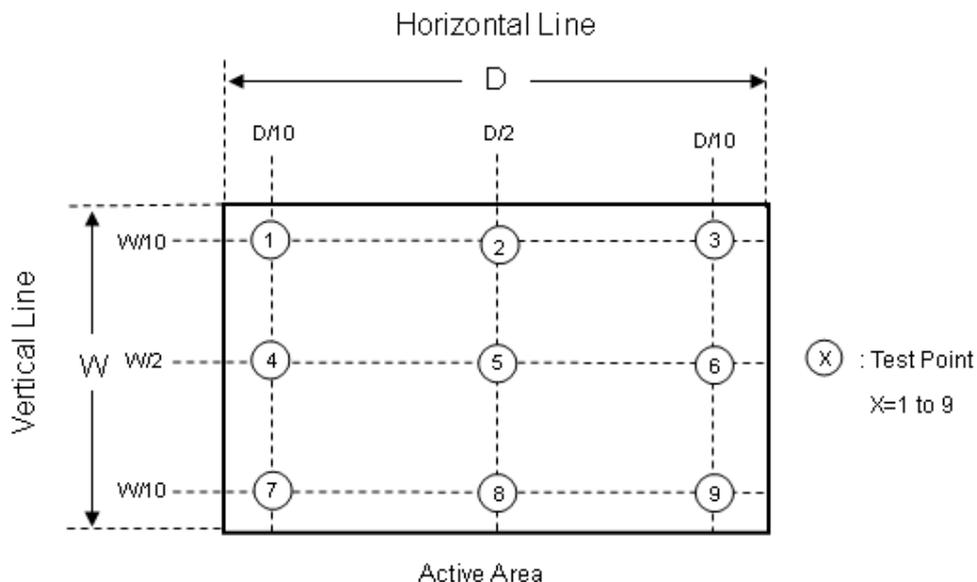| Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50℃ , 80%RH, 240hours	
High Temperature Operation (HTO)	Ta= 60℃ , 50%RH , 240hours	
Low Temperature Operation (LTO)	Ta= 0℃ , 240hours	
High Temperature Storage (HTS)	Ta= 60℃ , 240hours	
Low Temperature Storage (LTS)	Ta= -20℃ , 240hours	
Vibration Test (Non-operation)	Acceleration: 1.5 Grms Wave: Half-sine Frequency: 10 - 300 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 11 ms Direction : ± X, ± Y, ± Z.(one time for each Axis)	
Thermal Shock Test (TST)	-20℃/30min , 60℃ / 30min , 100 cycles	
On/Off Test	25℃ ,On/10sec , Off /10sec , 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω)	
	Air Discharge: ± 15KV, 150pF(330Ω)	
Altitude Test	Operation:10,000 ft / 24hours Non-Operation:30,000 ft / 24hours	

Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

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.

The fixing condition is shown as below:

7. PACKING

7.1 PACKING SPECIFICATIONS

(1) 10 pcs LCD modules / 1 Box

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

(3) Weight: approximately 17Kg (10 modules per box)

7.2 PACKING METHOD

Figure. 7-1 Packing method

Sea / Land Transportation (40ft Container)   Air Transportation

Figure. 7-2 Packing method

7.3 UN-PACKING METHOD
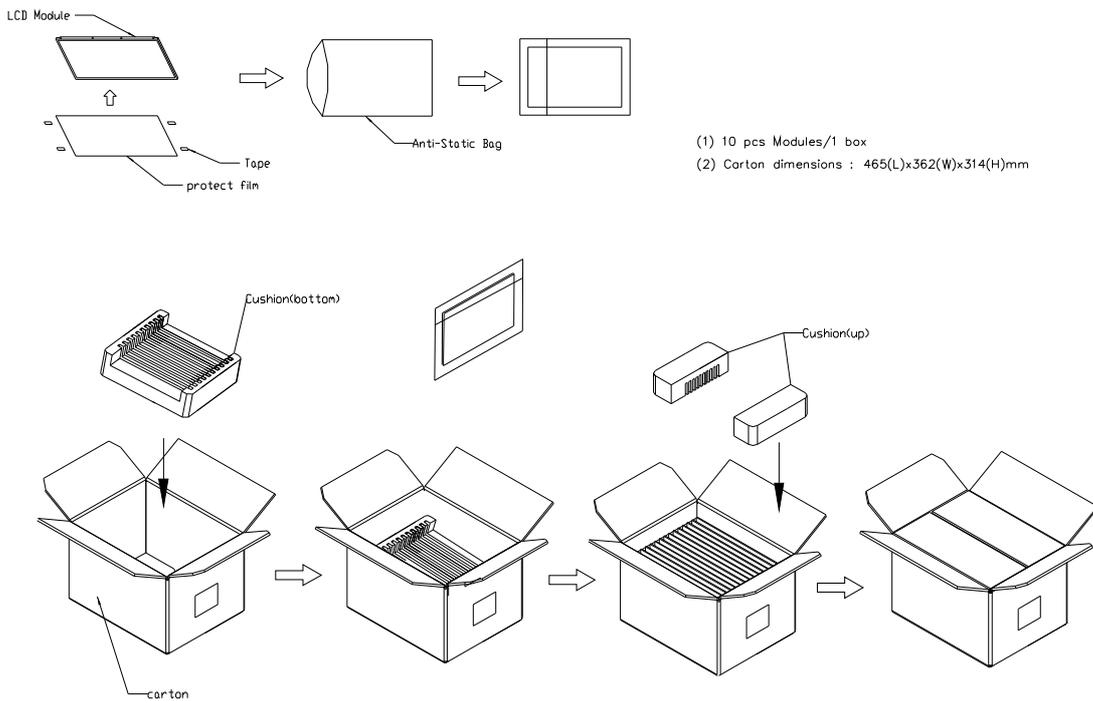
Figure. 7-3 UN-Packing method

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.
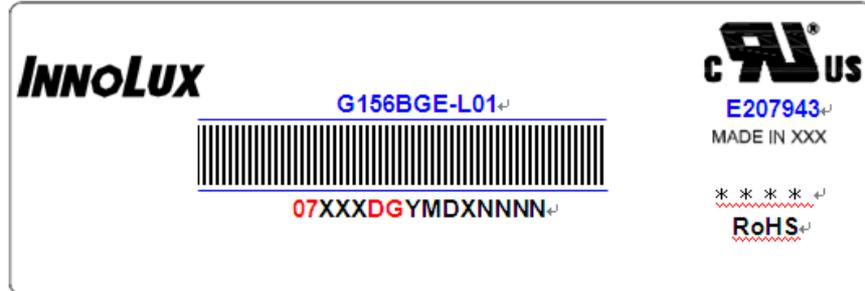
(a) Model Name: G156BGE   -L01

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

(c) ＊ ＊ ＊ ＊ : Factory ID

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

            Serial

            INX Internal Use

            Year, Month, Date

            INX Internal Use

            Revision

            INX Internal Use

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

Data COF Position
(SI mechanical structure should not touch the positions of Data COF)

Data COF Position
(SI mechanical structure should not touch the positions of Data COF)

363.8 ±0.5

(44.07)
8.13
(1.65)
(44.5)
(70.41)
(44.5)
(70.41)
(44.5)
8.134

16.85 ±0.5
2-6.4 ±0.5

2-6.4 ±0.5

Active Area   344.232X193.536

63.16
(45)
90

63.16
(45)
90

8.74
(1.65)
196.84 ±0.5

215.92±0.5

USER_HOLE   USER_HOLE

(1.65)
(1.65)

347.53 ±0.5

GAP MAX. 0.5mm

4-M3 USER HOLE
SCREW LENGTH 4mm(Max.)

SECTION USER_HOLE-USER_HOLE
SCALE 4:1

BEZEL OPEN

D
A   B
C

ACTIVE AREA

NOTE:
1. DISPLAY AREA POSITION TOLERANCE: IA-BK<=1mm & IC-DK<=1mm.
2. UNSPECIFIED TOLERANCE: ±0.5mm.
3. SIDE MOUNT HOLE ROTATIONAL TORQUE MAX. IS 5kgf-cm

66.9 ±0.5

(115)

(38.41)

69.75 ±0.5

P1 ~ P30

YY

YY

LVDS CONNECTOR
(187114-30091,P2)

P Cover to Frame Rear Gap=0.5 (Reference Dimension)

SECTION YY-YY

P5 ~ P1

POWER IN CONNECTOR
(CI4205M2HRP-NH,CVILUX)

6.37 ±2

56±2

NOTE:
1. DISPLAY AREA POSITION TOLERANCE: IA-BI<=1mm & IC-DI<=1mm.
2. UNSPECIFIED TOLERANCE: ±0.5mm.
3. SIDE MOUNT HOLE ROTATIONAL TORQUE MAX. IS 5kgf-cm.

InnoLux
群創光電

☐ Tentative Specification
☐ Preliminary Specification
■ Approval Specification

MODEL NO.: G104X1
SUFFIX: L03

Customer:

APPROVED BY   **SIGNATURE**

Name / Title

Note
Product Version C5

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

Approved By	Checked By	Prepared By
陳立錚	林秋森	許秝茵

CONTENTS

REVISION HISTORY

Version	Date	Page	Description
3.0	Aug,20,2018	ALL	Spec Ver.3.0 was fist issued

1. GENERAL DESCRIPTION

1.1 OVERVIEW

G104X1- L03 is a 10.4" IAV TFT Liquid Crystal Display module with LED backlight unit and 30-pin-and-1ch LVDS interface. This product supports 1024 x 768 XGA format and can display true 16.2M colors (6-bits colors with FRC). The converter module for LED backlight is built-in.

1.2 FEATURES

-Excellent brightness (350 nits)

- Ultra high contrast ratio (1000:1)

- Fast response time (Ton+Toff average 25 ms)

- XGA (1024 x 768 pixels) resolution

- DE (Data Enable) only mode

- LVDS (Low Voltage Differential Signaling) interface

- Ultra wide viewing angle: 176(H)/ 176(V) (CR>10) Super MVA technology

-180 degree rotation display option

-Color reproduction (Nature color)

-Wide operation and storage temperature range

1.3 APPLICATION

-TFT LCD monitor for Industrial applications

-Slim design display for portable applications

-Digitizer Applicable Design

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	210.4 (H) x 157.8 (V) (10.4" diagonal)	mm	(1)
Bezel Opening Area	215.4 (H) x 161.8 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1024 x R.G.B. x 768	pixel	-
Pixel Pitch (Sub Pixel)	0.0685 (H) x 0.2055 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.2 M	color	-
Display Operation Mode	Normally black / VA	-	-
Surface Treatment	Anti Glare	-	-
Total power consumption(typ)	5.8	W	typ

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

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	238.1	238.6	239.1	mm	(1)
	Vertical (V)	175.3	175.8	176.3	mm	
	Depth (D)	-	7.47	-	mm	-
Weight		-	280	291	g	-

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

Note (2) Measurement should be done by pressing down the PCBA.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Operating Ambient Temperature	T_{OP}	-20	+70	ºC	
Storage Temperature	T_{ST}	-20	+70	ºC	

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
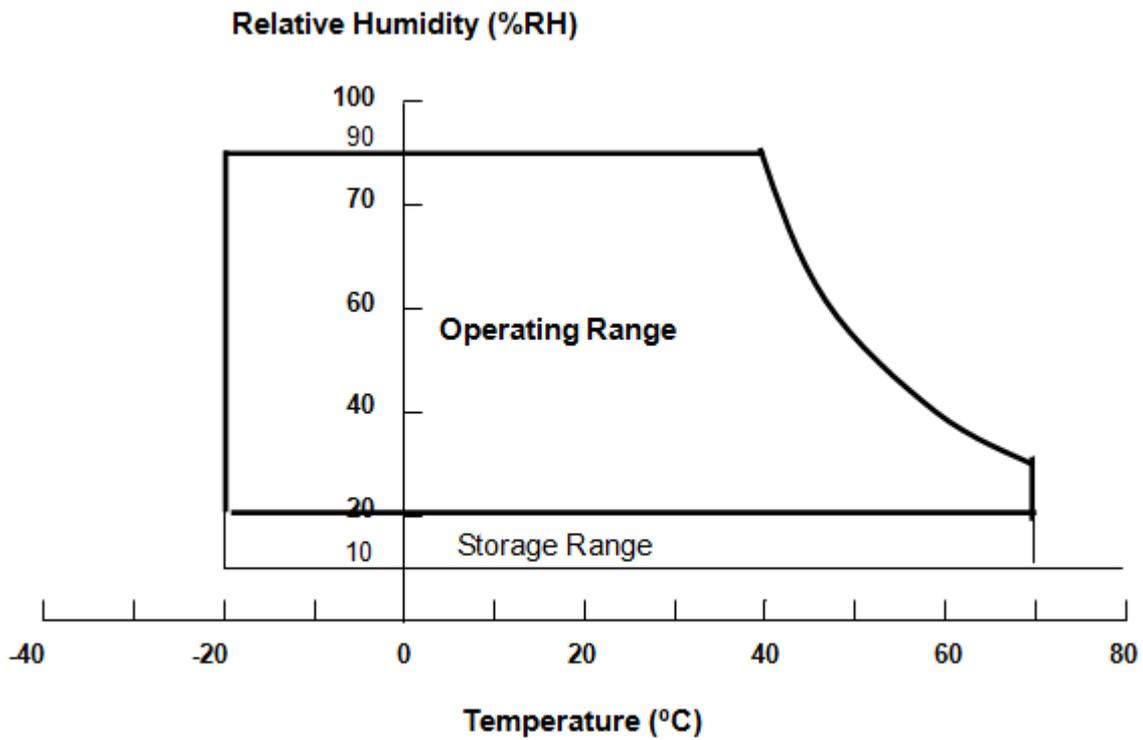
2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCC	-0.3	4	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	-0.3	5.5	V	
Backlight Adjust	ADJ	-0.3	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 light bar (Refer to 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	3.0	3.3	3.6	V	(1)
Rush Current		I_{RUSH}	-	-	4.0	A	(2)
Power Supply Current	White	-		660	790	mA	(3)
	Black			500	600	mA	
Power Consumption		P_L	---	2.2	2.6	W	
LVDS differential input voltage		|VID|	100	-	600	mV	-
LVDS common input voltage		VICM	0.7	-	1.6	V	-

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

Note (2)Measurement Conditions:
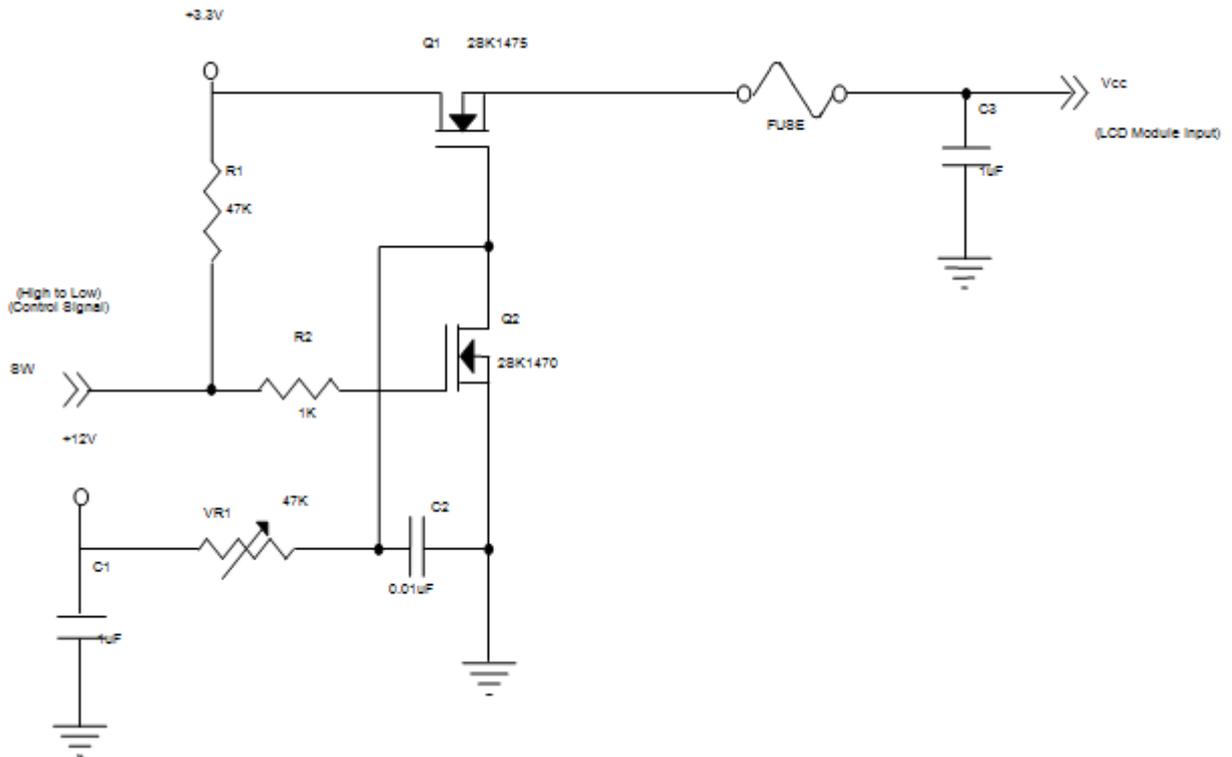
VCC rising time is 470us
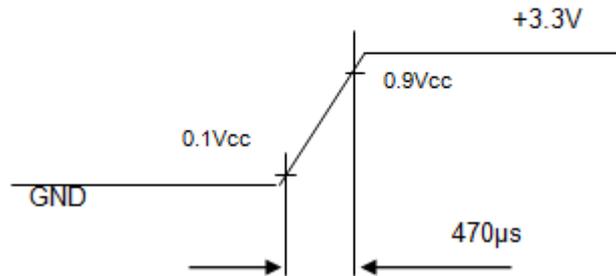
Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 °C, fv = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern
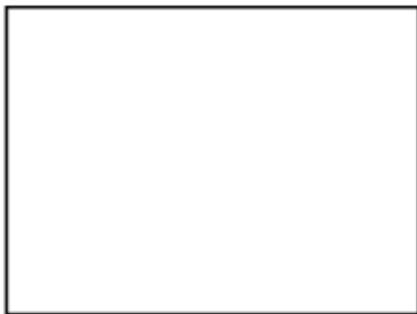
Active Area

b. Black Pattern

Active Area

c. Vertical Stripe Pattern
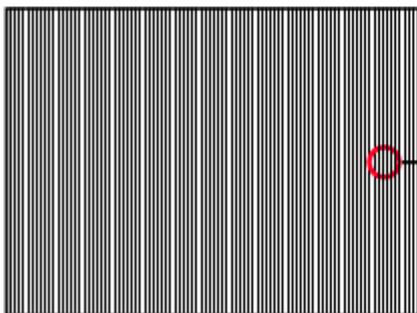
Active Area

3.2 LED CONVERTER

Ta = 25 ± 2 ºC

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Power Supply Voltage		V_i	10.8	12.0	13.2	V	(Duty 100%)
Converter Power Supply Ripple Voltage		Vi_{RP}			500	mV	
Converter Power Supply Current		I_i	---	0.3	0.4	A	@ Vi = 12V (Duty 100%)
Converter Inrush Current		Ii_{RUSH}			3.0	A	@ Vi rising time = 10ms (Vi =12V)
LED Power Consumption		P_{LED}	---	3.6	---	W	@ Vi = 12V (Duty 100%)
EN Control Level	Backlight on	BLON	2.5	3.3	5	V	
	Backlight off		0	---	0.3	V	
PWM Control Level	PWM High Level	E_PWM	2.5	3.3	5	V	
	PWM Low Level		0	---	0.15	V	
PWM Noise Range		V_{Noise}			0.1	V	
PWM Control Duty Ratio			2		100	%	@200Hz
PWM Control Frequency		f_{PWM}	190	200	20k	Hz	(2)
LED Life Time		L_L	30,000			Hrs	(3)

Note (1) LED current is measured by utilizing a high frequency current meter as shown below

Note (2) At 190 ~1KHz PWM control frequency, duty ratio range is restricted from 2% to 100%.

1K ~20KHz PWM control frequency，minimum duty on-time ≧ 20 us.

Note (3) 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 ILED = 20mADC(LED forward current) until the brightness becomes ≦ 50% of its original value. Operating LED under high temperature environment will reduce life time and lead to color shift
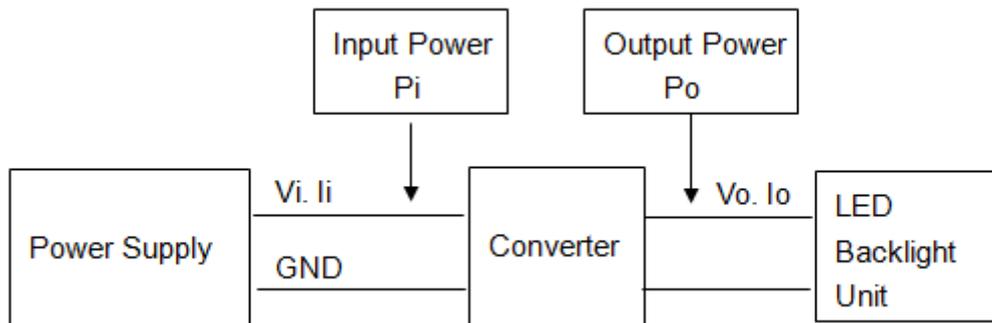
4. BLOCK DIAGRAM

4.1 TFT LCD MODULE
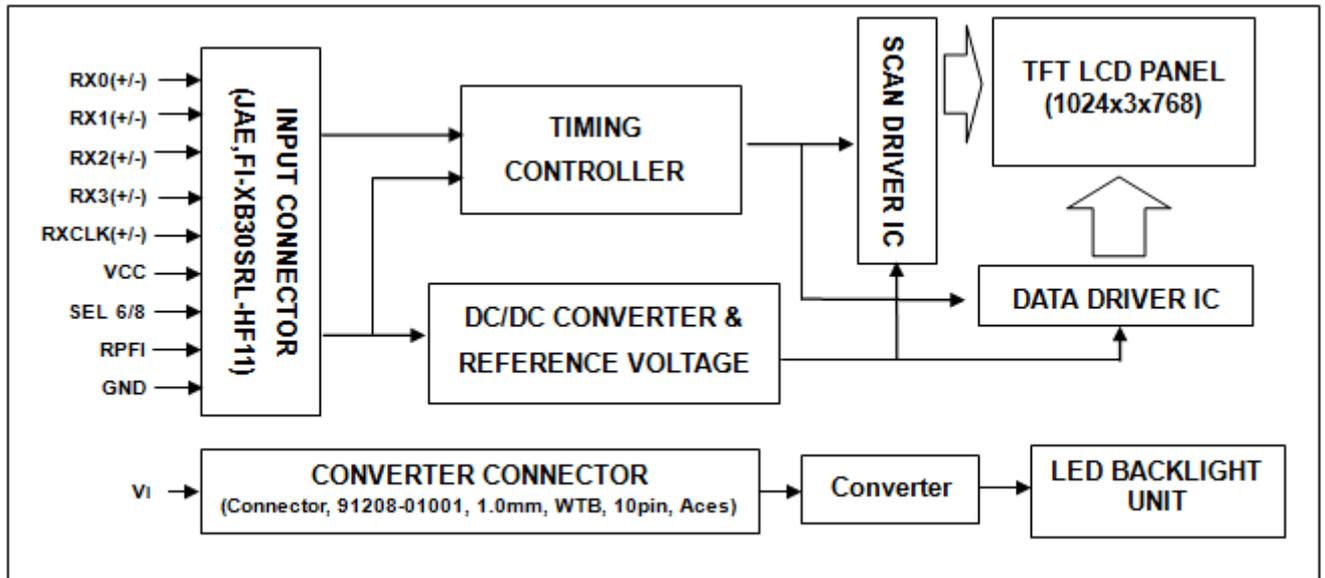
5. INTERFACE PIN ASIGNMENT

5.1 TFT LCD MODULE

CN1 Connector Pin Assignment

Pin No.	Symbol	Description	Note
1	VCC	Power supply: +3.3V	-
2	VCC	Power supply: +3.3V	-
3	VCC	Power supply: +3.3V	-
4	GND	Ground	-
5	GND	Ground	-
6	GND	Ground	-
7	RPFI	Reverse Panel Function (Display Rotation)	(2)
8	NC	No Connection	
9	NC	No Connection	-
10	NC	No Connection	-
11	SEL6/8	LVDS 6/8 bit select function control, Low or NC → 8 bit Input Mode High → 6bit Input Mode	(2)
12	GND	Ground	-
13	NC	No Connection	-
14	GND	Ground	-
15	RX0-	Negative transmission data of pixel 0	-
16	RX0+	Positive transmission data of pixel 0	-
17	GND	Ground	-
18	RX1-	Negative transmission data of pixel 1	-
19	RX1+	Positive transmission data of pixel 1	-
20	GND	Ground	-
21	RX2-	Negative transmission data of pixel 2	-
22	RX2+	Positive transmission data of pixel 2	-
23	GND	Ground	-
24	RXCLK-	Negative of clock	-
25	RXCLK+	Positive of clock	-
26	GND	Ground	-
27	RX3-	Negative transmission data of pixel 3	-
28	RX3+	Positive transmission data of pixel 3	-
29	GND	Ground	-
30	NC	No Connection	(2)

Note (1) Connector Part No.: JAE, FI-XB30SRL-HF11 or compatible connector

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

5.2 BACKLIGHT UNIT (Converter connector pin)

Pin	Symbol	Description	Remark
1	V_i	Converter input voltage	12V
2	V_i	Converter input voltage	12V
3	V_i	Converter input voltage	12V
4	V_i	Converter input voltage	12V
5	V_{GND}	Converter ground	Ground
6	V_{GND}	Converter ground	Ground
7	V_{GND}	Converter ground	Ground
8	V_{GND}	Converter ground	Ground
9	EN	Enable pin	3.3V
10	ADJ	Backlight Adjust	PWM Dimming (190-210Hz,Hi: $3.3V_{DC}$, Lo: $0V_{DC}$)

Note (1)Connector Part No.: 91208-01001(ACES) or equivalent

Note (2)User's connector Part No.: 91209-01011(ACES) or equivalent

5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																								
		Red								Green								Blue								
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	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 (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
DCLK	Frequency	Fc	55	65	75	MHz	
Vertical Active Display Term	Total	Tv	770	806	950	Th	Tv=Tvd+Tvb
	Display	Tvd	768	768	768	Th	-
	Blank	Tvb	2	38	182	Th	-
Horizontal Active Display Term	Total	Th	1104	1344	1800	Tc	Th=Thd+Thb
	Display	Thd	1024	1024	1024	Tc	-
	Blank	Thb	76	320	776	Tc	-

Note (1) Since this assembly is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this assembly would operate abnormally.

(2) Frame rate is 60Hz

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

INPUT SIGNAL TIMING DIAGRAM
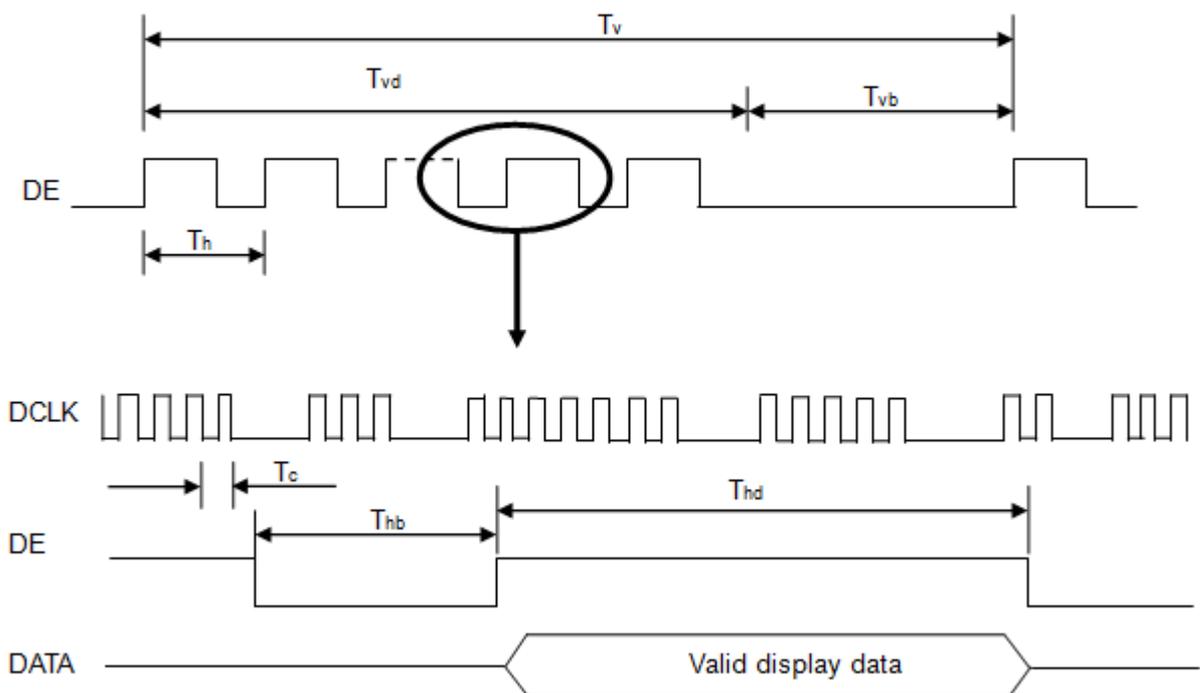
6.2 POWER ON/OFF SEQUENCE

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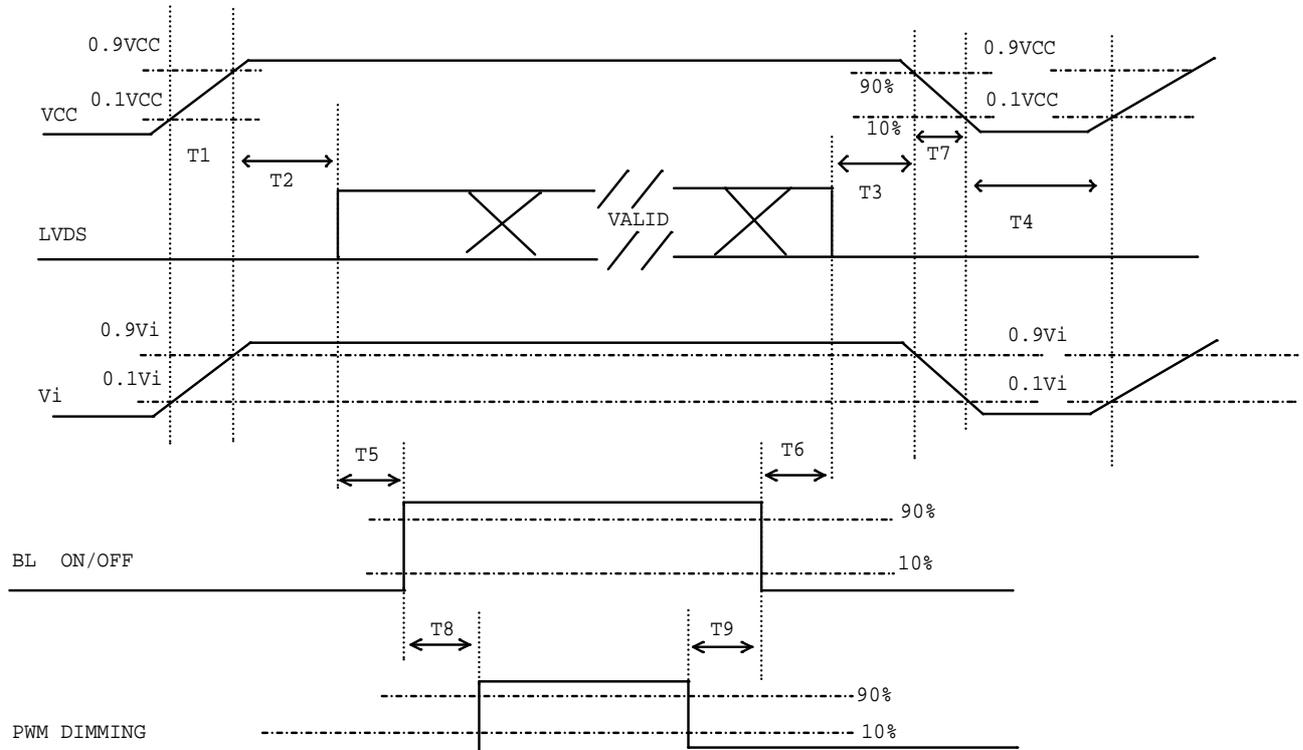

Power ON/OFF sequence

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 THE INPUT DATA FORMAT
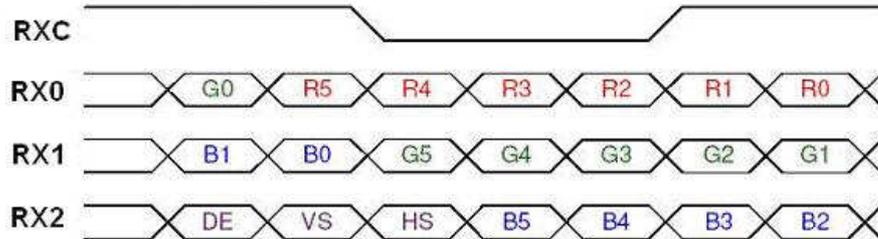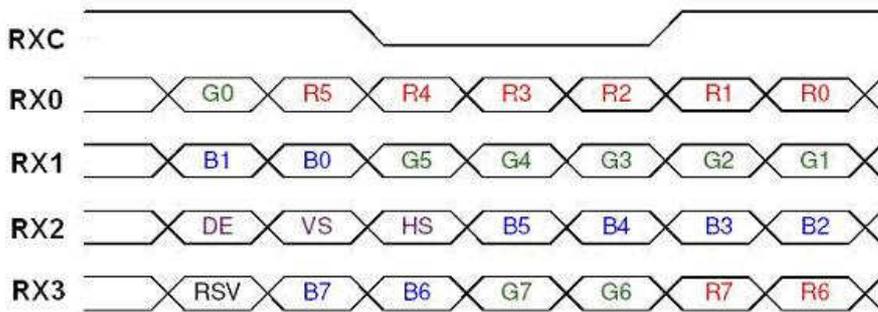
Note (1) R/G/B data 7: MSB, R/G/B data 0: LSB

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	

Note (3) Output signals from any system shall be low or Hi-Z state when VCC is off

6.4 SCANNING DIRECTION

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

RPFI = Low/floating; normal display (default)

RPFI = high: display with 180degree rotation

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

| 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 SPECIFICATIONS

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 (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR		700	1000		-	(2)
Response Time		T_R		-	14	19	ms	(3)
		T_F		-	11	16	ms	
Center Luminance of White		L_C		300	350	-	cd/m²	(4)
White Variation		δW		-	-	1.4	-	(7)
Cross Talk		CT	$\theta_x=0°$, $\theta_Y=0°$ Viewing angle at normal direction	-	-	4	%	(5)
Chromaticity	Red	Rx		Typ. -0.05	0.610	Typ. +0.05	-	(6)
		Ry			0.365		-	
	Green	Gx			0.341		-	
		Gy			0.564		-	
	Blue	Bx			0.147		-	
		By			0.087		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
Viewing Angle	Horizontal	θ_x+	CR≥10	80	88	-	Deg.	(1)
		θ_x-		80	88	-		
	Vertical	θ_Y+		80	88	-		
		θ_Y-		80	88	-		

Note (1)Definition of Viewing Angle (θx, θy):

Viewing angles are measured by BM5A
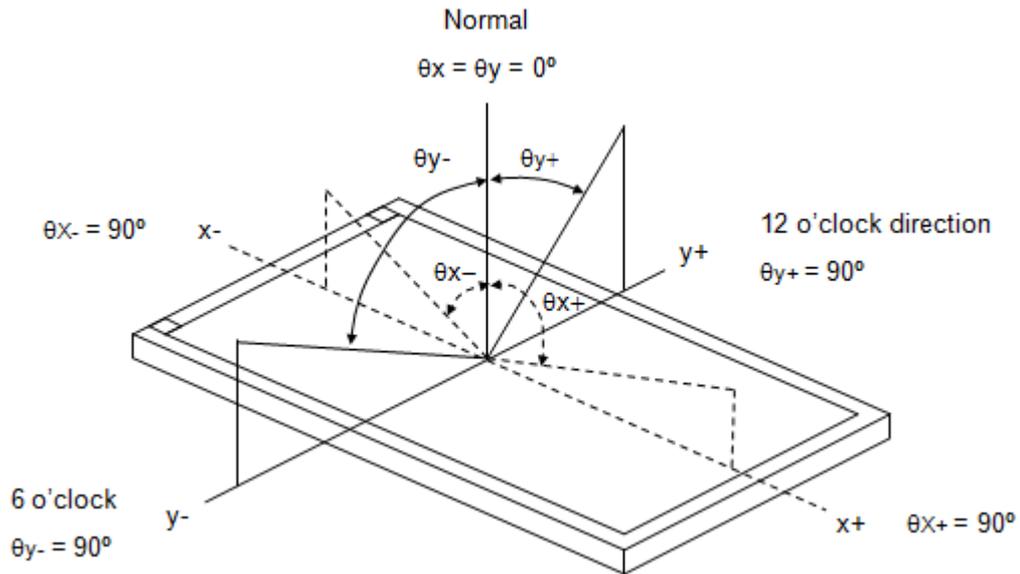
Note (2) Definition of Contrast Ratio (CR):

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

Note (3) Definition of Response Time (TR, TF):
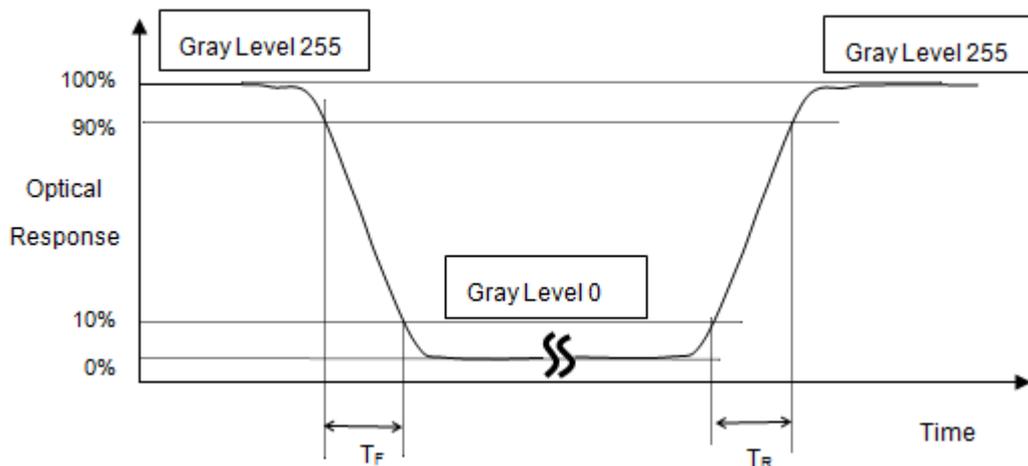
Note (4)Definition of Luminance of White (LC):

Measure the luminance of gray level 255 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 (7).

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

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

Where:

Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)
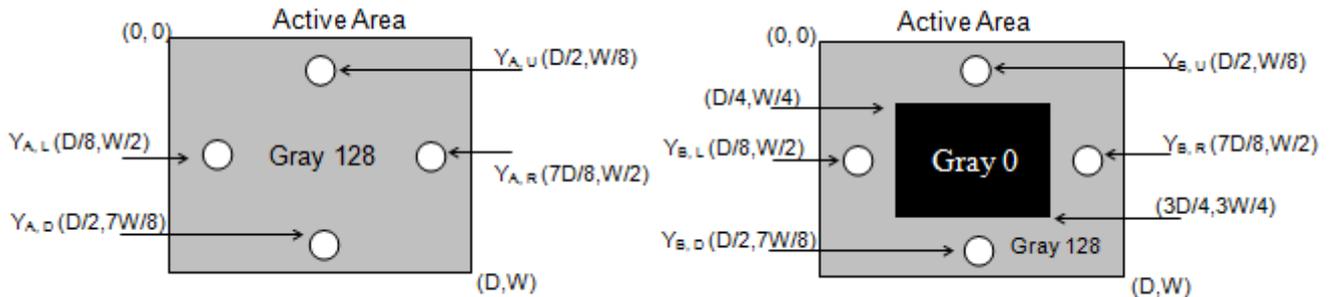
Note (6)Measurement Setup:

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.
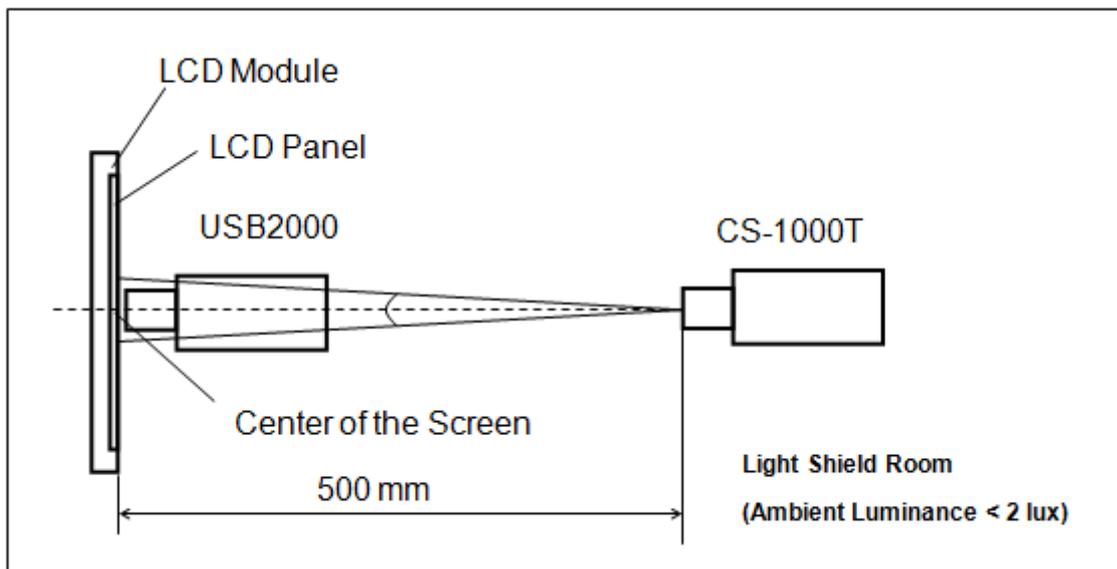
Note (7)Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

δW = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]
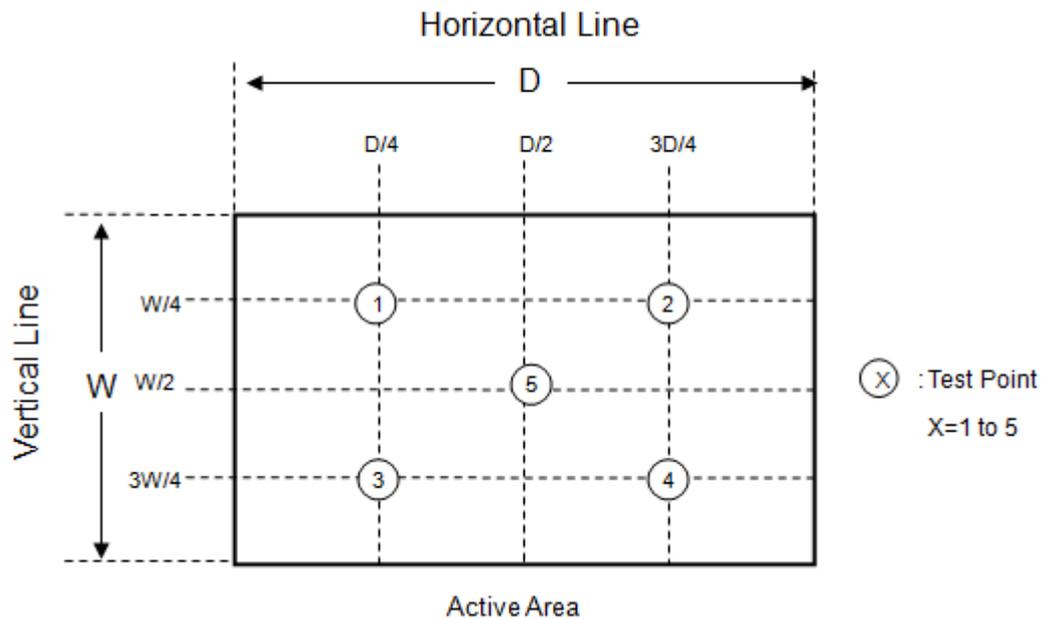
8. RELIABILITY TEST CRITERIA

Test Item	Test Condition	Note
High Temperature Storage Test	70ºC, 240 hours	(1) (2) (4) (5)
Low Temperature Storage Test	-20ºC, 240 hours	
Thermal Shock Storage Test	-20ºC, 0.5hour⟷70℃, 0.5hour; 100cycles, 1hour/cycle	
High Temperature Operation Test	70ºC, 240 hours	
Low Temperature Operation Test	-20ºC, 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 87 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 the 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. PACKAGING

9.1 PACKING SPECIFICATIONS

(1) 18pcs LCD modules / 1 Box

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

(3) Weight: approximately 8.3Kg (18 modules per box)

9.2 PACKING METHOD
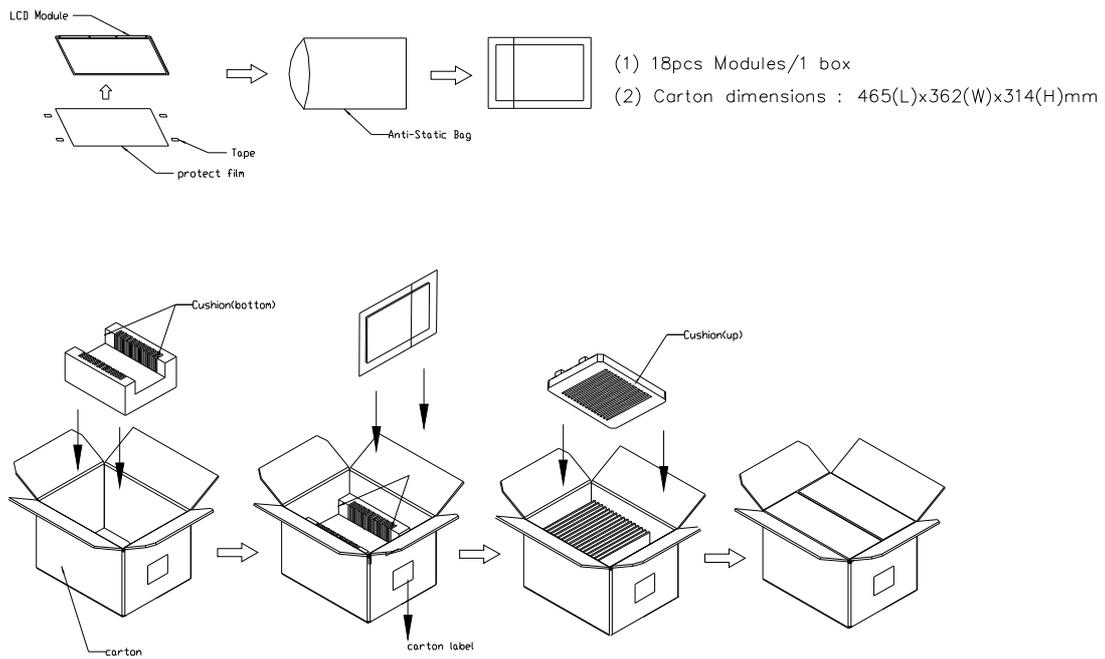
Figure.9-1 packing method

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
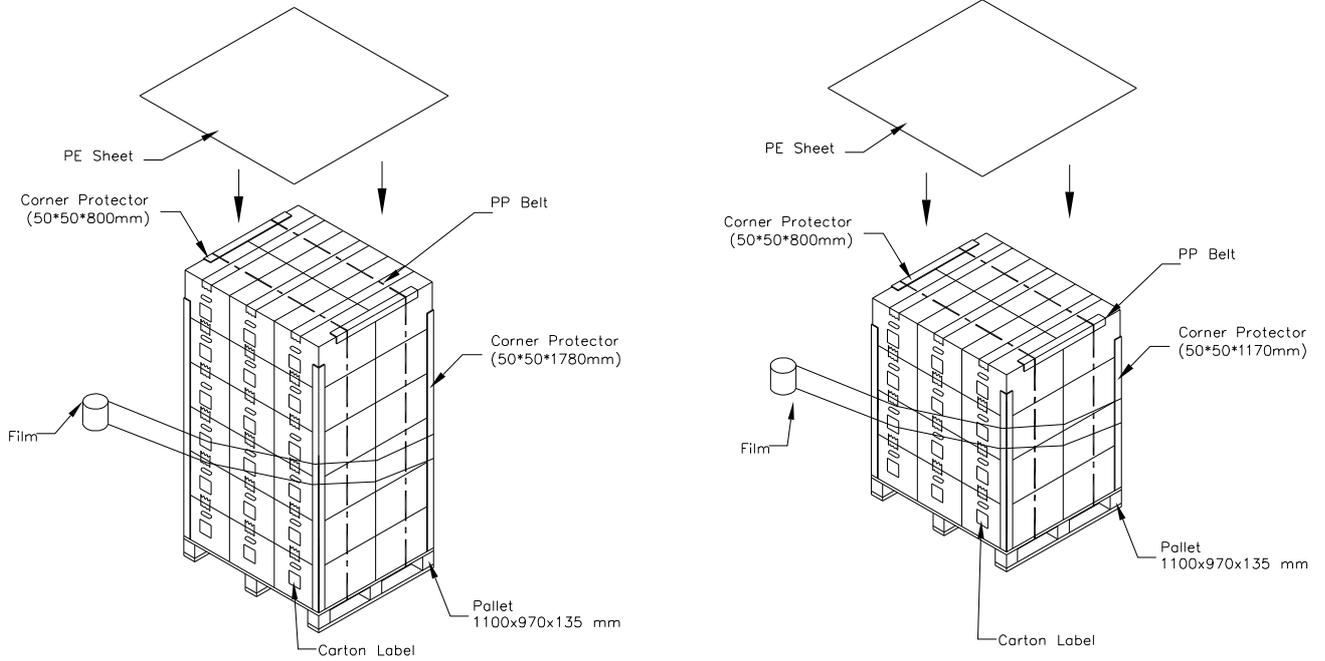
Figure. 9-2 Packing method

9.3 UN-PACKING METHOD

remove cushion(top)

take Module
out

open carton

LCD Module
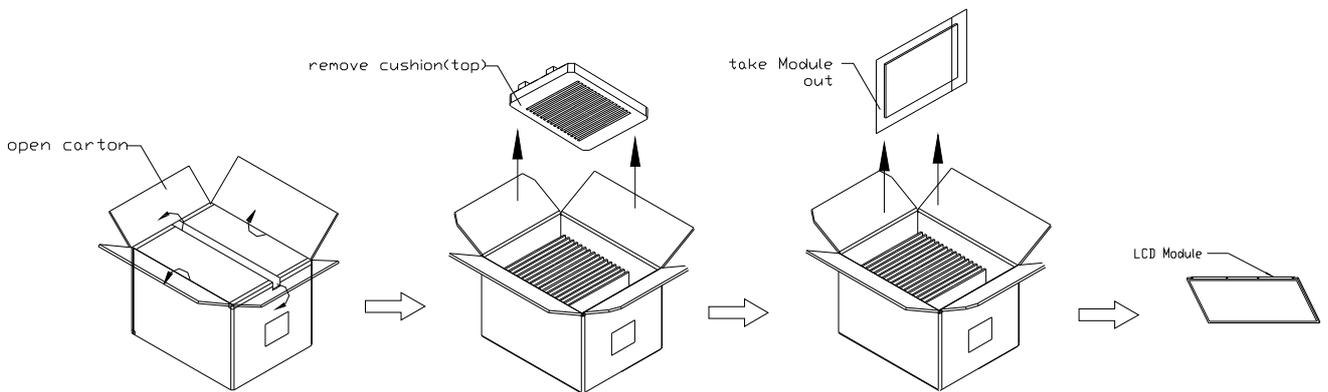
10. DEFINITION OF LABELS

10.1 INX MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.
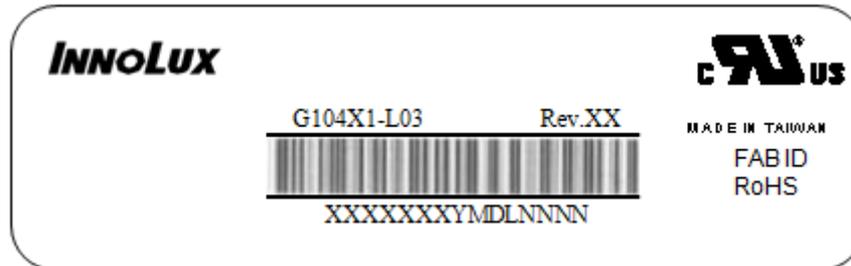
(a)Model Name: G104X1-L03

(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) It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
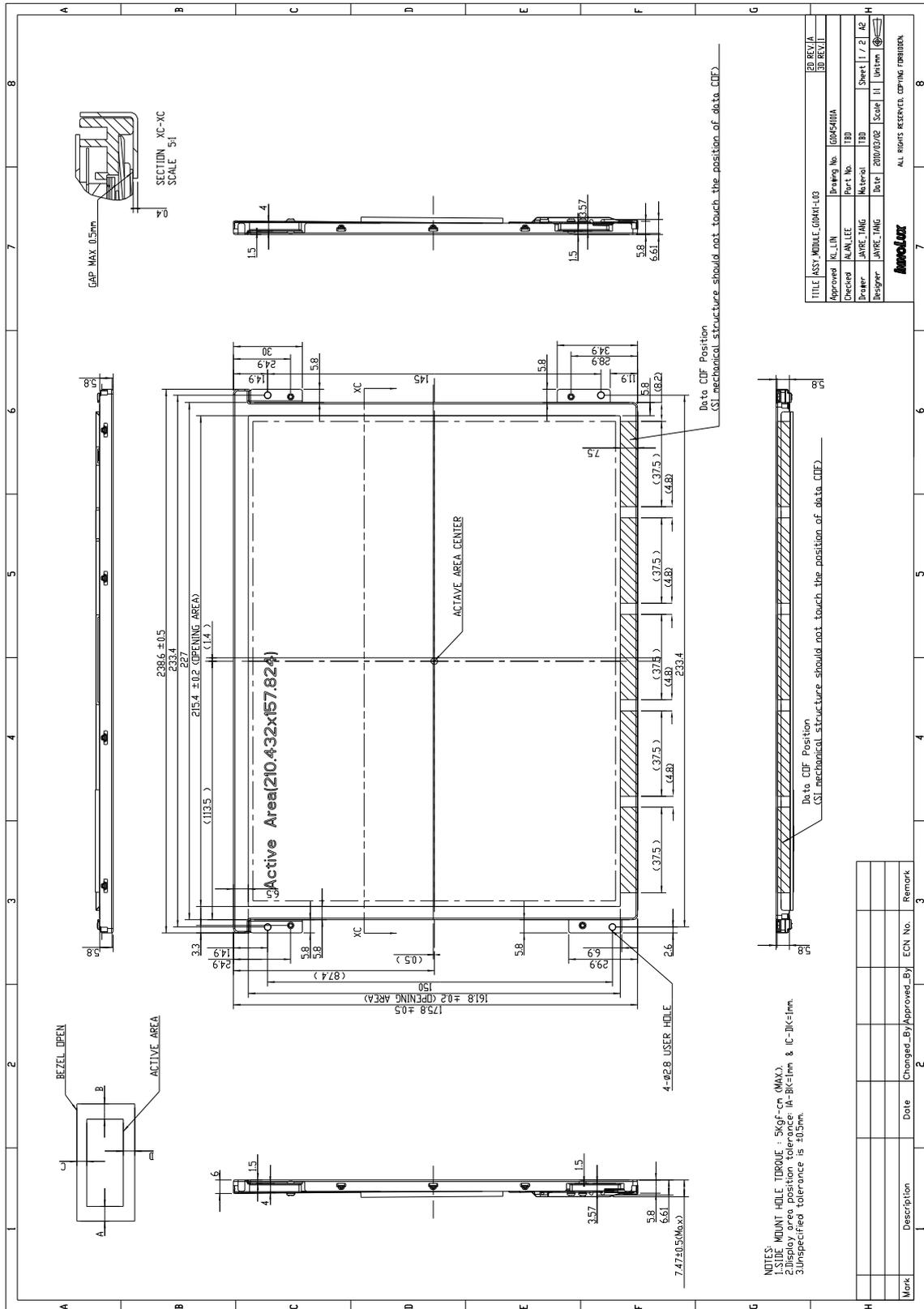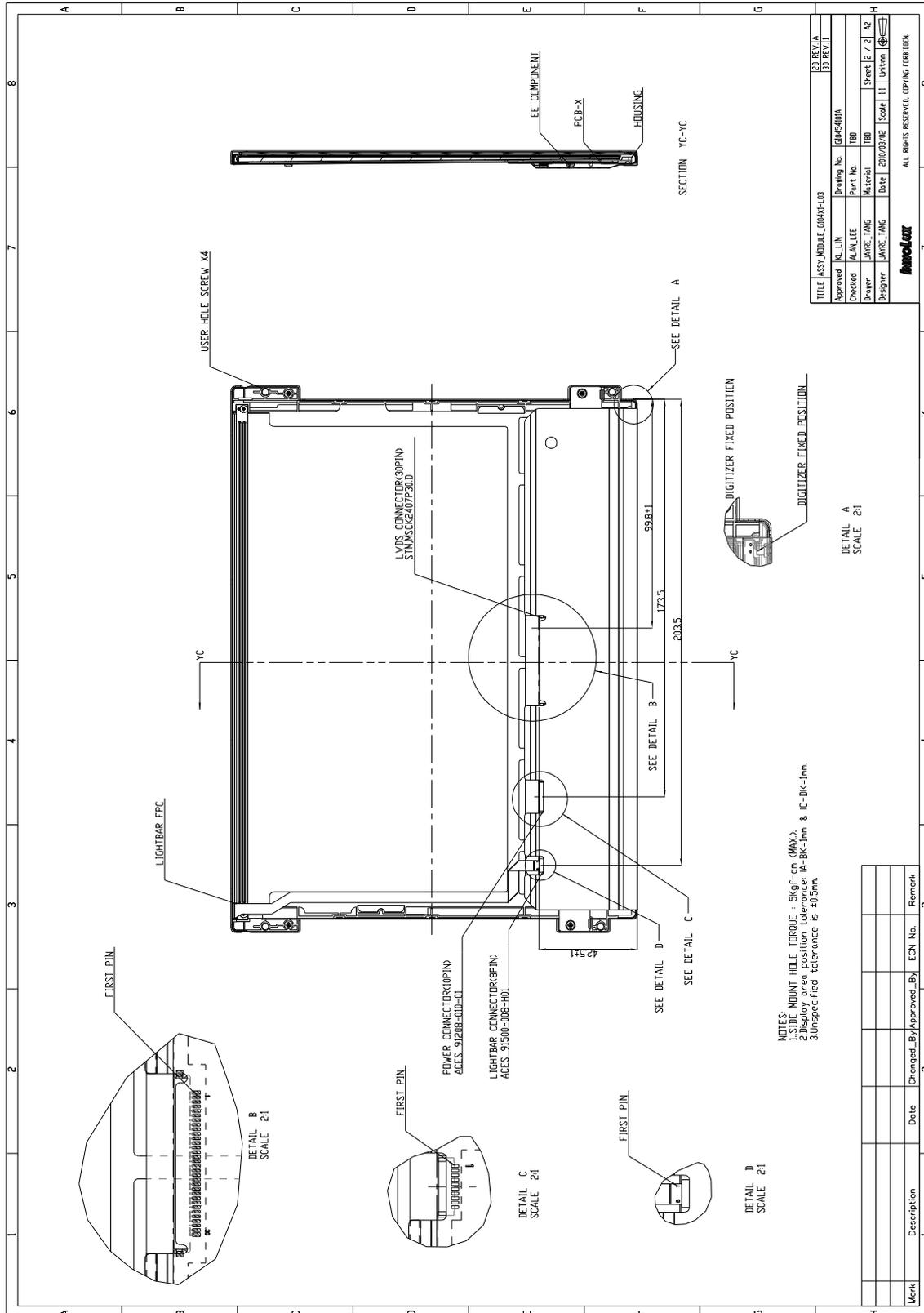
(3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.

(4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.

(5) Do not plug in or pull out the I/F connector while the module is in operation.

(6) Do not disassemble the module.

(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(8) Moisture can easily penetrate into LCD module and may cause the damage during operation.

(9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.

(10) When ambient temperature is lower than 10ºC, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of backlight will be higher than that of 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) The startup voltage of a Backlight is approximately 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the Backlight unit.

(2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

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

12. MECHANICAL CHARACTERISTICS

EE COMPONENT

PCB-X

HOUSING

SECTION YC-YC

USER HOLE SCREW X4

SEE DETAIL A

LVDS CONNECTOR(30PIN)
STM.MSCK2407P30.0

99.8±1

173.5

203.5

YC

SEE DETAIL B

YC

DIGITIZER FIXED POSITION

DIGITIZER FIXED POSITION

DETAIL A
SCALE 2:1

LIGHTBAR FPC

SEE DETAIL C

SEE DETAIL D

42.5±1

FIRST PIN

DETAIL B
SCALE 2:1

POWER CONNECTOR(10PIN)
ACES 91208-010-01

LIGHTBAR CONNECTOR(8PIN)
ACES 91500-008-H01

FIRST PIN

DETAIL C
SCALE 2:1

FIRST PIN

DETAIL D
SCALE 2:1

NOTES:
1.SIDE MOUNT HOLE TORQUE : 5Kgf-cm (MAX.).
2.Display area position tolerance: IA-BI<=1mm & IC-DI<=1mm.
3.Unspecified tolerance is ±0.5mm.

TITLE	ASSY_MIDDLE_G104X1-L03		
Approved	KL_LIN	Drawing No.	G104X1A
Checked	ALAN_LEE	Part No.	TBD
Drawer	JAYRE_TANG	Material	TBD
Designer	JAYRE_TANG	Date	2010/03/02	Scale	1:1	Unit mm

2D REV:A
3D REV:1

Sheet 2 / 2   A2

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Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark

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	May.4, 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 16.2M 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	RGB 8bits=16M	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 3.46 W (Typ) @ cell 0.66 W (Typ), BL 2.8 W (Typ))		

2. MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	167.7	168.0	168.3	mm	(1) (2)
	Vertical (V)	107.4	107.7	108.0	mm	
	Thickness (T)	5.7	6.0	6.3	mm	
Bezel Area	Horizontal	154.10	154.40	154.70	mm	
	Vertical	93.14	93.44	93.74	mm	
Active Area	Horizontal	-	152.4	-	mm	
	Vertical	-	91.44	-	mm	
Weight		-	TBD	-	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	-30	90	℃	(1), (2)
Operating Ambient Temperature	Top	-20	80	℃	(1), (2)

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) 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
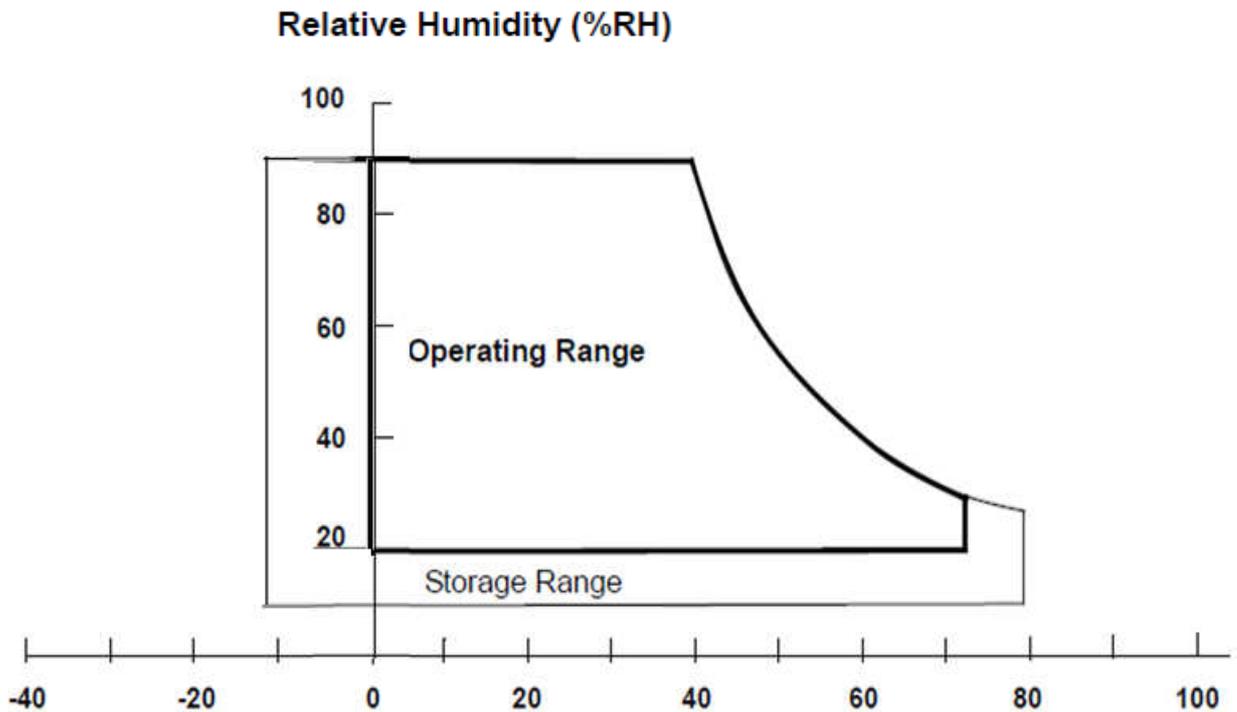
3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 TFT LCD MODULE

Item	Symbol	Value Min.	Value Max.	Unit	Note
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	Min.	Typ	Max.	Unit	Note
Converter Voltage	LED_V_{in}	0	12.0	18.0	V	(1), (2)
Enable Voltage	LED_EN	0	3.3 / 5	7	V	Duty=100%
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	P_SCL	P-Gamma CLK pin(for Auto Vcom function)	-
8	P_SDA	P-Gamma Data pin(for Auto Vcom function)	-
9	VCC	Power supply: +3.3V	-
10	VCC	Power supply: +3.3V	-
11	GND	Ground	-
12	P_WP	P-Gamma Write Portection pin(for Auto Vcom function). When the pin is low, I2C data is allowed to write register.	-
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	BIST	Low or NC → Normal Mode High → BIST Mode	(2)-

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

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

4.3 ELECTRICAL CHARACTERISTICS
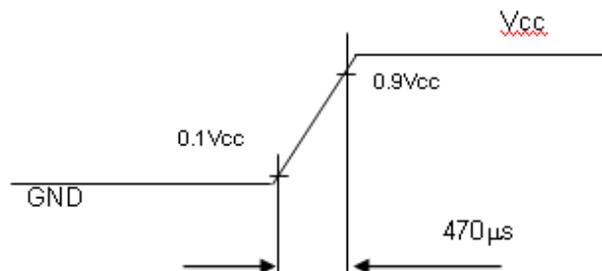
4.3.1 LCD ELETRONICS SPECIFICATION

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3	3.3	3.6	V	-
Ripple Voltage		V$_{RP}$	-	-	100	mVp-p	-
Rush Current		I$_{RUSH}$	-	-	TBD	A	(2)
Power Supply Current	White	-	-	(200)	-	A	(3)a
	Black	-	-	(200)	-	A	(3)b
	Vertical Stripe	-	-	(200)	-	A	(3)c
Power Consumption		PLCD	-	(0.66)	-	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 ℃.
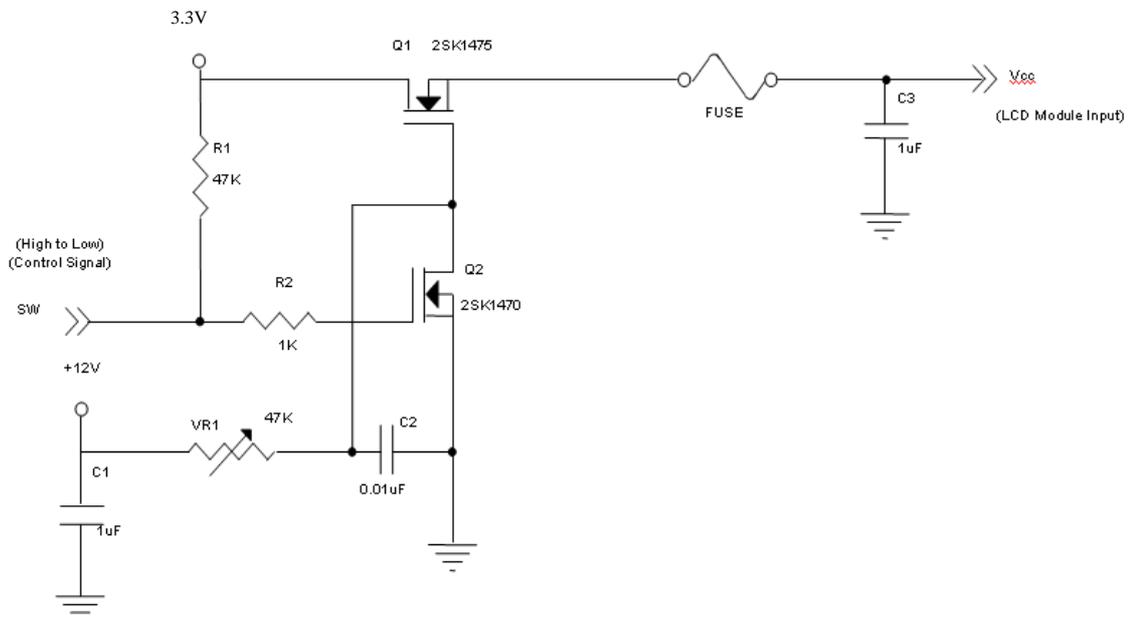
Note (2) Measurement Conditions:

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.
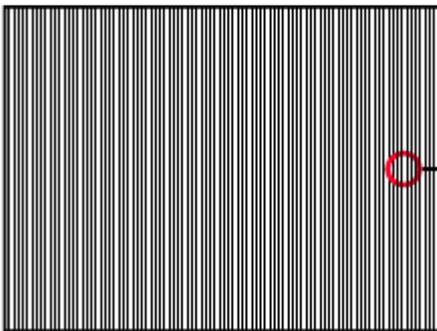
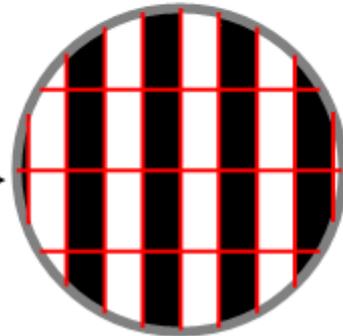a. White Pattern

Active Area

b. Black Pattern
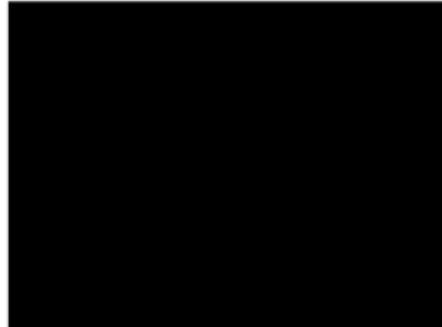
Active Area

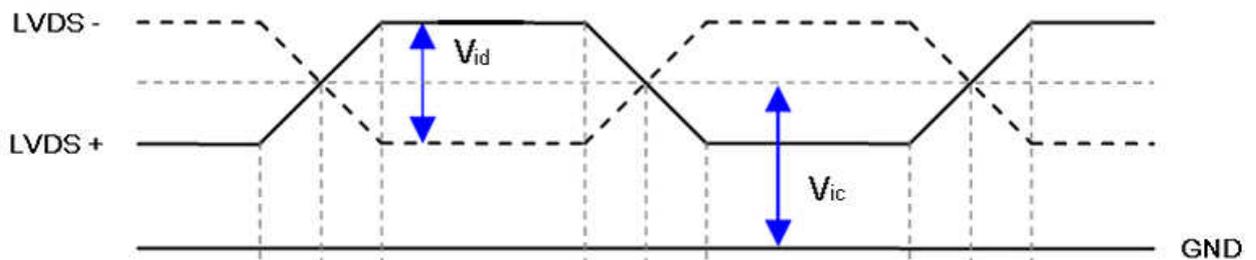c. Vertical Stripe Pattern

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		0.36		A	@LED_Vin= 12V Duty=100%
Converter Input Rush Current		Iirsh		4.3		A	@LED_Vin rising = 1mS
Power Consumption		P_{LED}		2.8		W	@ LED_Vin = 12V Duty=100%
EN Control Level	Backlight on	LED_EN	2.0	0	5.0	V	
	Backlight off		0	0	0.8		
PWM Control Level	PWM High Level	LED_PWM	2.0	0	5.0	V	
	PWM Low Level		0	0	0.15		
PWM Control Duty Ratio			5	--	100	%	
PWM Control Frequency		f_{PWM}	100	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.
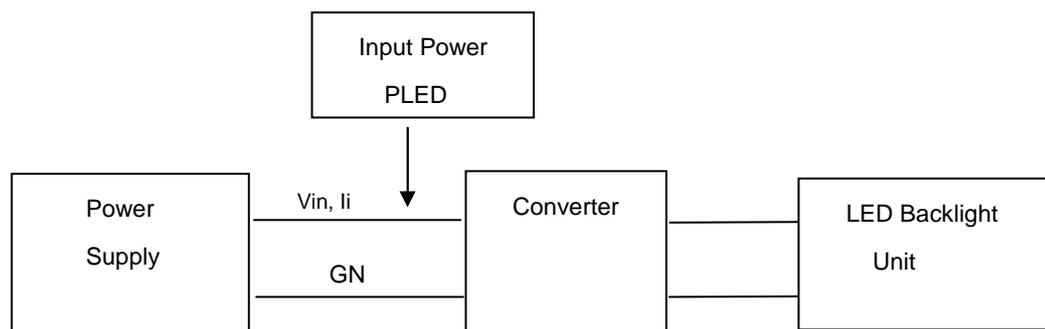
4.4 LVDS INPUT SIGNAL SPECIFICATIONS

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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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 (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		(25.4)		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$_{SSM}$			(200)	KHz	
Vertical Display Term	Frame Rate	Fr		60		Hz	Tv=Tvd+Tvb
	Total	Tv		(490)		Th	-
	Active Display	Tvd		480		Th	-
	Blank	Tvb	Tv-Tvd	(10)	Tv-Tvd	Th	-
Horizontal Display Term	Total	Th		(864)		Tc	Th=Thd+Thb
	Active Display	Thd		800		Tc	-
	Blank	Thb	Th-Thd	(64)	Th-Thd	Tc	-

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

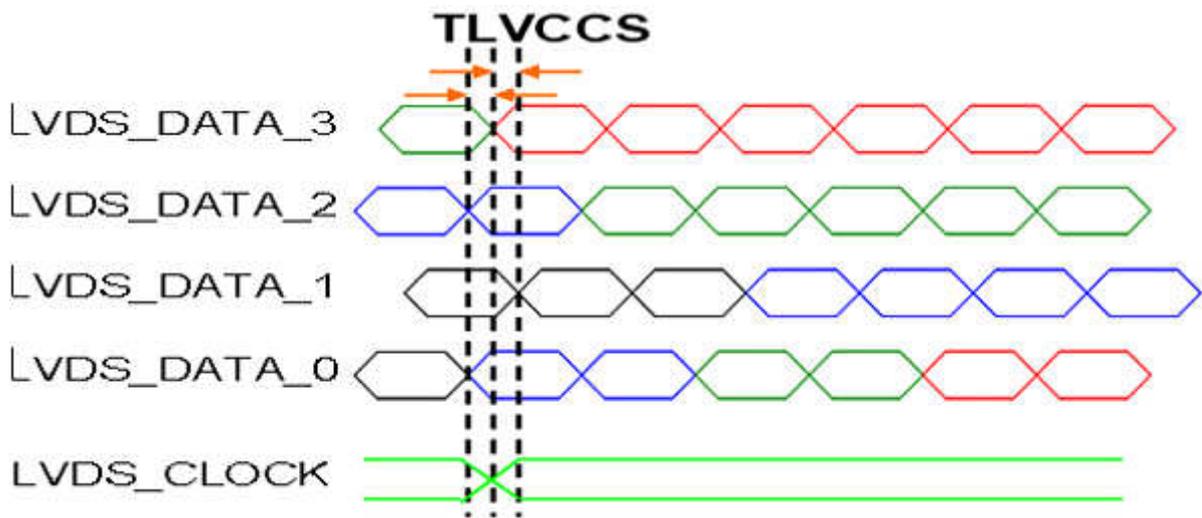Note (2) The Tv(Tvd+Tvb) must be integer, otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM
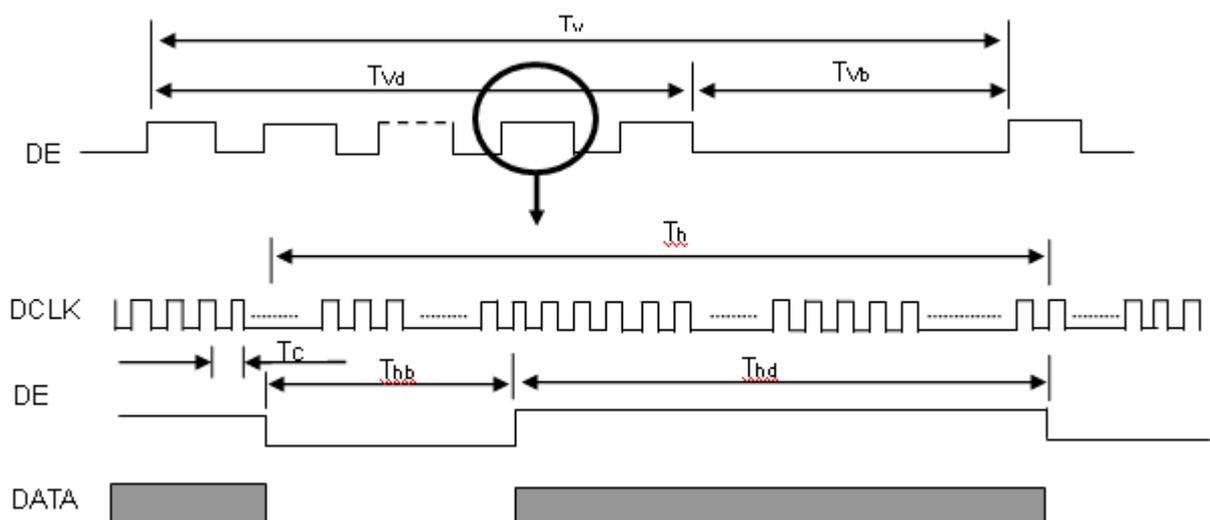
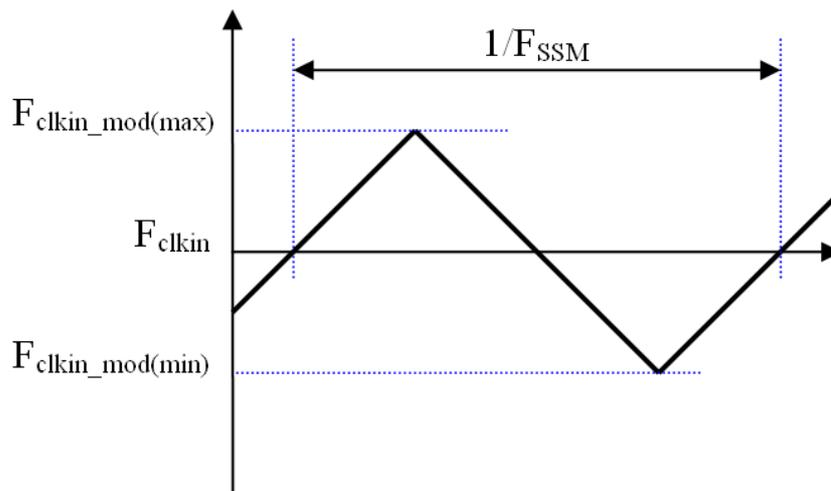Note (3) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T_1 – TI
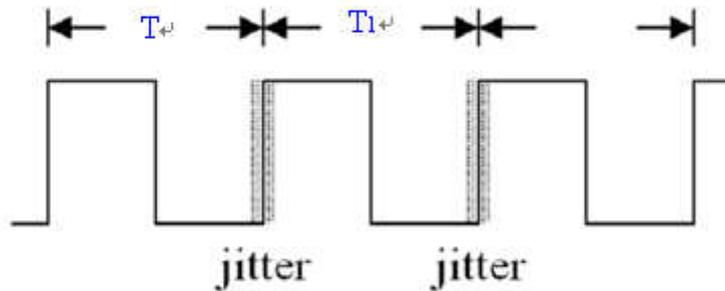
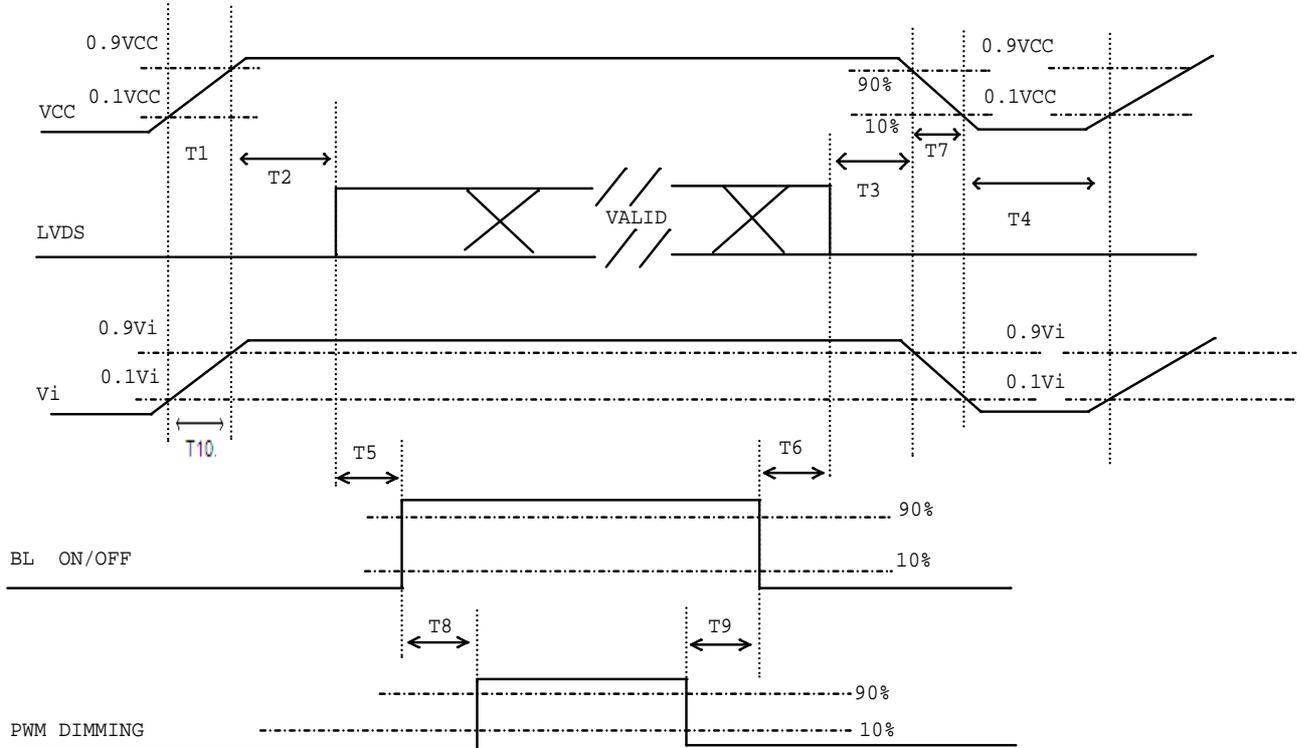Note (4) Input Clock to data skew is defined as below figures.

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	200	-	-	ms
T6	200	-	-	ms
T7	5	-	100	ms
T8	10	-	-	ms
T9	10	-	-	ms
T10	20			

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
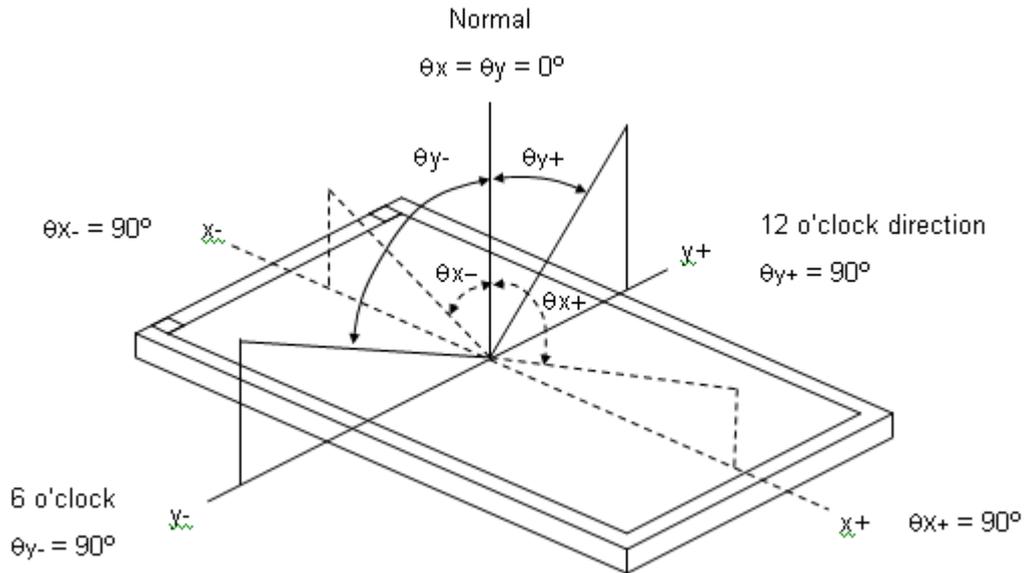
5.1 TEST CONDITIONS

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	$\theta_x=0°$, $\theta_Y=0°$ CS-2000 R=G=B=255 Gray scale	Typ – 0.05	TBD	Typ + 0.05	-	(1), (5)
		Ry			TBD			
	Green	Gx			TBD			
		Gy			TBD			
	Blue	Bx			TBD			
		By			TBD			
	White	Wx			(0.313)			
		Wy			(0.329)			
Center Luminance of White		L_C		(360)	(450)	-	cd/m^2	(4), (5)
Contrast Ratio		CR		(600)	(800)	-	-	(2), (5)
Response Time		T_R	$\theta_x=0°$, $\theta_Y=0°$	-	(13)	-	ms	(3)
		T_F		-	(12)	-		
White Variation		W	$\theta_x=0°$, $\theta_Y=0°$	(70)	-	-	%	(5), (6)
Viewing Angle	Horizontal	θ_x+	CR ≧ 10	(89)	(89)	---	Deg.	(1), (5)
		θ_x-		(89)	(89)			
	Vertical	θ_Y+		(89)	(89)			
		θ_Y-		(89)	(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.
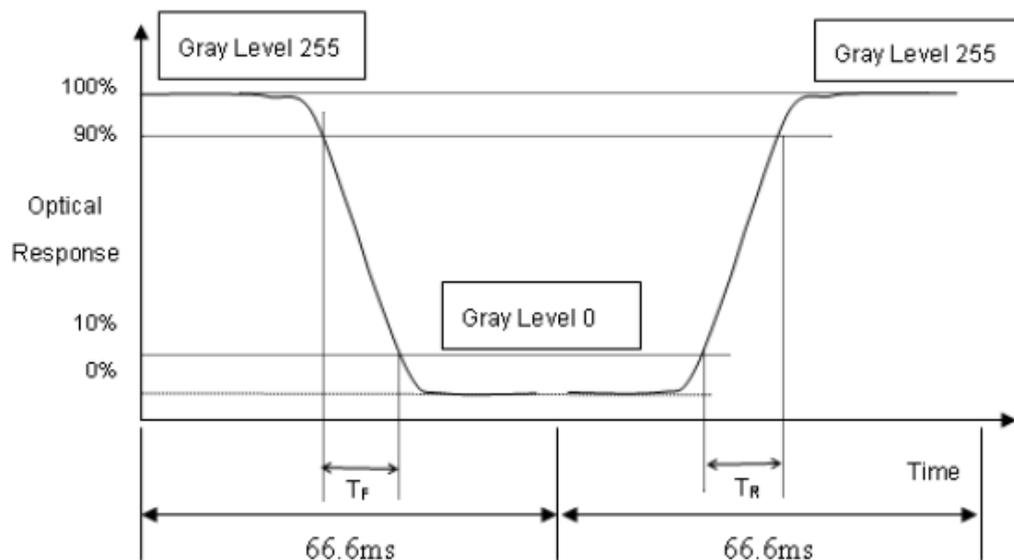
Contrast Ratio (CR) = L255 / L0

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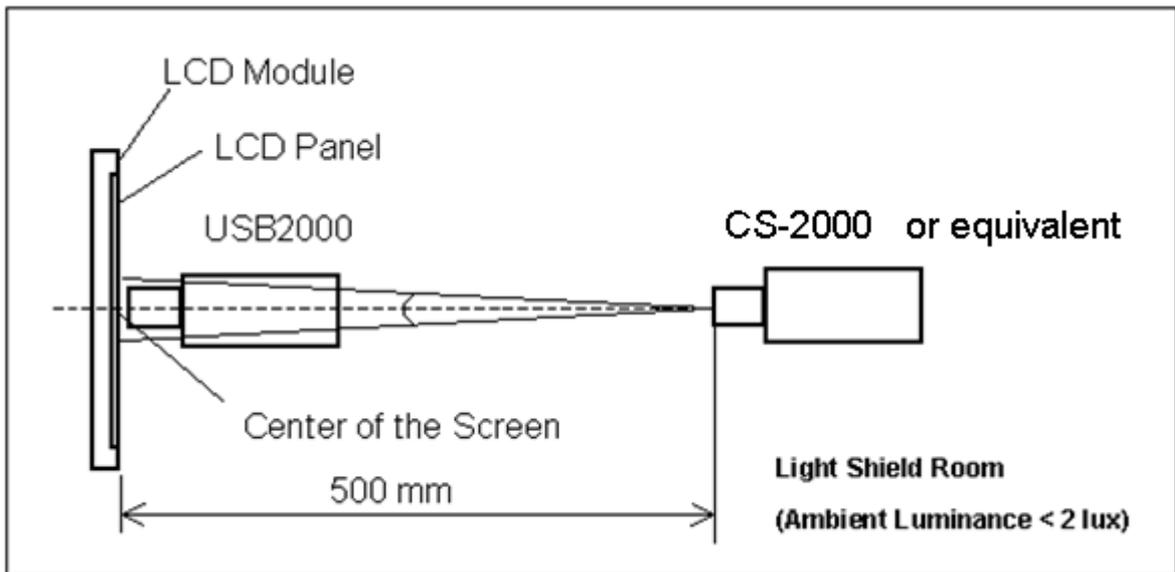
Note (4) Definition of Luminance of White (L_C):

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

$\delta W = (\text{Minimum} [L (1) \sim L (5)] / \text{Maximum} [L (1) \sim L (5)]) *100\%$
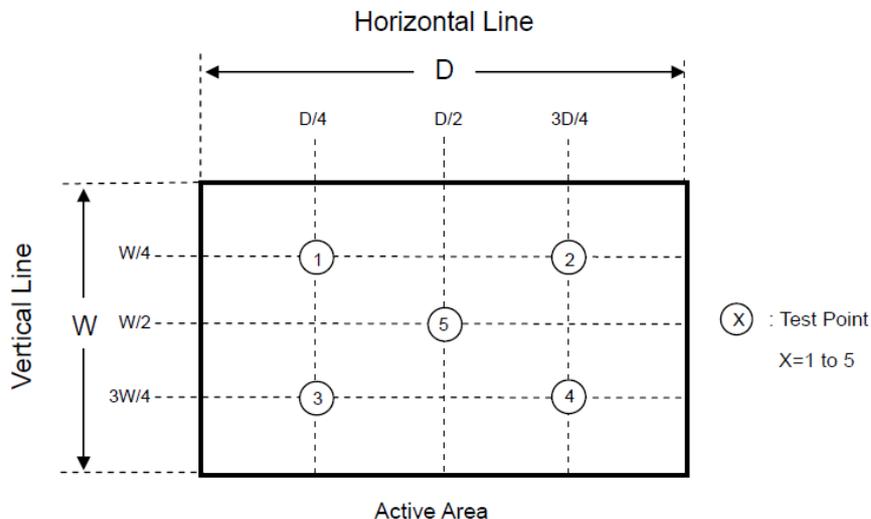
6. RELIABILITY TEST ITEM

Test Item	Test Condition	Note
High Temperature Storage Test	80ºC, 504 hours	(1)(2) (4)(5)
Low Temperature Storage Test	-10ºC, 504 hours	
Thermal Shock Storage Test	-10ºC, 0.5hour⟷80℃, 0.5hour; 1hour/cycle,100cycles	
High Temperature Operation Test	70ºC, 504 hours	
Low Temperature Operation Test	0ºC, 504 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.
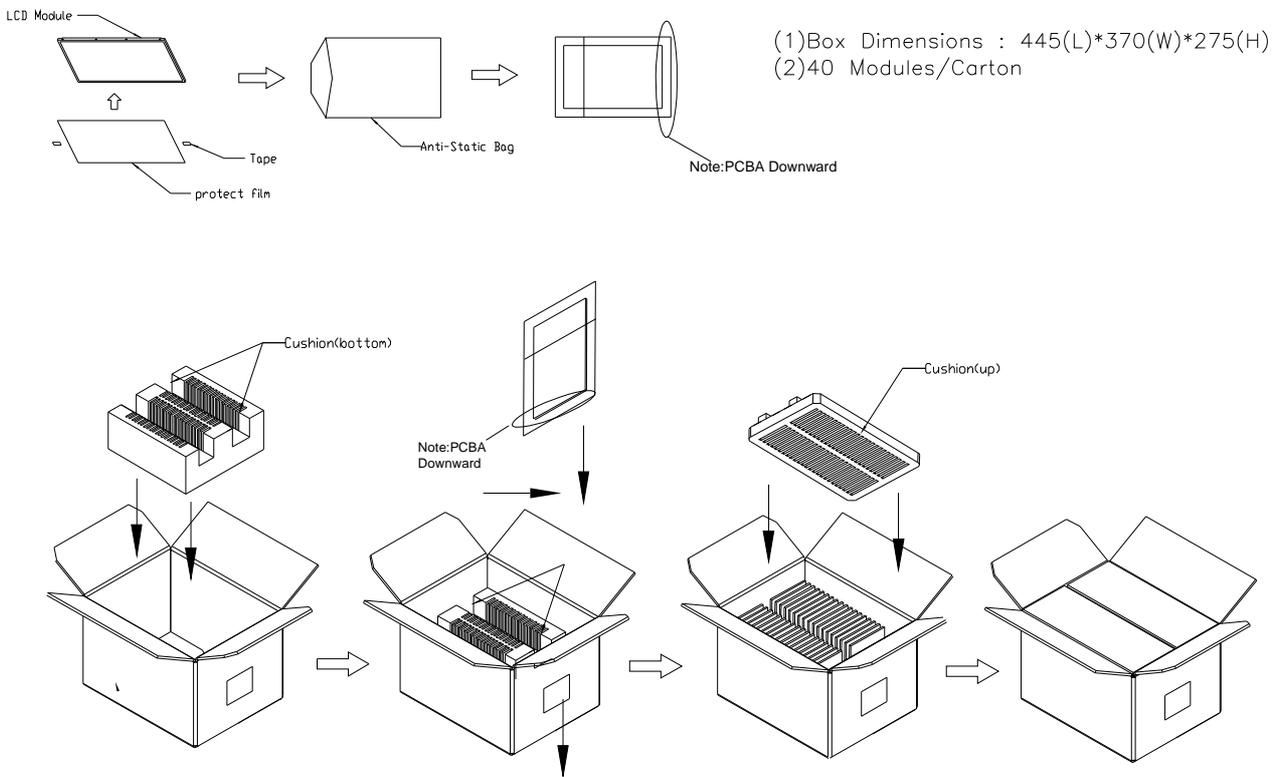
Note (6) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

7. PACKING

7.1 PACKING SPECIFICATIONS

(1) 40 pcs LCD modules / 1 Box

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

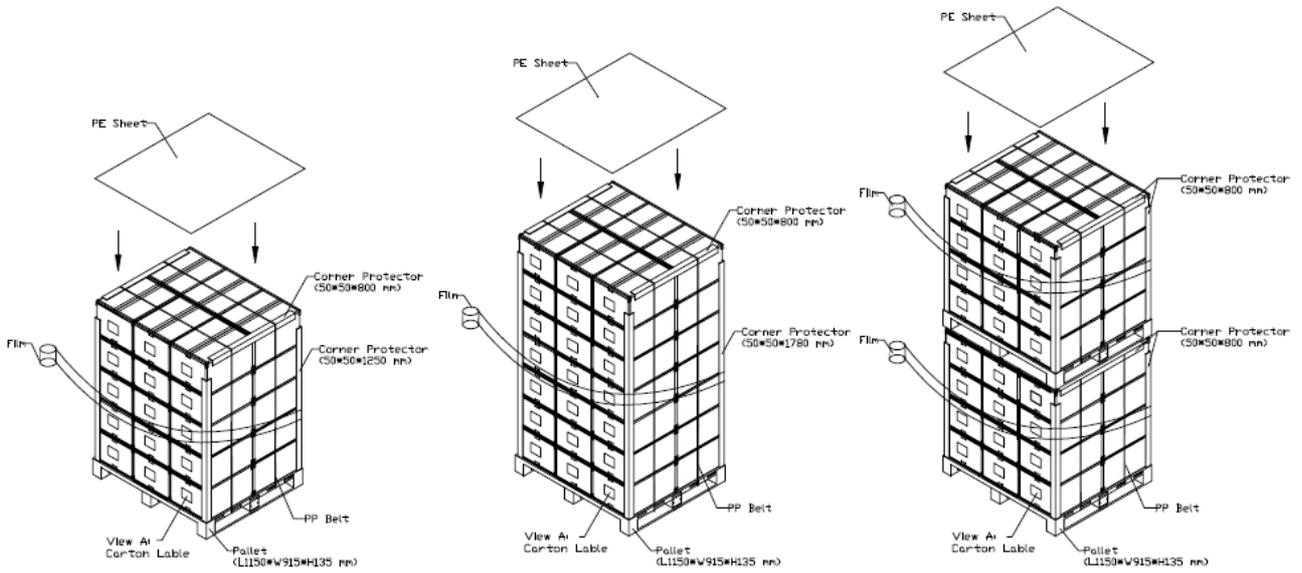(3) Weight: approximately 8.08Kg (40modules per box)
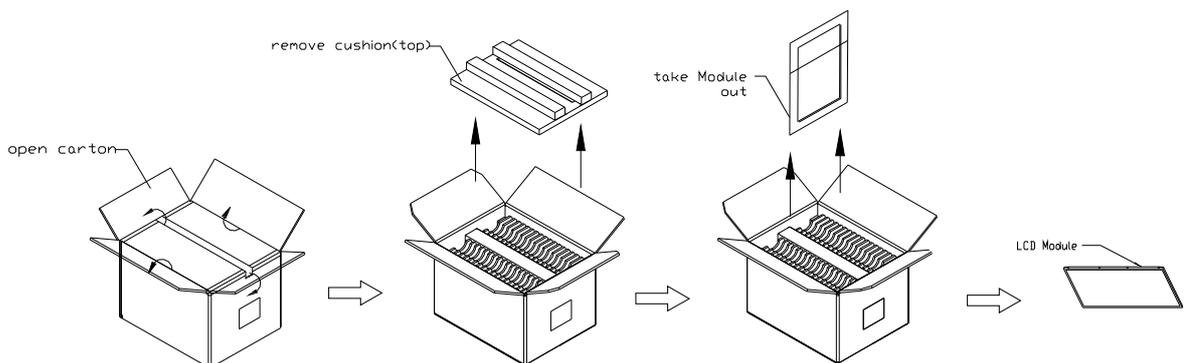
7.2 PACKING METHOD

Figure. 7-1 Packing

Figure. 7-2 Packing
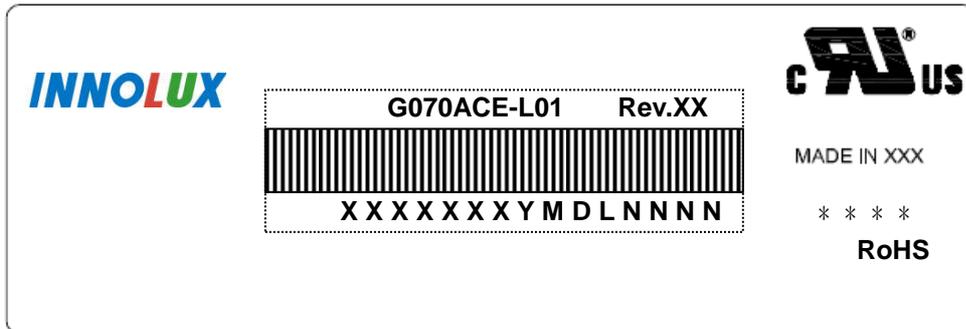
7.3 UN-PACKING METHOD
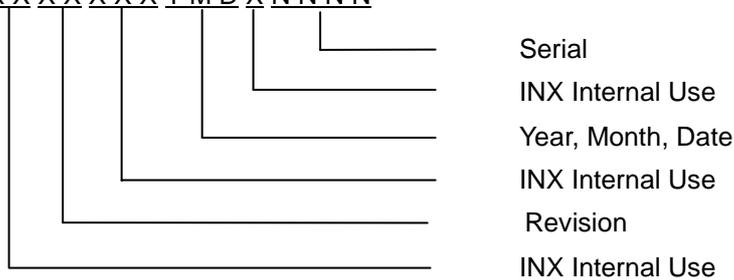

Figure. 7-3 UN-Packing

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 X Y M D X N N N N

Serial

INX Internal Use

Year, Month, Date

INX Internal Use

Revision

INX Internal Use

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.