

- Tentative Specification
- Preliminary Specification
- Approval Specification

MODEL NO.: G238HCJ
SUFFIX: EE1

Customer:	
APPROVED BY	SIGNATURE
<u>Name / Title</u> Note	_____ _____
_____ Please return 1 copy for your confirmation with your signature and comments.	

Approved By	Checked By	Prepared By
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1. GENERAL DESCRIPTION

1.1 OVERVIEW

G238HCJ-EE1 is a 23.8" TFT Liquid Crystal Display IAV module with LED Backlight units and 30 pins eDP interface. This module supports 1920 x 1080 Full HD mode and can display 16.7M colors.

The PSWG is to establish a set of displays with standard mechanical dimensions and select electrical interface requirements for an industry standard 23.8" XGA LCD panel and the LED driving device for Backlight is built in PCBA.

1.2 FEATURE

- FHD(1920 x1080 pixels) resolution
- PSWG (Panel Standardization Working Group).
- RoHS compliance

1.3 APPLICATION

- TFT LCD Monitor
- Factory Application
- Amusement

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	527.04 (H) x 296.46 (V) (23.8" diagonal)	mm	(1)
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	1920 x R.G.B x 1080	pixel	-
Pixel Pitch	0.2745 (H) x 0.2745(W)	mm	-
Pixel Arrangement	RGB vertical Stripe	-	-
Display Colors	16,777,216	color	-
Display Mode	Normally Black	-	-
Surface Treatment	Hard Coating (3H), Anti-Glare	-	-
Module Power Consumption	Total TBD(Max.)@cell TBD (Max.), BL 19.2W (Max.)	W	Typ

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	539.74	540.24	540.74	mm	(1)
	Vertical(V)	315.16	315.66	316.16	mm	
	Depth(D)	13.05	13.55	13.85	mm	
Bezel Area	Horizontal	529.74	530.24	530.74	mm	-
	Vertical	299.16	299.66	300.16	mm	
Active Area	Horizontal		527.04		mm	
	Vertical		296.46		mm	
Weight			TBD		g	

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

2. ABSOLUTE MAXIMUM RATINGS

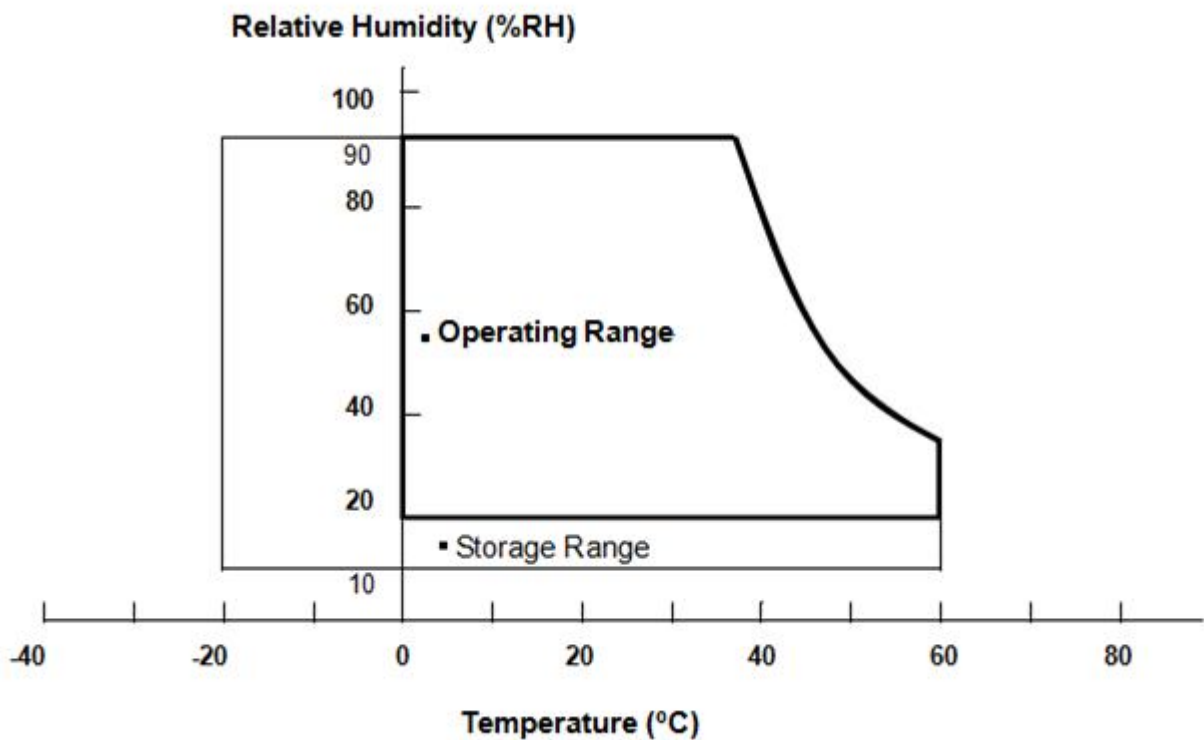
2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Operating Ambient Temperature	TOP	0	+60	°C	(1)(2)(3)
Storage Temperature	TST	-20	+60	°C	(1)(2)(3)

Note (1)

- (a) 90 %RH Max.
- (b) Wet-bulb temperature should be 39 °C Max.
- (c) No condensation.

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



2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCC	-0.3	6	V	(1)
Logic Input Voltage	V _{IN}	-0.3	3.6	V	

2.2.2 BACKLIGHT UNIT

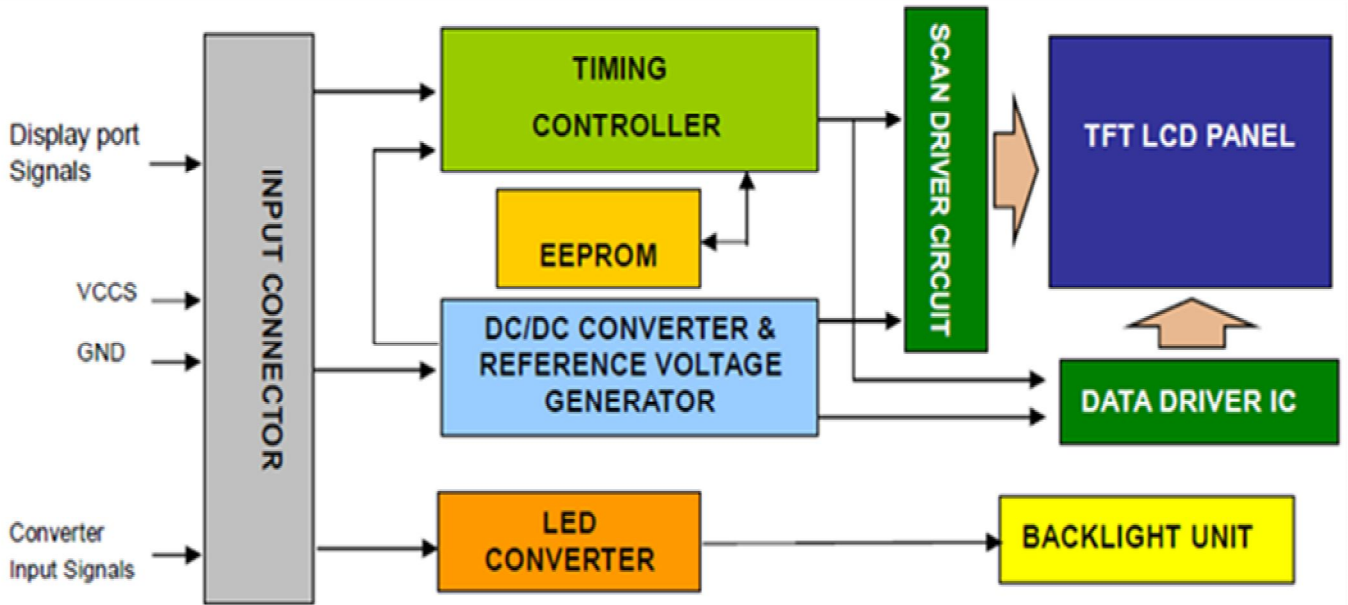
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Converter Voltage	V _i	-0.3	18	V	(1), (2)
Enable Voltage	EN	---	5.5	V	
Backlight Adjust	Dimming	---	5.5	V	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for LED (Refer to 3.3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE



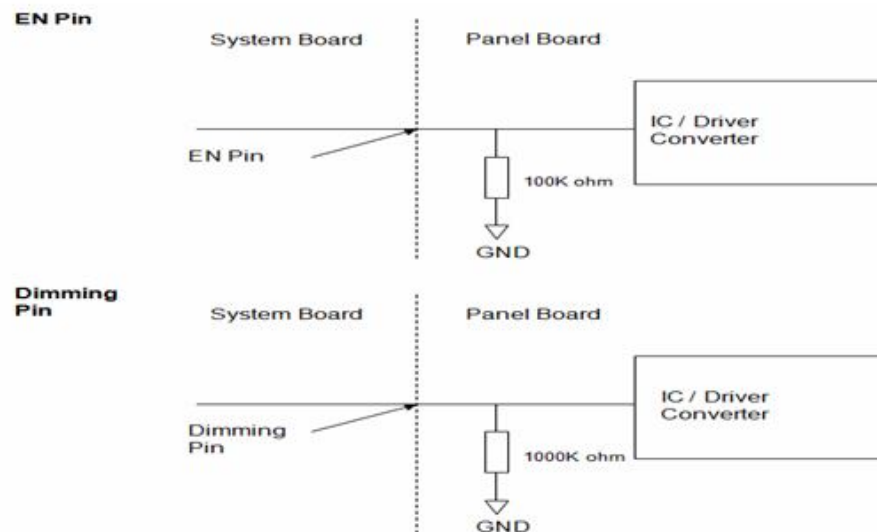
3.2 INPUT TERMINAL PIN ASSIGNMENT

PIN ASSIGNMENT

Pin No.	Symbol	Function	Polarity	Note
1	NC	No Connection(Reserved LCD test)		
2	H_GND	High Speed Ground		
3	Lane1_N	Complement Signal Link Lane 1		
4	Lane1_P	True Signal Link Lane 1		
5	H_GND	High Speed Ground		
6	Lane0_N	Complement Signal-Lane 0		
7	Lane0_P	True Signal-Main-Lane 0		
8	H_GND	High Speed Ground		
9	AUX_CH_P	True Signal-Auxiliary Channel		
10	AUX_CH_N	Complement Signal- Auxiliary Channel		
11	H_GND	High Speed Ground		
12	VCCS	Power Supply +5V (typical)		
13	VCCS	Power Supply +5V (typical)		
14	NC	No Connection(Reserved 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 LCD test)		
25	NC	No Connection(Reserved LCD test)		
26	LED_VCCS	BL Power +12.0V (typical)		
27	LED_VCCS	BL Power +12.0V (typical)		
28	LED_VCCS	BL Power +12.0V (typical)		
29	LED_VCCS	BL Power +12.0V (typical)		
30	NC	No Connection(Reserved LCD test)		

Note (1) Connector Part No.: I-PEX 20455-030E-76 or STM MSAK24025P30MB.

Note (2) User's connector Part No.: I-PEX 20453-030T-03 or equivalent.



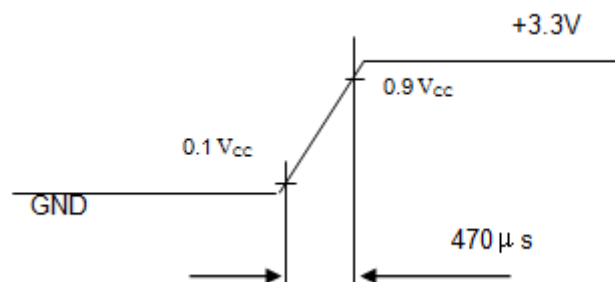
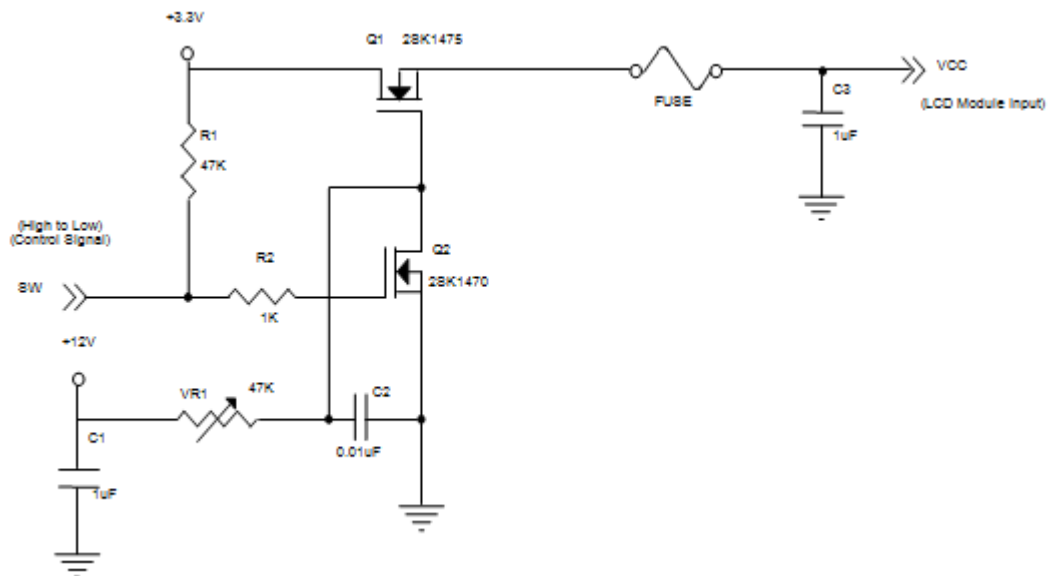
3.3 ELECTRICAL CHARACTERISTICS

3.3.1 TFT LCD MODULE

Parameter	Symbol	Value			Unit	Note	
		Min.	Typ.	Max.			
Power Supply Voltage	V_{CC}	4.5	5.0	5.5	V	-	
Ripple Voltage	V_{RP}	-	-	300	mVp-p		
Inrush Current	I_{INRUSH}	-	-	3	A	(2)	
Power Supply Current	White	-	TBD	TBD	mA	(3)a	
	Black	-	TBD	TBD	mA	(3)b	
HPD Impedance	V_{HPD}	30K			ohm		
HPD	High Level	V_{IH}	2.25	-	3.6	V	-
	Low Level	V_{IL}	0	-	0.4	V	-

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

Note (2)Measurement Conditions:



Note (3)The specified power supply current is under the conditions at $V_{CC}=5V$, $T_a = 25 \pm 2^\circ C$, DC Current and $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern

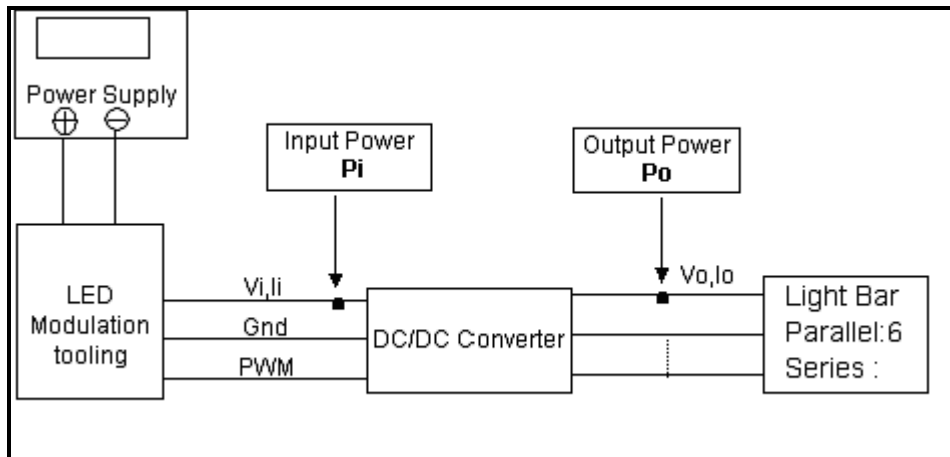


Active Area

3.3.2 BACKLIGHT UNIT

Parameter	Symbol	Value			Unit	Note	
		Min.	Typ.	Max.			
(Converter input voltage)	V_i	10.8	12.0	13.2	VDC	(Duty 100%)	
(Converter input ripple voltage)	V_{iRP}	-	-	1000	mV		
(Converter input current)	I_i	-	1.3	1.6	ADC	@ $V_i = 12V$ (Duty 100%)	
(Converter inrush current)	I_{iRUSH}	-	-	3.0	A	@ V_i rising time=10ms ($V_i=12V$)	
Input Power Consumption	P_i	-	15.6	19.2	W	(1)	
EN Control Level	Backlight on	ENLED	2.0	3.3	5.0	V	
	Backlight off	(BLON)	0	-	0.15	V	
PWM Control Level	PWM High Level	Dimming	2.0	--	5.0	V	
	PWM Low Level	(E_PWM)	0	--	0.15	V	
PWM Noise Range	V_{Noise}	-	-	0.1	V		
PWM Control Frequency	f_{PWM}	190	200	20k	Hz	(2)	
PWM Control Duty Ratio	-	-	1		100	%	(2), @ 190Hz < f_{PWM} < 1kHz
			20		100	%	(2), @ 1kHz $\leq f_{PWM}$ < 20kHz
LED Life Time	LLED	50000	-	-	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 5% to 100%.

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

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

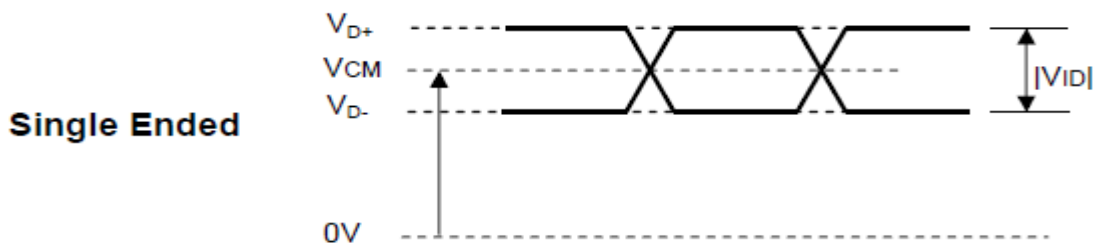
Note (3) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ and Duty 100% until the brightness becomes $\leq 50\%$ of its original value. Operating LED at high temperature condition will reduce life time and lead to color shift.

3.4 DISPLAY PORT INPUT SIGNAL TIMING SPECIFICATIONS

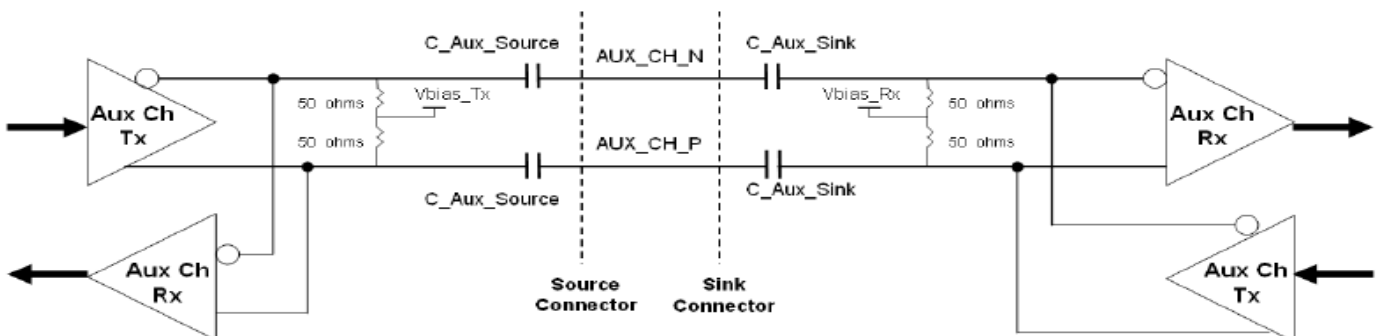
3.4.1 ELECTRICAL SPECIFICATIONS

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)

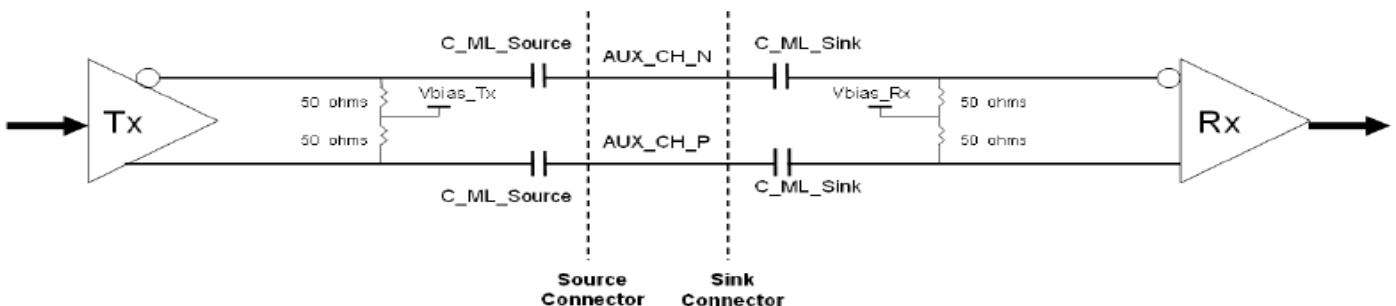
Note (1) Display port interface related AC coupled signals should follow VESA DisplayPort Standard Version 1. Revision 1a and VESA Embedded DisplayPort™ Standard Version 1.2. There are many optional items described in eDP 1.2. If some optional item is requested, please contact us.



Note (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.



Note (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.



Note (4) The source device should pass the test criteria described in DisplayPort Compliance Test Specification(CTS) 1.1

3.4.2 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	
	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	
	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	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	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	
	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	
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		
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	
	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	
	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	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	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	
	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	
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		
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	
	Blue(1)	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	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	
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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		

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

3.5 INTERFACE TIMING

INPUT SIGNAL TIMING SPECIFICATIONS

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

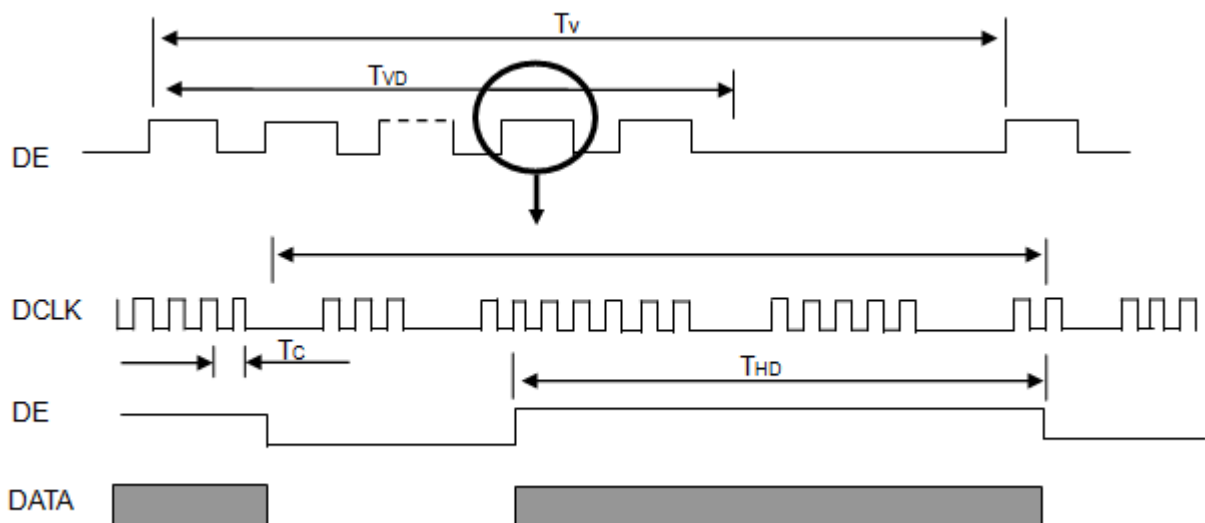
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame rate	Frequency	Fr	-	60	-	Hz	-
DCLK	Clock frequency	Fc	90	151.8	170	MHz	-
Vertical Display Term	Total	Tv	1092	1125	2280	Th	-
	Active Display	Tvd	-	1080	-	Th	-
	Blank	Tvb	Tv-Tvd	45	Tv-Tvd	Th	-
Horizontal Display Term	Total	Th	2040	2250	2520	Tc	Th=Thd+Thb
	Active Display	Thd	-	1920	-	Tc	-
	Blank	Thb	Th-Thd	330	Th-Thd	Tc	-

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

Note (2) The $T_v(T_{vd}+T_{vb})$ must be integer, otherwise, the module would operate abnormally.

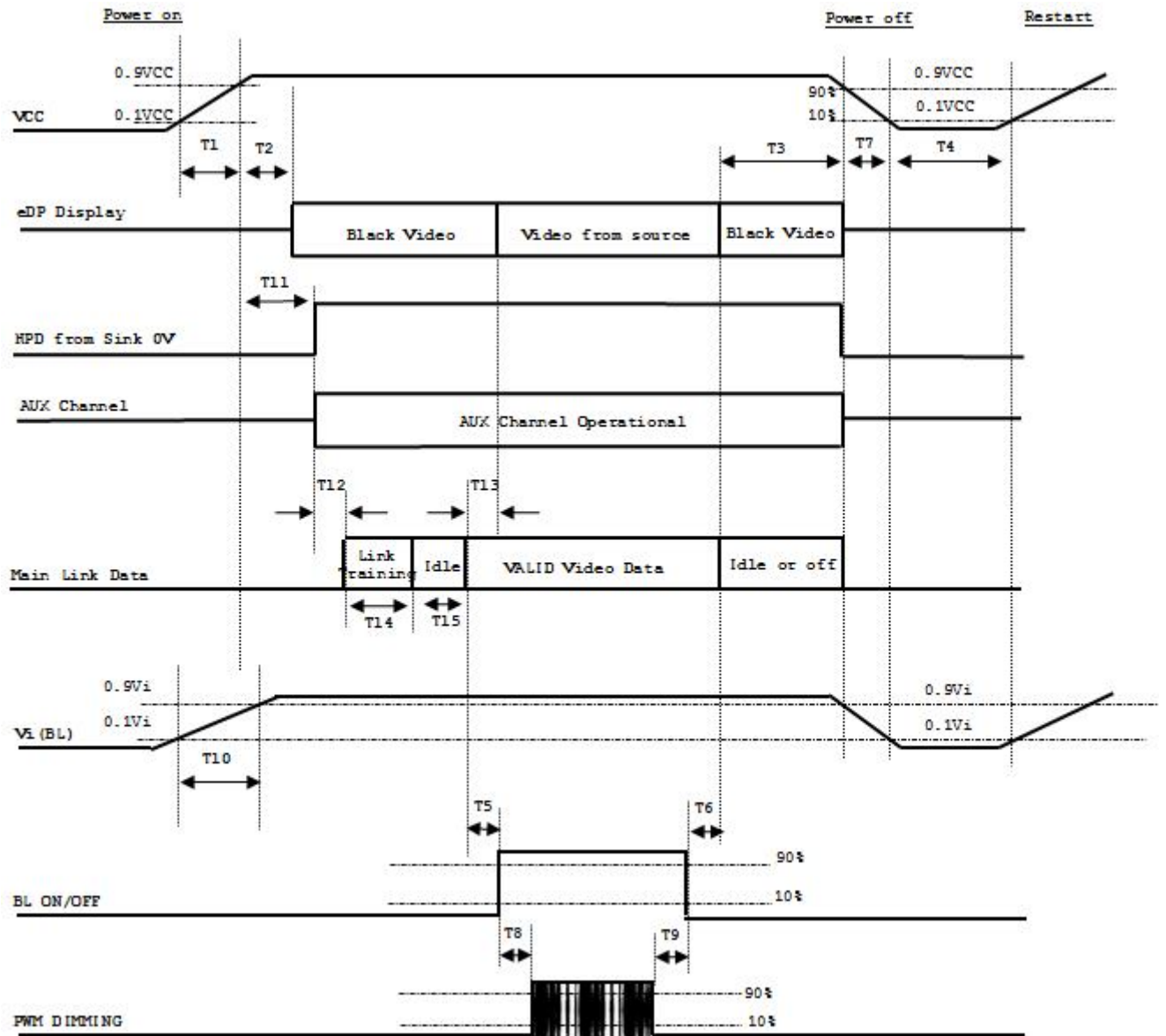
Note (3) The maximum clock frequency = $T_v \cdot T_h \cdot 60 < 170$ MHz.

INPUT SIGNAL TIMING DIAGRAM



3.6 POWER ON/OFF SEQUENCE

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



Timing Specification

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	ms
T2(2)(3)	0	-	200	ms
T3	0	-	500	ms
T4	500	-	-	ms
T5	450	-	-	ms
T6(2)(3)	200	-	-	ms
T7	10	-	100	ms
T8	10	-	-	ms
T9	10	-	-	ms
T10	20	-	50	ms
T11(4)	0	-	200	ms
T12	0	-	-	ms
T13	0	-	50	ms
T14	0	-	-	ms
T15	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) s received from the Source (at the end of T6)

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 T11 max.

4. OPTICAL CHARACTERISTICS

4.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	oC
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	According to typical value and tolerance in "ELECTRICAL CHARACTERISTICS"		
Input Signal			
PWM Duty Ratio	D	100	%

4.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 4.2 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 4.1 and stable environment shown in Note (5).

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note			
Color Chromaticity	Red	Rx	0.622	0.652	0.682	-	(1), (5)			
		Ry	0.307	0.337	0.367					
	Green	Gx	0.283	0.313	0.343					
		Gy	0.596	0.626	0.656					
	Blue	Bx	0.121	0.151	0.181					
		By	0.036	0.066	0.096					
	White	Wx	0.283	0.313	0.343					
		Wy	0.299	0.329	0.359					
	Center Luminance of White	L _C		360	450					(4), (5)
	Contrast Ratio	CR		700	1000					(2), (5)
Response Time	T _R	$\theta_x=0^\circ, \theta_y=0^\circ$	-	8		-	(3)			
	T _F		-	7		-				
White Variation	δW	$\theta_x=0^\circ, \theta_y=0^\circ$	75		-	%	(5), (6)			
Viewing Angle	Horizontal	θ_{x+}	85	89	-	Deg.	(1), (5)			
		θ_{x-}	85	89	-					
	Vertical	θ_{y+}	85	89	-					
		θ_{y-}	85	89	-					

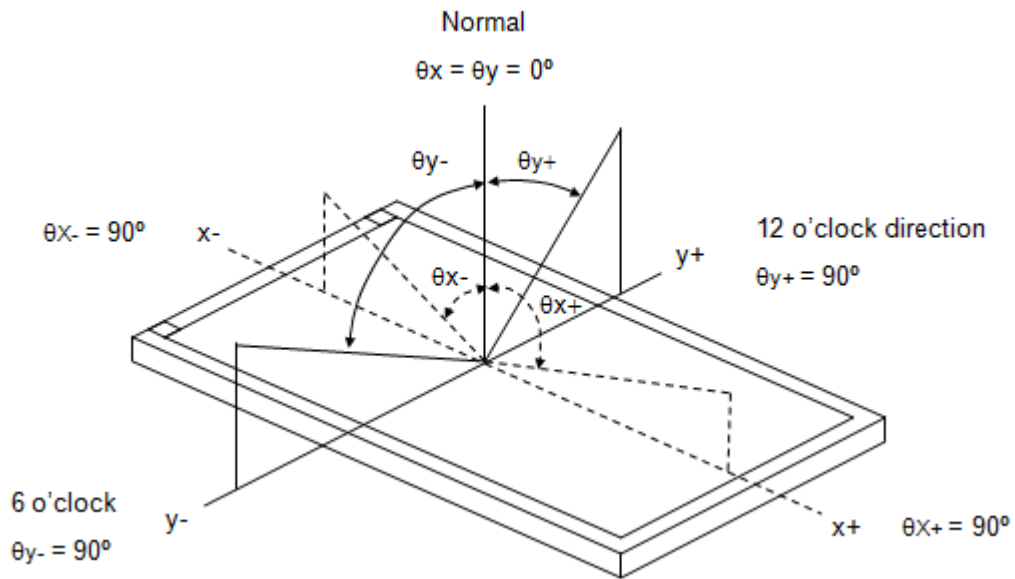
Definition :

Grayscale Maximum : Grayscale 255 (10 bits: grayscale 1023 ; 8 bits : grayscale 255 ; 6 bits: grayscale 63)

White : Luminance of Grayscale Maximum (All R,G,B)

Black : Luminance of grayscale 0 (All R,G,B)

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

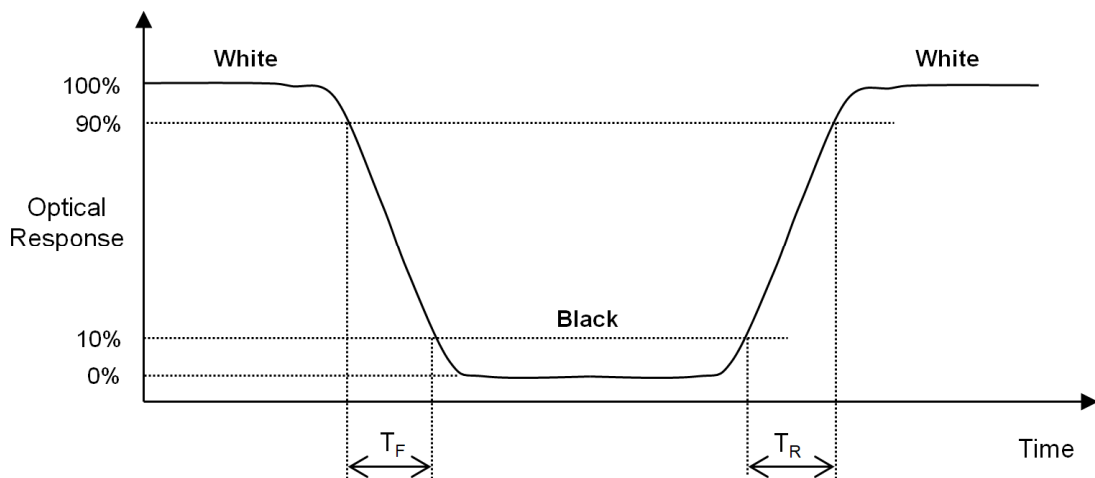


Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression at center point.

$$\text{Contrast Ratio (CR)} = \text{White} / \text{Black}$$

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

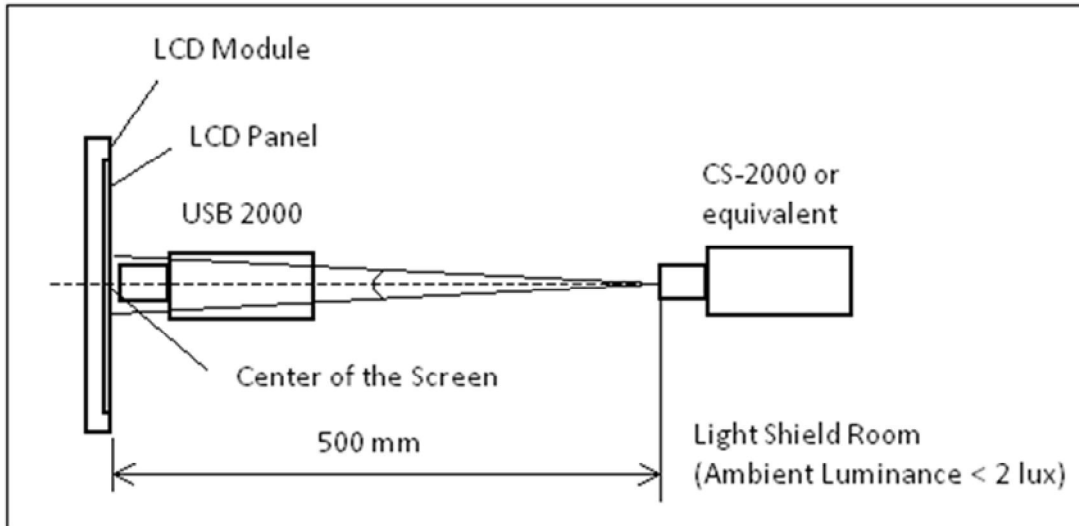


Note (4) Definition of Luminance of White (L_C):

Measure the luminance of White at center point.

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature 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.

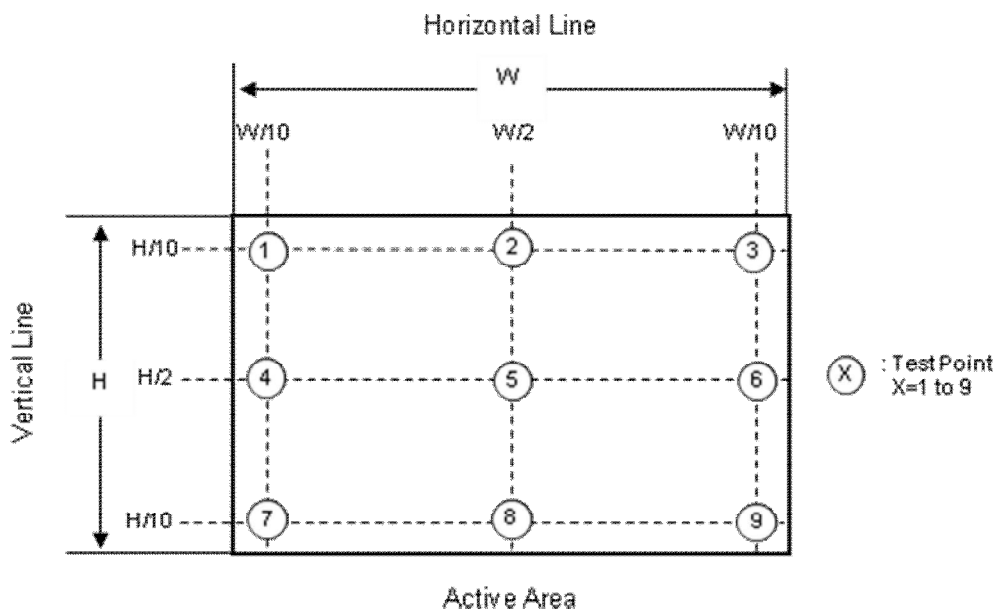


Note (6) Definition of White Variation (δW):

Measure the luminance of White at 9 points.

Luminance of White : $L(X)$, where X is from 1 to 9

$$\delta W = \frac{\text{Minimum [} L(1) \text{ to } L(9)\text{]}}{\text{Maximum [} L(1) \text{ to } L(9)\text{]}} \times 100\%$$



5. RELIABILITY TEST CRITERIA

Test Item	Test Condition	Note
High Temperature Storage Test	60°C, 240 hours	(1),(2) (4),(5)
Low Temperature Storage Test	-20°C, 240 hours	
Thermal Shock Storage Test	-20°C, 0.5 hour ↔ 60°C, 0.5 hour; 100cycles, 1 hour/cycle)	
High Temperature Operation Test	60°C, 240 hours	
Low Temperature Operation Test	0°C, 240 hours	
High Temperature & High Humidity Operation Test	50°C, RH 80%, 300 hours	
ESD Test (Operation)	150pF, 330Ω, 1 sec/cycle Condition 1 : panel contact, ±8 KV Condition 2 : panel non-contact ±15 KV	(1), (4)
Shock (Non-Operating)	50G, 11ms, half sine wave, 1 time for ± X, ± Y, ± Z direction	(2), (3)
Vibration (Non-Operating)	1.5G, 10 ~ 300 Hz sine wave, 10 min/cycle, 3 cycles each X, Y, Z direction	

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

Note (2) Temperature of panel display surface area should be 65°C Max.

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

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

Note (5) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

6. PACKAGING

6.1 PACKING SPECIFICATIONS

- (1) 12 LCD modules / 1 Box
- (2) Box dimensions: 620(L) X 348(W) X 390(H) mm
- (3) Weight: approximately: 28.8kg

6.2 PACKING METHOD

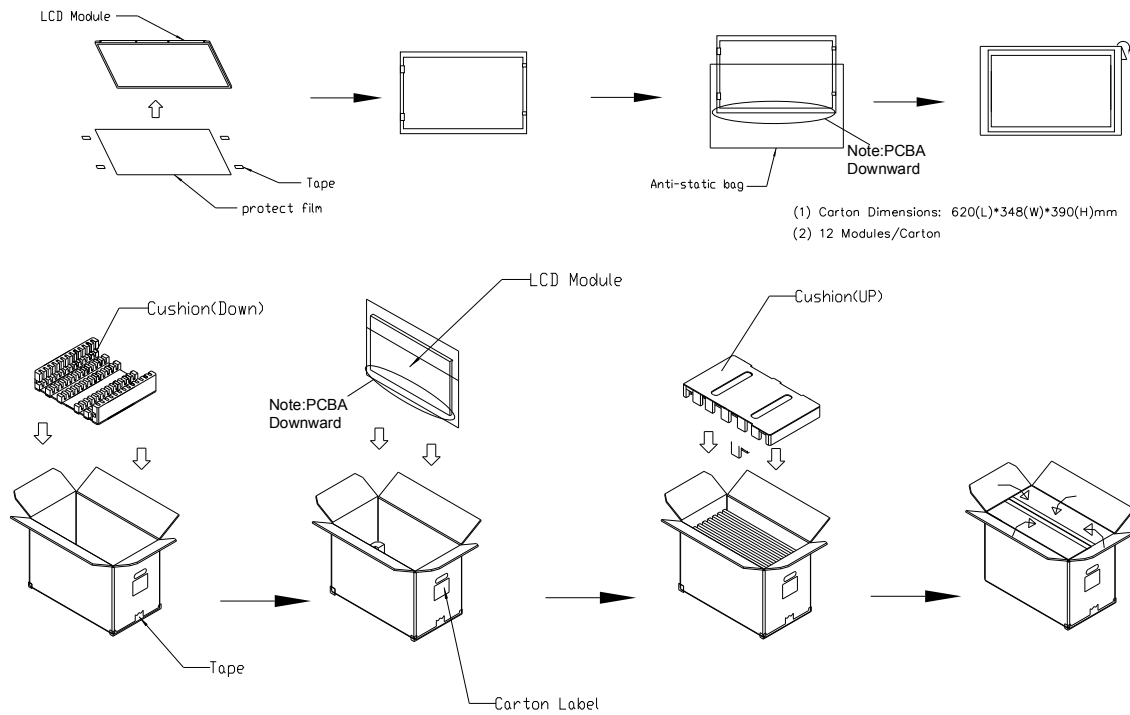
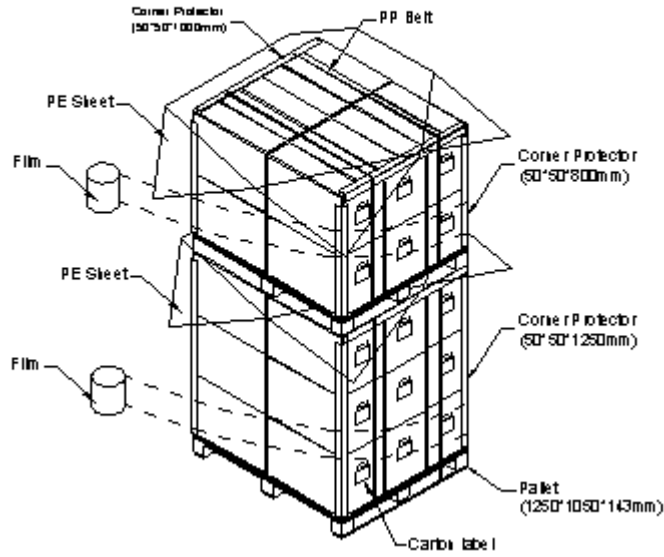


Figure. 6-1 Packing method

For ocean shipping

Sea / Land Transportation (40ft HQ/40ft Container)



For air transport

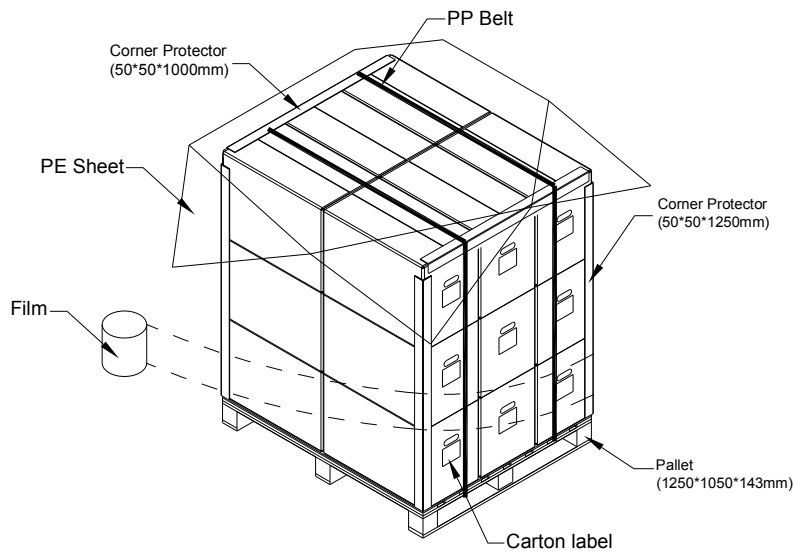


Figure. 6-2 Packing method

6.3 UN-PACKING METHOD

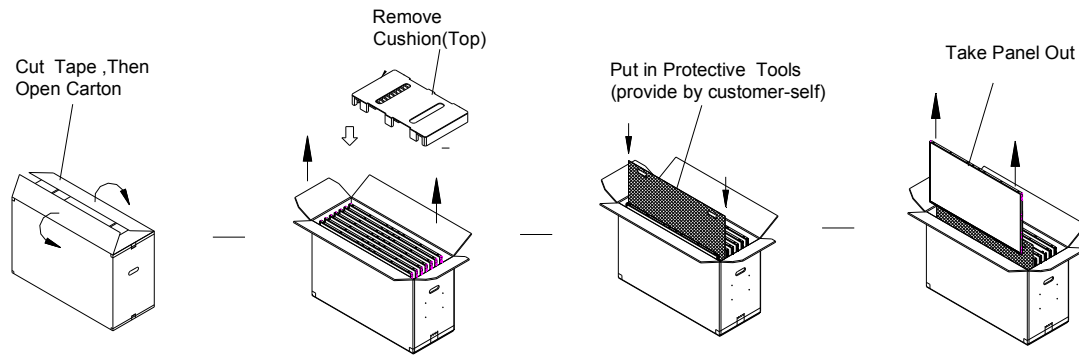
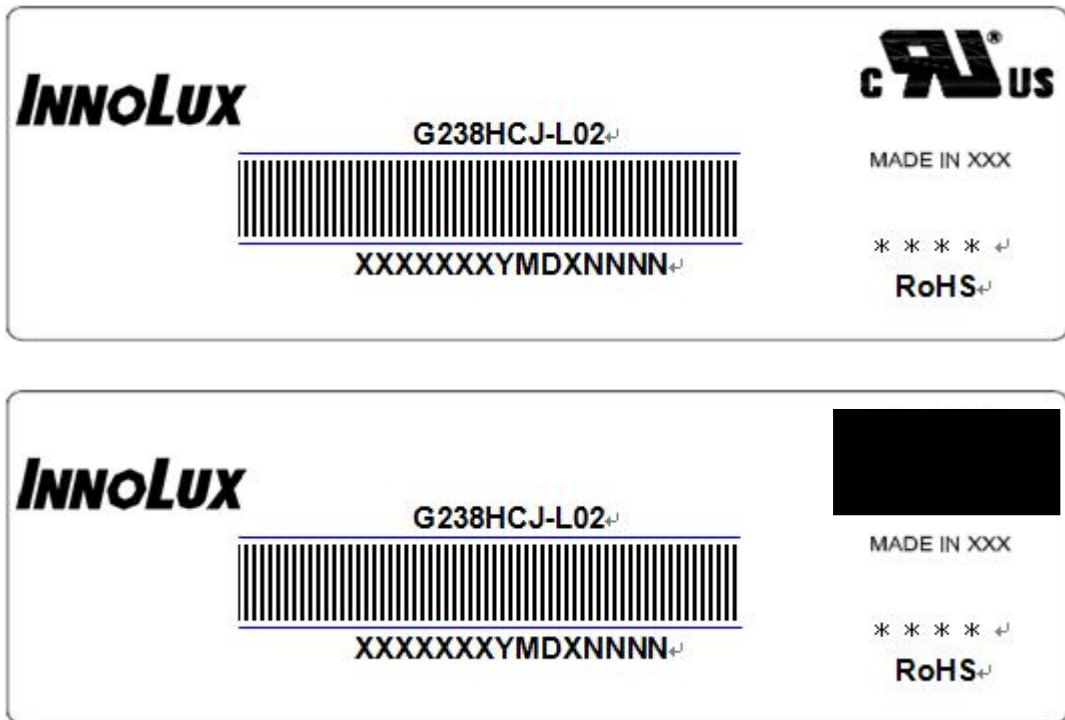


Figure. 6-3 UN-Packing method

7. DEFINITION OF LABELS

7.1 INX MODULE LABEL

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

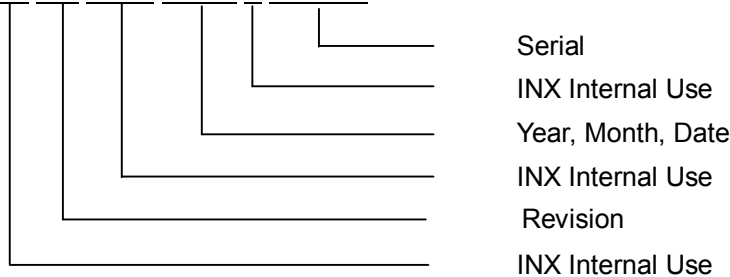


Note (1) Safety Compliance(UL logo) will open after C1 version.

(a) Model Name: G238HCJ-EE1

(b) * * * * : Factory ID

(c) Serial ID: XXXXXXYMDXNNNN



Serial ID includes the information as below:

- (a) Manufactured Date: Year: 1~9, for 2021~2029
 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

8. PRECAUTIONS

8.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1)The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2)While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3)Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4)Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5)If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6)Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7)If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8)Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9)Do not disassemble the module.
- (10)Do not pull or fold the lamp wire.
- (11)Pins of I/F connector should not be touched directly with bare hands.

8.2 STORAGE PRECAUTIONS

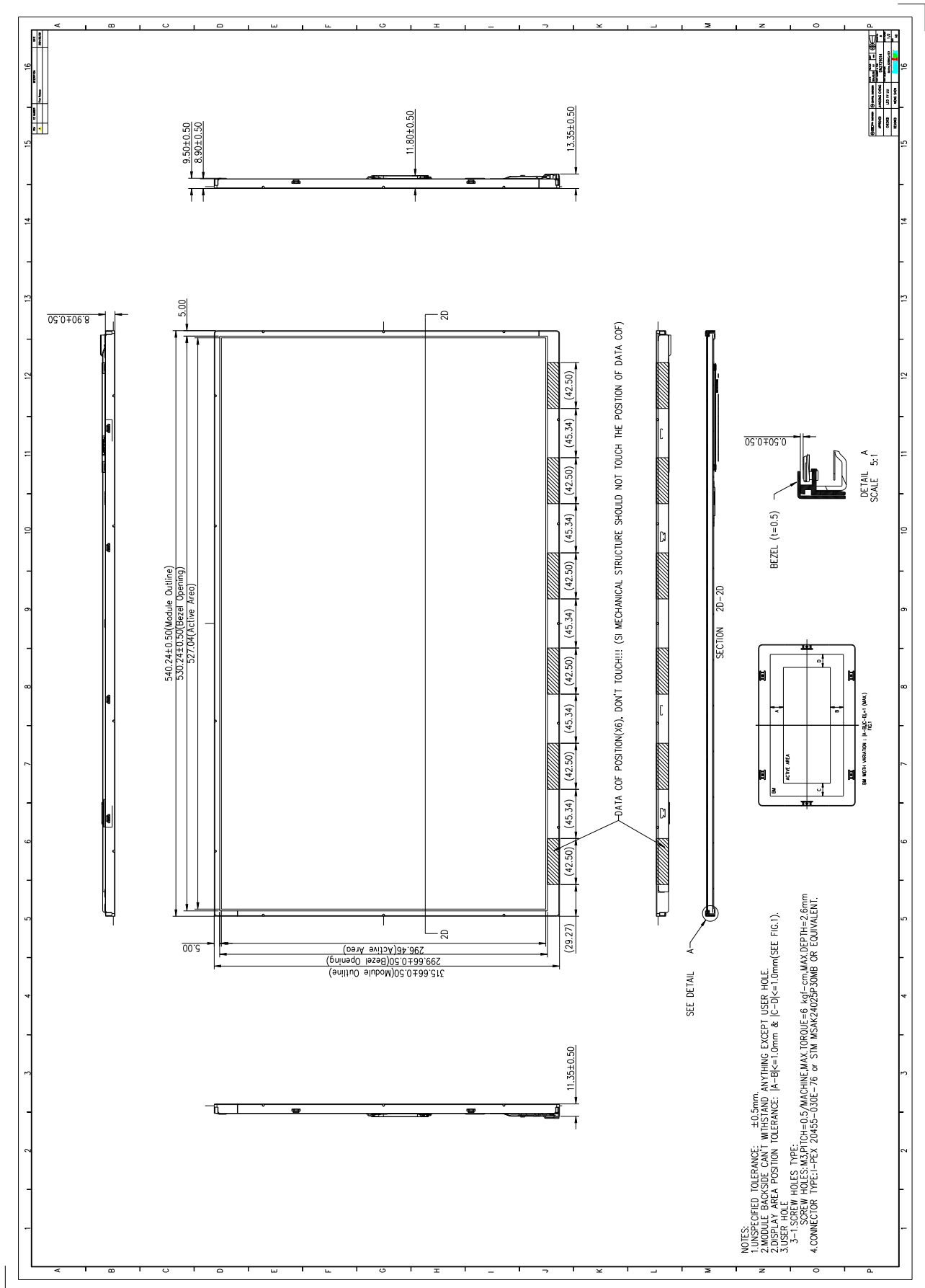
- (1)When storing for a long time, the following precautions are necessary.
 - (a) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 30°C at humidity 50+-10%RH.
 - (b) The polarizer surface should not come in contact with any other object.
 - (c) It is recommended that they be stored in the container in which they were shipped.
 - (d) Storage condition is guaranteed under packing conditions.

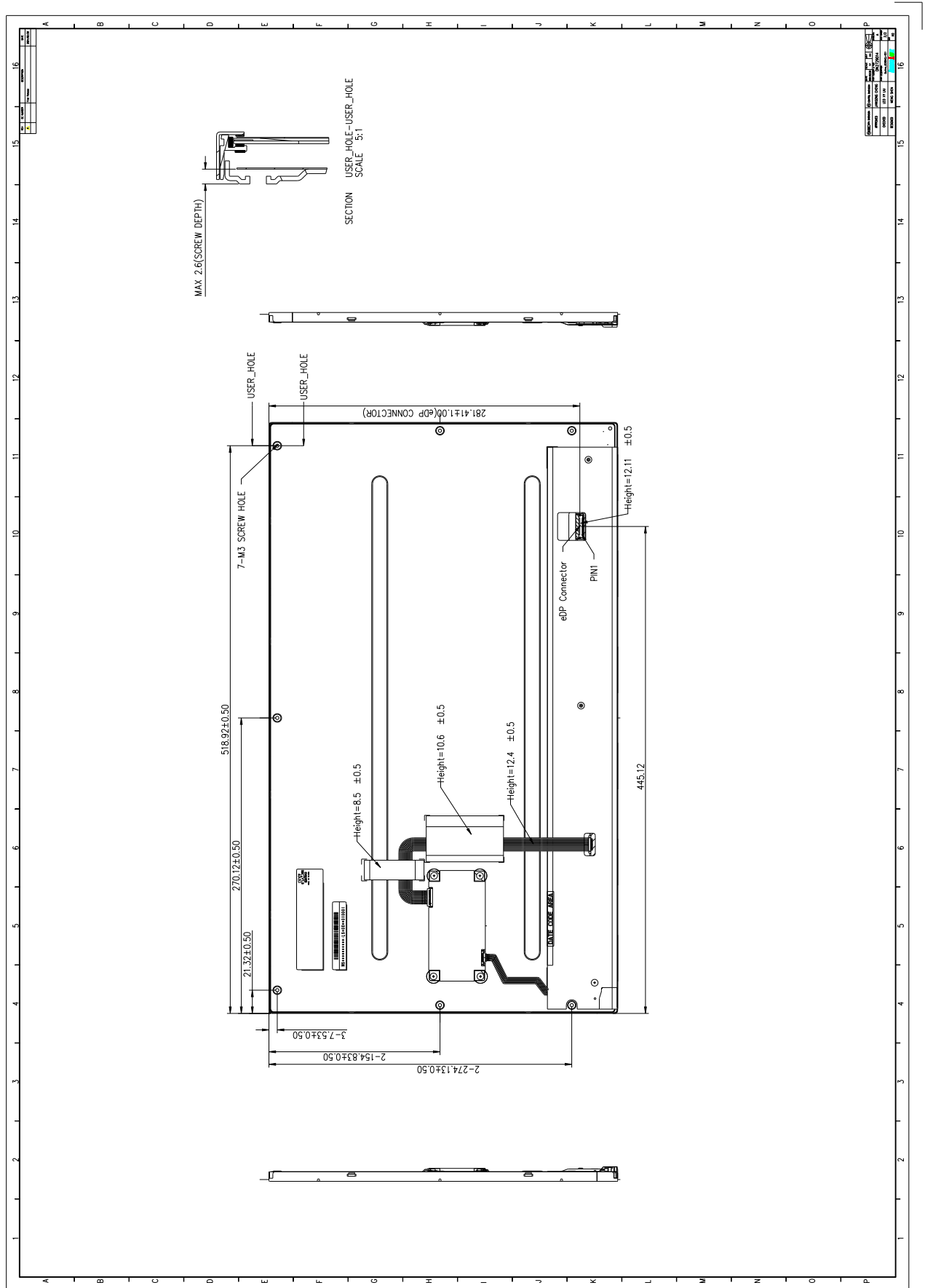
The phase transition of Liquid Crystal in the condition of the low or high storage temperature will be recovered when the LCD module returns to the normal condition
- (2)High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (3)It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (4)It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

8.3 OTHER PRECAUTIONS




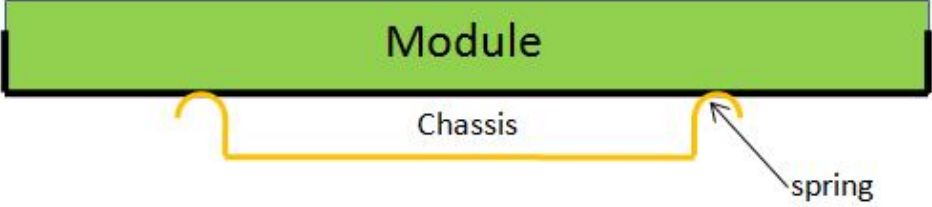

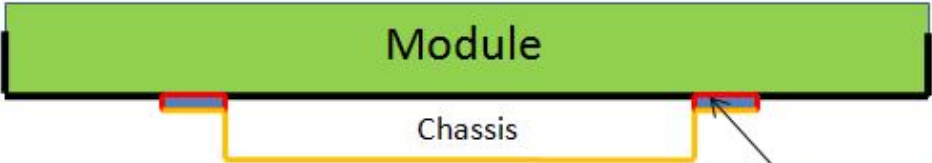
- (1) Normal operating condition
 - (a) Display pattern: dynamic pattern (Real display)
(Note) Long-term static display can cause image sticking.
- (2) Operating usages to protect against image sticking due to long-term static display
 - (a) Suitable operating time: under 16 hours a day.
 - (b) Static information display recommended to use with moving image.
 - (c) Cycling display between 5 minutes' information(static) display and 10 seconds' moving image.
- (3) Abnormal condition just means conditions except normal condition.

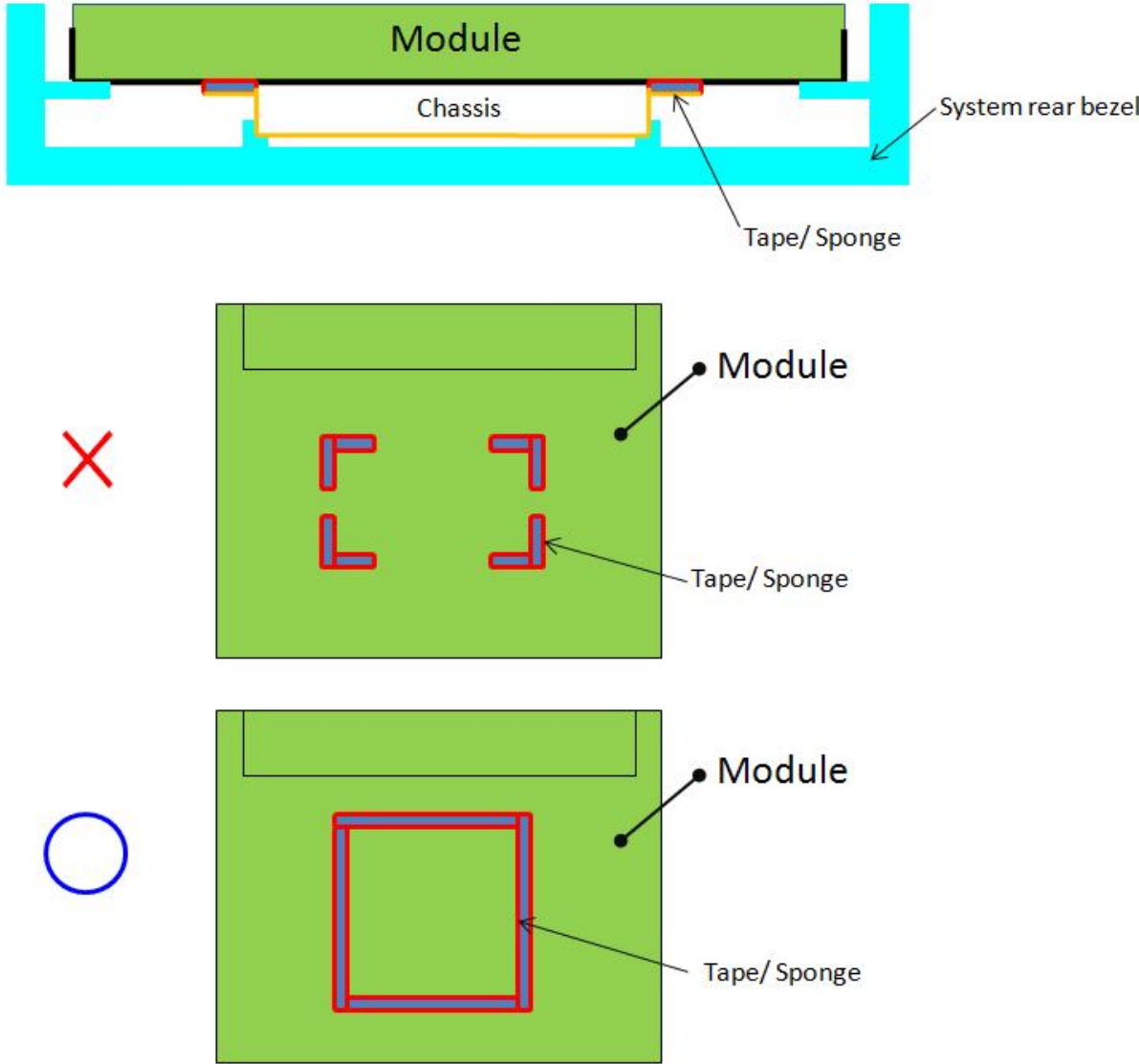
9. MECHANICAL CHARACTERISTICS



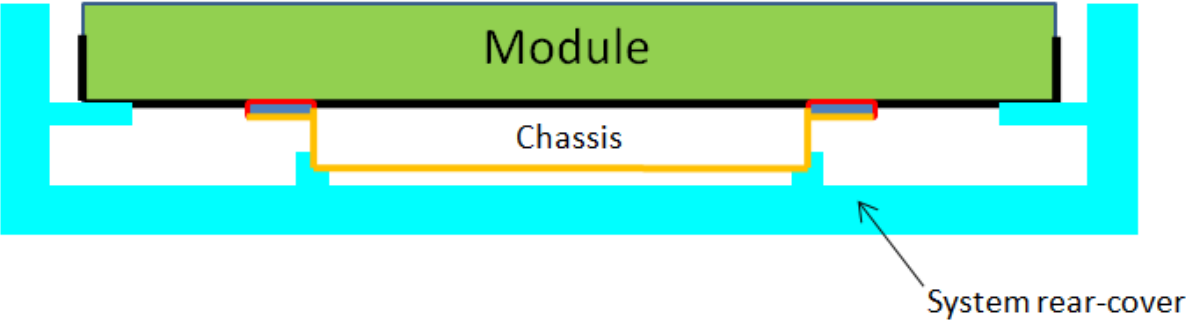


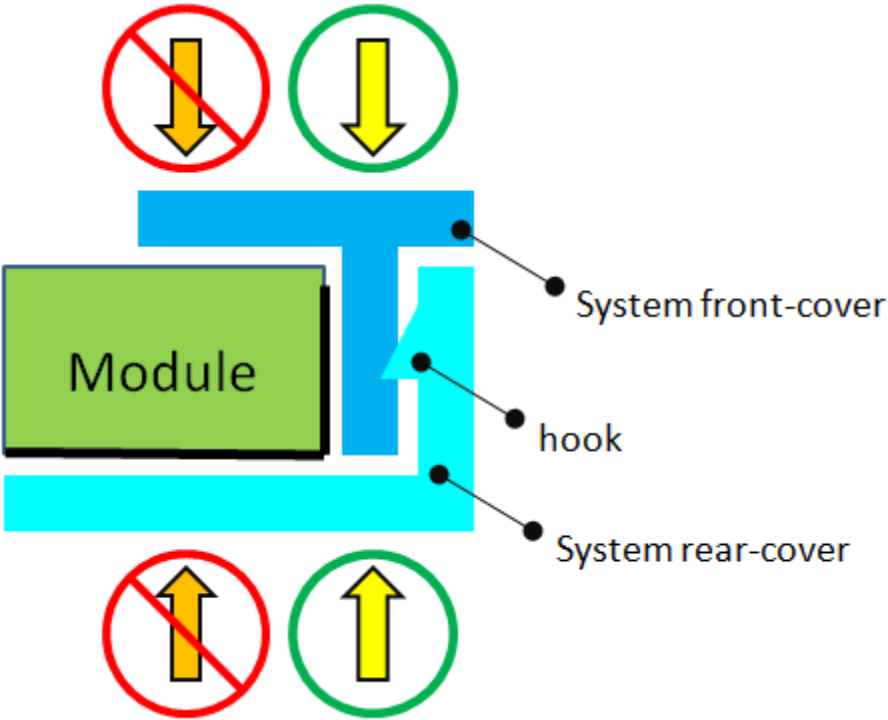
Appendix . SYSTEM COVER DESIGN NOTICE

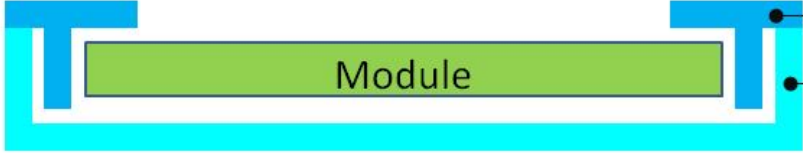
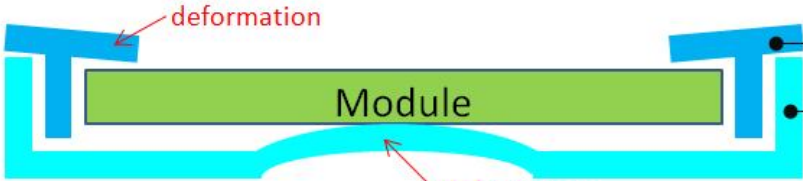
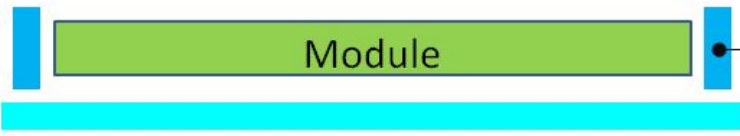
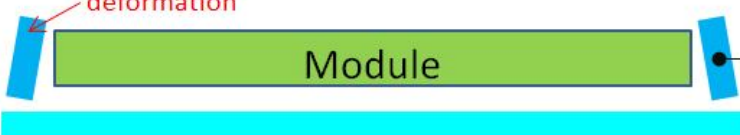
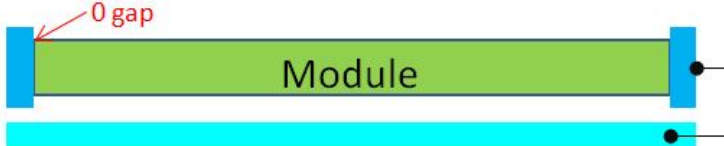
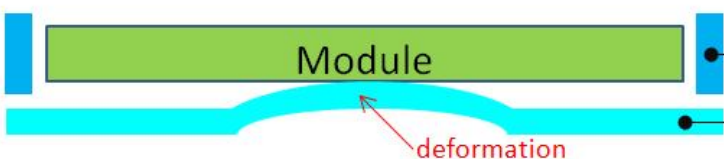
1	Set Chassis and IAVM Module touching Mode
  	 <p>Module</p> <p>Chassis</p> <p>spring</p>  <p>Module</p> <p>Chassis</p> <p>Flat sheetmetal</p>  <p>Module</p> <p>Chassis</p> <p>EMI Shielding Gasket (Tape/ Sponge)</p>
Definition	<p>a. To prevent from abnormal display & white spot after mechanical test, it is not recommended to use spring type chassis.</p> <p>b. We suggest the contact mode between Chassis and Module rear cover is Tape/Sponge, second is Flat sheet metal type chassis.</p>

2	Tape/Sponge design on system inner surface
 <p>The top diagram shows a cross-section of a system with a green Module, a yellow Chassis, and a cyan System rear bezel. Red Tape/Sponge is applied between the Chassis and the Module. The middle diagram, marked with a red 'X', shows a top-down view of a green Module with four red L-shaped Tape/Sponge pieces placed at the corners. The bottom diagram, marked with a blue circle, shows a top-down view of a green Module with a single red rectangular Tape/Sponge piece placed centrally between the Module and the bezel.</p>	
Definition	<p>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.</p> <p>b. When using the Tape/Sponge, we 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.</p>

3	System inner surface examination
<p>The diagram illustrates the system inner surface examination. The top portion shows a top-down view of the 'Module PCBA' (green) with a red hatched area labeled 'The hatch area'. The bottom portion shows a cross-sectional view of the 'Module' assembly, highlighting potential defects: 'Burr' (sharp edges), 'Chassis' (the base structure), 'Step' (a change in height), 'PCBA' (the printed circuit board assembly), and 'System cover inner surface' (the inner surface of the cover).</p>	
Definition	<p>a. The hatch area on Module PCBA should keep at least 1mm gap(X,Y,Z direction) to any structure with system cover inner surface.</p> <p>b. Burr, Step, PCB protrusion may cause stress concentration. White spot may occur during reliability test.</p>

4	Material used for system rear-cover
	
Definition	<p>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 position for module's bracket are deformed 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.</p>

5	Assembly SOP examination for system front-cover with hook structure
	
Definition	<p>To prevent panel crack during system front-cover assembly process with hook structure, it is not recommended to press panel or any location that relate directly to the panel.</p>

6	Permanent deformation of system cover after reliability test
○	
✗	
○	
✗	
✗	
✗	
Definition	<p>System cover including front cover and rear cover may deform during reliability test. Permanent deformation of system front cover and rear cover after reliability test should not interfere with panel. Because it may cause issue such as pooling, abnormal display, white spot and also cell crack.</p> <p>Note: If the interference cannot be avoided, please feel free to contract INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.</p>