

Specification

G070ACE-LH2

7,0" - 800 X 480 – WVGA-LVDS

Spec Revision: 2.0
Revision Date: 11.04.2022

Note: This specification is subject to change without prior notice

- ☐ Tentative Specification
☐ Preliminary Specification
☒ Approval Specification

MODEL NO.: G070ACE
 SUFFIX: LH2

Customer:

APPROVED BY

SIGNATURE

Name / Title

Note

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

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CONTENTS

1. GENERAL DESCRIPTION	5
1.1 OVERVIEW	5
1.2 FEATURE	5
1.3 APPLICATION	5
1.4 GENERAL SPECIFICATIONS	5
1.5 MECHANICAL SPECIFICATIONS	6
2. ABSOLUTE MAXIMUM RATINGS	7
2.1 ABSOLUTE RATINGS OF ENVIRONMENT	7
2.2 ELECTRICAL ABSOLUTE RATINGS	8
2.2.1 TFT LCD MODULE	8
2.2.2 BACKLIGHT UNIT	8
3. ELECTRICAL CHARACTERISTICS	9
3.1 TFT LCD MODULE	9
3.2 BACKLIGHT UNIT	10
4. BLOCK DIAGRAM	12
4.1 TFT LCD MODULE	12
5. INPUT TERMINAL PIN ASSIGNMENT	13
5.1 TFT LCD MODULE	13
5.2 COLOR DATA INPUT ASSIGNMENT	14
6. INTERFACE TIMING	15
6.1 INPUT SIGNAL TIMING SPECIFICATIONS	15
6.2 POWER ON/OFF SEQUENCE	17
6.3 SCANNING DIRECTION	19
7. OPTICAL CHARACTERISTICS	20
7.1 TEST CONDITIONS	20
7.2 OPTICAL SPECIFICATIONS	20
8. RELIABILITY TEST CRITERIA	24
9. PACKAGING	25
9.1 PACKING SPECIFICATIONS	25
9.2 PACKING METHOD	25
9.3 UN-PACKING METHOD	27
10. DEFINITION OF LABELS	28
10.1 INX MODULE LABEL	28
11. PRECAUTIONS	29
11.1 ASSEMBLY AND HANDLING PRECAUTIONS	29
11.2 STORAGE PRECAUTIONS	29
11.3 OTHER PRECAUTIONS	30

12. MECHANICAL CHARACTERISTICS	31
Appendix . SYSTEM COVER DESIGN NOTICE	32

REVISION HISTORY

Version	Date	Page	Description
Ver 2.0	11 Apr, 2022	All	Approval Specification was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

G070ACE-LH2 is a 7" TFT Liquid Crystal Display module with WLED Backlight unit and 30 pins 1ch-LVDS interface. This module supports 800xRGBx480 AAS mode and can display 262k or 16.7M colors.

The PSWG is to establish a set of displays with standard mechanical dimensions and select electrical interface requirements for an industry standard 7" WVGA LCD panel and the LED driving device for Backlight is built in PCBA.

1.2 FEATURE

- WVGA (800 x 480 pixels) resolution
- DE (Data Enable) only mode
- LVDS Interface with 1pixel/clock
- PSWG (Panel Standardization Working Group)
- Wide operating temperature.
- RoHS compliance

1.3 APPLICATION

- TFT LCD Monitor
- Factory Application
- Amusement

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	152.4 (H) x 91.44 (V) (7" diagonal)	mm	(1)
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 vertical Stripe	-	-
Display Colors	16.7M / 262K	color	-
Display Mode	Normally Black	-	-
Surface Treatment	Hard Coating (3H), Anti-Glare	-	-
Module Power Consumption	Total 2.45 W @ cell 0.45 W, BL 2.0 W	W	Typ.

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	169.5	170	170.5	mm	(1)
	Vertical (V)	109.5	110	110.5	mm	
	Thickness (T)	5.5	6	6.5	mm	
Bezel Area	Horizontal	154.1	154.40	154.7	mm	
	Vertical	93.14	93.44	93.74	mm	
Active Area	Horizontal	-	152.4	-	mm	
	Vertical	-	91.44	-	mm	
Weight		173.66	182.8	191.94	g	

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

2. ABSOLUTE MAXIMUM RATINGS

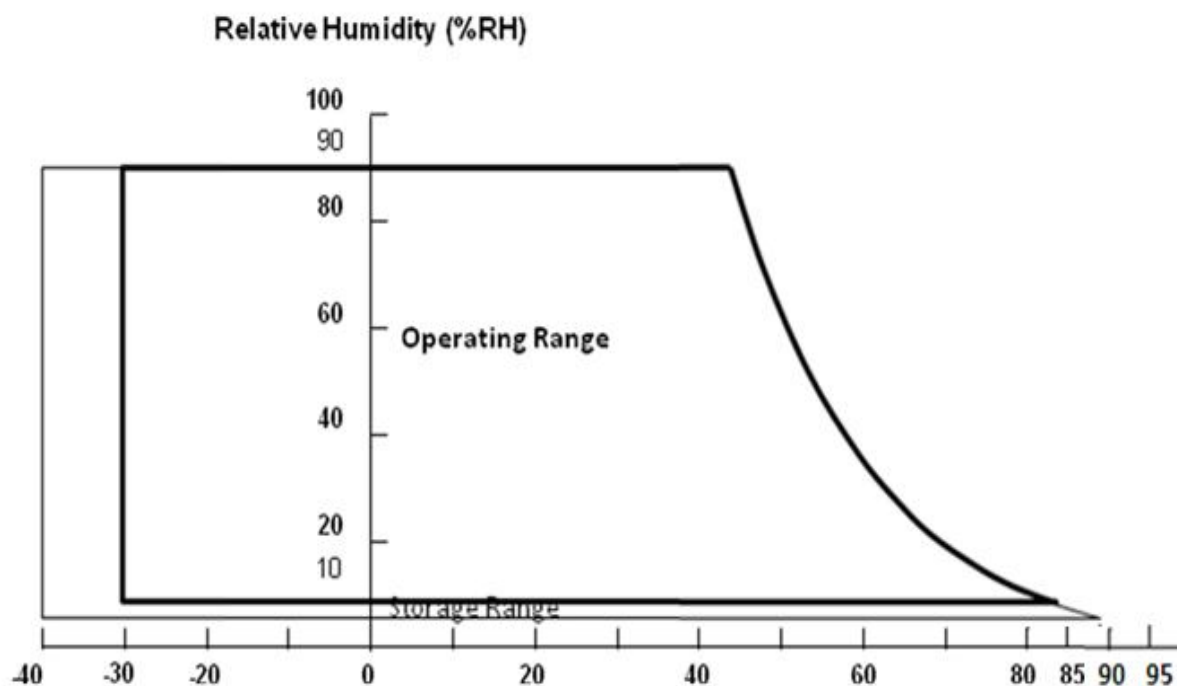
2.1 ABSOLUTE RATINGS OF ENVIRONMENT

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

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	V _{CC}	-0.3	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	18.0	V	(1) , (2)
Enable Voltage	EN	---	7	V	
Backlight Adjust	Dimming	---	7	V	

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

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

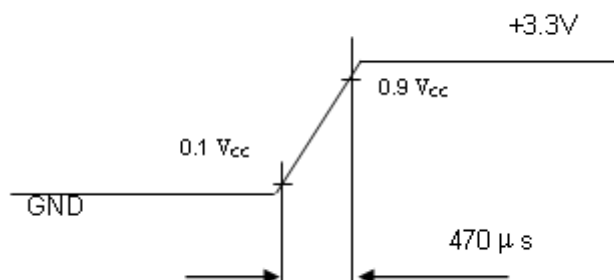
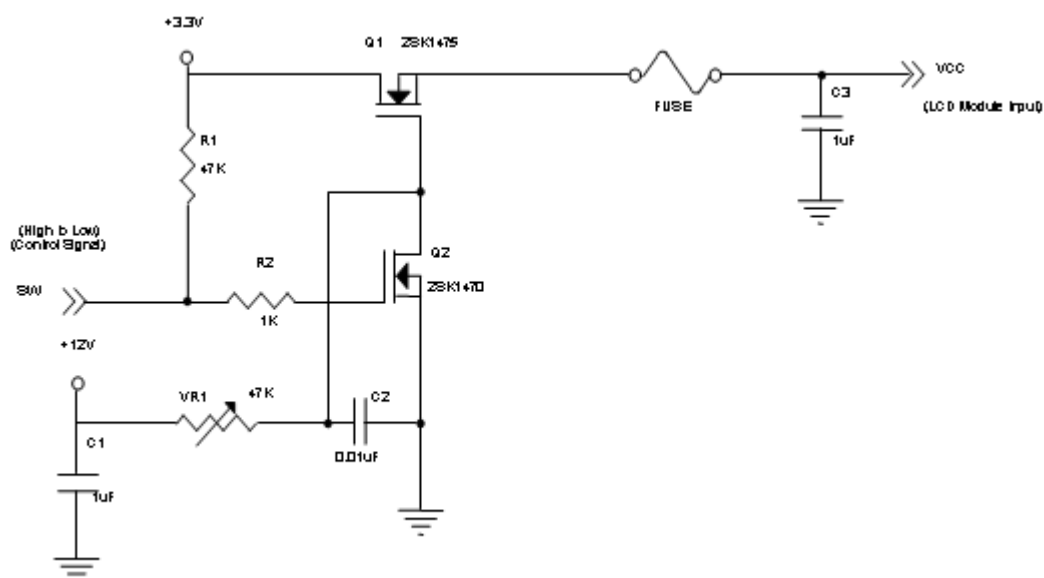
3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V _{CC}	3.0	3.3	3.6	V	-
Ripple Voltage		V _{RP}	-	-	100	mVp-p	-
Rush Current		I _{RUSH}	-	-	2	A	(2)
Power Supply Current	White	I _{CC}	-	135	200	mA	(3)a
	Black		-	85	135	mA	(3)b
LVDS differential input voltage		V _{id}	200	-	600	mV	
LVDS common input voltage		V _{ic}	1.0	1.2	1.4	V	
Differential Input Voltage for LVDS Receiver Threshold	"H" Level	V _{TH}	-	-	+100	mV	-
	"L" Level	V _{TL}	-100	-	-	mV	-
Logic Input Voltage	"H" Level	V _{IH}	2.6	-	V _{CC}	V	
	"L" Level	V _{IL}	0	-	0.7	V	
Terminating Resistor		R _T	-	100	-	Ohm	-

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

Note (2) Measurement Conditions:



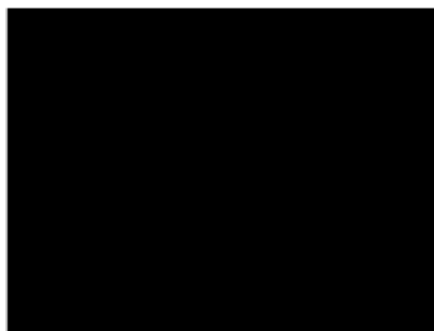
Note (3) The specified power supply current is under the conditions at $V_{CC} = 3.3V$, $T_a = 25 \pm 2^\circ C$, DC Current and $f_v = 60$ Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern

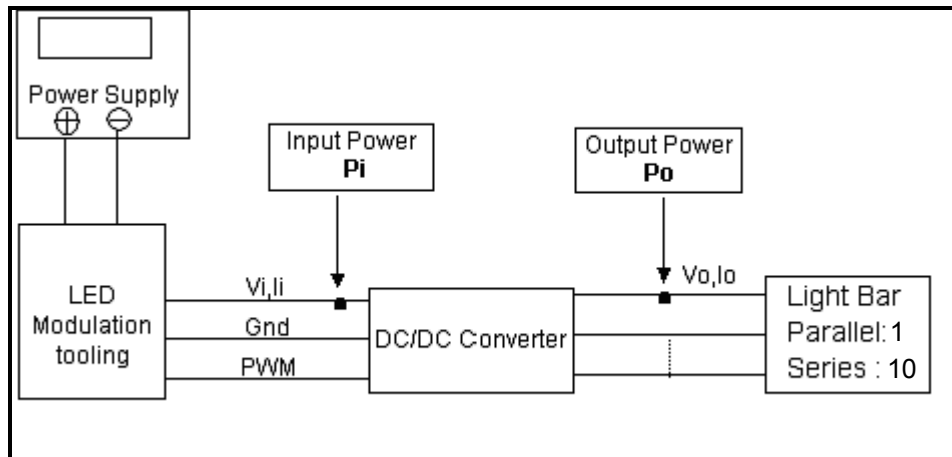


Active Area

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 Input Ripple Voltage		V_{IRP}	-	-	500	mV	
Converter Power Supply Current		I_i	0.1	0.17	0.2	A	@LED_Vin= 12V Duty=100%
Converter Input Rush Current		I_{irsh}		4.3		A	@LED_Vin rising = 1mS(Vi=12V)
Input Power Consumption		P_i	-	2.0	2.3	W	(1)
EN Control Level	Backlight on	ENLED (BLON)	2.0	3.3	5.0	V	
	Backlight off		0	-	0.3	V	
PWM Control Level	PWM High Level	Dimming (E_PWM)	2.0	--	5.0	V	
	PWM Low Level		0	--	0.15	V	
PWN Noise Range		V_{Noise}	-	-	0.1	V	
PWM Control Frequency		f_{PWM}	190	200	300	Hz	(3)
PWM Dimming Control Duty Ratio		-	5	-	100	%	(3), @ 190Hz< f_{PWM} <1kHz
			20	-	100	%	(3), @ 1kHz≤ f_{PWM} <20kHz
LED Life Time		L_{LED}	50,000		-	Hrs	(2)

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



Note (2) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at $T_a = 25 \pm 2^\circ\text{C}$ 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.

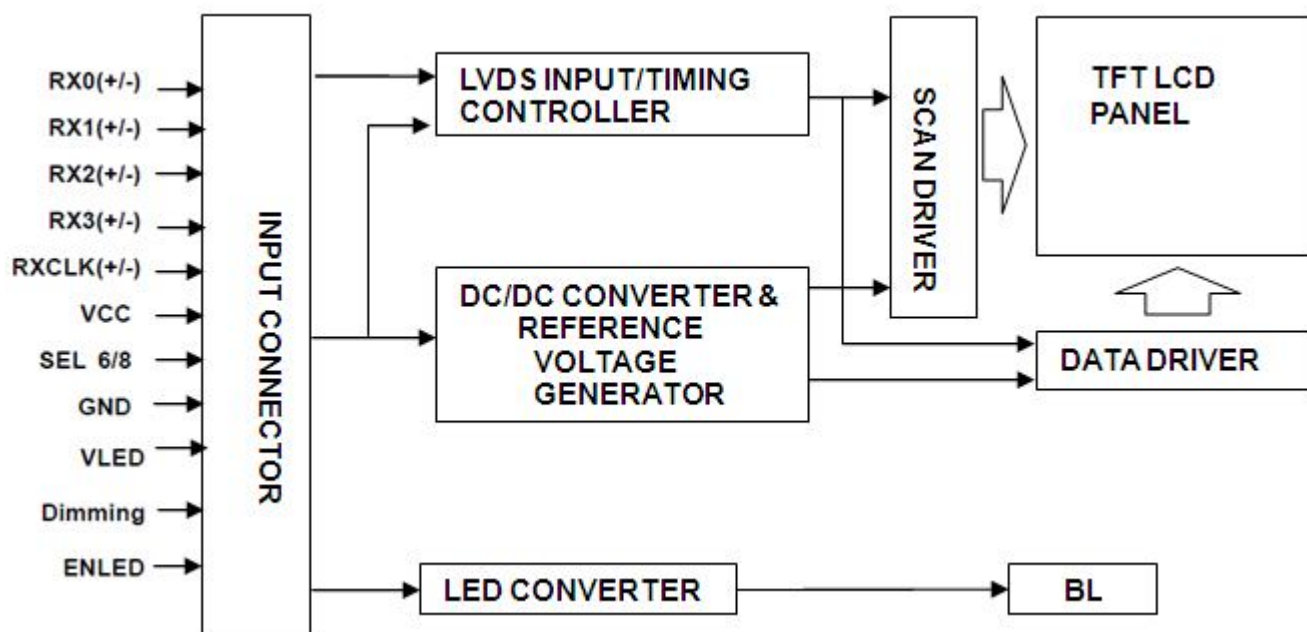
Note (3) At 190 ~1kHz PWM control frequency, duty ratio range is restricted from 5% to 100%.

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

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

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

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

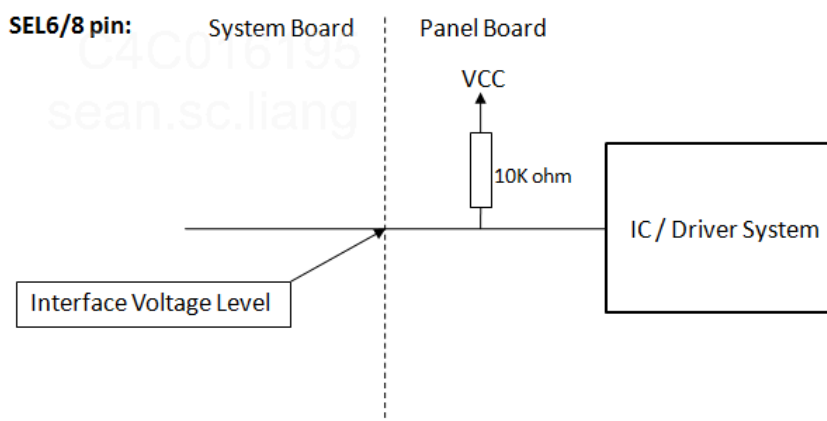
Note (1) Connector Part No.: Starconn 093G30-B0001A-G4.or P-TWO 187114-30091

Note (2) User's connector Part No:

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

Note (3) "Low" stands for 0V. "High" stands for 3.3V

Note (4) Pin7, Pin8 input signals should be set to no connection or ground, this module



5.2 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

6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

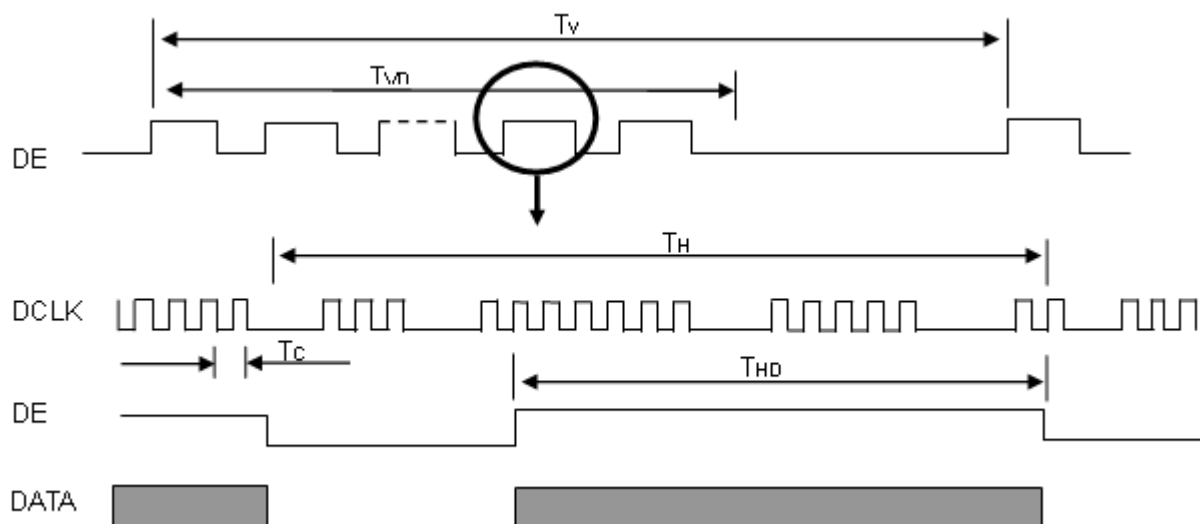
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	F_c	25.2	25.4	35.7	MHz	-
	Period	T_c		39.37		ns	
	Input cycle to cycle jitter	T_{rcj}	$-0.02 \cdot T_c$	-	$0.02 \cdot T_c$	ns	(a)
	Input Clock to data skew	TLVCCS	$-0.02 \cdot T_c$	-	$0.02 \cdot T_c$	ps	(b)
	Spread spectrum modulation range	F_{clkin_mod}	-	-	$1.02 \cdot F_c$	MHz	(c)
	Spread spectrum modulation frequency	F_{SSM}	23	-	93	KHz	
Vertical Display Term	Frame Rate	F_r	-	60	-	Hz	-
	Total	T_v	488	490	611	T_h	$T_v = T_{vd} + T_{vb}$
	Active Display	T_{vd}	480	480	480	T_h	-
	Blank	T_{vb}	8	10	131	T_h	-
Horizontal Display Term	Total	T_h	860	864	974	T_c	$T_h = T_{hd} + T_{hb}$
	Active Display	T_{hd}	800	800	800	T_c	-
	Blank	T_{hb}	60	64	174	T_c	-

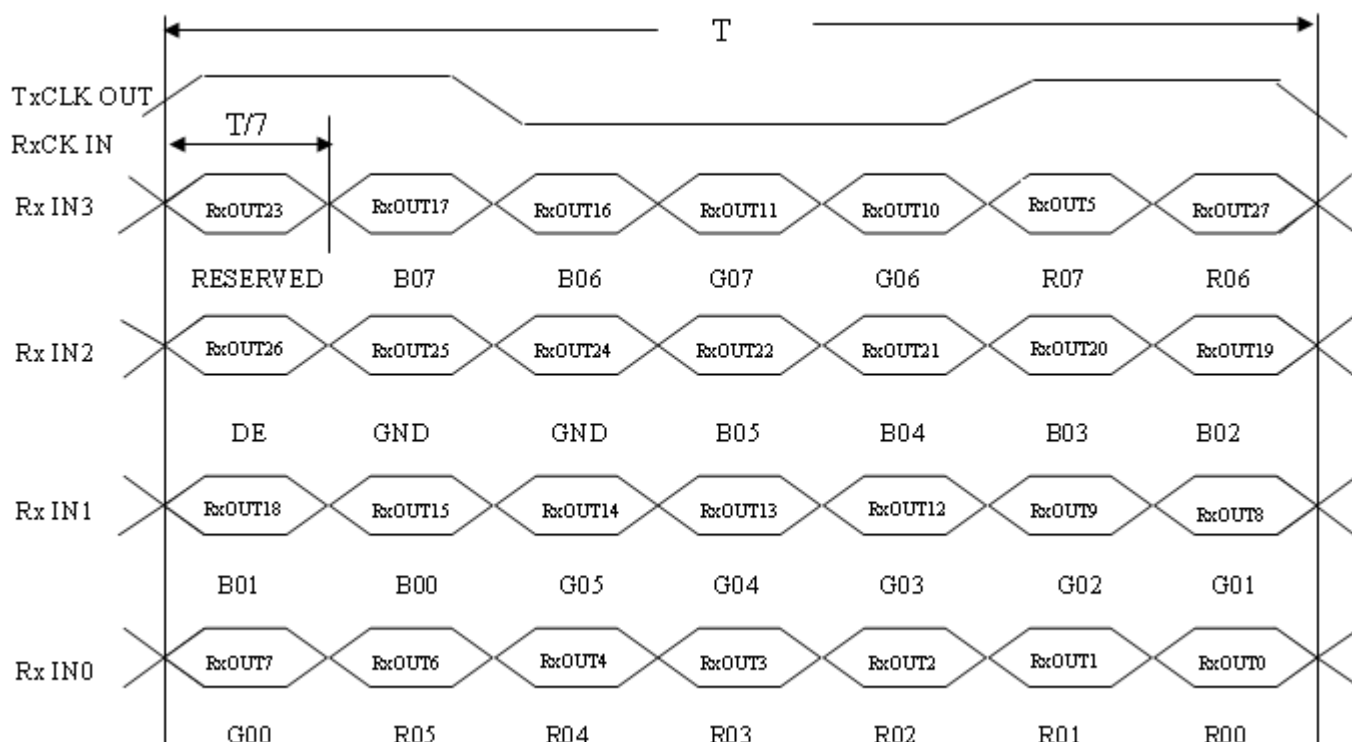
Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

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

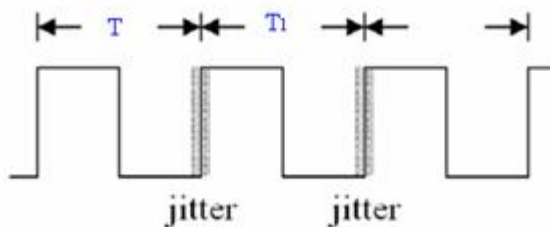
INPUT SIGNAL TIMING DIAGRAM



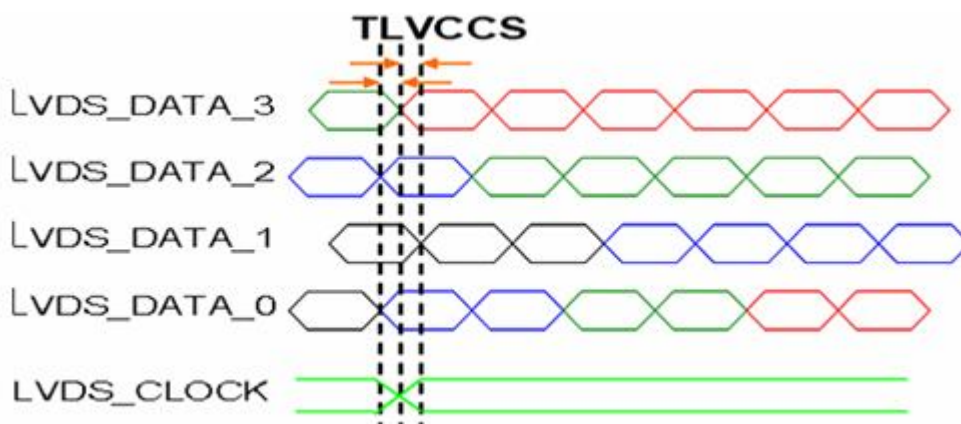
TIMING DIAGRAM of LVDS



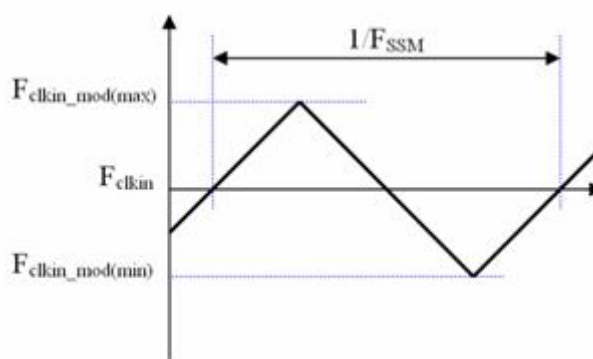
Note (a) The input clock cycle-to-cycle jitter is defined as below figures. $T_{rc1} = |T1 - T|$



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

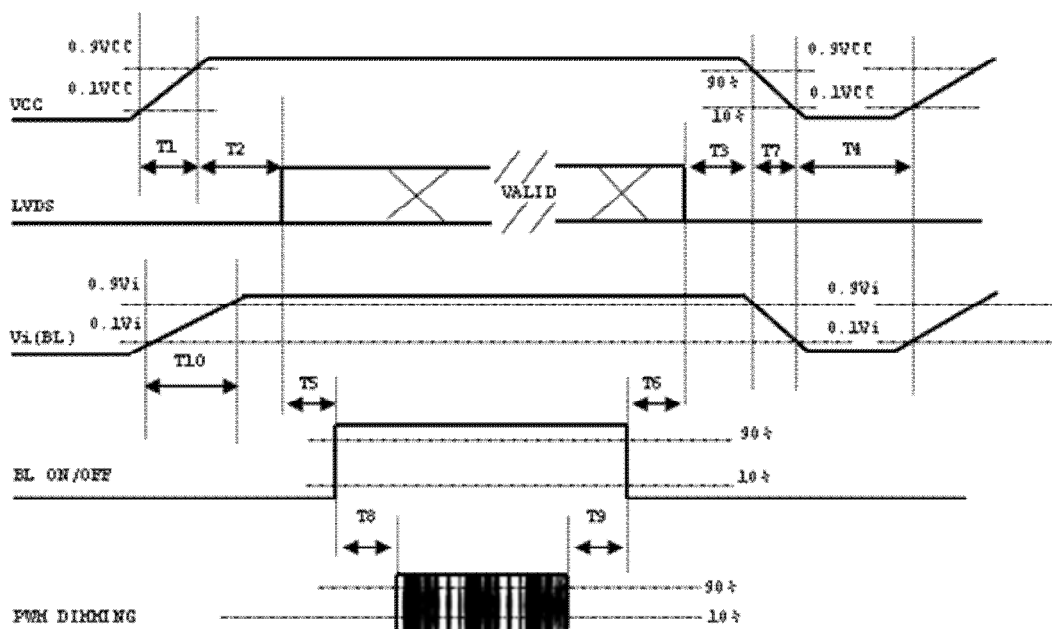


Note (c) The SSCG (Spread spectrum clock generator) is defined as below figures.



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.



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

T8	10	-	-	ms
T9	10	-	-	ms
T10	20	-	50	ms

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.

6.3 SCANNING DIRECTION

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

Fig.1 Normal Scan



PCBA on the bottom side

7. OPTICAL CHARACTERISTICS

7.1 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	%

7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown here and all items are measured at the center point of screen unless otherwise noted. The following items should be measured under the test conditions described above and stable conditions shown in Note (5).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	Rx	$\theta X=0^{\circ}, \theta Y=0^{\circ}$ Grayscale Maximum	0.534	0.584	0.634	-	(1), (5)
		Ry		0.280	0.330	0.380		
	Green	Gx		0.284	0.334	0.384		
		Gy		0.550	0.600	0.650		
	Blue	Bx		0.100	0.150	0.200		
		By		0.004	0.054	0.104		
	White	Wx		0.263	0.313	0.363		
		Wy		0.279	0.329	0.379		
Center Luminance of White		LC	400	500		cd/m ²	(4), (5)	
Contrast Ratio		CR	600	800			(2), (5)	
Response Time		TR	$\theta X=0^{\circ}, \theta Y=0^{\circ}$	-	13	-	ms	(3)
		TF		-	12	-		
White Variation		δW	$\theta X=0^{\circ}, \theta Y=0^{\circ}$	70	-	-	%	(5), (6)
Viewing Angle	Horizontal	$\theta X+$	$CR \geq 10$	80	89	-	Deg.	(1), (5)
		$\theta X-$		80	89	-		
	Vertical	$\theta Y+$		80	89	-		
		$\theta Y-$		80	89	-		

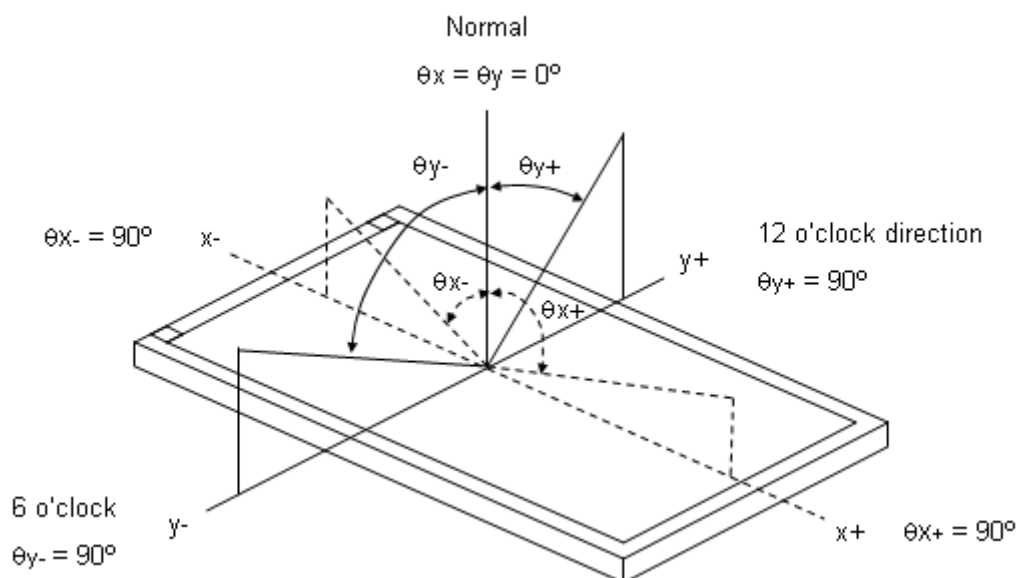
Definition :

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):

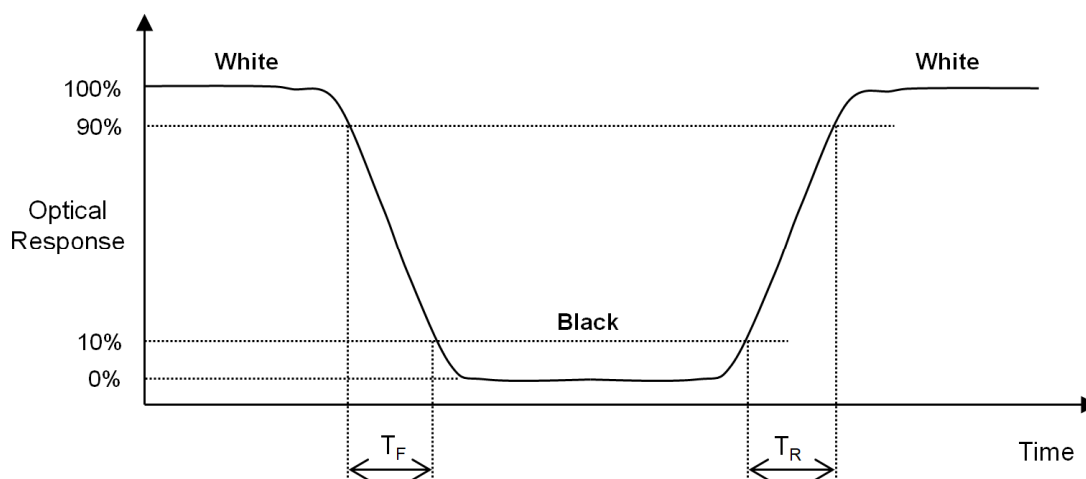


Note (2) Definition of Contrast Ratio (CR):

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):

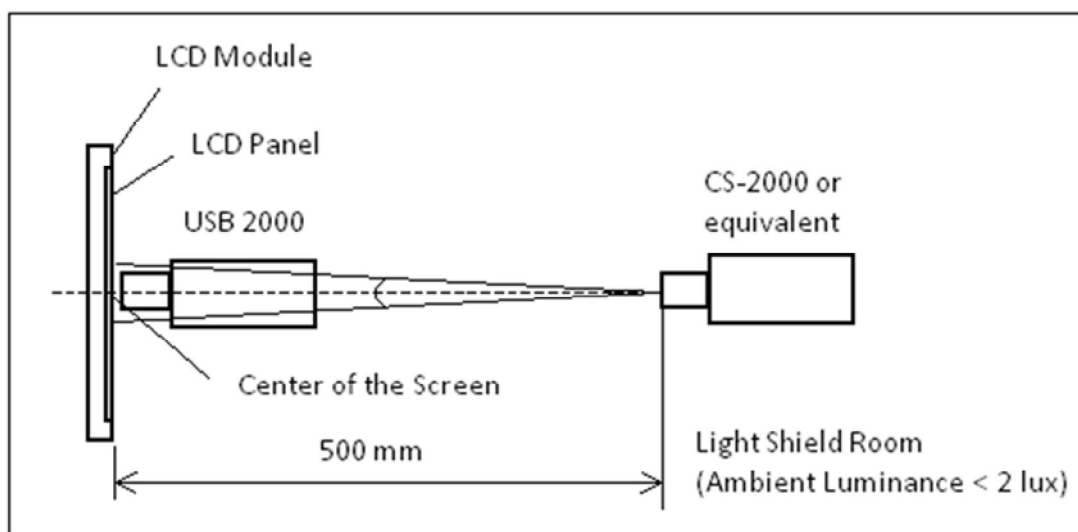


Note (4) Definition of Luminance of White (L_c):

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. The measurement placement of module should be in accordance with module drawing.

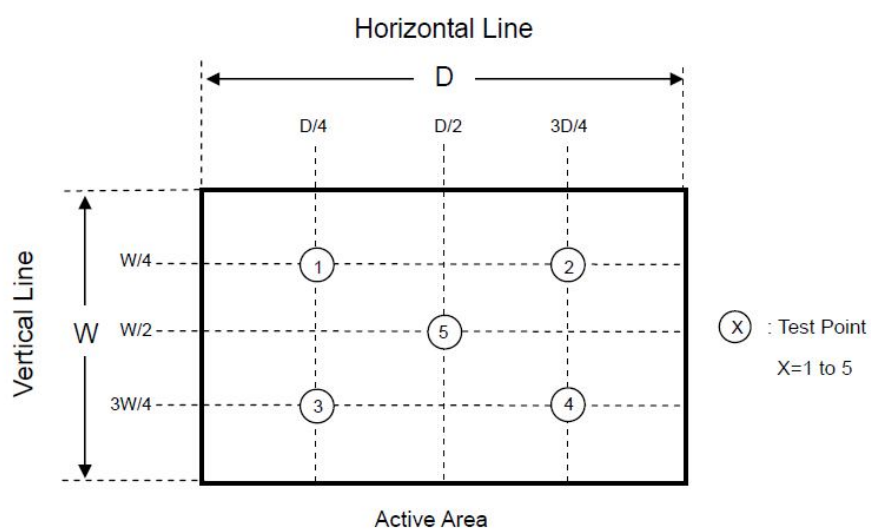


Note (6) Definition of White Variation (δW):

Measure the luminance of White at 5 points.

Luminance of White : $L(X)$, where X is from 1 to 5.

$$\delta W = \frac{\text{Minimum [} L(1) \text{ to } L(5) \text{]}}{\text{Maximum [} L(1) \text{ to } L(5) \text{]}} \times 100\%$$



8. RELIABILITY TEST CRITERIA

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

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°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.

9. PACKAGING

9.1 PACKING SPECIFICATIONS

- (1) 38 pcs LCD modules / 1 Box
- (2) Box dimensions: 445 (L) X 370 (W) X 275 (H) mm
- (3) Weight: approximately 8.3Kg (38modules per box)

9.2 PACKING METHOD

LCD Module

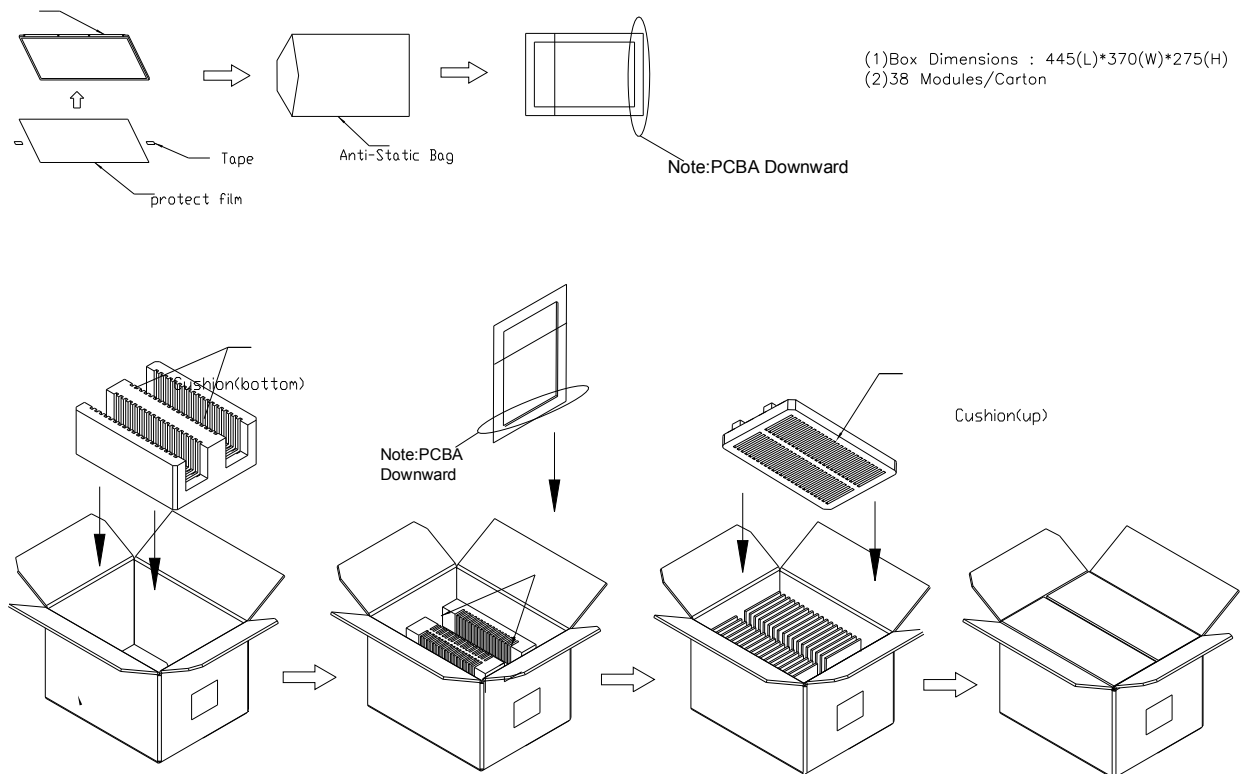


Figure. 9-1 Packing method

Air Transportation

Sea & Land Transportation
(for Normal)

Sea & Land Transportation
(for HQ)

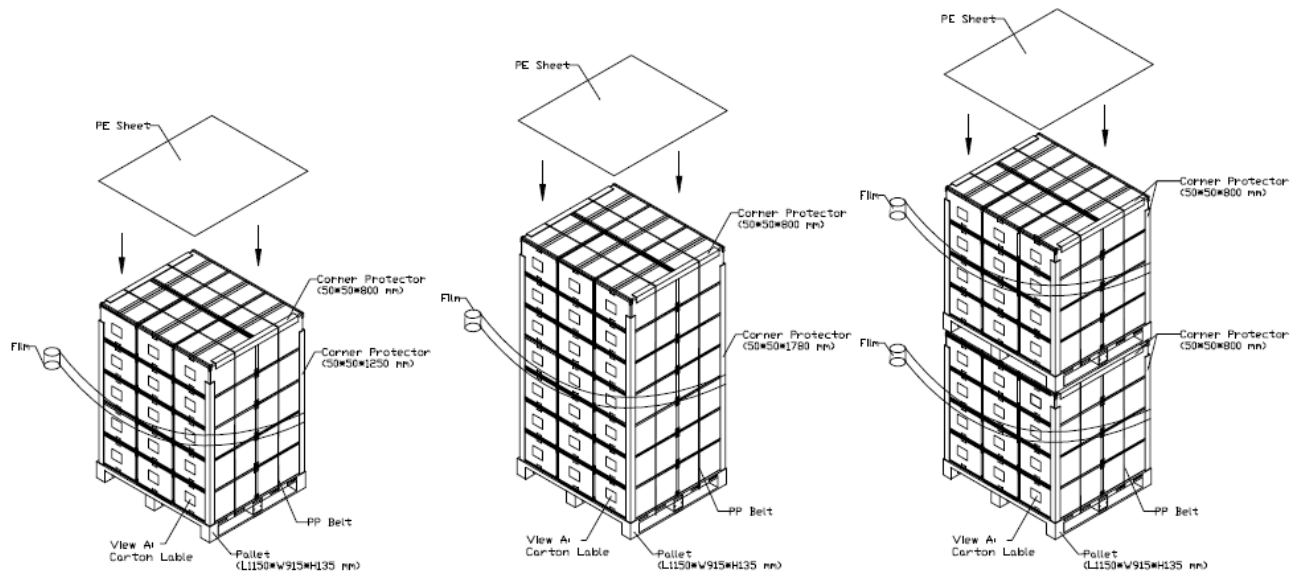


Figure. 9-2 Packing method

9.3 UN-PACKING METHOD

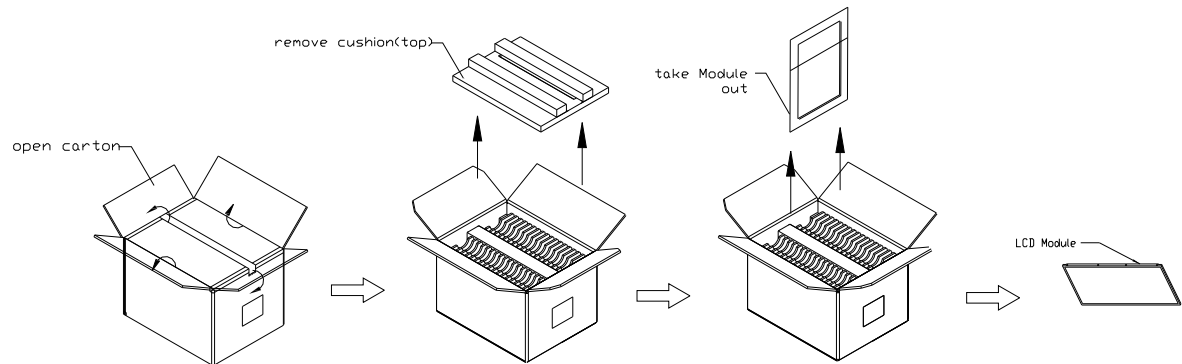
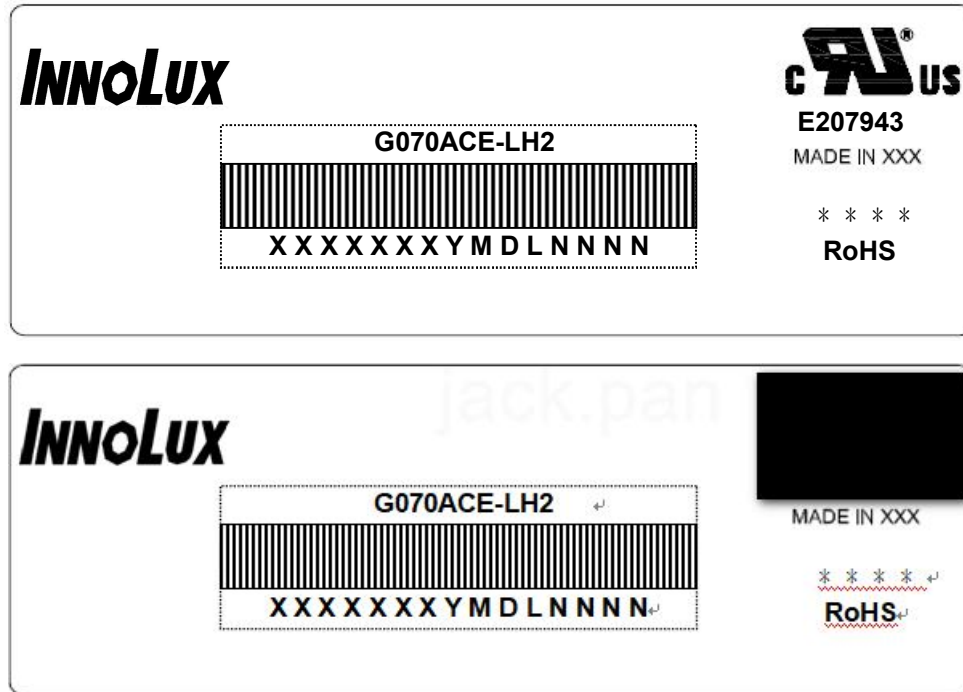


Figure. 9-3 UN-Packing method

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.

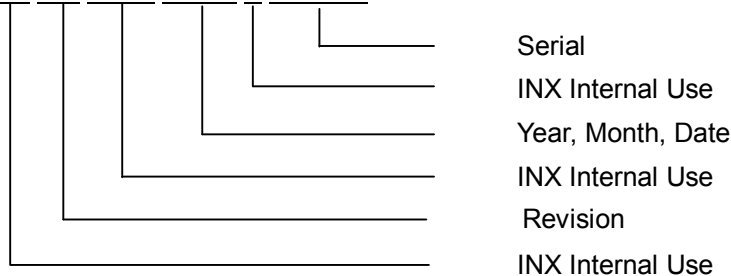


Note (1) Safety Compliance(UL logo) will open after C1 version.

(a) Model Name: G070ACE-LH2

(b) * * * * : Factory ID

(c) Serial ID: XXXXXXXYMDLNNNN



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

11. PRECAUTIONS

11.1 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.

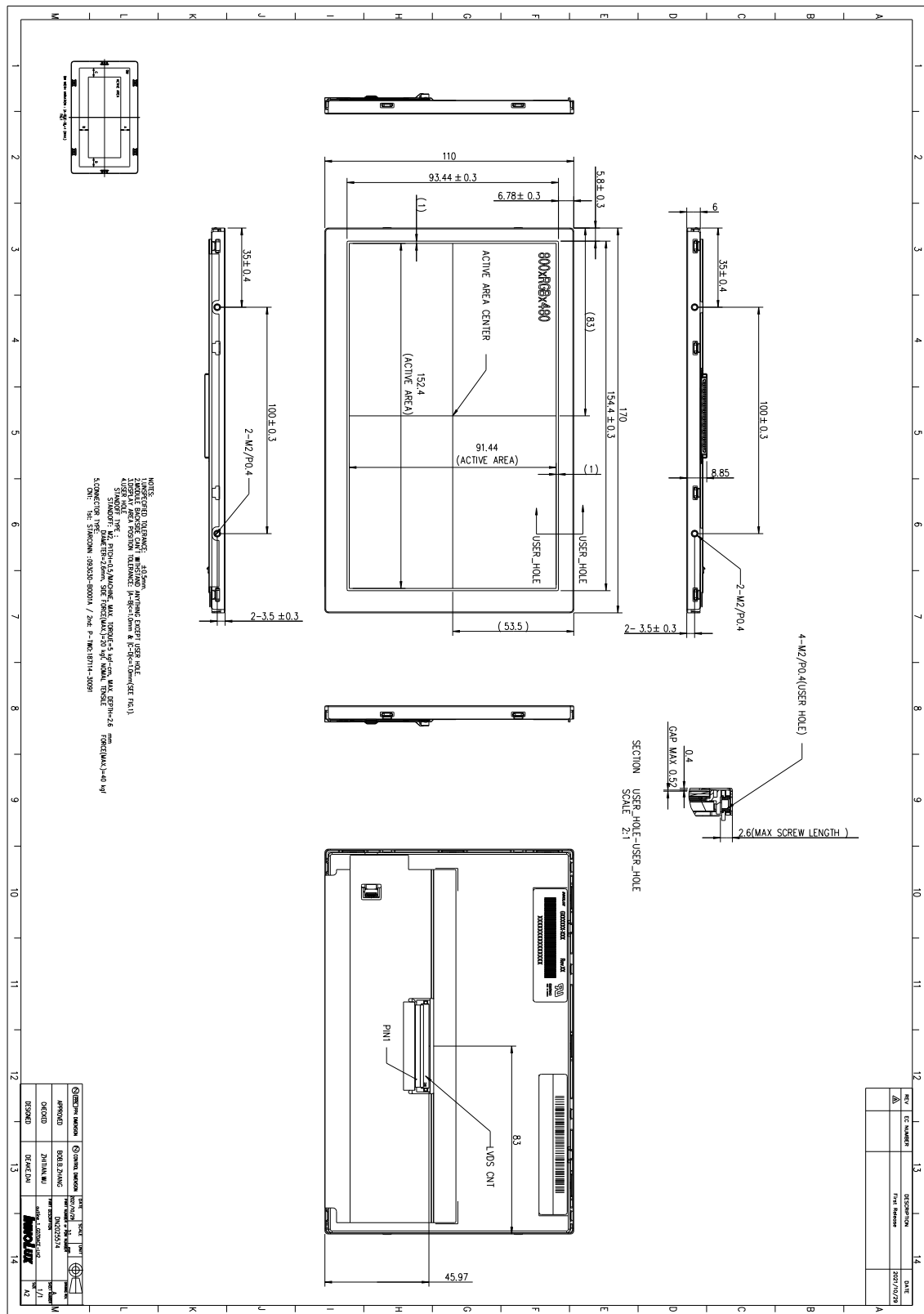
11.2 STORAGE PRECAUTIONS

- (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.
 - (e) 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.


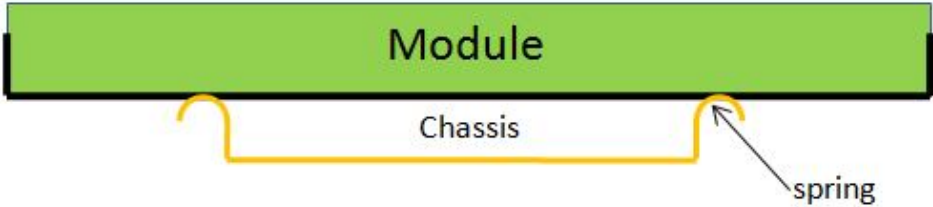
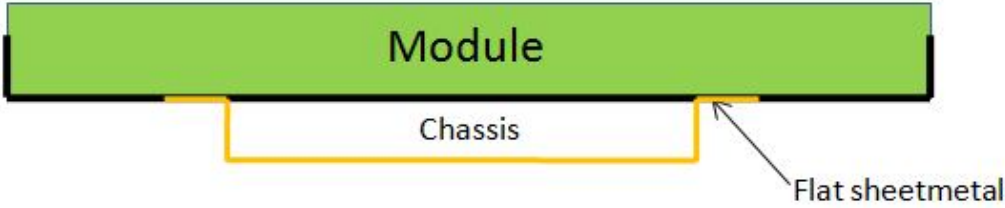
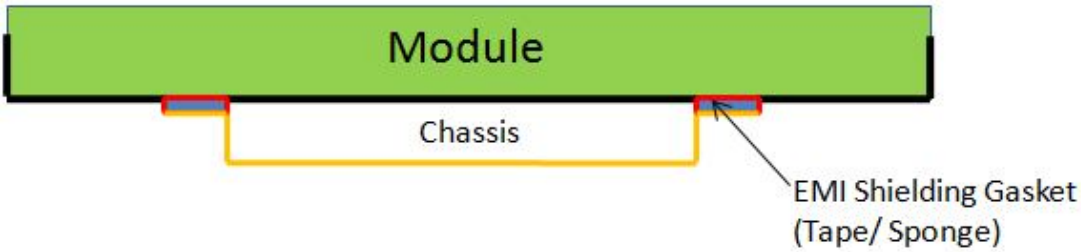
11.3 OTHER PRECAUTIONS

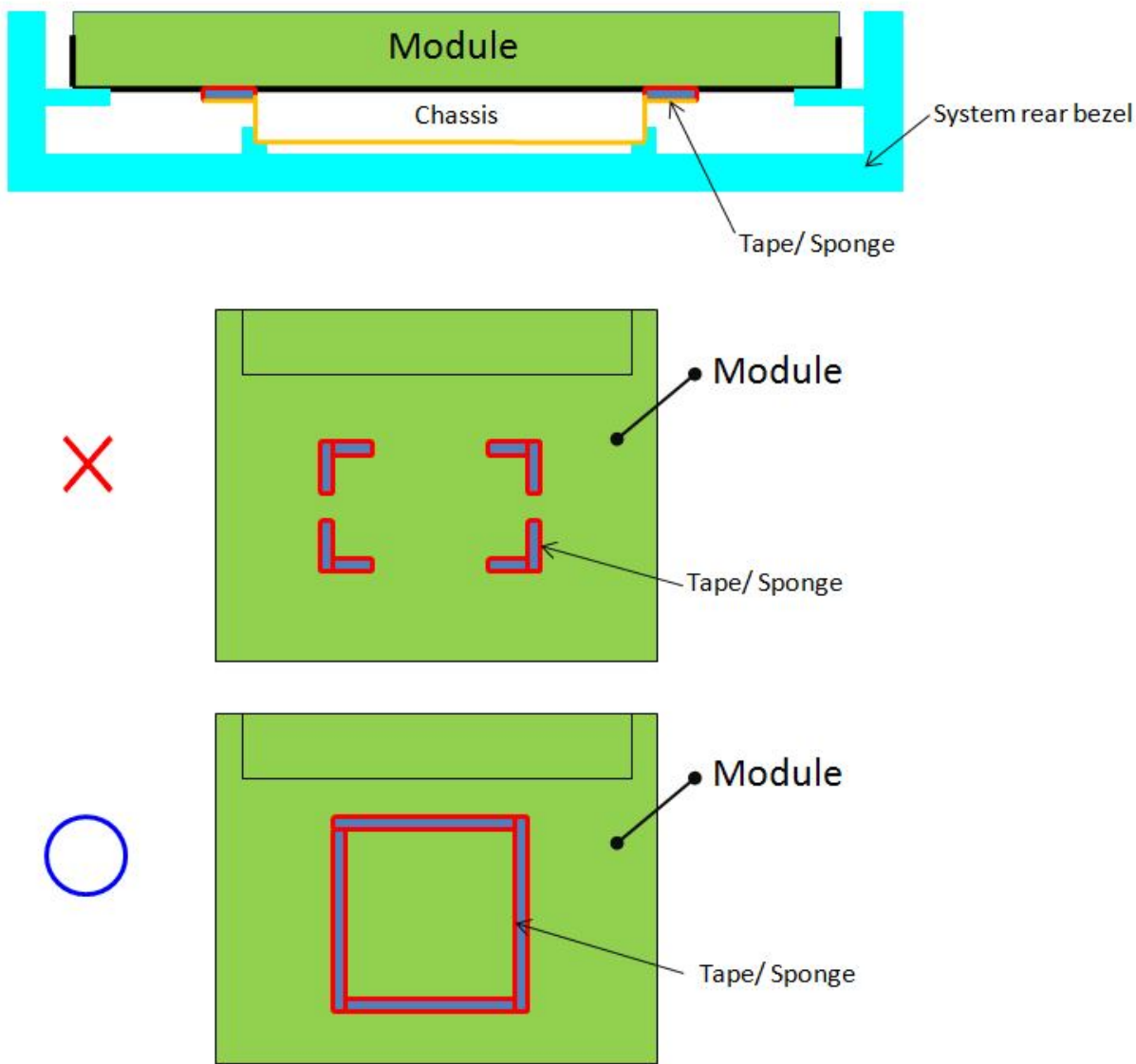
- (1) Normal operating condition
 - (a) Display pattern: dynamic pattern (Real display)
 - (Note) Long-term static display can cause image sticking.
- (2) Operating usages to protect against image sticking due to long-term static display
 - (a) Suitable operating time: under 16 hours a day.
 - (b) Static 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.

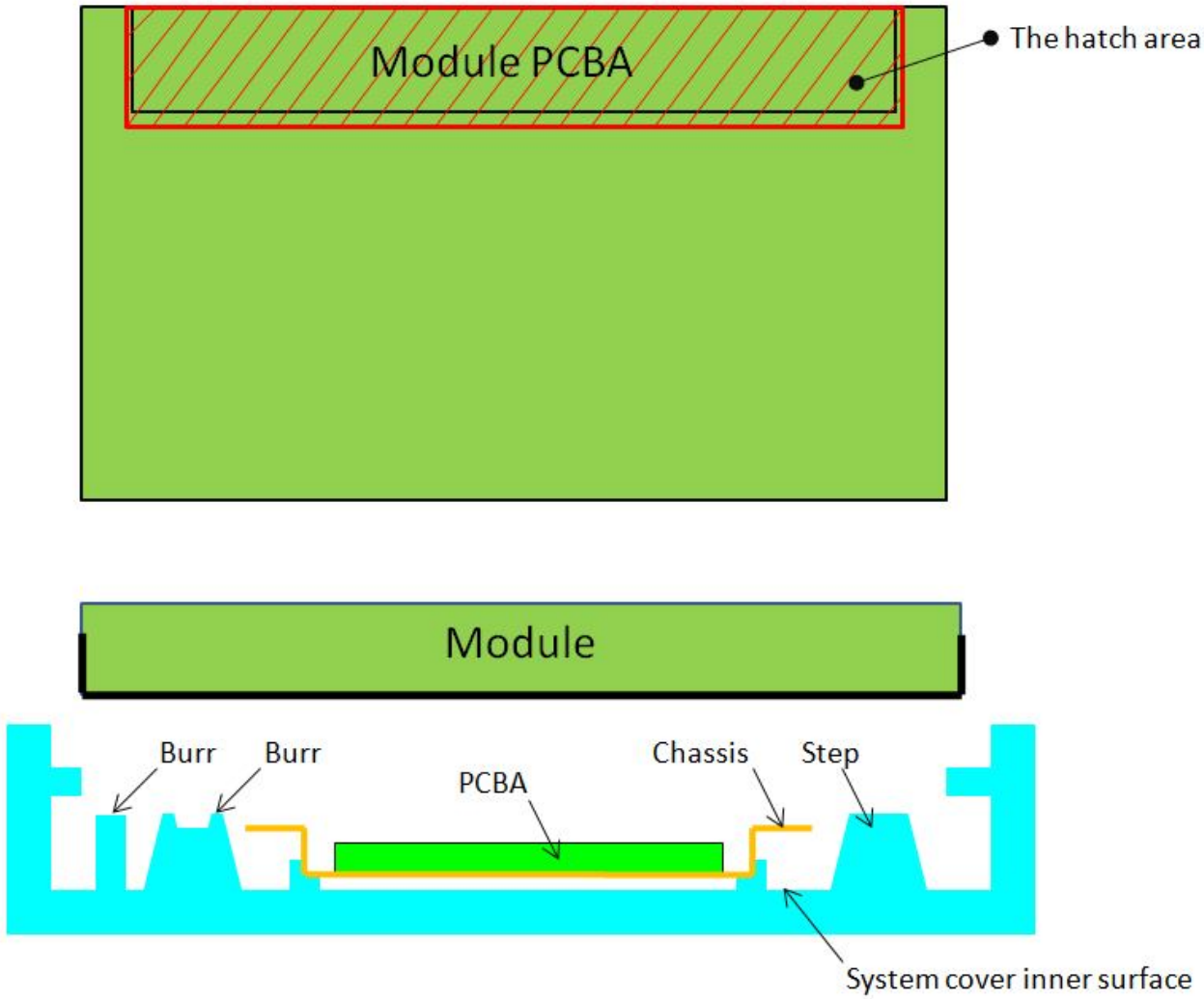
12. MECHANICAL CHARACTERISTICS

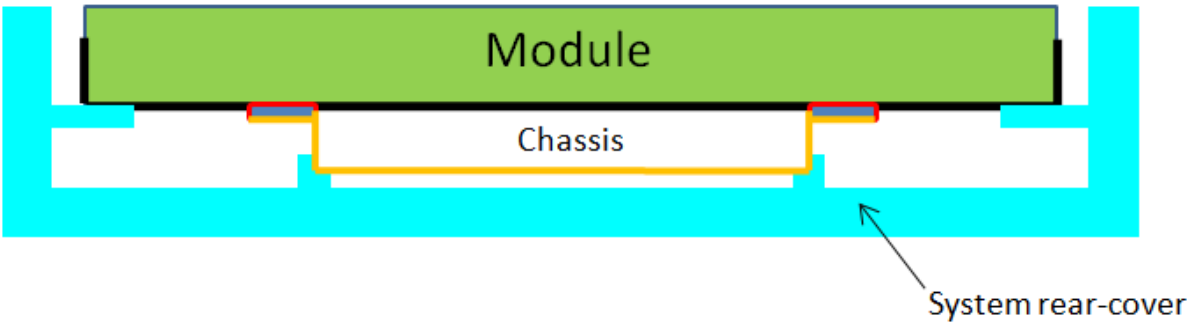


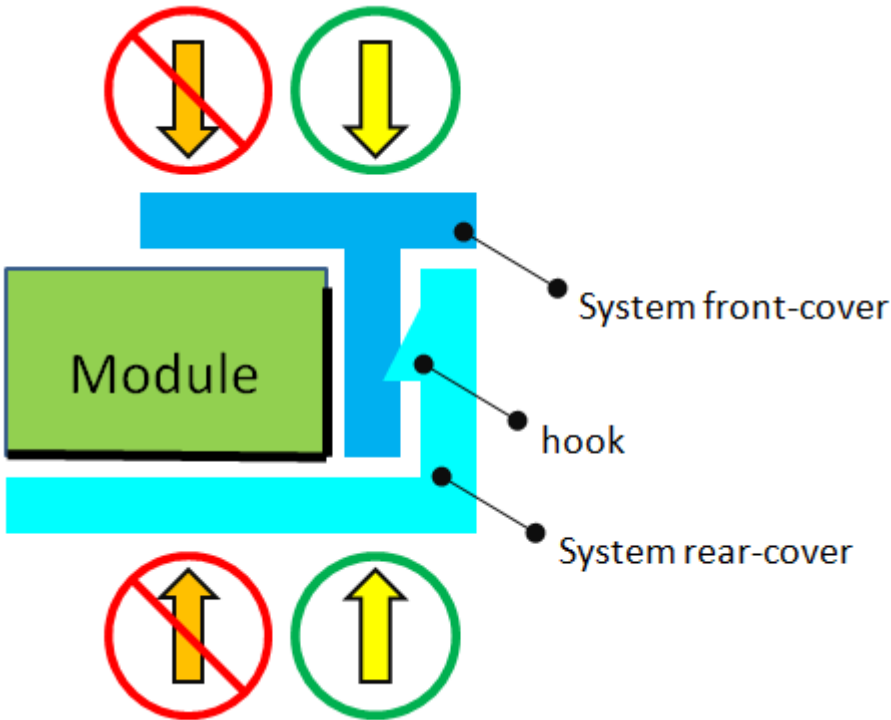
Appendix . SYSTEM COVER DESIGN NOTICE

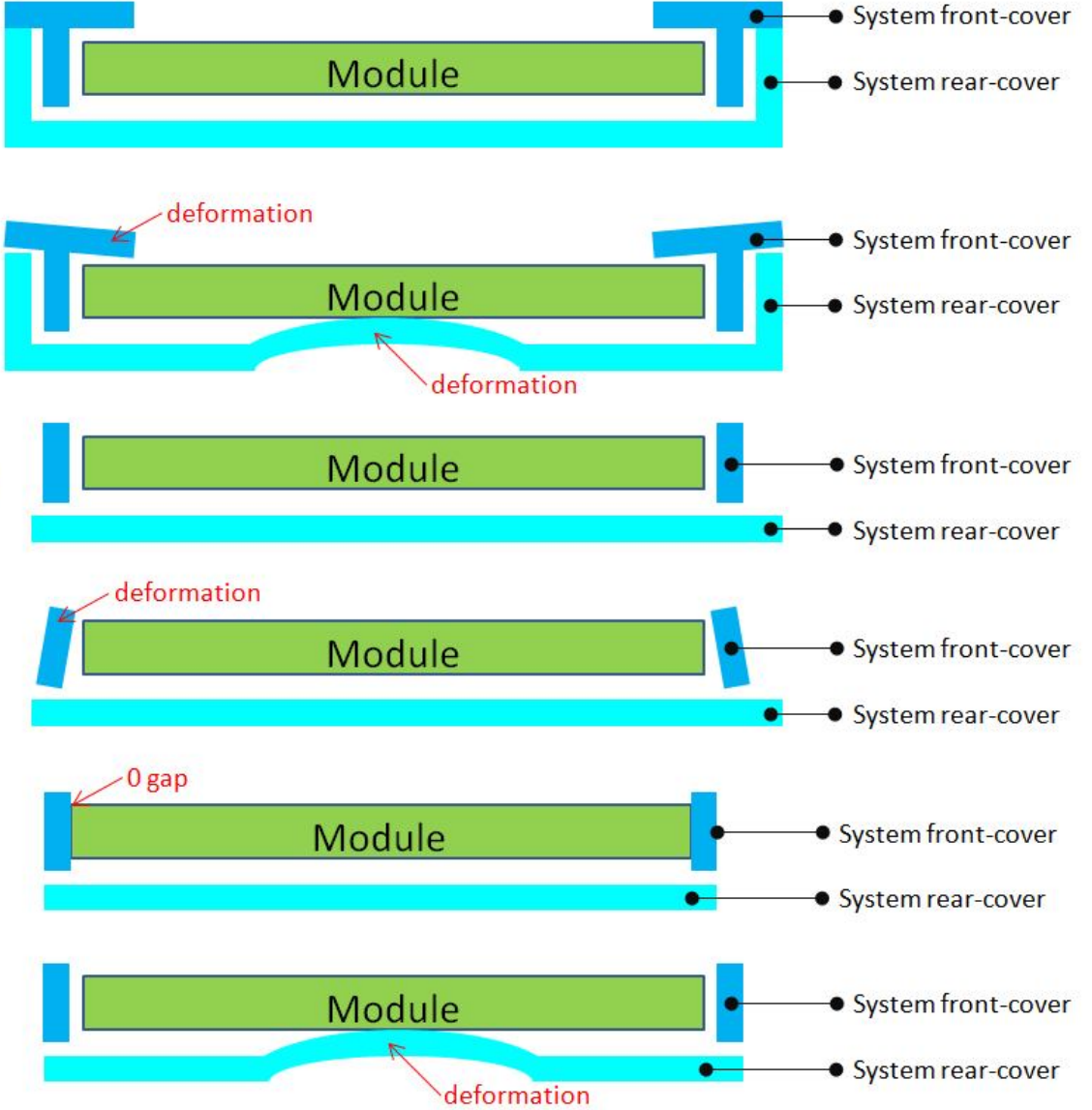
1	Set Chassis and IAVM Module touching Mode
	  
Definition	<p>a. To prevent from abnormal display & white spot after mechanical test, it is not recommended to use spring type chassis.</p> <p>b. We suggest the contact mode between Chassis and Module rear cover is Tape/Sponge, second is Flat sheet metal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

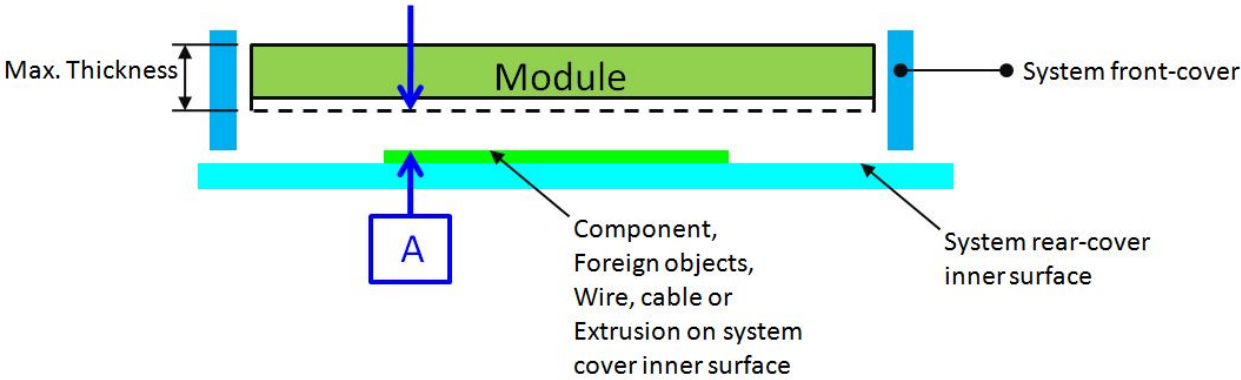
2	Tape/Sponge design on system inner surface
	 <p>The top diagram shows a cross-section of the system inner surface. A green 'Module' is mounted on a yellow 'Chassis'. A red 'Tape/Sponge' is placed between the module and the chassis. A blue 'System rear bezel' is shown on the right. The bottom two diagrams show top-down views of the module. The middle diagram, marked with a red 'X', shows four small red 'Tape/Sponge' pieces placed at the corners of the module. The bottom diagram, marked with a blue circle, shows a single large red 'Tape/Sponge' piece placed around the perimeter of the module.</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>

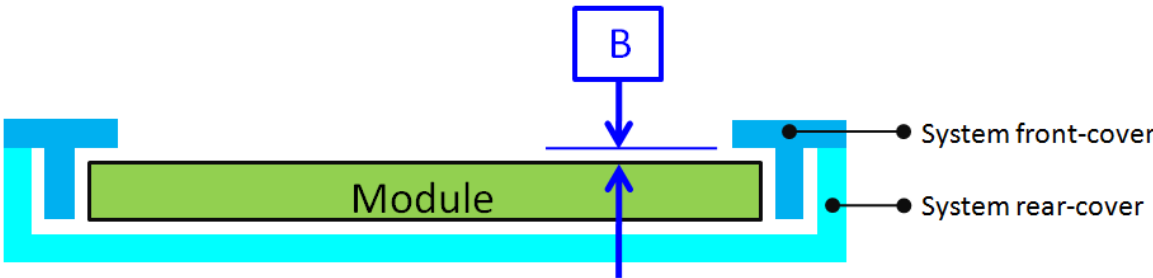
3	System inner surface examination
	
Definition	<p>a. The hatch area on Module PCBA should keep at least 1mm gap(X,Y,Z direction) to any structure with system cover inner surface.</p> <p>b. Burr, Step, PCB protrusion may cause stress concentration. White spot may occur during reliability test.</p>

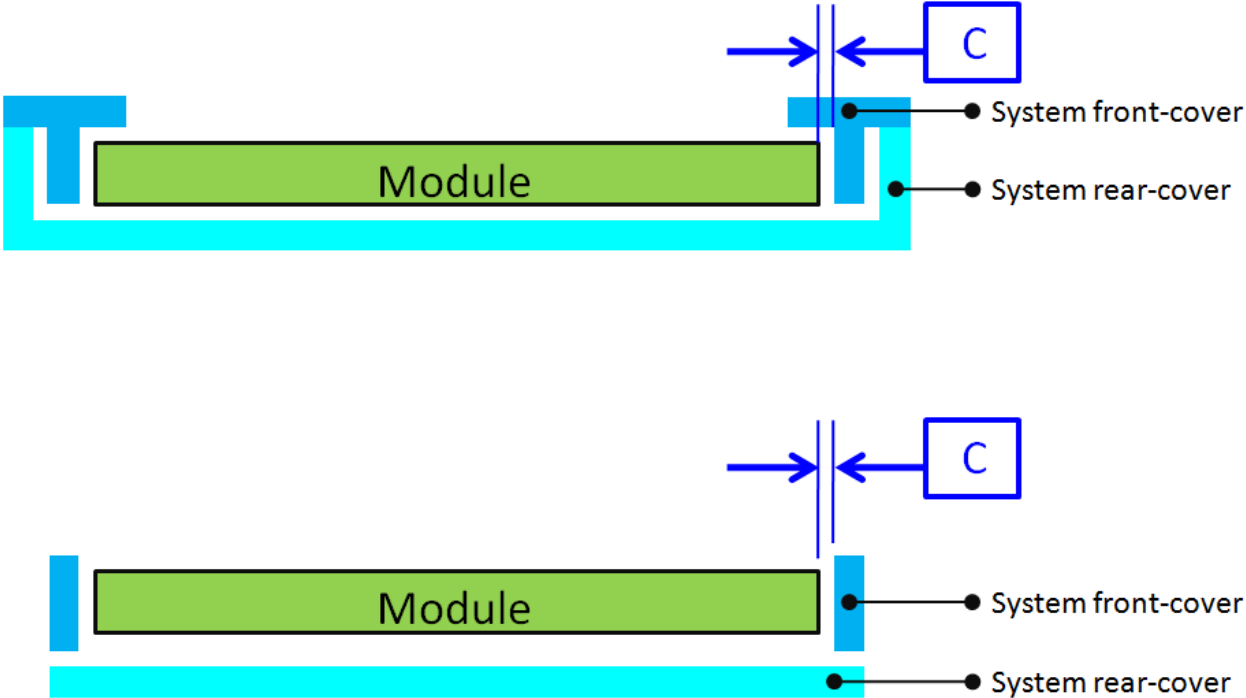
4	Material used for system rear-cover
	
Definition	<p>System rear-cover material with high rigidity is needed to resist deformation during scuffing test, hinge test, pogo test or backpack test. Abnormal display, white spot, pooling issue may occur if low rigidity material is used. Pooling issue may occur 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>

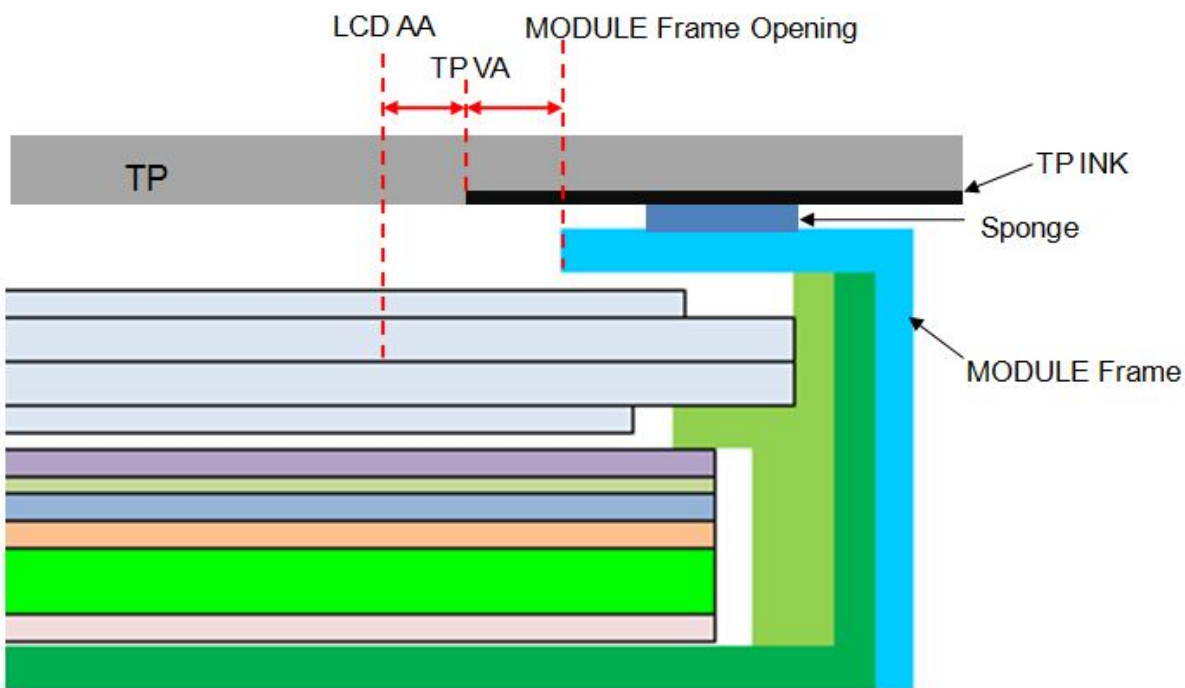
5	Assembly SOP examination for system front-cover with hook structure
	
Definition	<p>To prevent panel crack during system front-cover assembly process with hook structure, it is not recommended to press panel or any location that relate directly to the panel.</p>

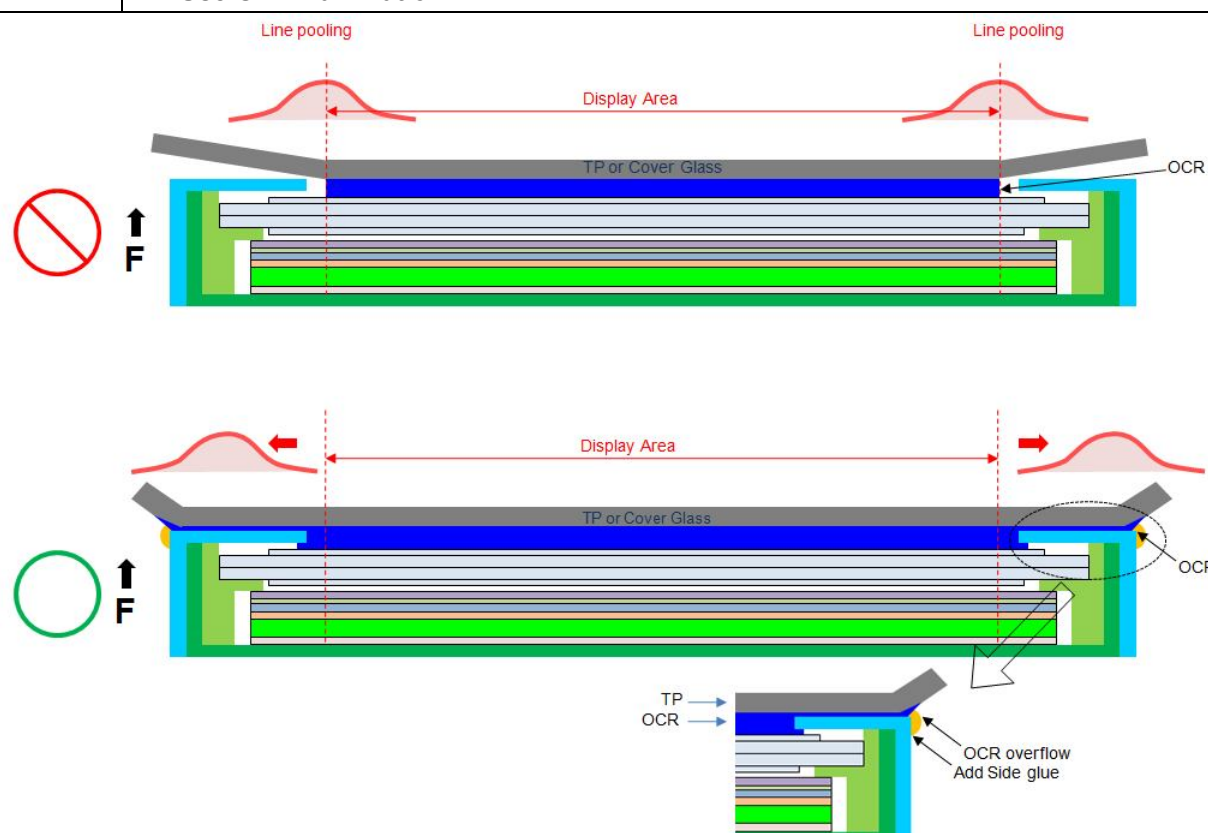
6	Permanent deformation of system cover after reliability test
<p>○</p> <p>×</p> <p>○</p> <p>×</p> <p>×</p> <p>×</p>	 <p>The diagrams illustrate various failure modes of system cover deformation:</p> <ul style="list-style-type: none"> Top diagram (Pass): Shows a green 'Module' correctly seated between a blue 'System front-cover' and a red 'System rear-cover' without any deformation. Second diagram (Fail): Marked with a red 'X', it shows the front cover deformed upwards (labeled 'deformation') and the rear cover deformed downwards (labeled 'deformation'), creating a gap around the module. Third diagram (Pass): Marked with a blue circle, it shows the module correctly seated with no deformation. Fourth diagram (Fail): Marked with a red 'X', it shows the front cover deformed inwards (labeled 'deformation') and the rear cover deformed inwards, creating a gap. Fifth diagram (Fail): Marked with a red 'X', it shows the front cover deformed inwards (labeled '0 gap') and the rear cover deformed inwards, creating a gap. Sixth diagram (Fail): Marked with a red 'X', it shows the rear cover deformed downwards (labeled 'deformation') while the front cover remains flat, creating a gap.
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>

7	Design gap A between panel & any components on system rear-cover
	
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>

8	Design gap B between system front-cover & panel surface
	
Definition	<p>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 front-cover opening edge. This phenomenon is obvious during swing test, hinge test, knock test or during pooling inspection procedure.</p> <p>To remain sufficient gap, design with system rib higher than maximum panel thickness is recommended.</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>

9	Design gap C between panel & system front-cover or protrusions
	 <p>The diagrams illustrate the required gap 'C' between the module and the system front-cover or protrusions. The top diagram shows a module (green rectangle) with a blue frame (cyan) representing the system front-cover and rear-cover. A gap 'C' is indicated between the module and the front-cover. The bottom diagram shows a similar setup but with the module positioned lower, also showing a gap 'C' between the module and the front-cover.</p>
Definition	<p>Gap between panel & system front-cover or protrusions is needed to prevent shock test failure. Because system front-cover or protrusions with small gap may hit panel during the test. Issue such as cell crack, abnormal display may occur.</p> <p>The gap should be large enough to absorb the maximum displacement during the test.</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>

10	Design distance between TP AA to LCD AA
 <p>The diagram illustrates the cross-sectional structure of a display module. Key components and their relative positions are as follows:</p> <ul style="list-style-type: none"> TP (Touch Panel): A grey layer at the top. TP VA (Touch Panel Vertical Alignment): A red double-headed arrow indicates the distance between the LCD AA and MODULE Frame Opening boundaries. LCD AA (Liquid Crystal Display Active Area): A vertical dashed line marks the left boundary. MODULE Frame Opening: A vertical dashed line marks the right boundary. TP INK: A black layer on the right side of the TP. Sponge: A blue layer below the TP INK. MODULE Frame: A green layer at the bottom. 	
Definition	TP VA should avoid TP ink area covering LCD AA or causing the module frame to be exposed.

11	Use OCR Lamination
 <p>The diagram illustrates the correct use of OCR Lamination to avoid line pooling. It shows a cross-section of a display module with a red 'X' and a red circle with a diagonal line, indicating that line pooling is incorrect. The bottom part shows a cross-section with a green circle and an upward arrow 'F', indicating that the correct method is to use OCR Lamination. The diagram labels the 'Display Area', 'TP or Cover Glass', and 'OCR'. A detailed inset shows the 'OCR overflow' and 'Add Side glue' process.</p>	
Definition	<ol style="list-style-type: none"> 1.OCR glue as possible beyond module, in order to avoid Line Pooling 2.Add side glue to avoid Line Pooling

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