

- Tentative Specification
- Preliminary Specification
- Approval Specification

MODEL NO.: G101ICE
SUFFIX: LM1

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

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REVISION HISTORY

[illegible]

1. GENERAL DESCRIPTION

1.1 OVERVIEW

G101ICE-LM1 is a 10.1" TFT Liquid Crystal Display module with LED Backlight units and 30 pins LVDS interface. This module supports 1280 x 800 WXGA mode and can display 16.7M/ 262k colors. The LED driving device for Backlight is built in PCBA.

1.2 FEATURE

- WXGA (1280 x 800 pixels) resolution
- DE (Data Enable) only mode
- LVDS Interface with 1pixel/clock
- Wide operating temperature.
- RoHS compliance

1.3 APPLICATION

- TFT LCD Monitor
- Factory Application
- Amusement

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	216.96 (H) x 135.60 (V) (10.1" diagonal)	mm	(1)
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	1280 x R.G.B x 800	pixel	-
Pixel Pitch	0.1695 (H) x 0.1695 (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	(3.0)	W	Typ.

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	226.92	227.42	227.92	mm	(1)
	Vertical(V)	147.19	147.69	148.19	mm	
	Depth(D)	-	2.55(w/o PCBA) 4.35(w/PCBA)	2.8 4.85	mm	
CF Polarizer	Horizontal	219.06	219.31	219.56	mm	-
	Vertical	138.0	138.25	138.50	mm	
Active Area	Horizontal	216.86	216.96	217.06	mm	
	Vertical	135.50	135.60	135.70	mm	
Weight		-	(183)	(190)	g	

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

2. ABSOLUTE MAXIMUM RATINGS

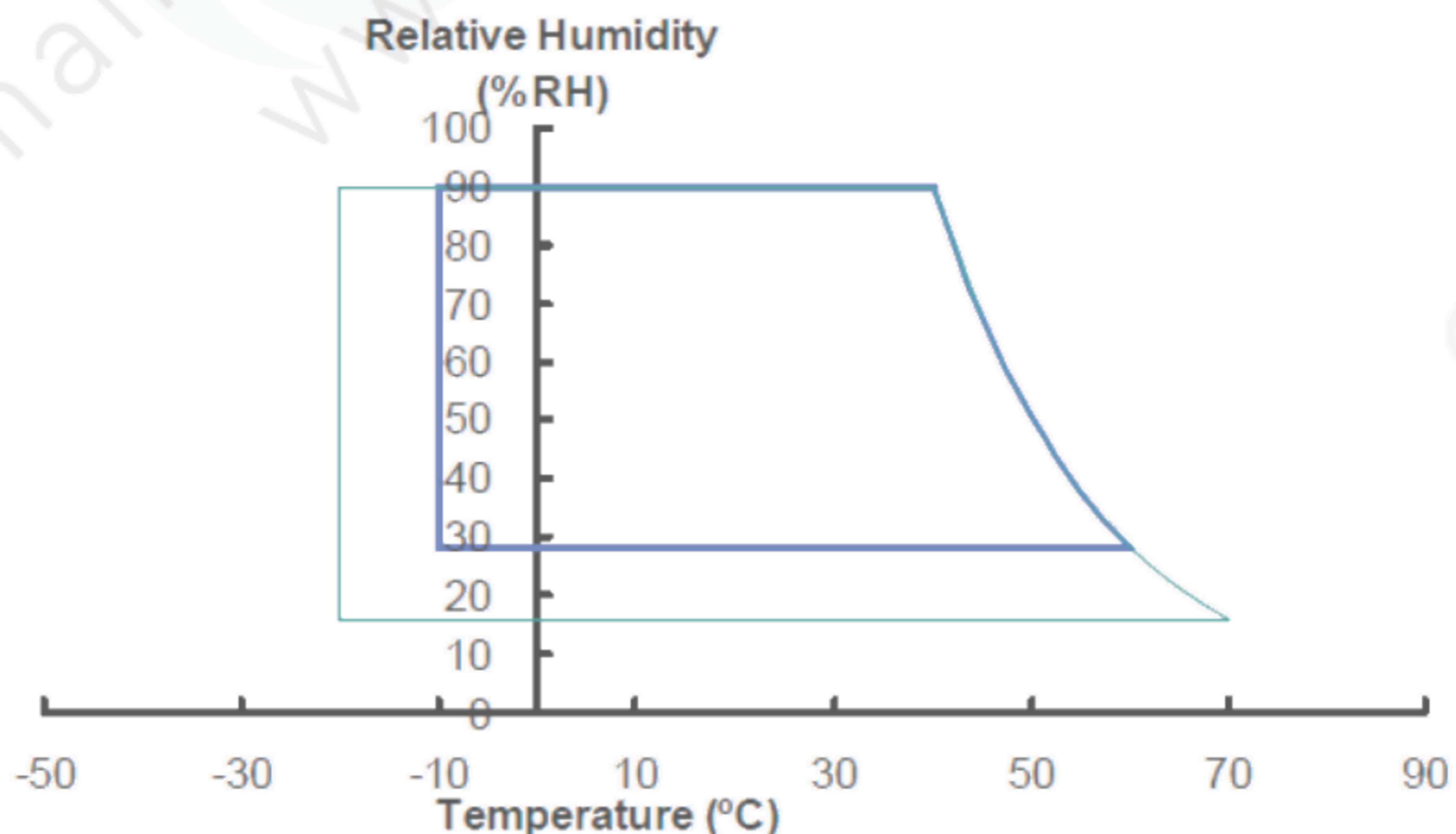
2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Operating Ambient Temperature	T _{OP}	-10	+60	°C	(1)(2)
Storage Temperature	T _{ST}	-20	+70	°C	

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

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

Note (2) Any condition of ambient operating temperature ,the surface of active area should be keeping not higher than 60°C.(Panel surface temperature).



2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCC	-0.3	5.5	V	(1)
Logic Input Voltage	V _{IN}	-0.3	4.0	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	-0.3	5.5	V	
Backlight Adjust	Dimming	-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 (Refer to 3.2 for further information).

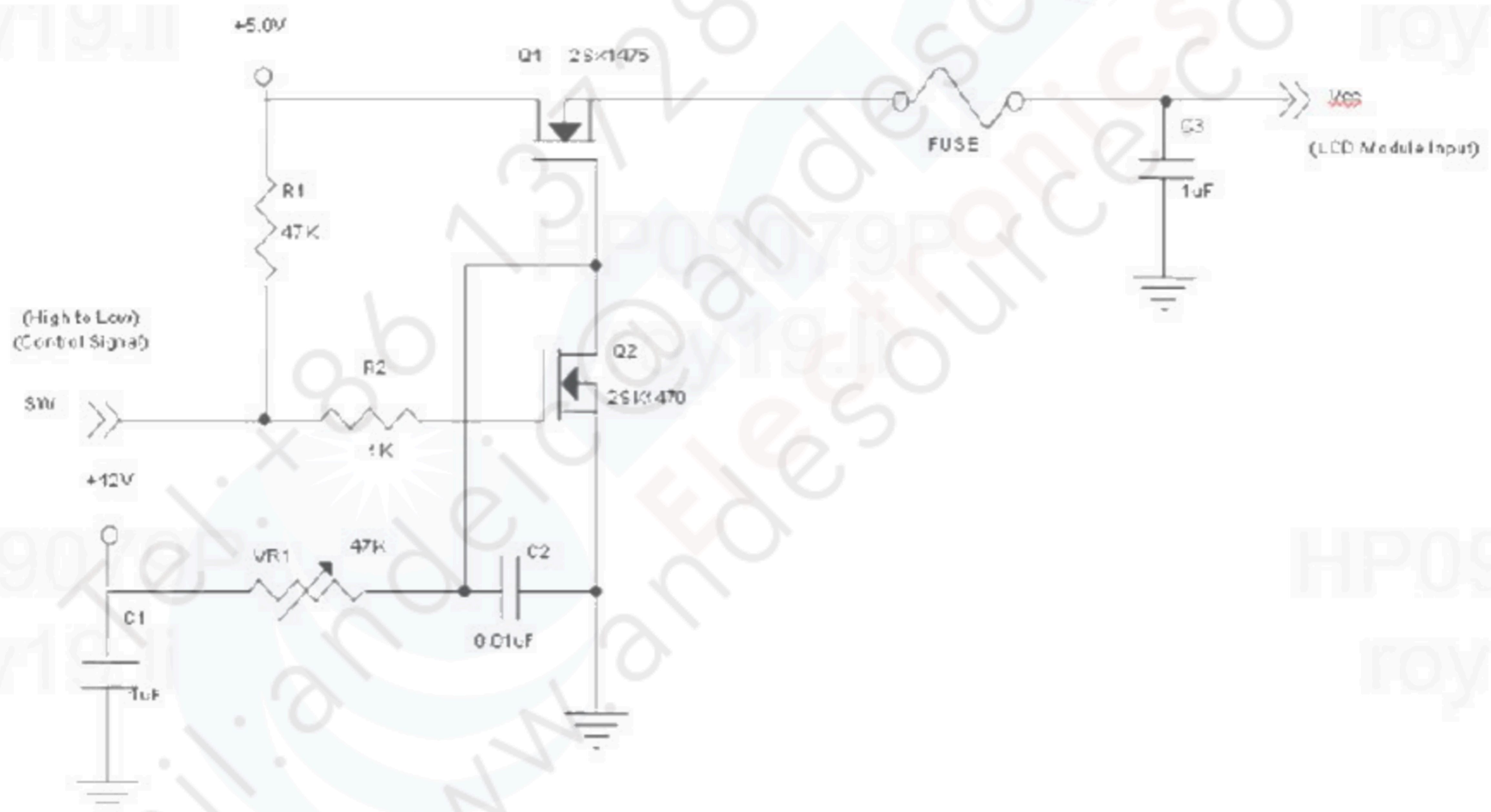
3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

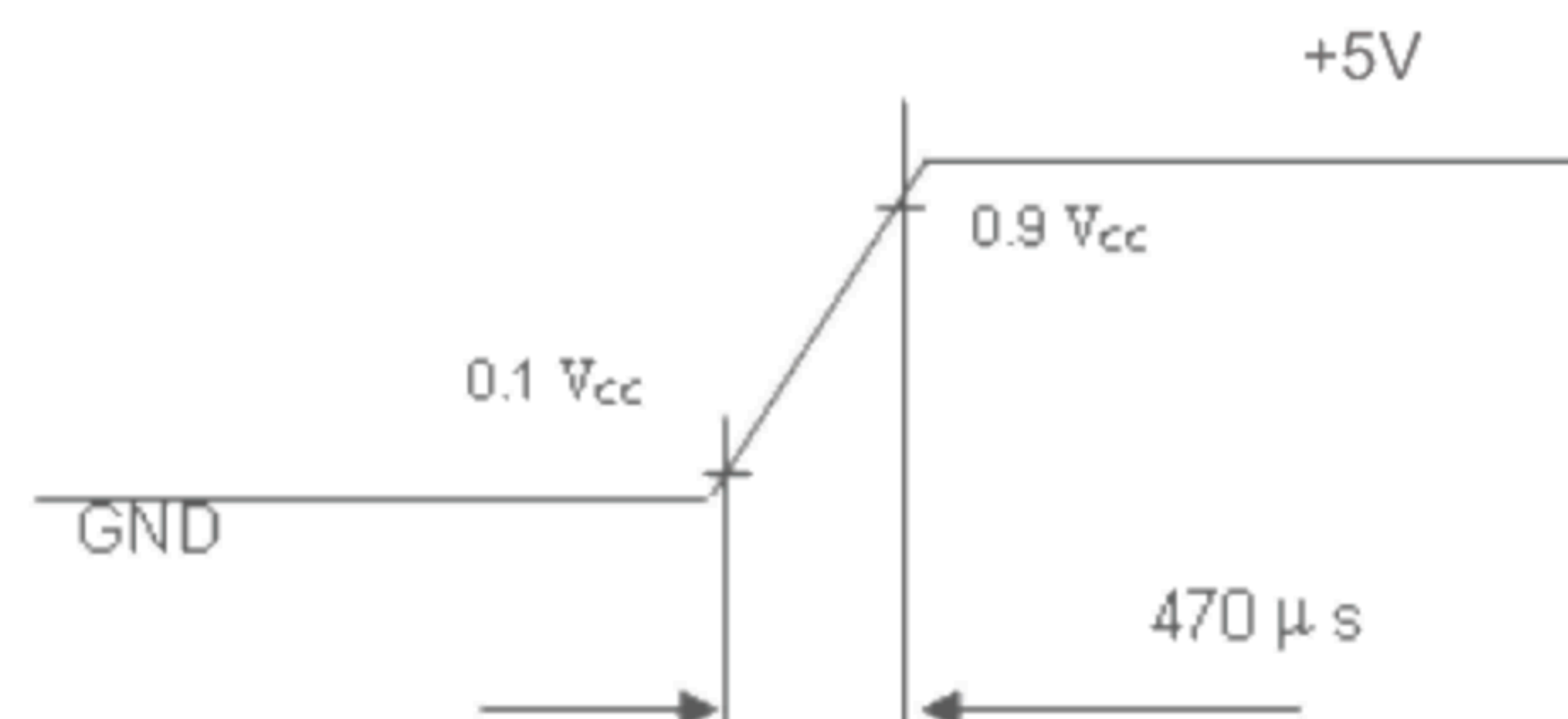
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V_{CC}	4.5	5	5.5	V	-
Ripple Voltage	V_{RP}	-	-	(300)	mVp-p	
Inrush Current	I_{INRUSH}	-	-	(3.0)	A	(2)
Power Supply Current	White		(150)	(200)	mA	(3)a
	Black		(140)	(190)	mA	(3)b
LVDS differential input voltage	V_{id}	200	-	600	mV	(5)
LVDS common input voltage	V_{ic}	1.0	1.2	1.4	V	(5)
Differential Input Voltage for LVDS Receiver Threshold	"H" Level	V_{IH}	-	100	mV	-
	"L" Level	V_{IL}	-100	-	mV	-
Terminating Resistor	R_T	-	100	-	Ohm	-

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

Note (2) Measurement Conditions:



Vcc 上升時間為 470μs



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

a. White Pattern



Active Area

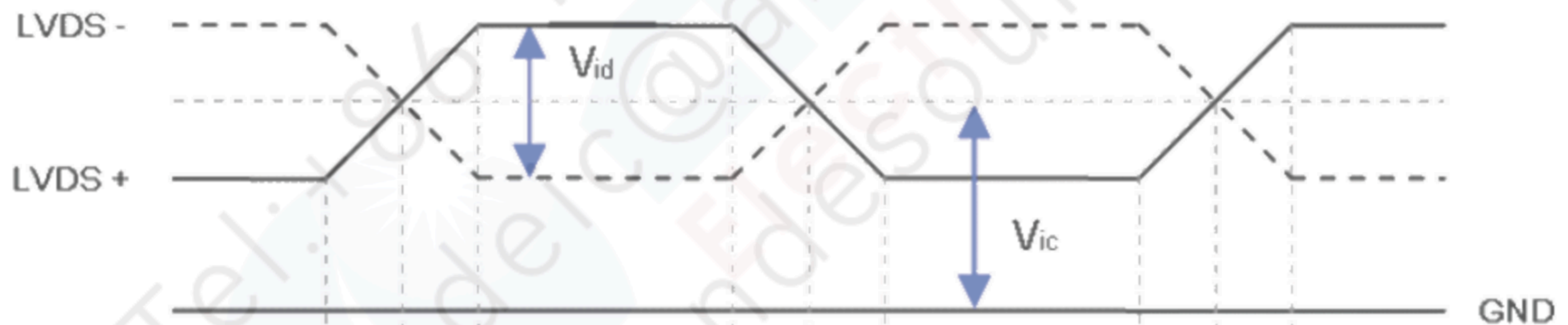
b. Black Pattern



Active Area

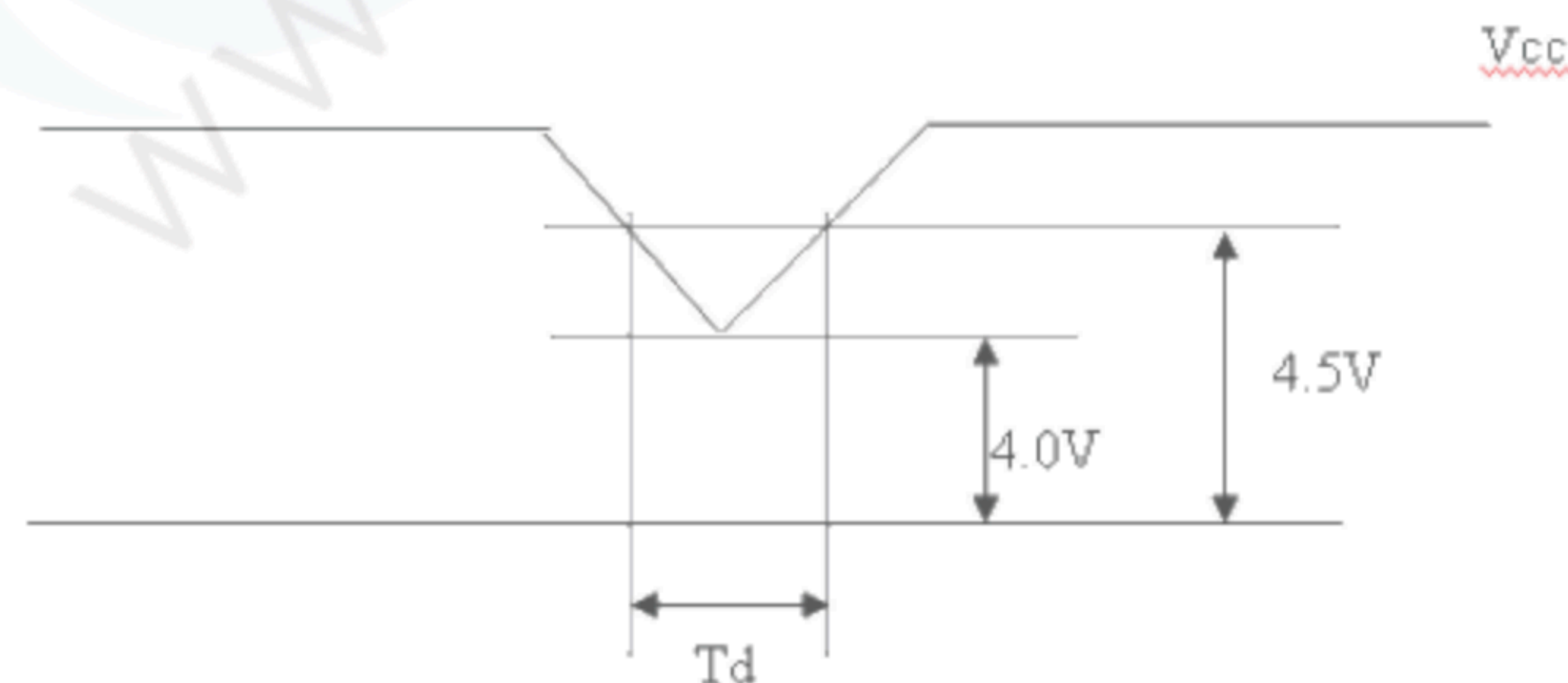
Note (4) The power consumption is specified at the pattern with the maximum current.

Note (5) VID waveform condition



3.2 Vcc Power Dip Condition

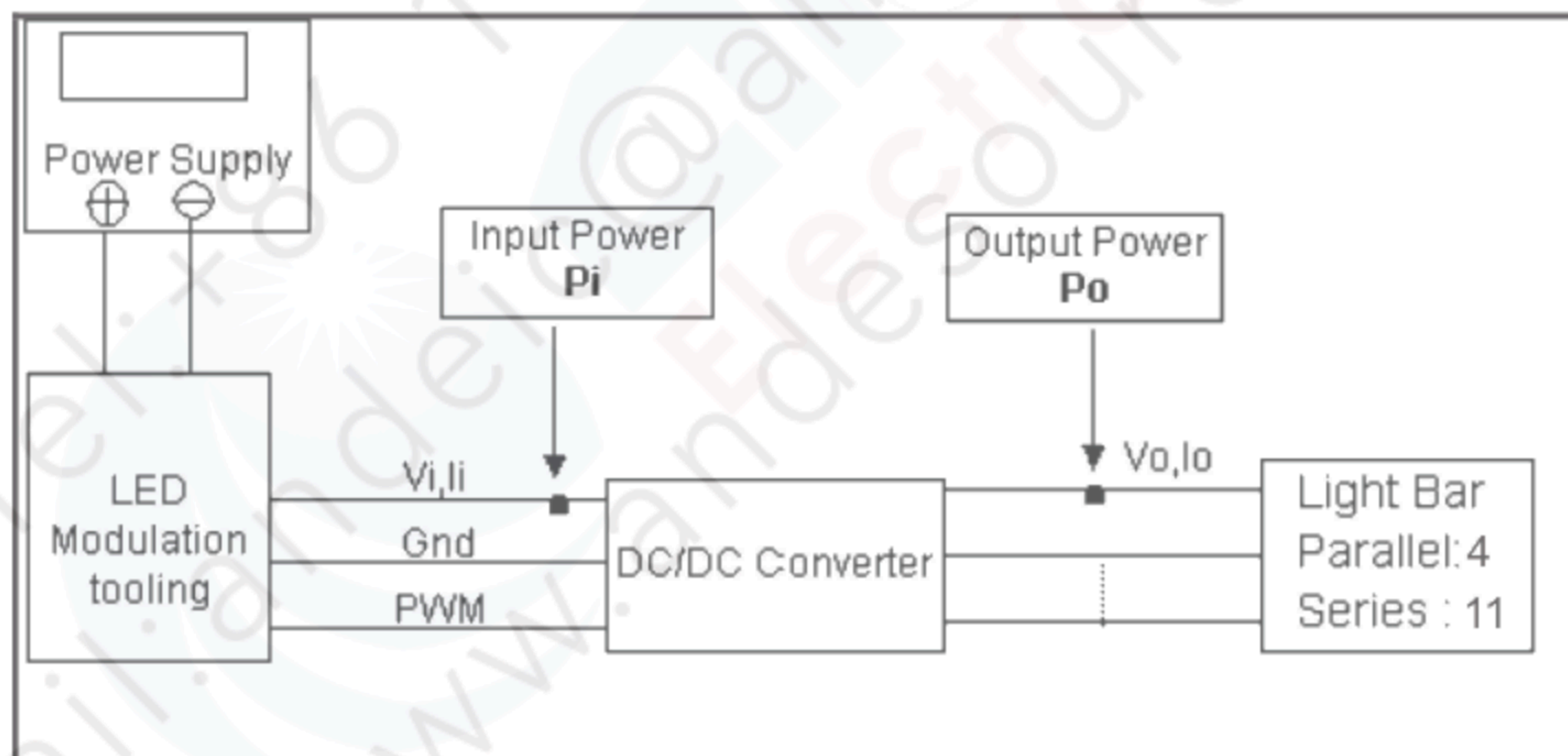
- Dip condition: $4.0V \leq V_{cc} \leq 4.5V$, $T_d \leq 20ms$



3.3 BACKLIGHT UNIT

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Input Voltage		V_i	10.8	12.0	13.2	V_{DC}	(Duty 100%)
Converter Input Ripple Voltage		V_{IRP}	-	-	350	mV	
Converter Input Current		I_i	-	(0.17)	(0.2)	A_{DC}	@ $V_i = 12V$ (Duty 100%)
Converter Inrush Current		I_{IRUSH}	-	-	3.0	A	@ V_i rising time = 20ms ($V_i = 12V$)
Input Power Consumption		P_i	-	(2.0)	(2.4)	W	(1), @ $V_i = 12V$ (Duty 100%)
EN Control Level	Backlight on	ENLED (BLON)	2.5	3.3	5.0		
	Backlight off		0	---	0.3		
PWM Control Level	PWM High Level	Dimming (E_PWM)	2.5	3.3	5.0		
	PWM Low Level		0	-	0.15		
PWN Noise Range		V_{Noise}	-	-	0.1	V	
PWM Control Frequency		f_{PWM}	190	200	20k	Hz	(2)
PWM Dimming Control Duty Ratio		-	5		100	%	(2), Suggestion@ $190Hz \leq f_{PWM} < 1kHz$
			20	-	100	%	(2), @ $1kHz \leq f_{PWM} \leq 20kHz$
LED Life Time		L_{LED}	12,000	-	-	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 5% to 100%.

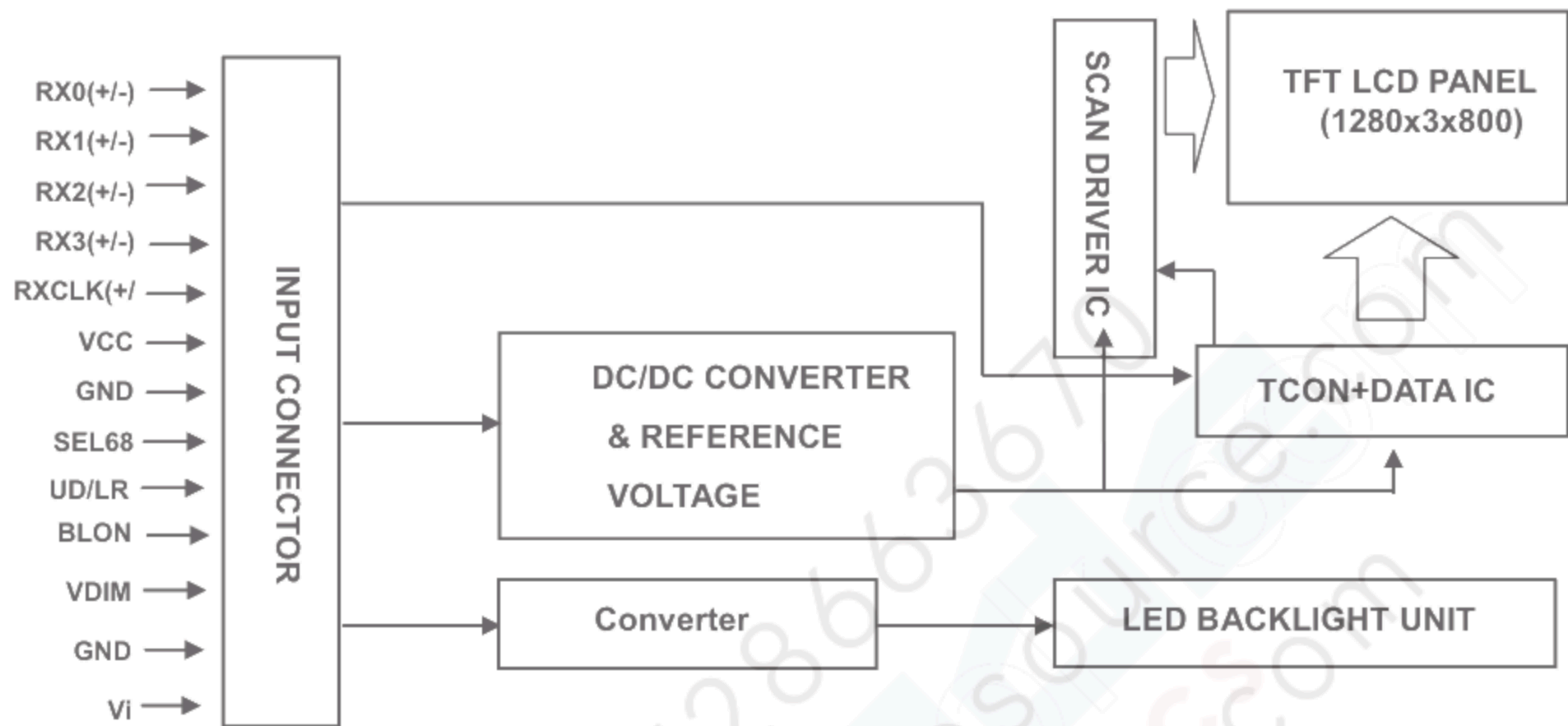
1K ~20kHz PWM control frequency, duty ratio range is restricted from 20% to 100%.

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 $T_a = 25 \pm 2^\circ C$ 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.

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	VCC	Power supply 5V		(5)
2	VCC	Power supply 5V		
3	UD/LR	Reverse Scan Control, Low or NC à Normal Mode. High à Reverse Scan		(3)(4)
4	NC	Not connection, this pin should be open		
5	NC	Not connection, this pin should be open		
6	SEL68	LVDS 6/8 bit select function control, Low or NC → 6 bit Input Mode.High → 8bit Input Mode.		(3)(4)
7	NC	Not connection, this pin should be open		
8	NC	Not connection, this pin should be open		
9	LED_VCC	Converter input voltage 12V		
10	LED_VCC	Converter input voltage 12V		
11	LED_VCC	Converter input voltage 12V		
12	NC	Not connection, this pin should be open		
13	LED_GND	Converter ground		
14	LED_GND	Converter ground		
15	LED_GND	Converter ground		
16	LED_EN	Enable pin 3.3V		
17	LED_PWM	Backlight Adjust (PWM Dimming 190-210Hz,H: 3.3VDC, L: 0VDC)		
18	NC	Not connection, this pin should be open		
19	GND	Ground		
20	RXO3+	Positive LVDS differential data input. Channel O3	Positive	
21	RXO3-	Negative LVDS differential data input. Channel O3	Negative	
22	RXOC+	Positive LVDS differential clock input.	Positive	
23	RXOC-	Negative LVDS differential clock input.	Negative	
24	GND	Ground		
25	RXO2+	Positive LVDS differential data input. Channel O2	Positive	
26	RXO2-	Negative LVDS differential data input. Channel O2	Negative	
27	RXO1+	Positive LVDS differential data input. Channel O1	Positive	
28	RXO1-	Negative LVDS differential data input. Channel O1	Negative	
29	RXO0+	Positive LVDS differential data input. Channel O0	Positive	
30	RXO0-	Negative LVDS differential data input. Channel O0	Negative	

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

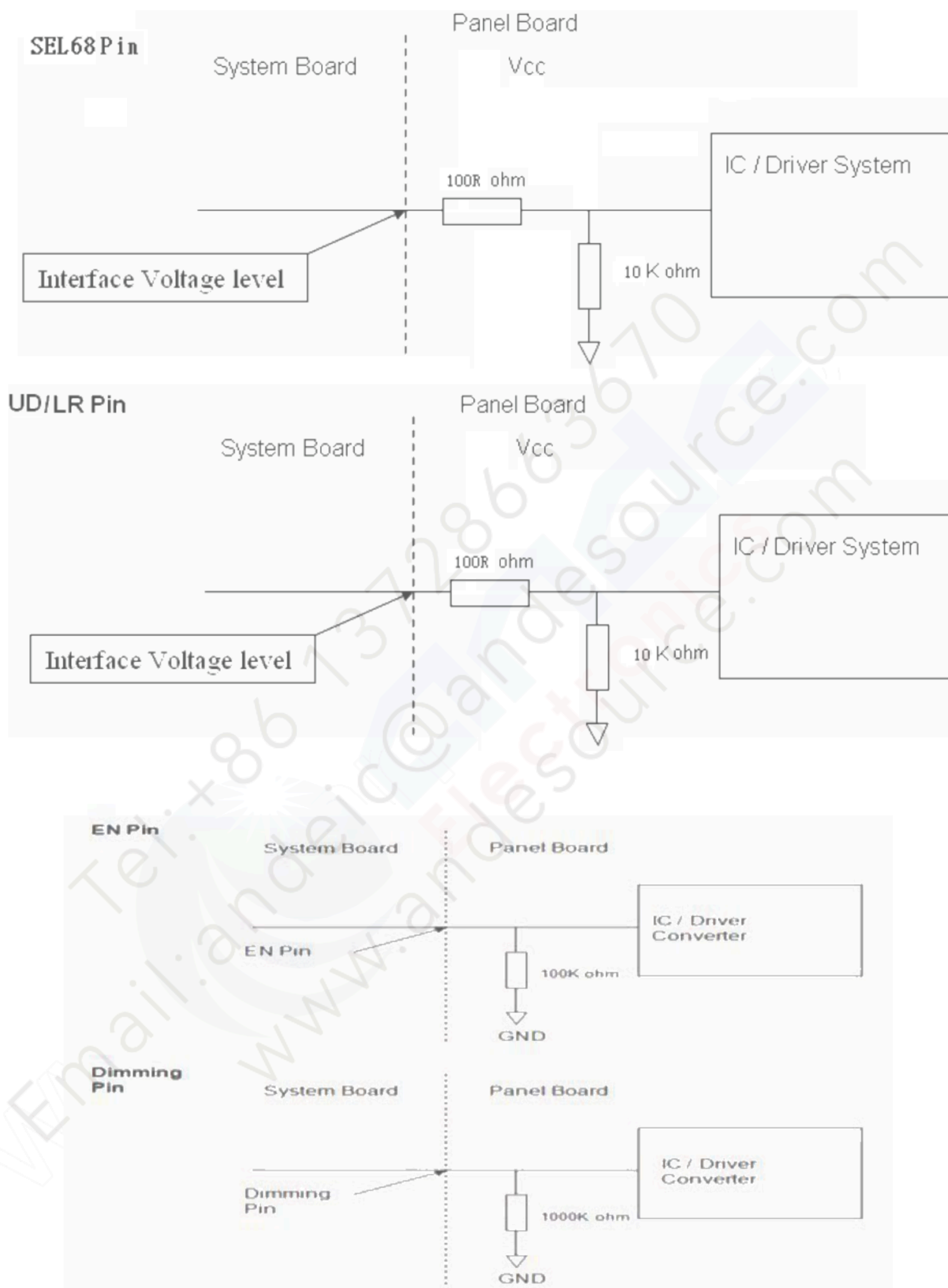
Note (2) User's connector Part No.: **I-PEX 20453-030T-03 or equivalent**

Note (3) "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connection".

Note (4) Interface optional pin has internal scheme as following diagram, Customer should keep the interface voltage level requirement which including panel board loading as below.

Note (5) Pin1 location is Power supply 5V to comply with **MECHANICAL CHARACTERISTICS.**





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
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	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
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	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

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

6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

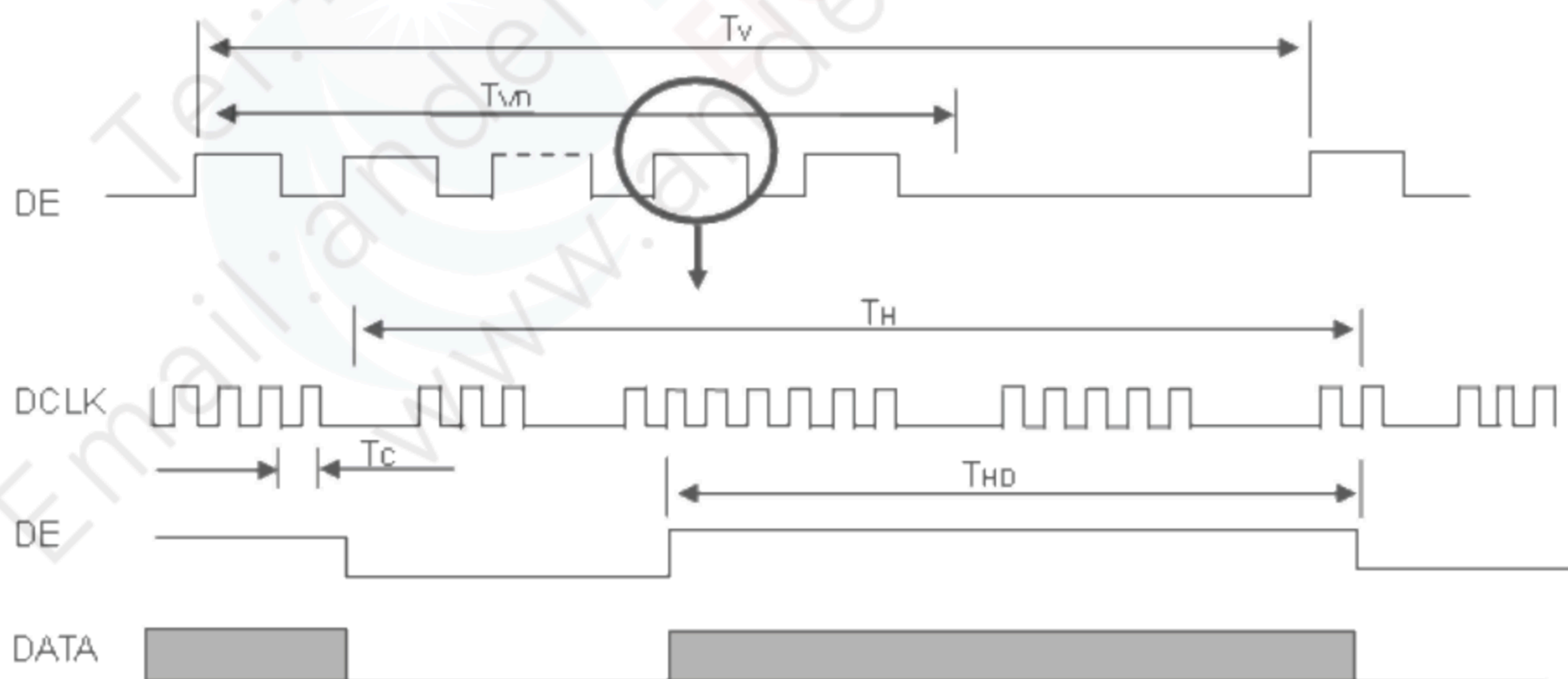
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	F_c	(60.40)	71.1	(74.7)	MHz	-
	Period	T_c	(16.55)	14.06	(13.38)	ns	
	Input cycle to cycle jitter	T_{rcl}	---	---	200	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}	-	-	200	KHz	
Vertical Display Term	Frame Rate	F_r	(50)	60	(60)	Hz	$T_v = T_{vd} + T_{vb}$
	Total	T_v	(810)	823	(900)	Th	-
	Active Display	T_{vd}	800	800	800	Th	-
	Blank	T_{vb}	10	23	(100)	Th	-
Horizontal Display Term	Total	T_h	(1362)	1440	(1480)	Tc	$T_h = T_{hd} + T_{hb}$
	Active Display	T_{hd}	1280	1280	1280	Tc	-
	Blank	T_{hb}	(82)	160	(170)	Tc	-

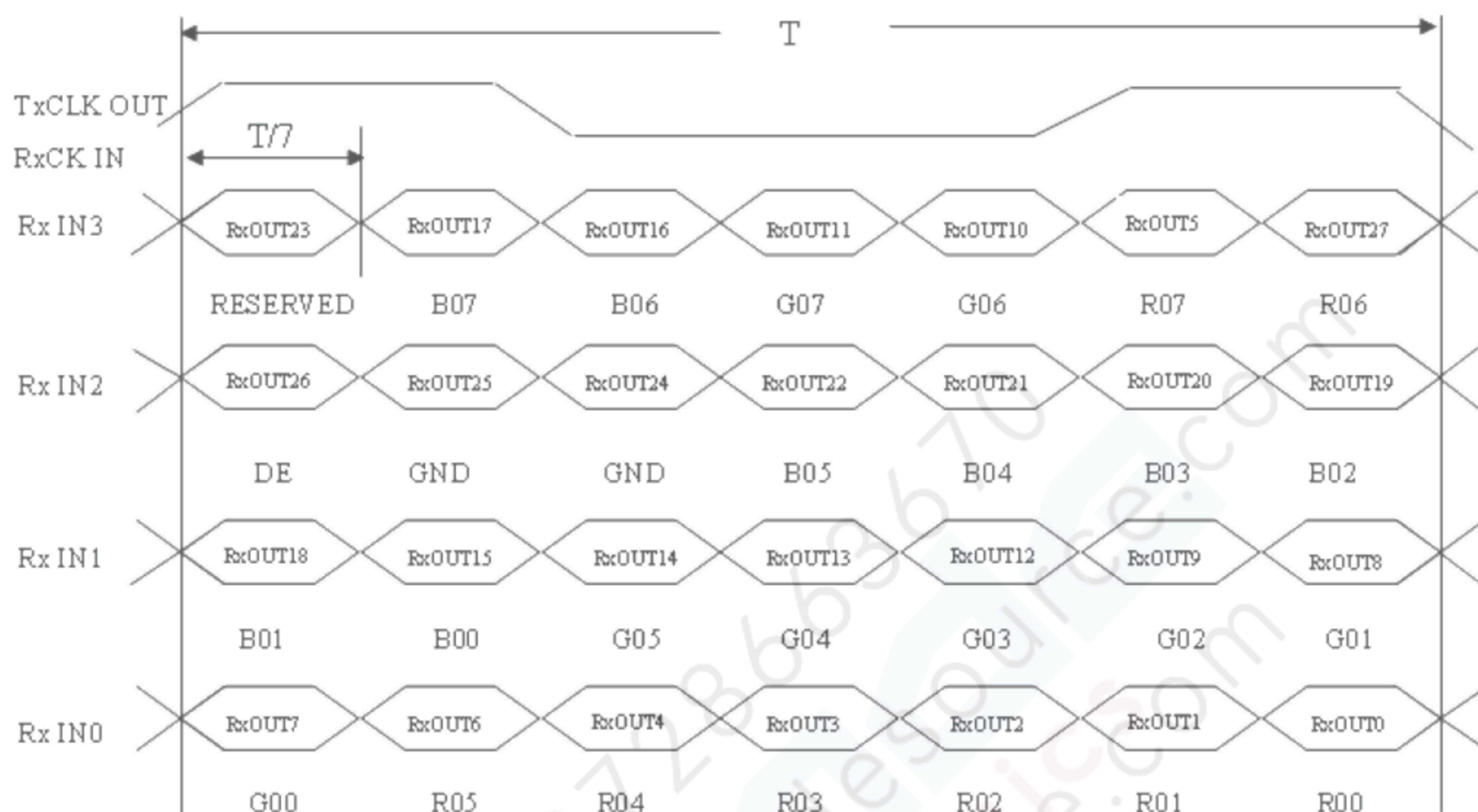
Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

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

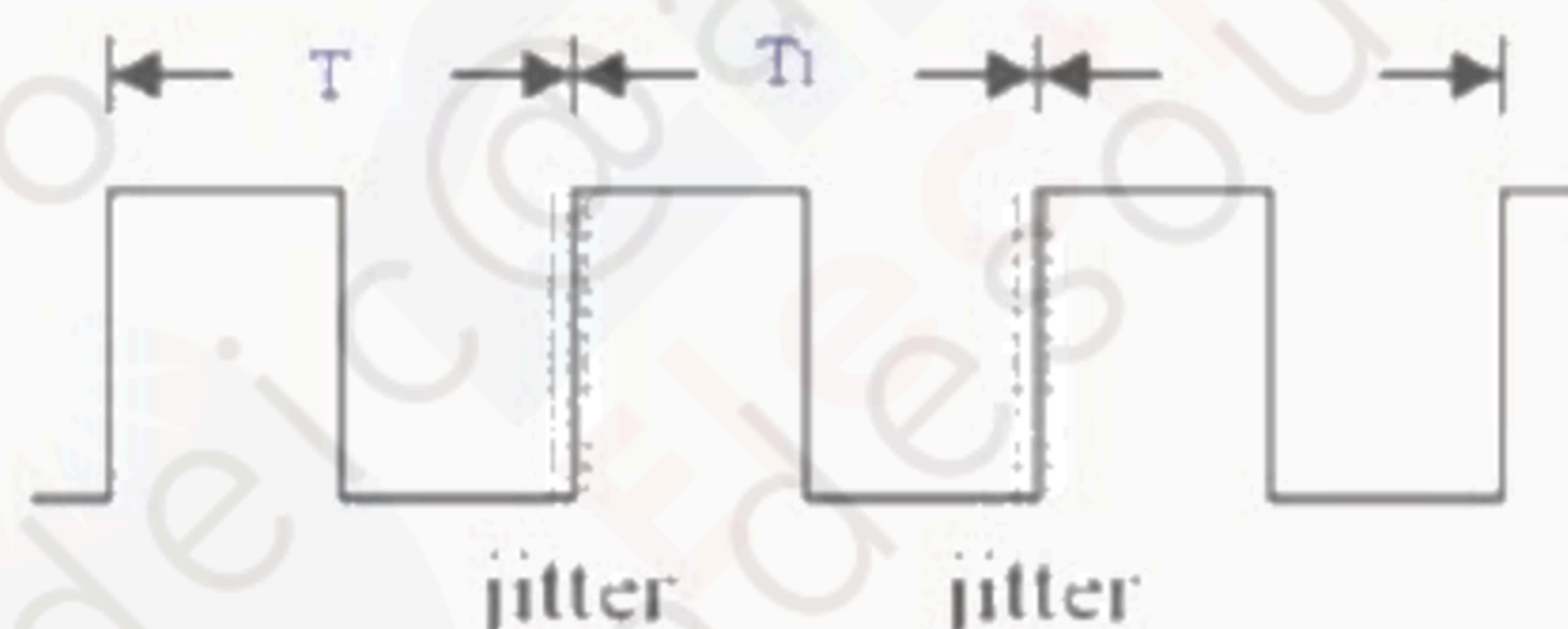
INPUT SIGNAL TIMING DIAGRAM



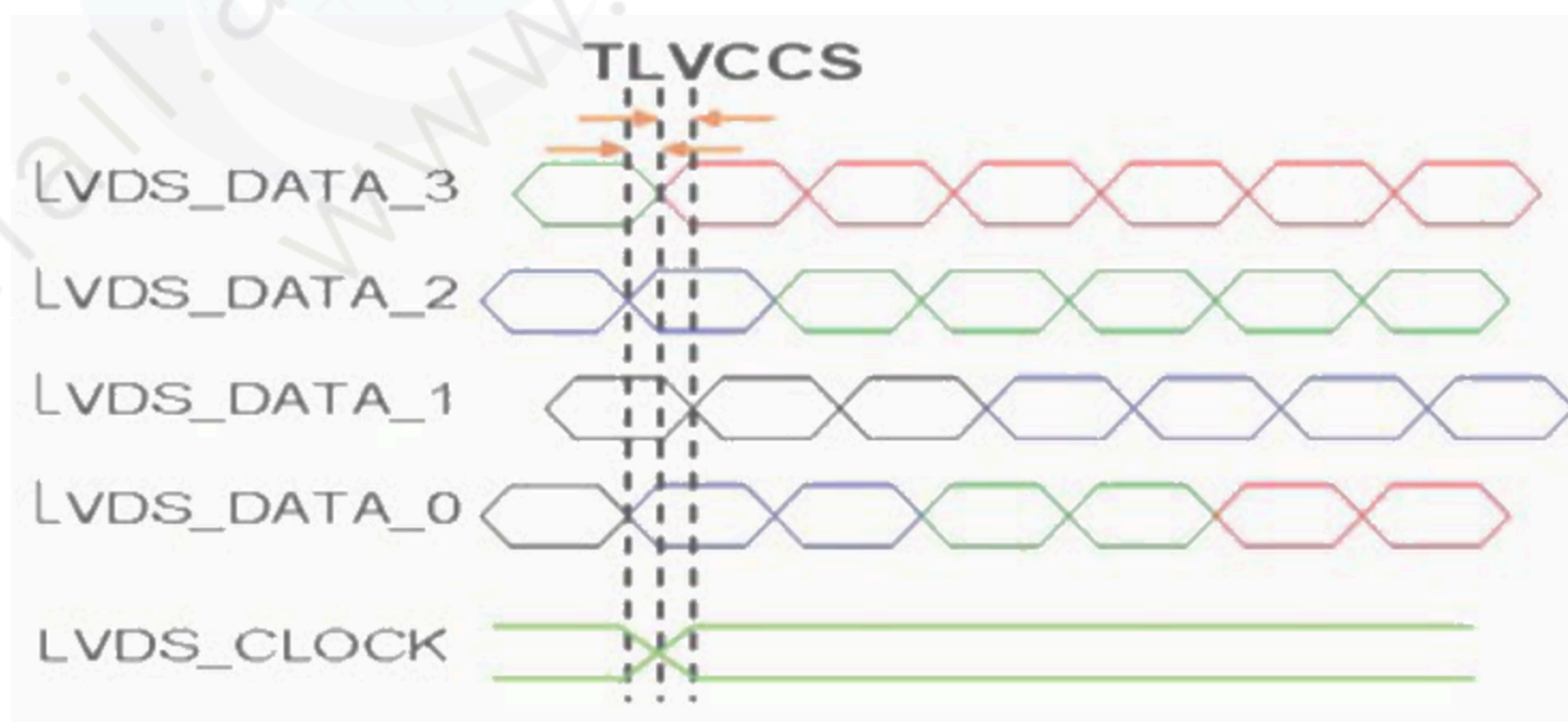
TIMING DIAGRAM of LVDS



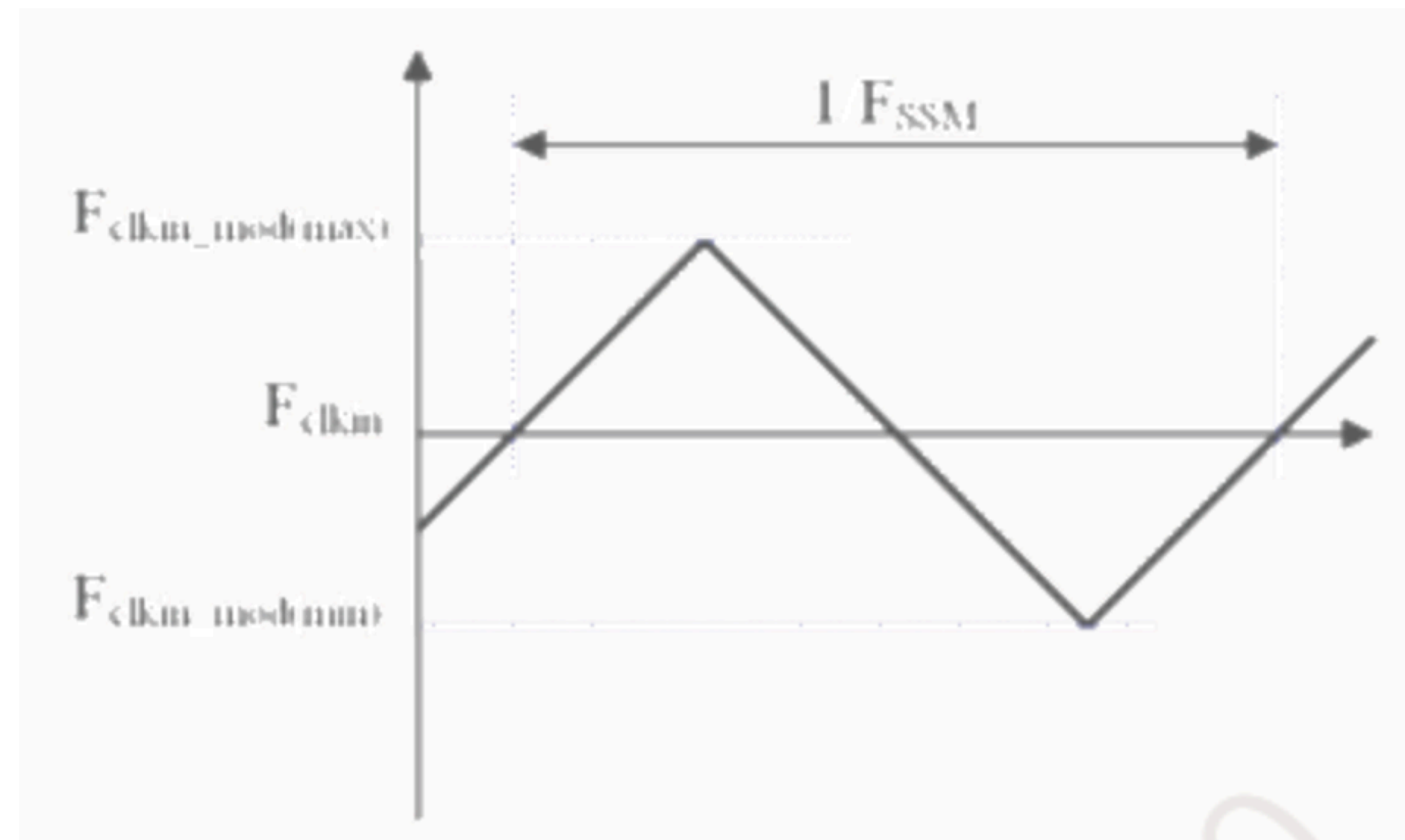
Note (a) The input clock cycle-to-cycle jitter is defined as below figures. $T_{rel} = |T_1 - T|$



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

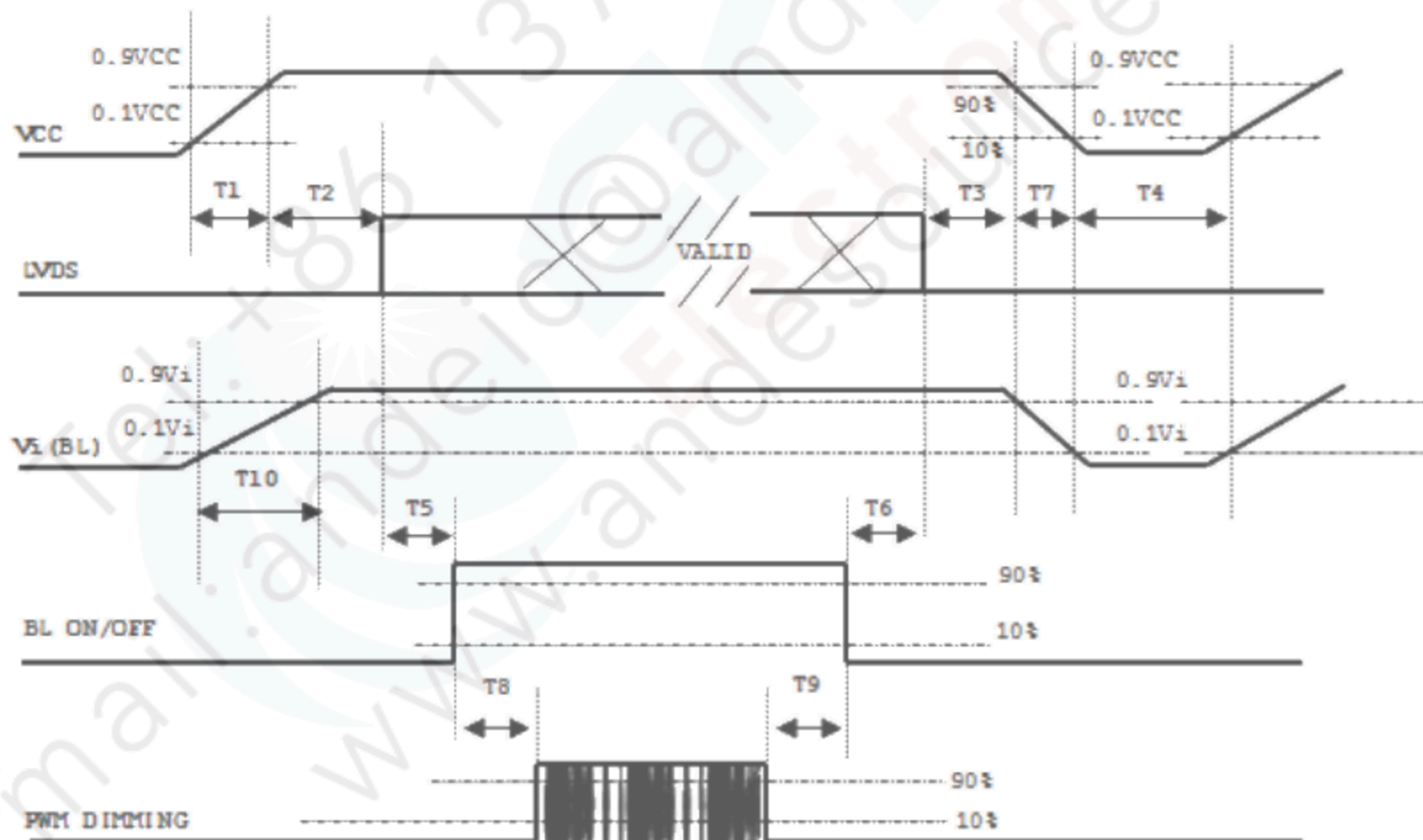


Note (c) The SSCG (Spread spectrum clock generator) is defined as below figures.



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

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

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

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

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

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

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

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

Fig.2 Reverse Scan



PCBA on the bottom side

Fig. 1 Normal scan (pin 28, UD/LR = Low or NC)

Fig. 2 Reverse scan (pin 28, UD/LR = High)

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
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	(0.599)	(0.649)	(0.699)	-	(1), (5)
		Ry	(0.290)	(0.340)	(0.390)		
	Green	Gx	(0.270)	(0.320)	(0.370)		
		Gy	(0.556)	(0.606)	(0.656)		
	Blue	Bx	(0.099)	(0.149)	(0.199)		
		By	(0.005)	(0.055)	(0.105)		
	White	Wx	(0.263)	(0.313)	(0.363)		
		Wy	(0.279)	(0.329)	(0.379)		
Center Luminance of White	LC	$\theta X=0^\circ, \theta Y=0^\circ$ Grayscale Maximum	(300)	(350)	-	nits	(4), (5)
Contrast Ratio	CR		(600)	(800)	-	-	(2), (5)
Response Time	TR	$\theta X=0^\circ, \theta Y=0^\circ$	-	(13)	(18)	-	(3)
	TF		-	(12)	(17)	-	
White Variation	δW	$\theta X=0^\circ, \theta Y=0^\circ$	(80)	-	-	%	(5), (6)
Viewing Angle	Horizontal	$\theta X+$	(80)	(88)	-	Deg.	(1), (5)
		$\theta X-$	(80)	(88)	-		
	Vertical	$\theta Y+$	(80)	(88)	-		
		$\theta Y-$	(80)	(88)	-		

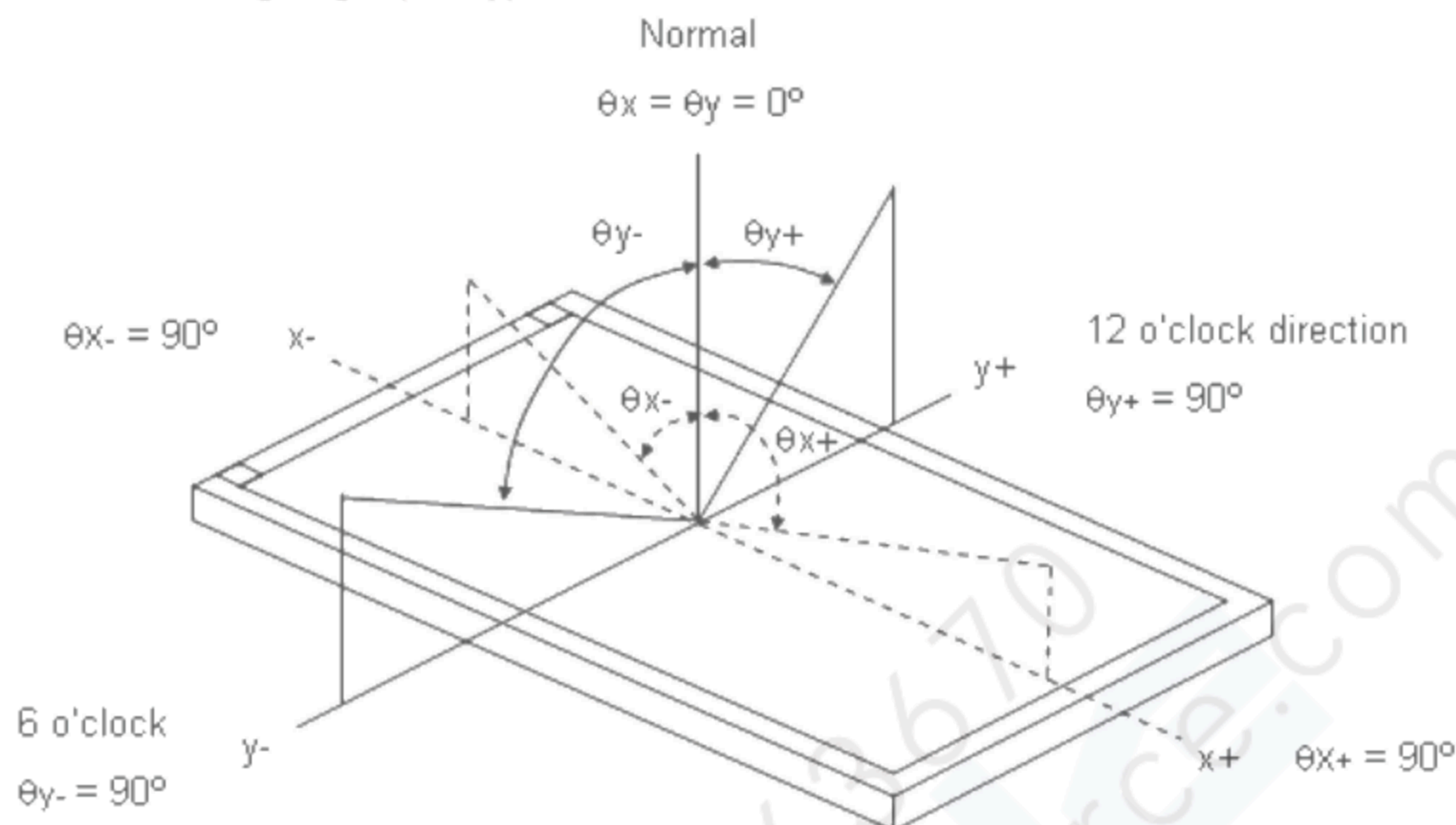
Definition :

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):

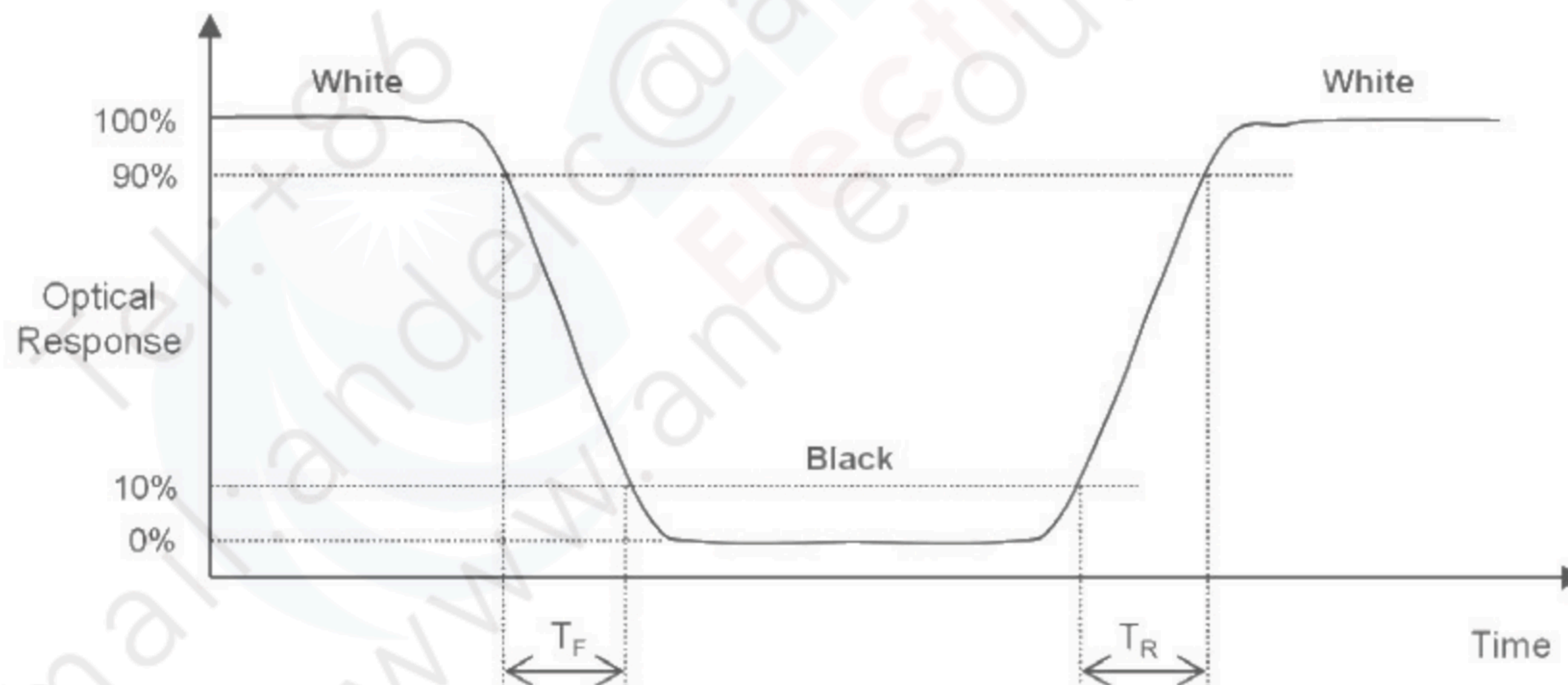


Note (2) Definition of Contrast Ratio (CR):

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

Contrast Ratio (CR) = White / Black

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

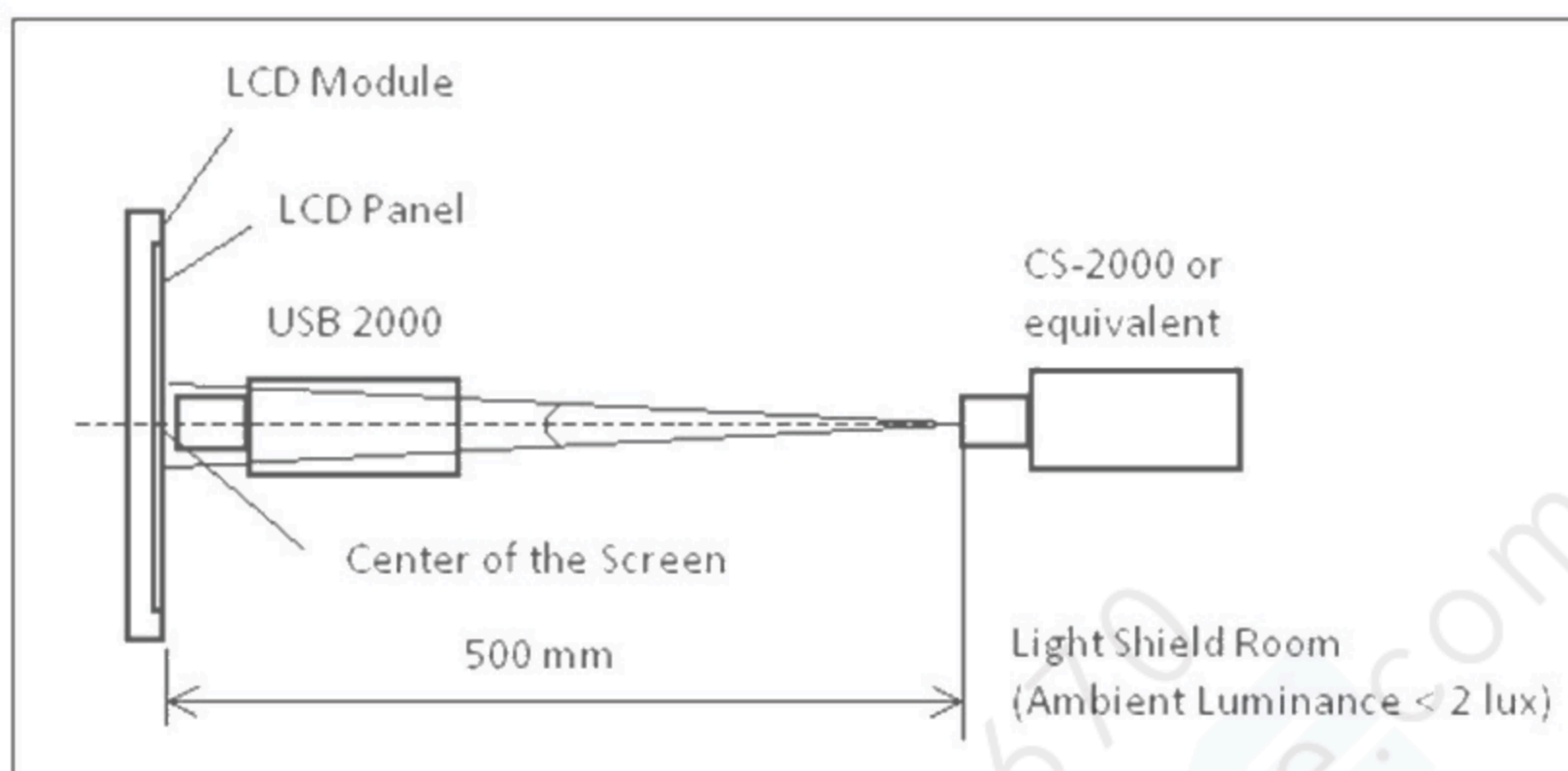


Note (4) Definition of Luminance of White (L_C):

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.

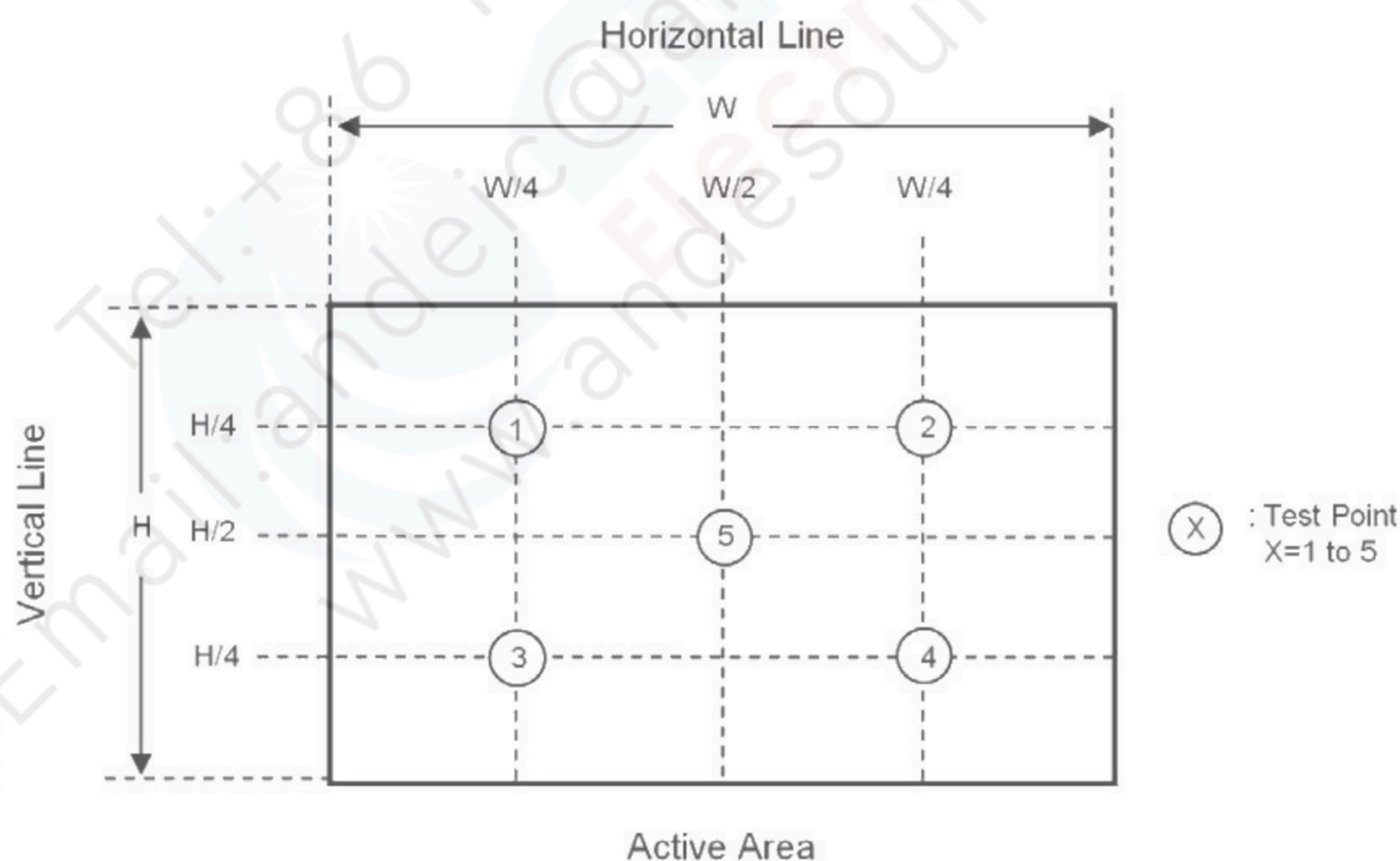


Note (6) Definition of White Variation (δW):

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	70°C , 240 hours	(1),(2) (4),(5)
Low Temperature Storage Test	-20°C , 240 hours	
Thermal Shock Storage Test	-20°C , 0.5 hour \longleftrightarrow 70°C , 0.5 hour; 100cycles, 1 hour/cycle)	
High Temperature Operation Test	60°C , 240 hours	
Low Temperature Operation Test	-10°C , 240 hours	
High Temperature & High Humidity Operation Test	50°C , RH 80%, 240 hours	(1), (4)
ESD Test (Operation)	150pF, 330Ω, 1 sec/cycle Condition 1 : Contact Discharge, $\pm 8\text{KV}$ Condition 2 : Air Discharge, $\pm 15\text{KV}$	
Shock (Non-Operating)	50G, 11ms, half sine wave, 1 time for $\pm X$, $\pm Y$, $\pm Z$ direction	
Vibration (Non-Operating)	1.5G, 10 ~ 300 Hz sine wave, 10 min/cycle, 3 cycles each X, Y, Z direction	(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 **60°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) 28pcs LCD modules / 1 Box
- (2) Box dimensions: 435(L) X 350 (W) X 275 (H) mm
- (3) Weight: approximately (12)Kg (28 modules per box)

9.2 PACKING METHOD

- (1) Box Dimensions : 435(L)*350(W)*275(H)
- (2) 28 Modules/Carton

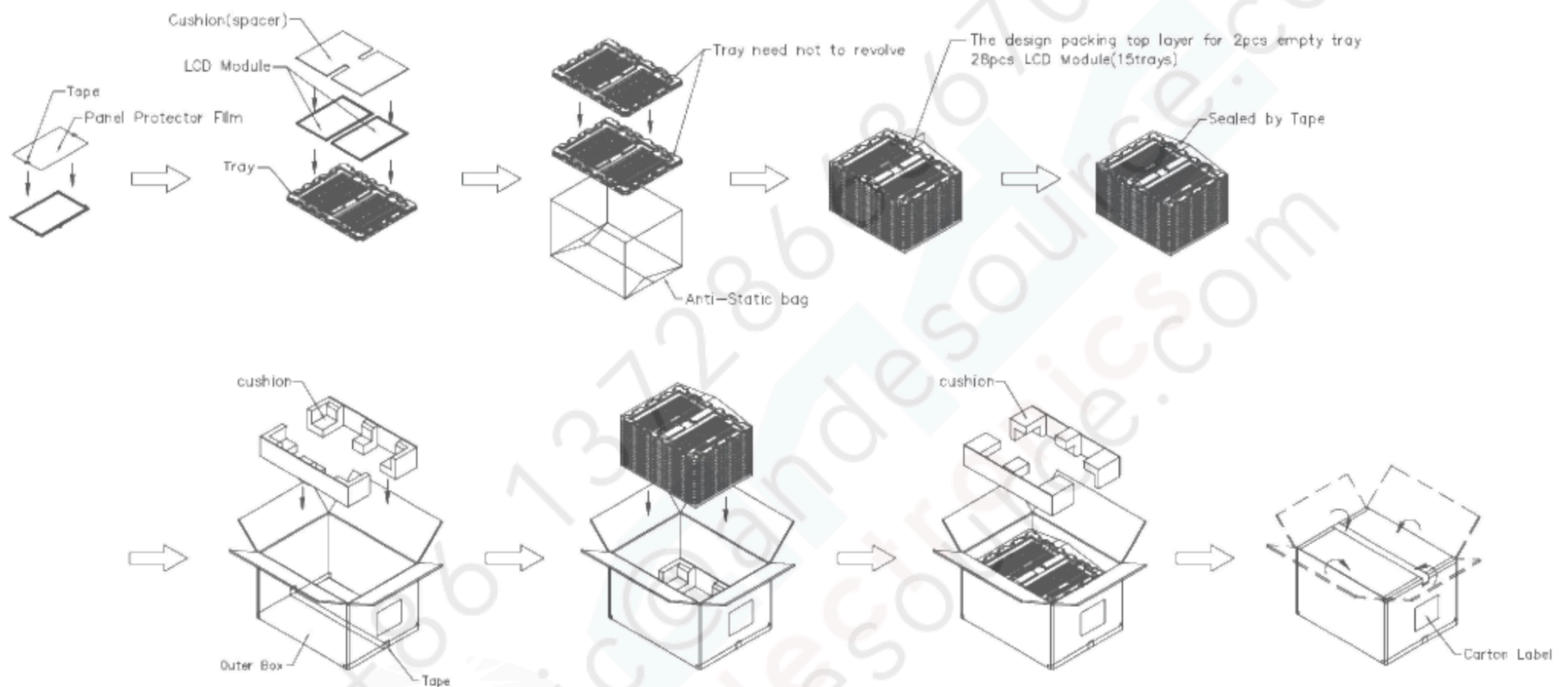


Figure. 9-1 Packing method

Sea & Land Transportation

Air Transportation

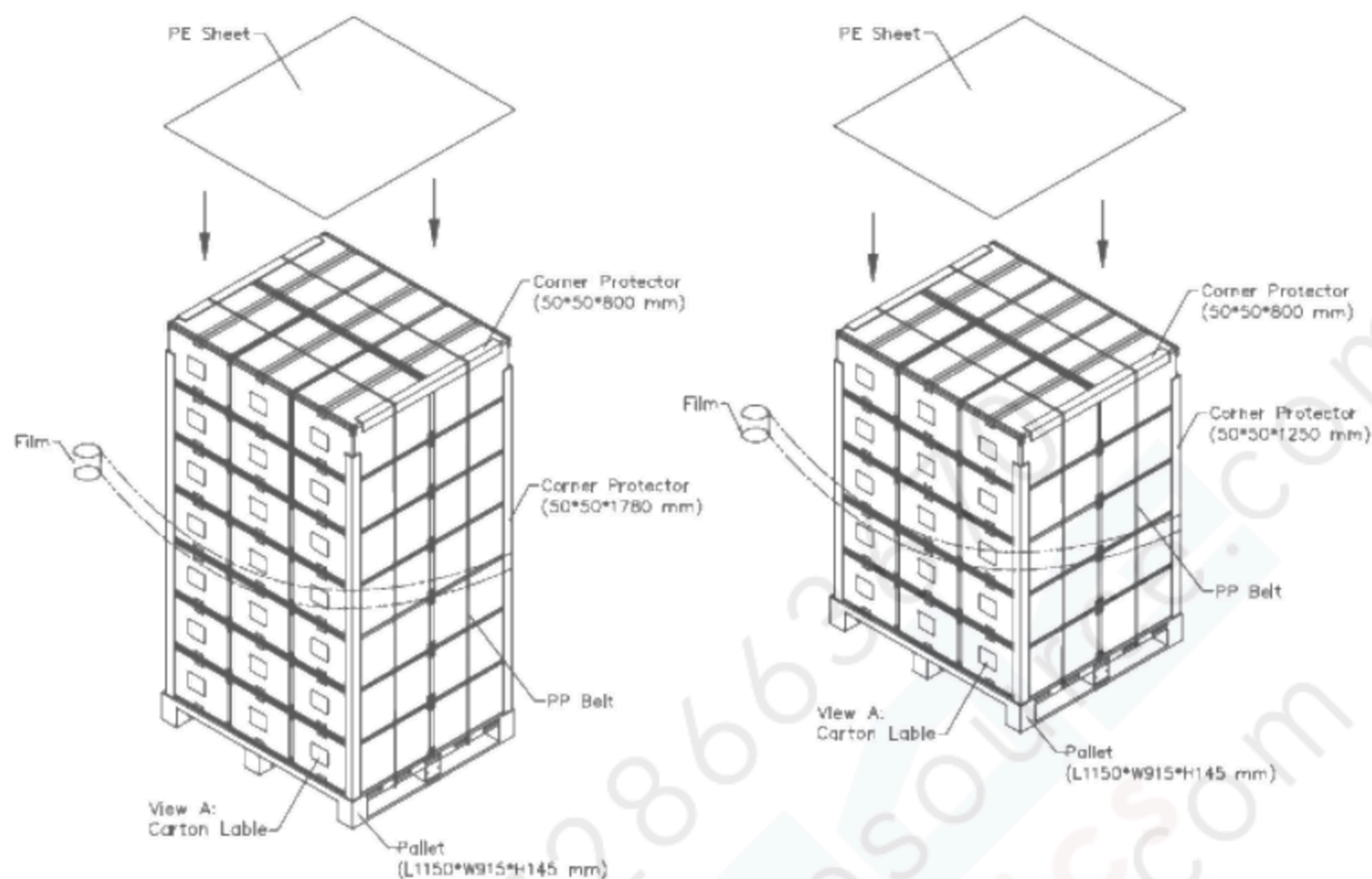


Figure. 9-2 Packing method

9.3 UN-PACKING METHOD

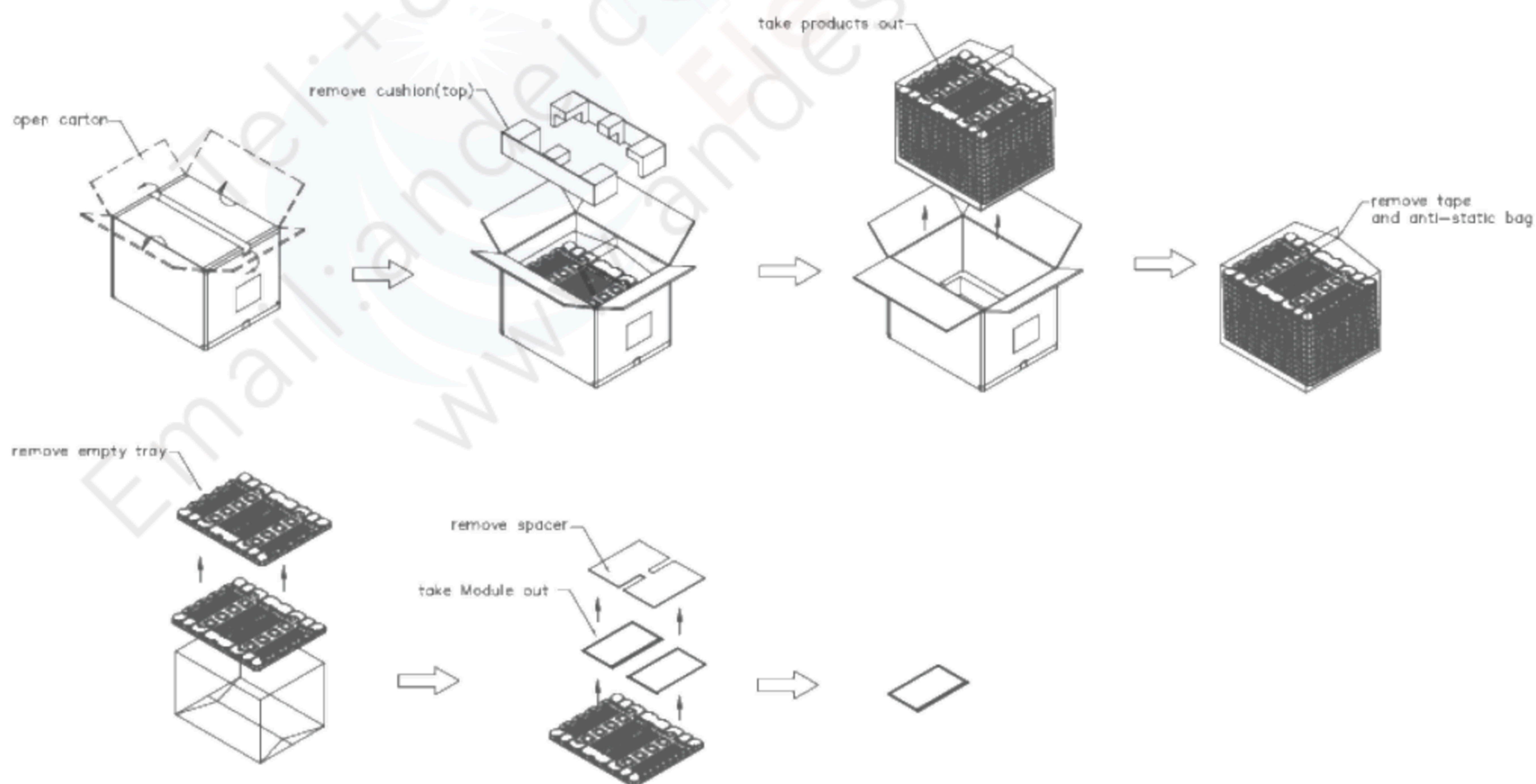
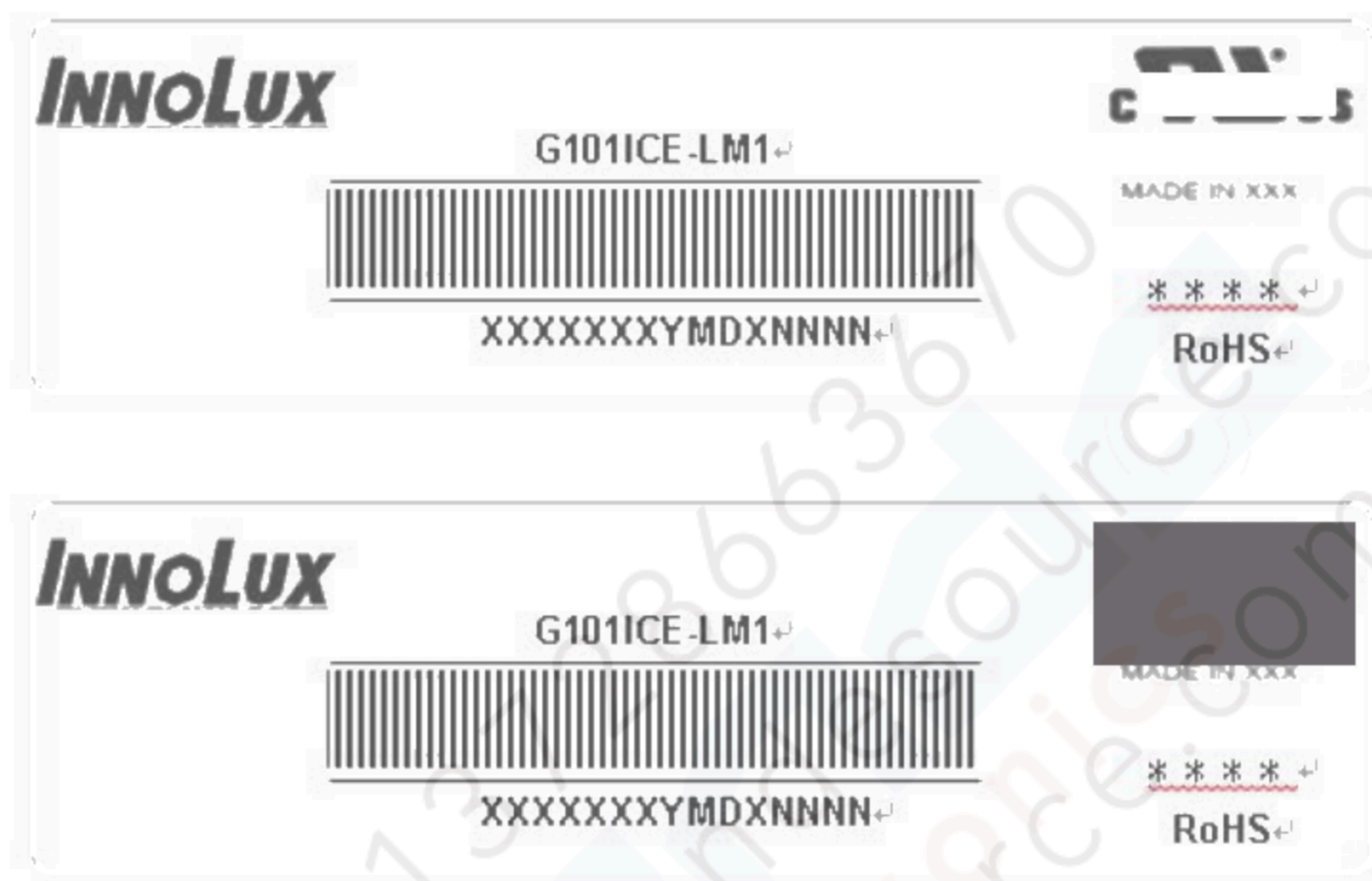


Figure. 9-3 UN-Packing method

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.

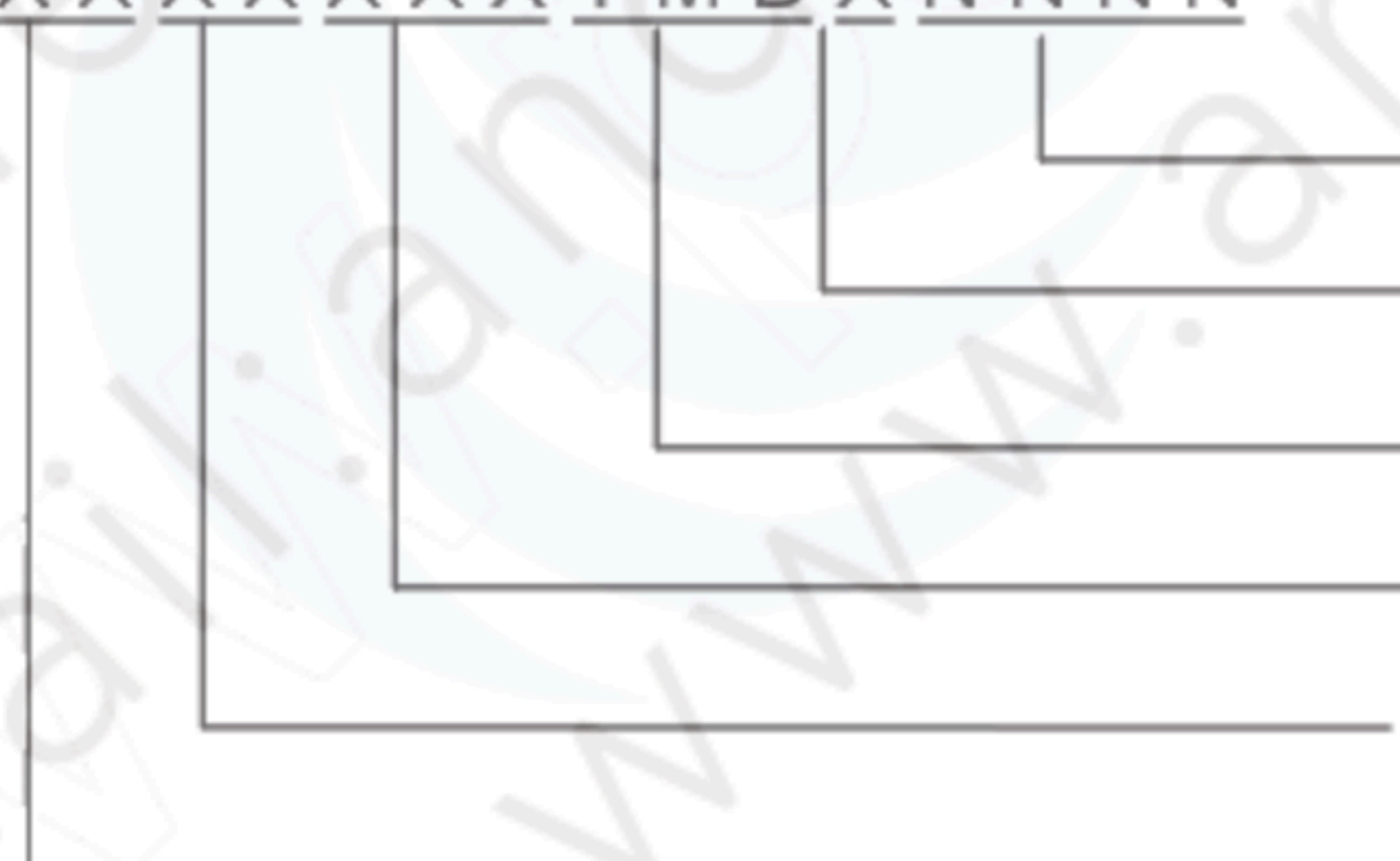


Note (1) Safety Compliance(UL logo) will open after C1 version.

(a) Model Name: G101ICE-LM1

(b) * * * * : Factory ID

(c) 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 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

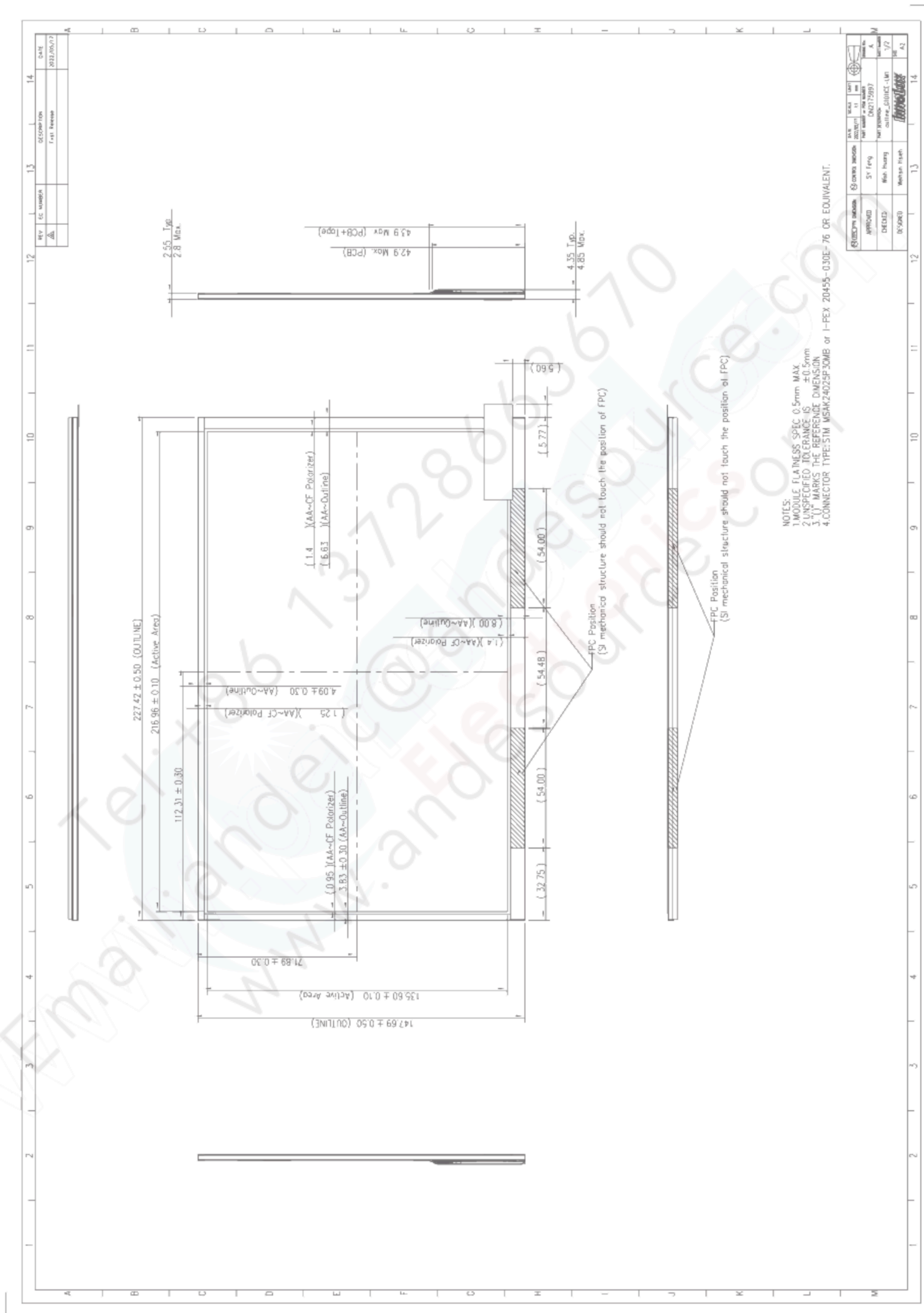
(a) Suitable operating time: under 16 hours a day.

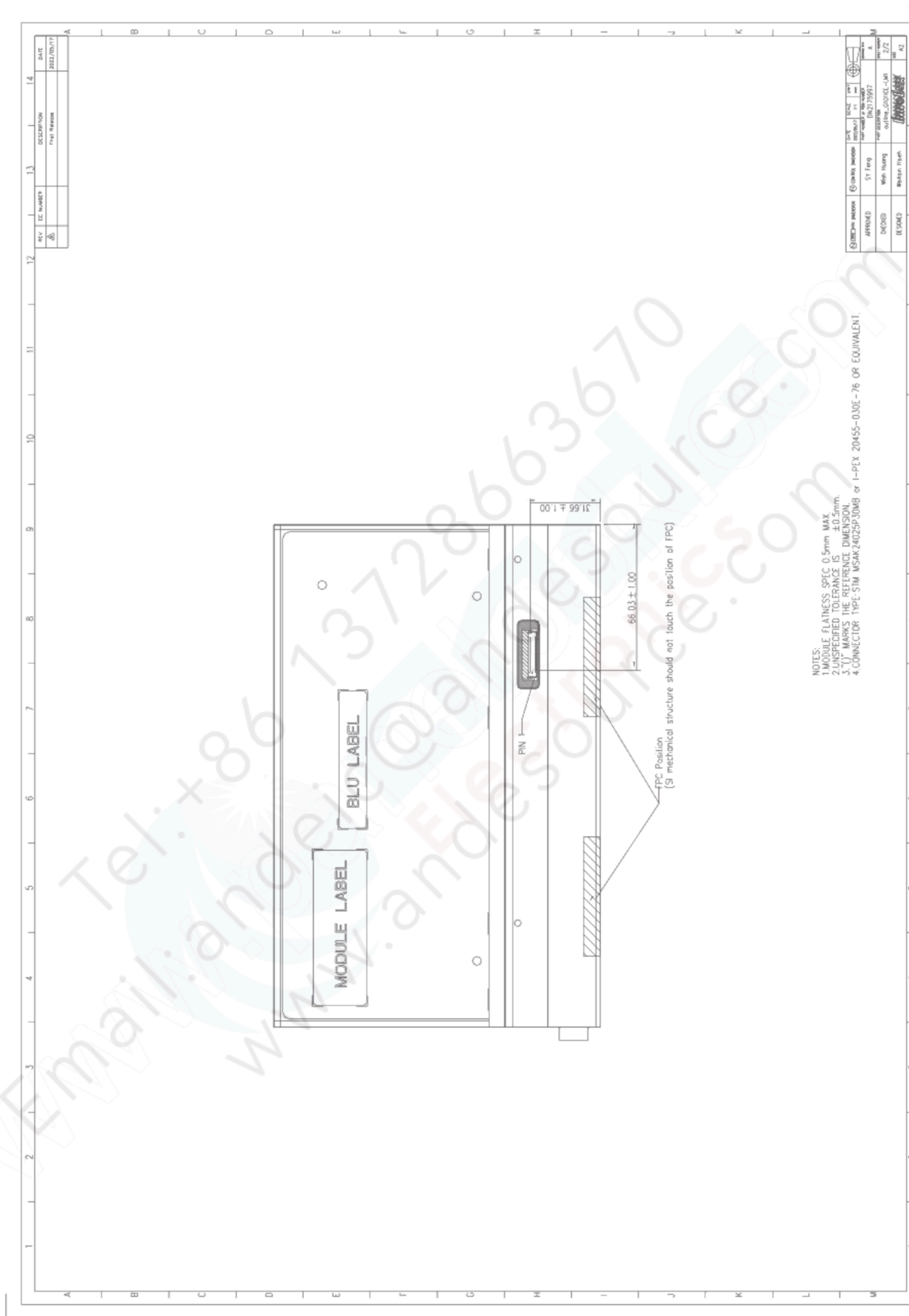
(b) Static information display recommended to use with moving image.

(c) Cycling display between 5 minutes' information(static) display and 10 seconds' moving image.


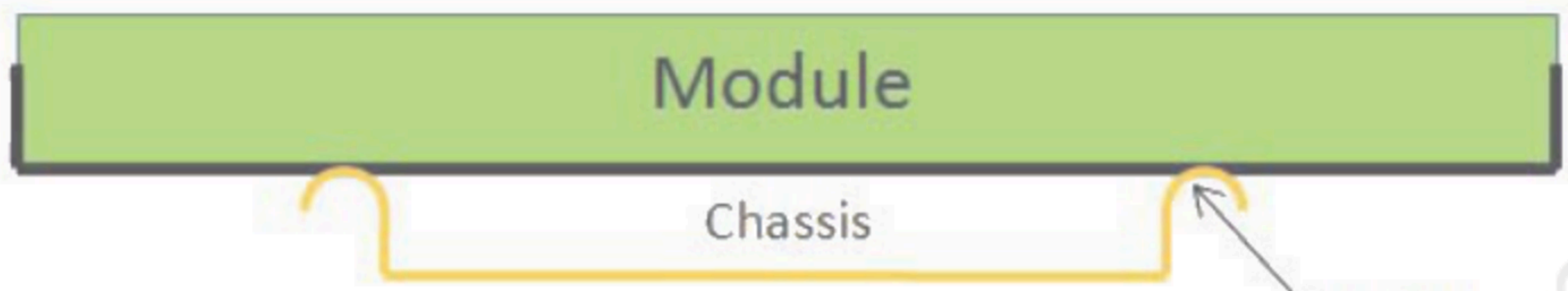


(3) Abnormal condition just means conditions except normal condition.

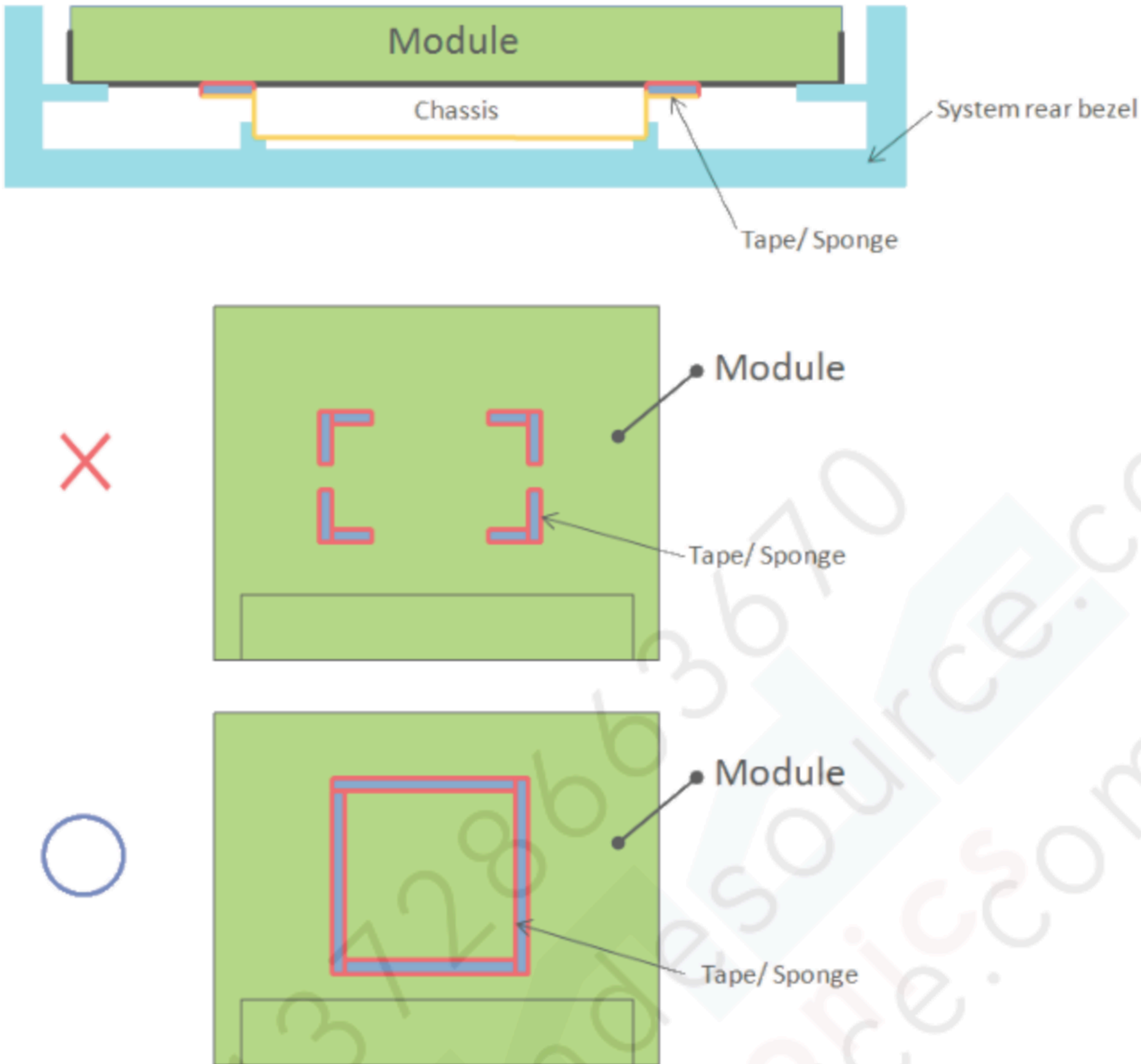
12. MECHANICAL CHARACTERISTICS

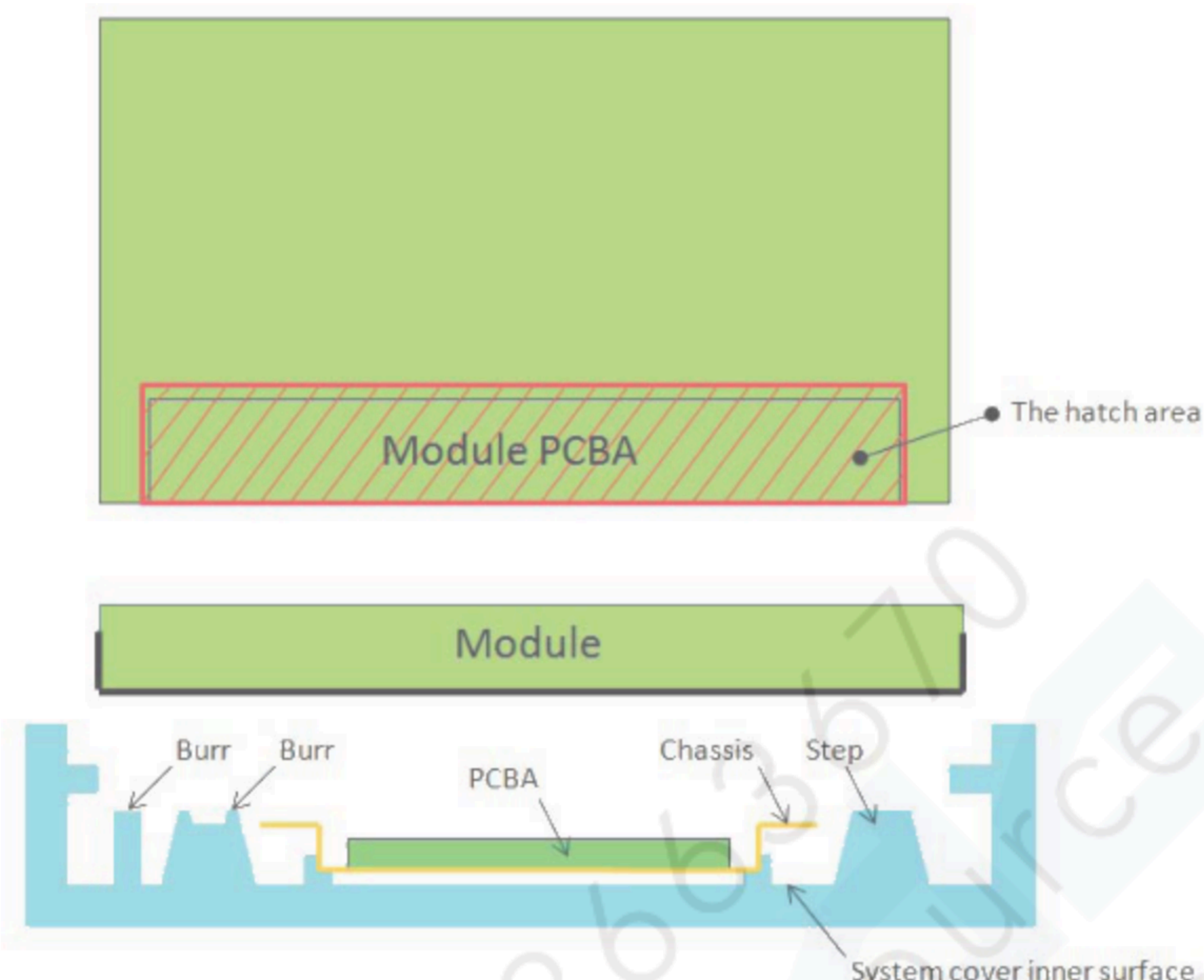
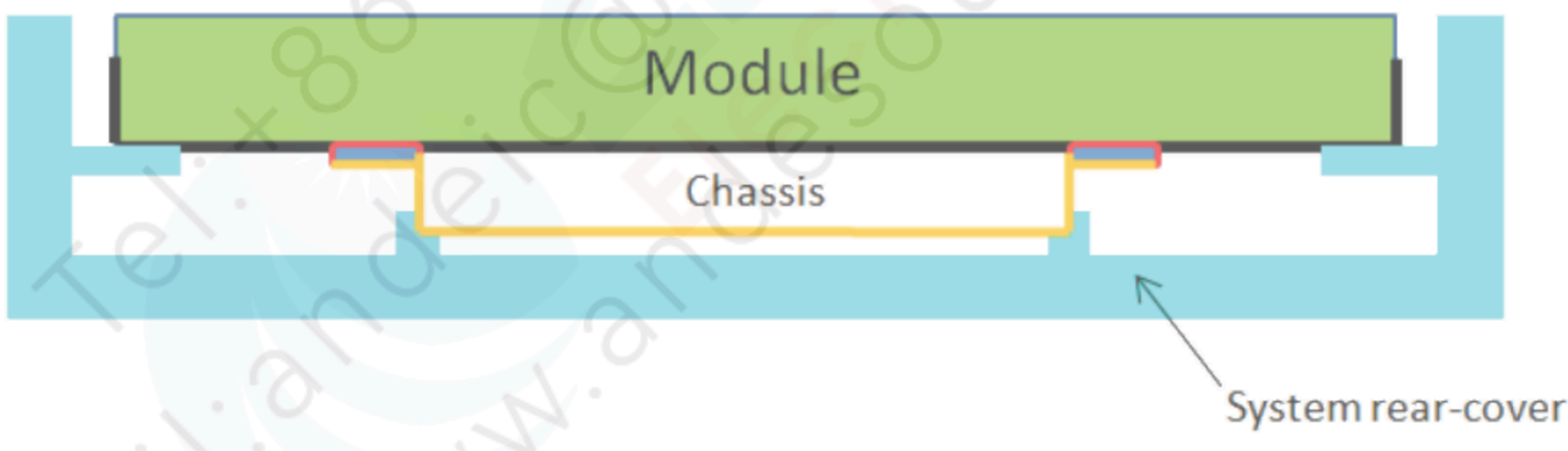


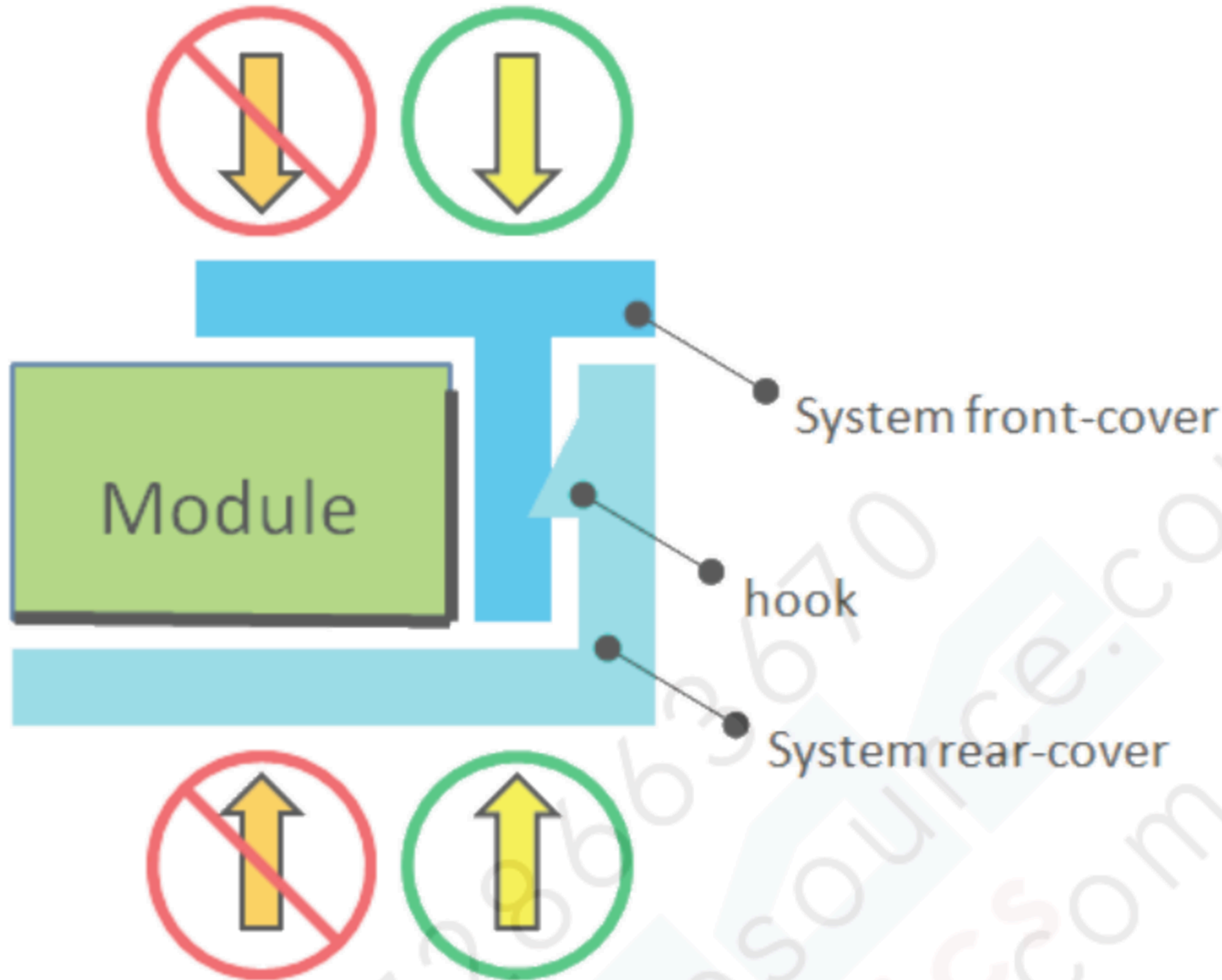




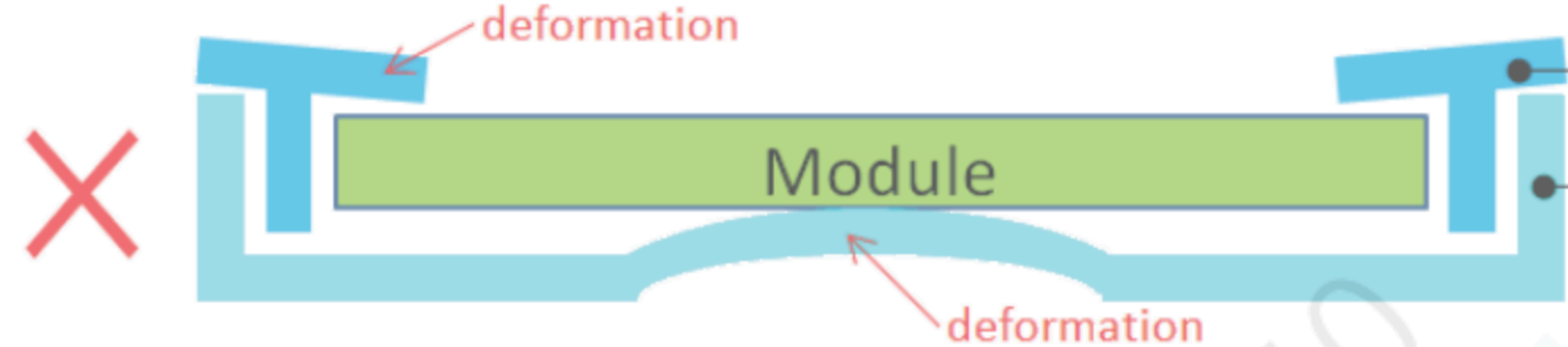
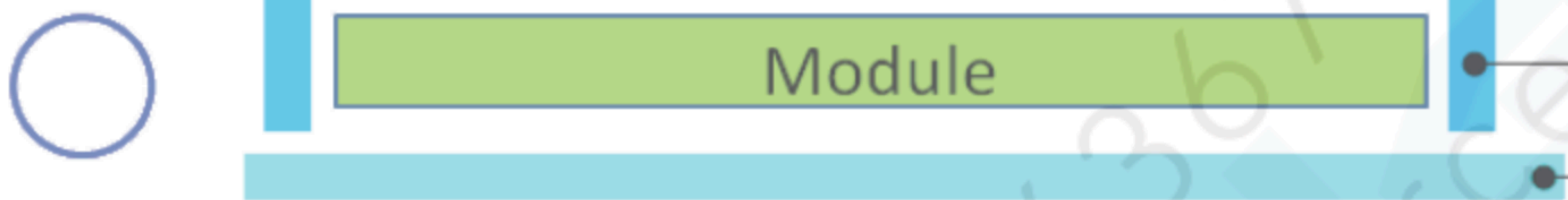
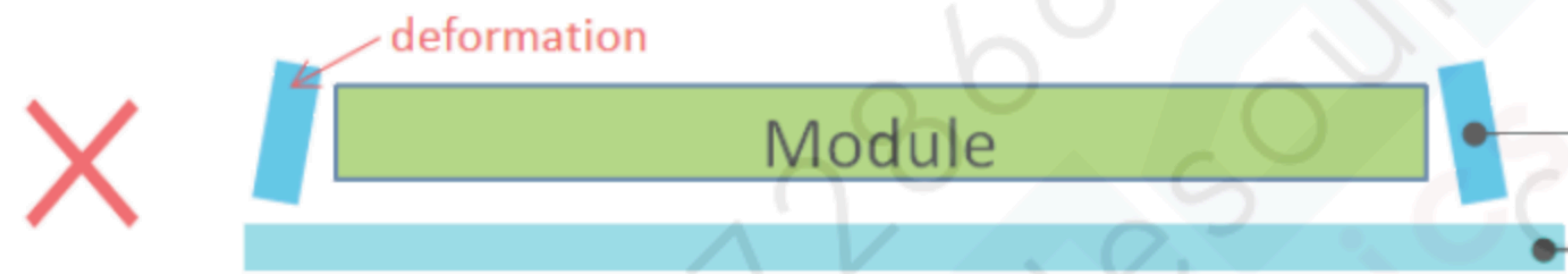

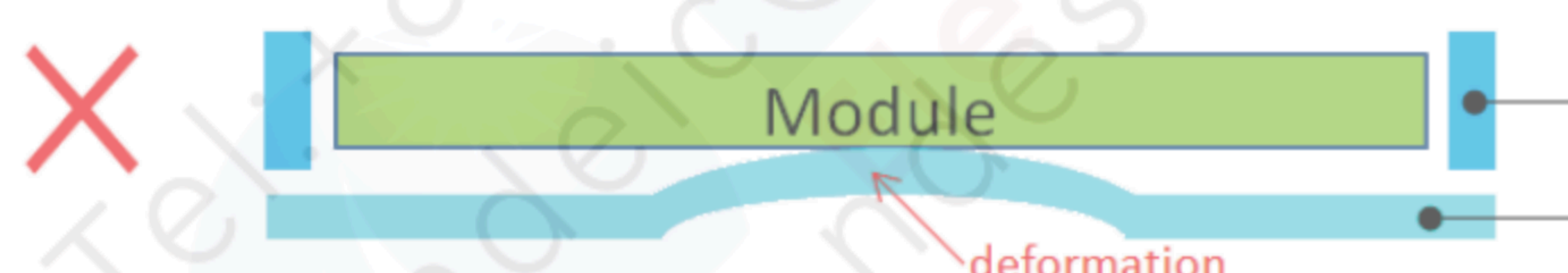
Appendix. SYSTEM COVER DESIGN NOTICE

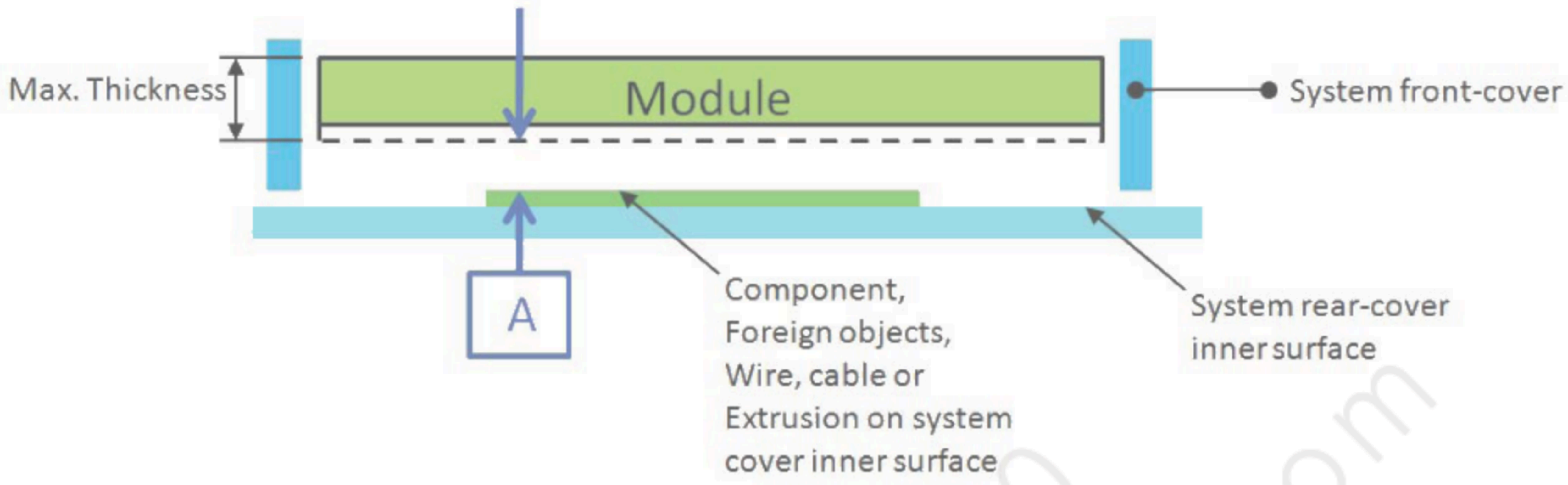
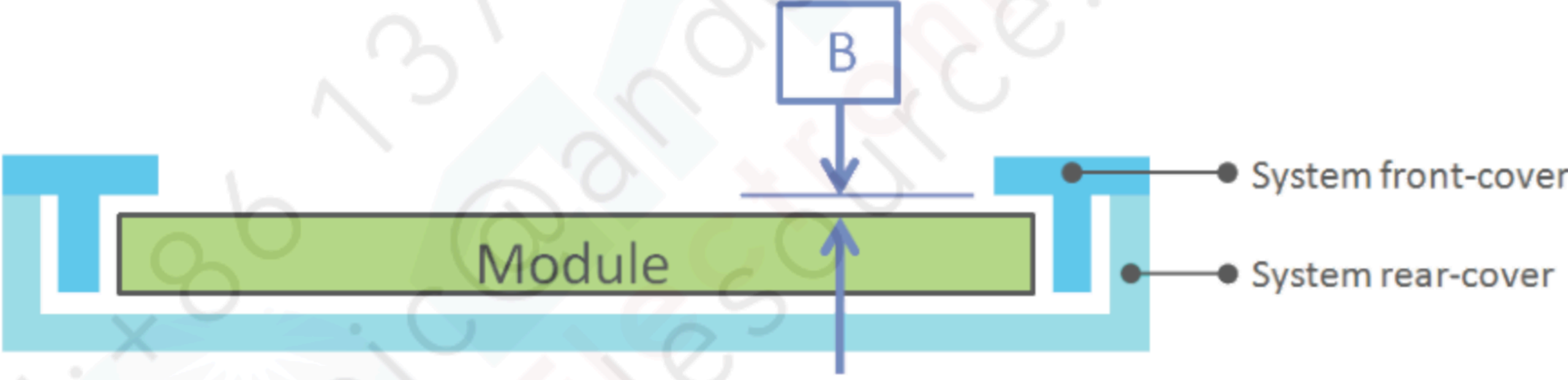
1	Set Chassis and IAVM Module touching Mode
	 <p>Module</p> <p>Chassis</p> <p>spring</p>  <p>Module</p> <p>Chassis</p> <p>Flat sheet metal</p>  <p>Module</p> <p>Chassis</p> <p>EMI Shielding Gasket (Tape/ Sponge)</p>
Definition	<p>a. To prevent from abnormal display & white spot after mechanical test, 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>

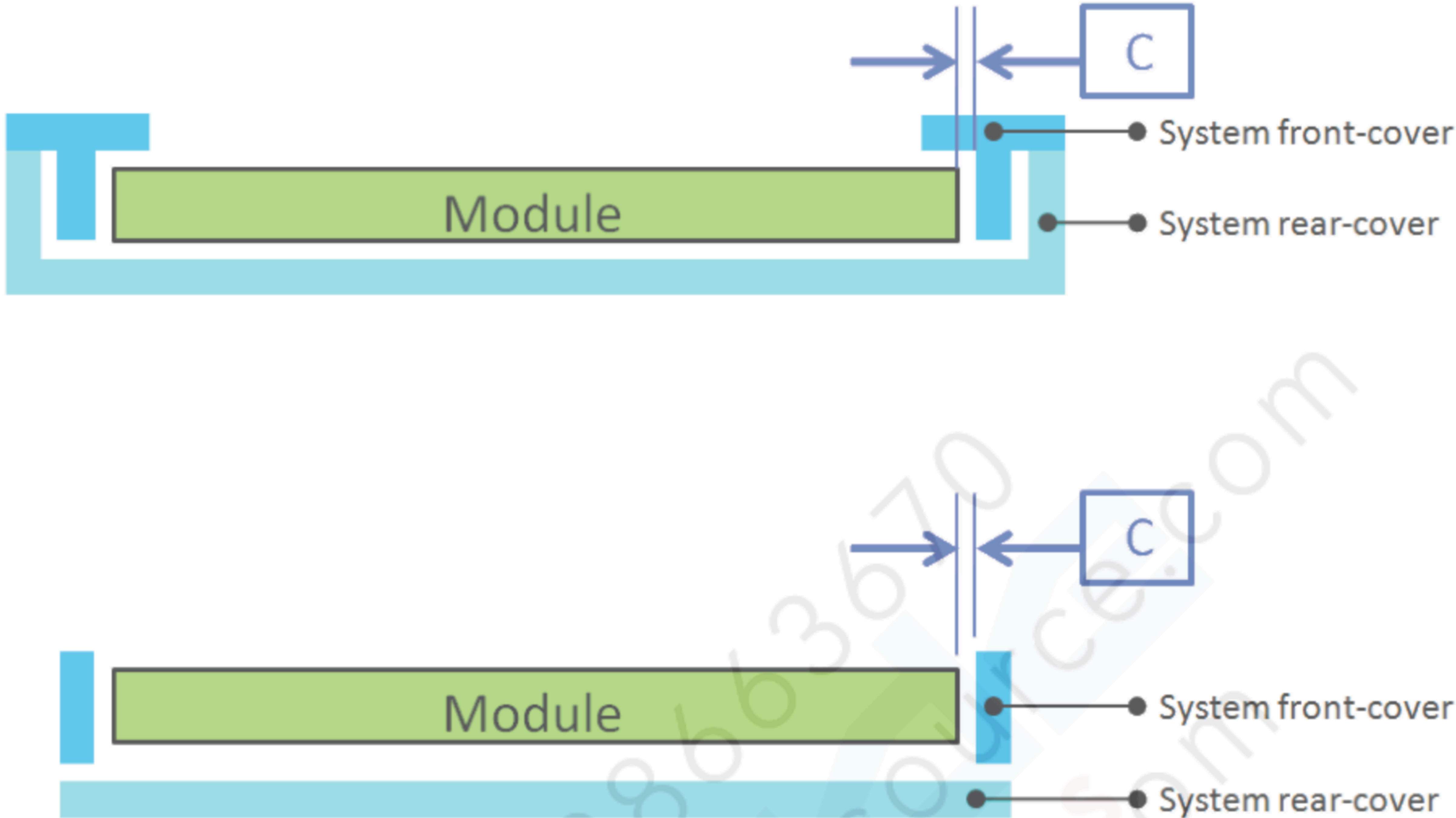
2	Tape/Sponge design on system inner surface
	 <p>The top diagram shows a cross-section of the system assembly. A green 'Module' is mounted on a yellow 'Chassis'. A blue 'System rear bezel' is at the back. Red 'Tape/Sponge' is applied between the module and the chassis. Below this, two top-down views of the module are shown. The first view, marked with a red 'X', shows four separate red rectangular pieces of Tape/Sponge at the corners. The second view, marked with a blue circle, shows a single red rectangular piece of Tape/Sponge covering the entire back 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	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.

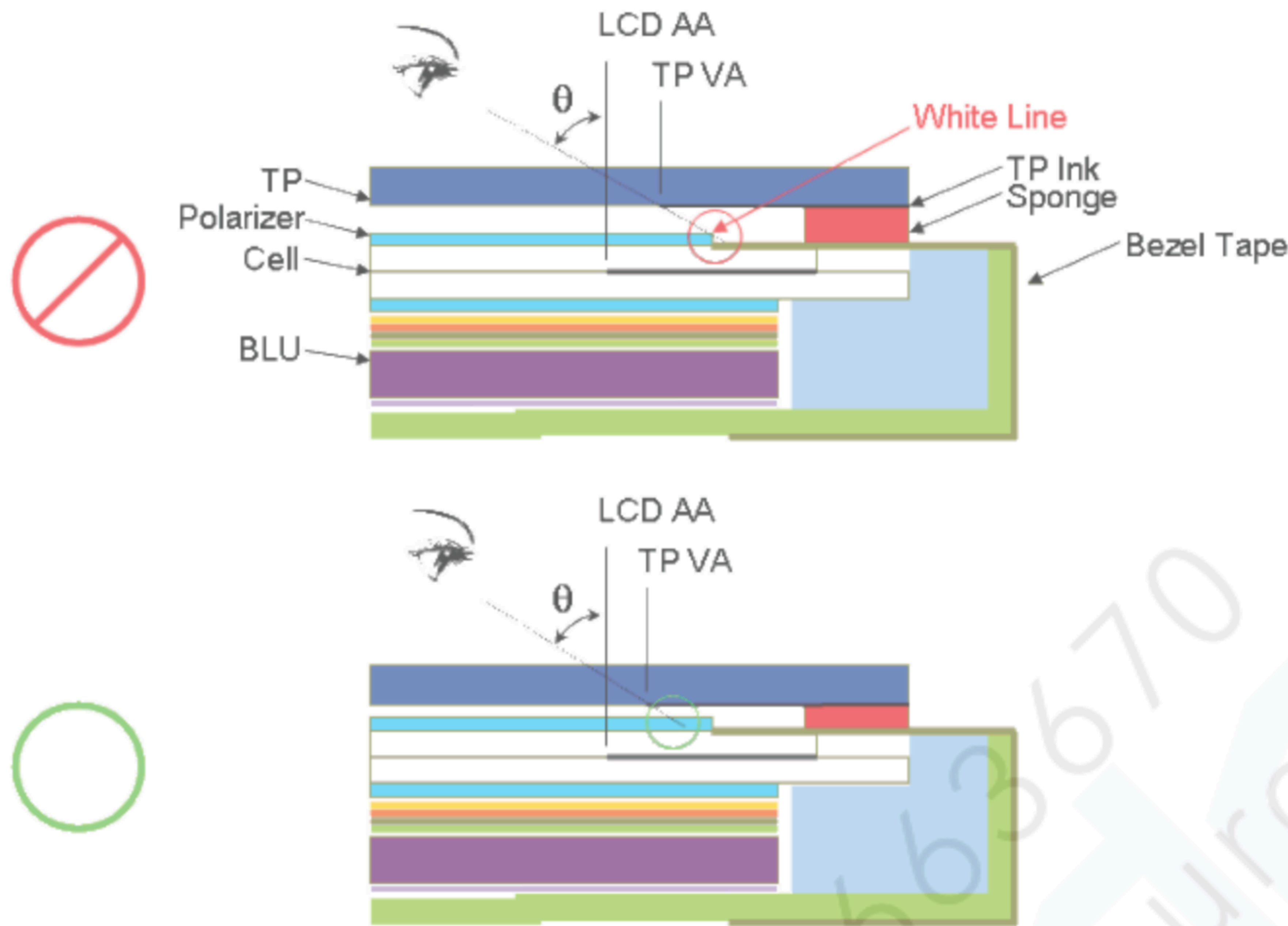
6	Permanent deformation of system cover after reliability test
	     
Definition	<p>System cover including front cover and rear cover may deform during reliability test. Permanent deformation of system front cover and rear cover after reliability test should not interfere with panel. Because it may cause issue such as pooling, abnormal display, white spot and also cell creak.</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 within a frame, while the bottom diagram shows a module on a base. In both cases, the gap 'C' is defined between the module and the front cover. Labels indicate the 'System front-cover' and 'System rear-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

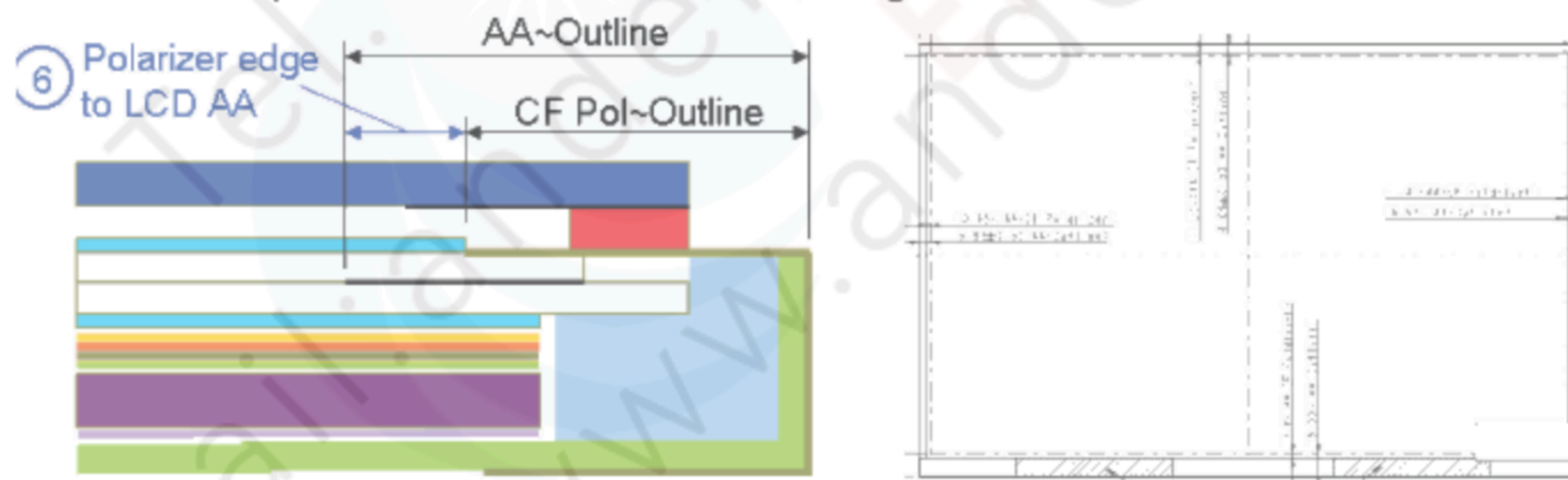
Touch Application : TP and LCD Module Combination for White Line Prevention



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

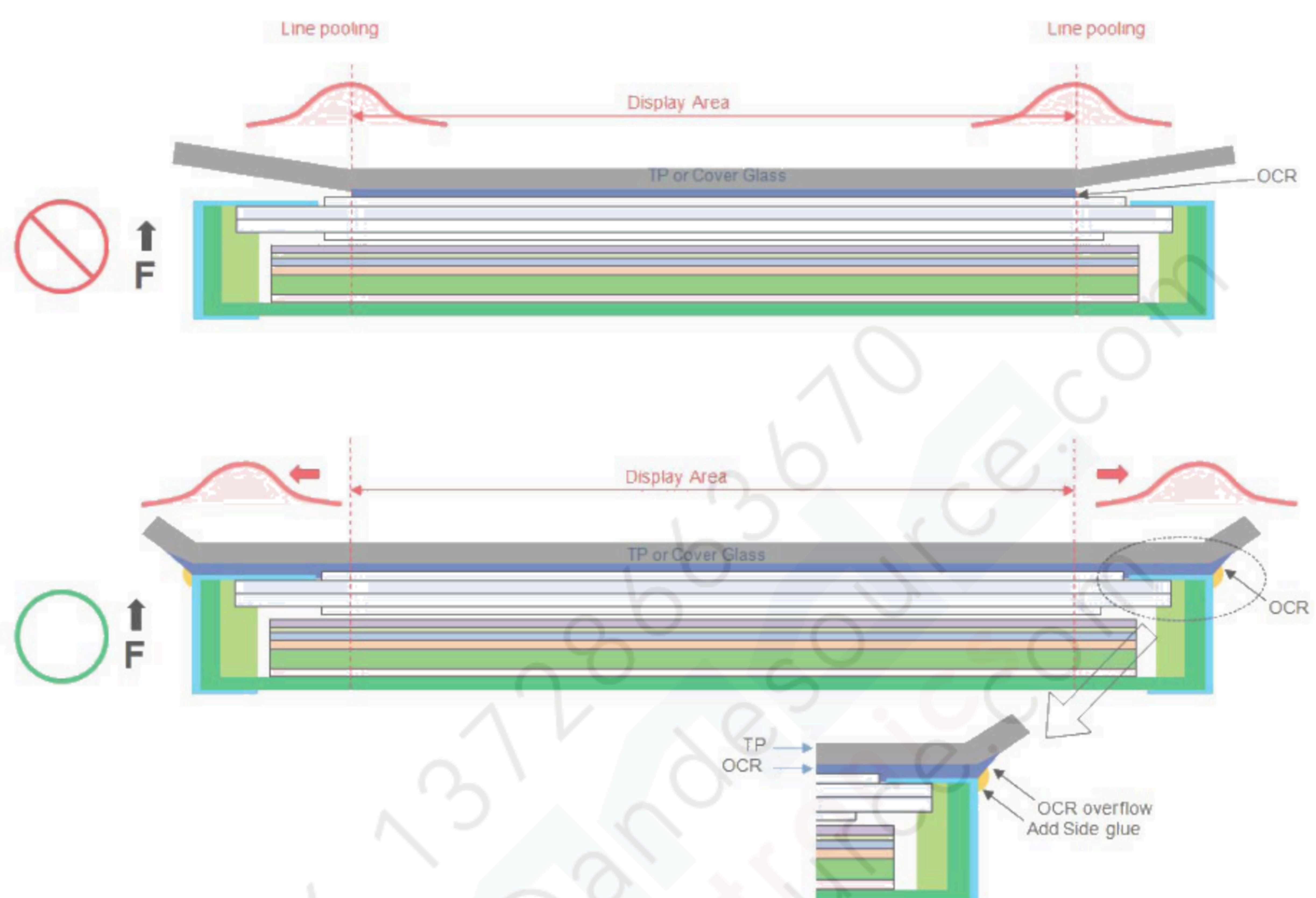
For using in Touch Application: to prevent White Line appears between TP and LCD module combination, the maximum inspection angle location must not fall onto LCD polarizer edge, otherwise light line near edge of polarizer will be appear.


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.

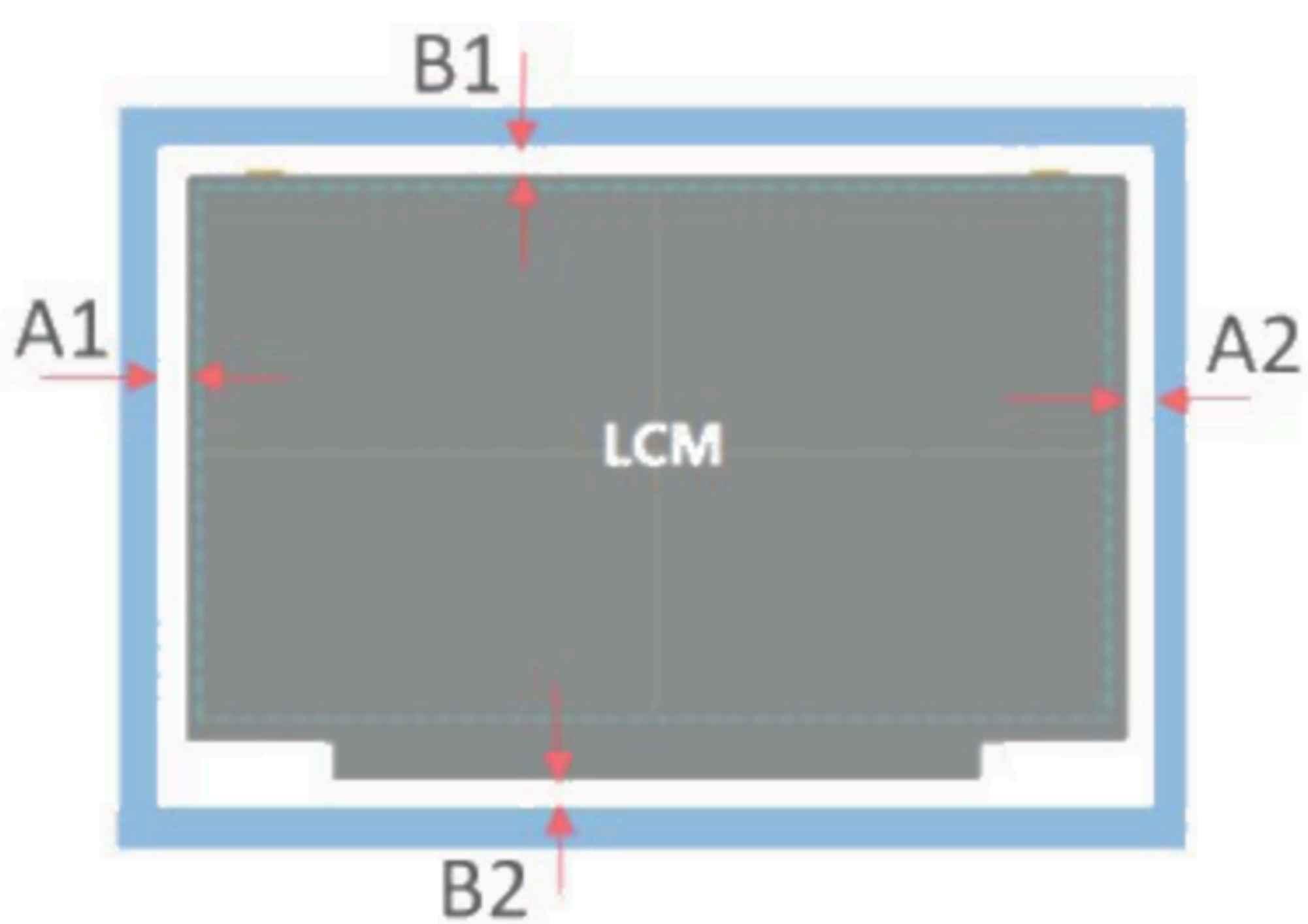
The goal is to find parameters combination that allow maximum inspection angle falls inside polarizer black margin area.

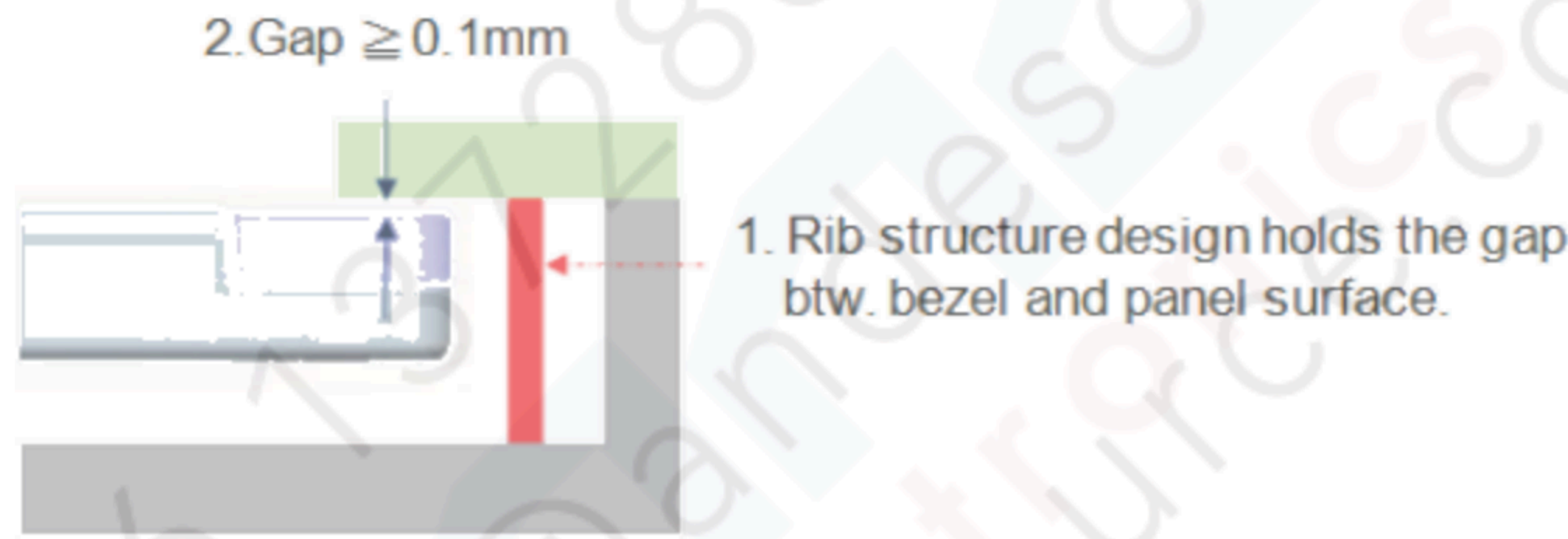
Note: Information for Polarizer edge location and its tolerance can be derived from INX 2D Outline Drawing ("AA ~Outline" - "CF Pol~Outline").

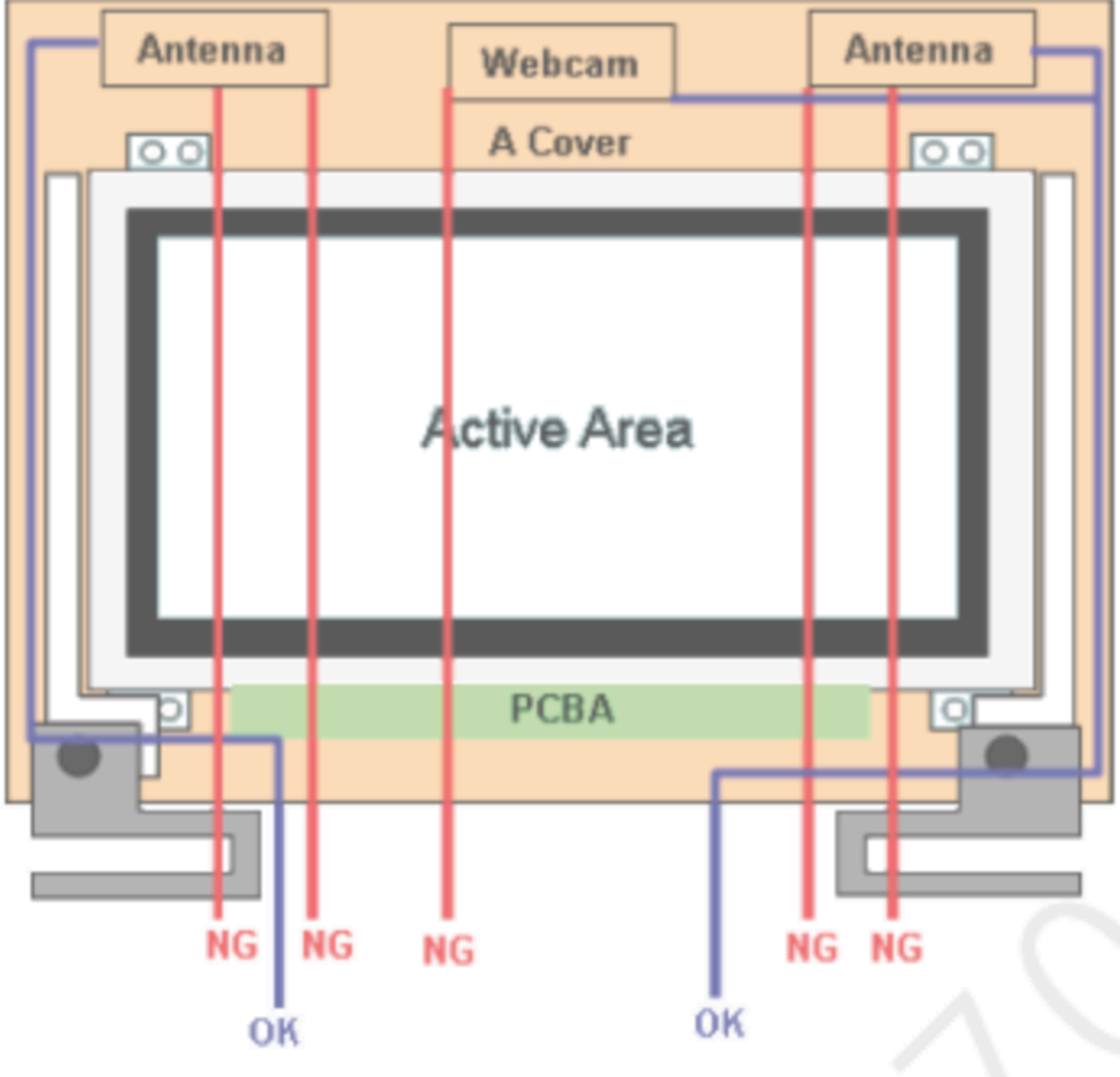
Note: Please feel free to contact INX FAE Engineer. By providing value of parameters above on each side, we can help to verify and pass the white line risk assessment for customer reference.

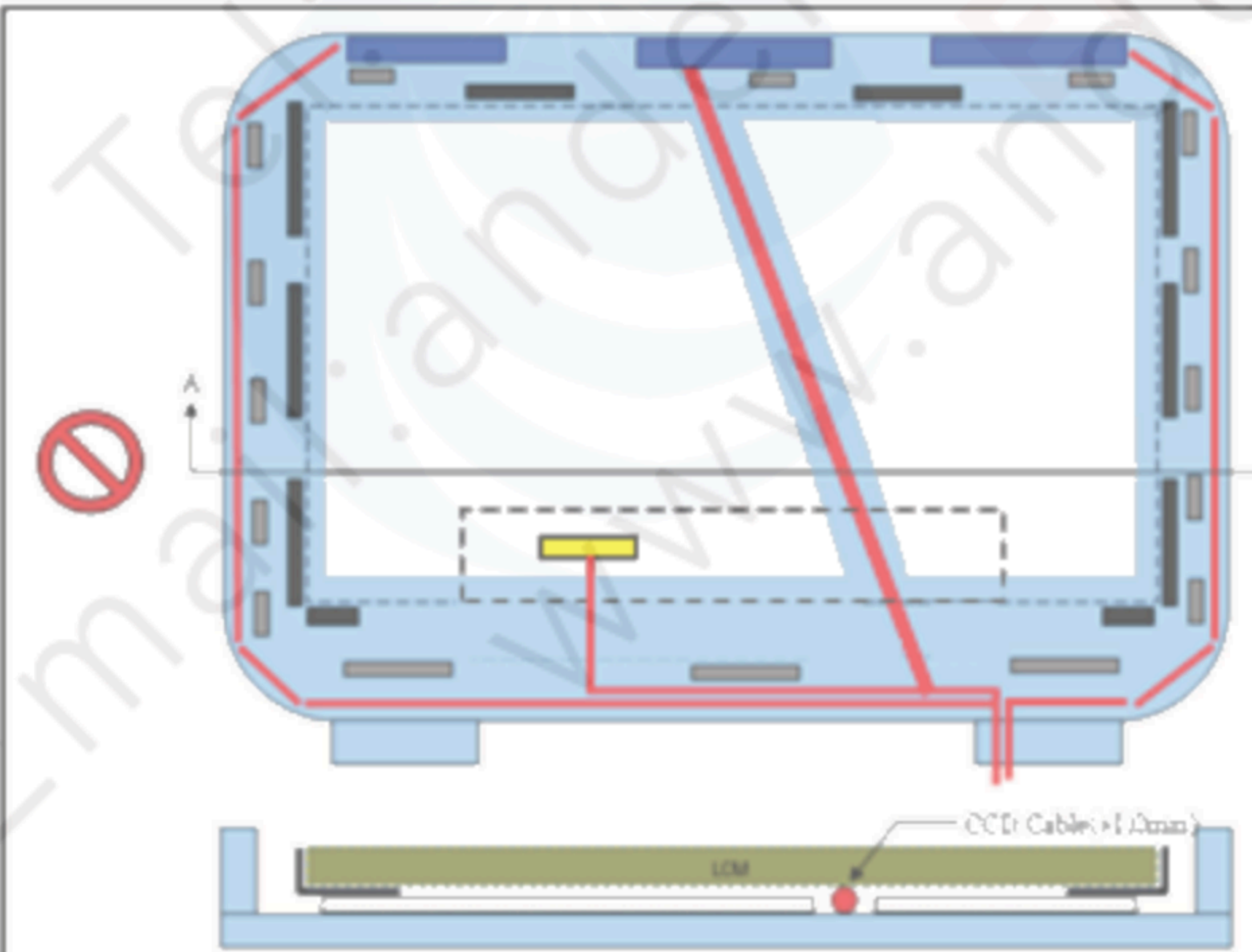
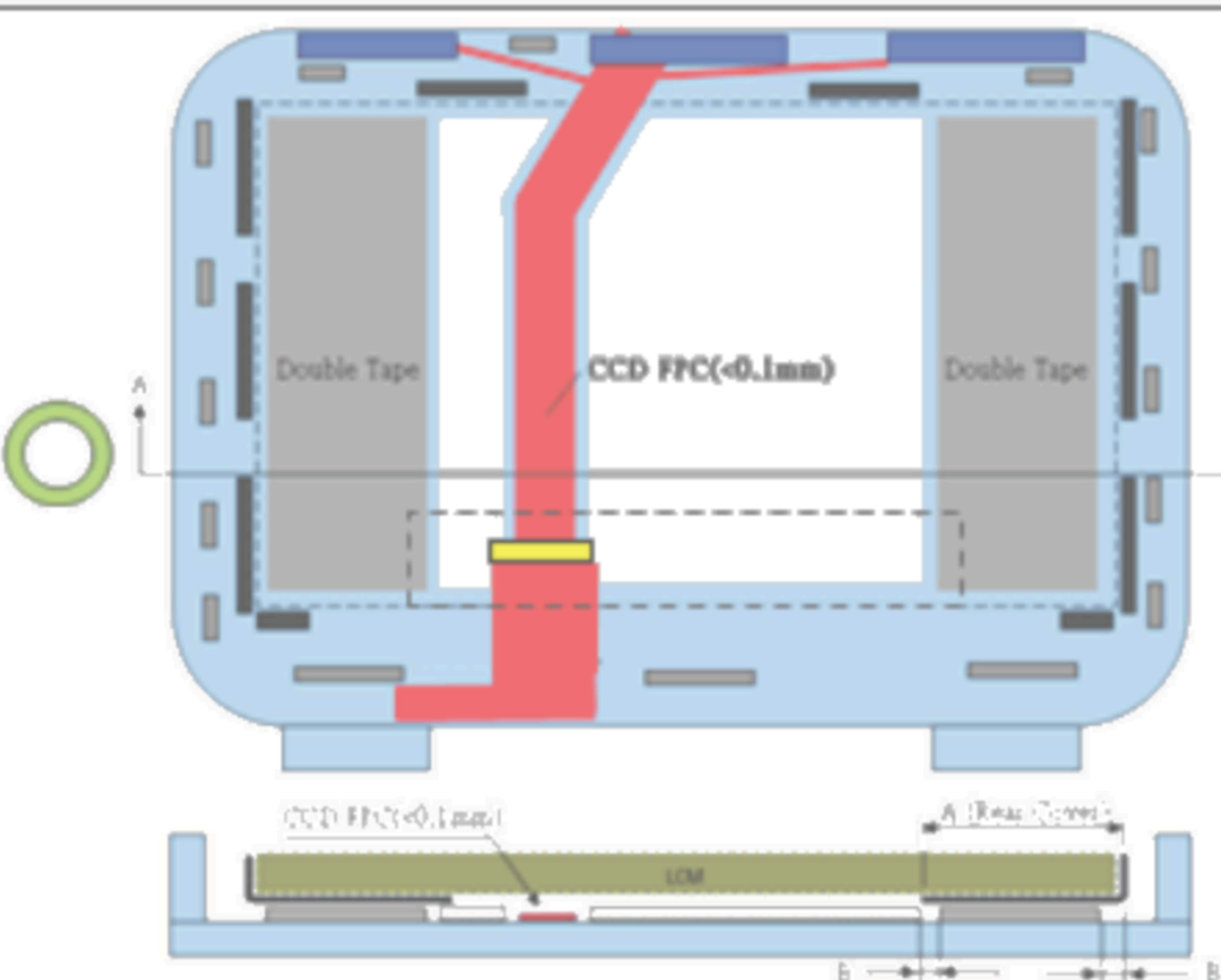



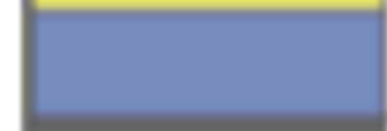
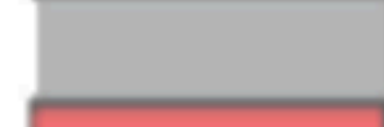








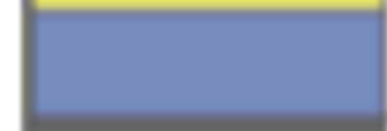
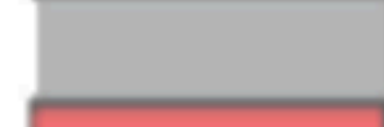








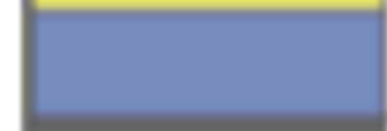
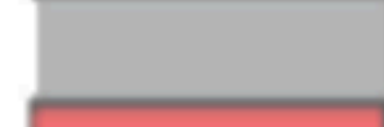





11	Use OCR Lamination
 <p>The diagrams illustrate the correct and incorrect methods for OCR lamination. The top diagram, marked with a red 'X', shows 'Line pooling' occurring at the edges of the 'Display Area' due to insufficient OCR glue. The bottom diagram, marked with a green circle, shows the correct method where OCR glue is applied beyond the module edges, and 'OCR overflow' is managed by 'Add Side glue' to prevent line pooling. Labels include 'Line pooling', 'Display Area', 'TP or Cover Glass', 'OCR', and 'Add Side glue'.</p>	
Definition	1.OCR glue as possible beyond module, in order to avoid Line Pooling 2.Add side glue to avoid Line Pooling

12	Use OCA Lamination
 <p>The diagrams illustrate the correct and incorrect methods for OCA lamination. The top diagram, marked with a red 'X', shows 'Line pooling' occurring at the edges of the 'Display Area' due to insufficient OCA glue. The bottom diagram, marked with a green circle, shows the correct method where OCA glue is plastered throughout the module, and 'Add Side glue' is applied to the edges to prevent line pooling. Labels include 'Line pooling', 'Display Area', 'TP or Cover Glass', 'OCA', and 'Add Side glue'.</p>	
Definition	1.OCA glue as possible plastered throughout the module, in order to avoid Line Pooling. 2.Add side glue to avoid Line Pooling

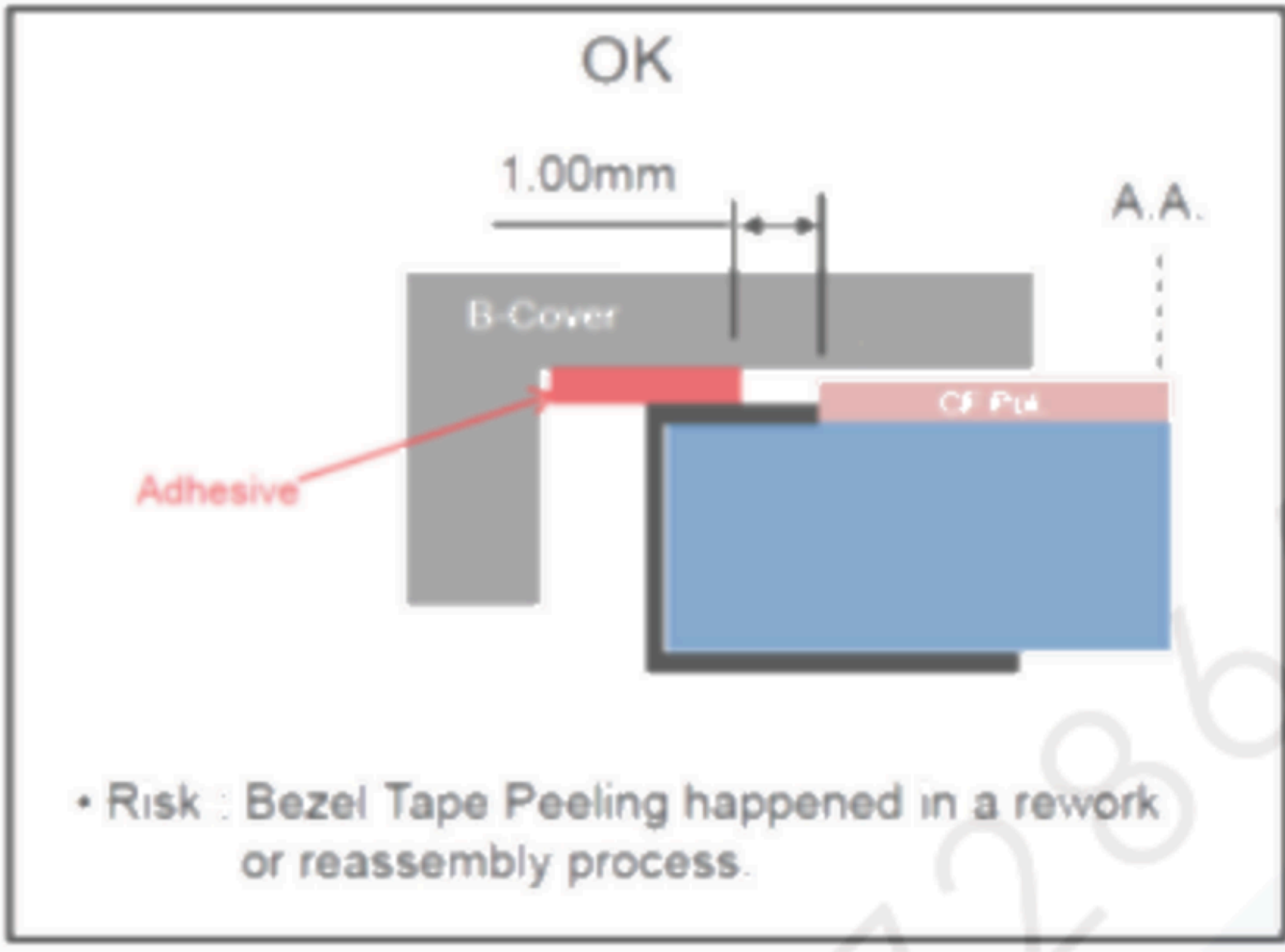
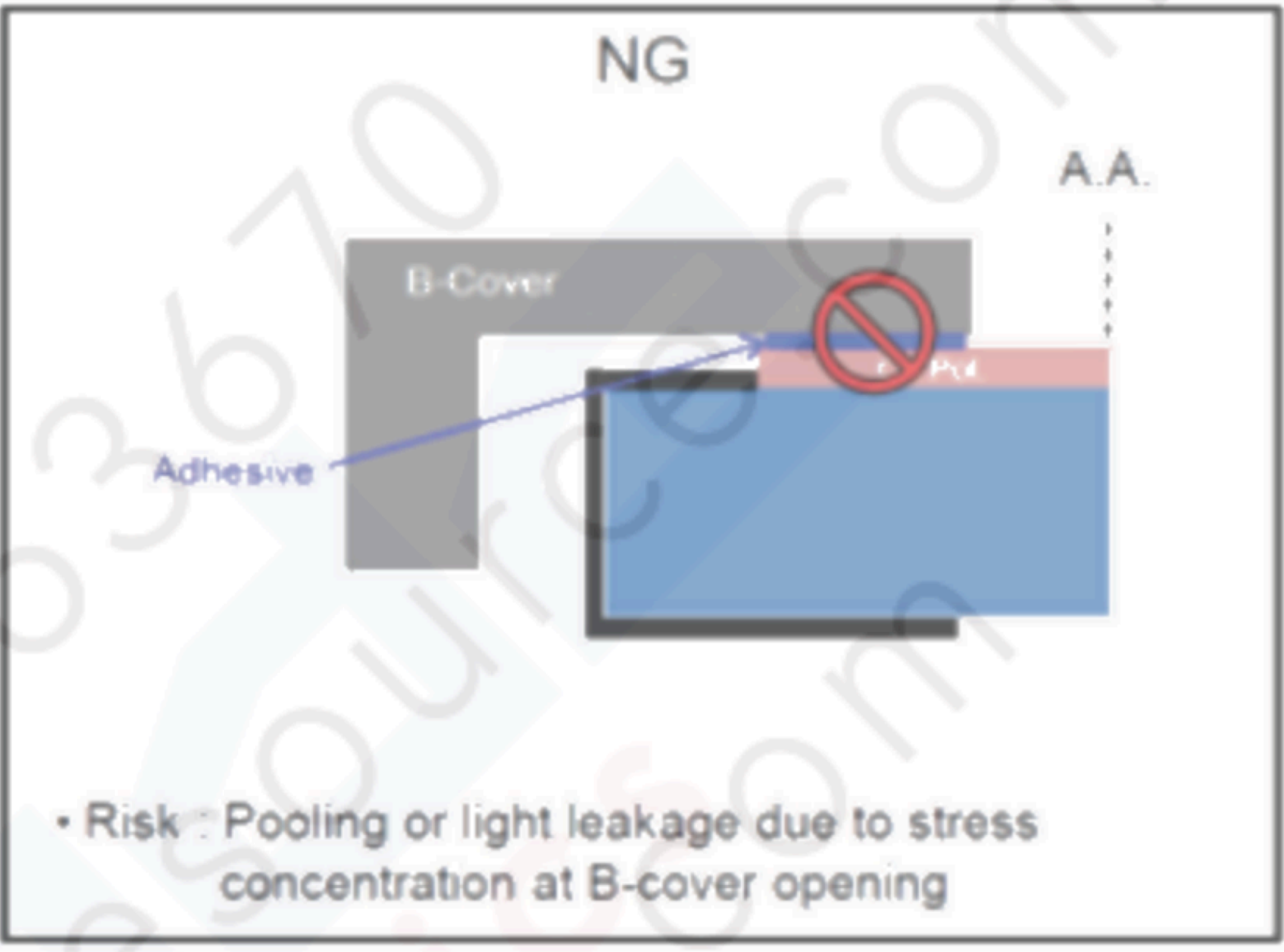
13	Gap Design between panel & around structure												
<div></div> <table><thead><tr><th>Item</th><th>Suggestion</th><th>Remark</th></tr></thead><tbody><tr><td>A1</td><td>$A1 \geq 0.5$</td><td rowspan="4">Gap \geq Panel outline max. tolerance + Assembly max. tolerance</td></tr><tr><td>A2</td><td>$A2 \geq 0.5$</td></tr><tr><td>B1</td><td>$B1 \geq 0.5$</td></tr><tr><td>B2</td><td>$B2 \geq 0.8$</td></tr></tbody></table>		Item	Suggestion	Remark	A1	$A1 \geq 0.5$	Gap \geq Panel outline max. tolerance + Assembly max. tolerance	A2	$A2 \geq 0.5$	B1	$B1 \geq 0.5$	B2	$B2 \geq 0.8$
Item	Suggestion	Remark											
A1	$A1 \geq 0.5$	Gap \geq Panel outline max. tolerance + Assembly max. tolerance											
A2	$A2 \geq 0.5$												
B1	$B1 \geq 0.5$												
B2	$B2 \geq 0.8$												
Definition	Gap Design between panel & around structure needs to consider the maximum tolerances of panel outline and assembly at the same time. Gap Design suggestion is shown as A1/A2/B1/B2 on the chart.												

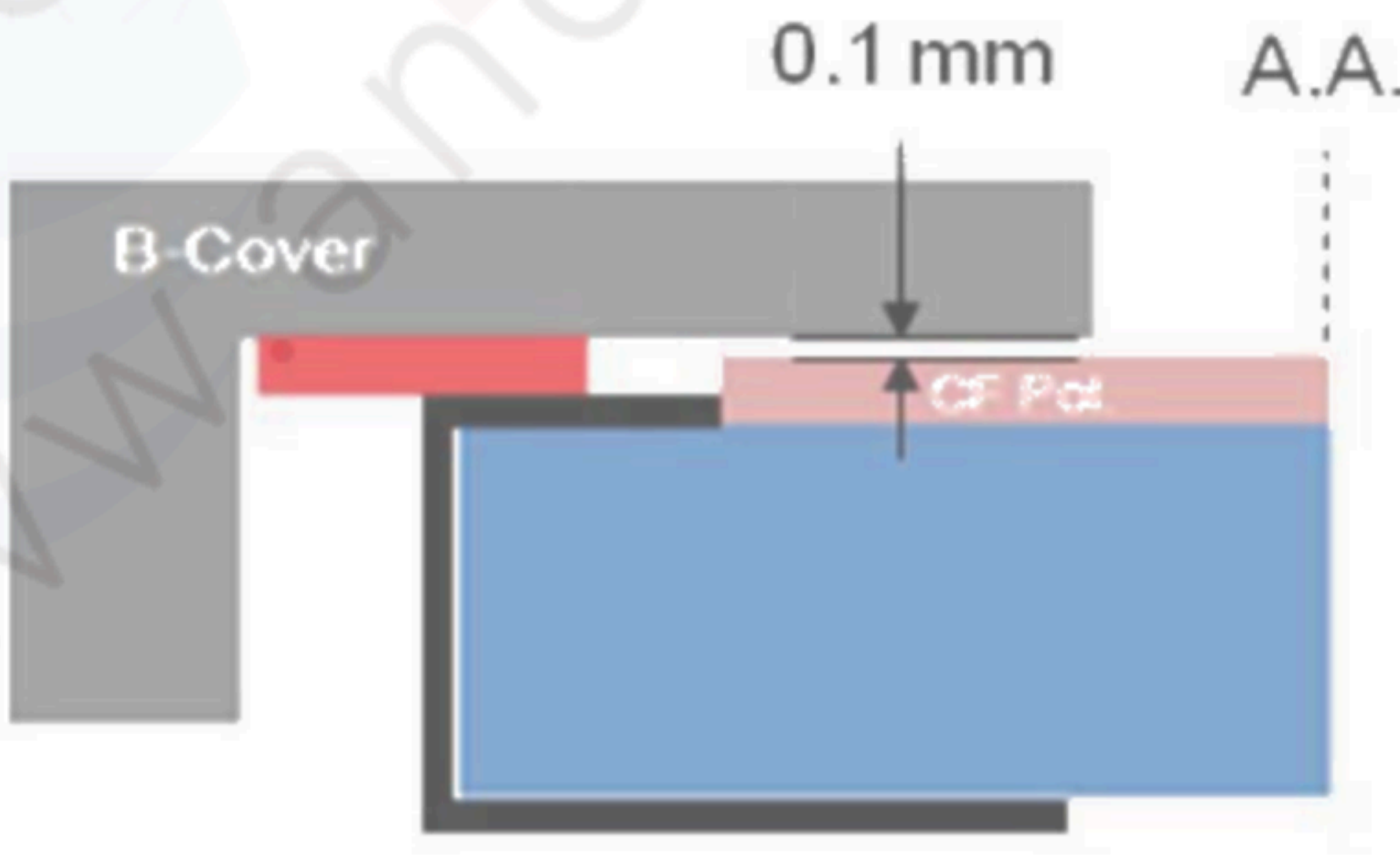
14	Gap between panel & bezel
	
Definition	<p>The gap between system bezel & panel surface is needed to prevent pooling or glass broken. Zero gap or interference such as burr and warpage from mold frame may cause pooling issue near system front-cover opening edge. This phenomenon is obvious during swing test, hinge test, knock test, or during pooling inspection procedure.</p> <p>To remain the sufficient gap, design with system rib higher than maximum panel thickness is recommended.</p> <p>The sufficient gap design is greater or equal to 0.1mm.</p>

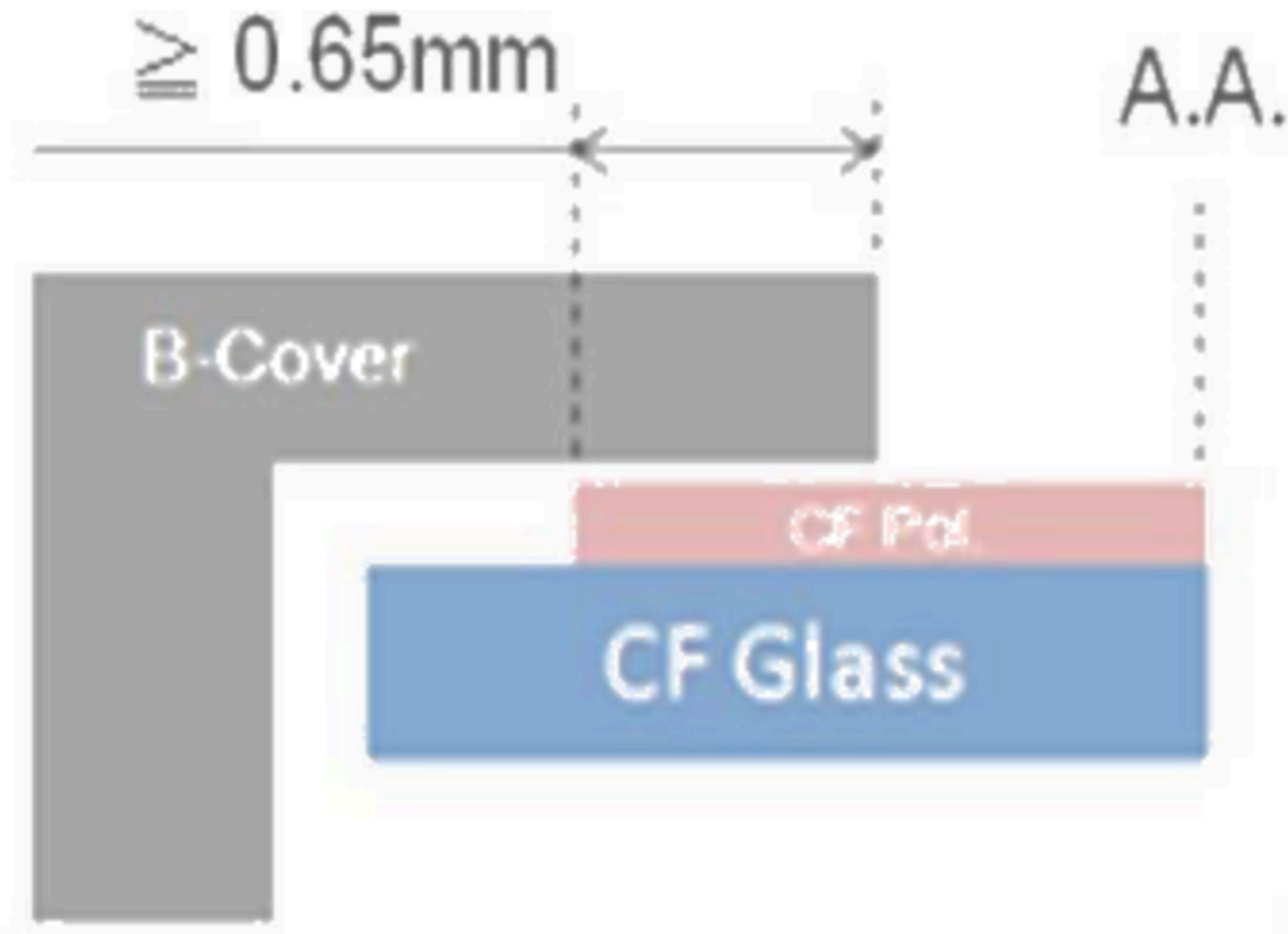
15	Cable routing behind panel
	
Definition	<p>It is strongly recommended that cables route around the panel outline, not overlap with the panel outline (including PCB). Because issue such as abnormal display & white spot after backpack test, hinge test, twist test or pogo test may occur.</p> <p>If any routings across panel outline are needed, we suggest design as below:</p> <ul style="list-style-type: none"> -Using FFC/FPC to replace cables. -Routing at the right or left area of panel metal rear. -Avoid any routings at the step of panel or A cover. -No interference to panel. -It should not overlap TCON, COF/FPC, Driver IC

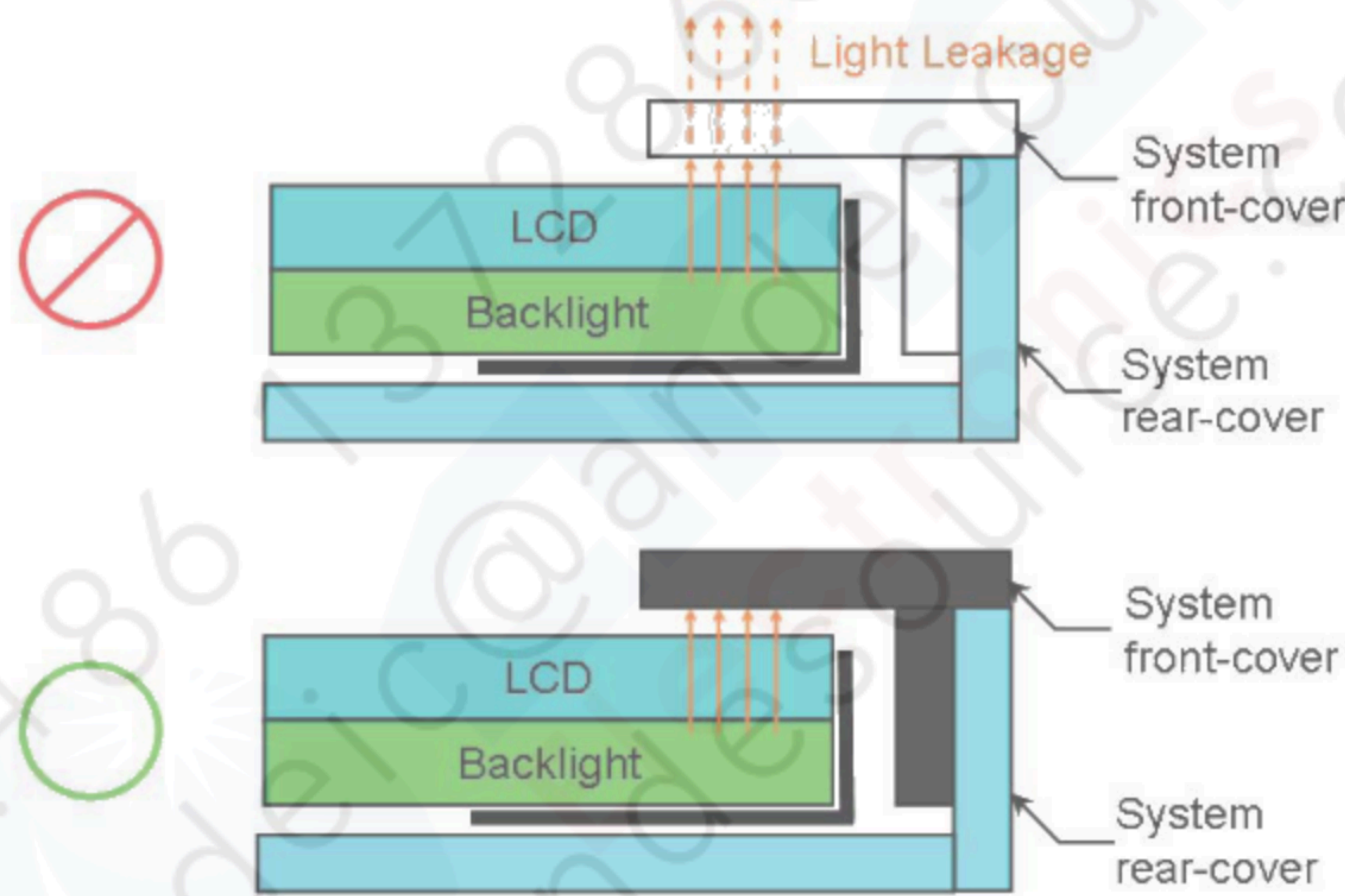
16	Interference examination of antenna cable and Web Cam wire																													
<ul style="list-style-type: none">To prevent panel damage, we suggest using CCD FPC to replace CCD cableUsing double tape to fix LCM module for no bracket design.																														
<div><div></div><div></div></div> <table><tr><td></td><td>Rear-cover</td><td></td><td>Connector</td></tr><tr><td></td><td>Sponge</td><td></td><td>Camera/Antenna</td></tr><tr><td></td><td>Double Tape</td><td></td><td>Stopper</td></tr><tr><td></td><td>CCD Cable/FPC</td><td></td><td>LCM Module</td></tr><tr><td></td><td>Hook</td><td></td><td>Panel outline</td></tr></table> <table><tr><td>Rear Cover Width(A)</td><td>A = 30mm</td></tr><tr><td>Cover edge to Double Tape(B)</td><td>B = 3.0mm</td></tr><tr><td>CCD FPC thickness</td><td><0.1mm</td></tr><tr><td>Sponge thickness</td><td>0.5mm 0.2~0.3mm(compressed)</td></tr></table>				Rear-cover		Connector		Sponge		Camera/Antenna		Double Tape		Stopper		CCD Cable/FPC		LCM Module		Hook		Panel outline	Rear Cover Width(A)	A = 30mm	Cover edge to Double Tape(B)	B = 3.0mm	CCD FPC thickness	<0.1mm	Sponge thickness	0.5mm 0.2~0.3mm(compressed)
	Rear-cover		Connector																											
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Definition	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																													



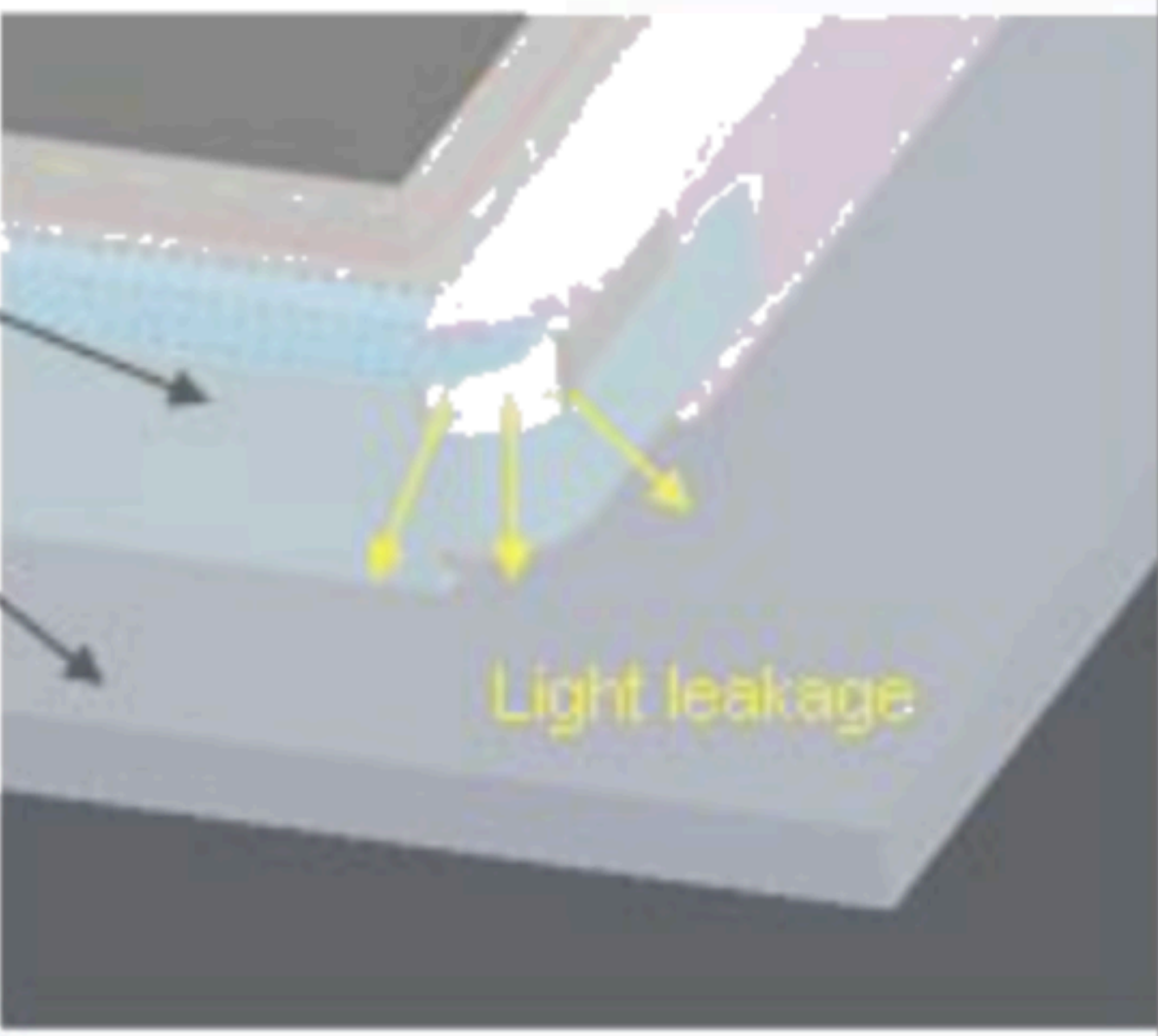



	<p>cable or Web Cam wire should not overlap with TCON,COF/FPC,Driver IC)</p> <p>Note: If the interference can not be avoided, please feel free to contact INX FAE Engineer for collaboration design. We can help to verify and pass risk assessment for customer reference.</p>
Definition	<p>To prevent peeling the bezel tape in rework process. The length of double tape is 30 – (A+B), A is bezel tape length and B is the double tape attaching tolerance.</p> <p>Ex :A :2mm, B:2mm, the length of double tape is 30-(2+2)=26mm.</p>

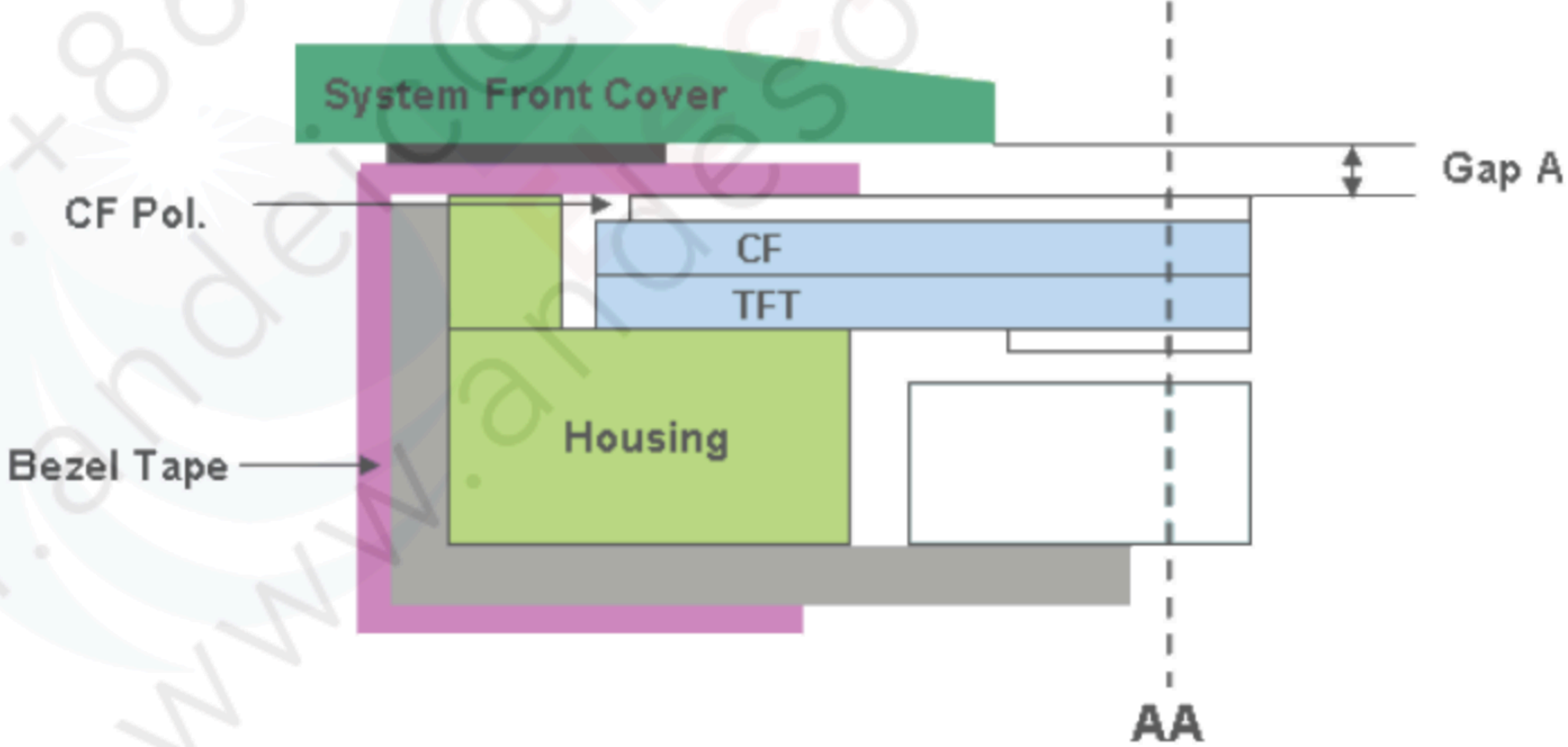
17	<p>Adhesive design between panel & bezel</p>
	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>OK</p>  <p>• Risk : Bezel Tape Peeling happened in a rework or reassembly process.</p> </div> <div style="text-align: center;"> <p>NG</p>  <p>• Risk : Pooling or light leakage due to stress concentration at B-cover opening</p> </div> </div>
Definition	<p>To prevent panel crack during system front-cover assembly process with double tape design, When system applied adhesive between B-Cover and LCD module, please design a distance 1.00mm between B-Cover's adhesive and CF pol. Do NOT put adhesive on CF pol.</p> <p>Adhesive material need be qualified to prevent from doing damage to cell tape after rework.</p> <p>Adhesive material need be qualified to prevent abnormal noise when hinge swinging test.</p>

18	<p>System front-cover assembly reference with Double tape design</p>
	
Definition	<p>To prevent system front-cover peeling at double tape contact area, A gap between B-Cover & CF-Pol. Is 0.1mm min.</p>

19	System front-cover opening area reference with TFT-LCD module
	
Definition	To prevent panel the noise of B-cover & CF Pol. Distance from CF Pol. edge to front-cover edge more than 0.65mm.

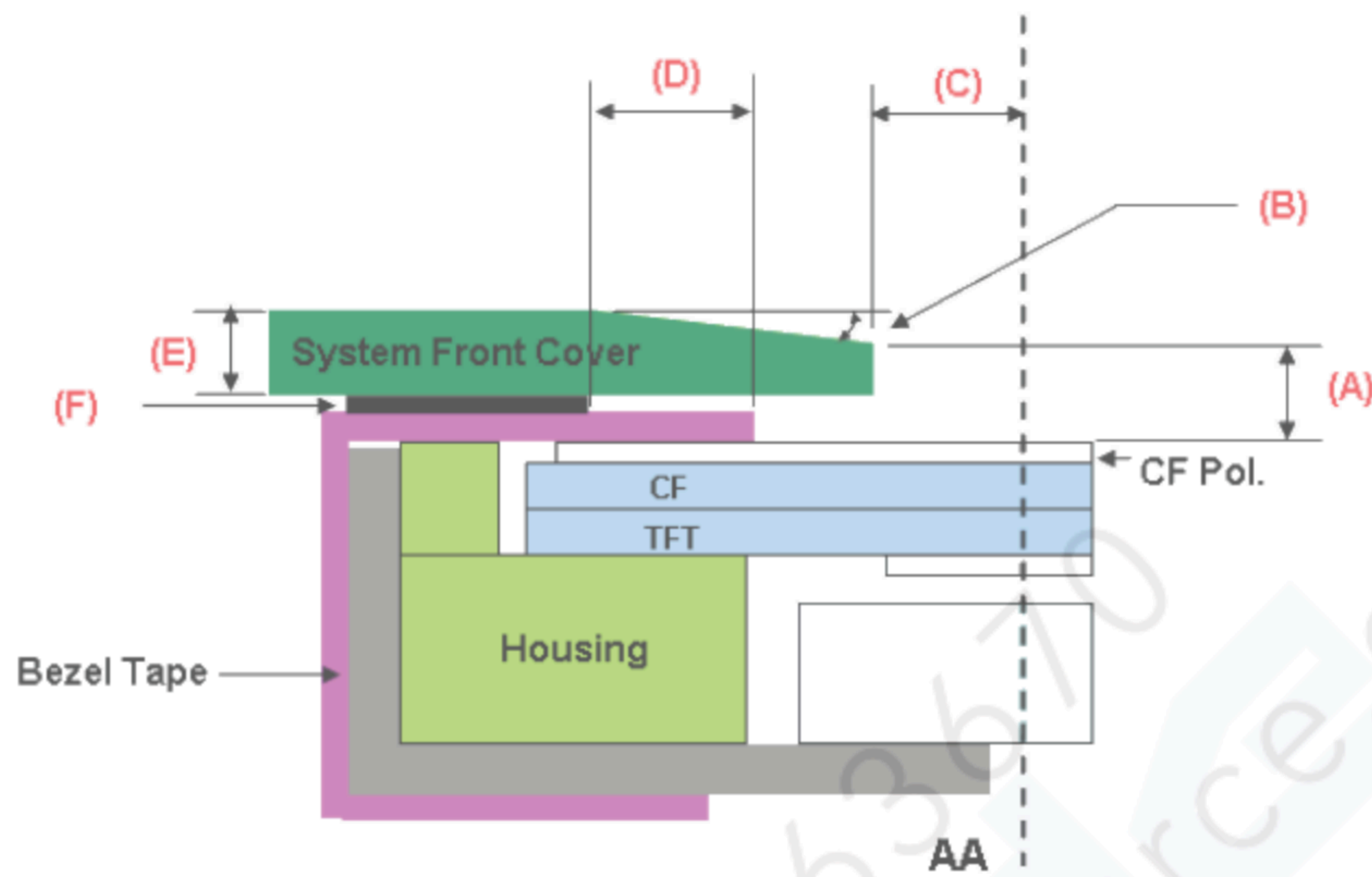
20	Color of system front-cover material
	

	 
	 
Definition	<p>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.</p>

21	Design Gap between System Front-cover & TOD LCD module surface
	 <p style="text-align: center;">$0.15 \leq \text{Gap A} \leq 0.20 \text{ mm}$</p>
Definition	<p>Gap A between system front-cover & TOD LCD module 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.</p> <p>To remain sufficient gap for first graph, design value for front-cover depth is recommended higher than module wing depth.</p>

22

System Front-cover dimension suggestion



System Front Cover Open TOP to CF Pol. (A)	System Front Cover Chamfer (B)	System Front Cover Open to AA (C)	Bezel Tape Edge to Double Tape (D)	System Front Cover thickness (E)	Double Tape Thickness (F)
0.8mm Max	8~20°	$0.7 \leq (B) \leq 0.9\text{mm}$	1.0 mm Min	1.2mm MAX	$0.05 \leq (F) \leq 0.08\text{mm}$

CAUTION :

In order to avoid the risk of bezel tape peeling, INX suggest not to attach any double tape on bezel tape; if necessary, the location of double tape attach must follow INX design guidance.

Definition

To achieve better touch sensibility, INX suggests to follow design value as recommended , Recommended dimension is shown in above graph.