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# Specifications

## TFT-LCD module

**Model No: QD3958**

**Customer name:**

**The project name:QD3958**

For Customer's Acceptance	
Approved by	Comment

	Signature	Date
Prepared by		
Checked by		
Approved by		

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## 1 General Description

**QD3958** is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module, which is composed of a TFT-LCD panel, a driver circuit a backlight unit, The panel size is 3.95inch and thresolution is 320x480. High image quality a-Si TFT LCD module. Partial-screen display function is available. Sleep and Stand-by modes are available for power saving.

### 1.1 Features

No	Item	Specification	Remark
1	Display Mode	Normally Black	
2	Screen Size	3.95inch (diagonal)	
3	Resolution	320XRGBX480	
4	Color Number	16.7M	
5	Color Arrangement	RGB-stripe	
6	Driver IC	ST7796S	
7	Back Light	White LED*8	
8	Viewing Direction	12 O'CLOCK	
9	Interface	SPI_RGB 兼容	
10	Surface Treatment	UV Cut	

### 1.2 Application

- ◆ Mobile phone.
- ◆ Portable multimedia device.

## 2 Outline Dimension

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Parameter	Specifications	Unit
Outline dimensions	60.88 (W) x94.57(H) x2.5+-0.1(D) (LCM,no include FPC)	mm
Active area	55.68(W) x83.52(H)	mm
Resolution	320(H)RGBx 480(V) dots	-
Dot size	0.174(H) x0.174	mm
Module brightness	300	cd/m <sup>2</sup>



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3 Electrical Characteristics

3.1 TFT-LCD Module

Ta=25℃

Item	Symbo	Value			Unit	Notes
		Min	Typ	Max		
Supply Voltage for logic	Vcc	2.5	2.8	3.3	V	
	Vci	2.5	2.8	3.3		
TFT Gate ON Voltage	VGH *	11.5		19	V	
TFT Gate OFF Voltage	VGL	-15.5		-7	V	
Operating temperature	Top	-20		+70	℃	
Storage temperature	Tst	-30		+80	℃	

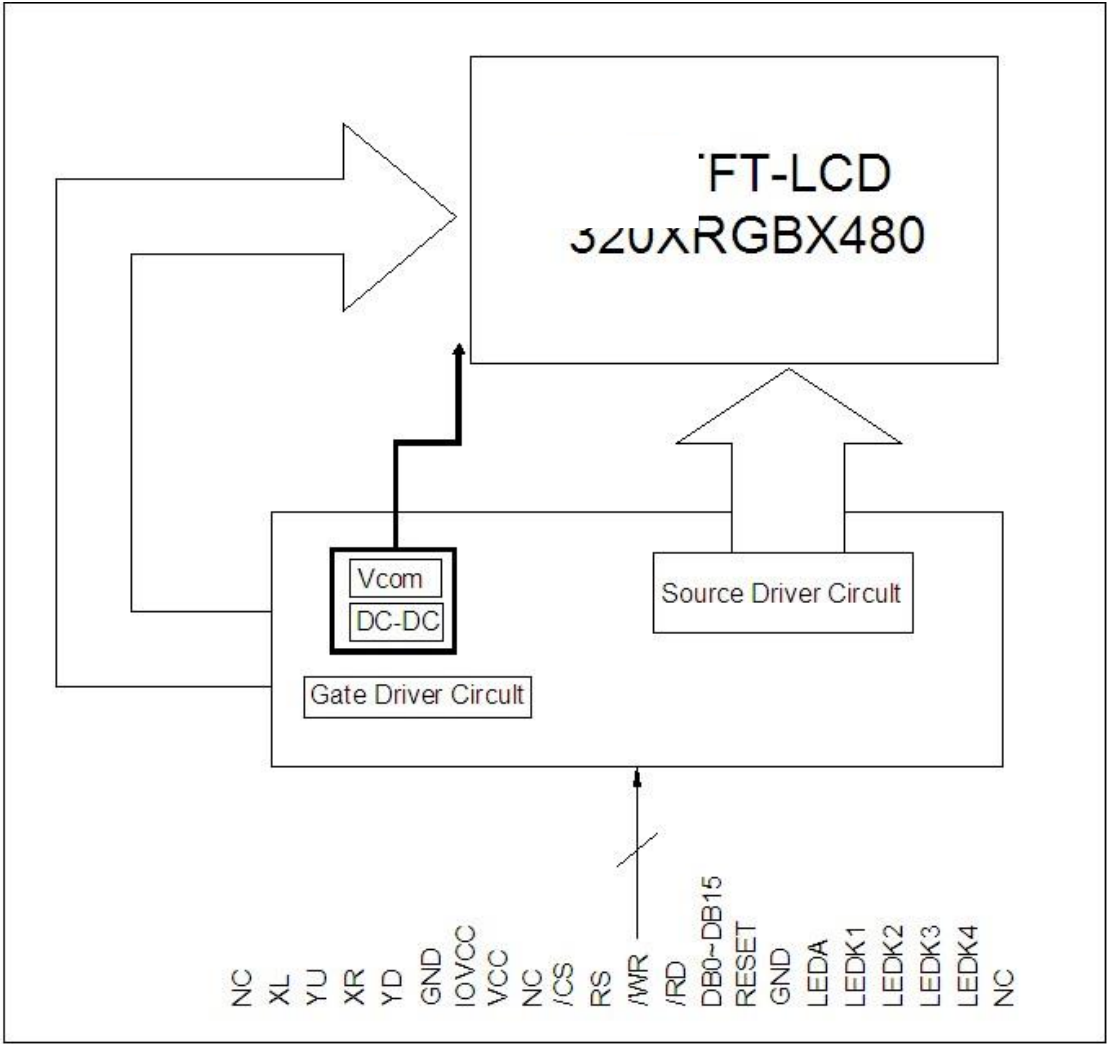
3.2 Back-Light Unit

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Current	IF	--	120	160	mA	IF=160mA VF=3.2V
Forward voltage	VF	3.0	3.2	3.4	V	
Chroma	X	0.240		0.28		
	Y	0.250		0.29		
Brightness	L	4500			Cd/m2	
Uniformity	UBL	80			%	

- 8 LED
- The luminous intensity of LED is strongly dependent on the driving current.
- It is recommended the input of backlight to be constant current rather than constant voltage.

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4 Block Diagram



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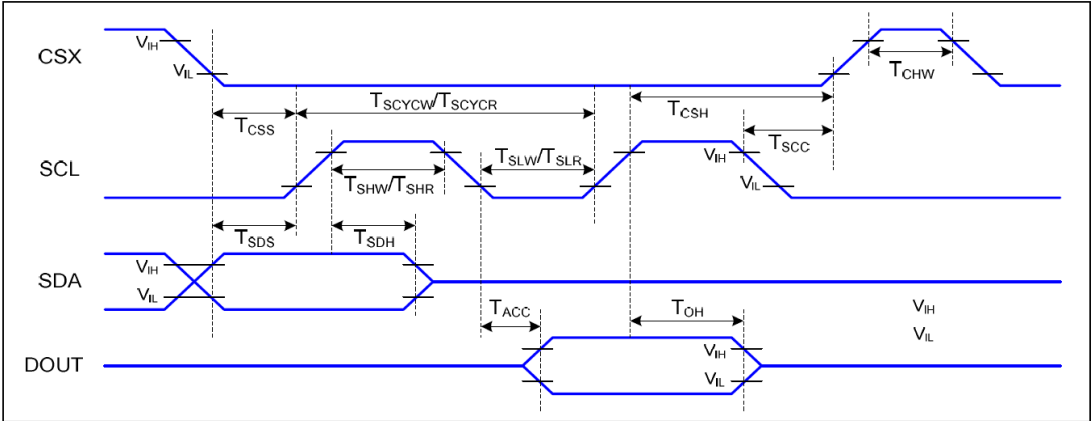
## 5 TFT-LCM Interface Specification

Pin No.	Symbol	Functional	I/O
1	YU	Y+	I
2	XL	X-	I
3	YD	X-	I
4	XR	X+	I
5	VCC	Power supply input for LCM:2.8V	Power supply
6	IOVCC	Power supply input for LCM: 1.8V/2.8V	Power supply
7	TE	Serve as a TE (Tearing Effect) output signal	I
8	CS	Chip select input pin.	O
9	RS/A0	The SPI interface (DCX): The signal for command or ---RS='H ': Display data. ---RS='L ': Instruction data.	I
10	WR/SCL	A write strobe signal can be input via this pin and initializes a write Serial clock input for SPI interface operation when the signal is low.	I
11	RD	A read strobe signal can be input via this pin and initializes a read	I
12	SDI	Serial data input/output bidirectional pin for SPI Interface	I/O
13	SDO	Serial data output pin used for the SPI Interface	O
14	GND	Power Ground	Power supply
15~32	DB0~DB17	Data interface	I/O
33	GND	Power Ground	Power supply
34	DEN	Data enable signal	I
35	PCLK	Dot clock signal for RGB interface operation	I
36	HSYNC	Horizontal sync	I
37	VSNC	Vertical sync	I
38	RESET	Reset signal input Pin	I
39~41	IM2-IM0	The System interface mode select IM2~IM0=011,MCU8 BIT DB0~DB7 IM2~IM0=010,MCU16 BIT DB0~DB15 IM2~IM0=111,4-line 8bit serial IM2~IM0=101,3-line 9bit serial	I
42	LEDA	Power supply for backlight anode input terminal.	BL Power
43~48	LED-K	Power supply for backlight cathode input terminal.	BL Power

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6 Description of Interface'Signal

7.4.2 3-SPI Serial Data Transfer Interface Characteristics:



3-SPI Interface Timing Characteristics

VDDI=1.8V,VDDA=2.8V, AGND=DGND=0V, Ta=25 ℃

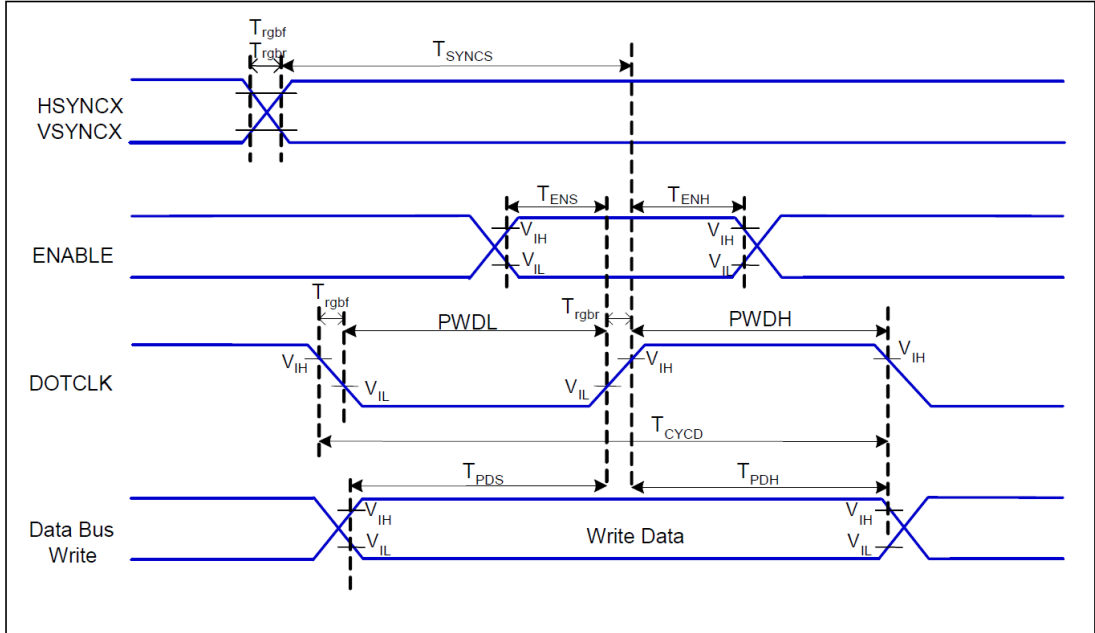
Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	$T_{CSS}$	Chip select setup time (write)	15		ns	
	$T_{CSH}$	Chip select hold time (write)	15		ns	
	$T_{CSS}$	Chip select setup time (read)	60		ns	
	$T_{SCC}$	Chip select hold time (read)	65		ns	
	$T_{CHW}$	Chip select "H" pulse width	40		ns	
SCL	$T_{SCYCW}$	Serial clock cycle (Write)	66		ns	
	$T_{SHW}$	SCL "H" pulse width (Write)	15		ns	
	$T_{SLW}$	SCL "L" pulse width (Write)	15		ns	
	$T_{SCYCR}$	Serial clock cycle (Read)	150		ns	
	$T_{SHR}$	SCL "H" pulse width (Read)	60		ns	
	$T_{SLR}$	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	$T_{SDS}$	Data setup time	10		ns	
	$T_{SDH}$	Data hold time	10		ns	
DOUT	$T_{ACC}$	Access time	10	50	ns	For maximum CL=30pF
	$T_{OH}$	Output disable time	15	50	ns	For minimum CL=8pF

3-SPI Interface Characteristics

6.2 RGB Interface Timing Charateristics



7.4.4 RGB Interface Characteristics:



VDDI=1.8V,VDDA=2.8V, AGND=DGND=0V, Ta=25℃

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	$T_{\text{SYNCX}}$	VSYNC, HSYNC Setup Time	15	-	ns	
ENABLE	$T_{\text{ENS}}$	Enable Setup Time	15	-	ns	
	$T_{\text{ENH}}$	Enable Hold Time	15	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	30	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	30	-	ns	
	$T_{\text{CYCD}}$	DOTCLK Cycle Time	66	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	15	ns	
DB	$T_{\text{PDS}}$	PD Data Setup Time	15	-	ns	
	$T_{\text{PDH}}$	PD Data Hold Time	15	-	ns	

RGB Interface Timing Characteristics

6.3 Reset Timing

7.5.6 Reset Timing:

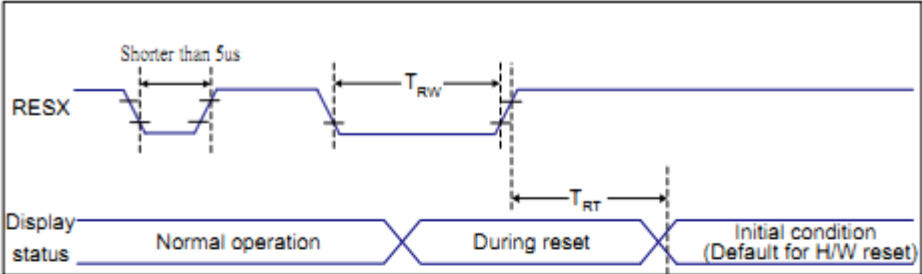


Figure 10 Reset Timing

VDD1=1.8, VDD=2.8, AGND=DGND=0V, Ta=25 ℃

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120(Note 1, 6, 7)	ms

Table 10 Reset Timing

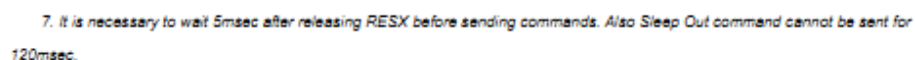
Notes:

1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (TRT) within 5 ms after a rising edge of RESX.
2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out -mode. The display remains the blank state in Sleep In -mode.) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:



Parameter		Symbol	Condition	Min.	Typ	Max.	Unit	Remark
Viewing Angle Range	Horizontal	Θ3	CR>10	80	85	-	Deg.	Note1
		Θ9		80	85	-	Deg.	
	Vertical	Θ12		80	85	-	Deg.	
		Θ6		80	85	-	Deg.	
Contrast ratio		CR	Θ = 0	800	1000	-	-	Note2
Transmittance		Tr		3.45	4.05	-	%	Note3 H C+Clear
Color Gamut		CG		65	70	-	%	CF@C-Light
Reproduction of color	Red	Rx	Θ = 0°	0.625	0.655	0.685	-	Note4 (CF@C Light)
		Ry		0.287	0.317	0.347	-	
	Green	Gx		0.232	0.262	0.292	-	
		Gy		0.538	0.568	0.598	-	
	Blue	Bx		0.107	0.137	0.167	-	
		By		0.055	0.085	0.115	-	





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8 Environment Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Remark
Operation temperature range	Top	-10	60	℃	Ambient
Storage temperature range	Tst	-20	70	℃	Ambient

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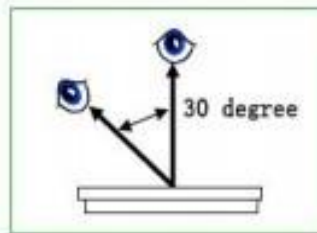
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## 9 Inspection Standard

This standard apply to TFT module specification.

### 1. Inspection condition:

Under daylight lamp 20~40W, product distance inspector'eye 30cm.incline degree 30° .



### 2. Inspection standard

NO.	Item	Inspection standard	Rate															
2.1	Dot	<p>Case of Dot defect is below</p> <p>① Bright Dot (whit spot) : "0"</p> <p>② Dark Dot (black spot) : "0" (In case of Dark Dot on Main TFT LCD)</p> <p>- NG if there's full Dot defect.</p> <p>- Damaged less than the size of sub-pixel is not counted as defect</p> <p>- Dots darker than the size of sub-pixel are not defined as bright dot defect</p> <table><tr><th>area size ( mm )</th><th>Acceptable number</th></tr><tr><td><math>\Phi \leq 0.10</math></td><td>ignore</td></tr><tr><td><math>0.10 &lt; \Phi \leq 0.15</math></td><td>3</td></tr><tr><td><math>0.15 &lt; \Phi \leq 0.20</math></td><td>2</td></tr><tr><td><math>0.25 &lt; \Phi \leq 0.25</math></td><td>1</td></tr><tr><td><math>0.25 &lt; \Phi</math></td><td>0</td></tr></table>	area size ( mm )	Acceptable number	$\Phi \leq 0.10$	ignore	$0.10 < \Phi \leq 0.15$	3	$0.15 < \Phi \leq 0.20$	2	$0.25 < \Phi \leq 0.25$	1	$0.25 < \Phi$	0	minor			
area size ( mm )	Acceptable number																	
$\Phi \leq 0.10$	ignore																	
$0.10 < \Phi \leq 0.15$	3																	
$0.15 < \Phi \leq 0.20$	2																	
$0.25 < \Phi \leq 0.25$	1																	
$0.25 < \Phi$	0																	
2.2	line	<table><tr><th colspan="2">Size ( mm )</th><th>Acceptable number</th></tr><tr><td>ignore</td><td><math>W \leq 0.03</math></td><td>ignore</td></tr><tr><td><math>L \leq 4.0</math></td><td><math>0.03 &lt; W \leq 0.04</math></td><td>2</td></tr><tr><td><math>L \leq 4.0</math></td><td><math>0.04 &lt; W \leq 0.05</math></td><td>1</td></tr><tr><td></td><td><math>0.05 &lt; W</math></td><td>Treat with dot non-conformance</td></tr></table>	Size ( mm )		Acceptable number	ignore	$W \leq 0.03$	ignore	$L \leq 4.0$	$0.03 < W \leq 0.04$	2	$L \leq 4.0$	$0.04 < W \leq 0.05$	1		$0.05 < W$	Treat with dot non-conformance	
Size ( mm )		Acceptable number																
ignore	$W \leq 0.03$	ignore																
$L \leq 4.0$	$0.03 < W \leq 0.04$	2																
$L \leq 4.0$	$0.04 < W \leq 0.05$	1																
	$0.05 < W$	Treat with dot non-conformance																





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	Carton outline size: 400×295×145 (mm)
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## 11 Precautions

Please pay attentions to the followings as using the LCD module.

### 11.1 Handling

- (a) Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.
- (b) Because the polarizer is very fragile and easy to be damaged, do not hit, press or rub the display surface with hard materials.
- (c) Do not put heavy or hard material on the display surface, and do not stack LCD modules.
- (d) If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.
- (e) Avoid using Ketone type materials (e.g. Acetone), Toluene, Ethyl acid or Methyl chloride to clean the display surface. It might damage the touch panel surface permanently. The recommended solvents are water and Isopropyl alcohol.
- (f) Wipe off water droplets or oil immediately.
- (g) Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.
- (h) Do not touch the output pins directly with bare hands.
- (i) Do not disassemble the LCD module.
- (j) Do not lift the FPC of Touch Panel.

### 11.2 Storage

- (a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.
- (b) Do not expose the LCD modules to sunlight directly.
- (c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong

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ultraviolet ray for a long time.

- (d) Avoid condensation of water. It may cause improper operation.
- (e) Please stack only up to the number stated on carton box for storage and transportation. Excessive weight will cause deformation and damage of carton box.

### 11.3Operation

- (a) When mounting or dismounting the LCD modules, turn the power off.
- (b) Protect the LCD modules from electric shock.
- (c) The Driver IC control algorithms stated above should always obeyed to avoid damaging the LSI and electronic circuit.
- (d) Be careful to avoid mixing up the polarity of power supply for backlight.
- (e) Absolute maximum rating specified above has to be always kept in any case. Exceeding it may cause non-recoverable damage of electronic components or, nevertheless, burning.
- (f) When a static image is displayed for a long time, remnant image is likely to occur.
- (g) Be sure to avoid bending the FPC to an acute shape, it might break FPC.
- (h) Most of the touch screens have air vent to equalize the inside air pressure to the outside one. The air vent must be open and liquid contact must be avoided as the liquid may be absorbed if the liquid is accumulated near the air vent.
- (i) For the fragility of ITO film, it should avoid to use too tapering pen as the input material.

### 11.4Touch Panel Mounting Notes

- (a) If a cushion is used between bezel/housing and film must be choose as free as enough to absorb the expansion and contraction to avoid the distortion of film.
- (b) The cushion must be placed out of the Viewing Area.
- (c) Bezel/Housing edge must be posited between Key Area and Viewing Area. The edge enters the Key Area may cause unexpected input if the gap is too narrow or foreign particles like dusts exist between Bezel/Housing and ITO film.



