



## ASI-T-650GA8 LN/D

Item	Contents	Unit
Size	6.5	inch
Resolution	640(RGB) x 480	/
Interface	6bit LVDS	/
Technology type	a-Si TFT	/
Pixel pitch	0.207x0.207	mm
Pixel Configuration	R.G.B. Vertical Stripe	
Outline Dimension (W x H x D)	153.0x118.0x11.9	mm
Active Area	132.48x 99.36	mm
Display Mode	Transmissive Normally White	/
Backlight Type	LED	/
Driver IC	NT39413B × 2 + NT39207B × 1	/



Record of Revision

Date	Revision No.	Summary
2011-09-29	1.0	Rev 1.0 was issued



# ASI-T-650GA8 LN/D

## 1. Scope

This data sheet is to introduce the specification of ASI-T-650GA8 LN/D active matrix TFT module. It is composed of a color TFT-LCD panel, driver ICs, FPC and a backlight unit. The 6.5" display area contains 640(RGB) x 480 pixels.

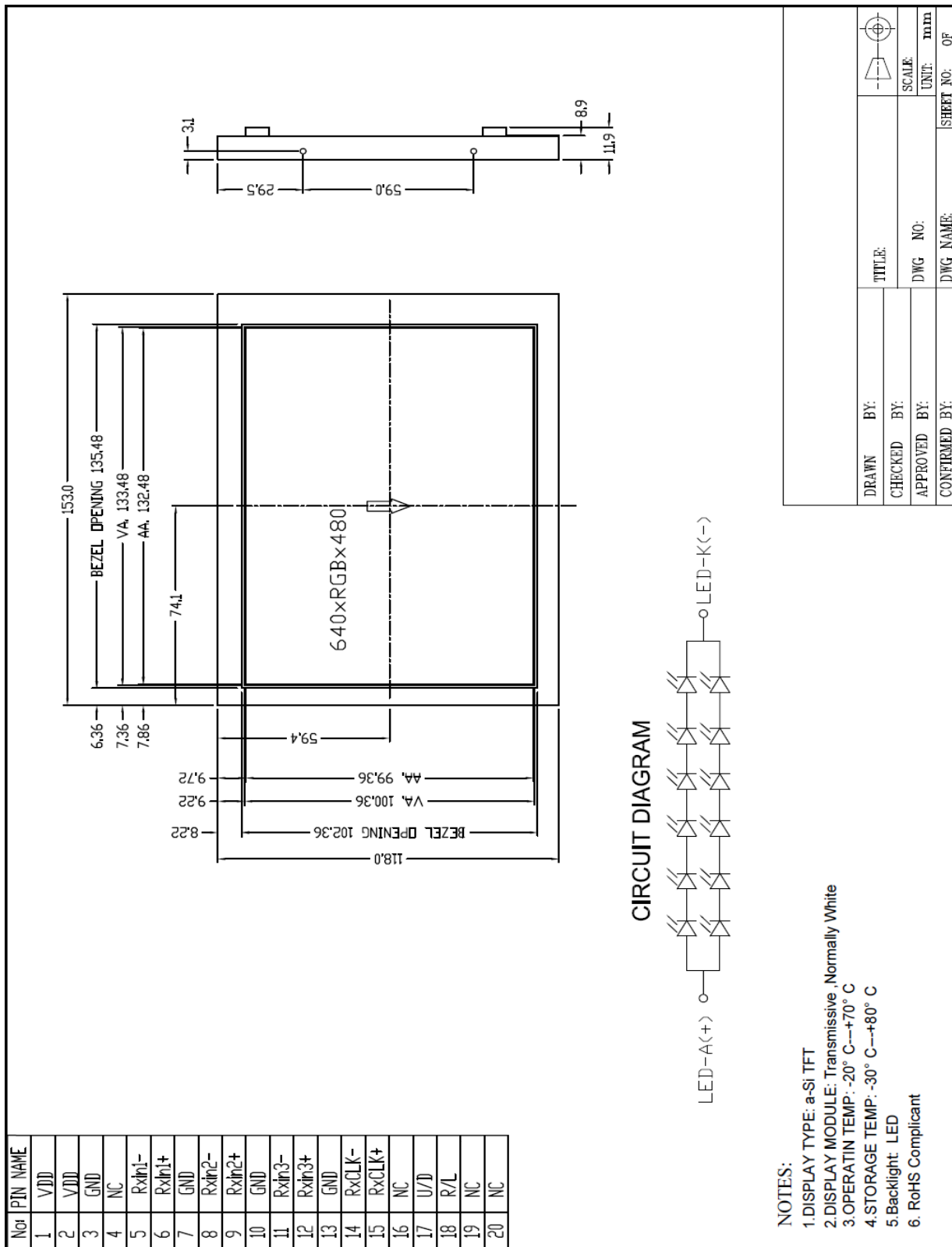
## 2. Application

Digital equipments which need color display, mobile phone, mobile navigator/video systems.

## 3. General Information

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4. Outline Drawing





5. Interface signals

TFT LCD Panel

No	Symbol	I/O	Description	Remarks
1	VDD	P	Power Supply	
2	VDD	P	Power Supply	
3	GND	P	Ground	
4	NC	-	Not connected	
5	RXIN1-	I	LVDS Receiver Signal(-)	
6	RXIN1+	I	LVDS Receiver Signal(+)	
7	GND	P	Ground	
8	RXIN2-	I	LVDS Receiver Signal(-)	
9	RXIN2+	I	LVDS Receiver Signal(+)	
10	GND	P	Ground	
11	RXIN3-	I	LVDS Receiver Signal(-)	
12	RXIN3+	I	LVDS Receiver Signal(+)	
13	GND	P	Ground	
14	RXCLK-	I	LVDS Receiver Clock Signal(-)	
15	RXCLK+	I	LVDS Receiver Clock Signal(+)	
16	NC	-	Not connected	
17	U/D	I	Vertical reverse (L: up to down scan H: down to up scan )	Note: Don't let this pin open
18	R/L	I	Horizontal reverse (H ; left to right scan L : right to left)	
19	NC	-	Not connected	
20	NC	-	Not connected	

P: Power/GND; I: input pin; O: output

**CN2 (Backlight Interface)**

Pin	Symbol	Pin Description
1	VLED	12V Input
2	VLED	12V Input
3	GND	Ground
4	GND	Ground
5	LED ON/OFF	3.3V On; GND Off
6	PWM DIM	Dimming signal



6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

Parameter	Symbol	MIN	MAX	Unit	Remark
LCD Drive Voltage	VCC	-0.5	5.0	V	

6.2. Environment Conditions

Item	Symbol	MIN	MAX	Unit	Remark
Operating Temperature	TOPR	-20	70	°C	
Storage Temperature	TSTG	-30	80	°C	

6.3. LED Backlight Absolute max. ratings

Item	Symbol	MIN	MAX	Unit	Remark
LED BLU Drive Voltage	VLED	0	20	V	
LED BLU Drive Dim Voltage	DIM	0	5	V	

## 7. Electrical Specifications

### 7.1 Electrical characteristics

GND=0V, Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Digital supply Voltage	VCC	3.00	3.30	3.60	V	
Current consumption	ICC	--	210	315	mA	Note
Input Signal Voltage	VIL	--	--	0.2xIOVCC	V	HD,VD,R0~R5, G0~G5,B0~B5, DENA,REV.
	VIH	0.8xIOVCC	--	IOVCC	V	

Note: To test the current dissipation, use "all Black Pattern" test pattern at 3.3V of VCC.

### 7.2 LED Backlight

Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
LED driver input voltage	VLED	9	12	15	V	100% Duty
LED driver input current	ILED	180	200	240	mA	100% Duty
Backlight Power Consumption	WBL	--	2400	--	mW	100% Duty
VLED On/Off	on	2.4	3.3	--	V	
	off	--	0	0.5	V	
PWM voltage	High	2.4	3.3	--	V	
	Low	--	0	0.6	V	
Dimming Frequency	Fpwm	200	--	30K	HZ	
Dimming Duty	Dpwm	5	--	100	%	

### LED Driving Characteristics(internal use only).

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	ILED	--	120	160	mA	
Forward Voltage	VLED	--	19.2	21.0	V	Note2
Backlight Power Consumption	WBL	--	2304			

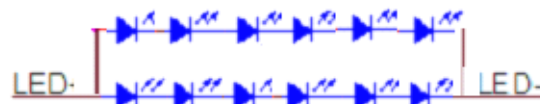
Note 1: The LED driving condition is defined for each LED module.

Note 2: The LED must be drive by constant forward current and the LED forward voltage only for reference. Optical performance should be evaluated at Ta=25°C only.If LED is driven by high current, high ambient temperature & humidity condition.The life time of LED will be reduced.Operating life means brightness goes down to 50% initial brightness.Typical operating life time is estimated data.

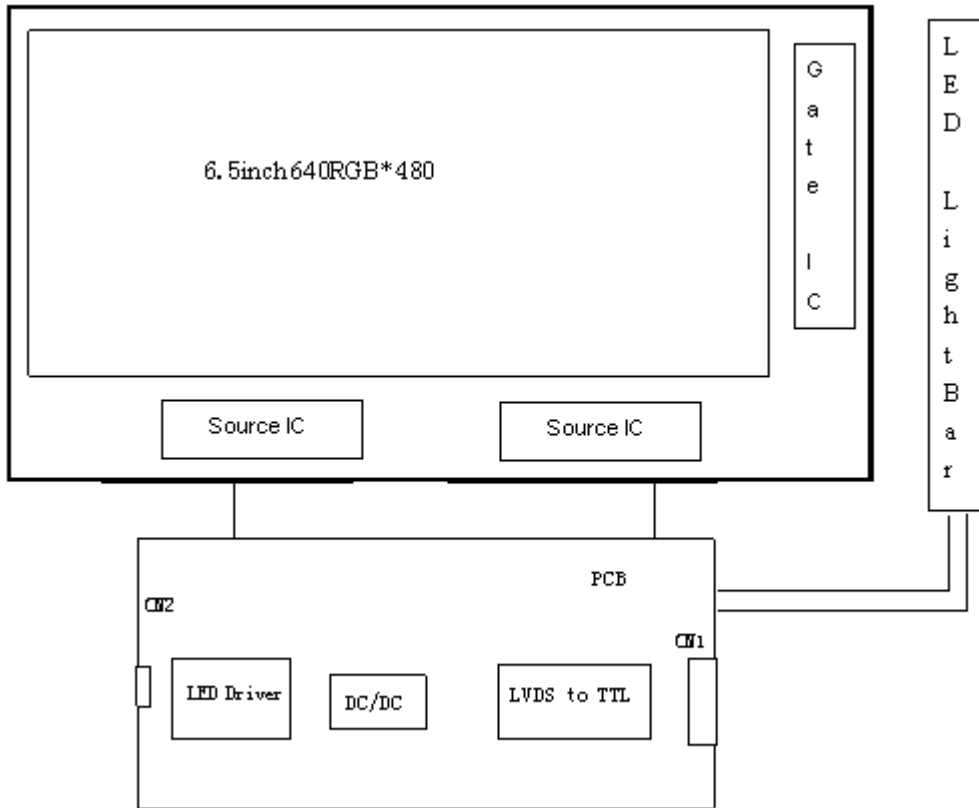
Note 3: One LED: IF =60 mA, VF =3.2V.

Note 4: Lifetime : 50000H (typ)

LED Connection of Backlight



7.3 BLOCK DIAGRAM

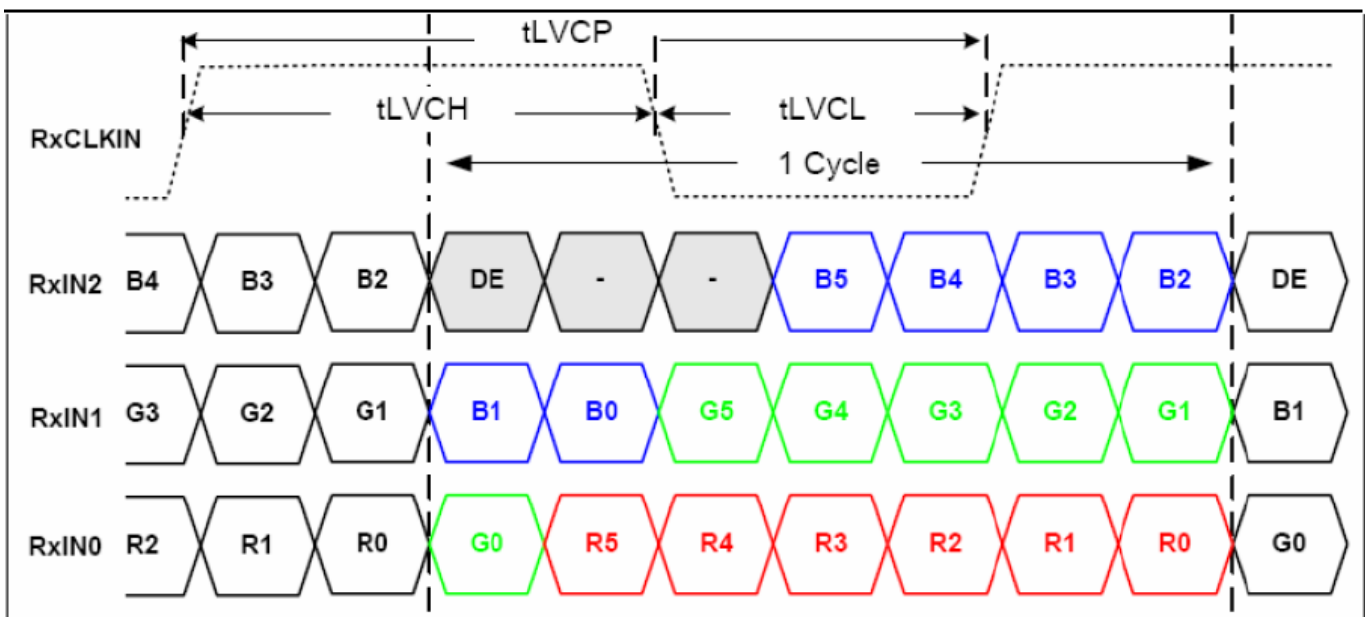


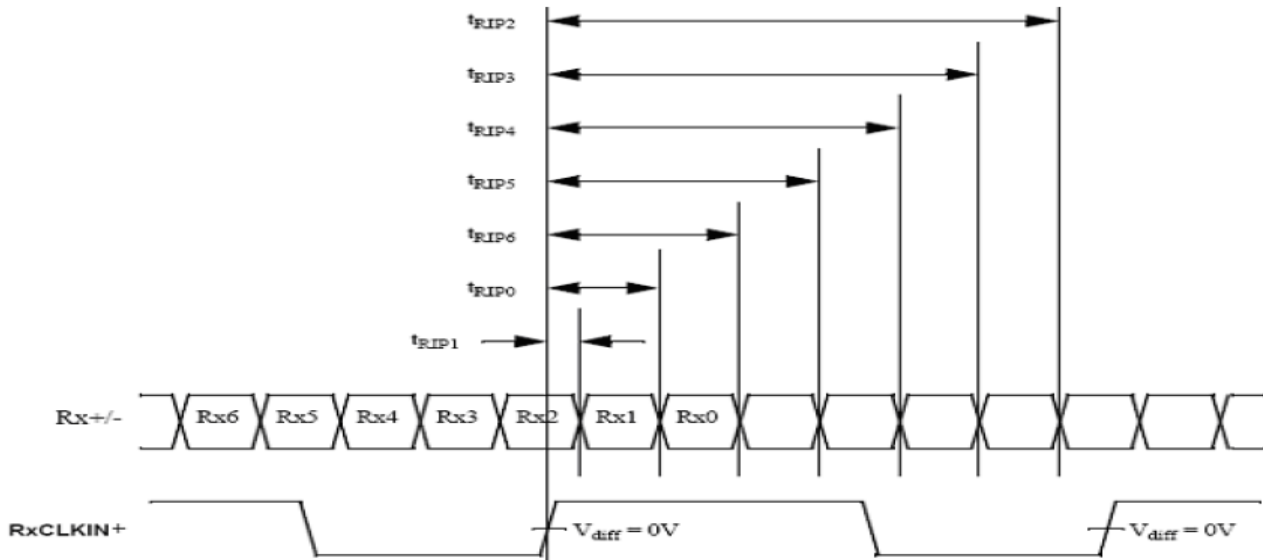


## 8. Command/AC Timing

### 8.1 AC Electrical Characteristics

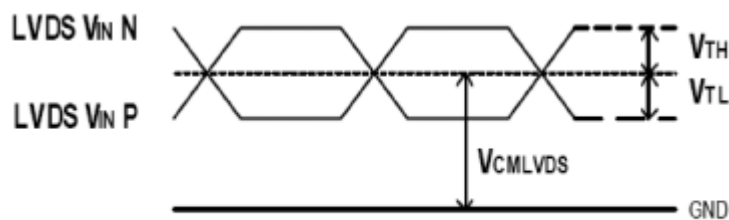
Item	Symbol	Min	Typ	Max	Unit	Remark
RxCLKIN frequency	flvcp	24.8	25.2	31.5	MHz	
RxCLKIN Period	tlvcp	40.3	39.7	3.1.7	ns	
RxCLKIN High Time	tlvch		4T/7		ns	
RxCLKIN Low Time	tlvcl		3T/7		ns	
Input Data Position0	tRIP1	-0.4	0.0	+0.4	ns	
Input Data Position1	tRIP0	T/7-0.4	T/7	T/7+0.4	ns	
Input Data Position2	tRIP6	2T/7-0.4	2T/7	2T/7+0.4	ns	
Input Data Position3	tRIP5	3T/7-0.4	3T/7	3T/7+0.4	ns	
Input Data Position4	tRIP4	4T/7-0.4	4T/7	4T/7+0.4	ns	
Input Data Position5	tRIP3	5T/7-0.4	5T/7	5T/7+0.4	ns	
Input Data Position6	tRIP2	6T/7-0.4	6T/7	6T/7+0.4	ns	





### 8.2 SPI Interface Timing DC Electrical Characteristics

Item	Symbol	Min	Typ	Max	Unit	Remark
Digital supply Voltage	VCC	3.00	3.30	3.60	V	
Input Signal Voltage	Low Level	VIL	0	0.3*VCC	V	Only for REV
	High Level	VIH	0.7*VCC	VCC	V	
Common Mode Voltage	VCMLVDS	-	1.25	-	V	For RxINx+/-, RxCLKIN+/-
Differential Input High Threshold	VTH	-	-	+100	mV	
Differential Input Low Threshold	VTL	-100	-	-	mV	
Input Current	IIN	-10	-	+10	uA	
Resistance	R	-	100	-	Ω	
Current of digital supply voltage	IVCC	-	205	-	mA	VCC=3.3V colorbar pattern

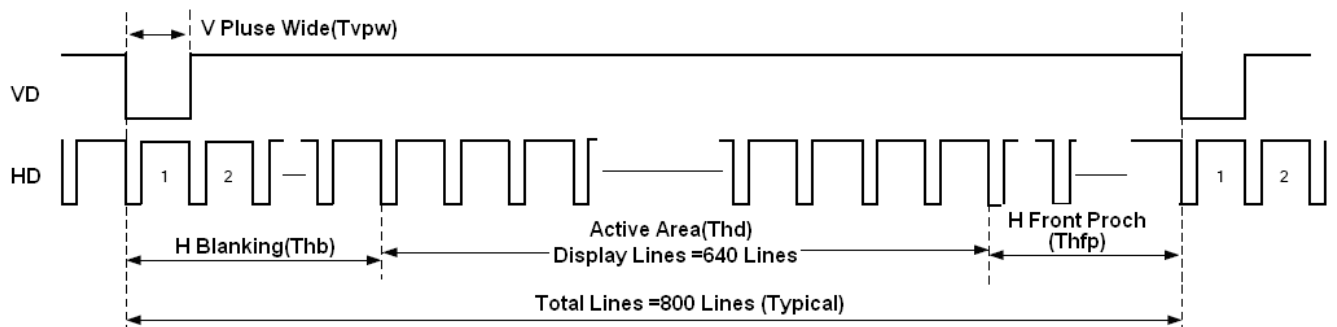
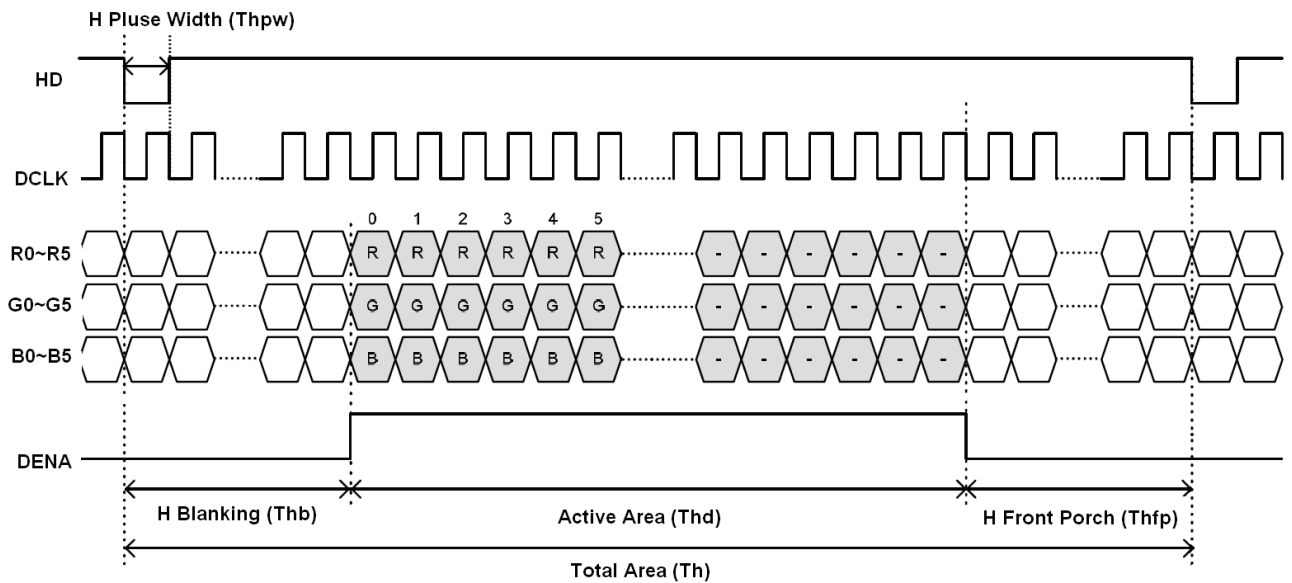


LVDS DC timing diagram

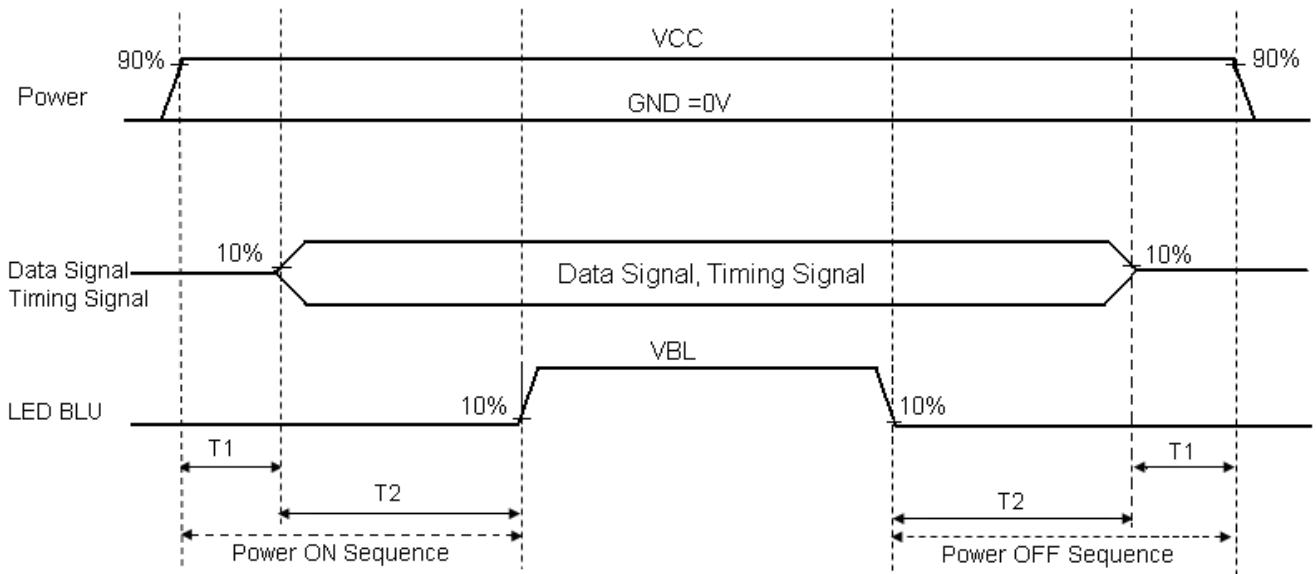
## 8.3 Timing Table

Item	Symbol	Symbol	Min	Typ	Max	Unit
DOTCLK	DOTCLK frequency	Fclk	24.8	25.2	31.5	MHz
	DOTCLK cycle	Tclk	31.75	39.68	40.32	ns
HD	Horizontal	Thd	640	640	640	Tclk
	1 horizontal line	Th	800	800	1000	Tclk
	Hsync pulse width	Thpw	1	-	-	Tclk
	Horizontal blanking	Thb	144	144	144	Tclk
	Horizontal front porch	Thfp	16	16	216	Tclk
VD	Vertical display area	Tvd	480			Th
	Vsync period time	Tv	516	525	570	Th
	Vsync pulse width	Tvpw	1	-	-	Th
	Vsync blanking	Tvb	35	35	35	Th
	Vsync front porch	Tvfp	1	10	55	Th

Note1: DEN timing refer to HD, VD input timing



### 8.4 Power ON/Off Sequence



NOTE: T1 ≥ 30ms; T2 ≥ 100ms;

### 8.5 APPENDIX

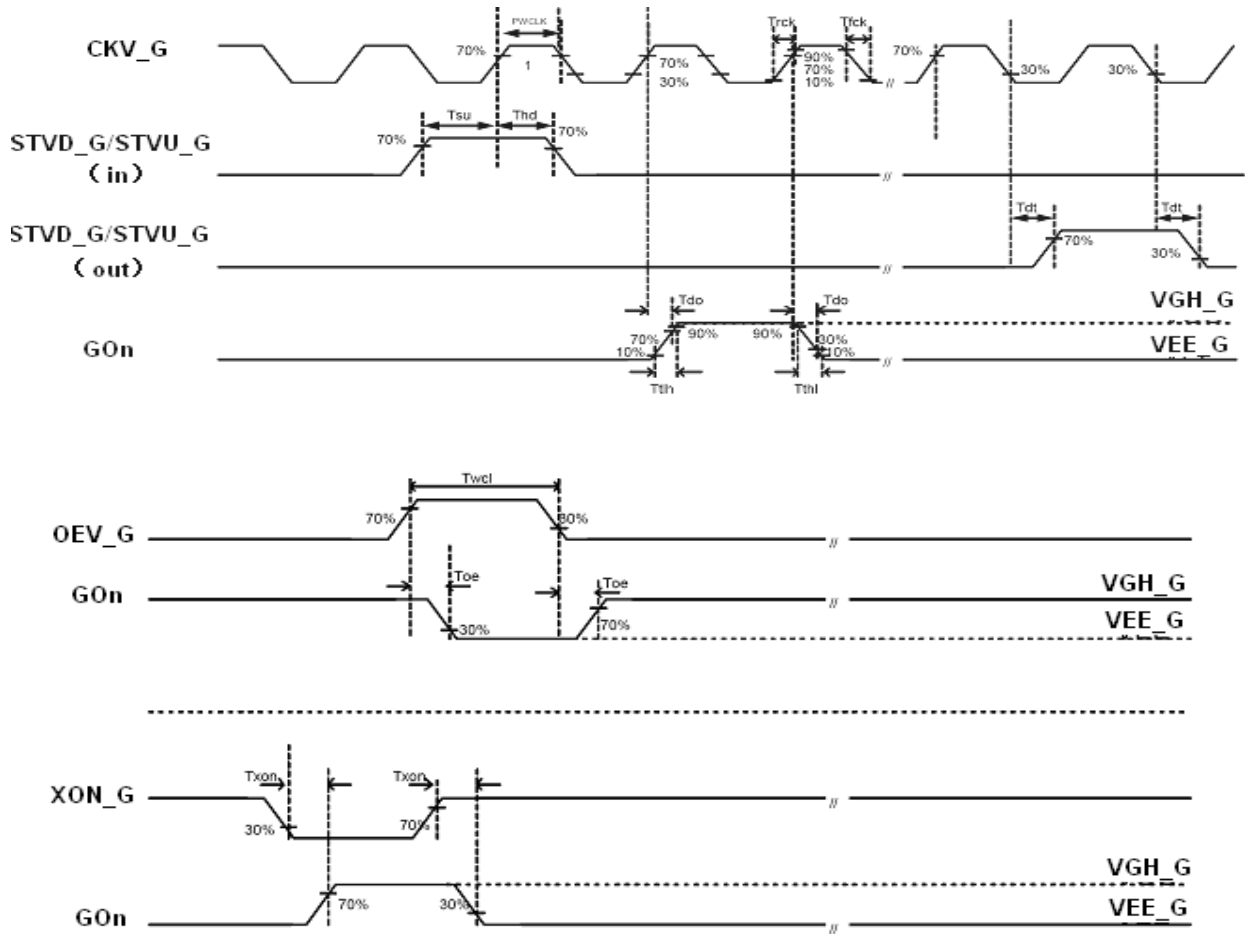
#### 8.5.1 LCD DC Characteristics

Item	Symbol	Min	Typ	Max	Unit	Remark	
Digital supply Voltage	VCC	3.00	3.30	3.60	V		
Analog supply Voltage	AVDD	10.37	10.95	11.34	V		
Gate on voltage	VGH_G	19.00	20.00	21.00	V		
Gate off voltage	VEE_G	-6.30	-6.00	-5.70	V		
Common Electrode	VCOM	-	4.73	-	V	Note1	
Input Signal Voltage	Low Level	VIL	0	-	0.3*VCC	V	
	High Level	VIH	0.7*VCC	-	VCC	V	
Output Signal Voltage	Low Level	VOL	GND	-	0.2*VCC	V	
	High Level	VOH	0.8*VCC	-	VCC	V	
Current of VCC Power supply	Ivcc	-	TBD	-	mA	Note2	
VCC Current			-	22.78	mA		
AVDD Current			-	36.14	mA		
VGH_G Current			-	0.34	mA		
VEE_G Current			-	0.36	mA		

Note1: For different LCM, the value may have a bit of difference.

Note2: To test the current dissipation, use "all Black Pattern".

8.5.2 Gate Driver Input Timing



AC Characteristics

(VGH\_G=20V, VEE\_G=-6V, VCC=3.3V, GND=0V, TA=25°C)

Symbol	Parameters	Min	Typ	Max	Unit	Remark
Tdt	STVD_G/STVU_G Delay Time	-	-	500	ns	
Tdo	Driver Output Delay Time	-	-	900	ns	
Tthl	Output Falling Time	-	400	800	ns	
Ttlh	Output Rise Time	-	500	1000	ns	
Toe	OEV_G to Driver Output Delay Time	-	-	900	ns	
Fclk	CKV_G Frequency	-	-	200	KHz	
Trck	CKV_G Rise Time	-	-	100	ns	
Tfck	CKV_G Falling Time	-	-	100	ns	
PWCLK	CKV_G Pluse Width (High period or Low period)	500	-	-	ns	
Tsu	STVD_G/STVU_G Setup Time	200	-	-	ns	
Thd	STVD_G/STVU_G Hold Time	300	-	-	ns	
Twcl	Output Enable pluse width	1	-	-	ns	



# ASI-T-650GA8 LN/D

## 9. Optical Specification

Ta=25°C

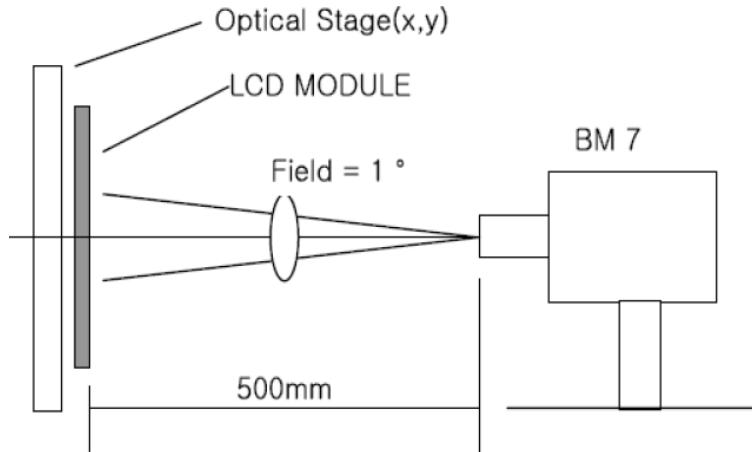
Item	Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio	CR	$\theta=0^\circ$	400	500	-		Note1 Note2
Response Time	Ton/ Toff	25°C	-	20	30	ms	Note1 Note3
View Angles	$\theta_T$	$CR \geq 10$	50	60	-	Degree	Note 4
	$\theta_B$		60	70	-		
	$\theta_L$		60	70	-		
	$\theta_R$		60	70	-		
Chromaticity	White	x	Brightness is on	Typ.-0.05	0.319	Typ.+0.05	Note5, Note1
		y			0.355		
	Red	x			0.597		
		y			0.329		
	Green	x			0.354		
		y			0.594		
	Blue	x			0.157		
		y			0.114		
NTSC	S			50		%	Note5
Luminance	L		600	800	-	cd/m <sup>2</sup>	Note1 Note6
Uniformity	U		75	80	-	%	Note1 Note7

Test condition: IF= 20mA, VF=22.4V,the ambient temperature is 25°C.

**Note 1: Definition of optical measurement system.**

Temperature = 25°C (±3°C)

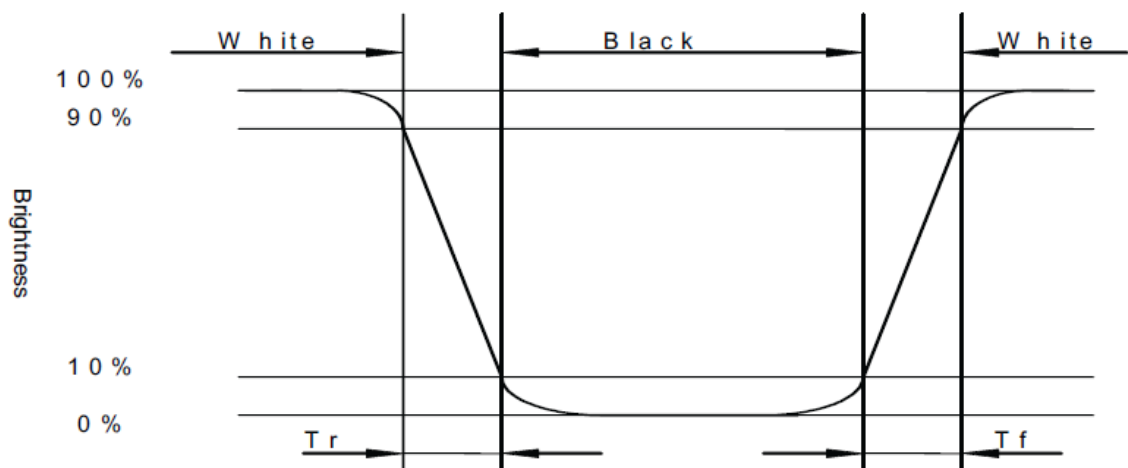
LED back-light: ON, Environment brightness < 150 lx



**Note 2: Contrast ratio is defined as follow:**

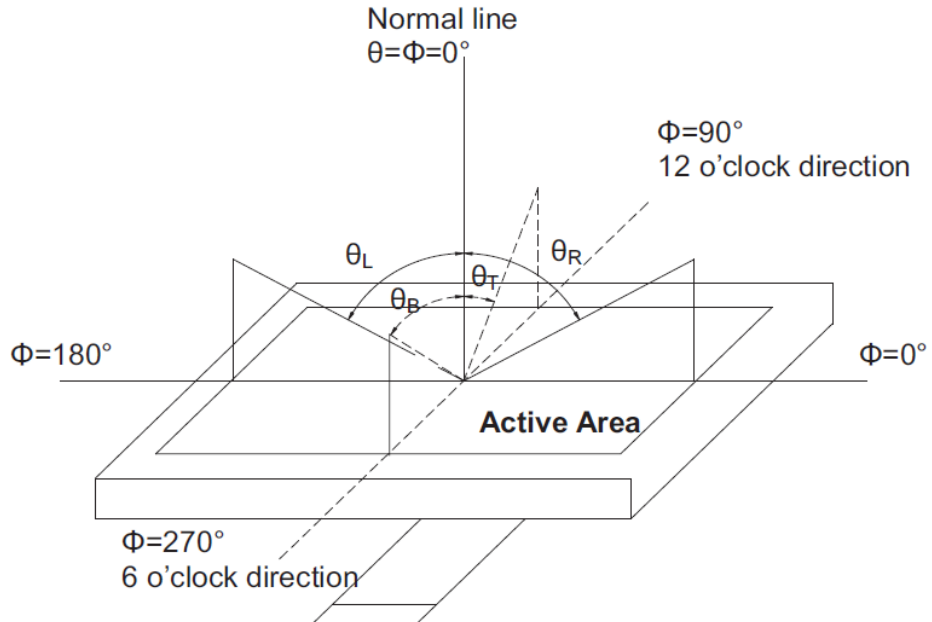
**Note 3: Response time is defined as follow:**

Response time is the time required for the display to transition from black to white (Rise Time,  $T_r$ ) and from white to black(Decay Time,  $T_f$ ).



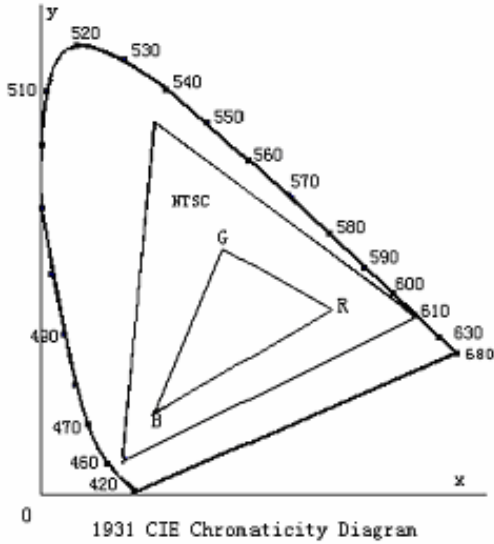
**Note 4: Viewing angle range is defined as follow:**

Viewing angle is measured at the center point of the LCD.



Note 5: Color chromaticity is defined as follow: (CIE1931)

Color coordinates measured at center point of LCD.



$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$



Note 6: Luminance is defined as follow:

Luminance is defined as the brightness of all pixels “White” at the center of display area on optimum contrast.

Note 7: Luminance Uniformity is defined as follow:

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Uniformity}(U) = \frac{\text{Minimum Luminance(brightness) in 9 points}}{\text{Maximum Luminance(brightness) in 9 points}}$$

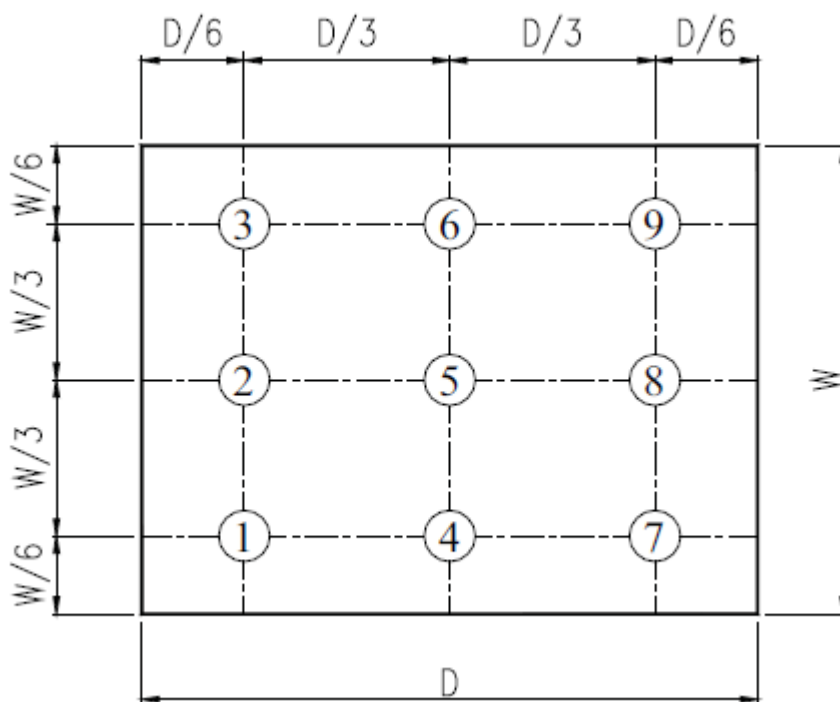


Fig. 2 Definition of uniformity

10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ts=+70°C, 120hrs	Per table in below
2	Low Temp Operation	Ta=-20°C, 120hrs	Per table in below
3	High Temp Storage	Ta=+80°C, 120hrs	Per table in below
4	Low Temp Storage	Ta=-30°C, 120hrs	Per table in below
5	High Temp & High Humidity Storage	Ta=+60°C, 90% RH 120 hours	Per table in below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	-30°C 30 min~+80°C 30 min, Change time:5min, 10 Cycles	Per table in below
7	ESD (Operation)	C=150pF, R=330Ω , 5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times;	Per table in below
8	Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z.	Per table in below
9	Shock (Non-operation)	60G 6ms, ±X,±Y,±Z 3times, for each direction	Per table in below
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	Per table in below

INSPECTION	CRITERION(after test)
Appearance	No Crack on the FPC, on the LCD Panel
Alignment of LCD Panel	No Bubbles in the LCD Panel No other Defects of Alignment in Active area
Electrical current	Within device specifications
Function / Display	No Broken Circuit, No Short Circuit or No Black line No Other Defects of Display

## 11. Precautions for Use of LCD Modules

### 11.1 Safety

The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

### 11.2 Handling

A. The LCD and touch panel is made of plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.

B. Do not handle the product by holding the flexible pattern portion in order to assure the reliability

C. Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.

D. Provide a space so that the panel does not come into contact with other components.

E. To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.

F. Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.

G. Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.

H. To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

### 11.3 Static Electricity

A. Ground soldering iron tips, tools and testers when they are in operation.

B. Ground your body when handling the products.

C. Power on the LCD module before applying the voltage to the input terminals.

D. Do not apply voltage which exceeds the absolute maximum rating.

E. Store the products in an anti-electrostatic bag or container.

### 11.4 Storage

A. Store the products in a dark place at  $+25^{\circ}\text{C} \pm 10^{\circ}\text{C}$  with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.

B. Storage in a clean environment, free from dust, active gas, and solvent.

### 11.5 Cleaning

A. Do not wipe the touch panel with dry cloth, as it may cause scratch.

B. Wipe off the stain on the product by using soft cloth moistened with ethanol. Do not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. Do not use any organic solvent or detergent other than ethanol.

### 11.6 Cautions for installing and assembling

Bezel edge must be positioned in the area between the Active area and View area. The bezel may press the touch screen and cause activation if the edge touches the active area.

A gap of approximately 0.5mm is needed between the bezel and the top electrode. It may cause unexpected activation if the gap is too narrow. There is a tolerance of 0.2 to 0.3mm for the outside dimensions of the touch panel and tail. A gap must be made to absorb the tolerance in the case and connector.

