



## ASI-T-2602A3SMN/D

<b>Item</b>	<b>Contents</b>	<b>Unit</b>
Size	2.6	inch
Resolution	240(RGB) x 240	/
Display Color	262K	
Interface	MCU 16-bit/SPI	/
Technology type	IPS	/
Pixel Configuration	R.G.B. Vertical Stripe	
Pixel Pitch	0.180 x 0.180	
Outline Dimension (W x H x D)	47.70 x 51.35 x 2.20	mm
Active Area	43.20 x 43.20	mm
Display Mode	Transmissive, Normally Black	/
View Direction	ALL	O'clock
Backlight Type	LED	/
Driver IC	ST7789V	/



## Record of Revision

Date	Revision No.	Summary
2022-05-09	1.0	Rev 1.0 was issued

1. Scope

This data sheet is to introduce the specification of ASI-T-2602A3SMN/D active matrix TFT module.

It is composed of a color TFT-LCD panel, driver IC, FPC and a backlight unit. The 2.6" display area contains 240(RGB) x 240 pixels.

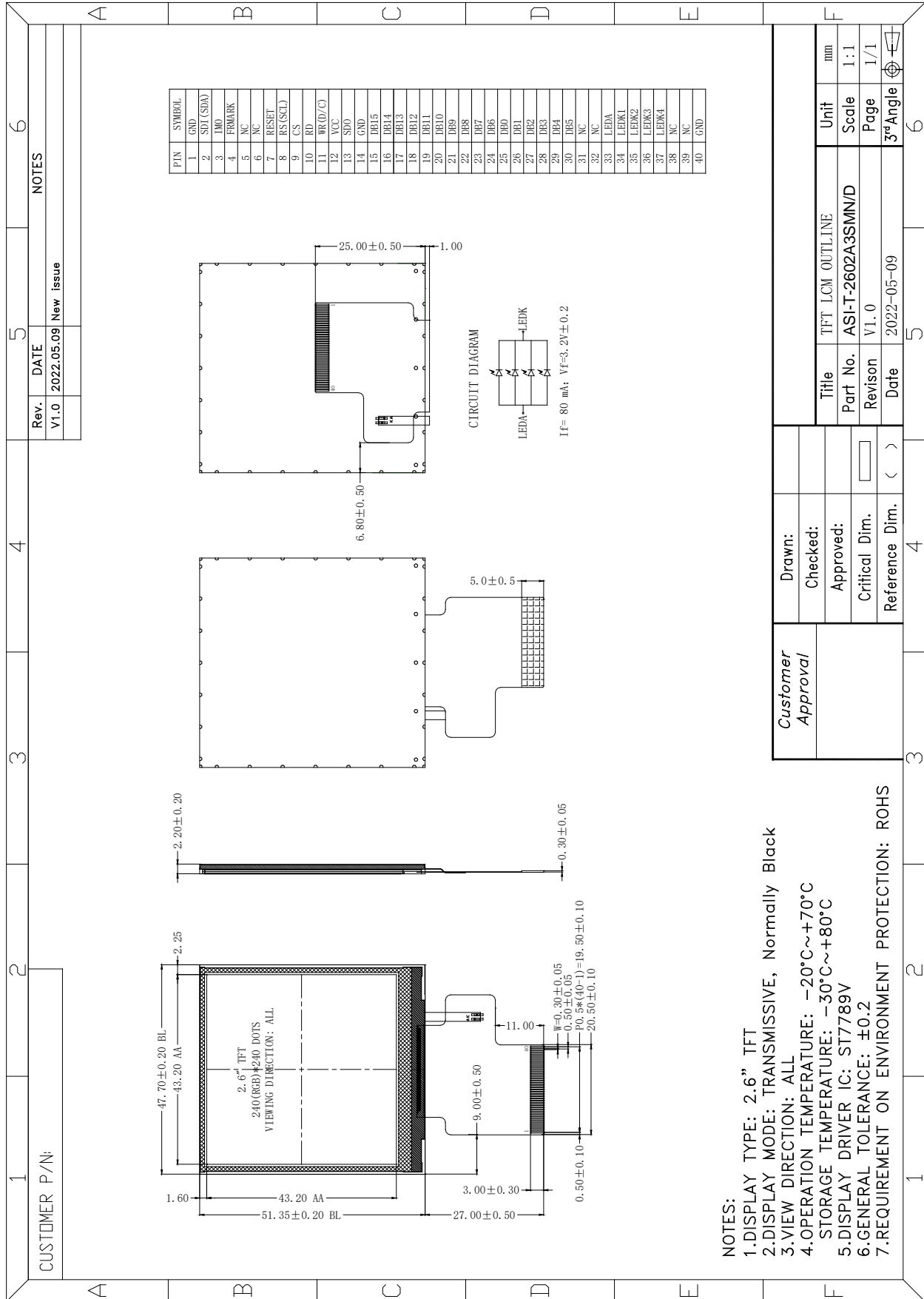
2. Application

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

3. General Information

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### 4. Outline Drawing





5. Interface signals

Pin No.	Symbol	I/O	Function
1	GND	P	Ground
2	SDI(SDA)	I	SPI serial input signal
3	IM0	I	MCU-16 bit / SPI selection pin      Note 1
4	FRMARK	I	Tearing effect output signal
5~6	NC	-	No connection
7	RESET	I	Reset input pin. Signal is active low.
8	RS(SCL)	I	Data /Command selection pin /SPI serial interface clock
9	CS	I	Chip select input pin
10	RD	I	Read signal
11	WR(D/C)	I	Write signal/SPI serves as command or parameter select
12	VCC	P	Power supply
13	SDO	I	SPI serial output signal
14	GND	P	Ground
15	DB15	I/O	Data bus
16	DB14	I/O	Data bus
17	DB13	I/O	Data bus
18	DB12	I/O	Data bus
19	DB11	I/O	Data bus
20	DB10	I/O	Data bus
21	DB9	I/O	Data bus
22	DB8	I/O	Data bus
23	DB7	I/O	Data bus
24	DB6	I/O	Data bus
25	DB0	I/O	Data bus
26	DB1	I/O	Data bus
27	DB2	I/O	Data bus
28	DB3	I/O	Data bus
29	DB4	I/O	Data bus
30	D5	I/O	Data bus
31~32	NC	-	No connection
33	LEDA	P	Anode of LED backlight
34	LEDK1	P	Cathode of LED backlight
35	LEDK2	P	Cathode of LED backlight
36	LEDK3	P	Cathode of LED backlight
37	LEDK4	P	Cathode of LED backlight
38~39	NC	-	No connection
40	GND	P	Ground



Note 1: IM0 (MCU/SPI)

IM0	Interface	Remark
0	MCU-16 bit	Data bus: DB0~DB15
1	SPI	

## 6. Absolute maximum Ratings

### 6.1. Electrical Absolute max. ratings

Item	Symbol	MIN	MAX	Unit	Remark
Power Supply Voltage	VCC	-0.3	4.6	V	
	Vin	VSS-0.5	VCC	V	

### 6.2. Environment Conditions

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

## 7. Electrical Specifications

### 7.1 Electrical characteristics

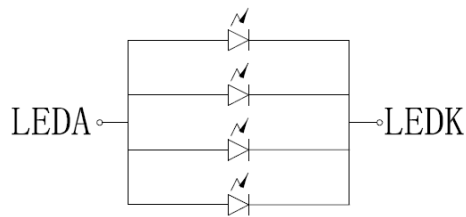
Parameter	Symbol	Min	Typ.	Max	Unit	Note
Power supply voltage	VCC	2.6	2.8	3.3	V	
Logic low input voltage	V <sub>IL</sub>	0	-	0.3*VCC	V	
Logic high input voltage	V <sub>IH</sub>	0.7*VCC	-	VCC	V	

### 7.2 LED Backlight

Item	Symbol	Min	Typ	Max	Unit
Forward voltage	V <sub>f</sub>	3.0	3.2	3.4	V
Forward current	I <sub>f</sub>	-	80	-	mA
LED life time	-	-	30,000	-	Hrs

Note: The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25°C and I<sub>L</sub> =120mA. The LED lifetime could be decreased if operating I<sub>L</sub> is larger than 120mA

### CIRCUIT DIAGRAM



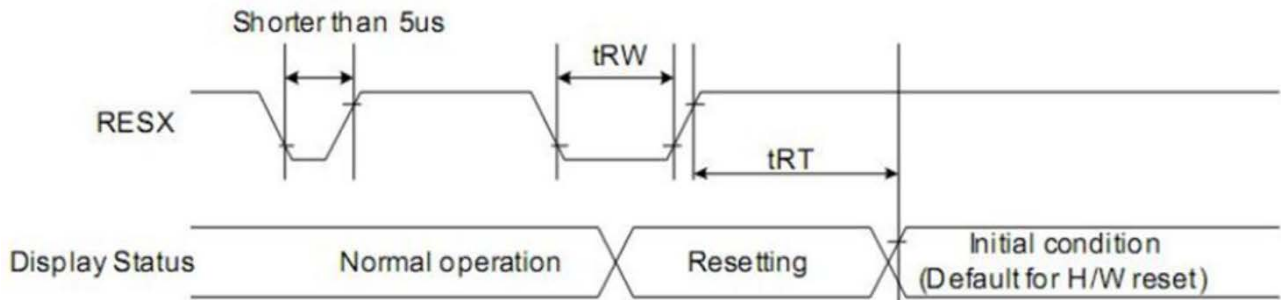
$$I_f = 80 \text{ mA}; V_f = 3.2V \pm 0.2$$





D[17:0]	tdst	Write data setup time	10	-	ns	
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

### 8.2 Reset Timing

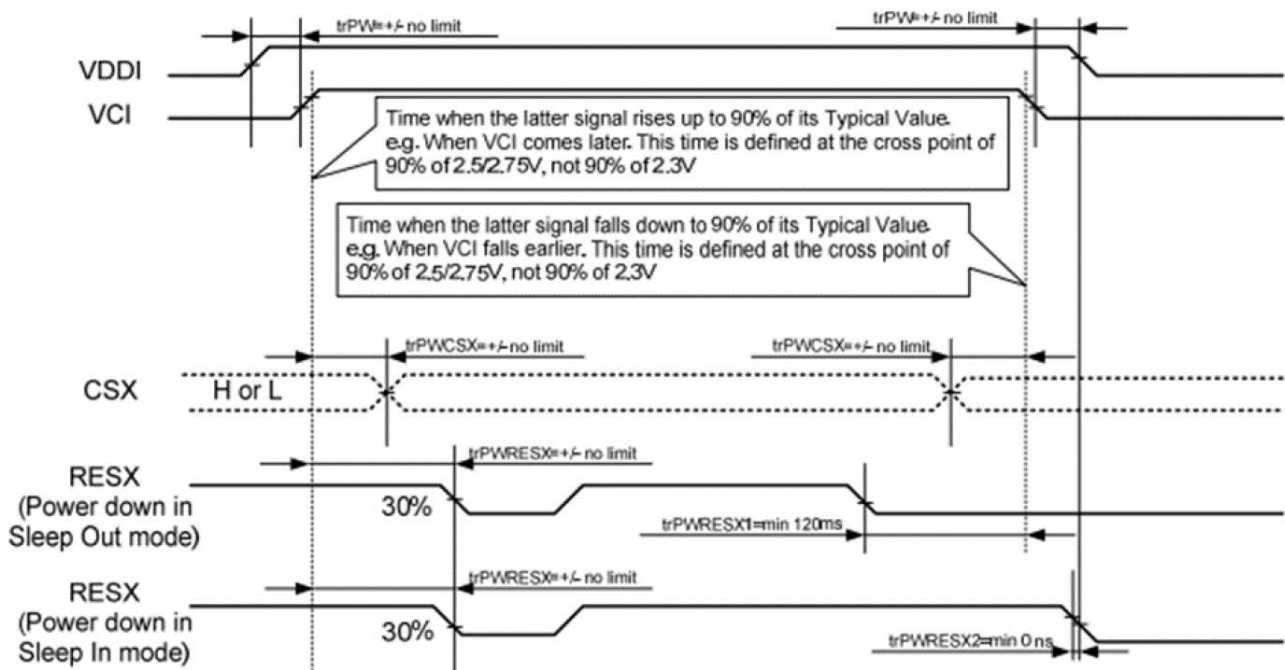


Signal	Symbol	Parameter	Min.	Max.	Unit	Description
RESET	tRW	Reset low pulse width	10	-	us	
	tRT	Reset complete time	-	5(Note 1)	ms	
			-	120(Note 2)	ms	

Notes:

1. When reset applied during SLPIN mode
2. When reset applied during SLPOUT mode.

### 8.3 Power On Sequence



trPWRESX1 is applied to RESX falling in the Sleep Out Mode  
trPWRESX2 is applied to RESX falling in the Sleep In Mode

Figure: Case 1 - RES line is held High or Unstable by Host at Power ON

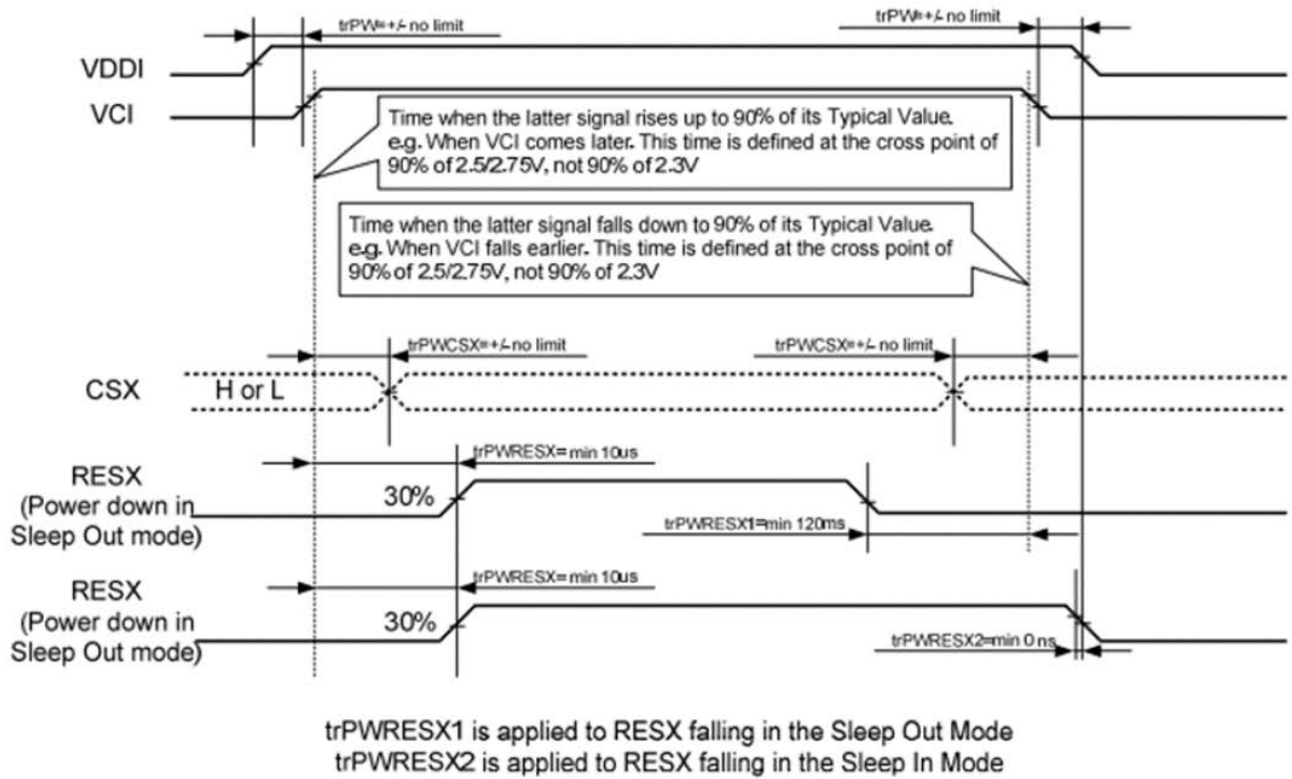


Figure: Case 2 - RES line is held Low by Host at Power ON

#### 8.4 Power-off Sequence - Uncontrolled Power Off

Uncontrolled power off is a situation where power is removed unexpectedly, e.g. a battery powering a device is disconnected without using the controlled power off sequence. There will not be any damage to the display module, nor will the display module cause any damage to the host. During an uncontrolled power off event, the display to blank its content and there will not be any further abnormal visible effects on the display after 1 second of the power being removed. The display will remain blank until the Power On Sequence occurs.

## 9. Optical Specification

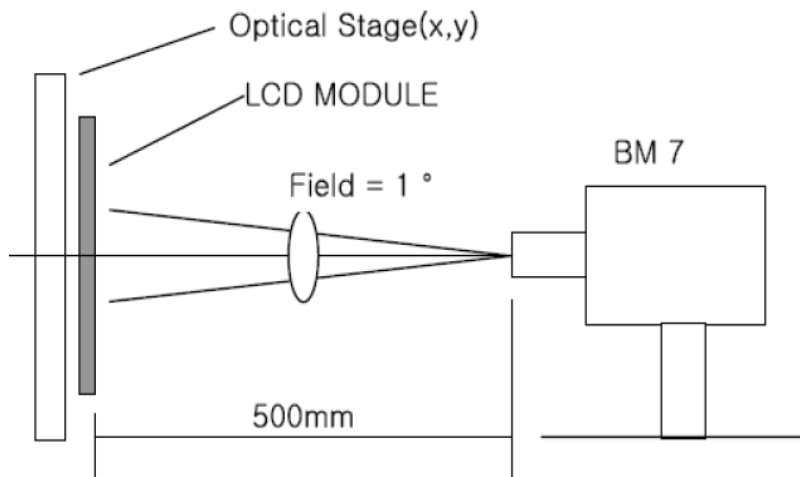
Ta=25°C

Item	Symbol	Condition	Min	Typ.	Max.	Unit	Remark		
Contrast Ratio	CR	$\theta=0^\circ$	-	800	-		Note1 Note2		
Response Time	Tr+Tf	25°C		30		ms	Note1 Note3		
View Angles	$\theta T$	CR $\geq$ 10	-	80	-	Degree	Note 4		
	$\theta B$		-	80	-				
	$\theta L$		-	80	-				
	$\theta R$		-	80	-				
Chromaticity	White	Brightness is on	Typ-0.05	Typ+0.05			Note5, Note1		
								x	0.308
	y							0.330	
	Red							x	0.641
								y	0.337
	Green							x	0.274
								y	0.560
	Blue							x	0.141
y		0.113							
Luminance	L		-	300	-	cd/m <sup>2</sup>	Note1 Note6		
Uniformity	U		-	60	-	%	Note1 Note7		

Note 1: Definition of optical measurement system.

Temperature = 25°C(±3°C);

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

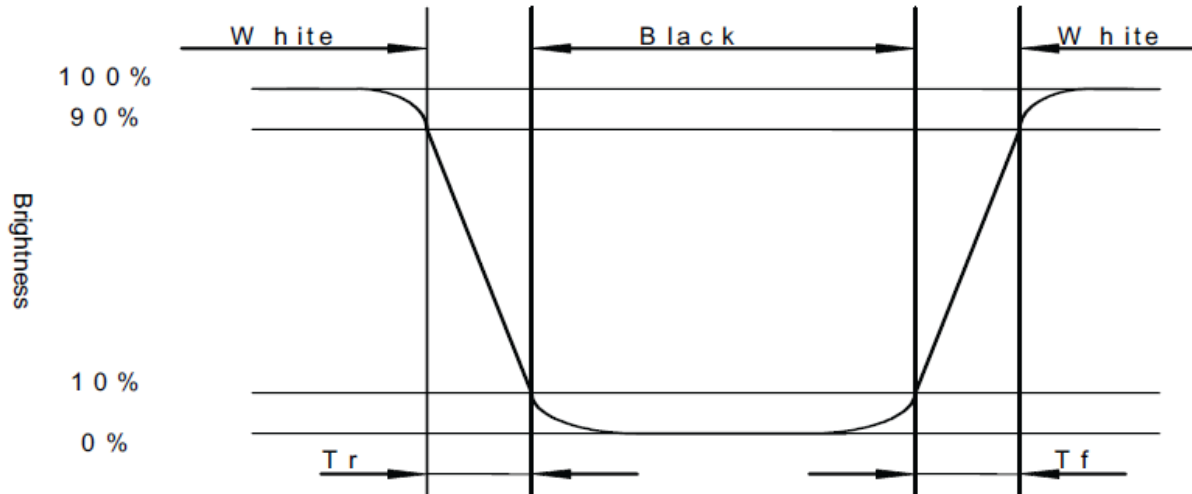


Note 2: Contrast ratio is defined as follow:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

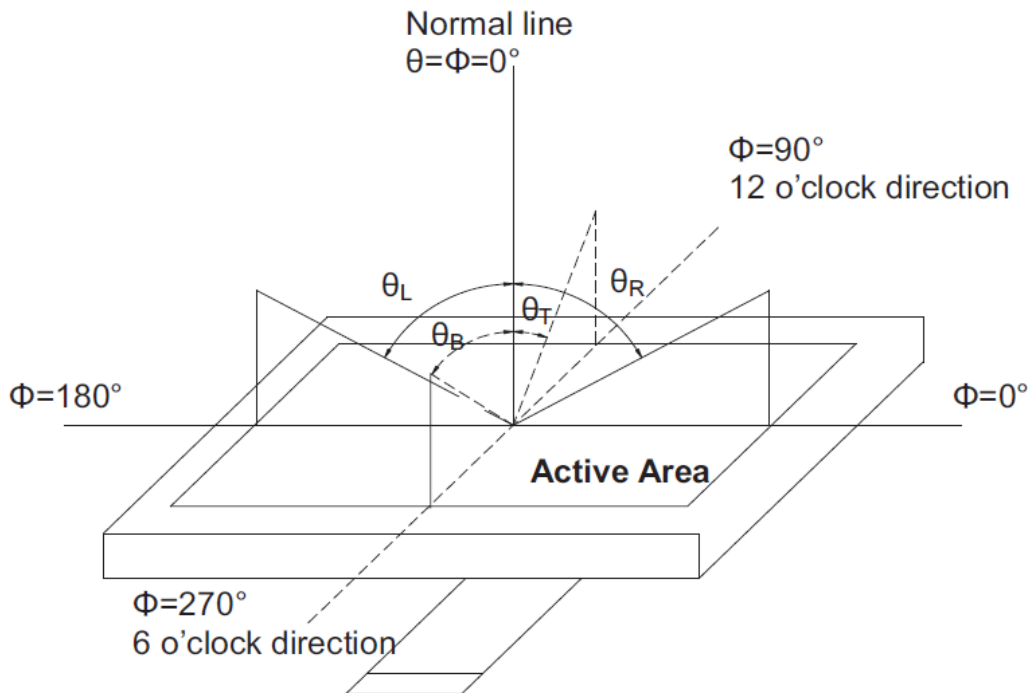
Note 3: Response time is defined as follow:

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,  $T_f$ ).



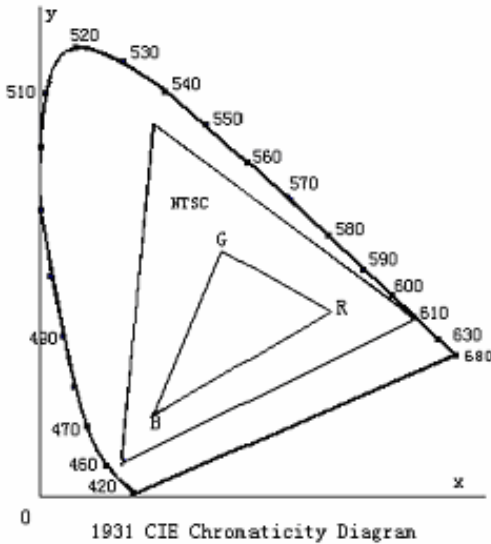
Note 4: Viewing angle range is defined as follow:

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.

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

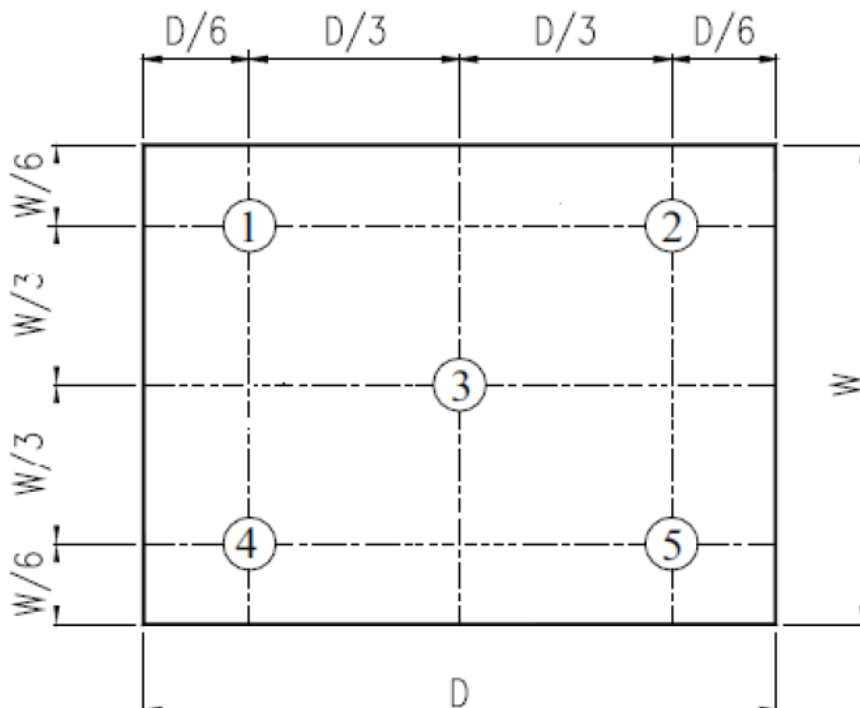


Fig. 2 Definition of uniformity

**10. Environmental / Reliability Tests**

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ta=+70°C, 96hrs	Per table in below
2	Low Temp Operation	Ta=-20°C, 96hrs	Per table in below
3	High Temp Storage	Ts=+80°C, 96hrs	Per table in below
4	Low Temp Storage	Ts=-30°C, 96hrs	Per table in below
5	High Temp & High Humidity Storage	Ts=+60°C, 90% RH, 96 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, 5 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)	10Hz~150Hz, 100m/s <sup>2</sup> , 120min	Per table in below
9	Shock (Non-operation)	Half- sine wave,300m/s <sup>2</sup> ,11ms	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

- A. 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.
- B. In order to make the display assembly stable and firm, ASI recommends to design some supporting at the display backside, especially for the display with tape-attached touch panel, such supporting is important and essential, or else, the display may drop-off from front after some period of time.
- C. Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. If the screen is displayed with fixed pattern, use a screen saver.

