



## ASI-T-350EA3FT/D

Item	Contents	Unit
Size	3.5	inch
Resolution	320(RGB) X 240	/
Interface	RGB 24-bit with Serial	/
Technology type	a-Si TFT	/
Pixel pitch	0.219 x 0.219	mm
Pixel Configuration	R.G.B. Vertical Stripe	
Outline Dimension (W x H x D)	76.90 x 63.90 x 4.20	mm
Active Area	70.08 x 52.56	mm
Display Mode	Transmissive	/
Viewing Direction	12 o'clock	/
Backlight Type	LED	/
Driver IC	HX8238-D	/



### Record of Revision

Date	Revision No.	Summary
2017-12-19	1.0	Rev 1.0 was issued



### 1. Scope

This data sheet is to introduce the specification of ASI-T-350EA3FT/D active matrix TFT module. It is composed of a color TFT-LCD panel, driver IC, FPC, RTP and a backlight unit. The 3.5" display area contains 320 (RGB) x 240 pixels.

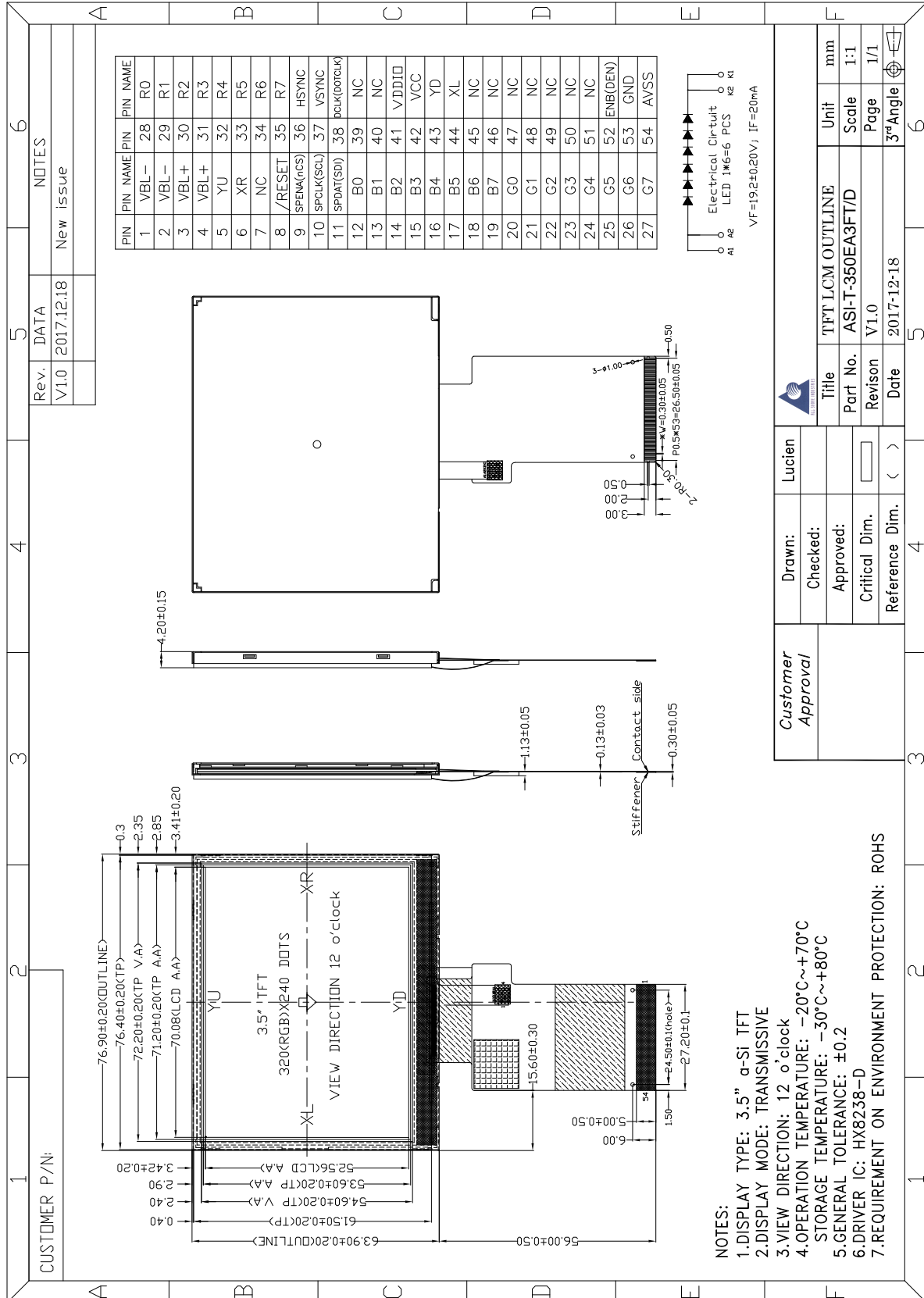
### 2. Application

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

### 3. General Information

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4. Outline Drawing



5. Interface signals

No	Symbol	Description	Remarks
1~2	VBL-	Power for LED Backlight Cathode	
3~4	VBL+	Power for LED Backlight Anode	
5	YU	Touch panel pin	
6	XR	Touch panel pin	
7	NC	No connection	
8	/RESET	Reset pin	
9	SPENA(nCS)	Serial data enable signal	
10	SPCLK(SCL)	Serial clock signal	
11	SPDAT(SDI)	Serial data signal	
12~19	B0~B7	Blue data	
20~27	G0~G7	Green data	
28~35	R0~R7	Red data	
36	HSYNC	Line synchronization signal	
37	VSYNC	Frame synchronization signal	
38	DCLK	Dot clock	
39~40	NC	No connection	
41	VDDIO	Power supply	
42	VCC	Power supply	
43	YD	Touch panel pin	
44	XL	Touch panel pin	
45~51	NC	No connection	
52	ENB(DEN)	Display enable pin from controller	
53	GND	Power ground	
54	AVSS	Power ground	

**6. Absolute maximum Ratings**

**6.1. Electrical Absolute max. ratings**

Parameter	Symbol	MIN	MAX	Unit	Remark
Power Supply Voltage	VCC	0.3	4.0	V	
Input voltage	VIN	-0.3	VCC+0.3	V	

Notes:

- The HX8238-D may be permanently damaged if it is used under the condition exceeding the above absolute maximum values. It is also recommended to use the driver IC within the limit of its electric characteristics during normal operation. Exceeding the conditions may lead to malfunction of HX8238-D and affect its credibility.
- The voltage from VSS.

**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**

GND=0V, Ta=25°C

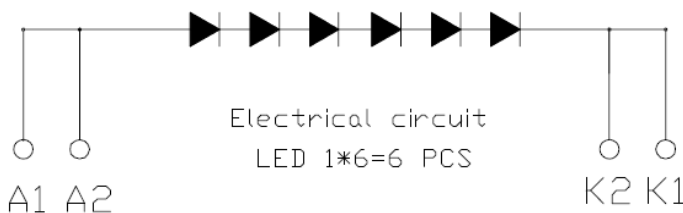
Item	Symbol	MIN	TYP	MAX	Unit	Remark
Power Supply Voltage	VCC	2.5	3.3	3.6	V	Note1
Input Signal Voltage	Low Level	VIL	-0.3	--	0.2*VCC	VCC=2.5~3.6V
	High Level	VIH	0.8*VCC	--	--	
Current consumption	ILCD	-	TBD	--	mA	--

Note1:Vcom must be adjusted to optimize display quality: Cross-talk, Contrast Ratio and etc.

**7.2 LED Backlight**

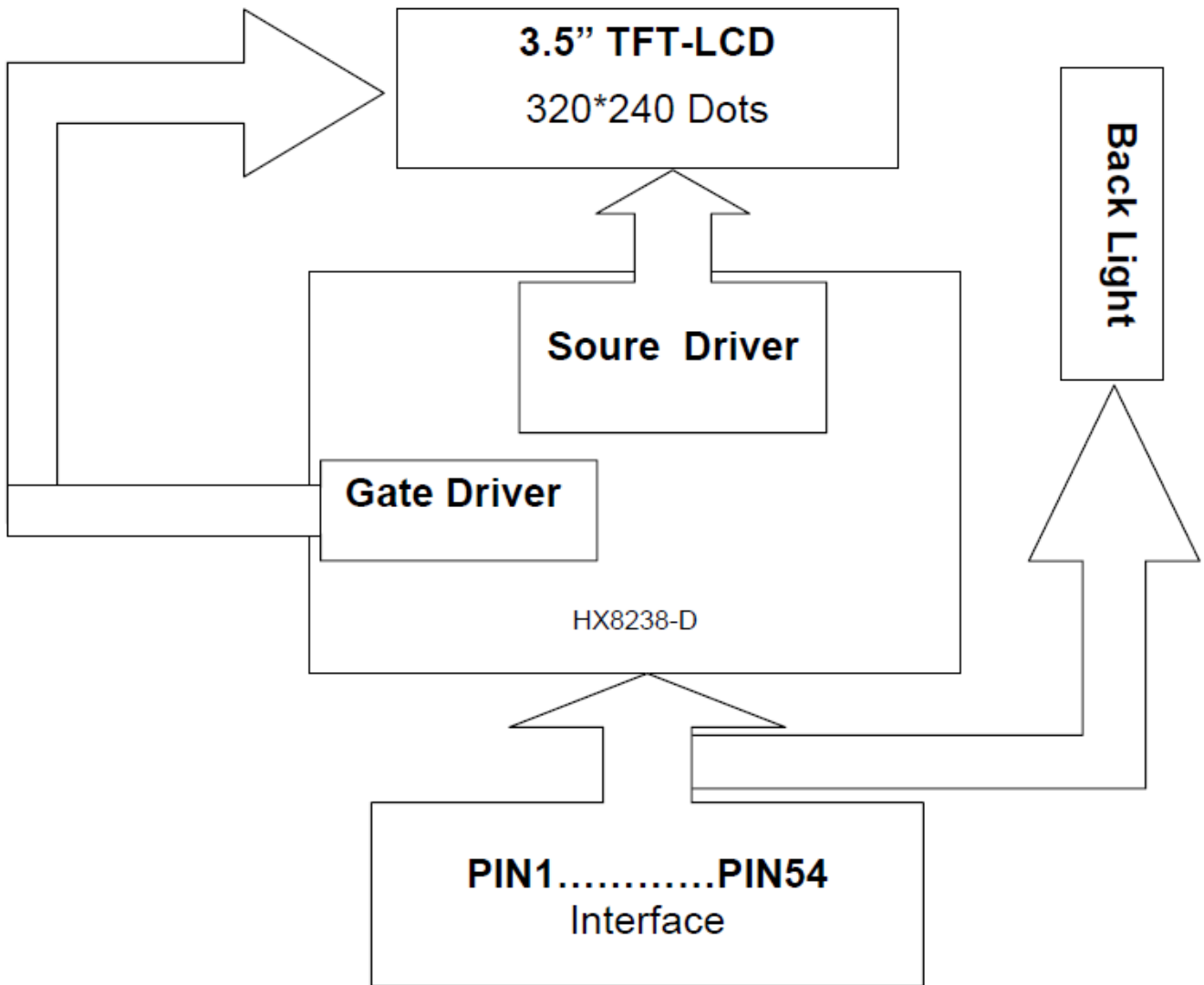
Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	IBL	--	20	-	mA	
Forward Voltage	VBL	18	19.2	20	V	



$V_F = 19.2 \pm 0.20V$ ;  $I_F = 20mA$

### 7.3 Block Diagram of LCM

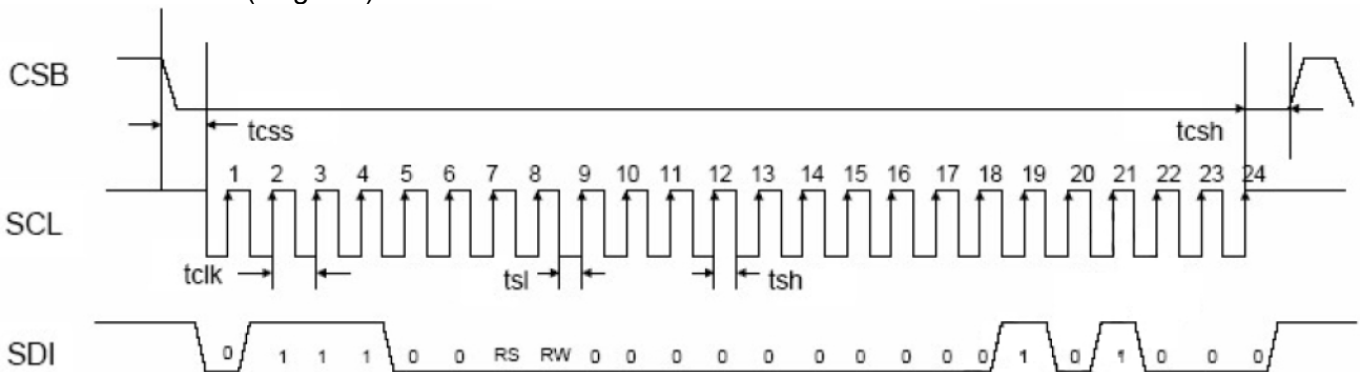


## 8. Command/AC Timing

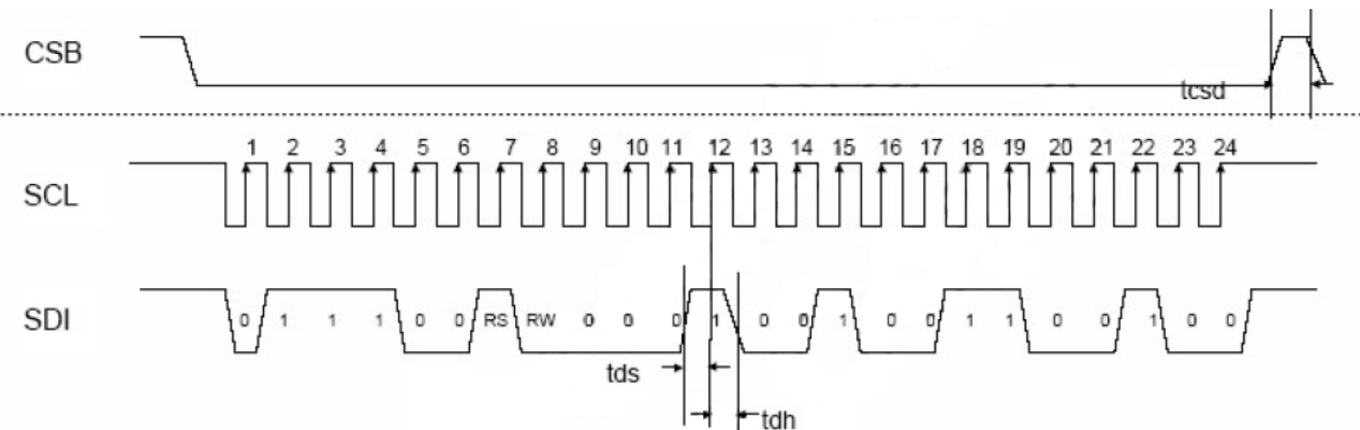
### 8.1 3Wire SPI Timing Characteristics

Characteristics	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Serial clock frequency	fclk	-	-	20	MHz
Serial clock cycle time	tclk	50	-	-	ns
Clock low width	tsl	25	-	-	ns
Clock high width	tsh	25	-	-	ns
Clock rising time	trs	-	-	30	ns
Clock falling time	tfl	-	-	30	ns
Chip select hold time	tcsH	10	-	-	ns
Chip select high delay time	tcsd	20	-	-	ns
Data setup time	tds	5	-	-	ns
Data hold time	tdh	10	-	-	ns

#### First Transmission (Register)



#### Second Transmission (Data)

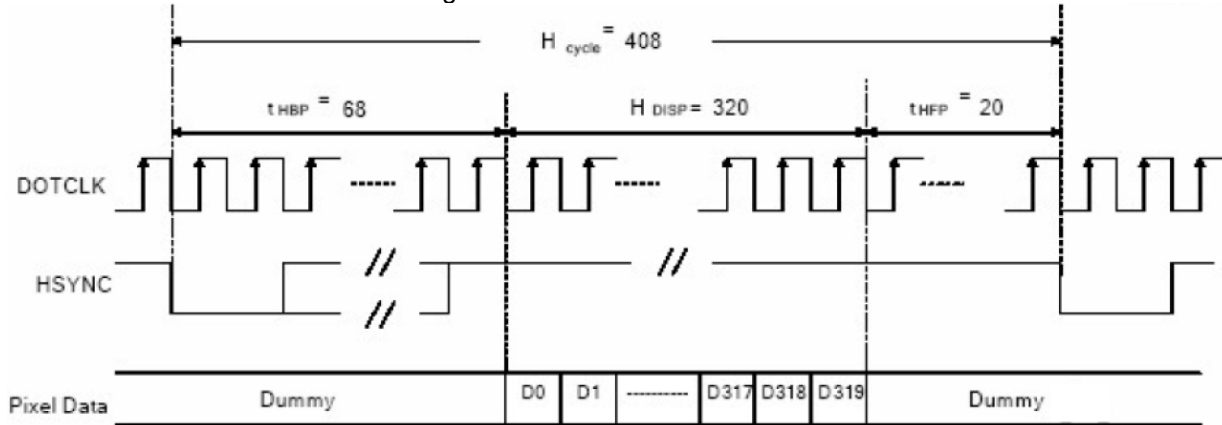


Notes: The example writes "0x1264h" to register R28h.  
SPID connected to VSS.

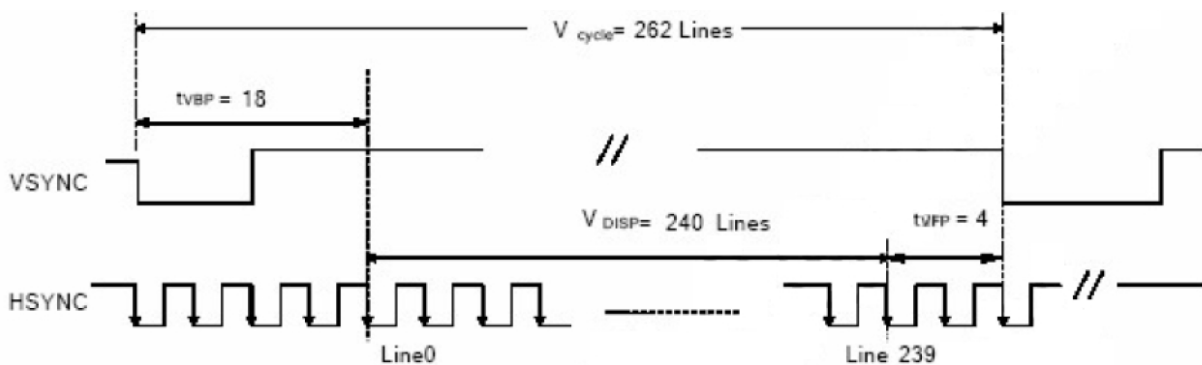


### 8.2. RGB Interface Timing Characteristics

#### Horizontal Data Transaction Timing



#### Vertical Data Transaction Timing



### 8.3. Input Timing Specifications

Characteristics	Symbol	Min.		Typ.		Max.		Unit
		24-bit	8-bit	24-bit	8-bit	24-bit	8-bit	
DOTCLK frequency	tDOTCLK	-	-	6.5	19.5	10	30	MHz
DOTCLK period	tDOTCLK	100	33.3	154	51.3	-	-	ns
Horizontal frequency (Line)	tH	-		14.9		22.35		KHz
Vertical frequency (Refresh)	fV	-		60		90		Hz
Horizontal back porch	tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal front porch	tHFP	-	-	20	60	-	-	tDOTCLK
Horizontal data start point	tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal blanking period	tHBP+ tHFP	52	146	88	264	180	960	tDOTCLK
Horizontal display area	HDISP	-	-	320	960	-	-	tDOTCLK
Horizontal cycle	Hcycle	372	1106	408	1224	500	1920	tDOTCLK
Vertical back porch	tVBP	-		18		-		Lines
Vertical front porch	tVFP	-		4		-		Lines
Vertical data start point	tVBP	-		18		-		Lines



Vertical blanking period	NTSC	tVBP+ tVFP	10	22	47	Lines
	PAL		20	33	120	
	PAL		12	25	112	
Vertical display area	NTSC	VDISP	-	240	-	Lines
	PAL			280(PALM=0)		
	PAL			288(PALM=1)		
Vertical cycle	NTSC	Vcycle	250	262	287	Lines
	PAL		300	313	400	

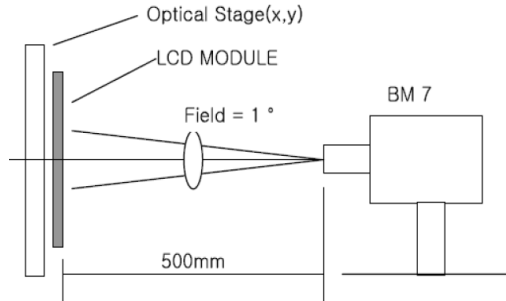
9. Optical Specification

Item	Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio	CR	$\theta=0^\circ$	300	350	-		Note1 Note2
Response Time	Ton+Toff	25°C	-	25	40	ms	Note1 Note3
View Angles	$\theta T$	$CR \geq 10$	-	50	-	Degree	Note 4
	$\theta L$		-	70	-		
	$\theta R$		-	70	-		
	$\theta B$		-	70	-		
Chromaticity	White	Brightness is on	x	0.285	0.305	0.325	Note5, Note1
			y	0.314	0.334	0.354	
	Red		x	0.588	0.608	0.628	
			y	0.296	0.316	0.336	
	Green		x	0.285	0.305	0.325	
			y	0.536	0.556	0.576	
	Blue		x	0.125	0.135	0.155	
			y	0.117	0.137	0.157	
	NTSC		-	53%	-		
Transmittance	T(%)		6.7	7.2	-	%	Note5
Luminance	L		300	330	-	cd/m <sup>2</sup>	Note1 Note6
Uniformity (White)	U		80	-	-	%	Note1 Note7

Note 1: Definition of optical measurement system.

Temperature = 25°C(±3°C)

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

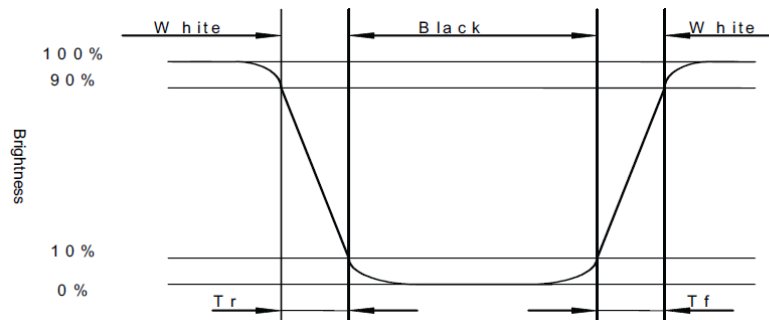


Note 2: Contrast ratio is defined as follow:

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

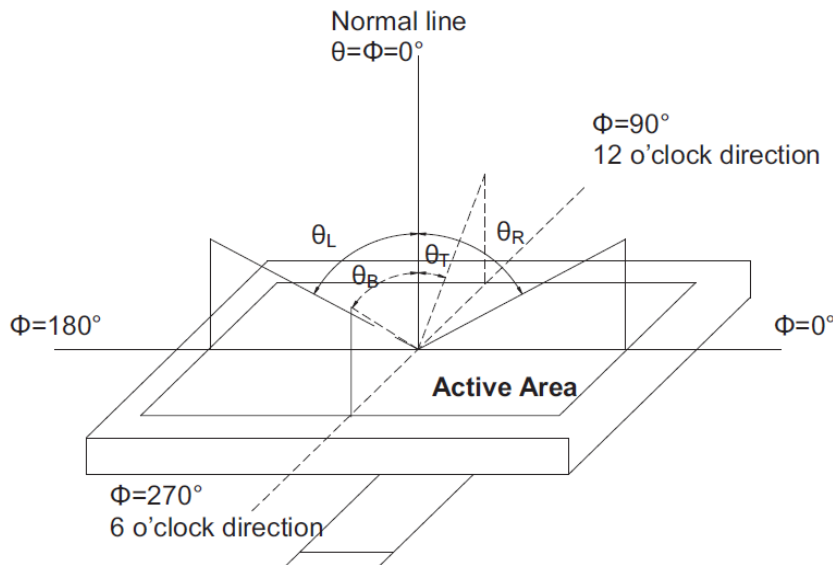
Note 3: Response time is defined as follow:

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,  $T_f$ ).



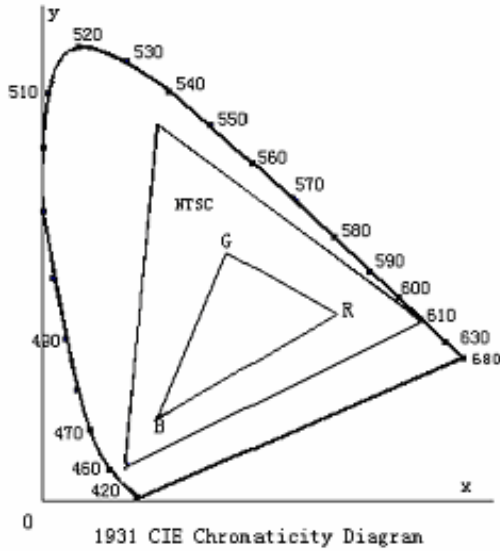
Note 4: Viewing angle range is defined as follow:

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.

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

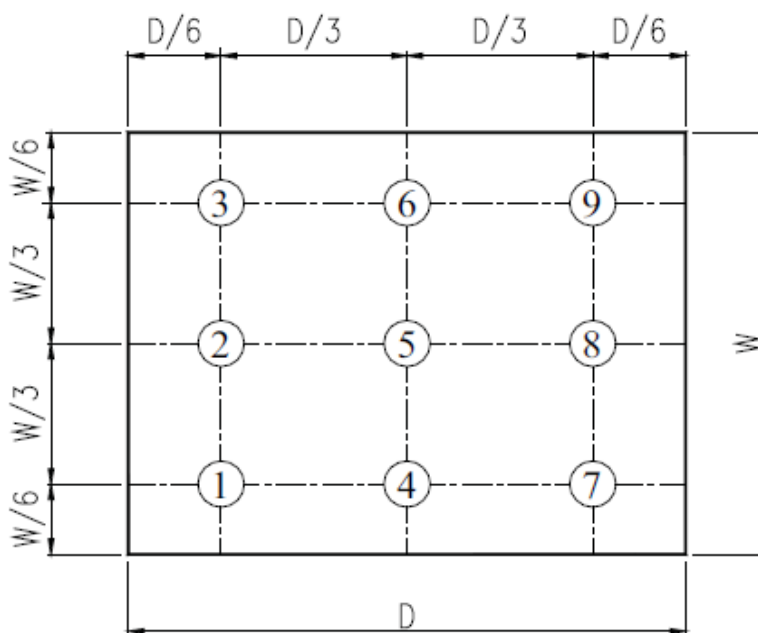


Fig. 2 Definition of uniformity



10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ts=+70°C, 96hrs	Per table in below
2	Low Temp Operation	Ta=-20°C, 96hrs	Per table in below
3	High Temp Storage	Ta=+80°C, 96hrs	Per table in below
4	Low Temp Storage	Ta=-30°C, 96hrs	Per table in below
5	High Temp & High Humidity Storage	Ta=+60°C, 90% RH 96 hours	Per table in below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	-30°C 30 min~+70°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

- 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.

