



## ASI-T-4001QA2AN/D

Item	Contents	Unit
Size	4.0	inch
Resolution	360(RGB) x 600	/
Interface	RGB / MCU	/
Technology type	a-Si TFT	/
Pixel Configuration	R.G.B. Vertical Stripe	
Outline Dimension (W x H x D)	60.04 x 102.8 x 2.8	mm
Active Area	51.84 x 86.4	mm
Display Mode	Transflective, NW	/
Backlight Type	LED	/
Driver IC	HX8376-A	/
Weight	33.2	g



## 1. Scope

This data sheet is to introduce the specification of ASI-T-4001QA2AN/D active matrix TFT module. It is composed of a color TFT-LCD panel, driver IC, FPC and backlight . The 4.0 display area contains 360(RGB) x 600 pixels.

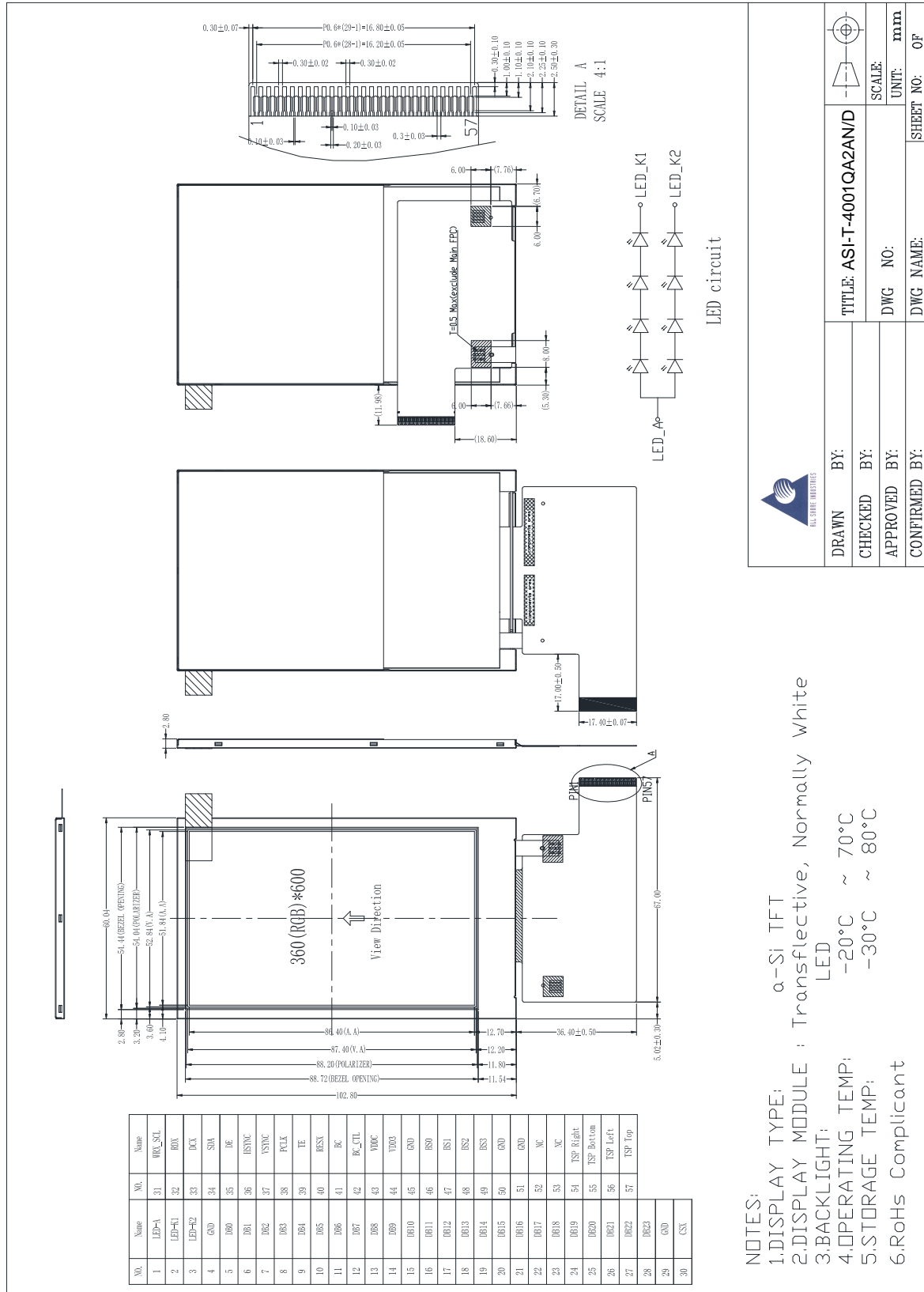
## 2. Application

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

Pin No	Symbol	Function
1	LED-A	Led anode
2	LED-K1	Led cathode
3	LED-K2	Led cathode
4	GND	Ground
5-28	DB0-DB23	Ground
29	GND	Ground
30	CSX	Chip select signal
31	WRX_SCL	a write signal or Serial Clock
32	RDX	read signal
33	DCX	Data / Command Selection pin
34	SDA	Serial data
35	DE	data enable signal
36	HSYNC	Line synchronizing signal
37	VSXNC	VS signal
38	PCLK	Ground
39	TE	Tearing Effect pin
40	RESX	Reset pin
41	BC	PWM output pin of Backlight control
42	BC_CTL	Enable signal of Backlight LED driver
43	VDDC	A power supply for the I/O circuit and logic power
44	VDD3	A power supply for the analog power
45	GND	Ground
46	BS0	Select the MPU interface mode
47	BS1	Select the MPU interface mode
48	BS2	Select the MPU interface mode
49	BS3	Select the MPU interface mode
50	GND	Ground
51	GND	Ground
52	NC	NC
53	NC	NC
54	RIGHT	TP right pin, No connection
55	BOTTOM	TP bottom pin, No connection
56	LEFT	TP left pin, No connection
57	TOP	TP top pin, No connection

Matching Connection Type: PF030-O57B-C10-H

## 6. Absolute maximum Ratings

### 6.1. Electrical Absolute max. ratings

Parameter	Symbol	MIN	MAX	Unit	Remark
I/O circuit power	VDDC	-0.3	3.6	V	
Analog power	VCC	-0.3	5.5	V	
Input voltage	DB[0~23], VSYNC, HSYNC, DE, PCLK	-0.3	3.6	V	
Back Light Forward Current	I <sub>LED</sub>		25	mA	For each LED

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.

### 6.2. Environment Conditions

Item	Symbol	MIN	MAX	Unit	Remark
Operating Temperature	T <sub>OPR</sub>	-20	70	°C	
Storage Temperature	T <sub>STG</sub>	-30	80	°C	

Note:

1. The response time will become lower when operated at low temperature.
2. Background color changes slightly depending on ambient temperature.  
The phenomenon is reversible.
3. Ta ≤ 40°C: 85%RH MAX.  
Ta ≥ 40°C: Absolute humidity must be lower than the humidity of 85%RH at 40°C.

## 7. Electrical Specifications

### 7.1 Recommended Operating Condition

Parameter		Symbol	Min	Typ	Max	Unit	Note
I/O circuit power		VDDC	2.4	2.8	3.3	V	
Analog power		VCC	1.65	2.8	3.3	V	
Output Signal Voltage	Low Level	V <sub>OL</sub>	-	-	0.2*VDDC	V	
	High Level	V <sub>OH</sub>	0.8*VDDC	-	-	V	
Input Signal Voltage	Low Level	V <sub>IL</sub>	-0.3	-	0.3*VDDC	V	
	High Level	V <sub>IH</sub>	0.7*VDDC	-	VDDC	V	

### 7.2 Backlight Unit Driving Condition

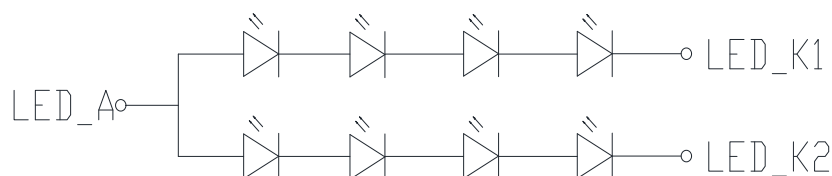
Parameter	Symbol	Min	Typ	Max	Unit	Note
Forward Current	I <sub>F</sub>	-	40	50	mA	
Forward Current Voltage	V <sub>F</sub>	12	12.8	14.4	V	
Backlight Power Consumption	W <sub>BL</sub>	-	512	-	mW	
Operating Life Time	-	-	20000	-	Hrs	

Note1: The LED driving condition is defined for each LED module (2 LED Serial).for each led:3.2V,20mA

Note2: Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

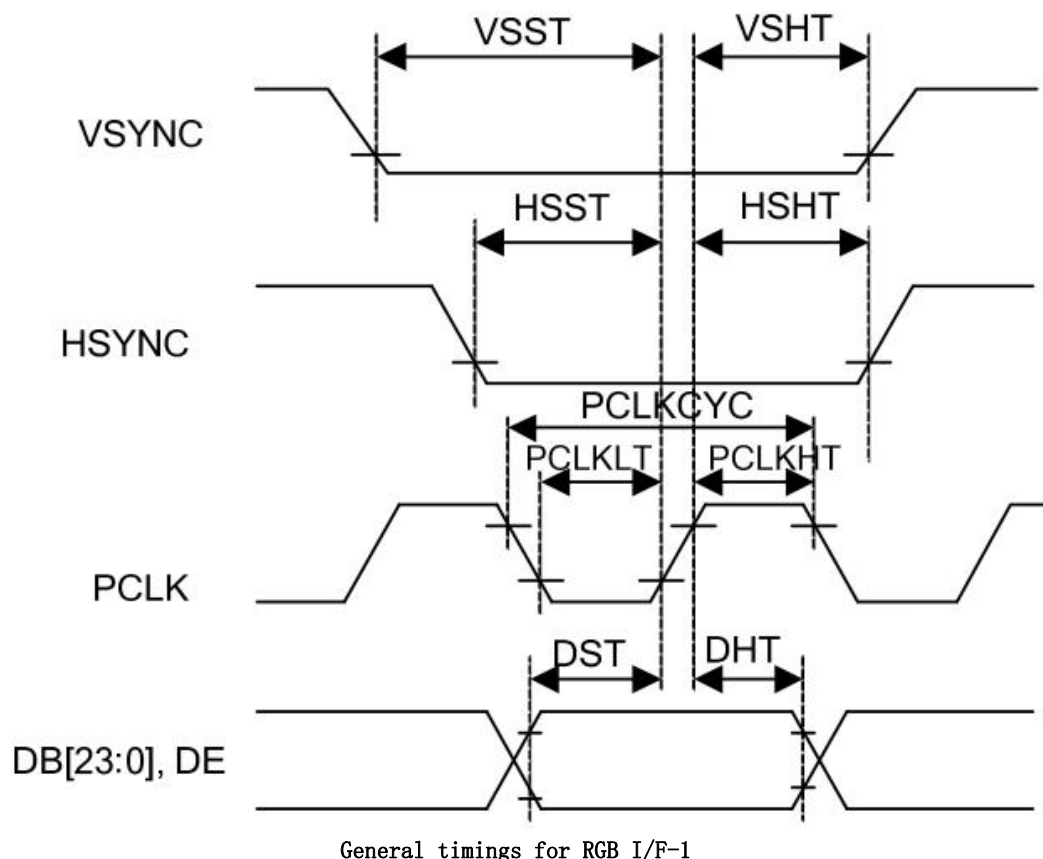
Note3: Optical performance should be evaluated at Ta=25°C only If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life Means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

Note4: The LED driving condition is defined for each LED module.



## 8. Timing Chart

### 8.1 DPI interface characteristics-1



General timings for RGB I/F-1

### 8.2 General timings parameter setting for RGB I/F-1

( $T_A=2.5^{\circ}\text{C}$ ,  $V_{DD1}=1.65\sim 1.95\text{V}$ ,  $V_{DD3}=2.3\sim 3.3\text{V}$ ,  $V_{SSA}=0\text{V}$ )

Parameter	Symbol	Condition	Min	TYP	Max	Unit
Vertical sync. Setup time	VSST		10	-	-	ns
Vertical sync. Hold time	VSHT		10	-	-	ns
Horizontal sync. Setup time	HSST		10	-	-	ns
Horizontal sync. Hold time	HSHT		10	-	-	ns
Pixel clock Cycle	PCLKCYC	24-/18-/16-bit	47	-	-	ns
Pixel clock Setup time	PCLKLT		10	-	-	ns
Pixel clock High time	PCLKHT		10	-	-	ns
Data Setup time DB(17:0), Enable	DST		10	-	-	ns
Data Hold time DB(17:0), Enable	DHT		10	-	-	ns

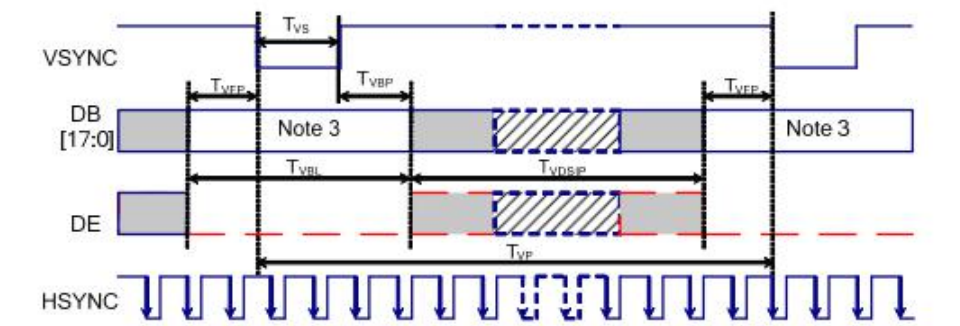
Note 1: Signal rise and fall times are equal or less than 20ns

Note 2: Measure of input signals are using  $0.3 \cdot V_{DD1}$  for low state and  $0.7 \cdot V_{DD1}$  for high state

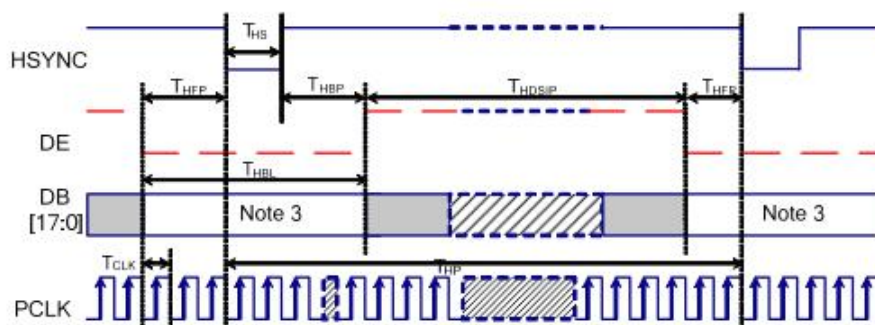


## 8.2.1 DPI interface characteristics-2

Vertical Timing for RGB I/F



Horizontal Timing for RGB I/F



## 8.2.2 General timings parameter setting for RGB I/F-2

Item	Symbol	Condition	Specification			Unit
			Min	Typ.	Max	
Vertical Timing						
Vertical cycle period	T <sub>VP</sub>	-	646	-	-	HS
Vertical low pulse width	T <sub>VS</sub>	-	2	-	-	HS
Vertical front porch	T <sub>VFP</sub>	-	2	-	-	HS
Vertical back porch	T <sub>VBP</sub>	-	2	-	-	HS
Vertical blanking period	T <sub>VBL</sub>	T <sub>VBP</sub> + T <sub>VFP</sub>	6	-	-	HS
Vertical active area	T <sub>VDISP</sub>	-	-	640	-	HS
			-		-	HS
					-	HS
Vertical refresh rate	T <sub>VRR</sub>	Frame rate	50	60	70	Hz
Horizontal Timing						
Horizontal cycle period	T <sub>HP</sub>	-	375	-	-	DOTCLK
Horizontal low pulse width	T <sub>HS</sub>	-	5	-	-	DOTCLK
Horizontal front porch	T <sub>HFP</sub>	-	5	-	-	DOTCLK
Horizontal back porch	T <sub>HBP</sub>	-	5	-	-	DOTCLK
Horizontal blanking period	T <sub>HBL</sub>	T <sub>HBP</sub> + T <sub>HFP</sub>	15	-	-	DOTCLK
Horizontal active area	T <sub>HDISP</sub>	-	-	-	-	DOTCLK
Pixel clock cycle TVRR=60Hz	f <sub>CLKCYC</sub>	-	14.1	-	-	MHz

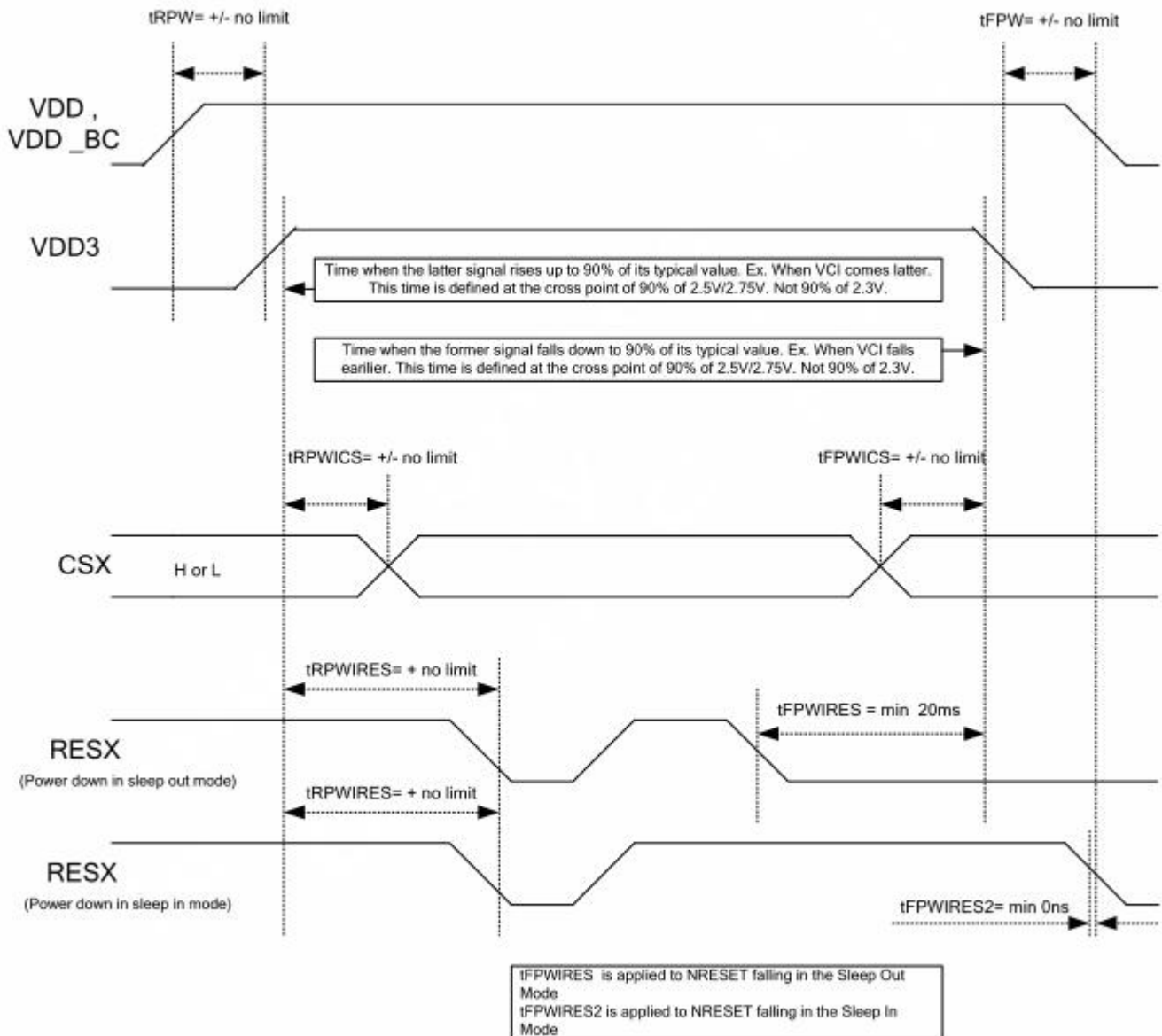
Note 1: VDD1=1.65 to 3.3V, VDD3=2.3 to 3.3V, VSSA=VSSD=0V,  $T_A$ =-30 to 70°C  
(to +85°C no damage)

Note 2; Data lines can be set to "High" or "Low" during blanking time--Don't care

Note 3: HP is multiples of PCLK

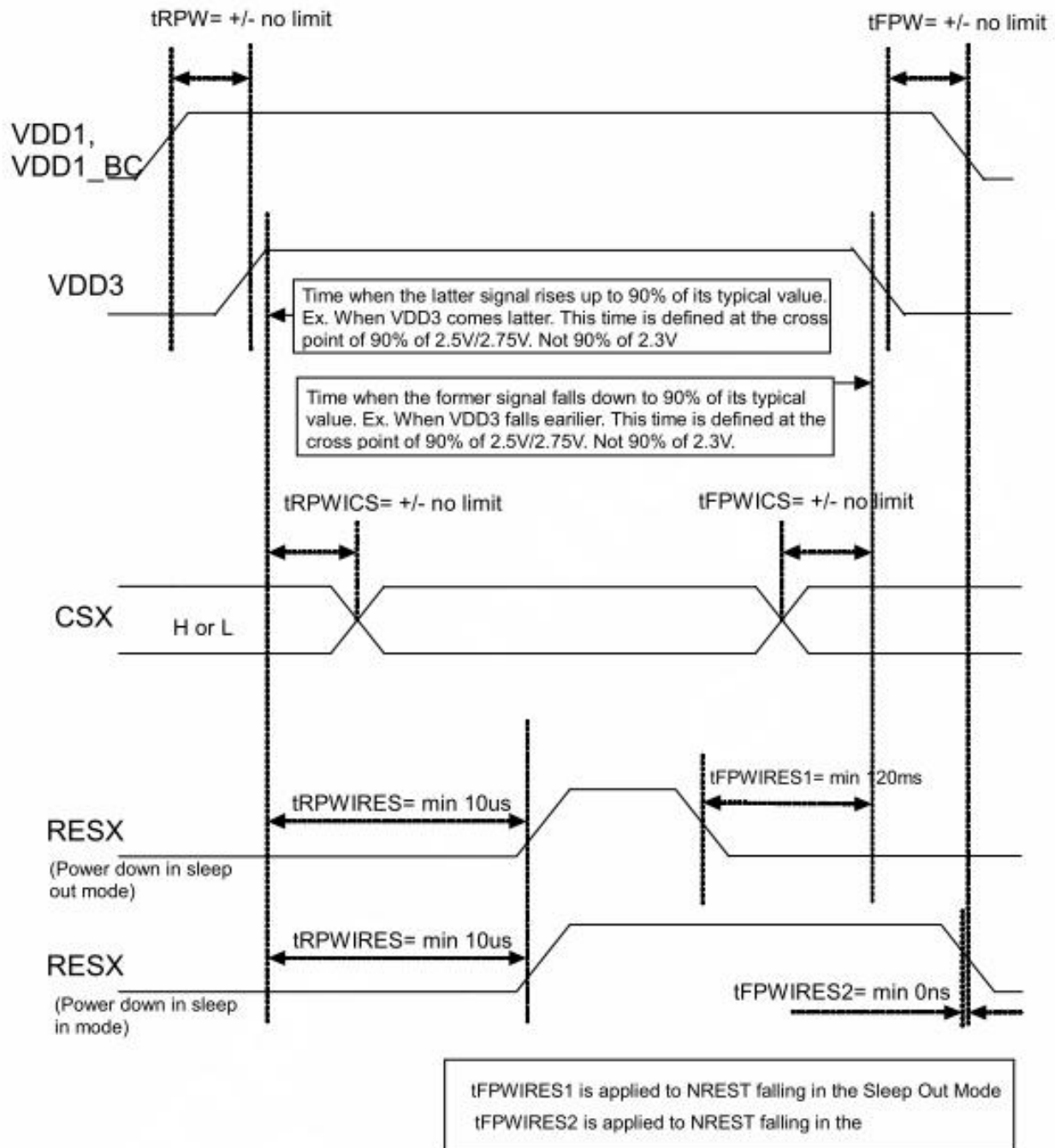
### 8.3 POWER ON SEQUENCE

#### 8.3.1 RESX line is held high or unstable by host at power on



RESX line is held high or unstable by host at power on

### 8.3.2 RESX line is held low by host at power on



RESX line is held low by host at power on

## 9. Optical Specification

### 9.1 Transmissive mode

Ta=25°C

Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio		CR	$\theta=0^{\circ}$	80	100	-		Note1 Note2
Response Time		Tr+Tf	25℃	35	40	50	ms	Note1 Note3
View Angles		$\theta T$	$CR \geq 10$	45	55	-	Degree	Note 4
		$\theta B$		30	40	-		
		$\theta L$		30	40			
		$\theta R$		35	45	-		
Chromaticity	White	x	Brightness is on	TYP-0.05	0.30	TYP+0.05		Note5, Note1
		y			0.33			
	Red	x			0.57			
		y			0.33			
	Green	x			0.33			
		y			0.49			
	Blue	x			0.16			
		y			0.16			
NTSC				-	35	-	%	Note5
Luminance		L		160	200	-	cd/m <sup>2</sup>	Note1 Note6
Gamma Curve		U			2.2	-		
Transmittance				1.6	1.8		%	

### 9.2 Reflective mode

Ta=25°C

Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio		CR	$\theta=0^\circ$	5	8	-		
Reflectance				5.4	6	-	%	
View Angles		$\theta T$	$CR \geq 10$	50	60	-	Degree	Note 4
		$\theta B$		50	60	-		
		$\theta L$		45	55			
		$\theta R$		50	60	-		

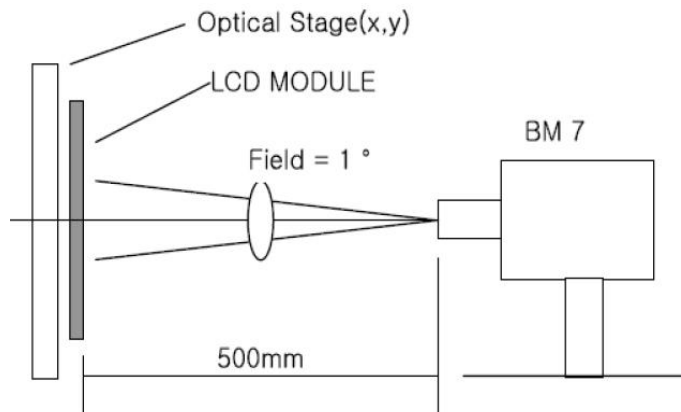
Chromaticity	White	x	Brightness is on	TYP-0.05	0.32	TYP+0.05		Note5, Note1
		y			0.34			
	Red	x			0.39			
		y			0.33			
	Green	x			0.33			
		y			0.39			
	Blue	x			0.22			
		y			0.23			
NTSC				-	5	-	%	Note5

Test Conditions:

1. IF= 20 mA, VF=6.4 V and the ambient temperature is  $25 \pm 2^{\circ}\text{C}$ .humidity is  $65 \pm 7\%$
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

Temperature =  $25^{\circ}\text{C}(\pm 3^{\circ}\text{C})$ ; LED back-light: ON, Environment brightness < 150 lx

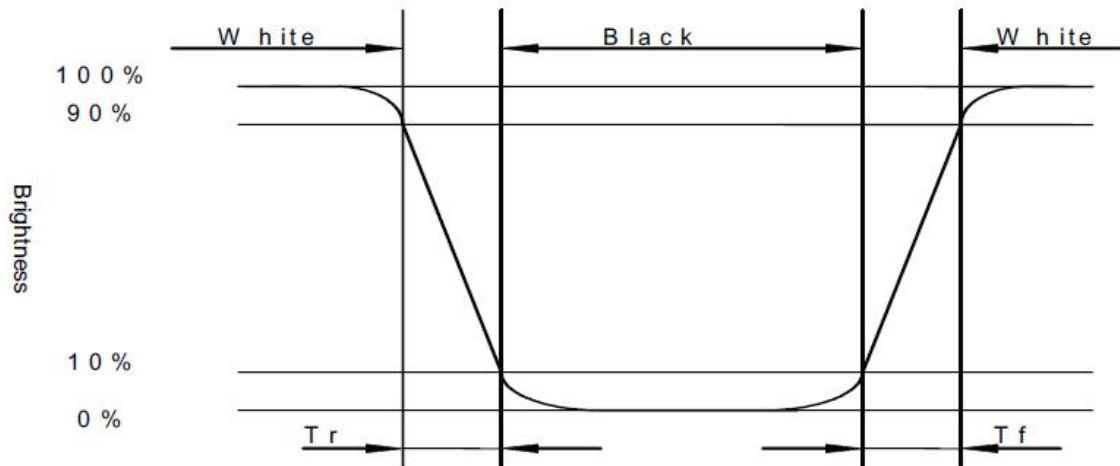


Note 2: Contrast ratio is defined as follow:

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

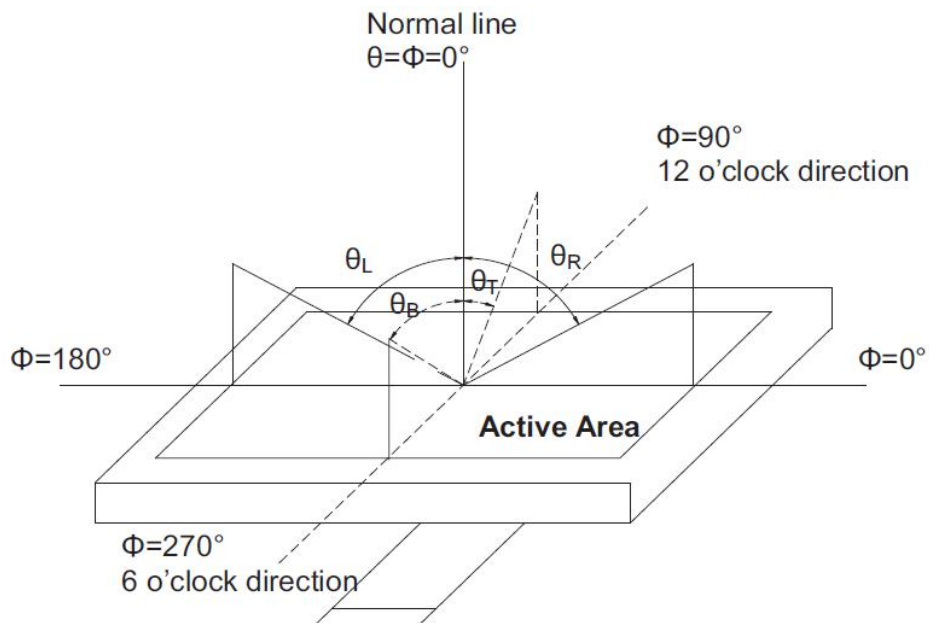
**Note 3: Response time is defined as follow:**

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: Definition of color chromaticity (CIE1931)**

Color coordinates measured at center point of LCD.

**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.

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

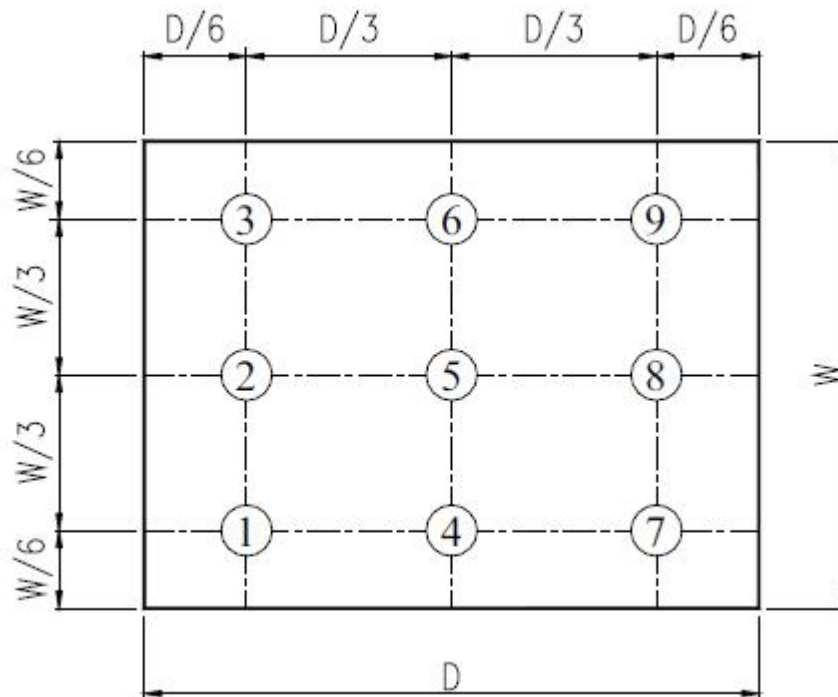


Fig. 2 Definition of uniformity



## 10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ts=+70°C, 240hrs	Per table in below
2	Low Temp Operation	Ta=-20°C, 240hrs	Per table in below
3	High Temp Storage	Ta=+80°C, 240hrs	Per table in below
4	Low Temp Storage	Ta=-30°C, 240hrs	Per table in below
5	High Temp & High Humidity Storage	Ta=+60°C, 90% RH 240 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, 200 Cycles	Per table in below
7	ESD (Operation)	C=150pF,R=330 Ω ,5point/panel Air: ± 8Kv,5times; Contact: ± 4Kv,5times (Environment:15°C~35°C, 30%~60%.86Kpa~106Kpa)	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. (6 hours for total)	Per table in below
9	Shock (Non-operation)	Half Sine Wave 60G 6ms, ± X, ± Y, ± Z 3times for each direction	Per table in below
10	Package Drop Test	Height:80cm, 1corner,3edges,6surfaces	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.

