



SPEC TITLE
DOCUMENT CONTROL SPECIFICATION

SPECIFICATION FOR 4.0" 720X720 TFT LCD MODULE MODEL NO.: SF-TO400XC-8996A2-N

Customer Approval:

☐ Accept

☐ Reject

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Cert. No.: 22ACM17147Q
ISO9001:2015



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1. Record of Revision

Rev.	Issued Date	Description	Editor
1.0	2022-05-14	First release	HOU

2.General Specifications

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180° shift.

Note 2: ROHS compliant.

Item	Specification	Unit
LCD size	4.0	inch
Display Mode	Normally Black	--
Resolution	720(RGB)x720	Pixel
Pixel pitch	0.047*RGB*0.141	mm
Pixel Arrangement	RGB Vertical Stripe	
Viewing direction	IPS	-
Module outline dimension	105.3(H)*109.6(V)*2.3(D)	mm
LCD AA	101.52*101.52	mm
TP VA	-	mm
Colors	262K	-
Driver IC	NV3052CGRB	-
Driver IC RAM Size	-	-
Interface	3SPI+18RGB	--
Backlight	White LED	--
Touch IC	-	--
Surface hardness	-	--
Touch structure	-	--
Cover lens	-	--
Colors	-	--
Operating Temperature	-20℃~ +70℃	--
Storage Temperature	-30℃~ +80℃	--

3.Pin Assignment

PIN	Symbol	Description	Remark
1	LEDA	LED ANODE	
2	LEDK	LED CATHODE	
3	LEDK	LED CATHODE	
4	GND	Ground	
5	VCI	LCD analog power supply (3.3V)	
6	RESET	Reset Signal	
7	NC	Not connect	
8	NC	Not connect	
9	SDA	SPI Data signal	
10	SCK	SPI Clock signal	
11	CS	SPI Chip select signal	
12	PCLK	RGB dot clock signal	
13	DE	RGB data enable signal	
14	VSYNC	RGB frame synchronizing signal	
15	HSYNC	RGB line synchronizing signal	
16-33	DB0-DB17	RGB data(B2-B7,G2-G7,R2-R7)	
34	GND	Ground	
35	TP_INT	Touch Interrupt	
36	TP_SDA	Touch IIC Data signal	
37	TP_SCL	Touch IIC Clock signal	
38	TP_RESET	Touch Reset Signal	
39	TP_VCI	Touch Power supply	
40	TP_GND	Touch Ground	

4.Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Voltage	V _{CI}	-0.30	+3.3	V	
	IOVCC	-	-	V	
	TP_VCI	/	/	V	
	TP_IOVCC	/	/	V	
Operating Temperature	T _{op}	-20.0	70.0	°C	
Storage Temperature	T _{st}	-30.0	80.0	°C	
Operating and Storage Humidity	H _{stg}	10%	90%	%(RH)	

5.Electrical Characteristics

5.1Recommended Operating Condition

V_{CI}=3.3V, GND=0V, T_a = 25°C

Item		Symbol	Min.	TYP.	Max.	Unit	Remark
Digital supply Voltage		IOVCC	-	-	-	V	
Analog supply Voltage		V _{CI}	2.5	2.8	3.3	V	
TP Power		TP_VCI	/	/	/	V	
TP Power		TP_IOVCC	/	/	/	V	NOTES
Input Signal Voltage	Low Level	V _{IL}	0	-	0.3 x IOVCC	V	
	High Level	V _{IH}	0.7 x IOVCC	-	IOVCC	V	
Current of digital supply voltage		I _{IOVCC}	-	/	/	Ma	V _{CI} =3.3V, color bar pattern
Current of analog supply voltage		I _{VCI}	-	/	/	Ma	

5.2 Backlight Unit Driving Condition

Item	Symbol	Min.	TYP.	Max.	Unit	Remark
Forward Current	I_F	-	40	-	mA	
Forward Current Voltage	V_F	-	30	-	V	
Backlight Power Consumption	W_{BL}	-	1200	-	mW	
Operating Life Time	--	20000	--	--	hrs	Note 2, Note 3

Note1: The LED driving condition is defined for each module.

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

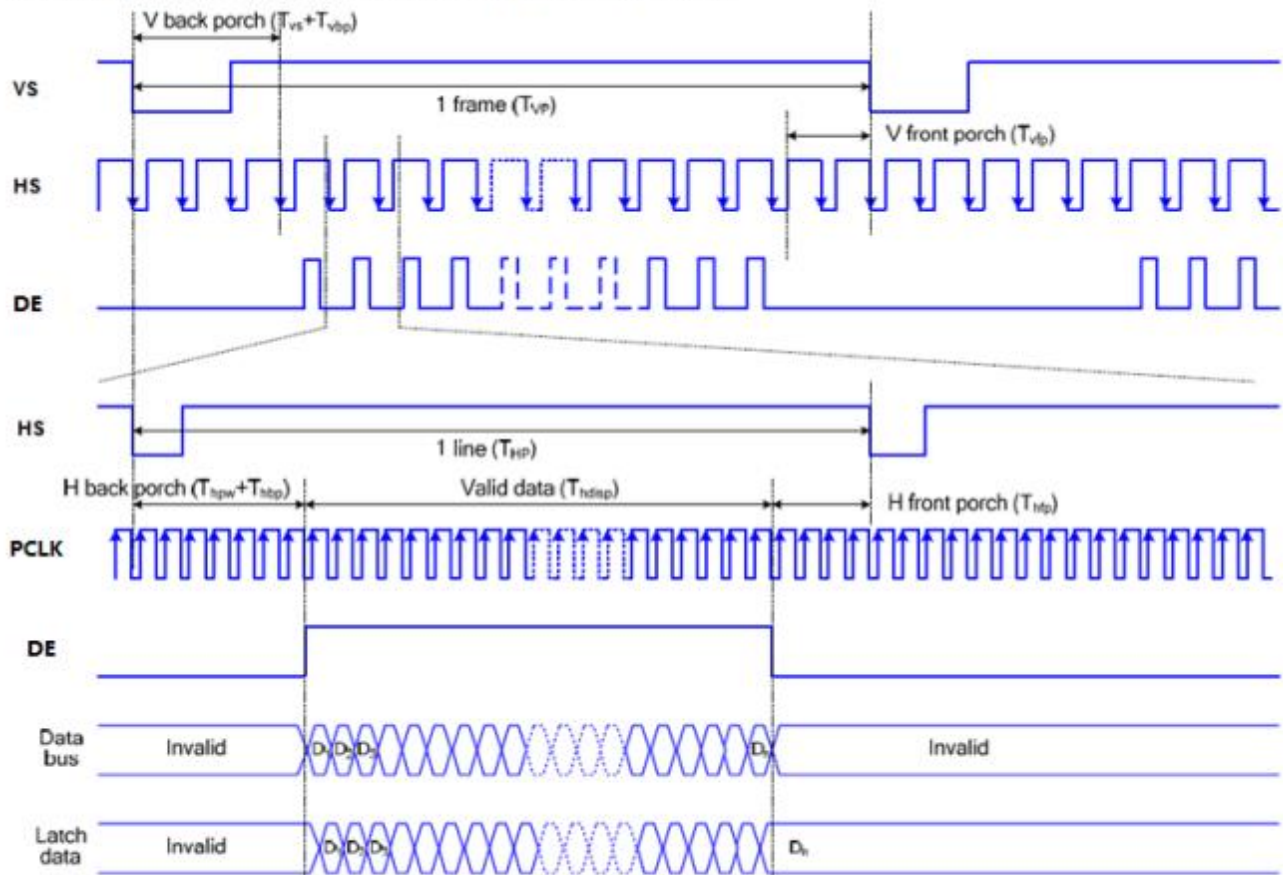
Note3: Optical performance should be evaluated at $T_a=25^{\circ}\text{C}$ When LED is driven at high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

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

6. Timing Characteristics

6.1 RGB Interface

The timing chart of RGB interface DE mode is shown as follows.



Timing Chart of Signals in RGB Interface DE Mode

Note: The setting of front porch and back porch in host must match that in IC as this mode.

6.2 Parallel 18-bit RGB Input Timing Table

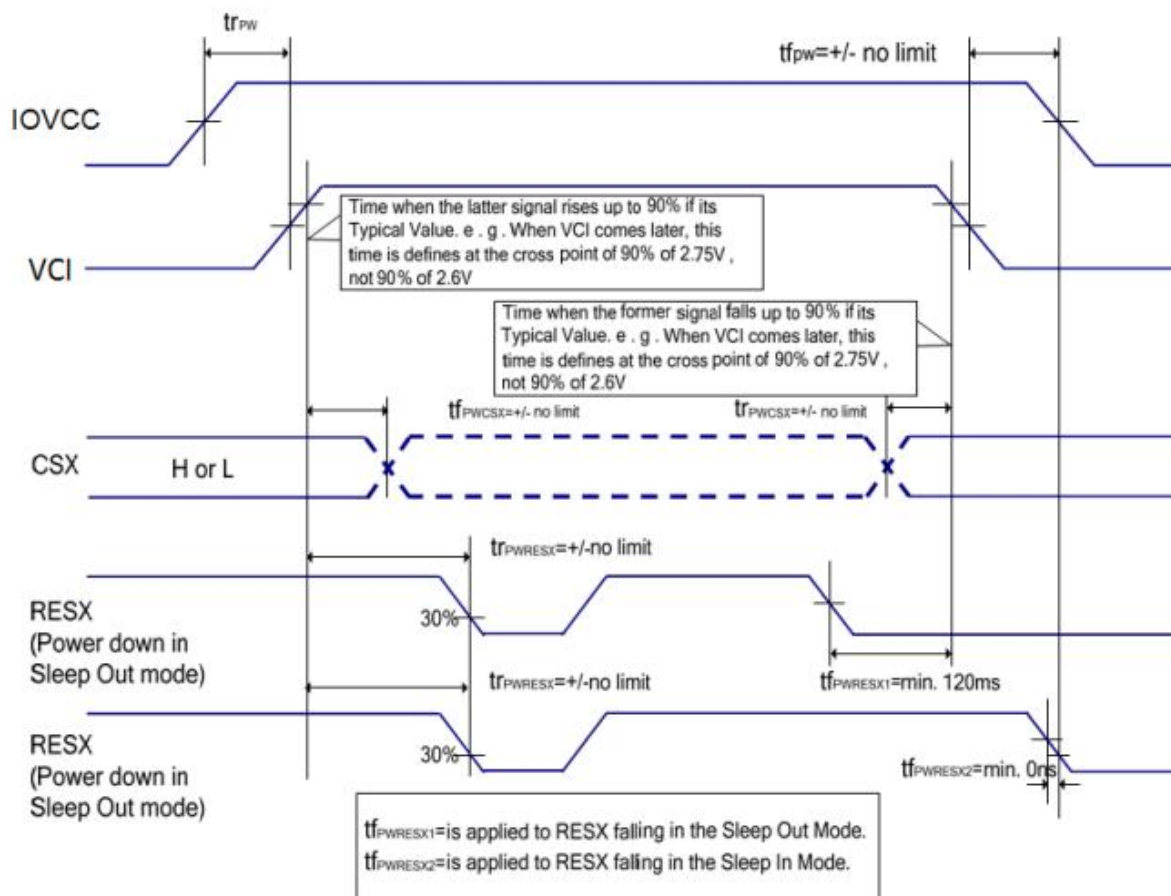
Parallel 18-bit RGB Input Timing (VDDI= 1.8V, PVDD=VDD= 3.3V, AGND= 0V, TA=25。 C)

720RGB X 720 Resolution Timing Table							
Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK Frequency		Fclk	33	49	-	MHz	
HSYNC	Period Time	Th	730	1080	-	DCLK	
	Display Period	Thdisp	720			DCLK	
	Back Porch	Thbp	4	120	255	DCLK	
	Front Porch	Thfp	4	120	255	DCLK	
	Pulse Width	Thw	2	120	255	DCLK	
VSYNC	Period Time	Tv	738	756	776	HSYNC	
	Display Period	Tvdisp	720			HSYNC	
	Back Porch	Tvbp	8	16	24	HSYNC	
	Front Porch	Tvfp	8	16	24	HSYNC	
	Pulse Width	Tvw	2	4	8	HSYNC	

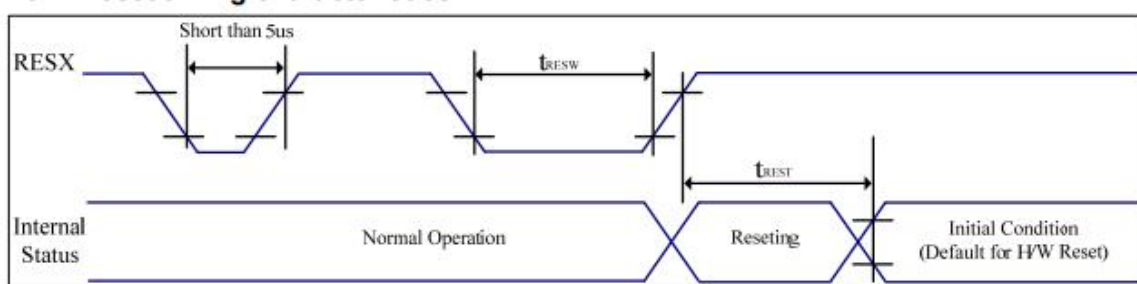
Note: 1. The minimum blanking time depends on the GIP timing of the panel specification

2. To ensure the compatibility of different panels, it is recommended to use the typical setting.

6.3 Power On/Off Timing



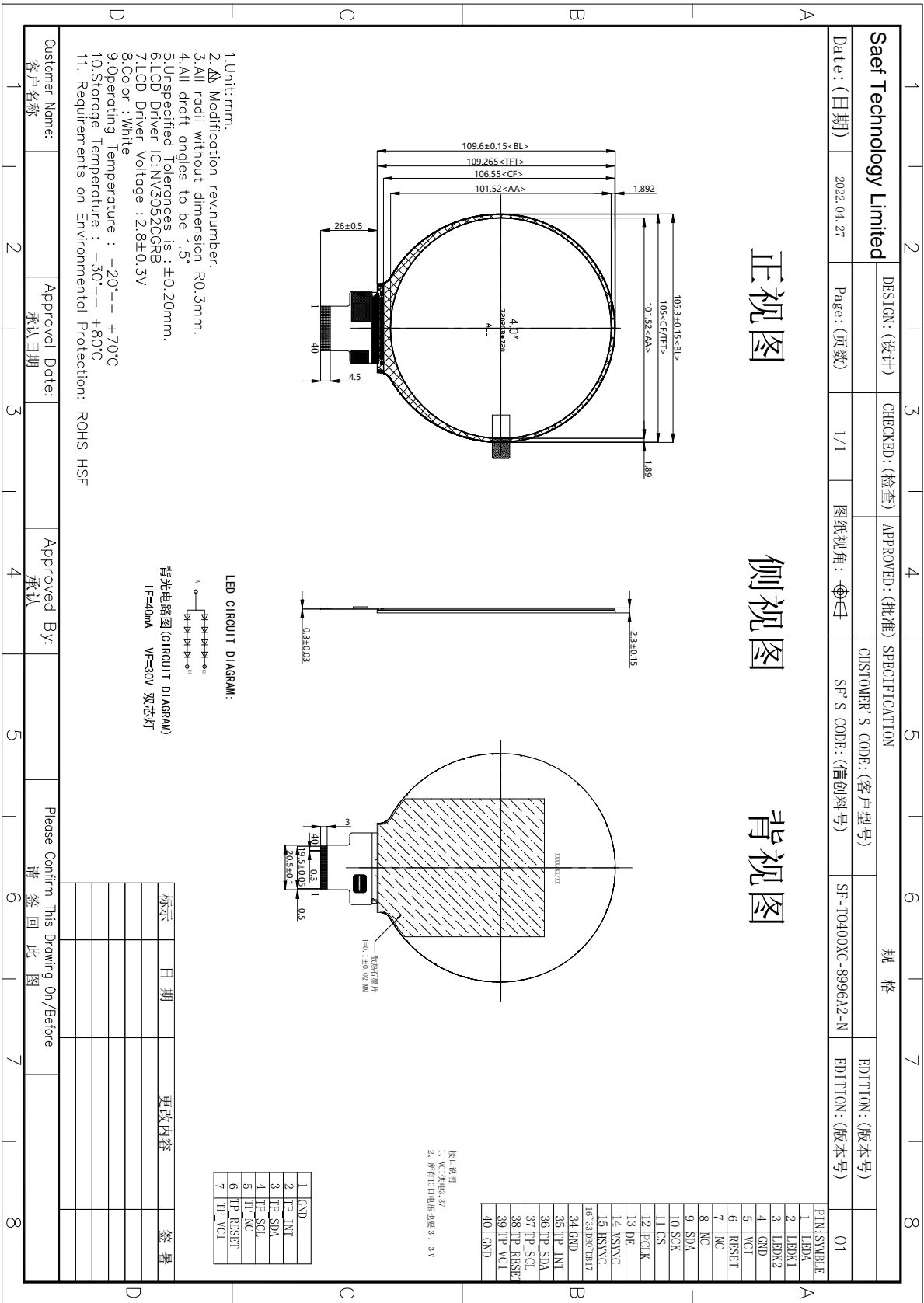
6.4 Reset timing characteristics



VSS=0V, IOVCC=1.65V to 3.6V, VCI=2.5V to 6.0V, Ta = -30°C to 85°C

Symbol	Parameter	Related Pins	MIN	TYP	MAX	Note	Unit
t_{RESW}	*1) Reset low pulse width	RESX	10	-	-	-	us
t_{REST}	*2) Reset complete time	-	-	-	5	When reset applied during Sleep in mode	ms
		-	-	-	120	When reset applied during Sleep out mode	ms

7.Mechanical Drawing



8.Optical Characteristics

Item		Symbol	Condition	Min.	TYP.	Max.	Unit	Remark
View Angles		θT	CR≧10	80	85	-	Degree	Note 2
		θB		80	85	-		
		θL		80	85	-		
		θR		80	85	-		
Contrast Ratio		CR	θ=0°	1000	1200	-		Note1 Note3
Response Time		T _{ON}	25℃	30	35	-	ms	Note1 Note4
		T _{OFF}						
Chromaticity	White	x	Backlight is on	-	-	-		Note1 Note5
		y		-	-	-		
Uniformity		U		80	85	-	%	Note1 Note6
NTSC				45	50	-	%	Note 5
Luminance		L		-	800	-	CD/m ²	Note1 Note7

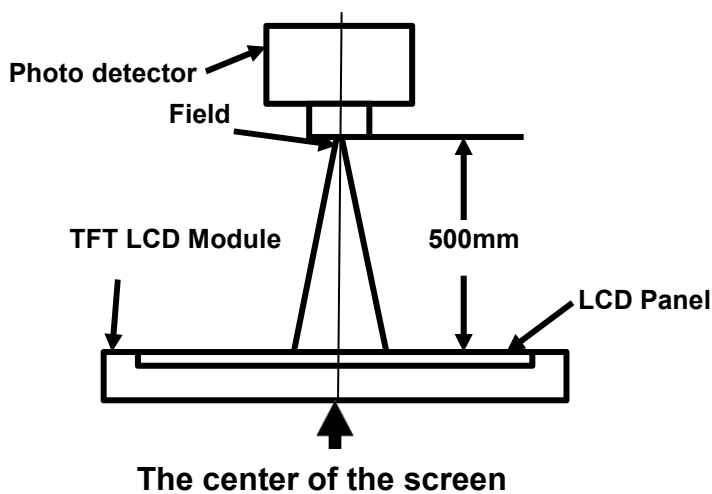
Test Conditions:

1.IF= 40 Ma, VF=30V and the ambient temperature is $25 \pm 2^\circ C$.humidity is $65 \pm 7\%$

2.The test systems refer to Note 1 and Note 2.

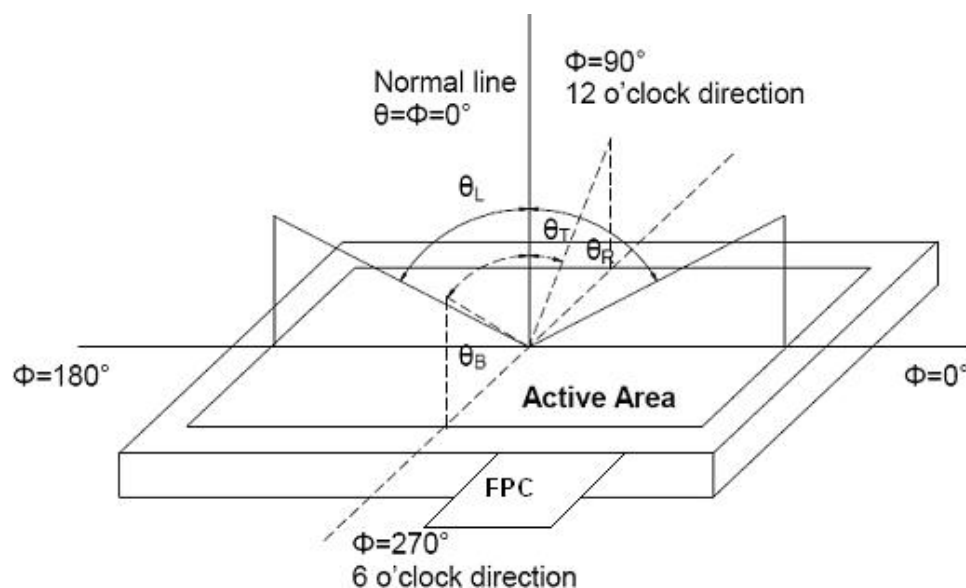
Note 1: Definition of optical measurement system.

Properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Note 2: Definition of viewing angle range and measurement system.

Viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

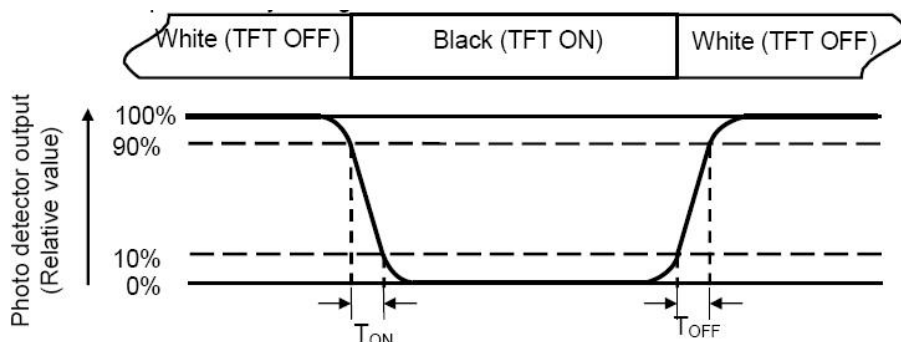


Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

Note 4: Definition of response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

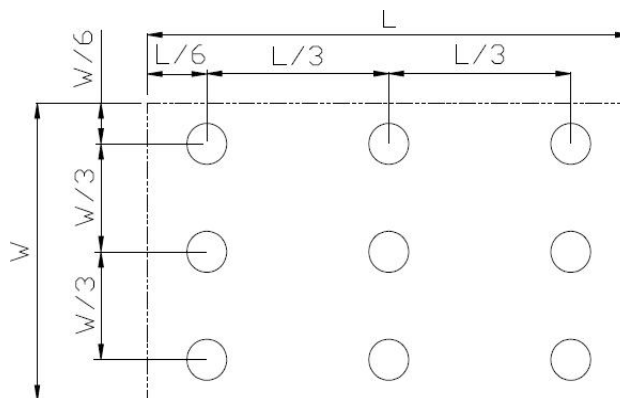
Color coordinates measured at center point of LCD.

Note 6: Definition of luminance uniformity

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

$$\text{Luminance Uniformity (U)} = \text{Luminance min} / \text{Luminance max}$$

L-----Active area length W-----Active area width



Luminance max: The measured Maximum luminance of all measurement position. Luminance min: The measured Minimum luminance of all measurement position.

Note 7: Definition of luminance:

Measure the luminance of white state at center point

9.Environmental / Reliability Test

No.	Items	Condition	Inspection after test
1	High Temperature Storage	T = 80°C for 96 hr	Inspection after 4 hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD 2.Seal leak; 3.Non-display; 4.missing segments; 5.Glass crack; 6.Current IDD is twice higher than initial value.
2	Low Temperature Storage	T = -30°C for 96 hr	
3	High Temperature Operating	T = 70°C for 96 hr	
4	Low Temperature Operating	T = -20°C for 96 hr (But no condensation of dew)	
5	High Temp. and High Humidity Operating	T = 60°C /90% for 96 hr (But no condensation dew)	
6	Thermal Shock	-20°C~25~70°C×10cycles (30min.) (5min.) (30min.)	
7	ESD	Voltage:±2KV R: 330Ω C: 150pF Air discharge, 10time	

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of samples

10. Precautions for Use of LCD Modules Handling Precautions

10.1 Handling Precautions

10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4 The Polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this Polarizer carefully.

10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the Polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

10.1.6 Do not attempt to disassemble the LCD Module.

10.1.7 If the logic circuit power is off, do not apply the input signals.

10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

10.1.8.1 Be sure to ground the body when handling the LCD Modules.

Tools required for assembly, such as soldering irons, must be properly ground.

10.1.8.2 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

10.1.8.3 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage Precautions

10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is: Temperature : 0°C ~ 40°C Relatively humidity: ≤80%

10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.