深圳市方九电子科技有限公司

Shenzhen Fangjiu Electronic Technology Co., LTD

Specification

TFT-LCD module

Module(型号)：	FJ016I24003-A
Customer（客户）：	
Customer P/N（客户型号）：	

Approved by（批准）：	
Qualified（合格）：	Unqualified（不合格）：

PREPARED	CHECKED	APPROVED

REVISION RECORD

REV NO	REV DATE	CONTENTS	REMARKS
1.0	2020-5-20	FirstRelease	

TABLE OF CONTENT

1.0 General Specifications

FJ016I24003-A is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver IC, FPC and a back light unit. The module display area contains 400X400 pixels and can display up to 262K colors. This product accords with RoHS environmental criterion.

Item	Contents	Unit
LCD Type	Normally Black Transmissive LCD	/
Viewing direction	IPS(Full View)	O' Clock
Module outline (W x HxD)	42.94 x45.89x1.65	mm
Active area (WxH)	39.84 x39.84	mm
Number of Dots	400(RGB) x400	/
Driver IC	ST7797	/
Colors	262K	/
Backlight Type	2 LED Series	/
Interface Type	MIPI interface	/
Input voltage	2.8~3.2V	V

2.0 ABSOLUTE MAXIMUM RATINGS

Parameter	*Symbol*	*Min*	*Max*	*Unit*
Supply voltage for logic	Vcc1,Vcc2	*-0.3*	*4.6*	**V**
Input voltage	Vin	*-0.3*	*VCC+ 0.3*	**V**
Operating temperatur	Top	*-20*	*70*	℃
Storage temperature	Tst	*-30*	*80*	℃
Humidity	RH	*--*	*90%(Max60C)*	RH

3.0 ELECTRICAL CHARACTERISTICS

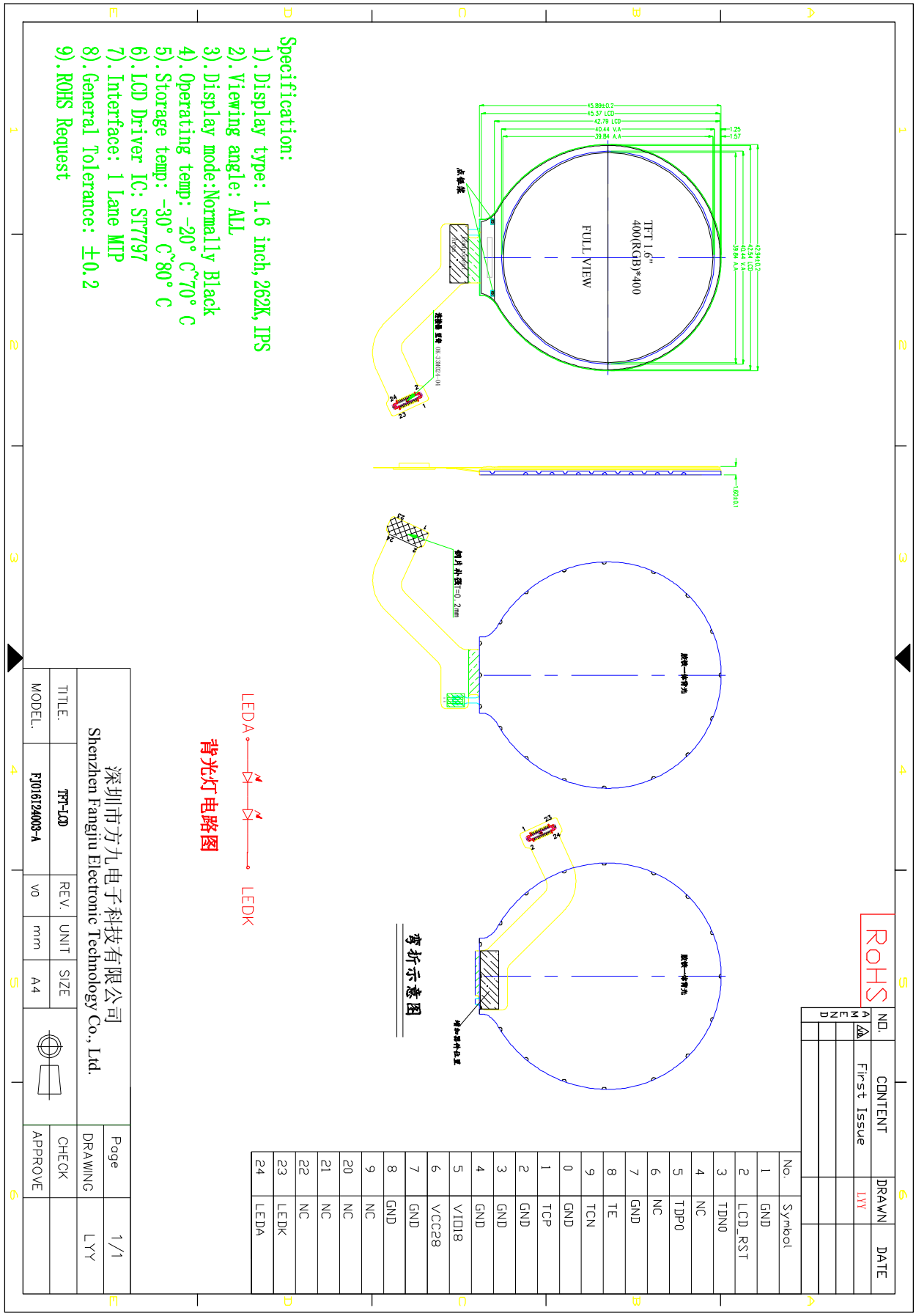
Parameter	*Symbol*	*Min*	*Typ*	*Max*	*Unit*
Supply voltage for logic	Vcc -Vss	*2.6*	*2.8*	*3.2*	V
Input Current	Idd	*--*	*10*	*--*	mA
Input voltage ' H ' level	Vih	*0.7Vdd*	*--*	*Vdd*	V
Input voltage ' L ' level	Vil	*-Vss*	*--*	*0.2 Vdd*	V
Output voltage ' H ' level	Voh	*0.8 Vcc*	*--*	*Vcc*	V
Output voltage ' L ' level	Vol	*0*	*0*	*0.2 Vcc*	V

4.0 BACKLIGHT CHARACTERISTICS

Item	*Symbol*	*Min*	*Typ*	*Max*	*Unit*	*Condition*
Forward voltage	***Vf***	*5.6*	*6.0*	*6.5*	**V**	**--**
Luminance	***Lv***	*--*	*250*	*--*	*cd/m2*	***If=20mA***
Number of LED	**--**	*2*			**Piece**	**--**
Connection mode	***P***	*Serial*			--	**--**

Using condition: constant current driving method If= 20 mA(+/-10%)

5.0 DIMENSIONAL DRAWING



6.0 INTERFACE PIN CONNECTIONS

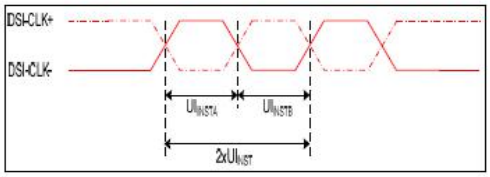
Pin.No	***Symbol***	***Function***
1	*GND*	*Ground*
2	*RESET*	*This signal will reset the device and it must be applied to properly initialize the chip.*
3	*TDN0*	*Negative polarity of low voltage differential data signal.*
4	*NC*	*No Connect*
5	*TDP0*	*Positive polarity of low voltage differential data signal.*
6	*NC*	*No Connect*
7	*GND*	*Ground*
8	*TE*	*Tearing effect output. If not used, leave this pin open.*
9	*TCN*	*Negative polarity of low voltage differential clock signal.*
10	*GND*	*Ground*
11	*TCP*	*Positive polarity of low voltage differential clock signal.*
12~14	*GND*	*Ground*
15	*IOVCC1.8*	*Power Supply for I/O system.(1.8V or VCC)*
16	*VCC2.8*	*Power Supply for Analog, Digital System and Booster Circuit.*
17,18	*GND*	*Ground*
19~22	*NC*	*No Connect*
23	*LEDK*	*back light power supply negative*
24	*LEDA*	*back light power supply positive*

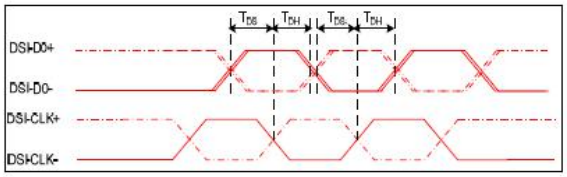
6. 1 TIMING CHARACTERISTICS

6.1.1 MIPI Interface Characteristics

--High Speed Mode

- Clock Channel Timing

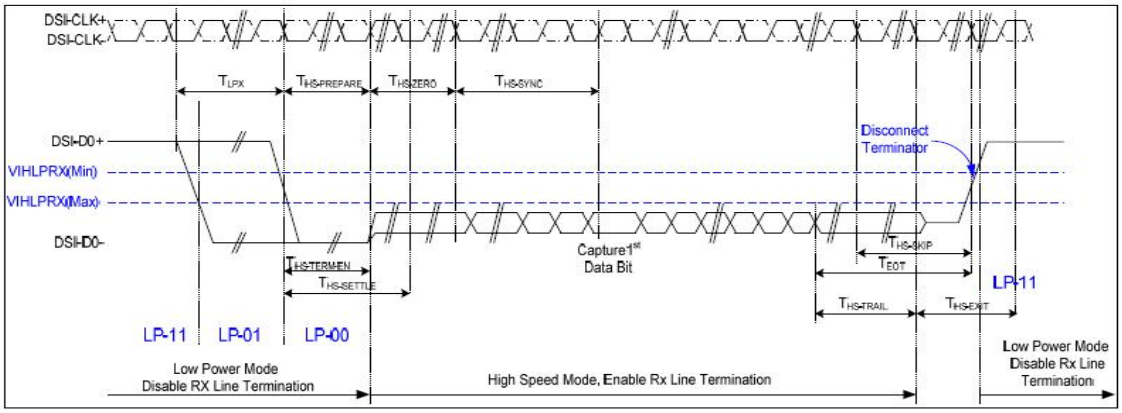




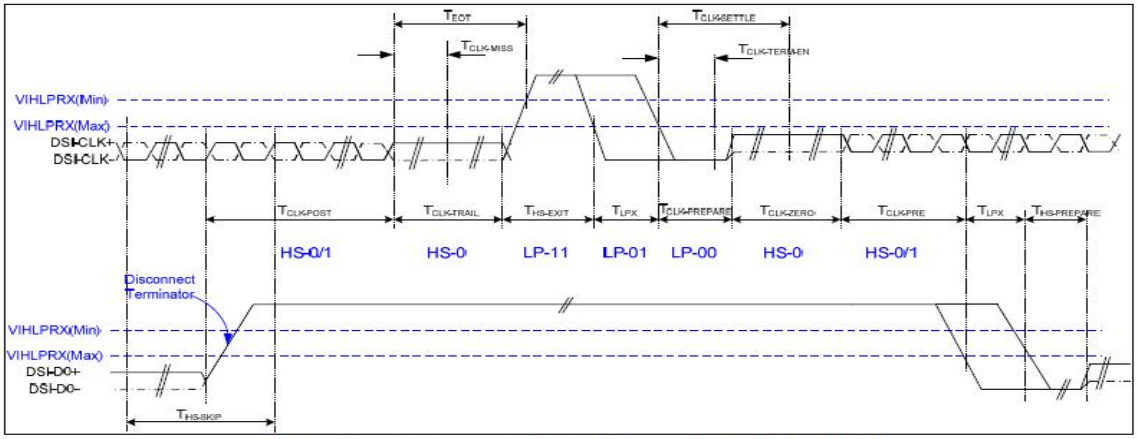
- Timing Characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-CLK+/-	$2xUI_{INSTA}$	Double UI instantaneous	4	25	ns	-
DSI-CLK+/-	UI_{INSTA} UI_{INSTB}	UI instantaneous halfs	2	12.5	ns	$UI = UI_{INSTA} = UI_{INSTB}$
DSI-Dn+/-	tDS	Data to clock setup time	0.15	-	UI	-
DSI-Dn+/-	tDH	Data to clock hold time	0.15	-	UI	-

- Data Transmission



Data lanes-Low Power Mode to/from High Speed Mode Timing

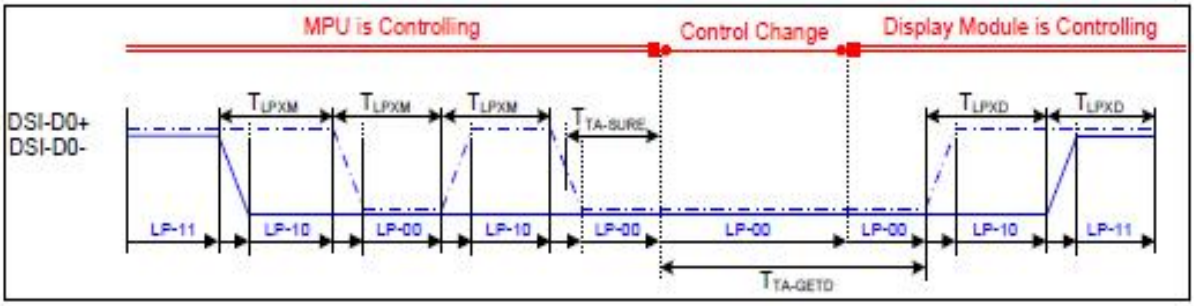


Clock lanes- High Speed Mode to/from Low Power Mode Timing

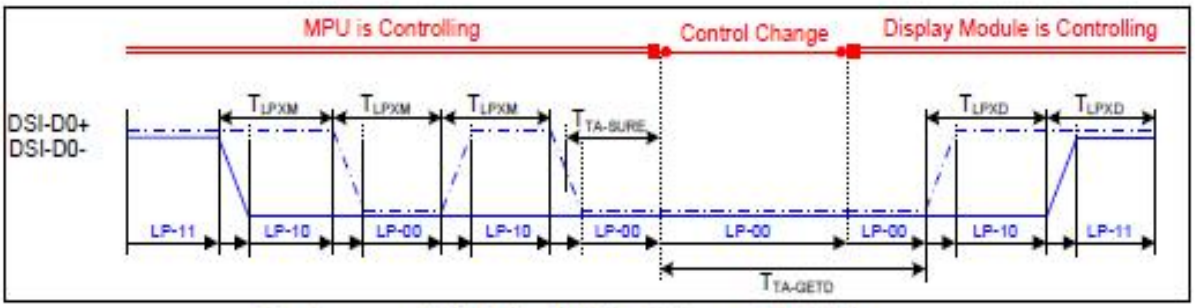
Signal	Symbol	Parameter	MIN	MAX	Unit	Description
Low Power Mode to High Speed Mode Timing						
DSI-Dn+/-	TLPX	Length of any low power state period	50	-	ns	Input
DSI-Dn+/-	THS-PREPARE	Time to drive LP-00 to prepare for HS transmission	40+4UI	85+6UI	ns	Input
DSI-Dn+/-	THS-TERM-EN	Time to enable data receiver line termination measured from when Dn crosses VILMAX	-	35+4UI	ns	Input
DSI-Dn+/-	THS-PREPARE + THS-ZERO	THS-PREPARE + time to drive HS-0 before the sync sequence	140+10UI	-	ns	Input
High Speed Mode to Low Power Mode Timing						
DSI-Dn+/-	THS-SKIP	Time-out at display module to ignore transition period of EoT	40	55+4UI	ns	Input
DSI-Dn+/-	THS-EXIT	Time to drive LP-11 after HS burst	100	-	ns	Input
DSI-Dn+/-	THS-TRAIL	Time to drive flipped differential state after last payload data bit of a HS transmission burst	60+4UI	-	ns	Input
High Speed Mode to/from Low Power Mode Timing						
DSI-CLK+/-	TCLK-POS	Time that the MPU shall continue sending HS clock after the last associated data lane has transition to LP mode	60+52 UI	-	ns	Input
DSI-CLK+/-	TCLK-TRAIL	Time to drive HS differential state after last payload clock bit of a HS transmission burst	60	-	ns	Input
DSI-CLK+/-	THS-EXIT	Time to drive LP-11 after HS burst	100	-	ns	Input
DSI-CLK+/-	TCLK-PREPARE	Time to drive LP-00 to prepare for HS transmission	38	95	ns	Input
DSI-CLK+/-	TCLK-TERM-EN	Time-out at clock lan display module to enable HS transmission	--	38	ns	Input
DSI-CLK+/-	TCLK-PREPARE + TCLK-ZERO	Minimum lead HS-0 drive period before starting clock	300	-	ns	Input
DSI-CLK+/-	TCLK-PRE	Time that the HS clock shall be driven prior to any associated data lane beginning the transition from LP to HS mode	8UI	-	ns	Input
DSI-CLK+/-	TEOT	Time form start of TCLK-TRAIL period to start of LP-11 state	-	105ns+ 12UI	ns	Input

Mipi Interface- High Speed Mode Timing Characteristics

--Bus Turnaround Procedure



Bus Turnaround (BTA) from display module to MPU Timing



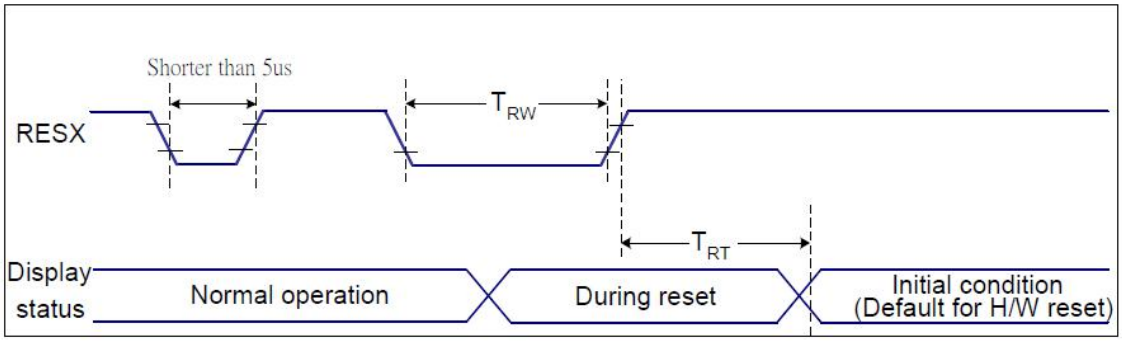
Bus Turnaround (BTA) from MPU to display module Timing

VDDI=1.8V,VCI=2.8V, AGND=DGND=AGNDR=0V, Ta=25℃

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-D0+/-	TLPXM	Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module	50	75	ns	Input
DSI-D0+/-	TLPXD	Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module	50	75	ns	Output
DSI-D0+/-	TTA-SURED	Time-out before the MPU start driving	T_{LPXD}	$2xT_{LPXD}$	ns	Output
DSI-D0+/-	TTA-GETD	Time to drive LP-00 by display module	$5xT_{LPXD}$		ns	Input
DSI-D0+/-	TTA-GOD	Time to drive LP-00 after turnaround request-MPU	$4xT_{LPXD}$		ns	Output

MIPI Interface BTA ModeTiming Characteristics

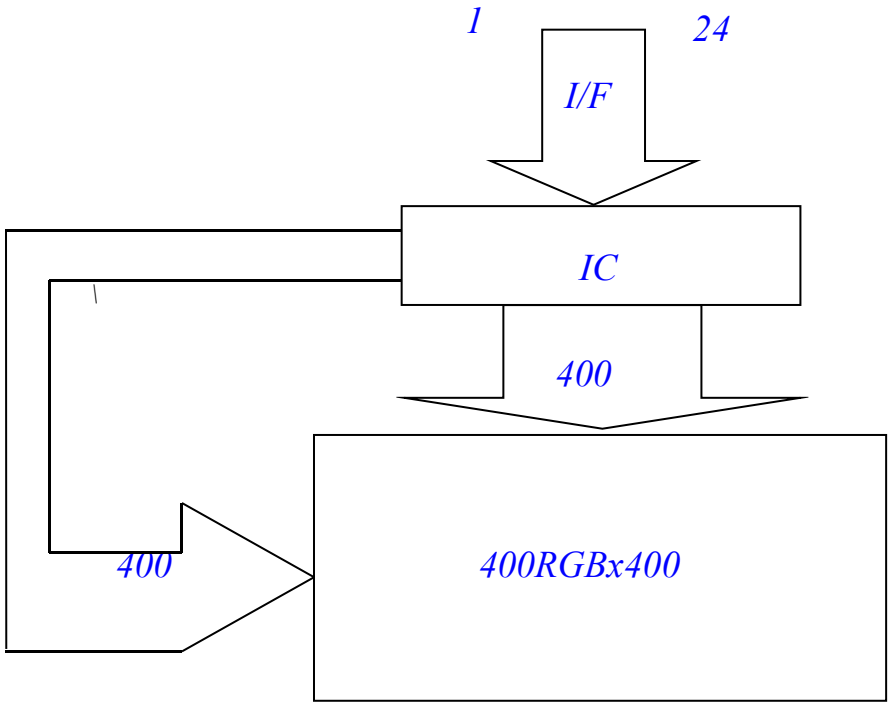
6.2. **Reset Input Timing**



VDDI=1.8V,VCI=2.8V, AGND=DGND=AGNDR=0V, Ta=25℃

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
			-	120 (Note 1, 6, 7)	ms

6.3 BLOCK DIAGRAM OF LCM



7. ELECTRO-OPTICAL CHARACTERISTICS

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Transmittance	Center		(3.3)	(3.67)	-	%	Under C-light (1),(5),(7),(8) θx=θy=0°
Contrast Ratio	Center		(800)	(1000)	-	-	(1),(3),(6),(7),(8) θx=θy=0°
Response Time	Rising + Falling		-	(30)	(40)	ms	(1),(4),(6),(7),(8) θx=θy=0°
CF Color Chromaticity (CIE1931)	Red x		Typ. -0.03	(0.657)	Typ +0.03	-	Under C-light (1),(5),(8) θx=θy=0°
	Red y			(0.322)		-	
	Green x			(0.284)		-	
	Green y			(0.566)		-	
	Blue x			(0.139)		-	
	Blue y			(0.108)		-	
	White x			(0.303)		-	
	White y			(0.333)		-	
NTSC	CIE1931		(60)	(65)	-	%	
Viewing Angle (CR≥10)	Horizontal	θ_{x+}	(75)	(85)	-	degree	(1),(2),(3),(6),(7),(8)
		θ_{x-}	(75)	(85)	-		
	Vertical	θ_{y+}	(75)	(85)	-		
		θ_{y-}	(75)	(85)	-		

Note(1) Measurement Setup:

The LCD module should be stabilized at given ambient temperature (25°C) for 30 minutes to avoid abrupt temperature changing during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 30 minutes in the windless room.

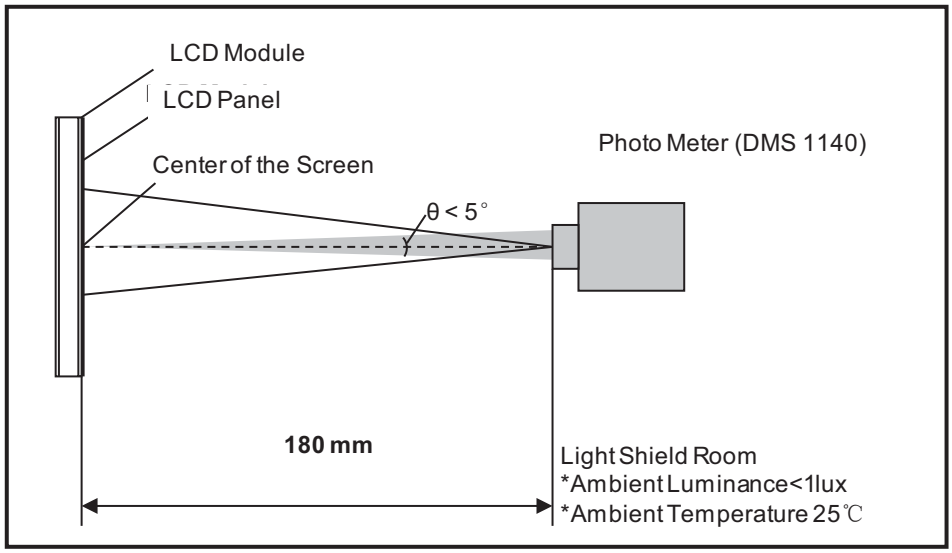


Figure 1 Optical Characteristic Measurement Equipment and Method

Note(2) Definition of Viewing Angle.

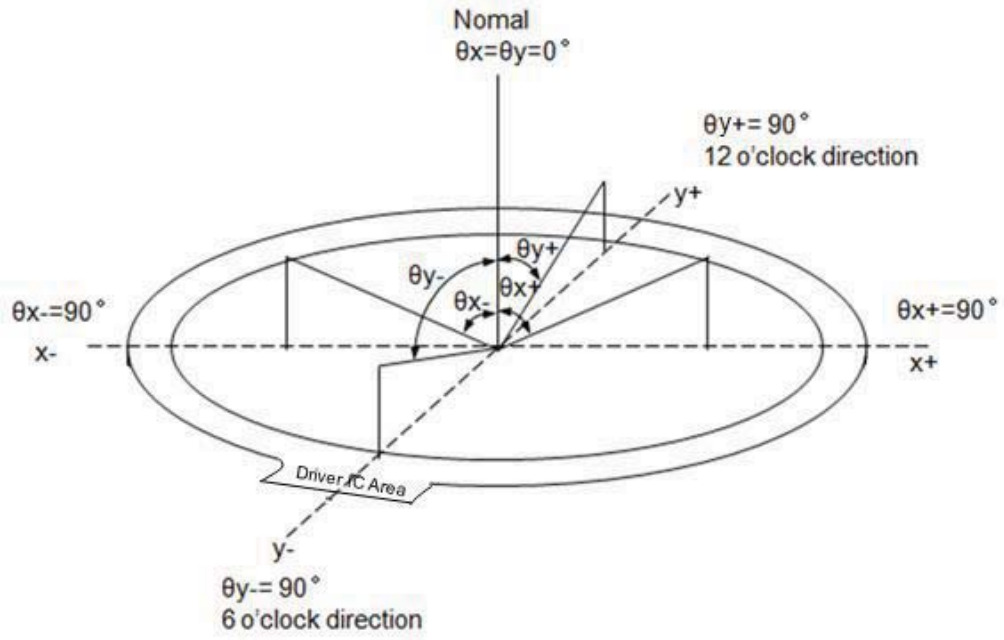


Figure 2 Definition of Viewing Angle

Note(3) Definition of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression:

Contrast Ratio (CR) = the luminance of White pattern/ the luminance of Black pattern

Note(4) Definition of Response Time

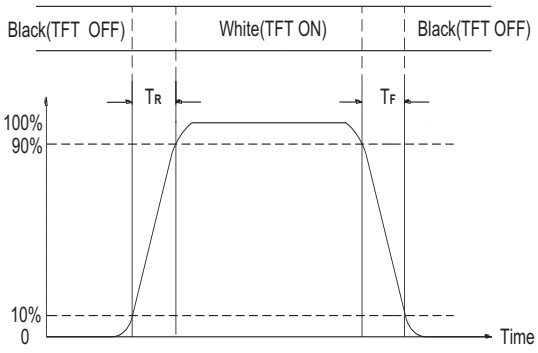


Figure 3 Definition of Response Time

Note(5) C-light Spectrum

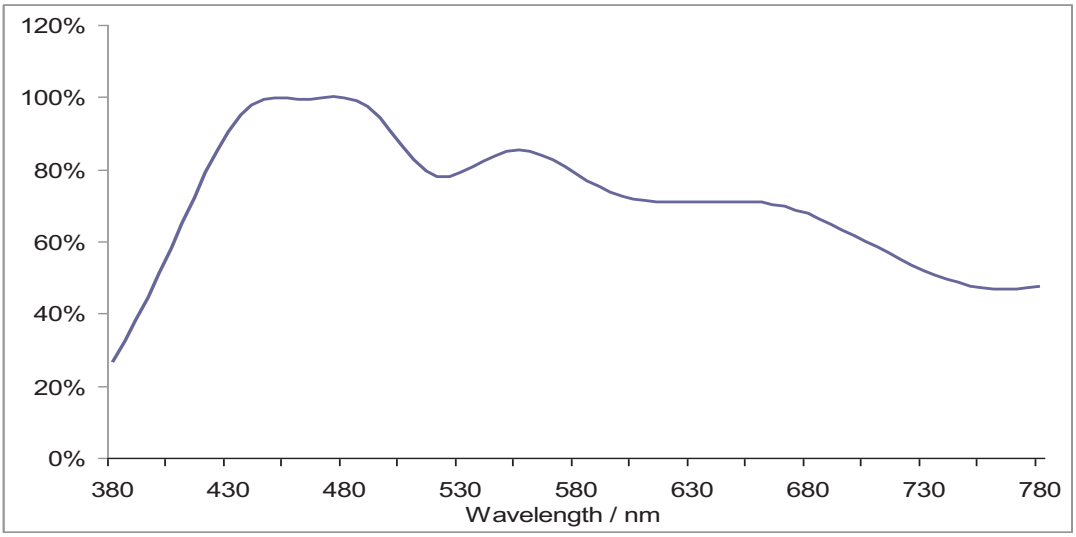


Figure 4 C-Light Spectrum

Note(6) The Back Light Spectrum

TBD

Figure 5 Back Light Spectrum

Note(7) The polarizer type: Sunnypol-Normal HC /CF; Sunnypol-Normal Clear/TFT.

Note(8) All optical data are based on IVO given system & nominal parameter & testing machine in this document.

Note(9) The direction of polarizer. It is recommended that customer should choose O Mode or E Mode according to the actual situation.

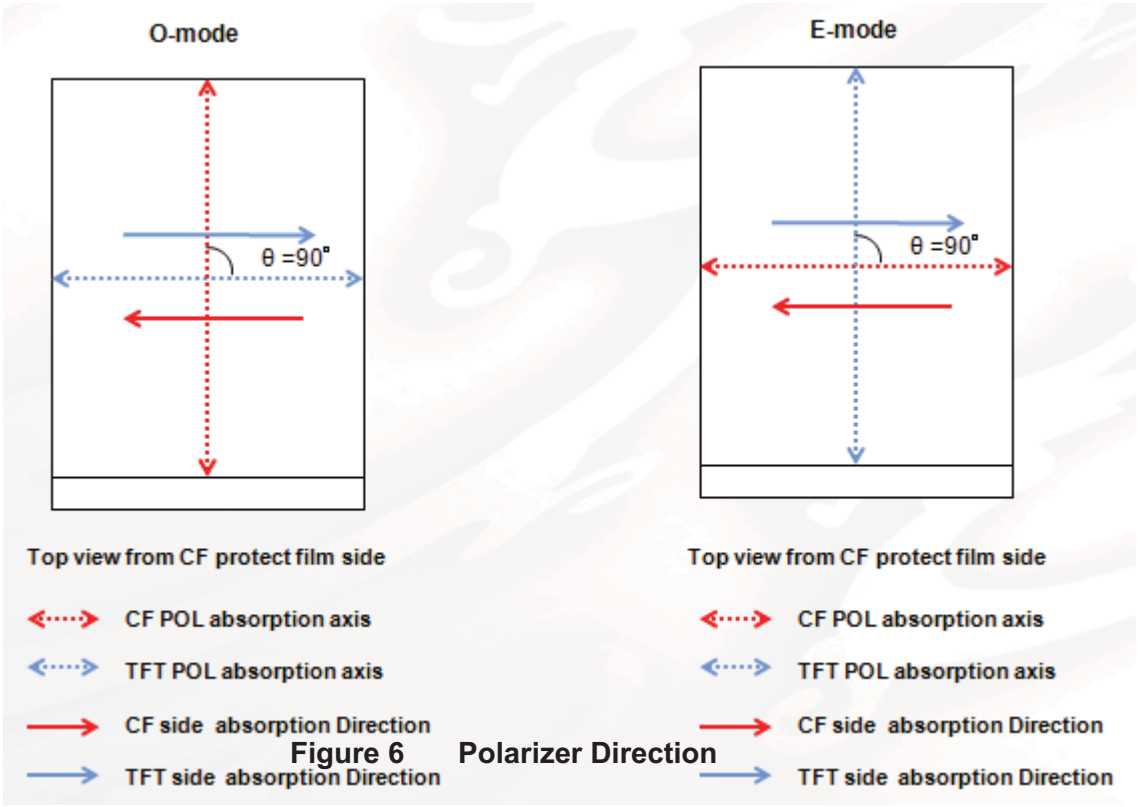


Figure 6 Polarizer Direction

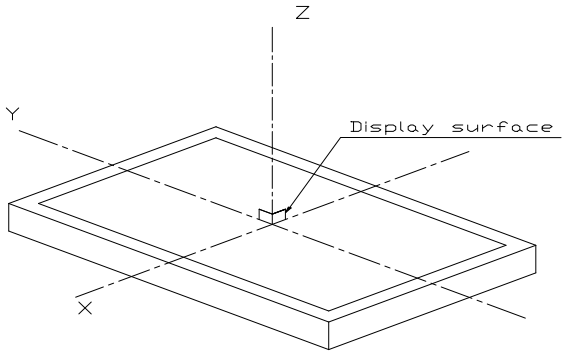
8.*INSPECTION CRITERIA*

8.1*Inspection Conditions*

8.1.1Environmental conditions
The environmental conditions for inspection shall be as follows
Room temperature: 20±3°C
Humidity: 65±20%RH

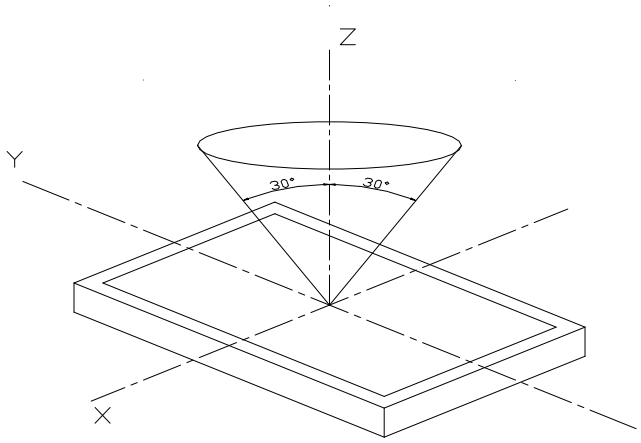
8.1.2 The external visual inspection
With a single 20-watt fluorescent lamp as the light source, the inspection was in the distance of 30cm or more from the LCD to the inspector's eyes .

8.2 LIGHT METHOD



Fluorescent lamp perpendicular to the display surface.

Inspection distance and angle



Inspection should be performed within angle Φ(Φis usually 30°) from Z axis to each X and Y.

Inspection distance in any direction within Φmust be kept 30±5cm from the display surface.

8.3 Classification of defects

9.3.1*Major defect*

A major defect refers to a defect that may substantially degrade usability for product applications.

9.3.2 Minor defect

A minor defect refers to a defect which is not considered to be able substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation.

9. RELIABILITY

9.1 MTBF

The LCD module shall be designed to meet a minimum MTBF value of 50000 hours with normal. (25°C in the room without sunlight)

9.2 TESTS

NO.	Test Item	Test condition	Criterion
1	High Temperature Storage	80℃±2℃ 96H Restore 2H at 25℃ Power off	Aftertesting,cosmetic and electrical defects should not happen.
2	Low Temperature Storage	-30℃±2℃ 96H Restore 2H at 25℃ Power off	
3	High Temperature Operation	70℃±2℃ 96H Restore 2H at 25℃ Power on	
4	Low Temperature Operation	-20℃±2℃ 96H Restore 4H at 25℃ Power on	
5	High Temperature & Humidity Operation	60℃±2℃ 90%RH 96H Power on	
6	Temperature Cycle	--30℃←→25℃←→80℃ 30min 5min 30min after 10cycle, Restore 2H at 25℃ Power off	
7	Vibration Test	10Hz~150Hz, 100m/s2, 120min	
8	Shock Test	Half-sinewave,300m/s2,11ms	
9	Drop Test(package state)	800mm, concrete floor,1corner, 3edges, 6 sides each time	1.After testing, cosmetic and electrical defects should not happen. 2.the product should remain at initial place 3.Product uncovered or package broken is not permitted.

10. **PRECAUTIONS FOR USING LCD MODULE**

10.1 handing precautions

(1) The display panel is made of glass. Do not subject it to a mechanical shock or impact by dropping it.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

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

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

(5) If the display surface becomes contaminated,breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten a cloth with one of the following solvents:

- Isopropyl alcohol

- Ethyl alcohol

(6) Solvents other than those above mentioned may damage the polarizer.

Especially, do not use the following:

- Water

- Ketone

- Aromatic solvents

(7) Extra care to minimize corrosion of the electrode. Water droplets, moisture condensation or a current flow in a high-humidity environment accelerates corrosion of the electrode.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD Module, make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD Module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

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

- Be sure to ground the body when handling he LCD Module.

- Tools required for assembling, such as soldering irons, must be properly grounded.

-To reduce the amount of static electricity generated, do not conduct assembling and other

work under dry conditions.

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

10.2 STORAGE PRECAUTIONS

When storing The LCD Module, avoid exposure to direct sunlight of fluorescent lamps. Keep the modules in bags (avoid high temperature/ high humidity and low temperatures below 0 ℃). Whenever possible, the LCD Module should be stored in the same conditions in which they were shipped from our company.

10.3 OTHERS

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD Module have been operating for a long time showing the same display patterns the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be recovered by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD Module resulting from destruction caused by static electricity etc. exercise care to avoid holding the following sections when handling the modules.

- Exposed area of the printed circuit board.

- Terminal electrode sections.