

# LCM Specification

Preliminary specification

Final Specification

Project No. 项目编号	TFT-H013A1HQIST2C16		
Customer 客户名称			
Module No. 客户型号			
Product type 产品内容	TFT LCD Module 320 x 3RGB x 320 Dots 1.3" TFT LCD		
Signature by customer: 客户确认签章:			
<input type="checkbox"/> Trial production <input type="checkbox"/> Mass production			
编 制	电子审核	结构审核	批 准
Liu. YL			

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Shenzhen Hot Display Technology Co., Ltd

**1 Document revision history :**

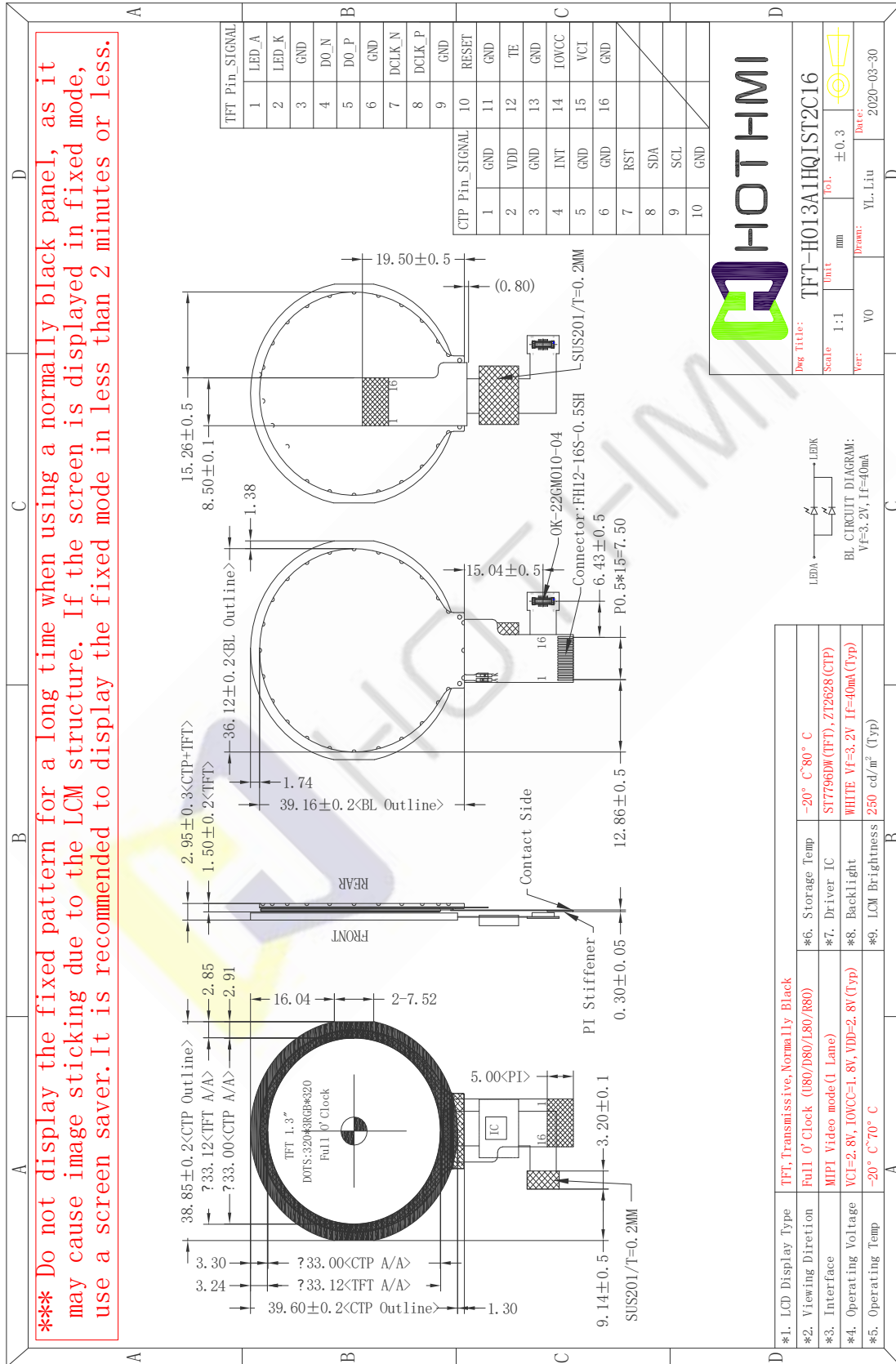
DOCUMENT REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
0	2020-04-11	First Release.	Liu.YL	



## 1. General Feature:

Item	Standard Value	Unit
Display Size	1.3"	--
Number of Pixels	320(H)x3(RGB)*320(V)	--
Active Area	33.12(H) *33.12(V)	mm
Outline Dimension	36.12(H) ×39.16× 1.50(V)	mm
Viewing Direction	Full O'clock	-
Interface	MIPI Video mode(1 Lane)	-
Driver IC	ST7796DW	-
Driver Condition	VCI=2.8V,IOVCC=1.8V(Typ)	V
Backlight	White LED	-
Touch Panel	Cap Touch Panel	-
CTP Driver IC	ZT2628	
CTP Driver Voltage	VDD=3.3V(Typ)	V
LCD Operation Temperature	-20~70	°C
LCD Storage Temperature	-20~80	°C

## 2.Outline Dimensions



### 3. Pin Description

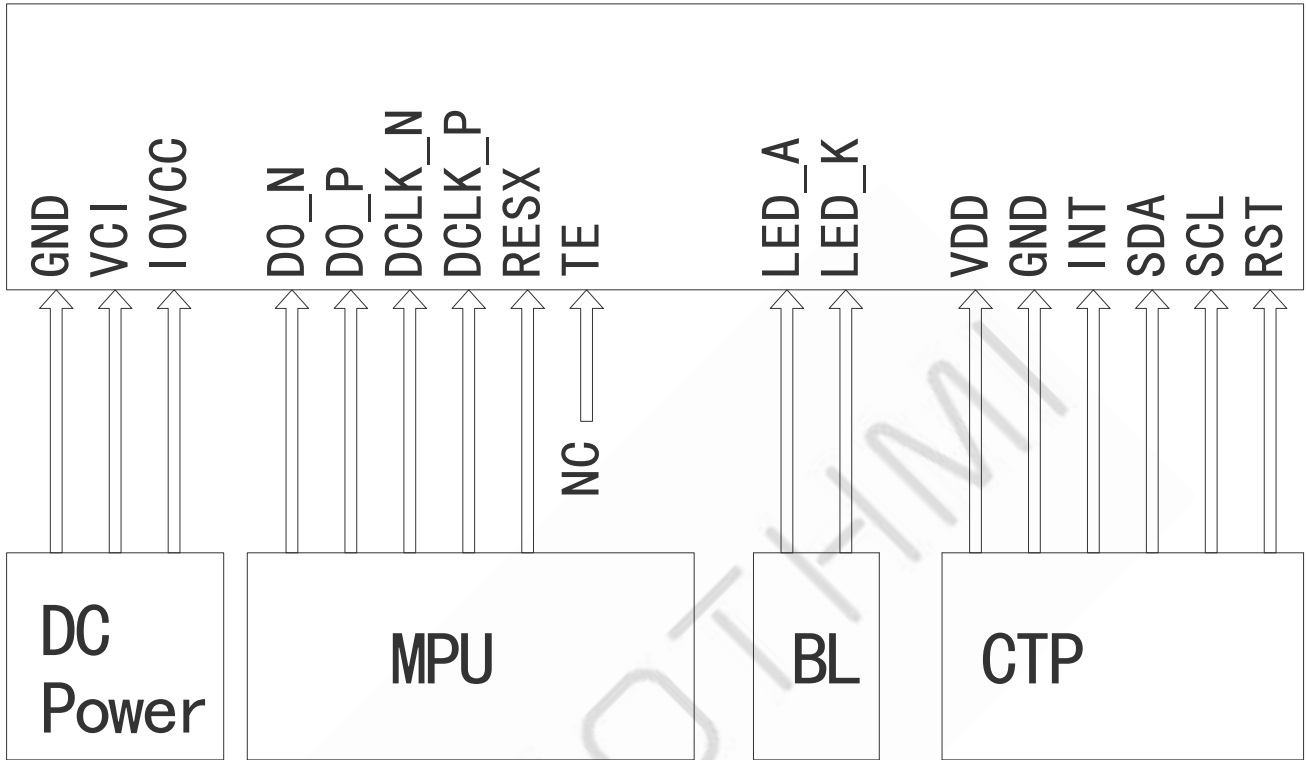
#### 3.1 TFT Pin Description

Pin NO.	Symbol	Description
1	LED_A	LED Anode(+3.2V/40mA)
2	LED_K	LED Cathode
3	GND	Ground
4	D0_N	Negative polarity of low voltage differential data signal
5	D0_P	Positive polarity of low voltage differential data signal
6	GND	Ground
7	DCLK_N	Negative polarity of low voltage differential clock signal
8	DCLK_P	Positive polarity of low voltage differential clock signal
9	GND	Ground
10	RESX	Reset Pin
11	GND	Ground
12	TE	◆Tearing effect output. ◆If not used, please let this pin open
13	GND	Ground
14	IOVCC	Analog Power(1.65 ~ 3.3 V)
15	VCI	Analog Power(2.7 ~ 3.6 V)
16	GND	Ground
---END---		

#### 3.2 CTP Pin Description

Pin NO.	Symbol	Description
1	GND	Ground
2	VDD	Power supply input for CTP(2.8 ~ 3.6 V).
3	GND	Ground
4	INT	CTP_External interrupt to the host.
5	GND	Ground
6	GND	Ground
7	RST	Reset Pin
8	SDA	CTP Serial data input signal.
9	SCL	CTP Serial clock signal.
10	GND	Ground

**3.3 Wiring Diagram**



## 4. Electrical Characteristics

### 4-1 TFT LCD Module Operating Conditions

Item	Symbol	Condition	Min	Type	Max	Unit
Interface logic circuits	IOVCC	-	1.65	1.80	3.30	V
Analog Power supply	VCI	-	2.50	2.80	3.30	V
TFT Gate on voltage	VGH	-	10.0	-	16.0	V
TFT Gate off voltage	VGL	-	-16.0	-	-10.0	V

### 4-2 LED back light specification (pera chip)

Item	Symbol	Condition	Min	Type	Max	Unit
Forward voltage	Vt	If=20mA	-	3.2	-	V
Forward current	Ipn	/1-chip	-	40	-	mA
Luminance(With LCD)	Lv	If=40mA	-	250	-	cd/m <sup>2</sup>
Luminous color	White					

### 4-3 CTP Operating Conditions

Item	Symbol	Condition	Min	Type	Max	Unit
Power Supply Voltages	VDD	-	2.8	3.30	3.60	V
I/O Digital Voltage	IOVDD	-	2.8	3.30	3.60	V
Operating Temperature	Topr	-	-10	-	60	°C
Storage Temperature	Tstg	-	-20	-	70	°C

## 5.OPTICAL SPECIFICATION

### 5.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance 1lux and temperature = 25 ± 2°C) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of  $\theta$  and  $\Phi$  equal to 0°. The center of the measuring spot on the Display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement.

### 5.2 Optical Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	$\Theta$ 3	CR>10	-	80	-	Deg.	Note 1
		$\Theta$ 9		-	80	-	Deg.	
	Vertical	$\Theta$ 12		-	80	-	Deg.	
		$\Theta$ 6		-	80	-	Deg.	
Contrast ratio		CR	$\Theta = 0^\circ$	900	1100	-		Note2
Color Gamut		CG		-	35	-	%	
White Chromaticity		Wx			0.300			
		Wy			0.326			
Reproduction of color	Red	Rx	$\Theta = 0^\circ$	-0.02	0.655	+0.02		Note4 (Based on C Light)
		Ry			0.327			
	Green	Gx			0.284			
		Gy			0.594			
	Blue	Bx			0.138			
		By			0.111			
Response Time (Rising + Falling)		Tr+Tf	$\Theta = 0^\circ$ Ta= 25°C	-	30	35	ms	Note5
Transmittance		Tr		4.18	4.65		%	Note3

### Note:

1.Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o' clock direction and the vertical or 6, 12 o' clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2.Contrast measurements shall be made at viewing angle of  $\Theta = 0$  and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black)



state . (see FIGUR 1) Luminance Contrast Ratio (CR) is defined mathematically.

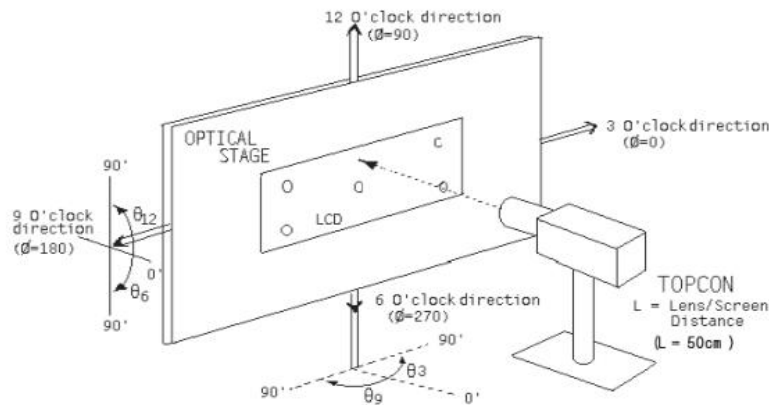
$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Transmittance is the Value without APF and without CG.

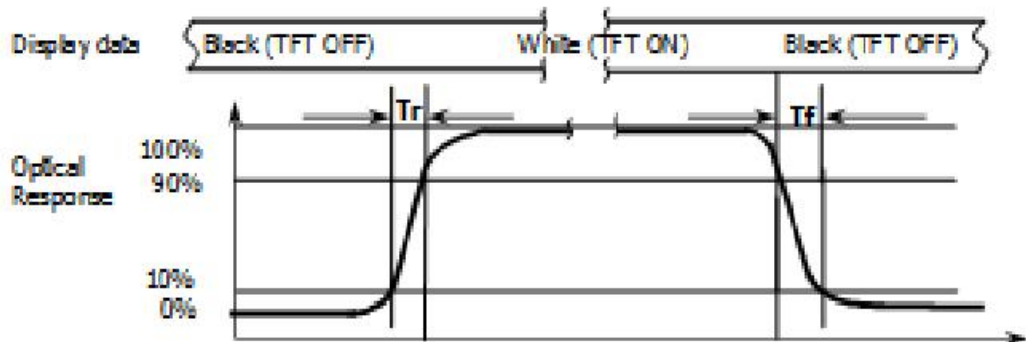
4. The color chromaticity coordinates specified in the above table shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

5. The electro-optical response time measurements shall be made as FIGURE 2 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is  $T_r$ , and 90% to 10% is  $T_f$ .

**Figure1 Measurement Set Up**



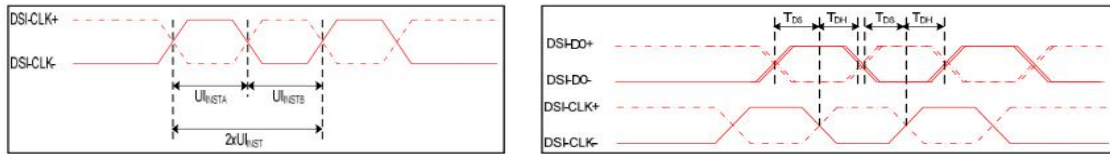
**Figure2 Response Time Testing**



## 6. Timing Characteristics of Input Signals

### 6-1 MIPI Interface Characteristics

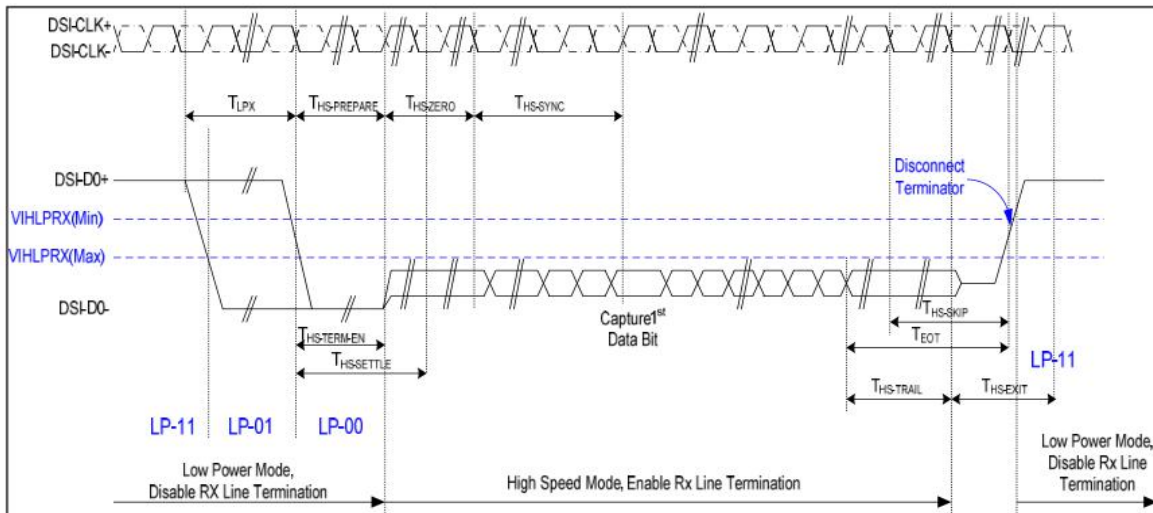
- Clock Channel Timing



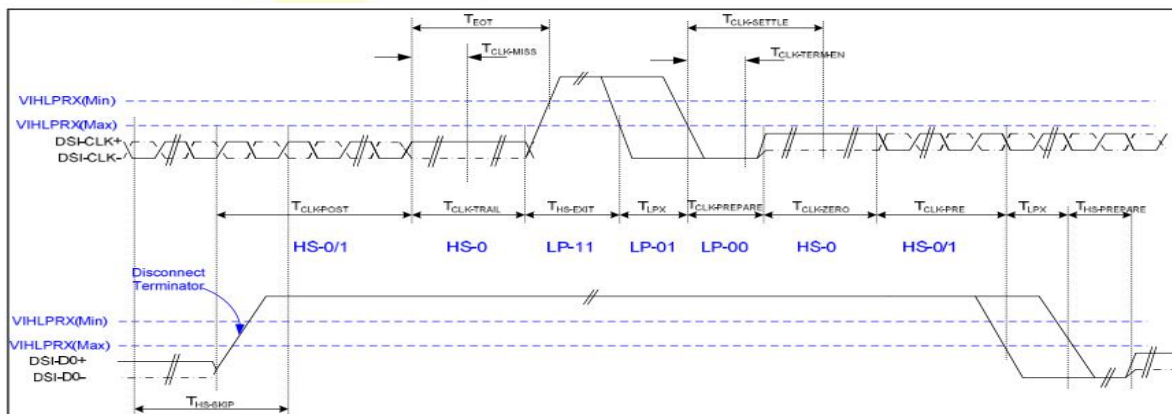
- Timing Characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-CLK+/-	$2xU_{INSTA}$	Double UI instantaneous	4	25	ns	-
DSI-CLK+/-	$U_{INSTA}$ $U_{INSTB}$	UI instantaneous halves	2	12.5	ns	$UI = U_{INSTA} = U_{INSTB}$
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+52UI	-	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

## 6-2 CTP Timing Characteristics

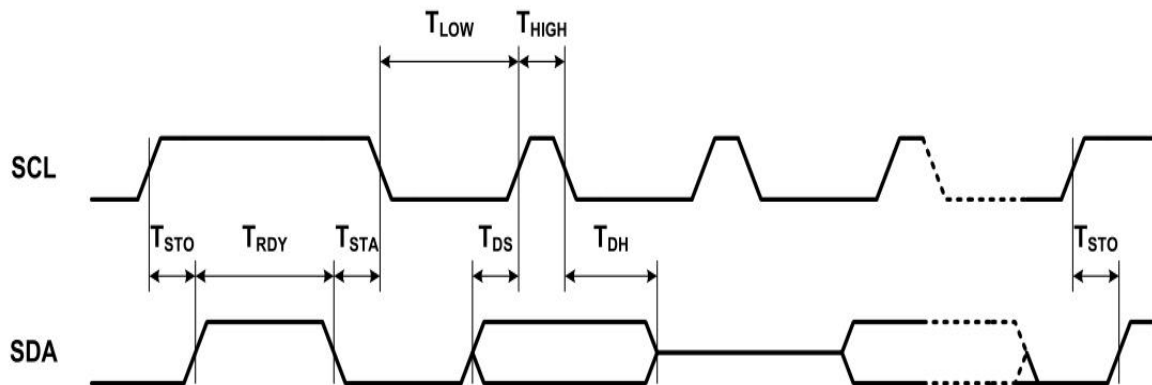
### 6-2-1: I2C INTERFACE

SYMBOL	DESCRIPTION	MIN	TYP	MAX	UNIT
V <sub>IN</sub>	Input voltage range	0	-	3.6	V
V <sub>OUT</sub>	Output voltage range	0	-	VBUS	V
V <sub>IH</sub>	Input threshold voltage for logic HIGH	1.2	-	-	V
V <sub>IL</sub>	Input threshold voltage for logic LOW	-	-	0.6	V
V <sub>OL</sub>	Output voltage for logic LOW	-	-	0.4	V
RPU	Input pull-up resistance	none	none	none	KΩ

(NOTE)

- I<sub>O</sub> = 4mA
- VBUS is defined by the pull-up voltage

### 6-2-2: I2C INTERFACE TIMING



SYMBOL	PARAMETER	FAST-MODE		HS-MODE		UNIT
		MIN	MAX	MIN	MAX	
F <sub>SCL</sub>	SCL clock frequency	0	400	0	1000	KHz
T <sub>LOW</sub>	LOW period of SCL	1300	-	500	-	ns
T <sub>HIGH</sub>	HIGH period of SCL	600	-	260	-	ns
T <sub>STA</sub>	Hold time for START condition	600	-	260	-	ns
T <sub>STO</sub>	Setup time for STOP condition	600	-	260	-	ns
T <sub>DH</sub>	Data hold time	0	900	0	900	ns
T <sub>DS</sub>	Data set-up time	100	-	50	-	ns
T <sub>rc</sub>	Rise time of SCL	20	300	20	120	ns
T <sub>fc</sub>	Fall time of SCL	20	300	20	120	ns
T <sub>rd</sub>	Rise Time of SDA	20	300	20	120	ns
T <sub>fd</sub>	Fall time of SDA	20	300	20	120	ns
T <sub>RDY</sub>	Ready time between STOP and START condition	20	-	20	-	us

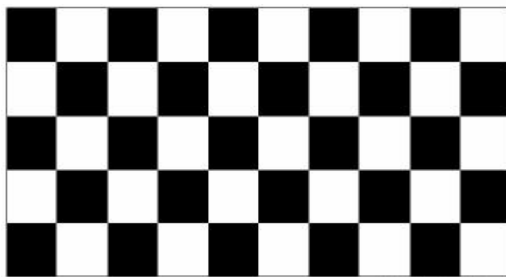
## 7. RELIABILITY TEST

### 7-1 Temperature and Humidity

TEST ITEMS	CONDITIONS	NOTE
High Temperature Operation	70°C ; 120hrs	
High Temperature Storage	80°C ; 120hrs	
High Temperature High Humidity Operation	60°C; 90%RH ; 120hrs (No condensation)	
Low Temperature Operation	-20°C ; 120hrs	
Low Temperature Storage	-20°C ; 120hrs	
Thermal Shock	-20°C (0.5hr) ~ 80°C (0.5hr) ; 40 Cycles	Non-Operating
Image Sticking	25°C ; 1hrs	1

Note 1: Condition of Image Sticking test: 25°C ±2°C

Operation with test pattern sustained for 4 hrs, then change to gray pattern immediately. After 5 mins, the mura must be disappeared completely .



(a) Test Pattern (chess board Pattern )



(b) Gray Pattern

### 7-2 Shock and Vibration

ITEMS	CONDITIONS
Packing Shock (Non-Operation)	<ul style="list-style-type: none"> <li>● Shock level:980m/s<sup>2</sup></li> <li>● Waveform:1/2 Sine wave,6msec</li> <li>● ±X, ±Y ±Z,each axis 1 times</li> </ul>
Packing Vibration (Non-Operation)	<ul style="list-style-type: none"> <li>● Frequency range:8-33.3HZ</li> <li>● Stoke:1.0mm</li> <li>● Sweep: 10Hz-50Hz</li> <li>● x,y,z 2 hours for each direction</li> </ul>

### 7-3 Electrostatic Discharge

TEST ITEM	CONDITIONS
ESD (Non-operation)	150pF,330Ω , Contact±4KV,Air :±8KV.Note 1
	200pF,0Ω , ±200V Contact test.Note 2

Note:Measure Point:

- 1.LCD glass and metal bezel
- 2.IF connector pins

## 8.HANDDLING & CAUTIONS

### 8-1 Caution For Operation

◆Since the LCM is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass maybe broken.

◆It is indispensable to drive the LCM within the specified voltage limit since the higher voltage than the limit causes LCM's life shorter. An electro-chemical reaction due to DC causes undesirable deterioration of the LCM so that the use of DC drive should avoid.

◆Do not connect or disconnect the LCM to or from the system when power is on.

◆Never use the LCM under abnormal conditions of high temperature and high humidity.

◆When expose to drastic fluctuation of temperature(hot to cold or cold to hot), the LCM may be affected; specifically, drastic temperature fluctuation from cold to hot, produces dew on the LCM's surface which may affect the operation of the polarizer on the LCM.

◆Response time will be extremely delay at lower temperature than the operating temperature range and on the other hand LCM may turn black at temperature above its operational range. However those phenomenon do not mean malfunction or out of order with the LCM. The LCM will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.

◆Do not display the fixed pattern for a long time when using a normally black panel, as it may cause image sticking due to the LCM structure. If the screen is displayed in fixed mode, use a screen saver. It is recommended to display the fixed mode in less than 2 minutes or less.

◆Do not disassemble and/or re-assemble LCM module

### 7-2 Caution Against Static Charge

◆The LCM use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.

◆Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, if possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.

◆Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

◆In handling the LCM, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary

## 9.LCD display initialization code

```
Void Panel_initial_code(void)
{
    //Resulation:320X320
    //Inversion: 1 Dot
    //External system porch setting: VBP+VSW> >5, VFP> >3
    //(VBP+VFP+VSW< 13) Line Time minima: 50.0uS
    //IF VDDI>1.8v, Cmd0xE7 Para.1 must be 0x80
    //Cmd0xE5 Para.7 must be 0x10
    //Frame Rate < 60Hz
    //-----Reset sequence-----//
    LCD_RESET=1;
    Delaysms(1); //Delay 1ms
    LCD_RESET=0;
    Delaysms(10); //Delay 10ms
    LCD_RESET=1;
    Delaysms(120); //Delay 120ms
    //-----//
    WriteComm (0xF0);
    WriteData (0xC3);
    WriteComm (0xF0);
    WriteData (0x96);
    WriteComm (0xE7);
    WriteData (0x83);
    WriteComm (0xA5);
    WriteData (0x00);
    WriteData (0x01);
    WriteData (0x40);
    WriteData (0x00);
    WriteData (0x00);
    WriteData (0x17);
    WriteData (0x2A);
    WriteData (0x0A);
    WriteData (0x02);
    WriteComm (0xB1);
    WriteData (0xFE);
    WriteData (0xE2);
    WriteComm (0xB2);
    WriteData (0x00);
}
```

WriteComm (0xB3);  
WriteData (0x01);  
WriteComm (0xBA);  
WriteData (0x59);  
WriteData (0x02);  
WriteData (0x03);  
WriteData (0x00);  
WriteData (0x22);  
WriteData (0x04);  
WriteData (0x00);  
WriteComm (0xBB);  
WriteData (0x00);  
WriteData (0x35);  
WriteData (0x00);  
WriteData (0x33);  
WriteData (0x08);  
WriteData (0x87);  
WriteData (0x07);  
WriteData (0x00);  
WriteComm (0xBD);  
WriteData (0x33);  
WriteData (0xFF);  
WriteData (0xFF);  
WriteData (0xFF);  
WriteData (0x67);  
WriteData (0x76);  
WriteData (0xFF);  
WriteData (0xFF);  
WriteData (0x14);  
WriteData (0xFF);  
WriteData (0x02);  
WriteComm (0xC1);  
WriteData (0x44);  
WriteData (0x06);  
WriteData (0xAC);  
WriteData (0x1B);  
WriteComm (0xC3);  
WriteData (0x42);  
WriteData (0x02);  
WriteData (0x24);



WriteData (0x03);  
WriteComm (0xC5);  
WriteData (0x56);  
WriteComm (0xE0);  
WriteData (0xF0);  
WriteData (0x06);  
WriteData (0x0A);  
WriteData (0x07);  
WriteData (0x06);  
WriteData (0x03);  
WriteData (0x31);  
WriteData (0x44);  
WriteData (0x49);  
WriteData (0x09);  
WriteData (0x14);  
WriteData (0x14);  
WriteData (0x2E);  
WriteData (0x33);  
WriteComm (0xE1);  
WriteData (0xF0);  
WriteData (0x06);  
WriteData (0x0A);  
WriteData (0x08);  
WriteData (0x06);  
WriteData (0x02);  
WriteData (0x31);  
WriteData (0x33);  
WriteData (0x49);  
WriteData (0x08);  
WriteData (0x14);  
WriteData (0x14);  
WriteData (0x2E);  
WriteData (0x33);  
WriteComm (0xE5);  
WriteData (0x9A);  
WriteData (0xF5);  
WriteData (0x95);  
WriteData (0x34);  
WriteData (0x22);  
WriteData (0x25);

```
WriteData (0x11);  
WriteData (0x25);  
WriteData (0x25);  
WriteData (0x25);  
WriteData (0x25);  
WriteData (0x25);  
WriteData (0x25);  
WriteComm (0x21);  
WriteComm (0x36);  
WriteData (0x08);  
WriteComm (0xF0);  
WriteData (0x3C);  
WriteComm (0xF0);  
WriteData (0x69);  
WriteComm (0x11);  
Delay_ms(10);  
WriteComm (0x29);  
}
```

```
Void Panel_SleepIn_Mode (void)
```

```
{  
    WriteComm(0x28);  
    Delays(120);  
    WriteComm(0x10);  
    Delays(120);  
}
```

```
Void Panel_SleepOut_Mode (void)
```

```
{  
    WriteComm(0x11);  
    Delays(120);  
    WriteComm(0x29);  
    Delays(120);  
}
```

--- END ---