深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAY TECH. CO, LTD.

TFT-LCD Module Specification

Module NO.: TST350MTQV-03C

Version: V1.1

☐ APPROVAL FOR SPECIFICATION ☐ APPROVAL FOR SAMPLE

For Customer's Acceptance:	
Approved by	Comment

Team Source Display:		
Presented by	Reviewed by	Organized by

Version No.	Date	Content	Remark
V1.0	2018-1-10	Initial Release	

CONTENTS

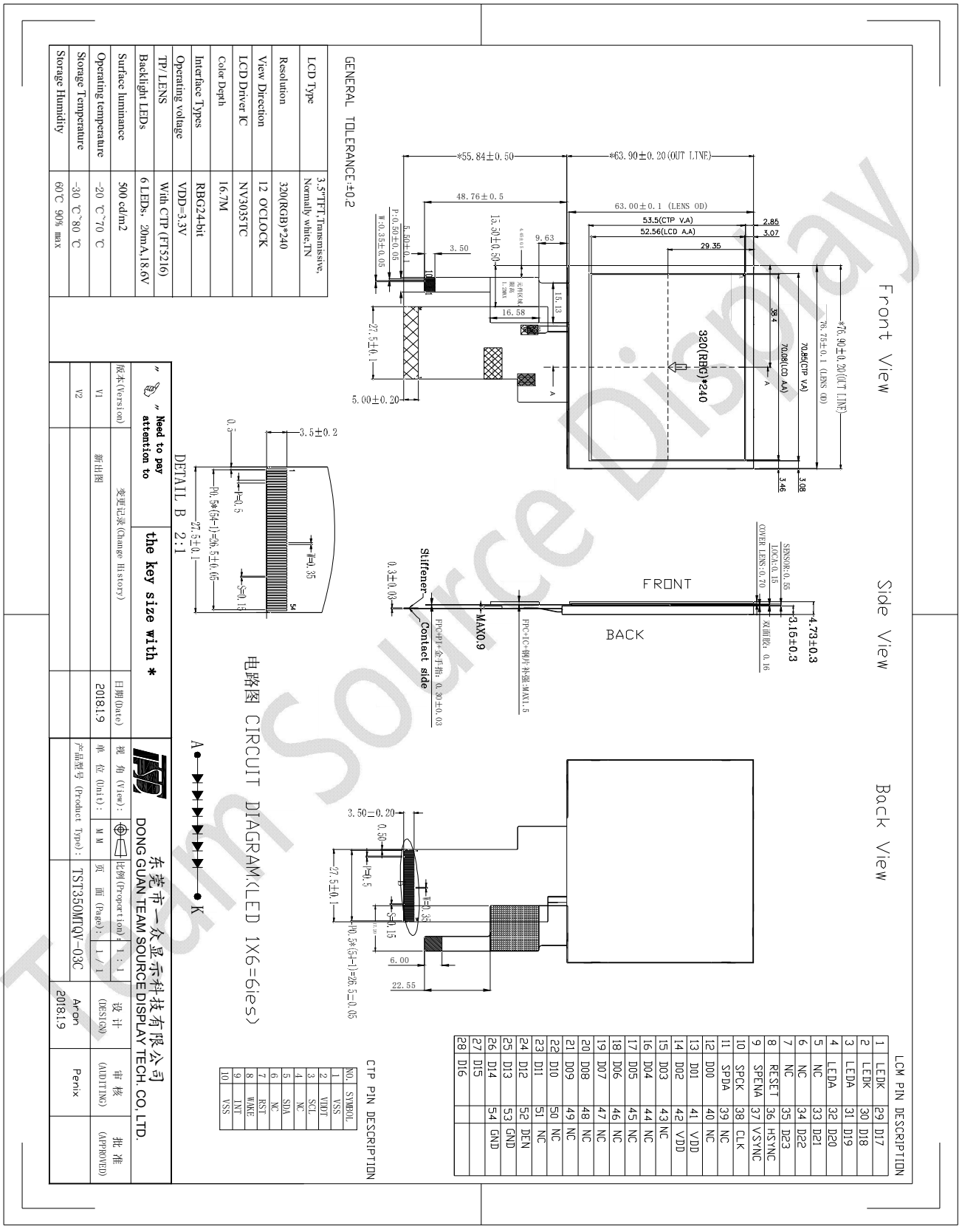
1 General Characteristics

ITEM	Specification	Unit
LCD Type	a-Si TFT,Transmissive,Normally white,TN	-
LCD Size	3.5	inch
Resolution (W x H)	320x (RGB) × 240	pixel
LCM size	76.9(W) x 63.9(H) x 4.73(D)	mm
Active Area	70.08 (W) x 52.56 (H)	mm
Dot Pitch	0.219(H)x0.219(V)	mm
Viewing Direction	12 o'clock	-
Gray Scale Inversion Direction	6 o'clock	-
Viewing Angle	Top:60,Bottom:40; Left/ Right:60	deg.
Color Depth	16.7M	-
Pixel Arrangement	RGB-stripe	-
Backlight Type	6 LEDs，20mA	-
Surface Luminance	500	cd/m2
POL Surface Treatment	Anti-Glare	-
Driver IC	NV3035GTC	-
Interface Type	TTL(RGB-24bit)	-
Input Voltage	3.3	V
With/Without TP	With CTP(FT5216)	-
Weight	TBD	g

Note 1: RoHS compliant

Note 2: LCM weight tolerance: ± 5%.

2 Product drawings



LCD Type	3.5"TFT,Transmissive, Normally white,TN
Resolution	320(RGB)*240
View Direction	12 OCLOCK
LCD Driver IC	NV3035TC
Color Depth	16.7M
Interface Types	RBG24-bit
Operating voltage	VDD=3.3V
TP/ LENS	With CTP (FT5216)
Backlight LEDs	6 LEDs, 20mA,18.6V
Surface luminance	500 cd/m2
Operating temperature	-20 ℃~70 ℃
Storage Temperature	-30 ℃~80 ℃
Storage Humidity	60℃ 90% max

1	LEDK	29	D17
2	LEDK	30	D18
3	LEDA	31	D19
4	LEDA	32	D20
5	NC	33	D21
6	NC	34	D22
7	NC	35	D23
8	RESET	36	HSYNC
9	SPENA	37	VSYNC
10	SPCK	38	CLK
11	SPDA	39	NC
12	D00	40	NC
13	D01	41	VDD
14	D02	42	VDD
15	D03	43	NC
16	D04	44	NC
17	D05	45	NC
18	D06	46	NC
19	D07	47	NC
20	D08	48	NC
21	D09	49	NC
22	D10	50	NC
23	D11	51	NC
24	D12	52	DEN
25	D13	53	GND
26	D14	54	GND
27	D15		
28	D16		

NO.	SYMBOL
1	VSS
2	VDDT
3	SCL
4	NC
5	SDA
6	NC
7	RST
8	WAKE
9	INT
10	VSS

版本(Version)	变更记录(Change History)	日期(Date)
V1	新出图	2018.1.9
V2		

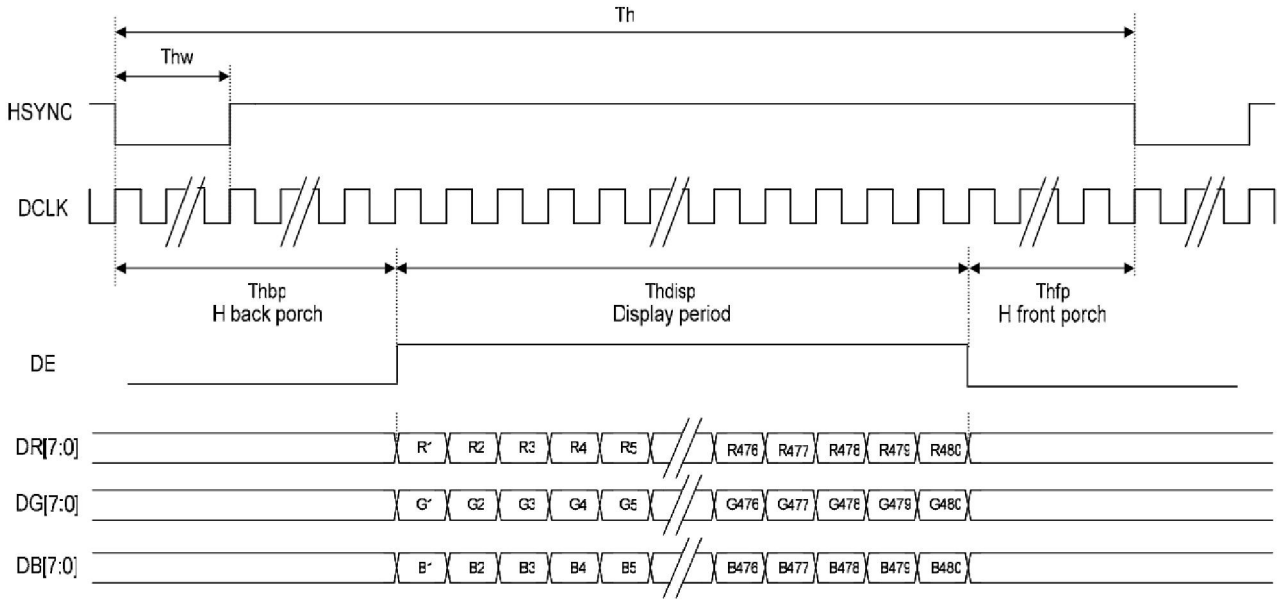
视 角 (View):		比例(Proportion):	1 : 1	设 计 (DESIGN)	审 核 (AUDITING)	批 准 (APPROVED)
单 位 (Unit):	M M	页 面 (Page):	1 / 1	Arron	Penix	
产品型号 (Product Type):	TST350MTQV-03C			2018.1.9		

3 Interface description

PIN NO.	Symbol	description
1	LEDK	Backlight Cathode input pin.
2	LEDK	Backlight Cathode input pin.
3	LEDA	Backlight Anode input pin.
4	LEDA	Backlight Anode input pin.
5~7	NC	
8	RESET	Global reset pin. Active Low to enter Reset State
9	SPENA	3-Wire Communication Enable
10	SPCK	3-Wire Communication Clock input. Rising edge latch
11	SPDA	3-Wire Communication Data input/output
12~35	D0~D23	D0~D7:blue;D8~D15:green; D16~D23:Red.
36	HSYNC	Horizontal sync input in digital parallel RGB. Negative polarity.
37	VSYNC	Vertical sync input in digital parallel RGB. Negative polarity.
38	DCLK	Clock for input data. Data latched at rising/falling edge of this signal. Default is falling edge.
39	NC	
40	NC	
41	VDD	Power supply +3.3V
42	VDD	Power supply +3.3V
43~47	NC	
48	NC/X-/XR	NC
49	NC/Y-/YD	NC
50	NC/X+/XL	NC
51	NC/Y+/YU	NC
52	DE	Input data enable control. When DE mode, active High to enable data input. (Normally pull low)
53	GND	System Ground. (0V)
54	GND	System Ground. (0V)

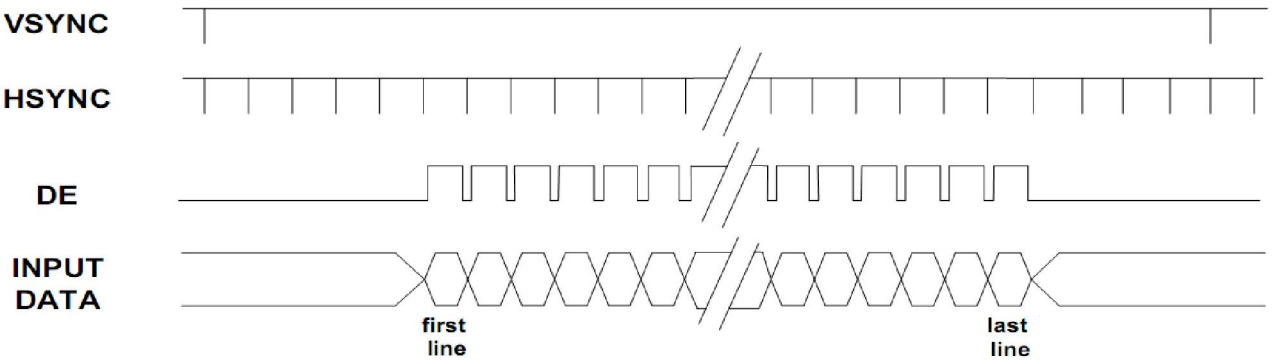
4 RGB Timing Characteristics

DE Mode Timing Diagram



Horizontal Input Timing

Parameter	Symbol	min	Typ.	max	Unit
Horizontal display area	tHD	-	320	-	CLKIN
CLKIN frequency	f_{clk}	6.1	6.4	8	MHz
1 Horizontal line period	t_H	-	408	-	CLKIN
HSD pulse width	t_{HPW}	1	1	-	
HSD back porch	t_{HBP}	-	18	-	
HSD front porch	t_{HFP}	-	70	-	



Vertical Input Timing

Parameter	Symbol	min	Typ.	max	Unit
Vertical display area	t_{VD}	-	240	-	HSD
VSD period time	t_V	275	263	335	
VSD pulse width	T_{VPW}	1	1	-	
VSD back porch	t_{VBP}	-	10	-	
VSD front porch	t_{VFP}	-	13	-	

5 Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage (Analog)	VDD~GND	-0.5	+5.0	V
Logic signal voltage(I/O)	IOVDD~GND	-0.5	+5.0	V
Operating Temperature	TOP	-20	70	° C
Storage Temperature	TST	-30	80	° C
Humidity	RH	-	90%(Max 60° C)	RH

6 Electrical Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Analog operating voltage	VDD	3.0	3.3	3.6	V
Logic operating voltage	IOVDD	3.0	3.3	3.6	V
Input Current	IDD	-	TBD	-	mA
Input Voltage ' H ' level	VIH	0.7IOVCC	-	IOVCC	V
Input Voltage ' L ' level	VIL	GND	-	0.3IOVCC	
Output Voltage ' H ' level	VOH	0.8IOVCC	-	IOVCC	
Output Voltage ' L ' level	VOL	GND	-	0.2IOVCC	

7 Backlight Characteristics

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Voltage for LED backlight	V_f	-	18.6	19.2	V
Current for LED backlight	I_f	-	15	20	mA
Power consumption	Wbl	-	279	384	mW
Uniformity	Avg	80	-	-	%
LED Life Time	-	30000	40000	-	Hrs

Note:

1.The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C, 60%RH ±5 %.

2. The life time of LED will be reduced if LED is driven by high current, high ambient temperature and humidity conditions.

3. Typical operating life time is an estimated data.

4. Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded .Functional operation should be restricted to the conditions described under normal operating conditions.

8 LCD Optical specifications

Item	Symbol	Condition	Specification			Unit	Remark
			Min	Typ	Max		
Response time (By Quick)	Tr+Tf	θ = 0°	-	25	40	ms	Note 5
Contrast ratio	CR	θ = 0°	-	350	-		Note 2,6
Viewing angle	Top	CR≧10	50	60	-	Deg.	Note 2,6,7
	Bottom	CR≧10	30	40	-		
	Left	CR≧10	50	60	-		
	Right	CR≧10	50	60	-		
Color Filter Chromacicity with C light	Wx	θ = 0°	0. 261	0. 311	0. 361		Note 3
	Wy		0. 300	0. 350	0. 400		
	Rx		0. 586	0. 636	0. 686		
	Ry		0. 300	0. 350	0. 40		
	Gx		0. 261	0. 311	0. 361		
	Gy		0. 501	0. 551	0. 601		
	Bx		0. 084	0. 134	0. 184		
	By		0. 101	0. 151	0. 201		
NTSC			-	50%	-		Note 3
Transmittance	Trans		6.9%	7.5%	-		Note 4

Note 1: Ambient temperature = 25°C.

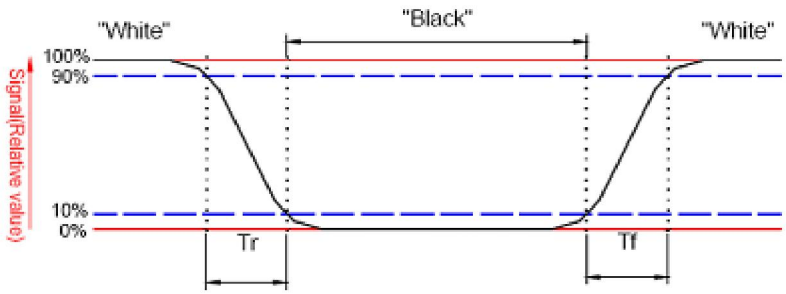
Note 2: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.

Note 3: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light simulation.

Note 4: CTC shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer. The tolerance of Transmittance is ±10%.

Note 5: Definition of response time:

The output signals of TRD-100 are measured when the input signals are changed to “White” (falling time) and from “White” to “Black” (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.

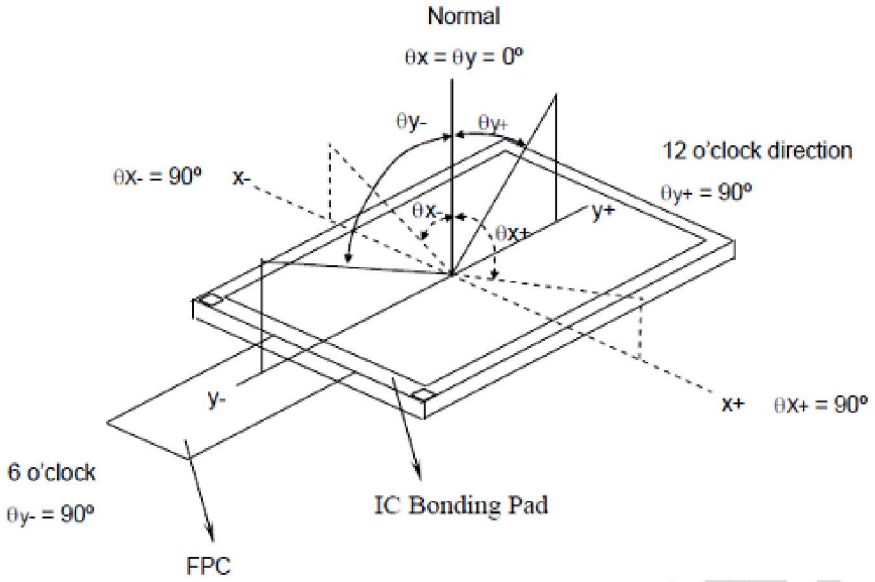


Note 6: Definition of contrast ratio:

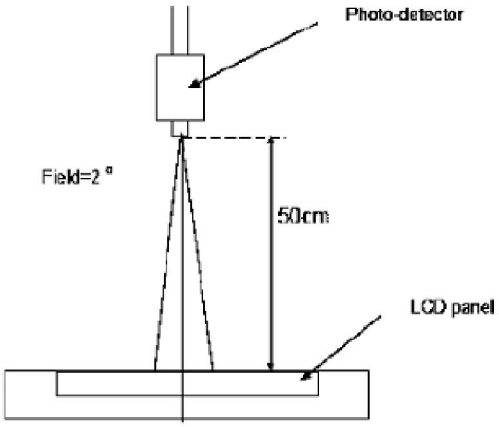
Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

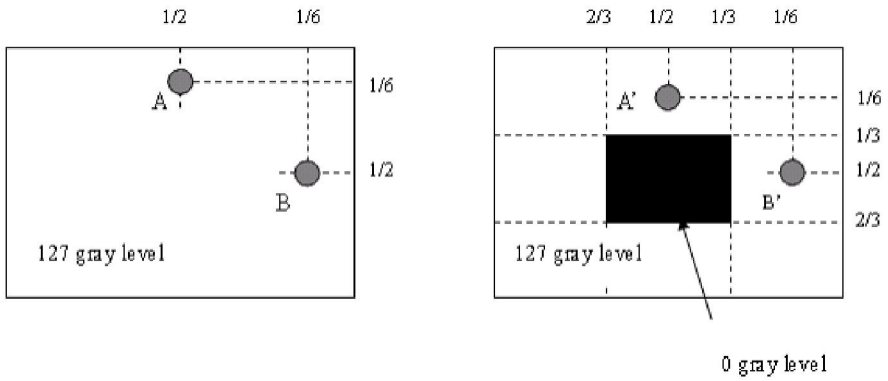
Note 7: Definition of viewing angle



Note 8: Optical characteristic measurement setup.



Note 9:



l LA-LA' l / LA x 100%= 2% max., LA and LA' are brightness at location A and A'.

l LB-LB' l / LB x 100%= 2% max., LB and LB' are brightness at location B and B'.

9 Capacitive Touch Panel specifications

9.1 Mechanical characteristics

DESCRIPTION	INL SPECIFICATION	REMARK
Touch Panel Size	3.5	
Outline Dimension (OD)	76.75x 63mm	Cover Lens Outline
Product Thickness	1.55mm(max)	With D.S.T
Glass Cover lens Thickness	0.7mm	
Ink View Area	70.85x53.5mm	
Sensor Active Area	73.25x55.9mm	
Input Method	5 Fingers	
Activation Force	Touch	
Surface Hardness	≥6H	

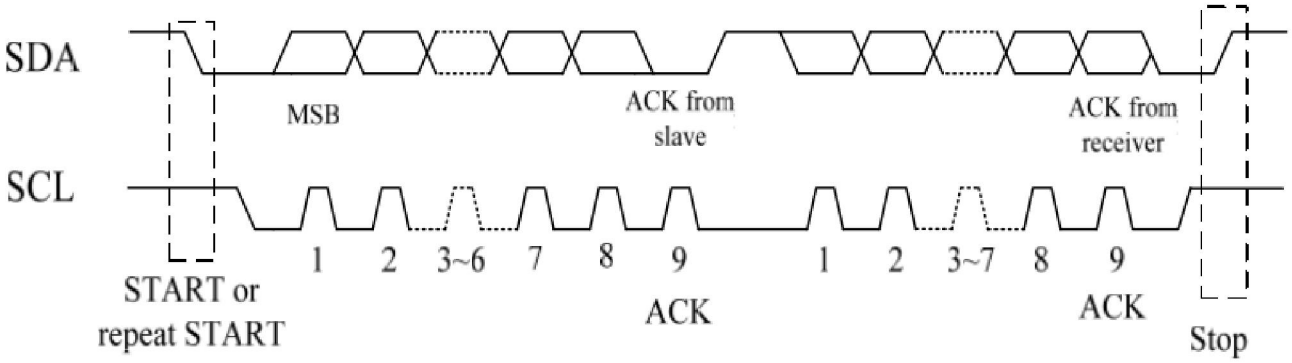
9.2 Electrical characteristics

DESCRIPTION		SPECIFICATION
Operating Voltage		DC 2.8~3.3V
Power Consumption (IDD)	Active Mode	12~4.5mA
	Sleep Mode	TBD
Interface		I^2C
Controller IC		FT5216
I^2C address		0x70
Resolution		900*640

9.3 Interface description

PIN NO.	SYMBOL	DESCRIPTION	REMARK
1	VSS	Ground	
2	VDDT	Power supply 3.3V	
3	SCL	I2C clock input	
4	NC		
5	SDA	I2C data signal	
6	NC		
7	RST	Reset pin	
8	WAKE	NC	
9	INT	Interrupt signal from CTP	
10	VSS	Ground	

9.4 I²C Interface timing characteristics



The I2C is always configured in the Slave mode

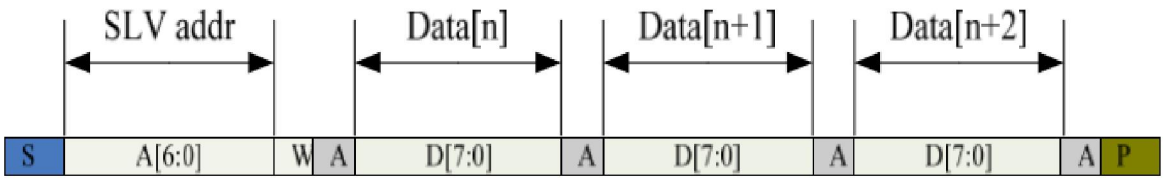
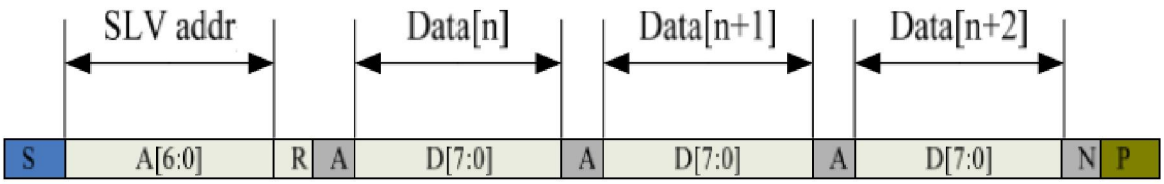


Figure 2-5 I2C master write, slave read



I2C master read, slave write

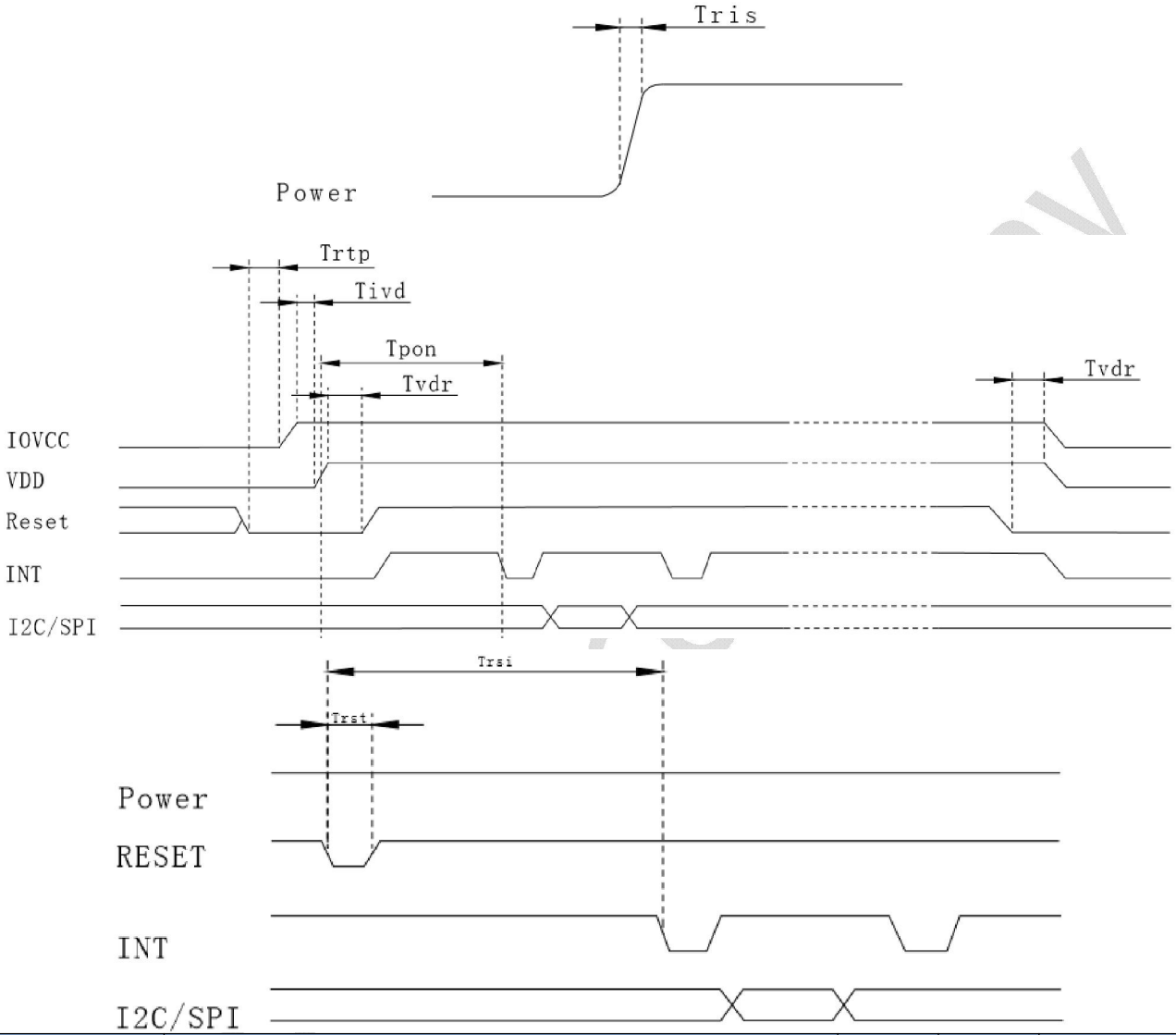
Mnemonics	Description
S	I2C Start or I2C Restart
A[6:0]	Slave address A[6:0]: address bits are identical to those of I2CADDR [7:1] register.
R/W	‘1’ for read, ‘0’ for write
A(N)	ACK(NACK)
P	STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet)

I2C Interface Timing Characteristics is shown in Table

PARAMETER	MIN	MAX	UNIT
SCL Frequency	-	400K	Hz
Bus Free Time Between a STOP and START Condition	4.7	-	uS
Hold Time (repeated) START Condition	4.0	-	uS
Data Setup Time	250	-	nS
Setup Time for Repeated START Condition	4.7	-	uS
Setup Time for STOP Condition	4.0	-	uS

9.5 CTP Power on Sequence

Reset should be pulled down to be low before powering on and powering down. INT signal will be sent to the host after initializing all parameters and then start to report points to the host.



Parameter	Description	MIN	MAX	UNIT
Tris	Rise time from 0.1VDD to 0.9VDD	-	5	mS
Trtp	Time of resetting to be low before powering on	100	-	uS
Tivd	Delay time of VDD powering on after IOVCC powering on	10	-	uS
Tpon	Time of starting to report point after powering on	200	-	nS
Tvdr	Reset time after VDD powering on	1	-	uS
Trsi	Time of starting to report point after resetting	200	-	uS
Trst	Reset time	1	-	uS

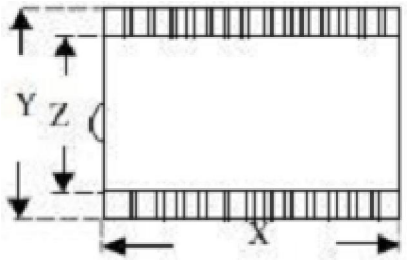
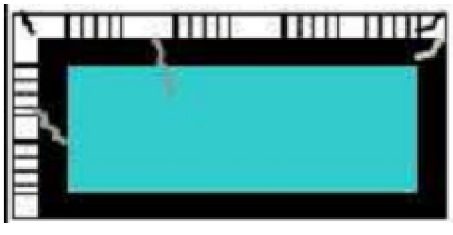
10 RELIABILITY TEST

NO.	TEST ITEM	TEST CONDITION	INSPECTION AFTER TEST
1	High Temperature Storage	80±2°C/96 hours	Inspection after 2~4 hours storage at room temperature and humidity. The condensation is not accepted. 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
2	Low Temperature Storage	-30±2°C/96 hours	
3	High Temperature Operating	70±2°C/96 hours	
4	Low Temperature Operating	-20±2°C/96 hours	
5	Temperature Cycle	-30±2°C ~ 25~ 80± 2°C × 10 cycles (30 min.) (5min.) (30min.)	
6	Damp Proof Test	60°C ±5°C × 90%RH/96 hours	
7	Vibration Test	Frequency 10Hz~55Hz Stroke: 1.5mm Sweep: 10Hz~150 Hz~10Hz 2 hours For each direction of X, Y, Z	
8	Shock Test	Half-sine, wave, 300m/s	
9	Packing Drop Test	Height: 80 cm 1 corner, concrete floor	
10	Electrostatic Discharge Test	C=150pF, R=330 Ω Air: ±8KV 150pF/330Ω 30 times Contact: ±4KV,20 times	

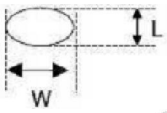
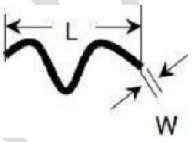
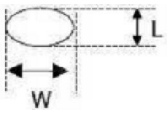
11 Inspection standards

11.1 Visual inspection criterion in cosmetic

11.1.1 Glass defect

NO.	Defect	Criteria	Remark
1	Dimension(Minor)	By engineering diagram	
2	Cracks(Major)	Extensive crack [Reject]	

11.1.2 LCM appearance defect

NO.	Defect	Criteria		Remark
		Spec	Permissible Qty	
1	Round type(Minor)	ϕ ≤0.1mm	Disregard	1. ϕ=(W+L)/2, L:Length,W=Width 2.Disregard if out of A.A 
		0.1mm< ϕ ≤0.2mm	2	
		ϕ >0.2mm	0	
2	Line type(Minor)	W ≤0.03mm	Disregard	
		L≤ 3.0mm and 0.03mm<W≤0.05mm	2	1. L:Length,W=Width 2.Disregard if out of A.A 
		L≤ 3.0mm and 0.05mm<W≤0.1mm	1	
		W>0.10mm or L>3.0mm	0	
3	Polarizer dent(Minor)	ϕ ≤0.1mm	Disregard	1. ϕ=(W+L)/2, L:Length,W=Width 2.Disregard if out of A.A 
		0.1mm< ϕ ≤0.2mm	2	
		0.2mm< ϕ ≤0.3mm	1	
		ϕ >0.3mm	0	

11.1.3 FPC

NO.	Defect	Criteria	Remark
1	Copper peeling(Minor)	Copper peeling [Reject]	
2	Damaged	Damaged[Reject]	

11.1.4 Black tape

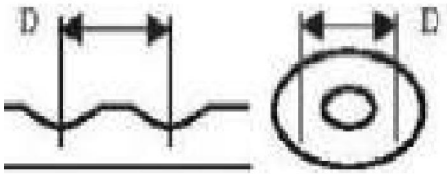
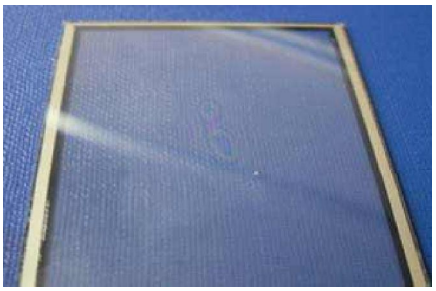
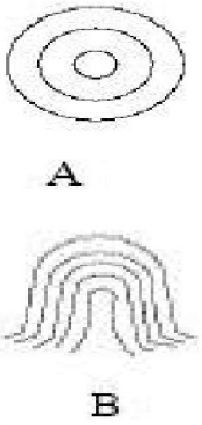
NO.	Defect	Criteria	Remark
1	Shift(Minor)	IC exposed [Reject]	
2	No black tape(Minor)	No black tape [Reject]	

11.1.5 Silicon

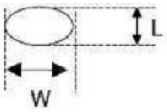
NO.	Defect	Criteria	Remark
1	Amount of silicon (Minor)	ITO exposed [Reject]	

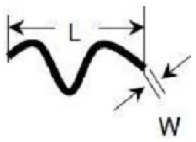
11.1.6 Touch Panel

Defect	Criteria	Remark
TP shift	Click on the TP, the distance between the show position and click position>1.5mm [Reject]	

<table>
<tr><td>TP Circle, Dent Dot, Bubble MI</td><td><table><tr><th>Size(mm)</th><th>Accessible QTY</th></tr><tr><td>D ≤0.1</td><td>Access</td></tr><tr><td>0.1＜D≤0.2</td><td>2</td></tr><tr><td>0.3＜D≤0.5</td><td>1</td></tr><tr><td>D>0.5</td><td>0</td></tr></table></td><td>  </td></tr>
<tr><td>TP Ripple MI</td><td>1.(Figure A): Ripple D>5mm [Reject]
2.(Figure B): Ripple area<1/7 TP area and not impact fonts display effect [Access]
  </td><td>  </td></tr>
<tr><td colspan="3">Remark: Tear up the protective film to inspect.
The distance of two dirt must>10mm;
The white dot found in manufacture is conformity to 0.1mm, if >0.1mm [Reject]</td></tr>
</table>

11.2 Visual inspection criterion in electrical display

NO.	Defect	Criteria		Remark
		Spec.	Permissible Qty	
1	No display (Major)	Not allowed		
2	Missing line (Major)	Not allowed		
3	Darker or lighter Line (Major)	Not allowed		
4	Weak line(Major)	By limited sample		
5	Bright / Dark point (Minor)	Bright point	1	1:1sub-pixel: 1R or 1G or 1B 2:Point defect area 1/2 sub pixel.
		Dark point	2	
6	Round type (Minor)	ϕ≤0.1mm	Disregard	1. ϕ=(W+L)/2, L:Length,W=Width 2.Disregard if out of A.A 
		0.1＜ϕ≤0.2	3	
		ϕ>0.2mm	0	
	Line type (Minor)	W ≤0.03mm	Disregard	1. L:Length,W=Width 2.Disregard if out of A.A
		L≤ 3.0mm and 0.03mm<W≤0.05mm	2	
		L≤ 3.0mm and	1	

		0.05mm<W≤0.1mm		
		W>0.10mm or L>3.0mm	0	
	Mura (Minor)	By 5% ND filter invisible		

11.3 Others

1. Issues that are not defined in this document shall be discussed and agreed with both parties. (Customer and supplier)
2. Unless otherwise agreed upon in writing, the criteria shall be applied to both parties. (Customer and supplier)

12 Suggestions for using LCD modules

12.1 Handling of LCM

1. The LCD screen is made of glass. Don't give excessive external shock, or drop from a high place.
2. If the LCD screen is damaged and the liquid crystal leaks out, do not lick and swallow. When the liquid is attach to your hand, skin, cloth etc, wash it off by using soap and water thoroughly and immediately.
3. Don't apply excessive force on the surface of the LCM.
4. If the surface is contaminated, clean it with soft cloth. If the LCM is severely contaminated, use Isopropyl alcohol/Ethyl alcohol to clean. Other solvents may damage the polarizer. The following solvents is especially prohibited: water , ketone Aromatic solvents etc.
5. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
6. 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.
7. Don’t disassemble the LCM.
8. 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 the LCD modules.
- 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.

9. Do not alter, modify or change the the shape of the tab on the metal frame.
10. Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
11. Do not damage or modify the pattern writing on the printed circuit board.
12. Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector
13. Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
14. Do not drop, bend or twist LCM.

12.2 Storage

1. Store in an ambient temperature of 5 to 45 C, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.
2. Storage in a clean environment, free from dust, active gas, and solvent.
3. Store in antistatic container.