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.： TST035HVSI-23C

Version： V1.0

☐ 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	2017-7-20	Initial Release	

CONTENTS

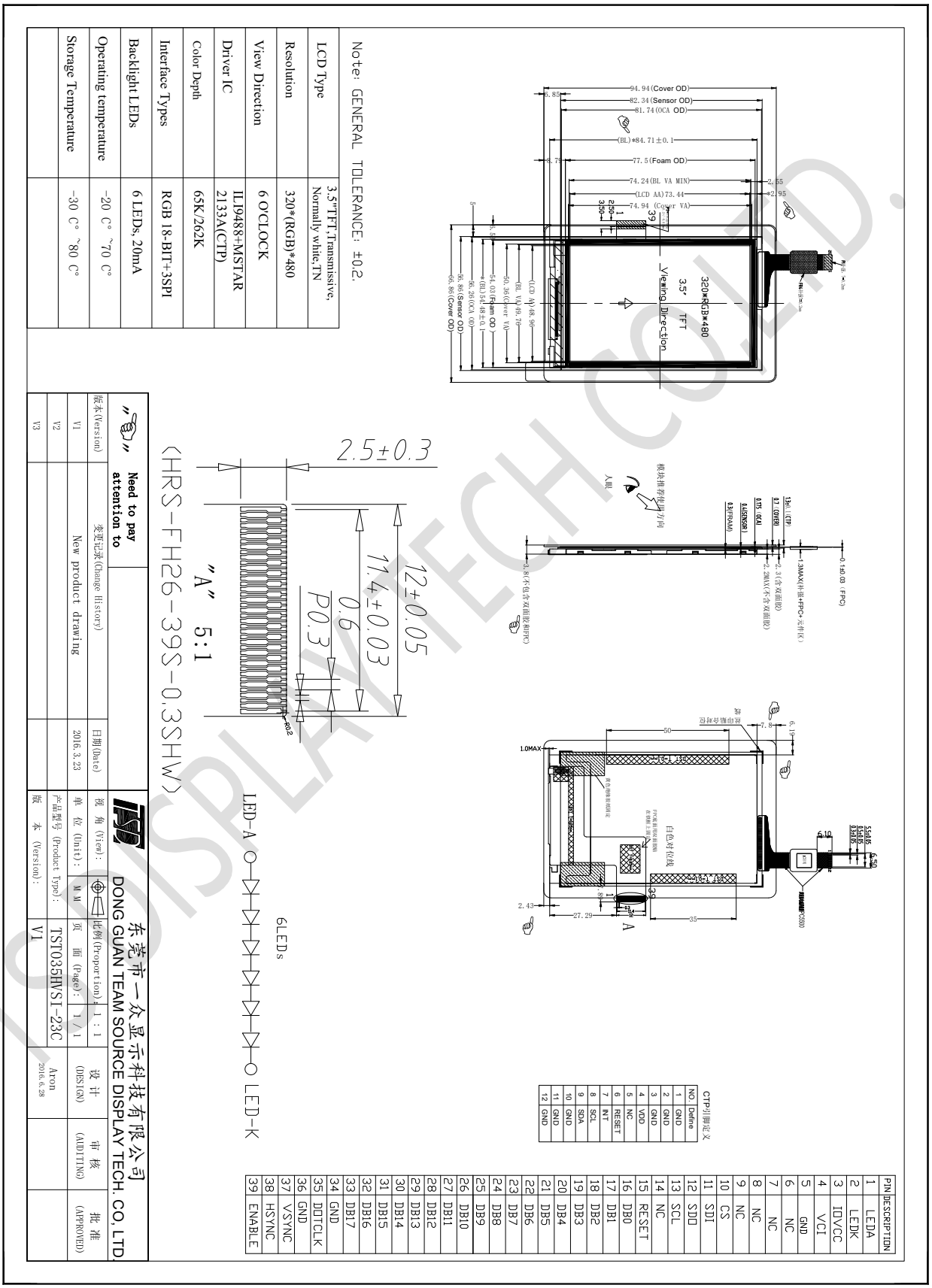
1 General Characteristics

ITEM	Specification	Unit
LCD Type	a-Si TFT,Transmissive,Normally white,TN	-
LCD Size	3.5	inch
Resolution	320 x (RGB) × 480	pixel
LCM (W × H × D)	54.48(W) x 84.71(H) x2.2(T)	mm
LCM+CTP	66.86(W) x 94.94(H) x3.8(T)	
Active Area (W × H)	48.96 (W) x 73.44 (H)	mm
Dot Pitch (W × H)	0.153 x 0.153	mm
Viewing Direction	6 o'clock	-
Gray Scale Inversion Direction	12 o'clock	-
Viewing Angle	Top:45,Bottom:60; Left/ Right:70	deg.
Color Depth	262K	-
Pixel Arrangement	RGB-stripe	-
Backlight Type	6 LEDs, 20mA,18.6V	-
Surface Luminance	250	cd/m2
Surface Treatment	Anti-Glare	-
Polarizer	0.22mm,EWV	-
Driver IC	ILI9488	-
Interface Type	3SPI+RGB18-bit	-
Input Voltage	2.8~3.3V	V
TP/LENS	With CTP (MSTAR 2133A)	-
Weight	35	g

Note 1: RoHS compliant

Note 2: LCM weight tolerance: ± 5%.

2 Product drawings

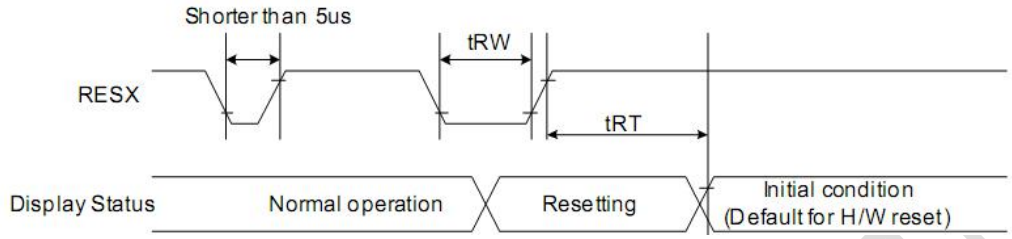


3 Interface description

PIN NO.	Symbol	Description
1	LEDA	Backlight anode input pin.
2	LEDK	Backlight Cathode input pin.
3	IOVCC	Power supply for I/O: +1.8V~VCI
4	VCI	Power supply: +2.8V~3.3V
5	GND	System Ground. (0V)
6	YU	The touch panel Y up pin
7	XL	The touch panel X left pin
8	YD	The touch panel Y down pin
9	XR	The touch panel X right pin
10	CS	Chip select signal.
11	SDI	serial data input bi-direction pin
12	SDO	serial data output bi-direction pin
13	SCLK	Serial Clock
14	NC	
15	RESET	Reset input signal
16~33	DB0~DB17	Data BUS[DB0~DB5:B0~B5; DB6~DB11:G0~G5; DB12~DB17:R0~R5]
34	GND	System Ground. (0V)
35	DOTCLK	Dot clock signal for RGB interface operation.
36	GND	System Ground. (0V)
37	VSYNC	Vertical sync input in digital parallel RGB.
38	HSYNC	Horizontal sync input in digital parallel RGB.
39	ENABLE	Data enable signal for RGB interface operation.

4 LCM Interface Timing

4.1 Reset Timing

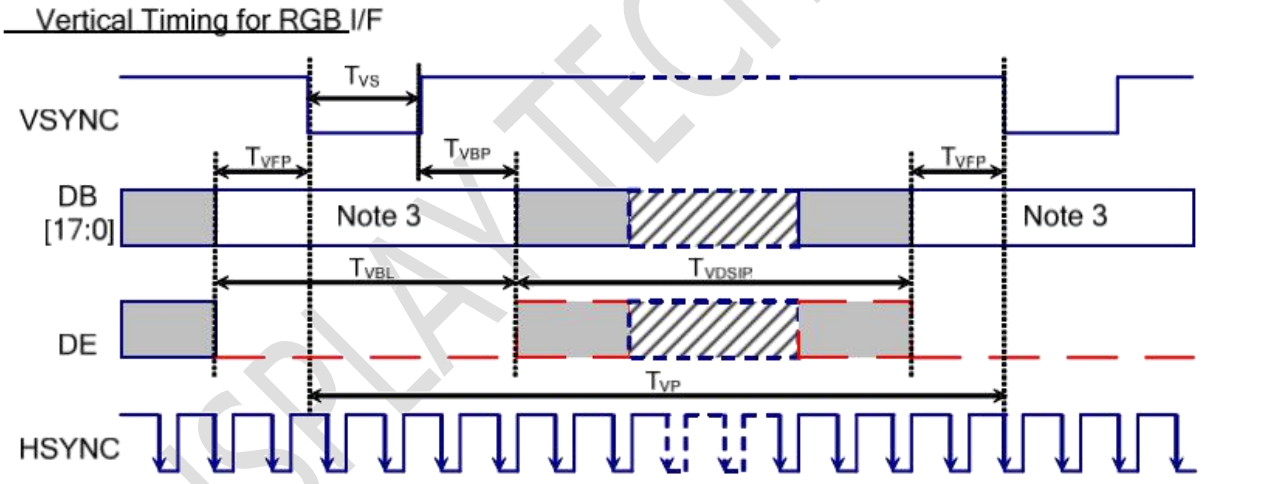


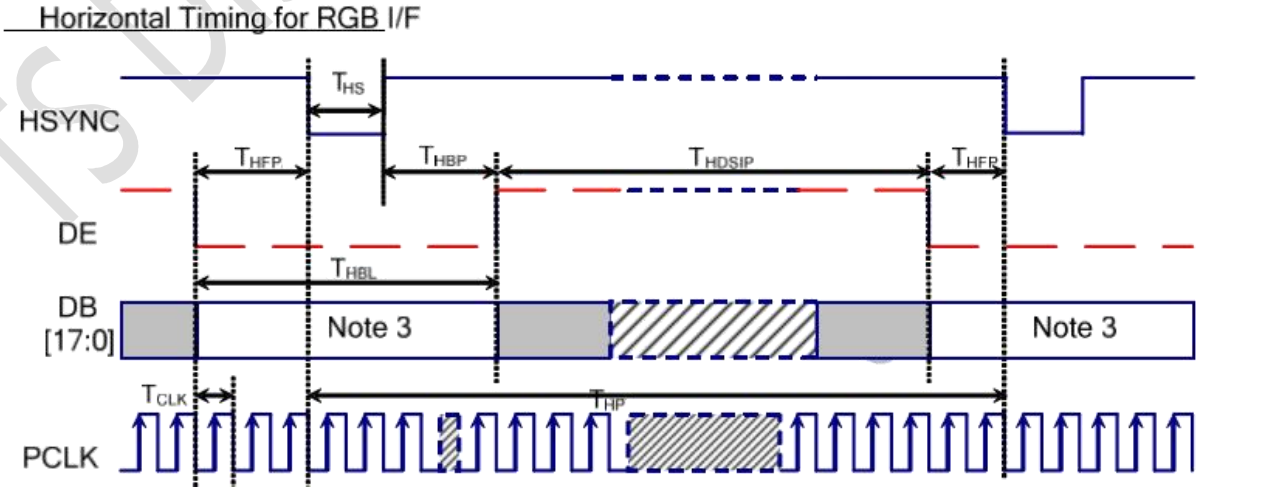
Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset low pulse width	10	-	us
	tRT	Reset complete time	5 (note 1)	-	ms
			120(note 2)	-	ms

Note: (1) When reset applied during SLPIN mode;

(2) When reset applied during SLPOUT mode.

4.2 RGB interface characteristics

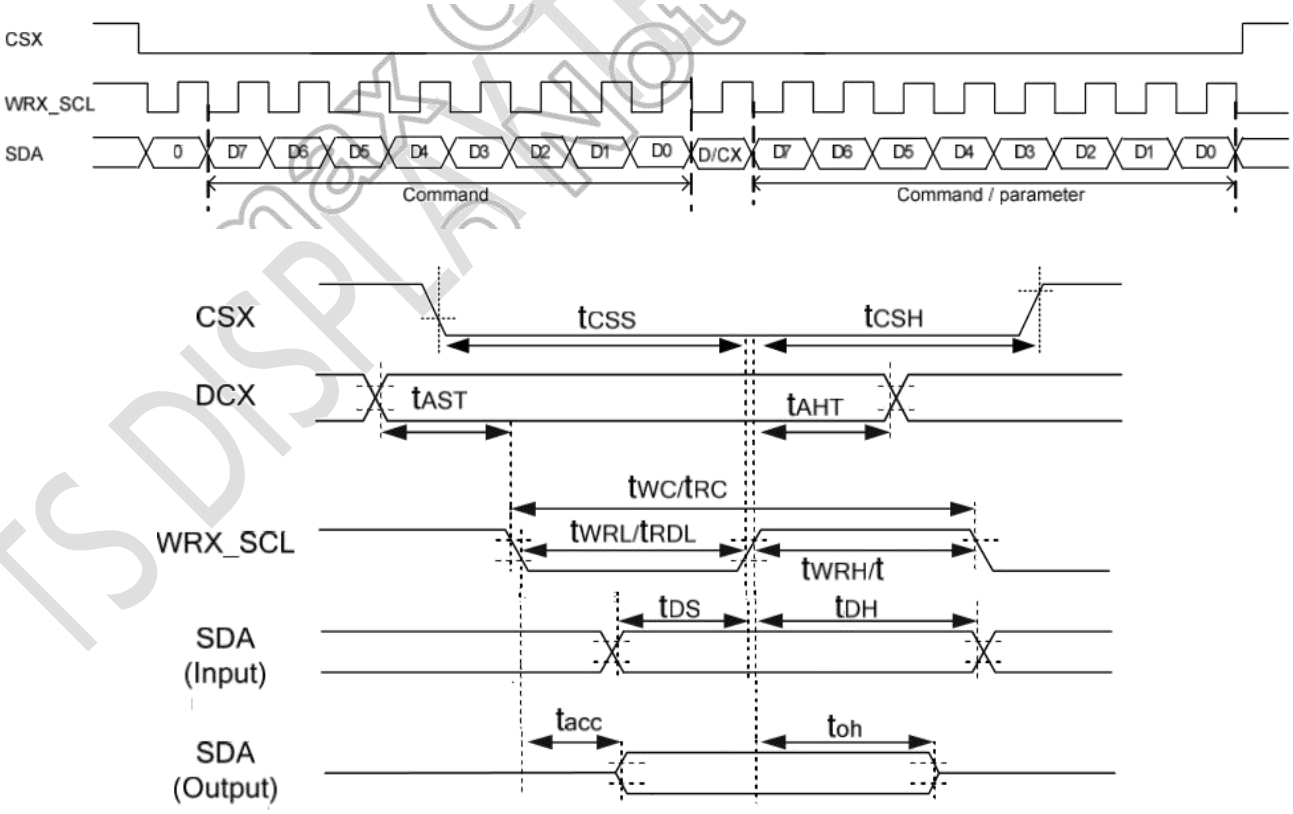




Item	Symbol	Condition	Specification			Unit
			Min.	Typ.	Max.	
Vertical Timing						
Vertical cycle period	T_{VP}	-	486	-	-	HS
Vertical low pulse width	T_{VS}	-	2	-	-	HS
Vertical front porch	T_{VFP}	-	2	-	-	HS
Vertical back porch	T_{VBP}	-	2	-	-	HS
Vertical blanking period	T_{VBL}	$T_{VBP}+T_{VFP}$	6	-	-	HS
Vertical active area	T_{VDISP}	-	-	480	-	HS
			-		-	HS
					-	HS
Vertical refresh rate	T_{VRR}	Frame rate	50	60	70	Hz
Horizontal Timing						
Horizontal cycle period	T_{HP}	-	326	-	-	DOTCLK
Horizontal low pulse width	T_{HS}	-	2	-	-	DOTCLK
Horizontal front porch	T_{HFP}	-	2	-	-	DOTCLK
Horizontal back porch	T_{HBP}	-	2	-	-	DOTCLK
Horizontal blanking period	T_{HBL}	$T_{HBP}+T_{HFP}$	6	-	-	DOTCLK
Horizontal active area	T_{HDISP}	-	-	320	-	DOTCLK
Pixel clock cycle TVRR=60Hz	f_{CLKCYC}	-	9	-	-	MHz

Note: (1) IOVCC=1.65 to 3.3V, VCI=2.3 to 3.3V, VSSA=VSSD=0V, Ta=-30 to 70℃ (to +85℃ no damage)
(2) Data lines can be set to "High" or "Low" during blanking time – Don't care.
(3) HP is multiples of PCLK.

4.3 3-SPI interface characteristics



(VSSA=0V, IOVCC=1.8V, VCI=2.8V, T_A = 25℃)

Signal	Symbol	Parameter	Min.	Max.	Unit	Description
CSX	tCSS	Chip select setup time (Write)	15	-	ns	-
	tCSS	Chip select setup time (Read)	60	-		
	tCSH	Chip select hold time (Write)	15	-		
	tCSH	Chip select hold time (Read)	65	-		
DCX	tAST	Address setup time	0	-	ns	-
	tAHT	Address hold time (Write/Read)	10	-		
WRX_SCL (Write)	tWC	Write cycle	66	-	ns	-
	tWRH	Control pulse "H" duration	15	-		
	tWRL	Control pulse "L" duration	15	-		
WRX_SCL (Read)	tRC	Read cycle	150	-	ns	-
	tRDH	Control pulse "H" duration	60	-		
	tRDL	Control pulse "L" duration	60	-		
SDA (Input)	tDS	Data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tDH	Data hold time	10	-		
SDA (Output)	tACC	Read access time	10	50	ns	
	tOH	Output disable time	15	50		

Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

5 Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage (Analog)	VCC~GND	-0.3	4.6	V
Logic signal voltage(I/O)	IOVCC~GND	-0.3	4.6	V
Operating Temperature	Top	-20	70	° C
Storage Temperature	Tst	-30	80	° C
Operating Ambient Humidity	Hop	10	90%(Max 60° C)	RH

6 Electrical Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Analog operating voltage	VCC	2.5	2.8	3.3	V
Logic operating voltage	IOVCC	1.65	1.8	3.3	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	-	18.3	18.6	V
Current for LED backlight	I_f	-	15	20	mA
Power consumption	Wbl	-	274.5	372	mW
Uniformity	Avg	80	-	-	%
LED Life Time	-	30000	50000	-	

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°	-	20	40	ms	Note 5
Contrast ratio	CR	θ = 0°	-	500	-		Note 2,6
Viewing angle	Top	CR≧10	-	45	-	Deg.	Note 2,6,7
	Bottom	CR≧10	-	60	-		
	Left	CR≧10	-	70	-		
	Right	CR≧10	-	70	-		
Color chromaticity (CF only with ITO, light source is C light, CIE 1931)	Wx	θ = 0°	0.292	0.307	0.322		Note 3
	Wy		0.312	0.327	0.342		
	Rx		0.609	0.624	0.639		
	Ry		0.316	0.331	0.346		
	Gx		0.281	0.296	0.311		
	Gy		0.562	0.577	0.592		
	Bx		0.128	0.143	0.158		
	By		0.094	0.109	0.124		
NTSC			57%	60%	-		Note 3
Cross talk	Ct		-	-	2%		Note 9
Transmittance	Trans		-	5.5%	-		Note 4

Note 1: Ambient temperature = 25°C.

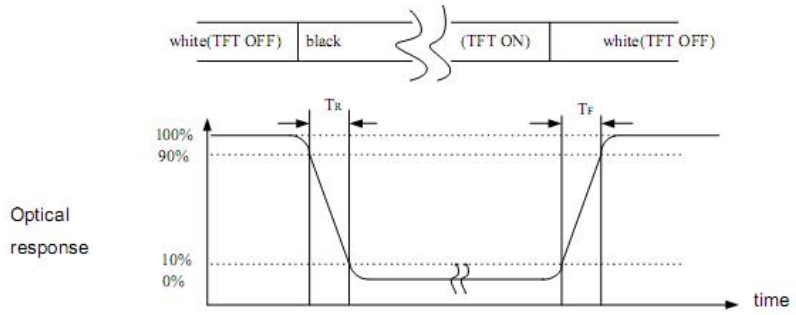
Note 2: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.

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

Note 4: This 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.

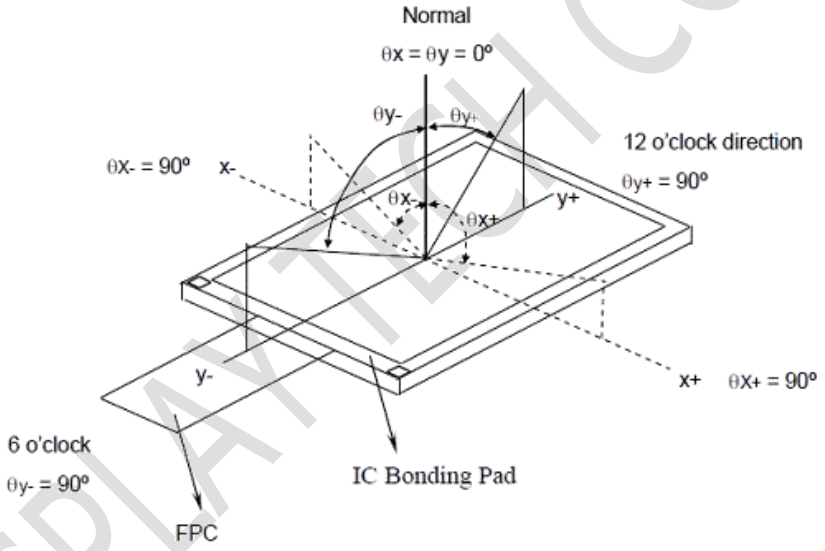


Note 6: Definition of contrast ratio:

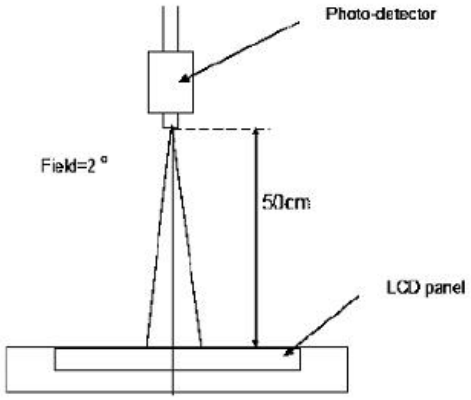
Contrast ratio is calculated by the following formula.

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

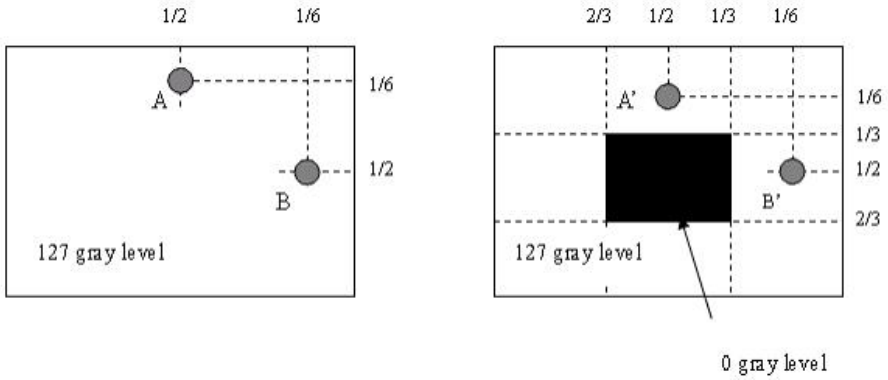
Note 7: Definition of viewing angle



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)	66.86x 94.94mm	Cover Lens Outline
Product Thickness	1.35mm(max)	Without FPC and form
Glass Thickness	0.7mm	
Ink View Area	50.36x74.94mm	
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		MSTAR 2133A
I^2C address		0x70
Resolution		320*480

9.3 Interface description

PIN NO.	SYMBOL	DESCRIPTION	REMARK
1~3	GND	Ground	
4	VDD	Power supply	
5	NC		
6	RESET	Reset pin	

7	INT	Interrupt signal from CTP	
8	SCL	I2C clock input	
9	SDA	I2C data signal	
10	GND	Ground	
11	GND	Ground	
12	GND	Ground	

9.4 Interface timing characteristics

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	2.0	-	uS

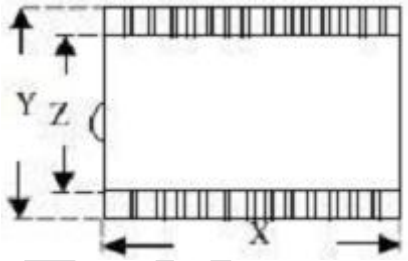
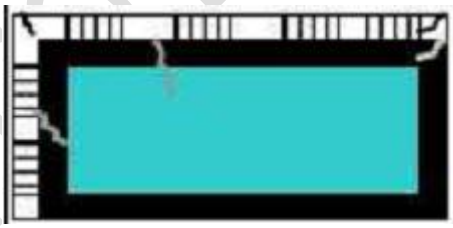
10 RELIABILITY TEST

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	

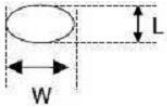
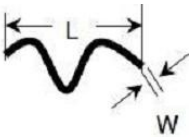
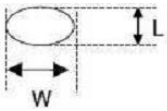
11 Inspection standards

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 ≤0.2mm	Disregard	1. ϕ=(W+L)/2, L:Length,W=Width 2.Disregard if out of A.A 
		0.2mm< ϕ ≤0.3mm	2	
		0.3mm< ϕ ≤0.5mm	1	
		ϕ >0.5mm	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

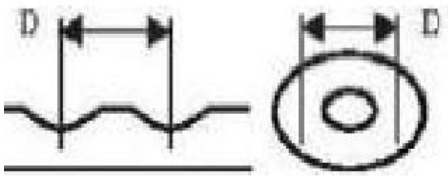
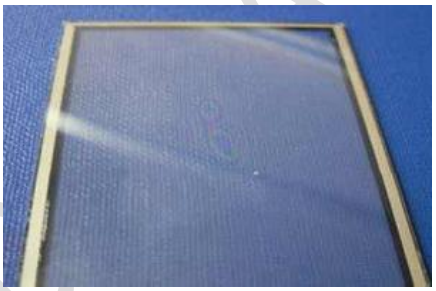
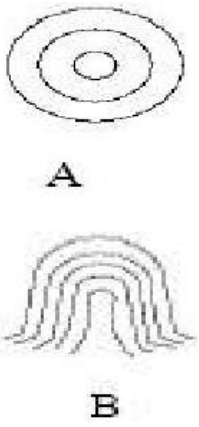
NO.	Defect	Criteria	Remark
1	Shift(Minor)	IC exposed [Reject]	
2	No black tape(Minor)	No black tape [Reject]	

11.1.5 Silicon

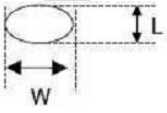
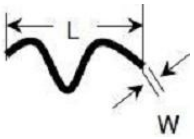
NO.	Defect	Criteria	Remark
1	Amount of silicon (Minor)	ITO exposed [Reject]	

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 ≤0.20</td><td>Access</td></tr>
<tr><td>0.2＜D≤0.3</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 0.05mm<W≤0.1mm	1	
		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.