



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.:** TSO014VGHR-02C

**Version:** V1.0

APPROVAL FOR SPECIFICATION

APPROVAL FOR SAMPLE

<b>For Customer' s Acceptance:</b>	
<b>Approved by</b>	<b>Comment</b>

<b>Team Source Display:</b>		
<b>Presented by</b>	<b>Reviewed by</b>	<b>Organized by</b>

Version No.	Date	Content	Remark
V1.0	2022-04-08	Initial Release	

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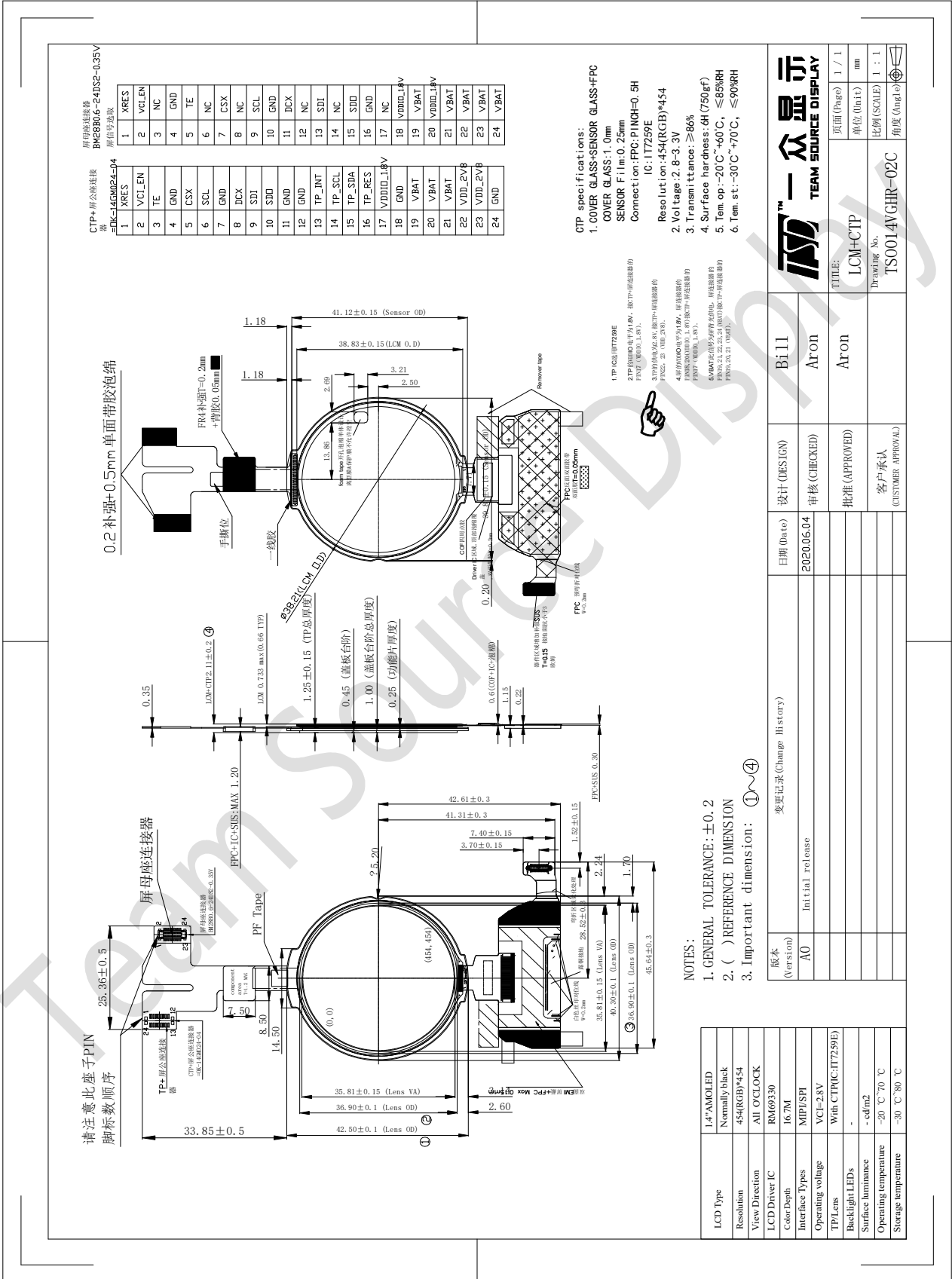
## 1 General Characteristics

ITEM	Specification	Unit
LCD Type	AMOLDE,Normally Black,IPS	-
LCD Size	1.4	inch
Resolution (W x H)	454x (RGB) ×454	pixel
LCM size	38.83(H) x 38.21(V) x 0.68(D)	mm
Active Area	Ø35.412	mm
Pixel Pitch	0.078(H)x 0.078(V)	mm
Viewing Direction	ALL o'clock	-
Color Depth	16.7M	-
Pixel Arrangement	RGB-stripe	-
Backlight Type	-	-
Surface Treatment	-	-
Interface Type	MIPI/SPI	-
Input Voltage	VCI=2.8V	V
With/Without TP	With CTP(IT7259E)	-
Weight	TBD	g

**Note 1: RoHS compliant**

**Note 2: LCM weight tolerance: ± 5%.**

## 2 Product drawings



原屏的连接器  
BME8006-24MS=0.35V  
屏后写总取

1	XRES
2	VCLEN
3	NC
4	GND
5	TE
6	NC
7	CSX
8	NC
9	SCL
10	GND
11	DCX
12	NC
13	TP_INT
14	NC
15	TP_SCL
16	TP_SDA
17	TP_RES
18	VDDIO_1.8V
19	VBAT
20	VDDIO_1.8V
21	VBAT
22	VDD_2V8
23	VBAT
24	GND

CTP+屏公端连接器  
=FK=146MM24L04

1	XRES
2	VCLEN
3	TE
4	GND
5	CSX
6	SCL
7	GND
8	DCX
9	SDI
10	SDD
11	GND
12	GND
13	TP_INT
14	TP_SCL
15	TP_SDA
16	TP_RES
17	VDDIO_1.8V
18	GND
19	VBAT
20	VBAT
21	VBAT
22	VDD_2V8
23	VDD_2V8
24	GND

CTP specifications:  
 1. COVER GLASS-SENSOR GLASS-FPC  
 SENSOR Film: 0.25mm  
 Connection: FPC; PINCH=0.5H  
 IC: IT7259E  
 Resolution: 454(RGB)\*454  
 2. Voltage: 2.8~3.3V  
 3. Transmittance: ≥86%  
 4. Surface hardness: 4H (750f)  
 5. Temp. op.: -20°C~+60°C, ≤85%RH  
 6. Temp. st.: -30°C~+70°C, ≤90%RH

1. TP: IC: IT7259E
2. TP: DRIVER: RM0930
3. TP: FILM: 0.25mm
4. TP: COVER: 0.25mm
5. TP: GLASS: 0.25mm
6. TP: SENSOR: 0.25mm
7. TP: LENS: 0.25mm
8. TP: FPC: 0.25mm
9. TP: PCB: 0.25mm
10. TP: CASE: 0.25mm
11. TP: BATTERY: 0.25mm
12. TP: WIRE: 0.25mm
13. TP: ADHESIVE: 0.25mm
14. TP: SEALANT: 0.25mm
15. TP: SPRING: 0.25mm
16. TP: SCREW: 0.25mm
17. TP: NAIL: 0.25mm
18. TP: BUSH: 0.25mm
19. TP: RING: 0.25mm
20. TP: GASKET: 0.25mm
21. TP: O-RING: 0.25mm
22. TP: GROMMET: 0.25mm
23. TP: WASHER: 0.25mm
24. TP: NUT: 0.25mm

NOTES:

1. GENERAL TOLERANCE: ±0.2
2. ( ) REFERENCE DIMENSION
3. Important dimension: ①④

版本	变更记录(Change History)	设计(DESIGN)	设计(DESIGN)	日期(Date)	Bill	
AO	Initial release	审核(CHECKED)	审核(CHECKED)	2020.06.04	Arton	
		批准(APPROVED)	批准(APPROVED)		Arton	
		客户承认	客户承认			
		(CUSTOMER APPROVAL)	(CUSTOMER APPROVAL)			

TITLE:  
LCM+CTP  
Drawing No:  
TSO014VGHR-02C

项数(Page) 1 / 1  
单位(Unit) mm  
比例(SCALE) 1 : 1  
角度(Angle) 0°

LCD Type	1.4"AMOLED
Resolution	Normally black 454(RGB)*454
View Direction	All OCLOCK
LCD Driver IC	RM0930
Color Depth	16.7M
Interface Types	MIPI/SP
Operating voltage	VCI=2.8V
TP/Lens	With CTP(IC:IT7259E)
Backlight LEDs	-
Surface lumiance	- cd/m2
Operating temperature	-20 °C~70 °C
Storage temperature	-30 °C~80 °C

### 3 Interface description

#### 3.1 LCM interface description

Pin No.	Symbol	Description
1	XRES	Reset input pin
2	VCI_EN	This signal enables Power IC's Driver IC analog supply
3	TE	Tear effect output
4	GND	Power ground
5	CSX	SPI Chip select input pin ("Low" enable)
6	SCL	SPI Serial clock
7	GND	Power ground
8	DCX	SPI CMD/Data selection signal
9	SDI	SPI input signal
10	SDO	SPI Output signal
11~12	GND	Power ground
13	TP_INT	CTP_INT input pin
14	TP_SCL	CTP clock input pin
15	TP_SDA	CTP data input/ouput pin
16	TP_RES	CTP reset input pin
17	VDDIO_1.8V	Driver IC digital I/O supply
18	GND	Power ground
19~21	VBAT	Power IC supply
22~23	VDD_2V8	Power supply+
24	GND	Power ground

## 4 Timing Characteristics

Symbol	Description	Min	Typ	Max	Unit
TREOT	30%-85% rise time and fall time	-	-	35	ns
TCLK-MISS	Timeout for receiver to detect absence of Clock transitions and disable the Clock Lane HS-RX.	-	-	60	ns
TCLK-POST*1	Time that the transmitter continues to send HS clock after the last associated Data Lane has transitioned to LP Mode. Interval is defined as the period from the end of THS-TRAIL to the beginning of TCLK-TRAIL.	60ns + 52*UI (For DCS)	-	-	ns
TCLK-PRE	Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.	8	-	-	ns

TCLK-SETTLE	which the HS receiver shall ignore any Clock Lane HS transitions, starting from the beginning of TCLK-PRE.	95	-	300	ns
TCLK-TERM-EN	Time for the Clock Lane receiver to enable the HS line termination, starting from the time point when Dn crosses VIL,MAX.	Time for Dn to reach VTERM-EN		38	ns
THS-SETTLE	Time interval during which the HS receiver shall ignore any Data Lane HS transitions, starting from the beginning of THSPREPARE.	85 ns + 6*UI		145 ns + 10*UI	ns
TEOT	Time from start of THS-TRAIL or TCLK-TRAIL period to start of LP-11 state	-	-	105ns+48*UI	ns
THS-EXIT(1)	time to drive LP-11 after HS burst	100	-	-	ns
THS-PREPARE	Time to drive LP-00 to prepare for HS transmission	40ns + 4*UI	-	85ns+6*UI	ns
THS-PREPARE + THS-ZERO	THS-PREPARE + Time to drive HS-0 before the Sync sequence	145ns + 10*UI	-	-	ns
THS-SKIP	Time-out at RX to ignore transition period of EoT	40	-	55ns+4*UI	ns
THS-TRAIL	Time to drive flipped differential state after last payload data bit of a HS transmission burst	60 + 4*UI	-	-	ns
TLPX	Length of any Low-Power state period	50	-	-	ns

Ratio TLPX	Ratio of TLPX(MASTER)/TLPS(SLAVE) between Master and Slave side	2/3	-	3/2	ns
TTA-GET	Time to drive LP-00 by new TX	5*TLPX	5*TLPX	5*TLPX	ns
TTA-GO	Time to drive LP-00 after Turnaround Request	4*TLPX	4*TLPX	4*TLPX	ns
TTA-SURE	Time-out before new TX side starts driving	TLPX	-	2*TLPX	ns

**5.6.5 Timing requirements for RESETB**

When RESETB of the reset pin equals to Low, it will be in the condition of reset.

When it is in the condition of reset, it will make the device recover the initial set.

However, in order to avoid the reset noise cause reset, there is a mechanism to judge about whether the reset is needed or not.

The closed interval of Low can be shown as the following.

(Test condition: VDDIO=1.65V~3.6V, VSS=0V, TA=-20°C~+70°C)

Parameter	Symbol	Conditions	Spec			Unit
			Min.	Typ.	Max.	
Reset low pulse width	Trst	-	20	-	-	μs

Table: Reset timing

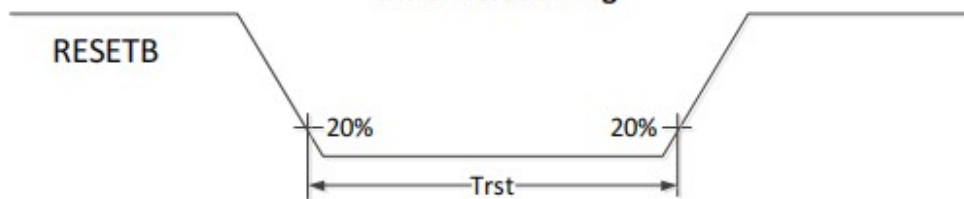


Figure: Reset timing



## 5 Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage (Analog)	VCI~GND	-0.3	5.5	V
Logic signal voltage(I/O)	IOVDD~GND	-0.3	5.5	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	VCI	2.7	2.8	3.6	V
Logic operating voltage	VDDI	1.65	1.8	3.3	
Input Voltage ' H ' level	VIH	0.7VDDI	-	VDDI	
Input Voltage ' L ' level	VIL	GND	-	0.3VDDI	
Output Voltage ' H ' level	VOH	VDDI-0.4	-	VDDI	
Output Voltage ' L ' level	VOL	GND	-	GND+0.4	

## 7 Backlight Characteristics

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Voltage for LED backlight	V <sub>f</sub>	-	-	-	V
Current for LED backlight	I <sub>f</sub>	-	-	-	mA
Power consumption	W <sub>bl</sub>	-	-	-	mW
Uniformity	Avg	-	-	-	%
LED Life Time	-	-	-	-	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.

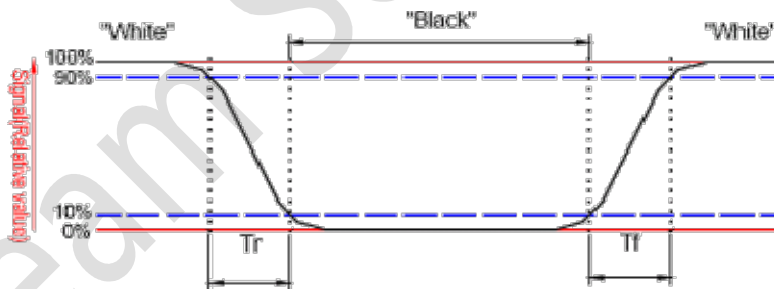
## 8 LCD Optical specifications

Item	Symbol	Condition	Specification			Unit	Remark
			Min	Typ	Max		
Response time (By Quick)	Tr+Tf	-	-	2	-	ms	Note 2
Contrast ratio	CR	-	-	10000	-	-	Note 3
Surface luminance	Lv	$\theta=0^\circ$	-	280	-	cd/m <sup>2</sup>	Note 4
Luminance uniformity	Yu	$\theta=0^\circ$	80	-	-	%	Note 6
NTSC	-	$\theta=0^\circ$	45	50	-	%	Note 6
Viewing angle	Top	$CR \geq 10$	80	85	-	Deg.	Note 7
	Bottom	$CR \geq 10$	80	85	-		
	Left	$CR \geq 10$	80	85	-		
	Right	$CR \geq 10$	80	85	-		
CIE(x,y) chromaticity	Wx	$\theta=0^\circ$	Typ -0.04	0.302	Typ +0.04		Note 5
	Wy			0.338			
	Rx			0.612			
	Ry			0.337			
	Gx			0.344			
	Gy			0.598			
	Bx			0.150			
	By			0.102			

Note 1: Ambient temperature = 25°C.

Note 2: 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 3: Definition of contrast ratio:

Contrast ratio is calculated by the following formula.

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

Measured at the center area of the LCD.

Note 4: Definition of surface luminance

Surface luminance is the luminance with all pixels displaying white

Note 5: For contrast ratio, Surface Luminance, Luminance uniformity and CIE, the testing data is based on TOPCON's BM-7 photo detector or compatible.

Size :  $S \leq 4.3''$  (see Figure A B)

H,V : Active area

Light spot size=7.7mm (BM-7)50cm distance or compatible distance from the LCD surface to detector lens.

test spot position : see Figure B.

measurement instrument : TOPCON' s luminance meter BM-7 or compatible.

Size :  $4.3 < S \leq 12.3''$  (see Figure A C)

H,V : Active area

Light spot size=7.7mm (BM-7)50cm distance or compatible distance from the LCD surface to detector lens.

test spot position : see Figure C.

measurement instrument : TOPCON' s luminance meter BM-7 or compatible.

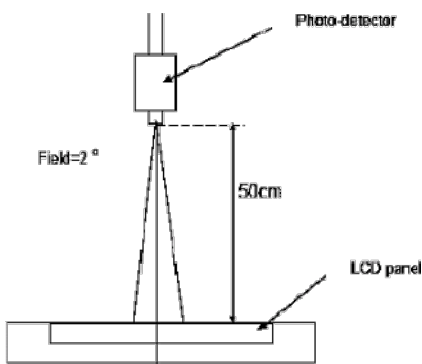


Figure A

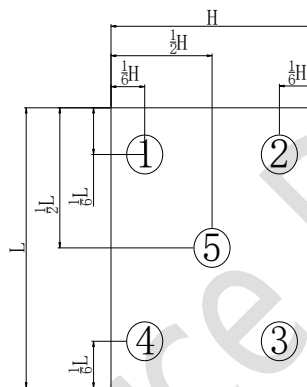


Figure B

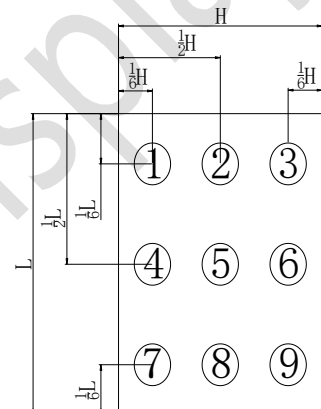


Figure C

Note 6:Definition of Luminance Uniformity

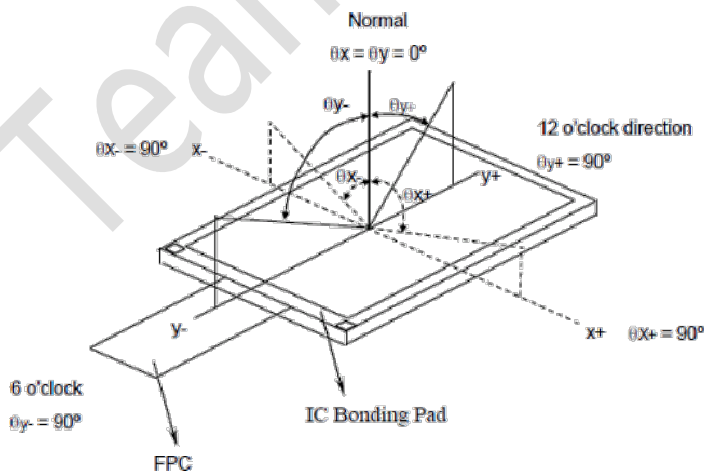
Active area is divided into 5 or 9 measuring areas,Every measuring point is placed at the center of each measuring area

Bmax: The measured maximum luminance of all measurement position.

Bmin: The measured minimum luminance of all measurement position.

**Luminance Uniformity (Yu) = (Bmin/Bmax)x100%**

Note 7: Definition of viewing angle



## 9 Touch Panel specifications

### 9.1 Mechanical characteristics

DESCRIPTION	INL SPECIFICATION	REMARK
Touch Panel Size	1.4	
Outline Dimension (OD)	36.9(H) x 42.5(V) mm	Cover Lens Outline
Product Thickness	1.25mm(±0.15)	
Glass Thickness	1.0mm	
Ink View Area	∅35.81mm	
Input Method	1 Fingers	
Activation Force	Touch	
Surface Hardness	≥6H	

### 9.2 Electrical characteristics

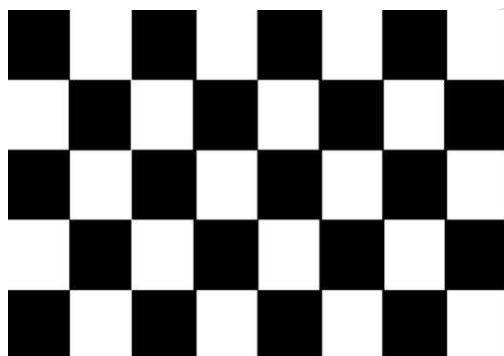
DESCRIPTION		SPECIFICATION
Operating Voltage		DC 2.8~33V
Power Consumption (IDD)	Active Mode	12~4.5mA
	Sleep Mode	TBD
Interface		I <sup>2</sup> C
Controller IC		IT7259E
I <sup>2</sup> C address		-
Resolution		454*454

### 9.3 Interface timing characteristics

PARAMETER	MIN	MAX	UNIT
SCL Frequency	-	400K	Hz
Bus Free Time Between a STOP and START Condition	1.3	-	uS
Hold Time (repeated) START Condition	0.6	-	uS
Data Setup Time	100	-	nS
Setup Time for Repeated START Condition	0.6	-	uS
Setup Time for STOP Condition	0.6	-	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	Packing Drop Test	Height: 50 cm 1 corner, concrete floor	
9	Electrostatic Discharge Test	C=150pF, R=330 Ω Air: ±8KV 150pF/330Ω 30 times Contact: ±4KV,20 times	
10	Image Sticking	25°C, 60%RH (ref. to Remark(1))	



5\*8 chess pattern

## 11 Image Sticking

### 11.1 What is image sticking?

If you remain a fixed image on LCD Display for a long period of time, you may experience a phenomenon called Image Sticking. Image Sticking - sometimes also called "image retention" or "ghosting" - is a phenomenon where a faint outline of a previously displayed image remains visible on the screen when the image is changed. It can occur at variable levels of intensity depending on the specific image makeup, as well as the amount of time the core image elements are allowed to remain unchanged on the screen. In POS applications, for example, a button menu which remains fixed, or in which the "frame" elements (core image) remain fixed and the buttons

may change, may be susceptible to image sticking. It is important to note that if the screen is used exclusively for this application, the user may never notice this phenomenon since the screen never displays other content. It is only when an image other than the “retained” image is shown on the screen that this issue becomes evident. Image sticking is different than the “burn-in” effect commonly associated with phosphor based devices.

## 11.2 What cause image sticking?

Image sticking is an intrinsic behavior of LCD displays due to the susceptibility to polarization of the interior materials (liquid crystals) when used under static, charged conditions (continuously displaying the same image). The individual liquid crystals in an LCD panel have unique electrical properties. Displaying a fixed pattern - such as the POS menu described above – over prolonged periods can cause a parasitic charge build-up (polarization) within the liquid crystals which affects the crystals’ optical properties and ultimately prevents the liquid crystal from returning to its normal, relaxed state when the pattern is finally changed. This effect takes place at a cellular level within the LCD, and the effect can cause charged crystal alignment at the bottom or top of a crystal cell in the “z” axis, or even crystal migration to the edges of a cell, again based on their polarity. These conditions can cause image sticking over an entire area, or at boundaries of distinct color change respectively. In either case, when the liquid crystals in the pixels and sub-pixels utilized to display the static image are polarized such that they can not return fully to their “relaxed” state upon deactivation, the result is a faint, visible, retained image on the panel upon presentation of a new, different image. The actual rate of image retention depends on variation factors such as the specific image, how long it is displayed unchanged, the temperature within the panel and even the specific panel brand due to manufacturing differences amongst panel manufacturers.

## 11.3 How to avoid image sticking?

- Try not to operate the LCD with a “fixed” image on the screen for more than 2 hours.
- If you are operating the monitor in an elevated temperature environment and with a displayed image which is contrary to the recommendations in “For Software Developers” below, image stick can occur in as little as 30 minutes. Adjust your screen saver settings accordingly.
- Power down the unit during prolonged periods of inactivity such as the hours a store is closed or a shift during which the piece of equipment isn’t used.
- Use a screensaver with a black or medium gray background that is automatically set to come on if the device is inactive for more than 5-10 minutes.
- Avoid placing the monitor in poorly ventilated areas or in areas that will create excess heat around the monitor for software developers.
- In defining the icons, buttons, or windows in the screen, try to utilize block patterns instead of distinct lines as borders for dividing the display into distinct areas.
- If it is necessary to display a static image, try to use colors that are symmetric to the middle grey level at the boundary of two different colors, and slightly shift the borders line once in a while.
- Try to utilize medium gray hues for those areas that will have prolonged display times or remain static as other menu elements change.

## 11.4 How to fix the image sticking?

Unlike the usually irreversible “burn-in” effects commonly associated with direct view phosphor display devices such as CRTs, an image retained on an LCD display can be reversed – often to a point of total invisibility. However, the severity of the underlying causes (as described above) of the image retained on a specific display, as well as the variation factors under which the retained image was created, will dictate the final level of retention reversal.

One way to erase a retained image on a panel is to run the screen (monitor "on" ) in an "all black" pattern for 4-6 hours. It is also helpful to do this in an elevated temperature environment of approximately 35° to 50°C. Again, utilizing a dynamic screen saver with an all black background during prolonged idle display periods is a good way to avoid image retention issues.

## 11.5 Is image sticking covered by TSD warranty?

Image sticking is a phenomenon inherent to LCD Display technology itself, and as such, the occurrence of this "ghosting" effect is considered normal operation by the manufacturers of the LCD display modules which are integrated into today's monitor solutions. TSD does not warrant any display against the occurrence of image sticking. We strongly advise that you follow the operating recommendations listed above to avoid the occurrence of this phenomenon.

## 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.

## 13 Limited Warranty

### 13.1

Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.

### 13.2

If possible, we suggest customer to use up all LCD modules as soon as possible. If the LCD module storage time over twelve months, we suggest to recheck it before being used.

### 13.3

Any product issues must be feedback to TSD within twelve months since delivery, otherwise, we will not be responsible for the subsequent or consequential events.

