Surenoo SMC0700B-800480 Series MCU Interface TFT LCD Module User Manual

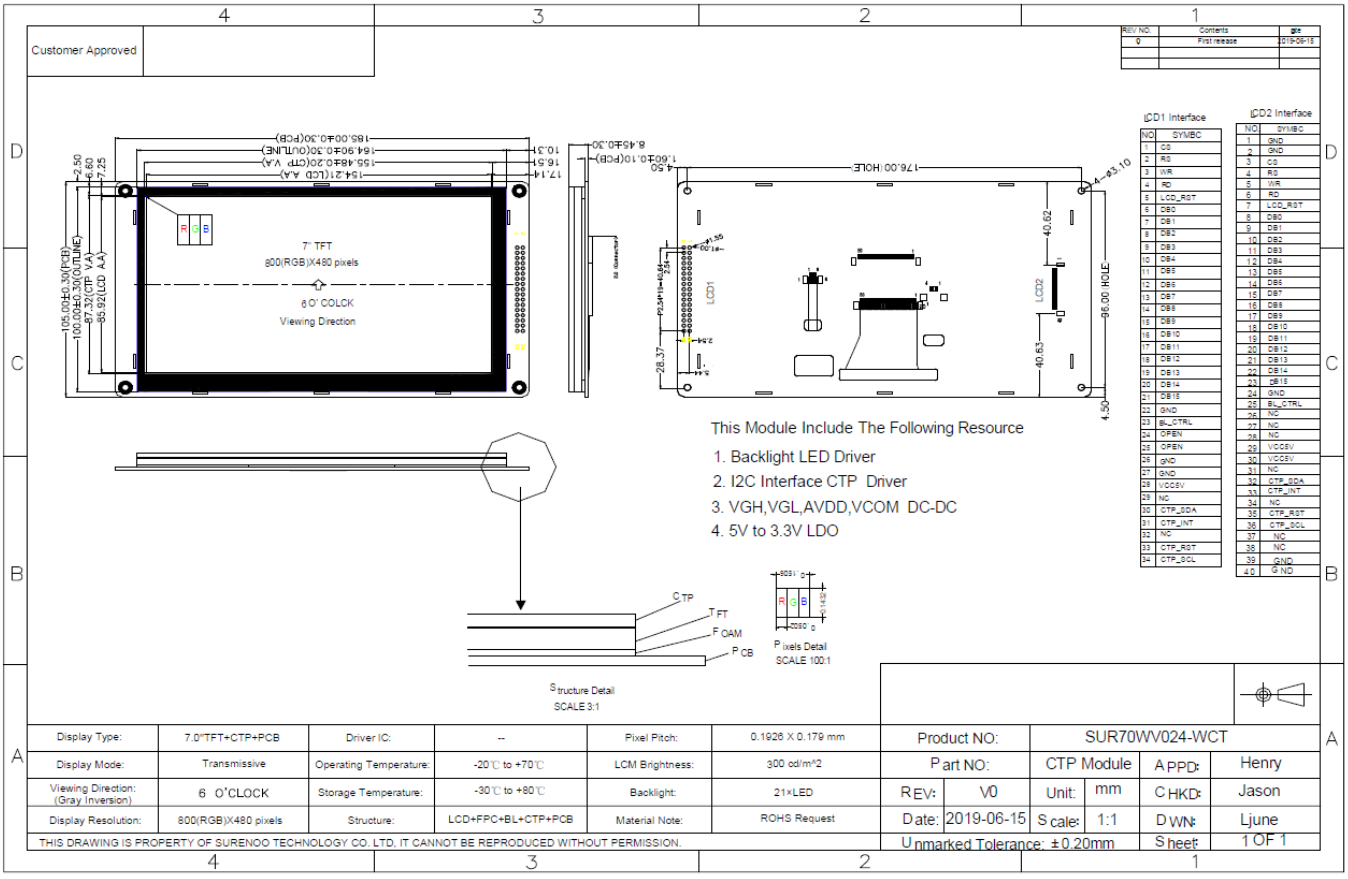
Contents

Surenoo SMC0700B-800480 Series MCU Interface TFT LCD Module

GENERAL INFORMATION

Item of general information	Contents		Unit
LCD Display Size (Diagonal)	7.0		inch
Module Structure	LCD Display + RTP Touch + PCB LCD Display + CTP Touch + PCB		–
LCD Display Type	TFT/TRANSMISSIVE		–
LCD Display Mode	Normally White		–
Viewing Direction	12 O'CLOCK		–
Gray inversion Direction	6 O'CLOCK		
Module size (W×H×T)	185.00×105.00×8.45		mm
Active area (W×H)	154.21×85.92		mm
Number of pixels (Resolution)	800RGB×480		pixel
Pixel pitch (W×H)	0.1926 × 0.1790		mm
LCD Driver IC	LT7381		–
Module Interface Type	LCD	MCU 16bit/8bit interface	–
	RTP	4-Wire Resistive Touch	–
	CTP	IIC interface	
Module Input voltage	5.0V		V
Module Power consumption	–		mW
Color Numbers	16.7M		–
Backlight Type	White LED		–

EXTERNAL DIMENSIONS



ABSOLUTE MAXIMUM RATINGS

Parameter of absolute maximum ratings	**Symbol**	**Min**	**Max**	**Unit**
Operating temperature	Top	-20	70	℃
Storage temperature	Tst	-30	80	℃
Humidity	RH	–	90%(Max 60℃)	RH

Note: Absolute maximum ratings means the product can withstand short-term, not more than 120 hours. If the product is a long time to withstand these conditions, the life time would be shorter.

ELECTRICAL CHARACTERISTICS(DC CHARACTERISTICS)

Parameter of DC characteristics	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**
PCB operating voltage	VCC5V	–	5.0	–	V
LCD I/O operating voltage	VDD	3.0	3.3	3.6	V
Input voltage 'H' level	VIH	2	–	3.6	V
Input voltage 'L' level	VIL	-0.3	–	0.8	V
Output voltage 'H' level	VOH	2.4	–	–	V
Output voltage 'L' level	VOL	–	–	0.4	V

BACKLIGHT CHARACTERISTICS

Item of backlight characteristics	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Voltage	Vf	8.4	9.3	9.9	V	Note1
Forward Current	If	–	140	–	mA	–
Number of LED	–	–	7*3	–	Piece	–
LED Connection mode	P/S	–	Serial	–	–	–
Lifetime of LED	–	–	10000	–	hour	Note2

Note:

- Note1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and If=140mA.
- Note2: The LED lifetime define as the estimated time to 50% degradation of initial luminous. The LED lifetime could be decreased if operating If is larger than 140mA.

ELECTRO-OPTICAL CHARACTERISTICS

Item of electro-optical characteristics		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	Note
Response time		Tr + Tf	θ=0 =0 Ta=25℃	–	25	40	ms	FIG 1.	4
Contrast Ratio		CR		–	350	–	–	FIG 2.	1
Luminance uniformity		WHITE		–	80	–	%	FIG 2.	3
Surface Luminance		Lv		–	300	–	cd/m2	FIG 2.	2
CIE (x, y) chromaticity	White	White x	θ=0 =0 Ta=25℃	–	0.310	–	–	FIG 2.	5
		White y		–	0.33	–			
	Red	Red x		–	0.587	–			
		Red y		–	0.331	–			
	Green	Green x		–	0.344	–			
		Green y		–	0.571	–			
	Blue	Blue x		–	0.146	–			
		Blue y		–	0.0092	–			
Viewing angle range	=90(12 o'clock)		CR 10	–	50	–	deg	FIG 3.	6
	=270(6 o'clock)			–	70	–	deg		
	=0(3 o'clock)			–	70	–	deg		
	=180(9 o'clock)			–	70	–	deg		
NTSC ratio	–		–	–	50	–	%	–	–

1. **Note 1**. Contrast Ratio (CR) is defined mathematically by the following formula. For more information see FIG 2.:

$$\text{Contrast Ratio(CR)} = \frac{\text{Average Surface Luminance with all white pixels(P1,P2,P3,P4,P5,P6,P7,P8,P9)}}{\text{Average Surface Luminance with all black pixels(P1,P2,P3,P4,P5,P6,P7,P8,P9)}}$$

2. **Note 2.** Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see FIG 2.
   Lv=Average Surface Luminance with all white pixels (P1,P2,P3,P4,P5,P6,P7,P8,P9)
3. **Note 3.** The uniformity in surface luminance WHITE is determined by measuring luminance at each test position 1 through 9, and then dividing the maximum luminance of 9points luminance by minimum luminance of 9 points luminance. For more information see FIG 2.

$$\delta\text{WHITE} = \frac{Minimum\ Surface\ Luminance\ with\ all\ white\ pixels\ (P1,P2,P3,P4,P5,P6,P7,P8,P9)}{Maximum\ Surface\ Luminance\ with\ all\ white\ pixels\ (P1,P2,P3,P4,P5,P6,P7,P8,P9)}$$

4. **Note 4.** Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 1.
5. **Note 5**. CIE (x, y) chromaticity ,The x,y value is determined by screen active area position 5. For more

information see FIG 2.

6. **Note 6**. Viewing angle is the angle at which the contrast ratio is greater than a specific value. For TFT module, the specific value of contrast ratio is 10.The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 3.
7. **Note 7**. For Viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope. Series Instruments. For contrast ratio, Surface Luminance, Luminance uniformity and CIE the testing data is base on BM-7 photo detector.
8. **Note 8**. For TN type TFT transmissive module, Gray scale reverse occurs in the direction of panel viewing angle.

FIG.1. The definition of Response Time

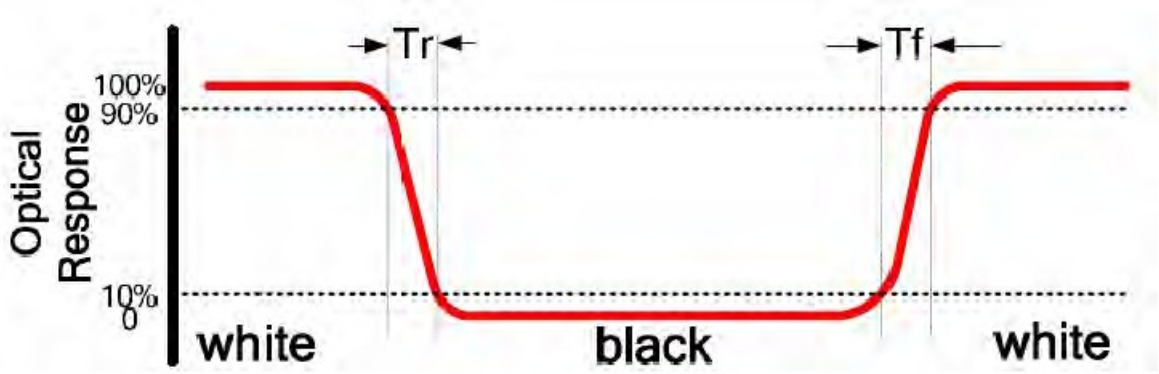


FIG.2. Measuring method for Contrast ratio, surface luminance, Luminance uniformity,
CIE (x , y) chromaticity
A : H/6 ;
B : V/6 ;
H,V : Active Area(AA) size
Measurement instrument: BM-7; Light spot size=5mm, 350mm distance from the LCD surface to detector lens.

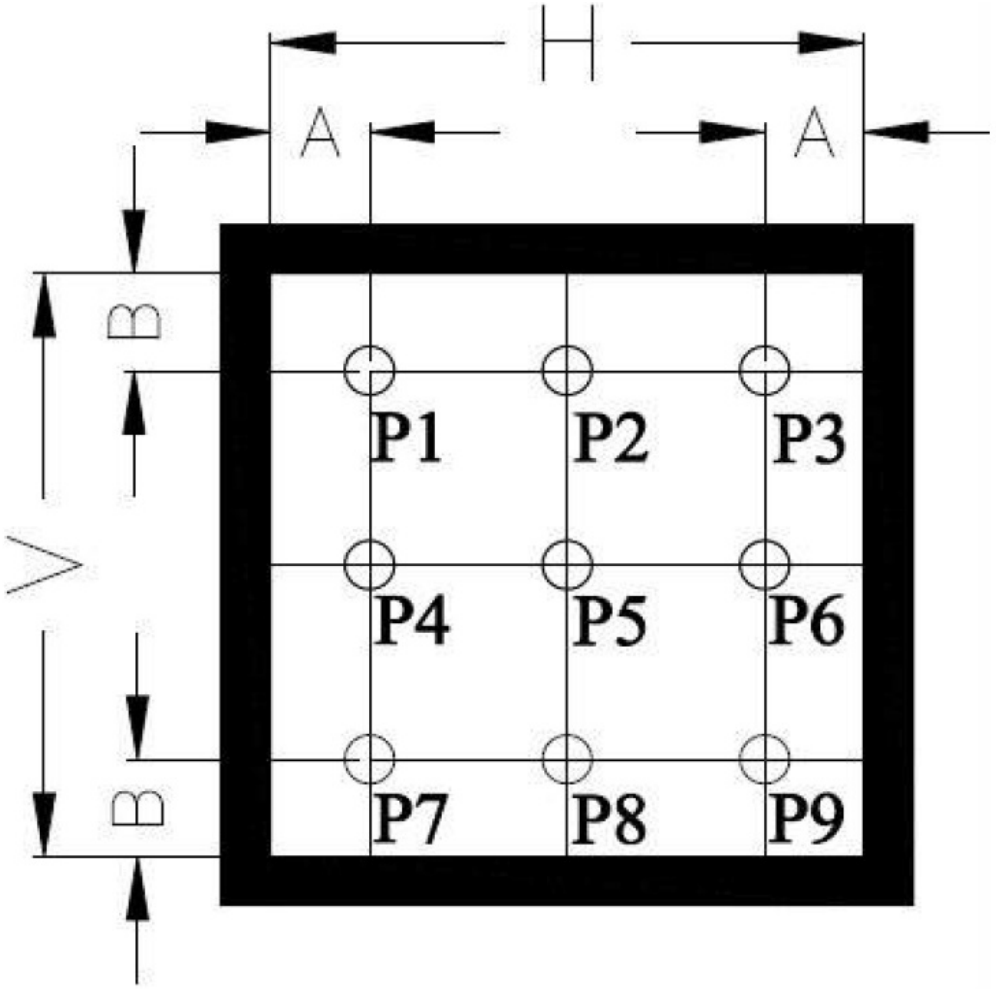
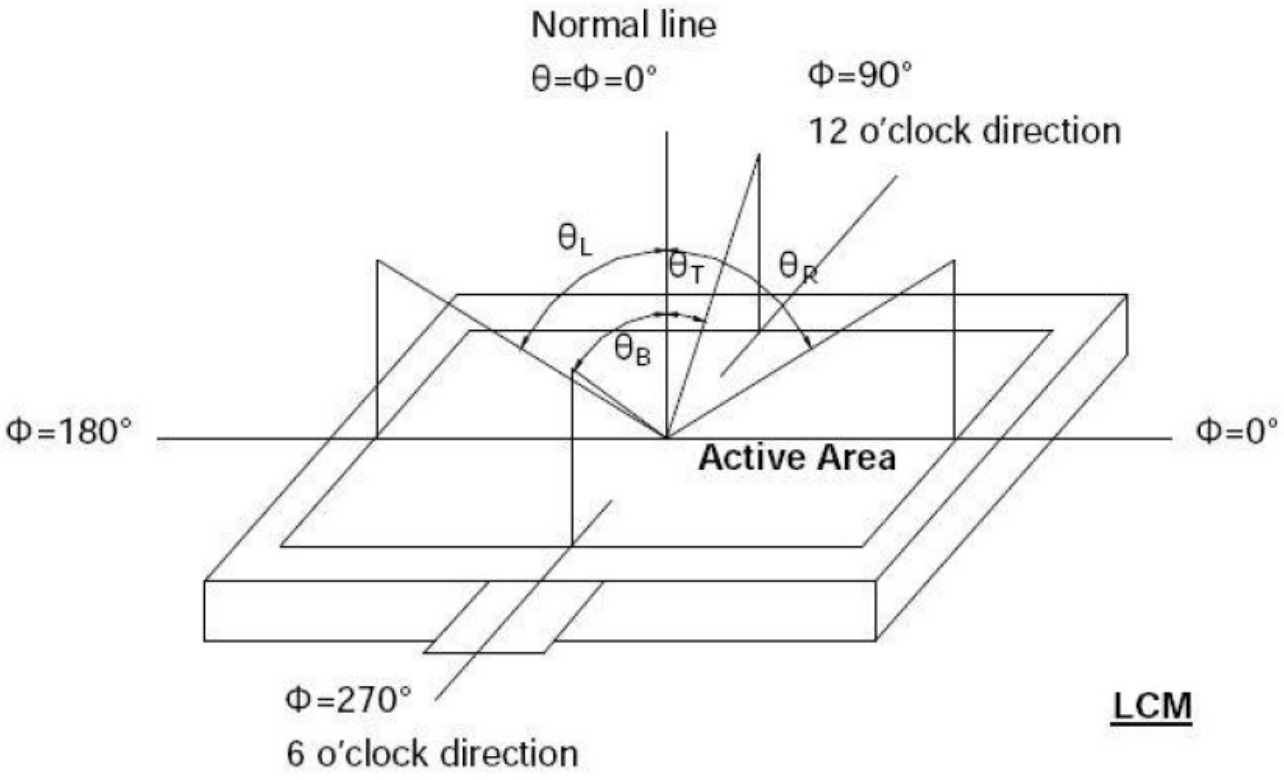


FIG.3. The definition of viewing angle



INTERFACE DESCRIPTION

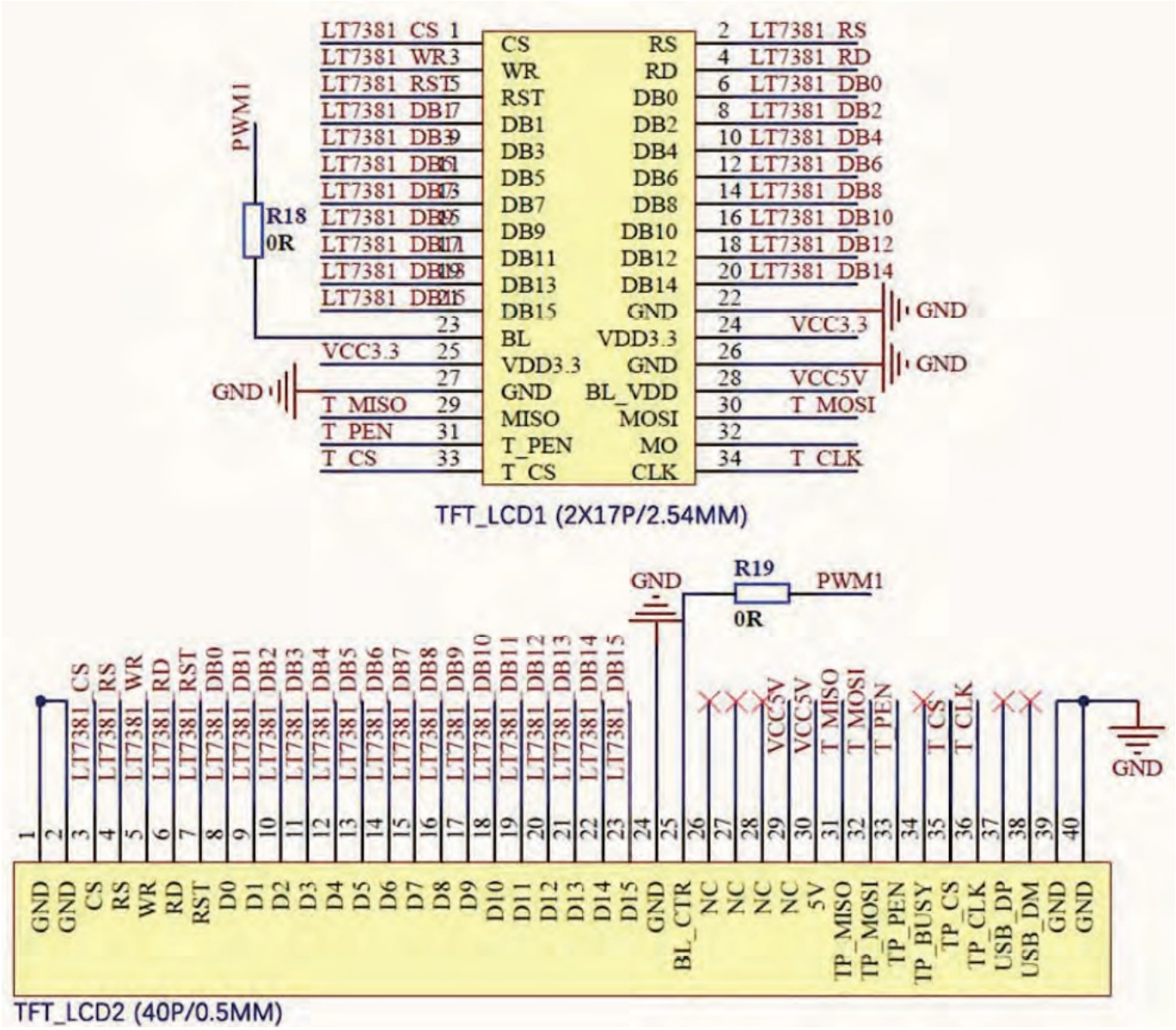
LCD1 Interface Description for CTP

NO.	Symbol	I/O	DESCRIPTION
1	CS	I	Chip select
2	RS	I	Data/Command select
3	WR	I	Write strobe signal
4	RD	I	Read strobe signal
5	LCD_RST	I	LCD RESET signal, Low is active
6~21	DB0~ DB15	I/O	Data bus(D0:LSB; D15:MSB)
22	GND	Power Supply	Power ground
23	BL_CTRL	I	Backlight control pin
24~25	OPEN	–	No connection
26~27	GND	Power supply	Power ground
28	VDD5V	Power supply	Module Power input (5V Typ.) (*note1)
29	NC	O	No connection
30	CTP_SDA	I	TP Serial Data Input
31	CTP_INT	I	TP INT Interrupt Output
32	NC	–	No connection
33	CTP_CS	I	TP Chip reset pin
34	CTP_SCL	I	TP Clock Input

LCD2 Interface Description for CTP

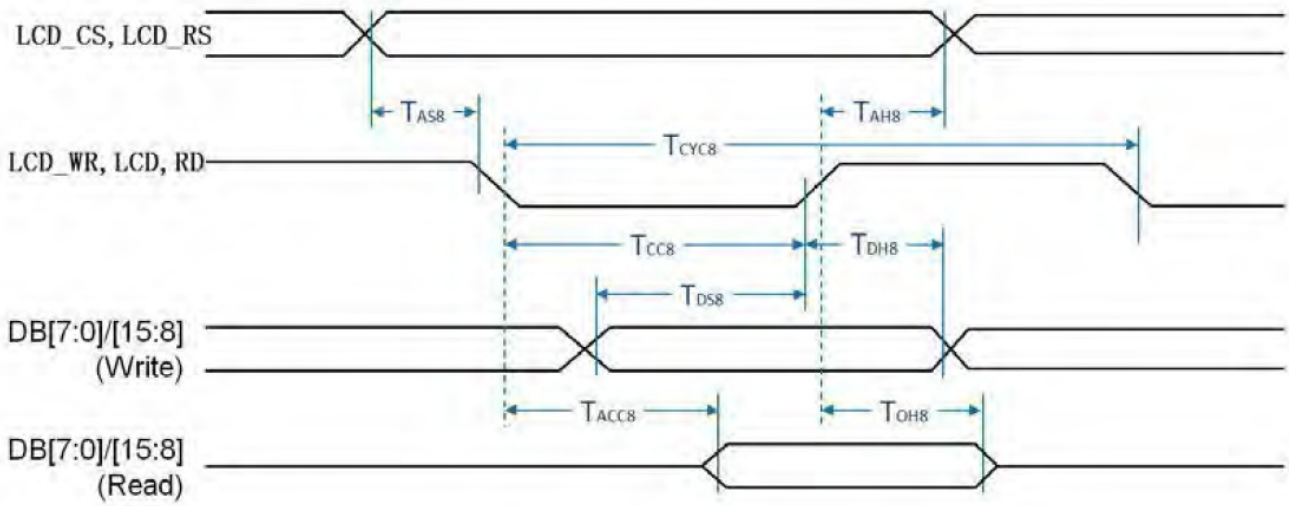
NO.	Symbol	I/O	DESCRIPTION
1~2	GND	Power supply	Power ground
3	CS	I	Chip select
4	RS	I	Data/Command select
5	WR	I	Write strobe signal
6	RD	I	Read strobe signal
7	LCD_RST	I	LCD RESET signal, Low is active
8~23	DB0~ DB15	I/O	Data bus(D0:LSB; D15:MSB)
24	GND	Power supply	Power ground
25	BL_CTRL	I	Backlight control pin
26~28	NC	–	No connection
29~30	VDD5V	Power supply	Module Power input (5V Typ.)
31	NC	O	No connection
32	CTP_SDA	I	TP Serial Data Input
33	CTP_INT	I	TP INT Interrupt Output
34	NC	–	No connection
35	CTP_RST	I	TP Chip Select Input
36	CTP_CLK	I	TP Clock Input
37	NC	I	No connection
38	NC	I	No connection
39~40	GND	–	Power ground

LCD1 / LCD2 Interface Description for RTP



INPUT TIMING

8080 Parallel Mode Interface Timing



Symbol	Parameter		Rating		Unit	Note
			Min.	Max.		
TCYC8	Cycle Time		50	—	ns	tc is one system clock period: tc = 1/SYS_CLK
TCC8	Strobe Pulse Width		20	—	ns	
TAS8	Address Setup Time		0	—	ns	
TAH8	Address Hold Time		10	—	ns	
TDS8	Data Setup Time		20	—	ns	
TDH8	Data Hold Time		10	—	ns	
TACC8	Data Output Access Time		0	20	ns	
TOH8	Data Output Hold Time		0	20	ns	

Register Write:

1. Address Write: Write the Register's Address. For example, 00h i.e. REG[00h], 01h i.e. REG[01h], 02h i.e. REG[02h] ……
2. Data Write: Write Data to the Register

Register Read:

1. Address Write: Write the Register's Address
2. Data Write: Read Data from the Register
   Displays Memory (Display RAM) is where the TFT screen image data is stored,. Host through interface and write data into Display RAM. The procedure of access Display RAM is as following:

Display RAM Write:

1. Set the Active Window Registers before writing any image data.
2. Perform an register write to Graphic R/W Position Register 0, REG[5Fh]).
3. Repeat step 2 until setup all the Active Window & Graphic R/W Position Coordinates.
4. Perform an address write to point to Memory Data Port Register (REG[04h])
5. Perform data writes to fill the window. Each write to the Memory Data Port will auto-increment the internal memory address.

RELIABILITY TEST CONDITIONS

No.	Test Item	Test Condition
1	High Temperature Storage	80℃/120 hours
2	Low Temperature Storage	-30℃/120 hours
3	High Temperature Operating	70℃/120 hours
4	Low Temperature Operating	-20℃/120 hours
5	Temperature Cycle Storage	-20℃(30min.)~25(5min.)~70℃(30min.)×10cycles

A Inspection after test:

Inspection after 2~4 hours storage at room temperature, the sample shall be free from defects:

Ø Air bubble in the LCD;

Ø Sealleak;

Ø Non-display;

Ø Missing segments;

Ø Glass crack;

Ø Current is twice higher than initial value.

B Remark:

Ø The test samples should be applied to only one test item.

Ø Sample size for each test item is 5~10pcs.

Ø Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

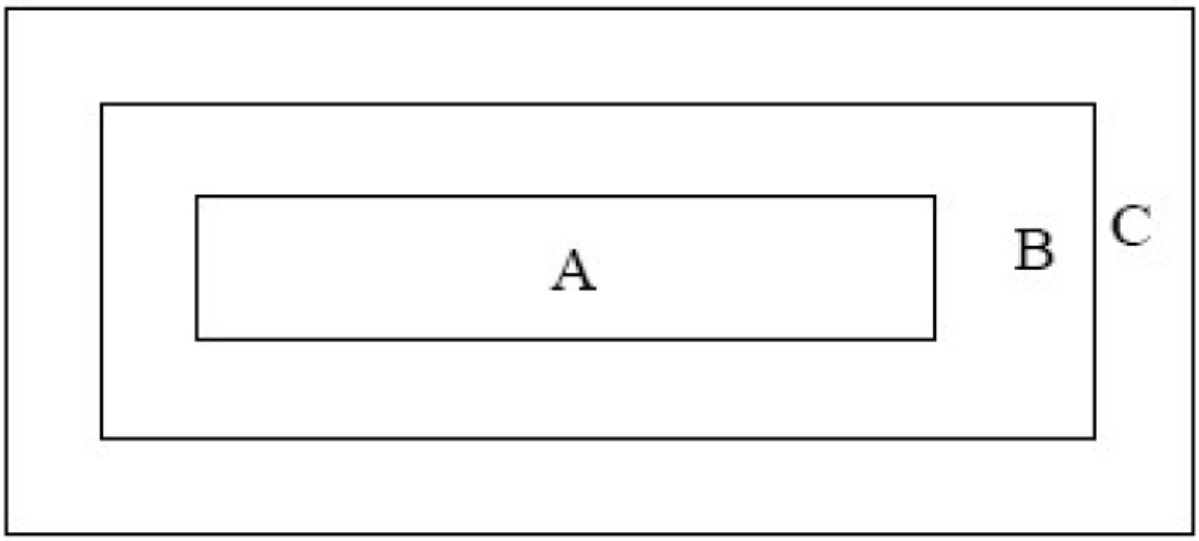
INSPECTION CRITERION

This specification is made to be used as the standard of acceptance/rejection criteria for TFT-LCD/IPS TFT-LCD module product, and this specification is applicable only in the case that the size of module equal to or exceed than 3.5 inch.

Sample plan
Sampling plan according to GB/T2828.1-2003/ISO 2859-1 1999 and ANSI/ASQC Z1.4-1993,normal level 2 and based on:
Major defect: AQL 0.65
Minor defect: AQL 1.5

Inspection condition
Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45°against perpendicular line. (Normal temperature 20~25°Cand normal humidity 60±15%RH)

Definition of Inspection Item.
Definition of inspection zone in LCD.



Zone A: character/Digit area
Zone B: viewing area except Zone A (Zone A + Zone B=minimum Viewing area)
Zone C: Outside viewing area (invisible area after assembly in customer's product)

Fig.1 Inspection zones in an LCD
Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.

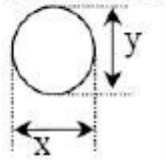
Definition of some visual defect

Bright dot	Because of losing all or part function, bad pixel dots appear bright and the size is more than 50% of one dot in which LCD panel is displaying under black pattern.
Dark dot	Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture, or pure whiter picture.

Major Defect

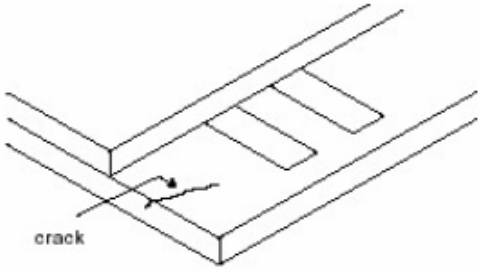
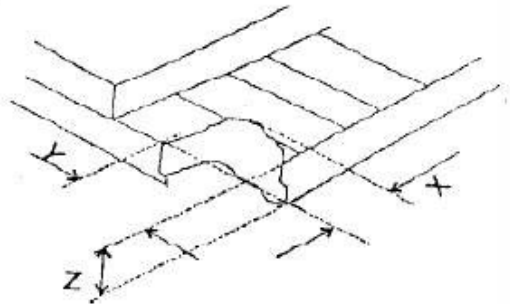
Item No.	**Items to be inspected**	**Inspection standard**	**Classification of defects**
1	Functional defects	1) No display 2) Display abnormally 3) Missing vertical, horizontal segment 4) Short circuit 5) Excess power consumption 6)Backlight no lighting, flickering and abnormal lighting	major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	

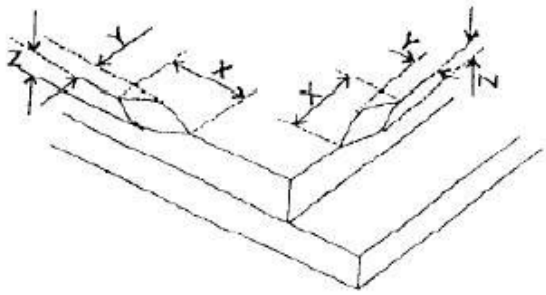
Minor Defect

<table>
<tr><th>Item No.</th><th>Items to be inspected</th><th>Inspection standard</th><th>Classification of defects</th></tr>
<tr><td>1</td><td>Bright dot /dark dot defect</td><td>
<table>
<tr><td rowspan="2">Zone</td><td colspan="3">Acceptable Qty</td><td rowspan="2"></td></tr>
<tr><td colspan="3">A+B</td></tr>
<tr><td></td><td>3.5" ~ 7"</td><td>7~10.1"</td><td>>10.1"</td><td>C</td></tr>
<tr><td>Bright pixel dot</td><td>1</td><td>2</td><td>3</td><td rowspan="5">Acceptable</td></tr>
<tr><td>Dark pixel dot</td><td>4</td><td>4</td><td>4</td></tr>
<tr><td>2bright dots adjacent</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>2dark dots adjacent</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total bright and dark dots</td><td>5</td><td>6</td><td>7</td></tr>
</table>
Note: Minimum distance between defective dots is more than 5mm; Pixel dots' function is normal, but bright dots caused by foreign material and other reasons are judged by the dot defect of 5.2.
</td><td>Minor</td></tr>
<tr><td>2</td><td>Dot defect
 

Φ=(x+y) /2</td><td>
<table>
<tr><td rowspan="2">Zone
Size(mm)</td><td colspan="3">Acceptable Qty</td><td rowspan="2"></td></tr>
<tr><td colspan="3">A+B</td></tr>
<tr><td></td><td>3.5"~7"</td><td>7~10.1"</td><td>>10.1"</td><td>C</td></tr>
<tr><td>Φ≤0.2</td><td>Acceptable</td><td>Acceptable</td><td>Acceptable</td><td rowspan="3">Acceptable</td></tr>
<tr><td>0.2<Φ≤0.5</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>Φ>0.5</td><td>0</td><td>0</td><td>0</td></tr>
</table>
Note:
1. Minimum distance between defective dots is more than 5 mm;
2. The quantity of defect is zero in operating condition.
</td><td>Minor</td></tr>
<tr><td>3</td><td>Linear defect</td><td>
<table>
<tr><td colspan="2" rowspan="2">Zone
Size (mm)</td><td colspan="3">Acceptable Qty</td><td rowspan="2"></td></tr>
<tr><td colspan="3">A+B</td></tr>
<tr><td>Length</td><td>Width</td><td>3.5"~7"</td><td>7~10.1"</td><td>>10.1"</td><td>C</td></tr>
<tr><td>Ignore</td><td>W≤0.05</td><td>Acceptable</td><td>Acceptable</td><td>Acceptable</td><td rowspan="3">Acceptable</td></tr>
<tr><td>L≤5.0</td><td>0.05< W≤0.1</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>L>5.0</td><td>W>0.1</td><td>0</td><td>0</td><td>0</td></tr>
</table>
</td><td>Minor</td></tr>
</table>

<table>
<tr>
<td>4</td>
<td>Polarizer defect</td>
<td>
5.4.1 Polarizer Position
(i) Shifting in position should not exceed the glass outline dimension.
(ii) Incomplete covering of the viewing area due to shifting is not allowed.
5.4.2 Dirt on polarizer
Dirt which can be wiped easily should be acceptable.
5.4.3 Polarizer Dent & Air bubble
<table>
<tr><td rowspan="2">Zone
Size(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td colspan="3">A+B</td><td>C</td></tr>
<tr><td>Φ≤0.2</td><td>Acceptable</td><td>Acceptable</td><td>Acceptable</td><td rowspan="3">Acceptable</td></tr>
<tr><td>0.2＜Φ≤0.5</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>Φ＞0.5</td><td>0</td><td>0</td><td>0</td></tr>
</table>
5.4.4 Polarizer scratch
(i) If the polarizer scratch can be seen after cover assembling or in the operating condition, judge by the linear defect of 5.3.
(ii)If the polarizer scratch can be seen only in non-operating condition or some special angle, judge by the following:
<table>
<tr><td colspan="2" rowspan="2">Zone
Size (mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td colspan="3">A+B</td><td rowspan="2">C</td></tr>
<tr><td>Length</td><td>Width</td><td>3.5"～7"</td><td>7～10.1"</td><td>＞10.1"</td></tr>
<tr><td>Ignore</td><td>W≤0.05</td><td>Acceptable</td><td>Acceptable</td><td>Acceptable</td><td rowspan="3">Acceptable</td></tr>
<tr><td>1.0＜L≤5.0</td><td>0.05＜W≤0.20</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>L＞5.0</td><td>W＞0.2</td><td>0</td><td>0</td><td>0</td></tr>
</table>
</td>
<td>Minor</td>
</tr>
<tr>
<td rowspan="2">5</td>
<td>MURA</td>
<td>Using 3% ND filter, it's NG if it can be seen in R,G,B picture.</td>
<td rowspan="2">Minor</td>
</tr>
<tr>
<td>White/Black dot（MURA）</td>
<td>Visible under：ND3%：D≦0.15mm, Acceptable：
0.15mm＜D≦0.5mm, N≦4：D＞0.5mm, Not allowable.</td>
</tr>
</table>

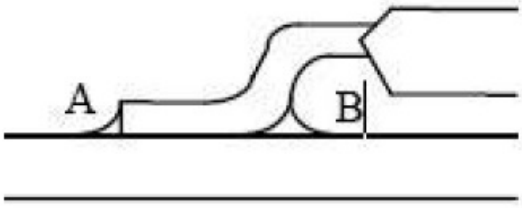
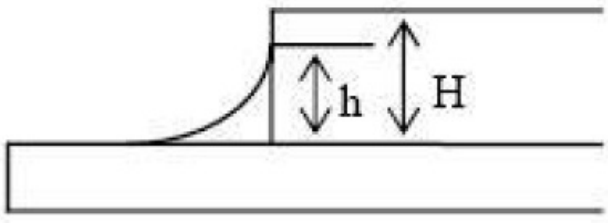
<table>
<tr>
<td rowspan="3">6</td>
<td rowspan="3">Glass defect</td>
<td>(i) Crack
Cracks are not allowed.
 
</td>
<td>Minor</td>
</tr>
<tr>
<td>(ii) TFT chips on corner
 

<table>
<tr><th>X</th><th>Y</th><th>Z</th><th>Acceptable</th></tr>
<tr><td>≤3.0</td><td>≤3.0</td><td>Not more than the thickness of glass</td><td>N≤3</td></tr>
</table>
Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.</td>
<td>Minor</td>
</tr>
<tr>
<td>(iii) Usual surface crack
 

<table>
<tr><th>X</th><th>Y</th><th>Z</th><th>Acceptable</th></tr>
<tr><td>≤1.5</td><td>≤1.5</td><td>Not more than the thickness of glass</td><td>N≤4</td></tr>
</table>
It is only applicable to the upper glass of LCD.</td>
<td>Minor</td>
</tr>
</table>

Module Cosmetic Criteria

Item No.	Items to be inspected	Inspection Standard	Classification of defects
1	Difference in Spec.	Not allowable	Major
2	Pattern peeling	No substrate pattern peeling and floating	Major
3	Soldering defects	No soldering missing	Major
		No soldering bridge	Major

		No cold soldering	Minor
4	Resist flaw on PC B	Visible copper foil (Φ0.5 mm or more) on substrate pattern is not allowed	Minor
5	FPC gold finger	No dirt, breaking, oxidation lead to black	Major
6	Backlight plastic frame	No deformation, crack, breaking, backlight positioning colum n breaking, obvious nick.	Minor
7	Marking printing effect	No dark marking, incomplete, deformation lead to unable to j udge	Minor
8	Accretion of metalli c Foreign matter	No accretion of metallic foreign matter (Not exceed Φ0.2mm)	Minor
9	Stain	No stain to spoil cosmetic badly	Minor
10	Plate discoloring	No plate fading, rusting and discoloring	Minor
11	1. Lead parts	a. Soldering side of PCB Solder to form a 'Filet' all around th e lead. Solder should not hide the lead form perfectly.	Minor
		b. Components side(In case of 'Through Hole PCB') Solder t o reach the Components side of PCB.	Minor
	2. Flat packages	Either 'Toe'(A) or 'Seal'(B)of the lead to be covered by "Filet". Lead form to be assume over Solder. 	Minor
	3. Chips	(3/2) H ≥h ≥(1/2) H 	Minor
	4. Solder ball/Sold er splash	a. The spacing between solder ball and the conductor or sol der pad h ≥0.13 mm. The diameter of solder ball d≤0.15 mm.	Minor
		b. The quantity of solder balls or solder splashes isn't beyond 5 in 600 mm2.	Minor

		c. Solder balls/Solder splashes do not violate minimum electrical clearance.	Major

Documents / Resources

	Surenoo SMC0700B-800480 Series MCU Interface TFT LCD Module [pdf] User Manual SMC0700BA3-800480, SMC0700B-800480 Series, SMC0700B-800480 Series MCU Interface TFT LCD Module, MCU Interface TFT LCD Module, TFT LCD Module, LCD Module, Module

References

- Surenoo Tech: Professional LCD Module Supplier Since 2005