Specification for Approval

Customer:_____

Model Name:_____

Supplier Approval			Customer approval
R&D Designed	R&D Approved	QC Approved	
Peter	Peng Jun		

Revision Record

REV NO.	REV DATE	CONTENTS	Note
A	2025-12-19	NEW ISSUE	

Table of Contents

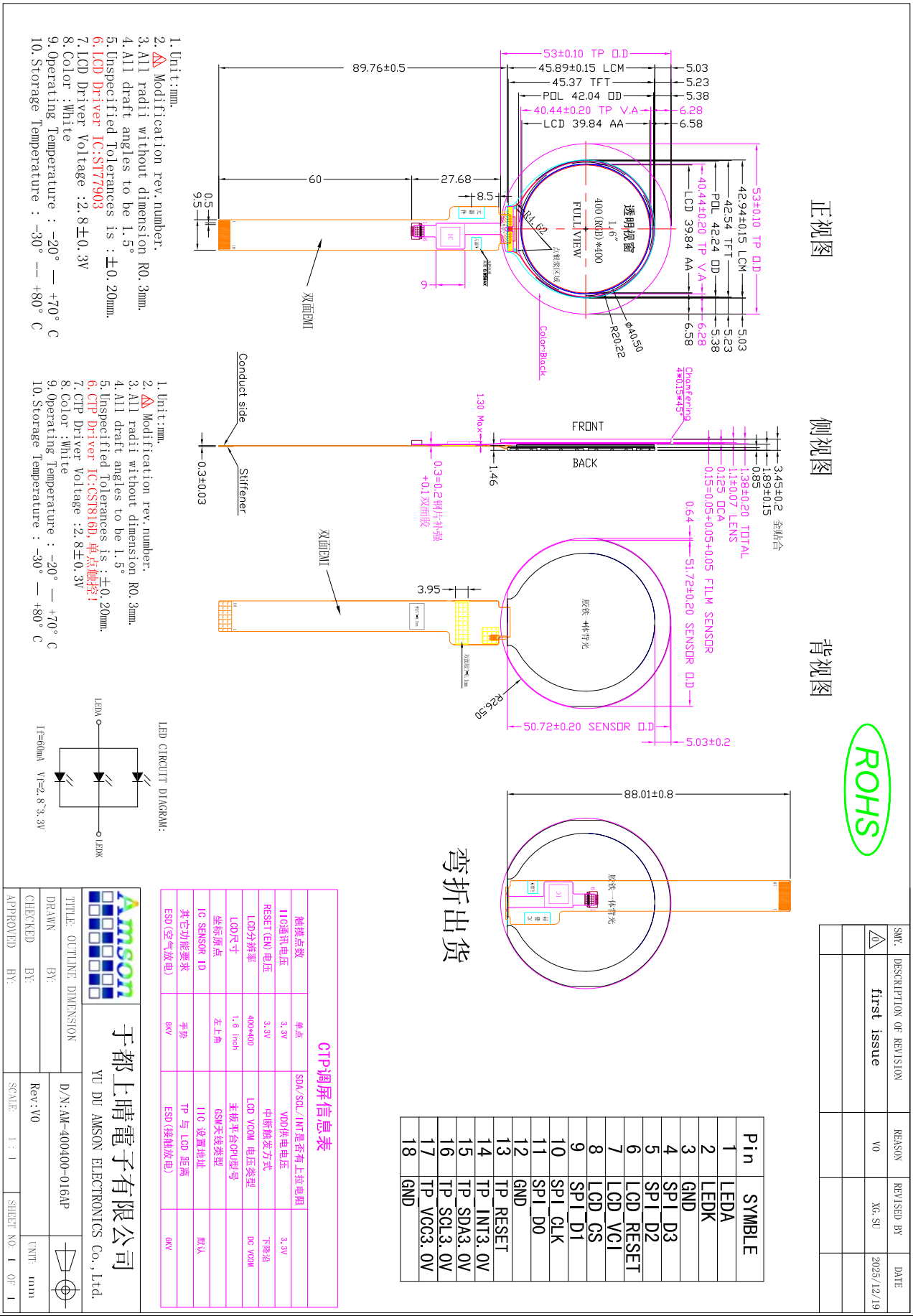
1. Scope

This specification defines general provisions as well as inspection standards for TFT module supplied by AMSON electronics.
If the event of unforeseen problem or unspecified items may occur, naturally shall negotiate and agree to solution.

2. General Information

Item	Specification	Unit
LCD size	1.6	inch
Display Mode	Normally Black	--
Resolution	400(RGB)x400	Pixel
Pixel pitch	0.0996*0.0996	mm
Pixel Arrangement	RGB Stripe	
Viewing direction	ALL	-
outline dimension	53.00(H)*53.00(V)*3.45(D)	mm
LCD AA	39.84x39.84	mm
CTP VA	40.44x40.44	-
Colors	16.7M	-
Driver IC	ST77903	--
Interface	QSPI	--
Backlight	White LED	
Touch IC	CST816D	
Surface hardness	TBD	
Touch structure	G+F	
Cover lens	GLASS	
Color	Black	--
Operating Temperature	-20℃~ +70℃	--
Storage Temperature	-30℃~ +80℃	

3. External Dimensions



4. Interface Description

PIN	Symbol	Description	Remark
1	LEDA	LED ANODE	
2	LEDK	LED CATHODE	
3	GND	ground	
4	SPI-D3	QSPI Data pin	
5	SPI-D2	QSPI Data pin	
6	LCD-RESET	This signal will reset the device and it must be applied to properly initialize the chip	
7	LCD-VCI	Power supply	
8	LCD-CS	Chip select pin. Low Enable	
9	SPI-D1	QSPI Data pin	
10	SPI-CLK	The serial input/output clock in serial interface mode	
11	SPI-D0	QSPI Data pin	
12	GND	ground	
13	TP-RESET	Touch Reset Signal	
14	TP-INT	Touch Interrupt	
15	TP-SDA	Touch IIC Data signal	
16	TP-SCL	Touch IIC Clock signal	
17	TP-VCC	Touch Power Supply	
18	GND	ground	

5. Absolute Maximum Ratings

Item	Symbol	Range	Unit
Supply Voltage (Analog)	VCI	- 0.3 ~ +4.6	V
Supply Voltage (I/O)	VDDI	- 0.3 ~ +4.6	V
Supply Voltage (Logic)	VCC	-0.3 ~ +2	V
Driver Supply Voltage	VGH-VGL	-0.3 ~ +30.0	V
Logic Input Voltage Range	VIN	0.5 ~ VDDI + 0.5	V
Logic Output Voltage Range	VO	0.5 ~ VDDI + 0.5	V

6. DC Characteristics

Parameter	Symbol	Condition	Specification			Unit	Related Pins
			MIN.	TYP.	MAX.		
Power & Operation Voltage							
System Voltage	VDD / VDDA	Operating voltage	2.6	2.75	3.3	V	-
Interface Operation Voltage	VDDI	I/O Supply Voltage	1.65	1.8	3.3	V	-
Gate Driver High Voltage	VGH	-	12.6	-	15.5	V	-
Gate Driver Low Voltage	VGL	-	-11.8	-	-8.4	V	-
Gate Driver Supply Voltage	-	| VGH-VGL |	-	-	27.3	V	-
Input / Output							
Logic-High Input Voltage	VIH	-	0.7VDDI	-	VDDI	V	Note 1
Logic-Low Input Voltage	VIL	-	VSS	-	0.3VDDI	V	Note 1
Logic-High Output Voltage	VOH	IOH = -1.0mA	0.8VDDI	-	VDDI	V	Note 1
Logic-Low Output Voltage	VOL	IOL = +1.0mA	VSS	-	0.2VDDI	V	Note 1
Logic-High Input Current	IIH	VIN = VDDI	-	-	1	uA	Note 1
Logic-Low Input Current	IIL	VIN = VSS	-1	-	-	uA	Note 1
Input Leakage Current	ILI	IOH = -1.0mA	-0.1	-	+0.1	uA	Note 1
VCOM Voltage							
VCOM Voltage	VCOM	-	-	VSS	-	V	-
Source Driver							
Gamma Reference Voltage(Positive)	VAP	-	3.6	-	6.6	V	-
Gamma Reference Voltage(Negative)	VAN	-	-4.2	-	-1.6	-	-
Source Output Settling Time	Tr	Below with 99% precision	-	-	20	us	
Output Offset Voltage	VOFFSET	-	-	-	35	mV	Note 2

7. Timing Characteristics

7.1 QSPI Interface Timing Characteristics

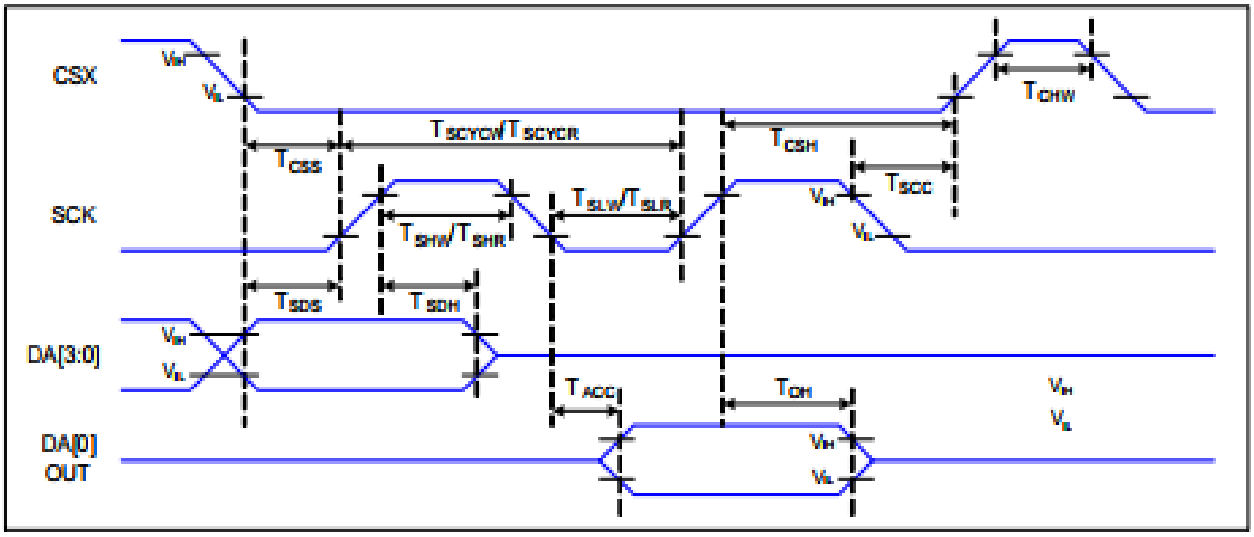
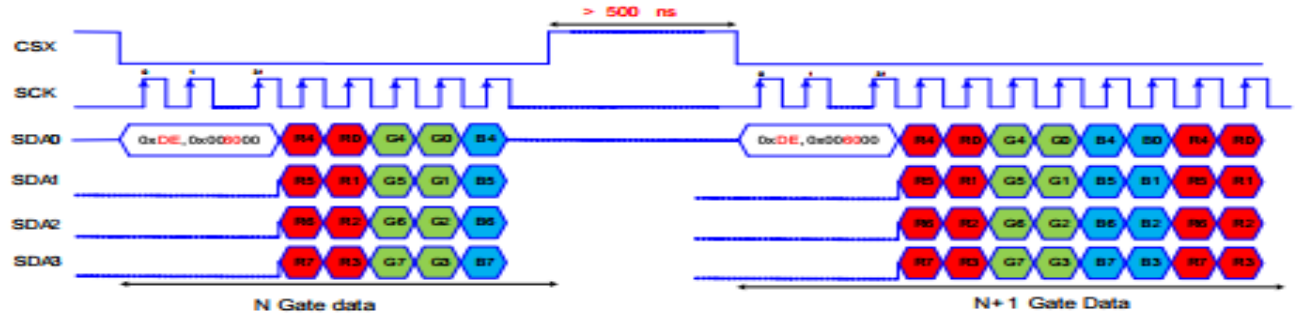


Figure 1 QSPI Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25℃

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	19		ns	
	T_{CSH}	Chip select hold time (write)	19		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
			500		ns	*Note1*
SCL	T_{SCYCW}	Serial clock cycle (Write)	16		ns	
	T_{SHW}	SCL "H" pulse width (Write)	7		ns	
	T_{SLW}	SCL "L" pulse width (Write)	7		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	7		ns	
	T_{SDH}	Data hold time	7		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	TBD	TBD	ns	For minimum CL=8pF

Note1 At display data (CMD 0x006000). When CSX go to "H", must be wait over 500ns than CSX should be returned "L" level.



Minimum line time must be > 40us ; Vsync width and Vsync porch >40us

For example: In 60Hz, 320RGBx400 resolution. Vsync width=1, Vsync front+back porch=12

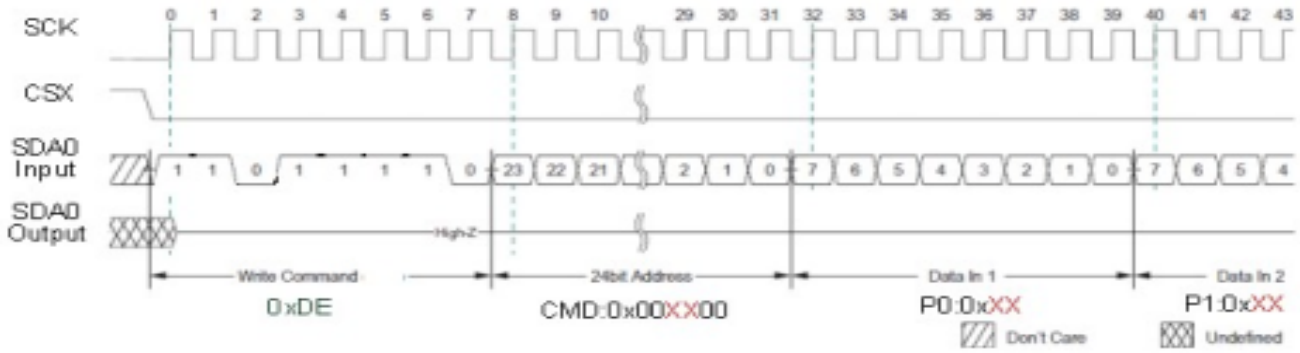
Line time= 16.67/(400+1+12)= 40.363us

This line time is fit minimum line time condition.

Pin Name	Description
SCKP	Clock signal (Max=50MHz)
DA0	Serial input data lane 0
DA1	Serial input data lane 1
DA2	Serial input data lane 2
DA3	Serial input data lane 3

Write command mode

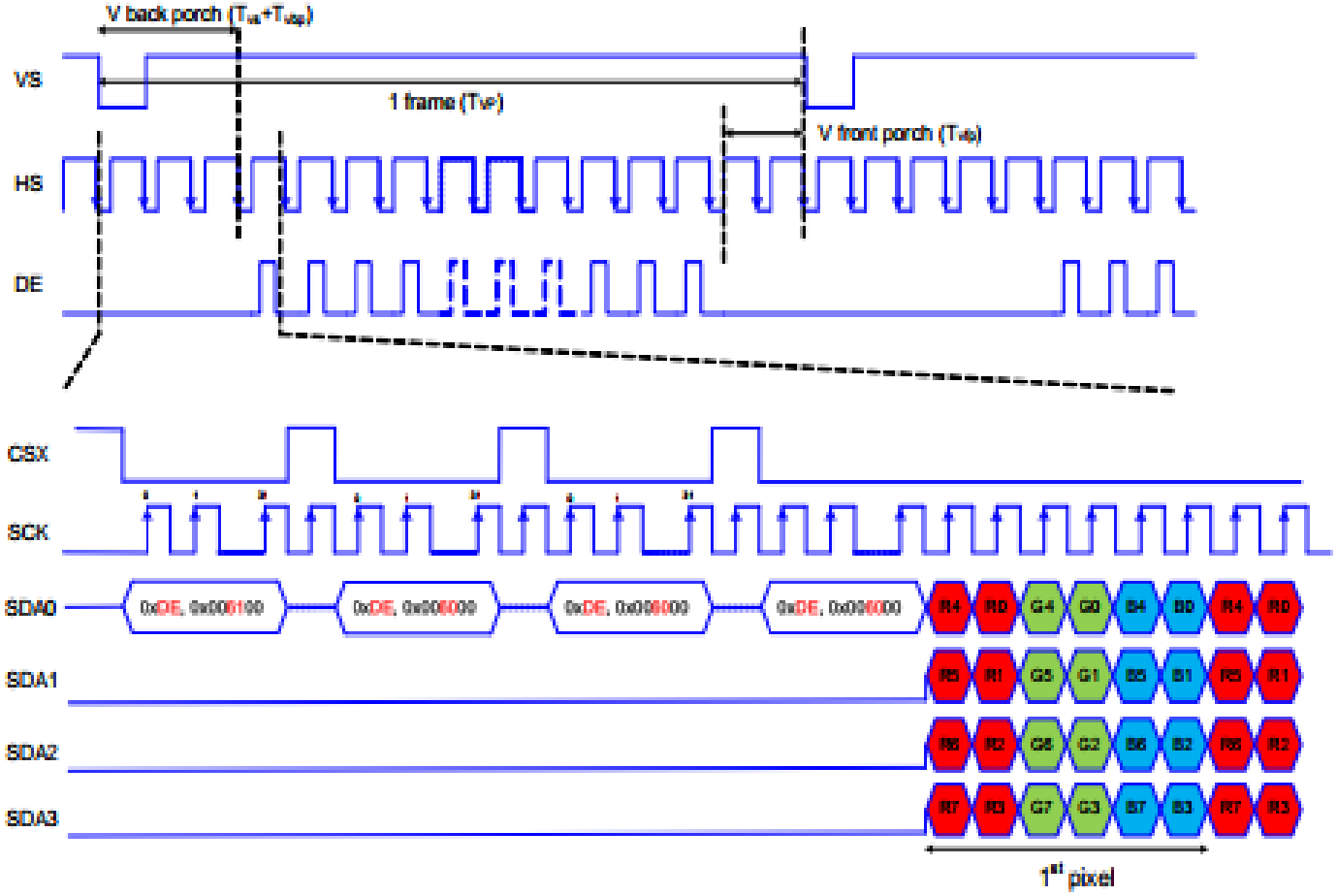
When host writes commands or parameter to ST77903, host needs to send 1 byte of write command instruction (0xDE). Then host sends 3 bytes of AD[23:0] which is composed of 1 byte of 0x00, 1 byte of command address and 1 byte of 0x00. After host sending instruction and AD[23:0], the following data is parameter (are parameters). When the last bit of parameter has been sent, CSX pin should be returned "H" level.



Write pixel data

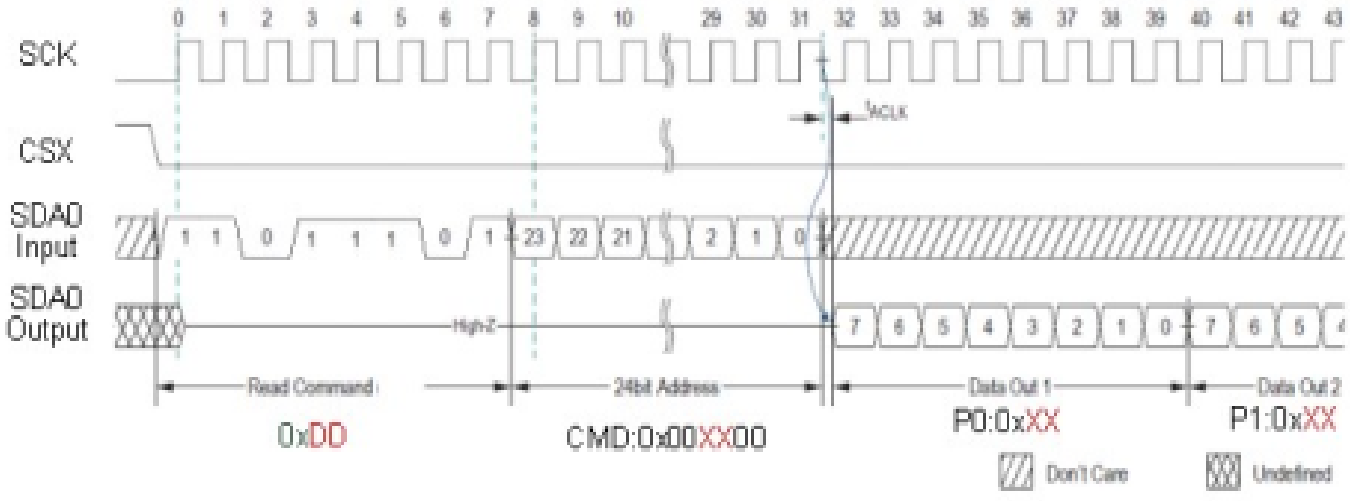
In write pixel data mode, the host sends one byte of instruction, 3 byte of AD[23:0] and pixel data. The instruction is transferred only by one lane of DA0, and data can be transferred 4 DA lanes.

The 0xDE+0x006100 must be issued at the beginning of each frame. The 0xDE+0x006000 must be issued at the beginning of each line.



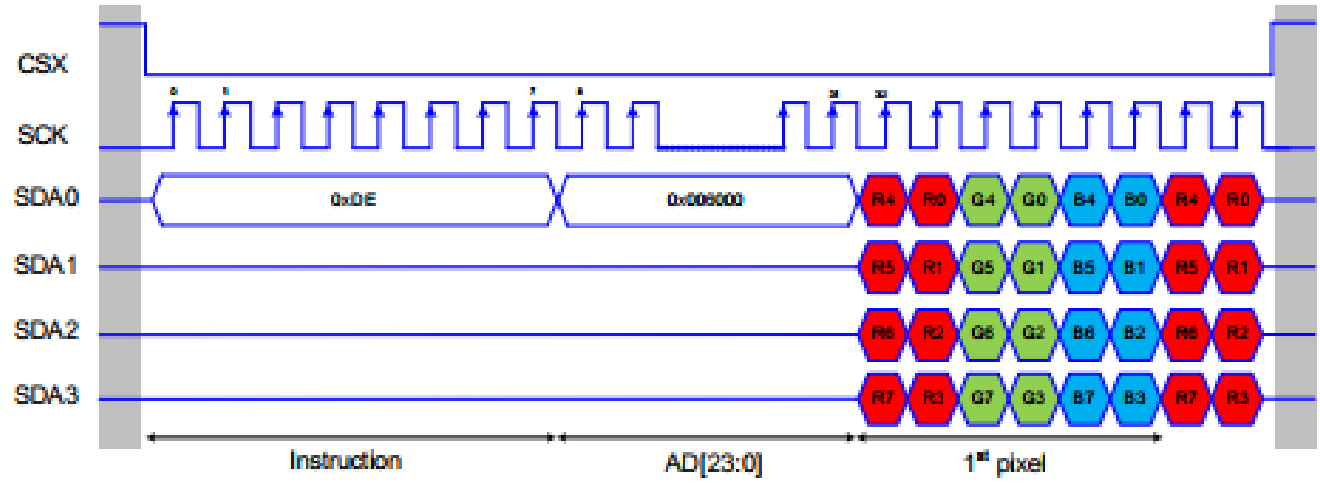
Read command mode

When host reads commands or parameter to ST77903, host needs to send 1 byte of write command instruction (0xDD). Then host sends 3 bytes of AD[23:0] which is composed of 1 byte of 0x00, 1 byte of command address and 1 byte of 0x00. After host sending read command and AD[23:0], the following output data is command address parameter (are parameters). When the last bit of parameter has been output, CSX pin should be returned "H" level.

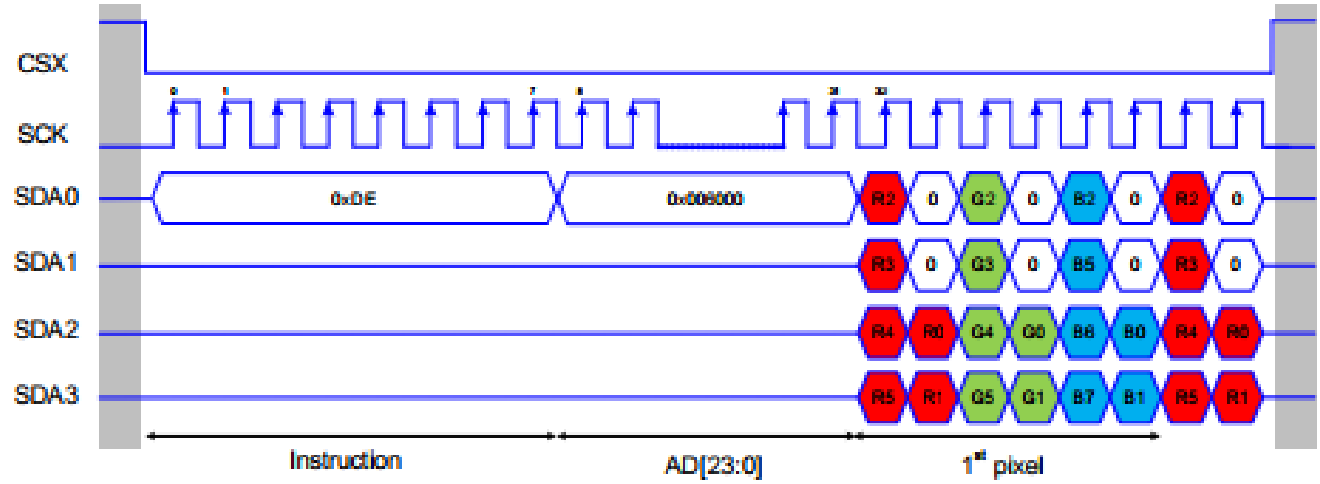


Color Format

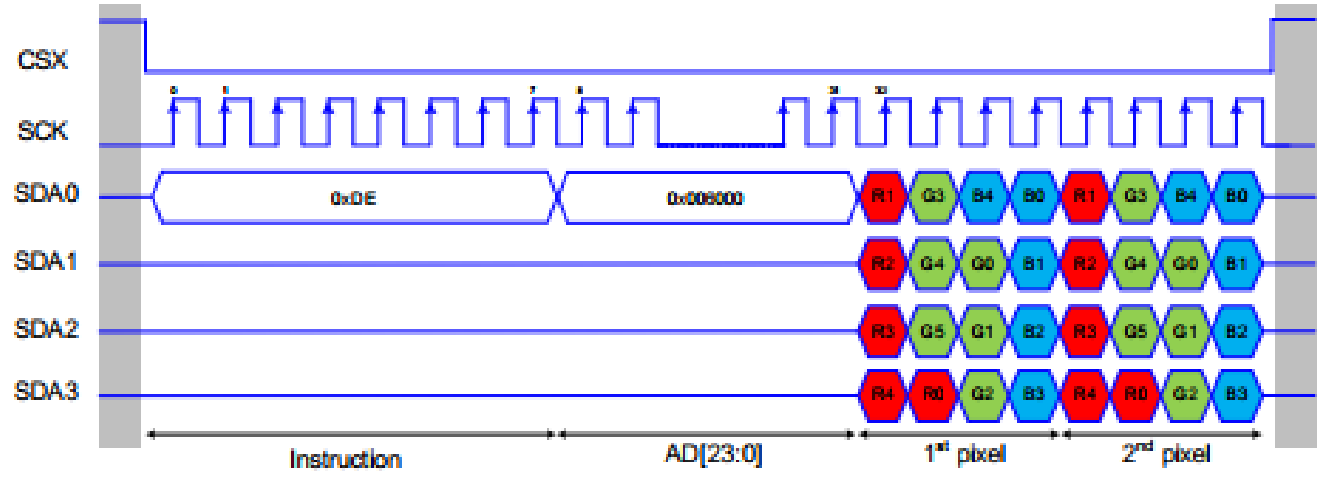
QSPI RGB888



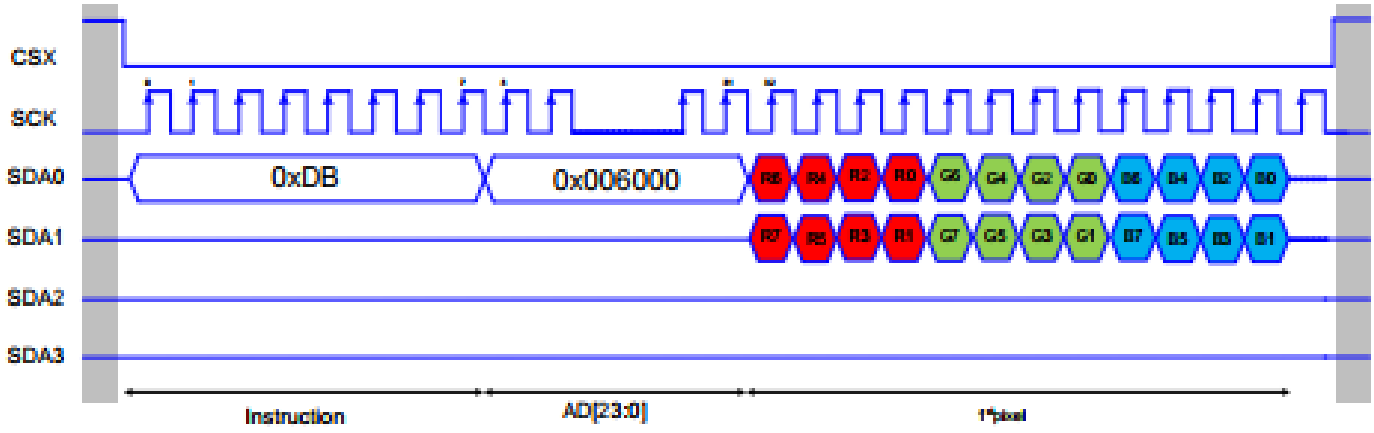
QSPI RGB666



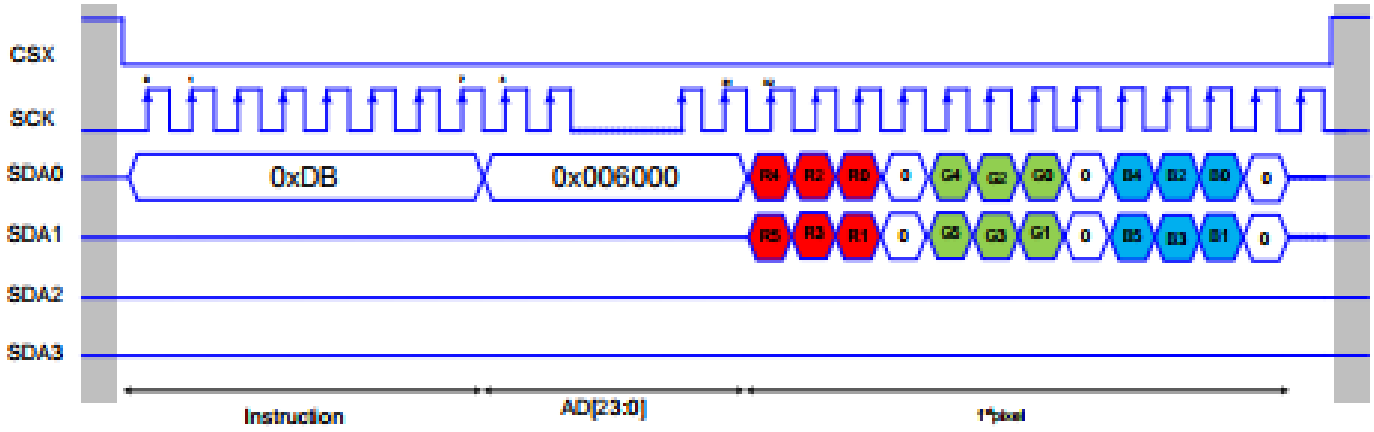
QSPI RGB565



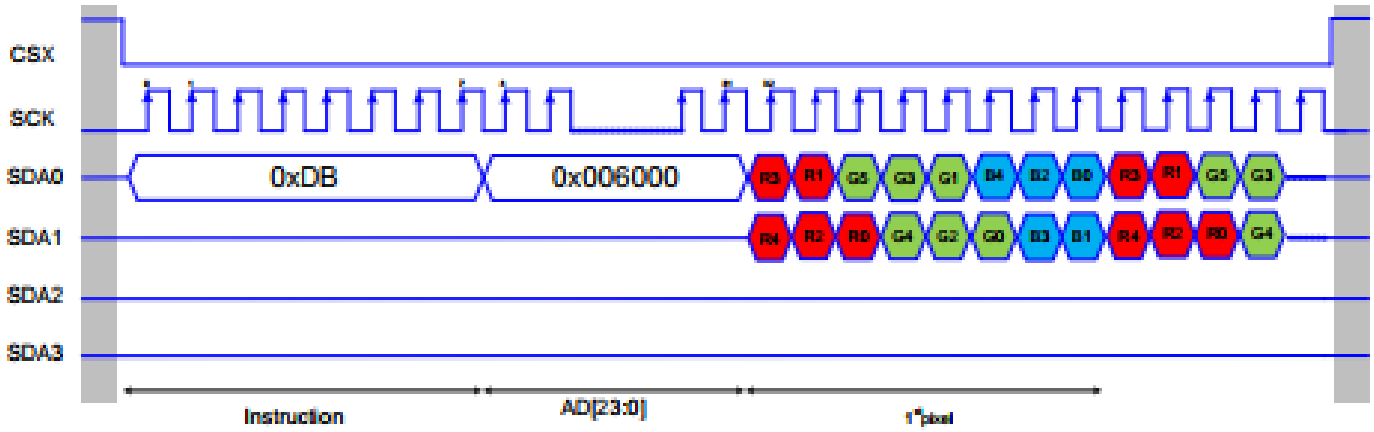
Dual-SPI, RGB888



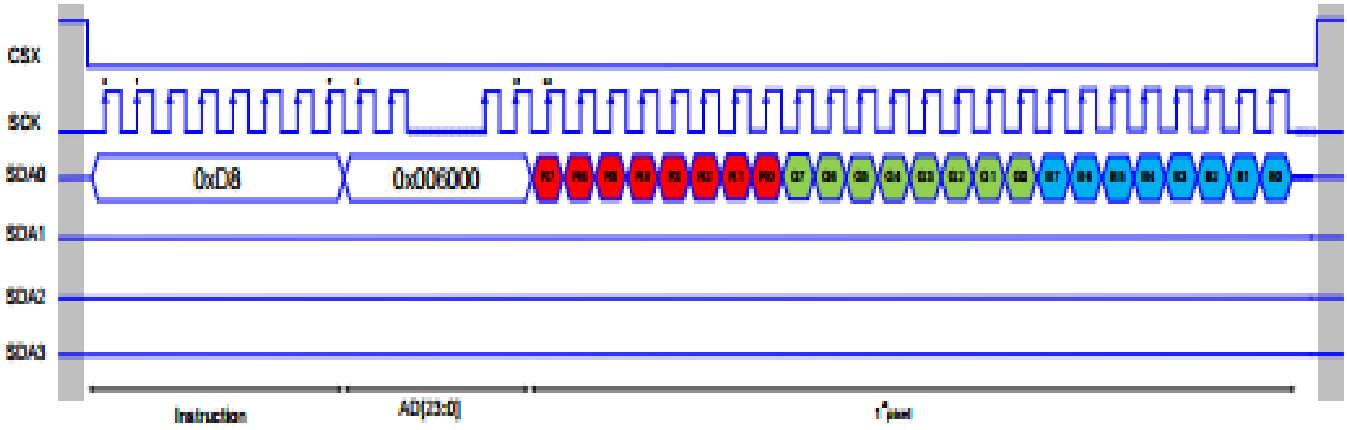
Dual-SPI, RGB666



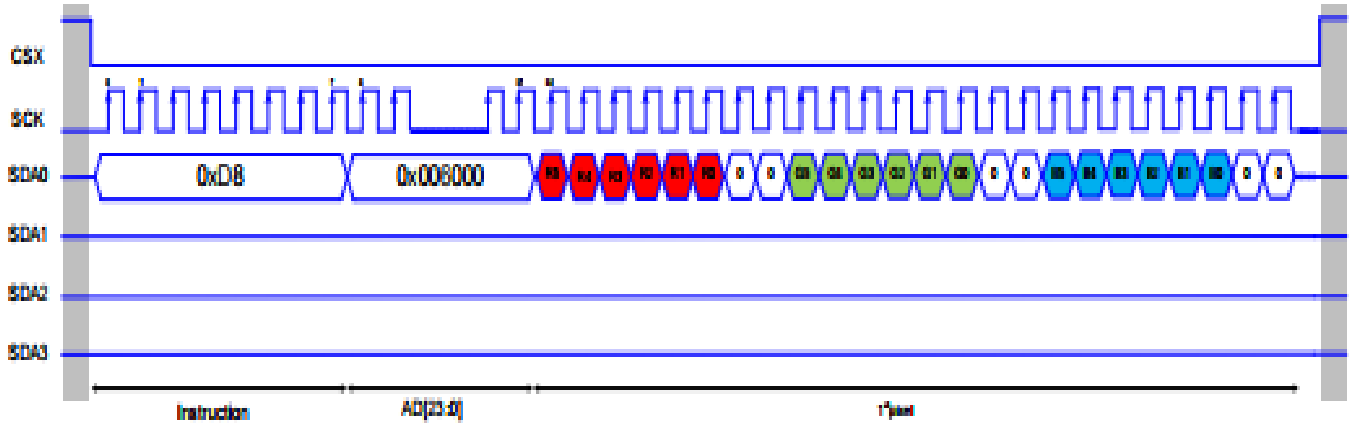
Dual-SPI, RGB565



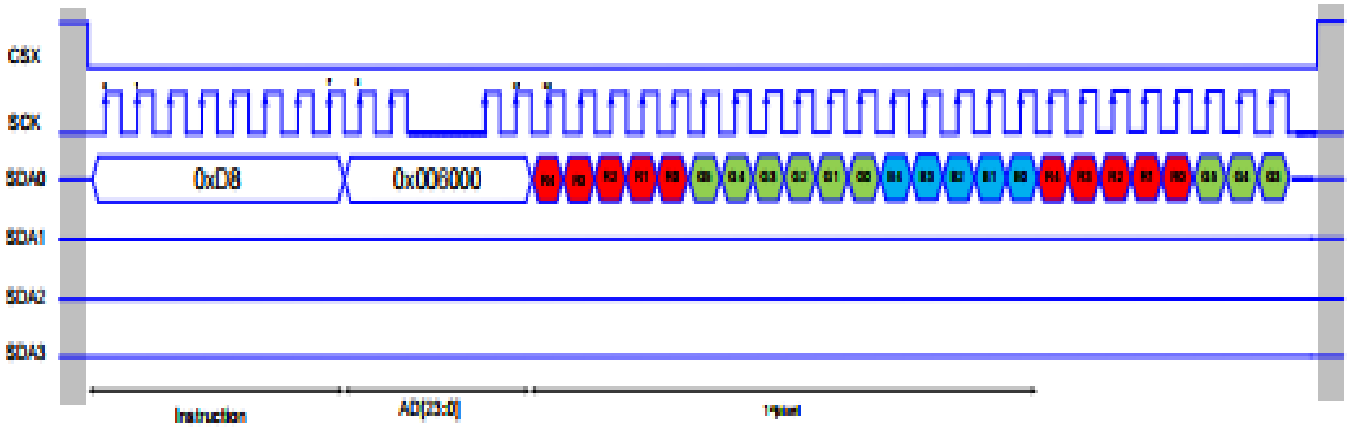
Single-SPI, RGB888



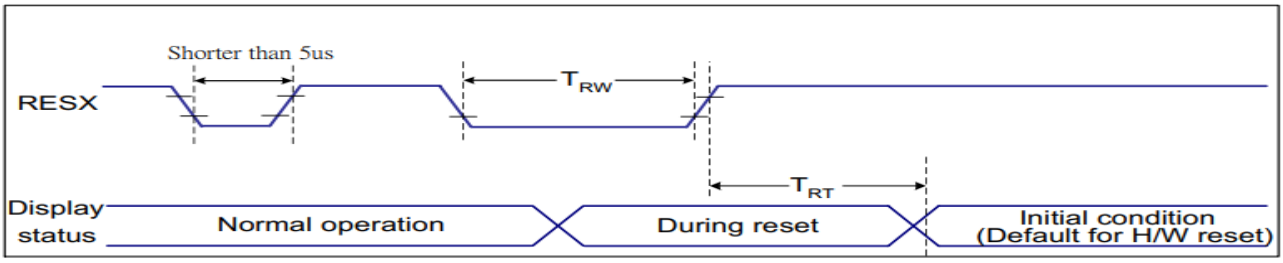
Single-SPI, RGB666



Single-SPI, RGB565



7.2 Reset Timing



VDDI=1.8V,VCI=2.8V, AGND=DGND=AGNDR=0V, Ta=25℃

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
			-	120 (Note 1, 6, 7)	ms

7.3 Power On /OFF Timing

VDDI and VCI can be applied in any order.

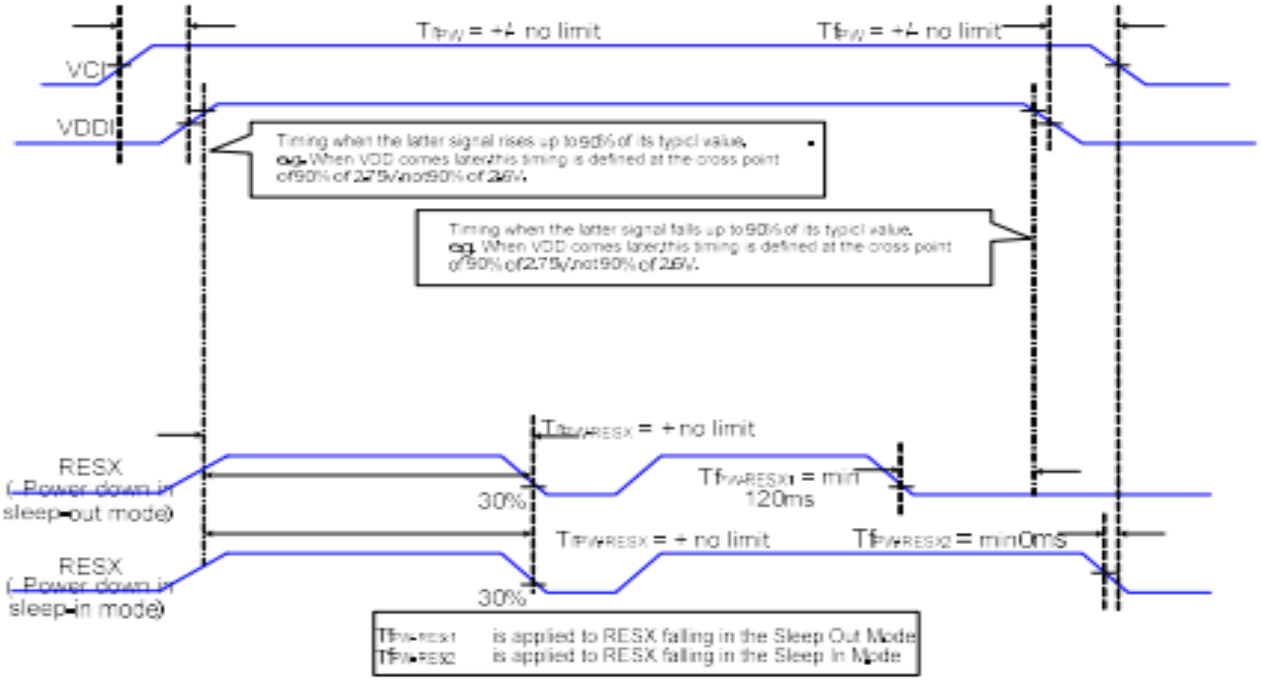
VCI and VDDI can be power down in any order.

During power off, if LCD is in the Sleep Out mode, VCI and VDDI must be powered down minimum 120msec after RESX has been released.

During power off, if LCD is in the Sleep In mode, VDDI or VCI can be powered down minimum 0msec after RESX has been released.

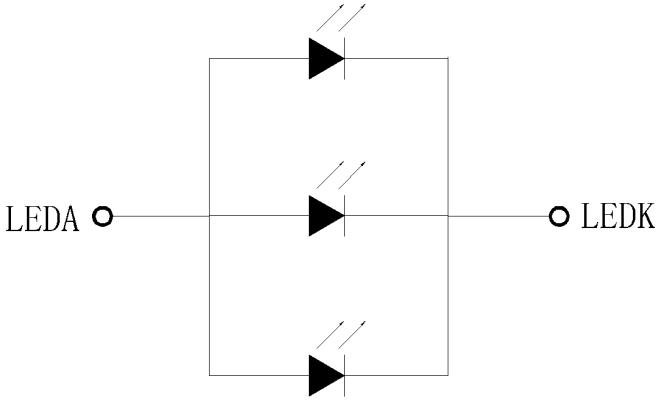
Note 1: There will be no damage to the display module if the power sequences are not met.
Note 2: There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.
Note 3: There will be no abnormal visible effects on the display between end of Power On Sequence and before receiving Sleep Out command. Also between receiving Sleep In command and Power Off Sequence.
Note 4: If RESX line is not held stable by host during Power On Sequence as defined in the sequence below, then it will be necessary to apply a Hardware Reset (RESX) after Host Power On Sequence is complete to ensure correct operation. Otherwise function is not guaranteed.

The power on/off sequence is illustrated below



8. Backlight Characteristics

LED CIRCUIT DIAGRAM:



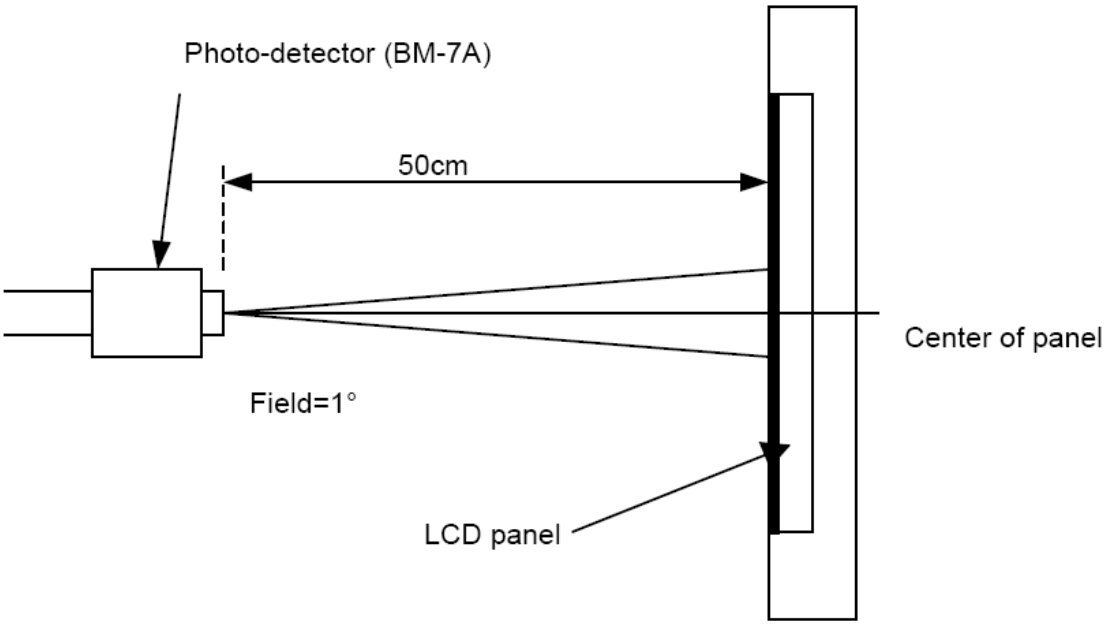
If=60mA Vf=2.8~3.3V

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	-	3.2V	-	V	If=60mA
Supply Current	If	-	60	-	mA	-
Luminous Intensity for LCM	-	250	320	-	cd/m^2	If=60mA
Life Time	-	20000	-	-	Hr	If=60mA
Backlight Color	White					

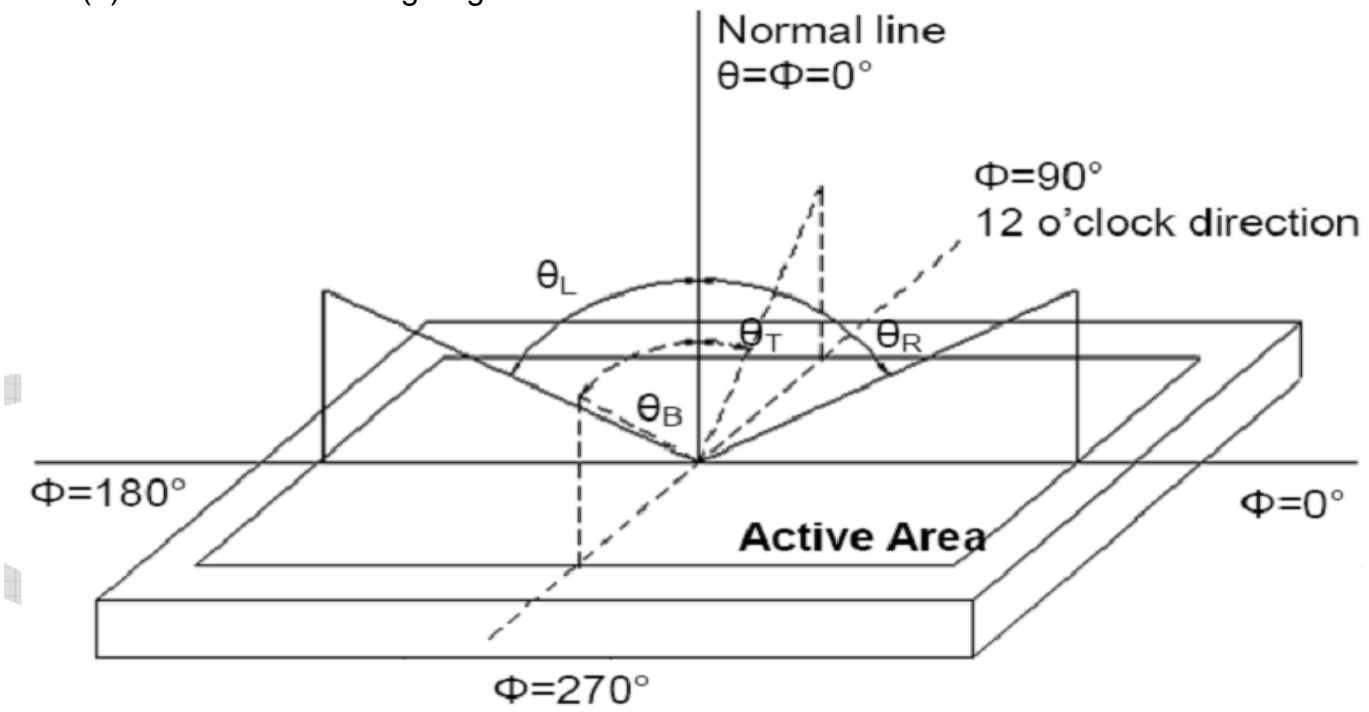
9. Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR>10)	Horizontal	θ_L	-	80	-	degree	(1),(2),(6)
		θ_R	-	80	-		
	Vertical	θ_T	-	80	-		
		θ_B	-	80	-		
Contrast Ratio	Center		640	800	-	-	(1),(3),(6)
Response Time	$T_r + T_f$		-	30	40	ms	(1),(4),(6)
NTSC ratio	%		65	70	-	-	(6)
CF Color Chromaticity (CIE1931)	Red x		Typ. -0.05	TBD	Typ. +0.05	-	(1), (6)
	Red y			TBD		-	
	Green x			TBD		-	
	Green y			TBD		-	
	Blue x			TBD		-	
	Blue y			TBD		-	
	White x			TBD		-	
	White y			TBD		-	

Note (1) Measurement Setup: The LCD module should be stabilized at given temp. 25°C for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 15 minutes in a windless room.



Note (2) Definition of Viewing Angle



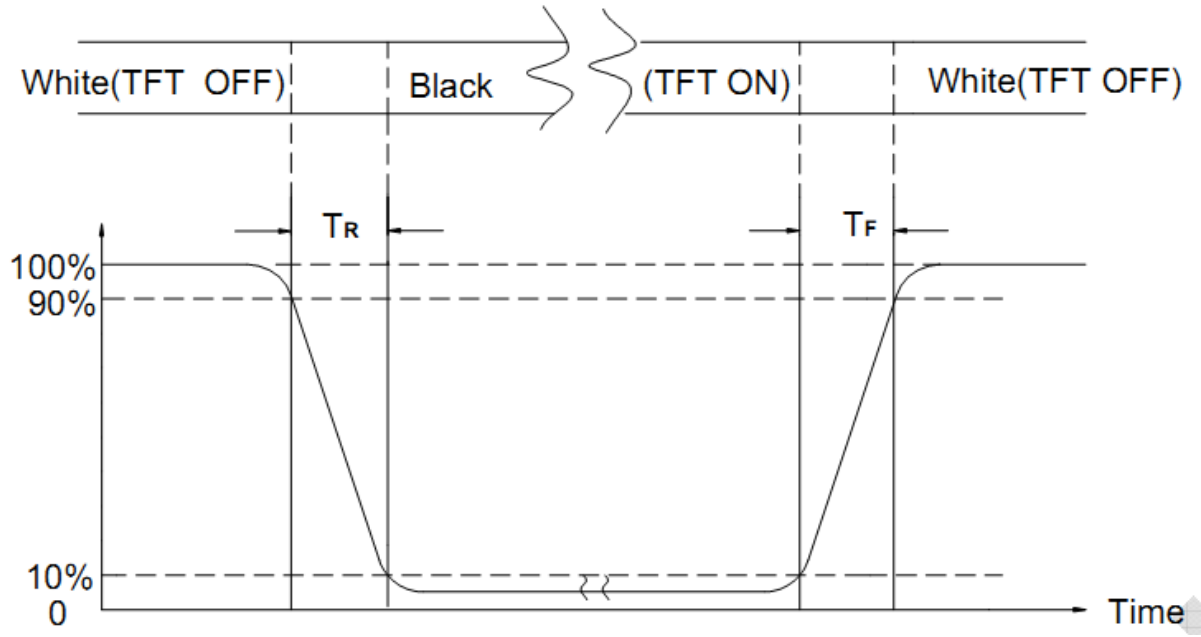
Note (3) Definition of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression

Contrast Ratio (CR) = L63 / L0

L63: Luminance of gray level 63, L0: Luminance of gray level 0

Note (4) Definition of response time



Note (5) Definition of Transmittance (Module is without signal input)

Transmittance = Center Luminance of LCD / Center Luminance of Back Light x 100%

Note (6) Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of LCD

10. Reliability Test Conditions and Methods

No.	Items	Condition	Inspection after test
1	High Temperature Storage	T = 80℃for 96 hr	Inspection after 4 hours storage at room temperature, 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; 6.Current IDD is twice higher than initial value.
2	Low Temperature Storage	T = -30℃for 69 hr	
3	High Temperature Operating	T = 70℃for 96 hr	
4	Low Temperature Operating	T = -20℃for 96 hr (But no condensation of dew)	
5	High Temp. and High Humidity Operating	T = 60℃/90% for 96 hr (But no condensation dew)	
6	Thermal Shock	-20±2℃~25~70±2℃×10cycles (30min.) (5min.) (30min.)	
7	ESD	Voltage:±2KV R: 330Ω C: 150pF Air discharge, 10time	

11. Inspection Standard

1. Inspection conditions is as follows:

(1)Viewing distance is approximately 25 ~ 30 cm
(2)Viewing angle is normal to the LCD panel as Fig _1 (45°)
(3)Ambient temperature is approximately 25 ± 5°C
(4)Ambient humidity is 60 ± 5% RH
(5)Function ambient luminance is from 300 ~ 500 Lux,
Appearance ambient luminance is from 500 ~ 800 Lux.
(6)Input signal timing should be typical value.
(7) Mura &Light leakage in View Area should be judged through ND-Filter 5% .

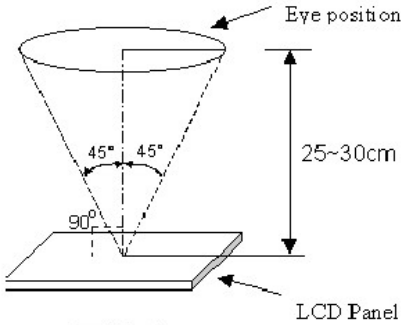


Fig _1

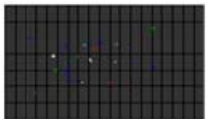
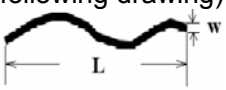
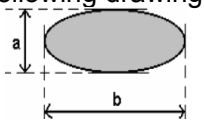
2. Test method: According to MIL-STD105E.General Inspection Level Ⅱ take a single time.

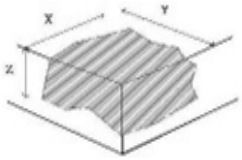
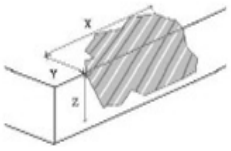
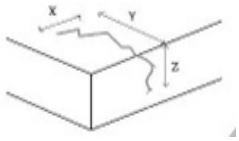
The defects classify of AQL as following:
Major defect: AQL = 0.65
Minor defect: AQL = 1.5
Total defects: AQL = 1.5
Major defects (MA): A major defect refers to a defect that may substantially degrade usability for product applications, including all functional defects (such as no display, abnormal display, open or missing segment, short circuit, missing component), outline dimension beyond the drawing, progressive defects and those affecting reliability.
Minor defects (MI): A minor defect refers to a defect which is not considered to be able to substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation, such as black spot, white spot, bright spot, pinhole, black line, white line, contrast variation, glass defect, polarizer defect, etc.

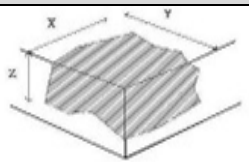
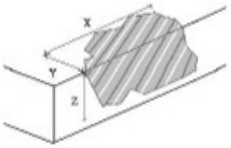
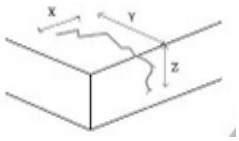
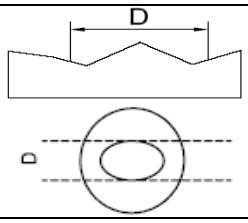
3. Non-conforming Analysis & Deal with Manners

3.1 Non- conforming Analysis:
3.1.1 Purchaser should supply the detail data of non- conforming sample and the non-conforming.
3.1.2 After accepting the detail data from purchaser, the analysis of non- conforming should be finished in two weeks.
3.1.3 If supplier cannot finish analysis on time, must announce purchaser before 3 days.
3.2 Disposition of non- conforming:
3.2.1 If find any product defect of supplier during assembly time, supplier must change the good product for every defect after recognition.
3.2.2 Both supplier and customer should analyze the reason and discuss the disposition of non-conforming when the reason of nonconforming is not sure.

4. Inspection Criteria

<table>
<tr><th>NO</th><th>Item</th><th colspan="2">Criterion</th><th>AQL</th></tr>
<tr><td>01</td><td>Electrical Testing</td><td colspan="2">1.1 Missing vertical, horizontal segment, segment contrast defect.
1.2 Missing character, dot or icon.
1.3 Display malfunction.
1.4 No function or no display.
1.5 Current consumption exceeds product specifications.
1.6 LCD viewing angle defect.
1.7 Mixed product types.
1.8 Flicker
1.9 Touch Panel：no touch, bad touch</td><td>0.65</td></tr>
<tr><td>02</td><td>Black or White spots or Bright spots or Color spots on LCD (Display only)</td><td colspan="2">2.1 White and black or color spots on display ≤ 0.25mm, no more than two spots. The distance between spots are larger than 10mm.</td><td>1.5</td></tr>
<tr><td>03</td><td>Frame Pattern</td><td colspan="2">Four border lines are fully visible in vertical view angle.</td><td>0.65</td></tr>
<tr><td>04</td><td>Mura</td><td colspan="2">Invisible through 5% ND filter or limited
(Judged by limit sample if it has been defined)</td><td>1.5</td></tr>
<tr><td>05</td><td>Tiny bright dot</td><td>  </td><td>Invisible through 5% ND filter or limited sample.
Densely spaced: more than three spots within 10mm.</td><td>1.5</td></tr>
<tr><td rowspan="2">06</td><td rowspan="2">LCD Panel black spots, white spots, contamination (non – display)</td><td>Line type: (As following drawing)
  </td><td>
<table>
<tr><th>Length(mm)</th><th>Width(mm)</th><th>Acceptable Q'ty</th></tr>
<tr><td>---</td><td>W ≤ 0.03</td><td>ignore</td></tr>
<tr><td>L ≤ 5.0</td><td>0.03 < W ≤ 0.05</td><td>2</td></tr>
<tr><td>---</td><td>0.05 < W</td><td>Rejection</td></tr>
</table>
</td><td rowspan="2">1.5</td></tr>
<tr><td>Round type: As following drawing
 
D=（a+b）/2</td><td>
<table>
<tr><th>Size(mm)</th><th>Acceptable Q'ty</th></tr>
<tr><td>D ≤ 0.10</td><td>ignore</td></tr>
<tr><td>0.10 < D ≤ 0.25</td><td>2</td></tr>
<tr><td>0.25 < D</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>07</td><td>Polarizer bubbles</td><td>If bubbles are visible, judge using black spot specifications,</td><td>
<table>
<tr><th>Size D(mm)</th><th>Acceptable Q'ty</th></tr>
<tr><td>D ≤ 0.10</td><td>Accept no dense</td></tr>
<tr><td>0.10 < D ≤ 0.20</td><td>2</td></tr>
<tr><td>0.20 < D ≤ 0.25</td><td>1</td></tr>
<tr><td>0.25 < D</td><td>0</td></tr>
</table>
</td><td>1.5</td></tr>
</table>

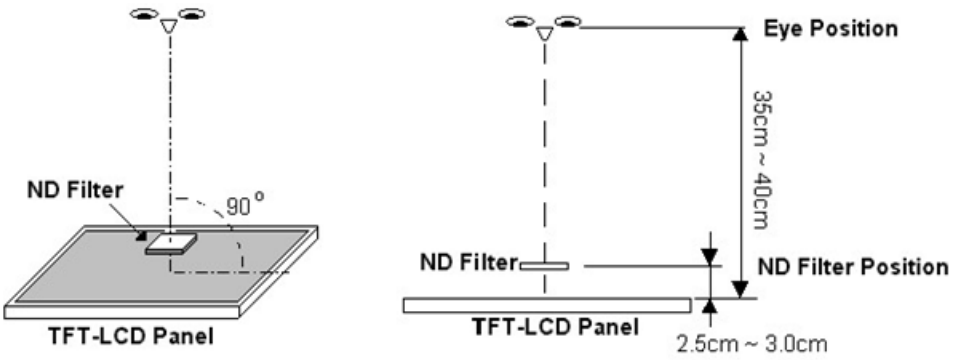
NO	Item	Criterion		AQL
08	Chipped glass	 Corner Fragment	Length X < 0.5mm Width Y < 0.5 mm Thickness Z ≦ Glass thickness (Sealant area could not be broken)	1.5
		 Side Fragment	Length X < 1.0 mm Width Y < 0.5 mm Thickness Z ≦ Glass thickness (Sealant area could not be broken)	1.5
		 Bad Crack	NOT ALLOWED	0.65
09	Backlight elements	Illumination source flickers when lit.		0.65
		Spots or scratches that appear when lit must be judged. Using LCD spot, lines and contamination standards.		1.5
		Backlight doesn't light or color is wrong		0.65
		Light leak	View Area: Invisible through 5% ND filter or limited sample. Outside of View Area: ignore	1.5
10	Bezel	Bezel must comply with product specifications.		0.65
11	FPC	FPC terminal damage ≦ 1/2 FPC terminal width and can not affect the function, we judge accept.		1.5
		FPC alignment hole damage ≦ 1/2 alignment area and can not affect the function, we judge accept.		0.65
12	Soldering	No cold solder joints, missing solder connections, oxidation or icicle.		1.5
		No short circuits in components on FPC		0.65

<table>
<tr><th>No</th><th>Item</th><th colspan="2">Description</th><th>AQL</th></tr>
<tr><td rowspan="3">13</td><td rowspan="3">Touch Panel
Chipped glass</td><td> 
Corner Fragment</td><td>Length X ＜ 0.5mm
Width Y ＜ 0.5 mm
Thickness Z ≦ Glass thickness
(Sealant area could not be broken)</td><td>1.5</td></tr>
<tr><td> 
Side Fragment</td><td>Length X ＜ 1.0 mm
Width Y ＜ 0.5 mm
Thickness Z ≦ Glass thickness
(Sealant area could not be broken)</td><td>1.5</td></tr>
<tr><td> 
Bad Crack</td><td>NOT ALLOWED</td><td>0.65</td></tr>
<tr><td>14</td><td>Touch Panel(Fish eye、dent、bubble on film and off the paint)</td><td colspan="2"> 
<table>
<tr><th>Size(mm)</th><th>Acceptable Q'ty</th></tr>
<tr><td>D ≦ 0.15</td><td>Accept no dense</td></tr>
<tr><td>0.15 ＜ D ≦ 0.25</td><td>2</td></tr>
<tr><td>0.25 ＜ D</td><td>0</td></tr>
</table></td><td>1.5</td></tr>
<tr><td>15</td><td>Touch Panel
Newton ring</td><td colspan="2">Newton ring dimension ≦ 1/2 touch panel area and not affect font and line distortion (≦2.5%), it is acceptable.</td><td>1.5</td></tr>
<tr><td>16</td><td>General appearance</td><td colspan="2">13.1 Pin type must match type in specification sheet.
13.2 LCD pin loose or missing pins.
13.3 Product packaging must the same as specified on packaging specification sheet.
13.4 Product dimension and structure must conform to product specification sheet.</td><td>0.65</td></tr>
</table>

[Note1] The definition of Bright dot

(1)The defective area of the dot is larger than 50% of one sub-pixel area.

(2)The bright dot shall be visible under ND-Filter 5%as following.



5. PRECAUTIONS FOR USING LCD MODULES

5.1 Handing Precautions

5.1.1 The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

5.1.2 If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

5.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

5.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on it. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming in to contact with room temperature air.

5.1.5 If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

5.1.6 Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contact with oil and fats.

5.1.7 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.

5.1.8 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.

5.1.9 Do not attempt to disassemble or process the LCD module.

5.1.10 NC terminal should be open. Do not connect anything.

5.1.11 If the logic circuit power is off, do not apply the input signals.

5.1.12 Electro-Static Discharge Control，Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

(1) Before removing LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.

(2) Tools required for assembling, such as soldering irons, must be properly grounded. Make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much

as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

(3) To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dry. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.

(4)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.

5.1.13 Since LCM has been assembled and adjusted with a high degree of precision; avoid applying excessive shocks to the module or making any alterations or modifications to it.

(1) Do not alter, modify or change the shape of the tab on the metal frame.

(2) Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

(3) Do not damage or modify the pattern writing on the printed circuit board.

(4)Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.

(5)Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

(6) Do not drop, bend or twist the LCM

5.2 Handling precaution for LCM

5.2.1 LCM is easy to be damaged. Please note below and be careful for handling.

5.2.2 Correct handling:

As above picture, please handle with anti-static gloves around LCM edges.

Please don’t touch IC directly.

Please don’t stack LCM.

Please don’t hold the surface of panel such as FPC cable.

Please don’t stretch interface of output,

Please don't hold the surface of IC.

Please don't operate with sharp stick such as pens.

5.3 Storage Precautions

5.3.1 When storing the LCD modules, the following precaution are necessary.
5.3.1.1 Store them in a sealed polyethylene bag. If properly sealed, there is no need for the
5.3.1.2 Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C, and keep the relative humidity between 40%RH and 60%RH.
5.3.1.3 The polarizer surface should not come in contact with any other objects (We advise you to store them in the anti-static electricity container in which they were shipped).
5.3.2 Transportation Precautions
5.3.2.1 During shipment, please handle with care. The packaging bag cannot be broken, step on trap. Packaging Carton layer height cannot be over two meters.
5.3.2.2 The transportation process should pay attention to the waterproof and moisture-proof measures. Product cannot be watering. Ethylene sealed bags cannot be unsealed.
5.3.3 Others
5.3.3.1 Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.
5.3.3.2 If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability. Please do not use in one picture for a long time; If fixed for a long time, an unrecoverable ghost images will appear.
5.3.4 Precautions for Operation
5.3.4.1 Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.
5.3.4.2 It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
5.3.4.3 Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operating temperature.
5.3.4.4 If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
5.3.4.5 A slight dews depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature, 50%RH or less is required.
5.3.4.6 Input logic voltage before apply analog high voltage such as LCD driving voltage when power on. Remove analog high voltage before logic voltage when power off the module. Input each signal after the positive/negative voltage becomes stable.

5.3.4.7 Please keep the temperature within the specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.
5.3.4.8 It is easy to cause image sticking while displaying the same pattern for very long time.

5.4 Safety
5.4.1 It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
5.4.2 If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

5.5 Limited Warranty
Unless agreed between AMSON and the customer, AMSON will replace or repair any of its LCD modules and Touch Panel which are found to be functionally defective when inspected in accordance with AMSON LCD acceptance standards (copies available upon request) for a period of one year from date of production.
Cosmetic/visual defects must be returned to AMSON within 90 days of shipment. Confirmation of such date shall be based on data code on product. The warranty liability of AMSON limited to repair and/or replace on the terms set forth above. AMSON will not be responsible for any subsequent or consequential events.

5.6 Return LCM under warranty
5.6.1 No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are:
5.6.1.1 - Broken LCD glass and Touch Panel Chipped glass.
5.6.1.2- FPC eyelet is damaged or modified
5.6.1.3- FPC conductors damaged.
5.6.1.4- Circuit modified in any way, including addition of components.
5.6.1.5- FPC tampered with by grinding, engraving or painting varnish.
5.6.1.6- Soldering to or modifying the bezel in any manner.

6. Agreement items
Both sides should discuss together when the following problems happen.
6.1 There is any problem of standard of quality assurance, and both sides should think that must be modified.
6.2 There is any argument item which does not record in the standard of quality assurance.
6.3 Any other special problem.

12. Packing Method
TBD