Part Name	TFT Display Module
SWI Part ID	IE-S-0908CV04R18-C0-1
Customer Part ID	

PRODUCT SPECIFICATION

Version: 1.0

Approved By	Prepared By	Customer Approval
Yang D 	Luis Liu	

CONTENTS

REVISION RECORD 修订记录

DATE	CONTENTS	REVISION	PREPARED BY
2022-03-18	First Release	V1.0	Luis Liu

1) GENERAL DATA

1.1. TFT Data TFT

NO.	ITEM	SPECIFICATIONS	UNIT
1	Display Mode	TFT	-
2	Diagonal Size	3.5	Inch
3	Resolution	320(RGB)x480	Dots
4	Active Area	48.96(H) x 73.44(V)	mm
5	TFT Dimension	52.36(H) x 80.42(V)	mm
6	Thickness	2.0 Max	mm
7	Pixel Pitch	0.153x0.153	mm
8	Pixel Size	0.153x0.153	mm
9	Display Driver IC	ST7796S	-
10	Viewing Direction	All View	O'Clock
11	Display Color	262K	-
12	Gray Scale	8	Bit
13	Brightness	TBD (Typ.)	cd /m2
14	Contrast Ratio	TBD (Typ.)	-
15	Interface	SPI+18 Bit RGB	-
16	IC Package Type IC	COG	-
17	Module Connecting Type	Connector (Pitch: 0.5mm)	-
18	Weight	TBD±10%	g
19	Pins	40	Pins
20	Operating Temperature	-20~70	℃
21	Storage Temperature	-30~80	℃

1.2. TP Data TP

NO.	ITEM	SPECIFICATIONS	UNIT
1	Outline Dimension	54.5(H) x 83(V)	mm
2	Active Area	49.66(H) x74.14(V)	mm
3	Total Thickness(TFT+TP)	3.43±0.2	mm
4	Touch Driver IC	FT6336U	-
5	Interface	I2C	-
6	Structure	G+G	-
7	Connecting Type	Connector (Pitch: 0.5mm)	-
8	Cover Material	AGC (旭硝子)	-
9	Surface Hardness	≧6H	-
10	Light transmittance	≧83%	-
11	Working environment	-20~70	℃
12	Storage environment	-30~80	℃

2) ABSOLUTE MAXIMUM RATINGS

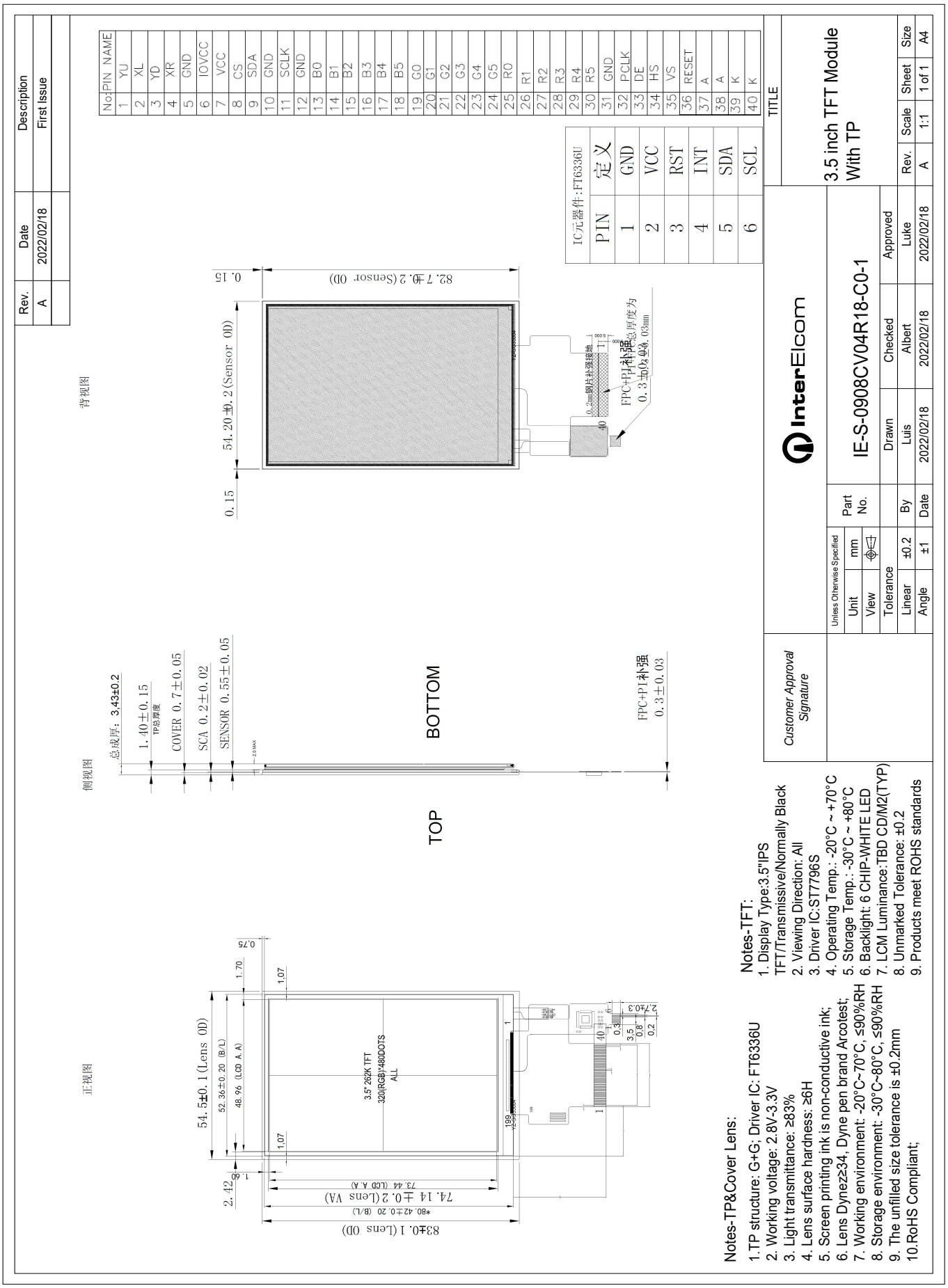
Unless otherwise specified, VSS = 0V (Ta=25℃)

Items	Min.	Max.	Unit	Remark
Analog Supply Voltage (VCC)	-0.3	+4.6	V	
I/O Supply Voltage (IOVCC)	-0.3	+4.6	V	
Input Voltage (VIN)	-0.3	IOVCC+0.3	V	
Operating Temperature (T_{OP})	-20	70	℃	
Storage Temperature (T_{ST})	-30	80	℃	
Humidity (RH)	-	90	%	

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.

3) EXTERNAL DIMENSIONS



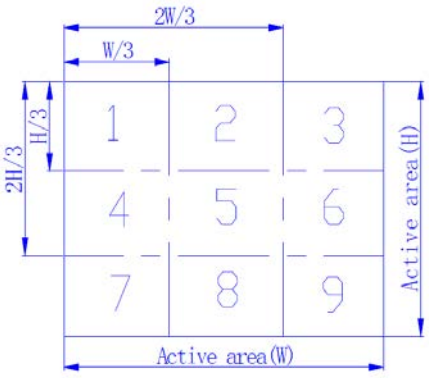
4) ELECTRICAL CHARACTERISTICS

4.1. Backlight Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Voltage for LED backlight	VLED	3.0	3.2	3.3	V	-
Current for LED backlight	ILED	-	120	-	mA	-
Power Consumption	Pbl	-	384	-	mW	1
Brightness	Lbr	-	TBD	-	cd/m2	2
LED Life time	-	20000	-	-	hr	3
Number of LED	-	6			Pic	-
Connection mode	S/P	P			-	-

Note ：

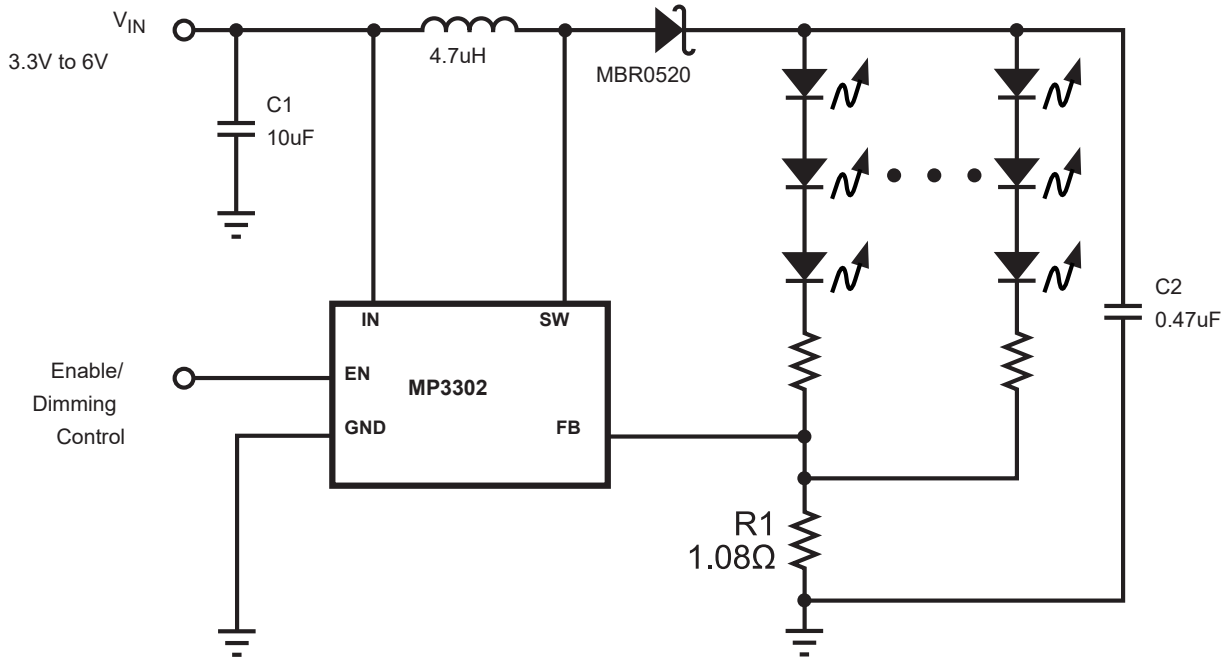
1. Where ILED =120mA, VLED=3.2V, Pbl= ILED x VLED
2. Uniform measure condition
   a. Measure 9 point, Measure location is show below.
   b. Uniform=(Min brightness/Max brightness)x100%
   c. Best Contrast.



3. The environmental conducted under ambient air flow, at Ta=25±2℃,60%RH±5%

4.2. Backlight Recommended Circuit

Motherboard driver backlight is need constant current circuit, if threated voltage screen after light brightness difference. Current and power consumption of the machine are inconsistent, so recommend a backlight driving circuit is best rated current. It is recommended to use IC (MP3302). The reference circuit is as follows:

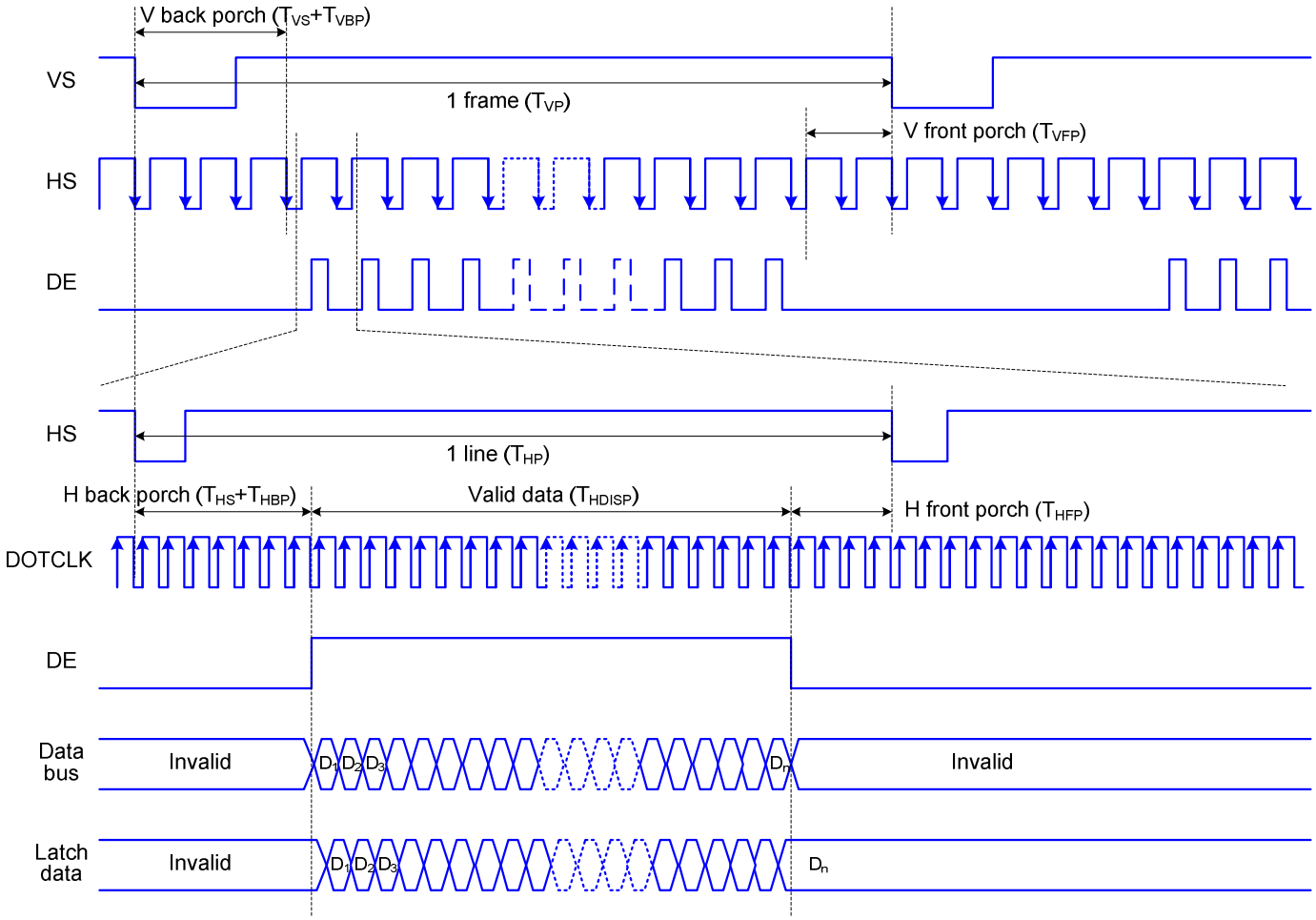


4.3. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	VCC	3.0	3.3	3.6	V	
Input voltage 'H' level	VIH	0.8*IOVCC	-	IOVCC	V	
Input voltage 'L' level	VIL	VSS	-	0.2 *IOVCC	V	
Output voltage 'H' level	VOH	0.8*IOVCC	-	IOVCC	V	
Output voltage 'L' level	VOL	VSS	-	0.2 *IOVCC	V	
Operating Current for VDD	I_{DD}	-	20	25	mA	VDD=2.8V

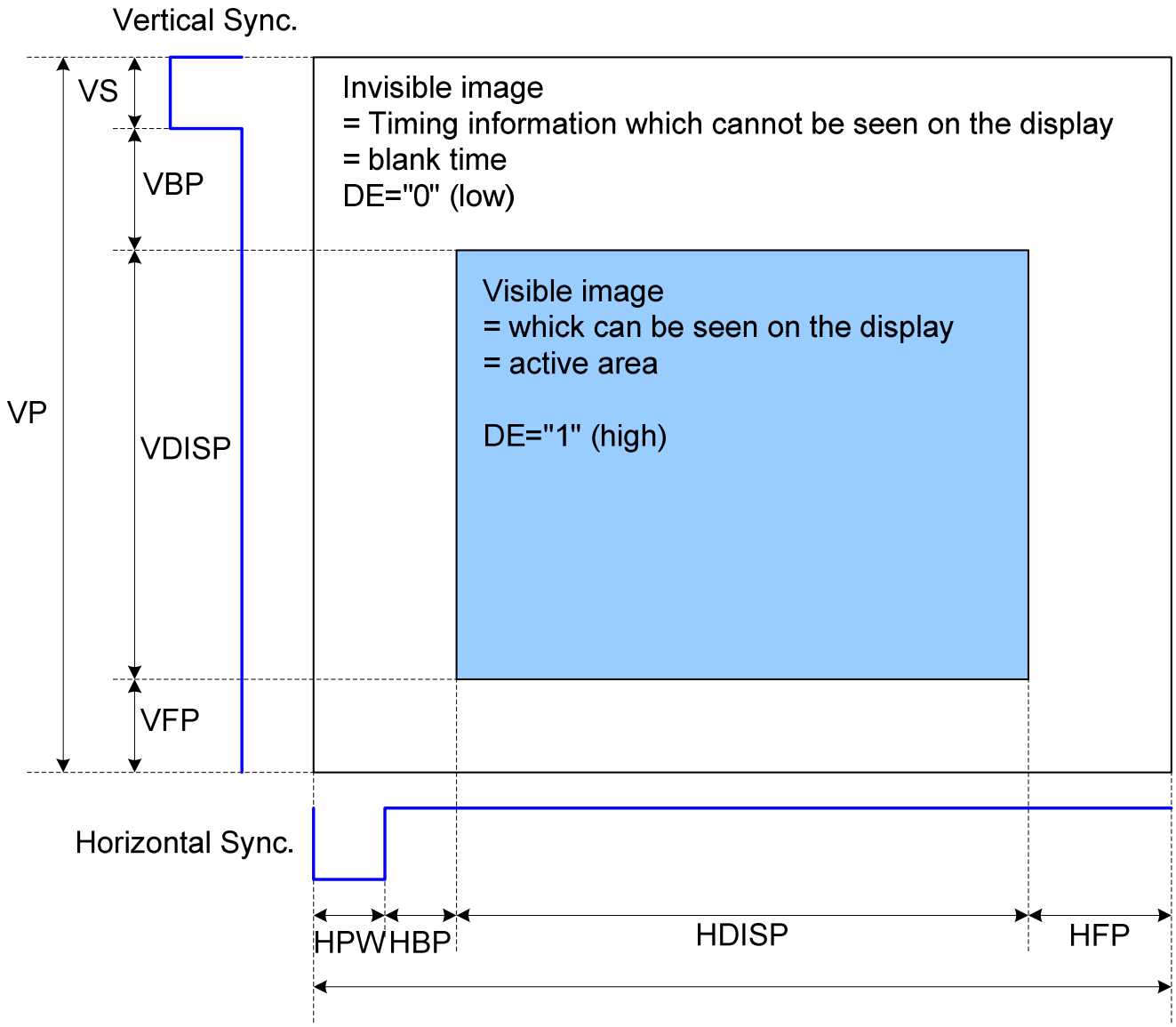
4.4. AC Characteristics

4.4.1. RGB Interface Characteristics :



Note: The setting of front porch and back porch in host must match that in IC as this mode.

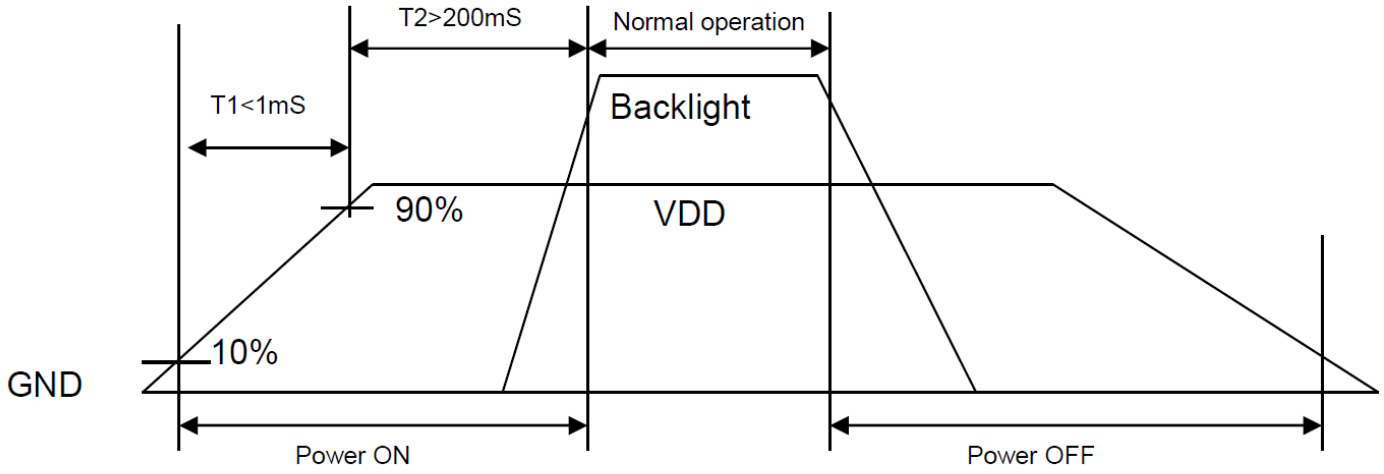
4.4.2. System Bus Read/Write Characteristics :

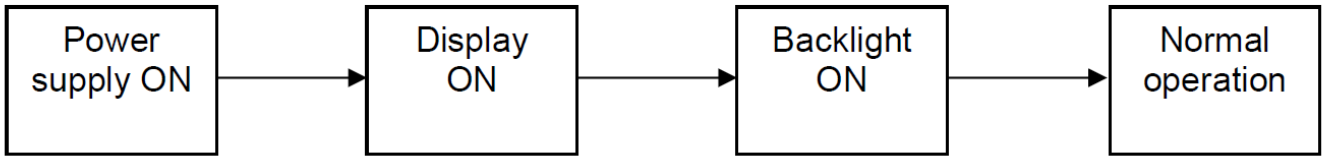


Please refer to the following table for the setting limitation of RGB interface signals.

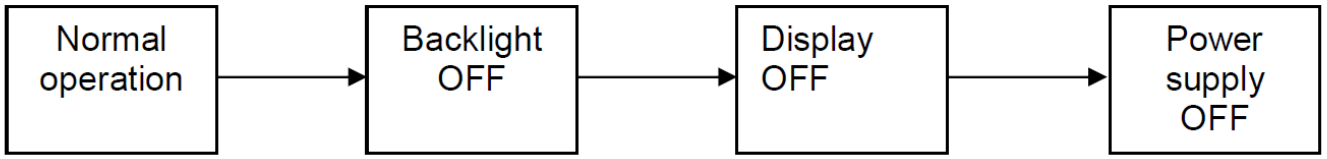
Parameter	Symbol	Min.	Typ.	Max.	Unit
Horizontal Sync. Width	hpw	2	-	hpw + hbp = 75	Clock
Horizontal Sync. Back Porch	hbp	4	-		Clock
Horizontal Sync. Front Porch	hfp	2	38	-	Clock
Vertical Sync. Width	vs	2	4	-	Line
Vertical Sync. Back Porch	vbp	2	4		Line
Vertical Sync. Front Porch	vfp	2	8	-	Line

4.4.3. Power ON/OFF Timing:



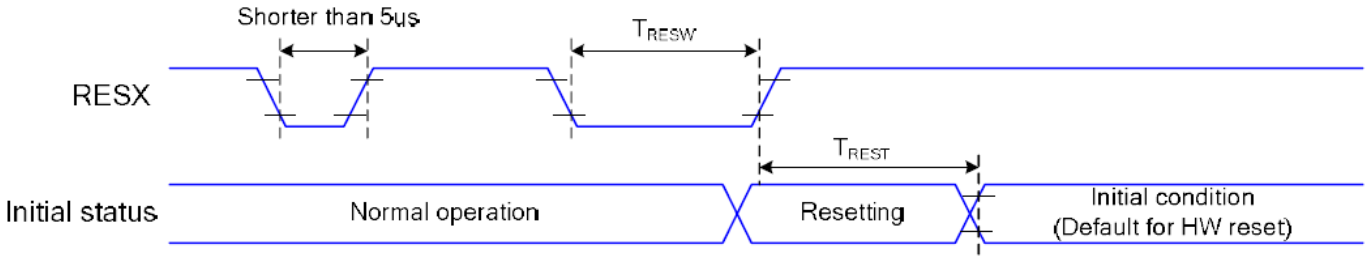


Power ON sequence



Power OFF sequence

4.4.4. Reset Timing:



Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	tRESW	Reset Pulse Duration	10	-	us
	tREST	Reset Cancel	-	5	ms
				120	ms

Notes:

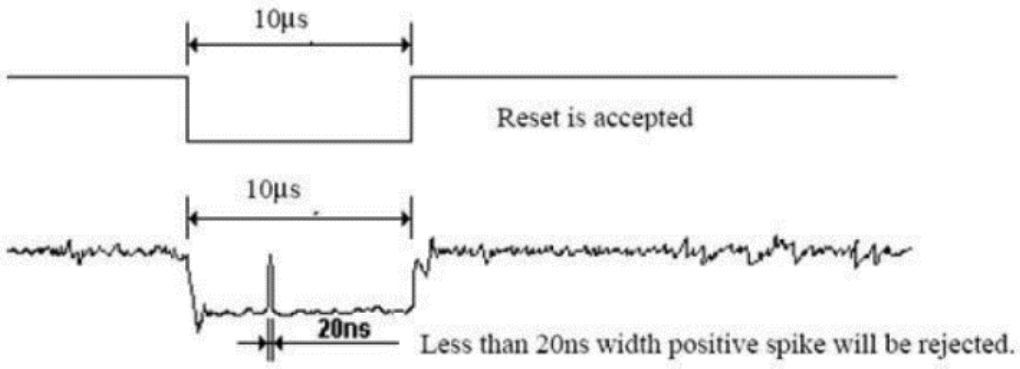
1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below ：

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence， which maximum time is 120 ms, when Reset Starts at Sleep-Out status. The display remains the blank state in Sleep-In mode). Then return to Default condition for Hardware Reset

4. Spike Rejection also applies during a valid reset pulse as shown below ：



5. When Reset applied during Sleep-In Mode.

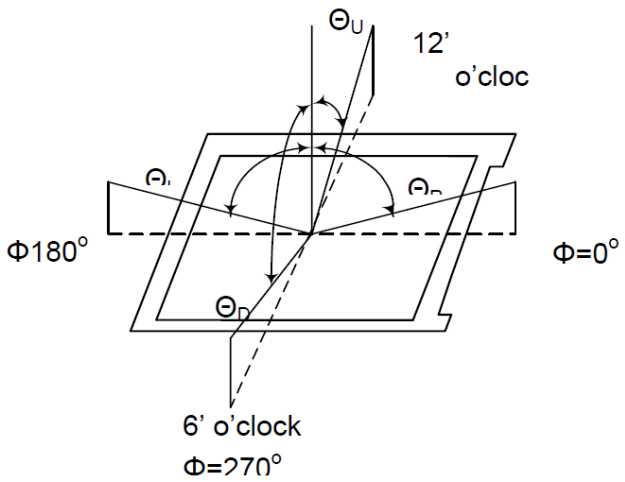
6. When Reset applied during Sleep-Out Mode.

7. It is necessary to wait 10ms after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120 ms.

5) ELECTRO-OPTICAL CHARACTERISTICS

Items	Symbol	Condition		Min.	Typ.	Max.	Unit	Note
Viewing angle	θ	Φ=0°	25℃	-	TBD	-	Deg	Note1
		Φ=180°	25℃	-	TBD	-		
	θ	Φ=90°	25℃	-	TBD	-		
		Φ=270°	25℃	-	TBD	-		
Brightness	Lbr	-	-	-	TBD	-	Cd/m2	
Luminance Uniformity	△L	-	-	-	TBD	-	-	
Contrast Ratio	CR	-	25℃	-	TBD	-	-	Note2
Response Time	Tr+Tf	θ=0° Φ=0°	25℃	-	TBD	-	ms	Note3
CIE(x,y) chromaticity	White	X	25℃	-	TBD	-	-	BM-7A
		Y	25℃	-	TBD	-		
	Red	X	25℃	-	TBD	-		
		Y	25℃	-	TBD	-		
	Green	X	25℃	-	TBD	-		
		Y	25℃	-	TBD	-		
	Blue	X	25℃	-	TBD	-		
		Y	25℃	-	TBD	-		
Transmittance (with polarizer)	-	-		-	TBD	-	%	

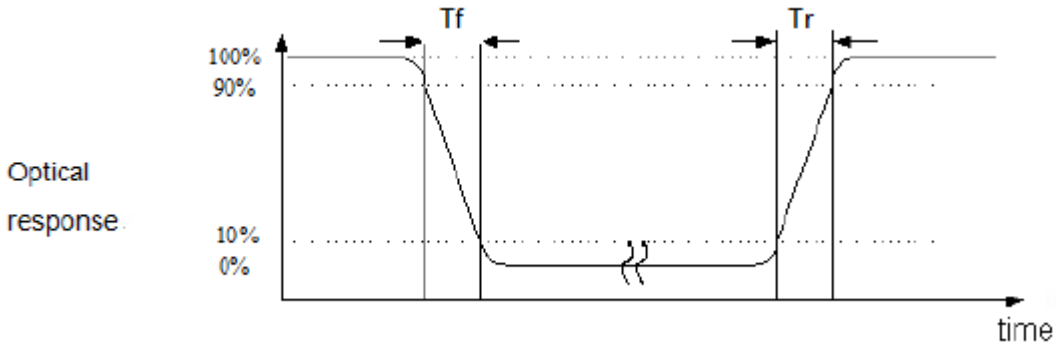
Note1. Definition of Viewing Angle :



Note 2. Definition of Contrast Ratio:

$$\text{Contrast Ratio} = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note3. Definition of Response Time: Sum of Tr and Tf:



6) INTERFACE PIN CONNECTIONS

6.1. TFT Pin Interface

No.	Symbol	Description
1	YU	No Connect
2	XL	
3	YD	
4	XR	
5	GND	Ground
6	IOVCC	Power supply (1.8/2.8V)
7	VCC	Power supply (2.8V)
8	CS	Chip select signal
9	SDA	Serial data input pin
10	GND	Ground
11	SCLK	Serial clock input pin
12	GND	Ground
13~18	B0~B5	Blue Data Bus
19~24	G0~G5	Green Data Bus
25~30	R0~R5	Red Data Bus
31	GND	Ground
32	PCLK	RGB dot clock signal
33	DE	RGB data enable signal
34	HS	RGB line synchronizing signal
35	VS	RGB frame synchronizing signal
36	RESET	Reset Signal, Active Low
37~38	A	Anode pin of backlight.
39~40	K	Cathode pin of backlight.

6.2. CTP Pin Interface CTP

No.	Symbol	Description
1	GND	Ground
2	VCC	Power Supply for Analog
3	RES	Touch Reset Signal
4	INT	Touch Interrupt
5	SDA	Touch IIC Data signal
6	SCL	Touch IIC Clock signal

7) RELIABILITY TEST

No.	Item	Conditions	Inspection after Test
1	High Temperature Storage	80℃, 200 hours	Inspection after 2~4 hours storage at room temperature, the sample shall be free from defects: 1. Air Bubble in the LCD; 2. Non-display; 4. Missing Segments; 5. Glass Crack; 6. Current Idd is Twice Higher than Initial Value
2	Low Temperature Storage	-30℃, 200 hours	
3	High Temperature Operating	70℃, 120 hours	
4	Low Temperature Operating	-20℃, 120 hours	
5	High Temperature & High Humidity Storage	+50℃,90% RH, 120 hours	
6	Thermal Shock	-20℃ ~ 70℃ (30min) (30min) Change time:5min 10CYC	
7	ESD Test	C=150pF, R=330,5points/panel Air:±4KV, 5times; Contact:±2KV, 5 times; (Environment: 15℃~35℃,30%~60%).	
8	Vibration (Non-operation)	Frequency: 10 ~ 55Hz Amplitude: 1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
9	Box Drop Test	1 Corner 3 Edges 6 faces,76cm (MEDIUM BOX)	

Remark:

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

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

3. For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.

4. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

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

6. The color fading mura of polarizing filter should not care.

8) OUTGOING QUALITY CONTROL SPECIFICATIONS

8.1. Standard

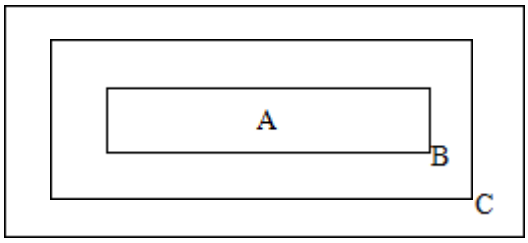
According to GB/T2828.1-2003/ISO 2859-1:1999 and ANSI/ASQC Z1.4-1993, General Inspection Level II.

8.2. Definition

1) Major Defect: The defect that greatly affect the usability of product.

2) Minor Defect: The other defects, such as cosmetic defects, etc.

3) Definition of Inspection Zone

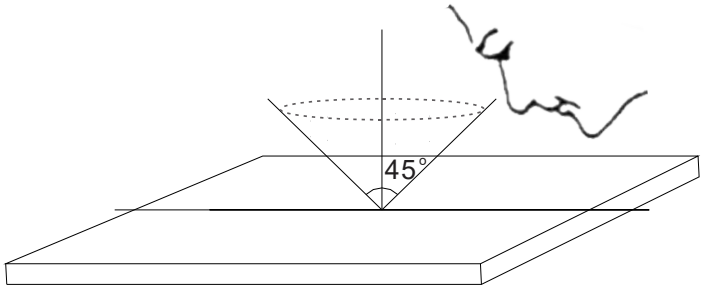


Zone A: Active Area
Zone B: Viewing Area except Zone A Zone
C: Outside Viewing Area

Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble of quality and assembly to customer`s product.

8.3. Inspection Methods

1) General Inspection: under 20W x 2 or 40W fluorescent light, about 30cm viewing distance, within 45º viewing angle, under 25±5℃.

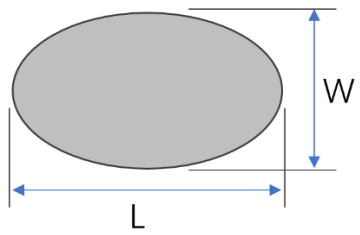


2) The Brightness and Color Coordinate Inspection: By CS2000/09A-LCD-117 or the equal equipment, in the dark room, under 25±5℃.

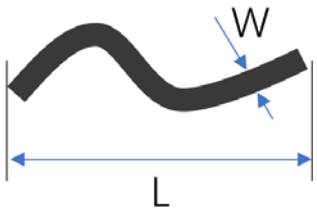
8.4. Inspection Criteria

1) Definition of the Defect Size:

Spot Shape:



Line Shape:

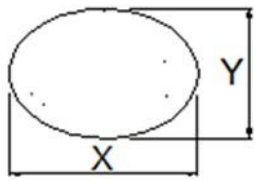
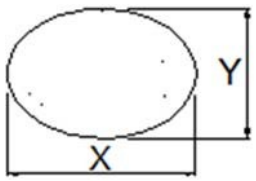


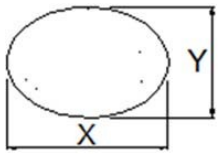
Φ= (L+W)/2
L: Length W: Width N: Number

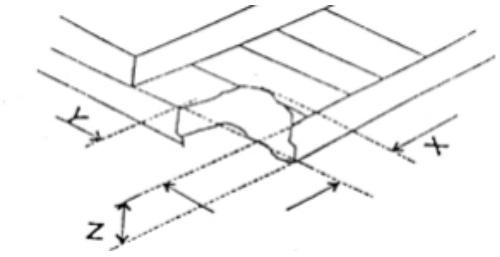
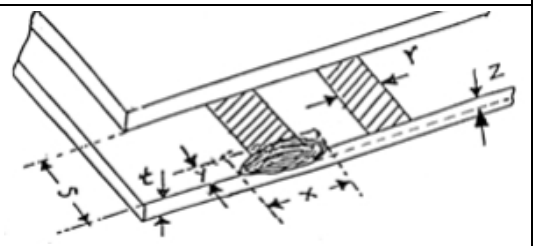
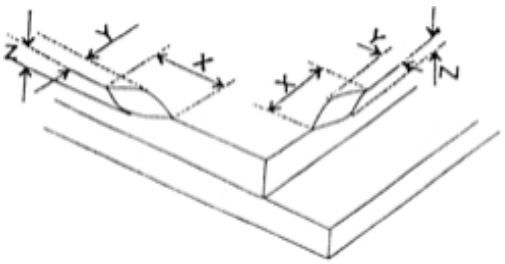
2) Major Defect: AQL= 0.65

Item	Criterion
Function Defect	1. No display or abnormal display is not accepted
	2. Open or short is not accepted.
	3. Bright/Dark line or other line shapes are not accepted
	4. Missing vertical or horizontal segment are not accepted
	5. Back Light has no lighting, flickering or abnormal lighting are not accepted
Component Defect	Missing/Broken component is not accepted.
Outline Dimension	Outline dimension exceeding the spec is not accepted.
Glass Crack	Glass crack tends to enlarge is not accepted.
FPC Defect	Split/Broken FPC is not accepted.

3) Minor Defect: AQL= 1.5

<table>
<tr><th>Item</th><th colspan="4">Criterion</th></tr>
<tr><td rowspan="6">Clear Spot Defect (Black & White Spot, Foreign Particle, Pinhole, Stain under Polarizer)</td><td colspan="2" rowspan="2">Size (mm)</td><td colspan="2">Accepted Qty.</td></tr>
<tr><td>Area A + Area B</td><td>Area C</td></tr>
<tr><td rowspan="4">  </td><td>Φ≦0.1</td><td>Ignored</td><td></td></tr>
<tr><td>0.10 < Φ≦0.15</td><td>N≦2</td><td rowspan="3">Ignored</td></tr>
<tr><td>0.15 < Φ≦0.20</td><td>N≦1</td></tr>
<tr><td>0.20 < Φ</td><td>N=0</td></tr>
<tr><td colspan="4">Note: Φ= (x + y) / 2</td></tr>
<tr><td rowspan="6">Dim Spot Defect (Circle Shaped and Dim Edged Defects)</td><td colspan="2" rowspan="2">Size (mm)</td><td colspan="2">Accepted Qty.</td></tr>
<tr><td>Area A + Area B</td><td>Area C</td></tr>
<tr><td rowspan="4">  </td><td>Φ≦0.2</td><td>Ignored</td><td></td></tr>
<tr><td>0.20 < Φ≦0.40</td><td>N≦2</td><td rowspan="3">Ignored</td></tr>
<tr><td>0.40 < Φ≦0.60</td><td>N≦1</td></tr>
<tr><td>0.60 < Φ</td><td>N=0</td></tr>
<tr><td colspan="4">Note: Φ= (x + y) / 2</td></tr>
<tr><td rowspan="3">Dot (Pixel) Defect</td><td colspan="2">Item</td><td>Area A + Area B</td><td>Area C</td></tr>
<tr><td colspan="2">Bright Dot</td><td>N=0</td><td rowspan="2">Ignored</td></tr>
<tr><td colspan="2">Dark Dot</td><td>N≦4</td></tr>
</table>

<table>
<tr><th>Item</th><th colspan="4">Criterion</th></tr>
<tr><td rowspan="5">Line Defect
(Dimming and
Lighting Line)</td><td>L (Length): mm</td><td>W (Width): mm</td><td>Area A + Area B</td><td>Area C</td></tr>
<tr><td>/</td><td>W≦0.02</td><td colspan="2">Ignored</td></tr>
<tr><td>L≦3.0</td><td>0.02 < W≦0.03</td><td>N≦2</td><td rowspan="3">Ignored</td></tr>
<tr><td>L≦2.0</td><td>0.03 < W≦0.05</td><td>N≦1</td></tr>
<tr><td>/</td><td>0.05 < W</td><td>As spot defect</td></tr>
<tr><td colspan="5">Note: The total of spot defects and line defects shall not exceed 4 PCS. The distance between two lines defects must exceed 1 mm</td></tr>
<tr><td>Mura</td><td colspan="4">Judged OK if unviewable by using 3% ND Filter on 128 gray scale pattern.</td></tr>
<tr><td>FPC Defect</td><td colspan="4">Crack, deep fold and deep pressure mark on the FPC are not accepted</td></tr>
<tr><td>Polarizer Stain</td><td colspan="4">Stain which can be wiped off lightly with a soft cloth or similar cleaning is accepted, otherwise, according to the Spot Defect and the Line Defect.</td></tr>
<tr><td rowspan="6">Polarizer Scratch</td><td colspan="4">1. If scratch can be seen during operation, according to the criterions of the Spot Defect and the Line Defect.</td></tr>
<tr><td colspan="4">2. If scratch can be seen only under non-operation or some special angle, the criterion is as below:</td></tr>
<tr><td>L (Length): mm</td><td>W (Width) : mm</td><td>Area A + Area B</td><td>Area C</td></tr>
<tr><td>/</td><td>W≦0.03</td><td colspan="2">Ignore 忽略</td></tr>
<tr><td>L≦10.0</td><td>0.03 < W≦0.05</td><td>N≦2</td><td rowspan="3">Ignore</td></tr>
<tr><td>L≦5.0</td><td>0.05 < W≦0.08</td><td>N≦1</td></tr>
<tr><td>/</td><td>0.08 < W</td><td>N=0</td></tr>
<tr><td rowspan="6">Polarizer Air
Bubble</td><td colspan="2">Size (mm)</td><td>Area A + Area B</td><td>Area C</td></tr>
<tr><td rowspan="4">  </td><td>Φ≦0.20</td><td colspan="2">Ignored 忽略</td></tr>
<tr><td>0.20 < Φ≦0.30</td><td>N≦2</td><td rowspan="3">Ignored</td></tr>
<tr><td>0.30 < Φ≦0.50</td><td>N≦1</td></tr>
<tr><td>0.50 < Φ</td><td>N=0</td></tr>
<tr><td colspan="4">Note: Φ= (x + y) / 2</td></tr>
</table>

<table>
<tr><th>Item</th><th>Criterion</th></tr>
<tr><td rowspan="4">Glass Defect
(Glass
Chipped))</td><td>1. On the corner (mm)
<table><tr><td>x</td><td>y</td><td>z</td></tr><tr><td>≦2.0</td><td>≦s</td><td>Disregard</td></tr></table>  </td></tr>
<tr><td>2. On the Bonding Edge (mm)
<table><tr><td>x</td><td>y</td><td>z</td></tr><tr><td>≦a/4</td><td>≦s/3 & ≦0.7</td><td>Disregard</td></tr></table>  </td></tr>
<tr><td>3. On the Other Edges (mm)
<table><tr><td>x</td><td>y</td><td>z</td></tr><tr><td>≦3.0</td><td>≦0.5</td><td>Disregard</td></tr></table>  </td></tr>
<tr><td>Note: t: Glass Thickness; s: Pad Width; a: Edge Length, x: Chip Length, y: Chip Width, z: Chip Thickness</td></tr>
</table>

4) Parts Defect

Item	Criterion
Parts Alignment	**Minor Defect:** IC and FPC/heat-seal lead width is more than 50% beyond lead pattern. Chip or solder component shifted from center more than 50% of the pad outline. I
SMT	According to the <Acceptability of Electronic Assemblies> IPC-A-610E Class 2 Standard, component missing or function defect is Major defect, the others are Minor defect.

9) CAUTIONS FOR USING LCD MODULES

9.1. Precautions for Handling LCD Modules

1) The display panel is made of glass and polarizer. As glass is fragile. It tends to become 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.

2) Do not apply excessive force to the display surface or the adjoining areas since this may cause abnormal. Do not touch the display with bare hands. This will stain the display area (some cosmetics are determined to the polarizer).

3) 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.

4) 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.
   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.

6) 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.

7) 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.

8) Do not attempt to disassemble or process the LCD module.

9) NC terminal should be open. Do not connect anything.

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

11) 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.

- Before removing LCD 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.

- 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.

- 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.

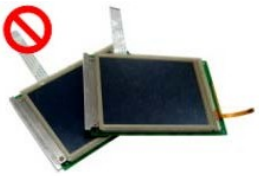
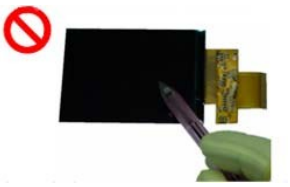
- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

12) LCD module is easy to be damaged. Please note below and be careful for handling.
LCD

i. Correct Handling:

As showed above, please handle with anti-static gloves around LCD module edges.

ii. Incorrect Handling:

 Don't touch IC directly	 Don't hold the surface of panel	 Don't stack LCD modules
 Don't hold the surface of IC	 Don't operate with sharp stick such as pens	 Don't stretch interface of input, such as FPC

9.2. Precautions for Storing LCD Module

When storing the LCD modules, the following precautions are necessary:

1) Store them in a sealed polyethylene bag with the desiccant.

2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0℃and 35℃, and keep the relative humidity between 40%RH and 60%RH.

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).

4) To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.
   - Exposed area of the printed circuit board.
   - Terminal electrode sections.

9.3. Precautions for Transportation

1) During shipment, please handle with care. The packaging bag can not be broken, step on trap. Packaging Carton layer height can not be over two meters.

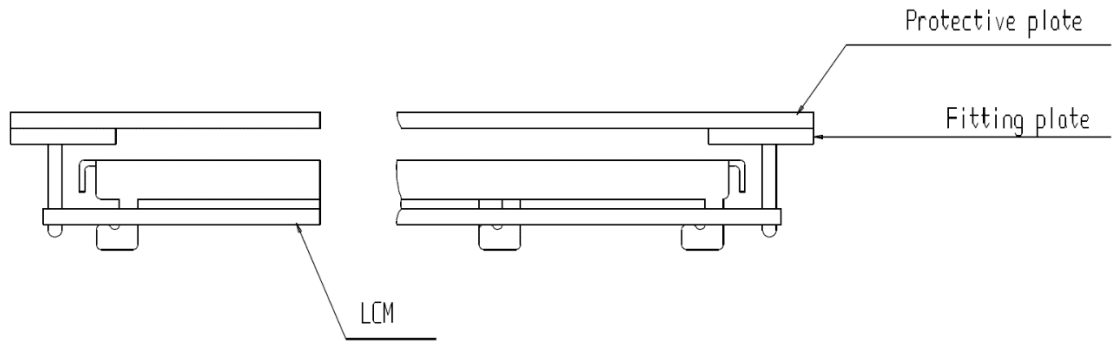
2) The transportation process should pay attention to the waterproof and moisture-proof measures. Product can not be watering. Ethylene sealed bags can not be unsealed.

9.4. Using LCD Modules LCD

Installing LCD Modules

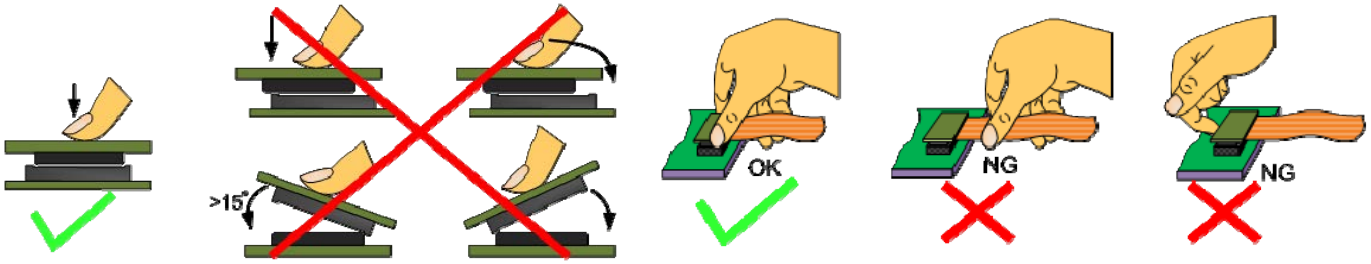
1) When assembling the LCD module into other equipment, the spacer to the bit between the LCD module and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

2) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



3) Precaution for assembling the module with BTB connector:

Please mind the connecting position of the male and female connectors, don't assemble the LCD in improper ways shown below.



9.5. Precautions for Soldering LCD Module LCD

	Manual Soldering	Machine Drag Soldering	Machine Press Soldering
Non-RoHS Product	290℃ ~350℃ Time: 3-5s	330℃ ~350℃ Speed: 15-17mm/s	300℃ ~330℃ Time: 3-6S. Press: 0.8~1.2Mpa
RoHS Product	340℃ ~370℃ Time: 3-5s	350℃ ~370℃. Speed: 15-17mm/s	330℃ ~360℃ Time: 3-6s Press: 0.8~1.2Mpa

1) If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation (This does not apply in the case of a non-halogen type of flux). It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

2) When soldering the LCD module and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

3) When remove the LCD module from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

9.6. Precautions for Operation

1) Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.

2) It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit will damage the driver IC. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

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.

4) If the display area is pushed hard, the display will cause pixel short, it will become the display defect.

5) A slight dew 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.

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.

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.

8) 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.

9) 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.

9.7. Safety

1) It is recommended to crush damaged or unnecessary LCD into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

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.

9.8. Limited Warranty

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

9.9. Return LCD Module under Warranty LCD

1) No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.
- PCB eyelet is damaged or modified.
- PCB conductors damaged.
- Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
- Soldering to or modifying the bezel in any manner.

2) Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet, conductors and terminals.

10) PRIOR CONSULTING MATTERS

1) For SWI standard products, we keep the right to change the materials and processes without prior notification to our customers.

2) For OEM products, if any changes are needed which may affect the product property, we will consult with our customer in advance.

3) If you have special requirement about reliability condition, please let us know before you start the test on our samples.