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Research & Development

Firmware

EMC tests

on-site service

In-house Manufacturing

Cover glass

System solutions

OEM Solutions

Custom Display

PCAP

Mechanical design

Production Custom designs Installation



Product Specification

Part Name: AMOLED Display Module

Customer Part ID:

YOURITECH Part ID: ET095XVT-01

Ver: A

Customer:

Approved by

From: YOURITECH TECHNOLOGY

Approved by



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WRITTEN BY	CHECKED BY	APPROVED BY



SCOPE

This AMOLED module Specification defines general provisions and inspection standard, AMOLED modules Involved are supplied by TRULY . In the process of using, if unforeseen problem or unspecified items may occur, we have to negotiate to resolve the issue with the customer certainly.

FEATURES

Display color: 16.7M colors(24bits)

Display format: 0.95 Inch 120 RGB×240

Interface: 4-wire SPI

Driver IC: SH8501G

Touch IC:

Polarizer: Hard Coating Polarizer

APPLICATION

Smart Watch



GENERAL INFORMATION

Item	Contents	Unit
Display Mode	AMOLED	/
GlassOutline(W×H)	12.8×27.35	mm
		mm
Active area(W×H)	10.8×21.6	mm
Number of Dots	120×3(RGB)×240	/
Diagonal Inch	0.95	inch
Pixelpitch(W×H)	90×90	um
Glass Thickness	0.5(LTPS) 0.305(Encap)	mm

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Ratings	Unit
Supply Voltage for I/O Block	VDDI-VSS	- 0.3 to + 3.6	V
Supply Voltage for Step-up Circuit	VCI-VSS	- 0.3 to + 4.0	V
AMOLED Supply Voltage Range	AVDD-VSS	- 0.3 to + 6.5	V
	VSS-VCL	- 0.3 to + 5.5	V
	VSS-VINT	- 0.3 to + 5.0	V
	VLOUT2-VSS	- 0.3 to + 16.5	V
	VSS-VLOUT3	- 0.3 to + 16.5	V
	VGH-VSS	- 0.3 to + 11	V
	VSS-VGL	- 0.3 to + 11	V
	ELVDD - VSS	- 0.3 to + 5.5	V
	VSS- ELVSS	- 0.3 to + 4.4	V
	VLOUT2-VLOUT3	- 0.3 to + 33	V
Supply Voltage for OTP	VOTP-VSS	- 0.3 to + 7.5	V
Input Voltage Range	V _{in}	- 0.3 to VDDI + 0.3	V
Storage Temperature	T _{stg}	- 55 to + 125	°C

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply voltage (Display)	VGL	-	-8	-6	-5	V
	VGH	-	6	6.5	8	V
	ELVDD	-	4.55	4.6	4.65	V
	ELVSS	-	-2.3	-2.2	-2.1	V
	VINIT	-	-	-3	-	V
Current (Display)	I _{ELVDD/ELVSS}	Full white display 450nits,60Hz	-	7	10.5	mA



OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Surface Luminance	Lv	$\theta=0^\circ$ $\varnothing=0^\circ$ $T_a=25^\circ\text{C}$	-	450	-	cd/m ²	Note1
Luminance uniformity	δ WHITE		85	-	-	%	Note2
Contrast Ratio	Cr		30000	-	-	-	Note3
Viewing Angle	θ	Up/Down/ Right/Left $Cr \geq 10$	88	-	-	deg	Note4
Color Coordinate of CIE1931	Red x	$\theta=0^\circ$ $\varnothing=0^\circ$ $T_a=25^\circ\text{C}$	0.630	0.660	0.690	-	Note 5
	Red y		0.310	0.340	0.370		
	Green x		0.170	0.220	0.270		
	Green y		0.680	0.730	0.780		
	Blue x		0.115	0.140	0.165		
	Blue y		0.025	0.050	0.075		
	White x		-	0.300	-		
	White y		-	0.310	-		
NTSC ratio	-	-	85	100	-	%	CIE1931
Life Time	T95	25 $^\circ\text{C}$	240	-	-	hours	-

Note1. Surface Luminance

Measurement equipment: CS2000 or similar equipment.

Measuring surroundings: Dark room.

Measuring temperature: $T_a=25^\circ\text{C}$.

The data are measured after OLEDs are lighted on for more than 5 minutes and all pixels are fully white.

The Surface Luminance is the average value of 5 measured spots (Fig-1):

L_v = Average Luminance with all white pixels (P_1, P_2, P_3, P_4, P_5)

Note2. Luminance Uniformity

Measurement equipment: CS2000 or similar equipment.

Measuring surroundings: Dark room.

Measuring temperature: $T_a=25^\circ\text{C}$.

The data are measured after OLEDs are lighted on for more than 5 minutes and all pixels are fully white.

The Luminance Uniformity is calculated by using following formula:

$\delta \text{ WHITE} = L_p (\text{Min.}) / L_p (\text{Max.}) \times 100 (\%)$

$L_p (\text{Min.})$ = Minimum Luminance with all white pixels (P_1, P_2, P_3, P_4, P_5)

$L_p (\text{Max.})$ = Maximum Luminance with all white pixels (P_1, P_2, P_3, P_4, P_5)

Note3. Contrast Ratio

Measurement equipment: CS2000 or similar equipment.

Measuring surroundings: Dark room.

Measuring temperature: $T_a=25^\circ\text{C}$.

The data are measured after OLEDs are lighted on for more than 5 minutes.



The Contrast Ratio is calculated by using following formula:

$$\text{Contrast Ratio(Cr)} = L_w / L_b$$

L_w =Average Luminance with all **white** pixels (P_1, P_2, P_3, P_4, P_5) L_b =Average Luminance with all **black** pixels (P_1, P_2, P_3, P_4, P_5)

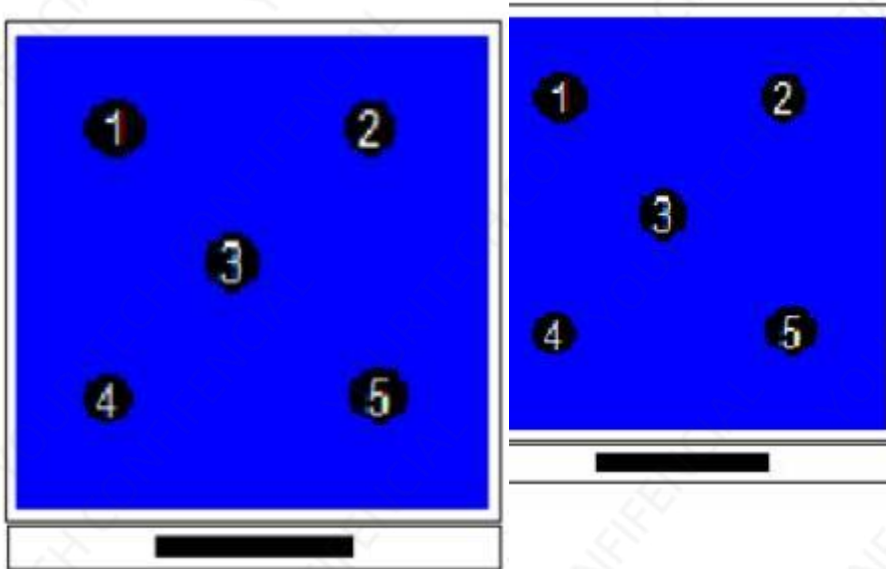


Fig-1

Note4. Viewing Angle

Measurement equipment: DMS803 or similar equipment.

Measuring surroundings: Dark room.

Measuring temperature: $T_a=25^{\circ}\text{C}$.

The Viewing Angle is the angle at which the contrast ratio is greater than 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 display surface.

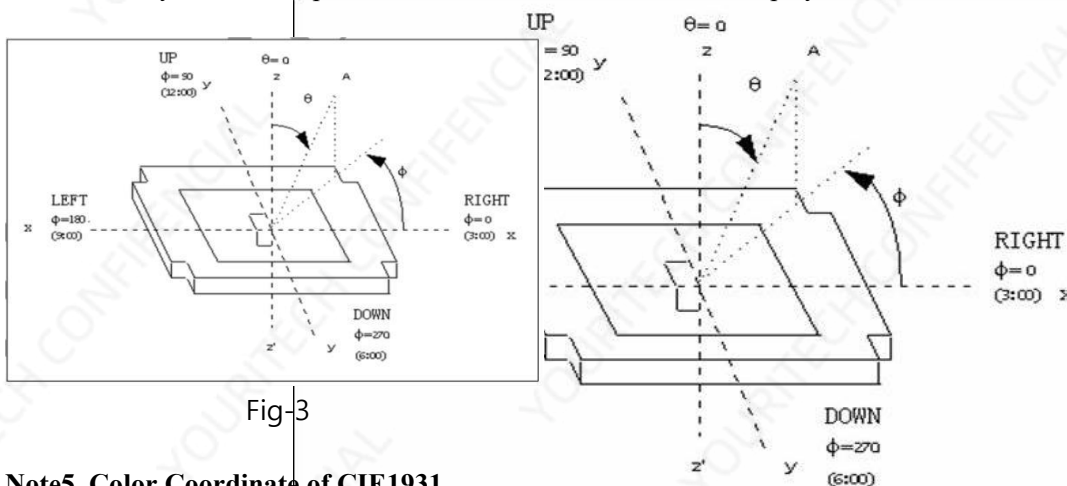


Fig-3

Note5. Color Coordinate of CIE1931

Measurement equipment: CS2000 or similar equipment.

Measuring surroundings: Dark room.

Measuring temperature: $T_a=25^{\circ}\text{C}$.

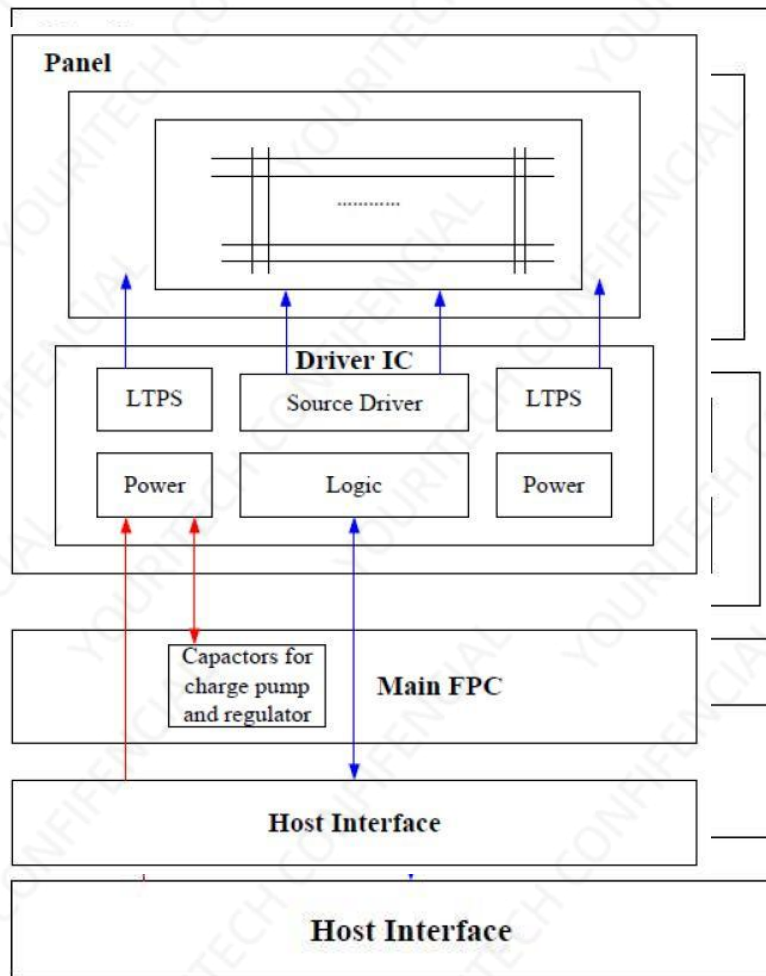
The x, y value of Color Coordinate is determined by measuring at center position of the display panel.



INTERFACE DESCRIPTION

Interface NO.	Symbol	I/O or Connected to	Description
1	ELVSS	power	Power supply for pix elcircuit.
2	ELVDD	power	Power supply for pix elcircuit.
3	MTP	power	burn pin
4	VCI	power	Power supply for Analog circuit.
5	IOVCC	power	IO/Power supply for Analog circuit.
6	SWIRE	O	Swire protocol setting pin of Power
7	TE	O	Tearing effect signal is used
8	RESET	I	This signal will reset the device and must be applied to properly initialize the chip.
9	CS	I	Chip select input pin ("Low" enable) in SPI I/F.
10	SCL	I	A synchronous clock signal in SPI I/F.
11	DCX	I	Display data / command selection in 4-wire SPI I/F.
12	SDA	I	Reads strobe signal to write data when RDX is "Low".
13-15	GND	power	Ground

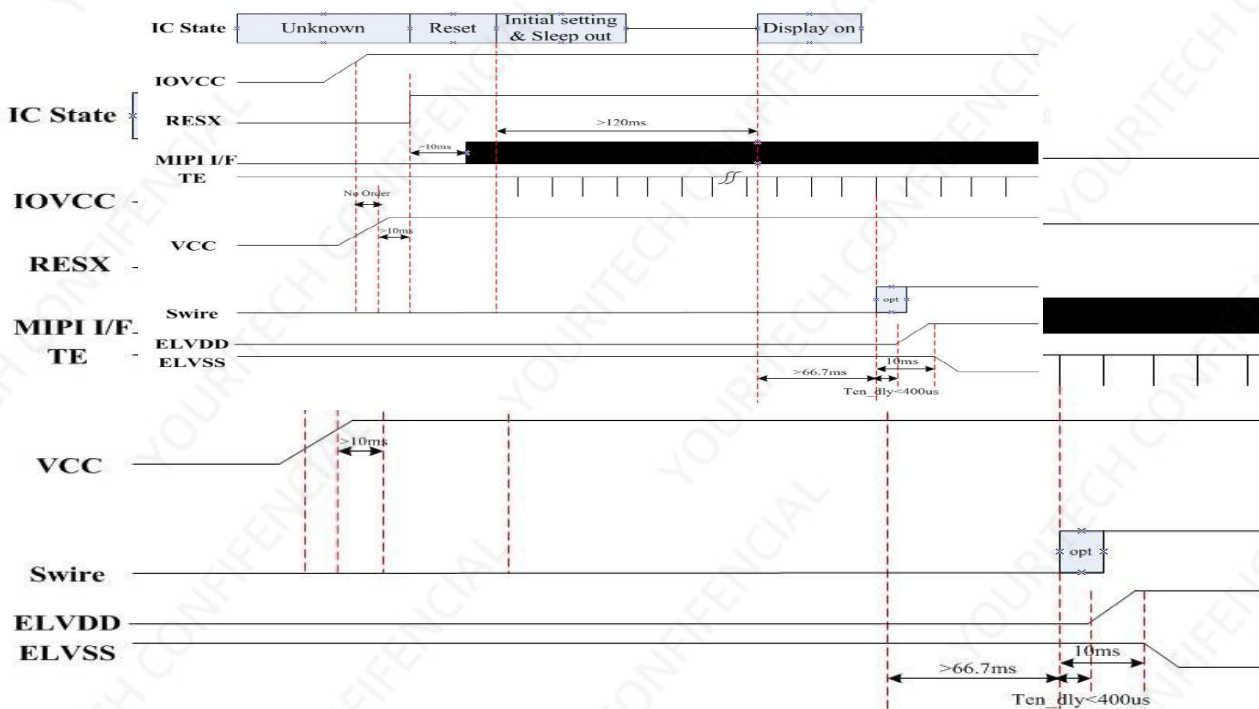




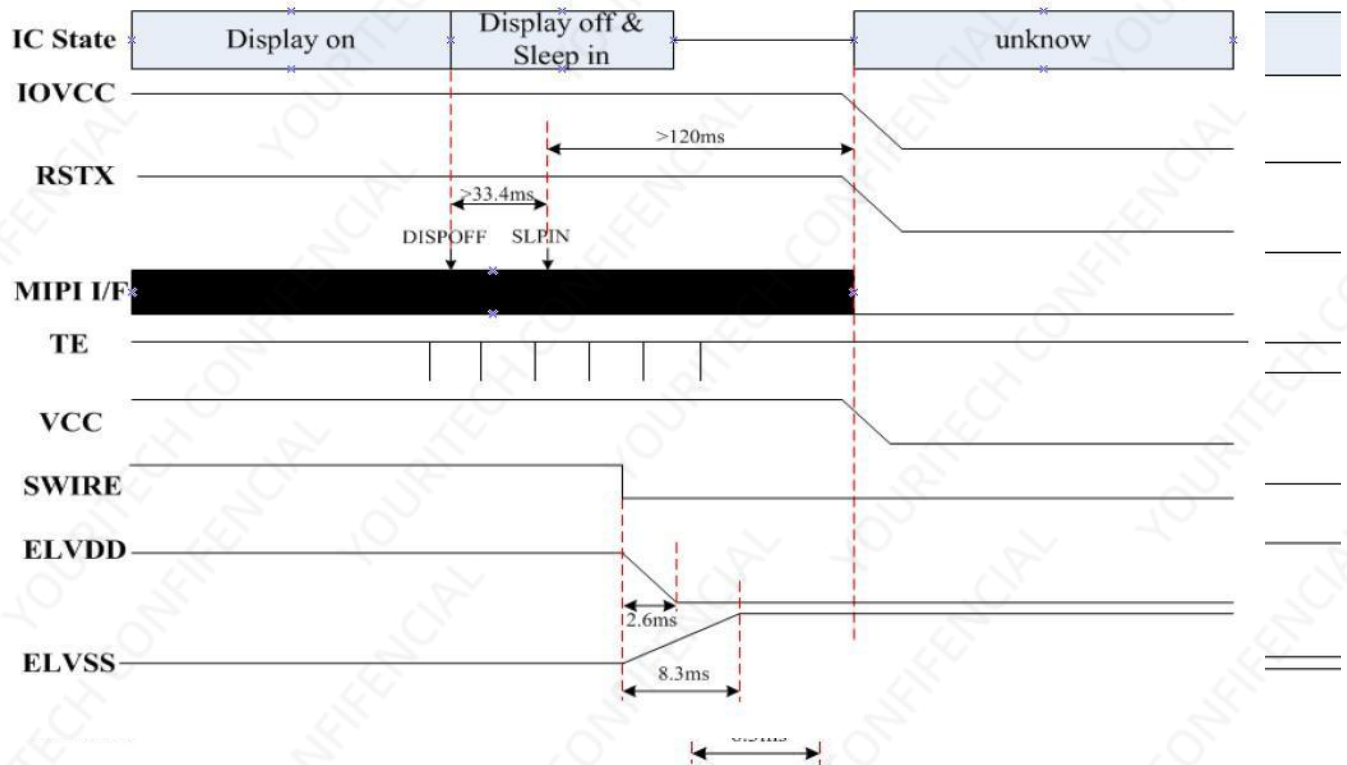
Module Block Diagram

Recommended Operating Sequence

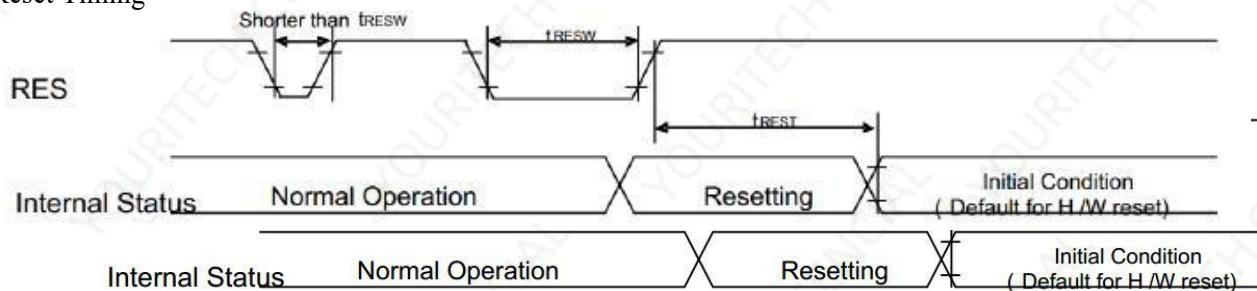
Power on sequence



Power off sequence



Reset Timing



Reset input timing:

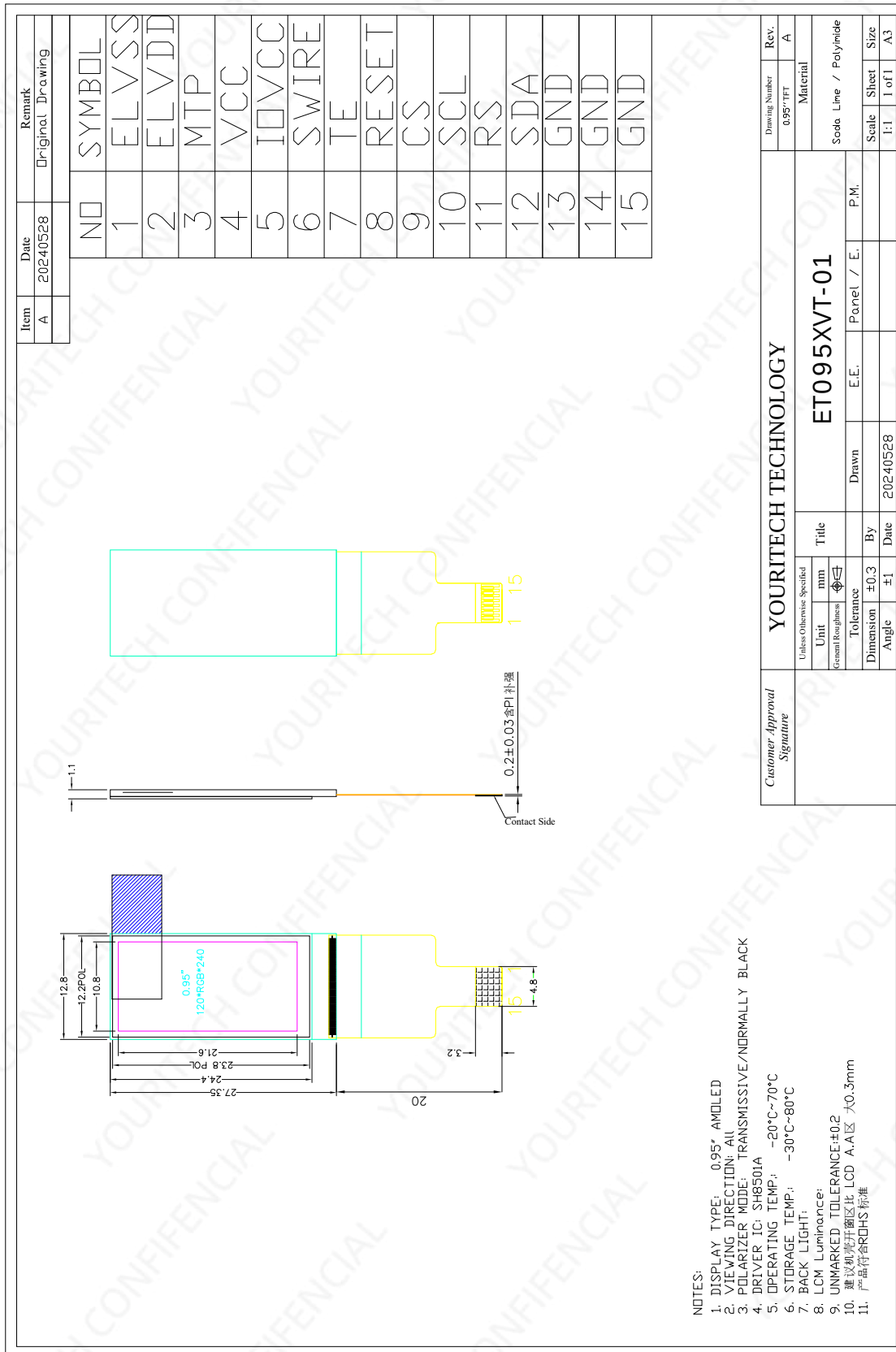
IOVCC=1.65 to 3.3V, VCC=2.7 to 3.6V, AGND=DGND=0V, Ta=-40 to 85°C

Symbol	Parameter	Related Pins	MIN	TYP	MAX	Note	Unit
tRESW	Reset low pulse width	RESX	10	-	-	-	μs
tREST	Resetcomplete time	-	-	-	5	When reset applied during Sleep inmode	ms
		-	-	-	120	When reset applied during Sleep out mode	ms



EXTERNAL DIMENSIONS

These drawings and specifications are confidential Customer shall undertake confidentiality obligations and liabilities.



RELIABILITY TEST CONDITIONS

N	Test Item	Test Condition	Q	Inspection after test
1	High Temperature Storage	80°C ± 2°C/120 hours	5	Inspection after 2 hours storage at room temperature, the sample shall be free from defects: 1、Remarkable deterioration of No clearly visible defects or display quality. However, any polarizer's deteriorations by the high temperature/High humidity Storage test and the High temperature/High humidity Operation test are permitted. 2、No function-related abnormalities. 3、Optical criteria: White $\Delta u'v' \leq 0.02$ 4、No visible defects. (optical /mechanical).
2	Low Temperature Storage	-30°C ± 2°C/120 hours	5	
3	High Temperature Operating	70°C ± 2°C/120 hours	5	
4	Low Temperature Operating	-20°C ± 2°C/120 hours	5	
5	Temperature Cycle storage	-30°C ± 2°C ~ 25~80°C ± 2°C × 10cycles (30min.) (5min.) (30min.)	5	
6	High Temperature Humidity Storage	60°C ± 5°C × 90%RH/120 hours	5	
7	ESD test	Voltage: ±8KV; R: 330Ω; C: 150pF Air discharge, 10 times	5	
8	Vibration Test	Frequency: 10Hz~55Hz~10Hz Amplitude: 1.5mm, X, Y, Z direction for total 3 hours (Packing condition)	5	
9	Dropping test	Drop to the ground from 75cm height, one time, every side of carton. (Packing condition)	5	

Remark:

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

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

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.

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



■INSPECTION CRITERION

OUTGOINGQUALITYSTANDARD	Edition:A
TITLE:FUNCTIONALTEST&INSPECTION CRITERIA	AMOLED Product

This specification is made to be used as the standard acceptance/rejection criteria for AMOLED Product.

1.1 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:

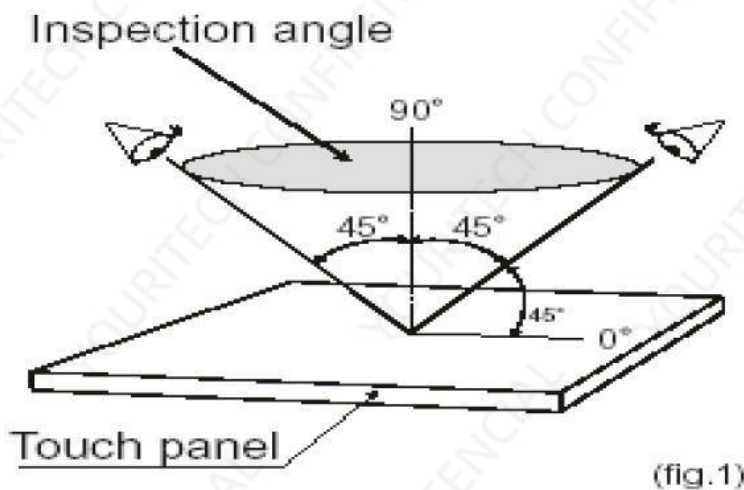
Major defect: AQL 0.65

Minor defect: AQL 1.5

1.2 Inspection condition

Visual: Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 30~40W light intensity (1000 ± 200 LUX) or function inspection (illumination intensity ≤ 50 LUX), all directions for inspecting the samples should be within 45° against perpendicular line. Cosmetic inspection time is 10s, judged pass if the defect cannot be seen in 15s.

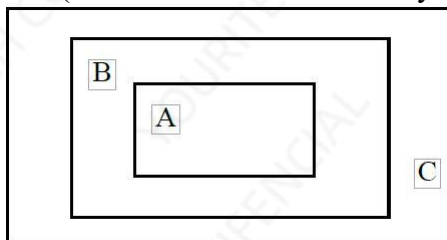
Inspection pattern: Red/Green/Blue/White/Black/128 gray scale



1.3 Definition of AMOLED inspection zone

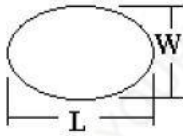
Zone A: Character/Digit area

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)



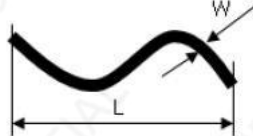
1.4 Inspection standards

1.4.1 Definition of the defect size:



$$D = (L+W) / 2$$

Spot shape:



Line shape:

$D = (L+W) / 2$ D: Diameter L: Length W: Width N: Number DS: Distance

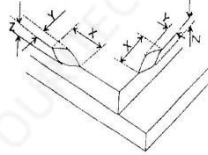
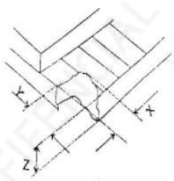
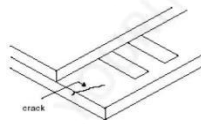
1.4.2 Major defect

Item No.	Inspection Item	Inspection standards
(1)	Function defects	1) No display not allowed 2) Display abnormally not allowed 3) Bright/Dark line and other line-shape function defect not allowed
(2)	Component	Missing/breakage component not allowed
(3)	Outline dimension	Overall outline dimension beyond the drawing is not allowed
(4)	Sharp edge	Not allowed
(5)	FPC	Split/Breakage FPC not allowed

1.4.3 Minor defect

Item No.	Inspection Item	Inspection standards			
(1)	Spot defect: Black and white Spot, Foreign Particle, Dirt under polarizer (Except dark pixel)	Grade A		Grade B	
		Size (mm)	Acceptable Qty.	Size (mm)	Acceptable Qty.
		$D \leq 0.10, DS \geq 5$	Disregard	$D \leq 0.10, DS \geq 5$	Disregard
		$0.10 < D \leq 0.2, DS \geq 10$	$N \leq 2$	$0.10 < D \leq 0.25, DS \geq 10$	$N \leq 3$
		$D > 0.2$	$N = 0$	$D > 0.25$	$N = 0$
(2)	Bright spot (pixel)	$N \leq 0$		$N \leq 0$	
(3)	Dark spot (pixel)	$N \leq 4, DS \geq 5$		$N \leq 8, DS \geq 5$	



(4)	Line defect Black line, White line, Foreign material under polarizer	Grade A			Grade B		
		L(Length)	W(Width)	Acceptable Qty.	L(Length)	W(Width)	Acceptable Qty.
			$W \leq 0.02$	Disregard		$W \leq 0.02$	Disregard
		$L \leq 2.0$	$0.02 < W \leq 0.03$	$N \leq 2$	$L \leq 2.0$	$0.02 < W \leq 0.03$	$N \leq 3$
		$L \leq 1.0$	$0.03 < W \leq 0.05$	$N \leq 2$	$L \leq 1.0$	$0.03 < W \leq 0.05$	$N \leq 3$
		$W > 0.05$	$N = 0$		$W > 0.05$	$N = 0$	
(5)	Mura	Judged OK if unviewable by using 3% ND Filter on 128 gray scale pattern. Special requirement refer to the limit sample signed by customer			Not affect assembly use. Special requirement refer to the limit sample signed by customer		
(6)	Color mixing	Judged OK if unviewable by using 2% ND Filter on White (255 gray scale) pattern. Special requirement refer to the limit sample signed by customer			Not affect assembly use. Special requirement refer to the limit sample signed by customer		
(7)	Bubble	Size (mm)		Acceptable Qty.	Size (mm)		Acceptable Qty.
		$D \leq 0.2$		Disregard	$D \leq 0.2$		Disregard
		$0.2 < D \leq 0.5$		$N \leq 2$	$0.2 < D \leq 0.5$		$N \leq 3$
		$D > 0.5$		$N = 0$	$D > 0.5$		$N = 0$
(8)	Polarizer dirty	Solvent erasable , allowed					
(9)	Usual surface cracks 	$z \leq t$: $Y \leq 0.5\text{mm}$, $X \leq 2\text{mm}$ z: Crack thickness; t: Glass thickness			$z \leq t$: $Y \leq 1\text{mm}$, $X \leq 3\text{mm}$ z: Crack thickness; t: Glass thickness		
(10)	Chips on corner 	$z \leq t$: $Y \leq 2\text{mm}$, $X \leq 2\text{mm}$ z: Chips thickness; t: Glass thickness			$z \leq t$: $Y \leq 3\text{mm}$, $X \leq 3\text{mm}$ z: Chips thickness; t: Glass thickness		
(11)	Cracks tend to break 	Cracks tend to break are not allowed. Edge burrs disregard.					

Notes: Base on DONGGUAN JUNDE PHOTOELECTRONIC TECHNOLOGY CO.,LTD. standard if the defects not be mentioned above, all the standards ultimately oriented to the terminal customer and satisfy customer's request.



■ PRECAUTIONS FOR USING AMOLED MODULES

Handling Precautions

- 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.
- 2、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).
- 3、The polarizer covering the display surface 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
 - EthylalcoholDo not scrub hard to avoid damaging the display surface.
- 5、Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
 - Water
 - Ketone
 - Aromatic solventsWipe 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、Do not attempt to disassemble or process the AMOLED module.
- 8、NC terminal should be open. Do not connect anything.
- 9、If the logic circuit power is off, do not apply the input signals.
- 10、Electro-Static Discharge Control, Since this module uses a CMOSLSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOSIC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Before removing AMOLED 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 AMOLED 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 AMOLED modules, 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 AMOLED 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.
- 11、Since AMOLED 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.
 - Do not alter, modify or change the shape of the tab on the metal frame.
 - Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
 - Do not damage or modify the pattern writing on the printed circuit board.
 - Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
 - Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
 - Do not drop, bend or twist the AMOLED.

Handling precaution for AMOLED

- 1、AMOLED is easy to be damaged. Please note below and be careful for handling.
- 2、Correct handling:
- 3、Incorrect handling:



Storage Precautions

1、When storing the AMOLED modules, the following precaution are necessary.

- 1) 、Store them in a sealed polyethylene bag. If properly sealed, there is no need for the desiccant.
- 2) 、Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0C and 35C, 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).

2、Transportation Precautions

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

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

3、Others

1) 、To minimize the performance degradation of the AMOLED 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.

USING AMOLED MODULES

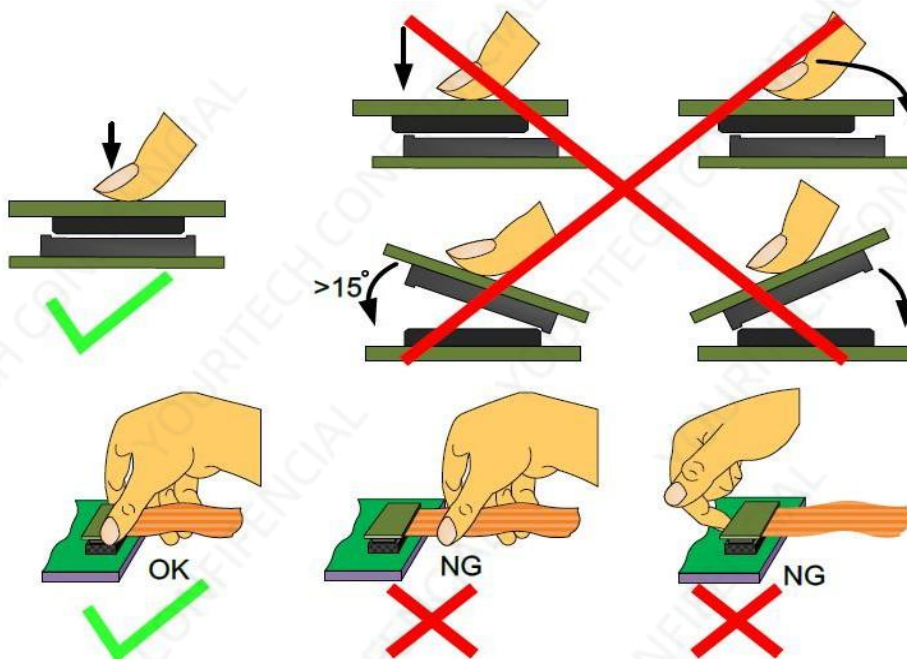
1、Installing AMOLED Modules

The hole in the printed circuit board is used to fix AMOLED as shown in the picture below. Attend to the following items when installing the AMOLED.

- 1) 、Cover the surface with a transparent protective plate to protect the polarizer.
- 2) 、When assembling the AMOLED into other equipment, the spacer to the bit between the AMOLED 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 0.1 mm.

2、Precaution for assemble the module with BTB connector:

Please note the position of the male and female connector position, don't assemble or assemble like the method which the following picture shows



3、Precaution for soldering the AMOLED

	Manual soldering	Machine drag soldering	Machine press soldering
No RoHS Product	290C~350C. Time:3-5S.	330C ~350C. Speed:4-8mm/s.	300C ~330C. Time: 3-6S. Press: 0.8~1.2Mpa
RoHS Product	340 C~370 C. Time:3-5S.	350 C ~370C. Time: 4-8 mm/s.	330C ~360C. 、 Time: 3-6S. Press: .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 AMOLED surface with a cover during soldering to prevent any damage due to flux spatters.

2) 、 When soldering the PC board, the 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.

4、Precautions for Operation

1) 、 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.

2) 、 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.

3) 、 Input logic voltage before apply analog high voltage such as AMOLED driving voltage when power on.

4) 、 Remove analog high voltage before logic voltage when power off the module. Input each signal after the positive/negative voltage becomes stable.

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、Safety

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

6、Limited Warranty

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

7、Return AMOLED under warranty

1) 、 Now warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are:

- Broken AMOLED 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.

