



SPECIFICATION FOR AMOLED Module

MODULE No:	HX016HVOQN006
CUSTOMER:	

STARTEK	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		

Revision History

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* Description

This is a color active matrix AMOLED module using Low Temperature Poly-silicon Thin Film Transistors as active switching devices. This module has a 1.6 inch diagonally measured active area with resolutions (320horizontal by 360vertical pixel arrays). Each pixel is divided into RED and GREEN and BLUE dots, which are arranged in vertical stripe and this module can display 16.7M colors.

* Features

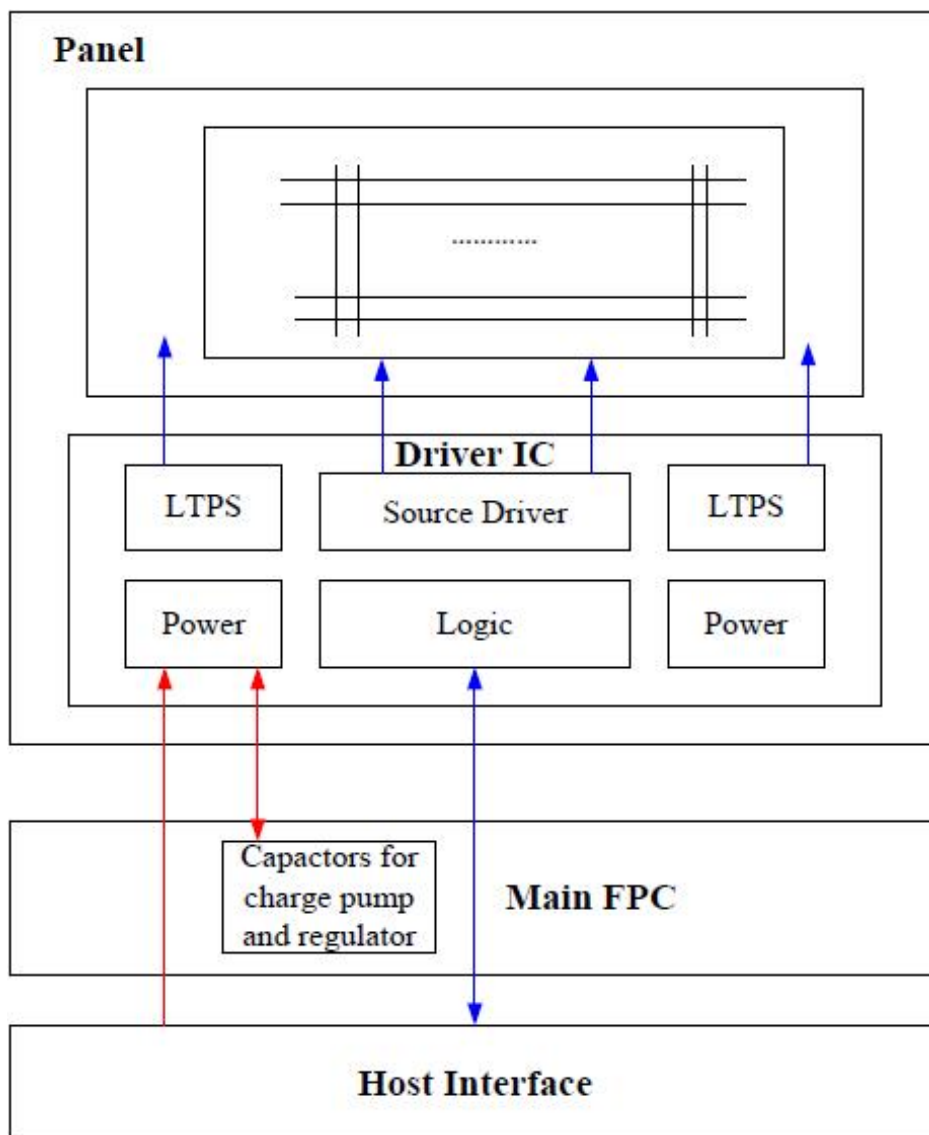
General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	27.02(H)*30.40(V) (1.6inch)	mm	
Driver element	active matrix OLED	-	
Display colors	16.7M	colors	
Number of pixels	320(RGB)*360	dots	
Pixel arrangement	RGB vertical stripe	-	
Pixel pitch	0.08445(H)*0.08445(V)	mm	
Viewing angle	ALL	o'clock	
Controller IC	RM69092	-	
LCM Interface	QSPI	-	
Display mode	AMOLED	-	
Operating temperature	-20~+70	°C	
Storage temperature	-30~+80	°C	

* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	28.92	-	mm	
	Vertical(V)	-	33.35	-	mm	
	Depth(D)	-	0.76	-	mm	
Weight		-	2	-	g	



1. Block Diagram



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3. Input terminal Pin Assignment

NO.	SYMBOL	DISCRIPTION	I/O
1	TP_OPT_I2C_SDA	TP&OPT&I2C DATA/NC	I/O
2	TP_OPT_I2C_SCL	TP&OPT&I2C CLK/NC	I
3	OPTIC_INT	ALS INT/NC	I/O
4	NC	NC	
5	LCD_MSPIO_3	OELD QSPI interface	P
6	LCD_MSPIO_CEO	OELD QSPI interface	P
7	LCD_MSPIO_1	OELD QSPI interface	P
8	GND	Ground.	P
9	AVDD_3V3	3.3V power for OLED DDIC	P
10	OVDD_3V3	OLED power supply	P
11	OVSS_3V3	OLED power supply	P
12	GND	Ground.	P
13	OVSS_3V3	OLED power supply	P
14	OVSS_3V3	OLED power supply	P
15	GND	Ground.	P
16	SWDIO(NC)	Floating	I
17	TP_INT/NC	TP INT/NC	I
18	TP_VDD/NC	3.3V power for TP/NC	P
19	TP_RST/NC	TP RESET/NC	I
20	LCM_TP_CD1V8/NC	1.8V Power foe TP& OPTIC/NC	P
21	LCM_DC 1V8	1.8V Power foe OLED DDIC	P
22	LCD_ID	Customer ID	O
23	SWIRE	Swire control interface	P
24	LCD_TE	Synchronous signal output from panel to avoid tearing effect	I
25	LCD_RST_IN	OLED Device reset signal(0:enable;1:Disable)	O
26	GND	Ground.	P



27	LCD_MSPIO_0	OELD QSPI interface	I/O
28	LCD_MSPIO_SCK	OELD QSPI interface	O
29	LCD_MSPIO_2	OELD QSPI interface	I
30	GND	Ground.	P
31	VPP	Floating	I/O
32	GND	Ground.	P
33	NFC_P	NFC TX1	I/O
34	NFC_N	NFC TX2	I/O



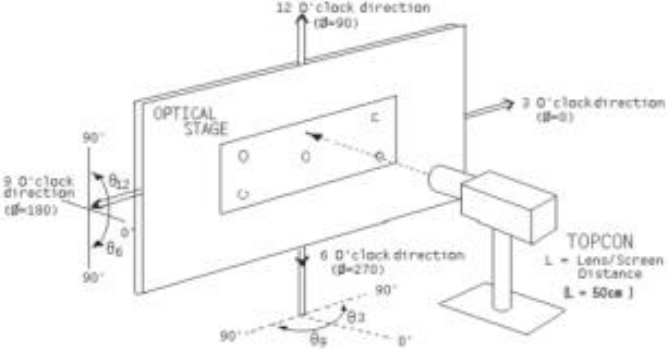
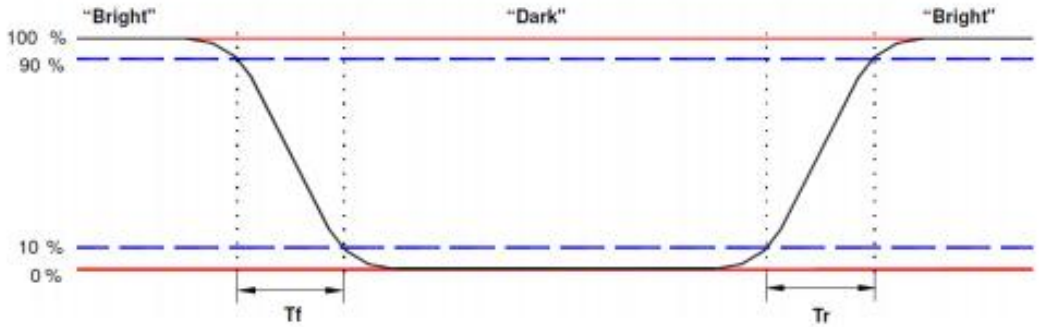
4. OLED Optical Characteristics

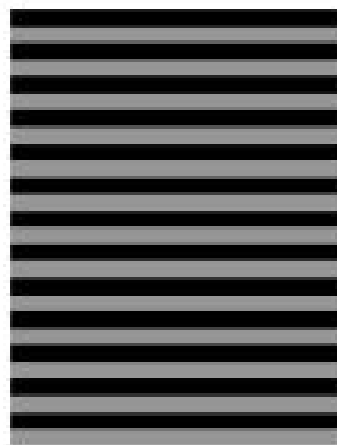
4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Surface Luminance		Lv	$\theta=0^{\circ}$ $\Phi=0^{\circ}$ Ta=25℃	400	450	500	cd/m2	(1)
Luminance uniformity		δ WHITE		85	--	--	%	(2)
Contrast Ratio		Cr		10000	--	--	--	(3)
Response time		Ton+Toff	Normal $\theta=0^{\circ}$ $\Phi=0^{\circ}$		2	4	Ms	
Viewing Angle		θ	Up/Down/Right/Left Cr≥200	80	--	--	deg	(4)
Color Coordinate of CIE1931	White	WX	$\theta=0^{\circ}$ $\Phi=0^{\circ}$ Ta=25℃.	-0.04	0.30	+0.04	--	(5)
		WY			0.31			
	Red	RX			0.686			
		RY			0.310			
	Green	GX			0.235			
		GY			0.720			
	Blue	BX			0.143			
		BY			0.044			
NTSC ratio		--	--	97	108	--	%	CIE1931
Gamma			Log(Lv Lb)=log(V)+log(a) V(Gray)= 48,72,104,132,164,192,224 Lum(gray255)=450nit	2.0	2.2	2.4	-	
Lifetime			Ta=25℃	30000	--	--	Hrs	



see the note in the table below:

No	Item	Details
Note1	Brightness	
Note 2	Response time	



Odd row : L0 Black
Even row : L186 gray level

Flicker Test Pattern

The flicker level is defined by Fast Fourier Transformation (FFT) as follows:

$$Flicker = 20 \log_{10} \left(2 \frac{f_{FFT}(n)}{f_{FFT}(0)} \right) + FS(Hz) \quad (dB)$$

Where

$f_{FFT}(n)$ is the n-th FFT coefficient.

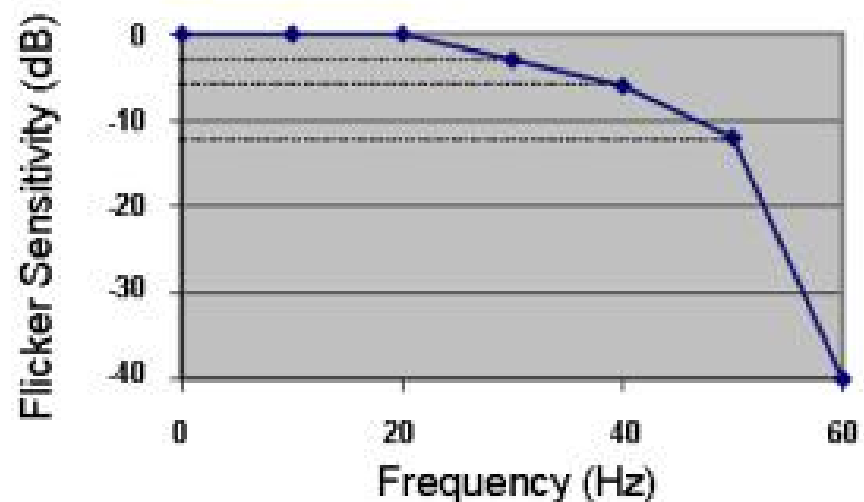
$f_{FFT}(0)$ is the 0-th FFT coefficient which is DC component.

$FS(Hz)$ is the flicker sensitivity as a function of frequency.

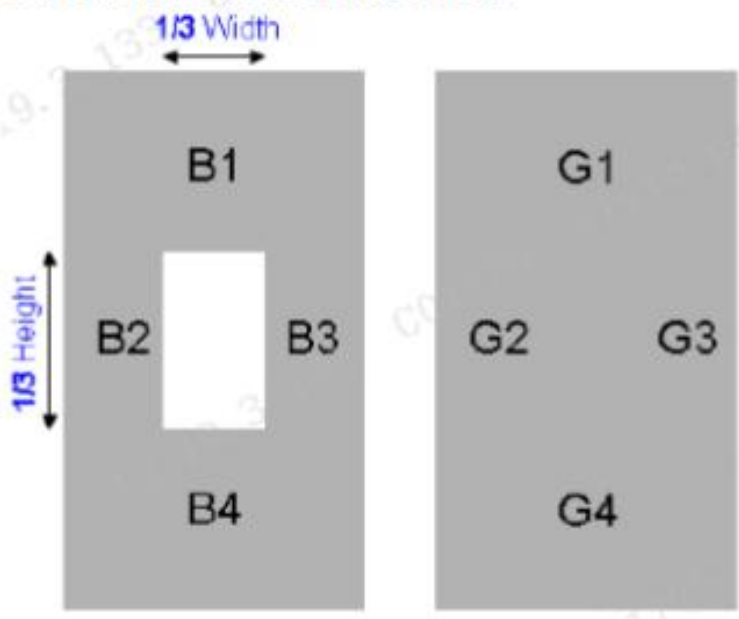
The peak flicker level shall be reported based on the calculation using above formula in

which $FS(Hz)$ is determined by the flicker weighing factor shown below.

Flicker Weighing Factor





Note 7	Crosstalk	Box Pattern: L128 gray level background with a L255 White window in the central area. Gray Pattern: L128 gray level background only.  Box Pattern Gray Pattern <i>Crosstalk</i> $\equiv \text{Maximum} : \left\{ \frac{ B1 - G1 }{G1}, \frac{ B2 - G2 }{G2}, \frac{ B3 - G3 }{G3}, \frac{ B4 - G4 }{G4} \right\} \times 100\%$
Note 8	Life Time	OLED life time is defined by the Minimum Duration Time that the luminance is decayed to a specific ratio (ex. 92%) of initial state. Test Pattern under duration period: L255 White



5. Electrical Characteristics

5.1 Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit
Supply voltage (Display)	V _{CI}	-0.3	5.5	V
	IOVCC	-0.3	5.5	
	ELVDD	0.0	6.0	
	ELVSS	-6.5	0.0	
Operating temperature	T _{OP}	-20	70	°C
Storage temperature	T _{ST}	-30	80	°C
Humidity	RH	-	90	%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.



5.2 Electrical specifications

Power Characteristic:

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
AMOLED Power Positive	ELVDD	3.25	3.3	3.35	V	-
AMOLED power Negative	ELVSS	-3.35	-3.3	-3.25	V	Ref
Digital Power supply	VDDIO	1.65	1.8	1.95	V	Ref
Analog Power supply	VCI	3.25	3.3	3.35	V	Ref

1) Normal Mode

Power Supply: VDDIO =1.8V , VCI=3.3V , ELVSS=-3.3V , ELVDD=3.3V

Frame Frequency: F_{frame} =60HZ @ 25degC, Brightness 500 nits, Command Mode,

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
100% Pixel On 450nits	IELVDD /ELVSS	-	21.6	26.10	mA	Ref
	IVCI	-	5.8	6.5	mA	Ref
	IVDDIO	-	5.5	5.8	mA	Ref

2) Idle Mode

Power Supply: VDDIO=1.8V VCI=3.3V

Frame Frequency: F_{frame} =15HZ @ 25degC, Brightness 50 nits

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
10% Pixel On 50 nits	IELVDD /ELVSS	-	-	-	mA	Supplied by Driver IC
	IVCI	-	3.4	4.0	mA	Ref
	IVDDIO	-	0.8	1	mA	Ref

3) Deep Standby Mode

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
Deep Standby	IVCI	-	-	3	uA	-
	IVDDIO	-	-	3	uA	-

4) HBM Mode

Power Supply: VDDIO =1.8V VCI=3.3V ELVSS=-3.7V ELVDD=3.3V

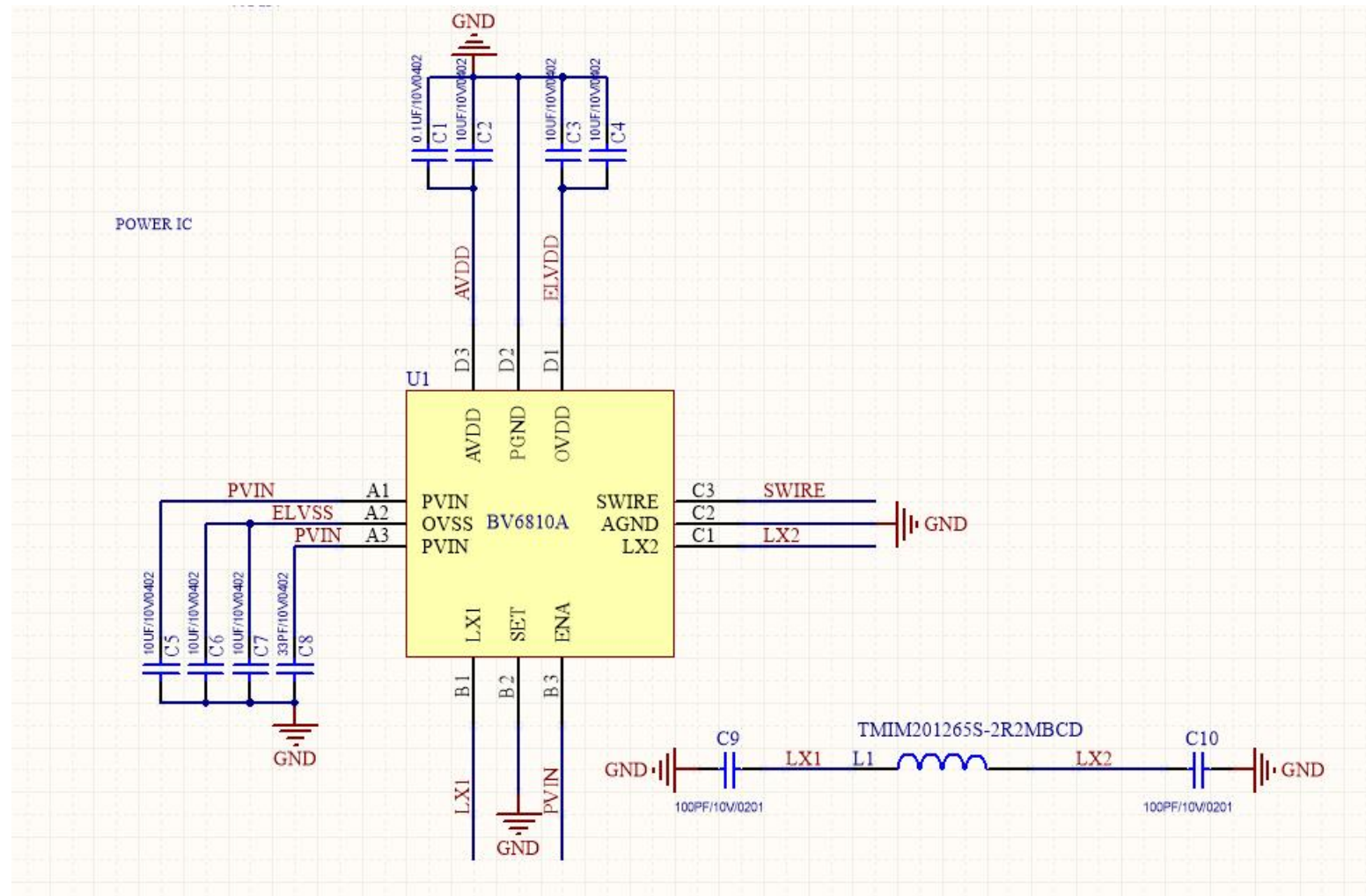
Frame Frequency: F_{frame} =60HZ @ 25degC, Brightness 1000 nits, Command Mode,

Display Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
100% Pixel On 1000nits	IELVDD /ELVSS	-	43.2	52.3	mA	-
	IVCI	-	5.9	6.6	mA	
	IVDDIO	-	5.6	5.9	mA	



6. Application Circuit

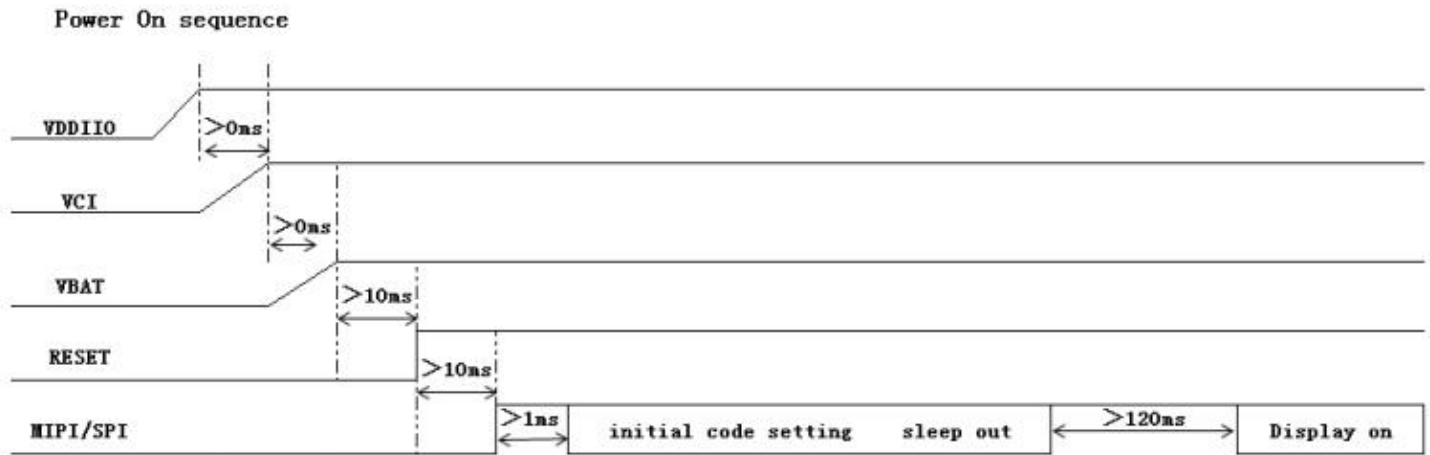
ELVDD&ELVSS power supply schematic, The Triple DC/DC converter BV6810A is recommended. The application schematics and external components are as below.



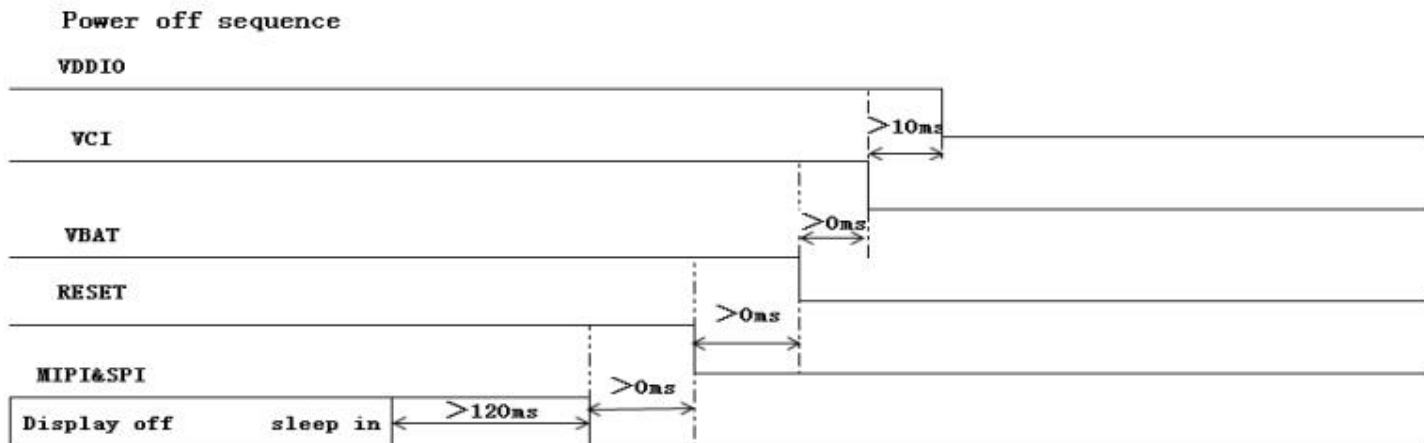


7. Recommended Operating Sequence

7.1 Power on sequence

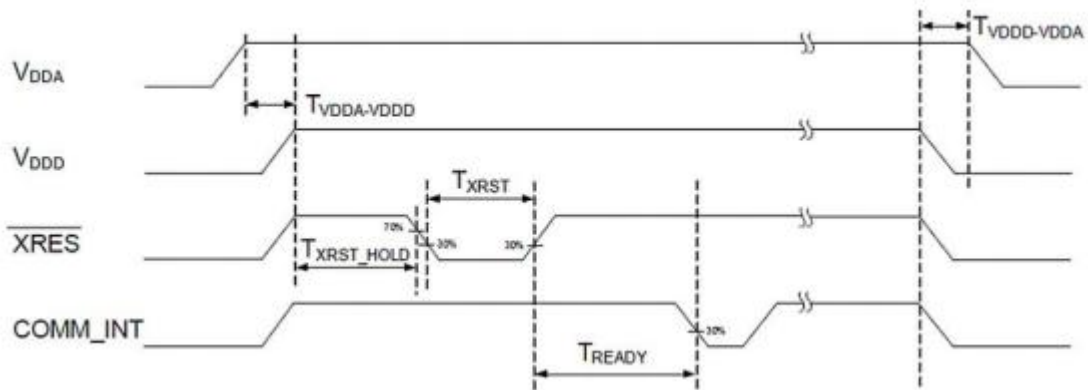


7.2 Power off sequence





7.3 Power on/off sequence (touch panel)



Symbol	Description	Conditions	Min	Typ	Max	Units
T _{VDDA-VDDD}	Time of V _{DDA} Ready Time before V _{DDD} Ready Time	-	0	-	-	ms
T _{XRST_HOLD}	Hold time before External Reset (XRES) Asserted	-	2	-	-	ms
T _{XRST}	External Reset (XRES) Pulse Width	After V _{DDD} is valid	0.01	-	20	ms
T _{VDDD-VDDA}	Time of V _{DDD} Discharge before V _{DDA} Discharge Time	-	0	-	-	ms
T _{READY}	Time from Deassertion of XRES to COMM_INT	-	-	-	16	ms

7.4 Timing requirements for RESETB(For RM69092)

When RESETB of the reset pin equals to Low, it will be in the condition of reset. When it is in the condition of reset, it will make the device recover the initial set. However, in order to avoid the reset noise cause reset, there is a mechanism to judge about whether the reset is needed or not. The closed interval of Low can be shown as the following

(Test condition: V_{DDIO}=1.65V~3.6V, V_{SS}=0V, T_A=-20°C~+70°C)

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

Table: Reset timing





8. OLED Module Out-Going Quality Level

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

8.1 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:

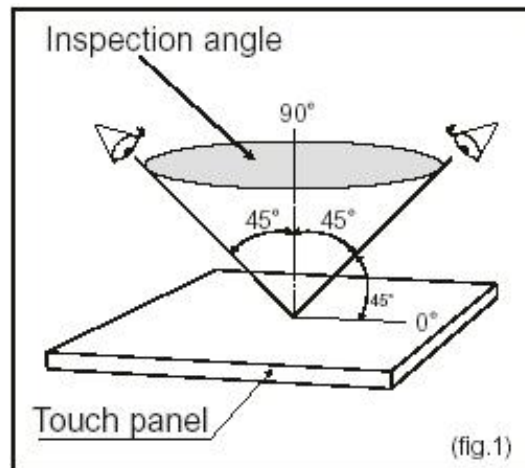
Major defect : AQL 0.65

Minor defect : AQL 1.5

8.2 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 sample 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.

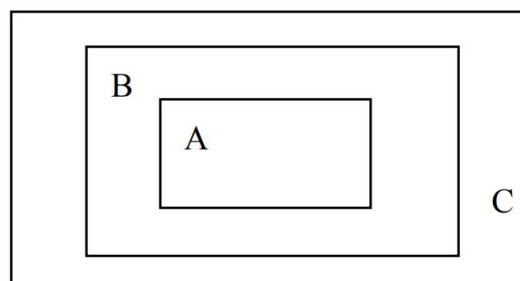


8.3 Definition of AMOLED inspection zone

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)

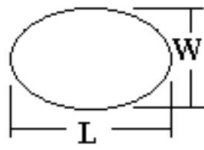


8.4 Inspection standards

8.4.1 Definition of the defect size :



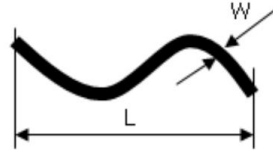
Spot shape :



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

D: Diameter L: Length W: Width N: Number DS: Distance

Line shape :



8.4.2 Major defect

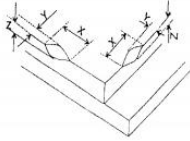
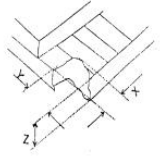
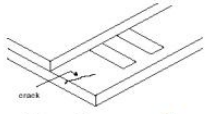
Item No.	Inspection Item	Inspection standards
(1)	Function defects	1) No display not allowed 2) Display abnormally not allowed 3) Bright/Dark line and other line-shape function defect not allowed
(2)	Component	Missing/breakage component not allowed
(3)	Outline dimension	Overall outline dimension beyond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

8.4.3 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.
		$D \leq 0.10, DS \geq 10$		Disregard	$D \leq 0.10, DS \geq 10$		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)	$N \leq 4, DS \geq 10$			$N \leq 8, DS \geq 10$		
(4)	Line defect Black line, White line, Foreign material	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
	under polarizer	$L \leq 2.0$	$0.02 < W \leq 0.03$	$N \leq 2$	$L \leq 2.0$	$0.02 < W \leq 0.03$	$N \leq 3$
		$L \leq 1.0$	$0.03 < W \leq 0.05$	$N \leq 2$	$L \leq 1.0$	$0.03 < W \leq 0.05$	$N \leq 3$
			$W > 0.05$	$N = 0$		$W > 0.05$	$N = 0$
(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≤0.2	Disregard	D≤0.2	Disregard
		0.2<D≤0.5	N≤2	0.2<D≤0.5	N≤3
		D> 0.5	N=0	D> 0.5	N=0
(8)	Fingerprint	Not allowed			
(9)	 Usual surface cracks	$z \leq t$: Y≤0.5mm, X≤2mm z: Crack thickness; t: Glass thickness		$z \leq t$: Y≤1mm, X≤3mm z: Crack thickness; t: Glass thickness	
(10)	 Chips on corner	$z \leq t$: Y≤2mm, X≤2mm z: Chips thickness; t: Glass thickness		$z \leq t$: Y≤3mm, X≤3mm z: Chips thickness; t: Glass thickness	
(11)	 Cracks tend to break	Cracks tend to break are not allowed. Edge burrs disregard.			

Notes: Base on Shenzhen Startek Electronic 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.



9.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
 - Ethyl alcoholDo 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 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 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 0°C and 35°C, 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 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.

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.
 - a) - Exposed area of the printed circuit board.
 - b) -Terminal electrode sections.

USING AMOLED MODULES

1 Installing AMOLED Modules

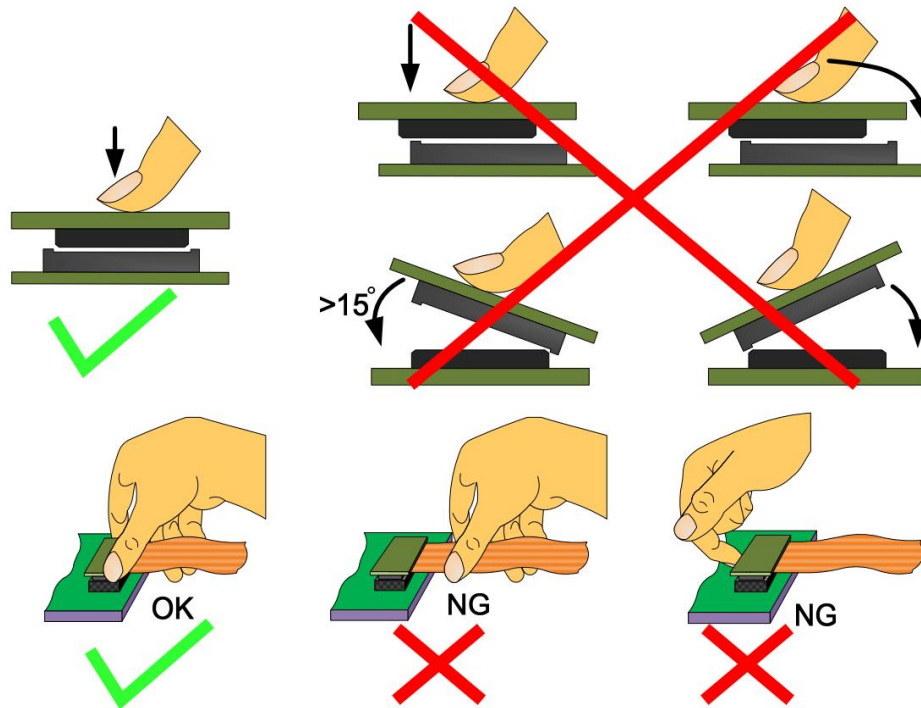
The hole in the printed circuit board is used to fix AMOLED as shown in the picture below. Attend to the Following items when installing the AMOLED.

- 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 $\pm 0.1\text{mm}$.

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	290°C ~350°C. Time: 3-5S.	330°C ~350°C. Speed : 4-8 mm/s.	300°C ~330°C. Time: 3-6S. Press: 0.8~1.2Mpa
RoHS Product	340°C ~370°C. Time: 3-5S.	350°C ~370°C. Speed : 4-8 mm/s.	330°C ~360°C. 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 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. Remove analog high voltage before logic voltage when power off the module. Input each signal after the positive/negative voltage becomes stable.

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

7 Return AMOLED under warranty

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

- a) - Broken AMOLED glass.
- b) - PCB eyelet is damaged or modified.
- c) - PCB conductors damaged.



- d) - Circuit modified in any way, including addition of components.
 - e) - PCB tampered with by grinding, engraving or painting varnish.
 - f) - 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.

PACKING SPECIFICATION

Please consult our technical department for detail information.

PRIOR CONSULT MATTER

- 1 For Startek standard products, we keep the right to change material, process ... for improving the product Property without prior notice to our customer.
- 2 If you have special requirement about reliability condition, please let us know before you start the test on Our samples.



10. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	70°C/96 hours	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).
Low Temperature Operating	-20°C/96hours	
High Temperature Storage	80°C/96hours	
Low Temperature Storage	-30°C/96hours	
High Temperature & High Humidity Operating	60°C $\pm$ 5°C $\times$ 90%RH/96hours	
Thermal Shock (Non-operation)	-40°C $\pm$ 2°C~80°C $\pm$ 2°C $\times$ 30cycles (30min.) (5min.) (30min.)	
ESD test	Voltage: $\pm$ 2KV R: 330 Ω C:150pF,Air discharge, 5time; C:150pF,contact discharge, 5time; (Environment: 15°C~35°C, 30%~60%).	
Vibration (Non-operation)	Frequency : 10Hz~55Hz~10Hz Amplitude : 1.5mm, X , Y , Z direction for total 3hours (Packing condition)	

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 > 10M Ω) 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.



11. Packing

----TBD-----