



# Specification

Customer Project Name	
Module Name	DW60QVSA11H1FQ-CO
Version No.	V0
Release Date	2023-12-16

**Customer Approval:**

- Approve Specification Only**
- Approve Specification and Sample**

Approved By
Date

Designed By	Checked By	Approved By





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## 1. Introduction

This display module is designed by Kingtech. All materials and processes of this display module are Lead Free.

Display, display module, LCM or module in this specification has the same meaning.

## 2. General Specification

### 2.1 Display Module General Specification

Item	Content	Unit
Display Module Size (inch)	6.01	inch
Active Area (W×H)	68.256×136.512	mm
Module Size (W×H×T)	74.03×155.36×2.47	mm
Pixel Pitch (W*H)	0.06320×0.06273	mm
Display Type	AMOLED	/
Viewing Direction	ALL	/
Number of Dots	1080×(RGB)×2160	Dots
Pixel Per Inch (PPI)	401	/
Driver IC	CH13721C	/
Interface Type	MIPI	/
Approx. Weight	TBD	g
Display Colors	16.7M(8bits)	
NTSC	100%(Type)	/
Cover Lens Supplier	Corning GG5	
TP Type	GFF	
Touch IC	GT1151QM	
Touch Interface	I2C	
Touch Point	10	





## 4. Display Module Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Supply Voltage for Logic	VDDIO	-0.3	5.5	V
DC/DC Converter Circuit Output	VCI	-0.3	5.5	V
Driver Supply Voltage	VGH	-0.3	+15	V
Driver Supply Voltage	VGL	0.3	-15	V
Operating Temperature	Top	-20	+70	°C
Storage Temperature	Tst	-30	+80	°C

## 5. Electrical Characteristics

### 5.1 Display Module Electrical Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage for Logic	VDDIO	1.65	1.8	3.6	V
Supply Voltage for Analogic	VCI	2.5	3.0	3.6	V
Supply Voltage for Analogic	AVDD	4.5	6.4	6.5	V
Supply Voltage for Analogic	ELVDD	-	4.6	-	V
Supply Voltage for Analogic	ELVSS	-	-3.0	-	V
Input Voltage	V <sub>IL</sub>	V <sub>SS</sub>	-	0.3VDDIO	V
	V <sub>IH</sub>	0.7VDDIO	-	VDDIO	V

### 5.2 TP Electrical Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage for TP	TP_VCC	-	2.8	-	V
Supply Voltage for IO	TP_VDDIO	-	1.8	-	V



## 6. Display Module Optical Characteristics

Item	Symbol	Condition	Specifications			Unit	Remark
			Min.	Typ.	Max.		
Brightness	Lv		365	450	--	Cd/m2	Note 2
Contrast Ratio	CR		100000	--	--	/	Note 1
Response Time	Tr+Tf		--	--	1	ms	Note 4
Chromaticity CIE(x,y)	Red	x	0.655±0.03			/	Note 6
		y	0.345±0.03			/	
	Green	x	0.250±0.03			/	
		y	0.710±0.03			/	
	Blue	x	0.135±0.03			/	
		y	0.060±0.03			/	
	White	x	0.27±0.03			/	
		y	0.27±0.03			/	
Viewing Angle	Hor.	$\theta_{X+}$	80	--	--	Deg.	Note 5
		$\theta_{X-}$	80	--	--		
	Ver.	$\theta_{Y+}$	80	--	--		
		$\theta_{Y-}$	80	--	--		
Luminance Uniformity	White		75	--	--	%	Note 3

Note1. Contrast Ratio (CR) is defined mathematically by the following formula. For more information see FIG.1  
 Contrast=  $\frac{\text{Average Surface Luminance with all white pixels (P1,P2,P3,P4,P5,P6,P7,P8,P9)}}{\text{Average Surface Luminance with all black pixels (P1,P2,P3,P4,P5,P6,P7,P8,P9)}}$

Note2. Surface luminance is defined mathematically by the following formula. For more information see FIG.1  
 Brightness = Average Surface Luminance with all white pixels (P1,P2,P3,P4,P5,P6,P7,P8,P9)

Note3. The luminance uniformity is defined mathematically by the following formula. For more information see FIG.1  
 Luminance =  $\frac{\text{Minimum Surface Luminance with all white pixels (P1,P2,P3,P4,P5,P6,P7,P8,P9)}}{\text{Maximum Surface Luminance with all white pixels (P1,P2,P3,P4,P5,P6,P7,P8,P9)}}$

Note4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For more information see FIG.2



Note5. Viewing angle means the best contrast ratio of display for user. For more information see FIG.3

Note6. Chromaticity CIE(x, y) is determined by the CIE(x, y) value of the point5. For more information see FIG.1

Note7: NTSC ratio is defined mathematically by the following formula. For more information see FIG.4

$$\text{NTSC Ratio} = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}}$$

Note8. For viewing angle and response time testing, the testing data is base on instruments of Autronic-Melchers's ConoScope series. For contrast ratio, Surface Luminance, Luminance uniformity and CIE(x,y), the testing data is base on BM-7 photo detector.

FIG.1. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE(x,y) chromaticity

A: 6 mm

B: 6 mm

H, V: Active Area

Light spot size  $\Phi=5\text{mm}$ , 500mm distance from the display surface.

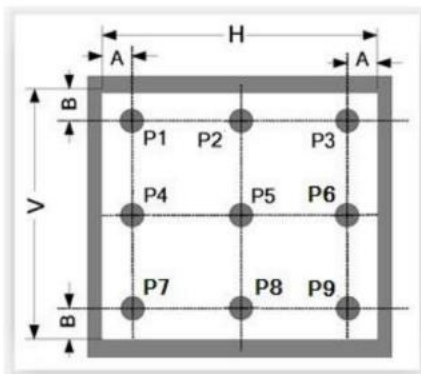


FIG.1. 9-point position on display 测量点位置示意

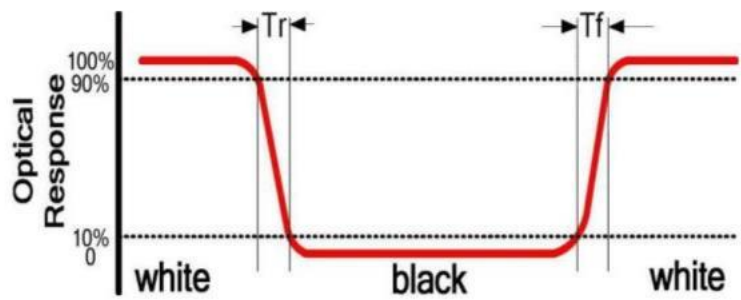


FIG.2. The definition of response time 响应时间定义

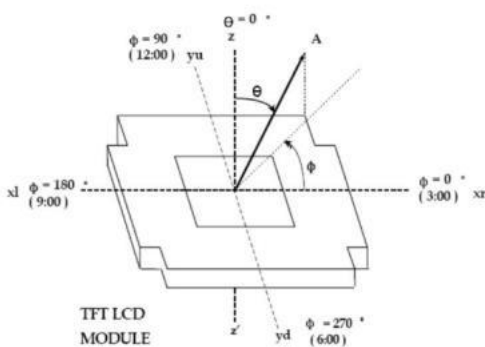


FIG.3. The definition of viewing angle 视角定义

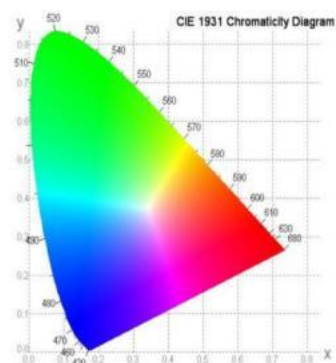


FIG.4. NTSC ratio 色域定义



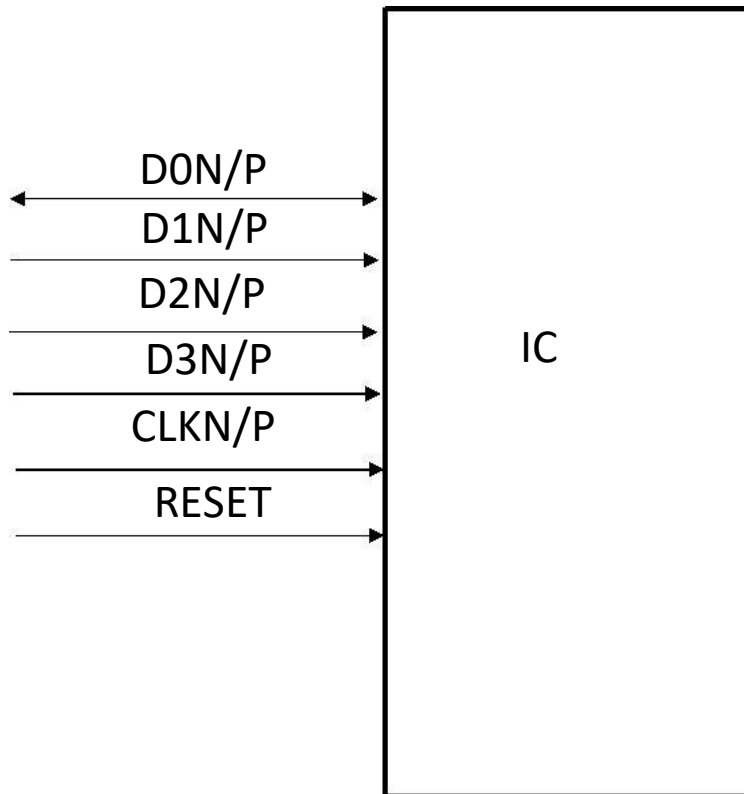


## 7. Display Module Interface Description(Pin Definition)

No.	Symbol	Description	I/O
1	GND	Ground	P
2	TP_INT	TP int lane	I
3	TP_VDD	TP power supply 2.8V	P
4	TP_SDA	TP serial data lane	I
5	TP_SCL	TP serial clock	I
6	TP_RST	TP reset signal	I
7	GND	Ground	P
8	VDDIO	Power supply 1.8V	P
9	NC	Not connect	-
10	LCD_ID	System Hardware ID Select	-
11	VCI	Power supply 2.8V	P
12	TE	Tearing effect signal is used to synchronize MCU to frame memory	O
13	RESET	Reset signal	I
14	ERR_FG	Error flag output pin	O
15	AVDD_EN	Power IC enable control pin	O
16	SWIRE	SWIRE Control Interface	O
17	MTP	OTP programming power supply pin.	P
18	ELVSS	AMOLED Negative Power Supply	P
19	ELVSS	AMOLED Negative Power Supply	P
20	ELVSS	AMOLED Negative Power Supply	P
21	NC	Not connect	-
22	D2P	MIPI-DSI Data differential signal input pins.(data lane 2)	I
23	D2N	MIPI-DSI Data differential signal input pins.(data lane 2)	I
24	GND	Ground	P
25	D1P	MIPI-DSI Data differential signal input pins.(data lane 1)	I
26	D1N	MIPI-DSI Data differential signal input pins.(data lane 1)	I
27	GND	Ground	P
28	CLKP	MIPI-DSI CLOCK differential signal input pins	I
29	CLKN	MIPI-DSI CLOCK differential signal input pins	I
30	GND	Ground	P
31	D0P	MIPI-DSI Data differential signal input pins.(data lane 0)	I/O
32	D0N	MIPI-DSI Data differential signal input pins.(data lane 0)	I/O
33	GND	Ground	P
34	D3P	MIPI-DSI Data differential signal input pins.(data lane 3)	I
35	D3N	MIPI-DSI Data differential signal input pins.(data lane 3)	I
36	GND	Ground	P
37	AVDD	Power supply for analog	P
38	ELVDD	AMOLED Positive Power Supply	P
39	ELVDD	AMOLED Positive Power Supply	P
40	ELVDD	AMOLED Positive Power Supply	P



## 8. Display Module Block Diagram



## 9. Caution

### 9.1 Handling of Display Module

Be sure to ground the body when handling the display module.

Do not give external shock.

Do not apply excessive force on the surface.

Material in display is hazardous substance, do not lick and swallow.

When the material is attached to your hand, skin, cloth etc., wash it out thoroughly and immediately.

Do not operate it above the absolute maximum rating.

Do not disassemble the display module.

### 9.2 Storage

Store in an ambient temperature of 5°C to 45°C, and in a relative humidity of 40% to 60%. Do not expose to sunlight or intensive ultraviolet rays.

Storage in a clean environment, free from dust, active gas, and solvent.

Store in anti-static electricity container.

Store without any physical load.

## 10. Display Module Quality Criteria

### 10.1 Inspection Conditions

Inspection performed under the following conditions:

Temperature: 25 ± 5°C

Humidity: 65% ± 10%RH

Viewing angle  $\theta$ : ≤ 30°

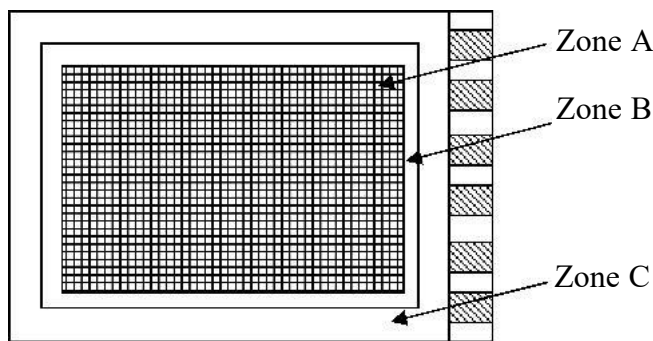
Illumination: under a fluorescent lamp at a distance of 50cm with 300~700Lux

Viewing distance: 30cm ± 5cm



Fluorescent lamp

**10.2 Zone Definition**



Zone A : Effective viewing area(AA)

Zone B : Viewing area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Note: Visual defect in Zone C can be ignored, as it does not effect display function or appearance after being assembled by customer.

**10.3 Inspection Specification**

Sampling plan according to GB/T2828.1-2012/ISO 2859-1: 1999 and ANSI/ASQC

Z1.4-1993,normal level 2 and based on:

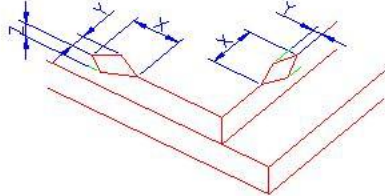
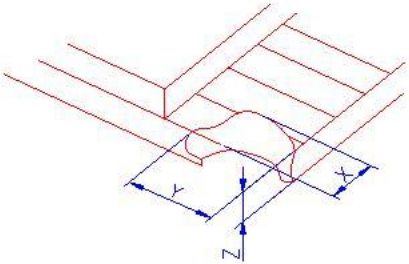
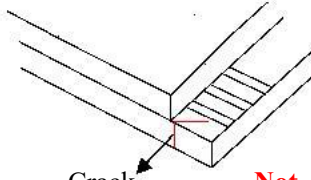
AQL:

Major Defect	Minor Defect
0.4	1.0

No.	Items to be inspected	Criteria	Classification of Defect
1	Functional Defects	1) No display, open or miss line. 2) Display abnormally, short. 3) Backlight no lighting, abnormal lighting. 4) TP no function.	Major
2	Missing	Missing component.	
3	Outline Dimension	Overall outline dimensions are larger or shorten than the drawing.	
4	Color Tone	Color unevenness, refer to limited sample.	Minor
5	Soldering Appearance	Good soldering , Peeling off is not allowed.	
6	Display/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	
7	Linearity	No more than 1.5%.	



**10.4 Criteria (Visual)**

No.	Items	Criteria(mm)						
1	Display Edge Broken	 <table border="1" data-bbox="544 689 1062 819"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td>≤3.0mm</td> <td>&lt;Inner border line of the seal</td> <td>≤T</td> </tr> </table> <p>No effective function. <b>Allowed</b></p>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
	X	Y	Z					
	≤3.0mm	<Inner border line of the seal	≤T					
Display Corner Broken	 <table border="1" data-bbox="544 1120 967 1209"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td>≤3.0mm</td> <td>≤L</td> <td>≤T</td> </tr> </table> <p>No effective function. <b>Allowed</b></p>	X	Y	Z	≤3.0mm	≤L	≤T	
X	Y	Z						
≤3.0mm	≤L	≤T						
Display Crack	 <p><b>Crack</b> <span style="color: red;"><b>Not allowed</b></span></p>							

Notes: X=Length of defect, Y=Width of defect, Z=Height of defect, L=Length of ITO, T=Height of display.



2	<p>Clear Spot Defect</p> <p><math>\Phi=(X+Y)/2</math></p>	1.Light dot(Display/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)				
		Size (mm) \ Zone		Acceptable Qty		
				A	B	C
		$\Phi \leq 0.1$		Ignore		
		$0.1 < \Phi \leq 0.2$		2( distance $\geq 5\text{mm}$ )		
		$\Phi > 0.2$		0		
				Ignore		
		2.Dim spot(Display/TP/Polarizer dim dot, light leakage、 dark spot)				
		Size (mm) \ Zone		Acceptable Qty		
				A	B	C
$\Phi \leq 0.1$		Ignore				
$0.1 < \Phi \leq 0.2$		2( distance $\geq 5\text{mm}$ )				
$0.2 < \Phi \leq 0.25$		1				
$\Phi > 0.25$		0				
		Ignore				
3.TP Dirt						
Size (mm) \ Zone		Acceptable Qty				
		A	B	C		
$\Phi \leq 0.1$		Ignore				
$0.1 < \Phi \leq 0.25$		2( distance $\geq 5\text{mm}$ )				
$\Phi > 0.25$		0				
		Ignore				
Line Defect	Black or white line, foreign material, scratch, stain on Display/TP/polarizer.					
	Width(mm)	Length(mm)	Acceptable Qty			
			A	B	C	
	$\Phi \leq 0.02$	Ignore	Ignore			
	$0.02 < W \leq 0.03$	$L \leq 2.0$	$N \leq 1$			
$0.03 < W \leq 0.05$	$L \leq 1.0$	$N \leq 1$				
$W > 0.05$	Define as spot defect					
3	Polarizer Bubble	Size (mm) \ Zone		Acceptable Qty		
				A	B	C
		$\Phi \leq 0.1$		Ignore		
		$0.1 < \Phi \leq 0.25$		2(distance $\geq 5\text{mm}$ )		
$\Phi > 0.25$		0				
		Ignore				
4	SMT	According to IPC-A-610C class II standard.Function defects and missing parts are major defects, others are minor defects.				



		Newton Ring area > 1/6 TP area	NG			
		Newton Ring area ≤ 1/6 TP area	OK			
	Newton Ring	Rule-less Newton Ring area > 1/4 TP area	NG			
		Rule-less Newton Ring area ≤ 1/4 TP area	OK			
5						
	TP Corner Broken	X X ≤ 2.0mm	Y Y ≤ 2.0mm	Z Z < Lens thickness	X Z	Y
		* Circuitry broken is not allowed.				
	TP Edge Broken	X X ≤ 2.0mm	Y Y ≤ 0.15mm	Z Z < lens thickness	X	Y Z
		* Circuitry broken is not allowed.				
		Zone Size (mm)			Acceptable Qty	
				A	B	C
	TP Dirt	Φ ≤ 0.1		Ignore		
6		0.1 < Φ ≤ 0.2		2 (distance ≥ 5mm)		Ignore
		Φ > 0.2		0		
		The line can be seen after mobile phone in the operating condition				
					Acceptable Qty	
		Width (mm)	Length (mm)		A	B C
	Foreign Material on TP Film	Φ ≤ 0.03	Ignore	Ignore		Ignore
7		0.03 < W ≤ 0.05	L ≤ 3.0	N ≤ 2		
		W > 0.05	L > 3	Define as spot defect		
					Acceptable Qty	
		Width (mm)	Length (mm)		A	B C
	Dim Line on TP Film	Φ ≤ 0.03	Ignore	Ignore		
8		0.03 < W ≤ 0.05	L ≤ 3.0	N ≤ 2		Ignore
		W > 0.05		Define as spot defect		
9	Pattern Font	Pattern fonts are clear and symmetrical, slightly uneven are allowed. Font swing is no more than 1mm, font line should be smooth.				



## 11. Reliability Test

No.	Item	Condition	Standard
1	High Temp. Storage	80°C, 48 hours	1. Functional test is OK. Missing segment, short, unclear segment, display abnormally and liquid crystal leak are not allowed. 2. No low temperature bubbles, end seal loose and fall, frame rainbow.
2	Low Temp. Storage	-30°C, 48 hours	
3	High Temp. Operation	70°C, 48 hours	
4	Low Temp. Operation	-30°C, 48 hours	
5	High Temp. and High Humidity Storage	60°C,90%RH ,48 hours	
6	Thermal and Cold Shock	Static state, -40°C(30 Min)~80°C(30 Min)~ -40°C(30Min),packaging,10 cycles	1. Function test is OK. 2. No glass crack, chipped glass, end seal loose and fall, epoxy frame crack and so on. 3. No structure loose and fall.
7	Vibration Test	Packaging, Frequency: 10-55Hz Amplitude: 1.0mm Each direction on X,Y,Z for 2 hours	
8	Dropping Test	Pack products into a carton box,and drop it to ground from 80cm height,once each side of the carton.	

### Notes:

- 11.1 The reliability items will be fully carried out in new project sample-test.
- 11.2 The reliability items will be tested as a continuous monitoring during mass production by plan.
- 11.3 All samples are inspected after being kept in the room with normal temperature and humidity for 2 hours or above after reliability test.
- 11.4 Vibration test: It is not necessary without assembly frame of backlight, or PCB/FPC etc..
- 11.5 Dropping test: It is not necessary until confirm new package.
- 11.6 For the high temperature and high humidity test, pure water of over 10 MΩ.cm should be used.
- 11.7 Each test item applies only once for every test display. Tested display cannot be used again in any other test item.
- 11.8 The quantity of display for each reliability item is 5pcs to 10pcs.

## 12 Precautions for Using Display Modules

### 12.1 Safety Instructions

- 12.1.1 If the display panel breaks, be careful not to get any liquid crystal substance or other materials in your mouth.
- 12.1.2 If the liquid crystal substance touches your skin or clothes, please wash it off immediately by using soap and water.

### 12.2 Handling Precautions

- 12.2.1 Avoid static electricity damaging the display.
- 12.2.2 Do not remove the panel or frame from the module .
- 12.2.3 The polarizer of the display is very fragile, so please handle it very carefully.
- 12.2.4 Do not wipe the polarizer with a dry cloth, as it may easily scratch the surface of it.
- 12.2.5 The color tone of Display has the possibility of being changed in the large storage temperature range.
- 12.2.6 Pay attention to the working environment, as the components may be destroyed by static electricity.
  - Be sure to ground human body and electric appliance during working.
  - Avoid working in a dry environment to minimize the generation of static electricity.
  - Static electricity may be generated when the protective film is quickly peeled off.
- 12.2.7 When soldering the terminal of display, make sure the power source of soldering iron does not leak.
- 12.2.8 If the display surface contaminated, clean it gently with a clean cloth. If it is heavily contaminated, moisten the clean cloth with the following solvent (ex:ethyl alcohol). Solvents without mentioned may damage the polarizer.

### 12.3 Operation Instructions





12.3.1 It is recommended to drive the display within the specified voltage limits, try to adjust the operating voltage for the optimal contrast, the color and contrast of display panel will varies at different temperature.

12.3.2 Response time is greatly delayed at low operating temperature range. However, it does not mean the display is damaged, it will recover in the specified temperature range.

12.3.3 If the display area is pushed hard during operation, the display will become abnormal.

12.3.4 Do not operate the display at the environments over the specified conditions, this may cause damage on the display and shorten the lifetime.

## 12.4 Storage Instructions:

12.4.1 Store display in a sealed polyethylene bag.

12.4.2 Store display in a dark place, Do not expose to sunlight or fluorescent light. Keep the temperature between 0°C and 35°C.

12.4.3 Avoid the polarizer being touched by any objects.(Recommend to store in the container while shipped)

## 12.5 Limited Warranty

12.5.1 Kingtech will replace or repair any of its display module, after customers inspected defects according to Kingtech's quality standard (in this specification), with a period of 12 months from ink-print date on product.

12.5.2 Any defect product must be returned to Kingtech within 60 days since shipped out. Confirmation of such date shall be based on freight documents. The warranty liability of Kingtech limited to repair and/or replacement on defects above (10.4) 12.5.3 No warranty can be granted if the precautions stated above have been disregarded. The typical samples are as below:

12.5.3 No warranty can be granted if the precautions stated above have been disregarded. The typical samples are as below:

--Display glass cracked or broke.

--Display modified by grinding or engraving or painting varnished etc..

--PCB/FPC components damaged or modified.

--PCB/FPC cracked or damaged.

--Protect film of polarizer removed.

12.5.4 Modules must be returned with sufficient descriptions of defects. Any connectors or cable installed by the customer must be removed completely without damaging the display. Modules must be packed with the container in which they were shipped. The figures below illustrate the correct and incorrect packaging.



## 13. Packing Specification

-TBD-