

PRODUCT SPECIFICATION

TFT LCD MODULE

MODEL : KWH040ZX07-F01 Version: 1.0

- Preliminary Specification
 Finally Specification

OLD

CUSTOMER'S APPROVAL	
SIGNATURE:	DATE:

● It signifies that you fully understand and accept all the contents of this specification if you sign and send back the first page of this specifications.

Designed by	R&D Checked by	Quality Department by	Approved by
LEO			

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● This specification is subject to change without notice. Please contact FORMIKE or it's representative before designing your product based on this specification.

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LCD

MODULE

TD

Revision History

Rev	Issued Date	Description	Page	Editor
1.0	2020-01-22			

FORMIKE LCD OTC , TD

1 General Specifications

Feature		Specifications
Display Spec.	LCD type	4.0 inch
	Resolution (H*V)	480(RGB) × 480
	Technology Type	a-Si TFT
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	Normally Black
	Viewing Direction	ALL
	Gray Scale Inversion Direction	-
Mechanical Characteristics	OutlineDimensions (W x H x T) (mm)	84*84*3.10
	Active Area(mm)	71.86*70.18
	CTP View Area(mm)	72.45*70.78
	With /Without Touch screen	With CTP
	Connector Type	0.5 PITCH
	Backlight Type	LED 8PCS
	Weight (g)	TBD
Electrical Characteristics	Display Interface	3SPI+RGB
	Touch Interface	I2C
	Number of color	262K / 16.7M
	Display Driver IC	ST7701S
	Touch Driver IC	FT6336U

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180 degree shift.

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2 Pin Assignment

1	LED A	LED ANODE
2	LED K1	LED CATHODE
3	LED K2	LED CATHODE
4	GND	Ground
5	VCI	Power supply
6	RESET	Reset Signal ,Active Low
7	NC	NC
8	NC	NC
9	SDA	SPI Data signal
10	SCK	SPI Clock signal
11	CS	SPI Chip select signal
12	PCLK	RGB dot clock signal
13	DE	RGB data enable signal
14	VSYNC	RGB frame synchronizing signal
15	HSYNC	RGB line synchronizing signal
16~33	DB0~DB17	RGB data signal (DB0:BLUE LSB;DB5:BLUE MSB;DB6:GREEN LSB;DB11:GREEN MSB;DB12:RED LSB;DB17:RED MSB)
34	GND	Ground
35	TP_INT	Touch Interrupt
36	TP_SDA	Touch IIC Data signal
37	TP_SCL	Touch IIC Clock signal
38	TP_RESET	Touch Reset Signal
39	TP_VCI	Touch Power supply
40	GND	Ground

Note:

1:SPI+RGB interface

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3 Absolute Maximum Ratings

Item	Symbol	Value	Unit
Power supply voltage for logic	V_{DD}	0.3~3.6	V
Input voltage	V_{in}	$V_{DD}+0.3$	V
Operating temperature	T_{opr}	-20 to 70	°C
Storage temperature	T_{stg}	-30 to 80	°C

Note: Note1: Absolute maximum rating is the limit value beyond which the IC may be broken.

They do not assure operations.

Note2: Background color changes slightly depending on ambient temperature. This Phenomenon is reversible.

$T_a \leq 70^\circ\text{C}$: 75%RH max

$T_a > 70^\circ\text{C}$: absolute humidity must be lower than the humidity of 75%RH at 70°C

Note3: T_a at -30°C will be <48hrs, at 80°C will be <120hrs

4 Electrical Characteristics

4.1 Driving TFT LCD Panel

Item	Symbol	Min	Type	Max	Unit	Test condition
Operating voltage	V_{DD}	2.8	3.3	3.6	V	-
Supply current	I_{DD}	-	-	50	mA	$V_{DD}=2.8\text{V}, T_a=25^\circ\text{C}$
Input voltage	V_{IH}	0.8VDD	-	VDD	V	-
	V_{IL}	0	-	0.2VDD	V	
Input leakage current	I_{IL}	1.0	-	1.0	μA	$V_{IN}=V_{DD}$ or V_{SS}

Note: Voltage greater than above may damage the module.

All voltages are specified relative to $V_{SS}=0\text{V}$.

Note1: (TFT LCD panel) Refer to IC st7701s for more details.

Note2: (Touch Panel) Refer to Driver IC FT6336U for more details

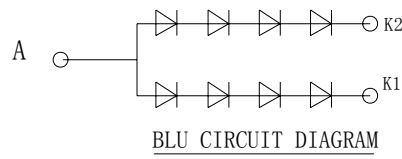
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4.2 Driving Backlight

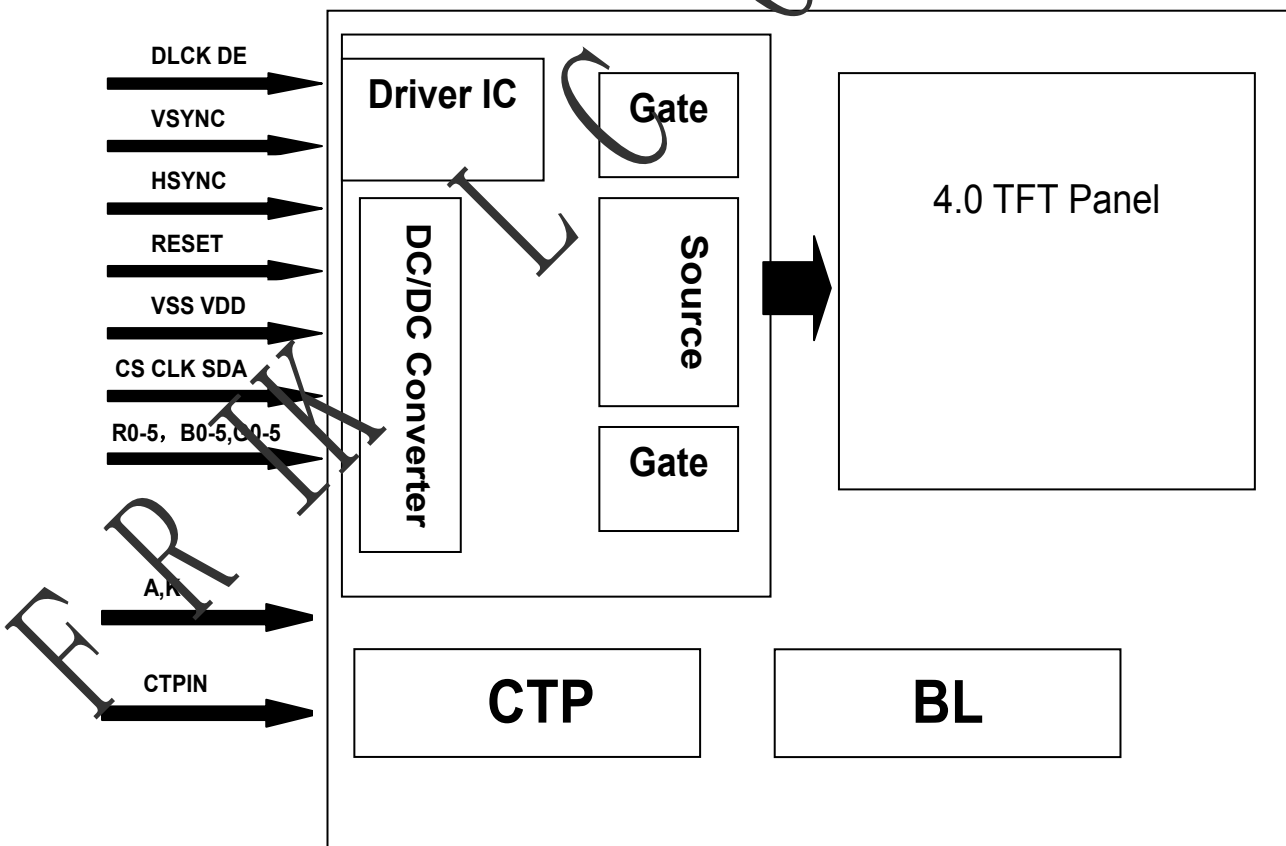
Ta=25°C

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I _F	--	40	45	mA	
Forward Voltage	V _F	-	12.8	-	V	
Connection mode		--		--		
LED number	/		8		pcs	

Note1: Optical performance should be evaluated at Ta=25°C only .If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

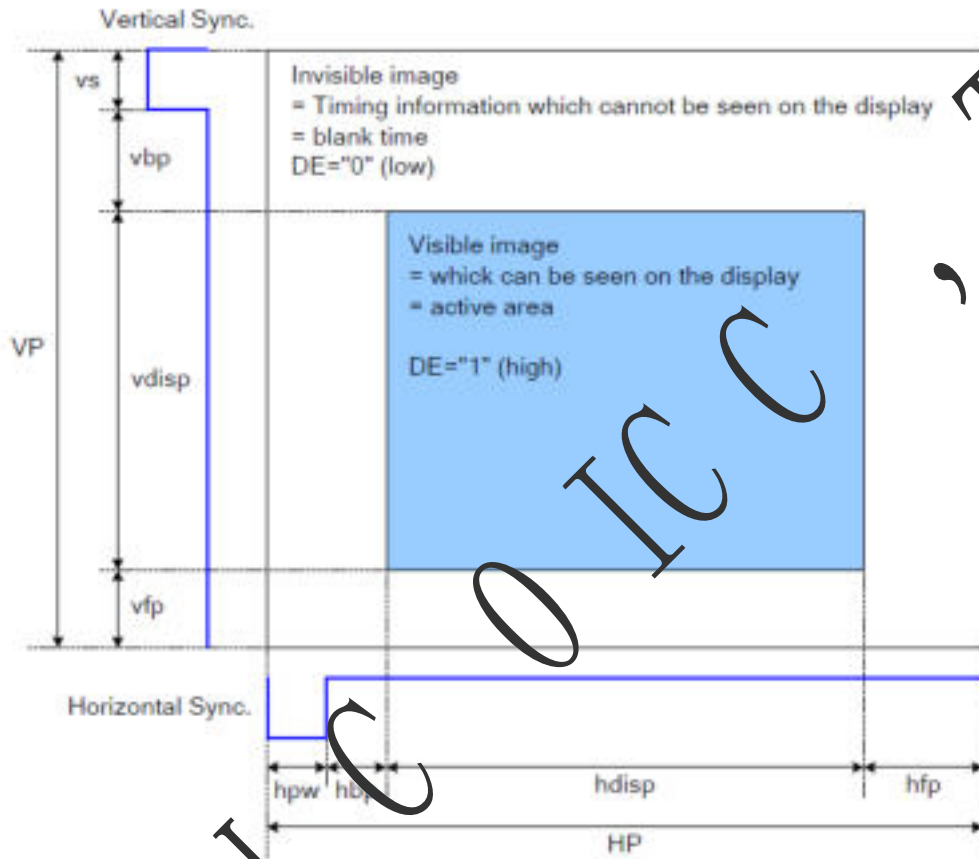


4.3 Block Diagram



5 INTERFACE TIMING

5.1 System Bus Read/Write Characteristics.

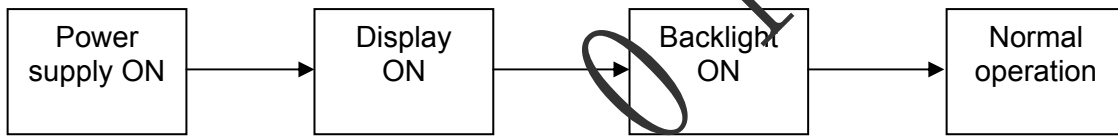
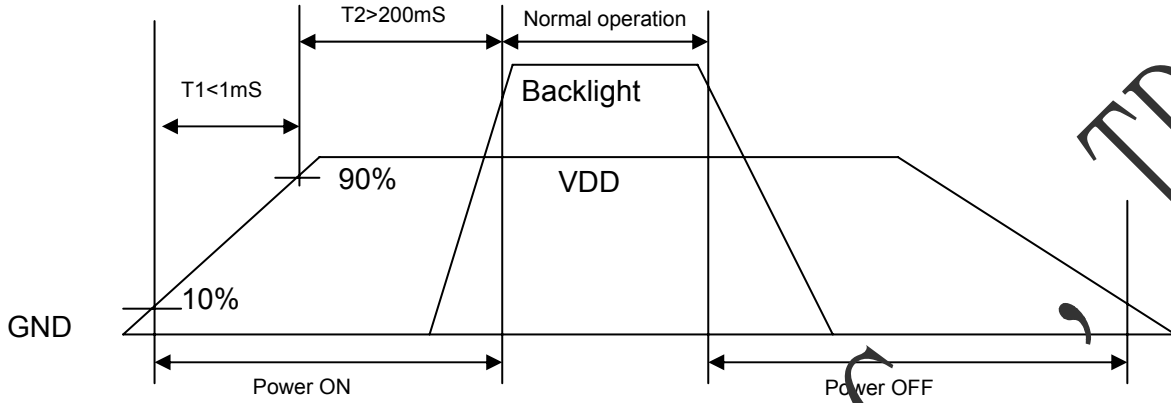


Please refer to the following table for the setting limitation of RGB interface signals.

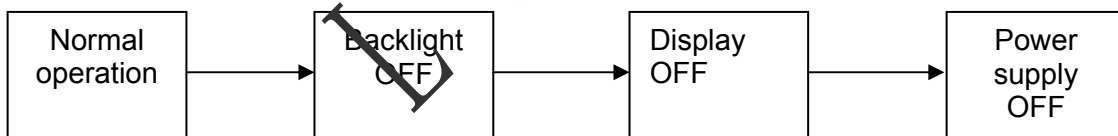
Parameter	Symbol	Min.	Typ.	Max.	Unit
Horizontal Sync. Width	hpw	1	-	255	Clock
Horizontal Sync. Back Porch	hbp	1	--	255	Clock
Horizontal Sync. Front Porch	hfp	1	--	-	Clock
Vertical Sync. Width	vs	1	--	254	Line
Vertical Sync. Back Porch	vbp	1	--	254	Line
Vertical Sync. Front Porch	vfp	2	--	--	Line

Note:
1. Typical value are related to the setting frame rate is 60Hz.

5.2 Power ON/OFF Timing



Power ON sequence



Power OFF sequence

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6 Optical Characteristics

Ta=25°C

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	θT	CR ≧ 10	-	80	-	Degree	Note 2
	θB		-	80	-		
	θL		-	80	-		
	θR		-	80	-		
Contrast Ratio	CR	θ=0°	700	900	-	-	Note1 Note3
Response Time	T _{ON}	25°C	-	30	40	ms	Note1 Note4
	T _{OFF}		-	30	40		
Uniformity	U	-	70	80	-	%	Note1 Note6
NTSC	-	-	-	70	-	%	Note 5
Luminance	L		380	400		cd/m ²	Note1 Note7

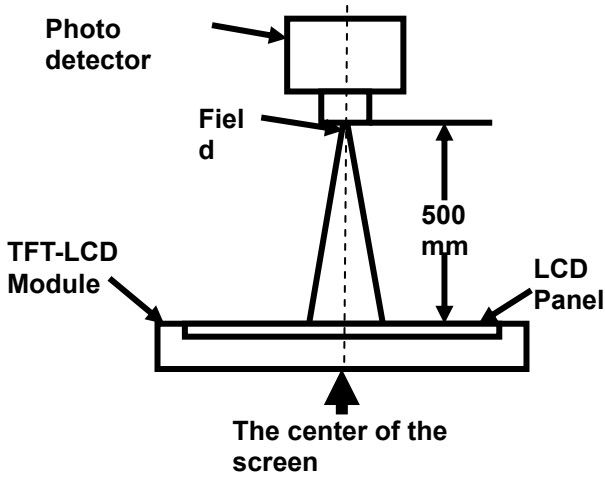
Test Conditions:

1. V_F=12.8V, I_F=40mA, the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.

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Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity	BM-7A	2°
Response Time		

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

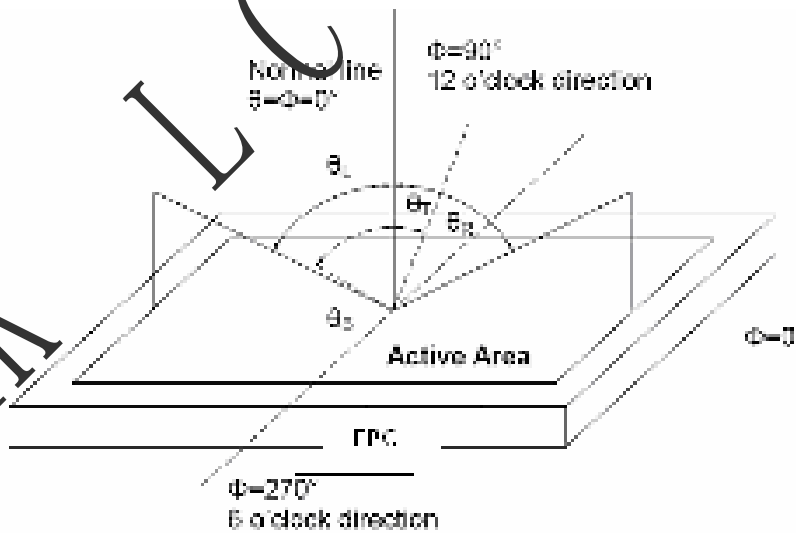


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

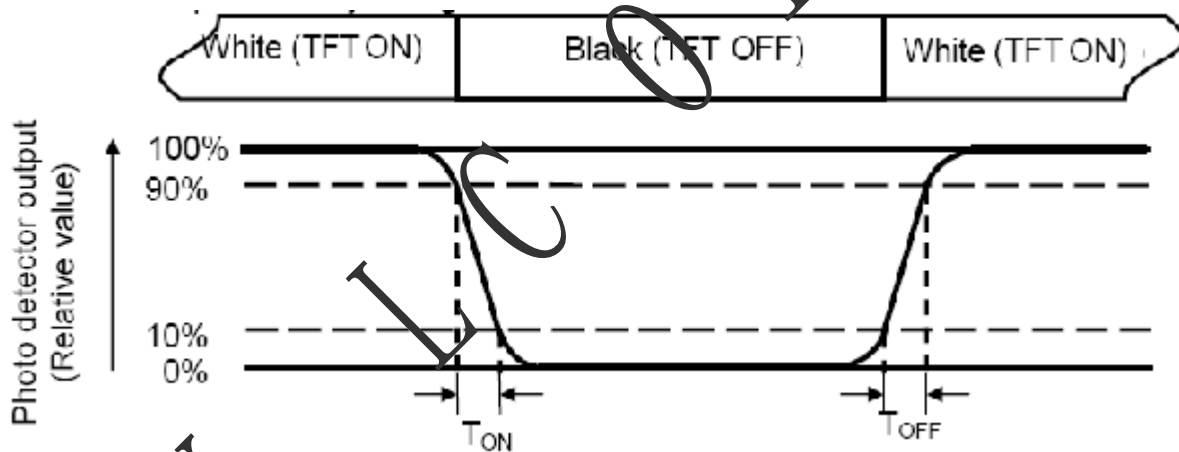
“White state “:The state is that the LCD should be driven by Vwhite.

“Black state”: The state is that the LCD should be driven by Vblack.

Vwhite: To be determined Vblack: To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = L_{min} / L_{max}

L-----Active area length W----- Active area width

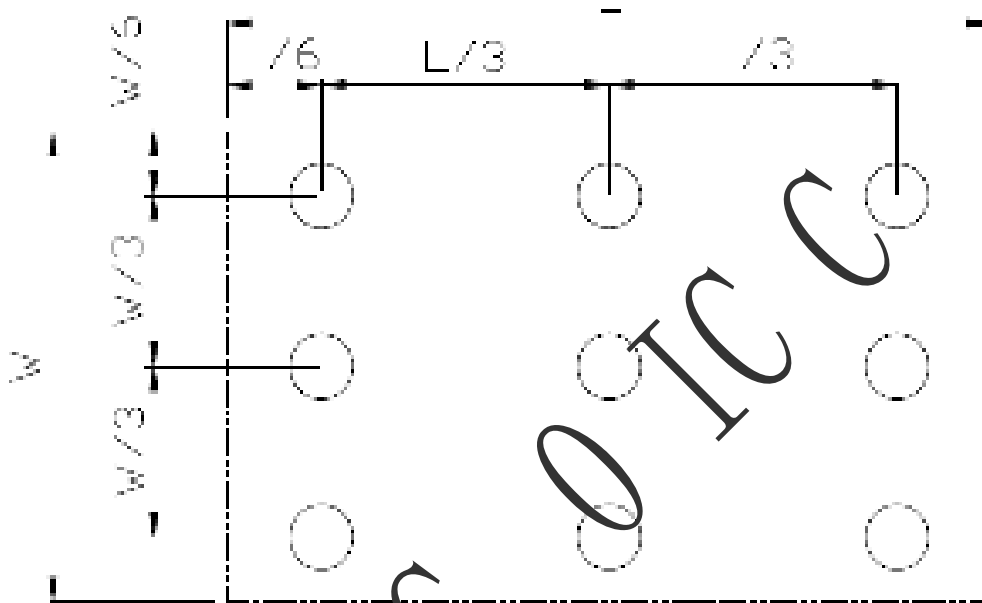


Fig. 2 Definition of uniformity

L_{max} : The measured maximum luminance of all measurement position.

L_{min} : The measured minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

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7 Environmental / Reliability Test

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	120	No abnormalities in functions and appearance
High temp. Operating	70°C	120	
Low temp. Storage	-30°C	120	
Low temp. Operating	-20°C	120	
Humidity	40°C/ 90%RH	120	
Thermal Shock(Non-operation)	-20°C ← 25°C →70°C (0.5 hour ← 5 min → 0.5 hour)	10cycles	

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LC010CC

9 Precautions For Use of LCD Modules

9.1 Handling Precautions

9.1.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

9.1.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

9.1.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

9.1.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

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

- Water
- Ketone
- Aromatic solvents

9.1.1.6 Do not attempt to disassemble the LCD Module.

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

9.1.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

9.1.1.9 Be sure to ground the body when handling the LCD Modules.

9.1.1.10 Tools required for assembly, such as soldering irons, must be properly ground.

9.1.1.11 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

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

9.1.1.13 Storage precautions

9.1.1.14 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.1.1.15 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

9.1.1.16 Temperature : 0°C ~ 40°C Relatively humidity: ≤80%

9.1.1.17 The LCD modules should be stored in the room without acid, alkali and harmful gas.

9.2 Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

10. Packing information

TBD

FORMIKE LCD OLC, TD

INSPECTION CRITERIA

TFT LCD Module

Apply to > 4.3inch ≤ 7.0inch

Customer Approved	
Signature:	Date: (MM/DD/YY)

- This inspection criteria is subject to change without notice, please contact with FORMIKE before design or place order.
- Once signature is seen as agree and accept to all inspection criteria. Further mass production will subject to it.

FORMIKE ELECTRONIC CO., LTD

Approved	Checked	Issued
LD	ZL	CS

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1. 检测标准 Incoming Inspection

合约双方同意此检测标准为 TFT LCD（以下被称为“模组”）检测中的唯一也是最终标准。除“模组”本身不良，科万宏公司不再对第三方的任何品质不良问题或遗失等负有任何责任或义务，包括意外附带损失，产品责任，其它间接损失等。

Both parties agree that the inspection specifications of TFT LCD Modules (hereinafter known as "Modules") stipulated hereunder is the only and final standard applicable in the process of inspection. Except Modules itself, Formike shall be under no liability or obligation whatsoever for any defect or loss caused by the third party, including incidental loss, products liability or other consequential loss and so on.

2. 责任 Liability

2.1 检测期限 Inspection Deadline

客户应在发货地点或模组到达目的地日起20个自然日内在交货目的地检测模组。

The customer should inspect the Modules either at the delivery point or within twenty (20) calendar days after modules arrival at the Delivery Destination.

2.2 拒收通知 Notification of Rejection

当模组不能达到AQL（合格质量水平）且无法通过验收，客户可以拒绝一个或一个以上的不良或不合格的模组。在这种情况下，客户应当在收到产品后的3个工作日内通过文件或邮件给到科万宏拒绝通知，否则，该批产品被视为已符合AQL并验收合格。

The Customer may reject one or more defective or non-conforming Modules if the Modules fail to meet the AQL (Acceptable Quality Level) and pass the inspection. In that case, the customer should notify FORMIKE of the rejection by either documents or mail within in three (3) business days from the date of reception of the Modules. Otherwise, the Modules shall be deemed to have met the AQL and passed the inspection.

3. 检测规格 Inspection Specifications

双方共同认定检测应该包含并遵循如下列明的检测规格，包括：

Both parties agree that the inspection shall contain and follow the inspection specifications stipulated in the attachment, including:

- 3.1 范围 Scope
- 3.2 抽样检验方法 Sampling Plan
- 3.3 面板检测条件 Panel Inspection Condition
- 3.4 显示质量 Display Quality
- 3.5 机构规格 Mechanics Specifications
- 3.6 存储处理说明 Notification for Storage Handling

4. 质量保证 Quality Warranty

4.1. 自出货日起提供十二（12）个月的质量保证期，质量保证不包括客户责任不良品。

The period is within 12 months since the date of shipping out under normal using and storage conditions. The warranty will be avoided in case of defect induced by customer.

4.2. 科万宏有权选择对确认为科万宏责任的不良品进行更换，重工，或扣款，前提条件为

- (1) 客户在保质期限内立即就不良或非符合标准的产品通知了科万宏公司。
- (2) 符合以下指明的规格或条件。
- (3) 符合科万宏公司关于模组补货，重工，或退货的程序。

Formike replace, rework or refund to customer for the defective or non-conforming Modules at Formike option only when Formike confirm that it is Formike responsibility, also provided that the Customer (i) promptly informs Formike of the defects or non-conformities within the warranty period, (ii) complies with the specifications and conditions hereunder, and (iii) complies with Formike procedure for modules replacement, reworking and/or return.

4.3. 补货或返工的模组保质期应当是剩余的期限。

The warranty period for the modules replaced or reworked shall be the remaining term for such Modules.

4.4. 当客户发现不良品时，科万宏有权要求其退回科万宏指定的地址作进一步分析，并且由客户支付退回产品的费用。

When customers found defective or non-conforming, Formike has the right to require customers to send them back on customer's expenses to Formike specified address for further analysis.

4.5. 有限保修

(1) 科万宏的模组不是消费性产品，但有可能补用于客户的消费性产品或部件，因此科万宏不会保证模组或部件适用于任何特定用途。

(2) 科万宏对于维修或换货是有限责任，条款列于以下

附带损失或间接损失，事故，损害，损毁对任何对个人，使用者包括第三方的个人或使用者，科万宏不会负责任何责任，除非另有科万宏与客户的书面协议。科万宏只会对按照科万宏检验标准检验而发现电性不良或外观不良模组进行更换或维修。

(3) 如果不按照科万宏指定的对液晶显示屏的预防操作，将不会给予任何的保证

(4) 所退回的模组必须妥善包装，并且详细列出不良明细

Limited Warranty

(1) FORMIKE modules are not consumer products, but may be incorporated by FORMIKE's customers into consumer products or components thereof, FORMIKE does not warrant that its modules and components are fit for any such particular purpose.

(2) The liability of FORMIKE is limited to repair or replacement on the terms set forth below. FORMIKE will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between FORMIKE and the customer, FORMIKE will only replace or repair any of its Modules which is found defective electrically or visually when inspected in accordance with FORMIKE INSPECTION CRITERIA

(3) No warranty can be granted if any of the precautions state in handling liquid crystal display has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.

(4) In returning the Modules, they must be properly packaged; there should be detailed description of the failures or defect.

5. 如上设定的保证和解决办法为唯一的并替代了其他所有的保证，条文或条件，表述或暗指，不管是事实上还是法定的。此外，包括担保或适销性和特殊目的的适用性都会被明确否认。科万宏公司就此作出的所有保证，仅仅适用于客户，不延伸到任何第三方。

The Warranties and remedies set forth above are exclusive and in lieu of all other warranties, terms or conditions, express or implied, either in fact or by operation of law, statutory or otherwise, including warranties or conditions of merchantability and fitness for a particular purpose, all of which are expressly disclaimed, Formike warranties herein apply only to the customer and are not to be extended to any third party.

Tems 规格:

1. 范围 Scope

- 1.1 显示屏质量评估 Display Quality Evaluation
- 1.2 结构规格 Mechanics Specification

2. 抽样计划 Sampling Plan

除非特别说明，抽样计划都应该遵循MIL-STD-105E

Unless there is other agreement, the sampling plan for incoming inspection shall follow MIL-STD-105E.

- 2.1 批量大小:每次发货的数量为一批 (不同产品则为不同批次)
Lot size: Quantity per shipment as one lot (different model as different lot).
- 2.2 抽样类型: 一般检验, 单次抽样 Sampling type: Normal inspection, single sampling.
- 2.3 抽样级别: 二级 (II级) Sampling level: Level II.
- 2.4 AQL: 可接受品质标准Acceptable Quality Level

项目 Item	重大缺陷Major	轻微缺陷Minor
外观Appearance	1.0%	1.5%
电性Electrical	0.65	1.0%

3. 不良级别分类 Classification of defects:

3.1 重大缺陷 Major defect

任何缺陷可能导致故障,或减少产品的可用性的。例子: 电讯故障、产品变形等。

Any defect may result in functional failure, or reduce the usability of product for its purpose. For

Example: Electrical failure, deformation and etc.

3.2 轻微缺陷 Minor defect

不减低产品预期的可使用性, 如: 点不良

A defect that is not to reduce the usability of product for its intended purpose and un-uniformity, dot defect and etc..

判断重大缺陷和轻微缺陷将依据不良级别分类

The criteria on major or minor judgment will be according with the classification of defects.

4. 显示屏检测条件 Panel Inspection Condition

4.1 环境Environment:

室温Room Temperature: 25±5°C.

湿度Humidity: 50±20% RH.

照明Illumination: 300 ~ 700 Lux.

4.2 检测距离Inspection Distance: 35±5 cm

4.3 检测角度Inspection Angle:

±15° to the front surface of display panel in vertical direction

±15° to the front surface of display panel in horizontal direction

4.4 检测时间Inspection time

可察觉的测试时间:最多10秒 Perceptibility Test Time: 10 seconds max.

5. 结构规格 Mechanics specifications

关于模组的外观尺寸，细节请参考产品规格书。

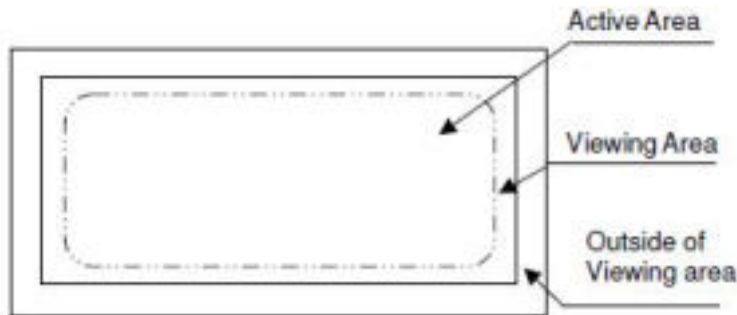
As for the outside dimensions of the Modules, please refer to product specifications for more details.

6. 检验区域定义 Definition Of Inspection Area

Active Area: AA

Viewing Area: A

Outside of viewing area: B



7. 存储处理的说明 Notification for Storage Handling

7.1 存储 Storage:

7.1.1 存储环境需遵循产品规格，否则模组可能被毁坏。

Environment condition must be within the product specifications, otherwise the Module might be damaged.

7.1.2 叠放的层数应在科万宏公司指导下进行。

Pile of stacking shall follow the instruction of Formike.

7.2 操作方法 Handling:

7.2.1 不可扭曲或弯折模组。

Twisting or Bending of the Module is prohibited.

7.2.2 除非有科万宏的指导，所有化学品都不宜用在模块上

All chemicals are unfit for use unless otherwise instructed by Formike.

7.2.3 插塞或拔取: 插塞或拔取模组前要先要保证电源关掉。

Plugging in & unplugging:

The power must be turned off before plugging in or unplugging the Module

7.2.4 ESD protection: 没有合适的接地线情况下，禁止接触模组。

The Module must not be touched without proper grounding.

7.2.5 高压: 没有保护的情况下，模组背部禁止接触。

High Voltage: The rear side of Module must not be touched without protection

7.2.6 上电时序: 请遵循科万宏公司说明。

Power on sequence: Shall follow the instruction of FORMIKE

8. 检验标准 Inspection criterion

8.1 贴合 Bonding

8.1.1 贴合的范围 Range of Bonding:

- (i) Touch screen bonded with LCD
- (ii) PMMA/PC bonded with LCD
- (iii) Cover glass bonded with touch sensor

8.1.2 贴合检验定义 Definition of inspection of Bonding:

所有的以下列明的不良只针对产品正面，对产品背面不良，只要在正常安装或使用后正面不可视均为良品

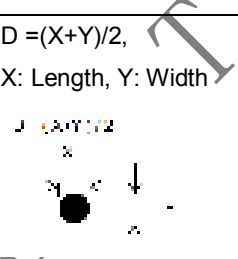
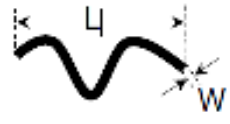
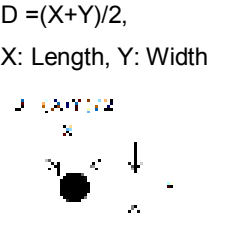
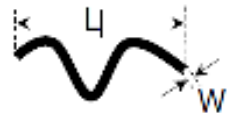
Stated below is only for bad products surface, the defects is allowed that the reverse side of products as long as invisible after installing or using the product.

8.1.3 外观检验标准（目检） Visual inspection criterion in cosmetic / appearance

● Glass defect			
No	Item	Criteria	Remark
1	Dimension (Minor)	By engineering diagram	
2	Crack (Major)	Extensive crack	

● PMMA/PC/GLASS defect			
No	Item	Criteria	Remark
1	Crack (Minor)	<ul style="list-style-type: none"> ➢ Any crack that are not to reduce the usability of product for its intended purpose is ignore. ➢ After the installation of the product are invisible is allowed 	<p>For cover PMMA / PC / glass only</p>
2	Color (Minor)	Conform to approved sample or judged by Formike QA standard level. Slightly color difference in different lots is allowed	For cover PMMA / PC / glass only
3	Silk-screen (Minor) Including: <ul style="list-style-type: none"> ■ Color ■ Pattern ■ Font 	<ul style="list-style-type: none"> ➢ Conform to approved sample or judged by Formike QA standard level. Slightly color difference in different lots is allowed ➢ Tolerances of sizes and position $\pm 0.2\text{mm}$ are allowed. It is shown in (i), (ii) & (iii), other tolerances are according to drawing 	<p>(iii)</p>

4	Ink Peeling/scratches (Minor) (Surface)	<ul style="list-style-type: none"> ➤ Any defect in Area A & B that are not to reduce the usability of product for its intended purpose is ignore. ➤ Any defect on A & B area has been repaired and it is invisible on surface is acceptable ➤ Area AA is not allowed 	
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● Bonding defect			
1	Foreign Spot (Minor) Including: ■ Black spot, ■ White spot ■ Pin hole ■ Foreign particle	<ul style="list-style-type: none"> ➤ $D \leq 0.25\text{mm}$, Ignore ➤ $0.25\text{mm} < D \leq 0.5\text{mm}$, $N \leq 4$ ➤ $0.5\text{mm} < D$, $N = 0$ ➤ Distance $\geq 5\text{mm}$ ➤ Ignore if out of Area AA 	$D = (X+Y)/2$, X: Length, Y: Width 
2	Foreign Line(Minor) Including: ■ Black line ■ White line ■ Bright line	<ul style="list-style-type: none"> ➤ $W \leq 0.05\text{mm}$, Ignore ➤ $0.05\text{mm} < W \leq 0.08\text{mm}$, $L \leq 4\text{mm}$, $N \leq 4$ ➤ $0.08\text{mm} < W \leq 0.1\text{mm}$, $L \leq 4\text{mm}$, $N \leq 1$ ➤ $W > 0.1\text{mm}$, $N = 0$ ➤ Ignore if out of Area AA 	L: Length, W: Width 
3	Polarizer Dent/Air Bubble (Minor)	<ul style="list-style-type: none"> ➤ $D \leq 0.25\text{mm}$, Ignore ➤ $0.25\text{mm} < D \leq 0.5\text{mm}$, $N \leq 4$ ➤ $D > 0.50\text{mm}$, $N = 0$ ➤ Distance $\geq 5\text{mm}$ 	$D = (X+Y)/2$, X: Length, Y: Width 
4	Polarizer Scratches (Minor)	<ul style="list-style-type: none"> ➤ $W \leq 0.05\text{mm}$, Ignore ➤ $0.05\text{mm} < W \leq 0.08\text{mm}$, $L \leq 4\text{mm}$, $N \leq 3$ ➤ $0.08\text{mm} < W \leq 0.1\text{mm}$, $L \leq 4\text{mm}$, $N \leq 1$ ➤ $W > 0.1\text{mm}$, $N = 0$ ➤ Ignore if out of Area AA 	L: Length, W: Width 
5	Inside Dirt (Minor)	<ul style="list-style-type: none"> ➤ Visible inside dirt would be judged as Line 1 & 2 as above ➤ Erasable dirt is ignore 	
6	Adhesive/OCA (Minor)	It is not allowed if the adhesive overflow to the Viewing Area or its boundary due to the adhesive is not placed correctly	
7	OCA Bubble (Minor)	<ul style="list-style-type: none"> ➤ Judged as Line 1 as above. ➤ 5% OCA bubble of delivery is allowed and acceptable. 	
8	Surfacing(Minor)	Conform to approved sample or judged by Formike QA standard level.	

● Other defects			
No	Item	Criteria	Remark
1	FPC (Minor)	<ul style="list-style-type: none"> ➤ Any crack or breakage which effect the function are not allowed ➤ Disregard if the dirty removed 	
2	Backlight (Minor)	<ul style="list-style-type: none"> ➤ Power up is allowed. ➤ Breaking off is not allowed. ➤ The scratch which may causes a problem in practical use is not allowed 	
3	Bezel (Minor)	<ul style="list-style-type: none"> ➤ Erasable dirt is ignore 	

Notes:

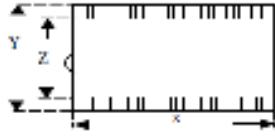

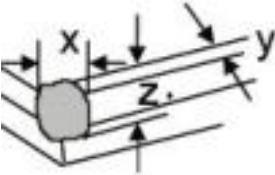
1. If any specific defect is not included in the above defect table, this defect should be judged by Formike.
2. W: Width, L: Length D: Average Diameter N: Count.

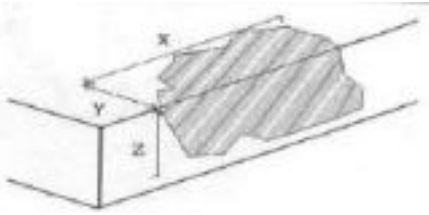
8.1.4 贴合的电讯检验标准请参考各自贴合的液晶屏


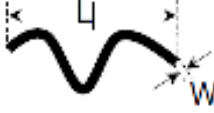

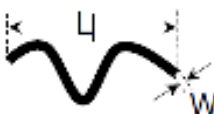
Visual inspection criterion in electrical display of bonding refer to each display.

8.2 TFT 检测标准 TFT Inspection Criteria

8.2.1 外观检验标准（目检） Visual inspection criterion in cosmetic / appearance

● Glass defect			
No	Item	Criteria	Remark
1	Dimension (Minor)	By engineering diagram	
2	Crack (Major)	Extensive crack	
3	Corner (Minor)	$X \leq 3 \text{ mm}$ $Y \leq 3 \text{ mm}$ $Z \leq T$ Ignore	 <p>T: Glass thickness Z: Thickness X: Length Y: Width</p>

4	Side (Minor)	$X \leq 5\text{mm}$ $Y \leq 3\text{mm}$ $Z \leq T$ Ignore	 <p>T: Glass thickness Z: Thickness X: Length Y: Width</p>
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● TFT defect in appearance			
No	Item	Criteria	Remark
1	Foreign Spot (Minor) Including: ■ Black spot, ■ White spot ■ Pin hole ■ Foreign particle	<ul style="list-style-type: none"> ➢ $D \leq 0.25\text{mm}$, Ignore ➢ $0.25\text{mm} < D \leq 0.5\text{mm}$, $N \leq 3$ ➢ $0.5\text{mm} < D$, $N = 0$ ➢ Distance $\geq 5\text{mm}$ ➢ Ignore if out of Area AA 	$D = (X+Y)/2$, X: Length, Y: Width 
2	Foreign Line(Minor) Including: ■ Black line ■ White line ■ Bright line	<ul style="list-style-type: none"> ➢ $W \leq 0.05\text{mm}$, Ignore ➢ $0.05\text{mm} < W \leq 0.08\text{mm}$, $L \leq 4\text{mm}$, $N \leq 3$ ➢ $0.08\text{mm} < W \leq 0.1\text{mm}$, $L \leq 4\text{mm}$, $N \leq 1$ ➢ $W > 0.1\text{mm}$, $N = 0$ ➢ Ignore if out of Area AA 	L: Length, W: Width 
3	Polarizer Dent/Air Bubble (Minor)	<ul style="list-style-type: none"> ➢ $D \leq 0.25\text{mm}$, Ignore ➢ $0.25\text{mm} < D \leq 0.5\text{mm}$, $N \leq 4$ ➢ $D > 0.50\text{mm}$, $N = 0$ ➢ Distance $\geq 5\text{mm}$ 	$D = (X+Y)/2$, X: Length, Y: Width 
4	Polarizer Scratches (Minor)	<ul style="list-style-type: none"> ➢ $W \leq 0.05\text{mm}$, Ignore ➢ $0.05\text{mm} < W \leq 0.08\text{mm}$, $L \leq 4\text{mm}$, $N \leq 3$ ➢ $0.08\text{mm} < W \leq 0.1\text{mm}$, $L \leq 4\text{mm}$, $N \leq 1$ ➢ $W > 0.1\text{mm}$, $N = 0$ ➢ Ignore if out of Area AA 	L: Length, W: Width 

● Other defects			
No	Item	Criteria	Remark
1	FPC (Minor)	<ul style="list-style-type: none"> ➢ Any crack or breakage which effect the function are not allowed ➢ Disregard if the dirty removed 	

2	Backlight (Minor)	<ul style="list-style-type: none"> ➤ Power up is allowed. ➤ Breaking off is not allowed. ➤ The scratch which may causes a problem in practical use is not allowed 	
3	Bezel (Minor)	<ul style="list-style-type: none"> ➤ Erasable dirt is ignore 	

8.2.2 电讯检验标准（目检） Visual inspection criterion in electrical display

● Glass defect			
No	Item	Criteria	Remark
1	No display (Major) <ul style="list-style-type: none"> ■ Abnormally ■ Short circuit 	Not allowed	
2	Missing line (Major)	Not allowed	
3	Darker or lighter line (Major)	Not allowed	
4	Weak line (Minor)	By limit sample	

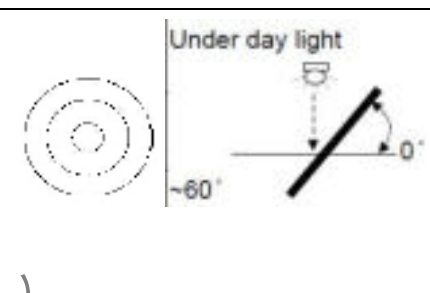
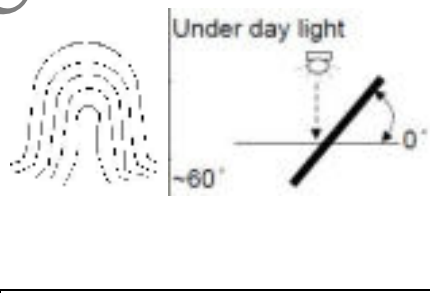
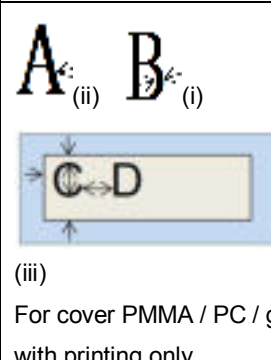
● Display Inspection						
No	Item	Criteria			Remark	
1	Bright / Dark dot	Items	Area I	Area O	Total	<p>1.1sub-pixel: 1R or 1G or 1B 2.Point defect area ≥ 1/2 sub pixel</p>
		Bright	1	2	2	
		Dark	2	3	4	
		Bright & Dark	2	4	5	
		2 adjacent dots	0	0	0	
		Minimum Distance ≥ 5mm				
2	Tiny bright dot	Visible through 6% ND filter <ul style="list-style-type: none"> ➤ $D \leq 0.25\text{mm}$, Ignore ➤ $0.25\text{mm} < D \leq 0.5\text{mm}$, $N \leq 4$ ➤ $D > 0.5\text{mm}$, $N = 0$ ➤ Distance $\geq 5\text{mm}$ Ignore if out of Area AA			$D = (X+Y)/2$, X: Length, Y: Width $D = (X-Y)/2$	


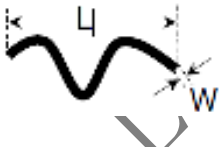


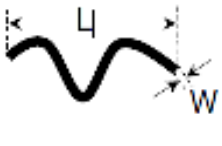
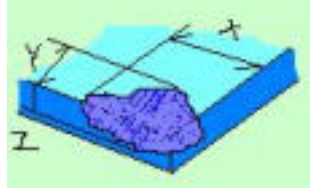
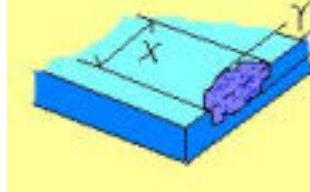
4	Mura/Waving/ Hot spot	Not visible through 6% ND filter in 50% gray or judge by limit sample if necessary	
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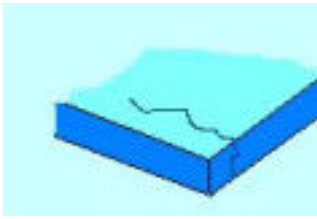
* Note:

1. Defect which is on the Black Matrix (outside of active area) are not considered as a defect.
2. If any specific defect is not included in the above defect table, this defect should be judged by Formike.
3. W: Width, L: Length D: Average Diameter N: Count.

8.3. 触摸屏标准 Touch screen criteria

No	Item	Criteria	Remark
1	Newton's ring (regular) (Minor)	<ul style="list-style-type: none"> ➢ $\leq 1/4$ of the whole area of touch screen and it is not to reduce the usability of product for its intended purpose is allowed ➢ $> 1/4$ of the whole area of touch screen and it is reduce the usability of product for its intended purpose is not allowed 	 <p>Under day light -60° 0°</p>
2	Newton's ring (irregular) (Minor)	<ul style="list-style-type: none"> ➢ $\leq 1/3$ of the whole area of touch screen and it is not to reduce the usability of product for its intended purpose is acceptable ➢ $> 1/3$ of the whole area of touch screen and it is reduce the usability of product for its intended purpose is not allowed 	 <p>Under day light -60° 0°</p>
3	Color (Minor)	Conform to approved sample or judged by Formike QA standard level. Slightly color difference in different lots is allowed	For cover PMMA / PC / glass which are with printing only
4	Silk-screen (Minor) Including: <ul style="list-style-type: none"> ■ Color ■ Pattern ■ Font 	<ul style="list-style-type: none"> ➢ Conform to approved sample or judged by Formike QA standard level. Slightly color difference in different lots is allowed ➢ Tolerances of sizes and position $\pm 0.15\text{mm}$ are allowed. It is shown in (i), (ii) & (iii), other tolerances are according to drawing 	 <p>A_(ii) B_(i) (iii) For cover PMMA / PC / glass which are with printing only</p>
5	Ink Peeling/scratches (Minor) (Surface)	<ul style="list-style-type: none"> ➢ Any defect in Area A & B that are not to reduce the usability of product for its intended purpose is ignore. ➢ Any defect on A & B area has been repaired and it is invisible on surface is acceptable ➢ Area AA is not allowed 	For cover PMMA / PC / glass which are with printing only

1	<p>Foreign Spot (Minor)</p> <p>Including:</p> <ul style="list-style-type: none"> ■ Black spot, ■ White spot ■ Pin hole ■ Foreign particle 	<ul style="list-style-type: none"> ➤ $D \leq 0.25\text{mm}$, Ignore ➤ $0.25\text{mm} < D \leq 0.5\text{mm}$, $N \leq 3$ ➤ $0.5\text{mm} < D$, $N = 0$ ➤ Distance $\geq 5\text{mm}$ ➤ Ignore if out of Area AA 	<p>$D = (X+Y)/2$, X: Length, Y: Width</p> 
2	<p>Foreign Line(Minor)</p> <p>Including:</p> <ul style="list-style-type: none"> ■ Black line ■ White line ■ Bright line 	<ul style="list-style-type: none"> ➤ $W \leq 0.05\text{mm}$, Ignore ➤ $0.05\text{mm} < W \leq 0.08\text{mm}$, $L \leq 4\text{mm}$, $N \leq 3$ ➤ $0.08\text{mm} < W \leq 0.1\text{mm}$, $L \leq 4\text{mm}$, $N \leq 1$ ➤ $W > 0.1\text{mm}$, $N = 0$ ➤ Ignore if out of Area AA 	<p>L: Length, W: Width</p> 
8	<p>Inside Dirt (Minor)</p>	<ul style="list-style-type: none"> ➤ Visible inside dirt would be judged as Line 1 & 2 as above ➤ Erasable dirt is ignore 	
3	<p>Dent/Air Bubble (Minor)</p>	<ul style="list-style-type: none"> ➤ $D \leq 0.25\text{mm}$, Ignore ➤ $0.25\text{mm} < D \leq 0.5\text{mm}$, $N \leq 4$ ➤ $D > 0.50\text{mm}$, $N = 0$ ➤ Distance $\geq 5\text{mm}$ 	<p>$D = (X+Y)/2$, X: Length, Y: Width</p> 
4	<p>Scratches (Minor)</p>	<ul style="list-style-type: none"> ➤ $W \leq 0.05\text{mm}$, Ignore ➤ $0.05\text{mm} < W \leq 0.08\text{mm}$, $L \leq 4\text{mm}$, $N \leq 3$ ➤ $0.08\text{mm} < W \leq 0.1\text{mm}$, $L \leq 4\text{mm}$, $N \leq 1$ ➤ $W > 0.1\text{mm}$, $N = 0$ ➤ Ignore if out of Area AA 	<p>L: Length, W: Width</p> 
11	<p>Glass defect (Corner) (Minor)</p>	<p>Corner</p> <ul style="list-style-type: none"> ➤ $X \leq 4.0\text{mm}$, ➤ $Y \leq 3.0\text{mm}$ ➤ $Z \leq T$ <p>Ignore if they do not affect the function</p>	 <p>T:thickness of glass, X: Length, Y: Width of thickness</p>
12	<p>Glass defect (edges) (Minor)</p>	<p>Edges</p> <ul style="list-style-type: none"> ➤ $X \leq 5.0\text{mm}$, ➤ $Y \leq 2.0\text{mm}$ ➤ $Z \leq T$ <p>Ignore if they do not affect the function</p>	 <p>T:thickness of glass, X: Length, Y: Width of thickness</p>

13	Glass defect (area AA & A) (Major)	Not allowed	
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Notes:

1. If any specific defect is not included in the above defect table, this defect should be judged by Formike.
2. W: Width, L: Length D: Average Diameter N: Count.

9. Others.

Issues that are not defined in the INSPECTION CRITERIA shall be discussed and agreed with both parties. The final result is subject to FORMIKE

10. Revised Record

Version	Revise record	Issued	date
1.0	First issue	May Zeng	Feb. 20 th , 2010.
2.0	Adding bonding standard	CS	June. 1 st , 2015
3.0	Revise Doc No. completed the standard	CS	July. 1 st , 2015
4.0	Revise Doc No. completed the standard	CS	Oct. 10 th , 2015
5.0	Revised line 1 in page 2/13 & line 4.4 in page 4/13	CS	Dec. 1 st , 2015