Approval sheet

Customer: _____

Model name: JT350MTQVV01

Spec NO: _____

Date: 2013.9.24

Version: 01

☐ **Preliminary Specification**

☐ **Final Specification**

For Customer's Acceptance

Approved by	Content

Approved by	Reviewed by	Prepared by

Records of Revision

DATE	REF.PAGE PARAGRAPH DRAWING No.	REVISED No.	SUMMARY	REMARK
2013-9-24		01	FIRST ISSUE	

Contents

1	Introduction	4
2	General specification	5
3	Mechanical drawing	6
4	Absolute maximum ratings	7
5	Electrical characteristics	7
6	Optical characteristics	8
7	Pin Assignment	11
8	Block diagram	12
9	Timing/Characteristics	13
10	LCM reliability	14
11	LCM quality	16
12	Packing method	23

1. Introduction

1.1 Scope of application

This specification applies to the Negative type TFT transmissive dot matrix LCD module.
LCD specification: Dots 320xRGBx240.
As to basic specification of the driver IC, refer to the IC (NV3035GTC) specification and data sheet.

1.2 Structure:

Double display structure:
TFT Module + FPC +BL
FULL 16.7M Color3.5 inch TFT LCD size for main LCD;
One bare chip with gold bump (COG) TECH;
24 BITS RGB interface;

1.3 TFT features:

Structure: TFT PANNEL+IC+FPC+BL;
Transmissive Type LCD
320 dot-source and 240 dot-gate outputs;
16.7 M Color
White LED back light;
24 BITS RGB interface;

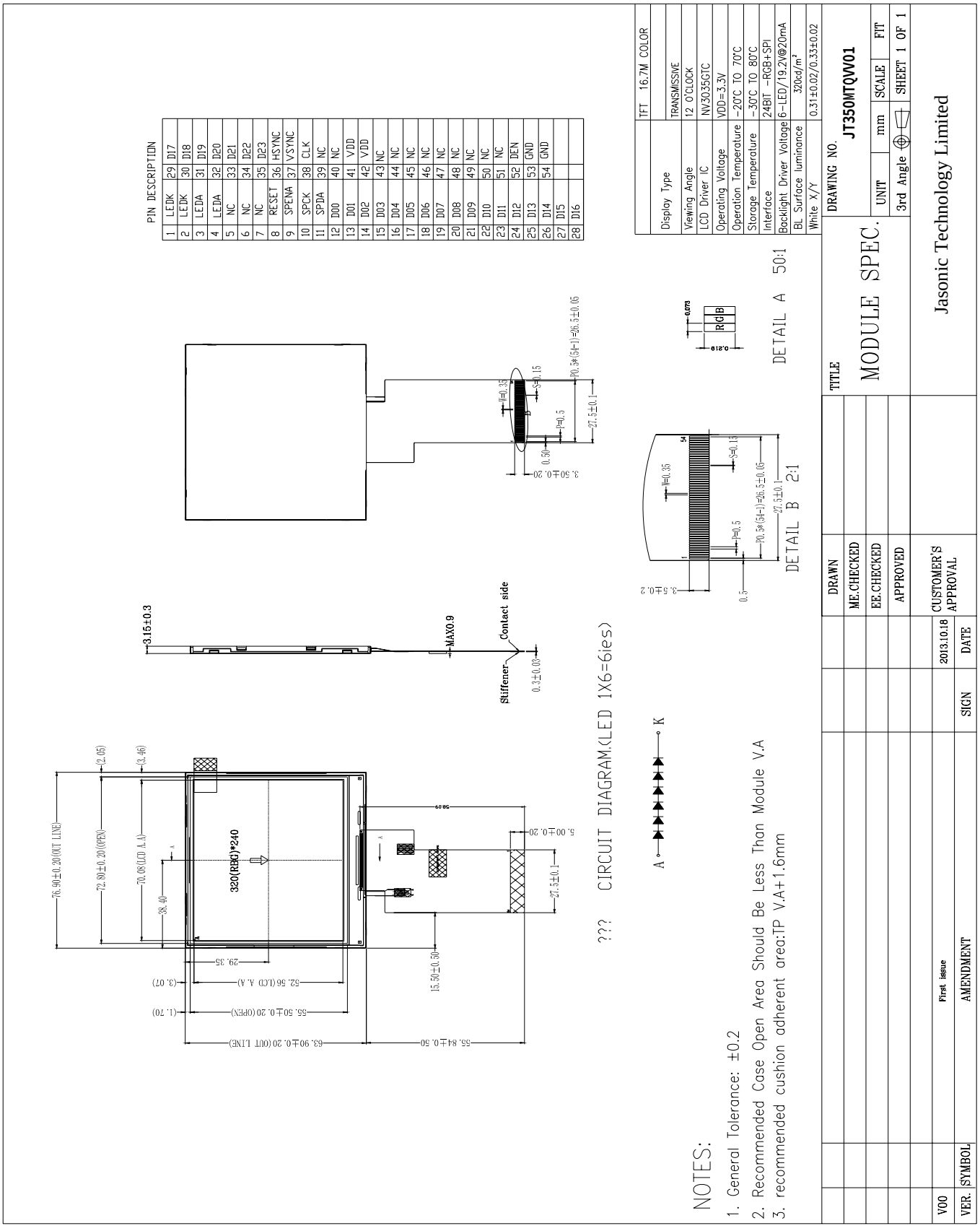
1.4 Applications:

Mobile phone
PSP
PDA
GPS
Etc…

2. General specification

ITEM	Standard value	UNIT
LCD Type	TFT Transmissive Normal White	---
Driver element	a-Si TFT Active matrix	
Number of Dots	320*(RGB)*240	Dots
Pixel Arrangement	RGB Vertical Stripe	
Active Area	52.56 *70.08	mm
Viewing Direction	12 O’ clock	
Driver IC	NV3035GTC	
Module Size(W*H*T)	76.90x63.90x3.15	mm
Approx. Weight	TBD	g
Back Light	6-LED WHITE	
System interface	24 BITS RGB interface	

3. Mechanical drawing



4. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	V_{DD}	-0.3	4.0	V
Input voltage for logic	V_{IN}	-0.5	V_{DD} +0.3	V
Supply current (One LED)	I_{LED}		30	mA
Operating temperature	T_{OP}	-20	+70	℃
Storage temperature	T_{ST}	-30	+80	℃

5. ELECTRICAL CHARACTERISTICS

Item	Symbol	Min	Typ	Max	Unit	Applicable terminal
Supply voltage for logic	V_{DD}	3.0	3.3	3.6	V	V_{DD}
Input voltage	V_{IL}	-0.3	-	$0.3V_{DD}$	V	
	V_{IH}	$0.8\ V_{DD}$	-	V_{DD}	V	
Input current	I_{DD}	-	10	-	mA	
LED Forward voltage	V_f	3.0	3.2	3.4	V	With one LED
Input backlight current	I_{LED}	-	20	25	mA	With One LED

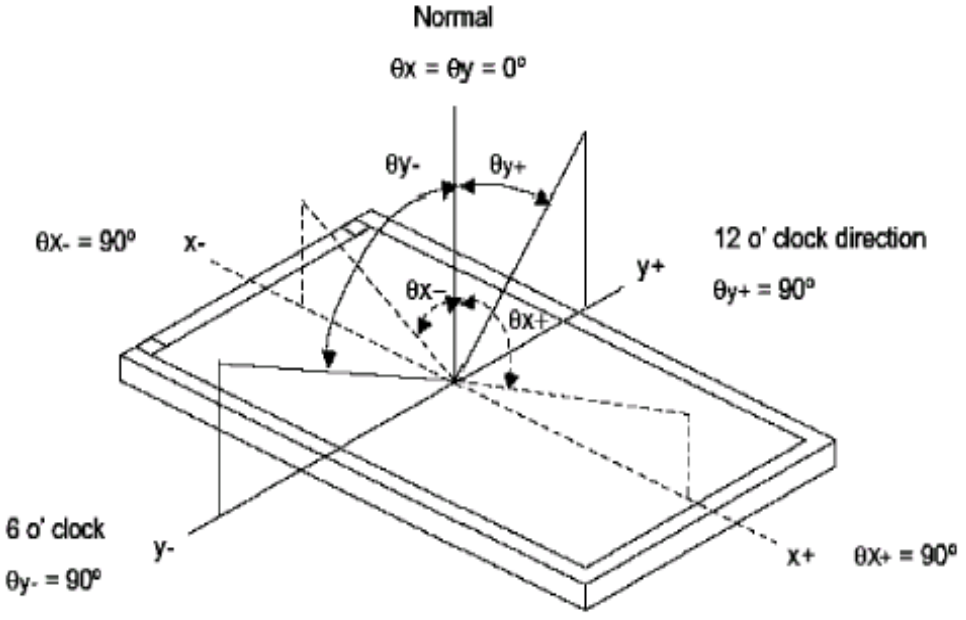
BACKLIGHT DRIVING CONDITIONS

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED backlight	V_L	18	19.2	20.4	V	Note 1
Current for LED backlight	I_L	--	20	25	mA	
LED life time	-	20,000	-	-	Hr	Note 2

6. OPTICAL CHARACTERISTICS

ITEM		SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	NOTE
				MIN.	TYP.	MAX		
Brightness		B	Viewing normal angle $\theta_X = \theta_Y = 0°$ BL Brightness =4000 Cd/m^2	--	320	-	Cd/m^2	All left side data are based on TIANMA's product reference only
Contrast Ratio		CR		400	500	--	--	
Response Time		Tr+Tf		--	25	30	ms	
Chromaticity Coordinate (Transmissive)	Red	X		0.551	0.591	0.631		
		Y		0.270	0.310	0.350		
	Green	X		0.302	0.342	0.382		
		Y		0.516	0.561	0.601		
	Blue	X		0.105	0.145	0.185		
		Y		0.047	0.087	0.127		
	White	X		0.260	0.310	0.360		
		Y		0.283	0.333	0.383		
Viewing Angle	Hor.	θ_{X+}	Center CR>=10	60	70	--	Deg.	
		θ_{X-}		60	70	--		
	Ver.	θ_{Y+}		40	50	--		
		θ_{Y-}		60	70			
Uniformity	Un			75	80		%	

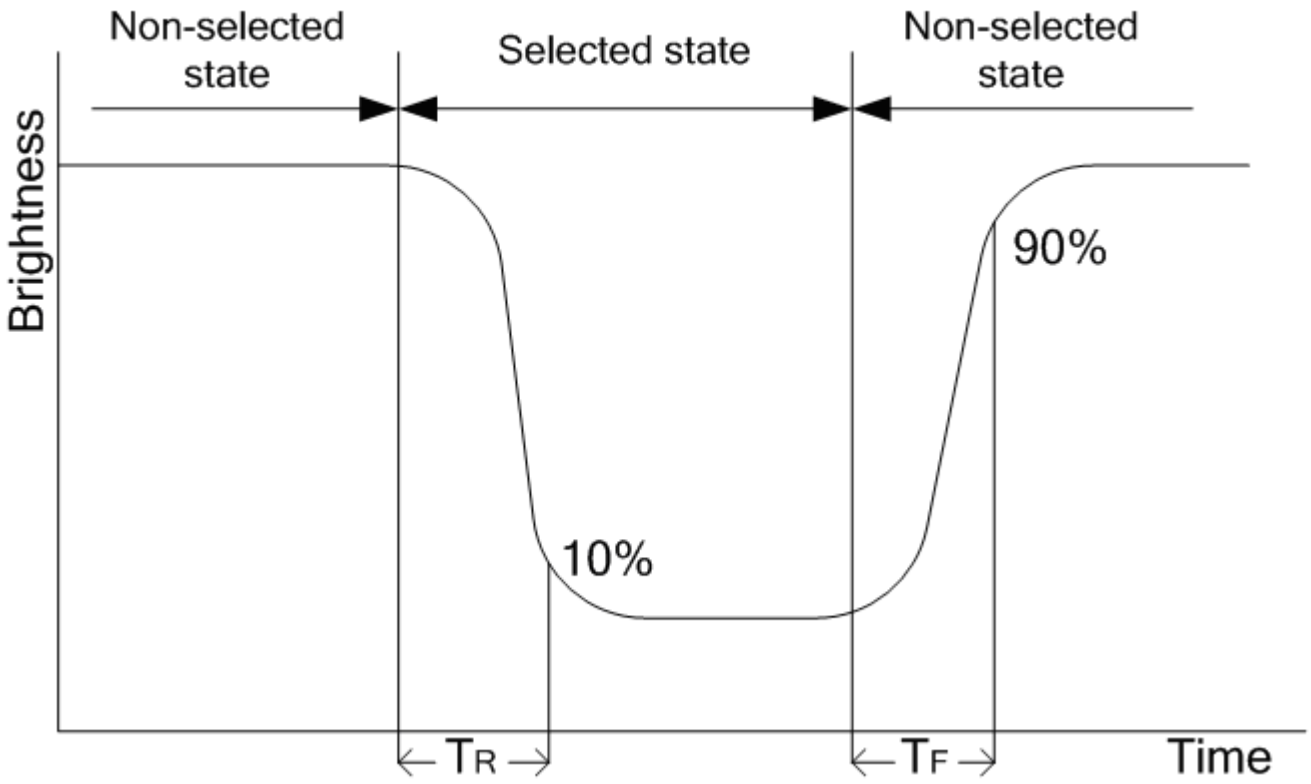
Note 1 : Definition of Viewing Angle θ_x and θ_y :



Note 2: Definition of contrast ratio CR:

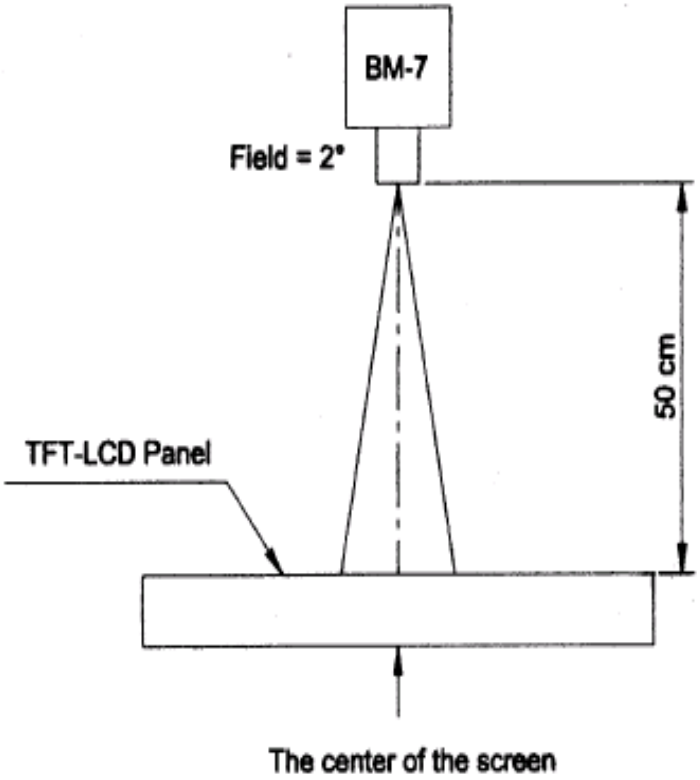
$$CR = \frac{\text{Brightness of non-selected dots (white)}}{\text{Brightness of selected dots (black)}}$$

Note 3: Definition of response time (T_R, T_F)

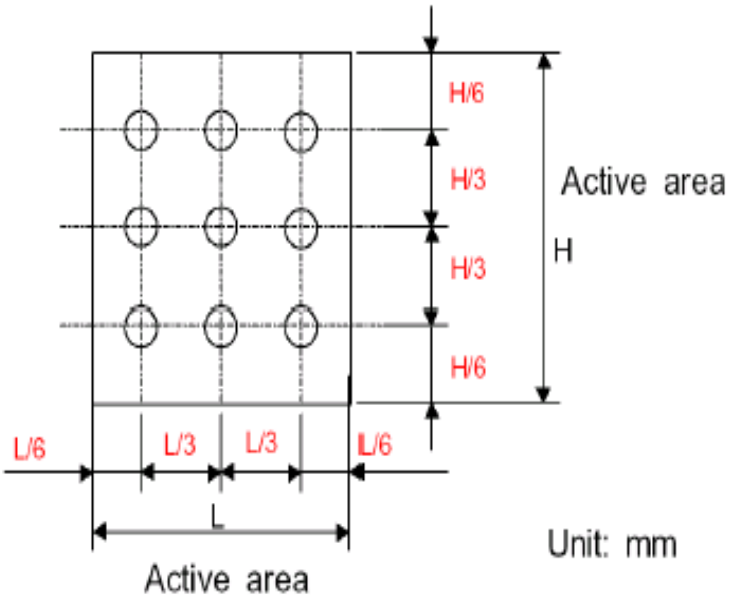


: The brightness test equipment setup

20mA Field=2° (As measuring "black" image, field=2° is the best testing condition)



Note 4 :



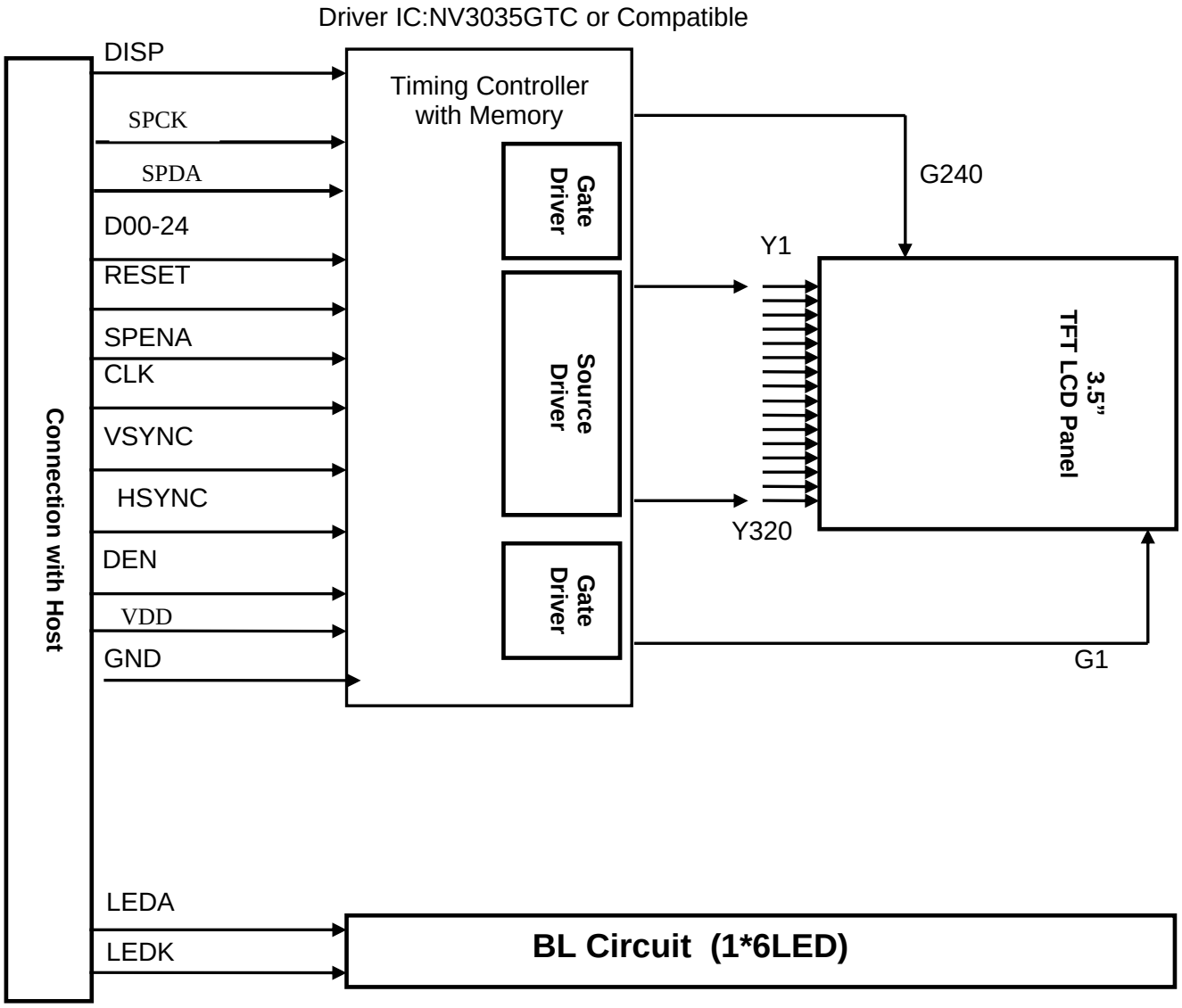
7. Interface Pin Function

. Table 2: Pin assignment

Pin No.	Symbol	Description
1	VLED-	Cathode of LED backlight
2	VLED-	Cathode of LED backlight
3	VLED+	Anode of LED backlight
4	VLED+	Anode of LED backlight
5	NC	No connect
6	NC	No connect
7	NC	No connect
8	RESET	Reset pin
9	SPENA	Serial transmissive enable
10	SPCK	Serial clock
11	SPDA	Serial data input
12	D00	Data bus
13	D01	Data bus
14	D02	Data bus
15	D03	Data bus
16	D04	Data bus
17	D05	Data bus
18	D06	Data bus
19	D07	Data bus
20	D08	Data bus
21	D09	Data bus
22	D10	Data bus
23	D11	Data bus
24	D12	Data bus
25	D13	Data bus
26	D14	Data bus
27	D15	Data bus
28	D16	Data bus
29	D17	Data bus
30	D18	Data bus
31	D19	Data bus
32	D20	Data bus
33	D21	Data bus
34	D22	Data bus
35	D23	Data bus
36	HSYNC	Horizontal sync signal
37	VSYNC	Vertical sync signal
38	CLK	Pixel clock
39	NC	NO connect
40	NC	NO connect

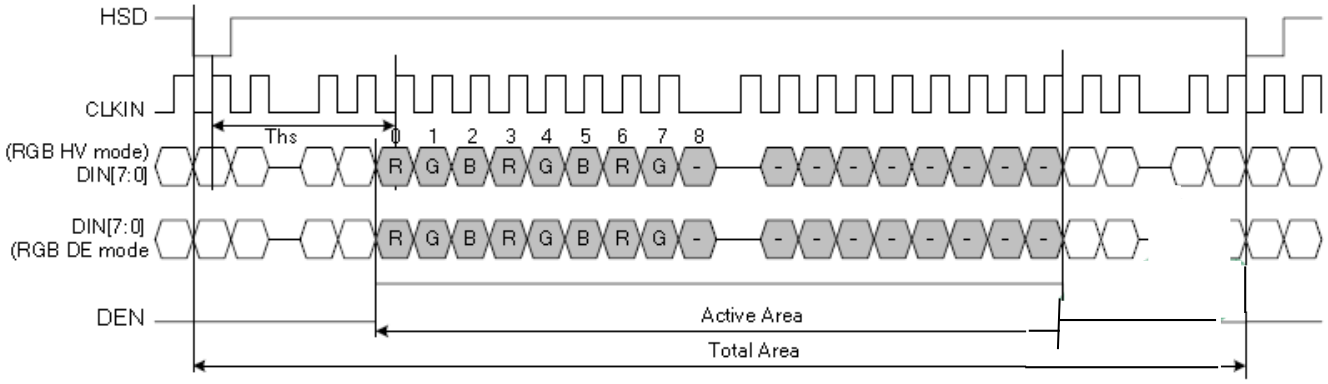
41	VDD	Power supply
42	VDD	Power supply
43	NC	No connect
44	NC	No connect
45	NC	No connect
46	NC	No connect
47	NC	No connect
48	NC	No connect
49	NC	No connect
50	NC	No connect
51	NC	No connect
52	DEN	Data enable
53	GND	Ground
54	GND	Ground

8. BLOCK DIAGRAM



9. Timing/Characteristics

9.1 Clock and data input time diagram



9.2 Parallel RGB input timing table

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLKIN frequency	Fclk	6.1	6.4	8	MHz	VDD=3.0~3.6V
CLKIN cycle time	Tclk	125	156	164	ns	
CLKIN pulse duty	Tcwh	40	50	60	%	Tclk
Time that HSD to 1st data input(NTSC)	Ths	40	70	255	CLKIN	DDLY=70, Offset=0 (fixed)

10. Standard Specification for Reliability :

10－1. Standard Specifications for Reliability of LCD Module

No	Item	Description
01	High temperature operation	The sample should be allowed to stand at 70℃ for 120 hours under driving condition and then returning it to normal temperature condition, and allowing it stand for 2 hours.
02	Low temperature operation	The sample should be allowed to stand at -20℃ for 120 hours under driving condition and then returning it to normal temperature condition, and allowing it stand for 2 hours.
03	High temperature storage	The sample should be allowed to stand at 80℃ for 240 hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 2 hours.
04	Low temperature storage	The sample should be allowed to stand at -30℃ for 240 hours under no-load condition, then returning it to normal temperature condition, and allowing it stand for 2 hours.
05	Moisture storage	The sample should be allowed to stand at 60℃,90%RH MAX for 240 hours under no-load condition, then taking it out and drying it at normal temperature for 2 hours.
06	Thermal shock storage	The sample should be allowed to stand the following 10 cycles : -30℃ for 30 minutes → normal temperature for 5 minutes → +80℃ for 30 minutes → normal temperature for 5 minutes, as one cycle.
07	Packing vibration	Frequency range : 10Hz ~ 55Hz Amplitude of vibration : 1.5mm Sweep time: 12 min X,Y,Z 2 hours for each direction.
08	Packing drop test	According to ISTA 1A 2001.
09	Electrical Static Discharge	Air: ±4KV 150pF/330Ω 5 times
		Contact: ±2KV 150pF/330Ω 5 time

*Sample size for each test item is 3~5pcs

10 - 2. Testing Conditions and Inspection Criteria

For the final test the testing sample must be stored at room temperature for 24 hours, after the tests listed in Table 12.2, Standard specifications for Reliability have been executed in order to ensure stability.

No	Item	Test Model	In section Criteria
01	Current Consumption	Refer To Specification	The current consumption should conform to the product specification.
02	Contrast	Refer To Specification	After the tests have been executed, the contrast must be larger than half of its initial value prior to the tests.
03	Appearance	Visual inspection	Defect free.

10- 3. MTBF

MTBF	Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (25±5℃), normal humidity (50±10% RH), and in area not exposed to direct sun light.

11. Specification of Quality Assurance:

11-1. Purpose

This standard for Quality Assurance should affirm the quality of LCD module products to supply to purchaserbyus.

11-2. Standard for Quality Test

a. Inspection:

Before delivering, the supplier should take the following tests, and affirm the quality of product.

b. Electro-Optical Characteristics:

According to the individual specification to test the product.

c. Test of Appearance Characteristics:

According to the individual specification to test the product.

d. Test of Reliability Characteristics:

According to the definition of reliability on the specification for testing products.

e. Delivery Test:

Before delivering, the supplier should take the delivery test.

(i) Test method: According to MIL-STD105E.General Inspection Level Ⅱ take a single time.

(ii) The defects classify of AQL as following:

Major defect: AQL = 0.65

Minor defect: AQL = 2.5

Total defects: AQL = 2.5

11-3. Non- conforming Analysis & Deal With Manners

a. Non- conforming Analysis:

(i) Purchaser should supply the detail data of non- conforming sample and the non- conforming.

(ii) After accepting the detail data from purchaser, the analysis of non- conforming should be finished in two weeks.

(iii) If supplier can not finish analysis on time, must announce purchaser before 3 days.

b. Disposition of non- conforming:

(i) If find any product defect of supplier during assembly time, supplier must change the good product for every defect after recognition.

(ii) Both supplier and customer should analyze the reason and discuss the disposition of non-conforming when the reason of nonconforming is not sure.

11-4. Agreement items

Both sides should discuss together when the following problems happen.

a. There is any problem of standard of quality assurance, and both sides should think that must be modified.

b. There is any argument item which does not record in the standard of quality assurance.

c. Any other special problem.

11-5. Standard of The Product Appearance Test

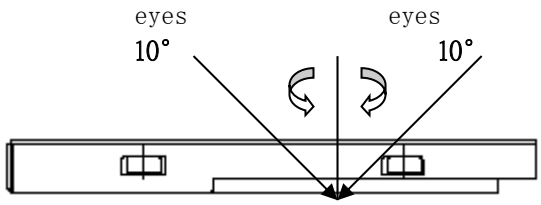
a. Manner of appearance test:

(i) The test must be under 20W × 2 or 40W fluorescent light, and the distance of view must be at 30±5cm.

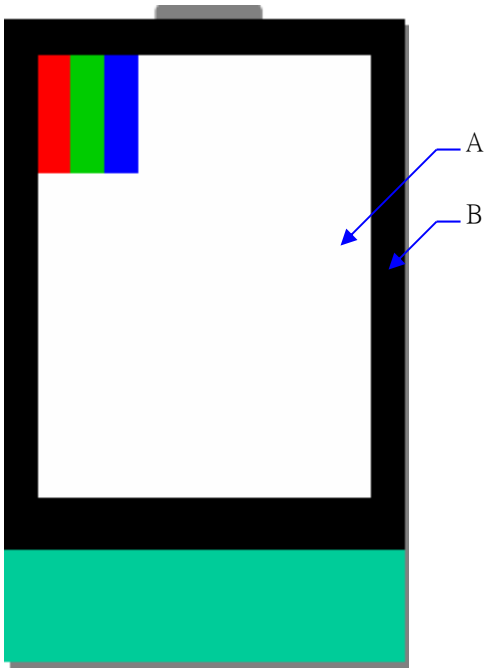
(ii) When test the model of transmissive product must add the reflective plate.

(iii)The test direction is base on around 10° of vertical line.

(iiii)Temperature: 25±5℃ Humidity: 60±10%RH



(iv) Definition of area:



A. Area: Viewing area.

B. Area: Out of viewing area.
(Outside viewing area)

b. Basic principle:

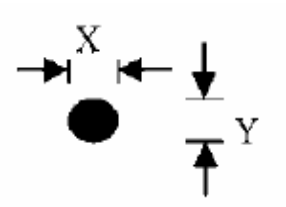
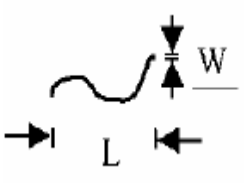
(i) It will accord to the AQL when the standard can not be described.

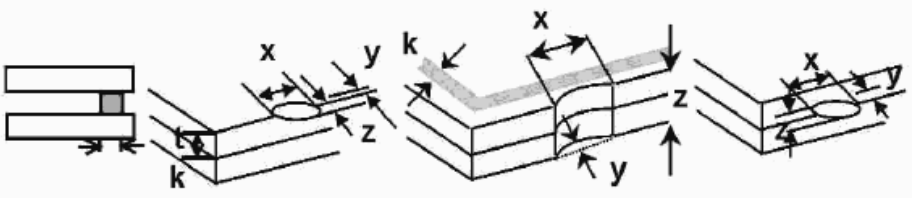
(ii) The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.

(iii) Must add new item on time when it is necessary.

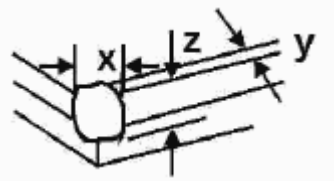
c. Standard of inspection: (Unit: mm)

11-6. Inspection specification

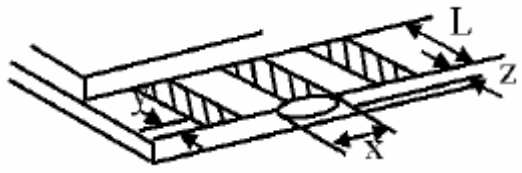
<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>01</td><td>Electrical Testing</td><td>1.1 Missing vertical, horizontal segment, segment contrast defect.
1.2 Missing character, dot or icon.
1.3 Display malfunction.
1.4 No function or no display.
1.5 Current consumption exceeds product specifications.
1.6 LCD viewing angle defect.
1.7 Mixed product types.
1.8 Flicker</td><td>0.65</td></tr>
<tr><td>02</td><td>Black or White spots or Bright spots or Color spots on LCD (Display only)</td><td>2.1 White and black or color spots on display ≦ 0.25mm, no more than Five spots.
2.2 Densely spaced: No more than three spots within 3mm.</td><td>2.5</td></tr>
<tr><td rowspan="2">03</td><td rowspan="2">LCD and Touch Panel black spots, white spots, contamination (non-display)</td><td>3.1 Round type: As following drawing
Φ = (X+Y) / 2
 
<table><tr><th>Size(mm)</th><th>Acceptable Q'ty</th></tr><tr><td>Φ≦0.10</td><td>Accept no dense</td></tr><tr><td>0.10< Φ≦0.20</td><td>2</td></tr><tr><td>0.20< Φ≦0.25</td><td>2</td></tr><tr><td>0.25< Φ≦0.30</td><td>1</td></tr><tr><td>0.30< Φ</td><td>0</td></tr></table>* Densely spaced: No more than two spots within 3mm.</td><td>2.5</td></tr>
<tr><td>3.2 Line type: (As following drawing)
 
<table><tr><th>Length(mm)</th><th>Width(mm)</th><th>Acceptable Q'ty</th></tr><tr><td>---</td><td>W≦0.02</td><td>Accept no dense</td></tr><tr><td>L≦3.0</td><td>0.02<W≦0.05</td><td rowspan="2">2</td></tr><tr><td>L≦2.5</td><td>0.03<W≦0.08</td></tr><tr><td>---</td><td>0.08<W</td><td>Rejection</td></tr></table>* Densely spaced: No more than two lines within 3mm.</td><td>2.5</td></tr>
</table>

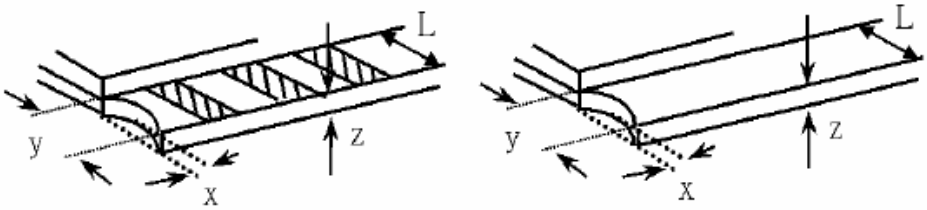
<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>04</td><td>Polarizer bubbles</td><td>If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction
<table>
<tr><td>Size Φ(mm)</td><td>Acceptable Q'ty</td></tr>
<tr><td>Φ≦0.20</td><td>Accept no dense</td></tr>
<tr><td>0.20< Φ≦0.50</td><td>3</td></tr>
<tr><td>0.50< Φ≦1.00</td><td>2</td></tr>
<tr><td>1.00< Φ</td><td>0</td></tr>
<tr><td>Total Q'ty</td><td>3</td></tr>
</table></td><td>2.5</td></tr>
<tr><td>05</td><td>Scratches</td><td>Follow NO.3 -2 Line Type.</td><td></td></tr>
<tr><td>06</td><td>Chipped glass</td><td>Symbols:
x: Chip length y: Chip width z: Chip thickness
k: Seal width t: Glass thickness a: LCD side length
L: Electrode pad length
6.1 General glass chip:
6.1.1 Chip on panel surface and crack between panels:
 

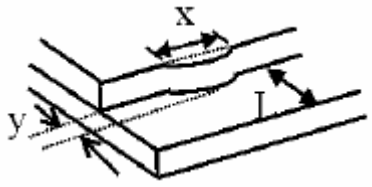
<table>
<tr><td>z: Chip thickness</td><td>y: Chip width</td><td>x: Chip length</td></tr>
<tr><td>Z≦1/2t</td><td>Not over viewing area</td><td>x≦1/8a</td></tr>
<tr><td>1/2t< z≦2t</td><td>Not exceed 1/3k</td><td>x≦1/8a</td></tr>
</table>
⊙ Unit: mm
⊙ If there are 2 or more chips, x is the total length of each chip

6.1.2 Corner crack:
 

<table>
<tr><td>z: Chip thickness</td><td>y: Chip width</td><td>x: Chip length</td></tr>
<tr><td>Z≦1/2t</td><td>Not over viewing area</td><td>x≦1/8a</td></tr>
<tr><td>1/2t< z≦2t</td><td>Not exceed 1/3k</td><td>x≦1/8a</td></tr>
</table>
⊙ Unit: mm
⊙ If there are 2 or more chips, x is the total length of each chip</td><td>2.5</td></tr>
</table>

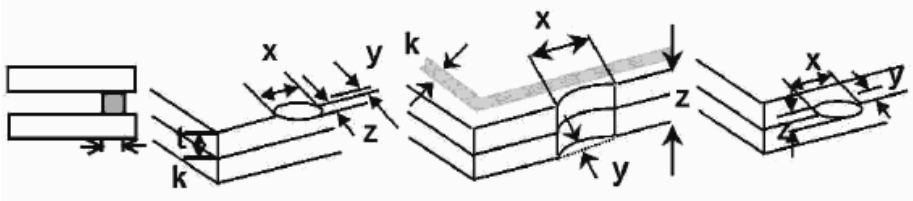
<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>07</td><td>Glass crack</td><td>
Symbols:
x: Chip length y: Chip width z: Chip thickness
k: Seal width t: Glass thickness a: LCD side length
L: Electrode pad length
7.2 Protrusion over terminal:
7.2.1 Chip on electrode pad:


<table>
<tr><th>y: Chip width</th><th>x: Chip length</th><th>z: Chip thickness</th></tr>
<tr><td>y≦0.5mm</td><td>x≦1/8a</td><td>0< z≦t</td></tr>
</table>
7.2.2 Non-conductive portion:


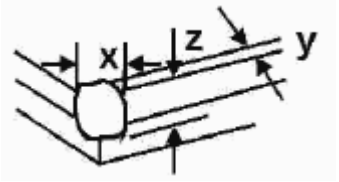
<table>
<tr><th>y: Chip width</th><th>x: Chip length</th><th>z: Chip thickness</th></tr>
<tr><td>y≦L</td><td>x≦1/8a</td><td>0< z≦t</td></tr>
</table>
⊙ If there chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications.
⊙ If the product will be heat sealed by the customer, the alignment mark must mot be damaged.
7.2.3 Substrate protuberance and internal crack


<table>
<tr><th>y: width</th><th>x: length</th></tr>
<tr><td>y≦1/3L</td><td>X≦a</td></tr>
</table>
</td><td>2.5</td></tr>
</table>

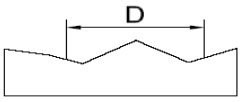
NO	Item	Criterion	AQL
08	Cracked glass	The LCD with extensive crack is not acceptable.	2.5
09	Backlight elements	9.1 Illumination source flickers when lit. 9.2 Spots or scratches that appear when lit must be judged. Using LCD spot, lines and contamination standards. 9.3 Backlight doesn’t light or color is wrong.	2.5 2.5 0.65
10	Bezel	Bezel must comply with product specifications.	2.5
11	PCB、COB	11.1 COB seal may not have pinholes larger than 0.2mm or contamination. 11.2 COB seal surface may not have pinholes through to the IC. 11.3 The height of the COB should not exceed the height indicated in the assembly diagram. 11.4 There may not be more than 2mm of sealant outside the seal area on PCB. And there should be no more than three places. 11.5 Parts on PCB must be the same as on the production characteristic chart, There should be no wrong parts, missing parts or excess parts. 11.6 The jumper on the PCB should conform to the product characteristic chart.	2.5 2.5 2.5 2.5 0.65 0.65
12	FPC	12.1 FPC terminal damage ≦ 1/2 FPC terminal width and can not affect the function , we judge accept. 12.2 FPC alignment hole damage ≦ 1/2 alignment area and can not affect the function , we judge accept.	2.5 2.5
13	Soldering	13.1 No cold solder joints, missing solder connections, oxidation or icicle. 13.2 No short circuits in components on PCB or FPC.	2.5 0.65

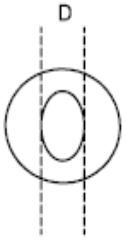
<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>14</td><td>Touch Panel Chipped glass</td><td>
Symbols:
x: Chip length y: Chip width z: Chip thickness
k: Seal width t: Touch Panel Total thickness a: LCD side length
L: Electrode pad length
14.1 General glass chip:
14.1.1 Chip on panel surface and crack between panels:


<table>
<tr><th>z: Chip thickness</th><th>y: Chip width</th><th>x: Chip length</th></tr>
<tr><td>Z≦t</td><td>≦1/2 k and not over viewing area</td><td>x≦1/8a</td></tr>
</table>
⊙ Unit: mm
⊙ If there are 2 or more chips, x is the total length of each chip

14.1.2 Corner crack:


<table>
<tr><th>z: Chip thickness</th><th>y: Chip width</th><th>x: Chip length</th></tr>
<tr><td>z≦t</td><td>≦1/2 k and not over viewing area</td><td>x≦1/8a</td></tr>
</table>
⊙ Unit: mm
⊙ If there are 2 or more chips, x is the total length of each chip
</td><td>2.5</td></tr>
</table>

<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>15</td><td>Touch Panel(Fish eye、dent and bubble on film)</td><td>
<table>
<tr><th>SIZE(mm)</th><th>Acceptable Q’ty</th></tr>
<tr><td>Φ≦0.2</td><td>Accept no dense</td></tr>
<tr><td>0.2< D ≦0.4</td><td>5</td></tr>
<tr><td>0.4< D ≦0.5</td><td>2</td></tr>
<tr><td>0.5< D</td><td>0</td></tr>
</table>




</td><td>2.5</td></tr>
<tr><td>16</td><td>Touch Panel Newton ring</td><td>Newton ring dimension ≦ 1/2 touch panel area and not affect font and line distortion(≦2.5%) , it is acceptable.</td><td>2.5</td></tr>
<tr><td>17</td><td>Touch Panel Linearity</td><td>Less than 2.5% is acceptable.</td><td>2.5</td></tr>
<tr><td>18</td><td>LCD Ripple</td><td>Touch the touch panel , can not see the LCD ripple.
Pen: R 1.0mm silicon rubber.
Operation Force: 80g</td><td>2.5</td></tr>
<tr><td>19</td><td>General appearance</td><td>19.1 Pin type must match type in specification sheet.
19.2 LCD pin loose or missing pins.
19.3 Product packaging must the same as specified on packaging specification sheet.
19.4 Product dimension and structure must conform to product specification sheet.</td><td>0.65
0.65
0.65
0.65</td></tr>
</table>

12. Packing method

------TBD