LCD Module

Product Specification

□：APPROVAL FOR SPECIFICATION
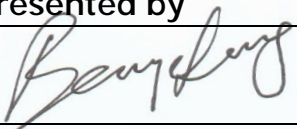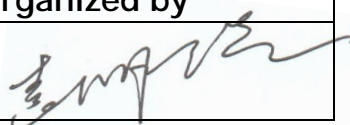
For Customer： _____ □：APPROVAL FOR SAMPLE

Module No.： TST500MTWH-01P
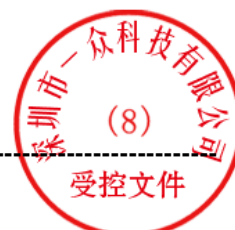
For Customer's Acceptance ：

Approved by	Comment

Team Source Display ：

Presented by	Reviewed by	Organized by

This module uses ROHS material

Records of Revision

DATE	REF. PAGE PARAGRAPH DRAWING No.	REVISED No.	SUMMARY	REMARK
2014-2-15		01	First issue	

Contents

1. Introduction

1.1 Scope of application

  This specification applies to the Negative type TFT transmissive dot matrix LCD module ,This LCD module should be designed for mobile phone use.

LCD specification: Dots 800xRGBx480.

As to basic specification of the driver IC, refer to the IC (HX8664B+HX8264D) specification and datasheet.

1.2 Structure:

Double display structure:

TFT Module + FPC +BL+TP;

FULL 16.7M Color 5.0inch TFT LCD size for main LCD;

One bare chip with gold bump (COG) TECH;

24BIT RGB interface;

1.3 TFT features:

Structure: TFT PANNEL+IC+FPC+BL;

Transmissive Type LCD

800 dot-source and 480 dot-gate outputs;

White LED back light;

24BIT RGB interface;

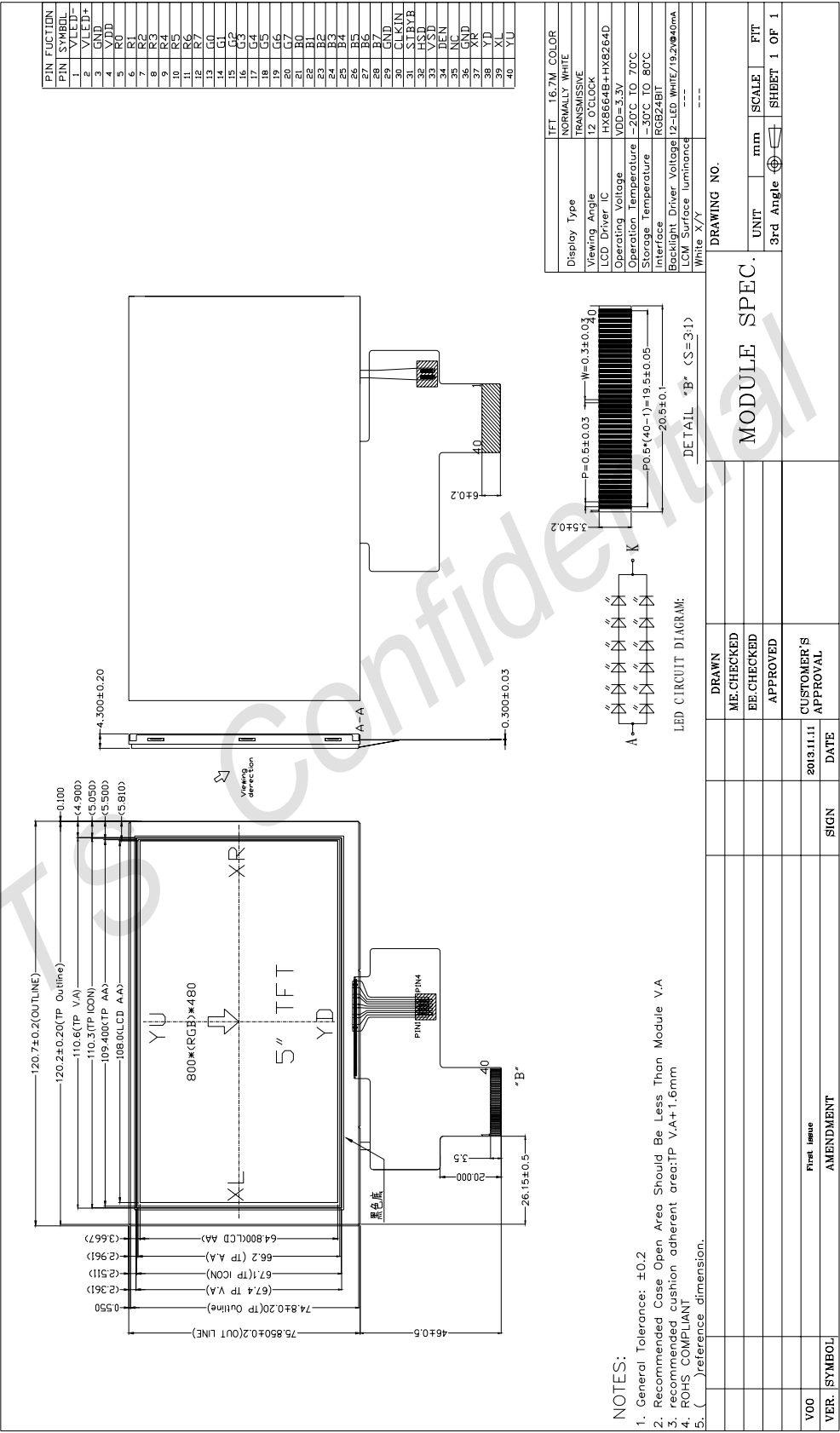## 1.4 Applications:

Mobile phone

   PSP

   PDA

   GPS

   Etc…

2. General specification

ITEM	Standard value	UNIT
LCD Type	TFT Transmissive	---
Driver element	a-Si TFT Active matrix	
Number of Dots	800*(RGB)*480	Dots
Pixel Arrangement	RGB Vertical Stripe	
Active Area	108.0 *64.8	mm
Viewing Direction	12 O' clock	
Driver IC	HX8664B+HX8264D	
Module Size(W*H*T)	120.70x75.85x4.30	mm
Approx. Weight	TBD	g
Back Light	White LED	
System interface	24 Bit RGB interface	
Backlight power consumption	730mW	
Panel power consumption	~350mW	

3. Mechanical drawing

PIN FUCTION	
PIN	SYMBOL
1	VLED-
2	VLED+
3	GND
4	VDD
5	R0
6	R1
7	R2
8	R3
9	R4
10	R5
11	R6
12	R7
13	G0
14	G1
15	G2
16	G3
17	G4
18	G5
19	G6
20	G7
21	B0
22	B1
23	B2
24	B3
25	B4
26	B5
27	B6
28	B7
29	GND
30	CLKIN
31	ST.BYR
32	HSD
33	VSD
34	DEN
35	NC
36	GND
37	XR
38	YD
39	XL
40	YU

Display Type	TFT 16.7M COLOR NORMALLY WHITE TRANSMISSIVE
Viewing Angle	12 O'CLOCK
LCD Driver IC	HX8664B+HX8264D
Operating Voltage	VDD=3.3V
Operation Temperature	-20°C TO 70°C
Storage Temperature	-30°C TO 80°C
Interface	RGB24BIT
Backlight Driver Voltage	12-LED WHITE/19.2V@40mA
LCM Surface luminance	---
White X/Y	

MODULE SPEC.

		SIGN	DATE
DRAWN			2013.11.11
ME.CHECKED			
EE.CHECKED			
APPROVED			
CUSTOMER'S APPROVAL			

DRAWING NO.

UNIT	mm	SCALE	FIT
3rd Angle		SHEET 1 OF 1	

LED CIRCUIT DIAGRAM:

DETAIL "B" (S=3:1)

NOTES:
1. General Tolerance: ±0.2
2. Recommended Case Open Area Should Be Less Than Module V.A
3. recommended cushion adherent area:TP V.A+1.6mm
4. ROHS COMPLIANT
5. ( )reference dimension.

VER.	SYMBOL	AMENDMENT		
V00		First issue	SIGN	DATE

5" TFT
800*(RGB)*480

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}		60	mA
Operating temperature	T_{OP}	-20	+70	℃
Storage temperature	T_{ST}	-30	+80	℃

5. ELECTRICAL CHARACTERISTICS

5.1 Typical Operation Conditions

Item	Symbol	Min	Typ	Max	Unit	Applicable terminal
Supply voltage	V_{dd}	3.0	3.3	3.6	V	V_{DD}
Input voltage	V_{IL}	-0.3	-	$0.2\ V_{dd}$	V	
	V_{IH}	$0.8\ V_{dd}$	-	V_{dd}	V	
Input leakage current	I_{LKG}	-	-	-	μA	

5.2 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	（30）	(40)	(50)	mA	
LED life time	-	20,000	-	-	Hr	Note 2

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and
I_L =40mA.

Note 2: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and I_L =40mA. The LED lifetime could be decreased if operating I_L is lager than 40mA.

5.3. Timing Characteristics

5.3.1. AC Electrical Characteristics

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
HS setup time	T_{hst}	8	-	-	ns	
HS hold time	T_{hhd}	8	-	-	ns	
VS setup time	T_{vst}	8	-	-	ns	
VS hold time	T_{vhd}	8	-	-	ns	
Data setup time	T_{dsu}	8	-	-	ns	
Data hold time	T_{dhd}	8	-	-	ns	
DE setup time	T_{esu}	8	-	-	ns	
DE hold time	T_{ehd}	8	-	-	ns	
DV_{DD} Power On Slew rate	T_{POR}	-	-	20	ms	From 0 to 90% DV_{DD}
RESET pulse width	T_{Rst}	10	-	-	ms	
DCLK cycle time	T_{coh}	20	-	-	ns	
DCLK pulse duty	T_{cwh}	40	50	60	%	

5.3.2.   Data Input Format
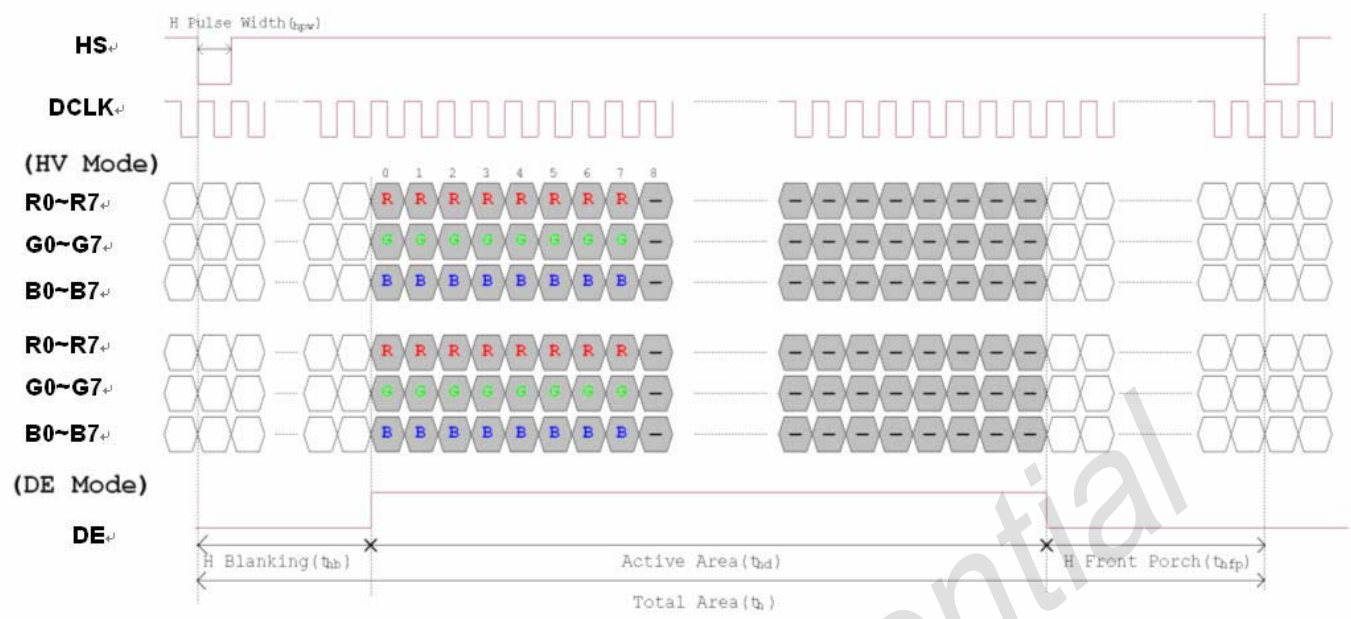
Figure 3. 1 Horizontal input timing diagram.
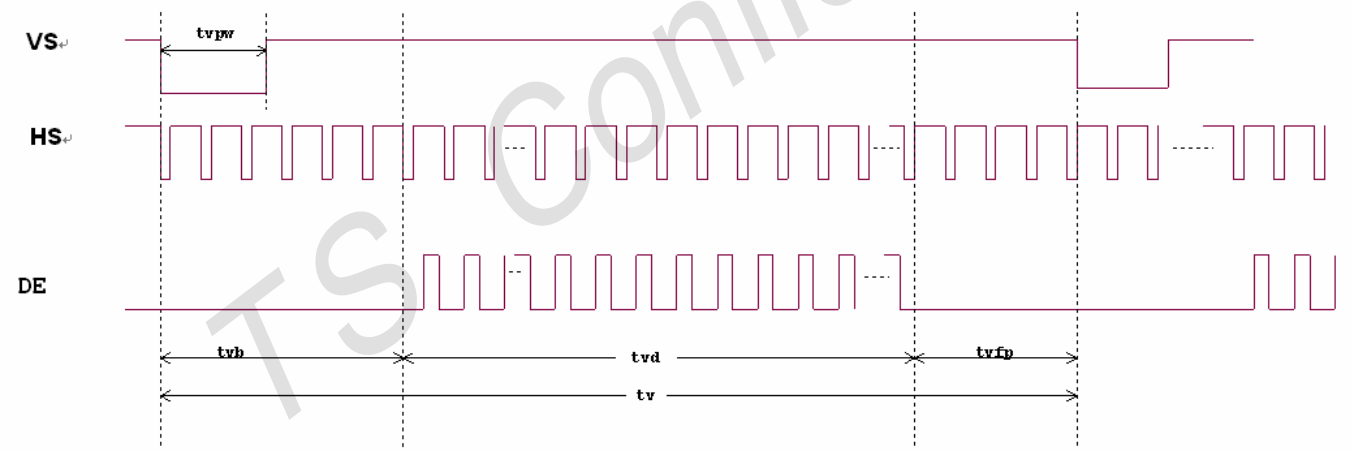
Figure 3. 2 Vertical input timing diagram.

5.3.3. Timing

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Horizontal Display Area	thd	-	800	-	DCLK	
DCLK Frequency	fclk		30	50	MHz	
One Horizontal Line	th	889	928	1143	DCLK	
HS pulse width	thpw	1	48-	255	DCLK	
HS Blanking	thb		88		DCLK	
HS Front Porch	thfp	1	40	255	DCLK	

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Vertical Display Area	tvd	-	480	-	TH	
VS period time	tv	513	525	767	TH	
VS pulse width	tvpw	3	3	255	TH	
VS Blanking	tvb		32		TH	
VS Front Porch	tvfp	1	13	255	TH	

6. OPTICAL CHARACTERISTICS

ITEM		SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	NOTE
				MIN.	TYP.	MAX		
Brightness		B		--	200	--	Cd/m^2	
Contrast Ratio		CR		-	500	--	--	
Response Time		Tr+Tf		--	20	--	ms	
CIE Color coordinate	Red	X$_R$	Viewing normal angle	0.540	0.590	0.640		All left side data are based on TIANMA's product reference only
		Y$_R$		0.300	0.350	0.400		
	Green	X$_G$		0.298	0.348	0.398		
		Y$_G$		0.520	0.570	0.620		
	Blue	X$_B$		0.095	0.145	0.195		
		Y$_B$		0.060	0.110	0.160		
	White	X$_W$						
		Y$_W$						
Viewing Angle	Hor.	θ_{X+}	Center CR>=10	60	70	--	Deg.	
		θ_{X-}		60	70	--		
	Ver.	θ_{Y+}		60	70	--		
		θ_{Y-}		40	50			
Uniformity		Un		75	80		%	

Note 1 : Definition of Viewing Angle θx and θy :

www.tslcd.com Email: tslcd@tslcd.com
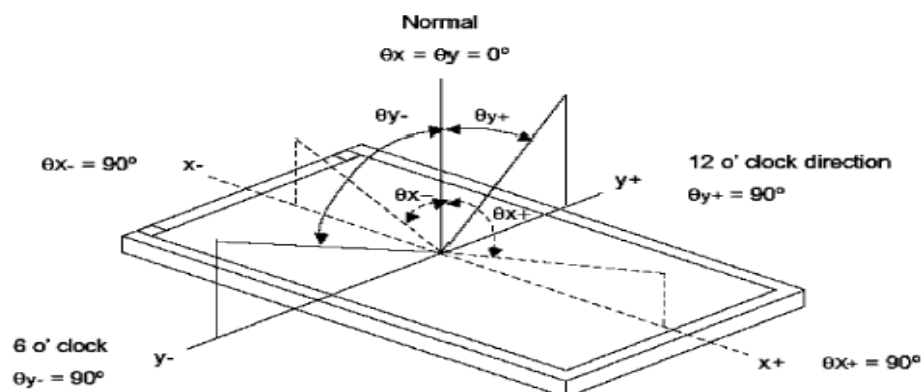
Note 2: Definition of contrast ratio CR:

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

Note 3: Definition of response time (T$_R$, T$_F$)

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www.tslcd.com Email: tslcd@tslcd.com
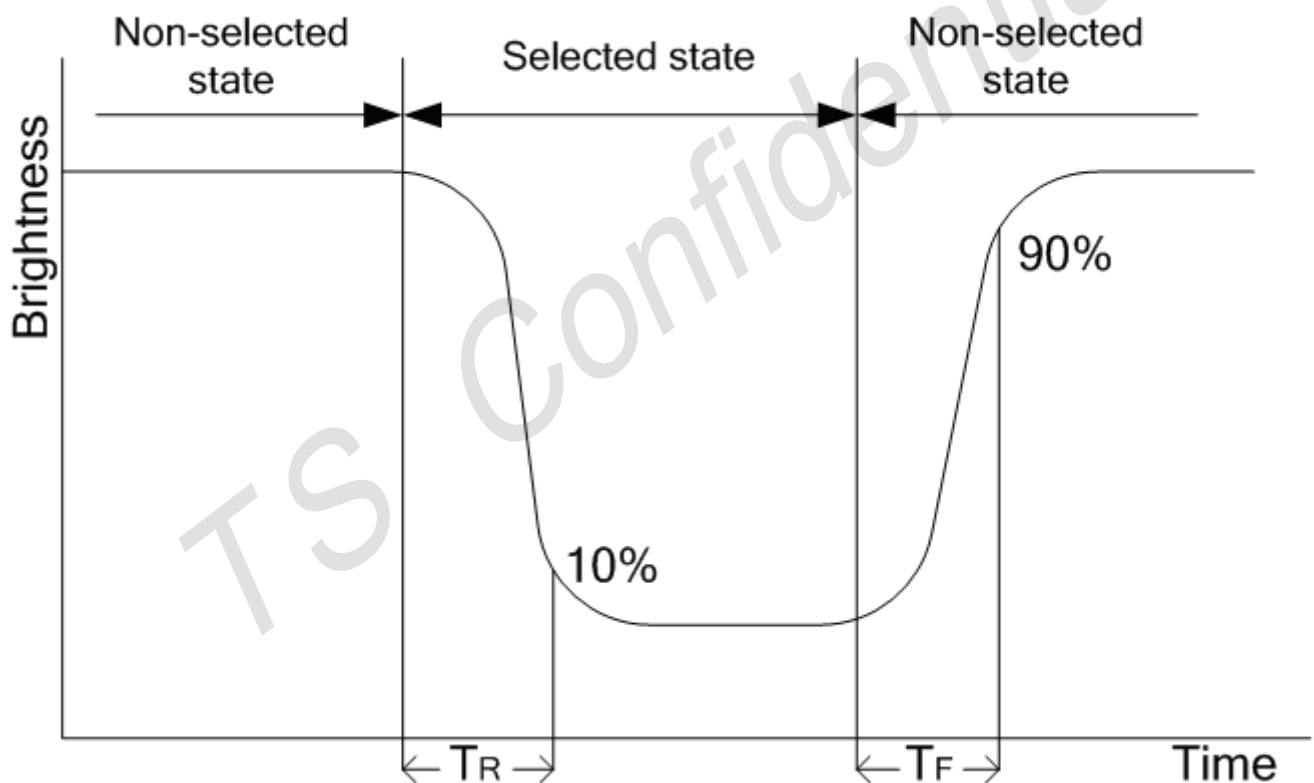
: The brightness test equipment setup
  20mA   Field=2° (As measuring "black" image, field=2° is the best testing condition)

BM-7

Field = 2°

50 cm

TFT-LCD Panel

The center of the screen

Note 4 :

H/6

H/3

H/3

H/6

Active area

H

L/6   L/3   L/3   L/6

L

Active area

Unit: mm
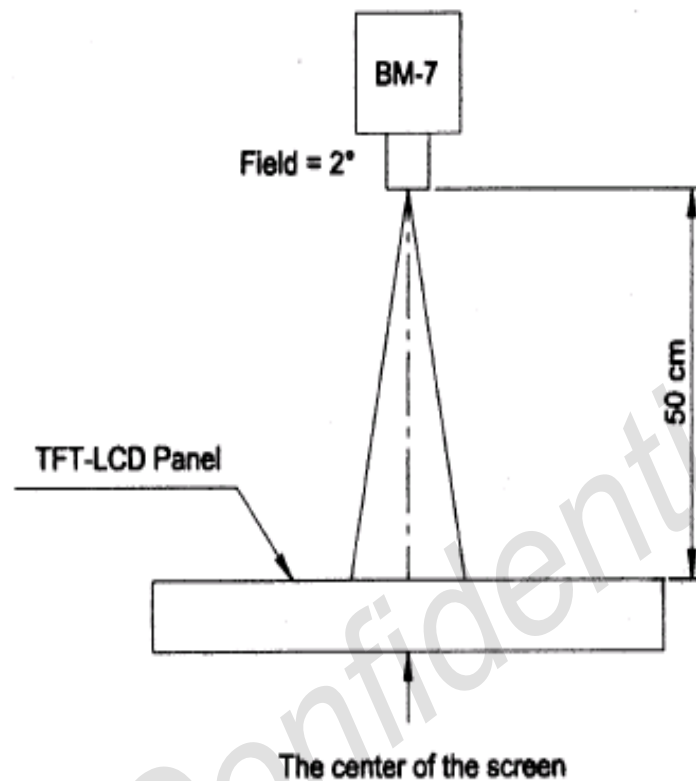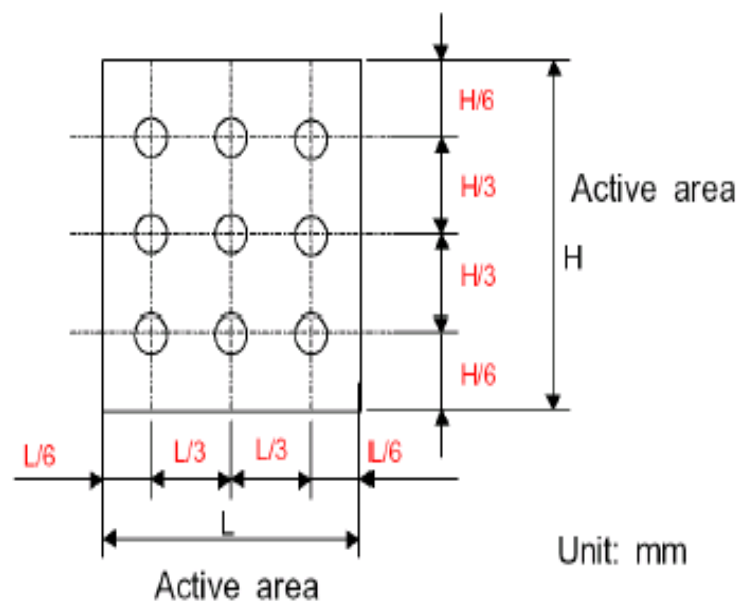
7. Interface Pin Function

Pin No	Symbol	Function
1	VLED-	BACK LIGHT POWER GROUND
2	VLED+	BACK LIGHT POWER SUPPLY
3	GND	POWER GROUND
4	VDD	POWER SUPPLY
5-12	R0-R7	RED DATA
13-20	G0-G7	GREEN DATA
21-28	B0-B7	BLUE DATA
29	GND	POWER GROUND
30	CLKIN	In external interface mode, served as a dot clock signal.
31	STBYB	standby mode control pin
32	HSD	In external interface mode, served as a horizontal synchronized signal input
33	VSD	In external interface mode, served as a vertical synchronize signal input
34	DEN	In external interface mode, polarity of ENABLE signal is synchronized with valid graphic data input.
35	NC	NC
36	GND	POWER GROUND
37	XR	TOUCH PANEL CONTROL PIN
38	YD	
39	XL	
40	YU	

NOTE:For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported. If ENB signal is fixed low. SYNC mode is used. Otherwise, DEN+SYNC is used

8. BLOCK DIAGRAM

Driver IC:HX8664B+HX8264Dor Compatible

Timing Controller
with Memory

Gate Driver

Source Driver

Gate Driver

G480

G1

Y1

Y800

5.0" TFT LCD Panel

Connection with Host

/RESET

R[0:7]

G[0:7]

B[0:7]

CLKIN

VSD

HSD

DEN

VDD

VSS

XR

YD

XL

YU

LEDA

LEDK

TP

BL Circuit (2*6LED)
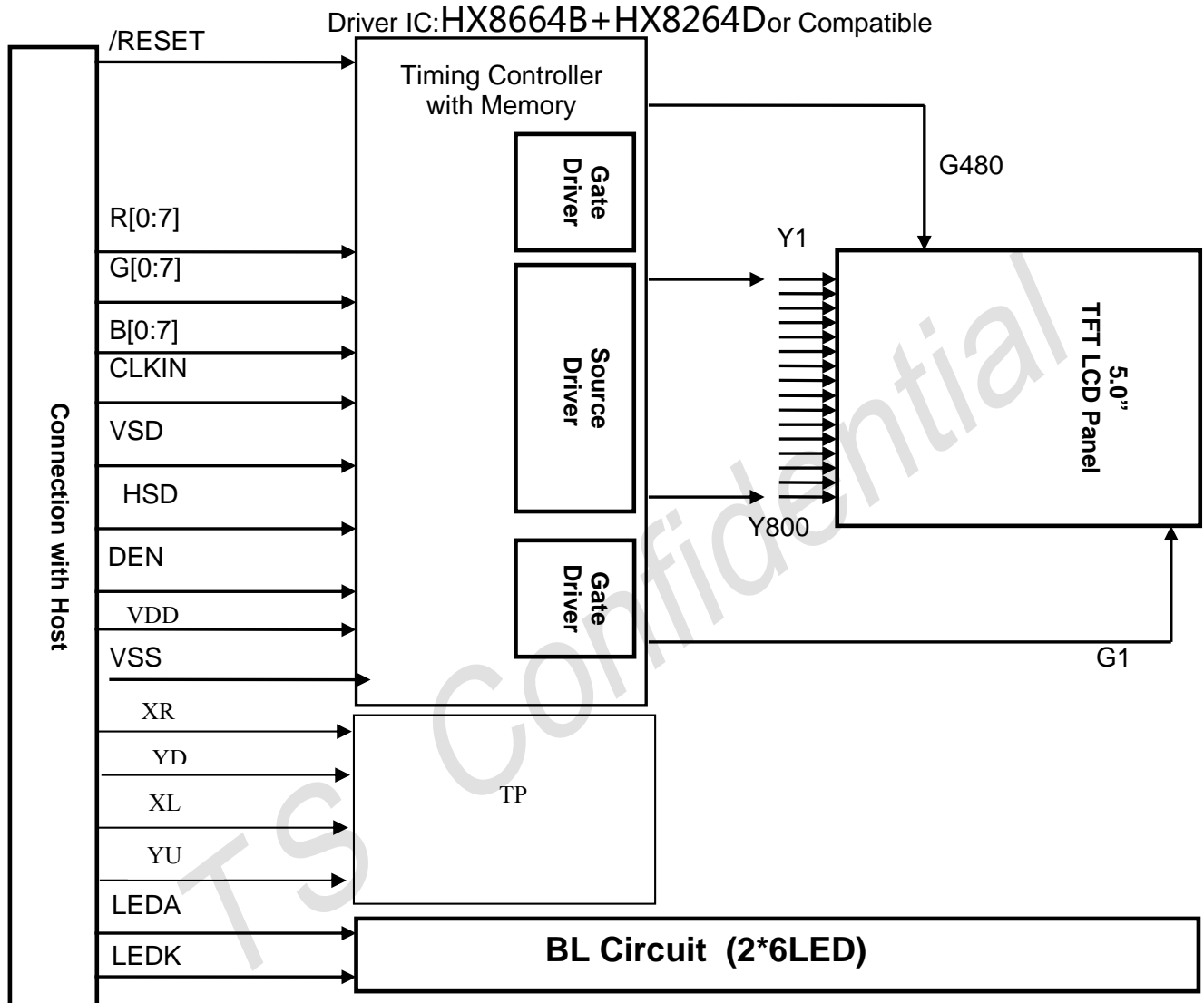
9. Touch Panel Specification
9.1. Electrical Characteristics

ITEM	SPECIFICATIONS			UNIT	REMARK
	MIN.	TYP.	MAX		
Linearity	−1.5	−	1.5	%	After environment & life test
Terminal Resistance	350	−	1000	ohm	X(Film side)
	100	−	450	ohm	Y(Glass side)
Insulation Resistance	10	−	−	Mohm	DC 25V 1min
Operating Voltage	−	−	10	V	DC

9.2. Optical Characteristics

ITEM	SPECIFICATIONS			UNIT	REMARK
	MIN.	TYP.	MAX		
Response Time	−	−	10	ms	100kohm pull-up
Light Transparency	80	−	−	%	

9.3. Mechanical Characteristics

ITEM	SPECIFICATIONS			UNIT	REMARK
	MIN.	TYP.	MAX		
Operation Force	−	−	100	gf	Note1
Surface Hardness	3	−	−	H	
Pen Sliding Durability	100,000			times	Note2
Hitting Durability	1,000,000			times	Note3

Note 1: Do not operate it with a thing except a polyacetal pen (tip R0.8mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

Depending on the pitch & the dimension of the spacer dots in between.

Note 2: Measurement for surface area.

-Scratch 100,000 times straight line on the film with a stylus change every 20,000 times.

-Force: 100gf.

-Speed: 60mm/sec.

-Stylus: R0.8 polyacetal tip.

Note 3: Hit 1,000,000 times on the film with an R12.5mm tip.

-Force: 250gf.

-Speed: 2 times/sec.

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 ASTM-D-5327.
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 purchaser byTSLCD (Supplier).

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

   eyes   eyes
     10°   10°
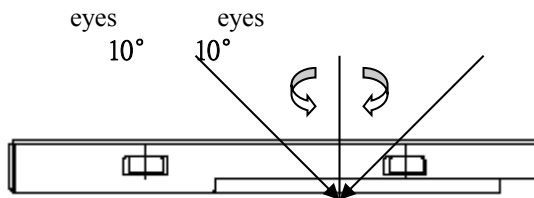
      (iv) Definition of area:
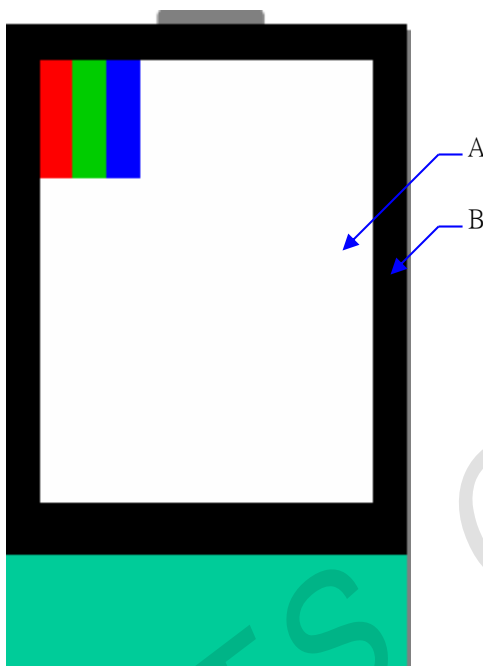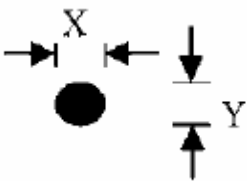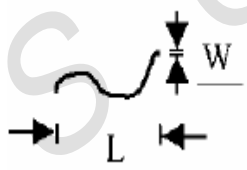
A.   Area: Viewing area.
B.   Area: Out of viewing area.
     (Outside viewing area)
b. Basic principle:
 (i) It will accord to the AQL when the standard can not be described.
 (ii) The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute
     happened.
 (iii) Must add new item on time when it is necessary.
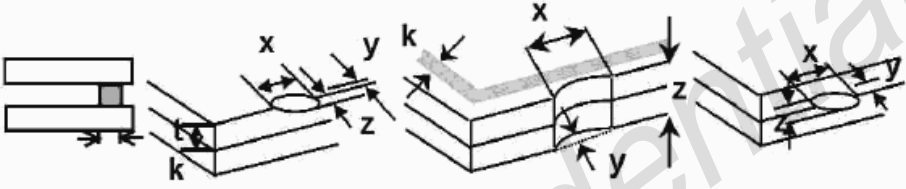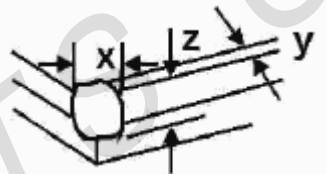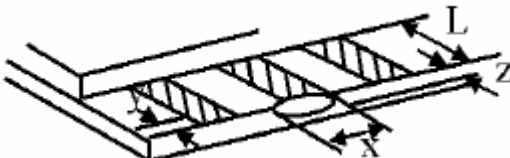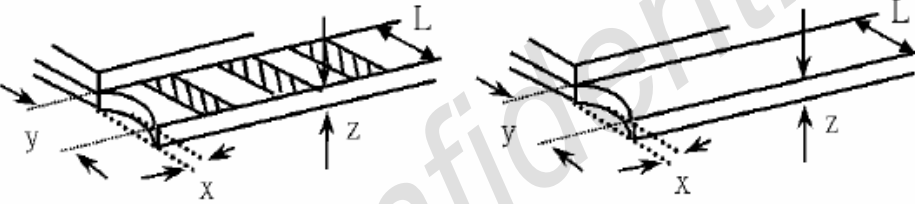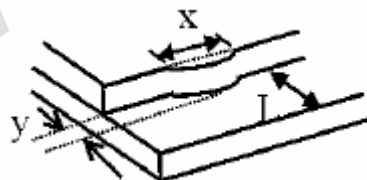
 c. Standard of inspection: (Unit: mm)
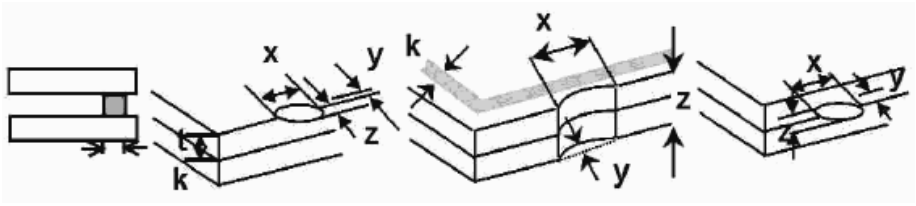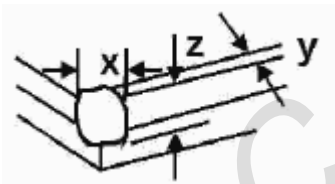
11-6. Inspection specification

NO	Item	Criterion	AQL
01	Electrical Testing	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	**0.65**
02	Black or White spots or Bright spots or Color spots on LCD (Display only)	2.1 White and black or color spots on display $\leqq$ 0.25mm, no more than Five spots. 2.2 Densely spaced: No more than three spots within 3mm.	**2.5**
03	LCD and Touch Panel black spots, white spots, contamination (non – display)	3.1 Round type: As following drawing $\Phi = (X+Y) / 2$	**2.5**

3.1 Round type table:

Size(mm)	Acceptable Q'ty
$\Phi \leqq 0.10$	Accept no dense
$0.10< \Phi \leqq 0.20$	2
$0.20< \Phi \leqq 0.25$	2
$0.25< \Phi \leqq 0.30$	1
$0.30< \Phi$	0

* Densely spaced: No more than two spots within 3mm.

3.2 Line type: (As following drawing)

Length(mm)	Width(mm)	Acceptable Q'ty
---	$W \leqq 0.02$	Accept no dense
$L \leqq 3.0$	$0.02<W \leqq 0.05$	2
$L \leqq 2.5$	$0.03<W \leqq 0.08$	2
---	$0.08<W$	Rejection

(AQL: **2.5**)

* Densely spaced: No more than two lines within 3mm.

NO	Item	Criterion	AQL
04	Polarizer bubbles	If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction | Size Φ(mm)	Acceptable Q'ty
Φ≦0.20	Accept no dense
0.20< Φ≦0.50	3
0.50< Φ≦1.00	2
1.00< Φ	0
Total Q'ty	3		2.5
05	Scratches	Follow NO.3 -2 Line Type.	
06	Chipped glass	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: | z: Chip thickness	y: Chip width	x: Chip length
$Z≦1/2t$	Not over viewing area	$x≦1/8a$
$1/2t< z≦2t$	Not exceed 1/3k	$x≦1/8a$ | ⊙ Unit: mm ⊙ If there are 2 or more chips, x is the total length of each chip 6.1.2 Corner crack: | z: Chip thickness	y: Chip width	x: Chip length
$Z≦1/2t$	Not over viewing area	$x≦1/8a$
$1/2t< z≦2t$	Not exceed 1/3k	$x≦1/8a$ | ⊙ Unit: mm ⊙ If there are 2 or more chips, x is the total length of each chip	2.5

NO	Item	Criterion	AQL
07	Glass crack	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><td>y: Chip width</td><td>x: Chip length</td><td>z: Chip thickness</td></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><td>y: Chip width</td><td>x: Chip length</td><td>z: Chip thickness</td></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><td>y: width</td><td>x: length</td></tr><tr><td>y ≦ 1/3L</td><td>X ≦ a</td></tr></table>	2.5

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

NO	Item	Criterion	AQL
14	Touch Panel Chipped glass	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><td>z: Chip thickness</td><td>y: Chip width</td><td>x: Chip length</td></tr><tr><td>$Z \leqq t$</td><td>$\leqq 1/2$ k and not over viewing area</td><td>$x \leqq 1/8a$</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><td>z: Chip thickness</td><td>y: Chip width</td><td>x: Chip length</td></tr><tr><td>$z \leqq t$</td><td>$\leqq 1/2$ k and not over viewing area</td><td>$x \leqq 1/8a$</td></tr></table>⊙ Unit: mm ⊙ If there are 2 or more chips, x is the total length of each chip	2.5

NO	Item	Criterion	AQL
15	Touch Panel(Fish eye、dent and bubble on film)	<table><tr><td>SIZE(mm)</td><td>Acceptable Q'ty</td></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>	2.5
16	Touch Panel Newton ring	Newton ring dimension ≦ 1/2 touch panel area and not affect font and line distortion(≦2.5%) , it is acceptable.	2.5
17	Touch Panel Linearity	Less than 2.5% is acceptable.	2.5
18	LCD Ripple	Touch the touch panel , can not see the LCD ripple. Pen: R 1.0mm silicon rubber. Operation Force: 80g	2.5
19	General appearance	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.	0.65 0.65 0.65 0.65