Shenzhen Leadtek Electronics Co.,Ltd

PRODUCT SPECIFICATION

TFT-LCD MODULE

Module No：LTK060FHBLM10-V0

☑ Preliminary Specification

☐ Approval Specification

Designed by	Checked by	Approved by

Final Approval by Customer

Approved by	Comment

※The specification of “TBD” should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.

1.Document Revision History

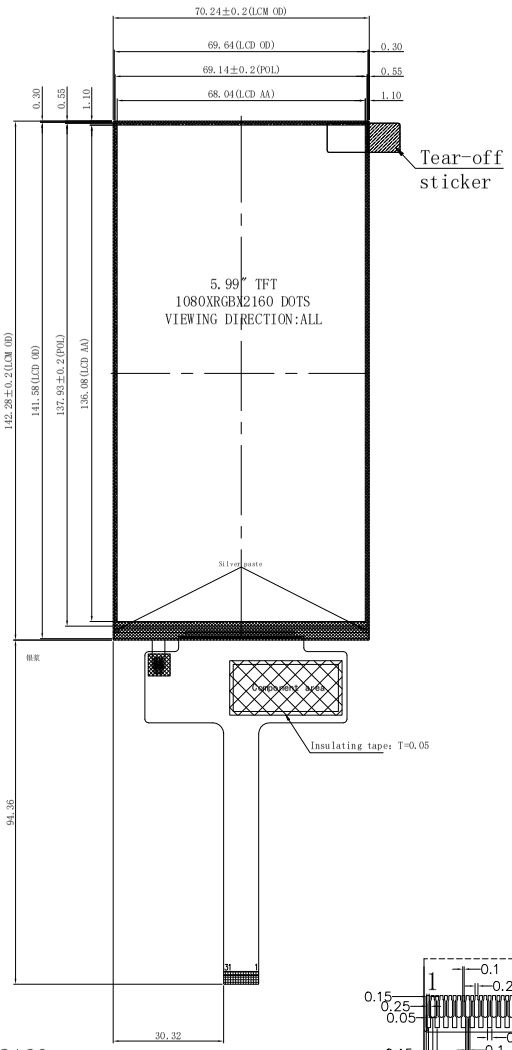
Version	Contents	Date	Note
V0	Original	2021.12.06	

2. General Information

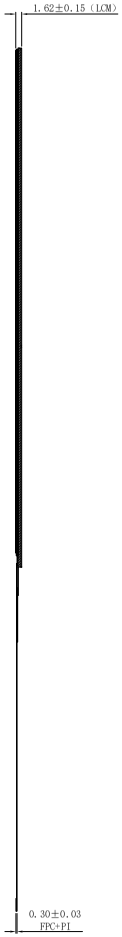
ITEM	STANDARD VALUES	UNITS
LCD type	5.99“ FHD	--
Dot arrangement	1080×RGB×2160	pixels
Color filter array	RGB Vertical stripe	--
Display mode	Transmissive / Normally Black	--
Viewing Direction	80/80/80/80	--
LCM Module size	70.24(W)×142.28(H)×1.62(T)	mm
Active area	68.04 (W)×136.08 (H)	mm
Dot pitch	63.0*(W)×63.0*(H)	um
Color gamut	70	%
Display colors	16.7M	colors
TFT Driver IC	XM91080G-CINC	mm
Interface	MIPI	--
Operating temperature	-20 ~ +70	℃
Storage temperature	-30 ~ +80	℃
Back Light	20 White LED	--
Weight	TBD	g

3. Mechanical Drawing

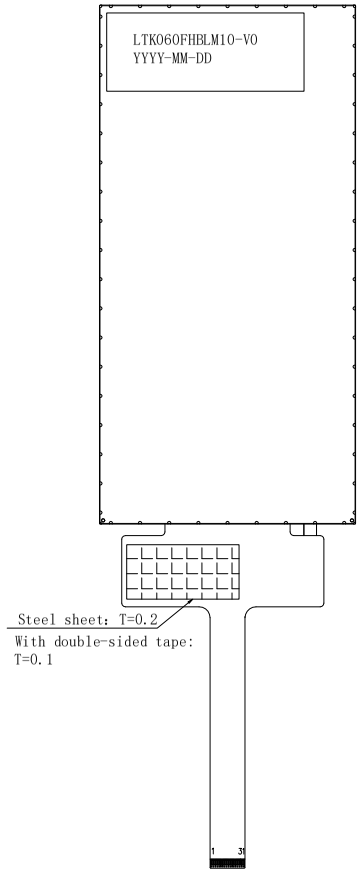
Front View



Side View

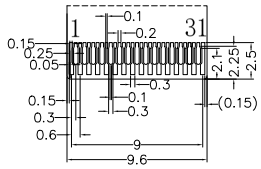


Back View

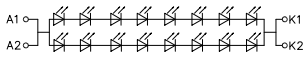


PIN DESCRIPTION

1	LED+
2	LED+
3	LED+
4	NC
5	LED-
6	LED-
7	LED-
8	LED-
9	GND
10	GND
11	MIPI_D0+
12	MIPI_D0-
13	GND
14	MIPI_D1+
15	MIPI_D1-
16	GND
17	MIPI_CLK+
18	MIPI_CLK-
19	GND
20	MIPI_D2+
21	MIPI_D2-
22	GND
23	MIPI_D3+
24	MIPI_D3-
25	GND
26	VSN
27	RESET(1.8V)
28	VSP
29	IOVCC(1.8V)
30	TE
31	GND



A
SCALE 4:1



If= 40 mA(20mA/LED)

Vf= 24 V(typ)

Notes:
1. Display : 6.0", TFT
2. Resolution: 1080xRGBx2160
3. LCD Viewing Direction: ALL,
4. Drive IC:XM91080-CINC
5. Display Mode: Normally Black
6. LCM Bringhtness: 650cd/m²(TYP),uniformity≥80%
7. unmark Tolerance:±0.2
8. OPERATING TEMP: -20° C~ +70° C
9. STORAGE TEMP: -30° C~ +80° C
10. Requirements on Environmental Protection: ROHS

REV	DESCRIPTION	DATE	NAME
3			
2			
1			
0	NEW	2023.03.10	IAN

LEADTEK COMPANY LIMITED

LEADTEK DISPLAY

SCALE:1/1	UNIT:mm	PAGE:1/1		Approve	Check	Drawn
Part No:	LTK060FHBLM10	VER:V0				IAN
Customer No:						

4. Interface signals

Pin No.	Symbol	Description
1	LEDA	Power supply for backlight anode input terminal
2	LEDA	Power supply for backlight anode input terminal
3	LEDA	Power supply for backlight anode input terminal
4	NC	NC
5	LEDK	Power supply for backlight cathode input terminal
6	LEDK	Power supply for backlight cathode input terminal
7	LEDK	Power supply for backlight cathode input terminal
8	LEDK	Powersupplyforbacklightcathodeinputterminal
9	GND	Power Ground
10	GND	Power Ground
11	MIPI_D0+	MIPI DSI differential data 0 postive
12	MIPI_D0-	MIPI DSI differential data 0 negative
13	GND	Power Ground
14	MIPI_D1+	MIPI DSI differential data 1 postive
15	MIPI_D1-	MIPI DSI differential data 1 negative
16	GND	Power Ground
17	MIPI_CLK+	MIPI DSI differential clock postive
18	MIPI_CLK-	MIPI DSI differential clock negative
19	GND	Power Ground
20	MIPI_D2+	MIPI DSI differential data 2 postive
21	MIPI_D2-	MIPI DSI differential data 2 negative
22	GND	Power Ground
23	MIPI_D3+	MIPI DSI differential data 3 postive
24	MIPI_D3-	MIPI DSI differential data 3 negative
25	GND	Power Ground
26	VSN	Power supply(-5v)
27	RESET(1.8V)	Reset signal（LowW Active)
28	VSP	Power supply(+5v)
29	IOVCC(1.8V)	Power supply pin 1.8v
30	TE	Tearingeffectoutput(Reserved)
31	GND	Power Ground

5. Absolute Maximum Ratings

5.1 Electrical Maximum Ratings – for IC Only

Table 3: Electrical Maximum Ratings – for IC

Parameter	Symbol	Min.	Max.	Unit	Note
Power supply voltage (IOVCC)	IOVCC	+1.65	+1.8	V	1
Power supply(AVDD)	AVDD	+4.5	+6	V	1
Power supply(AVEE)	AVEE	-4.5	-6	V	1

Note:

1.VCC, GND must be maintained.

2.The modules may be destroyed if they are used beyond the absolute maximum ratings.

5.2 Environment Absolute Rating

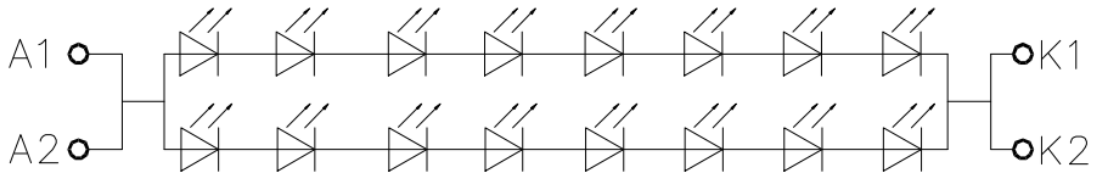
Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	Topa	-20	70	℃	
Storage Temperature	Tstg	-30	80	℃	

5.3 Back-light Unit:

PARAMETER	Sym.	Min.	Typ.	Max.	Unit	Test Condition	Note
LED Current	IF	–	40	–	mA	–	–
LED Voltage	VF	–	24	–	V	I=40mA	–
Luminous	IV		650	–	Cd/m²	I=40mA	_
Life Time		–	30000	–	Hr.	I=40mA	–
Color	White						

Note (1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.

(2)Ta=25±2℃



If= 40 mA(20mA/LED)

Vf= 24 V(typ)

6.0 OPTICAL SPECIFICATION

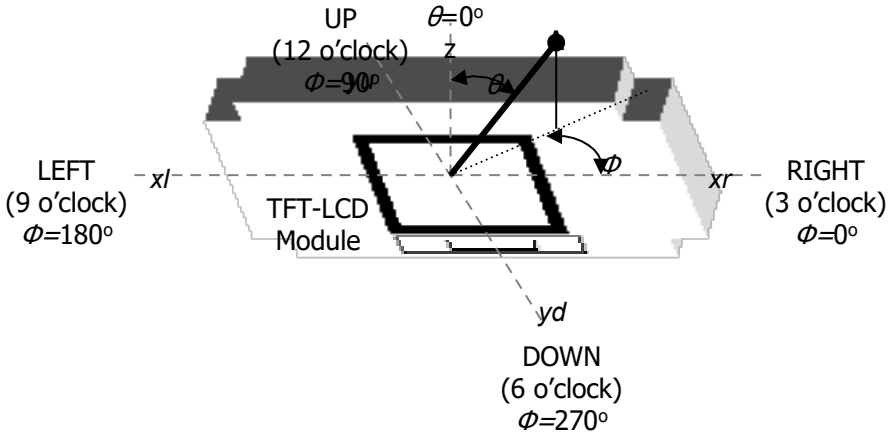
6.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤1lux and temperature = 25±2°C) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to θØ=0 (=θ3) as the 3 o‟clock direction (the "right"), θØ=90 (= θ12) as the 12 o‟clock direction ("upward"), θØ=180 (= θ9) as the 9 o‟clock direction ("left") and θØ=270(= θ6) as the 6 o‟clock direction ("bottom"). While scanning θand/or Ø, the center of the measuring spot on the Display surface shall stay fixed.
Optimum viewing angle direction is 6 ‟clock.

6.2 Optical Specifications

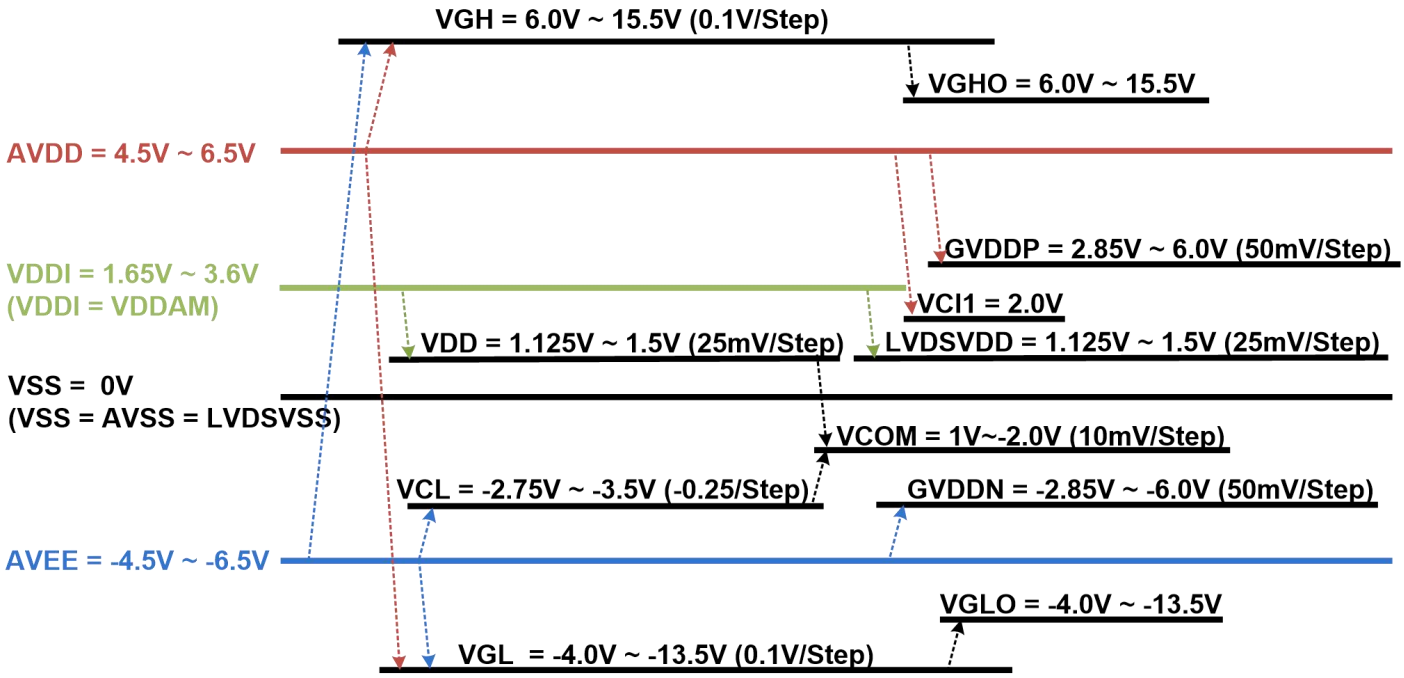
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Luminance Contrast ratio	CR	Θ = 0°	1000	1500	-		
Cell Transmittance	Tr		-	6.85%	-	%	@C Light Wi APF, Wo Haze & CG
White Chromaticity	x	CIE 1931	0.286	0.301	0.316		CF @ C Light
	y		0.315	0.330	0.345		
Red Chromaticity	x	CIE 1931	0.641	0.656	0.671		
	y		0.302	0.317	0.332		
Green Chromaticity	x	CIE 1931	0.248	0.263	0.278		
	y		0.552	0.567	0.582		
Blue Chromaticity	x	CIE 1931	0.122	0.137	0.152		
	y		0.068	0.083	0.098		
Color Gamut (C light)			-	70	-	%	C Light
Response Time (Rising + Falling)	T_{RT}	Ta= 25° C Θ = 0°	-	25	-	ms	Tr+Tf

6.3 Viewing Angle Range is defined as follows;



7.0 Power Supply Configuration

7.1 Power Block Diagram



7.2 Reset Timing Characteristics

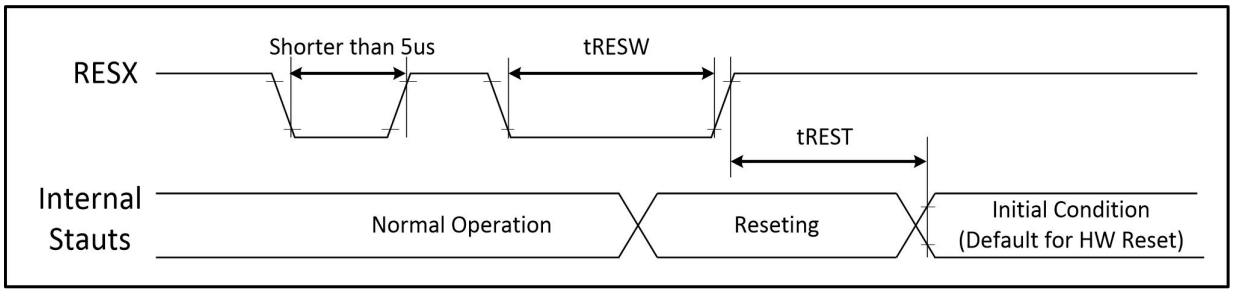


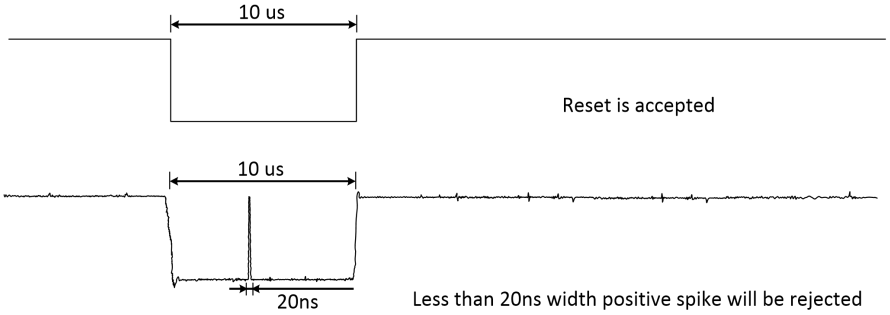
Figure 1. Reset Input Timing

Symbol	Parameter	Related Pins	Spec.			Unit	Note
			Min.	Typ.	Max.		
tRESW	Reset low pulse width	RESX	10	-	-	µs	-
tREST	Reset complete time	-	-	-	5	ms	During Sleep in mode
tREST	Reset complete time	-	-	-	120	ms	During Sleep out mode

Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

RESX Pulse	Action
Shorter than 5µs	Reset low pulse width
Longer than 10µs	Reset complete time
Between 5µs and 10µs	Reset start (by voltage and temperature condition)

During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120ms, when Reset Starts in Sleep Out mode. The display remains the blank state in Sleep In mode) and then return to Default condition for H/W reset. During Reset Complete Time, ID1/ID2/ID3/ID4 and VCOM value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 5ms after a rising edge of RESX. Spike Rejection also applies during a valid reset pulse as shown below:



8. RELIABILITY TEST

Reliability test conditions (Polarizer characteristics null)

No.	Items	Condition	Inspection after test
1	High Temperature Storage	T = 80℃ for 96 hr	Inspection after 4 hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD 2.Sealleak; 3.Non-display; 4.missing segments; 5.Glass crack; 6.Current Idd is twice higher than initial value.
2	Low Temperature Storage	T = -30℃ for 96 hr	
3	High Temperature Operating	T = 70℃ for 96 hr	
4	Low Temperature Operating	T = -20℃ for 96 hr (But no condensation of dew)	
5	High Temp. and High Humidity	T = 60℃ /90% for 96 hr (But no condensation dew)	
6	Thermal Shock	-20℃~25℃~70℃×5cycles (30min.) (5min.) (30min.)	
7	Dropping test (non-operation)	Drop to the ground from 76cm height, one time, every side of carton. (Packing condition)	
8	Packing Vibration (non-operation)	Frequency：10Hz~55Hz~10Hz Amplitude：1.0mm, X，Y，Z direction for total 3hours (Packing condition)	
9	ESD	Voltage:±6KV R: 330Ω C: 150pF Air discharge, 10time	

Note:

(1)The test samples should be applied to only one test item.

(2)Sample size for each test item is 5~10pcs.

(3)In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
Using ionizer(an antistatic blower) is recommended at working area in order to reduce electro-static voltage.
When removing protection film from LCM panel, peel off the tag slowly (recommended more than one second) while blowing with ionizer toward the peeling face to minimize ESD which may damage electrical circuit.

(4)Please use automatic switch testing mode when test operating mode.

9.0 INSPECTION CRITERION

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

9.1 **Sample plan**

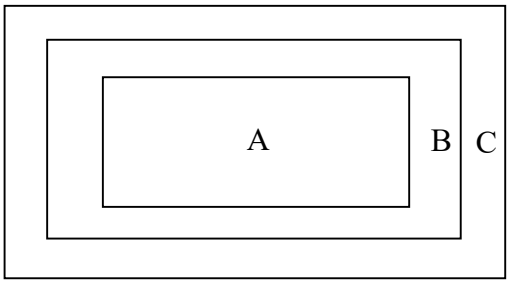
Sampling plan according to GB/T2828.1-2003/ISO 2859-1：1999 and ANSI/ASQC Z1.4-1993,normal level 2 and based on:

Major defect: AQL 0.65
Minor defect: AQL 1.0

9.2. Inspection condition

Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45° against perpendicular line. (Normal temperature 20~25°C and normal humidity 60±15%RH).

9.3. Definition of inspection zone in LCD.



Zone A: character/Digit area

Zone B: viewing area except Zone A (Zone A + Zone B=minimum Viewing area)

Zone C: Outside viewing area (invisible area after assembly in customer's product)

Fig.1 Inspection zones in an LCD.

Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.

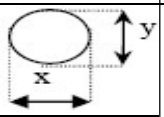
10.Standards of inspection items

10.1 Major Defect

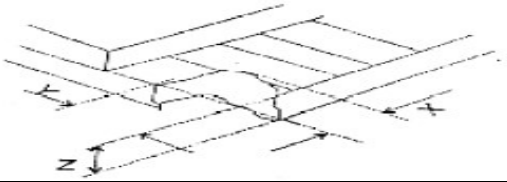
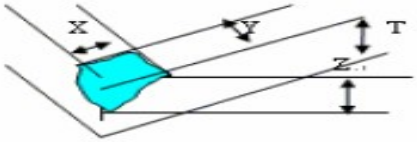
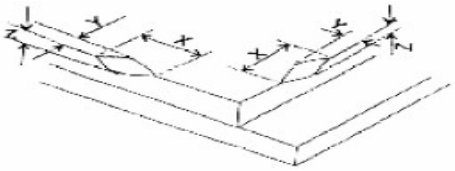
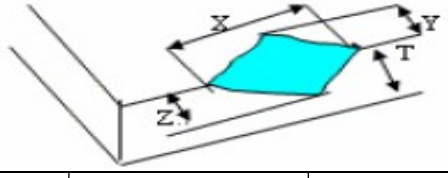
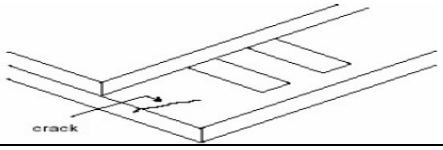
Item No	Items to be inspected	Inspection Standard	Classification of defects
10.1.1	All functional defects	1.No display	Major
		2.Display abnormally	
		3.Missing vertical，horizontal segment	
		4.Short circuit	
		5. Back-light no lighting, flickering and abnormal lighting.	

10.1.2	Missing	Missing component	
10.1.3	Outline dimension	Overall outline dimension beyond the drawing is not allowed.	
10.1.4	linearity	No more than 1.5%	

10.2 Cosmetic Defect

<table>
<tr><th>Item No</th><th>Items to be inspected</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="3">10.2.1</td><td>Clear Spots Black and white Spot defect Pinhole, Foreign Particle, polarizer Dirt</td><td>For dark/white spot, sizeΦis defined as Φ=(x + y)/2 
1
<table>
<tr><th rowspan="2">Zone
Size(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.15</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.15＜Φ≤0.20</td><td colspan="2">2</td></tr>
<tr><td>0.20＜Φ≤0.30</td><td colspan="2">1</td></tr>
<tr><td>Φ＞0.30</td><td colspan="2">0</td></tr>
</table></td><td>Minor</td></tr>
<tr><td>Clear Spots TP Dirt</td><td>2
<table>
<tr><th rowspan="2">Zone
Size(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.15</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.15＜Φ≤0.20</td><td colspan="2">2</td></tr>
<tr><td>0.20＜Φ≤0.30</td><td colspan="2">1</td></tr>
<tr><td>Φ＞0.30</td><td colspan="2">0</td></tr>
</table></td><td>Minor</td></tr>
<tr><td>Dim Spots Circle shaped and dim edged defects</td><td>3
<table>
<tr><th rowspan="2">Zone
Size(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.20＜Φ≤0.40</td><td colspan="2">2</td></tr>
<tr><td>0.40＜Φ≤0.60</td><td colspan="2">1</td></tr>
<tr><td>Φ＞0.60</td><td colspan="2">0</td></tr>
</table></td><td>Minor</td></tr>
</table>

<table>
<tr><th>Item No</th><th>Items to be inspected</th><th colspan="5">Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="6">10.2.2</td><td rowspan="6">Line defect Black line, White line, Foreign material on polarizer</td><td colspan="3">Size(mm)</td><td colspan="2">Acceptable Qty</td><td rowspan="6">Minor</td></tr>
<tr><td rowspan="2">L(Length)</td><td rowspan="2">W(Width)</td><td colspan="2">Zone</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Ignore</td><td>W≤0.05</td><td>Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>L ≤5.0</td><td>0.05＜W≤0.08</td><td>2</td></tr>
<tr><td></td><td>W＞0.08</td><td>0</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td rowspan="6">Foreign material on TP film</td><td colspan="5">The line can be seen after mobile phone in the operating condition:</td><td rowspan="6">Minor</td></tr>
<tr><td colspan="3">Size(mm)</td><td colspan="2">Acceptable Qty</td></tr>
<tr><td rowspan="2">L(Length)</td><td rowspan="2">W(Width)</td><td colspan="2">Zone</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Ignore</td><td>W≤0.05</td><td>Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>L ≤5.0</td><td>0.05＜W≤0.08</td><td>3</td></tr>
<tr><td></td><td>W＞0.08</td><td>0</td></tr>
<tr><td>10.2.3</td><td>Dim line defect Polarizer scratch TP film scratch</td><td colspan="5">If the scratch can be seen after mobile phone cover assembling or in the operating condition, judge by the line defect of 4.2.2. If the scratch can be seen only in non-operating condition or some special angle, judge by the following.</td><td>Minor</td></tr>
<tr><td colspan="3">Size(mm)</td><td colspan="2">Acceptable Qty</td></tr>
<tr><td rowspan="2">L(Length)</td><td rowspan="2">W(Width)</td><td colspan="2">Zone</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Ignore</td><td>W≤0.03</td><td>Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>5.0＜ L≤10.0</td><td>0.03＜W≤0.05</td><td>2</td></tr>
<tr><td>L≤5.0</td><td>0.05＜W≤0.08</td><td>1</td></tr>
<tr><td></td><td>W＞0.08</td><td>0</td></tr>
<tr><td rowspan="5">10.2.4</td><td rowspan="5">Polarize Air bubble</td><td colspan="5">Air bubbles between glass & polarizer</td><td rowspan="5">Minor</td></tr>
<tr><td colspan="3">Zone
Size(mm)</td><td colspan="2">Acceptable Qty</td></tr>
<tr><td colspan="3"></td><td>A</td><td>B</td><td>C</td></tr>
<tr><td colspan="3">Φ≤0.20</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td colspan="3">0.20＜Φ≤0.3</td><td colspan="2">2</td></tr>
<tr><td colspan="3">Φ＞0.30</td><td colspan="2">0</td></tr>
</table>

<table>
<tr><th>Item No</th><th>Items to be inspected</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="11">10.25</td><td rowspan="11">Glass defect</td><td>(i) Chips on corner
A:LCD Glass defect
 
</td><td rowspan="11">Minor</td></tr>
<tr><td><table><tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr><tr><td>≤3.0</td><td>≤3.0</td><td>Disregard</td></tr></table></td></tr>
<tr><td>Notes: S=contact pad length
Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.
B:TP Glass defect
 
</td></tr>
<tr><td><table><tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr><tr><td>≤3.0</td><td>≤3.0</td><td>Disregard</td></tr></table></td></tr>
<tr><td>(ii)Usual surface cracks
A:LCD Glass defect
  </td></tr>
<tr><td><table><tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr><tr><td>≤3.0</td><td><Inner border line of the seal</td><td>Disregard</td></tr></table></td></tr>
<tr><td>B:TP Glass defect
 
</td></tr>
<tr><td><table><tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr><tr><td>≤6.0</td><td>＜2.0</td><td>Disregard</td></tr></table></td></tr>
<tr><td>(iii) Crack
Cracks tend to break are not allowed.
 
</td></tr>
</table>

11 PRECAUTIONS FOR USE OF LCD MODULES

1. Handling Precautions

(1) The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) Electro-Static Discharge Control， Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.
- Tools required for assembling, such as soldering irons, must be properly grounded. Make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor. - To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential
- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated

(13)Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

(14)Do not alter, modify or change the shape of the tab on the metal frame.

(15)Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

(16)Do not damage or modify the pattern writing on the printed circuit board.

(17)Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.

(18)Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

(19)Do not drop, bend or twist LCM.

(20)**Storage precautions**

2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. 2.2 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:

Temperature : 0℃ ～ 40℃ Relatively humidity: ≤80%

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

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

12 Packing form

TBD