



FORMIKE ELECTRONIC CO.,LTD

PRDUCT SPECIFICATON

TFT LCD MODULE

MODEL : KWH022A02-F02

【 】 Preliminary Specification

【 ♦ 】 Finally Specification

CUSTOMER'S APPROVAL	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWD	PD REVIEWD	PREPARED BY
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Http:// www.wandisplay.com

- This specification is subject to change withouth notice.Please contact FORMIKE or it's representative before designing your product based on this specification.

Issued Date: Feb-28-2008



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■ GENERAL INFORMATION

Item	Contents	Unit
LCD type	TFT TRANSMISSIVE	/
Viewing direction	12:00	O' Clock
Module size(W × H)	41.70 × 56.16	mm ²
Viewing area (W×H)	37.40 × 46.16	mm ²
Active area (W×H)	34.848 × 43.56	mm ²
Number of Dots	176 (RGB) × 220	/
Driver IC	LGDP4524	/
Colors	262K	/
Backlight Type	LED	/
Module Power consumption	220	mw
Interface Type	16-bit CPU bus, 8-bit Compatible	/
Input voltage	2.8/1.8	V

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Supply voltage range	IOV _{CC} /V _{CI} /V _{CC}	-0.3	4.2	V
Input voltage	V _{IN}	-0.3	4.2	V
Operating temperature	T _{OP}	-20	70	°C
Storage temperature	T _{ST}	-30	80	°C
Humidity	RH		90%(Max60°C)	RH

■ ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage for logic	V _{CC}	2.7	2.8	2.9	V
Supply voltage for analog	V _{CI}	2.7	2.8	2.9	V
Supply voltage for I/O	IOV _{CC}	2.7/1.7	2.8/1.8	2.9/1.9	V
Input Current	I _{DD}	-	5.0	10.0	mA
Input voltage 'H' level	V _{IH}	0.8IOV _{CC}	-	IOV _{CC}	V
Input voltage 'L' level	V _{IL}	-0.3	-	0.2 IOV _{CC}	V
Output voltage 'H' level	V _{OH}	0.8IOV _{CC}	-	-	V
Output voltage 'L' level	V _{OL}	-	-	0.2 IOV _{CC}	V



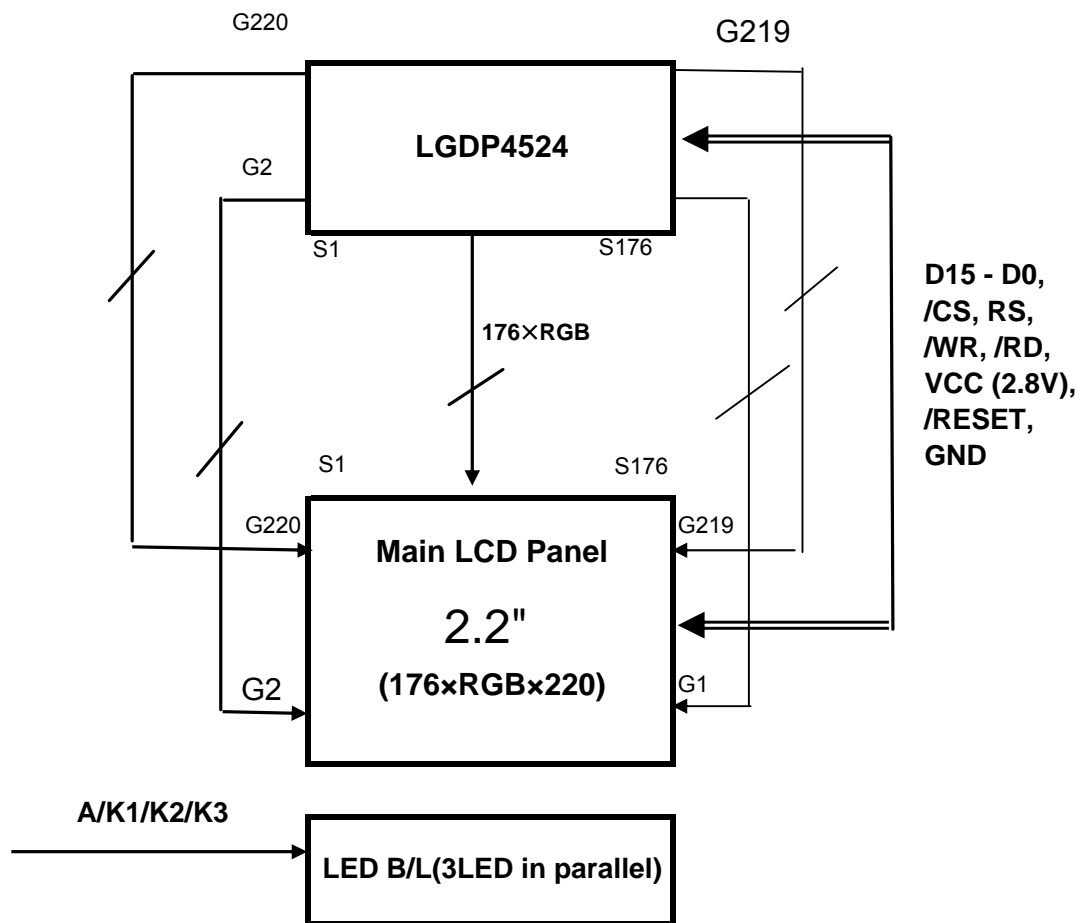
■ TIMING OF POWER SUPPLY

PLEASE REFER TO THE DRIVER IC SPECIFICATION.

■ BACKLIGHT CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage	Vf	3.1	3.2	3.3	V	If= 45 mA
Luminance	Lv	3000	3400	3800	cd/m ²	Ta=25 °C
Number of LED	-	3			Piece	-
Connection mode	P	parallel			-	-

Block Diagram





EXTERNAL DIMENSIONS

Customer No.:

LED CIRCUIT

PIN DISCUSSION	
NO.	NAME
1	GND
2	VDD
3	VDD
4	CS
5	RS
6	WR
7	RD
8	DB0
9	DB1
10	DB2
11	DB3
12	DB4
13	DB5
14	DB6
15	DB7
16	DB8
17	DB9
18	DB10
19	DB11
20	DB12
21	DB13
22	DB14
23	DB15
24	RESET
25	IMO
26	GND
27	YD
28	XL
29	YU
30	XR
31	LED_K3
32	LED_K2
33	LED_K1
34	LED_A

NOTES:

1. DISPLAY TYPE: Main LCD: 262K Color LCD, Transmissive,
2. OPERATING TEMP: -10°C~60°C
3. STORAGE TEMP: -20°C~70°C
4. MAIN LCD DRIVER: LGDP4524
5. BACKLIGHT: 3CHIP-WHITE LED, Parallel connection
6. Please ensure there is a distance of 0.4mm from TP V.A. outward on the place of contact TP side and customer cover side.

CUSTOMER APPROVE	AMEND	NO.	NAME	QTY	Part No.	REVISION
Mechanical						Formi e Electronic o. Ltd
Electrical						PRODUCT NO. H022A02-F02
						DRWN DSN
						CHKD KAM
						APPD STEPHEN
						UNIT mm
						SHEET

NO.	CONTENT	DATE

**■ELECTRO-OPTICAL CHARACTERISTICS**

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time	Tr+Tf	$\theta=0^\circ$ $\varnothing=0^\circ$ Ta=25°C	---	32	48	ms	FIG 1.	4
Contrast ratio	Cr		260	520	---	---	FIG 2.	1
Luminance uniformity	δ WHITE		80	88	---	%	FIG 2.	3
Surface Luminance	Lv		200	220	---	cd/m ²	FIG 2.	2
Viewing angle range	θ	$\varnothing = 90^\circ$	58	68	---	deg	FIG 3.	6
		$\varnothing = 270^\circ$	43	53	---	deg	FIG 3.	
		$\varnothing = 0^\circ$	59	69	---	deg	FIG 3.	
		$\varnothing = 180^\circ$	60	70	---	deg	FIG 3.	
CIE (x, y) chromaticity	Red	x	0.547	0.597	0.647	---	FIG 2.	5
		y	0.286	0.336	0.386			
	Green	x	0.303	0.353	0.403			
		y	0.507	0.557	0.607			
	Blue	x	0.096	0.146	0.196			
		y	0.056	0.106	0.156			
	White	x	0.239	0.299	0.359			
		y	0.249	0.309	0.369			

Note 1. Contrast Ratio(CR) is defined mathematically as For more information see FIG 2.

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P3, P4, P5)}}$$

Note 2. Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see FIG 2.

$$L_v = \text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}$$

Note 3. The uniformity in surface luminance , δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see FIG 2.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}$$

Note 4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 1. The test equipment is Autronic-Melchers's ConoScope. Series.

Note 5. CIE (x, y) chromaticity, The x, y value is determined by measuring luminance at each test position 1 through 5, and then make average value.

Note 6. Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 3.

Note 7. For Viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope. Series Instruments For contrast ratio, Surface Luminance, Luminance uniformity, CIE The test data is base on TOPCON's BM-5 photo detector.

FIG. 1 The definition of Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”.

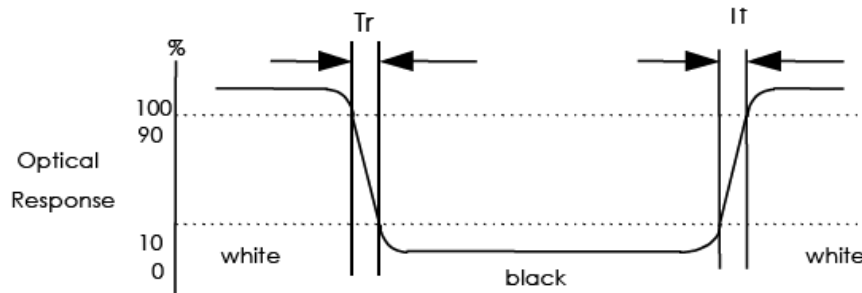


FIG. 2 Measuring method for Contrast ratio, surface luminance, Luminance uniformity , CIE (x, y) chromaticity

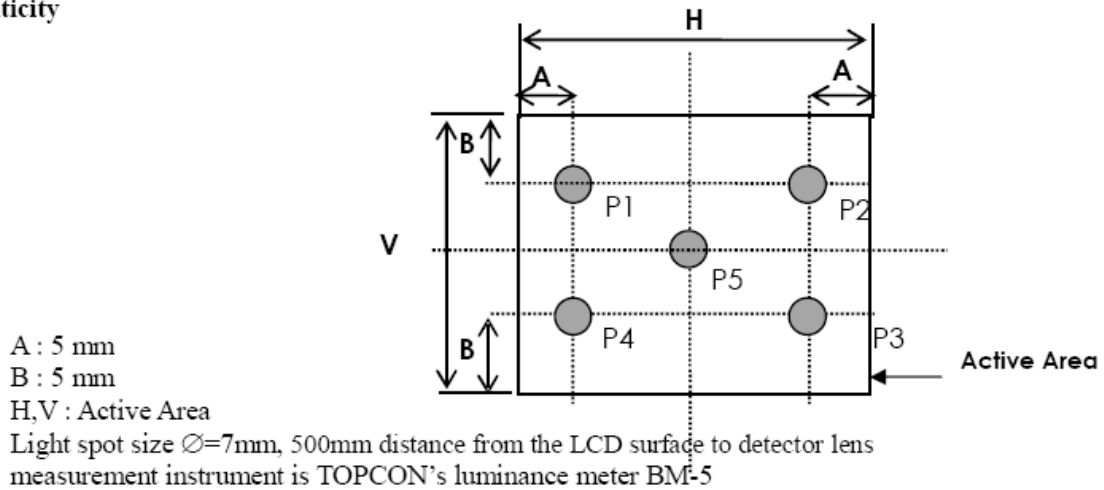
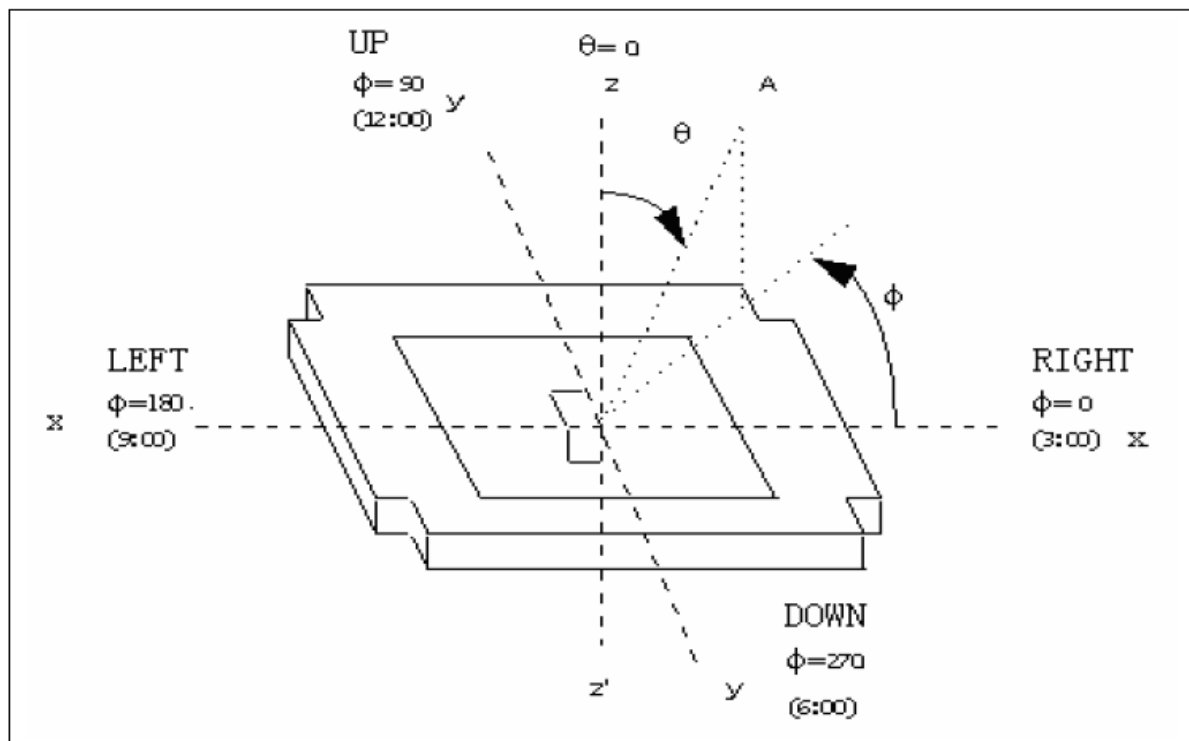


FIG. 3 The definition of viewing angle





■ INTERFACE DESCRIPTION

Pin	SYMBOL	I/O	Description	Comment
1	GND		Ground	
2	VDD		LCD Power Supply	
3	VDD		LCD Power Supply	
4	CS		Chip select input	
5	RS		Resister select input	
6	WR		Write control input	
7	RD		Read control input	
8	D0	I/O	Data Bus(LSB)	
9	D1	I/O	Data Bus	
10	D2	I/O	Data Bus	
11	D3	I/O	Data Bus	
12	D4	I/O	Data Bus	
13	D5	I/O	Data Bus	
14	D6	I/O	Data Bus	
15	D7	I/O	Data Bus	
16	D8	I/O	Data Bus	
17	D9	I/O	Data Bus	
18	D10	I/O	Data Bus	
19	D11	I/O	Data Bus	
20	D12	I/O	Data Bus	
21	D13	I/O	Data Bus	
22	D14	I/O	Data Bus	
23	D15	I/O	Data Bus	
24	RES		Reset signal input	
25	IM0		System Interface Mode Select	
26	GND		Ground-	
27	YD		TP	
28	XL		TP	
29	YU		TP	
30	XR		TP	
31	LED-K3		LED	
32	LED-K2		LED	
33	LED-K1		LED	
34	LED-A		LED	

■ APPLICATION CIRCUIT

Please consult our technical department for detail information.

■ INITIAL CODE

Please consult our technical department for detail information.



■ RELIABILITY TEST

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	80 ± 2°C/200 hours	Inspection after 2~4 hours storage at room temperature, the sample shall be free from defects: 1. Airbubble 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	-30 ± 2°C/200 hours	
3	High Temperature Operating	70 ± 2°C/120 hours	
4	Low Temperature Operating	-20 ± 2°C/120 hours	
5	Temperature Cycle	-20 ± 2°C ~ 25 ~ 70 ± 2°C × 10 cycles (30min.) (5min.) (30min.)	
6	Damp Proof Test	50°C ± 5°C × 90%RH/120 hours	
7	Vibration Test	Frequency: 10Hz~55Hz~10Hz Amplitude: 1.5mm, X, Y, Z direction for total 3hours (Packing condition)	
8	Drooping test	Drop to the ground from 1m height, one time, every side of carton. (Packing condition)	
9	ESD test	Voltage: ± 8KV R: 330 Ω C: 150pF Air discharge, 10time	

Remark:

- The test samples should be applied to only one test item.
- Sample size for each test item is 5~10pcs.
- For Damp Proof Test, Pure water (Resistance > 10MΩ) should be used.
- 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..
- EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
- Please use automatic switch menu (or roll menu) testing mode when test operating mode.



■ INSPECTION CRITERION

PAGE 1 OF 4

TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA

MDS Product(B)

This specification is made to be used as the standard acceptance/rejection criteria for Color mobile phone LCM.

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:

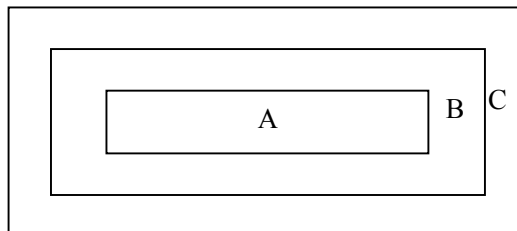
Major defect: AQL 0.65

Minor defect: AQL 1.5

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.

3. Definition of inspection zone in LCD.



Zone A: character/Digit area

Zone B: viewing area except Zone A (ZoneA+ZoneB=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.



TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA

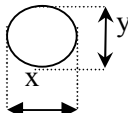
MDS Product

4. Inspection standards

4.1 Major Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
4.1.1	All functional defects	1) No display 2) Display abnormally 3) Missing vertical, horizontal segment 4) Short circuit 5) Back-light no lighting, flickering and abnormal lighting.	Major
4.1.2	Missing	Missing component	
4.1.3	Outline dimension	Overall outline dimension beyond the drawing is not allowed.	

4.2 Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects																											
4.2.1	Clear Spots	For dark/white spot, size Φ is defined as $\Phi = \frac{(x+y)}{2}$ 	Minor																											
	Black and white Spot defect Pinhole, Foreign Particle, Dirt under polarizer	1. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Size(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.10$</td> <td colspan="3">Ignore</td> </tr> <tr> <td>$0.10 < \Phi \leq 0.15$</td> <td colspan="3">2</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.20$</td> <td colspan="3">1</td> </tr> <tr> <td>$\Phi > 0.20$</td> <td colspan="3">0</td> </tr> </tbody> </table>		Size(mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.10$	Ignore			$0.10 < \Phi \leq 0.15$	2			$0.15 < \Phi \leq 0.20$	1			$\Phi > 0.20$	0						
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$\Phi > 0.20$	0																													
	Dim Spots Circle shaped and dim edged defects	2. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">2. Zone Size(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.2$</td> <td colspan="3">Ignore</td> </tr> <tr> <td>$0.20 < \Phi \leq 0.40$</td> <td colspan="3">3</td> </tr> <tr> <td>$0.40 < \Phi \leq 0.60$</td> <td colspan="3">2</td> </tr> <tr> <td>$0.60 < \Phi \leq 0.80$</td> <td colspan="3">1</td> </tr> <tr> <td>$0.80 < \Phi$</td> <td colspan="3">0</td> </tr> </tbody> </table>	2. Zone Size(mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore			$0.20 < \Phi \leq 0.40$	3			$0.40 < \Phi \leq 0.60$	2			$0.60 < \Phi \leq 0.80$	1			$0.80 < \Phi$	0			Minor
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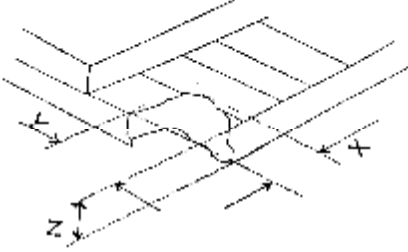
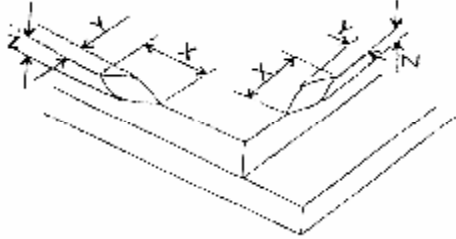
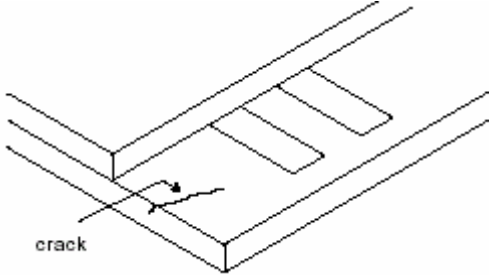
TITLE: FUNCTIONAL TEST & INSPECTION CRITERIA

MDS Product

4.2. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects																																	
4.2.2	Line defect Black line, White line, Foreign material under polarizer,	<table border="1"> <thead> <tr> <th colspan="2">Size(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th rowspan="2">L(Length)</th> <th rowspan="2">W(Width)</th> <th colspan="3">Zone</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>Ignore</td> <td>$W \leq 0.02$</td> <td colspan="3">Ignore</td> </tr> <tr> <td>$L \leq 3.0$</td> <td>$0.02 < W \leq 0.03$</td> <td colspan="3">2</td> </tr> <tr> <td>$L \leq 2.0$</td> <td>$0.03 < W \leq 0.05$</td> <td colspan="3">1</td> </tr> <tr> <td></td> <td>$0.05 < W$</td> <td colspan="3">Define as spot defect</td> </tr> </tbody> </table>	Size(mm)		Acceptable Qty			L(Length)	W(Width)	Zone			A	B	C	Ignore	$W \leq 0.02$	Ignore			$L \leq 3.0$	$0.02 < W \leq 0.03$	2			$L \leq 2.0$	$0.03 < W \leq 0.05$	1				$0.05 < W$	Define as spot defect			Minor
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$L \leq 2.0$	$0.03 < W \leq 0.05$	1																																		
	$0.05 < W$	Define as spot defect																																		
4.2.3	Polarizer scratch	<p>If the Polarizer scratch can be seen after mobile phone cover assembling or in the operating condition, judge by the line defect of 4.2.2.</p> <p>If the Polarizer scratch can be seen only in non-operating condition or some special angle, judge by the following.</p> <table border="1"> <thead> <tr> <th colspan="2">Size(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th rowspan="2">L(Length)</th> <th rowspan="2">W(Width)</th> <th colspan="3">Zone</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>Ignore</td> <td>$W \leq 0.03$</td> <td colspan="3">Ignore</td> </tr> <tr> <td>$5.0 < L \leq 10.0$</td> <td>$0.03 < W \leq 0.05$</td> <td colspan="3">2</td> </tr> <tr> <td>$L \leq 5.0$</td> <td>$0.05 < W \leq 0.08$</td> <td colspan="3">1</td> </tr> <tr> <td></td> <td>$0.08 < W$</td> <td colspan="3">0</td> </tr> </tbody> </table>	Size(mm)		Acceptable Qty			L(Length)	W(Width)	Zone			A	B	C	Ignore	$W \leq 0.03$	Ignore			$5.0 < L \leq 10.0$	$0.03 < W \leq 0.05$	2			$L \leq 5.0$	$0.05 < W \leq 0.08$	1				$0.08 < W$	0			Minor
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	$0.08 < W$	0																																		
4.2.4	Polarize Air bubble	<p>Air bubbles between glass & polarizer</p> <table border="1"> <thead> <tr> <th rowspan="2">Size(mm) 2. Zone</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.2$</td> <td colspan="3">Ignore</td> </tr> <tr> <td>$0.20 < \Phi \leq 0.30$</td> <td colspan="3">2</td> </tr> <tr> <td>$0.30 < \Phi \leq 0.50$</td> <td colspan="3">1</td> </tr> <tr> <td>$0.50 < \Phi$</td> <td colspan="3">0</td> </tr> </tbody> </table>	Size(mm) 2. Zone	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore			$0.20 < \Phi \leq 0.30$	2			$0.30 < \Phi \leq 0.50$	1			$0.50 < \Phi$	0			Minor										
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4.3. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects						
4.3.5	Glass defect	<p>(i) Chips on corner</p>  <table border="1" data-bbox="475 801 1109 900"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td>≤2.0</td> <td>≤S</td> <td>Disregard</td> </tr> </table> <p>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.</p>	X	Y	Z	≤2.0	≤S	Disregard	Minor
		X	Y	Z					
		≤2.0	≤S	Disregard					
<p>(ii) Usual surface cracks</p>  <table border="1" data-bbox="454 1339 1129 1438"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td>≤3.0</td> <td><Inner border line of the seal</td> <td>Disregard</td> </tr> </table>	X	Y	Z	≤3.0	<Inner border line of the seal	Disregard	Minor		
X	Y	Z							
≤3.0	<Inner border line of the seal	Disregard							
<p>(iii) Crack Cracks tend to break are not allowed.</p> 	Major								
4.3.6	Parts alignment	<p>1) Not allow IC and FPC/heat-seal lead width is more than 50% beyond lead pattern. 2) Not allow chip or solder component is off center more than 50% of the pad outline.</p>	Minor						
4.3.7	SMT	According to the <Acceptability of electronic assemblies> IPC-A-610C class 2 standard. Component missing or function defect are Major defect, the others are Minor defect.							



■ **PACKING SPECIFICATION**

TBD