WINSTAR Display Co.,Ltd.

Industrial Display Manufacturer

Date: May 15, 2017

Quality Assurance System

Issued By : Quality Assurance Department		
Approved By :	Checked By :	Prepared By :

Revises record

Version	Revise Date	Revise Note	Reviser
03	2013/12/25	Copy fitting	Benjamin
04	2017/01/02	Modify the format 3. Inspection specification: add the TFT and OLED module product. 4. Reliability test condition: add the TFT and OLED module product. 5. Revised the RMA process. 7. Precaution with use for module: add the OLED module product.	Kelly tsai

Contents

I. Quality Assurance System

1. WINSTAR ISO 9001-2015 Quality Policy：

1-1 Quality Priority
1-2 Service Excellence
1-3 Timely Delivery
1-4 Technology Innovation
1-5 R & D orientation

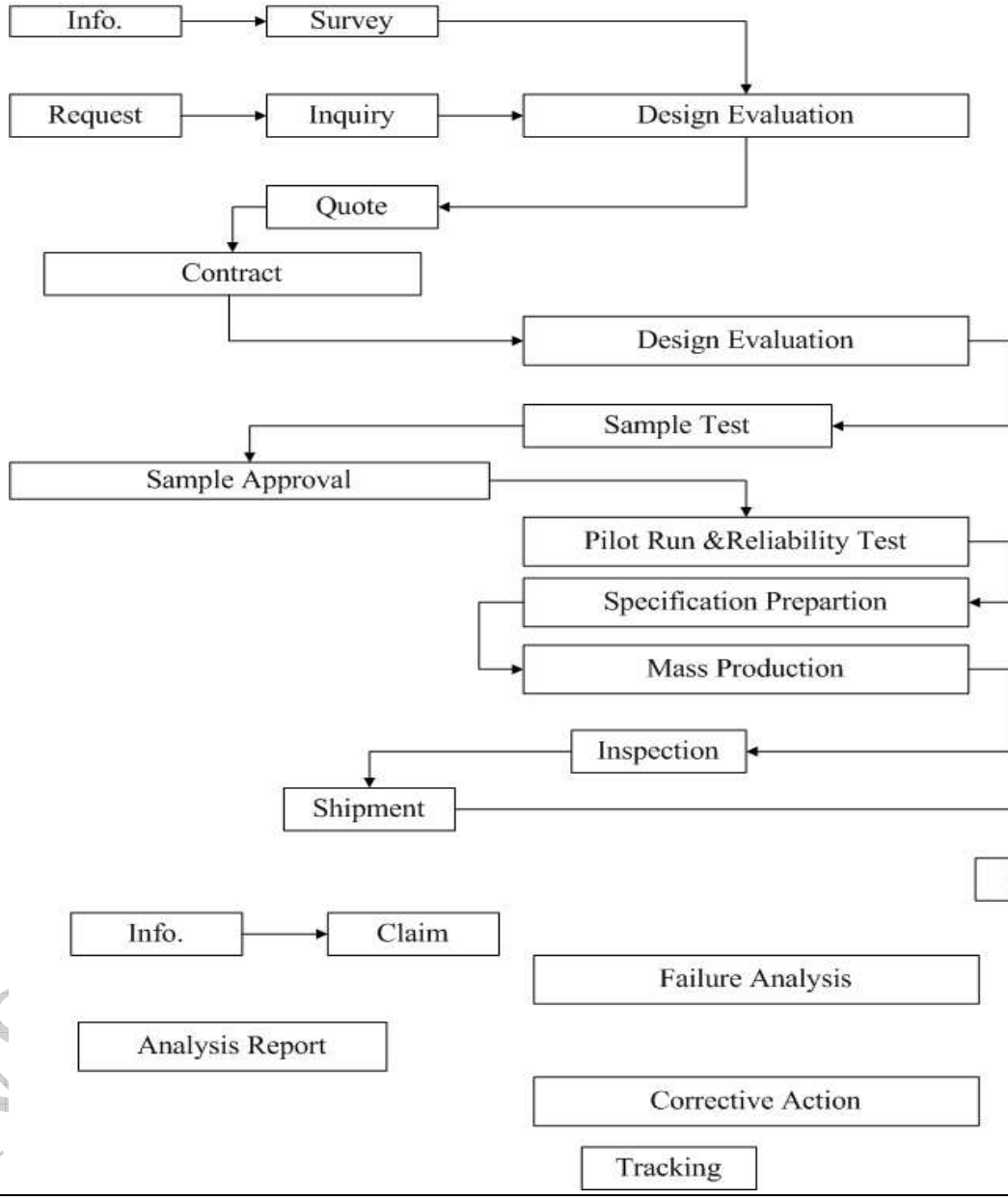
2. WINSTAR ISO 9001-2015 Quality Promise：

2-1 Quality Priority
We strive for the high-quality products and aim for the perfection.
2-2 Service Excellence
One of our missions is to provide our customers the satisfactory service.
2-3 Timely Delivery
Our on-time delivery wins glowing reputations.

3. WINSTAR ISO 9001-2015 Quality Object：

3-1 Decrease the finish good defective rate.
3-2 Decrease the customer complaint.
3-3 Decrease the in process defective rate.
3-3-1 Decrease the solder defective rate.
3-3-2 Decrease the S.M.T defective rate.
3-3-3 Decrease the wire bonding defective rate.
3-3-4 Decrease the assembly defective rate.

II. Quality Assurance Flow Chart

Item	Customer	Sales	R&D	QA	Manufacturing	Product Control	Inventory Control
Marketing & Design							
Sample Approval							
Pilot Run & Mass Product							
Ship Out							
Sales service							
QA Activity	1. ISO 9001-2015 Maintenance Activities 2.Process Improvement Proposal 3. Education-And Training Activities 4.Standardization Management						

III. Inspection Specification

1. Inspection specification of panel module for common item (include LCD and OLED)

1-1 Inspection Standard：MIL-STD-105E Table Normal Inspection Single Sampling Level Ⅱ。

1-2 Equipment：Gauge、MIL-STD、WINSTAR Tester、Sample。

1-3 IQC Defect Level：Major Defect AQL 0.65; Minor Defect AQL 2.5。

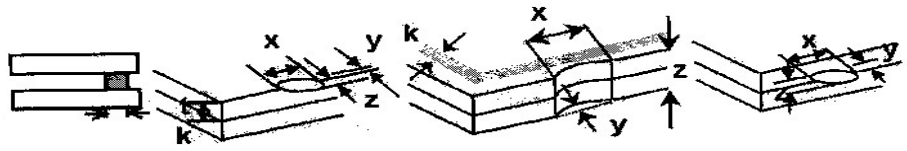
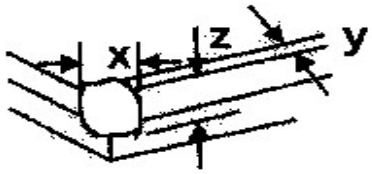
1-4 FQC Defect Level：100% Inspection。

1-5 OUT Going Defect Level：Sampling。

1-6 Inspection Distance: 20cm~30cm。The test direction is base on about around 45º of Vertical line, under 25±5°C。

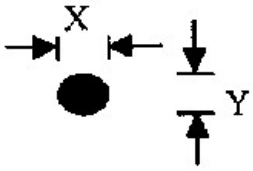
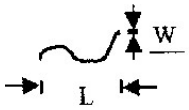
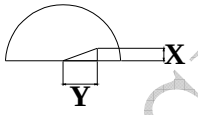
1-7 Specification as below：

<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 OLED viewing angle defect.
1.7 Mixed product types.
1.8 Contrast defect.</td><td>0.65</td></tr>
<tr><td>02</td><td>Black or white spots on panel (display only)</td><td>2.1 White and black spots on display ≦0.25mm, no more than three white or black spots present.
2.2 Densely spaced: No more than two spots or lines within 3mm</td><td>2.5</td></tr>
<tr><td>03</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</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>04</td><td>Chipped glass</td><td>Symbols Define:
x: Chip length y: Chip width z: Chip thickness
k: Seal width t: Glass thickness a: LCD side length
L: Electrode pad length:
4.1 General glass chip :
4.1.1 Chip on panel surface and crack between panels:</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>Chipped glass</td><td>

<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>
⊙If there are 2 or more chips, x is total length of each chip.
4.1.2 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>
⊙If there are 2 or more chips, x is the total length of each chip.
</td><td>2.5</td></tr>
<tr><td>05</td><td>Cracked glass</td><td>The panel with extensive crack is not acceptable.</td><td>2.5</td></tr>
<tr><td>06</td><td>Bezel</td><td>6.1 Bezel may not have rust, be deformed or have fingerprints, stains or other contamination.
6.2 Bezel must comply with job specifications.</td><td>2.5
0.65</td></tr>
<tr><td>07</td><td>PCB、COB</td><td>7.1 COB seal may not have pinholes larger than 0.2mm or contamination.
7.2 COB seal surface may not have pinholes through to the IC.
7.3 The height of the COB should not exceed the height indicated in the assembly diagram.
7.4 There may not be more than 2mm of sealant outside the seal area on the PCB. And there should be no more than three places.
7.5 No oxidation or contamination PCB terminals.
7.6 Parts on PCB must be the same as on the production characteristic chart. There should be no wrong parts, missing parts or excess parts.
7.7 The jumper on the PCB should conform to the product characteristic chart.</td><td>2.5
2.5
0.65
2.5
2.5
0.65</td></tr>
</table>

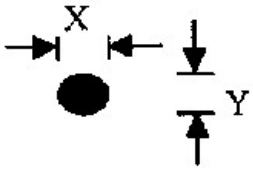
NO.	Item	Criterion	AQL
07	PCB、COB	7.8 If solder gets on bezel tab pads, LED pad, zebra pad or screw hold pad, make sure it is smoothed down.	0.65
08	Soldering	8.1 No un-melted solder paste may be present on the PCB. 8.2 No cold solder joints, missing solder connections, oxidation or icicle. 8.3 No residue or solder balls on PCB. 8.4 No short circuits in components on PCB.	2.5 2.5 2.5 0.65
09	General appearance	9.1 No oxidation, contamination, curves or, bends on interface Pin (OLB) of TCP. 9.2 No cracks on interface pin (OLB) of TCP. 9.3 No contamination, solder residue or solder balls on product. 9.4 The IC on the TCP may not be damaged, circuits. 9.5 The uppermost edge of the protective strip on the interface pin must be present or look as if it cause the interface pin to sever. 9.6 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color. 9.7 Sealant on top of the ITO circuit has not hardened. 9.8 Pin type must match type in specification sheet. 9.9 LCD pin loose or missing pins. 9.10 Product packaging must the same as specified on packaging specification sheet. 9.11 Product dimension and structure must conform to product specification sheet.	2.5 0.65 2.5 2.5 2.5 2.5 2.5 0.65 0.65 0.65 0.65

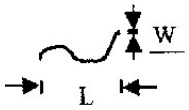
2. Inspection specification of LCD module (special item)

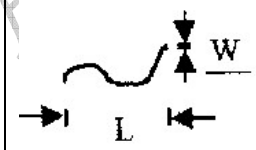
<table>
<tr><th>NO.</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td rowspan="2">01</td><td rowspan="2">Panel black spots, white spots, contamination (non-display)</td><td>3.1 Round type : As following drawing
Φ=(x + y) / 2
 
<table>
<tr><td>SIZE</td><td>Acceptable Q TY</td></tr>
<tr><td>Φ≦0.10</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>1</td></tr>
<tr><td>0.25＜Φ</td><td>0</td></tr>
</table></td><td>2.5</td></tr>
<tr><td>3.2 Line type : (As following drawing)
 
<table>
<tr><td>Length</td><td>Width</td><td>Acceptable Q TY</td></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≦0.03</td><td rowspan="2">2</td></tr>
<tr><td>L≦2.5</td><td>0.03＜W≦0.05</td></tr>
<tr><td>---</td><td>0.05＜W</td><td>As round type</td></tr>
</table></td><td>2.5</td></tr>
<tr><td>02</td><td>PCB、COB</td><td>1.1 The Scraping testing standard for Copper Coating of PCB
 

X * Y<=2mm2</td><td>2.5</td></tr>
<tr><td>03</td><td>Backlight elements</td><td>8.1 Illumination source flickers when lit.
8.2 Spots or scratched that appear when lit must be judged. Using panel spot, lines and contamination standards.
8.3 Backlight doesn’t light or color wrong.</td><td>0.65
2.5
0.65</td></tr>
<tr><td>04</td><td>Scratches</td><td>Follow NO.3 panel black spots, white spots, contamination</td><td></td></tr>
<tr><td>05</td><td>General appearance</td><td>2.1 Visual defect outside of VA is not considered to be rejection.</td><td>0.65</td></tr>
</table>

3. Inspection specification of OLED module (special item)

<table>
<tr><th>NO.</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td rowspan="2">01</td><td rowspan="2">Panel black spots, white spots, contamination (non-display)</td><td>3.1 Round type : As following drawing
Φ=(x + y) / 2
 

<table>
<tr><td>SIZE</td><td>Acceptable Q TY</td></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>1</td></tr>
<tr><td>0.25＜Φ</td><td>0</td></tr>
</table></td><td>2.5</td></tr>
<tr><td>3.2 Line type : (As following drawing)
 

<table>
<tr><td>Length</td><td>Width</td><td>Acceptable Q TY</td></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≦0.03</td><td rowspan="2">2</td></tr>
<tr><td>L≦2.5</td><td>0.03＜W≦0.05</td></tr>
<tr><td>---</td><td>0.05＜W</td><td>As round type</td></tr>
</table></td><td>2.5</td></tr>
<tr><td colspan="4">Remarks: The total of round defect and line defect shall not exceed 5 pcs. The distance between two lines defects must exceed 1 mm</td></tr>
<tr><td>02</td><td>Polarizer Stain</td><td>Stain which can be wiped off lightly with a soft cloth or similar cleaning is accepted, otherwise, according to the round type defect and the line type defect.</td><td>2.5</td></tr>
<tr><td>03</td><td>Polarizer Scratch</td><td>3.1 If scratch can be seen during operation, according to the criterions of the round type defect and the line type defect.
3.2 If scratch can be seen only under non-operation or some special angle, the criterion is as below :
 

<table>
<tr><td>Length</td><td>Width</td><td>Acceptable Q TY</td></tr>
<tr><td>---</td><td>W≦0.02</td><td>Ignored</td></tr>
<tr><td>3.0＜L≦5.0</td><td>0.02＜W≦0.04</td><td>2</td></tr>
<tr><td>L≦3.0</td><td>0.04＜W≦0.06</td><td>1</td></tr>
<tr><td>---</td><td>0.06＜W</td><td>0</td></tr>
</table></td><td>2.5</td></tr>
</table>

4. Inspection specification of TFT-LCD module

4-1 Inspection Standard：MIL-STD-105E Table Normal Inspection Single Sampling Level Ⅱ。

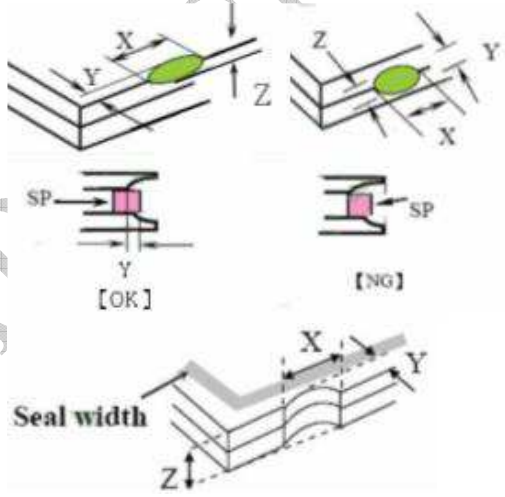
4-2 Equipment：Gauge、MIL-STD、WINSTAR Tester、Sample。

4-3 IQC Defect Level：Major Defect AQL 0.65; Minor Defect AQL 2.5。

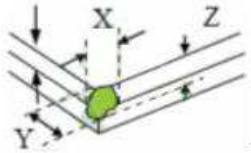
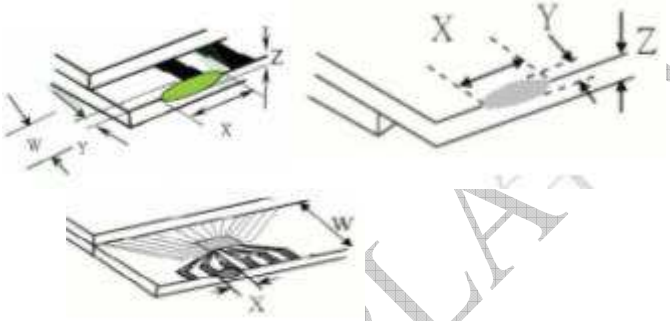
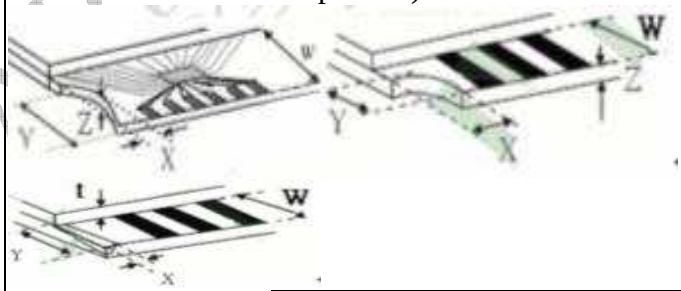
4-4 FQC Defect Level：100% Inspection。

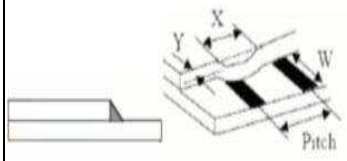
4-5 Inspection Distance: 20cm~30cm。The test direction is base on about around 45º of Vertical line。

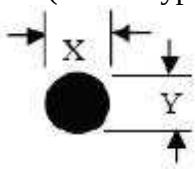
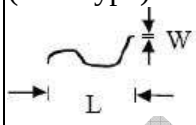
4-6 Specification as below：

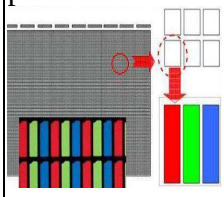
<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>01</td><td>Packing and indicate</td><td>1.1 Mixde product types.
1.2 The part number is inconsistent with work order of production.
1.3 Assembled in inverse direction.
1.4 The quantity is inconsistent with work order of production.</td><td>0.65</td></tr>
<tr><td>02</td><td>Size</td><td>Product size and structure must meet the structure diagram.</td><td>0.65</td></tr>
<tr><td rowspan="2">03</td><td rowspan="2">The crack of glass</td><td>Symbols:
X: Symbols Y: The width of crack Z: The thickness of crack
W: Terminal length T: The thickness of glass a: LCD side length.</td><td rowspan="2">2.5</td></tr>
<tr><td>3.1 General glass chip:
3.1.1 Chip on panel surface and crack between panels.
 

<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤a</td><td>Crack can't enter viewing area</td><td>≤1/2t</td></tr>
<tr><td>≤a</td><td>Crack can't exceed the half of SP width</td><td>1/2t＜Z≤2t</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td rowspan="2">03</td><td rowspan="2">The crack of glass</td><td>3.1.2 Corner crack：
 
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤1/5a</td><td>Crack can't enter viewing area</td><td>≤1/2t</td></tr>
<tr><td>≤1/5a</td><td>Crack can't exceed the half of SP width</td><td>1/2t＜Z≤2t</td></tr>
</table>
3.2 Protrusion over terminal:
3.2.1 Chip on electrode pad:
 
<table>
<tr><th>Position</th><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>Front</td><td>≤a</td><td>≤1/2W</td><td>≤t</td></tr>
<tr><td>Back</td><td>≤a</td><td>≤W</td><td>≤1/2t</td></tr>
</table>
3.2.2. Non-conductive portion):
 
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤1/3a</td><td>≤W</td><td>≤t</td></tr>
</table>
Note：
If the chipped area touches the ITO terminal,over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications).</td><td>2.5</td></tr>
<tr><td>No.</td><td>Item</td><td>Criterion</td><td>AQL</td></tr>
</table>

<table>
<tr>
<td>03</td>
<td>The crack of glass</td>
<td>3.2.3.Glass remain：
 

<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>≤a</td><td>≤1/3W</td><td>≤t</td></tr>
</table>
</td>
<td>2.5</td>
</tr>
<tr>
<td>04</td>
<td>Black or white dot (Round type)
 
</td>
<td>4.1 Round type(Non-display or display):
<table>
<tr><th>Size</th><th>Judging standard</th><th>Acceptance(Q'ty))</th></tr>
<tr><td rowspan="3">1.44”~4.9”</td><td>D ≤0.1 mm</td><td>Ignore</td></tr>
<tr><td>0.10mm < D ≤ 0.4mm</td><td>N≦3</td></tr>
<tr><td>D > 0.4mm</td><td>N≦0</td></tr>
<tr><td rowspan="3">5.0”~7.0”</td><td>D ≤0.25mm</td><td>Ignore</td></tr>
<tr><td>0.25mm < D ≤ 0.5mm</td><td>N≦4</td></tr>
<tr><td>D > 0.5mm</td><td>N≦0</td></tr>
<tr><td rowspan="3">7.1”~12.0”</td><td>D ≤0.3 mm</td><td>Ignore</td></tr>
<tr><td>0.30mm < D ≤ 0.5mm</td><td>N≦5</td></tr>
<tr><td>D > 0.5mm</td><td>N≦0</td></tr>
</table>
</td>
<td>2.5</td>
</tr>
<tr>
<td>05</td>
<td>Scratch、Contamination (Line type)
 
</td>
<td>5.1 Line type(Non-display or display):
<table>
<tr><th rowspan="2">Size</th><th colspan="2">Judging standard</th><th rowspan="2">Acceptance(Q'ty))</th></tr>
<tr><th>W</th><th>L</th></tr>
<tr><td rowspan="3">1.44”~7.0”</td><td>W≦ 0.01mm</td><td>—</td><td>Ignore</td></tr>
<tr><td>0.01mm＜
W≦0.5mm</td><td>L ≦ 5mm</td><td>N≦4</td></tr>
<tr><td>W ＞ 0.05mm</td><td>L ＞ 5mm</td><td>N≦0</td></tr>
<tr><td rowspan="3">7.1”~12.0”</td><td>W≦ 0.07mm</td><td>—</td><td>Ignore</td></tr>
<tr><td>0.07mm＜
W≦0.1mm</td><td>L ≦ 5mm</td><td>N≦5</td></tr>
<tr><td>W ＞ 0.1mm</td><td>L ＞ 5mm</td><td>N≦0</td></tr>
</table>
</td>
<td>2.5</td>
</tr>
<tr>
<td>06</td>
<td>Polarizer Bubble</td>
<td>
<table>
<tr><th>Area</th><th>Judging standard</th><th>Acceptance(Q'ty)</th></tr>
<tr><td rowspan="4">A area (Viewing area)</td><td>D < 0.2 mm</td><td>Ignore</td></tr>
<tr><td>0.2mm＜D≦0.3mm</td><td>N≦3</td></tr>
<tr><td>0.3mm＜D≦0.5mm</td><td>N≦1</td></tr>
<tr><td>0.5mm＜D</td><td>N≦0</td></tr>
<tr><td>B area (Outside of viewing area)</td><td>–</td><td>Ignore</td></tr>
</table>
</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>The folding and peeled off in polarizer</td><td>The folding and peeled off in polarizer are not acceptable.</td><td>2.5</td></tr>
<tr><td>08</td><td>Brightness and uniformity、chroma</td><td>Shall be in accordance with the drawings and specification requirements specifications.</td><td>0.65</td></tr>
<tr><td>09</td><td>Electrical Testing</td><td>9.1 Missing line character and icon.
9.2 No function or no display.
9.3 Display malfunction.
9.4 LCD viewing angle defect.
9.5 Current consumption exceeds product specifications.</td><td>0.65</td></tr>
<tr><td>10</td><td>Bright dot、Dark dot On-display Pixel：3 dot in 1 pixel
  </td><td>
<table>
<tr><th>Size</th><th colspan="2">Item</th><th>Judging standard</th></tr>
<tr><td rowspan="5">1.44”~4.9”</td><td rowspan="2">Bright dot</td><td>D≦1/2 Pixel</td><td>Ignore</td></tr>
<tr><td>1/2 Pixel＜D≦1 Pixel</td><td>N≦1</td></tr>
<tr><td rowspan="2">Dark dot</td><td>D≦1/2 Pixel</td><td>Ignore</td></tr>
<tr><td>1/2 Pixel＜D≦1 Pixel</td><td>N≦2</td></tr>
<tr><td colspan="2">Total</td><td>N≦2</td></tr>
<tr><td rowspan="5">5.0”~7.0”</td><td rowspan="2">Bright dot</td><td>D≦1/2 Pixel</td><td>Ignore</td></tr>
<tr><td>1/2 Pixel＜D≦1 Pixel</td><td>N≦2</td></tr>
<tr><td rowspan="2">Dark dot</td><td>D≦1/2 Pixel</td><td>Ignore</td></tr>
<tr><td>1/2 Pixel＜D≦1 Pixel</td><td>N≦3</td></tr>
<tr><td colspan="2">Total</td><td>N≦4</td></tr>
<tr><td rowspan="5">7.1”~12.0”</td><td rowspan="2">Bright dot</td><td>D≦1/2 Pixel</td><td>Ignore</td></tr>
<tr><td>1/2 Pixel＜D≦1 Pixel</td><td>N≦3</td></tr>
<tr><td rowspan="2">Dark dot</td><td>D≦1/2 Pixel</td><td>Ignore</td></tr>
<tr><td>1/2 Pixel＜D≦1 Pixel</td><td>N≦4</td></tr>
<tr><td colspan="2">Total</td><td>N≦6</td></tr>
</table>
</td><td>2.5</td></tr>
</table>

IV. Reliability Test Condition

1. Reliability test condition of LCD module

Content of Reliability test for Normal temperature of standard module (0℃~50℃).

Above detail data or other refer to the SPEC.

Environmental Test			
Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	60℃ 200hrs	2
Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-10℃ 200hrs	2,4
High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	40℃,90%RH 96hrs	-
Temperature Cycle	Endurance test applying the low and high temperature cycle. 0℃ 25℃ 50℃ 30min 5min 30min 1 cycle	0℃/50℃ 10 cycles	-
Mechanical Test			
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude :1.5mm Vibration Frequency :10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	5
Others			
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=800V,RS=1.5kΩ CS=100pF 1 time	—

Note1: Supply voltage for logic system=5V. Supply voltage for LCD system =Operating voltage at 25℃

Note2: All High /Low Temperature storage or High Temperature/Humidity Storage the LCM after tested then must storage at normal condition 4hrs.

Note 3: Conducted in accordance with the conditions of the product specification book

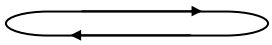
Note 4: No dew condensation to be observed.

Note 5: The packing have to including into the vibration testing.

2. Reliability test condition of TFT-LCD module

Content of Reliability test (Wide temperature, -20℃~70℃) .

Above detail data or other refer to the SPEC.

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80℃ 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30℃ 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70℃ 200hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20℃ 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60℃,90%RH max	60℃,90%RH 96hrs	1,2
Thermal cycle resistance	The sample should be allowed stand the following 10 cycles of operation -20℃ 25℃ 70℃  30min 5min 30min 1 cycle	-20℃/70℃ 10 cycles	—
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±600V(contact), ±800v(air), RS=330Ω CS=150pF 10 times	—

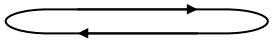
Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

3. Reliability test condition of OLED module

3-1 Content of Reliability Test

Environmental Test			
Test Item	Content of Test	Test Condition	Applicable Standard
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80℃ 240hrs	—
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-40℃ 240hrs	—
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	80℃ 240hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-40℃ 240hrs	—
High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	60℃,90%RH 240hrs	—
Temperature Cycle	Endurance test applying the low and high temperature cycle. -40℃ 25℃ 80℃  30min 5min 30min 1 cycle	-40℃/80℃ 30 cycles	—
Mechanical Test			
Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hr	—
Others			
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±600V(contact), ±800v(air), RS=330Ω CS=150pF 10 times	—

*** Supply voltage for OLED system =Operating voltage at 25℃

3-2 Test and measurement conditions

3-2-1. All measurements shall not be started until the specimens attain to temperature stability. After the completion of the described reliability test, the samples were left at room temperature for 2 hrs prior to conducting the failure test at 23±5°C; 55±15% RH.

3-2-2 All-pixels-on is used as operation test pattern.

3-2-3 The degradation of Polarizer are ignored for High Temperature storage, High Temperature/ Humidity Storage, Temperature Cycle

3-3 Evaluation criteria

3-3-1. The function test is OK.

3-3-2. No observable defects.

3-3-3. Luminance: > 50% of initial value.

3-3-4. Current consumption: within ± 50% of initial value.

3-4 APPENDIX:

RESIDUE IMAGE: Because the pixels are lighted in different time, the luminance of active pixels may reduce or differ from inactive pixels. Therefore, the residue image will occur. To avoid the residue image, every pixel needs to be lighted up uniformly.

V. RMA System

RMA system

Department	Customer	Sales	QA	RMA
Process	Apply RMA NO Product	Sheet Shipment	Analysis Out-going test	Rework

VI. Warning for the returned products

For a speedy analysis to the returned products, please provide us the information as follows)

1. What was the application for the products ?
2. What was the ambience while the products were used ?
3. Please give details or notes for each defective product.
4. Please describe the input conditions to the products [including Backlight] such as Vdd=DC 5.0V or EL backlight=AC=110V/ 400Hz…etc.)
5. How was the Vop controlled or adjusted ? [Ex：drawing of the connected circuit.])

VII. Precautions with use for module

1. Precautions with use for LCD module

1-1 Warning For Static Electricity: The followed actions must be done before opening or fixing or soldering the LCM：

□ To wear an anti-static wrist-strap.

□ To wear the anti-static clothes.

□ The anti-static floor can be applied, especially in a dry and low temperature [low humidity] environment.

□ To use a container with anti-static material.

1-2 Turn off the power switch before installing, detaching or soldering the LCM.

1-3 To avoid the EMI problem, please properly connect the LCM to the equipment with EMC protection.

1-4 The contrast has to be adjusted to a proper situation with VR if the LCM is run at a higher range of temperature.

1-5 It is better to have a heater built-in on the LCM to improve the display speed at a lower temperature.

1-6 To avoid scratching the LCD, please do not remove the protective film before installing the LCM.

1-7 Please keep a cleanly working area to protect LCM from dirty particles.

1-8 Please do not open the LCM if it has failed, that may affect the processing of analysis.

1-9 Sensitive to ultraviolet，avoid used or exposed under sunlight unless it’s applicable to ultraviolet.

1-10 If you need to increase PIN or flexible flat cable when operation, please take care the welding effect, such as short-circuit or bad welding.

2. Precaution with use for OLED module

2-1 Module

2-1-1 Avoid applying excessive shocks to module or making any alterations or modifications to it.

2-1-2 Don't make extra holes on the printed circuit board, modify its shape or change the components of OLED display module.

2-1-3 Don't disassemble the OLED display module.

2-1-4 Don't operate it above the absolute maximum rating.

2-1-5 Don't drop, bend or twist OLED display module.

2-1-6 Soldering: only to the I/O terminals.

2-1-7 Storage: please storage in anti-static electricity container and clean environment.

2-1-8 It's pretty common to use "Screen Saver" to extend the lifetime and Don't use fix information for long time in real application.

2-1-9 Don't use fixed information in OLED panel for long time, that will extend "screen burn" effect time.

2-1-10 Winstar has the right to change the passive components, including R2and R3 adjust resistors. (Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.)

2-1-11 Winstar have the right to change the PCB Rev. (In order to satisfy the supplying stability, management optimization and the best product performance...etc, under the premise of not affecting the electrical characteristics and external dimensions, Winstar have the right to modify the version.)

2-2 Handling Precautions

2-2-1 Since the display panel is being made of glass, do not apply mechanical impacts such us dropping from a high position.

2-2-2 If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.

2-2-3 If pressure is applied to the display surface or its neighborhood of the OLED display module, the cell structure may be damaged and be careful not to apply pressure to these sections.

2-2-4 The polarizer covering the surface of the OLED display module is soft and easily scratched. Please be careful when handling the OLED display module.

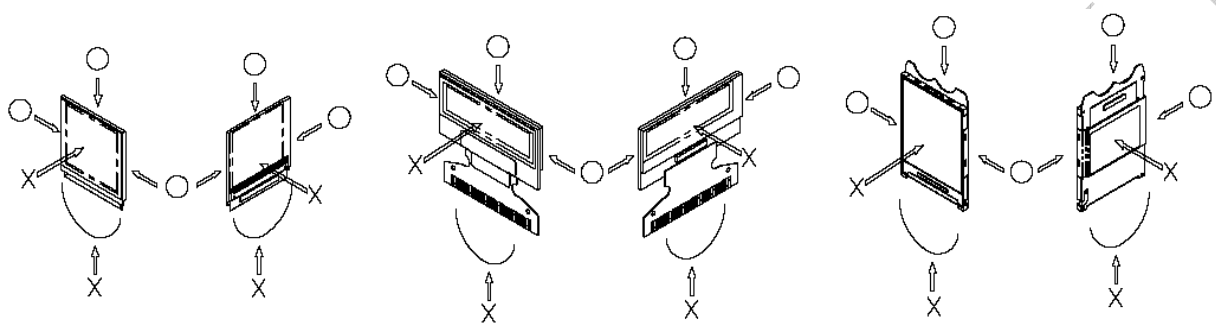
2-2-5 When the surface of the polarizer of the OLED display module has soil, clean the surface. It takes advantage of by using following adhesion tape.

* Scotch Mending Tape No. 810 or an equivalent

Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy. Also, pay attention that the following liquid and solvent may spoil the polarizer:

* Water
* Ketone
* Aromatic Solvents

2-2-6 Hold OLED display module very carefully when placing OLED display module into the System housing. Do not apply excessive stress or pressure to OLED display module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, secure sufficient rigidity for the outer cases.



2-2-7 Do not apply stress to the LSI chips and the surrounding molded sections.

2-2-8 Do not disassemble nor modify the OLED display module.

2-2-9 Do not apply input signals while the logic power is off.

2-2-10 Pay sufficient attention to the working environments when handing OLED display modules to prevent occurrence of element breakage accidents by static electricity.

* Be sure to make human body grounding when handling OLED display modules.
* Be sure to ground tools to use or assembly such as soldering irons.
* To suppress generation of static electricity, avoid carrying out assembly work under dry environments.
* Protective film is being applied to the surface of the display panel of the OLED display module. Be careful since static electricity may be generated when exfoliating the protective film.

2-2-11 Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. At this time, if the OLED display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after removed of the film. In such case, remove the residue material by the method introduced in the above Section 5.

2-2-12. If electric current is applied when the OLED display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above.

3-1Storage Precautions

3-1-1 When storing OLED display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps. and, also, avoiding high temperature and high humidity environment or low temperature (less than 0°C) environments.

(We recommend you to store these modules in the packaged state when they were shipped from Winstar.

At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.

3-1-2 If electric current is applied when water drops are adhering to the surface of the OLED display module, when the OLED display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

4-1 Designing Precautions

4-1-1 The absolute maximum ratings are the ratings which cannot be exceeded for OLED display module, and if these values are exceeded, panel damage may be happen.

4-1-2 To prevent occurrence of malfunctioning by noise, pay attention to satisfy the VIL and VIH specifications and, at the same time, to make the signal line cable as short as possible.

4-1-3 We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (VDD). (Recommend value: 0.5A)

4-1-4 Pay sufficient attention to avoid occurrence of mutual noise interference with the neighboring devices.

4-1-5 As for EMI, take necessary measures on the equipment side basically.

4-1-6 When fastening the OLED display module, fasten the external plastic housing section.

4-1-7 If power supply to the OLED display module is forcibly shut down by such errors as taking out the main battery while the OLED display panel is in operation, we cannot guarantee the quality of this OLED display module.

* Connection (contact) to any other potential than the above may lead to rupture of the IC.

5-1 Precautions when disposing of the OLED display modules

5-1-1 Request the qualified companies to handle industrial wastes when disposing of the OLED display modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations.

6-1 Other Precautions

6-1-1 When an OLED display module is operated for a long of time with fixed pattern may remain as an after image or slight contrast deviation may occur.

Nonetheless, if the operation is interrupted and left unused for a while, normal state can be restored. Also, there will be no problem in the reliability of the module.

6-1-2 To protect OLED display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the OLED display modules.

* Pins and electrodes

* Pattern layouts such as the TCP & FPC

6-1-3 With this OLED display module, the OLED driver is being exposed. Generally speaking, semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if this OLED driver is exposed to light, malfunctioning may occur.

* Design the product and installation method so that the OLED driver may be shielded from Light in actual usage.

6-1-4 Although this OLED display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.

6-1-5 We recommend you to construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.

6-1-6 Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.

6-1-7 Our company will has the right to upgrade and modify the product function.

6-1-8 The limitation of FPC bending