

**SPECIFICATION
FOR
LCM MODULE**

**MODULE NO.: ABG240128M01-BIW-R
DOC.REVISION 00**

Customer Approval:

| |
|--|
| |
|--|

| | SIGNATURE | DATE |
|------------------------------|-----------|------------|
| PREPARED BY (RD ENGINEER) | | Apr-5-2006 |
| PREPARED BY (QA ENGINEER) | | |
| CHECKED BY | | |
| APPROVED BY | | |

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DOCUMENT REVISION HISTORY

| Version | DATE | DESCRIPTION | CHANGED BY |
|----------------|-------------|--------------------|-------------------|
| 00 | Apr-5-2006 | First issue | |

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1. FUNCTIONS & FEATURES

| | |
|---|--|
| 1.1. Format | : 240x128 Dots |
| 1.2. LCD mode | : STN /Negative transmissive mode / Blue |
| 1.3. Viewing direction | : 6 o'clock |
| 1.4. Driving scheme | : 1/128 Duty cycle, 1/9 Bias |
| 1.5. Power supply voltage(V _{DD}) | : 5.0V |
| 1.6. LCD driving voltage | : 14.5V |
| 1.7. Operation temp | : -20~70°C |
| 1.8. Storage temp | : -30~80°C |
| 1.9. Backlight color | : White |

2. MECHANICAL SPECIFICATIONS

| | |
|-------------------|--|
| 2.1. Module size | : 144.0mm(L)*104.0mm(W)* 17.0max mm(H) |
| 2.2. Viewing area | : 114.0mm(L)*64.0mm(W) |
| 2.3. Dot pitch | : 0.45mm(L)*0.45mm(W) |
| 2.4. Dot size | : 0.40mm(L)*0.40mm(W) |
| 2.5. Weight | : Approx. |

3. BLOCK DIAGRAM

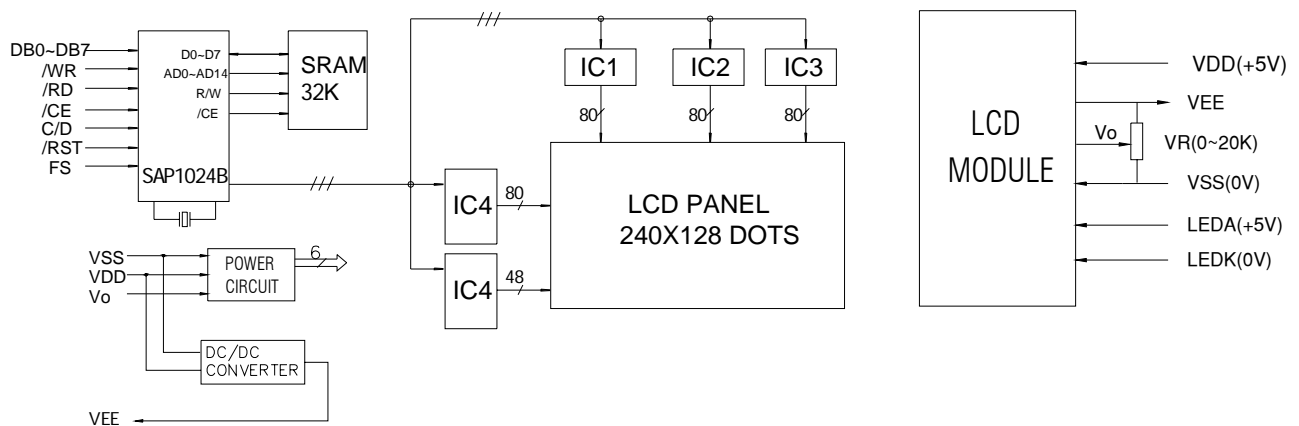


Figure 1. Block diagram

5. PIN DESCRIPTION

| No. | Symbol | Function |
|------|---------|---|
| 1 | VSS | GND (0V) |
| 2 | VDD | Power supply for the logic (+5V) |
| 3 | V0 | Power supply for the LCD drive |
| 4 | C/D | Data or Instruction select signal(H:data register,L:instruction register) |
| 5 | /RD | Read signal |
| 6 | /WR | Write signal |
| 7~14 | DB0~DB7 | Data bus lines |
| 15 | /CE | Chip enable signal |
| 16 | /RST | Reset signal |
| 17 | VEE | Negative voltage output |
| 18 | FS | Font selection terminal |
| 19 | LEDA | Power supply for backlight(+5V) |
| 20 | LEDK | Power supply for backlight(0V) |

6. MAXIMUM ABSOLUTE LIMIT

(For IC)

($V_{SS}=0V, T_1=25^\circ C$)

| Item | Symbol | Value | Units |
|-----------------------|-----------|----------------------|------------|
| Power supply voltage | V_{DD} | -0.3 to +7.0 | V |
| Input voltage | V_{in} | -0.3 to $V_{DD}+0.3$ | V |
| Operating Temperature | T_{op} | -10 to +70 | $^\circ C$ |
| Storage Temperature | T_{stg} | -55 to +125 | $^\circ C$ |

Note: Specification is for T6963C only. LCD module specifications may differ.

7. ELECTRICAL CHARACTERISTICS

($V_{DD}=+5V\pm 5\%$, $GND=0V$, $T_a=+25^\circ C$)

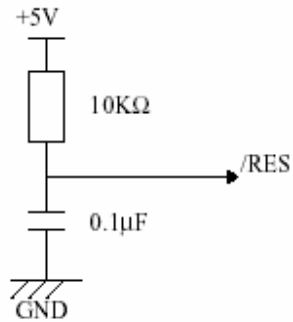
| Item | Symbol | Condition | Min | Max | Units | Notes | |
|---------------------------|----------|--------------------|---|----------|-------|----------|---|
| Operating Voltage | V_{DD} | | 4.5 | 5.5 | V | | |
| Input voltage | "H" | V_{IH} | $V_{DD}-2.2$ | V_{DD} | V | 1, 3 | |
| | "L" | V_{IL} | 0 | 0.8 | V | 1, 2, 3 | |
| Output voltage | "H" | V_{OH} | $V_{DD}-0.3$ | V_{DD} | V | 3 | |
| | "L" | V_{OL} | 0 | 0.3 | V | 3 | |
| Output Resistance | "H" | R_{OH} | $V_{OUT}=V_{DD}-0.5$ | - | 400 | Ω | 3 |
| | "L" | R_{OL} | $V_{OUT}=0.5$ | - | 400 | Ω | 3 |
| Current | Oper. | $I_{DD(1)}$ | $V_{DD}=5.0V$ $f_{osc}=3.0\text{ MHz}$ | - | 6 | mA | |
| Consumption | Halt | $I_{DD(2)}$ | | - | 3 | μA | |
| Input leakage current | | I_{IL} | $V_{in}=0\sim V_{DD}$ | -5 | 5 | μA | 3 |
| Output leakage current | | I_{OL} | $V_{out}=0\sim V_{DD}$ | -10 | 10 | μA | 3 |
| Internal Oscillation | | f_{osc} | | 0.4 | 5.5 | MHz | |
| External clock frequency | | f_{cp} | | - | 2750 | KHz | |
| Ext. clock rise/fall time | | t_{rep}, t_{fcp} | | - | 30 | ns | |

Notes:

- \overline{CE} , $\overline{C/D}$, \overline{RD} , \overline{WR}
- \overline{RES}
- DB0 to DB7

8. The /RES (RESET) Terminal

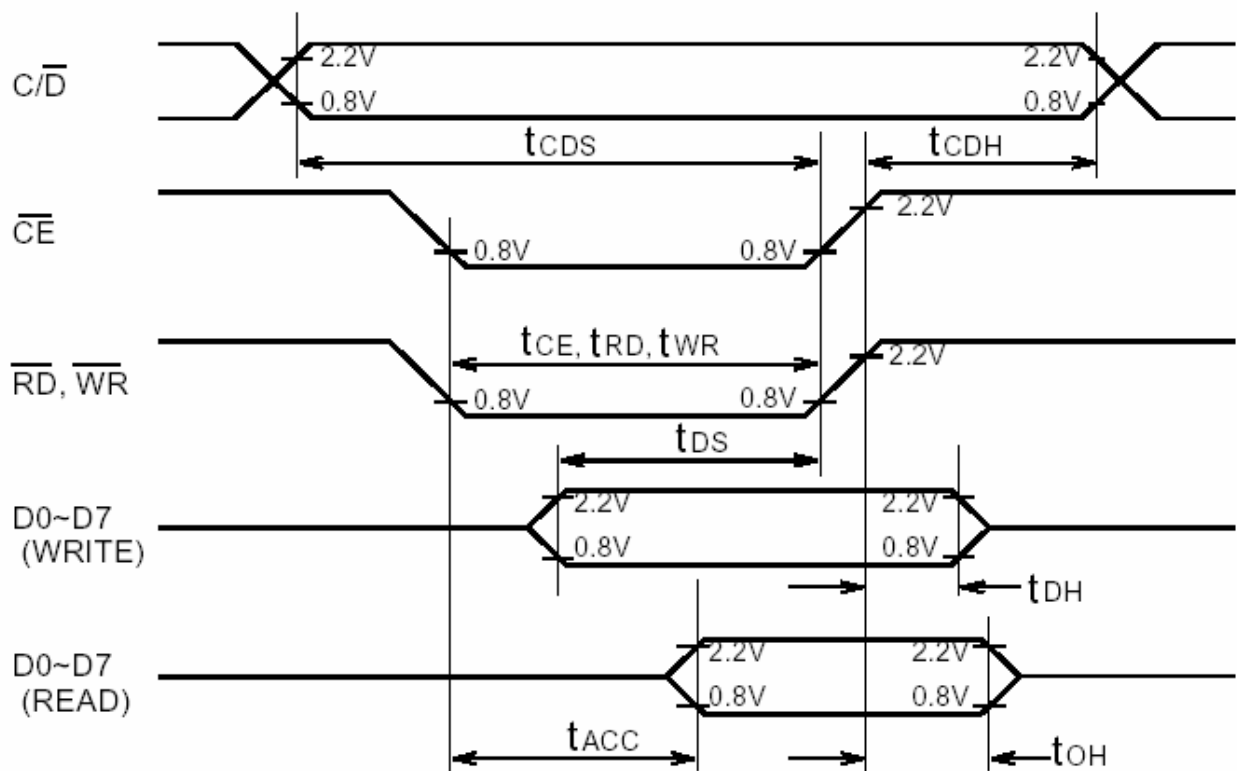
The T6963C may be reset by an external active low TTL signal from a MPU or other logic device or it may be reset using the following circuit.



9. TIMING CHARACTERISTICS

MPU Interface Timing (MPU \leftrightarrow T6963C)

| Item | Symbol | Min | Typ | Max | Unit |
|---|--------------------------------|-----|-----|-----|------|
| $\overline{C/D}$ Set Up Time | t_{CDS} | 100 | - | - | ns |
| $\overline{C/D}$ Hold Time | t_{CDH} | 10 | - | - | ns |
| \overline{CE} , \overline{RD} , \overline{WR} Pulse Width | t_{CE} , t_{RD} , t_{WR} | 80 | - | - | ns |
| Data Set Up Time | t_{DS} | 80 | - | - | ns |
| Data Hold Time | t_{DH} | 40 | - | - | ns |
| Access time | t_{ACC} | - | - | 150 | ns |
| Output Hold Time | t_{OH} | 10 | - | 50 | ns |



10. CONTROL AND DISPLAY INSTRUCTION

| Commands | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Description | Execute Time |
|---------------------------|----|----|----|----|----|----|----|-------------|---|--------------|
| Pointer Set | 0 | 0 | 1 | 0 | 0 | N2 | N1 | N0 | | Status check |
| | | | | | | 0 | 0 | 1 | Cursor Pointer Set | |
| | | | | | | 0 | 1 | 0 | Offset Register Set | |
| Control Word Set Commands | 0 | 1 | 0 | 0 | 0 | 0 | N1 | N0 | | 32 x 1/fosc |
| | | | | | | | 0 | 0 | Text Home Address Set | |
| | | | | | | | 0 | 1 | Text Area Set | |
| | | | | | | | 1 | 0 | Graphic Home Address Set | |
| Mode Set | 1 | 0 | 0 | 0 | CG | N2 | N1 | N0 | | 32 x 1/fosc |
| | | | | | 0 | | | | CG ROM Mode | |
| | | | | | 1 | | | | CG RAM Mode | |
| | | | | | | 0 | 0 | 0 | "OR" Mode | |
| | | | | | | 0 | 0 | 1 | "EXOR" Mode | |
| Display Modes | 1 | 0 | 0 | 1 | N3 | N2 | N1 | N0 | | 32 x 1/fosc |
| | | | | | 0 | | | | Graphics Off | |
| | | | | | 1 | | | | Graphics On | |
| | | | | | | 0 | | | Text Off | |
| | | | | | | 1 | | | Text On | |
| | | | | | | | 0 | | Cursor Off | |
| | | | | | | | 1 | | Cursor On | |
| Cursor Pattern Select | 1 | 0 | 1 | 0 | 0 | N2 | N1 | N0 | N2~N0: No. of lines for cursor +1 | 32 x 1/fosc |
| | | | | | | 0 | 0 | 0 | Bottom Line cursor | |
| | | | | | | 0 | 0 | 1 | 2 line cursor | |
| | | | | | | 1 | 1 | 1 | 8 line cursor (block cursor) | |
| Data Auto Read/Write | 1 | 1 | 0 | 0 | 0 | 0 | N1 | N0 | | 32 x 1/fosc |
| | | | | | | | 0 | 0 | Data Auto Write Set | |
| | | | | | | | 0 | 1 | Data Auto Read Set | |
| Data Read/Write | 1 | 1 | 0 | 0 | 0 | N2 | N1 | N0 | | |
| | | | | | | 0 | | | Address Pointer up/down | |
| | | | | | | 1 | | | Address Pointer unchanged | |
| | | | | | | | 0 | | Address Pointer up | |
| | | | | | | | 1 | | Address Pointer down | |
| Screen Peeking | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Read Displayed Data | Status |
| | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | Copies 1 line of displayed data whose address is indicated by the Address Pointer to Graphic RAM area | Status check |
| | 1 | 1 | 1 | 1 | N3 | N2 | N1 | N0 | N2~N0 indicates the bit in the pointed address | Status check |
| | | | | 0 | | | | Bit Reset | | |
| | | | | 1 | | | | Bit Set | | |
| | | | | | 0 | 0 | 0 | Bit 0 (LSB) | | |
| | | | | | 0 | 0 | 1 | Bit 1 | | |
| Bit Set/Reset | | | | | | | | | | |
| | | | | | | 1 | 1 | 1 | Bit 7 (MSB) | |

Note:

- * = DONT CARE
- Read the status of the STA0 and STA1 Flags before each new command or data byte is sent to the T6963C. If these two flags are set (i.e.=1) then the T6963C is not busy processing the previous instruction and it is safe to write a new command or data byte to the T6963C. If a new instruction is sent to the T6963C while these two flags are not set (i.e.=0), then that command shall be ignored by the T6963C.
- In the case of a dual screen LCD the screen copy command should not be used.

11. Recommended Initialization

The Mode Set and Control Word Set commands must be initialized after power is turned ON. These command define what size display the T6963C is to control and which mode to run in.

| Commands | C/D | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Hex | Description | |
|--|--|----|----|----|----|----|----|----|----|-----|---|----------------------------------|
| Power On. | Power On | | | | | | | | | | | |
| Hard Reset (/RES) | /RES="L" (1 msec min. After $V_{DD}>4.75V$) | | | | | | | | | | | |
| Mode Set | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80H | "OR" , "CG-ROM" Mode | |
| Control Word Set | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00H | Graphic Home address data | |
| Graphic Home Address Set | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 42H | Graphic Home Address Set command |
| Control Word Set | 0 | * | * | * | * | * | * | * | * | * | See section 10.1.2 for value of GA data | |
| Graphic Home Address Set | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 43H | Graphic Area Set command | |
| Control Word Set | 0 | * | * | * | * | * | * | * | * | * | See section 10.1.2 for value of TH data | |
| Text Home Address Set | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 40H | Text Home Address Set command | |
| Control Word Set | 0 | * | * | * | * | * | * | * | * | * | See section 10.1.2 for value of TA data | |
| Text Home Address Set | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 41H | Text Area Set command | |
| Initialisation Ends----- - | ----- ---- | | | | | | | | | | | |
| Address Pointer Set | 0 | * | * | * | * | * | * | * | * | * | Text Home address data (section 10.1.2) | |
| | 0 | * | * | * | * | * | * | * | * | * | TH=****H | |
| | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 24H | Address Pointer Set command | |
| Data Write (Text) D | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 24H | Character code 24H="D" | |
| | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | C0H | Data Write Autoincrement | |
| Data Write (Text) E | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 25H | Character code 25H="E" | |
| | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | C0H | Data Write Autoincrement | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Data Write (Text) N | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2EH | Character code 2EH="N" | |
| | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | C0H | Data Write Autoincrement | |
| Display Mode Set (Text/Graphics ON) | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 9CH | Display Mode Set command | |

12. BACK LIGHT CHARACTERISTICS

LCD Module with side LED Backlight
ELECTRICAL RATINGS

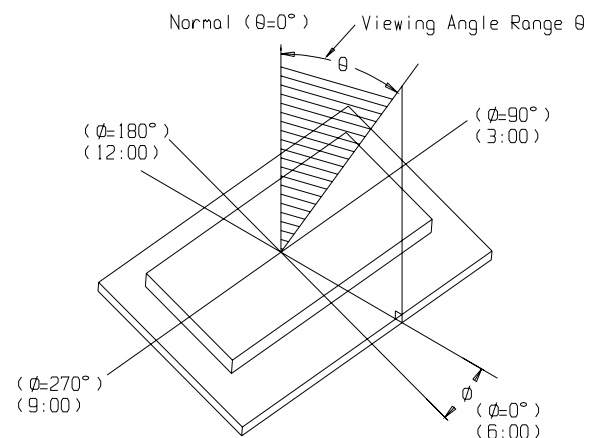
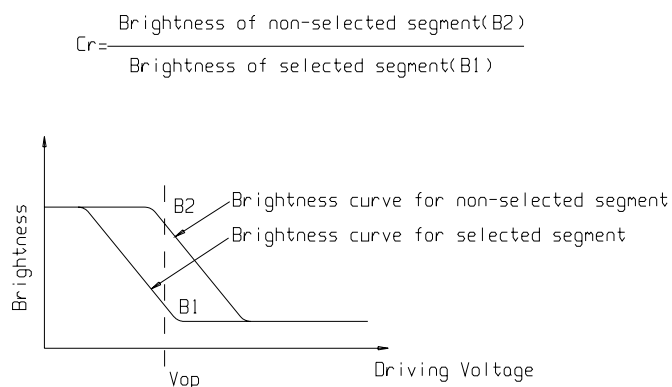
Ta = 25°C

| Item | Symbol | Condition | Min | Typ | Max | Unit |
|---|--------|-----------|-----|-----|-----|-------------------|
| Forward Voltage | VF | IF=180mA | 3.0 | 3.2 | 3.4 | V |
| Reverse Current | IR | VR= V | --- | --- | --- | mA |
| Luminous Intensity (With LCD dots off) | IV | IF=180mA | --- | --- | --- | Cd/m ² |
| Wave length | λp | | --- | --- | --- | nm |
| Color | White | | | | | |

13. ELECTRO-OPTICAL CHARACTERISTICS

(V_{OP} = 14.5V, Ta = 25°C)

| Item | Symbol | Condition | Min | Typ | Max | Unit |
|---------------------|--------|------------|------|------|------|------|
| Operating Voltage | Vop | Ta = -20°C | 14.9 | 15.0 | 15.2 | V |
| | | Ta = 25°C | 14.3 | 14.5 | 14.7 | |
| | | Ta = 70°C | 13.9 | 14.0 | 14.1 | |
| Response time | Tr | Ta = 25°C | --- | 185 | --- | ms |
| | Tf | | --- | 200 | --- | ms |
| Contrast | Cr | Ta = 25°C | --- | 4 | --- | --- |
| Viewing angle range | θ | Cr ≥ 2 | -40 | --- | +40 | deg |
| | Φ | | -40 | --- | +40 | deg |

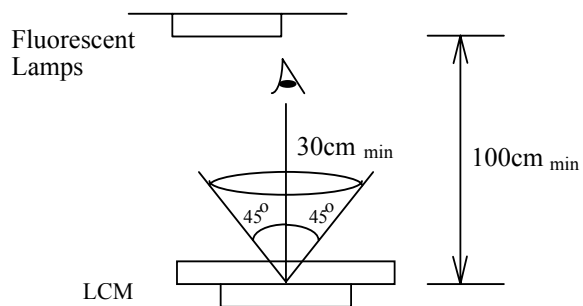


14.QUALITY SPECIFICATIONS

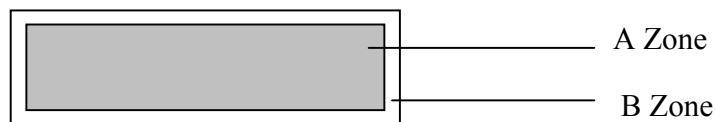
14.1 Standard of the product appearance test

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.



Definition of zone:



A Zone: Active display area (minimum viewing area).

B Zone: Non-active display area (outside viewing area).

14.2 Specification of quality assurance

AQL inspection standard

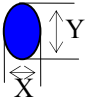
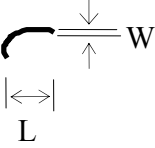
Sampling method: MIL-STD-105E, Level II, single sampling

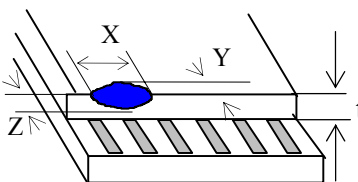
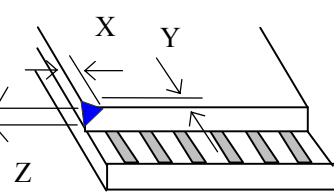
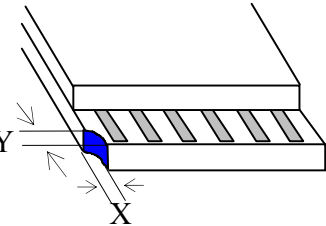
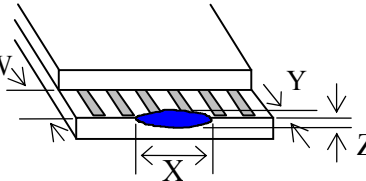
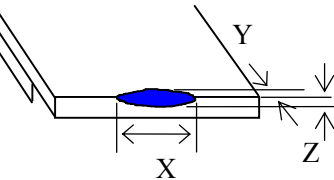
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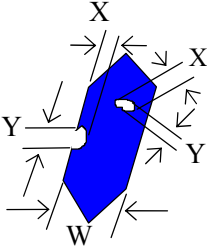
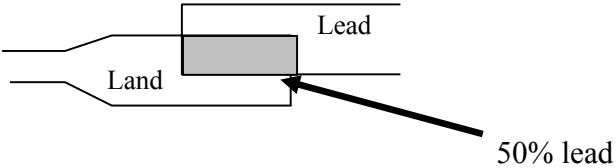
Defect classification (Note: * is not including)

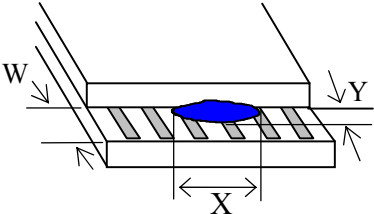
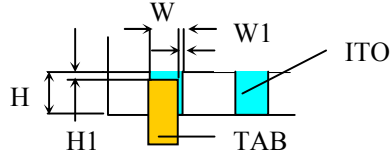
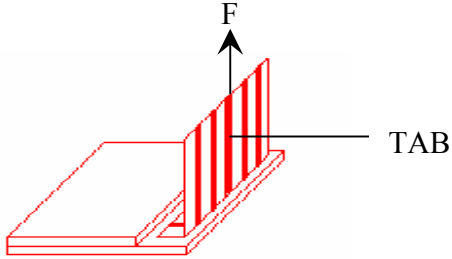
| Classify | Item | | Note | AQL |
|----------------------------|---------------|------------------------------|------|------|
| Major | Display state | Short or open circuit | 1 | 0.65 |
| | | LC leakage | | |
| | | Flickering | | |
| | | No display | | |
| | | Wrong viewing direction | | |
| | | Contrast defect (dim, ghost) | 2 | |
| | | Back-light | 1,8 | |
| | Non-display | Flat cable or pin reverse | 10 | |
| Wrong or missing component | | 11 | | |
| Minor | Display state | Background color deviation | 2 | 1.0 |
| | | Black spot and dust | 3 | |
| | | Line defect, Scratch | 4 | |
| | | Rainbow | 5 | |
| | | Chip | 6 | |
| | | Pin hole | 7 | |
| | Polarizer | Protruded | 12 | |
| | | Bubble and foreign material | 3 | |
| | Soldering | Poor connection | 9 | |
| | Wire | Poor connection | 10 | |
| | TAB | Position, Bonding strength | 13 | |

Note on defect classification

| No. | Item | Criterion | | | | | | | | | | | | | | | | | | | | |
|-------------------------|--|---|------------|-----------------|------------------|-----------|-------------------------|---|-------------------------|----------------|-------------------------|--------------|---------------|---|--------------|---------------|--------------|-----------|---|-----|------------|-------------------------|
| 1 | Short or open circuit | Not allow | | | | | | | | | | | | | | | | | | | | |
| | LC leakage | | | | | | | | | | | | | | | | | | | | | |
| | Flickering | | | | | | | | | | | | | | | | | | | | | |
| | No display | | | | | | | | | | | | | | | | | | | | | |
| | Wrong viewing direction | | | | | | | | | | | | | | | | | | | | | |
| | Wrong Back-light | | | | | | | | | | | | | | | | | | | | | |
| 2 | Contrast defect | Refer to approval sample | | | | | | | | | | | | | | | | | | | | |
| | Background color deviation | | | | | | | | | | | | | | | | | | | | | |
| 3 | Point defect, Black spot, dust (including Polarizer) $\phi = (X+Y)/2$ |  <table border="1" data-bbox="916 1028 1342 1317"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty.</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 0.10$</td> <td>Disregard</td> </tr> <tr> <td>$0.10 < \phi \leq 0.20$</td> <td>3</td> </tr> <tr> <td>$0.20 < \phi \leq 0.25$</td> <td>2</td> </tr> <tr> <td>$0.25 < \phi \leq 0.30$</td> <td>1</td> </tr> <tr> <td>$\phi > 0.30$</td> <td>0</td> </tr> </tbody> </table> <p>Unit: mm</p> | Point Size | Acceptable Qty. | $\phi \leq 0.10$ | Disregard | $0.10 < \phi \leq 0.20$ | 3 | $0.20 < \phi \leq 0.25$ | 2 | $0.25 < \phi \leq 0.30$ | 1 | $\phi > 0.30$ | 0 | | | | | | | | |
| Point Size | Acceptable Qty. | | | | | | | | | | | | | | | | | | | | | |
| $\phi \leq 0.10$ | Disregard | | | | | | | | | | | | | | | | | | | | | |
| $0.10 < \phi \leq 0.20$ | 3 | | | | | | | | | | | | | | | | | | | | | |
| $0.20 < \phi \leq 0.25$ | 2 | | | | | | | | | | | | | | | | | | | | | |
| $0.25 < \phi \leq 0.30$ | 1 | | | | | | | | | | | | | | | | | | | | | |
| $\phi > 0.30$ | 0 | | | | | | | | | | | | | | | | | | | | | |
| 4 | Line defect, Scratch |  <table border="1" data-bbox="847 1487 1382 1738"> <thead> <tr> <th colspan="2">Line</th> <th>Acceptable Qty.</th> </tr> <tr> <th>L</th> <th>W</th> <th></th> </tr> </thead> <tbody> <tr> <td>---</td> <td>$0.015 \geq W$</td> <td>Disregard</td> </tr> <tr> <td>$3.0 \geq L$</td> <td>$0.03 \geq W$</td> <td rowspan="2">2</td> </tr> <tr> <td>$2.0 \geq L$</td> <td>$0.05 \geq W$</td> </tr> <tr> <td>$1.0 \geq L$</td> <td>$0.1 > W$</td> <td>1</td> </tr> <tr> <td>---</td> <td>$0.05 < W$</td> <td>Applied as point defect</td> </tr> </tbody> </table> <p>Unit: mm</p> | Line | | Acceptable Qty. | L | W | | --- | $0.015 \geq W$ | Disregard | $3.0 \geq L$ | $0.03 \geq W$ | 2 | $2.0 \geq L$ | $0.05 \geq W$ | $1.0 \geq L$ | $0.1 > W$ | 1 | --- | $0.05 < W$ | Applied as point defect |
| Line | | Acceptable Qty. | | | | | | | | | | | | | | | | | | | | |
| L | W | | | | | | | | | | | | | | | | | | | | | |
| --- | $0.015 \geq W$ | Disregard | | | | | | | | | | | | | | | | | | | | |
| $3.0 \geq L$ | $0.03 \geq W$ | 2 | | | | | | | | | | | | | | | | | | | | |
| $2.0 \geq L$ | $0.05 \geq W$ | | | | | | | | | | | | | | | | | | | | | |
| $1.0 \geq L$ | $0.1 > W$ | 1 | | | | | | | | | | | | | | | | | | | | |
| --- | $0.05 < W$ | Applied as point defect | | | | | | | | | | | | | | | | | | | | |
| 5 | Rainbow | Not more than two color changes across the viewing area. | | | | | | | | | | | | | | | | | | | | |

| No | Item | Criterion | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------|--|---|---|---|---|----------|-------|------------|---|---|---|----------|-------|----------|---|---|---|----------|----------|----------|------------------------|--|--|---|---|---|-----------|------------|----------|---|---|---|----------|----------|------------|
| 6 | <p>Chip</p> <p>Remark:</p> <p>X: Length direction</p> <p>Y: Short direction</p> <p>Z: Thickness direction</p> <p>t: Glass thickness</p> <p>W: Terminal Width</p> |  <p>Acceptable criterion</p> <table border="1" data-bbox="981 526 1364 604"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤ 2</td> <td>0.5mm</td> <td>$\leq t/2$</td> </tr> </tbody> </table>  <p>Acceptable criterion</p> <table border="1" data-bbox="973 828 1364 907"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤ 2</td> <td>0.5mm</td> <td>$\leq t$</td> </tr> </tbody> </table>  <p>Acceptable criterion</p> <table border="1" data-bbox="989 1108 1364 1220"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤ 3</td> <td>≤ 2</td> <td>$\leq t$</td> </tr> <tr> <td colspan="2">shall not reach to ITO</td> <td></td> </tr> </tbody> </table>  <p>Acceptable criterion</p> <table border="1" data-bbox="973 1478 1364 1556"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>Disregard</td> <td>≤ 0.2</td> <td>$\leq t$</td> </tr> </tbody> </table>  <p>Acceptable criterion</p> <table border="1" data-bbox="973 1758 1332 1836"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤ 5</td> <td>≤ 2</td> <td>$\leq t/3$</td> </tr> </tbody> </table> | X | Y | Z | ≤ 2 | 0.5mm | $\leq t/2$ | X | Y | Z | ≤ 2 | 0.5mm | $\leq t$ | X | Y | Z | ≤ 3 | ≤ 2 | $\leq t$ | shall not reach to ITO | | | X | Y | Z | Disregard | ≤ 0.2 | $\leq t$ | X | Y | Z | ≤ 5 | ≤ 2 | $\leq t/3$ |
| X | Y | Z | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≤ 2 | 0.5mm | $\leq t/2$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | Y | Z | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≤ 2 | 0.5mm | $\leq t$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | Y | Z | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≤ 3 | ≤ 2 | $\leq t$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| shall not reach to ITO | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | Y | Z | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Disregard | ≤ 0.2 | $\leq t$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | Y | Z | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ≤ 5 | ≤ 2 | $\leq t/3$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| No. | Item | Criterion | | | | | | | | |
|-------------------------|--|--|------------|----------------|------------------|-----------|-------------------------|---|---------------|---|
| 7 | Segment pattern W = Segment width $\phi = (X+Y)/2$ | <p>(1) Pin hole $\phi < 0.10\text{mm}$ is acceptable.</p>  <table border="1" data-bbox="906 689 1358 862"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 1/4W$</td> <td>Disregard</td> </tr> <tr> <td>$1/4W < \phi \leq 1/2W$</td> <td>1</td> </tr> <tr> <td>$\phi > 1/2W$</td> <td>0</td> </tr> </tbody> </table> <p>Unit: mm</p> | Point Size | Acceptable Qty | $\phi \leq 1/4W$ | Disregard | $1/4W < \phi \leq 1/2W$ | 1 | $\phi > 1/2W$ | 0 |
| Point Size | Acceptable Qty | | | | | | | | | |
| $\phi \leq 1/4W$ | Disregard | | | | | | | | | |
| $1/4W < \phi \leq 1/2W$ | 1 | | | | | | | | | |
| $\phi > 1/2W$ | 0 | | | | | | | | | |
| 8 | Back-light | <p>(1) The color of backlight should correspond its specification. (2) Not allow flickering</p> | | | | | | | | |
| 9 | Soldering | <p>(1) Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect) (2) Over 50% of lead should be soldered on Land.</p>  | | | | | | | | |
| 10 | Wire | <p>(1) Copper wire should not be rusted (2) Not allow crack on copper wire connection. (3) Not allow reversing the position of the flat cable. (4) Not allow exposed copper wire inside the flat cable.</p> | | | | | | | | |
| 11* | PCB | <p>(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.</p> | | | | | | | | |

| No | Item | Criterion |
|----|--------------------------------|---|
| 12 | Protruded W: Terminal Width |  <p>Acceptable criteria: $Y \leq 0.4$</p> |
| 13 | TAB | <p>1. Position</p>  <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> $W1 \leq 1/3W$ $H1 \leq 1/3H$ </div> <p>2. TAB bonding strength test</p>  <p> $P (=F/TAB \text{ bonding width}) \geq 650\text{gf/cm}$,(speed rate: 1mm/min) 5pcs per SOA (shipment) </p> |

| | | |
|----|--------------------------------|---|
| 14 | Total no. of acceptable Defect | <p>A. Zone</p> <p>Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm</p> <p>B. Zone</p> <p>It is acceptable when it is no trouble for quality and assembly in customer's end product.</p> |
|----|--------------------------------|---|

14.3 Reliability of LCM

Reliability test condition:

| Item | Condition | Time (hrs) | Assessment |
|----------------------|---|------------|--|
| High temp. Storage | 65°C | 48 | No abnormalities in functions and appearance |
| High temp. Operating | 55°C | 48 | |
| Low temp. Storage | -20°C | 48 | |
| Low temp. Operating | -10°C | 48 | |
| Humidity | 40°C/ 90%RH | 48 | |
| Temp. Cycle | 0°C ← 25°C → 50°C (30 min ← 5 min → 30min) | 10cycles | |

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (20±8°C), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

14.4 Precaution for using LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.

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2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isopropyl alcohol, ethyl alcohol or trichlorotrifluoroethane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting FindLCD.
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage V_o .

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2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

FindLCDs and modules are not consumer products, but may be incorporated by AV's customers into consumer products or components thereof, FindLCD does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of FindLCD is limited to repair or replacement on the terms set forth below. FindLCD will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between FindLCD and the customer, FindLCD will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with FindLCD general LCD inspection standard . (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.