



MULTI-INNO TECHNOLOGY CO., LTD.

LCD MODULE SPECIFICATION

Model : MI12864M-3

| | |
|---------------|-----|
| Revision | 1.0 |
| Engineering | |
| Date | |
| Our Reference | |

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REVISION RECORD

| Version | Page | Revision Items | Name | Date |
|---------|------|----------------|------|------------|
| 1.0 | 1 | First release | | 2010-04-28 |
| | | | | |
| | | | | |



TABLE OF CONTENTS

| | Page |
|--|------|
| 1. Description ----- | 3 |
| 2. Features ----- | 3 |
| 3. Absolute maximum ratings ----- | 4 |
| 4. Mechanical Characteristics----- | 4 |
| 5. Circuit ----- | 6 |
| 6. Interface description ----- | 8 |
| 7. Instruction Code & Timing characteristics ----- | 9 |
| 8. Electrical Specifications----- | 13 |
| 9.LED backlight characteristics----- | 13 |
| 10.Optical Characteristics----- | 14 |
| 11.Reliability----- | 18 |
| 12.Package ----- | 19 |
| 13. Quality level ----- | 19 |
| 14 .Precautions for Use of LCD Modules ----- | 25 |

1 Description

The MI12864M-3, Graphics LCM unit consists of 128(segment) x 64(common) dots dot-matrix LCD panel, LCD driver, controller LSI. Incorporating display data RAM in the controller LSI, the unit can efficiently display the desired graphic under microprocessor control.

- ◆ Requirements on environmental protection: RoHS.

2 Features

| Item | Contents |
|-----------------------|------------------------------------|
| LCD type | FSTN |
| | Positive |
| LCD Duty | 1/64 |
| LCD Bias | 1/9 |
| Polarizer | Transflective |
| LCD background color | Blue-White |
| Segment color | Blue-black |
| Backlighting | LED |
| Backlighting type | Bottom |
| Backlighting color | Blue White |
| Backlighting drive | I=180mA, V _F =4.2V(MAX) |
| View direction | 6:00 |
| Operating temperature | -20°C~70°C |
| Storage temperature | -30°C~80°C |
| Controller | SBN6400G&SBN0064G |
| Frame | Black |
| Technology | COB |
| Power supply | VDD=5.0V |
| Data Transfer | 8 Bit Parallel |

Notes:

- Color tone can slightly change with temperature and driving voltage.
- Color tone will be changed by backlight.

3 Absolute maximum ratings

(Without LED backlighting , Ta=25°C)

| Parameter | Symbol | Min | Max | Unit | Remark |
|------------------------------|------------------|------|-------|------|------------------------|
| Logic circuit supply voltage | V _{DD} | -0.3 | +7.0 | V | |
| LCD driving voltage | V _{LCD} | -0.3 | +13.0 | V | |
| Operating temperature range | Top | -20 | +70 | °C | No Condensatio n |
| Storage temperature range | Tst | -30 | +80 | °C | |

Note :

- If the module is above these absolute maximum ratings. It may become permanently damaged.
- V_{DD} > V_{SS} must be maintained.

4 Mechanical Characteristics

4.1 Mechanical features

| Parameter | Standard Value | Unit |
|------------------------------|--------------------------------------|------|
| Display type | Dot matrix module | -- |
| Character size(W×H) | -- | mm |
| Number of dots (W×H) | 128 x 64 | -- |
| View area (W×H) | 60.0 x 32.5 | mm |
| Active Area (W×H) | 55.01 x 27.49 | mm |
| Dot Size (W×H) | 0.40 x 0.40 | mm |
| Dot Pitch (W×H) | 0.43 x 0.43 | mm |
| Module size(W×H×D) | 75.0 x 52.7x 14.5 (MAX) | mm |
| Module total weight (approx) | TBD | g |
| Module outline dimensions | Refer to page 5-“Mechanical drawing” | -- |

4.2 Mechanical drawing.

DETAIL A:

Notes:

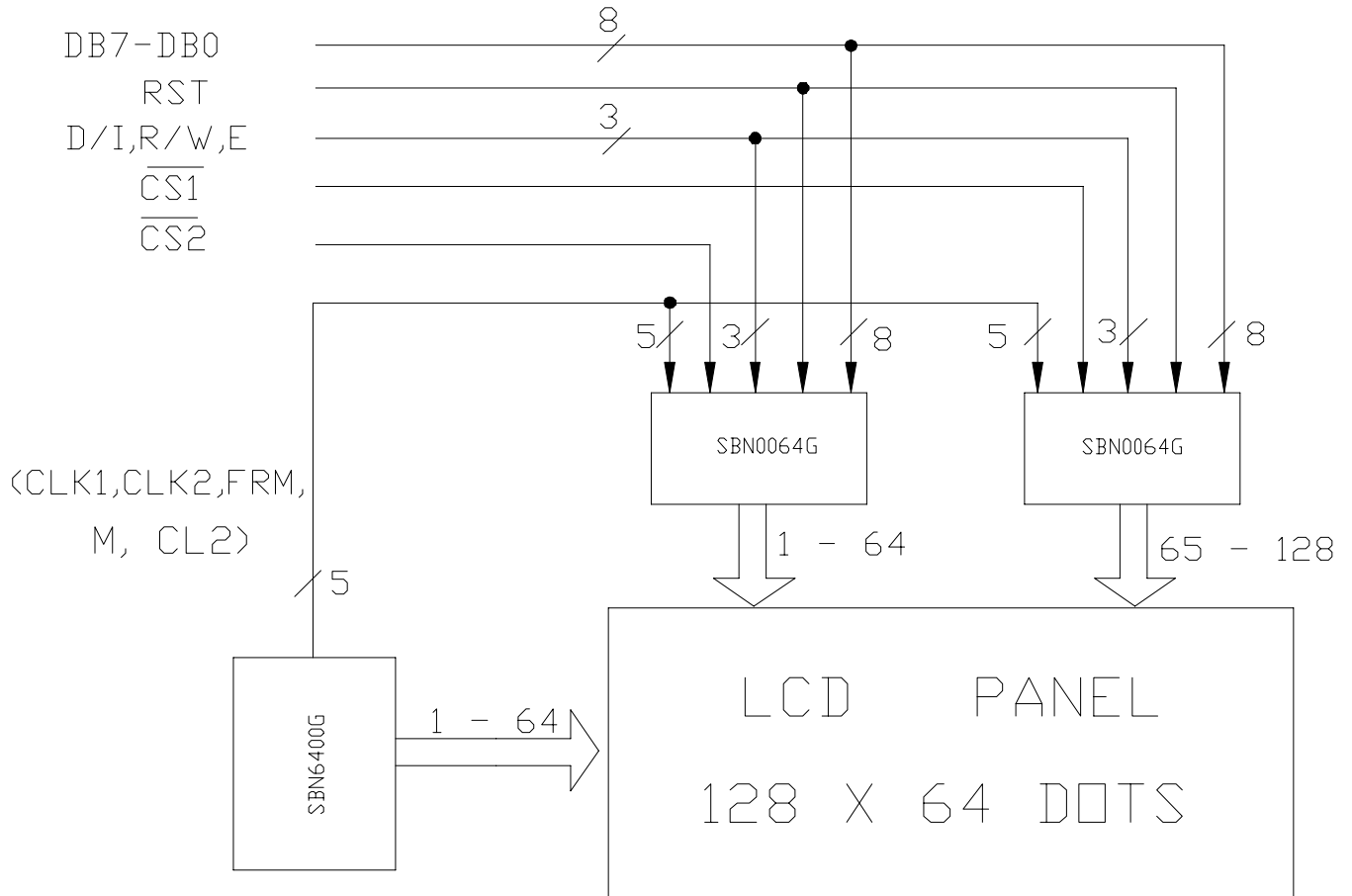
- DISPLAY TYPE: FSTN/B-W MODE
- VIEWING DIRECTION: 6:00
- POLARIZER MODE: TRANSPARENT/POSITIVE
- DRIVE METHOD: 1/64 DUTY 1/9 BIAS
- LCD OPERATING VOLTAGE: 13.5V
- OPERATING TEMP: -20°C~+70°C
- STORAGE TEMP: -30°C~+80°C
- CONTROLLER: SBN6400G&SBN0064G LED
- BACKLIGHT:
- BEZEL IS TO BE PAINTED BLACK
- UNMARKED TOLERANCE: ±0.3mm
- REQUIREMENTS ON ENVIRONMENTAL PROTECTION: RoHS

| | | | | | | | | | | | | | | | | | | | |
|----|-----------------|----|-----------------|----|-----------------|----|-----|----|-----|----|-----|----|------------------|----|-----|----|-----|----|-----|
| 1 | V _{DD} | 2 | V _{SS} | 3 | V _{EE} | 4 | DB0 | 5 | DB1 | 6 | DB2 | 7 | DB3 | 8 | DB4 | 9 | DB5 | 10 | DB6 |
| 11 | C _{S1} | 12 | C _{S2} | 13 | RST | 14 | R/W | 15 | D/I | 16 | E | 17 | F _{IND} | 18 | A | 19 | K | | |

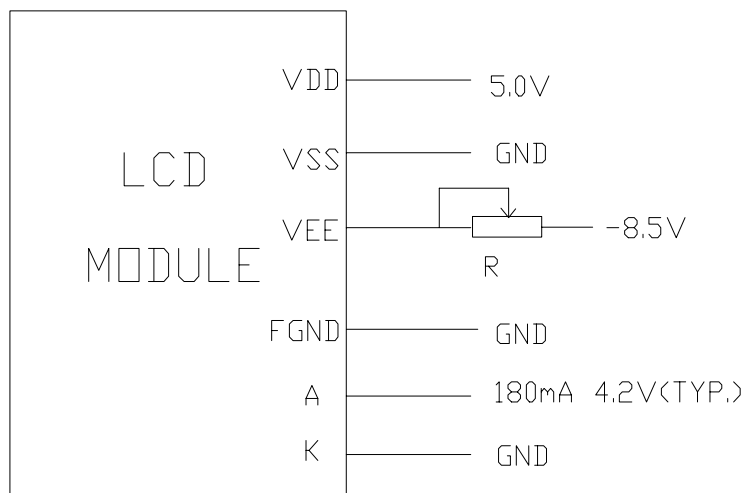
| | | |
|--------------------------------|----------|------------|
| CUSTOMER APVL | CUSTOMER | DATE |
| DRAWN | SCALE | TITLE |
| DFTG CHK | UNIT | MI12864M-3 |
| ENGR CHK | mm | MODEL |
| APPROVAL | | |
| MULTI-INNO TECHNOLOGY CO.,LTD. | | DWG NO |
| | | PAGE |
| | | 1/1 |

5 Circuit

5.1 Block Diagram



5.2 Recommend contrast adjustment circuit



6 Interface descriptions.

| Pin No. | Symbol | Level | Description |
|---------|--------|-------|--|
| 1 | VDD | 5.0V | LCD MODULE driving logic voltage |
| 2 | VDD | 0V | Ground |
| 3 | VEE | -- | LCD contrast adjust voltage supply |
| 4 | DB0 | H/L | Data bit0 |
| 5 | DB1 | H/L | Data bit1 |
| 6 | DB2 | H/L | Data bit2 |
| 7 | DB3 | H/L | Data bit3 |
| 8 | DB4 | H/L | Data bit4 |
| 9 | DB5 | H/L | Data bit5 |
| 10 | DB6 | H/L | Data bit6 |
| 11 | DB7 | H/L | Data bit7 |
| 12 | /CS1 | H/L | Chip select for U2 |
| 13 | /CS2 | H/L | Chip select for U3 |
| 14 | RST | H/L | Reset signal |
| 15 | R/W | H/L | Read or write select signal |
| 16 | D/I | H/L | data or command Selection |
| 17 | E | H/L | Enable signal from the microcontroller |
| 18 | FGND | 0V | GND |
| 19 | A | 4.2V | Power supply voltage for LED(+) |
| 20 | K | 0V | Power supply voltage for LED(-) |

7 Instruction Code & Timing characteristics

7.1 COMMAND

The module MI12864M-3 include the controller & driver- SBN0064G & SBN6400G. The table below lists the types of commands, including the code of each command. more details refer to SBN6400G&SBN0064G data sheet please.

Table.1 INSTRUCTION

| COMMAND | C/DR/W | D7 | CODE | | | | | | | | HEX | DESCRIPTION | |
|--------------------|--------|----|------|----|----|-------|----|----|----|----|-----|-------------|---|
| | | | D6 | D5 | D4 | D3 | D2 | D1 | D0 | | | | |
| DISPLAY ON/OFF | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | D0 | | D0=1, DISPLAY ON D0=0, DISPLAY OFF |
| DISPLAY START LINE | 0 | 0 | 1 | 1 | A5 | A4 | A3 | A2 | A1 | A0 | | CO TO FF | SETTING DISPLAY START LINE |
| PAGE ADDRESS | 0 | 0 | 1 | 0 | 1 | 1 | 1 | A2 | A1 | A0 | | B8 TO BF | SETTING PAGE ADDRESS |
| COLUMN ADDRESS | 0 | 0 | 0 | 1 | A5 | A4 | A3 | A2 | A1 | A0 | | 40 TO 7F | SETTING COLUMN ADDRESS |
| STATUS READ | 0 | 1 | BUSY | 0 | F | RESET | 0 | 0 | 0 | 0 | | | BUSY=1 indicates that the SBN0064G is currently busy and can not accept new code or data. BUSY=0 indicates that the SBN0064G is not busy and is ready to accept new code or data. If ON/OFF=0, the display has been turned ON. If ON/OFF=1, the display has been turned OFF. Note that the polarity of this bit is inverse to that of the Display ON/OFF Register. RESET=1 indicates that the SBN0064G is currently in the process of being RESET=0 indicates that the SBN0064G is currently in normal operation. |
| READ DATA | 1 | 1 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | | | READ DATA |
| WRITE DATA | 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | | | WRITE DATA |

7.2 Interface Timing characteristics

Note: Please refer to IC: SBN6400G&SBN0064G data sheet for more details.

7.2.1 Microcontroller interface timing for writing to the SBN0064G

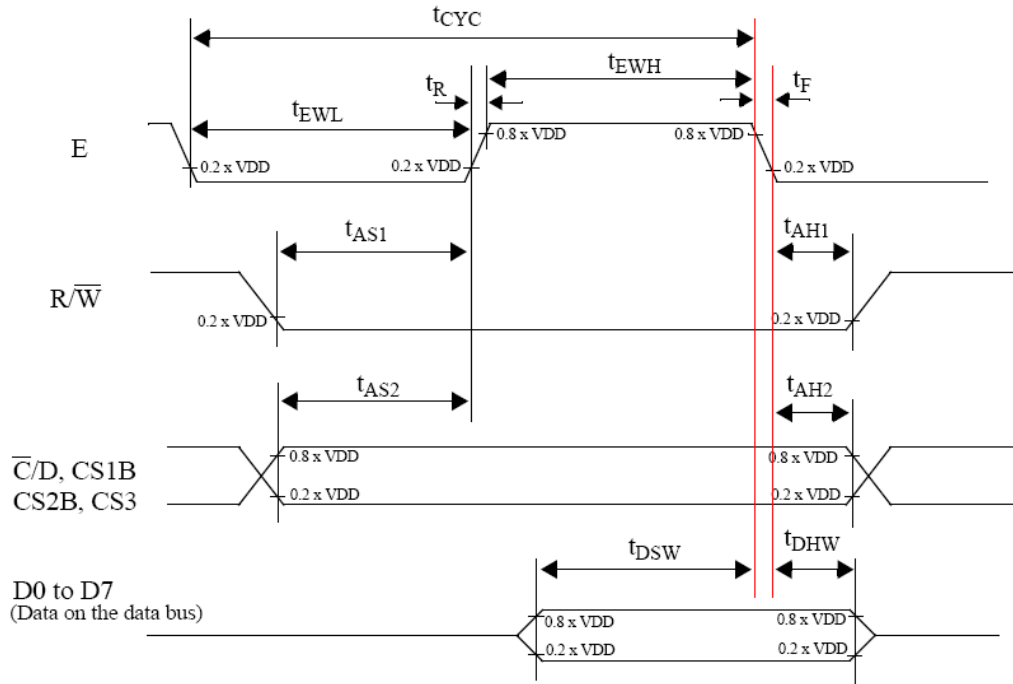


Fig.1 Microcontroller interface timing for writing to the SBN0064G

Table.2 AC timing for writing to the SBN0064G

$V_{DD}=5V\pm 10\%$; $V_{SS}=0V$; $T_{amb}=-20\text{ }^{\circ}\text{C}$ to $+75\text{ }^{\circ}\text{C}$

| symbol | parameter | min. | max. | test conditions | unit |
|-----------|-----------------------------------|------|------|--|------|
| t_{CYC} | Enable (E) cycle time | 1000 | | | ns |
| t_{EWL} | Enable (E) LOW width | 450 | | | |
| t_{EWH} | Enable (E) HIGH width | 450 | | | |
| t_R | Enable (R) rise time | | 20 | | |
| t_F | Enable (F) fall time | | 20 | | |
| t_{AS1} | Write set-up time | 140 | | | |
| t_{AH1} | Write hold time | 10 | | | |
| t_{AS2} | C/D, CS1B, CS2B, CS3 set-up time | 140 | | | |
| t_{AH2} | C/D, CS1B, CS2B, CS3 hold time | 10 | | | |
| t_{DSW} | Data setup time (on the data bus) | 200 | | The loading on the data bus is shown in Fig. 18. | |
| t_{DHW} | Data hold time (on the data bus) | 10 | | | |

7.2.2 Microcontroller interface timing for reading to the SBN0064G

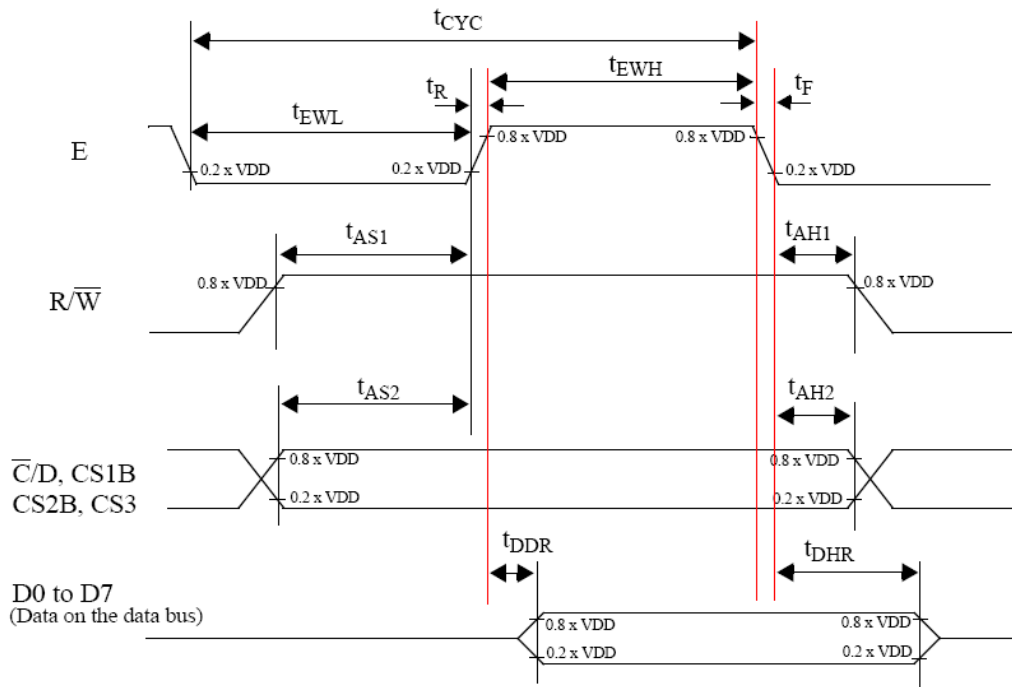


Fig.2 Microcontroller interface timing for reading to the SBN0064G

Table.3 AC timing for reading to the SBN0064G

$V_{DD}=5V\pm 10\%$; $V_{SS}=0V$; $T_{amb}=-20\text{ }^{\circ}\text{C}$ to $+75\text{ }^{\circ}\text{C}$

| symbol | parameter | min. | max. | test conditions | unit |
|-----------|-----------------------------------|------|------|--|------|
| t_{CYC} | Enable (E) cycle time | 1000 | | | ns |
| t_{EWL} | Enable (E) LOW width | 450 | | | |
| t_{EWH} | Enable (E) HIGH width | 450 | | | |
| t_R | Enable (R) rise time | | 20 | | |
| t_F | Enable (F) fall time | | 20 | | |
| t_{AS1} | READ set-up time | 140 | | | |
| t_{AH1} | READ hold time | 20 | | | |
| t_{AS2} | C/D, CS1B, CS2B, CS3 set-up time | 140 | | | |
| t_{AH2} | C/D, CS1B, CS2B, CS3 hold time | 10 | | | |
| t_{DDR} | Data delay time (on the data bus) | 320 | | The loading on the data bus is shown in Fig. 18. | |
| t_{DHR} | Data hold time (on the data bus) | 20 | | | |

7.2.3 Recommended power up/down sequence

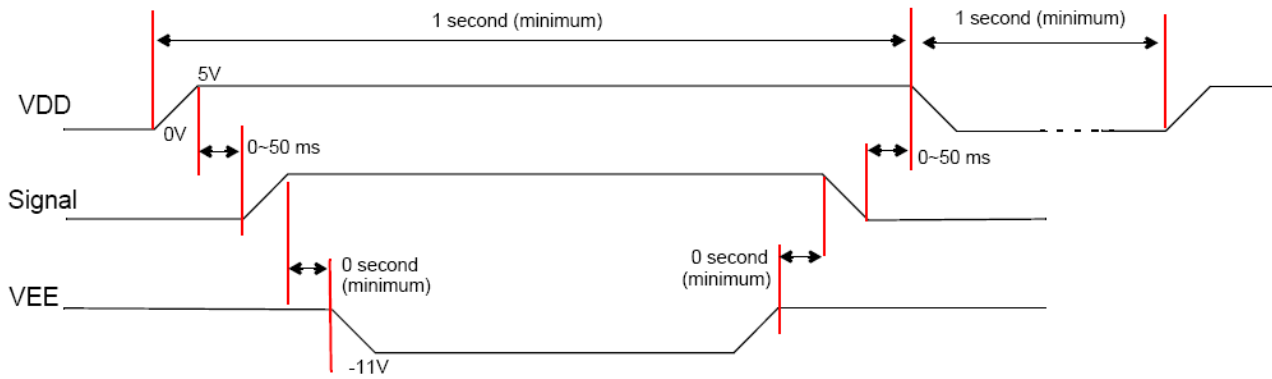


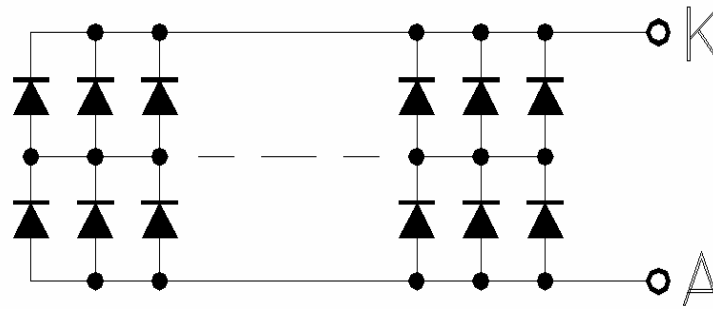
Fig.6 Recommended power up/down sequence

8 Electrical characteristics

 $V_{SS}=0V, T_a=25^{\circ}C$

| Parameter | Symbol | Condition | MIN | TYP | MAX | UNIT |
|----------------------------------|-------------------|---------------|--------------|-------|----------|------|
| Logic circuit supply voltage | V_{DD} | -- | 4.5 | 5.0 | 5.5 | V |
| Power supply LCD(-) | V_{EE} | | -- | -15.0 | -- | |
| Input voltage for logic circuit | "H"level | $V_{DD}=5.0V$ | $V_{DD}-2.2$ | -- | V_{DD} | |
| | "L"level | | 0 | -- | 0.8 | |
| Output voltage for logic circuit | "H"level | | $V_{DD}-0.3$ | -- | V_{DD} | |
| | "L"level | | 0 | -- | 0.3 | |
| Used driver IC | SBN6400G&SBN0064G | | | | | |

9 LED backlight characteristics

 $T_a=25^{\circ}C$


LED 2X18=36 DIES

| Item | Symbol | Condition | MIN. | TYP. | MAX. | Unit |
|----------------------|-------------|-------------|------|------|------|-------------------|
| Forward voltage | V_f | $I_f=180mA$ | -- | -- | 4.2 | V |
| Luminous intensity* | Bp | | 100 | 120 | -- | cd/m ² |
| Luminous Uniformity* | ΔBp | | 70 | -- | -- | % |
| Peak Wave Length* | λ | | 569 | 572 | 575 | nm |

Note:

- Measured at the bare LED backlight unit.
- If the backlight is above these maximum ratings for long time, the service life of the LED backlight will reduce or it will cause poor reliability.

10 Optical Characteristics

10.1 Optical Characteristics

 $T_a=25^{\circ}\text{C}$

| Parameter | Symbol | Ratings | | | Unit | Measuring Temp. | Reference | |
|----------------------------------|--|---|------|------|------|-----------------|------------|------------|
| | | Min | Type | Max. | | | | |
| Operating voltage | $V_{dd}-V_{EE}$ | 13.2 | 13.5 | 13.8 | V | 25°C | (Note10-1) | |
| Frame frequency | f | -- | 75 | -- | Hz | | (Note10-2) | |
| Contrast ratio | $Cr(\theta=20^{\circ}, \Phi=90^{\circ} \text{ or } 270^{\circ})$ | 3.0 | -- | -- | -- | 25°C | (Note10-3) | |
| Response time | Turn on | t_{on} | -- | -- | 300 | ms | 25°C | (Note10-4) |
| | | | -- | -- | -- | | 0°C | |
| | Turn off | t_{off} | -- | -- | 300 | ms | 25°C | |
| | | | -- | -- | -- | | 0°C | |
| Viewing angle ($Cr \geq 2$) | Up-down | θ_1 ($\Phi=90^{\circ}$ or | -20 | -- | 30 | deg | 25°C | (Note10-5) |
| | Left-right | θ_2 ($\Phi=0^{\circ}$ or 180°) | -20 | -- | 30 | deg | 25°C | |

(Note10-1) The maximum and minimum ratings don't mean the LCD works well in the whole range of V_o . V_o must be adjusted to optimize the viewing angle and contrast. Refer to definition of drive voltage, refer to 10.2.

(Note10-2) The frequency shouldn't be too low to avoid flicker. Refer to definition of drive voltage, refer to 10.2.

(Note10-3) Refer to 10.2/10.3/10.4/10.5.

(Note10-4) The selected state is dark and non-selected state is white(or bright) with positive type, reversely the selected state is white (or bright) and non-selected state is dark with negative type. Refer to 10.6 definition of response time.

(Note10-5) Generally the viewing direction is 6:00 or 12:00, sometimes 3:00 or 9:00. The range of left to right and up to down based on $Cr=2$ show the viewing angle. Viewing angle range isn't the range of defects inspection. Refer to 10.4.

10.2 Definition of drive voltage

(1) Definition of drive voltage and waveform

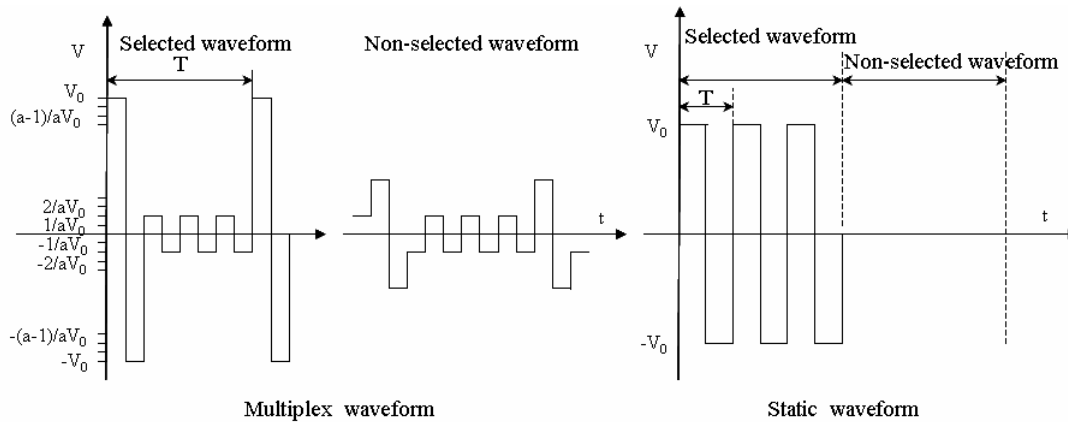


Fig.1 Definition of drive voltage and waveform

Operating voltage: V_0

Frame frequency: $f=1/T$

Duty: $1/N$

Bias: $1/a$

(2) Operating voltage: V_0

Multi-Inno can evaluate whether the LCD can be redesigned to obtain customer preferable performance if customer's LCD drive voltage isn't adjustable.

10.3 Optical characteristics measurement equipment and method

The setup and test method are showed in fig.2. Test methods are different according to different illumination mode.

Transmissive mode: light resource is placed at the back of LCD.

Reflective mode and transflective mode: light resource is placed at the front side of LCD.

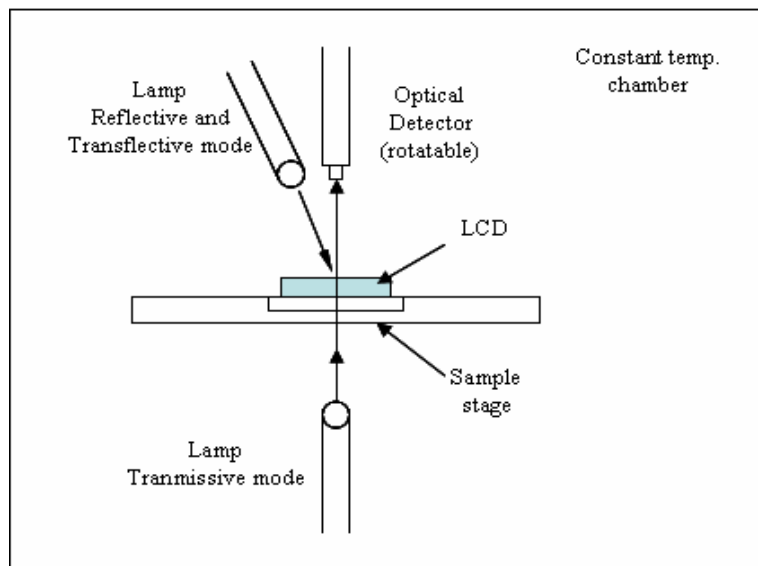


Fig.2 Optical characteristics measurement equipment

The chamber temperature, light resource and driving signal should be stable before testing. If test the characteristics under high or low temperature, the test system should be stable for more than 10 minutes before testing.

10.4 Definition of viewing direction

Refer to the graph below marked by θ and ϕ

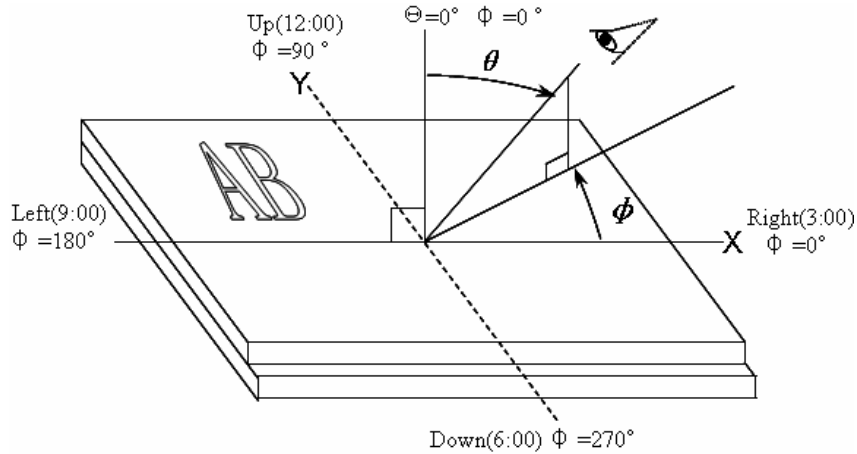


Fig.3 Definition of viewing direction

10.5 Definition of contrast ratio

Contrast ratio can be calculated by the formula (10-1) below for positive type. If the LCD is negative type, $Cr(\theta, \phi)$ is equal to luminance (θ, ϕ , non-selected state) divided by luminance (θ, ϕ , selected state). Note3-4 shows the relationship between selected state, non-selected state and bright state, dark state.

$$Cr(\theta, \phi) = \frac{L_2}{L_1} = \frac{\text{Luminance}(\theta, \phi) \text{ (Bright state)}}{\text{Luminance}(\theta, \phi) \text{ (Dark state)}} \quad (10-1)$$

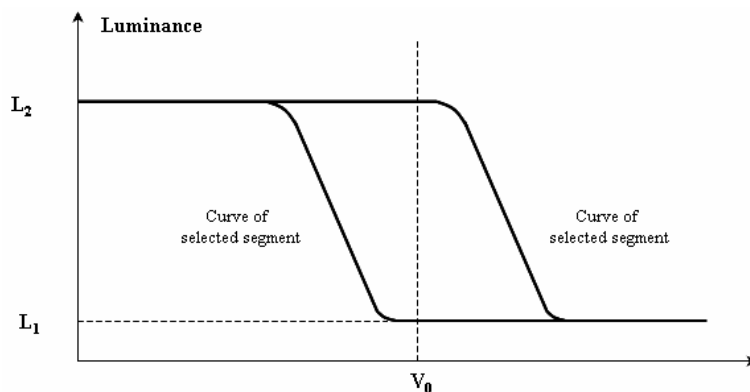


Fig.4 Electro-optical characteristic (EOC) graph (positive type)

10.6 Definition of response time

Turn on time (rise time): $t_{on} = t_d + t_r$ (from non-selected state to selected state)

Turn off time (fall time): $t_{off} = t_D + t_R$ (from selected state to non-selected state)

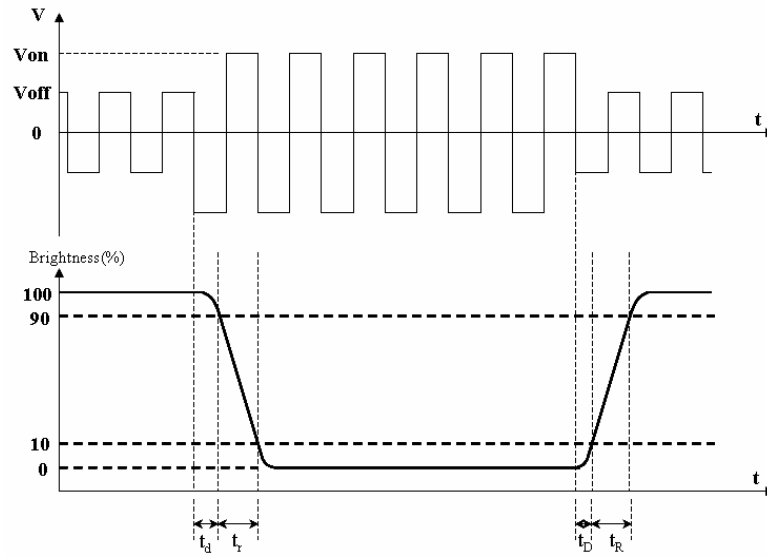


Fig.5 Definition of response time (positive type)

10.7 Definition of viewing angle

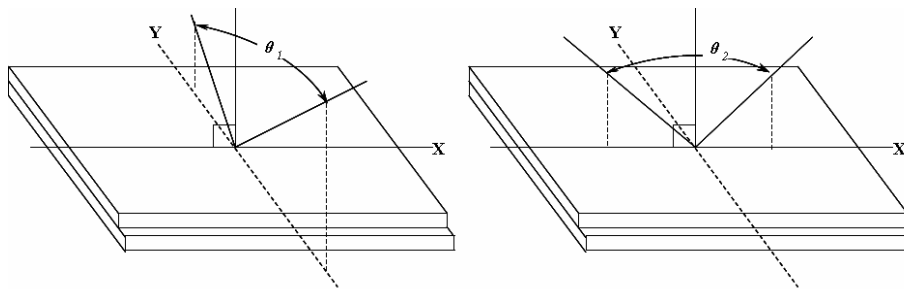


Fig 6 Definition of viewing angle

θ_1 ——range of viewing angle from up to down θ_2 ——range of viewing angle from left to right.

11 Reliability

11.1 Content of Reliability Test

Ta=25°C

| No | Test Item | Test condition | Criterion |
|----|---------------------------------------|---|---|
| 1 | High Temperature Storage | 80°C±2°C 120H Restore 2H at 25°C Power off | After testing, cosmetic and electrical defects should not happen. |
| 2 | Low Temperature Storage | -30°C±2°C 120H Restore 2H at 25°C Power off | |
| 3 | High Temperature Operation | 70°C±2°C 120H Restore 2H at 25°C Power on | |
| 4 | Low Temperature Operation | -20°C±2°C 120H Restore 2H at 25°C Power on | |
| 5 | High Temperature & Humidity Operation | 40°C±2°C 90%RH 120H Power on | |
| 6 | Temperature Cycle | -30°C→25°C→70°C 30min 5min 30min after 10cycle, Restore 2H at 25°C Power off | |
| 7 | Vibration Test | 10Hz~150Hz, 50m/s ² , 40min | |
| 8 | Shock Test | Half-sine wave, 100m/s ² , 11ms | |

Notes:

1. Each test item applies for a test sample only once, The test sample can not be used again in any other test item.
2. The test sample is inspected after 2 hours or more storing at room temperature and room humidity after each test item is finished.
3. The criteria refer to 11.2.

11.2 Inspection of criteria

| Remark NO. | Content |
|-------------------|---|
| 1 | Functional test is OK. Missing Segment, shorts, unclear segment, nondisplay, display abnormally, liquid crystal leak are unallowable. |
| 2 | After testing, cosmetic defects should not happen, no low temperature bubbles, seal loose and fall, frame rainbow, ACF bubble growing are unallowable in the appearance test. |
| 3 | Total current consumption should not be over double of initial value. |
| 4 | After tests being executed, Contrast must be larger than 70% of its initial value prior to the tests. |
| 5 | No glass crack, chipped glass, end seal loose frame crack and so on. |
| 6 | No structure loose and fall. |

12 Package

TBD

13 Quality level

13.1 Classification of defects

Major defects (MA): A major defect refers to a defect that may substantially degrade usability for product applications, including all functional defects (such as no display, abnormal display, open or missing segment, short circuit, missing component), outline dimension beyond the drawing, progressive defects and those affecting reliability.

Minor defects (MI): A minor defect refers to a defect which is not considered to be able to substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation, such as black spot, white spot, bright spot, pinhole, black line, white line, contrast variation, glass defect, polarizer defect, etc.

13.2 Definition of inspection range

| | |
|--|---|
| <p>For LCD defects, dividing two areas to make a judgment (according figure 1).</p> <p>A zone : Inside Viewing area B zone : Outside Viewing area</p> <p>X1(A.A~V.A): 2.5mm X2(A.A~V.A): 2.5mm Y1(A.A~V.A): 2.5mm Y2(A.A~V.A): 2.5mm</p> | <p style="text-align: center;">Figure 1</p> |
|--|---|

13.3 Inspection items and general notes

| | | |
|-------------------------|--|--|
| <p>General notes</p> | <p>①Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and Multi-Inno.</p> <p>②Viewing area should be the area which Multi-Inno guarantees.</p> <p>③Limit sample should be prior to this Inspection standard.</p> <p>④Viewing judgment should be under static pattern.</p> <p>⑤Inspection conditions Inspection distance: 250 mm (from the sample) Temperature : 25±5 °C Inspection angle : 45 degrees in 6 o'clock direction (all defects in viewing area should be inspected from this direction)</p> | |
| <p>Inspection items</p> | <p>Pinhole, Bright spot, Black spot, White spot, Black line, White Line, Foreign particle, Bubble</p> | <p>The color of a small area is different from the remainder. The phenomenon doesn't change with voltage</p> |
| | <p>Contrast variation</p> | <p>The color of a small area is different from the remainder. The phenomenon changes with voltage</p> |
| | <p>Polarizer defect</p> | <p>Scratch, Dirt, Particle, Bubble on polarizer or between polarizer and glass</p> |
| | <p>Functional defect</p> | <p>no display, display abnormally, open or missing segment, short circuit, False viewing direction</p> |

| | | |
|--|----------------|---|
| | Glass defect | Glass crack, Shaved corner of glass, Surplus glass |
| | Segment defect | Pin holes or cracks in segment, Transformation of segment |
| | PCB defect | Components assembly defect |

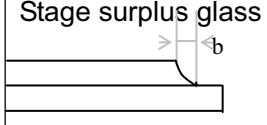
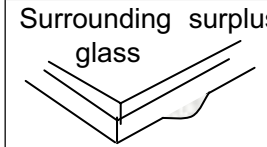
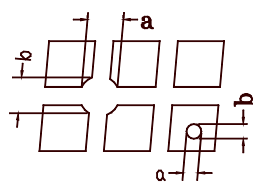
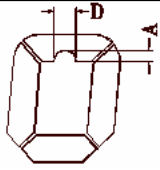
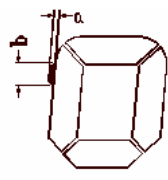
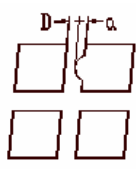
13.4 Outgoing Inspection level

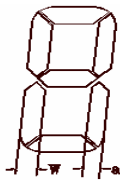
| Outgoing Inspection standard | Inspection conditions | Inspection | | | | |
|------------------------------|------------------------|------------|------|------|----|------|
| | | Min. | Max. | Unit | IL | AQL |
| Major Defects | See 13.3 general notes | See 13.5 | | | II | 0.65 |
| Minor Defects | See 13.3 general notes | See 13.5 | | | II | 1.5 |

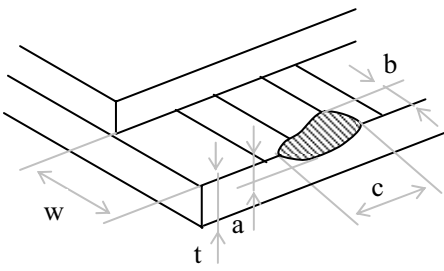
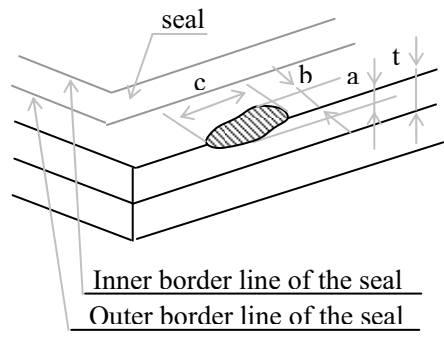
Note: Sampling standard conforms to GB2828

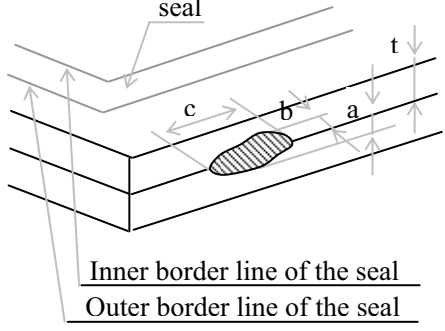
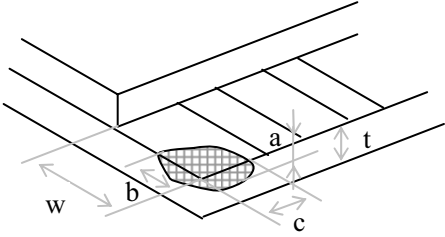
13.5 Inspection Items and Criteria

| Inspection items | | | Judgment standard | | | | |
|------------------|---|---|-----------------------------|--------------------------------------|-------------------|-----------|--|
| | | | Category | | Acceptable number | | |
| | | | | | A zone | B zone | |
| 1 | Black spot, White spot, Bright Spot, Pinhole, Foreign Particle, Particle in or on glass, Scratch on glass | | A | $\Phi \leq 0.10$ | Neglected | | |
| | | | B | $0.10 < \Phi \leq 0.20$ | 3 | Neglected | |
| | | | C | $0.20 < \Phi$ | 0 | | |
| 2 | Black line, White line, Particle Between Polarizer and glass, Scratch on glass | | A | $W \leq 0.02$ | Neglected | | |
| | | | B | $0.02 < W \leq 0.05$ $L \leq 3.0$ | 3 | Neglected | |
| | | | C | $W > 0.05$ or $L > 3.0$ | 0 | | |
| 3 | Contrast variation | | A | $\Phi \leq 0.2$ | Neglected | | |
| | | | B | $0.2 < \Phi \leq 0.3$ | 2 | Neglected | |
| | | | C | $0.3 < \Phi \leq 0.4$ | 1 | Neglected | |
| | | | D | $0.4 < \Phi$ | 0 | | |
| | | | Total defective point(B,C) | | 3 | | |
| 4 | Bubble inside cell | | any size | | none | none | |
| 5 | Polarizer defect (if Polarizer is used) | Scratch, damage on polarizer, Particle on polarizer or between polarizer and glass. | Refer to item 1 and item 2. | | | | |
| | | Bubble, dent and | A | $\Phi \leq 0.3$ | Neglected | Neglected | |

| | | | | | | |
|--------------------|--|--|--|---|---|-----------------------|
| | | convex | B | $0.3 < \Phi \leq 0.7$ | 2 | d |
| | | | C | $0.7 < \Phi$ | 0 | |
| 6 | Surplus glass | Stage surplus glass  | $b \leq 0.3\text{mm}$ | | | |
| | | Surrounding surplus glass  | Should not influence outline dimension and assembling. | | | |
| 7 | Open segment or open common | | Not permitted | | | |
| 8 | Short circuit | | Not permitted | | | |
| 9 | False viewing direction | | Not permitted | | | |
| 10 | Contrast ratio uneven | | According to the limit specimen | | | |
| 11 | Crosstalk | | According to the limit specimen | | | |
| 12 | Black /White spot(display) | | Refer to item 1 | | | |
| 13 | Black /White line(display) | | Refer to item 2 | | | |
| 14 | Pin holes and cracks in segment |  | not counted | Max.3 dots allowed | | Max.3 dots allowed |
| | | | $x < 0.1\text{mm}$ | $0.1\text{mm} \leq x \leq 0.2\text{mm}$ | | |
| | | | $x = (a+b)/2$ | | | |
| | |  | not counted | Max.2 dots allowed each segment | | |
| $A < 0.1\text{mm}$ | $0.1\text{mm} \leq A \leq 0.2\text{mm}$ $D < 0.25\text{mm}$ | | | | | |
| 15 | Transformation of segment |  | not counted | Max.1 defect allowed each segment | | Max.3 defects allowed |
| | | | $x < 0.1\text{mm}$ | $0.1\text{mm} \leq x \leq 0.2\text{mm}$ | | |
| | | | $x = (a+b)/2$ | | | |
| | |  | not counted | Max.1 defect allowed each segment | | |
| $a < 0.1\text{mm}$ | $0.1\text{mm} \leq a \leq 0.2\text{mm}$ $D > 0$ | | | | | |

| | | | | |
|--|--|---|--|-----------------------|
| | |  | $0.8W \leq a \leq 1.2W$ a=measured value of width W=nominal value of width | Max.2 defects allowed |
|--|--|---|--|-----------------------|

| Inspection items | | Judgment standard | | |
|------------------|--|--|--|-----------------------|
| | | Category(application: B zone) | Acceptable number | |
| 16 | Glass defect crack | ①The front of lead terminals  | A $a \leq t, b \leq 1/5W, c \leq 3\text{mm}$ | Max.3 defects allowed |
| | | B Crack at two sides of lead terminals should not cover patterns and alignment mark | | |
| | ②Surrounding crack—non-contact side  | $b < \text{Inner borderline of the seal}$ | | |

| | | | | | |
|--|--|---|----------|---|--|
| | | <p>③ Surrounding crack— contact side seal</p>  <p>$b < \text{Outer border line of the seal}$</p> | | | |
| | | <p>④ Corner</p>  | <p>A</p> | <p>$a \leq t, b \leq 3.0, c \leq 3.0$</p> | |
| | | | <p>B</p> | <p>Glass crack should not cover patterns u and alignment mark and patterns.</p> | |

| Inspection items | | Judgment standard | |
|------------------|------------|---|--|
| | | Category(application: B zone) | |
| 17 | PCB defect | <p>Component soldering: No cold soldering、short、open circuit、burr、tin ball The flat encapsulation component position deviation must be less than 1/3 width of the pin (Pic.1); the sheet component deviation: Pin deviates from the pad and contact with the near components is not permitted (Pic.2)</p> | |
| | | <p>lead defect: The lead lack must be less than 1/3 of its width; The lead burr must be less than 1/3 of the seam; Impurities connect with the near leads is not permitted</p> | |
| | | <p>Connector soldering: Soldering tin is at contact position of the plug and socket is not permitted No foundation is scald Serious cave distortion on plug and socket contact pin is not permitted</p> | |
| | | <p>Glue on root of the speaker receiver and motor lead: The insulative coat of the lead must join into the PCB; the protected glue must envelop to the insulative coat.</p> | |

14 Precautions for Use of LCD Modules

14.1 Handling Precautions

- 14.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 14.1.2 Liquid in LCD is hazardous substance, if the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, thoroughly and promptly wash it off using soap and water.
- 14.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 14.1.4 Don't touch, push or rub the exposed polarizer covering the display surface of the LCD module with anything harder than an HB pencil lead, the polarizer is soft and easily scratched, handle it carefully.
- 14.1.5 Don't put or attach anything on the display area to avoid leaving any marks on.
- 14.1.6 If the display surface is contaminated or becomes dusty, breathe on the surface and gently wipe it with a soft dry cloth. do not scrub hard to avoid damage the surface. If still not completely clear, moisten cloth with one of the following solvents:
- Isopropyl alcohol
 - Ethyl alcohol
- Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:
- Water
 - Ketone
 - Aromatic solvents
- 14.1.7 Do not attempt to disassemble the LCD Module.
- 14.1.8 If the logic circuit power is off, do not apply the input signals.
- 14.1.9 Avoid using the same display pattern long time (continuous ON segment).Software must be prepared so that the pattern will be changed
- 14.1.10 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
- a. Be sure to ground the body and electric appliances when handling the LCD Modules. It is preferable to use conductive mat on table and wear cotton clothes or conductive processed fibre. Synthetic fibre is not recommended.
 - b. Tools required for assembly, such as soldering irons, must be properly ground.
 - c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - d. The LCD Module is coated with a film to protect the display surface. Be careful and slow when peeling off this protective film since static electricity may be generated. It is recommended to use ionic fan or machine when operating. It is recommended to remove the protection foil slowly (> 3 sec.).
 - e. It is preferable to wear gloves etc, to avoid damaging the LCD. Please do not touch electrodes with bare hands or avoid any other contamination.

14.2 Storage precautions

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

14.2.2 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 : $5^{\circ}\text{C} \sim 40^{\circ}\text{C}$

Relatively humidity: $\leq 80\%$

14.2.3 The LCD modules should be stored in a clean environment or room, free from acid, alkali and harmful gas.

14.2.4 Store the module in anti-static electricity container and without any physical load.

14.3 Transportation precautions

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

14.4 Soldering

14.4.1 Use the high quality solders, only solder the I/O terminals.

14.4.2 No higher than 280°C and time less than 3-4 second during soldering.

14.4.3 Rewiring: no more than 3 times.

14.4.4 when you remove connector or cable soldered to I/O terminals, please confirm that solder is fully melted. If you remove by force, electrodes at I/O terminals may be damaged (or stripped off). It is recommended to use solder suction machine.