



PRODUCTION SPECIFICATION FOR SP0096 (12864) MWN-01AOR (3~5V)

(Version 1.0)

Optional model:

| Part Number | Descriptions | Interface |
|----------------------------|------------------------|-----------|
| SP0096(12864)MWN-01AOR(3V) | OLED/White/SPIVDD:3.3V | PIN |
| SP0096(12864)MWN-01AOR(5V) | OLED/White/SPIVDD:5.0V | PIN |

Note:

1. Please contact the Sales Department to get more details.

SALES DEPARTMENT:

TEL: 010-80750102 /03 /04 - SALES

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北京集粹电子设备制造有限公司

RECORDS OF REVISION

| REVISED NO | DATA | PREPAIRED | REVISED DESCRIPTIONS | APPROVED |
|------------|------------|-----------|----------------------|-----------|
| 1 | 2016-10-09 | Liujun Li | FIRST ISSUE | Peng Zhao |



CONTENTS

| | |
|--|----|
| 1. MECHANICAL DATA | 4 |
| 2. ABSOLUTE MAXIMUM RATINGS | 4 |
| 3. ELECTRICAL CHARACTERISTICS | 5 |
| 4. AC CHARACTERISTICS | 6 |
| 5. BLOCK DIAGRAM | 6 |
| 6. TIMING CHARACTERISTICS | 7 |
| 7. COMMAND TABLE | 8 |
| 8. RELIABILITY TEST | 8 |
| 9. INTERNAL PIN CONNECTIONS | 9 |
| 10. DIMENSIONAL OUTLINE | 10 |
| 11. PRECAUTIONS IN USE OF OLED MODULE | 11 |
| 12. RECOMMENDED SOFTWARE INITIALIZATION | 12 |

1. MECHANICAL DATA

| Item | Contents | Unit |
|-----------------------------------|----------------------|------|
| OLED Mounting mode | COG+FPC+PCB | |
| Display Format | 128×64 Dot-matrix | |
| Active Area | 21.74(W)×10.86(H) | mm |
| OLED Module size | 32(W)×30(H)×4.0(MAX) | mm |
| Dot Size | 0.154(W)×0.154(H) | mm |
| Dot Pitch | 0.17(W)×0.17(H) | mm |
| OLED controller /driver | SSD1306BZ | |
| OLED module Operation temperature | -40~+70 | °C |
| OLED module Storage temperature | -40~+85 | °C |
| Diagonal A/A Size | 0.96 | inch |
| Viewing directive | 160° | |
| Contrast | 2000:1 | |

2. ABSOLUTE MAXIMUM RATINGS

| Item | Min | Max | Unit | Condition | Remark |
|----------------------------|--------|-----|------|---|---------------------------|
| Logic supply voltage (VDD) | -0.3 | 4 | V | Ta = 25°C | for 3V products |
| Logic supply voltage (VDD) | -0.3 | 6 | V | Ta = 25°C | for 5V products |
| Operating Temp. | -40 | 70 | °C | - | - |
| Storage Temp | -40 | 85 | °C | - | Note (1) |
| Humidity | - | 85 | % | - | - |
| Life Time | 27,000 | - | Hrs | 70 cd/m ² , 50% checkerboard | (Charge pump) Note (2) |
| Life Time | 24,000 | - | Hrs | 80 cd/m ² , 50% checkerboard | (Charge pump) Note (3) |

Note:

- (1) The defined temperature ranges do not include the polarizer. The maximum withstood temperature of the polarizer should be 80°C.
- (2) Setting of 70 cd/m²: (Charge Pump)
 - Contrast setting: 0x42
 - Frame rate: 105Hz
 - Duty setting: 1/64
 Life time is defined the amount of time when the luminance has decayed to less than 50% of the initial measured luminance.
- (3) Setting of 80 cd/m²: (Charge Pump)
 - Contrast setting: 0x66

- Frame rate: 105Hz
- Duty setting: 1/64

Life time is defined the amount of time when the luminance has decayed to less than 50% of the initial measured luminance.

3. ELECTRICAL CHARACTERISTICS

3.1 ELECTRICAL CHARACTERISTICS

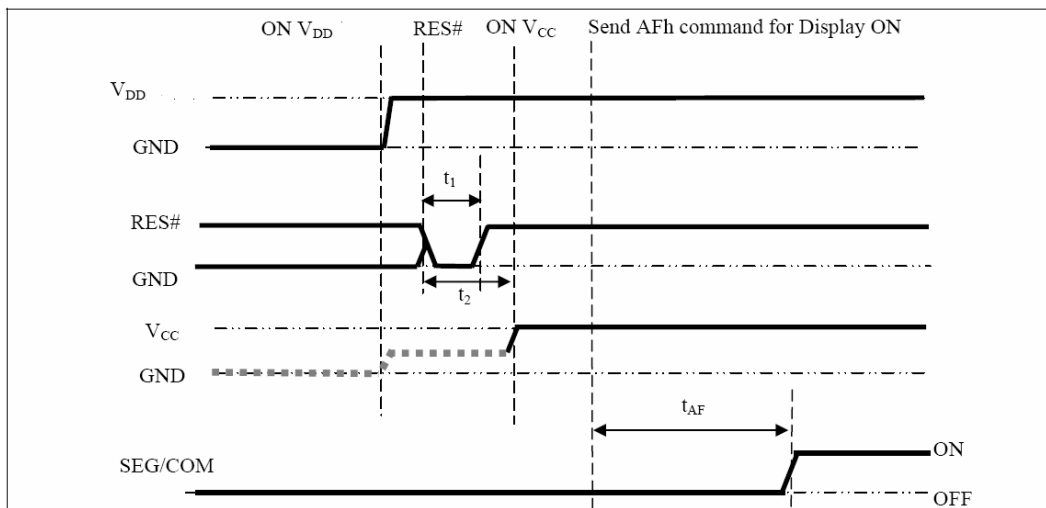
V_{SS}=0V

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|--------|-------------------------|---------------------------|----------|-------------------|---------|------|
| VDD | Logic Supply Voltage | for 3V products | 2.7 | 3.3 | 3.5 | V |
| VDD | Logic Supply Voltage | for 5V products | 4.5 | 5.0 | 5.5 | V |
| VOH | High Logic Output Level | IOUT = 100uA, 3.3MHz | 0.9* VDD | - | VDD | V |
| VOL | Low Logic Output Level | IOUT = 100uA, 3.3MHz | 1 | - | 0.1*VDD | V |
| VIH | High Logic Input Level | - | 0.8* VDD | - | - | V |
| VIL | Low Logic Input Level | - | 0 | - | 0.2*VDD | V |
| IDD | VDD Supply Current | Contrast=7F Display ON | - | 15(50% Pixels) | - | mA |

3.2 Power、Signal Sequence

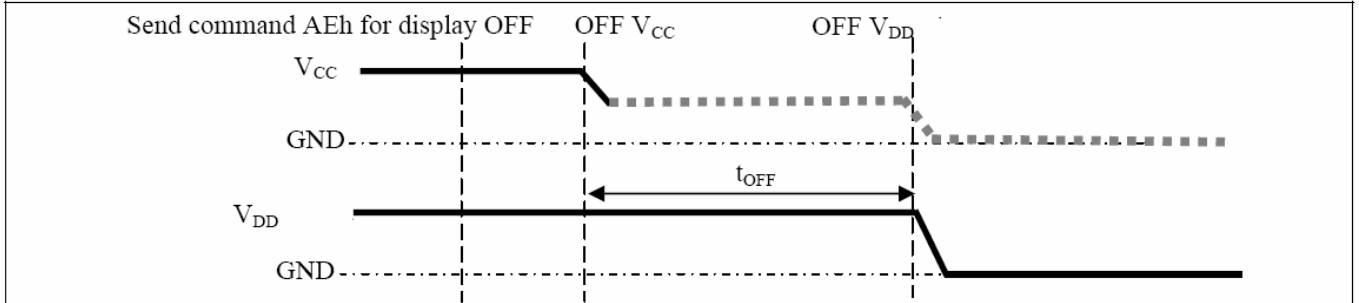
Power ON Sequence:

1. Power ON VDD
2. After VDD, become stable, set RES# pin LOW (logic low) for at least 3us (t₁) (4) and then HIGH (Logic high).
3. After set RES# pin LOW (logic low), wait for at least 3us (t₂). Then Power ON VCC (1).
4. After VCC become stable, send command AFh for display ON. SEG/COM will be ON after 100ms (t_{AF}).



Power OFF Sequence:

1. Send command AEh for display OFF.
2. Power OFF VCC (1), (2), (3).
3. Wait for t_{OFF}. Power OFF VDD (where Minimum t_{OFF}=0ms (5), Typical t_{OFF}=100ms)



Note:

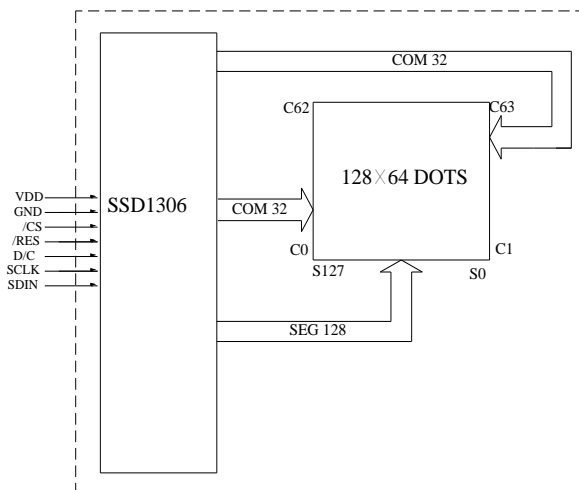
- (1) Since an ESD protection circuit is connected between VDD and VCC, VCC becomes lower than VDD whenever VDD is ON and VCC is OFF as shown in the dotted line of VCC in above figures.
- (2) VCC should be kept float (disable) when it is OFF.
- (3) Power Pins (VDD, VCC) can never be pulled to ground under any circumstance.
- (4) The register values are reset after t₁.
- (5) VDD should not be Power OFF before VCC Power OFF

4. AC CHARACTERISTICS

VDD = 2.7V to 3.5V TA = 25° C

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|--------|---|----------------|-----|-----|-----|------|
| FOSC | Oscillation Frequency of Display Timing Generator | VDD= 2.7V | 330 | 370 | 407 | kHz |
| RES | Reset LOW pulse width | | 3 | | | us |
| | Reset complete time | | 3 | | | us |

5. BLOCK DIAGRAM

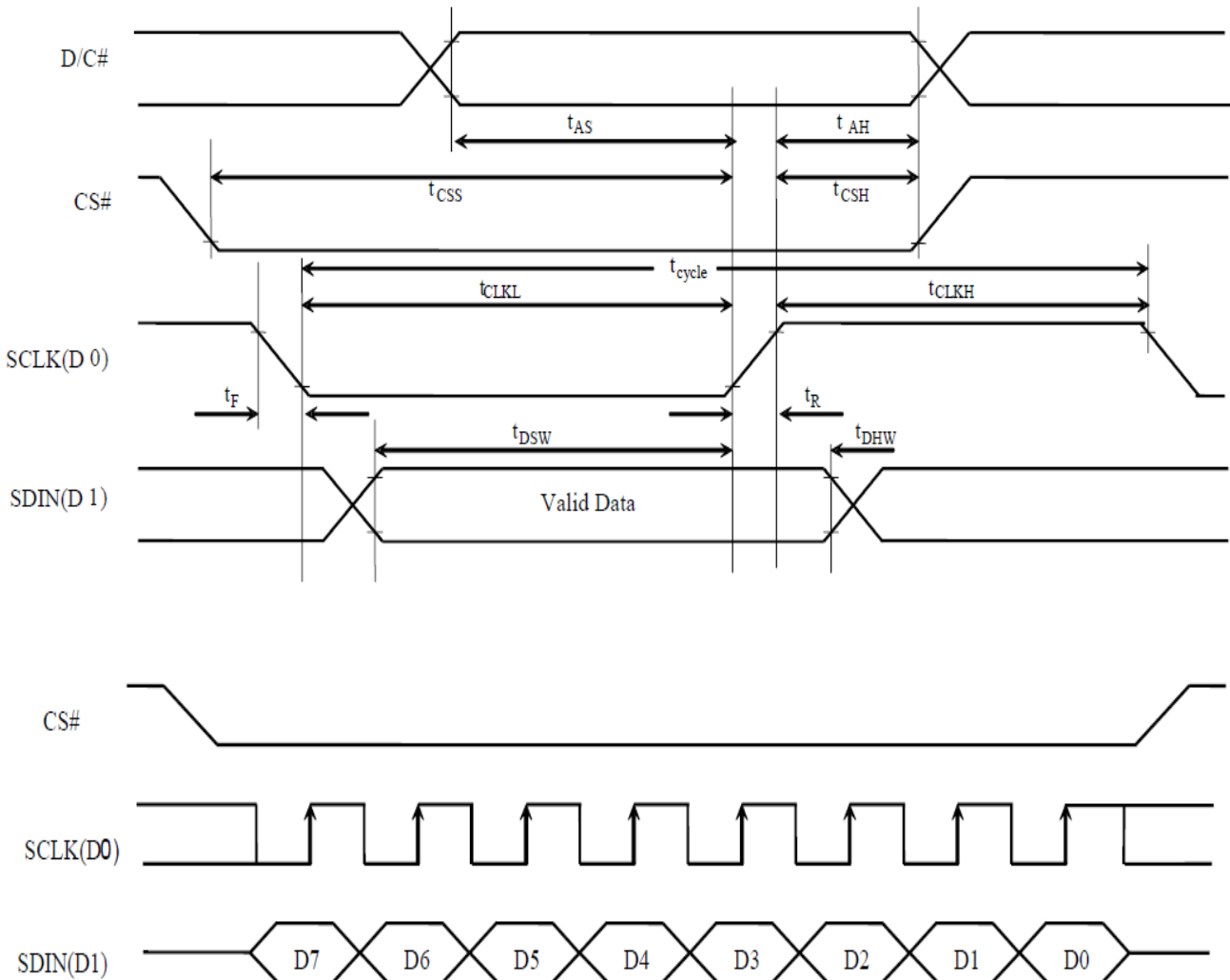


6. TIMING CHARACTERISTICS

4-wire Serial Interface Timing Characteristics

($V_{DD} - V_{SS} = 1.65V$ to $3.3V$, $T_A = 25^\circ C$)

| Symbol | Parameter | Min | Typ | Max | Unit |
|-------------|------------------------|-----|-----|-----|------|
| t_{cycle} | Clock Cycle Time | 100 | - | - | ns |
| t_{AS} | Address Setup Time | 15 | - | - | ns |
| t_{AH} | Address Hold Time | 15 | - | - | ns |
| t_{CSS} | Chip Select Setup Time | 20 | - | - | ns |
| t_{CSH} | Chip Select Hold Time | 10 | - | - | ns |
| t_{DSW} | Write Data Setup Time | 15 | - | - | ns |
| t_{DHW} | Write Data Hold Time | 15 | - | - | ns |
| t_{CLKL} | Clock Low Time | 20 | - | - | ns |
| t_{CLKH} | Clock High Time | 20 | - | - | ns |
| t_R | Rise Time | - | - | 40 | ns |
| t_F | Fall Time | - | - | 40 | ns |





7. COMMAND TABLE

Refer to SSD1306BZ IC Spec.

8. RELIABILITY TEST

Vdd=3.3V Ta=25°C

| No. | Items | Specification | Quantity |
|-----|--|---|----------|
| 1 | High temp. (Non-operation) | 85°C, 240hrs | 5 |
| 2 | High temp. (Operation) | 70°C, 120hrs | 5 |
| 3 | Low temp. (Operation) | -40°C, 120hrs | 5 |
| 4 | High temp. / High humidity (Operation) | 65°C, 90%RH, 120hrs | 5 |
| 5 | Thermal shock (Non-operation) | -40°C ~85°C (-40°C /30min;transit /3min; 85°C /30min; transit/3min) 1cycle: 66min, 100 cycles | 5 |
| 6 | Vibration | Frequency : 5~50HZ, 0.5G Scan rate : 1 oct/min Time : 2 hrs/axis Test axis : X, Y, Z | 1 Carton |
| 7 | Drop | Height: 120cm Sequence : 1 angle、3 edges and 6 faces Cycles: 1 | 1 Carton |
| 8 | ESD (Non-operation) | Air discharge model, ±8kV, 10 times | 5 |

Test and measurement conditions

1. All measurements shall not be started until the specimens attain to temperature stability, the stable Time is at least 15 minutes.
2. The degradation of polarizer is ignored for item 5.
3. The tolerance of temperature is $\pm 3^{\circ}\text{C}$, and the tolerance of relative humidity is $\pm 5\%$.

Evaluation criteria

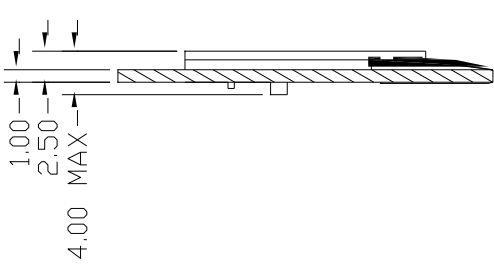
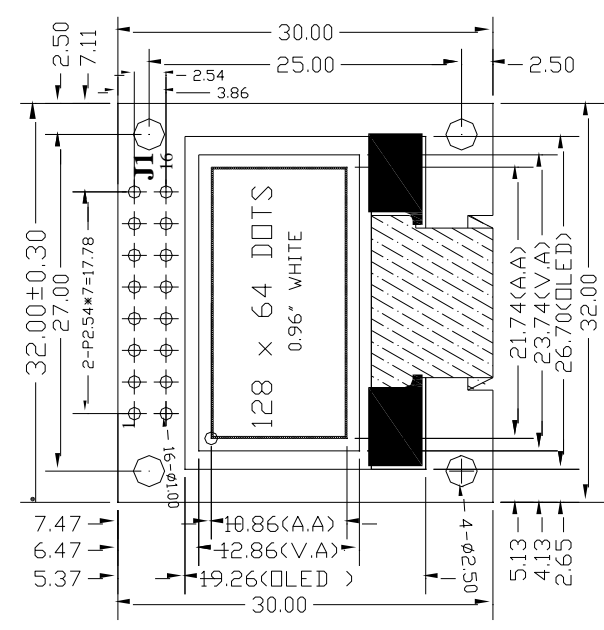
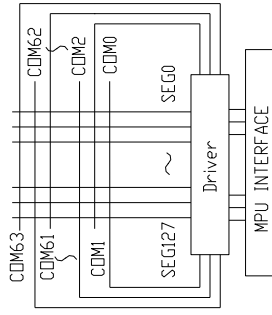
1. The function test is OK.
2. No observable defects.
3. Luminance: $\geq 50\%$ of initial value.
4. Current consumption: within $\pm 50\%$ of initial value.



9. INTERNAL PIN CONNECTIONS

| Pin No. | Symbol | Level | Function |
|---------|--------|-------|--|
| 1 | VDD | P | Power supply pin for core logic operation. |
| 2 | GND | P | Power ground |
| 3 | /CS | I | Chip Select, active low. I |
| 4 | /RES | I | Reset, active low. |
| 5 | D/C | I | Data /Command Control PIN.H: Data; L: Command. |
| 6-7 | NC | - | No Connection |
| 8 | SCLK | I | Serial Clock Input |
| 9 | SDIN | I | Serial Data Input |
| 10-15 | NC | - | No Connection |
| 16 | GND | P | Power ground |

10. DIMENSIONAL OUTLINE

| <p>CUSTOMER'S MODEL NO.:</p> <p>CUSTOMER APPROVED:</p> <p>DATE:</p> | <p>Pin</p> <p>Pin Description</p> | <p>J1</p> <table border="1" style="width:100%; border-collapse: collapse;"> <tr><td>1</td><td>VDD</td></tr> <tr><td>2</td><td>GND</td></tr> <tr><td>3</td><td>/CS</td></tr> <tr><td>4</td><td>/RES</td></tr> <tr><td>5</td><td>D/C</td></tr> <tr><td>6</td><td>NC</td></tr> <tr><td>7</td><td>NC</td></tr> <tr><td>8</td><td>SCLK</td></tr> <tr><td>9</td><td>SDIN</td></tr> <tr><td>10</td><td>NC</td></tr> <tr><td>11</td><td>NC</td></tr> <tr><td>12</td><td>NC</td></tr> <tr><td>13</td><td>NC</td></tr> <tr><td>14</td><td>NC</td></tr> <tr><td>15</td><td>NC</td></tr> <tr><td>16</td><td>GND</td></tr> </table> | 1 | VDD | 2 | GND | 3 | /CS | 4 | /RES | 5 | D/C | 6 | NC | 7 | NC | 8 | SCLK | 9 | SDIN | 10 | NC | 11 | NC | 12 | NC | 13 | NC | 14 | NC | 15 | NC | 16 | GND |
|---|-----------------------------------|---|-----------------|------------|-------------|---|---------------------|---------------------|---------------------------|-------------------------|--------------------------|-----|---|----|---|----|---|------|---|------|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| 1 | VDD | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | GND | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | /CS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | /RES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | D/C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | NC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | NC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | SCLK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | SDIN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | NC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | NC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | NC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | NC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | NC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | NC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | GND | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | |  <p style="text-align: center;">DETAIL DOTS</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>VER: 1.0</p> <p>REVISION RECORD</p> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>DATE</th> <th>REVISION RECORD</th> </tr> <tr> <td>2016.10.09</td> <td>FIRST ISSUE</td> </tr> </table> | | DATE | REVISION RECORD | 2016.10.09 | FIRST ISSUE | <p>oled specification</p> <table border="1" style="width:100%; border-collapse: collapse;"> <tr><td>RESPONSE TIME: 10ms</td></tr> <tr><td>DRIVER IC : SSDI306</td></tr> <tr><td>OPERATING TEMP: -40C~+70C</td></tr> <tr><td>STORAGE TEMP: -40C~+85C</td></tr> <tr><td>GENERAL TOLERANCE: ± 0.3</td></tr> </table> | RESPONSE TIME: 10ms | DRIVER IC : SSDI306 | OPERATING TEMP: -40C~+70C | STORAGE TEMP: -40C~+85C | GENERAL TOLERANCE: ± 0.3 | | | | | | | | | | | | | | | | | | | | | | | |
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| 2016.10.09 | FIRST ISSUE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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11. PRECAUTIONS IN USE OF OLED MODULE

A.OLED MODULE

▼Precautions for handling OLED modules

Our OLED has been assembled and adjusted accurately before delivery; therefore, observe the following points for handling:

- (1) Do not subject it to excessive shocks by dropping it.
- (2) Do not modify the tab of the metal holder nor make any arrangement to it.
- (3) Do not work on the printed circuit board
- (4) Limit the soldering to the printed circuit board only to I/O terminals.
- (5) Do not touch the connection rubber (inter-connector), nor modify its location.

▼warning for static electricity

Our OLED uses CMOS LSI. Therefore, countermeasures for static electricity are taken through all the process from manufacturing into shipping. When using, taken sufficient care to prevent static electricity as in the case of a normal CMOSIC.

- (1) Do not take OLED from its packing bag until it is assembled.

OLED are individually packing in bags treated to resist static electricity. Control them so they are not taken out of the bag until just before the soldering operation for the OLED terminals. When storing them keep them as packed in the bags, or store them in a container processed to be resistant to static electricity, or in an electric conductive container.

- (2) Always use a human body grounded when handling OLED.

Always apply grounding to your body while you are working with OLED from the time it is taken out of the anti-static bag until it is assembled in a set to keep the human body and OLED at the same potential. When it is necessary to transfer OLED after it is taken out of the bag, always place it in a electric conductive container.

Moreover, avoid wearing clothes of chemical fiber. Cotton or conductive treated fiber clothes are recommended.

- (3) Use a no-leak iron for soldering OLED.

The soldering iron to be used for soldering of I/O terminals OLED, is to be insulated at the iron tip, or grounded at the iron tip.

- (4) Grounded electrical apparatus are always required for assembly .Electrical apparatus required to assemble OLED in set, especially electric drivers, are to be grounded to avoid the efforts of transmitting spike noise generated when the motor is rotated.

- (5) Make the potential of operation bench equal to the grounded potential.

When the operation bench is grounded with aluminum or steel plate, there is a possibility of damaging the OLED, or in rare cases of electric shocks being generated because the impedance is too low; therefore, it is recommended to use an electric conductive (rubber) mat.

- (6) Peel off the OLED protective film slowly.

Our OLED are attached with protective film to protect the display surface from contamination, flaw, adhesion of flux, etc, however, peeling it off abruptly may cause some static electricity to be generated, so pay attention when peeling off the tape slowly.

12. RECOMMENDED SOFTWARE INITIALIZATION

```
void wr_lcd (uchar dat_comm, uchar content)
{
    // chk_busy ();
    CS=0;
    if (dat_comm)
    {
        RS=1; //data
    }
    else
    {
        RS=0; //command
    }
    RE=1;
    RW=0; //write
    DATA_PORT=content; //output data or comm
    // delay(5);
    RW=1;
    CS=1;
    //delay (50);
}
wr_lcd (comm, 0xAE); //Set Display Off
wr_lcd (comm, 0xD5); //Set Display Clock Divide Ratio/Oscillator Frequency
wr_lcd (comm, 0x80);
wr_lcd (comm, 0xA8); //Set Multiplex Ratio
wr_lcd (comm, 0x3F);
wr_lcd (comm, 0xD3); //Set Display Offset
wr_lcd (comm, 0x00);
wr_lcd (comm, 0x40); //Set Display Start Line
wr_lcd (comm, 0xA0); //0xA1 Set Segment Re-Map
wr_lcd (comm, 0xC0); //0xC8 Set COM Output Scan Direction
wr_lcd (comm, 0xDA); //Set COM Pins Hardware Configuration
wr_lcd (comm, 0x12);
wr_lcd (comm, 0x81); //Set Contrast Control
wr_lcd (comm, 0x7F);
wr_lcd (comm, 0xD9); //Set Pre-Charge Period
wr_lcd (comm, 0xF1);
wr_lcd (comm, 0xDB); // Set VCOMH Deselect Level
wr_lcd (comm, 0x40);
wr_lcd (comm, 0xA4); //Set Entire Display On/off
wr_lcd (comm, 0xA6); //Set Normal/Inverse Display
//Clear Screen
```



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```
wr_lcd (comm, 0x8D); // Set Charge Pump  
wr_lcd (comm, 0x14);  
wr_lcd (comm, 0xAF); // Set Display On  
//Power Stabilized (100ms Delay Recommended)  
wr_lcd (comm, 0x20); //Set Memory Addressing Mode //  
wr_lcd (comm, 0x02);
```