



**SPECIFICATIONS
FOR LCD MODULE**

| | |
|--------------------|---------------|
| MATRIX ORBITAL NO. | MOP-GL240128D |
|--------------------|---------------|

DOCUMENT REVISION HISTORY:

| DATE | PAGE | DESCRIPTION |
|------------|--------|---------------|
| 2006-10-7. | - - | First release |

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1. Precautions in use of LCD Modules

- (1) Avoid applying excessive shocks to the module or making any alterations or modifications to it.
- (2) Don't make extra holes on the printed circuit board, modify its shape or change the components of LCD module.
- (3) Don't disassemble the LCM.
- (4) Don't operate it above the absolute maximum rating.
- (5) Don't drop, bend or twist LCM.
- (6) Soldering: only to the I/O terminals.
- (7) Storage: please storage in anti-static electricity container and clean environment.

2. General Specification

| Item | Dimension | Unit |
|-----------------------------------|------------------------------------|-------------|
| Number of Dots | 240 x 128 | □ |
| Module dimension(None Backlight) | 144.0 x 104.0 x 13.0□MAX□ | mm |
| Module dimension(With Backlight) | 144.0 x 104.0 x 15.0□MAX□ | mm |
| View area | 114.0 x 64.0 | mm |
| Active area | 107.95 x 57.55 | mm |
| Dot size | 0.40 x 0.40 | mm |
| Dot pitch | 0.45x 0.45 | mm |
| LCD type | STN | |
| Duty | 1/128 | |
| View direction | 6 o'clock or 12 o'clock | |
| Backlight Type | None, YELLOW-GREEN,WHITE backlight | |

3. Absolute Maximum Ratings

| Item | | Symbol | Min | Max | Unit |
|--------------------------|-----------------|---------------------------------|----------|---------|------|
| Input Voltage | | V_I | -0.3 | VDD+0.3 | V |
| Supply Voltage For Logic | | VDD-V _{SS} | -0.3 | 7.0 | V |
| Supply Voltage For LCD | | V _{DD} -V ₀ | Vdd-13.5 | 0 | V |
| Standard | Operating Temp. | Top | 0 | 50 | □ |
| Temperature LCM | Storage Temp. | Tstr | -10 | 60 | □ |
| Wide Temperature | Operating Temp. | Top | -20 | 70 | □ |
| LCM | Storage Temp. | Tstr | -30 | 80 | □ |

4. Electrical Characteristics

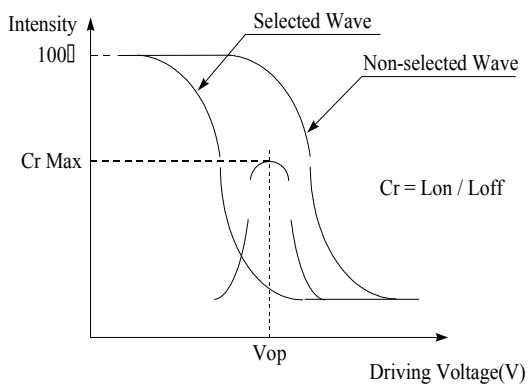
| Item | Symbol | Condition | Min | Typ | Max | Unit |
|--|----------------------------------|--|---------------------|------|---------------------|------|
| Supply Voltage For Logic | V _{DD} -V _{SS} | □ | 4.5 | 5.0 | 5.5 | V |
| Supply Voltage For LCD | V _{DD} -V ₀ | Ta=25□ | 18.0 | 18.5 | 19.0 | V |
| Input High Volt. | V _{IH} | □ | 0.7 V _{DD} | □ | V _{DD} | V |
| Input Low Volt. | V _{IL} | □ | V _{SS} | □ | 0.3 V _{DD} | V |
| Supply Current | I _{DD} | V _{DD} =5V | 8.5 | 9.5 | 12.5 | mA |
| Supply Voltage of Yellow-green backlight | V _{LED} | Forward current =720 mA Number of LED die 2x72= 144 | 3.8 | 4.2 | 4.3 | V |
| Supply Voltage of White backlight | V _{LED} | Forward current =90 mA | 2.9 | 3.1 | 3.3 | V |

5. Optical Characteristics

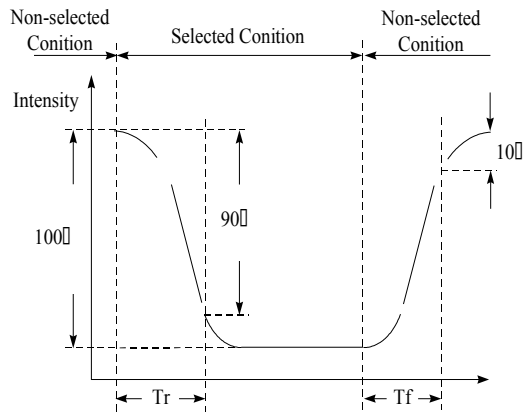
| Item | Symbol | Condition | Min | Typ | Max | Unit |
|----------------|--------------|----------------|-----------|-----------|-----------|-----------|
| View Angle | (V) θ | CR \square 2 | -20 | \square | 35 | deg |
| | (H) ϕ | CR \square 2 | -30 | \square | 30 | deg |
| Contrast Ratio | CR | \square | \square | 3 | \square | \square |
| Response Time | T rise | \square | \square | \square | 250 | ms |
| | T fall | \square | \square | \square | 250 | ms |

Definition of Operation Voltage (Vop)

Definition of Response Time (Tr, Tf)



[positive type]



[positive type]

Conditions :

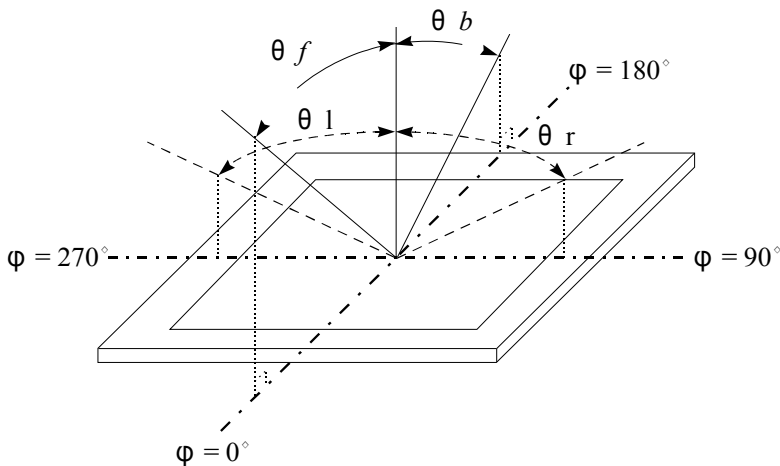
Operating Voltage : Vop

Viewing Angle(θ / ϕ) : 0° \square 0°

Frame Frequency : 64 HZ

Driving Waveform : 1/N duty , 1/a bias

Definition of viewing angle(CR \square 2)

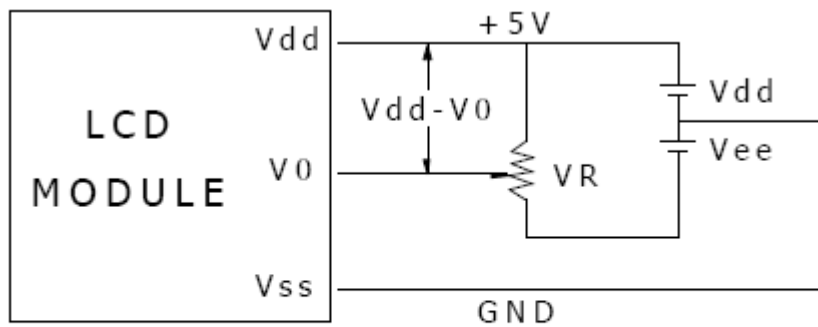


6. Interface Pin Function

| PIN CONNECTIONS(CN1) | | |
|----------------------|----------|---|
| PIN | SYMBOL | DESCRIPTION |
| 1 | LEDA | Anode for backlight |
| 2 | LEDK | Cathode for backlight |
| 3 | VSS | Ground |
| 4 | VDD | Supply voltage for LCD(+) |
| 5 | V0 | Supply voltage for LCD(-) |
| 6 | C/D | Data write/read |
| 7 | /RD | Read Data from T6963C |
| 8 | /WR | Write Data into T6963C |
| 9-16 | DB0-DB7 | Data Bus |
| 17 | /CE | CHIP Enable For T6963 |
| 18 | /RST | Reset |
| 19 | VEE | Negative Voltage Output |
| 20 | MD2 | Pins for selection of number of columns |
| 21 | FS | Pins for selection of font |
| 22 | NC | NO CONNECTER |
| 23 | LEDA | Anode for backlight |
| 24 | LEDK | Cathode for backlight |
| PIN CONNECTIONS(CN2) | | |
| 1 | FRM | Frame signal |
| 2 | CP | Shift clock pulse for column driver |
| 3 | LP | Latch pulse and Shift clock pulse |
| 4 | M | AC Signal For LCD Driver |
| 5 | VDD | Supply voltage |
| 6 | VSS | Ground |
| 7 | VEE | Negative Voltage Output |
| 8-11 | D1-D3 | Display Data Input |
| 12 | V0 | Supply voltage for LCD |
| 13 | IDISPOFF | H:ON L:OFF |
| 14 | LEDA | Anode for backlight |
| 15 | LEDK | Cathode for backlight |

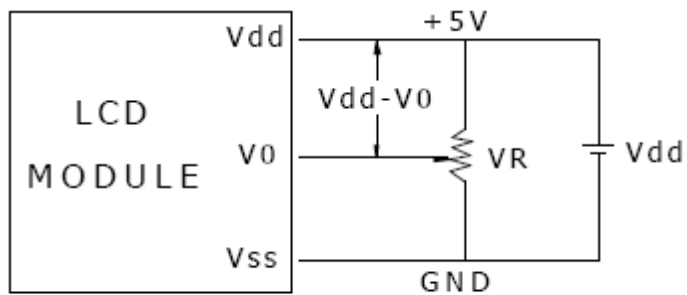
7. POWER SUPPLY

Without Negative Power on PCB



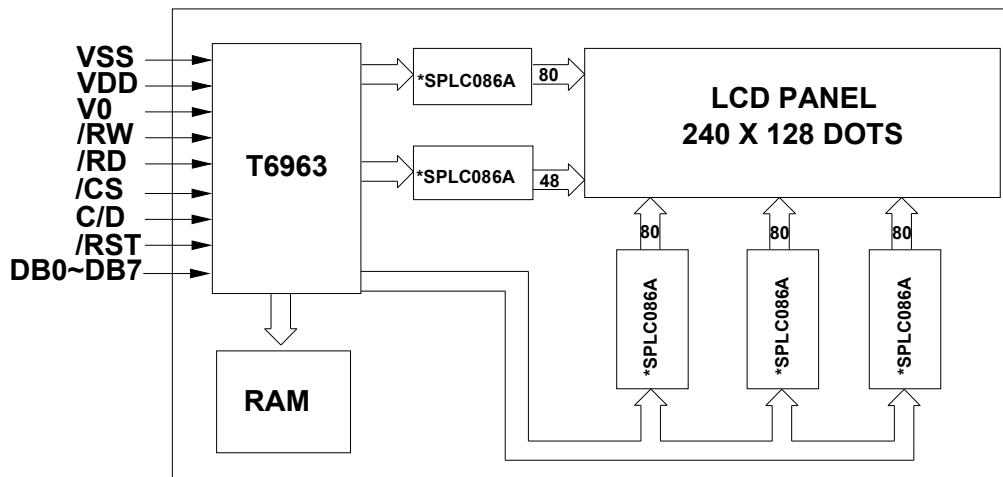
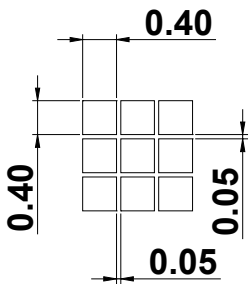
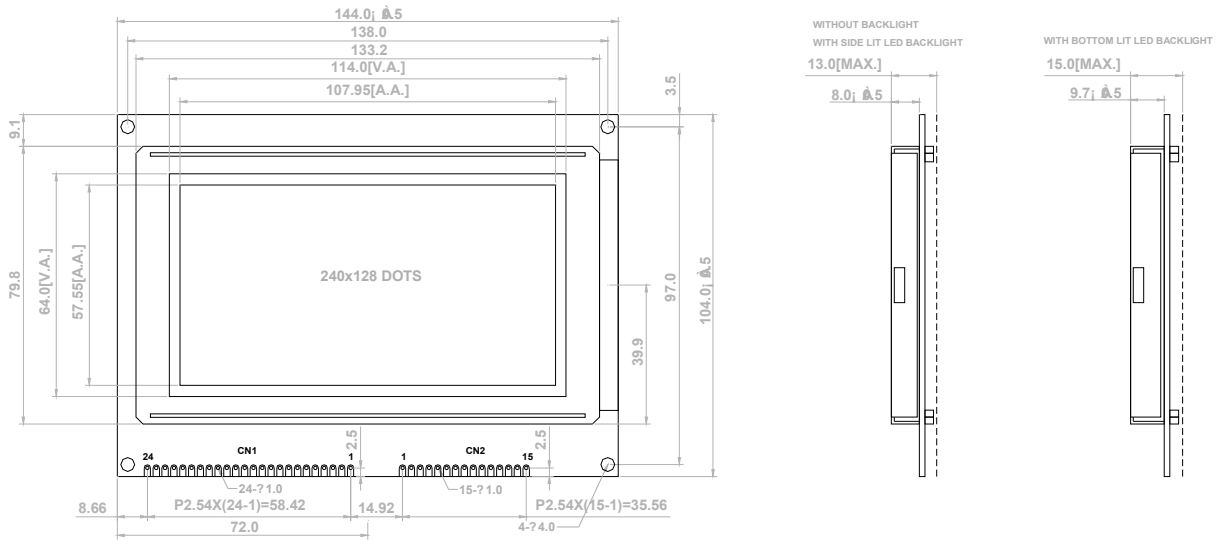
Vdd-V0: LCD Driving Voltage
VR: 10K - 20K

With Negative Power on PCB



Vdd-V0: LCD Driving Voltage
VR: 10K - 20K

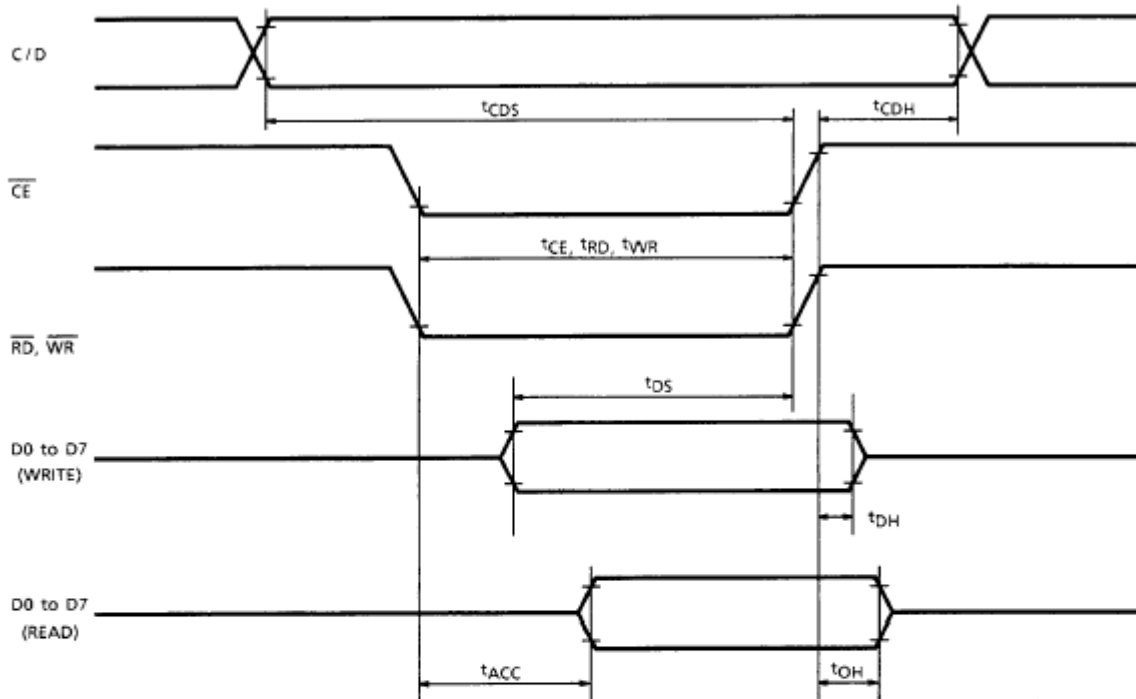
8. Contour Drawing & Block Diagram



**** OR EQUIVALENT**

9. Timing Characteristics

Bus Timing



TEST CONDITIONS (Unless otherwise noted, $V_{DD} = 5.0V \pm 10\%$, $V_{SS} = 0V$, $T_a = -20$ to $75^\circ C$)

| ITEM | SYMBOL | TEST CONDITIONS | MIN | MAX | UNIT |
|---|--------------------------|-----------------|-----|-----|------|
| C/D Set-up Time | t_{CDS} | — | 100 | — | ns |
| 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. Table of T6963C Commands

COMMAND DEFINITIONS

| COMMAND | CODE | D1 | D2 | FUNCTION |
|------------------------|----------|-------------|--------------|--------------------------------|
| REGISTERS SETTING | 00100001 | X address | Y address | Set Cursor Pointer |
| | 00100010 | Data | 00H | Set Offset Register |
| | 00100100 | Low address | High address | Set Address Pointer |
| SET CONTROL WORD | 01000000 | Low address | High address | Set Text Home Address |
| | 01000001 | Columns | 00H | Set Text Area |
| | 01000010 | Low address | High address | Set Graphic Home Address |
| | 01000011 | Columns | 00H | Set Graphic Area |
| MODE SET | 1000X000 | — | — | OR mode |
| | 1000X001 | — | — | EXOR mode |
| | 1000X011 | — | — | AND mode |
| | 1000X100 | — | — | Text Attribute mode |
| | 10000XXX | — | — | Internal CG ROM mode |
| | 10001XXX | — | — | External CG RAM mode |
| DISPLAY MODE | 10010000 | — | — | Display off |
| | 1001XX10 | — | — | Cursor on, blink off |
| | 1001XX11 | — | — | Cursor on, blink on |
| | 100101XX | — | — | Text on, graphic off |
| | 100110XX | — | — | Text off, graphic on |
| | 100111XX | — | — | Text on, graphic on |
| CURSOR PATTERN SELECT | 10100000 | — | — | 1-line cursor |
| | 10100001 | — | — | 2-line cursor |
| | 10100010 | — | — | 3-line cursor |
| | 10100011 | — | — | 4-line cursor |
| | 10100100 | — | — | 5-line cursor |
| | 10100101 | — | — | 6-line cursor |
| | 10100110 | — | — | 7-line cursor |
| | 10100111 | — | — | 8-line cursor |
| DATA AUTO READ / WRITE | 10110000 | — | — | Set Data Auto Write |
| | 10110001 | — | — | Set Data Auto Read |
| | 10110010 | — | — | Auto Reset |
| DATA READ / WRITE | 11000000 | Data | — | Data Write and Increment ADP |
| | 11000001 | — | — | Data Read and Increment ADP |
| | 11000010 | Data | — | Data Write and Decrement ADP |
| | 11000011 | — | — | Data Read and Decrement ADP |
| | 11000100 | Data | — | Data Write and Nonvariable ADP |
| | 11000101 | — | — | Data Read and Nonvariable ADP |
| SCREEN PEEK | 11100000 | — | — | Screen Peek |
| SCREEN COPY | 11101000 | — | — | Screen Copy |

X : invalid

| COMMAND | CODE | D1 | D2 | FUNCTION |
|---------------|----------|----|----|-------------|
| BIT SET/RESET | 11110XXX | — | — | Bit Reset |
| | 11111XXX | — | — | Bit Set |
| | 1111X000 | — | — | Bit 0 (LSB) |
| | 1111X001 | — | — | Bit 1 |
| | 1111X010 | — | — | Bit 2 |
| | 1111X011 | — | — | Bit 3 |
| | 1111X100 | — | — | Bit 4 |
| | 1111X101 | — | — | Bit 5 |
| | 1111X110 | — | — | Bit 6 |
| | 1111X111 | — | — | Bit 7 (MSB) |

X : invalid

11. Quality Assurance

Screen Cosmetic Criteria

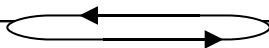
| Item | Defect | Judgment Criterion | Partition |
|------|----------------------|--|-----------|
| 1 | Spots | <p>A)Clear</p> <p><u>Size: d mm</u> <u>Acceptable Qty in active area</u></p> <p>d \square 0.1 Disregard</p> <p>0.1 < d \square 0.2 6</p> <p>0.2 < d \square 0.3 2</p> <p>0.3 < d 0</p> <p>Note: Including pin holes and defective dots which must be within one pixel size.</p> <p>B)Unclear</p> <p><u>Size: d mm</u> <u>Acceptable Qty in active area</u></p> <p>d \square 0.2 Disregard</p> <p>0.2 < d \square 0.5 6</p> <p>0.5 < d \square 0.7 2</p> <p>0.7 < d 0</p> | Minor |
| 2 | Bubbles in Polarizer | <p><u>Size: d mm</u> <u>Acceptable Qty in active area</u></p> <p>d \square 0.3 Disregard</p> <p>0.3 < d \square 1.0 3</p> <p>1.0 < d \square 1.5 1</p> <p>1.5 < d 0</p> | Minor |
| 3 | Scratch | In accordance with spots cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable. | Minor |
| 4 | Allowable Density | Above defects should be separated more than 30mm each other. | Minor |
| 5 | Coloration | Not to be noticeable coloration in the viewing area of the LCD panels. | Minor |

| | | | |
|--|--|---|--|
| | | Back-light type should be judged with back-light on state only. | |
|--|--|---|--|

12. Reliability

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. | 60□ 96hrs | --- |
| Low Temperature storage | Endurance test applying the high storage temperature for a long time. | -10□ 96hrs | --- |
| High Temperature Operation | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time. | 50□ 96hrs | --- |
| Low Temperature Operation | Endurance test applying the electric stress under low temperature for a long time. | 0□ 96hrs | --- |
| High Temperature/ Humidity Storage | Endurance test applying the high temperature and high humidity storage for a long time. | 60□,90%RH 96hrs | --- |
| High Temperature/ Humidity Operation | Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time. | 50□,90%RH 96hrs | --- |
| Temperature Cycle | Endurance test applying the low and high temperature cycle. | -10□/60□ 10 cycles | --- |



| | | | |
|-----------------|--|---|----|
| | -10□ 25□ 60□ 30min 5min 30min 1 cycle | | |
| Mechanical Test | | | |
| Vibration test | Endurance test applying the vibration during transportation and using. | 10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hrs | —— |
| Shock test | Constructional and mechanical endurance test applying the shock during transportation. | 50G Half sign wave 11 msdc 3 times of each direction | —— |

***Supply voltage for logic system=5V. Supply voltage for LCD system =Operating voltage at 25□