

XIAMEN OCULAR OPTICS CO.,LTD

**SPECIFICATIONS OF
LCD MODULE**

PART NUMBER GDM1602B SERIES
DATE JULY 28, 1998

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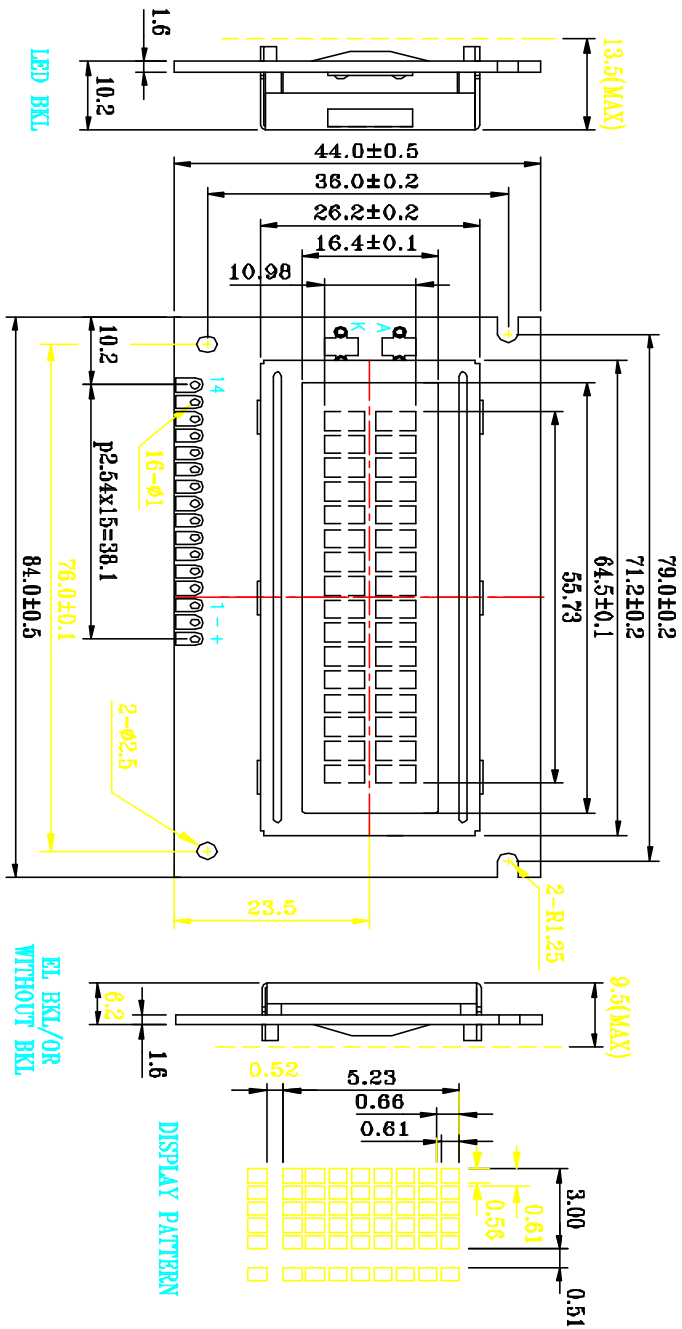
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Mechanical Diagram



| |
|------------------------------------|
| PERFORMANCE FEATURES |
| IC FLUID: JN, STN |
| POLARIZER: REFLECTIVE, TRANSPARENT |
| TRANSMISSIVE |
| COLOR: GRAY, YELLOW, BLUE |
| BACKLIGHT: LED, YELLOW-GREEN |
| TEMPERATURE RANGE: STANDARD, WIDE |
| CONTROLLER: KS0066 |

| PIN | SIGNAL | PIN | SIGNAL |
|-----|--------|-----|--------|
| 1 | VSS | 9 | DB2 |
| 2 | VDD | 10 | DB3 |
| 3 | Y0 | 11 | DB4 |
| 4 | RS | 12 | DB5 |
| 5 | R/W | 13 | DB6 |
| 6 | R | 14 | DB7 |
| 7 | DB0 | + | LED+ |
| 8 | DB1 | - | LED- |

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Absolute Maximum Ratings

| Item | Symbol | Min | Max | Unit |
|-----------------------------|-----------------|----------|----------|------|
| Power Voltage | $V_{DD}-V_{SS}$ | 0 | 7.0 | V |
| Input Voltage | V_{in} | V_{SS} | V_{DD} | |
| Operating Temperature Range | T_{OP} | 0 | +50 | . |
| Storage Temperature Range | T_{ST} | -20 | +60 | |

*Wide Temperature range is available

(operating/storage temperature as wide as -20.+70/-30.+80.).

Description Of Terminals

| Pin No. | Pin Name | Input/Output | External Connection | Function |
|---------|------------------------|--------------|----------------------------|--|
| 1 | VSS | — | Power Supply | VSS:GND |
| 2 | VDD | — | | VDD: +5V |
| 3 | VO | — | | V_{LCD} adjustment |
| 4 | RS | INPUT | MPU | Register select signal “0”:Instruction register (when writing) Busy flag & address counter (When reading) “1”:Data register (when writing & reading) |
| 5 | R/W | Input | MPU | Read/write select signal “0” for writing , “1” for reading |
| 6 | E | Input | MPU | Operation (data read/write) enable signal |
| 7 / 10 | DB0-DB3 | Input | MPU | Low-order lines of data bus with 3-state, bi-directional function for use in data transaction with the MPU. These lines are not used when interfacing with a 4-bit microprocessor. |
| 11 / 14 | DB4-DB7 | Input | MPU | High-order lines of data bus with 3-state, bi-directional function for use in data transactions with the MPU. DB7 may also be used to check the busy flag. |
| 15 / 16 | LED ..+.. LED ..-.. | Input | LED BACKLIGHT POWER SUPPLY | LED..+..VOLTAGE TYPE:4.2V MAX : 4.5V LED..-..: GND |

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Optical Characteristics

for TN Type Display Module ($T_a=25.$, $V_{DD}=5.0V\pm 0.25V$)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------|----------------|-------------------|------|------|------|------|
| Viewing angle | | C _r .4 | -25 | | | deg |
| | | | -30 | | 30 | |
| Contrast ratio | C _r | | | 2 | | |
| Response time(rise) | T _r | | | 120 | 150 | ms |
| Response time(fall) | T _r | | | 120 | 150 | ms |

for STN Type Display Module ($T_a=25.$, $V_{DD}=5.0V\pm 0.25V$)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------|----------------|-------------------|------|------|------|------|
| Viewing angle | | C _r .2 | -60 | | 35 | deg |
| | | | -40 | | 40 | |
| Contrast ratio | C _r | | | 6 | | |
| Response time(rise) | T _r | | | 150 | 250 | ms |
| Response time(fall) | T _r | | | 150 | 250 | ms |

Electrical Characteristics

DC Characteristics

| Parameter | Symbol | Conditions | Min. | Type | Max. | Unit |
|--------------------------|---------------------------------|---|------|------|-----------------|------|
| Supply voltage for LCD | V _{DD} .V _O | T _A =25. | — | 4.6 | — | V |
| Input voltage | V _{DD} | | 4.7 | — | 5.5 | V |
| Supply current | I _{DD} | V _{DD} =5.0V;T _A =25. | — | 1.5 | 2.5 | mA |
| Input leakage current | I _{LKG} | | — | — | 1.0 | μA |
| “H” level input voltage | V _{IH} | | 2.2 | — | V _{DD} | V |
| “L” level input voltage | V _{IL} | Twice initial value or less | 0 | — | 0.6 | V |
| “H” level output voltage | V _{OH} | LOH= -0.25MA | 2.4 | — | — | V |
| “L” level output voltage | V _{OL} | LOL=1.6MA | — | — | 0.4 | V |
| Backlight supply power | V _F | | — | 4.2 | 4.5 | V |

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AC Characteristics

Read Cycle ($V_{DD}=5.0V+10\%$, $V_{SS}=0V$, $T_a=25$.)

| Parameter | Symbol | Test pin | Min. | Type | Max. | Unit |
|--------------------------|------------|----------|------|------|------|------|
| Enable cycle time | t_c | E | 500 | . | . | ns |
| Enable pulse width | t_w | E | 300 | . | . | |
| Enable rise/fall time | t_r, t_f | E | . | . | 25 | |
| RS,R/W setup time | t_{su} | RS; R/W | 100 | . | . | |
| RS,R/W address hold time | t_h | RS; R/W | 10 | . | . | |
| Read data output delay | t_D | DB0-DB7 | 60 | . | 190 | |
| Read data hold time | t_{DH} | DB0-DB7 | 20 | . | . | |

Write Cycle

| Parameter | Symbol | Test pin | Min. | Type | Max. | Unit |
|--------------------------|------------|----------|------|------|------|------|
| Enable cycle time | t_c | E | 500 | . | . | ns |
| Enable pulse width | t_w | E | 300 | . | . | |
| Enable rise/fall time | t_r, t_f | E | . | . | 25 | |
| RS,R/W setup time | t_{su1} | RS; R/W | 100 | . | . | |
| RS,R/W address hold time | t_{h1} | RS; R/W | 10 | . | . | |
| Data setup time | t_{su2} | DB0-DB7 | 60 | . | . | |
| Data hold time | t_{h2} | DB0-DB7 | 10 | . | . | |

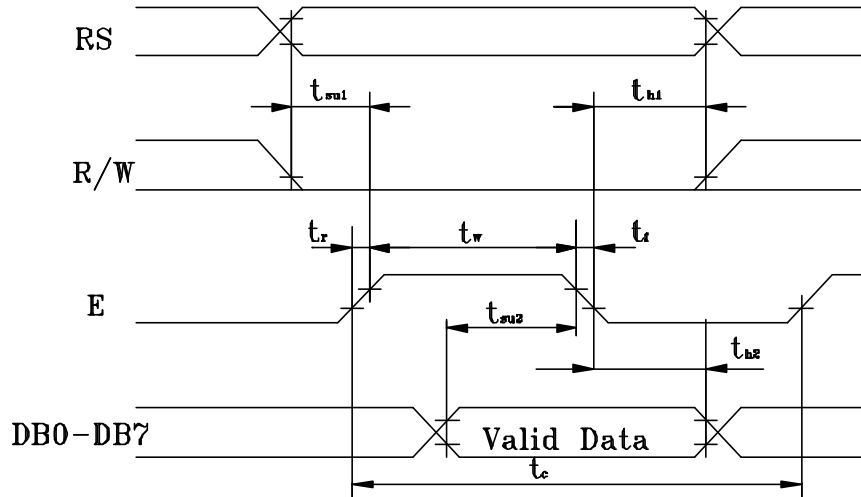
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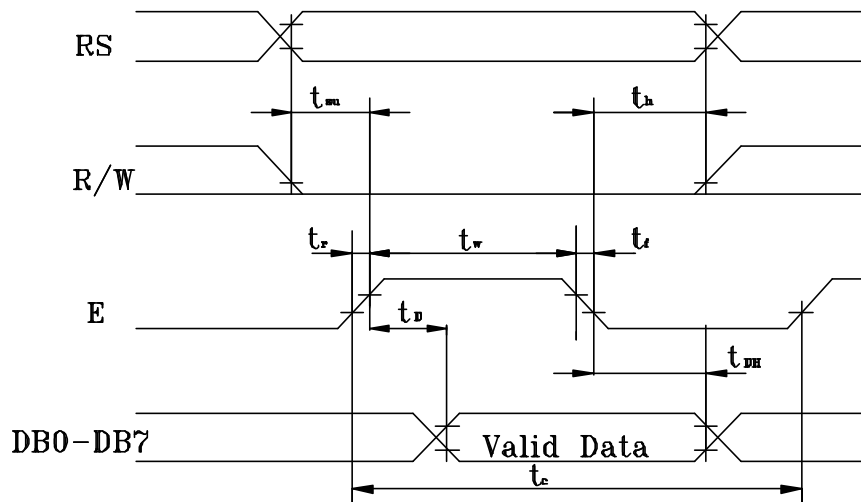
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Timing Characteristics

Write Timing



Read Timing

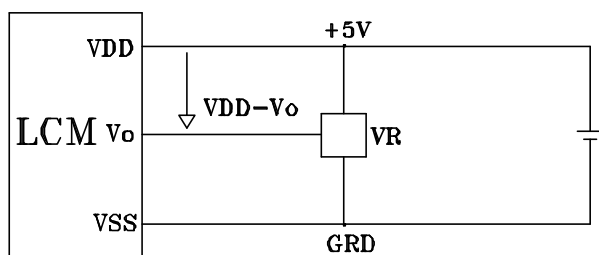
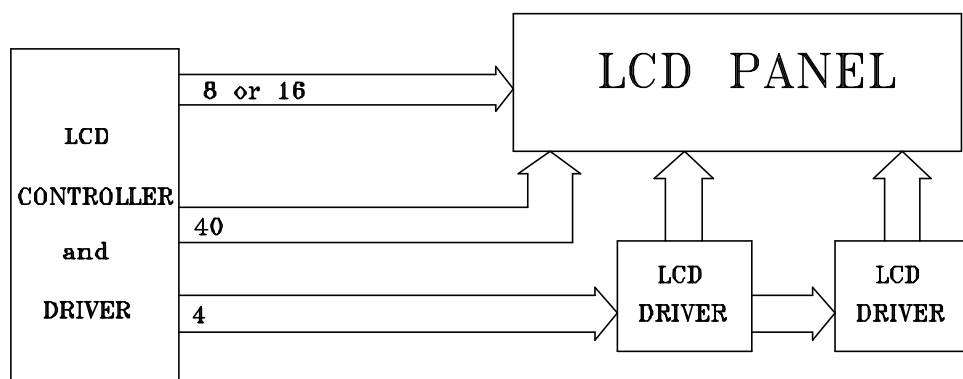


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Block Diagram



VDD-V_o: LCD DRIVING VOLTAGE

VR: 10K-20K.

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Display command

| Parameter | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Note | Executing time fosc=250k hz |
|--------------------------------|----|-----|------------|---|--|-----|-----|-----|---|--|---|-----------------------------------|
| Clear Display | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | | 1.64ms |
| Cursor home | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | * | | 1.64ms |
| Entry Mode Set | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1/D | S | DB1=1:Increment DB1=0:Decrement DB0=1:The display is shifted DB0=0:The display is not shifted | 40.s |
| Display on/off | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | DB2=1:Display on DB2=0: Display off DB1=1:Cursor on DB1=0: Cursor off DB0=1:Brinking on DB0=0:Brinking off | 40.s |
| Cursor / Display Shift | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | * | * | DB3=1:Shifts display one character DB2=1:Right shift DB2=0:Left shift | 40.s |
| System Set | 0 | 0 | 0 | 0 | 1 | DL | N | F | * | * | DB4=1:8 bits DB4=0:4 bits DB3=1:2 lines display (1/16 duty) DB3=0:1 line display DB2=1:5.10 dots , 1/11 duty DB2=1:5.7 dots , 1/8 duty | 40.s |
| Set CG RAM Address | 0 | 0 | 0 | 1 | CG RAM address corresponds to cursor address | | | | | The address length that can be set is 64 address | | 40.s |
| Set DD RAM Address | 0 | 0 | 1 | DD RAM address | | | | | The address length that can be set is 80 address | | 40.s | |
| Read Busy Flag/Address Counter | 0 | 1 | BF | Address counter used for both DD&CG RAM address | | | | | DB7=1:Busy (instruction not accepted) DB7=0:Ready(for instruction) | | 40.s | |
| Write Data | 1 | 0 | Write data | | | | | | | | | 46.s |
| Read Data | 1 | 1 | Read data | | | | | | | | | 46.s |

DD RAM Address:

| | | | | | | | | | | | | | | | | |
|--------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Address for line 1 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 1A | 1B | 1C | 1D | 1E | 1F |
| Address for line 2 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F |

Reliability and Life Time

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1. Reliability Test

| Storage Condition | Content | Evaluations and Assessment* | | | |
|--|-------------------|-----------------------------|--------|--------------------------------|-------------------|
| | | Current consumption | Oozing | Contrast | Other appearances |
| Operation at high temperature and humidity | 40.,90% RH,240hrs | Twice initial value or less | none | More than 80% of initial value | No abnormality |
| High temperature storage | 60., 240hrs | Twice initial value or less | none | More than 80% of initial value | No abnormality |
| Low temperature storage | -20., 240hrs | Twice initial value or less | | More than 80% of initial value | No abnormality |

*Evaluations and assessment to be made two hours after returning to room temperature (25.±5.).

*The LCDs subjected to the test must not have dew condensation.

2. Liquid crystal panel service life

50,000 hours minimum at 25±10.,45±20%RH.

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Standard Character Pattern

| Lower & Bits | Upper 4 Bits | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|-----------------|------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| xxxx0000 | CG RAM (1) | | | 0 | a | P | ` | P | | | | - | 夕 | 三 | α | ρ | |
| xxxx0001 | (2) | | ! | 1 | A | Q | a | q | | | | 。 | ア | チ | △ | ā | q |
| xxxx0010 | (3) | | " | 2 | B | R | b | r | | | | 「 | イ | ツ | × | β | θ |
| xxxx0011 | (4) | | # | 3 | C | S | c | s | | | | 」 | ウ | テ | モ | ε | ω |
| xxxx0100 | (5) | | \$ | 4 | D | T | d | t | | | | 、 | エ | ト | ト | μ | Ω |
| xxxx0101 | (6) | | % | 5 | E | U | e | u | | | | ・ | オ | ナ | 1 | ε | ü |
| xxxx0110 | (7) | | & | 6 | F | V | f | v | | | | ヲ | カ | ニ | ヨ | ρ | π |
| xxxx0111 | (8) | | ' | 7 | G | W | g | w | | | | ア | キ | ヌ | ウ | g | π |
| xxxx1000 | (1) | | (| 8 | H | X | h | x | | | | イ | ク | ネ | リ | γ | π |
| xxxx1001 | (2) | |) | 9 | I | Y | i | y | | | | ウ | ケ | ル | ル | γ | π |
| xxxx1010 | (3) | | * | : | J | Z | j | z | | | | エ | コ | ン | レ | j | π |
| xxxx1011 | (4) | | + | ; | K | [| k | [| | | | オ | サ | ヒ | ロ | * | π |
| xxxx1100 | (5) | | , | < | L | ¥ | l | l | | | | カ | シ | フ | ワ | φ | π |
| xxxx1101 | (6) | | - | = | M |] | m |] | | | | ユ | ス | ハ | ン | φ | π |
| xxxx1110 | (7) | | . | > | N | ^ | n | ^ | | | | ヨ | セ | ホ | ° | π | |
| xxxx1111 | (8) | | / | ? | O | _ | o | + | | | | ッ | ソ | マ | ° | ö | ■ |

Note: The user can specify any pattern for character-generator RAM.

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