# User's Guide

# GXM12232-3SL

## Liquid Crystal Display Module

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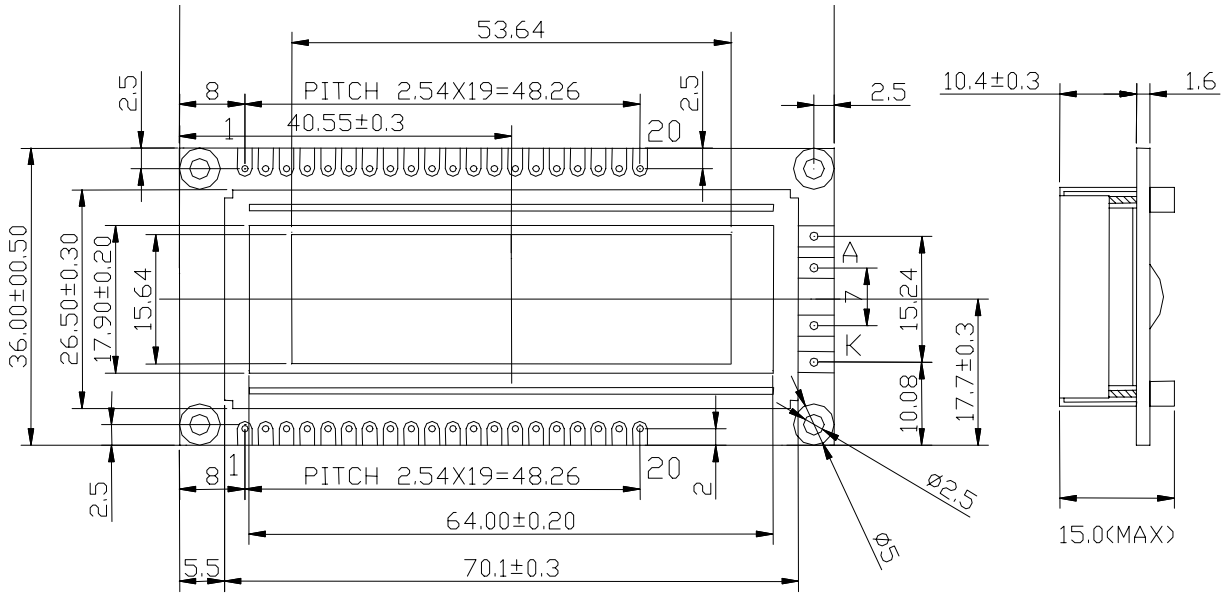
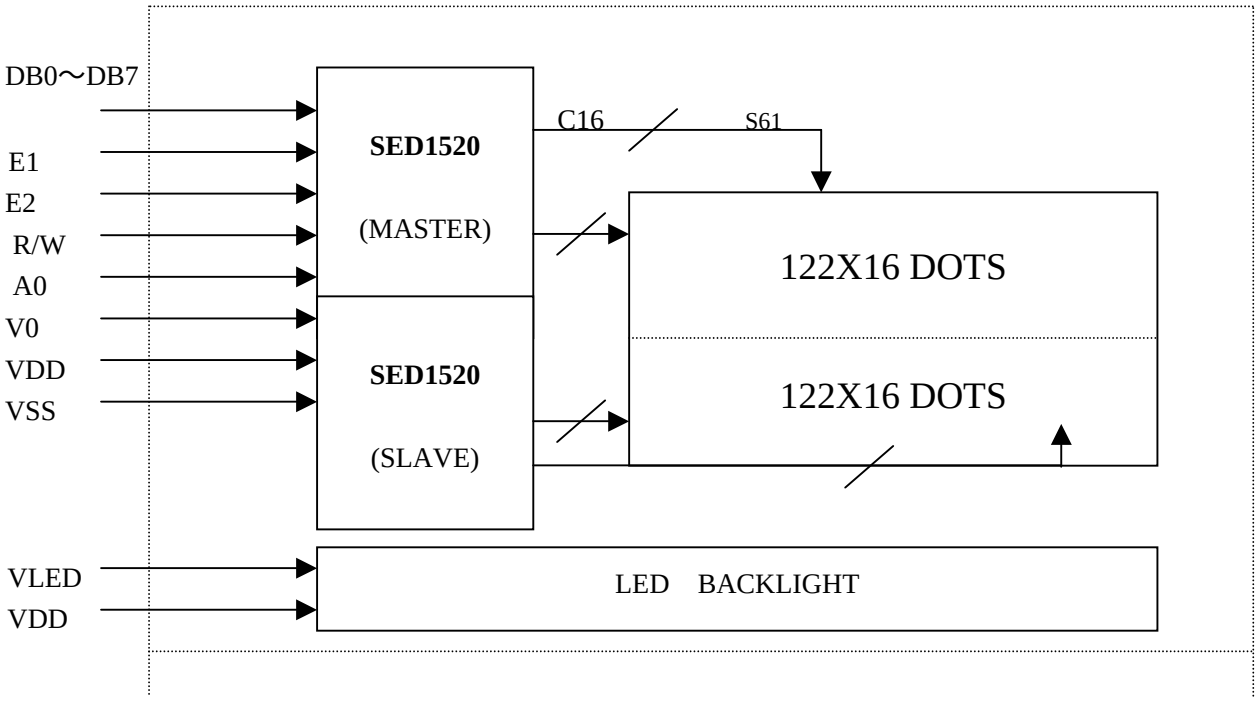
contents

## ■ Mechanical Diagram




## ■BLOCK DIAGRAM




## ■ PIN ASSIGNMENTS

| PIN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| SIGNAL | VSS | VDD | V0 | A0 | CS1 | CS2 | CL | E | R/W | DB0 |
| PIN | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| SIGNAL | DB1 | DB2 | DB3 | DB4 | DB5 | DB6 | DB7 | /RES | LEDA | LEDK |

## ■ABSOLUTE MAXIMUM RATINGS(Ta=25℃)

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply Voltage for logic | VDD | 0 | 6.7 | V |
| Supply Voltage for LCD | VDD-V0 | 0 | 10 | V |
| Input voltage | VI | 0 | VDD | V |
| Operating Temp. | TOP | -10℃ | +50℃ | ℃ |
| Storage Temp. | TST | -20℃ | +70℃ | ℃ |

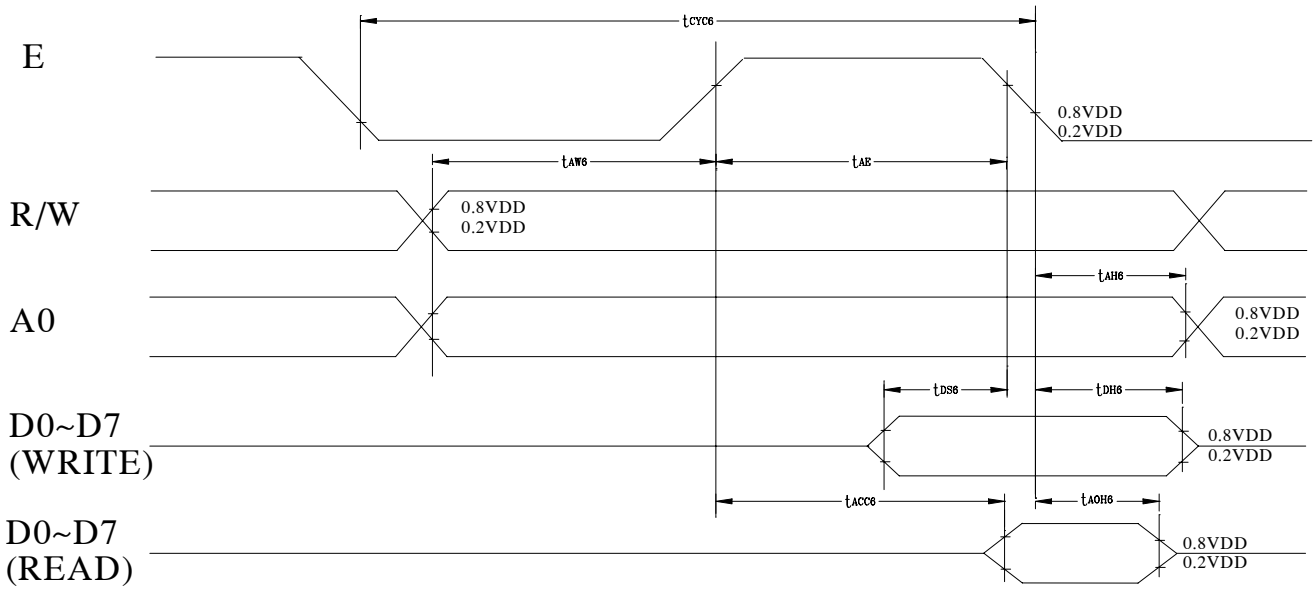
## ■ELECTRICAL CHRACTERISTICS(VDD=+5V±10%,VSS=0V,Ta=25℃)

### ▼DC Characteristics

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Supply voltage for logic | VDD | ---- | 4.5 | 5.0 | 5.5 | V |
| Supply current for logic | IDD | ---- | ---- | 0.8 | 1.5 | mA |
| Operating voltage for LCD | VDD-V0 | 25℃ | ---- | 4.5 | ---- | V |
| Supply voltage for LED backlight | $V_{LED}$ | ---- | ---- | 4.2 | ---- | V |
| Supply current for LED backlight | $I_{LED}$ | $V_{LED}$=4.2V | ---- | 110 | ---- | mA |

### ▼AC Characteristics

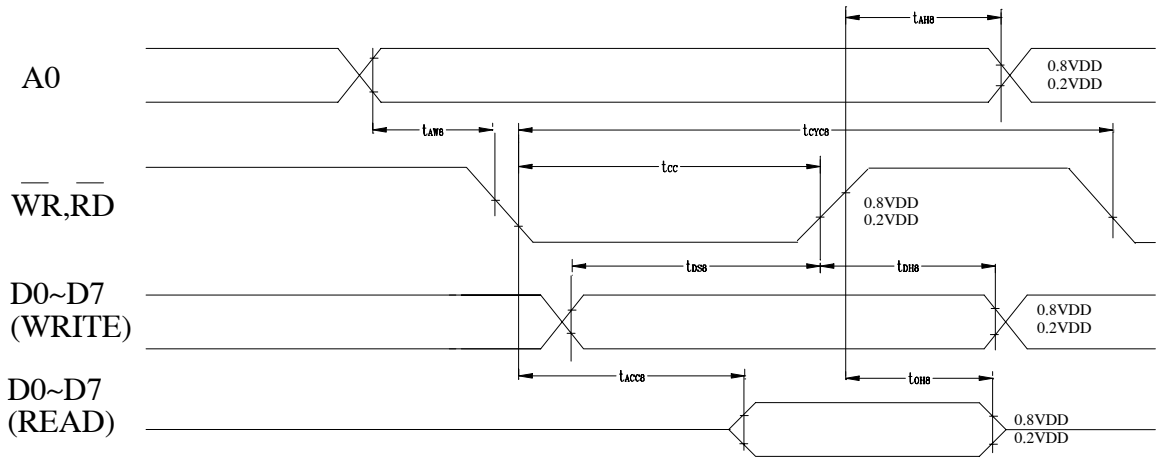
⊙ **Read/Write operation sequence(68 Type MPU)**



**Ta=-20 to +75 ,VDD=5.0V±10%,VSS=0V**

| Parameter | | Symbol | Min | Max | unit | Condition |
|---|---|---|---|---|---|---|
| System cycle time | | $t_{CYC6}$ | 1000 | ----- | ns | |
| Address setup time | | $t_{AW6}$ | 20 | ----- | ns | |
| Address hold time | | Tah6 | 10 | ----- | ns | |
| Enable pulse width | Read | $t_{EW}$ | 100 | ----- | ns | |
| | Write | $t_{EW}$ | 80 | ----- | ns | |
| Data setup time | | $t_{DS6}$ | 80 | ----- | ns | |
| Data hold time | | $t_{DH6}$ | 10 | ----- | ns | |
| Access time | | $t_{ACC6}$ | ---- | 90 | ns | CL=100Pf |
| Output disable time | | $t_{OH6}$ | 10 | 60 | ns | |
| Input wave form rise time | | $t_r$ | ---- | 15 | ns | |

## ⊙ Read/Write operation sequence(80 Type MPU)




**Ta=-20 to +75 ,VDD=5.0V±10%,VSS=0V**

| Parameter | Symbol | Min | Max | unit | Condition |
|---|---|---|---|---|---|
| System cycle time | $t_{CYC8}$ | 1000 | ----- | ns | |
| Address setup time | $t_{AW8}$ | 20 | ----- | ns | |
| Address hold time | $t_{AH8}$ | 10 | ----- | ns | |
| Control pulse width | $t_{CC}$ | 200 | ----- | ns | |
| Data setup time | $t_{DS8}$ | 80 | ----- | ns | |
| Data hold time | $t_{DH8}$ | 10 | ----- | ns | |
| RD access time | $t_{ACC8}$ | ---- | 90 | ns | CL=100Pf |
| Output disable time | $t_{CH8}$ | 10 | 60 | ns | |

## ■OPERATING PRINCIPLES & METHODS

### ▼Control and Display Command

| ommand | R/W | RD | A0 | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Function |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Display ON/OFF | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0/1 | Whole display ON/OFF<br>1: ON , 0: OFF(Power Save mode if the static drive on) |
| Display start line | 0 | 1 | 0 | 1 | 1 | 0 | Display start line (0 to 31) | | | | | Determine the display line correspond to the com0. |
| Set page address | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | Page( 0 to 3) | | Set the page of display .Data RAM to the Column Register |
| Set column address | 0 | 1 | 0 | 0 | Column address ( 0 to 79 ) | | | | | | | Set the Column Address of Display data RAM to the column register |
| Read status | 0 | 0 | 1 | Busy | ADC | On/ Off | Reset | 0 | 0 | 0 | 0 | Read the status.<br>BUSY 1: Working<br>0: Ready<br>ADC 1: Clockwise output<br>0: Counter clockwise<br>ON/OFF 1: Display off<br>0: Display on<br>RESET 1: Reset<br>0: Normal |
| Write display data | 1 | 1 | 0 | Write data | | | | | | | | Write data from data bus into display RAM |
| Read display data | 1 | 0 | 1 | Read data | | | | | | | | Read data from display RAM onto data bus |
| Select ADC | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0/1 | Determine the clockwise or counterclockwise reading of the display data RAM 0: Clockwise Output<br>1: Counterclockwise Output |
| Static drive ON/OFF | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0/1 | Select the dynamic or static driving<br>1: Static driving(Power save)<br>0: Dynamic driving |
| Select duty | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0/1 | Select the duty ratio<br>1: 1/32 duty 0: 1/16 duty |
| Read-Modify-Write | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Increment the column address register when writing but no-change when reading. |
| Reset | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | Set the display start line register to 1st line ,Column add. Counter and page add. register to "0". |
| End | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | Release from the Read Modify Write Mode. |

## ■ DIAPLAY DATA RAM ADDRESS MAP

<table>
<tr><td>Page</td><td>Data</td><td colspan="2"></td><td>Com NO.</td><td>Driver</td></tr>
<tr><td>1</td><td>DB0<br>……<br>DB7</td><td colspan="2" rowspan="2">122×16 Pixels</td><td rowspan="2">0<br>|<br>|<br>|<br>|<br>15</td><td rowspan="2">Master</td></tr>
<tr><td>2</td><td>DB0<br>……<br>DB7</td></tr>
<tr><td>3</td><td>DB0<br>……<br>DB7</td><td colspan="2" rowspan="2">122×16 Pixels</td><td rowspan="2">16<br>|<br>|<br>|<br>|<br>31</td><td rowspan="2">Slave</td></tr>
<tr><td>4</td><td>DB0<br>……<br>DB7</td></tr>
<tr><td></td><td>Seg NO.</td><td>0 ---------- 60</td><td>0---------- 60</td><td colspan="2"></td></tr>
<tr><td></td><td>Driver</td><td>Master</td><td>Slave</td><td colspan="2"></td></tr>
</table>