

**DM-COG12832-718**

**12832 COG GRAPHIC LCD WITH 4-LINE  
SPI MPU INTERFACE**

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## 1 Revision History

| Date       | Changes       |
|------------|---------------|
| 2018-12-13 | First release |

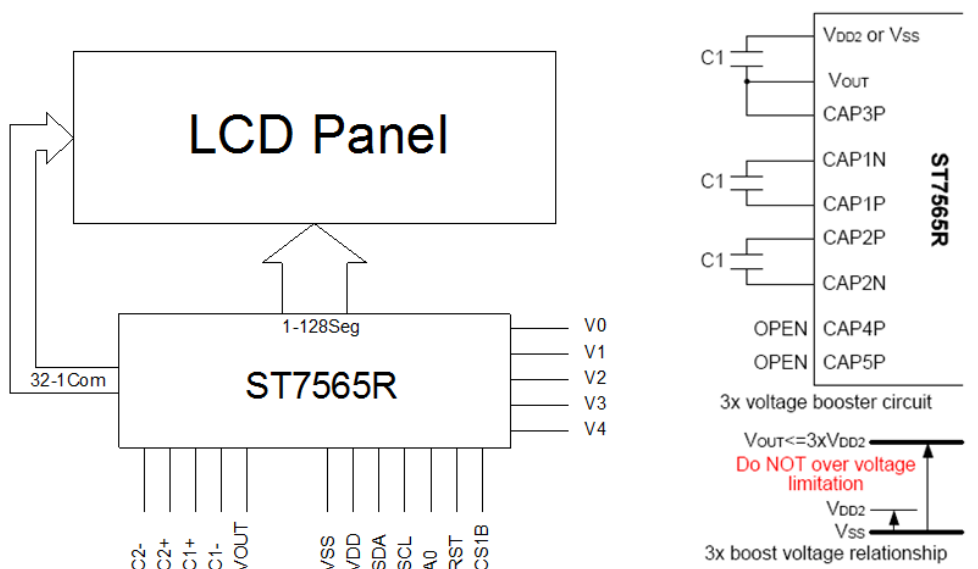
## 2 Main Features

| Item           | Specification            | Unit   |
|----------------|--------------------------|--------|
| Resolution     | 128 x 32                 | pixels |
| Display Mode   | STN Blue Negative        | -      |
| Controller IC  | ST7565R                  | -      |
| Interface      | 4-line SPI MPU interface | -      |
| Power Supply   | 3V                       | V      |
| View Direction | 6:00                     | -      |
| Duty           | 1/33 duty, 1/6 bias      |        |
| Backlight      | Edge White LED           | -      |
| Weight         | 5.6                      | g      |

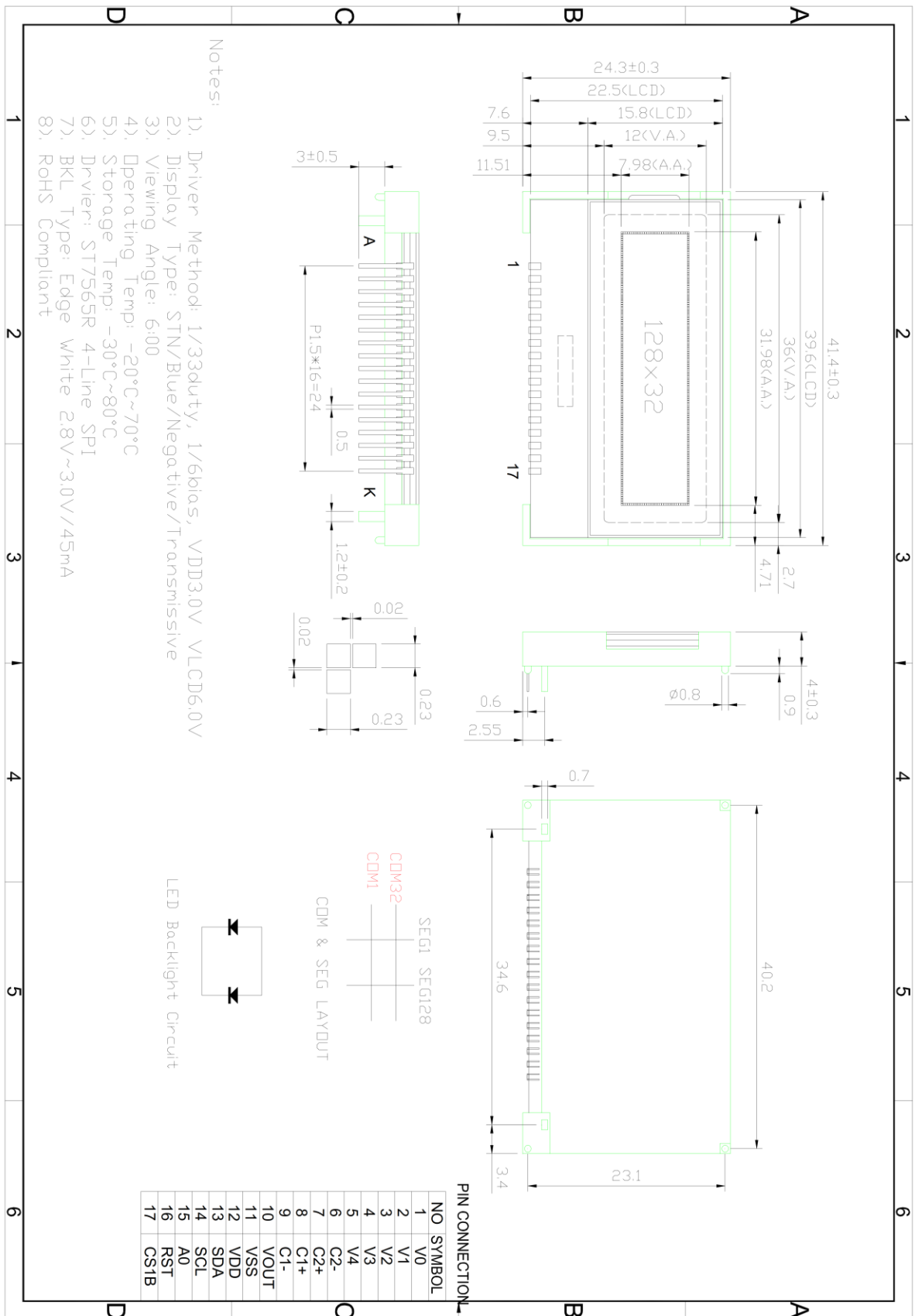
### 3 Pin Description

| Pin No. | Symbol  | Function Description  |
|---------|---------|---|
| 1~5     | VO~V4   | Power supply LCD  |
| 6       | C2+     | For voltage booster circuit. External capacitor about 0.47uF~2.2Uf. |
| 7       | C2-     |   |
| 8       | C1+     |   |
| 9       | C1-     |   |
| 10      | VOUT    |   |
| 11      | VSS     | Signal ground for LCM   |
| 12      | VDD     | Power supply for logic for LCM                                      |
| 13      | SDA(SI) | Input Data  |
| 14      | SCL     | Serial Clock  |
| 15      | A0      | Select registers. 0: Instruction, 1: Data register                  |
| 16      | RST     | External reset PIN. Must be fixed to VDD low active.                |
| 17      | CS1B    | Chip select in serial interface low active                          |
| A       | LED+    | Power supply for BKL  |
| K       | LED-    | Power supply for BKL  |

### 4 Block diagram



# 5 Mechanical Drawing



## 6 Electrical Characteristics

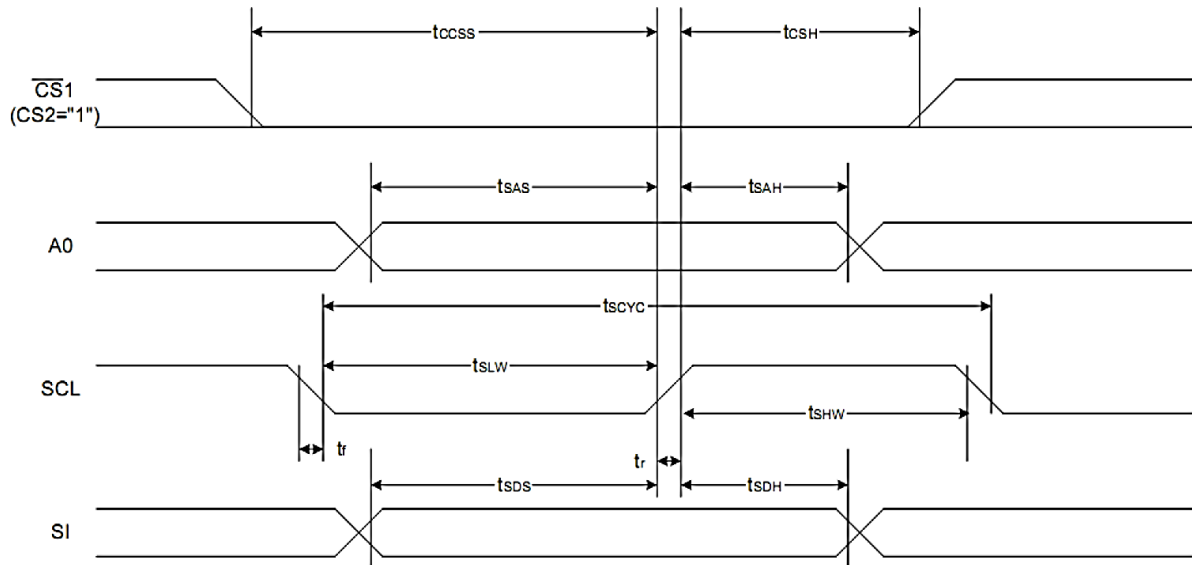
| Item                      | Symbol           | Condition    | Min | Typ. | Max  | Unit |
|---------------------------|------------------|--------------|-----|------|------|------|
| Supply Voltage for LCD    | VDD              |              | -   | 3.0  | -    | V    |
| Input Current             | IDD              | -            | -   | 0.25 | 0.45 | mA   |
| Low Level Input Voltage   | V <sub>IL</sub>  |              | -   | -    | 0.6  | V    |
| High Level Input Voltage  | V <sub>IH</sub>  |              | 2.2 | -    | VDD  | V    |
| Low Level Output Voltage  | V <sub>OL</sub>  |              | 0   | -    | 0.4  | V    |
| High Level Output Voltage | V <sub>OH</sub>  |              | 2.4 | -    | -    | V    |
| Backlight Forward Voltage | V <sub>LED</sub> |              | 2.8 |      | 3.4  | V    |
| Backlight Forward Current | I <sub>LED</sub> |              | -   | 15   | 20   | mA   |
| Operating Temperature     | TOP              | Absolute Max | -20 |      | 70   | °C   |
| Storage Temperature       | TST              | Absolute Max | -30 |      | 80   | °C   |

## 7 Optical Characteristics

| Item                   | Symbol         | Min | Typ | Max | Unit              |
|------------------------|----------------|-----|-----|-----|-------------------|
| View Angles-Vertical   | AV             |     | 70  |     | °                 |
| View Angles-Horizontal | AH             |     | 60  |     |                   |
| Response Time (25 °C)  | Tr + Tf        |     | 350 | 550 | ms                |
| Contrast Ratio         | CR             | 3   | 5   |     |                   |
| Luminance              | L <sub>v</sub> |     |     |     | cd/m <sup>2</sup> |

## 8 Timing Characteristics

The Serial interface

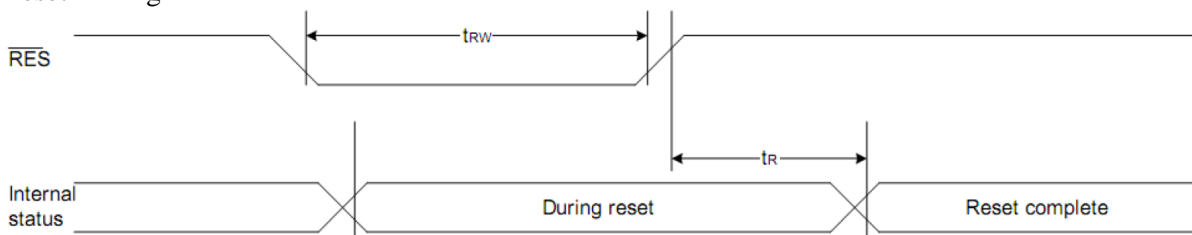


| Symbol     | Item                | Min | Typ | Max | Unit |
|------------|---------------------|-----|-----|-----|------|
| $t_{scyc}$ | Serial Clock Period | 100 | -   | -   | ns   |
| $t_{SHW}$  | SCL 'H' pulse width | 50  | -   | -   | ns   |
| $t_{SLW}$  | SCL 'L' pulse width | 50  | -   | -   | ns   |
| $t_{SAS}$  | Address setup time  | 30  | -   | -   | ns   |
| $t_{SAH}$  | Address hold time   | 20  | -   | -   | ns   |
| $t_{SDS}$  | Data setup time     | 30  | -   | -   | ns   |
| $t_{SDH}$  | Data hold time      | 20  | -   | -   | ns   |
| $t_{CSS}$  | CS-SCL time         | 30  | -   | -   | ns   |
| $t_{CSH}$  | CS-SCL time         | 60  | -   | -   | ns   |

Note: The input signal rise and fall time ( $t_r$ ,  $t_f$ ) are specified at 15 ns or less

All timing is specified using 20% and 80% of VDD as the standard

### Reset Timing



| Item                  | Signal | Symbol | Min. | Typ. | Max. | Unit |
|-----------------------|--------|--------|------|------|------|------|
| Reset time            |        | tR     | -    | -    | 2.0  | us   |
| Reset 'L' pulse width | /RES   | tRW    | 2.0  | -    | -    |      |

## 9 Table of Commands

| Command   | Command Code |     |     |            |    |                         |              |                                  |                | Function |    |  |   |
|---|--------------|-----|-----|------------|----|-------------------------|--------------|----------------------------------|----------------|----------|----|--|---|
|   | A0           | /RD | /WR | D7         | D6 | D5                      | D4           | D3                               | D2             |          | D1 | D0   |   |
| (1) Display ON/OFF  | 0            | 1   | 0   | 1          | 0  | 1                       | 0            | 1                                | 1              | 1        | 0  | 1  | LCD display ON/OFF<br>0: OFF, 1: ON   |
| (2) Display start line set  | 0            | 1   | 0   | 0          | 1  | Display start address   |              |                                  |                |          | 0  | Sets the display RAM display start line address                      |   |
| (3) Page address set  | 0            | 1   | 0   | 1          | 0  | 1                       | Page address |                                  |                |          | 0  | Sets the display RAM page address                                    |   |
| (4) Column address set upper bit<br>Column address set lower bit  | 0            | 1   | 0   | 0          | 0  | 0                       | 1            | Most significant column address  |                |          | 0  | Sets the most significant 4 bits of the display RAM column address.  |   |
|   |              |     |     | 0          | 0  | 0                       | 0            | Least significant column address |                |          | 0  | Sets the least significant 4 bits of the display RAM column address. |   |
| (5) Status read   | 0            | 0   | 1   | Status     |    |                         | 0            | 0                                | 0              | 0        | 0  | 0  | Reads the status data   |
| (6) Display data write  | 1            | 1   | 0   | Write data |    |                         |              |                                  |                |          | 0  | Writes to the display RAM  |   |
| (7) Display data read   | 1            | 0   | 1   | Read data  |    |                         |              |                                  |                |          | 0  | Reads from the display RAM   |   |
| (8) ADC select  | 0            | 1   | 0   | 1          | 0  | 1                       | 0            | 0                                | 0              | 0        | 0  | 0  | Sets the display RAM address SEG output correspondence<br>0: normal, 1: reverse |
| (9) Display normal/reverse  | 0            | 1   | 0   | 1          | 0  | 1                       | 0            | 0                                | 1              | 1        | 0  | 0  | Sets the LCD display normal/ reverse<br>0: normal, 1: reverse                   |
| (10) Display all points ON/OFF                                    | 0            | 1   | 0   | 1          | 0  | 1                       | 0            | 0                                | 1              | 0        | 0  | 0  | Display all points<br>0: normal display<br>1: all points ON                     |
| (11) LCD bias set   | 0            | 1   | 0   | 1          | 0  | 1                       | 0            | 0                                | 0              | 1        | 0  | 0  | Sets the LCD drive voltage bias ratio<br>0: 1/9 bias, 1: 1/7 bias (ST7565R)     |
| (12) Read-modify-write  | 0            | 1   | 0   | 1          | 1  | 1                       | 0            | 0                                | 0              | 0        | 0  | 0  | Column address increment<br>At write: +1<br>At read: 0                          |
| (13) End  | 0            | 1   | 0   | 1          | 1  | 1                       | 0            | 1                                | 1              | 1        | 0  | 0  | Clear read/modify/write   |
| (14) Reset  | 0            | 1   | 0   | 1          | 1  | 1                       | 0            | 0                                | 0              | 0        | 1  | 0  | Internal reset  |
| (15) Common output mode select                                    | 0            | 1   | 0   | 1          | 1  | 0                       | 0            | 0                                | *              | *        | *  | *  | Select COM output scan direction<br>0: normal direction<br>1: reverse direction |
| (16) Power control set  | 0            | 1   | 0   | 0          | 0  | 1                       | 0            | 1                                | Operating mode |          | 0  | 0  | Select internal power supply operating mode                                     |
| (17) V <sub>D</sub> voltage regulator internal resistor ratio set | 0            | 1   | 0   | 0          | 0  | 1                       | 0            | 0                                | Resistor ratio |          | 0  | 0  | Select internal resistor ratio(Rb/Ra) mode                                      |
| (18) Electronic volume mode set<br>Electronic volume register set | 0            | 1   | 0   | 1          | 0  | 0                       | 0            | 0                                | 0              | 0        | 0  | 1  | Set the V <sub>D</sub> output voltage electronic volume register                |
|   |              |     |     | 0          | 0  | Electronic volume value |              |                                  |                |          | 0  |  |   |
| (19) Sleep mode set   | 0            | 1   | 0   | 1          | 0  | 1                       | 0            | 1                                | 1              | 0        | 0  | 0  | 0: Sleep mode, 1: Normal mode   |
|   |              |     |     | *          | *  | *                       | *            | *                                | *              | 0        | 0  | 0  |   |
| (20) Booster ratio set  | 0            | 1   | 0   | 1          | 1  | 1                       | 1            | 1                                | 0              | 0        | 0  | 0  | select booster ratio<br>00: 2x,3x,4x<br>01: 5x<br>11: 6x                        |
|   |              |     |     | 0          | 0  | 0                       | 0            | 0                                | 0              | 0        | 0  | 0  | step-up value   |
| (21) NOP  | 0            | 1   | 0   | 1          | 1  | 1                       | 0            | 0                                | 0              | 0        | 1  | 1  | Command for non-operation   |
| (22) Test   | 0            | 1   | 0   | 1          | 1  | 1                       | 1            | *                                | *              | *        | *  | *  | Command for IC test. Do not use this command                                    |

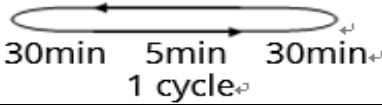
## 10 Driver/Controller Information

Built-in ST7565R Controller

<https://drive.google.com/file/d/0Bxu0OURUiyL5TUVKSnURXRUBFE/view?usp=sharing>



## 11 Reliability

| Test Item                               | Content of Test   | Test Condition  | Note |
|---|---|---|------|
| High Temperature Storage                | Endurance test applying the high storage temperature for a long time.   | 80°C<br>200hrs  | 2    |
| Low Temperature Storage                 | Endurance test applying the high storage temperature for a long time.   | -30°C<br>200hrs   | 1,2  |
| High Temperature Operation              | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.  | 70°C<br>200hrs  | -    |
| Low Temperature Operation               | Endurance test applying the electric stress under low temperature for a long time.  | -20 °C<br>200hrs  | 1    |
| High Temperature/<br>Humidity Operation | The module should be allowed to stand at 60°C,90%RH max, for 96hrs under no-load condition excluding the polarizer. Then taking it out and drying it at normal temperature. | 60°C,90%RH<br>96hrs   | 1,2  |
| Thermal Shock Resistance                | The sample should be allowed stand the following 10 cycles of operation<br>                | -20°C/70°C<br>10 cycles   | -    |
| Vibration Test                          | Endurance test applying the vibration during transportation and using   | Total fixed amplitude:<br>15mm; Vibration:<br>10~55Hz;<br>One cycle 60 seconds to 3 directions of X, Y, Z, for each 16 minutes. | 3    |
| Static Electricity Test                 | Endurance test apply the electric stress to the terminal.   | VS=800V,<br>RS=1.5kΩ,<br>CS=100pF,<br>1 time.   | -    |

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal. Temperature and humidity after remove from the rest chamber.

Note3: Test performed on product itself, not inside a container.

## 12 Warranty and Conditions

<http://www.displaymodule.com/pages/faq>