

**DM-LCD12864-456**  
**12864 FSTN(+) GRAPHIC LCD WITH**  
**PARALLEL MPU INTERFACE**

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## 1 Revision History

| Date       | Changes       |
|------------|---------------|
| 2015-04-15 | First release |

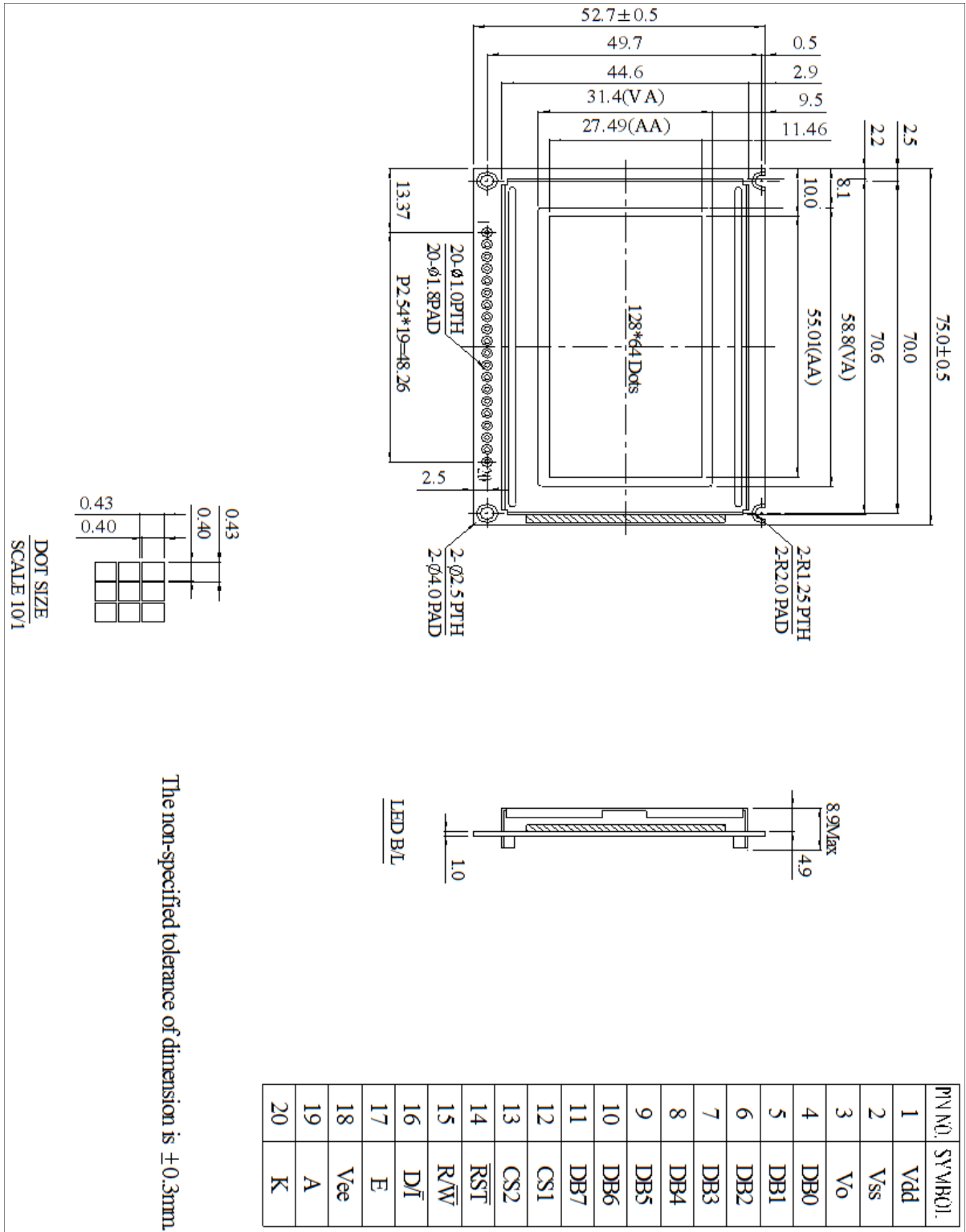
## 2 Main Features

| Item             | Specification                | Unit |
|------------------|------------------------------|------|
| Resolution       | 128 x 64                     | dots |
| Display Mode     | FSTN Positive, Transflective | -    |
| Module dimension | 75.0 x 52.7 x 8.9 (MAX)      | mm   |
| Controller IC    | NT7108                       | -    |
| Interface        | Parallel MPU Interface       | -    |
| Power Supply     | 5.0                          | V    |
| View Direction   | 6:00                         | -    |
| Duty             | 1/64                         |      |
| Backlight        | White LED                    | -    |
| Weight           | 35.5                         | g    |

## 3 Pin Description

| Pin No. | Symbol | Description                                  |
|---------|--------|--|
| 1       | VDD    | Power Supply for logic                       |
| 2       | VSS    | Ground                                       |
| 3       | Vo     | Contrast Adjustment(Variable)                |
| 4       | DB0    | Data bus line                                |
| 5       | DB1    | Data bus line                                |
| 6       | DB2    | Data bus line                                |
| 7       | DB3    | Data bus line                                |
| 8       | DB4    | Data bus line                                |
| 9       | DB5    | Data bus line                                |
| 10      | DB6    | Data bus line                                |
| 11      | DB7    | Data bus line                                |
| 12      | CS1    | Select Column 1~ Column 64                   |
| 13      | CS2    | Select Column 65~ Column 128                 |
| 14      | /RST   | Reset signal                                 |
| 15      | R/W    | H: Read (MPU←Module) , L: Write (MPU→Module) |
| 16      | D/I    | H: Data , L : Instruction                    |
| 17      | E      | Enable signal                                |
| 18      | Vee    | Negative Voltage output (Vout)               |
| 19      | A      | Power Supply for LED backlight ( + )         |
| 20      | K      | Power Supply for LED backlight ( - )         |

# 4 Mechanical Drawing



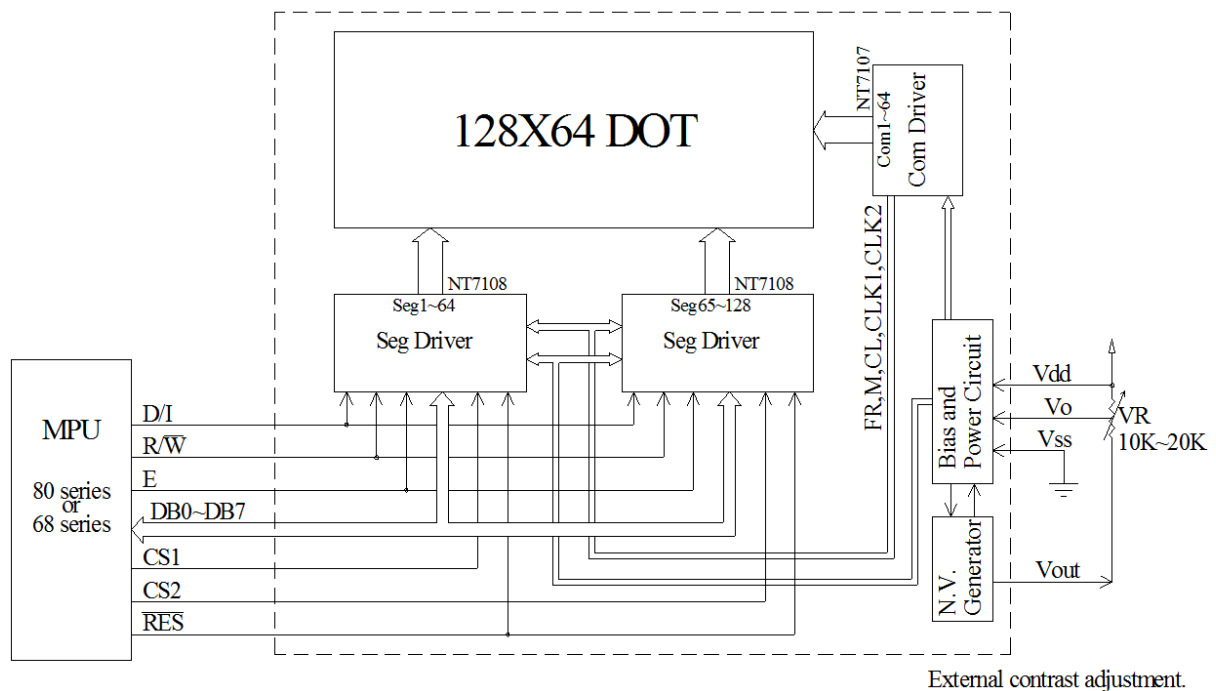
## 5 Electrical Characteristics

| Item                      | Symbol           | Condition    | Min    | Typ. | Max | Unit |
|---------------------------|------------------|--------------|--------|------|-----|------|
| Supply Voltage For Logic  | VDD              |              | 4.5    | 5.0  | 5.5 | V    |
| Supply Current            | IDD              | VDD=5.0V     | 3.0    | 4.0  | 5.0 | mA   |
| Low Level Input Voltage   | V <sub>IL</sub>  |              | 0      | -    | 0.8 | V    |
| High Level Input Voltage  | V <sub>IH</sub>  |              | 0.7VDD | -    | 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 Supply Voltage  | V                |              | 3.4    | 3.5  | 3.6 | V    |
| Backlight Supply Current  | I <sub>LED</sub> |              | 43.2   | 48   | 60  | mA   |
| Operating Temperature     | TOP              | Absolute Max | -20    | -    | +70 | °C   |
| Storage Temperature       | TST              | Absolute Max | -30    | -    | +80 | °C   |

## 6 Optical Characteristics

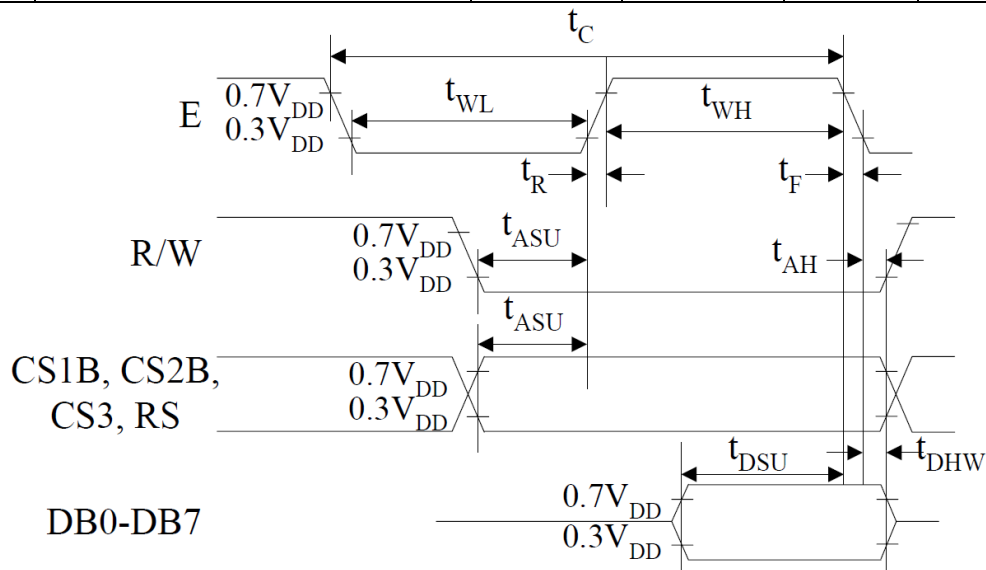
| Item                     | Symbol  | Min | Typ | Max | Unit              | Note |
|--------------------------|---------|-----|-----|-----|-------------------|------|
| View Angles Top          | AV      |     | 30  |     | °                 |      |
| View Angles Bottom       | AV      |     | 60  |     | °                 |      |
| View Angles Left         | AH      |     | 45  |     | °                 |      |
| View Angles Right        | AH      |     | 45  |     | °                 |      |
| Response Time (25°C)     | Tr + Tf |     | 300 | 400 | ms                |      |
| Contrast Ratio           | CR      |     | 5   |     |                   |      |
| Luminance ( Without LCD) | Ly      | 416 | 520 |     | cd/m <sup>2</sup> |      |

## 7 Block Diagram

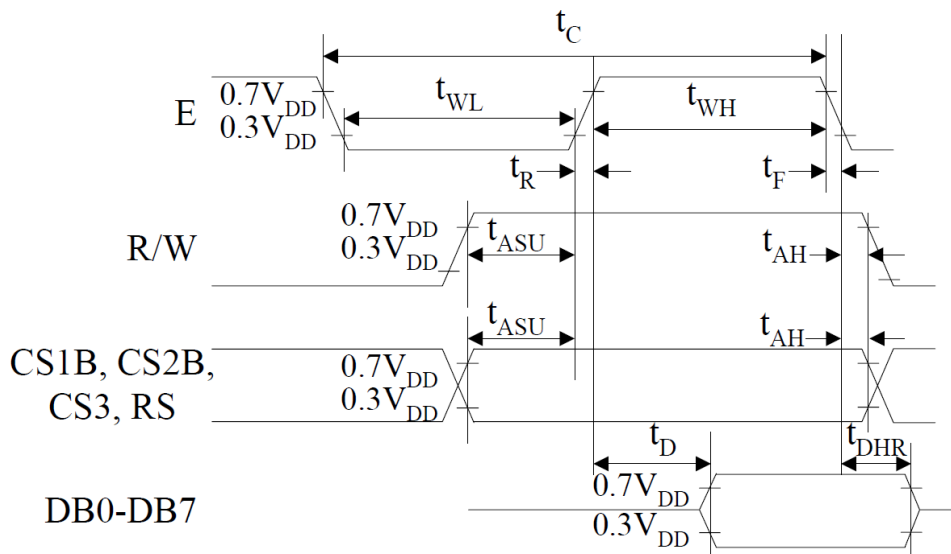


## 8 Timing Characteristics

| Symbol    | Parameter              | Min  | Typ | Max | Unit |
|-----------|------------------------|------|-----|-----|------|
| $t_C$     | E cycle                | 1000 | -   | -   | ns   |
| $t_{WH}$  | E high level width     | 450  | -   | -   | ns   |
| $t_{WL}$  | E low level width      | 450  | -   | -   | ns   |
| $t_R$     | E rise time            | -    | -   | 25  | ns   |
| $t_F$     | E fall time            | -    | -   | 25  | ns   |
| $t_{ASU}$ | Address set-up time    | 140  | -   | -   | ns   |
| $t_{AH}$  | Address hold time      | 10   | -   | -   | ns   |
| $t_{DSU}$ | Data set-up time       | 200  | -   | -   | ns   |
| $t_D$     | Data delay time        | -    | -   | 320 | ns   |
| $t_{DHW}$ | Data hold time (write) | 10   | -   | -   | ns   |
| $t_{DHR}$ | Data hold time (read)  | 20   | -   | -   | ns   |



MPU Write Timing



MPU Read Timing

## 9 Commands

| Instruction                    | RS | R/W | DB7        | DB6 | DB5                       | DB4   | DB3 | DB2        | DB1 | DB0 | Function  |   |
|--------------------------------|----|-----|------------|-----|---------------------------|-------|-----|------------|-----|-----|---|---|
| Display on/off                 | L  | L   | L          | L   | H                         | H     | H   | H          | H   | L/H | Controls the display on or off. Internal status and display RAM data is not affected.<br>L:OFF, H:ON                      |   |
| Set address (Y address)        | L  | L   | L          | H   | Y address (0-63)          |       |     |            |     |     | Sets the Y address in the Y address counter.  |   |
| Set page (X address)           | L  | L   | H          | L   | H                         | H     | H   | Page (0-7) |     |     | Sets the X address at the X address register.   |   |
| Display Start line (Z address) | L  | L   | H          | H   | Display start line (0-63) |       |     |            |     |     | Indicates the display data RAM displayed at the top of the screen.  |   |
| Status read                    | L  | H   | Busy       | L   | On/Off                    | Reset | L   | L          | L   | L   | Read status.<br>BUSY L: Ready<br>H: In operation<br>ON/OFF L: Display ON<br>H: Display OFF<br>RESET L: Normal<br>H: Reset |   |
| Write display data             | H  | L   | Write data |     |                           |       |     |            |     |     |   | Writes data (DB0: 7) into display data RAM. After writing instruction, Y address is increased by 1 automatically. |
| Read display data              | H  | H   | Read data  |     |                           |       |     |            |     |     |   | Reads data (DB0: 7) from display data RAM to the data bus.  |

### DISPLAY ON/OFF

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 1   | D   |

The display data appears when D is 1 and disappears when D is 0. Though the data is not on the screen with D=0, it remains in the display data RAM. Therefore, you can make it appear by changing D=0 into D=1.

### SET ADDRESS(Y ADDRESS)

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 0   | 1   | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 |

Y address (AC0-AC5) of the display data RAM is set in the Y address counter. An address is set by instruction and increased by 1 automatically by read or write operations of display data.

### SET PAGE (X ADDRESS)

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 1   | 0   | 1   | 1   | 1   | AC2 | AC1 | AC0 |

X address (AC0-AC2) of the display data RAM is set in the X address register. Writing or reading to or from MPU is executed in this specified page until the next page is set.

### DISPLAY START LINE(Z ADDRESS)

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | 0   | 1   | 1   | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 |

Z address (AC0-AC5) of the display data RAM is set in the display start line register and displayed at the top of the screen. When the display duty cycle is 1/64 or others (1/32-1/64), the data of total line number of LCD screen, from the line specified by display start line instruction, is displayed.

### STATUS READ

| RS | R/W | DB7  | DB6 | DB5    | DB4   | DB3 | DB2 | DB1 | DB0 |
|----|-----|------|-----|--------|-------|-----|-----|-----|-----|
| 0  | 1   | BUSY | 0   | ON/OFF | RESET | 0   | 0   | 0   | 0   |

**·BUSY**

When BUSY is 1, the Chip is executing internal operation and no instructions are accepted.

When BUSY is 0, the Chip is ready to accept any instructions.

**·ON/OFF**

When ON/OFF is 1, the display is OFF.

When ON/OFF is 0, the display is ON.

**·RESET**

When RESET is 1, the system is being initialized.

In this condition, no instructions except status read can be accepted.

When RESET is 0, initializing has finished and the system is in usual operation condition.

**WRITE DISPLAY DATA**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | 0   | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  |

Writes data (D0-D7) into the display data RAM. After writing instruction, Y address is increased by 1 automatically.

**READ DISPLAY DATA**

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | 1   | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  |

Reads data (D0-D7) from the display data RAM. After reading instruction, Y address is increased by 1 automatically.

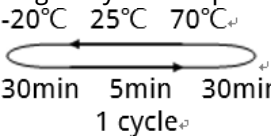
## 10 Driver/Controller Information

Built-in NT7108 IC

<https://drive.google.com/file/d/0B5IkVYnewKTGZ1d0RjVvX1BXRik/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;<br>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>