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## Graphic Display Module

Part Number

G12864A-FTW-LW63

### Overview:

- 128x64 dots
- Area: 89.7x49.8mm
- Viewing Area: 69.0x 36.5mm
- FSTN Gray Positive
- Parallel & Serial Interfaces
- Wide Temp  
(-20° - 70°C operating / -30° - 80°C storage)
- Bottom View
- Transflective (positive)
- 3V LCD, 1/64 duty, 1/9 bias
- 3.5V White LED backlight
- Controller: NT7534
- RoHS Compliant

## Graphic LCD Features

Resolution: 128x64 dots

Interfaces: 8-bit parallel (8080/6800) and 4-wire SPI

Built in IC Controller: NT7534

Built in DC to DC Circuits

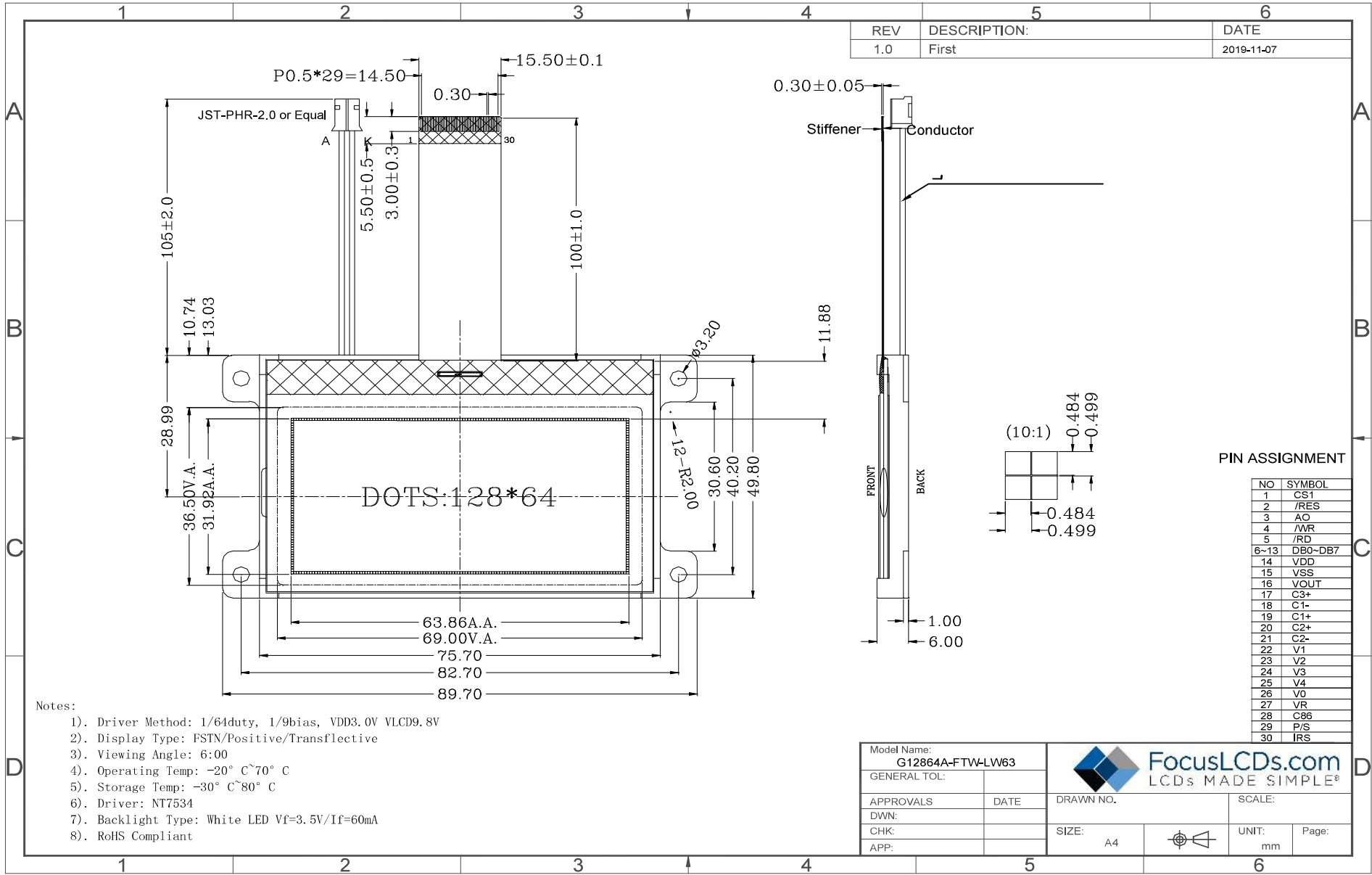
RoHS Compliant

| General Information Items | Specification                | Unit    | Note        |
|---------------------------|------------------------------|---------|-------------|
|                           | Main Panel                   |         |             |
| Viewing Area              | 69.0(L) x 36.5(W)            | mm      | -           |
| LCD Type                  | FSTN Gray Positive           | -       | -           |
| Viewing Direction         | 6:00                         | o'clock | -           |
| Rear Polarizer            | Transflective                | -       | -           |
| Number of Pixels          | 128x64                       | dots    | -           |
| Backlight Type            | LED                          | -       | -           |
| Backlight Color           | White                        | -       | -           |
| Controller IC             | NT7534                       | -       | -           |
| Interfaces                | 8-bit Parallel/4-wire Serial | -       | 8080 & 6800 |
| DC to DC Circuit          | Built In                     | -       | -           |
| Operating temperature     | -20~+70                      | °C      | -           |
| Storage temperature       | -30~+80                      | °C      | -           |

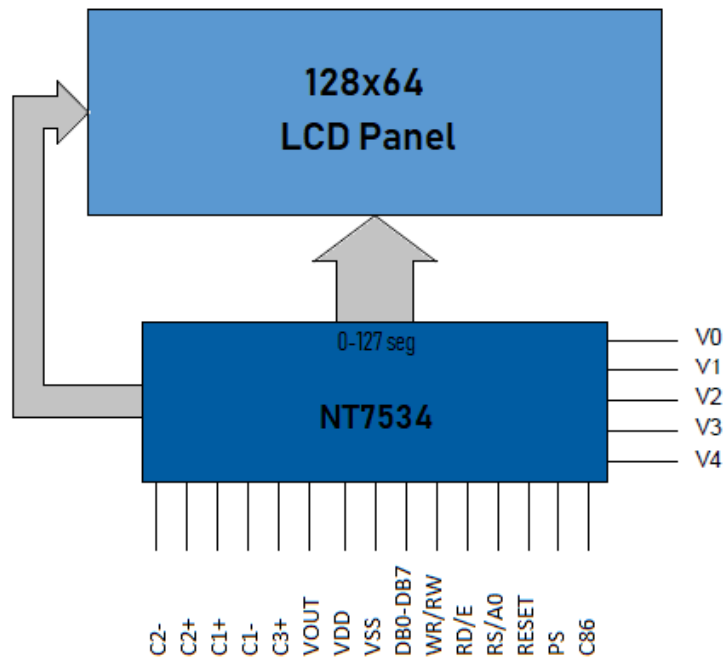
## Mechanical Information

| Item        |            | Min | Typ. | Max | Unit | Note |
|-------------|------------|-----|------|-----|------|------|
| Module size | Length (L) |     | 89.7 |     | mm   | -    |
|             | Width (W)  |     | 49.8 |     | mm   | -    |
|             | Height (H) |     | 6.0  |     | mm   | -    |

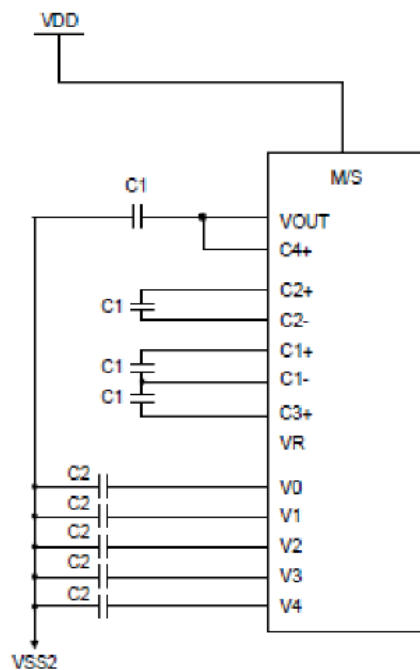
# 1. Outline Dimensions



## 2. Block Diagrams



Capacitance 1uF-2.2uF



C1: 1uF-4.7uF for Voltage rating from 10-35V  
C2: 1uF-2.2uF for Voltage rating from 6.3-25V

*NOTE: See IC controller spec NT7534 for more information on internal voltage regulating circuits. Additional information on DC-DC voltage regulating circuits for graphic LCD's is available on our website at [www.FocusLCDs.com](http://www.FocusLCDs.com).*

### 3. Input Terminal Pin Assignment

Recommended Connector: FH19C-30S-0.5SH(99)

| NO. | Symbol   | Description   | I/O |
|-----|----------|---|-----|
| 1   | CS1      | Chip select in serial interface. Low is active.                                     | MPU |
| 2   | RES      | External reset pin. Must be fixed to VDD. Low is active.                            | MPU |
| 3   | A0       | Select registers. 0: instructions, 1: data registers.                               | MPU |
| 4   | WR       | Read/write select signal  | MPU |
| 5   | RD       | Operation (data read/write) enable signal   | MPU |
| 6   | DB0      | Display data  | MPU |
| 7   | DB1      | Display data  | MPU |
| 8   | DB2      | Display data  | MPU |
| 9   | DB3      | Display data  | MPU |
| 10  | DB4      | Display data  | MPU |
| 11  | DB5      | Display data  | MPU |
| 12  | DB6(SCL) | Display data (or serial clock in serial interface)                                  | MPU |
| 13  | DB7(SI)  | Display data (or serial data input in serial interface)                             | MPU |
| 14  | VDD      | Power supply for logic LCM  | MPU |
| 15  | VSS      | Signal ground for LCM   | MPU |
| 16  | VOUT     | DC/DC voltage converter output  | MPU |
| 17  | C3+      | For voltage booster circuit External capacitors 0.47uF-2.2uF.                       | P   |
| 18  | C1-      |   | P   |
| 19  | C1+      |   | P   |
| 20  | C2+      |   | P   |
| 21  | C2-      |   | P   |
| 22  | V1       | Power supply for LCD.   | P   |
| 23  | V2       |   | P   |
| 24  | V3       |   | P   |
| 25  | V4       |   | P   |
| 26  | V0       |   | P   |
| 27  | VR       | Voltage adjustment pin. Applies voltage between V0 and VSS using resistive divider. | MPU |
| 28  | C86      | MPU parallel interface switch terminal (8080 or 6800)                               | MPU |
| 29  | P/S      | Parallel or serial interface select   | MPU |
| 30  | IRS      | Resistor select for internal voltage divider for V0 voltage level adjustment        | MPU |

### 4. LCD Optical Characteristics

#### 4.1 Optical Specifications

FSTN Type Display Module

(Ta=25°C, VDD=3.0V)

| Item           | Symbol     | Condition | Min      | Typ. | Max | Unit | Note   |  |
|----------------|------------|-----------|----------|------|-----|------|--------|--|
| Contrast Ratio | CR         | Ta=25°C   | --       | 6    | --  | --   |        |  |
| Response Time  | Rising     |           | TR       | --   | 150 | 250  | ms     |  |
|                | Falling    |           | TF       | --   | 150 | 250  |        |  |
| Viewing Angle  | Left-Right |           | $\theta$ | -60  | --  | 35   | degree |  |
|                | Top-Bottom |           | $\theta$ | - 40 | --  | 40   |        |  |

## 5. Electrical Characteristics

### 5.1 Absolute Maximum Rating (Ta=25 °C, VSS=0V)

| Characteristics              | Symbol  | Min  | Max     | Unit |
|------------------------------|---------|------|---------|------|
| Power Voltage Logic          | VDD-VSS | 0.3  | 3.6     | V    |
| Input Voltage                | VIN     | -0.3 | VDD+0.3 | V    |
| Power Supply Voltage for LCD | V0-VSS  | -0.3 | 14.2    | V    |
| Operating Temperature        | TOP     | -20  | +70     | °C   |
| Storage Temperature          | TST     | -30  | +80     | °C   |

*NOTE: If the absolute maximum rating of the above parameters is exceeded, even momentarily, the quality of the product may be degraded. Absolute maximum ratings specify the values which the product may be physically damaged if exceeded. Be sure to use the product within the range of the absolute maximum ratings.*

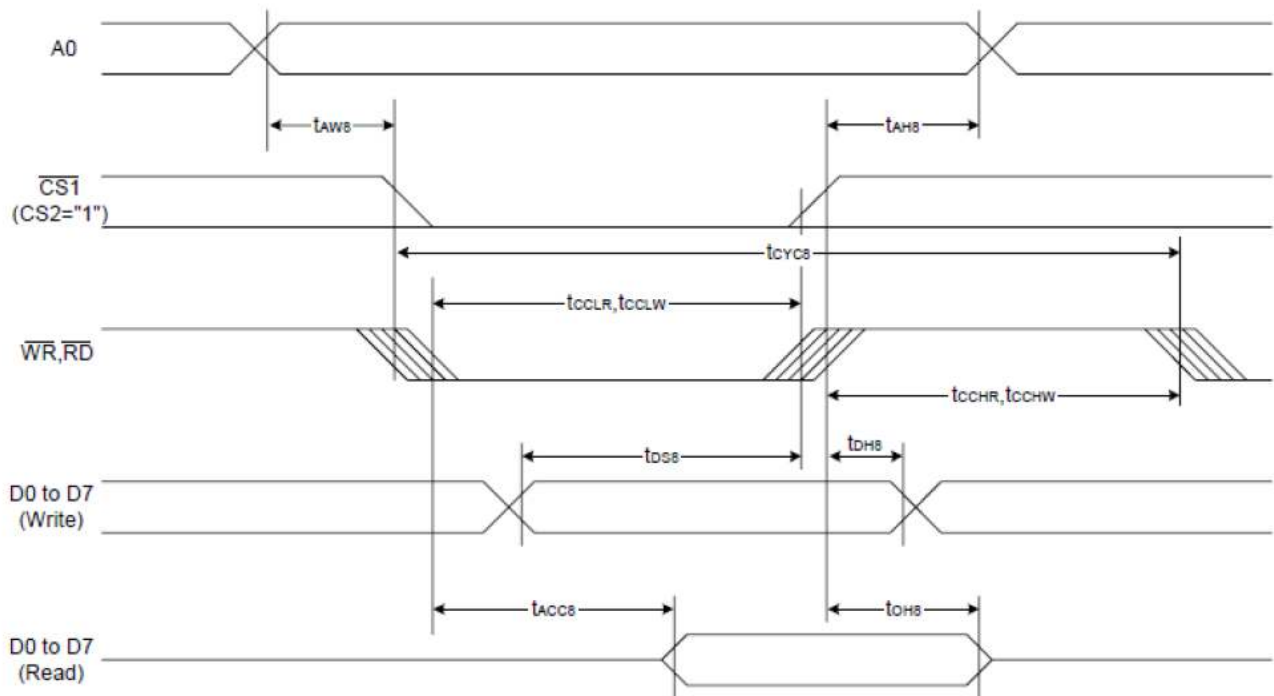
### 5.2 DC Electrical Characteristics

| Characteristics          | Symbol | Conditions        | Min | Typ. | Max  | Unit |
|--------------------------|--------|-------------------|-----|------|------|------|
| Supply Voltage for LCD   | V0-VSS | Ta=25°C           | 9.3 | 9.8  | 12.7 | V    |
| Supply Voltage for Logic | VDD    |                   | 2.8 | 3.0  | 3.3  | V    |
| Supply Current           | IDD    | Ta=25°C, VDD=3.0V | --  | 1.1  | --   | mA   |
| Backlight Supply Voltage | VF     |                   | 2.8 | 3.0  | 3.2  | V    |
| Backlight Supply Current | ILED   | VF=3.5V           | 30  | 60   | 90   | mA   |

## 6. Signal Timing Characteristics

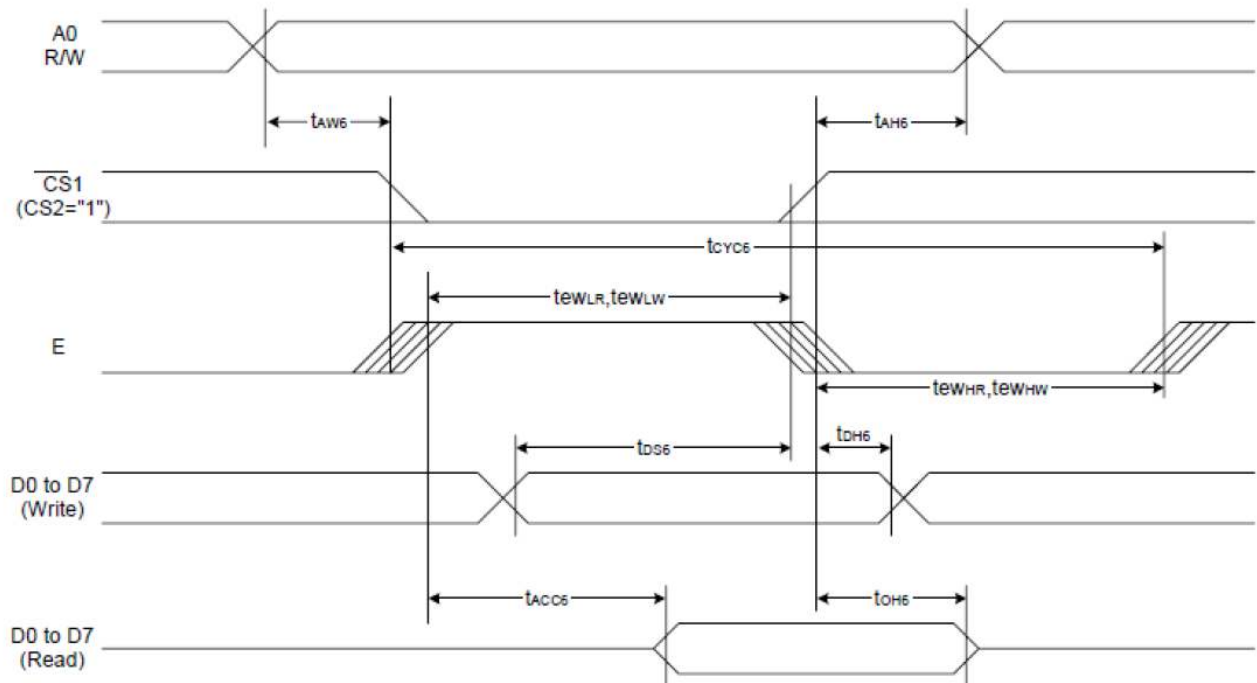
### 6.1 8-bit Parallel Timing Characteristics (8080-series)

| Parameter                    | Signal  | Symbol            | Min | Max | Unit | Note     |
|------------------------------|---------|-------------------|-----|-----|------|----------|
| Address hold time            | A0      | t <sub>AH8</sub>  | 0   | --  | ns   |          |
| Address setup time           |         | t <sub>AW8</sub>  | 0   | --  | ns   |          |
| Address cycle time           |         | t <sub>CYC8</sub> | 240 | --  | ns   |          |
| Enable L pulse width (write) | WR      | t <sub>CCLW</sub> | 90  | --  | ns   |          |
| Enable H pulse width (write) |         | t <sub>CCHW</sub> | 100 | --  | ns   |          |
| Enable L pulse width (read)  | RD      | t <sub>CCLR</sub> | 120 | --  | ns   |          |
| Enable H pulse width (read)  |         | t <sub>CCHR</sub> | 60  | --  | ns   |          |
| Write data setup time        | DB0-DB7 | t <sub>DS8</sub>  | 40  | --  | ns   |          |
| Write address hold time      |         | t <sub>DH8</sub>  | 10  | --  | ns   |          |
| Read access time             |         | t <sub>ACC8</sub> | --  | 140 | ns   | CL=100pF |
| Read output disable time     |         | t <sub>OH8</sub>  | 5   | 50  | ns   | CL=100pF |



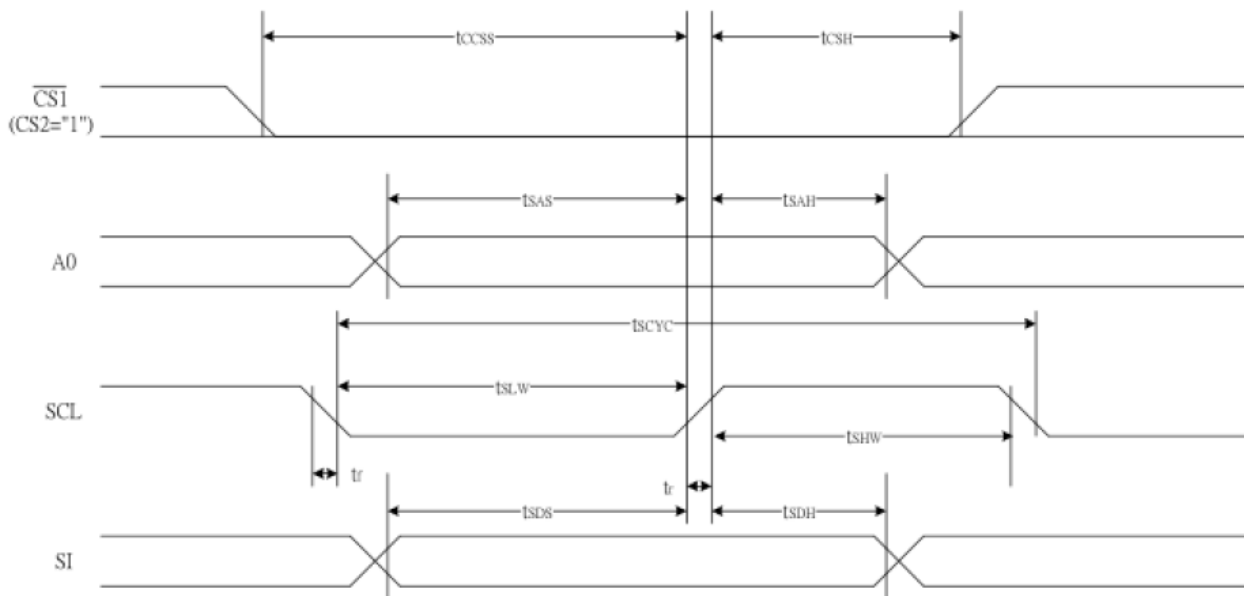
## 6.2 8-bit Parallel Timing Characteristics (6800-series)

| Parameter                    | Signal  | Symbol     | Min | Max | Unit | Note     |
|------------------------------|---------|------------|-----|-----|------|----------|
| Address hold time            | A0      | $t_{AH6}$  | 0   | --  | ns   |          |
| Address setup time           |         | $t_{AW6}$  | 0   | --  | ns   |          |
| Address cycle time           |         | $t_{CYC6}$ | 240 | --  | ns   |          |
| Enable L pulse width (write) | WR      | $t_{CCLW}$ | 100 | --  | ns   |          |
| Enable H pulse width (write) |         | $t_{CCHW}$ | 90  | --  | ns   |          |
| Enable L pulse width (read)  | RD      | $t_{CCLR}$ | 60  | --  | ns   |          |
| Enable H pulse width (read)  |         | $t_{CCHR}$ | 120 | --  | ns   |          |
| Write data setup time        | DB0-DB7 | $t_{DS6}$  | 40  | --  | ns   |          |
| Write address hold time      |         | $t_{DH6}$  | 10  | --  | ns   |          |
| Read access time             |         | $t_{ACC6}$ | --  | 140 | ns   | CL=100pF |
| Read output disable time     |         | $t_{OH6}$  | 5   | 50  | ns   | CL=100pF |





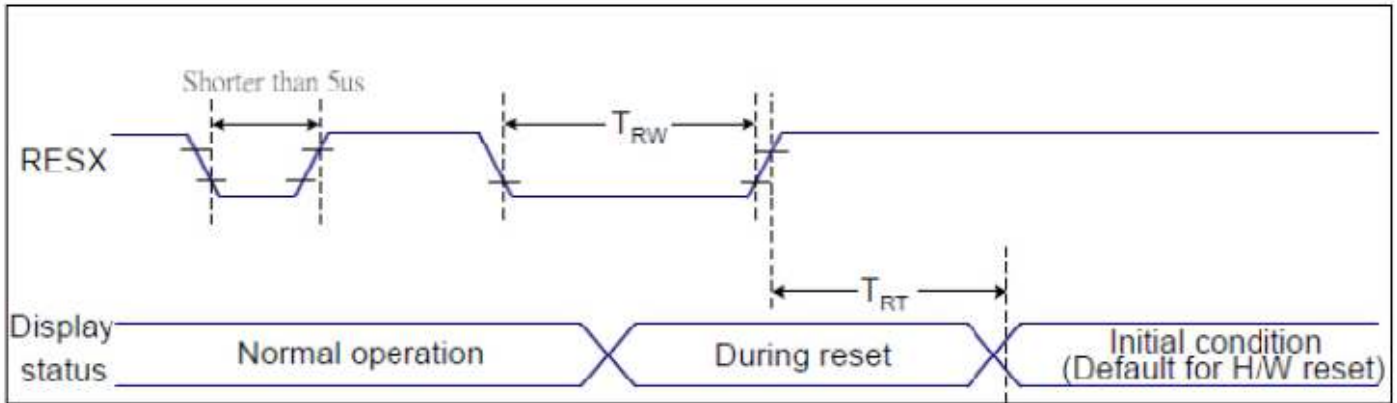
### 6.3 Serial Interface



(VDD=3.0V, Ta=25°C)

| Parameter           | Signal | Symbol     | Min | Max | Unit | Note |
|---------------------|--------|------------|-----|-----|------|------|
| Serial Clock Period | SCL    | $T_{scyc}$ | 120 | --  | ns   |      |
| SCL "H" pulse width |        | $T_{shw}$  | 60  | --  | ns   |      |
| SCL "L" pulse width |        | $T_{slw}$  | 60  | --  | ns   |      |
| Address setup time  | A0     | $T_{sas}$  | 30  | --  | ns   |      |
| Address hold time   |        | $T_{sah}$  | 20  | --  | ns   |      |
| Data setup time     | SI     | $T_{sds}$  | 30  | --  | ns   |      |
| Data hold time      |        | $T_{sdh}$  | 20  | --  | ns   |      |
| CS-SCL time         | CS     | $T_{css}$  | 20  | --  | ns   |      |
| CS-SCL time         |        | $T_{csh}$  | 40  | --  | ns   |      |

## 6.4 Reset Timing



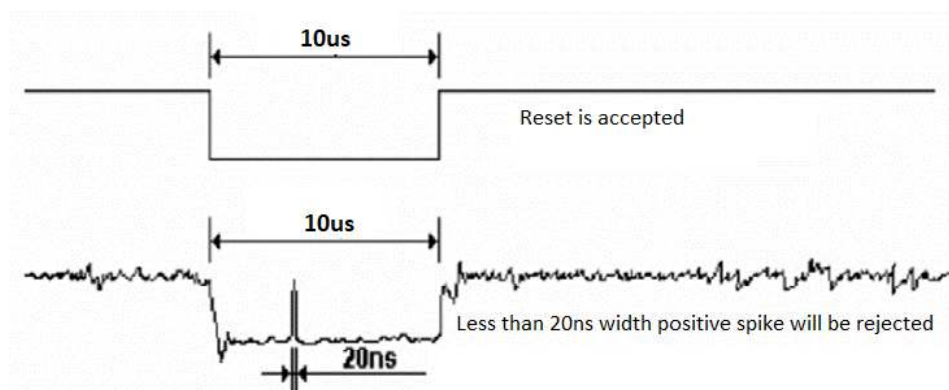
| Related Pins | Symbol | Parameter            | Min | Max                | Unit |
|--------------|--------|----------------------|-----|--------------------|------|
| RESX         | TRW    | Reset pulse duration | 10  | -                  | us   |
|              | TRT    | Reset cancel         | -   | 5 (Note 1,5)       | ms   |
|              |        |                      |     | 120 (Note 1, 6, 7) | ms   |

Notes:

- The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5ms after a rising edge of RESX.
- Spike due to an electrostatic discharge on RESX line does not because irregular system reset according to the table below:

| RESX Pulse           | Action         |
|----------------------|----------------|
| Shorter than 5us     | Reset Rejected |
| Longer than 9us      | Reset          |
| Between 5us and 9 us | Reset starts   |

- During the resetting period, the display will be blanked (the display is entering blanking sequence, which maximum time is 120ms, when reset starts in Sleep Out mode. The display remains the blank state in Sleep in mode) and then return to Default condition for Hardware Reset.
- Spike Rejection also applies during a valid reset pulse as shown below:



- When Reset applied during Sleep In Mode.
- When Reset applied during Sleep Out Mode.
- It is necessary to wait 5ms after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120ms.

## 7. Commands for Initialization of the Display

| Command   | A0 RD WR | D7 D6 D5 D4 D3 D2 D1 D0                | Description   |
|---|----------|--|---|
| Display On/Off                                    | 0 1 0    | 1 0 1 0 1 1 1 0/1                      | Display on/off, 0: OFF, 1:ON                                |
| Display start line set                            | 0 1 0    | 0 1 Display start address              | Sets RAM start address                                      |
| Page address set                                  | 0 1 0    | 1 0 1 1 Page address                   | Sets RAM page address                                       |
| Column address set                                | 0 1 0    | 0 0 0 1 MS col address                 | Sets most MSB of RAM column address                         |
| Status read                                       | 0 0 1    | Status 0 0 0 0                         | Reads status of data  |
| Display data write                                | 1 1 0    | Write data (D3-D1)                     | Writes data to RAM  |
| Display data read                                 | 1 0 1    | Read data (D3-D1)                      | Reads data from RAM   |
| Display normal/reverse                            | 0 1 0    | 1 0 1 0 0 0 0 0/1                      | Sets display in normal or reverse mode. 0:normal, 1:reverse |
| Display all points On/Off                         | 0 1 0    | 1 0 1 0 0 1 0 0                        | Display all points. 0: normal, 1: all points on             |
| LCD bias set                                      | 0 1 0    | 1 0 1 0 0 0 0 0/1                      | Set LCD voltage bias ratio. 0: 1/9 bias, 1: 1/7 bias        |
| Read modify write                                 | 0 1 0    | 1 1 1 0 0 0 0 0                        | Column address increment                                    |
| End   | 0 1 0    | 1 1 1 0 1 1 1 0                        | Clear read/modify/write                                     |
| Reset   | 0 1 0    | 1 1 1 0 0 0 1 0                        | Internal reset  |
| Power control set                                 | 0 1 0    | 0 0 1 0 1 Mode                         | Internal power supply operating mode                        |
| V0 voltage regulator, internal resistor ratio set | 0 1 0    | 0 0 1 0 1 Res. ratio                   | Select internal resistor ratio (Rb/Ra) mode                 |
| Electronic volume mode set                        | 0 1 0    | 1 0 0 0 0 0 0 1                        | Set V0 output voltage                                       |
| Electronic volume register set                    | 0 1 0    | 0 0 Electronic volume                  | Electronic volume value                                     |
| Sleep mode set                                    | 0 1 0    | 1 0 1 0 1 1 0 0                        | 0: Sleep mode, 1: Normal mode                               |
| Booster ratio set                                 | 0 1 0    | 1 1 1 1 1 0 0 0<br>0 0 0 0 0 0 step-up | Select booster ratio<br>00: 2x, 3x, 4x 01:5x, 11: 6x        |
| NOP   | 0 1 0    | 1 1 1 0 0 0 1 1                        | Command for non-operation                                   |

For more information on commands and register instructions for your display, please visit [FocusLCDs.com](http://FocusLCDs.com)!  
 Additional information can be found in the IC controller specification sheet NT7534

## 8. Cautions and Handling Precautions

### 8.1 Handling and Operating the Module

1. When the module is assembled, it should be attached to the system firmly. Do not warp or twist the module during assembly work.
2. Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
3. Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
4. Do not allow drops of water or chemicals to remain on the display surface. If you have the droplets for a long time, staining and discoloration may occur.
5. If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
6. The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
7. If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
8. Protect the module from static, it may cause damage to the CMOS ICs.
9. Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
10. Do not disassemble the module.
11. Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
12. Pins of I/F connector shall not be touched directly with bare hands.
13. Do not connect, disconnect the module in the "Power ON" condition.
14. Power supply should always be turned on/off by the item Power On Sequence & Power Off Sequence.

### 8.2 Storage and Transportation

1. Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%
2. Do not store the Graphic LCD module in direct sunlight.
3. The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
4. It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module. In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
5. This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.