NEWHAVEN DISPLAY INTERNATIONAL

**Product Specification**

# NHD-C0420BZ-NSW-BBW-3V3

## COG (Chip-On-Glass) Liquid Crystal Display Module

| | |
|---|---|
| **NHD-** | Newhaven Display |
| **C0420-** | COG, 4 Lines x 20 Characters |
| **BZ-** | Model |
| **N-** | Transmissive |
| **SW-** | Side white LED Backlight |
| **B-** | STN (-) Blue |
| **B-** | 6:00 Optimal View |
| **W-** | Wide Temperature |
| **3V3-** | 3.3V LCD, 3.0V Backlight |

Newhaven Display International, Inc.
2661 Galvin Court, Elgin, IL 60124 USA

Ph: 847.844.8795 | Fx: 847.844.8796
www.newhavendisplay.com

REACH Compliant

RoHS Compliant

NEWHAVEN DISPLAY INTERNATIONAL

# Table of Contents


Document Revision History ..... 2
Mechanical Drawing ..... 3
Pin Description ..... 4
Interface Selection ..... 4
DDRAM address ..... 4
Wiring Diagram ..... 5
Electrical Characteristics ..... 7
Optical Characteristics ..... 7
Controller Information ..... 7
Table of Commands ..... 8
Timing Characteristics ..... 10
Built-in Font Table ..... 16
Example Initialization Code ..... 17
Quality Information ..... 19


---

## Additional Resources

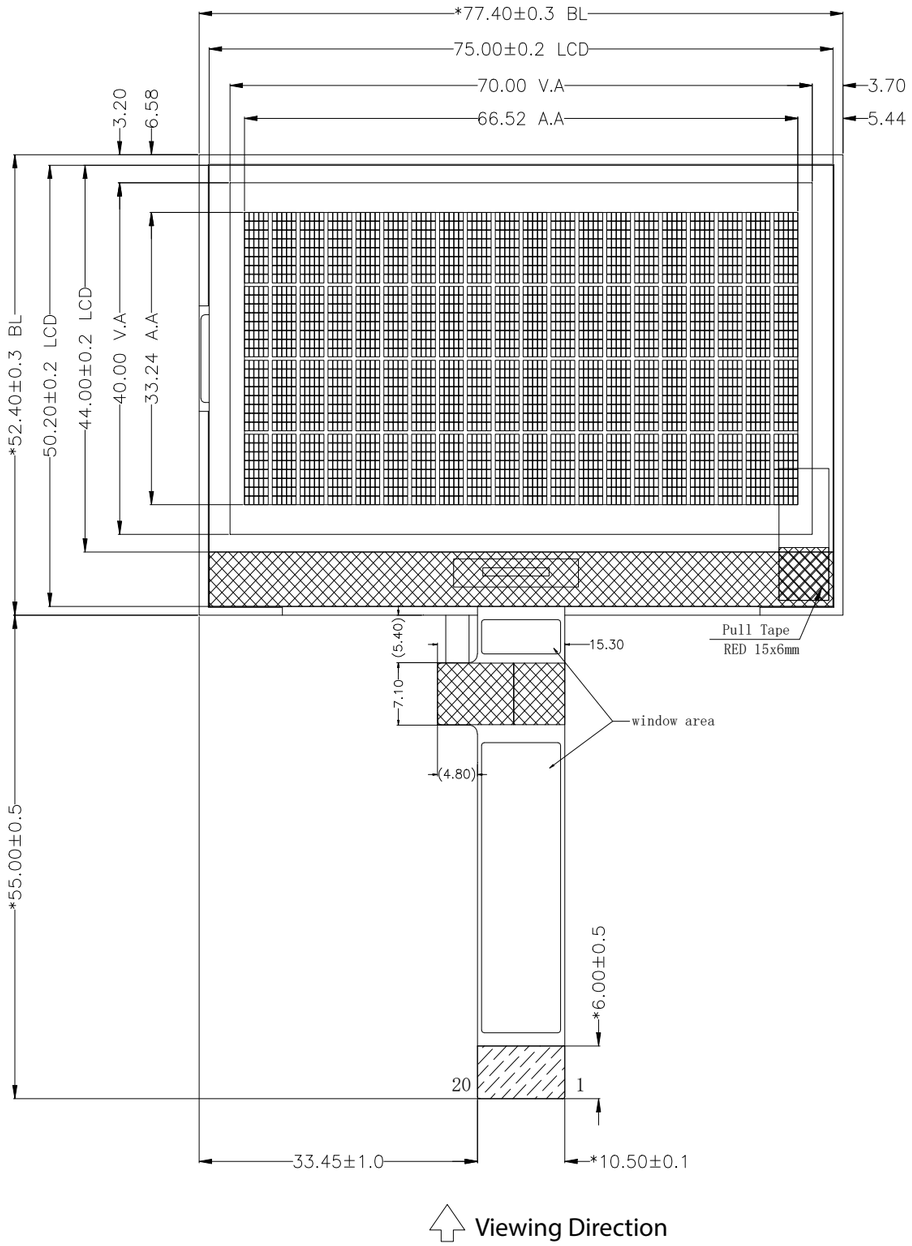
- **Support Forum:** https://support.newhavendisplay.com/hc/en-us/community/topics
- **GitHub:** https://github.com/newhavendisplay
- **Example Code:** https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html
- **Quality Center:** https://www.newhavendisplay.com/quality_center.html
- **Precautions for using LCDs/LCMs:** https://www.newhavendisplay.com/specs/precautions.pdf
- **Warranty / Terms & Conditions:** https://www.newhavendisplay.com/terms.html

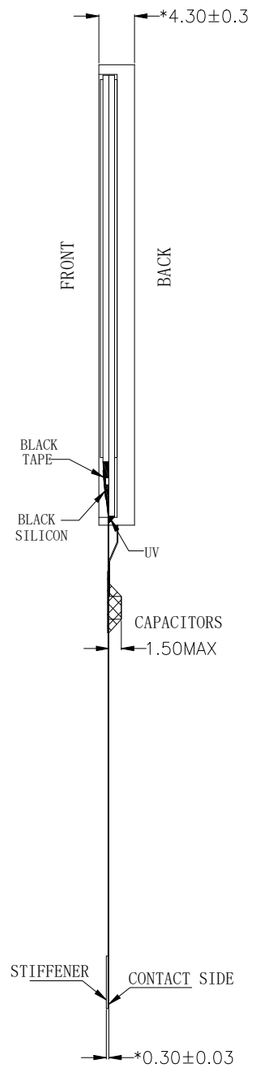
NEWHAVEN DISPLAY INTERNATIONAL

# Document Revision History

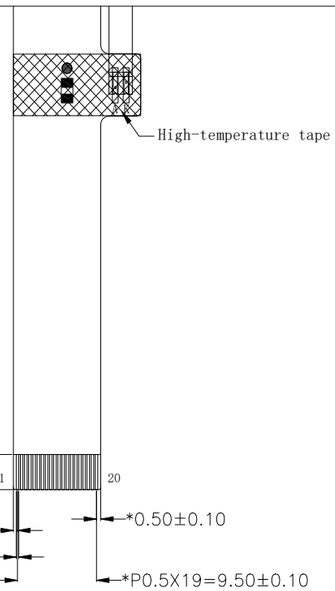
| Revision | Date | Description | Changed By |
|---|---|---|---|
| - | 01/11/2026 | Initial Release | KL |

# Mechanical Drawing

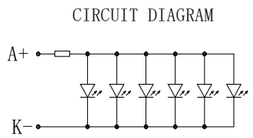


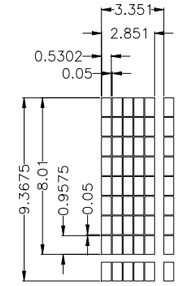




NEWHAVEN DISPLAY
NHD-C0420BZ-NSW-BBW-3V3
LOT-YYWW




CIRCUIT DIAGRAM



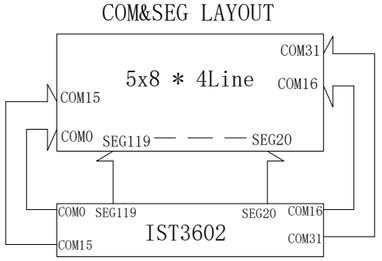

DOTS DETAIL
SCALE 2:1

| PIN | SIGNAL |
|---|---|
| 1 | VSS |
| 2 | VDD |
| 3 | CSB |
| 4 | RESB |
| 5 | A0 |
| 6 | R/W |
| 7 | E |
| 8 | DB0 |
| 9 | DB1 |
| 10 | DB2 |
| 11 | DB3 |
| 12 | DB4 |
| 13 | DB5 |
| 14 | DB6 |
| 15 | DB7 |
| 16 | C68 |
| 17 | PS |
| 18 | IIC |
| 19 | LED-A |
| 20 | LED-K |

Product Description: 4x20 Character COG LCD

1. Driver IC: IST3602
2. Driving Mode: 1/33 Duty, 1/7 Bias
3. Interface: 8-bit 6800/8080 Parallel, 3/4-wire SPI, I²C
4. Power Requirement: 3.3V LCD, 3.0V/80mA Backlight
5. Optical Features: STN(-) Blue, Transmissive, 6:00 View, White Backlight
6. Recommended FFC Connector: 20pin 0.5mm pitch

COM&SEG LAYOUT




**Standard Tolerance:**
(Unless otherwise specified)
Linear: ±0.3mm

NEWHAVEN DISPLAY INTERNATIONAL

Drawing/Part Number: NHD-C0420BZ-NSW-BBW-3V3
Revision: -

**Unless otherwise specified:**
• Dimensions are in Millimeters
• Third Angle Projection

Drawn By: K. Lewis
Approved By: K. Lewis
Drawn Date: 07/22/2025
Approved Date: 07/22/2025

This drawing is solely the property of Newhaven Display International, Inc. The information it contains is not to be disclosed, reproduced or copied in whole or part without written approval from Newhaven Display.

# Pin Description

| Pin No. | Symbol | External Connection | Function Description |
|---|---|---|---|
| 1 | $V_{SS}$ | Power Supply | Ground |
| 2 | $V_{DD}$ | Power Supply | Supply voltage for logic (3.3V) |
| 3 | CSB | MPU | Active LOW Chip Select signal |
| 4 | RESB | MPU | Active LOW Reset signal |
| 5 | A0 | MPU | Register Select Signal. A0=0: Command, A0=1: Data |
| 6 | R/W<br>/WR | MPU | **6800 Mode:** Read/Write select signal, R/W=1: Read R/W=0: Write<br>**8080 Mode:** Active LOW Write signal |
| 7 | E<br>/RD | MPU | **6800 Mode:** Operation Enable signal. Falling edge triggered.<br>**8080 Mode:** Active LOW Read signal |
| 8-15 | DB0-DB7 | MPU | **Parallel Interface:**<br>DB0-DB7: Bi-direction 8-bit data bus<br>**Serial Interface:**<br>DB6: Serial Clock (SCL)<br>DB7: Serial Data (SDA) |
| 16 | C68 | MPU | Select MPU interface pin. C86=H: 6800; C86=L: 8080 |
| 17 | PS | MPU | Parallel/Serial Select. PS= H: Parallel; PS=L: Serial (IIC=H) |
| 18 | IIC | MPU | $I^2C$ mode select. IIC=H: $I^2C$ mode disabled; IIC=L: $I^2C$ mode enabled |
| 19 | LED-A | Power Supply | Backlight Anode (3.0V) |
| 20 | LEK-K | Power Supply | Backlight Cathode (Ground) |

**Recommended LCD connector:** 20pin 0.5mm pitch

# Interface Selection

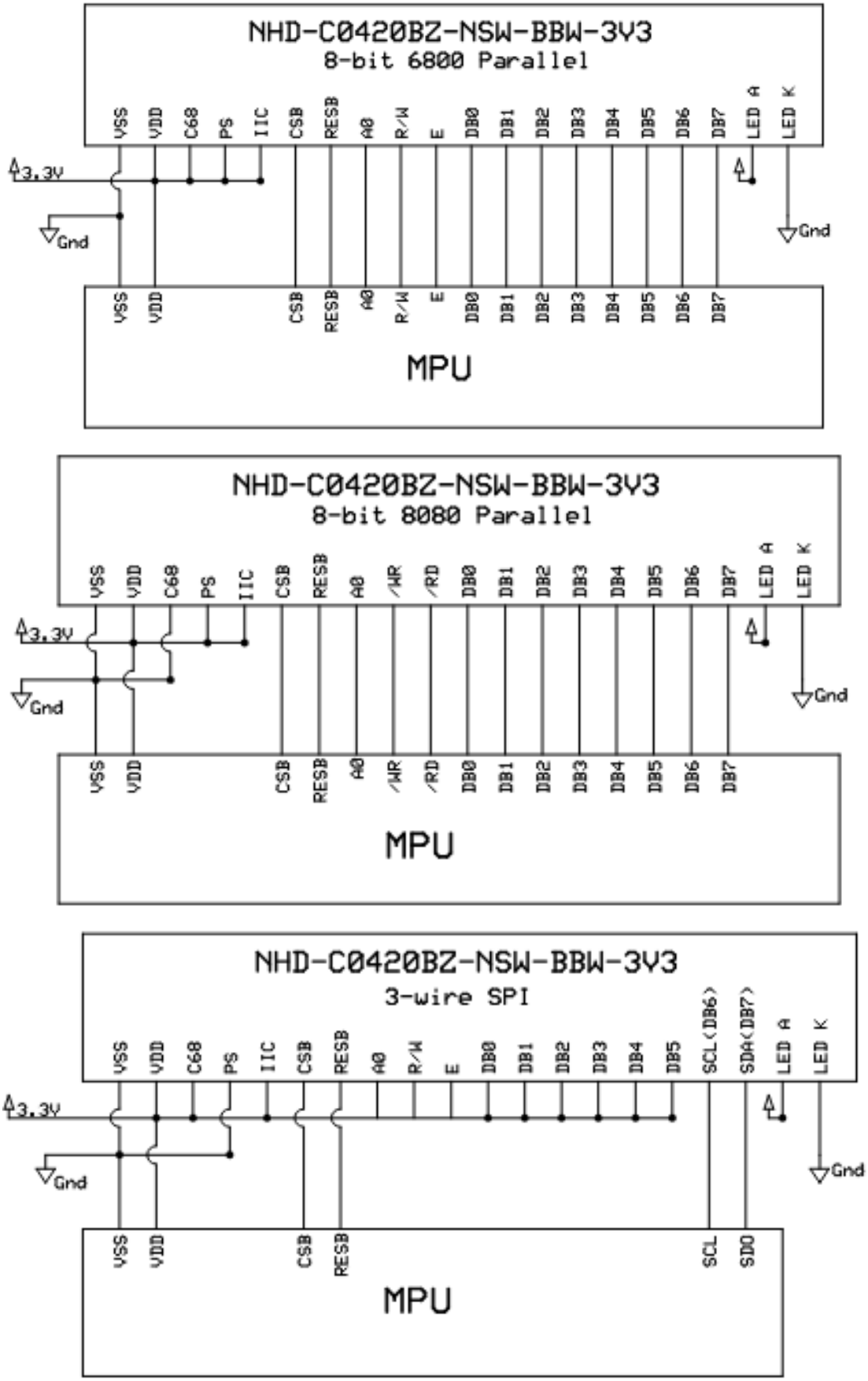
| Pin Name | IIC | PS | C68 |
|---|---|---|---|
| **8-bit 6800 Parallel** | H | H | H |
| **8-bit 8080 Parallel** | H | H | L |
| **3-wire SPI** | H | L | H |
| **4-wire SPI** | H | L | L |
| **$I^2C$** | L | ID1 | ID0 |

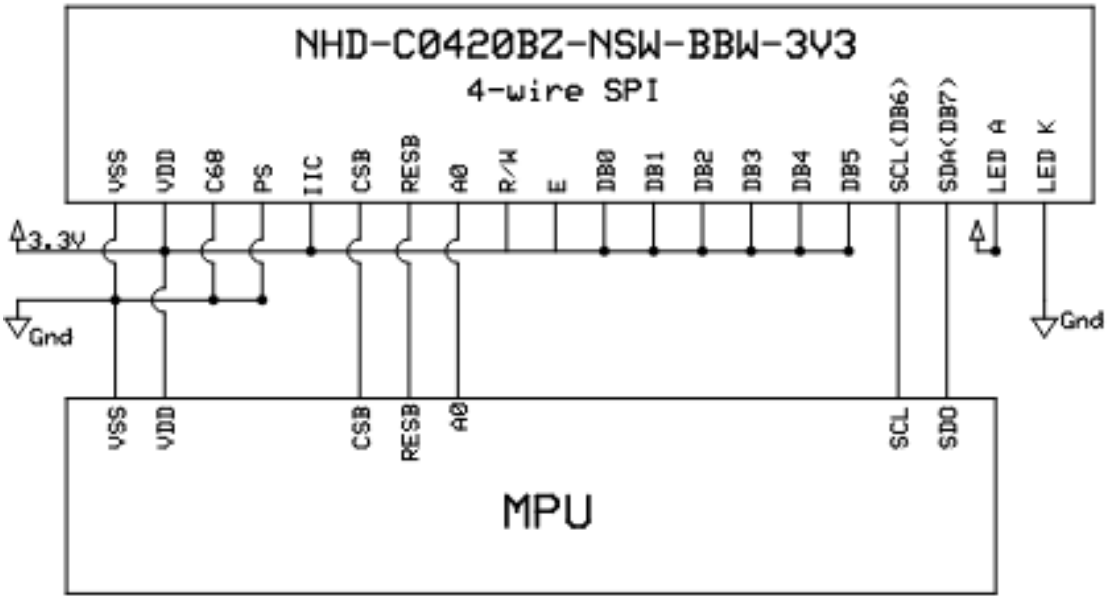
The PS and C68 pins configure the least significant bits of the $I^2C$ slave address (ID1 and ID0), allowing four options: 0111100 (C68=0, PS=0), 0111101 (C68=0, PS=1), 0111110 (C68=1, PS=0), and 0111111 (C68=1, PS=1).

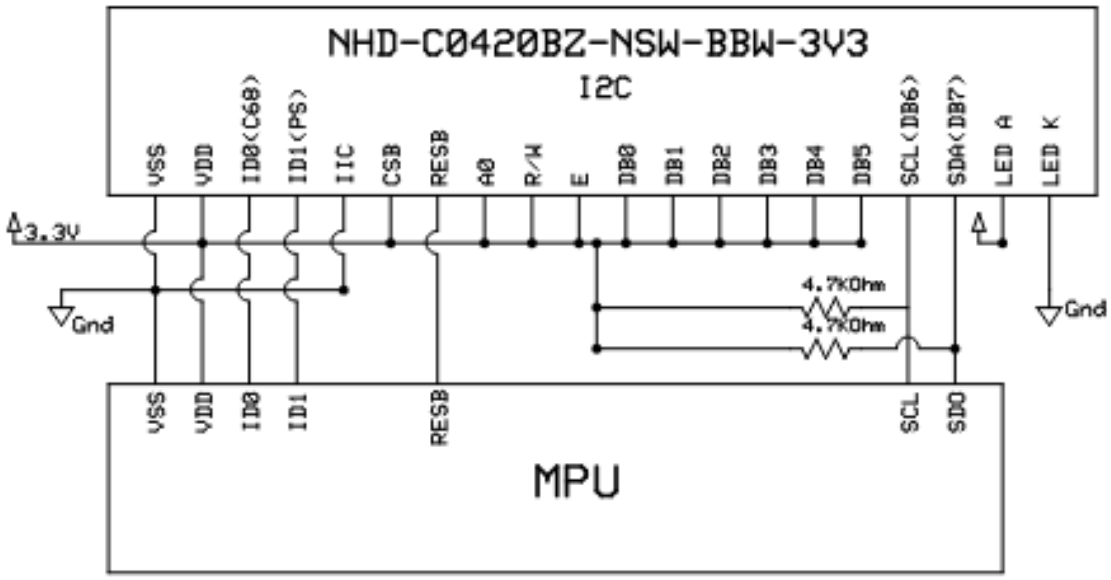
# DDRAM address

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F | 10 | 11 | 12 | 13 |
| 18 | 19 | 1A | 1B | 1C | 1D | 1E | 1F | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 2A | 2B |
| 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 3A | 3B | 3C | 3D | 3E | 3F | 40 | 41 | 42 | 43 |
| 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 5A | 5B |

# Wiring Diagram




NHD-C0420BZ-NSW-BBW-3V3
4-wire SPI
VSS
VDD
C68
PS
IIC
CSB
RESB
A0
R/W
E
DB0
DB1
DB2
DB3
DB4
DB5
SCL(DB6)
SDA(DB7)
LED A
LED K
3.3V
Gnd
Gnd
VSS
VDD
CSB
RESB
A0
SCL
SDO
MPU


NHD-C0420BZ-NSW-BBW-3V3
I2C
VSS
VDD
ID0(C68)
ID1(PS)
IIC
CSB
RESB
A0
R/W
E
DB0
DB1
DB2
DB3
DB4
DB5
SCL(DB6)
SDA(DB7)
LED A
LED K
3.3V
Gnd
4.7KOhm
4.7KOhm
Gnd
VSS
VDD
ID0
ID1
RESB
SCL
SDO
MPU

# Electrical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating Temperature Range | $T_{OP}$ | Absolute Max | -20 | - | +70 | °C |
| Storage Temperature Range | $T_{ST}$ | Absolute Max | -30 | - | +80 | °C |
| Supply Voltage | $V_{DD}$ | - | 3.0 | 3.3 | 3.6 | V |
| Supply Current | $I_{DD}$ | $T_{OP}$ =25°C, $V_{DD}$=3.3V | 0.5 | 1.75 | 3.5 | mA |
| Supply for LCD (contrast) | $V_{LCD}$ | | 8.30 | 8.50 | 870 | V |
| "H" Level input | $V_{IH}$ | - | 0.8 * $V_{DD}$ | - | $V_{DD}$ | V |
| "L" Level input | $V_{IL}$ | - | $V_{SS}$ | - | 0.2 * $V_{DD}$ | V |
| "H" Level output | $V_{OH}$ | - | 0.8 $V_{DD}$ | - | Vss | V |
| "L" Level output | $V_{OL}$ | - | $V_{SS}$ | - | 0.2 $V_{DD}$ | V |
| | | | | | | |
| Backlight Supply Current | $I_{LED}$ | - | 40 | 80 | 120 | mA |
| Backlight Supply Voltage | $V_{LED}$ | $I_{LED}$ = 80mA | 2.7 | 3.0 | 3.3 | V |

*The LED of the backlight is driven by current drain; drive voltage is for reference only. Drive voltage must be selected to ensure backlight current drain is below MAX level stated.

# Optical Characteristics

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Optimal Viewing Angles | Top | ϕY+ | CR ≥ 2 | - | 30 | - | o |
| | Bottom | ϕY- | | - | 40 | - | o |
| | Left | θX- | | - | 30 | - | o |
| | Right | θX+ | | - | 30 | - | o |
| Contrast Ratio | | CR | - | 2 | 6 | - | - |
| Response Time | Rise | $T_R$ | $T_{OP}$ = 25°C | - | 50 | 200 | ms |
| | Fall | $T_F$ | | - | 90 | 300 | ms |

# Controller Information

Built-in IST3602 Controller: https://support.newhavendisplay.com/hc/en-us/articles/33466233169175-IST3602

# Table of Commands

**Default Instruction Table**
**IS[1:0]=Don't Care**

| No | Instruction | A0 | W/R | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Description | Instruction Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Display Clear | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Display clear and set AC to "00H". Set AC to "00H". It will return cursor | 1ms |
| 2 | AC Return Zero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | Return to the original position if shifted. The contents in DDRAM are not changed. | 20us |
| 3 | Set Entry Mode | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | 0 | Set cursor move direction. The effects are performed after each data access (write or read). | 20us |
| 4 | Display Control | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | D=1: Entire display on; C=1: Cursor on; B=1: Cursor position blinks. | 20us |
| 5 | Function Set | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | IS1 | IS0 | DL: Interface data is 8/4 bits; IS[1:0]: select instruction table. | 20us |
| 6 | Set DDRAM Address | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | Set DDRAM address into AC (address counter). | 20us |
| | | 0 | 0 | 0 | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | | |
| 7 | Read Status | 0 | 1 | 0 | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Read the content of AC (address counter) | 20us |
| 8 | Write Data | 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Write data into internal RAM (DDRAM/ CGRAM/ ICONRAM) | 20us |
| 9 | Read Data | 1 | 1 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Read data from internal RAM (DDRAM/ CGRAM/ ICONRAM) | 20us |

**IS[1:0]=(0,0)**

| No | Instruction | A0 | W/R | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Description | Instruction Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Cursor Shift or Display Shift | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | 0 | 0 | S/C and R/L: Immediately move cursor or shift display by 1. | 20us |
| 2 | Set CGRAM Address | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | Set CGRAM address into AC (address counter) | 20us |
| | | 0 | 0 | 0 | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address into AC (address counter) | |

**IS[1:0]=(0,1)**

| No | Instruction | A0 | W/R | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Description | Instruction Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Follows Control | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | BS1 | BS0 | BS[1:0]: Bias select | 20us |
| 2 | Set ICON RAM Address | 0 | 0 | 0 | 1 | 0 | AC4 | AC3 | AC2 | AC1 | AC0 | Set ICON address into AC (address counter). | 20us |
| 3 | Power Control 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | SLEEP | Enter sleep mode | 20us |
| 4 | ICON/Power Control2 | 0 | 0 | 0 | 1 | 1 | 0 | Icon | Bon | Ron | Fon | Ion: ICON display on/off Bon: Set booster circuit on/off Ron: Set regulator circuit on/off Fon: Set follower circuit on/off. | 1ms |
| 5 | V0 Control 2 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | BT[1:0] | | Set booster | 20us |

**IS[1:0]=(1,0)**

| No | Instruction | A0 | W/R | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Description | Instruction Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Set Display Mode | 0 | 0 | 0 | 0 | 0 | 1 | DH1 | DH0 | N2 | N1 | DH[2:1]:Set n-Line height<br>N[2:1]: Display line number | 20us |
| 2 | Set Display pattern | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | INV | AP | INV: reverse display<br>AP : Pixel all on | 20us |
| 3 | Select CGRAM & COM/SEG direction | 0 | 0 | 0 | 1 | 0 | 0 | OPR 2 | OPR 1 | SHLS | SHL C | OPR[2:1]: Set CGRAM mapping<br>SHLS: Set SEG scan direction<br>SHLC: Set COM scan direction | 20us |

**IS[1:0]=(1,1)**

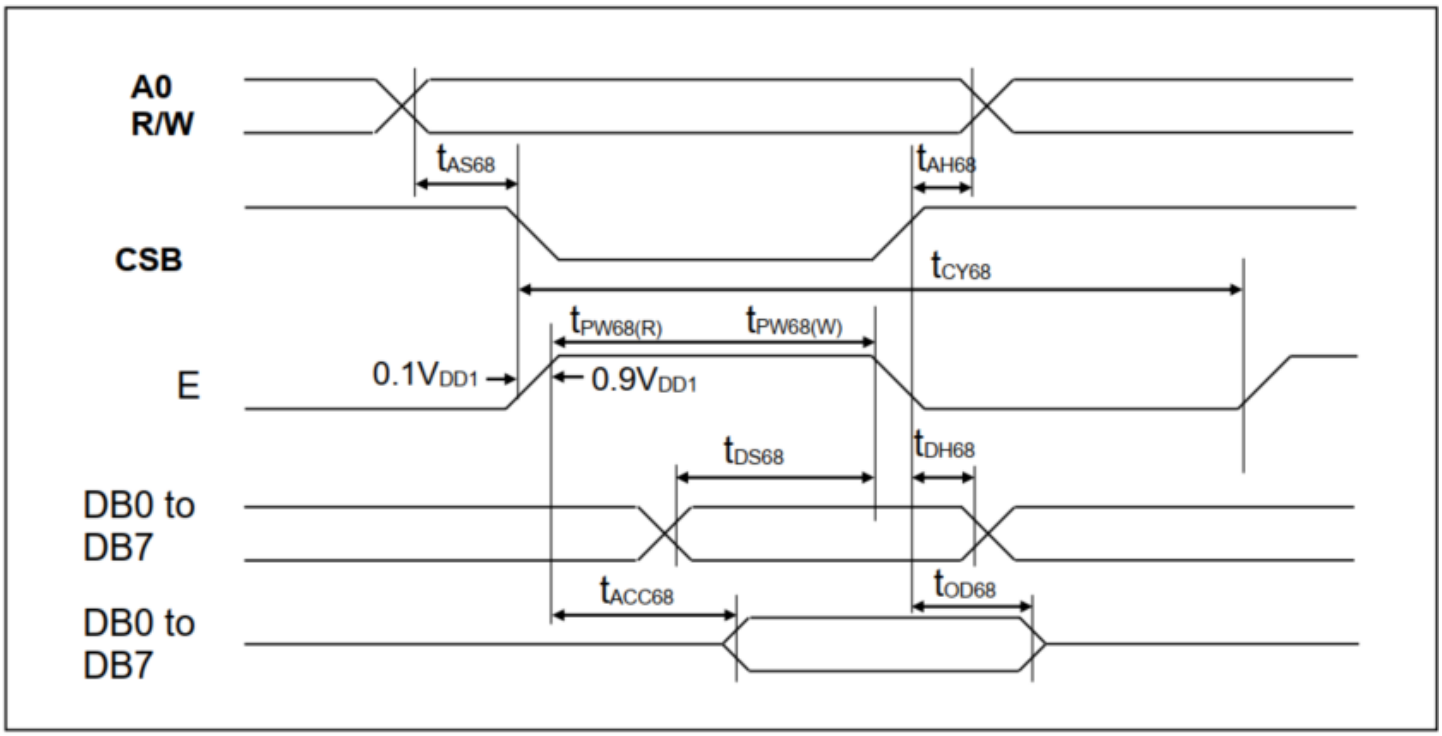
| No | Instruction | A0 | W/R | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Description | Instruction Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Power Loss Detection | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | PLD: Set the function of power loss detection | 20us |
| | | 0 | 0 | 0 | 0 | 1 | 0 | 0 | VBON | 0 | 0 | | |
| 2 | Start line | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | start line setting | 20us |
| | | 0 | 0 | 0 | 0 | ST[5:0] | | | | | | | |
| 3 | Contrast | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | CT setting | 20us |
| | | 0 | 0 | CT[7:0] | | | | | | | | | |
| 4 | Rgain set | 0 | 0 | 1 | 0 | 1 | 0 | RGR[3:0] | | | | Rgain set | 20us |
| 5 | Soft reset | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | soft reset | 20us |
| 6 | spi3&spi4 read ram command | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | spi read ram data command | 20us |
| 7 | spi3&spi4 read status command | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | spi3&spi4&iic read status command | 20us |

**IST Test Mode**

| No | Instruction | A0 | W/R | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Description | Instruction Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | IST command entry | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | Test command entry | 20us |
| 2 | Frame rate adjusting enable | 0 | 0 | 0 | 0 | 1 | 0 | FMEN | 0 | 0 | 0 | Frame rate adjusting enable | 20us |
| 3 | Frame rate control(3B) | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | Set frame rate control | 20us |
| | | | | LN7 | LN6 | LN5 | LN4 | LN3 | LN2 | LN1 | LN0 | | |
| | | | | LN15 | LN14 | LN13 | LN12 | LN11 | LN10 | LN9 | LN8 | | |
| 4 | OSC clock select | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | VCK_SEL [1:0] | | DCDC pump clock select | 20us |
| 5 | OSC Divide Select | 0 | 0 | 1 | 0 | 0 | 1 | 1 | OSC_DIV[2:0] | | | Select 1,1/2,1/4,1/8 Oscillator frequency for display operation | 20us |
| 6 | Exit entry | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | | Exit test entry | `20us |

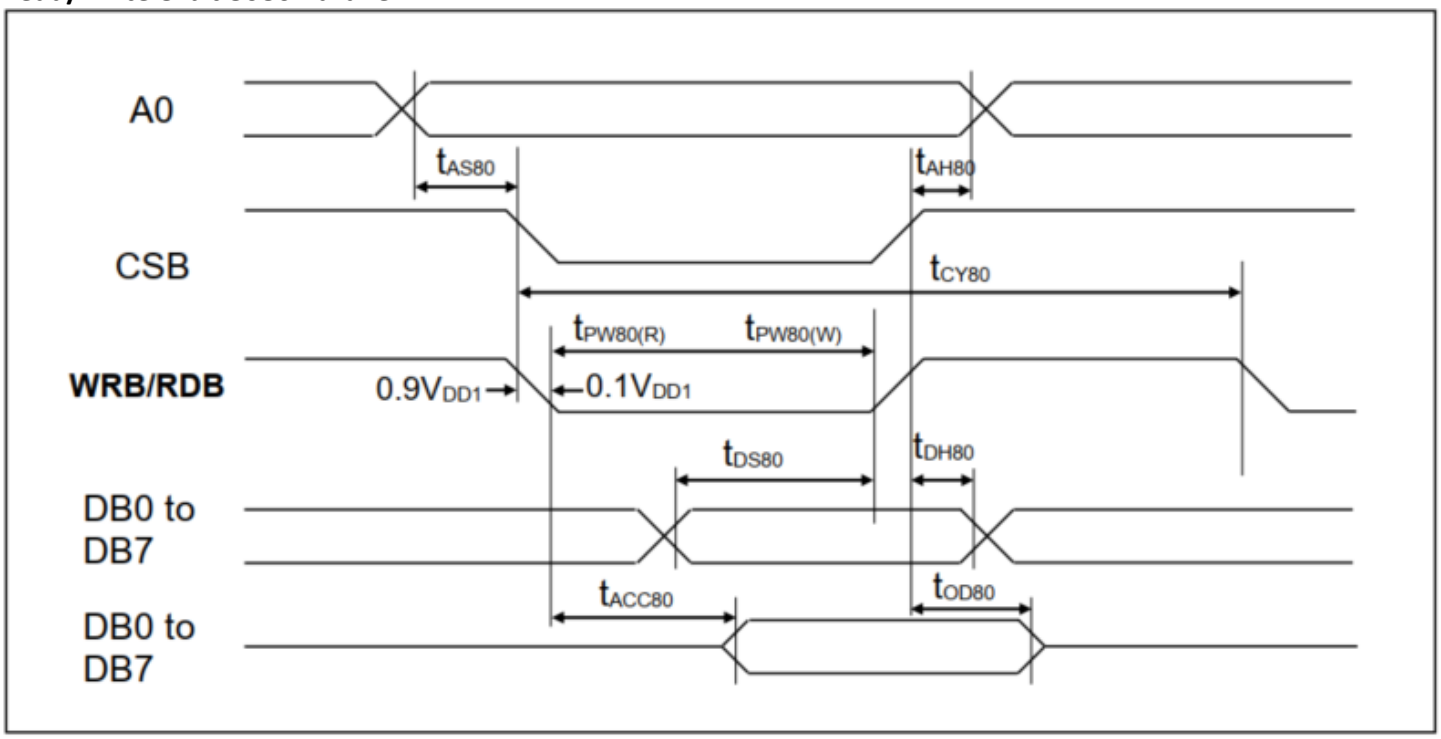
# Timing Characteristics

**Read/write 8-bit 6800 Parallel**



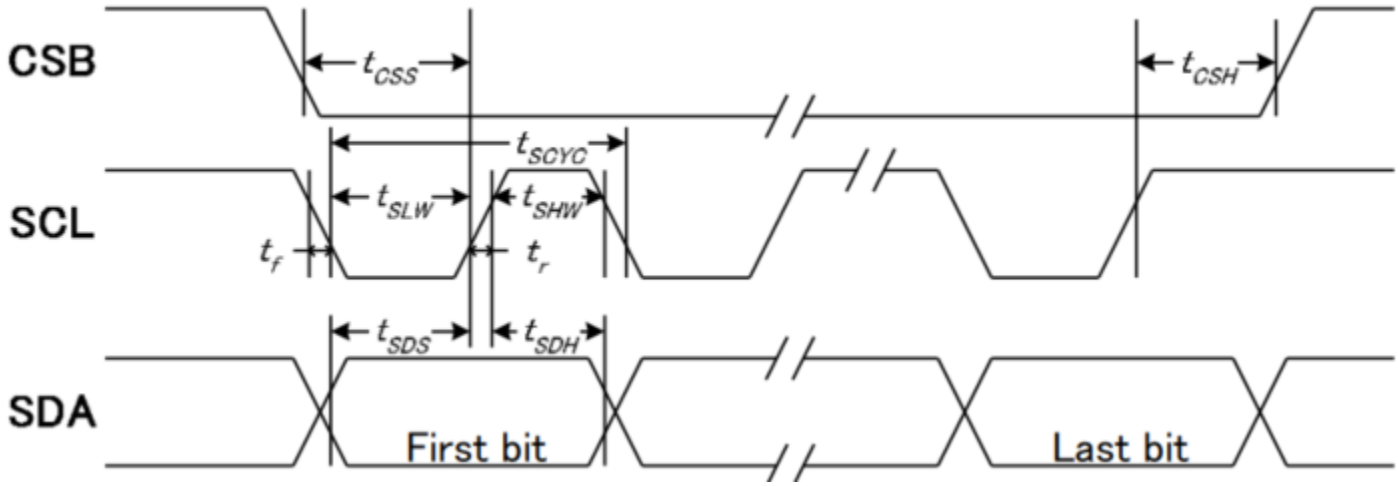

| Item | Signal | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Address setup time<br>Address hold time | A0 | tAS68<br>tAH68 | 0<br>0 | - | - | ns | |
| System cycle time | | tCY68 | 300 | - | - | ns | |
| Pulse width (E) | RW_WRB | tPW68(W) | 150 | - | - | ns | |
| Pulse width (E) | E_RDB | tPW68(R) | 150 | - | - | ns | |
| Data setup time<br>Data hold time | DB7<br>to<br>DB0 | tDS68<br>tDH68 | 60<br>0 | - | - | ns | |
| Read access time<br>Output disable time | | tACC68<br>tOD68 | 140<br>- | - | -<br>10 | ns | (No load) |

**Read/write 8-bit 8080 Parallel**



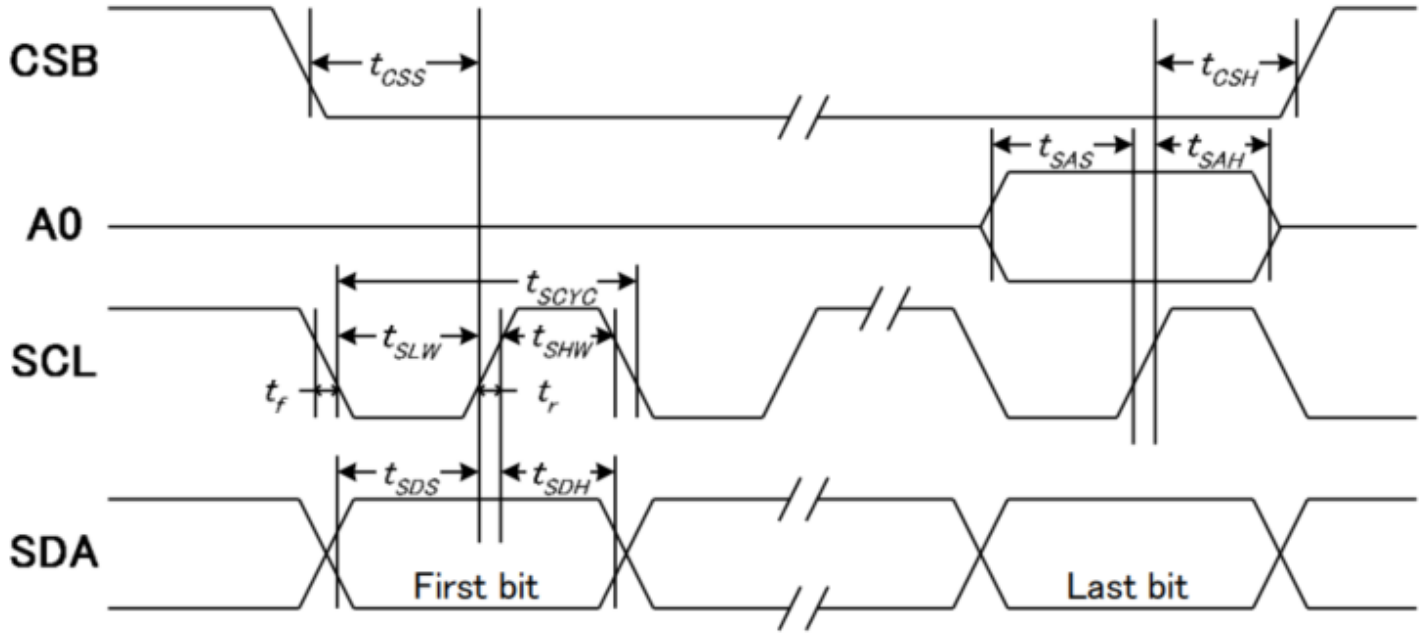

| Item | Signal | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Address setup time<br>Address hold time | A0 | tAS80<br>tAH80 | 0<br>0 | - | - | ns | |
| System cycle time | | tCY80 | 300 | - | - | ns | |
| Pulse width (WRB) | RW_WRB | tPW80(W) | 150 | - | - | ns | |
| Pulse width (RDB) | E_RDB | tPW80(R) | 150 | - | - | ns | |
| Data setup time<br>Data hold time | DB7 to DB0 | tDS80<br>tDH80 | 60<br>0 | - | - | ns | |
| Read access time<br>Output disable time | | tACC80<br>tOD80 | 140<br>- | - | -<br>10 | ns | (No load) |

**3-Wire SPI Interface**



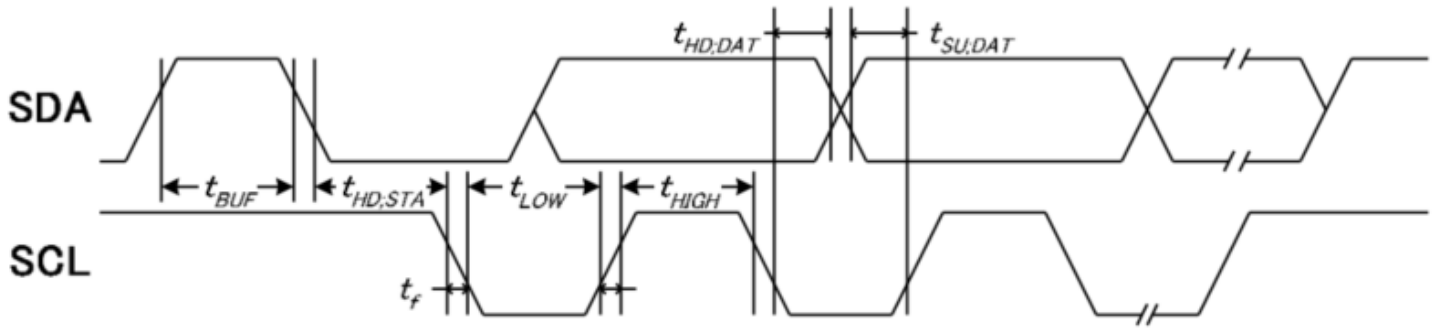

| Item | Signal | Symbol | VDD1=1.8V | | VDD1=2.8V | | VDD1=3.3V | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min. | Max. | Min. | Max. | Min. | Max. | |
| Serial Clock Period | SCL | tSCYC | 200 | - | 200 | - | 200 | - | ns |
| SCL "H" pulse width | | tSHW | 90 | - | 90 | - | 90 | - | |
| SCL "L" pulse width | | tSLW | 90 | - | 90 | - | 90 | - | |
| Data setup time | SDA | tSDS | 45 | - | 45 | - | 45 | - | ns |
| Data hold time | | tSDH | 45 | - | 45 | - | 45 | - | |
| Chip select setup time | CSB | tCSS | 90 | - | 90 | - | 90 | - | ns |
| Chip select hold time | | tCSH | 90 | - | 90 | - | 90 | - | |

**4-wire SPI Interface**



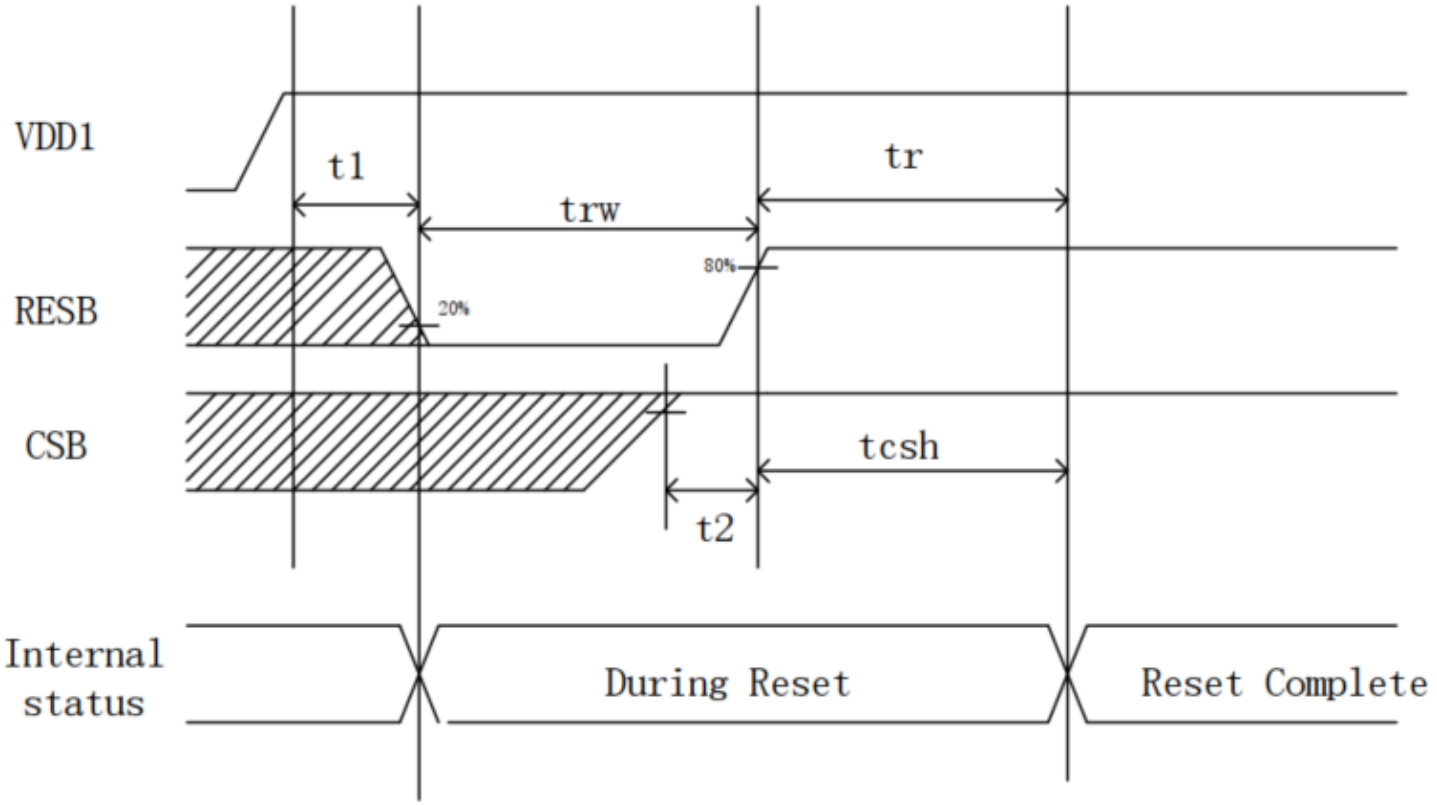

| Item | Signal | Symbol | VDD1=2.8V | | VDD1=3.3V | | Unit |
|---|---|---|---|---|---|---|---|
| | | | Min. | Max. | Min. | Max. | |
| Serial Clock Period | SCL | tSCYC | 200 | - | 200 | - | ns |
| SCL “H” pulse width | | tSHW | 90 | - | 90 | - | |
| SCL “L” pulse width | | tSLW | 90 | - | 90 | - | |
| Address setup time | A0 | tSAS | 45 | - | 45 | - | ns |
| Address hold time | | tSAH | 45 | - | 45 | - | |
| Data setup time | SI | tSDS | 45 | - | 45 | - | ns |
| Data hold time | | tSDH | 45 | - | 45 | - | |
| Chip select setup time | CSB | tCSS | 90 | - | 90 | - | ns |
| Chip select hold time | | tCSH | 90 | - | 90 | - | |

**I²C Interface**




| Item | Signal | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| SCL clock frequency | | fSCL | 0 | - | 400 | kHz | |
| Set-up time for START condition | | tSU/STA | 600 | - | - | ns | |
| Hold time for START condition | | tHD/STA | 600 | - | - | ns | |
| Low period of the SCL clock | | tLow | 1300 | - | - | ns | |
| High period of the SCL clock | | tHIGH | 600 | - | - | ns | |
| Data set-up time | | tSU/DAT | 100 | - | - | ns | |
| Data hold time | | tHD/DAT | - | - | 900 | ns | |
| Rise time of both SDA and SCL signals | | tr | - | - | 30 | ns | |
| Fall time of both SDA and SCL signals | | tf | - | - | 30 | ns | |
| Set-up time for STOP condition | | tSU/STO | 600 | - | - | ns | |

**Reset Input Timing**




| Item | Signal | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Reset low pulse width | RESB | $t_{RW}$ | 50 | - | - | us | |
| Reset time | - | $t_R$ | 50 | - | | us | |
| Reset after VDD stable | RESB | t1 | 0 | - | - | us | |
| CSB to RESB pull High | CSB | t2 | 0 | | | us | |
| CSB hold | CSB | tcsh | 50 | | | us | |

# Built-in Font Table

# Example Initialization Code

```
void LCD_Cmd(unsigned char command)
{
  digitalWrite(CSB, LOW);
  digitalWrite(A0, LOW);
  digitalWrite(RD, HIGH);
  PORTD = command;
  digitalWrite(WR, LOW);
    digitalWrite(WR, HIGH);
  digitalWrite(CSB, HIGH);
   delay(100);
}
void LCD_data(unsigned char data)
{
  digitalWrite(CSB, LOW);
  digitalWrite(A0, HIGH);
  digitalWrite(RD, HIGH);
  PORTD = data;
  digitalWrite(WR, LOW);
  digitalWrite(WR, HIGH);
  digitalWrite(CSB, HIGH);
}
void LCD_Initialize()
{
delay(50);
digitalWrite(RESB, LOW);
delay(50);
digitalWrite(RESB, HIGH);
delay(50);

// ================================================================

// IS Instruction Table 2
LCD_Cmd(0x22); //Function Set
LCD_Cmd(0x13); //Set Display Mode : Normal font, 4-line
LCD_Cmd(0x60); //Set Display pattern : Normal mode,All Pixels on Function not enable.
LCD_Cmd(0x44); //Select CGRAM & COM/SEG direction (8, Column address 119~0, Row address 31~0 (Invert))
//LCD_Cmd(0x47);
 delay(10);

// ================================================================

// IS Instruction Table 3
LCD_Cmd(0x23); //Function Set : 0 0 1 0 0 0 IS2 IS1
LCD_Cmd(0x82); //start line setting
LCD_Cmd(0x00); //start line setting : 0 0 ST[5:0]
// LCD_Cmd(0xab); //Regulator Set: RGR[3:0]=1011(RGR=7.5)
LCD_Cmd(0xA7); //Rgain set :1 0 1 0 RR[3:0]
LCD_Cmd(0x81); //Contrast: VOP SET
LCD_Cmd(0x4B); // VOP SET contrast value 142  (//132=84)//75 = 4B
 delay(10);
LCD_Cmd(0x21);//Function set: Table IS[1:0]=01
LCD_Cmd(0x13);//Follow Control: BS[2:1]=(1,1):1/7 BIAS
LCD_Cmd(0x30);//Power Save: Sleep=0(Out Sleep Mode)
LCD_Cmd(0x71);//V0 Control 2: BT[1:0]=01(Booster Will Be 6X)
 delay(100);
```

```
LCD_Cmd(0x61);//ICON/Power Control: ICON OFF, VB OFF, VR OFF, VF ON
 delay(20);
LCD_Cmd(0x63);//ICON/Power Control: ICON OFF, VB OFF, VR ON, VF ON
 delay(20);
LCD_Cmd(0x67);//ICON/Power Control: ICON OFF, VB ON, VR ON, VF ON
 delay(20);
LCD_Cmd(0x6F);//ICON/Power Control: ICON ON, VB ON, VR ON, VF ON
delay(20);

// ============================================================

// IS Instruction Table 4
LCD_Cmd(0x23); //Function Set
LCD_Cmd(0x88); // Set 88H 4 times to entry IST test command mode
LCD_Cmd(0x88);
LCD_Cmd(0x88);
LCD_Cmd(0x88);
LCD_Cmd(0x28); //Frame rate adjusting enable
delay(20);
LCD_Cmd(0xB2); //1st Frame rate control
LCD_Cmd(0x71); //FR=Fdck/(LN[15:0]+1)/Duty (FR=200Hz,Duty=33,LN[15:0]=0x0071])
LCD_Cmd(0x00);
LCD_Cmd(0x93); //OSC Clock Select :Fdck= 750KHz/1=750KHz
LCD_Cmd(0x99); //OSC Divide Select :750KHz
LCD_Cmd(0xE3); //Exit IST test command
delay(20);
LCD_Cmd(0x20); //Function Set
LCD_Cmd(0x01); //Clear Display
delay(20);
LCD_Cmd(0x90); //Set DDRAM address
LCD_Cmd(0x00); //Set DDRAM address
LCD_Cmd(0x06); //Set Entry Mode (I/D = "1", cursor moves right and DDRAM addressn increased by 1)
LCD_Cmd(0x0C); //Display Control(Entire display on, cursor off, blink off)
 delay(100);
LCM_Write_CGRAM();
 delay(100);
}
```

# Quality Information

| Test Item | Content of Test | Test Condition | Note |
|---|---|---|---|
| High Temperature storage | Endurance test applying the high storage temperature for a long time. | +80°C, 200 Hrs. | 2 |
| Low Temperature storage | Endurance test applying the low storage temperature for a long time. | -30°C, 200 Hrs. | 1,2 |
| High Temperature Operation | Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time. | +70°C, 200 Hrs. | 2 |
| Low Temperature Operation | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time. | -20°C, 200 Hrs. | 1,2 |
| High Temperature / Humidity Operation | Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time. | +60°C, 90% RH, 96 Hrs. | 1,2 |
| Thermal Shock resistance | Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress. | -20°C, 30min -> 25°C, 5min -> 70°C, 30min = 1 cycle<br>For 10 cycles | |
| Vibration test | Endurance test applying vibration to simulate transportation and use. | 10-55Hz, 1.5mm amplitude. 2g Acceleration.<br>60 sec in each of 3 directions X, Y, Z<br>For 30 minutes | 3 |
| Static electricity test | Endurance test applying electric static discharge. (5 Times) | Air: ±8KV<br>Contact: ±4KV | |

**Note 1:** No condensation to be observed.
**Note 2:** Conducted after 4 hours of storage at 25°C, 0%RH.
**Note 3:** Test performed on product itself, not inside a container.