# NHD-0216KZW-AB5

## OLED Display Module

| | |
|---|---|
| NHD- | Newhaven Display |
| 0216- | 2 lines x 16 characters |
| KZW- | OLED |
| A- | Model |
| B- | Emitting Color: Blue |
| 5- | +5V power supply |


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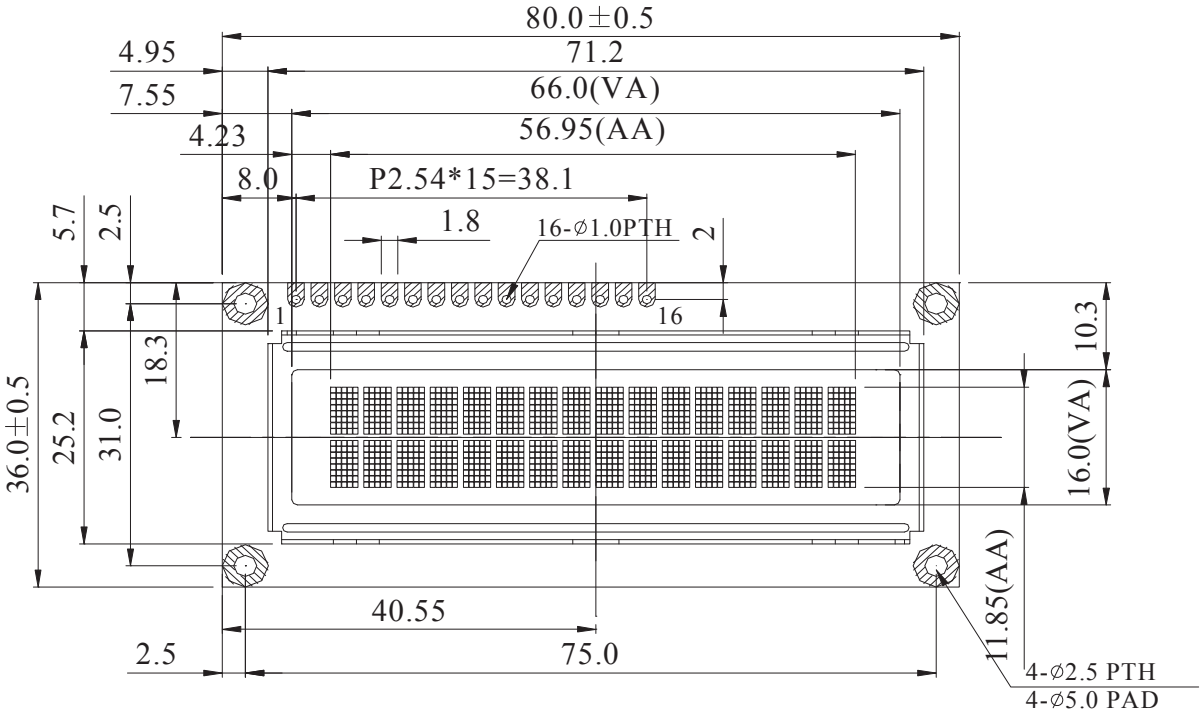
## Document Revision History

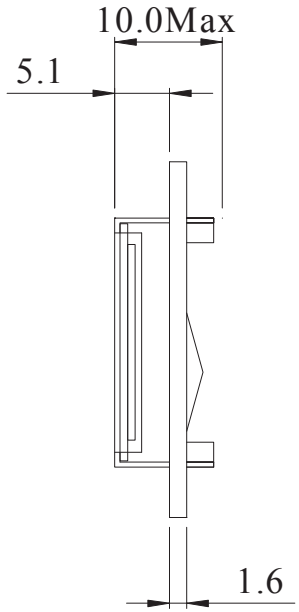
| Revision | Date | Description | Changed by |
|---|---|---|---|
| 0 | 4/1/2011 | Initial Product Release | - |
| 1 | 6/30/11 | Update serial interface description | CL |
| 2 | 8/31/2011 | Font tables updated | AK |
| 3 | 10/18/2011 | Jumper selections updated | AK |
| 4 | 3/26/2012 | Jumper selections updated | AK |

## Functions and Features

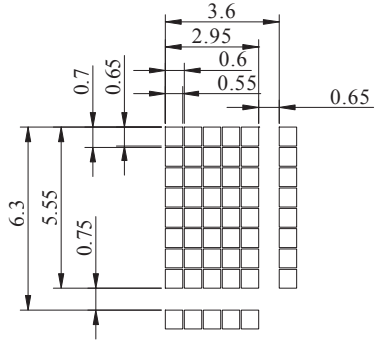
- **2 lines x 16 characters**
- **Built-in LCD comparable controller**
- **Parallel or serial MPU interface (Default 6800 MPU parallel)**
- **+3.0V or +5.0V Power Supply**
- **RoHS compliant**
- **Size compatible to NHD-0216K1Z series Character LCDs**

# Mechanical Drawing




| PIN NO. | SYMBOL |
|---|---|
| 1 | Vss |
| 2 | Vdd |
| 3 | NC |
| 4 | RS |
| 5 | R/$\overline{W}$ |
| 6 | E |
| 7 | DB0 |
| 8 | DB1 |
| 9 | DB2 |
| 10 | DB3 |
| 11 | DB4 |
| 12 | DB5 |
| 13 | DB6 |
| 14 | DB7 |
| 15 | NC |
| 16 | NC |




DOT SIZES
SCALE 5/1

The non-specified tolerance is ± 0.3 mm .

| Newhaven Display |
|---|
| NHD-0216KZW-AB5 |

# Pin Description

**Parallel Interface (default):**

| Pin No. | Symbol | External Connection | Function Description |
|---|---|---|---|
| 1 | VSS | Power Supply | Ground |
| 2 | VDD | Power Supply | Supply Voltage for OLED and logic |
| 3 | NC | - | No Connect |
| 4 | RS | MPU | Register select signal. RS=0: Command, RS=1: Data |
| 5 | R/W | MPU | Read/Write select signal, R/W=1: Read R/W: =0: Write |
| 6 | E | MPU | Operation enable signal. Falling edge triggered. |
| 7-10 | DB0 – DB3 | MPU | Four low order bi-directional three-state data bus lines. These four are not used during 4-bit operation. |
| 11-14 | DB4 – DB7 | MPU | Four high order bi-directional three-state data bus lines. |
| 15 | NC | - | No Connect |
| 16 | NC | - | No Connect |

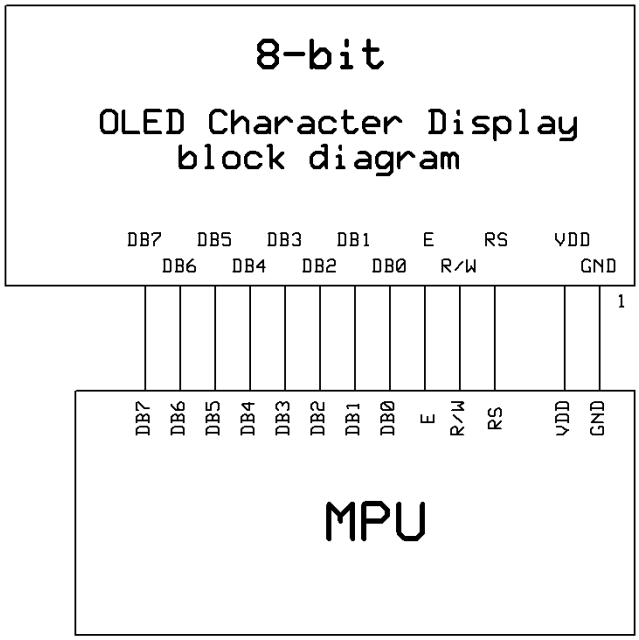
**Serial Interface:**

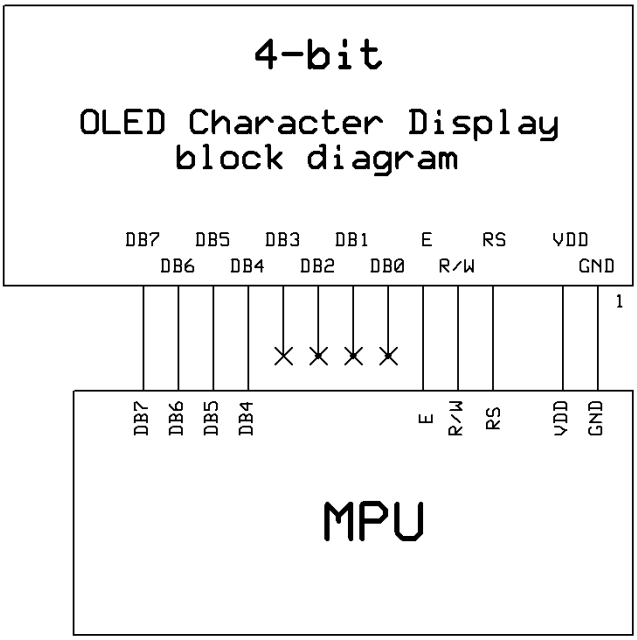
| Pin No. | Symbol | External Connection | Function Description |
|---|---|---|---|
| 1 | VSS | Power Supply | Ground |
| 2 | VDD | Power Supply | Supply Voltage for OLED and logic |
| 3-11 | NC | - | No Connect |
| 12 | SCL | MPU | Serial Clock signal |
| 13 | SDO | MPU | Serial Data output signal |
| 14 | SDI | MPU | Serial Data input signal |
| 15 | NC | - | No Connect |
| 16 | /CS | MPU | Active LOW Chip Select signal |

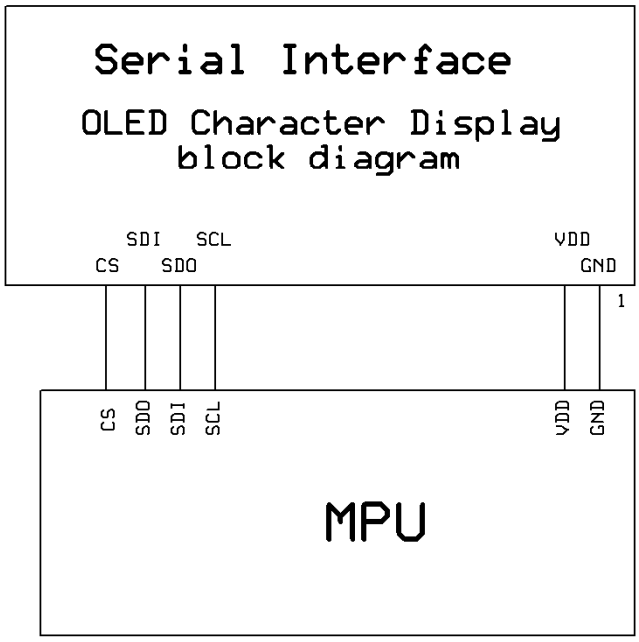
**Jumper Selections**

| MPU Interface | L_PS_H | J80_J68 | L_CS_H | JCS | L_SHL_H |
|---|---|---|---|---|---|
| 6800-MPU Parallel (default) | H | J68 | L | X | H |
| 8080-MPU Parallel | H | J80 | L | X | H |
| Serial MPU | L | X | Open | Short | H |

## Wiring Diagrams



## Electrical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating Temperature Range | Top | Absolute Max | -40 | - | +80 | °C |
| Storage Temperature Range | Tst | Absolute Max | -40 | - | +80 | °C |
| | | | | | | |
| Supply Voltage | VDD | | 3.0 | 5.0 | 5.3 | V |
| Supply Current | IDD | Ta=25°C, VDD=5.0V | - | 30 | - | mA |
| "H" Level input | Vih | | 0.9*VDD | - | VDD | V |
| "L" Level input | Vil | | VSS | - | 0.1*VDD | V |
| "H" Level output | Voh | | 0.8*VDD | - | VDD | V |
| "L" Level output | Vol | | VSS | - | 0.2VDD | V |

## Optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Viewing Angle – Vertical (top) | AV | | 80 | - | - | º |
| Viewing Angle – Vertical (bottom) | AV | | 80 | - | - | º |
| Viewing Angle – Horizontal (left) | AH | | 80 | - | - | º |
| Viewing Angle – Horizontal (right) | AH | | 80 | - | - | º |
| Contrast Ratio | Cr | | 2000:1 | - | - | - |
| Response Time (rise) | Tr | - | - | 10 | - | us |
| Response Time (fall) | Tf | - | - | 10 | - | us |
| Brightness | | 50% checkerboard | - | 125 | - | $cd/m^2$ |
| Lifetime | | Ta=25°C, 50% checkerboard | 50,000 | - | - | Hrs |

**Note**: Lifetime at typical temperature is based on accelerated high-temperature operation. Lifetime is tested at average 50% pixels on and is rated as Hours until Half-Brightness. The Display OFF command can be used to extend the lifetime of the display.

Luminance of active pixels will degrade faster than inactive pixels. Residual (burn-in) images may occur. To avoid this, every pixel should be illuminated uniformly.

# Instruction Table

| Instruction | Code | | | | | | | | | | Description | Max Execution Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | |
| Clear Display | 0 | 0 | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | Clears entire display. **Does not change DDRAM address.** | 2ms |
| Return Home | 0 | 0 | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | Sets DDRAM Address to 0x00. Returns shifted display to original position. | 600us |
| Entry Mode Set | 0 | 0 | **0** | **0** | **0** | **0** | **0** | **1** | **I/D** | **S** | Sets cursor to auto Increment or Decrement, and sets display shift. | 600us |
| Display ON/OFF control | 0 | 0 | **0** | **0** | **0** | **0** | **1** | **D** | **C** | **B** | Sets Display (D) ON/OFF. Sets Cursor (C) ON/OFF. Sets Blinking (B) of cursor ON/OFF. | 600us |
| Cursor/Display Shift | 0 | 0 | **0** | **0** | **0** | **1** | **S/C** | **R/L** | **0** | **0** | Moves cursor & shifts display without changing DDRAM contents. | 600us |
| Function Set | 0 | 0 | **0** | **0** | **1** | **DL** | **1** | **0** | **FT1** | **FT0** | Set interface data length. Select Font Table. | 600us |
| Set CGRAM address | 0 | 0 | **0** | **1** | **ACG5** | **ACG4** | **ACG3** | **ACG2** | **ACG1** | **ACG0** | Move to CGRAM address. | 600us |
| Set DDRAM address | 0 | 0 | **1** | **ADD6** | **ADD5** | **ADD4** | **ADD3** | **ADD2** | **ADD1** | **ADD0** | Move to DDRAM address. | 600us |
| Read Busy Flag & Address | 0 | 1 | **BF** | **AC6** | **AC5** | **AC4** | **AC3** | **AC2** | **AC1** | **AC0** | Read Busy Flag (BF) and Address Counter. | 600us |
| Write data to CGRAM or DDRAM | 1 | 0 | **Write Data** | | | | | | | | Write data to CGRAM or DDRAM | 600us |
| Read data from CGRAM or DDRAM | 1 | 1 | **Read Data** | | | | | | | | Read data from CGRAM or DDRAM | 600us |

# Instruction Descriptions

**When an instruction is being executed, only the Busy Flag read instruction can be performed. During execution of an instruction, the Busy Flag = "1". When BF = "0" instructions can be sent to the controller.**

## Clear Display

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

This instruction is used to clear the display by writing 0x20 in all DDRAM addresses. This instruction does not change the DDRAM Address.

## Return Home

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

This instruction is used to set the DDRAM Address to 0x00 and shifts the display back to the original state. The cursor (if on) will be at the first line's left-most character. The DDRAM contents on the display do not change.

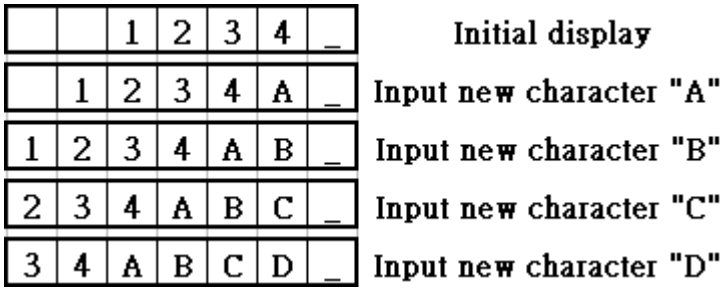
## Entry Mode Set

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

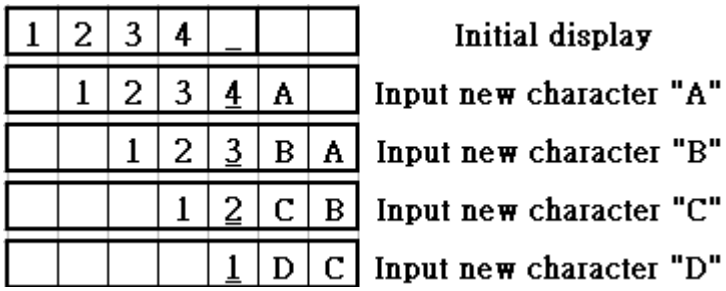
I/D = Increment/Decrement
When I/D = "1", the DDRAM or CGRAM Address with automatically increment when a character code is written into or read from the DDRAM or CGRAM. The auto-increment will move the cursor one character space to the right.
When I/D = "0", the DDRAM or CGRAM Address with automatically decrement when a character code is written into or read from the DDRAM or CGRAM. The auto-decrement will move the cursor one character space to the left.

S = Shift Entire Display
When S = "1", the entire display is shifted to the right (when I/D = "0") or left (when I/D = "1").

**I/D=1, S=1**




**I/D=0, S=1**



## Display ON/OFF

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

D = Display ON/OFF
When D = “1”, the display is turned ON. When D = “0”, the display is turned OFF. Contents in DDRAM are not changed.

C = Cursor ON/OFF
When C = “1”, the cursor is displayed. The cursor is displayed as 5 dots on the 8$^{th}$ line of a character. When C = “0”, the cursor is OFF.

B = Blinking Cursor
When B = “1”, the entire character specified by the cursor blinks at a speed of 409.6ms intervals. When B = “0”, the character does not blink, the cursor remains on.

## Cursor/Display Shift

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | **0** | **0** | **0** | **1** | **S/C** | **R/L** | **0** | **0** |

| S/C | R/L | Shift Function |
|---|---|---|
| **0** | **0** | **Shifts the cursor position to the left (AC is decremented by 1).** |
| **0** | **1** | **Shifts the cursor position to the right (AC is incremented by 1).** |
| **1** | **0** | **Shifts the entire display to the left. The cursor follows the display shift.** |
| **1** | **1** | **Shifts the entire display to the right. The cursor follows the display shift.** |

When the display is shifted repeatedly, each line moves only horizontally. The second line display does not shift into the first line.
The Address Counter does not change during a Display Shift.

## Function Set

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | **0** | **0** | **1** | **DL** | **1** | **0** | **FT1** | **FT0** |

DL = Interface Data Length
When DL = “1”, the data is sent or received in 8-bit length via DB7..DB0.
When DL = “0”, the data is sent or received in 4-bit length via DB7..DB4. When the 4-bit data length is used, the data must be sent or received in two consecutive writes/reads to combine the data into full 8-bits.

FT1, FT0 = Font Table Selection

| FT1 | FT0 | Font Table |
|---|---|---|
| **0** | **0** | **English / Japanese** |
| **0** | **1** | **Western European #1** |
| **1** | **0** | **English / Russian** |
| **1** | **1** | **Western European #2** |

**Note:** Changing the font table during operation will immediately change any data currently on the display to the corresponding character on the newly selected font table.

## Set CGRAM Address

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | **0** | **1** | **ACG5** | **ACG4** | **ACG3** | **ACG2** | **ACG1** | **ACG0** |

This instruction is used to set the CGRAM address into the Address Counter. Data can then be written to or read from the CGRAM locations. See section: “How to use CGRAM”.
ACG5..ACG0 is the binary CGRAM address.

## Set DDRAM Address

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | **1** | **ADD6** | **ADD5** | **ADD4** | **ADD3** | **ADD2** | **ADD1** | **ADD0** |

This instruction is used to set the DDRAM address into the Address Counter. Data can then be written to or read from the DDRAM locations.
ADD6..ADD0 is the binary DDRAM address.
Line 1 = Address 0x00 through 0x0F
Line 2 = Address 0x40 through 0x4F

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F |

## Read Busy Flag and Address Counter

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | **BF** | **AC6** | **AC5** | **AC4** | **AC3** | **AC2** | **AC1** | **AC0** |

This instruction is used to read the Busy Flag (BF) to indicate if the display controller is performing an internal operation. The Address Counter is read simultaneously with checking the Busy Flag.
When BF = “1”, the controller is busy and the next instruction will be ignored.
When BF = “0”, the controller is not busy and is ready to accept instructions.
AC6..AC0 is the binary location of either the CGRAM or DDRAM current address.

## Write Data to CGRAM or DDRAM

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

This instruction is used to write 8-bits of data to the CGRAM or DDRAM at the current address counter. After the write is complete, the address is automatically incremented or decremented by 1 according to the Entry Mode.

## Read Data from CGRAM or DDRAM

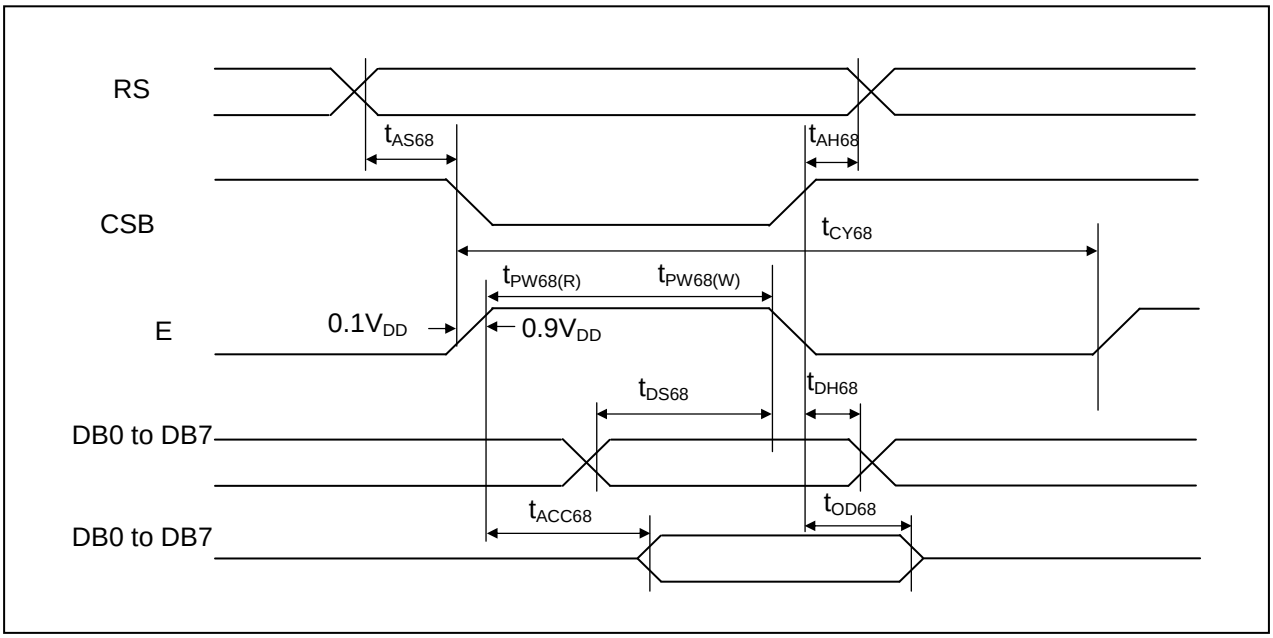
| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | **Read Data** | | | | | | | |

This instruction is used to read 8-bits of data to the CGRAM or DDRAM at the current address counter. After the read is complete, the address is automatically incremented or decremented by 1 according to the Entry Mode.
The Set CGRAM Address or Set DDRAM Address Instruction must be executed before this instruction can be performed, otherwise the first Read Data will not be valid.

## MPU Interface

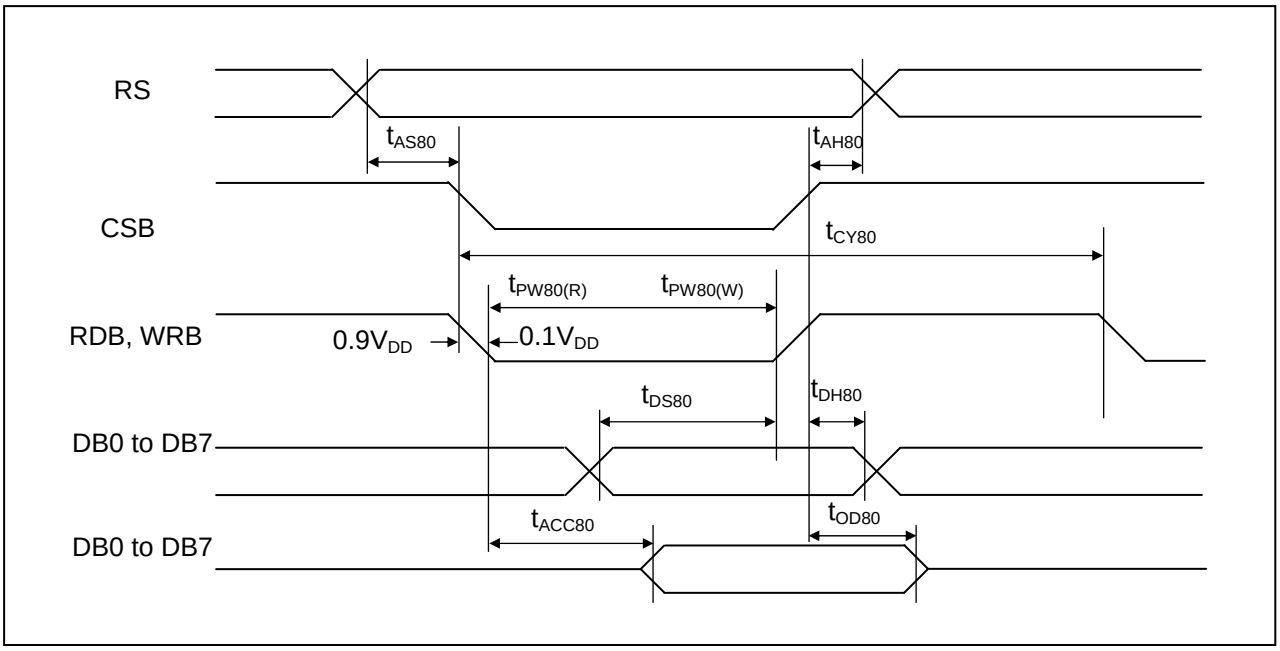
When DL is set for 8-bit mode, the display interfaces with the MPU with DB7..DB0 (DB7 is the MSB).
When DL is set for 4-bit mode, the display interfaces with the MPU with only DB7..DB4 (DB7 is the MSB). Each instruction must be sent in two operations, the 4 high-order bits first, followed by the 4 low-order bits. The Busy Flag must be checked after completion of the entire 8-bit instruction.

## 6800-MPU Parallel Interface (default)




| Item | Signal | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Address setup time | RS | tAS68 | 20 | - | - | ns | |
| Address hold time | RS | tAH68 | 0 | - | - | ns | |
| System cycle time | | tCY68 | 500 | - | - | ns | |
| Pulse width (write) | E | tPW68(W) | 250 | - | - | ns | |
| Pulse width (read) | E | tPW68(R) | 250 | - | - | ns | |
| Data setup time | DB7..DB0 | tDS68 | 40 | - | - | ns | |
| Data hold time | DB7..DB0 | tDH68 | 20 | - | - | ns | |
| Read access time | DB7..DB0 | tACC68 | - | - | 180 | ns | CL=100pF |
| Output disable time | DB7..DB0 | tOD68 | 10 | - | - | ns | |

## 8080-MPU Parallel Interface

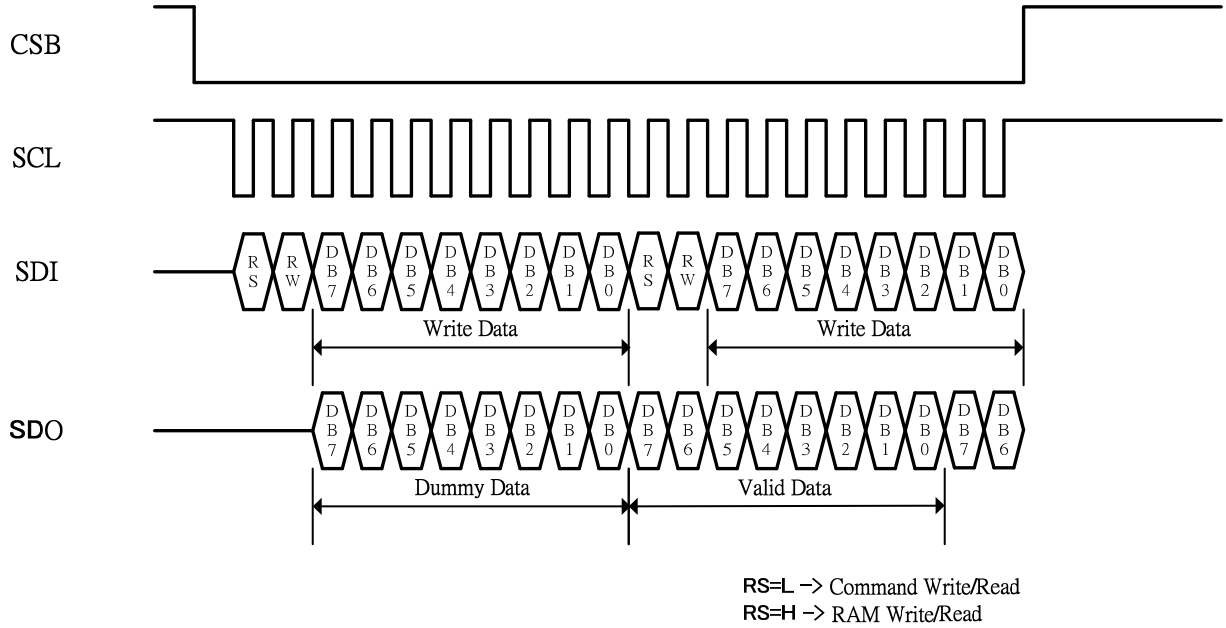



| Item | Signal | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Address setup time | RS | tAS80 | 20 | - | - | ns | |
| Address hold time | RS | tAH80 | 0 | - | - | ns | |
| System cycle time | | tCY80 | 500 | - | - | ns | |
| Pulse width (write) | /WR | tPW80(W) | 250 | - | - | ns | |
| Pulse width (read) | /RD | tPW80(R) | 250 | - | - | ns | |
| Data setup time | DB7..DB0 | tDS80 | 40 | - | - | ns | |
| Data hold time | DB7..DB0 | tDH80 | 20 | - | - | ns | |
| Read access time | DB7..DB0 | tACC80 | - | - | 180 | ns | CL=100pF |
| Output disable time | DB7..DB0 | tOD80 | 10 | - | - | ns | |

## Serial Interface

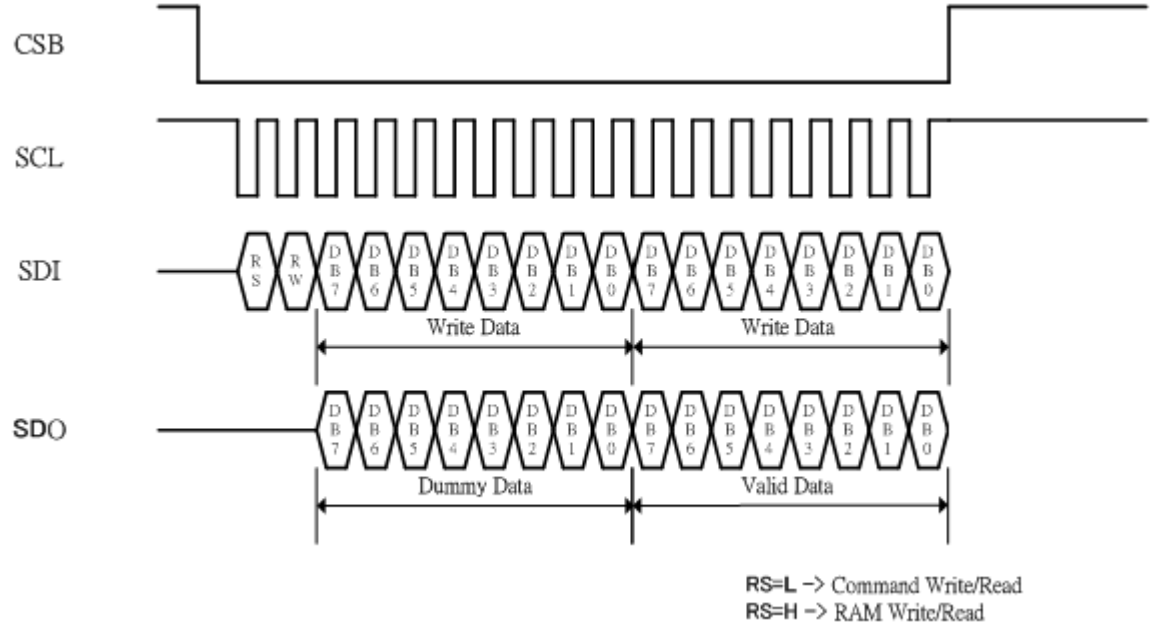
In serial interface mode, instructions and data are both sent on the SDI line and clocked in with the SCL line.
/CS must go LOW before transmission, and must go HIGH when switching between writing instructions and writing data.
The data on SDI is clocked into the LCD controller on the rising edge of SCL in the following format:

Instruction transmission:

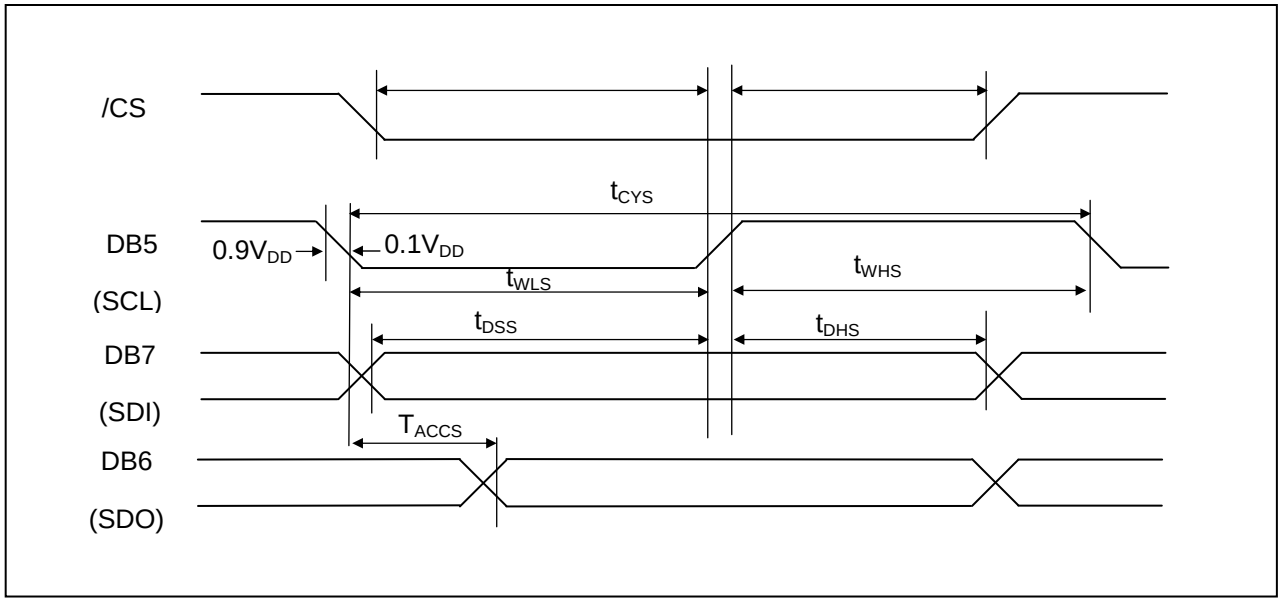



*Note: RS and RW should be used between each instruction.

Data transmission:



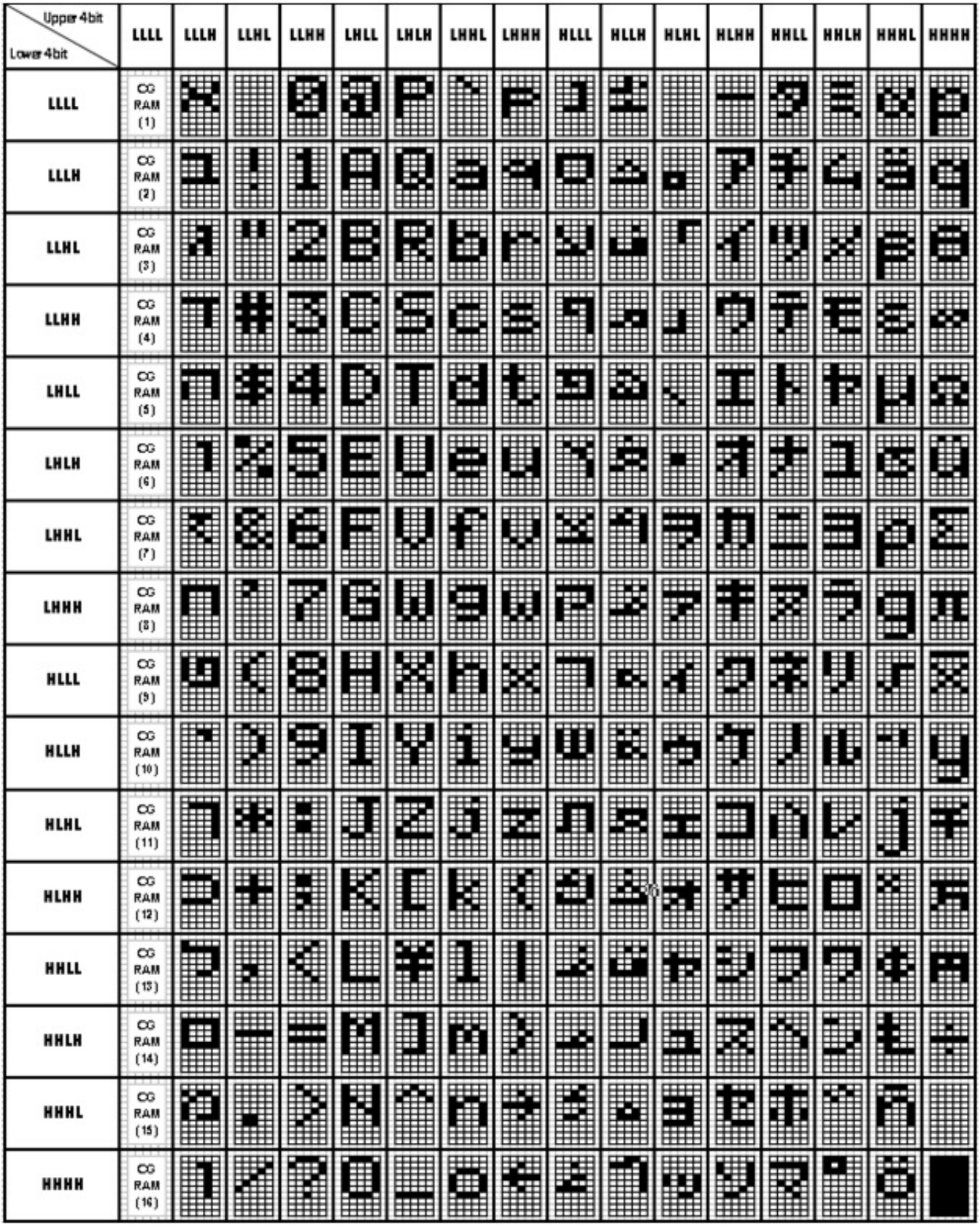

*Note: RS and RW only need to be set at the start of continuous data transmission.



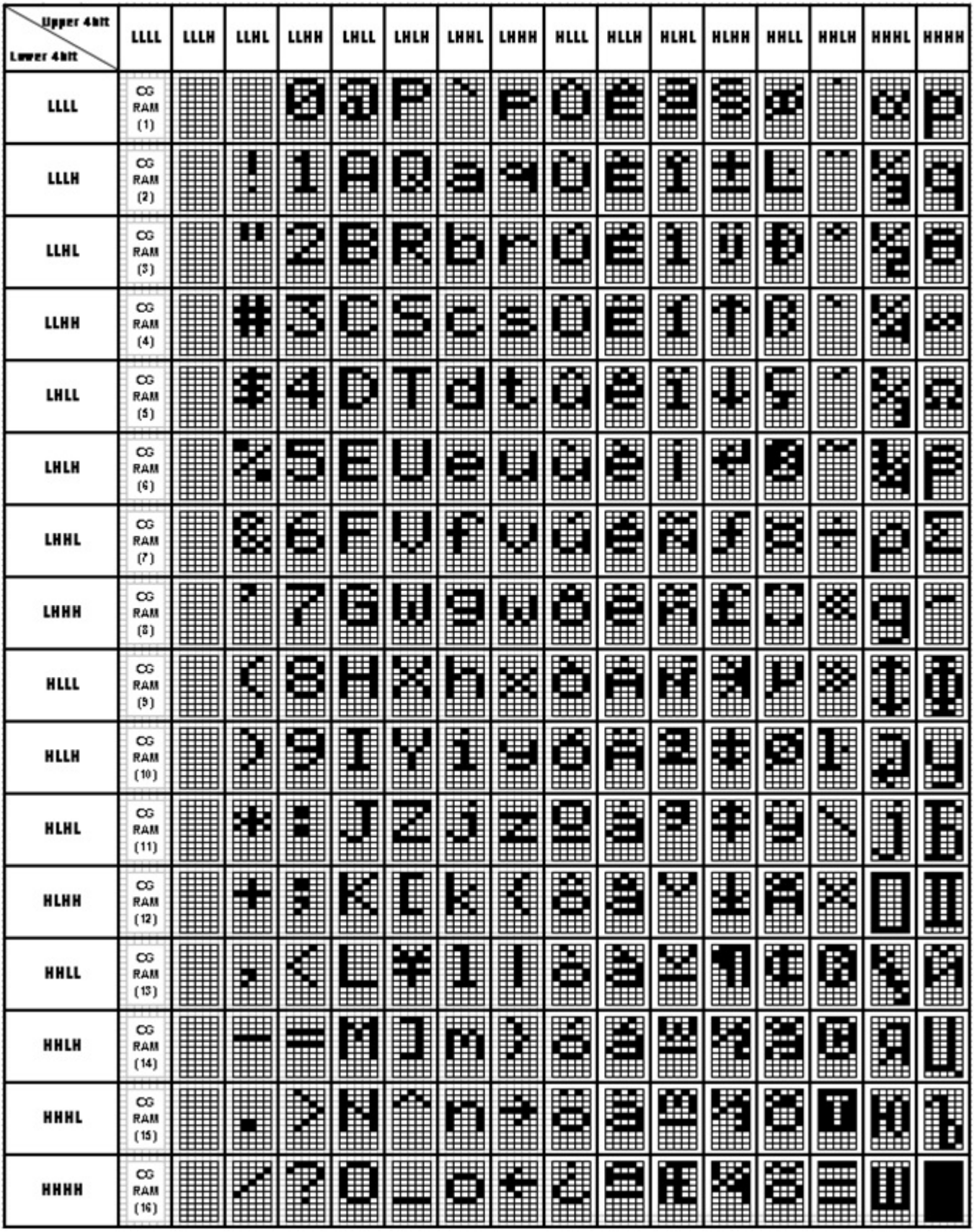

| Item | Signal | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Serial clock cycle | DB5 (SCL) | tCYS | 300 | - | - | ns | |
| SCL high pulse width | DB5 (SCL) | tWHS | 100 | - | - | ns | |
| SCL low pulse width | DB5 (SCL) | tWLS | 100 | - | - | ns | |
| CSB setup time | CSB | tCSS | 150 | - | - | ns | |
| CSB hold time | CSB | tCHS | 150 | - | - | ns | |
| Data setup time | DB7 (SDI) | tDSS | 100 | - | - | ns | |
| Data hold time | DB7 (SDI) | tDHS | 100 | - | - | ns | |
| Read access time | DB6 (SDO) | tACCS | - | - | 80 | ns | |

## Built-in Font Tables

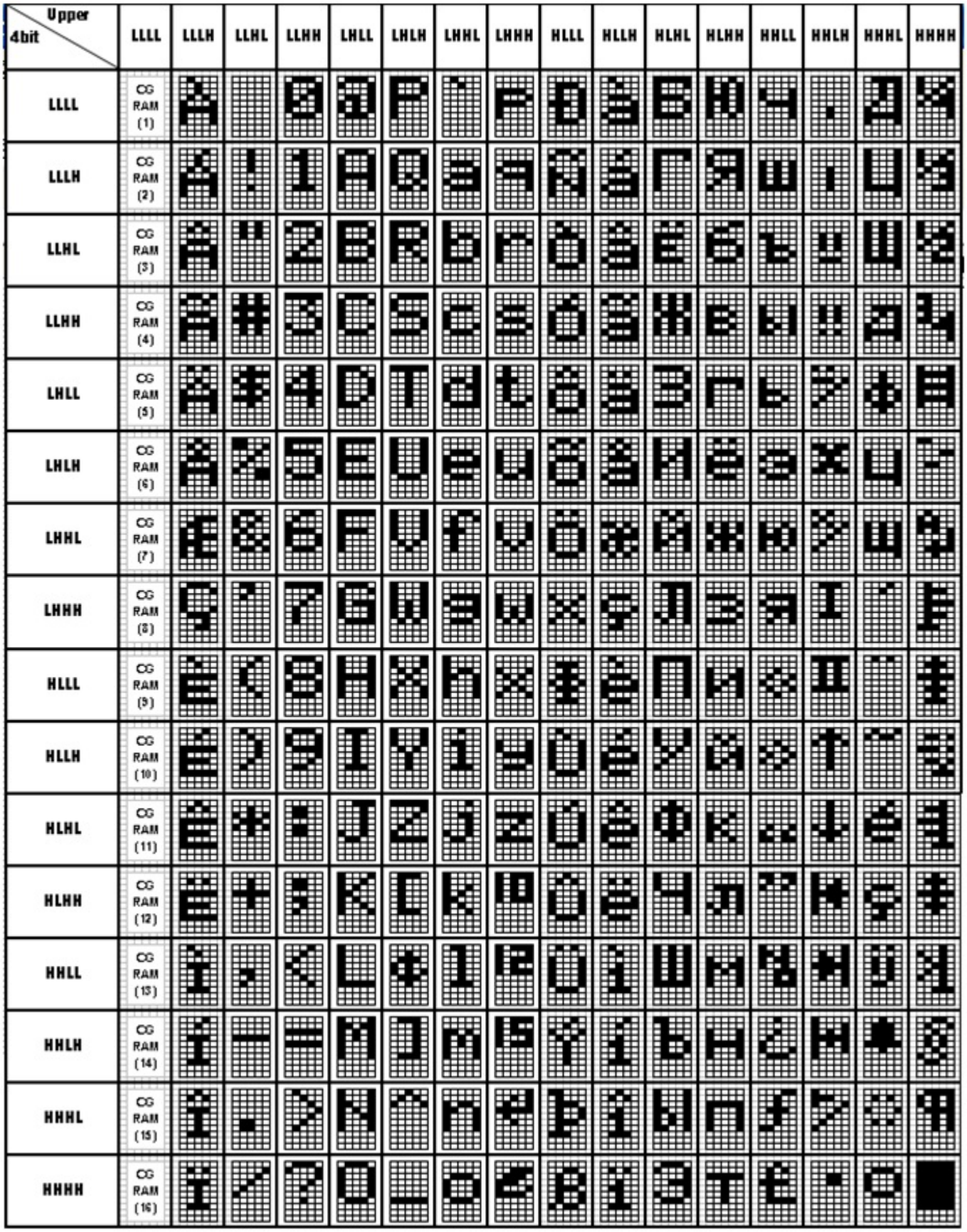
## English/Japanese (FT[1:0] = 00, default)



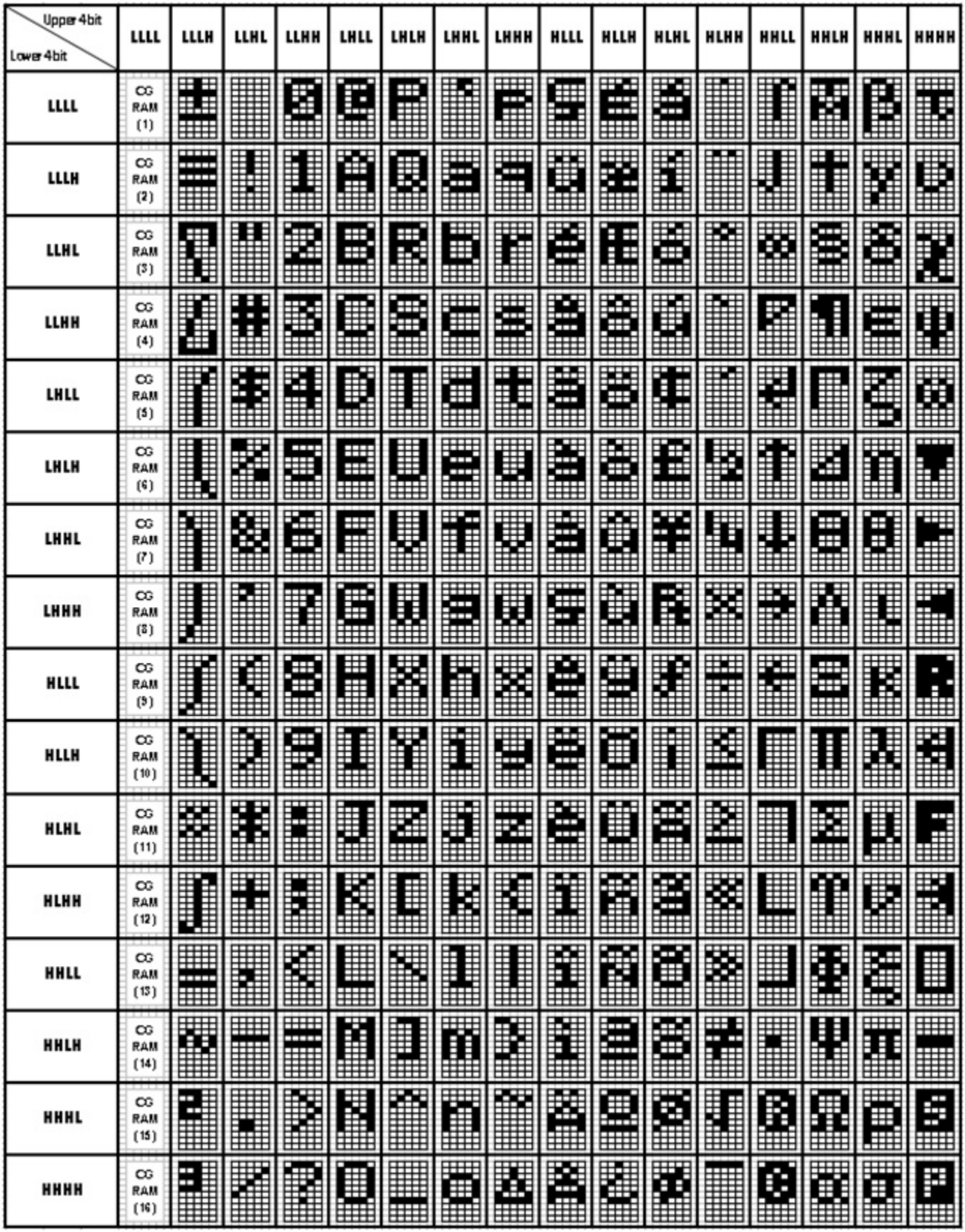
## Western European table 1 (FT[1:0] = 01)



## English/Russian (FT[1:0] = 10)



## Western European table 2 (FT[1:0] = 11)



## How to use CGRAM

The Character Generator RAM (CGRAM) is used to generate custom 5x8 character patterns. There are 8 available addresses: CGRAM Address 0x00 through 0x08.

| **Character Code**<br>**DDRAM address on Font Table used to write CGRAM character to display** | **CGRAM Address** | | | | | | **Character Patterns (CGRAM data)** | | | | | | | | **Character Patterns (CGRAM data)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | - | - | - | 1 | 1 | 1 | 1 | 0 | Character pattern #0 |
| | | | | 0 | 0 | 1 | - | - | - | 1 | 0 | 0 | 0 | 1 | |
| | | | | 0 | 1 | 0 | - | - | - | 1 | 0 | 0 | 0 | 1 | |
| | | | | 0 | 1 | 1 | - | - | - | 1 | 1 | 1 | 1 | 0 | |
| | | | | 1 | 0 | 0 | - | - | - | 1 | 0 | 1 | 0 | 0 | |
| | | | | 1 | 0 | 1 | - | - | - | 1 | 0 | 0 | 1 | 0 | |
| | | | | 1 | 1 | 0 | - | - | - | 1 | 0 | 0 | 0 | 1 | |
| | | | | 1 | 1 | 1 | - | - | - | 0 | 0 | 0 | 0 | 0 | Cursor position |
| 0x01 | 0 | 0 | 1 | 0 | 0 | 0 | - | - | - | 1 | 0 | 0 | 0 | 1 | Character pattern #1 |
| | | | | 0 | 0 | 1 | - | - | - | 0 | 1 | 0 | 1 | 0 | |
| | | | | 0 | 1 | 0 | - | - | - | 1 | 1 | 1 | 1 | 1 | |
| | | | | 0 | 1 | 1 | - | - | - | 0 | 0 | 1 | 0 | 0 | |
| | | | | 1 | 0 | 0 | - | - | - | 1 | 1 | 1 | 1 | 1 | |
| | | | | 1 | 0 | 1 | - | - | - | 0 | 0 | 1 | 0 | 0 | |
| | | | | 1 | 1 | 0 | - | - | - | 0 | 0 | 1 | 0 | 0 | |
| | | | | 1 | 1 | 1 | - | - | - | 0 | 0 | 0 | 0 | 0 | Cursor position |
| 0x02..0x06 | . | . | . | . | . | . | - | - | - | . | . | . | . | . | |
| | . | . | . | . | . | . | - | - | - | . | . | . | . | . | |
| | . | . | . | . | . | . | - | - | - | . | . | . | . | . | |
| 0x07 | 1 | 1 | 1 | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | 0 | 0 | Character pattern #7 |
| | | | | 0 | 0 | 1 | - | - | - | 0 | 1 | 0 | 1 | 0 | |
| | | | | 0 | 1 | 0 | - | - | - | 0 | 0 | 0 | 0 | 0 | |
| | | | | 0 | 1 | 1 | - | - | - | 0 | 0 | 0 | 0 | 0 | |
| | | | | 1 | 0 | 0 | - | - | - | 1 | 0 | 0 | 0 | 1 | |
| | | | | 1 | 0 | 1 | - | - | - | 0 | 1 | 1 | 1 | 0 | |
| | | | | 1 | 1 | 0 | - | - | - | 0 | 0 | 1 | 0 | 0 | |
| | | | | 1 | 1 | 1 | - | - | - | 0 | 0 | 0 | 0 | 0 | Cursor position |

Notes:

"-" = Not used

The cursor line position can be used, it will be displayed as a logic-OR if the cursor is turned ON.

CGRAM is stored in positions 0x00 through 0x07 of the font table. Therefore, to write the first CGRAM character to the display, you would move the cursor to the desired DDRAM location on the display and write character data 0x00.

# Initialization Sequence

8-bit mode:

**Power ON**

**Wait for power stabilization: ≥ 1ms**

**Function Set:**

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

**Check BUSY flag**

**Display OFF:**

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

**Check BUSY flag**

**Display Clear:**

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

**Check BUSY flag**

**Entry Mode Set:**

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

**Check BUSY flag**

**Home Command:**

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

**Check BUSY flag**

**Display ON:**

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

**Initialization End**

# Initialization Sequence

4-bit mode:

**Power ON**

**Wait for power stabilization: ≥ 1ms**

**Function Set:**

| RS | R/W | DB7 | DB6 | DB5 | DB4 |
|---|---|---|---|---|---|
| 0 | 0 | **0** | **0** | **1** | **0** |
| 0 | 0 | **0** | **0** | **1** | **0** |
| 0 | 0 | **1** | **0** | **X** | **X** |

**Check BUSY flag**

**Display OFF:**

| RS | R/W | DB7 | DB6 | DB5 | DB4 |
|---|---|---|---|---|---|
| 0 | 0 | **0** | **0** | **0** | **0** |
| 0 | 0 | **1** | **0** | **X** | **X** |

**Check BUSY flag**

**Display Clear:**

| RS | R/W | DB7 | DB6 | DB5 | DB4 |
|---|---|---|---|---|---|
| 0 | 0 | **0** | **0** | **0** | **0** |
| 0 | 0 | **0** | **0** | **0** | **1** |

**Check BUSY flag**

**Entry Mode Set:**

| RS | R/W | DB7 | DB6 | DB5 | DB4 |
|---|---|---|---|---|---|
| 0 | 0 | **0** | **0** | **0** | **0** |
| 0 | 0 | **0** | **1** | **1** | **0** |

**Check BUSY flag**

**Home Command:**

| RS | R/W | DB7 | DB6 | DB5 | DB4 |
|---|---|---|---|---|---|
| 0 | 0 | **0** | **0** | **0** | **0** |
| 0 | 0 | **0** | **0** | **1** | **0** |

**Check BUSY flag**

**Display ON:**

| RS | R/W | DB7 | DB6 | DB5 | DB4 |
|---|---|---|---|---|---|
| 0 | 0 | **0** | **0** | **0** | **0** |
| 0 | 0 | **1** | **1** | **X** | **X** |

**Initialization End**

# Quality Information

| Test Item | Content of Test | Test Condition | Note |
|---|---|---|---|
| High Temperature storage | Test the endurance of the display at high storage temperature. | +80°C , 240hrs | 2 |
| Low Temperature storage | Test the endurance of the display at low storage temperature. | -40°C , 240hrs | 1,2 |
| High Temperature Operation | Test the endurance of the display by applying electric stress (voltage & current) at high temperature. | +80°C 240hrs | 2 |
| Low Temperature Operation | Test the endurance of the display by applying electric stress (voltage & current) at low temperature. | -40°C , 240hrs | 1,2 |
| High Temperature / Humidity Operation | Test the endurance of the display by applying electric stress (voltage & current) at high temperature with high humidity. | +60°C , 90% RH , 240hrs | 1,2 |
| Thermal Shock resistance | Test the endurance of the display by applying electric stress (voltage & current) during a cycle of low and high temperatures. | -40°C,30min -> 25°C,5min -> 80°C,30min = 1 cycle<br>100 cycles | |
| Vibration test | Test the endurance of the display by applying vibration to simulate transportation and use. | 10-22Hz , 15mm amplitude.<br>22-500Hz, 1.5G<br>30min in each of 3 directions X,Y,Z | 3 |
| Atmospheric Pressure test | Test the endurance of the display by applying atmospheric pressure to simulate transportation by air. | 115mbar, 40hrs | 3 |
| Static electricity test | Test the endurance of the display by applying electric static discharge. | VS=800V, RS=1.5kΩ, CS=100pF<br>One time | |

**Note 1:** No condensation to be observed.
**Note 2:** Conducted after 2 hours of storage at 25°C, 0%RH.
**Note 3:** Test performed on product itself, not inside a container.
**Evaluation Criteria:**
1: Display is fully functional during operational tests and after all tests, at room temperature.
2: No observable defects.
3: Luminance >50% of initial value.
4: Current consumption within 50% of initial value

# Precautions for using OLEDs/LCDs/LCMs

See Precautions at www.newhavendisplay.com/specs/precautions.pdf

# Warranty Information and Terms & Conditions

**http://www.newhavendisplay.com/index.php?main_page=terms**

**Newhaven Display International, Inc. reserves the right to alter this product or specification at any time without notification.**

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Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

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- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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**«FORSTAR»** (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

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