

# NHD-C12865AR-FSW-GBW

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

NHD- Newhaven Display  
C12865- 128 x 65 Pixels  
AR- Model  
F- Transflective  
SW- Side White LED Backlight  
G- STN Positive, Gray  
B- 6:00 Optimal View  
W- Wide Temperature  
**RoHS Compliant**

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## Document Revision History

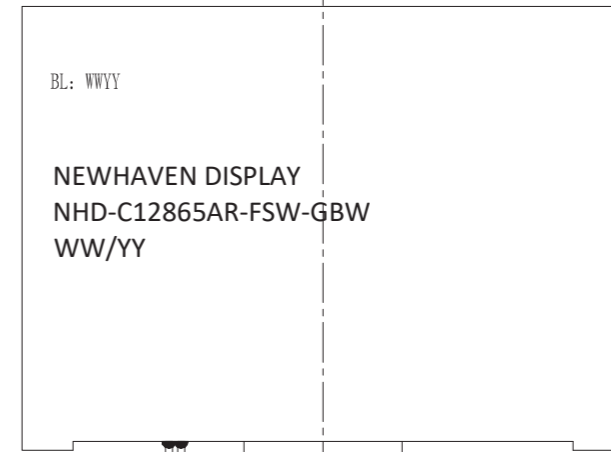
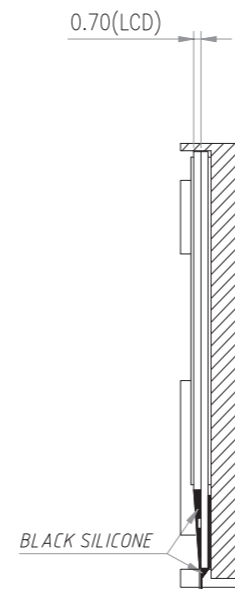
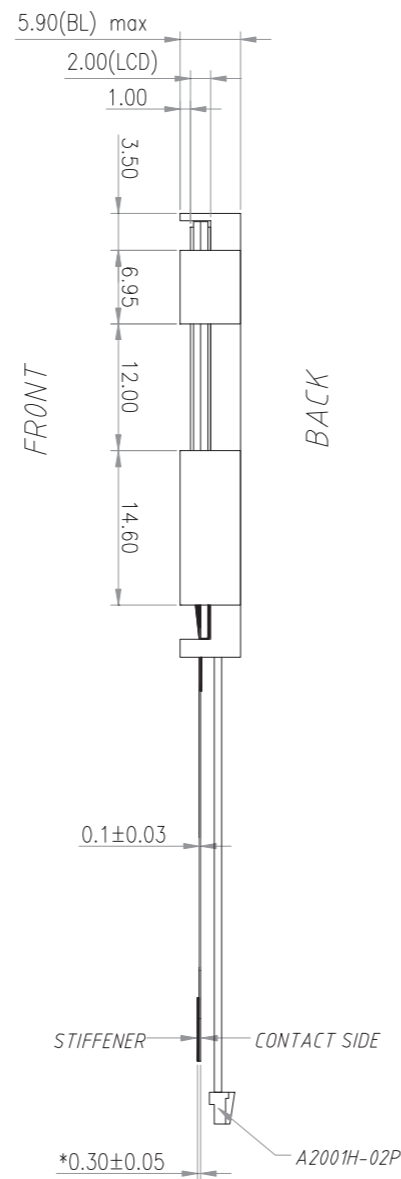
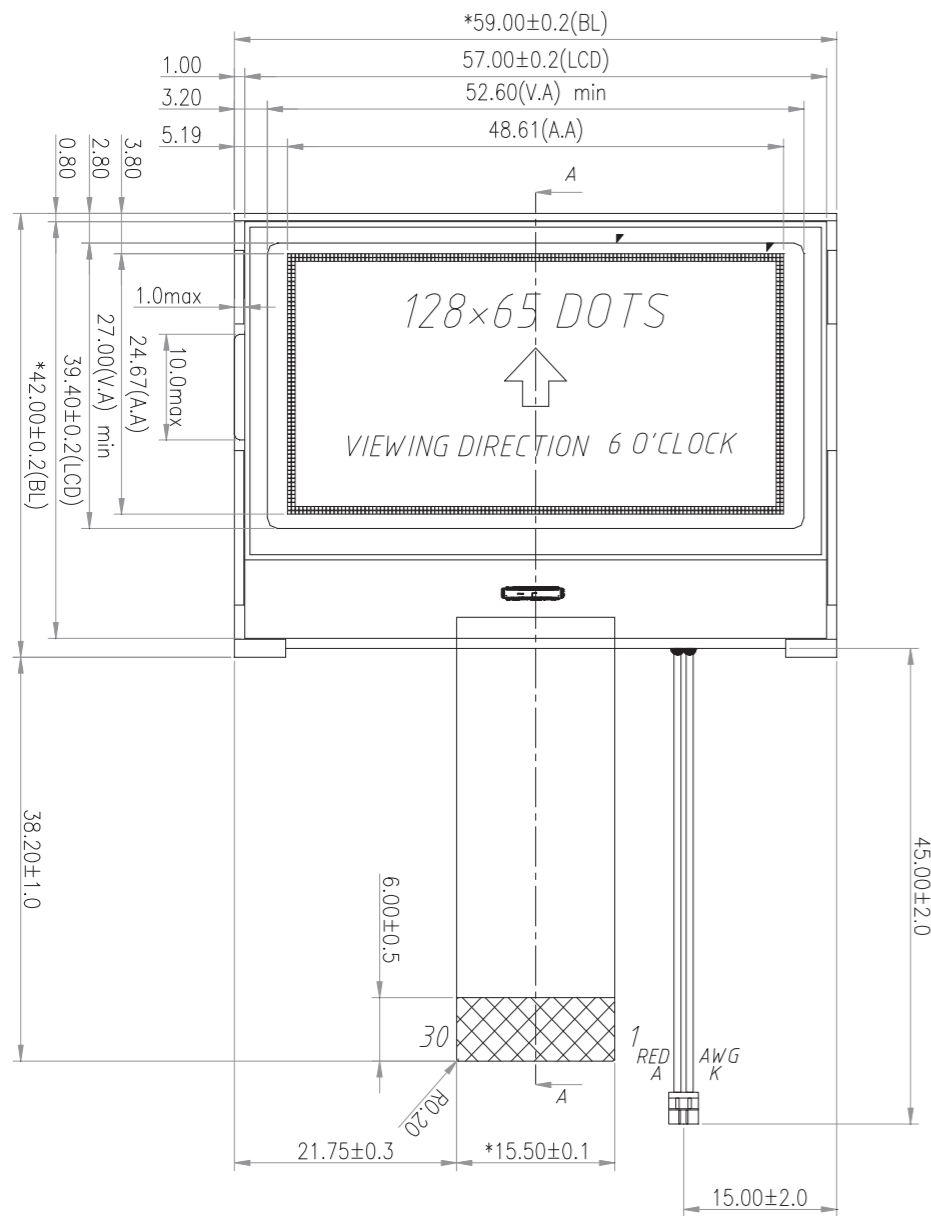
Revision	Date	Description	Changed by
0	9/12/2011	Initial Release	-
1	4/4/2013	Backlight mating connector updated	AK
2	3/17/2015	Pin Description updated	RM
3	11/30/16	Mechanical Drawing, Electrical & Optical Char. Updated	SB
4	9/6/19	Mechanical Drawing & Backlight Characteristics Updated	SB
5	1/15/21	Updated 2D Mechanical Drawing Notes	AS

## Functions and Features

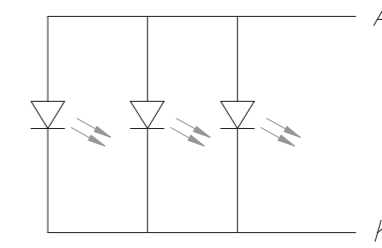
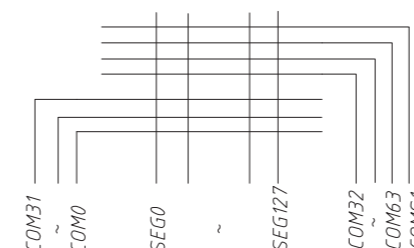
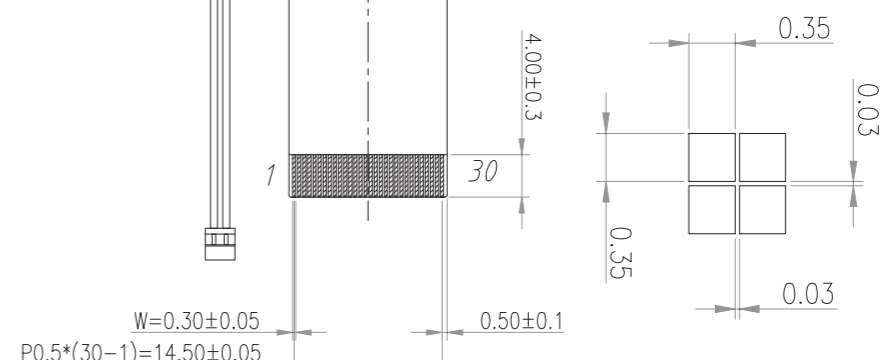
- 128 x 65 pixels
- Built-in ST7565R controller
- +3.3V power supply
- 1/65 duty cycle; 1/9 bias
- Parallel/Serial Interface
- RoHS Compliant

# Mechanical Drawing

SYMBOL	REVISION	DATE



Pin No	Define
1	/CS1
2	/RES
3	A0
4	/WR
5	/RD
6	D0
7	D1
8	D2
9	D3
10	D4
11	D5
12	D6
13	D7
14	VDD
15	VSS
16	VOUT
17	CAP3-
18	CAP1+
19	CAP1-
20	CAP2-
21	CAP2+
22	V1
23	V2
24	V3
25	V4
26	V5
27	VR
28	C86
29	PS
30	/IRS



## Notes:

1. Driver: 1/65 Duty, 1/9 Bias
2. Voltage: 3.3V VDD, 9.5 VLCD
3. Display Mode: STN Positive / Gray / Transflective
4. Optimal View: 6:00
5. Backlight: White
6. Driver IC: ST7565R
7. Liner: Black Line on Glass Liner

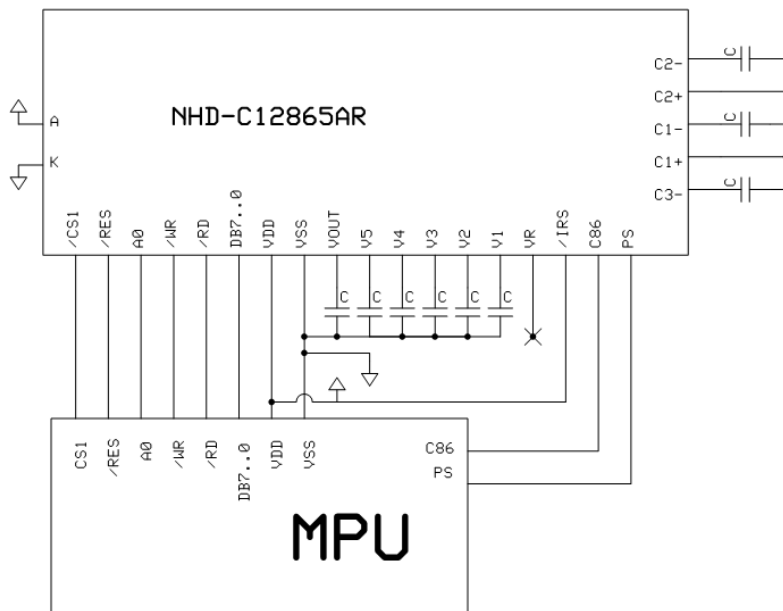
STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)			
LINEAR: ±0.3mm			
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION		DRAWING/PART NUMBER: <b>NHD-C12865AR-FSW-GBW</b>	REVISION: 1.0 SIZE: A3 SCALE: NS
		DRAWN BY: A. Shah	APPROVED BY: A. Shah
		DRAWN DATE: 1/15/21	APPROVED DATE: 1/15/21
DO NOT SCALE DRAWING			SHEET 1 OF 1
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## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description		
1	/CS1	MPU	Active LOW Chip select		
2	/RES	MPU	Active LOW Reset signal		
3	A0	MPU	Register select signal. A0=1: Data, A0=0: Command		
4	R/W /WR	MPU	6800 Mode: Read/Write select signal. R/W=1: Read R/W=0: Write 8080 Mode: Active LOW Write Signal		
5	E /RD	MPU	6800 Mode: Active HIGH Enable Signal 8080 Mode: Active LOW Read Signal		
6	DB0	MPU	Parallel Interface DB0-DB7: Bi-directional 8-bit data bus		
7	DB1				
8	DB2				
9	DB3				
10	DB4				
11	DB5				
12	DB6/SCL				
13	DB7/SI				
14	V <sub>DD</sub>			Power Supply	Supply Voltage for LCD and logic (+3.3V)
15	V <sub>SS</sub>			Power Supply	Ground
16	V <sub>OUT</sub>			Power Supply	Voltage booster circuit – connect to 1uF Cap to V <sub>SS</sub> or V <sub>DD</sub>
17	CAP3-			Power Supply	Connect to 1μF-2.2μF Cap to CAP1+ (Pin-18)
18	CAP1+			Power Supply	Connect to 1μF-2.2μF Cap to CAP1-(Pin-19) and CAP3-(Pin17)
19	CAP1-	Power Supply	Connect to 1μF-2.2μF Cap to CAP1+ (Pin-18)		
20	CAP2-	Power Supply	Connect to 1μF-2.2μF Cap to CAP2+ (Pin-21)		
21	CAP2+	Power Supply	Connect to 1μF-2.2μF Cap to CAP2- (Pin-20)		
22~26	V <sub>1</sub> ~V <sub>5</sub>	Power Supply	0.1μF-1μF cap to VDD or VSS		
27	V <sub>R</sub>	-	No Connect		
28	C86	MPU	Select MPU interface pin. C86 = H: 6800; C86 = L: 8080		
29	PS	MPU	Parallel/Serial select. PS = H: Parallel; PS = L: Serial		
30	/IRS	MPU	This terminal selects the resistors for the V5 voltage level adjustment. IRS = H : Use internal resistors		

**Recommended LCD connector:** 0.5mm pitch, 30 pin FFC. Molex p/n: 52892-3095

**Backlight connector:** A2001H-02P      **Mates with:** A2001WR-2P, A2001WR-S-2P, A2001WV-2P, A2001WV-S-2P



## 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	$I_{DD}$	$V_{DD} = 3.3V$ $T_{OP} = 25^{\circ}C$	100	200	400	$\mu A$
Supply for LCD (contrast)	$V_{LCD}$		9.2	9.5	9.8	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	$V_{OH}$	-	$0.8 * V_{DD}$	-	$V_{DD}$	V
"L" Level output	$V_{OL}$	-	$V_{SS}$	-	$0.2 * V_{DD}$	V
Backlight supply current	$I_{LED}$	-	-	60	75	mA
Backlight supply voltage	$V_{LED}$	$I_{LED} = 60 \text{ mA}$	3.0	3.2	3.4	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	$CR \geq 2$	-	20	-	°
	Bottom		-	40	-	°
	Left		-	40	-	°
	Right		-	40	-	°
Contrast Ratio	CR	-	2	4	-	-
Response Time	Rise	$T_{OP} = 25^{\circ}C$	-	60	120	ms
	Fall		-	100	180	ms

## Controller Information

Built-in ST7565R Controller.

Please download specification at [http://www.newhavendisplay.com/app\\_notes/ST7565R.pdf](http://www.newhavendisplay.com/app_notes/ST7565R.pdf)

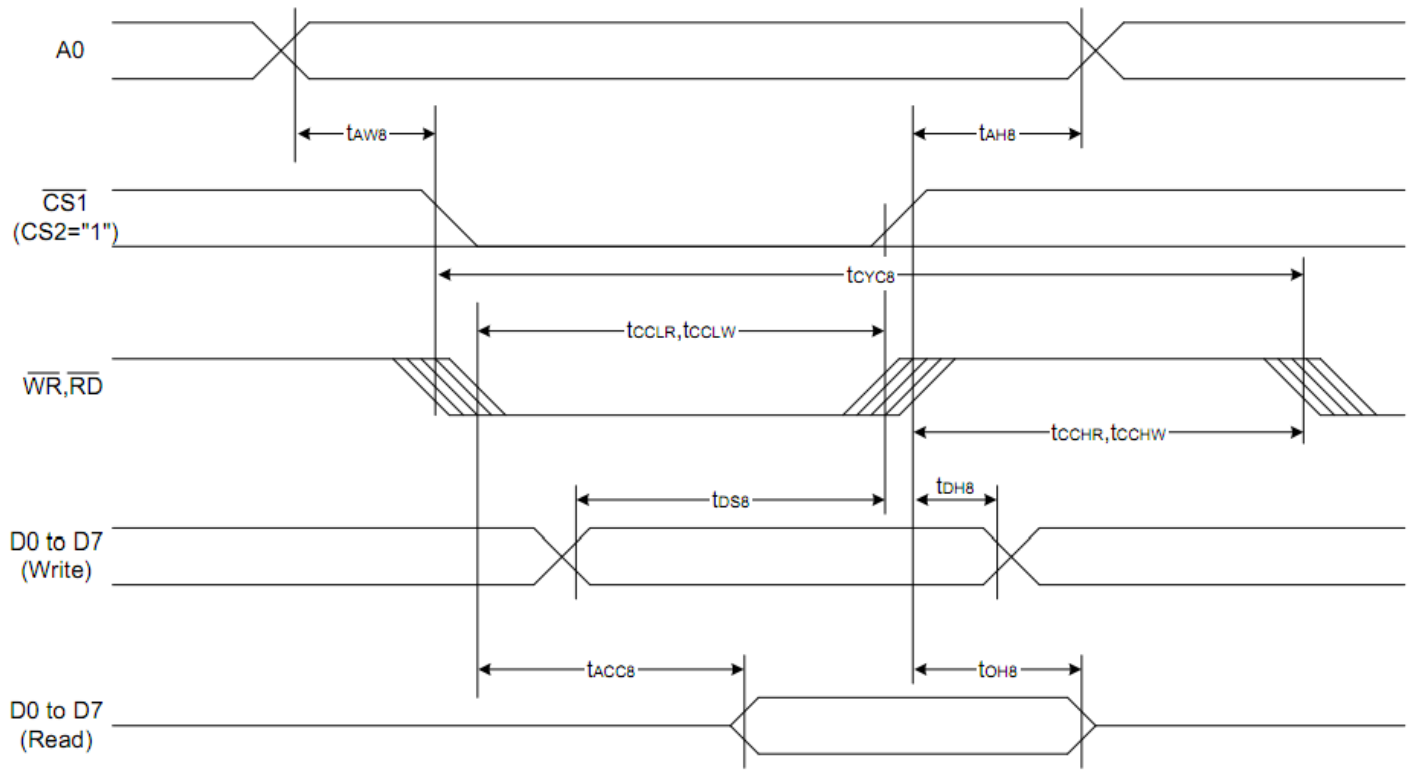
## Table of Commands

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 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address					1	Sets the display RAM display start line address	
(3) Page address set	0	1	0	1	0	1	1	Page address				1	Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address			1	Sets the most significant 4 bits of the display RAM column address. Sets the least significant 4 bits of the display RAM column address.	
Column address set lower bit	0	1	0	0	0	0	0	Least significant column address			1		
(5) Status read	0	0	1	Status				0	0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data								Writes to the display RAM	
(7) Display data read	1	0	1	Read data								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 0: normal, 1: reverse
(9) Display normal/reverse	0	1	0	1	0	1	0	0	0	1	1	0	Sets the LCD display normal/reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	0	1	0	0	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	0	1	0	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565)
(12) Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	0	Column address increment At write: +1 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	0	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			1	Select internal power supply operating mode
(17) V <sub>5</sub> voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			1	Select internal resistor ratio(R <sub>b</sub> /R <sub>a</sub> ) mode
(18) Electronic volume mode set Electronic volume register set	0	1	0	1	0	0	0	0	0	0	0	1	Set the V <sub>5</sub> output voltage electronic volume register
(19) Static indicator ON/OFF Static indicator register set	0	1	0	1	0	1	0	1	1	0	0	0	0: OFF, 1: ON Set the flashing mode
(20) Power saver													Display OFF and display all points ON compound command
(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

(Note) \*: disabled data

# Timing Characteristics

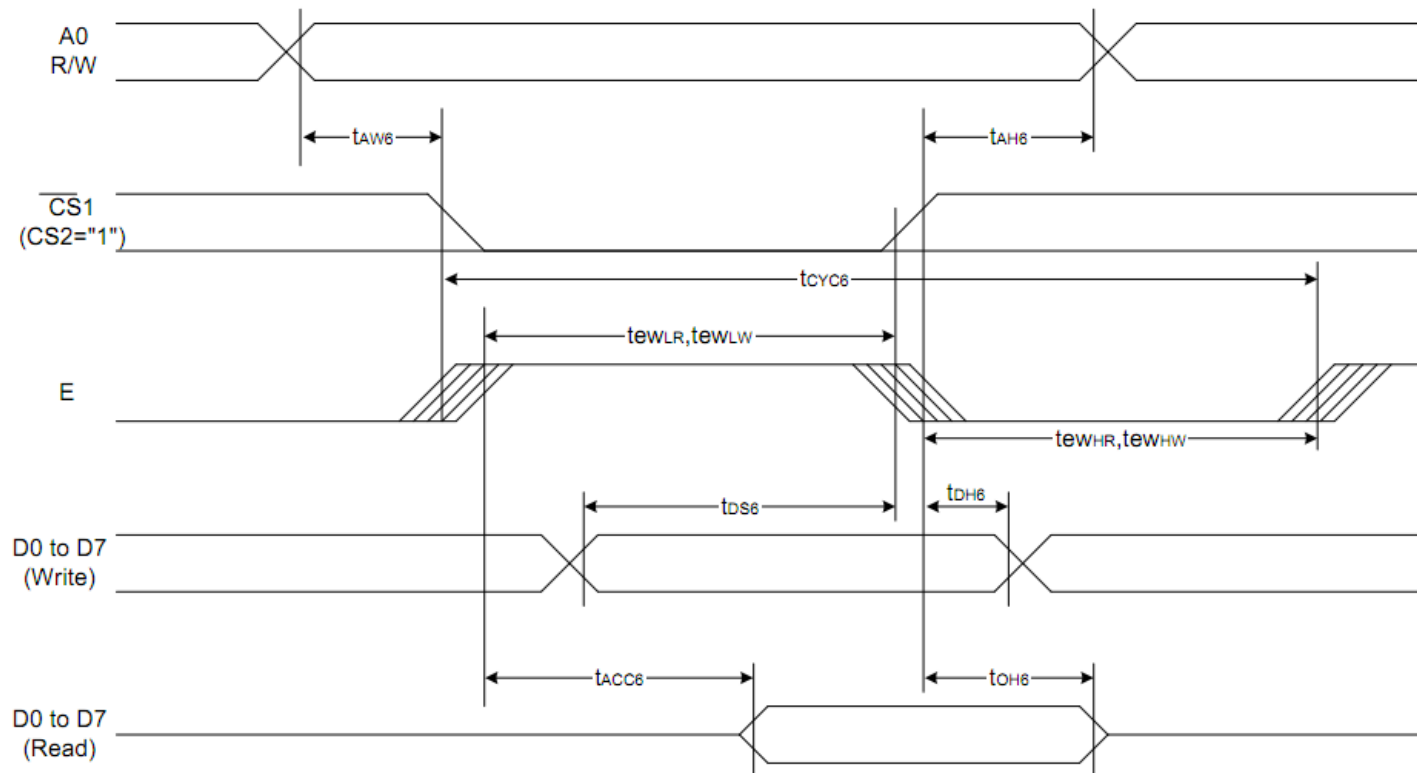
## System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)



(VDD = 3.3V, Ta = -30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAH8		0	—	Ns
Address setup time		tAW8		0	—	
System cycle time		tCYC8		240	—	
Enable L pulse width (WRITE)	WR	tCCLW		80	—	
Enable H pulse width (WRITE)		tCCHW		80	—	
Enable L pulse width (READ)	RD	tCCLR		140	—	
Enable H pulse width (READ)		tCCHR		80	—	
WRITE Data setup time	D0 to D7	tDS8		40	—	
WRITE Address hold time		tDH8		0	—	
READ access time		tACC8	CL = 100 pF	—	70	
READ Output disable time		tOH8	CL = 100 pF	5	50	

## System Bus Read/Write Characteristics 2 (For the 6800 Series MPU)

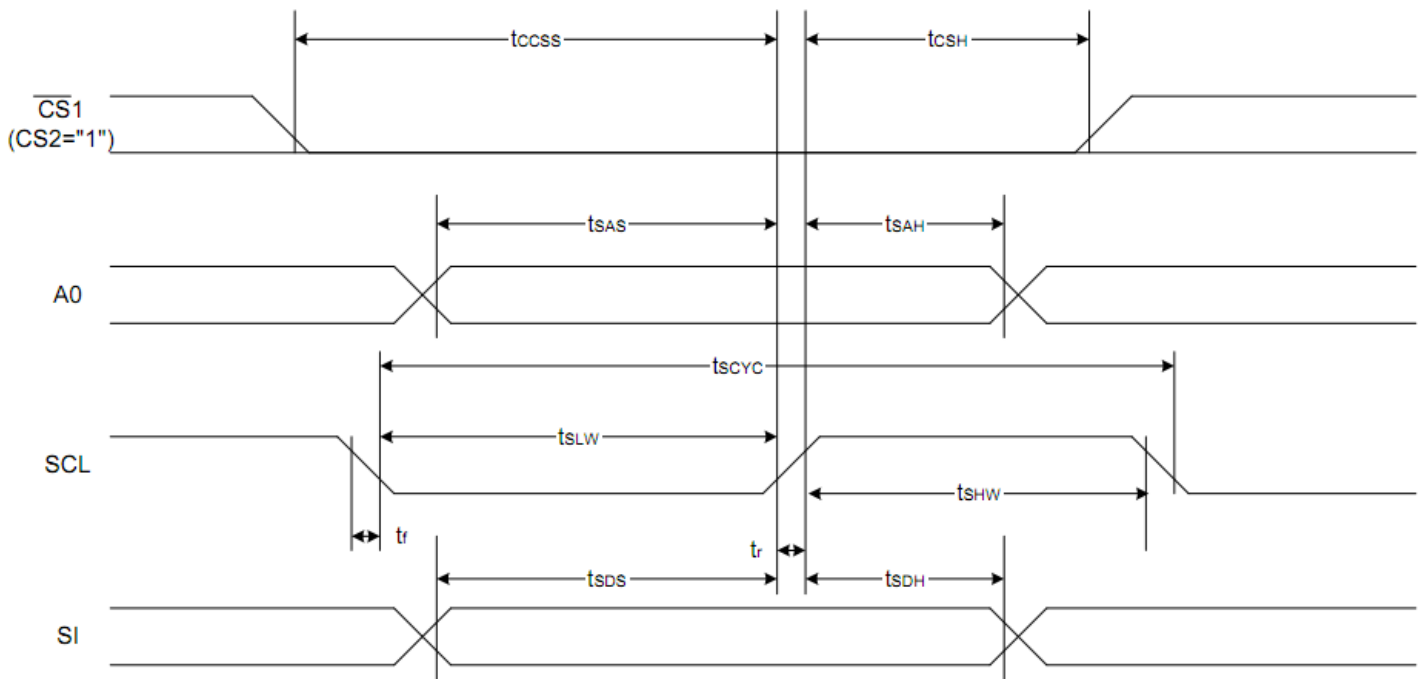


( $V_{DD} = 3.3V, T_a = -30$  to  $85^{\circ}C$ )

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	$t_{AH6}$		0	—	ns
Address setup time		$t_{AW6}$		0	—	
System cycle time		$t_{CYC6}$		240	—	
Enable L pulse width (WRITE)	WR	$t_{ewLW}$		80	—	
Enable H pulse width (WRITE)		$t_{ewHW}$		80	—	
Enable L pulse width (READ)	RD	$t_{ewLR}$		80	—	
Enable H pulse width (READ)		$t_{ewHR}$		140	—	
WRITE Data setup time	D0 to D7	$t_{ds6}$		40	—	
WRITE Address hold time		$t_{DH6}$		0	—	
READ access time		$t_{ACC6}$	$C_L = 100$ pF	—	70	
READ Output disable time		$t_{oH6}$	$C_L = 100$ pF	5	50	



## The 4-line SPI Interface



( $V_{\text{DD}} = 3.3\text{V}$ ,  $T_{\text{a}} = -30$  to  $85^{\circ}\text{C}$ )

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
4-line SPI Clock Period	SCL	$T_{\text{scyc}}$		50	—	ns
SCL "H" pulse width		$T_{\text{shw}}$		25	—	
SCL "L" pulse width		$T_{\text{SLW}}$		25	—	
Address setup time	A0	$T_{\text{SAS}}$		20	—	
Address hold time		$T_{\text{SAH}}$		10	—	
Data setup time	SI	$T_{\text{SDS}}$		20	—	
Data hold time		$T_{\text{SDH}}$		10	—	
CS-SCL time	CS	$T_{\text{CSS}}$		20	—	
CS-SCL time		$T_{\text{CSH}}$		40	—	

# Example Initialization Program

```
/******
```

```
Sub Command  
Reset P3.7  
Reset P3.4  
Reset P3.1  
P1 = A  
Set P3.1  
Set P3.7  
End Sub
```

```
/******
```

```
Sub Write  
Reset P3.7  
Set P3.4  
Reset P3.1  
P1 = A  
Set P3.1  
Set P3.7  
End Sub
```

```
/******
```

```
Sub Init  
A = &HA0  
Call Command  
A = &HAE  
Call Command  
A = &HC0  
Call Command  
A = &HA2  
Call Command  
A = &H2F  
Call Command  
A = &H26  
Call Command  
A = &H81  
Call Command  
A = &H2F  
Call Command  
End Sub
```

```
/******
```

## 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, 240hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C, 240hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C, 240hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C, 240hrs	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.	+40°C, 90% RH, 240hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	-0°C,30min -> 25°C,5min -> 50°C,30min = 1 cycle 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz, 1.5mm amplitude. 60 sec in each of 3 directions X, Y, Z For 10 Minutes	3
Static electricity test	Endurance test applying electric static discharge.	VS=800V, RS=1.5kΩ, CS=100pF One time	

**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.

## Precautions for using LCDs/LCMs

See Precautions at [www.newhavendisplay.com/specs/precautions.pdf](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information and Terms & Conditions

[http://www.newhavendisplay.com/index.php?main\\_page=terms](http://www.newhavendisplay.com/index.php?main_page=terms)