

# NHD-C12865BR-FSW-GBW

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

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

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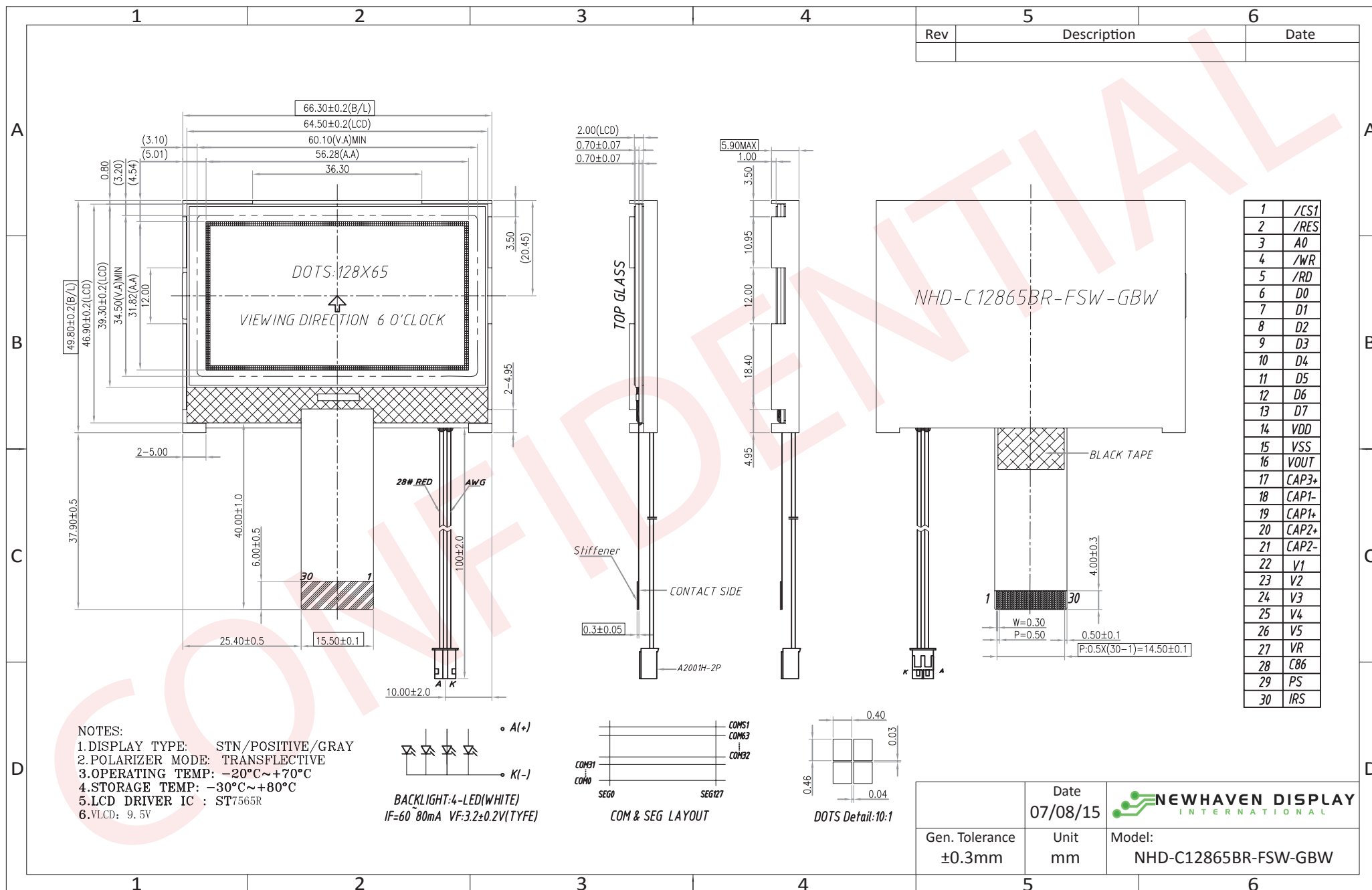
## Document Revision History

Revision	Date	Description	Changed by
0	9/12/2011	Initial Release	-
1	11/26/2012	Backlight connector information updated	AK
2	4/23/2013	LCD backlight connector changed to A2001H-2P	AK
3	4/13/2015	LCD redesigned	AK
4	7/8/2015	Mechanical drawing updated	AK

## 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



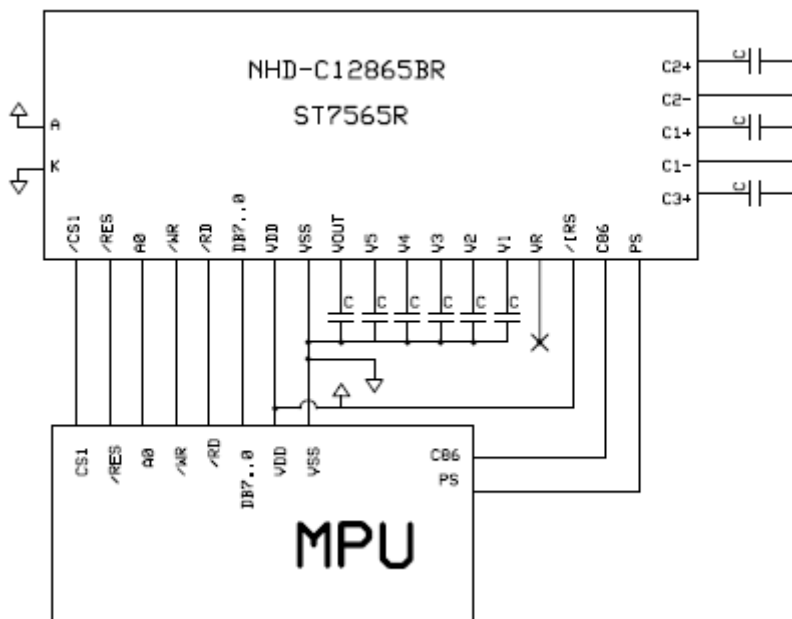
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## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description		
1	/CS1	MPU	Active LOW Chip Select signal		
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  Serial Interface: DB0-DB5: No connect DB6= Serial Clock Input signal (SCL) DB7= Serial Data Input signal (SI)		
7	DB1				
8	DB2				
9	DB3				
10	DB4				
11	DB5				
12	DB6/SCL				
13	DB7/SI				
14	VDD			Power Supply	Power supply for LCD and logic (+3.3V)
15	VSS			Power Supply	Ground
16	VOUT			Power Supply	Connect to 1uF cap to VSS or VDD
17	CAP3+			Power Supply	Connect to 1uF Cap to CAP1- (Pin-18)
18	CAP1-			Power Supply	Connect to 1uF Cap to CAP1+(Pin-19) and CAP3+(Pin17)
19	CAP1+	Power Supply	Connect to 1uF Cap to CAP1- (Pin-18)		
20	CAP2+	Power Supply	Connect to 1uF Cap to CAP2- (Pin-21)		
21	CAP2-	Power Supply	Connect to 1uF Cap to CAP2+ (Pin-20)		
22-26	V1-V5	Power Supply	1.0uF-2.2uF cap to VSS or VDD		
27	VR	-	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	Set HIGH to use internal resistors for V0 voltage level adjustment		

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

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



## Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	Top	Absolute Max	-20	-	+70	°C
Storage Temperature Range	Tst	Absolute Max	-30	-	+80	°C
Supply Voltage	VDD		-	3.3	-	V
Supply Current	IDD	Ta=25°, VDD=3.3V	-	1.5	2.5	mA
Supply for LCD (contrast)	VLCD	Ta =25°C	-	9.5	10	V
"H" Level input	Vih		0.8*VDD	-	VDD	V
"L" Level input	Vil		0	-	0.2*VDD	V
"H" Level output	Voh		0.8*VDD	-	-	V
"L" Level output	Vol		-	-	0.2*VDD	V
Backlight supply voltage	VLED		-	3.2	3.4	V
Backlight supply current	ILED	VLED=3.2V	-	60	80	mA

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Top		Cr≥3	-	25	-	°
Viewing Angle – Bottom			-	45	-	°
Viewing Angle – Left			-	35	-	°
Viewing Angle – Right			-	35	-	°
Contrast Ratio	CR		3.0	-	-	-
Response Time (rise)	Tr	Ta=25°C	-	-	250	ms
Response Time (fall)	Tf	Ta=25°C	-	-	250	ms

## Controller Information

Built-in ST7565R controller.

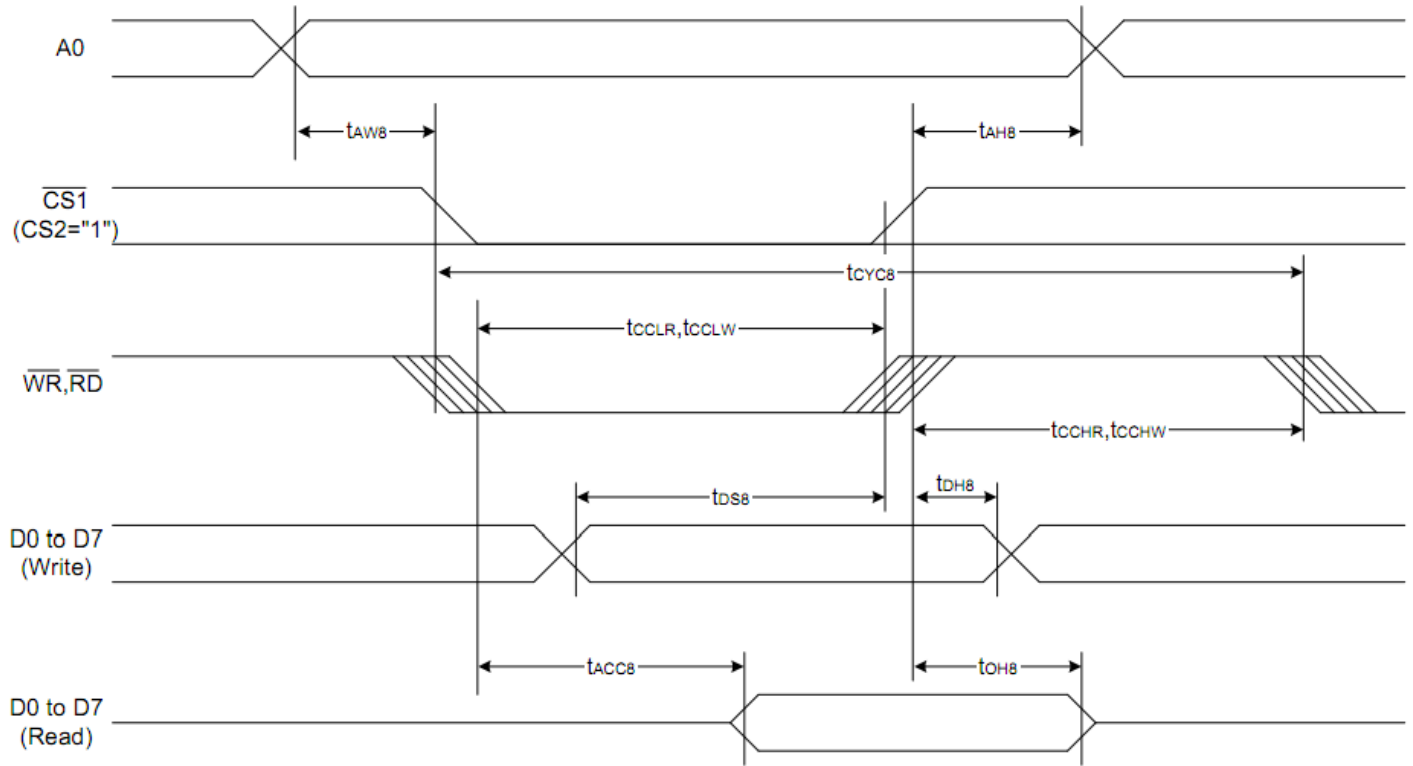
Please download specification at [http://www.newhavendisplay.com/app\\_notes/ST7565R.pdf](http://www.newhavendisplay.com/app_notes/ST7565R.pdf)

## 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					0	Sets the display RAM display start line address	
(3) Page address set	0	1	0	1	0	1	Page address					0	Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				0	Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit				0	0	0	0	Least significant column address				0	Sets the least significant 4 bits of the display RAM column address.
(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							0	Writes to the display RAM	
(7) Display data read	1	0	1	Read data							0	Reads from the display RAM	
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0	1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/reverse	0	1	0	1	0	1	0	0	1	1	0	1	Sets the LCD display normal/ reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0	1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0	1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565R)
(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	1	0	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0	*	*	*	1	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			0	Select internal power supply operating mode
(17) V <sub>0</sub> voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			0	Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	0	1	Set the V <sub>0</sub> output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value					0		
(19) Sleep mode set	0	1	0	1	0	1	0	1	1	0	0	1	0: Sleep mode, 1: Normal mode
				*	*	*	*	*	*	0	0	0	
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
				0	0	0	0	0	0	0	0	step-up value	
(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

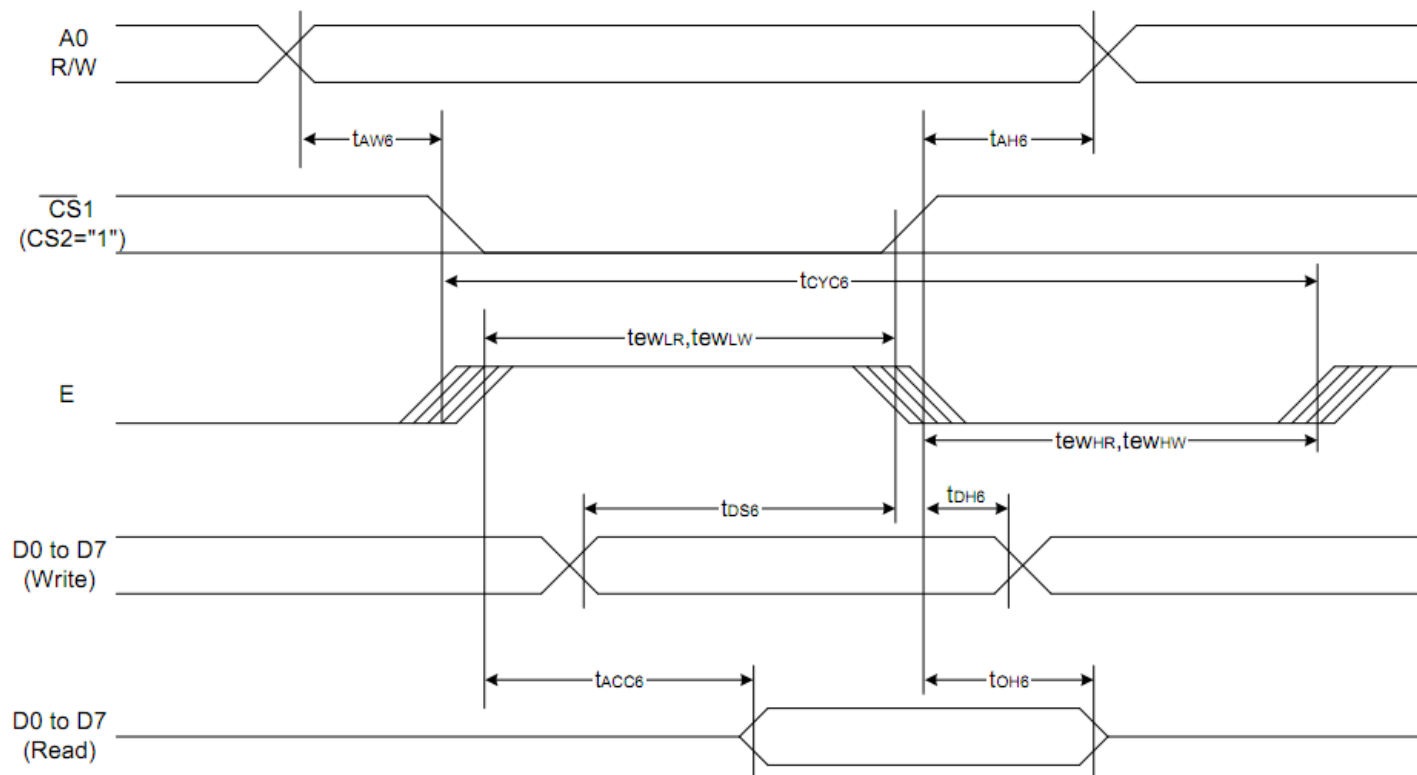
# Timing Characteristics

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



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	

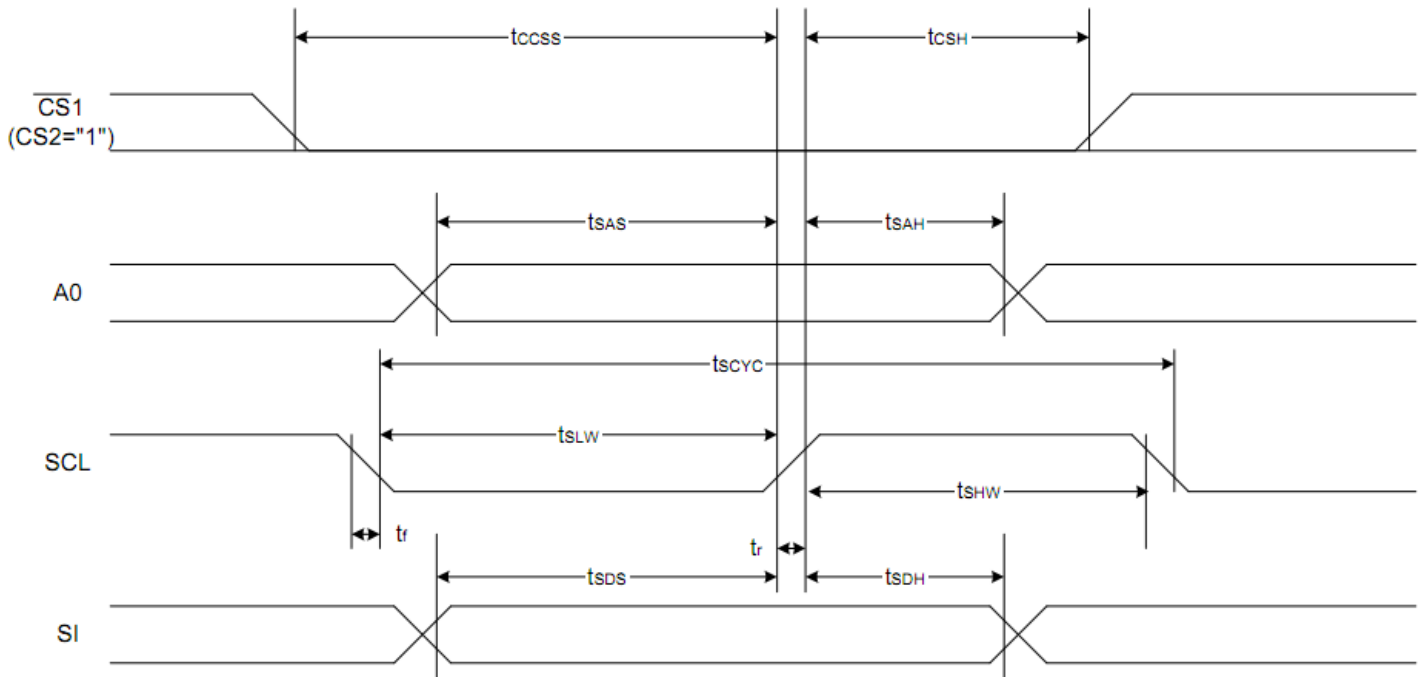
## System Bus Read/Write Characteristics 2 (For the 6800 Series MPU)



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		$t_{ACC6}$	$C_L = 100 \text{ pF}$	—	70	
READ Output disable time		$t_{OH6}$	$C_L = 100 \text{ pF}$	5	50	



## The 4-line SPI Interface



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 , 48hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 48hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 48hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 48hrs	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 , 48hrs	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 , 15mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 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)