

# NHD-C12864WC-FSW-FBW-3V3-M

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

NHD-	Newhaven Display
C12864-	128 x 64 Pixels
WM-	Model
F-	Transflective
SW-	Side White LED Backlight
F-	FSTN (+)
B-	6:00 Optimal View
W-	Wide Temp.
3V3-	3.0V LCD, 3.0V Backlight
M-	Mounting Holes
	<b>RoHS Compliant</b>

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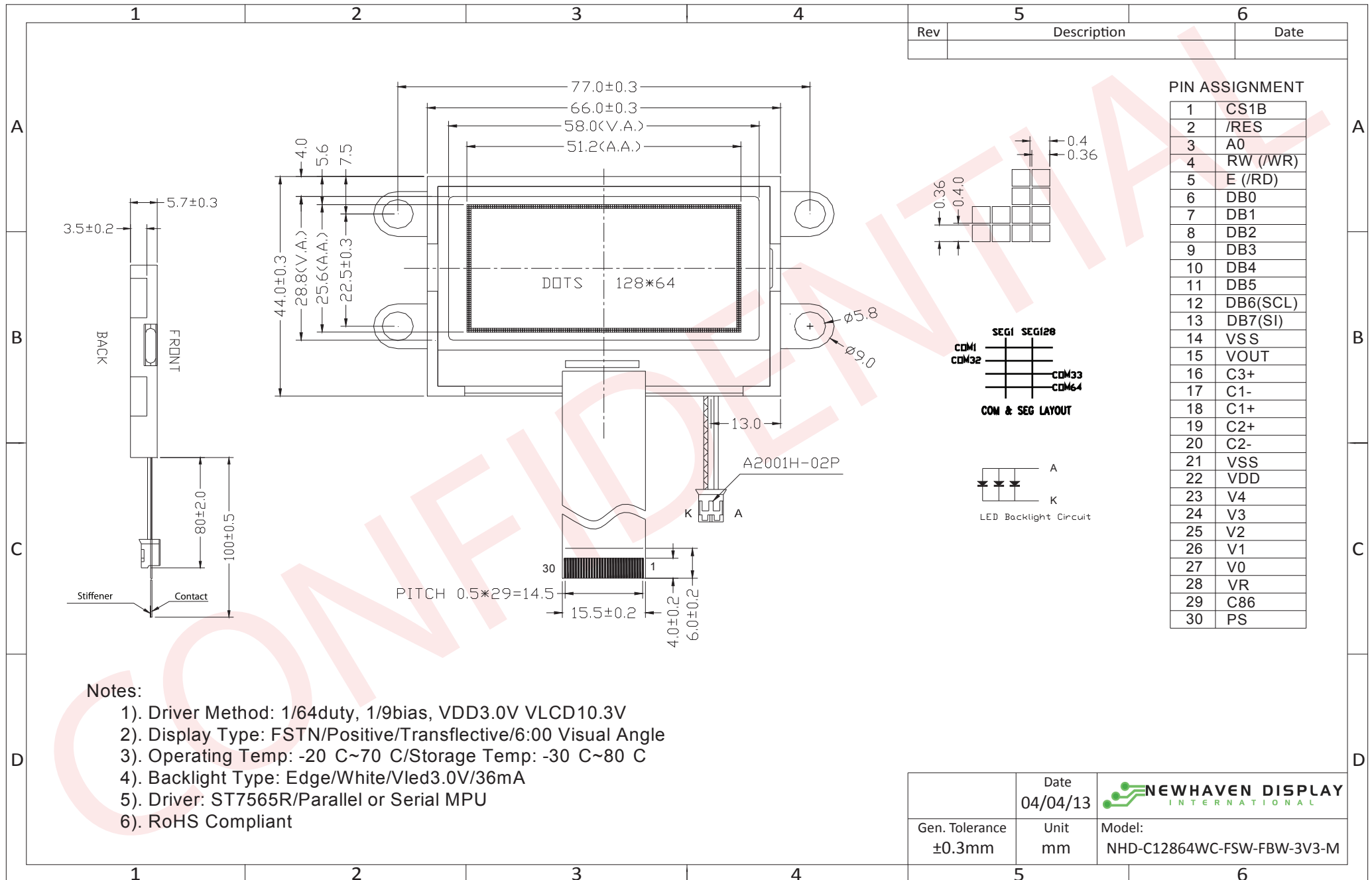
## Document Revision History

Revision	Date	Description	Changed by
0	10/12/2010	Initial Release	MC
1	5/25/2010	Electrical characteristics updated	AK
2	4/4/2013	Backlight mating connector part number updated	AK
3	3/16/2015	Pin Description updated	RM
4	9/30/2015	Wiring Diagram updated, Backlight Current rating added	SB
5	9/13/16	Capacitor Values Adjusted	SB

## Functions and Features

- 128 x 64 pixels
- Built-in ST7565R controller
- Parallel/Serial interface
- 1/64 duty cycle; 1/9 bias
- RoHS Compliant

# Mechanical Drawing



## PIN ASSIGNMENT

Pin	Function
1	CS1B
2	/RES
3	A0
4	RW (/WR)
5	E (/RD)
6	DB0
7	DB1
8	DB2
9	DB3
10	DB4
11	DB5
12	DB6(SCL)
13	DB7(SI)
14	VSS
15	VOUT
16	C3+
17	C1-
18	C1+
19	C2+
20	C2-
21	VSS
22	VDD
23	V4
24	V3
25	V2
26	V1
27	V0
28	VR
29	C86
30	PS

### Notes:

- 1). Driver Method: 1/64duty, 1/9bias, VDD3.0V VLCD10.3V
- 2). Display Type: FSTN/Positive/Transflective/6:00 Visual Angle
- 3). Operating Temp: -20 C~70 C/Storage Temp: -30 C~80 C
- 4). Backlight Type: Edge/White/Vled3.0V/36mA
- 5). Driver: ST7565R/Parallel or Serial MPU
- 6). RoHS Compliant

	Date	 NEWHAVEN DISPLAY INTERNATIONAL
	04/04/13	
Gen. Tolerance	Unit	Model:
±0.3mm	mm	NHD-C12864WC-FSW-FBW-3V3-M

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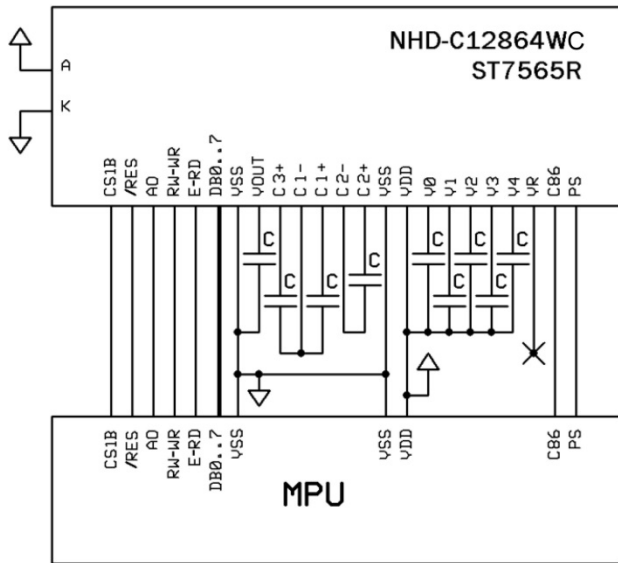
## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description	
1	CS1B	MPU	Active LOW chip select	
2	/RES	MPU	Active LOW Reset signal	
3	A0	MPU	Register Select signal. A0=0: Command, A0=1: Data	
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 in serial mode DB6 = Serial clock DB7 = Serial data	
7	DB1	MPU		
8	DB2	MPU		
9	DB3	MPU		
10	DB4	MPU		
11	DB5	MPU		
12	DB6(SCL)	MPU		
13	DB7(SI)	MPU		
14	VSS	Power Supply		Ground (reference for voltage step-up circuit)
15	VOOUT	Power Supply		Connect capacitor to VSS (PIN-14) (1.0-2.2 $\mu$ F)
16	CAP3+	Power Supply		Connect capacitor to CAP1- (PIN-17) (1.0-2.2 $\mu$ F)
17	CAP1-	Power Supply		Connect capacitor to CAP3+(PIN16) and CAP1+(PIN18) (1.0-2.2 $\mu$ F)
18	CAP1+	Power Supply		Connect capacitor to CAP1- (PIN-17) (1.0-2.2 $\mu$ F)
19	CAP2+	Power Supply	Connect capacitor to CAP2- (PIN-20) (1.0-2.2 $\mu$ F)	
20	CAP2-	Power Supply	Connect capacitor to CAP2+ (PIN-19) (1.0-2.2 $\mu$ F)	
21	VSS	Power Supply	Ground	
22	VDD	Power Supply	Supply voltage for LCD and logic (3.0V)	
23~27	V4~V0	Power Supply	0.1 – 1.0 $\mu$ F capacitor to V <sub>DD</sub> or V <sub>SS</sub>	
28	VR	-	No Connect	
29	C86	MPU	Select MPU interface pin. C86=H: 6800; C86=L: 8080	
30	PS	MPU	Parallel/Serial Select. PS= H: Parallel; PS=L: Serial	
A	LED+	Power Supply	Backlight Anode (+3.0V)	
K	LED-	Power Supply	Backlight Cathode (Ground)	

**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

## Wiring Diagram



## 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	$V_{DD}$	-	2.7	3.0	3.3	V
Supply Current	$I_{DD}$	$V_{DD} = 5.0V$ $T_{OP} = 25^{\circ}C$	-	-	0.5	mA
Supply for LCD (contrast)	$V_{LCD}$		-	10.3	-	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	$V_{OH}$	-	$0.8 * V_{DD}$	-	$V_{DD}$	-
"L" Level output	$V_{OL}$	-	$V_{SS}$	-	$0.2 * V_{DD}$	-
LED BKL voltage	$V_{LED}$	-	-	3.0	-	V
LED BKL current	$I_{LED}$	$V_{LED} = 3.0V$	21	36	50	mA

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	$\phi Y+$	-	20	-	°
	Bottom	$\phi Y-$	-	50	-	°
	Left	$\theta X-$	-	30	-	°
	Right	$\theta X+$	-	30	-	°
Contrast Ratio	CR	-	3	5	-	-
Response Time	Rise	$T_R$	-	150	250	ms
	Fall	$T_F$	-	150	250	ms

## Controller Information

Built-in ST7565R controller.

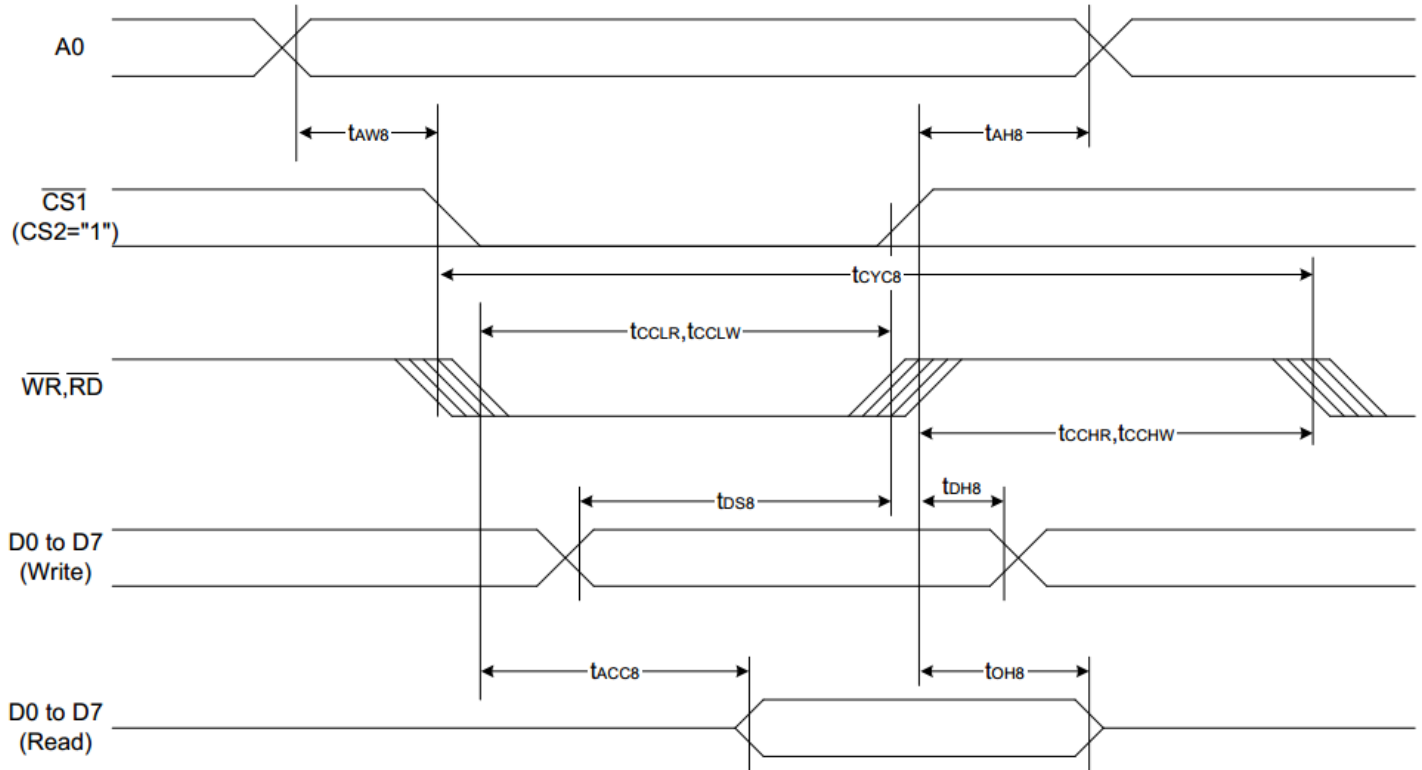
Please download specification at [http://www.newhavendisplay.com/app\\_notes/ST7565R.pdf](http://www.newhavendisplay.com/app_notes/ST7565R.pdf)

## 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	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	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			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
(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	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

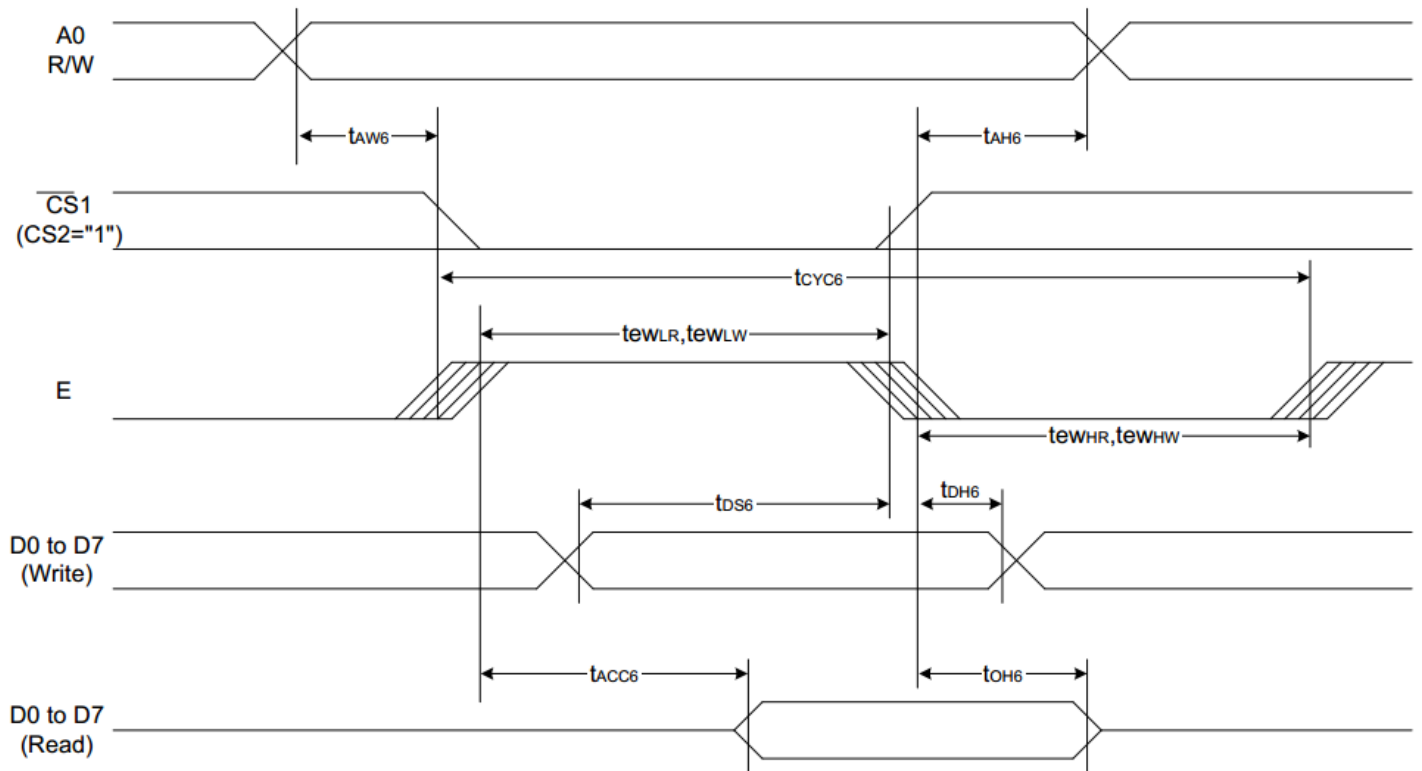
## System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)



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

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)

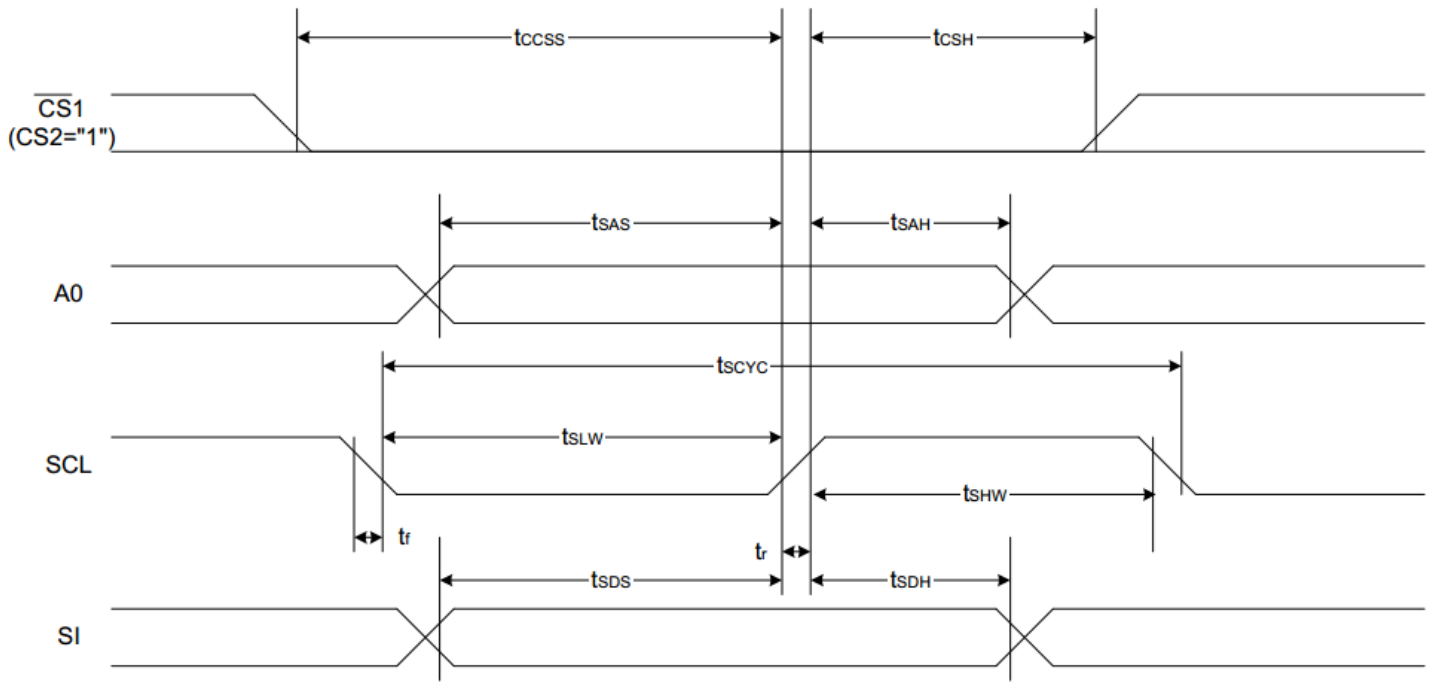


( $V_{DD} = 3.3V, T_a = -30$  to  $85^{\circ}C$ )

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 Init  
Reset P3.7          'set Read/write to '0' for write  
Reset P3.0          'RS  
Set P3.1            'reset  
Reset P3.4 'E  
'Set P3.3  
'Reset P3.3  
Waitms 2  
'Set P3.3  
Waitms 20  
A = &HA2            '1/9 BIAS  
Call Writecom  
A = &HA0            'ADC SELECT , NORMAL  
Call Writecom  
A = &HC8            'COM OUTPUT REVERSE  
Call Writecom  
A = &HA4            'DISPLAY ALL POINTS NORMAL  
Call Writecom  
A = &H40            'DISPLAY START LINE SET  
Call Writecom  
A = &H25            'INTERNAL RESISTOR RATIO  
Call Writecom  
A = &H81            'ELECTRONIC VOLUME MODE SET  
Call Writecom  
A = &H10            'ELECTRONIC VOLUME  
Call Writecom  
A = &H2F            'POWER CONTROLLER SET  
Call Writecom  
A = &HAF            'DISPLAY ON  
Call Writecom  
End Sub
```

```
'-----  
Sub Writecom  
Reset P3.0          'A0 low  
Reset P3.7          'R/W low  
Set P3.6            'CS2  
Set P3.4            'E  
P1 = A  
Reset P3.4  
Reset P3.6  
Reset P3.7  
End Sub
```

```
Sub Writedata  
Set P3.0            'A0 high  
Reset P3.7          'R/W low  
Set P3.6            'CS2  
Set P3.4            'E  
P1 = A  
Reset P3.4  
Reset P3.6  
Reset P3.7  
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 , 96hrs	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 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)