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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



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-Gray
B- 6:00 Optimal View
W- Wide Temperature
RoHS Compliant

Newhaven Display International, Inc.

2661 Galvin Court

Elgin IL, 60124

Ph: 847-844-8795

Fax: 847-844-8796

www.newhavendisplay.com

nhtech@newhavendisplay.com

nhsales@newhavendisplay.com

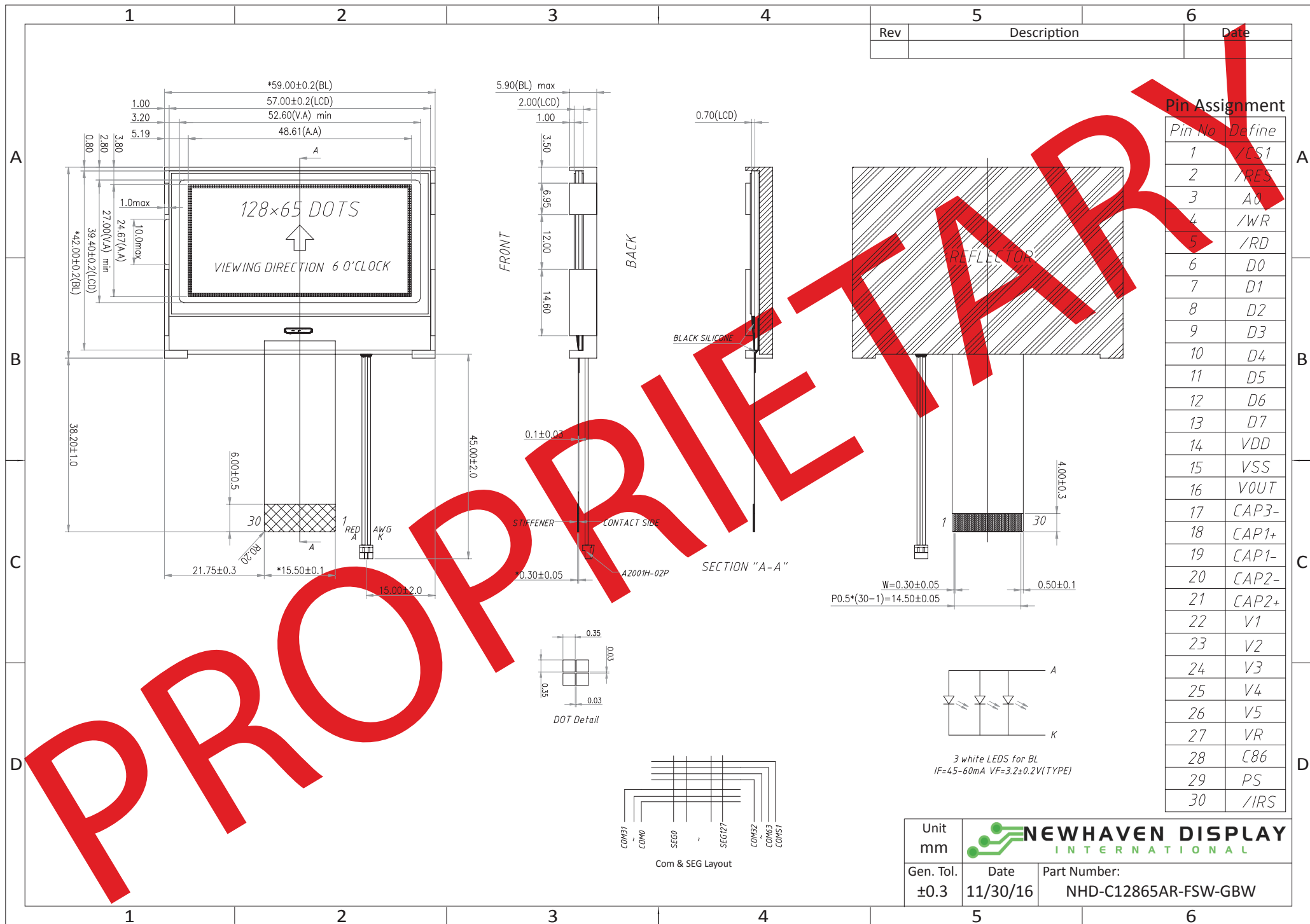
Document Revision History

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

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



PROPRIETARY

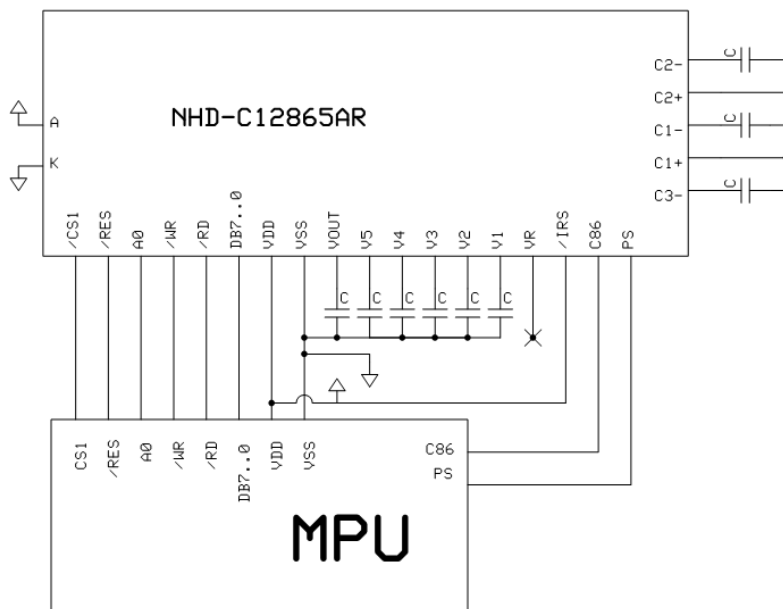
Pin Description and Wiring Diagram

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 Serial Interface: DB0-DB5: No connect in serial mode DB6= Serial clock (SCL) DB7= Serial data (SI)		
7	DB1				
8	DB2				
9	DB3				
10	DB4				
11	DB5				
12	DB6/SCL				
13	DB7/SI				
14	V _{DD}			Power Supply	Supply Voltage for LCD and logic (+3.3V)
15	V _{SS}			Power Supply	Ground
16	V _{OUT}			Power Supply	Voltage booster circuit – connect to 1uF Cap to V _{SS} or V _{DD}
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 ₁ ~V ₅	Power Supply	0.1μF-1μF cap to VDD or VSS		
27	V _R	-	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	500	μA
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 voltage	V_{LED}	-	3.0	3.2	3.4	V
Backlight supply current	I_{LED}	$V_{LED} = 3.2V$	40	60	80	mA

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

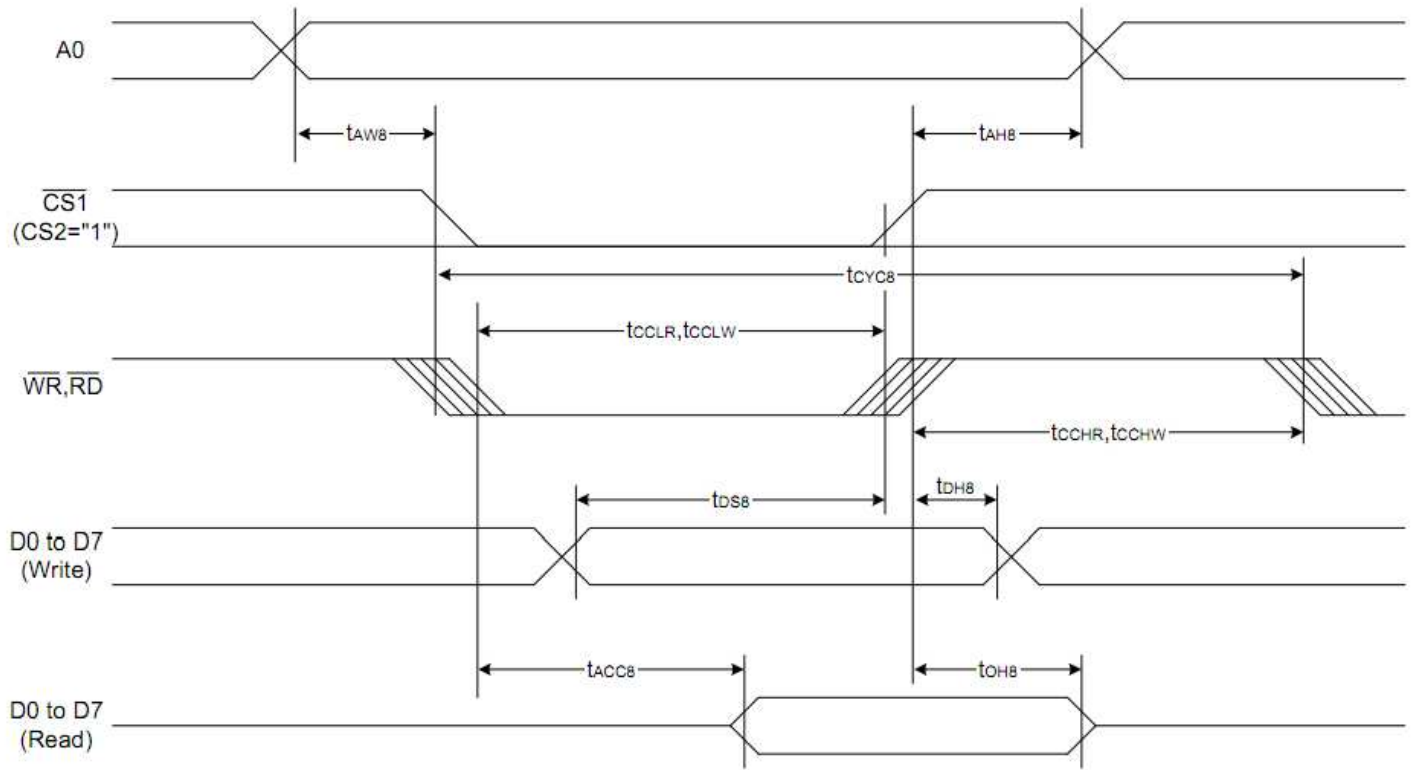
Table of Commands

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						Sets the display RAM display start line address	
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address	
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				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					
(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	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 (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	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			Select internal power supply operating mode	
(17) V ₅ voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(R _b /R _a) 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 ₅ 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	1	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	1	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

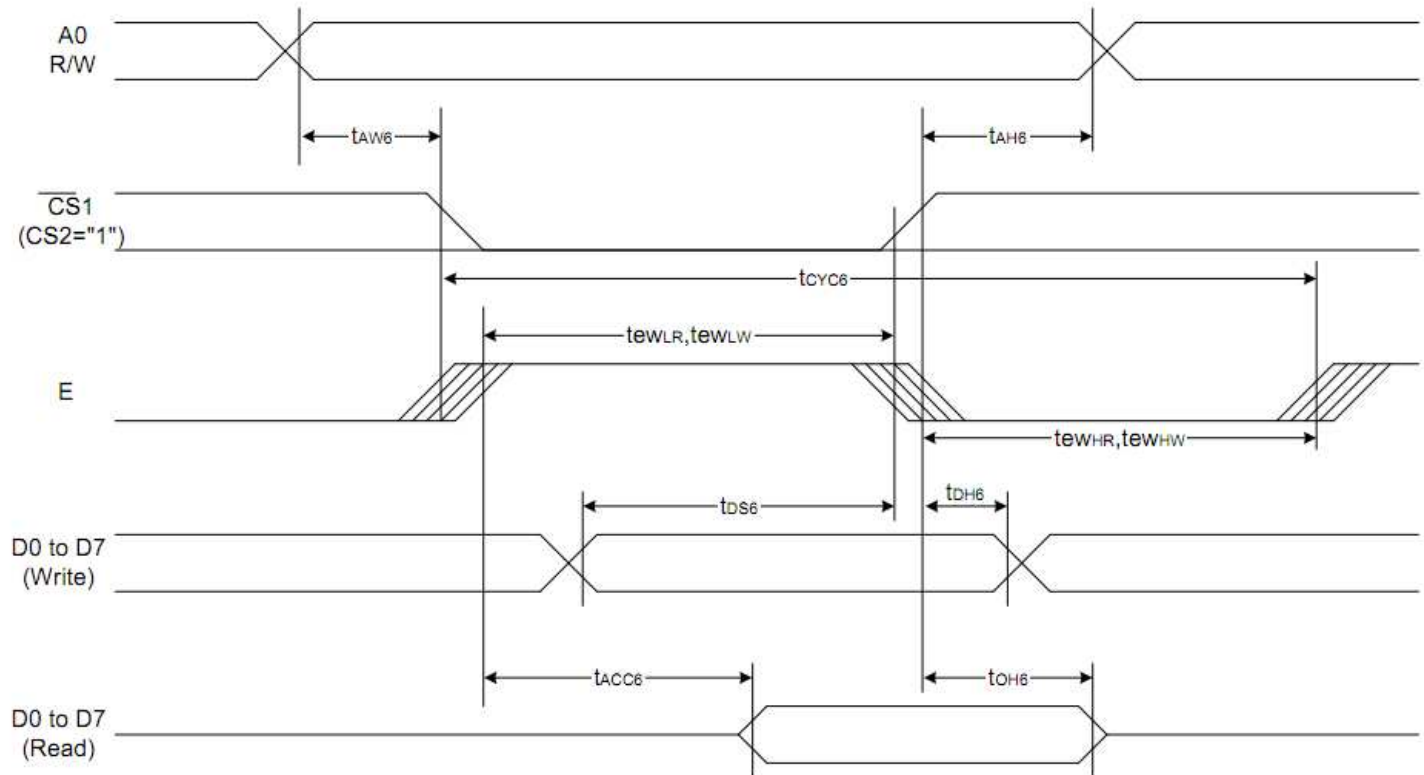
System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)



(V_{DD} = 3.3V, T_a = -30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t _{AH8}		0	—	Ns
Address setup time		t _{AW8}		0	—	
System cycle time		t _{CYC8}		240	—	
Enable L pulse width (WRITE)	WR	t _{CCLW}		80	—	
Enable H pulse width (WRITE)		t _{CCHW}		80	—	
Enable L pulse width (READ)	RD	t _{CCLR}		140	—	
Enable H pulse width (READ)		t _{CCHR}		80	—	
WRITE Data setup time	D0 to D7	t _{DS8}		40	—	
WRITE Address hold time		t _{DH8}		0	—	
READ access time		t _{ACC8}	CL = 100 pF	—	70	
READ Output disable time		t _{OH8}	CL = 100 pF	5	50	

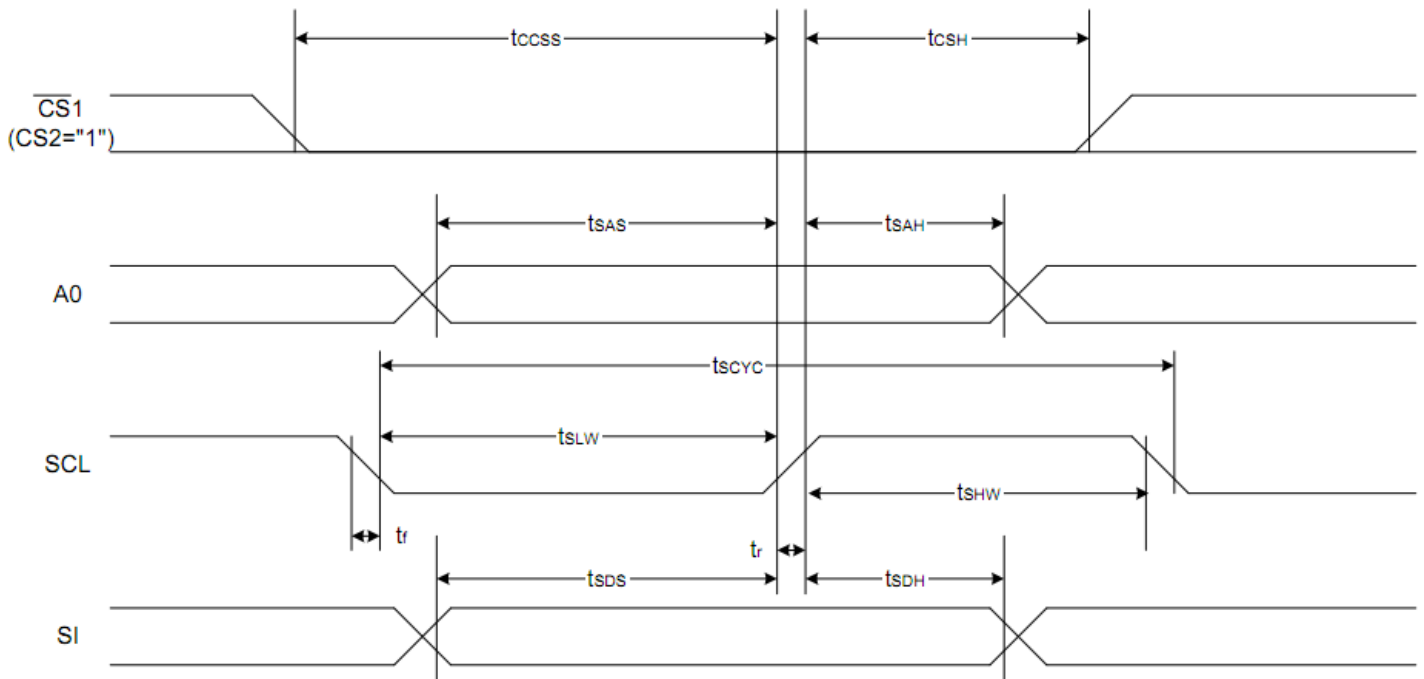
System Bus Read/Write Characteristics 2 (For the 6800 Series MPU)



($V_{DD} = 3.3V, T_a = -30$ 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°C)

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

Warranty Information and Terms & Conditions

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