

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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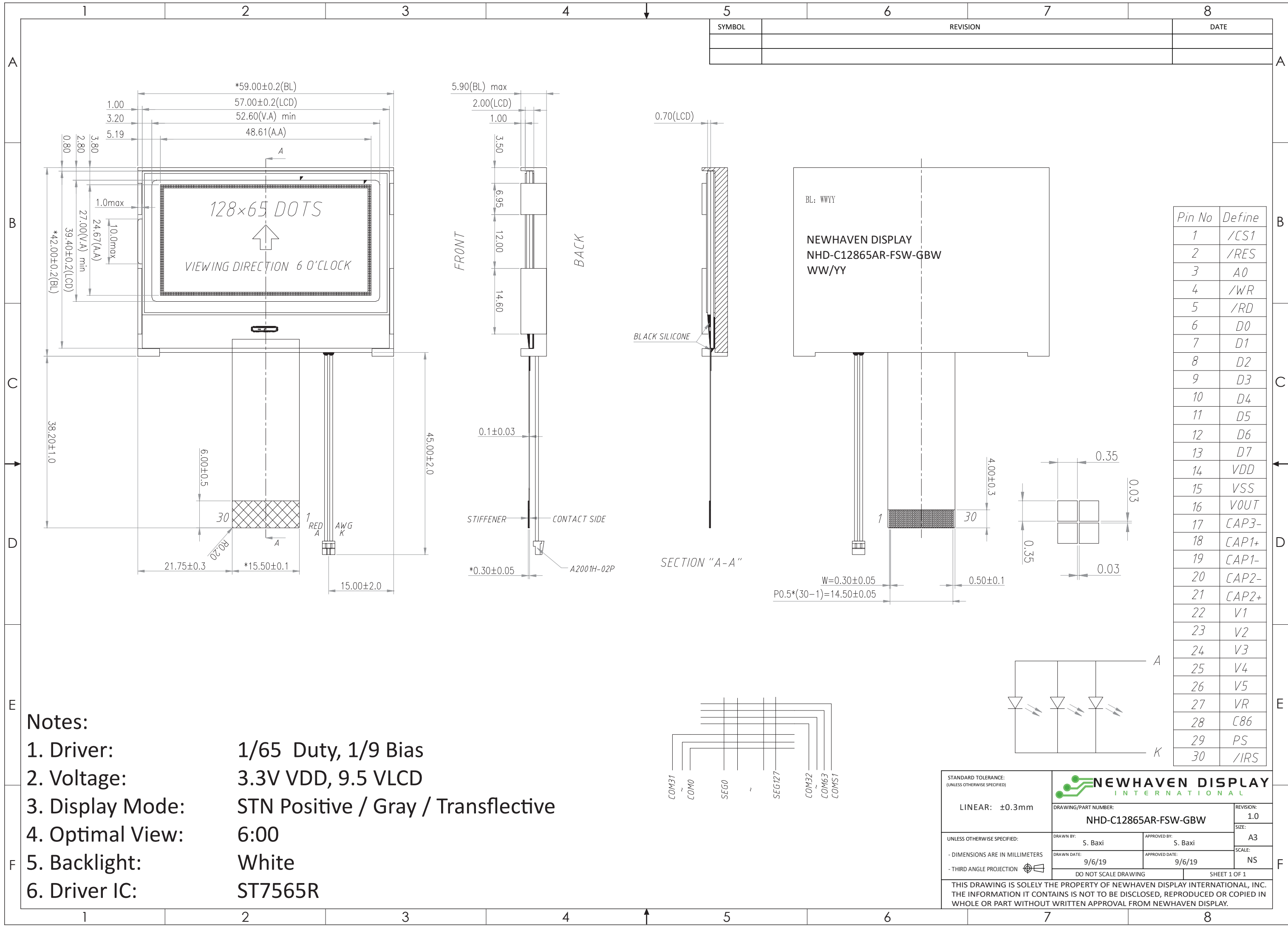
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Document Revision History

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

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



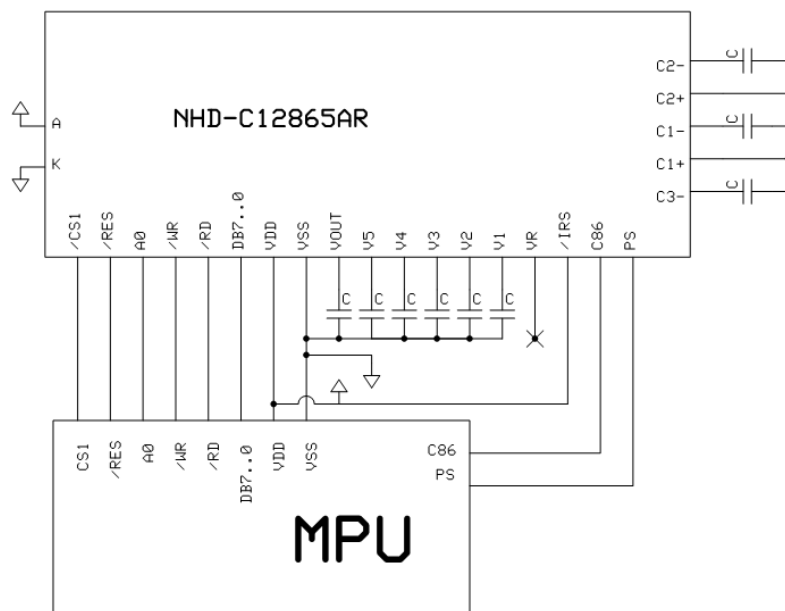
Pin Description and Wiring Diagram

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	MPU	
8	DB2	MPU	
9	DB3	MPU	
10	DB4	MPU	
11	DB5	MPU	Serial Interface: DB0-DB5: No connect in serial mode
12	DB6/SCL	MPU	DB6= Serial clock (SCL)
13	DB7/SI	MPU	DB7= Serial data (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°C	100	200	400	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 current	I _{LED}	-	-	60	75	mA
Backlight supply voltage	V _{LED}	I _{LED} = 60 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	φY+	CR ≥ 2	-	20	-	°
	Bottom	φY-		-	40	-	°
	Left	θX-		-	40	-	°
	Right	θX+		-	40	-	°
Contrast Ratio		CR	-	2	4	-	-
Response Time	Rise	T _R	T _{OP} = 25°C	-	60	120	ms
	Fall	T _F		-	100	180	ms

Controller Information

Built-in ST7565R Controller.

Please download specification at http://www.newhavendisplay.com/app_notes/ST7565R.pdf

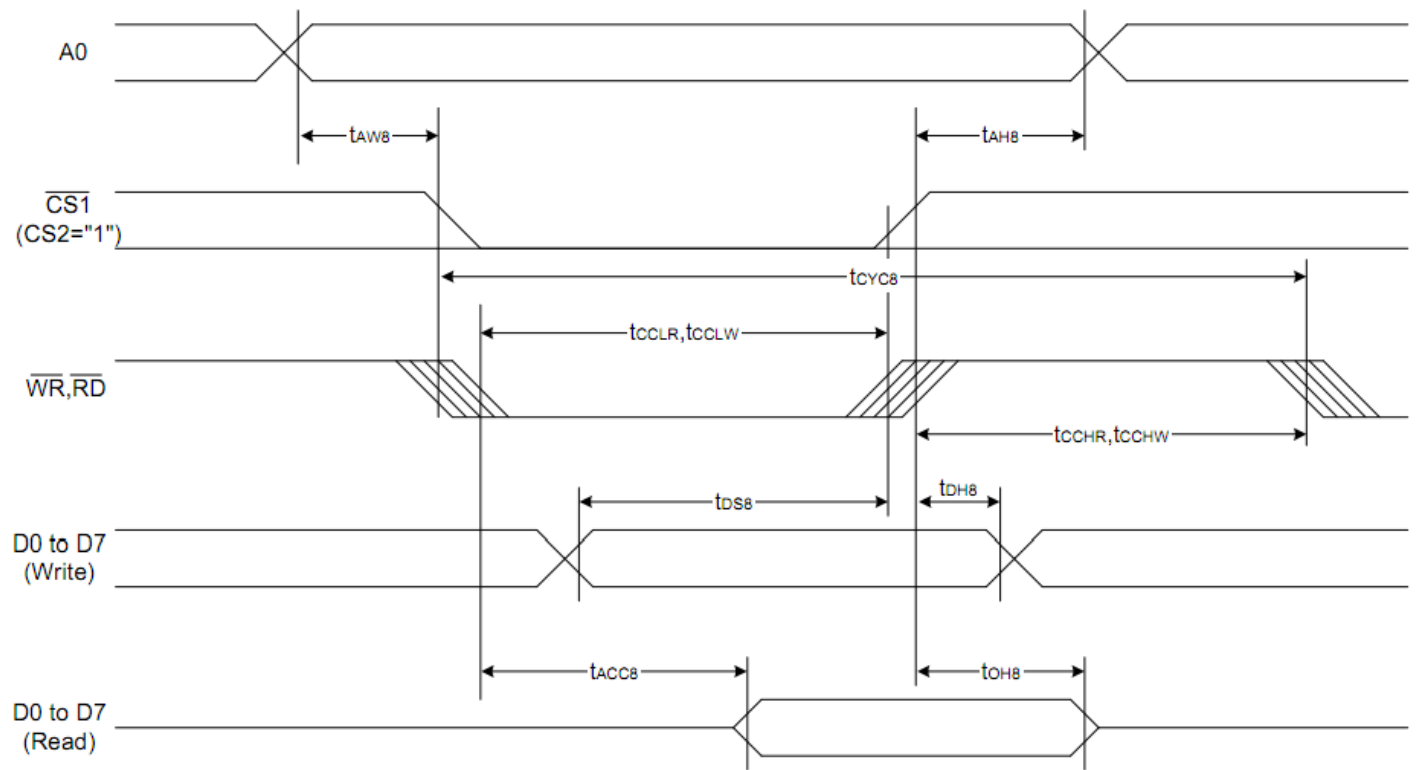
Table of Commands

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	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.
Column address set lower bit	0	1	0	0	0	0	0	Least significant column address					Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				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	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	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	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	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	Column address increment At write: +1 At read: 0	
(13) End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write	
(14) Reset	0	1	0	1	1	1	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			Select internal power supply operating mode	
(17) V _s 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	0	1	0	1	0	0	0	0	0	0	1	Set the V _s output voltage electronic volume register	
Electronic volume register set				0	0	Electronic volume value							
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0	0: OFF, 1: ON	
Static indicator register set				0	0	0	0	0	0	0	Mode		1
(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	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

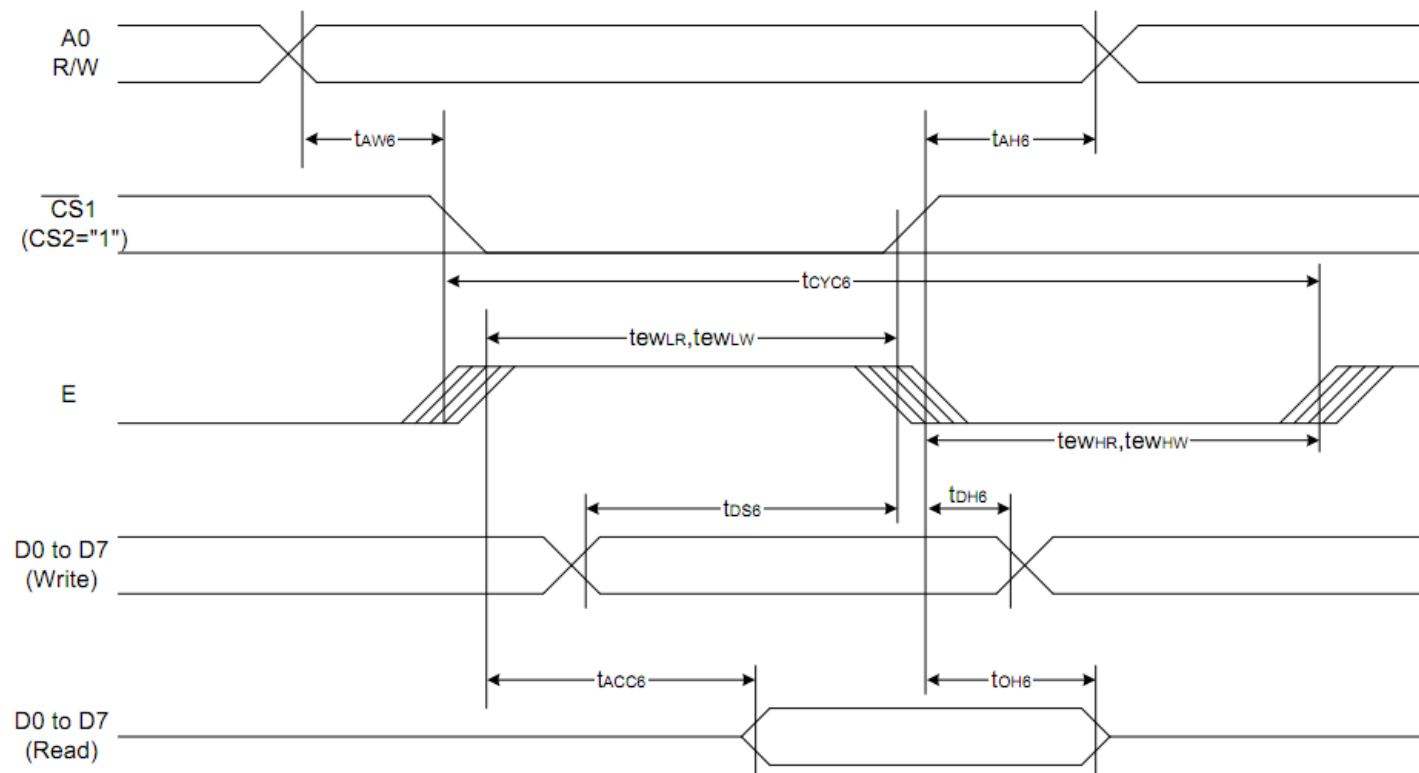
System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)



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

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}	$CL = 100 \text{ pF}$	—	70	
READ Output disable time		t_{OH8}	$CL = 100 \text{ pF}$	5	50	

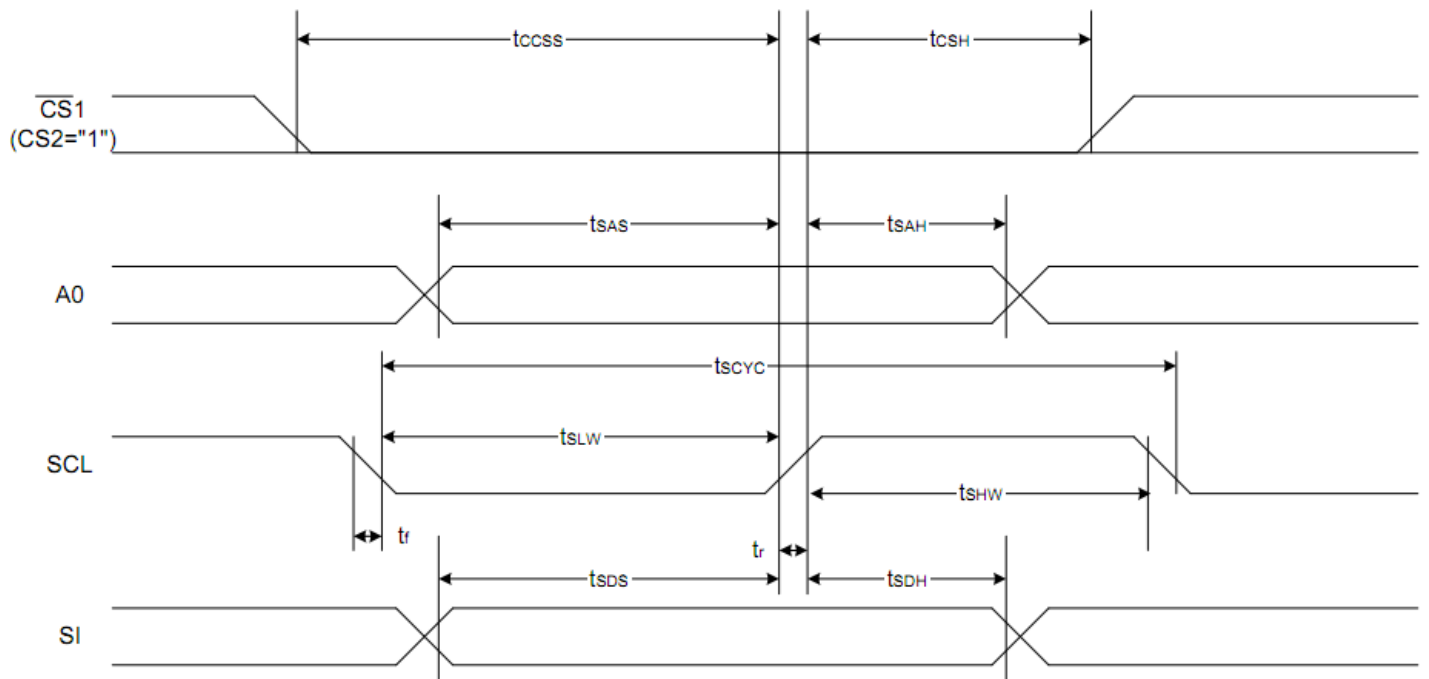
System Bus Read/Write Characteristics 2 (For the 6800 Series MPU)



(V_{DD} = 3.3V, T_a = -30 to 85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t _{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}	CL = 100 pF	—	70	
READ Output disable time		t _{OH6}	CL = 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

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