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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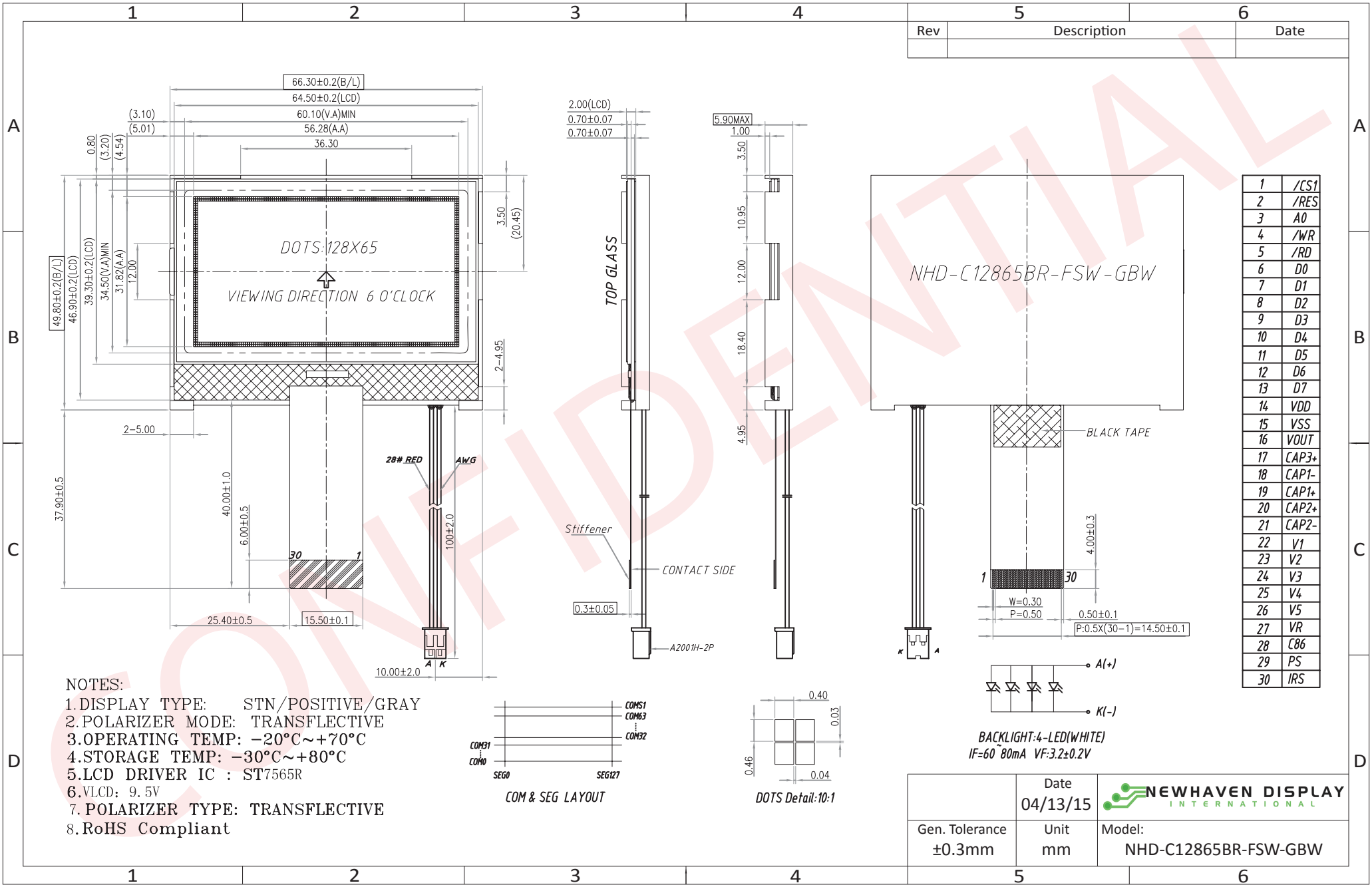
Document Revision History

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

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

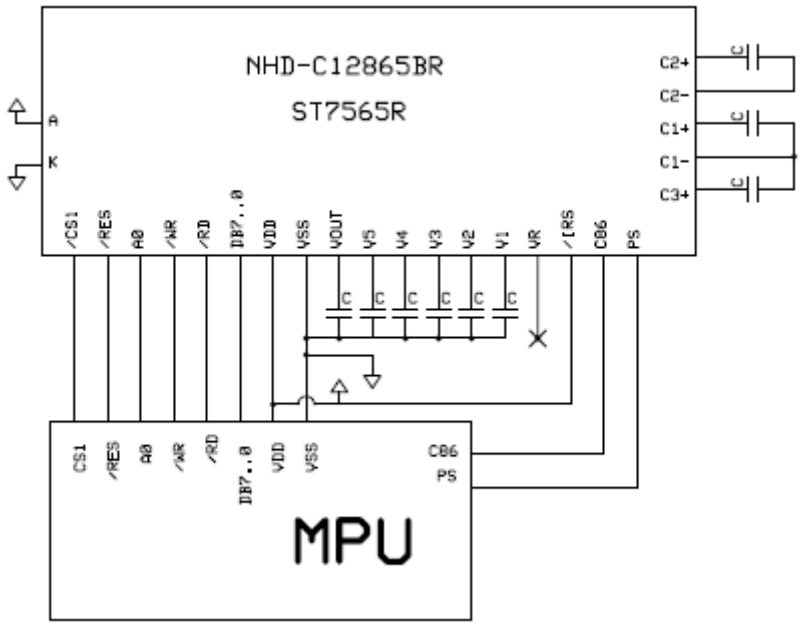


1	/CS1
2	/RES
3	A0
4	/WR
5	/RD
6	D0
7	D1
8	D2
9	D3
10	D4
11	D5
12	D6
13	D7
14	VDD
15	VSS
16	VOUT
17	CAP3+
18	CAP1-
19	CAP1+
20	CAP2+
21	CAP2-
22	V1
23	V2
24	V3
25	V4
26	V5
27	VR
28	C86
29	PS
30	IRS

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	MPU	
8	DB2	MPU	
9	DB3	MPU	
10	DB4	MPU	
11	DB5	MPU	
12	DB6/SCL	MPU	
13	DB7/SI	MPU	
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	ºC
Storage Temperature Range	Tst	Absolute Max	-30	-	+80	ºC
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℃	-	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	-	º
Viewing Angle – Bottom			-	45	-	º
Viewing Angle – Left			-	35	-	º
Viewing Angle – Right			-	35	-	º
Contrast Ratio	CR		3.0	-	-	-
Response Time (rise)	Tr	Ta=25℃	-	-	250	ms
Response Time (fall)	Tf	Ta=25℃	-	-	250	ms

Controller Information

Built-in ST7565R controller.

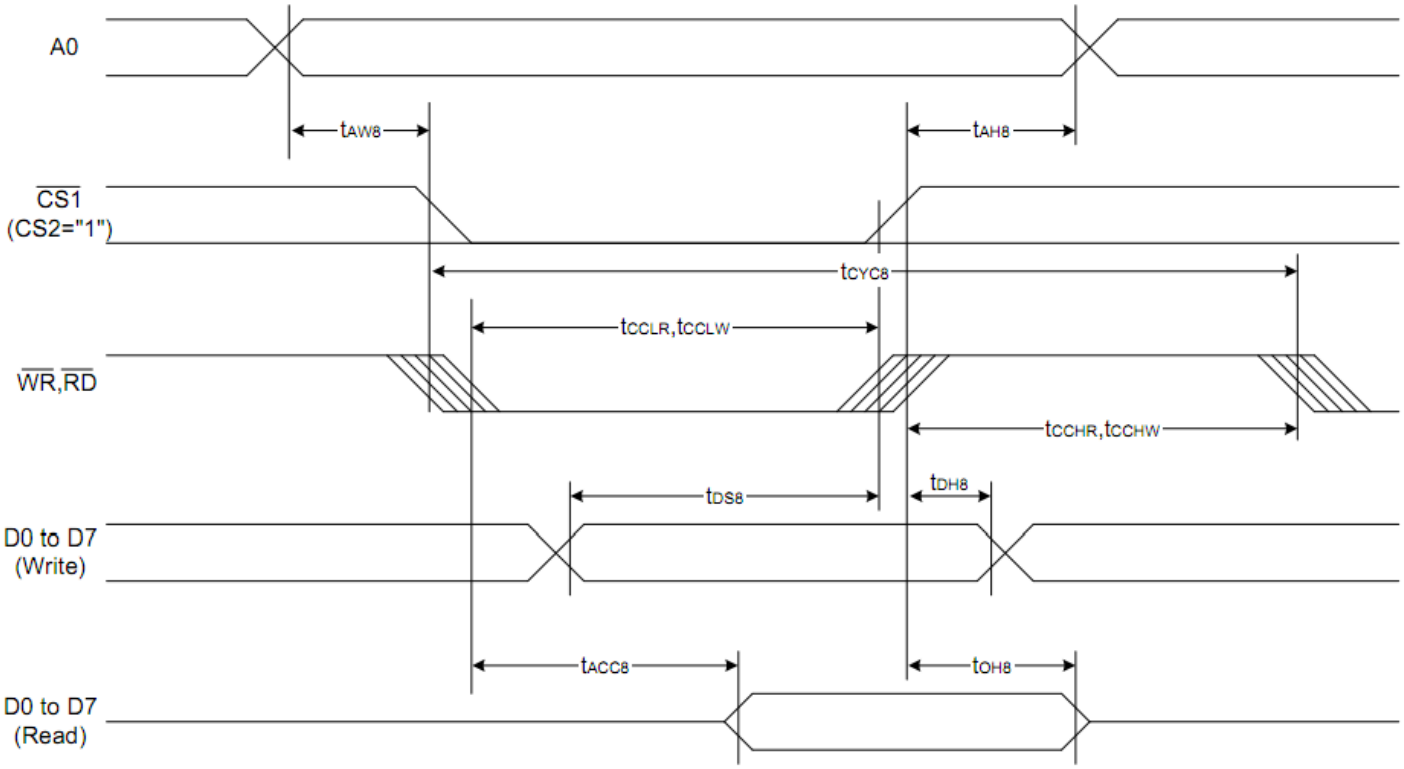
Please download specification at http://www.newhavendisplay.com/app_notes/ST7565R.pdf

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 Column address set lower 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.
				0	0	0	0	Least significant 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 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	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 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_0 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set Electronic volume register set	0	1	0	1	0	0	0	0	0	0	1	Set the V_0 output voltage electronic volume register
				0	0	Electronic volume value						
(19) Sleep mode set	0	1	0	1	0	1	0	1	1	0	0 1	0: Sleep mode, 1: Normal mode
				*	*	*	*	*	*	0	0	
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
				0	0	0	0	0	0	step-up value		
(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

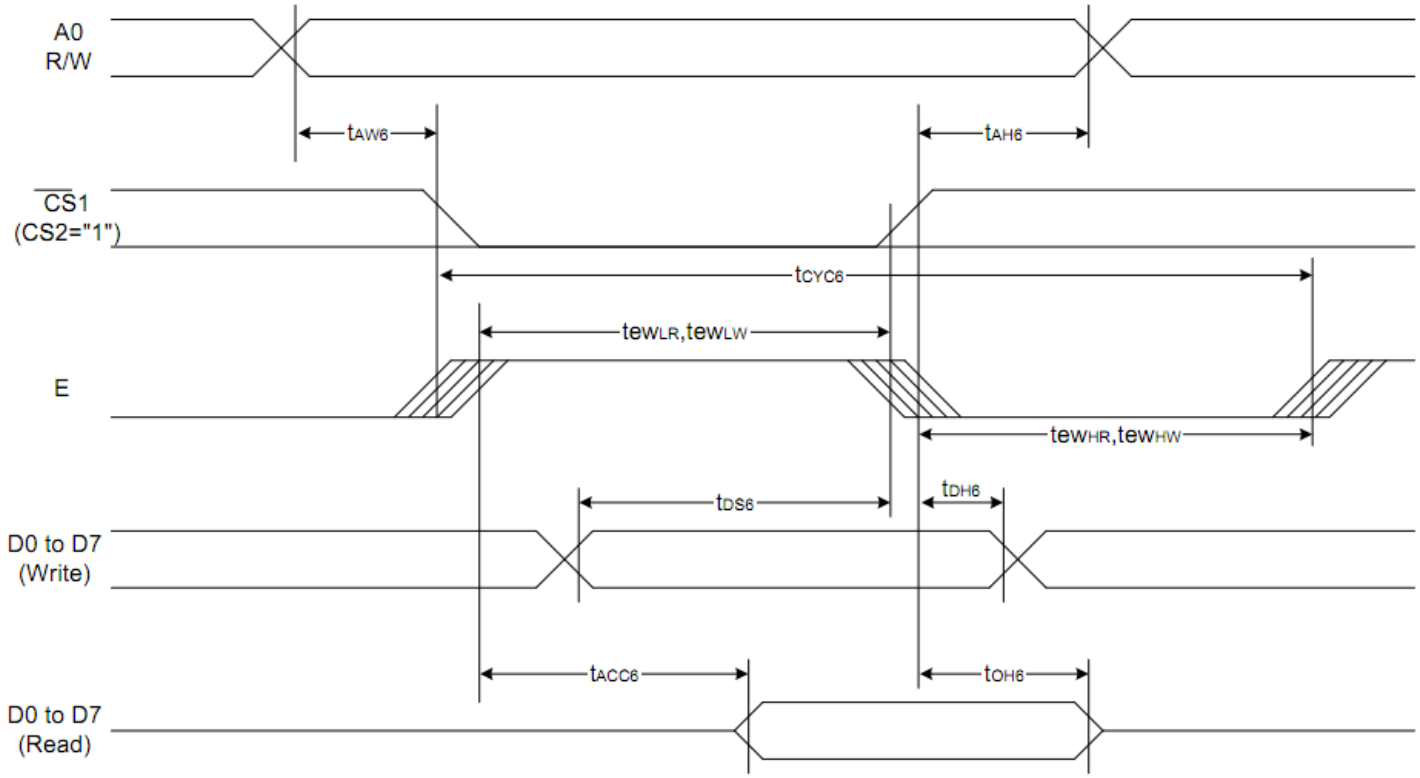
Timing Characteristics

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



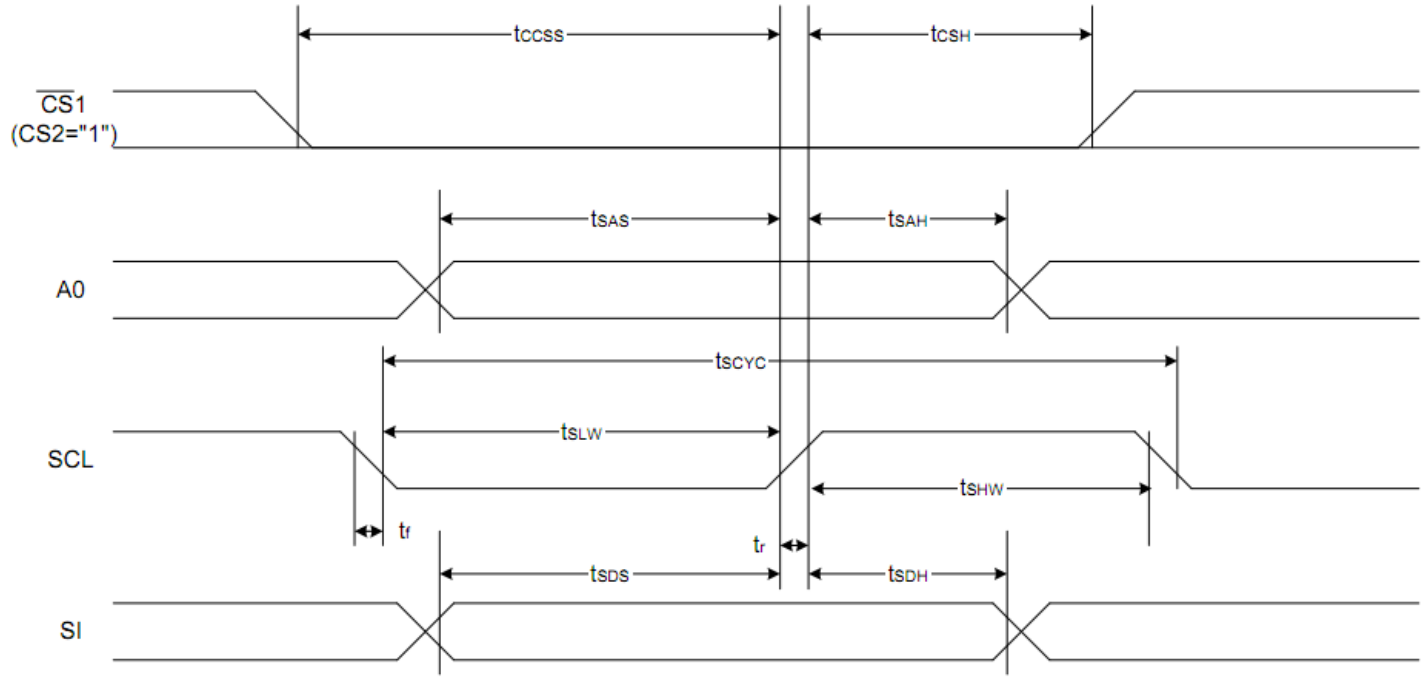
Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH8}		0	—	Ns
Address setup time		t_{AW8}		0	—	
System cycle time		t_{CYC8}		240	—	
Enable L pulse width (WRITE)	WR	t_{CCLW}		80	—	
Enable H pulse width (WRITE)		t_{CCHW}		80	—	
Enable L pulse width (READ)	RD	t_{CCLR}		140	—	
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}	C_L = 100 pF	—	70	
READ Output disable time		t_{OH8}	C_L = 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 pF	—	70	
READ Output disable time		t_{OH6}	C_L = 100 pF	5	50	

The 4-line SPI Interface



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 , 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

Warranty Information and Terms & Conditions

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