

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, Positive
B-	6:00 Optimal View
W-	Wide Temp.
3V3-	3.0V LCD, 3.0V Backlight
M-	Mounting Holes
	RoHS Compliant

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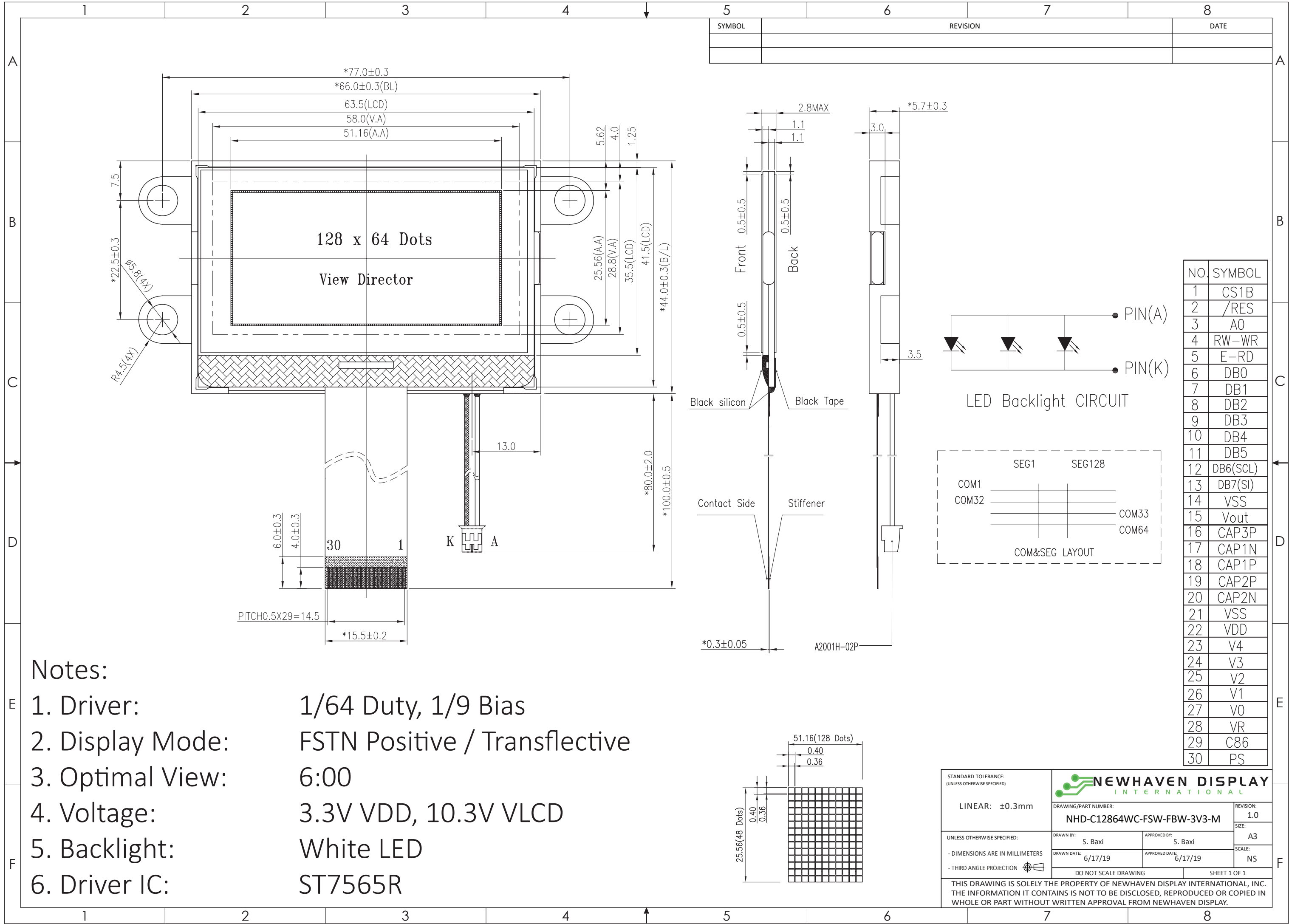
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Document Revision History

Revision	Date	Description	Changed by
0	10/12/10	Initial Release	MC
1	5/25/10	Electrical characteristics updated	AK
2	4/4/13	Backlight mating connector part number updated	AK
3	3/16/15	Pin Description updated	RM
4	9/30/15	Wiring Diagram updated, Backlight Current rating added	SB
5	9/13/16	Capacitor Values Adjusted	SB
6	2/22/19	Mechanical Drawing Updated, Supply Current Updated	SB
7	3/3/19	Backlight Current Updated	SB

Functions and Features

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



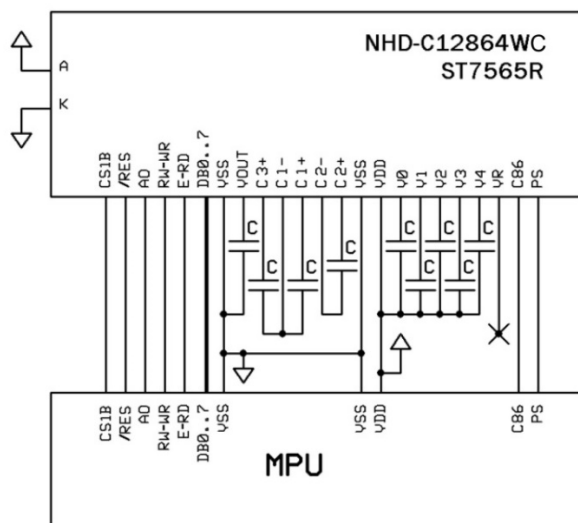
Pin Description and Wiring Diagram

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) (1.0-2.2μF)
16	CAP3+	Power Supply	Connect capacitor to CAP1- (PIN-17) (1.0-2.2μF)
17	CAP1-	Power Supply	Connect capacitor to CAP3+(PIN16) and CAP1+(PIN18) (1.0-2.2μF)
18	CAP1+	Power Supply	Connect capacitor to CAP1- (PIN-17) (1.0-2.2μF)
19	CAP2+	Power Supply	Connect capacitor to CAP2- (PIN-20) (1.0-2.2μF)
20	CAP2-	Power Supply	Connect capacitor to CAP2+ (PIN-19) (1.0-2.2μF)
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 μF capacitor to V _{DD} or V _{SS}
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}	-	3.0	3.3	3.6	V
Supply Current	I _{DD}	V _{DD} = 3.3V	0.1	0.32	1.20	mA
Supply for LCD (contrast)	V _{LCD}	T _{OP} = 25°C	10.0	10.3	10.6	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}	-	2.8	3.0	3.2	V
LED BKL current	I _{LED}	V _{LED} = 3.0V	21	36	55	mA

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	$\phi Y+$	$CR \geq 2$	-	20	-	°
	Bottom	$\phi Y-$		-	40	-	°
	Left	$\theta X-$		-	45	-	°
	Right	$\theta X+$		-	45	-	°
Contrast Ratio		CR	-	2	8	-	-
Response Time	Rise	T_R	$T_{OP} = 25^\circ C$	-	150	300	ms
	Fall	T_F		-	150	200	ms

Controller Information

Built-in ST7565R controller.

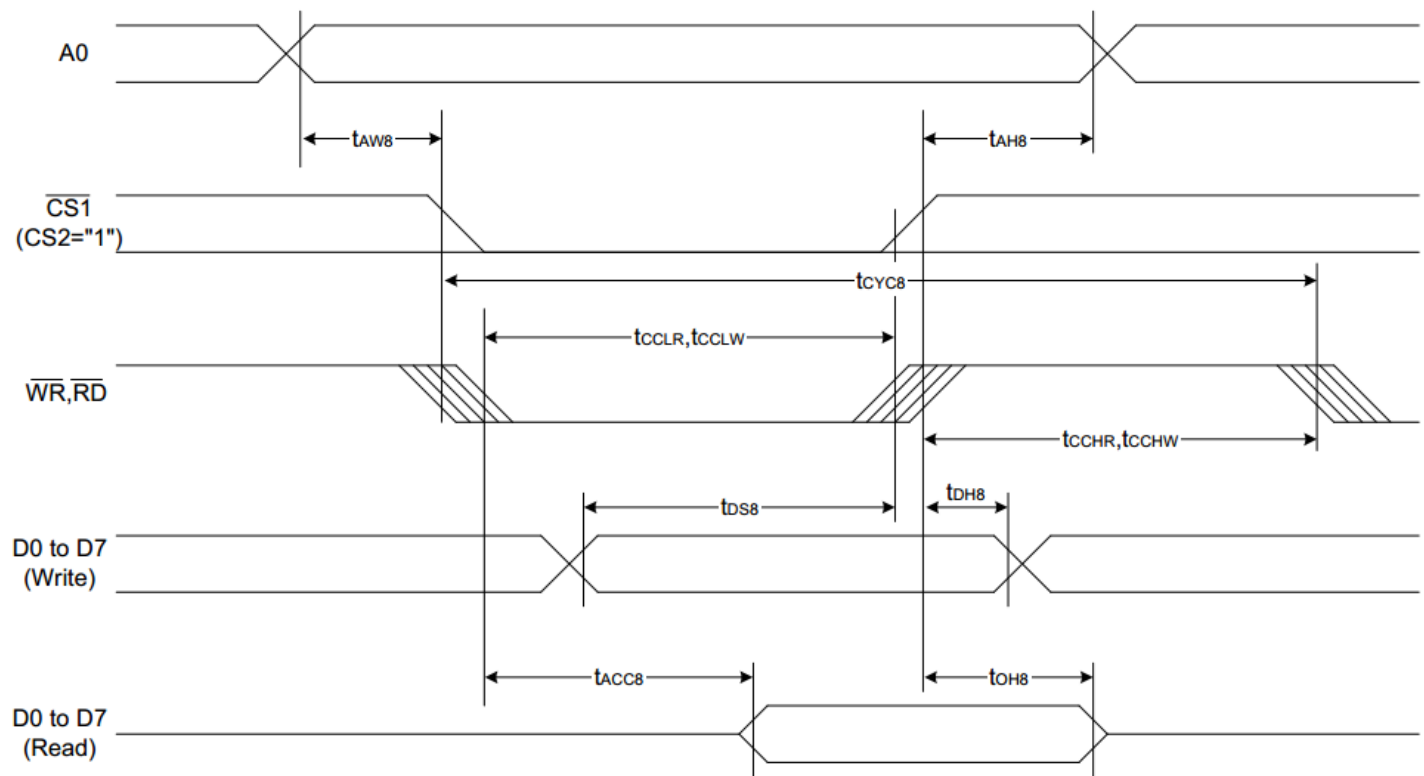
Please download specification at http://www.newhavendisplay.com/app_notes/ST7565R.pdf

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.	
				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 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	*	*	*	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	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

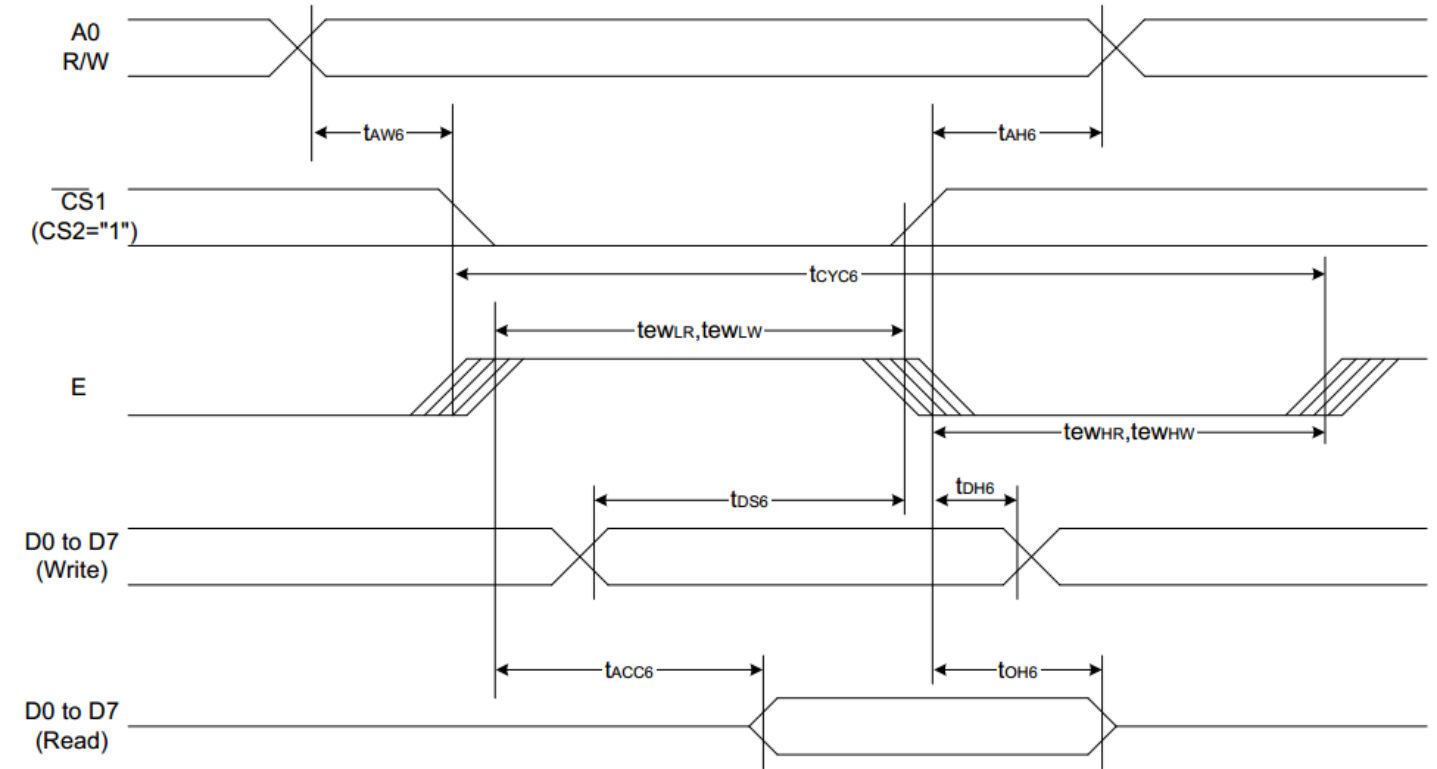
System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)



($V_{DD} = 3.3V$, $T_a = -30$ 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}	$C_L = 100 \text{ pF}$	—	70	
READ Output disable time		t_{OH8}	$C_L = 100 \text{ pF}$	5	50	

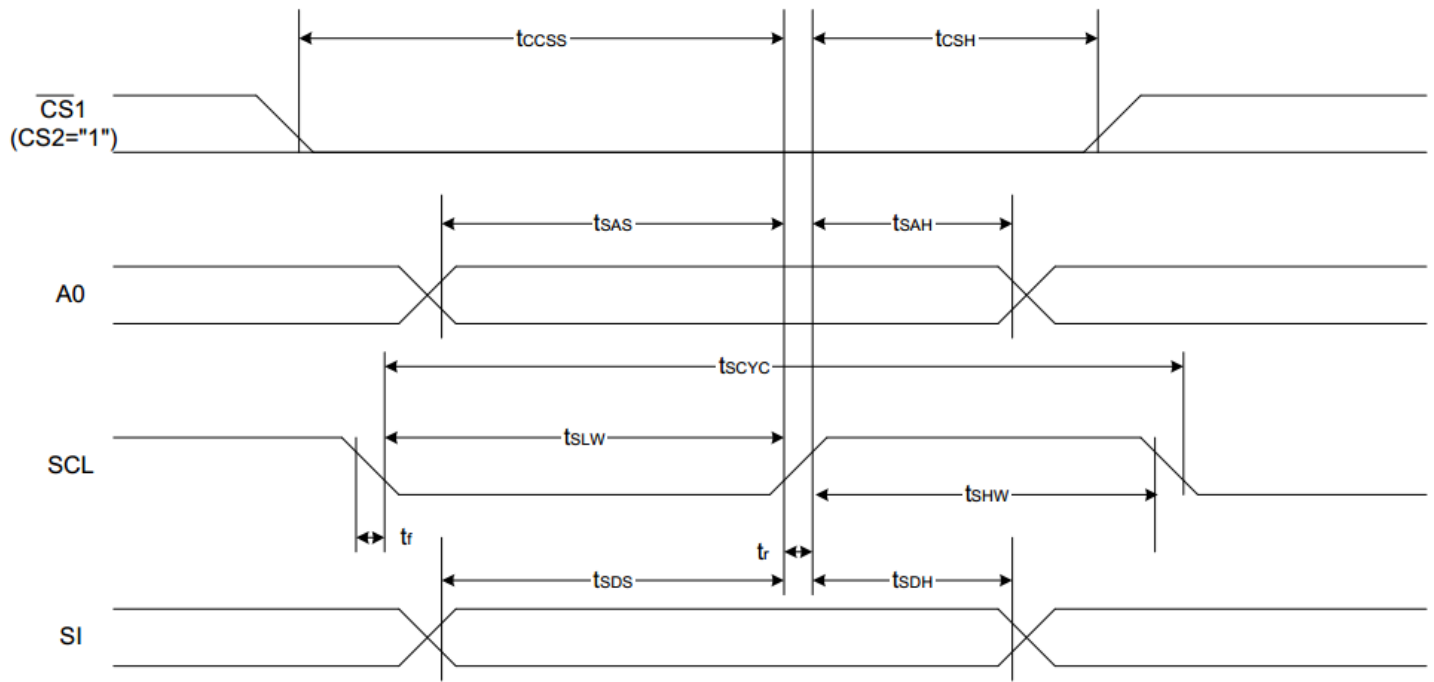
System Bus Read/Write Characteristics 2 (For the 6800 Series MPU)



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

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}	$CL = 100 \text{ pF}$	—	70	
READ Output disable time		t_{OH6}	$CL = 100 \text{ pF}$	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 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

Warranty Information and Terms & Conditions

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

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