

NHD-12864WX-T1TFH#

Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
12864-	128 x 64 Pixels
WX-	Display Type: Graphic, Tab Type
T1-	Model
T-	White LED Backlight
F-	FSTN (+)
H-	Transflective, Wide Temp, 6:00 Optimal View
#-	RoHS Compliant

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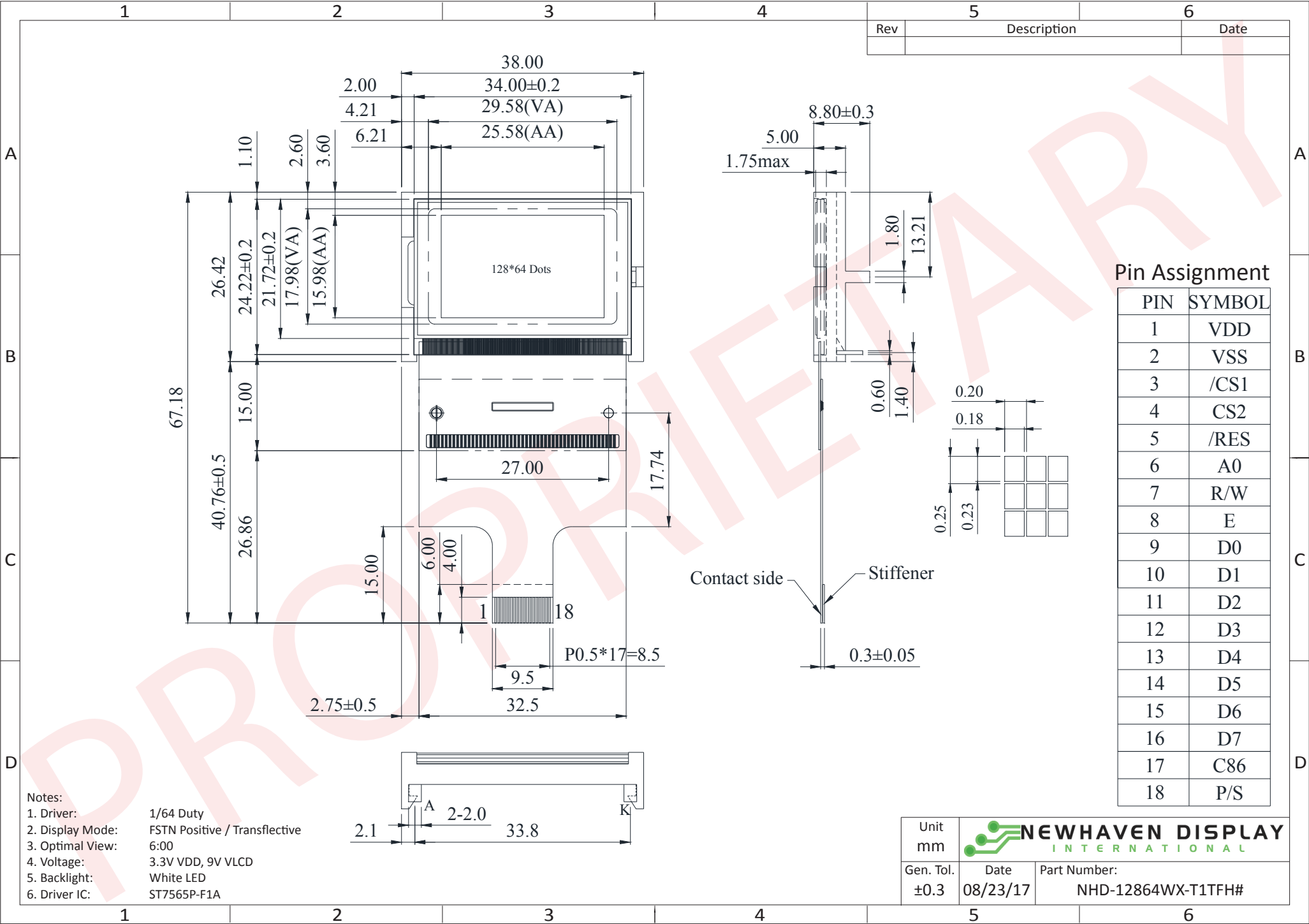
Document Revision History

Revision	Date	Description	Changed by
0	8/22/08	Initial Release	-
1	10/22/08	Backlight modification	-
2	3/17/10	User guide reformat	BE
3	4/14/10	Block diagram/initialization updated	BE
4	5/12/10	Pin description updated	BE
5	9/21/12	Mechanical drawing & Pin description updated	AK
6	8/5/13	Mechanical drawing & optical characteristics updated	ML
7	8/23/17	Controller IC Updated	SB

Functions and Features

- 128 x 64 pixels
- Built-in ST7565P-F1A Controller
- +3.3V power supply
- 1/64 duty cycle
- Parallel or Serial Interface
- RoHS Compliant

Mechanical Drawing

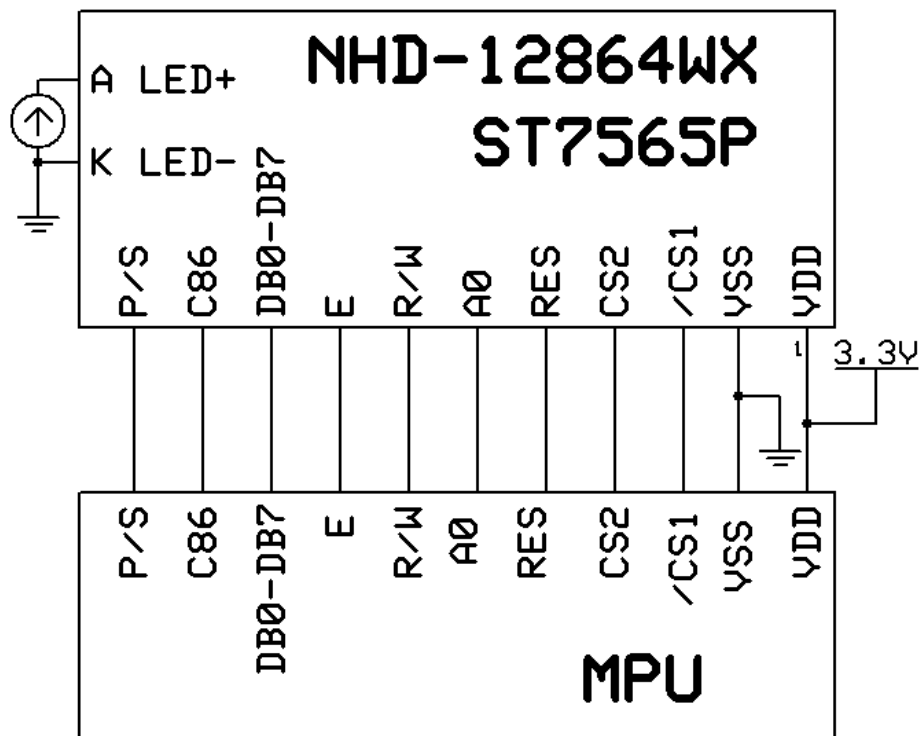


Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V _{DD}	Power Supply	Power supply for logic (+3.3V)
2	V _{SS}	Power Supply	Ground
3	/CS1	MPU	Active LOW Chip Select Signal
4	CS2	MPU	Active HIGH Chip Select Signal
5	RES	MPU	Active LOW Reset signal
6	A0	MPU	Register Select. A0 = 0: Instruction; A0 = 1: Data
7	R/W	MPU	Read/Write select signal. R/W=1: Read R/W =0: Write
8	E	MPU	Operation Enable signal. Falling edge triggered.
9-16	DB0-DB7	MPU	Bi-directional 8-bit data bus In Serial mode: DB0-DB5: High Impedance DB6: Serial Input Clock (SCL) DB7: Serial Input Data (SI)
17	C86	MPU	Select MPU interface pin. C86 = H: 6800; C86 = L: 8080
18	P/S	MPU	Parallel/Serial select. PS = H: Parallel; PS = L: Serial
A	LED+	Power Supply	Power supply for LED Backlight (32mA @ 3.5V)
K	LED-	Power Supply	Ground for Backlight

Recommended LCD connector: 0.5mm pitch, 18 pin FFC. Molex p/n: 52892-1895

Backlight connector: - **Mates with:** -



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	300	750	μA
Supply for LCD (contrast)	V _{LCD}		8.8	9.0	9.2	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}	-	-	32	40	mA
Backlight Supply Voltage	V _{LED}	-	3.3	3.5	3.7	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	CR ≥ 2	-	30	-	°
	Bottom		-	60	-	°
	Left		-	45	-	°
	Right		-	45	-	°
Contrast Ratio	CR	-	2	5	-	-
Response Time	Rise	T _{OP} = 25°C	-	200	300	ms
	Fall		-	250	350	ms

Controller Information

Built-in ST7565P-F1A controller.

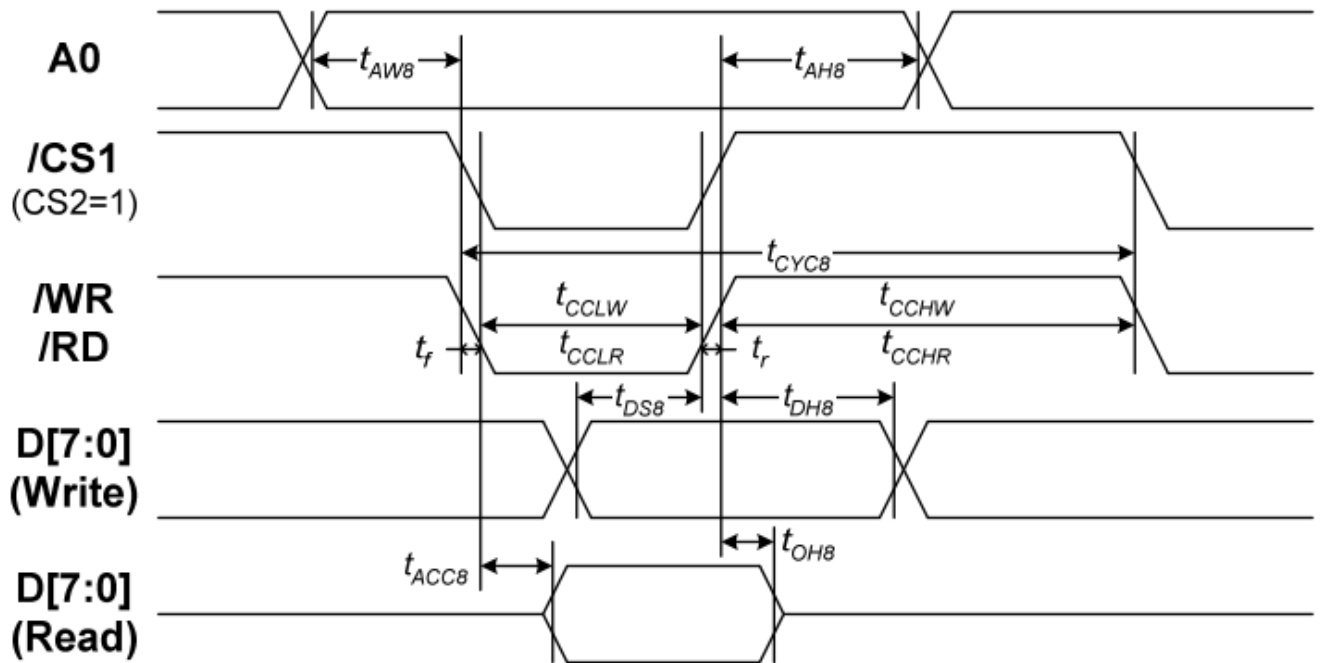
Please download specification at http://www.newhavendisplay.com/app_notes/ST7565P.pdf.

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	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) Vs 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	0	1	0	1	0	0	0	0	0	0	1	Set the Vs 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 Set the flashing mode	
Static indicator register set				0	0	0	0	0	0	0	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	Command for non-operation	
(22) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command	

Timing Characteristics

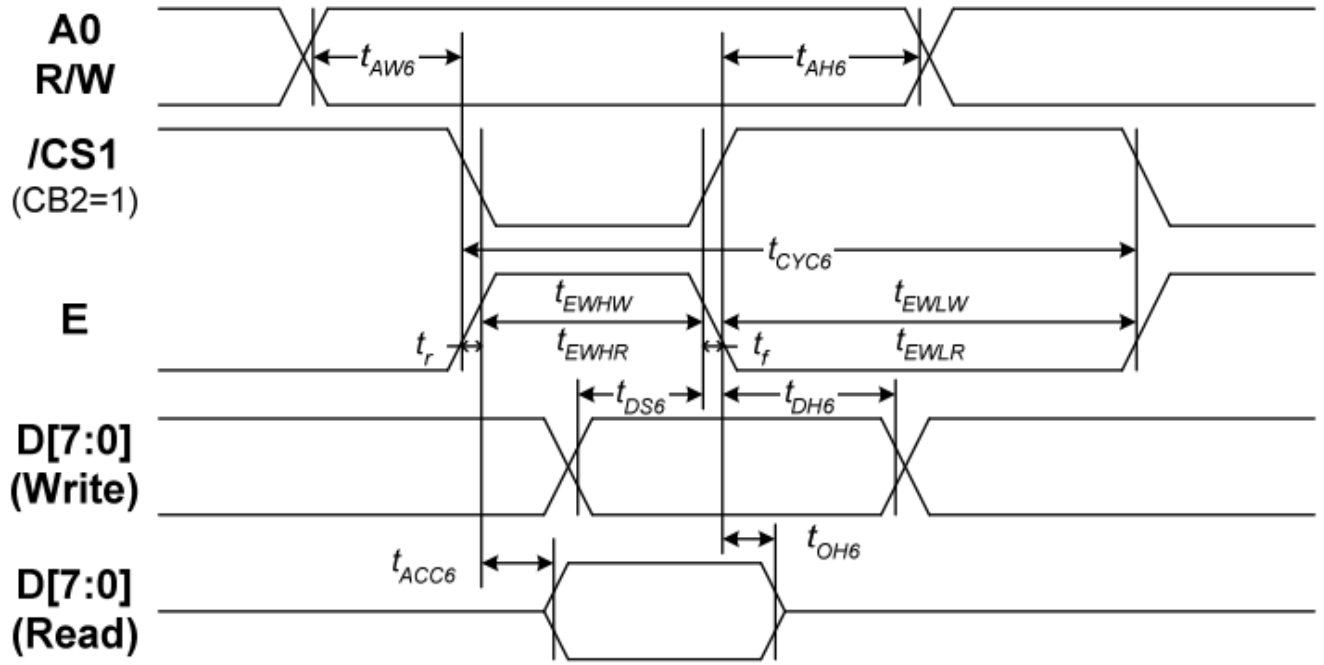
System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)



($V_{DD} = 3.3V$, $T_a = -30$ 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	—	
Write L pulse width	/WR	t_{CCLW}		80	—	
Write H pulse width		t_{CCHW}		80	—	
Read L pulse width	/RD	t_{CCLR}		140	—	
Read H pulse width		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	

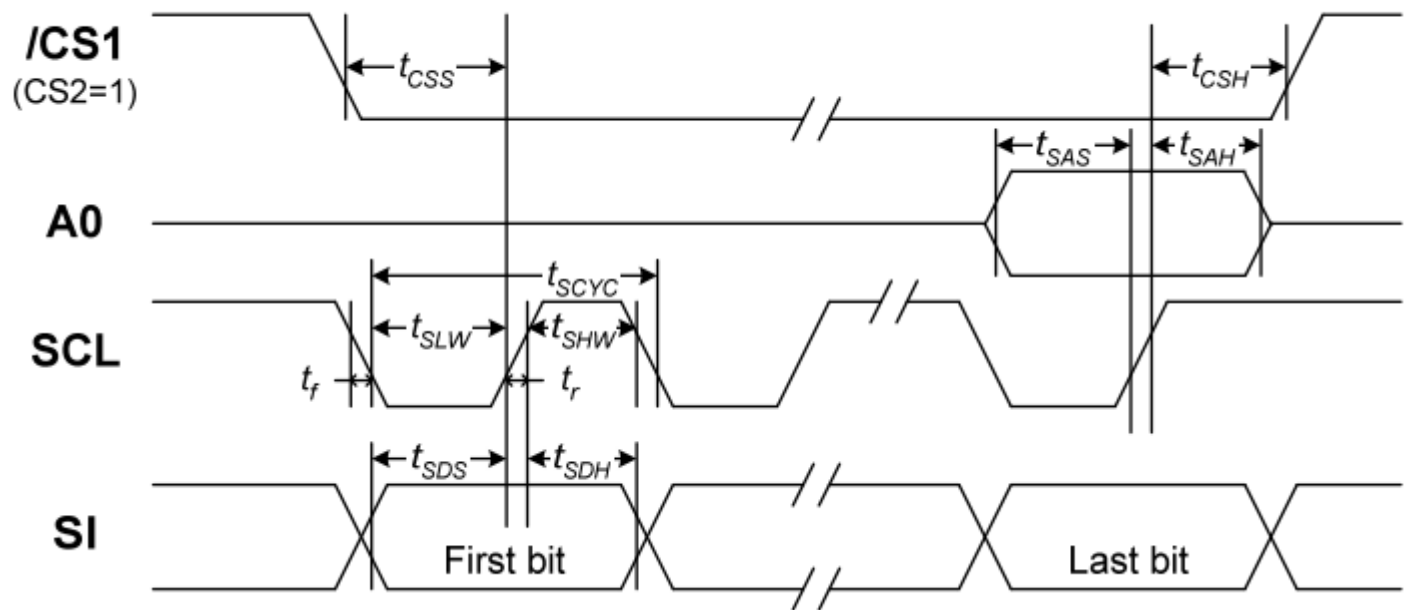
System Bus Read/Write Characteristics 2 (For the 6800 Series MPU)



($V_{DD} = 3.3V$, $T_a = -30$ 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)	E	t_{EWLW}		80	—	
Enable H pulse width (WRITE)		t_{EHWL}		80	—	
Enable L pulse width (READ)		t_{EWLR}		80	—	
Enable H pulse width (READ)		t_{EHR}		140	—	
WRITE Data setup time	D0 to D7	t_{DS6}		40	—	
WRITE Address hold time		t_{DH6}		0	—	
READ access time		t_{ACC6}	$C_L = 100 \text{ pF}$	—	70	
READ Output disable time		t_{OH6}	$C_L = 100 \text{ pF}$	5	50	

The Serial Interface



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

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial 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

```

/*****/
void data_out(unsigned char i) //Data Output 8-bit parallel Interface
{
    A0 = 1;                //Data register
    WR1 = 0;               //Write enable
    P1 = i;                //put data on port 1
    WR1 = 1;               //Clock in data
}

void comm_out(unsigned char i) //Command Output 8-bit parallel Interface
{
    A0 = 0;                //Instruction register
    WR1 = 0;               //Write enable
    P1 = i;                //put data on port 1
    WR1 = 1;               //Clock in data
}
/*****/
/*****
*      Initialization For NT7534H      *
*****/
void resetLCD()
{
    RES = 0;
    delay(100);
    RES = 1;
    delay(100);
}

void init_LCD()
{
    CS1 = 0;                //Chip Select
    CS2 = 1;                //Chip Select
    RD1 = 1;                //Read disable
    comm_out(0xA2);         //1/9 bias
    comm_out(0xA0);         //ADC select
    comm_out(0xC8);         //COM output reverse
    comm_out(0xA4);         //display all points normal
    comm_out(0x40);         //display start line set
    comm_out(0x25);         //internal resistor ratio
    comm_out(0x81);         //electronic volume mode set
    comm_out(0x18);         //electronic volume
    comm_out(0x2F);         //power controller set
    comm_out(0xAF);         //display on
}
/*****/
```

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 , 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 200hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 200hrs	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.	+60°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