

# 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
#-	<b>RoHS Compliant</b>

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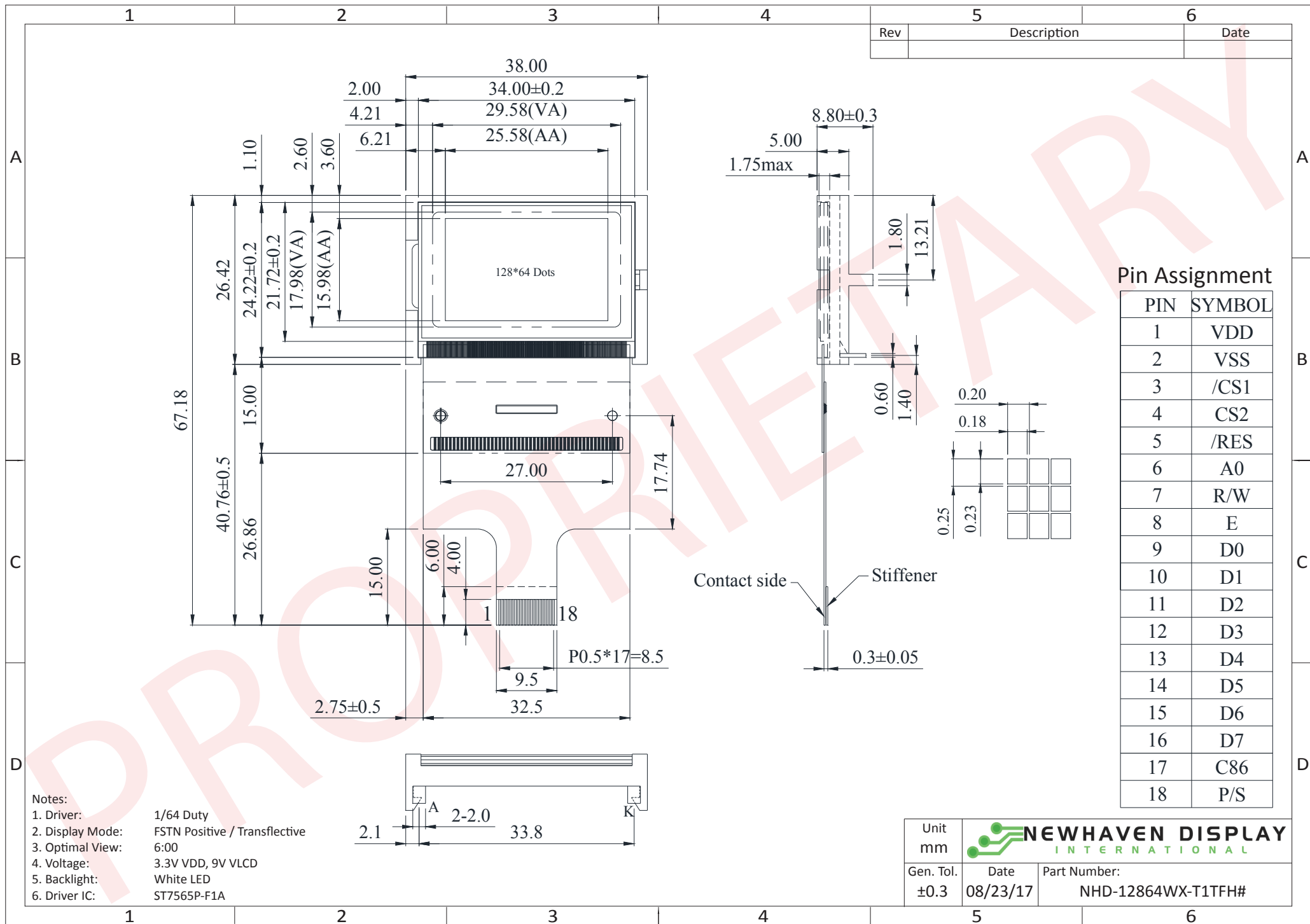
## Document Revision History

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



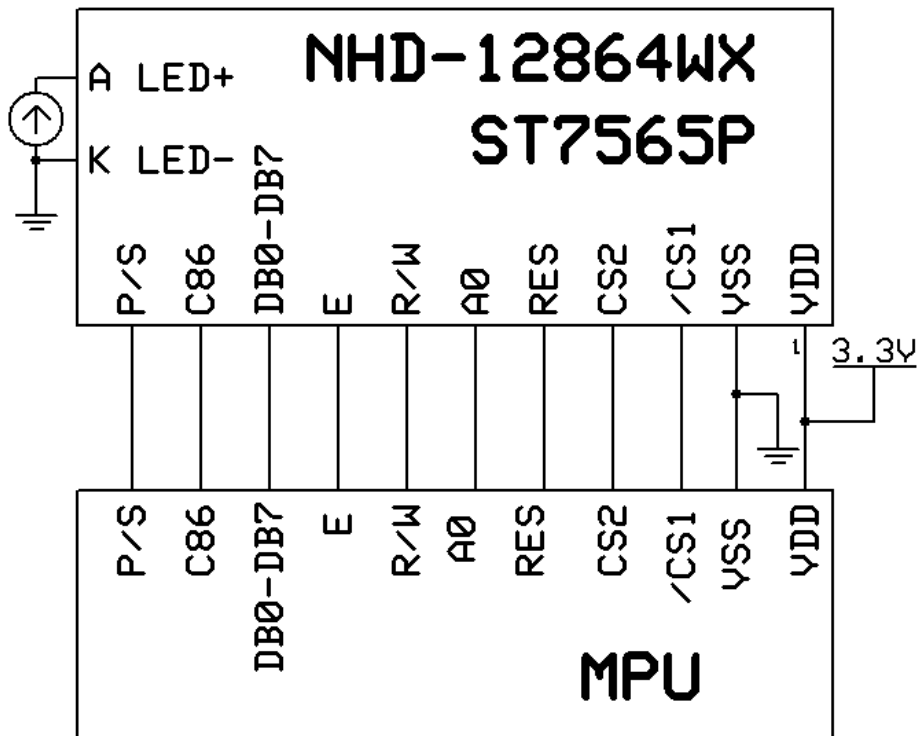
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## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V <sub>DD</sub>	Power Supply	Power supply for logic (+3.3V)
2	V <sub>SS</sub>	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	$I_{DD}$	$V_{DD} = 3.3V$ $T_{OP} = 25^{\circ}C$	100	300	750	$\mu A$
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	$CR \geq 2$	-	30	-	°
	Bottom		-	60	-	°
	Left		-	45	-	°
	Right		-	45	-	°
Contrast Ratio	CR	-	2	5	-	-
Response Time	Rise	$T_{OP} = 25^{\circ}C$	-	200	300	ms
	Fall		-	250	350	ms

## Controller Information

Built-in ST7565P-F1A controller.

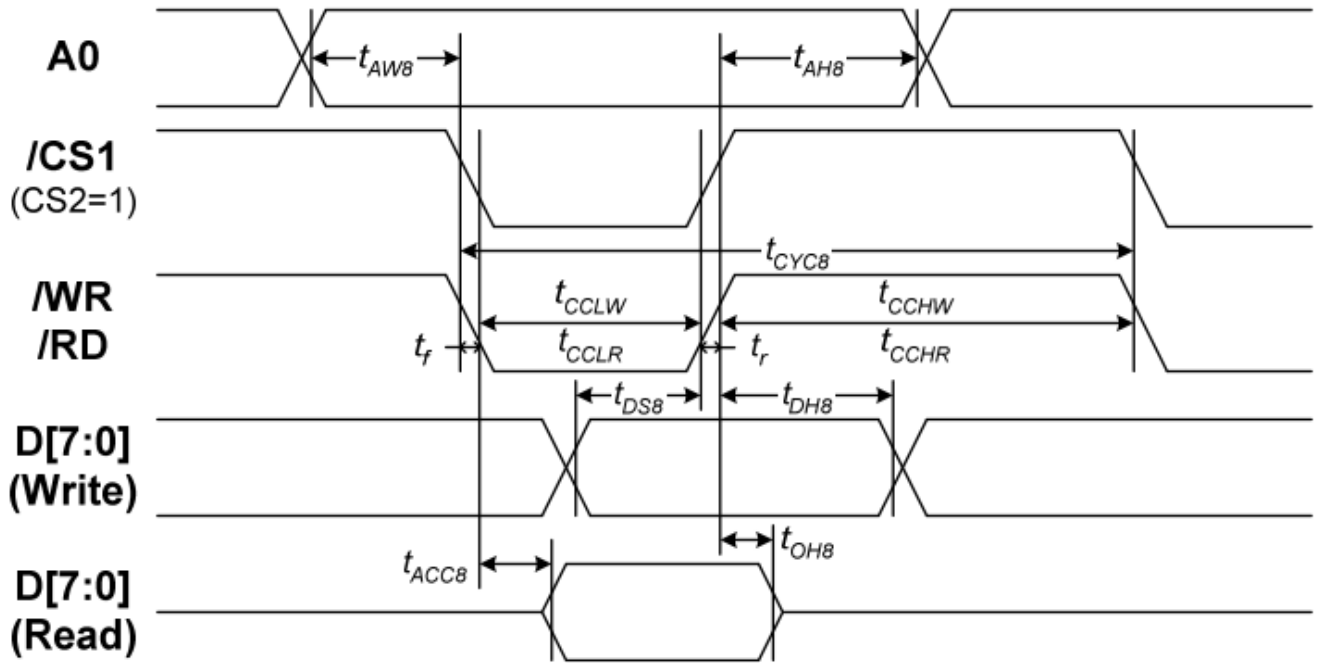
Please download specification at [http://www.newhavendisplay.com/app\\_notes/ST7565P.pdf](http://www.newhavendisplay.com/app_notes/ST7565P.pdf).

## 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	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.	
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	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	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) 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	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	0: OFF, 1: ON
Static indicator register set				0	0	0	0	0	0	0	0	Mode	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

# Timing Characteristics

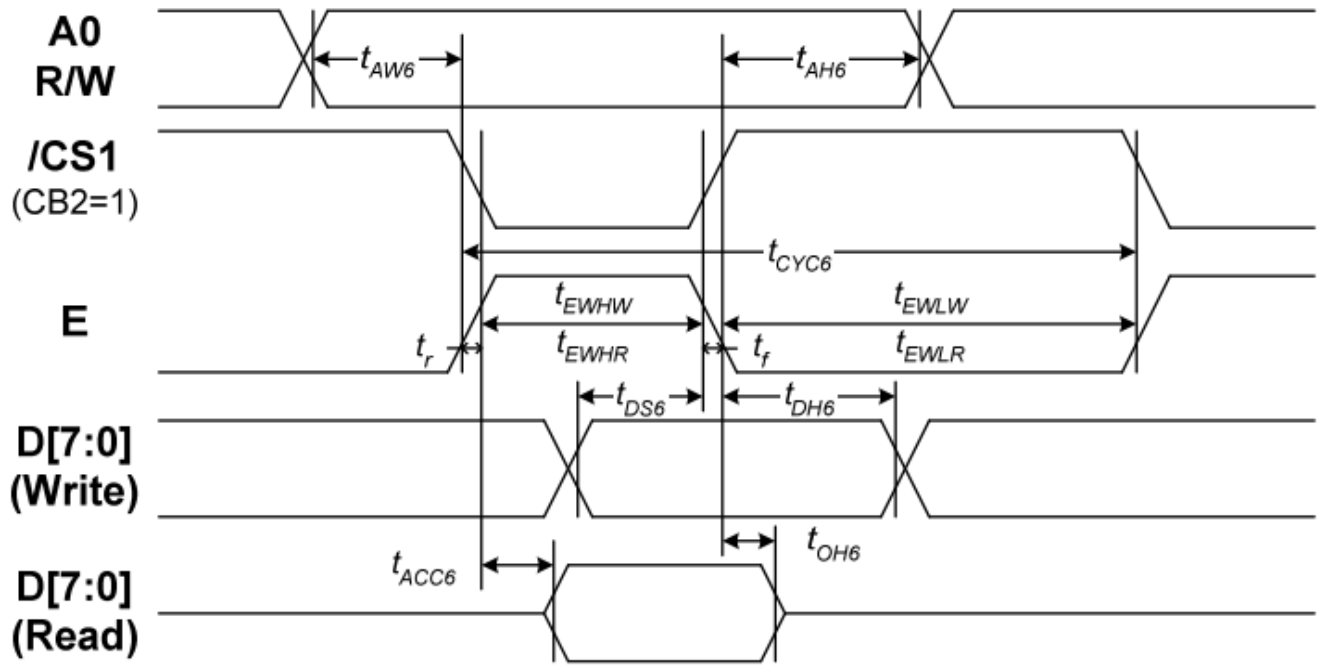
## System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)



( $V_{DD} = 3.3V$ ,  $T_a = -30$  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		$t_{ACC8}$	$C_L = 100$ 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)

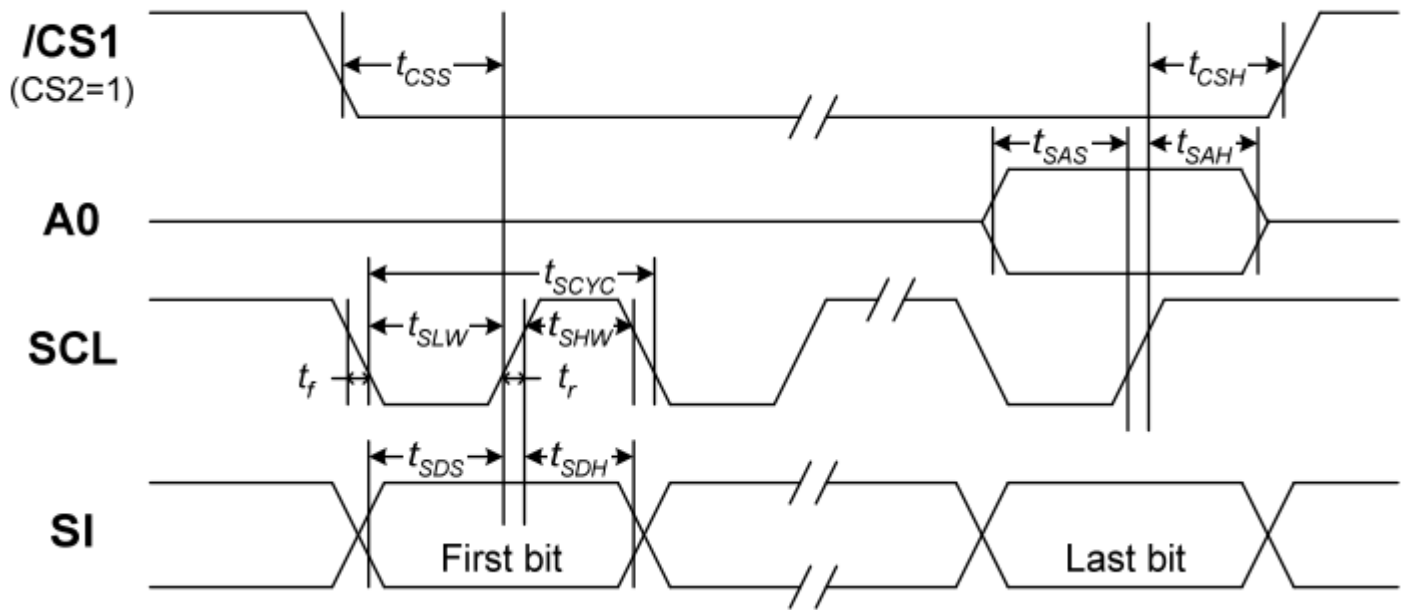


( $V_{DD} = 3.3V$ ,  $T_a = -30$  to  $85^\circ C$ )

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	$t_{EHLW}$		80	—	
Enable H pulse width (WRITE)		$t_{EHWLW}$		80	—	
Enable L pulse width (READ)		$t_{EHLR}$		80	—	
Enable H pulse width (READ)		$t_{EHWLR}$		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 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](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information and Terms & Conditions

[http://www.newhavendisplay.com/index.php?main\\_page=terms](http://www.newhavendisplay.com/index.php?main_page=terms)

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