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 (-20°C ~ +70°C), 6:00 view
#-	**RoHS Compliant**

Newhaven Display International, Inc.
2511 Technology Drive, Suite 101
Elgin IL, 60124
Ph: 847-844-8795 Fax: 847-844-8796

www.newhavendisplay.com
nhtech@newhavendisplay.com nhsales@newhavendisplay.com

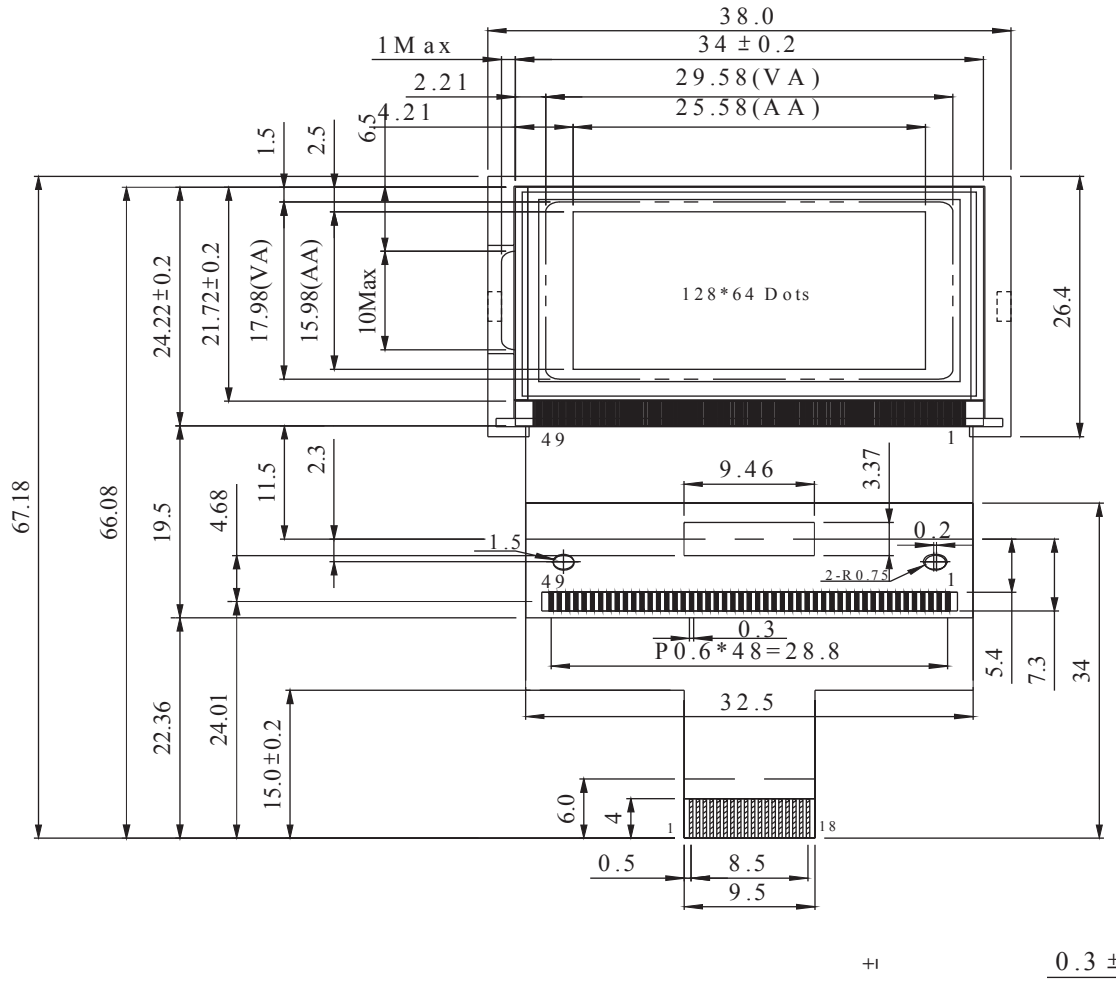
Document Revision History

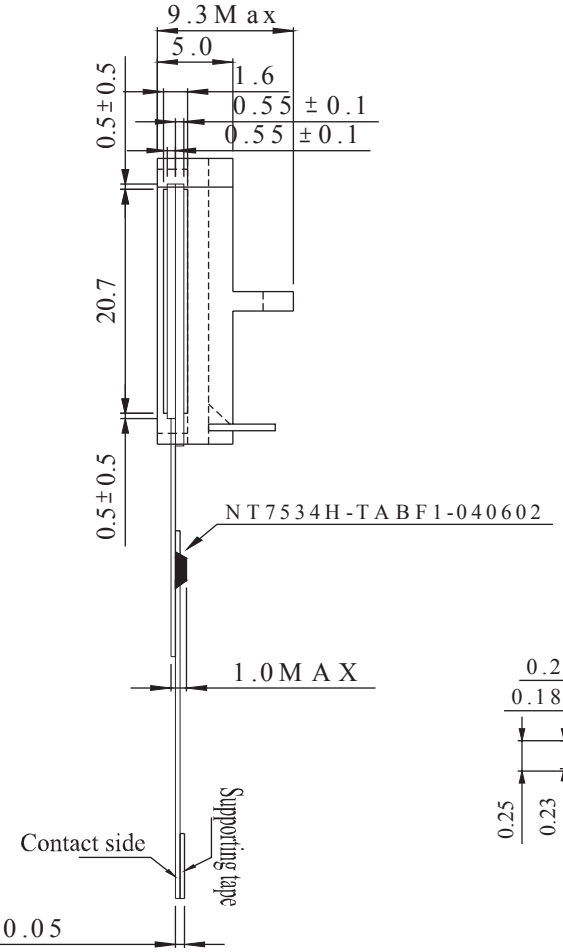
Revision	Date	Description	Changed by
0	**8/22/2008**	**Initial Release**	**-**
1	**10/22/2008**	**Backlight modification**	**-**
2	**3/17/2010**	**User guide reformat**	**BE**
3	**4/14/2010**	**Block diagram/initialization updated**	**BE**
4	**5/12/2010**	**Pin description updated**	**BE**

Functions and Features

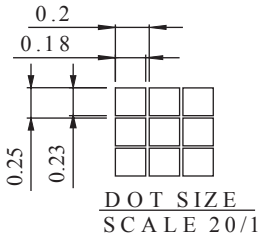
- **128 x 64 pixels**
- **Built-in NT7534H Controller**
- **+3.3V power supply**
- **1/64 duty cycle**
- **Parallel or Serial Interface**
- **RoHS Compliant**

Mechanical Drawing





PIN NO.	SYMBOL
1	VDD
2	VSS
3	CS1B
4	CS2
5	RES
6	A0
7	R/W
8	E
9	DB0
10	DB1
11	DB2
12	DB3
13	DB4
14	DB5
15	DB6
16	DB7
17	C86
18	P/S
A	LED+
K	LED-



The non-specified tolerance of dimension is ±0.2 mm .

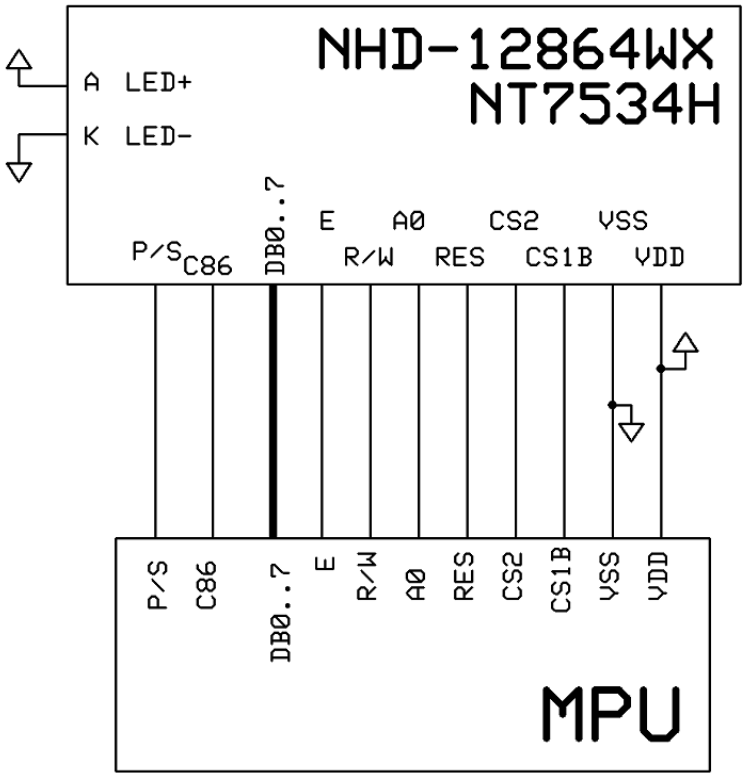
Newhaven Display	
Part No.	NHD-12864WX-T1TFH#

Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	VDD	Power Supply	Power supply for logic (+3.3V)
2	VSS	Power Supply	Ground
3	CS1B	MPU	Active LOW Chip Select Signal for LEFT half of LCD
4	CS2	MPU	Active LOW Chip Select Signal for RIGHT half of LCD
5	RES	MPU	Active Reset signal
6	A0	MPU	Register Select. 0: instruction; 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
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 (+3.5V)
K	LED-	Power Supply	Ground for Backlight

Recommended LCD connector: 0.6mm 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	Top	Absolute Max	-20	-	+70	°C
Storage Temperature Range	Tst	Absolute Max	-30	-	+80	°C
Supply Voltage	VDD		3.0	3.3	3.6	V
Supply Current	IDD	-	-	0.18	-	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°C	-	9.0	-	V
"H" Level input	VIH		2.0	-	VDD	V
"L" Level input	VIL	-	0	-	0.8	V
"H" Level output	VOH	-	2.4	-	-	V
"L" Level output	VOL	-	-	-	0.4	V
Backlight Supply Voltage	VLED	-	3.4	3.5	3.6	V
Backlight Supply Current	ILED	VLED=3.5V	28.8	32	50	mA
Backlight Lifetime	-	ILED=32mA	-	10,000	-	Hrs.

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical (top)	AV	Cr ≥ 2	-	30	-	º
Viewing Angle - Vertical (bottom)	AV	Cr ≥ 2	-	60	-	º
Viewing Angle - Horizontal (left)	AH	Cr ≥ 2	-	45	-	º
Viewing Angle - Horizontal (right)	AH	Cr ≥ 2	-	45	-	º
Contrast Ratio	Cr		-	5	-	-
Response Time (rise)	Tr	-	-	110	220	ms
Response Time (fall)	Tf	-	-	260	520	ms

Controller Information

Built-in NT7534H**. Download specification at** http://www.newhavendisplay.com/app_notes/NT7534.pdf

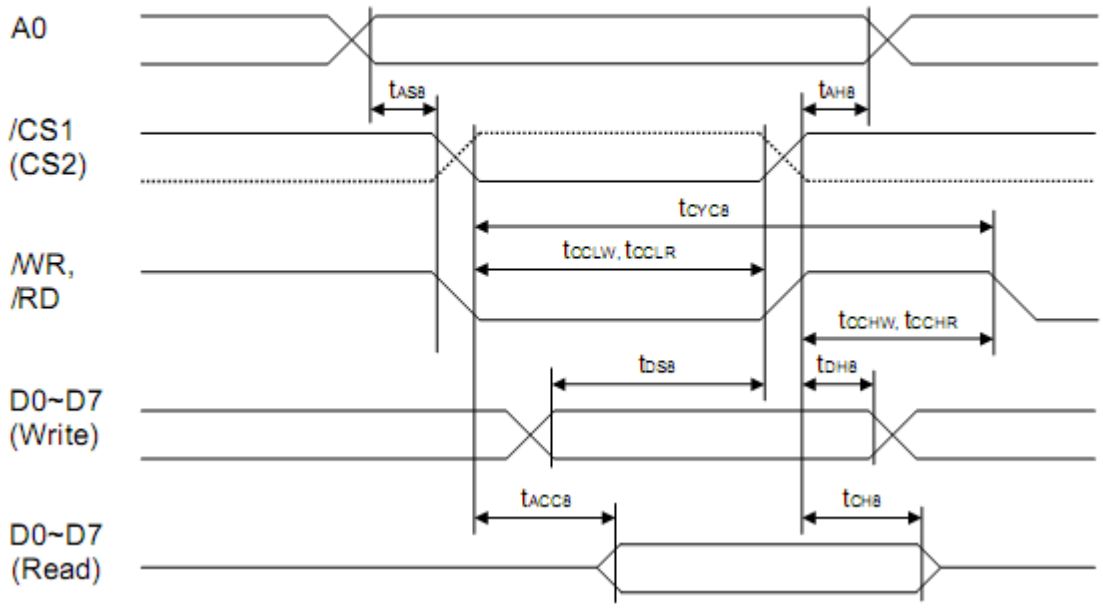
Table of Commands

Command	A0	/RD	/WR	Code									Function
				D7	D6	D5	D4	D3	D2	D1	D0	Hex	
(1) Display OFF	0	1	0	1	0	1	0	1	1	1	0 1	AEh AFh	Turn on LCD panel when high, and turn off when low
(2) Display Start Line Set	0	1	0	0	1	Display Start Address						40h to 7Fh	Specifies RAM display line for COM0
(3) Page Address Set	0	1	0	1	0	1	1	Page Address				B0h to B8h	Set the display data RAM page in Page Address register
(4) Column Address Set	0	1	0	0	0	0	1	Higher Column Address				00h to 18h	Set 4 higher bits and 4 lower bits of column address of display data RAM in register
	0	1	0	0	0	0	0	Lower Column Address					
(5) Read Status	0	0	1	Status				0	0	0	0	XX	Reads the status information
(6) Write Display Data	1	1	0	Write Data								XX	Write data in display data RAM
(7) Read Display Data	1	0	1	Read Data								XX	Read data from display data RAM
(8) ADC Select	0	1	0	1	0	1	0	0	0	0	0 1	A0h A1h	Set the display data RAM address SEG output correspondence
(9) Normal/Reverse Display	0	1	0	1	0	1	0	0	1	1	0 1	A6h A7h	Normal indication when low, but full indication when high
(10)Entire Display ON/OFF	0	1	0	1	0	1	0	0	1	0	0 1	A4h A5h	Select normal display (0) or entire display on
(11)LCD Bias Set	0	1	0	1	0	1	0	0	0	1	0 1	A2h A3h	Sets LCD driving voltage bias ratio
(12)Read-Modify-Write	0	1	0	1	1	1	0	0	0	0	0	E0h	Increments column address counter during each write
(13)End	0	1	0	1	1	1	0	1	1	1	0	EEh	Releases the Read-Modify-Write
(14)Reset	0	1	0	1	1	1	0	0	0	1	0	E2h	Resets internal functions
(15)Common Output Mode Select	0	1	0	1	1	0	0	0 1	*	*	*	C0h to CFh	Select COM output scan direction *: invalid data
(16)Power Control Set	0	1	0	0	0	1	0	1	Operation Status			28h to 2Fh	Select the power circuit operation mode
(17)V0 Voltage Regulator Internal Resistor ratio Set	0	1	0	0	0	1	0	0	Resistor Ratio			20h to 27h	Select internal resistor ratio Rb/Ra mode
(18)Electronic Volume mode Set	0	1	0	1	0	0	0	0	0	0	1	81h	
Electronic Volume Register Set	0	1	0	*	*	Electronic Control Value						XX	Sets the V0 output voltage electronic volume register
(19)Set Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0 1	ACh ADh	Sets static indicator ON/OFF 0: OFF, 1: ON
Set Static Indicator Register	0	1	0	*	*	*	*	*	*	Mode		XX	Sets the flash mode
(20)Power Save	0	1	0	-	-	-	-	-	-	-	-	-	Compound command of Display OFF and Entire Display ON
(21)NOP	0	1	0	1	1	1	0	0	0	1	1	E3h	Command for non-operation

Command	A0	/RD	/WR	Code									Function
				D7	D6	D5	D4	D3	D2	D1	D0	Hex	
(22)Oscillation Frequency Select	0	1	0	1	1	1	0	0	1	0	0 1	E4h E5h	Select the oscillation frequency
(23)Partial Display mode Set	0	1	0	1	0	0	0	0	0	1	0 1	82h 83h	Enter/Release the partial display mode
(24)Partial Display Duty Set	0	1	0	0	0	1	1	0	Duty Ratio			30h 37h	Sets the LCD duty ratio for partial display mode
(25)Partial Display Bias Set	0	1	0	0	0	1	1	1	Bias Ratio			38h 3Fh	Sets the LCD bias ratio for partial display mode
(26)Partial Start Line Set	0	1	0	1	1	0	1	0	0	1	1	D3h	Enter Partial Start Line Set
Partial Start Line Set	0	1	0	1	1	Partial Start Line						XX	Sets the LCD Number of partial display start line
(27)N-Line Inversion Set	0	1	0	1	0	0	0	0	1	0	1	85h	Enter N-Line inversion
Number of Line Set	0	1	0	*	*	*	Number of Line					XX	Sets the number of line used for N-Line inversion
(28)N-Line Inversion Release	0	1	0	1	0	0	0	0	1	0	0	84h	Exit N-Line Inversion
(29)DC/DC Clock Set	0	1	0	1	1	1	0	0	1	1	0	E6h	Set DC/DC Clock Frequency
DC/DC Clock Division Set	0	1	0	1	1	0	0	Clock Division				XX	Set the Division of DC/DC Clock Frequency
(30)Test Command	0	1	0	1	1	1	1	*	*	*	*	F1h to FFh	IC test command. Do not use!
(31)Test Mode Reset	0	1	0	1	1	1	1	0	0	0	0	F0h	Command of test mode reset

Timing Characteristics

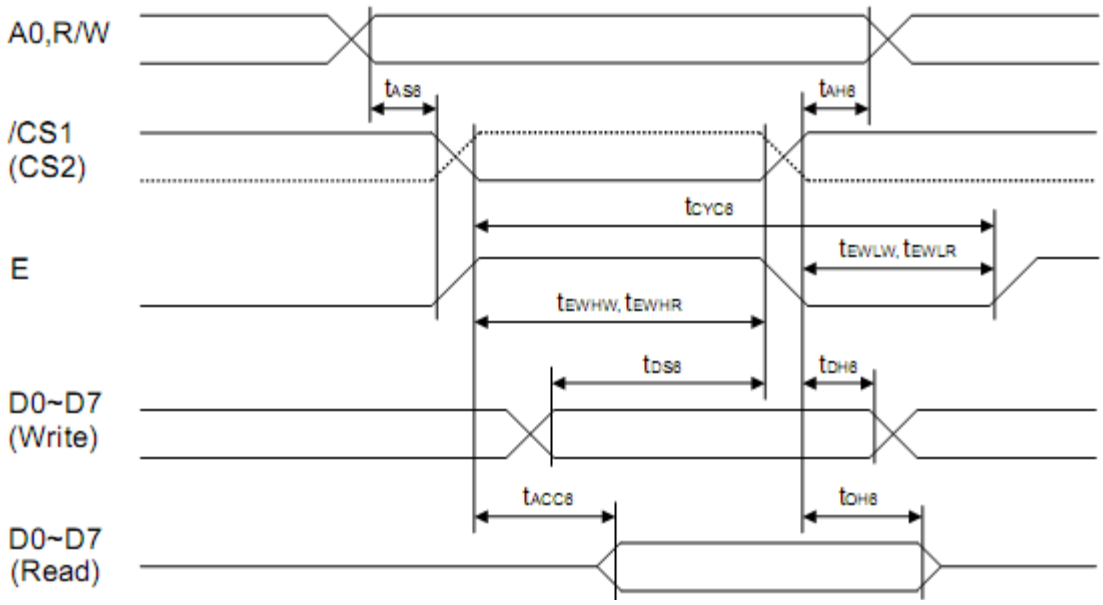
1. System Buses Read/Write Characteristics (for 8080 Series MPU)



(VDD = 2.7 ~ 3.6V, Ta = -40 ~ +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
T_{AH8}	Address hold time	0	-	-	ns	A0
T_{AS8}	Address setup time	0	-	-	ns	
t_{CYC8}	System cycle time	240	-	-	ns	
t_{CCLW}	Control low pulse width (write)	90	-	-	ns	/WR
t_{CCLR}	Control low pulse width (read)	120	-	-	ns	/RD
t_{CCHW}	Control high pulse width (write)	100	-	-	ns	/WR
t_{CCHR}	Control high pulse width (read)	60	-	-	ns	/RD
T_{DS8}	Data setup time	40	-	-	ns	D0~D7
T_{DH8}	Data hold time	10	-	-	ns	
t_{ACC8}	/RD access time	-	-	140	ns	D0~D7, CL = 100pF
T_{CH8}	Output disable time	5	-	50	ns	

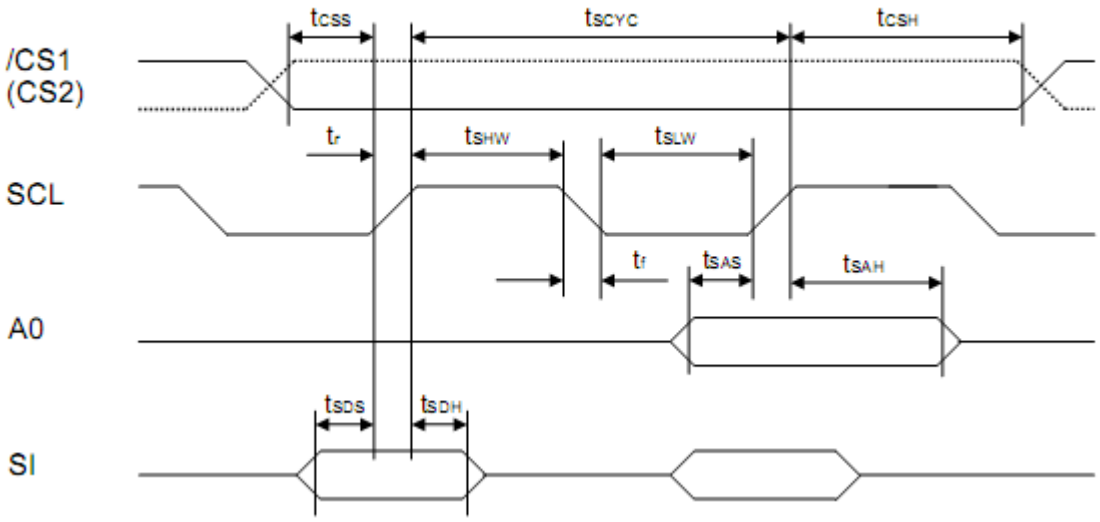
System Buses Read/Write Characteristics (for 6800 Series MPU)



(VDD = 2.7 ~ 3.6V, Ta = -40 ~ +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{AH6}	Address hold time	0	-	-	ns	A0, R/W
t_{AS6}	Address setup time	0	-	-	ns	
t_{CYC6}	System cycle time	240	-	-	ns	
t_{EWHW}	Control high pulse width (write)	90	-	-	ns	E
t_{EWHR}	Control high pulse width (read)	120	-	-	ns	E
t_{EWLW}	Control low pulse width (write)	100	-	-	ns	E
t_{EWLR}	Control low pulse width (read)	60	-	-	ns	E
t_{DS6}	Data setup time	40	-	-	ns	D0~D7
t_{DH6}	Data hold time	10	-	-	ns	
t_{ACC6}	/RD access time	-	-	140	ns	D0~D7 CL = 100pF
t_{OH6}	Output disable time	5	-	50	ns	

Serial Interface Timing



(VDD = 2.7 ~ 3.6V, Ta = -40 ~ +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
tSCYC	Serial clock cycle	120	-	-	ns	SCL
tSHW	Serial clock H pulse width	60	-	-	ns	SCL
tSLW	Serial clock L pulse width	60	-	-	ns	SCL
tSAS	Address setup time	30	-	-	ns	A0
tSAH	Address hold time	20	-	-	ns	A0
tSDS	Data setup time	30	-	-	ns	SI
tSDH	Data hold time	20	-	-	ns	SI
tCSS	Chip select setup time	20	-	-	ns	/CS1, CS2
tCSH	Chip select hold time	40	-	-	ns	/CS1, CS2

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