

# NHD-C12864GG-RN-GBW

## COG (Chip-On-Glass) Liquid Crystal Display Module

NHD-	Newhaven Display
C12864-	128 x 64 Pixels
GG-	Model
R-	Reflective
N-	No Backlight
G-	STN - Gray
B-	6:00 Optimal View
W-	Wide Temperature
	<b>RoHS Compliant</b>

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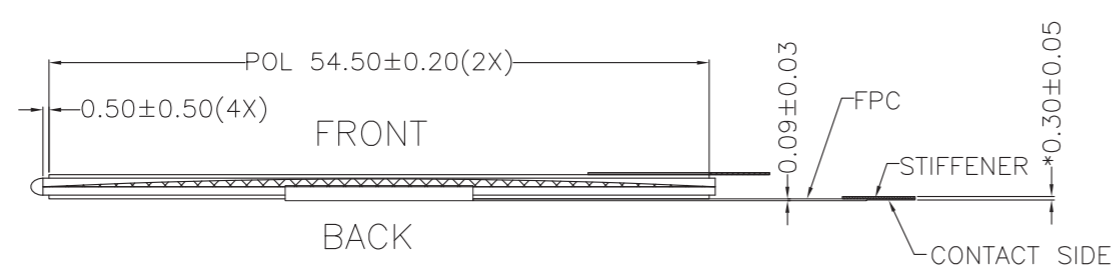
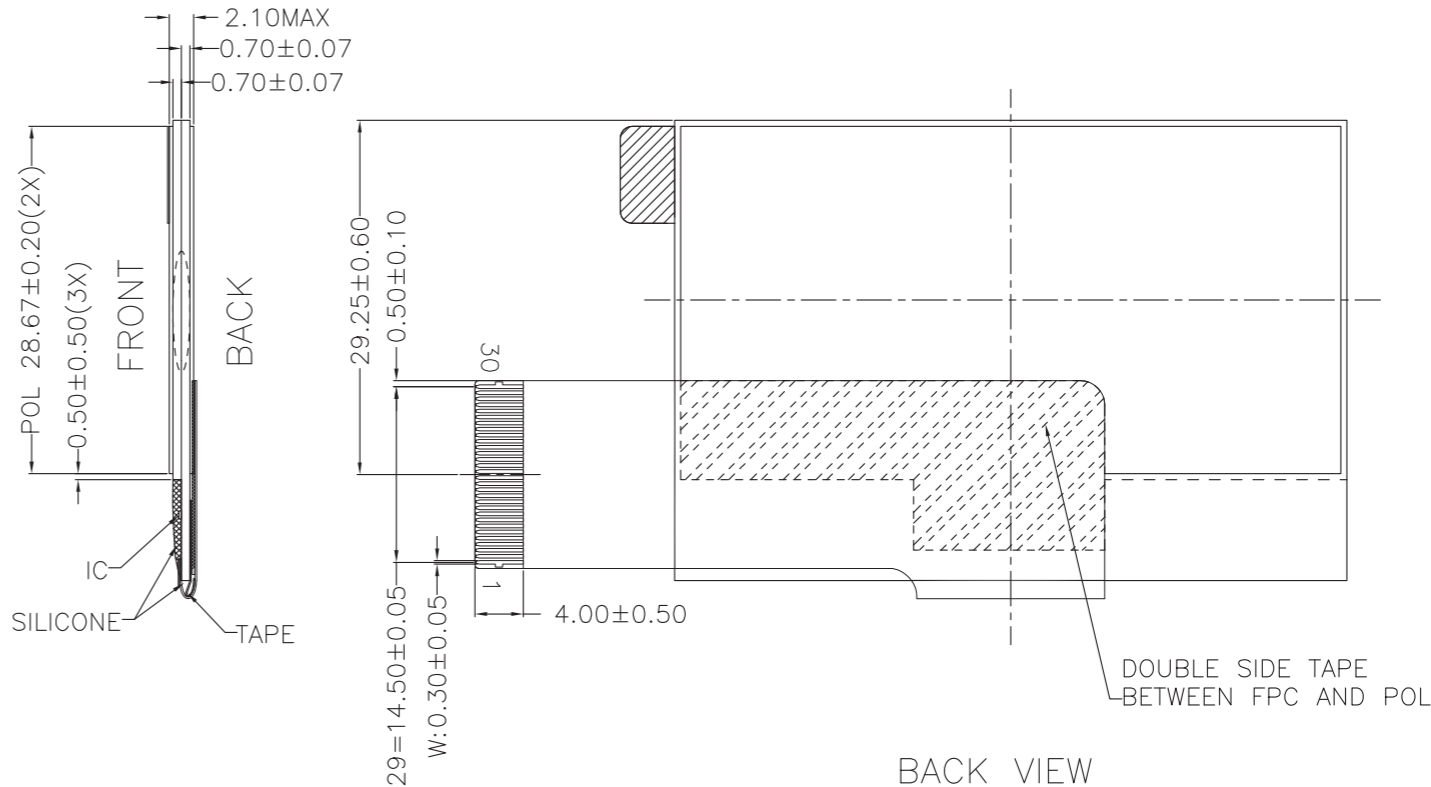
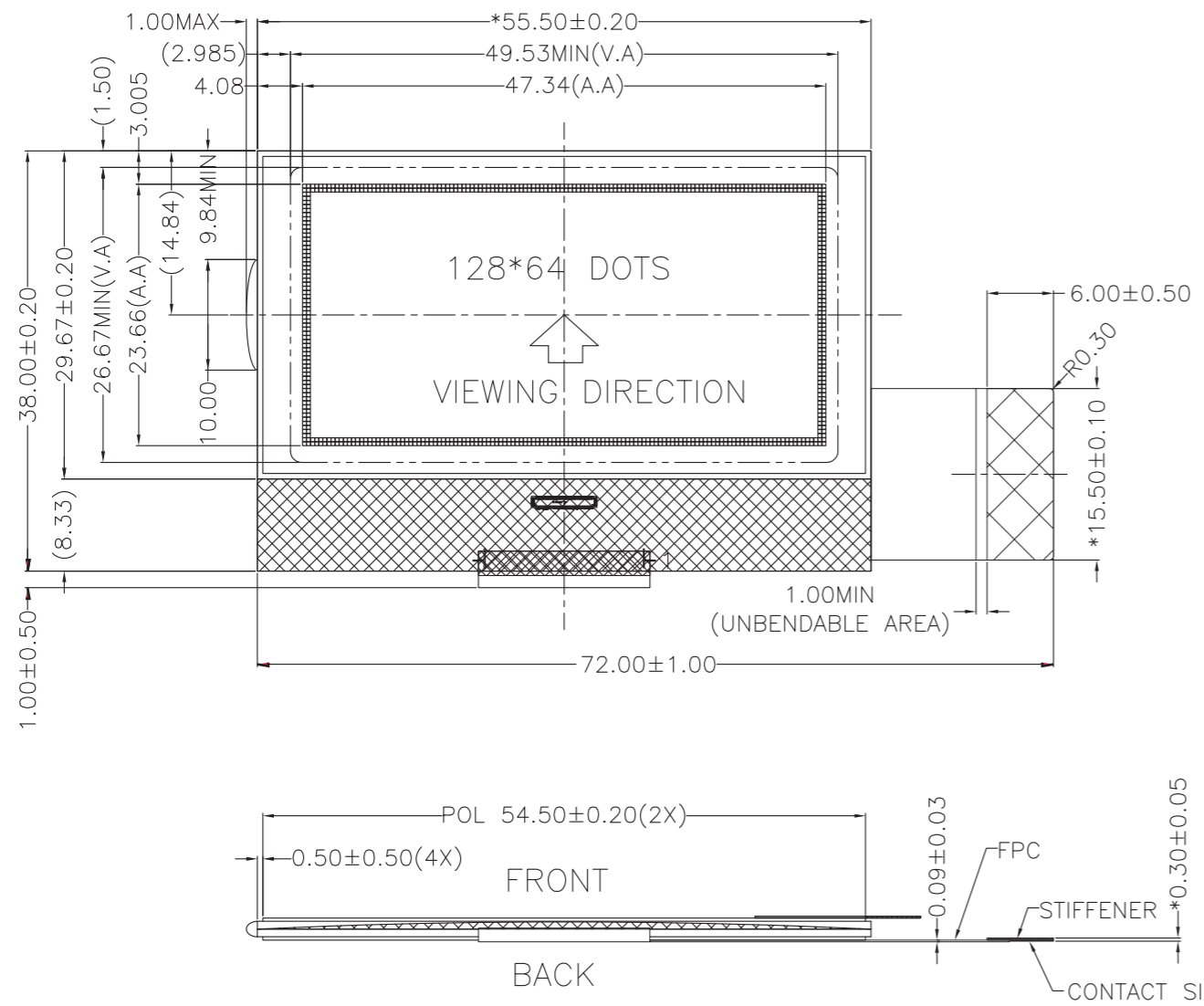
## Document Revision History

Revision	Date	Description	Changed by
0	3/25/08	Initial Release	-
1	9/10/09	User guide reformat	BE
2	10/8/09	Update pin description	BE
3	10/13/09	Updated Electrical Characteristic	MC
4	10/9/13	Mechanical Drawing, Pin Description, Electrical/Optical Characteristics, Example Code updated	ML
5	11/1/17	Mech. Drawing, Supply Current & Contrast Voltage Updated	SB

## Functions and Features

- 128 x 64 pixels
- Built-in ST7565R controller
- 1/65 duty, 1/9 bias
- Parallel 8080 MPU interface
- RoHS Compliant

SYMBOL	REVISION	DATE



# Pin Assignments

PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CONNECTION	ESD-GND	/CS1	/RES	A0	/WR	/RD	D0	D1	D2	D3	D4	D5	D6	D7	VDD
PIN	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
CONNECTION	VSS	VOUT	CAP3P	CAP1N	CAP1P	CAP2P	CAP2N	CAP4P	V4	V3	V2	V1	V0	ESD-GND	NC

- Notes:**
1. Driver: 1/65 Duty, 1/9 Bias
  2. Display Mode: STN Positive / Gray / Reflective
  3. Optimal View: 6:00
  4. Voltage: 3.0V VDD, 9V VLCD
  5. Driver IC: ST7565R

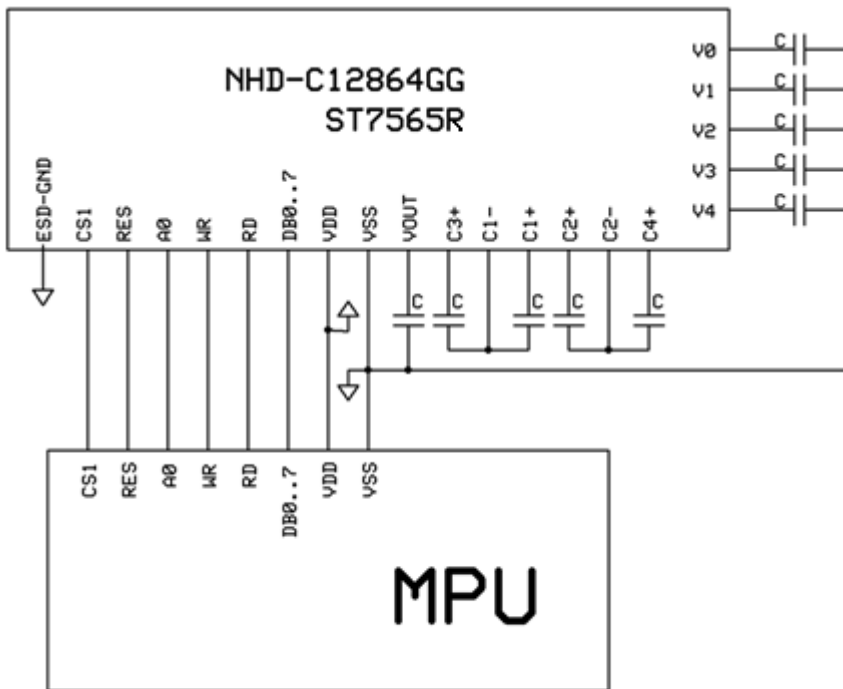
STANDARD TOLERANCES (UNLESS OTHERWISE SPECIFIED) LINEAR: XX. ±0.3 mm XX.X ±0.3 mm XX.XX ±0.3 mm				REVISION: 1.0
	DRAWING/PART NUMBER: <b>NHD-C12864GG-RN-GBW</b>			SIZE: A3
UNLESS OTHERWISE SPECIFIED - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	DRAWN BY: S. Baxi DRAWN DATE: 11/01/17	CHECKED BY: S. Baxi CHECKED DATE: 11/01/17	APPROVED BY: S. Baxi APPROVED DATE: 11/01/17	SCALE: NS
DO NOT SCALE DRAWING				SHEET 1 OF 1
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## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	ESD-GND	Power Supply	Ground (can be a No Connect)
2	/CS1	MPU	Active LOW Chip Select signal
3	/RES	MPU	Active LOW Reset signal
4	A0	MPU	Register Select: '0' = Command, '1' = Data
5	/WR	MPU	Active LOW Write signal
6	/RD	MPU	Active LOW Read signal
7-14	D0-D7	MPU	8-bit bi-directional data bus
15	V <sub>DD</sub>	Power Supply	Supply Voltage for LCD and Logic (3.0V)
16	V <sub>SS</sub>	Power Supply	Ground
17	V <sub>OUT</sub>	Power Supply	1.0uF-2.2uF Capacitor to V <sub>SS</sub>
18	C <sub>3+</sub>	Power Supply	1.0uF-2.2uF Capacitor to C1- (Pin-19)
19	C <sub>1-</sub>	Power Supply	1.0uF-2.2uF Capacitor to C3+ (Pin-18) and C1+ (Pin-20)
20	C <sub>1+</sub>	Power Supply	1.0uF-2.2uF Capacitor to C1- (Pin-19)
21	C <sub>2+</sub>	Power Supply	1.0uF-2.2uF Capacitor to C2- (Pin-22)
22	C <sub>2-</sub>	Power Supply	1.0uF-2.2uF Capacitor to C2+(Pin-21) and C4+ (Pin-23)
23	C <sub>4+</sub>	Power Supply	1.0uF-2.2uF Capacitor to C2- (Pin-22)
24	V <sub>4</sub>	Power Supply	0.1uF-1.0uF Capacitor to V <sub>DD</sub> or V <sub>SS</sub>
25	V <sub>3</sub>	Power Supply	0.1uF-1.0uF Capacitor to V <sub>DD</sub> or V <sub>SS</sub>
26	V <sub>2</sub>	Power Supply	0.1uF-1.0uF Capacitor to V <sub>DD</sub> or V <sub>SS</sub>
27	V <sub>1</sub>	Power Supply	0.1uF-1.0uF Capacitor to V <sub>DD</sub> or V <sub>SS</sub>
28	V <sub>0</sub>	Power Supply	0.1uF-1.0uF Capacitor to V <sub>DD</sub> or V <sub>SS</sub>
29	ESD-GND	Power Supply	Ground (can be a No Connect)
30	NC	-	No Connect

**Recommended LCD connector:** 0.5mm pitch, 30 conductor FFC. Molex p/n: 52892-3095

**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	$V_{DD}$	-	2.8	3.0	3.3	V
Supply Current	$I_{DD}$	$V_{DD} = 3.0V$ $T_{OP} = 25^{\circ}C$	0.2	0.5	1	mA
Supply for LCD (contrast)	$V_{LCD}$		8.6	8.8	9.0	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

\*User should employ SW/HW methods for tuning contrast. (Refer to Electronic Volume Register)

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	$CR \geq 2$	-	25	-	°
	Bottom		-	45	-	°
	Left		-	30	-	°
	Right		-	30	-	°
Contrast Ratio	CR	-	3	4	-	-
Response Time	Rise	$T_{OP} = 25^{\circ}C$	-	250	300	ms
	Fall		-	250	350	ms

## Controller Information

Built-in ST7565R controller.

Please download specification at [http://www.newhavendisplay.com/app\\_notes/ST7565R.pdf](http://www.newhavendisplay.com/app_notes/ST7565R.pdf)

## Table of Commands

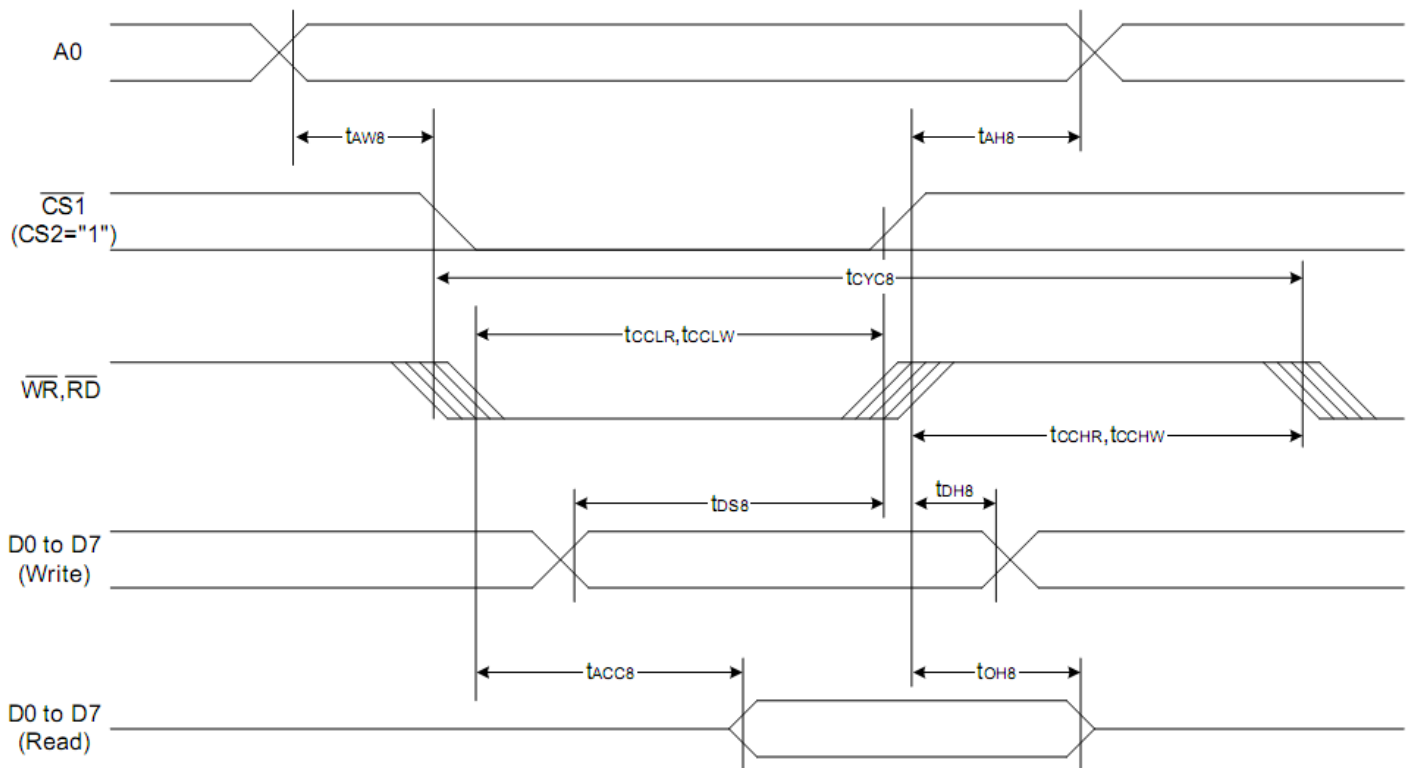
Command	Command Code									Function			
	A0	/RD	/WR	D7	D6	D5	D4	D3	D2		D1	D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0	1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address					0	Sets the display RAM display start line address	
(3) Page address set	0	1	0	1	0	1	1	Page address				0	Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				0	Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit				0	0	0	0	Least significant column address				0	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							0	Writes to the display RAM	
(7) Display data read	1	0	1	Read data							0	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 (ST7565R)
(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	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			0	Select internal power supply operating mode
(17) V <sub>0</sub> voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			0	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 V <sub>0</sub> output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value					0		
(19) Sleep mode set	0	1	0	1	0	1	1	0	0	0	0	1	0: Sleep mode, 1: Normal mode
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
(21) NOP	0	1	0	1	1	1	0	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

## 8080 MPU Interface

Item	Signal	Symbol	condition	Min.	Max.	Unit
Address hold time	A0	t <sub>AH8</sub>		0	-	ns
Address setup time		t <sub>AW8</sub>		0	-	
Address cycle time		t <sub>CYC8</sub>		240	-	
Enable L pulse width(write)	WR	t <sub>CCLW</sub>		80	-	
Enable H pulse width(write)		t <sub>CCHW</sub>		80	-	
Enable L pulse width(read)	RD	t <sub>CCLR</sub>		140	-	
Enable H pulse width(read)		t <sub>CCHR</sub>		80	-	
Write data setup time	DB0~DB7	t <sub>DS8</sub>		40	-	
Write address hold time		t <sub>DH8</sub>		0	-	
Read access time		t <sub>ACC8</sub>	CL=100Pf	-	70	
Read output disable time		t <sub>OH8</sub>	CL=100Pf	5	50	

Item	Signal	Symbol	Min.	Typ.	Max.	Unit
Reset time		t <sub>R</sub>	-	-	1.0	us
Reset 'L' pulse width	/RES	t <sub>RW</sub>	1.0	-	-	



## Example Initialization Code

```
/**
 *
 */

void comm_out(unsigned char c)
{
    CS1 = 0;
    AO = 0;                //LOW = instruction
    WRT = 0;
    P1 = c;
    WRT = 1;
    CS1 = 1;
}

/**
 *
 */

void data_out(unsigned char d)
{
    CS1 = 0;
    AO = 1;                //HIGH = data
    WRT = 0;
    P1 = d;
    WRT = 1;
    CS1 = 1;
}

/**
 *
 */

void disp()
{
    unsigned int i, j;
    unsigned char page=0xB0;
    for(i=0;i<8;i++)        //fill display with checkerboard pattern
    {
        comm_out(0x10);    //set column address
        comm_out(0x00);    //set column address
        comm_out(page);    //set page address
        for(j=0;j<64;j++)
        {
            data_out(0xAA);
            data_out(0x55);
        }
        page++;
    }
}

/**
 *
 */
```



```

/*****
/***** NHD-C12864GG DISPLAY INITIALIZATION *****/
/*****

void init()
{
    RDD = 1;
    WRT = 1;
    CS1 = 0;
    RST = 0;
    delay(150);
    RST = 1;
    delay(150);

    comm_out(0xA2); //added 1/9 bias
    comm_out(0xA0); //ADC segment driver direction (A0=Normal)
    comm_out(0xC0); //COM output scan direction (C0=Normal)
    comm_out(0x25); //resistor ratio
    comm_out(0x81); //electronic volume mode set
    comm_out(0x15); //electronic volume register set
    comm_out(0x2F); //operating mode
    comm_out(0x40); //start line set
    comm_out(0xAF); //display ON

    delay(10);
}

/*****

```

## 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 , 96hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 96hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C, 96hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 96hrs	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.	-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](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information

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