NEWHAVEN DISPLAY INTERNATIONAL

Product Specification

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

Newhaven Display International, Inc.
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REACH Compliant

RoHS Compliant

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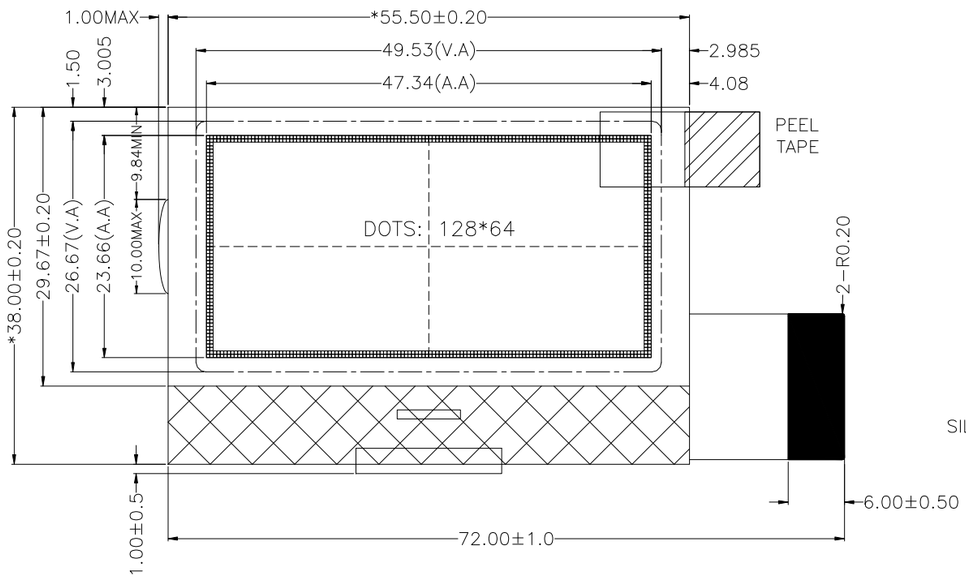
Additional Resources

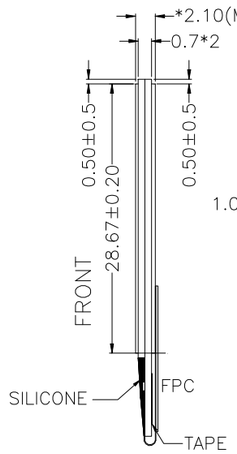
- **Support Forum:** https://support.newhavendisplay.com/hc/en-us/community/topics
- **GitHub:** https://github.com/newhavendisplay
- **Example Code:** https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html
- **Quality Center:** https://www.newhavendisplay.com/quality_center.html
- **Precautions for using LCDs/LCMs:** https://www.newhavendisplay.com/specs/precautions.pdf
- **Warranty / Terms & Conditions:** https://www.newhavendisplay.com/terms.html

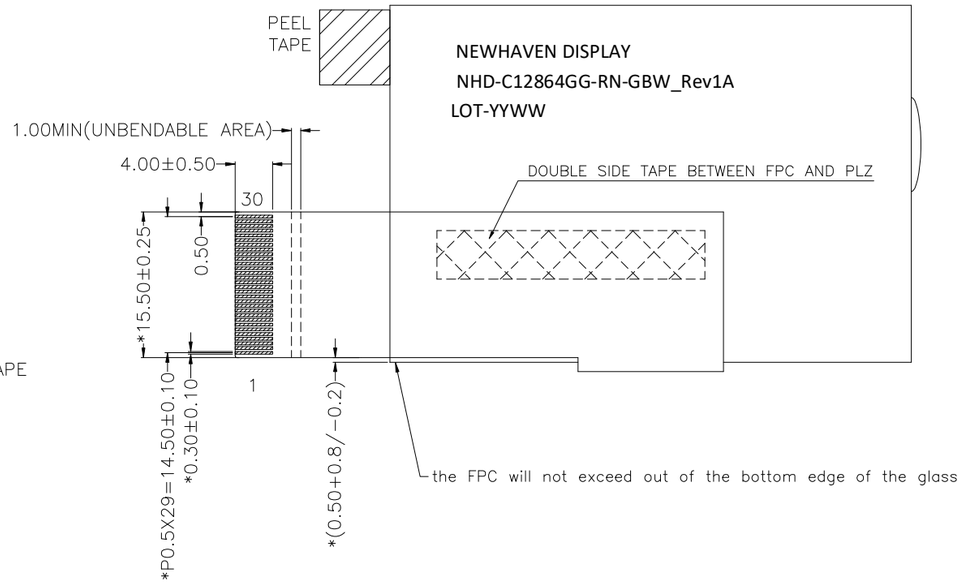
Document Revision History

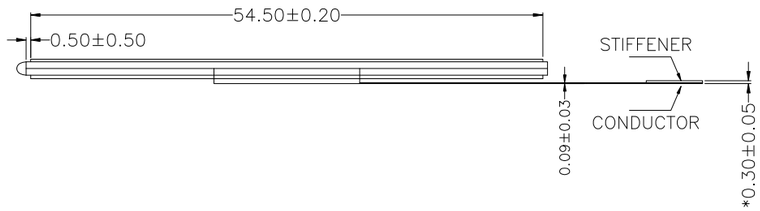
Revision	Date	Description	Changed By
0	03/25/2008	Initial Release	-
1	09/10/2009	User Guide Reformat	BE
2	10/08/2009	Update Pin Description	BE
3	10/13/2009	Updated Electrical Characteristic	MC
4	10/09/2013	Mechanical Drawing, Pin Description, Electrical/Optical Characteristics, Example Code updated	ML
5	11/01/2017	Mech. Drawing, Supply Current & Contrast Voltage Updated	SB
6	11/12/2020	Updated Mechanical Drawing, Viewing Angles & Response Times	AS
7	05/31/2023	Mechanical Drawing Updated	KL
8	06/27/2023	Part Changed to Rev1A	KL
9	07/28/2023	Mechanical Drawing and Quality Information Updated	KL
10	08/01/2023	Electrical Characteristics Updated	KL

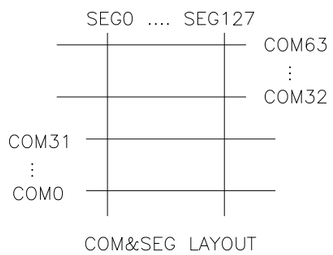
Mechanical Drawing

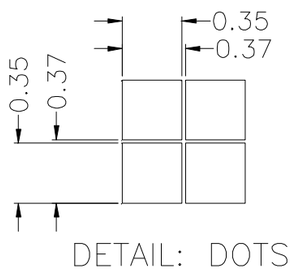












PIN ASSIGNMENT

NO.	SIGNAL
1	ESD-GND
2	/CS1
3	/RES
4	A0
5	/WR
6	/RD
7	D0
8	D1
9	D2
10	D3
11	D4
12	D5
13	D6
14	D7
15	VDD
16	VSS
17	VOUT
18	CAP3P
19	CAP1N
20	CAP1P
21	CAP2P
22	CAP2N
23	CAP4P
24	V4
25	V3
26	V2
27	V1
28	V0
29	ESD-GND
30	NC

Product Description: 128x64 Graphic COG LCD

1. Driver IC: ST7565R
2. Driving Mode: 1/65 Duty, 1/9 Bias
3. Interface: 8080 Parallel
4. Power Requirement: 3.0V
5. Optical Features: STN (+) Gray, Reflective, 6:00 View,
6. Recommended FFC Connector: 30pin 0.5 pitch

Standard Tolerance:
(Unless otherwise specified)
Linear: ±0.3mm

NEWHAVEN DISPLAY INTERNATIONAL

Drawing/Part Number: NHD-C12864GG-RN-GBW
Revision: 1A

Unless otherwise specified:
• Dimensions are in Millimeters
• Third Angle Projection

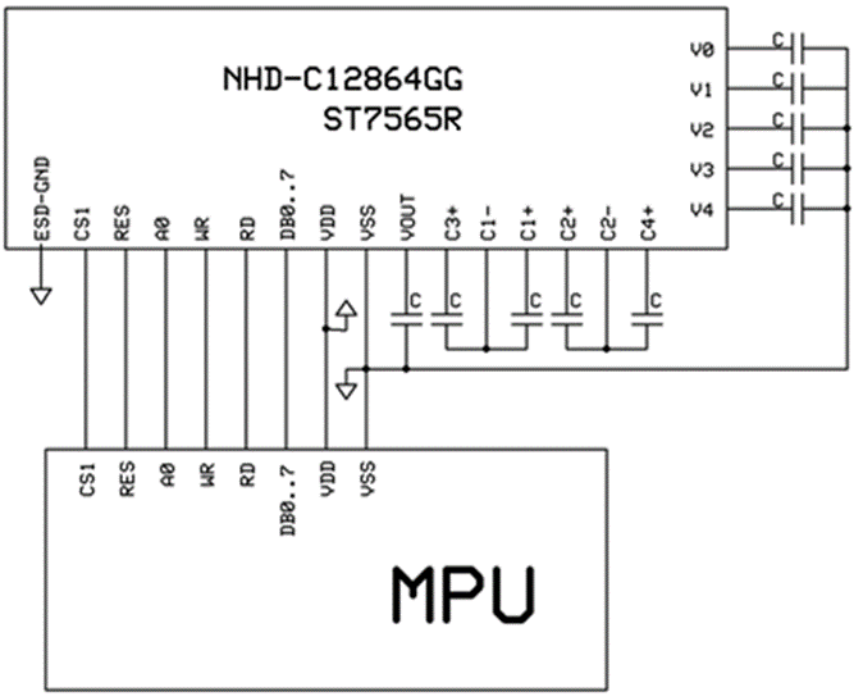
Drawn By: K. Lewis
Drawn Date: 07/28/2023
Approved By: K. Lewis
Approved Date: 07/28/2023

Pin Description

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_{DD}	Power Supply	Supply Voltage for LCD and Logic (3.0V)
16	V_{SS}	Power Supply	Ground
17	V_{OUT}	Power Supply	1.0uF-2.2uF Capacitor to V_{SS}
18	C_{3+}	Power Supply	1.0uF-2.2uF Capacitor to C1- (Pin-19)
19	C_{1-}	Power Supply	1.0uF-2.2uF Capacitor to C3+ (Pin-18) and C1+ (Pin-20)
20	C_{1+}	Power Supply	1.0uF-2.2uF Capacitor to C1- (Pin-19)
21	C_{2+}	Power Supply	1.0uF-2.2uF Capacitor to C2- (Pin-22)
22	C_{2-}	Power Supply	1.0uF-2.2uF Capacitor to C2+(Pin-21) and C4+ (Pin-23)
23	C_{4+}	Power Supply	1.0uF-2.2uF Capacitor to C2- (Pin-22)
24	V_4	Power Supply	0.1uF-1.0uF Capacitor to V_{DD} or V_{SS}
25	V_3	Power Supply	0.1uF-1.0uF Capacitor to V_{DD} or V_{SS}
26	V_2	Power Supply	0.1uF-1.0uF Capacitor to V_{DD} or V_{SS}
27	V_1	Power Supply	0.1uF-1.0uF Capacitor to V_{DD} or V_{SS}
28	V_0	Power Supply	0.1uF-1.0uF Capacitor to V_{DD} or V_{SS}
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**: ---

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}	-	2.8	3.0	3.3	V
Supply Current	I_{DD}	V_{DD} = 3.0V	0.05	0.5	1.0	mA
Supply for LCD (contrast)	V_{LCD}	T_{OP} = 25°C	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	φY+	CR ≥ 2	-	40	-	°
	Bottom	φY-		-	60	-	°
	Left	θX-		-	60	-	°
	Right	θX+		-	60	-	°
Contrast Ratio		CR	-	2	5	-	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	150	250	ms
	Fall	T_F		-	200	300	ms

Controller Information

Built-in ST7565R Controller: https://support.newhavendisplay.com/hc/en-us/articles/4414899357591-ST7565R

Table of Commands

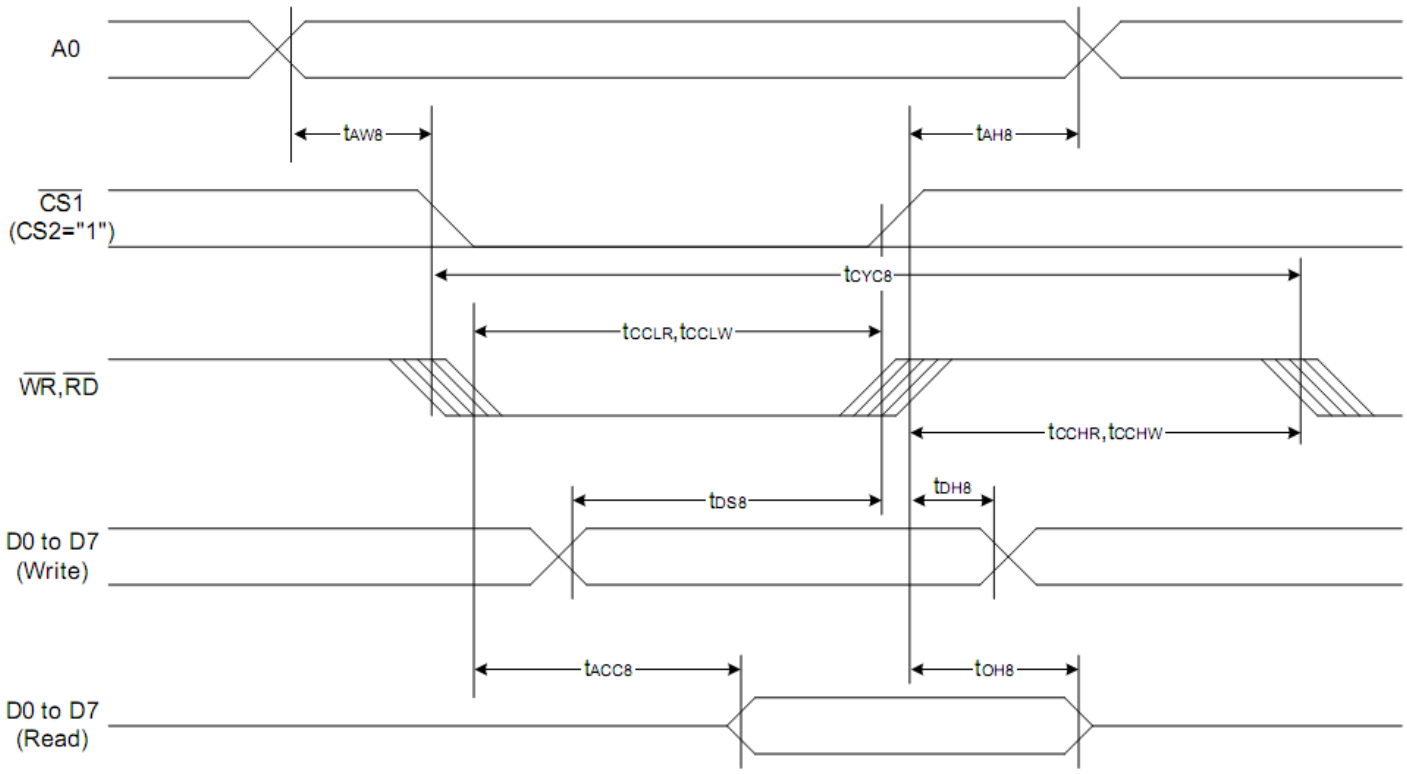
Command	Command Code											Function
	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page 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. Sets the least significant 4 bits of the display RAM column address.
				0	0	0	0	Least significant 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 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) 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	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

8080 MPU Interface

Item	Signal	Symbol	condition	Min.	Max.	Unit
Address hold time	A0	t_{AH8}		0	-	ns
Address setup time		t_{AW8}		0	-	
Address 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	DB0~DB7	t_{DS8}		40	-	
Write address hold time		t_{DH8}		0	-	
Read access time		t_{ACC8}	CL=100Pf	-	70	
Read output disable time		t_{OH8}	CL=100Pf	5	50	

Item	Signal	Symbol	Min.	Typ.	Max.	Unit
Reset time		tR	-	-	1.0	us
Reset 'L' pulse width	/RES	tRW	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 Storage	Endurance test applying the high storage temperature and humidity 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, 1.5mm amplitude. 2g Acceleration. 60 sec in each of 3 directions X,Y,Z For 30 minutes	3
Static electricity test	Endurance test applying electric static discharge.	Air: ±8KV, Contact: ±4KV	4

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.