

**Product Specification** 

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# NHD- C12864A1Z-FSW-FBW-HTT

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

<b>NHD-</b>	Newhaven Display
<b>C12864-</b>	128 x 64 Pixels
<b>A1Z-</b>	Model
<b>F-</b>	Transflective
<b>SW-</b>	Side White LED Backlight
<b>F-</b>	FSTN (+)
<b>B-</b>	6:00 Optimal View
<b>W-</b>	Wide Temperature
<b>HTT-</b>	With 12V Heater (-40°C to +70°C)

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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](https://www.newhavendisplay.com/knowledge_center.html)
- **Quality Center:** [https://www.newhavendisplay.com/quality\\_center.html](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	07/17/2008	Initial Release	-
1	09/28/2009	User Guide Reformat	BE
2	10/14/2009	Updated Electrical Characteristic	MC
3	11/20/2009	Updated Backlight Supply Current	MC
4	10/26/2010	Updated Backlight Current	BE
5	10/27/2010	Supply Current Updated	BE
6	08/31/2015	Electrical characteristics, Optical Characteristics, Mechanical Drawings Updated	SB
7	08/03/2016	Updated Electrical Characteristics and Quality Info	TM
8	09/23/2016	Updated Electrical Characteristics	TM
9	03/30/2017	Updated Electrical Characteristics	TM
10	12/20/2018	Updated Heater Resistance, Response time & Double-Sided Tape added to drawing	SB
11	03/21/2019	Heater Resistance Updated	SB
12	05/14/2019	Heater Resistance Modified, Backlight Current Updated	SB
13	05/23/2019	Heater Note Added	SB
14	06/04/2019	Added PCB Footprint Drawing	AS
15	01/24/2020	Heater Resistance, Backlight Design & Electrical Characteristics Updated	SB
16	07/16/2020	Updated Serial Interface Timing Characteristics	AS
17	10/09/2020	Updated LCD Contrast Range from 8.7V/9.0V/9.3V to 8.8V/9.0V/9.2V Part Revision Upgraded to Rev1D	AS
18	03/26/2021	Updated MIN Backlight Current & MAX Supply Voltage	AS
19	04/08/2021	Updated the Electrical, Optical Characteristics, Table of Commands, Quality Information and Mechanical Drawing	JT
20	04/20/2023	Date Code Format Updated on Mechanical Drawing	KL
21	01/05/2026	Updated Max VDD from 3.2V to 3.3V in Electrical Characteristics	KL



## Pin Description

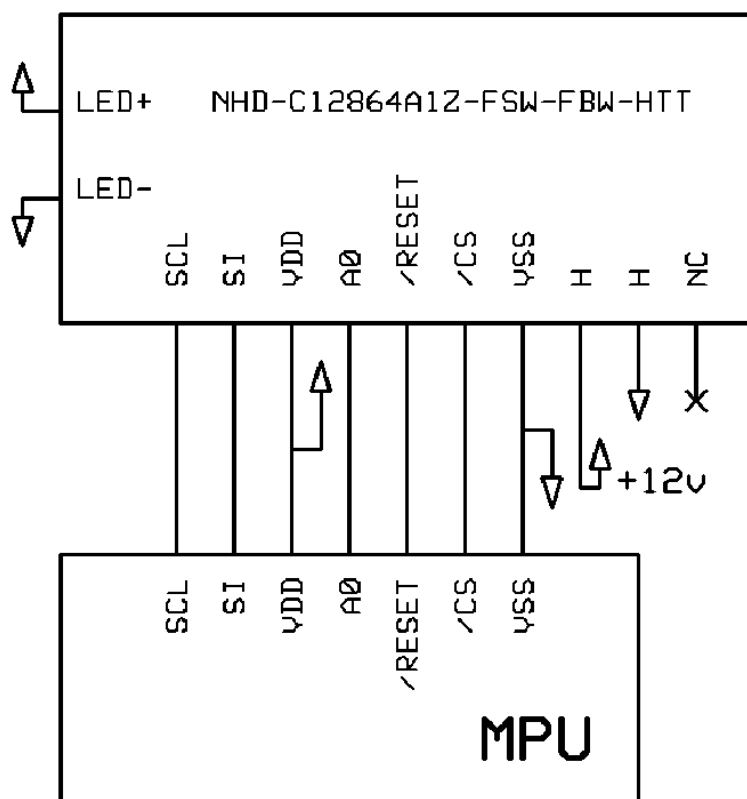
Pin No.	Symbol	External Connection	Function Description
1	SCL	MPU	Serial Clock input
2	SI	MPU	Serial Data input
3	V <sub>DD</sub>	Power Supply	Supply Voltage for LCD and logic (+3.0V)
4	A0	MPU	Register Select. 0: instruction; 1: data
5	/RESET	MPU	Operation Active LOW Reset signal
6	/CS	MPU	Active LOW Chip Select Signal
7	V <sub>SS</sub>	Power Supply	Ground
8	H	Power Supply	Heater Connection (+12V)
9	H	Power Supply	Heater Connection (GND)
10	LED-	Power Supply	Backlight Cathode (Ground)
11	LED+	Power Supply	Backlight Anode (+3.3V)
12	NC	-	No Connect

**Recommended LCD connector:** 2.54mm pitch thru-hole connection on PCB

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

**Recommended Breakout Board:** [NHD-PCB40](#)

## Wiring Diagram



## Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range <sup>1</sup>	T <sub>OP</sub>	V <sub>H</sub> = 0V	-20	-	+70	°C
		V <sub>H</sub> = 12.0V	-40	-	+70	°C
Storage Temperature Range	T <sub>ST</sub>	-	-40	-	+80	°C
Supply Voltage	V <sub>DD</sub>	-	2.8	3.0	3.3	V
Supply Current	I <sub>DD</sub>	V <sub>DD</sub> = 3.0V	0.1	0.2	1.0	mA
Supply for LCD (contrast)	V <sub>LCD</sub>	T <sub>OP</sub> = 25°C	8.8	9.0	9.2	V
"H" Level input	V <sub>IH</sub>	-	0.8*V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level input	V <sub>IL</sub>	-	0	-	0.2*V <sub>DD</sub>	V
"H" Level output	V <sub>OH</sub>	-	0.8*V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level output	V <sub>OL</sub>	-	V <sub>SS</sub>	-	0.2*V <sub>DD</sub>	V
Backlight Supply Voltage	V <sub>LED</sub>	-	3.2	3.3	3.4	V
Backlight Supply Current	I <sub>LED</sub>	V <sub>LED</sub> = 3.3V	20	50	60	mA
Heater Panel Resistance <sup>2</sup>	R <sub>H</sub> +/-	T = 25°C	5	20	35	Ω
Heater Voltage Supply	V <sub>H</sub>	-	-	12	15	V

<sup>1</sup>Heater **MUST** be activated when operating temperature drops below -20°C

<sup>2</sup>Heater measured using digital multi-meter

## Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 3	-	20	-	°
	Bottom	φY-		-	40	-	°
	Left	θX-		-	40	-	°
	Right	θX+		-	40	-	°
Contrast Ratio		CR	-	2	4	10	-
Response Time	Rise	T <sub>R</sub>	T <sub>OP</sub> = 25°C	-	135	240	ms
	Fall	T <sub>F</sub>		-	235	325	ms
	Rise	T <sub>R</sub>	T <sub>OP</sub> = -40°C V <sub>H</sub> = 12V	-	7.3	-	s
	Fall	T <sub>F</sub>		-	6.7	-	s

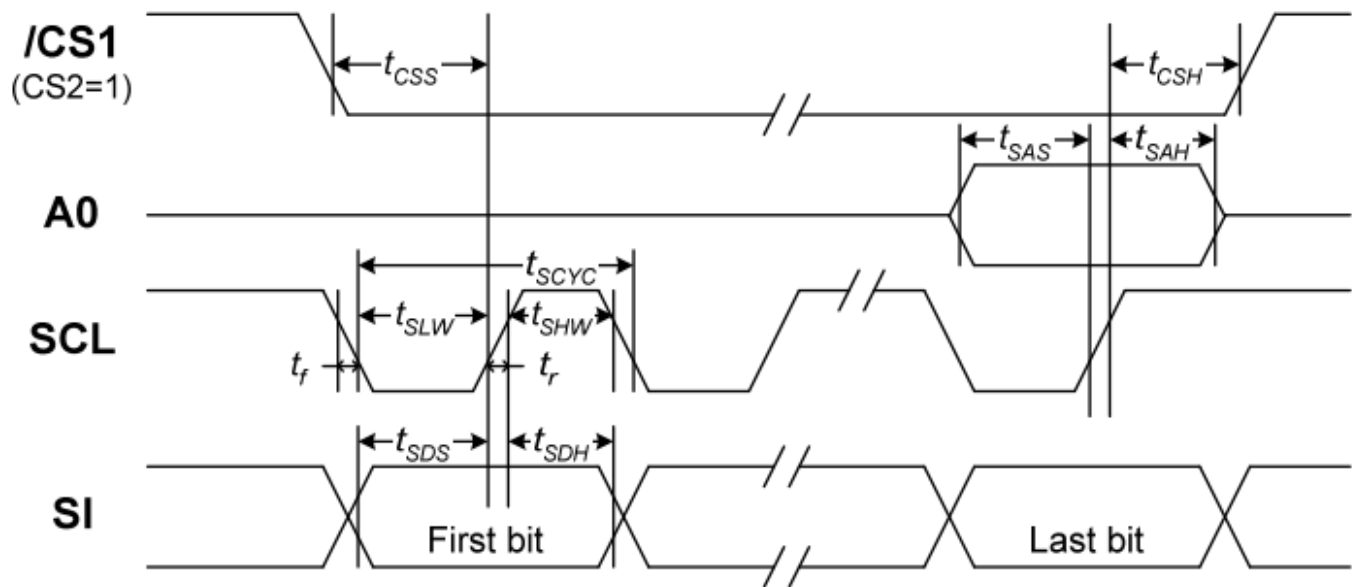
## Controller Information

Built-in ST7565P Controller: <https://support.newhavendisplay.com/hc/en-us/articles/4414878951703-ST7565P>

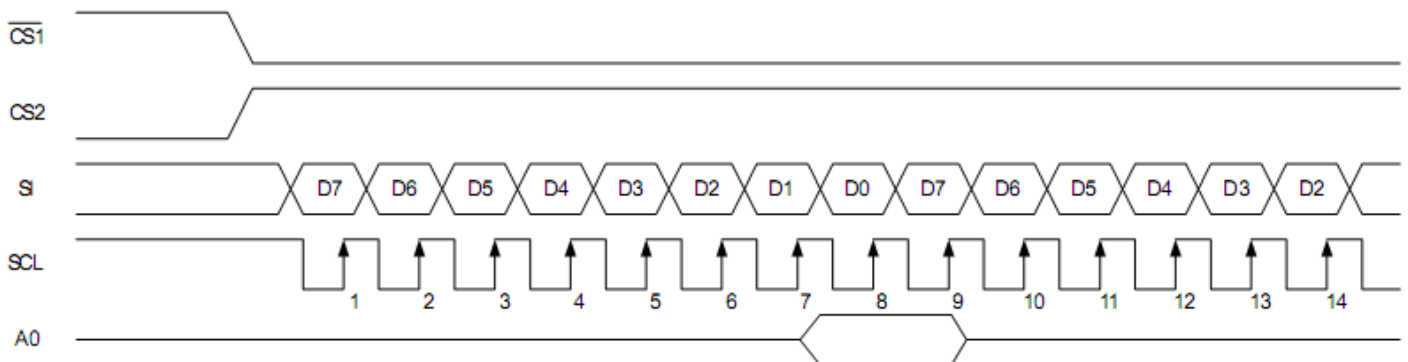


## Timing Characteristics

### The Serial Interface



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	—	



## 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 Least 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					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 (ST7565P)
(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	*	*	*	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 <sub>0</sub> voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(R <sub>b</sub> /R <sub>a</sub> ) mode
(18) Electronic volume mode set Electronic volume register set	0	1	0	1	0	0	0	0	0	0	1	Set the V <sub>0</sub> output voltage electronic volume register
(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
(21) Power saver												Display OFF and display all points ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(23) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command



## Example Initialization Program

.....

```
Sub Command
Reset P3.7
Reset P3.4
For Writecount = 1 To 8
  Rotate A , Left , 1
  Reset P3.1
  P1 = A
  Set P3.1
Next Writecount
Set P3.7
End Sub
```

.....

```
Sub Write
Reset P3.7
Set P3.4
For Writecount = 1 To 8
  Rotate A , Left , 1
  Reset P3.1
  P1 = A
  Set P3.1
Next Writecount
Set P3.7
End Sub
```

.....

```
Sub Init
Waitms 100
A = &HA0
Call Command
A = &HAE
Call Command
A = &HC0
Call Command
A = &HA2
Call Command
A = &H2F
Call Command
A = &H26
Call Command
A = &H81
Call Command
A = &H11
Call Command
A = &HAF
Call Command
End Sub
```

.....

## 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.	-40°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.	-40°C /-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.	+50°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.	-40°C /-20°C , 60min --> 70°C , 60min = 1 cycle For 20 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-50Hz , Acceleration of Gravity:5G 30 min in each of 3 directions X,Y,Z	3
Static electricity test	Endurance test applying electric static discharge.	Air: ±8kV 150pF/330Ω, 5 Times	
		Contact: ±4kV 150pF/330Ω, 5 Times	

**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.

