

# NHD-C12864B2Z-RN-FBW

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

NHD-	Newhaven Display
C12864-	128 x 64 Pixels
B2Z-	Model
R-	Reflective
N-	No Backlight
F-	FSTN (+)
B-	6:00 view
W-	Wide Temp (-20°C ~ +70°C)
	<b>RoHS Compliant</b>

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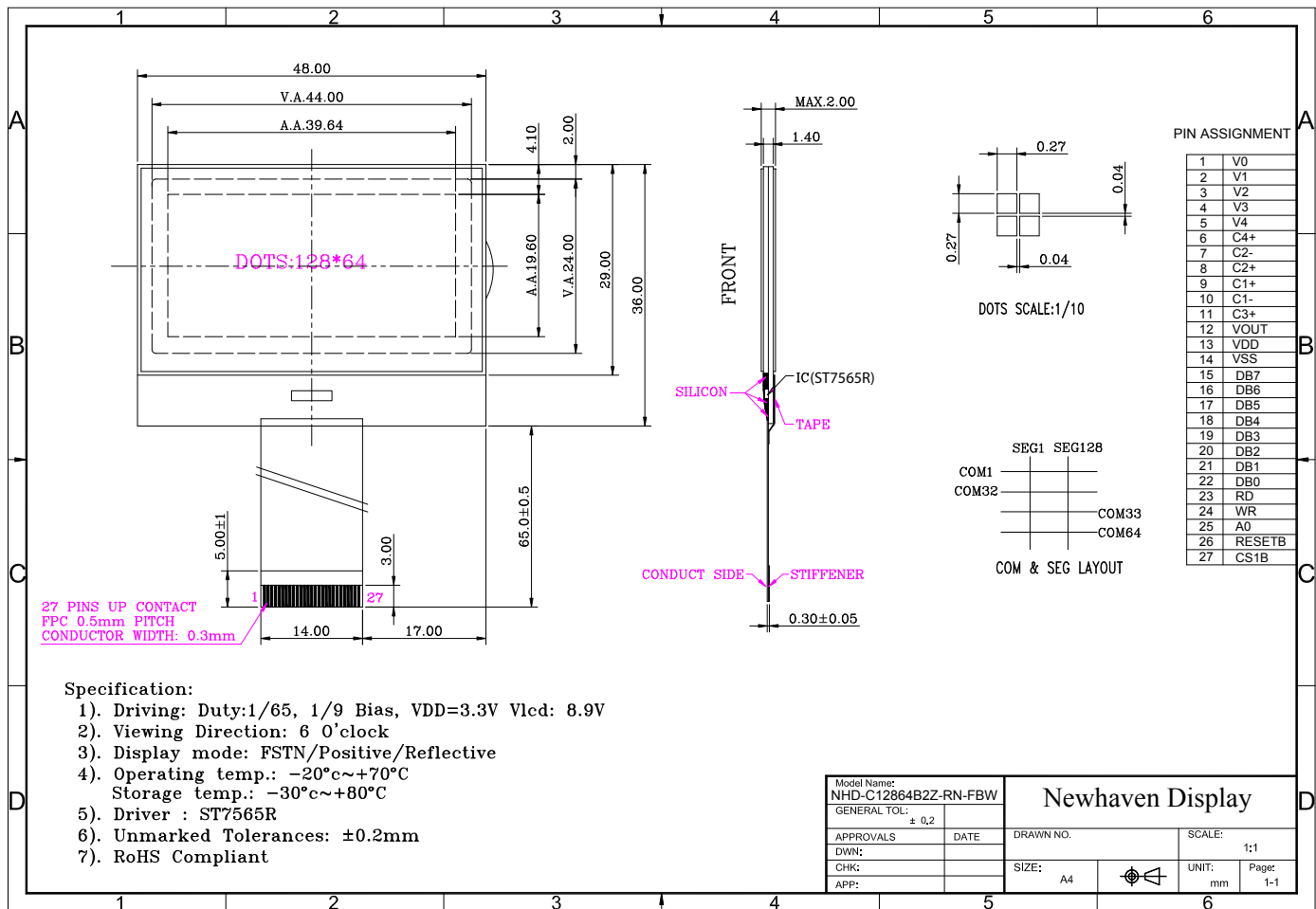
## Document Revision History

Revision	Date	Description	Changed by
0	5/12/2008	Initial Release	-
1	3/18/2009	User guide reformat	-
2	7/14/2009	User guide reformat	BE

## Functions and Features

- 128 x 64 Pixels
- Built-in ST7565R controller
- 8080 MPU interfaces
- RoHS Compliant

# Mechanical Drawing

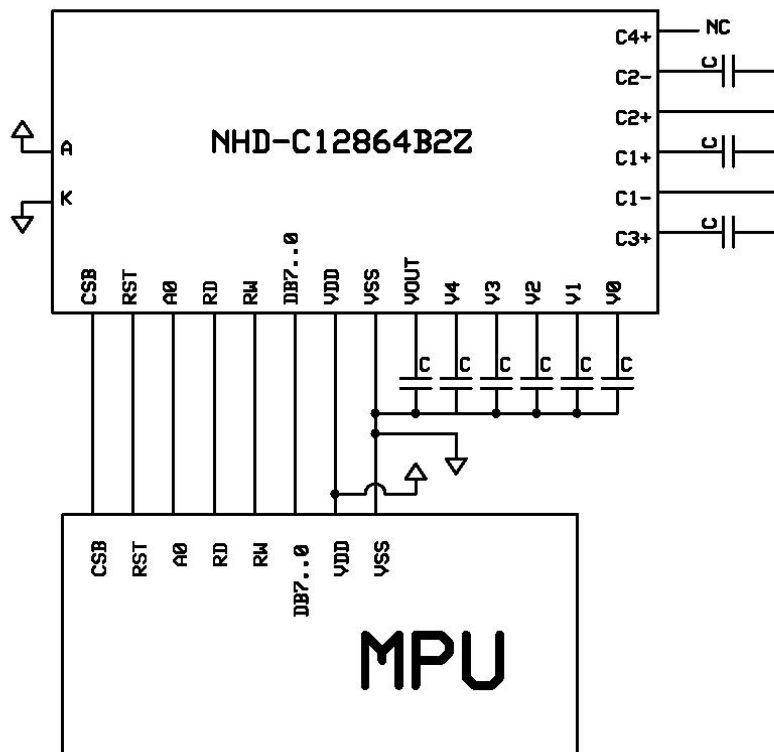


## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V0	Power Supply	CAP to VSS (0.1~1Uf)
2	V1	Power supply	CAP to VSS (0.1~1Uf)
3	V2	Power Supply	CAP to VSS (0.1~1Uf)
4	V3	Power Supply	CAP to VSS (0.1~1Uf)
5	V4	Power Supply	CAP to VSS (0.1~1Uf)
6	C4+	Power Supply	No Connect
7	C2-	Power Supply	CAP to PIN8 (1~2.2uF)
8	C2+	Power Supply	CAP to PIN7 (1~2.2uF)
9	C1+	Power Supply	CAP to PIN10(1~2.2uF)
10	C1-	Power Supply	CAP to PIN9 (1~2.2uF)
11	C3+	Power Supply	CAP to PIN10 (1~2.2uF)
12	VOUT	Power Supply	CAP to VSS (1~2.2uF)
13	VDD	Power Supply	Power Supply for logic
14	Vss	Power Supply	Ground
15~22	DB7~DB0	MPU	This is an 8-bit-directional data bus.
23	/RD	MPU	Active low Read signal
24	/WR	MPU	Active low Write signal
25	A0	MPU	Register Select. 0: instruction; 1: data register
26	RESTB	MPU	Active low Reset signal. (May tie to VDD)
27	CS1B	MPU	Active low Chip Select. (May tie to VSS)

**Recommended LCD connector:** 27 pins, 0.5mm Pitch FFC

**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		-	3.3	-	V
Supply Current	IDD	Ta=25°C, VDD=3.3V	-	0.5	-	mA
Supply for LCD (contrast)	VDD-V0	Ta =25°C	-	8.9	-	V
"H" Level input	Vih		0.7VDD	-	VDD	V
"L" Level input	Vil		0	-	0.8	V
"H" Level output	Voh		0.7VDD	-	VDD	V
"L" Level output	Vol		-	-	0.8	V

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical	$\theta 2- \theta 1$	CR = 2.0	70	-	-	°
Viewing Angle - Horizontal	$\Phi$	CR = 2.0	-	$\pm 30$	-	°
Contrast Ratio	CR	$\Phi=0, \theta=25$	3	5	-	-
Response Time (rise)	Tr	$\Phi=0, \theta=25$	-	150	250	ms
Response Time (fall)	Tf	$\Phi=0, \theta=25$	-	200	300	ms

## Controller Information

Built-in ST7565R. Download specification at [http://www.newhavendisplay.com/app\\_notes/ST7565R.pdf](http://www.newhavendisplay.com/app_notes/ST7565R.pdf)

# Timing Characteristics

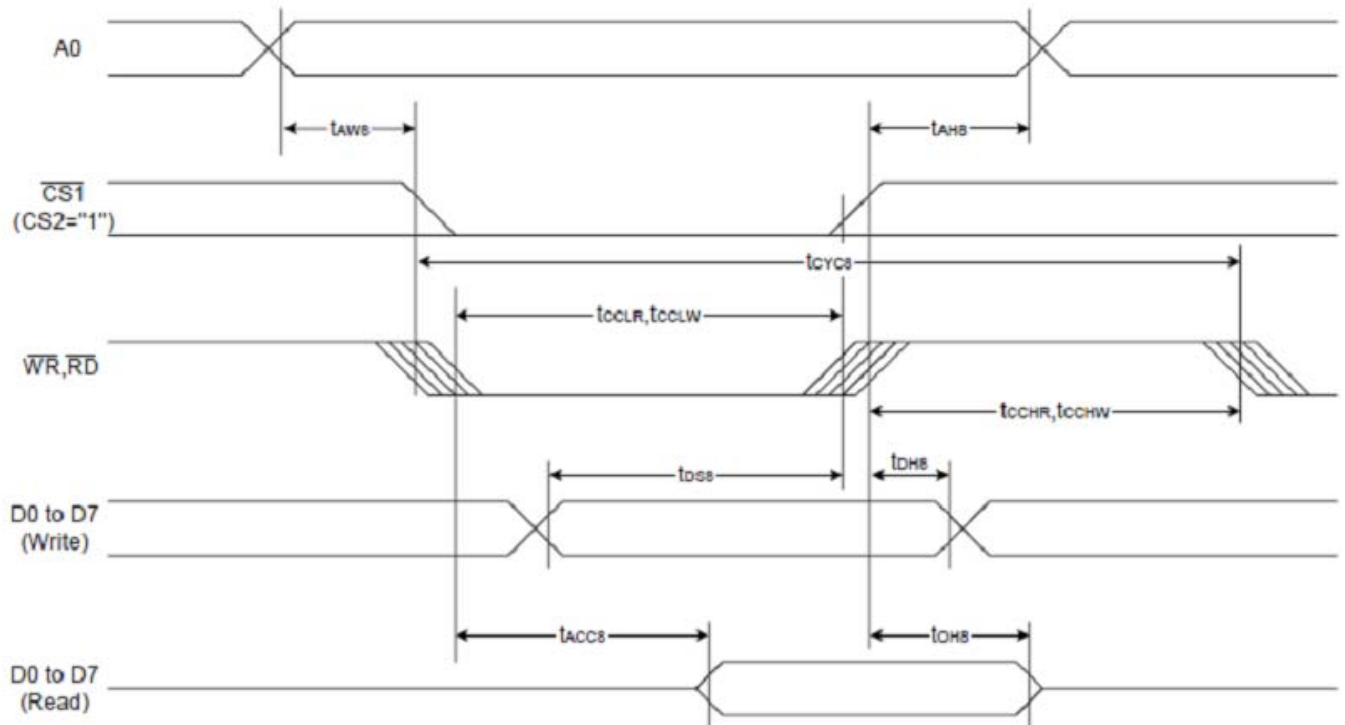
System bus read/write characteristics 1 (for the 8080 series MPU)

(Ta=25°C, VDD=3.0V)

Item	Signal	Symbol	condition	Min.	Max.	Unit
Address hold time	A0	tAH8		0	-	ns
Address setup time		tAW8		0	-	
Address cycle time		tCYC8		240	-	
Enable L pulse width(write)	WR	tCCLW		80	-	
Enable H pulse width(write)		tCCHW		80	-	
Enable L pulse width(read)	RD	tCCLR		140	-	
Enable H pulse width(read)		tCCHR		80	-	
Write data setup time	DB0~DB7	tDS8		40	-	
Write address hold time		tDH8		0	-	
Read access time		tACC8	CL=100Pf	-	70	
Read output disable time		tOH8	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	-	-	

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



# Table of Commands

Table 16: Table of ST7565R Commands

(Note) \*: ignored data

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	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	1	0	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		0	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	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	0	
(19) Sleep mode set	0	1	0	1	0	1	0	1	1	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

## Example Initialization Program

```
void init()
{
    RDD = set;
    WRT = set;
    CS1 = reset;
    RST = set;
    RST = reset;
    delay(2);
    RST = set;
    delay(2);
    comm_out(0xA2);           //1/9 bias
    comm_out(0xA0);         //ADC segment driver direction (A0=Normal)
    comm_out(0xC8);
    delay(2);
    comm_out(0xC0);         //COM output scan direction (C0= Normal)
    comm_out(0x40);         //Operating Mode
    delay(2);
    comm_out(0x25);         //resistor ratio
    comm_out(0x81);         //Electronic volume control set
    comm_out(0x15);         //Set contrast volume set
    delay(2);
    comm_out(0x2F);
    delay(0);
    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 , 48hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 48hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 48hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 48hrs	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 , 48hrs	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 and Terms & Conditions

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