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 Optimal View
W-	Wide Temp
	RoHS Compliant

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Document Revision History

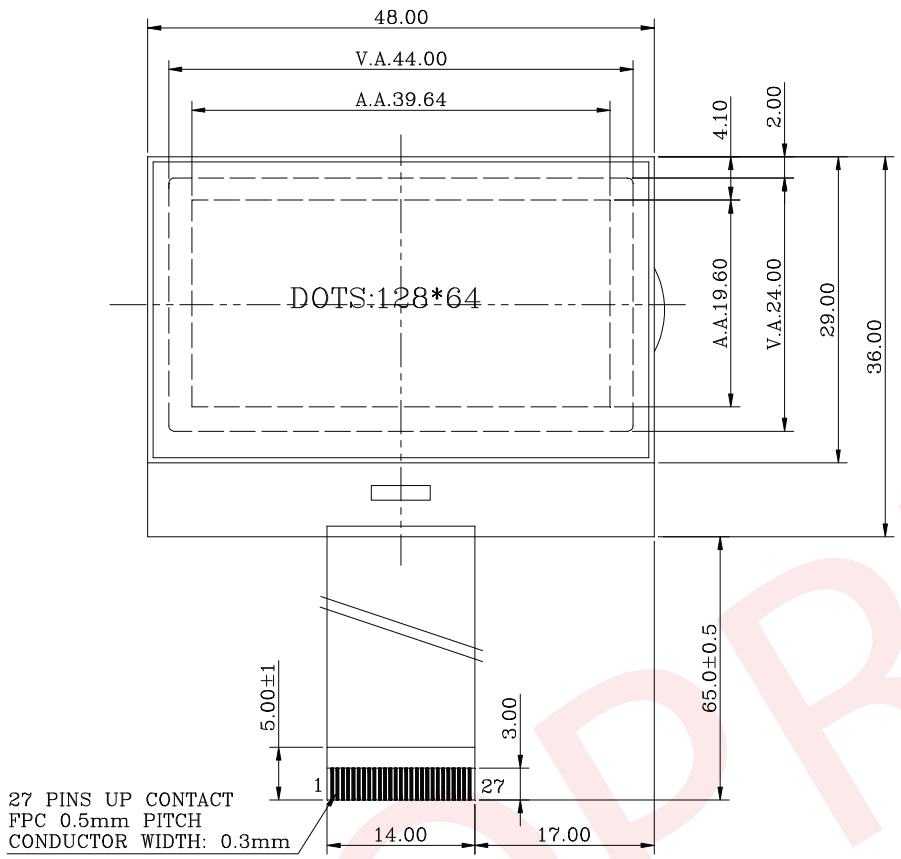
Revision	Date	Description	Changed by
0	5/12/2008	Initial Release	-
1	3/18/2009	User guide reformat	-
2	7/14/2009	User guide reformat	BE
3	5/10/2011	Code Update	JT
4	11/7/2011	Example program updated	AK
5	8/25/16	Mechanical Drawing, Electrical & Optical Char. Updated	SB

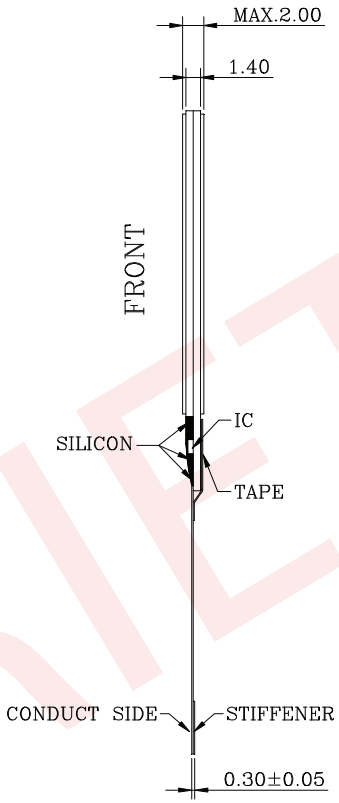
Functions and Features

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

Mechanical Drawing

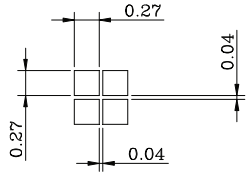
Rev	Description	Date



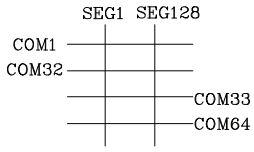


PIN ASSIGNMENT

1	V0
2	V1
3	V2
4	V3
5	V4
6	C4+
7	C2-
8	C2+
9	C1+
10	C1-
11	C3+
12	VOUT
13	VDD
14	VSS
15	DB7
16	DB6
17	DB5
18	DB4
19	DB3
20	DB2
21	DB1
22	DB0
23	RD
24	WR
25	A0
26	RESETB
27	CS1B



DOTS SCALE:1/10



COM & SEG LAYOUT

Notes:

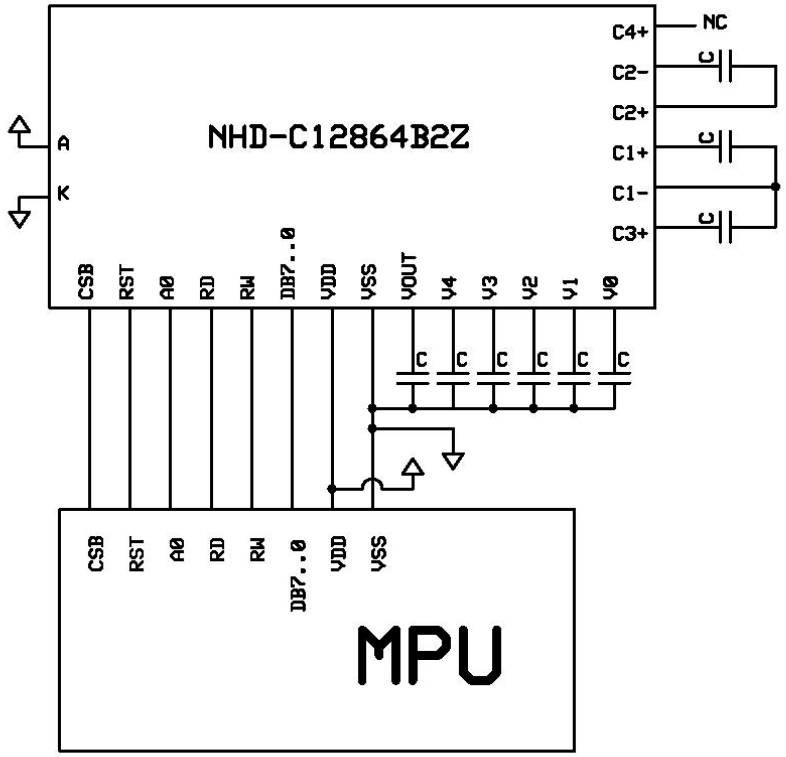
1. Driver:	1/85 Duty, 1/9 Bias
2. Voltage:	3.3V V_{DD}, 8.9V V_{LCD}
3. Optimal View:	6:00
4. Display Mode:	FSTN Positive / Reflective
5. Driver IC:	ST7565R

Unit		
mm	NEWHAVEN DISPLAY INTERNATIONAL	
Gen. Tol.	Date	Part Number:
±0.3	08/25/16	NHD-C12864B2Z-RN-FBW

Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V_0	Power Supply	CAP to VSS (0.1~1Uf)
2	V_1	Power supply	CAP to VSS (0.1~1Uf)
3	V_2	Power Supply	CAP to VSS (0.1~1Uf)
4	V_3	Power Supply	CAP to VSS (0.1~1Uf)
5	V_4	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	V_{OUT}	Power Supply	CAP to VSS (1~2.2uF)
13	V_{DD}	Power Supply	Power Supply for logic
14	V_{SS}	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	T_{OP}	Absolute Max	-20	-	+70	ºC
Storage Temperature Range	T_{ST}	Absolute Max	-30	-	+80	ºC
Supply Voltage	V_{DD}	-	3.0	3.3	3.5	V
Supply Current	I_{DD}	V_{DD} = 3.3V	-	0.5	-	mA
Supply for LCD (contrast)	V_{LCD}	T_{OP} = 25°C	8.7	8.9	9.1	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

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 2	-	40	-	º
	Bottom	φY-		-	60	-	º
	Left	θX-		-	60	-	º
	Right	θX+		-	60	-	º
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.
Please download specification at http://www.newhavendisplay.com/app_notes/ST7565R.pdf

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						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

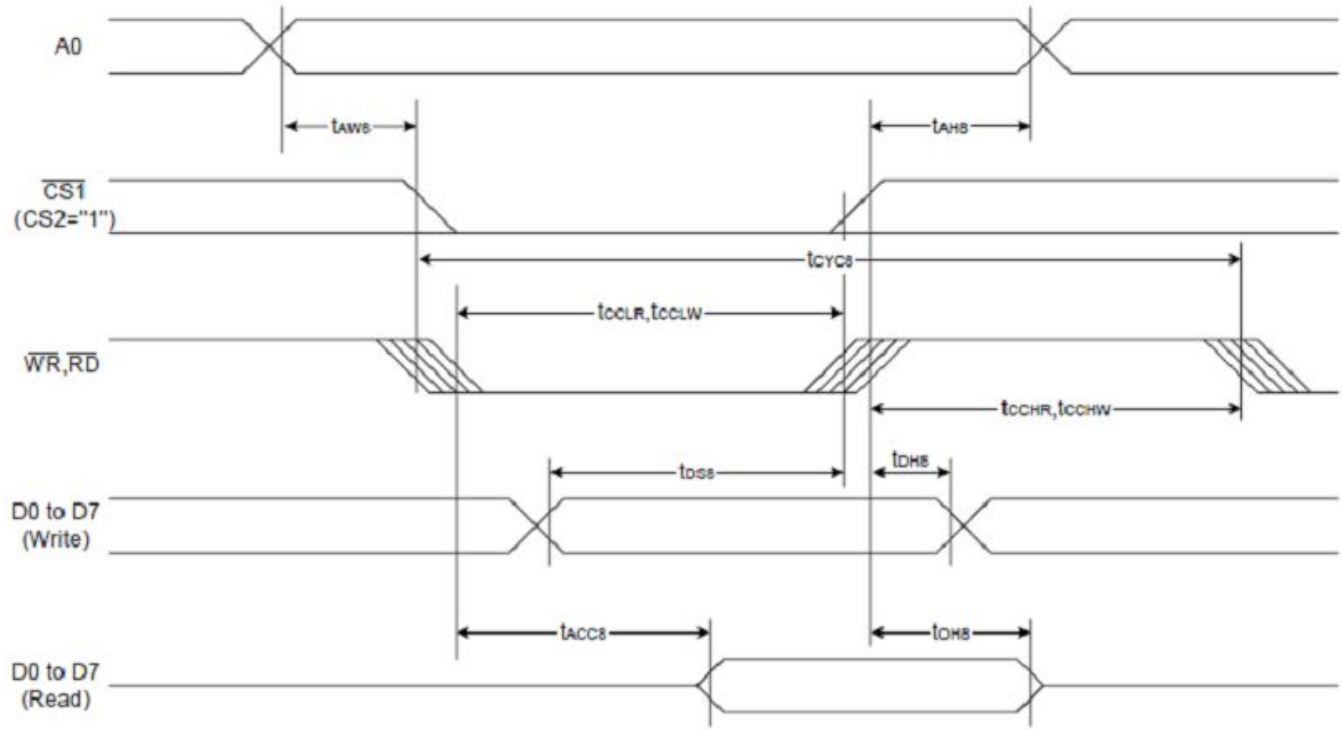
System bus read/write characteristics 1 (for the 8080 series MPU)

(Ta=25℃, VDD=3.0V)

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	/RES	tR	-	-	1.0	us
Reset 'L' pulse width		tRW	1.0	-	-	

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



Example Initialization Program

```
'-------------------------------------------------------------------------------
Sub Init
 Reset P3.7                          'set Read/write to '0' for write
 Reset P3.0                          'RS
 Set P3.1                           'reset
 Reset P3.4 'E
 'Set P3.3
 'Reset P3.3
 Waitms 2
 'Set P3.3
 Waitms 20
 A = &HA2                            '1/9 BIAS
 Call Writecom
 A = &HA0                            'ADC SELECT , NORMAL
 Call Writecom
 A = &HC8                            'COM OUTPUT REVERSE
 Call Writecom
 A = &HA4                            'DISPLAY ALL POINTS NORMAL
 Call Writecom
 A = &H40                            'DISPLAY START LINE SET
 Call Writecom
 A = &H25                            'INTERNAL RESISTOR RATIO
 Call Writecom
 A = &H81                            'ELECTRONIC VOLUME MODE SET
 Call Writecom
 A = &H10                            'ELECTRONIC VOLUME
 Call Writecom
 A = &H2F                            'POWER CONTROLLER SET
 Call Writecom
 A = &HAF                            'DISPLAY ON
 Call Writecom
End Sub

'-------------------------------------------------------------------------------

Sub Writecom
 Reset P3.0                          'A0  low
 Reset P3.7                          'R/W low
 Set P3.6                           'CS2
 Set P3.4                           'E
 P1 = A
 Reset P3.4
 Reset P3.6
 Reset P3.7
End Sub


Sub Writedata
 Set P3.0                           'A0  high
 Reset P3.7                          'R/W low
 Set P3.6                           'CS2
 Set P3.4                           'E
 P1 = A
 Reset P3.4
 Reset P3.6
 Reset P3.7
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 , 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

Warranty Information and Terms & Conditions

http://www.newhavendisplay.com/index.php?main_page=terms