



NHD-2.7-12864UCY3

OLED Display Module

NHD- Newhaven Display 2.7- 2.7" diagonal size

12864- 128 x 64 pixel resolution

UC- Model

Y- Emitting Color: Yellow 3- +3V power supply

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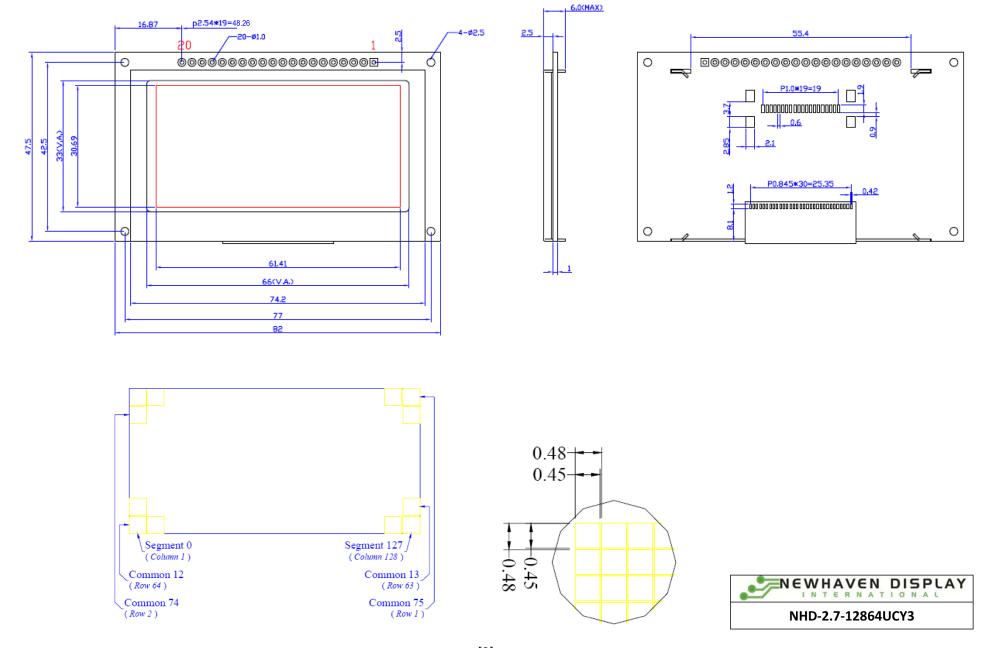
Document Revision History

Revision	Date	Description	Changed by
0	5/1/2011	Initial Product Release	-
1	7/01/2011	Updated Pin Measurement on Mechanical Drawing	MC

Functions and Features

- 128 x 64 pixel resolution
- Built-in SSD1325 controller
- Parallel or serial MPU interface
- Single, low voltage power supply
- RoHS compliant

Mechanical Drawing



Interface Description

Parallel Interface:

Pin No.	Symbol	External Connection	Function Description			
1	VSS	Power Supply	Ground			
2	VDD	Power Supply	Supply Voltage for OLED and logic.			
3	NC	-	No Connect			
4	D/C	MPU	Register select signal. D/C=0: Command, D/C=1: Data			
5	R/W or /WR	MPU	6800-interface:			
			Read/Write select signal, R/W=1: Read R/W: =0: Write			
			8080-interface:			
			Active LOW Write signal.			
6	E or /RD	MPU	6800-interface:			
			Operation enable signal. Falling edge triggered.			
			8080-interface:			
			Active LOW Read signal.			
7-14	DB0 – DB7	MPU	8-bit Bi-directional data bus lines.			
15	NC	-	No Connect			
16	/RES	MPU	Active LOW Reset signal.			
17	/CS	MPU	Active LOW Chip Select signal.			
18	NC	-	No Connect			
19	BS2	MPU	MPU Interface Select signal.			
20	BS1	MPU	MPU Interface Select signal.			

Serial Interface:

Pin No.	Symbol	External	Function Description
		Connection	·
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Supply Voltage for OLED and logic.
3	NC	-	No Connect
4	D/C	MPU	Register select signal. D/C=0: Command, D/C=1: Data
5-6	VSS	Power Supply	Ground
7	SCLK	MPU	Serial Clock signal.
8	SDIN	MPU	Serial Data Input signal.
9	NC	-	No Connect
10-14	VSS	Power Supply	Ground
15	NC	-	No Connect
16	/RES	MPU	Active LOW Reset signal.
17	/CS	MPU	Active LOW Chip Select signal.
18	NC	-	No Connect
19	BS2	MPU	MPU Interface Select signal.
20	BS1	MPU	MPU Interface Select signal.

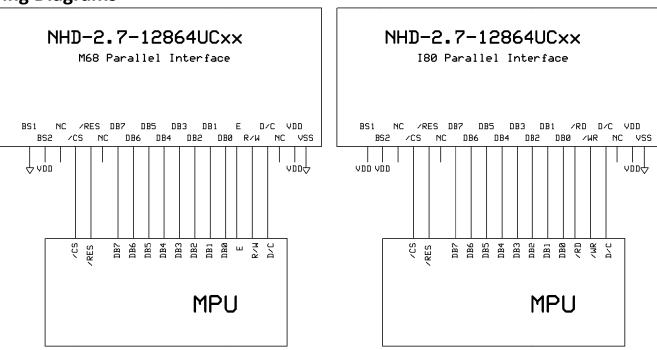
MPU Interface Pin Selections

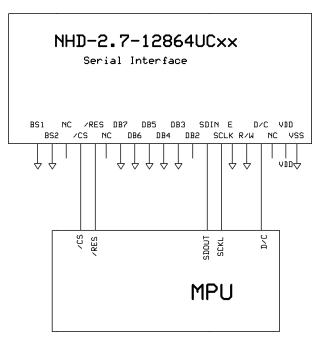
Pin Name	6800 Parallel 8-bit interface	8080 Parallel 8-bit interface	Serial Interface		
BS2	1	1	0		
BS1	0	1	0		

MPU Interface Pin Assignment Summery

Bus			D	ata/C	omm	and Interfa	Control Signals						
Interface	D7 D6 D5 D4 D3 D2 D1 D0									R/W	/cs	D/C	/RES
8-bit 6800					D[7:0]		E	R/W	/CS	D/C	/RES	
8-bit 8080					D[7:0]		/RD	/WR	/CS	D/C	/RES	
SPI	Tie LOW NC SDIN SCLK Tie LOW /CS D/C									/RES			

Wiring Diagrams





Electrical Characteristics

Item	Symbol	Condition	Min.	Тур.	Max.	Unit
Operating Temperature Range	Тор	Absolute Max	-40	-	+85	°C
Storage Temperature Range	Tst	Absolute Max	-40	-	+90	°C
Supply Voltage	VDD		2.4	2.8	3.5	V
Supply Current (logic)	IDD	Ta=25°C, VDD=2.8V	-	250	400	μΑ
Supply Current (display)	ICC	VDD=2.8V, 50% ON	-	31	39	mA
Supply Current (display)	icc	VDD=2.8V, 100% ON	-	53	66	mA
Sleep Mode Current	IDD+ICC _{SLEEP}		-	2	10	μΑ
"H" Level input	Vih		0.8*VDD	1	VDD	V
"L" Level input	Vil		VSS	-	0.2*VDD	V
"H" Level output	Voh		0.9*VDD	-	VDD	V
"L" Level output	Vol		VSS	-	0.1VDD	V

Optical Characteristics

Item	Symbol	Condition	Min.	Тур.	Max.	Unit
Viewing Angle – Vertical (top)	AV		80	-	-	0
Viewing Angle – Vertical (bottom)	AV		80	-	-	0
Viewing Angle – Horizontal (left)	AH		80	-	-	0
Viewing Angle – Horizontal (right)	AH		80	-	-	0
Contrast Ratio	Cr		2000:1	-	-	-
Response Time (rise)	Tr	-	-	10	-	us
Response Time (fall)	Tf	-	-	10	-	us
Brightness		50% checkerboard	70	100	-	cd/m ²
Lifetime		Ta=25°C, 50%	40,000	-	-	Hrs
		checkerboard				

Note: Lifetime at typical temperature is based on accelerated high-temperature operation. Lifetime is tested at average 50% pixels on and is rated as Hours until **Half-Brightness**. The Display OFF command can be used to extend the lifetime of the display.

Luminance of active pixels will degrade faster than inactive pixels. Residual (burn-in) images may occur. To avoid this, every pixel should be illuminated uniformly.

Built-in SSD1325 controller

Instruction Table

lu atuu ati a a	Code										Description	RESET
Instruction	D/C	HEX	DB7	DB6	DB5	B5 DB4 DB3 DB2 DB1 DB0					Description	value
Set Column	0	15	0	0	0	1	0	1	0	1	Set column start and end address	
Address	0	A[5:0]	*	*	A5	A4	А3	A2	A1	A0	A[5:0]: Column start address. Range: 0-63d	0
	0	B[5:0]	*	*	B5	В4	В3	B2	B1	В0	B[5:0]: Column end address. Range: 0-63d	63d
Set Row Address	0	75	0	1	1	1	0	1	0	1	Set row start and end address	
	0	A[6:0]	*	A6	A5	A4	А3	A2	A1	A0	A[6:0]: Row start address. Range: 0-79d	0
	0	B[6:0]	*	В6	B5	В4	В3	B2	B1	В0	B[6:0]: Row end address. Range: 0-79d	79d
Set Contrast	0	81	1	0	0	0	0	0	0	1	Double byte command to select 1 out of 128 contrast steps. Contrast	
Control	0	A[6:0]	*	A6	A5	A4	А3	A2	A1	A0	increases as the value increases.	0x40
Set Current Range	0	84~86	1	0	0	0	0	1	X1	X0	0x84 = Quarter Current Range	0x84
•											0x85 = Half Current Range	
											0x86 = Full Current Range	
Set Remap	0	A0	1	0	1	0	0	0	0	0	A[0] = 0; Disable Column Address remap	0
•	0	A[6:0]	*	A6	*	A4	*	A2	A1	A0	A[0] = 1; Enable Column Address remap	
											A[1] = 0; Disable Nibble remap	0
											A[1] = 1; Enable Nibble remap	
											A[2] = 0; Horizontal Address Increment	0
											A[2] = 1; Vertical Address Increment	
											A[4] = 0; Disable COM remap	0
											A[4] = 1; Enable COM	
											A[6] = 0; Disable COM split Odd/Even	0
											A[6] = 1; Enable COM split Odd/Even	
Set Display Start	0	A1	1	0	1	0	0	0	0	1	Set display RAM display start line register from 0-79.	0
Line	0	A[6:0]	*	A6	A5	A4	А3	A2	A1	A0		
Set Display Offset	0	A2	1	0	1	0	0	0	1	0	Set vertical shift by COM from 0~79.	0
	0	A[6:0]	*	A6	A5	A4	А3	A2	A1	A0		
Display Mode	0	A4/A7	1	0	1	0	0	X2	X1	X0	0xA4 = Normal display	0xA4
		-									0xA5 = Entire display ON, all pixels Grayscale level 15	
											0xA6 = Entire display OFF	
											0xA7 = Inverse display	
Set Multiplex	0	A8	1	0	1	0	1	0	0	0	Set MUX ratio to N+1 MUX	80
Ratio	0	A[6:0]	*	A6	A5	A4	А3	A2	A1	A0	N=A[6:0]; from 16MUX to 80MUX (0 to 14 are invalid)	
Master	0	AD	1	0	1	0	1	1	0	1	A[0] = 0; Disable DC-DC converter	
configuration	0	A[1:0]	*	*	*	*	*	*	A1	A0	A[0] = 1; Enable DC-DC converter	1
											A[1] = 0; Disable internal VCOMH	
											A[1] = 1; Enable internal VCOMH	1

Set Display ON/ OFF	0	AE~AF	1	0	1	0	Х3	1	1	1	0xAE = Display OFF (sleep mode) 0xAF = Display ON	AEh
Set VCOMH	0	BE	1	0	1	1	1	1	1	0	Sets the VCOMH voltage level 000000-011111.	010001
Voltage	0	A[5:0]	*	*	A5	A4	А3	A2	A1	A0	A[5:0] = 1xxxxx = 1.0*VREF	
Set Precharge	0	ВС	1	0	1	1	1	1	0	0	Sets the precharge voltage level 00000000-00011111	00011000
Voltage	0	A[7:0]	A7	A6	A5	A4	А3	A2	A1	A0	A[7:0] = 1xxxxxxx connects to VCOMH	
											A[7:0] = 001xxxxx equals 1.0*VREF	
Set Phase Length	0	B1	1	0	1	1	0	0	0	1		
	0	A[3:0]	*	*	*	*	А3	A2	A1	A0	A[3:0] = P1. Phase 1 period of 1-15 DCLK clocks	3 5
	0	A[7:4]	A7	A6	A5	A4	*	*	*	*	A[7:4] = P2. Phase 2 period of 1-15 DCLK clocks	-
Set Row Period	0	B2	1	0	1	1	0	0	1	0	Sets number of DCLKs (K) per row. Range 2-158DCLKs.	37DCLKs
	0	A[7:0]	A7	A6	A5	A4	A3	A2	A1	A0	K = P1 + P2 + GS15 pulse width (RESET values: 3 + 5 + 29)	(0x25)
Set Display Clock	0	В3	1	0	1	1	0	0	1	1	A[3:0] = Define the divide ratio of the display clocks. Range 1-16	2
Divide Ratio /	0	A[3:0]	*	*	*	*	А3	A2	A1	A0	Divide ratio = A[3:0] +1	
Oscillator	0	A[7:4]	A7	A6	A5	A4	*	*	*	*	A[7:4] = Set the Oscillator Frequency. Frequency increases with the	0
Frequency											value of A[7:4]. Range 0000b~1111b.	
Set Grayscale	0	B8	1	0	0	0	1	0	0	0	Sets the gray scale level. Range 1-15	
Table	0	A[2:0]	*	*	*	*	*	A2	A1	A0	A[2:0] = L1	1
	0	B[2:0]	*	*	*	*	*	B2	B1	В0	B[2:0] = L2	1
	0	B[6:4]	*	В6	B5	В4	*	*	*	*	B[6:4] = L3	1
	0	C[2:0]	*	*	*	*	*	C2	C1	C0	C[2:0] = L4	1
	0	C[6:4]	*	C6	C5	C4	*	*	*	*	C[6:4] = L5	1
	0	D[2:0]	*	*	*	*	*	D2	D1	D0	D[2:0] = L6	1
	0	D[6:4]	*	D6	D5	D4	*	*	*	*	D[6:4] = L7	1
	0	E[2:0]	*	*	*	*	*	E2	E1	EO	E[2:0] = L8	1
	0	E[6:4]	*	E6	E5	E4	*	*	*	*	E[6:4] = L9	1
	0	F[2:0]	*	*	*	*	*	F2	F1	F0	F[2:0] = L10	1
	0	F[6:4]	*	F6	F5	F4	*	*	*	*	F[6:4] = L11	1
	0	G[2:0]	*	*	*	*	*	G2	G1	G0	G[2:0] = L12	1
	0	G[6:4]	*	G6	G5	G4	*	*	*	*	G[6:4] = L13	1
	0	H[2:0]	*	*	*	*	*	H2	H1	но	H[2:0] = L14	1
	0	H[6:4]	*	Н6	Н5	Н4	*	*	*	*	H[6:4] = L15	1
Set Biasing	0	CF	1	1	0	0	1	1	1	1	0xF0 = HIGH	0xF0
Current for DC-DC	0	A[7:6]	A7	A6	*	*	*	*	*	*	0x70 = LOW	
converter		_ •										
NOP	0	E3	1	1	1	0	0	0	1	1	Command for No Operation	

 $\textbf{For detailed instruction information, see datasheet:} \ \underline{\texttt{http://www.newhavendisplay.com/app_notes/SSD1325.pdf}}$

MPU Interface

For detailed timing information, see datasheet: http://www.newhavendisplay.com/app_notes/SSD1325.pdf

6800-MPU Parallel Interface

The parallel interface consists of 8 bi-directional data pins, R/W, D/C, E, and /CS.

A LOW on R/W indicates write operation, and HIGH on R/W indicates read operation.

A LOW on D/C indicates "Command" read or write, and HIGH on D/C indicates "Data" read or write.

The E input serves as data latch signal, while /CS is LOW. Data is latched at the falling edge of E signal.

Function	E	R/W	/cs	D/C
Write Command	\downarrow	0	0	0
Read Status	\downarrow	1	0	0
Write Data	\downarrow	0	0	1
Read Data	\downarrow	1	0	1

8080-MPU Parallel Interface

The parallel interface consists of 8 bi-directional data pins, /RD, /WR, D/C, and /CS.

A LOW on D/C indicates "Command" read or write, and HIGH on D/C indicates "Data" read or write.

A rising edge of /RS input serves as a data read latch signal while /CS is LOW.

A rising edge of /WR input serves as a data/command write latch signal while /CS is LOW.

Function	/RD	/WR	/cs	D/C
Write Command	1	\uparrow	0	0
Read Status	1	1	0	0
Write Data	1	\uparrow	0	1
Read Data	\uparrow	1	0	1

Alternatively, /RD and /WR can be kept stable while /CS serves as the data/command latch signal.

Function	/RD	/WR	/cs	D/C
Write Command	1	0	\uparrow	0
Read Status	0	1	\uparrow	0
Write Data	1	0	\uparrow	1
Read Data	0	1	\uparrow	1

Serial Interface

The serial interface consists of serial clock SCLK, serial data SDIN, D/C, and /CS.

D0 acts as SCLK and D1 acts as SDIN. D2 should be left open. D3~D7, E, and R/W should be connected to GND.

Function	/RD	/WR	/cs	D/C	D0
Write Command	0	0	0	0	\uparrow
Write Data	0	0	0	1	\uparrow

SDIN is shifted into an 8-bit shift register on every rising edge of SCLK in the order of D7, D6,...D0. D/C is sampled on every eighth clock and the data byte in the shift register is written to the GDRAM or command register in the same clock.

Note: Read is not available in serial mode.

For detailed protocol information, see datasheet: http://www.newhavendisplay.com/app notes/SSD1325.pdf

Example Initialization Sequence:

```
Set_Display_On_Off_12864(0x00);
                                             // Display Off (0x00/0x01)
Set Display Clock 12864(0x91);
                                             // Set Clock as 135 Frames/Sec
Set_Multiplex_Ratio_12864(0x3F);
                                             // 1/64 Duty (0x0F~0x5F)
Set_Display_Offset_12864(0x4C);
                                             // Shift Mapping RAM Counter (0x00~0x5F)
Set_Start_Line_12864(0x00);
                                             // Set Mapping RAM Display Start Line (0x00~0x5F)
Set_Master_Config_12864(0x00);
                                             // Disable Embedded DC/DC Converter (0x00/0x01)
Set_Remap_Format_12864(0x50);
                                             // Set Column Address 0 Mapped to SEG0
                                             //
                                                 Disable Nibble Remap
                                             //
                                                 Horizontal Address Increment
                                             // Scan from COM[N-1] to COM0
                                                 Enable COM Split Odd Even
Set Current Range 12864(0x02);
                                             // Set Full Current Range
Set Gray Scale Table 12864();
                                             // Set Pulse Width for Gray Scale Table
Set_Contrast_Current_12864(brightness);
                                             // Set Scale Factor of Segment Output Current Control
Set_Frame_Frequency_12864(0x51);
                                             // Set Frame Frequency
Set_Phase_Length_12864(0x55);
                                             // Set Phase 1 as 5 Clocks & Phase 2 as 5 Clocks
Set_Precharge_Voltage_12864(0x10);
                                             // Set Pre-Charge Voltage Level
Set_Precharge_Compensation_12864(0x20,0x02);
                                                    // Set Pre-Charge Compensation
Set_VCOMH_12864(0x1C);
                                             // Set High Voltage Level of COM Pin
Set VSL 12864(0x0D);
                                             // Set Low Voltage Level of SEG Pin
Set_Display_Mode_12864(0x00);
                                             // Normal Display Mode (0x00/0x01/0x02/0x03)
Fill RAM 12864(0x00);
                                             // Clear Screen
Set_Display_On_Off_12864(0x01);
                                             // Display On (0x00/0x01)
```

Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Test the endurance of the display at high storage temperature.	+90°C , 240hrs	2
Low Temperature storage	Test the endurance of the display at low storage temperature.	-40°C , 240hrs	1,2
High Temperature Operation	Test the endurance of the display by applying electric stress (voltage & current) at high temperature.	+85°C 240hrs	2
Low Temperature Operation	Test the endurance of the display by applying electric stress (voltage & current) at low temperature.	-40°C , 240hrs	1,2
High Temperature / Humidity Operation	Test the endurance of the display by applying electric stress (voltage & current) at high temperature with high humidity.	+60°C, 90% RH, 240hrs	1,2
Thermal Shock resistance	Test the endurance of the display by applying electric stress (voltage & current) during a cycle of low and high temperatures.	-40°C,30min -> 25°C,5min -> 85°C,30min = 1 cycle 100 cycles	
Vibration test	Test the endurance of the display by applying vibration to simulate transportation and use.	10-22Hz , 15mm amplitude. 22-500Hz, 1.5G 30min in each of 3 directions X,Y,Z	3
Atmospheric Pressure test	Test the endurance of the display by applying atmospheric pressure to simulate transportation by air.	115mbar, 40hrs	3
Static electricity test	Test the endurance of the display by applying electric static discharge.	VS=800V, RS=1.5k Ω , CS=100pF One time	

Note 1: No condensation to be observed.

Note 2: Conducted after 2 hours of storage at 25°C, 0%RH.

Note 3: Test performed on product itself, not inside a container.

Evaluation Criteria:

- 1: Display is fully functional during operational tests and after all tests, at room temperature.
- 2: No observable defects.
- 3: Luminance >50% of initial value.
- 4: Current consumption within 50% of initial value

Precautions for using OLEDs/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

Newhaven Display International, Inc. reserves the right to alter this product or specification at any time without notification.