

PRODUCT CATALOG

Featuring OLED, LCD and VFD Technologies



“Committed to providing the highest quality display products and design services.”



COMPANY PROFILE

Since 2001, Newhaven Display has been providing the North American marketplace with cost effective, high quality OLED, LCD, and VFD display devices. In addition to our vast standard part offerings, we develop custom designs for all industries. We pride ourselves on first-rate customer support and development assistance.

We have two office locations, USA and China. All products are stocked at our Elgin, Illinois USA warehouse. Marketing is done through a nationwide network of independent sales representatives and stocking distributors. All displays are manufactured at our partner factories located in Mainland China and Taiwan. These are state-of-the-art facilities with extensive experience in display development. Our facilities are TS-16949, ISO-9001 and ISO-14001 certified.

Your Advantages

Newhaven Display customers enjoy a 7-point advantage by using our products:

- 1) **PRODUCT KNOWLEDGE:** Our staff consists of industry experts with a clear focus on current display technologies being developed for the North American marketplace.
- 2) **GLOBAL DISPLAY TECHNOLOGY SOLUTIONS:** Utilizing our global partner/supplier relationships, our customers enjoy the most basic display solutions to highly complex turnkey solutions. We offer one of the largest supplies of standard displays in the industry.
- 3) **COST EFFECTIVE PRODUCTS:** Our high quality products are manufactured in state-of-the-art ISO certified factories located throughout Mainland China and Taiwan.
- 4) **TIME TO MARKET:** Our expedited lead times allow customers to go from product idea to actual production faster than anyone else in the market. We maintain this speed by offering JIT/MRP programs.
- 5) **TECHNICAL SUPPORT:** Our Engineering Department provides high quality hardware and software design support.
- 6) **US ENVIRONMENTAL TESTING:** Our US facility in Elgin, Illinois offers state-of-the-art temperature, humidity and vibration testing.
- 7) **VALUE-ADD SERVICES:** In addition to modifying displays, we offer custom plastic injection molding, metal stamping and complete assembly productions.



• Global Sourcing • Expert Design • Quality Displays



CONTENTS

■ Organic Light Emitting Diode (OLED)

- I-2 OLED Technology
- I-3 OLED Character Font Tables
- I-4 Standard OLED Product Tables
- I-6 Slim OLED Technology
- I-7 Slim OLED Product Tables
- I-8 Multi-Font OLED Technology
- I-9 Multi-Font OLED Product Tables
- I-10 Full Color OLED Technology
- I-11 Full Color OLED Product Tables

■ Liquid Crystal Display (LCD)

- 2-2 LCD Active Matrix TFT Technology
- 2-3 LCD Touch Panels
- 2-4 LCD TFT Product Tables
- 2-10 LCD Passive Matrix Technology
- 2-11 LCD Passive Matrix Display Types
- 2-12 LCD Display Modes
- 2-13 LCD Light Modes
- 2-14 LCD Backlight Color Options
- 2-16 LCD Connection Methods
- 2-17 LCD Character Font Tables
- 2-18 LCD Product Tables

■ Newhaven Display Development Tools

- 3-1 NHDev Development Board
- 3-2 LCD Controller Boards

■ Vacuum Fluorescent Display (VFD)

- 4-2 VFD Technology
- 4-3 VFD Terminology
- 4-4 VFD Classifications
- 4-5 VFD Product Tables



OLED Displays

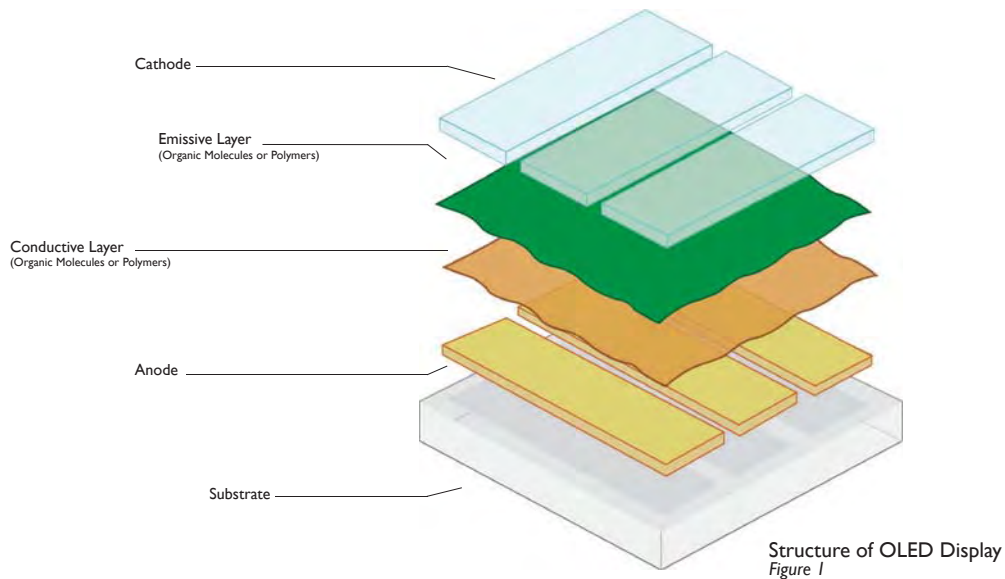


OLED Technology

How it works

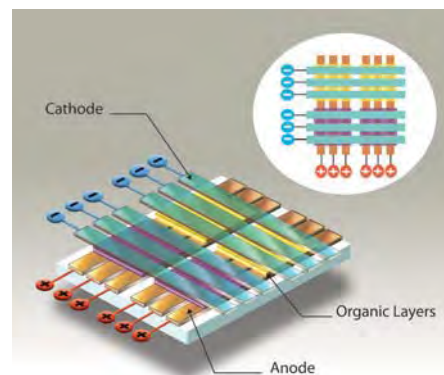
Organic Light Emitting Diode (OLED) Displays are brighter, higher contrast displays that have faster response times, wider viewing angles and use less power than the conventional VFD, LED, or LCD displays. OLED Displays are self-illuminating, therefore they do not require a backlight for maximum visibility in all environments. This allows OLEDs to be significantly thinner than standard VFD, LED, or LCD displays.

OLED Displays are made up of a layer of organic material placed between two conductors (see Fig. 1). These two conductors (an anode and a cathode) are then positioned between a glass top plate (seal) and a glass bottom plate (substrate). When an electric current is applied to the two conductors, the organic material produces a bright, electroluminescent light. When energy passes from the negatively charged layer (cathode) to the other (anode) layer, it stimulates the organic material between the two, which in turn, emits light that is visible through the outermost layer of glass.



How color is produced

In order for OLED displays to produce color, an electric current is needed to stimulate the relevant pixels on the OLED display. The pixels are created by the perpendicular arrangement of the cathodes and anodes (see Fig. 2). Light is emitted where the cathodes and anodes intersect. The electric current applied to the selected strips of anodes and cathodes determine which pixels get turned on and which pixels remain off. The brightness of each pixel is proportional to the amount of applied current.



English / Russian Character Font Table

[illegible]

	Lower 4-bit	Upper 4-bit															
		LLLL	LLHH	LLHL	LLHH	LHLH	LHLH	LHHH	LHHH	HLLL	HLLH	HHLH	HHLH	HHLL	HHHL	HHHL	HHHH
LLLL	CG RAM (1)																
LLLL	CG RAM (2)																
LLHL	CG RAM (3)																
LLHH	CG RAM (4)																
LHLH	CG RAM (5)																
LHLH	CG RAM (6)																
LHHL	CG RAM (7)																
LHHH	CG RAM (8)																
HLLL	CG RAM (9)																
HLLH	CG RAM (10)																
HLHL	CG RAM (11)																
HLHH	CG RAM (12)																
HHLH	CG RAM (13)																
HHHL	CG RAM (14)																
HHHL	CG RAM (15)																
HHHH	CG RAM (16)																

Western European Character Font Table 2

Lower 4-bit \ Upper 4-bit	LLLL	LLHL	LLHH	LHLH	LHLH	LHLH	LHHH	HLLL	HLHL	HLHL	HLHL	HHHL	HHHH
LLLL	CG RAM (1)												
LLLL	CG RAM (2)												
LLHL	CG RAM (3)												
LLHH	CG RAM (4)												
LHLH	CG RAM (5)												
LHLH	CG RAM (6)												
LHHH	CG RAM (7)												
LHHH	CG RAM (8)												
HLLL	CG RAM (9)												
HLLH	CG RAM (10)												
HLLH	CG RAM (11)												
HLHH	CG RAM (12)												
HLHL	CG RAM (13)												
HHHL	CG RAM (14)												
HHHL	CG RAM (15)												
HHHH	CG RAM (16)												

	Upper 4-bit	LLLL	LLHL	LLHH	LHLL	LHHL	LHHH	LLLL	LLHL	LLHL	HLHL	HLHL	HHLL	HHHL	HHHH
LLLL	CG RAM (1)														
LLLL	CG RAM (2)														
LLHL	CG RAM (3)														
LLHH	CG RAM (4)														
LHLL	CG RAM (5)														
LHLH	CG RAM (6)														
LHHL	CG RAM (7)														
LHHH	CG RAM (8)														
LLLL	CG RAM (9)														
LLHL	CG RAM (10)														
LLHL	CG RAM (11)														
LLHH	CG RAM (12)														
HLHL	CG RAM (13)														
HLHL	CG RAM (14)														
HHHL	CG RAM (15)														
HHHH	CG RAM (16)														

OLED Character Displays

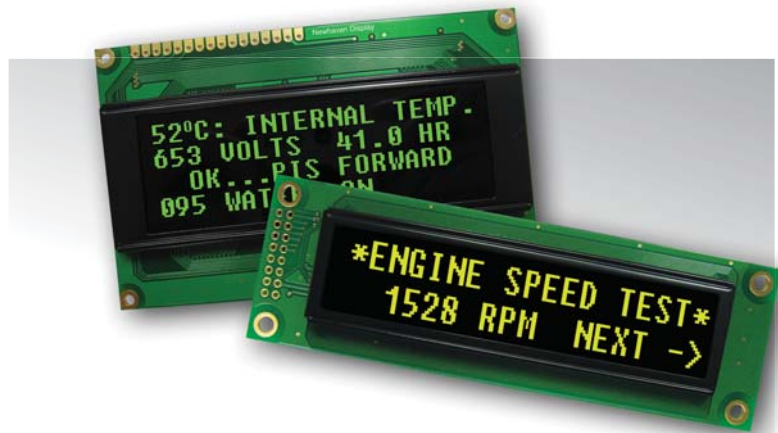
Character OLED displays can be used as compatible replacements for some of our Character LCD displays and VFD displays. To the right is a chart indicating which LCD Character and VFD modules the Character OLEDs can replace.

Compatible Displays		
Character OLED Models	Character LCD Models	VFD Module Models
NHD-0216KZW NHD-0216SZW NHD-0220DZW NHD-0420DZW	NHD-0216K1Z NHD-0216SZ NHD-0220DZ NHD-0420DZ	M0216SD-162SDAR2-I M0216MD-162MDBR2-J M0220SD-202SDAR I M0420SD-204SDAR I-3

Lines x Characters	Newhaven Part Number	Display Mode/ Color Options (ending suffixes)	Module Size (W x H) mm	Interface	Brightness cd/m ²	Life to 1/2 Brightness (hrs)	Operating Temperature
2 x 16	NHD-0216KZW-A	Y5 (Yellow) G5 (Green) B5 (Blue)	80 x 36	Parallel/ 3-wire SPI	125	50K	-40°C - +80°C
2 x 16	NHD-0216SZW-B	Y5 (Yellow) G5 (Green) B5 (Blue)	122 x 40	Parallel/ 3-wire SPI	90	100K	-40°C - +80°C
2 x 20	NHD-0220DZW-A	Y5 (Yellow) G5 (Green) B5 (Blue)	116 x 37	Parallel/ 3-wire SPI	125	100K	-40°C - +80°C
4 x 20	NHD-0420DZW-A	Y5 (Yellow) G5 (Green) B5 (Blue)	98 x 60	Parallel/ 3-wire SPI	90 40 (Blue)	100K 50k (Blue)	-40°C - +80°C
2 x 16	NHD-0216MW-A	B3 (Blue)	41 x 20	4/8-bit Parallel/ SPI/ I ² C	80	25K	-40°C - +85°C
2 x 16	NHD-0216MW-P	B3 (Blue)	49 x 24	4/8-bit Parallel	80	25K	-40°C - +85°C
2 x 16	NHD-0216MW-E	B3 (Blue)	49 x 27	RJ-45 SPI	80	25K	-40°C - +85°C
2 x 16	NHD-0216MW	-SB3 (Blue) -IB3 (Blue)	49 x 24	SPI (-SB3) / I ² C (-IB3)	80	25K	-40°C - +85°C
2 x 16	NHD-0216AW	-SB3 (Blue) -IB3 (Blue)	49 x 26	SPI (-SB3) / I ² C (-IB3)	80	25K	-40°C - +85°C

Key Features:

- Fast response time: 10 μs
- Wide viewing angle: up to 160°
- Thin designs
- Self-illuminated; no backlight necessary
- Low power consumption
- High brightness
- High contrast ratio: 2000:1
- Wide operation temperature: -40°C to +80°C
- Serial or parallel MPU interface
- Character module OLEDs include 4 built-in font tables.
- RoHS compliant



OLED Graphic Displays

Key Features:

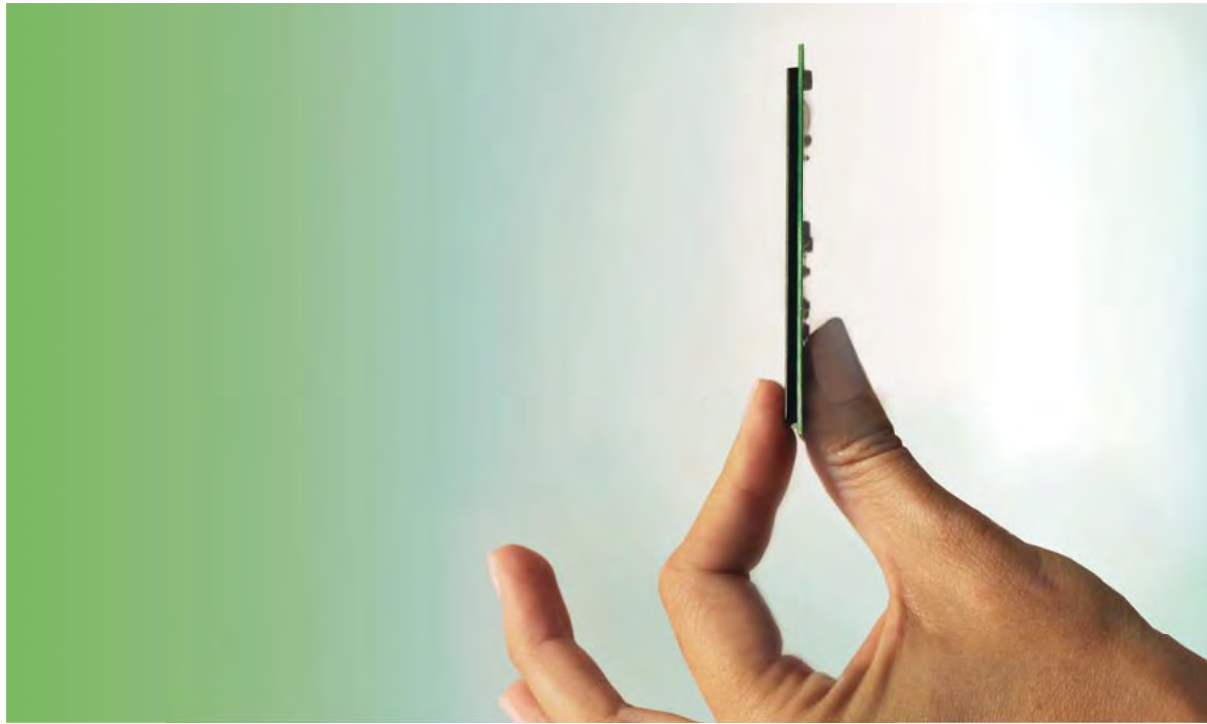
- Fast response time: 10 μ s
- Wide viewing angle: up to 160°
- Thin designs
- Self-illuminated; no backlight necessary
- Low power consumption
- High brightness
- High contrast ratio: 2000:1
- Wide operation temperature: -40°C to +80°C
- Serial or parallel MPU interface
- Graphic module OLEDs include required external logic and voltages
- RoHS compliant



Newhaven Display's Graphic OLED modules are easy to use, all-in-one designs. Most Graphic OLED displays require multiple high-voltage power supplies and external logic components. Newhaven Display's custom designed module boards for each Graphic OLED allow the user to have just one interface supply. The Graphic OLED module board has all the required external logic components, making it fast and easy to start using the displays.

Diagonal Size (inches)	Newhaven Part Number	Display Mode/ Color Options (ending suffixes)	Module Size (W x H) mm	Interface	Brightness cd/m ²	Life to 1/2 Brightness (hrs)	Operating Temperature
2.23	NHD-2.23-12832UC	Y3 (Yellow) B3 (Blue) W3 (White)	63 x 43	8-bit Parallel/ I ² C/ SPI	120	40K 10K (B3/W3)	-40°C - +85°C
2.7	NHD-2.7-12864WD	Y3 (Yellow) Y3-M (Molex conn.)	82 x 47	8-bit Parallel/ 3-wire SPI or 4-wire SPI	100	60K	-40°C - +85°C
2.7	NHD-2.7-12864WD	W3 (White) W-M (Molex conn.)	82 x 47	8-bit Parallel/ 3-wire SPI or 4-wire SPI	80	30K	-40°C - +85°C
2.8	NHD-2.8-25664UC	Y2 (Yellow) B2 (Blue)	85 x 39	8-bit Parallel/ 3-wire SPI or 4-wire SPI	80	40K 10K (Blue)	-40°C - +85°C
3.12	NHD-3.12-25664UC	Y2 (Yellow) B2 (Blue) W2 (White)	89 x 44	8-bit Parallel/ 3-wire SPI or 4-wire SPI	80	40K 10K (B2/W2)	-40°C - +85°C

OLED Slim Technology



The slim character OLEDs bring to Newhaven Display's vast product line a more affordable OLED option that is half the thickness and twice the contrast. Available in 2x16, 2x20 and 4x20 character formats, the slim character OLEDs add additional color options to the OLED display line. Red, green, blue, and yellow color options are offered in each display size. These displays come packaged as a complete module that includes all required logic at only a 5mm thickness. With 3 built-in font tables, 10,000:1 contrast ratio, 10μsec response time, and built-in screen savers, these new displays will offer any industry an upgrade to their current monochromatic character application.

Standard vs Slim Character OLEDs

The Slim Character OLEDs feature several upgrades to the standard character OLED display types.

Characteristic	Standard OLED Display	Slim OLED Display
Contrast Ratio	2,000:1	10,000:1
Interface	Serial/Parallel	SPI, I ² C, Parallel
Module Thickness	10mm	5mm
Character	Standard height	Standard height and Double-height
Power Supply	3.0VDD-5.0VDD	2.4VDD-3.6VDD

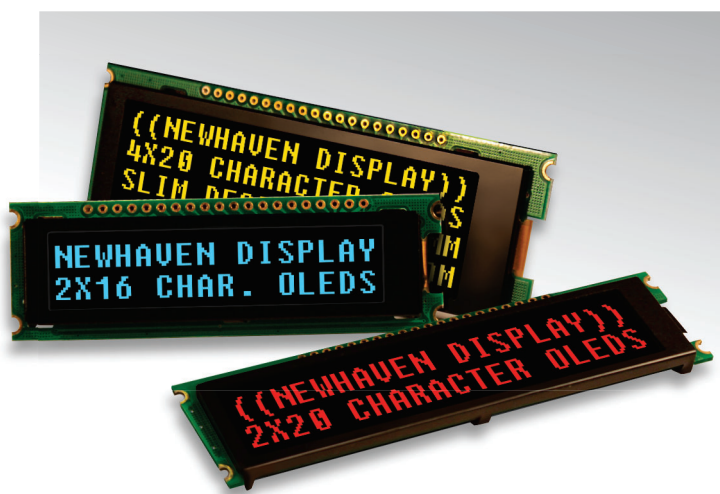


*This image illustrates the difference in thickness between the standard character (right) and the slim character (left) OLED display.

OLED Slim Character Displays

Key Features:

- Only 5mm thin
- Yellow, blue, red, or green colors
- Response time: 10 microseconds
- Serial and parallel interface
- 3 built-in font tables
- Double height characters
- -40°C - +85°C operating temperature
- Contrast ratio: 10,000:1
- Viewing angle: >160°
- US2066 built-in controller
- Low power 2.4 ~ 3.6VDD
- Built-in screen saver
- Built-in required logic
- RoHS compliant



Lines x Characters	Newhaven Part Number	Display Mode/ Color Options (ending suffixes)	Module Size (W x H) mm	Interface	Brightness cd/m ²	Life to 1/2 Brightness (hrs)	Operating Temperature
2 x 16	NHD-0216CW-A	Y3 (Yellow) G3 (Green) B3 (Blue) W3 (White)	76 x 25	Parallel, I ² C, SPI	150	80K	-40°C - +85°C
2 x 20	NHD-0220CW-A	Y3 (Yellow) G3 (Green) B3 (Blue) W3 (White)	92 x 23	Parallel, I ² C, SPI	150	80K	-40°C - +85°C
4 x 20	NHD-0420CW-A	Y3 (Yellow) G3 (Green) B3 (Blue) W3 (White)	92 x 32	Parallel, I ² C, SPI	120	150K	-40°C - +85°C

*Brightness and Lifetime is based off of the yellow OLED. These numbers may vary between the different color options.

OLED Multi-Font Technology

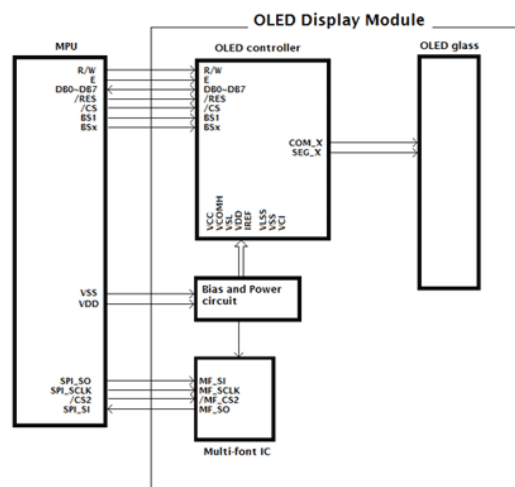


The Multi-Font Graphic OLEDs feature an additional serial interface IC that has 50+ languages and 37 font tables. This Multi-Font IC contains ASCII, Unicode, and ISO8859 tables for flexibility and compatibility. The fonts featured are either fixed width or proportional width and can be read at a clock rate up to 30 MHz. When using this display line, the user's MPU can communicate directly with the Multi-Font IC to read the font data strings and then output the desired character onto the display. Using just a 4-wire SPI interface, the selected font data is read in vertical structured bytes from the Multi-Font IC and is sent out of the display's controller.

How it works

The Multi-Font Graphic OLEDs have a built-in serial interface memory IC with preloaded font tables. These font tables contain the dot-matrix (pixel) data that makes up each individual character in the supported languages.

The multi-font IC communicates with the main host MPU by receiving the specified font address and then sending the dot-matrix data back to the main host MPU. When the data is received by the main host MPU, it can then be written to the Display Data RAM.



OLED Multi-Font Displays

The Multi-Font displays have the ability to support multiple languages on one display due to the variety of predefined font tables. These charts represent the various languages and features the predefined font tables on this display type.

Supported Languages

English	Slovak	Latvian
French	Polish	Lithuanian
Italian	Hungarian	Turkish
Dutch	Romanian	Ukrainian
Spanish	Slovenian	Bulgarian
Portuguese	Croatian	Serbian
German	Russian	Macedonian
Thai	Maltese	Azeri
Japanese	Albanian	Kyrgyz
Korean	Vietnamese	Tajik
Chinese	Malaysian	Turkmen
Faroeese	Indonesian	Uzbek
Greenlandic	Greek	Kazakh
Icelandic	Arabic	Mongolian
Finnish	Farsi	Tagalog
Estonian	Urdu	Kiswahili
Czech	Pashto	Hebrew

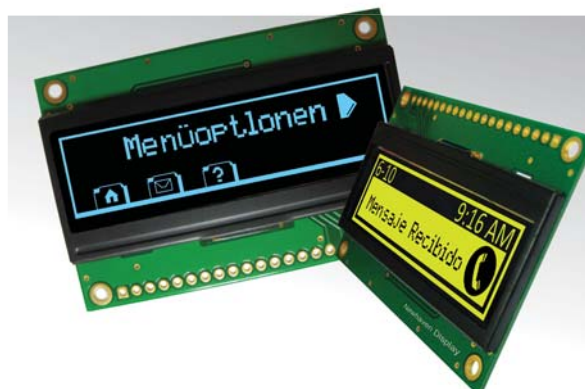
Predefined Font Tables

ISO8859	Width-Adjusted Latin
5x7 ASCII	Width-Adjusted Greek
7x8 ASCII	Width-Adjusted Cyrillic
8x16 Bold ASCII	Width-Adjusted Arabic
Width-adjusted Arial ASCII	GB2312
8x16 Latin	5x10 LCM
8x16 Greek	KSC5605
8x16 Hebrew	JIS0208
8x16 Thai	

Diagonal Size (inches)	Newhaven Part Number	Display Mode/ Color Options (ending suffixes)	Module Size (W x H) mm	Interface	Brightness cd/m ²	Life to 1/2 Brightness (hrs)	Operating Temperature
2.23	NHD-2.23-12832UM	Y3 (Yellow) B3 (Blue)	63 x 43	8-bit Parallel/I ² C/ SPI	120	40K 10K (Blue)	-20°C - +70°C
2.8	NHD-2.8-25664UM	Y3 (Yellow) B3 (Blue)	85 x 39	8-bit Parallel/ 3-wire SPI or 4-wire SPI	80	40K 10K (Blue)	-20°C - +70°C
3.12	NHD-3.12-25664UM	Y3 (Yellow) B3 (Blue)	89 x 44	8-bit Parallel/3-wire SPI or 4-wire SPI	80	40K 10K (Blue)	-20°C - +70°C

Key Features:

- Supports over 50 languages
- Features 37 font tables
- Cost effective
- Fast response time: 10 µs
- Wide viewing angle: up to 160°
- Thin designs
- Self-illuminated; no backlight necessary
- Low power consumption
- High brightness
- High contrast ratio: 2000:1
- Wide operation temperature: -40°C to +80°C
- RoHS compliant



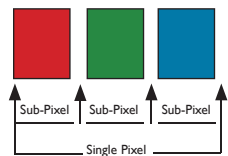
OLED Full Color Technology



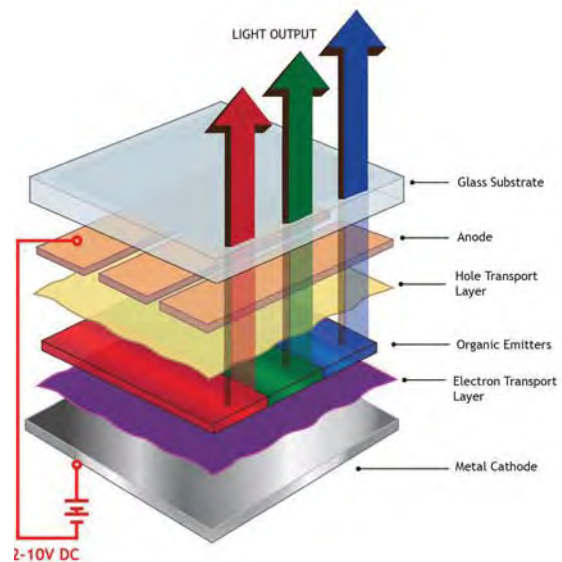
Full Color OLEDs are passive matrix displays that feature 256k colors, rich black levels, and a 2001:1 contrast ratio. These displays also have a faster and smoother graphic animation than standard TFT displays because of their 10μsec response time. Newhaven Display offers these displays as complete modules containing all necessary logic in three different sizes.

How it works

In order for OLED displays to produce color, an electric current is needed to stimulate the pixels on the OLED display. The pixels are created by the perpendicular arrangement of the cathodes and anodes. Where the anode and cathode intersect is where light is emitted. The electric current applied to the selected strips of anodes and cathodes determine which pixels get turned on and which pixels remain off. The thickness of the organic layer and the applied current can be adjusted to produce the desired brightness. The overall contrast is enhanced by a micro-cavity encasement designed to greatly reduce ambient light interference.

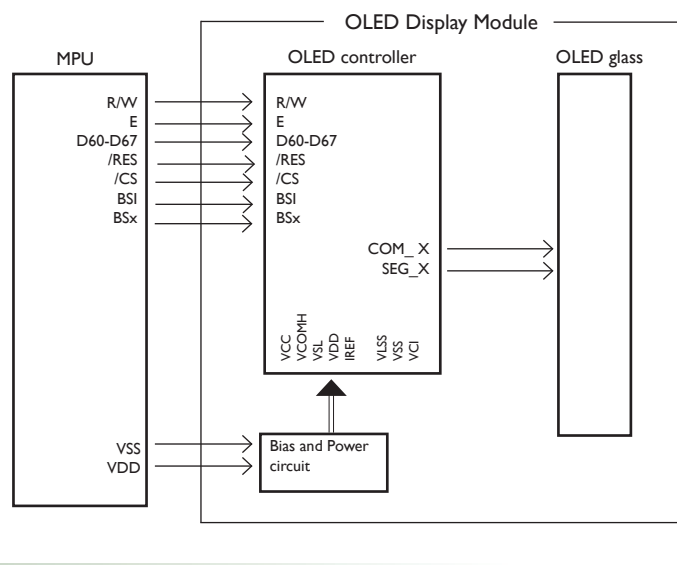


Each pixel of a Color OLED is divided into red, green, and blue sub-pixels. By adjusting the intensity of each sub-pixel, the resulting combination of red, green, and blue provides the OLED's vivid color depth. Color OLED modules include built-in controllers that typically feature 256-step brightness control for each sub-pixel and support 18-bit (262k) colors.



How to use

Using a single low-voltage power supply and either a parallel or serial interface, simple program code is sent from the main MPU to the OLED controller to perform commands or show fonts and images on the display.



OLED Full Color Displays

The Full Color OLED Display is ideal for any industry, especially consumer and handheld because of their low power consumption. Available upon request, Newhaven Display's full color OLEDs can include a resistive or capacitive touch panel.

Key Features:

- 262k colors
- Fast response time: 10μs
- Wide viewing angle: up to 160°
- Self-illuminated; no backlight necessary
- Low power consumption
- Built-in controller
- Built-in sleep mode
- High contrast ratio: 2000:1
- 256-step brightness
- Wide operation temperature: -30°C to +70°C
- Serial or parallel MPU interface
- 128x96, 128x128, & 160x128 resolution
- RoHS compliant

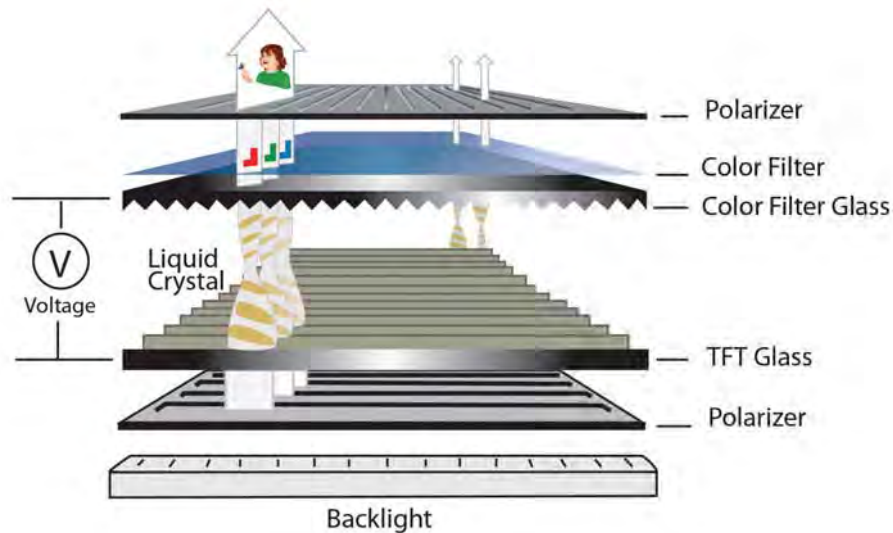
Diag. Size	Newhaven Part Number	Module (M) Glass(G)	Size (W x H) mm	Interface	Supply Volt.	Brightness cd/m ²	Life to 1/2 Brightness (hrs)	Operating Temperature (Celsius)
1.27	NHD-1.27-12896UGC3	M	45 x 45	Serial/Parallel	2.8	100	10K	-30° - +70°
1.5	NHD-1.5-128128UGC3	M	45 x 52	Serial/Parallel	2.8	90	10K	-30° - +70°
1.69	NHD-1.69-160128UGC3	M	45 x 52	Serial/Parallel	2.8	75	10K	-30° - +70°
1.27	NHD-1.27-12896ASC3	M	45 x 58	Serial	3.3	100	10K	-30° - +70°
1.5	NHD-1.5-128128ASC3	M	45 x 58	Serial	3.3	90	10K	-30° - +70°
1.69	NHD-1.69-160128ASC3	M	45 x 58	Serial	3.3	75	10K	-30° - +70°
.6	NHD-0.6-6464G	G	15 x 18	Serial	3.3	200	10K	-40° - +70°
.95	NHD-0.95-9664G	G	26 x 22	Serial/Parallel	3.3	100	10K	-40° - +70°
1.1	NHD-1.1-9696G	G	26 x 30	Serial/Parallel	3.3	100	10K	-40° - +70°
1.27	NHD-1.27-12896G	G	34 x 27	Serial/Parallel	3.3	100	10K	-40° - +70°
1.45	NHD-1.45-160128G	G	36 x 31	Serial/Parallel/RGB	3.3	90	10K	-40° - +70°
1.5	NHD-1.5-128128G	G	34 x 34	Serial/Parallel	3.3	90	10K	-40° - +70°
1.69	NHD-1.69160128G	G	40 x 34	Serial/Parallel/RGB	3.3	75	10K	-40° - +70°

An abstract digital background featuring glowing binary code (0s and 1s) in shades of blue and green, overlaid with golden circuit board traces. A dark brown horizontal bar is positioned across the middle of the image.

LCD Displays



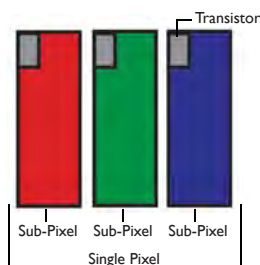
LCD Active-Matrix Technology



How it works

Active-Matrix TFT displays have tiny switching transistors that control each pixel on the display. These transistors require very little energy to actively change the orientation of the liquid crystal in the display. This allows for faster control of each red, green and blue sub-pixel cell thus producing clear fast-moving color graphics.

The transistors in the TFT are arranged in a matrix on the glass substrate. Each pixel on the display remains off until addressed by applying a charge to the transistor. Unlike conventional Passive-Matrix displays, in order to activate a specific pixel, the corresponding row is turned on and a charge is sent down the proper column. This is where only the capacitor at the designated pixel receives a charge and is held until the next refresh cycle. Essentially, each transistor acts as an active switch. By incorporating an active switch, this limits the number of scan lines and eliminates cross-talk issues.

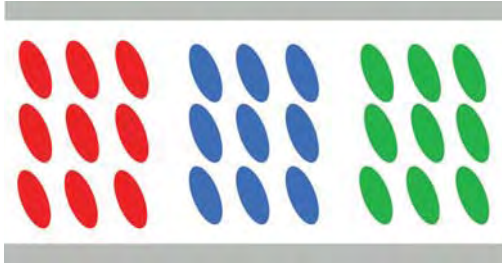


Producing Color

The pixels of the TFTs are divided into sub-pixels capable of producing various intensities of red, green or blue. The mixture of color and levels of intensity allows for an accurate depiction of any combination of 16.7 million colors.

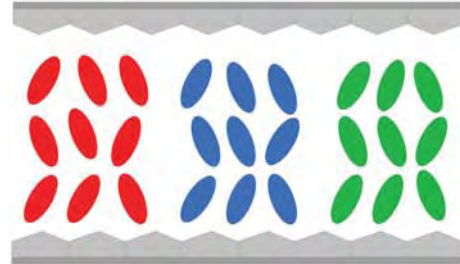
Types of TFT Technology

TN Technology



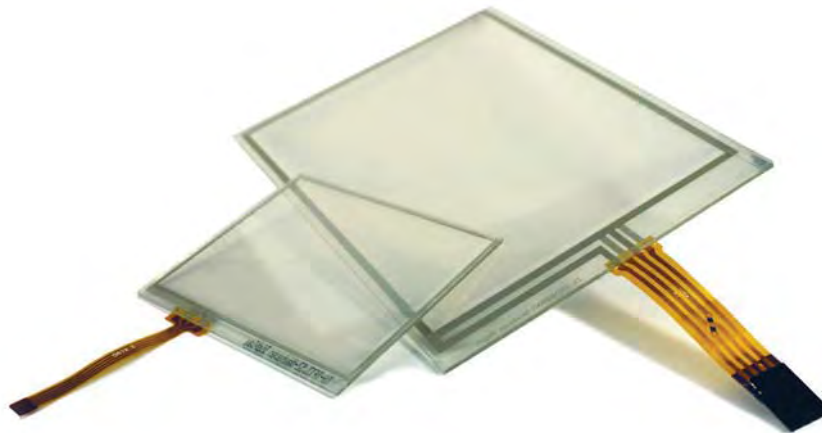
TN (Twisted Nematic) displays are the most common consumer type TFT displays. They offer basic characteristics such as wide operating temperatures, 12 or 6 o'clock viewing angles, and support full color motion graphics. To create an image, the liquid crystals within each pixel twist to allow light from the backlight to shine through. Since the liquid crystal is sandwiched between two oppositely charged polarizers, they twist down and towards their respective charge. The downward angle of the liquid crystals causes the backlight to bend. Depending on how the light bends creates the display's optimal viewing angle.

MVA Technology



MVA (Multi-domain Vertical Alignment) Technology offers wide viewing angles, good black depth, fast response times, and good color reproduction. Each pixel within an MVA type TFT consists of three sub-pixels (red, green and blue). Each of these sub-pixels is divided further into two or more sub-pixels, where the liquid crystals are randomly lined up due to a polarizer that has a ridged edge. When a charge is applied, the crystals twist. With these crystals being randomly placed, it allows the backlight to shine through in all different directions keeping the intended color saturation retained and gives the display a 150° viewing angle.

Touch Panels



Touch panels are used in a variety of applications to enhance the user experience. The main types of touch panel technology are resistive touch and capacitive touch. Each type of touch panel technology has unique features for a different user experience.

Resistive Touch: These touch panels are designed to allow items other than your finger to activate the touch. Resistive touch panels don't rely on organic properties of a finger so there are more options to interact with them. Resistive technology senses pressure which is why a gloved hand will work, but it requires harder contact so a stylus is recommended since it responds more accurately.

Capacitive Touch: These touch panels have multi-touch ability and are extremely durable in most environments including withstanding water contact, dust and grease. Capacitive touch panels will activate with either a bare finger or a capacitive stylus and have excellent dragging performance. Newhaven Display offers capacitive touch panels with mutual capacitive sensors on the 3.5", 4.3", 5.0" and 7.0" TFTs. These capacitive touch panels come with a built-in I²C interface controller. This allows for quick time to market while keeping development costs low.

LCD TFT Displays

Key Features:

- High brightness and contrast
- Fast response time
- WVGA, QVGA, and VGA
- Capacitive and resistive touch
- MVA and TN technologies
- Bright LED backlights
- Wide viewing angles
- Wide operating temperature
- RoHS compliant



* **Note:** See page 3-2 for optional controller boards

Diagonal Size (inches)	Newhaven Part Number	Touch Panel	Brightness (cd/m ²)	Module Size (W x H x T) mm	Interface	Operating Temperature
1.8	NHD-1.8-128160EF-CTXI#-F	-	350	34.7 x 46.7 x 2.25	8-bit Parallel	-20°C - +70°C
1.8	NHD-1.8-128160EF-CTXI#-FT	✓	280	34.7 x 46.7 x 3.45	8-bit Parallel	-20°C - +70°C
1.8	NHD-1.8-128160EF-CTXI#	-	350	34.7 x 46.7 x 2.25	8-bit Parallel	-20°C - +70°C
1.8	NHD-1.8-128160EF-CTXI#-T	✓	280	34.7 x 46.7 x 3.45	8-bit Parallel	-20°C - +70°C
1.8	NHD-1.8-128160EF-CSXN#	-	1000	34.7 x 46.7 x 2.4	8-bit Parallel	-20°C - +70°C
1.8	NHD-1.8-128160EF-CSXN#-F	-	1000	34.7 x 46.7 x 2.4	8-bit Parallel	-20°C - +70°C
2.4	NHD-2.4-240320CF-CSXV#-F	✓	850	42.8 x 60.0 x 2.4	8-bit or 16-bit Parallel	-20°C - +70°C
2.4	NHD-2.4-240320CF-CTXI#-F	-	350	42.8 x 60.0 x 2.4	8-bit or 16-bit Parallel	-20°C - +70°C
2.4	NHD-2.4-240320CF-CTXI#-FT	✓	280	42.8 x 60.0 x 3.9	8-bit or 16-bit Parallel	-20°C - +70°C
2.4	NHD-2.4-240320CF-CSXN#-F	-	1000	42.8 x 60.0 x 2.4	8-bit or 16-bit Parallel	-20°C - +70°C
2.4	NHD-2.4-240320CF-CSXN#-FT	✓	800	42.8 x 60.0 x 3.9	8-bit or 16-bit Parallel	-20°C - +70°C
2.8	NHD-2.8-240320AF-CSXP-F	-	600	50 x 69.2 x 2.4	8-bit or 16-bit Parallel	-20°C - +70°C
2.8	NHD-2.8-240320AF-CSXP-FT	✓	500	50 x 69.2 x 3.5	8-bit or 16-bit Parallel	-20°C - +70°C
3.5	NHD-3.5-320240MF-ATXL#-I	-	300	76.9 x 63.9 x 3.3	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MF-ATXL#-T-I	✓	240	76.9 x 63.9 x 4.4	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MF-ATXL#-CTP	✓	330	76.9 x 63.9 x 4.6	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MF-ASXV#	-	800	76.9 x 63.9 x 3.2	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MF-ASXV#-T	✓	620	76.9 x 63.9 x 4.4	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MF-ASXV#-CTP	✓	660	76.9 x 63.9 x 4.6	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MF-ASXN#	-	1000	76.9 x 63.9 x 3.2	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MF-ASXN#-T	✓	780	76.9 x 63.9 x 4.4	24-bit RGB	-20°C - +70°C

LCD TFT Displays

* **Note:** See page 3-2 for optional controller boards

Diagonal Size (inches)	Newhaven Part Number	Touch Panel	Brightness (cd/m ²)	Module Size (W x H x T) mm	Interface	Operating Temperature
3.5	NHD-3.5-320240MF-ASXN#-CTP	✓	830	76.9 x 63.9 x 4.6	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272EF-ATXL#	-	600	105.5 x 67.2 x 3.2	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272EF-ATXL#-T	✓	480	105.5 x 67.2 x 4.2	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272EF-ATXL#-CTP	✓	330	105.5 x 67.2 x 4.6	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272EF-ASXV#	-	850	105.5 x 67.2 x 3.2	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272EF-ASXV#-T	✓	680	105.5 x 67.2 x 4.5	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272EF-ASXV#-CTP	✓	700	105.5 x 67.2 x 4.5	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272EF-ASXN#	-	1000	105.5 x 67.2 x 3.2	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272EF-ASXN#-T	✓	780	105.5 x 67.2 x 4.5	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272EF-ASXN#-CTP	✓	830	105.5 x 67.2 x 4.5	24-bit RGB	-20°C - +70°C
5.0	NHD-5.0-800480TF-ATXL#	-	500	120.7 x 75.8 x 3.1	24-bit RGB	-20°C - +70°C
5.0	NHD-5.0-800480TF-ATXL#-T	✓	400	120.7 x 75.2 x 4.3	24-bit RGB	-20°C - +70°C
5.0	NHD-5.0-800480TF-ATXL#-CTP	✓	400	120.7 x 75.8 x 4.8	24-bit RGB	-20°C - +70°C
5.7	NHD-5.7-320240WFB-ATXI#-I	-	250	149.0 x 109.0 x 9.9	8 bit Digital	-20°C - +70°C
5.7	NHD-5.7-320240WFB-CTXI#-I	-	250	149.0 x 109.0 x 11.5	8-bit Parallel	-20°C - +70°C
5.7	NHD-5.7-320240WFB-CTXI#-T-I	✓	250	149.0 x 109.0 x 13.0	8-bit Parallel	-20°C - +70°C
5.7	NHD-5.7-320240WFB-ETXI#-I	-	350	149.0 x 109.0 x 11.5	16-bit Parallel	-20°C - +70°C
5.7	NHD-5.7-320240WFB-ETXI#-T-I	✓	350	149.0 x 109.0 x 13.0	16-bit Parallel	-20°C - +70°C
7.0	NHD-7.0-800480EF-ATXL#	-	280	165 x 104 x 3.5	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480EF-ATXL#-T	✓	220	165 x 104 x 4.7	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480EF-ATXL#-CTP	✓	280	165 x 104 x 4.7	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480EF-ASXV#	-	800	165 x 104 x 3.5	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480EF-ASXV#-T	✓	600	165 x 104 x 4.7	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480EF-ASXV#-CTP	✓	660	165 x 104 x 4.9	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480EF-ASXN#	-	1000	165 x 104 x 3.5	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480EF-ASXN#-T	✓	780	165 x 104 x 4.7	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480EF-ASXN#-CTP	✓	830	165 x 104 x 4.9	24-bit RGB	-20°C - +70°C
10.1	NHD-10.1-1024600AF-LSXV#	-	850	235 x 143 x 5.2	4-channel LVDS	0°C - +50°C
10.1	NHD-10.1-1024600AF-LSXV#-CTP	✓	700	235 x 143 x 8.9	4-channel LVDS	0°C - +50°C
10.1	NHD-10.1-1024600AF-ASXV#	-	800	235 x 143 x 5.2	24-Bit RGB	0°C - +50°C
10.1	NHD-10.1-1024600AF-ASXV#-CTP	✓	700	235 x 143 x 7.0	24-Bit RGB	0°C - +50°C

Mountable TFT Displays

Key Features:

- Steel Bracket with Rank-Unit Height
- M3 Standoffs for Accessory PCB Install
- Vibration Resistance
- No Driver Change from Similar TFTs
- Offset Mounting Tabs
- RoHS compliant



* **Note:** See page 3-2 for optional controller boards

Diagonal Size (inches)	Newhaven Part Number	Touch Panel	Brightness (cd/m ²)	Module Size (W x H x T) mm	Interface	Operating Temperature
3.5	NHD-3.5-320240MB-ATXL	-	300	103.9 x 66.6 x 11.2	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MB-ATXL-T	✓	240	103.9 x 66.6 x 12.6	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MB-ATXL-CTP	✓	270	103.9 x 66.6 x 12.7	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MB-ASXV	-	800	103.9 x 66.6 x 11.2	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MB-ASXV-T	✓	620	103.9 x 66.6 x 12.6	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MB-ASXV-CTP	✓	660	103.9 x 66.6 x 12.7	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MB-ASXN	-	1000	103.9 x 66.6 x 11.2	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MB-ASXN-T	✓	780	103.9 x 66.6 x 12.6	24-bit RGB	-20°C - +70°C
3.5	NHD-3.5-320240MB-ASXN-CTP	✓	830	103.9 x 66.6 x 12.7	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272MB-ATXL	-	600	132.6 x 69.9 x 10.9	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272MB-ATXL-T	✓	480	132.6 x 69.9 x 12.1	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272MB-ATXL-CTP	✓	400	132.6 x 69.9 x 12.5	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272MB-ASXV	-	850	132.6 x 69.9 x 10.9	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272MB-ASXV-T	✓	680	132.6 x 69.9 x 12.1	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272MB-ASXV-CTP	✓	680	132.6 x 69.9 x 12.5	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272MB-ASXN	-	1000	132.6 x 69.9 x 10.9	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272MB-ASXN-T	✓	780	132.6 x 69.9 x 12.1	24-bit RGB	-20°C - +70°C
4.3	NHD-4.3-480272MB-ASXN-CTP	✓	830	132.6 x 69.9 x 12.5	24-bit RGB	-20°C - +70°C
5.0	NHD-5.0-800480MB-ATXL	-	500	147.8 x 78.5 x 11.1	24-bit RGB	-20°C - +70°C

Mountable TFT Displays

* **Note:** See page 3-2 for optional controller boards

Diagonal Size (inches)	Newhaven Part Number	Touch Panel	Brightness (cd/m ²)	Module Size (W x H x T) mm	Interface	Operating Temperature
5.0	NHD-5.0-800480MB-ATXL-T	✓	400	147.8 x 78.5 x 12.3	24-bit RGB	-20°C - +70°C
5.0	NHD-5.0-800480MB-ATXL-CTP	✓	400	147.8 x 78.5 x 12.6	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480MB-ATXL	-	280	189.7 x 106.7 x 11.5	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480MB-ATXL-T	✓	220	189.7 x 106.7 x 12.7	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480MB-ATXL-CTP	✓	280	189.7 x 106.7 x 13.0	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480MB-ASXV	-	800	189.7 x 106.7 x 11.5	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480MB-ASXV-T	✓	600	189.7 x 106.7 x 12.7	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480MB-ASXV-CTP	✓	660	189.7 x 106.7 x 13.0	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480MB-ASXN	-	1000	189.7 x 106.7 x 11.5	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480MB-ASXN-T	✓	780	189.7 x 106.7 x 12.7	24-bit RGB	-20°C - +70°C
7.0	NHD-7.0-800480MB-ASXN-CTP	✓	830	189.7 x 106.7 x 13.0	24-bit RGB	-20°C - +70°C
10.1	NHD-10.1-1024600MB-LSXV	-	850	261.9 x 145.6 x 12.9	24-bit RGB	-20°C - +70°C
10.1	NHD-10.1-1024600MB-LSXV-CTP	✓	700	261.9 x 145.6 x 14.9	24-bit RGB	-20°C - +70°C

LCD TFT Modules



Key Features:

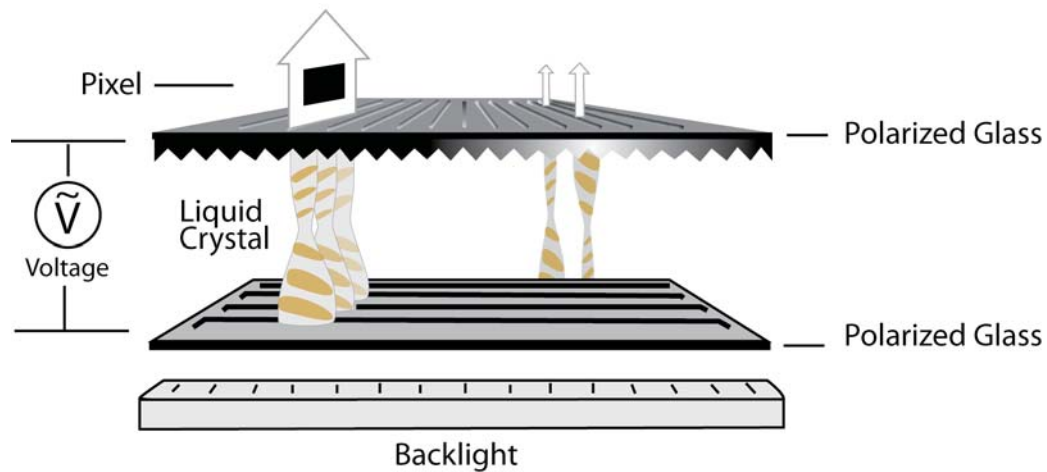
- On-board controllers
- Easy to use
- HDMI Compatible Versions
- EVE2 IC Models
- Capacitive and resistive touch
- Bright LED backlights
- Wide viewing angles
- Wide operating temperature
- RoHS compliant

Diagonal Size (inches)	Newhaven Part Number	Touch Panel	Brightness (cd/m ²)	Module Size (W x H x T) mm	Controller/Driver	Interface	Operating Temperature
3.5	NHD-3.5-320240FT-CTXL-T	✓	320	92.0 x 63.9 x 15.8	FT812 Video Engine	SPI	-20°C - +70°C
3.5	NHD-3.5-320240FT-CTXL-CTP	✓	330	92.0 x 63.9 x 15.9	FT813 Video Engine	SPI	-20°C - +70°C
3.5	NHD-3.5-320240FT-CSXV-T	✓	620	92.0 x 63.9 x 15.8	FT812 Video Engine	SPI	-20°C - +70°C
3.5	NHD-3.5-320240FT-CSXV-CTP	✓	660	92.0 x 63.9 x 15.9	FT813 Video Engine	SPI	-20°C - +70°C
3.5	NHD-3.5-320240FT-CSXN-T	✓	780	92.0 x 63.9 x 15.8	FT812 Video Engine	SPI	-20°C - +70°C
3.5	NHD-3.5-320240FT-CSXN-CTP	✓	830	92.0 x 63.9 x 15.9	FT813 Video Engine	SPI	-20°C - +70°C
4.3	NHD-4.3-480272FT-CTXL-T	✓	340	120.6 x 67.2 x 15.7	FT812 Video Engine	SPI	-20°C - +70°C
4.3	NHD-4.3-480272FT-CTXL-CTP	✓	350	120.6 x 67.2 x 15.9	FT813 Video Engine	SPI	-20°C - +70°C
4.3	NHD-4.3-480272FT-CSXV-T	✓	680	120.6 x 67.2 x 15.7	FT812 Video Engine	SPI	-20°C - +70°C
4.3	NHD-4.3-480272FT-CSXV-CTP	✓	700	120.6 x 67.2 x 15.9	FT813 Video Engine	SPI	-20°C - +70°C
4.3	NHD-4.3-480272FT-CSXN-T	✓	780	120.6 x 67.2 x 15.7	FT812 Video Engine	SPI	-20°C - +70°C
4.3	NHD-4.3-480272FT-CSXN-CTP	✓	830	120.6 x 67.2 x 15.9	FT813 Video Engine	SPI	-20°C - +70°C
5.0	NHD-5.0-HDMI-N-RTXL	-	500	135.8 x 75.8 x 21.2	TFP401A Receiver	HDMI	-20°C - +70°C
5.0	NHD-5.0-HDMI-N-RTXL-RTU	✓	400	135.8 x 75.8 x 23.6	TFP401A Receiver	HDMI	-20°C - +70°C
5.0	NHD-5.0-HDMI-N-RTXL-CTU	✓	415	135.8 x 75.8 x 24.3	TFP401A Receiver	HDMI	-20°C - +70°C
5.0	NHD-5.0-800480FT-CTXL-T	✓	400	135.8 x 75.8 x 15.7	FT812 Video Engine	SPI	-20°C - +70°C
5.0	NHD-5.0-800480FT-CTXL-CTP	✓	500	135.8 x 75.8 x 16.1	FT813 Video Engine	SPI	-20°C - +70°C

LCD TFT Modules

Diagonal Size (inches)	Newhaven Part Number	Touch Panel	Brightness (cd/m ²)	Module Size (W x H x T) mm	Controller/Driver	Interface	Operating Temperature
7.0	NHD-7.0-HDMI-N-RTXL	-	280	180.1 x 104 x 22.0	TFP401A Receiver	HDMI	-20°C - +70°C
7.0	NHD-7.0-HDMI-N-RTXL-RTU	✓	220	180.1 x 104 x 24.4	TFP401A Receiver	HDMI	-20°C - +70°C
7.0	NHD-7.0-HDMI-N-RTXL-CTU	✓	230	180.1 x 104 x 25.1	TFP401A Receiver	HDMI	-20°C - +70°C
7.0	NHD-7.0-HDMI-N-RSXV	-	800	180.1 x 104 x 22.0	TFP401A Receiver	HDMI	-20°C - +70°C
7.0	NHD-7.0-HDMI-N-RSXV-RTU	✓	600	180.1 x 104 x 24.4	TFP401A Receiver	HDMI	-20°C - +70°C
7.0	NHD-7.0-HDMI-N-RSXV-CTU	✓	660	180.1 x 104 x 25.1	TFP401A Receiver	HDMI	-20°C - +70°C
7.0	NHD-7.0-HDMI-N-RSXN	-	1000	180.1 x 104 x 22.0	TFP401A Receiver	HDMI	-20°C - +70°C
7.0	NHD-7.0-HDMI-N-RSXN-RTU	✓	780	180.1 x 104 x 24.4	TFP401A Receiver	HDMI	-20°C - +70°C
7.0	NHD-7.0-HDMI-N-RSXN-CTU	✓	830	180.1 x 104 x 25.1	TFP401A Receiver	HDMI	-20°C - +70°C
7.0	NHD-7.0-800480FT-CTXL-T	✓	220	180.1 x 104 x 16.1	FT812 Video Engine	SPI	-20°C - +70°C
7.0	NHD-7.0-800480FT-CTXL-CTP	✓	230	180.1 x 104 x 16.5	FT813 Video Engine	SPI	-20°C - +70°C
7.0	NHD-7.0-800480FT-CSXV-T	✓	600	180.1 x 104 x 16.1	FT812 Video Engine	SPI	-20°C - +70°C
7.0	NHD-7.0-800480FT-CSXV-CTP	✓	660	180.1 x 104 x 16.5	FT813 Video Engine	SPI	-20°C - +70°C
7.0	NHD-7.0-800480FT-CSXN-T	✓	780	180.1 x 104 x 16.1	FT812 Video Engine	SPI	-20°C - +70°C
7.0	NHD-7.0-800480FT-CSXN-CTP	✓	830	180.1 x 104 x 16.5	FT813 Video Engine	SPI	-20°C - +70°C
10.1	NHD-10.1-HDMI-A-RSXV	-	850	261.9 x 145.6 x 31.9	ADV7611 Receiver	HDMI	0°C - +50°C
10.1	NHD-10.1-HDMI-A-RSXV-CTU	✓	700	261.9 x 145.6 x 33.5	ADV7611 Receiver	HDMI	0°C - +50°C

LCD Passive-Matrix Technology

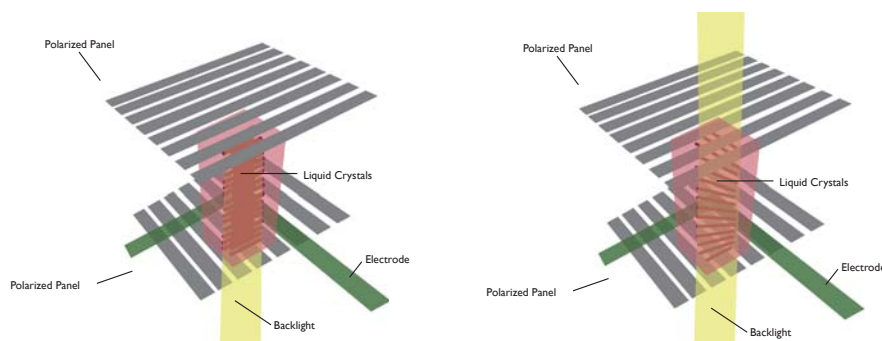


How it works

In order to understand how Passive-Matrix displays work, it is important to know how they are made. To start, Passive-Matrix displays are composed of two pieces of polarized glass. On the non-polarized side of the glass, a special polymer is added to create grooves that run in the same direction as the polarizing film. Once this is done, a liquid crystal material is added to the grooved side of one of the polarized glasses. These grooves align the liquid crystal with the glass. The second piece of glass is placed on top with the grooved side in, aligned perpendicular to the first piece of glass creating a row and column arrangement.

Where the grooves of the two pieces of polarized glass intersect is a pixel. By blocking the light from passing through the top piece of glass, it creates an area that is darker than its surrounding. This

gives the appearance of pixels being turned on or off. In order to block the light from passing through, the orientation of the liquid crystal has to be changed. To do this, an electric charge is needed. Without an electric charge, the liquid crystal is twisted which changes the angle of the light to match the angle of the top polarized glass. This allows light to pass through. When an electric charge is applied, the liquid crystal untwists leaving the angle of the light unchanged. This causes the light to be blocked by the top perpendicular piece of polarized glass (see the below images for example). Determining which pixels turn on and off is done by the controllers on the display. These controllers are programmed to translate user data into predefined fonts or to turn on the appropriately addressed pixels.

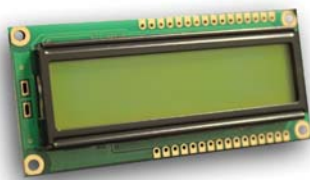


LCD Passive-Matrix Display Types

Chip-on-Board

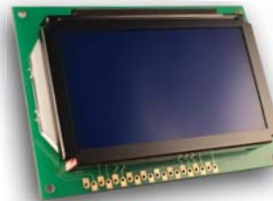
The term Chip-on-Board references a type of IC mounting that is commonly seen on Passive-Matrix Display types. The IC is directly mounted to the display's PCB offering a compact design. At Newhaven Display we offer this type of IC mounting as Character or Graphic displays. The Character LCDs show information as text and come with pre-programmed font tables. The Graphic LCDs come in standard sizes and interfaces. This type of display uses a dot matrix pattern to display both text and bitmap images. Both the Character and Graphic Chip-On-Board LCDs come in standard sizes and are offered as either STN or FSTN types, as well as positive or negative display modes.

Character Chip-on-Board LCDs



- Display information as text
- Monochromatic
- More than 8 backlight color options
- High brightness backlight
- Positive or Negative image options
- 4 pre-programmed font tables
- Industry standard sizes
- Wide operating temperatures
- RoHS Compliant

Graphic Chip-on-Board LCDs



- Display information as text or simple images
- Monochromatic
- More than 8 backlight color options
- High brightness backlight
- Positive or Negative image options
- Custom touch panels available
- Industry standard sizes
- Wide operating temperatures
- RoHS Compliant

Chip-on-Glass

Chip-on-Glass is a type of IC mounting ideal for compact applications. The IC is directly mounted to the display's glass, therefore a PCB is not required. At Newhaven Display we offer this type of IC mounting as a Character or Graphic display. The Character LCDs show information as text and come with pre-programmed font tables. The Graphic LCDs come in standard sizes and interfaces. This type of display uses a dot matrix pattern to display both text and bitmap images. Both the Character and Graphic Chip-On-Glass LCDs come in standard sizes and come as either STN or FSTN types, as well as positive or negative display modes.

Character Chip-on-Glass LCDs



- Display information as text
- Monochromatic thin designs
- More than 8 backlight color options
- High brightness backlight
- Positive or Negative image options
- 4 pre-programmed font tables
- Industry standard sizes
- Wide operating temperatures
- RoHS Compliant

Graphic Chip-on-Glass LCDs



- Display information as text or simple images
- Monochromatic thin design
- More than 8 backlight color options
- High brightness backlight
- Positive or Negative image options
- Industry standard sizes
- Wide operating temperatures
- RoHS Compliant



Helpful Hint

When starting your next project take into consideration how your application is going to be used. This will help to determine what type of display mode would be ideal for your final, overall look and readability.

LCD Display Modes

LCD Displays come in different display modes: positive and negative. The type of application in which the display will be used will impact which mode should be selected.

Positive Type

ABCD

Positive type displays provide an image with dark pixels on a light background. Ambient light or a backlight can be used for this type of display and is capable of multiple background colors.



Negative Type

ABCD

Negative type displays provide an image with light pixels on a dark background. The backlight must be used for this type of display and is capable of multiple pixel colors.



Types of Passive-Matrix Technologies

TN Technology

TN (Twisted Nematic) is one of the most commonly used passive-matrix LCD technology for every day applications. The TN technology consists of nematic liquid crystal sandwiched between two plates of glass. When power is applied to the electrodes, the liquid crystals twist 90°.

STN Technology

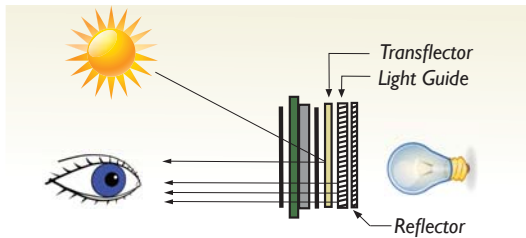
STN (Super Twisted Nematic) technology has rapidly become a standard for most passive-matrix LCDs. This type of technology uses the same principle as TN displays but uses less power and is typically less expensive. Unlike TN Technology, the liquid crystals in STN technology have a 210° - 270° twist which allows for a broader transition region for gray scaling.

FSTN Technology

FSTN (Film Compensated Super Twisted Nematic) technology is perfect for applications that require a higher contrast passive-matrix LCD. FSTN uses a film compensating layer between the STN display and the rear polarizer. This additional film creates better sharpness and contrast than the TN and STN technologies.

LCD Light Modes

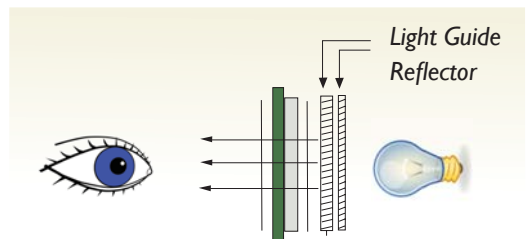
Transflective



Ambient light or backlighting can be used for this type of display.

Transflective polarizers have both reflecting and transmitting properties and offer the most versatile viewing characteristics. They can be viewed in direct sunlight and when combined with a backlight in low light conditions.

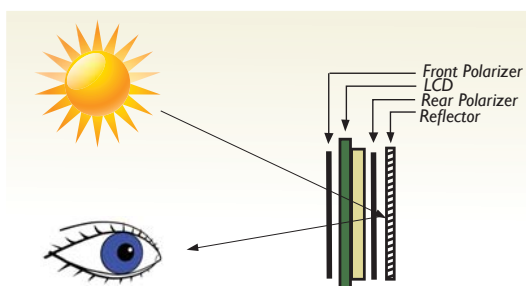
Transmissive



Backlighting is necessary.

Transmissive LCDs always require a backlight and provide the highest brightness display. They are best suited for applications where direct sunlight viewing is not involved.

Reflective



Ambient light is necessary to use this type of display.

Reflective polarizers are used in high ambient light environments or whenever sufficient power is not available to drive the backlight.

LCD Backlight Color Options

There are many decisions to make when backlighting an LCD since the color of the display can impact the overall look, feel and functionality of your application. The type of display will also effect the overall look of the display whether it's STN vs. FSTN, or Positive vs. Negative display modes. Below are examples of the wide variety of backlight colors there are to choose from.

STN Display Types

Display Type: STN(+) Gray	Backlight Color Examples	
 - STN (+) Gray Background - <u>BLUE</u>TEXT - Backlight "Off"	 Orange LED Backlight "On"	 White LED Backlight "On"
	 Blue LED Backlight "On"	 Yellow-Green LED Backlight "On"
	 Red LED Backlight "On"	
Display Type: STN(+) Yellow-Green	Backlight Color Examples	
 - STN (+) Yellow-Green Background - <u>BLUE</u>TEXT - Backlight "Off"	 Yellow-Green LED Backlight "On"	 Pure-Green LED Backlight "On"
Display Type: STN(-) Blue	Backlight Color Examples	
 - STN (-) Blue Background - <u>WHITE</u>TEXT - Backlight "Off"	 White LED Backlight "On"	



Helpful Hint

If you are looking for an LCD display that will offer a high contrast ratio and a wider viewing angle, then the FSTN is the perfect polarizer for your project.

FSTN Display Types

Display Type: FSTN(+)	Backlight Color Examples	
 - FSTN (+) Gray Background - BLACK TEXT - Backlight "Off"	 Red LED Backlight "On"	 Amber LED Backlight "On"
	 Orange LED Backlight "On"	 Blue LED Backlight "On"
	 White LED Backlight "On"	 Pure-Green LED Backlight "On"
Display Type: FSTN(-)	Backlight Color Examples	
 - FSTN (-) Black Background - GRAY TEXT - Backlight "Off"	 Red LED Backlight "On"	 Amber LED Backlight "On"
	 Orange LED Backlight "On"	 Blue LED Backlight "On"
	 White LED Backlight "On"	 Pure-Green LED Backlight "On"



Helpful Hint

We use the rubber connector method on our standard displays since it is the most economical and reliable connection method.

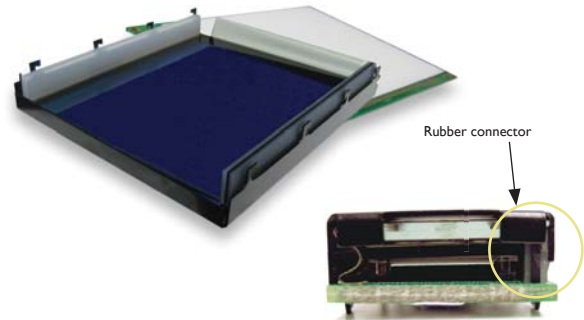
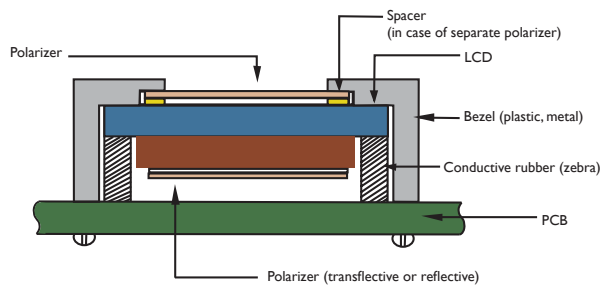
LCD Connection Methods

The following diagrams are the recommended methods for connecting the LCD panel to the drive circuit.

Rubber Connector



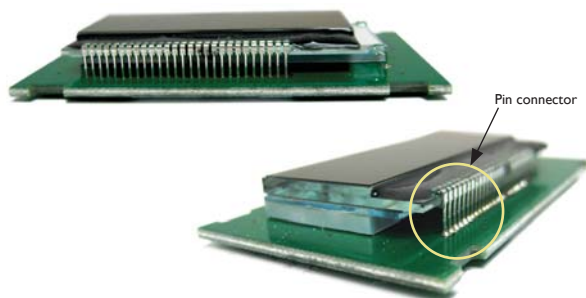
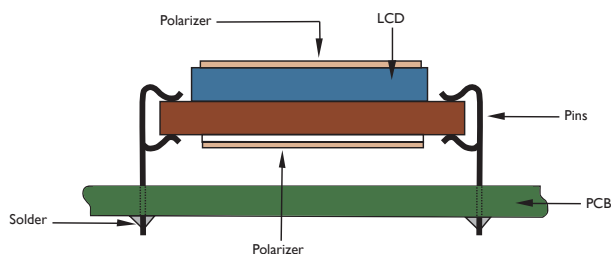
The rubber connector is a strip of material that is placed between the glass and the PCB. It is held in place by the PCB and is assembled using mechanical force. This type of connector is made of a conductive material that is surrounded by insulation. When it is placed between the glass and the PCB the conductive material lines up and connects the ITO traces on the glass with the COM & SEG traces on the PCB. The rubber connector is ideal for any application and has a long performance lifetime.



Pin Connector



The pin connector is a metal connector that fits onto the LCD glass and is held in place by glue. Each pin connector covers an ITO trace on the glass and connects to the PCB through holes. The plated thru-holes on the PCB lead to the COM & SEG lines of the controller/driver. To connect the PCB to the pin connector solder is used. This type of connector is suitable for small production runs and is proven to be very stable.



LCD Font Tables

English / Japanese Character Font Table

b7-b4 b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)															
0001	CG RAM (2)															
0010	CG RAM (3)															
0011	CG RAM (4)															
0100	CG RAM (5)															
0101	CG RAM (6)															
0110	CG RAM (7)															
0111	CG RAM (8)															
1000	CG RAM (1)															
1001	CG RAM (2)															
1010	CG RAM (3)															
1011	CG RAM (4)															
1100	CG RAM (5)															
1101	CG RAM (6)															
1110	CG RAM (7)															
1111	CG RAM (8)															

English / European Character Font Table

b7-b4 b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)															
0001	CG RAM (2)															
0010	CG RAM (3)															
0011	CG RAM (4)															
0100	CG RAM (5)															
0101	CG RAM (6)															
0110	CG RAM (7)															
0111	CG RAM (8)															
1000	CG RAM (1)															
1001	CG RAM (2)															
1010	CG RAM (3)															
1011	CG RAM (4)															
1100	CG RAM (5)															
1101	CG RAM (6)															
1110	CG RAM (7)															
1111	CG RAM (8)															

English / Hebrew Character Font Table

b7-b4 b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)															
0001	CG RAM (2)															
0010	CG RAM (3)															
0011	CG RAM (4)															
0100	CG RAM (5)															
0101	CG RAM (6)															
0110	CG RAM (7)															
0111	CG RAM (8)															
1000	CG RAM (1)															
1001	CG RAM (2)															
1010	CG RAM (3)															
1011	CG RAM (4)															
1100	CG RAM (5)															
1101	CG RAM (6)															
1110	CG RAM (7)															
1111	CG RAM (8)															

English / Russian / European Character Font Table

b7-b4 b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)															
0001	CG RAM (2)															
0010	CG RAM (3)															
0011	CG RAM (4)															
0100	CG RAM (5)															
0101	CG RAM (6)															
0110	CG RAM (7)															
0111	CG RAM (8)															
1000	CG RAM (1)															
1001	CG RAM (2)															
1010	CG RAM (3)															
1011	CG RAM (4)															
1100	CG RAM (5)															
1101	CG RAM (6)															
1110	CG RAM (7)															
1111	CG RAM (8)															

LCD Character Displays

Key Features:

- 8 different backlight color options
- Low power backlight
- Various font tables available
- Positive and negative image options
- Industry standard sizes
- Wide operating temperature
- RoHS compliant



Lines x Characters	Newhaven Part Number	Display Mode/Backlight Options (ending suffixes)	Module Size (W x H) mm	Character Size (W x H) mm	Connector Type	Operating Temperature
1 x 8	NHD-0108BZ	RN-YBW (STN+ YG, No BL) RN-YBW-33V (STN+ YG, No BL, 3.3Vdd) RN-GBW (STN+ Gray, No BL) FSY-YBW-33V3 (STN+ YG, YG BL, 3V, 3.3Vdd)	53 x 25	3.4 x 7.1	2x7 Back	-20°C - +70°C
1 x 8	NHD-0108CZ	RN-GBW (STN+ Gray, No BL) RN-GBW-33V (STN+ Gray, No BL, 3.3Vdd) FL-GBW (STN+ Gray, YG BL) FSW-GBW-33V3 (STN+ Gray, White BL, 3V, 3.3Vdd)	69 x 27	4.2 x 7.7	1x10 Left	-20°C - +70°C
1 x 8	NHD-0108HZ	FSW-GBW (STN+ Gray, White BL)	60.7 x 33.8	5.0 x 7.0	1x10 Left	-20°C - +70°C
1 x 8	NHD-0108FZ	RN-YBW (STN+ YG, No BL) FL-YBW-33V3 (STN+ YG, YG BL, 3V, 3.3Vdd)	84 x 44	6.4 x 10.7	1x16 Bottom	-20°C - +70°C
2 x 8	NHD-0208AZ	RN-YBW-33V (STN+ YG, No BL, 3.3Vdd) RN-YBW (STN+ YG, No BL) RN-GBW (STN+ Gray, No BL) FL-YBW (STN+ YG, YG BL) FL-GBW (STN+ Gray, YG BL) FSW-GBW-33V3 (STN+ Gray, White BL, 3V, 3.3Vdd)	40 x 35.9	3.0 x 4.8	2 x 8 Top	-20°C - +70°C

Lines x Characters	Newhaven Part Number	Display Mode/Backlight Options (ending suffixes)	Module Size (W x H) mm	Character Size (W x H) mm	Connector Type	Operating Temperature
2 x 8	NHD-0208BZ	RN-YBW (STN+ YG, No BL) RN-YBW-33V (STN+ YG, No BL, 3.3Vdd) RN-GBW (STN+ Gray, No BL) FL-YBW (STN+ YG, YG BL) FL-GBW (STN+ Gray, YG BL) FSW-GBW-33V3 (STN+ Gray, White BL, 3V, 3.3Vdd)	58 x 32	3.0 x 5.6	2 x 7 Left	-20°C - +70°C
1 x 12	NHD-0112BZ	FL-YBW (STN+ YG, YG BL)	69 x 27	2.6 x 5.5	1 x 10 Left	-20°C - +70°C
2 x 12	NHD-0212WH-A	YYH-JT# (STN+ YG, YG BL) YGH-JT# (STN+ Gray, YG BL) TGH-JT# (STN+ Gray, White BL) TMI-JT# (STN- Blue, White BL)	55.7 x 32	2.7 x 6.3	1 x 15 Bottom	-20°C - +70°C
1 x 16	NHD-0116AZ	RN-GBW (STN+ Gray, No BL) FL-YBW (STN+ YG, YG BL) FL-GBW (STN+ Gray, YG BL)	80 x 36	3.1 x 6.6	1 x 16 Top	-20°C - +70°C
1 x 16	NHD-0116DZ	FL-YBW (STN+ YG, YG BL) FL-YBW-33V (STN+ YG, YG BL, 3V, 3.3Vdd) FL-GBW (STN+ Gray, YG BL) NSW-BBW (STN- Blue, White BL)	122 x 33	4.8 x 9.6	1 x 16 Top	-20°C - +70°C
1 x 16	NHD-0116GZ	FL-YBW (STN+ YG, YG BL) FL-GBW (STN+ Gray, YG BL) FSB-GBW (STN+ Gray, Blue BL) FSW-GBW (STN+ Gray, White BL) NSW-BBW (STN- Blue, White BL) FSB-FBW (FSTN+ Blue BL) FSO-FBW (FSTN+ Orange BL) FSA-FBW (FSTN+ Amber BL) FSR-FBW (FSTN+ Red BL) FSW-FBW (FSTN+ White BL)	151 x 40	6.0 x 14.5	2 x 8 Left	-20°C - +70°C
2 x 16	NHD-0216IZ	FSY-YBW-C (STN+ YG, YG BL, w/ Flex Cable)	53 x 20	1.9 x 3.2	1 x 16 Bottom FFC	-20°C - +70°C
2 x 16	NHD-0216HZ	FL-YBW-C (STN+ YG, YG BL, Temp Comp) FSW-FBW-33V3C (FSTN+ White BL, 3V, 3.3Vdd, Temp Comp)	65.5 x 36.7	2.5 x 4.9	1 x 16 Bottom	-20°C - +70°C
2 x 16	NHD-0216T2Z	FSY-YBW-P (STN+ YG, YG BL, w/ Pin Header)	74.5 x 30.7	2.9 x 5.2	1 x 16 Bottom	-20°C - +70°C
2 x 16	NHD-0216PZ	FL-YBW (STN+ YG, YG BL) FL-YBW-PC (STN+ YG, YG BL, reversed pins, ESD)	80 x 36	2.9 x 4.3	1 x 16 Bottom	-20°C - +70°C
2 x 16	NHD-0216XZ	FSW-GBW (STN+ Gray, White BL)	80 x 36	3.0 x 5.2	1 x 16 Top	-20°C - +70°C

LCD Character Displays (continued)

[illegible]

LCD Character Displays (continued)

Lines x Characters	Newhaven Part Number	Display Mode/Backlight Options (ending suffixes)	Module Size (W x H) mm	Character Size (W x H) mm	Connector Type	Operating Temperature
2 x 20	NHD-0220GZ	FL-YBW (STN+ YG,YG BL) FL-GBW (STN+ Gray,YG BL) FSW-GBW-L (STN+ Gray,White BL, 20mA) FSW-GBW-LE-E (STN+ Gray,White BL, 20mA, Euro font)	80 x 36	2.4 x 4.6	1 x 16 Top	-20°C - +70°C
2 x 20	NHD-0220DZ	FL-YBW (STN+ YG,YG BL) FL-GBW (STN+ Gray,YG BL) FSW-GBW (STN+ Gray,White BL) NSW-BBW (STN- Blue,White BL) FSW-FBW (FSTN+ White BL)	116 x 37	3.2 x 5.5	1 x 16 Top	-20°C - +70°C
2 x 20	NHD-0220AZ	FL-YBW (STN+ YG,YG BL)	146 x 43	4.8 x 9.2	1 x 16 Top	-20°C - +70°C
2 x 20	NHD-0220WH-M	YGH-JT# (STN+ Gray,YG BL) TGH-JT# (STN+ Gray,White BL) TFH-JT#E (FSTN+ White BL)	146 x 43	4.8 x 9.2	1 x 16 Top	-20°C - +70°C
2 x 20	NHD-0220WH-L	YYH-JT# (STN+ YG,YG BL) TGH-JT# (STN+ Gray,White BL)	180 x 40	6.0 x 9.6	2 x 8 Left	-20°C - +70°C
2 x 20	NHD-0220JZ	FL-GBW (STN+ Gray,YG BL) FSPG-GBW (STN+ Gray,PureGreen BL) FSB-GBW (STN+ Gray,Blue BL) FSW-GBW (STN+ Gray,White BL) FSW-FBW (FSTN+ White BL)	182 x 60	6.0 x 12.7	1 x 16 Left	-20°C - +70°C
4 x 20	NHD-0420HIZ	FL-GBW-33V3 (STN+ Gray,YG BL, 3V, 3Vdd) FSW-GBW-3V33 (STN+Gray,White BL, 3V, 3.3Vdd) FSW-GBW (STN+ Gray,White BL)	79 x 36	2.4 x 5.2	1 x 16 Back	-20°C - +70°C
4 x 20	NHD-0420AZ	FL-YBW-33V3 (STN+ YG,YG BL, 3V, 3.3Vdd) FL-GBW-33V3 (STN+ Gray,YG BL, 3V, 3.3Vdd) FSW-GBW-33V3 (STN+ Gray,White BL, 3V, 3Vdd)	77 x 47	2.3 x 4.0	1 x 16 Top	-20°C - +70°C
4 x 20	NHD-0420DZ	FL-YBW (STN+ YG,YG BL) FL-YBW-33V3 (STN+ YG,YG BL, 3V, 3.3Vdd) NSW-BBW (STN- Blue,White BL) FSW-FBW (FSTN+ White BL)	98 x 60	2.9 x 4.7	1 x 16 Top	-20°C - +70°C
4 x 20	NHD-0420E2Z	FL-YBW (STN+ YG,YG BL) FL-GBW (STN+ Gray,YG BL) FSW-GBW (STN+ Gray,White BL) NSW-BBW (STN- Blue,White BL)	146 x 62	4.8 x 9.2	1 x 16 Top	-20°C - +70°C
2 x 24	NHD-0224BZ	FL-YBW (STN+ YG,YG BL) FSW-GBW (STN+ Gray,White BL)	116 x 37	2.7 x 5.6	2 x 8 Left	-20°C - +70°C

LCD Character Displays (continued)

Lines x Characters	Newhaven Part Number	Display Mode/Backlight Options (ending suffixes)	Module Size (W x H) mm	Character Size (W x H) mm	Connector Type	Operating Temperature
2 x 24	NHD-0224BZ-I	FSW-FBW (FSTN+ White BL)	116 x 37	2.7 x 5.5	2 x 8 Left	-20°C - +70°C
2 x 24	NHD-0224AZ	FSW-GBW (STN+ Gray, White BL)	118 x 36	3.2 x 5.5	2 x 8 Left	-20°C - +70°C
2 x 24	NHD-0224WH-A	TDI-JT# (DFSTN- White BL)	118 x 36	3.2 x 5.5	2 x 8 Left	-20°C - +70°C
2 x 40	NHD-0240AZ	FL-GBW (STN+ Gray, YG BL) FL-YBW (STN+ YG, YG BL)	182 x 33	3.2 x 5.5	2 x 8 Left	-20°C - +70°C
4 x 40	NHD-0440AZ	RN-FBW (FSTN+ No BL) FL-YBW (STN+ YG, YG BL)	190 x 54	2.7 x 4.8	2 x 8 Left	-20°C - +70°C
4 x 40	NHD-0440WH-A	TMI-JT# (STN- Blue, White BL) TFH-JT# (FSTN+ White BL)	190 x 54	2.7 x 4.8	2 x 8 Left	-20°C - +70°C

LCD Serial Displays



Key Features:

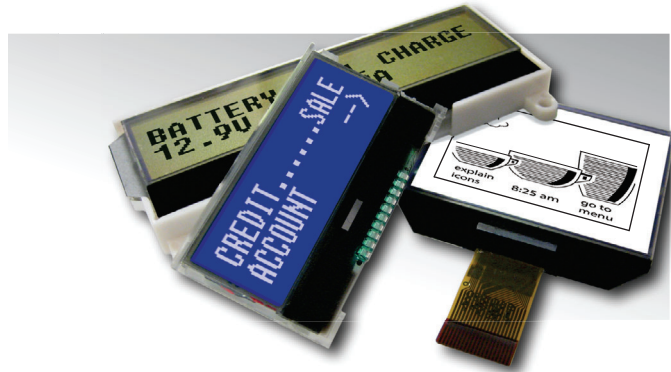
- I²C, SPI and RS232 serial interfaces
- Save development time and I/O lines
- Simple hardware interfacing
- Software controlled contrast and backlight brightness
- Standard LCD commands and fonts
- No extra boards or logic required
- Standard LCD sizes
- Custom development available
- RoHS compliant

Lines x Characters	Newhaven Part Number	Display Mode/Backlight Options (ending suffixes)	Module Size (W x H) mm	Character Size (W x H) mm	Interface	Operating Temperature
2 x 16	NHD-0216K3Z	FL-GBW-V3 (STN+ Gray,YG BL) NSW-BBW-V3 (STN- Blue,White BL) FS(RGB)-FBW-V3 (FSTN+ RGB BL) NS(RGB)-FBW-V3 (FSTN- RGB BL)	80.0 x 36.0	3.0 x 5.23	I ² C, RS232, SPI	-20°C - +70°C
2 x 16	NHD-0216B3Z	FL-GBW-V3 (STN+ Gray,YG BL)	84 x 44.0	3.0 x 5.23	I ² C, RS232, SPI	-20°C - +70°C
2 x 16	NHD-0216S3Z	FL-GBW-V3 (STN+ Gray,YG BL)	122.0 x 44.0	5.2 x 9.55	I ² C, RS232, SPI	-20°C - +70°C
2 x 20	NHD-0220D3Z	FL-GBW-V3 (STN+ Gray,YG BL) NSW-BBW-V3 (STN- Blue,White BL)	116.0 x 37.0	3.2 x 5.55	I ² C, RS232, SPI	-20°C - +70°C
2 x 40	NHD-0240BZ	NSW-BTW-P (STN- Blue,White BL, 5 Button Keypad)	210.0 x 22.0	3.2 x 5.55	RS232	-20°C - +70°C
4 x 20	NHD-0420D3Z	FL-GBW-V3 (STN+ Gray,YG BL) NSW-BBW-V3 (STN- Blue,White BL)	98.0 x 60.0	2.95 x 4.75	I ² C, RS232, SPI	-20°C - +70°C

LCD COG Displays

Key Features:

- Monochrome character or graphic icons
- Low power consumption
- Custom LED backlights available
- Wide operating temperature
- RoHS compliant



Lines x Characters	Newhaven Part Number	Display Mode/Backlight Options (ending suffixes)	Module Size (W x H x T) mm	Interface	Controller	Operating Temperature
2 x 16	NHD-C0216CZ	NSW-BBW-3V3 (STN- Blue, White BL, 3Vdd, 3V) FSW-FBW-3V3 (FSTN+ White BL, 3Vdd, 3V)	41.4 x 24.3 x 4.0	SPI	ST7032	-20°C - +70°C
2 x 16	NHD-C0216AZ	FN-GBW (STN+ Gray, No BL) FSW-GBW (STN+ Gray, White BL)	49.7 x 25.0 x 2.1	Parallel	NT7605	-20°C - +70°C
2 x 16	NHD-C0216CU	FN-GBW-3V (STN+ Gray, No BL, 3Vdd) FSW-GBW-3V3 (STN+ Gray, White BL, 3Vdd, 3.2V)	49.7 x 25.3 x 2.0 56.0 x 25.3 x 5.5	Parallel	ST7032	-20°C - +70°C
2 x 16	NHD-C0216CiZ	FSW-FBW-3V3 (FSTN+ White BL, 3Vdd, 3V) FN-FBW-3V (FSTN+ No BL, 3Vdd, 3V)	56.8 x 25.3 x 5.5	I ² C	ST7032i-OD	-20°C - +70°C
2 x 20	NHD-C0220AA	FSW-FTW (FSTN+ White BL, 3V, 12:00 view)	74.5 x 25.0 x 6.2	Parallel	NT7605	-20°C - +70°C
2 x 20	NHD-C0220AZ	FSW-FTW (FSTN+ White BL, 5V, 12:00 view)	74.5 x 25.0 x 6.2	Parallel	NT7605	-20°C - +70°C
2 x 20	NHD-C0220BiZ	FSW-FBW-3V3M (FSTN+ White BL, 3Vdd, 3V, w/ Mounting tabs) FS(RGB)-FBW-3VM (FSTN+ RGB BL, 3Vdd, w/ Mounting tabs)	75.7 x 25.0 x 6.2 75.7 x 39.1 x 6.2	I ² C	ST7036	-20°C - +70°C
128 x 32	NHD-C12832AIZ	NSW-BBW-3V3 (STN- Blue, White BL, 3Vdd, 3V) FSR-FBW-3V3 (FSTN+ Red BL, 3Vdd, 3V) FSB-FBW-3V3 (FSTN+ Blue BL, 3Vdd, 3V) FSW-FBW-3V3 (FSTN+ White BL, 3Vdd, 3V) FS(RGB)-FBW-3V (FSTN+ RGB BL, 3V)	41.4 x 24.3 x 4.0	SPI	ST7565R	-20°C - +70°C
128 x 64	NHD-C12864B2Z	RN-FBW (FSTN+ No BL)	48.0 x 36.0 x 2.0	Parallel	ST7565R	-20°C - +70°C
128 x 64	NHD-C12864GG	RN-GBW (STN+ Gray, No BL)	55.5 x 38.0 x 2.0	Serial/Parallel	ST7565P	-20°C - +70°C
128 x 64	NHD-C12864WC	FSW-FBW-3V3 (FSTN+ White BL, 3Vdd, 3V) FSW-FBW-3V3-M (FSTN+ White BL, 3Vdd, 3V w/ Mounting tabs)	66.0 x 44.0 x 5.7 77.0 x 44.0 x 5.7	Serial/Parallel	ST7565R	-20°C - +70°C
128 x 64	NHD-C12864KGZ	FSW-GBW (STN+ Gray, White BL)	55.5 x 38.0 x 5.0	Parallel	ST7565R	-20°C - +70°C
128 x 64	NHD-C12864LZ	FSW-FBW-3V3 (FSTN+ White BL, 3V, 3Vdd) NSW-FBW-3V3 (FSTN- White BL, 3V, 3Vdd)	77.4 x 52.4 x 6.5	Serial/Parallel	ST7565RG	-20°C - +70°C
128 x 64	NHD-C12864MIR	FSW-FTW-3V6 (FSTN+ White BL, 6V, 3.3Vdd)	69.9 x 42.9 x 5.8	Serial/Parallel	ST7565R	-20°C - +70°C

LCD COG Displays (continued)

Lines x Characters	Newhaven Part Number	Display Mode/Backlight Options (ending suffixes)	Module Size (W x H x T) mm	Interface	Controller	Operating Temperature
128 x 64	NHD-C12864AIZ	FSW-FBW-HTT (FSTN+ White BL, w/ Heater) FSR-FBW-HTT (FSTN+ Red BL, w/ Heater) FSB-FBW-HTT (FSTN+ Blue BL, w/ Heater) FS(RGB)-FBW-HTT (FSTN+ RGB BL, w/ Heater)	80.0 x 54.0 x 10.2	SPI	ST7565P	-40°C - +70°C
128 x 64	NHD-C12864WO	BITMI#-M (STN- Blue, White BL, w/ mounting tabs) BITFH#-M (FSTN+ White BL, w/ mounting tabs) BITTI#-M (FSTN- White BL, w/ mounting tabs) BITGH#-M (STN+ Gray, White BL, w/ mounting tabs)	89.7 x 49.8 x 6.0	Serial/Parallel	ST7565P	-20°C - +70°C
128 x 65	NHD-C12865AR	FSW-GBW (STN+ Gray, White BL)	57.0 x 39.4 x 2.0	Serial/Parallel	ST7565R	-20°C - +70°C
128 x 65	NHD-C12865BR	FSW-GBW (STN+ Gray, White BL)	66.3 x 49.8 x 5.9	Serial/Parallel	ST7565R	-20°C - +70°C
128 x 128	NHD-C128128BZ	FSW-GBW (STN+ Gray, White BL)	71.3 x 75.4 x 6.0	Serial/Parallel	ST7528	-20°C - +70°C
160 x 100	NHD-C160100AZ	RN-GBW (STN+ Gray, No BL)	41.5 x 36.0 x 2.1	Parallel	ST7528	-20°C - +70°C
160 x 100	NHD-C160100CZ	RN-FBW (FSTN+ No BL)	51.5 x 39.7 x 2.1	Serial/Parallel	ST7528	-20°C - +70°C
160 x 100	NHD-C160100DiZ	FSW-FBW (FSTN+ White BL)	48.2 x 47.6 x 4.0	I ² C	ST7528i	-20°C - +70°C
240 x 64	NHD-C24064WO	ATFH#-3V3 (FSTN+ White BL, 3V, 3Vdd)	142.5 x 51.7 x 14.9	Parallel	ST7565S(2)	-20°C - +70°C

LCD Graphic Displays

Key Features:

- 8 different backlight color options
- Low power backlight
- Optional touch panels available
- Positive and negative image options
- Industry standard sizes
- Wide operating temperature
- RoHS compliant



Columns x Rows	Newhaven Part Number	Display Mode/Backlight Options (ending suffixes)	Module Size (W x H) mm	Viewing Area (W x H) mm	Controller	Operating Temperature
122 x 32	NHD-12232KZ	NSW-BBW-P (STN- Blue,White BL, w/ pin header)	83.5 x 27.5	60.5 x 18.5	SBN1661G_M02	-20°C - +70°C
122 x 32	NHD-12232WG	EYYH-V#A (STN+ YG, YG BL)	80.0 x 36.0	60.0 x 18.0	SBN1661G	-20°C - +70°C
122 x 32	NHD-12232AZ	FL-YBW (STN+ YG,YG BL) FSW-GBW (STN+ Gray,White BL)	84.0 x 44.0	64.0 x 17.9	SBN1661G	-20°C - +70°C
128 x 64	NHD-12864MZ	FSW-GBW-L (STN+ Gray,White BL)	63.2 x 52.2	54.0 x 36.0	KS0108	-20°C - +70°C

LCD Graphic Displays (continued)

Columns x Rows	Newhaven Part Number	Display Mode/Backlight Options (ending suffixes)	Module Size (W x H) mm	Viewing Area (W x H) mm	Controller	Operating Temperature
128 x 64	NHD-12864WG-B	TGH-T#N (STN+ Gray, White BL w/ Temp Comp) TMI-V#N (STN- Blue, White BL) TFH-V#N (FSTN+ White BL)	75.0 x 52.7	58.8 x 31.4	NT7108	-20°C - +70°C
128 x 64	NHD-12864WG-C	TFH-V#N (FSTN+ White BL)	78.0 x 70.0	62.0 x 44.0	KS0108	-20°C - +70°C
128 x 64	NHD-12864WG-F	TGH-VZ# (STN+ Gray, White BL) TMI-VZ# (STN- Blue, White BL) TTI-VZ#000 (FSTN- White BL) TFH-VZ# (FSTN+ White BL)	87.0 x 70.0	72.0 x 40.0	RA6963	-20°C - +70°C
128 x 64	NHD-12864AZ	FL-YBW (STN+ YG, YG BL) FL-GBW (STN+ Gray, YG BL) FSW-GBW-VZ (STN+ Gray, White BL, w/ Neg V) FSW-FBW (FSTN+ White BL) NSW-BBW-TR (STN- Blue, White BL)	93.0 x 70.0	72.0 x 40.0	NT7108C	-20°C - +70°C
144 x 32	NHD-14432WG-A	TFH-V#T (FSTN+ White BL)	85.0 x 36.0	66.0 x 16.0	ST7920	-20°C - +70°C
144 x 32	NHD-14432WG-B	TFH-V#T (FSTN+ White BL)	80.0 x 36.0	66.0 x 16.0	ST7920	-20°C - +70°C
160 x 32	NHD-16032BZ	FL-YBW (STN+ YG, YG BL) FSW-GBW (STN+ Gray, White BL)	122.0 x 44.0	99.0 x 24.0	ST7920-OB	-20°C - +70°C
160 x 128	NHD-160128WG-B	TGH-VZ#-I (STN+ Gray, White BL) TMI-VZ#-I (STN- Blue, White BL)	129.0 x 102.0	101.0 x 82.0	RA6963	-20°C - +70°C
192 x 32	NHD-19232WG-B	GGH-V#T (STN+ Gray, Green BL) TMI-V#T (STN- Blue, White BL)	116.0 x 37.0	84.0 x 18.6	ST7920	-20°C - +70°C
240 x 64	NHD-24064CZ	FSW-GBW (STN+ Gray, White BL) NSW-BBW (STN- Blue, White BL) FSW-FBW (FSTN+ White BL)	118.0 x 45.0	96.0 x 30.0	RA6963	-20°C - +70°C
240 x 64	NHD-24064WG-A	YYH-VZ# (STN+ YG, YG BL) TGH-VZ# (STN+ Gray, White BL) TMI-VZ# (STN- Blue, White BL) TFH-VZ# (FSTN+ White BL)	180.0 x 65.0	133.0 x 39.0	RA6963	-20°C - +70°C

LCD Graphic Displays (continued)

Columns x Rows	Newhaven Part Number	Display Mode/Backlight Options (ending suffixes)	Module Size (W x H) mm	Viewing Area (W x H) mm	Controller	Operating Temperature
240 x 128	NHD-240128WG-B	TMI-VZ# (STN- Blue,White BL) TML-VZ# (STN- Blue,White BL 12:00View) TFH-VZ# (FSTN+ White BL) TGH-VZ# (STN+ Gray, White BL)	144.0 x 104.0	114.0 x 64.0	RA6963	-20°C - +70°C
240 x 128	NHD-240128WG-A	FTI-VZ#C5 (FSTN- CCFL BL, 5-pin conn.) TMI-VZ# (STN- Blue,White BL) TFH-VZ# (FSTN+ White BL)	170.0 x 103.5	128.0 x 93.4	RA6963	-20°C - +70°C
320 x 240	NHD-320240WG-A	TMI-TZ# (STN- Blue,White BL)	160.0 x 109.0	122.0 x 92.0	None	-20°C - +70°C
320 x 240	NHD-320240WG-Bx	TGH-VZ#-3VR (STN+ Gray,White,3V) TFH-VZ# (FSTN+White BL)	160 x 109.0	122.0 x 92.0	SID13700	-20°C - +70°C
320 x 240	NHD-320240WG-Bo	TMI-VZ# (STN- Blue,White BL) TFH-VZ# (FSTN+ White BL) TML-VZ#030 (STN- Blue,White BL, w/ Touch Panel, 12:00 View)	166.8 x 109.0	122.0 x 92.0	RA8835	-20°C - +70°C

TOOLS Development Board

NHDev Development Board

- Works on Newhaven Displays's OLEDs, TFT, COG, Character and Graphic LCD Displays.
- Save development time and money.
- Easy to use.

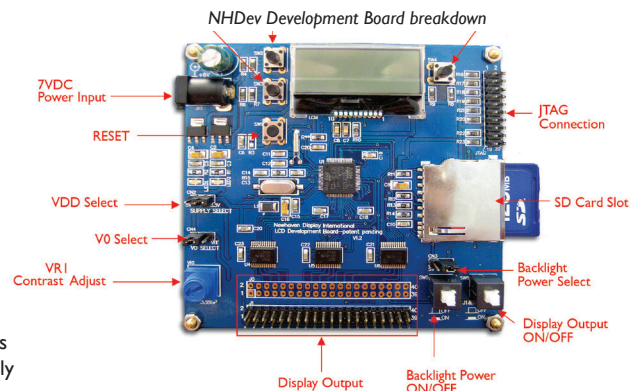


The NHDev Board is the ideal tool for prototyping and evaluating Newhaven Display's OLED, COG, TFT, Character and Graphic LCDs. This STM32F based device comes preprogrammed to demonstrate each display with preloaded images and text files from the included SD card. These files can also be easily edited or replaced with user created images allowing you to see what your actual application will look like.

The NHDev Board's easy-to-use functionality allows for quick time to market while keeping your development costs low. The design of the board has selection features making it easy for the user to plug in any display and with a push of a button have it up and running in minutes versus days. The NHDev Board now gives you the freedom to pick and choose several displays instead of just one when prototyping your product.

Features:

- One board to evaluate several displays
- Sample codes and wiring diagrams provided
- CPU: STM32F103RET6 ARM 32 bit Cortex-M3
- PCB dimensions: 100 x 95mm
- SD Card storage with preloaded images and text files
- JTAG connection with ARM2x10 pin layout for programming
- 3 push button user interface
- Features a NHD-C0216CZ-FSW-FBW display
- MPU reset switch
- Variable resistor to adjust contrast
- Backlight enable switch
- 2.54mm (0.1") pitch LCD development output pins and thru-holes
- 7VDC power supply, jumper to select +5V, 3.3V LCD power supply
- Jumper to select input to V0 potentiometer, either VSS or VEE (external voltage)



Supported Displays					
OLED Characters	OLED Graphics	TFT Displays * requires controller board	Character Modules	Graphic Modules	Chip-On-Glass Displays
NHD-0216KZW series NHD-0216SZW series NHD-0220DZW series NHD-0420DZW series	NHD-2.23-12832UC series NHD-2.7-12864UC series NHD-2.8-25664UC series NHD-3.12-25664UC series	NHD-1.8-128160EF-CTXI# NHD-1.8-128160EF-CTXI#-F NHD-2.4-240320SF-CTXI#-F1 NHD-2.4-240320SF-CTXI#-I * NHD-3.5-320240MF-ATXL#-1 * NHD-4.3-480272EF-ATXL# * NHD-5.0-800480TF-ATXI# * NHD-5.0-800480TF-ATXL# * NHD-5.7-320240WFB-ATXI#-1 * NHD-5.7-320240WFB-CTXI#-1 NHD-5.7-640480WF-CTXL# NHD-7.0-800480WF-CTXI# NHD-7.0-800480EF-ATXL# * NHD-7.0-800480EF-ATXV# *	NHD-0108 models NHD-0112 models NHD-0116 models NHD-0208 models NHD-0212 models NHD-0216 models NHD-0220 models NHD-0224 models NHD-0416 models NHD-0420 models NHD-0440 models	NHD-12232AZ series NHD-12864VW series NHD-12864WG-B series NHD-12864AZ series NHD-14432VG series NHD-16032AZ series NHD-16032BZ series NHD-160128WG series NHD-19232VG series NHD-24064CZ series NHD-24064VG series NHD-240128WG-B series NHD-240128WG-A series NHD-320240WG-B series NHD-320240WG-C series NHD-320240WX series	NHD-C0216CZ series NHD-C0216AZ series NHD-C0220A series NHD-C12832AIZ series NHD-C12864BZ series NHD-C12864GZ series NHD-C12864W series NHD-C12864M series NHD-C12864CR series NHD-C12865 series NHD-C128128BZ series NHD-C160100AZ series NHD-C160100CZ series NHD-C160100DZ series

TOOLS Controller Boards

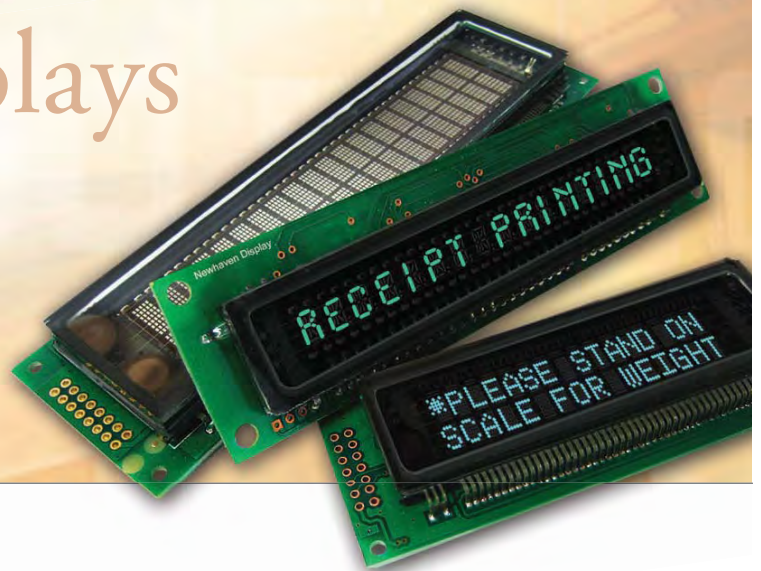
The TFT Controller boards provide the user with the ability to use an 8-bit or 16-bit parallel processor input instead of the standard 24-bit RGB input. When the processor being used doesn't have a built-in controller to run the driver on the TFT, these boards offer a simple solution that is quick and easy to use. Listed below are the controller boards that can be used to connect to our 3.5", 4.3", 5.0", 5.7" and 7.0" TFT displays.

Newhaven Part Number	Description	Module Size (W x H)mm	Controller	Voltage
NHD-3.5-320240MF-20	8-bit parallel input	78 x 64	SSD1963	+3.3V
NHD-3.5-320240MF-22	8-bit parallel input with touch panel input	78 x 64	SSD1963	+3.3V
NHD-4.3-480272MF-20	8-bit parallel input	105.5 x 40	SSD1963	+3.3V
NHD-4.3-480272MF-22	8-bit parallel input with touch panel input	105.5 x 40	SSD1963	+3.3V
NHD-4.3-480272MF-34	16-bit parallel input with touch panel input	105.5 x 40	SSD1963	+3.3V
NHD-5.0-800480MF-20	8-bit parallel input	105.5 x 40	SSD1963	+3.3V
NHD-5.0-800480MF-22	8-bit parallel with touch panel input	105.5 x 40	SSD1963	+3.3V
NHD-5.0-800480MF-34	16-bit parallel input with touch panel input	105.5 x 40	SSD1963	+3.3V
NHD-5.7-320240WFB-20	8-bit parallel input	78 x 70	SSD1963	+3.3V
NHD-7.0-800480WF-20	8-bit parallel input	94 x 45	SSD1963	+3.3V
NHD-7.0-800480WF-34	16-bit parallel input with touch panel	94 x 45	SSD1963	+3.3V

TOOLS Arduino Shields

Newhaven Part Number	Description	Size (W x H) mm	Module Resolution	Voltage
NHD-1.27-AU-SHIELD	Color OLED Arduino Shield with 1.27" Module	53 x 69	128 x 96 px	+3.3V
NHD-1.5-AU-SHIELD	Color OLED Arduino Shield with 1.5" Module	53 x 69	128 x 128 px	+3.3V
NHD-1.69-AU-SHIELD	Color OLED Arduino Shield with 1.69" Module	53 x 69	160 x 128 px	+3.3V
NHD-4.3CTP-SHIELD-L	4.3" Arduino Shield with cap touch & Standard TFT	105 x 67	480 x 272 px	+3.3V-+5.0V
NHD-4.3CTP-SHIELD-V	4.3" Arduino Shield with cap touch & Premium TFT	105 x 67	480 x 272 px	+3.3V-+5.0V
NHD-4.3CTP-SHIELD-N	4.3" Arduino Shield w/ cap touch & Sunlight-Readable TFT	105 x 67	480 x 272 px	+3.3V-+5.0V
NHD-4.3RTP-SHIELD-L	4.3" Arduino Shield with res touch & Standard TFT	105 x 67	480 x 272 px	+3.3V-+5.0V
NHD-4.3RTP-SHIELD-V	4.3" Arduino Shield with res touch & Premium TFT	105 x 67	480 x 272 px	+3.3V-+5.0V
NHD-4.3RTP-SHIELD-N	4.3" Arduino Shield w/ res touch & Sunlight-Readable TFT	105 x 67	480 x 272 px	+3.3V-+5.0V
NHD-FT81x-SHIELD	Arduino Shield for use w/ FT81x model EVE2 ICs	53 x 58	TFT resolution	+3.3V-+5.0V

VFD Displays



VFD Technology



VFDs (Vacuum Fluorescent Displays) are high contrast displays that can display 7-segment numerals, multi-segment alphanumeric characters or dot matrix characters. VFDs provide a bright, self-emitting fluorescent green light which is filtered to provide any desired color. VFDs perform well in both low and high sunlight environments and operate in extreme cold and hot temperatures.

VFDs are composed of a hot cathode filament, anode segments coated with phosphor, and grids within a vacuum sealed glass encasement. The filament is made up of alkaline coated tungsten wires which enable the display to emit light.

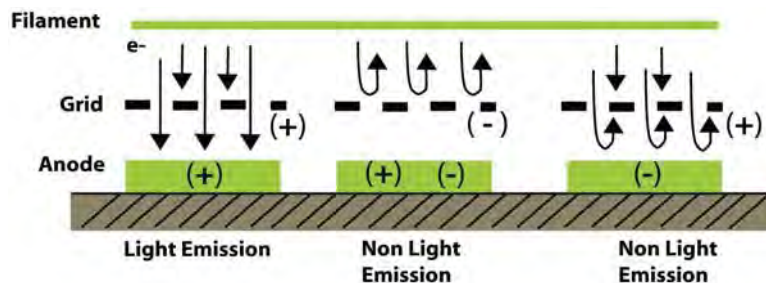
How it works

When heat generated by a power supply is applied to the tungsten wires, the alkaline coating emits electrons. These electrons are controlled and diffused by the thin metal grids within the display. When these electrons come in contact with the phosphor coated plates, they emit light.

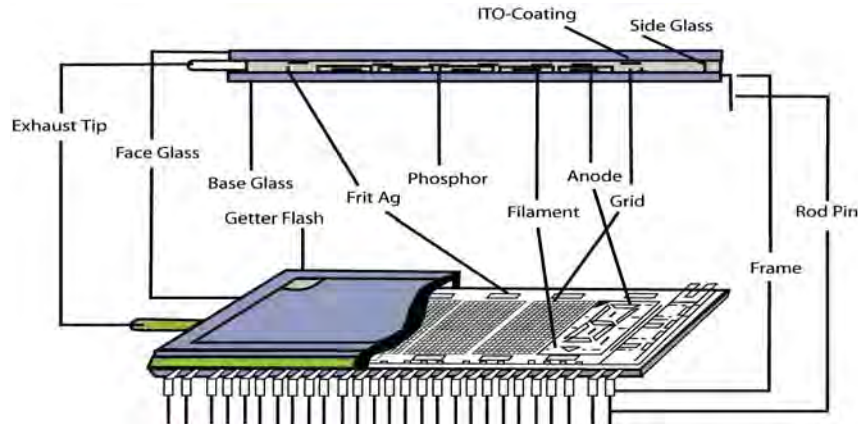
Cathode- The Cathode (Filament) is the barium oxide coated tungsten wire which is heated by the external power source to approximately 600°C and emits free thermal electrons.

The Grid- The Grid is a metal mesh over the phosphor coated anodes and controls the electrons emitted from the cathode.

Electrons- In the case of non-light emission, electrons from the cathode pass through the grid mesh with the negative potential applied. When the anodes are supplied with positive potential, electrons that pass through the grid mesh hit the anodes. Phosphor on the anode, excited by the electrons, emits luminous radiation.



VFD Terminology



Below are key words to help identify some of the commonly used terms within the VFD Industry.

process.

Filament

The Filament is the cathode of a VFD. It consists of a very thin tungsten wire coated with barium, strontium and calcium oxides. Application of a specified voltage raises the temperature of the filament, which causes thermionic emission.

ITO Contact Lead

The ITO Contact Lead lets the inside transparent conductive layer of the Front Glass connect to the filament voltage to prevent ESD effect.

Anode Electrode

The Anode Electrode generally consists of a graphic coating with phosphors. Both the graphic and phosphors are conductors.

Insulation Layer

The Insulation Layer electrically insulates the anode/grid electrode from the wiring pattern.

Wiring Pattern

The Wiring Pattern connects anode/grid electrodes to the metal leads.

Grid

The Grid controls the flow of the electrons with the application of positive or negative voltage.

Glass Substrate

The Glass Substrate is used to form the wiring pattern and other patterns.

Leads Getter

The Leads Getter is important in maintaining a high vacuum level in the inside of VFD after the exhausting process.

Exhaust Tip

The Exhaust Tip is used to remove the gasses from inside of the VFD during the production

Front Glass

The Front Glass is used together with a glass substrate to form a vacuum sealed package.

Frit Glass

The Frit Glass is heated and melted to fix and seal the Front Glass and Glass Substrate together.

Phosphors

Collided by the electrons emitted by the filament, the phosphor is excited and emits light.

Through Hole

The Through Hole is formed on the insulating layer connecting the anode electrode to the wiring pattern.

Transparent Conductive Layer

The Transparent Conductive Layer is formed on the inside of the Front Glass. It protects the display from external electrostatic effects.

VFD Classifications

VFDs come in a variety of different formats. Each format is available as a standard display type or can be customized to suite specific application needs. Typical VFD classifications include, 7-Segmented, Alphanumeric, Dot Matrix and Character.



Dot Matrix VFDs

Dot matrix VFD displays are typically used to display upper and lower case text, numerical information and limited symbols. Typical applications are measurement, scales, medical, vending machines, point-of-sales registers and industrial instrumentations.



Alphanumeric VFDs

Alphanumeric VFD displays are used to display upper and lower case text and numerical instrumentation. Typical applications are scales, test and measurement, vending machines, and gaming machines.

VFD Color Filters

Color filters can be applied to any VFD to change the overall look of the display. These filters can alter the color of the VFD and increase the contrast ratio, as well as act as a protective shield.

Some colors available include:

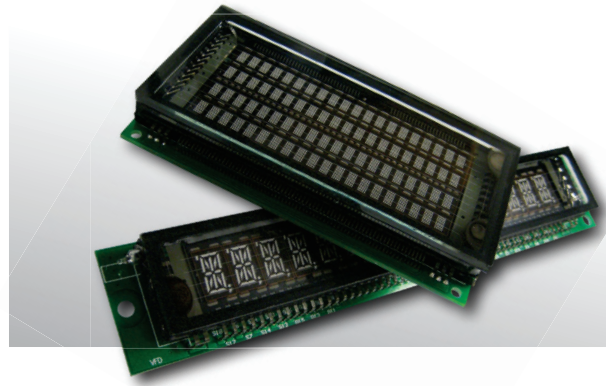
- Red
- Rose
- Blue
- Violet
- Green



VFD Module Displays

Key Features:

- LCD compatible sizes and instructions
- Self-emitting fluorescent light
- User definable fonts
- +5V power supply
- Wide operating temperature (-40°C to +85°C)
- Color filters available
- RoHS compliant



Alphanumeric VFD Modules

Lines x Characters	Module Size (L x H x T) mm	Character Size (W x H) mm	Character Type	Newhaven Part Number
1 x 16	125 x 35 x 18	3 x 5	Alphanumeric	M0116SY-161MSAR1-S2
1 x 16	177 x 32 x 15	6 x 11	Alphanumeric	M0116MY-161LSBR2-S2

Dot Matrix VFD Modules

Lines x Character	Module Size (L x H x T) mm	Character Size (W x H) mm	Character Type	Interface Serial/ Parallel	Newhaven Part Number
1 x 16	80 x 36 x 11	2 x 5	Dot Matrix	Serial/ Parallel	M0116SD-161SDBR1-I
1 x 16	100 x 28 x 22	3 x 5	Dot Matrix	Serial	M0116SD-161SDBR1-S
2 x 16	80 x 36 x 18	2 x 5	Dot Matrix	Serial/Parallel	M0216SD-162SDAR2-I
2 x 16	85 x 36 x 19	2 x 4	Dot Matrix	Serial/Parallel	M0216SD-162SDAR1
2 x 16	84 x 44 x 16	2 x 4	Dot Matrix	Serial/Parallel	M0216SD-162SDAR8
2 x 16	122 x 44 x 20	4 x 9	Dot Matrix	Serial/Parallel	M0216MD-162MDBR2-J
2 x 20	116 x 37 x 17	2 x 5	Dot Matrix	Serial/Parallel	M0220SD-202SDAR1
2 x 20	116 x 37 x 17	2 x 5	Dot Matrix	Serial/Parallel	M0220SD-202SDAR1-IG
2 x 20	146 x 43 x 19	4 x 9	Dot Matrix	Serial	M0220MD-202MDAR1-I
2 x 20	146 x 43 x 19	4 x 9	Dot Matrix	Parallel	M0220MD-202MDAR1-3
4 x 20	100 x 60 x 20	3 x 5	Dot Matrix	Parallel	M0420SD-204SDAR1-3



Newhaven Display International, Inc.

2661 Galvin Court Elgin, IL 60124, USA

www.newhavendisplay.com

Phone 847.844.8795

Fax 847.844.8796

Sales- nhsales@newhavendisplay.com

Tech Support- nhtech@newhavendisplay.com