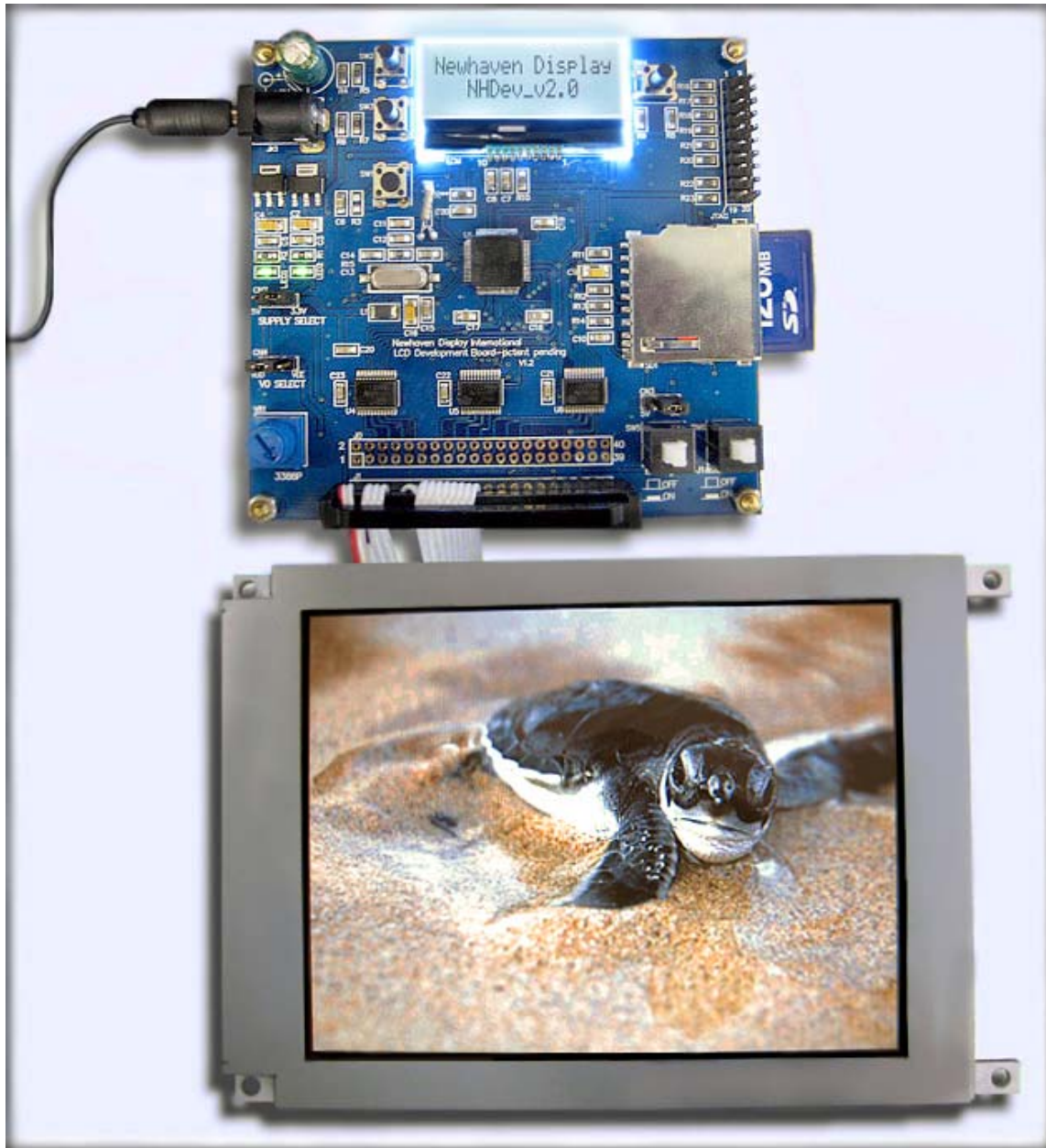# NHDev *LCD-OLED Development Board – User Manual*

Newhaven Display International, Inc

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Rev. 03.20.13

List of Supported Displays

TFTs
NHD-1.8-128160TF-CTXI#
NHD-2.4-240320SF-CTXI#-F1
NHD-2.4-240320SF-CTXI#-1
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-CTXI#-1
NHD-5.7-640480WF-CTXL#
NHD-7.0-800480WF-CTXI#
*: requires Controller Board

Graphic Modules
NHD-12232AZ series
NHD-12232DZ series
NHD-12232LZ series
NHD-12864WX series
NHD-12864WG-B series
NHD-12864AZ series
NHD-14432WG-A series
NHD-14432WG-B series
NHD-16032AZ series
NHD-16032BZ series
NHD-160128WG-B series
NHD-19232WG-B series
NHD-24064CZ series
NHD-24064WG-A series
NHD-240128WG-A series
NHD-240128WG-B series
NHD-320240WG-B series
NHD-320240WX series

OLED 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

Character Modules
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-0240 models
NHD-0416 models
NHD-0420 models
NHD-0440 models

Chip-On-Glass
NHD-C0216CZ series
NHD-0216AZ series
NHD-C0220A series
NHD-C12832A1Z series
NHD-C12864B2Z series
NHD-C12864GG series
NHD-C12864WC series
NHD-C12864WM series
NHD-C12864M series
NHD-C12864CR series
NHD-C12864AZ series
NHD-C12864A1Z series
NHD-C12865AR series
NHD-C12865BR series
NHD-C128128BZ series
NHD-C160100AZ series
NHD-C160100CZ series
NHD-C160100DiZ series

*TFT Controller Boards
NHD-3.5-320240MF-20
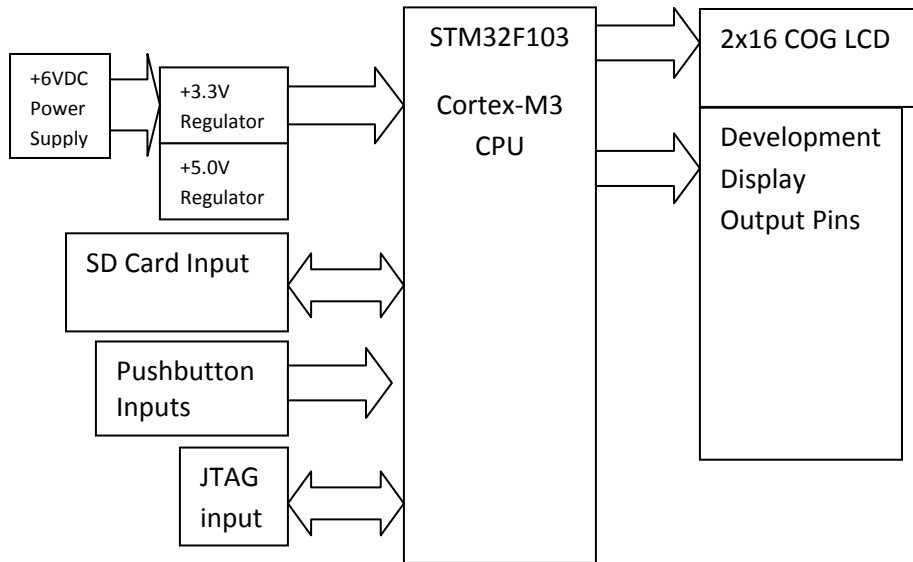NHD-4.3-480272MF-20
NHD-5.0-800480TF-20

Introduction

The NHDev is a development board for evaluating or prototyping Newhaven Display's TFT, COG, Graphic, and Character LCD displays. This development board is based on the STM32F103 Cortex-M3 microcontroller. The device has been preprogrammed to support most of Newhaven's LCD displays. The board includes a SD Card with preloaded images and text files for the supported displays, and can be reloaded or edited using a PC to evaluate the supported displays using custom designed images or text.

Features

- CPU: STM32F103RET6 ARM 32 bit Cortex-M3
- 2.54mm (0.1") pitch LCD development output pins and thru-holes
- PCB dimensions: 100 x 95mm
- SD Card storage with preloaded images and text files
- NHD-C0216CZ-FSW-FBW display
- 3 pushbutton user interface
- 6VDC power supply, jumper to select 5V or 3.3V LCD power supply.
- Jumper to select input to V0 potentiometer, either VDD or VEE (external voltage).
- Variable resistor to adjust contrast
- Backlight Enable switch
- MPU reset switch
- JTAG connection with ARM 2x10 pin layout for programming

Block Diagram

```
+6VDC          +3.3V
Power          Regulator  ─────►  STM32F103  ─────►  2x16 COG LCD
Supply                                                
               +5.0V              Cortex-M3   
               Regulator          CPU         ─────►  Development
                                                       Display
  SD Card Input  ◄────►                                Output Pins

  Pushbutton     ─────►
  Inputs

  JTAG           ◄────►
  input
```

Warning of Use

The NHDev board is shipped in protective anti-static packaging. General practice for working with static sensitive devices should be applied when working with this board.

The NHDev board is designed to be used as a learning tool and method to achieve quick-to-market product decisions. The programming and timing used may not completely match the requirements as stated in the product specifications, but can be used as general guidelines.

Though it may work, the NHDev board is not designed to be used with other manufacturer's LCDs. Consult the product specification to ensure no damage will be caused to the LCD or the NHDev board.

Damage to the NHDev board or evaluated LCD caused by improper wiring or testing sequence is not covered under warranty.

Board Use Requirements

- **Power Supply**: 6VDC, 600mA wall transformer included.
- **SD Card**: 128MB card with default files included.
- **Jumper shunts**: 3 included for VDD, V0, Backlight power select
- **LCD interface cable**: sold separately or build-your-own

Interface Introduction
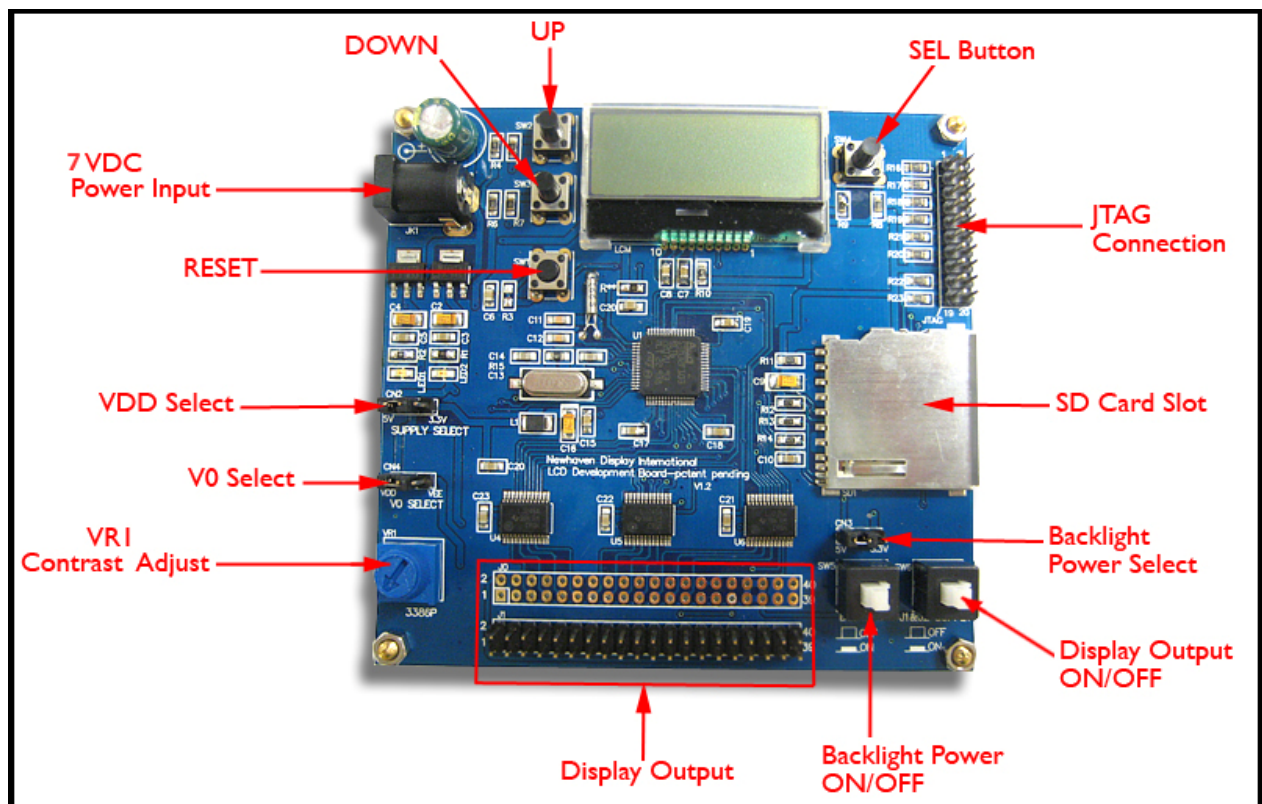
Output Pin Description

| Pin	Symbol	Level	Description
1	VSS	GND	Ground
2	VDD	5V / 3.3V	Selectable 5V, 3.3V Logic Power Supply
3	V0	Variable	LCD Contrast adjustment voltage selectable between VSS to VDD or VSS to VEE
4	VEE	Input	LCD voltage input (selected with J2)
5	RS or A0	H/L	Register Select. H=Data, L= Instruction
6	R/W or /WR	H/L	R/W in M6800 interface. H=Read, L=Write. /WR in I8080 interface. H=Write Inactive, L=Write Active
7	E or /RD	H/L	E in M6800 interface. H->L = Enable Strobe. /RD in I8080 interface. H=Read Inactive, L=Read Active
8	E2	H/L	H-> L = Enable Strobe for second controller
9	/CS1	H/L	Chip Select. L=Chip Active
10	/CS2 or DISP	H/L	Chip Select-Second Controller. L=Chip Active. DISP=Display ON signal
11	/RES	H/L	Reset. L=Reset controller.
12	BLE	5V / 3.3V	Backlight power switch (SW5)
13-16	DB0 – DB3	H/L	Bi-directional 3-state data bus lines. Not used in 4-bit mode.
17-20	DB4 – DB7	H/L	Bi-directional 3-state data bus lines.
21-28	DB8 – DB15	H/L	Bi-directional 3-state data bus lines.
29	SDI or SDA	H/L	Serial Data In
30	SCK or SCL	H/L	Serial Clock
31	SPISS	H/L	Serial Slave Select
32	BLE	5V / 3.3V	Backlight power switch (SW5)
33-36	VDD	5V / 3.3V	Selectable 5V, 3.3V Logic Power Supply
37-40	VSS	GND	Ground

Jumper Pin Description

Pins	Name	Level	Output	Description
CN2	SUPPLY SELECT	5V	VDD and logic pins	Select 5V as VDD for the display and logic
		3.3V		Select 3.3V as VDD for the display and logic
CN4	V0 SELECT	VDD	V0 (pin 3)	Select contrast voltage between VDD and VSS. (For a Positive LCD voltage). Adjustable via VR1 potentiometer.
		VEE		Select contrast voltage between VSS and VEE. (For a Negative LCD voltage). VEE must be supplied externally onto PIN4. Adjustable via VR1 potentiometer.
CN3	BACKLIGHT SUPPLY SELECT	5V	SW5 (pins 12,32)	Select 5V as voltage supply for LED backlight. External current limiting resistor may be required.
		3.3V		Select 3.3V as voltage supply for LED backlight. External current limiting resistor may be required.

Development Board Firmware Description

The NHDev Development Board comes programmed with demonstration firmware for all of the Newhaven Display modules listed above. By selecting the desired part number from the NHDev user interface, one is able to quickly demonstrate and evaluate any of these display modules. Prior to selecting the appropriate firmware, the display module must be wired to the NHDev board by matching the display's pin description to the NHDev output pin description. Then, when the firmware is selected by the display's part number the display is initialized and demonstration text or images is read from the SD Card and sent onto the display. The demonstration text and images can be edited or replaced in order to see the many capabilities of each display module.

Structure of the Demonstration Menu

NHDev Welcome Message → Category Select → Display Model Select → Display SD Card demo files
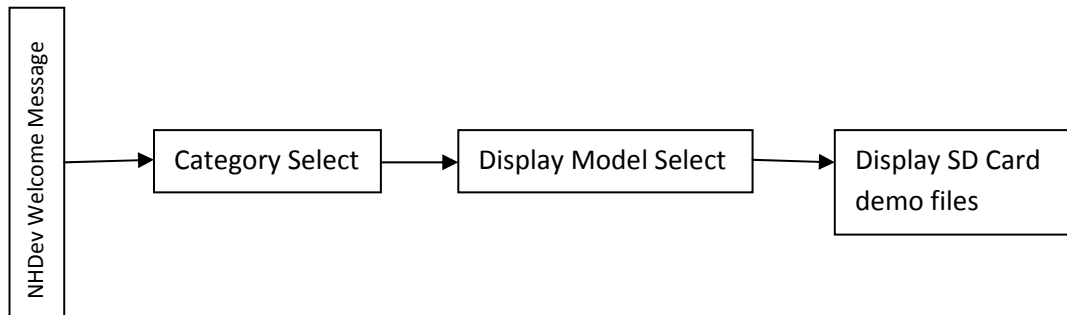
Running the Development Board

1. Wire the display by matching the pin descriptions of the display module to the NHDev output pin description.

See http://www.newhavendisplay.com/nhdev/NHDev_Wiring_Diagram.php for examples.

2. Select either 5V or 3.3V Power Supply for the display being evaluated. This is determined based on the specification of the desired display.

3. Select either VDD or VEE for the V0 Power Supply for the display being evaluated. This is determined based on the specification of the desired display.
   - If the display has a VEE Voltage Output connected to Pin 4, you should select VEE.
   - If the display's V0 (Contrast Voltage) is negative, you should select VEE.
   - If the display's V0 (Contrast Voltage) is greater than VDD, you should select VEE.
   - If the display's V0 (Contrast Voltage) is between VDD and 0V, you should select VDD.

4. Select either 5V or 3.3V for the Backlight Supply voltage. This is determined based on the specification of the desired display. If the backlight of the display requires any voltage other than 5V or 3.3V, select the greater voltage and include a current limiting resistor in line with the backlight when wiring.
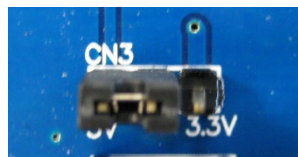
5. Push **ON** J1 and J2 (push buttons are clicked down)
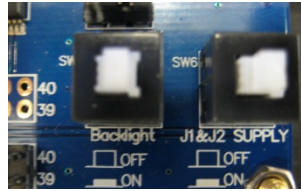
6. Make sure the SD Card is inserted into the NHDev board.

7. Apply power to NHDev board. A 6.0V DC wall transformer is included. On power up, the NHDev built-in display will show the current program revision.

8. The NHDev display will then show "Press UP to select type". Pressing the UP and DOWN buttons will cycle through the available display categories that NHDev is programmed to demonstrate. Pressing the SEL button will enter that category and begin listing specific part number models.
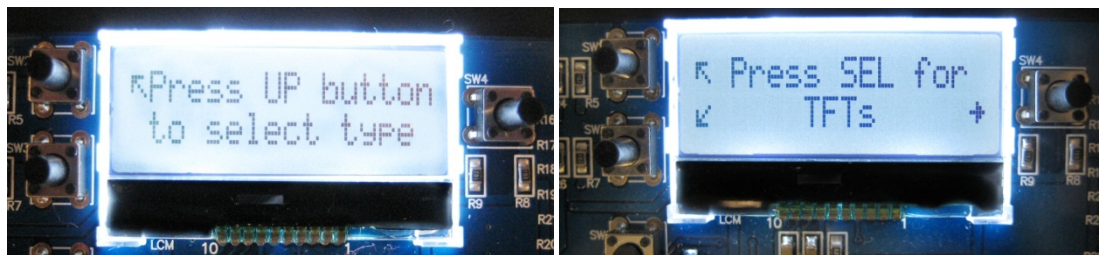
9. The NHDev display will show the first part number model in the selected category. Pressing UP and DOWN buttons will cycle through the available part number models that NHDev is programmed to demonstrate. When the desired part number model is reached, stop pressing buttons.
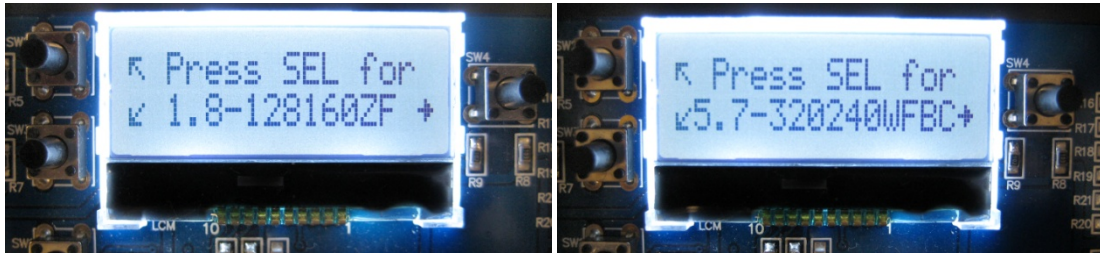
10. Press the SEL button to initialize the selected display and begin the demonstration program.

11. When prompted, press the SEL button to continue the demonstration program and scroll through the corresponding files on the SD Card. See Appendix B for SD Card file formatting and editing. You may see a blink on the display as the SD Card is being read and the display is being re-initialized and written.

12. To evaluate another display, disconnect the power and repeat all steps.

SD Card File Format

For each display model, the demonstration program will attempt to read a default file. The default file must be saved on the SD Card and be readable or the NHDev program will error and halt.

The default file is always signified by a 0 (zero) immediately before the .BMP or .TXT file format.

After reading and displaying the default file, if the SEL button is pressed, the next file, if available and readable, will be read and displayed. If no additional files are available, the default file will be displayed again.

The next file is determined by incrementing the number or letter immediately before the .BMP or .TXT.

- ✓ Char2x16_0.txt
- ➤ Char2x16_1.txt
- ➤ Char2x16_2.txt

  …
- ➤ Char2x16_9.txt
- ➤ Char2x16_A.txt
- ➤ Char2x16_B.txt

  …
- ➤ Char2x16_Y.txt
- ➤ Char2x16_Z.txt
- ✓ Char2x16_0.txt
- ➤ Char2x16_1.txt

You may edit the contents of any of the provided files or create your own according to the following table.

Model No.	Resolution	File Type	Default File Name (***Required File***)
TFTs			
NHD-1.8-128160ZF-CTXL#	128x160 pixels	24-bit bitmap .BMP	1_8_128160ZF_0.bmp
NHD-2.4-240320SF-CTXI#-F1	240x320 pixels	24-bit bitmap .BMP	2_4_240320SF_0.bmp
NHD-2.4-240320SF-CTXI#-1	240x320 pixels	24-bit bitmap .BMP	2_4_240320SF_0.bmp
NHD-3.5-320240MF-ATXL#-1	320x240 pixels	24-bit bitmap .BMP	3_5_320240MF_0.bmp
NHD-4.3-480272EF-ATXL#-1	480x272 pixels	24-bit bitmap .BMP	4_3_480272MF_0.bmp
NHD-5.0-800480TF-ATXI#	800x480 pixels	24-bit bitmap .BMP	5_0_800480TF_0.bmp
NHD-5.7-320240WFB-CTXI#-1	320x240 pixels	24-bit bitmap .BMP	5_7_320240WFB_0.bmp
NHD-5.7-640480WF-CTXL#	640x480 pixels	24-bit bitmap .BMP	5_7_640480WF_0.bmp
NHD-7.0-800480WF-CTXI#	800x480 pixels	24-bit bitmap .BMP	7_0_800480WF_0.bmp
Character Modules			
NHD-0108	8 characters	.TXT	Char1x8_0.txt
NHD-0112	12 characters	.TXT	Char1x12_0.txt
NHD-0116	16 characters	.TXT	Char1x16_0.txt
NHD-0208	16 characters	.TXT	Char2x8_0.txt
NHD-0212	24 characters	.TXT	Char2x12_0.txt
NHD-0216	32 characters	.TXT	Char2x16_0.txt
NHD-0220	40 characters	.TXT	Char2x20_0.txt

NHD-0224	48 characters	.TXT	Char2x24_0.txt
NHD-0240	80 characters	.TXT	Char2x40_0.txt
NHD-0416	64 characters	.TXT	Char4x16_0.txt
NHD-0420	80 characters	.TXT	Char4x20_0.txt
NHD-0440	160 characters	.TXT	Char4x40_0.txt
Graphic Modules			
NHD-12232AZ	122x32 pixels	Monochrome bitmap .BMP	12232AZ_0.bmp
NHD-12232LZ	122x32 pixels	Monochrome bitmap .BMP	12232LZ_0.bmp
NHD-12864WX	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-12864MZ	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-12864WG-B	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-12864AZ	128x64 pixels	Monochrome bitmap .BMP	12864AZ_0.bmp
NHD-14432WG	144x32 pixels	Monochrome bitmap .BMP	14432WG_0.bmp
NHD-16032AZ	160x32 pixels	Monochrome bitmap .BMP	16032_0.bmp
NHD-16032BZ	160x32 pixels	Monochrome bitmap .BMP	16032_0.bmp
NHD-160128WG-B	160x128 pixels	Monochrome bitmap .BMP	160128_0.bmp
NHD-19232WG-B	192x32 pixels	Monochrome bitmap .BMP	19232_0.bmp
NHD-24064CZ	240x64 pixels	Monochrome bitmap .BMP	24064_0.bmp
NHD-24064WG-A	240x64 pixels	Monochrome bitmap .BMP	24064_0.bmp
NHD-240128WG-A	240x128 pixels	Monochrome bitmap .BMP	240128_0.bmp
NHD-240128WG-B	240x128 pixels	Monochrome bitmap .BMP	240128_0.bmp
NHD-320240WG-B	320x240 pixels	Monochrome bitmap .BMP	320240_0.bmp
NHD-320240WX	320x240 pixels	Monochrome bitmap .BMP	320240_0.bmp
COG Modules			
NHD-C0216CZ	32 characters	.TXT	Char2x16_0.txt
NHD-C0216AZ	32 characters	.TXT	Char2x16_0.txt
NHD-C0216CU	32 characters	.TXT	Char2x16_0.txt
NHD-C0220A	40 characters	.TXT	Char2x20_0.txt
NHD-C12832A1Z	128x32 pixels	Monochrome bitmap .BMP	C12832_0.bmp
NHD-C12864B2Z	128x64 pixels	Monochrome bitmap .BMP	C12864_0.bmp
NHD-C12864GG	128x64 pixels	Monochrome bitmap .BMP	C12864_0.bmp
NHD-C12864WC	128x64 pixels	Monochrome bitmap .BMP	C12864_0.bmp
NHD-C12864WM	128x64 pixels	Monochrome bitmap .BMP	C12864_0.bmp
NHD-C12864M	128x64 pixels	Monochrome bitmap .BMP	C12864_0.bmp
NHD-C12864CR	128x64 pixels	Monochrome bitmap .BMP	C12864_0.bmp
NHD-C12864AZ	128x64 pixels	Monochrome bitmap .BMP	C12864_0.bmp
NHD-C12864A1Z	128x64 pixels	Monochrome bitmap .BMP	C12864_0.bmp
NHD-C12865AR	128x65 pixels	Monochrome bitmap .BMP	C12864_0.bmp
NHD-C12865BR	128x65 pixels	Monochrome bitmap .BMP	C12864_0.bmp
NHD-C128128BZ	128x128 pixels	Monochrome bitmap .BMP	C128128_0.bmp
NHD-C160100AZ	160x100 pixels	Monochrome bitmap .BMP	C160100_0.bmp
NHD-C160100CZ	160x100 pixels	Monochrome bitmap .BMP	C160100_0.bmp
NHD-C160100DiZ	160x100 pixels	Monochrome bitmap .BMP	C160100_0.bmp
OLED Modules			
NHD-0216KZW	32 characters	.TXT	Char2x16_0.txt
NHD-021SZW	32 characters	.TXT	Char2x16_0.txt
NHD-0220DZW	40 characters	.TXT	Char2x20_0.txt
NHD-0420DZW	80 characters	.TXT	Char4x20_0.txt
NHD-2.23-12832UC	128x32	Monochrome bitmap .BMP	OLED12832_0.bmp
NHD-2.7-12864UC	128x64 pixels	Monochrome bitmap .BMP	OLED12864_0.bmp
NHD-2.8-25664UC	256x64 pixels	Monochrome bitmap .BMP	OLED25664_0.bmp
NHD-3.12-25664UC	256x64 pixels	Monochrome bitmap .BMP	OLED25664_0.bmp

#