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# NHD-16032BZ-FSW-GBW

## Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
16032-	160 x 32 pixels
BZ-	Model
F-	Transflective
SW-	Side White LED backlight
G-	STN- Gray
B-	6:00 View
W-	Wide Temperature (-20°C ~ +70°C)
	<b>RoHS Compliant</b>

**Newhaven Display International, Inc.**

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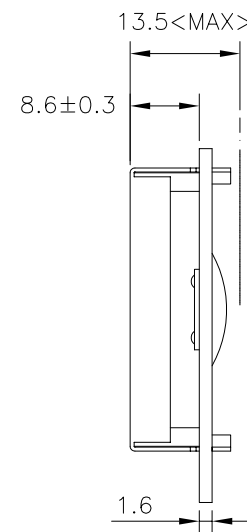
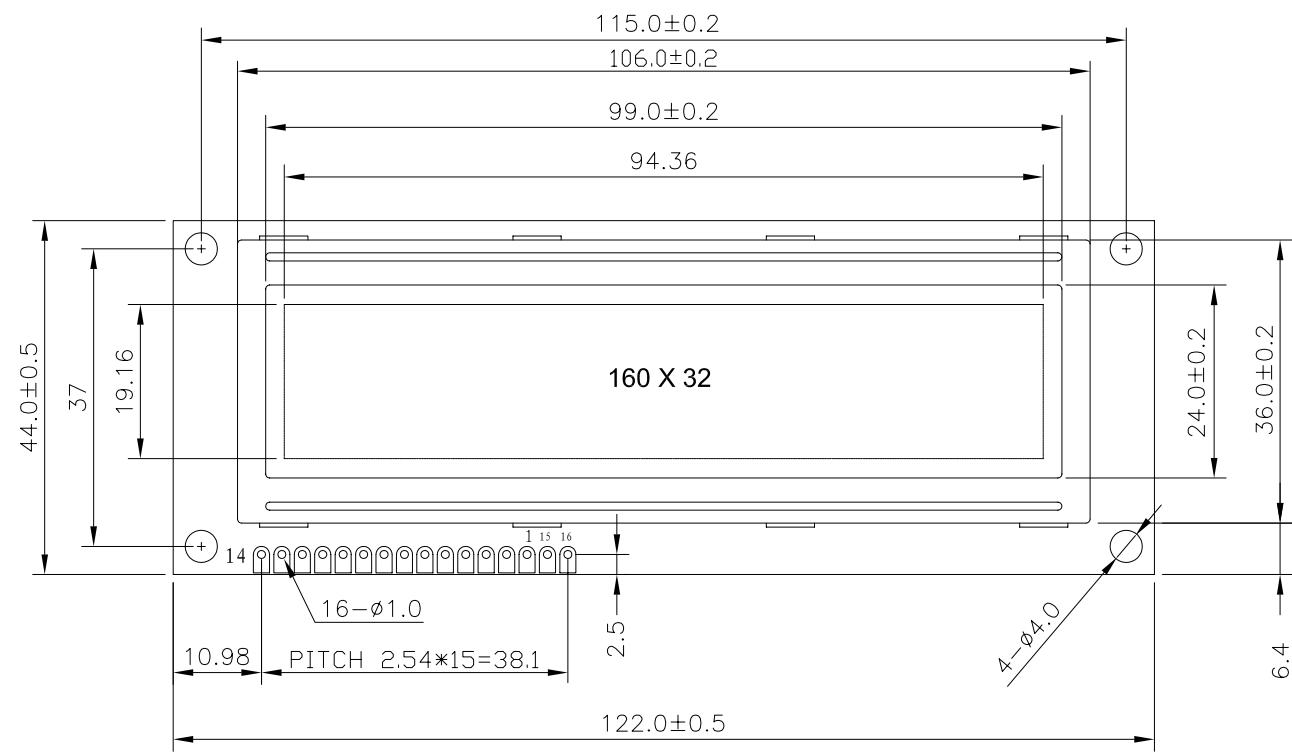
## Document Revision History

Revision	Date	Description	Changed by
0	2/28/2008	Initial Release	-
1	4/12/2010	User guide reformat	BE
2	5/7/2010	Mechanical drawing/initialization update	BE
3	6/23/2010	Pin description and Block diagram update	MP

## Functions and Features

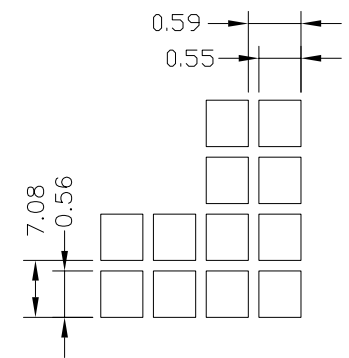
- 160x32 pixels
- Built-in ST7920 Controller
- +5.0V power supply
- 1/32 duty, 1/9 bias
- RoHS Compliant

REV	DESCRIPTION:	DATE



**PIN ASSIGNMENT**

1	VSS
2	VDD
3	NC
4	RS
5	R/W
6	E
7~14	DB0~DB7
15	LED+
16	LED-



**Specification:**

- 1). Driving: Duty:1/32, Bias:1/9, VLCD:4.6V, VDD:5.0V
- 2). Viewing Direction: 6 O'clock
- 3). Display mode: STN-Gray/Transflective
- 4). Operating temp.:  $-20^{\circ}C \sim +70^{\circ}C$   
Storage temp.:  $-30^{\circ}C \sim +80^{\circ}C$
- 5). Driver : ST7920
- 6). Backlight: White/5.0V

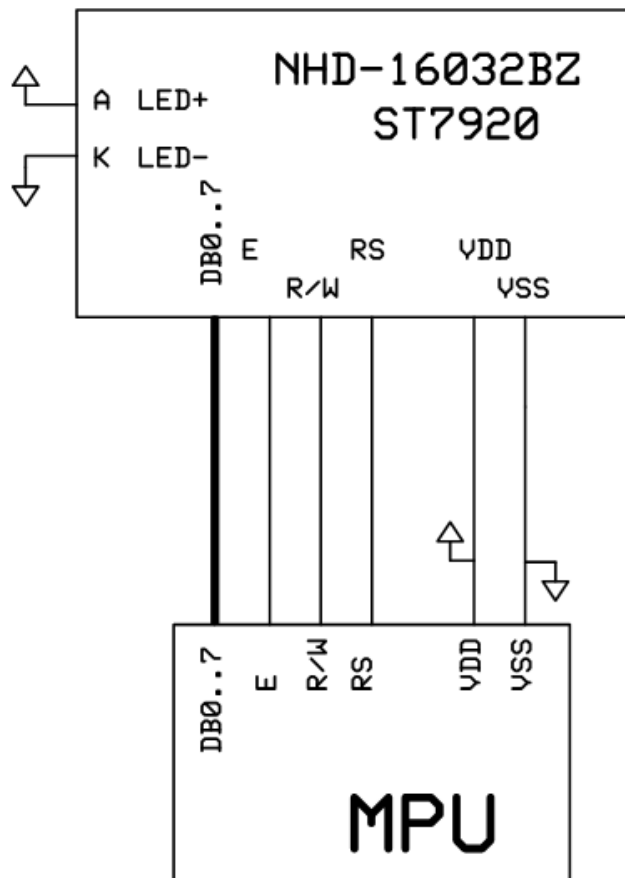
Model Name: <b>NHD-16032BZ-FSW-GBW</b>		<b>Newhaven Display</b>	
GENERAL TOL: $\pm 0.2$			
APPROVALS	DATE	DRAWN NO.	SCALE: 1:1
DWN: Qiwei Qiu			
CHK:		SIZE: A4	UNIT: mm
APP: Guoxiang Ye			Page: 1-1

## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Power supply for Logic (+5.0V)
3	NC	NC	No Connect
4	RS	MPU	Register select: 1=Data, 0=Instruction
5	R/W	MPU	Read/Write select signal, R/W=1: Read R/W: =0: Write
6	E	MPU	Operation enable signal. Falling edge triggered.
7-10	DB0-DB3	MPU	Four low order bi-directional three-state data bus lines. These four are not used during 4-bit operation.
11-14	DB4-DB7	MPU	Four high order bi-directional three-state data bus lines.
15	LED+	Power Supply	Power for LED backlight (+5.0V via on-board resistor)
16	LED-	Power Supply	Ground for Backlight

**Recommended LCD connector:** 2.54mm pitch pins

**Backlight connector:** -      **Mates with:** -



## Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	Top	Absolute Max	-20	-	+70	°C
Storage Temperature Range	Tst	Absolute Max	-30	-	+80	°C
Supply Voltage	VDD		4.7	5.0	5.5	V
Supply Current	IDD	Ta=25°, VDD=5.0V	-	1.5	2.5	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°	-	4.6	-	V
"H" Level input	Vih		2.2	-	VDD	V
"L" Level input	Vil		0	-	0.6	V
"H" Level output	Voh		2.4	-	-	V
"L" Level output	Vol		-	-	0.4	V
Backlight Supply Voltage	Vled		-	5.0	-	V
Backlight Supply Current	Iled	Vled=5.0V	-	20	-	mA

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical (top)	AH	Cr ≥ 2	-	35	-	°
Viewing Angle- Vertical (bottom)	AH	Cr ≥ 2	-	60	-	°
Viewing Angle- Horizontal (left)	AV	Cr ≥ 2	-	40	-	°
Viewing Angle - Horizontal (right)	AV	Cr ≥ 2	-	40	-	°
Contrast Ratio	Cr			6		
Response Time (rise)	Tr			150	250	ms
Response Time (fall)	Tf			150	250	ms

## Controller Information

Built-in ST7920. Download specification at [http://www.newhavendisplay.com/app\\_notes/ST7920.pdf](http://www.newhavendisplay.com/app_notes/ST7920.pdf)



## Table of Commands

### Instruction set 1: (RE=0: basic instruction)

Ins	code										Description	Exec time (540KHZ)
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
CLEAR	0	0	0	0	0	0	0	0	0	1	Fill DDRAM with "20H", and set DDRAM address counter ( AC ) to "00H"	1.6 ms
HOME	0	0	0	0	0	0	0	0	0	1 X	Set DDRAM address counter ( AC ) to "00H", and put cursor to origin ; the content of DDRAM are not changed	72us
ENTRY MODE	0	0	0	0	0	0	0	0	1	I/D S	Set cursor position and display shift when doing write or read operation	72us
DISPLAY ON/OFF	0	0	0	0	0	0	0	1	D	C B	D=1: display ON C=1: cursor ON B=1: blink ON	72 us
CURSOR DISPLAY CONTROL	0	0	0	0	0	0	1	S/C	R/L	X X	Cursor position and display shift control ; the content of DDRAM are not changed	72 us
FUNCTION SET	0	0	0	0	0	1	DL	X	0 RE	X X	DL=1 8-BIT interface DL=0 4-BIT interface <b><u>RE=1: extended instruction</u></b> <b><u>RE=0: basic instruction</u></b>	72 us
SET CGRAM ADDR.	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address to address counter ( AC ) <b><u>Make sure that in extended instruction SR=0 (scroll or RAM address select)</u></b>	72 us
SET DDRAM ADDR.	0	0	1	0 AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address to address counter ( AC ) AC6 is fixed to 0	72 us
READ BUSY FLAG (BF) & ADDR.	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Read busy flag ( BF ) for completion of internal operation, also Read out the value of address counter ( AC )	0 us
WRITE RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data to internal RAM (DDRAM/CGRAM/IRAM/GDRAM)	72 us
READ RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM/IRAM/GDRAM)	72 us

## Instruction set 2: (RE=1: extended instruction)

Inst.	code										description	Exec. time (540KHZ)
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
STAND BY	0	0	0	0	0	0	0	0	0	1	Enter stand by mode, any other instruction can terminate (Com1..32 halted, only Com33 ICON can display)	72 us
SCROLL or RAM ADDR. SELECT	0	0	0	0	0	0	0	0	0	1 SR	SR=1: enable vertical scroll position SR=0: enable IRAM address ( <b>extended instruction</b> ) SR=0: enable CGRAM address( <b>basic instruction</b> )	72 us
REVERSE	0	0	0	0	0	0	0	0	1 R1	R0	Select 1 out of 4 line ( in DDRAM) and decide whether to reverse the display by toggling this instruction <b>R1,R0 initial value is 00</b>	72 us
EXTENDED FUNCTION SET	0	0	0	0	1	DL	X	1 RE	G	0	DL=1 8-BIT interface DL=0 4-BIT interface <b>RE=1: extended instruction set</b> <b>RE=0: basic instruction set</b> G=1 :graphic display ON G=0 :graphic display OFF	72 us
SET IRAM or SCROLL ADDR	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	SR=1: AC5~AC0 the address of vertical scroll SR=0: AC3~AC0 the address of ICON RAM	72 us
SET GRAPHIC RAM ADDR.	0	0	1	0	0	0	AC3	AC2	AC1	AC0	Set GDRAM address to address counter ( AC ) First set vertical address and the horizontal address by consecutive writing Vertical address range AC6...AC0 Horizontal address range AC3...AC0	72 us

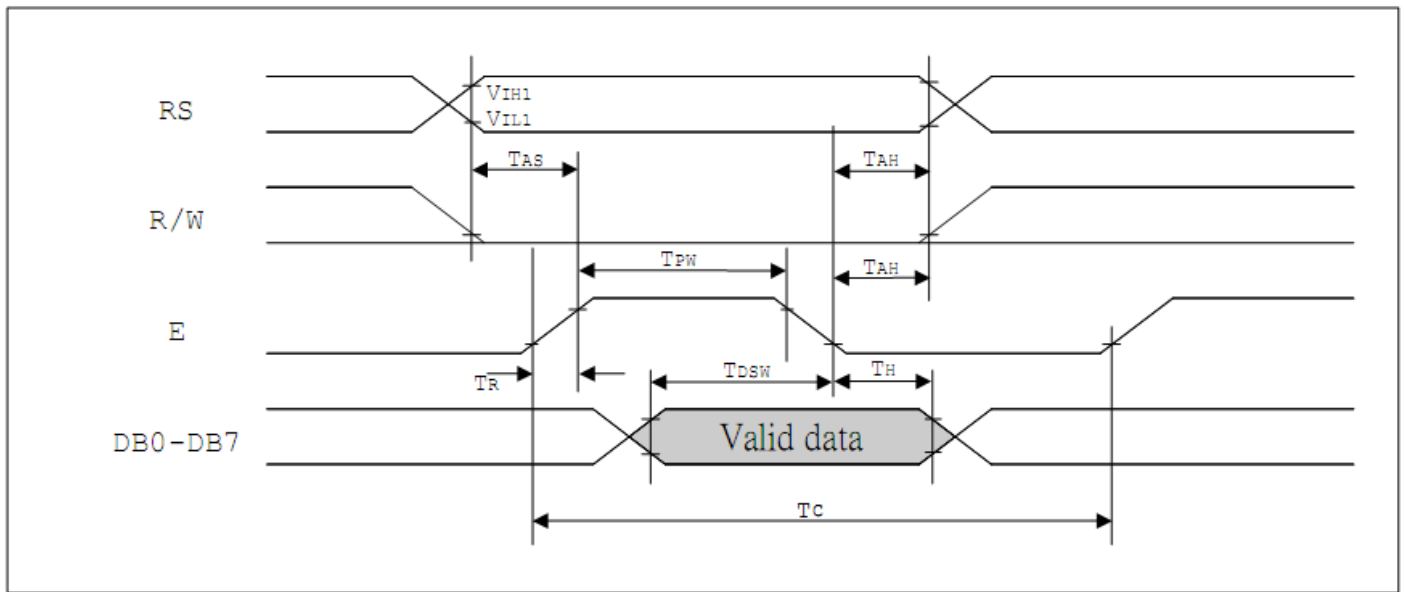


## Timing Characteristics

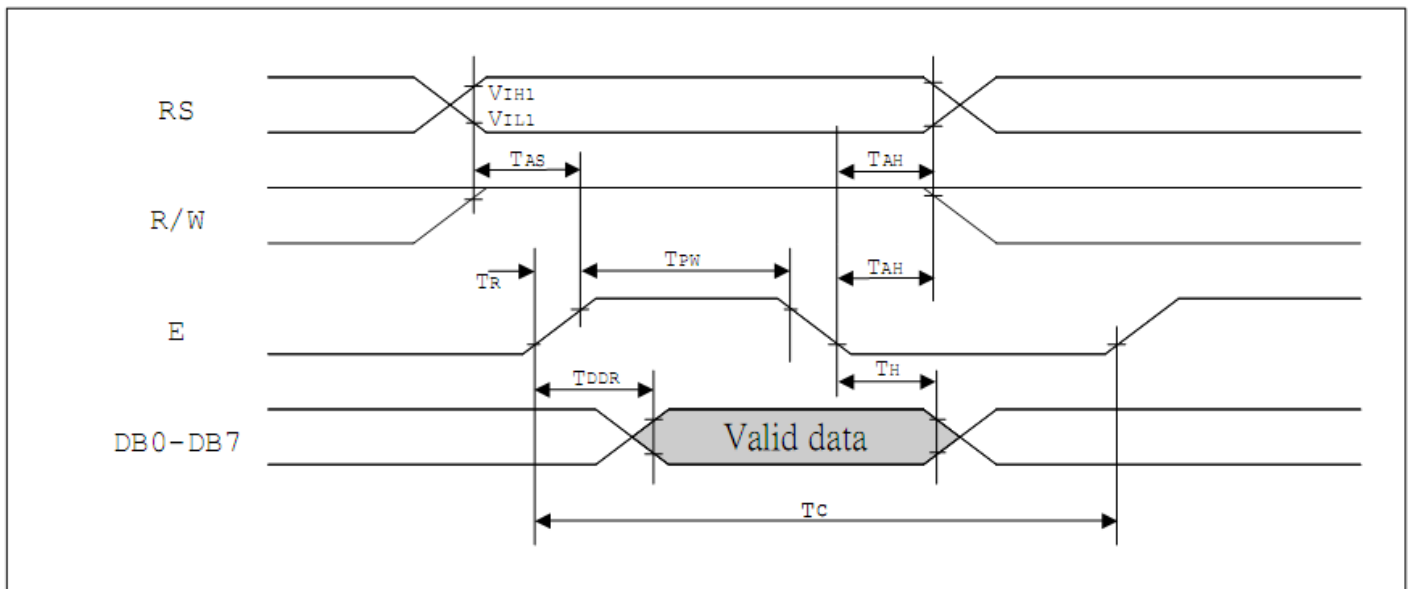
### DC Characteristics ( $T_A = 25^\circ\text{C}$ , $V_{DD} = 4.5\text{ V} - 5.5\text{ V}$ )

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
$V_{DD}$	Operating Voltage	-	4.5	-	5.5	V
$V_{LCD}$	LCD Voltage	$V_0 - V_{SS}$	3.0	-	7	V
$I_{CC}$	Power Supply Current	$f_{OSC} = 540\text{KHz}$ , $V_{DD} = 5\text{V}$ $R_f = 33\text{K}\Omega$	-	0.45	0.75	mA
$V_{IH1}$	Input High Voltage (Except OSC1)	-	$0.7V_{DD}$	-	$V_{DD}$	V
$V_{IL1}$	Input Low Voltage (Except OSC1)	-	-0.3	-	0.6	V
$V_{IH2}$	Input High Voltage (OSC1)	-	$V_{DD} - 1$	-	$V_{DD}$	V
$V_{IL2}$	Input Low Voltage (OSC1)	-	-	-	1.0	V
$V_{OH1}$	Output High Voltage (DB0 - DB7)	$I_{OH} = -0.1\text{mA}$	$0.8V_{DD}$	-	$V_{DD}$	V
$V_{OL1}$	Output Low Voltage (DB0 - DB7)	$I_{OL} = 0.1\text{mA}$	-	-	0.4	V
$V_{OH2}$	Output High Voltage (Except DB0 - DB7)	$I_{OH} = -0.04\text{mA}$	$0.8V_{DD}$	-	$V_{DD}$	V
$V_{OL2}$	Output Low Voltage (Except DB0 - DB7)	$I_{OL} = 0.04\text{mA}$	-	-	$0.1V_{DD}$	V
$I_{LEAK}$	Input Leakage Current	$V_{IN} = 0\text{V to } V_{DD}$	-1	-	1	$\mu\text{A}$
$I_{PUP}$	Pull Up MOS Current	$V_{DD} = 5\text{V}$	75	80	85	$\mu\text{A}$

## MPU write data to ST7920



## MPU read data from ST7920



## Example Initialization Program

```

//-----
#include <REG52.H>
#include "AL.h"
sbit ID = P3^0;
sbit RW = P3^7;
sbit E = P3^4;

//-----
void Init()
{
    Wcom(0x38);
    Wcom(0x0C);
    Wcom(0x06);
    Wcom(0x02);
    Wcom(0x01);
    delay(10);
    Row = 0x80;
    for(Counthi = 1; Counthi <=32; Counthi++)
    {
        Wcom(0x3E);
        Wcom(Row);
        Wcom(0x80);
        for(Count = 1; Count <=40; Count++)
        {
            Wdata(0x00);
        }
        Row++;
    }
}

//-----
void Wcom(char i)
{
    P1 = i;
    ID = 0;
    RW = 0;
    E = 1;
    delay(1);
    E = 0;
}

void Wdata(char i)
{
    P1 = i;
    ID = 1;
    RW = 0;
    E = 1;
    delay(1);
    E = 0;
}

```

## Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+80°C , 48hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 48hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C , 48hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 48hrs	1,2
High Temperature / Humidity Operation	Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time.	+40°C , 90% RH , 48hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	0°C,30min -> 25°C,5min -> 50°C,30min = 1 cycle 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz , 15mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	VS=800V, RS=1.5kΩ, CS=100pF One time	

**Note 1:** No condensation to be observed.

**Note 2:** Conducted after 4 hours of storage at 25°C, 0%RH.

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

## Precautions for using LCDs/LCMs

See Precautions at [www.newhavendisplay.com/specs/precautions.pdf](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information and Terms & Conditions

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