NHD-320240WG-BoTMI-VZ#

Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
320240-	320 x 240 pixels
WG-	Display Type: Graphic
Bo-	Model
T-	WhiteLED Backlight
M-	STN- Negative Blue
I-	Transmissive, 6:00 view, Wide Temperature (-20°C ~+70°C)
VZ#-	Built-in Negative Voltage
	RoHS Compliant

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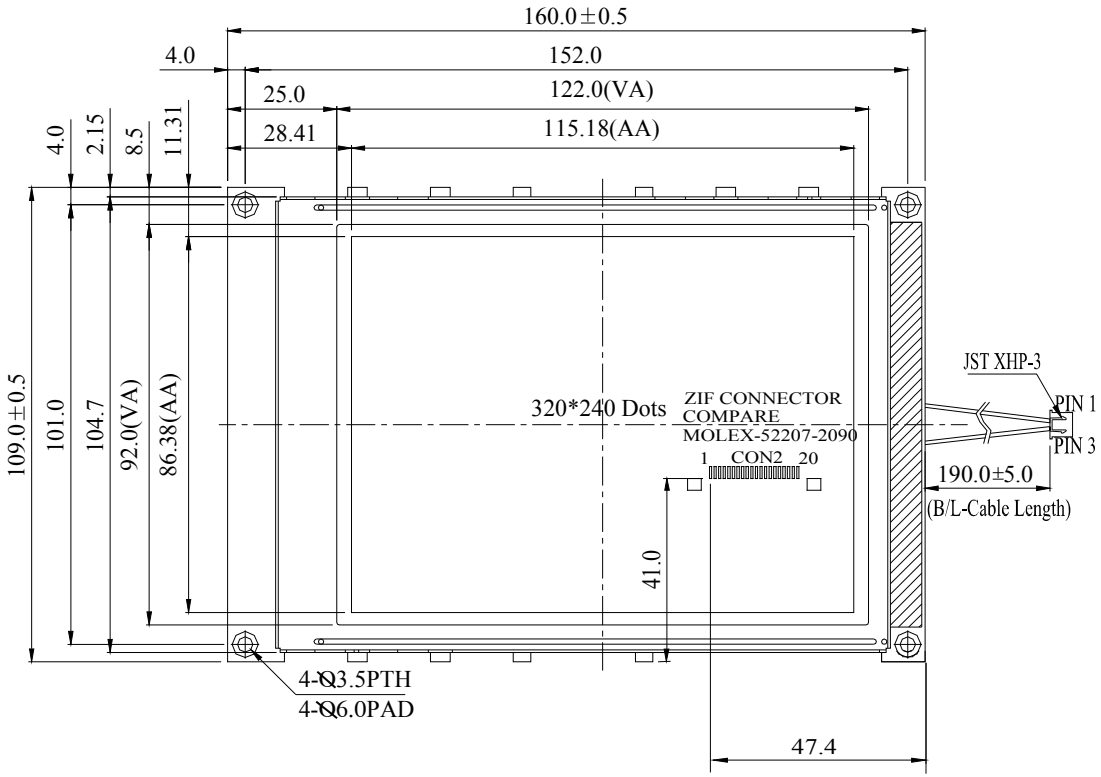
Document Revision History

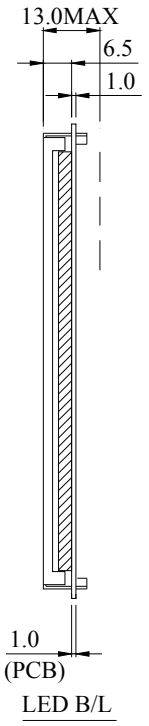
Revision	Date	Description	Changed by
0	**6/7/2007**	**Initial Release**	**-**
1	**4/16/2010**	**User guide reformat**	**MC**
2	**11/15/2010**	**Mechanical Drawing updated with ZIF connector**	**BE**

Functions and Features

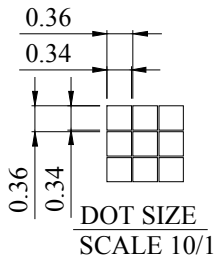
- **320 x 240pixels**
- **Built-in RA8835Controller**
- **+5.0V power supply**
- **RoHS Compliant**

Mechanical Drawing





PIN NO.	SYMBOL
1	VSS
2	Vcc
3	Vo
4	A0
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	/CS
16	/RST
17	Vee
18	NC
19	FG
20	NC



The non-specified tolerance of dimension is ±0.3mm.

Newhaven Display
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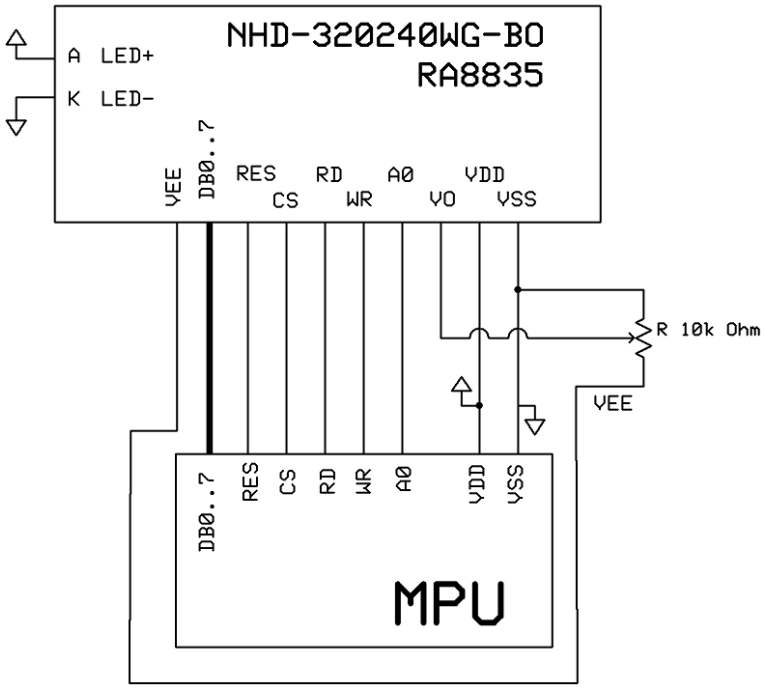
Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Power supply for logic (+5.0V)
3	V0	Adj Power Supply	Power supply for contrast (approx. -19.0V)
4	A0	MPU	Register select signal. A0=0: Command, A0=1: Data
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.
7-14	DB0-DB7	MPU	Bi-directional three-state data bus lines.
15	/CS	MPU	Active LOW chip select
16	/RST	MPU	Active LOW reset signal
17	VEE	Power Supply	Negative voltage output (-25V)
18	NC	-	No Connect
19	FG	-	No Connect
20	NC	-	No Connect

Recommended LCD connector: 1.0mm pitch, 20-pos FFC connector
Backlight connector:JST p/n: XHP-3**Mates with**: JST p/n: B 3B-XH-A



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		4.5	5.0	5.5	V
Supply Current	IDD	Ta=25°C, VDD=5.0V	95.0	100.0	110.0	mA
Supply for LCD (contrast)	VDD-VLCD	Ta=25°C	22.0	24.0	26.0	V
"H" Level input	VIH		0.5VDD	-	VDD	V
"L" Level input	VIL	-	0	-	0.2VDD	V
"H" Level output	VOH	-	2.4	-	-	V
"L" Level output	VOL	-	-	-	0.4	V
Backlight Supply Voltage	VLED		3.4	3.5	3.6	V
Backlight Supply Current	ILED	VLED=3.5V	120	160	240	mA
Backlight Lifetime		ILED=160mA	-	50,000	-	Hrs

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical	AV	Cr ≥3	-40	-	20	º
Viewing Angle - Horizontal	AH	Cr ≥3	-30	-	30	º
Contrast Ratio	Cr		-	3	-	-
Response Time (rise)	Tr	-	-	150	200	ms
Response Time (fall)	Tf	-	-	150	200	ms

Controller Information

Built-in RA8835. Download specification athttp://www.newhavendisplay.com/app_notes/RA8835.pdf

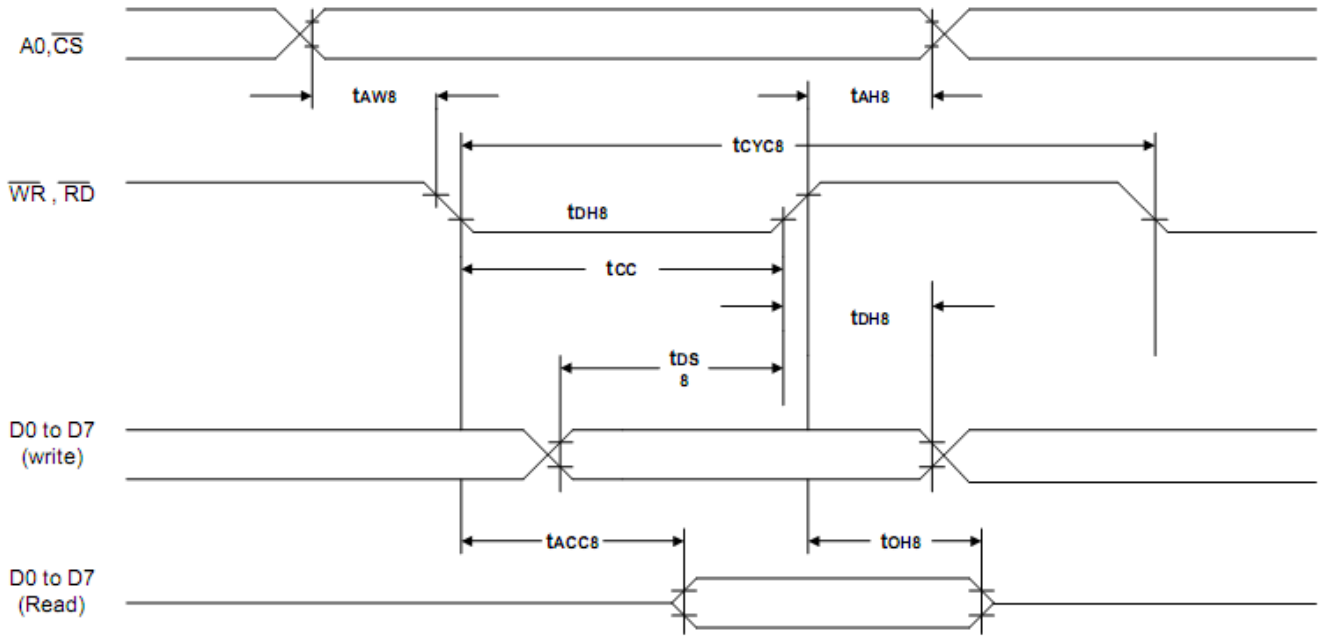
Table of Commands

Table-1: Command Set

Class	Command	Code											Hex	Command Description	Command Read Parameters	
		RD	WR	A0	D7	D6	D5	D4	D3	D2	D1	D0			No. of Bytes	Section
System Control	**SYSTEM SET**	1	0	1	0	1	0	0	0	0	0	0	40	Initialize device and display	8	9-2-1
	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter standby mode	0	9-2-2
Display Control	**DISPLAY ON/OFF**	1	0	1	0	1	0	1	1	0	0	D	58, 59	Enable and disable display and display flashing	1	9-3-1
	SCROLL	1	0	1	0	1	0	0	0	1	0	0	44	Set display start address and display regions	10	9-3-2
	CSRFORM	1	0	1	0	1	0	1	1	1	0	1	5D	Set cursor type	2	9-3-3
	CGRAM ADR	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character generator RAM	2	9-3-6
	CSRDIR	1	0	1	0	1	0	0	1	1	CD 1	CD 0	4C to 4F	Set direction of cursor movement	0	9-3-4
	HDOT SCR	1	0	1	0	1	0	1	1	0	1	0	5A	Set horizontal scroll position	1	9-3-7
	OVLAY	1	0	1	0	1	0	1	1	0	1	1	5B	Set display overlay format	1	9-3-5
Drawing Control	**CSRW**	1	0	1	0	1	0	0	0	1	1	0	46	Set cursor address	2	9-r1
	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	Read cursor address	2	9-4-2
Memory Control	**MWRITE**	1	0	1	0	1	0	0	0	0	1	0	42	Write to display memory	—	9-5-1
	MREAD	1	0	1	0	1	0	0	0	0	1	1	43	Read from display memory	—	9-5-2

Timing Characteristics

10-3-1 8080 Family Interface Timing



Ta = –20 to 75°C

Signal	Symbol	Parameter	V_{DD} = 4.5 to 5.5V		V_{DD} = 2.7 to 4.5V		Unit	Condition
			Min.	Max.	Min.	Max.		
A0, $\overline{CS}$	t_{AH8}	Address hold time	10	—	10	—	ns	CL = 100pF
	t_{AW8}	Address setup time	0	—	0	—	ns	
$\overline{WR}$, $\overline{RD}$	t_{CYC8}	System cycle time	note.	—	note.	—	ns	
	t_{CC}	Strobe pulse width	120	—	150	—	ns	
D0 to D7	t_{DS8}	Data setup time	120	—	120	—	ns	
	t_{DH8}	Data hold time	5	—	5	—	ns	
	t_{ACC8}	$\overline{RD}$ access time	—	50	—	80	ns	
	t_{OH8}	Output disable time	10	50	10	55	ns	

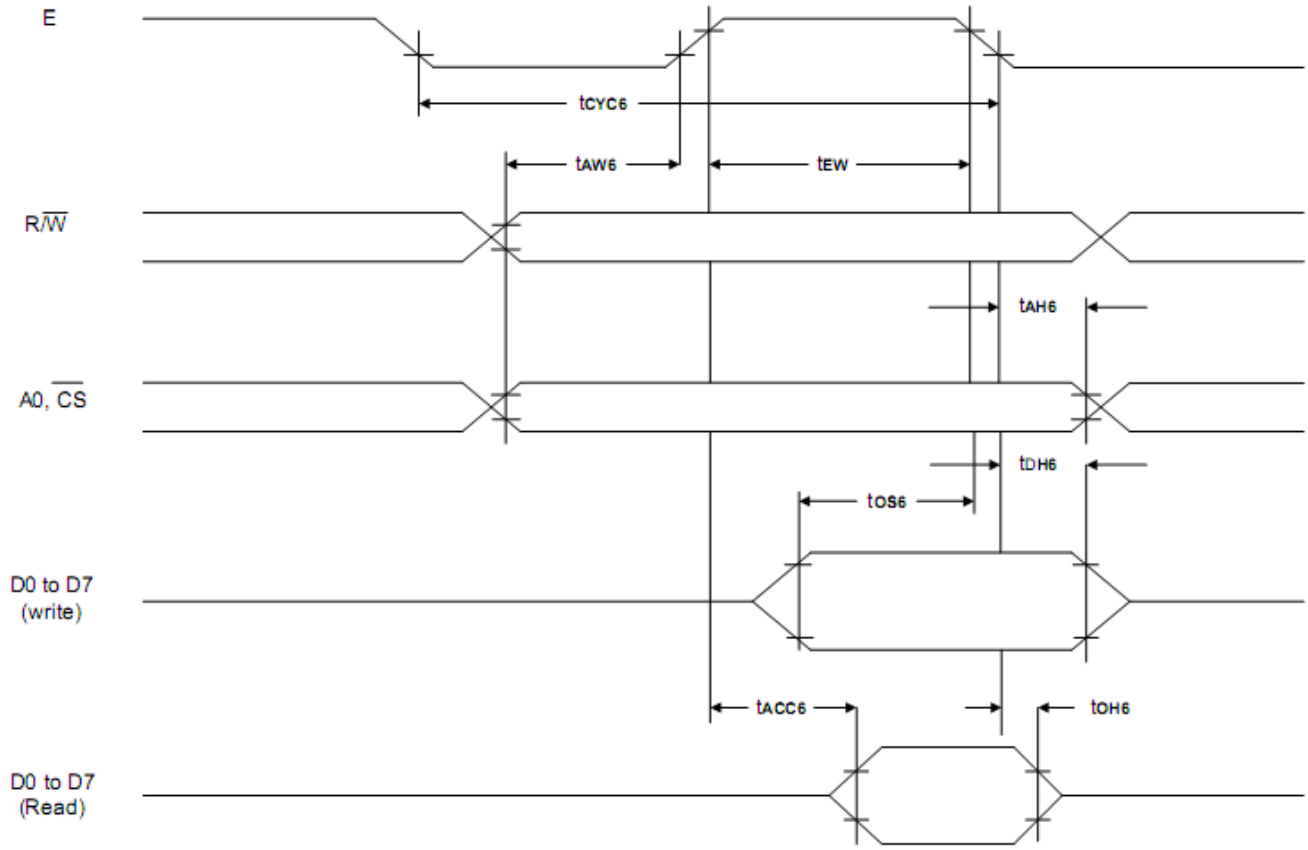
Note: For memory control and system control commands:

$t_{CYC8} = 2t_C + t_{CC} + t_{CEA} + 75 > t_{ACV} + 245$

For all other commands:

$t_{CYC8} = 4t_C + t_{CC} + 30$

10-3-2 6800 Family Interface Timing



Ta = –20 to 75°C

Signal	Symbol	Parameter	V_{DD} = 4.5 to 5.5V		V_{DD} = 2.7 to 4.5V		Unit	Condition
			Min.	Max.	Min.	Max.		
A0, $\overline{CS}$, R/(/W)	t_{CYC6}	System cycle time	note.	—	note.	—	ns	CL = 100 pF
	t_{AW6}	Address setup time	0	—	10	—	ns	
	t_{AH6}	Address hold time	0	—	0	—	ns	
D0 to D7	t_{DS6}	Data setup time	100	—	120	—	ns	
	t_{DH6}	Data hold time	0	—	0	—	ns	
	t_{OH6}	Output disable time	10	50	10	75	ns	
	t_{ACC6}	Access time	—	85	—	130	ns	
E	t_{EW}	Enable pulse width	120	—	150	—	ns	

Note: For memory control and system control commands:

$t_{CYC6} = 2t_C + t_{EW} + t_{CEA} + 75 > t_{ACV} + 245$

For all other commands:

$t_{CYC6} = 4t_C + t_{EW} + 30$

Example Initialization Program:

```
//-----------------------------------------------------------------
#define A0 P3_0
#define RW P3_7
#define E  P3_4
#define CS P3_1
#define RESET P3_6

//-----------------------------------------------------------------
voiddata_out(unsigned char i) //Data Output 16-bit Bus Interface
{
        A0  = 0;
        P1  = i;
        CS  = 0;
        RW  = 0;
        E   = 1;
        delay(1);
        E   = 0;
        RW  = 1;
        CS  = 1;
}
voidcomm_out(unsigned char j) //Command Output 8-bit Bus Interface
{
        A0  = 1;
        P1  = j;
        CS  = 0;
        RW  = 0;
        E   = 1;
        delay(1);
        E   = 0;
        RW  = 1;
        CS  = 1;
}

//-----------------------------------------------------------------
//              Initialization For RA8835
//-----------------------------------------------------------------
voidresetLCD()
{
        RESET = 0;
        delay(5);
        RESET = 1;
        delay(10);
}
voidinit_LCD()
{
comm_out(0x40);
```

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 , 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 200hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 200hrs	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.	+60°C , 90% RH , 96hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	-20°C,30min -> 25°C,5min - >70°C,30min = 1 cycle 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz , 15mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	VS=800V, RS=1.5kΩ, CS=100pF One time	

Note 1: No condensation to be observed.
Note 2: Conducted after 4 hours of storage at 25°C, 0%RH.
Note 3: Test performed on product itself, not inside a container.

Precautions for using LCDs/LCMs

See Precautions at www.newhavendisplay.com/specs/precautions.pdf

Warranty Information and Terms & Conditions

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