

NHD-0420Z-RN-GBW

Character Liquid Crystal Display Module

NHD- Newhaven Display
0420- 4 lines x 20 characters
Z- Model
R- Reflective
N- No Backlight
G- STN- Gray
B- 6:00 view
W- Wide Temperature (-20°C ~ +70°C)
RoHS Compliant

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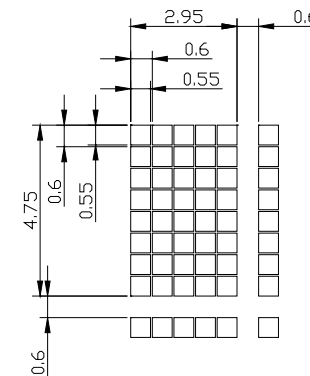
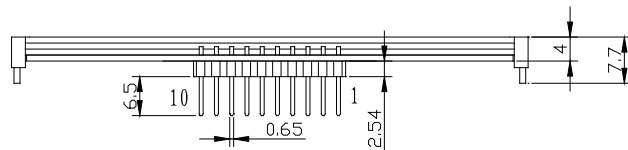
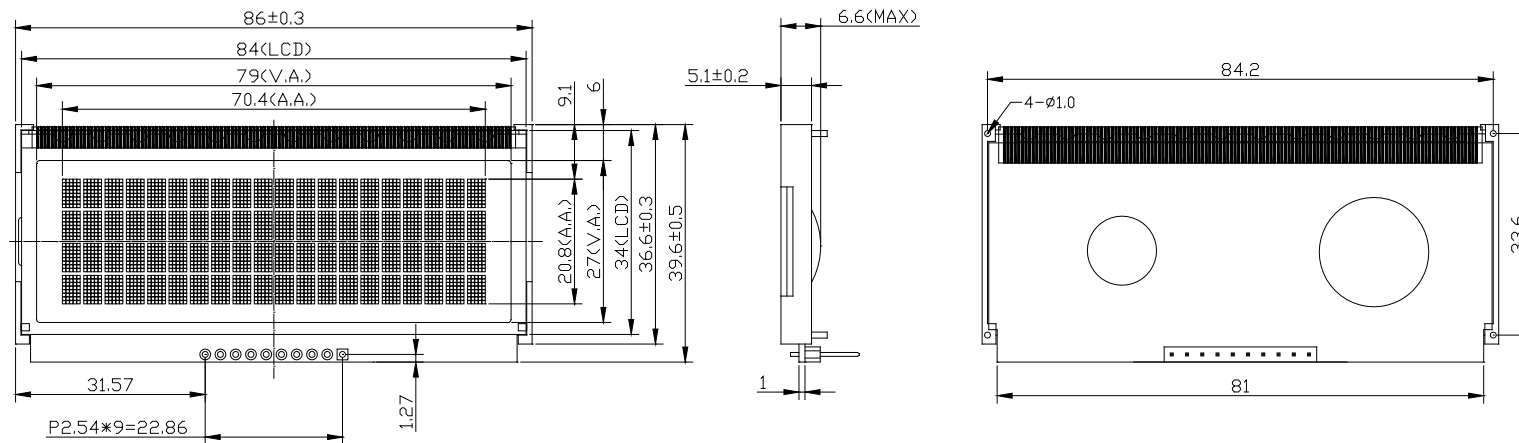
Document Revision History

Revision	Date	Description	Changed by
0	10/21/2008	Initial Release	-
1	1/27/2010	User Guide Reformat	MC
2	6/25/2010	Mechanical drawing updated	MP

Functions and Features

- 4 lines x 20 characters
- Built-in controllers (RW1067)
- +5.0V Power Supply
- 1/32 duty, 1/6 bias
- RoHS compliant

Mechanical Drawing



Pin connections

Pin NO	Symbol
1	VSS
2	VDD
3	V0
4	RS
5	R/W
6	E
7	DB4
8	DB5
9	DB6
10	DB7

Specification:

- 1). Driving: Duty:1/32, Bias:1/6, VLCD:6.8V, VDD:5.0V
- 2). Viewing Direction: 6 O'clock
- 3). Display mode: STN/Gray/Positive/Reflective
- 4). Operating temp.: -20°C~+70°C
Storage temp.: -30°C~+80°C
- 5). Driver : RW1067 4Bit MPU or 4Lines SPI
- 6). RoHS Compliant

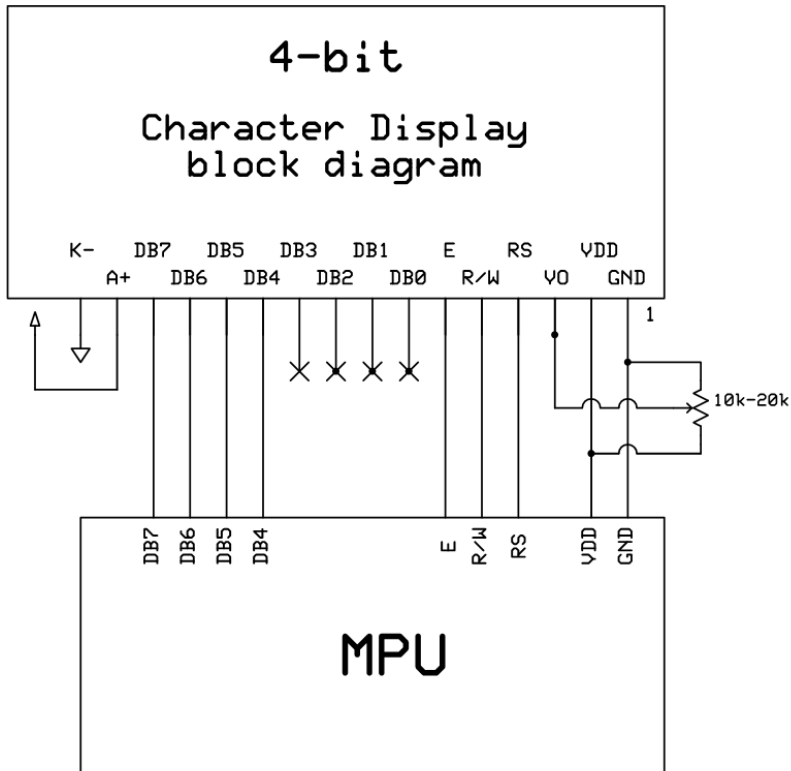
NEWHAVEN DISPLAY
 NHD-0420Z-RN-GBW

Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	Vss	Power Supply	Ground
2	VDD	Power Supply	Supply voltage for logic (+5.0V)
3	VO	Power Supply	Power supply for contrast (approx. -1.8V)
4	RS	MPU	Register select signal. RS=0: Command, RS=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.
7-10	DB4-DB7	MPU	Four high order bi-directional three-state data bus lines.

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°C, VDD=5.0V	-	2	2.5	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°C	-	6.8	-	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	-	-	-	-	V
Backlight Supply Current	Iled	-	-	-	-	mA

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Vertical (top)	AV	Cr ≥ 2	-	25	-	°
Viewing Angle – Vertical (bottom)	AV	Cr ≥ 2	-	70	-	°
Viewing Angle – Horizontal (left)	AH	Cr ≥ 2	-	30	-	°
Viewing Angle – Horizontal (right)	AH	Cr ≥ 2	-	30	-	°
Contrast Ratio	Cr		-	2	-	-
Response Time (rise)	Tr	-	-	120	150	ms
Response Time (fall)	Tf	-	-	120	150	ms

Controller Information

Built-in RW1067. Download specification at http://www.newhavendisplay.com/app_notes/RW1067.pdf

Table of Commands

Instruction	RE	Instruction Code										Description	Execution Time (fosc = 270 kHz)	
		RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Clear Display	x	0	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM, and set DDRAM address to "00H" from AC.	1.53ms
Return Home	0	0	0	0	0	0	0	0	0	0	1	X	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.53ms
Power Down Mode	1	0	0	0	0	0	0	0	0	0	1	PD	Set power down mode bit. PD = "1": power down mode set, PD = "0": power down mode disable.	37μs
Entry Mode Set	0	0	0	0	0	0	0	0	0	1	I/D	S	Assign cursor moving direction. I/D = "1": increment I/D = "0": decrement And display shift enable bit. S = "1": make display shift of the enabled lines by the DS4 - DS1 bits in the Shift Enable instruction. S = "0": display shift disable	37μs
	1	0	0	0	0	0	0	0	0	1	1	BID	Segment bi-direction function. BID = "1": Seg80→Seg1 BID = "0": Seg1→Seg80	
Display ON/OFF Control	0	0	0	0	0	0	0	0	1	D	C	B	Set display / cursor / blink on/off D = "1": display on, D = "0": display off, C = "1": cursor on, C = "0": cursor off, B = "1": blink on, B = "0": blink off.	37μs
Extended Function set	1	0	0	0	0	0	0	0	1	0	B/W	NW	Assign black/white inverting of cursor, and 4-line display mode control bit. B/W = "1": black/white inverting of cursor enable, B/W = "0": black/white inverting of cursor disable NW = "1": 4-line display mode, NW = "0": 2-line display mode.	37μs

Instruction	RE	Instruction Code										Description	Execution Time (fosc = 270 kHz)
		RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Cursor or Display shift	0	0	0	0	0	0	1	S/C	R/L	X	X	Cursor or display shift. S/C = "1" : display shift, S/C = "0" : cursor shift, R/L = "1" : shift to right, R/L = "0" : shift to left.	37µs
Shift Enable	1	0	0	0	0	0	1	DS4	DS3	DS2	DS1	(when DC = "1") Determine the line for display shift. DS1 = "1/0": 1st line display shift enable/disable DS2 = "1/0": 2nd line display shift enable/disable DS3 = "1/0": 3rd line display shift enable/disable DS4 = "1/0": 4th line display shift enable/disable.	37µs
Code Bank Selection	1	0	0	0	0	0	1	X	X	CB1	CB0	(when DC = "0") CB1, CB0 = (0, 0) ROM code Bank 0 selected (0, 1) ROM code Bank 1 selected (1, 0) ROM code Bank 2 selected (1, 1) ROM code Bank 3 selected	37µs
Function Set	0	0	0	0	0	1	IF	X	RE(0)	DC	REV	Set interface data length (IF = "1": 8-bit, IF = "0": 4-bit), extension register, RE("0"), shift enable. DC = "1": enable display shift per line. DC = "0": enable the selection of code bank. Reverse bit REV = "1": reverse display, REV = "0": normal display.	37µs
	1	0	0	0	0	1	IF	X	RE(1)	BE	0	Set IF, N, RE("1") and CGRAM/SEGRAM blink enable (BE) BE = "1/0": CGRAM/SEGRAM blink enable/disable.	37µs

Instruction	RE	Instruction Code										Description	Execution Time (fosc = 270 kHz)
		RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Set CGRAM Address	0	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	37µs
Set SEGRAM Address	1	0	0	0	1	X	X	AC3	AC2	AC1	AC0	Set SEGRAM address in address counter	37µs
Set DDRAM Address	0	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	37µs
Set Data Length	1	0	0	1	SD6	SD5	SD4	SD3	SD2	SD1	SD0	Set data length for 3 line SPI	37µs
Read Busy flag and Address	X	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Can know internal operation is ready or not by reading BF. The contents of address counter can also be read. BF = "1": busy state, BF = "0": ready state.	0µs
Write Data	X	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM. (DDRAM / CGRAM / SEGRAM).	43µs
Read Data	X	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM. (DDRAM / CGRAM / SEGRAM).	43µs

- Note : 1. When an MPU program with Busy Flag(DB7) checking is made, 1/2 FOSC (is necessary) for executing the next instruction by the " E " signal after the Busy Flag (DB7) goes to " Low ".
2. " X " Don't care

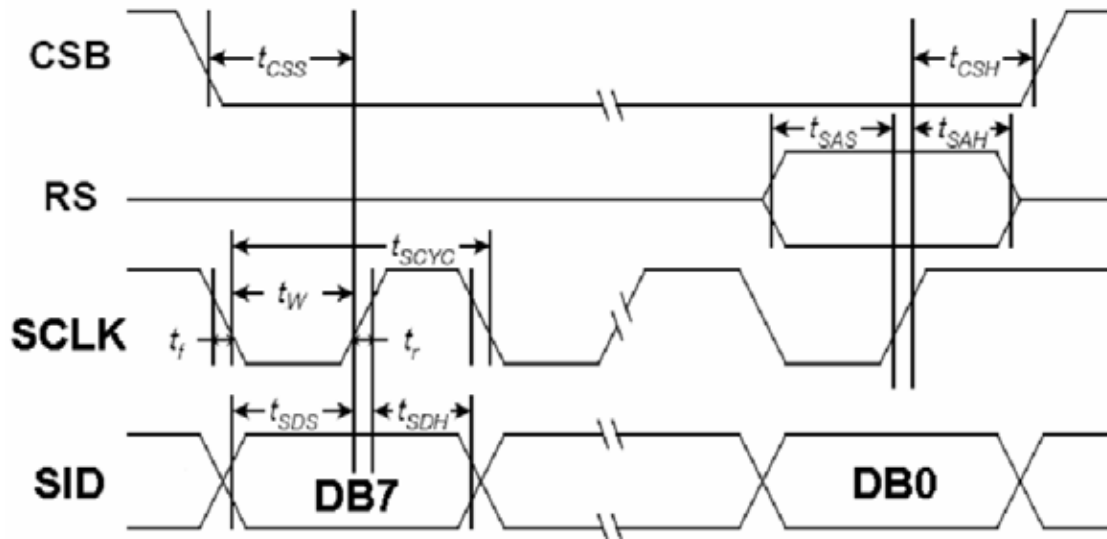
12. Display character address code:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53
14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	21	22	24	25	26	26	27
54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	60	61	62	63	64	65	66	67

Timing Characteristics

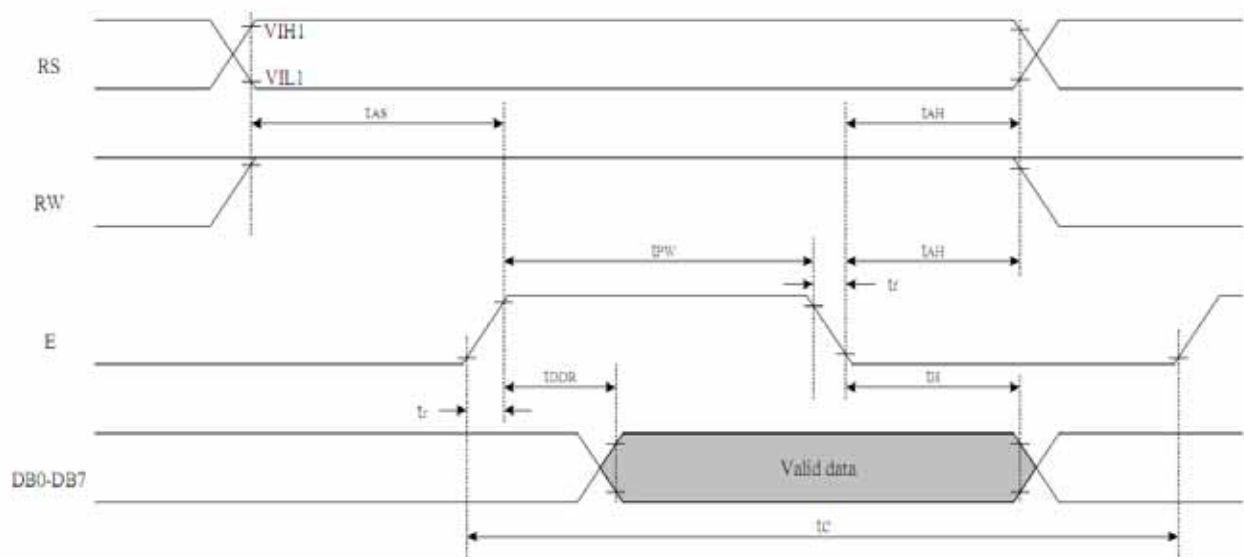
<i>Write Mode (Writing data from MPU to RW1067)</i>						
t_C	Enable Cycle Time	Pin E (except clear display)	80	-	-	ns
t_{PW}	Enable Pulse Width	Pin E	40	-	-	ns
t_{R,t_F}	Enable Rise/Fall Time	Pin E	-	-	25	ns
t_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
t_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
t_{DSW}	Data Setup Time	Pins: DB0 - DB7	20	-	-	ns
t_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

- Writing data from MPU to RW1067(serial)



<i>Read Mode (Reading Data from RW1067 to MPU)</i>						
t_C	Enable Cycle Time	Pin E	1200	-	-	ns
t_{PW}	Enable Pulse Width	Pin E	480	-	-	ns
t_{R,t_F}	Enable Rise/Fall Time	Pin E	-	-	25	ns
t_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
t_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
t_{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	320	ns
t_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

- Reading data from RW1067 to MPU(parallel)



Built-in Font Table

Lower 4 Bits \ Upper 4 Bits	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)			0	a	P	`	P				-	タ	ミ	&	P
xxxx0001	(2)		!	1	A	Q	a	q			。	ア	チ	△	ö	q
xxxx0010	(3)		"	2	B	R	b	r			「	イ	ツ	×	ß	θ
xxxx0011	(4)		#	3	C	S	c	s			」	ウ	テ	モ	ε	ε
xxxx0100	(5)		\$	4	D	T	d	t			、	エ	ト	ト	μ	Ω
xxxx0101	(6)		%	5	E	U	e	u			・	オ	ナ	1	ε	ü
xxxx0110	(7)		&	6	F	V	f	v			ヲ	カ	ニ	ヨ	ρ	Σ
xxxx0111	(8)		'	7	G	W	g	w			ア	キ	ヌ	ラ	g	π
xxxx1000	(1)		<	8	H	X	h	x			イ	ク	ネ	リ	√	×
xxxx1001	(2)		>	9	I	Y	i	y			ウ	ケ	ル	ル	ˆ	γ
xxxx1010	(3)		*	:	J	Z	j	z			エ	コ	ハ	レ	j	≠
xxxx1011	(4)		+	;	K	[	k	[			オ	サ	ヒ	ロ	*	≠
xxxx1100	(5)		,	<	L	¥	l	l			カ	シ	フ	ク	φ	≠
xxxx1101	(6)		-	=	M	]	m	]			ユ	ス	ハ	ン	も	÷
xxxx1110	(7)		.	>	N	^	n	→			ヨ	セ	ホ	°	ñ	
xxxx1111	(8)		/	?	O	_	o	←			ッ	ソ	マ	°	ö	■

Example Initialization Program

4-bit Initialization:

```

/*****/
void command(char i)
{
    P1 = i;                //put data on output Port
    D_I =0;               //D/I=LOW : send instruction
    R_W =0;               //R/W=LOW : Write
    Nybble();             //Send lower 4 bits
    i = i<<4;             //Shift over by 4 bits
    P1 = i;                //put data on output Port
    Nybble();             //Send upper 4 bits
}
/*****/
void write(char i)
{
    P1 = i;                //put data on output Port
    D_I =1;               //D/I=HIGH : send data
    R_W =0;               //R/W=LOW : Write
    Nybble();             //Clock lower 4 bits
    i = i<<4;             //Shift over by 4 bits
    P1 = i;                //put data on output Port
    Nybble();             //Clock upper 4 bits
}
/*****/
void Nybble()
{
    E = 1;
    Delay(1);             //enable pulse width >= 300ns
    E = 0;                 //Clock enable: falling edge
}
/*****/
void init()
{
    P1 = 0;
    P3 = 0;
    Delay(100);           //Wait >15 msec after power is applied
    P1 = 0x30;            //put 0x30 on the output port
    Delay(30);            //must wait 5ms, busy flag not available
    Nybble();             //command 0x30 = Wake up
    Delay(10);            //must wait 160us, busy flag not available
    Nybble();             //command 0x30 = Wake up #2
    Delay(10);            //must wait 160us, busy flag not available
    Nybble();             //command 0x30 = Wake up #3
    Delay(10);            //can check busy flag now instead of delay
    P1= 0x20;             //put 0x20 on the output port
    Nybble();             //Function set: 4-bit interface
    command(0x28);        //Function set: 4-bit/2-line
    command(0x10);        //Set cursor
    command(0x0F);        //Display ON; Blinking cursor
    command(0x06);        //Entry Mode set
}
/*****/
```

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

Warranty Information and Terms & Conditions

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