

NHD-320240WG-BoTFH-VZ#

Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
320240-	320 x 240 Pixels
WG-	Display Type: Graphic
Bo-	Model
T-	White LED Backlight
F-	FSTN Positive
H-	Transflective, 6:00 Optimal View, Wide Temperature
VZ#-	Built-in Negative Voltage
	RoHS Compliant

Newhaven Display International, Inc.

2661 Galvin Ct.

Elgin IL, 60124

Ph: 847-844-8795

Fax: 847-844-8796

www.newhavendisplay.com

nhtech@newhavendisplay.com

nhsales@newhavendisplay.com

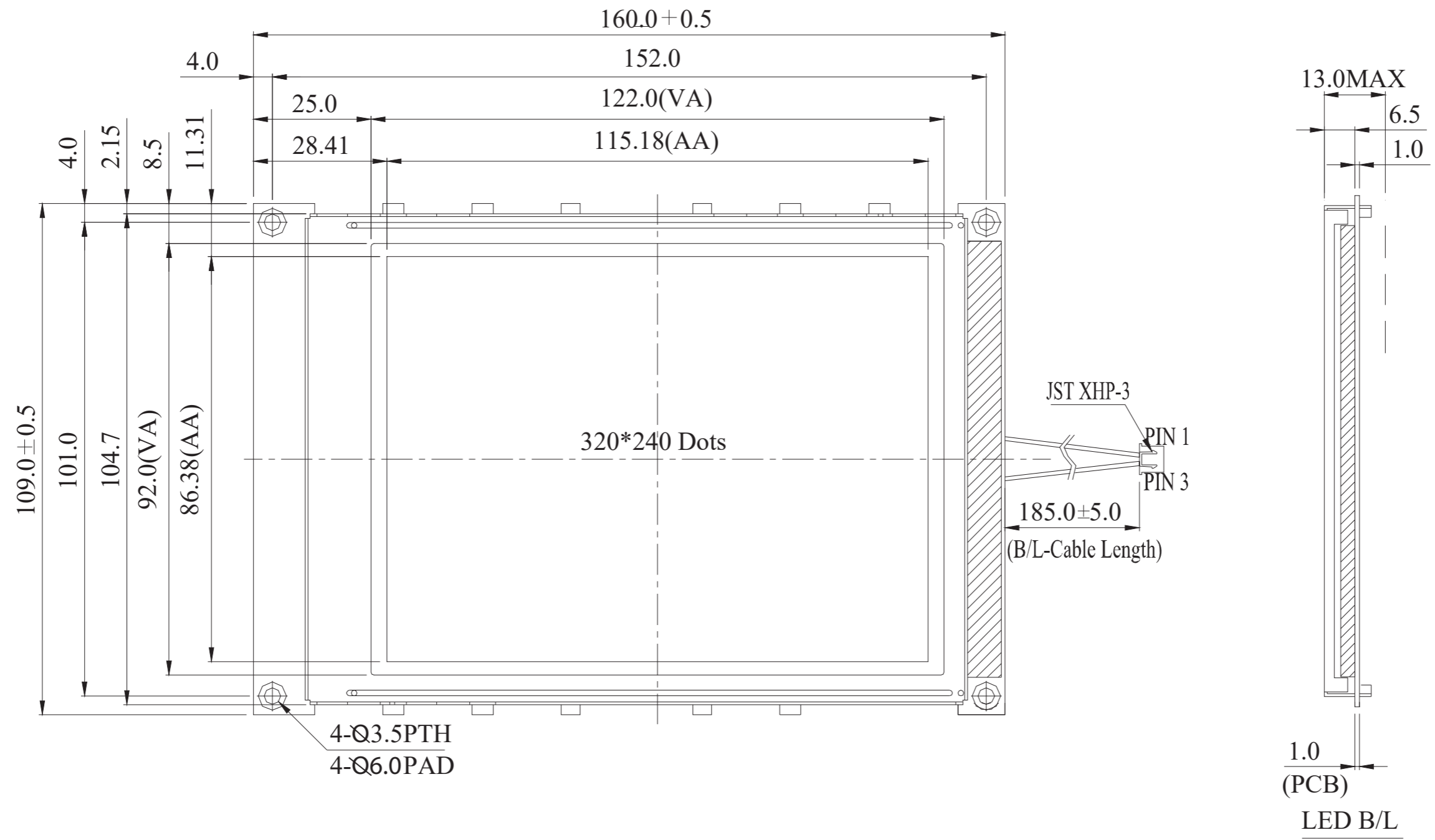
Document Revision History

Revision	Date	Description	Changed by
0	6/7/2007	Initial Release	-
1	4/15/2010	User guide reformat	MC
2	4/27/16	Initialization code update, datasheet reformat	TM
3	11/1/16	Updated Electrical Characteristics	TM
4	11/13/17	Supply Current, Backlight Characteristics & Mechanical Drawing Updated	SB
5	10/16/19	Datasheet Reformat, Updated Pinout	AS

Functions and Features

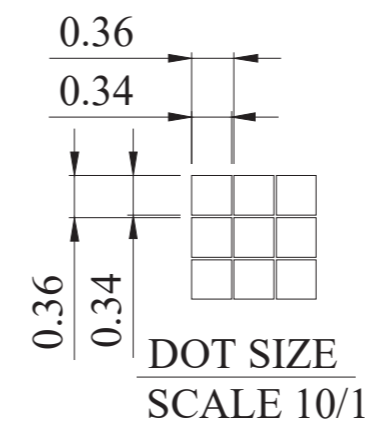
- 320 x 240 pixels
- Built-in RA8835 Controller
- +5.0V power supply
- RoHS Compliant

SYMBOL	REVISION	DATE



PIN NO.	SYMBOL
1	VSS
2	VDD
3	V _o
4	A0
5	/WR
6	/RD
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	/CS
16	/RST
17	V _{ee}
18	NC
19	FG
20	NC

- Notes:**
- Driver: 1/240 Duty
 - Display Mode: FSTN Positive / Transflective
 - Optimal View: 6:00
 - Voltage: 5.0V V_{DD}, 23.6V V_{LCD}
 - Backlight: White LED
 - Driver IC: RA8835



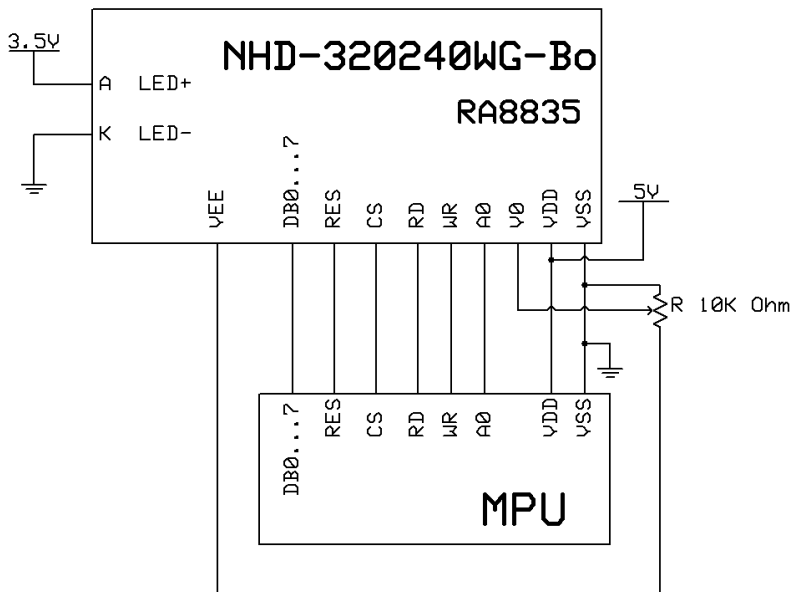
STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)		NEWHAVEN DISPLAY INTERNATIONAL	
LINEAR: ±0.3mm		DRAWING/PART NUMBER: NHD-320240WG-BoTFH-VZ#	REVISION: 1.0
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION		DRAWN BY: A. Shah	APPROVED BY: A. Shah
		DRAWN DATE: 10/16/19	APPROVED DATE: 10/16/19
		SCALE: A3	
		SHEET 1 OF 1	
THIS DRAWING IS SOLELY THE PROPERTY OF NEWHAVEN DISPLAY INTERNATIONAL, INC. THE INFORMATION IT CONTAINS IS NOT TO BE DISCLOSED, REPRODUCED OR COPIED IN WHOLE OR PART WITHOUT WRITTEN APPROVAL FROM NEWHAVEN DISPLAY.			

Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V _{SS}	Power Supply	Ground
2	V _{DD}	Power Supply	Supply Voltage for logic (+5.0V)
3	V ₀	Adj. Power Supply	Supply Voltage for contrast (approx. -19.0V)
4	A0	MPU	Register select signal. A0=0: Command, A0=1: Data
5	/WR R/W	MPU	8080: Active LOW Write Signal. 6800: Read/Write select signal, R/W=1: Read R/W: =0: Write
6	/RD E	MPU	8080: Active LOW Read Signal. 6800: 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	T _{OP}	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T _{ST}	Absolute Max	-30	-	+80	°C
Supply Voltage	V _{DD}	-	4.5	5.0	5.5	V
Supply Current	I _{DD}	T _{OP} =25°C, V _{DD} =5.0V	35	65	110	mA
Supply for LCD (contrast)	V _{LCD}		23.0	23.6	24.2	V
"H" Level input	V _{IH}	-	0.5 * V _{DD}	-	V _{DD}	V
"L" Level input	V _{IL}	-	V _{SS}	-	0.2 * V _{DD}	V
"H" Level output	V _{OH}	-	V _{DD} - 0.4	-	V _{DD}	V
"L" Level output	V _{OL}	-	V _{SS}	-	V _{SS} + 0.4	V
Backlight Supply Current	I _{LED}	-	-	128	160	mA
Backlight Supply Voltage	V _{LED}	I _{LED} = 128 mA	3.4	3.5	3.6	V
Backlight Lifetime	-	I _{LED} =128mA T _{OP} = 25°C	-	50,000	-	Hrs

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	Cr ≥ 2	-	30	-	°
	Bottom		-	60	-	°
	Left		-	45	-	°
	Right		-	45	-	°
Contrast Ratio	Cr	-	-	5	-	-
Response Time	Rise	T _{OP} = 25°C	-	200	300	ms
	Fall		-	150	200	ms

Controller Information

Built-in RA8835 controller.

Please download specification at http://www.newhavendisplay.com/app_notes/RA8835.pdf

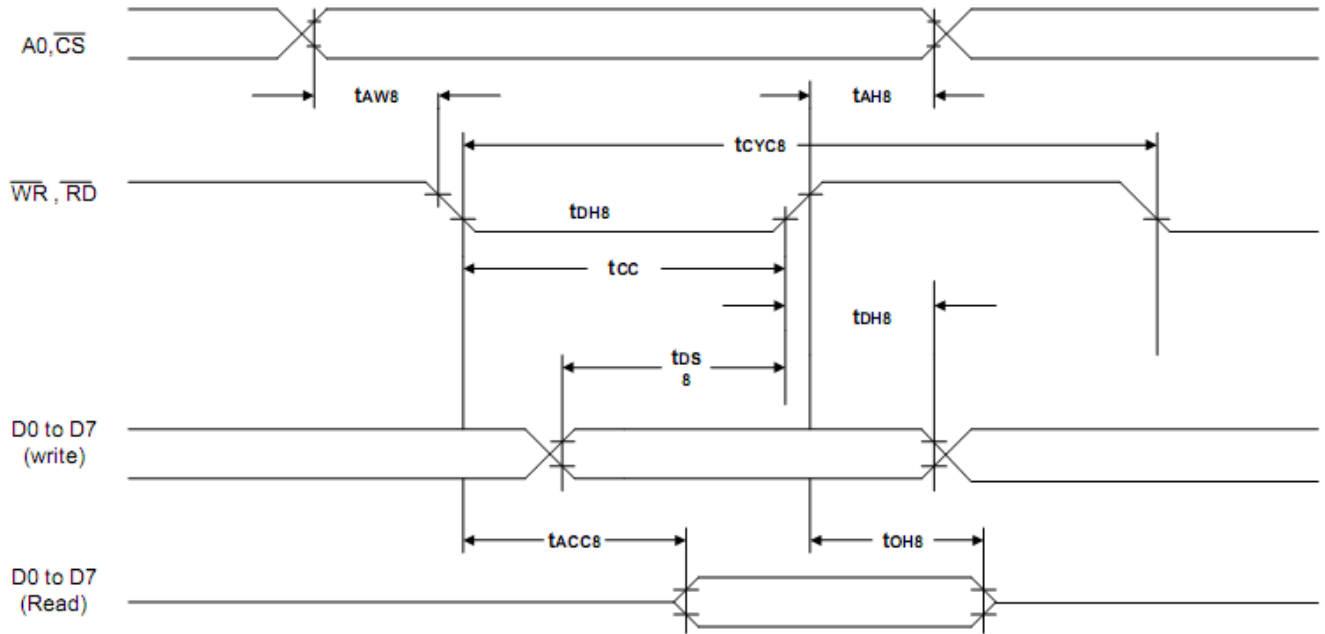
Table of Commands

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



$T_a = -20$ 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, $\overline{\text{CS}}$	t_{AH8}	Address hold time	10	—	10	—	ns	CL = 100pF
	t_{AW8}	Address setup time	0	—	0	—	ns	
$\overline{\text{WR}}$, $\overline{\text{RD}}$	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}	$\overline{\text{RD}}$ access time	—	50	—	80	ns	
	t_{OH8}	Output disable time	10	50	10	55	ns	

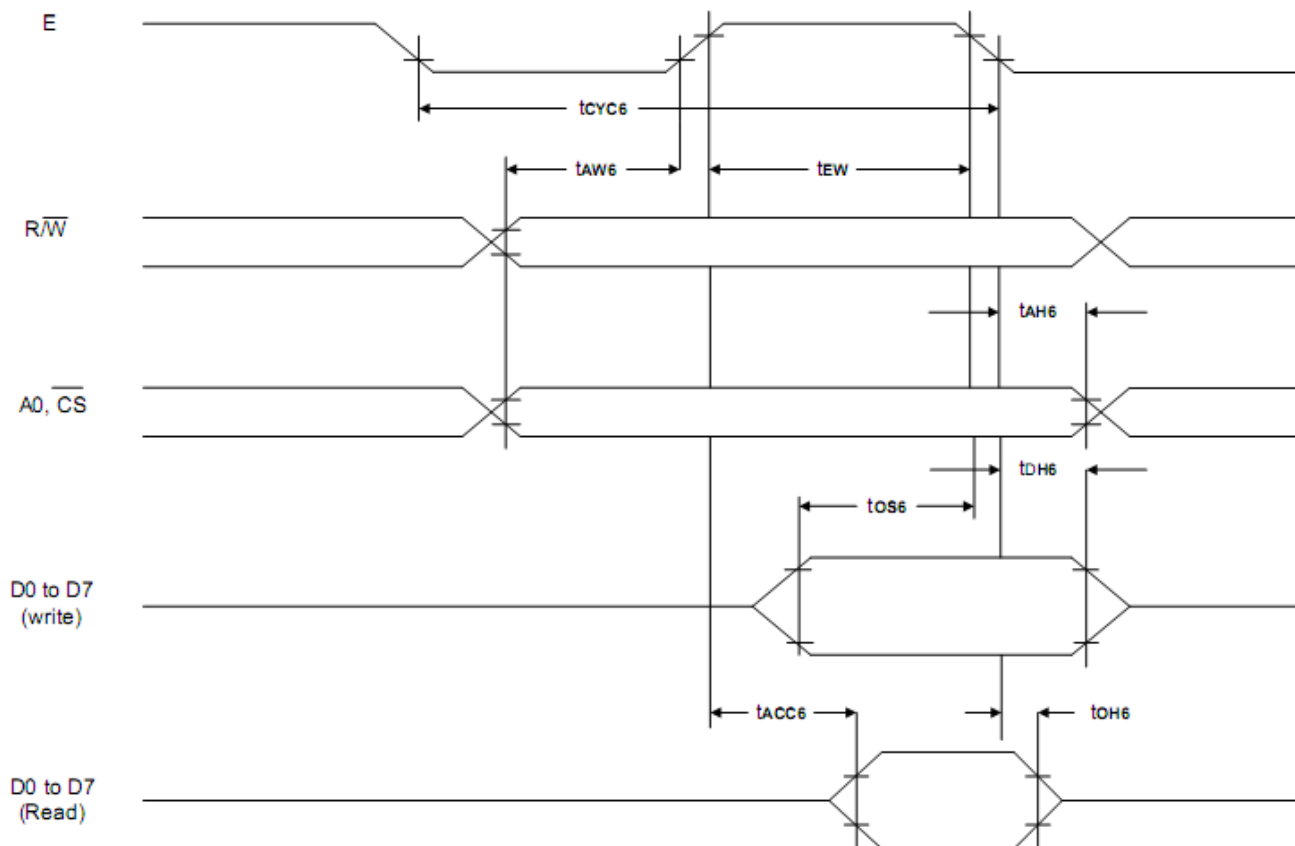
Note: For memory control and system control commands:

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

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, $\overline{\text{CS}}$, 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:

$$t_{\text{CYC6}} = 2t_{\text{C}} + t_{\text{EW}} + t_{\text{CEA}} + 75 > t_{\text{ACV}} + 245$$

For all other commands:

$$t_{\text{CYC6}} = 4t_{\text{C}} + t_{\text{EW}} + 30$$

Example Initialization Program:

```
//-----6800 Parallel Interface-----
#define A0 P3_0
#define RW P3_7
#define E P3_4
#define CS P3_1
#define RESET P3_6

//-----
void data_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;
}
void comm_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
//-----
void resetLCD()
{
    RESET = 0;
    delay(5);
    RESET = 1;
    delay(10);
}
```

```
void init_LCD()
{
comm_out(0x40);
delay(5);
data_out(0x34);
data_out(0x87);
data_out(0x07);
data_out(0x27);
data_out(0x39);
data_out(0xEF);
data_out(0x28);
data_out(0x00);
comm_out(0x44);
data_out(0x00);
data_out(0x00);
data_out(0xEF);
data_out(0xB0);
data_out(0x04);
data_out(0xEF);
data_out(0x00);
data_out(0x00);
data_out(0x00);
data_out(0x00);
comm_out(0x5A);
data_out(0x00);
comm_out(0x5B);
data_out(0x00);
comm_out(0x58);
data_out(0x56);
comm_out(0x5D);
data_out(0x04);
data_out(0x86);
comm_out(0x4C);
comm_out(0x59);
data_out(0x16);
delay(5);
}
//-----
```

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 For 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz, 1.5mm 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=330Ω, CS=150pF 10 times	

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