

NHD-320240WX-CoTFH-V#I041

Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
320240-	320 x 240 pixels
WX-	Display Type: Graphic
Co-	Model
T-	White LED Backlight
F-	FSTN (+)
H-	Transflective, 6:00 view, Wide Temperature (-20°C ~+70°C)
V#-	Built-in Positive Voltage
I041-	IST Driver, with mounting holes
	RoHS Compliant

Newhaven Display International, Inc.

2511 Technology Drive, Suite 101

Elgin IL, 60124

Ph: 847-844-8795

Fax: 847-844-8796

www.newhavendisplay.com

nhtech@newhavendisplay.com

nhsales@newhavendisplay.com

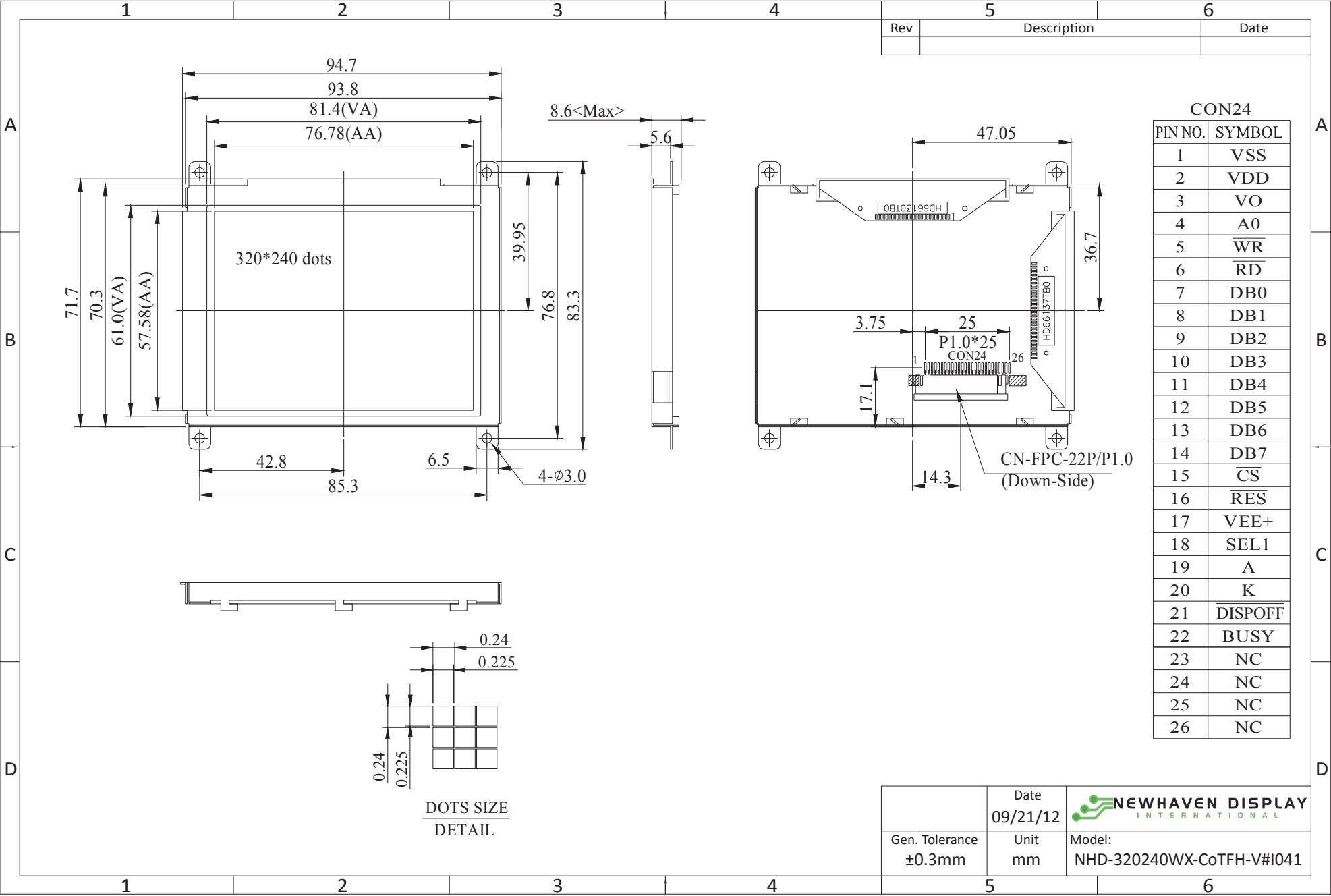
Document Revision History

Revision	Date	Description	Changed by
0	6/7/2007	Initial Release	-
1	4/23/2010	User guide reformat	MC
2	5/25/2010	Contrast revised	BE
3	6/3/2010	Backlight Supply Current updated	MC
4	2/3/2011	Pin description/block diagram updated	AK
5	2/4/2011	Drawing/pin description/block diagram updated	AK
6	9/21/2012	Drawing/electrical and optical characteristics/block diagram/table of commands updated	JN

Functions and Features

- 320 x 240 pixels
- Built-in RA8835 Controller
- +3.3V power supply
- RoHS Compliant

Mechanical Drawing



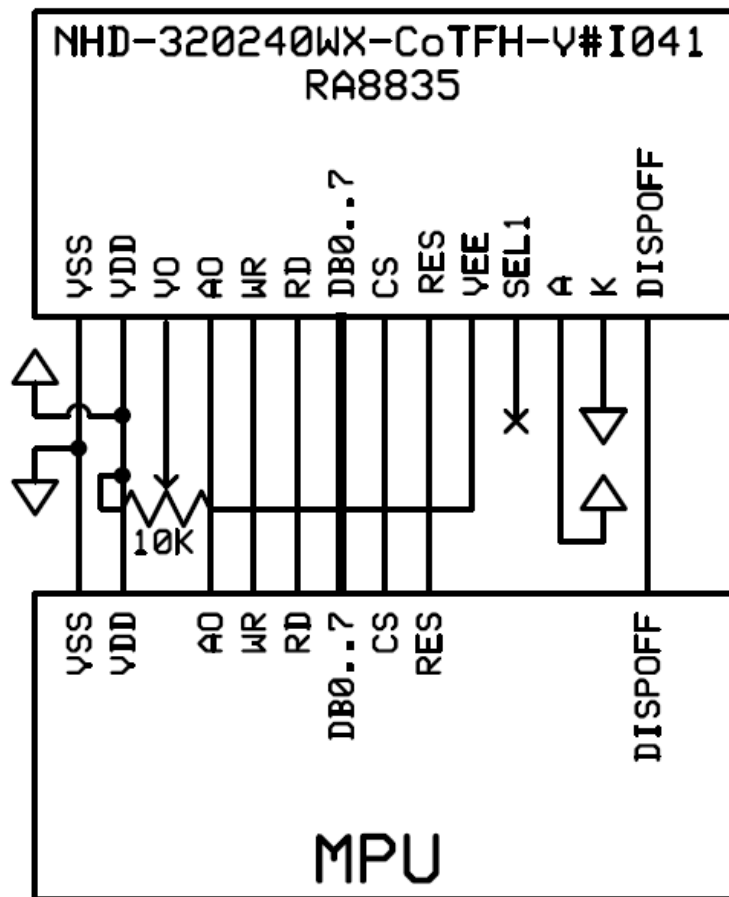
Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Power supply for logic (+3.3V)
3	VO	Adj Power Supply	Power supply for contrast (approx. +18.7V)
4	A0	MPU	Register select signal. A0=0: Command, A0=1: Data
5	WR	MPU	Read/Write select signal, R/W=1: Read R/W: =0: Write
6	RD	MPU	Active LOW read
7-14	DB0-DB7	MPU	Bi-directional three-state data bus lines.
15	CS	MPU	Active LOW chip select
16	RES	MPU	Active LOW reset signal
17	VEE+	Power Supply	Positive voltage output (+28V)
18	SEL1	NC	No Connect (selected by on-board jumper JSEL)
19	LED+	Power Supply	Power Supply for LED Backlight (+3.5V)
20	LED-	Power Supply	Ground for Backlight
21	DISPOFF	Power Supply	Active LOW display off signal.
22	NC	-	No Connect

Recommended LCD connector: 22 pin, 1.0mm pitch FFC Connector

Backlight connector: On LCD 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	-	3.0	3.3	3.6	V
Supply Current	IDD	Ta=25°C, VDD=3.3V	-	33	-	mA
Supply for LCD (contrast)	V0	Ta=25°C	21.1	21.7	22.3	V
"H" Level input	VIH	-	0.5*VDD	-	VDD	V
"L" Level input	VIL	-	VSS	-	0.2*VDD	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	72	82	120	mA
Backlight Lifetime	-	ILED≤82mA	-	50,000	-	Hrs

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Top		Cr ≥ 2	-	30	-	°
Viewing Angle - Bottom			-	60	-	°
Viewing Angle - Left			-	45	-	°
Viewing Angle - Right			-	45	-	°
Contrast Ratio	Cr	-	-	5	-	-
Response Time (rise)	Tr	-	-	200	300	ms
Response Time (fall)	Tf	-	-	150	200	ms

Controller Information

Built-in RA8835 controller.

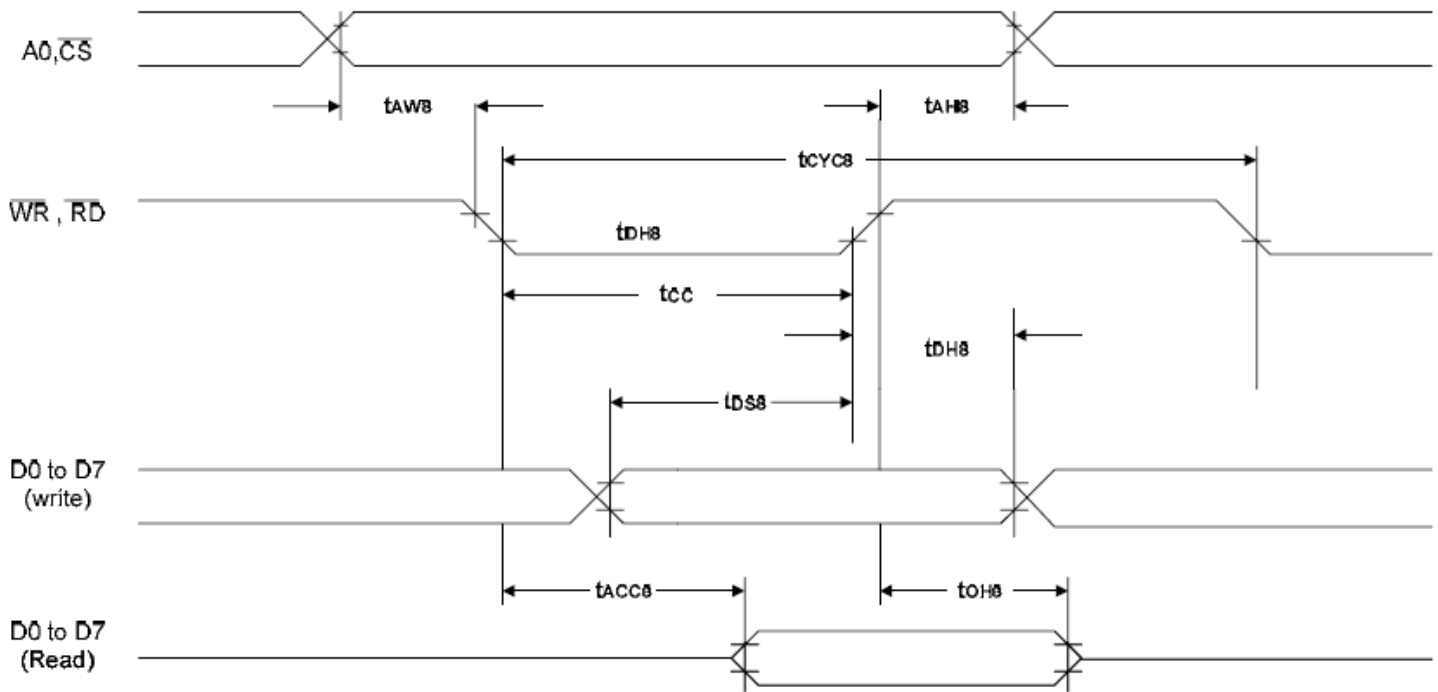
Please download specification at http://www.newhavendisplay.com/app_notes/RA8835.pdf

Table of Commands

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	6-2-1
	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter standby mode	0	6-2-2
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	6-3-1
	SCROLL	1	0	1	0	1	0	0	0	1	0	0	44	Set display start address and display regions	10	6-3-2
	CSRFORM	1	0	1	0	1	0	1	1	1	0	1	5D	Set cursor type	2	6-3-3
	CGRAM ADR	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character generator RAM	2	6-3-6
	CSRDIR	1	0	1	0	1	0	0	1	1	CD 1	CD 0	4C to 4F	Set direction of cursor movement	0	6-3-4
	HDOT SCR	1	0	1	0	1	0	1	1	0	1	0	5A	Set horizontal scroll position	1	6-3-7
	OVLAY	1	0	1	0	1	0	1	1	0	1	1	5B	Set display overlay format	1	6-3-5
Drawing Control	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	Set cursor address	2	6-4-1
	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	Read cursor address	2	6-4-2
Memory Control	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	Write to display memory	—	6-5-1
	MREAD	1	0	1	0	1	0	0	0	0	1	1	43	Read from display memory	—	6-5-2

Timing Characteristics

8080 Family Interface Timing



$T_a = -20 \text{ to } 75^\circ\text{C}$

Signal	Symbol	Parameter	$V_{DD} = 4.5 \text{ to } 5.5\text{V}$		$V_{DD} = 2.7 \text{ to } 4.5\text{V}$		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	

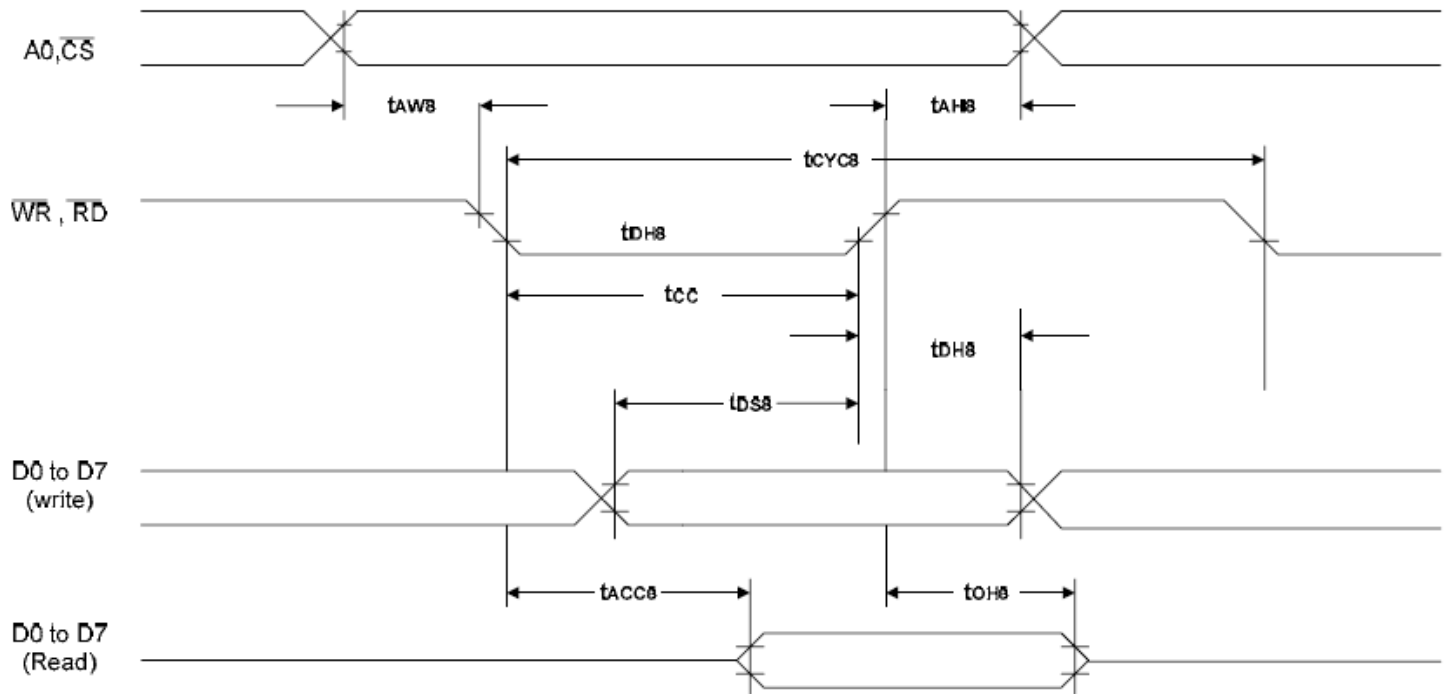
Note: For memory control and system control commands:

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

For all other commands:

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

6800 Family Interface Timing



$T_a = -20 \text{ to } 75^\circ\text{C}$

Signal	Symbol	Parameter	$V_{DD} = 4.5 \text{ to } 5.5\text{V}$		$V_{DD} = 2.7 \text{ to } 4.5\text{V}$		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 Code

```
//-----
#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 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

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