

# NHD-C128128BZ-FSW-GBW

## COG (Chip-On-Glass) Liquid Crystal Display Module

NHD-	Newhaven Display
C128128-	128 x 128 Pixels
BZ-	Model
F-	Transflective
SW-	Side White LED Backlight
G-	STN-Gray
B-	6:00 Optimal View
W-	Wide Temp
	<b>RoHS Compliant</b>

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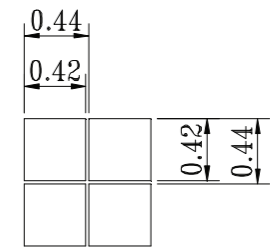
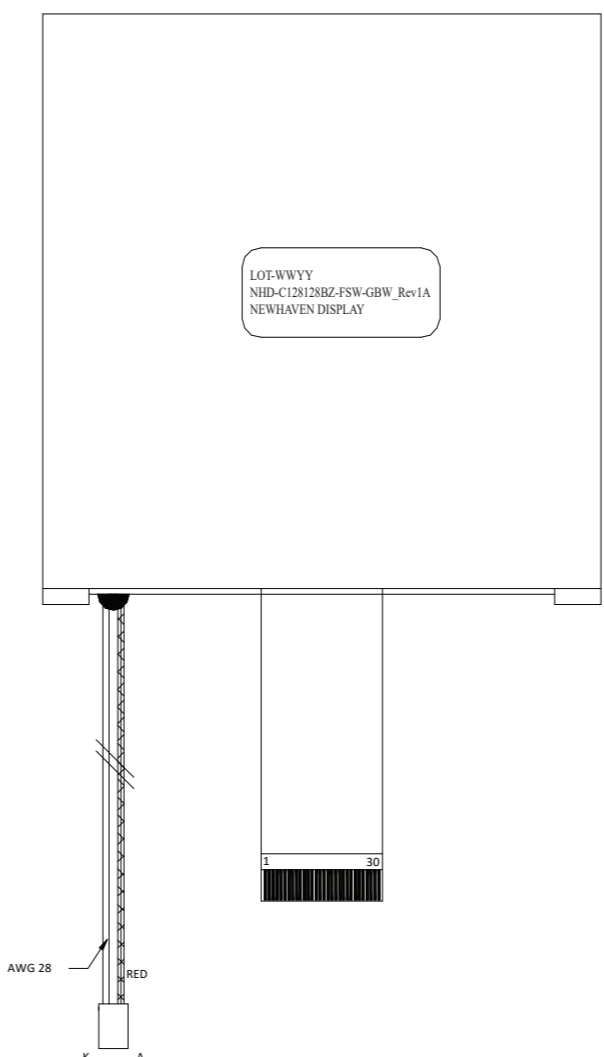
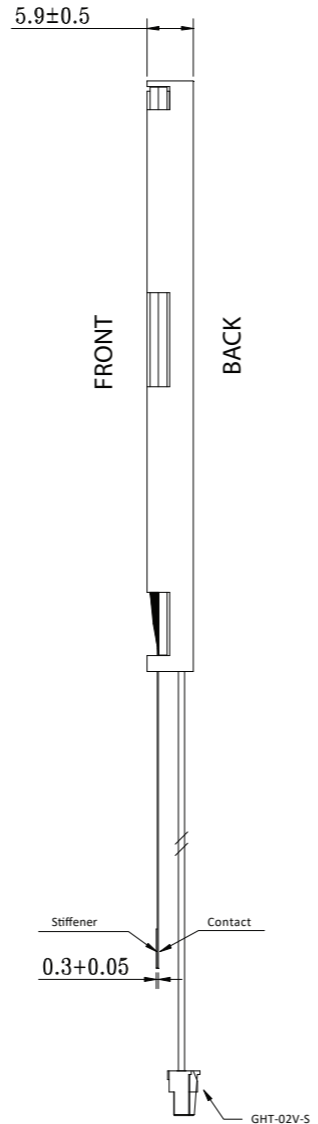
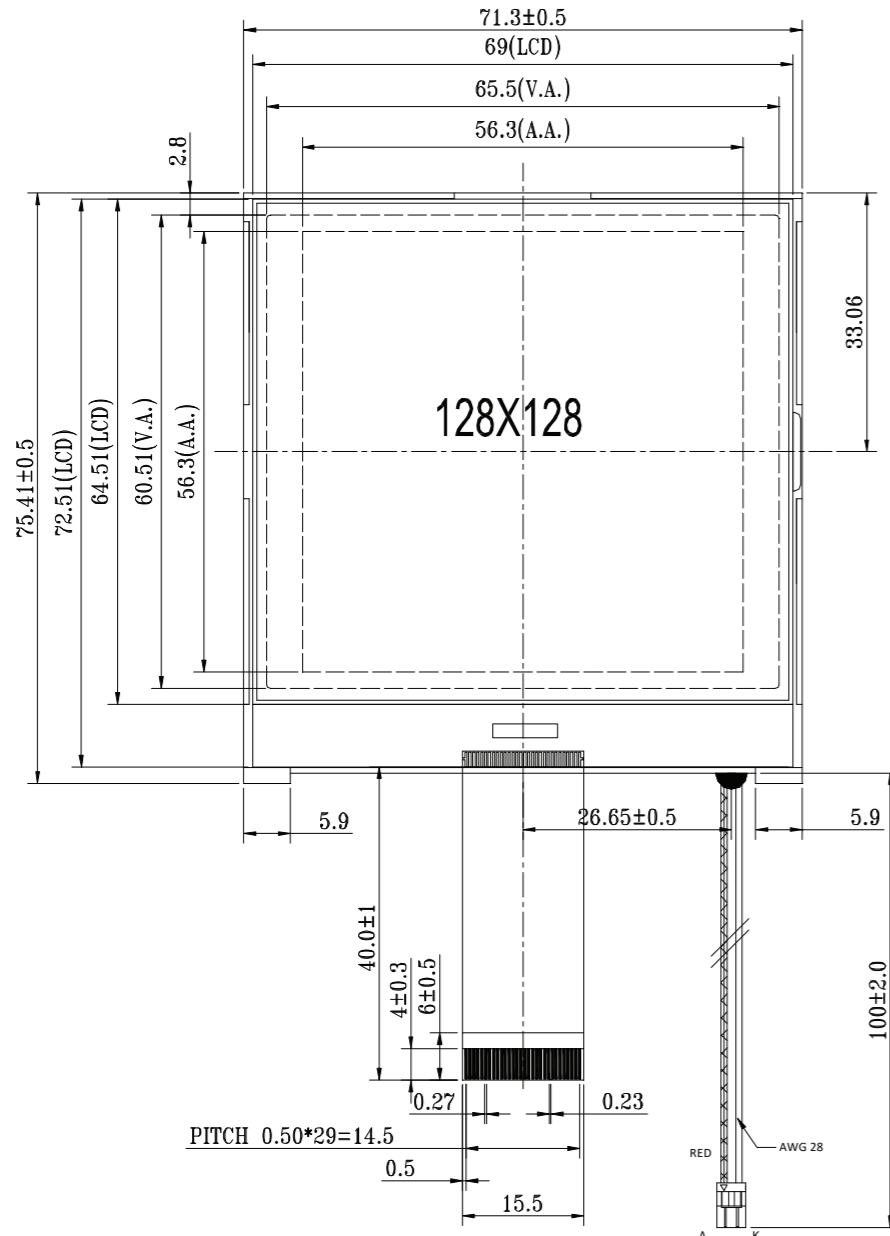
## Document Revision History

Revision	Date	Description	Changed by
0	6/17/2007	Initial Release	-
1	9/23/2009	User guide reformat	BE
2	10/14/2009	Updated Electrical Characteristic	MC
3	11/20/2009	Updated backlight supply current	MC
4	3/4/2011	Updated table of commands	AK
5	8/25/16	Mechanical Drawing, Electrical & Optical Char. Updated	SB
6	4/27/18	Mechanical Drawing & Electrical Characteristics Updated	SB
7	1/16/20	Updated LCD Panel	SB

## Functions and Features

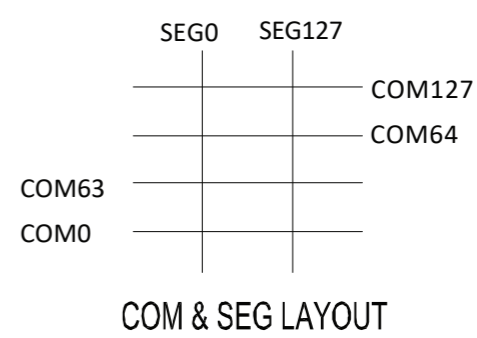
- 128 x 128 pixels
- Built-in ST7528 controller
- +3.0V power supply
- 1/128 duty cycle; 1/12 bias
- RoHS Compliant

SYMBOL	REVISION	DATE

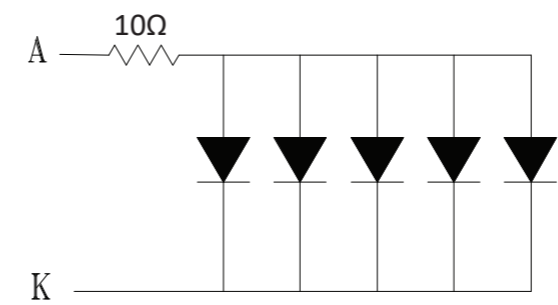


**PIN ASSIGNMENT**

NO.	SIGNAL
1	PS0
2	PS1
3	PS2
4	CSB
5	RST
6	A0
7	RW-WR
8	E-RD
9	DB0
10	DB1
11	DB2
12	DB3
13	DB4
14	DB5
15	DB6
16	DB7
17	VDD
18	VDD
19	VSS
20	VSS
21	VOU-OUT
22	VOU-IN
23	V4
24	V3
25	V2
26	V1
27	V0
28	VR
29	INTRS
30	NC



- Notes:**
- Driver: 1/128 Duty, 1/12 Bias
  - Display Mode: STN Positive / Gray / Transflective
  - Optimal View: 6:00
  - Voltage: 3.0V VDD, 13.6V VLCD
  - Backlight: White LED
  - Driver IC: ST7528



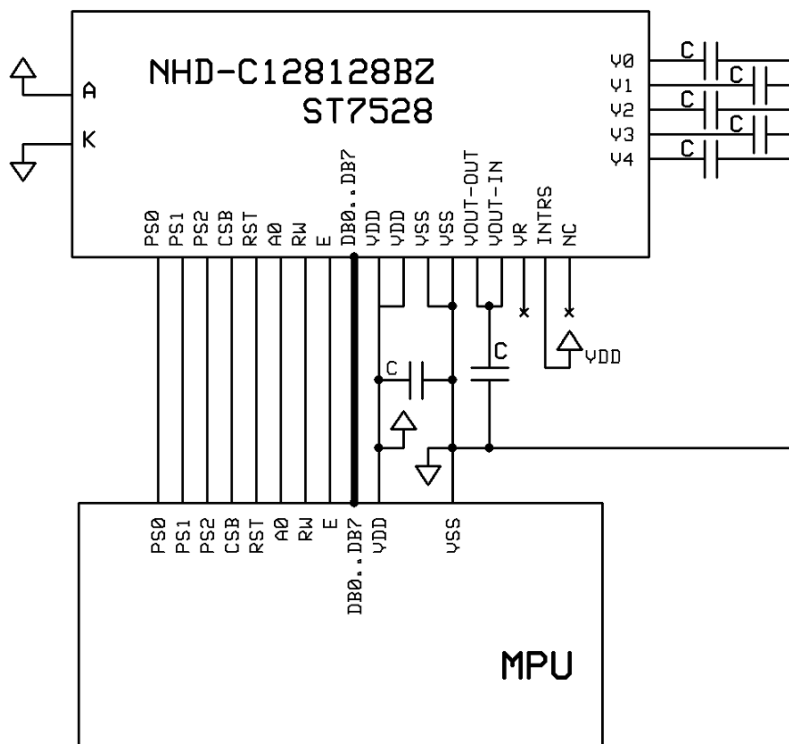
STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)			REVISION:
			1A
LINEAR: ±0.3mm	DRAWING/PART NUMBER:		SIZE:
	NHD-C128128BZ-FSW-GBW		A3
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	DRAWN BY:	APPROVED BY:	SCALE:
	S. Baxi	S. Baxi	NS
DRAWN DATE:		APPROVED DATE:	SHEET 1 OF 1
1/16/20		1/16/20	
DO NOT SCALE DRAWING			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	PS0	Input	Parallel/serial data input select input (see Parallel/Serial Select table)
2	PS1	Input	
3	PS2	Input	
4	CSB	MPU	Active LOW Chip select
5	RST	MPU	Active LOW Reset signal
6	A0	MPU	Register select signal. A0=1: Data, A0=0: Command
7	R/W /WR	MPU	6800 Mode: Read/Write select signal. R/W=1: Read R/W=0: Write 8080 Mode: Active LOW Write Signal
8	E /RD	MPU	6800 Mode: Active HIGH Enable Signal 8080 Mode: Active LOW Read Signal
9-16	DB0-DB7	MPU	Bi-directional, three-state data bus lines
17,18	V <sub>DD</sub>	Power Supply	Supply Voltage for logic (3.0V)
19,20	V <sub>SS</sub>	Power Supply	Ground
21	V <sub>OUT</sub>	Power Supply	Voltage booster circuit – connect to 1uF cap to V <sub>SS</sub> or V <sub>DD</sub>
22	V <sub>IN</sub>	Power Supply	Tie to V <sub>OUT</sub>
23	V <sub>4</sub>	Power Supply	1.0uF-2.2uF cap to V <sub>SS</sub>
24	V <sub>3</sub>	Power Supply	1.0uF-2.2uF cap to V <sub>SS</sub>
25	V <sub>2</sub>	Power Supply	1.0uF-2.2uF cap to V <sub>SS</sub>
26	V <sub>1</sub>	Power Supply	1.0uF-2.2uF cap to V <sub>SS</sub>
27	V <sub>0</sub>	Power Supply	1.0uF-2.2uF cap to V <sub>SS</sub>
28	V <sub>R</sub>	-	No Connect
29	INTRS	Input	Internal resistor select pin: V <sub>DD</sub> =Enabled
30	NC	-	No Connect

**Recommended LCD connector:** 0.5mm pitch, 30 pin FFC. Molex p/n: 52892-3095

**Backlight connector:** GHR-02V-S **Mates with:** BM02B-GHS-T



## Parallel/Serial Select Table

PS2	PS1	PS0	Interface mode	Data/Command	Data	Read/Write	Serial clock
L	L	H	Parallel 80	A0	DB0 to DB7	RD/WR	-
L	H	H	Parallel 68	A0	DB0 to DB7	E/RW	-
L	L	L	3Line Serial	-	SID (DB7)	Write only	SCLK (DB6)
L	H	L	4Line Serial	A0	SID (DB7)	Write only	SCLK (DB6)

\*Cannot read data from RAM in 4-line, 3-line, or IIC interface.

\*In 4-line or 3-line interface, DB0-DB5, E, and RW must be tied High or Low

\*In IIC or 3-line interface, A0 must be tied High or Low

## Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T <sub>OP</sub>	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T <sub>ST</sub>	Absolute Max	-30	-	+80	°C
Supply Voltage	V <sub>DD</sub>	-	2.7	3.0	3.3	V
Supply Current	I <sub>DD</sub>	V <sub>DD</sub> = 3.0V	0.5	1.0	1.5	mA
Supply for LCD (contrast)	V <sub>LCD</sub>	T <sub>OP</sub> = 25°C	13.3	13.6	13.9	V
"H" Level input	V <sub>IH</sub>	-	2.2	-	V <sub>DD</sub>	V
"L" Level input	V <sub>IL</sub>	-	V <sub>SS</sub>	-	0.6	V
"H" Level output	V <sub>OH</sub>	-	2.4	-	V <sub>DD</sub>	V
"L" Level output	V <sub>OL</sub>	-	V <sub>SS</sub>	-	0.4	V
Backlight supply voltage	V <sub>LED</sub>	-	3.0	3.3	3.5	V
Backlight supply current	I <sub>LED</sub>	V <sub>LED</sub> = 3.3V	30	45	60	mA

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	CR ≥ 2	-	35	-	°
	Bottom		-	60	-	°
	Left		-	60	-	°
	Right		-	60	-	°
Contrast Ratio	CR	-	2	6	-	-
Response Time	Rise	T <sub>OP</sub> = 25°C	-	150	250	ms
	Fall		-	200	300	ms

## Controller Information

Built-in ST7528 controller.

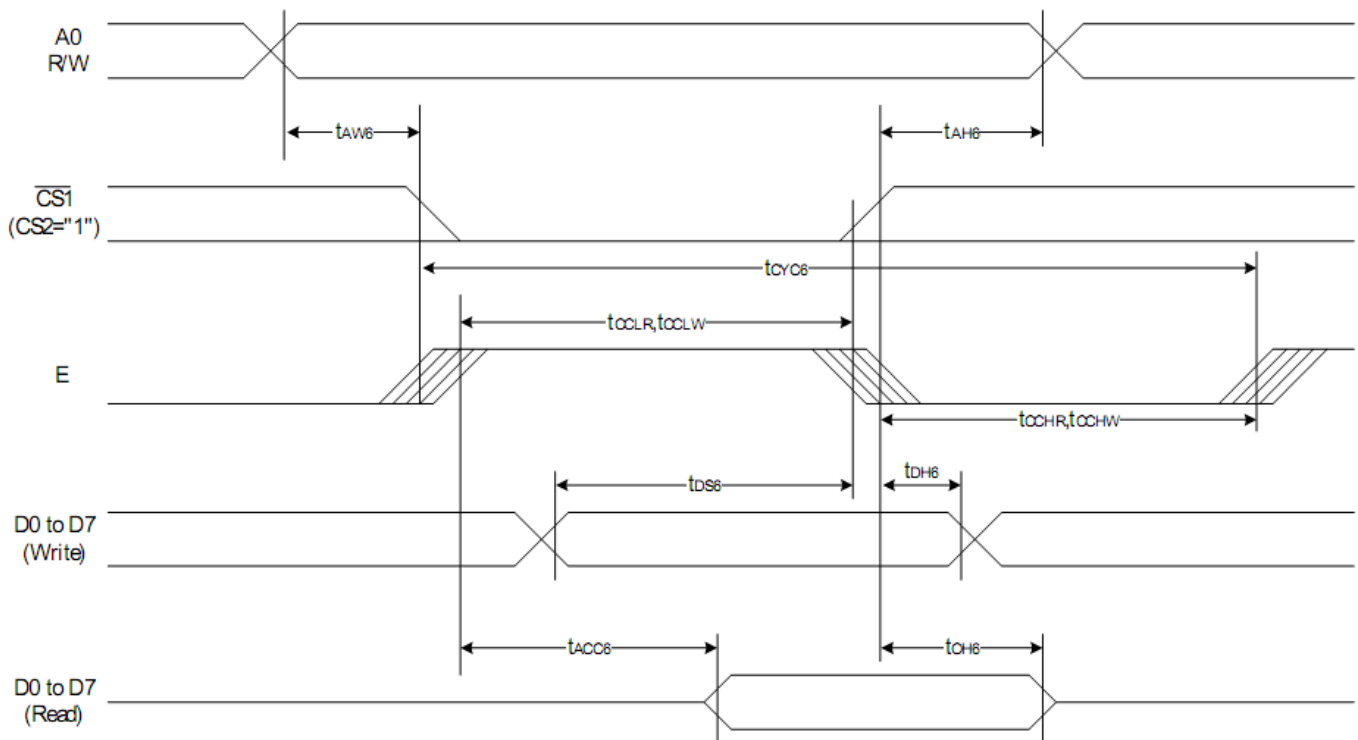
Please download specification at [http://www.newhavendisplay.com/app\\_notes/ST7528.pdf](http://www.newhavendisplay.com/app_notes/ST7528.pdf)

## Table of Commands

Instruction	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
<b>EXT=0 or 1</b>											
Mode Set	0	0	0	0	1	1	1	0	0	0	2-byte instruction to set Mode and FR( Frame frequency control) BE( Booster efficiency control)
	0	0	FR3	FR2	FR1	FR0	0	BE	x'	EXT	
<b>EXT=0</b>											
Read display data	1	1	Read data							Read data into DDRAM	
Write display data	1	0	Write data							Write data into DDRAM	
Read status	0	1	BUSY	ON	RES	MF2	MF1	MF0	DS1	DS0	Read the internal status
ICON control register ON/OFF	0	0	1	0	1	0	0	0	1	ICON	ICON=0: ICON disable(default) ICON=1: ICON enable & set the page address to 16
Set page address	0	0	1	0	1	1	P3	P2	P1	P0	Set page address
Set column address MSB	0	0	0	0	0	1	Y9	Y8	Y7	Y6	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y5	Y4	Y3	Y2	Set column address LSB
Set modify-read	0	0	1	1	1	0	0	0	0	0	Set modify-read mode
Reset modify-read	0	0	1	1	1	0	1	1	1	0	release modify-read mode
Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=0: Display OFF D=1: Display ON
Set initial display line register	0	0	0	1	0	0	0	0	x'	x'	2-byte instruction to specify the initial display line to realize vertical scrolling
	0	0	x'	S6	S5	S4	S3	S2	S1	S0	
Set initial COM0 register	0	0	0	1	0	0	0	1	x'	x'	2-byte instruction to specify the initial COM0 to realize window scrolling
	0	0	x'	C6	C5	C4	C3	C2	C1	C0	
Set partial display duty ration	0	0	0	1	0	0	1	0	x'	x'	2-byte instruction to set partial display duty ratio
	0	0	D7	D6	D5	D4	D3	D2	D1	D0	
Set N-line inversion	0	0	0	1	0	0	1	1	x'	x'	2-byte instruction to set N-line inversion register
	0	0	x'	x'	x'	N4	N3	N2	N1	N0	
Release N-line inversion	0	0	1	1	1	0	0	1	0	0	Release N-line inversion mode
Reverse display ON/OFF	0	0	1	0	1	0	0	1	1	REV	REV=0: normal display REV=1: reverse display
Entire display ON/OFF	0	0	1	0	1	0	0	1	0	EON	EON=0: normal display EON=1: entire display ON

Instruction	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
<b>Ext=0</b>											
Power control	0	0	0	0	1	0	1	VC	VR	VF	Control power circuit operation
Select DC-DC step-up	0	0	0	1	1	0	0	1	DC1	DC0	Select the step-up of internal voltage converter
Select regulator register	0	0	0	0	1	0	0	R2	R1	R0	Select the internal resistance ratio of the regulator resistor
Select electronic volume register	0	0	1	0	0	0	0	0	0	1	2-byte instruction to specify the reference voltage
	0	0	x'	x'	EV5	EV4	EV3	EV2	EV1	EV0	
Select LCD bias	0	0	0	1	0	1	0	B2	B1	B0	Select LCD bias
Bias Power Save	0	0	1	1	1	1	0	0	1	1	Bias Power save Save the Bias current consumption
	0	0	0	0	0	0	0	0	0	0	
SHL select	0	0	1	1	0	0	SHL	x'	x'	x'	COM bi-directional selection SHL=0: normal direction SHL=1: reverse direction
ADC select	0	0	1	0	1	0	0	0	0	ADC	SEG bi-directional selection ADC=0: normal direction ADC=1: reverse direction
Oscillator on start	0	0	1	0	1	0	1	0	1	1	Start the built-in oscillator
Set power save mode	0	0	1	0	1	0	1	0	0	P	P=0: normal mode P=1: sleep mode
Release power save mode	0	0	1	1	1	0	0	0	0	1	release power save mode
Reset	0	0	1	1	1	0	0	0	1	0	initial the internal function
Set data direction & display data length(DDL)	x'	x'	1	1	1	0	1	0	0	0	2-byte instruction to specify the number of data bytes. (SPI mode)
	x'	x'	D7	D6	D5	D4	D3	D2	D1	D0	
Select FRC and PWM mode	0	0	1	0	0	1	0	FRC	PWM1	PWM0	FRC(1:3FRC, 0:4FRC) PWM1 PWM0 0 0 45PWM 0 1 45 PWM 1 0 60PWM 1 1 ---
NOP	0	0	1	1	1	0	0	0	1	1	<i>No operation</i>
Test Instruction	0	0	1	1	1	1	x'	x'	x'	x'	<i>Don't use this instruction</i>

# Timing Characteristics



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t <sub>AH6</sub>		0	—	ns
Address setup time		t <sub>AW6</sub>		0	—	
System cycle time		t <sub>CYC6</sub>		240	—	
Enable L pulse width (WRITE)	WR	t <sub>EWLW</sub>		80	—	
Enable H pulse width (WRITE)		t <sub>EWHW</sub>		80	—	
Enable L pulse width (READ)	RD	t <sub>EWLR</sub>		80	—	
Enable H pulse width (READ)		t <sub>EWHR</sub>		140	—	
WRITE Data setup time	D0 to D7	t <sub>DS6</sub>		40	—	
WRITE Data hold time		t <sub>DH6</sub>		10	—	
READ access time		t <sub>ACC6</sub>	CL = 100 pF	—	70	
READ Output disable time		t <sub>OH6</sub>	CL = 100 pF	5	50	



## Example Initialization Program

```
/******  
/******  
void write_command(unsigned char datum)  
{  
    A0=0; /*Instruction register*/  
    E=1; /*Read inactive*/  
    bus=datum; /*put data on port 1*/  
    CSB=0; /*Chip select active*/  
    RW=0; /*Write active*/  
    RW=1; /*Write inactive; latch in data*/  
    CSB=1; /*Chip select inactive*/  
}  
/******  
void write_data(unsigned char datum)  
{  
    A0=1; /*DDRAM data register*/  
    E=1;  
    bus=datum;  
    CSB=0;  
    RW=0;  
    RW=1;  
    CSB=1;  
}  
/******  
void lcd_init(void){  
    write_command(0xA2); //ICON OFF;  
    write_command(0xAE); //Display OFF  
  
    write_command(0x48); //Set Duty ratio  
    write_command(0x80); //No operation  
    write_command(0xA0); //Set scan direction  
    write_command(0xC8); //SHL select  
    write_command(0x40); //Set START LINE  
    write_command(0x00);  
    write_command(0xab); //OSC on  
  
    write_command(0x64); //3x  
    delay(2000);  
    write_command(0x65); //4x  
    delay(2000);  
    write_command(0x66); //5x  
    delay(2000);  
    write_command(0x67); //6x  
    delay(2000);  
  
    write_command(Ra_Rb); //RESISTER SET  
    write_command(0x81); //Set electronic volume register  
    write_command(vopcode); //n=0~3f  
  
    write_command(0x57); //1/12bias  
    write_command(0x92); //FRC and pwm  
  
    write_command(0x2C);  
    delay(20000);//200ms  
    write_command(0x2E);  
    delay(20000);//200ms  
    write_command(0x2F);  
    delay(20000);//200ms
```

```

write_command(0x92); //frc and pwm
write_command(0x38); //external mode
write_command(0x75);

    /*** start settings for 16-level grayscale ***/

write_command(0x97); //3frc,45pwm

write_command(0x80);
write_command(0x00);
write_command(0x81);
write_command(0x00);
write_command(0x82);
write_command(0x00);
write_command(0x83);
write_command(0x00);

write_command(0x84);
write_command(0x06);
write_command(0x85);
write_command(0x06);
write_command(0x86);
write_command(0x06);
write_command(0x87);
write_command(0x06);

write_command(0x88);
write_command(0x0b);
write_command(0x89);
write_command(0x0b);
write_command(0x8a);
write_command(0x0b);
write_command(0x8b);
write_command(0x0b);

write_command(0x8c);
write_command(0x10);
write_command(0x8d);
write_command(0x10);
write_command(0x8e);
write_command(0x10);
write_command(0x8f);
write_command(0x10);

write_command(0x90);
write_command(0x15);
write_command(0x91);
write_command(0x15);
write_command(0x92);
write_command(0x15);
write_command(0x93);
write_command(0x15);

write_command(0x94);
write_command(0x1a);
write_command(0x95);
write_command(0x1a);
write_command(0x96);
write_command(0x1a);
write_command(0x97);
write_command(0x1a);

write_command(0x98);

```

```
write_command(0x1e);
write_command(0x99);
write_command(0x1e);
write_command(0x9a);
write_command(0x1e);
write_command(0x9b);
write_command(0x1e);
```

```
write_command(0x9c);
write_command(0x23);
write_command(0x9d);
write_command(0x23);
write_command(0x9e);
write_command(0x23);
write_command(0x9f);
write_command(0x23);
```

```
write_command(0xa0);
write_command(0x27);
write_command(0xa1);
write_command(0x27);
write_command(0xa2);
write_command(0x27);
write_command(0xa3);
write_command(0x27);
```

```
write_command(0xa4);
write_command(0x2b);
write_command(0xa5);
write_command(0x2b);
write_command(0xa6);
write_command(0x2b);
write_command(0xa7);
write_command(0x2b);
```

```
write_command(0xa8);
write_command(0x2f);
write_command(0xa9);
write_command(0x2f);
write_command(0xaa);
write_command(0x2f);
write_command(0xab);
write_command(0x2f);
```

```
write_command(0xac);
write_command(0x32);
write_command(0xad);
write_command(0x32);
write_command(0xae);
write_command(0x32);
write_command(0xaf);
write_command(0x32);
```

```
write_command(0xb0);
write_command(0x35);
write_command(0xb1);
write_command(0x35);
write_command(0xb2);
write_command(0x35);
write_command(0xb3);
write_command(0x35);
```

```
write_command(0xb4);
write_command(0x38);
write_command(0xb5);
write_command(0x38);
write_command(0xb6);
write_command(0x38);
write_command(0xb7);
write_command(0x38);

write_command(0xb8);
write_command(0x3a);
write_command(0xb9);
write_command(0x3a);
write_command(0xba);
write_command(0x3a);
write_command(0xbb);
write_command(0x3a);

write_command(0xbc);
write_command(0x3c);
write_command(0xbd);
write_command(0x3c);
write_command(0xbe);
write_command(0x3c);
write_command(0xbf);
write_command(0x3c);
    //end settings for 16-level grayscale
write_command(0x38);
write_command(0x74);
write_command(0xaf); //Display ON
}
/*****/
/*****/
```

## 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)

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