NEWHAVEN DISPLAY
INTERNATIONAL

NHD-C12832A1Z-NSW-BBW-3V3

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

NHD-	Newhaven Display
C12832-	128 x 32 pixels
A1Z-	Model
N-	Transmissive
SW-	Side White LED Backlight
B-	STN- Blue
B-	6:00 view
W-	Wide Temp (-20°C ~ +70°C)
3V3-	3Vdd, 3V Backlight
	RoHS Compliant

Document Revision History

Revision	Date	Description	Changed by
0	11/12/2008	Initial Release	-
1	5/18/2009	User guide reformat	BE
2	10/12/2009	Updated Electrical Characteristic	MC
3	5/6/2013	Electrical and Optical characteristics updated. Pin description, wiring diagram, mechanical drawing page and example initialization program updated.	JN

Functions and Features

- **128 x 32 pixels**
- **4-line SPI MPU interfaces**
- **Built-in ST7565R controller**
- **3V power supply**
- **1/33 duty cycle; 1/6 bias**
- **RoHS Compliant**

Mechanical Drawing
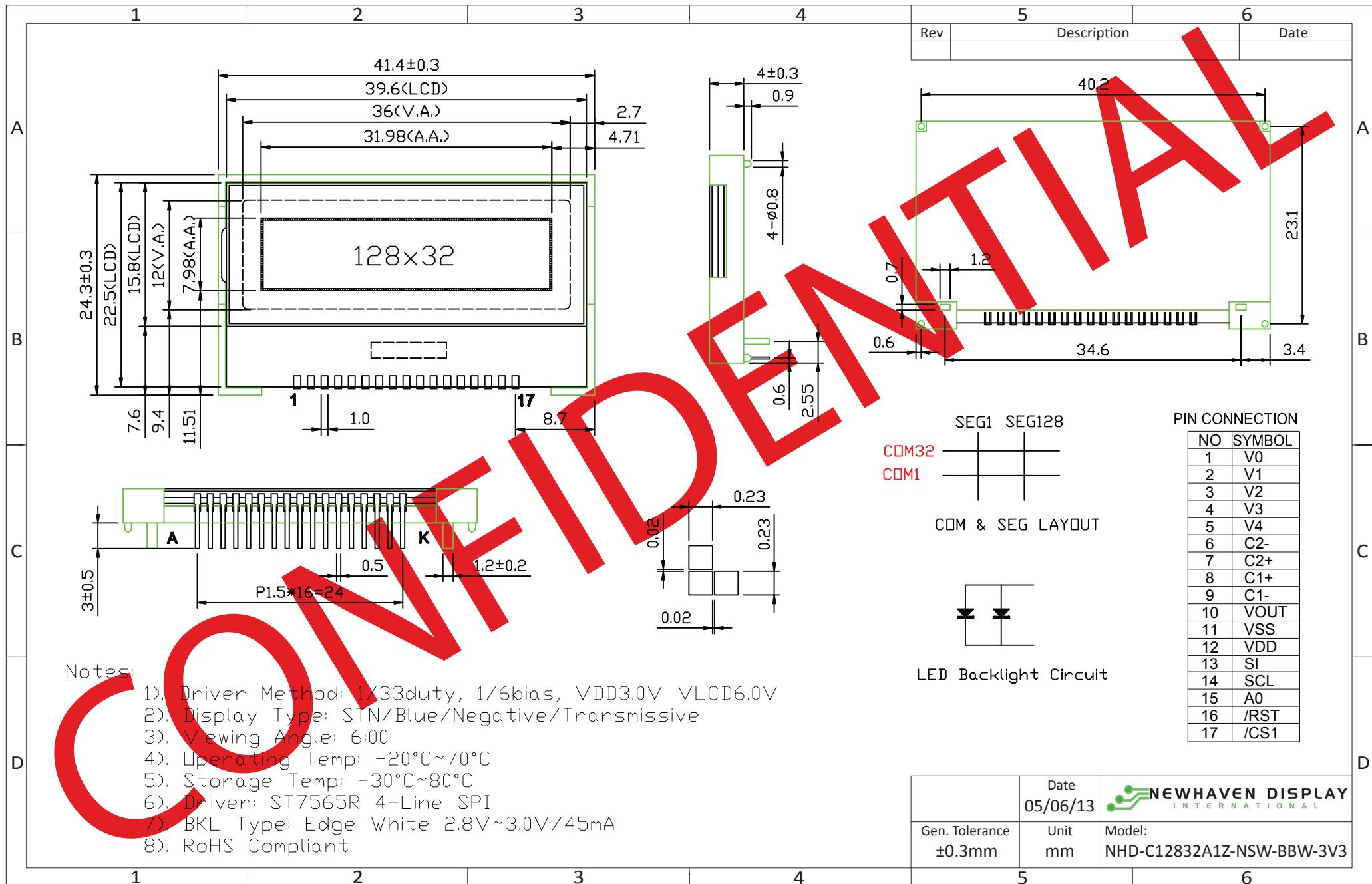
41.4±0.3
39.6(LCD)
36(V.A.)
31.98(A.A.)

128×32

2.7
4.71

24.3±0.3
22.5(LCD)
15.8(LCD)
12(V.A.)
7.98(A.A.)

7.6
9.4
11.51

1
17

1.0
8.7

4±0.3
0.9

4-Ø0.8

40.2

23.1

1.2
0.7

0.6
34.6
3.4

0.6
2.55

A
K

P1.5*16=24

0.5
1.2±0.2

3±0.5

0.23
0.23
0.02
0.02
0.02

SEG1 SEG128
COM32
COM1

COM & SEG LAYOUT

LED Backlight Circuit

PIN CONNECTION

NO	SYMBOL
1	V0
2	V1
3	V2
4	V3
5	V4
6	C2-
7	C2+
8	C1+
9	C1-
10	VOUT
11	VSS
12	VDD
13	SI
14	SCL
15	A0
16	/RST
17	/CS1

Notes:
1). Driver Method: 1/33duty, 1/6bias, VDD3.0V VLCD6.0V
2). Display Type: STN/Blue/Negative/Transmissive
3). Viewing Angle: 6:00
4). Operating Temp: -20°C~70°C
5). Storage Temp: -30°C~80°C
6). Driver: ST7565R 4-Line SPI
7). BKL Type: Edge White 2.8V~3.0V/45mA
8). RoHS Compliant

Rev	Description	Date

	Date 05/06/13	NEWHAVEN DISPLAY INTERNATIONAL
Gen. Tolerance ±0.3mm	Unit mm	Model: NHD-C12832A1Z-NSW-BBW-3V3

Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V0	Power Supply	0.47uF-2.2uF Cap to VSS
2	V1	Power Supply	0.47uF -2.2uF Cap to VSS
3	V2	Power Supply	0.47uF -2.2uF Cap to VSS
4	V3	Power Supply	0.47uF -2.2uF Cap to VSS
5	V4	Power Supply	0.47uF 2.2uF Cap to VSS
6	C2-	Power Supply	Connect to 1uF Cap to C2+ (pin 7)
7	C2+	Power Supply	Connect to 1uF Cap to C2- (pin 6)
8	C1+	Power Supply	Connect to 1uF Cap to C1- (pin 9)
9	C1-	Power Supply	Connect to 1uF Cap to C1+ (pin 8)
10	V_{OUT}	Power Supply	Connect to 1uF cap to VSS (pin 11)
11	VSS	Power Supply	Ground
12	VDD	Power Supply	Power supply for LCD and logic (+3V)
13	SI	MPU	Serial Data
14	SCL	MPU	Serial Clock
15	A0	MPU	Select registers. 0: Instruction, 1: Data register
16	/RST	MPU	Active LOW Reset signal
17	/CS1	MPU	Active LOW Chip Select signal
A	LED+	Power Supply	Power supply for LED Backlight (+3V)
K	LED-	Power Supply	Ground for Backlight

Recommended LCD connector: 1.5mm pitch pins, solder directly into PCB
Backlight connector: 1.2mm Wide pins, solder directly into PCB   **Mates with**: ---
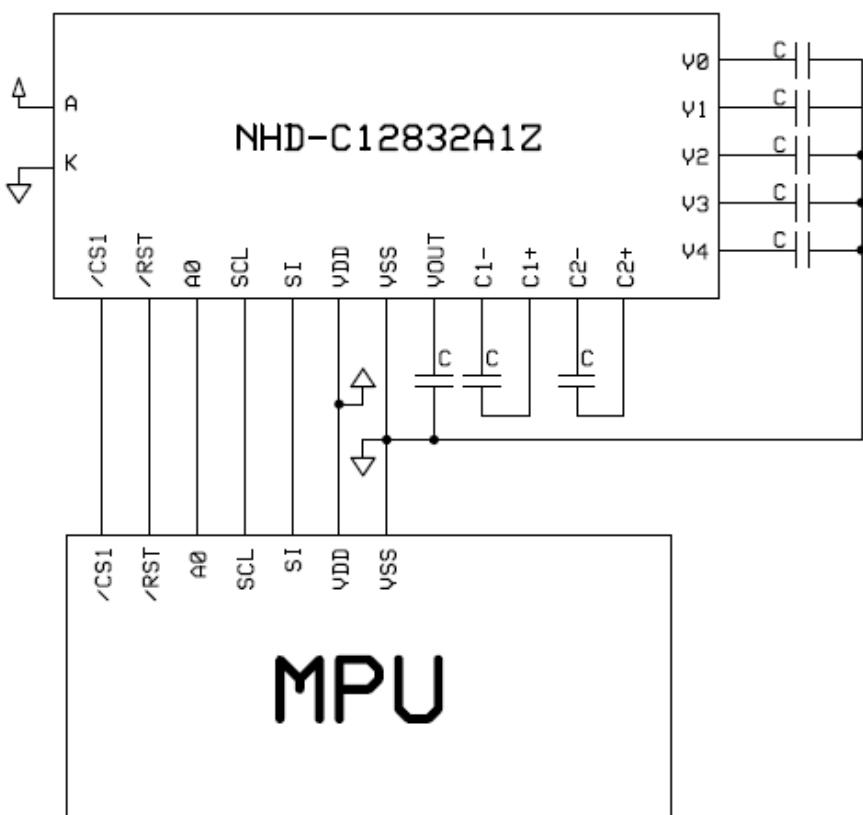
Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	Top	Absolute Max	-20	-	+70	ºC
Storage Temperature Range	Tst	Absolute Max	-30	-	+80	ºC
Supply Voltage	VDD		2.7	3.0	3.3	V
Supply Current	IDD	Ta=25℃, V$_{DD}$=3.0V	-	0.25	0.45	mA
Supply for LCD (contrast)	VDD-V0	Ta=25℃	-	6.0	-	V
"H" Level input	Vih		0.8*VDD	-	VDD	V
"L" Level input	Vil		VSS	-	0.2*VDD	V
"H" Level output	Voh		0.8*VDD	-	VDD	V
"L" Level output	Vol		VSS	-	0.2*VDD	V
Backlight supply voltage	V$_{LED}$		-	3.0	-	V
Backlight supply current	ILED	V$_{LED}$=3.0V	20	30	45	mA

Optical Characteristics

| Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Top			-	25	-	º
Viewing Angle - Bottom			-	50	-	º
Viewing Angle - Left		Cr≥2	-	30	-	º
Viewing Angle - Right			-	30	-	º
Contrast Ratio	CR		-	2	-	-
Response Time (rise)	Tr	-	-	120	150	ms
Response Time (fall)	Tf	-	-	120	150	ms

Controller Information

Built-in ST7565R controller.
Please download specification at http://www.newhavendisplay.com/app_notes/ST7565R.pdf

Timing Characteristics

The 4-line SPI Interface
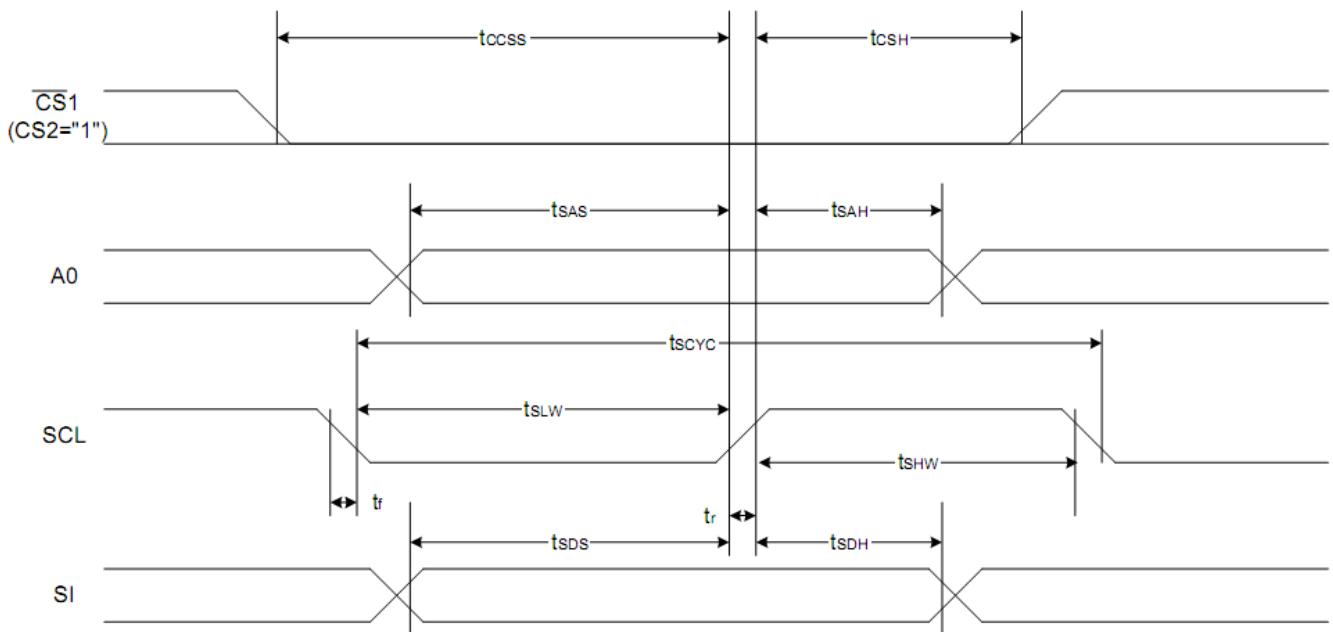
Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
4-line SPI Clock Period	SCL	T_{scyc}		50	—	ns
SCL "H" pulse width		T_{shw}		25	—	
SCL "L" pulse width		T_{SLW}		25	—	
Address setup time	A0	T_{SAS}		20	—	
Address hold time		T_{sah}		10	—	
Data setup time	SI	T_{sds}		20	—	
Data hold time		T_{SDH}		10	—	
CS-SCL time	CS	T_{css}		20	—	
CS-SCL time		T_{csh}		40	—	

*1 The input signal rise and fall time (t_r, t_f) are specified at 15 ns or less.
*2 All timing is specified using 20% and 80% of V_{DD} as the standard.

Reset Timing
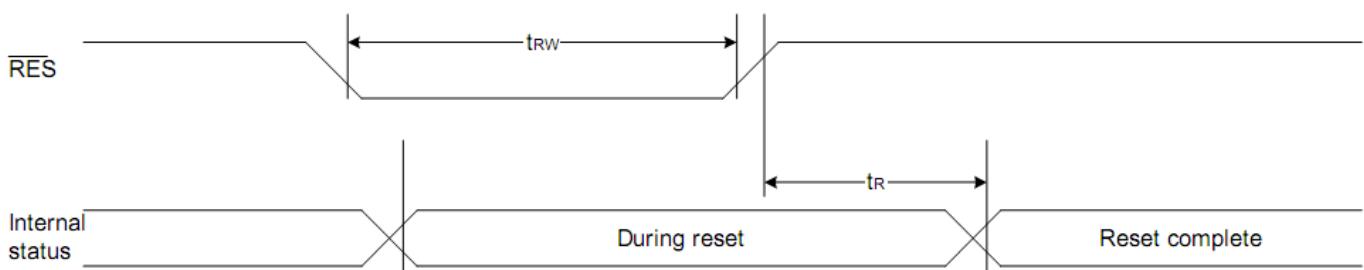
Table of Commands

Command	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit				0	0	0	0	Least significant column address				Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data								Writes to the display RAM
(7) Display data read	1	0	1	Read data								Reads from the display RAM
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0 1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/ reverse	0	1	0	1	0	1	0	0	1	1	0 1	Sets the LCD display normal/ reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0 1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0 1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565R)
(12) Read-modify-write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0 1	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17) V₀ voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(R_b/R_a) mode
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set the V_0 output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value						
(19) Sleep mode set	0	1	0	1	0	1	0	1	1	0	0 1	0: Sleep mode, 1: Normal mode
				*	*	*	*	*	*	0	0	
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
				0	0	0	0	0	0	step-up value		
(21) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(22) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

Example Initialization Program

```
 void data_out(unsigned char i) //Data Output Serial Interface
{
        unsigned int n;
        CS = 0;
        A0 = 1;
        for(n=0; n<8; n++){
  i <<=1;
        SCL = 0;
        P1  = i;
        delay(2);
        SCL = 1;
        }
        CS = 1;
}
void comm_out(unsigned char j) //Command Output Serial Interface
{
        unsigned int n;
        CS = 0;
        A0  = 0;
        for(n=0; n<8; n++){
  j <<=1;
        SCL = 0;
        P1  = j;
        delay(2);
        SCL = 1;
        }
        CS = 1;
}


/**************************************************
*        Initialization For controller        *
**************************************************/
void init_LCD()
{
comm_out(0xA0);
comm_out(0xAE);
comm_out(0xC0);
comm_out(0xA2);
comm_out(0x2F);
comm_out(0x21);
comm_out(0x81);
comm_out(0x3F);
}
/**************************************************/
```

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