

NHD-C12832A1Z-FS(RGB)-FBW-3V

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

NHD-	Newhaven Display
C12832-	128 x 32 Pixels
A1Z-	Model
F-	Transflective
SRGB-	Side Red/Green/Blue LED Backlight
F-	FSTN Positive
B-	6:00 Optimal View
W-	Wide Temp
3V-	3VDD
	RoHS Compliant

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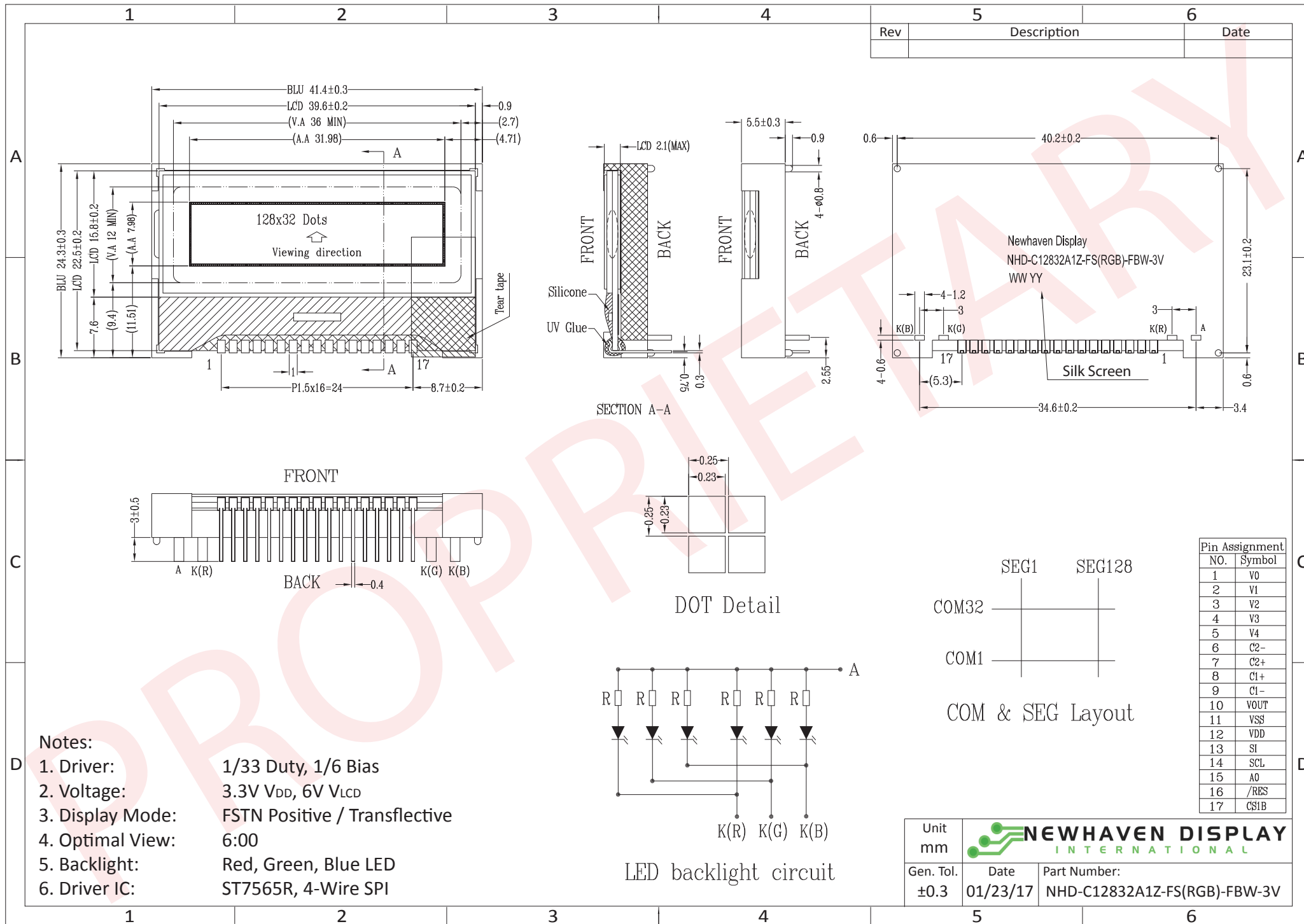
Document Revision History

Revision	Date	Description	Changed by
0	10/23/2012	Initial Release	AK
1	6/15/16	Mechanical Drawing, Electrical & Optical Char., Quality Information Updated	SB
2	1/23/17	Mechanical Drawing & Electrical Characteristics Updated	SB
3	4/14/17	Backlight Characteristics Updated	SB
4	8/4/17	Backlight Characteristics Updated	SB
5	4/2/18	Electrical Characteristics Updated	SB

Functions and Features

- 128 x 32 pixels
- 4-line SPI MPU interfaces
- Built-in ST7565R controller
- +3.0V power supply
- 1/33 duty cycle; 1/6 bias
- RoHS Compliant

Mechanical Drawing



- Notes:**
1. Driver: 1/33 Duty, 1/6 Bias
 2. Voltage: 3.3V V_{DD}, 6V V_{LCD}
 3. Display Mode: FSTN Positive / Transflective
 4. Optimal View: 6:00
 5. Backlight: Red, Green, Blue LED
 6. Driver IC: ST7565R, 4-Wire SPI

Rev	Description	Date

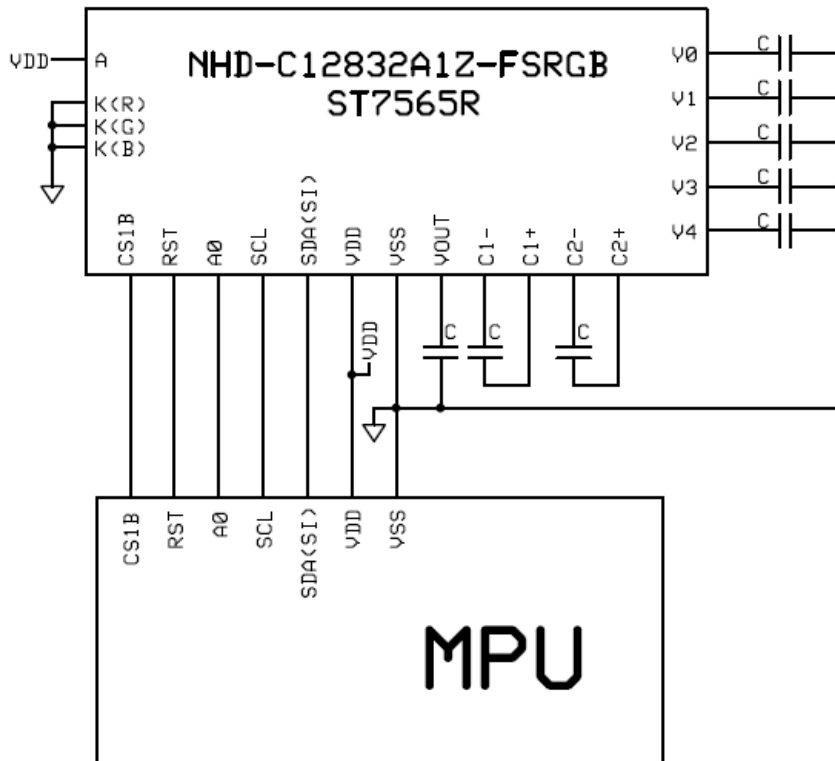
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Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V ₀	Power Supply	0.1μF – 1μF Capacitor to V _{SS}
2	V ₁	Power Supply	0.1μF – 1μF Capacitor to V _{SS}
3	V ₂	Power Supply	0.1μF – 1μF Capacitor to V _{SS}
4	V ₃	Power Supply	0.1μF – 1μF Capacitor to V _{SS}
5	V ₄	Power Supply	0.1μF – 1μF Capacitor to V _{SS}
6	C2-	Power Supply	Connect 1μF – 2.2μF Capacitor to C2+ (pin 7)
7	C2+	Power Supply	Connect 1μF – 2.2μF Capacitor to C2- (pin 6)
8	C1+	Power Supply	Connect 1μF – 2.2μF Capacitor to C1- (pin 9)
9	C1-	Power Supply	Connect 1μF – 2.2μF Capacitor to C1+ (pin 8)
10	V _{OUT}	Power Supply	Connect 1μF – 2.2μF Capacitor to V _{SS} (pin 11)
11	V _{SS}	Power Supply	Ground
12	V _{DD}	Power Supply	Supply Voltage for LCD and Logic (+3V)
13	SDA(SI)	MPU	Serial Data
14	SCL	MPU	Serial Clock
15	A0	MPU	Register Select. A0=0: Instruction, A0=1: Data
16	RST	MPU	Active LOW Reset signal
17	CS1B	MPU	Active LOW Chip Select signal
A	LED+	Power Supply	Backlight Anode
K(R)	(R)LED-	Power Supply	Red Backlight Cathode (Ground)
K(G)	(G)LED-	Power Supply	Green Backlight Cathode (Ground)
K(B)	(B)LED-	Power Supply	Blue Backlight Cathode (Ground)

Recommended LCD connector: 1.5mm pitch pins, solder directly into PCB

Backlight connector: 1.5mm wide pins solder directly into PCB **Mates with:** ---



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}	-	2.7	3.0	3.3	V
Supply Current	I _{DD}	V _{DD} =3.0V	0.1	0.4	1	mA
Supply for LCD (contrast)	V _{LCD}	T _{OP} = 25°C	5.8	6.0	6.2	V
"H" Level input	V _{IH}	-	0.8 * V _{DD}	-	V _{DD}	V
"L" Level input	V _{IL}	-	V _{SS}	-	0.2 * V _{DD}	V
"H" Level output	V _{OH}	-	0.8 * V _{DD}	-	V _{DD}	V
"L" Level output	V _{OL}	-	V _{SS}	-	0.2 * V _{DD}	V
Backlight supply voltage – Red	V _{LED}	-	2.0	2.1	2.2	V
Backlight supply current – Red	I _{LED}	V _{LED} = 2.1V	3	20	26	mA
Backlight supply voltage – Green	V _{LED}	-	2.9	3.0	3.1	V
Backlight supply current – Green	I _{LED}	V _{LED} = 3.0V	5	30	36	mA
Backlight supply voltage – Blue	V _{LED}	-	2.9	3.0	3.1	V
Backlight supply current – Blue	I _{LED}	V _{LED} = 3.0V	5	30	36	mA

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	CR≥2	-	20	-	°
	Bottom		-	40	-	°
	Left		-	40	-	°
	Right		-	40	-	°
Contrast Ratio	CR	-	2	6	-	-
Response Time	Rise	T _{OP} = 25°C	-	200	250	ms
	Fall		-	250	320	ms

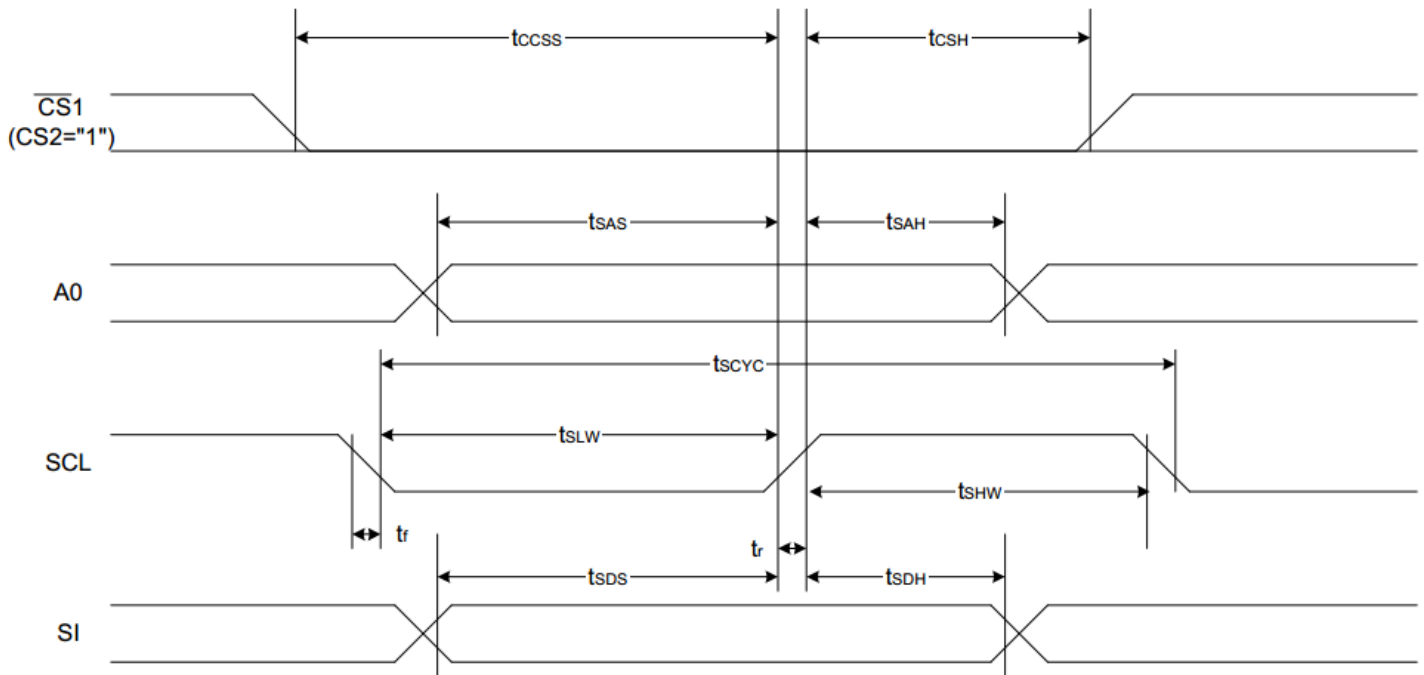
Controller Information

Built-in ST7565R controller.

Please download specification at http://www.newhavendisplay.com/app_notes/ST7565R.pdf

Timing Characteristics

The 4-line SPI Interface



($V_{DD} = 3.3V, T_a = -30$ to $85^\circ C$)

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	—	

Table of Commands

Command	Command Code										Function		
	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1		D0	
(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					0	Sets the display RAM display start line address	
(3) Page address set	0	1	0	1	0	1	Page address					0	Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				0	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				0	Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data							0	Writes to the display RAM	
(7) Display data read	1	0	1	Read data							0	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	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0	*	*	*	*	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		0	0	Select internal power supply operating mode
(17) V ₀ voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			0	Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set	0	1	0	1	0	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					0		
(19) Sleep mode set	0	1	0	1	0	1	0	1	1	0	0	1	0: Sleep mode, 1: Normal mode
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
				0	0	0	0	0	0	0	step-up value		
(21) NOP	0	1	0	1	1	1	0	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(0x26);
    comm_out(0x81);
    comm_out(0x2F);
}

/*****/
```


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 , 96hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 96hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 96hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 96hrs	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.	+50°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,60min -> 25°C,5min -> 70°C,60min = 1 cycle 20 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-50Hz 5g Acceleration. 30 min in each of 3 directions X,Y,Z	3
Static electricity test	Endurance test applying electric static discharge.	VS=8kV, RS=330kΩ, CS=150pF 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