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 Negative, Blue
B-	6:00 Optimal View
W-	Wide Temp
3V3-	$3V_{DD}$, 3V Backlight
	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

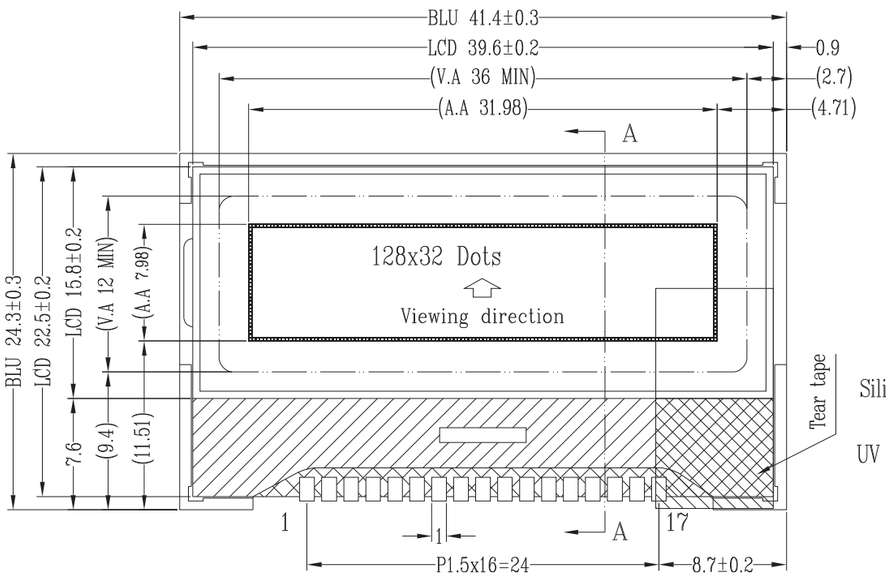
Document Revision History

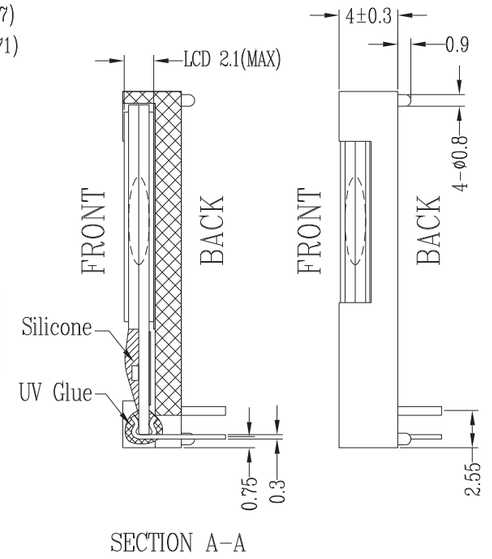
Revision	Date	Description	Changed by
0	11/12/08	Initial Release	-
1	5/18/09	User guide reformat	BE
2	10/12/09	Updated Electrical Characteristic	MC
3	5/6/13	Electrical and Optical characteristics updated. Pin description, wiring diagram, mechanical drawing page and example initialization program updated.	JN
4	1/26/17	Mechanical Drawing, Electrical & Optical Char. Updated	SB
5	7/5/19	Added PCB Footprint Drawing	AS

Functions and Features

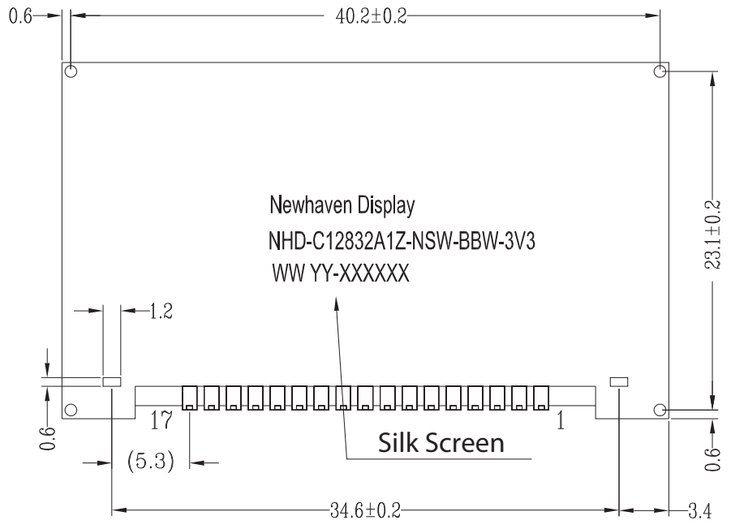
- **128 x 32 pixels**
- **4-line SPI MPU interfaces**
- **Built-in ST7565R controller**
- **3V power supply**
- **1/33 duty cycle; 1/6 bias**
- **RoHS Compliant**

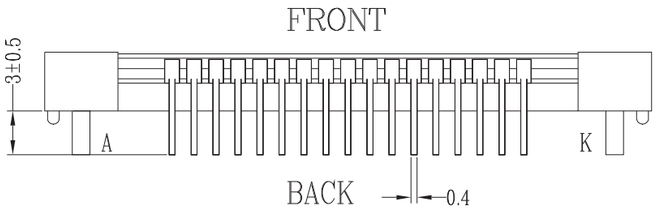
SYMBOL	REVISION	DATE

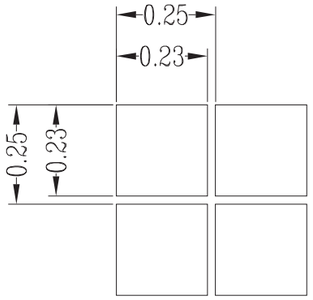


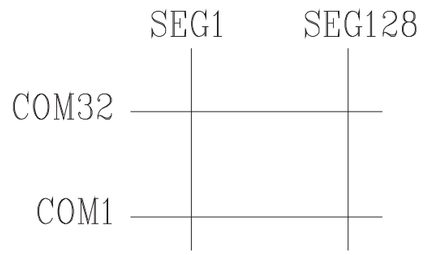


SECTION A-A







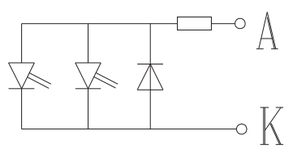


COM & SEG Layout

Pin Assignment	
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	/RES
17	CS1B

Notes:

1. Driver:	1/33 Duty, 1/6 Bias
2. Voltage:	3.0V V_{DD}, 6.0V V_{LCD}
3. Display Type:	FSTN Negative / Transmissive
4. Optimal View:	6:00
5. Backlight:	White LED
6. Driver IC:	ST7565R 4-Wire SPI



LED backlight circuit

STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)
LINEAR: ±0.3mm

NEWHAVEN DISPLAY INTERNATIONAL

DRAWING/PART NUMBER: NHD-C12832A1Z-NSW-BBW-3V3
REVISION: 1.0
SIZE: A3
SCALE: NS

UNLESS OTHERWISE SPECIFIED:
- DIMENSIONS ARE IN MILLIMETERS
- THIRD ANGLE PROJECTION

DRAWN BY: A. Shah
APPROVED BY: A. Khan
DRAWN DATE: 7/5/19
APPROVED DATE: 7/5/19

DO NOT SCALE DRAWING
SHEET 1 OF 1

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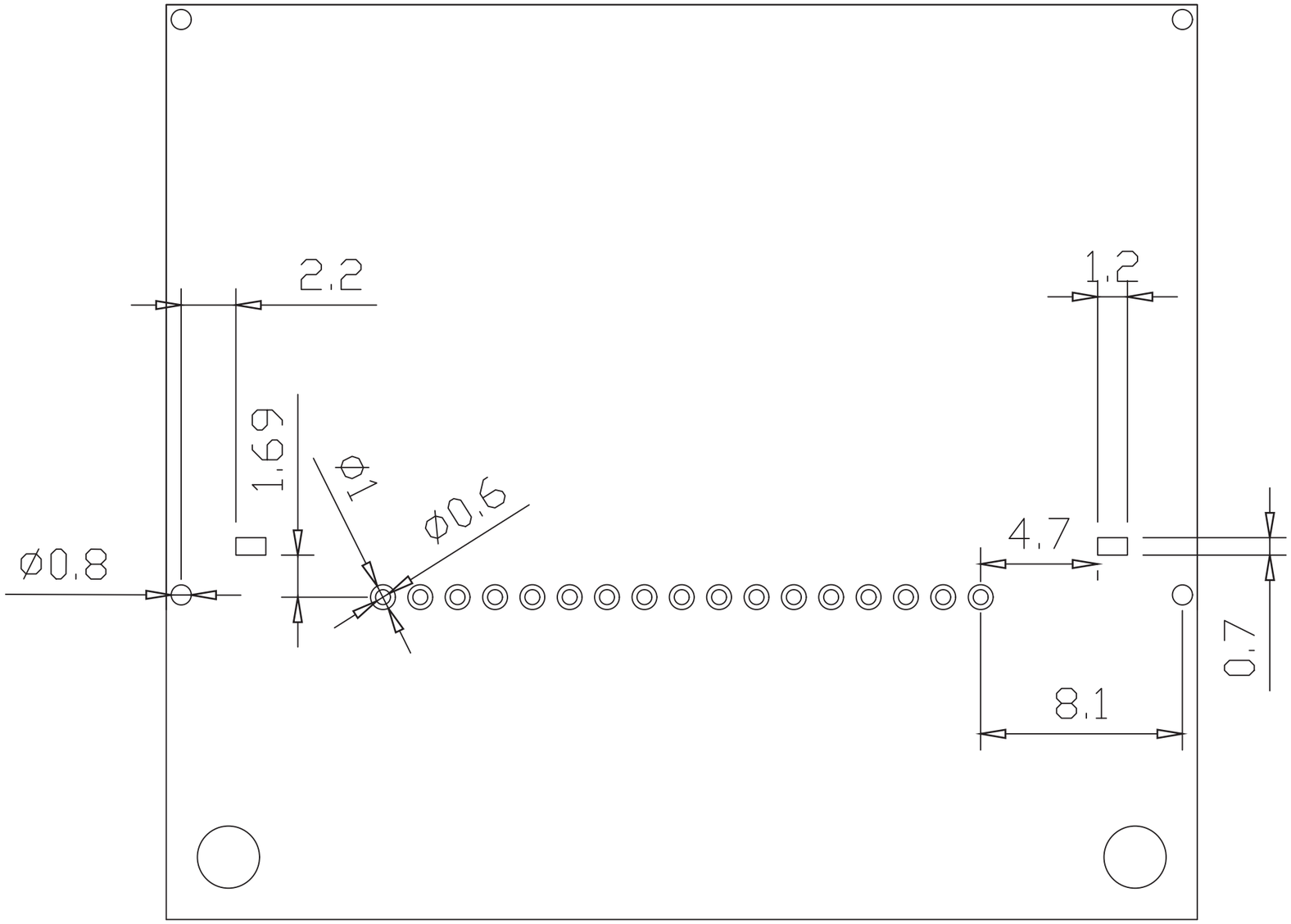
SYMBOL	REVISION	DATE

Recommended PCB Footprint



Applicable Displays:

1) NHD-C12832A1Z-FSW-FBW-3V3
2) NHD-C12832A1Z-NSW-BBW-3V3
3) NHD-C12832A1Z-FSR-FBW-3V3
4) NHD-C12832A1Z-FSB-FBW-3V3

STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED) LINEAR: ±0.3mm	NEWHAVEN DISPLAY INTERNATIONAL		
	DRAWING/PART NUMBER: NHD-C12832A1Z-Monochrome-Footprint		REVISION: 1.0
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	DRAWN BY: A. Shah	APPROVED BY: A. Khan	SIZE: A3
	DRAWN DATE: 7/1/19	APPROVED DATE: 7/1/19	SCALE: NS
	DO NOT SCALE DRAWING		SHEET 1 OF 1

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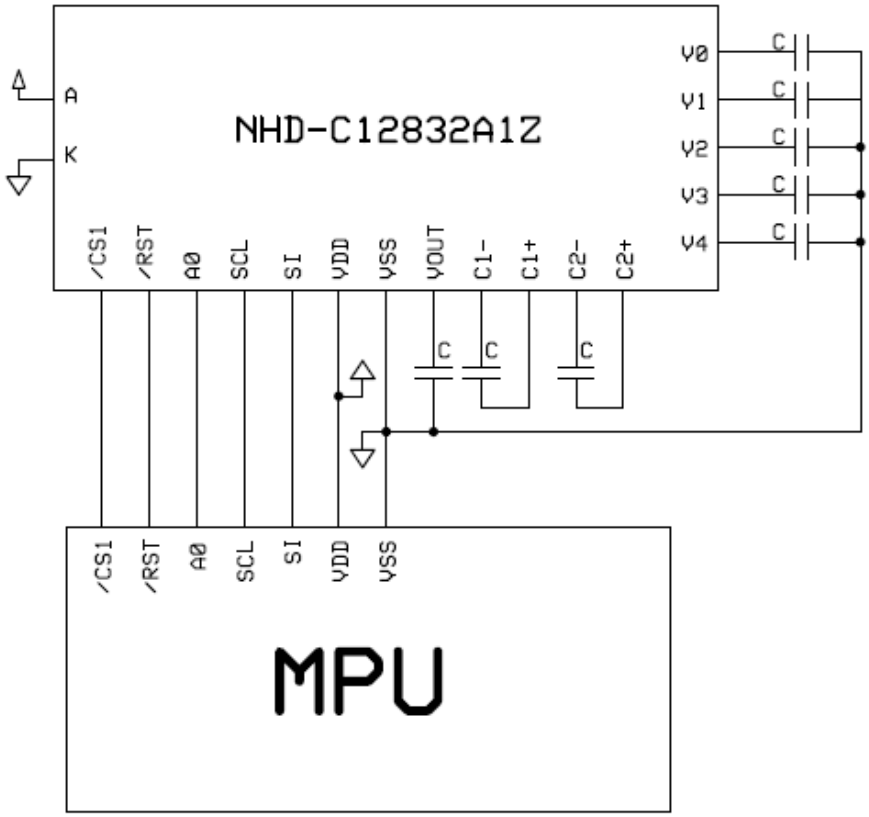
Pin Description and Wiring Diagram

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 VSS (pin 11)
11	V_{SS}	Power Supply	Ground
12	V_{DD}	Power Supply	Supply Voltage for LCD and Logic (+3V)
13	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	/CS1	MPU	Active LOW Chip Select signal
A	LED+	Power Supply	Backlight Anode(+3V)
K	LED-	Power Supply	Backlight Cathode (Ground)

Recommended LCD connector: 1.5mm pitch pins, solder directly into PCB
Backlight connector: 1.2mm Wide pins, solder directly into PCB **Mates with**: ---
Recommended Breakout Board: NHD-PCB12832A1Z



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	1.0	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	V_{LED}	-	2.9	3.0	3.1	V
Backlight supply current	I_{LED}	V_{LED}=3.0V	15	30	36	mA

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 2	-	20	-	º
	Bottom	φY-		-	40	-	º
	Left	θX-		-	40	-	º
	Right	θX+		-	40	-	º
Contrast Ratio		CR	-	2	5	-	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	200	250	ms
	Fall	T_F		-	250	320	ms

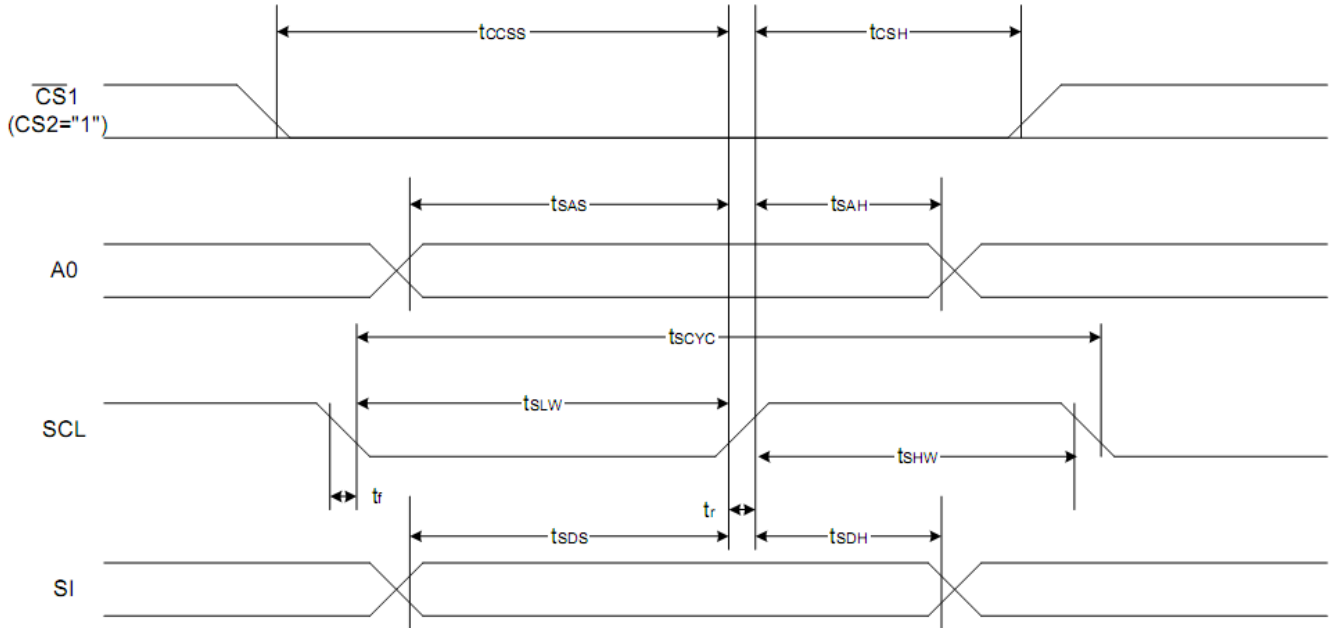
Controller Information

Built-in ST7565R controller.

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

Timing Characteristics

The 4-line SPI Interface



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
4-line SPI Clock Period	SCL	Tscyc		50	—	ns
SCL “H” pulse width		Tshw		25	—	
SCL “L” pulse width		TSLW		25	—	
Address setup time	A0	TSAS		20	—	
Address hold time		Tsah		10	—	
Data setup time	SI	Tsds		20	—	
Data hold time		TSDH		10	—	
CS-SCL time	CS	Tcss		20	—	
CS-SCL time		Tcsh		40	—	

*1 The input signal rise and fall time (tr, tf) are specified at 15 ns or less.
*2 All timing is specified using 20% and 80% of VDD as the standard.

Reset Timing

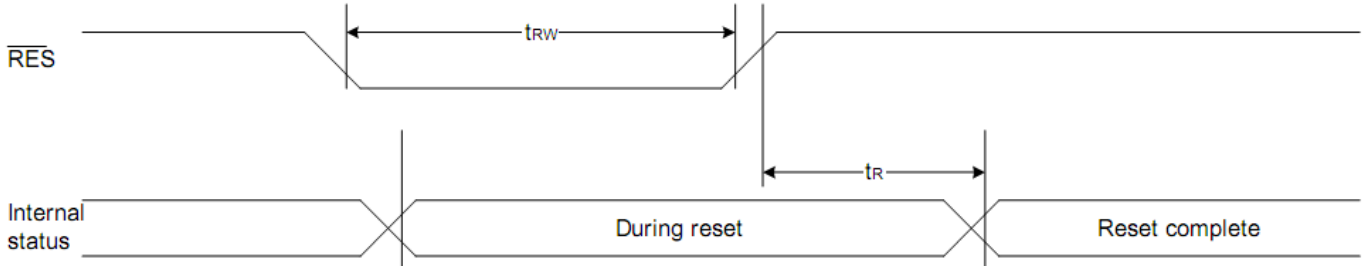


Table of Commands

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						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 Column address set lower bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address. Sets the least significant 4 bits of the display RAM column address.
				0	0	0	0	Least significant 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) V_0 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set Electronic volume register set	0	1	0	1	0	0	0	0	0	0	1	Set the V_0 output voltage electronic volume register
				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 , 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=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