

# NHD-C12864A1Z-FSR-FBW-HTT

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

NHD- Newhaven Display  
C12864- 128 x 64 Pixels  
A1Z- Model  
F- Transflective  
SR- Side Red LED Backlight  
F- FSTN Positive  
B- 6:00 Optimal View  
W- Wide Temp  
HTT- With 12V Heater (-40°C to +70°C)  
**RoHS Compliant**

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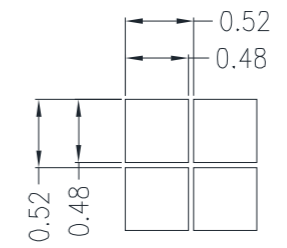
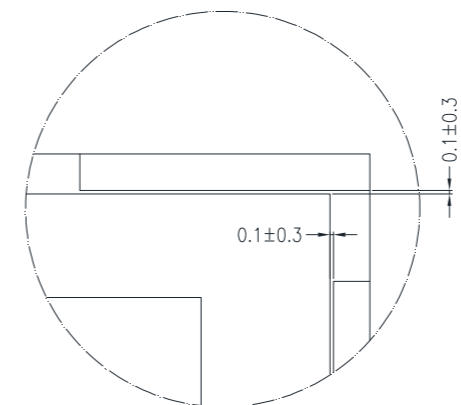
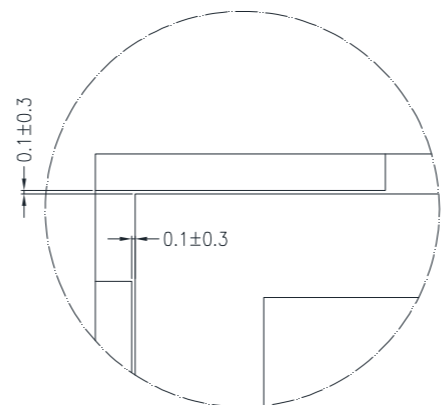
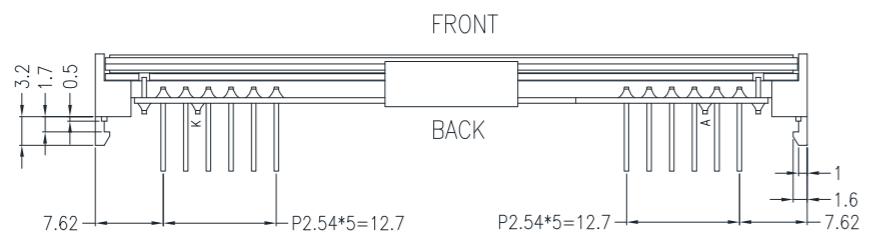
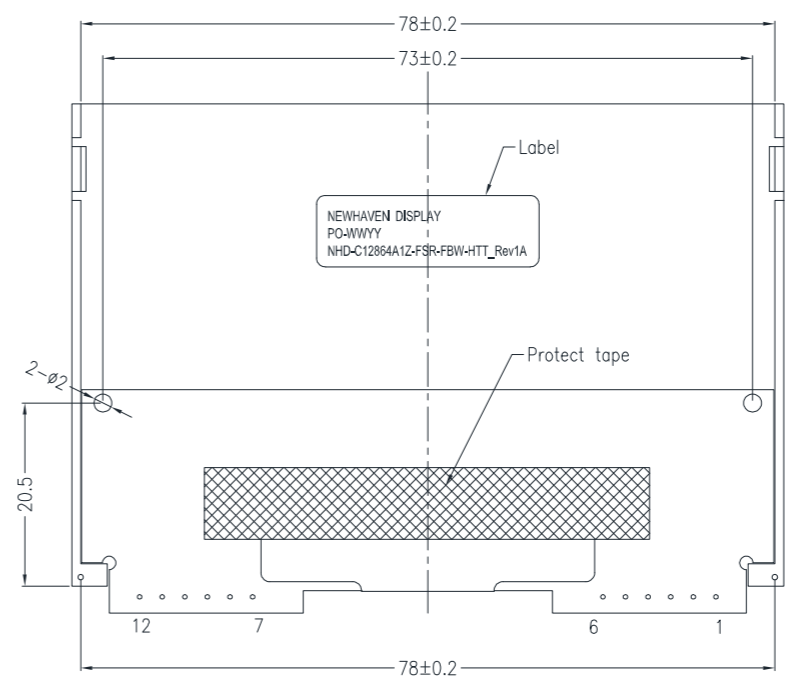
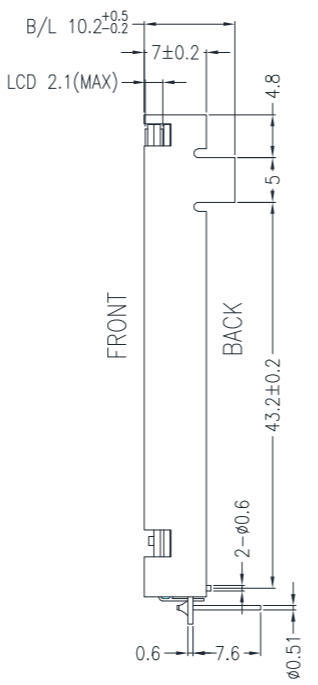
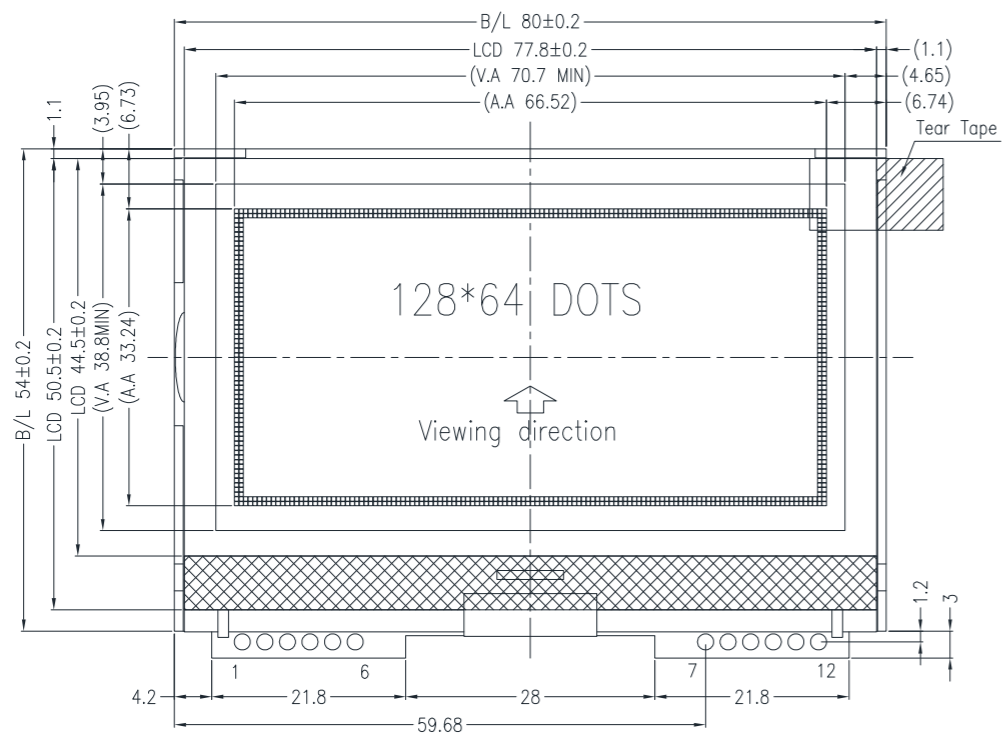
## Document Revision History

Revision	Date	Description	Changed by
0	10/20/10	Initial Release	-
1	10/26/10	Pin Length Adjusted from 0.5" to 0.3" on Mechanical drawing.	MC
2	10/27/10	Supply Current and block diagram updated	BE
3	1/20/11	Operating Temp updated	BE
4	8-31-11	Electrical characteristics updated	AK
5	7/30/12	Electrical characteristics updated	AK
6	8/31/15	Electrical characteristics, Mechanical drawing updated	SB
7	6/4/19	Added PCB Footprint Drawing	AS
8	1/31/20	Glass Panel Updated	SB

## Functions and Features

- 128 x 64 pixels
- Built-in ST7565P controller
- +3.3V power supply
- 1/65 duty cycle; 1/9 bias
- Built-in Heater
- RoHS Compliant

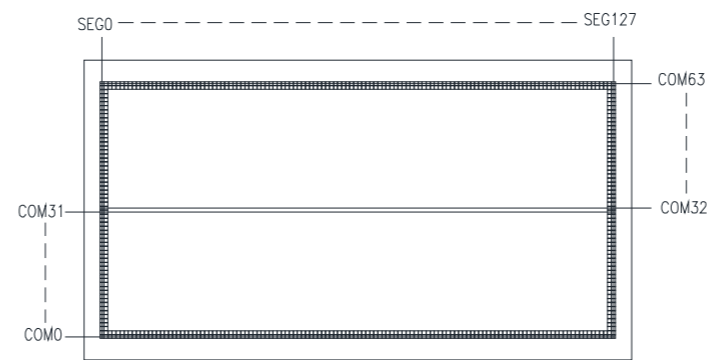
SYMBOL	REVISION	DATE



Pin assignment	
NO.	Symbol
1	SCL
2	SI
3	VDD
4	A0
5	/RESET
6	/CS
7	VSS
8	H-
9	H+
10	LED-
11	LED+
12	NC

**Notes:**

- Driving: 1/65 duty, 1/9 bias
- Voltage: 3.3V V<sub>DD</sub>, 8.7V V<sub>LCD</sub>
- Display Type: FSTN Positive / Transflective
- Optimal View: 6:00
- Backlight: Red Edge light LED`
- Driver IC: ST7565 2-Line SPI Interface
- Built-in Heater

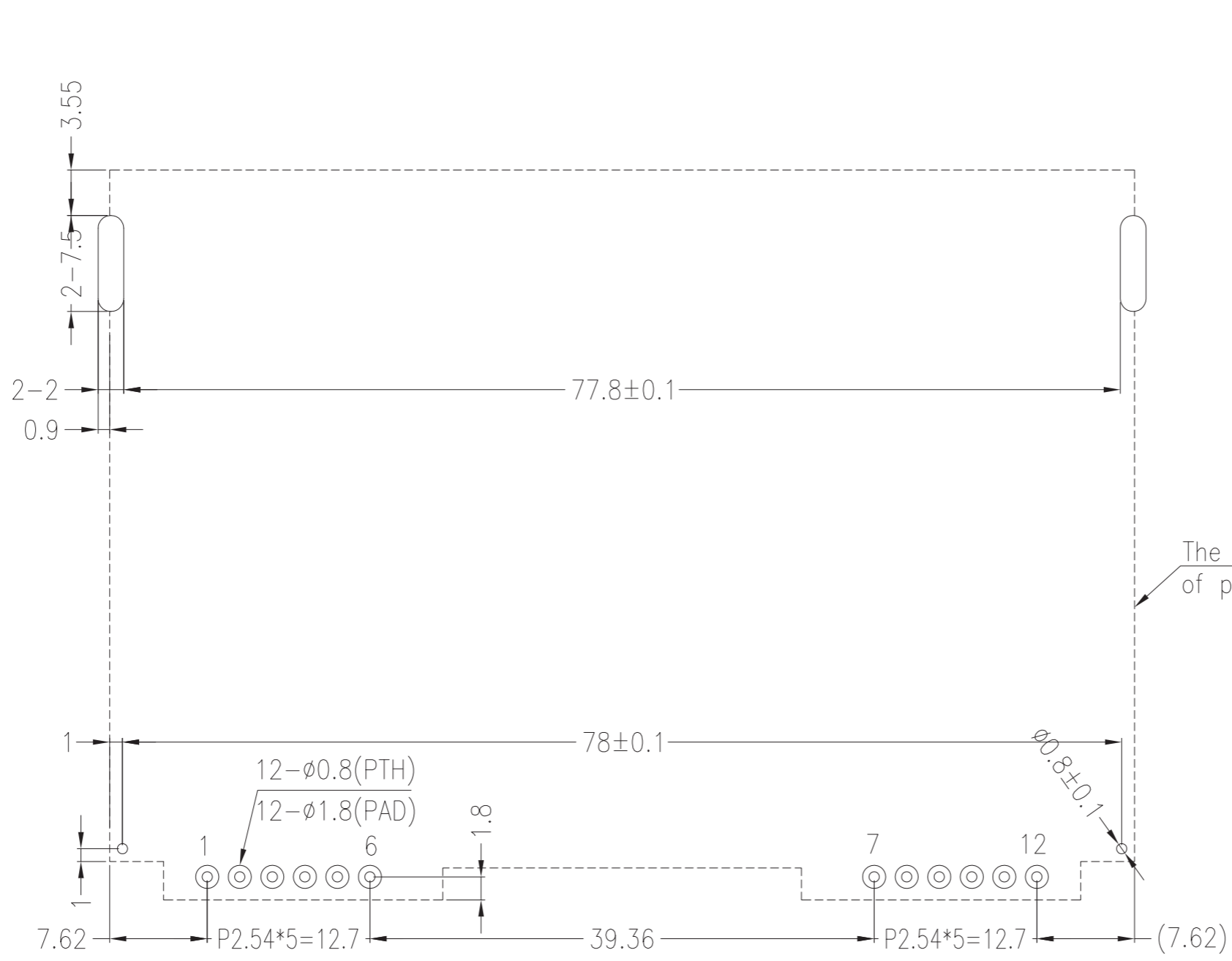


STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)	NEWHAVEN DISPLAY INTERNATIONAL	
LINEAR: ±0.3mm	DRAWING/PART NUMBER: NHD-C12864A1Z-FSR-FBW-HTT	REVISION: 1A
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	DRAWN BY: S. Baxi	APPROVED BY: S. Baxi
	DRAWN DATE: 1/31/20	APPROVED DATE: 1/31/20
	DO NOT SCALE DRAWING	
	SHEET 1 OF 1	

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# Recommended PCB Footprint

SYMBOL	REVISION	DATE



- Applicable Displays:**
- 1) NHD-C12864A1Z-FSW-FBW-HTT
  - 2) NHD-C12864A1Z-FSR-FBW-HTT
  - 3) NHD-C12864A1Z-FSB-FBW-HTT

STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)		
	LINEAR: ±0.3mm	REVISION: 1.0
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	DRAWING/PART NUMBER: NHD-C12864A1Z-Monochrome-Footprint	
	DRAWN BY: A. Shah	APPROVED BY: A. Khan
DO NOT SCALE DRAWING	DRAWN DATE: 6/3/19	APPROVED DATE: 6/3/19
	SHEET 1 OF 1	
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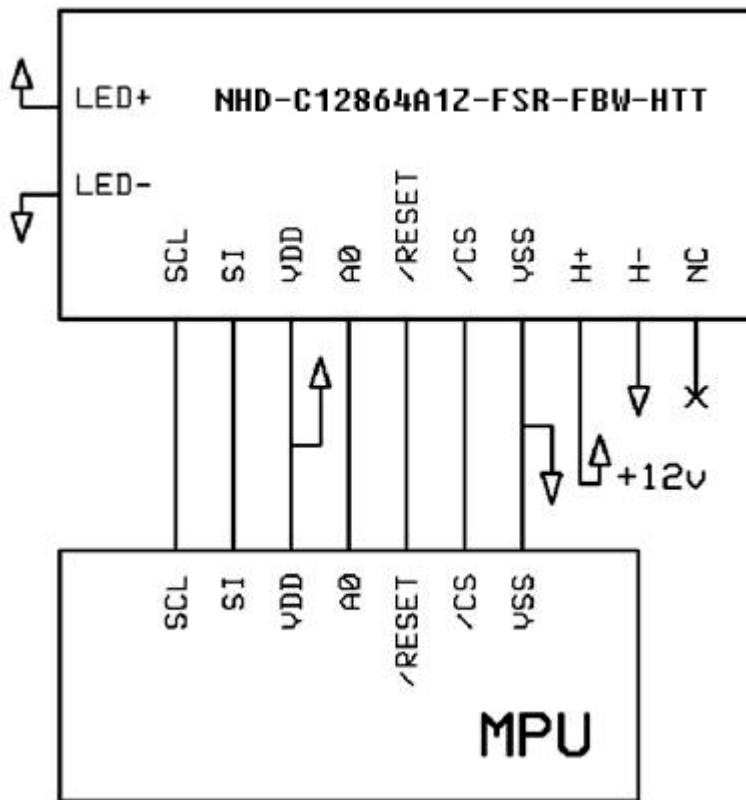
## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	SCL	MPU	Serial Clock Input
2	SI	MPU	Serial Data Input
3	V <sub>DD</sub>	Power Supply	Supply Voltage for LCD and Logic (+3.0V)
4	A0	MPU	Register Select. 0: instruction; 1: data
5	/RESET	MPU	Operation Active LOW Reset signal
6	/CS	MPU	Active LOW Chip Select Signal
7	V <sub>SS</sub>	Power Supply	Ground
8	H-	Power Supply	Ground for Heater
9	H+	Power Supply	Power for Heater (+12V)
10	LED-	Power Supply	Backlight Cathode (Ground)
11	LED+	Power Supply	Backlight Anode (+3.3V)
12	NC	-	No Connect

**Recommended LCD connector:** 2.54mm pitch thru-hole connection on PCB

**Backlight connector:** --- Mates with: ---

**Recommended Breakout Board:** [NHD-PCB40](#)



## Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T <sub>OP</sub>	Absolute Max	-40	-	+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>	T <sub>OP</sub> =25°C	0.1	0.5	1.0	mA
Supply for LCD (contrast)	V <sub>DD-V0</sub>	V <sub>DD</sub> =3.3V	8.5	8.7	8.9	V
"H" Level input	V <sub>IH</sub>	-	0.8 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level input	V <sub>IH</sub>	-	V <sub>SS</sub>	-	0.2 * V <sub>DD</sub>	V
"H" Level output	V <sub>OH</sub>	-	0.8 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level output	V <sub>OL</sub>	-	V <sub>SS</sub>	-	0.2 * V <sub>DD</sub>	V
Backlight Supply Voltage	V <sub>LED</sub>	-	3.2	3.3	3.4	V
Backlight Supply Current	I <sub>LED</sub>	V <sub>LED</sub> = 3.3V	30	60	75	mA
Heater panel resistance	R <sub>H+/-</sub>	-	10	20	30	Ω
Heater Voltage Supply	V <sub>H</sub>	-	-	12	15	V
Heater Current	I <sub>H</sub>	V <sub>H</sub> = 12.0V	0.40	0.6	1.2	A
Heater Power	W <sub>H</sub>	-	4.8	7.2	14.4	W

## 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	8	-	-
Response Time	Rise	T <sub>OP</sub> = 25°C	-	200	250	ms
	Fall		-	250	320	ms

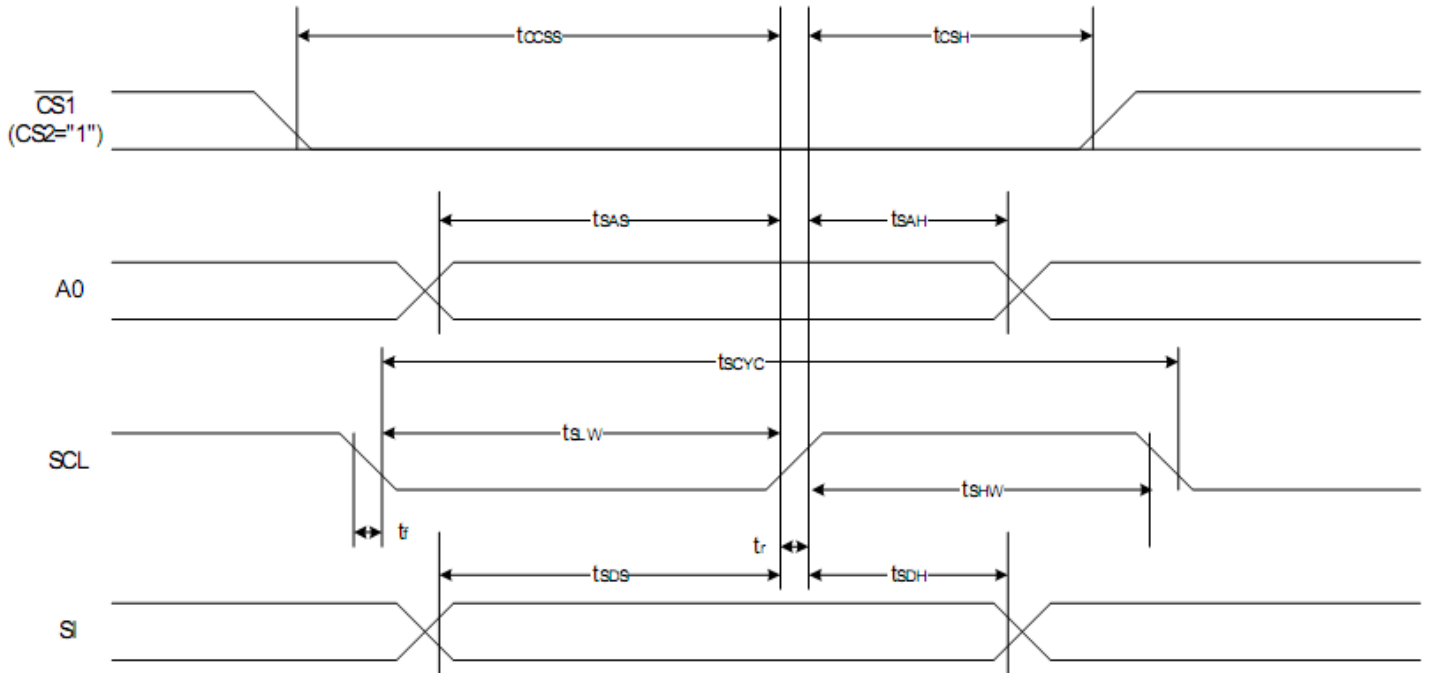
## Controller Information

Built-in ST7565P controller.

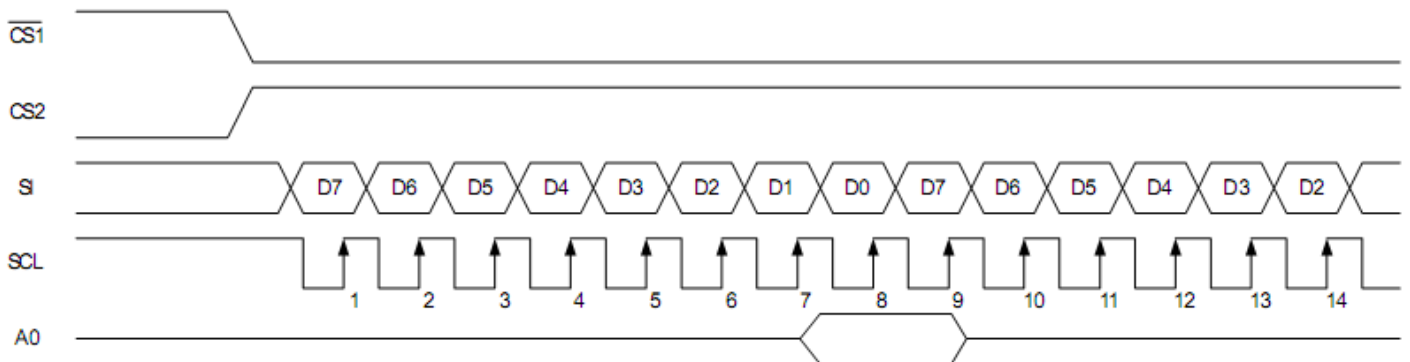
Please download specification at [http://www.newhavendisplay.com/app\\_notes/ST7565.pdf](http://www.newhavendisplay.com/app_notes/ST7565.pdf)

# Timing Characteristics

## The Serial Interface



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	$t_{SCYC}$		400	—	ns
SCL "H" pulse width		$t_{SHW}$		120	—	
SCL "L" pulse width		$t_{SLW}$		120	—	
Address setup time	A0	$t_{SAS}$		50	—	
Address hold time		$t_{SAH}$		50	—	
Data setup time	SI	$t_{SDS}$		50	—	
Data hold time		$t_{SDH}$		50	—	
CS-SCL time	CS	$t_{CSS}$		50	—	
CS-SCL time		$t_{CSH}$		150	—	



## 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	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	1	0	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	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 (ST7565)
(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	1	0	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) Vs 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	0	1	0	1	0	0	0	0	0	0	0	1	Set the Vs output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value							
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0	1	0: OFF, 1: ON
Static indicator register set				0	0	0	0	0	0	0	Mode	Set the flashing mode	
(20) Power saver													Display OFF and display all points ON compound command
(21) NOP	0	1	0	1	1	1	0	0	0	1	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

```
.....  
Sub Command  
Reset P3.7  
Reset P3.4  
For Writecount = 1 To 8  
Rotate A , Left , 1  
Reset P3.1  
P1 = A  
Set P3.1  
Next Writecount  
Set P3.7  
End Sub  
.....
```

```
Sub Write  
Reset P3.7  
Set P3.4  
For Writecount = 1 To 8  
Rotate A , Left , 1  
Reset P3.1  
P1 = A  
Set P3.1  
Next Writecount  
Set P3.7  
End Sub  
.....
```

```
Sub Init  
Waitms 100  
A = &HA0  
Call Command  
A = &HAE  
Call Command  
A = &HC0  
Call Command  
A = &HA2  
Call Command  
A = &H2F  
Call Command  
A = &H26  
Call Command  
A = &H81  
Call Command  
A = &H11  
Call Command  
A = &HAF  
Call Command  
End Sub  
.....
```

## 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.	-0°C, 30min -> 25°C, 5min -> 50°C, 30min = 1 cycle For 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 Ten Times	

**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)