

# NHD-C12864A1Z-FSB-FBW-HTT

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

NHD-	Newhaven Display
C12864-	128 x 64 Pixels
A1Z-	Model
F-	Transflective
SB-	Side Blue LED Backlight
F-	FSTN Positive
B-	6:00 Optimal View
W-	Wide Temp
HTT-	With 12V Heater
	<b>RoHS Compliant</b>

### Newhaven Display International, Inc.

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## Document Revision History

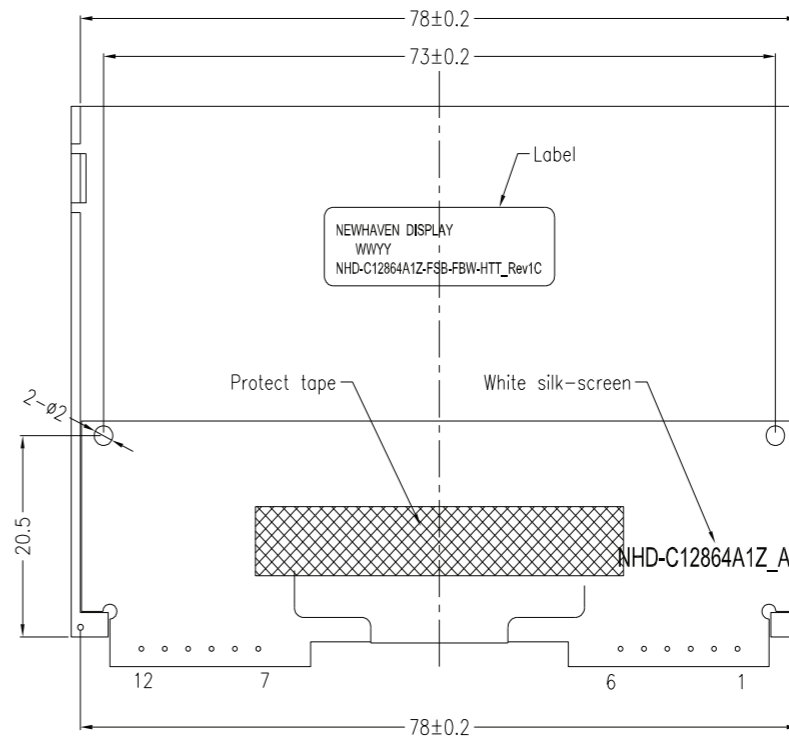
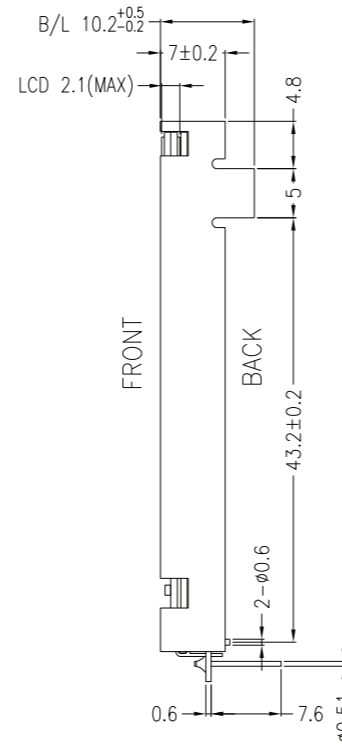
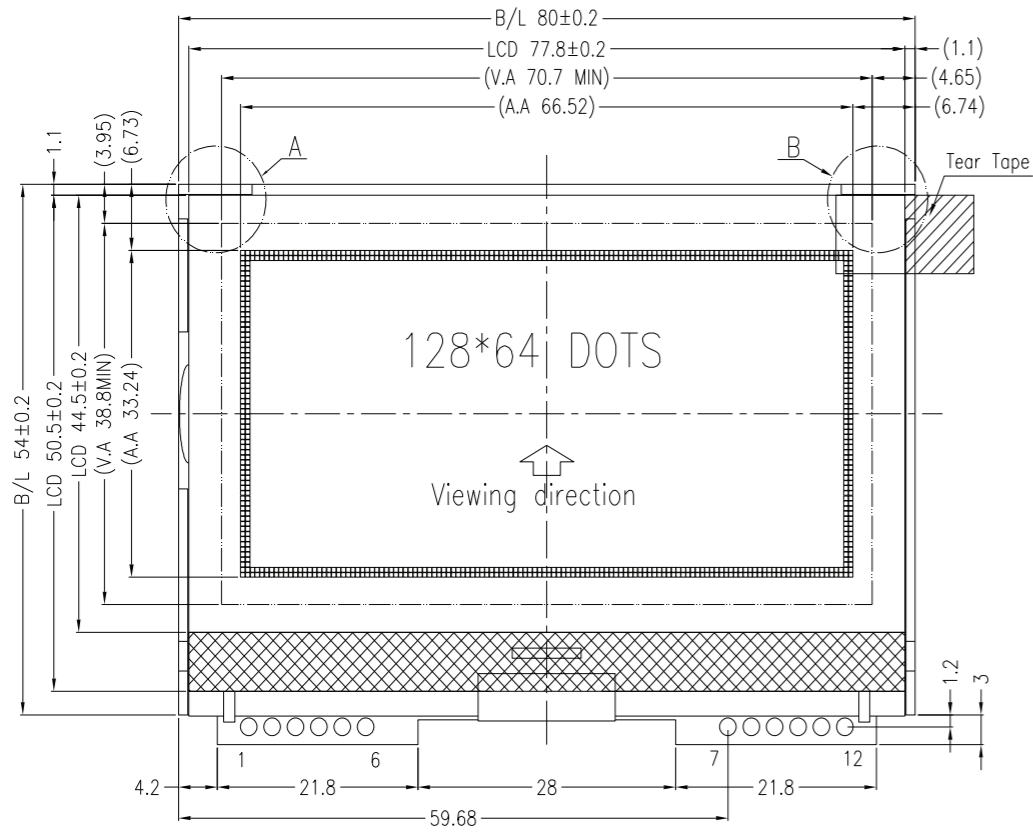
Revision	Date	Description	Changed by
0	10/20/10	Initial Release	-
1	10/26/10	Pin Length Adjusted from 0.5" to 0.3" on Drawing	MC
2	10/27/10	Supply Current and block diagram updated	BE
3	1/20/11	Operating Temp updated	BE
4	8/31/11	Electrical characteristics updated	AK
5	7/30/12	Electrical characteristics updated	AK
6	8/31/15	Electrical characteristics, Mechanical drawing updated	SB
7	8/24/18	Supply Current & Voltage Updated	SB
8	5/13/19	Heater Resistance Updated	SB
9	6/4/19	Added PCB Footprint Drawing	AS
10	1/31/20	Glass Panel Updated	SB
11	7/16/20	Updated Serial Interface Timing Characteristics	AS
12	10/9/20	Updated LCD Contrast Range from 8.5V/8.7V/8.9V to 8.8V/9.0V/9.2V Part Revision Upgraded to Rev1B	AS
13	4/8/21	Updated the Electrical, Optical Characteristics, Table of Commands, Quality Information and Mechanical Drawing	JT

## Functions and Features

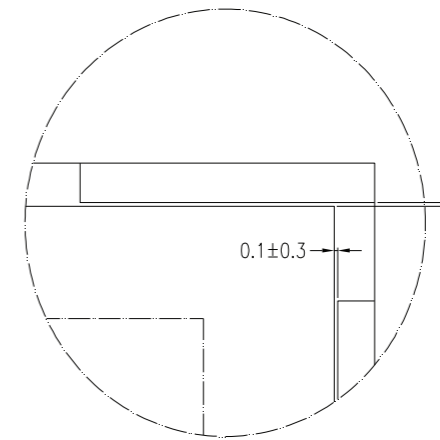
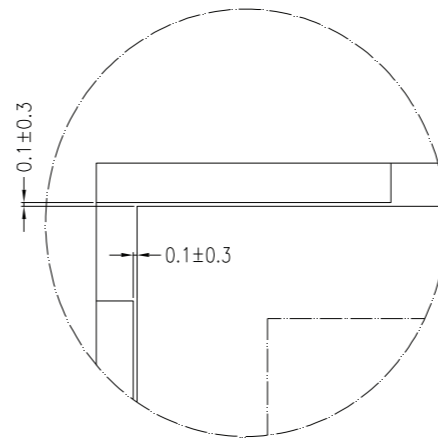
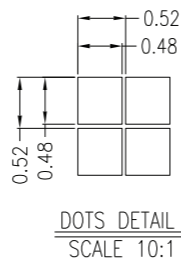
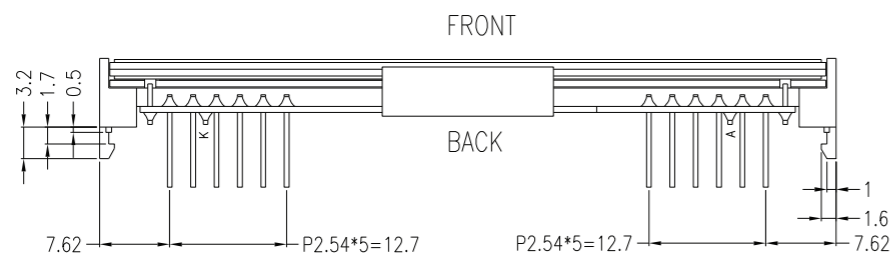
- 128 x 64 pixels
- Built-in ST7565P controller
- +3.0V power supply
- 1/65 duty cycle; 1/9 bias
- Built-in Heater
- RoHS Compliant

# Mechanical Drawing

SYMBOL	REVISION	DATE

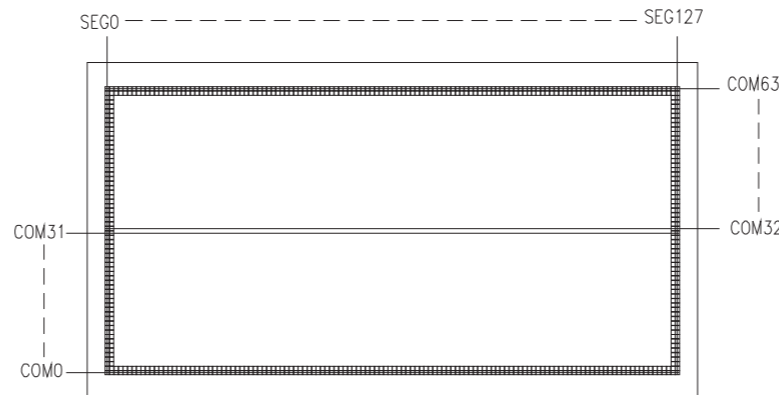


Capacitance(C1~C9): 4.7UF/50V/±10%/SMD/X5R/0805/T=1.25



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

1. Driver: 1/65 Duty, 1/9 Bias
2. Display Mode: FSTN Positive / Transflective
3. Optimal View: 6:00
4. Voltage: 3.0V V<sub>DD</sub>, 9.0V V<sub>LCD</sub>
5. Backlight: Blue LED
6. Driver IC: ST7565P
7. Built-In Heater



STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)

LINEAR: ±0.3mm

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

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**NEWHAVEN DISPLAY INTERNATIONAL**

DRAWING/PART NUMBER: NHD-C12864A1Z-FSB-FBW-HTT

REVISION: 1C

SIZE: A3

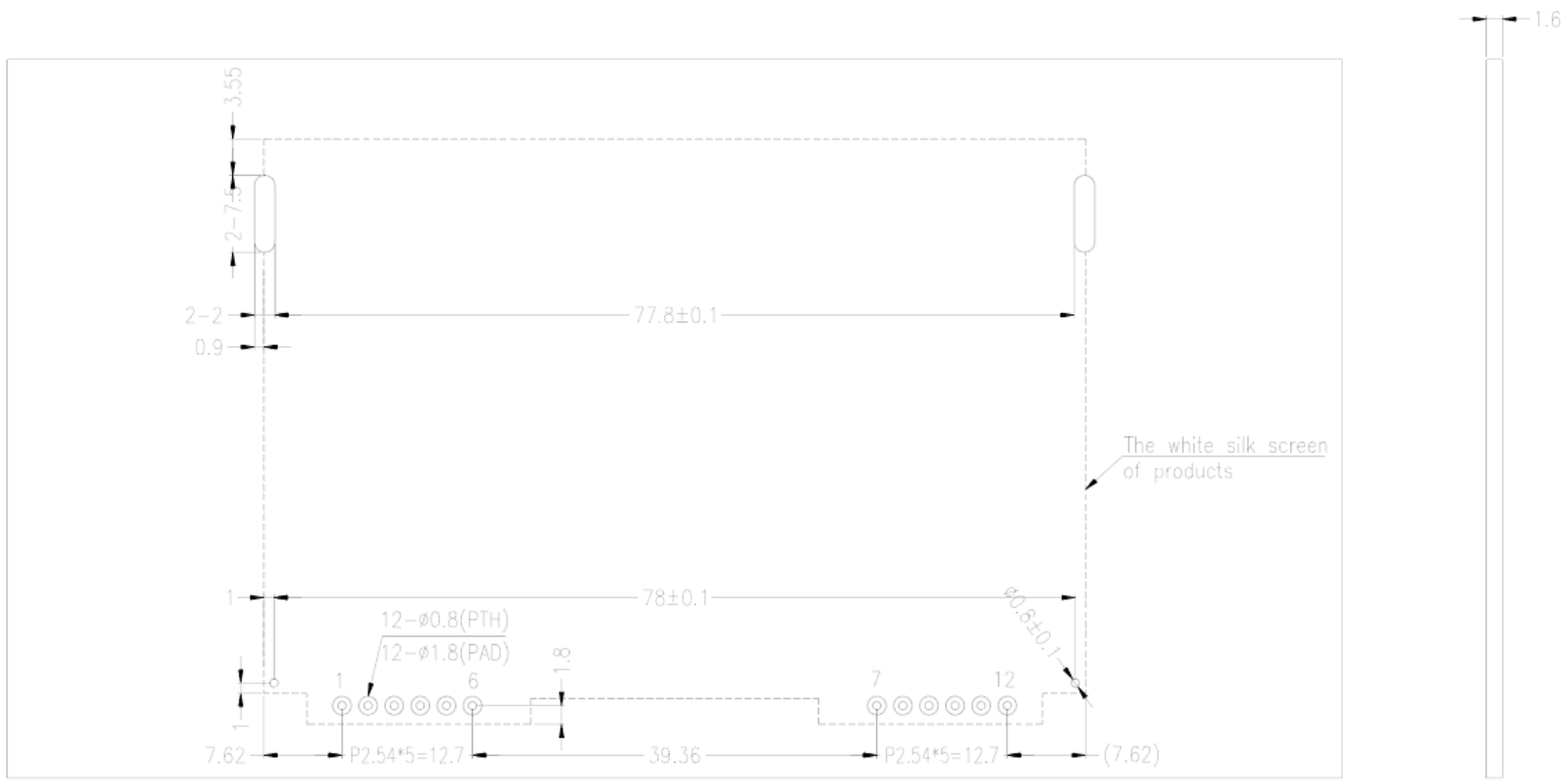
SCALE: NS

SHEET 1 OF 1

DRAWN BY: J.Thomas  
APPROVED BY: J.Thomas  
DRAWN DATE: 4/8/21  
APPROVED DATE: 4/8/21

# 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: $\pm 0.3$ mm		DRAWING/PART NUMBER: <b>NHD-C12864A1Z-Monochrome-Footprint</b>	REVISION: <b>1.0</b>
UNLESS OTHERWISE SPECIFIED:		DRAWN BY: A. Sheh	APPROVED BY: A. Khan
- DIMENSIONS ARE IN MILLIMETERS		DRAWN DATE: 6/3/19	APPROVED DATE: 6/3/19
- THIRD ANGLE PROJECTION		DO NOT SCALE DRAWING	
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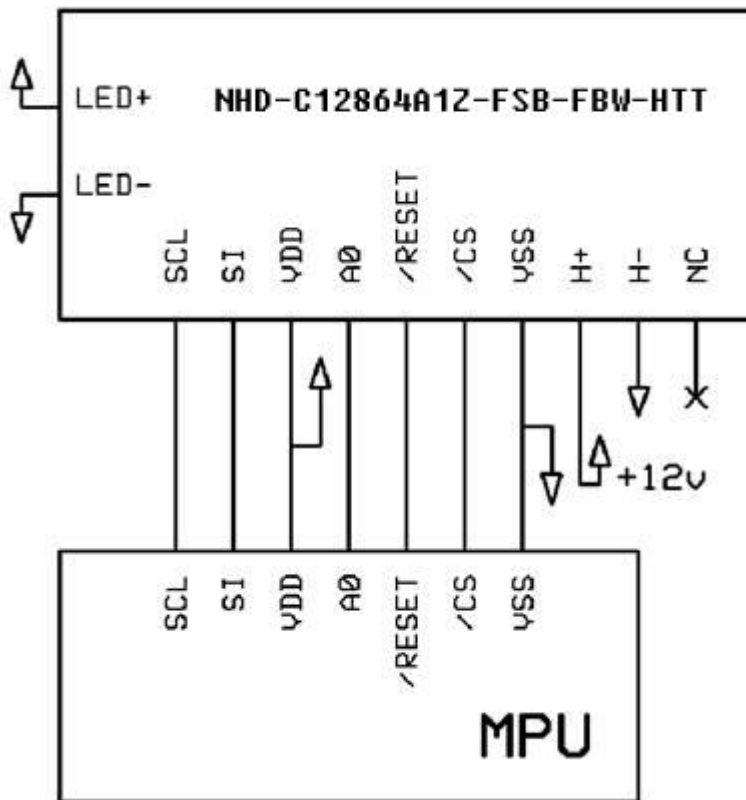
## Pin Description and Wiring Diagram

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>	-	2.8	3.0	3.2	V
Supply Current	I <sub>DD</sub>	T <sub>OP</sub> =25°C	0.1	0.2	1.0	mA
Supply for LCD (contrast)	V <sub>DD</sub> -V <sub>0</sub>	V <sub>DD</sub> =3.0V	8.8	9.0	9.2	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	25	50	60	mA
Heater panel resistance	R <sub>H</sub> +/-	-	5	20	35	Ω
Heater Voltage Supply	V <sub>H</sub>	-	-	12V	15	V
Heater Current	I <sub>H</sub>	V <sub>H</sub> = 12.0V	0.48	0.6	1	A
Heater Power	W <sub>H</sub>	-	5.76	7.2	12	W

<sup>1</sup>Heater **MUST** be activated when operating temperature drops below -20°C

<sup>2</sup>Heater measured using digital multi-meter

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	CR ≥ 3	15	20	25	°
	Bottom		30	40	50	°
	Left		30	40	50	°
	Right		30	40	50	°
Contrast Ratio	CR	-	2	4	10	-
Response Time	Rise	T <sub>OP</sub> = 25°C	-	135	240	ms
	Fall		-	235	325	ms

## Controller Information

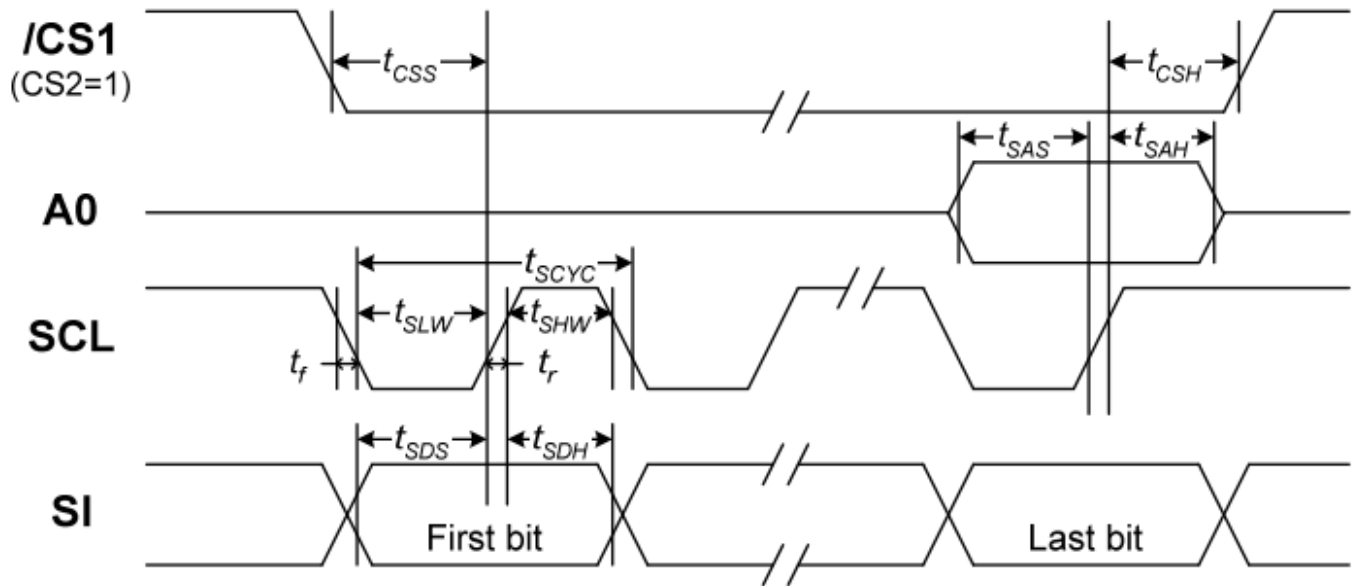
Built-in ST7565P controller.

Please download specification at

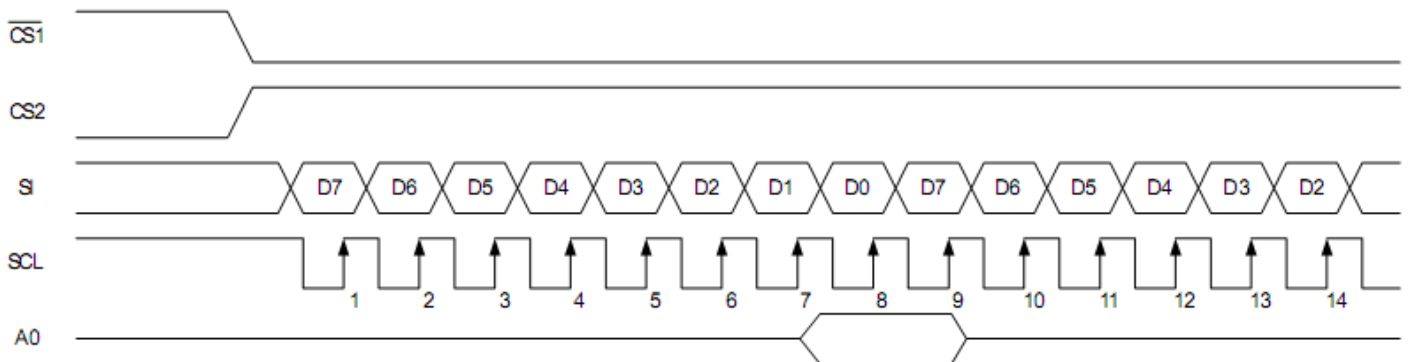
[https://www.newhavendisplay.com/resources\\_dataFiles/datasheets/LCDs/ST7565P.pdf](https://www.newhavendisplay.com/resources_dataFiles/datasheets/LCDs/ST7565P.pdf)

# Timing Characteristics

## The Serial Interface



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial 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	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	1	0	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	0	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 (ST7565P)
(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	*	*	*	*	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	Select internal power supply operating mode
(17) V <sub>0</sub> voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			0	Select internal resistor ratio(R <sub>b</sub> /R <sub>a</sub> ) mode
(18) Electronic volume mode set Electronic volume register set	0	1	0	1	0	0	0	0	0	0	0	1	Set the V <sub>0</sub> output voltage electronic volume register
(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
(21) Power saver													Display OFF and display all points ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	1	1	1	Command for non-operation
(23) 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.	-40°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.	-40°C /-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.	-40°C /-20°C , 60min --> 70°C , 60min = 1 cycle For 20 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-50Hz , Acceleration of Gravity:5G 30 min in each of 3 directions X,Y,Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	Air: ±8kV 150pF/330Ω, 5 Times	
		Contact: ±4kV 150pF/330Ω, 5 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)