

# NHD-C12864A1Z-FS(RGB)-FBW-HT1

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

NHD-	Newhaven Display
C12864-	128 x 64 Pixels
A1Z-	Model
F-	Transflective
SRGB-	Side LED Backlight (Red, Green, Blue)
F-	FSTN (+)
B-	6:00 Optimal View
W-	Wide Temp
HT1-	Pin Length 7.6mm; With Built-In 12V Heater (-40°C to +70°C)
	<b>RoHS Compliant</b>

### Newhaven Display International, Inc.

2661 Galvin Ct.

Elgin IL, 60124

Ph: 847-844-8795

Fax: 847-844-8796

[www.newhavendisplay.com](http://www.newhavendisplay.com)

[nhtech@newhavendisplay.com](mailto:nhtech@newhavendisplay.com)

[nhsales@newhavendisplay.com](mailto:nhsales@newhavendisplay.com)

## Document Revision History

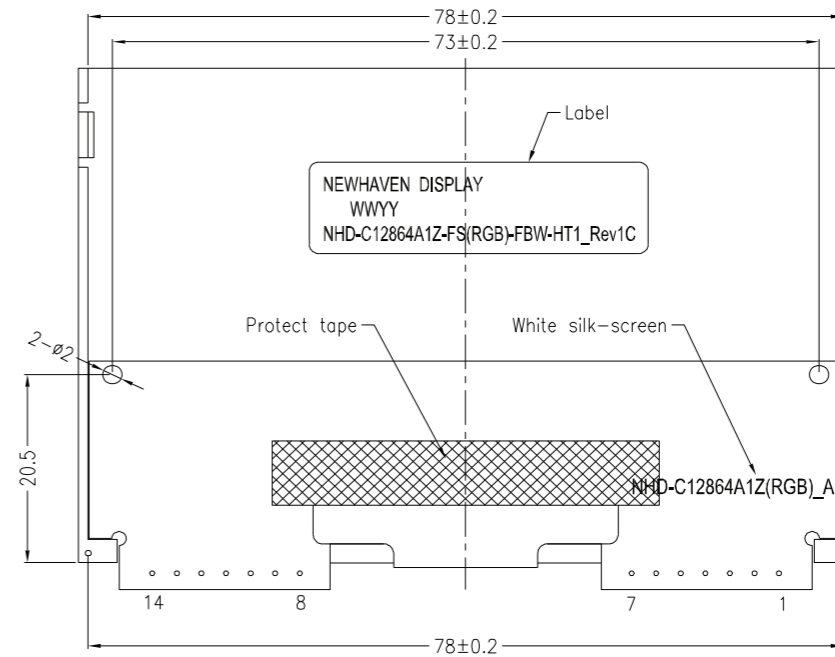
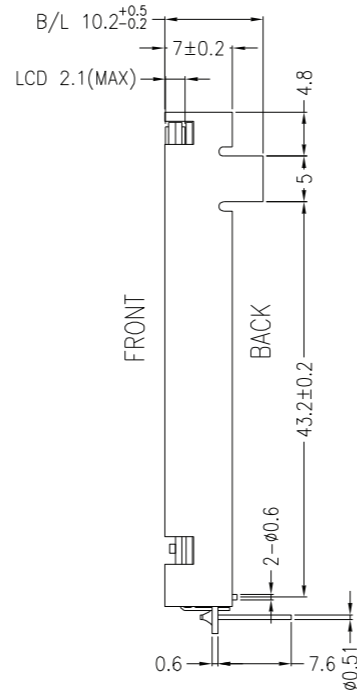
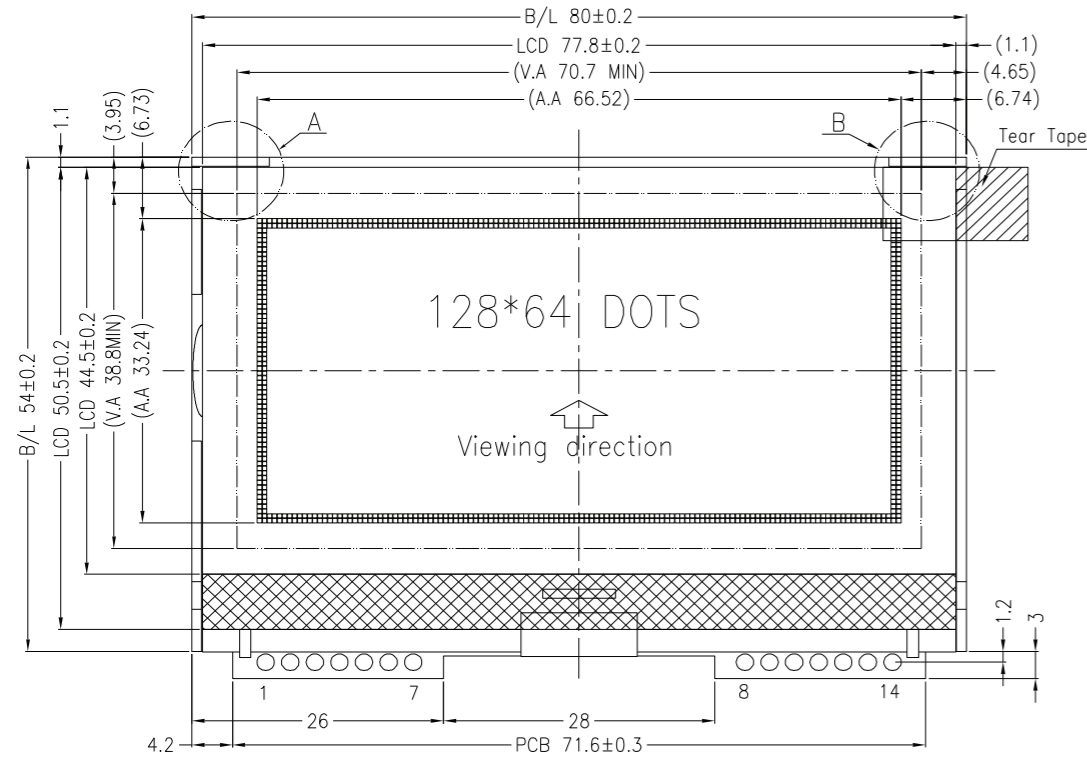
Revision	Date	Description	Changed by
0	9/1/2010	Initial Release	-
1	12/1/2010	User Guide Reformat	BE
2	12/3/2010	Backlight current updated	BE
3	5/24/2011	Mechanical drawing updated	AK
4	7/30/2012	Electrical characteristics updated	AK
5	8/28/15	Electrical characteristics, Mechanical drawing updated	SB
6	3/8/18	Electrical Characteristics Updated	SB
7	6/24/19	Added PCB Footprint Drawing	AS
8	10/9/20	Updated LCD Contrast Range from 8.7V/9.0V/9.3V to 8.8V/9.0V/9.2V & Quality Information Part Revision Upgraded to Rev1B	AS
9	3/26/21	Updated MAX Supply Voltage	AS
10	4/7/21	Updated Electrical & Optical Characteristics, Mechanical drawing, Quality Information, Table of Commands. Part Revision Upgraded to Rev1C	JT
11	4/8/22	Updated Electrical Characteristics	CJ

## Functions and Features

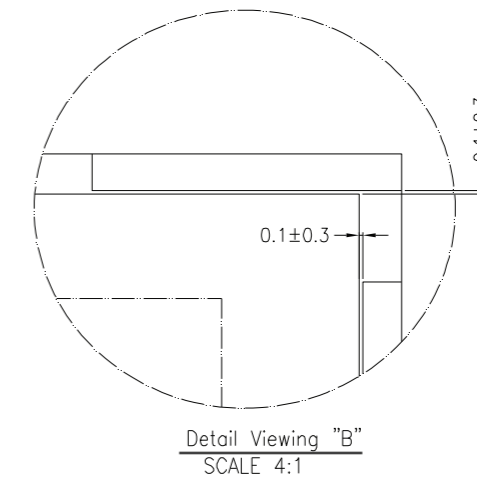
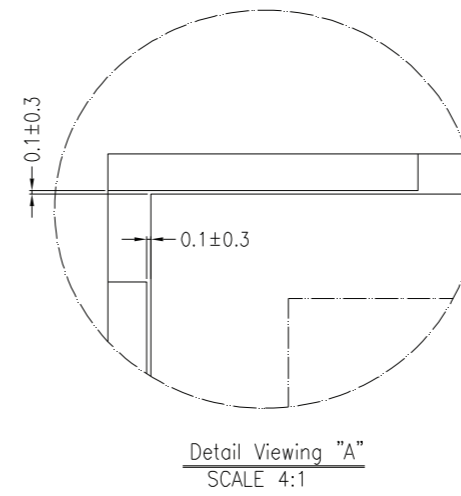
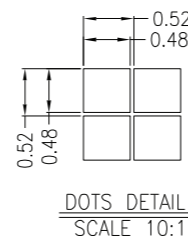
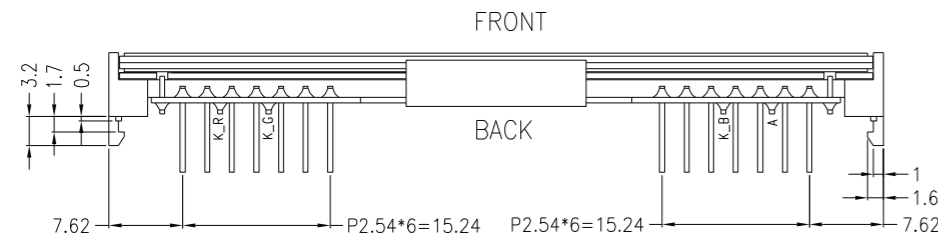
- 128 x 64 pixels
- Built-in ST7565P controller
- +3.0V power supply
- 1/65 duty cycle; 1/9 bias
- Built-in Heater
- RoHS Compliant

# Mechanical Drawing

SYMBOL	REVISION	DATE

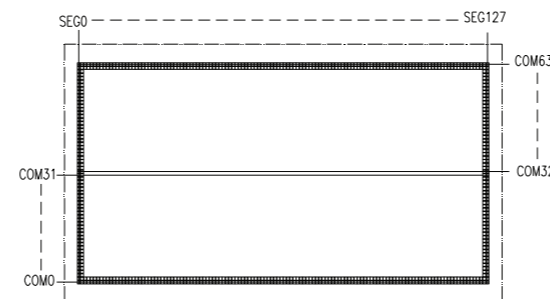
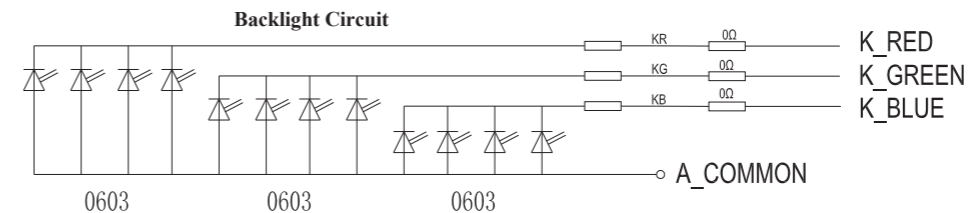


Capacitance(C1~C9): 4.7UF/50V/±10%/SMD/X5R/0805/T=1.25



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

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



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

**NEWHAVEN DISPLAY INTERNATIONAL**  
 DRAWING/PART NUMBER: NHD-C12864A1Z-FS(RGB)-FBW-HT1  
 REVISION: 1C  
 SIZE: A3  
 SCALE: NS

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

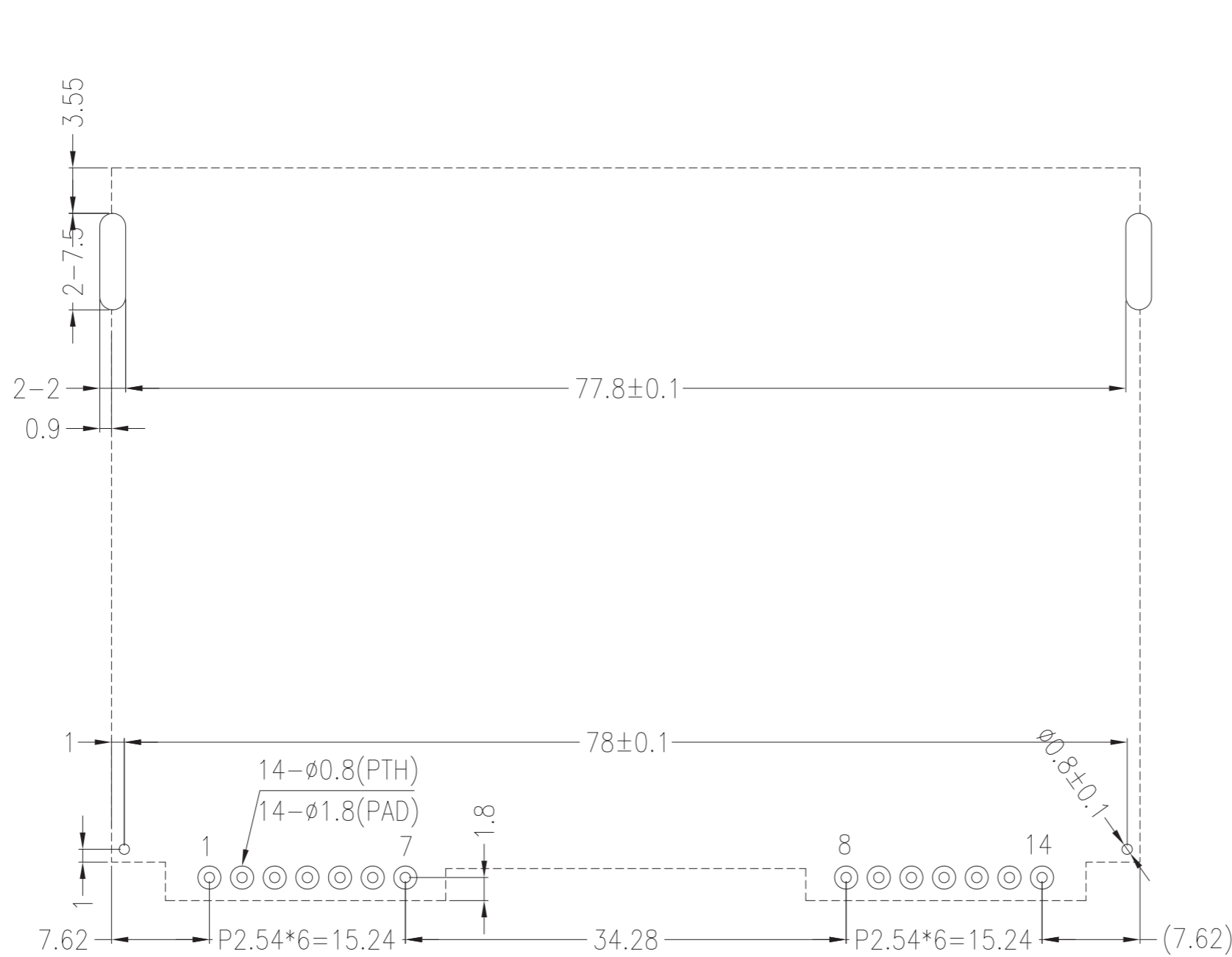
DRAWN BY: J.Thomas  
 APPROVED BY: J.Thomas  
 DRAWN DATE: 4/7/21  
 APPROVED DATE: 4/7/21

DO NOT SCALE DRAWING  
 SHEET 1 OF 1



THIS DRAWING IS SOLELY THE PROPERTY OF NEWHAVEN DISPLAY INTERNATIONAL, INC.  
 THE INFORMATION IT CONTAINS IS NOT TO BE DISCLOSED, REPRODUCED OR COPIED IN WHOLE OR PART WITHOUT WRITTEN APPROVAL FROM NEWHAVEN DISPLAY.

# Recommended PCB Footprint

SYMBOL	REVISION	DATE



Applicable Displays:  
**1) NHD-C12864A1Z-FS(RGB)-FBW-HT1**

STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)		
	LINEAR: $\pm 0.3$ mm	REVISION: 1.0
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION 	DRAWING/PART NUMBER: <b>NHD-C12864A1Z-RGB-Footprint</b>	
	DRAWN BY: A. Shah	APPROVED BY: A. Khan
	DRAWN DATE: 6/3/19	APPROVED DATE: 6/3/19
	DO NOT SCALE DRAWING	
THIS DRAWING IS SOLELY THE PROPERTY OF NEWHAVEN DISPLAY INTERNATIONAL, INC. THE INFORMATION IT CONTAINS IS NOT TO BE DISCLOSED, REPRODUCED OR COPIED IN WHOLE OR PART WITHOUT WRITTEN APPROVAL FROM NEWHAVEN DISPLAY.		SIZE: A3 SCALE: NS SHEET 1 OF 1

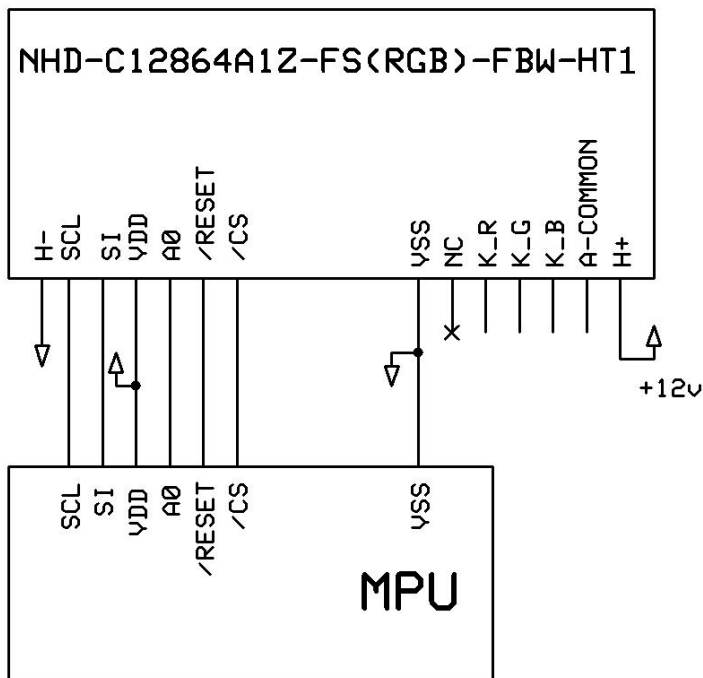
## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	H-	Power Supply	Ground for Heater
2	SCL	MPU	Serial Clock input
3	SI	MPU	Serial Data input
4	V <sub>DD</sub>	Power Supply	Supply voltage for LCD and logic (+3.0V)
5	A0	MPU	Register Select. 0: instruction; 1: data
6	/RESET	MPU	Operation Active LOW Reset signal
7	/CS	MPU	Active LOW Chip Select Signal
8	V <sub>SS</sub>	Power Supply	Ground
9	NC	-	No Connect
10	K-RED	Power Supply	Cathode Red (Ground)
11	K-GREEN	Power Supply	Cathode Green (Ground)
12	K-BLUE	Power Supply	Cathode Blue (Ground)
13	LED +	Power Supply	Common Anode for LEDs (3.3V)
14	H+	Power Supply	Power for Heater (+12V)

**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	3.3	V
Supply Current	I <sub>DD</sub>	V <sub>DD</sub> = 3.0V T <sub>OP</sub> = 25°C	0.1	0.2	1.0	mA
Supply for LCD (contrast)	V <sub>LCD</sub>		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>IL</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 – RED	V <sub>R</sub>	-	3.2	3.3	3.4	V
Backlight Supply Current – RED	I <sub>R</sub>	V <sub>R</sub> = 3.3V	15	30	35	mA
Backlight Supply Voltage – GREEN	V <sub>G</sub>	-	3.2	3.3	3.4	V
Backlight Supply Current – GREEN	I <sub>G</sub>	V <sub>G</sub> = 3.3V	10	25	30	mA
Backlight Supply Voltage – BLUE	V <sub>B</sub>	-	3.2	3.3	3.4	V
Backlight Supply Current – BLUE	I <sub>B</sub>	V <sub>B</sub> = 3.3V	10	25	30	mA
Heater panel resistance	R <sub>H</sub> +/-	T <sub>OP</sub> = 25°C	5	20	35	Ω
Heater Voltage Supply	V <sub>H</sub>	-	-	12	15	V
Heater Current	I <sub>H</sub>	V <sub>H</sub> =12.0V	0.48	0.6	1	A

<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	φY+	CR ≥ 2	15	20	25	°
	Bottom	φY-		30	40	50	°
	Left	θX-		30	40	50	°
	Right	θX+		30	40	50	°
Contrast Ratio		CR	-	2	4	10	-
Response Time	Rise	T <sub>R</sub>	-	-	135	240	ms
	Fall	T <sub>F</sub>		-	235	325	ms

## Controller Information

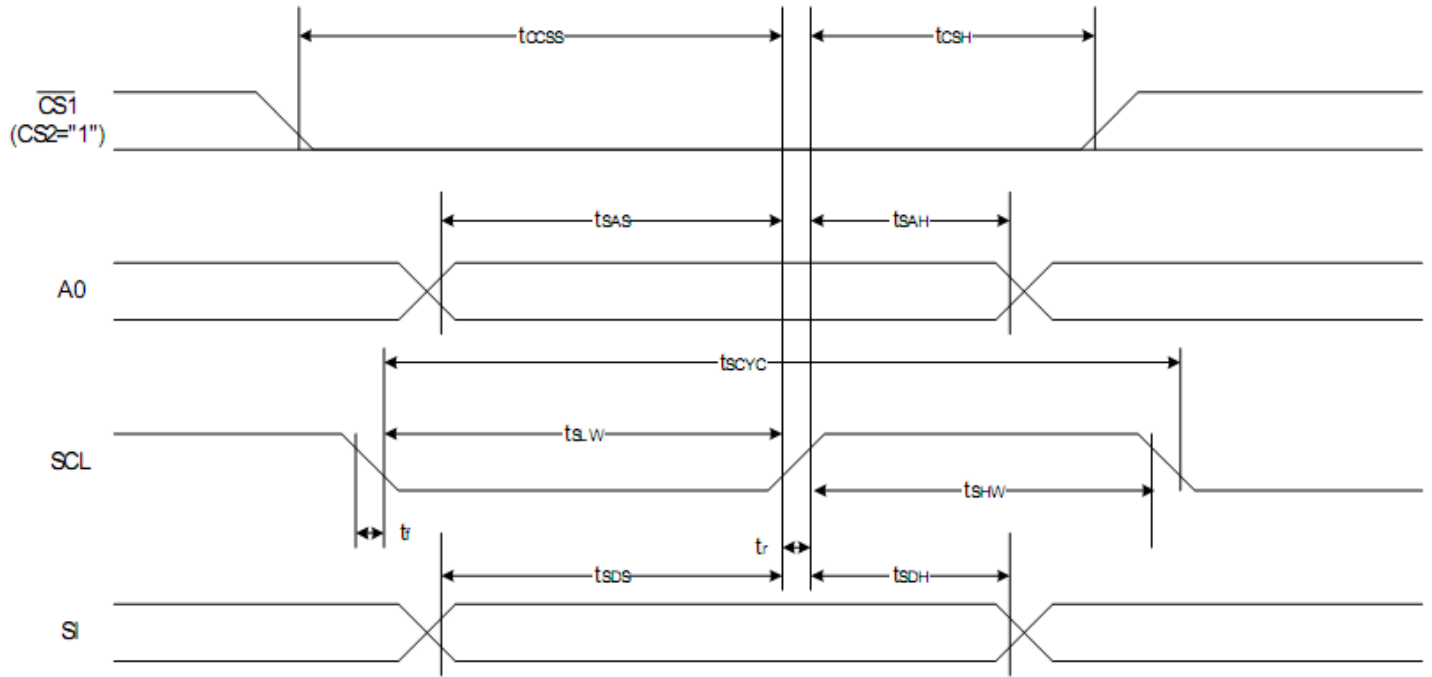
Built-in ST7565P controller.

Please download specification at

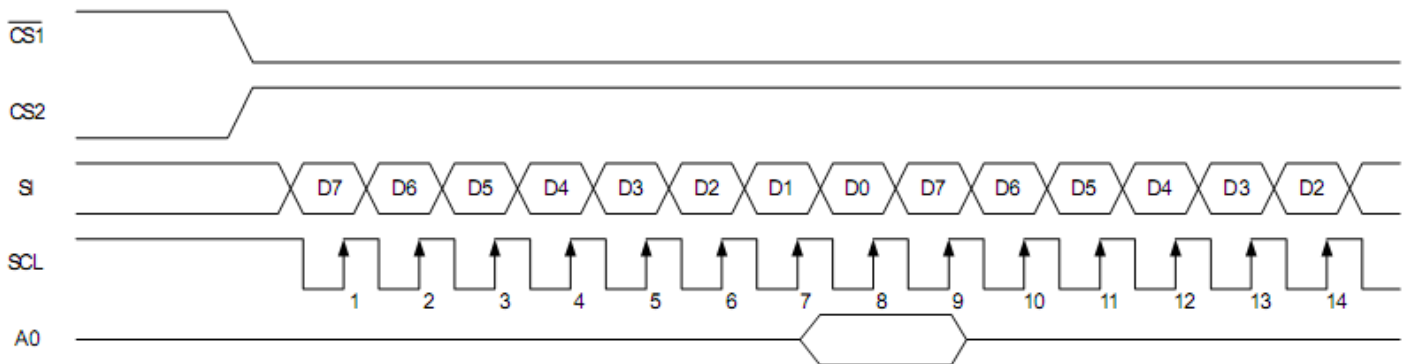
[https://www.newhavendisplay.com/resources\\_dataFiles/datasheets/LCDs/ST7565P.pdf](https://www.newhavendisplay.com/resources_dataFiles/datasheets/LCDs/ST7565P.pdf)

# Timing Characteristics

## The Serial Interface



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	$t_{SCYC}$		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	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			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			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.	-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.	-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.	-20°C, 60min~70°C, 60min, 20 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-50Hz, Acceleration of Gravity:5G 30 min for each directions X,Y,Z.	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)