

NHD-C12864A1Z-FSW-FBW-HTT

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

NHD- Newhaven Display
C12864- 128 x 64 Pixels
A1Z- Model
F- Transflective
SW- Side White 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

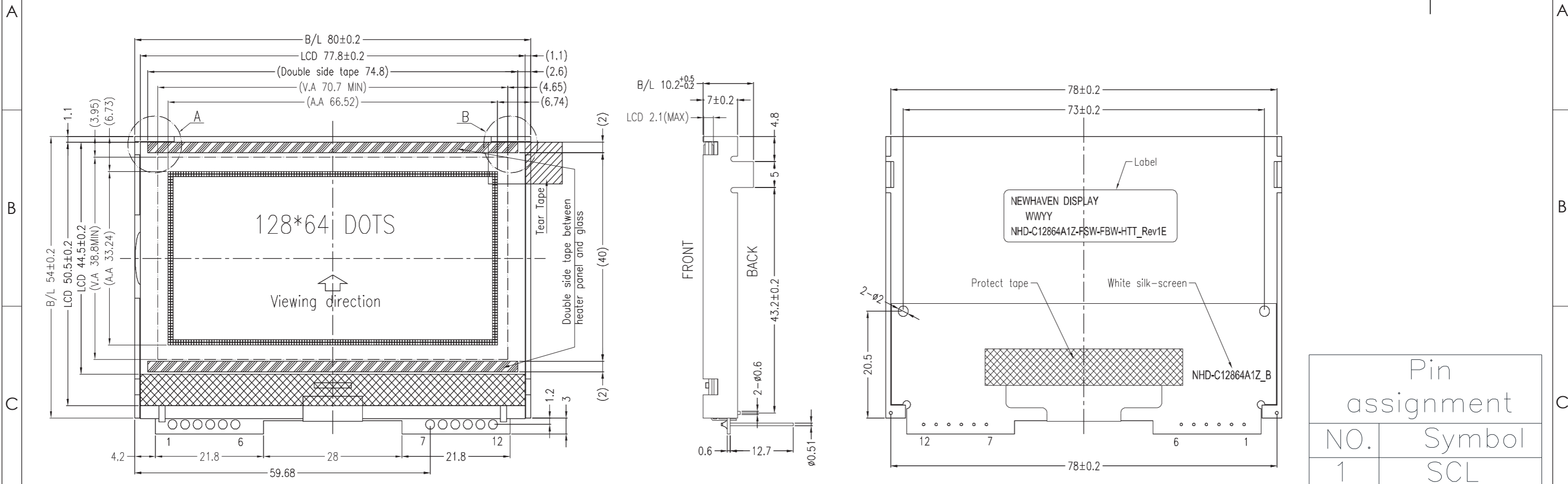
Revision	Date	Description	Changed by
0	7/17/08	Initial Release	-
1	9/28/09	User guide reformat	BE
2	10/14/09	Updated Electrical Characteristic	MC
3	11/20/09	Updated backlight supply current	MC
4	10/26/10	Updated backlight current	BE
5	10/27/10	Supply current updated	BE
6	08/31/15	Electrical characteristics, Optical characteristics, Mechanical drawings updated	SB
7	8/3/2016	Updated Electrical Characteristics and Quality Info	TM
8	9/23/16	Updated Electrical Characteristics	TM
9	3/30/17	Updated Electrical Characteristics	TM
10	12/20/18	Updated Heater Resistance, Response time & Double-Sided Tape added to drawing	SB
11	3/21/19	Heater Resistance Updated	SB
12	5/14/19	Heater Resistance Modified, Backlight Current Updated	SB
13	5/23/19	Heater Note Added	SB
14	6/4/19	Added PCB Footprint Drawing	AS
15	1/24/20	Heater Resistance, Backlight Design & Electrical Characteristics Updated	SB
16	7/16/20	Updated Serial Interface Timing Characteristics	AS
17	10/9/20	Updated LCD Contrast Range from 8.7V/9.0V/9.3V to 8.8V/9.0V/9.2V Part Revision Upgraded to Rev1D	AS
18	3/26/21	Updated MIN Backlight Current & MAX Supply Voltage	AS
19	4/8/21	Updated the Electrical, Optical Characteristics, Table of Commands, Quality Information and Mechanical Drawing	JT

Functions and Features

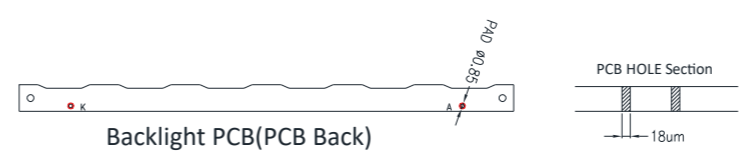
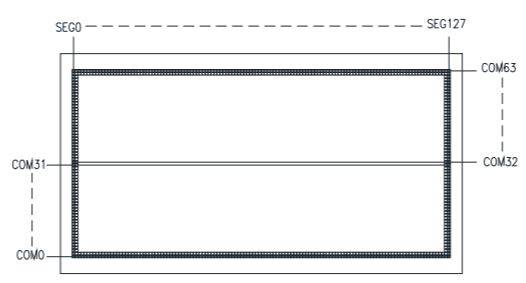
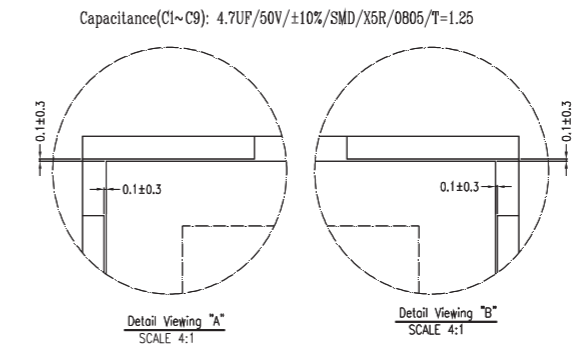
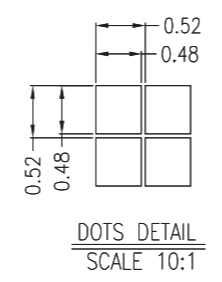
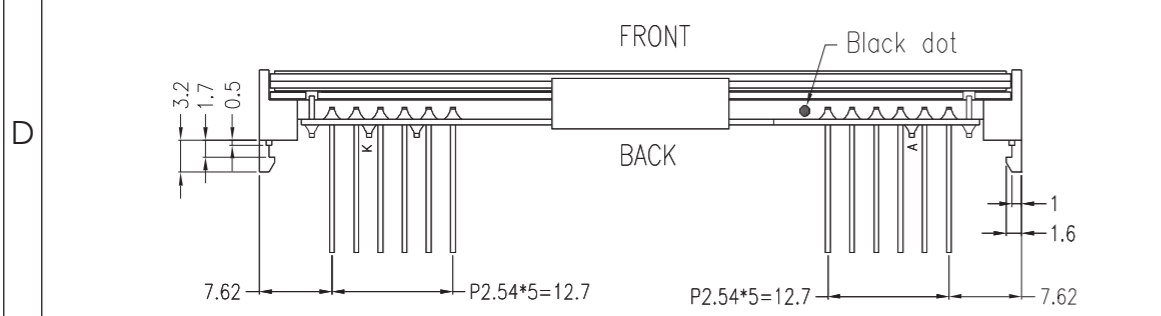
- 128 x 64 pixels
- Built-in ST7565P controller
- +3.0V power supply
- 1/65 duty cycle; 1/9 bias
- Built-in Heater
- RoHS Compliant

Mechanical Drawing

SYMBOL	REVISION	DATE



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: 3.0V V_{DD}, 9V V_{LCD}
 - Display Type: FSTN Positive / Transflective
 - Optimal View: 6:00
 - Backlight: White Edge light LED`
 - Driver IC: ST7565P 2-Line SPI Interface
 - Built-in Heater

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

NEWHAVEN DISPLAY INTERNATIONAL

DRAWING/PART NUMBER: NHD-C12864A1Z-FSW-FBW-HTT
REVISION: 1E
SIZE: A3

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

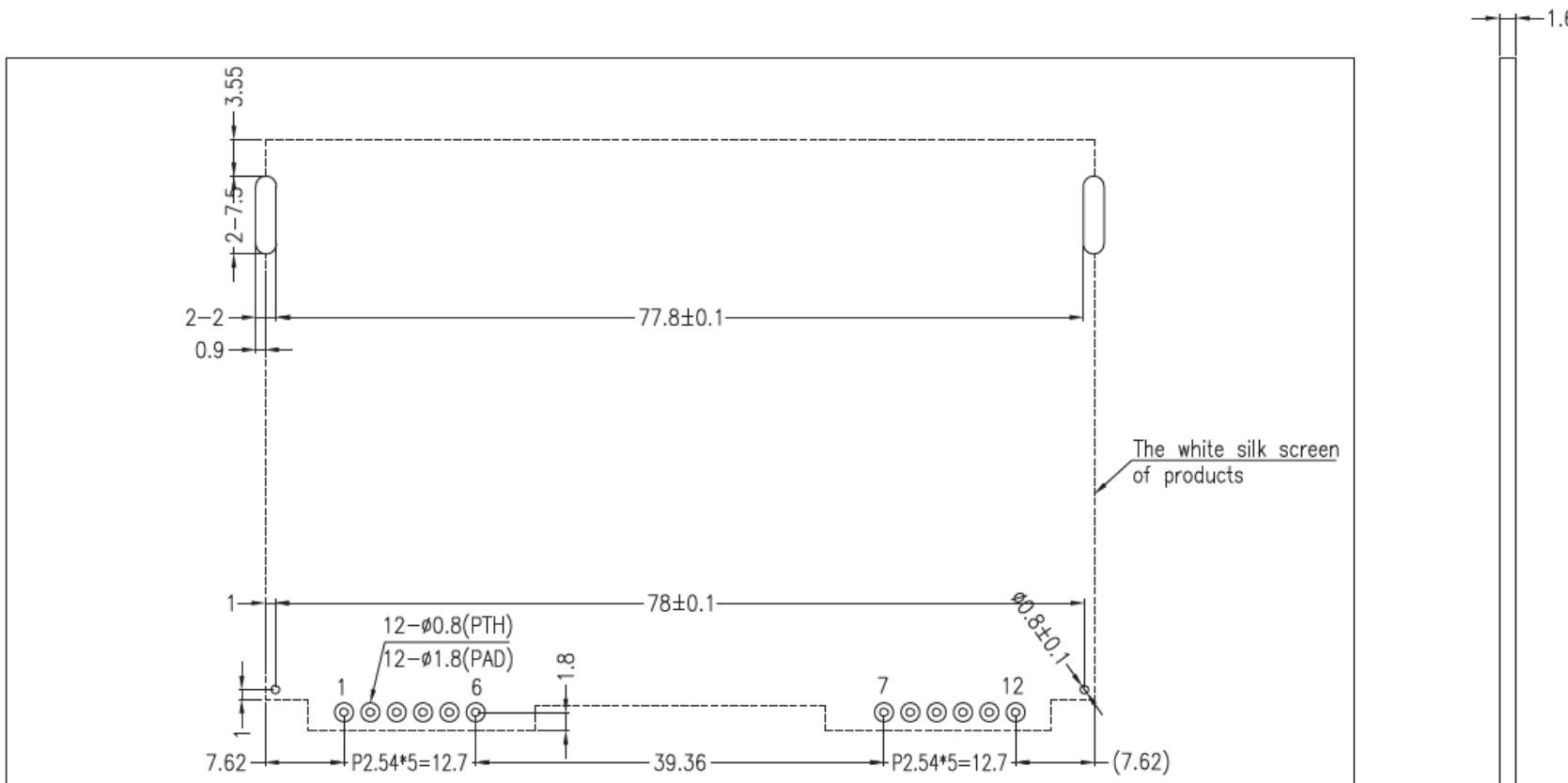
DRAWN BY: J.Thomas
APPROVED BY: J.Thomas
DRAWN DATE: 4/8/21
APPROVED DATE: 4/8/21

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Recommended PCB Footprint

5	6	7	8
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		NEWHAVEN DISPLAY INTERNATIONAL	
LINEAR: ± 0.3 mm		DRAWING/PART NUMBER: NHD-C12864A1Z-Monochrome-Footprint	REVISION: 1.0
UNLESS OTHERWISE SPECIFIED:		DRAWN BY: A. Shah	APPROVED BY: A. Khan
- DIMENSIONS ARE IN MILLIMETERS		DRAWN DATE: 6/3/19	APPROVED DATE: 6/3/19
- THIRD ANGLE PROJECTION:		SCALE: NS	
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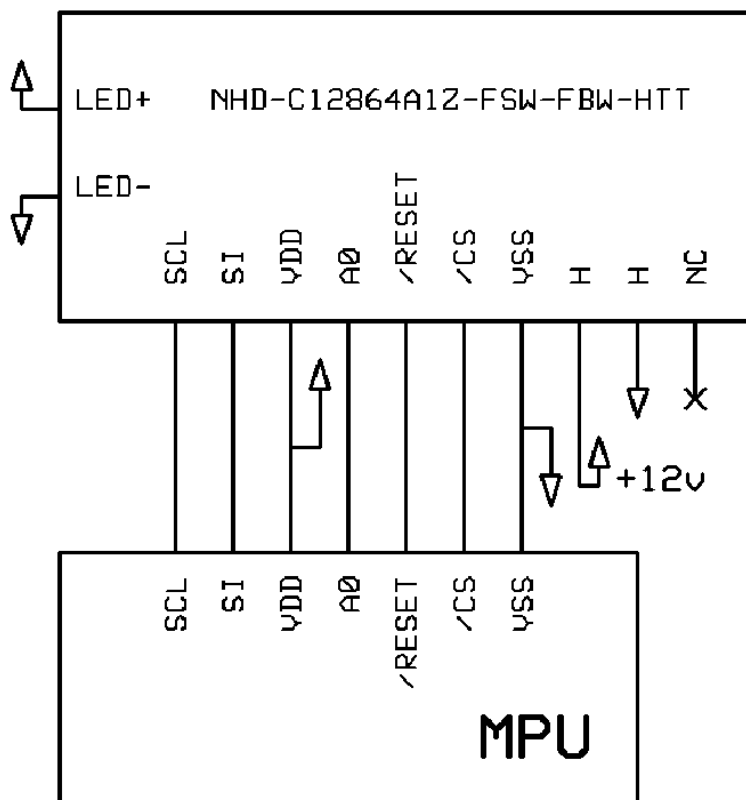
Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	SCL	MPU	Serial Clock input
2	SI	MPU	Serial Data input
3	V _{DD}	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 _{SS}	Power Supply	Ground
8	H	Power Supply	Heater Connection (+12V)
9	H	Power Supply	Heater Connection (GND)
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 ¹	T _{OP}	V _H = 0V	-20	-	+70	°C
		V _H = 12.0V	-40	-	+70	°C
Storage Temperature Range	T _{ST}	-	-40	-	+80	°C
Supply Voltage	V _{DD}	-	2.8	3.0	3.2	V
Supply Current	I _{DD}	V _{DD} = 3.0V T _{OP} = 25°C	0.1	0.2	1.0	mA
Supply for LCD (contrast)	V _{LCD}		8.8	9.0	9.2	V
"H" Level input	V _{IH}	-	0.8*V _{DD}	-	V _{DD}	V
"L" Level input	V _{IL}	-	0	-	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}	-	3.2	3.3	3.4	V
Backlight Supply Current	I _{LED}	V _{LED} = 3.3V	20	50	60	mA
Heater Panel Resistance ²	R _{H+/-}	T = 25°C	5	20	35	Ω
Heater Voltage Supply	V _H	-	-	12	15	V

¹Heater **MUST** be activated when operating temperature drops below -20°C

²Heater measured using digital multi-meter

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 3	-	20	-	°
	Bottom	φY-		-	40	-	°
	Left	θX-		-	40	-	°
	Right	θX+		-	40	-	°
Contrast Ratio		CR	-	2	4	10	-
Response Time	Rise	T _R	T _{OP} = 25°C	-	135	240	ms
	Fall	T _F		-	235	325	ms
	Rise	T _R	T _{OP} = -40°C V _H = 12V	-	7.3	-	s
	Fall	T _F		-	6.7	-	s

Controller Information

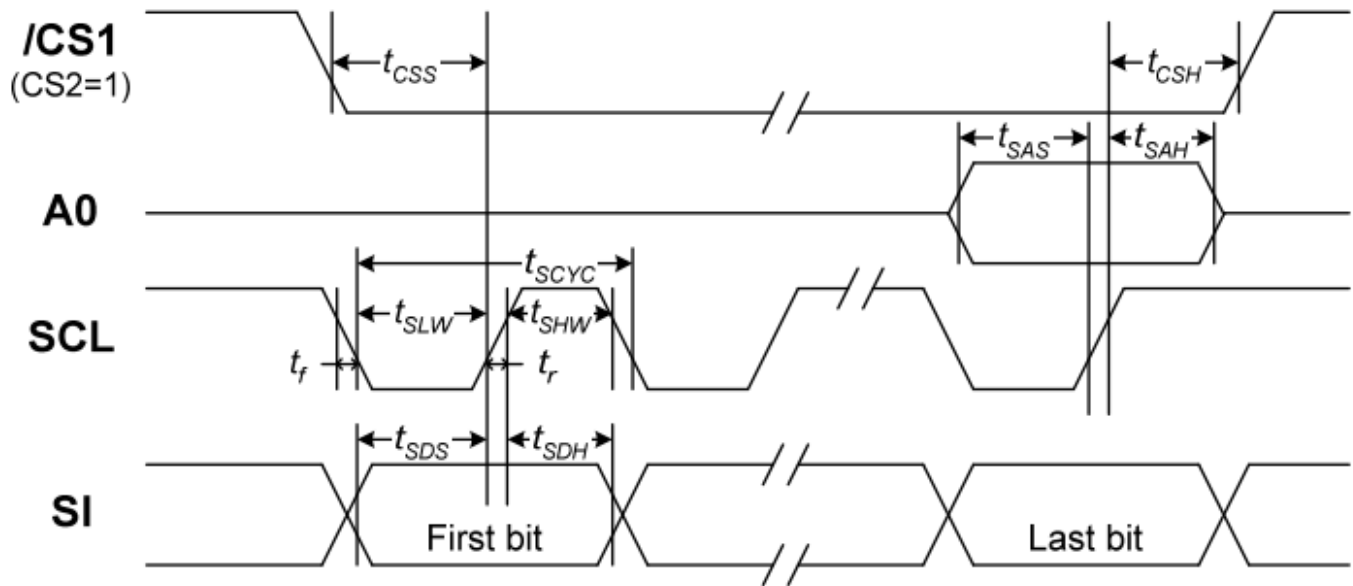
Built-in ST7565P controller.

Please download specification at

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	—	

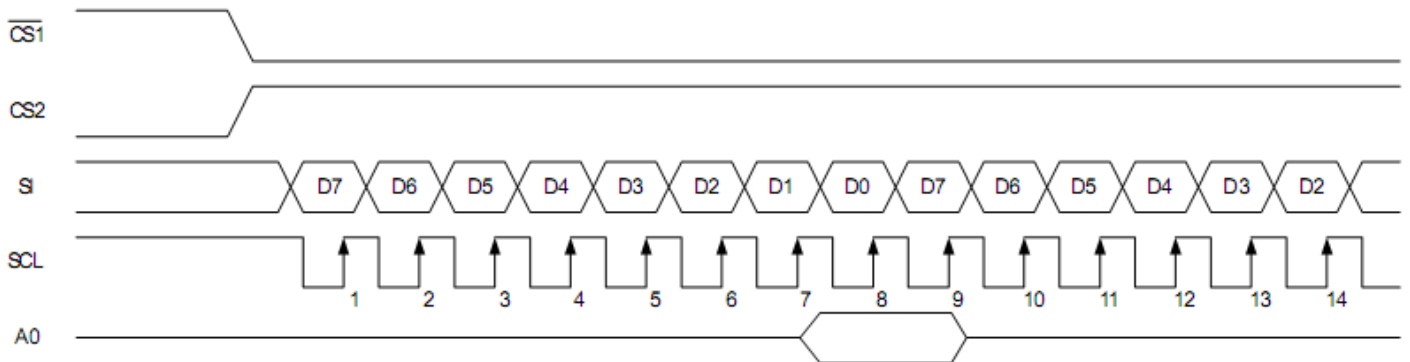


Table of Commands

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					1	Sets the display RAM display start line address	
(3) Page address set	0	1	0	1	0	1	1	Page address				1	Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				1	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				1	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	1	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			1	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			1	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							
(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	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

Warranty Information and Terms & Conditions

http://www.newhavendisplay.com/index.php?main_page=terms