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 Positive
B-	6:00 Optimal View
W-	Wide Temp
HT1-	Pin Length 7.6mm; With Built-In 12V Heater (-40°C to +70°C)
	RoHS Compliant

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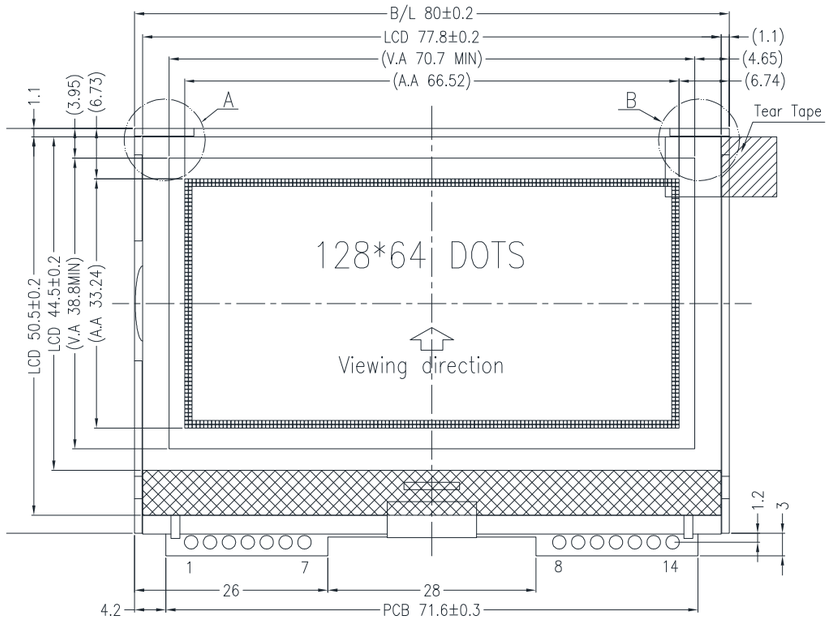
Document Revision History

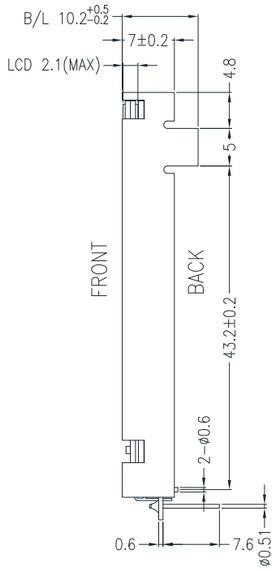
Revision	Date	Description	Changed by
0	9/1/2010	Initial Release	-
1	12/1/2010	User Guide Reformat	BE
2	12/3/2010	Backlight current updated	BE
3	5/24/2011	Mechanical drawing updated	AK
4	7/30/2012	Electrical characteristics updated	AK
5	8/28/15	Electrical characteristics, Mechanical drawing updated	SB
6	3/8/18	Electrical Characteristics Updated	SB
7	6/24/19	Added PCB Footprint Drawing	AS
8	1/30/20	Glass Panel Updated	SB

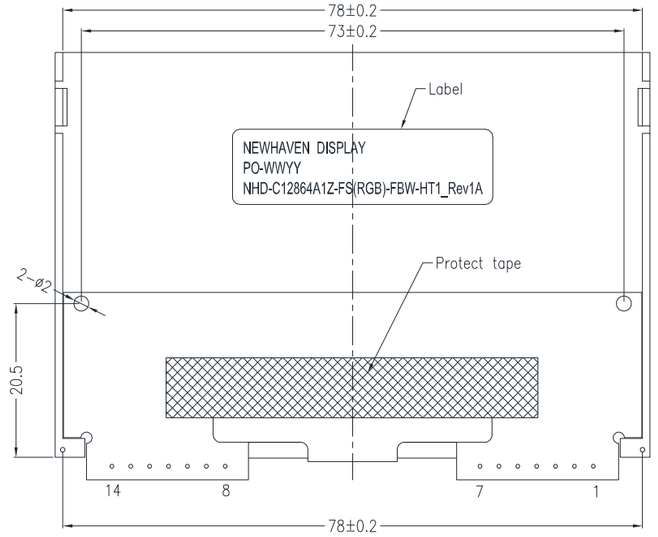
Functions and Features

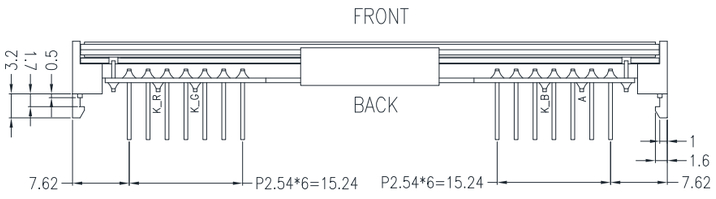
- **128 x 64 pixels**
- **Built-in ST7565P controller**
- **+3.3V power supply**
- **1/65 duty cycle; 1/9 bias**
- **Built-in Heater**
- **RoHS Compliant**

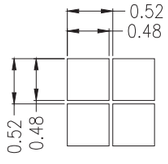
SYMBOL	REVISION	DATE

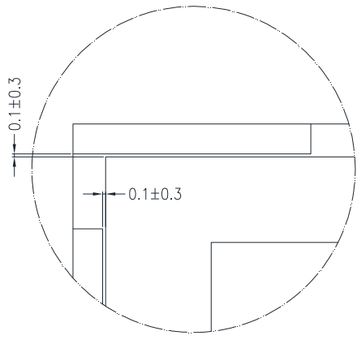




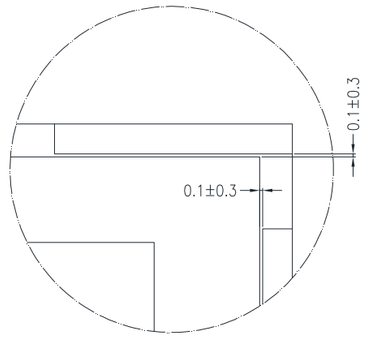




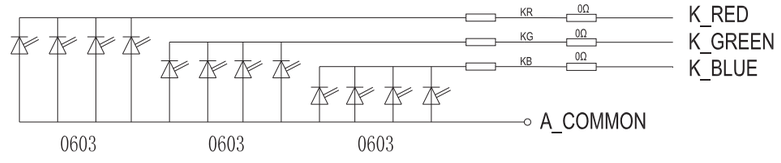




Detail Viewing "A"



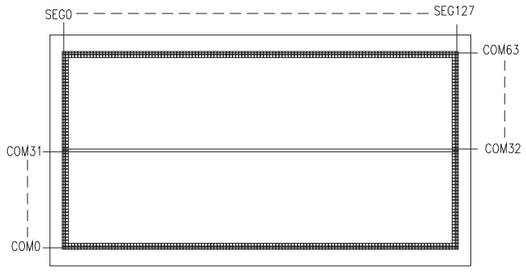
Detail Viewing "B"



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:	3V V_{DD}, 8.7V V_{LCD}
3. Display Mode:	FSTN Positive / Transflective
4. Optimal View:	6:00
5. Backlight:	Red, Green, Blue LED
6. Driver IC:	ST7565R



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

NEWHAVEN DISPLAY INTERNATIONAL

DRAWING/PART NUMBER: NHD-C12864A1Z-FS(RGB)-FBW-HT1
REVISION: 1A
SIZE: A3
SCALE: NS

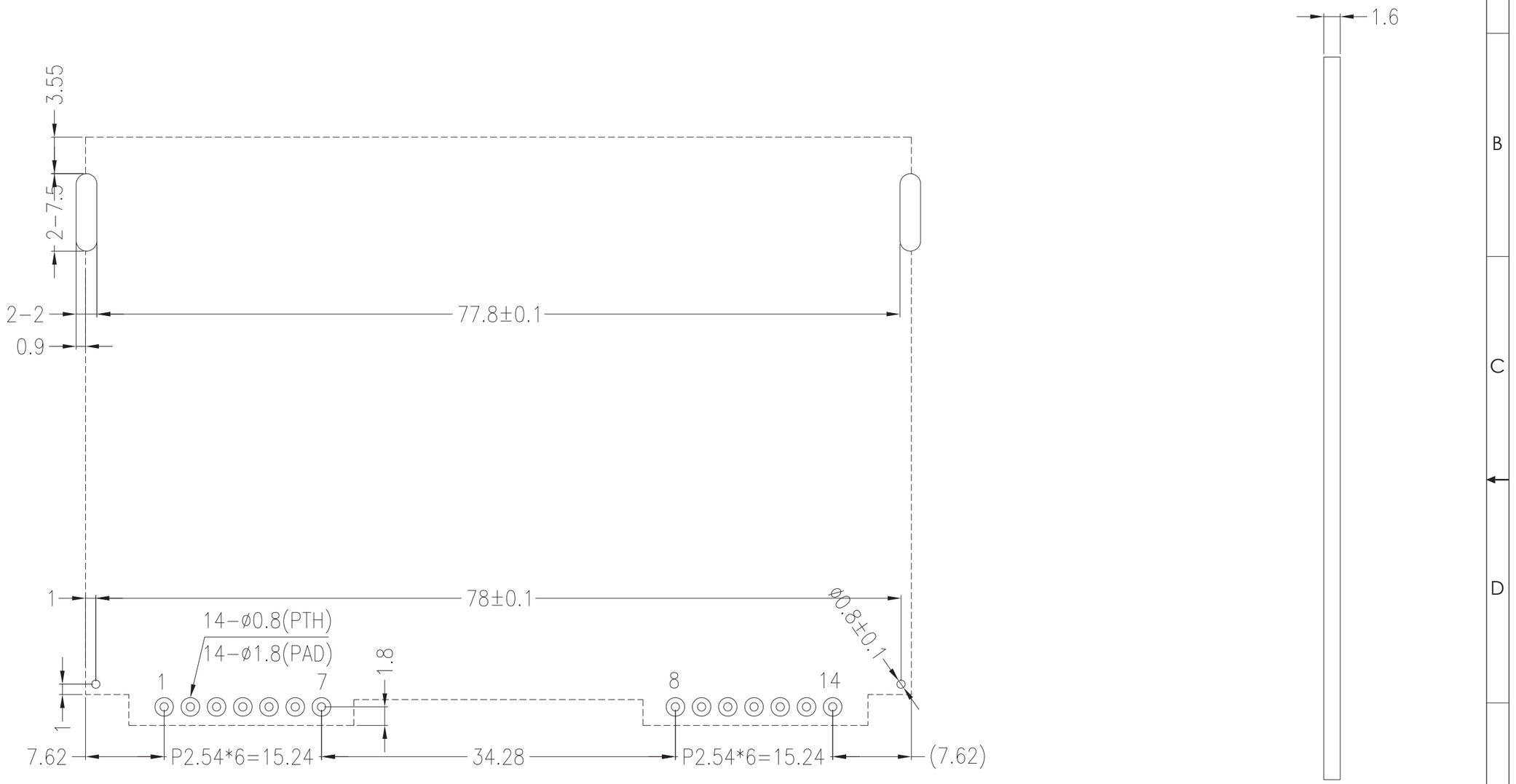
UNLESS OTHERWISE SPECIFIED:
- DIMENSIONS ARE IN MILLIMETERS
- THIRD ANGLE PROJECTION

DRAWN BY: S. Baxi
APPROVED BY: S. Baxi
DRAWN DATE: 01/30/20
APPROVED DATE: 01/30/20

DO NOT SCALE DRAWING
SHEET 1 OF 1

SYMBOL	REVISION	DATE

Recommended PCB Footprint



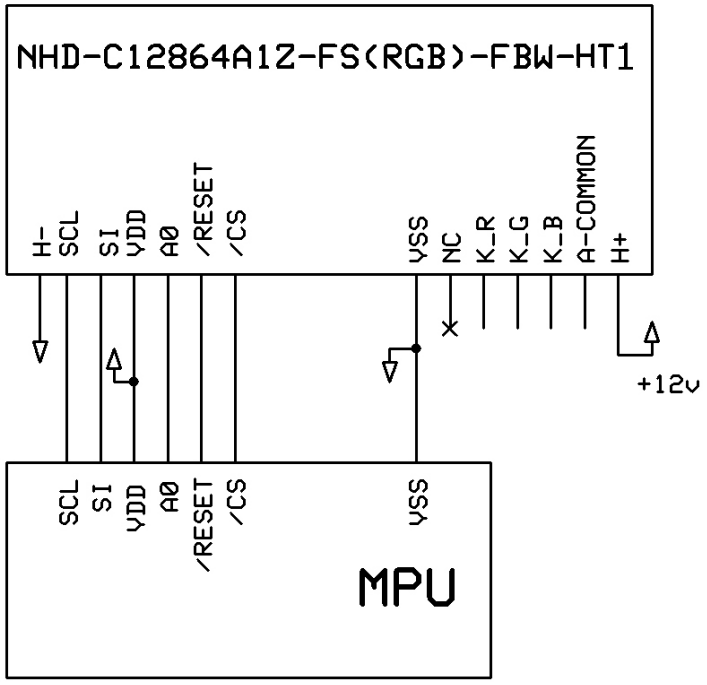
Applicable Displays:
1) NHD-C12864A1Z-FS(RGB)-FBW-HT1

STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED) LINEAR: ±0.3mm	NEWHAVEN DISPLAY INTERNATIONAL		
	DRAWING/PART NUMBER: NHD-C12864A1Z-RGB-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: 6/3/19	APPROVED DATE: 6/3/19	SCALE: NS
	DO NOT SCALE DRAWING		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_{DD}	Power Supply	Supply voltage for LCD and logic (+3.3V)
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_{SS}	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_{OP}	Absolute Max	-40	-	+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} = 5.0V	0.1	0.5	1.0	mA
Supply for LCD (contrast)	V_{LCD}	T_{OP} = 25°C	8.5	8.7	8.9	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 – RED	V_R	-	3.2	3.3	3.4	V
Backlight Supply Current – RED	I_R	V_R = 3.3V	15	30	35	mA
Backlight Supply Voltage – GREEN	V_G	-	3.2	3.3	3.4	V
Backlight Supply Current – GREEN	I_G	V_G = 3.3V	10	25	30	mA
Backlight Supply Voltage – BLUE	V_B	-	3.2	3.3	3.4	V
Backlight Supply Current – BLUE	I_B	V_B = 3.3V	10	25	30	mA
Heater panel resistance	RH+/-	T_{OP} = 25°C	12	20	30	Ω
Heater Voltage Supply	VH	-	-	12V	15	V
Heater Current	IH	VH=12.0V	0.48	0.6	1	A

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 2	-	40	-	°
	Bottom	φY-		-	60	-	°
	Left	θX-		-	60	-	°
	Right	θX+		-	60	-	°
Contrast Ratio		CR	-	2	5	-	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	200	250	ms
	Fall	T_F		-	250	350	ms

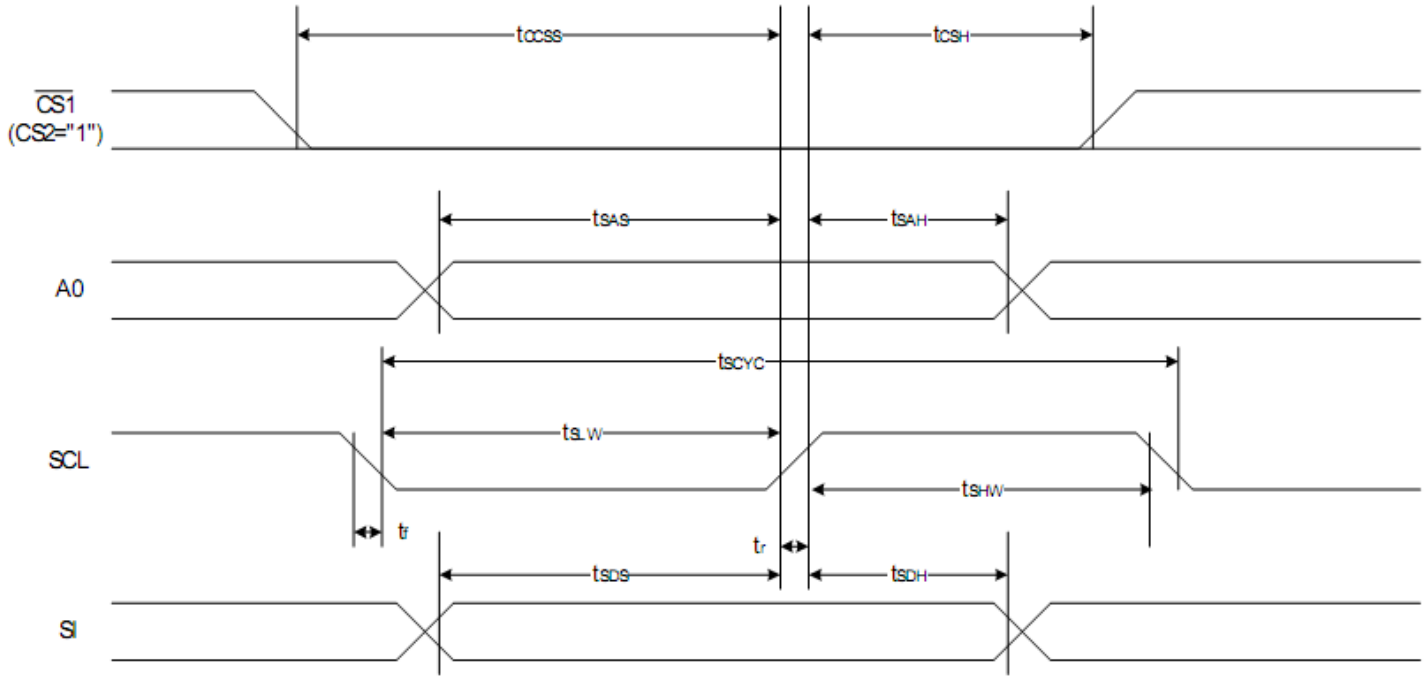
Controller Information

Built-in ST7565P controller.

Please download specification at 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	—	

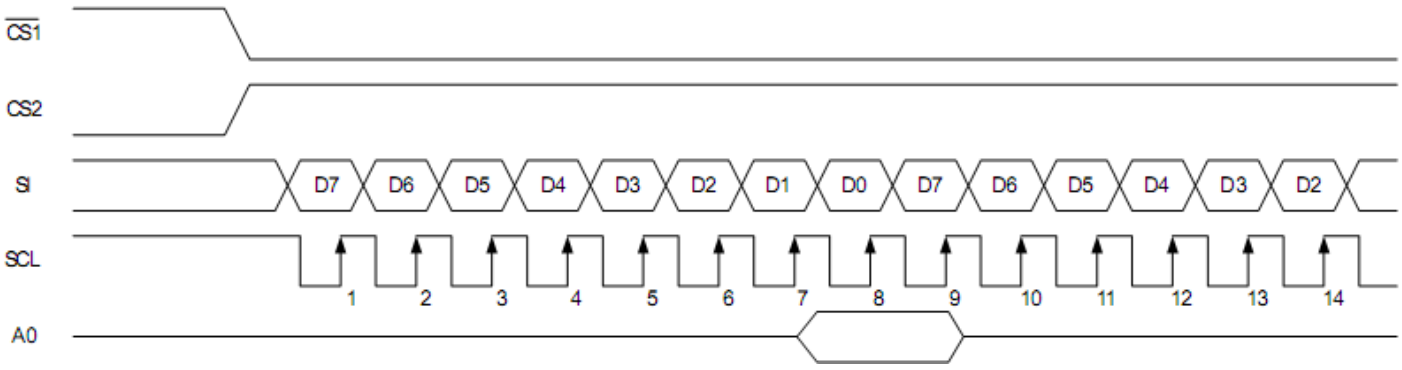


Table of Commands

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 Column address set lower bit	0 0	1 1	0 0	0 0	0 0	0 0	1 0	Most significant column address Least 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.
(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 (ST7565)
(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_5 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 Electronic volume value	0	0	0	0	1	Set the V_5 output voltage electronic volume register
(19) Static indicator ON/OFF Static indicator register set	0	1	0	1 0	0 0	1 0	0 0	1 0	1 0	0 Mode	0 1	0: OFF, 1: ON 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	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 , 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 , 15mm 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