

NHD-C12864M1R-FSW-FTW-3V6

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

NHD-	Newhaven Display
C12864-	128 x 64 pixels
M1R-	Model
F-	Transflective
SW-	Side White LED Backlight
F-	FSTN (+)
T-	12:00 Optimal View
W-	Wide Temperature
3V6-	3.3V LCD, 6.0V Backlight
	RoHS Compliant

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Document Revision History

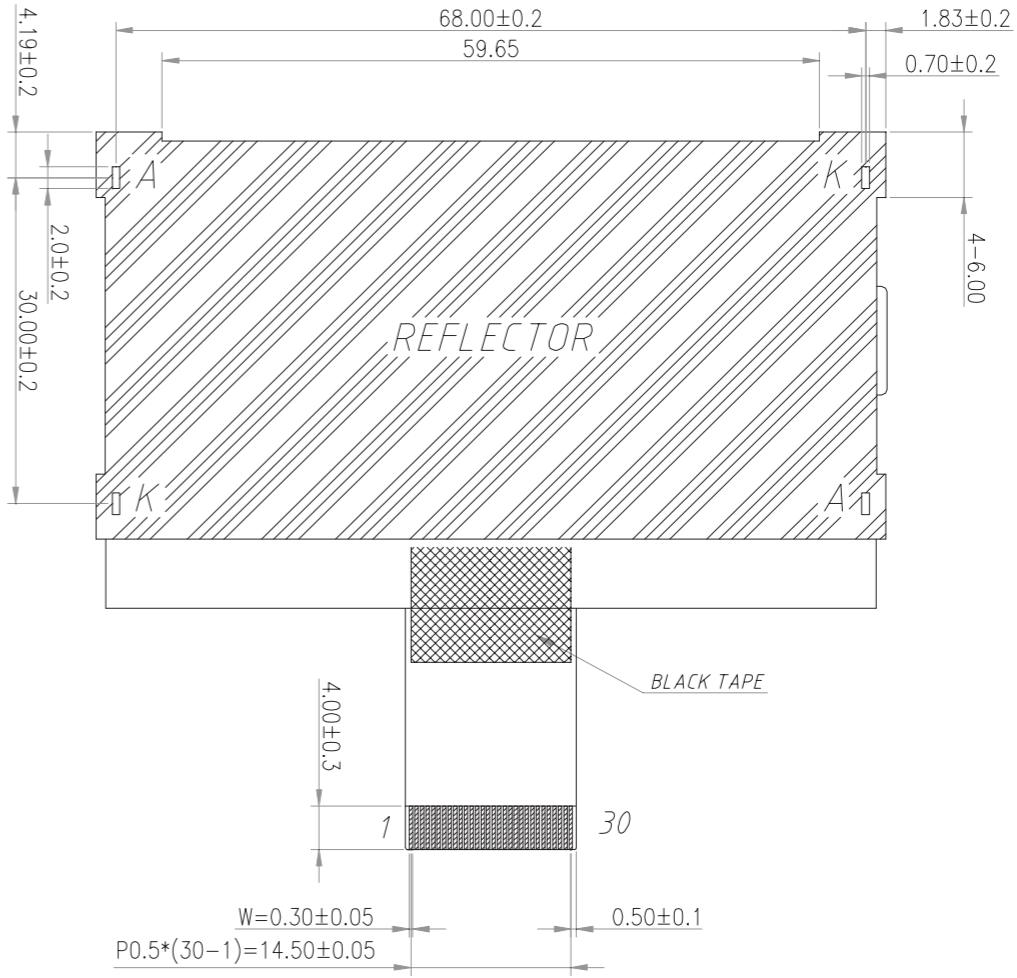
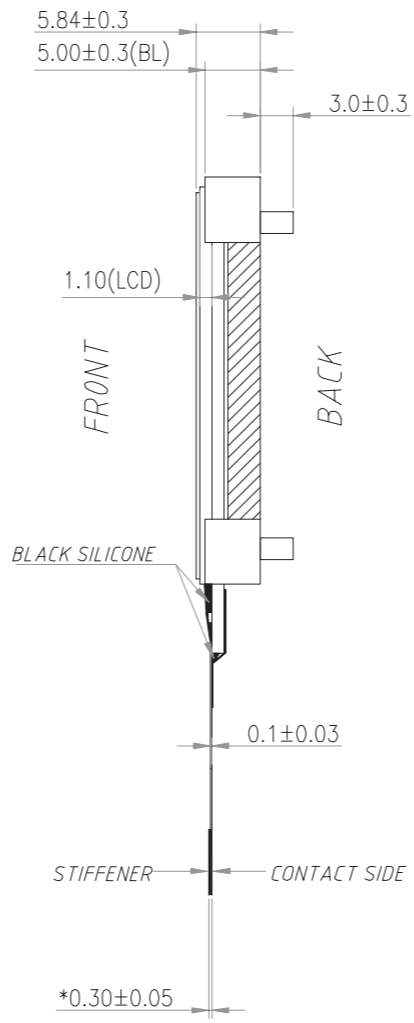
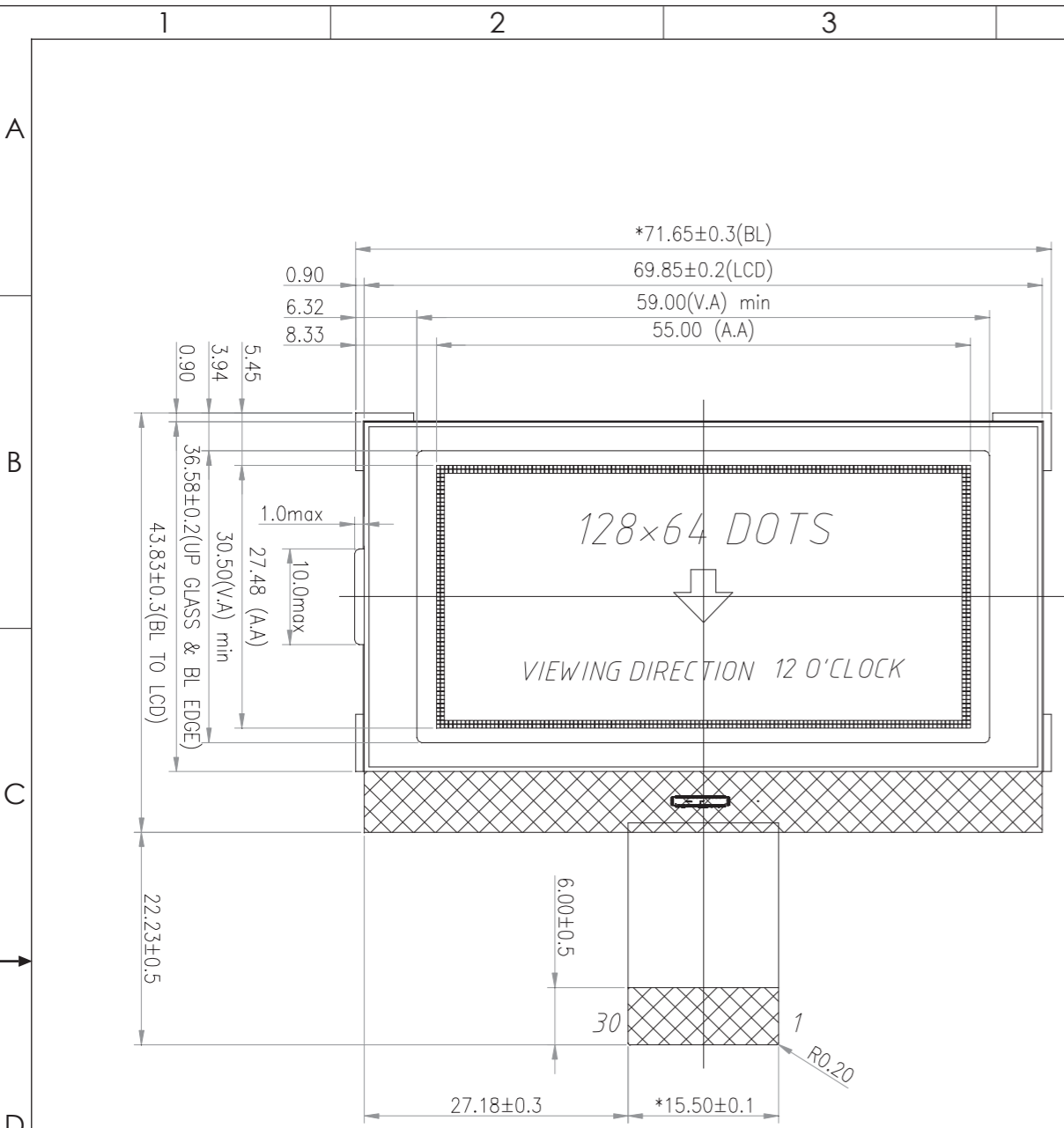
Revision	Date	Description	Changed by
0	5/6/2009	Initial Release	-
1	10/13/2009	User guide reformat	MC
2	11/20/2009	Updated backlight supply current	MC
3	6/22/2010	Updated drawing to include Backlight Adhesive	CL
4	2/3/2011	Updated drawing with pin numbers	AK
5	2/13/2011	Change controller to ST7565R	CL
6	3/28/2011	Controller information updated	AK
7	1/20/2014	Mechanical drawing, Electrical characteristics updated	AK
8	10/9/18	Backlight Drive Method Updated	SB

Functions and Features

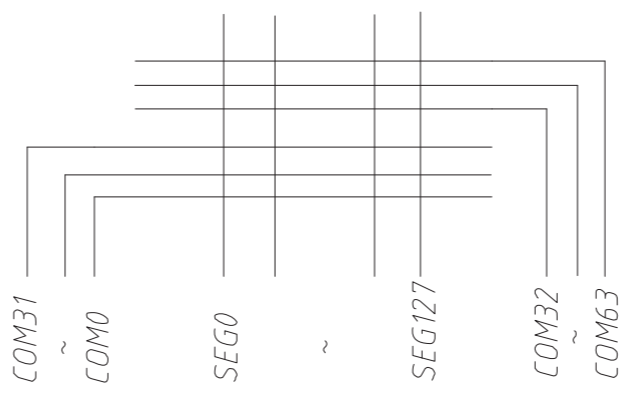
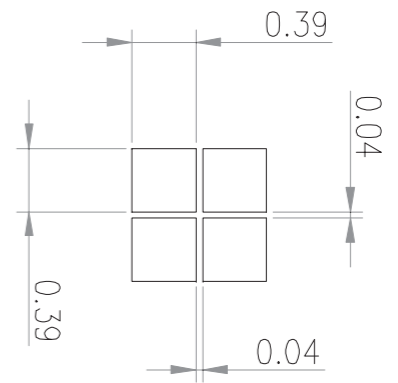
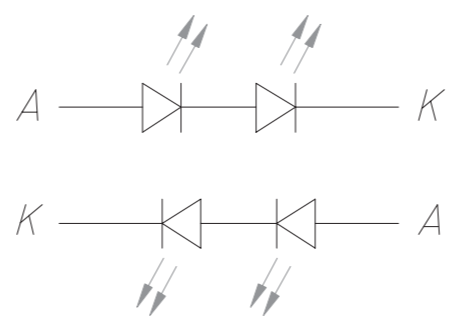
- 128 x 64 pixels
- 8080 or 6800 MPU interface
- Built-in ST7565R controller
- +3.3V power supply
- 1/64 duty cycle; 1/9 bias
- RoHS Compliant
- 3M 9080 adhesive on backlight assembly

<http://multimedia.3m.com/mws/mediawebserver?66666UuZjcFSLXTt4XfEnxfyEVuQEcuZgVs6EVs6E666666-->

SYMBOL	REVISION	DATE



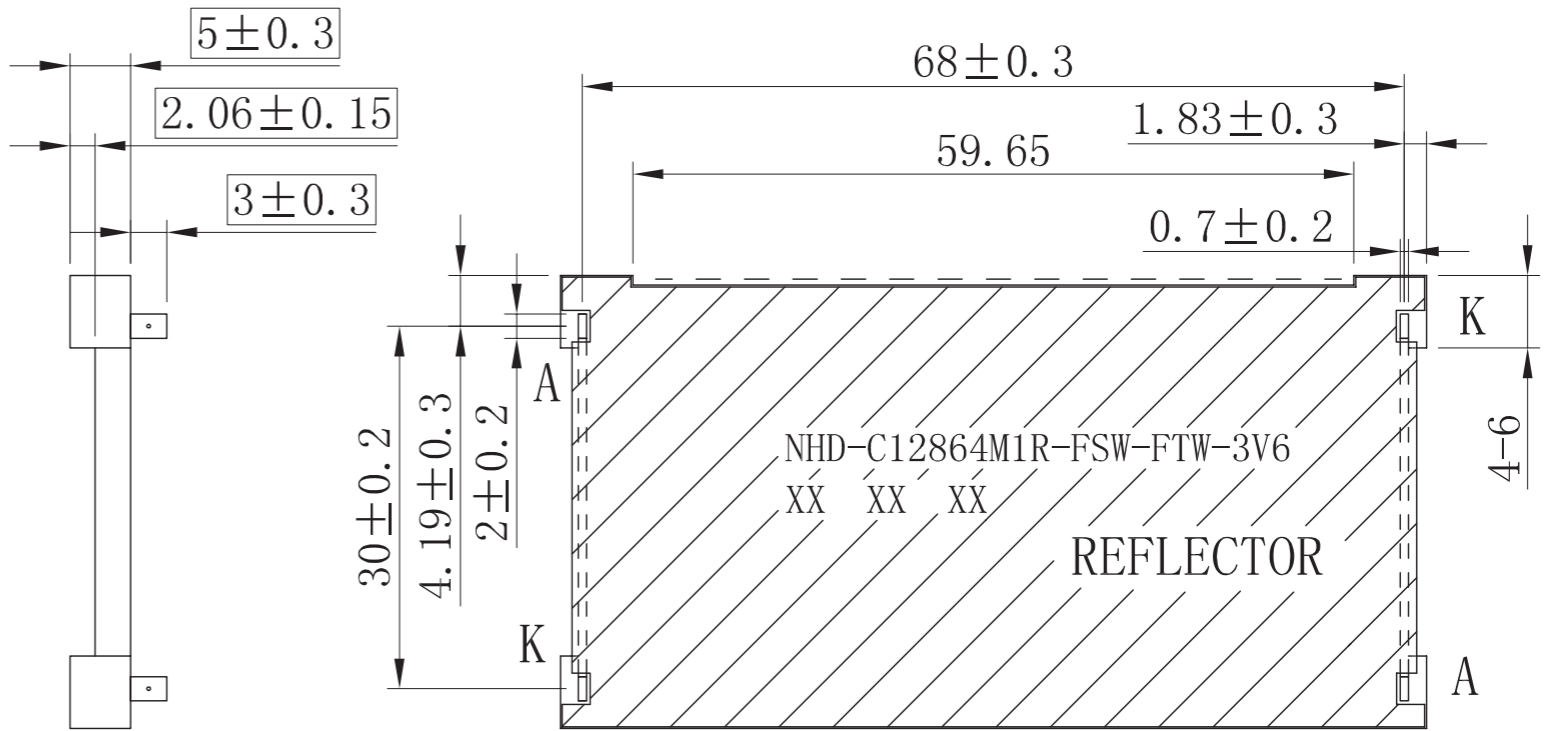
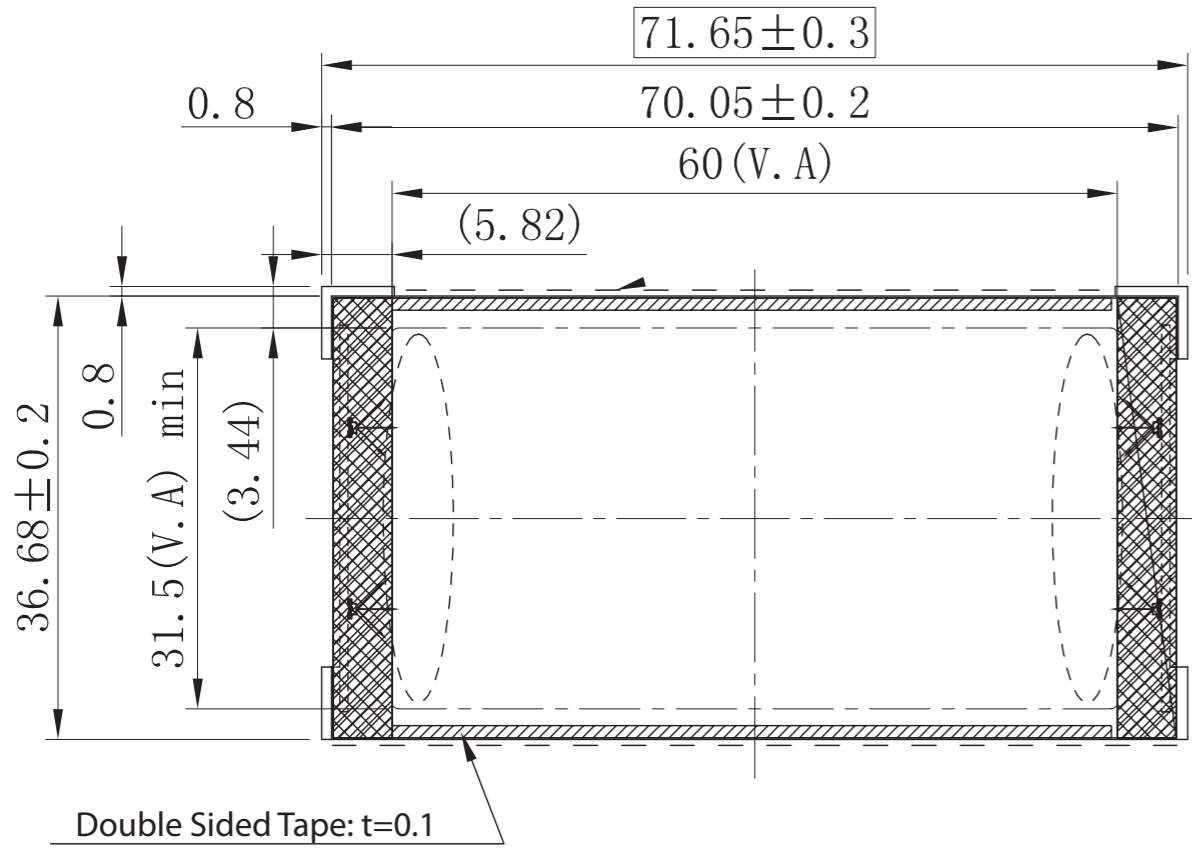
Pin No	Define
1	/CS1
2	/RES
3	A0
4	/WR
5	/RD
6	D0
7	D1
8	D2
9	D3
10	D4
11	D5
12	D6
13	D7
14	VDD
15	VSS
16	VOUT
17	CAP3-
18	CAP1+
19	CAP1-
20	CAP2-
21	CAP2+
22	V1
23	V2
24	V3
25	V4
26	V5
27	VR
28	C86
29	PS
30	/IRS



- Notes:**
1. Driver: 1/65 Duty, 1/9 Bias
 2. Display Mode: FSTN Positive / Transflective
 3. Optimal View: 12:00
 4. Voltage: 3.3V VDD, 9.5V VLCD
 5. Backlight: White LED
 6. Driver IC: ST7565

STANDARD TOLERANCES (UNLESS OTHERWISE SPECIFIED) LINEAR: XX. ±0.3 mm XX.X ±0.3 mm XX.XX ±0.3 mm	NEWHAVEN DISPLAY INTERNATIONAL		REVISION: 1.0
	DRAWING/PART NUMBER: NHD-C12864M1R-FSW-FTW-3V6		SIZE: A3
UNLESS OTHERWISE SPECIFIED - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	APPROVED BY: S. Baxi DRAWN DATE: 10/09/18	CHECKED BY: S. Baxi CHECKED DATE: 10/09/18	APPROVED BY: S. Baxi APPROVED DATE: 10/09/18 SCALE: NS
DO NOT SCALE DRAWING			SHEET 1 OF 2
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SYMBOL	REVISION	DATE



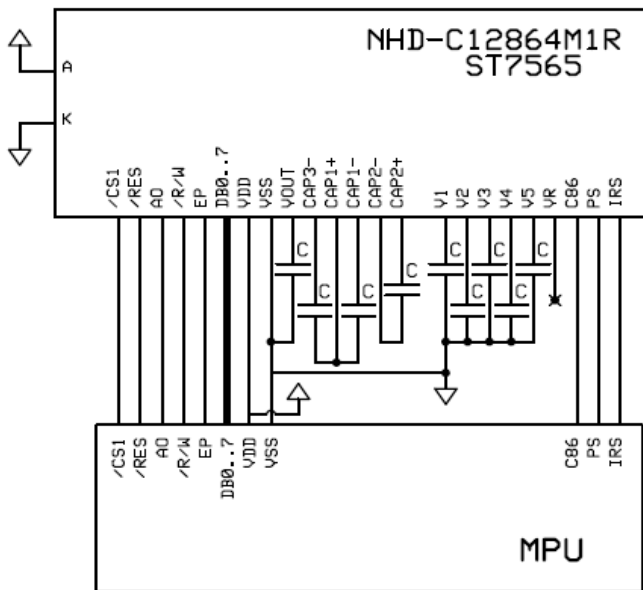
STANDARD TOLERANCES (UNLESS OTHERWISE SPECIFIED) LINEAR: XX. ± 0.3 mm XX.X ± 0.3 mm XX.XX ± 0.3 mm			
	DRAWING/PART NUMBER: NHD-C12864M1R-FSW-FTW-3V6		
UNLESS OTHERWISE SPECIFIED - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	DRAWN BY: S. Baxi	CHECKED BY: S. Baxi	APPROVED BY: S. Baxi
	DRAWN DATE: 10/09/18	CHECKED DATE: 10/09/18	APPROVED DATE: 10/09/18
DO NOT SCALE DRAWING			REVISION: 1.0 SIZE: A3 SCALE: NS
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Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description	
1	/CS1	MPU	Active LOW Chip Select	
2	/RES	MPU	Active LOW Reset signal	
3	A0	MPU	Register Select signal. 0: instruction; 1: data register	
4	R/W /WR	MPU	6800 Mode: Read/Write select signal. R/W=1: Read R/W=0: Write 8080 Mode: Active LOW Write Signal	
5	E /RD	MPU	6800 Mode: Active HIGH Enable Signal 8080 Mode: Active LOW Read Signal	
6	DB0	MPU	Parallel Interface DB0-DB7: Bi-directional 8-bit data bus Serial Interface: DB0-DB5: No connect in serial mode DB6= Serial clock (SCL) DB7= Serial data input (SI)	
7	DB1	MPU		
8	DB2	MPU		
9	DB3	MPU		
10	DB4	MPU		
11	DB5	MPU		
12	DB6 (SCL)	MPU		
13	DB7 (SI)	MPU		
14	V _{DD}	Power Supply		Power supply for LCD and logic (+3.3V)
15	V _{SS}	Power Supply		Ground
16	V _{OUT}	Power Supply	Connect to 1uF cap to V _{SS}	
17	CAP3-	Power Supply	Connect to 1uF cap to CAP1+ (PIN-18)	
18	CAP1+	Power Supply	Connect to 1uF cap to CAP3-(PIN17) and CAP1-(PIN19)	
19	CAP1-	Power Supply	Connect to 1uF cap to CAP1+ (PIN-18)	
20	CAP2-	Power Supply	Connect to 1uF cap to CAP2+ (PIN-21)	
21	CAP2+	Power Supply	Connect to 1uF cap to CAP2- (PIN-20)	
22	V ₁	Power Supply	1.0uF-2.2uF cap to V _{SS}	
23	V ₂	Power Supply	1.0uF-2.2uF cap to V _{SS}	
24	V ₃	Power Supply	1.0uF-2.2uF cap to V _{SS}	
25	V ₄	Power Supply	1.0uF-2.2uF cap to V _{SS}	
26	V ₅	Power Supply	1.0uF-2.2uF cap to V _{SS}	
27	V _R	-	No Connect	
28	C86	MPU	Select MPU interface pin. C86=H: 6800; C86=L: 8080	
29	PS	MPU	Parallel/Serial select. PS= H: Parallel; PS=L: Serial	
30	/IRS	MPU	Internal resistor select. Set HIGH to use internal resistors	

Recommended LCD connector: 0.5mm Pitch, 30 pin FFC. Molex p/n: 52892-3095

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



Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T _{OP}	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T _{ST}	Absolute Max	-30	-	+80	°C
Supply Voltage	V _{DD}	-	3.0	3.3	3.6	V
Supply Current	I _{DD}	V _{DD} = 3.3V T _{OP} = 25°C	-	0.25	0.50	mA
Supply for LCD (contrast)	V _{LCD}		9.2	9.5	9.8	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 Current	I _{LED}	-	-	40	50	mA
Backlight Supply Voltage	V _{LED}	I _{LED} = 40mA	5.7	6.1	6.5	V

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	CR ≥ 2	-	40	-	°
	Bottom		-	20	-	°
	Left		-	40	-	°
	Right		-	40	-	°
Contrast Ratio	CR	-	2	4	-	-
Response Time	Rise	T _{OP} = 25°C	-	150	250	ms
	Fall		-	150	250	ms

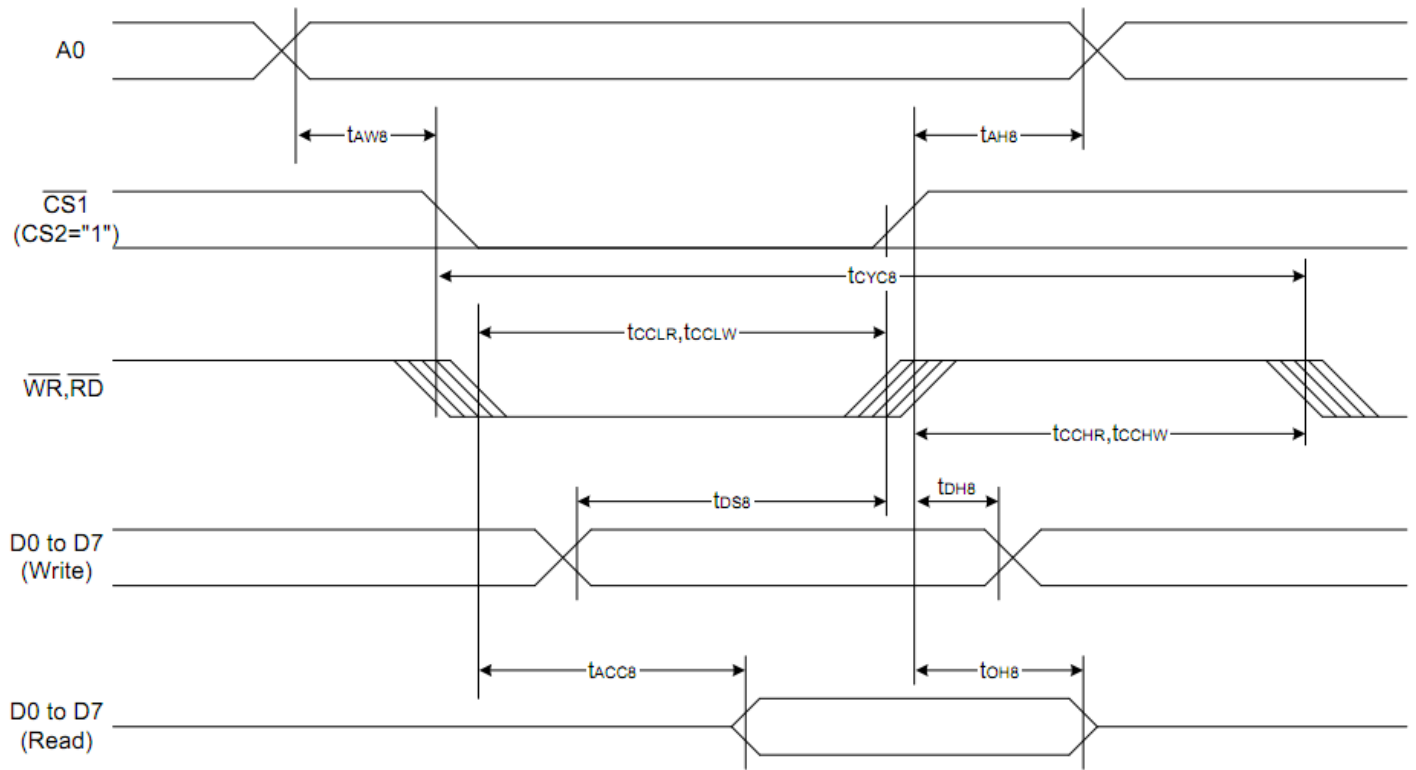
Controller Information

Built-in ST7565R controller.

Please download specification at http://www.newhavendisplay.com/app_notes/ST7565R.pdf

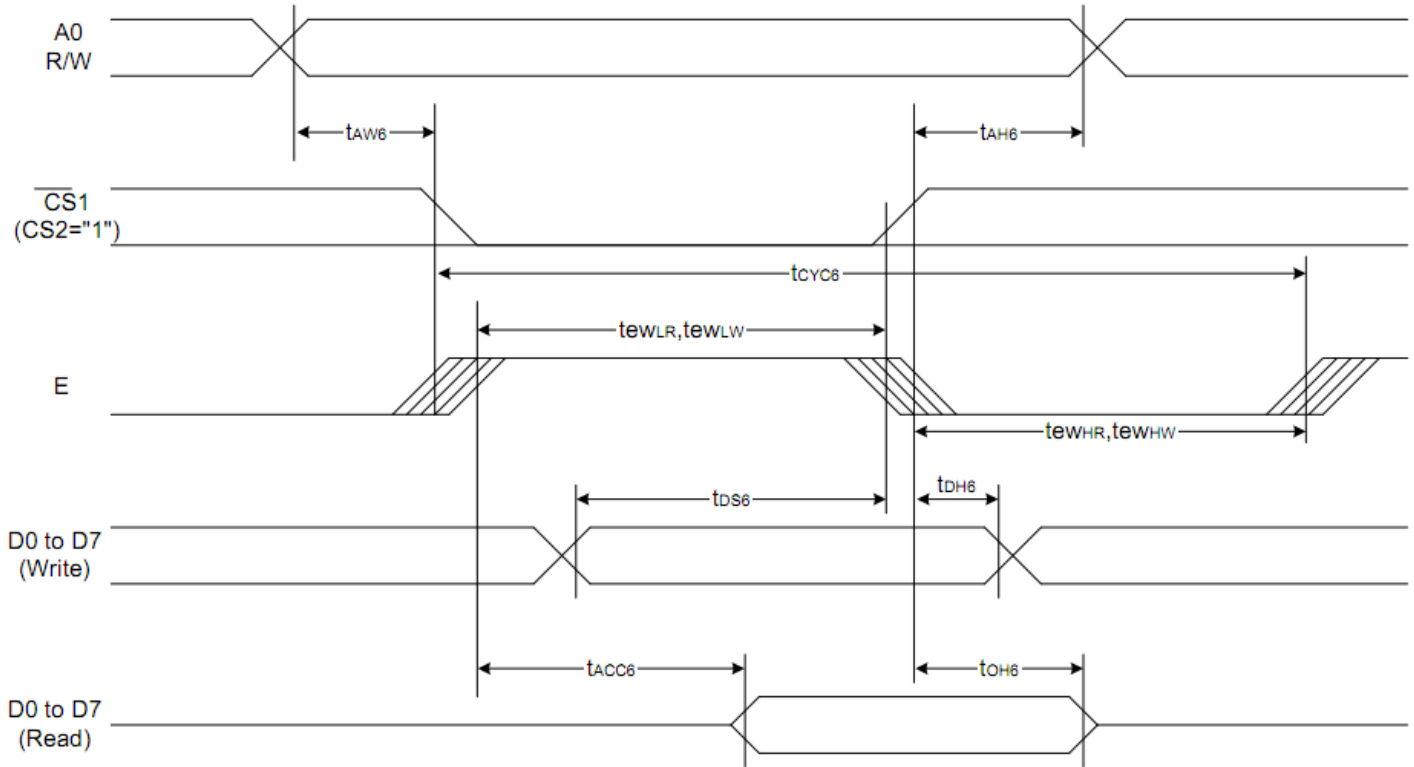
Timing Characteristics

System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)



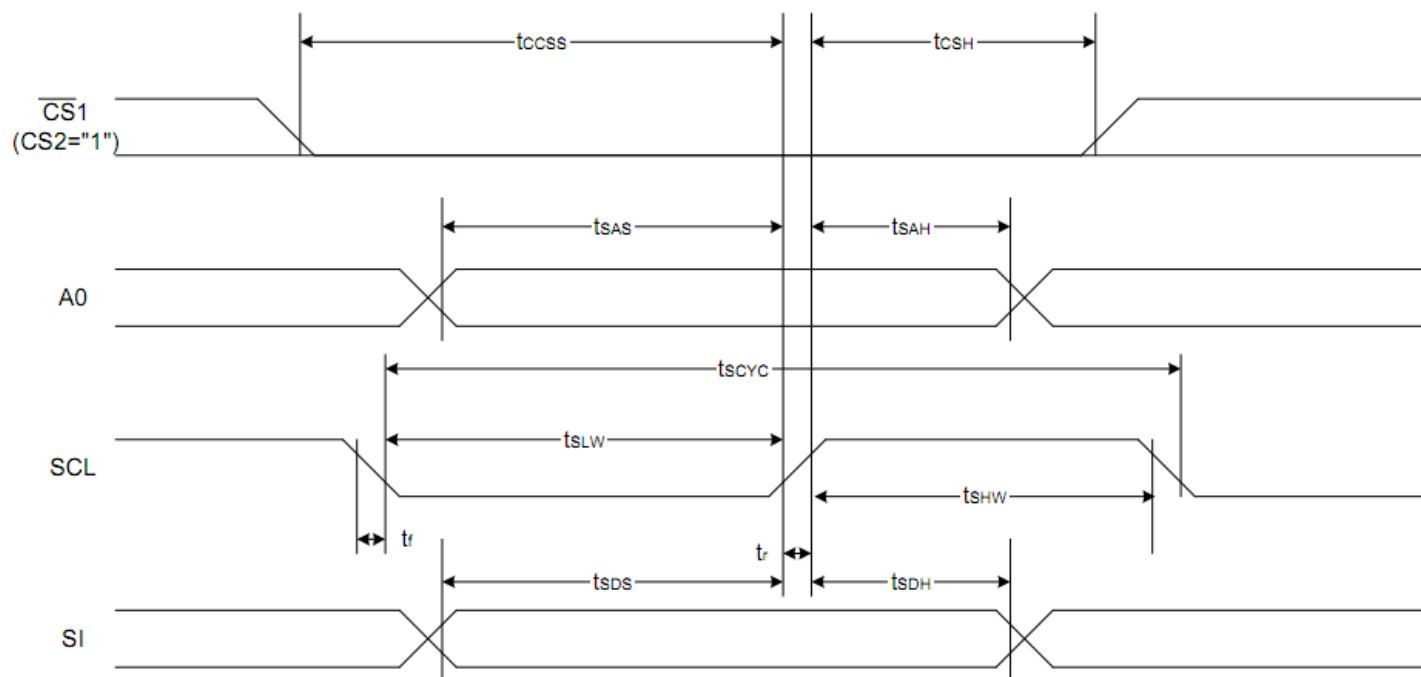
Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH8}		0	—	Ns
Address setup time		t_{AW8}		0	—	
System cycle time		t_{CYC8}		240	—	
Enable L pulse width (WRITE)	WR	t_{CCLW}		80	—	
Enable H pulse width (WRITE)		t_{CCHW}		80	—	
Enable L pulse width (READ)	RD	t_{CCLR}		140	—	
Enable H pulse width (READ)		t_{CCHR}		80	—	
WRITE Data setup time	D0 to D7	t_{DS8}		40	—	
WRITE Address hold time		t_{DH8}		0	—	
READ access time		t_{ACC8}	$C_L = 100 \text{ pF}$	—	70	
READ Output disable time		t_{OH8}	$C_L = 100 \text{ pF}$	5	50	

System Bus Read/Write Characteristics 2 (For the 6800 Series MPU)



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH6}		0	—	ns
Address setup time		t_{AW6}		0	—	
System cycle time		t_{CYC6}		240	—	
Enable L pulse width (WRITE)	WR	t_{EWLW}		80	—	
Enable H pulse width (WRITE)		t_{EWHW}		80	—	
Enable L pulse width (READ)	RD	t_{EWLR}		80	—	
Enable H pulse width (READ)		t_{EWHR}		140	—	
WRITE Data setup time	D0 to D7	t_{DSE6}		40	—	
WRITE Address hold time		t_{DH6}		0	—	
READ access time		t_{ACC6}	$C_L = 100 \text{ pF}$	—	70	
READ Output disable time		t_{OH6}	$C_L = 100 \text{ pF}$	5	50	

The 4-line SPI Interface



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
4-line SPI 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							Sets the display RAM display start line address	
(3) Page address set	0	1	0	1	0	1	Page address							Sets the display RAM page address
(4) Column address set upper bit Column address set lower bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.		
				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				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 (ST7565R)	
(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	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	*	*	*	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 ₀ 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	0	0	0	1	Set the V ₀ output voltage electronic volume register	
				0	0	Electronic volume value								
(19) Sleep mode set	0	1	0	1	0	1	0	1	1	0	0	1	0: Sleep mode, 1: Normal mode	
				*	*	*	*	*	*	0	0			
(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	
				0	0	0	0	0	0	step-up value				
(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 Init  
Reset P3.7          'set Read/write to '0' for write  
Reset P3.0          'RS  
Set P3.1            'reset  
Reset P3.4 'E  
'Set P3.3  
'Reset P3.3  
Waitms 2  
'Set P3.3  
Waitms 20  
A = &HA2            '1/9 BIAS  
Call Writecom  
A = &HA0            'ADC SELECT , NORMAL  
Call Writecom  
A = &HC8            'COM OUTPUT REVERSE  
Call Writecom  
A = &HA4            'DISPLAY ALL POINTS NORMAL  
Call Writecom  
A = &H40            'DISPLAY START LINE SET  
Call Writecom  
A = &H25            'INTERNAL RESISTOR RATIO  
Call Writecom  
A = &H81            'ELECTRONIC VOLUME MODE SET  
Call Writecom  
A = &H10            'ELECTRONIC VOLUME  
Call Writecom  
A = &H2F            'POWER CONTROLLER SET  
Call Writecom  
A = &HAF            'DISPLAY ON  
Call Writecom  
End Sub
```

```
'-----  
Sub Writecom  
Reset P3.0          'A0 low  
Reset P3.7          'R/W low  
Set P3.6            'CS1  
Set P3.4            'E  
P1 = A  
Reset P3.4  
Reset P3.6  
Reset P3.7  
End Sub
```

```
Sub Writedata  
Set P3.0            'A0 high  
Reset P3.7          'R/W low  
Set P3.6            'CS1  
Set P3.4            'E  
P1 = A  
Reset P3.4  
Reset P3.6  
Reset P3.7  
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 , 240hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 240hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 240hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 240hrs	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 , 240hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	-20°C,30min -> 25°C,5min -> 70°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.

See full Quality Specification at http://www.newhavendisplay.com/specs/quality_spec.pdf

Assembly Reliability Information

Test Item	Content of Test	Test Condition	Result	Note
High Temperature test on adhesive	Endurance of backlight adhesive applying high temperature for a long time.	60°C, 50% RH, 240hrs	>50N to separate backlight from LCD	1,2
Vibration test on adhesive	Endurance of backlight adhesive applying vibration to simulate transportation and use.	30Hz, 10min 35Hz, 10min 40Hz, 20min 45Hz, 20min	>50N to separate backlight from LCD	3
Drop test on adhesive	Endurance of backlight adhesive applying drop force to simulate transportation and use.	Corner: 25cm, 1 drop Edge: 25cm, 1 drop Face: 100cm, 1 drop	>50N to separate backlight from LCD	4

Note 1: No condensation to be observed.

Note 2: Conducted immediately after test condition.

Note 3: Test performed on product itself, not inside a container.

Note 4: Test performed inside standard shipping packaging.

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