

NHD-C12865AZ-RN-GBW

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

NHD-	Newhaven Display
C12865-	128 x 65 pixels
AZ-	Model
R-	Reflective
N-	No Backlight
G-	STN-Gray
B-	6:00 view
W-	Wide Temp (-20°C ~ +70°C)
	RoHS Compliant

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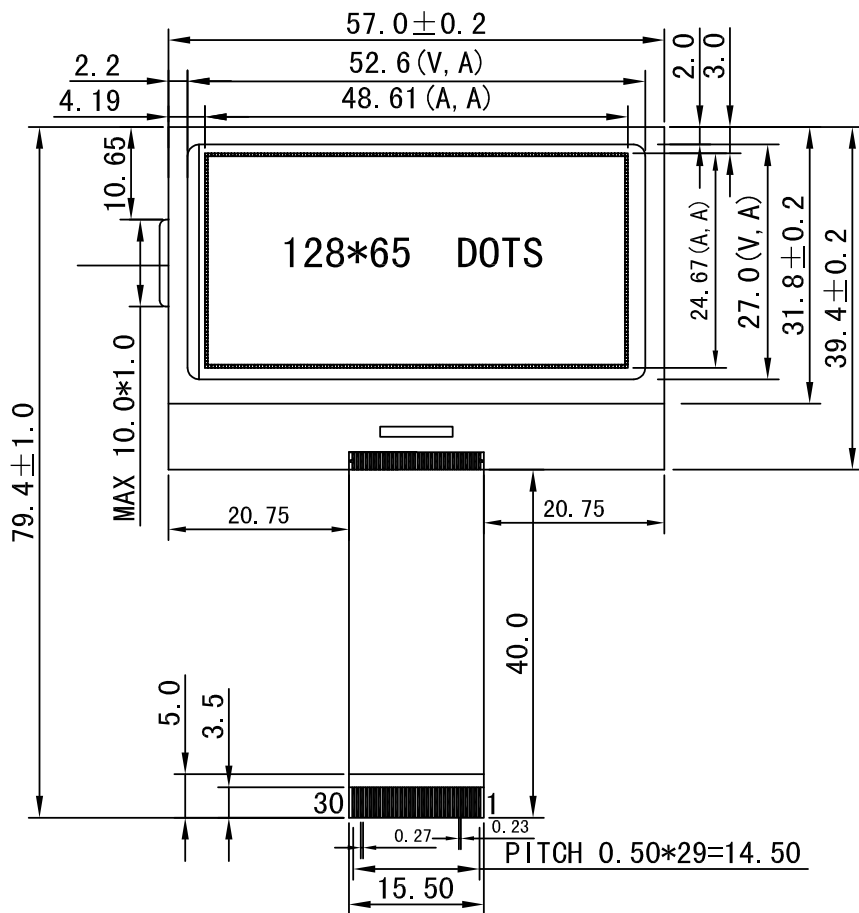
Document Revision History

Revision	Date	Description	Changed by
0	5/17/2007	Initial Release	-
1	9/18/2009	User guide reformat	BE
2	10/14/2009	Updated Electrical Characteristic	MC

Functions and Features

- 128 x 65 pixels
- Built-in SPLC501C controller
- +3.3V power supply
- 1/65 duty cycle; 1/9 bias
- Parallel/Serial Interface
- RoHS Compliant

Mechanical Drawing

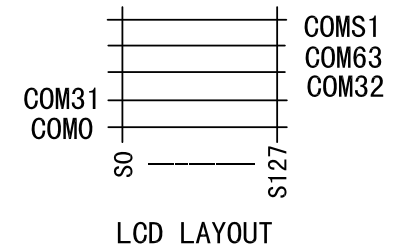
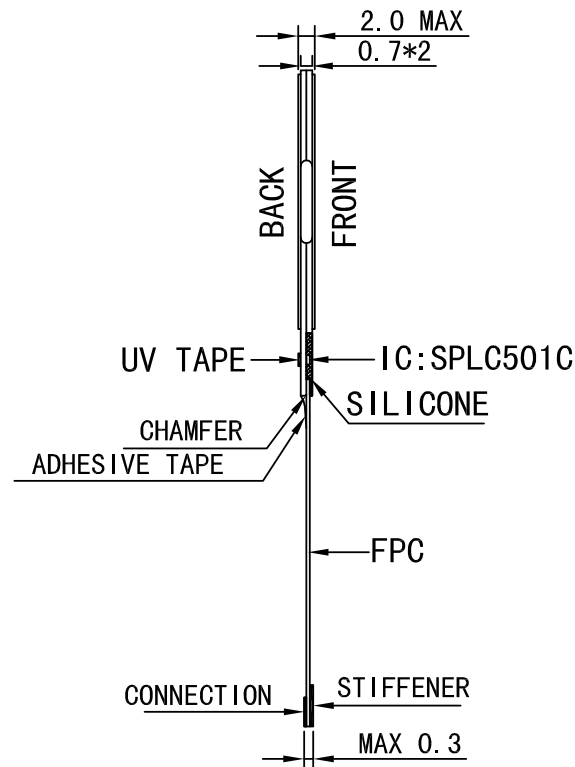


NOTE:

1. VIEWING ANGLE: 6:00 O' CLOCK
2. DISPLAY MODE: AS IS SHOWN IN TABLE1
3. DRIVING VOLTAGE: 9.5V, DUTY: 1/65, BIAS: 1/9, FREQUENCY: 64Hz
4. OPERATING TEMP.: $-20^{\circ}C$ TO $70^{\circ}C$
5. STORAGE TEMP.: $-30^{\circ}C$ TO $80^{\circ}C$
6. CONNECTOR: FPC TYPE

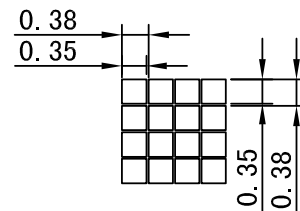
TABLE1:

	R	T	F
F	POSITIVE REFLECTIVE FSTN	POSITIVE TRANSMISSIVE FSTN	POSITIVE TRANSFLECTIVE FSTN
Y	POSITIVE REFLECTIVE YELLOW-GREEN STN	POSITIVE TRANSMISSIVE YELLOW-GREEN STN	POSITIVE TRANSFLECTIVE YELLOW-GREEN STN
G	POSITIVE REFLECTIVE GRAY STN		POSITIVE TRANSFLECTIVE GRAY STN
B		NEGATIVE TRANSMISSIVE BLUE STN	NEGATIVE TRANSFLECTIVE BLUE STN
W		NEGATIVE TRANSMISSIVE BLACK-WHITE STN	NEGATIVE TRANSFLECTIVE BLACK-WHITE STN



PIN CONNECTIONS:

PIN	SIGNAL	PIN	SIGNAL
1	/CS1	16	VOUT
2	/RES	17	CAP3N
3	A0	18	CAP1P
4	/RW	19	CAP1N
5	E	20	CAP2N
6	DB0	21	CAP2P
7	DB1	22	V1
8	DB2	23	V2
9	DB3	24	V3
10	DB4	25	V4
11	DB5	26	V5
12	DB6	27	VR
13	DB7	28	C86
14	VDD	29	PS
15	VSS	30	IRS



PIXEL DETAILS

Newhaven Display

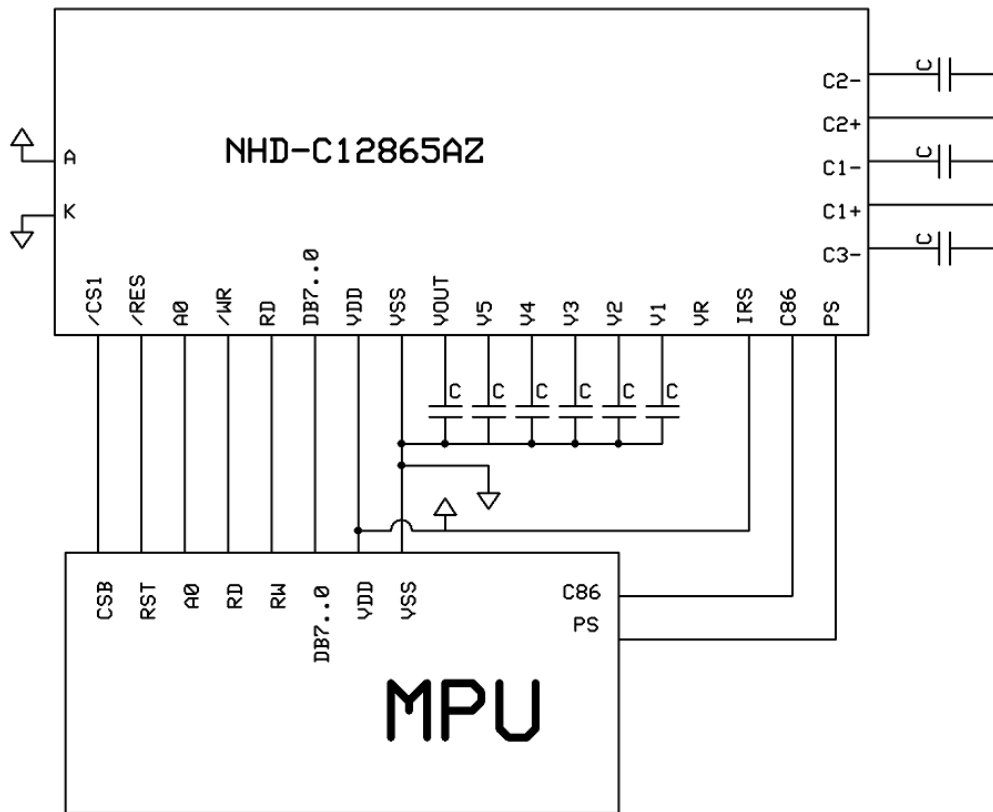
DATE	9/18/2009	PART NO.	NHD-C12865AZ-RN-GBW
DESIGN BY	CSL 24/06-2005		
CHECKED BY			
APP BY			

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. A0=1: Data, A0=0: Command
4	/RW	MPU	Read/Write select signal, R/W=1: Read R/W=0: Write
5	E	MPU	Operation enable signal. Falling edge triggered.
6	DB0	MPU	Parallel Interface
7	DB1	MPU	DB0-DB7: Bi-directional 8-bit data bus
8	DB2	MPU	
9	DB3	MPU	Serial Interface:
10	DB4	MPU	DB0-DB5: No connect in serial mode
11	DB5	MPU	
12	DB6	MPU	DB6= Serial clock (CLK)
13	DB7	MPU	DB7= Serial data input (SDA)
14	VDD	Power Supply	Power supply for LCD and logic (+3.3V)
15	Vss	Power Supply	Ground
16	VOOUT	Power Supply	Voltage booster circuit – connect to 1uF cap to Vss or VDD
17	CAP3-	Power Supply	Connect to 1uF Cap to CAP1+ (Pin-18)
18	CAP1+	Power Supply	Connect to 1uF Cap to CAP1-(Pin-19) and CAP3-(Pin17)
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	V1	Power Supply	1.0uF-2.2uF cap to VSS
23	V2	Power Supply	1.0uF-2.2uF cap to VSS
24	V3	Power Supply	1.0uF-2.2uF cap to VSS
25	V4	Power Supply	1.0uF-2.2uF cap to VSS
26	V5	Power Supply	1.0uF-2.2uF cap to VSS
27	VR	-	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	This terminal selects the resistors for the V5 voltage level adjustment

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	Top	Absolute Max	-20	-	+70	°C
Storage Temperature Range	Tst	Absolute Max	-30	-	+80	°C
Supply Voltage	VDD		-	3.3	3.4	V
Supply Current	IDD	Ta=25°, VDD=3.3V	-	1.5	2.5	mA
Supply for LCD (contrast)	VDD-V0	Ta =25	-	9.5	10	V
"H" Level input	Vih		0.7	-	VDD	V
"L" Level input	Vil		0	-	0.3VDD	V
"H" Level output	Voh		2.4	-	-	V
"L" Level output	Vol		-	-	0.4	V

Optical Characteristics

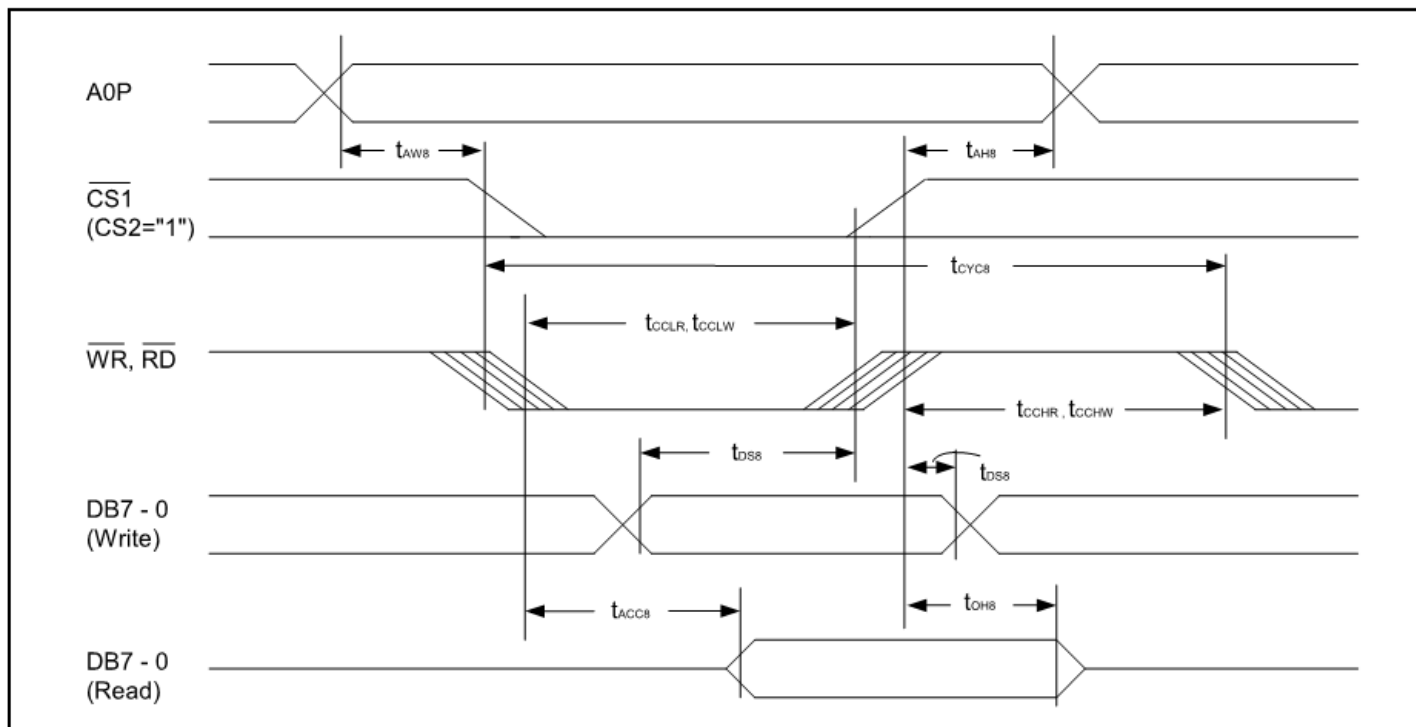
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical	θ	Cr≥3	-45	-	+25	°
Viewing Angle - Horizontal	ϕ		-35	-	+35	°
Contrast Ratio	K		3.0	-	-	-
Response Time (rise)	Tr	25°C	-	-	250	ms
Response Time (fall)	Tf	25°C	-	-	250	ms

Controller Information

Built-in SPLC501C. Download specification at http://www.newhavendisplay.com/app_notes/SPLC501C.pdf

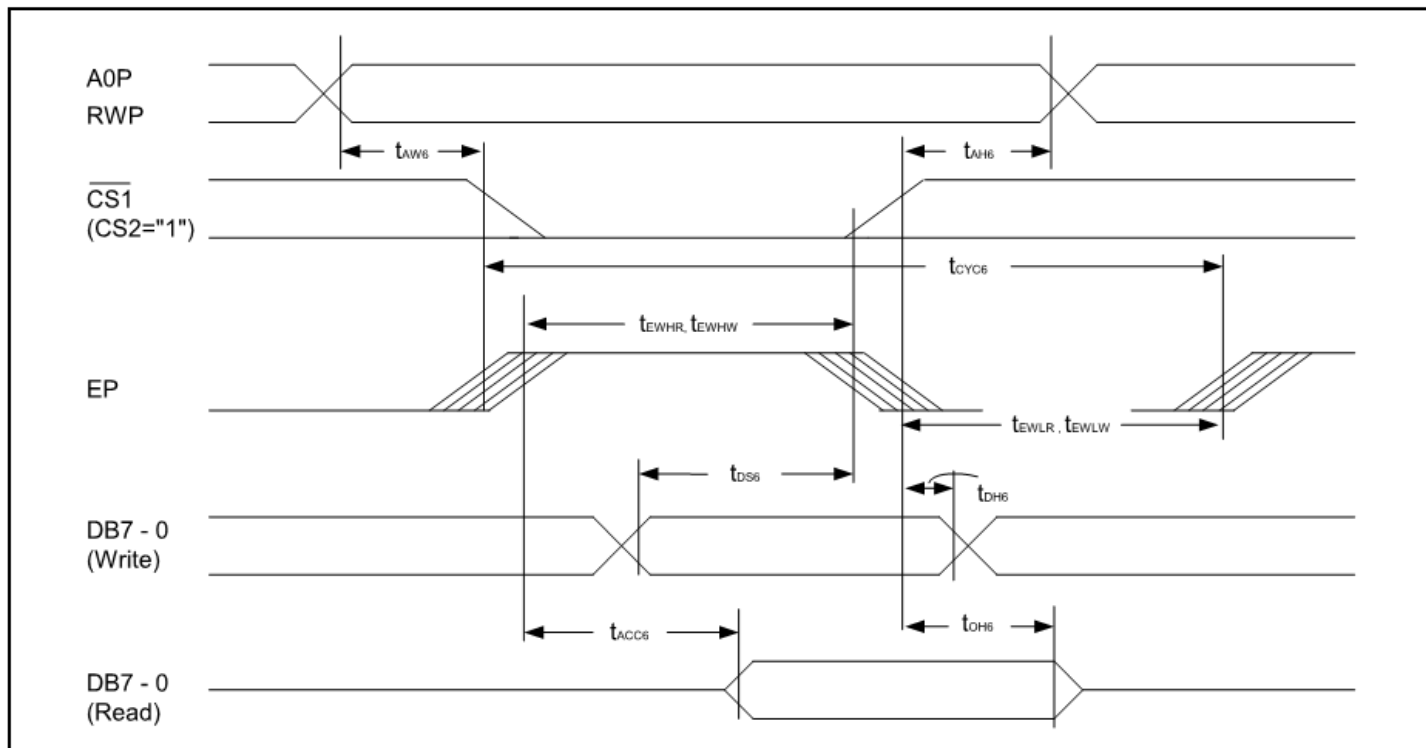
Timing Characteristics

8.6.1. System bus read/write characteristics 1 (For the 8080 Series MPU)



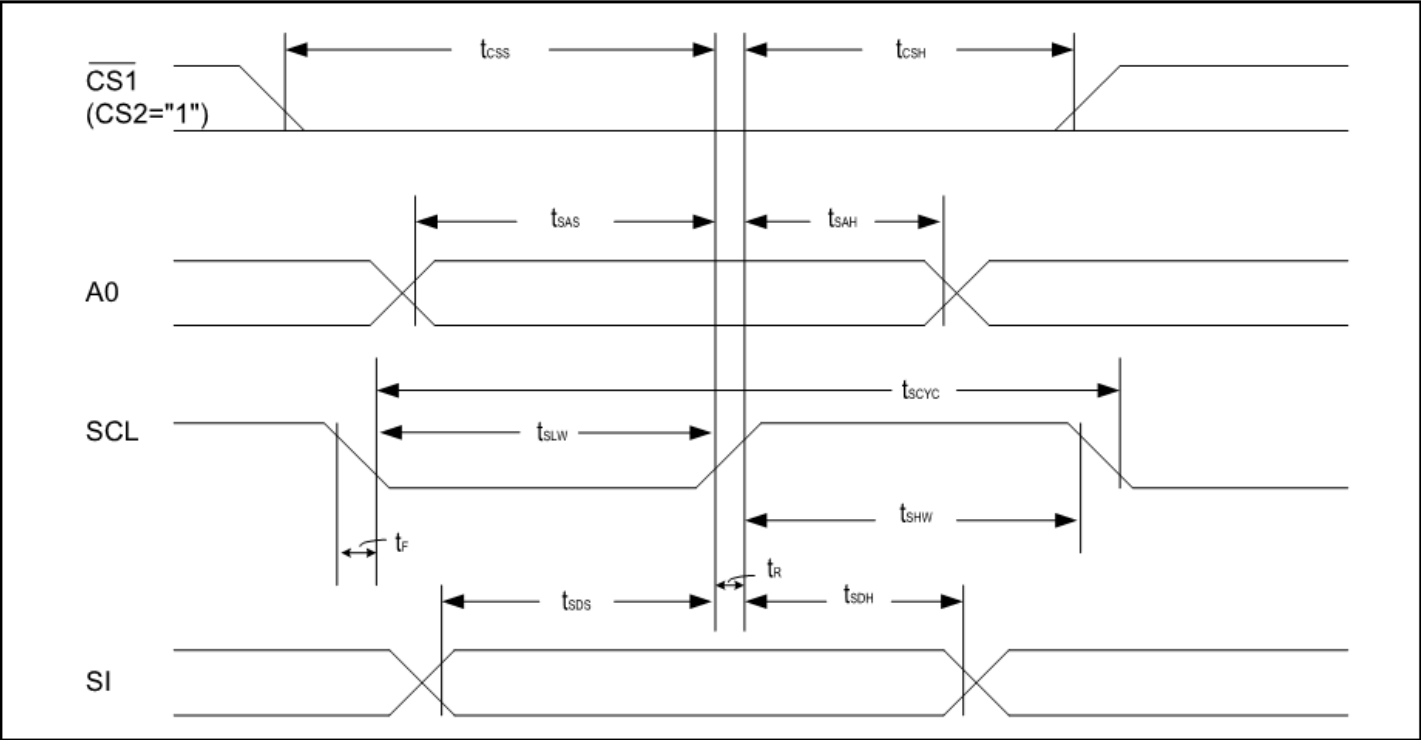
Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0P	t_{AH8}		0	-	ns
Address setup time	A0P	t_{AW8}		0	-	ns
System cycle time	A0P	t_{CYC8}		300	-	ns
Control L pulse width (WR)	WR	t_{CCLW}		60	-	ns
Control L pulse width (RD)	RD	t_{CCLR}		120	-	ns
Control H pulse width (WR)	WR	t_{CCHW}		60	-	ns
Control H pulse width (RD)	RD	t_{CCHR}		60	-	ns
Data setup time	DB7 - 0	t_{DS8}		40	-	ns
Address hold time		t_{DH8}		15	-	ns
RD access time		t_{ACC8}	$C_L = 100pF$	-	140	ns
Output disable time		t_{OH8}		10	100	ns

8.6.2. System bus read/write characteristics 2 (6800 series MPU)



Item		Signal	Symbol	Condition	Rating		Units
					Min.	Max.	
Address hold time		A0P	t_{AH6}		0	-	ns
Address setup time			t_{AW6}		0	-	ns
System cycle time		A0P	t_{CYC6}		300	-	ns
Data setup time		DB7 - 0	t_{DS6}	$C_L = 100\text{pF}$	40	-	ns
Data hold time			t_{DH6}		15	-	ns
Access time			t_{ACC6}		-	140	ns
Output disable time			t_{OH6}		10	100	ns
Enable H pulse time	Read	EP	t_{EWHR}		120	-	ns
	Write		t_{EWHW}		60	-	ns
Enable L pulse time	Read	EP	t_{EWLR}		60	-	ns
	Write		t_{EWLW}		60	-	ns

8.6.3. The serial interface



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	t_{SCYC}	-	250	-	ns
SCL 'H' pulse width		t_{SHW}	-	100	-	ns
SCL 'L' pulse width		t_{SLW}	-	100	-	ns
Address setup time	A0P	t_{SAS}	-	150	-	ns
Address hold time		t_{SAH}	-	150	-	ns
Data setup time	SI	t_{SDS}	-	100	-	ns
Data hold time		t_{SDH}	-	100	-	ns
CS-SCL time	CS	t_{CSS}	-	150	-	ns
		t_{CSH}	-	150	-	ns

Table of Commands

Command	Command Code											Function
	A0P	RD	WR	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
1). Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0	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				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				Set 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	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	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	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	Sets the LCD driver voltage bias ratio SPLC501C.....0:1/9, 1:1/7
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	*	*	*	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 _s 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	0	1	0	1	0	0	0	0	0	0	1	Set the V _s output voltage electronic volume register
Electronic volume register set	0	1	0	*	*	Electronic volume value						

Command	Command Code											Function
	A0P	RD	WR	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
19). Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0	0: OFF, 1: ON
Static indicator Register set	0	1	0	*	*	*	*	*	*	Mode	1	Set the flashing mode
20). Page Blink	0	1	0	1	1	0	1	0	1	0	1	P7 - 0: 1 - blinking page 0 - no blinking, normal display
Page selection	0	1	0	P7	P6	P5	P4	P3	P2	P1	P0	
21). Driving Mode Set	0	1	0	1	1	0	1	0	0	1	0	Set the driving mode register
Mode selection	0	1	0	D1	D0	0	0	0	0	0	0	Driving capability (D1, D0): (1,1)>(0,0)>(0,1)>(1,0)
22). Power saver												Display OFF and display all points ON compound command
23). NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
24). Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command
				1	1	0	1	0	1	0	0	

Example Initialization Program

```
.....

Sub Init
Set P3.0
Set P3.1
Reset P3.4
Set P3.3          'reset
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 = &H07          'ELECTRONIC VOLUME
Call Writecom
A = &H2F          'POWER CONTROLLER SET
Call Writecom
A = &HAF          'DISPLAY ON
Call Writecom
End Sub
```

```
.....

Sub Writecom
Reset P3.2        'A0
Reset P3.1        'R/W
Reset P3.4        'CS1
Set P3.0          'E
P1 = A
Reset P3.0
Set P3.4
End Sub
```

```
.....

Sub Writedata
Set P3.2
Reset P3.1
Reset P3.4
Set P3.0
P1 = A
Reset P3.0
Set P3.4
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