

# NHD-C12865AZ-FSW-GBW

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

NHD-	Newhaven Display
C12865-	128 x 65 pixels
AZ-	Model
F-	Transflective
SW-	Side White LED Backlight
G-	STN-Gray
B-	6:00 view
W-	Wide Temp (-20°C ~ +70°C)
	<b>RoHS Compliant</b>

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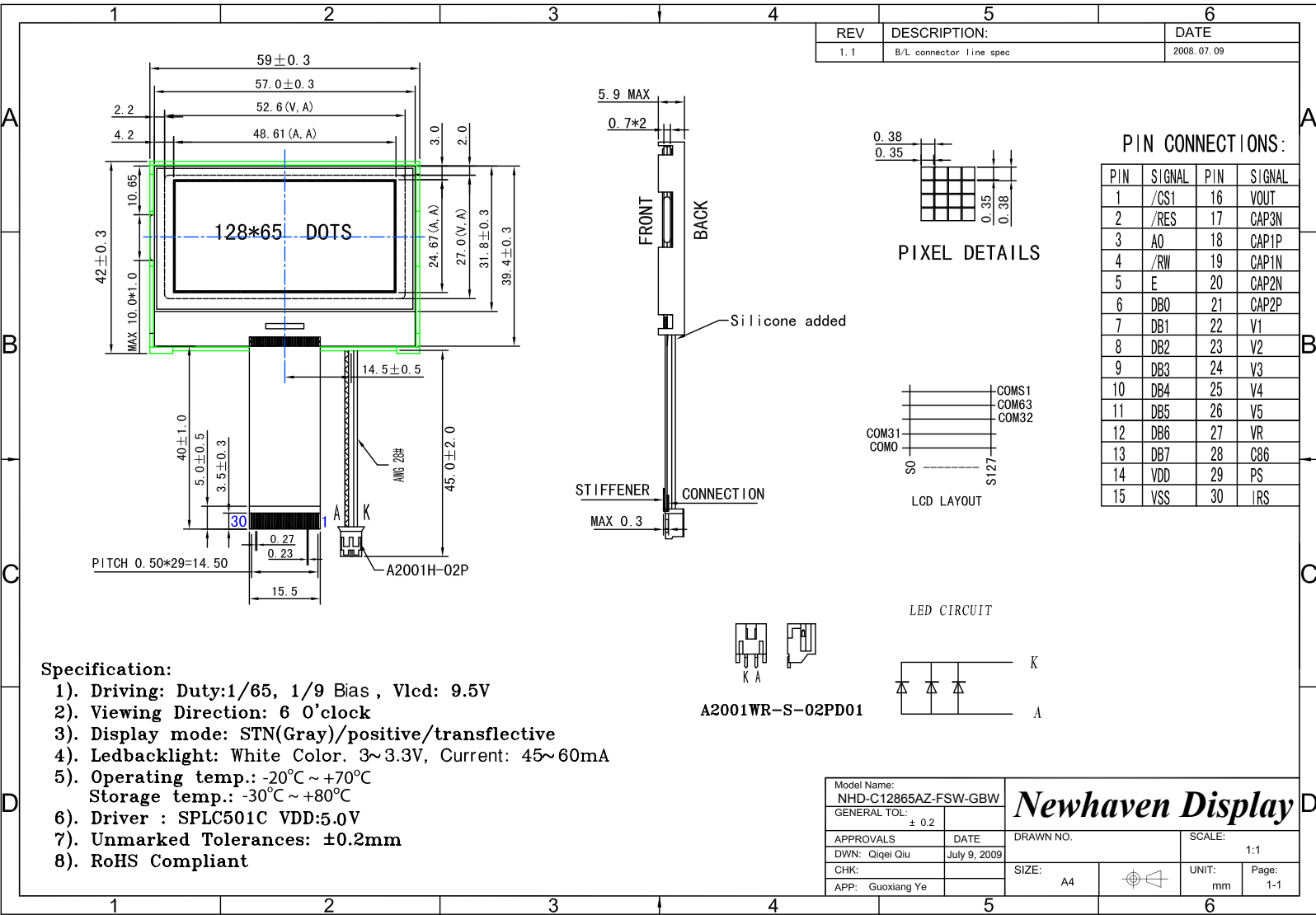
## Document Revision History

Revision	Date	Description	Changed by
0	5/17/2007	Initial Release	-
1	9/17/2009	User guide reformat	BE
2	10/14/2009	Updated Electrical Characteristic	MC
3	11/20/2009	Updated backlight supply current	MC
4	5/7/2010	Electrical properties updated	MP

## Functions and Features

- 128 x 65 pixels
- Built-in SPLC501C controller
- +5.0 V power supply
- 1/65 duty cycle; 1/9 bias
- Parallel/Serial Interface
- RoHS Compliant

# Mechanical Drawing



REV	DESCRIPTION:	DATE
1.1	B/L connector line spec	2008.07.09

**PIN CONNECTIONS:**

PIN	SIGNAL	PIN	SIGNAL
1	/CS1	16	VOUT
2	/RES	17	CAP3N
3	AO	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

**Specification:**

- 1). Driving: Duty:1/65, 1/9 Bias, Vlcd: 9.5V
- 2). Viewing Direction: 6 O'clock
- 3). Display mode: STN(Gray)/positive/transflective
- 4). Ledbacklight: White Color. 3~3.3V, Current: 45~60mA
- 5). Operating temp.: -20°C ~ +70°C  
Storage temp.: -30°C ~ +80°C
- 6). Driver : SPLC501C VDD:5.0V
- 7). Unmarked Tolerances: ±0.2mm
- 8). RoHS Compliant

Model Name: NHD-C12865AZ-FSW-GBW

GENERAL TOL: ± 0.2

APPROVALS: [Signature] DATE: July 9, 2009

DWN: Qiwei Qiu

CHK:

APP: Guoxiang Ye

**Newhaven Display**

DRAWN NO. [Blank] SCALE: 1:1

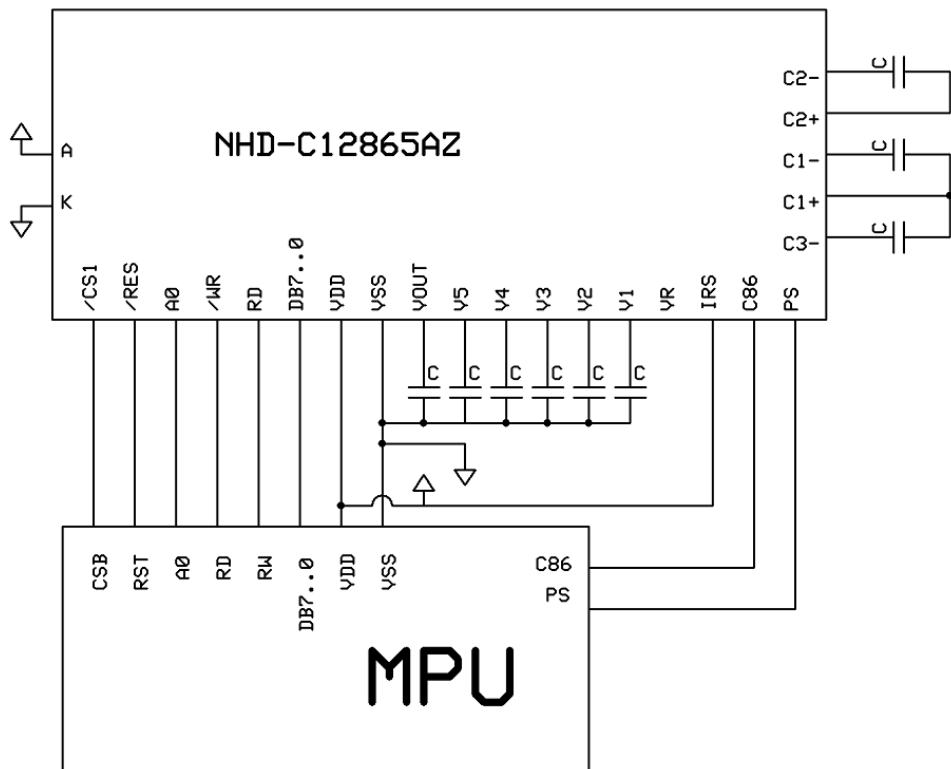
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## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	/CS1	MPU	Active LOW Chip select
2	/RESET	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 (+5.0V)
15	Vss	Power Supply	Ground
16	VOUT	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		-	5.0	-	V
Supply Current	IDD	Ta=25°, VDD=5.0V	-	1.5	2.5	mA
Supply for LCD (contrast)	VLCD	Ta =25	-	9.5	10	V
"H" Level input	Vih		2.2	-	VDD	V
"L" Level input	Vil		0	-	0.6	V
"H" Level output	Voh		2.4	-	-	V
"L" Level output	Vol		-	-	0.4	V
Backlight supply voltage	VLED		-	3.2	-	V
Backlight supply current	ILED	VLED=3.2V	-	45	60	mA

## Optical Characteristics

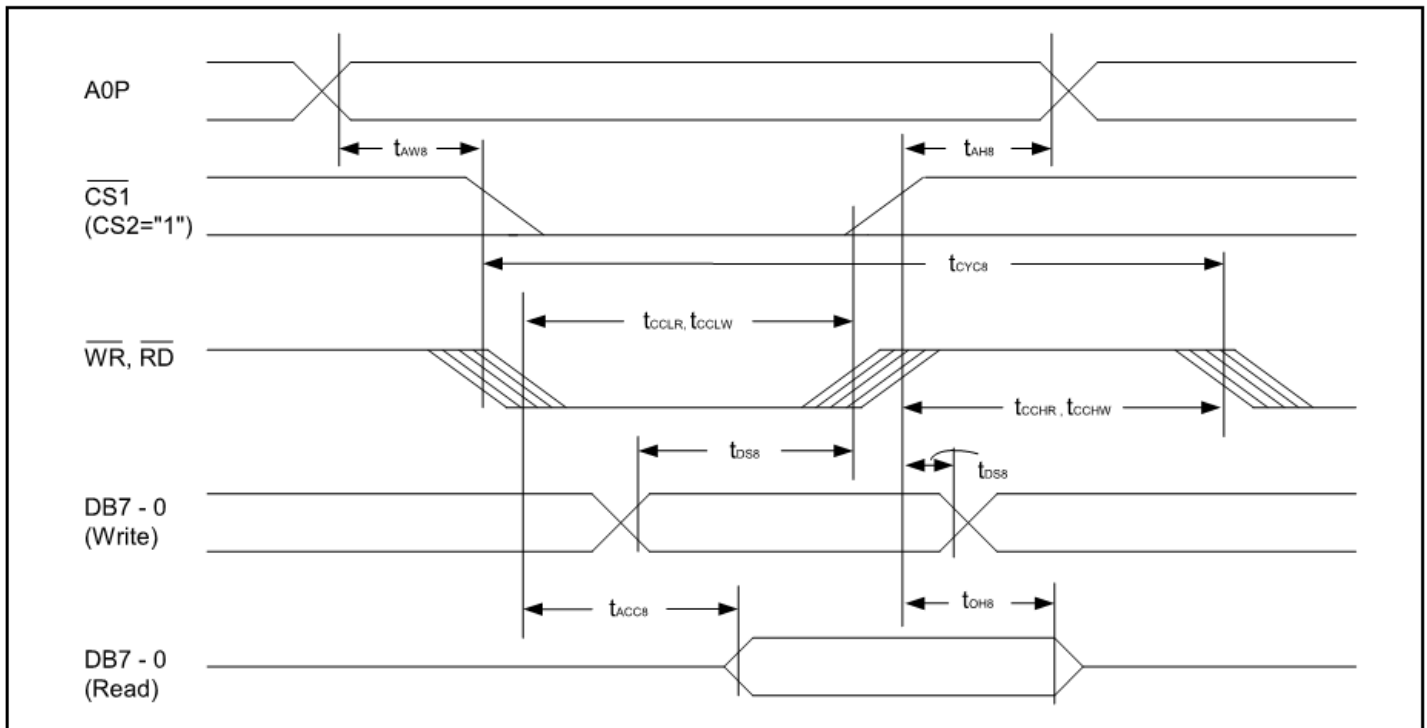
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical		Cr≥3	-45	-	+25	°
Viewing Angle - Horizontal	Φ		-35	-	+35	°
Contrast Ratio	K		3.0	-	-	-
Response Time (rise)	Tr	25°C	-	-	250	ms
Response Time (fall)	Tf	25°C	-	-	250	ms

# Controller Information

Built-in SPLC501C. Download specification at [http://www.newhavendisplay.com/app\\_notes/SPLC501C.pdf](http://www.newhavendisplay.com/app_notes/SPLC501C.pdf)

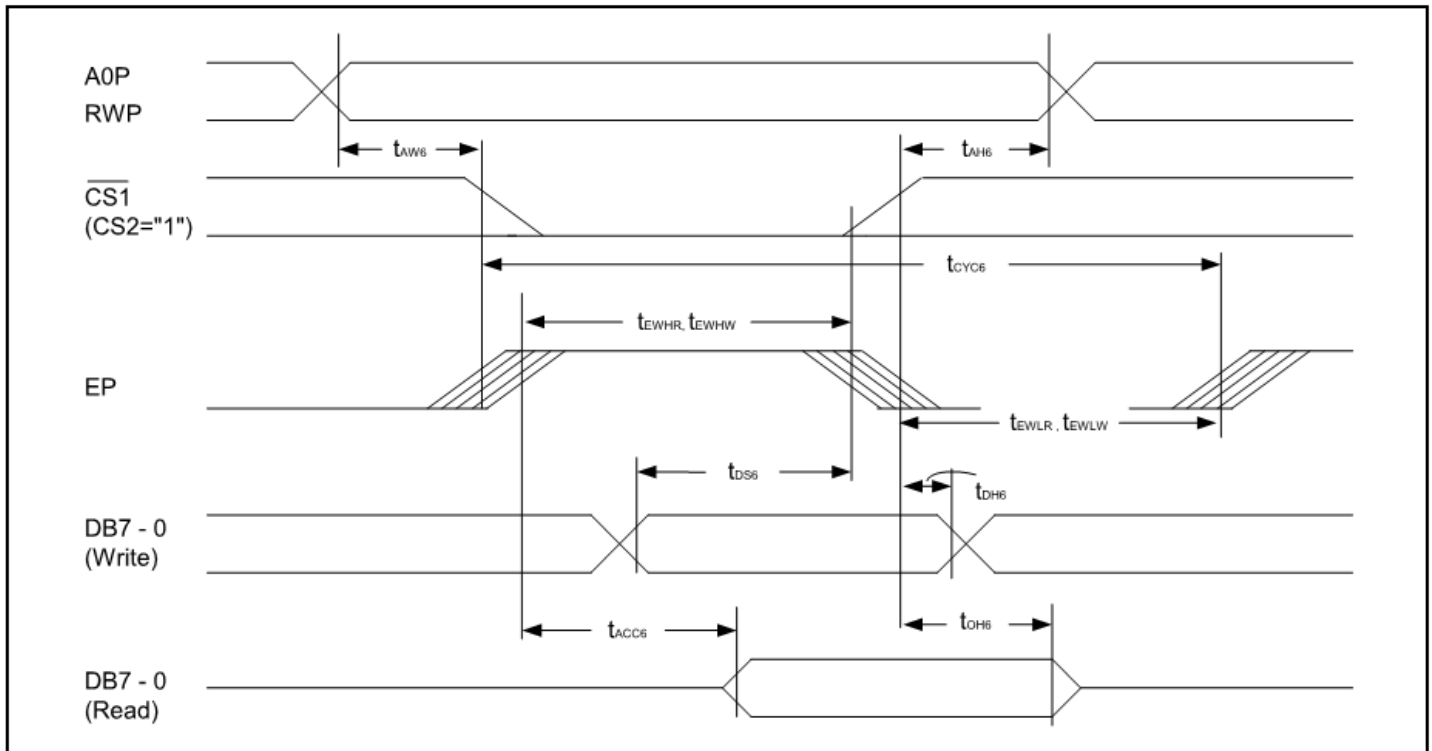
## Timing Characteristics

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



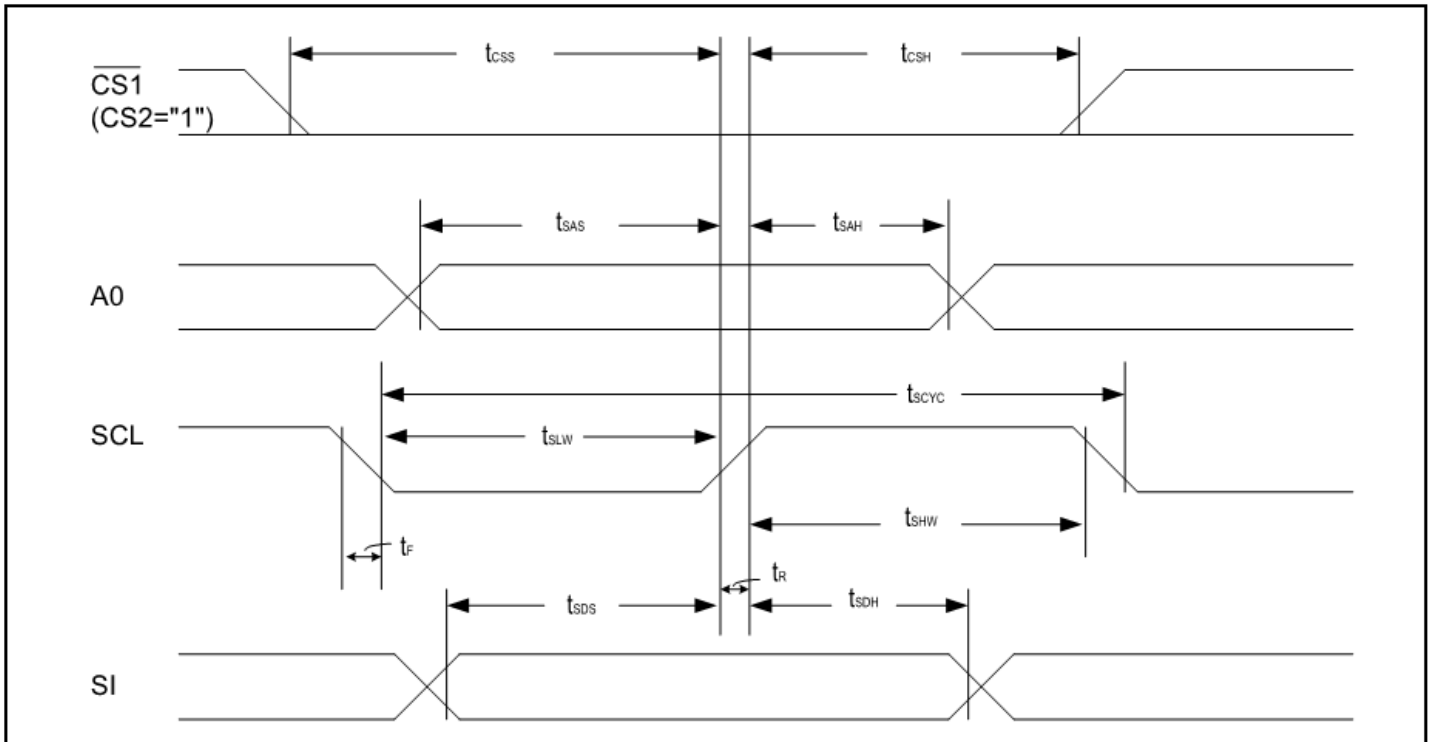
Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0P	$t_{AH8}$		0	-	ns
Address setup time	A0P	$t_{AW8}$		0	-	ns
System cycle time	A0P	$t_{CYC8}$		300	-	ns
Control L pulse width ( $\overline{WR}$ )	$\overline{WR}$	$t_{CCLW}$		60	-	ns
Control L pulse width ( $\overline{RD}$ )	$\overline{RD}$	$t_{CCLR}$		120	-	ns
Control H pulse width ( $\overline{WR}$ )	$\overline{WR}$	$t_{CCHW}$		60	-	ns
Control H pulse width ( $\overline{RD}$ )	$\overline{RD}$	$t_{CCHR}$		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	A0P	$t_{AW6}$		0	-	ns
System cycle time	A0P	$t_{CYC6}$		300	-	ns
Data setup time	DB7 - 0	$t_{DS6}$	$C_L = 100pF$	40	-	ns
Data hold time		$t_{DH6}$		15	-	ns
Access time	DB7 - 0	$t_{ACC6}$		-	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		$t_{SCYC}$	-	250	-	ns
SCL 'H' pulse width	SCL	$t_{SHW}$	-	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 <sub>5</sub> 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 <sub>5</sub> 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](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)