

# NHD-C12864LZ-FSW-FBW-3V3

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

NHD-	Newhaven Display
C12864-	128 x 64 pixels
LZ-	Model
F-	Transflective
SW-	Side White LED backlight
F-	FSTN (+)
B-	6:00 view
W-	Wide Temp (-20°C ~ +70°C)
3V3-	3Vdd, 3 Volt Backlight
	<b>RoHS Compliant</b>

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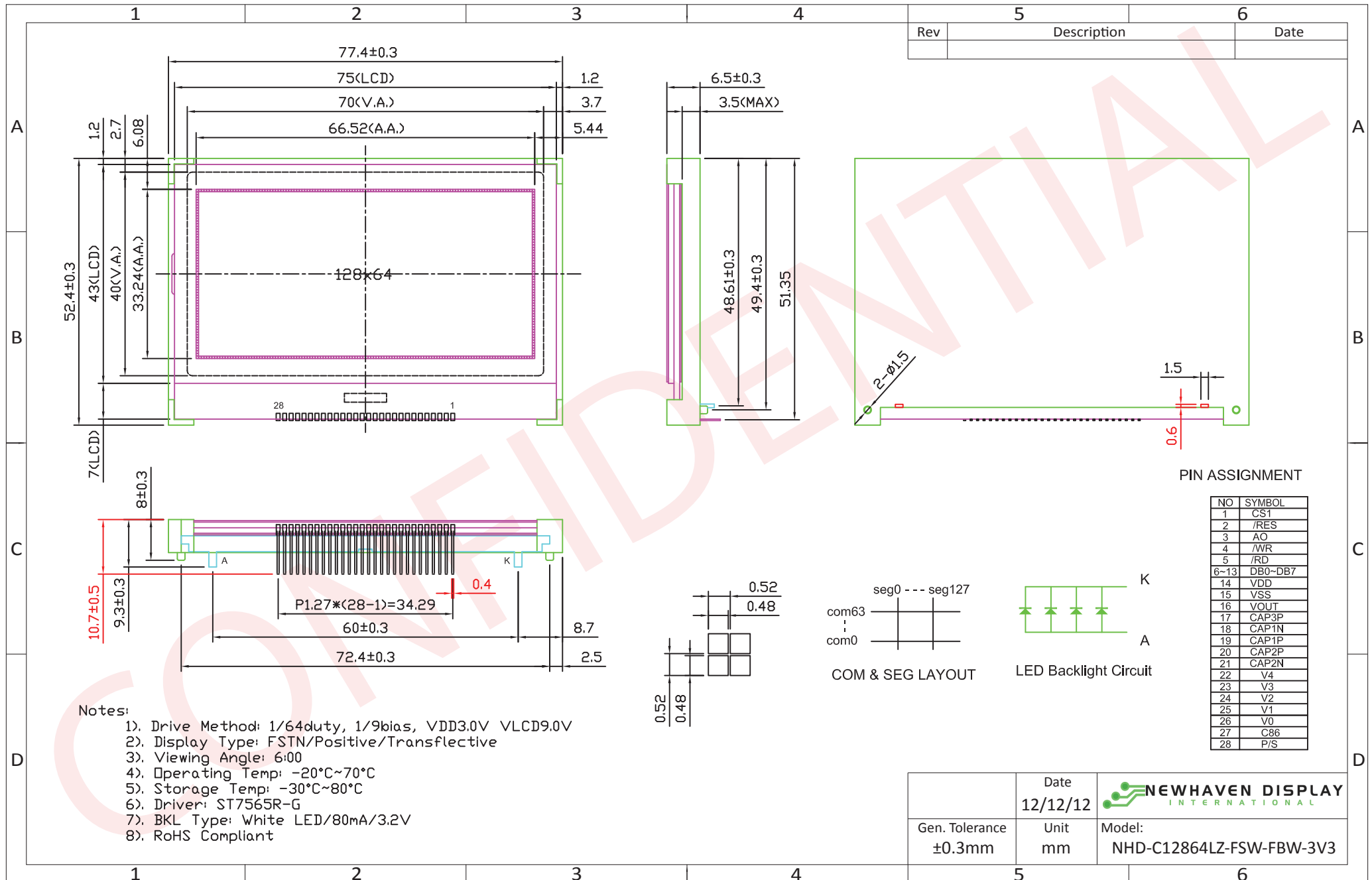
## Document Revision History

Revision	Date	Description	Changed by
0	1/10/2010	Initial Release	MC
1	7/7/2011	Packaging Procedure added	AK
2	12/12/2012	Example initialization program updated	AK
3	4/10/2013	Serial interface timing added	AK

## Functions and Features

- 128 x 64 pixels
- Parallel / Serial MPU interface
- Built-in ST7565R-G Controller
- +3.0V power supply
- 1/64 duty cycle; 1/9 bias
- RoHS Compliant

# Mechanical Drawing



**Notes:**

- 1). Drive Method: 1/64duty, 1/9bias, VDD3.0V VLCD9.0V
- 2). Display Type: FSTN/Positive/Transflective
- 3). Viewing Angle: 6:00
- 4). Operating Temp: -20°C~70°C
- 5). Storage Temp: -30°C~80°C
- 6). Driver: ST7565R-G
- 7). BKL Type: White LED/80mA/3.2V
- 8). RoHS Compliant

Rev	Description	Date

Date	12/12/12	 <b>NEWHAVEN DISPLAY</b> INTERNATIONAL
Gen. Tolerance	±0.3mm	
Date		Model:
Unit	mm	NHD-C12864LZ-FSW-FBW-3V3

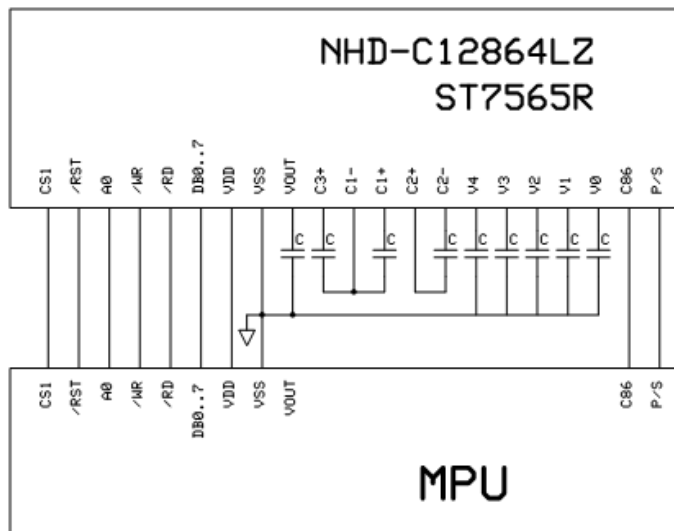
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## Pin Description and Wiring Diagram

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	/WR	MPU	Read/write select signal. R/W=1: Read R/W=0: Write
5	/RD	MPU	Operation enable signal. Falling edge triggered.
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	MPU	
13	DB7	MPU	
14	VDD	Power Supply	Power supply for LCD and logic (+3.0V)
15	VSS	Power Supply	Ground
16	VOOUT	Power Supply	Connect to 1uF cap to VSS
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	V4	Power Supply	1.0uF-2.2uF cap to VSS
23	V3	Power Supply	1.0uF-2.2uF cap to VSS
24	V2	Power Supply	1.0uF-2.2uF cap to VSS
25	V1	Power Supply	1.0uF-2.2uF cap to VSS
26	V0	Power Supply	1.0uF-2.2uF cap to VSS
27	C86	MPU	Select MPU interface pin. C86=H: 6800; C86=L: 8080
28	PS	MPU	Parallel/Serial select. PS= H: Parallel; PS=L: Serial

**LCD connector:** 1.27mm pitch pins.

**Backlight connector:** 1.5mm wide pins.



## 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		2.85	3.0	3.3	V
Supply Current	IDD	Ta=25°C, VDD=3.0V	-	0.25	0.45	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°C	-	9.0	-	V
"H" Level input	Vih		0.8*VDD	-	VDD	V
"L" Level input	Vil		VSS	-	0.2*VDD	V
"H" Level output	Voh		0.8*VDD	-	VDD	V
"L" Level output	Vol		VSS	-	0.2*VSS	V
LED Backlight voltage	VLED		-	3.2	-	V
LED Backlight current	ILED	VLED=3.2V	-	80	-	mA

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Top		CR ≥ 2	-	20	-	°
Viewing Angle – Bottom			-	50	-	°
Viewing Angle – Left			-	30	-	°
Viewing Angle – Right			-	30	-	°
Contrast Ratio	CR		3	5	-	-
Response Time (rise)	Tr		-	150	250	ms
Response Time (fall)	Tf		-	200	300	ms

## Controller Information

Built-in ST7565R-G controller.

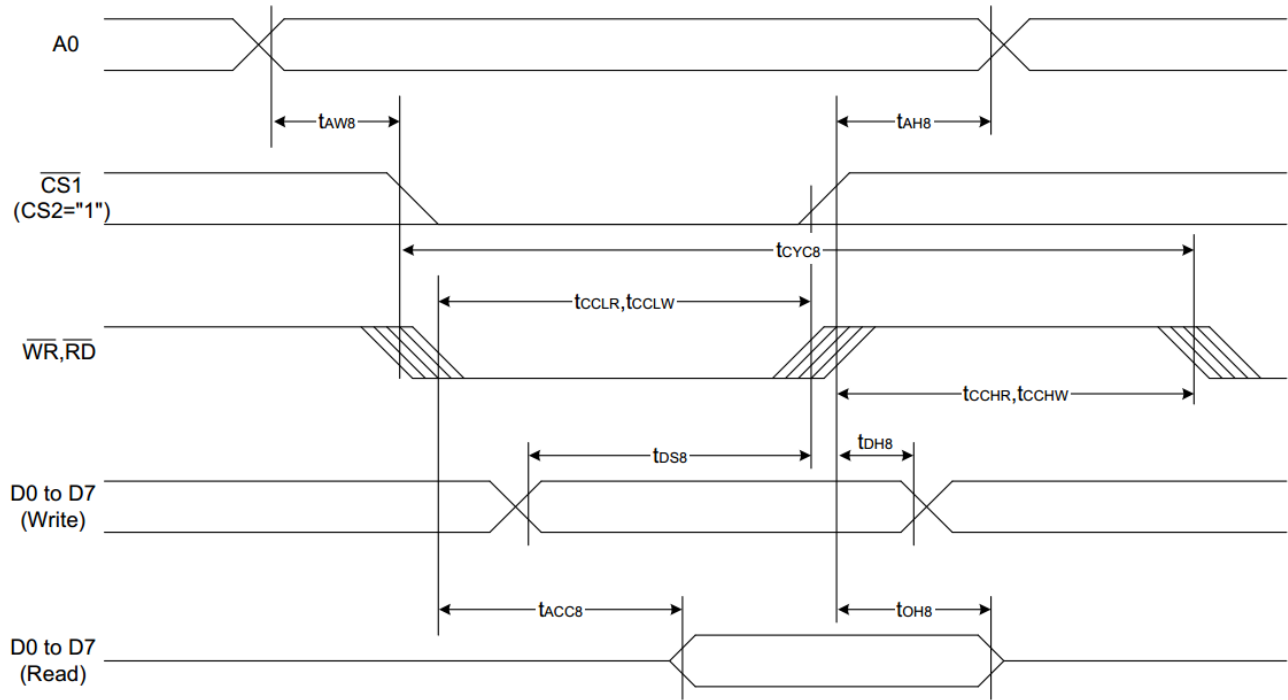
Please download specification at [http://www.newhavendisplay.com/app\\_notes/ST7565R.pdf](http://www.newhavendisplay.com/app_notes/ST7565R.pdf)

## 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					0	Sets the display RAM display start line address	
(3) Page address set	0	1	0	1	0	1	1	Page address				0	Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				0	Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit				0	0	0	0	Least significant column address				0	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							0	Writes to the display RAM	
(7) Display data read	1	0	1	Read data							0	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 (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	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	*	*	*	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			0	Select internal power supply operating mode
(17) V <sub>0</sub> voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			0	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 <sub>0</sub> output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value				0	0		
(19) Sleep mode set	0	1	0	1	0	1	0	1	1	0	0	1	0: Sleep mode, 1: Normal mode
(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	0	0	step-up value	
(21) NOP	0	1	0	1	1	1	0	0	0	1	1	1	Command for non-operation
(22) Test	0	1	0	1	1	1	1	*	*	*	*	*	Command for IC test. Do not use this command

# Timing Characteristics

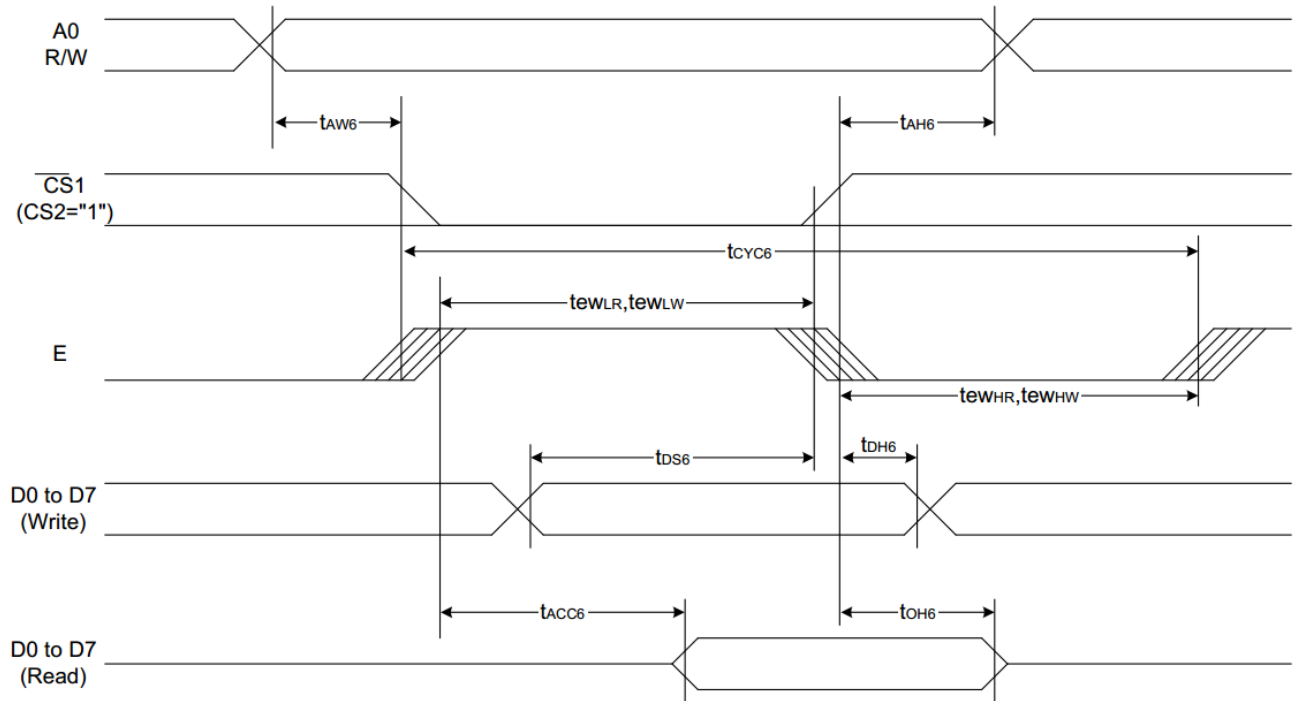
**System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)**



(V<sub>DD</sub> = 3.3V, T<sub>a</sub> = -30 to 85°C)

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

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

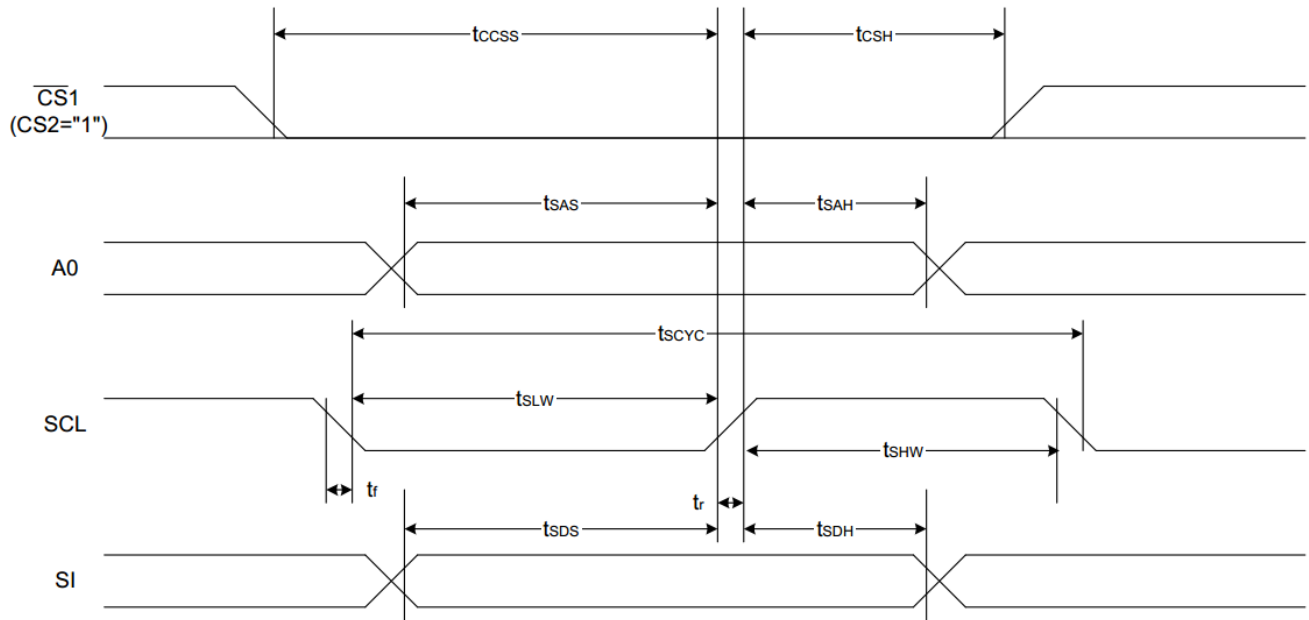


( $V_{DD} = 3.3V, T_a = -30$  to  $85^{\circ}C$ )

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	$t_{DS6}$		40	—	
WRITE Address hold time		$t_{DH6}$		0	—	
READ access time		$t_{ACC6}$	$C_L = 100$ pF	—	70	
READ Output disable time		$t_{OH6}$	$C_L = 100$ pF	5	50	



### The 4-line SPI Interface



( $V_{\text{DD}} = 3.3\text{V}$ ,  $T_{\text{a}} = -30$  to  $85^{\circ}\text{C}$ )

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
4-line SPI Clock Period	SCL	$T_{\text{scyc}}$		50	—	ns
SCL "H" pulse width		$T_{\text{shw}}$		25	—	
SCL "L" pulse width		$T_{\text{SLW}}$		25	—	
Address setup time	A0	$T_{\text{SAS}}$		20	—	
Address hold time		$T_{\text{SAH}}$		10	—	
Data setup time	SI	$T_{\text{SDS}}$		20	—	
Data hold time		$T_{\text{SDH}}$		10	—	
CS-SCL time	CS	$T_{\text{CSS}}$		20	—	
CS-SCL time		$T_{\text{CSH}}$		40	—	

## Example Initialization Program

```
void comm_out(unsigned int c)
{
    CS1 = 0;           //Active Low
    AO = 0;           //LOW = instruction
    delay(1);
    WRT = 0;          // /WR in 8080 mode; R/W in 6800 mode
    P1 = c;
    delay(1);
    WRT = 1;          // /WR in 8080 mode; R/W in 6800 mode
    CS1 = 1;          //inactive
    delay(5);
}

void data_out(unsigned int d)
{
    CS1 = 0;           //Active Low
    AO = 1;           //High = Data
    delay(1);
    WRT = 0;
    //RDD = 1;
    P1 = d;
    delay(1);
    WRT = 1;
    CS1 = 1;          //inactive
}

void init()
{
    RDD = 1;          // /RD in 8080 mode; E in 6800 mode
    WRT = 1;          // /WR in 8080 mode; R/W in 6800 mode
    CS1 = 0;
    RST = 1;          // /RST in 8080 mode; /RES in 6800 mode
    RST = 0;          // /RST in 8080 mode; /RES in 6800 mode
    delay(2);
    RST = 1;          // /RST in 8080 mode; /RES in 6800 mode
    delay(2);
    comm_out(0xA2);   //added 1/9 bias

    comm_out(0xA0);   //ADC segment driver direction (A0=Normal)
    comm_out(0xC8);   //added
    comm_out(0xC0);   //COM output scan direction (C0= Normal)
    comm_out(0x40);   //Operating Mode
    delay(0);
    comm_out(0x25);   //resistor ratio
    delay(0);

    comm_out(0x81);   //electronic volume mode set
    delay(0);
    comm_out(0x19);   //electronic volume register set
    delay(0);
    comm_out(0x2F);   //power control set
    delay(0);
    comm_out(0xAF);   //display ON/OFF - set to ON
}
```

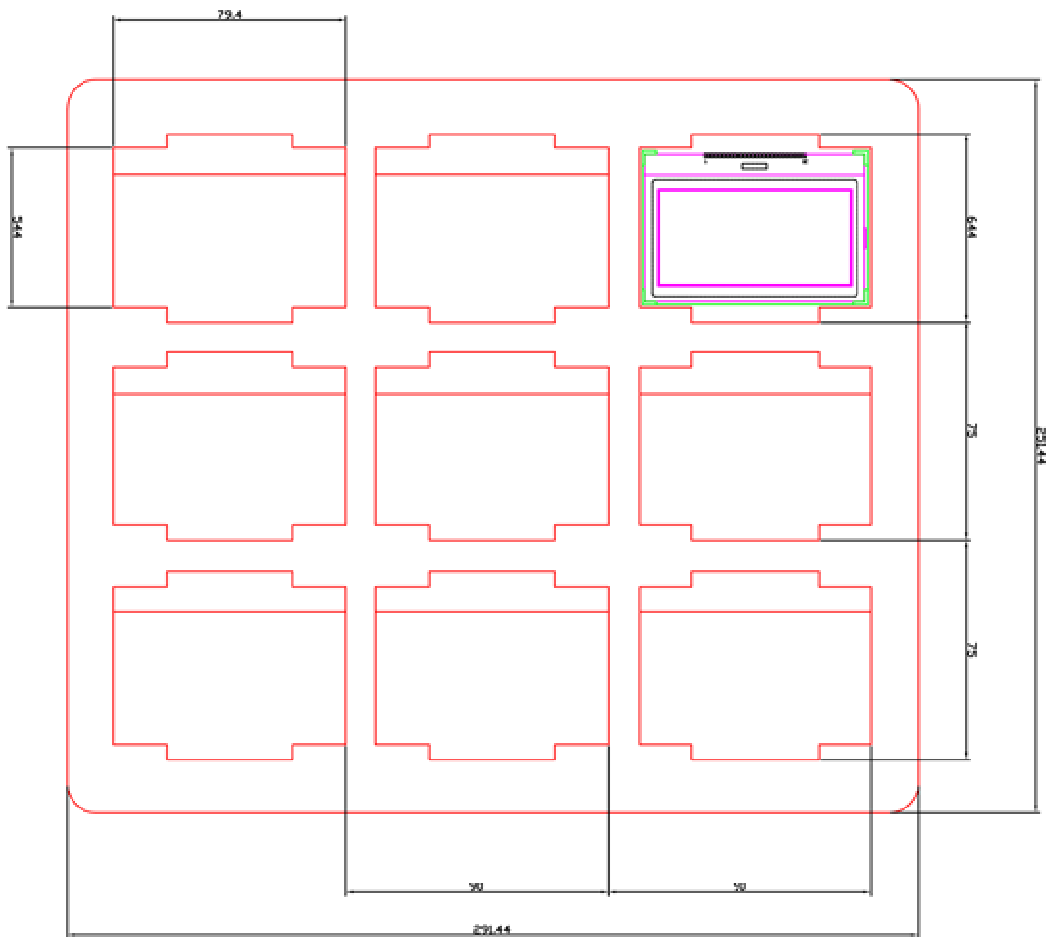
# Packaging Procedure

## 1. Packing Materials

NO.	ITEM	Dimension(LXWXH) (mm)	Quantity
1	Tray	292x251x20mm	9
2	Box	312x265x65mm	27
3	Carton	344x537x335mm	270

## 2. Packing Method

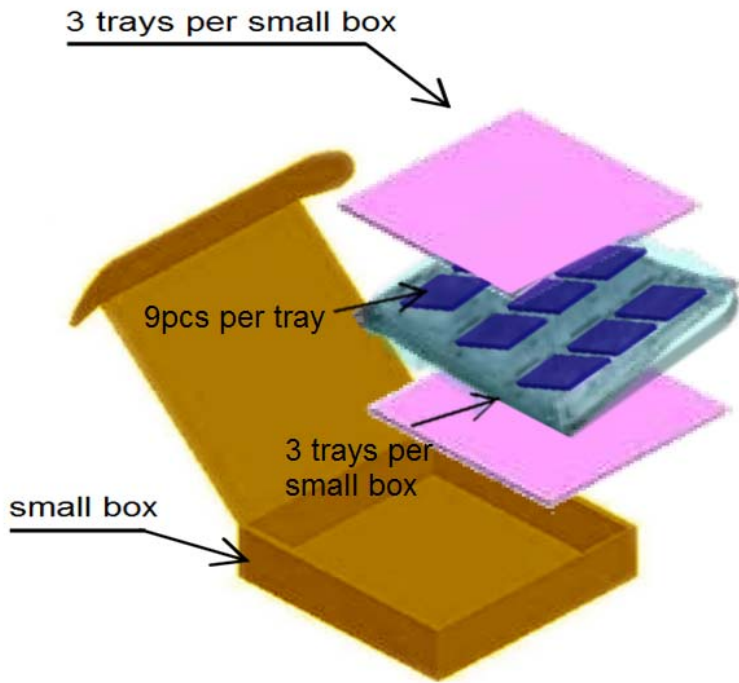
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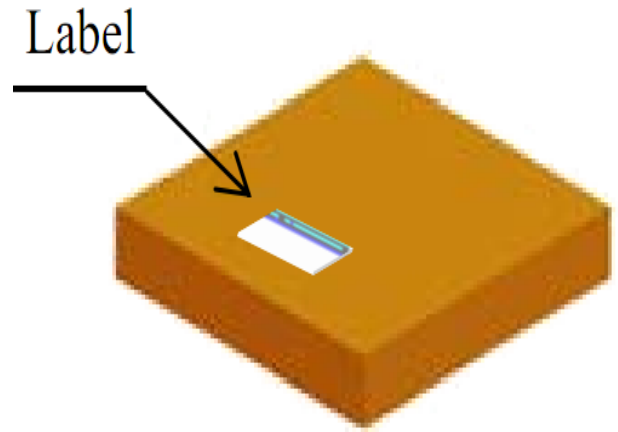
(2)



(3)

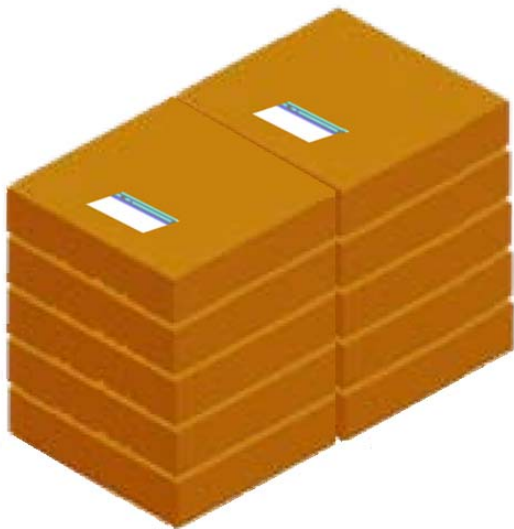


(4)

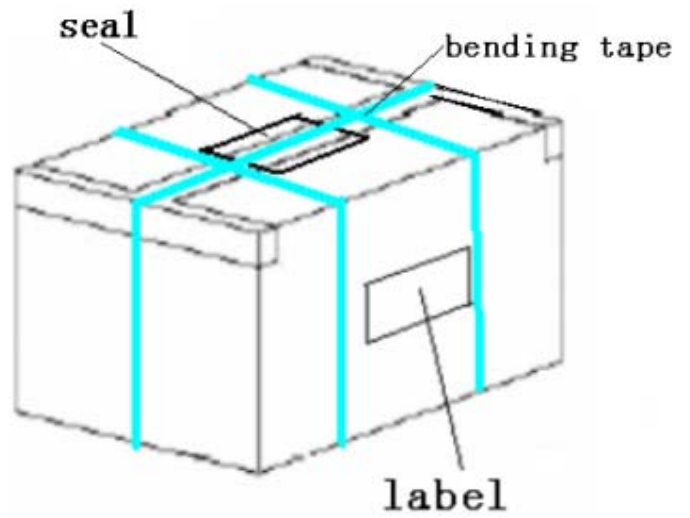


(5)

10 small boxes per carton



(6)



## 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.

See full Quality Specification at: [http://www.newhavendisplay.com/specs/quality\\_spec.pdf](http://www.newhavendisplay.com/specs/quality_spec.pdf)

## 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)