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
	RoHS Compliant

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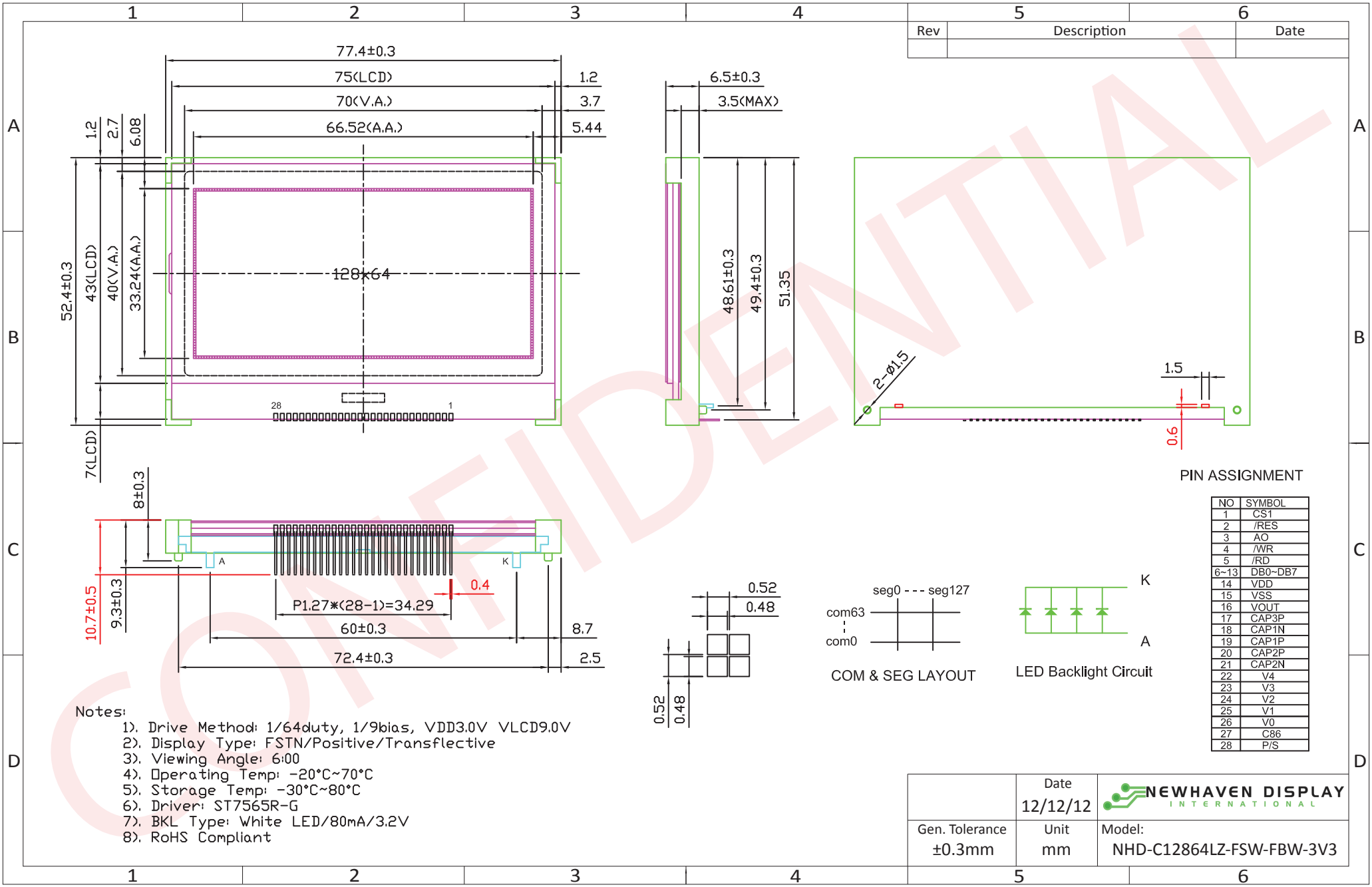
Document Revision History

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

Functions and Features

- **128 x 64 pixels**
- **8080 or 6800 MPU interface**
- **Built-in ST7565R-G Controller**
- **+3.0V power supply**
- **1/64 duty cycle; 1/9 bias**
- **RoHS Compliant**

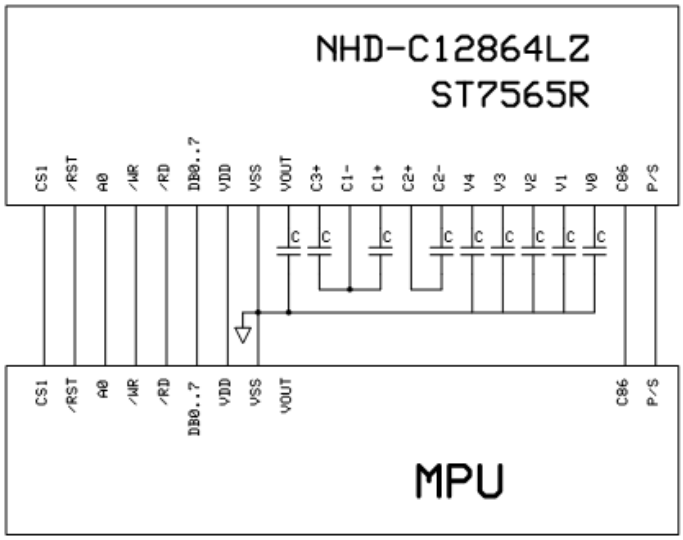
Mechanical Drawing



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	VOUT	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		2.4	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

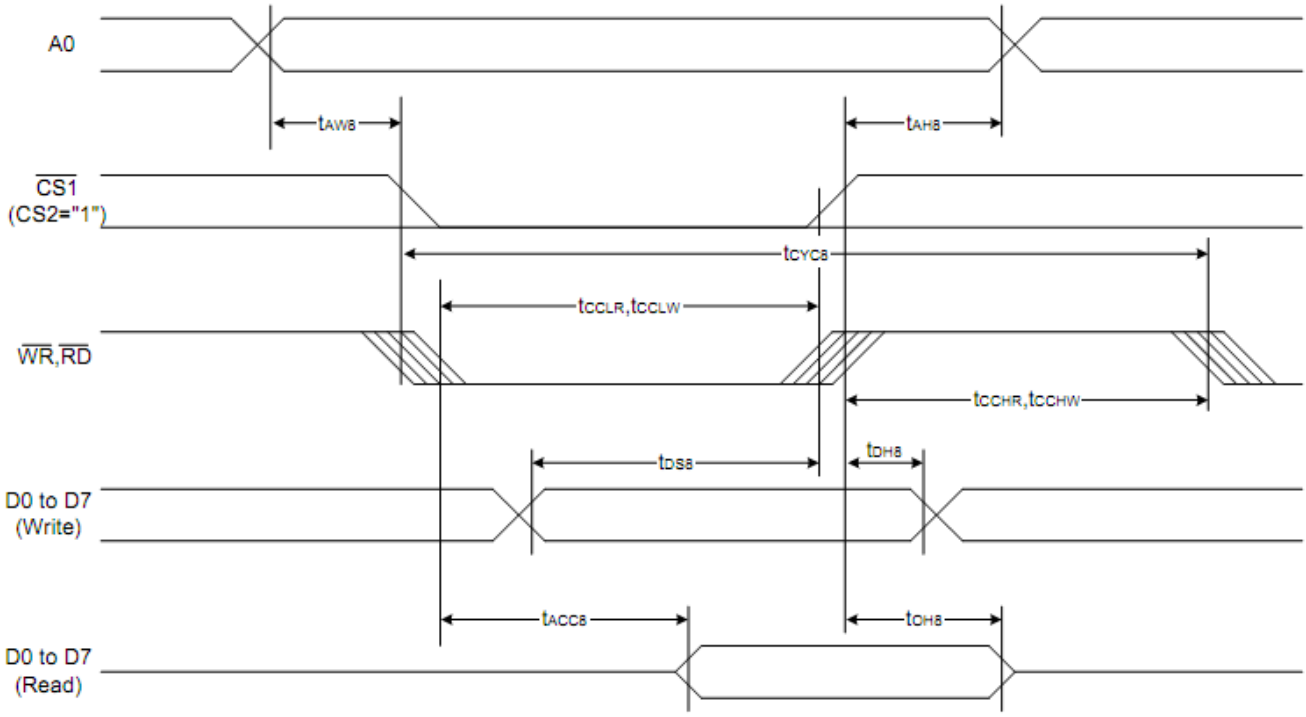
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical	K	CR ≥ 2	-50	-	+20	°
Viewing Angle - Horizontal	Φ	CR ≥ 2	-30	-	+30	°
Contrast Ratio	CR		3	5	-	-
Response Time (rise)	Tr		-	150	250	ms
Response Time (fall)	Tf		-	200	300	ms

Controller Information

Built-in ST7565R-G controller.
Please download specification at http://www.newhavendisplay.com/app_notes/ST7565R.pdf

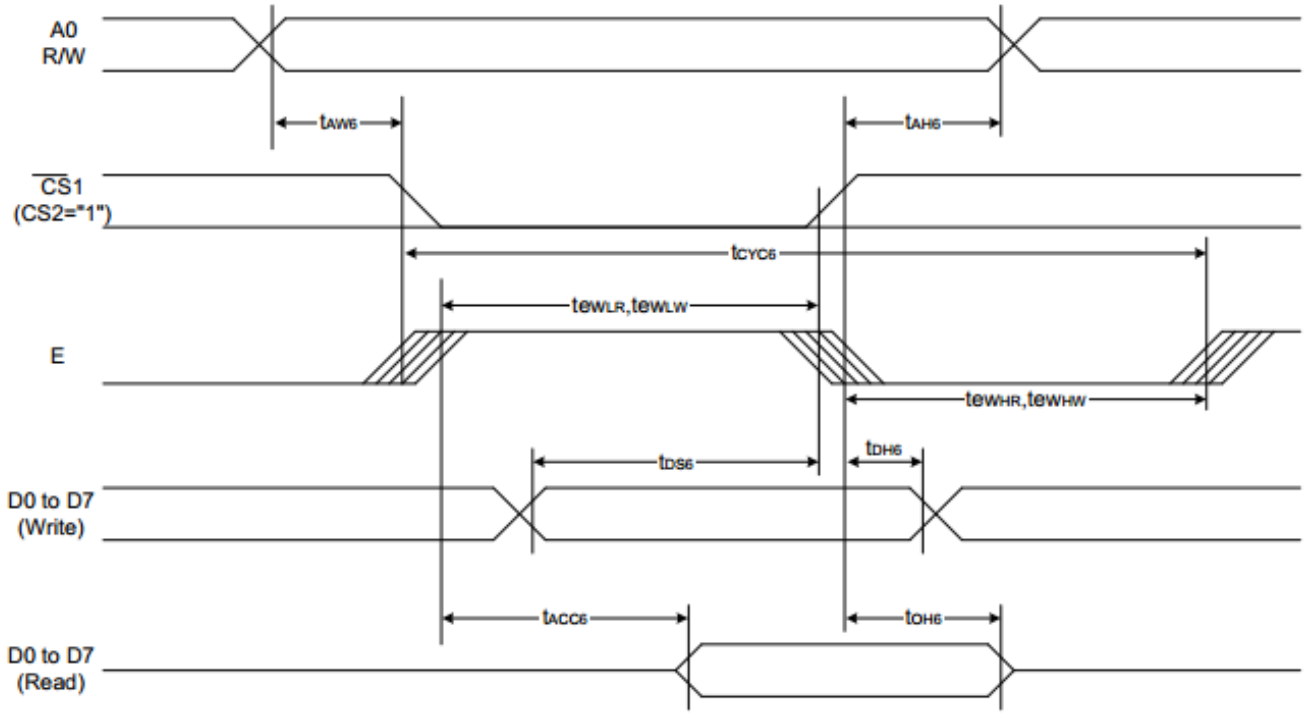
Timing Characteristics

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 pF	—	70	
READ Output disable time		t_{OH8}	C_L = 100 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_{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	

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	1	0	0	0	0	1	Most 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.
				0	0	0	0	Least significant 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	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_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	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	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

```
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
```

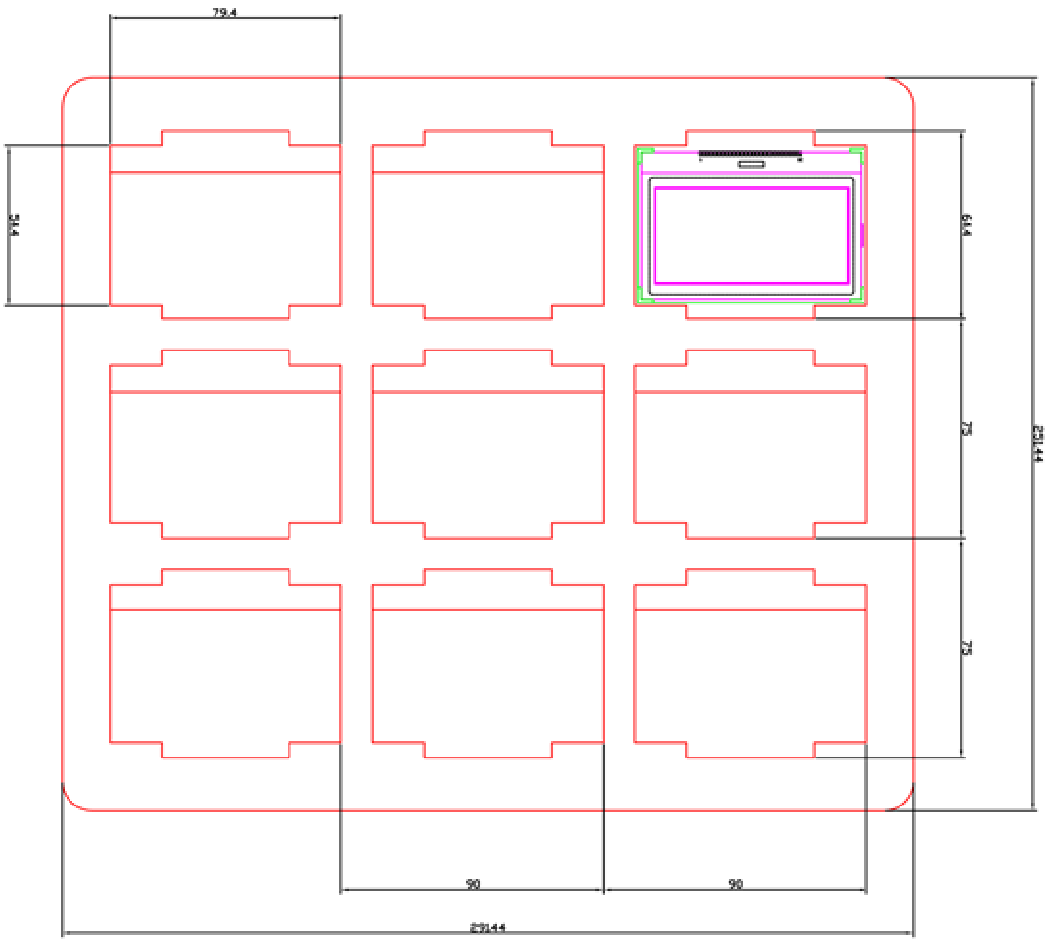
Packaging Procedure

1. Packing Materials

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

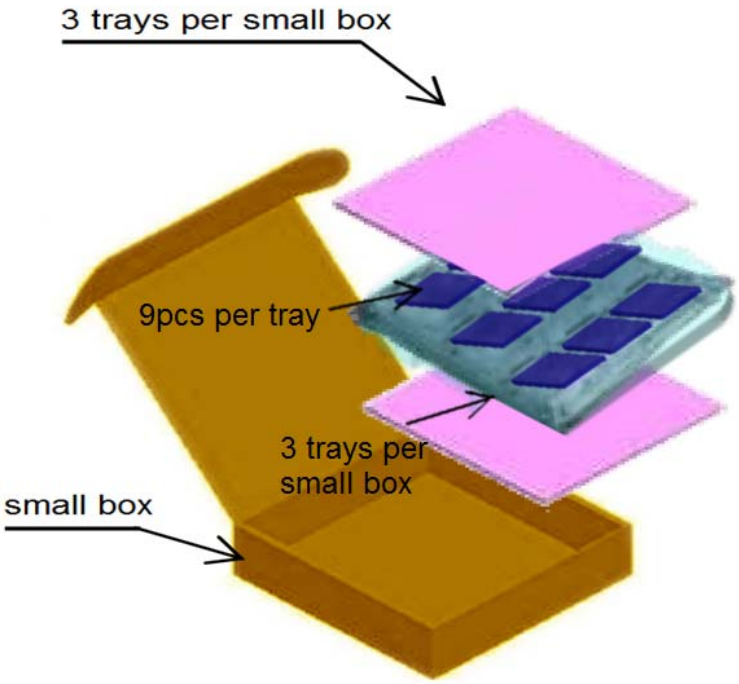
2. Packing Method

(1)

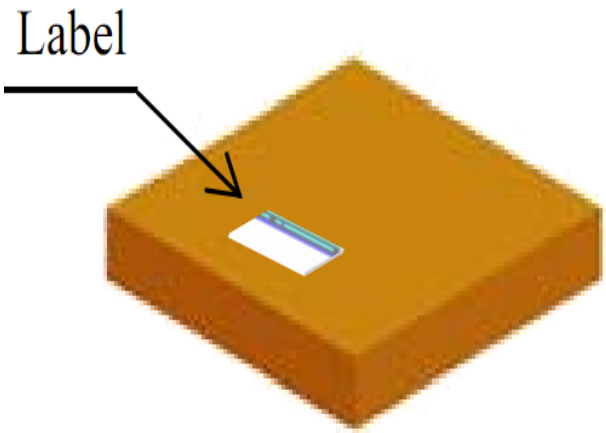


(2)

(3)

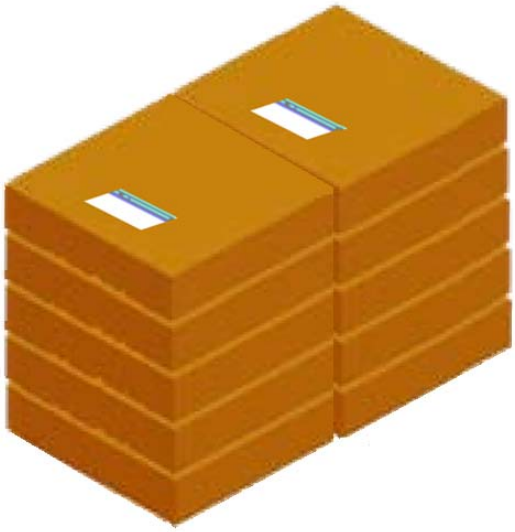


(4)

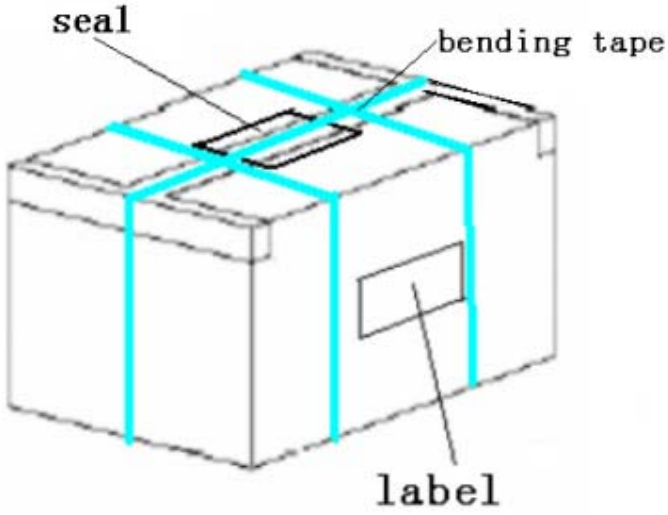


(5)

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

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