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NHD-12864WG-BTGH-T#N

Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
12864-	128 x 64 pixels
WG-	Display Type: Graphic
B-	Model
T-	White LED Backlight
G-	STN- Gray
H-	Transflective, Wide Temperature (-20°C ~ +70°C) 6:00 view
T#N-	Built-in Temperature Compensation Circuit
	RoHS Compliant

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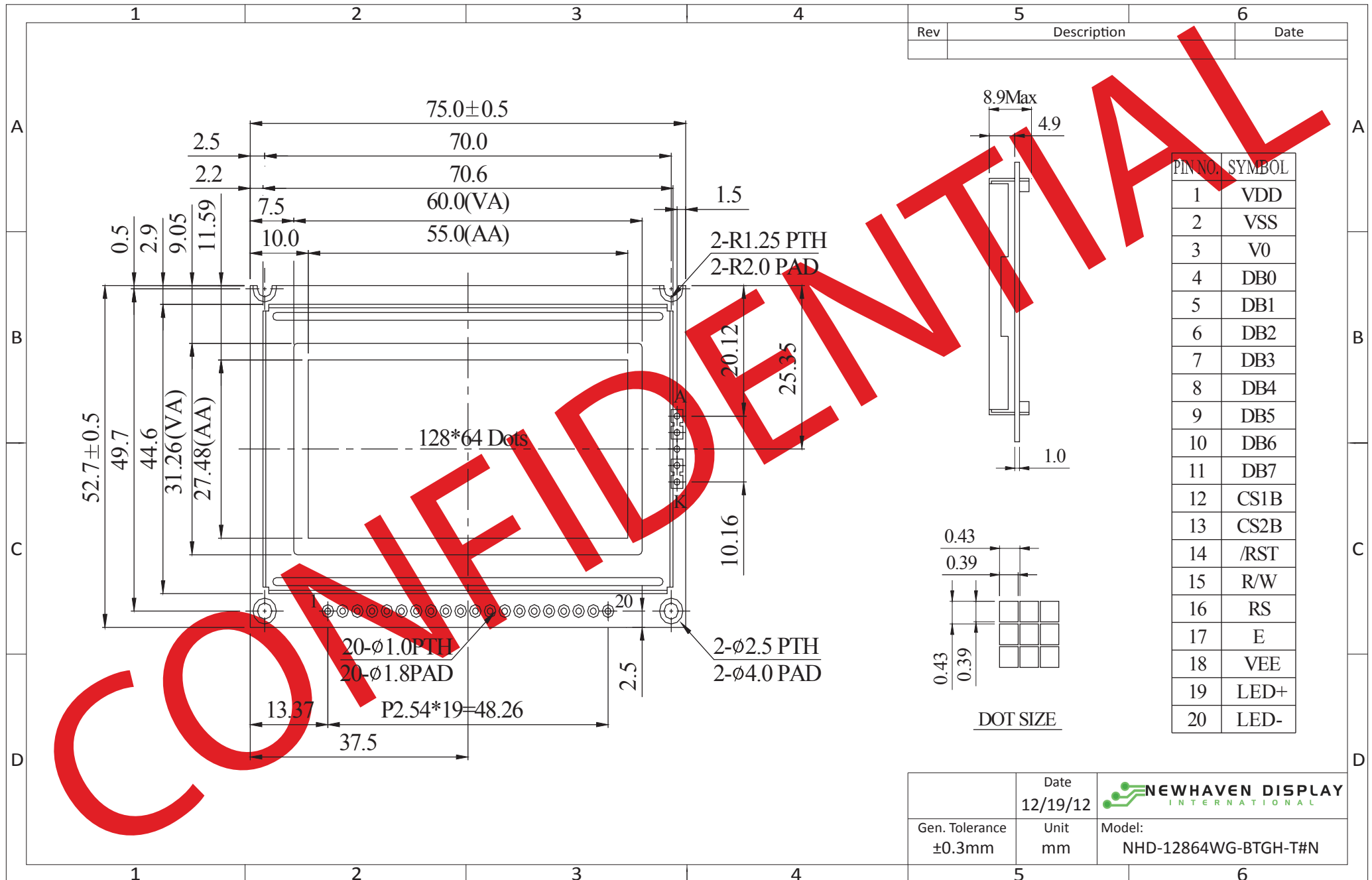
Document Revision History

Revision	Date	Description	Changed by
0	2/28/2008	Initial Release	-
1	3/22/2009	User guide reformat	BE
2	4/14/2010	Block diagram/Initialization updated	BE
3	2/16/2011	Mechanical drawing updated	AK
4	12/19/2012	Controller information updated	AK

Functions and Features

- 128 x 64 pixels
- Built-in NT7108C controller
- +5.0V power supply
- 1/64 duty cycle
- RoHS Compliant

Mechanical Drawing



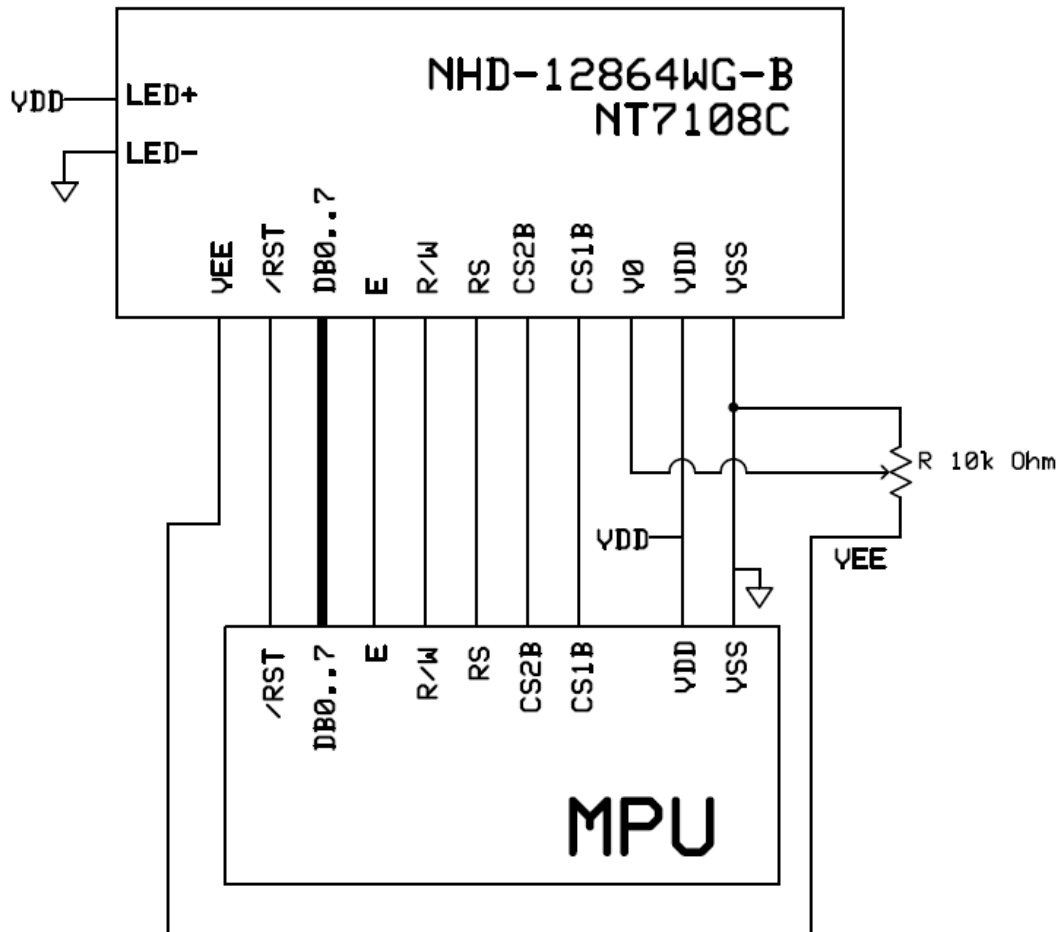
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Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	VDD	Power Supply	Power supply for logic (+5.0V)
2	VSS	Power Supply	Ground
3	V0	Adj.Power Supply	Power Supply for contrast (approx. -3.5V)
4-11	DB0-DB7	MPU	Bi-directional 8-bit data bus
12	CS1B	MPU	Chip Selection: CS1=H, CS2=L : select IC1 (left side) CS1=L, CS2=H : select IC2 (right side)
13	CS2B	MPU	
14	/RST	MPU	Active LOW Reset Signal
15	R/W	MPU	Read/Write select signal. R/W=1: Read R/W: =0: Write
16	RS	MPU	Register select: 1=Data, 0= Instruction
17	E	MPU	Operation enable signal. Falling edge triggered.
18	VEE	Power Supply	Negative voltage output (-10V)
19	LED+	Power Supply	Power for LED Backlight (+3.5V)
20	LED-	Power Supply	Ground for Backlight

Recommended LCD connector: 2.54mm pitch pins

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		4.75	5.0	5.25	V
Supply Current	IDD	Ta=25°, VDD=5.0V	-	1.5	-	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°	-	8.5	-	V
"H" Level input	Vih		0.7*VDD	-	VDD	V
"L" Level input	Vil	-	0	-	0.3*VDD	V
"H" Level output	Voh	-	2.4	-	-	V
"L" Level output	Vol	-	-	-	0.4	V
Backlight Supply Voltage	VLED	-	-	3.5	3.7	V
Backlight Supply Current	ILED	VLED=3.5V	-	80	120	mA

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Top		Cr ≥ 2	-	20	-	°
Viewing Angle – Bottom			-	40	-	°
Viewing Angle – Left			-	30	-	°
Viewing Angle – Right			-	30	-	°
Contrast Ratio	Cr		-	3	-	-
Response Time (rise)	Tr	-	-	200	300	ms
Response Time (fall)	Tf	-	-	200	300	ms

Controller Information

Built-in NT7108C controller.

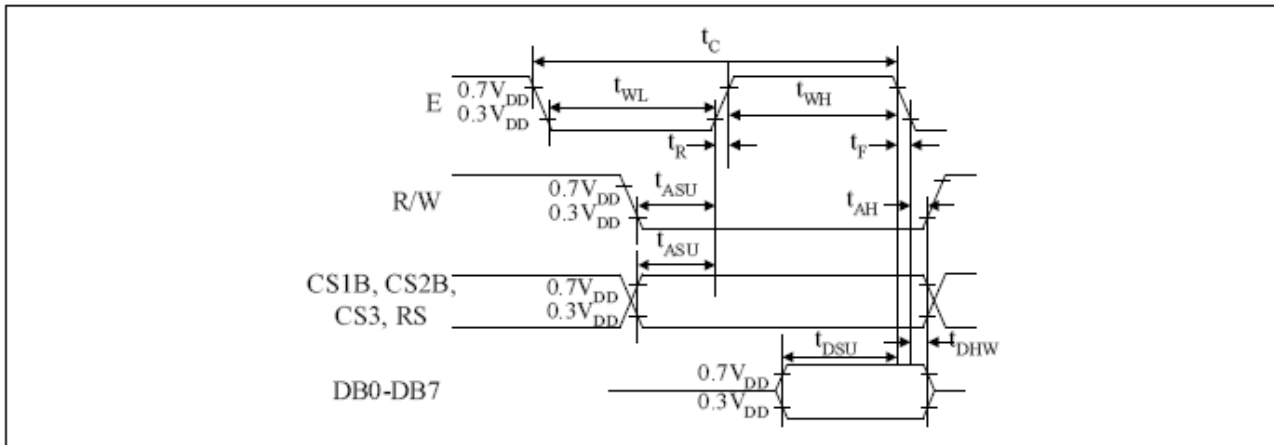
Please download specification at http://www.newhavendisplay.com/app_notes/NT7108.pdf

Table of Commands

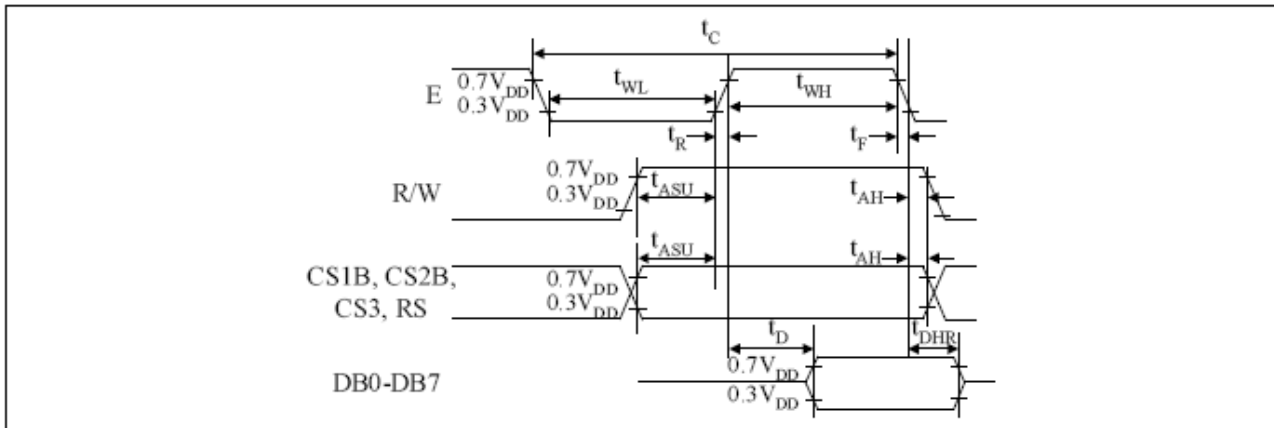
Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function	
Display on/off	L	L	L	L	H	H	H	H	H	L/H	Controls the display on or off. Internal status and display RAM data is not affected. L:OFF, H:ON	
Set address (Y address)	L	L	L	H	Y address (0-63)						Sets the Y address in the Y address counter.	
Set page (X address)	L	L	H	L	H	H	H	Page (0-7)			Sets the X address at the X address register.	
Display Start line (Z address)	L	L	H	H	Display start line (0-63)						Indicates the display data RAM displayed at the top of the screen.	
Status read	L	H	Busy	L	On/Off	Reset	L	L	L	L	Read status. BUSY L: Ready H: In operation ON/OFF L: Display ON H: Display OFF RESET L: Normal H: Reset	
Write display data	H	L	Write data									Writes data (DB0: 7) into display data RAM. After writing instruction, Y address is increased by 1 automatically.
Read display data	H	H	Read data									Reads data (DB0: 7) from display data RAM to the data bus.

Timing Characteristics

Characteristic	Symbol	Min	Type	Max	Unit
E cycle	t_c	1000	-	-	ns
E high level width	t_{WH}	450	-	-	
E low level width	t_{WL}	450	-	-	
E rise time	t_R	-	-	25	
E fall time	t_F	-	-	25	
Address set-up time	t_{ASU}	140	-	-	
Address hold time	t_{AH}	10	-	-	
Data set-up time	t_{DSU}	200	-	-	
Data delay time	t_D	-	-	320	
Data hold time (write)	t_{DHW}	10	-	-	
Data hold time (read)	t_{DHR}	20	-	-	



MPU Write Timing



MPU Read Timing

Example Initialization Program

```
'-----  
'DB0-DB7    7-14          P1  
'CS2B       16           P3.6  
'CS1B       15           P3.1  
'/RST       17           P3.2  
'R/W        5            P3.7  
'RS         4            P3.0  
'E          6            P3.4  
'-----  
Sub Init  
  Reset P3.2  
  Set P3.2  
  Reset P3.4  
  Reset P3.0  
  Reset P3.7  
  Reset P3.6  
  Reset P3.1  
  A = &H3F  
  Call Comleft                'display on  
  Call Comright              'display on  
End Sub  
'-----  
Sub Comleft  
  P1 = A  
  Set P3.6  
  Reset P3.0  
  Set P3.4  
  Reset P3.4  
  Reset P3.6  
End Sub  
  
Sub Comright  
  P1 = A  
  Set P3.1  
  Reset P3.0  
  Set P3.4  
  Reset P3.4  
  Reset P3.1  
End Sub  
  
Sub Writeleft  
  P1 = A  
  Set P3.6  
  Set P3.0  
  Set P3.4  
  Reset P3.4  
  Reset P3.6  
End Sub  
  
Sub Writeright  
  P1 = A  
  Set P3.1  
  Set P3.0  
  Set P3.4  
  Reset P3.4  
  Reset P3.1  
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 , 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 200hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 200hrs	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.	+60°C , 90% RH , 96hrs	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.

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