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 Positive, Gray
H-	Transflective, Wide Temperature, 6:00 Optimal View
T#N-	Built-in Temperature Compensation Circuit
	RoHS Compliant

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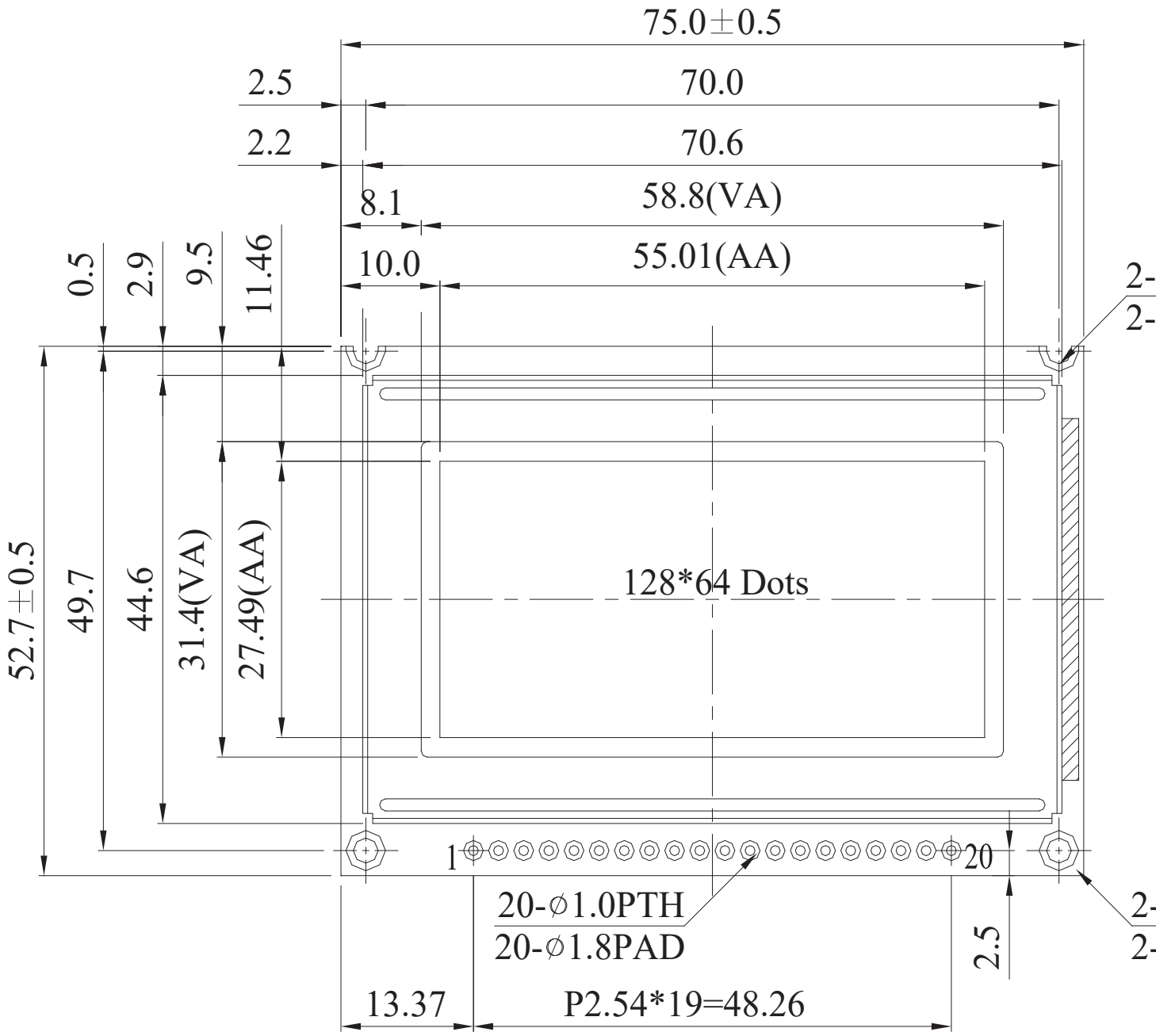
Document Revision History

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
5	5/3/16	Mechanical Drawing, Electrical & Mechanical Char. Updated	SB
6	12/8/16	Supply Current Updated	SB
7	4/8/19	Quality, Backlight & Wiring Diagram updated	AS

Functions and Features

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



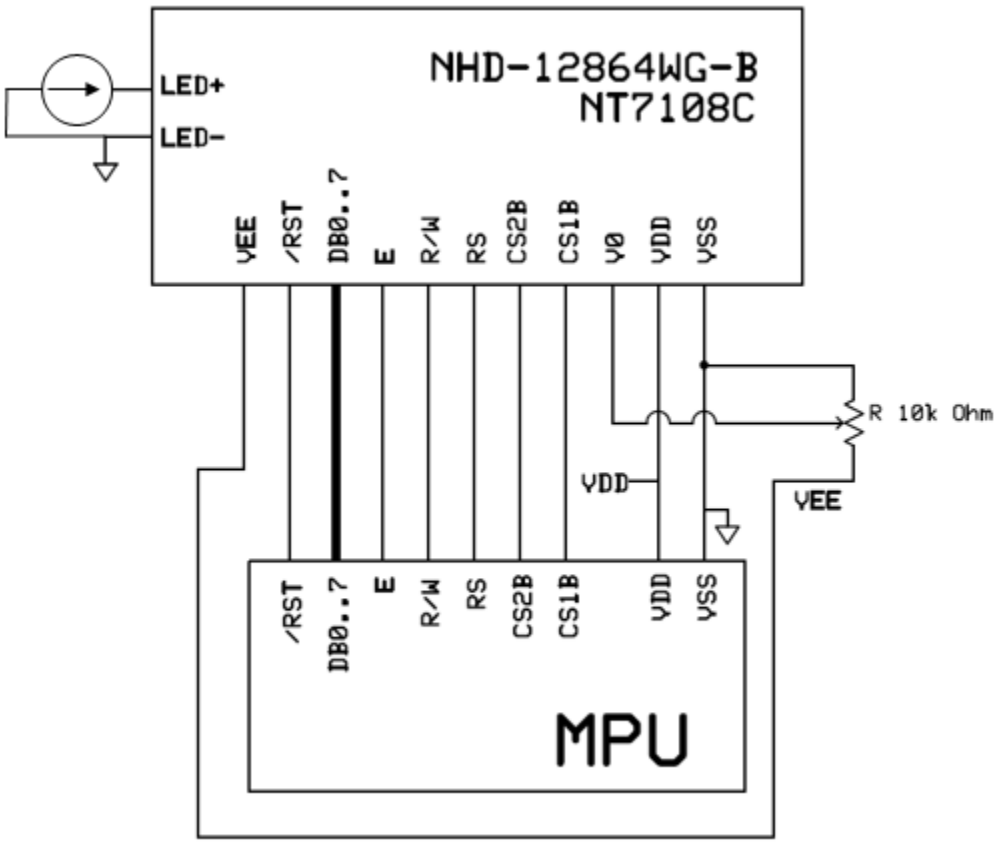
Notes:

1. Driver:	1/64 Duty
2. Voltage:	5.0V V_{DD}, 8.0V V_{LCD}
3. Display Mode:	STN Positive / Gray / Transflective
4. Optimal View:	6:00
5. Backlight:	White LED
6. Driver IC:	NT7108

Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V_{DD}	Power Supply	Supply Voltage for Logic (+5.0V)
2	V_{SS}	Power Supply	Ground
3	V_0	Adj. Power Supply	Supply Voltage for contrast (approx. -3.0V)
4-11	DB0-DB7	MPU	Bi-directional 8-bit data bus
12	CS1B	MPU	Chip Selection: CS1=H, CS2=L : select IC1 (left side)
13	CS2B	MPU	CS1=L, CS2=H : select IC2 (right side)
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	V_{EE}	Power Supply	Negative voltage output (-3.5±0.5 V)
19	LED+	Power Supply	Backlight Anode (+3.5V)
20	LED-	Power Supply	Backlight Cathode (Ground)

Recommended LCD connector: 2.54mm pitch pins
Backlight connector: - **Mates with**: -



Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T_{OP}	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T_{ST}	Absolute Max	-30	-	+80	°C
Supply Voltage	V_{DD}	-	4.5	5.0	5.5	V
Supply Current	I_{DD}	V_{DD} = 5.0V	2	3	6.6	mA
Supply for LCD (contrast)	V_{LCD}	T_{OP} = 25°C	7.8	8.0	8.2	V
"H" Level input	V_{IH}	-	0.7 * V_{DD}	-	VDD	V
"L" Level input	V_{IL}	-	V_{SS}	-	0.3*VDD	V
"H" Level output	V_{OH}	-	2.4	-	VDD	V
"L" Level output	V_{OL}	-	V_{SS}	-	0.4	V
Backlight Supply Voltage	V_{LED}	-	3.3	3.5	3.7	V
Backlight Supply Current	I_{LED}	V_{LED} = 3.5V	15	45	60	mA

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 2	-	20	-	o
	Bottom	φY-		-	40	-	o
	Left	θX-		-	30	-	o
	Right	θX+		-	30	-	o
Contrast Ratio		CR	-	-	3	-	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	150	200	ms
	Fall	T_F		-	150	200	ms

Controller Information

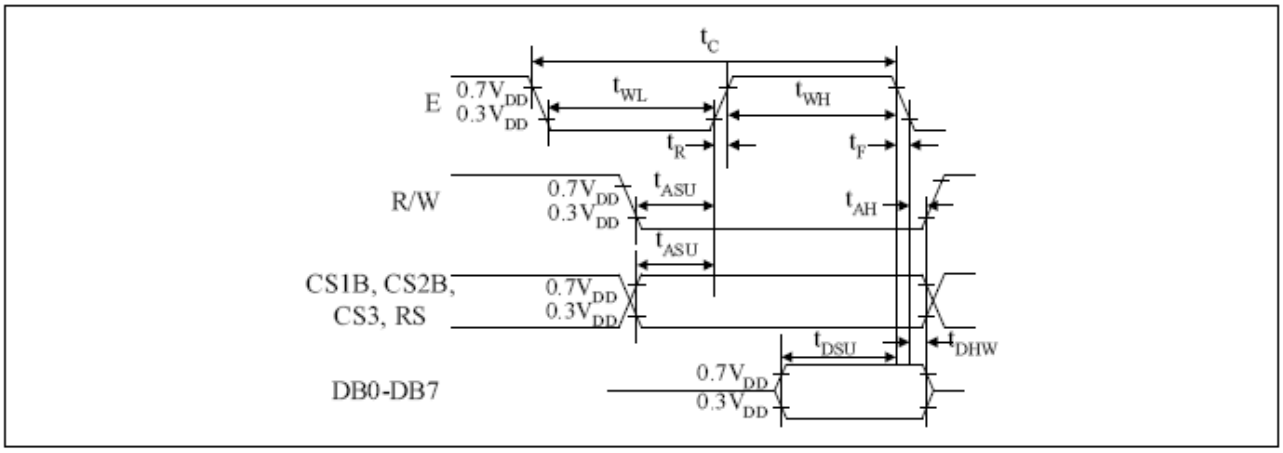
Built-in NT7108C controller.
Please download specification at http://www.newhavendisplay.com/app_notes/NT7108.pdf

Table of Commands

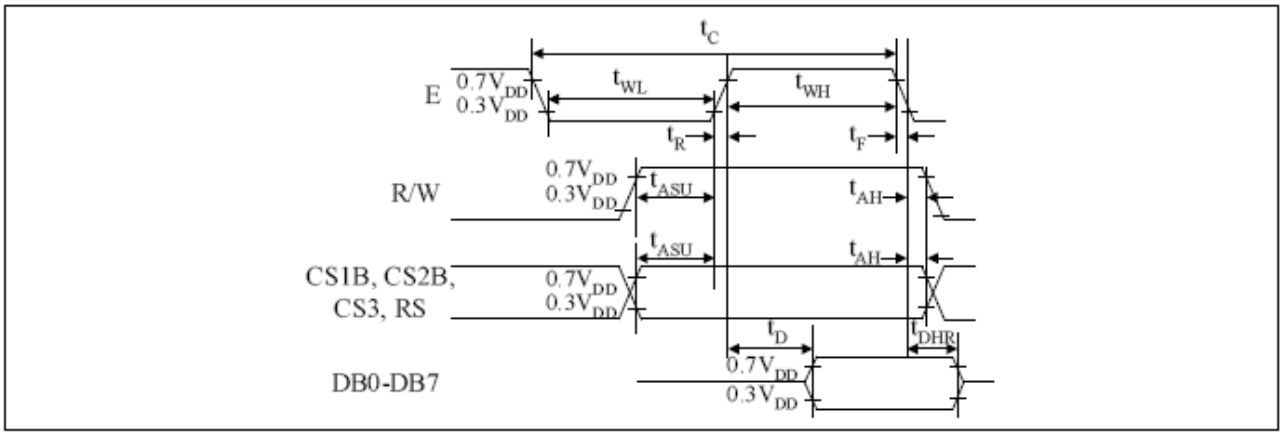
Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display on/off	L	L	L	L	H	H	H	H	H	L/H	Controls the display on or off. Internal status and display RAM data is not affected. L:OFF, H:ON
Set address (Y address)	L	L	L	H	Y address (0-63)						Sets the Y address in the Y address counter.
Set page (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	tC	1000	-	-	ns
E high level width	tWH	450	-	-	
E low level width	tWL	450	-	-	
E rise time	tR	-	-	25	
E fall time	tF	-	-	25	
Address set-up time	tASU	140	-	-	
Address hold time	tAH	10	-	-	
Data set-up time	tDSU	200	-	-	
Data delay time	tD	-	-	320	
Data hold time (write)	tDHW	10	-	-	
Data hold time (read)	tDHR	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 , 1.5mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	V_S=±600V, R_S=330Ω, C_S=150pF 10 times	

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

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