

# 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-	With Temp. Compensation Circuit
	<b>RoHS Compliant</b>

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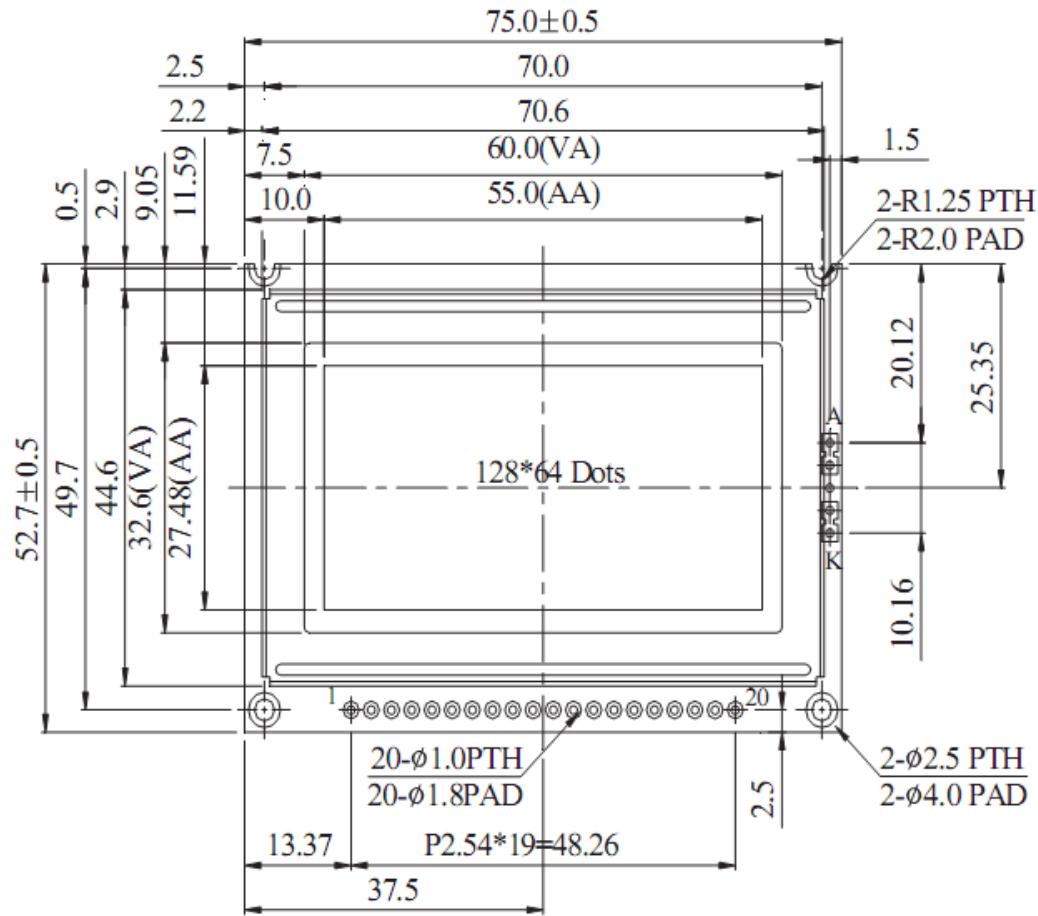
## Document Revision History

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

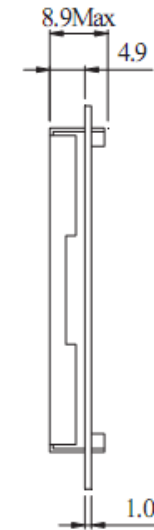
## Functions and Features

- 128 x 64 pixels
- Built-in KS0108B Controller
- +5.0V power supply
- 1/64 duty cycle
- RoHS Compliant

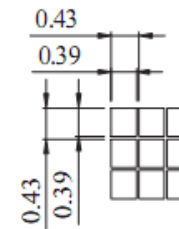
# Mechanical Drawing



The non-specified tolerance of dimension is ± 0.3mm.



LED B/L



DOT SIZE

PIN NO.	SYMBOL
1	Vdd
2	Vss
3	Vo
4	DB0
5	DB1
6	DB2
7	DB3
8	DB4
9	DB5
10	DB6
11	DB7
12	CS1
13	CS2
14	RST
15	R/W
16	D/I
17	E
18	Vee
19	LED+
20	LED-

Newhaven Display

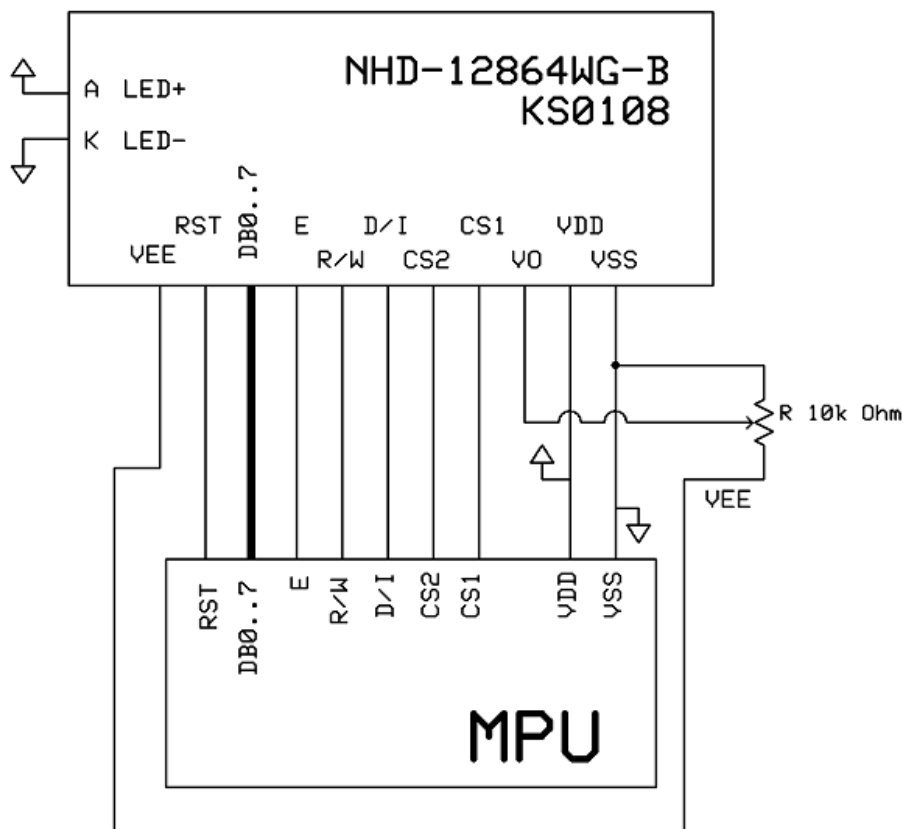
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## Pin Description and Wiring Diagram

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	CS1	MPU	Chip Selection: CS1=H, CS2=L : select IC1 (left side) CS1=L, CS2=H : select IC2 (right side)
13	CS2	MPU	
14	RST	MPU	Active Reset Signal
15	R/W	MPU	Read/Write select signal. R/W=1: Read R/W: =0: Write
16	D/I	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 with on-board resistor)
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		0.7VDD	-	VDD	V
"L" Level input	VIL	-	0	-	0.3VDD	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
Backlight Lifetime	-	ILED=80mA	-	20,000	-	Hrs.

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical (top)	AV	Cr ≥ 2	-	10	-	°
Viewing Angle - Vertical (bottom)	AV	Cr ≥ 2	-	105	-	°
Viewing Angle - Horizontal (left)	AH	Cr ≥ 2	-	30	-	°
Viewing Angle – Horizontal (right)	AH	Cr ≥ 2	-	30	-	°
Contrast Ratio	Cr		-	3	-	-
Response Time (rise)	Tr	-	-	200	300	ms
Response Time (fall)	Tf	-	-	200	300	ms

## Controller Information

Built-in KS0108B. Download specification at [http://www.newhavendisplay.com/app\\_notes/KS0108.pdf](http://www.newhavendisplay.com/app_notes/KS0108.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

## (3) MPU Interface

Chatacteristic	Symbol	Min	Typ	Max	Unit
E Cycle	$t_C$	1000	-	-	ns
E High Level Width	$t_{WH}$	450	-	-	ns
E Low Level Width	$t_{WL}$	450	-	-	ns
E Rise Time	$t_R$	-	-	25	ns
E Fall Time	$t_F$	-	-	25	ns
Address Set-Up Time	$t_{ASU}$	140	-	-	ns
Address Hold Time	$t_{AH}$	10	-	-	ns
Data Set-Up Time	$t_{SU}$	200	-	-	ns
Data Delay Time	$t_D$	-	-	320	ns
Data Hold Time (Write)	$t_{DHW}$	10	-	-	ns
Data Hold Time (Read)	$t_{DHR}$	20	-	-	ns

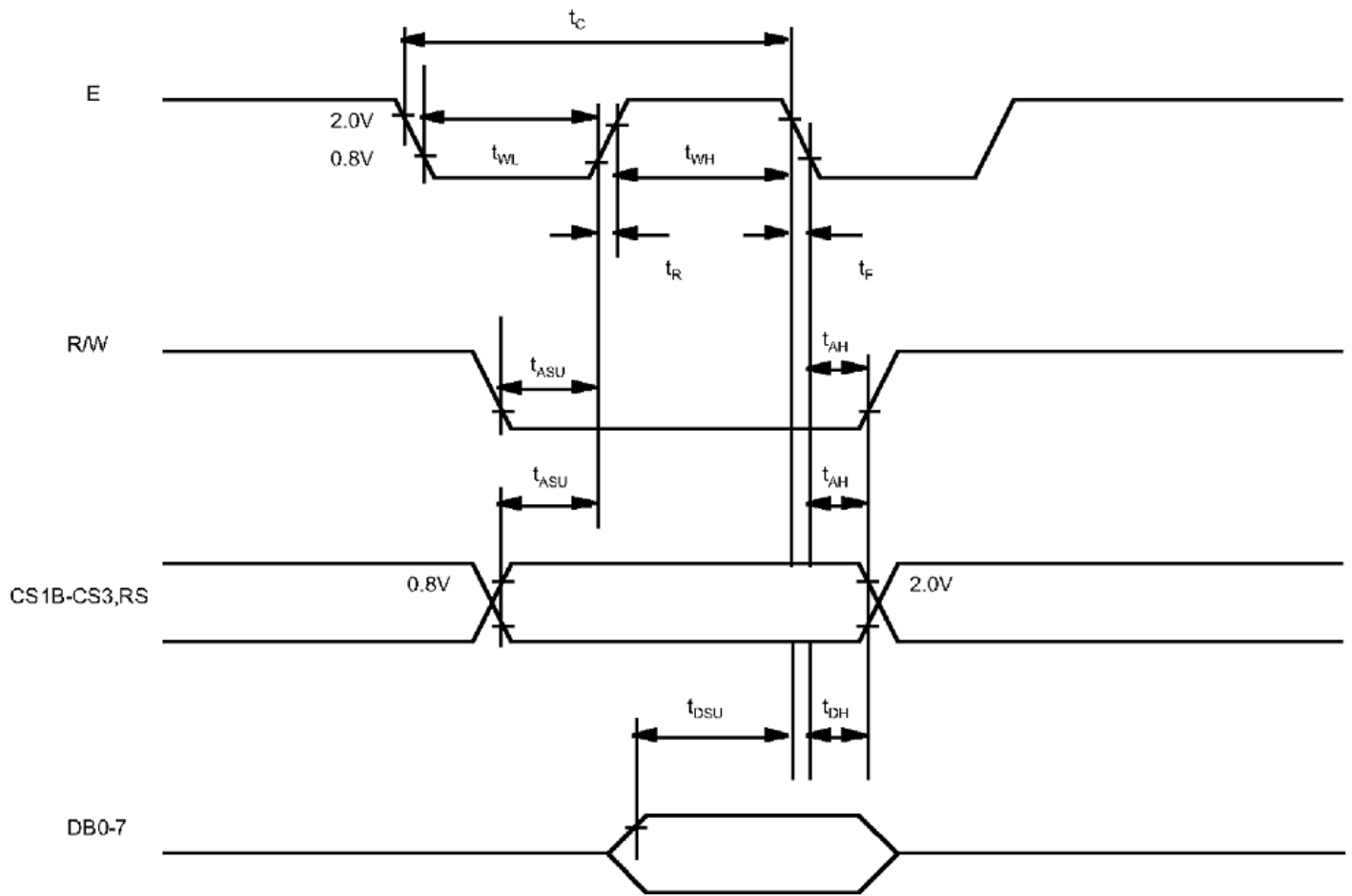


Fig 3. MPU write timing

## Example Initialization Program

```
'-----  
'DB0-DB7  7-14          P1  
'CS2      16           P3.6  
'CS1      15           P3.1  
'RST      17           P3.2  
'R/W      5            P3.7  
'D/I      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 Writerright  
  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](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)