

# NHD-12864AZ-FSW-FBW

## Graphic Liquid Crystal Display Module

NHD- Newhaven Display  
12864- 128 x 64 pixels  
AZ- Model  
F- Transflective  
SW- Side White LED backlight  
F- FSTN (+)  
B- 6:00 View  
W- Wide Temperature (-20°C ~ +70°C)  
**RoHS Compliant**

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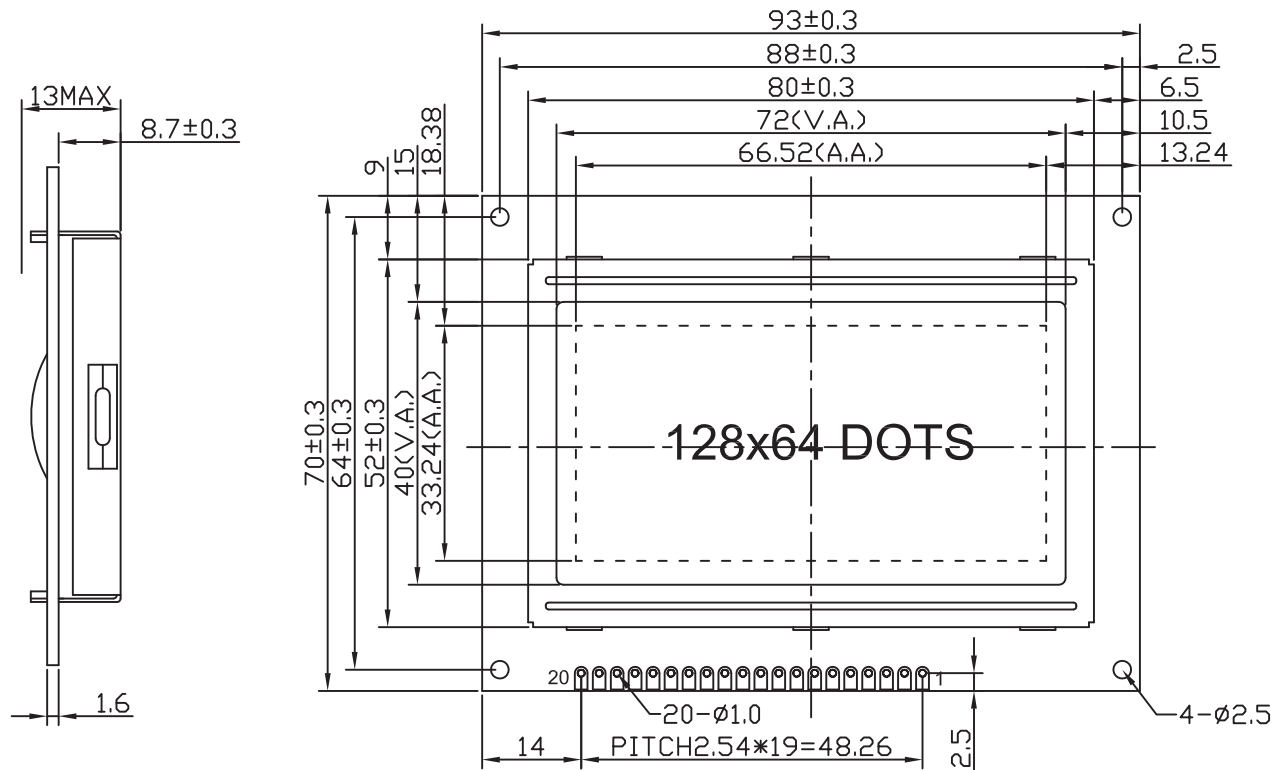
## Document Revision History

Revision	Date	Description	Changed by
0	11/15/2008	Initial Release	-
1	4/2/2010	User guide reformat	BE
2	5/6/2010	Block diagram/initialization update	BE
3	5/20/2010	Updated Pin Out and Electrical Characteristics	MC

## Functions and Features

- 128x64 pixels
- Built-in KS0108B Controller
- +5.0V power supply
- 1/64 duty, 1/9 bias
- RoHS Compliant

# Mechanical Drawing



## PIN ASSIGNMENT

1	VSS
2	VDD
3	V0
4	RS
5	R/W
6	E
7~14	DB0~DB7
15	CS1
16	CS2
17	RST
18	VEE
19	LED+
20	LED-

### Notes:

- 1). Driver Method: 1/64duty, 1/9bias, VDD5.0V
- 2). Display Type: FSTN/Positive/Transflective/6:00 Visual Angle
- 3). Operating Temp: -20°C~+70°C/Storage Temp: -30°C~+80°C
- 4). Backlight Type: Side White
- 5). Driver: KS0108
- 6). RoHS Compliant

## Newhaven Display

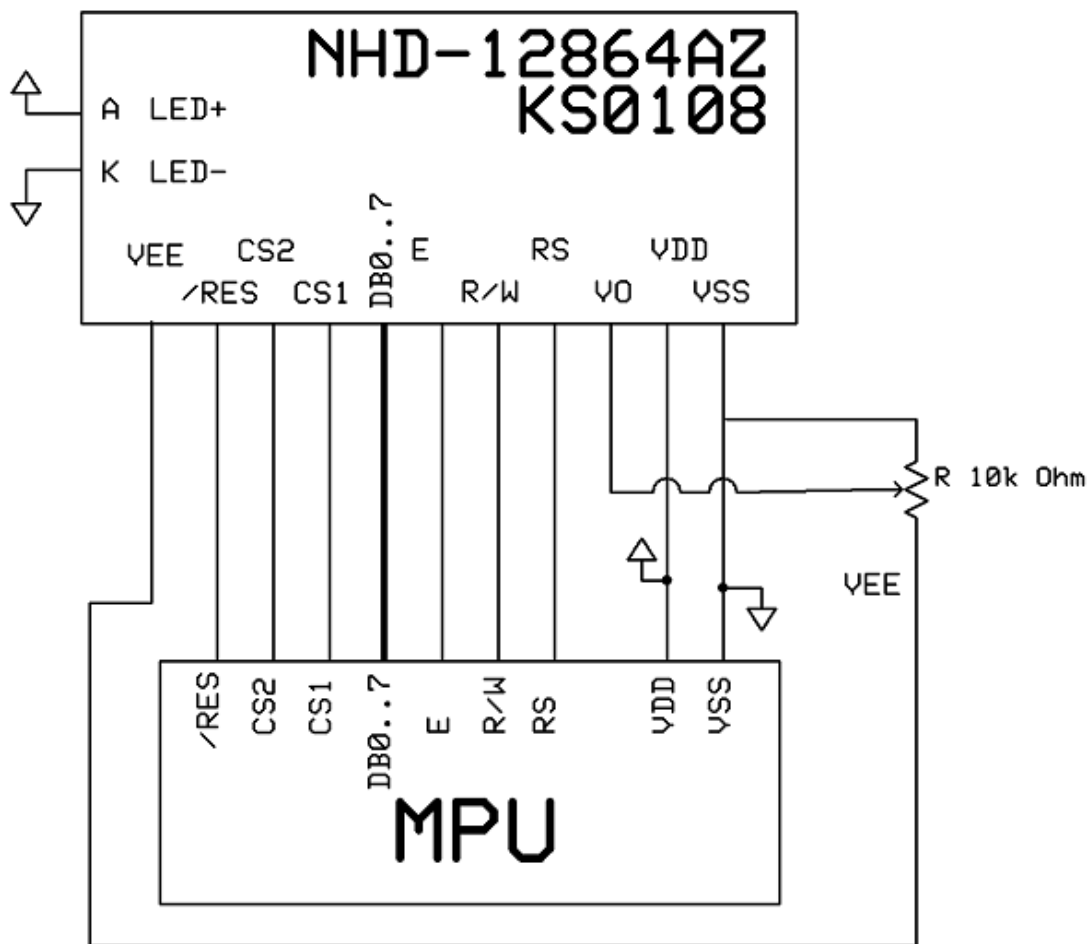
NHD-12864AZ-FSW-FBW

## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Power supply for Logic (+5.0V)
3	V0	Adj Power Supply	Power Supply for contrast (approx. -3.7)
4	D/I	MPU	Register select: 1=Data, 0=Instruction
5	R/W	MPU	Read/Write select signal, R/W=1: Read R/W: =0: Write
6	E	MPU	Operation enable signal. Falling edge triggered.
7-14	DB0-DB7	MPU	This is an 8-bit Bi-directional data bus
15	CS1	MPU	Chip Selection: CS1=H, CS2=L → select IC1 (left side) CS1=L, CS2=H → select IC2 (right side)
16	CS2	MPU	
17	/RES	MPU	Active LOW Reset signal
18	VEE	Power Supply	Negative voltage output (-5.0v)
19	LED+	Power Supply	Power for LED backlight (+5.0V via on-board resistor)
20	LED-	Power Supply	Ground for Backlight

**Recommended LCD connector:** 2.54mm pitch pins

**Backlight connector:**



## 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		4.7	5.0	5.5	V
Supply Current	IDD	Ta=25°, VDD=5.0V	-	3.5	5.5	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°		8.7		V
"H" Level input	Vih		2.2		VDD	V
"L" Level input	Vil		0		0.6	V
"H" Level output	Voh		2.4			V
"L" Level output	Vol				0.4	V
Backlight Supply Voltage	Vled		-	5.0	-	V
Backlight Supply Current	Iled	Vled=5.0V, R=68Ω	-	30	50	mA

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical (top)	AH	Cr ≥ 2	-	35	-	°
Viewing Angle- Vertical (bottom)	AH	Cr ≥ 2	-	60	-	°
Viewing Angle- Horizontal (left)	AV	Cr ≥ 2	-	40	-	°
Viewing Angle - Horizontal (right)	AV	Cr ≥ 2	-	40	-	°
Contrast Ratio	Cr			6		
Response Time (rise)	Tr			150	250	ms
Response Time (fall)	Tf			150	250	ms

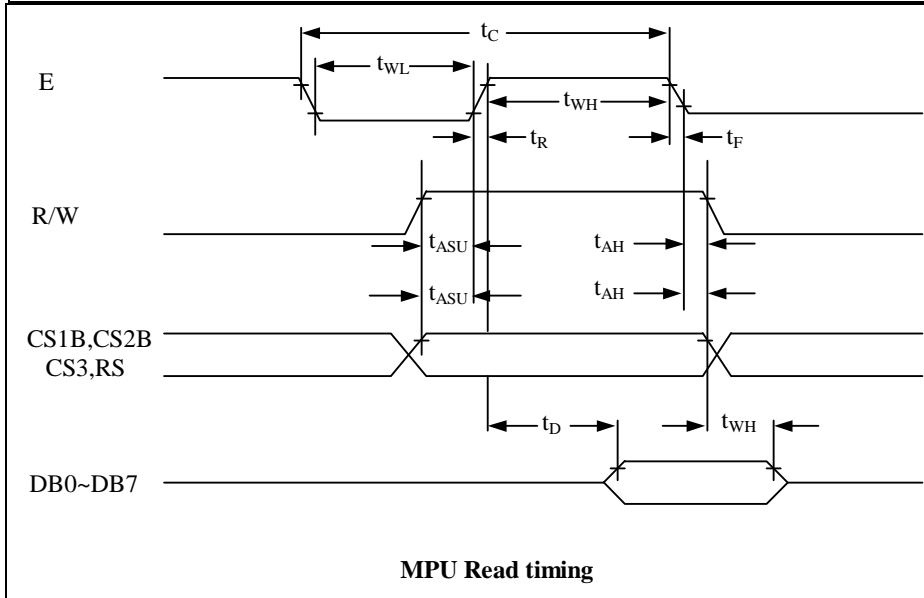
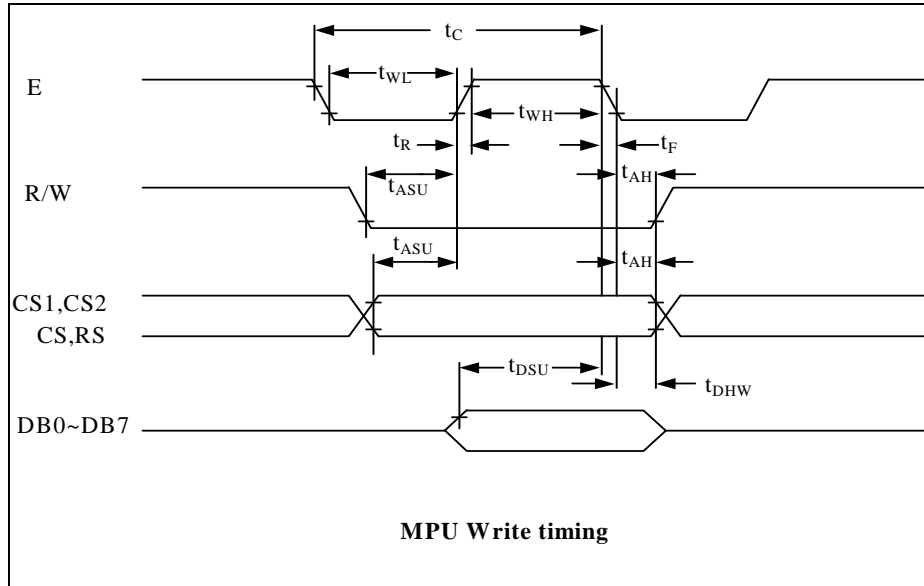
## Controller Information

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	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Read Display Date	1	1	Read data								Reads data (DB[7:0]) from display data RAM to the data bus.
Write Display Date	1	0	Write data								Writes data (DB[7:0]) into the DDRAM. After writing instruction, Y address is incremented by 1 automatically
Status Read	0	1	Busy	0	ON/OFF	Re-set	0	0	0	0	Reads the internal status <b>BUSY</b> 0: Ready 1: In operation <b>ON/OFF</b> 0: Display ON 1: Display OFF <b>RESET</b> 0: Normal 1: Reset
Set Address (Y address)	0	0	0	1	Y address (0~63)						Sets the Y address at the column address counter
Set Display Start Line	0	0	1	1	Display start line (0~63)						Indicates the Display Data RAM displayed at the top of the screen.
Set Address (X address)	0	0	1	0	1	1	1	Page (0~7)			Sets the X address at the X address register.
Display On/off	0	0	0	0	1	1	1	1	1	0/1	Controls the display ON or OFF. The internal status and the DDRAM data is not affected. 0: OFF, 1: ON

# Timing Characteristics



Characteristic	Symbol	Min	Typ	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	$t_{SU}$	200	-	-	
Data Delay Time	$t_D$	-	-	320	
Data Hold Time (Write)	$t_{DHW}$	10	-	-	
Data Hold Time (Read)	$t_{DHR}$	20	-	-	

## 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 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 , 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.

## 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)