



# NHD-0216KZW-AY5

# **OLED Display Module**

NHD-	Newhaven Display
0216-	2 Lines x 16 Characters
KZW-	OLED
A-	Model
Y-	Emitting Color: Yellow
5-	+5V power supply

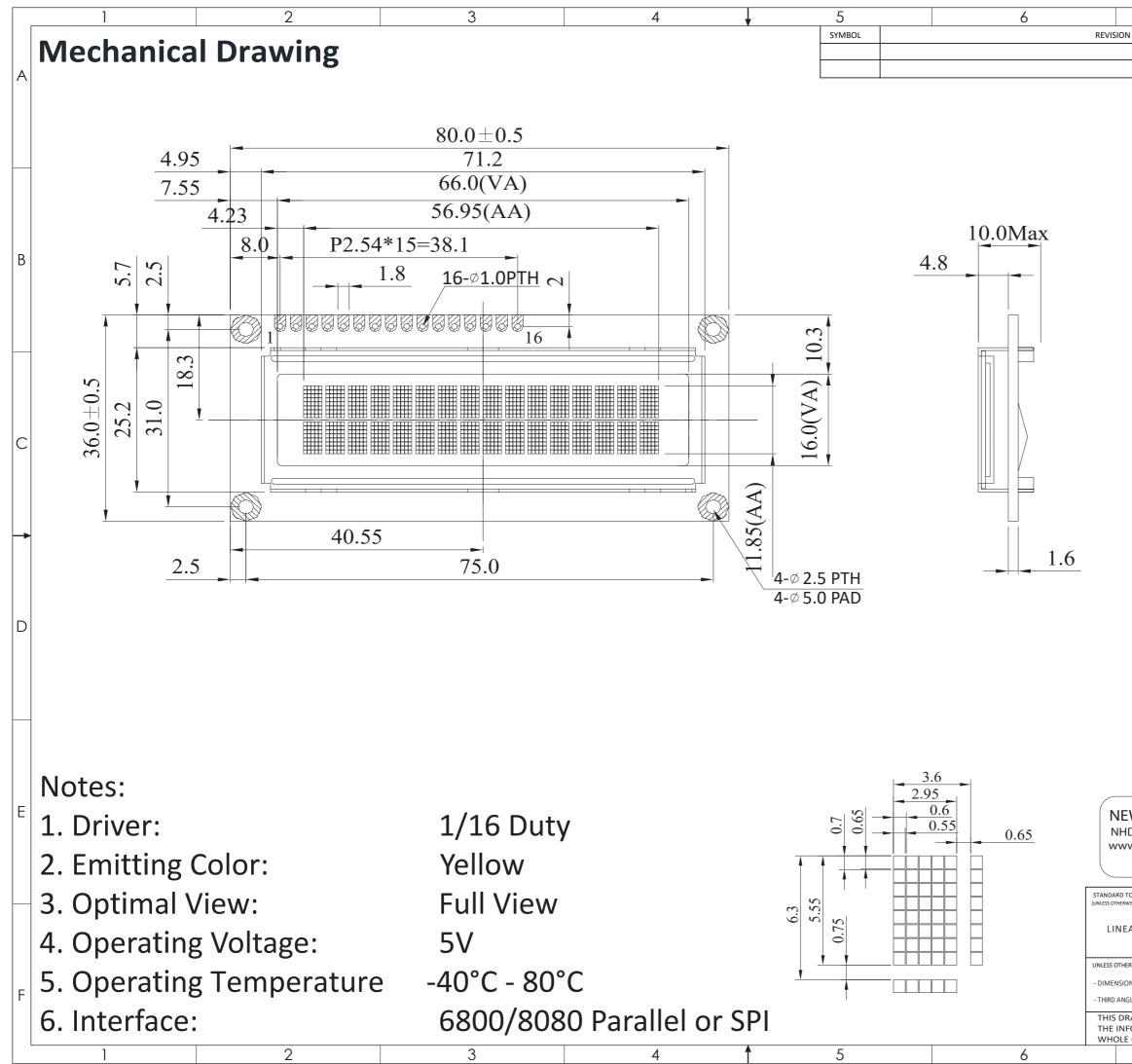
Newhaven Display International, Inc. 2661 Galvin Ct. Elgin IL, 60124 Ph: 847-844-8795 Fax: 847-844-8796

# **Document Revision History**

Revision	Date	Description	Changed by
0	4/1/2011	Initial Product Release	-
1	7/11/2011	Serial interface information updated	AK
2	8/31/2011	Font tables updated	AK
3	10/18/2011	Jumper selections updated	AK
4	3/26/2012	Jumper selections updated	AK
5	2/8/2013	Optical characteristics and mechanical drawing updated.	JN
6	9/7/2013	Photo of jumpers (solder pads) added	AK
7	1/29/2015	Photo of jumpers (solder pads) updated	КА
8	8/30/16	Supply Current & Brightness Updated	SB
9	3/2/17	Electrical Characteristics Updated	ТМ
10	10/5/18	Mechanical Drawing Reformat	SB
11	4/5/19	Supply Voltage Updated	SB
12	3/25/20	Label Added to Drawing	SB
13	2/25/21	Controller IC Upgraded; Updated Supply Current, MAX	AS
		Storage Temperature, Optical Characteristics & Quality	
		Information	
		Part Revision Upgraded from Rev1A to Rev1B	

# **Functions and Features**

- 2 lines x 16 characters
- Built-in LCD comparable controller
- Parallel or serial MPU interface (Default 6800 MPU parallel)
- +5V Power Supply
- RoHS compliant
- Size compatible to NHD-0216K1Z series Character LCDs



PIN NO.         SYMBOL           1         Vss           2         Vdd           3         NC           4         RS           5         R/W           6         E           7         DB0           8         DB1           9         DB2           10         DB3           11         DB4           12         DB5           13         DB6           14         DB7           15         NC           Made in China         Immedia           Materia         Shah         Materia           Materia         Shah         Shah           Materia         Shah         Shah	7			8		1
PIN NO. SYMBOL 1 Vss 2 Vdd 3 NC 4 RS 5 R/W 6 E 7 DB0 8 DB1 9 DB2 10 DB3 11 DB4 12 DB5 13 DB6 14 DB7 12 DB5 13 DB6 14 DB7 15 NC 15 NC 16 NC 16 NC Paper Label WHAVEN DISPLAY 0.2016KZW-AY5_RevIB Made in China PADE LABER CONSTRUCTION R: ±0.3mn West Strendon S Ashah Minocetting State Investor 2.25/21 State MANUNG D DISPLAY 15 NC 16 NC PADE LABER State MALLMETES 2.25/21 State MANUNG D DISPLAY 1.5 NC 1.5 NC	l			DATE		
PIN NO. SYMBOL 1 Vss 2 Vdd 3 NC 4 RS 5 R/W 6 E 7 DB0 8 DB1 9 DB2 10 DB3 11 DB4 12 DB5 13 DB6 14 DB7 12 DB5 13 DB6 14 DB7 15 NC 15 NC 16 NC 16 NC Paper Label WHAVEN DISPLAY 0.2016KZW-AY5_RevIB Made in China PADE LABER CONSTRUCTION R: ±0.3mn West Strendon S Ashah Minocetting State Investor 2.25/21 State MANUNG D DISPLAY 15 NC 16 NC PADE LABER State MALLMETES 2.25/21 State MANUNG D DISPLAY 1.5 NC 1.5 NC						A
PIN NO.       SYMBOL         1       Vss         2       Vdd         3       NC         4       RS         5       R/W         6       E         7       DB0         8       DB1         9       DB2         10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         16       NC         NEWHAVEN DISPLAY         Date-Code       16         Nade in China       N         N T E C N DI SPLAY         AR: ± 0.3mm       MUMMERATE NUMBER         NEWHAVEN DISPLAY         AR: ± 0.3mm       MUMMERATE NUMBER         MUMMERATE NUMBER       MUMMERATE NUMBER         ND DOI TOCALE DRAVING       State NALLIMERERS         MUMMERATE NUMBER       MUMMERATE NUMBER         MUMMERATE NUMBER       MUMMERATE NUMBER         MUMMERATE NUMBER       MUMMERATE NUMBER         MUMMERATE NUMBER       MUMMERATE NUMBER         MUMMERATE NUMBER       MUMMERATE NUMBERATE NUMBER <td< td=""><td></td><td>_</td><td></td><td></td><td></td><td></td></td<>		_				
PIN NO. SYMBOL 1 Vss 2 Vdd 3 NC 4 RS 5 R/W 6 E 7 DB0 8 DB1 9 DB2 10 DB3 11 DB4 12 DB5 13 DB6 14 DB7 15 NC 13 DB6 14 DB7 15 NC 15 NC 16 NC 16 NC 16 NC 18 SECRET R: ±0.3mm MEDICION ©CILICATIONNEL 10 DISPLAY 15 NC 16 NC 16 NC 10 DISPLAY 15 NC 16 NC 10 DISPLAY 15 NC 16 NC 18 SECRET 10 NDSPLAY 15 NC 16 NC 16 NC 18 SECRET 10 NDSPLAY 15 NC 16 NC 10 NC 15 NC 16 NC 18 SECRET 10 NC 10 NC 11 NC 15 NC 16 NC 16 NC 18 SECRET 10 NC 16 NC 10 NC						
PIN NO.       SYMBOL         1       Vss         2       Vdd         3       NC         4       RS         5       R/W         6       E         7       DB0         8       DB1         9       DB2         10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         16       NC         NUMERICATE NUMBER       NE         NET ± 0.3 mm       MANNER ASHALL DISPLAY         NET ± 0.3 mm       NET ± 0.5 mL         NUMERICATE NUMBER       NE         NET ± 0.3 mm       NET ± 0.3 mm						
PIN NO. SYMBOL 1 Vss 2 Vdd 3 NC 4 RS 5 R/W 6 E 7 DB0 8 DB1 9 DB2 10 DB3 11 DB4 12 DB5 13 DB6 14 DB7 15 NC 13 DB6 14 DB7 15 NC 15 NC 16 NC 16 NC 16 NC 18 SECRET R: ±0.3mm MEDICION ©CILICATIONNEL 10 DISPLAY 15 NC 16 NC 16 NC 10 DISPLAY 15 NC 16 NC 10 DISPLAY 15 NC 16 NC 18 SECRET 10 NDSPLAY 15 NC 16 NC 16 NC 18 SECRET 10 NDSPLAY 15 NC 16 NC 10 NC 15 NC 16 NC 18 SECRET 10 NC 10 NC 11 NC 15 NC 16 NC 16 NC 18 SECRET 10 NC 16 NC 10 NC						
PIN NO.       SYMBOL         1       Vss         2       Vdd         3       NC         4       RS         5       R/W         6       E         7       DB0         8       DB1         9       DB2         10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         16       NC         NUMERICATE NUMBER       NE         NET ± 0.3 mm       MANNER ASHALL DISPLAY         NET ± 0.3 mm       NET ± 0.5 mL         NUMERICATE NUMBER       NE         NET ± 0.3 mm       NET ± 0.3 mm						
PIN NO. SYMBOL 1 Vss 2 Vdd 3 NC 4 RS 5 R/W 6 E 7 DB0 8 DB1 9 DB2 10 DB3 11 DB4 12 DB5 13 DB6 14 DB7 15 NC 13 DB6 14 DB7 15 NC 15 NC 16 NC 16 NC 16 NC 18 SECRET R: ±0.3mm MEDICION ©CILICATIONNEL 10 DISPLAY 15 NC 16 NC 16 NC 10 DISPLAY 15 NC 16 NC 10 DISPLAY 15 NC 16 NC 18 SECRET 10 NDSPLAY 15 NC 16 NC 16 NC 18 SECRET 10 NDSPLAY 15 NC 16 NC 10 NC 15 NC 16 NC 18 SECRET 10 NC 10 NC 11 NC 15 NC 16 NC 16 NC 18 SECRET 10 NC 16 NC 10 NC						
1       Vss         2       Vdd         3       NC         4       RS         5       R/W         6       E         7       DB0         8       DB1         9       DB2         10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         16       NC         Image: Second Se						B
1       Vss         2       Vdd         3       NC         4       RS         5       R/W         6       E         7       DB0         8       DB1         9       DB2         10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         16       NC         Image: Second Se						
2       Vdd         3       NC         4       RS         5       R/W         6       E         7       DB0         8       DB1         9       DB2         10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         16       NC         New have ndisplay.com Date-Code Made in China       NEW HAVEN DISPLAY         New have ndisplay.com Date-Code Made in China       NEW HAVEN DISPLAY         NEW SERCERD       NEW MAY EMADE         NHD-0216KZW-AYS       IB         NEW SERCERD       NEW MAY EMADE         NHD-0216KZW-AYS       IB         NSARE IN MILLIMETERS       MER SERCERD         NARE EMADE       NSARE IN MILLIMETERS         NARE EMADE       NSARE IN MILLIMETERS         NARE EMADE       NSARE IN MILLIMETERS         NONTSCALE DRAWING       SHE			PIN NO.	SYME	BOL	
3       NC         4       RS         5       R/W         6       E         7       DB0         8       DB1         9       DB2         10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         16       NC         NEWHAVEN DISPLAY         Date-Code       16         Made in China       NT E R N A T LO N A L         NEWHAVEN DISPLAY         NERAMEE:       MIND-0216KZW-AYS         NEW E SPECIFIED:       AShah         MISE SPECIFIED:       AShah         MILLIMETERS       MANNARE         VIN IF*       AShah         MILLIMETERS       MANNARE         MANNARE       2/25/21         MANNARE       2/25/21         MANNARE       2/25/21         MANNARE       2/25/21         MANNARE       2/25/21         MANNARE       2/25/21			1	Vs	S	
3       NC         4       RS         5       R/W         6       E         7       DB0         8       DB1         9       DB2         10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         16       NC         REVENCE         REVENCE OF IS         REVENCE OF IS         REVENCE OF IS         REVENCE         REVENCE OF IS         NEWHAVEN DISPLAY         NEWHAVEN DISPLAY         NEWHAVEN DISPLAY         NEWHAVEN DISPLAY         NEWHAVEN DISPLAY         NEW AVEN DISPLAY         NHD-0216KZW-AYS         REVISION         NHD-0216KZW-AYS         REVISION         Ask = ± 0.3 mm         NHD-0216KZW-AYS         NSARE IM MILLIMETERS         Ask = ± 0.3 mm         NET COLSPANE			2	Vd	d	
4       RS         5       R/W         6       E         7       DB0         8       DB1         9       DB2         10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         16       NC         REWHAVEN DISPLAY         Date-Code       Int         Made in China       DEVENAVEN DISPLAY         NEWHAVEN DISPLAY       Int         15       NC         16       NC         NEWHAVEN DISPLAY       Int         NEWHAVEN DISPLAY       Int         NHD-0216KZW-AY5       Int         NEWHAVEN DISPLAY       Int         Made in China       Int         NHD-0216KZW-AY5       Int         NM E SPECIFIC:       A Shah         VISARE IN MILLIMETERS       Int         ISARE IN MILLIMETERS       International         ISARE IN MILLIMETERS       International         ISARE IN MILLIMETERS       International         ISARE IN MILLIMETERS       Internatin         ISARE IN MILLIMET				NC	ŗ	
5       R/W         6       E         7       DB0         8       DB1         9       DB2         10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         16       NC         REVENCE NATS - Rev1B         Networkavendisplay.com       DB5         16       NC         Revence:         Revence:         NEWHAVEN DISPLAY         15       NC         16       NC         New Haveen DISPLAY         Revence:         NEW HAVEN DISPLAY         N EW HAVEN DISPLAY         N EW HAVEN DISPLAY         N EW HAVEN DISPLAY         Revence:         NEW HAVEN DISPLAY         Revence:         N EW HAVEN DISPLAY         Revence:         N EW HAVEN DISPLAY         N EW COLSTON MALTE:         N EW COLSTON MALTE:       Revon: </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>С</td>						С
6       E         7       DB0         8       DB1         9       DB2         10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         Newhavendisplay.com       16         Date-Code       16         Made in China       NEWHAVEN DISPLAY         Newhavendisplay.com       16         Net ± 0.3mm       NEWHAVEN DISPLAY         NERANCE:       NEWHAVEN DISPLAY         NEWHAVEN DISPLAY       15         Net ± 0.3mm       NEWHAVEN DISPLAY         NEWHAVEN DISPLAY       NEWHAVEN DISPLAY         NEWHAVEN DISPLAY       NEWHAVEN DISPLAY         NEWHAVEN DISPLAY       NEWHAVEN DISPLAY         NEWNWY MATE       NEWNAVEN ATE NUMBER         NEWNWY MATE       NEWNAVEN ATE NUMBER         NAR: ± 0.3mm       NHD-0216KZW-AY5         NS ARE IN MILLIMETERS       NANN MATE         NS ARE IN MILLIMETERS       NANN MATE         NS ARE IN MILLIMETERS       MANN MATE         NS ARE IN MILLIMETERS       MANN MATE         NS ARE IN MILLIMETERS       MANN MATE						
7       DB0         8       DB1         9       DB2         10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         Date-Code Made in China       NEWACE:         NERANCE:       NEW HAVEN DISPLAY         NEW MAY       16         NEW MAY       NEW MAY         NEW MAY       NEW MAY         NEW MAY       NEW MAY         NEW MAY       NEW MAY         NEW MAY       AS ARE IN MILLIMETERS         NEW MAY       MAY MAY         DO NOT SCALE DRAWING       SHEET 10F 1					V	
NHAVEN DISPLAY       10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         16       NC         NEERARCE       NEW HAVEN DISPLAY         Newnowia wendisplay.com       16         Date-Code       NEW HAVEN DISPLAY         16       NC         NEERARCE:       NEW HAVEN DISPLAY         NEERARCE:       NEW HAVEN DISPLAY         NEERARCE:       NEW HAVEN DISPLAY         NEERARCE:       NEW HAVEN DISPLAY         NEW HAVEN DISPLAY       18         Sare IN MILLIMETERS       NEW HAVEN DISPLAY         NS ARE IN MILLIMETERS       NAWN DATE         MUSE SPECIFIED:       A. Shah         IS ARE IN MILLIMETERS       MAWN DATE         E PROJECTION INCL       MAWN DATE         DO NOT SCALE DRAWING       SHEET 10F 1			6	E		-
9       DB2       D         10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         16       NC         NHAVEN DISPLAY       16         0-0216KZW-AY5_Rev1B       16         Newhavendisplay.com       16         Date-Code       16         Made in China       NE CHAVEN DISPLAY         NERANCE:       NE CHAVEN DISPLAY         AR: ±0.3mm       Image: New Haven Display: Solution of the second of the secon			7	DB	0	
10       DB3         11       DB4         12       DB5         13       DB6         14       DB7         15       NC         16       NC         16       NC         NHAVEN DISPLAY       Image: Code grade in China         15       NC         16       NC         NERANCE:       Image: Code grade in China         NHD-0216KZW-AY5       Image: Code grade in China         NHD-0216KZW-AY5       Image: Code grade in China         Image: Code grade in China       Image: Code grade in China         Image: Code grade in China       Image: Code grade in China         Image: Code grade in China       Image: Code grade in China         Image: Code grade in China       Image: Code grade in China         Image: C			8	DB	1	
Image: Specified: State in Millingers: Service: Specified: State in Millingers: State in Mingers: State in Millingers: State in Millingers: State			9	DB	2	D
12       DB5         13       DB6         14       DB7         15       NC         16       NC         16       NC         NERANCE:       PROVED BY:         NERANCE:       NEW HAVEN DISPLAY         NERANCE:       NEW HAVEN DISPLAY         NERANCE:       NEW HAVEN DISPLAY         NERANCE:       NEW HAVEN DISPLAY         NEW HAVEN DISPLAY       NEW HAVEN DISPLAY         NEW NOW       NEW NOW         NHD-0216KZW-AY5       NEW         NHD-0216KZW-AY5       NEW:         NHD-0216KZW-AY5       NEW:         NHD-0216KZW-AY5       NEW:         NHD-0216KZW-AY5       SCALE:         NS ARE IN MILLIMETERS       PROVED DATE:         NS ARE IN MILLIMETERS       DRAWN DATE:         2/25/21       NS         DO NOT SCALE DRAWING       SHEET 1 0F 1			10	DB	3	
12       DB5         13       DB6         14       DB7         15       NC         16       NC         16       NC         NERANCE:       PROVED BY:         NERANCE:       NEW HAVEN DISPLAY         NERANCE:       NEW HAVEN DISPLAY         NERANCE:       NEW HAVEN DISPLAY         NERANCE:       NEW HAVEN DISPLAY         NEW HAVEN DISPLAY       NEW HAVEN DISPLAY         NEW NOW       NEW NOW         NHD-0216KZW-AY5       NEW         NHD-0216KZW-AY5       NEW:         NHD-0216KZW-AY5       NEW:         NHD-0216KZW-AY5       NEW:         NHD-0216KZW-AY5       SCALE:         NS ARE IN MILLIMETERS       PROVED DATE:         NS ARE IN MILLIMETERS       DRAWN DATE:         2/25/21       NS         DO NOT SCALE DRAWING       SHEET 1 0F 1			11	DB	4	
Paper Label       13       DB6         WHAVEN DISPLAY       14       DB7         0-0216KZW-AY5_Rev1B       15       NC         0-0216KZW-AY5_Rev1B       15       NC         0-0216KZW-AY5_Rev1B       16       NC         0ate-Code       16       NC         Made in China       16       NC         NEWHAVEN DISPLAY         NERANCE:       NEWHAVEN DISPLAY         REVISION:         Made in China       16         NEWHAVEN DISPLAY         NHD-0216KZW-AY5       18         Size:         NHD-0216KZW-AY5       18         Size:         NHD-0216KZW-AY5       18         Size:       A3         Scale:       NS         PROVED INT:       2/25/21       NS         I PROVED INT:       2/25/21       NS						
Paper Label       14       DB7         WHAVEN DISPLAY       15       NC         0-0216KZW-AY5_Rev1B       15       NC         0.16KZW-AY5_Rev1B       16       NC         0.16KZW-AY5_Rev1B       16       NC         0.16KZW-AY5_Rev1B       16       NC         0.16KZW-AY5_Rev1B       16       NC         0.16KZW-AY5       16       NC         0.16KARCE:       0.16KZW-AY5       18         0.16KZW-AY5       18       Size:         0.16KZW-AY5       0.16       Size:         0.16KZW-AY5       0.16       Size:         0.16KZW-AY5       0.16						
I4       DB'/         WHAVEN DISPLAY         0-0216KZW-AY5_Rev1B         Newhavendisplay.com         Date-Code         Made in China         I6         NC         I6         NC         IA         Date-Code         Made in China         IA         IA         NEWHAVEN         DIERANCE:         Sessecified:         NAR:         DRAWING/PART NUMBER:         NHD-0216KZW-AY5         IB         NHD-0216KZW-AY5         SARE IN MILLIMETERS         DRAWN BY:         A. Shah         DRAWN DATE:         2/25/21         DRAWN DATE:         2/25/21         DRAWN DATE:         2/25/21         DRAWN DATE:         2/25/21         NS         DO NOT SCALE DRAWING         SHEET 1 OF 1	Paper Labe	el				
D-0216KZW-AY5_Rev1B w.newhavendisplay.com Date-Code Made in China 15 16 NC 16 NC 16 NC 16 NC 16 NC 16 NC 16 NC 16 NC 16 NC 16 NC 16 NC 16 NC 16 NC 16 NC 16 NC 18 18 18 18 18 18 10 10 10 10 10 10 10 10 10 10	-					E
Date-Code Made in China DLERANCE: SE SPECIFIED: NR: ±0.3 mm DRAWING/PART NUMBER: NHD-0216KZW-AY5 NHD-0216KZW-AY5 NHD-0216KZW-AY5 NHD-0216KZW-AY5 SIZE: NHD-0216KZW-AY5 SIZE: NHD-0216KZW-AY5 SIZE: NHD-0216KZW-AY5 SIZE: NHD-0216KZW-AY5 SIZE: NHD-0216KZW-AY5 SIZE: NHD-0216KZW-AY5 SIZE: NS SCALE: NS DRAWN BY: A. Shah DRAWN DATE: 2/25/21 DRAWN DATE: 2/25/21 DRAWN DATE: 2/25/21 DRAWN NG SHEET 1 OF 1	D-0216KZW-AY	5_Rev1B	15	NC		
AR: ±0.3 mm	Date-Code		16	NC		
AR: ±0.3mm  DRAWING/PART NUMBER:  NHD-0216KZW-AY5  SIZE:  WISE SPECIFIED:  NS ARE IN MILLIMETERS  LE PROJECTION  DRAWN BY:  A. Shah  APPROVED BY:  A. Shah  APPROVED BY:  A. Shah  APPROVED DATE:  2/25/21  NS  F  CONT SCALE DRAWING  SHEET 1 OF 1  F	DLERANCE: ISE SPECIFIED)	N				
INFLD-U210K2VV-ATS	AR: ±0.3mm	DRAWING/PART NUM		ATION	REVISION:	
A. Shah A. Sha		DRAWN BY:	APPROVED BY	:	SIZE:	
LE PROJECTION		A. Sha	APPROVED DA	A. Shah	SCALE:	_
		DO NOT SO	CALE DRAWING	SHEET :	1 OF 1	
	7			8		

# **Pin Description**

## Parallel Interface (default):

Pin No.	Symbol	<b>External Connection</b>	Function Description
1	Vss	Power Supply	Ground
2	V <sub>DD</sub>	Power Supply	Supply Voltage for OLED and logic
3	NC	-	No Connect
4	RS	MPU	Register select signal. RS=0: Command; RS=1: Data
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.
7-10	DB0 – DB3	MPU	Four low order bi-directional three-state data bus lines. These
			four are not used during 4-bit operation.
11-14	DB4 – DB7	MPU	Four high order bi-directional three-state data bus lines.
15	NC	-	No Connect
16	NC	-	No Connect

## Serial Interface:

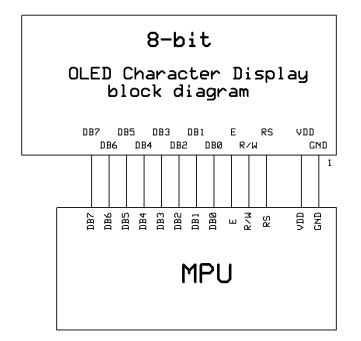
Pin No.	Symbol	<b>External Connection</b>	Function Description
1	Vss	Power Supply	Ground
2	V <sub>DD</sub>	Power Supply	Supply Voltage for OLED and logic
3-11	NC	-	No Connect
12	SCL	MPU	Serial Clock signal
13	SDO	MPU	Serial Data output signal
14	SDI	MPU	Serial Data input signal
15	NC	-	No Connect
16	/CS	MPU	Active LOW Chip Select signal

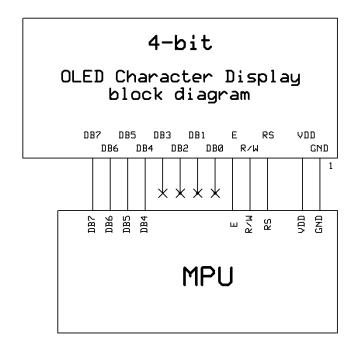
## **Jumper Selections**

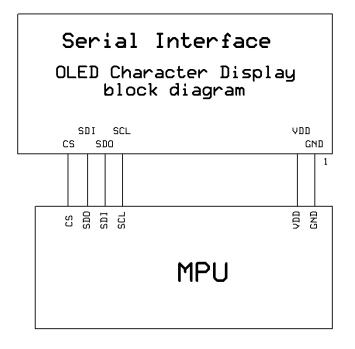
MPU Interface	L_PS_H	180 <sup>-</sup> 168	L_CS_H	JCS	L_SHL_H
6800-MPU Parallel (default)	Н	J68	L	Х	Н
8080-MPU Parallel	Н	J80	L	Х	Н
Serial MPU	L	Х	Open	Short	Н

X = Don't care

## **Wiring Diagrams**







# **Electrical Characteristics**

Item	Symbol	Condition	Min.	Тур.	Max.	Unit
Operating Temperature Range	TOP	Absolute Max	-40	-	+80	°C
Storage Temperature Range	Tst	Absolute Max	-40	-	+85	°C
Supply Voltage	V <sub>DD</sub>	-	4.8	5.0	5.3	V
Supply Current	IDD	T <sub>OP</sub> =25°C, V <sub>DD</sub> =5.0V 50% Checkerboard	-	31	50	mA
"H" Level input	VIH	-	0.8 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level input	VIL	-	Vss	-	0.2 * V <sub>DD</sub>	V
"H" Level output	Vон	-	0.8 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level output	V <sub>OL</sub>	-	V <sub>SS</sub>	-	0.2 * V <sub>DD</sub>	V

## **Optical Characteristics**

	lte	em	Symbol	Condition	Min.	Тур.	Max.	Unit	
Outlined	Тор		φY+		80	-	-	0	
Optimal Viewing	Bott	om	φΥ-		80	-	-	0	
Angles	Left		θХ-	-	80	-	-	0	
	Righ	it	θX+		80	-	-	0	
Contrast Rati	ю		CR	-	10,000:1	-	-	-	
Decrease T	-	Rise	T <sub>R</sub>	-	-	10	-	μs	
Response Time		Fall	TF	-	-	10	-	μs	
Brightness <sup>2,3</sup>	Brightness <sup>2,3</sup>		Lv	T <sub>OP</sub> =25°C, V <sub>DD</sub> =5.0V	100	120	-	cd/m <sup>2</sup>	
Lifetime <sup>1</sup>			-	50% Checkerboard	80,000	100,000	-	Hrs.	

Note:

1) Lifetime at typical temperature is based on accelerated high-temperature operation. Lifetime is tested at average 50% pixels on and is rated as hours until half-brightness. The Display OFF command can be used to extend the lifetime of the display.

2) Luminance of active pixels will degrade faster than inactive pixels. Residual (burn-in) images may occur. To avoid this, every pixel should be illuminated uniformly. Using a screensaver is highly recommended.

3) Brightness is related to the VDD, the brightness will be dimmer if used with lower voltages.

# **Table of Commands**

						Code						Max
Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	Execution Time
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears entire display. Does not change DDRAM address.	2ms
Return Home	0	0	0	0	0	0	0	0	1	0	Sets DDRAM Address to 0x00. Returns shifted display to original position.	600us
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor to auto Increment or Decrement, and sets display shift.	600us
Display ON/OFF control	0	0	0	0	0	0	1	D	с	В	Sets Display (D) ON/OFF. Sets Cursor (C) ON/OFF. Sets Blinking (B) of cursor ON/OFF.	600us
Cursor/Displ ay Shift	0	0	0	0	0	1	s/c	R/L	0	0	Moves cursor & shifts display without changing DDRAM contents.	600us
Function Set	0	0	0	0	1	DL	1	0	FT1	FT0	Set interface data length. Select Font Table.	600us
Set CGRAM address	0	0	0	1	ACG5	ACG4	ACG3	ACG2	ACG1	ACG0	Move to CGRAM address.	600us
Set DDRAM address	0	0	1	ADD6	ADD5	ADD4	ADD3	ADD2	ADD1	ADD0	Move to DDRAM address.	600us
Read Busy Flag & Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Read Busy Flag (BF) and Address Counter.	600us
Write data to CGRAM or DDRAM	1	0				Write data to CGRAM or DDRAM	600us					
Read data from CGRAM or DDRAM	1	1				Read data from CGRAM or DDRAM	600us					

## **Instruction Descriptions**

When an instruction is being executed, only the Busy Flag read instruction can be performed. During execution of an instruction, the Busy Flag = "1". When BF = "0" instructions can be sent to the controller.

## **Clear Display**

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	0	1

This instruction is used to clear the display by writing 0x20 in all DDRAM addresses. This instruction does not change the DDRAM Address.

## **Return Home**

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	1	0

This instruction is used to set the DDRAM Address to 0x00 and shifts the display back to the original state. The cursor (if on) will be at the first line's left-most character. The DDRAM contents on the display do not change.

## **Entry Mode Set**

0 0 0 0 0 0 0 1 I/D S	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
	0	0	0	0	0	0	0	1	I/D	S

I/D = Increment/Decrement

When I/D = "1", the DDRAM or CGRAM Address with automatically increment when a character code is written into or read from the DDRAM or CGRAM. The auto-increment will move the cursor one character space to the right. When I/D = "0", the DDRAM or CGRAM Address with automatically decrement when a character code is written into or read from the DDRAM or CGRAM. The auto-decrement will move the cursor one character space to the left.

S = Shift Entire Display

When S = "1", the entire display is shifted to the right (when I/D = "0") or left (when I/D = "1").

I/D=1, S=1

		1	2	3	4	
	1	2	3	4	A	
1	2	3	4	A	В	
2	3	4	A	В	С	
3	4	A	В	С	D	

Initial display Input new character "A" Input new character "B"

Input new character "C"

Input new character "D"

I/D=0, S=1

1	2	3	4	_		
	1	2	3	<u>4</u>	A	
		1	2	<u>3</u>	В	A
			1	2	С	В
				<u>1</u>	D	С

Input new character "A" Input new character "B" Input new character "C" Input new character "D"

Initial display

## Display ON/OFF

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	1	D	С	В

D = Display ON/OFF

When D = "1", the display is turned ON. When D = "0", the display is turned OFF. Contents in DDRAM are not changed.

C = Cursor ON/OFF

When C = "1", the cursor is displayed. The cursor is displayed as 5 dots on the  $8^{th}$  line of a character. When C = "0", the cursor is OFF.

B = Blinking Cursor

When B = "1", the entire character specified by the cursor blinks at a speed of 409.6ms intervals. When B = "0", the character does not blink, the cursor remains on.

## **Cursor/Display Shift**

	-	<u> </u>							
RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	1	S/C	R/L	0	0

S/C	R/L	Shift Function
0	0	Shifts the cursor position to the left (AC is decremented by 1).
0	1	Shifts the cursor position to the right (AC is incremented by 1).
1	0	Shifts the entire display to the left. The cursor follows the display shift.
1	1	Shifts the entire display to the right. The cursor follows the display shift.

When the display is shifted repeatedly, each line moves only horizontally. The second line display does not shift into the first line.

The Address Counter does not change during a Display Shift.

#### **Function Set**

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	DL	1	0	FT1	FT0

DL = Interface Data Length

When DL = "1", the data is sent or received in 8-bit length via DB7...DB0.

When DL = "0", the data is sent or received in 4-bit length via DB7...DB4. When the 4-bit data length is used, the data must be sent or received in two consecutive writes/reads to combine the data into full 8-bits.

FT1, FT0 = Font Table Selection

FT1	FT0	Font Table
0	0	English / Japanese
0	1	Western European #1
1	0	English / Russian
1	1	Western European #2

**Note:** Changing the font table during operation will immediately change any data currently on the display to the corresponding character on the newly selected font table.

#### Set CGRAM Address

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	ACG5	ACG4	ACG3	ACG2	ACG1	ACG0

This instruction is used to set the CGRAM address into the Address Counter. Data can then be written to or read from the CGRAM locations. See section: "How to use CGRAM".

ACG5...ACG0 is the binary CGRAM address.

#### Set DDRAM Address

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	ADD6	ADD5	ADD4	ADD3	ADD2	ADD1	ADD0

This instruction is used to set the DDRAM address into the Address Counter. Data can then be written to or read from the DDRAM locations.

ADD6...ADD0 is the binary DDRAM address.

Line 1 = Address 0x00 through 0x0F

Line 2 = Address 0x40 through 0x4F

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	OF
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

#### **Read Busy Flag and Address Counter**

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0

This instruction is used to read the Busy Flag (BF) to indicate if the display controller is performing an internal operation. The Address Counter is read simultaneously with checking the Busy Flag.

When BF = "1", the controller is busy and the next instruction will be ignored.

When BF = "0", the controller is not busy and is ready to accept instructions.

AC6...AC0 is the binary location of either the CGRAM or DDRAM current address.

#### Write Data to CGRAM or DDRAM

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
1	0		Write Data								

This instruction is used to write 8-bits of data to the CGRAM or DDRAM at the current address counter. After the write is complete, the address is automatically incremented or decremented by 1 according to the Entry Mode.

#### **Read Data from CGRAM or DDRAM**

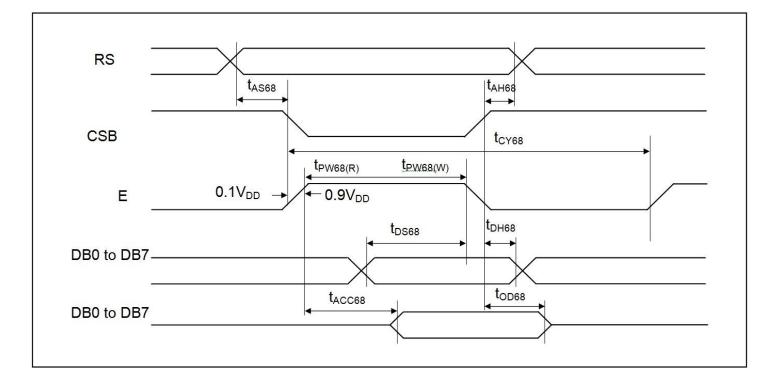
[	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0					
	1	1		Read Data											

This instruction is used to read 8-bits of data to the CGRAM or DDRAM at the current address counter. After the read is complete, the address is automatically incremented or decremented by 1 according to the Entry Mode.

The Set CGRAM Address or Set DDRAM Address Instruction must be executed before this instruction can be performed, otherwise the first Read Data will not be valid.

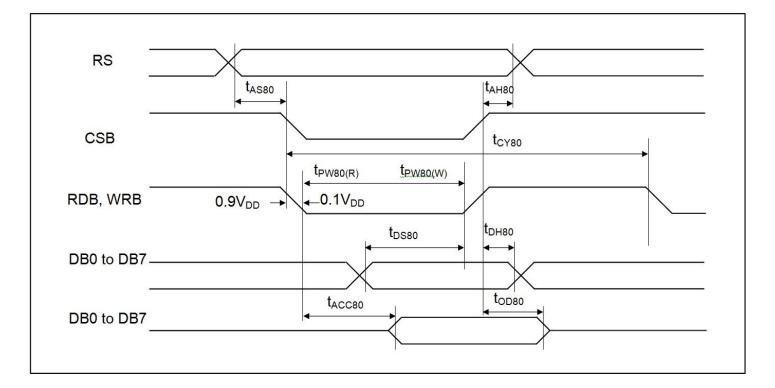
## **MPU Interface**

When DL is set for 8-bit mode, the display interfaces with the MPU with DB7...DB0 (DB7 is the MSB). When DL is set for 4-bit mode, the display interfaces with the MPU with only DB7...DB4 (DB7 is the MSB). Each instruction must be sent in two operations, the 4 high-order bits first, followed by the 4 low-order bits. The Busy Flag must be checked after completion of the entire 8-bit instruction.



## 6800-MPU Parallel Interface (default)

Item	Signal	Symbol	Min.	Тур.	Max.	Unit	Note
Address setup time	RS	tAS68	20	-	-	ns	
Address hold time	RS	tAH68	0	-	-	ns	
System cycle time		tCY68	500	-	-	ns	
Pulse width (write)	E	tPW68(W)	250	-	-	ns	
Pulse width (read)	E	tPW68(R)	250	-	-	ns	
Data setup time	DB7DB0	tDS68	40	-	-	ns	
Data hold time	DB7DB0	tDH68	20	-	-	ns	
Read access time	DB7DB0	tACC68	-	-	180	ns	CL=100pF
Output disable time	DB7DB0	tOD68	10	-	-	ns	

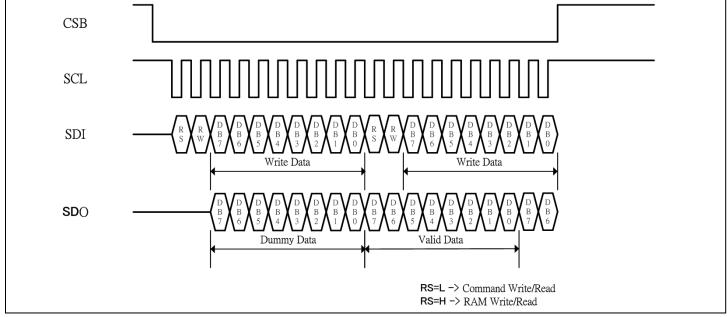


ltem	Signal	Symbol	Min.	Тур.	Max.	Unit	Note
Address setup time	RS	tAS80	20	-	-	ns	
Address hold time	RS	tAH80	0	-	-	ns	
System cycle time		tCY80	500	-	-	ns	
Pulse width (write)	/WR	tPW80(W)	250	-	-	ns	
Pulse width (read)	/RD	tPW80(R)	250	-	-	ns	
Data setup time	DB7DB0	tDS80	40	-	-	ns	
Data hold time	DB7DB0	tDH80	20	-	-	ns	
Read access time	DB7DB0	tACC80	-	-	180	ns	CL=100pF
Output disable time	DB7DB0	tOD80	10	-	-	ns	

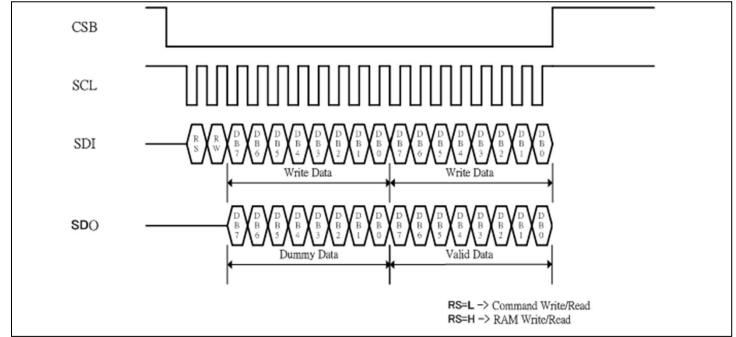
## **Serial Interface**

In serial interface mode, instructions and data are both sent on the SDI line and clocked in with the SCL line. /CS must go LOW before transmission, and must go HIGH when switching between writing instructions and writing data. The data on SDI is clocked into the LCD controller on the rising edge of SCL in the following format:

## Instruction transmission:

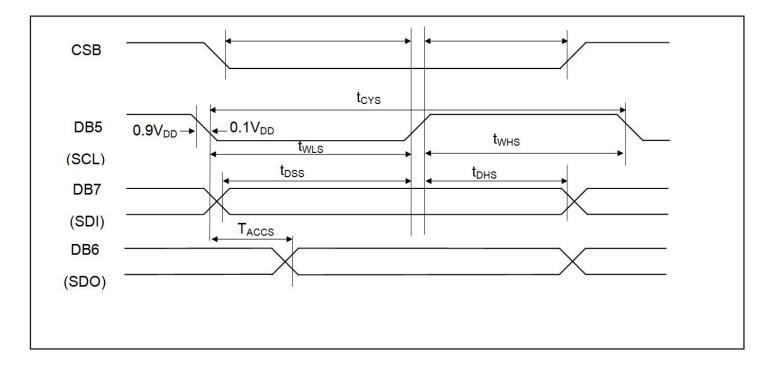


\*Note: RS and RW should be used between each instruction.



## Data transmission:

\*Note: RS and RW only need to be set at the start of continuous data transmission.



ltem	Signal	Symbol	Min.	Тур.	Max.	Unit	Note
Serial clock cycle	DB5 (SCL)	tCYS	300	-	-	ns	
SCL high pulse width	DB5 (SCL)	tWHS	100	-	-	ns	
SCL low pulse width	DB5 (SCL)	tWLS	100	-	-	ns	
CSB setup time	CSB	tCSS	150	-	-	ns	
CSB hold time	CSB	tCHS	150	-	-	ns	
Data setup time	DB7 (SDI)	tDSS	100	-	-	ns	
Data hold time	DB7 (SDI)	tDHS	100	-	-	ns	
Read access time	DB6 (SDO)	tACCS	-	-	80	ns	

# **Built-in Font Tables**

English/Japanese (FT[1:0] = 00, default)

Upper 4bit ower 4bit	ա	 LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	ннн
ш	CG RAM (1)		8	3			8					-		œ	P
LLLH	CG RAM (2)			Ħ			3				2				
LLHL	CG RAM (3)					b					ď			P	m
LLNN	CG RAM (4)	Ħ			9	•									
LHLL	CG RAM (5)		4			٠	ŧ.								
LHLH	CG RAM (6)					-		*			7			œ	
LHHL	CG RAM (7)	8				F					IJ			P	8
LHHH	CG RAM (8)		2	B	U	9	W				-				
HLLL	CG RAM (9)	K.	8			h				-	5				
HLLH	CG RAM (10)	3	9	I		1					7				
HLHL	CG RAM (11)			J		Ĵ	N								-
HLHH	CG RAM (12)			ĸ				3			Ţ			8	7
HHLL	CG RAM (13)				3	1		3				D		æ	P
HHLH	CG RAM (14)					P				h		***			
HHHL	CG RAM (15)					m		33			Þ			2	
нини	CG RAM (16)					O								œ	

# Western European table 1 (FT[1:0] = 01)

Upper 4att	ա	 LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	нннн
ш	CG RAM (1)			a	P		P								
LLLH	CG RAM (2)			m	٠	3									
LLHL	CG RAM (\$)				R	b									
LLHH	CG RAM (4)	Ħ			-										
LHLL	CG RAM (5)			D											
LHLH	CG RAM (6)				U	8									
LHHL	CG RAM (7)		6		IJ	F									
LHHH	CG RAM (8)				IJ										
HLLL	CG RAM (9)		8												
HLLH	CG RAM (10)		9												
HLHL	CG RAM (11)				2										I
HLNH	CG RAM (12)					k									
HHLL	CG RAM (13)				-										
HHLH	CG RAM (14)			M		m									
HHHL	CG RAM (15)					m									
ннни	CG RAM (16)														

Upper		I	1 - 1									-				
lbit	ա	ши	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHH
ш	CG RAM (1)	A								30		H				
LLLH	CG RAM (2)	Å														
LLHL	CG RAM (3)	A										30				
LLHH	CG RAM (4)	A										8				
LHLL	CG RAM (5)															
LHLH	CG RAM (6)	Ĥ											3			
LHHL	CG RAM (7)	Æ														
LHHH	CG RAM (8)	Q										8				
HLLL	CG RAM (3)									-11						
HLLH	CG RAM (10)	E														
HLHL	CG RAM (11)	Ē									æ				3	
HLHH	CG RAM (12)								Û							
HHLL	CG RAM (13)								Ü							
HHLH	CG RAM (14)	Í							Ŷ	1	b		ċ			
HHHL	CG RAM (15)	Î							þ							
ннни	CG RAM (16)	I														

# English/Russian (FT[1:0] = 10)

# Western European table 2 (FT[1:0] = 11)

Upper 4bit Lower 4bit	uu		LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	нннн
ա	CG RAM (1)			Ø		P										
LLLH	CG RAM (2)			1		٠										
LLHL	CG RAM (3)	Π				R	۵			Æ						
LLHH	CG RAM (4)		Ħ			8							and the second second	1		
LHLL	CG RAM (5)			4	D	T										
LHLH	CG RAM (6)						8		3		-					
LHHL	CG RAM (7)	1	8.	6		IJ					-				8	
LHHH	CG RAM (8)			P								*				
HLLL	CG RAM (9)	ſ		8			h		8						R	
HLLH	CG RAM (10)	1		9	I	1	1		8	۵				Π		
HLHL	CG RAM (11)														L.	
HLHH	CG RAM (12)	I	-	2	ĸ											
HHLL	CG RAM (13)										80					
HHLH	CG RAM (14)	•					m				20			Ψ		
HHHL	CG RAM (15)						n				3					
нннн	CG RAM (16)						۵				ø		8	œ	œ	

# How to use CGRAM

The Character Generator RAM (CGRAM) is used to generate custom 5x8 character patterns. There are 8 available addresses: CGRAM Address 0x00 through 0x08.

<u>Character Code</u> DDRAM address on Font Table used to write CGRAM character to display	<u>CG</u>	CGRAM Address					Character Patterns (CGRAM data) 7 6 5 4 3 2 1 0								<u>Character Patterns</u> (CGRAM data)	
	5	4	3	2	1	0		7	6	5	4	3	2	1	0	
	_	_	_	-	-	_				1					-	-1
	0	0	0	0	0	0		-	-	-	1	1	1	1	0	Character pattern #0
				0	0	1		-	-	-	1	0	0	0	1	
				0	1	0		-	-	-	1	0	0	0	1	
0x00				0	1 0	1		-	-	-	1	1 0	1	1 0	0 0	
				1	0	1		-	-	-	1	0	0	1	0	
				1	1	0		-	-	-	1	0	0	0	1	
				1	1	1		-	-	-	0	0	0	0	0	Cursor position
	0	0	1	0	0	0		-	-	-	1	0	0	0	1	Character pattern #1
				0	0	1		-	-	-	0	1	0	1	0	
				0	1	0		-	-	-	1	1	1	1	1	
0x01				0	1	1		-	-	-	0	0	1	0	0	
UXUI				1	0	0		-	-	-	1	1	1	1	1	
				1	0	1		-	-	-	0	0	1	0	0	
				1	1	0		-	-	-	0	0	1	0	0	
				1	1	1		-	-	-	0	0	0	0	0	Cursor position
	•	•	•	•	•	•		-	-	-	•	•	•	•	•	
0x020x06	•	•	•	•	•	•		-	-	-	•	·	·	·	•	
	•	•	•	•	•	•		-	-	-	•	·	·	•	•	
	1	1	1	0	0	0		-	-	-	0	0	0	0	0	Character pattern #7
	-	-	-	0	0	1		-	-	-	0	1	0	1	0	
				0	1	0		-	-	-	0	0	0	0	0	
0x07				0	1	1		-	-	-	0	0	0	0	0	
0x07				1	0	0		-	-	-	1	0	0	0	1	
				1	0	1		-	-	-	0	1	1	1	0	
				1	1	0		-	-	-	0	0	1	0	0	
				1	1	1		-	-	-	0	0	0	0	0	Cursor position

Notes:

"-" = Not used

The cursor line position can be used, it will be displayed as a logic-OR if the cursor is turned ON.

CGRAM is stored in positions 0x00 through 0x07 of the font table. Therefore, to write the first CGRAM character to the display, you would move the cursor to the desired DDRAM location on the display and write character data 0x00.

# **Initialization Sequence**

Power ON         Wait for power stabilization: 2 1ms           Function set:         Function is 2 1ms           RS         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0         0         0         0         1         1         0         X         X         X           RS         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0         0         X         X         X           Check BUSY flag         D         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0         0         X         X         X           RS         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0         0         X <th>8-bit m</th> <th>node:</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	8-bit m	node:									
Function Set:         RS       R/W       DB7       DB6       DB5       DB4       DB3       DB2       DB1       DB0         0       0       0       0       1       1       0       X       X         Check BUSY flag         Display OFF:         R/W       DB7       DB6       DB5       DB4       DB3       DB2       DB1       DB0         0       0       0       0       0       0       1       0       X       X         Check BUSY flag         Display Clear:         R/W       DB7       DB6       DB5       DB4       DB3       DB2       DB1       DB0         0       0       0       0       0       0       0       1       0       X         Check BUSY flag         Entry Mode Set:         R/W       DB7       DB6       DB5       DB4       DB3       DB2       DB1       DB0         0       0       0       0       0       0       1       0       0       1       0         Check BUSY flag </td <td>Power</td> <td>ON</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Power	ON									
R         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0         O         X         X           Check BUSY flag         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0         O         O         O         X         X           Check BUSY flag	Wait f	or power	stabilizatio	n: ≥ 1ms							
0         0         0         1         1         1         0         X         X           Check BUSY flag	Functi	on Set:			_						
Check BUSY flag         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         1         0         X         X           Check BUSY flag           Display Clear:         Vertication of the text of the text of te	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
Display OFF:         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         1         0         X         X           Check BUSY flag              X         X           Display Clear:             DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         0         1         0         1         1         0         1 </td <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>1</td> <td>0</td> <td>х</td> <td>X</td>	0	0	0	0	1	1	1	0	х	X	
R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         1         0         X         X           Check BUSY flag	Check	BUSY flag									
0         0         0         0         0         1         0         X         X           Check BUSY flag         -	Displa	y OFF:									
Check BUSY flag         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0         D <t< td=""><td></td><td>R/W</td><td></td><td>-</td><td>-</td><td></td><td>-</td><td></td><td></td><td>-</td></t<>		R/W		-	-		-			-	
Image: Norman and Strain and Str	0	0	0	0	0	0	1	0	X	X	
RS         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         0         0         1           Check JUSY flag           Entry Mode Set:           R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         1         1         0           Check JUSY flag           DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         1         1         0           Check JUSY flag           Home Command:           Check JUSY flag           DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         1         0	Check	BUSY flag									
0         0         0         0         0         0         0         1           Check BUSY flag           Entry Mode Set:           RS         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         1         1         0           Check BUSY flag           Home Command:           Check BUSY flag           DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         1         0           Check BUSY flag           DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         1         0           Check BUSY flag           Display ON:	Displa	y Clear:									
Check BUSY flag       DB7       DB6       DB5       DB4       DB3       DB2       DB1       DB0         0       0       0       0       0       1       1       0         Check BUSY flag         Check BUSY flag         Home Command:         Check BUSY flag         DB6       DB5       DB4       DB3       DB2       DB1       DB0         O       0       0       0       0       1       0         Check BUSY flag         Home Command:         Check BUSY flag       DB7       DB6       DB5       DB4       DB3       DB2       DB1       DB0         0       0       0       0       0       0       1       0         Check BUSY flag         Display ON:	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
RS         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0	0	0	0	0	0	0	0	0	0	1	
RS         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         1         1         0           0         0         0         0         0         0         1         1         0           Check BUSY flag           Home Command:           R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         0         1         0           Check BUSY flag           DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         1         0           Check BUSY flag           Display ON:           R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0	Check	BUSY flag									
0         0         0         0         0         0         1         1         0           Check BUSY flag           Home Command:           RS         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         1         0           Check BUSY flag           Display ON:           R\$         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0	Entry I	Mode Set:									
Check BUSY flag       DB7       DB6       DB5       DB4       DB3       DB2       DB1       DB0         0       0       0       0       0       0       1       0         Check BUSY flag         Display ON:         RS       R/W       DB7       DB6       DB5       DB4       DB3       DB2       DB1       DB0         O         O         O         O       0       0       0       1       0         O       0       0       0       0       1       0         O       O         O       O       O         O       O       O         O       O         O       O       O         O       O         O       O         O       O         O       O         O       O         O <td colsp<="" td=""><td>RS</td><td>R/W</td><td>DB7</td><td>DB6</td><td>DB5</td><td>DB4</td><td>DB3</td><td>DB2</td><td>DB1</td><td>DB0</td></td>	<td>RS</td> <td>R/W</td> <td>DB7</td> <td>DB6</td> <td>DB5</td> <td>DB4</td> <td>DB3</td> <td>DB2</td> <td>DB1</td> <td>DB0</td>	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Under State         Home Command:         RS       R/W       DB7       DB6       DB5       DB4       DB3       DB2       DB1       DB0         0       0       0       0       0       0       1       0         Check BUSY flag         Display ON:         R/W       DB7       DB6       DB5       DB4       DB3       DB2       DB1       DB0	0	0	0	0	0	0	0	1	1	0	
RS         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0           0         0         0         0         0         0         0         1         0           Check BUSY flag           Display ON:           RS         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0	Check	BUSY flag									
0         0         0         0         0         0         1         0           Check BUSY flag           Display ON:           RS         R/W         DB7         DB6         DB5         DB4         DB3         DB2         DB1         DB0	Home	Command	1:								
Check BUSY flag Display ON: RS R/W DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
Display ON: RS R/W DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0	0	0	0	0	0	0	0	0	1	0	
RS R/W DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0	Check	BUSY flag									
	Displa	y ON:									
0 0 0 0 0 0 0 1 X X	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
	0	0	0	0	0	0	1	1	X	X	

Initialization End

#### 4-bit mode:

Power ON

Wait for power stabilization: ≥ 1ms

Functi	on Set:												
RS	R/W	DB7	DB6	DB5	DB4								
0	0	0	0	1	0								
0 0 0 0 1 0													
0 0 <b>1 0 X X</b>													

## Check BUSY flag

Display	y OFF:				
RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	0	0
0	0	1	0	Х	Х

#### Check BUSY flag

Display Clear:						
RS	R/W	DB7	DB6	DB5	DB4	
0	0	0	0	0	0	
0	0	0	0	0	1	

#### Check BUSY flag

Entry Mode Set:

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	0	0
0	0	0	1	1	0

#### Check BUSY flag

Home	Command	d:			
RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	0	0
0	0	0	0	1	0

#### Check BUSY flag

Display ON: RS R/W DB7 DB6 DB5 DB4 0 0 0 0 0 0 0 0 1 1 Х Х

#### Initialization End

# **Quality Information**

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Test the endurance of the display at high	+85°C , 240hrs	2
	storage temperature.		
Low Temperature storage	Test the endurance of the display at low	-40°C , 240hrs	1,2
	storage temperature.		
High Temperature	Test the endurance of the display by	+80°C 240hrs	2
Operation	applying electric stress (voltage & current)		
	at high temperature.		
Low Temperature	Test the endurance of the display by	-40°C , 240hrs	1,2
Operation	applying electric stress (voltage & current)		
	at low temperature.		
High Temperature /	Test the endurance of the display by	+60°C , 90% RH , 240hrs	1,2
Humidity Storage	applying electric stress (voltage & current)		
	at high temperature with high humidity.		
Thermal Shock resistance	Test the endurance of the display by	-40°C,30min -> 25°C,5min ->	
	applying electric stress (voltage & current)	80°C,30min = 1 cycle	
	during a cycle of low and high	30 cycles	
	temperatures.		
Vibration test	Test the endurance of the display by	10-55Hz, 1.5mm amplitude.	3
	applying vibration to simulate	30min in each of 3 directions	
	transportation and use.	X,Y,Z	
Static electricity test	Test the endurance of the display by	Air: ±4kV, 10 Times	
	applying electric static discharge.		

Note 1: No condensation to be observed.

**Note 2:** Conducted after 2 hours of storage at 25°C, 0%RH.

**Note 3:** Test performed on product itself, not inside a container.

## **Evaluation Criteria:**

- 1: Display is fully functional during operational tests and after all tests, at room temperature.
- 2: No observable defects.
- 3: Luminance >50% of initial value.
- 4: Current consumption within 50% of initial value

## Precautions for using OLEDs/LCDs/LCMs

See Precautions at <a href="http://www.newhavendisplay.com/specs/precautions.pdf">www.newhavendisplay.com/specs/precautions.pdf</a>

## Warranty Information and Terms & Conditions

http://www.newhavendisplay.com/index.php?main\_page=terms