

**Product Specification**

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# NHD-240128WG-ATFH-VZ#

## Graphic Liquid Crystal Display Module

<b>NHD-</b>	Newhaven Display
<b>240128-</b>	240 x 128 Pixels
<b>WG-</b>	Display: Graphic
<b>A-</b>	Model
<b>T-</b>	White LED Backlight
<b>F-</b>	FSTN (+)
<b>H-</b>	Transflective, 6:00 Optimal View, Wide Temperature
<b>VZ#-</b>	Built-in Negative Voltage Supply

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## Additional Resources

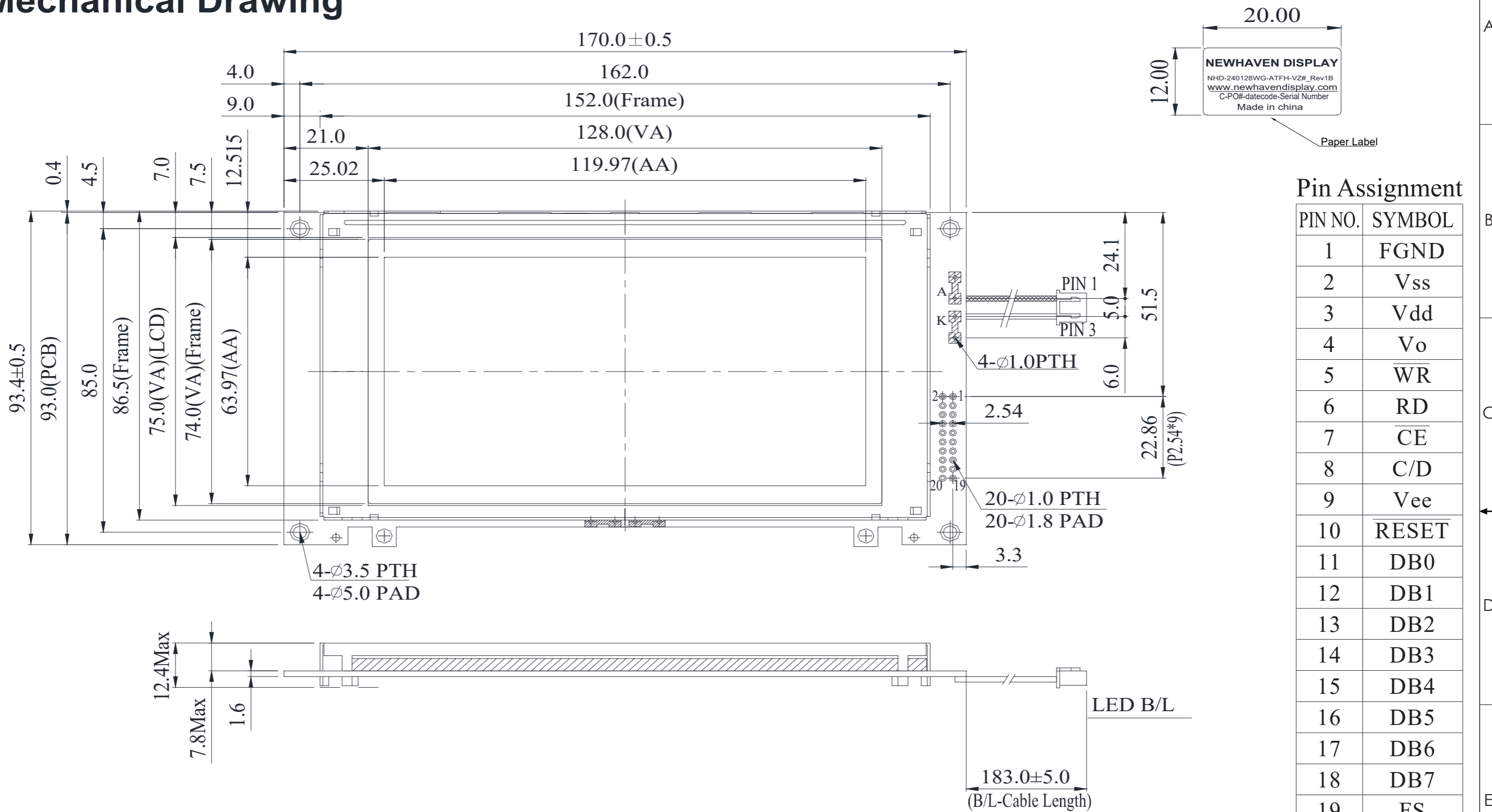
- **Support Forum:** <https://support.newhavendisplay.com/hc/en-us/community/topics>
- **GitHub:** <https://github.com/newhavendisplay>
- **Example Code:** <https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/>
- **Knowledge Center:** [https://www.newhavendisplay.com/knowledge\\_center.html](https://www.newhavendisplay.com/knowledge_center.html)
- **Quality Center:** [https://www.newhavendisplay.com/quality\\_center.html](https://www.newhavendisplay.com/quality_center.html)
- **Precautions for using LCDs/LCMs:** <https://www.newhavendisplay.com/specs/precautions.pdf>
- **Warranty / Terms & Conditions:** <https://www.newhavendisplay.com/terms.html>



## Document Revision History

Revision	Date	Description	Changed By
0	04/28/2010	User Guide Reformat	MC
1	07/01/2010	Pin Description Updated	MP
2	06/06/2013	Drawing Page and Electrical Characteristics Updated	KA
3	06/10/2020	Updated 2D Mechanical Drawing, Supply Current Range, Response times & Quality Information	AS
4	02/26/2021	LCD Glass Panel Upgrade; Updated Backlight Drive Conditions & Quality Information Part Revision Upgraded to Rev1A	AS
5	05/12/2021	Electrical, Optical & Controller IC Updated	ZP
6	08/12/2021	Optical and Quality Updated	ZP
7	01/08/2024	Mechanical Drawing Format Updated	KL

# Mechanical Drawing

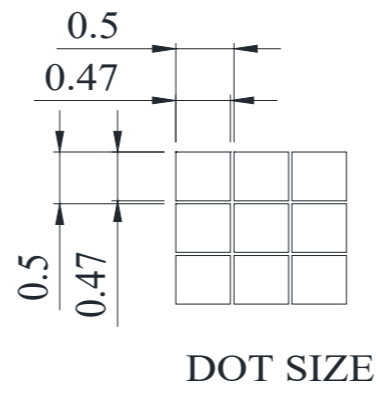


## Pin Assignment

PIN NO.	SYMBOL
1	FGND
2	Vss
3	Vdd
4	Vo
5	WR
6	RD
7	CE
8	C/D
9	Vee
10	RESET
11	DB0
12	DB1
13	DB2
14	DB3
15	DB4
16	DB5
17	DB6
18	DB7
19	FS
20	RV

### Product Description: 240x128 Graphic LCD

1. Driver IC: RA6963
2. Driving Mode: 1/128 Duty
3. Interface: 8-bit 8080 Parallel
4. Power Requirement: 5.0V
5. Optical Features: FSTN (+), Transflective, 6:00 View, White Backlight
6. Recommended Pin Header: 2x10pin 2.54mm pitch



<b>Standard Tolerance:</b> (Unless otherwise specified)  Linear: ±0.3mm		
	Drawing/Part Number: <b>NHD-240128WG-ATFH-VZ#</b>	Revision: <b>1B</b>
<b>Unless otherwise specified:</b> • Dimensions are in Millimeters • Third Angle Projection	Drawn By: K. Lewis	Approved By: K. Lewis
	Drawn Date: 01/08/2024	Approved Date: 01/08/2024
This drawing is solely the property of Newhaven Display International, Inc. The information it contains is not to be disclosed, reproduced or copied in whole or part without written approval from Newhaven Display.		

## Pin Description

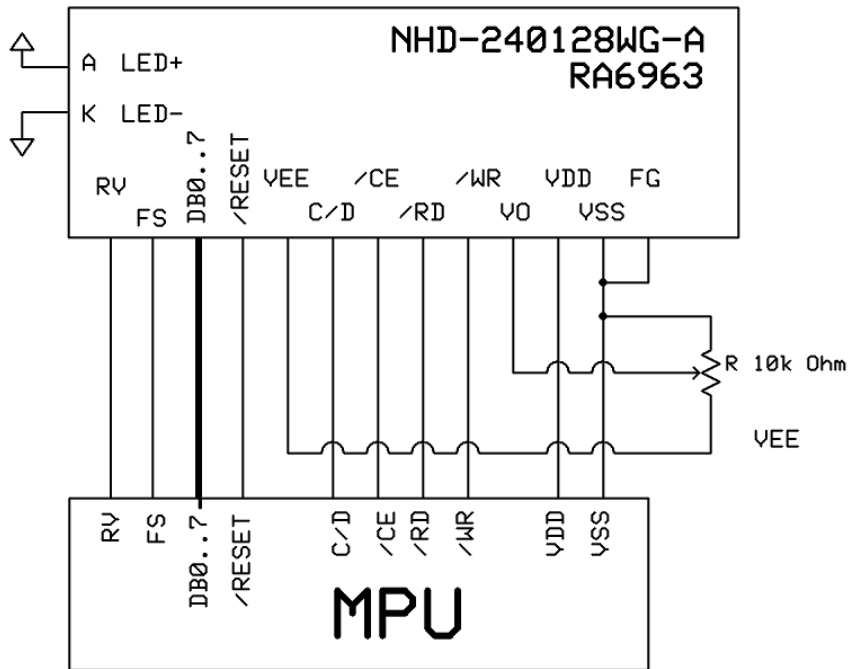
Pin No.	Symbol	External Connection	Function Description
1	FGND	Power Supply	Frame Ground
2	VSS	Power Supply	Ground
3	VDD	Power Supply	Power supply for LCD and logic (+5.0V)
4	V0	Adj Power Supply	Power supply for contrast (approx. -13.0V)
5	$\overline{WR}$	MPU	Active LOW Write signal
6	$\overline{RD}$	MPU	Active LOW Read signal
7	$\overline{CE}$	MPU	Active LOW Chip Enable signal
8	C/D	MPU	Command/Data select signal. CD=1: Command, CD=0: Data
9	VEE	Power Supply	Negative voltage output (-16V)
10	RESET	MPU	Active LOW Reset signal
11-18	DB0~DB7	MPU	8-bit bi-directional three-state data bus lines.
19	FS	Power Supply	Font Select signal. H:6x8, L:8x8
20	RV	MPU	Display mode signal. RV=1: Reverse display, RV=0: normal

**Recommended LCD connector:** 20 pin, 2.54mm pitch pins

**Backlight connector:** JST p/n: XHP-3

**Mates with:** JST p/n: B3B-XH-A

## Wiring Diagram



## Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T <sub>OP</sub>	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T <sub>ST</sub>	Absolute Max	-30	-	+80	°C
Supply Voltage	V <sub>DD</sub>	-	4.5	5.0	5.5	V
Supply Current	I <sub>DD</sub>	V <sub>DD</sub> = 5.0V	15	30	60	mA
Supply for LCD (Contrast)	V <sub>DD</sub> -V <sub>0</sub>	T <sub>OP</sub> = 25°C	17.5	18.0	18.5	V
"H" Level input	V <sub>IH</sub>	-	0.8 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level input	V <sub>IL</sub>	-	GND	-	0.15 * V <sub>DD</sub>	V
"H" Level output	V <sub>OH</sub>	-	V <sub>DD</sub> - 0.3	-	V <sub>DD</sub>	V
"L" Level output	V <sub>OL</sub>	-	GND	-	0.3	V
Backlight Supply Voltage	V <sub>L</sub>	-	3.4	3.5	3.6	V
Backlight Supply Current	I <sub>L</sub>	V <sub>LED</sub> = 3.5V	96	128	160	mA
Backlight Lifetime	-	I <sub>LED</sub> = 128mA	-	50,000	-	Hrs.

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Top		Cr ≥ 2	0	-	30	°
Viewing Angle – Bottom			0	-	60	°
Viewing Angle – Left			0	-	45	°
Viewing Angle – Right			0	-	45	°
Contrast Ratio	Cr	-	2	5	-	-
Response Time (rise)	Tr	-	-	200	300	ms
Response Time (fall)	Tf	-	-	250	350	ms

## Controller Information

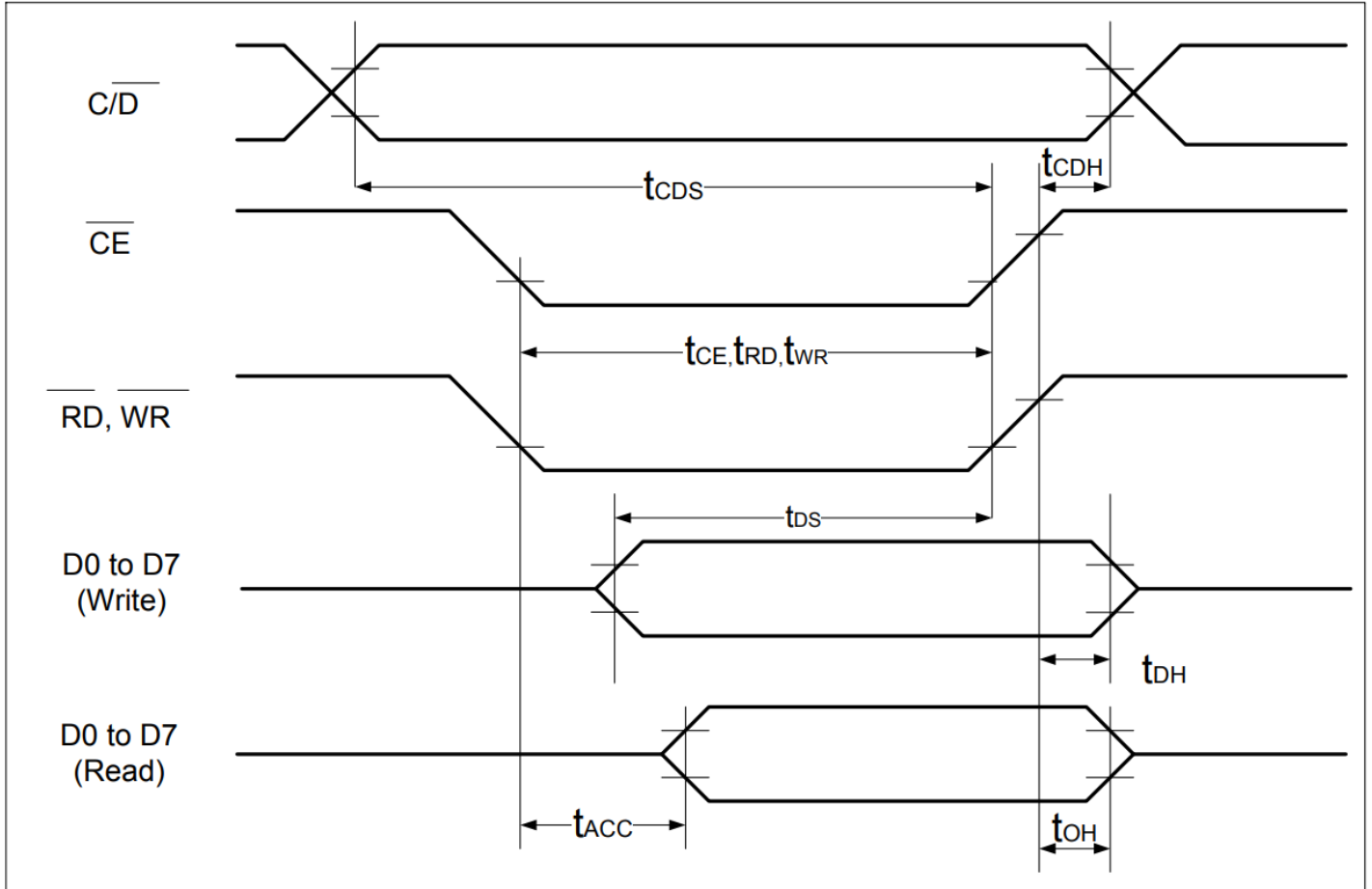
Built-in RA6963N1 Controller: <https://support.newhavendisplay.com/hc/en-us/articles/4414786723479-RA6963>



## Table of Commands

Command	Code	D1	D2	Function
<b>Registers Setting</b>	00100001	X address	Y address	Set cursor pointer
	00100010	Data	00h	Set Offset Register
	00100100	Low address	High address	Set Address pointer
<b>Set Control Word</b>	01000000	Low address	High address	Set Text Home Address
	01000001	Columns	00h	Set Text Area
	01000010	Low address	High address	Set Graphic Home Address
	01000011	Columns	00h	Set Graphic Area
<b>Mode Set</b>	1000X000	--	--	OR mode
	1000X001	--	--	EXOR mode
	1000X011	--	--	AND mode
	1000X100	--	--	Text Attribute mode
	10000XXX	--	--	Internal CG ROM mode
	10001XXX	--	--	External CG RAM mode
<b>Display Mode</b>	10010000	--	--	Display off
	1001XX10	--	--	Cursor on, blink off
	1001XX11	--	--	Cursor on, blink on
	100101XX	--	--	Text on, graphic off
	100110XX	--	--	Text off, graphic on
	100111XX	--	--	Text on, graphic on
<b>Cursor Pattern Select</b>	10100000	--	--	1-line cursor
	10100001	--	--	2-line cursor
	10100010	--	--	3-line cursor
	10100011	--	--	4-line cursor
	10100100	--	--	5-line cursor
	10100101	--	--	6-line cursor
	10100110	--	--	7-line cursor
	10100111	--	--	8-line cursor
<b>Data auto Read/Write</b>	10110000	--	--	Set Data Auto Write
	10110001	--	--	Set Data Auto Read
	10110010	--	--	Auto Reset
<b>Data Read/Write</b>	11000000	Data	--	Data Write and Increment ADP
	11000001	--	--	Data Read and Increment ADP
	11000010	Data	--	Data Write and Decrement ADP
	11000011	--	--	Data Read and Decrement ADP
	11000100	Data	--	Data Write and Non-variable ADP
	11000101	--	--	Data Read and Non-variable ADP
<b>Screen Peek</b>	11100000	--	--	Screen Peek
<b>Screen Copy</b>	11101000			Screen Copy
<b>Bit Set/Reset</b>	11110XXX	--	--	Bit Reset
	11111XXX	--	--	Bit Set
	1111X000	--	--	Bit 0 (LSB)
	1111X001	--	--	Bit 1
	1111X010	--	--	Bit 2
	1111X011	--	--	Bit 3
	1111X100	--	--	Bit 4
	1111X101	--	--	Bit 5
	1111X110	--	--	Bit 6
	1111X111	--	--	Bit 7 (MSB)

## Timing Characteristics



(  $V_{DD}=+5V\pm 5\%$ ,  $GND=0V$ ,  $T_a= -20$  to  $+70^{\circ}C$  )

Item	Symbol	Test Conditions	Min.	Max.	Unit
C/ $\overline{D}$ Set Up Time	$t_{CDS}$	--	100	--	ns
C/ $\overline{D}$ Hold Time	$t_{CDH}$	--	10	--	ns
$\overline{CE}$ , $\overline{RD}$ , $\overline{WR}$ Pulse Width	$t_{CE}, t_{RD}, t_{WR}$	--	80	--	ns
Data Set Up Time	$t_{DS}$	--	80	--	ns
Data Hold Time	$t_{DH}$	--	40	--	ns
Access Time	$t_{ACC}$	--	--	150	ns
Output Hold Time	$t_{OH}$	--	10	50	ns



## Built-In Font Table

LSB MSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/
1	Ø	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
2	a	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
3	P	Q	R	S	T	U	U	W	X	Y	Z	[	\	]	^	_
4	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
5	p	q	r	s	t	u	v	w	x	y	z	{		}	~	
6	Q	Ü	É	À	Á	Â	Ã	Ä	Å	Ö	Ë	È	Ï	Î	Ï	À
7	É	Æ	Æ	À	Ö	Ö	Ü	Ü	Ü	Ö	Ø	€	¥	£	£	£

## Example Program Code

```
//-----
Sub Writecom
P1 = A           'move data to port 1
Set P3.0         'set I/D for instruction
Reset P3.1       'reset /CS
Reset P3.4       'reset /WR
Set P3.1         'set /CS
Set P3.4         'set /WR
End Sub

Sub Writedata
P1 = A           'move data to port 1
Reset P3.0       'reset I/D for instruction
Reset P3.1
Reset P3.4       'toggle /CS and /WR
Set P3.1
Set P3.4
End Sub

//-----
Sub Init
Set P3.6
Set P3.7
Reset P3.3       'reset FS
A = &H00
Call Writedata
Call Writedata   'text address = 0000h
A = &H40
Call Writecom    'text home address set
A = &H00
Call Writedata
A = &H40         'graphic home address = 4000h
Call Writedata
A = &H42
Call Writecom    'graphic home address set
A = &H1E
Call Writedata
A = &H00         'text area address = 001Eh
Call Writedata
A = &H41
Call Writecom    'text area control set
A = &H1E
Call Writedata
A = &H00         'graphic area = 001Eh
Call Writedata
A = &H43
Call Writecom    'graphic area control set
A = &H80
Call Writecom    'set display mode
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 Storage	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, 5G Acceleration, 60 sec in each of 3 directions X,Y,Z for 2 hours	3
Static electricity test	Endurance test applying electric static discharge.	Air: ±800V 150pF/330Ω, 10 Times	
		Contact: ±600V 150pF/330Ω, 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.