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# NHD-C0220AU-FSW-FTS

## COG (Chip-on-Glass) Liquid Crystal Display Module

NHD- Newhaven Display  
C0220- COG, 2 lines x 20 characters  
AU- Model  
F- Transflective  
SW- Side White LED backlight  
F- FSTN+  
T- 12:00 View Angle  
S- Standard Temp (0C ~ +50C)  
**RoHS Compliant**

**Newhaven Display International, Inc.**

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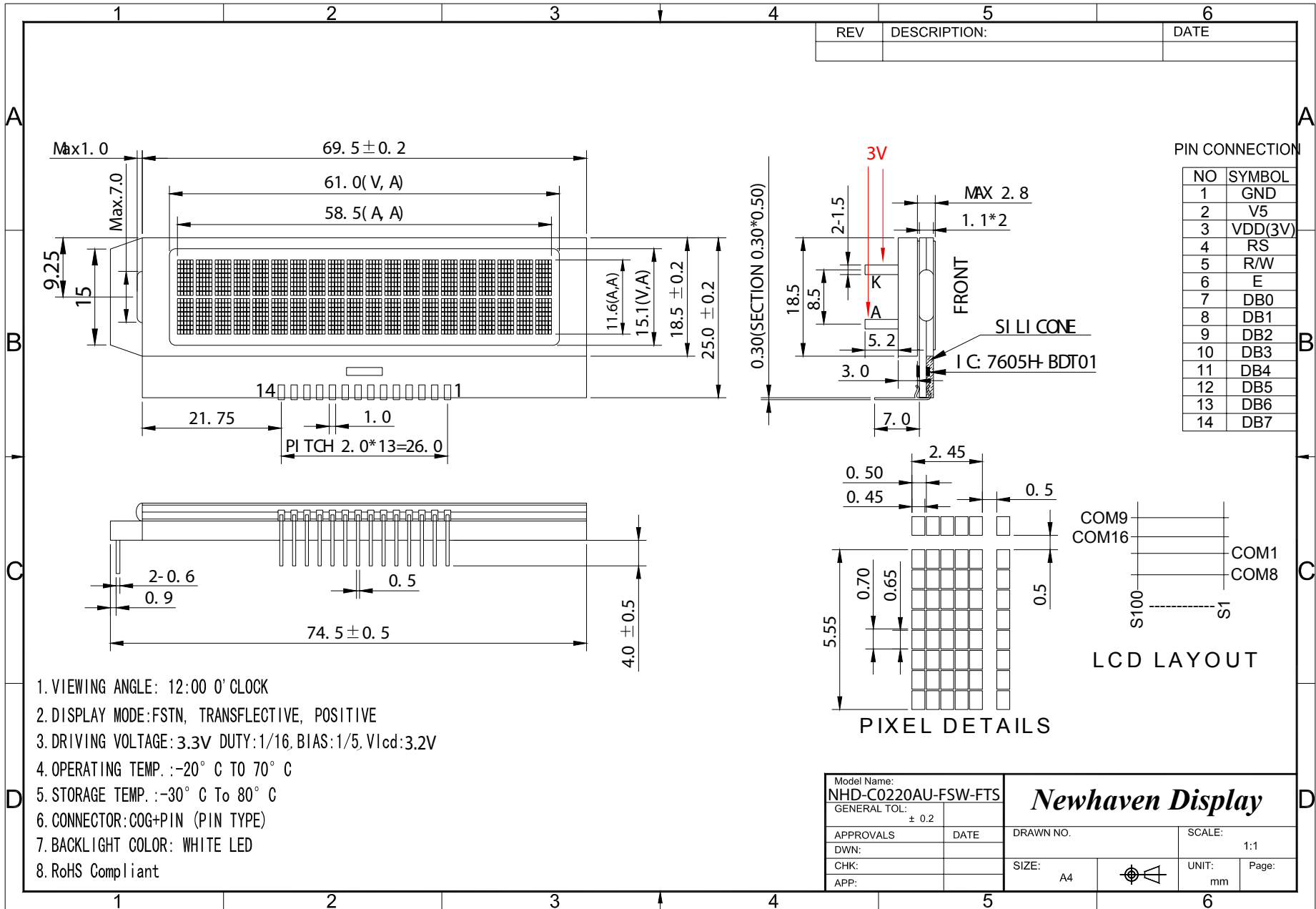
## Document Revision History

Revision	Date	Description	Changed by
0	5/17/2007	Initial Release	
1	6/25/2009	User guide reformat	CL
2	6/29/2009	Change typical backlight voltage	CL
3	6/30/2009	User guide reformat	BE
4	10/9/2009	Updated Electrical Characteristic	MC
5	5/14/2010	Controller Note	MP
6	8/27/2010	Drawing /Vlcd updated	BE
7	5/27/2011	Display character address code updated	AK
8	6/2/2011	Timing characteristics updated	AK

## Functions and Features

- 2 lines x 20 characters
- Built-in NT7605 controller
- 3.3V power supply
- 1/16 duty, 1/5 bias

# Mechanical Drawing



- VIEWING ANGLE: 12:00 O' CLOCK
- DISPLAY MODE: FSTN, TRANSFLECTIVE, POSITIVE
- DRIVING VOLTAGE: 3.3V DUTY: 1/16, BIAS: 1/5, V<sub>lcd</sub>: 3.2V
- OPERATING TEMP.: -20° C TO 70° C
- STORAGE TEMP.: -30° C TO 80° C
- CONNECTOR: COG+PIN (PIN TYPE)
- BACKLIGHT COLOR: WHITE LED
- RoHS Compliant

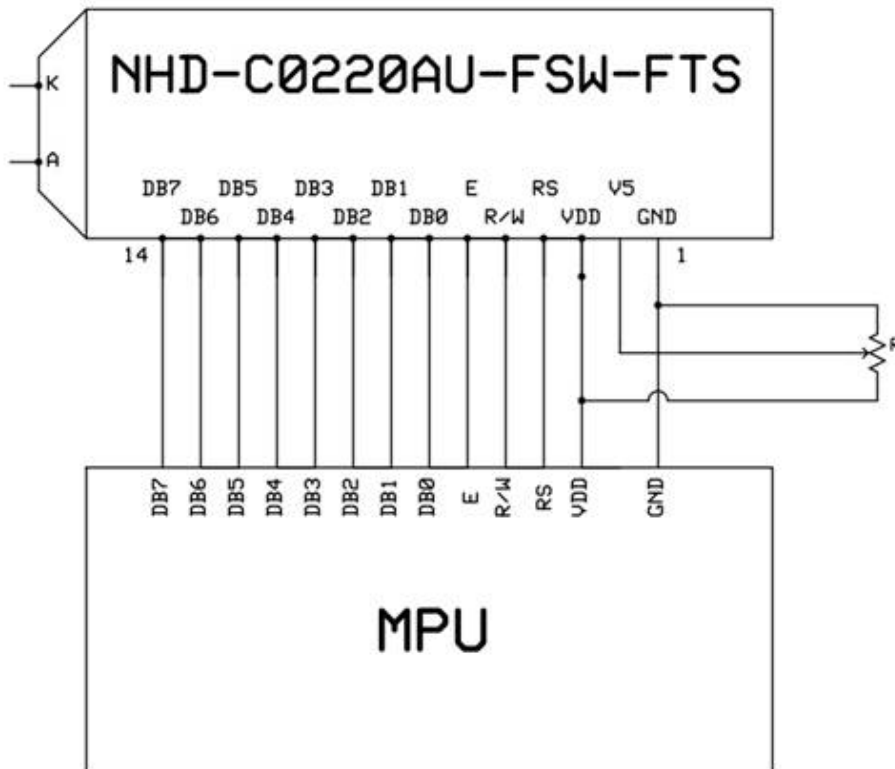
Model Name: <b>NHD-C0220AU-FSW-FTS</b>		<b>Newhaven Display</b>	
GENERAL TOL: ± 0.2			
APPROVALS	DATE	DRAWN NO.	SCALE: 1:1
DWN:			
CHK:		SIZE: A4	UNIT: mm
APP:			Page:

## Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	GND	Power Supply	Ground
2	V5	Adj Power Supply	Contrast voltage adjustment (~0.1V)
3	VDD	Power Supply	VDD=3.3V
4	RS	MPU	Register Select: 0=Instruction, 1=Data
5	R/W	MPU	Read / Write select: 0=Write, 1=Read
6	E	MPU	Read/Write start signal (Schmitt trigger input)
7-10	DB0 – DB3	MPU	Low 4 tri-state bi-directional data bus lines. Not used in 4-bit mode.
11-14	DB4 – DB7	MPU	High 4 tri-state bi-directional data bus lines.

**Recommended LCD connector:** 2.0mm pitch, 14pins Soldered to PCB, or JST p/n: PHR-14

**Backlight connector:** A and K pins **Mates with:** Solder to wires or PCB



## Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	Top	Absolute Max	0	25	+50	°C
Storage Temperature Range	Tst	Absolute Max	-30	25	+80	°C
Supply Voltage	VDD		3.2	3.3	3.4	V
Supply Current	IDD	VDD=3.3V			1.0	mA
Supply for LCD (contrast)	Vlcd	<b>VLCD=VDD-V5</b>	3.1	3.2	3.3	V
"H" Level input	Vih		0.8VDD		VDD	V
"L" Level input	Vil		0		0.2VDD	V
"H" Level output	Voh		VDD-0.6			V
"L" Level output	Vol				GND+0.6	V
Backlight Supply Voltage	VLED		3.0	3.1	3.2	V
Backlight Supply Current	Iled	VLED=3.1V	30	40	60	mA

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical	AV	Cr ≥ 2	-20		+60	°
Viewing Angle - Horizontal	AH	Cr ≥ 2	-50		+50	°
Contrast Ratio	Cr	25°C	9	15		
Response Time (rise)	Tr			150	200	ms
Response Time (fall)	Tr			250	400	ms

## Controller Information

Built-in NT7605N-BDT01. Download specification at [http://www.newhavendisplay.com/app\\_notes/NT7605.pdf](http://www.newhavendisplay.com/app_notes/NT7605.pdf)

**NOTE:** The Busy Flag of the NT7605 controller may not always be responsive. Add sufficient delays and/or a time-out check routine to continue operation if busy flag is not cleared.





# Timing Characteristics

## Read Operation

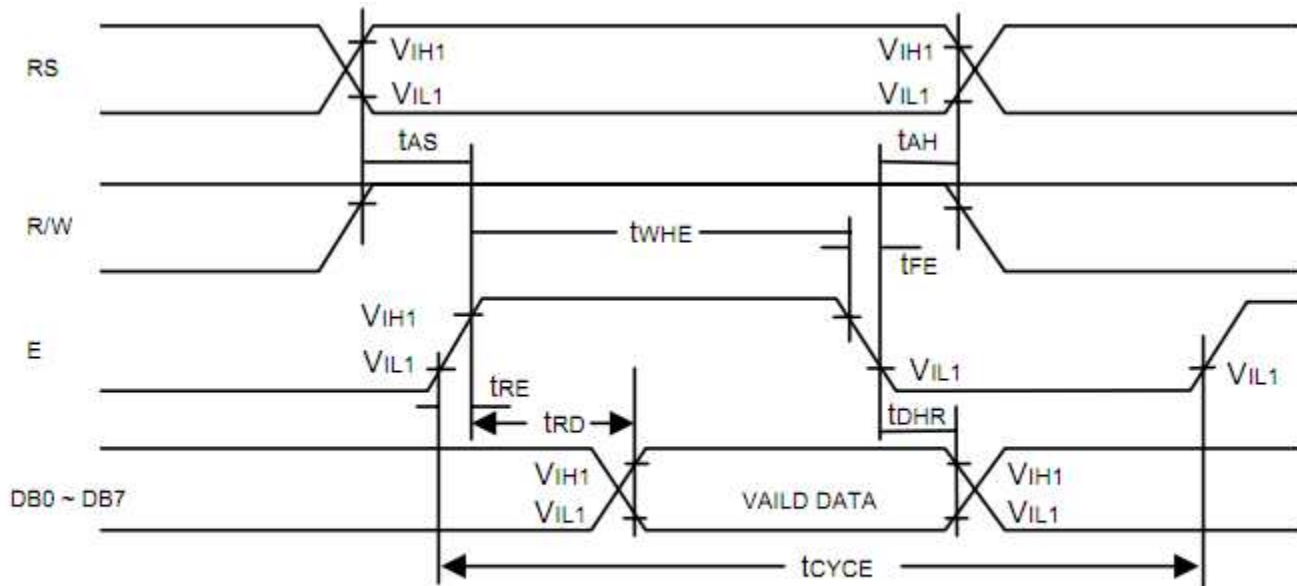


Figure 1. Bus Read Operation Sequence  
(Reading out data from NT7605 to MPU)

Read Cycle ( $V_{DD} = 5.0V$ ,  $GND = 0V$ ,  $T_A = 25^\circ C$ )

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
$t_{CYCE}$	Enable Cycle Time	500	-	-	ns	Figure 1
$t_{WHE}$	Enable "H" Level Pulse Width	300	-	-	ns	Figure 1
$t_{RE}, t_{FE}$	Enable Rise/Fall Time	-	-	25	ns	Figure 1
$t_{AS}$	RS, R/W Setup Time	$60^1$	-	-	ns	Figure 1
		$100^2$				
$t_{AH}$	RS, R/W Address Hold Time	10	-	-	ns	Figure 1
$t_{RD}$	Read Data Output Delay	-	-	190	ns	Figure 1
$t_{DHR}$	Read Data Hold Time	20	-	-	ns	Figure 1

Notes: 1: 8-bit operation mode  
2: 4-bit operation mode



## Write Operation

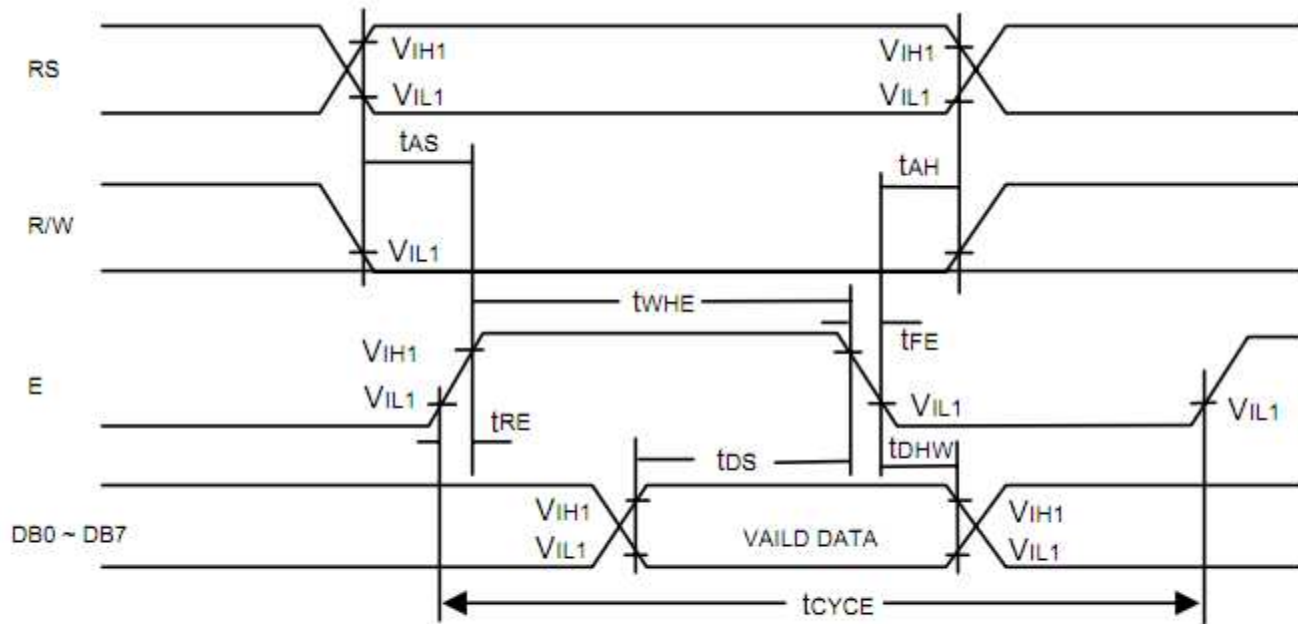


Figure 2. Bus Write Operation Sequence  
(Writing data from MPU to NT7605)

Write Cycle ( $V_{DD} = 5.0V$ ,  $GND = 0V$ ,  $T_A = 25^\circ C$ )

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
$t_{CYCE}$	Enable Cycle Time	500	-	-	ns	Figure 2
$t_{WHE}$	Enable "H" Level Pulse Width	300	-	-	ns	Figure 2
$t_{RE}$ , $t_{FE}$	Enable Rise/Fall Time	-	-	25	ns	Figure 2
$t_{AS}$	RS, R/W Setup Time	$60^1$	-	-	ns	Figure 2
		$100^2$				
$t_{AH}$	RS, R/W Address Hold Time	10	-	-	ns	Figure 2
$t_{DS}$	Data Output Delay	100	-	-	ns	Figure 2
$t_{DHW}$	Data Hold Time	10	-	-	ns	Figure 2

Notes: 1: 8-bit operation mode  
2: 4-bit operation mode

# Built-in Font Table

		Higher 4-bit (D4 to D7) of Character Code (Hexadecimal)																																	
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F																		
Lower 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	CG RAM (1)			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F															
	1	CG RAM (2)		!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@											
	2	CG RAM (3)		"	#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB											
	3	CG RAM (4)		#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB	CD											
	4	CG RAM (5)		#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB	CD	EF										
	5	CG RAM (6)		#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB	CD	EF	GH									
	6	CG RAM (7)		#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB	CD	EF	GH	IJ								
	7	CG RAM (8)		#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB	CD	EF	GH	IJ	KL							
	8	CG RAM (1)		#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB	CD	EF	GH	IJ	KL	MN						
	9	CG RAM (2)		#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB	CD	EF	GH	IJ	KL	MN	OP					
	A	CG RAM (3)		#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB	CD	EF	GH	IJ	KL	MN	OP	QR				
	B	CG RAM (4)		#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB	CD	EF	GH	IJ	KL	MN	OP	QR	ST			
	C	CG RAM (5)		#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB	CD	EF	GH	IJ	KL	MN	OP	QR	ST	UV		
	D	CG RAM (6)		#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB	CD	EF	GH	IJ	KL	MN	OP	QR	ST	UV	WX	
	E	CG RAM (7)		#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB	CD	EF	GH	IJ	KL	MN	OP	QR	ST	UV	WX	YZ
	F	CG RAM (8)		#	\$	%	&	'	(	)	*	+	,	-	.	/	:	;	<	=	>	?@	AB	CD	EF	GH	IJ	KL	MN	OP	QR	ST	UV	WX	YZ

## Example Initialization Program

```
'INIT-----  
A = &H30  
Call Writecom                                     'wake up  
Waitms 100  
Call Writecom                                     'wake up  
Waitms 10  
Call Writecom                                     'wake up  
Waitms 10  
A = &H38  
'function set  
Call Writecom  
A = &H10  
'shift display=no  
Call Writecom  
A = &H0C  
'display on  
Call Writecom  
A = &H06  
'entry mode set  
Call Writecom  
'-----  
Sub Writecom  
P1 = A  
Reset P3.0  
'instruction  
Reset P3.7  
'RW  
Waitms 1  
Set P3.4  
'E  
Waitms 1  
Reset P3.4                                     'E  
End Sub  
'-----  
Sub Writedata  
P1 = A  
Set P3.0  
'data  
Reset P3.7  
'RW  
Waitms 1  
Set P3.4  
'E  
Waitms 1  
Reset P3.4                                     'E  
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.	+50°C , 48hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	0°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 , 96hrs	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)