

# NHD-C0220AZ-FSW-FTW

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

NHD- Newhaven Display  
C0220- COG, 2 lines x 20 characters  
AZ- Model  
F- Transflective  
SW- Side White LED backlight  
F- FSTN+  
T- 12:00 View Angle  
W- Wide Temp (-20 ~ +70C)  
**RoHS Compliant**

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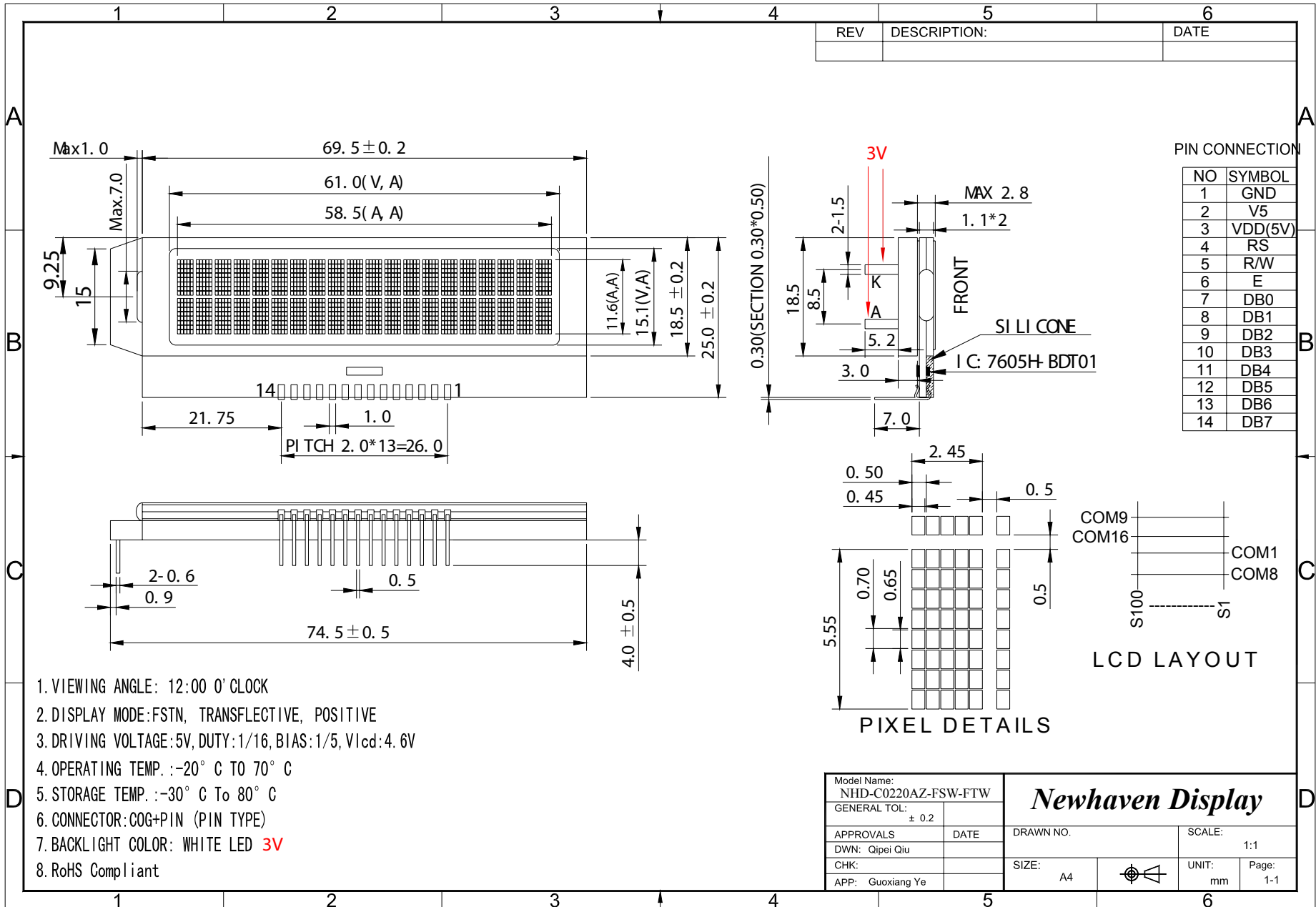
## Document Revision History

Revision	Date	Description	Changed by
0	7/20/2008	Initial Release	
1	6/29/2009	User guide reformat	BE
2	10/9/2009	Updated Electrical Characteristics	MC
3	11/16/2009	Min Supply Voltage = 3.3V, Max VLCD = 5.0V	CL
4	11/19/2009	Updated backlight supply current	MC

## Functions and Features

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

# Mechanical Drawing



- VIEWING ANGLE: 12:00 O' CLOCK
- DISPLAY MODE:FSTN, TRANSFLECTIVE, POSITIVE
- DRIVING VOLTAGE:5V, DUTY:1/16, BIAS:1/5, V<sub>lcd</sub>:4.6V
- OPERATING TEMP.: -20° C TO 70° C
- STORAGE TEMP.: -30° C TO 80° C
- CONNECTOR: COG+PIN (PIN TYPE)
- BACKLIGHT COLOR: WHITE LED 3V
- RoHS Compliant

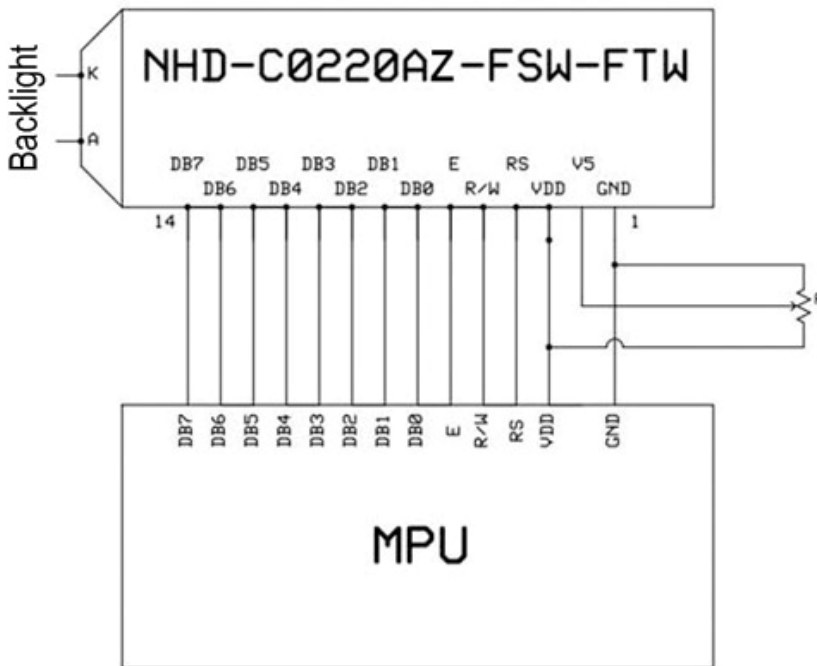
Model Name: NHD-C0220AZ-FSW-FTW		<b>Newhaven Display</b>	
GENERAL TOL: ± 0.2			
APPROVALS	DATE	DRAWN NO.	SCALE: 1:1
DWN: Qiwei Qiu			
CHK:		SIZE: A4	UNIT: mm
APP: Guoxiang Ye			Page: 1-1

## 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 (~0.4V)
3	VDD	Power Supply	Power supply for LCD and logic
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	-20	-	+70	°C
Storage Temperature Range	Tst	Absolute Max	-30	-	+80	°C
Supply Voltage	VDD	Ta =25℃	3.3	5.0	5.5	V
Supply Current	IDD	VDD=5.0V		1.0	1.5	mA
Supply for LCD (contrast)	VDD-V5	VLCD=VDD-V5	0	4.6	5.0	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		-	3.0	-	V
Backlight Supply Current	Iled	VLED=3.0V	-	30	45	mA

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical	AV	Cr ≥ 2	-60		+35	°
Viewing Angle - Horizontal	AH	Cr ≥ 2	-40		+40	°
Contrast Ratio	Cr		-	6	-	
Response Time (rise)	Tr	-	-	150	250	ms
Response Time (fall)	Tr	-	-	150	250	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: during internal operation, busy flag (DB7) is read "High".  
 Busy flag check must be preceded by the next instruction.

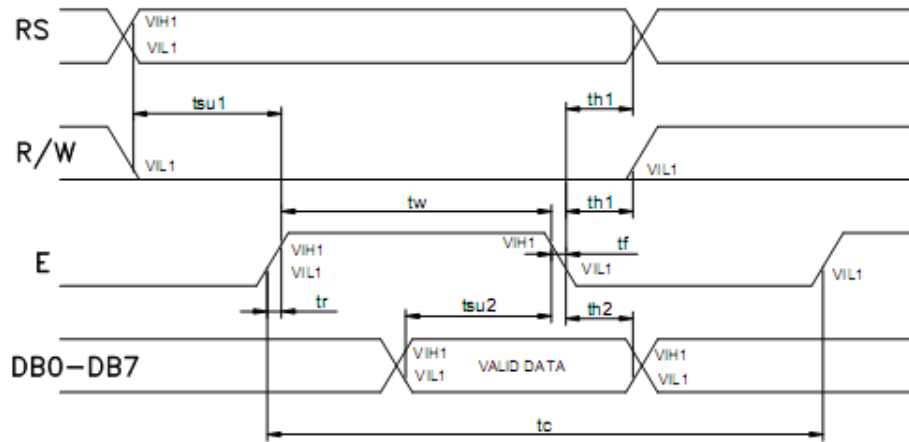
## Table of Commands

Instruction	Instruction code										Description	Execution time (fosc= 270 KHZ)	
	RS	R/W	DB7	DB6	DB 5	DB4	DB3	DB2	DB 1	DB0			
Clear Display	0	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRA and set DDRAM address to "00H" from AC	1.53ms
Return Home	0	0	0	0	0	0	0	0	0	1	-	Set DDRAM address to "00H" From AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.53ms
Entry mode Set	0	0	0	0	0	0	0	0	1	I/D	SH	Assign cursor moving direction And blinking of entire display	39us
Display ON/OFF control	0	0	0	0	0	0	0	1	D	C	B	Set display (D), cursor (C), and Blinking of cursor (B) on/off Control bit.	
Cursor or Display shift	0	0	0	0	0	0	1	S/C	R/L	-	-	Set cursor moving and display Shift control bit, and the Direction, without changing of DDRAM data.	39us
Function set	0	0	0	0	1	DL	N	F	-	-	-	Set interface data length (DL: 8-Bit/4-bit), numbers of display Line (N: =2-line/1-line) and, Display font type (F: 5x11/5x8)	39us
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0		Set CGRAM address in address Counter.	39us
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0		Set DDRAM address in address Counter.	39us
Read busy Flag and Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0		Whether during internal Operation or not can be known By reading BF. The contents of Address counter can also be read.	0us
Write data to Address	1	0	D7	D6	D5	D4	D3	D2	D1	D0		Write data into internal RAM (DDRAM/CGRAM).	43us
Read data From RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0		Read data from internal RAM (DDRAM/CGRAM).	43us

### Display character address code:

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	0F
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

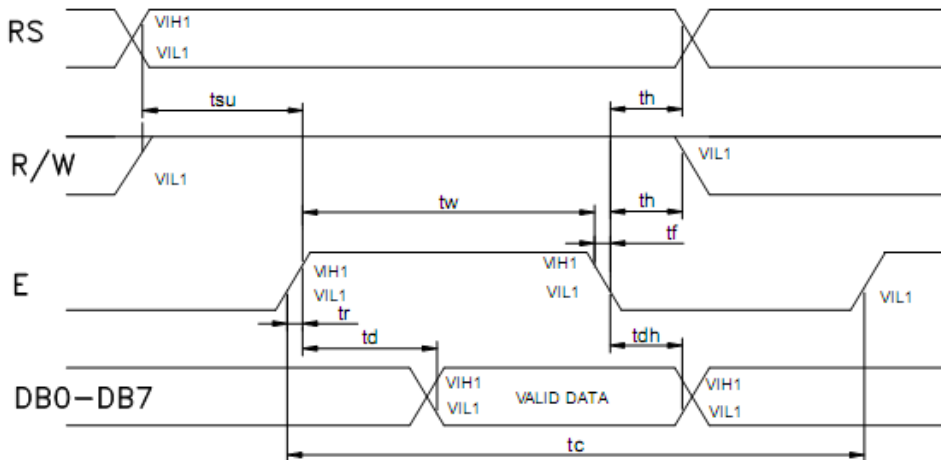
### Write mode timing diagram



Write cycle ( $T_a=25^\circ\text{C}$ ,  $V_{DD}=5.0\text{V}$ )

Parameter	Symbol	Test pin	Min.	Typ.	Max.	Unit
Enable cycle time	$t_c$	E	500	-	-	ns
Enable pulse width	$t_w$		300	-	-	
Enable rise/fall time	$t_r, t_f$		-	-	25	
RS; R/W setup time	$t_{su1}$	RS; R/W RS; R/W	100	-	-	
RS; R/W address hold time	$t_{h1}$		10	-	-	
Read data output delay	$t_{su2}$	DB0~DB7	60	-	-	
Read data hold time	$t_{h2}$		10	-	-	

### Read mode timing diagram



Read cycle ( $T_a=25^\circ\text{C}$ ,  $V_{DD}=5.0\text{V}$ )

Parameter	Symbol	Test pin	Min.	Typ.	Max.	Unit
Enable cycle time	$t_c$	E	500	-	-	ns
Enable pulse width	$t_w$		300	-	-	
Enable rise/fall time	$t_r, t_f$		-	-	25	
RS; R/W setup time	$t_{su}$	RS; R/W RS; R/W	100	-	-	
RS; R/W address hold time	$t_h$		10	-	-	
Read data output delay	$t_d$	DB0~DB7	60	-	90	
Read data hold time	$t_{dh}$		20	-	-	

## Built-in Font Table

Lower 4 Bits \ Upper 4 Bits	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)			0	Q	P	`	P				-	夕	三	α	p
xxxx0001	(2)		!	1	A	Q	a	q			。	ア	チ	△	ä	q
xxxx0010	(3)		"	2	B	R	b	r			「	イ	ツ	×	ß	θ
xxxx0011	(4)		#	3	C	S	c	s			」	ウ	テ	モ	ε	ø
xxxx0100	(5)		\$	4	D	T	d	t			、	エ	ト	ト	μ	Ω
xxxx0101	(6)		%	5	E	U	e	u			・	オ	ナ	1	ε	ü
xxxx0110	(7)		&	6	F	V	f	v			ヲ	カ	ニ	ヨ	ρ	Σ
xxxx0111	(8)		'	7	G	W	g	w			ア	キ	ヌ	ラ	g	π
xxxx1000	(1)		(	8	H	X	h	x			イ	ク	ネ	リ	√	×
xxxx1001	(2)		)	9	I	Y	i	y			ウ	ケ	ル	ル	'	y
xxxx1010	(3)		*	:	J	Z	j	z			エ	コ	ハ	レ	j	¥
xxxx1011	(4)		+	;	K	[	k	{			オ	サ	ヒ	ロ	*	¥
xxxx1100	(5)		,	<	L	¥	l				カ	シ	フ	ワ	¢	¥
xxxx1101	(6)		-	=	M	]	m	}			ユ	ス	ハ	ン	¢	÷
xxxx1110	(7)		.	>	N	^	n	→			ヨ	セ	ホ	°	ñ	
xxxx1111	(8)		/	?	O	_	o	€			ッ	ソ	マ	°	ö	■



## 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.	+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 , 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)