NHD-C0216AZ-FSW-GBW

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

NHD-	Newhaven Display
C0216-	COG, 2 lines x 16 characters
AZ-	Model
F-	Transflective
SW-	Side White LED Backlight
G-	STN- Gray
B-	6:00 View Angle
W-	Wide Temp (-20 c ~ +70 c)
	RoHS Compliant

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Document Revision History

Revision	Date	Description	Changed by
0	2/12/2007	Initial Release	
1	2/19/2009	User guide reformat	BE
2	10/9/2009	Updated Electrical Characteristics	MC
3	10/15/2009	Updated Block Diagram	MC
4	6/2/2011	Timing characteristics updated	AK
5	8/14/2012	Mechanical drawing updated	AK

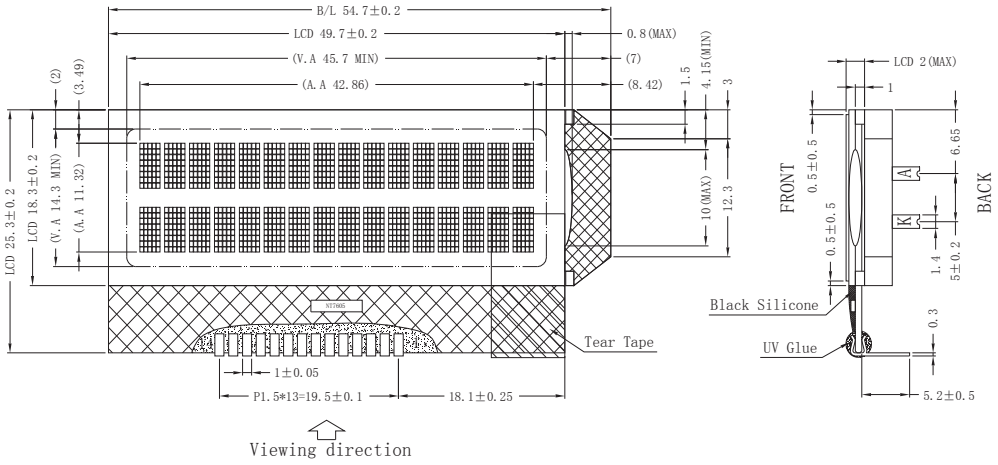
Functions and Features

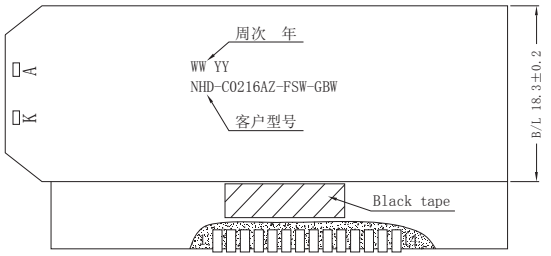
- **2 lines x 16 characters**
- **Built-in NT7605 controller**
- **5x8 dots with cursor**
- **+5V power supply**
- **1/16 duty, 1/5 bias**
- **RoHS Compliant**

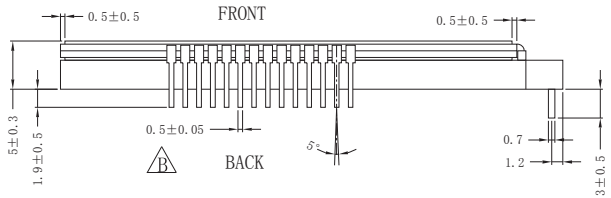
Mechanical Drawing

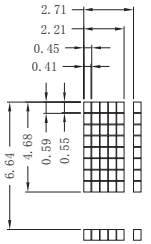
Rev	Description	Date

Pin assignment	
NO.	Symbol
1	VSS
2	V0
3	VDD
4	RS
5	R/W
6	E
7	D0
8	D1
9	D2
10	D3
11	D4
12	D5
13	D6
14	D7









Dots Detail
Scale 2:1

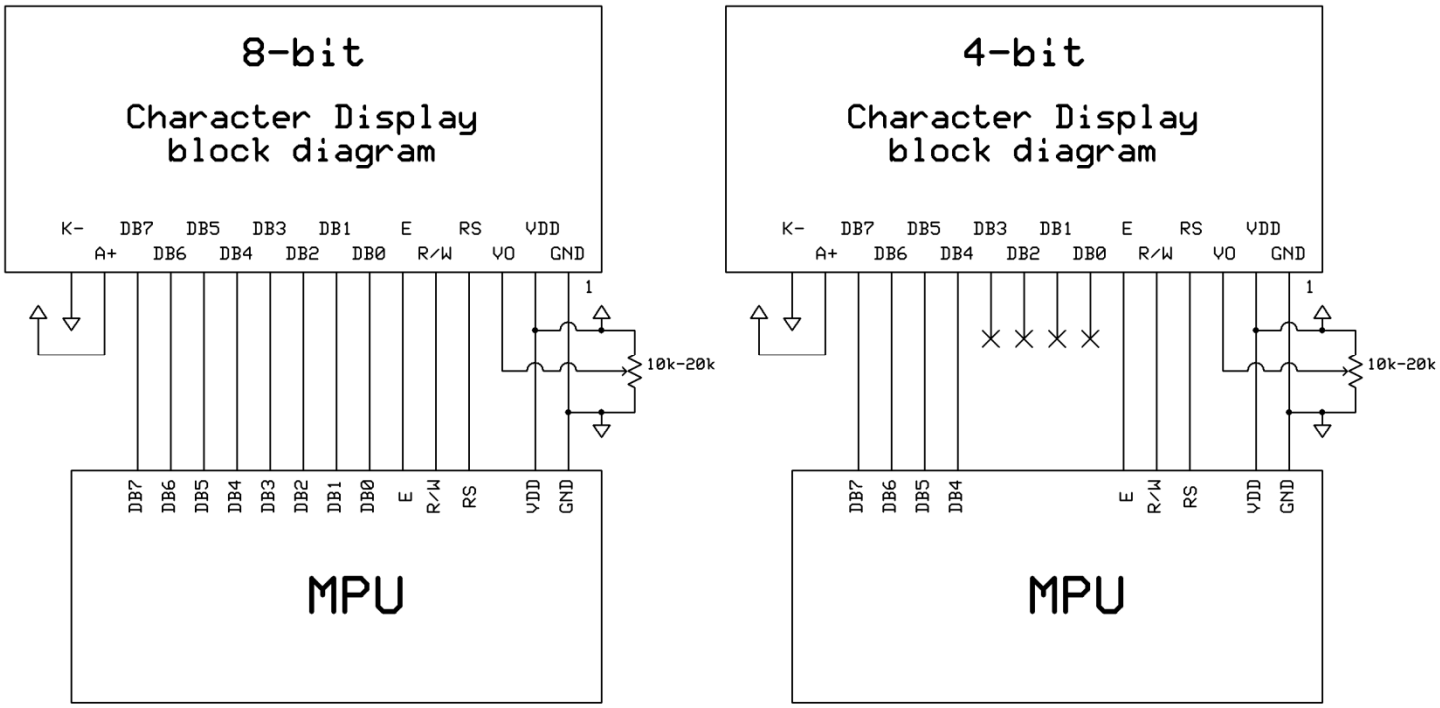
Display Type	STN GRAY/TRANSFLECTIVE/POSITIVE
Display Resolution	16*2 CHARACTER TYPE
Viewing Angle	6:00
Max.Ratio and Bias Level	1/16 DUTY,1/5 BIAS
LCD Controller/Driver	NT7605(COG)
Logic Voltage	5.0
LCD Driving Voltage	Approx 0.3V
Operation Temperature	-20 °C TO 70°C
Storage Temperature	-30°C TO 80°C
LED Backlight	White Edge Type 3.0V 15mA

	Date	
	08/14/12	NEWHAVEN DISPLAY INTERNATIONAL
Gen. Tolerance	Unit	Model:
±0.3mm	mm	NHD-C0216AZ-FSW-GBW

Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V_{SS}	Power Supply	Ground
2	Vo	Adj. Power supply	Power supply for contrast (approx. 0.3V)
3	V_{DD}	Power Supply	Supply voltage for logic (5.0V)
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		Four low order bi-directional three state data bus lines. These four are not used during 4-bit operation.
11-14	DB4-DB7		Four high order bi-directional three state data bus lines.
15	A	power supply	Power supply for LED Backlight (3.0V)
16	K		Ground for Backlight

Recommended LCD connector: 1.5 mm pitch, 14 pins Soldered to PCB
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		4.7	5.0	5.5	V
Supply Current	IDD	Ta=25°C,VDD=5.0V	-	1.0	1.5	mA
Supply for LCD (contrast)	VDD-Vo	**Ta=25°C**	-	4.7	-	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		-	3.0	-	V
Backlight Supply Current	I_{LED}	VLED=3.0V		15	20	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 NT7605. Download specification at http://www.newhavendisplay.com/app_notes/NT7605.pdf

DDRAM address location:

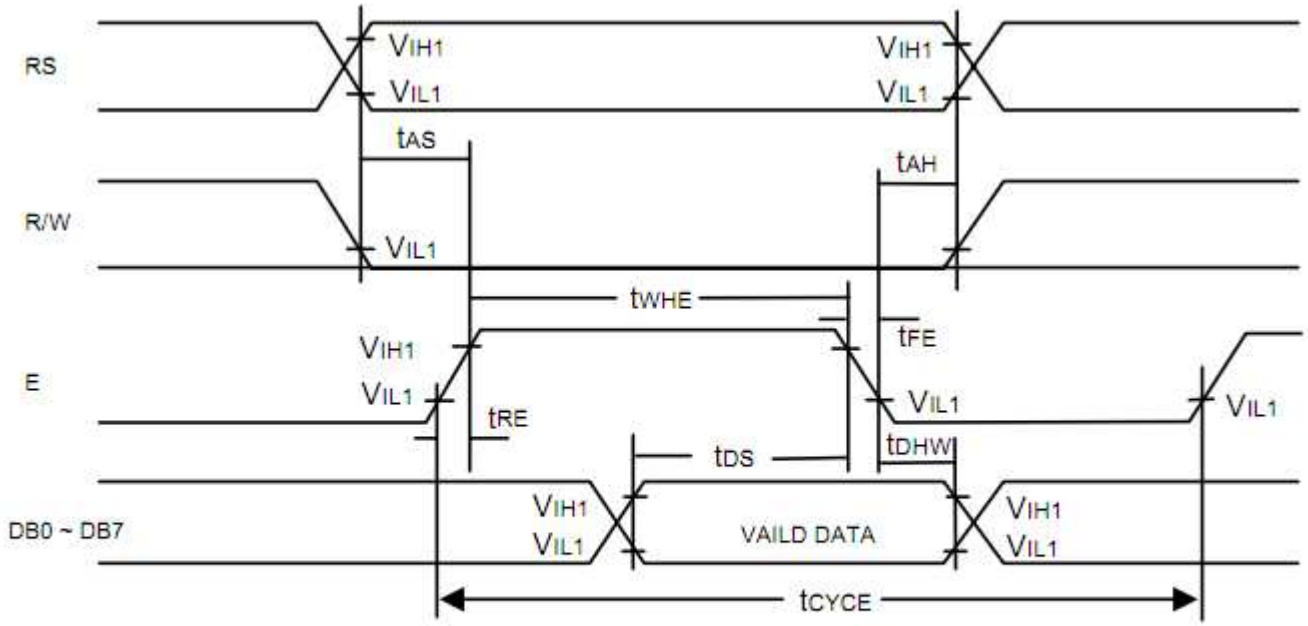
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

Table of Commands

Instruction	Code										Function	Execution time (max) (f_{osc} = 250KHz)
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Display Clear	0	0	0	0	0	0	0	0	0	1	Clear entire display area, Restore display from shift, and load address counter with DD RAM address 00H.	1.64ms
Display/ Cursor Home	0	0	0	0	0	0	0	0	1	*	Restore display from shift and load address counter with DD RAM address 00H.	1.64ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Specify direction of cursor movement and display shift mode. This operation takes place after each data transfer (read/write).	40µs
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	Specify activation of display (D) cursor (C) and blinking of character at cursor position (B).	40µs
Display/ Cursor Shift	0	0	0	0	0	1	S/C	R/L	*	*	Shift display or move cursor.	40µs
Function Set	0	0	0	0	1	DL	N	F	*	*	Set interface data length (DL), number of display line (N), and character font (F).	40µs
RAM Address Set	0	0	0	1	ACG						Load the address counter with a CG RAM address. Subsequent data access is for CG RAM data.	40µs
DD RAM Address Set	0	0	1	ADD							Load the address counter with a DD RAM address. Subsequent data access is for DD RAM data.	40µs
Busy Flag/ Address Counter Read	0	1	BF	AC							Read Busy Flag (BF) and contents of Address Counter (AC).	1µs
CG RAM/ DD RAM Data Write	1	0	Write data								Write data to CG RAM or DD RAM.	40µs
CG RAM/ DD RAM Data Read	1	1	Read data								Read data from CG RAM or DD RAM.	40µs
	I/D = 1 : Increment S = 1 : Display Shift On D = 1 : Display On C = 1 : Cursor Display On B = 1 : Cursor Blink On S/C = 1 : Shift Display R/L = 1 : Shift Right DL = 1 : 8-Bit N = 1 : Dual Line F = 1 : 5x10 dots BF = 1 : Internal Operation BF = 0 : Ready for Instruction						I/D = 0 : Decrement S/C = 0 : Move Cursor R/L = 0 : Shift Left DL = 0 : 4-Bit N = 0 : Signal Line F = 0 : 5x8 dots				DD RAM : Display Data RAM CG RAM : Character Generator RAM ACG : Character Generator RAM Address ADD : Display Data RAM Address AC : Address Counter	

Timing Characteristics

Write Operation



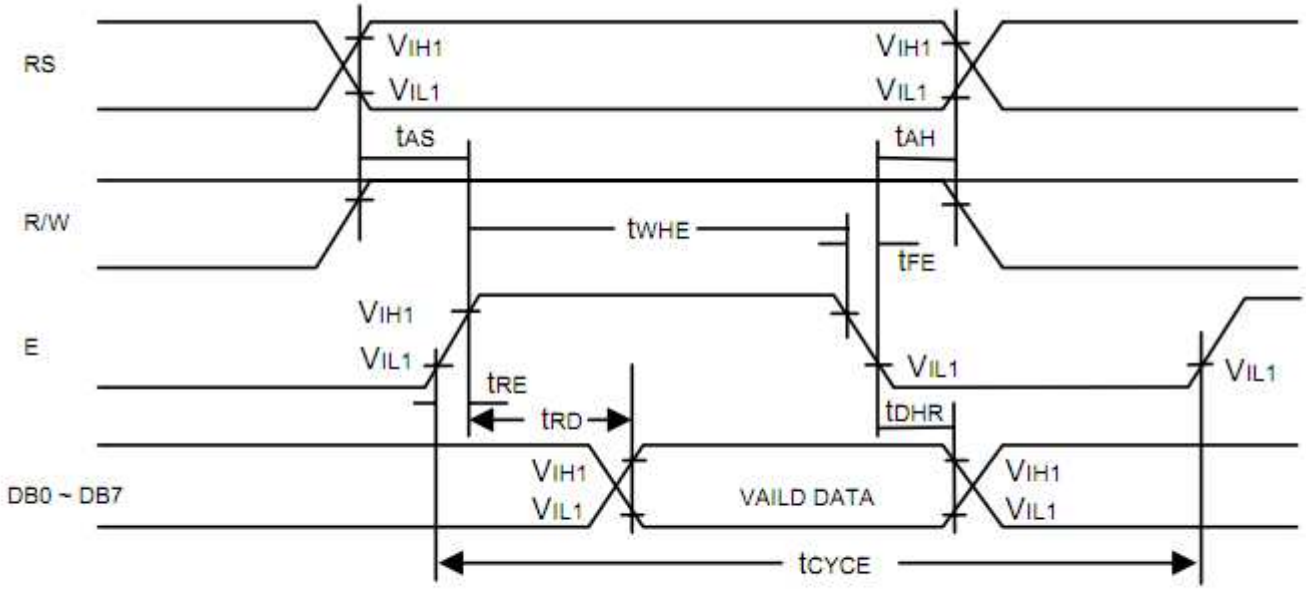
Bus Write Operation Sequence
(Writing data from MPU to NT7605)

Write Cycle (V_{DD} = 5.0V, GND = 0V, T_A = 25°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

Read Operation



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

Read Cycle (V_{DD} = 5.0V, GND = 0V, T_A = 25°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

Built-in Font Table

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 , 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

Warranty Information and Terms & Conditions

http://www.newhavendisplay.com/index.php?main_page=terms

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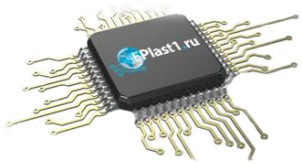

Как с нами связаться

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