NHD-C0216CZ-NSW-BBW-3V3

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

NHD-	Newhaven Display
C0216-	COG, 2 lines x 16 characters
CZ-	Model
N-	Transmissive
SW-	Side White LED Backlight
B-	STN- Blue Negative
B-	6:00 View Angle
W-	Wide Temp (-20 c ~ +70 c)
3V3-	3Vdd, 3V Backlight
	RoHS Compliant

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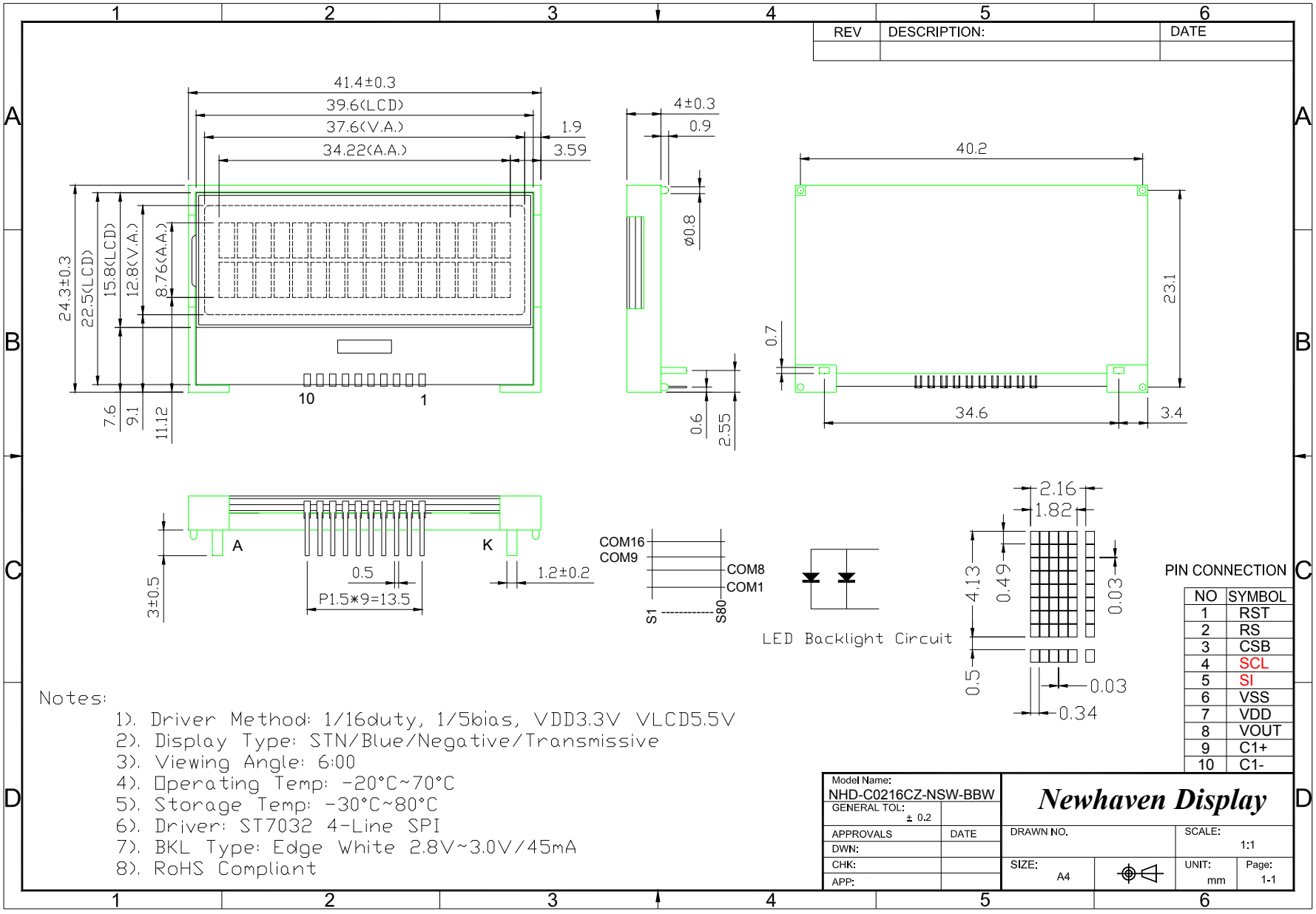
Document Revision History

Revision	Date	Description	Changed by
0	11/11/2008	Initial Release	
1	8/26/2009	User guide reformat	BE
2	10/9/2009	Updated Electrical Characteristics	MC
3	10/27/2009	Updated block diagram	MC
4	11/19/2009	Updated backlight supply current	MC
5	12/18/2009	Pin description updated	BE

Functions and Features

- **2 lines x 16 characters**
- **Built-in controller (ST7032 or equivalent)**
- **5x8 dots with cursor**
- **4-line SPI MPU interface**
- **1/16 duty, 1/5 bias**

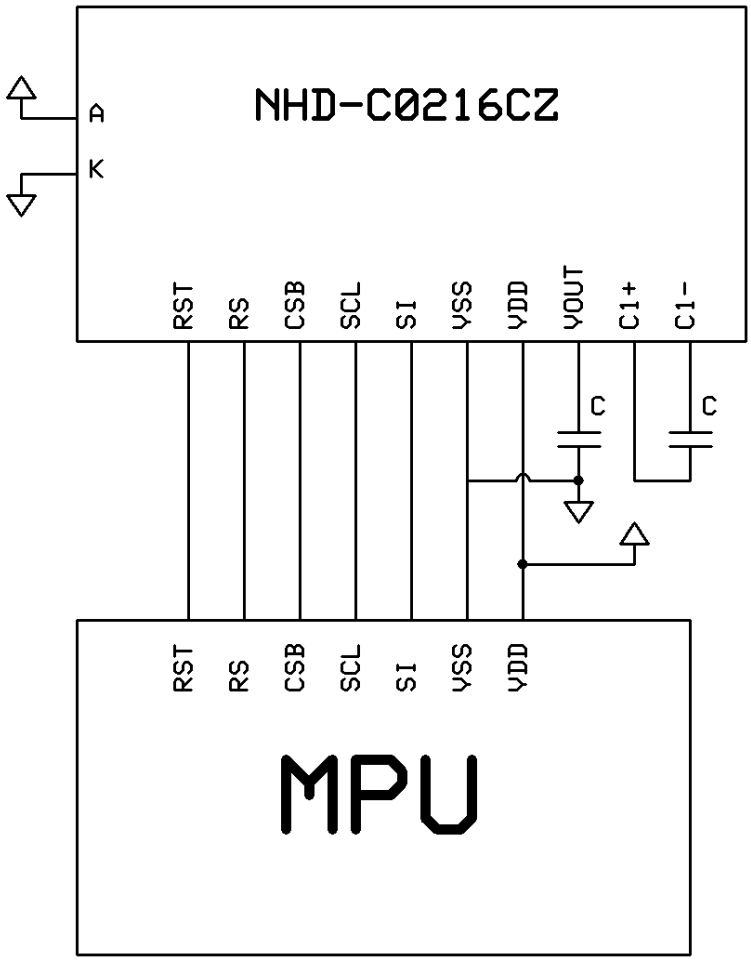
Mechanical Drawing



Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	RST	MPU	Active LOW Reset Signal
2	RS	MPU	Register Select signal. RS=0: instruction; RS=1: data
3	CSB	MPU	Active LOW Chip Select signal
4	SCL	MPU	Serial clock
5	SI	MPU	Input data
6	Vss	Power Supply	Ground
7	VDD		Power supply for logic for LCD (3.3V).
8	VOUT		DC/DC voltage converter. 1uF capacitor to Vdd or Vss
9	C1+		Voltage booster circuit. Connect to 0.47uF-2.2uF cap to PIN10.
10	C1-		Voltage booster circuit. Connect to 0.47uF-2.2uF cap to PIN9.
A	LED+	Power Supply	Power supply for Backlight(3.0V)
K	LED-	Power Supply	Backlight Ground

Recommended LCD connector: 1.5mm pitch, 10 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		2.7	3.3	4.5	V
Supply Current	IDD	VDD= 3.0	-	0.3	0.5	mA
Supply for LCD (contrast)	VDD-Vo	Ta=25°C	-	5.5	-	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 ≥ 4	-25	-	-	º
Viewing Angle - Horizontal	AH	Cr ≥ 4	-30	-	+30	º
Contrast Ratio	Cr		-	2	-	-
Response Time (rise)	Tr	-	-	120	150	ms
Response Time (fall)	Tr	-	-	120	150	ms

Controller Information

Built-in ST7032. Download specification at http://www.newhavendisplay.com/app_notes/ST7032.pdf

Table of Commands

Instruction	Instruction Code										Description	Instruction Execution Time		
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		OSC= 380KHz	OSC= 540kHz	OSC= 700KHz
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.08 ms	0.76 ms	0.59 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.08 ms	0.76 ms	0.59 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	26.3 us	18.5 us	14.3 us
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	26.3 us	18.5 us	14.3 us
Function Set	0	0	0	0	1	DL	N	DH	*0	IS	DL: interface data is 8/4 bits N: number of line is 2/1 DH: double height font IS: instruction table select	26.3 us	18.5 us	14.3 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	26.3 us	18.5 us	14.3 us
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.	0	0	0
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM/ICONRAM)	26.3 us	18.5 us	14.3 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM/ICONRAM)	26.3 us	18.5 us	14.3 us

Note * : this bit is for test command , and must always set to "0"

Instruction table 0(IS=0)														
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	S/C and R/L: Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	**26.3 us**	**18.5 us**	**14.3 us**
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	**26.3 us**	**18.5 us**	**14.3 us**

Instruction table 1(IS=1)														
Internal OSC frequency	0	0	0	0	0	1	BS	F2	F1	F0	BS=1:1/4 bias BS=0:1/5 bias F2~0: adjust internal OSC frequency for FR frequency.	**26.3 us**	**18.5 us**	**14.3 us**
Set ICON address	0	0	0	1	0	0	AC3	AC2	AC1	AC0	Set ICON address in address counter.	**26.3 us**	**18.5 us**	**14.3 us**
Power/ICON control/Contrast set	0	0	0	1	0	1	Ion	Bon	C5	C4	Ion: ICON display on/off Bon: set booster circuit on/off C5,C4: Contrast set for internal follower mode.	**26.3 us**	**18.5 us**	**14.3 us**
Follower control	0	0	0	1	1	0	Fon	Rab 2	Rab 1	Rab 0	Fon: set follower circuit on/off Rab2~0: select follower amplified ratio.	**26.3 us**	**18.5 us**	**14.3 us**
Contrast set	0	0	0	1	1	1	C3	C2	C1	C0	Contrast set for internal follower mode.	**26.3 us**	**18.5 us**	**14.3 us**

Display Position

	1	2	3	4	5	6		38	39	40
DDRAM Address (hexadecimal)	00	01	02	03	04	05	.....	25	26	27
	40	41	42	43	44	45	.....	65	66	67

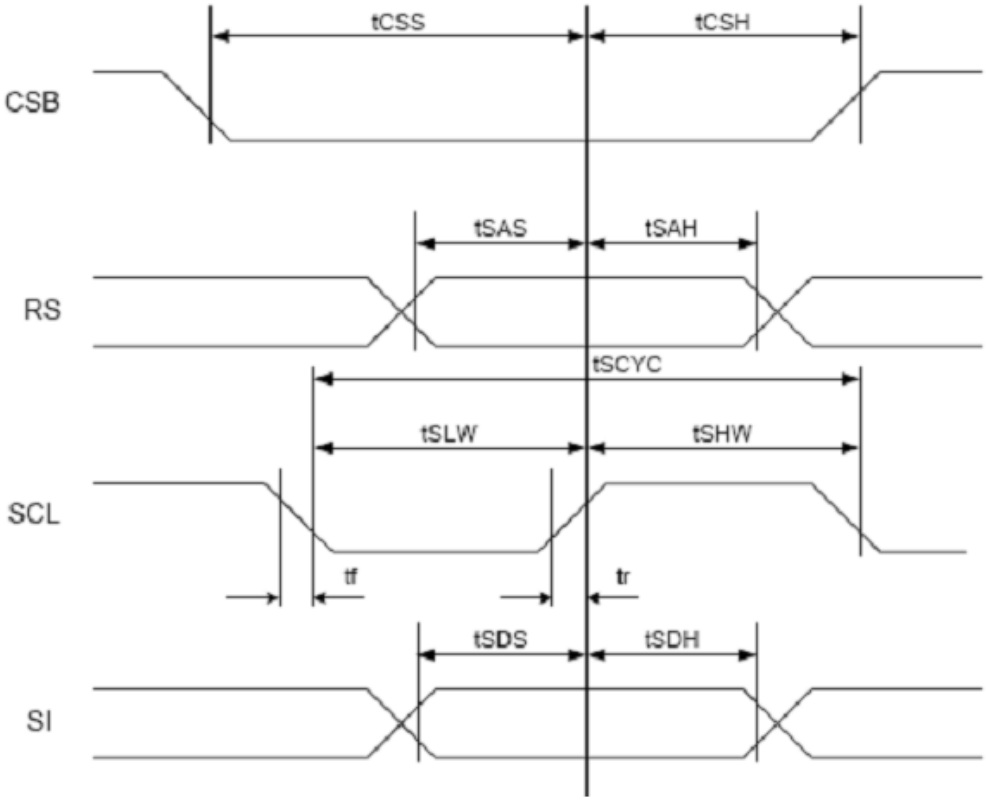
Figure 10. 2-Line Display

Timing Characteristics

(Ta=25°C, VDD=3.0V)

Item	Symbol	Symbol	Min.	Typ.	Max.	Unit
Serial clock period	SCL	tSCYC	200	-	-	ns
SCL 'H' pulse width		tSHW	20	-	-	
SCL 'L' pulse width		tSLW	160	-	-	
SCL rise/fall time	SCL	Tr,tf	-	-	20	
Address setup time	RS	tSAS	10	-	-	
Address hold time		tSAH	250	-	-	
Data setup time	SI	tSDS	10	-	-	
Data hold time		tSDH	10	-	-	
CS-SCL time	CS	tCSS	20	-	-	
		tCSH	350	-	-	

Serial interface



Built-in Font Table

ST7032-0D (ITO option OPR1=1, OPR2=1)

b7-b4 / b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111


0000
0001
0010
0011
0100
0101
0110
0111
1000
1001
1010
1011
1100
1101
1110
1111

Example Initialization Program

```
void init()
//initialize the LCD
{

 P3 = 1;
 P1 = 1;
 RST = 0;                                    //RESET
 delay(2);
 RST = 1;                                    //end reset
 delay(20);
 Writecom(0x30);                              //wake up
 delay(2);
 Call writecom(0x30);                         //wake up
 Call writecom(0x30);                         //wake up
 Call writecom(0x39);                         //function set
 Call writecom(0x14);                         //internal osc frequency
 Call writecom(0x56);                         //power control
 Call writecom(0x6D);                         //follower control

 Call writecom(0x70);                         //contrast
 Call writecom(0x0C);                         //display on
 Call writecom(0x06);                         //entry mode
 Call writecom(0x01);                         //clear
 delay(10);
}

void writecom(int d)
{
 CS = 0;                                      //CS
 RS = 0;                                      //A0 = Command
 for(serialcounter = 1; serialcounter <= 8; serialcounter++)  //send 8 bits
 {
  if((d&0x80)==0x80)                          //get only the MSB
          SI=1;                               //if 1, then SI=1
  else
          SI=0;                               //if 0, then SI=0
  d=(d<<1);                                   //shift data byte left
  SCL = 0;
  SCL = 1;
  SCL = 0;                                    //SCL
 }
 CS = 1;
}
void writedata(int d)
{
 CS = 0;                                      //CS
 RS = 1;                                      //A0 = Data
 for(serialcounter = 1; serialcounter <= 8; serialcounter++)   //send 8 bits
 {
  if((d&0x80)==0x80)                          //get only the MSB
          SI=1;                               //if 1, then SI=1
  else
          SI=0;                               //if 0, then SI=0
  d=(d<<1);                                   //shift data byte left
  SCL = 0;
  SCL = 1;
  SCL = 0;                                    //SCL
 }
 CS = 1;
}
```

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

Warranty Information and Terms & Conditions

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