NHD-C0216CiZ-FSW-FBW-3V3

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

NHD-	Newhaven Display
C0216-	COG, 2 lines x 16 characters
CiZ-	Model
F-	Transflective
SW-	Side White LED Backlight
F-	FSTN (+)
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

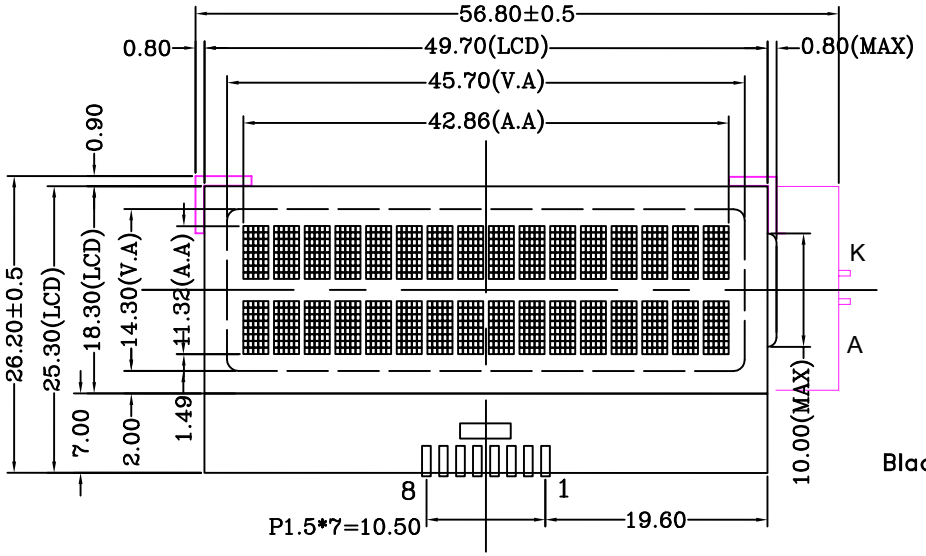
Revision	Date	Description	Changed by
0	3/10/2000	Initial Release	
1	5/14/2009	User guide reformat	BE
2	10/9/2009	Updated Electrical Characteristic Information	MC
3	11/5/2009	Block Diagram Update	BE
4	11/19/2009	Updated backlight current	MC
5	2/12/2010	Updated Font table	MC
6	4/18/2011	Mechanical drawing updated	AK
7	8/26/2011	Mechanical drawing updated	TJ
8	11/29/2011	Mechanical drawing updated	AK
9	3/30/2012	Example initialization program updated	AK

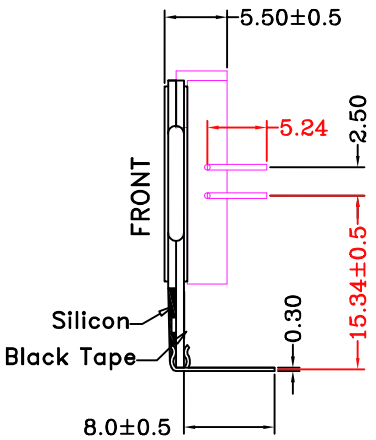
Functions and Features

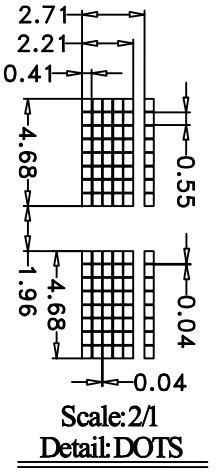
- **2 lines x 16 characters**
- **Built-in ST7032i-oD with I^2C interface**
- **5x8 pixels with cursor**
- **3V power supply**
- **1/16 duty, 1/5 bias**
- **RoHS Compliant**

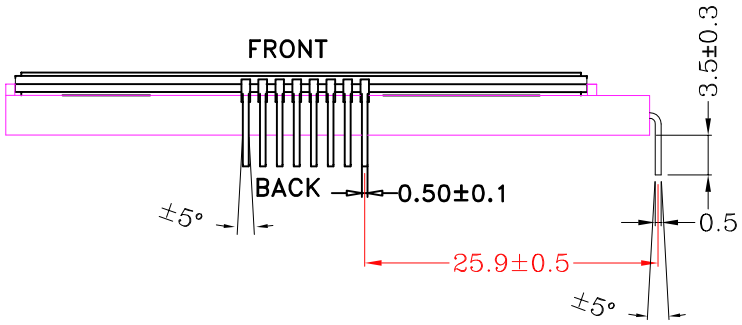
Mechanical Drawing

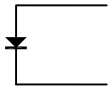
REV	DESCRIPTION:	DATE
1.0	First	
1.1	BKL Outline dimension	2011-2-23











LED Backlight Circuit

PIN CONNECTION

NO	SYMBOL
1	REST
2	SCL
3	SDA
4	VSS
5	VDD
6	VOUT
7	C1+
8	C1-

Notes:

1). Driver Method: 1/16duty, 1/5bias, VDD3.0V VLCD5.0V
2). Display Type: FSTN/Positive/Transflective
3). Viewing Angle: 6:00
4). Operating Temp: −20°C~70°C
5). Storage Temp: −30°C~80°C
6). Drvier: ST7032i−0D I2C Interface
7). BKL Type: Edge White 2.8V~3.0V/15mA
8). RoHS Compliant

Model Name:	NHD-C0216CiZ-FSW-FBW-3V3
GENERAL TOL:	± 0.3
APPROVALS	DATE
DWN:	
CHK:	
APP:	

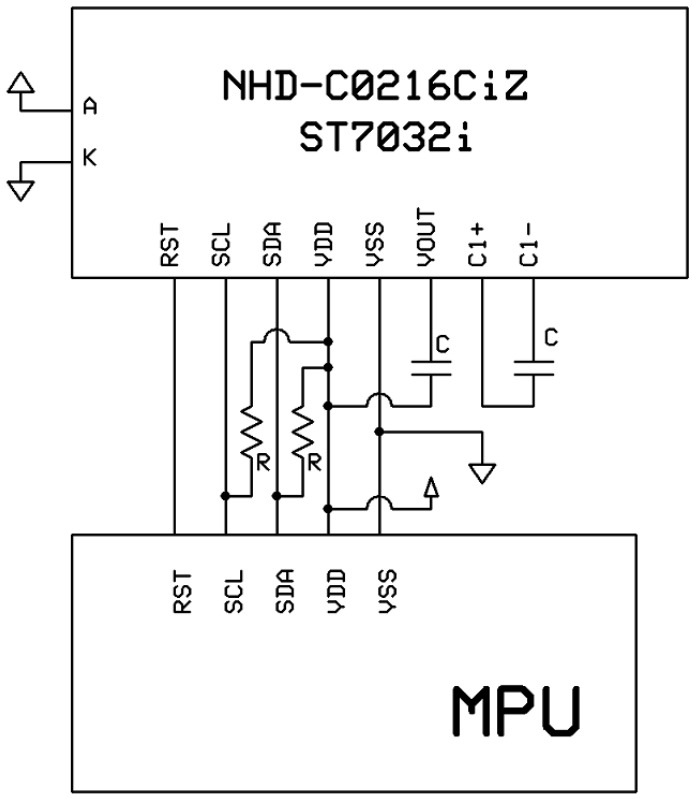
Newhaven Display

DRAWN NO.		SCALE:	1:1
SIZE:	A4	UNIT:	mm
		Page:	1-1

Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	RST	MPU	Active LOW Reset Signal
2	SCL	MPU	Serial clock
3	SDA	MPU	Input Data
4	Vss	Power Supply	Ground
5	VDD	Power Supply	Power supply for logic for LCD (3.0V)
6	VOUT	Power Supply	DC/DC voltage converter. Connect to 1uF capacitor to VDD
7	C1+	CAP	Voltage booster circuit. Connect to 1uF cap to PIN8
8	C1-	CAP	Voltage booster circuit. Connect to 1uF cap to PIN7
A	LED+	Power Supply	Power supply for Backlight(3.0V)
K	LED-	Power Supply	Backlight Ground

Recommended LCD connector: 1.5mm pitch pins
Backlight connector: A and K pins **Mates with**: -



Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	Top	Absolute Max	-20	-	+70	^{o}C
Storage Temperature Range	Tst	Absolute Max	-30	-	+80	^{o}C
Supply Voltage	VDD		2.7	3.0	3.3	V
Supply Current	IDD	Ta=25°C,VDD=3.0V	-	0.3	0.5	mA
Supply for LCD (contrast)	VDD-Vo	**Ta=25^{o}C**	-	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	-	15	20	mA

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Vertical	AV	Cr ≥ 2	-60	-	+35	^{o}
Viewing Angle - Horizontal	AH	Cr ≥ 2	-40	-	+40	^{o}
Contrast Ratio	Cr		-	6	-	-
Response Time (rise)	Tr	-	-	150	250	ms
Response Time (fall)	Tr	-	-	150	250	ms

Slave Address = 0x7C

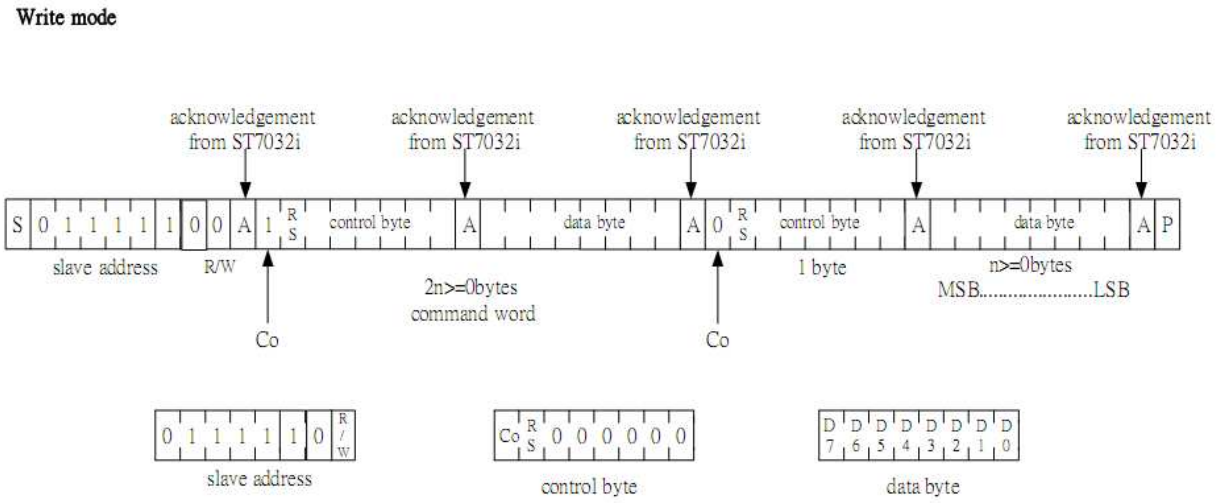
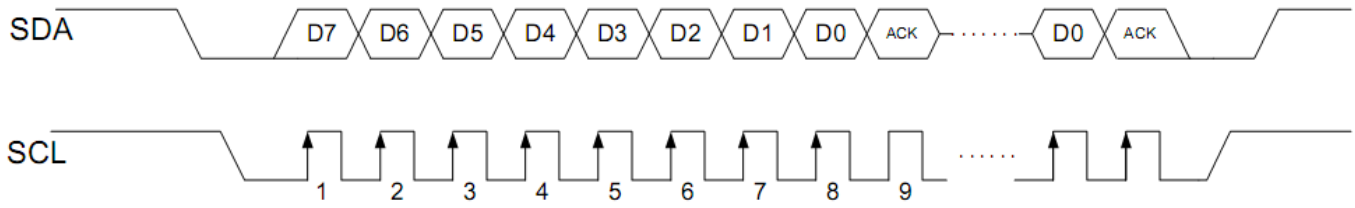


Figure 5. 2-line Interface protocol

Co	0	Last control byte to be sent. Only a stream of data bytes is allowed to follow. This stream may only be terminated by a STOP condition.
	1	Another control byte will follow the data byte unless a STOP condition is received.



Display Position

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

Controller Information

Built-in ST7032i-oD. Download specification at http://www.newhavendisplay.com/app_notes/ST7032.pdf

➢ instruction table at "Extension mode"

(when "EXT" option pin connect to Vss, the instruction set follow below table)

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

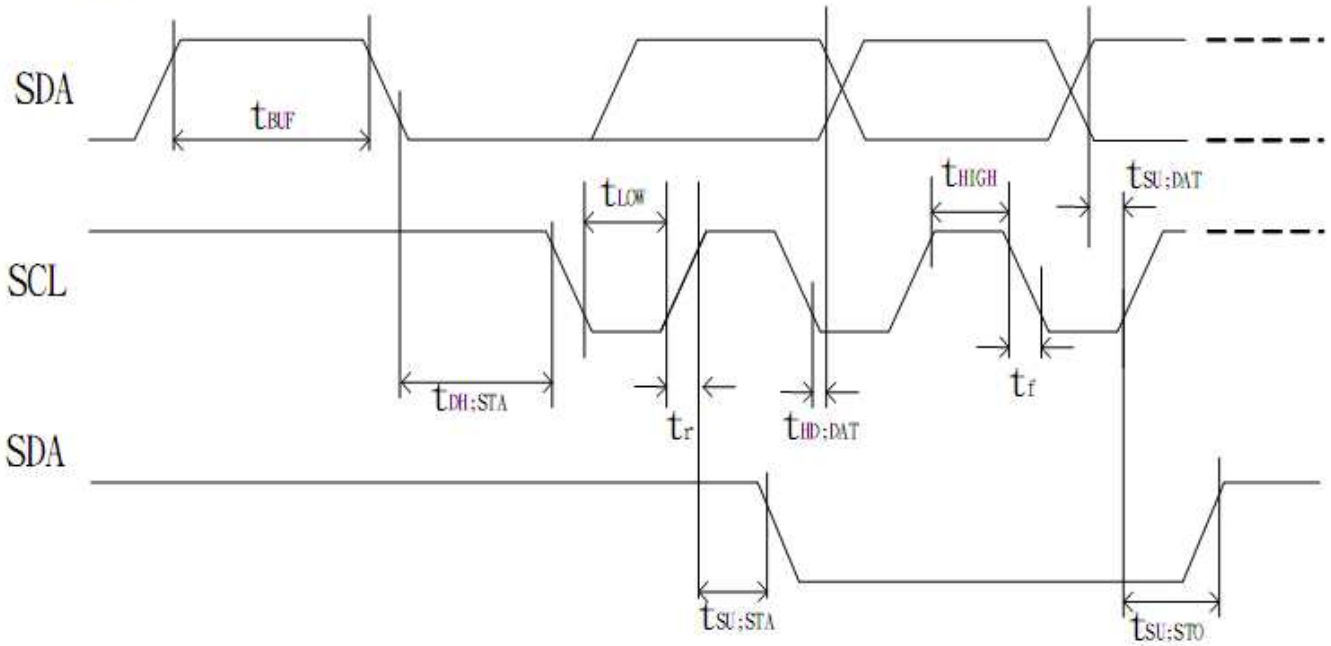
Instruction table 1(IS=1)														
Internal OSC frequency	0	0	0	0	0	1	BS	F2	F1	F0	BS=1:1/4 bias BS=0:1/5 bias F2~0: adjust internal OSC frequency for FR frequency.	26.3 us	18.5 us	14.3 us
Set ICON address	0	0	0	1	0	0	AC3	AC2	AC1	AC0	Set ICON address in address counter.	26.3 us	18.5 us	14.3 us
Power/ICON 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

Timing Characteristics

(Ta =-30°C to 85°C)

Item	Signal	Symbol	Condition	VDD=2.7 to 4.5V Rating		VDD=4.5 to 5.5V Rating		Units
				Min.	Max.	Min.	Max.	
SCL clock frequency	SCL	f_{SCLK}	—	DC	400	DC	400	KHz
SCL clock low period		t_{LOW}		1.3	—	1.3	—	us
SCL clock high period		t_{HIGH}		0.6	–	0.6	–	
Data set-up time	SI	$t_{SU;DAT}$	—	**180**	–	100	–	ns
Data hold time		$t_{HD;DAT}$		0	0.9	0	0.9	us
SCL,SDA rise time	SCL, SDA	t_r	—	20+0.1C_b	300	20+0.1C_b	300	ns
SCL,SDA fall time		t_f		20+0.1C_b	300	20+0.1C_b	300	
Capacitive load represent by each bus line		C_b	—	–	400	–	400	pf
Setup time for a repeated START condition	SI	$t_{SU;STA}$	—	0.6	–	0.6	–	us
Start condition hold time		$t_{HD;STA}$	—	0.6	–	0.6	–	us
Setup time for STOP condition		$t_{SU;STO}$	—	0.6	–	0.6	–	us
Bus free time between a Stop and START condition	SCL	t_{BUF}	—	1.3	–	1.3	–	us

- **I2C interface**



Built-in Font Table

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

Example Initialization Program

```
/*****************************************************/
void I2C_out(unsigned char j)                    //I2C Output
{
        int n;
        unsigned char d;
        d=j;
        for(n=0;n<8;n++){
                if((d&0x80)==0x80)
                SDA=1;
                else
                SDA=0;
                d=(d<<1);
                SCL = 0;
                SCL = 1;
                SCL = 0;
                }
        SCL = 1;
        while(SDA==1){
                SCL=0;
                SCL=1;
                }
        SCL=0;
}
/*****************************************************/
void I2C_Start(void)
{
        SCL=1;
        SDA=1;
        SDA=0;
        SCL=0;
}
/*****************************************************/
void I2C_Stop(void)
{
        SDA=0;
        SCL=0;
        SCL=1;
        SDA=1;
}
/*****************************************************/
void Show(unsigned char *text)
{
        int n;
        I2C_Start();
        I2C_out(Slave);
        I2C_out(Datasend);
        for(n=0;n<16;n++){
                I2C_out(*text);
                ++text;
                }
        I2C_Stop();
}
/*************************************************
```

```
*         Initialization For ST7032i           *
*************************************************/
void init_LCD()
{
I2C_Start();
I2C_out(0x7C);
I2C_out(0x00);
I2C_out(0x38);
delay(10);
I2C_out(0x39);
delay(10);
I2C_out(0x14);
I2C_out(0x78);
I2C_out(0x5E);
I2C_out(0x6D);
I2C_out(0x0C);
I2C_out(0x01);
I2C_out(0x06);
delay(10);
I2C_stop();
}
/*************************************************/
```

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

LifeElectronics
Живое партнерство

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