



# NHD-C0220BiZ-FS(RGB)-FBW-3VM

# COG (Chip-On-Glass) Character Liquid Crystal Display Module

NHD- Newhaven Display

CO220- COG, 2 Lines x 20 Characters

BiZ- Model, I<sup>2</sup>C Interface

F- Transflective

S(RGB)- Side LED Backlights – Red, Green, and Blue

F- FSTN (+)

B- 6:00 Optimal View W- Wide Temperature

3V- 3.3V LCD

M- Mounting Holes

**RoHS Compliant** 

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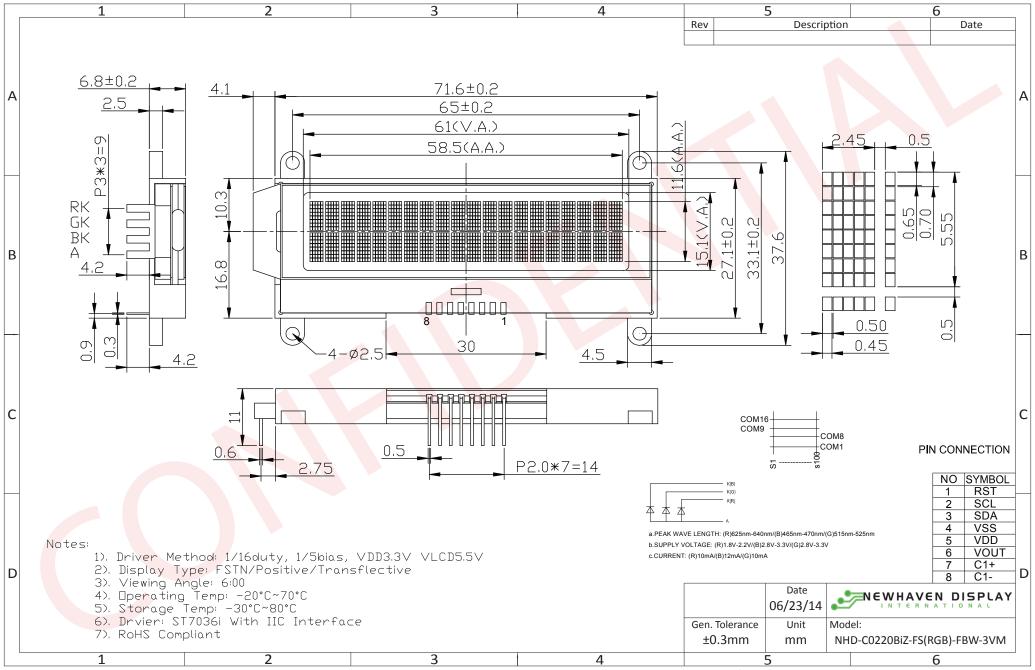
# **Document Revision History**

Revision	Date	Description	Changed by
0	7/8/2009	Initial Release	CL
1	7/10/2009	Mechanical Drawing updated	BE
2	9/8/2009	Backlight supply current	BE
3	10/9/2009	<b>Updated Electrical Characteristics</b>	MC
4	12/9/2009	Updated Backlight Power supply and Current	MC
5	5/27/2011	Display character address code updated	AK
6	6/13/2011	Electrical characteristics updated	AK
7	6/23/2014	Mechanical Drawing, Electrical & Optical characteristics updated	ML

#### **Functions and Features**

- 2 lines x 20 characters
- Built-in ST7036i controller with I<sup>2</sup>C interface
- 3.3V power supply
- 1/16 duty, 1/5 bias
- Built-in DC supply for VLCD (requires 2 external capacitors)

# **Mechanical Drawing**



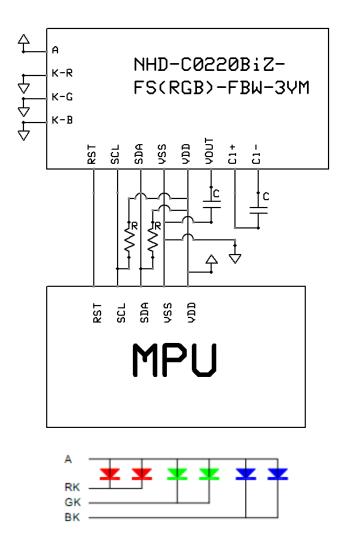
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# **Pin Description and Wiring Diagram**

Pin No.	Symbol	External	Function Description
		Connection	
1	RST	MPU	Active LOW Reset signal
2	SCL	MPU	Serial Clock signal (requires pull-up resistor)
3	SDA	MPU	Serial Data signal (requires pull-up resistor)
4	VSS	Power Supply	Ground
5	VDD	Power Supply	Supply Voltage for logic (+3.3V)
6	VOUT	CAP	Voltage booster circuit – connect 1μF cap to VSS or VDD
7	C1+	CAP	Connect 1µF cap to PIN8
8	C1-	CAP	Connect 1µF cap to PIN7

Recommended LCD connector: N/A, solder directly into PCB

Backlight connector: 3.0mm pitch pins, solder directly into PCB Mates with: ---



Capacitance 0.47μF~2.2μF

Recommended value =  $1\mu$ F

#### **Electrical Characteristics**

Item	Symbol	Condition	Min.	Тур.	Max.	Unit
Operating Temperature Range	Тор	Absolute Max	-20	•	+70	°C
Storage Temperature Range	Tst	Absolute Max	-30	ı	+80	°C
Supply Voltage	VDD	-	3.0	3.3	3.6	V
Supply Current	IDD	VDD=3.3V	-	0.5	1.0	mA
Supply for LCD (contrast)	VDD-V0	VLCD=VDD-V0	-	5.5	-	V
"H" Level input	Vih	-	0.7*VDD	-	VDD	V
"L" Level input	Vil	-	GND	-	0.2*VDD	V
"H" Level output	Voh	-	0.7*VDD	-	VDD	V
"L" Level output	Vol	-	GND	-	0.8	V
Backlight Supply Voltage – RED	VLED	-	-	1.9	-	V
Backlight Supply Current – RED	lled	-	-	10	-	mA
Backlight Supply Voltage – GREEN	VLED	-	-	3.0	-	V
Backlight Supply Current – GREEN	lled	-	-	10	-	mA
Backlight Supply Voltage – BLUE	VLED	-	-	3.0	-	V
Backlight Supply Current – BLUE	lled	-	-	12	-	mA

# **Optical Characteristics**

Item	Symbol	Condition	Min.	Тур.	Max.	Unit
Viewing Angle - Top	-		-	40	-	0
Viewing Angle - Bottom	-	Cr ≥ 2	-	60	-	0
Viewing Angle - Left	-	CI Z Z	-	60	-	0
Viewing Angle - Right	-		-	60	-	0
Contrast Ratio	Cr	-	-	5	-	-
Response Time (rise)	Tr	-	-	150	250	ms
Response Time (fall)	Tf	-	-	200	300	ms

#### **Controller Information**

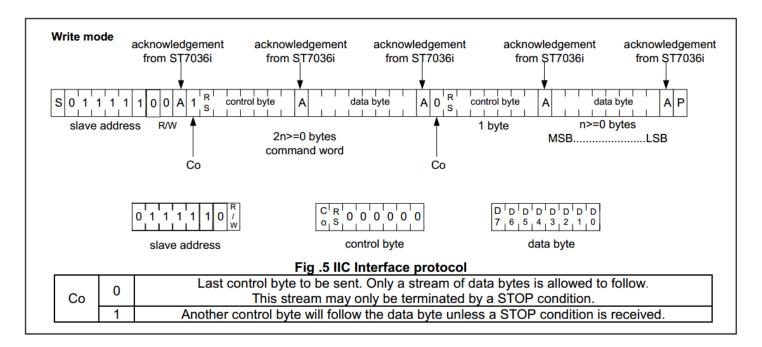
Built-in ST7036i controller.

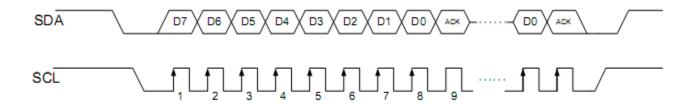
Please download specification at <a href="http://www.newhavendisplay.com/app">http://www.newhavendisplay.com/app</a> notes/ST7036.pdf</a>

#### **DDRAM Address**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
00	01	02	03	04	05	06	07	08	09	0A	OB	0C	0D	0E	OF	10	11	12	13
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53

### Slave Address = 0x78





# **Table of Commands**

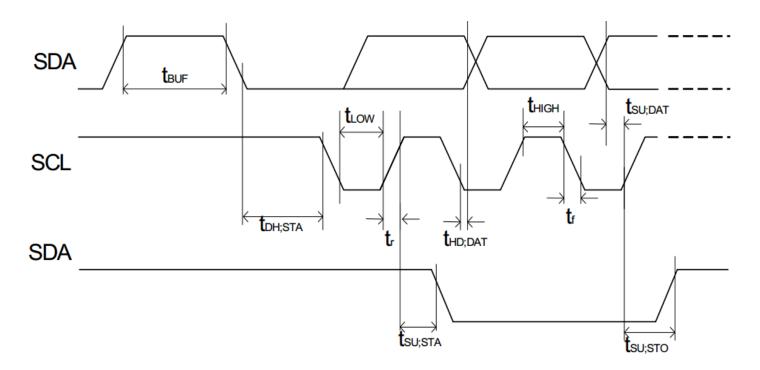
Instruction		-	lr	ıstr	ucti	on	Cod	le			Description		
mstruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC		
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.		
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.		
Display ON/OFF	0	0	0	0	0	0	1	D	С	В	D=1:entire display on C=1:cursor on B=1:cursor position on		
Function Set	0	0	0	0	1	DL	N	DH	IS2	IS1	DL: interface data is 8/4 bits N: number of line is 2/1 DH: double height font IS[2:1]: instruction table select		
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter		
Read Busy Flag and Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation not can be known by reading BF. The contents of address counter can also be read.		
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM/ICONRAM)		
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM/ICONRAM)		

						Inst	truc	tior	ı tal	ble	0(IS[2:1]=[0,0])
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.
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter

						Ins	truc	tion	ı tal	ble	1(IS[2:1]=[0,1])
Bias Set	0	0	0	0	0	1	BS	1	0	FX	BS=1:1/4 bias BS=0:1/5 bias FX: fixed on high in 3-line application and fixed on low in other applications.
Set ICON Address	0	0	0	1	0	0	AC3	AC2	AC1	AC0	Set ICON address in address counter.
Power/ICON Control/ Contrast Set	0	0	0	1	0	1	lon	Bon	C5	C4	Ion: ICON display on/off Bon: set booster circuit on/off C5,C4: Contrast set for internal follower mode.
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.
Contrast Set	0	0	0	1	1	1	СЗ	C2	C1	C0	Contrast set for internal follower mode.

						Inst	truc	tior	ı tal	ble	2(IS[2:1]=[1,0])
Double Height Position Select	0	0	0	0	0	1	UD	x	x	x	UD: Double height position select
Reserved	0	0	0	1	X	X	x	x	×	X	Do not use (reserved for test)

# **Timing Characteristics**



Item	Signal	Symbol	Condition	VDD=2.7 Rati		VDD=4.5 Ratio	Units	
itom	Oigilai	Cymbol	Condition	Min.	Max.	Min.	Max.	•
SCL clock frequency		f <sub>SCLK</sub>		DC	300K	DC	400	kHz
SCL clock low period	SCL	$t_{LOW}$	_	2.5	_	1.3	_	
SCL clock high period		t <sub>HIGH</sub>		0.6	_	0.6	_	μs
Data set-up time	SDA	t <sub>SU;DAT</sub>		1800	_	700	_	ns
Data hold time	SDA	t <sub>HD:DAT</sub>		0	_	0	0.5	μs
SCL,SDA rise time	SCL,	t <sub>r</sub>		20+0.1C <sub>b</sub>	300	20+0.1C <sub>b</sub>	300	ns
SCL,SDA fall time	SDA	t <sub>f</sub>		20+0.1C <sub>b</sub>	300	20+0.1C <sub>b</sub>	300	1113
Capacitive load represent by each bus line		Сь	_	_	400	_	400	pf
Setup time for a repeated START condition	SDA	t <sub>SU;STA</sub>	_	0.6	_	0.6	_	μs
Start condition hold time		t <sub>HD;STA</sub>	_	1.8	_	1.0	_	μs
Setup time for STOP condition		t <sub>su;sto</sub>	_	0.6	_	0.6	_	μs
Bus free time between a Stop and START condition	SCL	t <sub>BUF</sub>	_	1.3	_	1.3	_	μs

# **Built-in Font Table (OPR1 = 0, OPR2 = 0)**

57-54 50-50	0000	0001	0010	0011	0100	0101	0 110	0111	1000	1001	1010	10 <b>1</b> 1	<b>1</b> 100	1 <b>1</b> 01	11 10	1111
0000													***	***		
0001																
0010																
0011																
0 100																
0101																
0110																
0111																
1000																
1001																
1010																
1011																**
1100		•														
1101																
1110																
1111		**											**			

#### **Example Initialization Program**

```
/**************
         Initialization For ST7036i
**************
void init LCD()
I2C Start();
I2C out(Slave);//Slave=0x78
I2C out (Comsend); //Comsend = 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();
/*********************************
/**************
        Output command or data via I2C
**************
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;
/***********************************
```

```
/**************
    I2C Start
************************************
void I2C_Start(void)
{
    SCL=1;
    SDA=1;
    SDA=0;
    SCL=0;
/*************
       I2C Stop
********************************
void I2C Stop(void)
    SDA=0;
    SCL=0;
    SCL=1;
    SDA=1;
/***************
/*************
       Send string of ASCII data to LCD
****************
void Show(unsigned char *text)
    int n,d;
    d=0x00;
    I2C Start();
    I2C out(Slave); //Slave=0x78
    I2C out(Datasend);//Datasend=0x40
    for (n=0; n<20; n++) {
         I2C out(*text);
         ++text;
    I2C_Stop();
   ******************
/*************************************
```

# **Quality Information**

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high	+80°C, 96hrs	2
	storage temperature for a long time.		
Low Temperature storage	Endurance test applying the low storage	-30°C, 96hrs	1,2
	temperature for a long time.		
High Temperature	Endurance test applying the electric stress	+70°C, 96hrs	2
Operation	(voltage & current) and the high thermal		
	stress for a long time.		
Low Temperature	Endurance test applying the electric stress	-20°C, 96hrs	1,2
Operation	(voltage & current) and the low thermal		
	stress for a long time.		
High Temperature /	Endurance test applying the electric stress	+60°C, 90% RH, 96hrs	1,2
Humidity Operation	(voltage & current) and the high thermal		
	with high humidity stress for a long time.		
Thermal Shock resistance	Endurance test applying the electric stress	-20°C,30min -> 25°C,5min ->	
	(voltage & current) during a cycle of low	70°C,30min = 1 cycle	
	and high thermal stress.	10 cycles	
Vibration test	Endurance test applying vibration to	10-55Hz , 15mm amplitude.	3
	simulate transportation and use.	60 sec in each of 3 directions	
		X,Y,Z	
		For 15 minutes	
Static electricity test	Endurance test applying electric static	VS=800V, RS=1.5kΩ, CS=100pF	
	discharge.	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 <a href="https://www.newhavendisplay.com/specs/precautions.pdf">www.newhavendisplay.com/specs/precautions.pdf</a>

### **Warranty Information**

See Terms & Conditions at <a href="http://www.newhavendisplay.com/index.php?main\_page=terms">http://www.newhavendisplay.com/index.php?main\_page=terms</a>