Product Specification _____

NHD-C0220BiZ-FSW-FBW-3V3M

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

NHD-	Newhaven Display
C0220-	COG, 2 Lines x 20 Characters
BiZ-	Model, I²C Interface
F-	Transflective
SW-	Side White LED Backlight
F-	FSTN (+)
B-	6:00 Optimal View
W-	Wide Temperature
3V3-	3.3V LCD
M-	Mounting Holes

Table of Contents

Additional Resources

- **Support Forum:** https://support.newhavendisplay.com/hc/en-us/community/topics

- **GitHub:** https://github.com/newhavendisplay

- **Example Code:** https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/
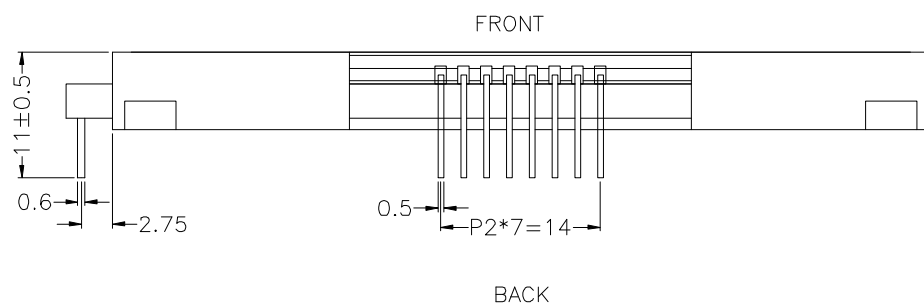
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html

- **Quality Center:** https://www.newhavendisplay.com/quality_center.html

- **Precautions for using LCDs/LCMs:** https://www.newhavendisplay.com/specs/precautions.pdf

- **Warranty / Terms & Conditions:** https://www.newhavendisplay.com/terms.html

Document Revision History

Revision	Date	Description	Changed By
0	07/08/2009	Initial Release	
1	10/09/2009	Updated Electrical Characteristic	MC
2	11/20/2009	Updated Backlight Supply Current	MC
3	05/27/2011	Display Character Address Code Updated	AK
4	06/23/2014	Mechanical Drawing, Electrical & Optical Characteristics Updated	ML
5	03/18/2019	Mechanical Drawing & Electrical Characteristics Updated	SB
6	06/24/2019	Added PCB Footprint Drawing	AS
7	09/22/2020	Updated Drive Conditions in Electrical Characteristics Table	AS
8	10/23/2020	Updated Symbol for LCD Supply Voltage	AS
9	05/09/2023	Part Changed to Rev1A	KL
10	07/26/2023	Mechanical Drawing, Electrical Characteristics, and Quality Information Updated	KL

Mechanical Drawing

71.6±0.5
65.0±0.5
61.0(V.A.)
58.5(A.A.)

6.8±0.5
2.5
1.5
8.5
4.2
0.9
0.3
4.2±0.5

4.1

10.3
16.8

11.6(A.A.)
15.1(V.A.)
27.1±0.5
33.1±0.5
37.6±0.5

BACK   FRONT

4-∅2.5

8   1
30
4.5

Black glue covers the chip

⬆ VIEWING DIRECTION

FRONT   BACK

K
A

NEWHAVEN DISPLAY
NHD-C0220BiZ-FSW-FBW-3V3M_Rev1A
LOT-YYWW

K
A

FRONT

11±0.5
0.6
2.75
0.5
P2*7=14

BACK

LED Backlight Circuit

COM16
COM9
COM8
COM1
S1 ----- S100

DOT SIZE
SCALE 2/1

2.45
0.5
0.65
0.7
5.55
0.5
0.5
0.45
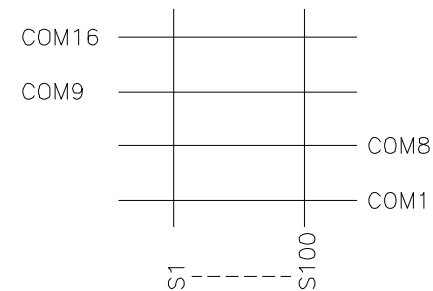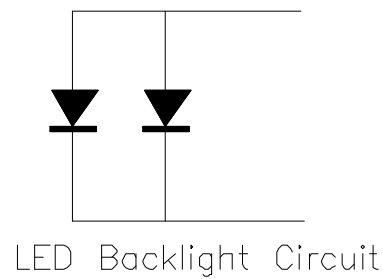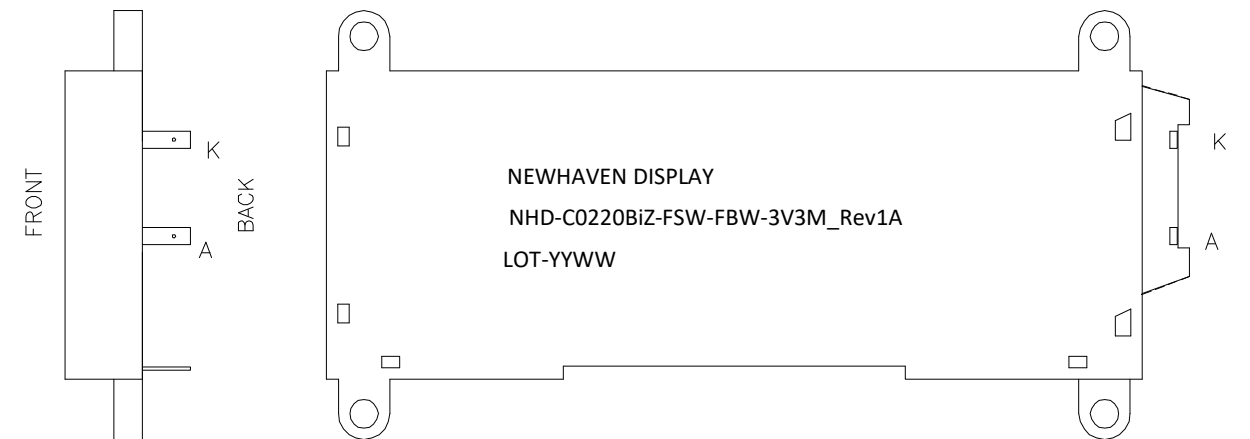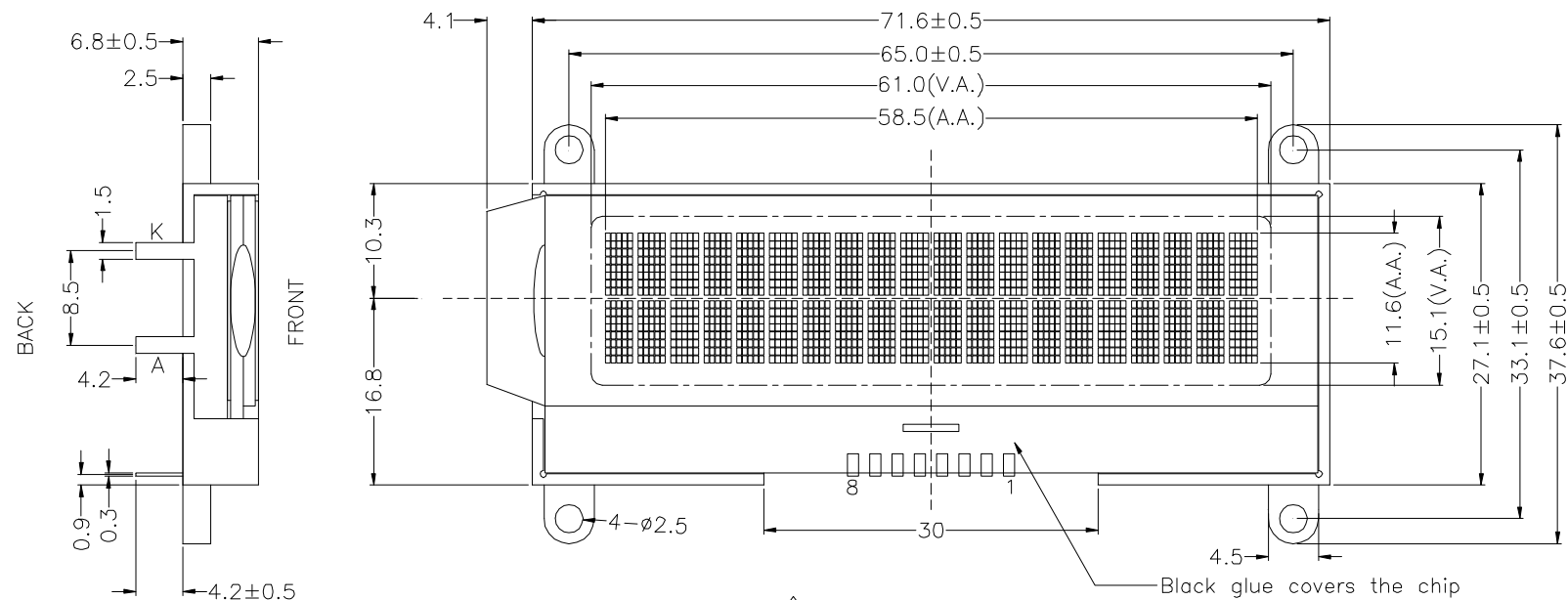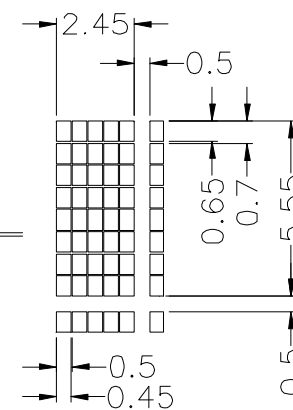
NO	SYMBOL
1	RST
2	SCL
3	SDA
4	VSS
5	VDD
6	VOUT
7	C1+
8	C1-

Product Description: 2x20 Character COG LCD
1. Driver IC: ST7036i
2. Driving Mode: 1/16 Duty, 1/5 Bias
3. Interface: I²C
4. Power Requirement: 3.3V LCD
5. Optical Features: FSTN (+), Transflective, 6:00 View, White Backlight

Recommended PCB Footprint

65

32.5

1.5

7

0.6

38.25

Ø2.5

P2.0*7=14

0.5

0.3

13.3

15.9

33.1

Pin Description

| Pin No.	Symbol	External Connection	Function Description
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	V_{SS}	Power Supply	Ground
5	V_{DD}	Power Supply	Supply Voltage for logic (+3.3V)
6	V_{OUT}	CAP	Voltage booster circuit – Connect 0.47µF~2.2µF cap to V_{SS} or V_{DD}
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: 8.5mm pitch pins, solder directly into PCB   **Mates with**: ---
Recommended Breakout Board: NHD-PCB40

Wiring Diagram
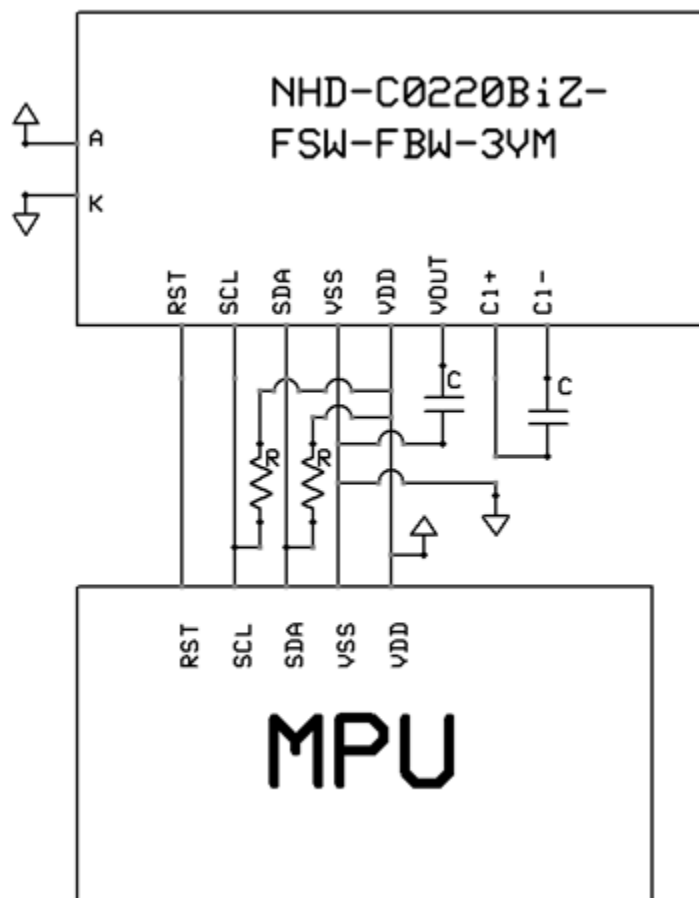
Capacitance 0.47µF~2.2µF   Recommended value = 1µF
Recommended Resistor: 10KΩ

Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T_{OP}	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T_{ST}	Absolute Max	-30	-	+80	°C
Supply Voltage	V_{DD}	-	3.0	3.3	3.6	V
Supply Current	I_{DD}	V_{DD} = 3.3V	0.05	0.5	1.5	mA
Supply for LCD (contrast)	V_{LCD}	V_0-V_{SS}, T_{OP} = 25°C	5.3	5.5	5.7	V
"H" Level input	V_{IH}	-	0.7 * V_{DD}	-	V_{DD}	V
"L" Level input	V_{IL}	-	V_{SS}	-	0.8 * V_{DD}	V
"H" Level output	V_{OH}	-	0.7 * V_{DD}	-	V_{DD}	V
"L" Level output	V_{OL}	-	V_{SS}	-	0.8	V
Backlight Supply Current – White	I_{LED}	-	15	30	35	mA
Backlight Supply Voltage – White*	V_{LED}	I_{LED} = 30 mA	2.8	3.0	3.3	V

*The LED of the backlight is driven by current drain; drive voltage is for reference only. Drive voltage must be selected to ensure backlight current drain is below MAX level stated.

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 2	30	40	-	°
	Bottom	φY-		50	60	-	°
	Left	θX-		50	60	-	°
	Right	θX+		50	60	-	°
Contrast Ratio		CR	-	2	5	-	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	150	250	ms
	Fall	T_F		-	200	300	ms

Controller Information

Built-in ST7036i Controller: https://support.newhavendisplay.com/hc/en-us/articles/4414860535575-ST7036

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	0B	0C	0D	0E	0F	10	11	12	13
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53

Table of Commands

Instruction	Instruction Code										Description
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
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	C	B	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 or 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)

Instruction table 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

Instruction table 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	Ion	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	C3	C2	C1	C0	Contrast set for internal follower mode.

Instruction table 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	X	Do not use (reserved for test)

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

Timing Characteristics
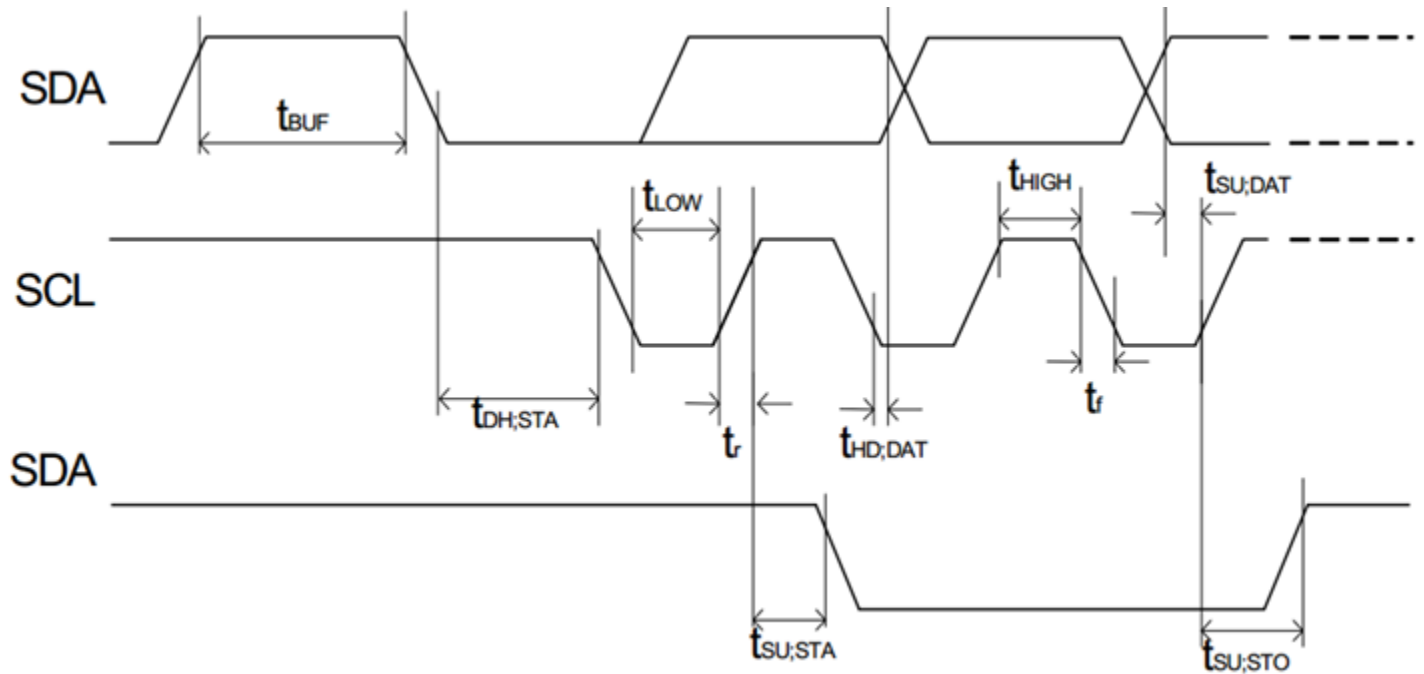
Item	Signal	Symbol	Condition	VDD=2.7 to 4.5V Rating		VDD=4.5 to 5.5V Rating		Units
				Min.	Max.	Min.	Max.	
SCL clock frequency	SCL	f_{SCLK}		DC	300K	DC	400	kHz
SCL clock low period		t_{LOW}	—	2.5	—	1.3	—	µs
SCL clock high period		t_{HIGH}		0.6	—	0.6	—	
Data set-up time	SDA	$t_{SU;DAT}$	—	1800	—	700	—	ns
Data hold time		$t_{HD:DAT}$		0	—	0	0.5	µs
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	SDA	$t_{SU;STA}$	—	0.6	—	0.6	—	µs
Start condition hold time		$t_{HD;STA}$	—	1.8	—	1.0	—	µs
Setup time for STOP condition		$t_{SU;STO}$	—	0.6	—	0.6	—	µs
Bus free time between a Stop and START condition	SCL	t_{BUF}	—	1.3	—	1.3	—	µs

Slave Address = 0x78

Fig .5 IIC Interface protocol

	Co		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.
		0	
		1	Another control byte will follow the data byte unless a STOP condition is received.
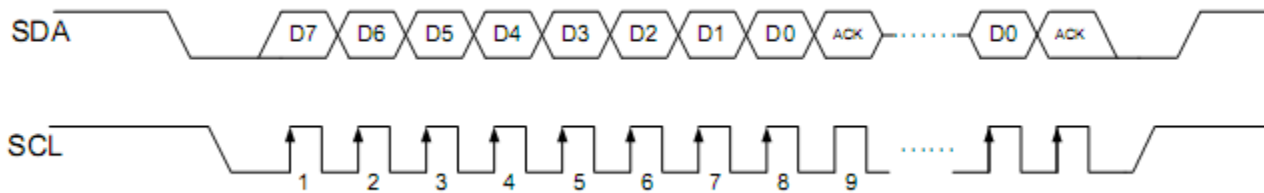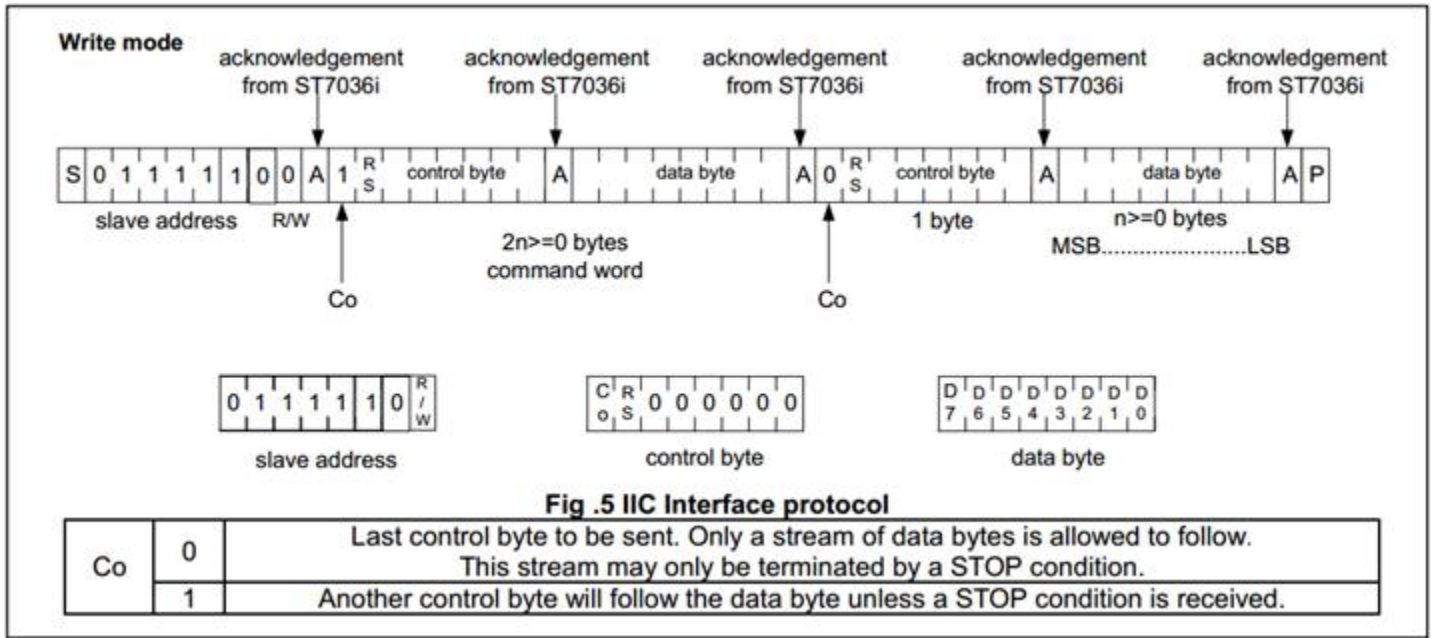
Example Initialization Program

```
/***************************************************
*            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 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, 1.5mm Amplitude. 2g Acceleration. 60 sec in each of 3 directions X, Y, Z For 30 minutes	3
Static electricity test	Endurance test applying electric static discharge.	Air: ±8KV, Contact: ±4KV	

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.