NEWHAVEN DISPLAY INTERNATIONAL

Product Specification

NHD-C160100AZ-RN-GBW

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

NHD-	Newhaven Display
C160100-	160 x 100 Pixels
AZ-	Model
R-	Reflective
N-	No Backlight
G-	STN (+) Gray
B-	6:00 Optimal View
W-	Wide Temperature

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REACH Compliant

RoHS Compliant

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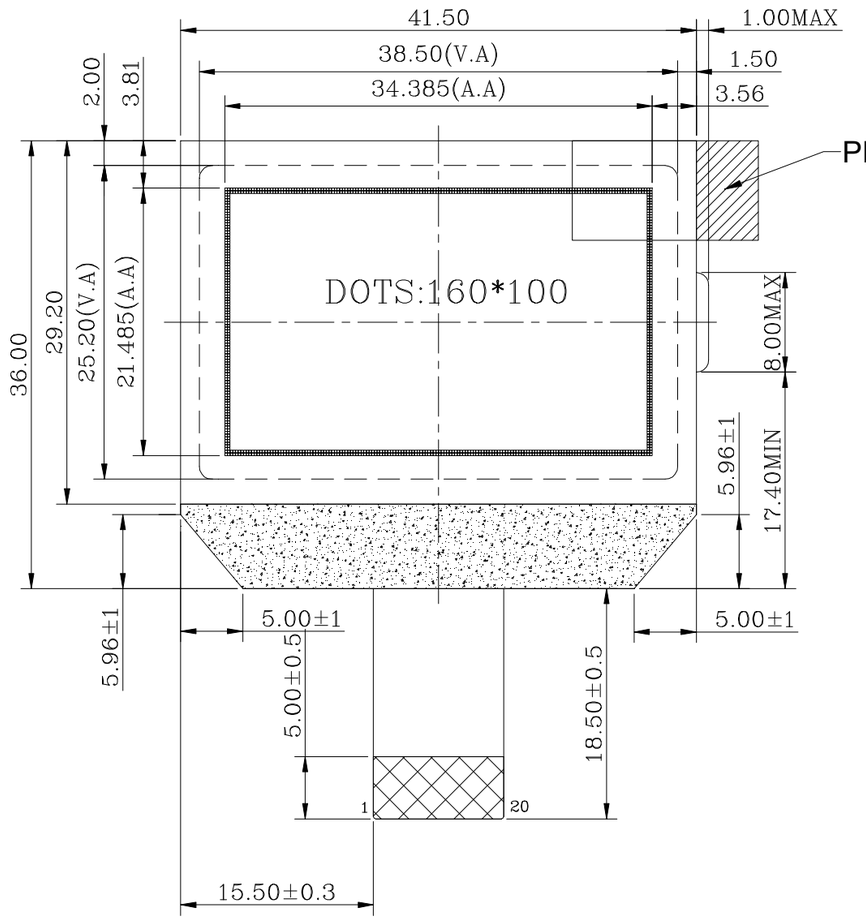
Additional Resources

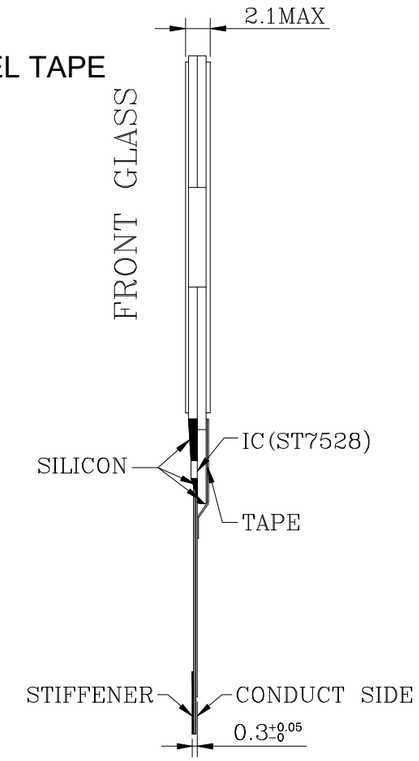
- **Support Forum:** https://support.newhavendisplay.com/hc/en-us/community/topics
- **GitHub:** https://github.com/newhavendisplay
- **Example Code:** https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html
- **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

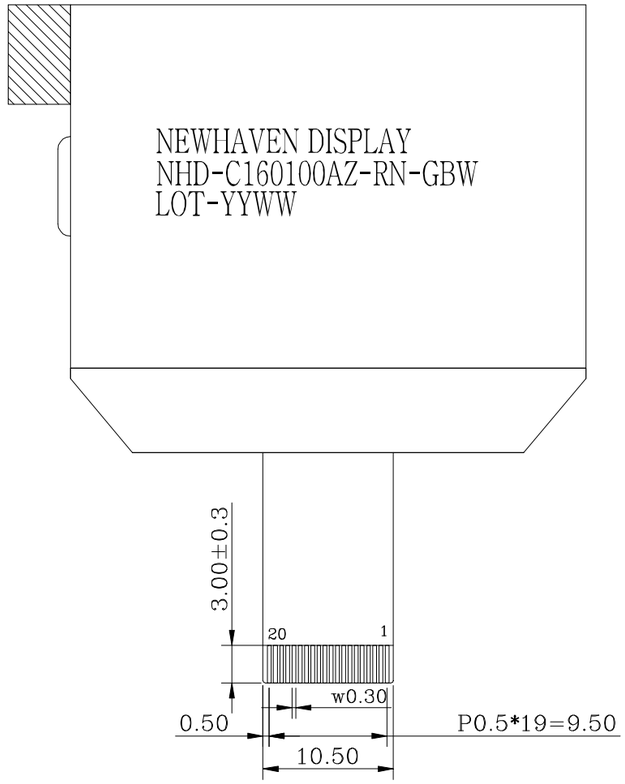
Document Revision History

Revision	Date	Description	Changed By
0	10/31/2007	Initial Release	-
1	09/14/2009	User Guide Reformat	BE
2	10/14/2009	Updated Electrical Characteristic	MC
3	12/08/2009	Updated Block Diagram, Pins 4 and 5, and Timing Characteristics	MC
4	06/27/2018	FPC Length, Supply & Logic Voltage Values Updated	SB
5	12/28/2018	Fixed Notes on Drawing	SB
6	05/21/2024	Mechanical Drawing Updated	KL

Mechanical Drawing



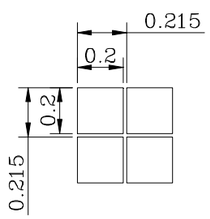




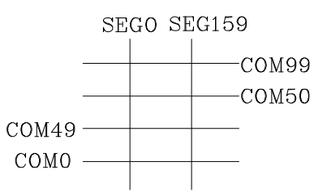
NO.	SIGNAL
1	V1
2	V2
3	V3
4	V4
5	VOUT
6	VSS
7	VDD
8	DB7
9	DB6
10	DB5
11	DB4
12	DB3
13	DB2
14	DB1
15	DB0
16	E−RD
17	RW−WR
18	A0
19	RST
20	CSB

Product Description: 160x100 Graphic COG LCD

1. Driver IC: ST7528
2. Driving Mode: 1/100 Duty, 1/11 Bias
3. Interface: 8-bit 8080 Parallel
4. Power Requirement: 3.0V LCD
5. Optical Features: STN (+) Gray, Reflective, 6:00 View
6. Recommended FFC Connector: 20pin 0.5mm pitch



DOTS SCALE:1/20



COM & SEG LAYOUT

Standard Tolerance:
(Unless otherwise specified)
Linear: ±0.3mm

NEWHAVEN DISPLAY INTERNATIONAL

Drawing/Part Number: NHD-C160100AZ-RN-GBW
Revision: -

Unless otherwise specified:
• Dimensions are in Millimeters
• Third Angle Projection

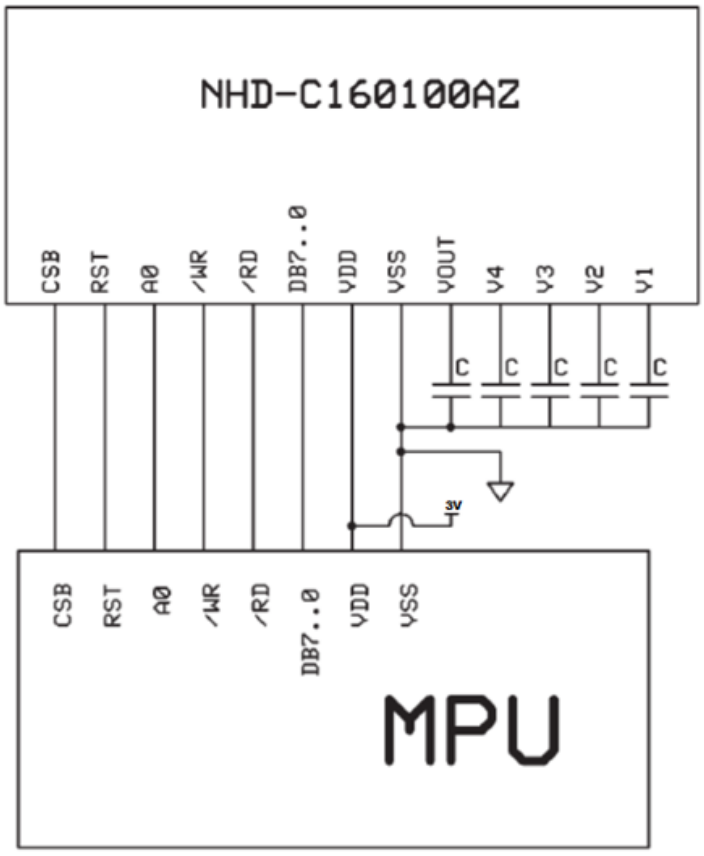
Drawn By: K. Lewis
Approved By: K. Lewis
Drawn Date: 05/21/2024
Approved Date: 05/21/2024

Pin Description

Pin No.	Symbol	External Connection	Function Description
1	CSB	MPU	Active LOW Chip Select
2	RST	MPU	Active LOW Reset signal
3	A0	MPU	Register Select Signal. A0=1: Data, A0=0: Command
4	/WR	MPU	Active LOW Write signal
5	/RD	MPU	Active LOW Read signal
6-13	DB0-DB7	MPU	Bi-directional 8-bit Data Bus.
14	V_{DD}	Power Supply	Supply Voltage for LCD and Logic (+3.0V)
15	V_{SS}	Power Supply	Ground
16	V_{OUT}	Power Supply	Connect to 1uF cap to V_{SS} or V_{DD}
17	V_4	Power Supply	1.0uF-2.2uF cap to V_{SS}
18	V_3	Power Supply	1.0uF-2.2uF cap to V_{SS}
19	V_2	Power Supply	1.0uF-2.2uF cap to V_{SS}
20	V_1	Power Supply	1.0uF-2.2uF cap to V_{SS}

Recommended LCD connector: 0.5mm pitch pins. Molex p/n: 52746-2070
Backlight connector: --- **Mates with**: ---

Wiring Diagram



Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T_{OP}	Absolute Max	-10	-	+60	°C
Storage Temperature Range	T_{ST}	Absolute Max	-20	-	+70	°C
Supply Voltage	V_{DD}	-	2.7	3.0	3.3	V
Supply Current	I_{DD}	V_{DD} = 3.0V T_{OP} = 25°C	0.5	1.5	2.5	mA
Supply for LCD (contrast)	V_{LCD}		11.2	11.5	11.8	V
"H" Level input	V_{IH}	-	0.7 * V_{DD}	-	V_{DD}	V
"L" Level input	V_{IL}	-	V_{SS}	-	0.3 * V_{DD}	V
"H" Level output	V_{OH}	-	0.7* V_{DD}	-	V_{DD}	V
"L" Level output	V_{OL}	-	V_{SS}	-	0.2 * V_{DD}	V

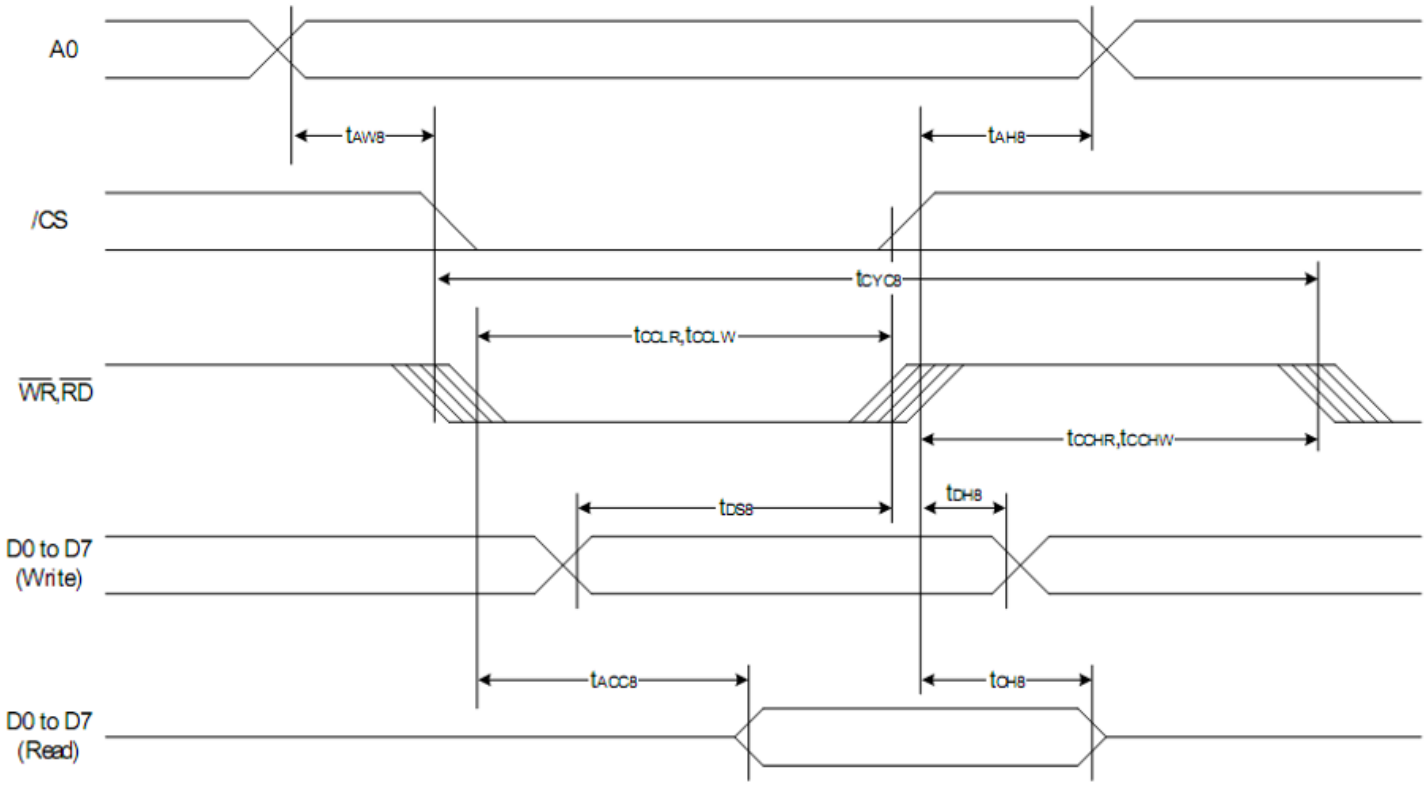
Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 2	-	435	-	°
	Bottom	φY-		-	60	-	°
	Left	θX-		-	40	-	°
	Right	θX+		-	40	-	°
Contrast Ratio		CR	-	2	6	-	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	150	250	ms
	Fall	T_F		-	200	250	ms

Controller Information

Built-in ST7528 Controller: https://support.newhavendisplay.com/hc/en-us/articles/4414862822295--ST7528

Timing Characteristics



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAH8		0	—	ns
Address setup time		tAW8		0	—	
System cycle time		tCYC8		240	—	
Enable L pulse width (WRITE)	WR	tCCLW		80	—	
Enable H pulse width (WRITE)		tCCHW		80	—	
Enable L pulse width (READ)	RD	tCCLR		140	—	
Enable H pulse width (READ)		tCCHR		80		
WRITE Data setup time	D0 to D7	tDS8		40	—	
WRITE Data hold time		tDH8		10	—	
READ access time		tACC8	CL = 100 pF	—	70	
READ Output disable time		tOH8	CL = 100 pF	5	50	

Table of Commands

Instruction	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
EXT=0 or 1											
Mode Set	0	0	0	0	1	1	1	0	0	0	2-byte instruction to set Mode and FR(Frame frequency control) BE(Booster efficiency control)
	0	0	FR3	FR2	FR1	FR0	0	BE	x'	EXT	
EXT=0											
Read display data	1	1	Read data								Read data into DDRAM
Write display data	1	0	Write data								Write data into DDRAM
Read status	0	1	BUSY	ON	RES	MF2	MF1	MF0	DS1	DS0	Read the internal status
ICON control register ON/OFF	0	0	1	0	1	0	0	0	1	ICON	ICON=0: ICON disable(default) ICON=1: ICON enable & set the page address to 16
Set page address	0	0	1	0	1	1	P3	P2	P1	P0	Set page address
Set column address MSB	0	0	0	0	0	1	Y9	Y8	Y7	Y6	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y5	Y4	Y3	Y2	Set column address LSB
Set modify-read	0	0	1	1	1	0	0	0	0	0	Set modify-read mode
Reset modify-read	0	0	1	1	1	0	1	1	1	0	release modify-read mode
Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=0: Display OFF D=1: Display ON
Set initial display line register	0	0	0	1	0	0	0	0	x'	x'	2-byte instruction to specify the initial display line to realize vertical scrolling
	0	0	x'	S6	S5	S4	S3	S2	S1	S0	
Set initial COM0 register	0	0	0	1	0	0	0	1	x'	x'	2-byte instruction to specify the initial COM0 to realize window scrolling
	0	0	x'	C6	C5	C4	C3	C2	C1	C0	
Set partial display duty ration	0	0	0	1	0	0	1	0	x'	x'	2-byte instruction to set partial display duty ratio
	0	0	D7	D6	D5	D4	D3	D2	D1	D0	
Set N-line inversion	0	0	0	1	0	0	1	1	x'	x'	2-byte instruction to set N-line inversion register
	0	0	x'	x'	x'	N4	N3	N2	N1	N0	
Release N-line inversion	0	0	1	1	1	0	0	1	0	0	Release N-line inversion mode
Reverse display ON/OFF	0	0	1	0	1	0	0	1	1	REV	REV=0: normal display REV=1: reverse display
Entire display ON/OFF	0	0	1	0	1	0	0	1	0	EON	EON=0: normal display EON=1: entire display ON

Example Initialization Program

```
//-------------------------------------------------------------

void write_command(unsigned char datum)
{
 A0=0;                                                  /*Instruction register*/
 E=1;                                                   /*Read inactive*/
 P1 = datum;                                            /*put data on port 1*/
 CS1=0;                                                 /*Chip select active*/
 RW=0;                                                  /*Write active*/
 RW=1;                                                  /*Write inactive; latch in data*/
 CS1=1;                                                 /*Chip select inactive*/
}

//-------------------------------------------------------------

void write_data(unsigned char datum)
{
 A0=1;                                                  /*DDRAM data register*/
 E=1;
 P1=datum;
 CS1=0;
 RW=0;
 RW=1;
 CS1=1;
}

//-------------------------------------------------------------

void lcd_init(void){
      write_command(0xA2);      //ICON  OFF;
      write_command(0xAE);      //Display OFF

      write_command(0x48);      //Set Duty ratio
      write_command(0x80);      //No operation
      write_command(0xa1);      //Set scan direction //changed from 0 to 1
      write_command(0xc8);      //SHL  select
      write_command(0x40);      //Set START LINE
      write_command(0x00);
      write_command(0xab);      //OSC on

      write_command(0x64);      //3x
      delay(2000);
      write_command(0x65);      //4x
      delay(2000);
      write_command(0x66);      //5x
      delay(2000);
      write_command(0x67);      //6x
      delay(2000);

      write_command(Ra_Rb);      //RESISTER SET
      write_command(0x81);      //Set electronic volume register
      write_command(vopcode);    //n=0~3f


      write_command(0x57);      //1/12bias
      write_command(0x92);      //FRC and pwm


      write_command(0x2C);
      delay(20000);//200ms
      write_command(0x2E);
```

```
delay(20000);//200ms
write_command(0x2F);
delay(20000);//200ms


write_command(0x92);       //frc and pwm
write_command(0x38);       //external  mode
write_command(0x75);
      //start settings for 16-level grayscale
write_command(0x97);       //3frc,45pwm

write_command(0x80);
write_command(0x00);
write_command(0x81);
write_command(0x00);
write_command(0x82);
write_command(0x00);
write_command(0x83);
write_command(0x00);

write_command(0x84);
write_command(0x06);
write_command(0x85);
write_command(0x06);
write_command(0x86);
write_command(0x06);
write_command(0x87);
write_command(0x06);

write_command(0x88);
write_command(0x0b);
write_command(0x89);
write_command(0x0b);
write_command(0x8a);
write_command(0x0b);
write_command(0x8b);
write_command(0x0b);

write_command(0x8c);
write_command(0x10);
write_command(0x8d);
write_command(0x10);
write_command(0x8e);
write_command(0x10);
write_command(0x8f);
write_command(0x10);

write_command(0x90);
write_command(0x15);
write_command(0x91);
write_command(0x15);
write_command(0x92);
write_command(0x15);
write_command(0x93);
write_command(0x15);

write_command(0x94);
write_command(0x1a);
write_command(0x95);
write_command(0x1a);
write_command(0x96);
write_command(0x1a);
write_command(0x97);
write_command(0x1a);
```

```
write_command(0x98);
write_command(0x1e);
write_command(0x99);
write_command(0x1e);
write_command(0x9a);
write_command(0x1e);
write_command(0x9b);
write_command(0x1e);

write_command(0x9c);
write_command(0x23);
write_command(0x9d);
write_command(0x23);
write_command(0x9e);
write_command(0x23);
write_command(0x9f);
write_command(0x23);

write_command(0xa0);
write_command(0x27);
write_command(0xa1);
write_command(0x27);
write_command(0xa2);
write_command(0x27);
write_command(0xa3);
write_command(0x27);

write_command(0xa4);
write_command(0x2b);
write_command(0xa5);
write_command(0x2b);
write_command(0xa6);
write_command(0x2b);
write_command(0xa7);
write_command(0x2b);

write_command(0xa8);
write_command(0x2f);
write_command(0xa9);
write_command(0x2f);
write_command(0xaa);
write_command(0x2f);
write_command(0xab);
write_command(0x2f);

write_command(0xac);
write_command(0x32);
write_command(0xad);
write_command(0x32);
write_command(0xae);
write_command(0x32);
write_command(0xaf);
write_command(0x32);

write_command(0xb0);
write_command(0x35);
write_command(0xb1);
write_command(0x35);
write_command(0xb2);
write_command(0x35);
write_command(0xb3);
write_command(0x35);
```

```
        write_command(0xb4);
        write_command(0x38);
        write_command(0xb5);
        write_command(0x38);
        write_command(0xb6);
        write_command(0x38);
        write_command(0xb7);
        write_command(0x38);

        write_command(0xb8);
        write_command(0x3a);
        write_command(0xb9);
        write_command(0x3a);
        write_command(0xba);
        write_command(0x3a);
        write_command(0xbb);
        write_command(0x3a);

        write_command(0xbc);
        write_command(0x3c);
        write_command(0xbd);
        write_command(0x3c);
        write_command(0xbe);
        write_command(0x3c);
        write_command(0xbf);
        write_command(0x3c);
              //end settings for 16-level grayscale
        write_command(0x38);
        write_command(0x74);
        write_command(0xaf);     //Display ON
}

//------------------------------------------------------------
```

Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+70°C , 48hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-20°C , 48hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+60°C 48hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-10°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.