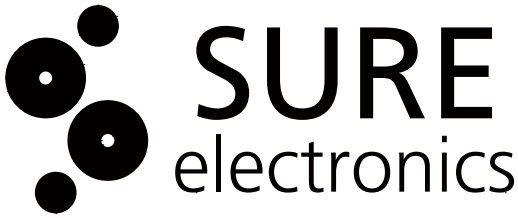


Demo Board for LCD Character Module User's Guide

Table of contents

NOTES:

Product Version : Ver 1.0

Document Version : Ver 1.0

Chapter1. Overview

1.1 Introduction

Thanks for buying the series product of LCD character module of Sure Electronics. Users can refer to the following table for the type of LCD module products.

Product Number	Types of LCD character display
DE-LM001	0802LCD（Green backlight，Black character）
DE-LM003	1602LCD（Blue backlight，white character）
DE-LM004	2002 OLED LCD（No backlight，Green character）
DE-LM005	2004LCD（Blue backlight，White character）
DE-LM006	2004LCD（Blue backlight，White character）
DE-LM008	1602LCD（No backlight，black character）
DE-LM009	2402LCD（No backlight，black character）
DE-LM0010	2402LCD（Red backlight，white character）
DE-LM0011	1602 OLED LCD（No backlight，Green character）
DE-LM0013	2002 LCD（No backlight，black character）

Note: the dimensions of DE-LM005 and DE-LM006 are different.
This product is delivered along with demo board for LCD test and related accessories, which are offered for free, so that users may test the performance of LCD display.

1.2 Quick Start

Step 1, Connect LCD display and demo board with pin header. It is recommended to connect the test board to the longer end of the pin header and connect the shorter end to the LCD display. Secure the connections of demo board and LCD display to the pin header and place the demo board upwards with the side having chips. When you are making connections, make sure that pin1 of LCD display (GND) are connected with pin1 (square-headed, GND) of demo board via pin header. While at the same time, Fig 1.1 and 1.2 are given for reference. Remember the angle that demo board makes with LCD display must have at least an amount of 15°to 20°when being connected as shown below so as to ensure a full contact.

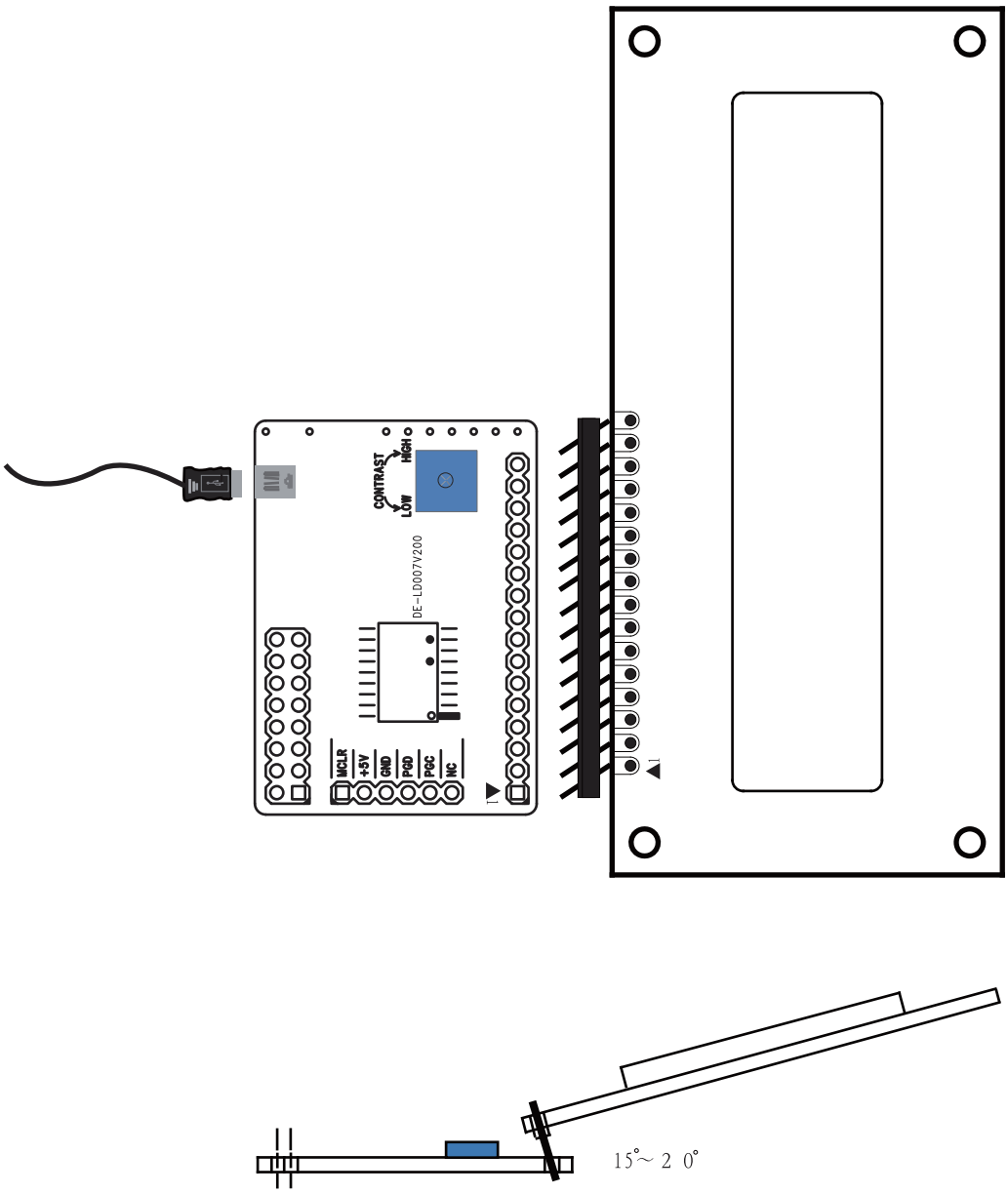


Fig 1.1 schematic diagram of connection (With single-row pin header)

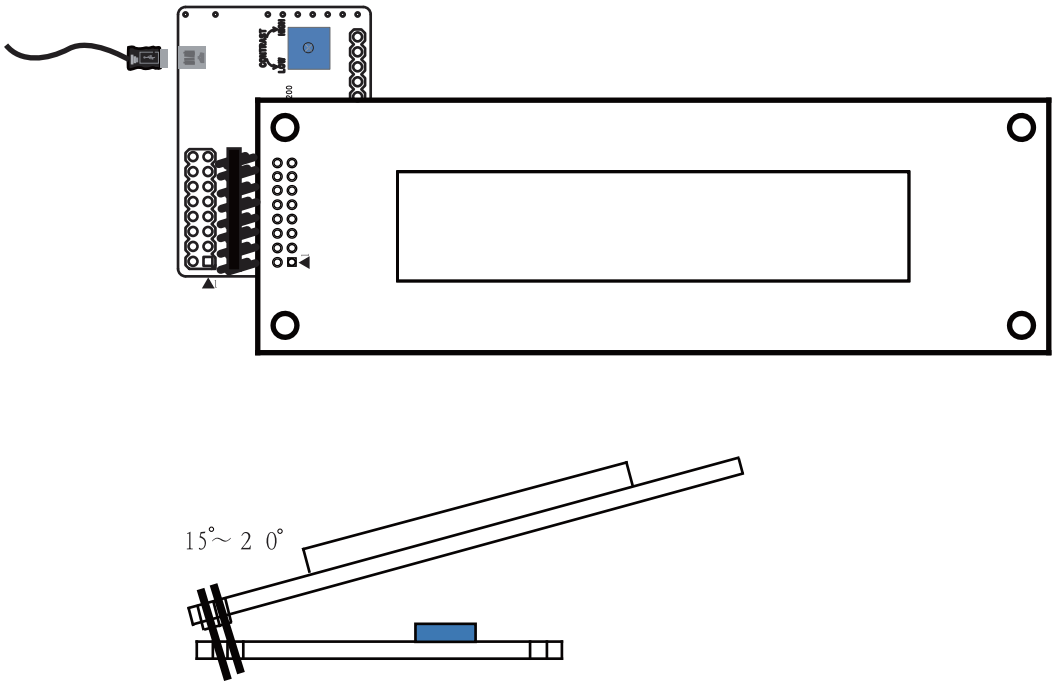


Fig 1.2 schematic diagram of connection (With double-row pin header)

Step2, Fig 1.3, fig 1.4, fig 1.5, fig 1.6 and fig 1.7 demonstrate how the LCDs of this series display step by step after being powered up by USB.

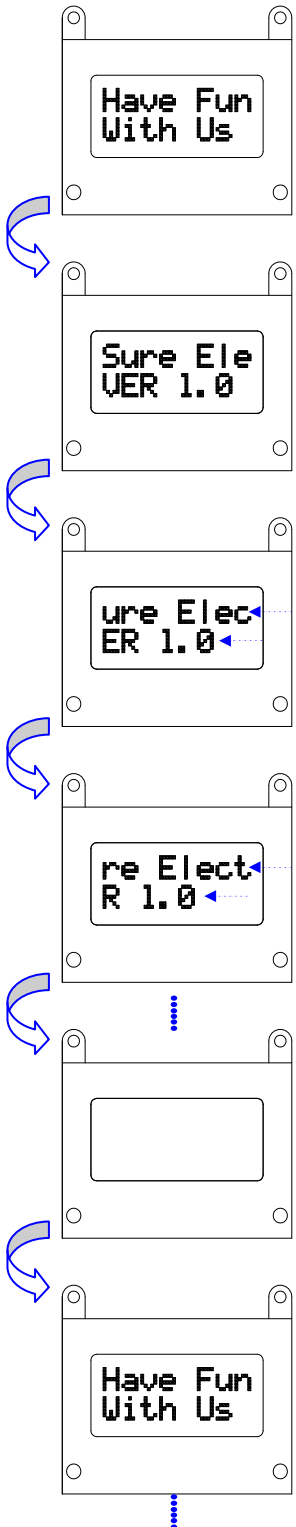


Fig 1.3 Schematic of 8*2LCD's displaying

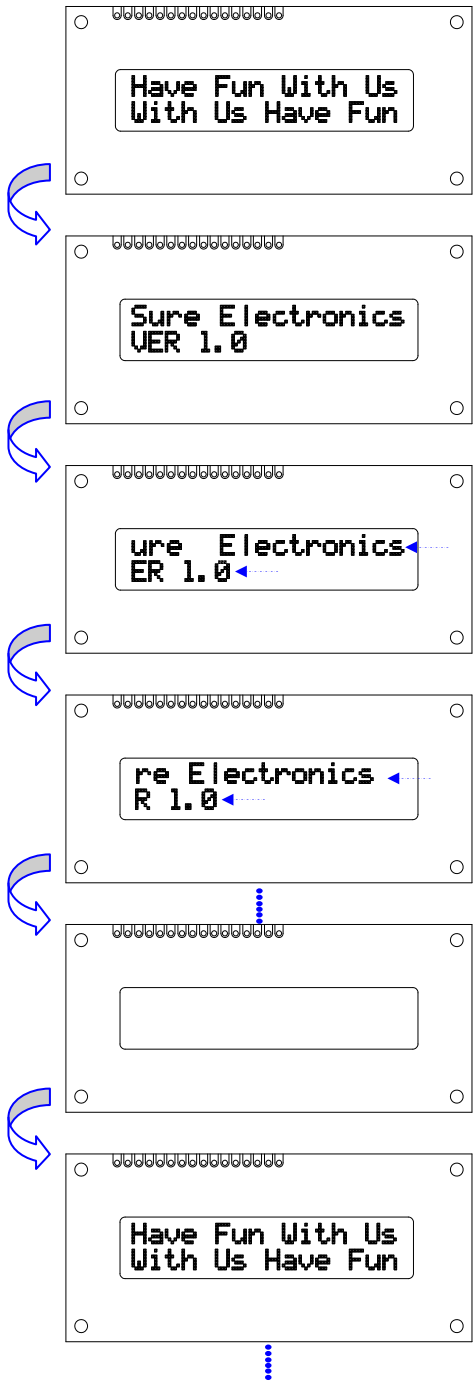


Fig 1.4 Schematic of 16*2 LCD's displaying

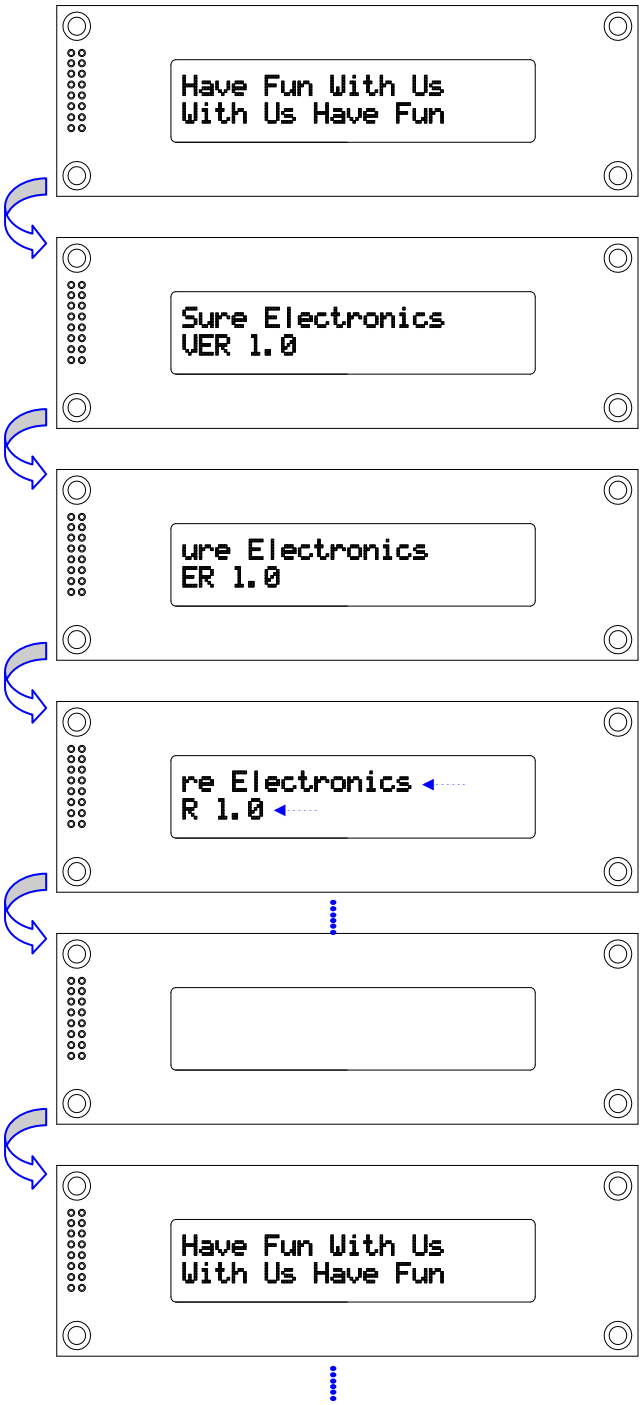


Fig 1.5 Schematic of 20*2 LCD's displaying

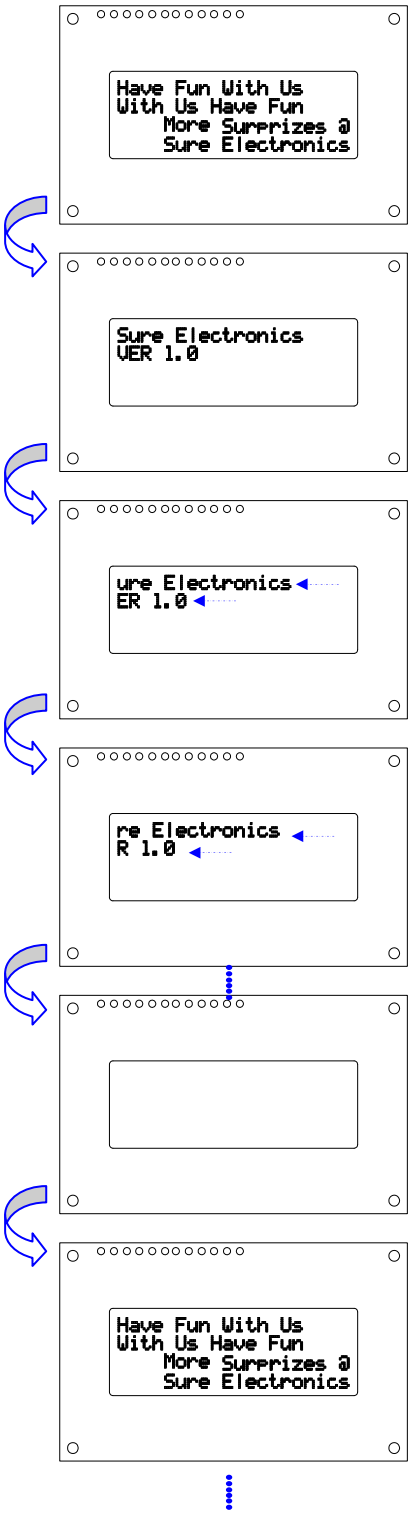


Fig 1.6: Schematic of 20*4 LCD's displaying

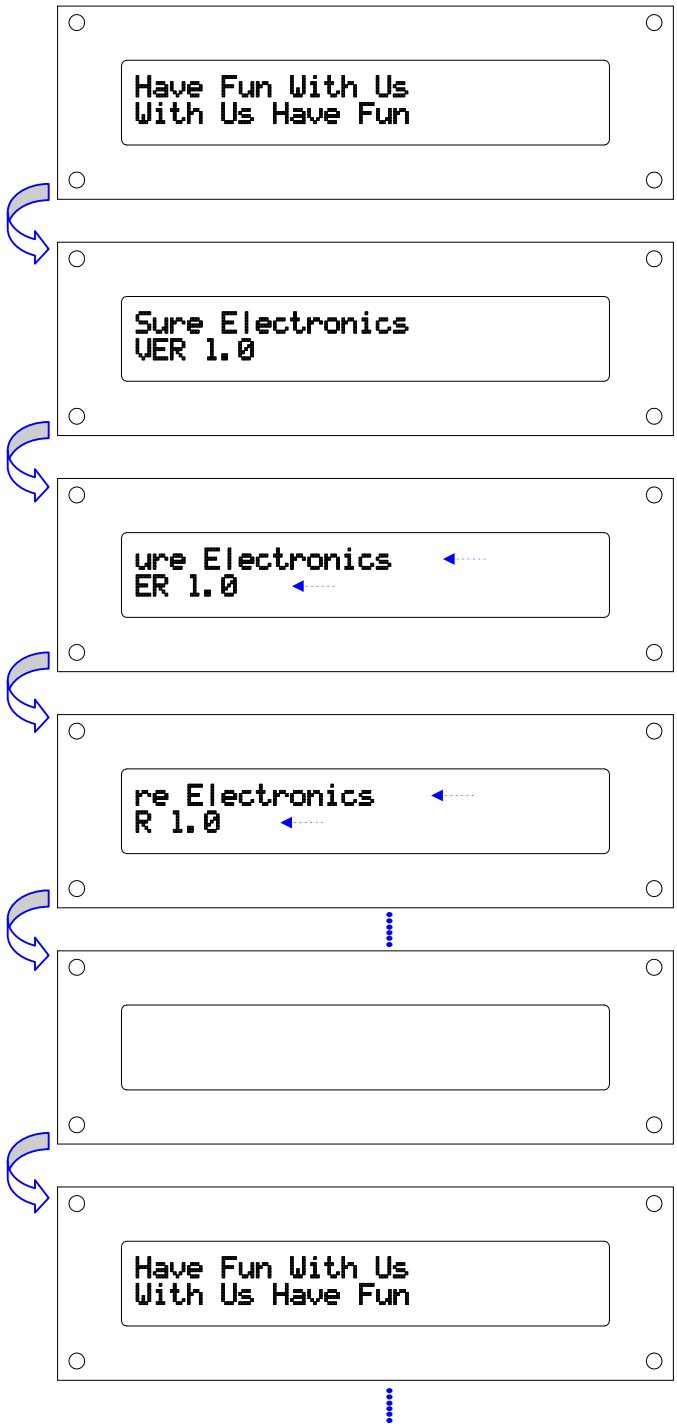


Fig 1.7: Schematic of 24*2 LCD's displaying

If the demo board is powered up before connecting with LCD display, LCD will start displaying from any random step like shown in the above schematic and proceed to the end, which is the first cycle of the displaying and will certainly start over again from the very beginning thereafter.

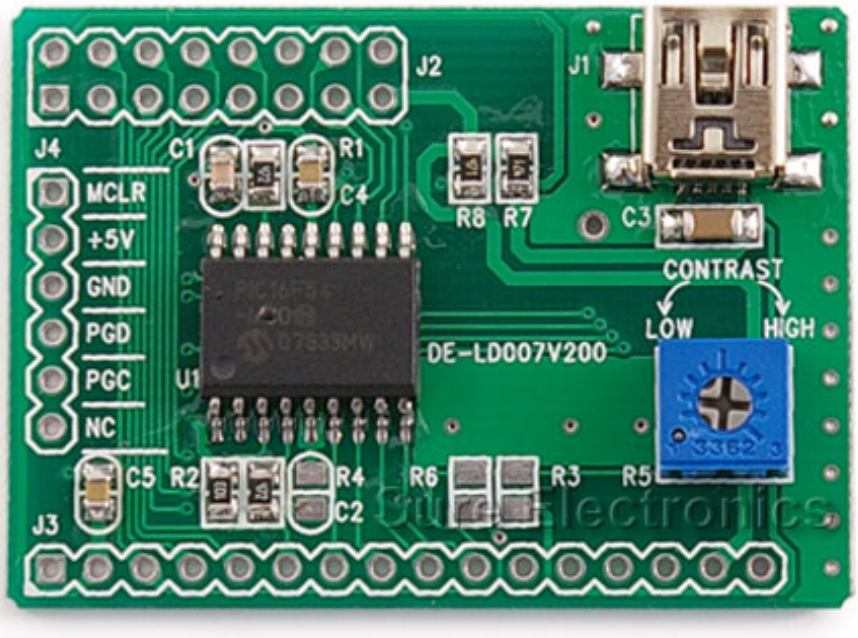


Fig 1.8 :demo board

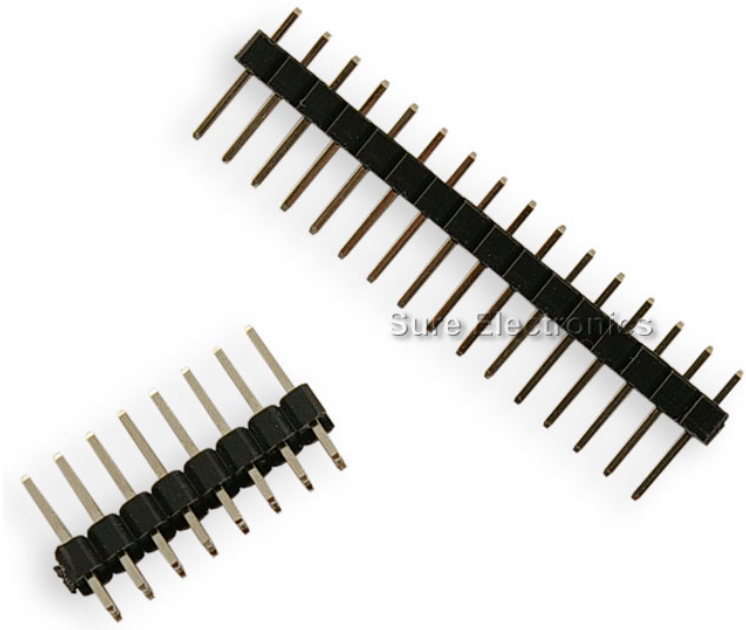


Fig 1.9:Single & double-row pin header

Chapter2. Hardware Specifications

2.1 hardware introduction

（1）Controlling chip: PIC16F54, packaging SOIC. It is connected with RC oscillator as clock source.

（2）Backlight current input: if LCD display supports backlight feature, pin A shall be connected with +5v power supply while pin k shall be connected to earth. Otherwise, pin A and K will be disabled.

（3）Connection Interface of LCD display and demo board: single-row or double-row 16 square-headed pin header

（4）Type mini B 5-pin USB port as +5v power supply, available current supply is no more than 500mA.

(5) Contrast adjustment can be implemented by adjustable Potentiometer R5.

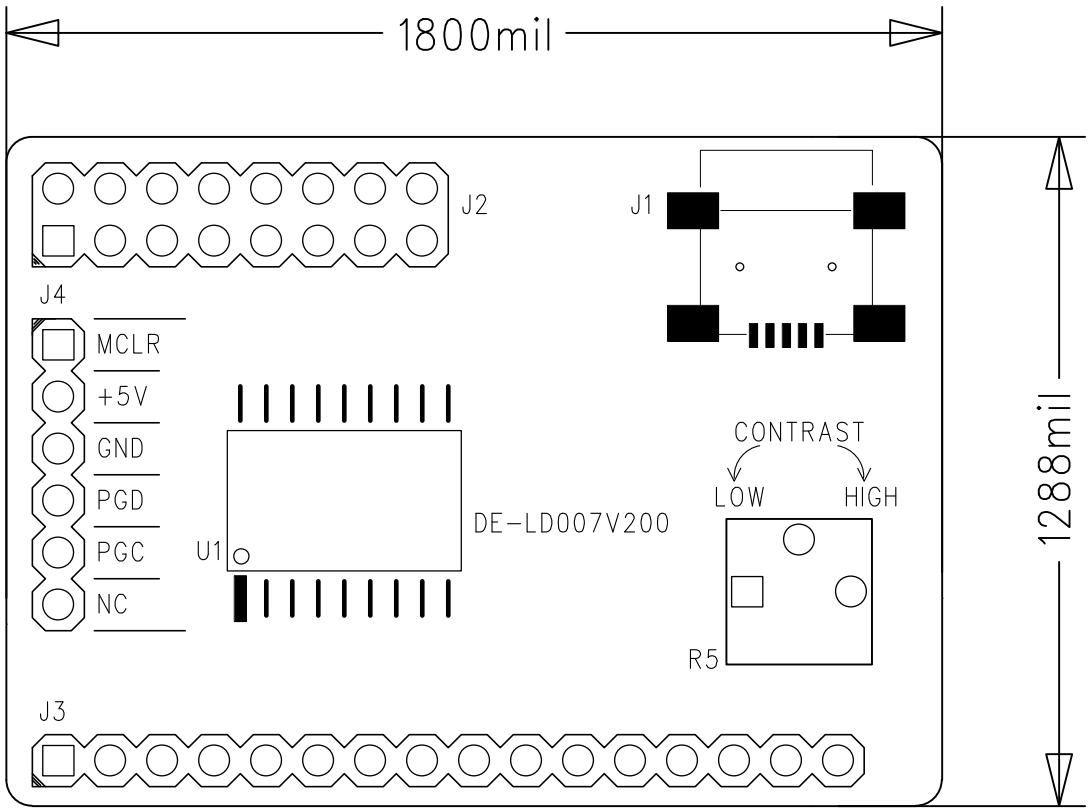
（6）Reserved programming interface

Note: Since the character brightness of 2002 OLED LCD had already been set, the contrast adjustment doesn't apply to this kind of display, while the contrast of other types of display can still be adjusted by R5.

2.2 Port Definition

No	port name	function
1	GND	Earth connection
2	＋5V	+5V power input
3	Vo	To adjust contrast of LCD display
4	RS	to select shift register
5	RW	read & write control
6	E	Enabling signal end
7¯14	DB0~DB7	data bus
15，16	A ，K	Backlight current out, A shall be connected to +5V power supply, k shall be connected to earth.

2.3 Mechanical Drawing



Chapter3. Small Tips for Application

（1）25℃ is an appropriate ambient temperature for LCD testing with demo board.

（2）It is highly recommended to secure the connection of display and demo board during testing. If you loose your hand accidentally during testing, LCD will display abnormally, which users need to readjust and secure the connection to make it normal again.

（3）Users are allowed to adjust the potentiometer if you think the characters on the LCD are not clearly displayed. It is highly recommended to adjust the viewing angle if you are still not satisfied with the displaying effect even after adjustment.

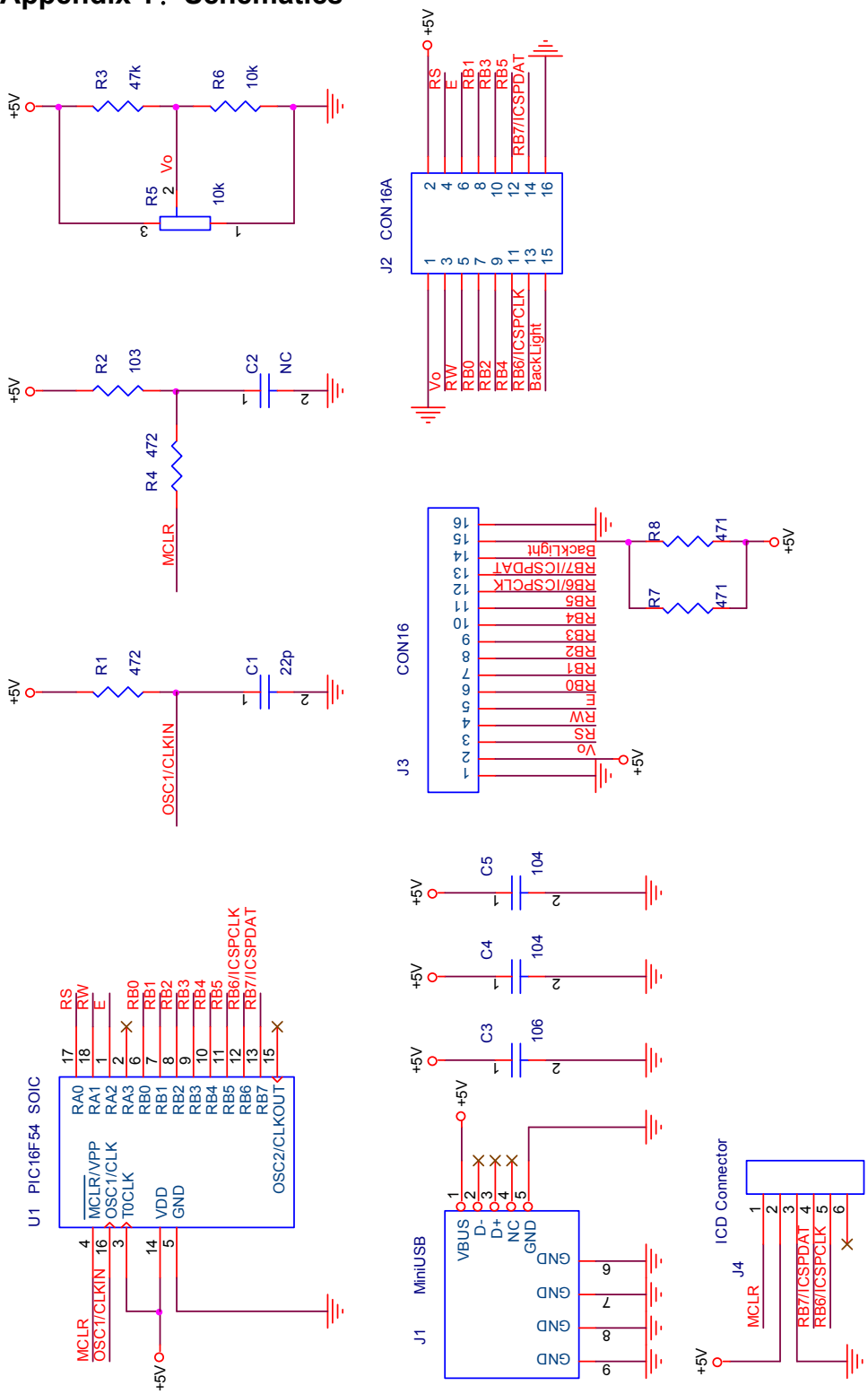
（4）The service life of the adjustable potentiometer is 1000 operations. If the potentiometer is found unable to perform its function, users may solder appropriate 0805 resistors in the area of R3, R6 pads.

（5）Do not connect LCD display and demo board when programming the chip. Otherwise, failure will occur.

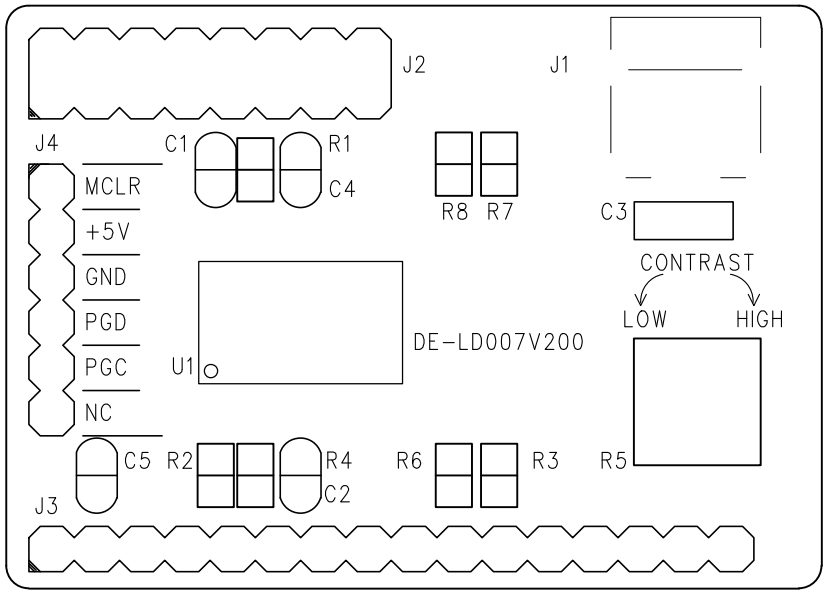
（6）In case that users need to replace the clock source and program by themselves, please refer to the datasheet of drive controlling chip HD44780 so that the requirements for time sequence can be met.

（7）Do not test LCD display under intense light source. Otherwise, the character and backlight of LCD will be difficult to recognize.

Appendix 1：Schematics



Appendix2: PADS Layout



Appendix3: Sample Code

The following code is specifically designed for this demo board.

```
#include<pic.h>
__CONFIG(WDTDIS & RC & UNPROTECT);

//I/O port
#define RS_PIN       RA0
#define RW_PIN     RA1
#define E_PIN        RA2

#define DATA_PORT          PORTB
#define TRIS_DATA_PORT TRISB


void Delay_4ms(void)//Delay 4.1ms
{
      unsigned int t;
      for(t=0;t<820;t++)
      ;
}
//Write Command
```

```
void WriteCommand(unsigned char cmd)
{
        TRIS_DATA_PORT=0x00;
        RS_PIN=0;
        RW_PIN=0;

        E_PIN=1;
        DATA_PORT=cmd;
        E_PIN=0;
}
//Read busy flag
unsigned char BusyCheck(void)
{
      unsigned char BF;
      TRIS_DATA_PORT=0xff;
      RS_PIN=0;
      RW_PIN=1;

      E_PIN=1;
      BF=DATA_PORT;
      E_PIN=0;
      if(BF & 0x80)
            return 1;
      else
            return 0;
}
//Initial by instruction
void InitByInstru(void)
{

      Delay_4ms();
      WriteCommand(0b00111111);
      Delay_4ms();
      WriteCommand(0b00111111);
      Delay_4ms();
      WriteCommand(0b00111111);

      WriteCommand(0b00111011);          //8-bit mode,two lines,5*7 character
      while(BusyCheck());
      WriteCommand(0b00001100);          //Display on,cursor off,blink off
```

```
    while(BusyCheck());
    WriteCommand(0b00000001);       //Clear display
    while(BusyCheck());
    WriteCommand(0b00000011);       //Return home,AC=0
    while(BusyCheck());
    WriteCommand(0b00000110);       //Set entry mode,increment adress by 1
                                    // and shift cursor to the right at the
                                    // time of write to DD/CGRAM.Display
                                    // is not shifted
}
//Write Address
void WriteAddress(unsigned char adr)
{
    TRIS_DATA_PORT=0x00;
    RS_PIN=0;
    RW_PIN=0;

    E_PIN=1;
    DATA_PORT=(adr | 0x80);
    E_PIN=0;
}
//Write character
void WriteChar(unsigned char data)
{
    TRIS_DATA_PORT=0x00;
    RS_PIN=1;
    RW_PIN=0;

    E_PIN=1;
    DATA_PORT=data;
    E_PIN=0;
}
//Write strings
void WriteStr(const char *string,unsigned char cnt)
{
    while(cnt--)
    {
        while(BusyCheck());
            WriteChar(*string++);
    }
```

```
}

  void Delay_500ms(void)
{
      unsigned int k;
      for(k=0;k<120;k++)
            Delay_4ms();

}

void init(void)
{
      TRIS_DATA_PORT=0b00000000;
      TRISA=0b0000;
      E_PIN=0;
}

//Characters used to display
const char poweron[]="Have Fun With Us";
const char disp1[]="More Surprizes ";
const char disp2[]="Sure Electronics";
const char disp3[]="VER 1.0";
void main(void)
{
      unsigned char cnt;
      init();
      InitByInstru();

      while(BusyCheck());
      WriteAddress(0x00);                    //Set display address at 0x00
      WriteStr(poweron,16);
      while(BusyCheck());
      WriteAddress(0x18);                    //Set display address at 0x18
      WriteStr(disp1,15);
      while(BusyCheck());
      WriteChar(0b01000000) ;                //Write '@'

      while(BusyCheck());
      WriteAddress(0x40);                    //Set display address at 0x40
      WriteStr(poweron+9,7);
```

```
    while(BusyCheck());
    WriteChar(' ');
    WriteStr(poweron,8);
    while(BusyCheck());
    WriteAddress(0x58);                    //Set display address at 0x58
    WriteStr(disp2,16);
    Delay_500ms();                         //Delay some time to keep dispaly stable
    Delay_500ms();
    Delay_500ms();
    Delay_500ms();

    //Write different data array each time
    //Simulate shift-display
    for(cnt=0;cnt<16;cnt++)
    {
        InitByInstru();

        while(BusyCheck());
        WriteAddress(0x00);
        WriteStr(disp2+cnt,16-cnt);
        if(cnt<7)
        {
            while(BusyCheck());
            WriteAddress(0x40);
            WriteStr(disp3+cnt,7-cnt);
        }
        Delay_500ms();                     //Delay some time to keep dispaly stable
    }
}
```

Chapter4. Contact Us

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