Relevant Device

This application note applies to the following device:

Mega 2560, UNO R3, LCD-2000,TFT LCD Shield for Mega 2560， TFT LCD Shield for UNO R3

1. What is a TFT screen

TFT（Thin Film Transistor）is a thin transistor liquid crystal display，each pixel can be drove by the thin film transistor which is behind the TFT. By this way, it is not only improves the response speed of the display, and you can precisely control display levels. Then the color of TFT LCD will be more realistic. TFT is composed of a light source, a light guide plate, polarizing plate, filter plate, a glass substrate, alignment film, the liquid crystal material, a thin film transistor and so on. When the TFT display and drive IC (controller) integrated together, it became a TFT display module. We should to distinguish TFT screen and TFT modules. In generally, we use the TFT module. For the TFT LCD module, we can display numbers, English characters, pictures color and the like.

2. The parameter comparison of these three modules

This application note describes three different drive LCD-2000 TFT screen module, and the parameter comparison of these three modules are as follows:

	Module Number	Control Chip	Size	Resolution	Color Number	Drive Library
1	LCD-2000-3916	NT3916	2.0 inch	176×220	65535	LCD_2000_3916.rar
2	LCD-2000-9225	ILI9225	2.0 inch	176×220	65535	LCD_2000_9225.rar
3	LCD-2000-7775	ST7775	2.0 inch	176×220	65535	LCD_2000_7775.rar

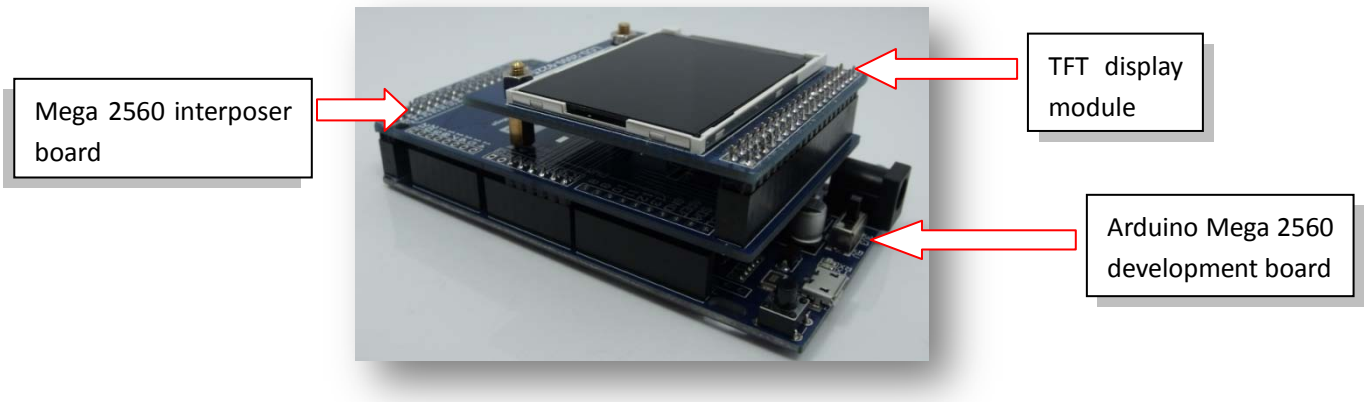
Module Number is type and controller chips numbered of TFT screen. Control Chip is TFT screen drive chip. The size of 2.0 inches is the distance between the corner of the screen. Resolution is the number which refers to the horizontal pixels and vertical pixels. Color Number refers to there is 65535 color in each point. Drive Library is the driver files which is prepared by our own.

3. Three kind low-level driver download address

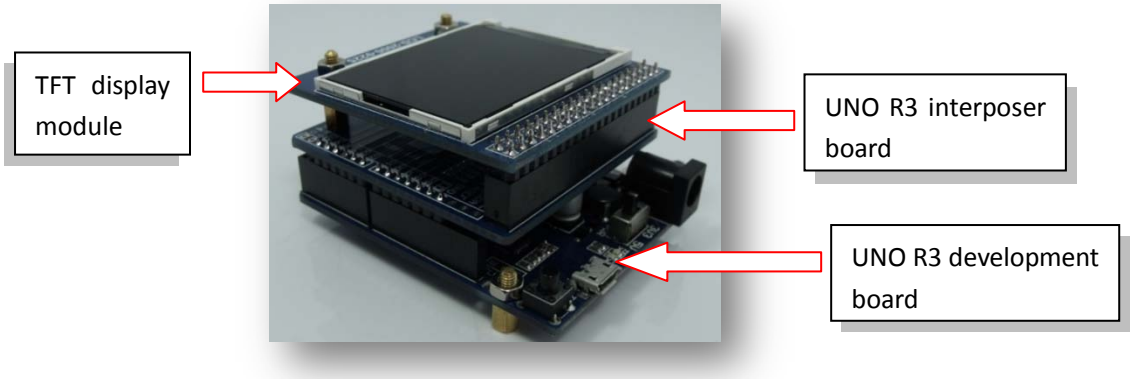
1) NT3916: http://www.inhaos.com/uploadfile/otherpic/NT3916.pdf
2) ILI9225: http://www.inhaos.com/uploadfile/otherpic/ILI9225B.pdf
3) ST7775: http://www.inhaos.com/uploadfile/otherpic/ST7775.pdf

4. Hardware connection

The TFT LCD Shield for Arduino Mega2560 should be directed put on Arduino Mega2560, and then put the LCD-2000 on the TFT LCD shield.



For the UNO R3 , it connect in the same way with Mega2560

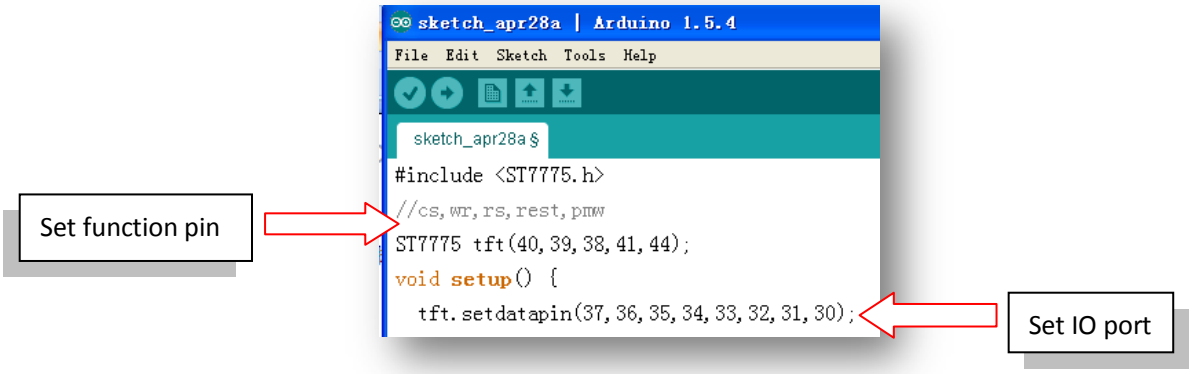


5. Load the driver library

You should extract the library package file to “arduino-1.5.4-r2-windows\arduino-1.5.4\libraries” directory directly. As shown in figure

6. TFT screen initialization

TFT screen with Mega2560 pin initialization, Example are as follows：



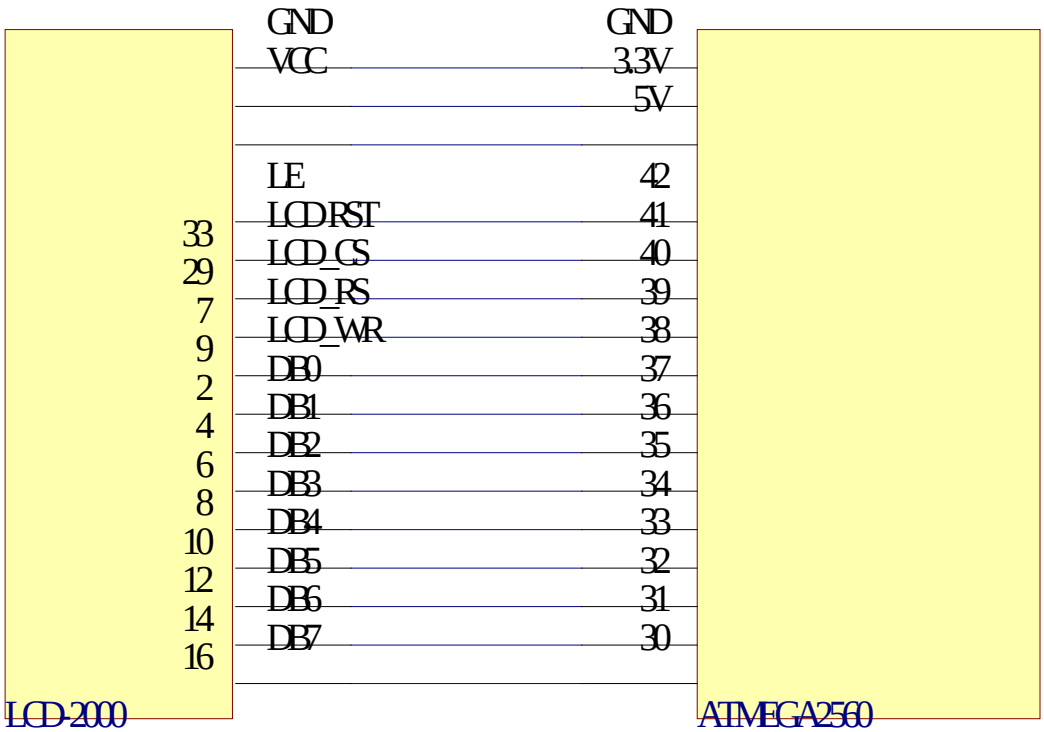
Description of IO port used by Mega2560：

IO	LCD Pin	Function
37	D0	Data bit 0
36	D1	Data bit 1
35	D2	Data bit 2
34	D3	Data bit 3
33	D4	Data bit 4
32	D5	Data bit 5
31	D6	Data bit 6
30	D7	Data bit 7
38	LCD RS	A register select signal
39	LCD WR	write strobe signal
40	LCD CS	A chip select signal
41	LCD RST	A reset pin
42	LE（ST7775 without this pin）	Latch enable pin

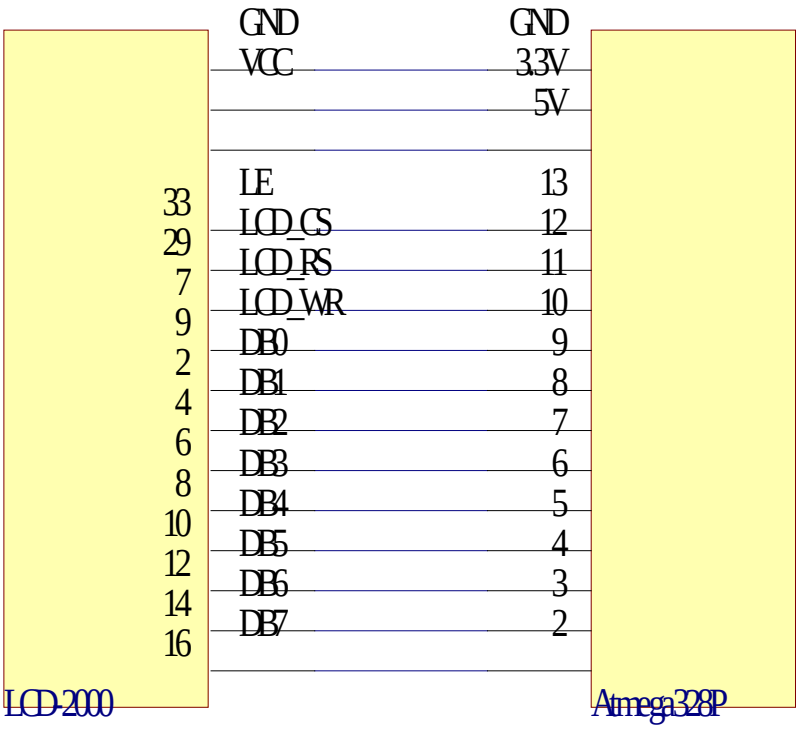
Description of IO port used by UNO R3：

IO	LCD Pin	Function
9	D0	Data bit 0
8	D1	Data bit 1
7	D2	Data bit 2
6	D3	Data bit 3
5	D4	Data bit 4
4	D5	Data bit 5
3	D6	Data bit 6
2	D7	Data bit 7
10	LCD WR	write strobe signal
12	LCD RS	A register select signal
11	LCD CS	A chip select signal
13	LCD LE（ST7775 without this pin）	Latch enable pin

It is the connection diagram of LCD-2000 screen and driver chip:

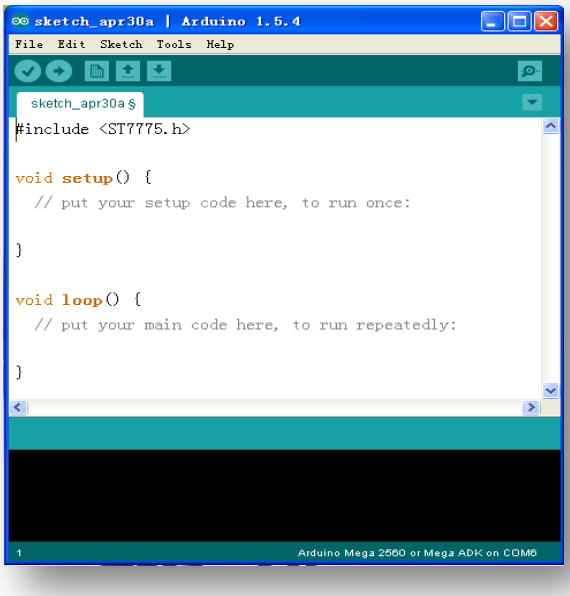


TFT screen with Mega2560 pin diagram corresponds



TFT screen with UNO R3 pin diagram corresponds

7. Open the Arduino software, and select the “ST7775”library(or anther library), now you can start writing a program to drive the LCD-2000-7775.



8. Program comparison

Arduino TFT driver example：

```
#include <TFT.h>
#include <SPI.h>
~~TFT TFTscreen = TFT(cs, dc, rst);~~
TFT TFTscreen = TFT(10,9,8);
char sensorPrintout[4];
void setup() {

TFTscreen.begin();
   TFTscreen.background(0, 0, 0);
   TFTscreen.stroke(255,255,255);
   TFTscreen.setTextSize(2);
   TFTscreen.text("Sensor Value :\n ",0,0);
   TFTscreen.setTextSize(5);
}
void loop() {
   String sensorVal = String(analogRead(A0));
   sensorVal.toCharArray(sensorPrintout, 4);
   TFTscreen.stroke(255,255,255);
   TFTscreen.text(sensorPrintout, 0, 20);
   delay(250);
   TFTscreen.stroke(0,0,0);
   TFTscreen.text(sensorPrintout, 0, 20);
}
```

LCD_2000_7775 driver example：

```
#include <LCD_2000_7775.h>

~~LCD_2000_7775 TFTscreen(cs,wr,rs,rst,pwm);~~
LCD_2000_7775 TFTscreen(40,39,38,41);
char sensorPrintout[4];
void setup() {
   TFTscreen.setdatapin(37,36,35,34,33,32,31,30);
   TFTscreen.begin();
   TFTscreen.background(0, 0, 0);
   TFTscreen.stroke(255,255,255);
   TFTscreen.setTextSize(2);
   TFTscreen.text("Sensor Value :\n ",0,0);
   TFTscreen.setTextSize(5);
}
void loop() {
   String sensorVal = String(analogRead(A0));
   sensorVal.toCharArray(sensorPrintout, 4);
   TFTscreen.stroke(255,255,255);
   TFTscreen.text(sensorPrintout, 0, 20);
   delay(250);
   TFTscreen.stroke(0,0,0);
   TFTscreen.text(sensorPrintout, 0, 20);
}
```

9. Sample code

a) We can call a function from the library, and respectively use Mega2560 and UNO R3 to drive the LCD-2000-3916. The screen will display as this:

For Mega2560 :

```
#include <LCD_2000_3916.h>
// pin definition for the Mega2560
LCD_2000_3916 TFTscreen(40,39,38,41,44,42);
const int analogInPin = A0;
int Value = 0;
int i;
float j;
int adcValue;
char sensorPrintout[10];
char voltage[10];
void setup()    {
// IO port initialization , to run once:
  TFTscreen.setdatapin(37,36,35,34,33,32,31,30);
  TFTscreen.begin();
// clear the screen with a black background
  TFTscreen.fillScreen(RGB(0,0,0));
  TFTscreen.setTextColor(0x000);
  TFTscreen.setTextSize(3);
  TFTscreen.stroke(100,255,255);
  TFTscreen.text("LCD-2000",18,5);
  TFTscreen.stroke(100,255,255);
  TFTscreen.text("DEMO ",50,30);
  TFTscreen.stroke(255,255,255);
  TFTscreen.fillRoundRect(25,95,120,50,10,0xffff);
  TFTscreen.setTextSize(2);
  TFTscreen.stroke(180,255,255);
  TFTscreen.text("Voltage",90,200);
}
void loop()    {
    for(i=9999 ;i>0;i--)
    {    // Read the value of the sensor on A0
         adcValue =analogRead(analogInPin);
         j = (adcValue/1024)*3.3;
         String Value =String(j);
         Value.toCharArray(voltage,4);
         String num = String(i);
         num.toCharArray(sensorPrintout,5);
         TFTscreen.stroke(0,0,0);
         TFTscreen.setTextSize(3.5);
         TFTscreen.text(sensorPrintout,50,110);
         TFTscreen.stroke(255,255,255);
         TFTscreen.setTextSize(4);
         TFTscreen.text(voltage,0,190);
         delay(200);
         TFTscreen.stroke(255,255,255);
         TFTscreen.setTextSize(3.5);
         TFTscreen.text(sensorPrintout,50,110);
         TFTscreen.stroke(0,0,0);
         TFTscreen.setTextSize(4);
         TFTscreen.text(voltage,0,190);
       }
}
```

For UNO R3 :

```
#include <LCD_2000_3916.h>
// pin definition for the UNO R3
LCD_2000_3916 TFTscreen(11,10,12,13);
const int analogInPin = A0;
int Value = 0;
int i;
float j;
int adcValue;
char sensorPrintout[10];
char voltage[10];
void setup()    {
// IO port initialization , to run once:
  TFTscreen.setdatapin(9,8,7,6,5,4,3,2);
  TFTscreen.begin();
// clear the screen with a black background
  TFTscreen.fillScreen(RGB(0,0,0));
  TFTscreen.setTextColor(0x000);
  TFTscreen.setTextSize(3);
  TFTscreen.stroke(100,255,255);
  TFTscreen.text("LCD-2000",18,5);
  TFTscreen.stroke(100,255,255);
  TFTscreen.text("DEMO ",50,30);
  TFTscreen.stroke(255,255,255);
  TFTscreen.fillRoundRect(25,95,120,50,10,0xffff);
  TFTscreen.setTextSize(2);
  TFTscreen.stroke(180,255,255);
  TFTscreen.text("Voltage",90,200);
}
void loop()    {
    for(i=9999 ;i>0;i--)
    {    // Read the value of the sensor on A0
         adcValue =analogRead(analogInPin);
         j = (adcValue/1024)*3.3;
         String Value =String(j);
         Value.toCharArray(voltage,4);
         String num = String(i);
         num.toCharArray(sensorPrintout,5);
         TFTscreen.stroke(0,0,0);
         TFTscreen.setTextSize(3.5);
         TFTscreen.text(sensorPrintout,50,110);
         TFTscreen.stroke(255,255,255);
         TFTscreen.setTextSize(4);
         TFTscreen.text(voltage,0,190);
         delay(200);
         TFTscreen.stroke(255,255,255);
         TFTscreen.setTextSize(3.5);
         TFTscreen.text(sensorPrintout,50,110);
         TFTscreen.stroke(0,0,0);
         TFTscreen.setTextSize(4);
         TFTscreen.text(voltage,0,190);
       }
}
```

b) We have a function explanation for our driver library, you can click on the link below to get it.

http://www.inhaos.com/uploadfile/otherpic/LCD-2000%20Function%20manual.pdf

10. Data link address

Arduino official website link：http://www.arduino.cc/
Mega 2560 official website link：http://arduino.cc/en/Main/arduinoBoardMega2560
UNO R3 official website link：http://arduino.cc/en/Main/arduinoBoardUno
More about Arduino Mega 2560 and Arduino UNO R3，please visit: www.inhaos.com

11. Contact us

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