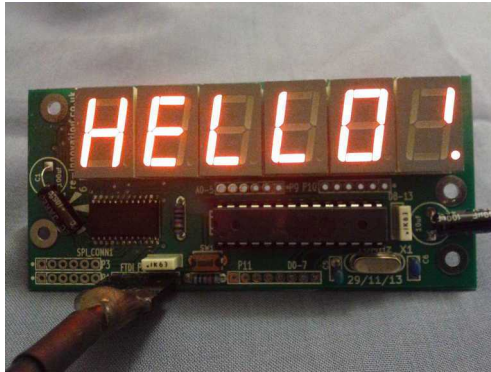


# Six Digit LED Display Unit

Date:	24/12/13	Version:	1.0	By:	Matt Little
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This **LED display unit** has a six digit 7-segment LED with decimal points.  
 It is controlled using the AS1107 8x8 LED SPI controller IC (identical in function to the MAX7219 IC).  
 There is an ATmega328 on-board programmed with the Arduino bootloader. This connects to the SPI lines and so can be used to control the display.  
 All the various I/O from the Arduino are also available as connection points.  
 Test code is available to download.  
 A number of displays can be wired together with just one main controller unit.

*Note: This requires an FTDI USB to serial 3V3 cable for programming.*

## Parts included:

6 x 7 Segment  
LED Displays

PCB

100uf  
Capacitor

AS1107  
SMD IC

100nf  
Capacitor

2 x 10k  
Resistors

Reset  
Switch

6 Way  
FTDI  
Header

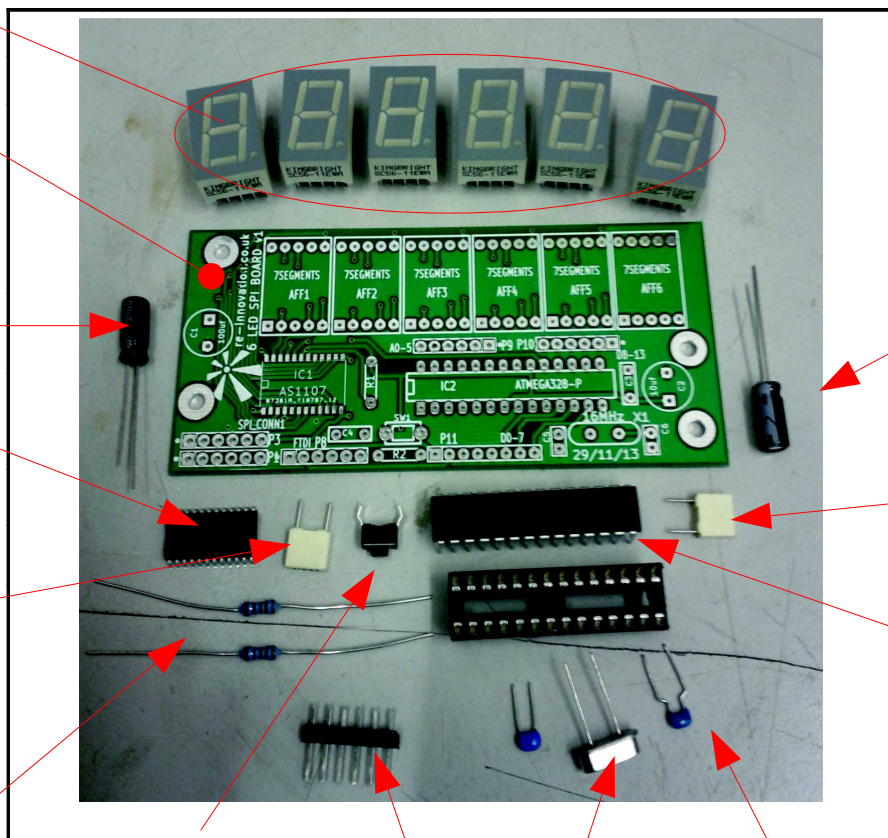
16MHz  
Crystal

2 x 22pf  
Capacitors

100uf Capacitor

100nf Capacitor

ATMEGA328  
with  
28 pin IC  
Socket



## Parts list:

Reference	Description	Reference	Description
AFF1-6	Battery holder	P4	Mounting hole
C1	100uf electrolytic capacitor	P5	Mounting hole
C2	100uf electrolytic capacitor	P6	Mounting hole
C3	100nf	P8	FTDI header (6-pin)
C4	100nf	P9	Analog 0-5 pads
C5	22pF	P10	Digital 8-13 pads
C6	22pF	P11	Digital 0-7 pads
IC1	AS1107 SPI LED Driver	R1	10k resistor
IC2	ATMEGA328P-P – UNO boot-loader	R2	10k resistor
	28 pin DIL socket	SW1	Reset switch
P1	SPI Input connector (not supplied)	X1	16MHz Crystal
P2	Mounting hole		PCB
P3	SPI Output connector (not supplied)		

You will also need (not supplied):

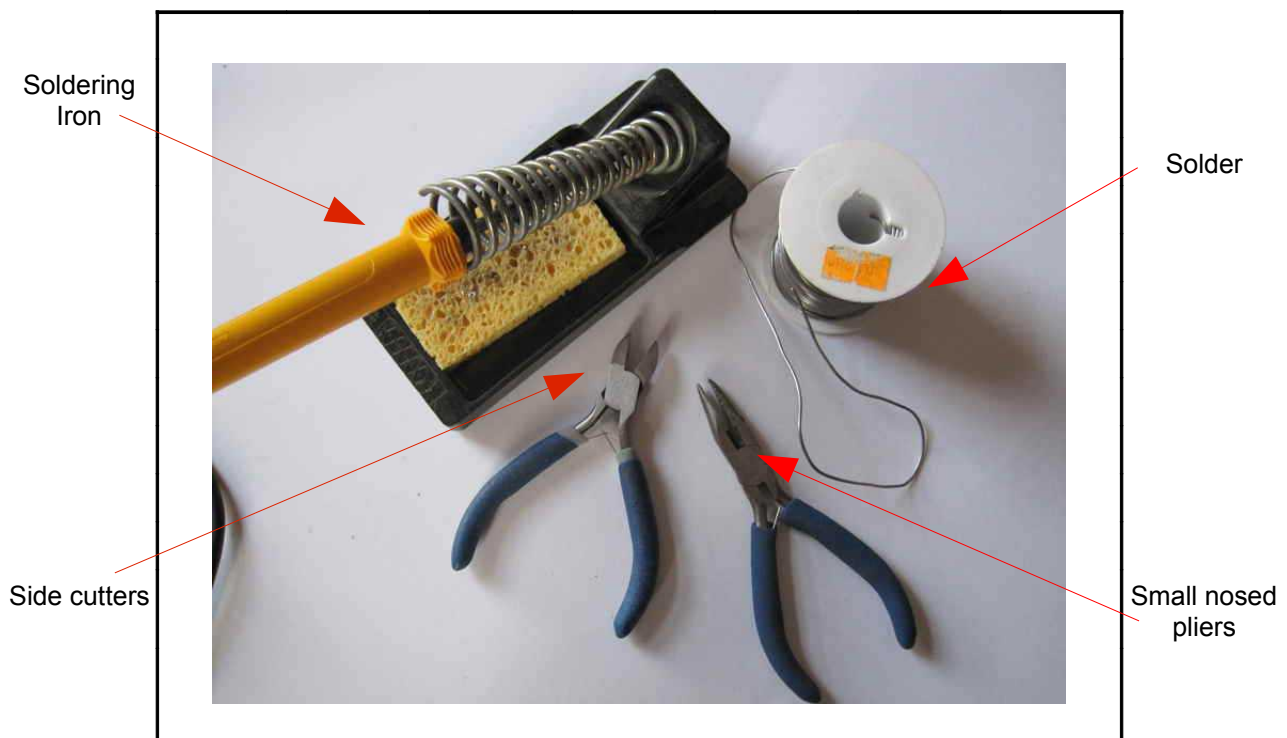
- a computer with the Arduino IDE installed
- a FTDI USB to serial cable with code: TTL-232R-3V3, such as this:



Available here (among other places):

<http://www.ftdichip.com/Products/Cables/USBTTLSerial.htm>

## Tools required:



## Instructions:

### Step: 1 Solder the SMD IC AS1107

Lets start with probably the most difficult soldering step. Its best to do this first, or the other components get in the way. Holding the IC with a pair of tweezers align over the solder pads.

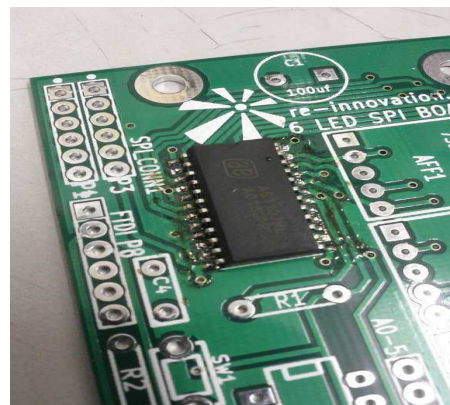
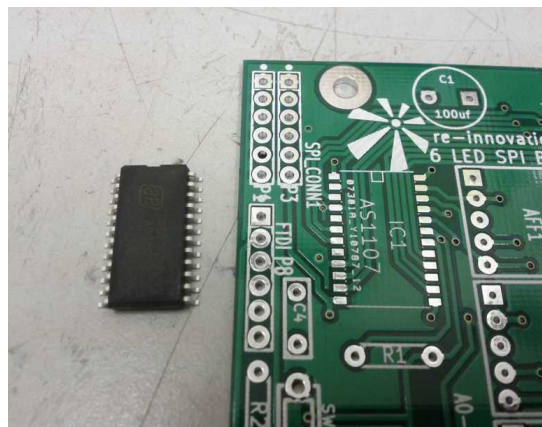
Ensure the correct orientation – the dot on the IC will be at the end with the notch on the PCB.

Solder one pin on the corner of the IC. Ensure that the IC lines up with all the other pads. If you need to adjust it then heat the solder on the soldered pin and correct the IC.

Once it is aligned then you can solder the whole row of pins on the other side to the already soldered pin.

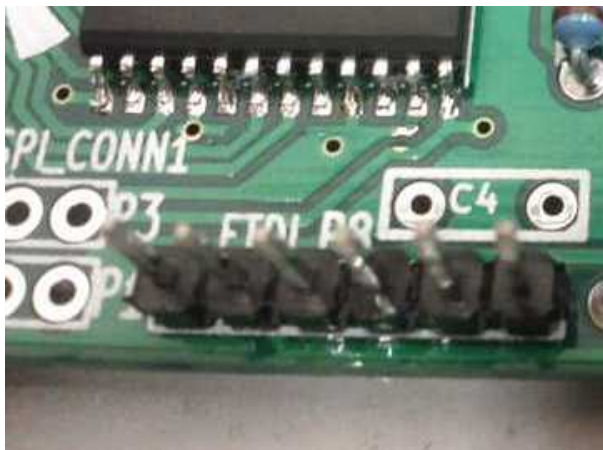
If you heat up the top pin and apply solder then drag down to the bottom pin, applying solder if required. This usually will solder all the pins. You may need to remove any excess solder using some solder wick.

Leave this to cool for a couple of seconds. Then use the same technique for the unsoldered side.





**Step: 2** Solder the FTDI programming header pins

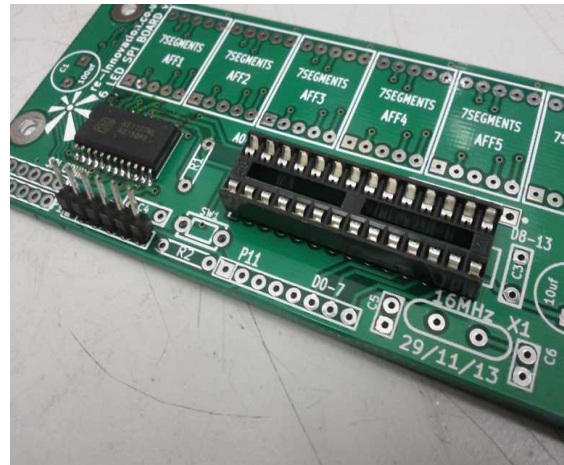


A 6 way header pin is used to program and interface to the micro-controller. This is soldered into port P8 FTDI.

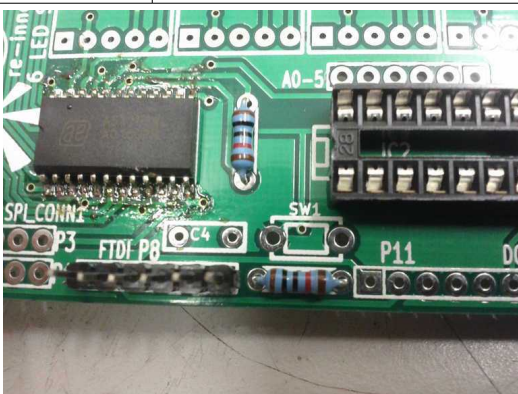
**Step: 3** Solder the IC socket

Check the orientation. The notch on the IC socket should align with the white notch drawn on the PCB.

Note: If you would like the LED units to be places flush against a surface, then do not use the IC socket – instead solder in the ATmega328 directly (but ensure it is in the correct orientation).



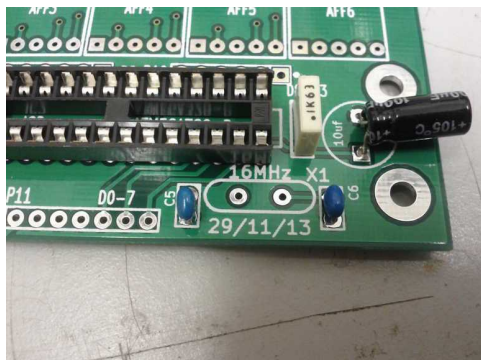
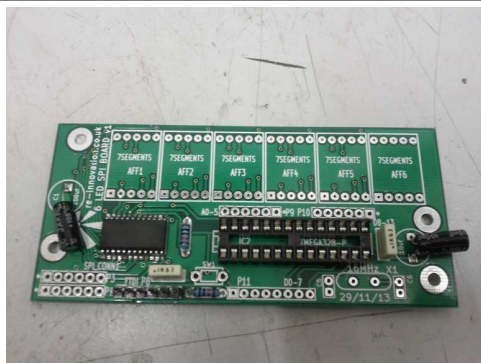
**Step: 4** Solder the resistors



Identify all the resistors. You will have:

Quantity	Value	Part Reference
2	10k	R1,R2

Use the identify chart at the end of these instructions or a multimeter.  
Solder into the relevant places.  
Their orientation does not matter.

**Step: 5** Solder the capacitors

Identify and then solder in the capacitors.

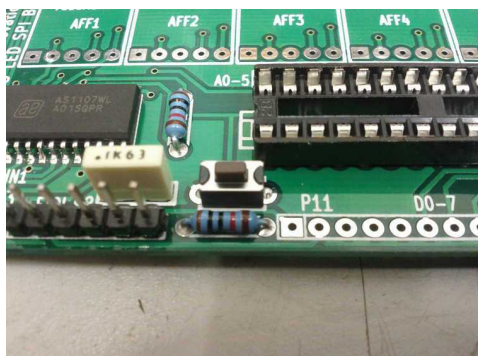
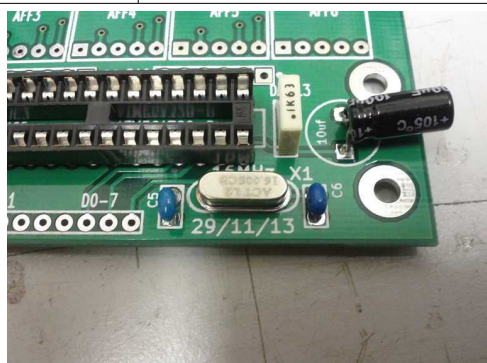
Quantity	Value	Reference	Photo
2	100uf	C1, C2	
2	100nf	C3, C4	
2	22pf	C4, C5	 (Blue or Brown)

Capacitors C3,C4,C5,C6 can be installed in either direction.

Check the orientation on capacitors C1,C2. The white line on the side signifies negative side. The round pad on the PCB signifies negative. The longer lead signifies positive. The square pad on the PCB is positive.

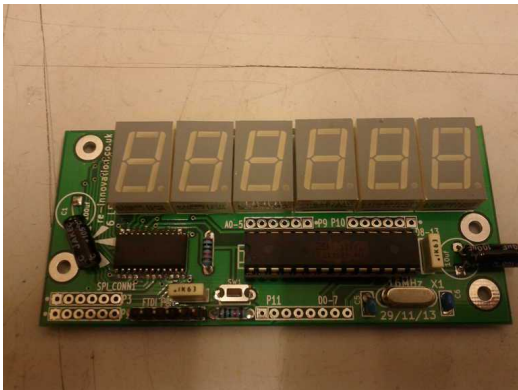
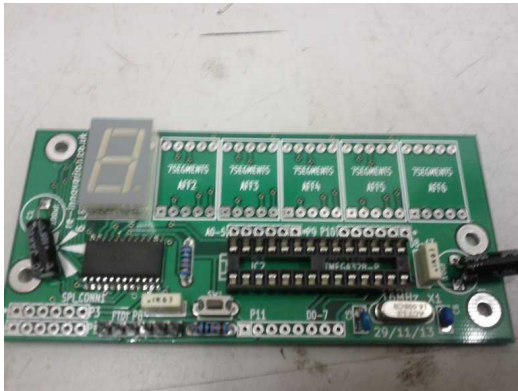
**Step: 7** Solder in reset switch

Solder in the two-pin reset switch.

**Step: 8** Solder the crystal

Solder in the crystal. Orientation does not matter.

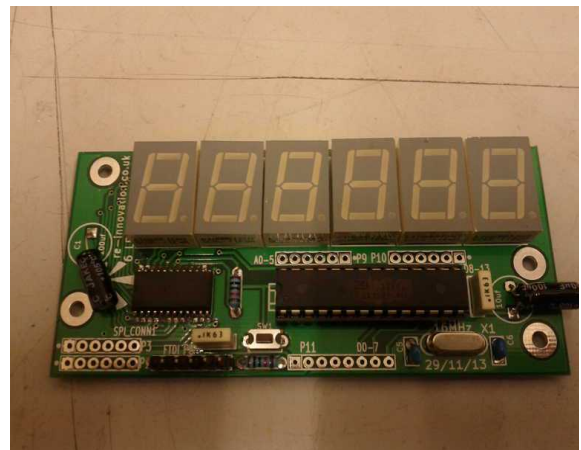
**Step: 9** Solder the 6 x 7 segment LED units



Solder in the LED units. Ensure that they are in the correct orientation, with the decimal points all towards the ICs.

**Step: 10** Insert ATmega328 IC

Ensure it is inserted with the notch in the correct orientation, matching the notch on the IC socket and the PCB silkscreen.



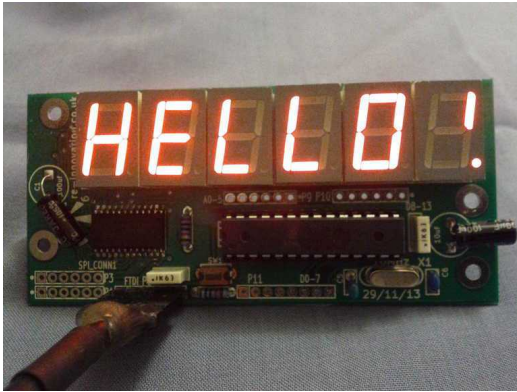
**Step: 11** Build is finished!

Have a nice cup of tea.



Once the device is constructed, the next step is check it powers up OK and then to program the device with test code.

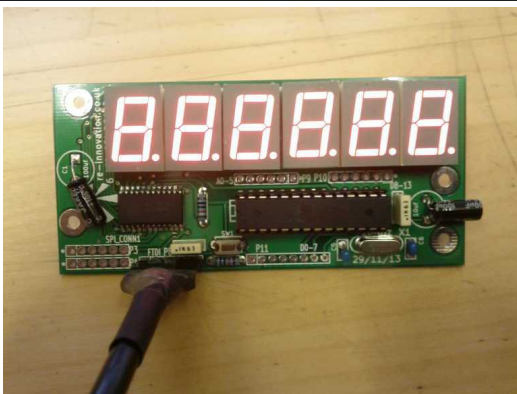


**Step: 12** Check device powers up

Plug in an FTDI cable from a computer to the FTDI programming header. The dot on the header silkscreen is the reset side (the other end is the black, negative, line which goes towards the resistor and reset switch). You should see the display read the test message.

If not:

- Test with a multimeter set to DC volts.
- Do you have 5V between pins 7 and 8 of the ATMEGA328P-P?
- If not, then re-check your soldering for short circuits. Also check the ICs and LED units are inserted in the correct orientation.

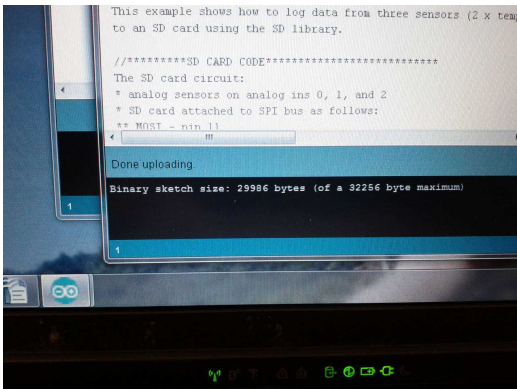
**Step: 18** Upload new code from a computer

*(Note: These instructions assume the user has some knowledge of the Arduino IDE environment and uploading code – if not please check [arduino.cc](http://arduino.cc) for numerous examples)*

If the unit has powered up OK then you can upload new code.

This requires:

- A computer running the Arduino IDE
- An FTDI USB to serial lead
- The test code
- The LEDControl libraries



1. Check that the FTDI cable works.
2. Download the test code from: [www.re-innovation.co.uk](http://www.re-innovation.co.uk). Save this to your Arduino sketch book.
3. Download the LEDControl files from: <http://playground.arduino.cc/Main/LedControl>. Save this to your Arduino sketch book, under libraries.
4. Open the Arduino IDE. This was written for IDE 1.0.5.
5. Open the test sketch.
6. Ensure that the sketch compiles with no errors.
7. Do NOT use any external power to the board. Power will be supplied via the FTDI cable.
8. Plug in the FTDI cable to you board. **Ensure that the BLACK cable goes at the end towards the resistor. The GREEN cable**

	<b>will go towards the dot.</b> 9. Upload code to the arduino. It uses the UNO boot-loader. It should say 'Done Uploading'
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### Contact details:

This kit has been designed and produced by:

**Renewable Energy Innovation.**

[info@re-innovation.co.uk](mailto:info@re-innovation.co.uk)

[www.re-innovation.co.uk](http://www.re-innovation.co.uk)

Hopkinson Gallery

21 Station Street

Nottingham

NG7 6PD

We would like you to be happy with this kit. If you are not happy for any reason then please contact us and we can help to sort it out. Please email [info@re-innovation.co.uk](mailto:info@re-innovation.co.uk) with any questions or comments.

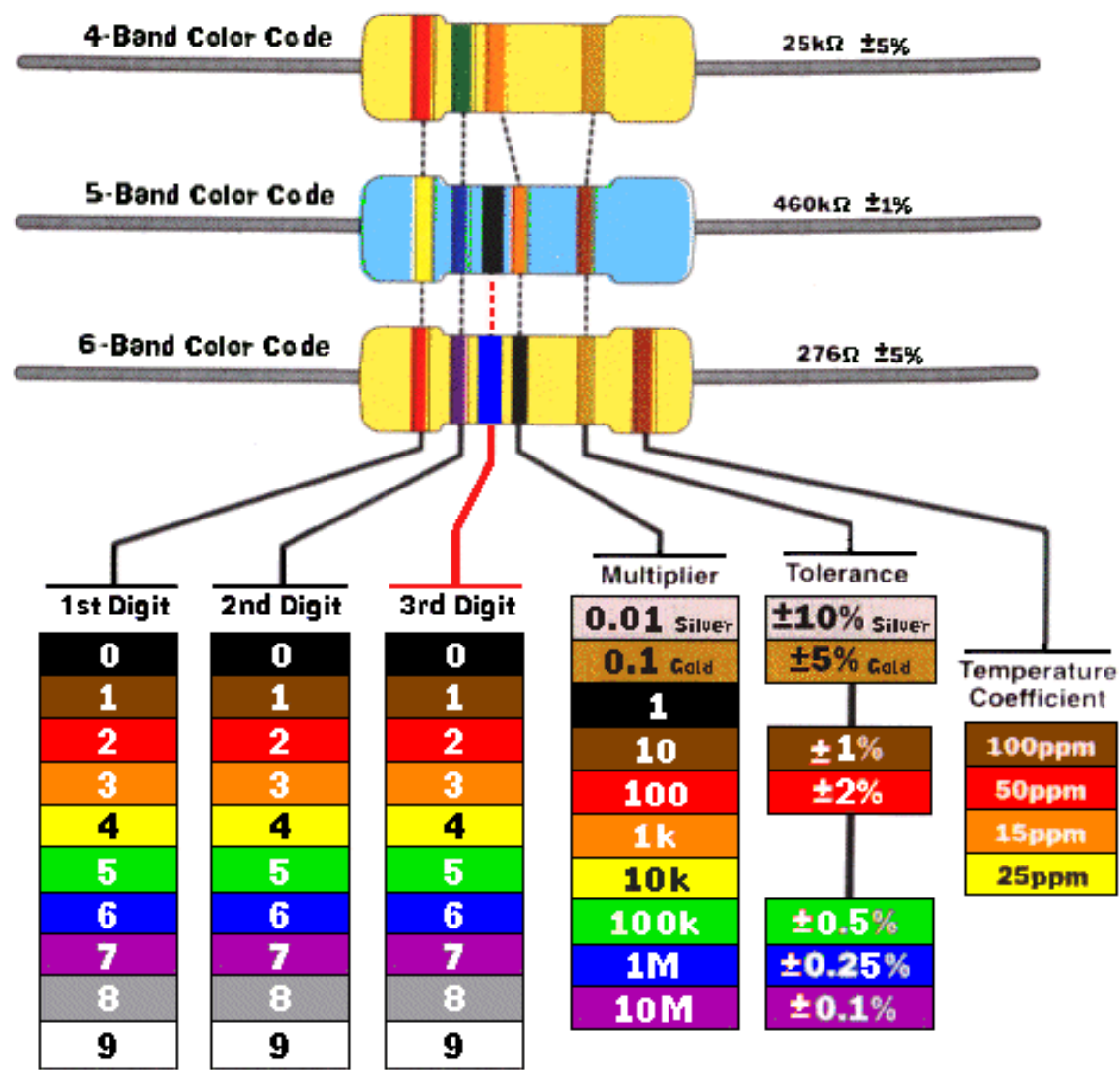
If any parts are missing from your kit then please email [info@re-innovation.co.uk](mailto:info@re-innovation.co.uk) with details, including where the kit was purchased.

More technical information can be found via [www.re-innovation.co.uk](http://www.re-innovation.co.uk).

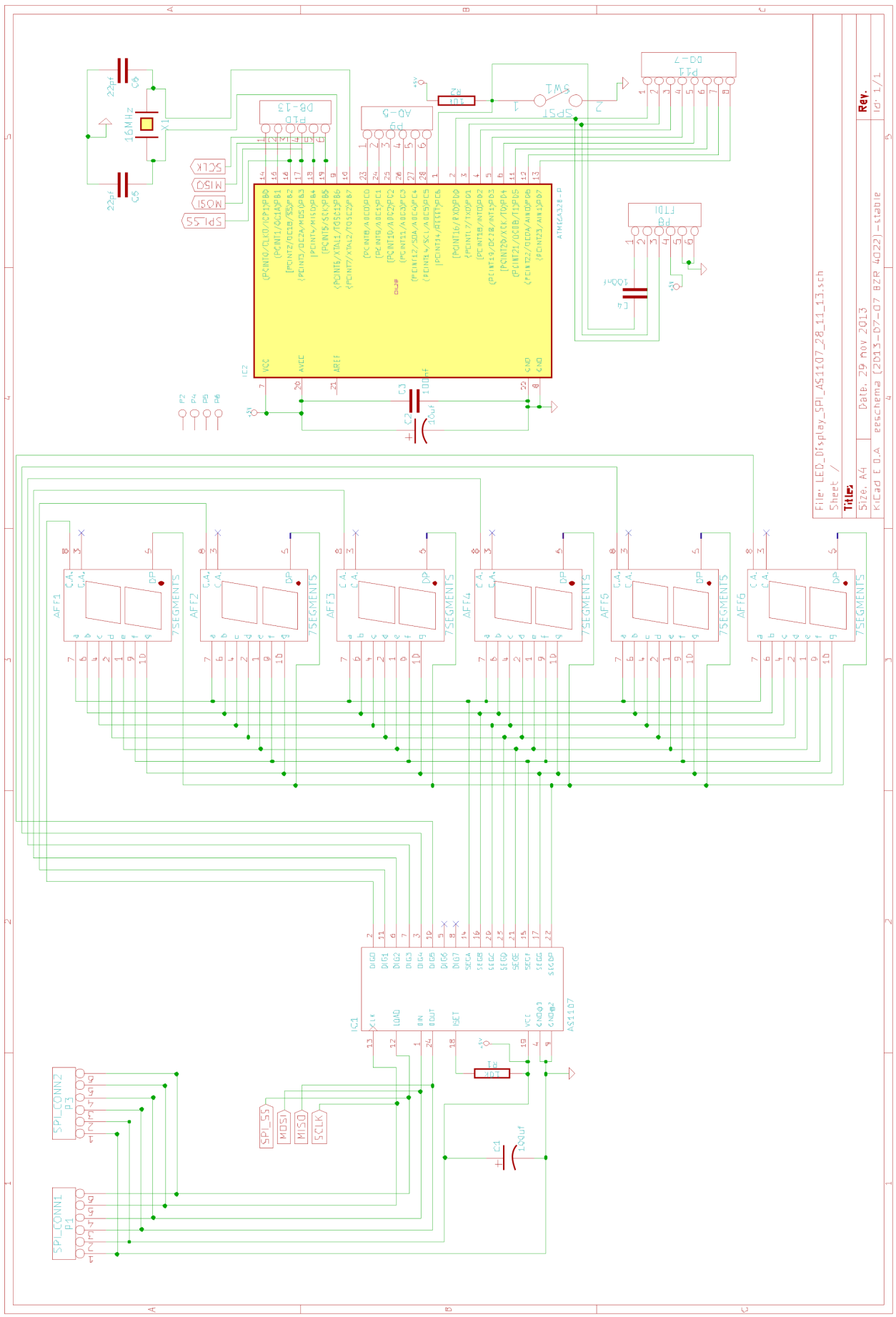


Useful Information:

Resistor colour codes:



Circuit schematic:



File: LED_Display_SPI_AS1107_28_11_13.sch			
Sheet /			
Title:			
Size: A4	Date: 29 nov 2013	Rev.	
Kicad E.D.A. eeschema (2013-07-07 BZR 4022)-stable	Id: 1/1		

PCB overview:

