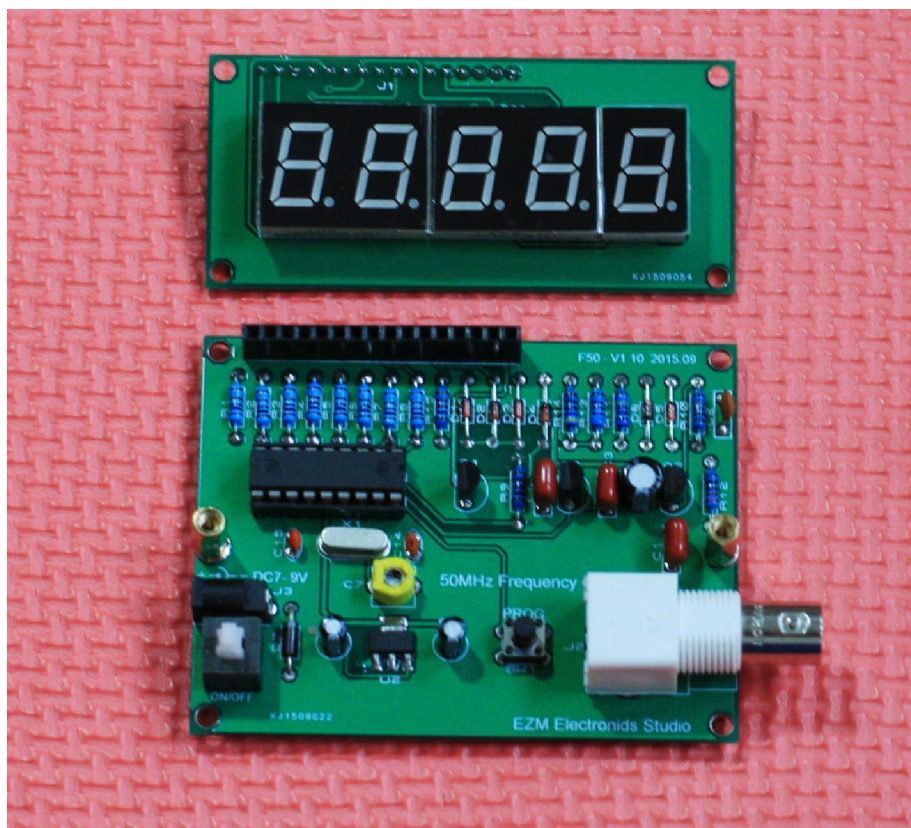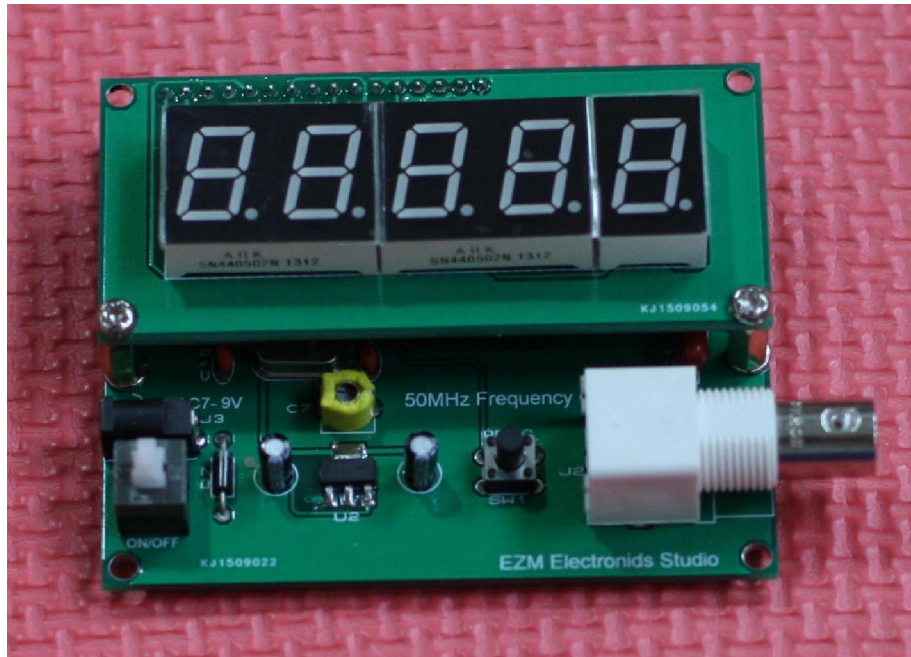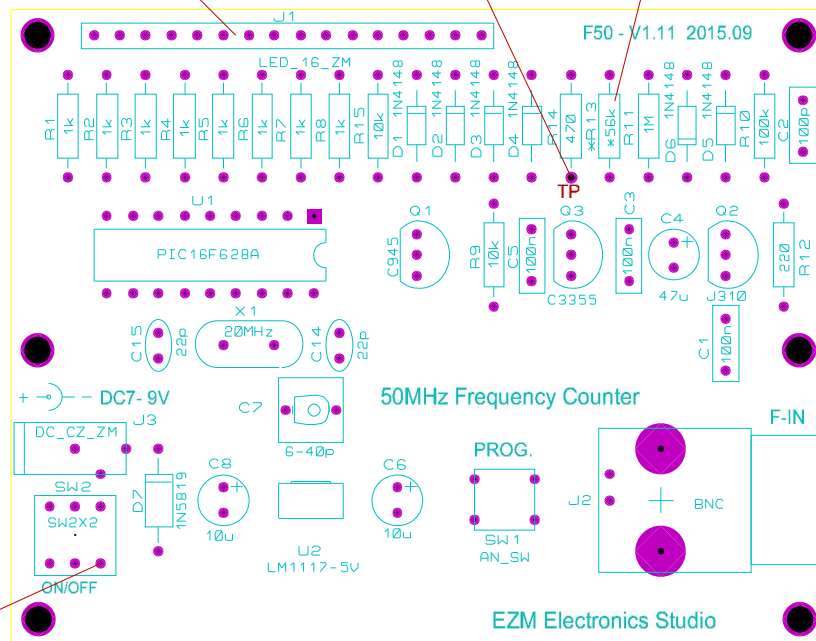# Assembly diagram of 50MHz frequency counter KIT

(from EZM Electronics studio)
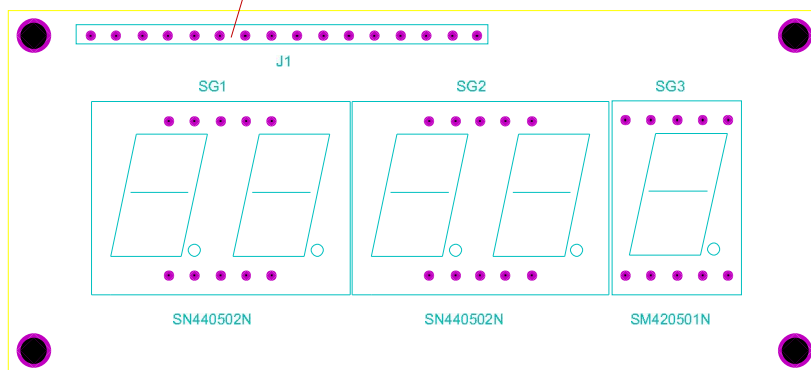
The DC voltage at the TP should almost equal 2.5v. if not, adjust * R13 resistor.

16-Pin SIL socket

J1

F50 - V1.11 2015.09

LED_16_ZM

R1 1k R2 1k R3 1k R4 1k R5 1k R6 1k R7 1k R8 1k R15 10k D1 1N4148 D2 1N4148 D3 1N4148 D4 1N4148 470 *R13 56k R11 1M D6 1N4148 D5 1N4148 R10 100k C2 100p

TP

U1

PIC16F628A

Q1 C945   R9 10k C5 100n   Q3 C3355 C3 100n   C4 47u   Q2 J310   R12 22Ω

X1 20MHz

C15 22p   C14 22p

C1 100n

+ ⊖ − DC7- 9V

J3 DC_CZ_ZM

C7   6-40p

PROG.

50MHz Frequency Counter

F-IN

SW2

SW2X2

D7 1N5819   C8 10u   U2 LM1117-5V   C6 10u

SW1 AN_SW

J2   BNC

ON/OFF

EZM Electronics Studio

Pay attention to the direction of the switch

16-Pin SIL header

J1

SG1   SG2   SG3

SN440502N   SN440502N   SM420501N
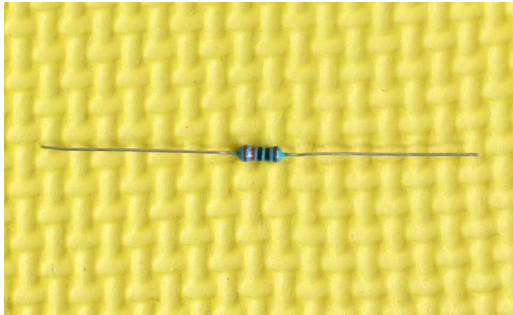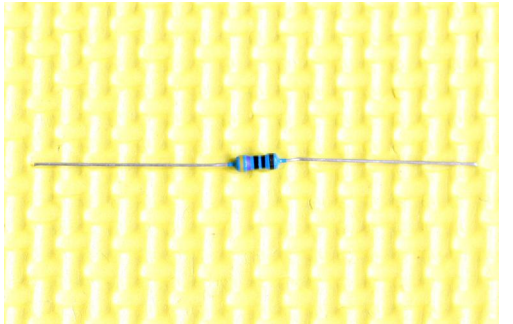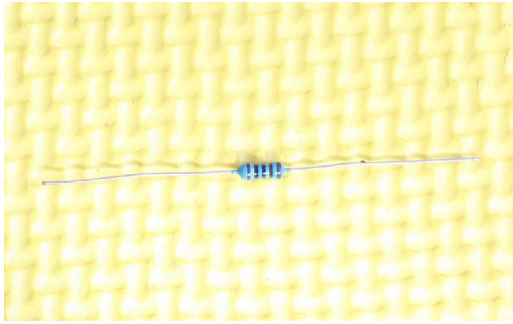
Thanks to the original author

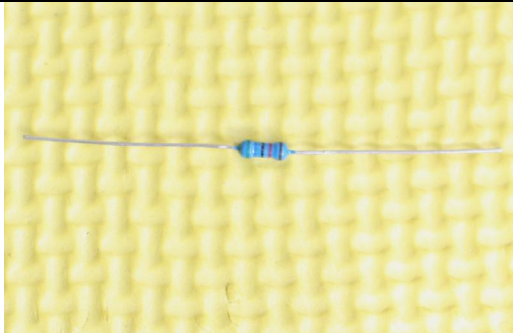For more information, please visit the original author's web page

http://www.qsl.net/dl4yhf/index.html

http://kc7zow.tripod.com/hamradio/id6.html
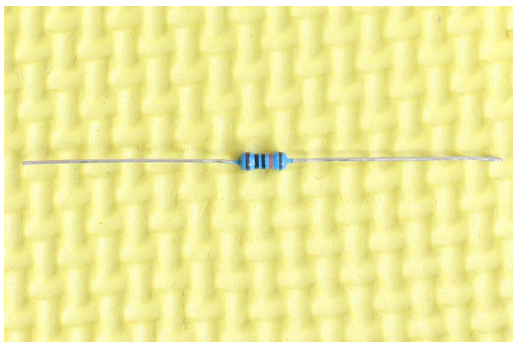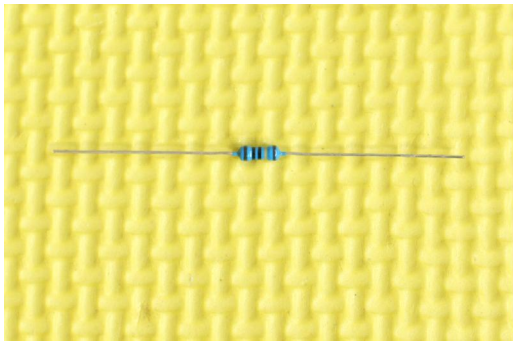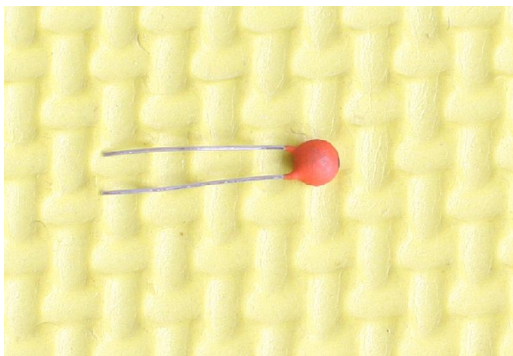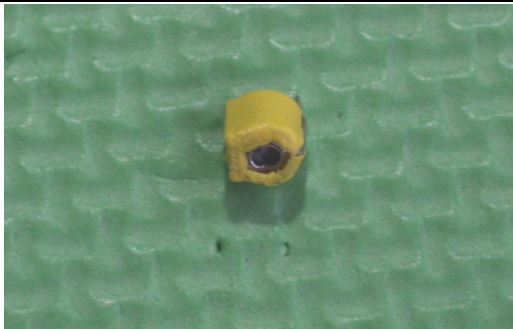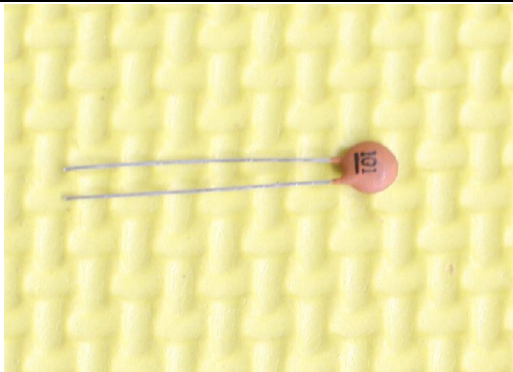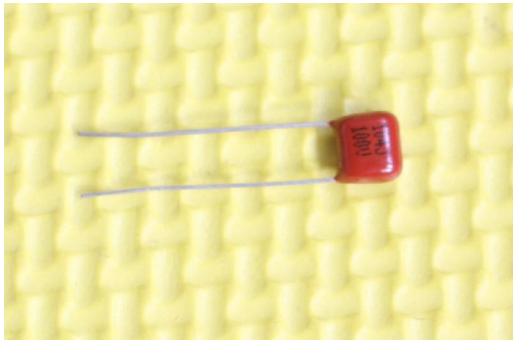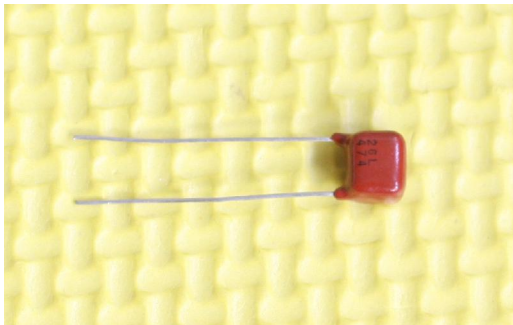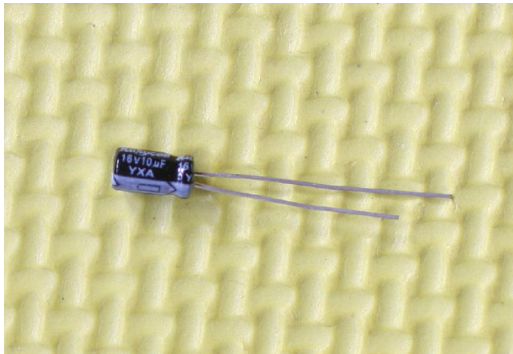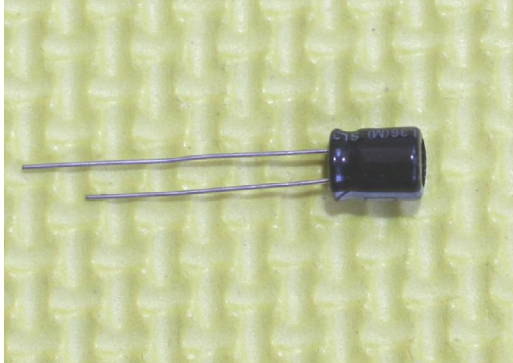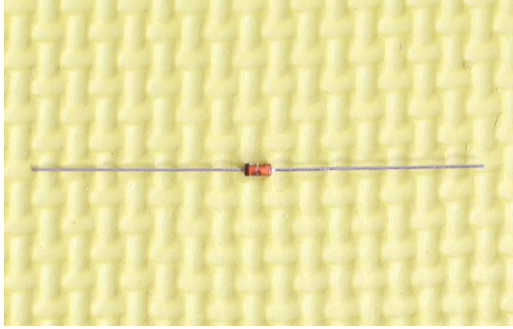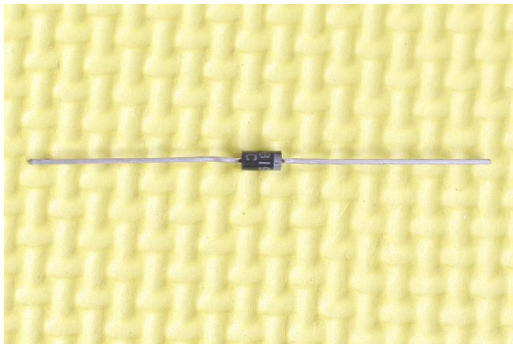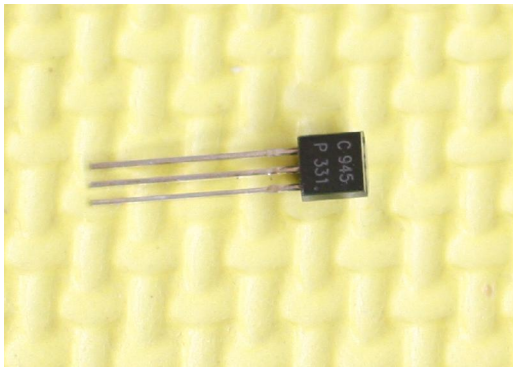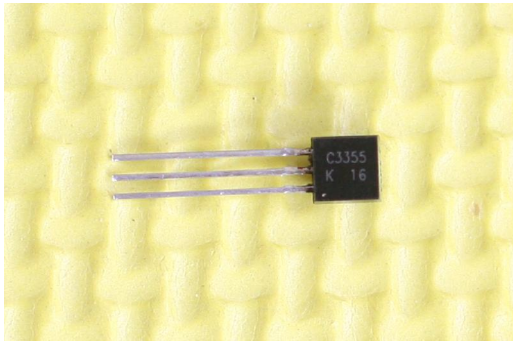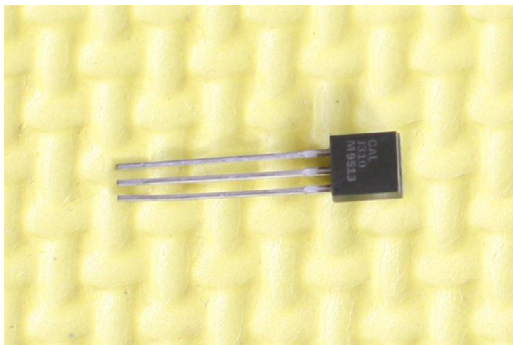
Bill of materials for 50MHz frequency counter KIT
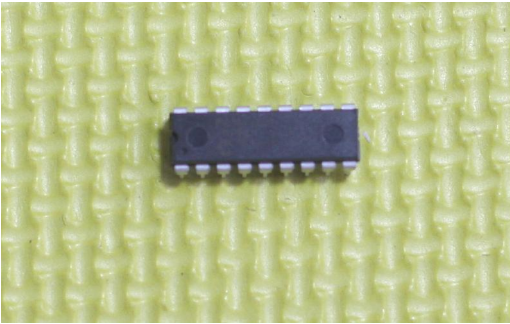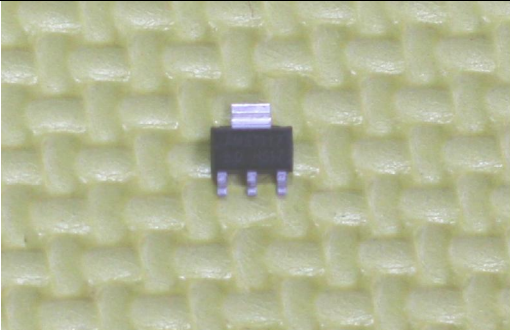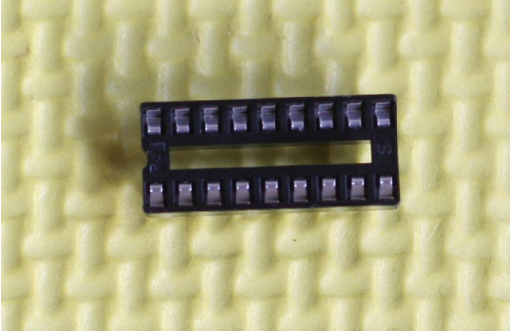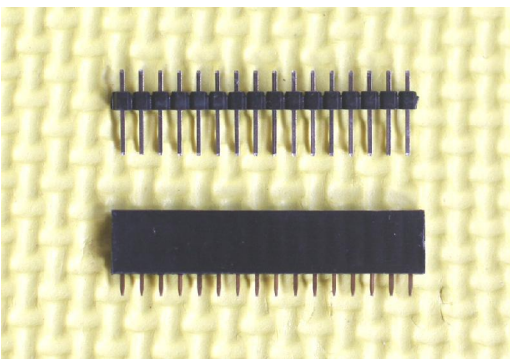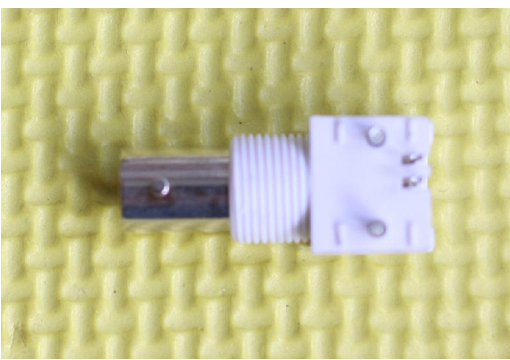
(from EZM Electronics studio)
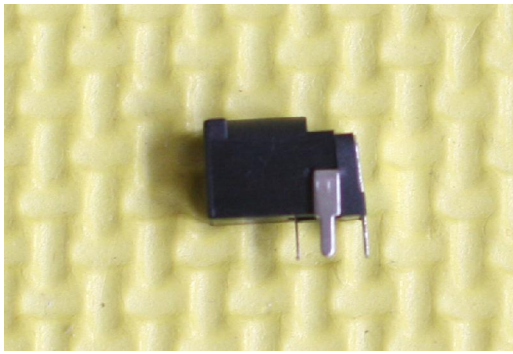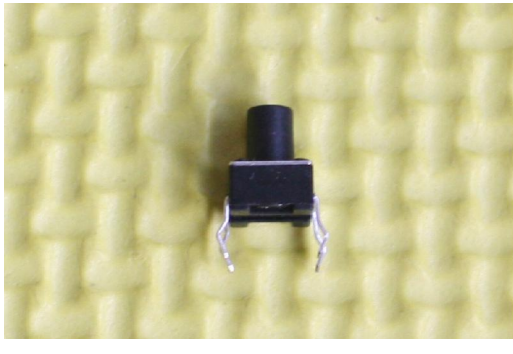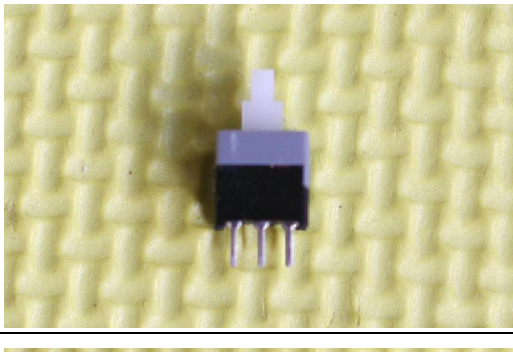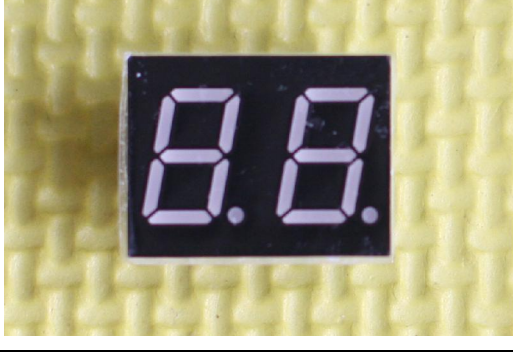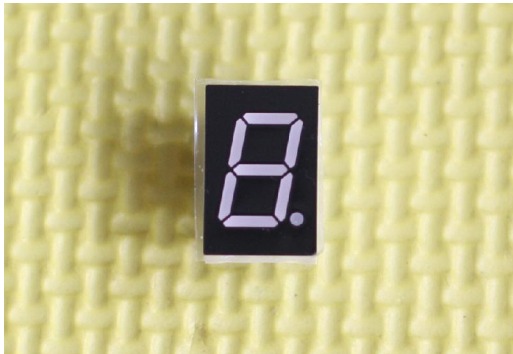
NO.	Name and parameters	Photo	Quantity	Note
1	Resistor 220R 1% 0.25W		1	R12
2	Resistor 470R 1% 0.25W		1	R14
3	Resistor 1k 1% 0.25W		8	R1-R8
4	Resistor 10k 1% 0.25W		2	R9,R15
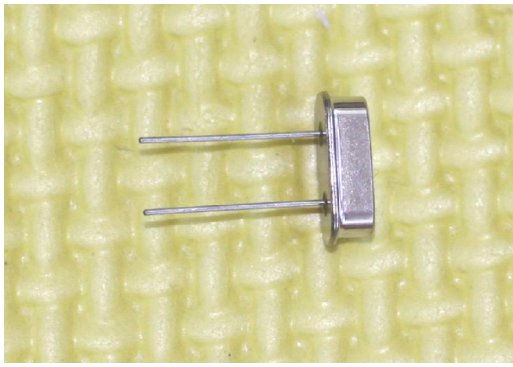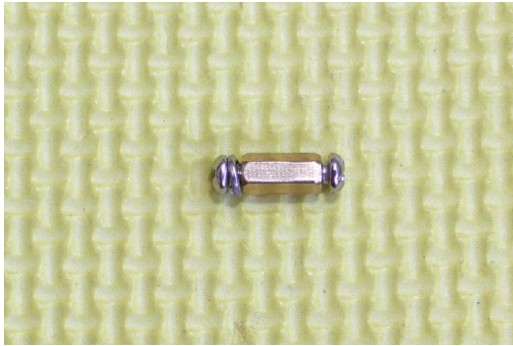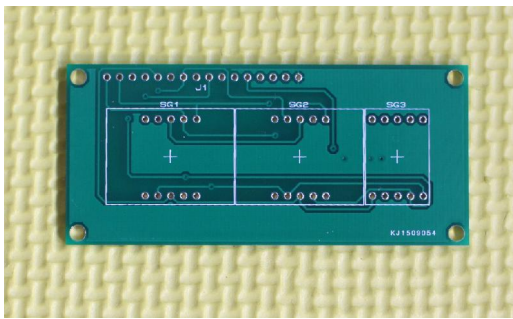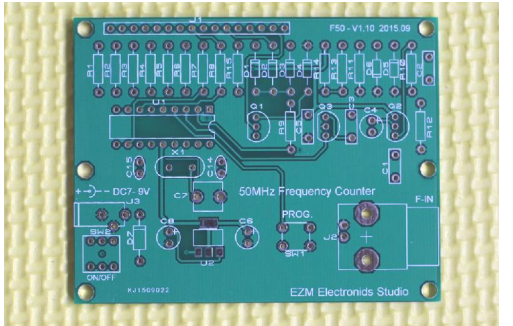
5	Resistor 56k 1% 0.25W * According to the different batches of C3355(Q3), the resistance may change		1	R13
6	Resistor 100k 1% 0.25W		1	R10
7	Resistor 1M 1% 0.25W		1	R11
8	Ceramic capacitor 22p		2	C14,C15
9	Variable capacitor 6-40p		1	C7

10	Ceramic capacitor 100p		1	C2
11	Polypropylene capacitor 104(100n)		2	C3,C5
12	Polypropylene capacitor 474(470n)		1	C1
13	Electrolytic capacitor 10u16V		2	C6,C8
14	Electrolytic capacitor 47u16V		1	C4

15	Diode 1N4148		6	D1-D6
16	Diode 1N5819		1	D7
17	Transistor NPN C945(2SC945)		1	Q1
18	Transistor NPN C3355(2SC3355)		1	Q3
19	J-FET J310		1	Q2

20	Microprocessor PIC16F628A (Programmed)		1	U1
21	Voltage regulator AS1117-5V		1	U2
22	18 pin IC socket		1	U1
23	16Pin SIL Socket & header		1	J1
24	BNC Socket		1	J2

25	DC adapter socket		1	J3
26	Push button switch		1	SW1
27	Push button switch		1	SW2
28	Red 2digit Common Cathode 7-segment display		2	SG1-SG2
29	Red 1digit Common Cathode 7-segment display		1	SG3

30	Crystal 20MHZ		1	X1
31	copper pillar+screw+spring washer		2	
32	Display PCB		1	KJ1509054
33	Main PCB		1	KJ1509022

This document describes the construction of small frequency counter with a cheap PIC microcontroller and a few seven-segment LED digits. The main features of the frequency counter are:

- frequency range 1 Hz ... 50 MHz
- five digits resolution (display for example x.xxxx kHz, x.xxxx MHz, or xx.xxx MHz)
- automatic range switching with different gate times
- optional addition or subtraction of a frequency offset (programmable)
- very low component count: a PIC 16F628, 5 7-segment LED displays, a 20MHz crystal and a few resistors
- optional (configurable) power-saving mode which automatically turns the display off if the frequency didn't change significantly within 15seconds
- USB 5V power supply can be used.

main schematic:
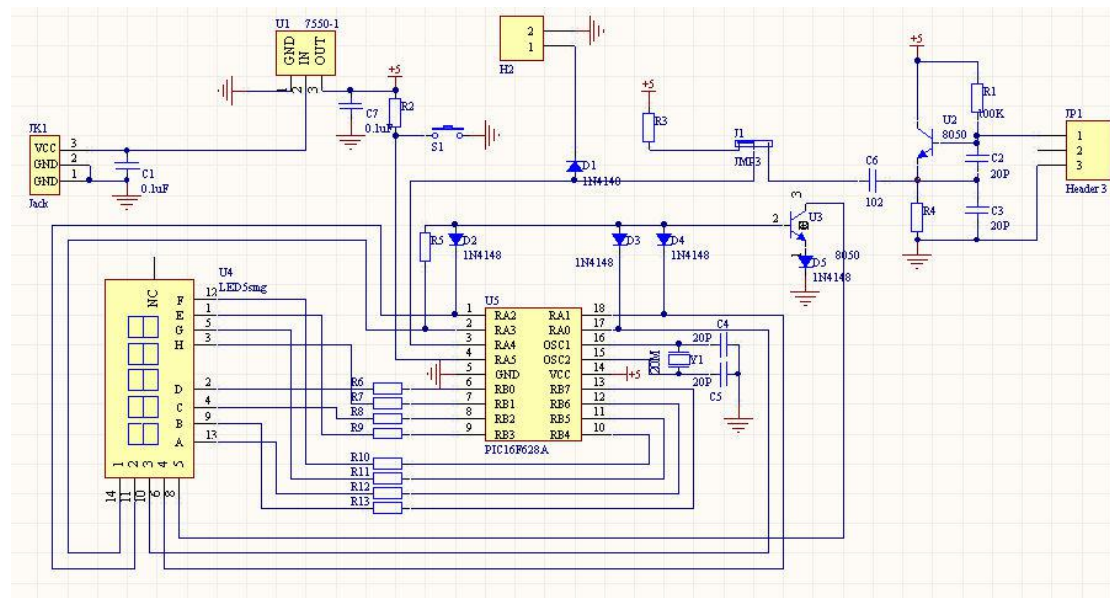
Display ranges

The display range is automatically switched to give the maximum
readout accuracy (with 4 digits). The gate time is also selected
automatically as listed in the following table:

Frequency range	Display	Gate time	Decimal point
0 ... 9.999 kHz	X.XXX	1 second	flashing (which means "kHz")
10 ... 99.99 kHz	XX.XX(X)	1/2 second	flashing
100 ... 999.9 kHz	XXX.X(X)	1/4 second	flashing
1 ... 9.999 MHz	X.XXX(X)	1/4 second	steady (which means "MHz")
10 ... 50.00 MHz	XX.XX(X)	1/4 second	steady

(On this occasion: "MHz" is Mega-Hertz, "mHz" would be milli-Hertz,
but that's another story...)

Adding or subtracting an offset frequency

If the counter is used in a shortwave receiver or transceiver,
you may want to add or subtract an offset value from the measured
frequeny. The offset frequency is the same as the intermediate
frequency in many cases, because the counter is usually connected
to the receivers VFO (variable frequency oscillator). For this
purpose, a programming mode (aka "setup mode") has been

implemented in the firmware so you can enter an offset frequency without reprogramming (or even reassembling) the PIC firmware.

The signal RA5 (pin 4 of the PIC 16F628) will is used to switch from normal counter mode into programming mode. Usually the level on RA5 is high because it is connected to the supply voltage via pullup resistor (10k to 22k). If you will never need to add or subtract a frequency offset, connect it permanently with the supply voltage (there must be a defined level on RA5, unfortunately it has no internal pullup resistor). By pulling RA5 low (connect pin 4 and pin 5 of the PIC with a small screwdriver), the firmware will be instructed to use the currently measured frequency as the new offset value. In other words, you must *apply the offset frequency to the counter's input*, wait until the value is displayed correctly, and then enter the programming mode as explained below.
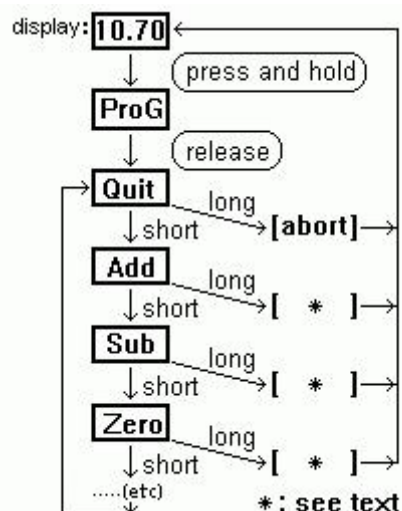
The program flow chart on the left shows how to enter programming mode, how to select a menu, and how to execute the associated function. To enter programming mode, press and hold the programming key (or connect pin 4 and

5 of the PIC with a small screwdriver), until the PIC shows "ProG" on the LED display. Then release the "key". You are now in the first menu of the programming mode.

To select the next menu, press the key for a *short* time (less than a second). To execute the selected function, press the key for a longer time (more than a second). The menu functions are :

- "Quit" : Aborts programming mode without changing anything.

- "Add" : Saves the previously measured frequency permanently, so it will be added in future.

- "Sub" : Saves the previously measured frequency permanently, so it will be subtracted in future.

- "Zero" : Sets the frequency offset to zero, so the display will show the measured frequency without offset. The previously programmed offset will be lost.

- "Table": Allows you to select a predefined offset value from a table. The table itself is also located in the PIC's data EEPROM, so you may find different values in it. When skipping through the table, the frequencies are shown in numeric form, like 455.0 (kHz), 4.1943 (MHz), 4.4336 (MHz), 10.700 (MHz). After selecting an entry (long keypress), you will be taken back to the main menu to select "Add" or "Subtract".

- "PSave" / "NoPSV": turns the power-saving on/off. In power-saving mode, the display is turned off after 15 seconds of no "significant" change in frequency, and on again as soon as the frequency changes by more than a few dozen Hertz (in the 3..4 MHz measuring range). Added in May 2006 for battery-powered equipment like QRP transceivers.