Blinking slogan

This electronic project has been created for advertising in the italian constitutional referendum end 2016. It is a little board of wearable electronics showing a blinking message.
At the moment of writing the referendum has not yet been done, vote day has been fixed for december 4, 2016.
Italy has to reply to te question about Constitution changes with yes or not (SI or NO in italian).
This project is in favor of NO, and the blinking message is just a NO.

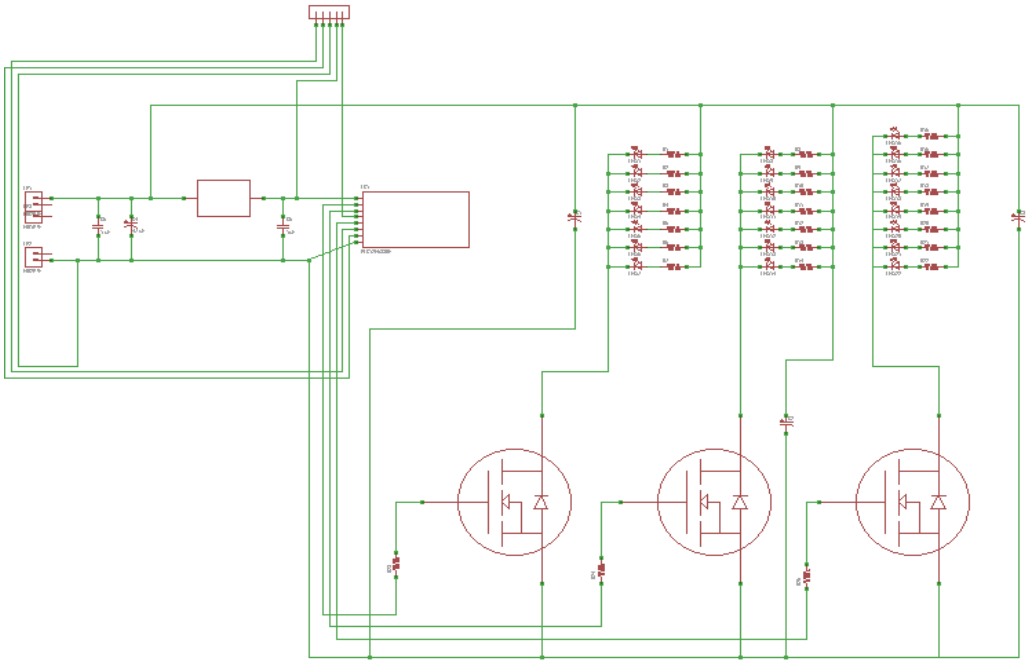
Technology should be neutral, then the project has been released under Creative Commons Open Source licence, and can be used even by SI supporters. Only disposition of LEDs composing the letters has to be changed, Accordingly, final name of the project is a quite neutral "Blinking slogan".

Italians can be divided by opinion about SI or NO, but they are all united by one Country and one Flag. Italian Flag has three colours, green, white and red. Then LEDs forming the NO are been divided in three vertical bands, and left band is made of seven green LEDs, central band of seven white, and right band of eight red LEDs. All in 1206 package. Two opinions, one Flag.

The blinking of the three bands of NO is driven by a Microchip PIC12F1840. It is a mid-range 8 bit PIC, here used in the SOIC-8 eight pin package. Two pins for power supply, one for MCLR, and two for ICSP. Three pins remain free, one for each colour of italian Flag. In fact MCLR and ICSP pins can be re-used, under program control, after programming, but here is not necessary.

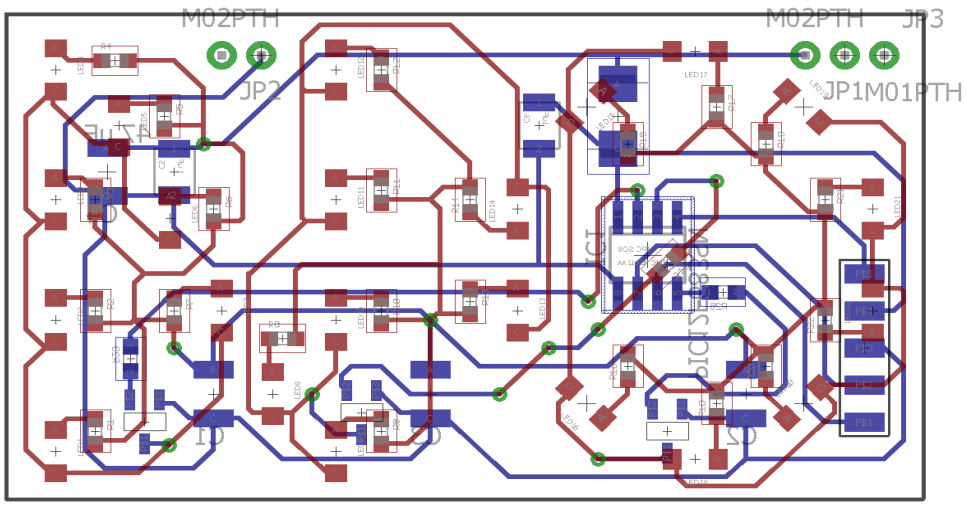
Since PIC pins can not drive directly such a number of LEDs, every pin drives the gate of a small MosFet. Pins are connected to gates thru a 470 ohm resistor, according to Microchip suggestions.
I have used the N-channel Irlml2502 from International Rectifier. Despite the very small SOT-23 package, it has a capability of more of 3 amps, when used in saturation, more than enough for 70-80 mA required here.

The electric schema of board can be seen in the picture.

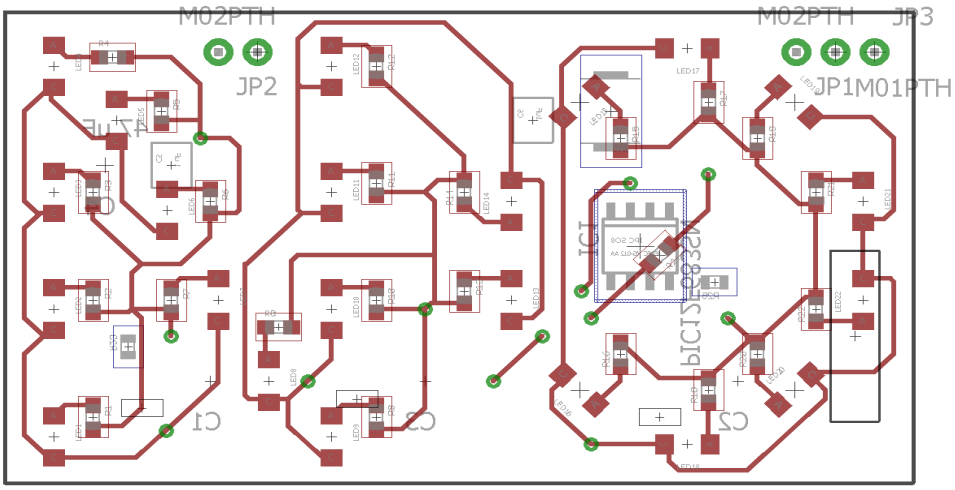


There is no voltage regulator, since the board is designed to be powered by a standard 5V power bank. There are only some filtering capacitors and not all are necessary. It depends only on your personal paranoia. LEDs of every colour are in parallel and driven low-side by the MosFets.

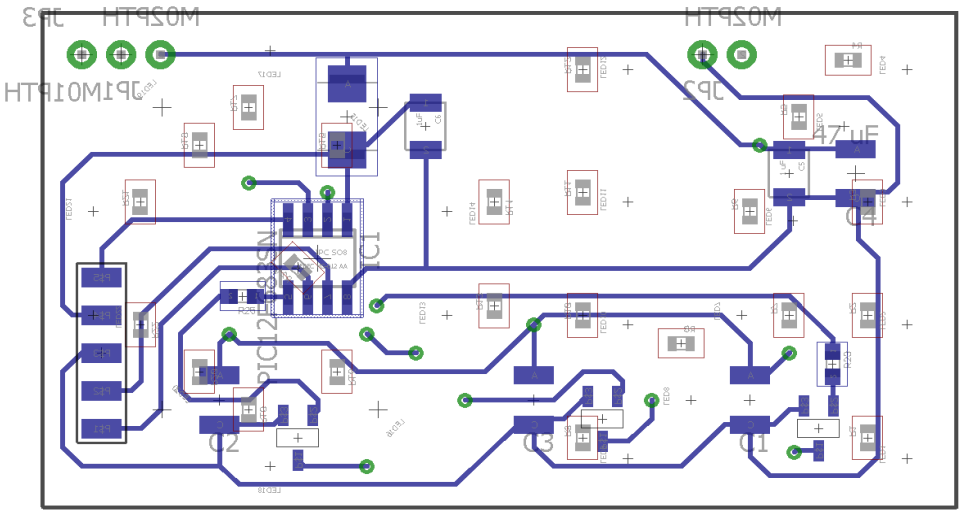
The PCB can be seen in the pictures, both sides,



top,



and bottom.

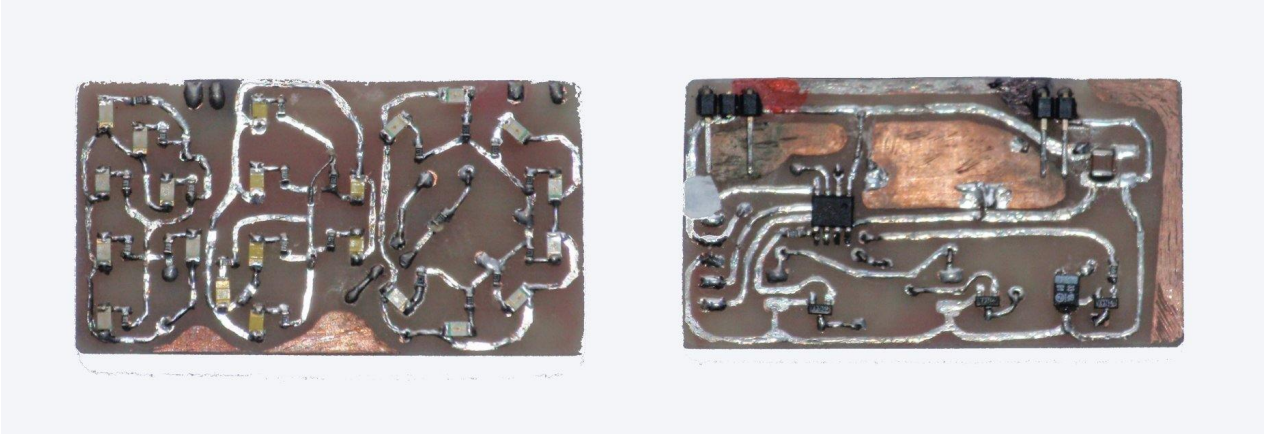


It seems complicated, but only for the number of LEDS to power.
Load resistors are 0603, while LEDs are 1206.

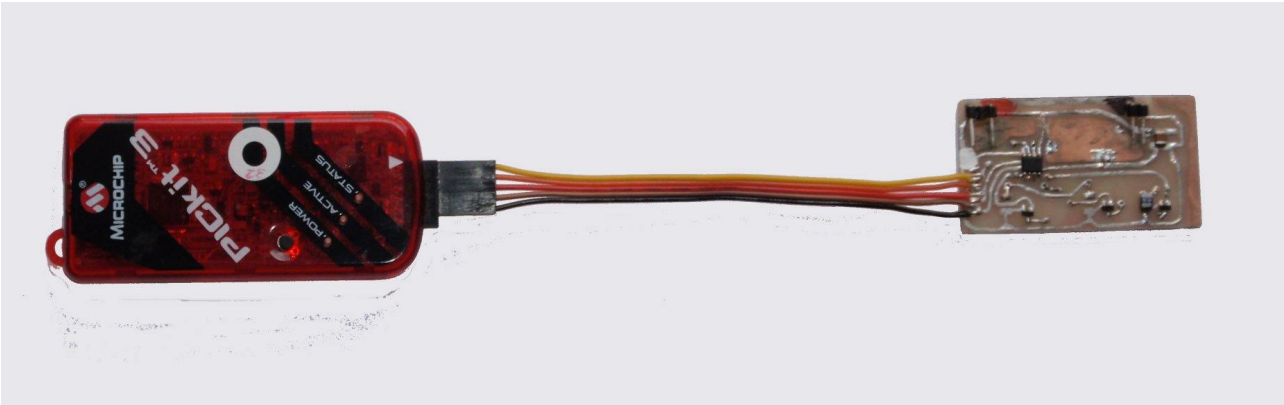
In the picture a hand made prototype of the PCB.

A technology remark: LEDs are built using different semiconductors, according to the colour, and the white LEDs are the most efficient, while the green are the less efficient. Consequently load resistor should be chosen in different values for a correct balance of the luminosity. The board has been designed to run at 5 volts, and this allows also a fine tuning for white LEDs load resistors.
For green LEDs i have used 270 ohm resistors, for white 820 ohm, and for red 510 ohm (non standard value, but i had them). Values are just a template, you have to tune them for the efficiency of the LEDs in your hand.

ICSP has no pins. Since the board has to be programmed once (or few times, when tuning your preferred blinking), on the board are just five pads (MCLR, VCC, GND, ICSPDAT and ICSPCLK according to Microchip specs). I have soldered a DuPont cable to connect to the PicKit-3, and i have de-soldered it after programming.
In the pictures can be seen the prototype of the board without

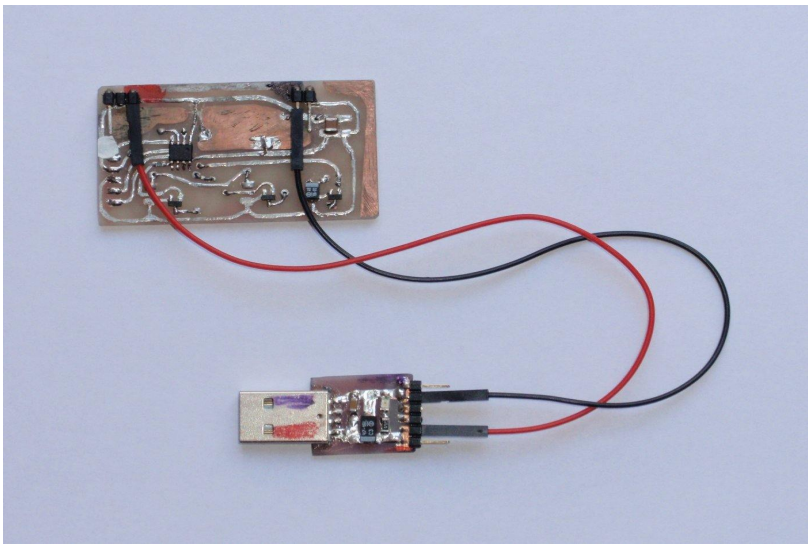


and with Du Pont ICSP connection.

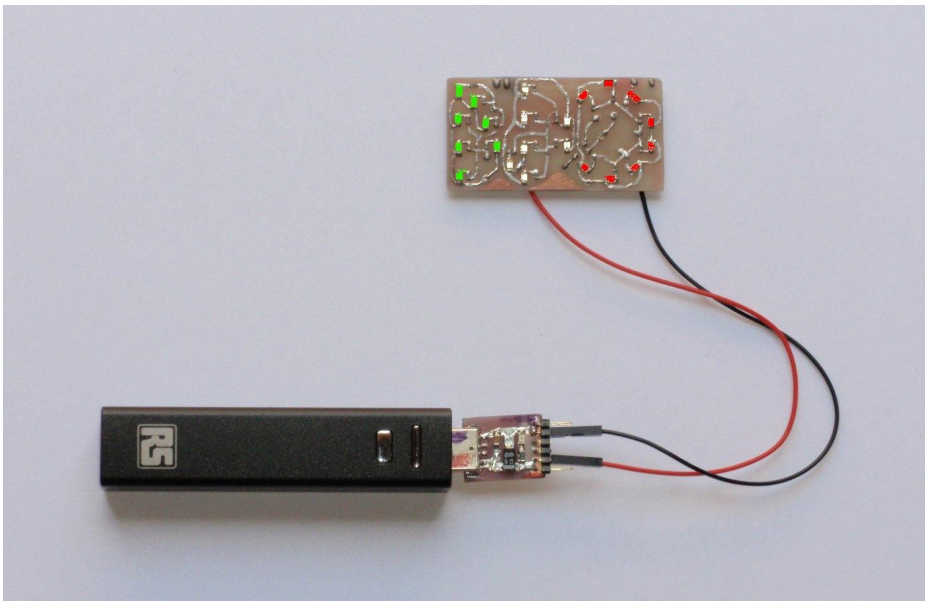


The PIC12F1840 can run from 3 to 5.5 volts. Since sometimes low-cost power banks can exceed this value, LEDs are connected directly to 5 volts, but the PIC is powered after a SM007 diode. It has the double protection purpose of a little voltage drop and against reverse polarity power-on. Accordingly, the after-diode voltage powering the PIC is routed to the VCC ICSP pad.

On my prototype power comes from two right angle standard 0.1" pins, each with another unused pin, just for mechanical solidity. The pins can go thru a cloth, to be powered on the other side from hidden Du Pont cables connected to a power bank hidden in a pocket. Cables in the picture are quite short, and are connected to a home-made USB to Du Pont converter. You can use cables as long as you want and your preferred converter.
In this picture can be seen the power side.



And in this picture the complete working system.



From software side everything is simple.

Create in MPLAB-X a template project for the 8 bit PIC. Replace empty files with supplied files, remember to set the low voltage programming option, and it is done. Anyway low voltage programming is remembered to you by MPLAB-X.

Clock speed in the configuration is set to 125 kHz, low, but more than enough for this application, reducing current consumption. Blinking times are in main.c and are self-evident. You can change them at your will.

Have fun !

Gianfranco

Torino (Italy) september 2016