

# 13V RS-232 ICSP PIC Programmer from 5V Supply

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The design is intended to be compatible with the Ludipipo style programmers that enable programming using just a serial port, with no external power supply.

Details of programming the PIC are available in Microchip datasheets. The basic procedure is:

1. Force CLKIN low to stop the clock oscillating.
2. Hold PGD and PGC low on the PIC.
3. Apply 13V to the MCLR pin to enter programming mode.
4. Clock commands in and out serially through PGC and PGD.

## The Usage Circuit to Permit ICSP

The left part of the diagram in Figure 1 shows a typical usage circuit for the PIC. The diode on the MCLR pin is to stop the 13V applied for programming affecting the 5V supply. The jumper JP1 must be shorted before programming begins, this is to stop the clock (necessary for programming).

## The Programmer

The right part of the diagram in Figure 1 shows the programmer circuit. A 10W DC-DC converter (the MAX 643) is used to generate a 15V voltage that is constant at currents easily in excess of the maximum 80mA needed by the PIC.

The MAX 643 gets its power through the inductor, to control the output voltage it is therefore necessary to turn on and off the supply to the inductor. As relatively large currents flow, a MOSFET (an IRF540) was used to switch it on and off. This is controlled by setting a “break” on the TXD pin. This makes  $V_{GS}$  on the MOSFET +7V and hence a large  $I_{DS}$  current can flow.

The MAX 233 is used exactly as on its datasheet, simply to convert between RS-232 and TTL levels. The serial pins are used as following:

- DTR controls PGD.
- RTS controls PGC.
- CTS is the input to the PC from the PIC.

The diodes on the PGC and PGD pin are to stop the programmer short circuiting the output from the circuit proper. Pull-down  $10k\Omega$  resistors are used to tie PGC and PGD low when not explicitly driven high (necessary because of the diode isolation). All the diodes used in the circuit I built were point-contact and as such have a low junction voltage (typ. 0.1V). It is probably OK to use normal junction diodes however, as the “high” level is typically 4V.

## Components

- I obtained the MAX 643 and MAX 233 as free samples from the excellent MAXIM.
- I obtained the PIC 16F877A from as a free sample from Microchip.
- All other parts, including the inductor and MOSFETs were purchased from Rapid Electronics.

## The Software

Software that works with Ludipipo programmers should work with this. My attempt at an extensible, universal device programmer can be found on my website.

## Notable Points

- I have only tested this with the PIC 16F877A, the programming specification for most PICs is similar however.
- When switching in and out of programming mode, it might be necessary to allow a few hundred milliseconds for the capacitor to discharge.
- I didn't use the potential divider to step-down the output voltage from the MAX 643, but everything worked OK. They are in the diagram to keep the programmer close to the proper electrical specification. The  $220\Omega$  resistor is appropriate to prevent more than 80mA flowing in at 13V.
- The manipulation of the signal pins DTR and RTS on my PC is quite slow compared to the minimum requirements for programming. One solution might be to use the parallel port instead, but a large voltage (higher than 5V) is needed to control the inductor on/off MOSFET. This slowness isn't so bad, as lots of people now use a boot-loader.

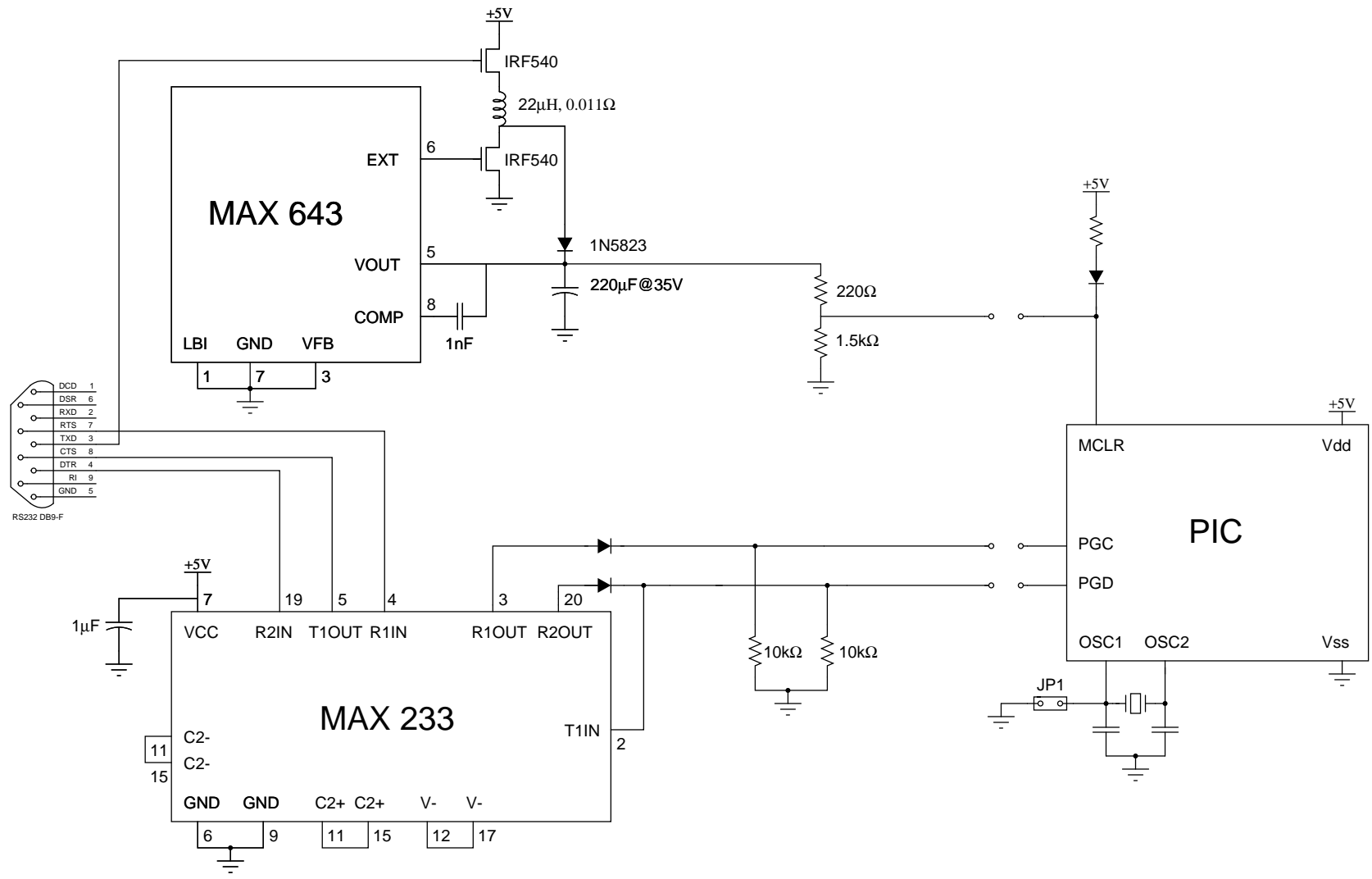
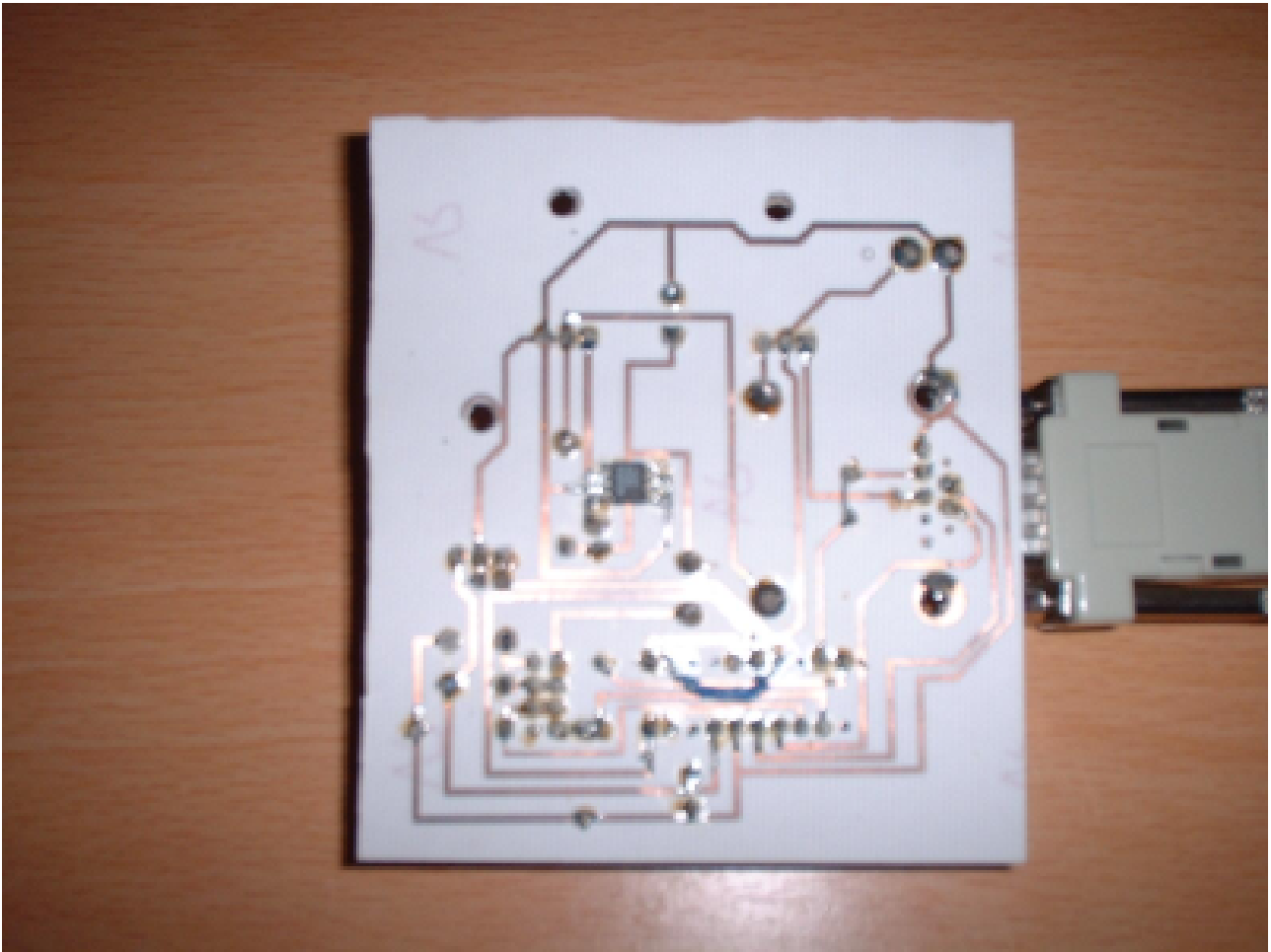


Figure 1: Hardware programmer schematic.

These are here purely for interest, other people's build quality is always something of interest to me.



**Figure 2:** My first attempt at building the circuit on PCB. The inductor is rather large, but was the only one I could get with appropriate  $R_{DC}$ . My programmer circuit is connected to the PIC circuit via a  $2 \times 4$  IDC connector. I also used a 7805 to regulate the +5V supply to the MAX 233.



**Figure 3:** The underside of the PCB. I foolishly ordered the SMT version of the MAX 643 and so had to solder it underneath as shown. The PCB was made on Fotoboard 2, with artwork created with GNU PCB.

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