iCP02 Application Note

When a programmer - such as the PICkit software - provides power to a target microcontroller, it is important to first check if power is already present.   Failure to do so can damage the programmer, the target microcontroller, the computer the PICkit programmer is connected to, or power regulators on the target board.   On the face of it, this seems fairly simple to achieve. The PICkit software needs to check if power is present first.

However, most PICkit software has the option to leave power on after programming (therefore power being provided from the programmer) - that is, instruct the PICkit to continue to provide power.   But, this causes difficulty when checking the power situation prior to any subsequent read/write programming operation.

For reasons known only to Microchip, the PICkit 2/3 firmware has no functionality to differentiate between "power is present" and "I am providing power". Therefore, the only way to determine if the target is externally powered is to [1] specifically stop providing power, then [2] drain power from the target's decoupling capacitors, and finally [3] check if power is present.

The official Pickit 2/3 hardware has two specific features that are relevant here. Firstly, when providing power to the target, it can switch this power on and off pretty much instantly using a MOSFET, independently of the circuit it uses to adjust the target voltage. Secondly, it has the ability to drain power out of the target, emptying any capacitors in the target circuit. This is important.

These two features give it the ability to safely determine the presence or absence of an external power source on the target.

Unfortunately, it seems that the third-party iCP02 programmer (and presumably the iCP01) by piccircuit.com lacks these necessary features.

Firstly, when providing power to the target, it lacks a switching MOSFET and therefore cannot switch this power on and off instantly. Instead, it merely reduces the voltage gradually to zero. By human standards, this would happen quickly; but to the microcontroller, this will take some noticeable time. Essentially, what we're talking about here is a **brown-out** - incidentally tripping any BOR detection on the chip.

Secondly - and more importantly - the iCP02 completely lacks the power-drain MOSFET; and as such is incapable of leeching power out of the target to drain the capacitors. This, combined with the fact that the power drops more slowly in any case, means the software will be unable to detect the presence or absence of external power with any reliability or alacrity.

The iCP02 is protected from damage from an external power source by a diode, which should also protect the computer connected to it. This protection does not, however, extend to the external power source itself. Voltage regulators on the target board are still at risk, and may heat up excessively during (and after) programming.

Using PKCMD with the iCP02 should, in theory, be safe.   PICkitCommandLine contains specific functionality that checks for the presence of external power.   If the power doesn't drop fast enough, PICkitCommandLine will exit with an error.

But, we cannot make any such safety assurances when using other software.

Also, we have identified a mechanism in the iCP02 circuitry that would, in theory, enable it to drain power from the target microcontroller. This would, however, necessitate changes to the internal firmware. Preliminary tests suggest that the iCP02 does not, at this time, offer such functionality to update the firmware.

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