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## Bipolar PICmicro<sup>®</sup> Power Systems

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### BIPOLAR PICMICRO POWER SYSTEMS

#### Introduction

On occasion, it is convenient to power a PICmicro microcontroller from a bipolar supply. This allows an ADC to read voltages below ground, greatly simplifying the analog circuitry for many devices. There are two simple ways to do this; both involve some type of capacitor charge pump.

#### Charge Pump Voltage Inverters

Charge pump circuits are based on older technology and are the basis of many commonly used devices. RS-232 transceivers are usually built around a doubler and an inverter. Gas lasers usually use some type of capacitor charge pump to get the required voltage.

A charge pump is simply a set of switches and a pair of capacitors. The switches are usually diodes. The arrangement of these elements is such that one capacitor will charge and then the switches toggle and the charge will transfer to the other capacitor. Depending on how the switches are configured, the result is a negative voltage or a doubled voltage. Both can be useful for PICmicro circuits.

#### EXTERNAL CHARGE PUMP DEVICE

Charge pumps, which are the easiest to use, are one of many stand-alone IC's that takes one or two external capacitors to generate a negative voltage from a positive voltage. These devices are easy to use because they self start, have a complete set of tables from which to choose capacitors, and have very low voltage losses. By attaching the Vss supply pin to a charge inverter, the PICmicro microcontroller is powered from +/- 2.5V. The PICmicro microcontroller sees this as 5V and runs normally. Bipolar signals can be directly converted by the ADC in the PICmicro MCU. This is a lot easier to do than using a precision summing circuit to add a fixed offset to the signal.

#### SELF DRIVEN CHARGE PUMP

If your application can not afford a charge pump device, perhaps you should look into driving the charge pump signals from the PICmicro MCU (Figures 1 & 2). Some PICmicro microcontrollers have CCP modules that can be used to generate a fixed clock. Of course, software can be used to generate any type of required pulse. Some PICmicro microcontrollers with internal RC oscillators have a clock out signal that runs while the CPU is awake. This signal can easily supply the steady stream of pulses to run a charge pump. The standard RC oscillator using external R & C can also use the OSC2 to drive a charge pump circuit.

#### CONCLUSION

With only a few simple components, a PICmicro microcontroller can be made to run with bipolar power. The PICmicro microcontroller can even generate its own negative power supply with no software overhead by using a simple-charge pump circuit.



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- The PICmicro family meets the specifications contained in the Microchip Data Sheet.
- Microchip believes that its family of PICmicro microcontrollers is one of the most secure products of its kind on the market today, when used in the intended manner and under normal conditions.
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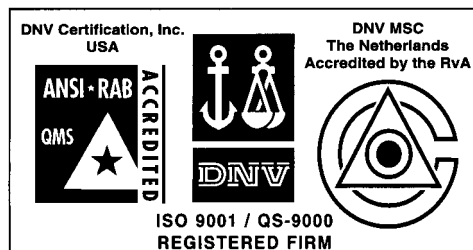
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