TIP #3 Configuring Port Pins

All PIC MCUs have bidirectional I/O pins. Some of these pins have analog input capabilities. It is very important to pay attention to the signals applied to these pins so the least amount of power will be consumed.

Unused Port Pins

If a port pin is unused, it may be left unconnected but configured as an output pin driving to either state (high or low), or it may be configured as an input with an external resistor (about 10 kΩ) pulling it to V_{DD} or V_{SS}. If configured as an input, only the pin input leakage current will be drawn through the pin (the same current would flow if the pin was connected directly to V_{DD} or V_{SS}). Both options allow the pin to be used later for either input or output without significant hardware modifications.

Digital Inputs

A digital input pin consumes the least amount of power when the input voltage is near V_{DD} or V_{SS}. If the input voltage is near the midpoint between V_{DD} and V_{SS}, the transistors inside the digital input buffer are biased in a linear region and they will consume a significant amount of current. If such a pin can be configured as an analog input, the digital buffer is turned off, reducing both the pin current as well as the total controller current.

Analog Inputs

Analog inputs have a very high-impedance so they consume very little current. They will consume less current than a digital input if the applied voltage would normally be centered between V_{DD} and V_{SS}. Sometimes it is appropriate and possible to configure digital inputs as analog inputs when the digital input must go to a low power state.

Digital Outputs

There is no additional current consumed by a digital output pin other than the current going through the pin to power the external circuit. Pay close attention to the external circuits to minimize their current consumption.

TIP #4 Use High-Value Pull-Up Resistors

It is more power efficient to use larger pull-up resistors on I/O pins such as MCLR, I^{2}C™ signals, switches and for resistor dividers. For example, a typical I^{2}C pull-up is 4.7k. However, when the I^{2}C is transmitting and pulling a line low, this consumes nearly 700 uA of current for each bus at 3.3V. By increasing the size of the I^{2}C pull-ups to 10k, this current can be halved. The tradeoff is a lower maximum I^{2}C bus speed, but this can be a worthwhile trade in for many low power applications. This technique is especially useful in cases where the pull-up can be increased to a very high resistance such as 100k or 1M.

TIP #5 Reduce Operating Voltage

Reducing the operating voltage of the device, V_{DD}, is a useful step to reduce the overall power consumption. When running, power consumption is mainly influenced by the clock speed. When sleeping, the most significant factor is leakage in the transistors. At lower voltages, less charge is required to switch the system clocks and transistors leak less current.

It is important to pay attention to how reducing the operating voltage reduces the maximum allowed operating frequency. Select the optimum voltage that allows the application to run at its maximum speed. Refer to the device data sheet for the maximum operating frequency of the device at the given voltage.