Using the adjustable voltage regulator on the HPC Explorer Board

The PICDEM HPC Explorer board features an adjustable voltage regulator, the venerable LM317. It is U2 on the board, and can be recognized by the TO-220 package that is commonly used for transistors. Nearby is a header, J2, and two resistors, R25 and R26. R25 and R26 are used to set the output voltage of the LM317. By default R25 = 1K and R26 = 330R. This gives an output voltage of 5.0V.

The reason an adjustable voltage regulator is provided, is so that the PICDEM HPC Explorer Board can be used with a wide range of 64/80 TQFP PIC microcontrollers. The PIC18F87J10 family tolerates a maximum Vdd of 3.6V. The adjustable voltage regulator allows a different Vdd to be provided for PIC18F87J10 family parts.

To make switching between 3.6V and 5.5V parts convenient, a break-off Plug-In Module board is provided, which mates with daughterboard/emulator header that surrounds the PIC18F8722 (U4). J2 on the PICDEM HPC Explorer board is intended to mate with J102 on the break-off Plug-In Module PCB. This allows the resistors R101 and R102 on the Plug-In Module to be connected in parallel to the resistors R25 and R26. This way Vdd can automatically be adjusted to the voltage appropriate to the part soldered on to the Plug-In Module.

For Vdd = 3.3 volts, R101 can be left unpopulated, and R102 can be 1.18K. (1% resistors are recommended for precise adjustment of Vdd.)

Now let's look at how to determine R101 and R102 if a different Vdd is desired. First, it is a good idea to look at the datasheet for the LM317 to understand how the voltage is adjusted. We won't duplicate all the details here. The following equation is taken from an LM317 datasheet:

Vout = Vref (1+ R2/R1) + Iadj * R2

Iadj is minimized by the LM317, so it can be assumed to be zero, or at least very small. Vref =1.25V, it is the reference voltage developed by the LM317 between the output and adjustment terminal.

That gives us the following equation:

Vout = 1.25V(1+R2/R1).

R2 = R25 || R102 = (R25* R102)/(R25+R102)

R1 = R26 || R101.= (R26* R101)/(R26+R101)

As stated previously, R25 = 1K, and R26 = 330. You can see that without R102 and R101, Vout = 1.25V(1+ 1K/330R) = 5.04V.

For a desired Vout, first solve for R2, given R1 = R26 = 330R. Then knowing R2 and R25, solve for R102. Determine the nearest available resistor value for R102 and recalculate the resulting Vdd to make sure it doesn't exceed the maximum Vdd for the part you will be using.

Here is a table showing values for R101 and R102 for different Vdd's assuming that R25 and R26 (on the HPC Explorer Board are left as their default values of 1K and 330R:

Values for Plug-in Module resistors R101 and R102, assuming that R25=1K and R26=330R.		
Vdd	**R101**	**R102**
5V	open	open
3.6V	open	1.62K
3.3V	open	1.18K
3.0V	open	866R