Digital Buck-Boost Converter

This is a more specific application of the “Digital Buck Converter” but also includes a boost converter option. A useful feature missing in the “Digital Buck Converter” is input and output current sensing which has been added to this project. The main goal is to provide low power output, be portable (at-least semi portable) and be low cost. It is meant to be powered through USB on a computer or an AC USB wall adapter. To keep the cost down the voltage and current are controlled through a computer interface which will be stored in the internal EEPROM so it can be powered without a computer. Input current control exists so it does not exceed the USB power limit of 2.5W (5V; 500mA) to prevent damage.

Hardware Limit

The latest revision is designed to output a maximum of 15V, 1A, 2W (about 80% efficient). 96kHz is recommend but up to 240kHz will also provide a decent PWM resolution without pushing FET drivers and MOSFETs too far. A PID control loop is implemented to enhance power supply performance.

Computer Software and Firmware

The computer software was created in Visual Basic 2010 just like the “Digital Buck Converter”. Its main use is to set the state of the power supply. The firmware is currently only for MPLAB C18 but mikroBasic and mikroC support is planned.

The firmware operates in Constant Voltage/Current Limit mode and the computer software switches is to Constant Current/Voltage Limit by changing the output voltage set point to the maximum setting and use current limit mode to adjust the actual voltage set point to match the current required.

Schematic & PCB

The project is open source and the schematic and PCB files are developed on Labcenter Proteus – ISIS (schematic) and ARES (PCB).

Ongoing Development

Rev. A3: Tested

- PID control gains of buck and boost converter retuned for this revision while using the FET driver and 96kHz frequency
- Output current amplifier does not match expected results; however, it is repeatable an can be individually calibrated for each board with two different graphs – one for Buck mode and another for Boost mode

Rev. A4: Untested

- A dedicated current sense amplifier is used instead of the op-amp to allow boost mode current sensing since the common mode voltage is higher than VDD.