# Solar Charger Project

Steak Electronics

## Contents

## 1 Overview

Want to charge a lead battery from a solar panel, and run some load on the battery occasionally. Want to monitor the load, and the charge of the panel.

## 2 Chip Hunting

Sorting by cheapest buck boost regulators, I've found a micrel chip, MIC4680, which is a simple buck reg. It can be adjustable, so I will take advantage of that with another slide pot, and use it to charge different battery types. These regs are $2. The next realistic option I see is around 5-6 which are the true buck/boost switching regs.

Looking at the Mic4680, I want at least 10mA of current passing through to the device downstream, in order to be around 70% efficient. Looking at the different graphs for output voltage: greatest efficiency is at 12V for low currents. As you lower output voltage, you need more current for equal efficiency. Good for my needs.

Not sure how I will handle overcurrent. Probably a fuse, or ptc. Too much current will blow the fuse. Don't do that.

Let's start building the board.

## 2.1 Board considerations

Input will be any number of solar cells, in series and or parallel. They will go to the vreg. The vreg will go to the battery, which in turn will have a load, of a micro (probably a nano on sleep mode). But actually, I might want a micro that can operate at up to 14 volts... So a nano might not work. Looks like there is a high voltage PIC and Atmega, but the Atmega is obsolete :/

So cheapest is the Pic16. Might try that. It can handle up to 15 volts, which should be safe, with the regulator offering a float voltage (but only a float voltage. Unfortunately, the AVR was up to 18v...)

Unfortunateyl the PIC is eprom (i.e. UV erasable) only or One time programmed OTP only. Ugh. There is another atmega, which is more expensive, but fully programmable. Let's run with that.

The atmega406, programs through JTAG on PortB. Page 70 for jtag pinouts. It is a LQFP so a board will be needed, but I don't enjoy breadboarding anyways, (microcontrollers).

So this chip has an internal regulator, and can run off a wide range of voltages. What is lowest current usage? The data sheet in page 225 mentions the following:

- Active 1.2mA

- idle 270uA

- ADC Noise Reduction 220 uA

- Power-save 35uA

- Power-down 20uA

- Power-off 1.5uA

Based on this, I'm thinking we can only run code when necessary and hopefully get somewhere between the 35uA and the 1.2mA with sleep states.

**RECAP**

Solar to vreg to battery, to low power micro with built in vreg with breakouts for pins so I can think of some sensor to attach. Since I do surveillance work, I think a motion sensor would be a good start. We will want to have something switch on and off a low power motion sensor. https://www.futurlec.com/PIR_Sensors.shtml has a low power pir (relatively cheap) sensor. 50uA. That might be someplace to start. Though I know that these sensors need an external light sensor, or software magic to

avoid false alarms. Breakouts for Vcc, Gnd. Breakouts for all pins. Slide pot for vreg (to use other batteries). Fuse to limit current. Switch on shutdown of vreg, for manual shutdown of power.
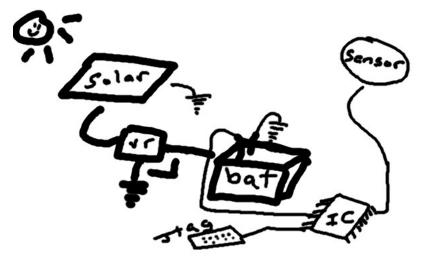


Figure 1: Solar Logger outline. Self sufficient sensors

Note that I will also have the capability to log this with the battery station. Which I will do in house. I think that is enough. I don't want to worry too much about the PIR. Anything else I'm forgetting...?
The connectors I used on the battery station that had a perfect fit for my standard two pin blue screw terminals was the following:

```
Connectors_Molex:Molex_MiniFit-JR-5556-02A_2x01x4.20mm_Straight
```

I will want to use that again for a few places. Except, that footprint doesn't scale past the 2x01, because all other footprints are 2x2 or 2x4 etc... I want single in line terminals. I'm going to need to look online.