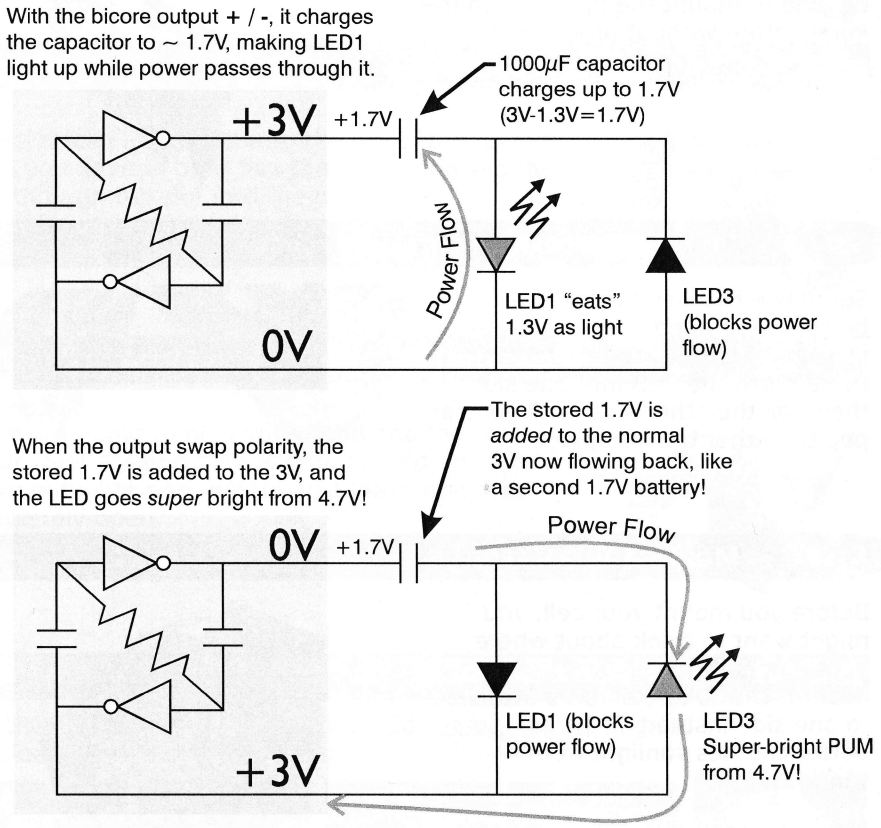
Circuit Theory

There's two parts to the PumLantern. The "dark turn-on" circuit, and the actual Pum circuit. Let's start with the Pum circuit!

The Pummer is based around a very simple BEAM circuit called a "Bicore", which is simply an oscillator that has two outputs that change voltage. When one is "high" (3V), the other is "low" (0V). Every so often, they trade voltages.

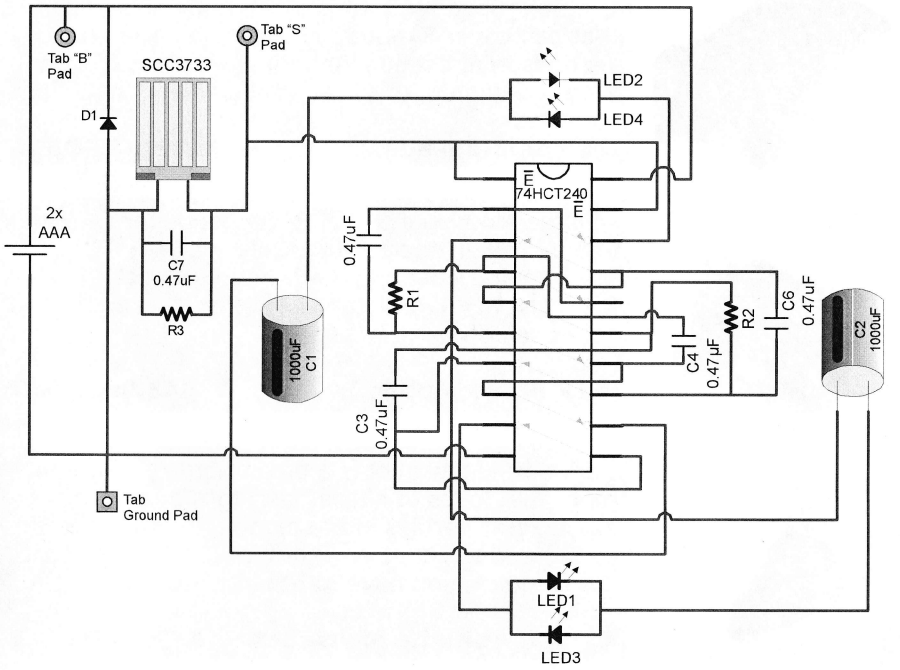
We're using this "trade voltage" behavior to create a charge-pump, which is a fancy way of saying we're building something that makes more voltage than what it normally has access to. Here's how it works (showing only one pair of LEDs in operation):



The "dark turn-on" circuit is pretty simple. The chip has an "enable-low" line, which means when it sees zero volts, it turns on. We attach this line to the solar cell, and when it stops generating power (sun goes down), the 100kOhm resistor forces the chip on. That simple!

Schematic

Here's the actual circuit diagram of the PumLantern's circuit. It's more useful for those of you who might want to modify your PumLantern, or build a second out of parts.



Additional Enhancements

You might have noticed that there are little pads on the tabs that stick out of your PumLantern. Once side has a single square pad, which is the *ground* pad that connects to common grounds in the circuit.

The other tab has two pads: One labeled "S" and one "B".

The "S" pad lets you add an additional solar cell (connected between "S" (+) and the ground pad). This lets you use a *large* cell and have it power a whole string of lanterns at the same time.

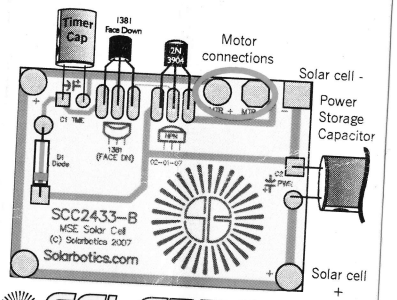
The "B" pad lets you directly connect to the battery (with the ground tab) for easy recharging, or measuring voltage.

Use the Miller Solarengine circuit to make useful bursts of energy for your motor or device!

NPN - 2n2222 or 2n3904 transistor
C1 - 2200μF or larger electrolytic power storage capacitor
C2 - 1μF to 47μF discharge duration time capacitor
D1 - 1N914-style signal diode (1N914)
Connect your load (motor/LED/etc) to the pads "Mtr -" and "Mtr +"

Performance Tips:
Bigger C1 = more power stored, but means longer recharge time
Bigger C2 = more time MSE stays on, but needs more time to recharge
Low 1381 trigger (C=2.2V) will activate MSE sooner, but with less vigor than a 1381-U (4.8V)

Recommended default settings (please experiment!):
Short bursts / quick recharge (~3sec): C1=4700μF, C2=4.7μF, 1381E
Long bursts / slow recharge (~2min): C1=0.33F, C2=22μF, 1381G



SOLARBOTICS Ltd
201 - 35th Avenue N.E., Calgary, Alberta, Canada T2E 2K5 Ph: (866)276-2687
Made in China

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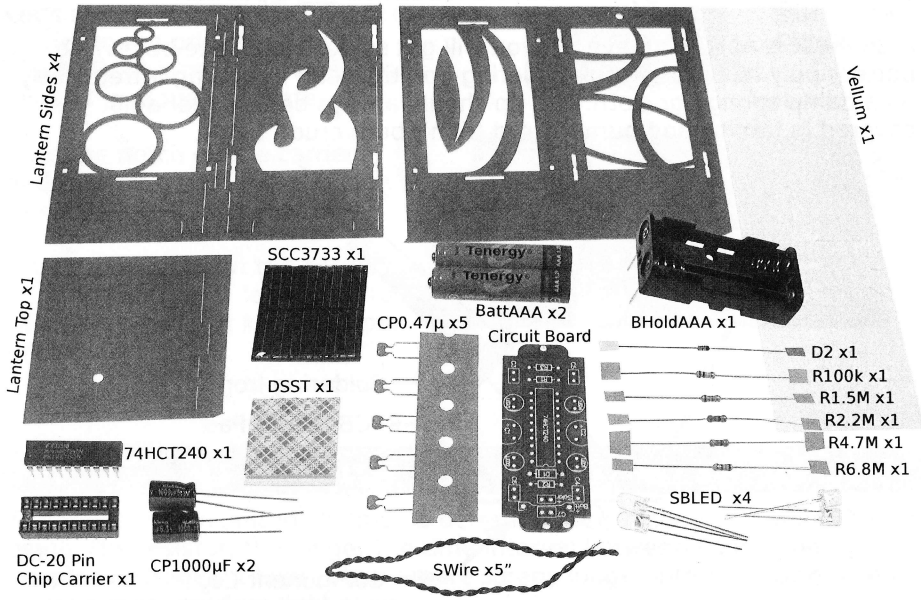
Yeah, it was going to be *completely* blank, but we needed to put that boring legal-type stuff somewhere. We were going to say "use this marvelous empty page as your blank canvas with which to create such illustrations or notes as to change the very fabric of society." Instead it's now a partially text-populated page with a large and awkward empty portion in the middle. Feel free to use it however you want.

Boring Legal-Type Stuff:

PARTS

Let's get started. Start by opening your bag of parts, and dumping them into a safe place like an egg-container (remove eggs), pie-plate (eat the pie), or cat-food bowl (give cat away to gypsies). Don't simply spread them about on a table-surface where they'll roll away, because then you'll think we forgot something in the kit and have to call us. Then we'll tell you to look under your chair, and you'll find it there and think we have magic powers. In short, keep your parts safe when you dump them out - they're small, and will try their hardest to hide from you!



PARTS LIST

SKU	Name	Qty
74HCT240	Octal Inverting Buffer	1
BattAAA	Rechargeable AAA Battery	2
BHoldAAA	2 x AAA Battery Holder	1
CP0.47µF	0.47µF Monolithic Capacitor	5
CP1000µF	1000µF Electrolytic Capacitor	2
D2	Schottky Barrier Diode	1
DC-20 Pin	20 Pin DIP Socket Carrier	1
DSST	Double-Sided Sticky Tape (1" Square)	1
KPL-PCB	PumLantern PCB	1
Lantern Sides		4
Lantern Top		1
R100k	100k ohm resistor (Brown, Black, Yellow)	1
R1.5M	1.5M ohm resistor (Brown, Green, Green)	1
R2.2M	2.2M ohm resistor (Red, Red, Green)	1
R4.7M	4.7M ohm resistor (Yellow, Purple, Green)	1
R6.8M	6.8M ohm resistor (Blue, Grey, Green)	1
SCC3733	37 x 33mm Polycrystalline Solar Cell	1
SBLED	Super Bright LED	4
SWire	5" of Twisted Wire	1
Vellum (8"x2.875" rectangle)		1