August 13, 2006

PROTOTYPE VOLTAGE ALARM FOR BURN TESTER

This document contains information on how I constructed an alarm for use when burn testing scooter and light batteries.

The circuit is presented for information only, and should not be considered as a fully developed project. In particular I would change a number of things in a production/project version:

- use something like LM339 quad comparator for the Schmitt triggers rather than discrete components
- if retaining the 12V / 24V switch, put a separate over-voltage comparator circuit in to trigger the alarm if the unit is set to 12V operation with a 24V battery connected (this and the "OR" logic could probably all fit in the LM339)
- add some RF bypass capacitors at appropriate points
- replace the 24V pot with a 2:1 potential divider from the 12V output using a couple of higher precision or matched resistors, saving the cost of a 10 turn pot.

The objective was to make a circuit which is as simple and reliable as possible. One LED comes on when the circuit is connected to a battery, and a second LED and the rather loud piezo buzzer come on when that voltage drops below a set voltage, e.g. 10V or 20V. In use, the time is measured using a kitchen timer. I personally don't favour the idea of a fully automatic unit which disconnects the battery from the burn tester when the threshold is reached because:

- it would need a big relay - that could be one of the relays used in the scooters, except this would presumably not operate at 12V, or one could use an auto one
- if the relay sticks on, then the circuit won't work
- there would need to be an internal timer which stopped when the unit disconnected
- its still a good idea to monitor the battery voltage during the test, as the most common feature I have seen is a 2V drop in one of the battery voltages early in the test due to a dud cell in one battery, and the burn time alone doesn't tell you this is happening.

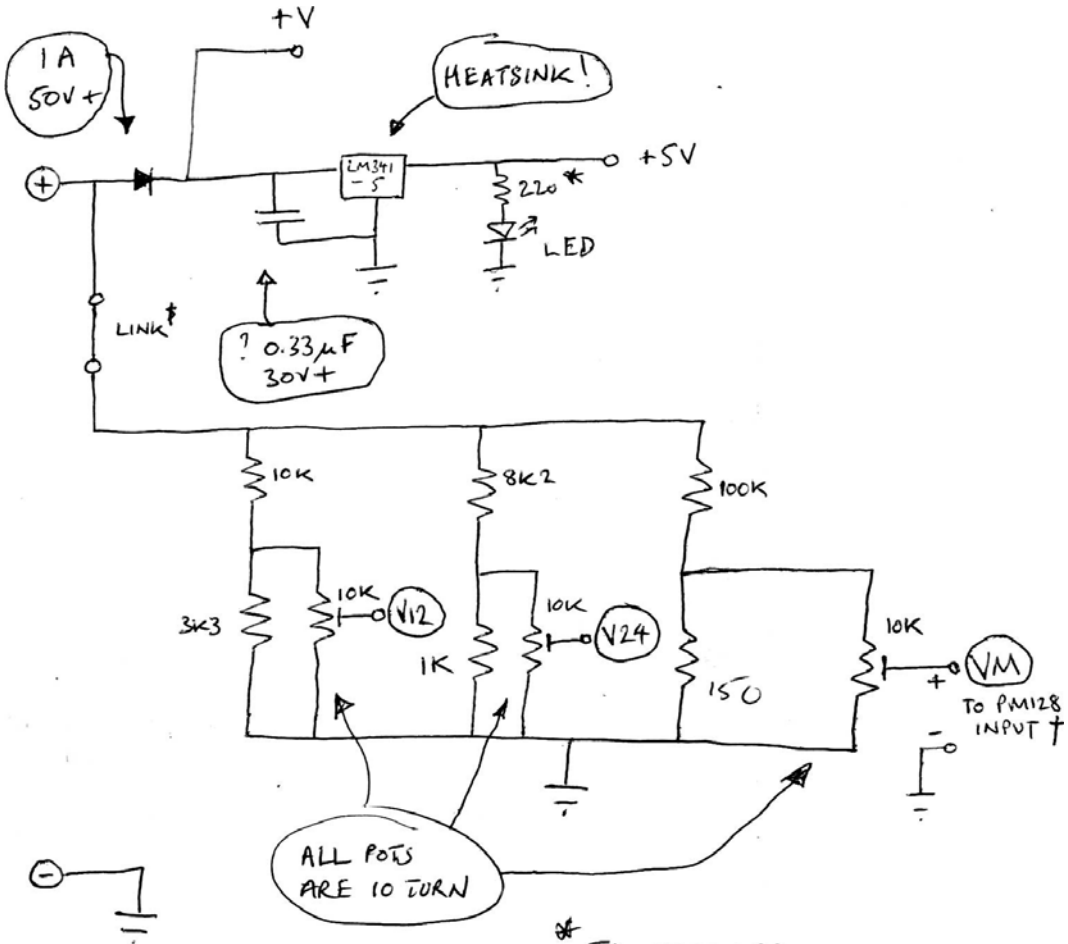
The circuit doesn't use batteries to operate, but does include a separate digital panel meter and battery (the PM128 datasheet says its power supply should be floating w.r.t. its inputs - probably this could be achieved with some suitable trickery/experimentation without using a separate battery, but for me it was easier just to put a battery in). The DPM isn't necessary and is just there for convenience - it saves forgetting to turn a separate DVM off etc.

The Schmitt trigger circuit is explained on www.play-hookey.com/digital/experiments/rtl_schmitt.html

I modified the values for just a couple of percent hysteresis.

Simon Richards
www.cave-exploration.com

+5V Power Supply and voltage dividers for 12V, 24V and DPM



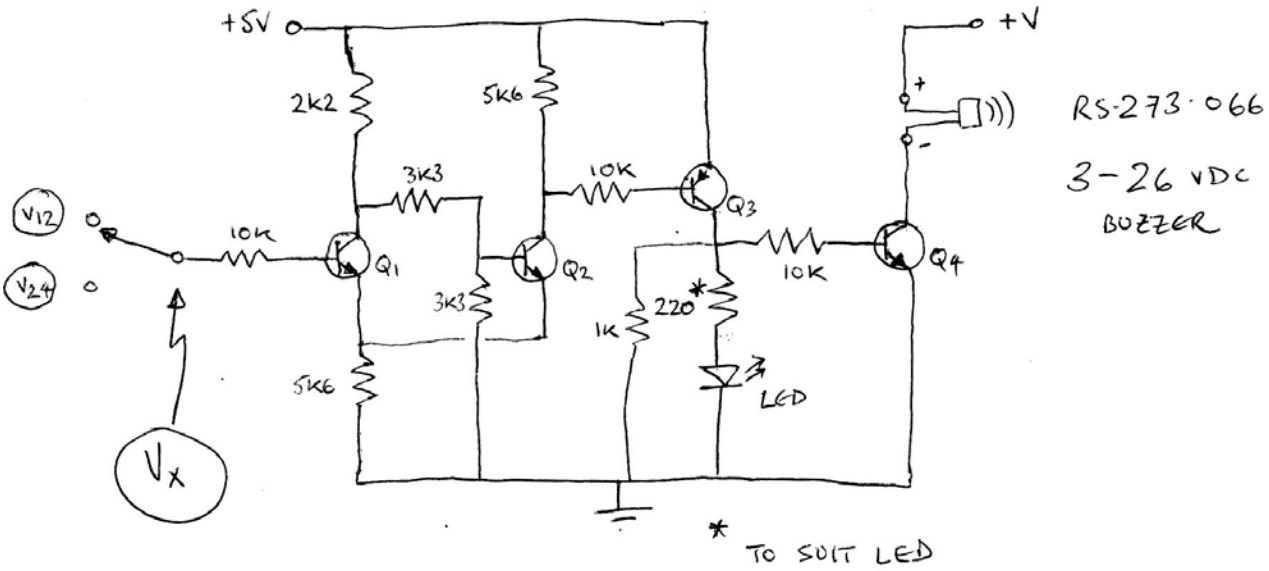
* TO SUIT LED

† Link "P1" on PM128 for decimal point

Power PM128 from 9V battery via pushbutton switch

‡ I put this in so I could apply separate voltage for setup — not necessary

Schmitt Trigger, Inverter and Buzzer Driver



N.B. SOME R.F. BYPASS CAPACITORS WOULD BE A VERY GOOD IDEA!!

Q_1 - Q_4 GENERAL PURPOSE SILICON (Q3 = PNP)

Setup Procedure

SETUP

1. Apply voltage V_S and measure V_X with DVM
2. Adjust relevant pot until alarm triggers @ $V_X = V_{XT}$ say
3. Adjust pot until:

$$V_X = \frac{V_{XT} \cdot V_S}{V_T}$$

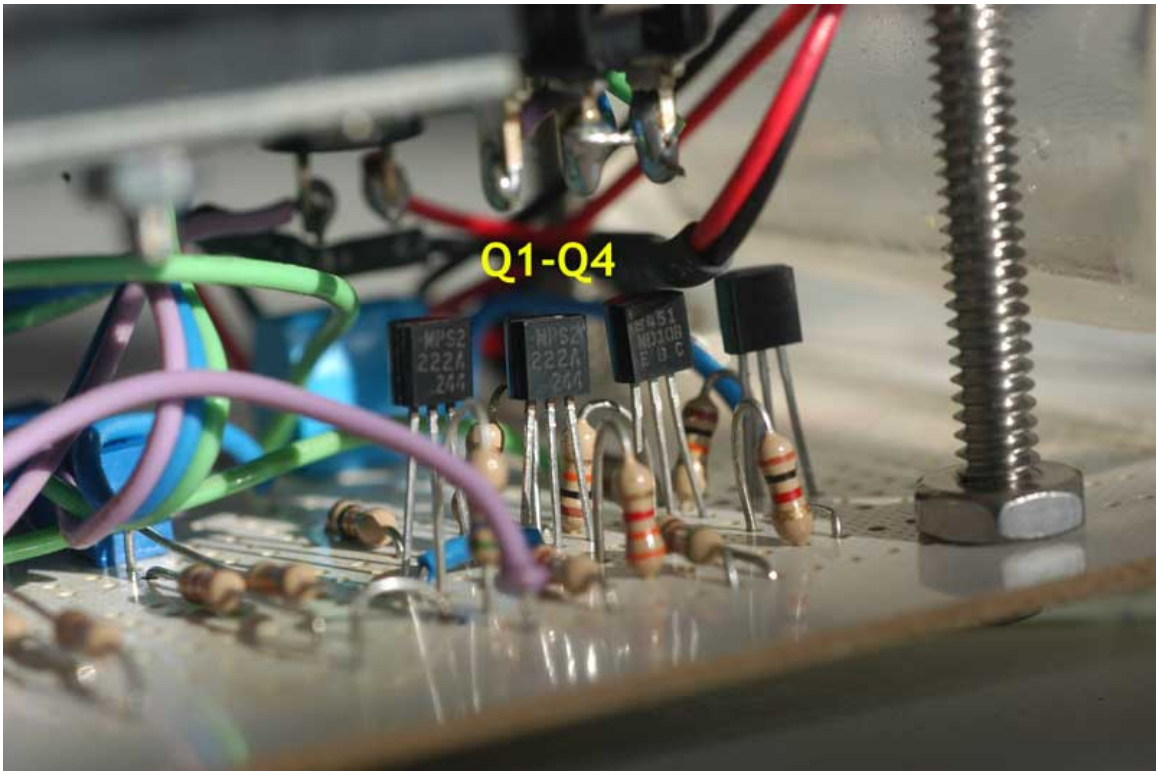
where V_T = desired trigger votage (e.g. 10v or 20v)

Prototype with Kitchen Timer

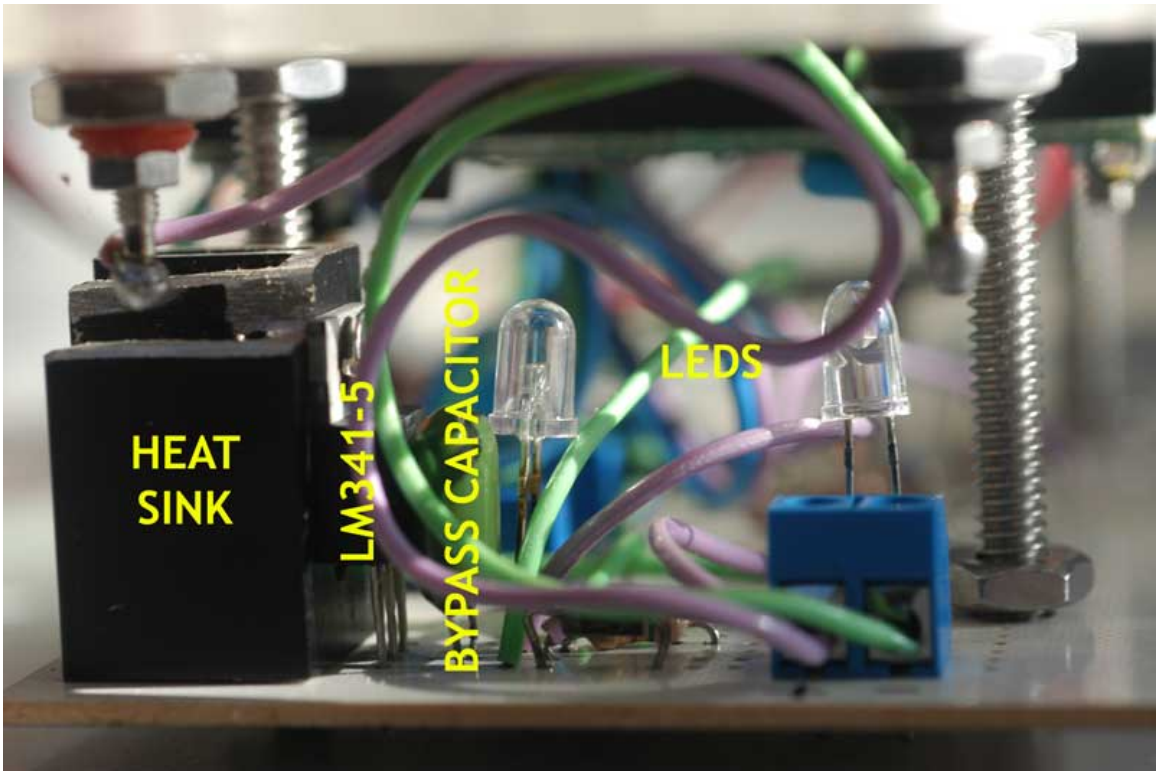
Piezo Buzzer
(Note that this gets the full battery voltage across it, so must be 24V+ rated)

Link on PM128 to Display Decimal Point

Transistor Circuitry



Power Supply Arrangements and LEDs



Multi-turn Pots for Voltage Dividers