Swap button cell for a GoldCap

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There is currently a good range of real-time clock chips available for use in microcontroller systems. One interesting, low-cost example is the DS1307 from Dallas Semiconductor which has a built-in serial I²C interface. The chip provides connections for a 3 V lithium button cell to ensure that the correct time and date are maintained in the event of a power failure. In applications where the system runs continuously the battery back-up should provide many years of service but will eventually need to be replaced. In these situations a better (lower-maintenance) alternative to the battery is a high capacity (GoldCap) capacitor.

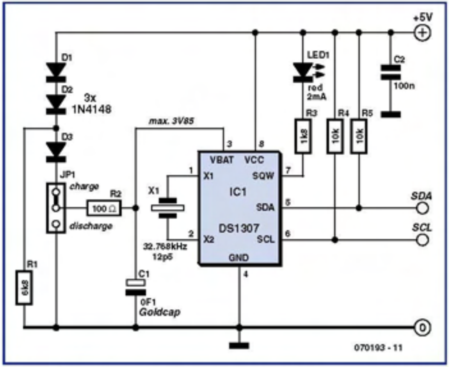

Figure 1: A few additional components are required to use a GoldCap to back-up the DS1307.

The simplest way to implement such a circuit would be to connect a GoldCap capacitor (a value of around 0.1 Farad should do) in place of the battery and arrange for it to be charged from the 5 V supply via a resistor (100 Ω). A diode in series with the GoldCap would prevent the capacitor discharging when the supply voltage fails. Unfortunately with the DS1307 this simple solution was not successful; once the GoldCap reached its maximum charge the I²C interface stopped talking. A closer look at the data sheet indicated that a 'no communication' mode is initiated when the supply voltage is below a level equivalent to 1.25 x V_{BAT}. This mode is intended to prevent any possible overwriting and corruption of data in the clock chip by a system controller which is undergoing a power-down or brown-out whilst attempting communication with the DS1307. As the supply voltage continues to fall below the battery voltage V_{BAT} the DS1307 switches into low-current mode.

With these constraints in mind the circuit shown in **Figure 1** was produced. Resistor R1 draws current through diodes D1 and D2 which together produce a voltage drop of around 1.2 V. With a supply of 5 V the voltage at V_{BAT} is approximately 3.85 V. D3 prevents the GoldCap being discharged when the supply voltage falls and R2 limits the charging current (and discharge current when jumper JP1 is used to discharge C1, this process takes a few minutes).

The maximum back-up time produced by the circuit depends on the capacity of the GoldCap and to some extent the operating temperature which will have an influence on both supply and leakage currents. You can expect the circuit to provide back-up for many hours or maybe even a whole day which should be sufficient for most applications.

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