2.4-V battery backup protects microprocessor memory

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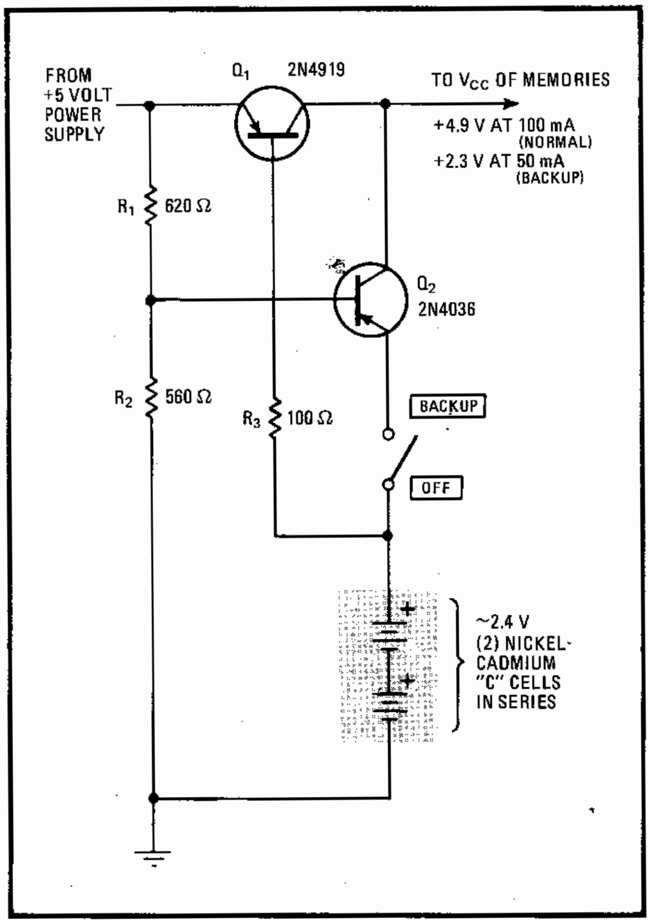

Memory saver. A series pair of nickel-cadmium "C" cells, each nominally rated at 1.25 volts, puts out about 2.4 volts and can deliver 2.3 volts to microprocessor memories to prevent loss of data in the event of supply failure. Transistors saturate to less than 100 mv.

Using diodes to isolate a backup battery from the power supply of microprocessor memories works fine—if the 0.7- to 1.0-volt drop across each diode can be tolerated. A more efficient circuit (see figure) substitutes saturable switching transistors that have a drop of less than 100 millivolts, which minimizes current drain and therefore extends battery life.

Moreover, the voltage of the nickel-cadmium battery supply need only be 2.4 volts, since during a power failure a saturated transistor then delivers all of 2.3 v to the memories. That is more than enough for such metal-oxide-semiconductor devices as the 2102 static random-access memory, which begins to lose data if its supply drops below about 2 v.

The circuit shown in the figure is connected between the +5-v power-supply line and the supply input of the memories. When the 5-v supply is functioning normally, transistor Q_1 is biased heavily into conduction by the difference between the supply voltage and that of the Ni-Cad batteries: 5 v − 2.4 v = 2.6 v. The voltage delivered to the memories is then about 4.9 v, since the drop across Q_1 is at most 100 millivolts. During this time, the R_1-R_2 voltage divider holds transistor Q_2 off, and the batteries receive a charge of about 20 milliamperes through R_3 and the base-emitter junction of Q_1.

When power failure occurs and the 5-v supply drops below about 3.1 v (which is 2.4 v + V_{BE}), Q_1 begins to cut off, isolating the dying 5-v supply from the load. At the same time, Q_2, biased by the R_1-R_2 voltage divider, begins to conduct, connecting the backup batteries to the load. The reverse bias on transistor Q_1 prevents the Ni-Cads from discharging through the supply circuit.

Both Q_1 and Q_2 were chosen for their very low saturation characteristics. Although their current ratings seem far in excess of what is needed, the result is that they exhibit a $V_{CE(SAT)}$ of less than 100 millivolts. But any pnp power transistors of the same general qualifications as those specified, such as the GE Powertab series, should suffice.

The standby switch has been included to permit defeating of the battery backup feature. □

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