A High Efficiency Constant Current Source for Battery Charging Applications

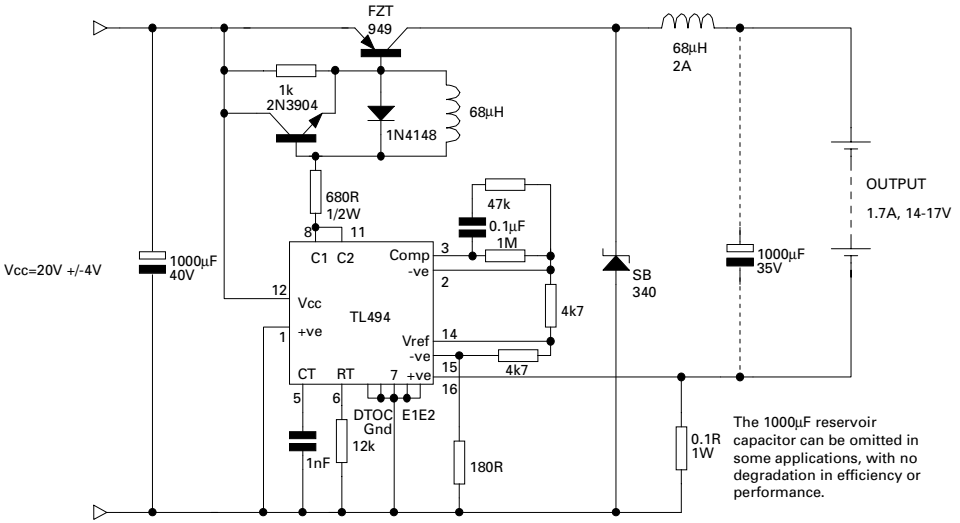

Figure 1
TL494 Constant-Current Source.

This design note describes a 1.7A constant current source for battery charging applications. With an input of 20V, constant current can be generated for loads from 5V to 17V - for charging from 4 to 12 Ni-Cd cell battery packs.

An efficiency of better than 85% is achieved using a very low $V_{CE(sat)}$ bipolar transistor, the FZT949 or the FZT789A, as the switching element.

The circuit uses the Texas Instrument TL494 converter IC (Please refer to Figure 1). A speed up circuit, using a 2N3904 and a 68µH inductor enhances the FZT949/FZT789A switching speed - Collector-to-0V, and drive waveforms are shown in Figure 2.

No heatsink is necessary for the FZT949/ZTX789A due to the high efficiency achieved. However, using the FZT789A will result in a slightly higher

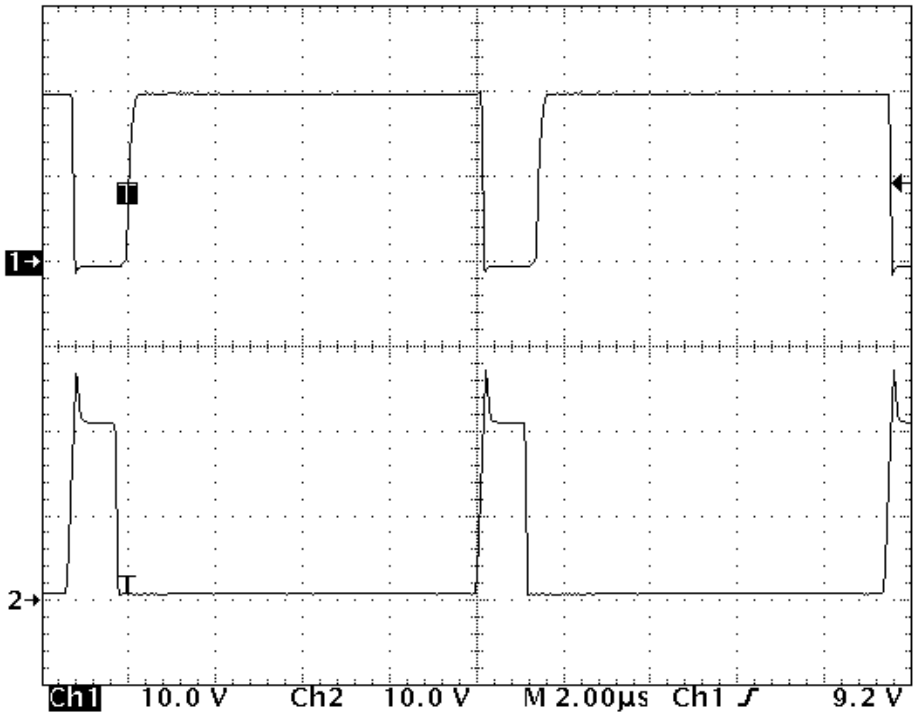

Figure 2
FZT949/FZT789A Switching speed-waveforms.
Upper Trace: Collector-to-0V; Lower Trace: IC Drive.

case temperature than the FZT949 - but still well within the accepted operational specification of the device. If the user prefers to run the case temperature lower, than the FZT949 is the preferred device.

An industry standard switching P-Channel MOSFET (BUZ271 - in TO220 outline) has been substituted for the Zetex device but did not improve on the efficiency - though it does cost considerably more and is only available in a larger package - TO220 compared to SOT223 for the FZT789A/FZT949.

In conclusion, it has been shown in this design note that with the selection of a very low $V_{CE(sat)}$ PNP Zetex bipolar transistor, high efficiencies can be achieved and at a much reduced cost compared to a MOSFET based design.