Keywords: USB ports, bipolar power supplies, stepup converter, charge pump, constant-frequency operation

APPLICATION NOTE 4434

USB-Powered Bipolar Supply

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Abstract: This application note shows a simple USB-powered circuit that generates a ±12V supply. The circuit delivers 50mA from both outputs. The MAX1896 step-up converter is featured in the design.

This design idea appeared in the September 1, 2006 issue of *Power Electronics Technology*.

The USB port on most PCs (personal computers) can be a handy source of power. It is not allowed to deliver the maximum specified current (500mA) without software negotiation, but in practice the PC has no direct control over current drawn from the USB port. PCs often limit the USB current only through the use of passive autoresettable fuses.

Figure 1 shows a simple USB-powered, ±12V supply capable of meeting most demands. Such bipolar supplies—popular for use in audio, instrumentation, and other industrial applications—should feature low noise, current limiting, and enough output-current to drive several amplifiers drawing 5mA to 10mA each.

Figure 1. Powered only by a USB port, this ±12V supply delivers 50mA from both outputs with reasonable output regulation.

This circuit includes a constant-frequency, current-mode step-up converter (U1, the MAX1896) with suitable current limiting. The step-up converter creates the +12V output; an external charge pump consisting of D1, D2, C1, and C2 generates the negative rail.

The circuit can source or sink about 50mA, and the MAX1896's current-mode topology limits the switch current on a cycle-by-cycle basis. Note that the MAX1896's internal switch is not in series with the current path, so it cannot limit current when the output voltage is forced below the input-supply voltage. Thus, a dead short is limited only by the USB current-limit fuse, which is usually rated much higher than 500mA. Load regulation for the +12V output is shown in the MAX1896 data sheet. For the -12V output, load regulation is shown in **Figure 2**.
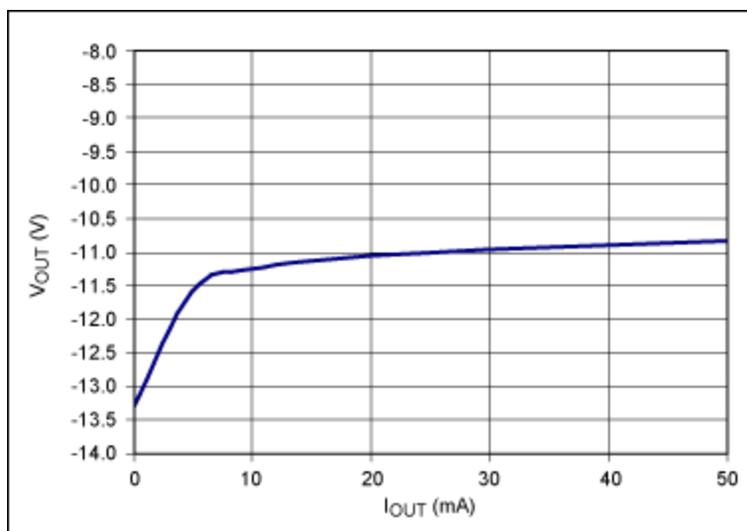
Figure 2. Negative supply load regulation. With a 50mA load connected to the +12V output in Figure 1, this graph shows typical load regulation of the -12V output.

The MAX1896's constant-frequency operation allows simple filtering and produces less noise than a frequency-modulation scheme. The high switching frequency is easily filtered with passive LC filters or with external transistor-buffered RC filters, as shown in Figure 1. As always for switching converters, a good PC-board layout is essential for low-noise operation. Further advice on these matters is available in the MAX1896 data sheet.

Related Parts

MAX1896	1.4MHz SOT23 Current-Mode Step-Up DC-DC Converter

More Information
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