Introduction

The LT3430 is a monolithic step-down DC/DC converter that features a 3A peak switch current limit and the ability to operate with up to 60V input. The LT3430 runs at a fixed frequency of 200kHz and is packaged in a small thermally enhanced 16-pin TSSOP package to save space and simplify thermal management. The 5.5V to 60V input range makes the LT3430 ideal for FireWire® Peripherals (typically 8V to 40V input), as well as automotive systems requiring 12V, 24V and 42V input voltages (with the ability to survive load dump transients as high as 60V). It is designed to maintain excellent efficiencies at both high and low input-to-output voltage differentials over a wide input voltage range. Its current mode architecture adds flexible frequency compensation with no restriction on the use of a ceramic output capacitor—resulting in small solutions with extremely low output ripple voltage.

The LT3430 is pin compatible with the LT1766 (60V, 1.5A, 200kHz) and LT1956 (60V transient, 1.5A, 500kHz) step down DC/DC converters.¹

LT3430 Features

- Wide input range 5.5V to 60V
- 3A peak switch current
- Small thermally enhanced 16-pin TSSOP Package
- Constant 200kHz switching frequency
- 100mΩ saturating switch
- Current mode architecture
- Peak switch current maintained over full duty cycle range
- 30µA shutdown current
- 1.2V feedback reference
- Easily synchronizable

Figure 1. Simplified block diagram
Circuit Description

The block diagram in Figure 1 shows all of the key functions of the LT3430 step-down DC/DC converter. Its current mode architecture uses two feedback loops to control the duty cycle of the internal power switch—a transconductance error amplifier monitors the error between output voltage (via the FB pin) and an internal 1.22V reference, and a current sense comparator monitors switch current on a cycle-by-cycle basis. The LT3430 maintains peak switch current over the full duty cycle range (wide input voltage range). Although current over the full duty cycle range prevents sub-harmonic oscillations for duty cycles above 50%. The LT3430 uses a patented process to cancel the effect of slope compensation on peak switch current without affecting frequency compensation. Applications that require high duty cycles, this offers significant advantages—including a lower inductor value, lower minimum $V_{IN}$ and/or higher output current capability—over typical current mode converters with similar peak switch current limits.

Efficiency

The LT3430 is designed to provide efficient solutions at both high and low input-to-output voltage differentials, over a wide input voltage range. A typical high input voltage application with a large input-to-output differential, a 42V to 5V converter, is shown in Figure 2. To obtain high efficiency at high input voltages requires fast output-switch edge rates, and minimal quiescent current drawn from the input at light loads. The BIAS pin allows power for the internal control circuitry to be supplied from the regulated output if it is greater than 3V. The peak efficiency for a 42V to 5V conversion is greater than 82% as shown in Figure 3.

The LT3430 is also capable of excellent efficiencies at lower input voltages. The peak efficiency for a 12V to 5V converter is greater than 90% as is also shown in Figure 3. One important factor in achieving high efficiency for low input-to-output voltage conversions is to use a low resistance saturating switch. A pre-biased capacitor, connected between the BOOST and SW pins, generates a boost voltage above the input supply during switching. Driving the switch from this boost voltage allows the 100mΩ power switch to fully saturate. Any output voltage of at least 3.3V is enough to generate the required boost supply.

Space Saving and Low Output Ripple Voltage Solutions

The high switching frequency and current mode architecture of the LT3430 combine to make it possible to design space-saving solutions with low output ripple voltage. The 200kHz switching frequency of the LT3430 reduces the inductor value required to achieve low inductor ripple current, allowing for the use of a physically smaller inductor. The current mode architecture of the LT3430 allows for flexible frequency compensation to accommodate various output voltages, load currents and output capacitor types. This flexibility allows for a small, low ESR ceramic capacitor to be used at the output—making for an extremely low output ripple voltage solution in a small space.
measure, such as one supply failing or one fuse damaged. The supply measurement is also more accurate, since the voltage drop across the fuses or diodes does not affect it. Resistors R9 and R10 pull up the fuse pins so that damaged fuses can be detected. The status signals may be wired off the card, with optoisolators, to an isolated microprocessor or microcontroller that controls system performance and warning functions. This allows an automated system supervisor to issue a warning or record the event, despite operating from an isolated supply. The LT4250L switches the –48V supply via Q1 during hot swapping and low supply conditions, and monitors the supply voltage provided to the load. The PWRGD output of the LT4250 drives an optoisolator, providing a supply status signal to the DC/DC converter. This signal may also be used to monitor the condition of the ORing diodes by comparing it to the supply status signals from the LTC1921.

**Conclusion**
Reliability is top priority for the designers of modern telephone and communication equipment. Designers take extra care to protect circuitry from failure-causing temperature and voltage changes, employing redundancy whenever possible, especially for power supplies. They monitor supplies for early warnings of impending failure, often using complicated circuitry that can include a voltage reference, comparators, an LDO and several precision resistor dividers. Designers may also use discrete components to indicate the state of power supply fuses. The resulting circuits can be expensive in terms of component cost, board space and engineering time. The LTC1921 replaces this complicated monitoring circuitry with a simple integrated precision monitoring system contained entirely in an MSOP-8 or SO-8 package.

**LT3430, continued from page 8**

Figure 4 shows a 5V/2A solution for FireWire peripherals which takes advantage of the LT3430 current mode architecture by using a low ESR ceramic capacitor at the output. The circuit provides a low profile (all components less than 3.0mm height), low output ripple voltage solution. Output ripple voltage is only 26mV_p-p as shown in Figure 5, using a 22µH inductor, with V_in = 24V and V_out = 5V at 2A.

**Conclusion**
The LT3430 features a 3A peak switch current limit, 100mΩ internal power switch and a 5.5V to 60V operating range, making it well suited to automotive, industrial and FireWire peripheral applications. It is highly efficient over the entire operating range, and it includes important features to save space and reduce output ripple—including a 200kHz fixed operating frequency, a current mode architecture and availability in a small thermally enhanced 16-pin TSSOP package.

**Notes**
1. The ‘no connect’ pins 3 and 5 of the LT1766 and LT1956 must be connected for the LT3430 to handle the increased current in the SW output (pins 2 and 5) and the VIN input (pins 3 and 4).