High Efficiency DC/DC Converter, using High Density SOT23-6 MOSFETs.

Introduction.

Portable applications such as laptop computers, mobile phones, digital cameras, video cameras, etc. require high efficiency DC/DC converters to extend battery life and give the manufacturers an edge in a very competitive marketplace. This design note shows a typical power converter application with improved overall circuit performance using a device from the Zetex range of High Density MOSFETs, the ZXM62N02E6.

Features.

- High efficiency >85%.
- Up to 5W output power.
- HDMOS Technology - loss reduction.
- SOT23-6 packaging, reducing physical size.

Circuit Operation.

The circuit in Figure 1. employs a boost topology combined with a Maxim controller IC. The energy stored in L1 during Q1 on time is delivered to the output via D1 when Q1 turns off and the polarity across L1 reverses. During Q1 on time the output capacitor,C4, supplies the output current and when Q1 is turned off the stored energy in C4 is recharged. This energy, together with the input current, supplies the load current.

The MAX608 IC is used to control the switching of the transistor to maintain the output voltage regulation over a wide range of load currents. The MAX608 employs a current-limited Pulse Frequency Modulation, PFM, scheme that combines the low quiescent current of PFM with the load driving capability of PWM. The current sense resistor, R1, monitors the output.

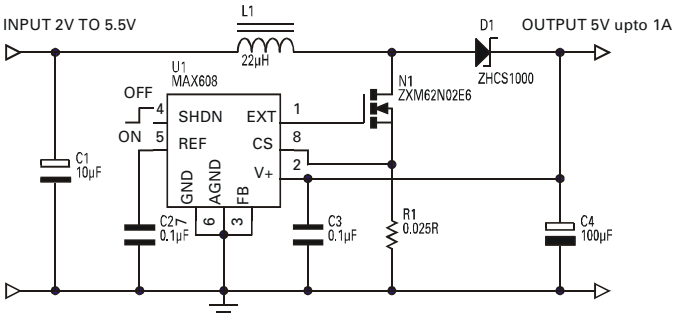

Figure 1. High Efficiency DC/DC Controller.

Circuit Performance.

Input voltages can range from 2V to 5.5V for a 5V output. Up to 1A output current can be achieved, maintaining a line regulation of +/-2% with a good EMC signature (see Figure 2). By utilising a Zetex HDMOS MOSFET, the ZXM62N02E6, as the main power switch in the converter, the major losses in the circuit can be significantly reduced (see Figure 3).

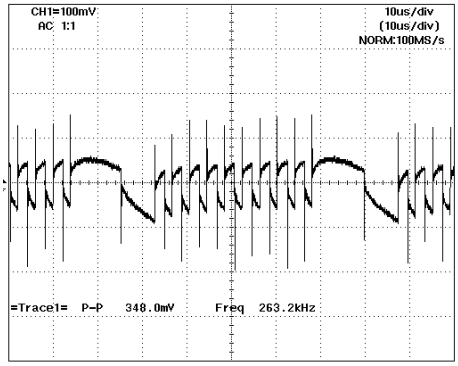

Figure 2.
Output Voltage Ripple.

The fast switching characteristics of the ZXM62N02E6 lower switching losses which, coupled with a low $R_{DS(on)}$ value, give a reduction in 'on-state' losses. This, combined with the Zetex ZHCS1000 1A DC rated Schottky diode further reduce circuit losses and therefore increase efficiency to >85% (see Figure 4).

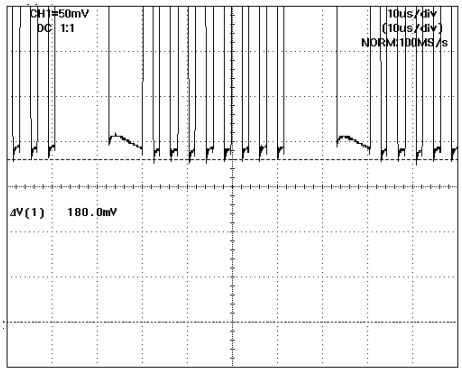

Figure 3.
'On-state' losses in Q1.

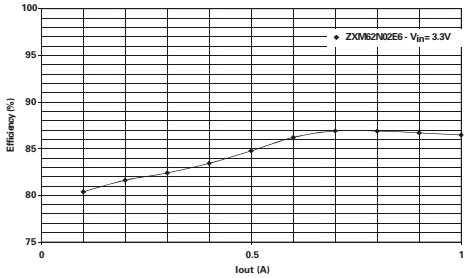

Figure 4.
Efficiency v Output Current.

Surface mount packaging for the ZXM62N02 includes SOT23-6 and SO8. These packages ensure a high power output to small physical size ratio, up to 5 watts, which is critical in portable applications.

For lower output currents (up to 0.5A) the ZXM61N02F, available in SOT23, is an option. A performance comparison between the SOT23 and SOT23-6 package options is shown below.

Part Number	Package	ID (max)	RDS(on)@ VGS=4.5V	Efficiency
ZXM62N02E6	SOT23-6	3.2A	0.1@2.2A	86.3%@1A
ZXM61N02F	SOT23	1.5A	0.18@0.93A	83.6%@0.5A