

DESIGN NOTES

36V, 3.5A Dual Monolithic Buck with Integrated Die Temperature Monitor and Standalone Comparator Block

Design Note 492

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INTRODUCTION

Multioutput monolithic regulators are easy to use and fit into spaces where multichip solutions cannot. Nevertheless, the popularity of multioutput regulators is tempered by a lack of options for input voltages above 30V and support of high output currents. The LT3692A fills this gap with a dual monolithic regulator that operates from inputs up to 36V. It also includes a number of channel optimization features that allow the LT3692A's per-channel performance to rival that of multichip solutions.

The LT3692A is available in two packages: a 5mm × 5mm QFN and a 38-lead plastic TSSOP. Although Both include the full feature set, the TSSOP package enhances the thermal performance of the dual buck.

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HIGH INPUT VOLTAGE WITH HIGH TRANSIENT CAPABILITY

The LT3692A can operate up to an input voltage of 36V and can sustain a transient voltage up to 60V for 1 second, making it suitable for harsh operating environments such as those commonly found in automotive environments.

ON-DIE TEMPERATURE MONITORING

The LT3692A provides an on-die temperature monitoring function which facilitates the application circuit design, debugging and package thermal optimization. The voltage at T_J pin is directly proportional to the die temperature in Celsius (i.e., 250mV equals 25°C and 1.5V equals 150°C).

The measured temperature of the LT3692A TSSOP die tops out at 80°C* with the two outputs each supporting 3A loads at 5V and 3.3V from an input voltage of 18V,

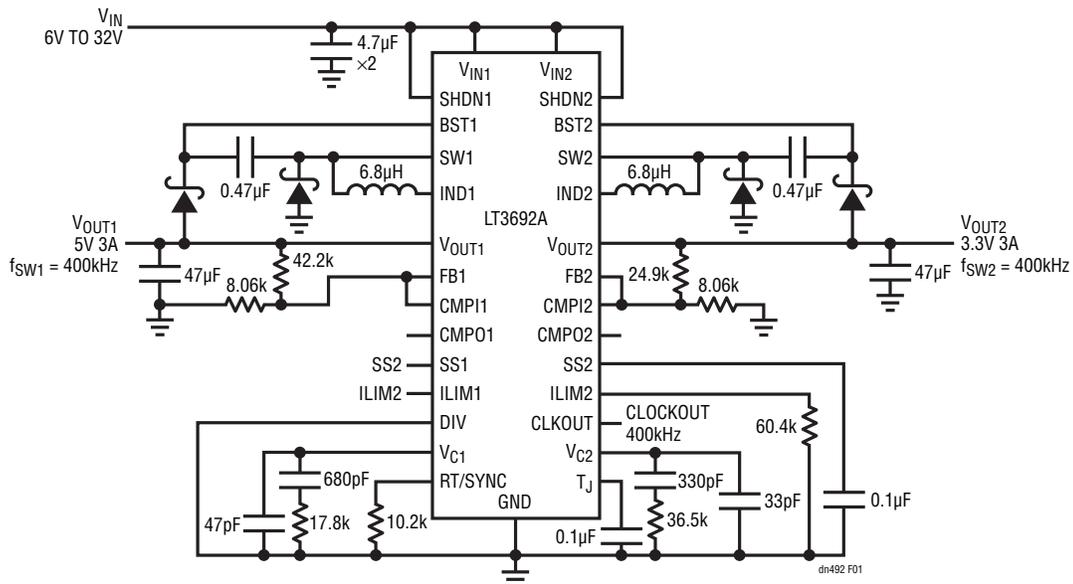


Figure 1. Dual 5V/3A/400kHz, 3.3V/3A/400kHz Application Keeps Temperature Rise Low at a V_{IN} of 18V

with a switching frequency of 400kHz. Figure 1 shows the schematic of the measured application circuit. The same setup, but with 2.5A loads, drops the max die temperature to 68°C.*

STANDALONE COMPARATOR BLOCK

The LT3692A also includes a standalone comparator block, which provides a 720mV threshold with hysteresis and outputs an open-collector signal. This comparator can be configured as a power good flag signal by connecting CMPI pin to FB pin to monitor the output voltage. It can also be configured as a temperature flag, which gives a warning signal when the die temperature rises to a preset point. This function is realized together with the on-die temperature monitor. Figure 2 shows how to configure a 100°C temperature flag.

OTHER FEATURES

Independent Adjustable Current Limit

The switch current limit on each output can be programmed from 2A to 4.8A. This expands the number of loading combinations that can be safely implemented without risking thermal overload of the package under extreme conditions, such as a short-circuit. Likewise, the current limit can be used to protect the part in compact designs where the saturation margin on inductors is lowered to meet size constraints.

Independent Synchronization

Independent synchronization allows any phase difference between the two outputs besides the standard 0° and

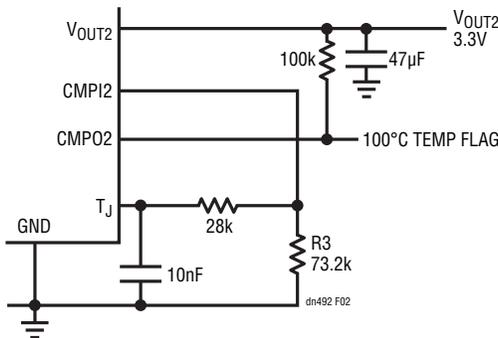


Figure 2. Temperature Flag Using Comparator Block and Temperature Monitor

*T_J pin reading on a standard demo board (DC1403A) running in a 25°C ambient temperature environment.

180°. The phase difference on the LT3692A is adjusted by controlling the duty cycle of the synchronization signal.

Frequency Division

Frequency division makes it possible to tune the operating frequency of each channel to optimize overall performance and size. The frequency of channel 1 can be programmed to run at 1, 1/2, 1/4 or 1/8 the frequency of channel 2. Figure 3 shows the layout of a 3.3V/2.5A/550kHz channel and a 1.2V/1A/2.2MHz channel application. The relatively low 550kHz frequency of V_{OUT1} maximizes channel 1's input voltage to 36V while meeting minimum on-time requirements and keeping the efficiency high. The high 2.2MHz frequency of V_{OUT2} allows the use of smaller components for channel 2 as shown in Figure 3. Despite the reduction in size, electrical and thermal performance is uncompromised.

CONCLUSION

The LT3692A is a dual output monolithic regulator that combines the ease-of-use and compact solution size of typical monolithic regulators with the flexibility of discrete, multichip solutions. Its high transient voltage capability, die temperature monitor, standalone comparator block, adjustable current limit, adjustable switching frequency and frequency division function and independent synchronization enable the LT3692A to work in many applications that other monolithic chips cannot.

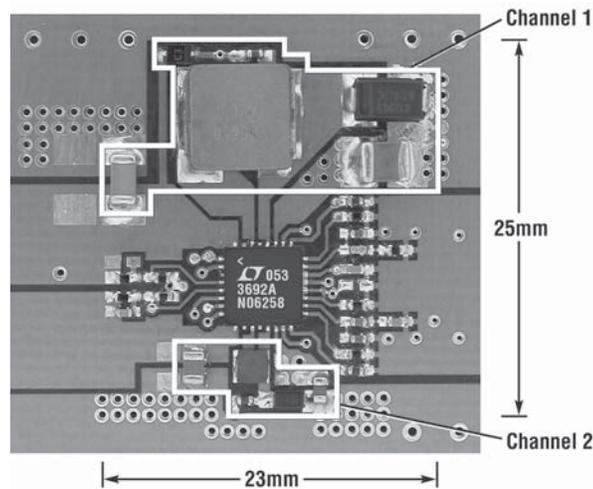


Figure 3. Dual 3.3V/2.5A/500kHz, 1.2V/1A/2.2MHz Layout. Channel 2 Requires Half of the Area of Channel 1

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