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.

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 TJ 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 VIN 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 pro-
grammed 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
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 VOUT1 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 VOUT2 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 synchro-
nization enable the LT3692A to work in many applications
that other monolithic chips cannot.