

QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 423

1A, 500KHZ HIGH VOLTAGE BUCK CONVERTER

LT1956

DESCRIPTION

Demonstration circuit 423 is a 60V, 500kHz, 1A load current, monolithic step-down DC/DC switching converter using the LT1956. With its wide input voltage range, 1.5A internal power switch, and thermally enhanced package, the LT1956 is a very versatile and powerful IC for DC/DC converters that require compact space and a wide variety of input voltage ranges. The constant 500kHz switching frequency allows all of the components to be small, surface mount devices. The current-mode control topology creates fast transient response and good loop stability with a minimum number of external compensation components and the use of ceramic input and output capacitors. The low resistance internal power switch (0.2Ω) maintains high efficiencies $>75\%$ and up to 90%. The SHDN pin and 25 μ A shutdown current extends battery life. The wide VIN range of the LT1956 allows steady state input voltages from 7.5V input up to 25V input. The LT1956 is capable of steady state operation of up to 60V if the output voltage is set higher than 5V and the duty cycle remains high enough (typically above 25%). Minimum on-time and maximum output power at high input voltages may have thermal restrictions (please see datasheet for more details). However, with 5V output, the LT1956 is designed for

transient operation up to 60V. Synchronization of switching frequencies up to 700kHz is possible.

Demonstration Circuit 423 is designed for 7.5V to 25V input (with up to 60V transient) to 5.0V output at 1A load current for automotive, industrial, portable computers, battery chargers, and distributed power systems. This board was designed for wide input voltage range applications where simplicity, small circuit size, and low component count are important as well as up to 1A of load current. The extremely low output voltage ripple ceramic capacitor not only demonstrates small size and low cost, but the advantage of current-mode control in step-down applications with a simple compensation network and a feedforward capacitor for more rugged stability and excellent transient response. Demonstration Circuit 423 is best used in 500kHz applications where the maximum duty cycle does not exceed 75% and the minimum steady state duty cycle remains above 25%. Duty cycles below 25% are capable, with the restriction of minimum on-time, the part may begin to skip pulses to effectively lower the overall minimum on-time.

Design files for this circuit board are available. Call the LTC factory.

Table 1. Typical Performance Summary

PARAMETER	CONDITION	VALUE
Steady State Input Voltage Range	$V_{OUT} = 5V, I_{OUT} \leq 1A$	7.5–25V
Maximum Transient Input Voltage		60V
V_{OUT}	$I_{OUT} \leq 1A$	5V $\pm 3\%$
Maximum Output Current		1A
Typical Switching Frequency		500kHz
Typical Efficiency	$V_{IN} = 12V, V_{OUT} = 5V, I_{OUT} = 1A$	83%

QUICK START PROCEDURE

Demonstration circuit 423 is easy to set up to evaluate the performance of the LT1956. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

Make sure that the input voltage does not exceed 60V.

The synchronization and shutdown functions are optional and their pins can be left floating (disconnected) if their functions are not being used.

1. Connect the 7.5V–25V input power supply to the Vin and Gnd terminals on the board.
2. After all connections are made, turn on input power and verify that the output voltage is 5.0V.

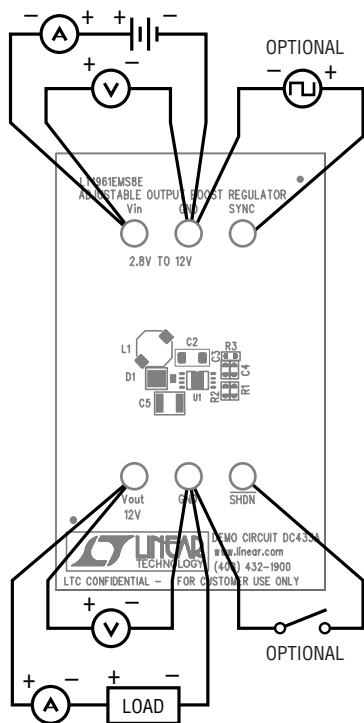


Figure 1. Proper Measurement Equipment Setup

CUSTOMIZING THE BOARD

The components assembled on the board are optimized for a wide input voltage range and a 5V output. The bandwidth can be increased for more specific input voltages such as $12V \pm 10\%$ or 18V–24V with 36V transient if desired (just a few examples). The adjustable feedback resistors allow the output voltage to be customized. For output voltages below 3.0V, the boost diode should be moved from D2 to D3 to provide the minimum boost voltage required for the internal power switch. Make sure that the boost capacitor (C8) has a voltage rating greater than or equal to the output voltage for applications where the boost diode is placed in D2. However, the boost capacitor must have a voltage rating greater than the input voltage whenever the boost diode is placed in position D3.

D4 is an optional boost voltage “blocking” diode. For custom applications in which the output voltage is significantly greater than 5V, this blocking diode reduces the boost driver voltage, reducing the power (and thus heat) dissipation inside the IC. It is recommended that a CMH5236B zener diode is used in D4 when $V_{OUT} = 12V$ and the junction temperature is hot without the use of the Zener. Note that in order to properly install D4, the small trace connecting the anode and cathode of D4 on the board must be separated (an Exacto knife works well) before D4 is soldered to the board.

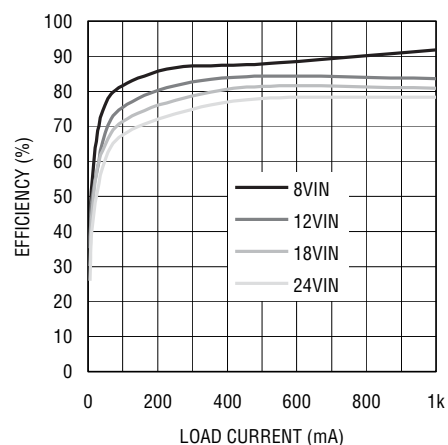
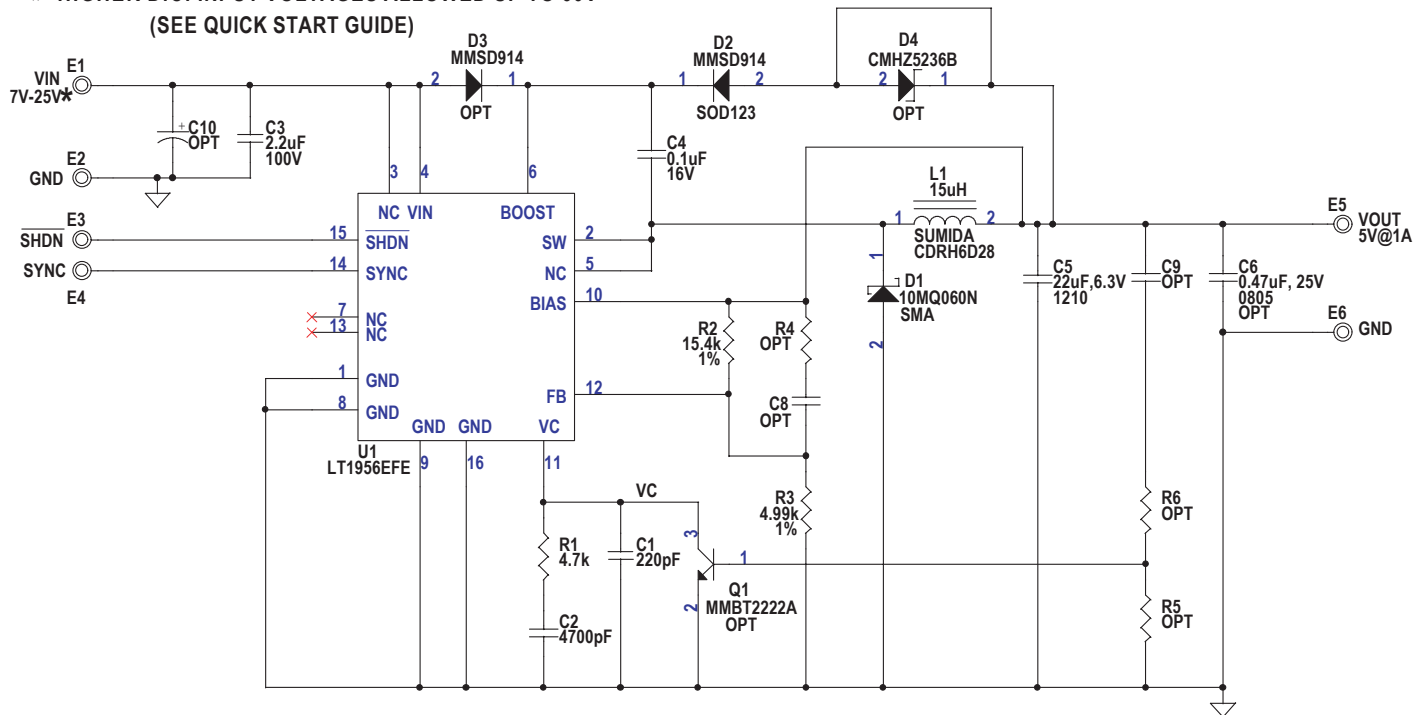


Figure 2. Efficiency

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* HIGHER D.C. INPUT VOLTAGES ALLOWED UP TO 60V
(SEE QUICK START GUIDE)



NOTE: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE IN OHMS, 0603.
ALL CAPACITORS ARE IN MICROFARADS, 0603.
2. ALL OPTIONAL COMPONENTS WILL HAVE NO COMPONENT OUTLINE ON BOARD EXCEPT Q1, R5, R6, AND C9.

Figure 3. Demo Circuit Schematic