Keywords: MAX8505, Internal Switch, Small Footprint

APPLICATION NOTE 2945

3A Internal Switch Step-Down Regulators Uses All Ceramic Capacitors for Small Footprint

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Abstract: As system integration becomes increasingly complex, the need for smaller power supplies with fast transient response becomes more pronounced. The MAX8505, an internal switch step-down regulator with 1MHz frequency, exemplies this by packing 3A output current in less than 0.6 sq. inches.

Today's compact designs demand small footprints. Power supplies are no exception.

The MAX8505, a 3A internal switch step-down regulator, is designed to meet this requirement. The part is available in a QSOP 16 package, which occupies the same footprint of an SO-8 package. Its 1MHz switching frequency, allows customers to use only ceramic capacitors in their designs, resulting in small footprint power supplies.

Figure 1 shows the schematic of the MAX8505 operating at 1MHz with all ceramic capacitors.

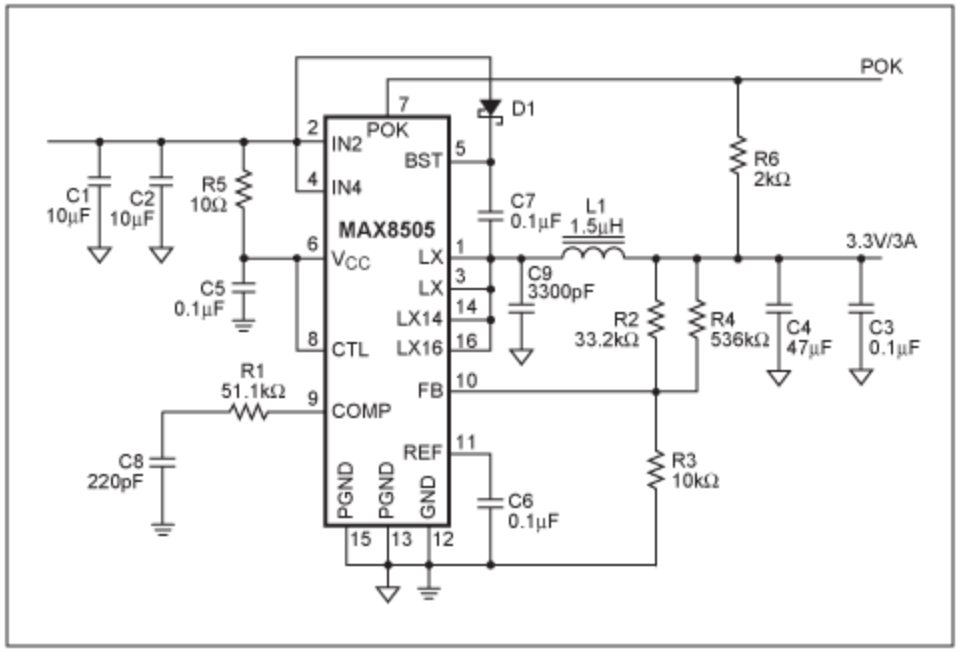

Figure 1. Schematics of the MAX8505 step-down regulator operating at 1MHz.

The MAX8505 employs a peak current mode control architecture that simplifies the voltage feedback

loop compensation. A simple Type II compensation network (R1 and C8) stabilizes its feedback loop, further reducing the external component account. The above circuit is designed for 1% initial set output voltage error and 5% maximum output voltage deviation for 50% step load change (25% to 75%), as shown in **Figure 2**. The output voltage is set to 3.3V, however, other output voltages (from 0.8V to 3.3V) can be set by changing the feedback resistor divider (R2, R3, and R4). The above circuit is stable with any output voltage from 0.8V to 3.3V. Table 1 shows the bill of materials.

Table 1. Bill of Materials

DESIGNATION	QTY	DESCRIPTION
C1, C2	2	10µF ±20% 10V X5R ceramic capacitor (1206) TDK: C3216X5R0J106M
C3, C5, C6, C7	4	0.1µF ±10% 50V X7R ceramic capacitor (0603) TDK: C1608X7R1H104KT
C4	1	47µF ±20% 6.3V X5R ceramic capacitor (1210) TDK: C3225X5R0J476M
C8	1	220pF ±10% 50V X7R ceramic capacitor (0603) TDK: C1608X7R1H221K
C9	1	3300pF ±10% X7R 50V ceramic capacitor (0603) Murata: GRM188R71H332K or TDK: C1608X7R1H332K
D1	1	100mA, 30V Schottky diode (SOD-523) Central: CMOSH-3 (Top Mark 53)
L1	1	1.0µH Inductor Coilcraft: DO3316P-152 or DO3316P-102
R1	1	51.1kΩ, 1% resistor (0603)
R2	1	33.2kΩ, 1% resistor (0603)
R3	1	10kΩ, 1% resister (0603)
R4	1	536kΩ, 1% resistor (0603)
R5	1	10Ω, 5% resistor (0603)
R6	1	2kΩ, 5% resistor (0603)
U1	1	MAX8505EEE (16 pin QSOP)

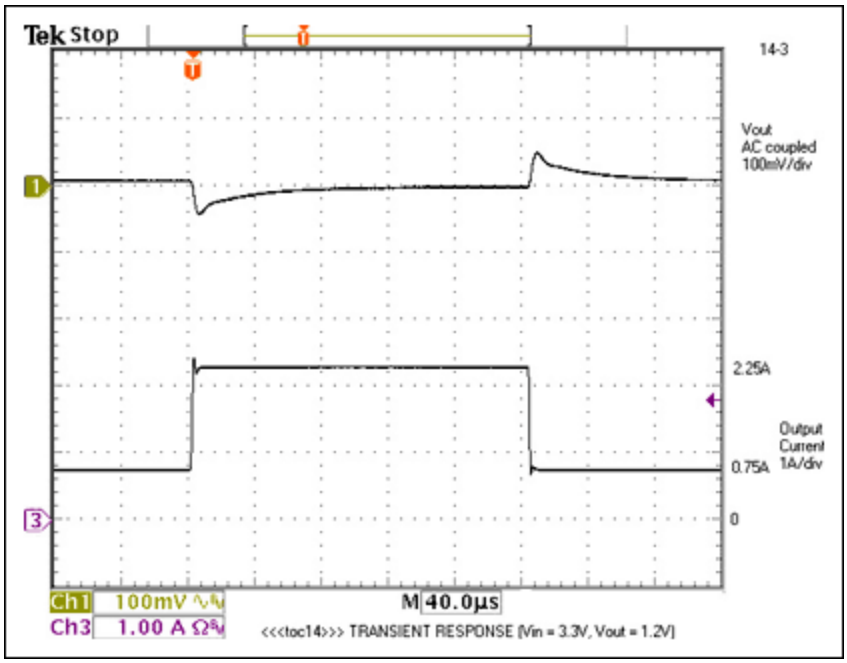

Figure 2. Shows the transient response for 50% step load change.

A layout example of the circuit shown in Figure 1 is given in **Figure 3**. The board has four 1oz copper layers. The total area is about 0.58in^2 excluding the jumpers and the POK pullup resistor.

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