LINEAR TECHNOLOGY

DESIGN NOTES

Compact Step-Up Converter Conserves Battery Power

Design Note 358

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Introduction

The LT®3464 is an ideal choice for portable devices which require a tiny, efficient and rugged step-up converter. The device, housed in a low profile (1mm) 8-lead ThinSOT™ package, integrates a Schottky diode, NPN main switch and PNP output disconnect switch. For light load efficiency, Burst Mode® operation is used to deliver power to the load. This results in high efficiency and minimal battery current draw over a broad range of load current. Quiescent current is only 25μA. While in shutdown, the output disconnect switch separates the load from the input, further increasing battery run time. This same feature reduces the fault current to 45mA (typ) when the output is shorted to ground, a feature that few boost converters offer.

Another advantage of the LT3464 is its small solution size. A constant off-time architecture is used with fixed peak current limit switching. The low current limit of 115mA and an off-time of 250ns enable the use of tiny surface mount inductors and capacitors, while an internal phase lead capacitor reduces output voltage ripple.

The LT3464 provides the designer with much flexibility. Output voltages up to 34V can be attained with the 36V rating of the main switch, while external control of the output voltage can be accomplished via the control pin. Its wide input voltage range of 2.3V to 10V allows for a variety of input voltage sources including one or two lithium-ion battery cells.

16V Bias Supply

Figure 1 shows a 16V bias supply that can provide 6.5mA at an efficiency of 77% from a lithium-ion battery (V_{IN} = 3.6V) as shown in Figure 2. The circuit uses a 22μH surface mount chip inductor with a 1210 footprint and a 0.33μF output capacitor with an 0805 footprint. The entire circuit occupies an area of 51mm^2. Smaller components can be used to further reduce the circuit area at the expense of efficiency. This supply can be used to bias small LCD panels and small passive organic LED (OLED) panels as well.

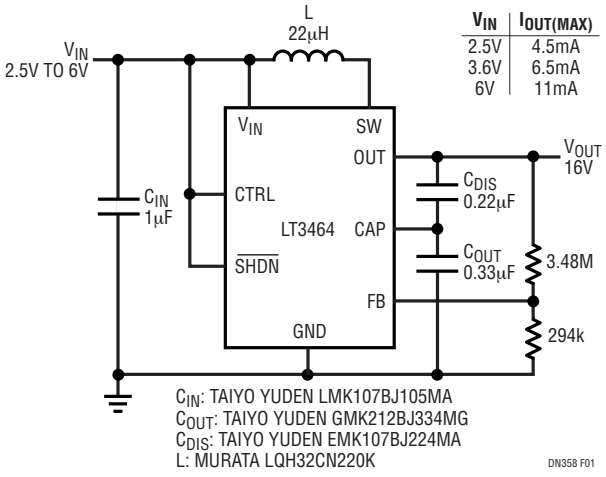

Figure 1. Efficient 16V Bias Supply Using 0805 Output Capacitor and 1210 Choke

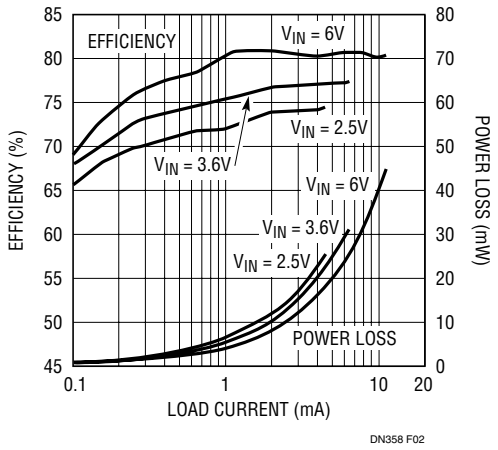

Figure 2. Efficiency and Power Loss of 16V Output LT3464 Boost Converter (Figure 1 Circuit)

20V Bias Supply with Variable Output Voltage

Manual adjustment of the bias voltage is required in some LCD applications in order to vary the contrast. The LT3464 CTRL pin eases this task. When a DC voltage of 1.25V or less is applied to the control pin, the internal reference is overridden, allowing external control of the bias voltage from (V_{IN} – 0.8V) to nominal V_{OUT}. Figure 3 shows a DAC-controlled bias supply. Other methods of driving the control pin include using a filtered PWM signal or a potentiometer.

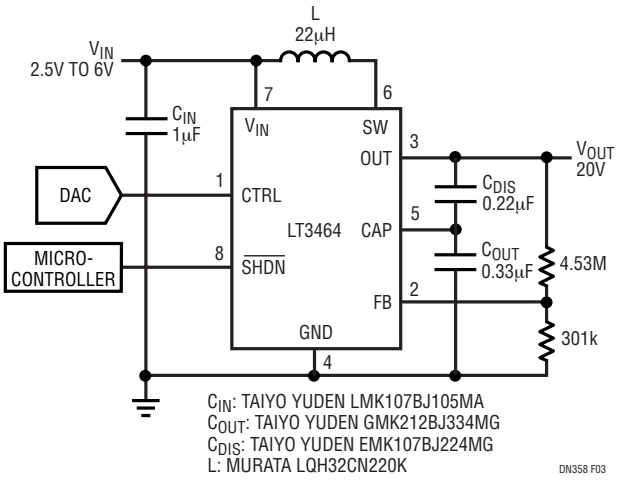

Figure 3. 20V Nominal Bias Supply with DAC Controlled Output Voltage and Shutdown

±20V Bias Supply

A dual, ±20V bias supply is shown in Figure 4. The +20V rail is regulated and an inverting charge pump tapped from its switch node forms a quasi-regulated –20V output. For a 10:1 difference in load currents, the two outputs are regulated within 5% of each other. The full load efficiency is 77% at an input voltage of 3.6V. One benefit of this circuit is that both outputs are isolated from the input during shutdown; the positive output is isolated by the internal disconnect switch and the negative output is isolated by the charge pump capacitor C_{CP}.

34V Bias Supply

The 36V rating of the main switch allows output voltages up to 34V as illustrated in Figure 5. The 34V bias supply shown can supply 3.5mA at 76% efficiency from a 3.6V

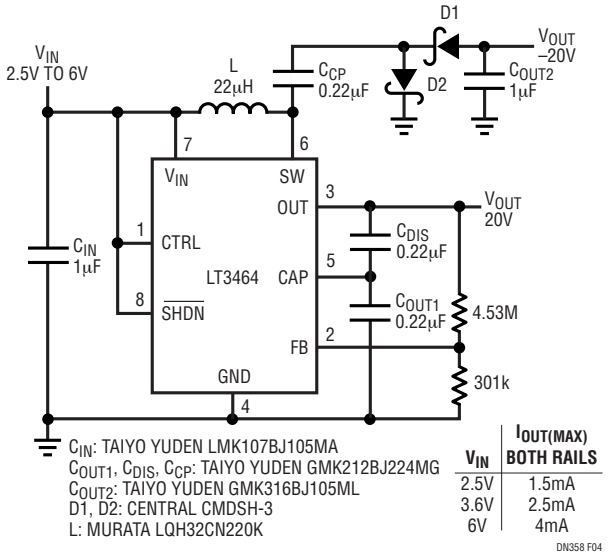

Figure 4. ±20V Bias Supply with Output Disconnect on Both Rails

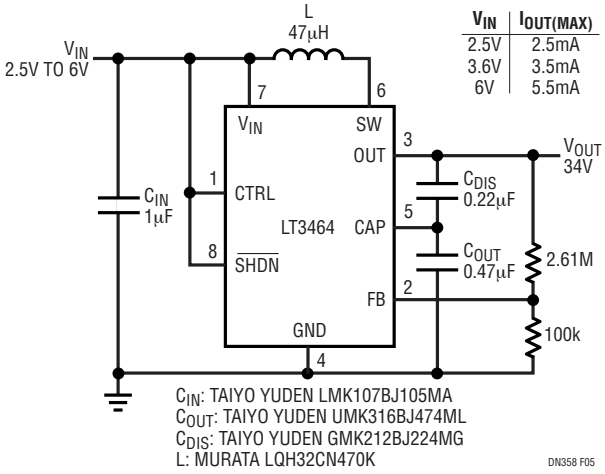

Figure 5. 34V Bias Supply Using the LT3464

input. The 47µH inductor has a 1210 footprint and the 0.47µF output capacitor has a 1206 footprint. The circuit occupies an area of only 55mm^2.

Conclusion

The LT3464 provides a compact, complete solution for generating high voltage, low current bias supplies.

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