**Features**

- Up to 95% Efficiency
- Output Disconnect and Inrush Current Limit
- Fixed Output Voltages of 3V, 3.3V or 5V
- Delivers 65mA at 3V from a 1V Input
- Delivers 60mA at 3.3V from a 1V Input, or 140mA at 3.3V from a 1.8V Input
- Delivers 175mA at 5V from a 3V Input
- Burst Mode® Operation: IQ = 7µA
- Only Three External Components
- VIN > VOUT Operation
- <1µA Shutdown Current
- Antiringing Control
- Short-Circuit and Ovetemperature Protection
- Very Low Profile of 1mm
- Tiny 6-Pin SC70 Package

**Applications**

- MP3 Players
- Portable Instruments
- Glucose Meters
- Digital Cameras

**Description**

The LTC3525-3/LTC3525-3.3/LTC3525-5 are high efficiency synchronous step-up DC/DC converters with output disconnect that can start up with an input as low as 1V. They offer a compact, high efficiency alternative to charge pumps in single cell or dual cell alkaline or Li-Ion applications. Only three small external components are required. The LTC3525 is offered in fixed output voltages of 3V, 3.3V or 5V.

The device includes a 0.5Ω N-channel MOSFET switch and a 0.8Ω P-channel synchronous rectifier. Peak switch current ranges from 150mA to 400mA, depending on load, providing enhanced efficiency. Quiescent current is an ultralow 7µA, maximizing battery life in portable applications.

Other features include <1µA shutdown current, antiringing control and thermal shutdown. The LTC3525 is available in a tiny 6-pin SC70 package.

**Typical Application**

\[ \text{LTC3525-3.3 Efficiency and Power Loss vs Load Current} \]
**LTC3525-3/ LTC3525-3.3/LTC3525-5**

**ABSOLUTE MAXIMUM RATINGS**

(Notes 1, 2, 3, 4, 5)

- **VIN, VOUT Voltage**: –0.3V to 6V
- **SW Voltage**: –0.3V to 6V
- **SW Voltage < 100ns**: –0.3V to 7V
- **SHDN Voltage**: –0.3V to 6V

Operating Temperature Range (Notes 2, 5)

- –40°C to 85°C

Storage Temperature Range

- –65°C to 125°C

Lead Temperature (Soldering, 10 sec)

- 300°C

---

**ORDER INFORMATION**

<table>
<thead>
<tr>
<th>LEAD FREE FINISH</th>
<th>TAPE AND REEL</th>
<th>PART MARKING</th>
<th>PACKAGE DESCRIPTION</th>
<th>TEMPERATURE RANGE</th>
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<tr>
<td>LTC3525ESC6-3#PBF</td>
<td>LTC3525ESC6-3#TRPBF</td>
<td>LCDR</td>
<td>6-Lead Plastic SC70</td>
<td>–40°C to 85°C</td>
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<tr>
<td>LTC3525ESC6-3.3#PBF</td>
<td>LTC3525ESC6-3.3#TRPBF</td>
<td>LBTG</td>
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<td>LTC3525ESC6-5#TRPBF</td>
<td>LBWT</td>
<td>6-Lead Plastic SC70</td>
<td>–40°C to 85°C</td>
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</tbody>
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Consult LTC Marketing for parts specified with wider operating temperature ranges.

Consult LTC Marketing for information on non-standard lead based finish parts.

For more information on lead free part marking, go to: [http://www.linear.com/leadfree/](http://www.linear.com/leadfree/)

For more information on tape and reel specifications, go to: [http://www.linear.com/tapeandreel/](http://www.linear.com/tapeandreel/)

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**ELECTRICAL CHARACTERISTICS** (LTC3525-3)

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at \( T_A = 25°C \).

\( V_{IN} = 1.2V, V_{SHDN} = 1.2V, V_{OUT} = 3V \) unless otherwise noted.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Start-Up Voltage</td>
<td></td>
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<td>1</td>
<td>V</td>
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<tr>
<td>Output Voltage</td>
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<td>3.00</td>
<td>3.09</td>
<td>V</td>
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<td>Quiescent Current, ( V_{OUT} )</td>
<td>( V_{IN} = V_{OUT} ) (Note 4)</td>
<td>7</td>
<td>15</td>
<td>µA</td>
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<tr>
<td>Quiescent Current, ( V_{IN} )</td>
<td>( V_{SHDN} = V_{IN} ) (Note 4)</td>
<td>0.5</td>
<td>3</td>
<td>µA</td>
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<tr>
<td>Quiescent Current, ( V_{IN} - ) Shutdown</td>
<td>( V_{SHDN} = 0V, V_{OUT} = 0V ) Not Including Switch Leakage</td>
<td>0.1</td>
<td>1</td>
<td>µA</td>
<td></td>
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<tr>
<td>NMOS Switch Leakage Current</td>
<td>( V_{IN} = V_{OUT} = V_{SW} = 5V, V_{SHDN} = 0V )</td>
<td>0.1</td>
<td>1</td>
<td>µA</td>
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<td>PMOS Switch Leakage Current</td>
<td>( V_{IN} = V_{SW} = 5V, V_{OUT} = 0V, V_{SHDN} = 0V )</td>
<td>0.1</td>
<td>3</td>
<td>µA</td>
<td></td>
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<tr>
<td>NMOS Switch On-Resistance</td>
<td>(Note 3)</td>
<td>0.6</td>
<td></td>
<td>Ω</td>
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<tr>
<td>PMOS Switch On-Resistance</td>
<td>(Note 3)</td>
<td>0.9</td>
<td></td>
<td>Ω</td>
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<td>Peak Current Limit</td>
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<td>0.4</td>
<td>0.45</td>
<td>A</td>
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<tr>
<td>SHDN Threshold Voltage</td>
<td></td>
<td>0.4</td>
<td>0.6</td>
<td>1</td>
<td>V</td>
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<tr>
<td>SHDN Input Current</td>
<td>( V_{SHDN} = V_{IN} ) or ( V_{OUT} )</td>
<td>0.01</td>
<td>1</td>
<td>µA</td>
<td></td>
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</tbody>
</table>
# ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25^\circ C$. $V_{IN} = 1.2V$, $V_{SHDN} = 1.2V$, $V_{OUT} = 3.3V$ unless otherwise noted.

## (LTC3525-3.3)

<table>
<thead>
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<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
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<th>UNITS</th>
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<tbody>
<tr>
<td>Input Start-Up Voltage</td>
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<td>0.85</td>
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<tr>
<td>Output Voltage</td>
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<td>V</td>
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<td></td>
<td>µA</td>
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<tr>
<td>Quiescent Current, $V_{IN}$</td>
<td>$SHDN = V_{IN}$ (Note 4)</td>
<td>0.5</td>
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<td></td>
<td>µA</td>
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<tr>
<td>Quiescent Current, $V_{IN} –$ Shutdown</td>
<td>$SHDN = 0V$, $V_{OUT} = 0V$ Not Including Switch Leakage</td>
<td>0.1</td>
<td>1</td>
<td></td>
<td>µA</td>
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<tr>
<td>NMOS Switch Leakage Current</td>
<td>$V_{IN} = V_{OUT} = V_{SW} = 5V$, $SHDN = 0V$</td>
<td>0.1</td>
<td>1</td>
<td></td>
<td>µA</td>
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<tr>
<td>PMOS Switch Leakage Current</td>
<td>$V_{IN} = V_{SW} = 5V$, $V_{OUT} = 0V$, $SHDN = 0V$</td>
<td>0.1</td>
<td>3</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>NMOS Switch On-Resistance</td>
<td>(Note 3)</td>
<td>0.5</td>
<td></td>
<td></td>
<td>Ω</td>
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<tr>
<td>PMOS Switch On-Resistance</td>
<td>(Note 3)</td>
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<td></td>
<td>Ω</td>
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<tr>
<td>Peak Current Limit</td>
<td></td>
<td>0.4</td>
<td>0.45</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>SHDN Threshold Voltage</td>
<td></td>
<td>0.4</td>
<td>0.6</td>
<td>1</td>
<td>V</td>
</tr>
<tr>
<td>SHDN Input Current</td>
<td>$V_{SHDN} = V_{IN}$ or $V_{OUT}$</td>
<td></td>
<td></td>
<td>0.01</td>
<td>µA</td>
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</table>

## (LTC3525-5)

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25^\circ C$. $V_{IN} = 2.4V$, $V_{SHDN} = 2.4V$, $V_{OUT} = 5V$ unless otherwise noted.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
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<tr>
<td>Input Start-Up Voltage</td>
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<td>0.85</td>
<td>1</td>
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<td>V</td>
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<tr>
<td>Output Voltage</td>
<td>(Note 6)</td>
<td>4.85</td>
<td>5.00</td>
<td>5.15</td>
<td>V</td>
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<td>Quiescent Current, $V_{OUT}$</td>
<td>$SHDN = V_{IN}$ (Note 4)</td>
<td>8</td>
<td>18</td>
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<td>µA</td>
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<td>$SHDN = V_{IN}$ (Note 4)</td>
<td>1.5</td>
<td>5</td>
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<td>µA</td>
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<tr>
<td>Quiescent Current, $V_{IN} –$ Shutdown</td>
<td>$SHDN = 0V$, $V_{OUT} = 0V$ Not Including Switch Leakage</td>
<td>0.1</td>
<td>1</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>NMOS Switch Leakage Current</td>
<td>$V_{IN} = V_{OUT} = V_{SW} = 5V$, $SHDN = 0V$</td>
<td>0.1</td>
<td>1</td>
<td></td>
<td>µA</td>
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<td>PMOS Switch Leakage Current</td>
<td>$V_{IN} = V_{SW} = 5V$, $V_{OUT} = 0V$, $SHDN = 0V$</td>
<td>0.1</td>
<td>3</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>NMOS Switch On-Resistance</td>
<td>(Note 3)</td>
<td>0.4</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>PMOS Switch On-Resistance</td>
<td>(Note 3)</td>
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<td></td>
<td>Ω</td>
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<tr>
<td>Peak Current Limit</td>
<td></td>
<td>0.4</td>
<td>0.5</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>SHDN Threshold Voltage</td>
<td></td>
<td>0.4</td>
<td>0.6</td>
<td>1</td>
<td>V</td>
</tr>
<tr>
<td>SHDN Input Current</td>
<td>$V_{SHDN} = V_{IN}$ or $V_{OUT}$</td>
<td></td>
<td></td>
<td>0.01</td>
<td>µA</td>
</tr>
</tbody>
</table>

**Note 1:** Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

**Note 2:** The LTC3525E is guaranteed to meet performance specifications from 0°C to 85°C. Specifications over the −40°C to 85°C operating temperature range are assured by design, characterization and correlation with statistical process controls.

**Note 3:** Specification is guaranteed by design and not 100% tested in production.

**Note 4:** Current Measurements are performed when the LTC3525 is not switching.

**Note 5:** This IC includes overtemperature protection that is intended to protect the device during momentary overload conditions. Junction temperature will exceed 125°C when overtemperature protection is active. Continuous operation above the specified maximum operating junction temperature may impair device reliability.

**Note 6:** Consult LTC Marketing for other output voltage options.
TYPICAL PERFORMANCE CHARACTERISTICS  \( T_A = 25^\circ C \) unless otherwise noted.
TYPICAL PERFORMANCE CHARACTERISTICS  $T_A = 25^\circ C$ unless otherwise noted.

**LTC3525-5 Load Regulation**

- $V_{IN} = 2.4V$
- $V_{IN} = 3.6V$
- $C_{OUT} = 22\mu F$
- $C_{OUT} = 10\mu F$

**Light Load Burst Frequency vs Load**

- Burst Frequency (kHz)
- $L = 10\mu H$
- $COUT = 22\mu F$
- $COUT = 10\mu F$

**V_{OUT} Variation vs Temperature** (Normalized to 25°C)

- $V_{IN} = 1.2V$
- $C_{OUT} = 22\mu F$
- $C_{OUT} = 10\mu F$

**Startup Delay Coming Out of Shutdown**

- Switching Frequency vs $V_{IN}$
- $L = 10\mu H$
- $LTC3525-5$
- $LTC3525-3.3$

**LTC3525-3.3 Input Current and $V_{OUT}$ at Start-Up**

- $V_{IN} = 1.2V$
- Input Current 100mA/DIV
- $VOUT 1V/DIV$
- 500µs/DIV

**LTC3525-3.3 Output Voltage Ripple**

- $V_{IN} = 1.2V$
- $C_{OUT} = 10\mu F$
- I_{OUT} 5mA
- I_{OUT} 40mA
- I_{OUT} 80mA
- 50µs/DIV
TYPICAL PERFORMANCE CHARACTERISTICS \( T_A = 25^\circ C \) unless otherwise noted.

- **LTC3525-3.3 Output Voltage Ripple**
  - \( V_{IN} = 1.2V \)
  - \( C_{OUT} = 22\mu F \)
  - \( I_{OUT} = 5mA, 40mA, 80mA \)
  - 50mV/DIV

- **LTC3525-3.3 Output Voltage Ripple**
  - \( V_{IN} = 2.4V \)
  - \( C_{OUT} = 22\mu F \)
  - \( I_{OUT} = 5mA, 100mA, 190mA \)
  - 50mV/DIV

- **LTC3525-5 Output Voltage Ripple**
  - \( V_{IN} = 2.4V \)
  - \( C_{OUT} = 22\mu F \)
  - \( I_{OUT} = 5mA, 50mA, 150mA \)
  - 50mV/DIV

- **LTC3525-5 Output Voltage Ripple**
  - \( V_{IN} = 3.6V \)
  - \( C_{OUT} = 22\mu F \)
  - \( I_{OUT} = 20mA, 100mA, 200mA \)
  - 50mV/DIV

- **LTC3525-3.3 50mA Load Step Response**
  - \( V_{IN} = 1.2V \)
  - \( C_{OUT} = 22\mu F \)
  - 500\mu s/DIV

- **LTC3525-3.3 100mA Load Step Response**
  - \( V_{IN} = 2.4V \)
  - \( C_{OUT} = 22\mu F \)
  - 500\mu s/DIV

- **LTC3525-5 100mA Load Step Response**
  - \( V_{IN} = 3.6V \)
  - \( C_{OUT} = 22\mu F \)
  - 500\mu s/DIV
PIN FUNCTIONS

**SHDN (Pin 1):** Logic-Controlled Shutdown Input. Connect to a voltage >1V to enable the LTC3525. Connect to a voltage <0.4V to disable the LTC3525.

**GND (Pins 2, 5):** Ground.

**VIN (Pin 3):** Input Voltage. The LTC3525 is powered from VIN until VOUT exceeds VIN. Once VOUT is greater than (VIN + 0.2V typical), it is powered from VOUT. Place a ceramic bypass capacitor from VIN to GND. A minimum value of 1µF is recommended.

**VOUT (Pin 4):** Output Voltage Sense and the Output of the Synchronous Rectifier. Connect the output filter capacitor from VOUT to GND, close to the IC. A minimum value of 10µF ceramic is recommended. Use 22µF for reduced output ripple. The output disconnect feature disconnects VOUT from VIN when SHDN is <0.4V.

**SW (Pin 6):** Switch Pin. Connect an inductor from this pin to VIN. An internal antiringing resistor is connected across SW and VIN after the inductor current has dropped to zero to minimize EMI.

**BLOCK DIAGRAM**

![Block Diagram](image-url)
The LTC3525 is a high performance Burst Mode operation only, synchronous boost converter requiring only three small external components. Its simplicity and small size make it a high efficiency alternative to charge pump designs. It is designed to start up from a single alkaline or nickel cell, with input voltages as low as 1V, or from two or three cells (or a Li-ion battery), with voltages as high as 4.5V. Once started, VIN can be as low as 0.5V (depending on load current) and maintain regulation. The output voltage is preset internally to either 3V, 3.3V or 5V. Peak switch current is 400mA minimum, providing regulation with load currents up to 150mA, depending on input voltage.

Synchronous rectification provides high efficiency operation while eliminating the need for an external Schottky diode. True output disconnect eliminates inrush current at start-up, and allows VOUT to be disconnected from VIN, for zero shutdown current.

The output disconnect feature also allows the LTC3525 to maintain regulation with an input voltage equal to or greater than VOUT. Note, however, that the synchronous rectifier is not enabled in this mode resulting in lower efficiency and reduced output current capability.

The operating quiescent current is only 7µA typical, allowing the converter to maintain high efficiency at extremely light loads.

Shutdown

The LTC3525 is shut down by pulling SHDN below 0.4V, and made active by raising it above 1V. Although SHDN can be driven above VIN or VOUT (up to the absolute maximum rating) without damage, the LTC3525 has a proprietary test mode that may be engaged if SHDN is held in the range of 0.5V to 1V higher than the greater of VIN or VOUT. If the test mode is engaged, normal PWM switching action is interrupted, which can cause undesirable operation in some applications. Therefore, in applications where SHDN may be driven above VIN, a resistor divider or other means must be employed to keep the SHDN voltage below (VIN + 0.4V) to prevent the possibility of the test mode being engaged. Please refer to Figure 1 for two possible implementations.

After the SHDN pin rises, there is a short delay before switching starts. The delay is 20µs to 120µs, depending on input voltage (see Typical Performance Characteristics curve).

Start-Up

A start-up oscillator allows the LTC3525 to start with input voltages as low as 1V. It remains in start-up mode until two conditions are met. VOUT must exceed VIN by at least 0.2V typical and either VIN or VOUT must be greater than 1.8V typical.

During start-up, the synchronous rectifier is not enabled, and the internal P-channel synchronous rectifier acts as a follower, causing the peak voltage on SW to reach (VIN + 1V) typical. This limits inrush current by maintaining control of the inductor current when VOUT is less than VIN. To reduce power dissipation in the P-channel synchronous rectifier when the output is shorted, a foldback feature is incorporated that reduces the peak inductor current when VIN is more than 1.7V greater than VOUT.

Normal Operation

Once VOUT has increased more than 0.2V typical above VIN, and either voltage is above 1.8V, normal operation begins, with synchronous rectification enabled. In this mode, the internal N-channel MOSFET connected between SW and GND stays on until the inductor current reaches a maximum peak value, after which it is turned off and the P-channel synchronous rectifier is turned on. It stays on, delivering current to the output, until the inductor current has dropped below a minimum value at...
which point it turns off and the cycle repeats. When the output voltage reaches its regulated value both switches are turned off and the LTC3525 goes to sleep, during which time the output capacitor supplies current to the load. Once the output voltage drops approximately 9mV below the regulation value the IC leaves sleep mode and switching is resumed.

The LTC3525 has been designed for low output voltage ripple. The output voltage ripple is typically only 20mV peak-to-peak at light load and 60mV peak-to-peak at full load using the minimum recommended 10µF output capacitor for the LTC3525-3.3 and a 22µF capacitor for the LTC3525-5 (due to the capacitor's DC bias effect). An antiring circuit damps any oscillation at the switch node when the inductor current falls to zero.

### Power Adjust Feature

The LTC3525 incorporates a feature that maximizes efficiency at light load while providing increased power capability at heavy load by adjusting the peak and valley of the inductor current as a function of load. Lowering the peak inductor current to 150mA at light load optimizes efficiency by reducing conduction losses in the internal MOSFET switches. As the load increases, the peak inductor current is automatically increased to a maximum of 400mA. At intermediate loads, the peak inductor current may vary from 150mA to 400mA. Figure 2 shows an example of how the inductor current changes as the load increases. Please note that output capacitor values greater than 47µF will result in higher peak currents than necessary at light load. This will lower the light load efficiency.

The valley of the inductor current is automatically adjusted as well, to maintain a relatively constant inductor ripple current. This keeps the switching frequency relatively constant.

The maximum average load current that can be supported is given by:

$$I_{O(MAX)} = \frac{0.3 \cdot V_{IN} \cdot \eta}{V_{O}} \text{Amps}$$

where \( \eta \) is the efficiency (see Typical Performance Characteristics).

The “burst” frequency (how often the LTC3525 delivers a burst of current pulses to the load) is determined by the internal hysteresis (output voltage ripple), the load current and the amount of output capacitance. All Burst Mode operation or hysteretic converters will enter the audible frequency range when the load is light enough. However, due to the low peak inductor current at light load, circuits using the LTC3525 do not typically generate any audible noise.

![Figure 2. Inductor Current Changing as a Function of Load](image)
**Component Selection**

Inductor values between 4.7µH and 15µH are recommended. In most applications 10µH will yield the best compromise between size and efficiency. The inductor should be a low loss ferrite design and must be rated for peak currents of at least 400mA without saturating. Inductors with lower DC resistance will improve efficiency. Note that the inductor value does not have a significant effect on ripple current, so while lower values will increase the operating frequency, they do not reduce output voltage ripple.

Some recommended inductor examples are Murata LQH32C and Coilcraft LPO4812, LPO3310, DO3314, DS1608 and MSS4020.

A ceramic input bypass capacitor should be located as close as possible to the V\textsubscript{IN} and GND pins of the IC. A minimum value of 1µF is recommended. If the battery is more than a few inches away, a bulk tantalum decoupling cap of at least 10µF is recommended on V\textsubscript{IN}.

The output capacitor should also be a ceramic, located close to the V\textsubscript{OUT} and GND pins. A minimum value of 10µF is recommended. Increasing the value of the output capacitor to 22µF will result in lower output ripple. Higher capacitor values will only offer a small reduction in output ripple, while reducing light load efficiency by causing the peak inductor current to increase above its minimum value of 150mA. The input and output capacitors should be X5R or X7R types, not Y5V.

### Table 1. Inductor Vendor Information

<table>
<thead>
<tr>
<th>SUPPLIER</th>
<th>PHONE</th>
<th>FAX</th>
<th>WEBSITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murata</td>
<td>USA: (814) 237-1431</td>
<td>USA: (814) 238-0490</td>
<td><a href="http://www.murata.com">www.murata.com</a></td>
</tr>
<tr>
<td>Coilcraft</td>
<td>(847) 639-6400</td>
<td>(847) 639-1469</td>
<td><a href="http://www.coilcraft.com">www.coilcraft.com</a></td>
</tr>
<tr>
<td>Sumida</td>
<td>USA: (847) 956-0666</td>
<td>USA: (847) 956-0702</td>
<td><a href="http://www.sumida.com">www.sumida.com</a></td>
</tr>
</tbody>
</table>

### Table 2. Capacitor Vendor Information

<table>
<thead>
<tr>
<th>SUPPLIER</th>
<th>PHONE</th>
<th>FAX</th>
<th>WEBSITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murata</td>
<td>USA: (814) 237-1431</td>
<td>USA: (814) 238-0490</td>
<td><a href="http://www.murata.com">www.murata.com</a></td>
</tr>
<tr>
<td>Taiyo Yuden</td>
<td>(408) 573-4150</td>
<td>(408) 573-4159</td>
<td><a href="http://www.t-yuden.com">www.t-yuden.com</a></td>
</tr>
<tr>
<td>TDK</td>
<td>(847) 803-6100</td>
<td>(847) 803-6296</td>
<td><a href="http://www.component.tdk.com">www.component.tdk.com</a></td>
</tr>
<tr>
<td>AVX</td>
<td>(803) 448-9411</td>
<td>(803) 448-1943</td>
<td><a href="http://www.avxcorp.com">www.avxcorp.com</a></td>
</tr>
</tbody>
</table>

Figure 3. Recommended Component Placement
**TYPICAL APPLICATIONS**

**Single Cell to 3V Converter Using 1mm High Monolithic Inductor**

- **LTC3525-3**
  - 1V TO 1.6V
  - VIN
  - SHDN
  - GND
  - VOUT 3V 65mA
  - 10µF 4V
  - 6.8µH*
  - *FDK MIP322606R8M

**Single Alkaline or NiMH to 3.3V Converter with 1mm Profile**

- **LTC3525-3.3**
  - 1V TO 1.6V
  - VIN
  - SW
  - VOUT 3V 100mA
  - 10µF 6.3V
  - 6.8µH*
  - *MURATA GRM219R60J106KE191D

- **LTC3525-3.3**
  - 1.8V TO 3.2V
  - VIN
  - SW
  - VOUT 3.3V 140mA
  - 10µF
  - 10µH*
  - *MURATA LQH32CN1002K53

- **LTC3525-5**
  - 3V TO 4.2V
  - VIN
  - SW
  - VOUT 5V 175mA
  - 10µF
  - 10µH*
  - *COILCRAFT MSS4020-103MXD
SC6 Package
6-Lead Plastic SC70
(Reference LTC DWG # 05-08-1638 Rev B)

NOTE:
1. DIMENSIONS ARE IN MILLIMETERS
2. DRAWING NOT TO SCALE
3. DIMENSIONS ARE INCLUSIVE OF PLATING
4. DIMENSIONS ARE EXCLUSIVE OF MOLD FLASH AND METAL BURR
5. MOLD FLASH SHALL NOT EXCEED 0.254mm
6. DETAILS OF THE PIN 1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE INDEX AREA
7. EIAJ PACKAGE REFERENCE IS EIAJ SC-70
8. JEDEC PACKAGE REFERENCE IS MO-203 VARIATION AB

 recommending solder pad layout per IPC calculator

Gauge plane 0.15 BSC

0.10 – 0.40

0.26 – 0.46

0.10 – 0.18 (NOTE 3)

0.65 BSC

0.65 – 0.30

6 PLCS (NOTE 3)

1.00 REF

INDEX AREA

(NOTE 6)

1.15 – 1.35 (NOTE 4)

1.80 – 2.40 (NOTE 4)

1.80 – 2.20

1.5 – 0.30

RECOMMENDED SOLDER PAD LAYOUT PER IPC CALCULATOR

PIN 1

0.80 – 1.00

0.00 – 0.10 REF

0.00 – 0.10

SC6 SC70 1205 REV B

2.8 BSC 1.8 REF

0.47 MAX

0.65 REF

1.00 REF

Gauge plane

0.15 BSC

0.10 – 0.40

0.26 – 0.46

0.10 – 0.18 (NOTE 3)
**REVISION HISTORY**  (Revision history begins at Rev B)

<table>
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<th>REV</th>
<th>DATE</th>
<th>DESCRIPTION</th>
<th>PAGE NUMBER</th>
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<tr>
<td>B</td>
<td>09/10</td>
<td>Updated “Shutdown” section</td>
<td>8</td>
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Information furnished by Linear Technology Corporation is believed to be accurate and reliable. However, no responsibility is assumed for its use. Linear Technology Corporation makes no representation that the interconnection of its circuits as described herein will not infringe on existing patent rights.
**TYPICAL APPLICATION**

3.3V TO 5V Converter with 1.4mm Profile

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**RELATED PARTS**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT1615/LT1615-1</td>
<td>300mA/80mA (I_{SW}), High Efficiency Step-Up DC/DC Converter</td>
<td>( V_{IN} ): 1V to 15V, ( V_{OUT(MAX)} ) = 34V, ( I_{Q} ) = 20( \mu A ), ( I_{SD} ) &lt; 1( \mu A ), ThinSOT™ Package</td>
</tr>
<tr>
<td>LTC1751-3.3/ LTC1751-5</td>
<td>100mA, 800kHz, Micropower, Regulated Charge Pump DC/DC Converters</td>
<td>( V_{IN} ): 2.5V to 5.5V, ( V_{OUT(MAX)} ) = 3.3V/5V, ( I_{Q} ) = 20( \mu A ), ( I_{SD} ) &lt; 1( \mu A ), MS8 Package</td>
</tr>
<tr>
<td>LT1930/LT1930A</td>
<td>1A (I_{SW}), 1.2MHz/2MHz, High Efficiency Step-Up DC/DC Converter</td>
<td>High Efficiency, ( V_{IN} ): 2.6V to 16V, ( V_{OUT(MAX)} ) = 34V, ( I_{Q} ) = 4.2mA/5.5mA, ( I_{SD} ) &lt; 1( \mu A ), ThinSOT Package</td>
</tr>
<tr>
<td>LTC3200-5</td>
<td>100mA, 2MHz, Regulated 5V Charge Pump</td>
<td>( V_{IN} ): 2.7V to 4.5V, ( V_{OUT(MAX)} ) = 5V, ( I_{Q} ) = 2mA, ( I_{SD} ) &lt; 1( \mu A ), ThinSOT Package</td>
</tr>
<tr>
<td>LTC3400/LTC3400B</td>
<td>600mA (I_{SW}), 1.2MHz, Synchronous Step-Up DC/DC Converter</td>
<td>92% Efficiency, ( V_{IN} ): 0.5V to 5V, ( V_{OUT(MAX)} ) = 5V, ( I_{Q} ) = 19( \mu A )/300( \mu A ), ( I_{SD} ) &lt; 1( \mu A ), ThinSOT Package</td>
</tr>
<tr>
<td>LTC3401</td>
<td>1A (I_{SW}), 3MHz, Synchronous Step-Up DC/DC Converter</td>
<td>97% Efficiency, ( V_{IN} ): 0.5V to 5V, ( V_{OUT(MAX)} ) = 5.5V, ( I_{Q} ) = 38( \mu A ), ( I_{SD} ) &lt; 1( \mu A ), MS Package</td>
</tr>
<tr>
<td>LTC3402</td>
<td>2A (I_{SW}), 3MHz, Synchronous Step-Up DC/DC Converter</td>
<td>97% Efficiency, ( V_{IN} ): 0.5V to 5V, ( V_{OUT(MAX)} ) = 5.5V, ( I_{Q} ) = 38( \mu A ), ( I_{SD} ) &lt; 1( \mu A ), MS Package</td>
</tr>
<tr>
<td>LTC3421</td>
<td>3A (I_{SW}), 3MHz, Synchronous Step-Up DC/DC Converter with Output Disconnect</td>
<td>95% Efficiency, ( V_{IN} ): 0.5V to 4.5V, ( V_{OUT(MAX)} ) = 5.25V, ( I_{Q} ) = 12( \mu A ), ( I_{SD} ) &lt; 1( \mu A ), QFN-24 Package</td>
</tr>
<tr>
<td>LTC3425</td>
<td>5A (I_{SW}), 8MHz, 4-Phase Synchronous Step-Up DC/DC Converter with Output Disconnect</td>
<td>95% Efficiency, ( V_{IN} ): 0.5V to 5V, ( V_{OUT(MAX)} ) = 5.25V, ( I_{Q} ) = 12( \mu A ), ( I_{SD} ) &lt; 1( \mu A ), QFN-32 Package</td>
</tr>
<tr>
<td>LTC3429/LTC3429B</td>
<td>600mA, 500kHz Single/Dual Cell Micropower Synchronous Boost Converter with Output Disconnect</td>
<td>95% Efficiency, ( V_{IN} ): 1V to 4.5V, ( V_{OUT(MAX)} ) = 5V, ( I_{Q} ) = 20( \mu A ), ( I_{SD} ) &lt; 1( \mu A ), SC70 Package</td>
</tr>
<tr>
<td>LTC3458</td>
<td>1.4A (I_{SW}), 1.5MHz, Synchronous Step-Up DC/DC Converter with Output Disconnect</td>
<td>( V_{IN} ): 1.5V to 6V, ( V_{OUT(MAX)} ) = 7.5V, ( I_{SD} ) &lt; 1( \mu A ), 3mm × 4mm DFN Package</td>
</tr>
<tr>
<td>LTC3458L</td>
<td>1.7A (I_{SW}), 1.5MHz, Synchronous Step-Up DC/DC Converter with Output Disconnect</td>
<td>( V_{IN} ): 1.5V to 6V, ( V_{OUT(MAX)} ) = 6V, ( I_{SD} ) &lt; 1( \mu A ), 3mm × 4mm DFN Package</td>
</tr>
<tr>
<td>LTC3459</td>
<td>60mA, 10V Micropower Synchronous Boost Converter</td>
<td>95% Efficiency, ( V_{IN} ): 1.5V to 6V, ( V_{OUT(MAX)} ) = 10V, ( I_{Q} ) = 10( \mu A ), ( I_{SD} ) &lt; 1( \mu A ), ThinSOT Package</td>
</tr>
<tr>
<td>LT3464</td>
<td>85mA (I_{SW}), High Efficiency Step-Up DC/DC Converter with Integrated Schottky and PNP Disconnect</td>
<td>( V_{IN} ): 2.3V to 10V, ( V_{OUT(MAX)} ) = 34V, ( I_{Q} ) = 25( \mu A ), ( I_{SD} ) &lt; 1( \mu A ), ThinSOT Package</td>
</tr>
</tbody>
</table>