The LT®3479 is a current mode, fixed frequency step-up DC/DC converter with an internal 3A, 42V switch. Efficiencies of up to 89% can be achieved in typical applications. It features a programmable soft-start function to limit inductor current during start-up and inrush current protection to protect the LT3479 during shorts and line transients. Both inputs of the error amplifier are available to the user allowing positive and negative output voltages. Through an external resistor, the user can program the switching frequency from 200kHz to 3.5MHz. The low profile (0.75mm) 14-pin, 4mm × 3mm DFN package provides excellent thermal performance in a small footprint. The LT3479 is also available in a thermally enhanced 16-pin TSSOP package.
LT3479

**ABSOLUTE MAXIMUM RATINGS** (Note 1)

- SW, L, VS Voltages: 42V
- \( V_{IN}, \text{SHDN} \) Voltages: 24V
- FBP, FBN, VREF, RT, VC Voltages: 2V
- Junction Temperature: 125°C

Operating Temperature Range (Note 2): -40°C to 85°C
Storage Temperature Range: -65°C to 125°C
Lead Temperature (Soldering, 10 sec): 300°C

**PIN CONFIGURATION**

**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>
</tr>
</thead>
<tbody>
<tr>
<td>LT3479EDE#PBF</td>
<td>LT3479EDE#TRPBF</td>
<td>3479</td>
<td>14-Lead (4mm × 3mm) Plastic DFN</td>
<td>-40°C to 85°C</td>
</tr>
<tr>
<td>LT3479EFE#PBF</td>
<td>LT3479EFE#TRPBF</td>
<td>3479EFE</td>
<td>16-Lead Plastic TSSOP</td>
<td>-40°C to 85°C</td>
</tr>
</tbody>
</table>

Consult LTC Marketing for parts specified with wider operating temperature ranges.
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/)
**ELECTRICAL CHARACTERISTICS**  The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25^\circ C$. $V_{IN} = 2.5V$, $V_{SHDN} = 2.5V$.

<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>Minimum Input Voltage</td>
<td></td>
<td>2.3</td>
<td>2.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Quiescent Current</td>
<td>$V_{IN} = 2.5V$, $V_{SHDN} = 0V$</td>
<td>0.1</td>
<td>1</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 2.5V$, $V_{SHDN} = 2.5V$, $V_C = 0.3V$ (Not Switching)</td>
<td>5</td>
<td>7.5</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Reference Voltage</td>
<td>Measured at $V_{REF}$ Pin</td>
<td></td>
<td>1.216</td>
<td>1.235</td>
<td>1.250</td>
</tr>
<tr>
<td>Reference Voltge Line Regulation</td>
<td>$2.5V &lt; V_{IN} &lt; 24V$, $V_C = 0.3V$</td>
<td>0.01</td>
<td>0.03</td>
<td></td>
<td>%/V</td>
</tr>
<tr>
<td>Maximum $V_{REF}$ Pin Current</td>
<td>Out of Pin</td>
<td>100</td>
<td></td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>Soft-Start Pin Current</td>
<td>$SS = 0.5V$, Out of Pin</td>
<td>9</td>
<td></td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>FBP Pin Bias Current</td>
<td></td>
<td>25</td>
<td>100</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>FBN Pin Bias Current</td>
<td></td>
<td>25</td>
<td>100</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>Feedback Amplifier Offset Voltage</td>
<td>$FBP – FBN$, $V_C = 1V$</td>
<td>–2</td>
<td>2</td>
<td>6</td>
<td>mV</td>
</tr>
<tr>
<td>Feedback Amplifier Voltage Gain</td>
<td></td>
<td>250</td>
<td></td>
<td></td>
<td>V/V</td>
</tr>
<tr>
<td>Feedback Amplifier Transconductance</td>
<td></td>
<td>150</td>
<td></td>
<td></td>
<td>μS</td>
</tr>
<tr>
<td>Feedback Amplifier Sink Current</td>
<td>$V_{FBP} = 1.25V$, $V_{FBN} = 1.5V$, $V_C = 0.5V$</td>
<td>10</td>
<td></td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>Feedback Amplifier Source Current</td>
<td>$V_{FBP} = 1.25V$, $V_{FBN} = 1V$, $V_C = 0.5V$</td>
<td>10</td>
<td></td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td>$R_T = 17.8k$</td>
<td>0.9</td>
<td>1</td>
<td>1.15</td>
<td>MHz</td>
</tr>
<tr>
<td></td>
<td>$R_T = 113k$</td>
<td>160</td>
<td>200</td>
<td>240</td>
<td>kHz</td>
</tr>
<tr>
<td></td>
<td>$R_T = 1.79k$</td>
<td>2.7</td>
<td>3.5</td>
<td>4.1</td>
<td>MHz</td>
</tr>
<tr>
<td>Maximum Switch Duty Cycle</td>
<td>$R_T = 17.8k$</td>
<td></td>
<td>84</td>
<td>93</td>
<td>%</td>
</tr>
<tr>
<td>SHDN Pin Current</td>
<td>$V_{SHDN} = 5V$</td>
<td>30</td>
<td>60</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td></td>
<td>$V_{SHDN} = 0V$</td>
<td>0.1</td>
<td>1</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>SHDN Pin Threshold</td>
<td></td>
<td>0.3</td>
<td>1.5</td>
<td>2</td>
<td>V</td>
</tr>
<tr>
<td>Inductor Current Limit</td>
<td>(Note 3)</td>
<td>3.5</td>
<td>5</td>
<td>6.5</td>
<td>A</td>
</tr>
<tr>
<td>Switch Current Limit</td>
<td>(Note 3)</td>
<td>3</td>
<td>4.5</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Switch $V_{CESAT}$</td>
<td>$I_{SW} = 1A$ (Note 3)</td>
<td>120</td>
<td>200</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>Switch Leakage Current</td>
<td>$SW = 40V$</td>
<td>0.2</td>
<td>5</td>
<td></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 LT3479 is guaranteed to meet performance specifications from 0°C to 70°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:** Inductor Current Limit, Switch Current Limit and Switch $V_{CESAT}$ for DE package guaranteed by design and/or correlation to static test.
TYPICAL PERFORMANCE CHARACTERISTICS

Switch \(V_{CE(SAT)}\)

- Switch current limit:
  - 2.5 A at 25°C
  - 3 A at 75°C
  - 3.5 A at 125°C

VREF

- Voltage reference:
  - 1.25 V at 25°C
  - 1.35 V at 125°C

SHDN Pin Turn-On Threshold

- Threshold voltage:
  - 1.375 V at 25°C
  - 1.5 V at 125°C

SHDN Pin Current

- Current at threshold voltage:
  - 10 μA at 25°C
  - 15 μA at 125°C

Vin Pin Current

- Current at VREF:
  - 2 mA at 25°C
  - 4 mA at 125°C

Soft-Start Pin Current

- Current:
  - 20 mA at 25°C

Oscillator Frequency

- Frequency vs. feedback resistance:
  - 1 MHz at RT = 10k
  - 0.5 MHz at RT = 15k
  - 0.2 MHz at RT = 20k

Feedback Amplifier Offset Voltage

- Offset voltage vs. temperature:
  - 4 mV at 25°C
  - 2 mV at 125°C

\(V_{IN} = 24\text{V}\)

- Current limit:
  - 5 A at 125°C

\(V_{IN} = 2.5\text{V}\)

- Current limit:
  - 2 A at 125°C

\(V_{IN} = 5\text{V}\)

- Current limit:
  - 1 A at 125°C

\(V_{IN} = 12\text{V}\)

- Current limit:
  - 0.5 A at 125°C

\(V_{IN} = 20\text{V}\)

- Current limit:
  - 0.25 A at 125°C

\(V_{IN} = 28\text{V}\)

- Current limit:
  - 0.1 A at 125°C

\(V_{IN} = 36\text{V}\)

- Current limit:
  - 0.05 A at 125°C

\(V_{IN} = 48\text{V}\)

- Current limit:
  - 0.025 A at 125°C

\(V_{IN} = 60\text{V}\)

- Current limit:
  - 0.0125 A at 125°C

\(V_{IN} = 75\text{V}\)

- Current limit:
  - 0.00625 A at 125°C

\(V_{IN} = 100\text{V}\)

- Current limit:
  - 0.003125 A at 125°C

\(V_{IN} = 125\text{V}\)

- Current limit:
  - 0.0015625 A at 125°C

\(V_{IN} = 150\text{V}\)

- Current limit:
  - 0.00078125 A at 125°C

\(V_{IN} = 180\text{V}\)

- Current limit:
  - 0.000390625 A at 125°C

\(V_{IN} = 200\text{V}\)

- Current limit:
  - 0.0001953125 A at 125°C

\(V_{IN} = 220\text{V}\)

- Current limit:
  - 0.00009765625 A at 125°C

\(V_{IN} = 240\text{V}\)

- Current limit:
  - 0.000048828125 A at 125°C

\(V_{IN} = 260\text{V}\)

- Current limit:
  - 0.0000244140625 A at 125°C

\(V_{IN} = 280\text{V}\)

- Current limit:
  - 0.00001220703125 A at 125°C

\(V_{IN} = 300\text{V}\)

- Current limit:
  - 0.000006103515625 A at 125°C

\(V_{IN} = 320\text{V}\)

- Current limit:
  - 0.0000030517578125 A at 125°C

\(V_{IN} = 340\text{V}\)

- Current limit:
  - 0.00000152587890625 A at 125°C

\(V_{IN} = 360\text{V}\)

- Current limit:
  - 0.000000762939453125 A at 125°C

\(V_{IN} = 380\text{V}\)

- Current limit:
  - 0.0000003814697265625 A at 125°C

\(V_{IN} = 400\text{V}\)

- Current limit:
  - 0.00000019073486328125 A at 125°C

\(V_{IN} = 420\text{V}\)

- Current limit:
  - 0.000000095367431640625 A at 125°C

\(V_{IN} = 440\text{V}\)

- Current limit:
  - 0.0000000476837158125 A at 125°C

\(V_{IN} = 460\text{V}\)

- Current limit:
  - 0.00000002384185790625 A at 125°C

\(V_{IN} = 480\text{V}\)

- Current limit:
  - 0.000000011920928953125 A at 125°C

\(V_{IN} = 500\text{V}\)

- Current limit:
  - 0.0000000059604644765625 A at 125°C
PIN FUNCTIONS  (DFN/TSSOP)

SW (Pins 1, 2/Pins 1, 2): Switch Pins. Collector of the internal NPN power switch. Connect the inductor and diode here and minimize the metal trace area connected to this pin to minimize electromagnetic interference.

L (Pin 3/Pin 3): Inductor Pin. Connect the inductor to this pin.

VS (Pin 4/Pin 4): Inductor Supply. Must be locally bypassed. Powers the switch and the inductor. In case only one supply voltage is available, tie VIN and VS together.

VIN (Pin 5/Pin 5): Input Supply. Must be locally bypassed. Powers the internal control circuitry.

Rt (Pin 6/Pin 6): Timing Resistor Pin. Adjusts the switching frequency. Do not leave this pin open. See Table 4 for Rt values and switching frequencies.

SHDN (Pin 7/Pin 7): Shutdown. Tie to 1.5V or greater to enable the device. Tie below 0.3V to turn off the device.

VREF (Pin 8/Pin 9): Bandgap Voltage Reference. Internally set to 1.235V. Connect this pin to FBP if generating a positive output, or to an external resistor divider if generating a negative voltage. This pin can provide up to 100μA of current and can be locally bypassed with a 100pF capacitor.

FBP (Pin 9/Pin 10): The Noninverting Input to the Error Amplifier. Connect resistive divider tap here for negative output voltage.

FBN (Pin 10/Pin 11): The Inverting Input to the Error Amplifier. Connect resistive divider tap here for positive output voltage.

VC (Pin 11/Pin 12): Compensation Pin for Error Amplifier. Connect a series RC from this pin to GND. Typical values are 10kΩ and 2.2nF.


GND (Pins 13, 14/Pins 8, 14, 15, 16): Ground. Tie directly to local ground plane.

Exposed Pad (Pin 15/Pin 17): Power Ground. Must be connected to electrical PCB ground.
OPERATION

The LT3479 uses a fixed frequency, current mode control scheme to provide excellent line and load regulation. Operation can be best understood by referring to the Block Diagram. The start of each oscillator cycle sets the SR latch and turns on power switch Q1. The signal at the inverting input of the PWM comparator (SLOPE) is proportional to the sum of the switch current and oscillator ramp. When SLOPE exceeds $V_C$ (the output of the feedback amplifier), the PWM comparator resets the latch and turns off the power switch. In this manner, the feedback amplifier and PWM comparators set the correct peak current level to keep the output in regulation.

The LT3479 also features a soft-start function. During start-up, 10μA of current charges the external soft-start capacitor. The SS pin directly limits the rate of voltage rise on the $V_C$ pin, which in turn limits the peak switch current. The switch current is constantly monitored and not allowed to exceed the nominal value of 3A. If the switch current reaches 3A, the SR latch is reset regardless of the output of the PWM comparator. Current limit protects the power switch and external components.

Soft-start plays an important role in applications where the switch will reach levels of 30V or higher. During startup, an overshoot in the switch current together with the presence of high switch voltage can overstress the switch. A properly used soft-start feature will greatly improve the robustness of such designs.

In addition to soft-start, inrush current protection protects the LT3479 against shorts and line transients. During such faults, the inductor current can momentarily exceed 3A and damage the switch. Through an internal 8.5mΩ resistor placed in series with the inductor, the inrush current protection comparator measures the inductor current. If it exceeds 5A, a soft-start cycle is initiated. The LT3479 will remain in the soft-start condition until the fault has passed.
**APPLICATIONS INFORMATION**

**Capacitor Selection**

Low ESR (equivalent series resistance) ceramic capacitors should be used at the output to minimize the output ripple voltage. Use only X5R or X7R dielectrics, as these materials retain their capacitance over wider voltage and temperature ranges better than other dielectrics. A 4.7μF to 10μF output capacitor is sufficient for most high output current designs. Converters with lower output currents may need only a 1μF or 2.2μF output capacitor.

**Table 1. Ceramic Capacitor Manufacturers**

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PHONE</th>
<th>WEB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taiyo Yuden</td>
<td>(408) 573-4150</td>
<td><a href="http://www.t-yuden.com">www.t-yuden.com</a></td>
</tr>
<tr>
<td>AVX</td>
<td>(803) 448-9411</td>
<td><a href="http://www.avxcorp.com">www.avxcorp.com</a></td>
</tr>
<tr>
<td>Murata</td>
<td>(714) 852-2001</td>
<td><a href="http://www.murata.com">www.murata.com</a></td>
</tr>
</tbody>
</table>

**Inductor Selection**

Several inductors that work well with the LT3479 are listed in Table 2. However, there are many other manufacturers and devices that can be used. Consult each manufacturer for more detailed information and their entire range of parts. Ferrite core inductors should be used to obtain the best efficiency. Choose an inductor that can handle the necessary peak current without saturating, and ensure that the inductor has a low DCR (copper-wire resistance) to minimize I²R power losses. A 4.7μH or 10μH inductor will suffice for most LT3479 applications.

Inductor manufacturers specify the maximum current rating as the current where the inductance falls to some percentage of its nominal value—typically 65%. An inductor can pass a current larger than its rated value without damaging it. Aggressive designs where board space is precious will exceed the maximum current rating of the inductor to save board space. Consult each manufacturer to determine how the maximum inductor current is measured and how much more current the inductor can reliably conduct.

Physically larger inductors provide better efficiency than smaller ones. Figure 1 shows a 3% to 4% efficiency gain in using a larger inductor in a 1MHz, 5V to 12V application. The efficiency of the TOKO FDV0630-4R7M, which measures 7mm × 7.7mm and 3 mm thick, peaks at 87%. The smaller Sumida CDRH4D28-4R7 which is 5mm × 5mm and 3mm thick yields a peak efficiency of 85% in an identical application. Thus, if board space is abundant, then larger inductors should be used to maximize efficiency.

**Table 2. Suggested Inductors**

<table>
<thead>
<tr>
<th>MANUFACTURER PART NUMBER</th>
<th>I(DC) (A)</th>
<th>INDUCTANCE (μH)</th>
<th>MAX DCR (mΩ)</th>
<th>L × W × H (mm)</th>
<th>MANUFACTURER</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDRH6D283R0</td>
<td>3</td>
<td>3</td>
<td>24</td>
<td>6.7 × 6.7 × 3.0</td>
<td>Sumida</td>
</tr>
<tr>
<td>CDRH6D28100</td>
<td>1.7</td>
<td>10</td>
<td>65</td>
<td>6.7 × 6.7 × 3.0</td>
<td><a href="http://www.sumida.com">www.sumida.com</a></td>
</tr>
<tr>
<td>CDRH4D284R7</td>
<td>1.32</td>
<td>4.7</td>
<td>72</td>
<td>5.0 × 5.0 × 3.0</td>
<td></td>
</tr>
<tr>
<td>LM N 050 B4R7M</td>
<td>2.2</td>
<td>4.7</td>
<td>49</td>
<td>5.9 × 6.1 × 2.8</td>
<td>Taiyo Yuden</td>
</tr>
<tr>
<td>LM N 050 B100K</td>
<td>1.6</td>
<td>10</td>
<td>10</td>
<td>5.9 × 6.1 × 2.8</td>
<td><a href="http://www.t-yuden.com">www.t-yuden.com</a></td>
</tr>
<tr>
<td>LQH55DN4R7M01L</td>
<td>2.7</td>
<td>4.7</td>
<td>57</td>
<td>5.7 × 5.0 × 4.7</td>
<td>Murata</td>
</tr>
<tr>
<td>LQH55DN100M01K</td>
<td>1.7</td>
<td>10</td>
<td>130</td>
<td>5.7 × 5.0 × 4.7</td>
<td><a href="http://www.murata.com">www.murata.com</a></td>
</tr>
<tr>
<td>FDV0630-4R7M</td>
<td>4.2</td>
<td>4.7</td>
<td>49</td>
<td>7.0 × 7.7 × 3.0</td>
<td>Toko</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><a href="http://www.toko.com">www.toko.com</a></td>
</tr>
</tbody>
</table>

**Figure 1. Efficiency vs Inductor Size**

...
APPLICATIONS INFORMATION

Diode Selection
Schottky diodes, with their low forward voltage drop and fast switching speed, are ideal for LT3479 applications. Table 3 lists several Schottky diodes that work well with the LT3479. The diode’s average current rating must exceed the average output current. The diode’s maximum reverse voltage must exceed the output voltage. The diode conducts current only when the power switch is turned off (typically less than 50% duty cycle), so a 3A diode is sufficient for most designs. The companies below also offer Schottky diodes with high voltage and current ratings.

Table 3. Suggested Diodes

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PART NUMBER</th>
<th>MAX CURRENT (A)</th>
<th>MAX REVERSE VOLTAGE (V)</th>
<th>MANUFACTURER</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPS340</td>
<td>3</td>
<td>40</td>
<td></td>
<td>Microsemi</td>
</tr>
<tr>
<td>UPS315</td>
<td>3</td>
<td>15</td>
<td></td>
<td><a href="http://www.microsemi.com">www.microsemi.com</a></td>
</tr>
<tr>
<td>B220</td>
<td>2</td>
<td>20</td>
<td></td>
<td>Diodes, Inc</td>
</tr>
<tr>
<td>B230</td>
<td>2</td>
<td>30</td>
<td></td>
<td><a href="http://www.diodes.com">www.diodes.com</a></td>
</tr>
<tr>
<td>B240</td>
<td>2</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B320</td>
<td>3</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B330</td>
<td>3</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B340</td>
<td>3</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBM340</td>
<td>3</td>
<td>40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Setting Positive Output Voltages
To set a positive output voltage, select the values of R1 and R2 (see Figure 2) according to the following equation:

\[ V_{OUT} = 1.235V \left(1 + \frac{R1}{R2}\right) \]

Setting Negative Output Voltages
To set a negative output voltage, select the values of R3 and R4 (see Figure 3) according to the following equation:

\[ V_{OUT} = -1.235V \left(\frac{R3}{R4}\right) \]

Figure 2. Positive Output Voltage Feedback Connections

Figure 3. Negative Output Voltage Feedback Connections

Board Layout
As with all switching regulators, careful attention must be paid to the PCB board layout and component placement. To maximize efficiency, switch rise and fall times are made as short as possible. To prevent radiation and high frequency resonance problems, proper layout of the high frequency switching path is essential. Minimize the length and area of all traces connected to the SW pin and always use a ground plane under the switching regulator to minimize interplane coupling. The signal path including the switch, output diode D1 and output capacitor COUT, contains nanosecond rise and fall times and should be kept as short as possible. Recommended component placement is shown in Figure 4.

Soft-Start
For many applications, it is necessary to minimize the inrush current at start-up. The built-in soft-start circuit significantly reduces the start-up current spike and output voltage overshoot. A typical value is 10nF for 1.65ms. Figure 5 shows the start-up output voltage and inductor current waveforms in a typical application without a soft-start capacitor. Notice the output voltage overshoot and the large initial current. The addition of a 22nF capacitor eliminates the output overshoot and reduces the peak inductor current (Figure 6).
Switching Frequency

The switching frequency of the LT3479 is set by an external resistor attached to the \( R_T \) pin. Do not leave this pin open. A resistor must always be connected for proper operation. See Table 4 and Figure 7 for resistor values and corresponding frequencies.

<table>
<thead>
<tr>
<th>SWITCHING FREQUENCY (MHz)</th>
<th>( R_T ) (k( \Omega ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5</td>
<td>1.78</td>
</tr>
<tr>
<td>3</td>
<td>2.87</td>
</tr>
<tr>
<td>2.5</td>
<td>4.32</td>
</tr>
<tr>
<td>2</td>
<td>6.49</td>
</tr>
<tr>
<td>1.5</td>
<td>10.2</td>
</tr>
<tr>
<td>1</td>
<td>17.8</td>
</tr>
<tr>
<td>0.5</td>
<td>39.2</td>
</tr>
<tr>
<td>0.2</td>
<td>113</td>
</tr>
</tbody>
</table>

Figure 4. Suggested Board Layout

Figure 5. Start-Up with No Soft-Start Capacitor

Figure 6. Start-Up with \( C_{SS} = 22 \text{nF} \)
APPLICATIONS INFORMATION

Increasing switching frequency reduces output voltage ripple but also reduces efficiency. The user should set the frequency for the maximum tolerable output voltage ripple. Figure 8 shows a reduction in efficiency of about 4% between 1MHz and 2MHz operation in a typical application.

Inrush Current Protection

The LT3479 features a novel inductor current sensing circuit that protects the LT3479 during hot plugging and short circuits. An internal resistor in series with the external inductor senses the inductor current at all times. When it exceeds 5A, a soft-start cycle is initiated. Figure 9 shows an output overload with inrush current protection disabled. Notice that soft-start remains high, and that the inductor current does not return to zero. Figure 10 illustrates the benefits of inrush current protection. The output short initiates a new soft start cycle reducing the inductor current. After the fault has passed, the inductor current slowly returns to its equilibrium value. To ensure bond wire integrity, the inductor current should not exceed 8A for more than 10ms.

Bypassing the 8.5mΩ inductor current sense resistor disables inrush current protection. Connect the inductor supply trace and bypass capacitor to the L pin and leave the VS pin open to disable this feature.
TYPICAL APPLICATIONS

5V to 12V/800mA 1MHz Boost Converter

Efficiency

C1: TAIYO YUDEN LMK316BJ225MD
C2: AVX 1206 YD106MAT
D1: DIODES INC B320A
L1: TOKO FDV0630-4R7M

C1: TAIYO YUDEN LMK316BJ225MD
C2: AVX 1206 YD106MAT
D1: DIODES INC B320A
L1: SUMIDA CDRH8D43-100

5V to 12V/800mA 500kHz Boost Converter

Efficiency

C1: TAIYO YUDEN LMK316BJ225MD
C2: AVX 1206 YD106MAT
D1: DIODES INC B320A
L1: SUMIDA CDRH8D43-100
TYPICAL APPLICATIONS

3.3V to 8V/900mA Boost Converter

5V to −5V/600mA Inverting DC/DC Converter

Efficiency
TYPICAL APPLICATIONS

500mA, 12 White LED Driver

C1, C2: TAIYO YUDEN LMK316BJ225MD
D1: PHILIPS PMEG 2010
D2, D3: LUMILEDS LXHL-PW01
L1: SUMIDA CDRH4D28-4R7
M1: VISHAY SILICONIX Si2302ADS
TYPICAL APPLICATIONS

500mA, 12 White LED Driver

Vin 8V TO 16V
C1 4.7μF

L1 10μH

D1

VOUT 16V TO 24V
C2 4.7μF

D2

Vin = 8V
Vin = 12V
Vin = 16V

500mA, 12 White LED Driver

C1: TAIYO YUDEN EMK316BJ475ML
C2: TAIYO YUDEN TMK325BJ475ML
D1: DIODES INC B330B
D2: LUMILEDS LXHL-NW99
L1: SUMIDA CDRH0329-100

Efficiency

EFFICIENCY (%)  100  90  80  70  60  50

VIN = 8V
VIN = 12V
VIN = 16V

IOUT (A)  0  0.1  0.2  0.3  0.4  0.5

50  60  70  80  90  100
8V, 16V, –8V Triple Output Power Supply for TFTLCD Panels

C1: AVX 0805ZD475MAT
C2: AVX 1210YD226MAT
C3 to C6: X5R/X7R 10V
D1: MBRM120 OR EQUIVALENT
D2, D3: BAT54S OR EQUIVALENT
L1: SUMIDA CDRH4D28-3R3

Efficiency

<table>
<thead>
<tr>
<th>LOAD CURRENT (A)</th>
<th>EFFICIENCY (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>90</td>
</tr>
<tr>
<td>0.2</td>
<td>85</td>
</tr>
<tr>
<td>0.3</td>
<td>80</td>
</tr>
<tr>
<td>0.4</td>
<td>75</td>
</tr>
<tr>
<td>0.5</td>
<td>70</td>
</tr>
<tr>
<td>0.6</td>
<td>65</td>
</tr>
<tr>
<td>0.7</td>
<td>60</td>
</tr>
</tbody>
</table>
1A Dual Tracking Power Supply with Adjustable Outputs

- **VIN** = 10V to 14V
- **VOUT** = –7V to –10V
- **VOUT** = 7V to 10V

**Components:**
- **L1, L2, L3, L4:** SUMIDA CDRH6D38-150
- **C1, C2, C3, C4:** 3.3nF
- **C5:** 1μF
- **C6:** 10μF
- **C7:** 4.7μF
- **D1, D2:** DIODES INC DFLS230 2A, 30V
- **D3:** PHILIPS 1PS79SB62
- **R1:** 10k
- **R2:** 3.3k
- **R3:** 10k
- **R4:** 4.99k
- **R5:** 4.99k
- **R6:** 3.3k

**Diagrams:**
- Efficiency graph showing efficiency percentage vs. output current (IOUT) for different input/output voltage combinations.

**Notes:**
- All capacitors X5R/X7R dielectric or equivalent.
- D1, D2: DIODES INC DFLS230 2A, 30V
- D3: PHILIPS 1PS79SB62
- L1-L4: SUMIDA CDRH6D38-150
- **VIN** = 14V, **VOUT** = ±10V
- **VIN** = 10V, **VOUT** = ±7V
- **VIN** = 14V, **VOUT** = ±7V

**Efficiency Chart:**
- Efficiency (%) vs. IOUT (A) for different voltage combinations.
DE Package
14-Lead Plastic DFN (4mm x 3mm)
(Reference LTC DWG # 05-08-1708 Rev B)

NOTE:
1. DRAWING PROPOSED TO BE MADE VARIATION OF VERSION (WG86-3) IN JEDEC PACKAGE OUTLINE MO-229
2. DRAWING NOT TO SCALE
3. ALL DIMENSIONS ARE IN MILLIMETERS
4. DIMENSIONS OF EXPOSED PAD ON BOTTOM OF PACKAGE DO NOT INCLUDE MOLD FLASH. MOLD FLASH, IF PRESENT, SHALL NOT EXCEED 0.15mm ON ANY SIDE
5. EXPOSED PAD SHALL BE SOLDER PLATED
6. SHADOWED AREA IS ONLY A REFERENCE FOR PIN 1 LOCATION ON THE TOP AND BOTTOM OF PACKAGE

PACKAGE DESCRIPTION
PACKAGE DESCRIPTION

FE Package
16-Lead Plastic TSSOP (4.4mm)
(Reference LTC DWG # 05-08-1663)
Exposed Pad Variation BC

NOTE:
1. CONTROLLING DIMENSION: MILLIMETERS
2. DIMENSIONS ARE IN MILLIMETERS (INCHES)
3. DRAWING NOT TO SCALE
4. RECOMMENDED MINIMUM PCB METAL SIZE FOR EXPOSED PAD ATTACHMENT
   *DIMENSIONS DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.150mm (.006") PER SIDE

MILLIMETERS (INCHES) *

SEE NOTE 4

MAX
BSC
REF

TYP

RECOMMENDED SOLDER PAD LAYOUT

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.
**RELATED PARTS**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT1618</td>
<td>Constant Current, Constant Voltage 1.4MHz, High Efficiency Boost Regulator</td>
<td>( V_{\text{IN}}: 1.6V \text{ to } 18V, V_{\text{OUT(MAX)}} = 5.5V, I_O = 2.5mA, I_{SD} = &lt;1\mu A, \text{ QFN16 Package} )</td>
</tr>
<tr>
<td>LTC3216</td>
<td>1A Low Noise High Current LED Charge Pump with Independent Torch/Flash Current Control</td>
<td>( V_{\text{IN}}: 2.9V \text{ to } 4.4V, V_{\text{OUT(MAX)}} = 5.5V, I_O = 300\mu A, I_{SD} = &lt;1\mu A, \text{ DFN12 Package} )</td>
</tr>
<tr>
<td>LTC3436</td>
<td>3A (I_{SW}), 1MHz, 34V Step-Up DC/DC Converter</td>
<td>( V_{\text{IN}}: 3V \text{ to } 25V, V_{\text{OUT(MAX)}} = 34V, I_O = 0.9mA, I_{SD} = &lt;6\mu A, \text{TSSOP16E Package} )</td>
</tr>
<tr>
<td>LTC3453</td>
<td>Synchronous Buck-Boost High Power White LED Driver</td>
<td>( V_{\text{IN}}: 2.7V \text{ to } 5.5V, V_{\text{OUT(MAX)}} = 5.5V, I_O = 2.5mA, I_{SD} = &lt;1\mu A, \text{ QFN16 Package} )</td>
</tr>
<tr>
<td>LT3466</td>
<td>Dual Constant Current, 2MHz, High Efficiency White LED Boost Regulator with Integrated Schottky Diode</td>
<td>( V_{\text{IN}}: 2.7V \text{ to } 24V, V_{\text{OUT(MAX)}} = 40V, I_O = 5mA, I_{SD} = &lt;16\mu A, \text{ DFN Package} )</td>
</tr>
</tbody>
</table>