

# 4A High Efficiency Switching Regulators

## FEATURES

- Wide Input Voltage Range 3.5V to 30V
- Low Quiescent Current: 7mA
- Internal 4A Switch
- Very Few External Parts Required
- Self Protected Against Overloads
- Shutdown Mode Draws Only 100µA Supply Current
- Flyback Regulated Mode Has Fully Floating Outputs
- Comes in Standard 5-Pin Package
- Can Be Externally Synchronized (See LT1072 Data Sheet)

## APPLICATIONS

- Boost Converter
- High Efficiency Buck Converter
- PC Power Supply with Multiple Outputs
- Battery Up-Converter
- Negative-to-Positive Converter

### USER NOTE:

This data sheet is only intended to provide specifications, graphs, and a general functional description of the LT1271/LT1269. Application circuits are included to show the capability of the LT1271/LT1269. A complete design manual (AN-19) should be obtained to assist in developing new designs. This manual contains a comprehensive discussion of both the LT1070 and the external components used with it, as well as complete formulas for calculating the values of these components. The manual can also be used for the LT1271/LT1269 by factoring in the higher switch current rating and higher operating frequency.

## DESCRIPTION

The LT<sup>®</sup>1271 and LT1269 are monolithic high power switching regulators. Identical to the popular LT1070, except for switching frequency (LT1271 = 60kHz, LT1269 = 100kHz) and slightly lower switch current, they can be operated in all standard switching configurations including buck, boost, flyback and inverting. A high current, high efficiency switch is included on the die along with all oscillator, control and protection circuitry. Integration of all functions allows the LT1271/LT1269 to be built in a standard TO-220 power package. This makes them extremely easy to use and provides “bust proof” operation similar to that obtained with 3-pin linear regulators.

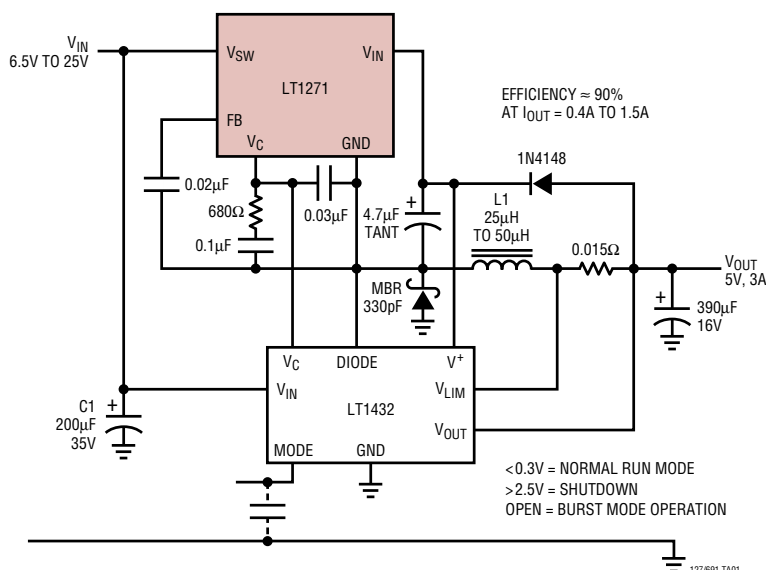
The LT1271/LT1269 operate with supply voltages from 3.5V to 30V, and draw only 7mA quiescent current. By utilizing current mode switching techniques, they provide excellent AC and DC load and line regulation.

A patented adaptive antisat switch drive allows very wide ranging load currents with no loss in efficiency. An externally activated shutdown mode reduces total supply current to 100µA typical for standby operation.

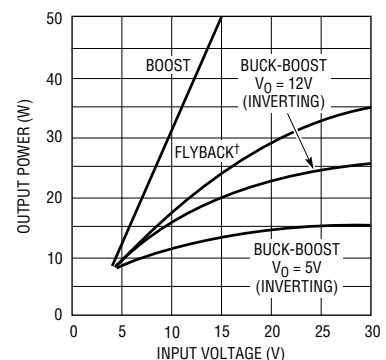
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## TYPICAL APPLICATION

### High Efficiency 5V Regulator with Burst Mode™ Operation



### Maximum Output Power



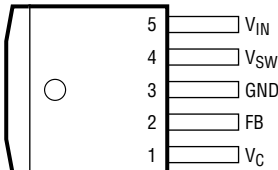
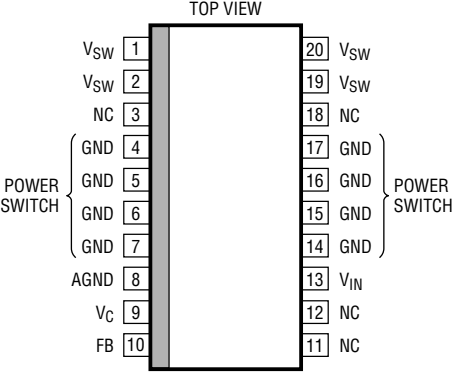
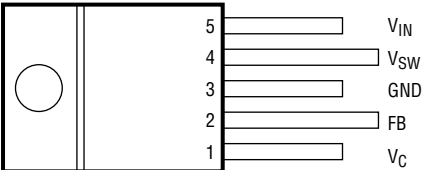
BUCK MODE OUTPUT POWER ≈ (3.5A)(V<sub>OUT</sub>)

†TRANSFORMER TURNS RATIO MUST BE OPTIMUM TO ACHIEVE FULL POWER.

## ABSOLUTE MAXIMUM RATINGS

|   |                |   |              |
|---|----------------|---|--------------|
| Supply Voltage .....                        | 30V            | Operating Junction Temperature Range        |              |
| Switch Output Voltage .....                 | 60V            | Operating .....                             | 0°C to 100°C |
| Feedback Pin Voltage (Transient, 1ms) ..... | ±15V           | Short Circuit .....                         | 0°C to 125°C |
| Storage Temperature Range .....             | -65°C to 150°C | Lead Temperature (Soldering, 10 sec.) ..... | 300°C        |

## PACKAGE/ORDER INFORMATION

|  |   |  |  |
|--|---|--|--|
| <p>FRONT VIEW</p>  <p>Q PACKAGE<br/>5-LEAD PLASTIC DD<br/><math>T_{J\text{ MAX}} = 100^{\circ}\text{C}</math>, <math>\theta_{\text{JC}} = 4^{\circ}\text{C/W}</math>, <math>\theta_{\text{JA}} = 30^{\circ}\text{C/W}^*</math></p>      | <p>ORDER PART NUMBER</p> <p>LT1271CQ<br/>LT1269CQ</p> | <p>TOP VIEW</p>  <p>SW PACKAGE<br/>20-LEAD PLASTIC WIDE SO</p> <p><math>\theta</math> WILL VARY FROM APPROXIMATELY 40°C/W WITH 0.75 SQ. IN. OF 1 OZ. COPPER TO 46°C/W WITH 0.33 SQ. IN. OF 1 OZ. COPPER</p> | <p>ORDER PART NUMBER</p> <p>LT1269CS</p> |
| <p>FRONT VIEW</p>  <p>T PACKAGE<br/>5-LEAD PLASTIC TO-220<br/><math>T_{J\text{ MAX}} = 100^{\circ}\text{C}</math>, <math>\theta_{\text{JC}} = 4^{\circ}\text{C/W}</math>, <math>\theta_{\text{JA}} = 50^{\circ}\text{C/W}^*</math></p> | <p>ORDER PART NUMBER</p> <p>LT1271CT<br/>LT1269CT</p> |  |  |

\*With device soldered to 1/2 square inch of 1oz copper over backside or internal layer ground plane. Consult factory for Industrial and Military grade parts.

## ELECTRICAL CHARACTERISTICS $V_{\text{IN}} = 15\text{V}$ , $V_{\text{C}} = 0.5\text{V}$ , $V_{\text{FB}} = V_{\text{REF}}$ , switch pin open, unless otherwise noted.

| SYMBOL           | PARAMETER                              | CONDITIONS  | MIN   | TYP   | MAX   | UNITS           |
|------------------|--|---|-------|-------|-------|-----------------|
| $V_{\text{REF}}$ | Reference Voltage                      | Measured at Feedback Pin  | 1.224 | 1.244 | 1.264 | V               |
|                  |  | $V_{\text{C}} = 0.8\text{V}$  | 1.214 | 1.244 | 1.274 | V               |
| $I_{\text{B}}$   | Feedback Input Current                 | $V_{\text{FB}} = V_{\text{REF}}$  |       | 350   | 750   | nA              |
|                  |  |   |       |       | 1100  | nA              |
| $g_{\text{m}}$   | Error Amplifier Transconductance       | $\Delta I_{\text{C}} = \pm 25\mu\text{A}$   |       | 3000  | 4400  | $\mu\text{mho}$ |
|                  |  |   |       | 2400  | 7000  | $\mu\text{mho}$ |
|                  | Error Amplifier Source or Sink Current | $V_{\text{C}} = 1.5\text{V}$  |       | 150   | 200   | $\mu\text{A}$   |
|                  |  |   |       | 120   | 400   | $\mu\text{A}$   |
|                  | Error Amplifier Clamp Voltage          | Hi Clamp, $V_{\text{FB}} = 1\text{V}$   | 1.8   |       | 2.3   | V               |
|                  |  | Lo Clamp, $V_{\text{FB}} = 1.5\text{V}$   | 0.25  | 0.38  | 0.52  | V               |
|                  | Reference Voltage Line Regulation      | $3\text{V} \leq V_{\text{IN}} \leq V_{\text{MAX}}$ , $V_{\text{C}} = 0.8\text{V}$ |       |       | 0.03  | %/V             |
| $A_{\text{V}}$   | Error Amplifier Voltage Gain           | $0.9\text{V} \leq V_{\text{C}} \leq 1.4\text{V}$                                  | 500   | 800   |       | V/V             |
|                  | Minimum Input Voltage (Note 3)         |   |       | 2.8   | 3.0   | V               |
| $I_{\text{Q}}$   | Supply Current                         | $3\text{V} \leq V_{\text{IN}} \leq V_{\text{MAX}}$ , $V_{\text{C}} = 0.6\text{V}$ |       | 7     | 10    | mA              |

**ELECTRICAL CHARACTERISTICS**  $V_{IN} = 15V$ ,  $V_C = 0.5V$ ,  $V_{FB} = V_{REF}$ , switch pin open, unless otherwise noted.

| SYMBOL                                | PARAMETER  | CONDITIONS  |        | MIN        | TYP       | MAX          | UNITS              |
|---------------------------------------|--|---|--------|------------|-----------|--------------|--------------------|
|                                       | Control Pin Threshold                              | Duty Cycle = 0                                      | ●      | 0.7<br>0.5 | 0.9       | 1.08<br>1.25 | V<br>V             |
|                                       | Normal/Flyback Threshold on Feedback Pin           |   |        | 0.4        | 0.45      | 0.54         | V                  |
| $V_{FB}$                              | Flyback Reference Voltage                          | $I_{FB} = 50\mu A$                                  | ●      | 15<br>14   | 16.3      | 17.6<br>18   | V<br>V             |
| $V_{FB}$                              | Change in Flyback Reference Voltage                | $0.05 \leq I_{FB} \leq 1mA$                         |        | 4.5        | 6.8       | 8.5          | V                  |
|                                       | Flyback Reference Voltage Line Regulation          | $I_{FB} = 50\mu A$<br>$3V \leq V_{IN} \leq V_{MAX}$ |        |            | 0.01      | 0.03         | %/V                |
|                                       | Flyback Amplifier Transconductance (gm)            | $\Delta I_C = \pm 10\mu A$                          |        | 150        | 300       | 650          | $\mu mho$          |
|                                       | Flyback Amplifier Source and Sink Current          | $V_C = 0.6V$ Source<br>$I_{FB} = 50\mu A$ Sink      | ●<br>● | 15<br>25   | 32<br>40  | 70<br>70     | $\mu A$<br>$\mu A$ |
| BV                                    | Output Switch Breakdown Voltage                    | $3V \leq V_{IN} \leq V_{MAX}$<br>$I_{SW} = 1.5mA$   | ●      | 60         | 75        |              | V                  |
| $V_{SAT}$                             | Output Switch (Note 1) "On" Resistance             |   | ●      |            | 0.2       | 0.33         | $\Omega$           |
|                                       | Control Voltage to Switch Current Transconductance |   |        |            | 6.4       |              | A/V                |
| $I_{LIM}$                             | Switch Current Limit (Note 2)                      | Duty Cycle = 50%<br>Duty Cycle = 80%                | ●<br>● | 4<br>3.2   |           | 8<br>8       | A<br>A             |
| $\frac{\Delta I_{IN}}{\Delta I_{SW}}$ | Supply Current Increase During Switch On-Time      |   |        |            | 25        | 40           | mA/A               |
| f                                     | Switching Frequency                                | LT1271<br>LT1269                                    | ●<br>● | 50<br>85   | 60<br>100 | 70<br>115    | kHz<br>kHz         |
| DC (max)                              | Maximum Switch Duty Cycle                          | LT1271<br>LT1269                                    |        | 85<br>80   | 92<br>90  | 95<br>95     | %<br>%             |
|                                       | Flyback Sense Delay Time                           |   |        |            | 1.5       |              | $\mu s$            |
|                                       | Shutdown Mode Supply Current                       | $3V \leq V_{IN} \leq V_{MAX}$ , $V_C = 0.05V$       |        |            | 100       | 400          | $\mu A$            |
|                                       | Shutdown Mode Threshold Voltage                    | $3V \leq V_{IN} \leq V_{MAX}$                       | ●      | 100<br>50  | 150       | 250<br>300   | mV<br>mV           |

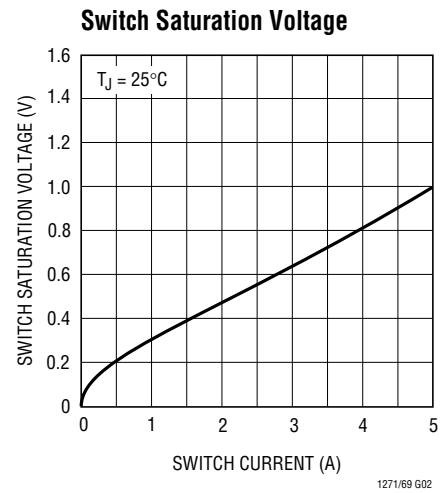
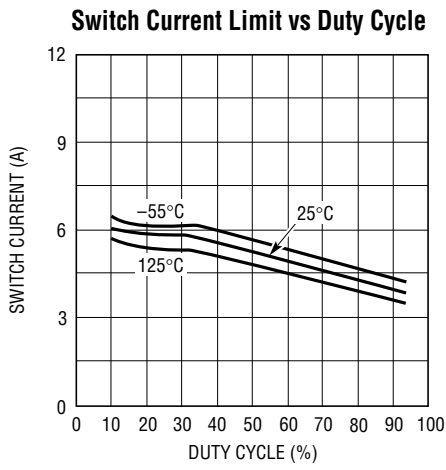
The ● denotes the specifications which apply over the full operating temperature range.

**Note 1:** Measured with  $V_C$  in hi clamp,  $V_{FB} = 0.8V$ .

**Note 2:** For duty cycles (DC) between 50% and 85%, minimum guaranteed switch current is given by  $I_{LIM} = 2.67 (2 - DC)$ .

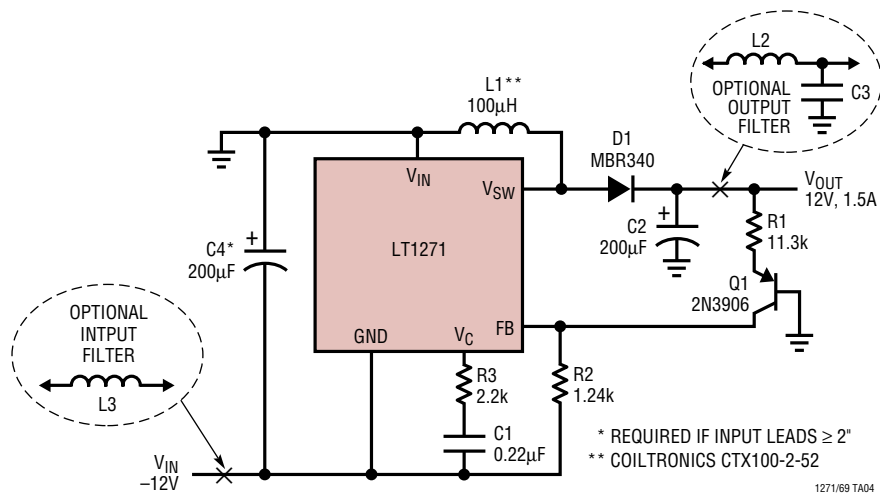
**Note 3:** Minimum input voltage.

## TYPICAL PERFORMANCE CHARACTERISTICS



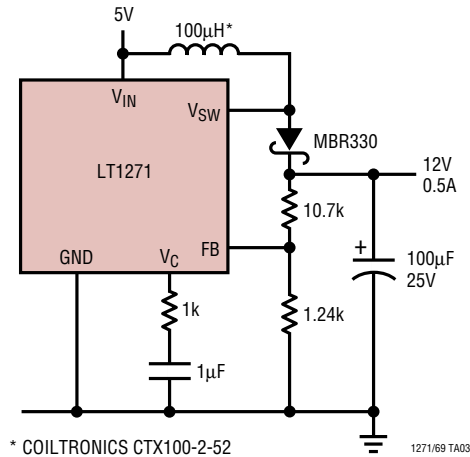
## TYPICAL APPLICATIONS

### Negative-to-Positive Buck-Boost Converter



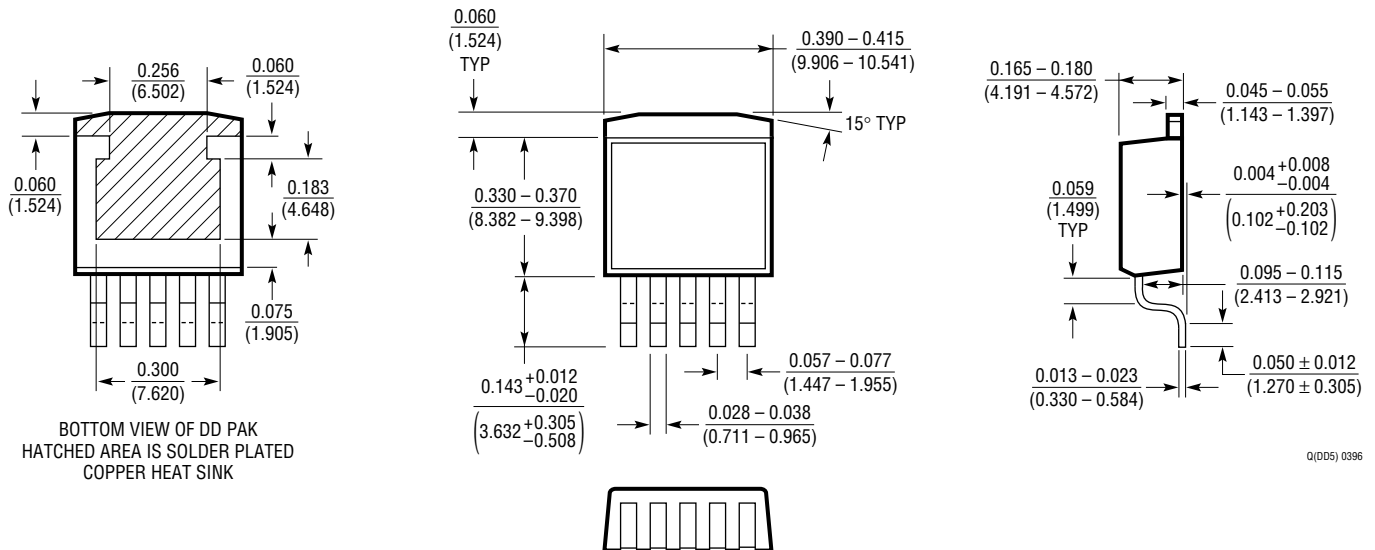
# TYPICAL APPLICATIONS

**Boost Converter (5V to 12V)**



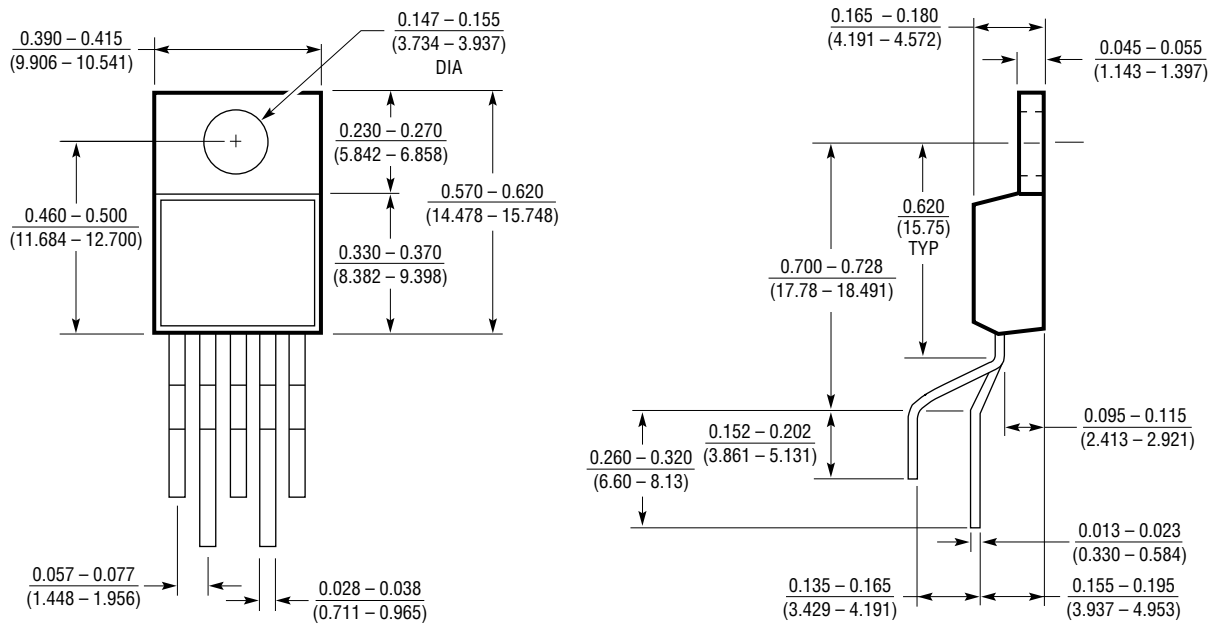
# PACKAGE DESCRIPTION Dimensions in inches (millimeters) unless otherwise noted.

**Q Package**  
**5-Lead Plastic DD Pak**  
 (LTC DWG # 05-08-1461)



**PACKAGE DESCRIPTION** Dimensions in inches (millimeters) unless otherwise noted.

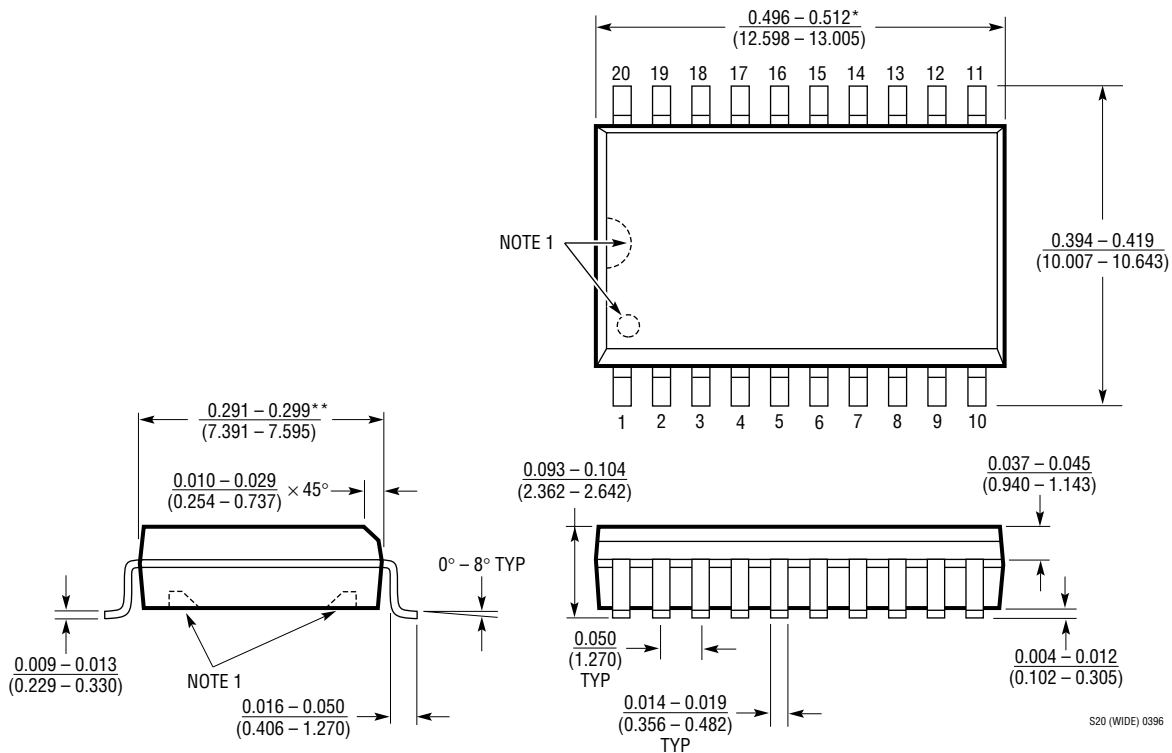
**T Package**  
**5-Lead Plastic TO-220 (Standard)**  
 (LTC DWG # 05-08-1421)



T5 (TO-220) 0398

**PACKAGE DESCRIPTION** Dimensions in inches (millimeters) unless otherwise noted.

**SW Package**  
**20-Lead Plastic Small Outline (Wide 0.300)**  
 (LTC DWG # 05-08-1620)



NOTE:

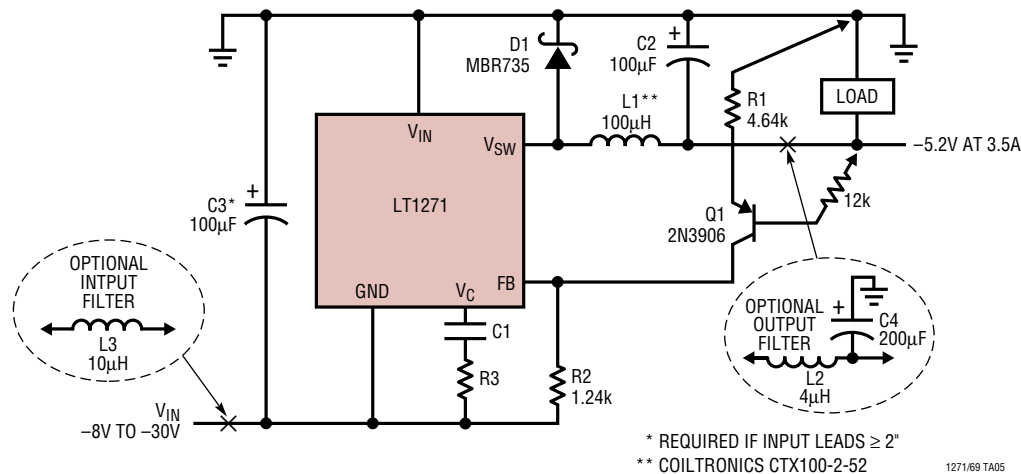
1. PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS. THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS

\*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

\*\*DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

# TYPICAL APPLICATION

Negative Buck Converter



## RELATED PARTS

| PART NUMBER | DESCRIPTION                            | COMMENTS                                |
|-------------|--|---|
| LT1171      | 100kHz, 2.5A Boost Switching Regulator | Good for $V_{IN}$ Up to 40V             |
| LT1370      | 500kHz, 6A Boost Switching Regulator   | 6A, 42V Internal Switch                 |
| LT1371      | 500kHz, 3A Boost Switching Regulator   | 3A, 42V Internal Switch, 90% Efficiency |
| LT1372      | 500kHz, 1.5A Boost Switching Regulator | Also Regulates Negative Flyback Outputs |
| LT1374      | 500kHz, 4.5A Buck Switching Regulator  | $V_{IN}$ Up to 25V, SO-8 Package        |
| LT1376      | 500kHz, 1.5A Buck Switching Regulator  | $V_{IN}$ Up to 25V, Uses 4.7µH Inductor |