# 1.5A STEP-DOWN/STEP-UP/INVERTING DC-DC CONVERTER TD34063

## General Description

The TD34063 is a monolithic switching regulator control circuit which contains the primary functions required for DC-DC converters. This device consists of internal temperature compensated reference, voltage comparator, controlled duty cycle oscillator with active current limit circuit, driver and high current output switch.

The TD34063 is specifically designed as a general DC-DC converter to be used in Step-Down, Step-Up and Voltage-Inverting applications with a minimum number of external components.

The TD34063 is available in 2 packages: SOIC-8 and DIP-8.

## Features

- Operation from 3.0V to 36V Input
- Low Standby Current
- Current Limiting
- Output Switch Current to 1.5A
- Output Voltage Adjustable
- Operation Frequency up to 180KHz
- Precision 2% Reference

## Applications

- Battery Chargers
- ADSL Modems
- Hubs
- Negative Voltage Power Supplies

## Package Types

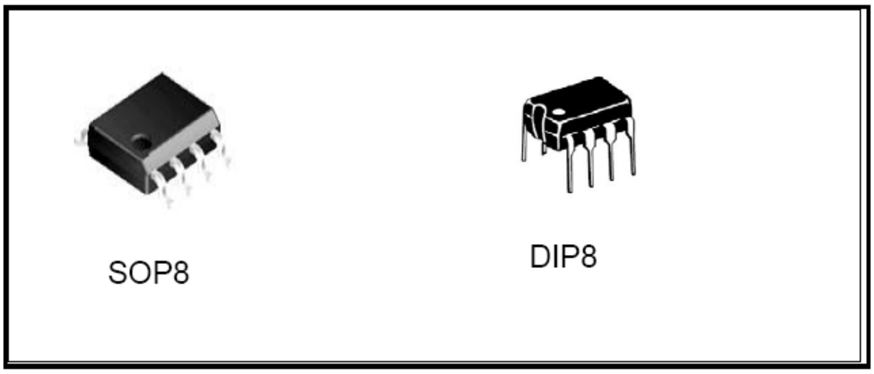



Figure 1. Package Types of TD34063

## Pin Configuration

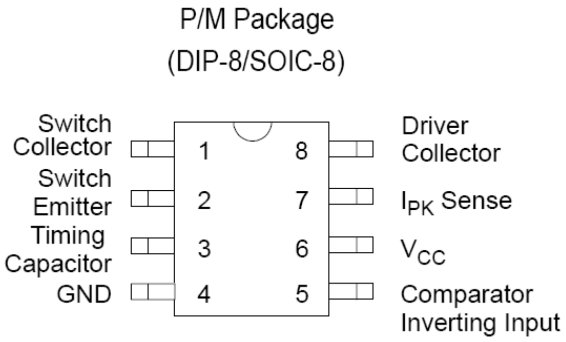



Figure 2. Pin Configuration of TD34063

## Functional Block Diagram

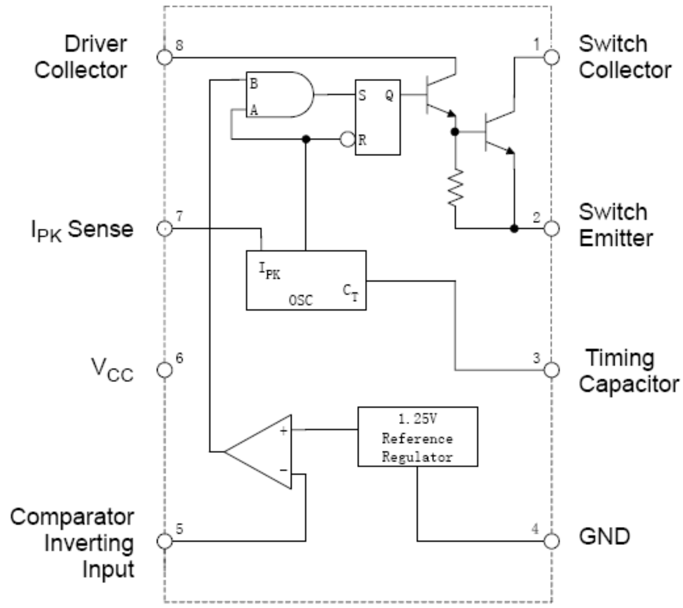
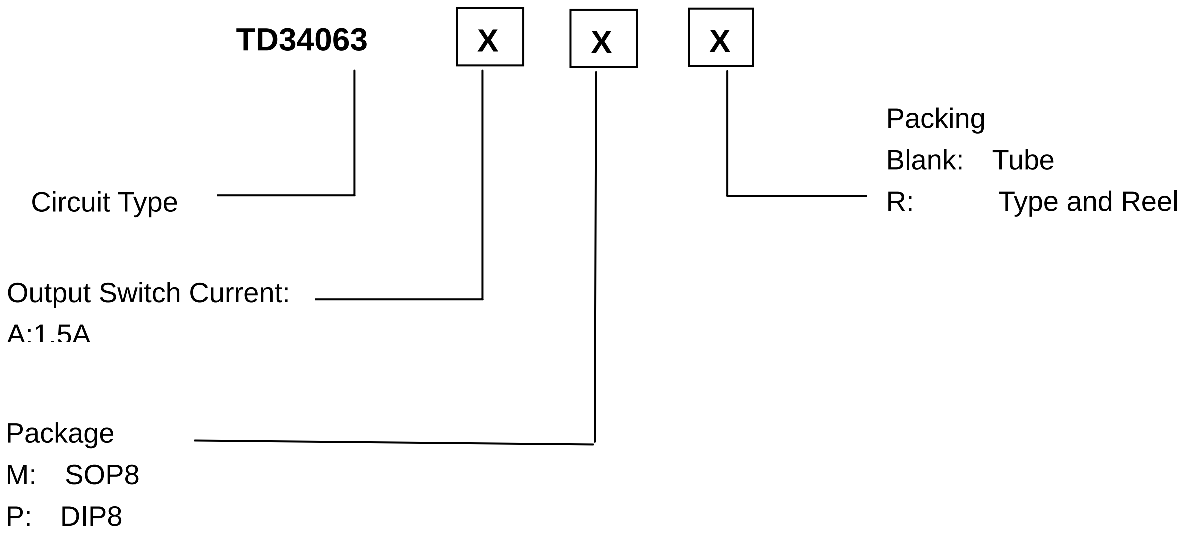



Figure 3. Functional Block Diagram of TD34063

## Pin Description

| Pin Number | Pin Name | Function |
|---|---|---|
| 1 | Switch Collector | Internal switch transistor collector |
| 2 | Switch Emitter | Internal switch transistor emitter |
| 3 | Timing Capacitor | Timing Capacitor to control the switching frequency |
| 4 | GND | Ground pin for all internal circuits |
| 5 | Comparator Inverting Input | Inverting input pin for internal comparator |
| 6 | VCC | Voltage supply |
| 7 | IPK Sense | Peak Current Sense Input by monitoring the voltage drop across an external current sense resistor to limit the peak current through the switch |
| 8 | Driver Collector | Voltage driver collector |

## Ordering Information



## Absolute Maximum Ratings (Note 1)

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Power Supply Voltage | | $V_{CC}$ | 40 | V |
| Comparator Input Voltage Range | | $V_{IR}$ | -0.3 to 40 | V |
| Switch Collector Voltage | | $V_{C(switch)}$ | 40 | V |
| Switch Emitter Voltage (VPIN 1=40V) | | $V_{E(switch)}$ | 40 | V |
| Switch Collector to Emitter Voltage | | $V_{CE(switch)}$ | 40 | V |
| Driver Collector Voltage | | $V_{C(driver)}$ | 40 | V |
| Driver Collector Current (Note 2) | | $I_{C(driver)}$ | 100 | mA |
| Switch Current | | $I_{SW}$ | 1.5 | A |
| Power Dissipation (TA=25 ℃ ) | DIP-8 | $P_D$ | 1.25 | W |
| | SOIC-8 | | 780 | mW |
| Thermal Resistance | DIP-8 | $R_{\theta JA}$ | 100 | ℃ /W |
| | SOIC-8 | | 160 | |
| Operating Junction Temperature | | $T_J$ | 150 | ℃ |
| Lead Temperature (Soldering, 10s) | | $T_{LEAD}$ | 260 | ℃ |
| Storage Temperature Range | | $T_{STG}$ | -65 to 150 | ℃ |
| ESD (Human body model) | | | 2000 | V |

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Note 2: Maximum package power dissipation limits must be observed.

## Recommended Operating Conditions

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply Voltage | VCC | 3 | 36 | V |
| Ambient Temperature | TA | -40 | 85 | ℃ |

## Electrical Characteristics

(VCC=5.0 V, TA=-40 to 85oC, unless otherwise specified.)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OSCILLATOR** | | | | | | |
| Frequency | fOSC | VPIN5=0V, CT=1.0nF TA=25℃ | 24 | 29 | 44 | KHz |
| Charge Current | ICHG | VCC=5.0V to 36V, TA=25℃ | 30 | 38 | 45 | uA |
| Discharge Current | IDISCHG | VCC=5.0V to 36V, TA=25℃ | 180 | 240 | 290 | uA |
| Discharge to Charge Current Ratio | IDISCHG/ICHG | Pin 7 to VCC, TA=25℃ | 5.2 | 6.5 | 7.5 | |
| Current Limit Sense Voltage | VIPK(sense) | ICHG=IDISCHG, TA=25℃ | 250 | 300 | 350 | mV |
| **OUTPUT SWITCH(Note3)** | | | | | | |
| Saturation Voltage,Dalington Connection | VCE(sat) | ISW=1.0A, Pins 1, 8 connected, Common Emitter | | 1.0 | 1.3 | V |
| Saturation Voltage (Note 4.) | VCE(sat) | ISW=1.0A, RPIN8=82Ω to VCC,Forced β=20, Common Emitter | | 0.45 | 0.7 | V |
| DC Current Gain | hFE | ISW=1.0A, VCE=5.0V,TA=25℃ | 50 | 75 | | |
| Collector Off-State Current | IC(off) | VCE=36V | | 0.01 | 100 | uA |
| **COMPARATOR** | | | | | | |
| Threshold Voltage | VTH | TA=25℃ | 1.225 | 1.250 | 1.275 | V |
| | | TA=-40 to 85℃ | 1.21 | 1.250 | 1.29 | |
| Threshold Voltage Line Regulation | REGLINE | VCC=3.0V to 36V | | 1.4 | 5 | mV |
| Input Bias Current | IIB | VIN=0V | | -20 | -400 | nA |
| **TOTAL DEVICE** | | | | | | |
| Supply Current | ICC | VCC=5.0V to 36V, CT=1.0nF,VPIN7=VCC, VPIN5 > VTH,VPIN2=GND, other pins open | | | 4 | mA |

Note 3: Low duty cycle pulse technique are used during test to maintain junction temperature as close to ambient temperature as possible.

Note 4: If the output switch is driven into hard saturation (non-Darlington configuration) at low switch currents (≤ 300mA) and high driver currents (≥ 30mA), it may take up to 2.0us for it to come out of saturation. This condition will shorten the off time at frequencies 30KHz, and is magnified at high temperatures. This condition does not occur with a Darlington configuration, since the output switch cannot saturate. If a non-Darlington configuration is used, the following output drive condition is recommended:

## Electrical Characteristics (Continued)

Forced β of output switch: $\frac{\text{IC output}}{\text{ICdriver - 7.0mA*}} \geqslant 10$

* The 100Ω resistor in the emitter of the driver device requires about 7.0 mA before the output switch conducts.

### Typical Performance Characteristics

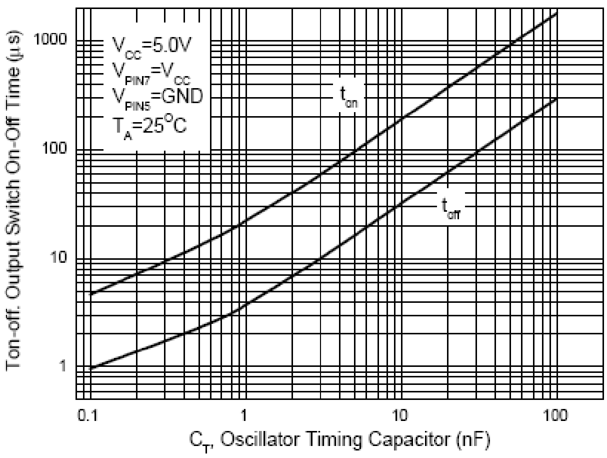



**Figure 4. Output Switch On-Off Time vs. Oscillator Timing Capacitor**

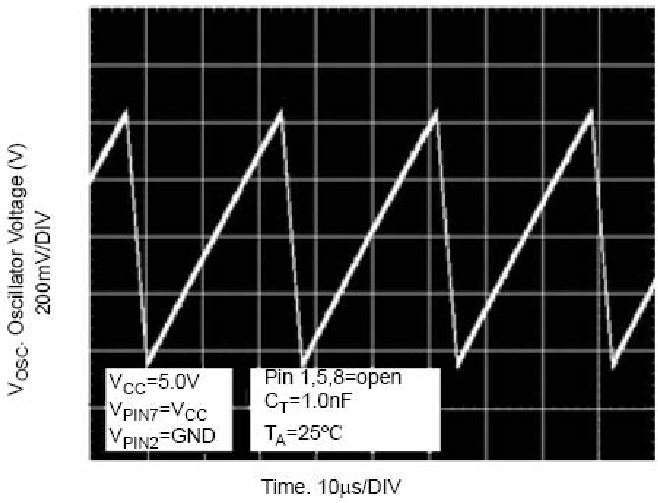



**Figure 5. Timing Capacitor Waveform**

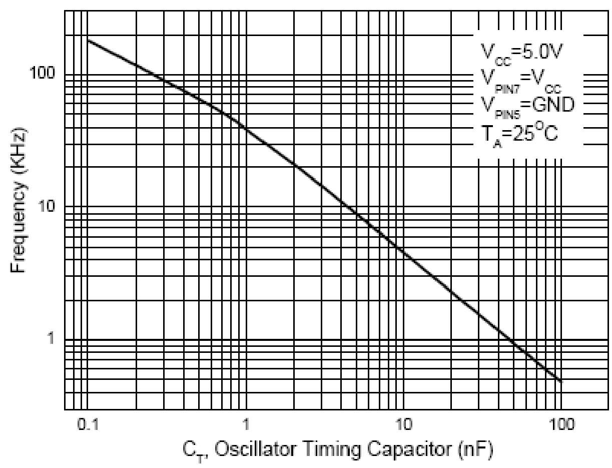



**Figure 6. Oscillator Frequency vs.Timing Capacitor**

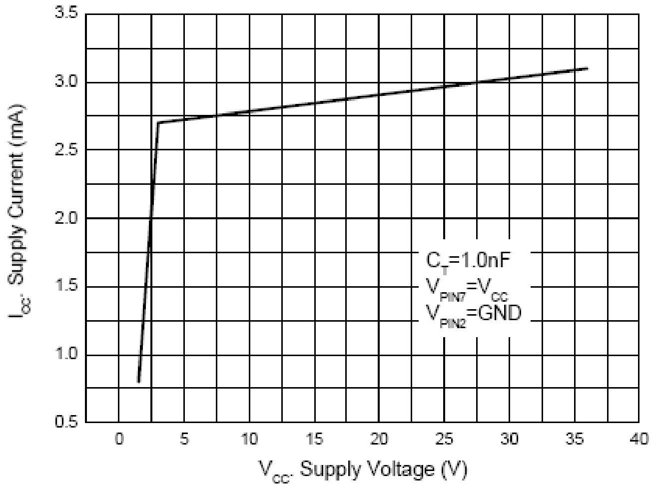



**Figure 7. Standard Supply Current vs. Supply Voltage**

# Typical Performance Characteristics (Continued)

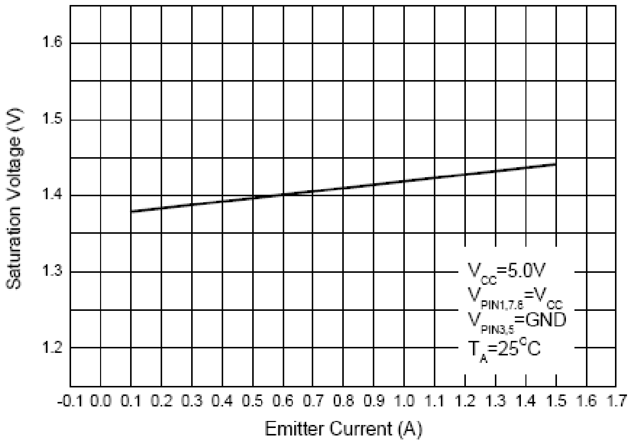



**Figure 8. Emitter Follower Configuration Output Saturation Voltage vs. Emitter current**

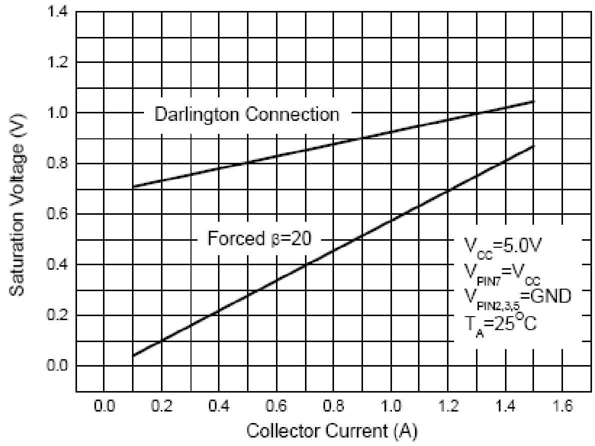



**Figure 9. Common Emitter Configuration Output Switch Saturation Voltage vs. Collector Current**

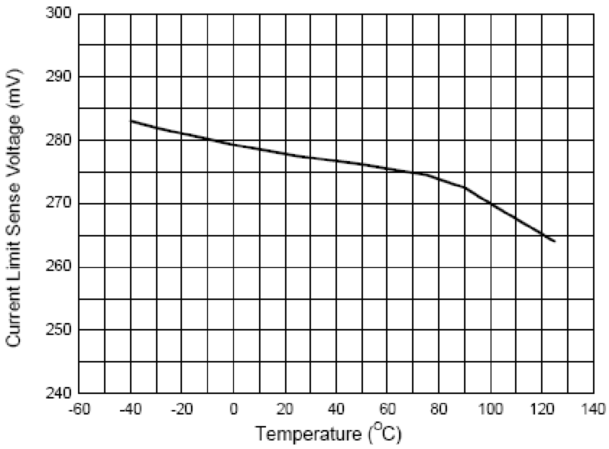



**Figure 10. Current Limit Sense Voltage vs. Temperature**

# Typical Applications

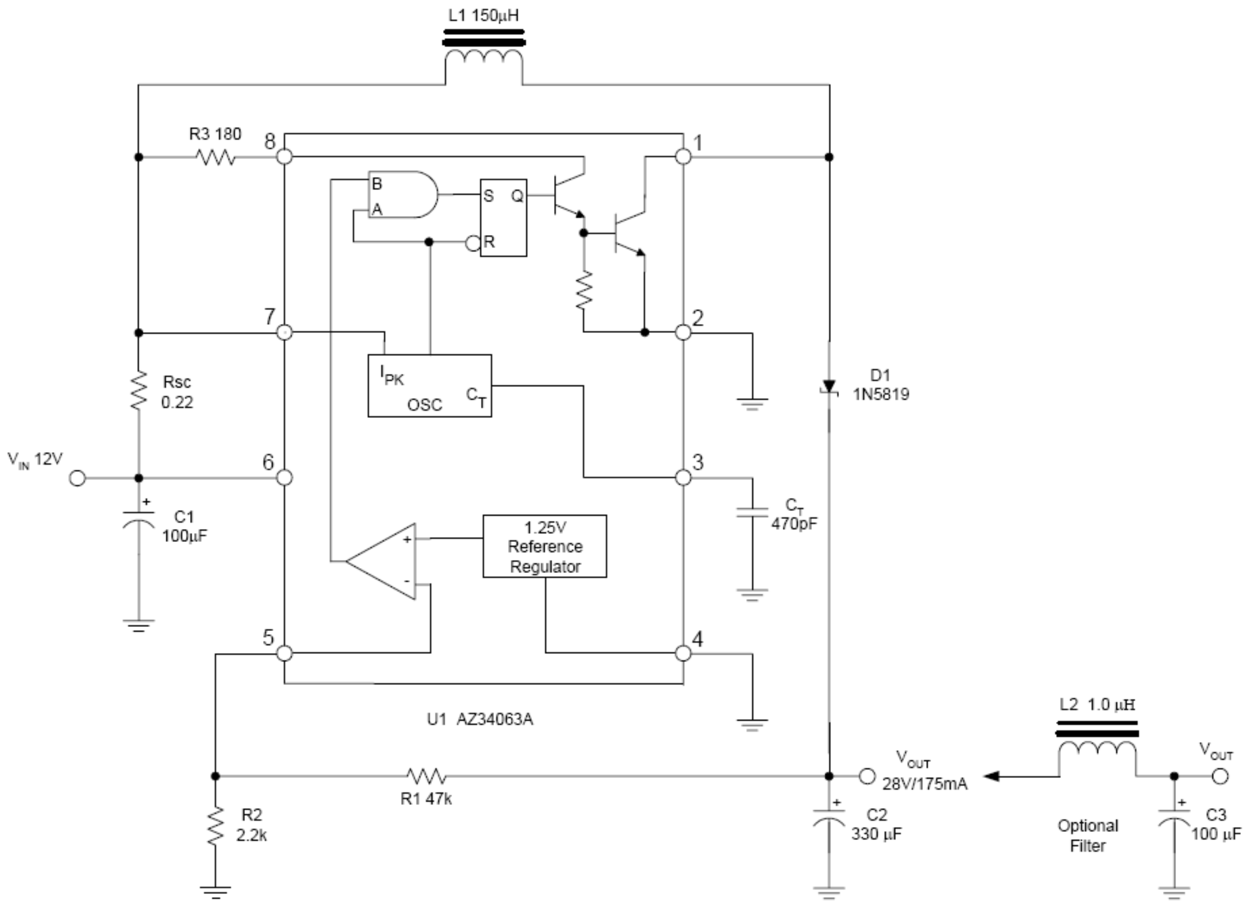



**Figure 10. Step-Up Converter (Note 5)**

Note 5: This is a typical step-up converter configuration. In the steady state, if the resistor divider voltage at pin5 is greater than the voltage in the non-inverting input, which is 1.25V determined by the internal reference, the output of the comparator will go low. At the next swithching period, the output switch will not conduct and the output voltage will eventually drop below its nominal voltage until the divider voltage at pin 5 is lower than 1.25V. Then the output of the comparator will go high, the output switch will be allowed to conduct. Since $V_{PIN5}=V_{OUT}*R2/(R1+R2)=1.25(V)$, the output voltage can be decided by $V_{OUT}=1.25 * (R1+R2)/R2$ (V).

# Typical Applications (Continued)

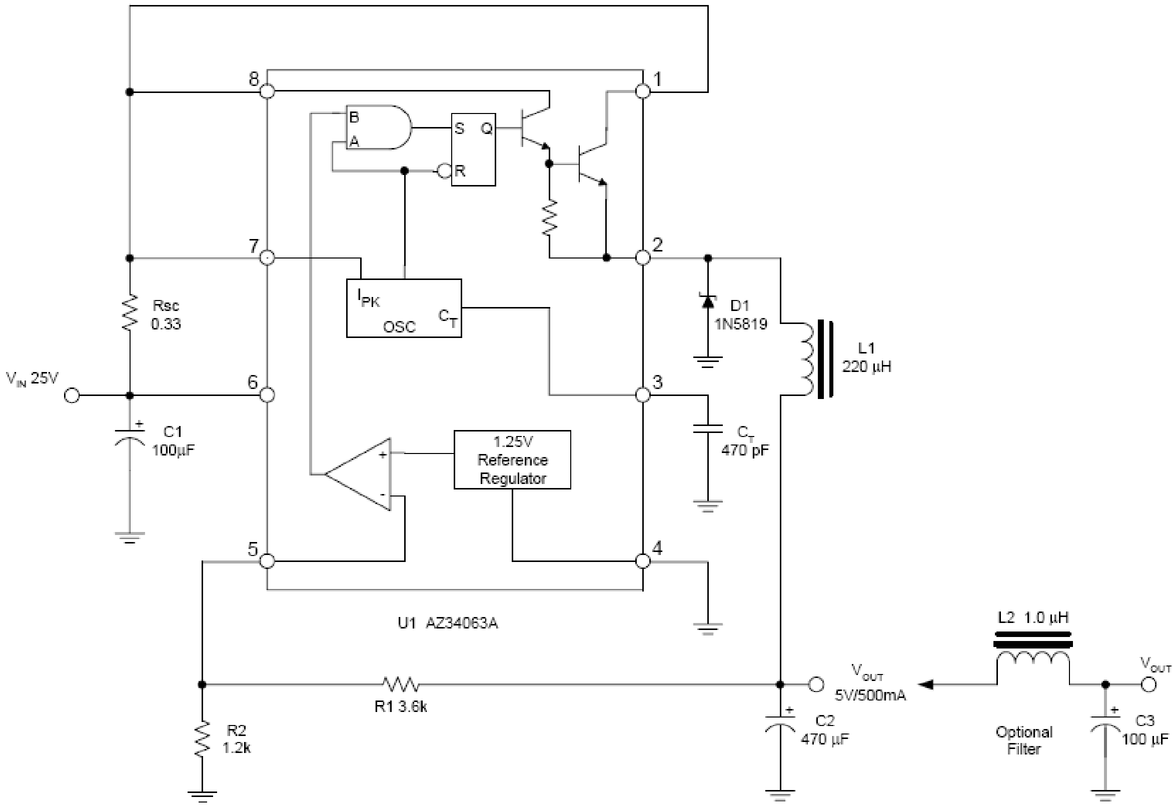



**Figure 11. Step-Down converter (Note 6)**

Note 6: This is a typical step-down converter configuration. The working process in the steady state is similar to step-up converter, $V_{PIN5}=V_{OUT}*R2/(R1+R2)=1.25$ (V), the output voltage can be decided by $V_{OUT}=1.25*(R1+R2)/R2$ (V).

## Typical Applications (Continued)

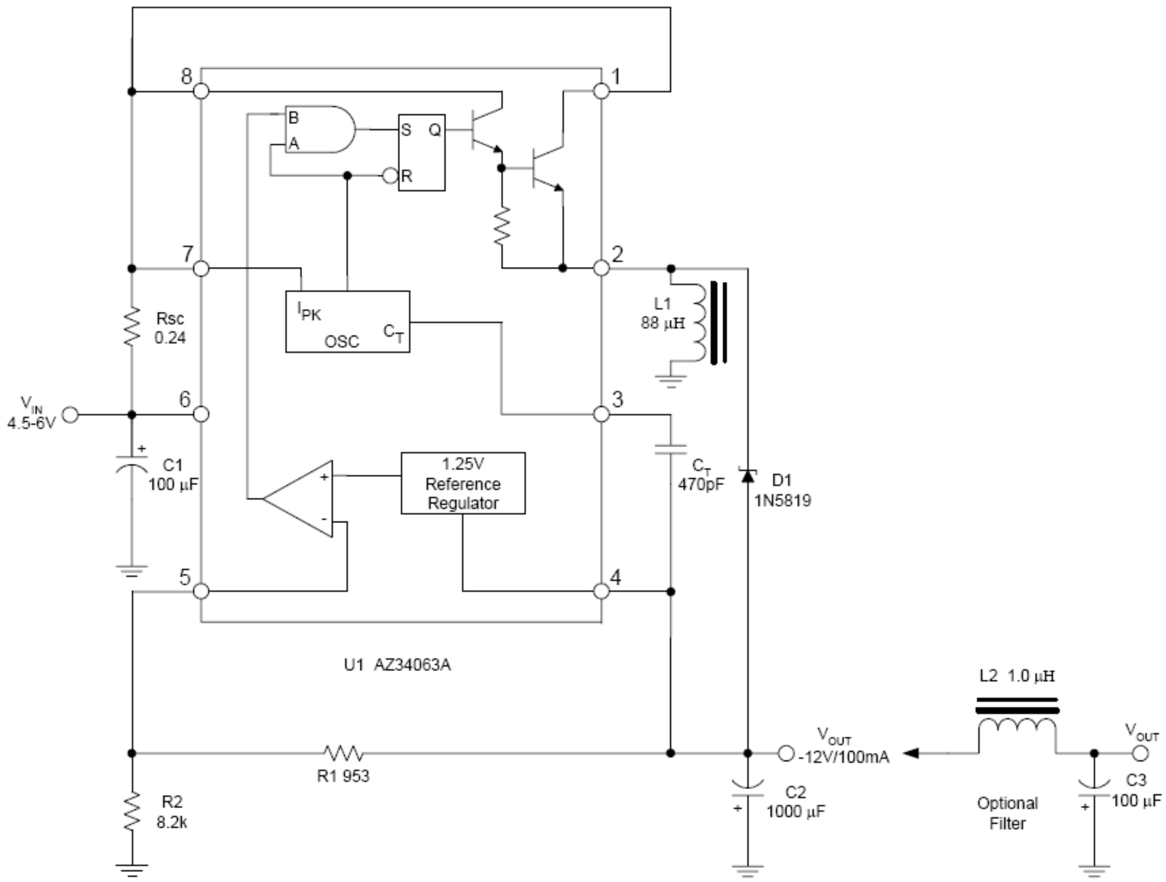
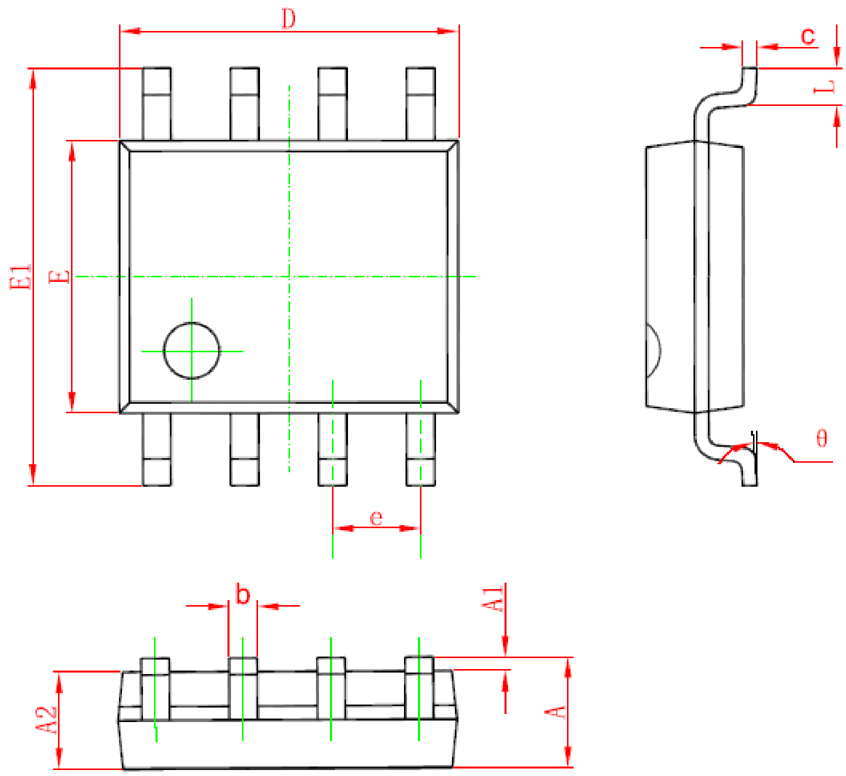



**Figure 12. Voltage Inverting Converter (Note 7)**

Note 7: This is a typical inverting converter configuration. The working process in the steady state is similar to step-up converter, the difference in this situation is that the voltage at the non-inverting pin of the comparator is equal to $1.25V+V_{OUT}$, then $V_{PIN5}=V_{OUT}*R2/(R1+R2)=1.25V+V_{OUT}$, so the output voltage can be decided by $V_{OUT}=-1.25*(R1+R2)/R1$ (V).

# Package Information

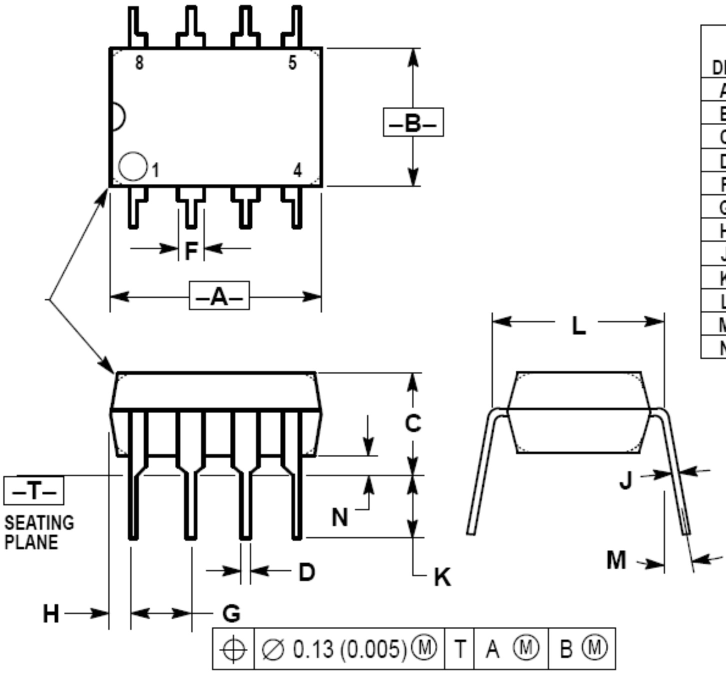
## SOP8 Package Outline Dimensions




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.006 | 0.010 |
| D | 4.700 | 5.100 | 0.185 | 0.200 |
| E | 3.800 | 4.000 | 0.150 | 0.157 |
| E1 | 5.800 | 6.200 | 0.228 | 0.244 |
| e | 1.270 (BSC) | | 0.050 (BSC) | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |

# Package Information

## DIP8 Package Outline Dimensions




| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 9.40 | 10.16 | 0.370 | 0.400 |
| B | 6.10 | 6.60 | 0.240 | 0.260 |
| C | 3.94 | 4.45 | 0.155 | 0.175 |
| D | 0.38 | 0.51 | 0.015 | 0.020 |
| F | 1.02 | 1.78 | 0.040 | 0.070 |
| G | 2.54 BSC | | 0.100 BSC | |
| H | 0.76 | 1.27 | 0.030 | 0.050 |
| J | 0.20 | 0.30 | 0.008 | 0.012 |
| K | 2.92 | 3.43 | 0.115 | 0.135 |
| L | 7.62 BSC | | 0.300 BSC | |
| M | — | 10° | — | 10° |
| N | 0.76 | 1.01 | 0.030 | 0.040 |

# Design Notes