

**1.5A STEP-DOWN/STEP-UP/INVERTING DC-DC CONVERTER****AZ34063U****General Description**

The AZ34063U 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 AZ34063U 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 AZ34063U 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

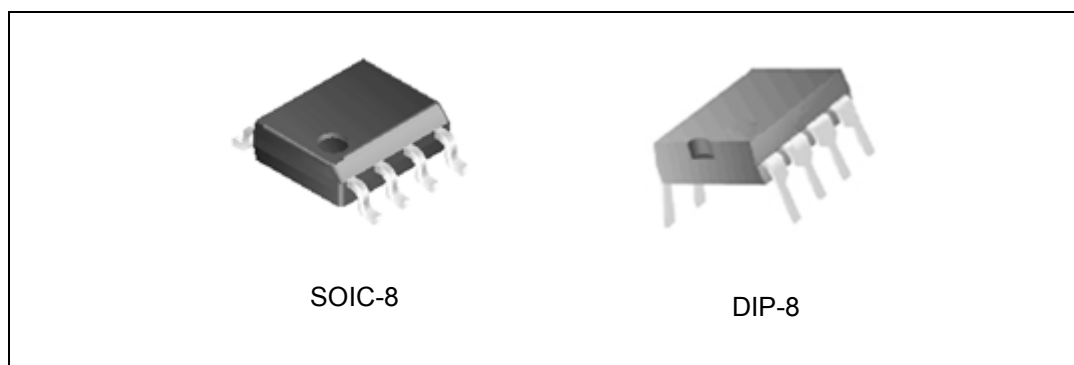


Figure 1. Package Types of AZ34063U

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

**AZ34063U**

## Pin Configuration

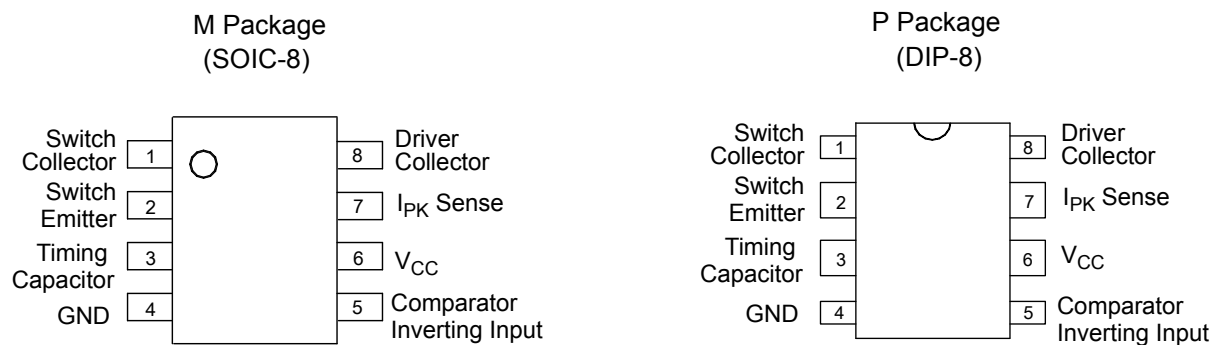


Figure 2. Pin Configuration of AZ34063U (Top View)

## Functional Block Diagram

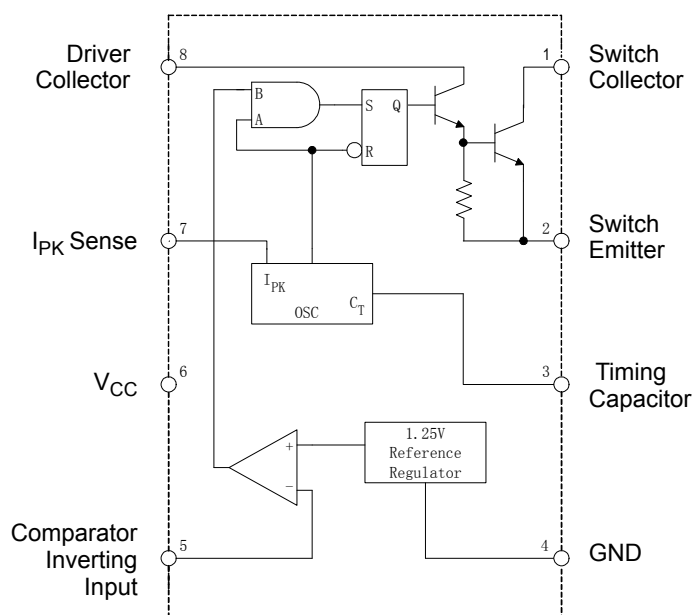
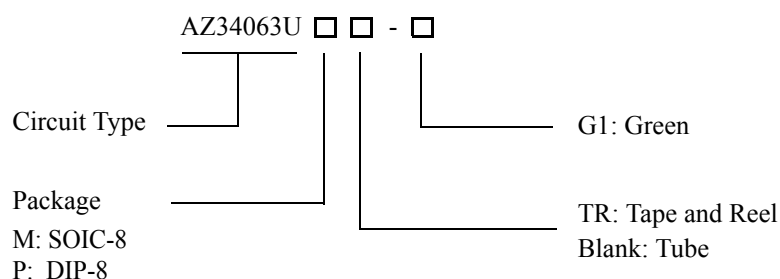


Figure 3. Functional Block Diagram of AZ34063U

**1.5A STEP-DOWN/STEP-UP/INVERTING DC-DC CONVERTER****AZ34063U****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          | V <sub>CC</sub>            | Voltage supply                                                                                                                                 |
| 7          | I <sub>PK</sub> 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**

| Package | Temperature Range | Part Number    | Marking ID   | Packing Type |
|---------|-------------------|----------------|--------------|--------------|
| SOIC-8  | -40 to 85°C       | AZ34063UM-G1   | 34063UM-G1   | Tube         |
|         |                   | AZ34063UMTR-G1 | 34063UM-G1   | Tape & Reel  |
| DIP-8   | -40 to 85°C       | AZ34063UP-G1   | AZ34063UP-G1 | Tube         |

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and green.

**1.5A STEP-DOWN/STEP-UP/INVERTING DC-DC CONVERTER****AZ34063U****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                     |        | $V_C(\text{switch})$    | 40         | V                  |
| Switch Emitter Voltage ( $V_{PIN1}=40V$ )    |        | $V_E(\text{switch})$    | 40         | V                  |
| Switch Collector to Emitter Voltage          |        | $V_{CE}(\text{switch})$ | 40         | V                  |
| Driver Collector Voltage                     |        | $V_C(\text{driver})$    | 40         | V                  |
| Driver Collector Current (Note 2)            |        | $I_C(\text{driver})$    | 100        | mA                 |
| Switch Current                               |        | $I_{SW}$                | 1.5        | A                  |
| Power Dissipation ( $T_A=25^\circ\text{C}$ ) | DIP-8  | $P_D$                   | 1.25       | W                  |
|                                              | SOIC-8 |                         | 780        | mW                 |
| Thermal Resistance                           | DIP-8  | $\theta_{JA}$           | 100        | $^\circ\text{C/W}$ |
|                                              | SOIC-8 |                         | 160        |                    |
| Operating Junction Temperature               |        | $T_J$                   | 150        | $^\circ\text{C}$   |
| Lead Temperature (Soldering, 10s)            |        | $T_{LEAD}$              | 260        | $^\circ\text{C}$   |
| Storage Temperature Range                    |        | $T_{STG}$               | -65 to 150 | $^\circ\text{C}$   |
| 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      | $V_{CC}$ | 3   | 36  | V                |
| Ambient Temperature | $T_A$    | -40 | 85  | $^\circ\text{C}$ |

**1.5A STEP-DOWN/STEP-UP/INVERTING DC-DC CONVERTER****AZ34063U****Electrical Characteristics**(V<sub>CC</sub>=5.0V, T<sub>A</sub>=-40 to 85°C, unless otherwise specified.)

| Parameter                                | Symbol                                | Conditions                                                                                                                                                             | Min   | Typ   | Max   | Unit |
|------------------------------------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|-------|------|
| <b>OSCILLATOR</b>                        |                                       |                                                                                                                                                                        |       |       |       |      |
| Frequency                                | f <sub>OSC</sub>                      | V <sub>PIN5</sub> =0V, C <sub>T</sub> =1.0nF<br>T <sub>A</sub> =25°C                                                                                                   | 30    | 38    | 45    | KHz  |
| Charge Current                           | I <sub>CHG</sub>                      | V <sub>CC</sub> =5.0V to 36V, T <sub>A</sub> =25°C                                                                                                                     | 30    | 38    | 45    | μA   |
| Discharge Current                        | I <sub>DISCHG</sub>                   | V <sub>CC</sub> =5.0V to 36V, T <sub>A</sub> =25°C                                                                                                                     | 180   | 240   | 290   | μA   |
| Discharge to Charge Current Ratio        | I <sub>DISCHG</sub> /I <sub>CHG</sub> | Pin 7 to V <sub>CC</sub> , T <sub>A</sub> =25°C                                                                                                                        | 5.2   | 6.5   | 7.5   |      |
| Current Limit Sense Voltage              | V <sub>IPK(sense)</sub>               | I <sub>CHG</sub> =I <sub>DISCHG</sub> , T <sub>A</sub> =25°C                                                                                                           | 250   | 300   | 350   | mV   |
| <b>OUTPUT SWITCH (Note 3)</b>            |                                       |                                                                                                                                                                        |       |       |       |      |
| Saturation Voltage, Dalington Connection | V <sub>CE(sat)</sub>                  | I <sub>SW</sub> =1.0A, Pins 1, 8 connected, Common Emitter                                                                                                             |       | 1.0   | 1.3   | V    |
| Saturation Voltage (Note 4.)             | V <sub>CE(sat)</sub>                  | I <sub>SW</sub> =1.0A, R <sub>PIN8</sub> =82Ω to V <sub>CC</sub> , Forced β=20, Common Emitter                                                                         |       | 0.45  | 0.7   | V    |
| DC Current Gain                          | h <sub>FE</sub>                       | I <sub>SW</sub> =1.0A, V <sub>CE</sub> =5.0V, T <sub>A</sub> =25°C                                                                                                     | 50    | 75    |       |      |
| Collector Off-State Current              | I <sub>C(off)</sub>                   | V <sub>CE</sub> =36V                                                                                                                                                   |       | 0.01  | 100   | μA   |
| <b>COMPARATOR</b>                        |                                       |                                                                                                                                                                        |       |       |       |      |
| Threshold Voltage                        | V <sub>TH</sub>                       | T <sub>A</sub> =25°C                                                                                                                                                   | 1.225 | 1.250 | 1.275 | V    |
|                                          |                                       | T <sub>A</sub> =-40 to 85°C                                                                                                                                            | 1.21  | 1.250 | 1.29  |      |
| Threshold Voltage Line Regulation        | R <sub>EGLINE</sub>                   | V <sub>CC</sub> =3.0V to 36V                                                                                                                                           |       | 1.4   | 5     | mV   |
| Input Bias Current                       | I <sub>IB</sub>                       | V <sub>IN</sub> =0V                                                                                                                                                    |       | -20   | -400  | nA   |
| <b>TOTAL DEVICE</b>                      |                                       |                                                                                                                                                                        |       |       |       |      |
| Supply Current                           | I <sub>CC</sub>                       | V <sub>CC</sub> =5.0V to 36V, C <sub>T</sub> =1.0nF, V <sub>PIN7</sub> =V <sub>CC</sub> , V <sub>PIN5</sub> >V <sub>TH</sub> , V <sub>PIN2</sub> =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 2.0μs 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:

**1.5A STEP-DOWN/STEP-UP/INVERTING DC-DC CONVERTER****AZ34063U****Electrical Characteristics (Continued)**

Forced  $\beta$  of output switch:  $\frac{I_C \text{ output}}{I_{C\text{driver}} - 7.0\text{mA}} \geq 10$

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

**Typical Performance Characteristics**

( $V_{CC}=5.0\text{V}$ ,  $T_A=25^\circ\text{C}$ , unless otherwise specified.)

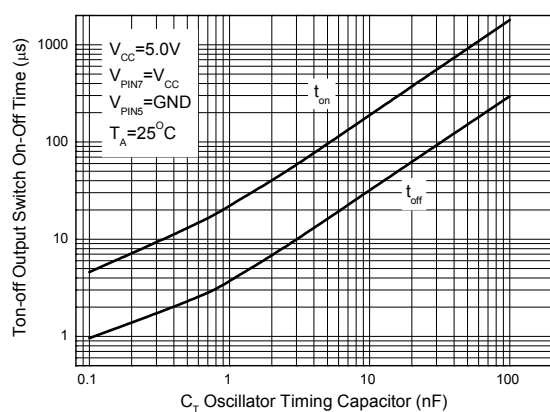


Figure 4. Output Switch On-Off Time vs. Oscillator Timing Capacitor

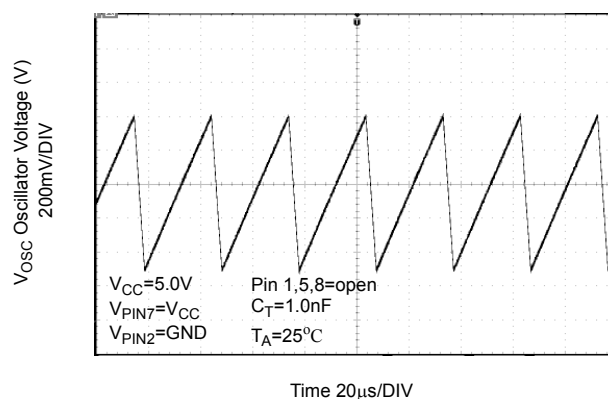


Figure 5. Timing Capacitor Waveform

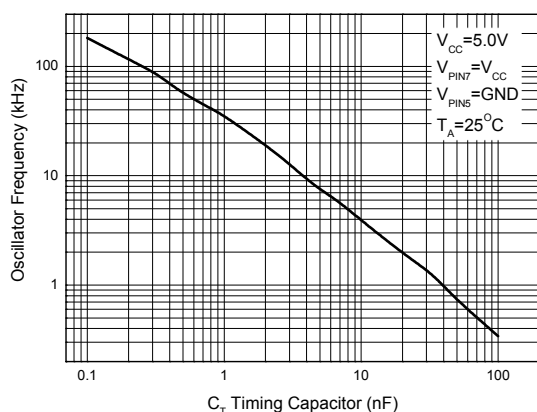


Figure 6. Oscillator Frequency vs. Timing Capacitor

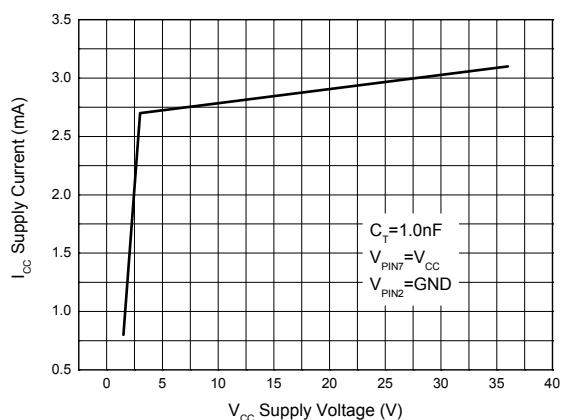


Figure 7. Standard Supply Current vs. Supply Voltage

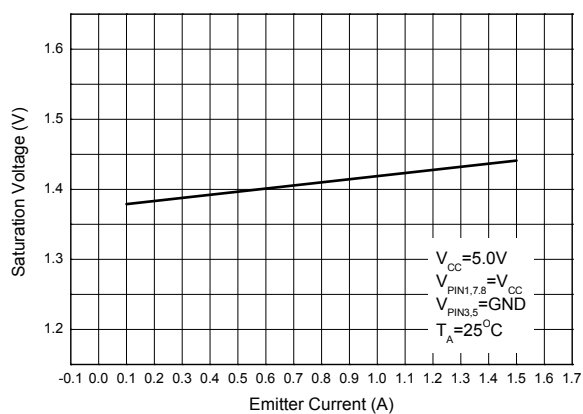
**1.5A STEP-DOWN/STEP-UP/INVERTING DC-DC CONVERTER****AZ34063U****Typical Performance Characteristics (Continued)** $(V_{CC}=5.0V, T_A=25^{\circ}C, \text{ unless otherwise specified.})$ 

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

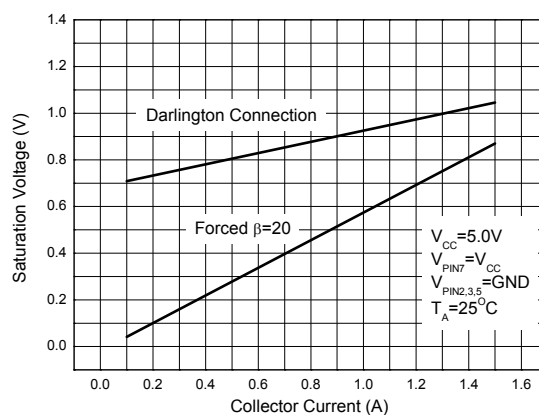


Figure 9. Common Emitter Configuration Output Switch  
Saturation Voltage vs. Collector Current

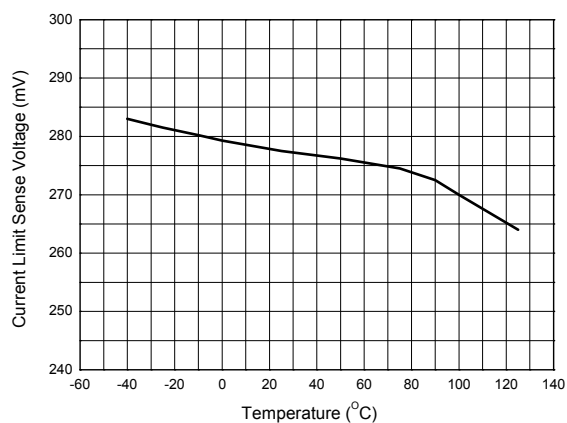


Figure 10. Current Limit Sense Voltage vs. Temperature

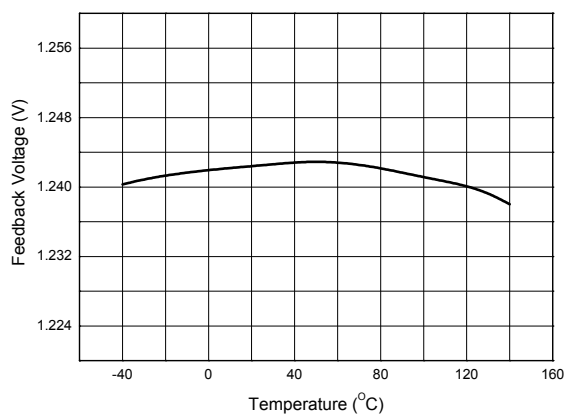


Figure 11. Feedback Voltage vs. Temperature

**1.5A STEP-DOWN/STEP-UP/INVERTING DC-DC CONVERTER****AZ34063U****Typical Performance Characteristics (Continued)**

( $V_{CC}=5.0V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified.)

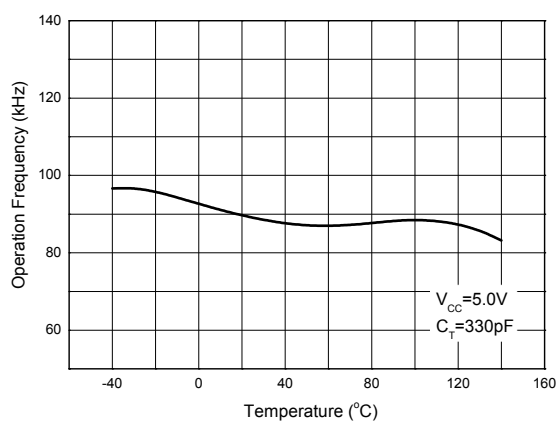


Figure 12. Operation Frequency vs. Temperature

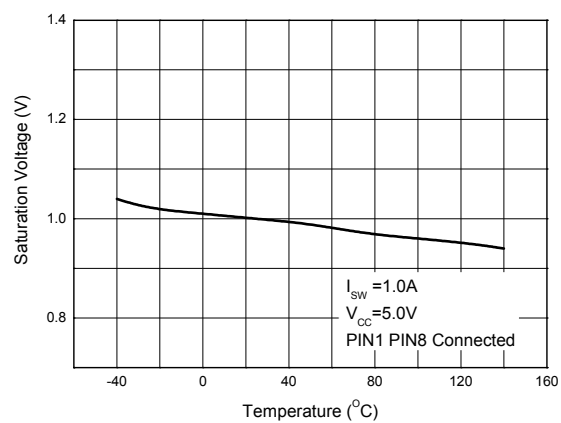


Figure 13. Saturation Voltage vs. Temperature



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

**AZ34063U**

## Typical Applications

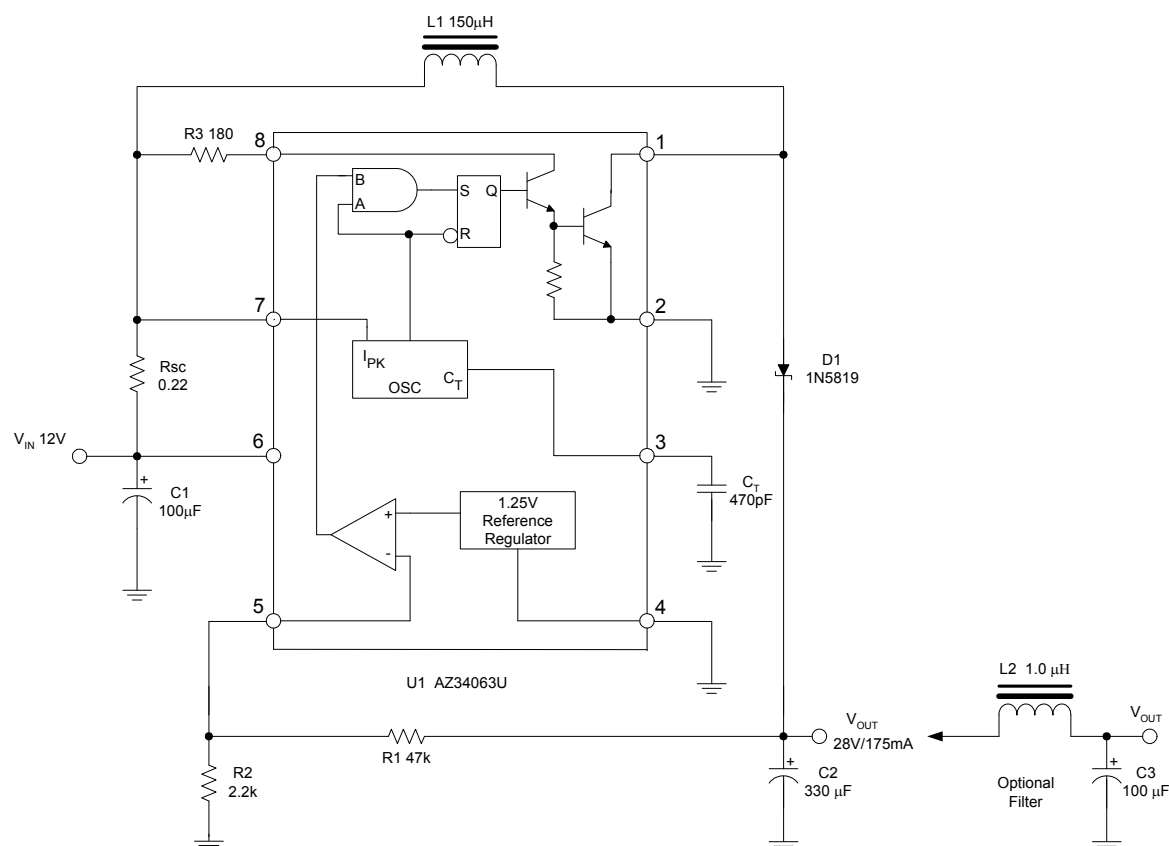


Figure 14. Step-Up Converter (Note 5)

Note 5: This is a typical step-up converter configuration. In the steady state, if the resistor divider voltage at pin 5 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 switching 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  $V_{PIN5} = V_{OUT} \cdot R2 / (R1 + R2) = 1.25(V)$ , the output voltage can be decided by  $V_{OUT} = 1.25 \cdot (R1 + R2) / R2 (V)$ .

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

**AZ34063U**

## Typical Applications (Continued)

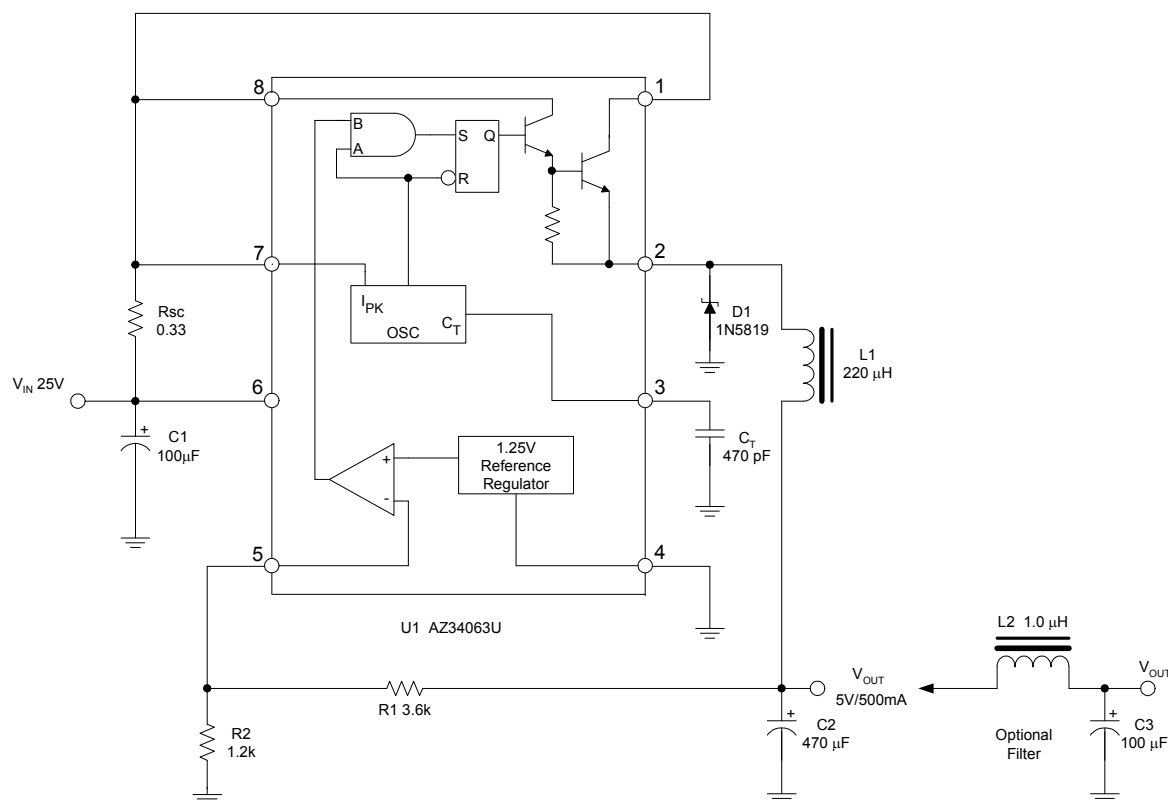


Figure 15. Step-Down converter (Note 6)

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

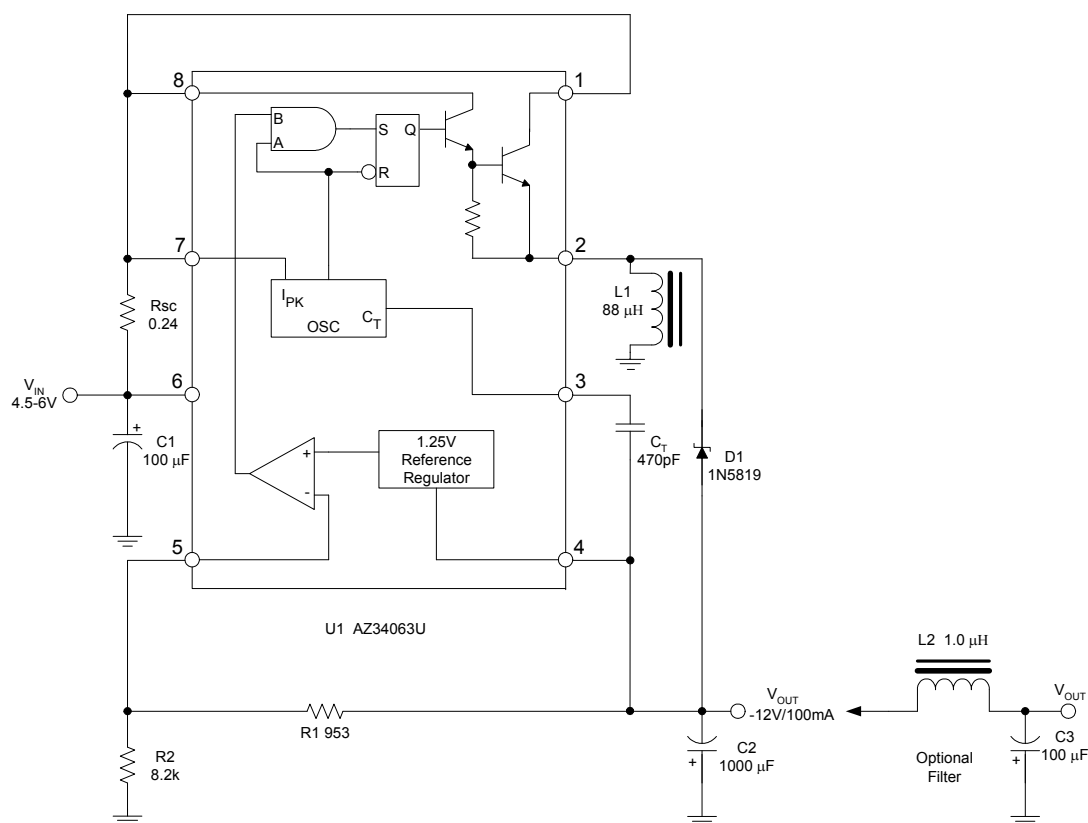
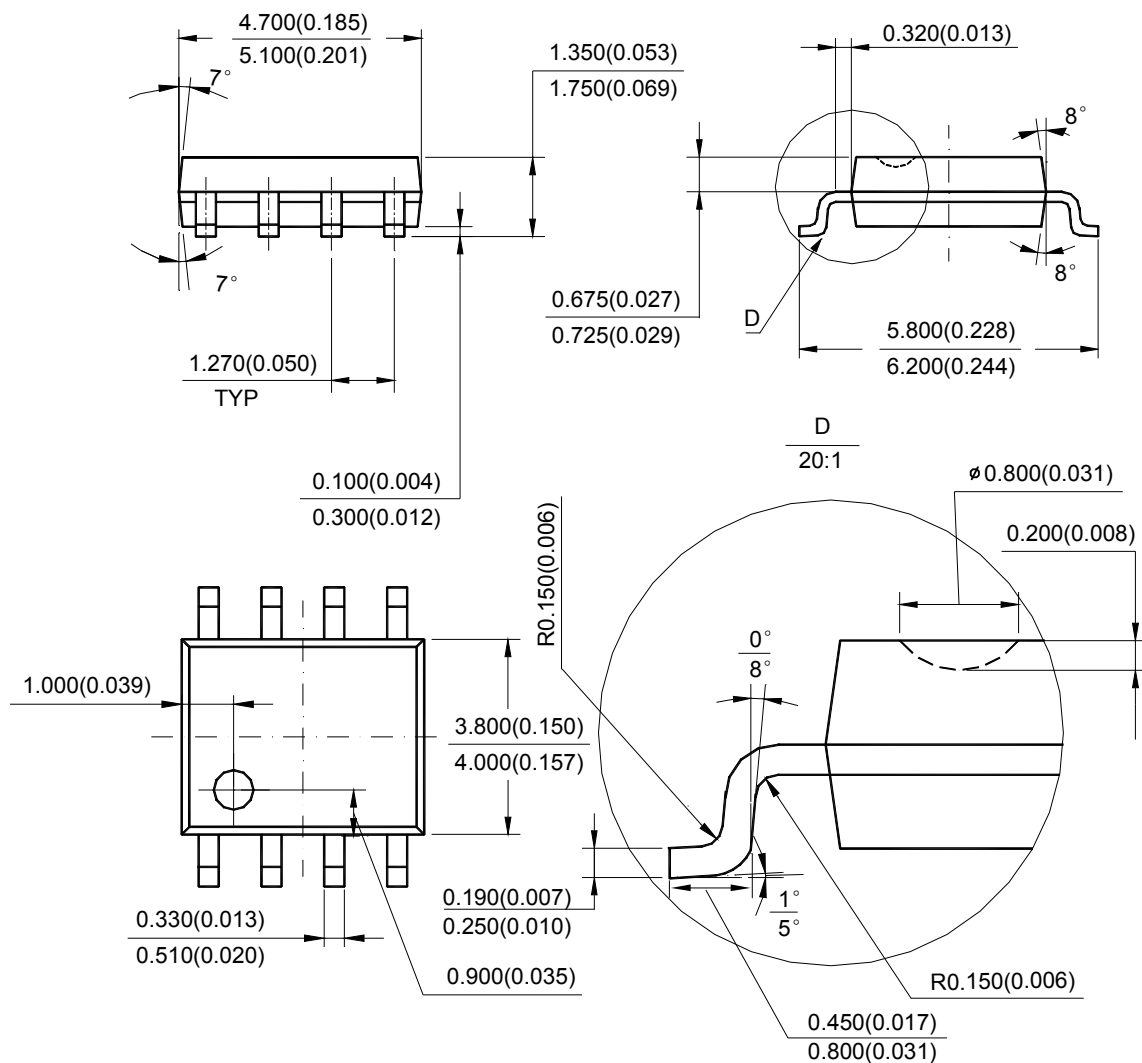
**Typical Applications (Continued)**


Figure 16. 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  $V_{PIN5} = V_{OUT} \cdot R2 / (R1 + R2) = 1.25V + V_{OUT}$ , so the output voltage can be decided by  $V_{OUT} = -1.25 \cdot (R1 + R2) / R1$  (V).

**1.5A STEP-DOWN/STEP-UP/INVERTING DC-DC CONVERTER****AZ34063U****Mechanical Dimensions****SOIC-8****Unit: mm(inch)**

Note: Eject hole, oriented hole and mold mark is optional.



**AZ34063U**

## DIP-8

Unit: mm(inch)





## **BCD Semiconductor Manufacturing Limited**

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