# 1A STEP-DOWN/STEP-UP INVERTING DC-DC CONVERTER



## Description

The AZ34063C 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 AZ34063C 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.

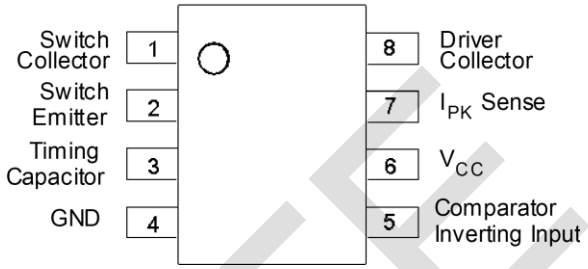
The AZ34063C is available in 2 packages: SOIC-8 and DIP-8.

## Features

- Operation from 3.0V to 36V Input
- Low Standby Current
- Current Limiting
- Output Switch Current to1A
- Output Voltage Adjustable
- Operation Frequency up to 180kHz ($C_T$=100pF)
- Precision 2% Reference
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

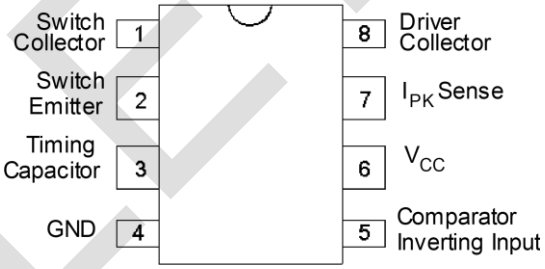
## Pin Assignments

**(Top View)**




**SOIC-8**

**(Top View)**



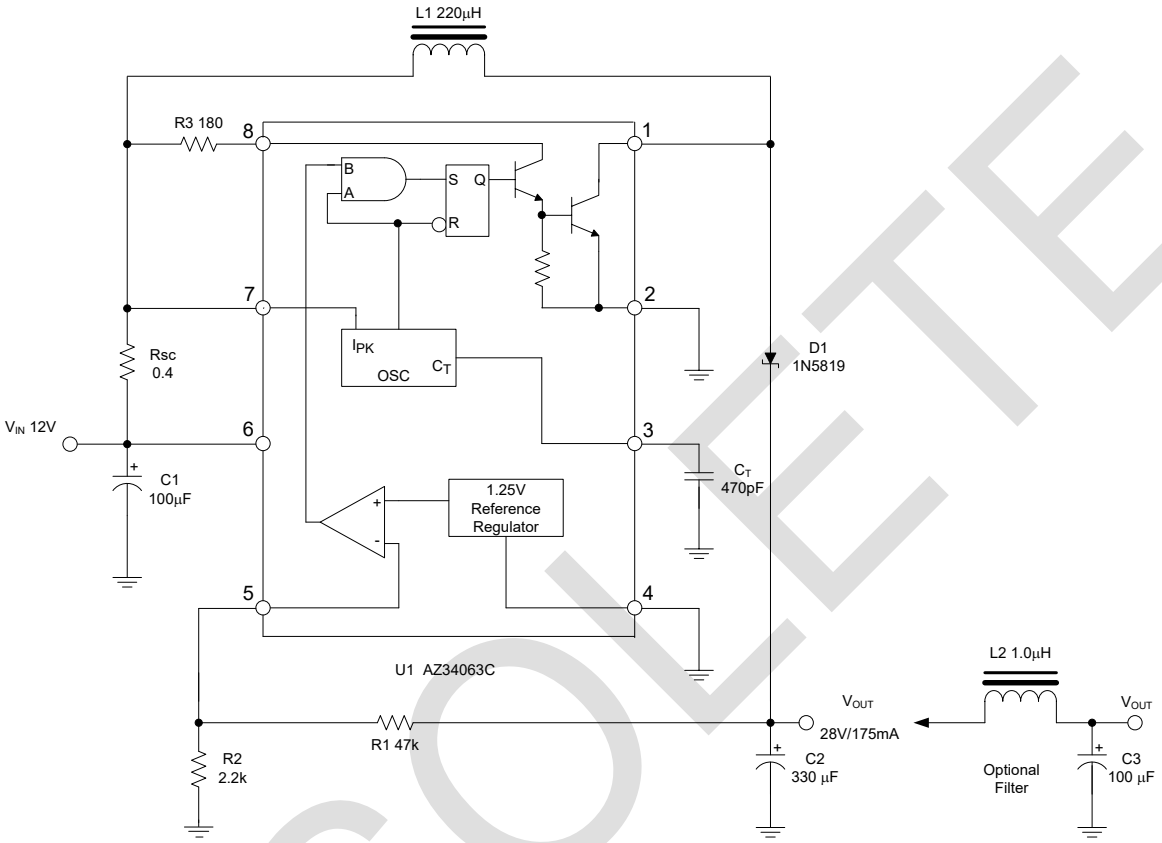

**DIP-8**

## Applications

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

## Typical Applications Circuit

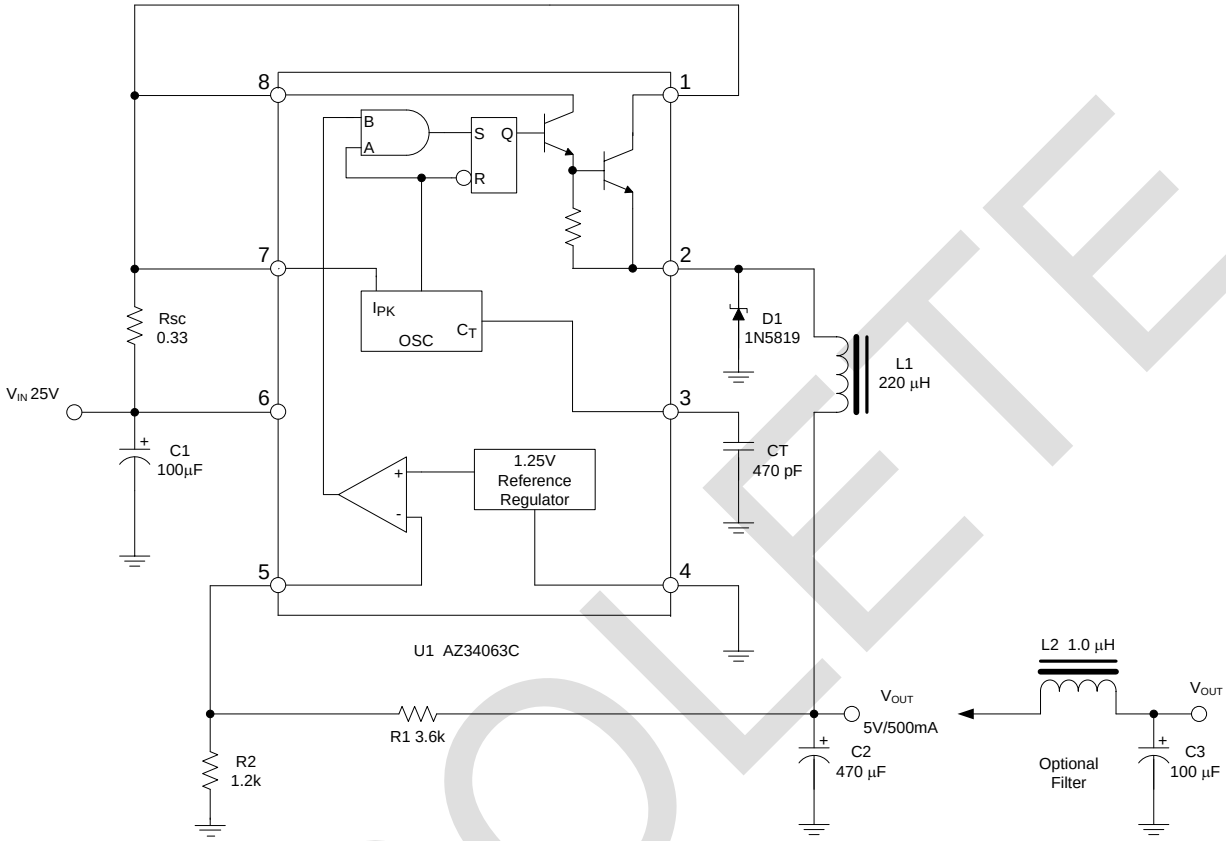
**Step-up Converter**




Note 1: 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 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 Circuit (Cont.)

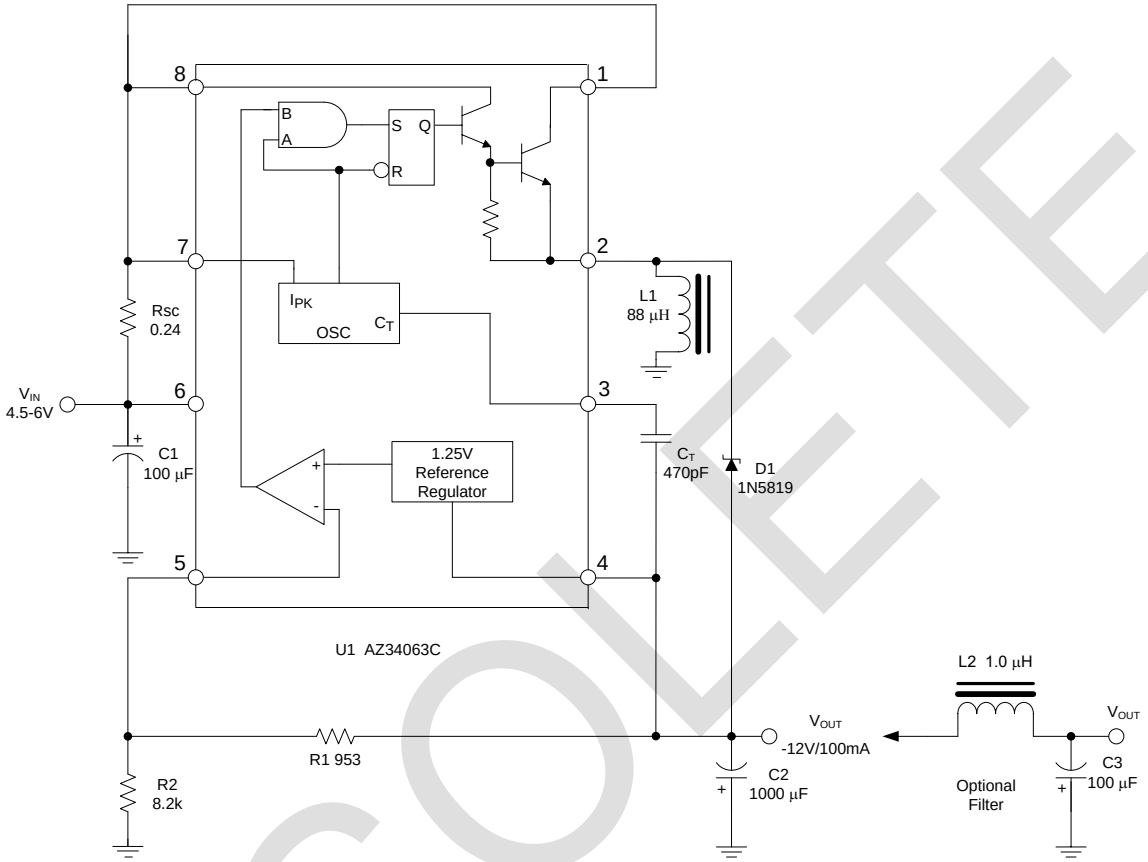
**Step-down Converter**




Note 2: 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 Circuit (Cont.)

**Voltage Inverting Converter**

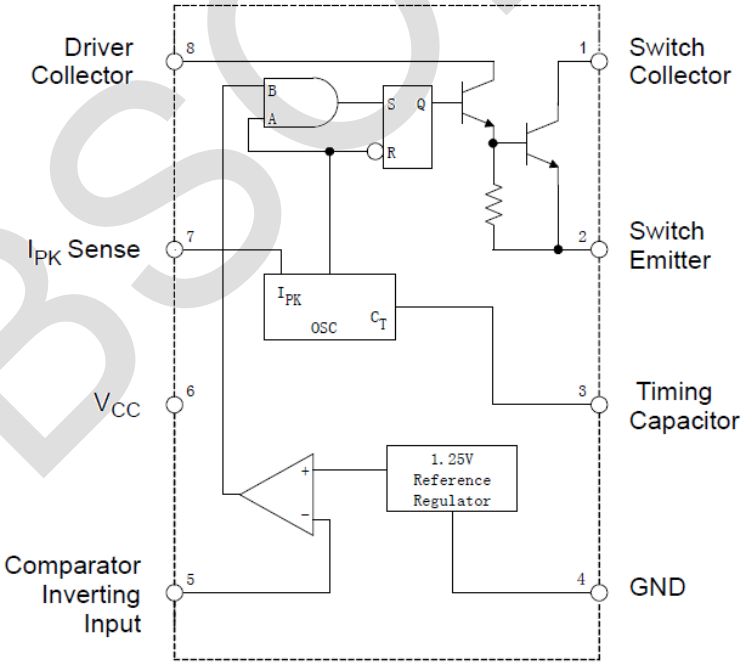



Note 3: This is a typical inverting converter configuration. The working process in the steady state is similar to step-up converter, the difference in this situation is that the voltage at the non-inverting pin of the comparator is equal to 1.25V+$V_{OUT}$, then $V_{PIN5}$=$V_{OUT}$*R2/(R1+R2)=1.25V+$V_{OUT}$, so the output voltage can be decided by $V_{OUT}$=-1.25*(R1+R2)/R1 (V).

## Pin Descriptions

| 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 | $V_{CC}$ | Voltage supply |
| 7 | $I_{PK}$ 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 |

## Functional Block Diagram



## Absolute Maximum Ratings (Note 4)

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Power Supply Voltage | | 40 | V |
| $V_{IR}$ | Comparator Input Voltage Range | | -0.3 to 40 | V |
| $V_C$(switch) | Switch Collector Voltage | | 40 | V |
| $V_E$(switch) | Switch Emitter Voltage ($V_{PIN\ 1}$=40V) | | 40 | V |
| $V_{CE}$(switch) | Switch Collector to Emitter Voltage | | 40 | V |
| $V_C$(driver) | Driver Collector Voltage | | 40 | V |
| $I_C$(driver) | Driver Collector Current (Note 5) | | 100 | mA |
| $I_{SW}$ | Switch Current | | 1 | A |
| $P_D$ | Power Dissipation ($T_A$=+25℃) | DIP-8 | 1.25 | W |
| | | SOIC-8 | 780 | mW |
| $R_{\theta JA}$ | Thermal Resistance | DIP-8 | 100 | ℃/W |
| | | SOIC-8 | 160 | |
| $T_J$ | Operating Junction Temperature | | +150 | ℃ |
| $T_{LEAD}$ | Lead Temperature (Soldering, 10s) | | +260 | ℃ |
| $T_{STG}$ | Storage Temperature Range | | -65 to +150 | ℃ |
| _ | ESD (Human body model) | | 2000 | V |

Note 4: 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 5: 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 | °C |

## Electrical Characteristics ($V_{CC}$=5.0 V, $T_A$=-40 to +85℃, unless otherwise specified.)

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **OSCILLATOR** | | | | | | | |
| $f_{OSC}$ | Frequency | $V_P$IN5=0V, $T_A$=25°C | $C_T$=1.0nF | 30 | 38 | 45 | KHz |
| | | | $C_T$=330pF | 75 | 88 | 100 | KHz |
| $I_{CHG}$ | Charge Current | $V_{CC}$=5.0V to 36 V, $T_A$=+25°C | | 30 | 38 | 45 | μA |
| $I_{DISCHG}$ | Discharge Current | $V_{CC}$=5.0V to 36V, $T_A$=+25°C | | 180 | 240 | 290 | μA |
| $I_{DISCHG}/I_{CHG}$ | Discharge to Charge Current Ratio | Pin 7 to $V_{CC}$, $T_A$=+25°C | | 5.2 | 6.5 | 7.5 | _ |
| $V_{IPK}$(sense) | Current Limit Sense Voltage | $I_{CHG}=I_{DISCHG}$, $T_A$=+25°C | | 250 | 300 | 350 | mV |
| **OUTPUT SWITCH (Note 6)** | | | | | | | |
| $V_{CE}$(sat) | Saturation Voltage, Dalington Connection | $I_{SW}$=1A, Pins 1, 8 connected, Common Emitter | | _ | 1.0 | 1.3 | V |
| $V_{CE}$(sat) | Saturation Voltage (Note 7) | $I_{SW}$=1A, $R_P$IN8=82 Ω to $V_{CC}$, Forced ß=20, Common Emitter | | _ | 0.45 | 0.8 | V |
| $h_{FE}$ | DC Current Gain | $I_{SW}$=1A, $V_{CE}$=5.0V, $T_A$=+25°C | | 50 | 75 | _ | _ |
| $I_C$(off) | Collector Off-State Current | $V_{CE}$=36V | | _ | 0.01 | 100 | μA |
| **COMPARATOR** | | | | | | | |
| $V_{TH}$ | Threshold Voltage | $T_A$=+25°C | | 1.225 | 1.250 | 1.275 | V |
| | | $T_A$=-40 to +85°C | | 1.21 | 1.250 | 1.29 | |
| $R_{EGLINE}$ | Threshold Voltage Line Regulation | $V_{CC}$=3.0V to 36V | | _ | 1.4 | 5 | mV |
| $I_{IB}$ | Input Bias Current | $V_{IN}$=0V | | _ | -20 | -400 | nA |
| **TOTAL DEVICE** | | | | | | | |
| $I_{CC}$ | Supply Current | $V_{CC}$=5.0V to 36V, $C_T$=1.0 nF, $V_{PIN7}=V_{CC}$, $V_P$IN5 > $V_{TH}$, $V_{PIN2}$=GND, other pins open | | _ | _ | 4 | mA |

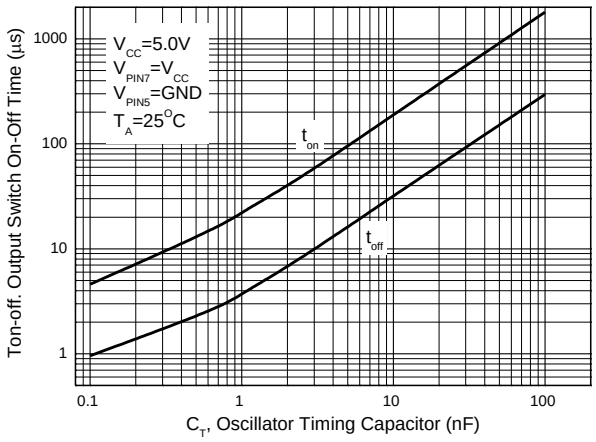
Note 6: Low duty cycle pulse technique are used during test to maintain junction temperature as close to ambient temperature as possible.

Note7: 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:

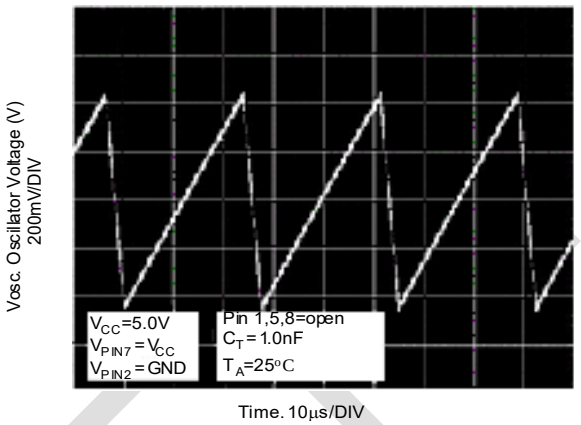
OBSOLETE – PART DISCONTINUED

## Performance Characteristics

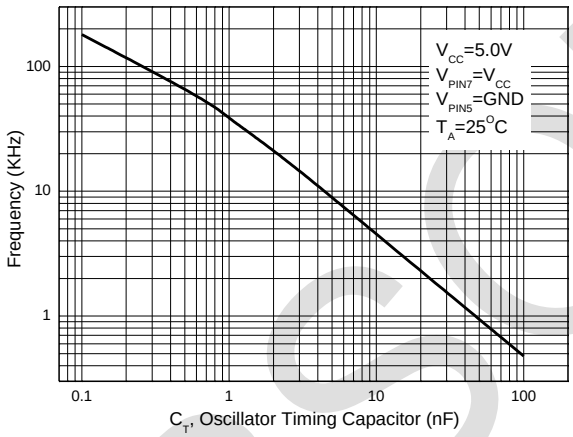
**Output Switch On-off Time vs. Oscillator Timing Capacitor**



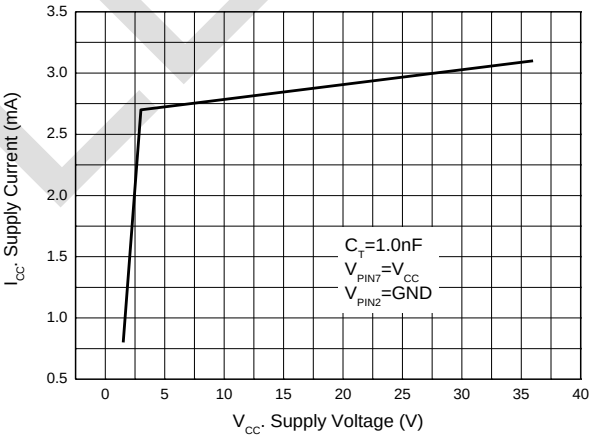

**Timing Capacitor Waveform**



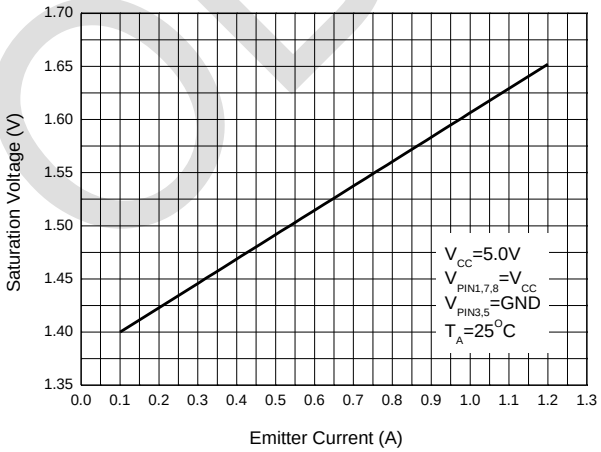

**Oscillator Frequency vs. Timing Capacitor**



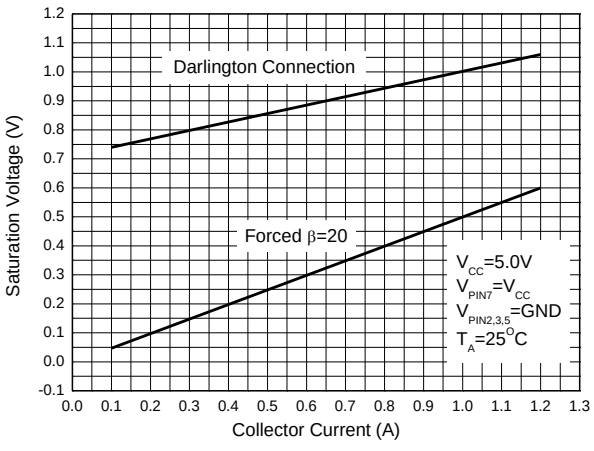

**Standard Supply Current vs. Supply Voltage**




**Emitter Follower Configuration Output Saturation Voltage vs. Emitter Current**

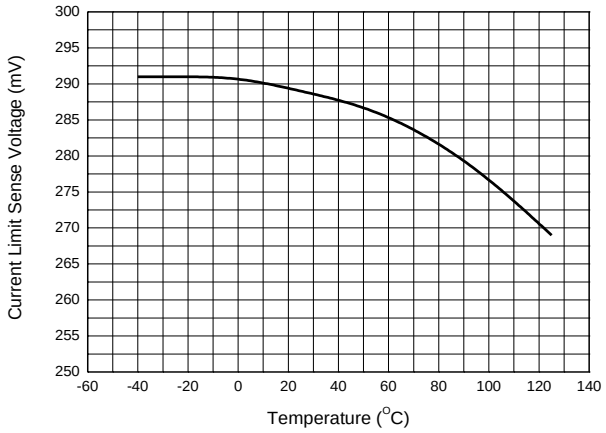



**Common Emitter Configuration Output Switch Saturation Voltage vs. Collector Current**

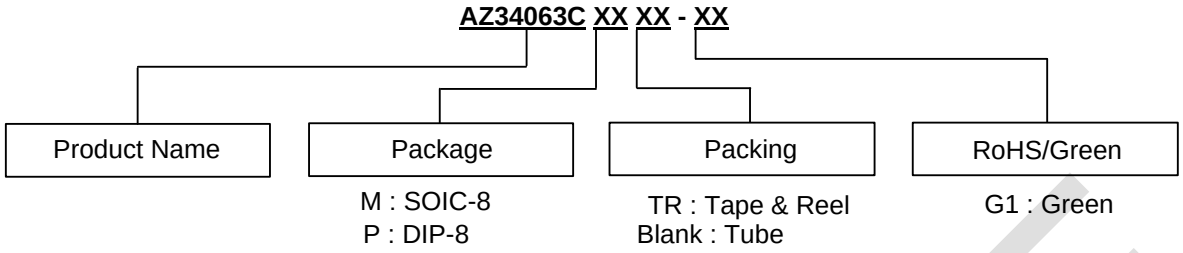


## Performance Characteristics (Cont.)

**Current Limit Sense Voltage vs. Temperature**



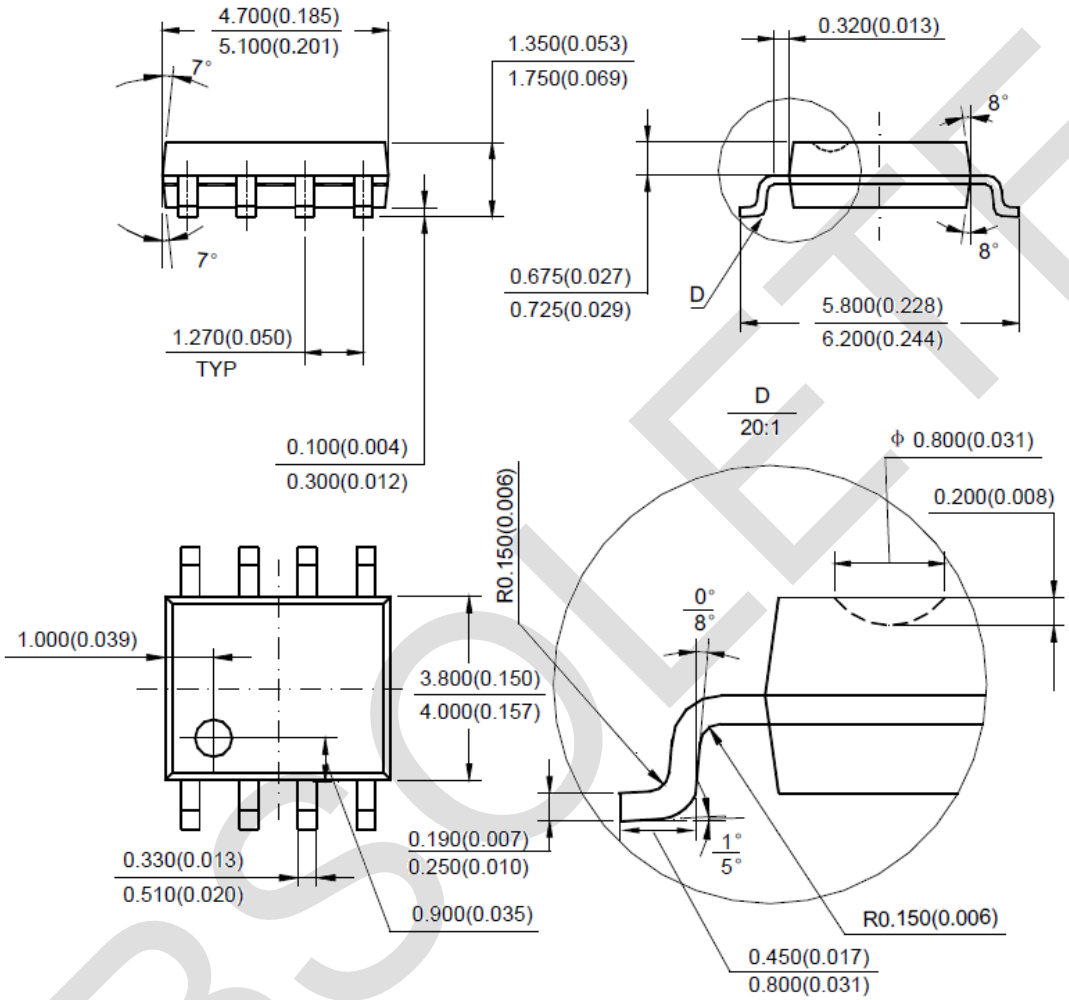
## Ordering Information




| Package | Temperature Range | Part Number | | Marking ID | | Packing |
|---|---|---|---|---|---|---|
| | | Lead Free | Green | Lead Free | Green | |
| SOIC-8 | -40 to +85°C | AZ34063CM-E1 | AZ34063CM-G1 | 34063CM-E1 | 34063CM-G1 | Tube |
| | | AZ34063CMTR-E1 | AZ34063CMTR-G1 | 34063CM-E1 | 34063CM-G1 | Tape & Reel |
| DIP-8 | -40 to +85°C | AZ34063CP-E1 | AZ34063CP-G1 | AZ34063CP-E1 | AZ34063CP-G1 | Tube |

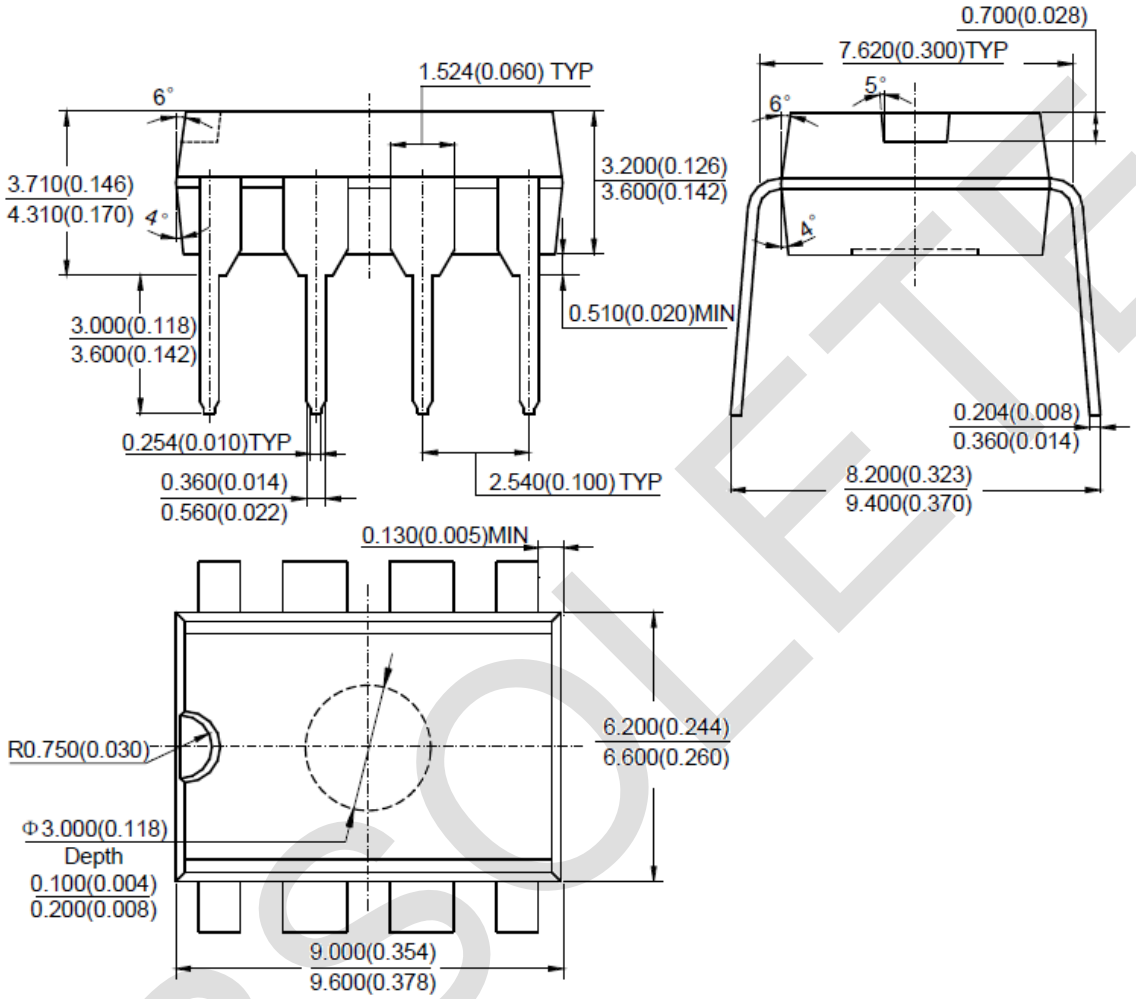
## Package Outline Dimensions (All dimensions in mm(inch).)

**(1) Package Type: SOIC-8**



## Package Outline Dimensions (Cont. All dimensions in mm(inch).)

**(2) Package Type: DIP-8**




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

**IMPORTANT NOTICE**

1. DIODES INCORPORATED AND ITS SUBSIDIARIES ("DIODES") MAKE NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

2. The Information contained herein is for informational purpose only and is provided only to illustrate the operation of Diodes products described herein and application examples. Diodes does not assume any liability arising out of the application or use of this document or any product described herein. This document is intended for skilled and technically trained engineering customers and users who design with Diodes products. Diodes products may be used to facilitate safety-related applications; however, in all instances customers and users are responsible for (a) selecting the appropriate Diodes products for their applications, (b) evaluating the suitability of the Diodes products for their intended applications, (c) ensuring their applications, which incorporate Diodes products, comply the applicable legal and regulatory requirements as well as safety and functional-safety related standards, and (d) ensuring they design with appropriate safeguards (including testing, validation, quality control techniques, redundancy, malfunction prevention, and appropriate treatment for aging degradation) to minimize the risks associated with their applications.

3. Diodes assumes no liability for any application-related information, support, assistance or feedback that may be provided by Diodes from time to time. Any customer or user of this document or products described herein will assume all risks and liabilities associated with such use, and will hold Diodes and all companies whose products are represented herein or on Diodes' websites, harmless against all damages and liabilities.

4. Products described herein may be covered by one or more United States, international or foreign patents and pending patent applications. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks and trademark applications. Diodes does not convey any license under any of its intellectual property rights or the rights of any third parties (including third parties whose products and services may be described in this document or on Diodes' website) under this document.

5. Diodes products are provided subject to Diodes' Standard Terms and Conditions of Sale (https://www.diodes.com/about/company/terms-and-conditions/terms-and-conditions-of-sales/) or other applicable terms. This document does not alter or expand the applicable warranties provided by Diodes. Diodes does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.

6. Diodes products and technology may not be used for or incorporated into any products or systems whose manufacture, use or sale is prohibited under any applicable laws and regulations. Should customers or users use Diodes products in contravention of any applicable laws or regulations, or for any unintended or unauthorized application, customers and users will (a) be solely responsible for any damages, losses or penalties arising in connection therewith or as a result thereof, and (b) indemnify and hold Diodes and its representatives and agents harmless against any and all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim relating to any noncompliance with the applicable laws and regulations, as well as any unintended or unauthorized application.

7. While efforts have been made to ensure the information contained in this document is accurate, complete and current, it may contain technical inaccuracies, omissions and typographical errors. Diodes does not warrant that information contained in this document is error-free and Diodes is under no obligation to update or otherwise correct this information. Notwithstanding the foregoing, Diodes reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes.

8. Any unauthorized copying, modification, distribution, transmission, display or other use of this document (or any portion hereof) is prohibited. Diodes assumes no responsibility for any losses incurred by the customers or users or any third parties arising from any such unauthorized use.



**www.diodes.com**