

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

The MC34063A 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 MC34063A 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 MC34063A is available in package : SOP -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



SOP-8

Figure 1. Package Types of MC34063A

## Pin Configuration

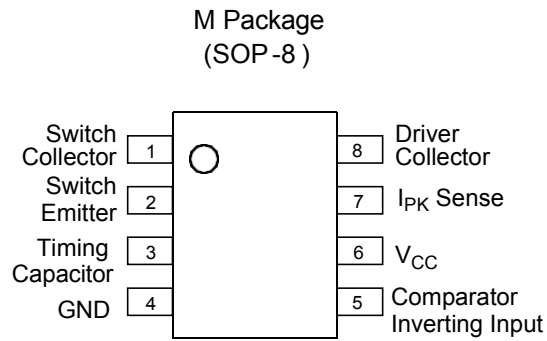


Figure 2. Pin Configuration of MC34063A (Top View)

## Functional Block Diagram

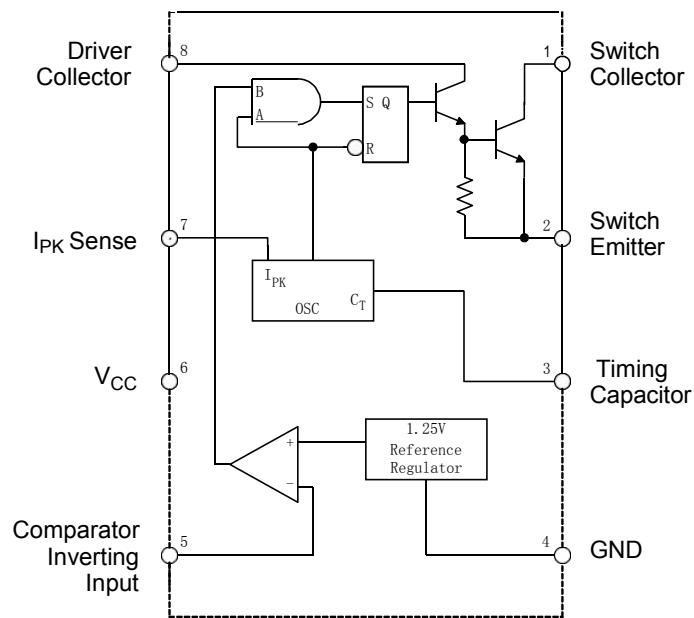


Figure 3. Functional Block Diagram of MC34063A

**Pin Description**

<b>Pin Number</b>	<b>Pin Name</b>	<b>Function</b>
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

**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 ( $V_{PIN\ 1}=40V$ )		$V_{E(\text{switch})}$	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 ( $T_A=25^\circ C$ )	SOP-8	$P_D$	780	mW
Thermal Resistance	SOP-8	$\theta_{JA}$	160	$^\circ C/W$
Operating Junction Temperature		$T_J$	150	$^\circ C$
Lead Temperature (Soldering, 10s)		$T_{LEAD}$	260	$^\circ C$
Storage Temperature Range		$T_{STG}$	-65 to 150	$^\circ C$
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	$^\circ C$

## Electrical Characteristics

( $V_{CC}=5.0V$ ,  $T_A=-40$  to  $85^{\circ}C$ , unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>OSCILLATOR</b>						
Frequency	$f_{OSC}$	$V_{PIN5}=0V$ , $C_T=1.0nF$ $T_A=25^{\circ}C$	30	38	45	KHz
Charge Current	$I_{CHG}$	$V_{CC}=5.0V$ to $36V$ , $T_A=25^{\circ}C$	30	38	45	$\mu A$
Discharge Current	$I_{DISCHG}$	$V_{CC}=5.0V$ to $36V$ , $T_A=25^{\circ}C$	180	240	290	$\mu A$
Discharge to Charge Current Ratio	$I_{DISCHG}/I_{CHG}$	Pin 7 to $V_{CC}$ , $T_A=25^{\circ}C$	5.2	6.5	7.5	
Current Limit Sense Voltage	$V_{IPK(sense)}$	$I_{CHG}=I_{DISCHG}$ , $T_A=25^{\circ}C$	250	300	350	mV
<b>OUTPUT SWITCH (Note 3)</b>						
Saturation Voltage, Darlington Connection	$V_{CE(sat)}$	$I_{SW}=1.0A$ , Pins 1, 8 connected, Common Emitter		1.0	1.3	V
Saturation Voltage (Note 4.)	$V_{CE(sat)}$	$I_{SW}=1.0A$ , $R_{PIN8}=82\ \Omega$ to $V_{CC}$ , Forced $\beta=20$ , Common Emitter		0.45	0.7	V
DC Current Gain	$h_{FE}$	$I_{SW}=1.0A$ , $V_{CE}=5.0V$ , $T_A=25^{\circ}C$	50	75		
Collector Off-State Current	$I_C(off)$	$V_{CE}=36V$		0.01	100	$\mu A$
<b>COMPARATOR</b>						
Threshold Voltage	$V_{TH}$	$T_A=25^{\circ}C$	1.225	1.250	1.275	V
		$T_A=-40$ to $85^{\circ}C$	1.21	1.250	1.29	
Threshold Voltage Line Regulation	$R_{EGLINE}$	$V_{CC}=3.0V$ to $36V$		1.4	5	mV
Input Bias Current	$I_{IB}$	$V_{IN}=0V$		-20	-40	nA
<b>TOTAL DEVICE</b>						
Supply Current	$I_{CC}$	$V_{CC}=5.0V$ to $36V$ , $C_T=1.0nF$ , $V_{PIN7}=V_{CC}$ , $V_{PIN5}>V_{TH}$ , $V_{PIN2}=GND$ , 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 ( $\leq 300mA$ ) and high driver currents ( $\geq 30mA$ ), it may take up to  $2.0\mu s$  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  $\beta$  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.)

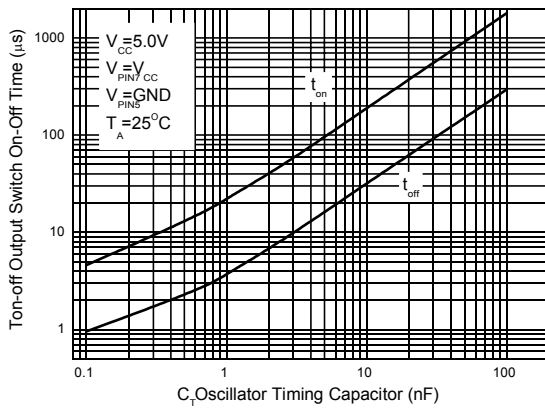


Figure 4. Output Switch On-Off Time vs. Oscillator Timing Capacitor

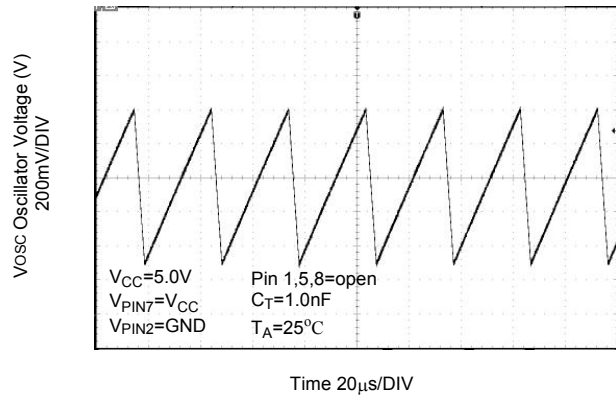


Figure 5. Timing Capacitor Waveform

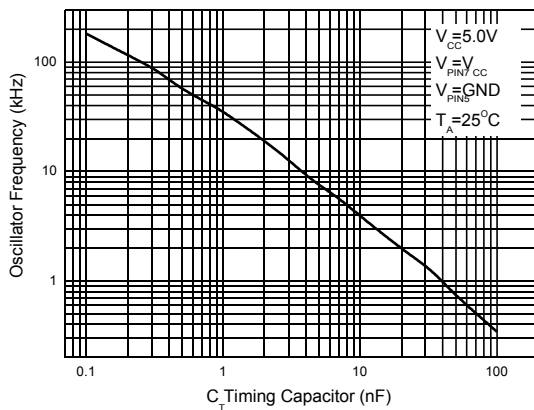


Figure 6. Oscillator Frequency vs. Timing Capacitor

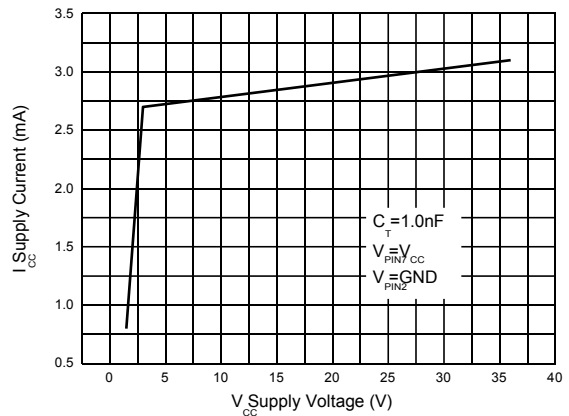


Figure 7. Standard Supply Current vs. Supply Voltage

## Typical Performance Characteristics (Continued)

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

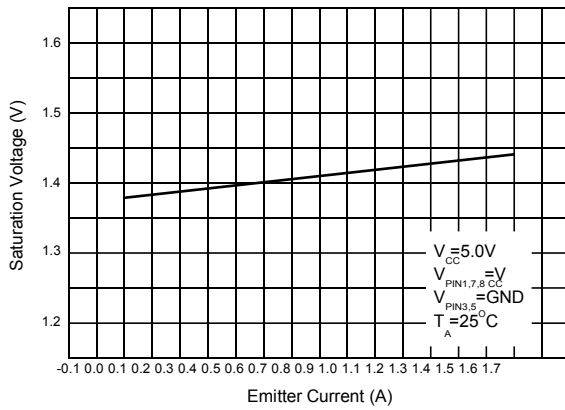


Figure 8. Emitter Follower Configuration Output Saturation Voltage vs. Emitter current

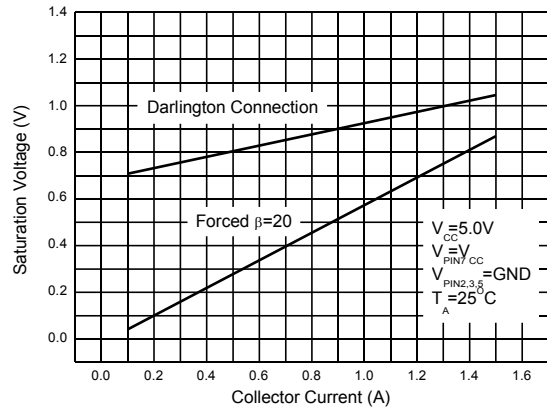


Figure 9. Common Emitter Configuration Output Switch Saturation Voltage vs. Collector Current

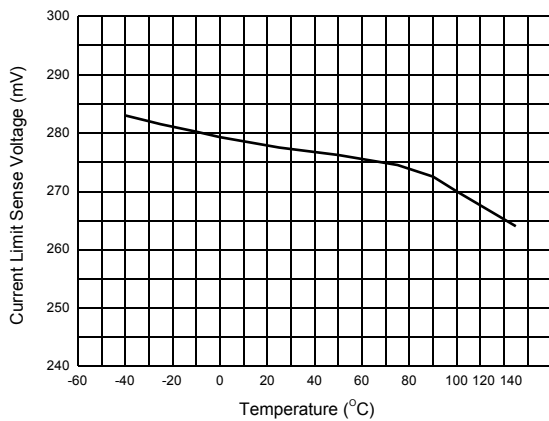


Figure 10. Current Limit Sense Voltage vs. Temperature

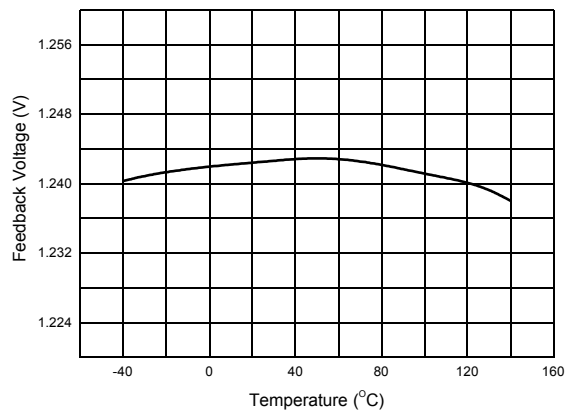


Figure 11. Feedback Voltage vs. Temperature

## Typical Performance Characteristics (Continued)

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

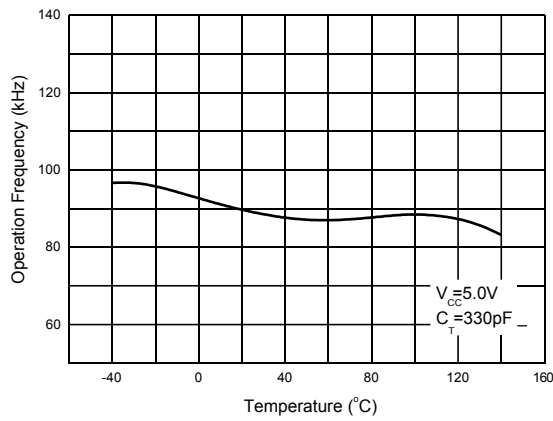


Figure 12. Operation Frequency vs. Temperature

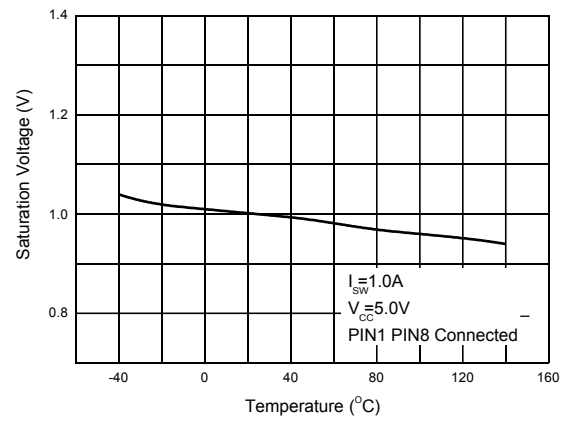


Figure 13. Saturation Voltage vs. Temperature



## Typical Applications

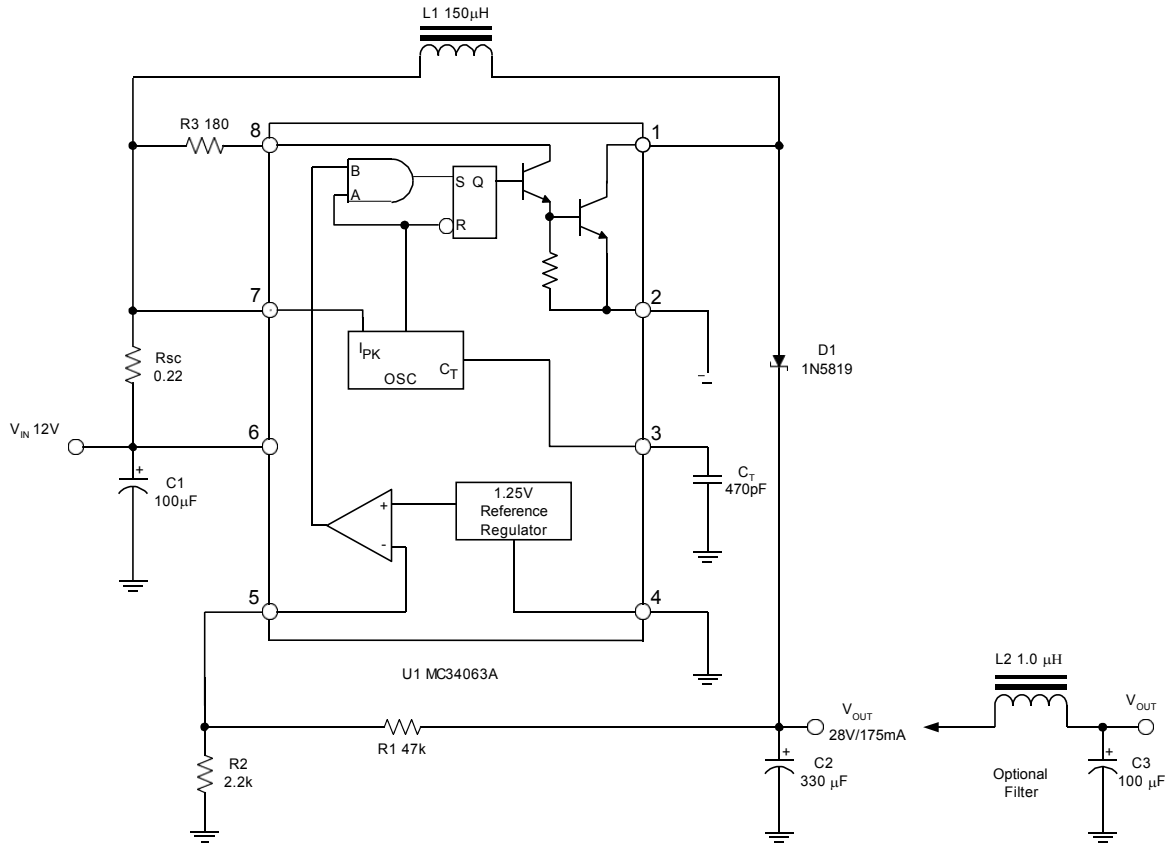


Figure 14. Step-Up Converter (Note 5)

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  $V_{OUT} = 1.25 \cdot (R1 + R2) / R2 (V)$ .

**Typical Applications (Continued)**

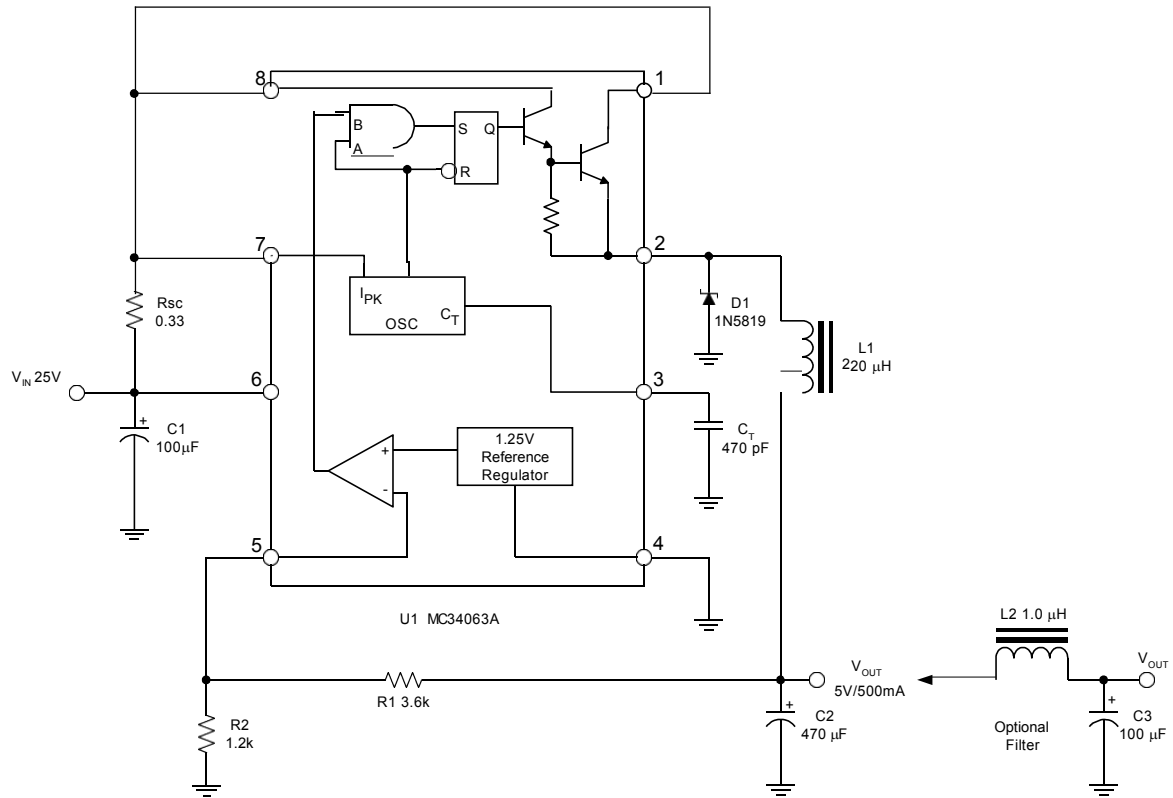


Figure 15. Step-Down converter (Note 6)

Note 6: This is a typical step-down converter configuration. The working process in the steady state is similar to step-up converter,  $V_{PIN5} = V_{OUT} * R_2 / (R_1 + R_2) = 1.25 (V)$ , the output voltage can be decided by  $V_{OUT} = 1.25 * (R_1 + R_2) / R_2 (V)$ .

**Typical Applications (Continued)**

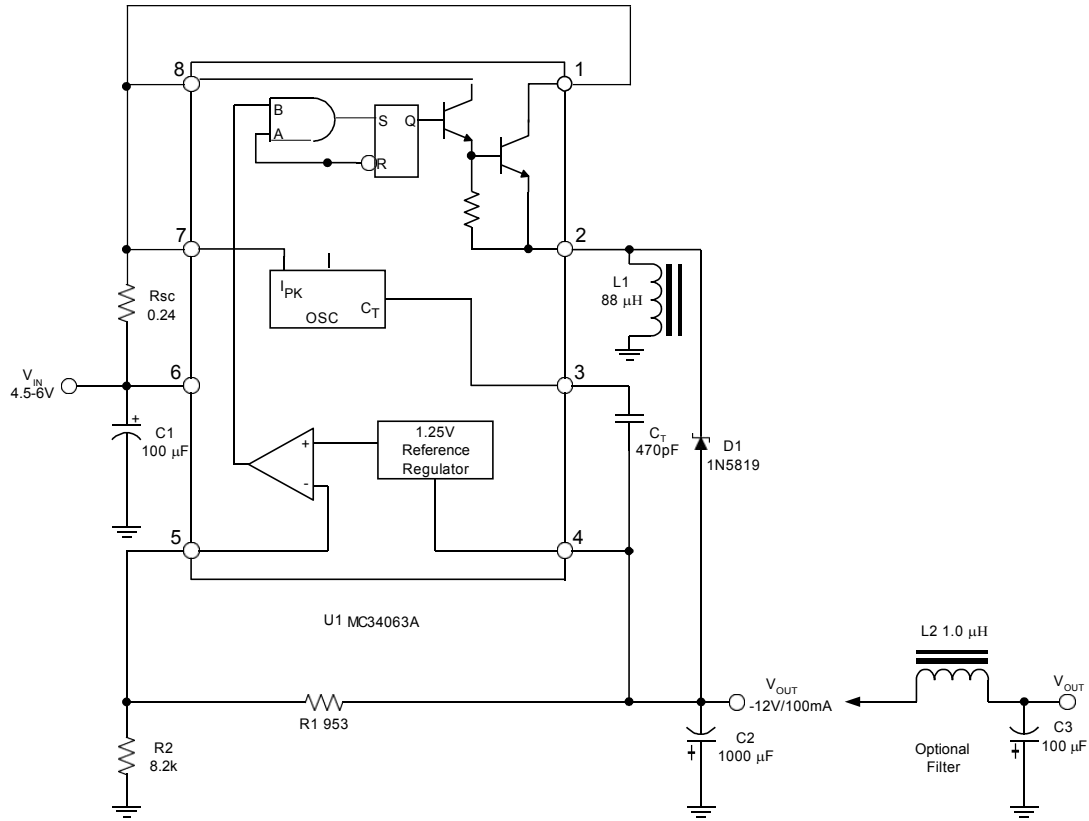


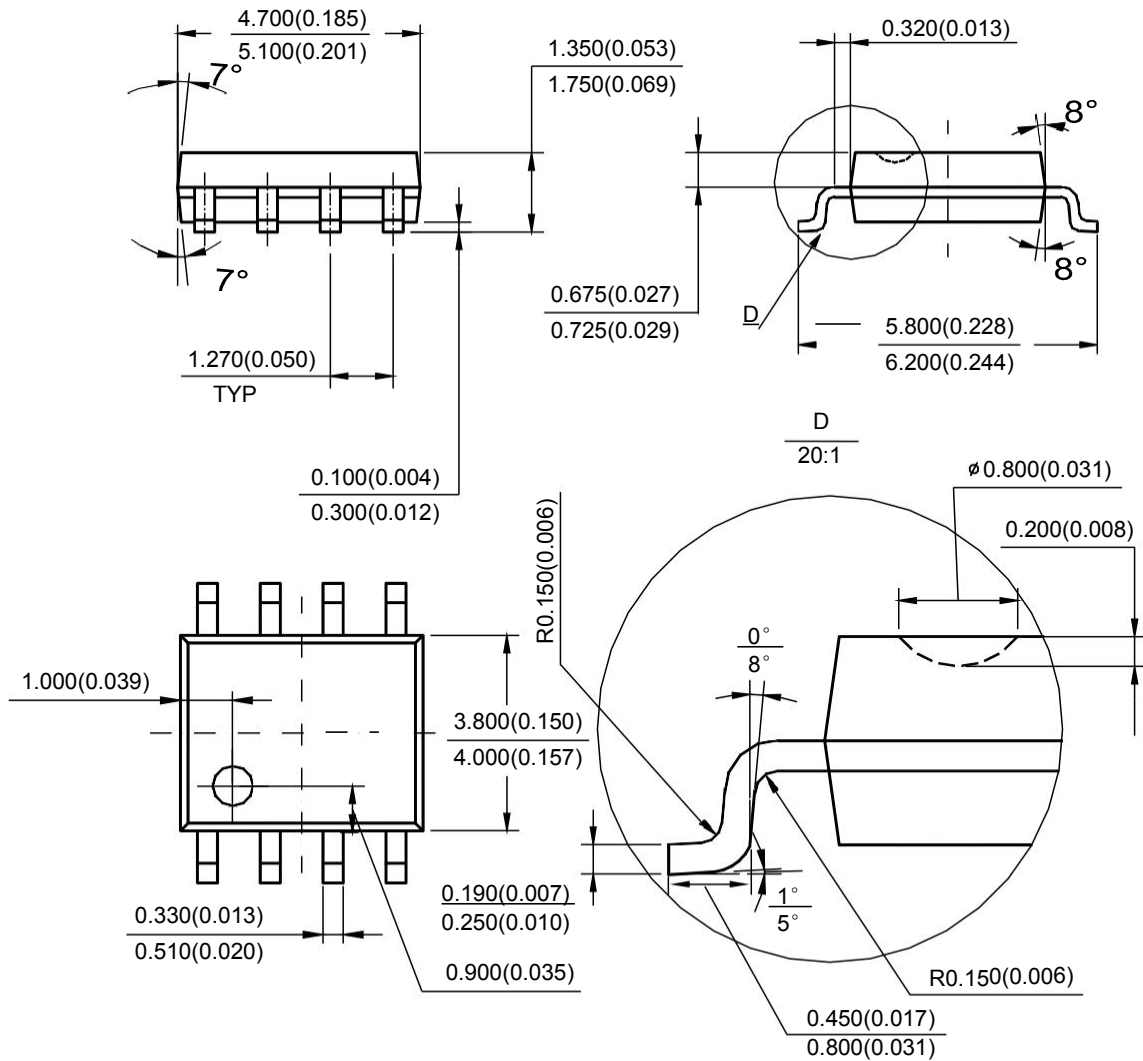
Figure 16. Voltage Inverting Converter (Note 7)

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

## Mechanical Dimensions

SOP-8

Unit: mm(inch)



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

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