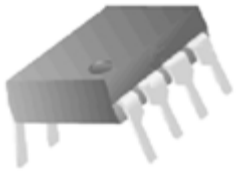
DC-DC Converter Control Circuits

LR34063



DIP-8

SOP-8

DESCRIPTION:

The LR34063 Series is a monolithic control circuit containing the primary functions required for DC-to-DC converters.These devices consist of an internal temperature compensated reference,comparator, controlled duty cycle oscillator with an active current limit circuit, driver and high current output switch.This series was specifically designed to be incorporated in Step-Down and Step-Up and Voltage-Inverting applications with a minimum number of external components.

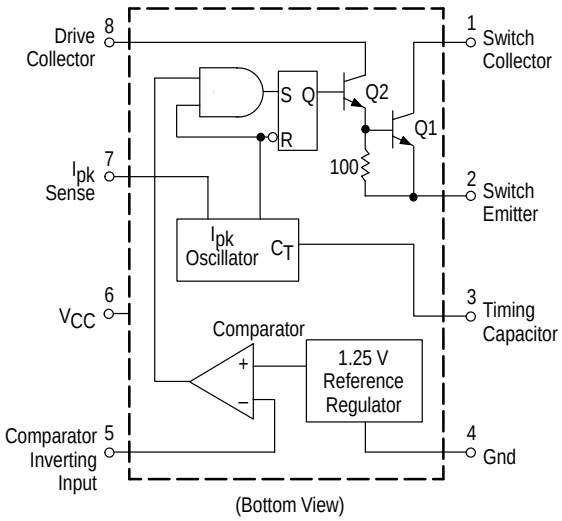
FEATURE:

- Operation from 3.0 V to 40 V Input
- Low Standby Current
- Current Limiting
- Output Switch Current to 1.5 A
- Output Voltage Adjustable
- Frequency Operation to 100 kHz
- Precision 2% Reference

ORDERING INFORMATION

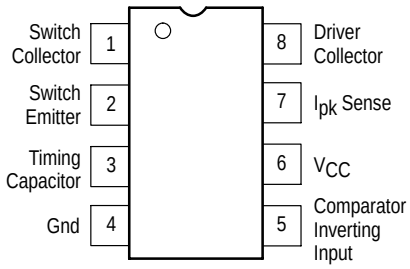
Device	Package
LR34063	DIP-8
LR34063D	SOP-8

BLOCK DIAGRAM



(Bottom View)

PIN CONNECTIONS



(Top View)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	40	Vdc
Comparator Input Voltage Range	V_{IR}	−0.3 to +40	Vdc
Switch Collector Voltage	$V_{C(switch)}$	40	Vdc
Switch Emitter Voltage ($V_{Pin\ 1}$ = 40 V)	$V_{E(switch)}$	40	Vdc
Switch Collector to Emitter Voltage	$V_{CE(switch)}$	40	Vdc
Driver Collector Voltage	$V_{C(driver)}$	40	Vdc
Driver Collector Current (Note 1)	$I_{C(driver)}$	100	mA
Switch Current	I_{SW}	1.5	A
Power Dissipation and Thermal Characteristics DIP-8 Package, T_A = 25°C Thermal Resistance SOP-8 Package, D Suffix T_A = 25°C Thermal Resistance	 P_D $R_{\theta JA}$ P_D $R_{\theta JA}$	 1.25 100 625 160	 W °C/W mW °C/W
Operating Junction Temperature	T_J	+150	°C
Operating Ambient Temperature Range	T_A	0 to +70	°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

NOTES: 1. Maximum package power dissipation limits must be observed.
2. ESD data available upon request.

ELECTRICAL CHARACTERISTICS (V_{CC} = 5.0 V, T_A = T_{low} to T_{high} [Note 3], unless otherwise specified.)

Characteristics	Symbol	Min	Typ	Max	Unit
OSCILLATOR					
Frequency ($V_{Pin\ 5}$ = 0 V, C_T = 1.0 nF, T_A = 25°C)	f_{osc}	24	33	42	kHz
Charge Current (V_{CC} = 5.0 V to 40 V, T_A = 25°C)	I_{chg}	24	35	42	µA
Discharge Current (V_{CC} = 5.0 V to 40 V, T_A = 25°C)	I_{dischg}	140	220	260	µA
Discharge to Charge Current Ratio (Pin 7 to V_{CC}, T_A = 25°C)	I_{dischg}/I_{chg}	5.2	6.5	7.5	–
Current Limit Sense Voltage (I_{chg} = I_{dischg}, T_A = 25°C)	$V_{ipk(sense)}$	250	300	350	mV
OUTPUT SWITCH (Note 4)					
Saturation Voltage, Darlington Connection (Note 5) (I_{SW} = 1.0 A, Pins 1, 8 connected)	$V_{CE(sat)}$	–	1.0	1.3	V
Saturation Voltage, Darlington Connection (I_{SW} = 1.0 A, $R_{Pin\ 8}$ = 82 Ω to V_{CC}, Forced β ≃ 20)	$V_{CE(sat)}$	–	0.45	0.7	V
DC Current Gain (I_{SW} = 1.0 A, V_{CE} = 5.0 V, T_A = 25°C)	h_{FE}	50	75	–	–
Collector Off–State Current (V_{CE} = 40 V)	$I_{C(off)}$	–	0.01	100	µA

NOTES: 3. T_{low} = 0°C ,T_{high} = +70°C
4. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible.
5. If the output switch is driven into hard saturation (non–Darlington configuration) at low switch currents (≤ 300 mA) and high driver currents (≥ 30 mA), it may take up to 2.0 µs for it to come out of saturation. This condition will shorten the off time at frequencies ≥ 30 kHz, 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:

Forced β of output switch : $\frac{I_C \text{ output}}{I_C \text{ driver} - 7.0 \text{ mA}^*} \geq 10$

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

ELECTRICAL CHARACTERISTICS (continued) (V_{CC} = 5.0 V, T_A = T_{low} to T_{high} [Note 3], unless otherwise specified.)

Characteristics	Symbol	Min	Typ	Max	Unit
COMPARATOR					
Threshold Voltage T_A = 25°C T_A = T_{low} to T_{high}	V_{th}	 1.23 1.21	 1.25 –	 1.27 1.29	V
Threshold Voltage Line Regulation (V_{CC} = 3.0 V to 40 V)	Reg_{line}	–	1.4	5.0	mV
Input Bias Current (V_{in} = 0 V)	I_{IB}	–	–20	–400	nA
TOTAL DEVICE					
Supply Current (V_{CC} = 5.0 V to 40 V, C_T = 1.0 nF, Pin 7 = V_{CC}, $V_{Pin\ 5}$ > V_{th}, Pin 2 = Gnd, remaining pins open)	I_{CC}	–	–	4.0	mA

NOTES: 3. T_{low} = 0°C , T_{high} = +70°C

4. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible.

5. If the output switch is driven into hard saturation (non–Darlington configuration) at low switch currents (≤ 300 mA) and high driver currents (≥ 30 mA), it may take up to 2.0 µs for it to come out of saturation. This condition will shorten the off time at frequencies ≥ 30 kHz, 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:

Forced β of output switch : $\frac{I_C \text{ output}}{I_C \text{ driver} - 7.0 \text{ mA}^*} \geq 10$

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

Figure 1. Output Switch On–Off Time versus Oscillator Timing Capacitor

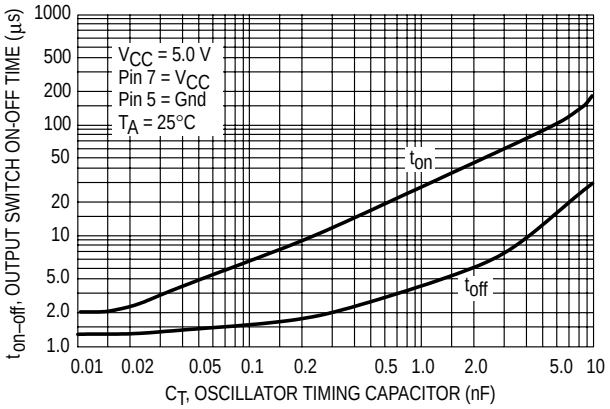


Figure 2. Timing Capacitor Waveform

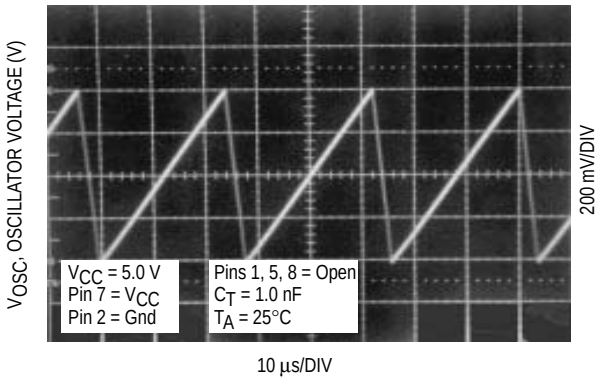


Figure 3. Emitter Follower Configuration Output Saturation Voltage versus Emitter Current

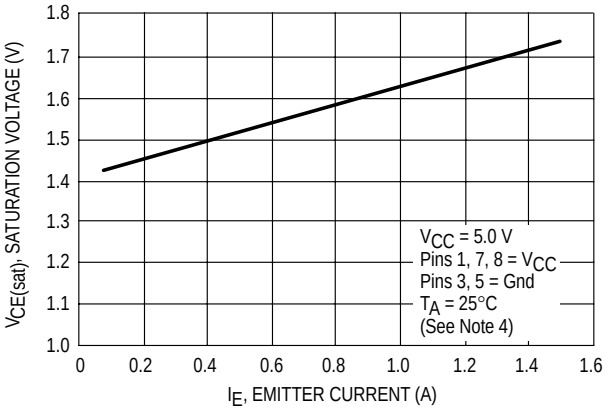


Figure 4. Common Emitter Configuration Output Switch Saturation Voltage versus Collector Current

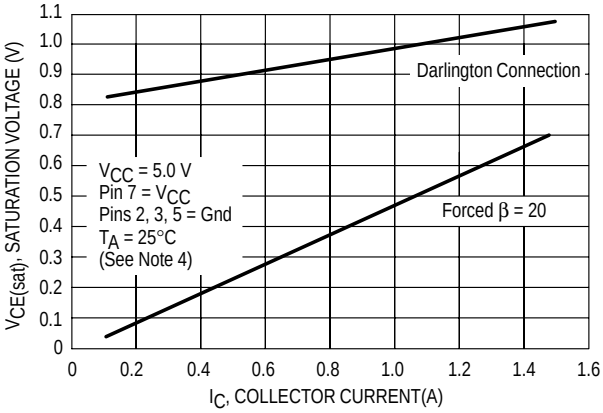


Figure 5. Current Limit Sense Voltage versus Temperature

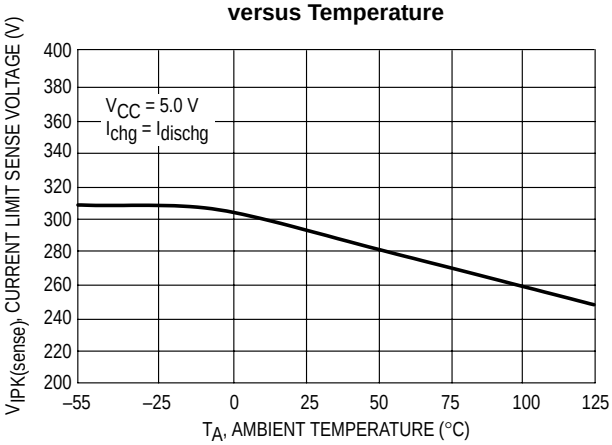
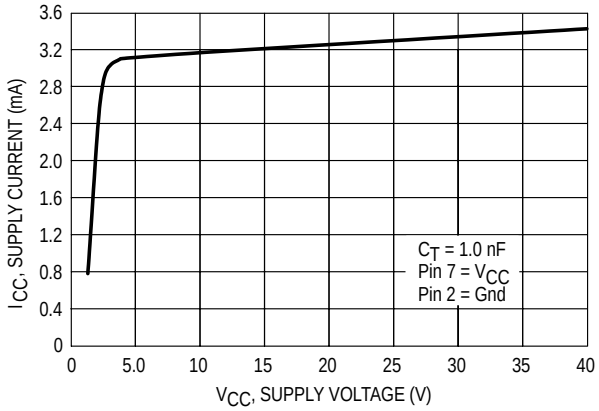
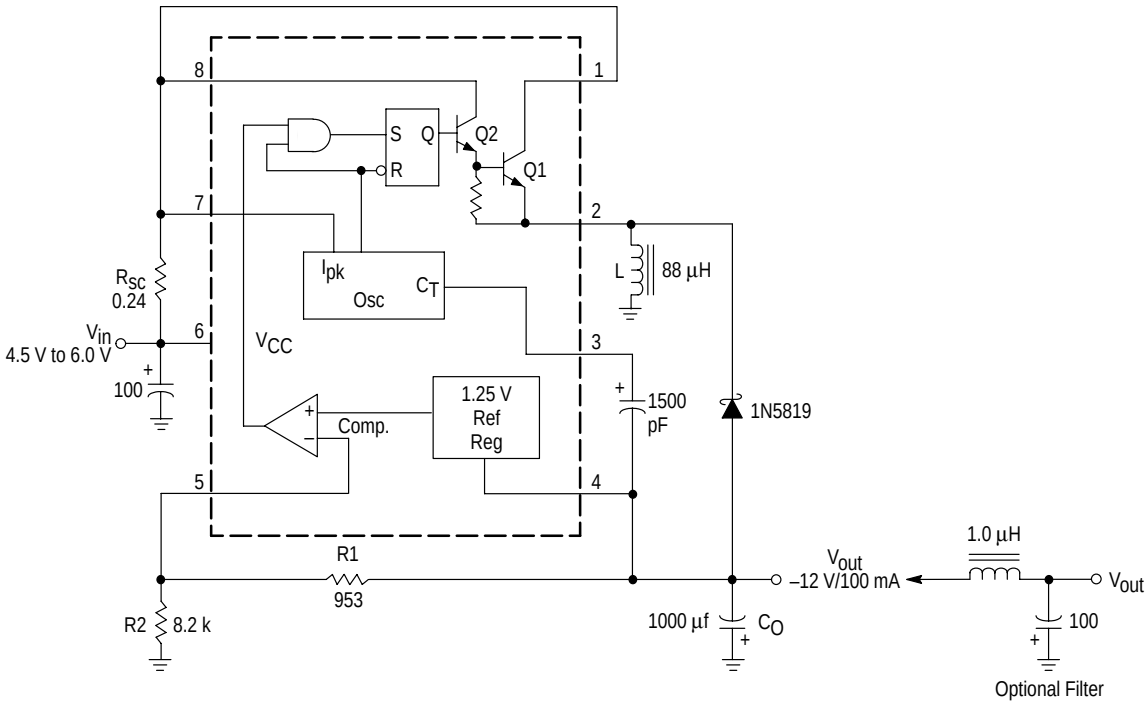


Figure 6. Standby Supply Current versus Supply Voltage



NOTE: 4. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible.

Figure 7. Voltage Inverting Converter

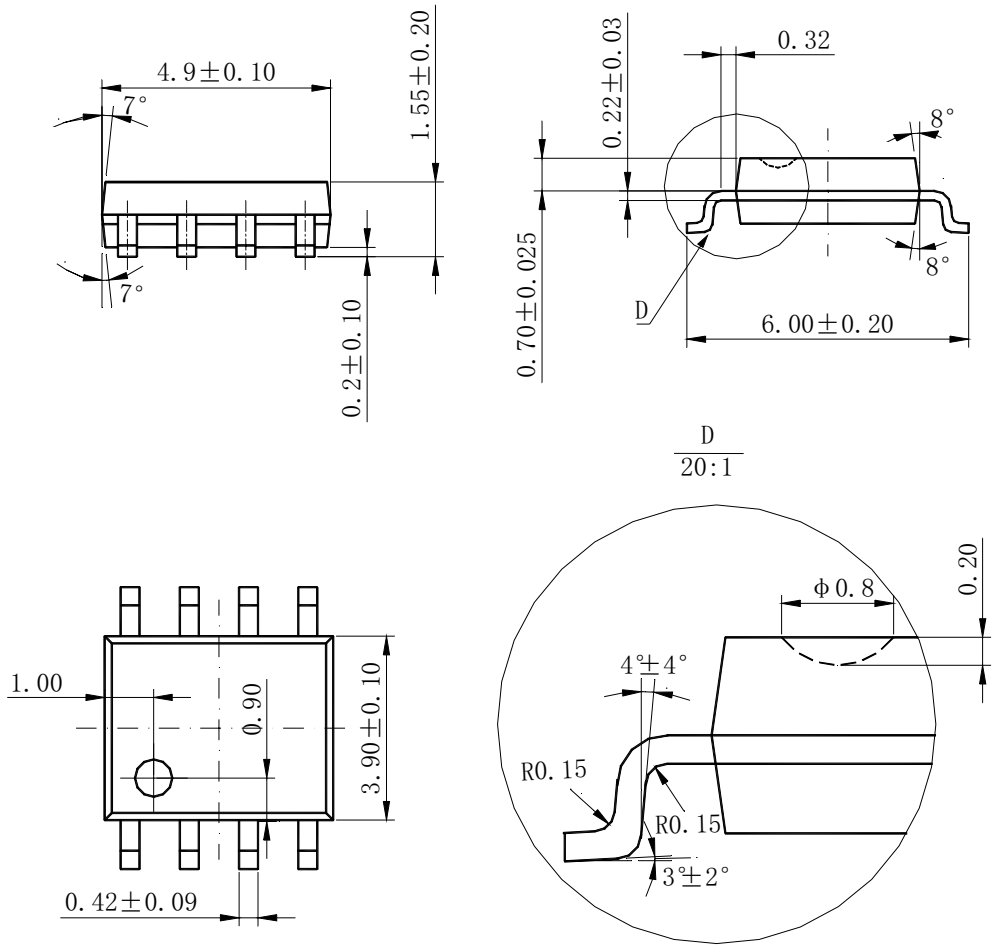


Test	Conditions	Results
Line Regulation	V_{in} = 4.5 V to 6.0 V, I_O = 100 mA	3.0 mV = ±0.012%
Load Regulation	V_{in} = 5.0 V, I_O = 10 mA to 100 mA	0.022 V = ±0.09%
Output Ripple	V_{in} = 5.0 V, I_O = 100 mA	500 mVpp
Short Circuit Current	V_{in} = 5.0 V, R_L = 0.1 Ω	910 mA
Efficiency	V_{in} = 5.0 V, I_O = 100 mA	62.2%
Output Ripple With Optional Filter	V_{in} = 5.0 V, I_O = 100 mA	70 mVpp

LR34063

Mechanical Dimensions

SOP-8 **Unit: mm**



LR34063

Mechanical Dimensions (Continued)

DIP-8 **Unit: mm**