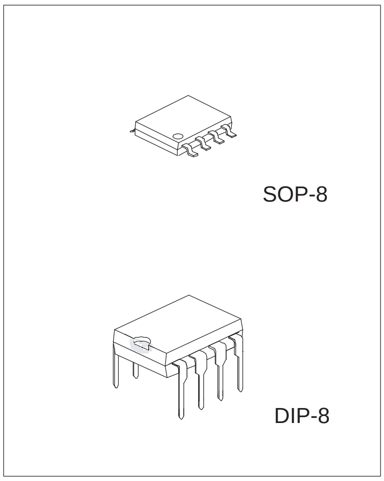
CKD Technology

CKD34063

DC TO DC CONVERTER CONTROLLER

DESCRIPTION

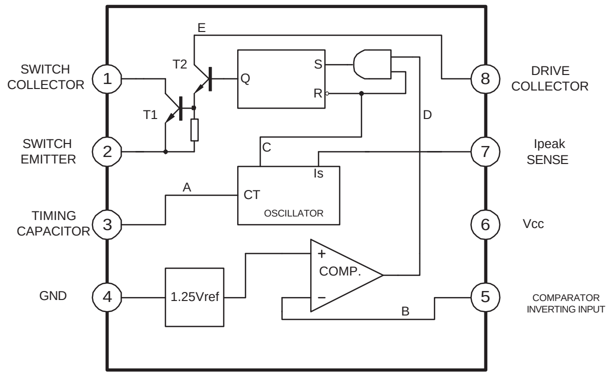
The CKD34063 Series is a monolithic control circuit containing the primary functions required for DC to DC converters. These devices consist of an internal temperature compensated reference, comparator controlled duty cycle oscillator with an active current limit circuit, driver and high current output 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.



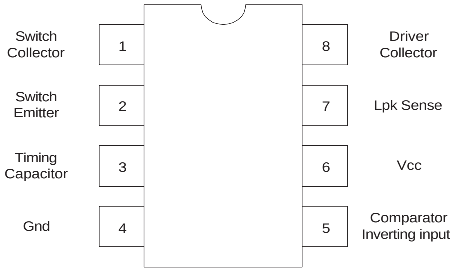
FEATURES

*Operation from 3.0V to 40V.
*Short circuit current limiting.
*Low standby current.
*Output switch current of 1.5A without external transistors.
*Frequency of operation from 100Hz to 100kHz.
*Step-up, step-down or inverting switch regulators.
*Pin to pin compatible with MC34063

BLOCK DIAGRAM



PIN CONFIGURATION



ORDERING INFORMATION

Device	Operating Temperature Range	Package
CKD34063D	T_A = 0°C to +70°C	PDIP-8
CKD34063S	T_A = 0°C to +70°C	SOP-8

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

Characteristics	Symbol	Min	Typ	Max	Unit
OSCILLATOR					
Frequency (V_{pin5} = 0 V, C_T = 1.0nF, 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}	22	33	42	uA
Discharge Current (V_{CC} =5.0 V to 40 V, T_A = 25°C)	I_{dischg}	140	200	260	uA
Discharge to Charge Current Ratio (Pin7 to V_{CC}, T_A = 25°C)	I_{dischg} / I_{chg}	250	300	350	mV
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	120	-	-
Collector Off-State Current (V_{CE} = 40 V)	$I_{C(off)}$	-	0.01	100	uA
COMPARATOR					
Threshold Voltage T_A = 25°C T_A = T_{low} to T_{high}	V_{th}	1.23 1.2225	1.25 -	1.27 1.2475	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}	-	-40	-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}	-	2.5	4.0	mA

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	MA0
Switch Current	I_{SW}	1.5	A
Power Dissipation and Thermal Characteristics T_A = 25°C Thermal Resistance	P_D $R_{\theta JA}$	1.0 100	W °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

NOTE :

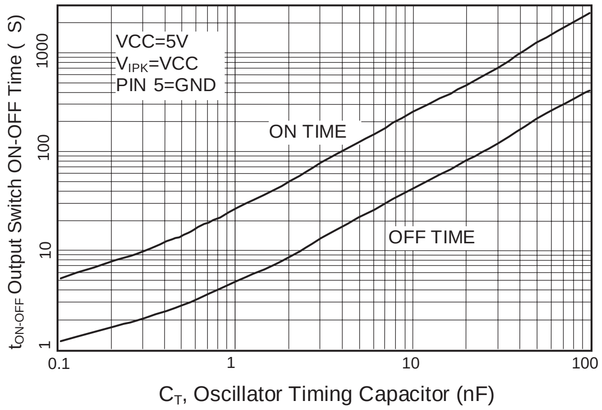
1. Maximum package power dissipation limits must be observed.
2. ESD data available upon request.
3. T_{low} = 0°C, T_{high} = +70°C
4. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible.
5. If the output switch is driven into hard saturation (non-Darlington configuration) at low switch currents (≤ 300mA) and high driver currents (≥30mA), it may take up to 2.0uS for it to come out of saturatiion. 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:

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

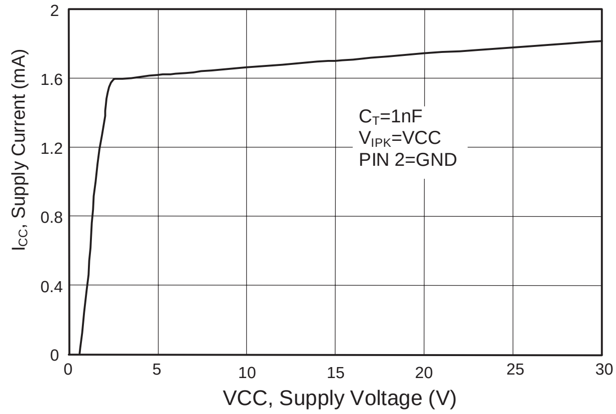
*The 100 Ω resistor in the emitter of the driver device requires about 7.0 mA before the output switch conducts.

TYPICAL PERFORMANCE CHARACTERISTICS

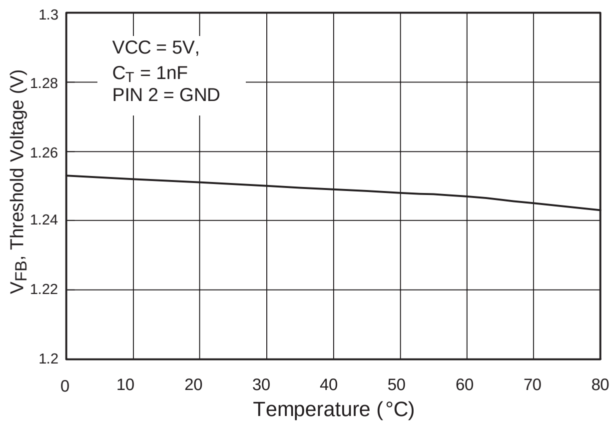
Output Switch ON-OFF Time vs. Oscillator Timing Capacitor



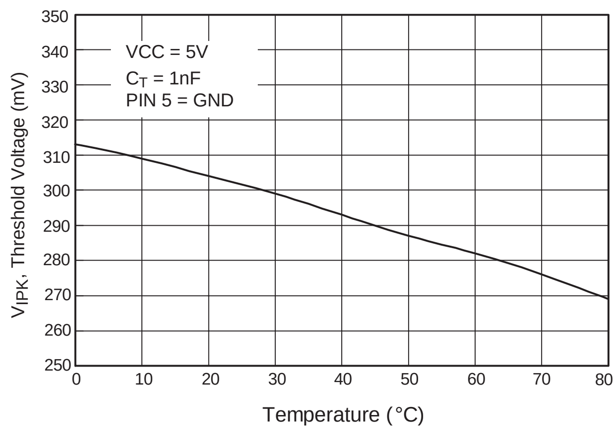
Standby Supply Current vs. Supply Voltage



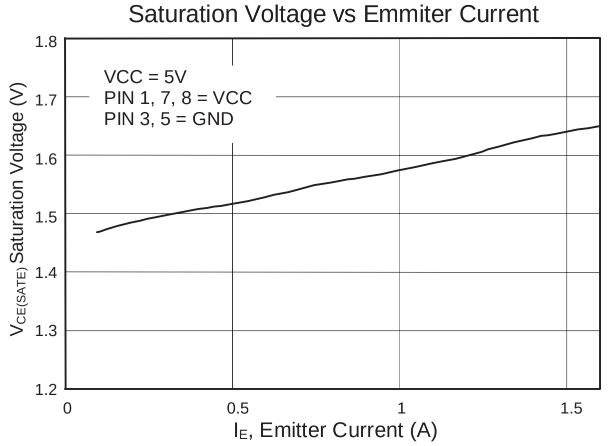
V_{FB}, Threshold Voltage vs Temperature



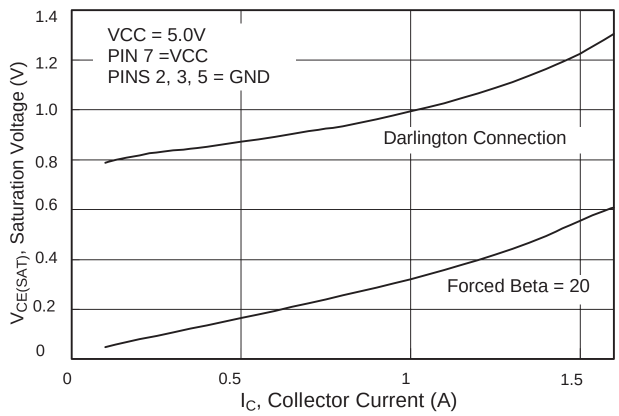
IPK Threshold Voltage vs Temperature



Emmiter-Follower Configuration Output Switch Saturation Voltage vs Emmiter Current

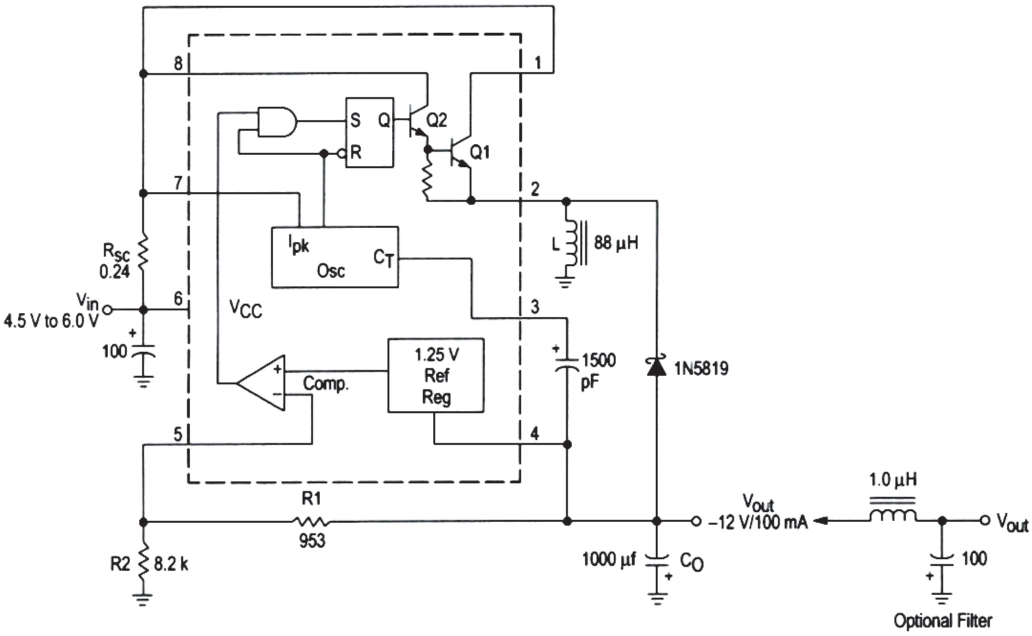


Common-Emitter Configuration Output Switch Saturation Voltage vs Collector Current



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

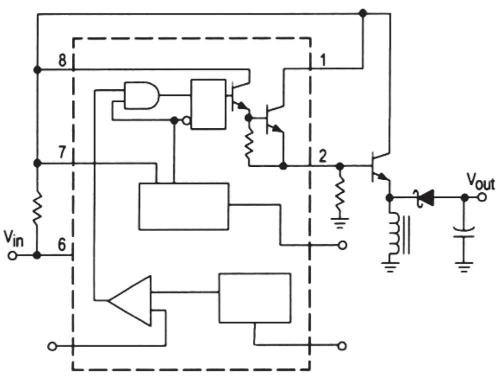
Figure 1. Voltage Inverting Converter



Test	Condition	Results
Line Regulation	V_{in} = 4.5 V to 6.0 V, Io = 100 mA	3.0 mV = ±0.012%
Load Regulation	V_{in} = 5.0 V, Io = 10 mA to 100 mA	0.022 V = ± 0.09%
Output Ripple	V_{in} = 5.0 V, Io = 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, Io = 100 mA	62.2%
Output Ripple With Optional Filter	V_{in} = 5.0 V, Io = 100 mA	70 mVpp

Figure 2. External Current Boost Connections for Ic Peak Greater than 1.5 A

2a. External NPN Switch



2b. External PNP Saturated Switch

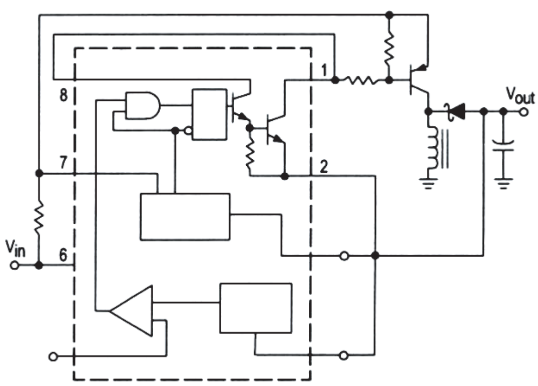
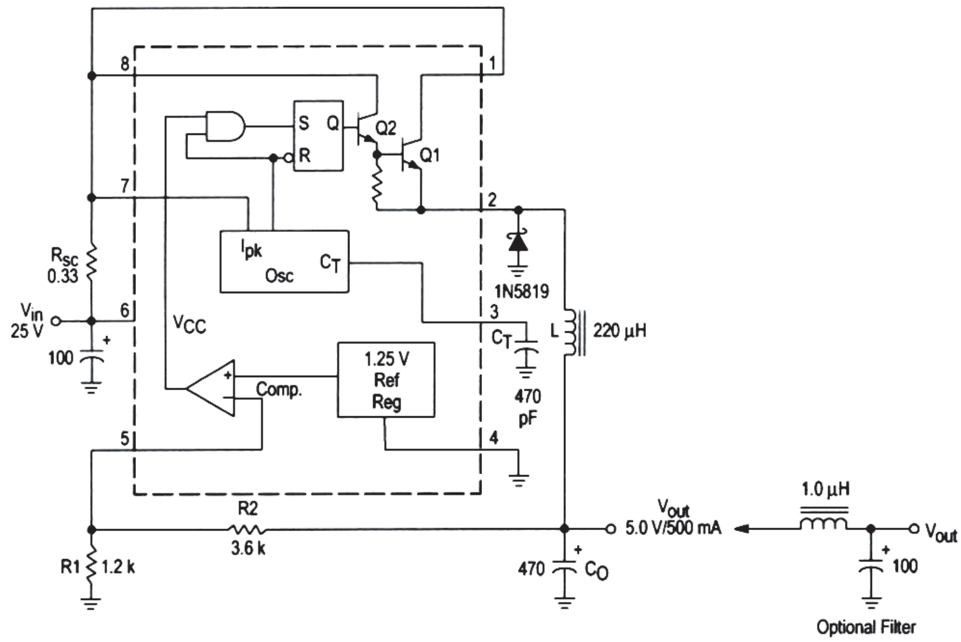


Figure 3. Step-Down Converter



Test	Condition	Results
Line Regulation	V_{in} = 15 V to 25 V, Io = 500 mA	12 mV = ±0.12%
Load Regulation	V_{in} = 25 V, Io = 50 mA to 500 mA	3.0 mV = ± 0.03%
Output Ripple	V_{in} = 25 V, Io = 500 mA	120 mVpp
Short Circuit Current	V_{in} = 25 V, R_L = 0.1 Ω	1.1 A
Efficiency	V_{in} = 25 V, Io = 500 mA	83.7%
Output Ripple With Optional Filter	V_{in} = 25 V, Io = 500 mA	40 mVpp

Figure 4. External Current Boost Connections for Ic Peak Greater than 1.5 A

4a. External NPN Switch **4b. External PNP Saturated Switch**

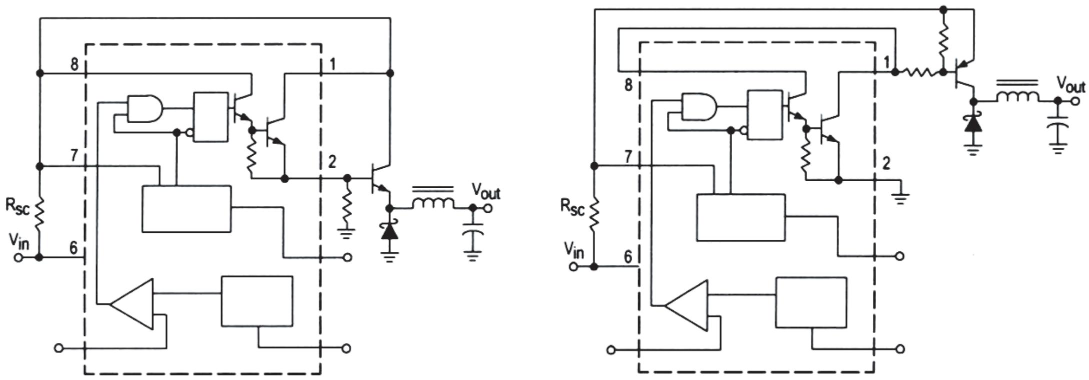
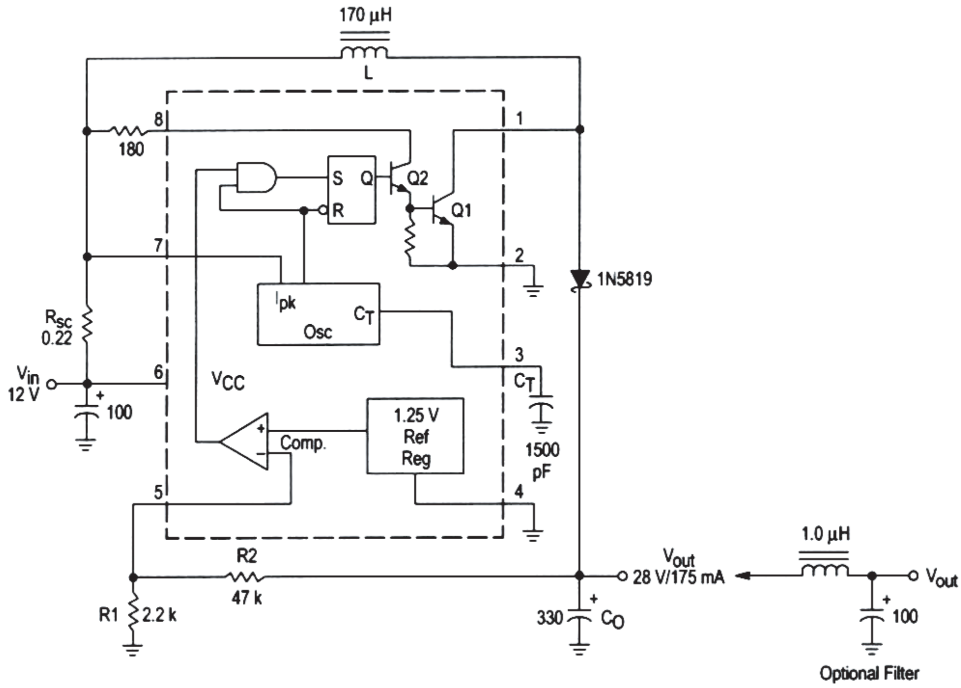


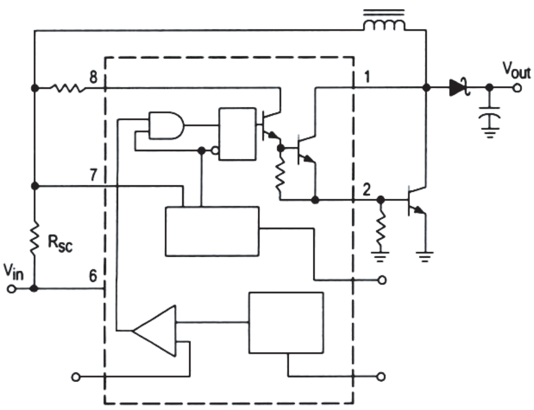
Figure 5. Step-Up Converter



Test	Condition	Results
Line Regulation	V_{in} = 8.0 V to 16 V, Io = 175 mA	30 mV = ±0.05%
Load Regulation	V_{in} = 12 V, Io = 75 mA to 175 mA	10 mV = ±0.017%
Output Ripple	V_{in} = 12 V, Io = 175 mA	400 mVpp
Efficiency	V_{in} = 12 V, Io = 175 mA	87.7%
Output Ripple With Optional Filter	V_{in} = 12 V, Io = 175 mA	40 mVpp

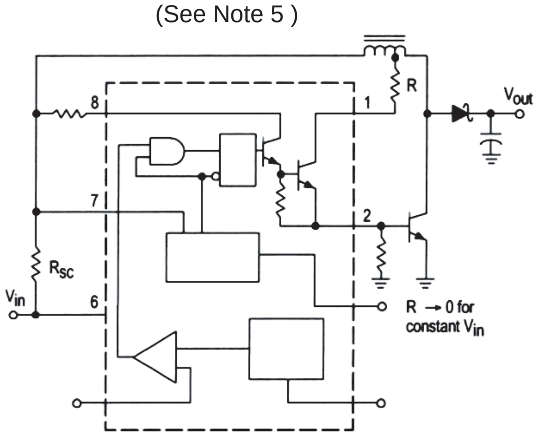
Figure 6. External Current Boost Connections for Ic Peak Greater than 1.5 A

6a. External NPN Switch

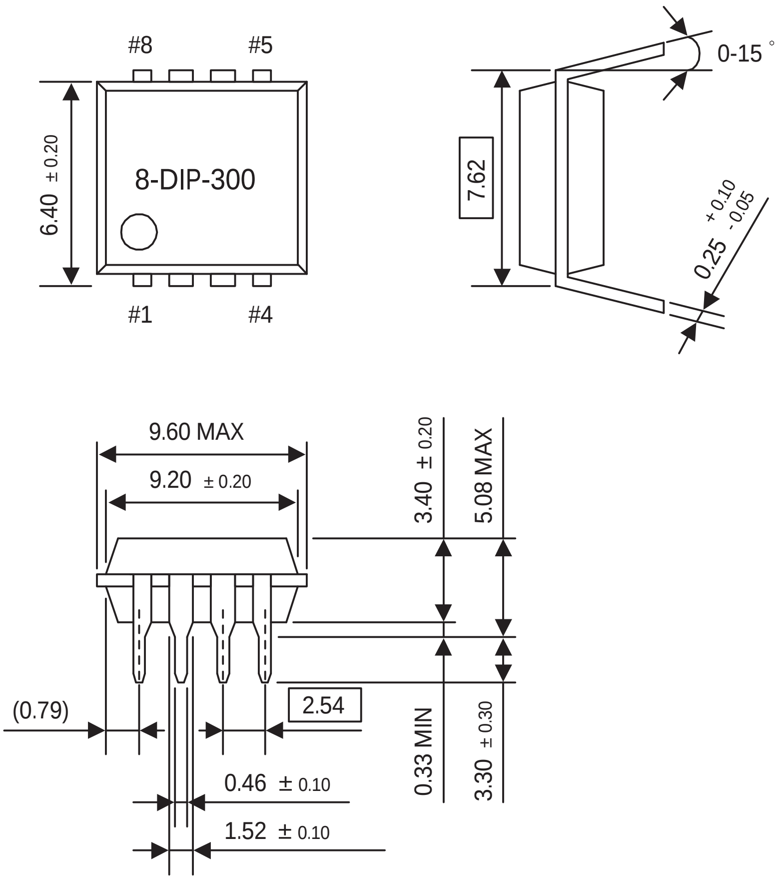


6 b. External NPN Saturated Switch

(See Note 5)

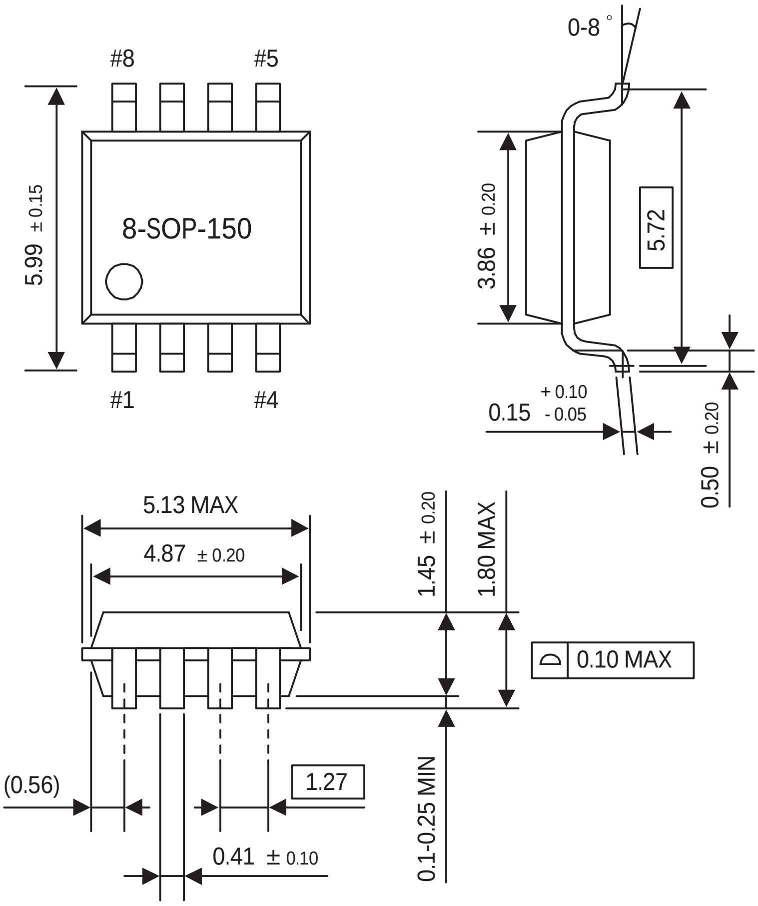


Note 5: If the output switch is driven into hard saturation (non-Darlington configuration) at low switch currents (≤ 300 mA) and high driver currents (≥ 30 mA), it may take up to 2.0 us to come out of saturation. This condition will shorten the off time at frequencies ≥ 30 kHz, and is magnified at high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



NOTE : Dimensions are in millimeters.

8-DIP-300 Package Dimensions



NOTE : Dimensions are in millimeters.

8-SOP-150 Package Dimensions