

DC-DC Converter Control Circuits

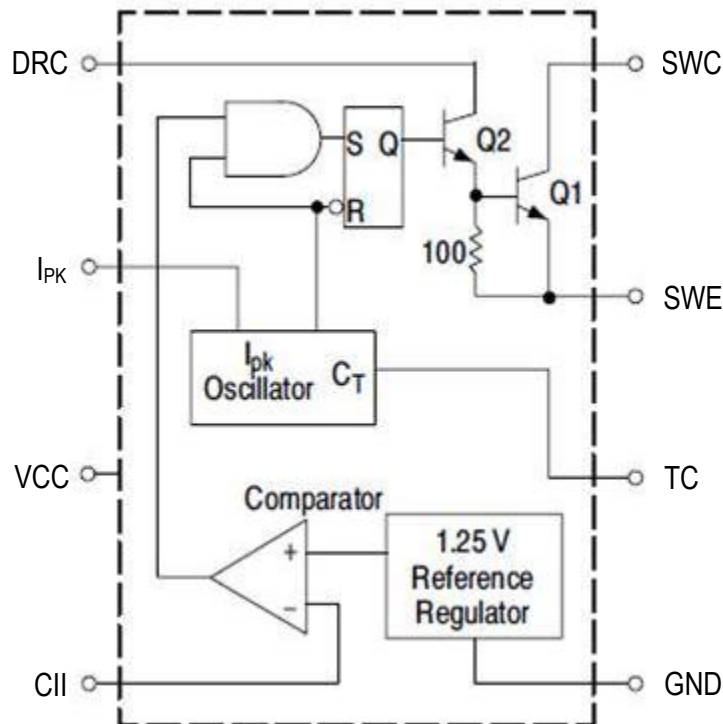
❖ GENERAL DESCRIPTION

The AX34063 Series is a monolithic control circuit containing the primary functions required for DC-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

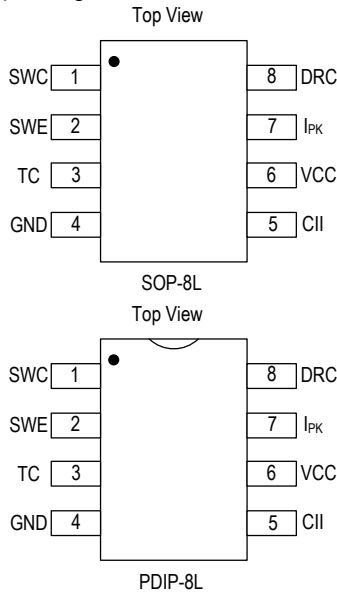
- Operation from 3.0 V to 40 V Input
- Low Standby Current
- Current Limiting
- Output Switch Current to 1.5 A
- Output Voltage Adjustable
- Frequency Operation to 100 KHz
- Precision 2% Reference

❖ BLOCK DIAGRAM



❖ PIN ASSIGNMENT

The packages of AX34063 are SOP-8L and PDIP-8L; the pin assignment is given by:



Name	Description
SWC	Switch Collector
SWE	Switch Emitter
TC	Timing Capacitor
GND	GND Pin
CII	Comparator Inverting Input
VCC	Voltage Supply
IpK	IpK Sense
DRC	Voltage Driver Collector

❖ ORDER/MARKING INFORMATION

Order Information	Top Marking
AX34063 X X Package Type Packing S: SOP-8L Blank: Tube N: PDIP-8L A: Taping	Logo ← AX 3 4 0 6 3 → Part number Y Y W W X → ID code: internal → WW: 01~52 → Year: 10=2010 11=2011

❖ ABSOLUTE MAXIMUM RATINGS (at T_A=25°C)

Characteristics	Symbol	Rating	Unit
Power Supply Voltage	V _{CC}	40	V
Comparator Input Voltage Range	V _{IR}	-0.3 to +40	V
Switch Collector Voltage	V _{SWC}	40	V
Switch Emitter Voltage (V _{SWC} =40V)	V _{SWE}	40	V
Switch Collector to Emitter Voltage	V _{CE}	40	V
Driver Collector Voltage	V _C	40	V
Driver Collector Current	I _C	100	mA
Switch Current	I _{SW}	1.5	A
Power Dissipation	PDIP-8L	1.25	W
	SOP-8L	0.625	
Operating Junction Temperature	T _J	+150	°C
Storage Temperature Range	T _{ST}	-40 to +150	°C
Operating Ambient Temperature Range AX34063	T _A	0 to +70	°C
Thermal Resistance from Junction to Ambient	PDIP-8L	100	°C/W
	SOP-8L	160	

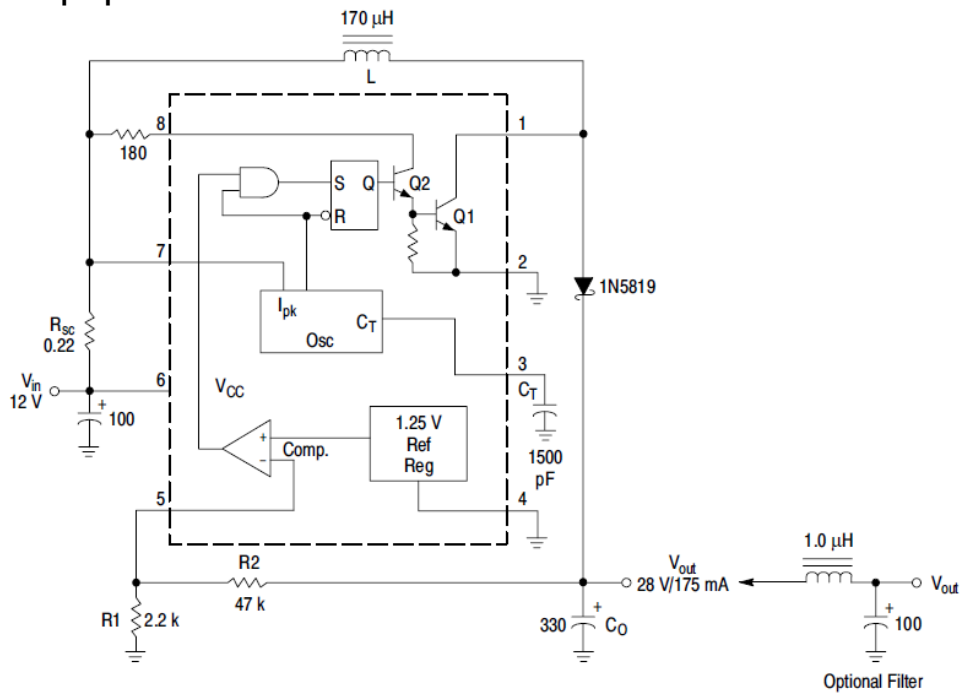
Note: θ_{JA} is measured with the PCB copper area of approximately 1 in²(Multi-layer).

❖ ELECTRICAL CHARACTERISTICS

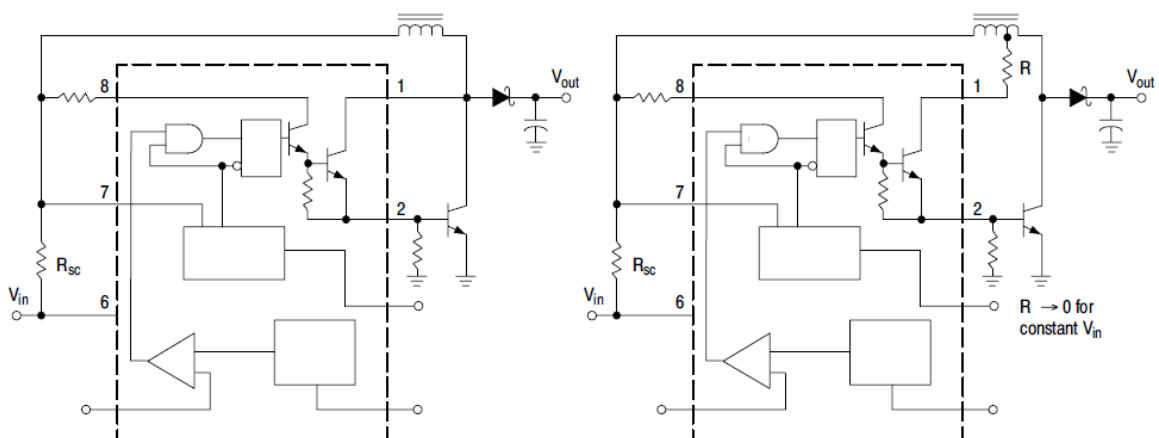
 (T_A = +25°C, unless otherwise noted.)

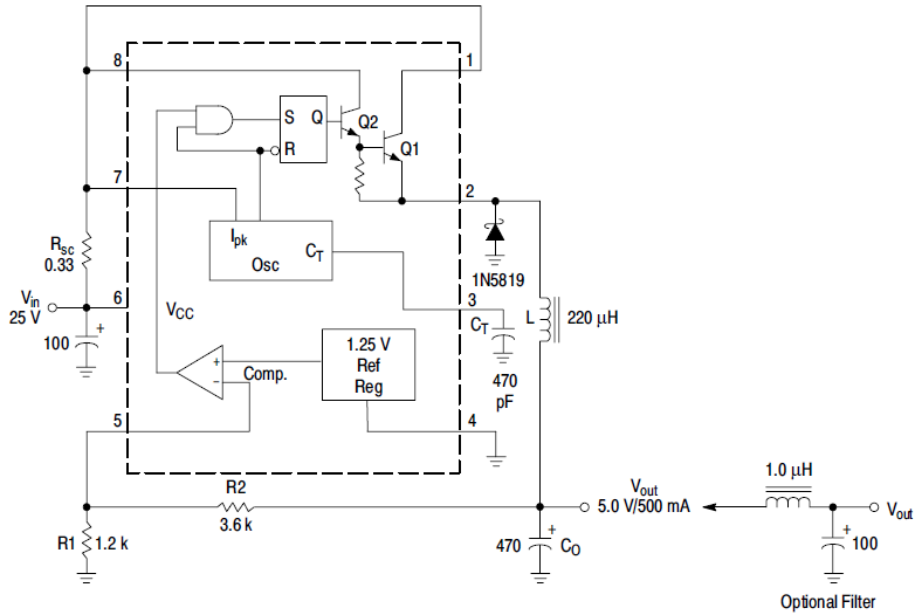
Characteristics	Symbol	Conditions	Min	Typ	Max	Units
OSCILLATOR						
Frequency	f _{OSC}	V _{Pin 5} =0V, C _T =1.0nF	24	33	42	KHz
Charge Current	I _{chg}	V _{CC} =5.0V to 40V	24	35	42	μA
Discharge Current	I _{dischg}	V _{CC} =5.0V to 40V	140	220	260	μA
Discharge to Charge Current Ratio	I _{dischg} /I _{chg}	Pin 7 to V _{CC}	5.2	6.5	7.5	-
Current Limit Sense Voltage	V _{ipk}	I _{chg} = I _{dischg}	250	300	350	mV
OUTPUT SWITCH						
Saturation Voltage, Darlington Connection	V _{CE(sat)}	I _{SW} =1.0A, Pins1,8 connected	-	1.0	1.3	V
Saturation Voltage	V _{CE(sat)}	I _{SW} =1.0A, R _{Pins 8} =82Ω to V _{CC} , Forced β ≈ 20	-	0.45	0.7	V
DC Current Gain	h _{FE}	I _{SW} =1.0A, V _{CE} =5.0V	50	75	-	-
Collector Off-State Current	I _{C(off)}	V _{CE} =40V	-	0.01	100	uA
COMPARATOR						
Threshold Voltage	V _{th}	T _A =25°C	1.225	1.25	1.275	V
		T _A =T _{low} to T _{high}	1.21	-	1.29	V
Threshold Voltage Line Regulation	R _{egline}	V _{CC} =3.0V to 40V	-	1.4	5.0	mV
Input Bias Current	I _{IB}	V _{IN} =0V	-	-20	-400	nA
TOTAL DEVICE						
Supply Current	I _{CC}	V _{CC} =5.0V to 40V, C _T =1.0nF, Pin7=V _{CC} , V _{Pin5} >V _{th} , Pin2=GND, remaining pins open	-	-	4.0	mA

Note: The 100W resistor in the emitter of the driver device requires about 7.0 mA before the output switch conducts.

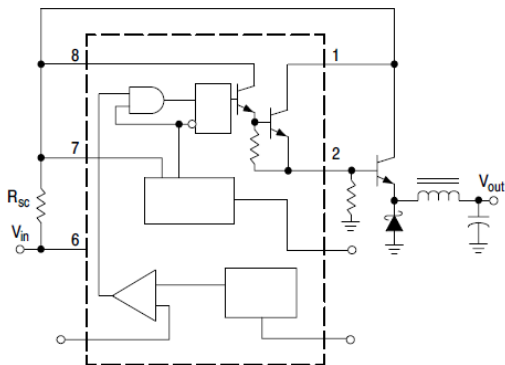
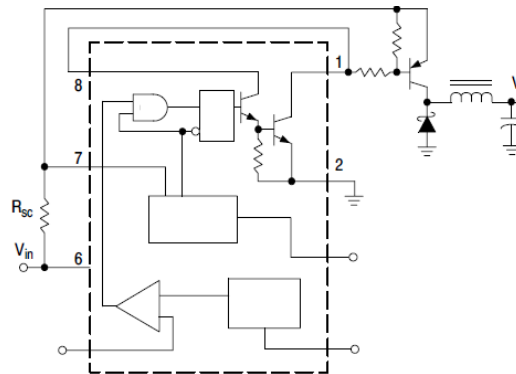
❖ APPLICATION CIRCUIT
1. Step-Up Converter


Test	Conditions	Results
Line Regulation	$V_{IN}=8.0V$ to $16V$, $I_O=175mA$	$30mV=\pm 0.05\%$
Load Regulation	$V_{IN}=12V$, $I_O=75mA$ to $175mA$	$10mV=\pm 0.017\%$
Output Ripple	$V_{IN}=12V$, $I_O=175mA$	400 mVpp
Efficiency	$V_{IN}=12V$, $I_O=175mA$	87.7%
Output Ripple With Optional Filter	$V_{IN}=12V$, $I_O=175mA$	$40mVpp$

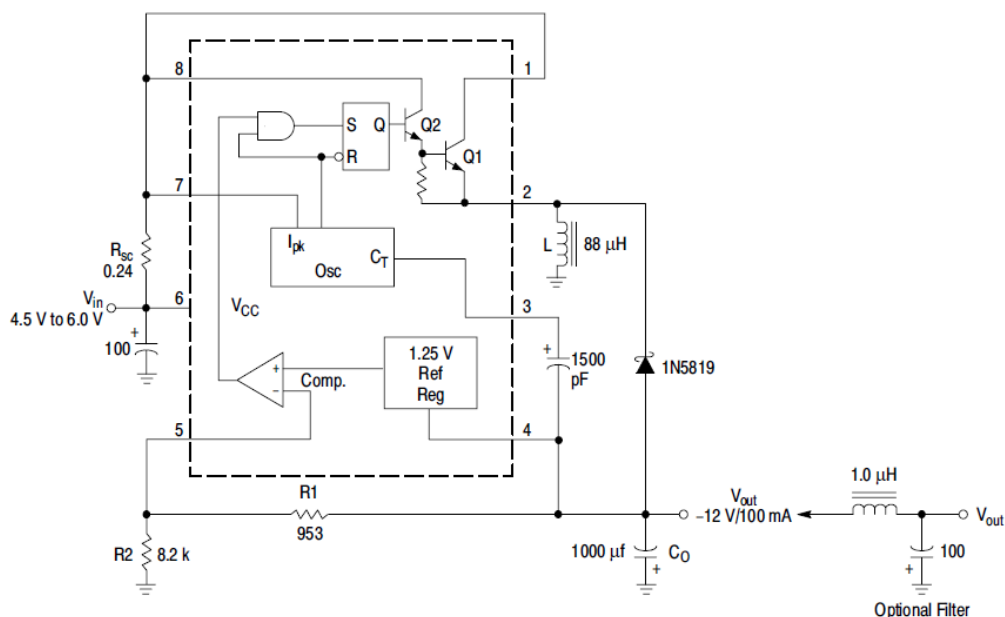
(1) Step-Up with External NPN Switch (2) Step-Up with External NPN Saturated Switch


2. Step-Down Converter


Test	Conditions	Results
Line Regulation	$V_{IN}=15V$ to $25V$, $I_O=500mA$	$12mV=\pm 0.12\%$
Load Regulation	$V_{IN}=25V$, $I_O=50mA$ to $500mA$	$3.0mV=\pm 0.03\%$
Output Ripple	$V_{IN}=25V$, $I_O=500mA$	120 mVpp
Short Circuit Current	$V_{IN}=25V$, $R_L=0.1\Omega$	$1.1A$
Efficiency	$V_{IN}=25V$, $I_O=500mA$	83.7%
Output Ripple With Optional Filter	$V_{IN}=25V$, $I_O=500mA$	$40mVpp$

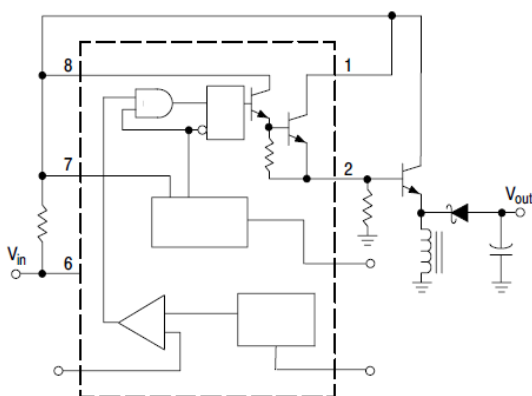
(1) Step-Down with External NPN Switch

(2) Step-Down with External PNP Switch


3. Voltage Inverting Converter

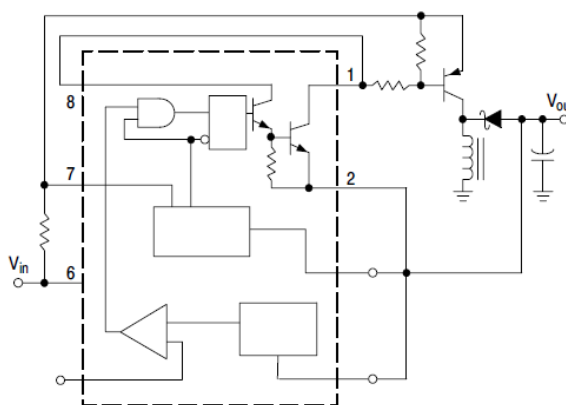


Test	Conditions	Results
Line Regulation	$V_{IN}=4.5V$ to $6.0V$, $I_O=100mA$	$3.0mV \pm 0.012\%$
Load Regulation	$V_{IN}=5.0V$, $I_O=10mA$ to $100mA$	$22mV \pm 0.09\%$
Output Ripple	$V_{IN}=5.0V$, $I_O=100mA$	$500mV_{pp}$
Short Circuit Current	$V_{IN}=5.0V$, $R_L=0.1\Omega$	$910mA$
Efficiency	$V_{IN}=5.0V$, $I_O=100mA$	62.2%
Output Ripple With Optional Filter	$V_{IN}=5.0V$, $I_O=100mA$	$70mV_{pp}$

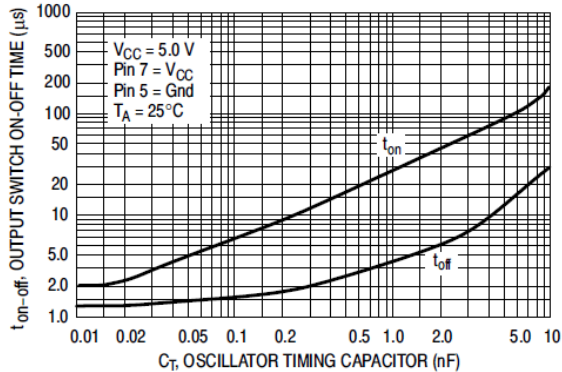
(1) Voltage Inverting with External NPN Switch



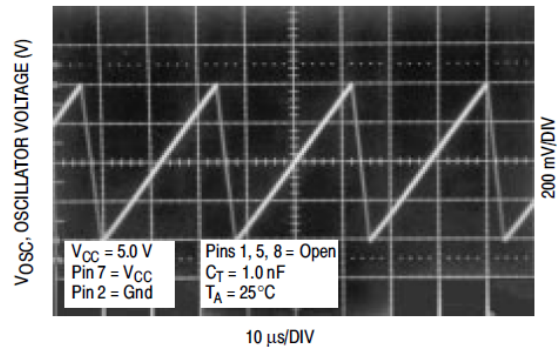
(2) Voltage Inverting with External PNP Switch



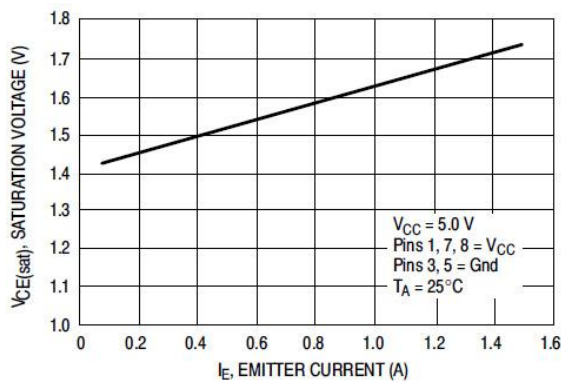
❖ **TYPICAL CHARACTERISTICS**



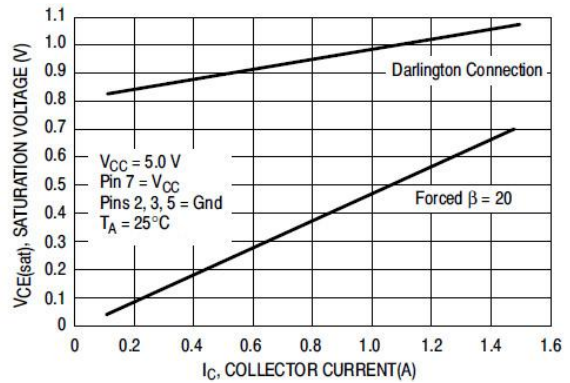
Output Switch On-Off Time vs. Oscillator Timing Capacitor



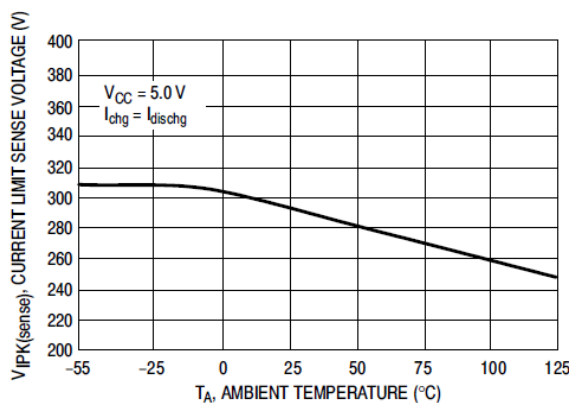
Timing Capacitor Waveform



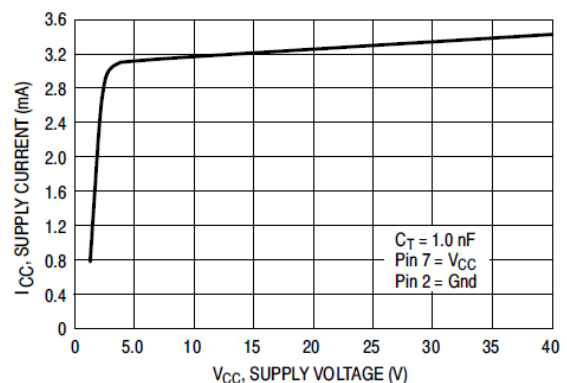
Emitter Follower Configuration Output Saturation Voltage vs. Emitter Current



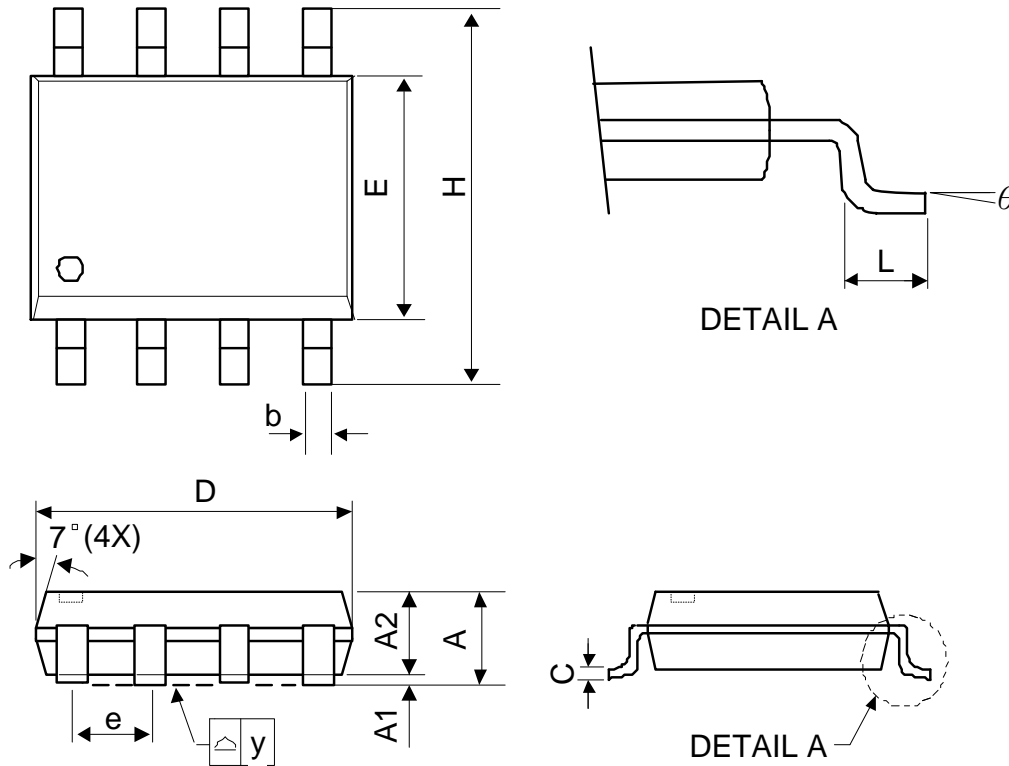
Common Emitter Configuration Output Switch Saturation Voltage vs. Collector Current



Current Limit Sense Voltage vs. Temperature

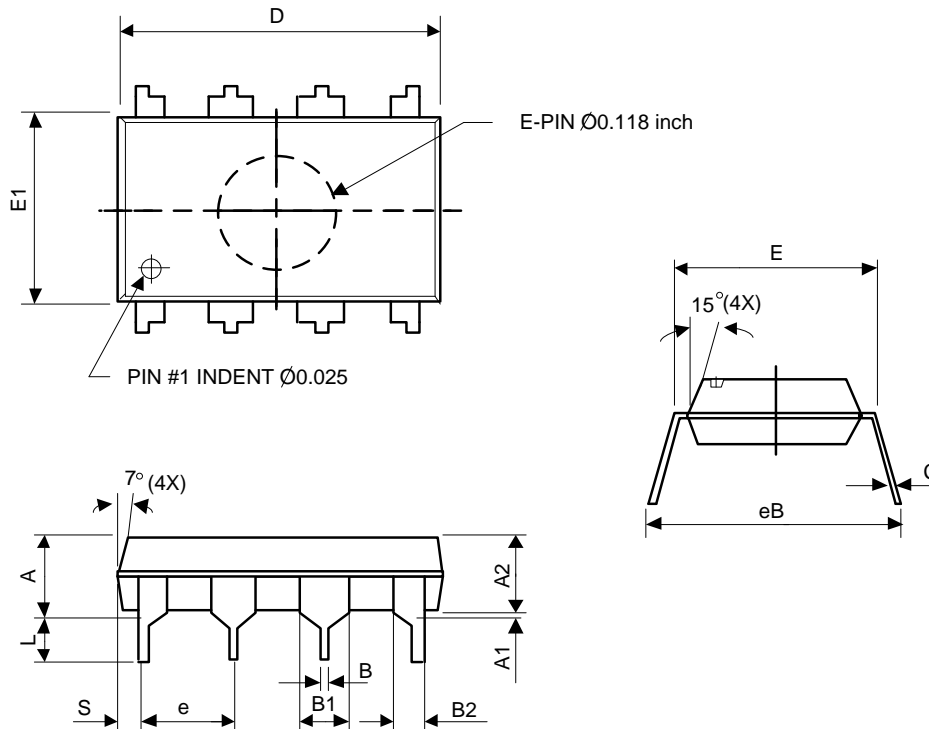


Standby Supply Current vs. Supply Voltage

❖ PACKAGE OUTLINES
(1) SOP-8L


Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.75	-	-	0.069
A1	0.1	-	0.25	0.04	-	0.1
A2	1.25	-	-	0.049	-	-
C	0.1	0.2	0.25	0.0075	0.008	0.01
D	4.7	4.9	5.1	0.185	0.193	0.2
E	3.7	3.9	4.1	0.146	0.154	0.161
H	5.8	6	6.2	0.228	0.236	0.244
L	0.4	-	1.27	0.015	-	0.05
b	0.31	0.41	0.51	0.012	0.016	0.02
e	1.27 BSC			0.050 BSC		
y	-	-	0.1	-	-	0.004
θ	0°	-	8°	0°	-	8°

Mold flash shall not exceed 0.25mm per side
JEDEC outline: MS-012 AA

(2) PDIP-8L


Symbol	Dimensions in millimeters			Dimensions in inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	5.33	-	-	0.21
A1	0.38			0.015	-	-
A2	2.92	3.3	4.95	0.115	0.13	0.195
B	0.36	0.46	0.51	0.014	0.018	0.02
B1	1.14	1.52	1.78	0.045	0.06	0.07
B2	0.76	0.99	1.14	0.03	0.039	0.045
C	0.2	0.25	0.36	0.008	0.01	0.014
D	9.02	9.27	10.16	0.355	0.365	0.4
E	7.62	7.87	8.26	0.3	0.31	0.325
E1	6.1	6.35	7.11	0.24	0.25	0.28
e	2.54 BSC			0.100 BSC		
L	2.92	3	3.81	0.115	0.13	0.15
eB	-	-	10.92	-	-	0.43
S	0.13	-	-	0.005	-	-

JEDEC outline: MO-100 BA