

DC-DC Converter Control Circuits

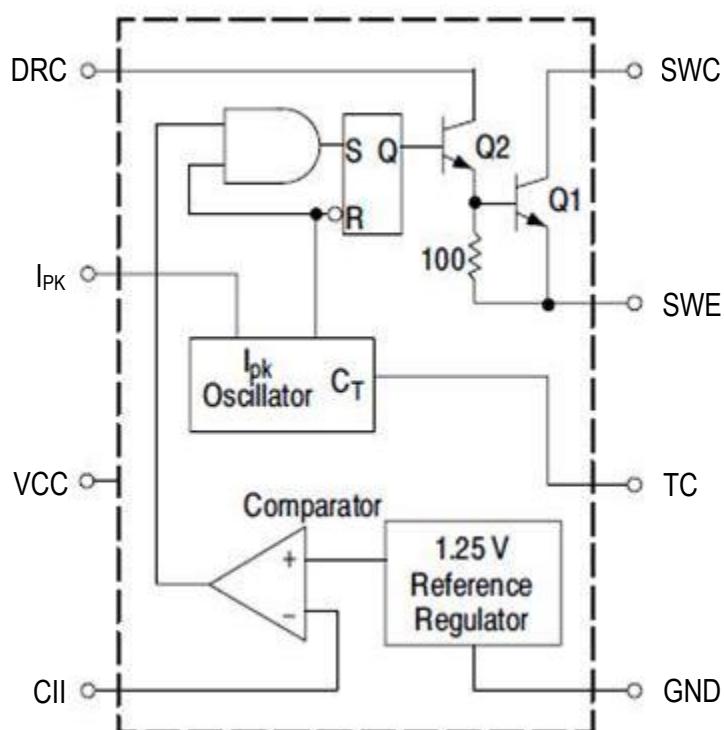
❖ GENERAL DESCRIPTION

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

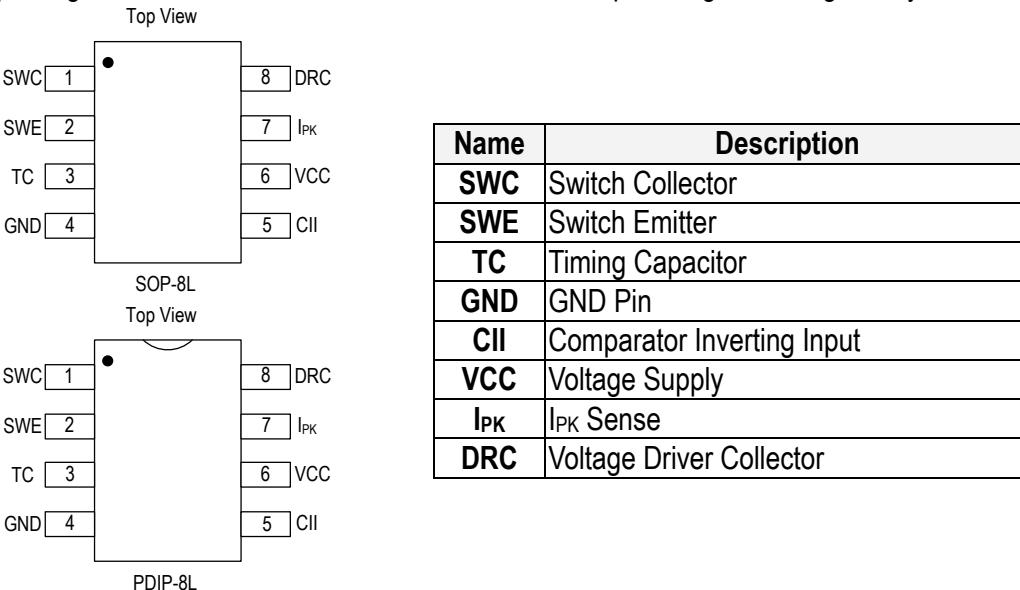
- Operation from 3.0 V to 40 V Input
- Low Standby Current
- Current Limiting
- Output Switch Current to 1.5 A
- Output Voltage Adjustable
- Frequency Operation to 100 KHz
- Precision 2% Reference

❖ BLOCK DIAGRAM

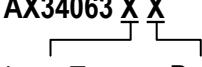
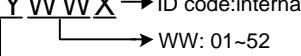


❖ PIN ASSIGNMENT

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



❖ 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 YYWWX → ID code:internal  

❖ ABSOLUTE MAXIMUM RATINGS (at $T_A=25^\circ\text{C}$)

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 ($V_{SWC}=40\text{V}$)	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 SOP-8L	1.25 0.625	W
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 SOP-8L	100 160	°C/W

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

❖ ELECTRICAL CHARACTERISTICS

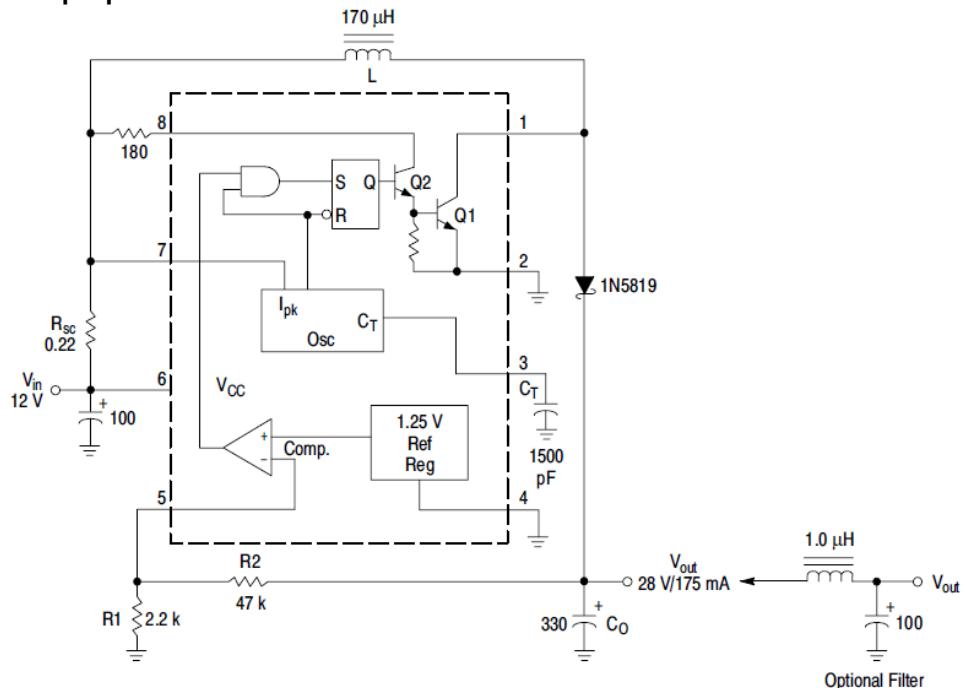
($T_A = +25^\circ\text{C}$, unless otherwise noted.)

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
OSCILLATOR						
Frequency	f_{osc}	$V_{\text{Pin}5}=0\text{V}$, $C_T=1.0\text{nF}$	24	33	42	KHz
Charge Current	I_{chg}	$V_{\text{CC}}=5.0\text{V}$ to 40V	24	35	42	μA
Discharge Current	I_{dischg}	$V_{\text{CC}}=5.0\text{V}$ to 40V	140	220	260	μA
Discharge to Charge Current Ratio	$I_{\text{dischg}}/I_{\text{chg}}$	Pin 7 to V_{CC}	5.2	6.5	7.5	-
Current Limit Sense Voltage	V_{ipk}	$I_{\text{chg}}=I_{\text{dischg}}$	250	300	350	mV
OUTPUT SWITCH						
Saturation Voltage, Darlington Connection	$V_{\text{CE(sat)}}$	$I_{\text{sw}}=1.0\text{A}$, Pins 1,8 connected	-	1.0	1.3	V
Saturation Voltage	$V_{\text{CE(sat)}}$	$I_{\text{sw}}=1.0\text{A}$, $R_{\text{Pins } 8}=82\Omega$ to V_{CC} , Forced $\beta \approx 20$	-	0.45	0.7	V
DC Current Gain	h_{FE}	$I_{\text{sw}}=1.0\text{A}$, $V_{\text{CE}}=5.0\text{V}$	50	75	-	-
Collector Off-State Current	$I_{\text{C(off)}}$	$V_{\text{CE}}=40\text{V}$	-	0.01	100	uA
COMPARATOR						
Threshold Voltage	V_{th}	$T_A=25^\circ\text{C}$	1.225	1.25	1.275	V
		$T_A=T_{\text{low}}$ to T_{high}	1.21	-	1.29	V
Threshold Voltage Line Regulation	R_{egline}	$V_{\text{CC}}=3.0\text{V}$ to 40V	-	1.4	5.0	mV
Input Bias Current	I_{IB}	$V_{\text{IN}}=0\text{V}$	-	-20	-400	nA
TOTAL DEVICE						
Supply Current	I_{CC}	$V_{\text{CC}}=5.0\text{V}$ to 40V , $C_T=1.0\text{nF}$, Pin 7= V_{CC} , $V_{\text{Pin}5}>V_{\text{th}}$, Pin 2=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.

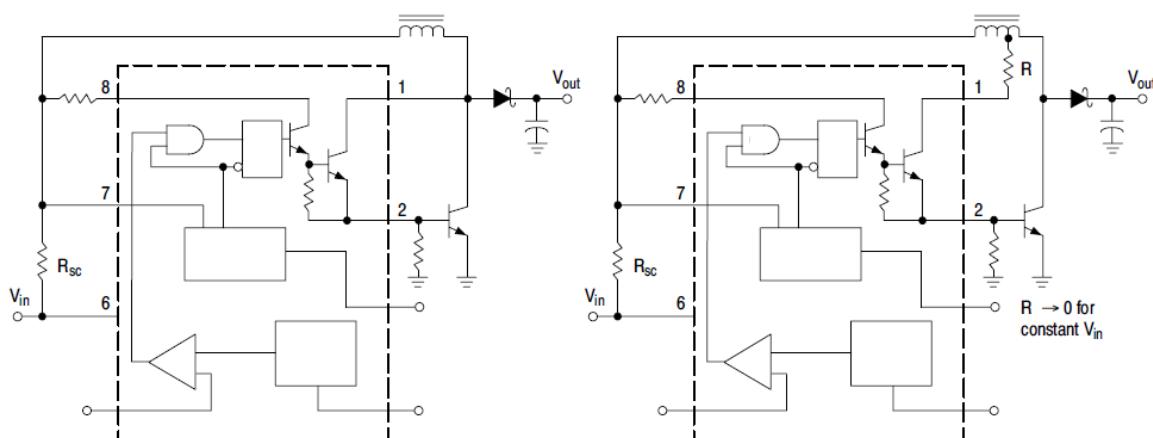
❖ APPLICATION CIRCUIT

1. Step-Up Converter

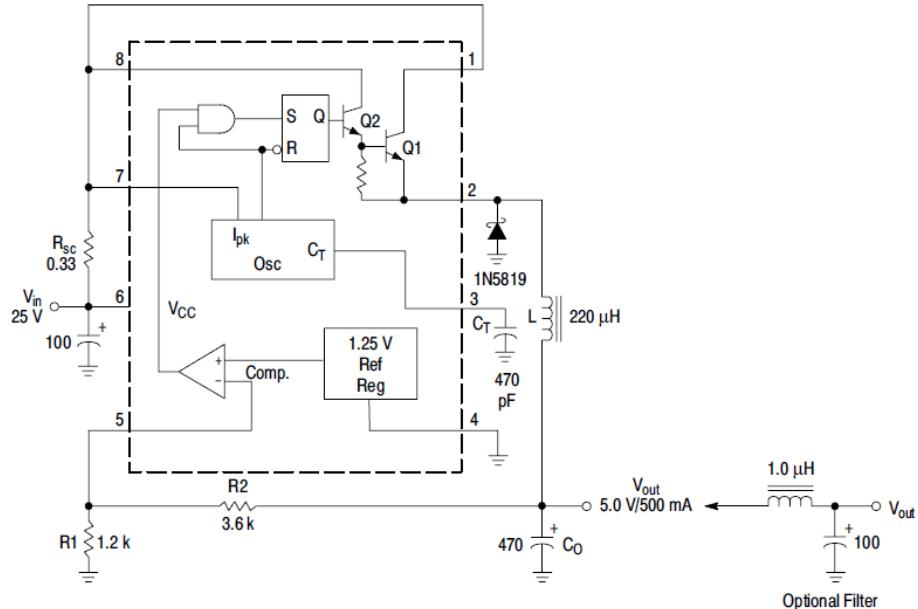


Test	Conditions	Results
Line Regulation	$V_{IN}=8.0V$ to $16V$, $I_O=175mA$	$30mV=\pm0.05\%$
Load Regulation	$V_{IN}=12V$, $I_O=75mA$ to $175mA$	$10mV=\pm0.017\%$
Output Ripple	$V_{IN}=12V$, $I_O= 175mA$	400 mVpp
Efficiency	$V_{IN}=12V$, $I_O= 175mA$	87.7%
Output Ripple With Optional Filter	$V_{IN}=12V$, $I_O= 175mA$	40mVpp

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

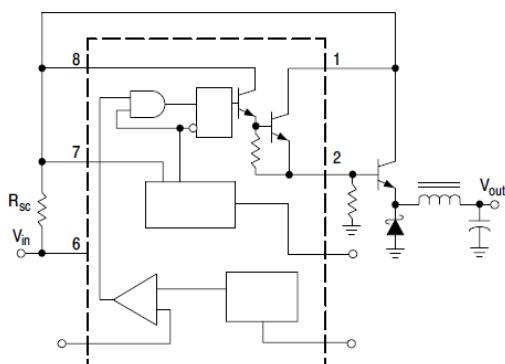


2. Step-Down Converter

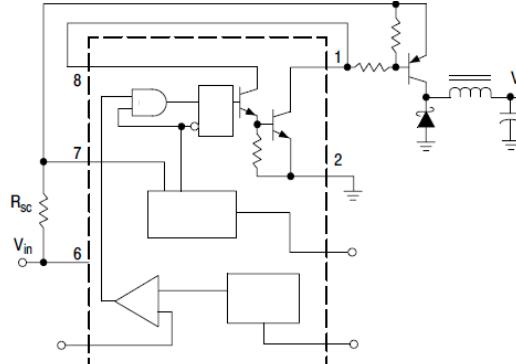


Test	Conditions	Results
Line Regulation	$V_{IN}=15V$ to $25V$, $I_O=500mA$	$12mV=\pm 0.12\%$
Load Regulation	$V_{IN}=25V$, $I_O=50mA$ to $500mA$	$3.0mV=\pm 0.03\%$
Output Ripple	$V_{IN}=25V$, $I_O= 500mA$	$120 mVpp$
Short Circuit Current	$V_{IN}=25V$, $R_L = 0.1\Omega$	$1.1A$
Efficiency	$V_{IN}=25V$,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

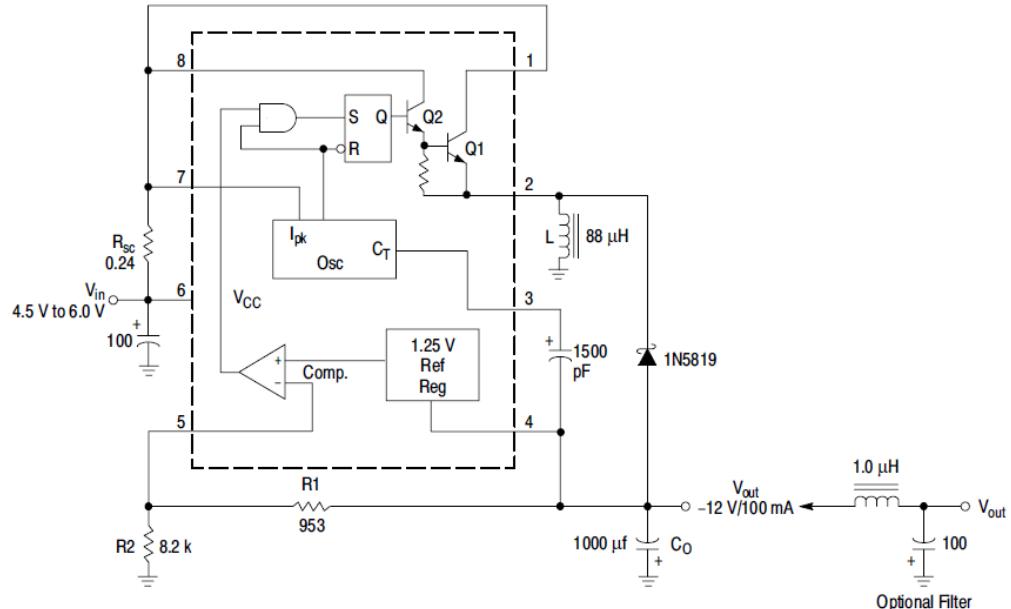
(1) Step-Down with External NPN Switch



(2) Step-Down with External PNP Switch

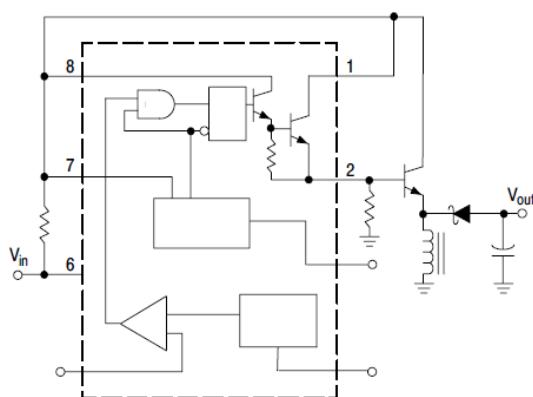


3. Voltage Inverting Converter

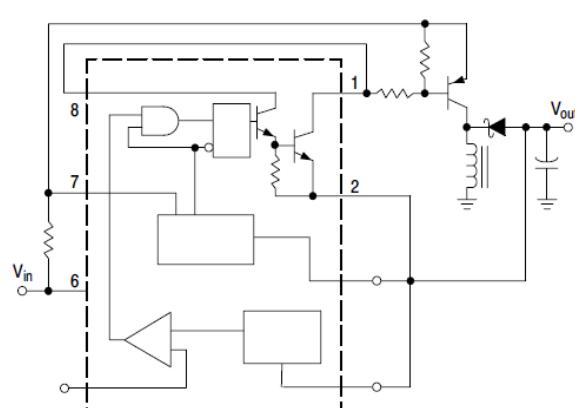


Test	Conditions	Results
Line Regulation	$V_{IN}=4.5V$ to $6.0V$, $I_O=100mA$	$3.0mV=\pm 0.012\%$
Load Regulation	$V_{IN}=5.0V$, $I_O=10mA$ to $100mA$	$22mV=\pm 0.09\%$
Output Ripple	$V_{IN}=5.0V$, $I_O= 100mA$	500 mVpp
Short Circuit Current	$V_{IN}=5.0V$, $R_L= 0.1\Omega$	910mA
Efficiency	$V_{IN}=5.0V$,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

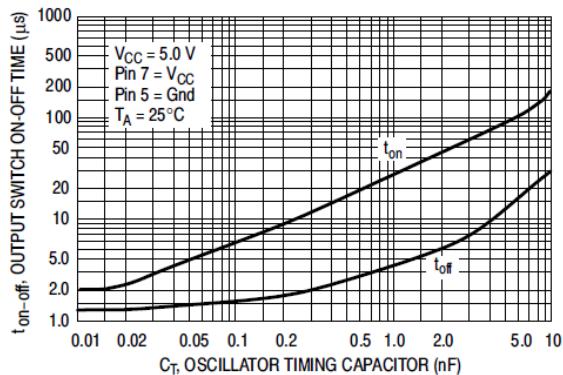
(1) Voltage Inverting with External NPN Switch



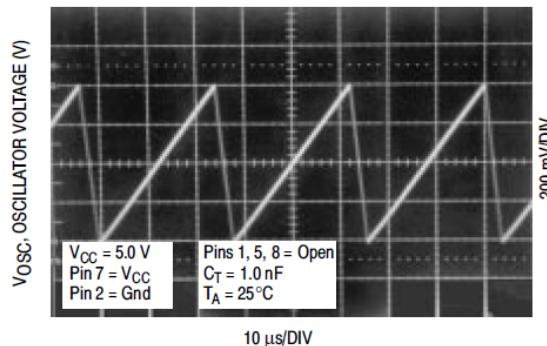
(2) Voltage Inverting with External PNP Switch



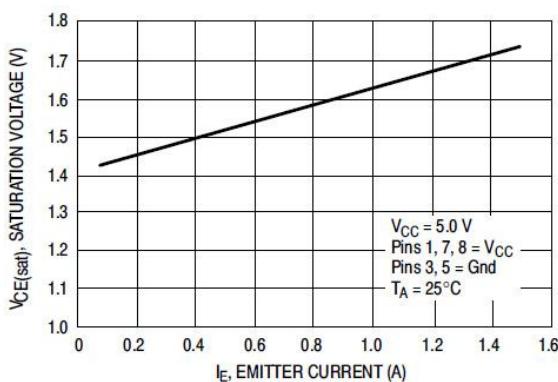
❖ TYPICAL CHARACTERISTICS



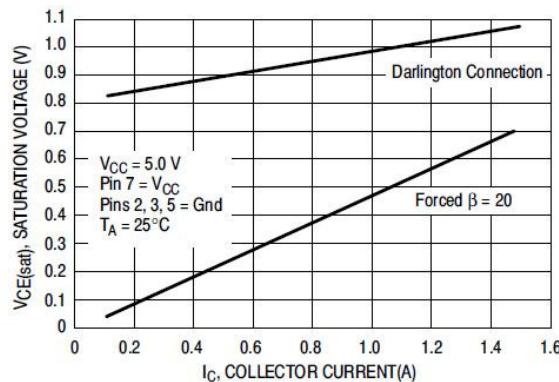
Output Switch On-Off Time vs.
Oscillator Timing Capacitor



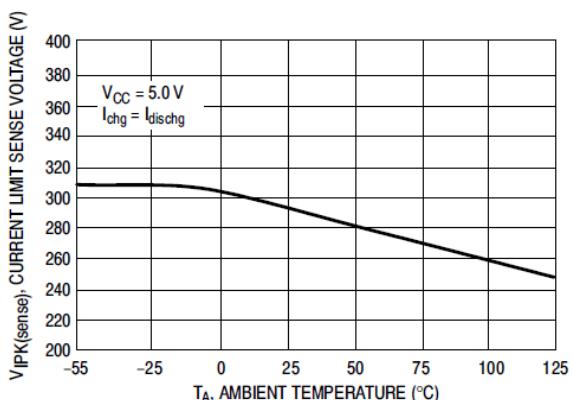
Timing Capacitor Waveform



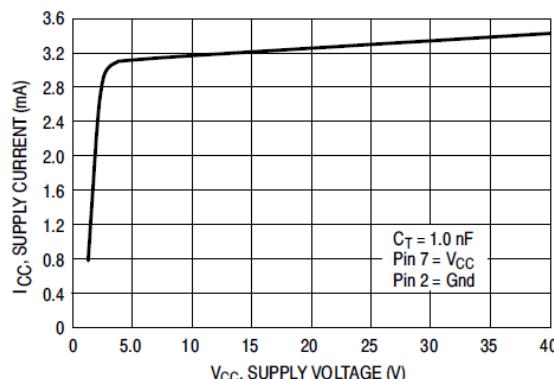
Emitter Follower Configuration Output
Saturation Voltage vs. Emitter Current



Common Emitter Configuration Output Switch
Saturation Voltage vs. Collector Current



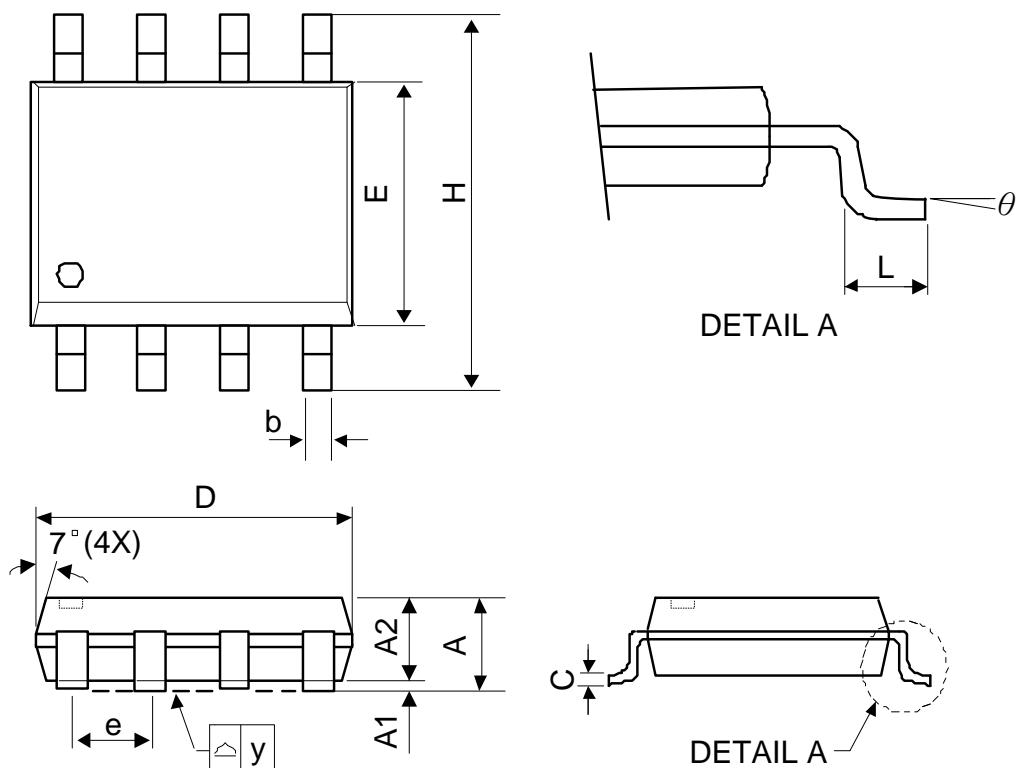
Current Limit Sense
Voltage vs. Temperature



Standby Supply Current vs. Supply Voltage

❖ PACKAGE OUTLINES

(1) SOP-8L

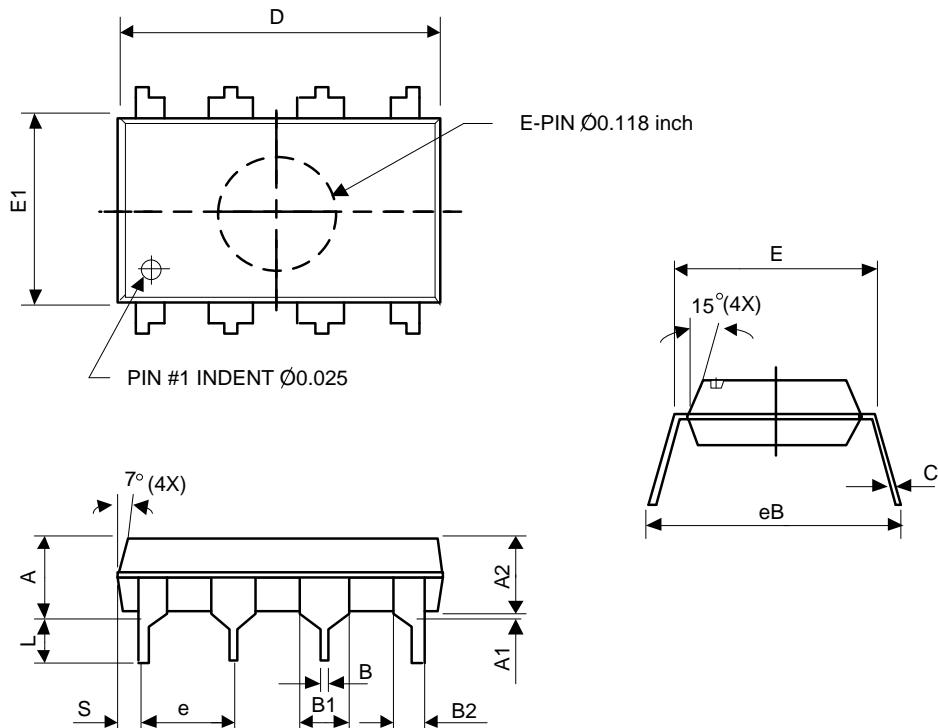


Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.75	-	-	0.069
A1	0.1	-	0.25	0.04	-	0.1
A2	1.25	-	-	0.049	-	-
C	0.1	0.2	0.25	0.0075	0.008	0.01
D	4.7	4.9	5.1	0.185	0.193	0.2
E	3.7	3.9	4.1	0.146	0.154	0.161
H	5.8	6	6.2	0.228	0.236	0.244
L	0.4	-	1.27	0.015	-	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
theta	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