MC34063

DC/DC CONVERTER CONTROL CIRCUIT

Description

The MC34063 is a monolithic control circuit containing the primary functions required for DC/DC converters. The device consists of an internal temperature compensated reference, comparator, controlled duty cycle oscillator with an active current limit circuit, driver and high current output switch. This device is specifically designed to be incorporated in stepdown, step-up and voltage-inverting applications with a minimum number of external components. The ±2% internal reference and low quiescent current of 1.6mA are among the improvements of the device over the competition

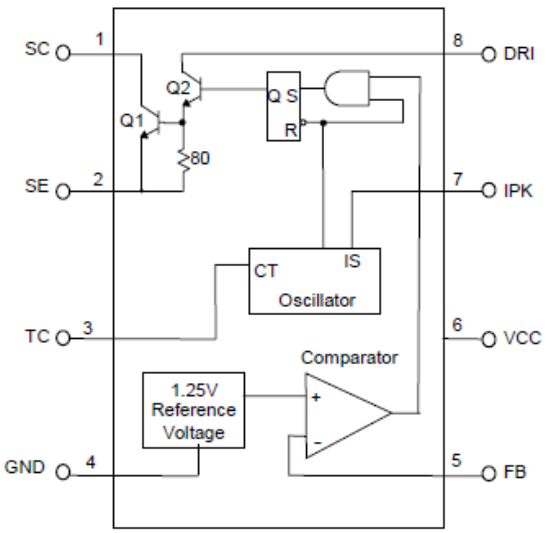
Features

- ✧ 3V to 30V Input Voltage Operation.
- ✧ Internal 1.2A Peak Current Switch.
- ✧ Internal ±2% Reference.
- ✧ Low Quiescent Current at 1.6mA.
- ✧ Frequency Operation from 100Hz to 100KHz.
- ✧ Low Dropout Operation: 100% Duty Cycle
- ✧ Current Limiting.
- ✧ Standard SOP8/DIP8 Packages

Applications

- ✧ DC-DC Converter Module
- ✧ ADSL Modems
- ✧ Hub.
- ✧ Battery Chargers

Functional Diagram



Pin Description

Symbol	Pin NO.	Description
SC	1	1.2A switch collector
SE	2	Darlington switch emitter
TC	3	Oscillator timing capacitor
GND	4	Power GND
FB	5	Feedback comparator inverting input
VCC	6	Power supply input
IPK	7	Highside current sense input, VCC - VIPK=300mV
DRI	8	Drive collector

Absolute Maximum Ratings

Supply Voltage ……40V
Comparator Input Voltage Range ……-0.3V~40V
Switch Collector Voltage …… 40V
Switch Emitter Voltage …… 40V
Switch Collector to Emitter Voltage …….. .40V
Driver Collector Voltage ……40V
Switch Current……..1.5A
Power Dissipation and Thermal Characteristics
DIP Package
Ta= 25°C……..1.0W
Thermal Resistance …….... 100°C /W
SO Package
Ta= 25°C ……625mW
Thermal Resistance ……...160°C /W

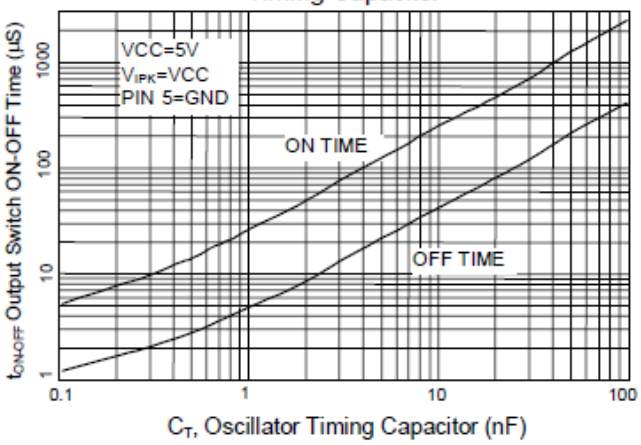
Operating Junction Temperature ……125°C
Operating Ambient Temperature Range …….. 0°C~70°C
Storage Temperature Range ……... - 65°C~150°C

Electrical Characteristics (Vcc= 5V, Ta=25°C (unless otherwise specified.)

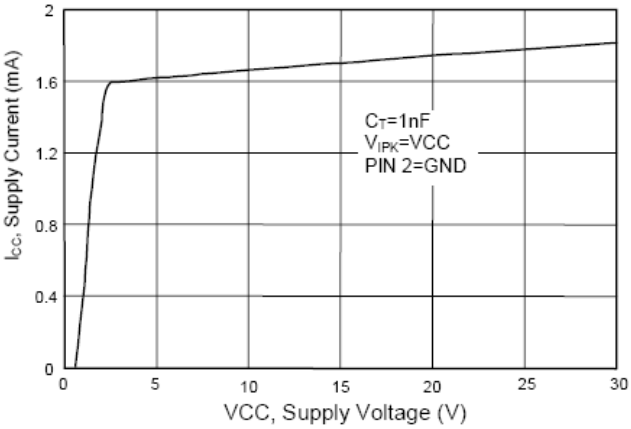
Parameter	Test Condictions	Symbol	MIN.	TYP.	MAX.	Unit
Oscillator						
Frequency	V_{PIN5} = 0V ,C_T = 1nF	f_{OSC}	24	35	46	KH_Z
Charging Current	5.0V~VCC~30V	I_{CHG}	24	35	46	µA
Discharge Current	5.0V~VCC~30V	I_{DISCHG}	140	220	260	µA
Voltage Swing	PIN 3	V_{OSC}		0.6		V
Discharge to Charge Current Ratio	$V_{IPK(SENSE)}$ =VCC	I_{DISCHG}/ I_{CHG}		6.0		
Current Limit Sense Voltage	I_{CHG}=I_{DISCHG}	$V_{IPK(SENSE)}$	250	300	400	mV
Output Switch						
Saturation Voltage, Darlington Connection	I_{SW}=1.0A; $V_{C(DRIVER)}$=$V_{C(SWITCH)}$	$V_{CE(SAT)}$		1.0	1.3	V
Saturation Voltage	I_{SW}=1.0A; $I_{C(DRIVER)}$=50mA (Forced ~~20)	$V_{CE\ (SAT)}$		0.45	0.7	V
DC Current Gain	I_{SW}=1.0A; V_{CE}=5.0V	h_{FE}	50	75		
Collector Off-State Current	V_{CE}=30V	$I_{C(OFF)}$		10		nA
Comparator						
Threshold Voltage Threshold Voltage	0°C~Ta~70°C	V_{FB}	1.225 1.19	1.25	1.275 1.31	V V
Threshold Voltage Line Regulation	3.0V~VCC~30V	REG_{LINE}		0.1	0.3	mV/V
Input Bias Current	V_{IN}=0V	I_{IB}		0.4	1	µA
Supply current	$V_{IPK(SENSE)}$=VCC $V_{PIN\ 5}$>V_{FB} 5.0V~VCC~30V C_T=0.001µF, PIN 2=GND Remaining pins open	I_{CC}		1.6	3	mA

Typical Performance Characteristics

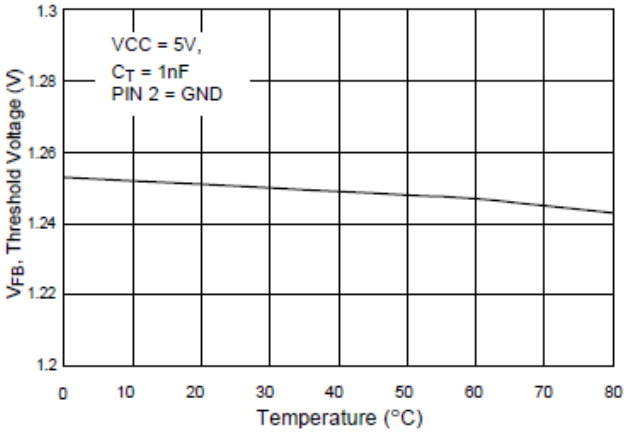
Output Switch ON-OFF Time vs. Oscillator Timing Capacitor



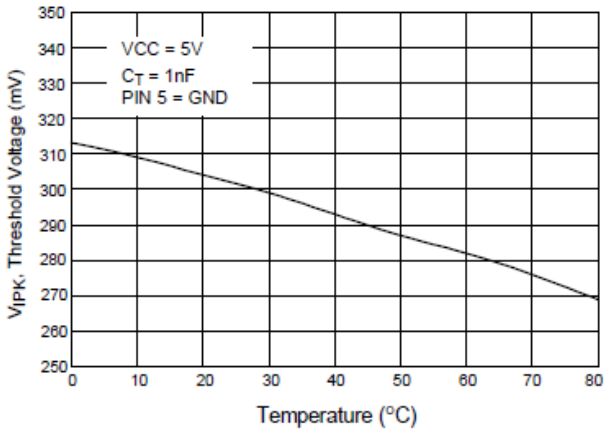
Standby Supply Current vs. Supply Voltage



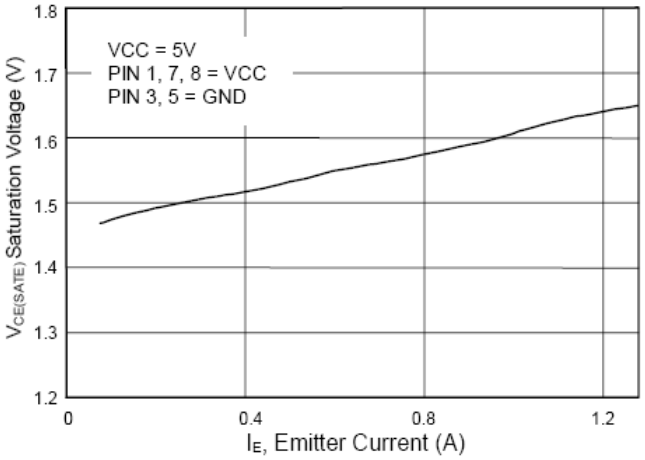
V_{FB}, Threshold Voltage vs Temperature



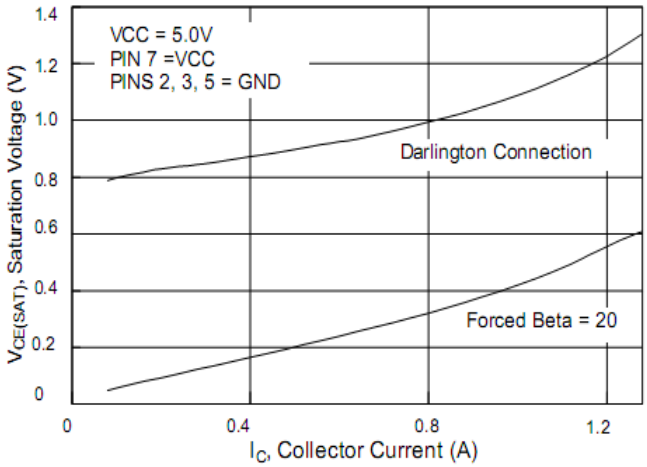
IPK Threshold Voltage vs Temperature



Emmiter-Follower Configuration Output Switch Saturation Voltage vs Emmiter Current



Common-Emitter Configuration Output Switch Saturation Voltage vs Collector Current



Application Information

Design Formula Table

CALCULATION	STEP-DOWN	STEP-UP	VOLTAGE-INVERTING
$\frac{t_{ON}}{t_{OFF}}$	$\frac{V_{OUT} + V_F}{V_{IN(MIN)} - V_{SAT} - V_{OUT}}$	$\frac{V_{OUT} + V_F - V_{IN(MIN)}}{V_{IN(MIN)} - V_{SAT}}$	$\frac{\lvert V_{OUT}\rvert + V_F}{V_{IN} - V_{SAT}}$
$(t_{ON} + t_{OFF})_{MAX}$	$\frac{1}{FMIN}$	$\frac{1}{FMIN}$	$\frac{1}{FMIN}$
C_T	$4x10^{-5}t_{ON}$	$4 \times 10^{-5}t_{ON}$	$4 \times 10^{-5}t_{ON}$
$I_{C\ (SWITCH)}$	$2I_{OUT(MAX)}$	$2I_{OUT(MAX)}\ (\frac{t_{ON} + t_{OFF}}{t_{OFF}})$	$2I_{OUT(MAX)}\ (\frac{t_{ON} + t_{OFF}}{t_{OFF}})$
RS	$0.33/I_{C(SWITCH)}$	$0.33/\ I_{C\ (SWITCH)}$	$0.33/\ I_{C\ (SWITCH)}$
L(MIN)	$(\frac{V_{IN(MIN)} - V_{SAT} - V_{OUT}}{I_{C(SWITCH)}})t_{ON(MAX)}$	$(\frac{V_{IN(MIN)} - V_{SAT}}{I_{C(SWITCH)}})t_{ON(MAX)}$	$(\frac{V_{IN(MIN)} - V_{SAT}}{I_{C(SWITCH)}})t_{ON(MAX)}$
Co	$\frac{I_{C(SWITCH)}\ (t_{ON} + t_{OFF})}{8V_{RIPPLE(P-P)}}$	$\frac{I_{OUT}\ t_{ON}}{V_{RIPPLE(P-P)}}$	$\frac{I_{OUT}\ t_{ON}}{V_{RIPPLE(P-P)}}$

V_{SAT} = Saturation voltage of the output switch.

V_F = voltage drop of the ringback rectifier

The following power supply characteristics must be chosen:

V_{IN} -Nominal input voltage.

V_{OUT} -Desired output voltage,

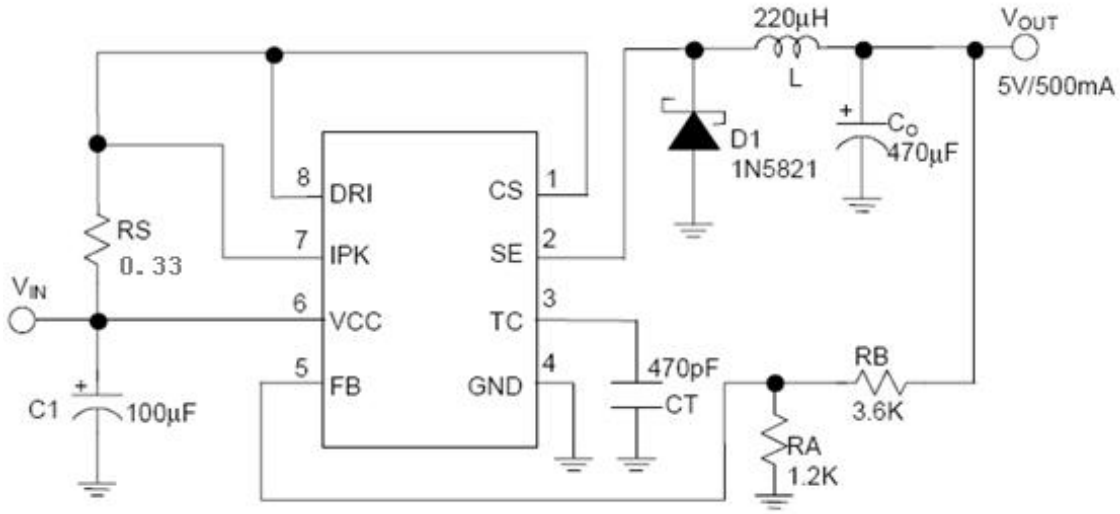
$|V_{OUT}| = 1.25\ (1 + RB/RA)$

I_{OUT} - Desired output current.

F_{MIN} - Minimum desired output switching frequency at the selected values for V_{IN} and I_{OUT}

$V_{RIPPLE\ (P-P)}$ - Desired peak-to-peak output ripple voltage.In practice, the calculated value will need to be increased due to the capacitor equivalent series resistance and board layout. The ripple voltage should be kept to a low value since it will directly effect the line and load regulation.

Application Examples



Line Regulation	V_{IN} = 10V ~20V @ I_O=500mA	40mV
Load Regulation	V_{IN} = 15V, @ I_O=10mA ~ 500mA	5mV
Short Circuit Current	V_{IN}=15V, @ R_L = 0.1 Ω	1.3A

Fig.1 Step-Down converter

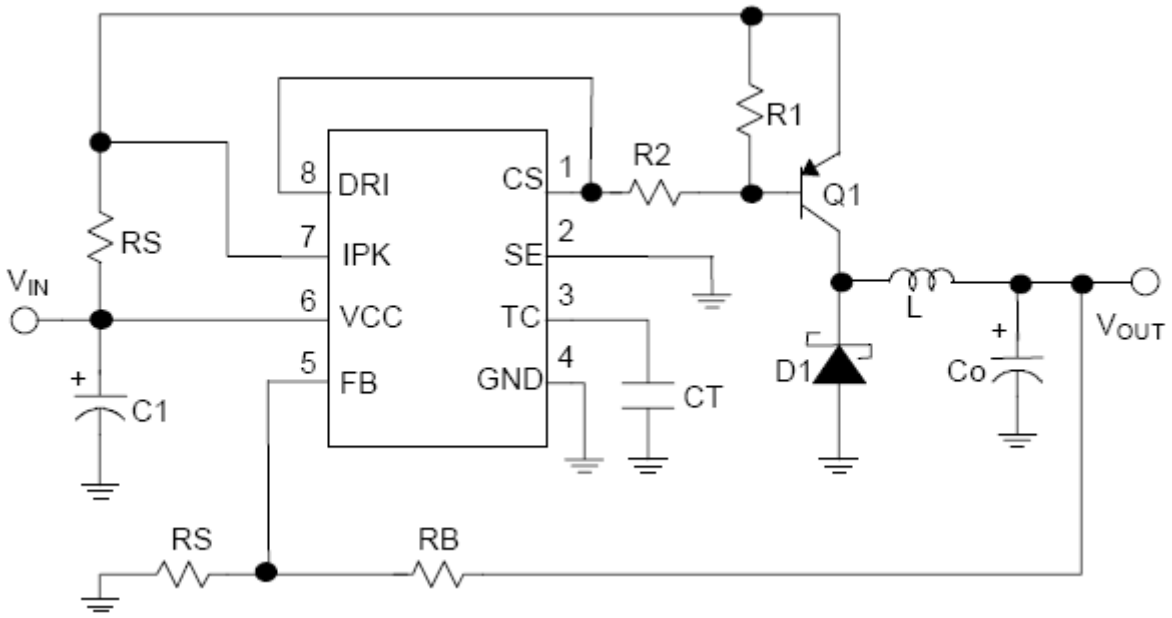
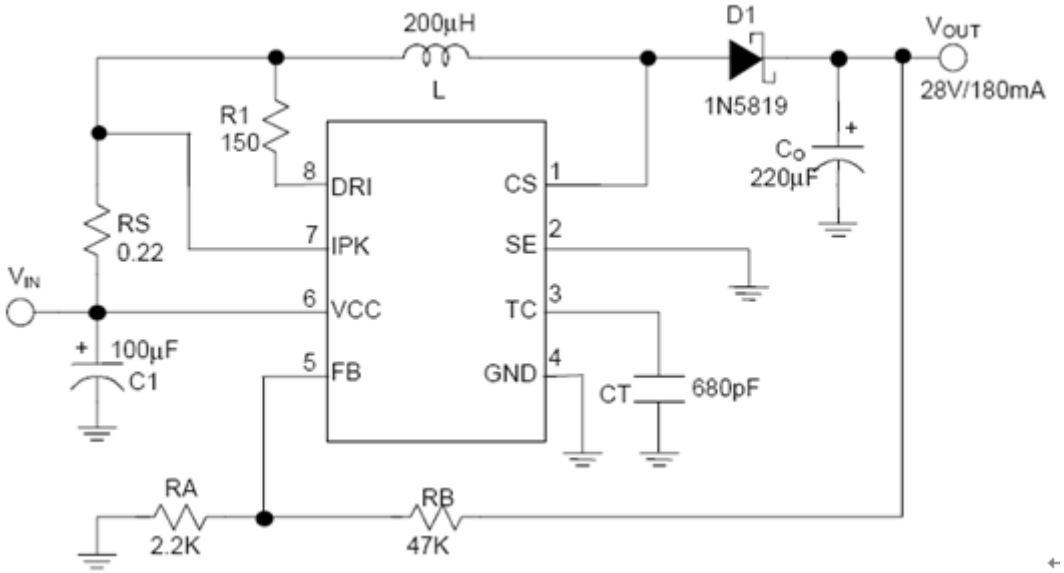


Fig.2 Step-Down converter with External PNP Saturation Switch

Application Examples (Continued)



Line Regulation	V_{IN} = 8V ~16V @ I_O=180mA	50mV
Load Regulation	V_{IN} = 12V, @ I_O=80mA ~ 180mA	10mV

Fig.3 Step-Up converter

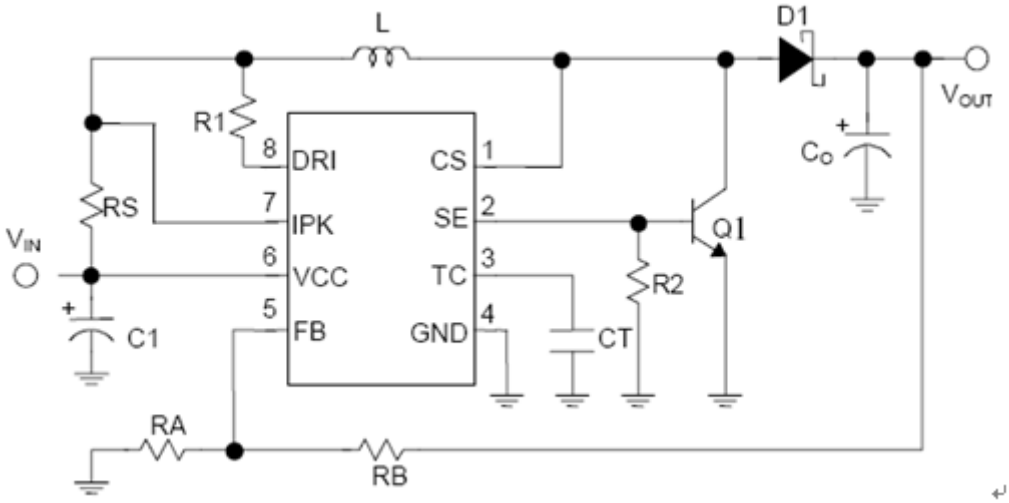
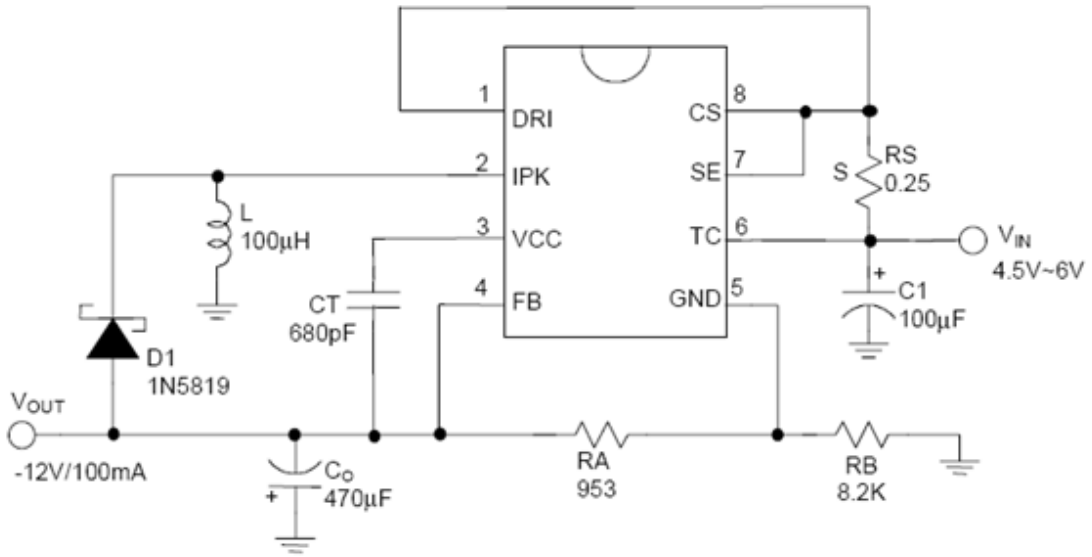


Fig.4 Step-up Converter with External NPN Switch

Application Examples (Continued)



Line Regulation	V_{IN}=4.5V~6V @I_O=100mA	20mV
Load Regulation	V_{IN}=4.5V~6V @I_O=100mA	100mV

Fig.5 lnverting Converter

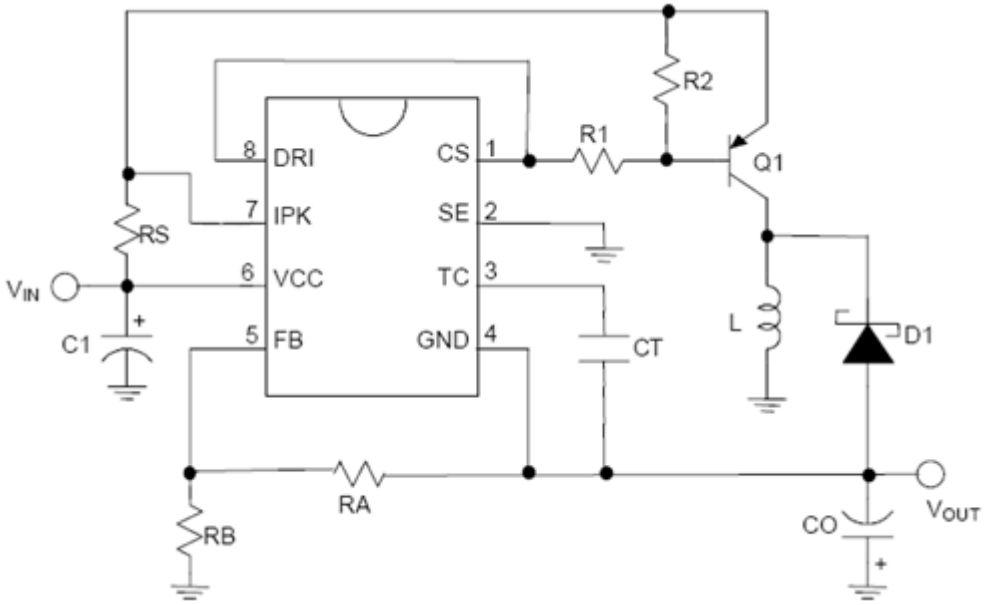
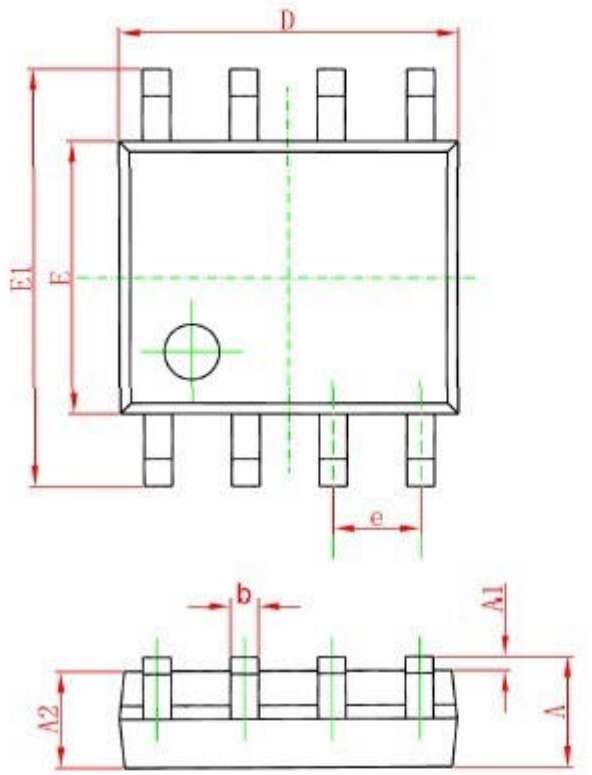


Fig 6. Voltage lnverting Converter With PNP Saturated Switch

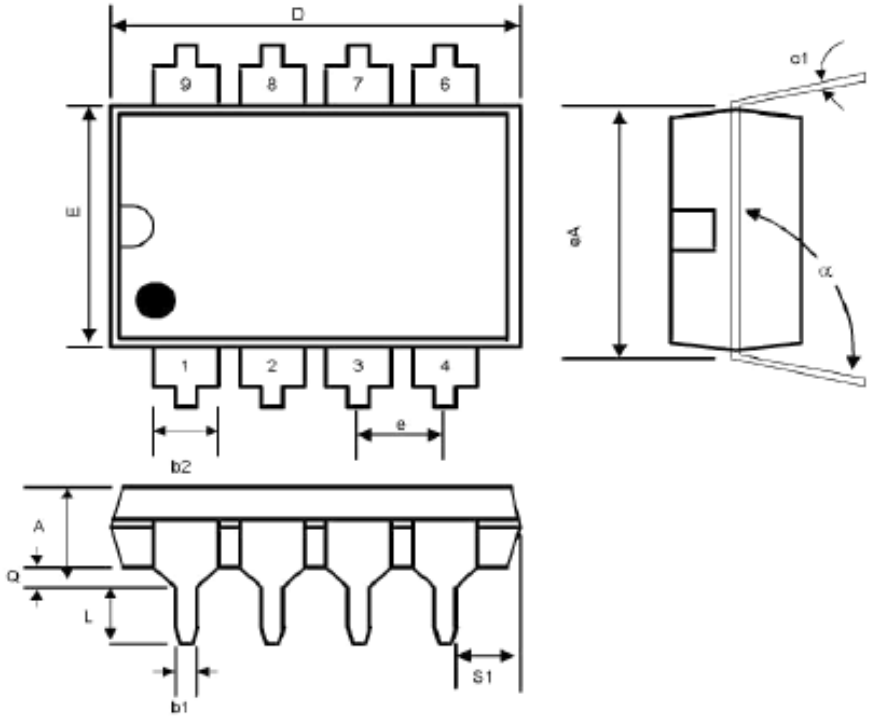
PACKAGE DESCRIPTION

SOP8 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

DIP8 PACKAGE OUTLINE DIMENSIONS



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	-	0.200	-	5.08	-
b1	0.014	0.023	0.36	0.58	-
b2	0.045	0.065	1.14	1.65	-
c1	0.008	0.015	0.20	0.38	-
D	0.355	0.400	9.02	10.16	-
E	0.220	0.310	5.59	7.87	-
e	0.100 BSC		2.54 BSC		-
eA	0.300 BSC		7.62 BSC		
L	0.125	0.200	3.18	5.08	-
Q	0.015	0.060	0.38	1.52	-
s1	0.005	-	0.13	-	-
α	90^0	105^0	90^0	105^0	-