RT34063A Data Sheet

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DC-to-DC Converter Control Circuits

General Description

The RT34063A 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 specially 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 30V Input
- Low Standby Current
- Current Limiting
- Internal Switch Current to 1.5A
- Output Voltage Adjustable
- Frequency Operation to 100kHz
- Precision 2% Reference

Applications

- Saver for Cellular Phones
- DC-DC Converter Module

Ordering Information

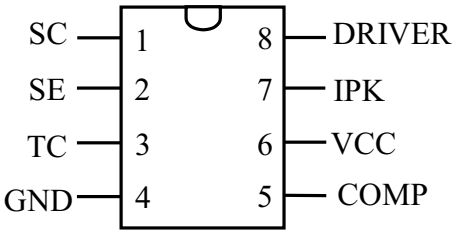
RT34063A-□ □

- Package type
  - N : DIP-8
  - S : SOP-8
- Operating temperature range
  - C: Commercial standard
  - M: Military standard

Marking Information

Part Number	Marking
RT34063ACN	RT34063ACN
RT34063ACS	RT34063ACS

Pin Configurations

Part Number	Pin Configurations
RT34063ACN (Plastic DIP-8)	
RT34063ACS (Plastic SOP-8)	

Absolute Maximum Ratings

- Power Supply Voltage, V_{CC} ---------- 30V
- Feedback Input Voltage Range ---------- –0.3 to +30V
- Switch Collector Voltage, V_C(switch) ---------- 30V
- Switch Emitter Voltage(V_{PIN1}=30V),V_E(switch) ---------- 30V
- Switch Collector to Emitter Voltage, V_{CE}(switch) ---------- 30V
- Driver Collector Voltage, V_C(driver) ---------- 30V
- Driver Collector Current (see Note 1), I_C(driver) ---------- 100mA
- Switch Current, I_{SW} ---------- 1.5A
- Power Dissipation and Thermal Characteristics:
  DIP Plastic Package, P_D @ T_A=25℃ ---------- 1.25W
  Thermal Resistance, $R_{\theta JA}$ ---------- 100℃/W
  SOP Plastic Package, P_D @ T_A=25℃ ---------- 0.625W
  Thermal Resistance, $R_{\theta JA}$ ---------- 160℃/W
- Operating Junction Temperature, T_J ---------- +150℃
- Storage Temperature Range, T_{STG} ---------- –60 to +150℃

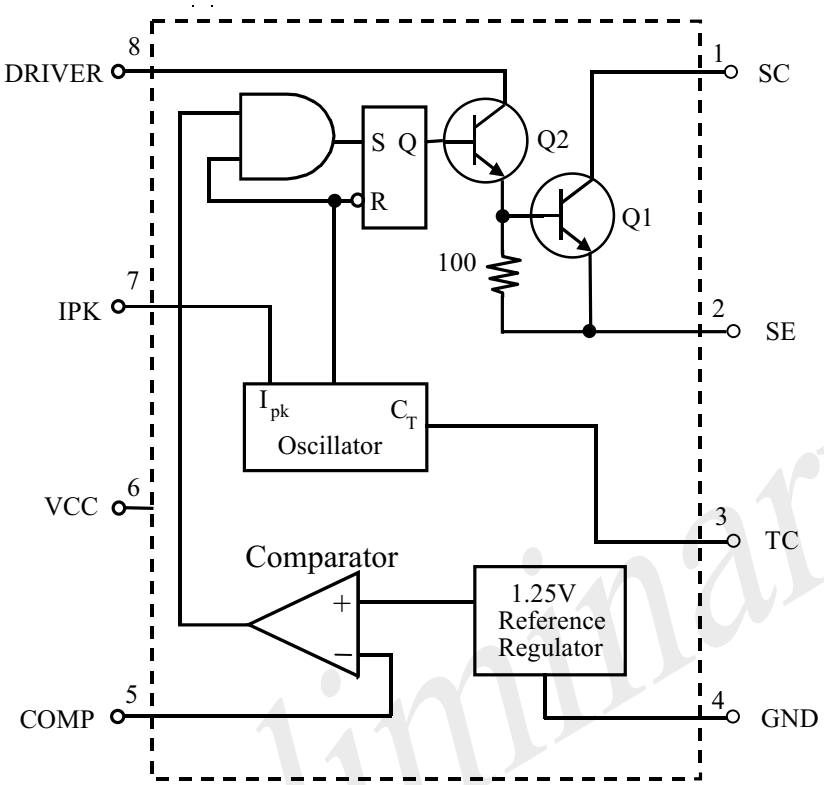
Note: 1. Maximum package power dissipation limits must be observed.

Electrical Characteristics

V_{CC}=5.0V, T_A =25℃, unless otherwise specified.

Parameter	Test Conditions	Min	Typ	Max	Units
Oscillator					
Frequency	V_{Pin5}=0V, C_T=1.0 nF	26	38	48	kHz
Charge Current	5.0V≦V_{CC}≦30V	25	36	43	μA
Discharge Current	5.0V≦V_{CC}≦30V	160	250	290	μA
Discharge to Charge Current Ratio	Pin7 to V_{CC}	5.5	6.9	7.9	--
Current Limit Sense Voltage	I_{chg}=I_{dischg}	280	330	380	mV
Output Switch					
Saturation Voltage, Darlington Connection	I_{SW}=1.0A, Pins 1, 8 connected	--	1.0	1.3	V
Saturation Voltage, Darlington Connection	I_{SW}=1.0A , R_{PIN8}=82Ω to V_{CC}, Forced β ≒20	--	0.45	0.7	V
DC Current Gain	I_{SW}=1.0A , V_{CE}=5.0V	50	75	--	--
Collector Off-state Current	V_{CE}=30V	--	0.01	100	μA
Comparator					
Threshold Voltage	-	1.225	1.25	1.275	V
Threshold Voltage Line Regulation	3.0V≦V_{CC}≦30V	--	1.4	5.0	mV
Input Bias Current	Vin=0V	--	–20	–400	nA
Total Device					
Supply Current	V_{CC}=5.0V to 30V, C_T=1.0nF, Pin7=V_{CC}, V_{PIN5}>V_{th} , Pin2=GND, Remaining pins open	--	3.0	4.5	mA

Function Block Diagram

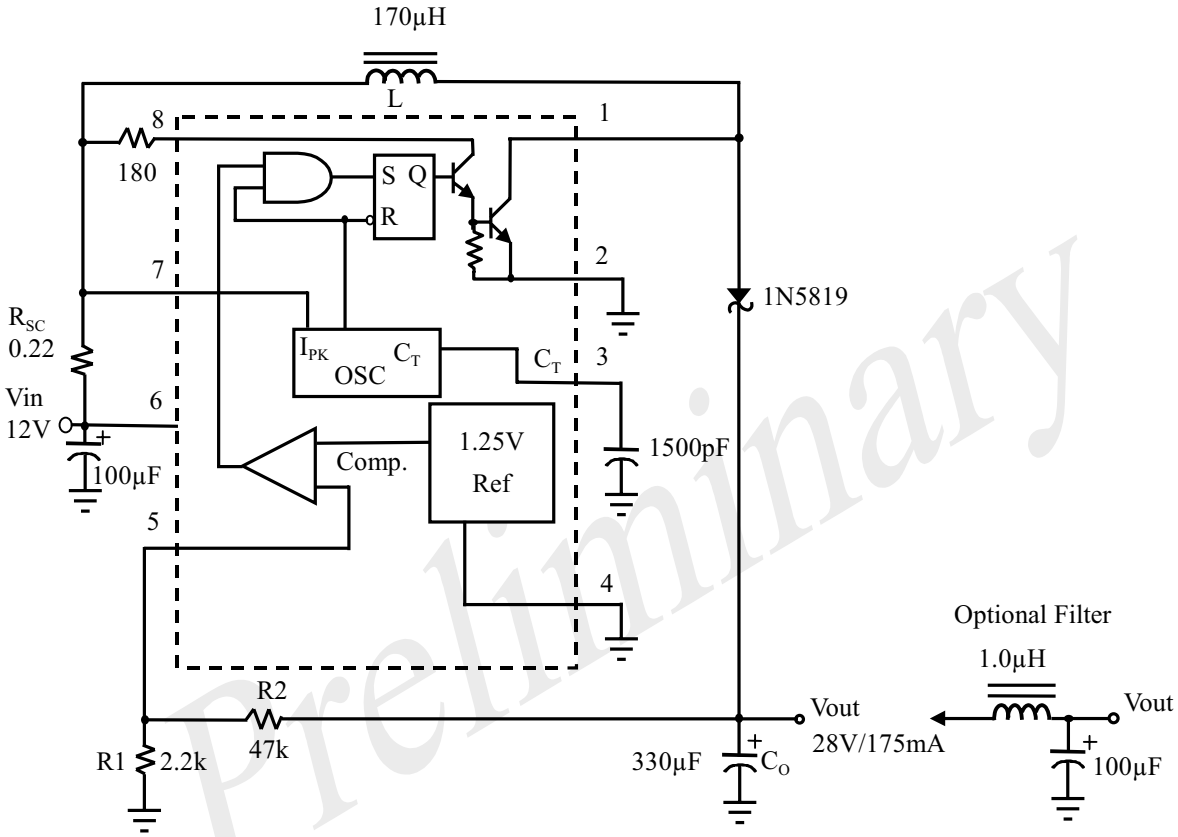


Pin Description

Pin No.	Pin Name	Pin Function
1	SC	1.5A switch collector
2	SE	Darlington switch emitter
3	TC	Oscillator timing capacitor
4	GND	Power GND
5	COMP	Feedback comparator inverting input
6	VCC	Power supply input
7	IPK	Highside current sense input VCC–V_{IPK}=330mV
8	DRIVER	Driver collector

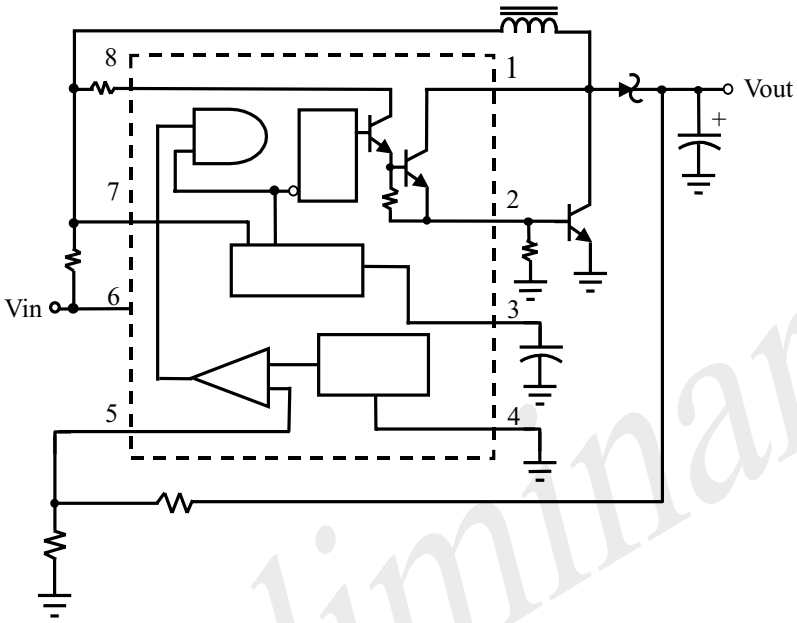
Typical Application Circuit

Step-up Converter

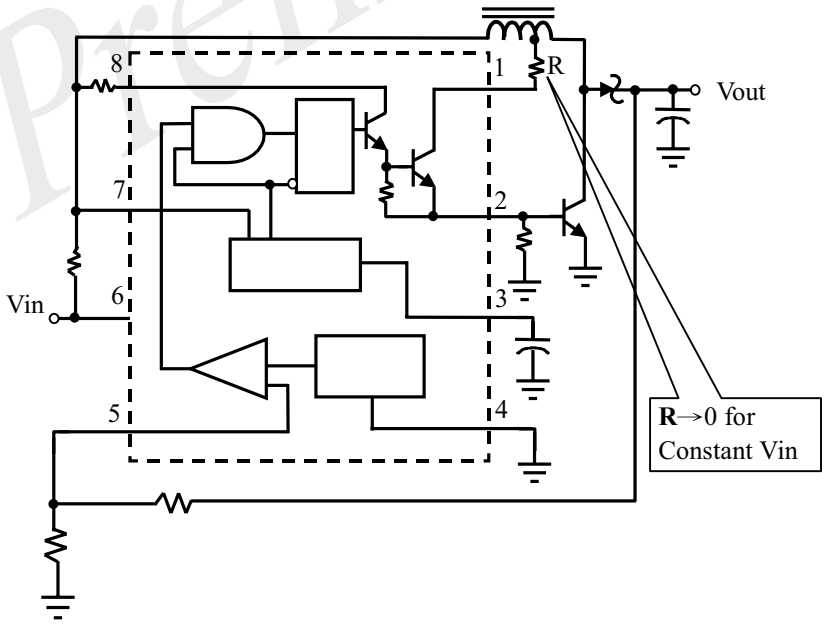


External Current Boost Connections for I_C Peak Greater than 1.5A

a. External NPN Switch

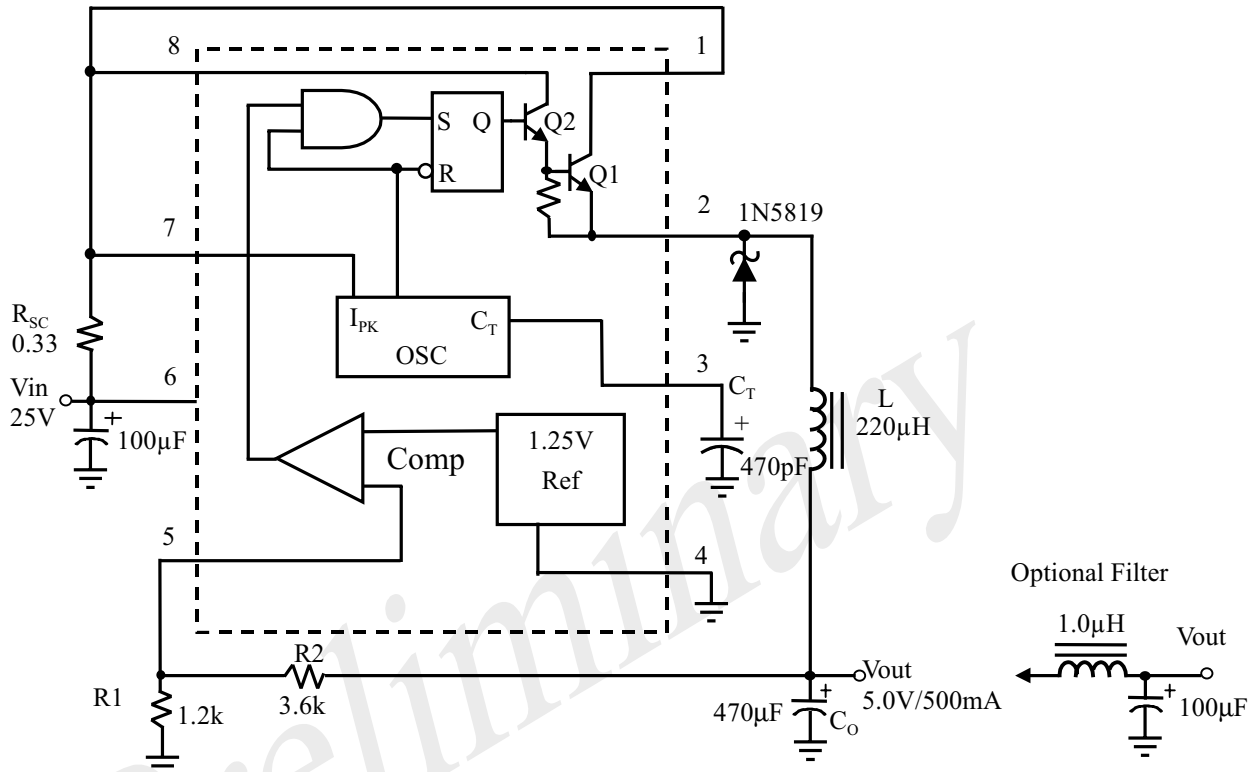


b. External NPN Saturated Switch (See Note)



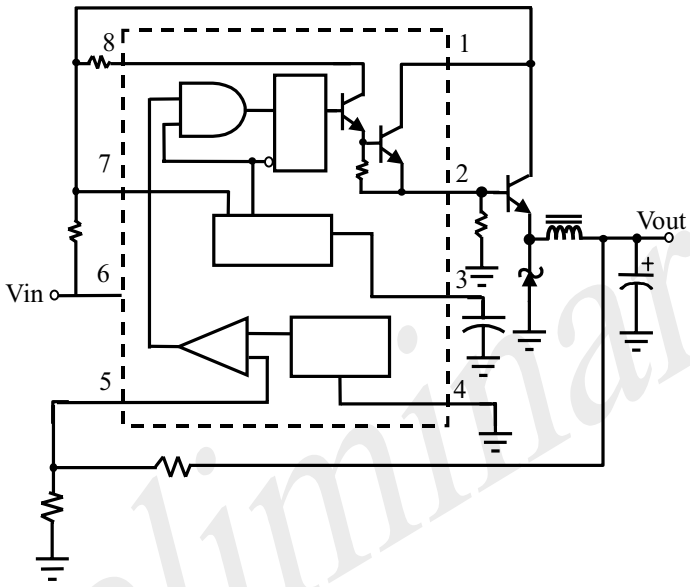
Note: If the output switch is driven into hard saturation (non-Darlington configuration) at low switch currents (≦300mA) and high driver currents (≧30mA), it may take up to 2.0μs to come out of saturation. This condition will shorten the off time at frequencies≧30kHz, and is magnified at high temperature.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

Step-down Converter

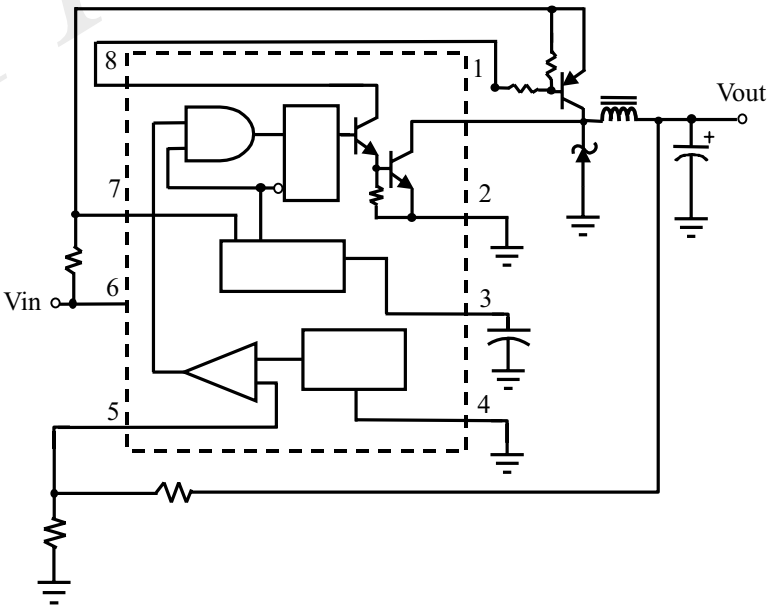


External Current Boost Connections for IC Peak Greater than 1.5A

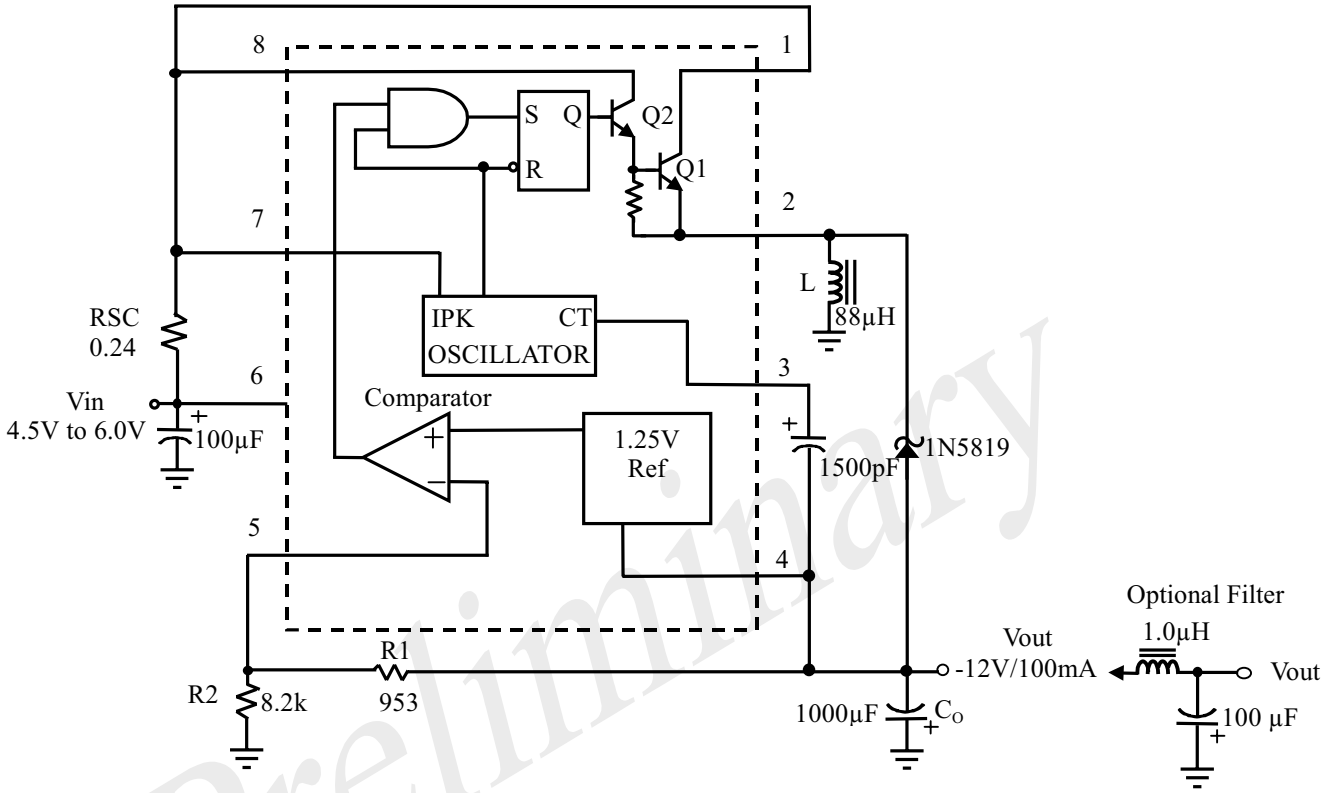
a. External NPN Switch



b. External PNP Saturated Switch

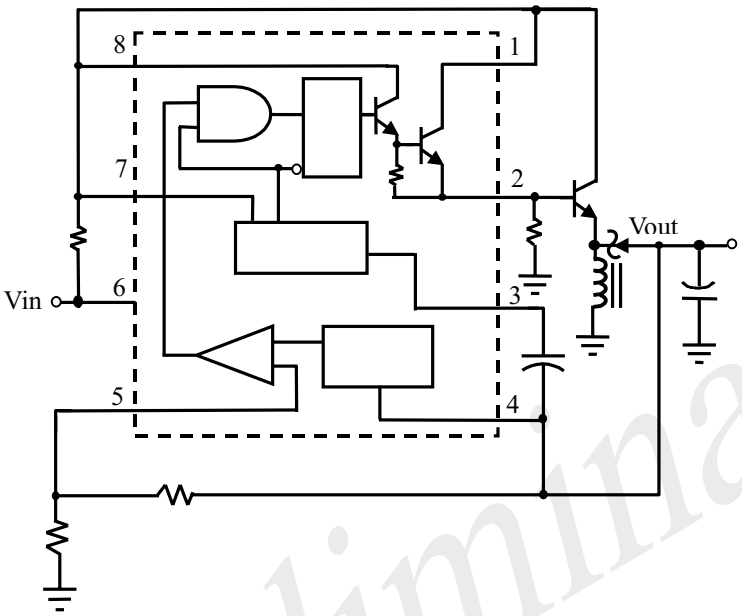


Voltage Inverting Converter

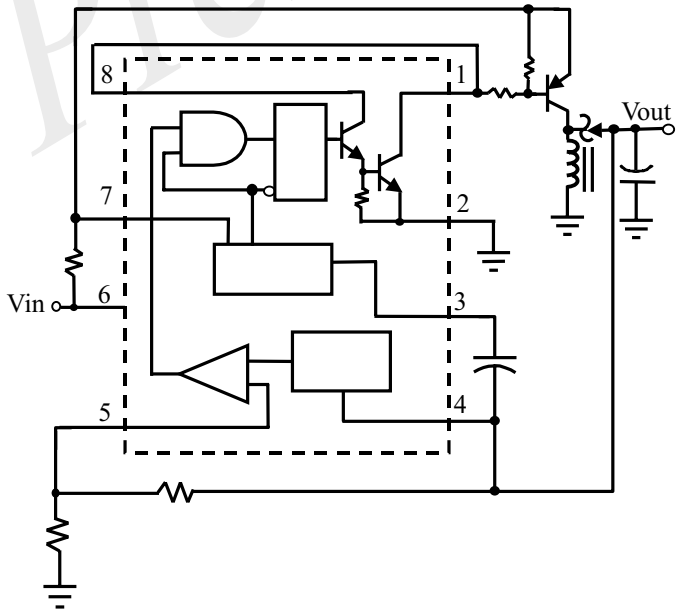


External Current Boost Connections for Peak Greater than 1.5A

a. External NPN Switch



b. External PNP Saturated Switch



Design Formula Table

Calculation	Step-up	Step-down	Voltage-Inverting
t_{on}/t_{off}	$\frac{V_{OUT} + V_F - V_{IN(min)}}{V_{IN(min)} - V_{sat}}$	$\frac{V_{OUT} + V_F}{V_{IN(min)} - V_{sat} - V_{OUT}}$	$\frac{\lvert V_{OUT}\rvert + V_F}{V_{IN} - V_{sat}}$
$(t_{on} + t_{off})$	$\frac{1}{f}$	$\frac{1}{f}$	$\frac{1}{f}$
t_{off}	$\frac{t_{on} + t_{off}}{\frac{t_{on}}{t_{off}} + 1}$	$\frac{t_{on} + t_{off}}{\frac{t_{on}}{t_{off}} + 1}$	$\frac{t_{on} + t_{off}}{\frac{t_{on}}{t_{off}} + 1}$
t_{on}	$(t_{on} + t_{off}) - t_{off}$	$(t_{on} + t_{off}) - t_{off}$	$(t_{on} + t_{off}) - t_{off}$
C_T	$4.0\times10^{-5}\, t_{on}$	$4.0\times10^{-5}\, t_{on}$	$4.0\times10^{-5}\, t_{on}$
Ipk(switch)	$2\, I_{out(max)} \left(\frac{t_{on}}{t_{off}} + 1\right)$	$2\, I_{out}(max)$	$2\, I_{out(max)} \left(\frac{t_{on}}{t_{off}} + 1\right)$
R_{SC}	0.3/Ipk(switch)	0.3/Ipk(switch)	0.3/Ipk(switch)
L(min)	$\left(\frac{(V_{IN(min)} - V_{sat})}{Ipk(switch)}\right) t_{on}(max)$	$\left(\frac{(V_{IN(min)} - V_{sat} - V_{OUT})}{Ipk(switch)}\right) t_{on}(max)$	$\left(\frac{(V_{IN(min)} - V_{sat})}{Ipk(switch)}\right) t_{on}(max)$
C_O	$9\frac{I_{OUT}\, t_{ON}}{V_{ripple(pp)}}$	$\frac{Ipk(switch)(t_{on} + t_{off})}{8 V_{ripple(pp)}}$	$9\frac{I_{OUT}\, t_{ON}}{V_{ripple(pp)}}$

Vsat : Saturation voltage of the output switch.

V_F : Forward voltage drop of the output rectifier.

The following power supply characteristics must be chosen:

V_{IN} : Nominal input voltage.

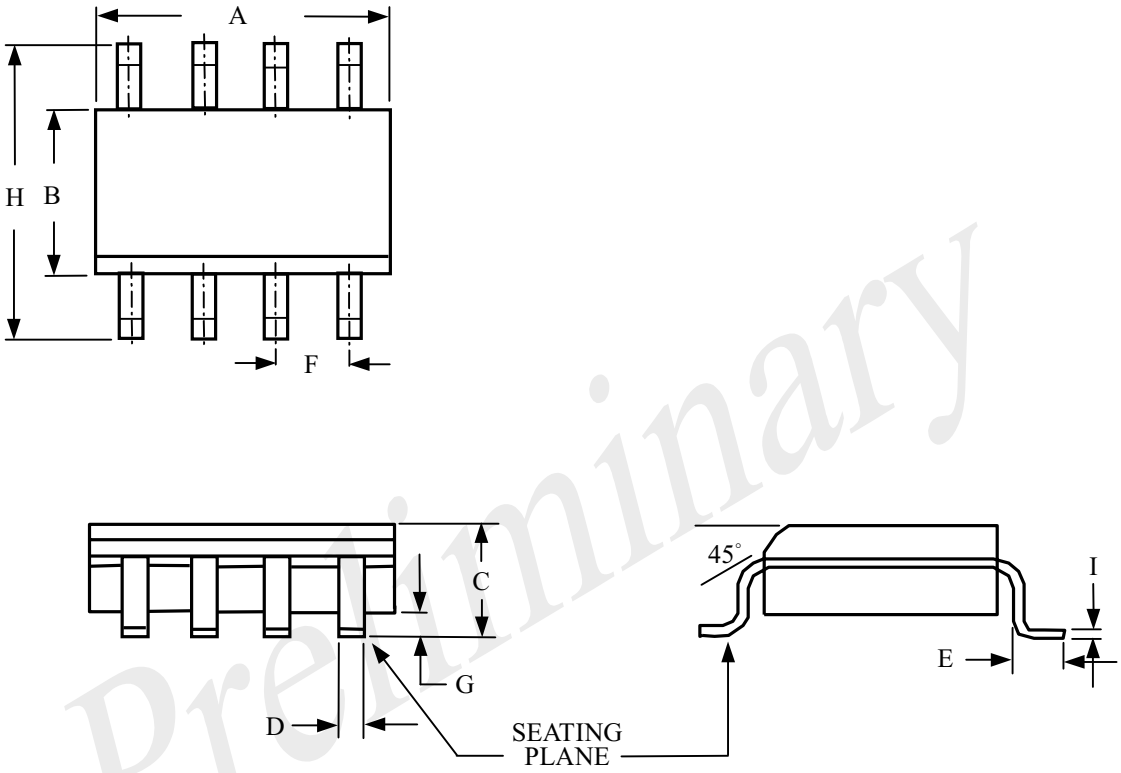
V_{OUT} : Desired output voltage, $|V_{OUT}| = 1.25(1 + \frac{R2}{R1})$

I_{OUT} : Desired output current.

f : Minimum desired output switching frequency at the selected values of Vin and I_O.

Vripple(pp): Desired peak-to-peak output ripple voltage. In practice, the calculated capacitor value needs to be increased due to its equivalent series resistance and board layout. The ripple voltage should be kept to a low value since it directly affects the line and load regulation.

Package Information



Symbols	Dimensions In Inches			Dimensions In Millimeter		
	Min	Norm	Max	Min	Norm	Max
A	0.185	0.191	0.197	4.70	4.85	5.00
B	0.150	0.153	0.157	3.80	3.90	4.00
C	0.054	0.061	0.068	1.35	1.55	1.75
D	0.012	0.016	0.020	0.30	0.40	0.50
E	0.016	--	0.050	0.40	--	1.27
F	--	0.050	--	--	1.27	--
G	0.004	0.006	0.009	0.10	0.17	0.25
H	0.229	0.237	0.244	5.80	6.00	6.20
I	0.007	0.008	0.009	0.18	0.22	0.25

8-Lead SOP Plastic Package

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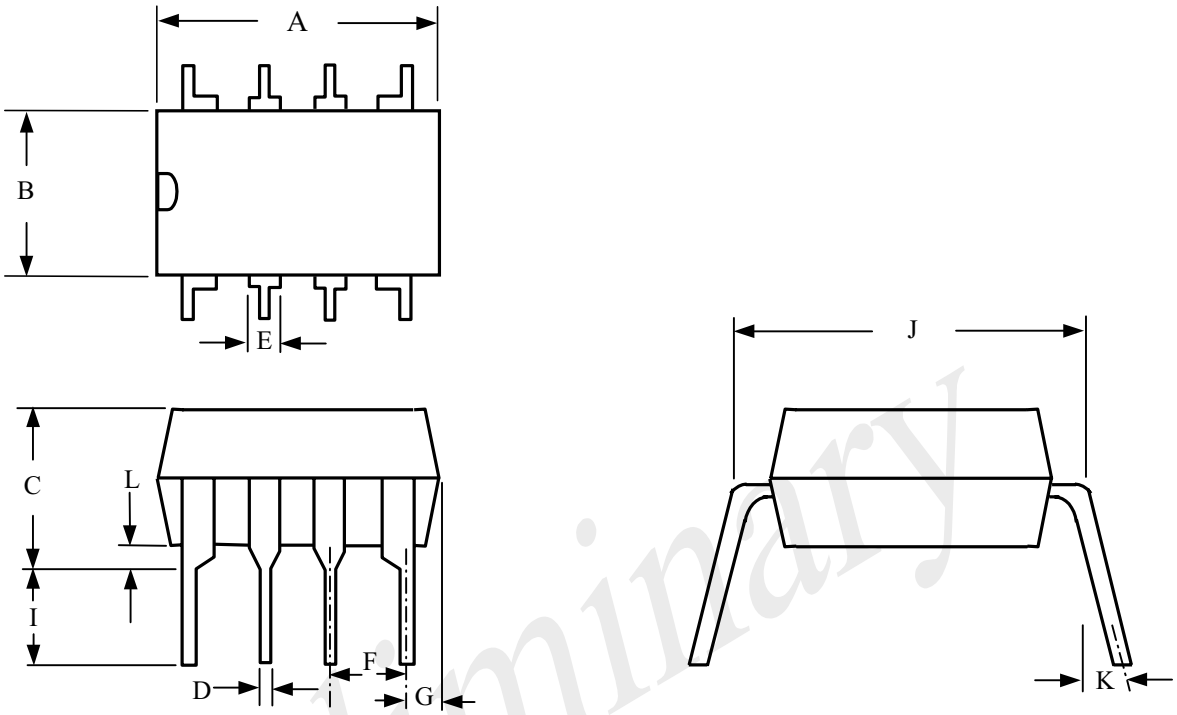

Symbols	Dimensions In Inches			Dimensions In Millimeter		
	Min	Norm	Max	Min	Norm	Max
A	0.357	0.362	0.367	9.00	9.30	9.60
B	0.244	0.254	0.264	6.20	6.45	6.70
C	--	--	0.180	--	--	4.57
D	0.016	0.018	0.020	0.35	0.45	0.55
E	0.040	0.055	0.070	1.02	1.40	1.78
F	--	0.100	--	--	2.54	--
G	--	0.035	0.050	--	0.89	1.27
I	0.120	0.130	0.140	3.05	3.30	3.55
J	0.290	0.300	0.310	7.60	8.00	8.40
K	--	--	15°	--	--	15°
L	0.015	0.025	0.035	0.39	0.64	0.89

8-Lead DIP Plastic Package