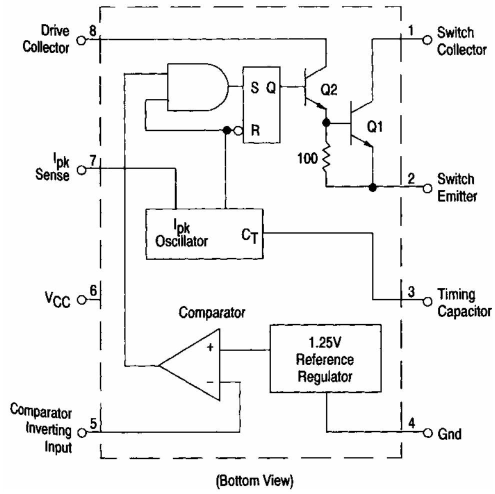
The 34063D is a monolithic control circuit containing the primary functions required for DC-to-DC converters. These devices consist of an internal temperature compensated reference, comparator, controlled duty cycle oscillator with an active current limit circuit, driver and high current output switch. 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

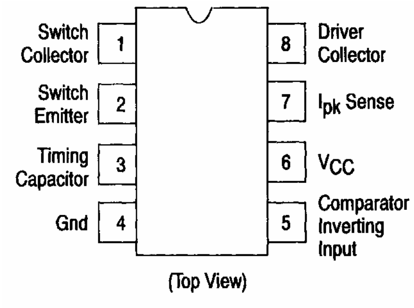
- Operation from 3.0 V to 40 V Input
- Low Standby Current
- Current Limiting
- Output Switch Current to 1.5 A
- Output Voltage Adjustable
- Frequency Operation to 100 kHz
- Precision 2% Reference

FUNCTIONAL BLOCK DIAGRAM



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 (Vpin 1 = 40 V)	$V_{E(switch)}$	40	Vdc
Switch Collector to Emitter Voltage	$V_{CE(switch)}$	40	Vdc
Driver Collector Voltage	$I_{C(driver)}$	40	Vdc
Driver Collector Current (Note 1)	$I_{C(driver)}$	100	mA
Switch Current	I_{SW}	1.5	A
Power Dissipation and Thermal Characteristics Plastic Package, P Suffix T_A = +25°C Thermal Resistance SOIC Package, D Suffix TA = +25°C Thermal Resistance	 P_D $R_{\theta JA}$ P_D $R_{\theta JA}$	 1.25 100 625 160	 W °C/W mW °C/W
Operating Junction Temperature	TJ	+150	°C
Operating Ambient Temperature Range	T_A	0 to +70	°C
Storage Temperature Range	Tstg	-65to+150	°C



ELECTRICAL CHARACTERICISTICS

(V_{CC} = 5.0 V, T_A= 0 to +70°C unless otherwise specified.)

Characteristics	Symbol	Min		Max	Unit
OSCILLATOR					
Frequency ($V_{Pin\ 5}$ = 0 V, C_T = 1.0 nF, T_A = 25°C)	fosc	24		42	kHz
Charge Current (V_{CC} = 5.0 V to 40 V, T_A = 25°C)	Ichg	24		42	μA
Discharge Current (V_{CC} = 5.0 V to 40 V, T_A = 25°C)	Idischg	140		260	μA
Discharge to Charge Current Ratio (Pin7 to Vcc, T_A=25°C)	Idischg/Ichg	5.2		7.5	—
Current Limit Sense Voltage (Ichg = Idischg, T_A = 25°C)	Vlpk(sense)	250		350	mV
OUTPUT SWITCH (Note 3)					
Saturation Voltage, Darlington Connection (I_{SW} = 1.0 A, Pins 1, 8 connected)	V_{CE}(sat)	—		1.3	V
Saturation Voltage (I_{SW} = 1.0 A, $R_{Pin\ 8}$ = 82 Ω to V_{CC}. Forced β = 20)	V_{CE}(sat)	—		0.7	V
DC Current Gain (I_{SW} = 1.0 A, V_{CE} = 5.0 V, T_A = 25°C)	h_{FE}	50		—	—
Collector Off-State Current (V_{CE} = 40V)	I_C(off)	—		100	μA
COMPARATOR					
Threshold Voltage (T_A = 25°C) (T_A = T_{LOW} to T_{HIGH})	Vth	1.225 1.21		1.275 1.29	V
Threshold Voltage Line Regulation (V_{CC} = 3 0 V to 40 V)	Reg_{line}			5.0	mV
Input Bias Current (Vin=0V)	I_{IB}	—		-400	nA
TOTAL DEVICE					
Supply Current (V_{CC} = 5 0 V to 40 V, C_T = 1 0 nF, V_{pin7} = V_{CC}. V_{Pin5} > Vth, Pin 2 = Gnd, Remaining pins open)	I_{CC}			4.0	mA

NOTES:

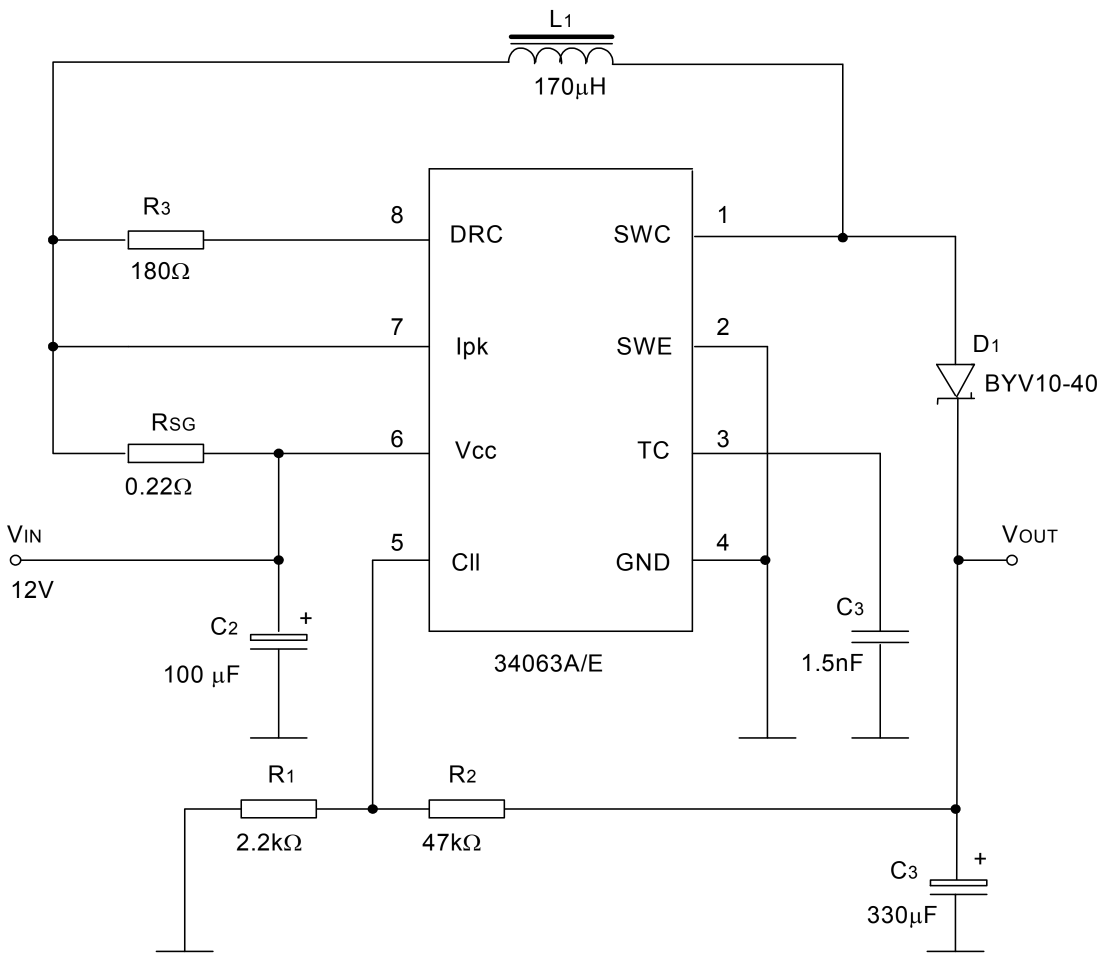
1. Maximum package power dissipation limits must be observed.
2. Low duty cycle pulse techniques are used during test to maintain Junction temperature as close to ambient temperature as possible
3. If the output switch is driven into hard saturation (non Darlington configuration) at low switch currents (< 300 mA) and high driver currents (>30 mA), it may take up to 2.0 μs 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

Forced β of output switch = I_C, output/(Ic, driver -7.0 mA*) > 10

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

TYPICAL APPLICATION CIRCUIT

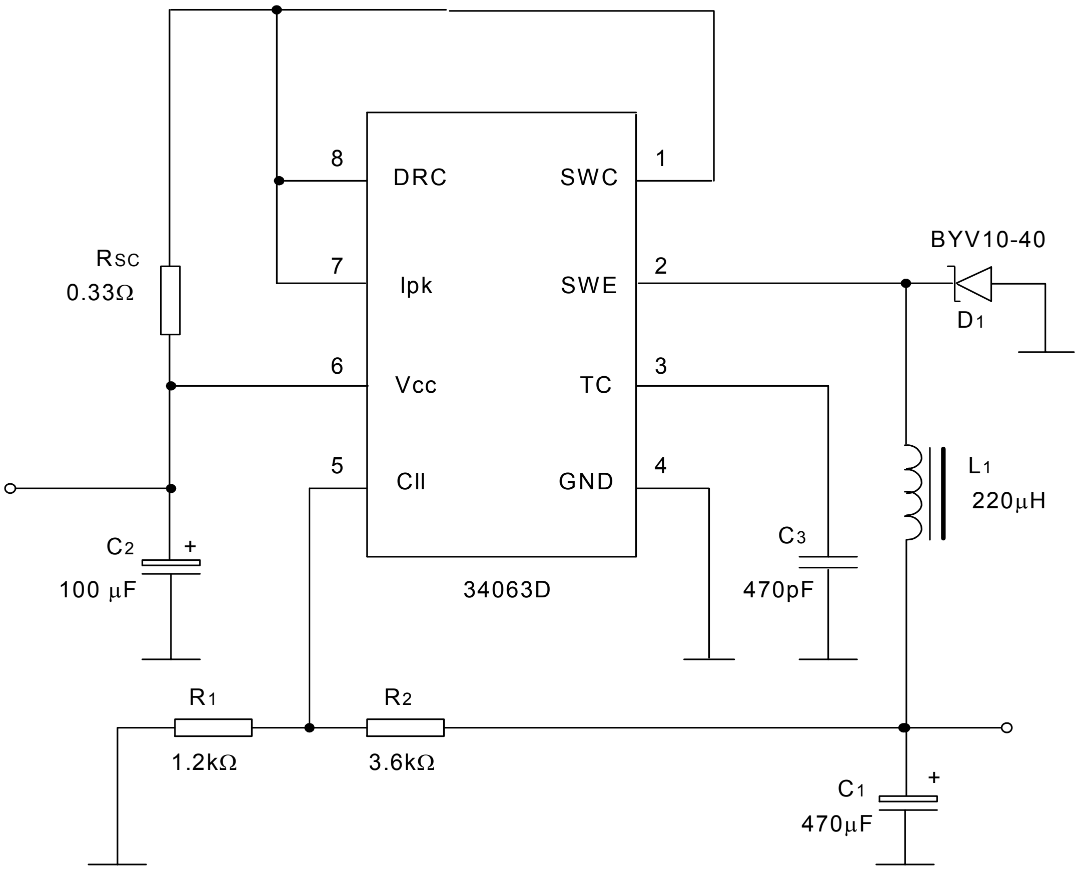
Step-Up Converter



Test Condition (V_{OUT} = 28 V)

Test	Conditions	Value (Typ)	Unit
Line Regulation	V_{IN} = 8 to 16 V, I_O = 175 mA	30	mV
Load Regulation	V_{IN} = 12 V, I_O = 75 to 175 mA	10	mV
Output Ripple	V_{IN} = 12 V, I_O = 175 mA	400	mV
Efficiency	V_{IN} = 12 V, I_O = 175 mA	87.7	%

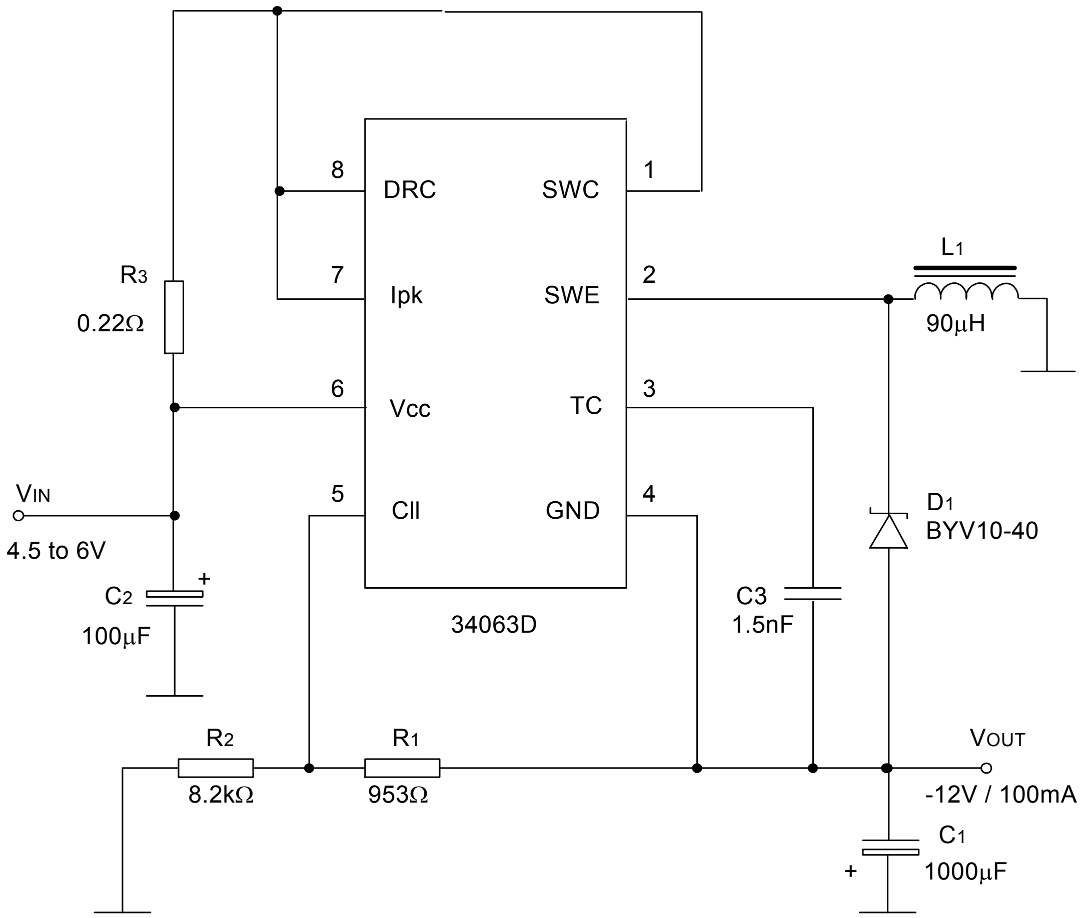
Step-Down Converter



Test Condition (V_{OUT} = 5 V)

Test	Conditions	Value (Typ)	Unit
Line Regulation	V_{IN} = 15 to 25 V, I_O = 500 mA	12	mV
Load Regulation	V_{IN} = 25 V, I_O = 50 to 500 mA	3	mV
Output Ripple	V_{IN} = 25 V, I_O = 500 mA	120	mV
Efficiency	V_{IN} = 25 V, I_O = 500 mA	83.7	%
ISC	V_{IN} = 25 V, RLOAD = 0.1 Ω	1.1	A

Voltage Inverting Converter



Test Condition (V_{OUT} = -12 V)

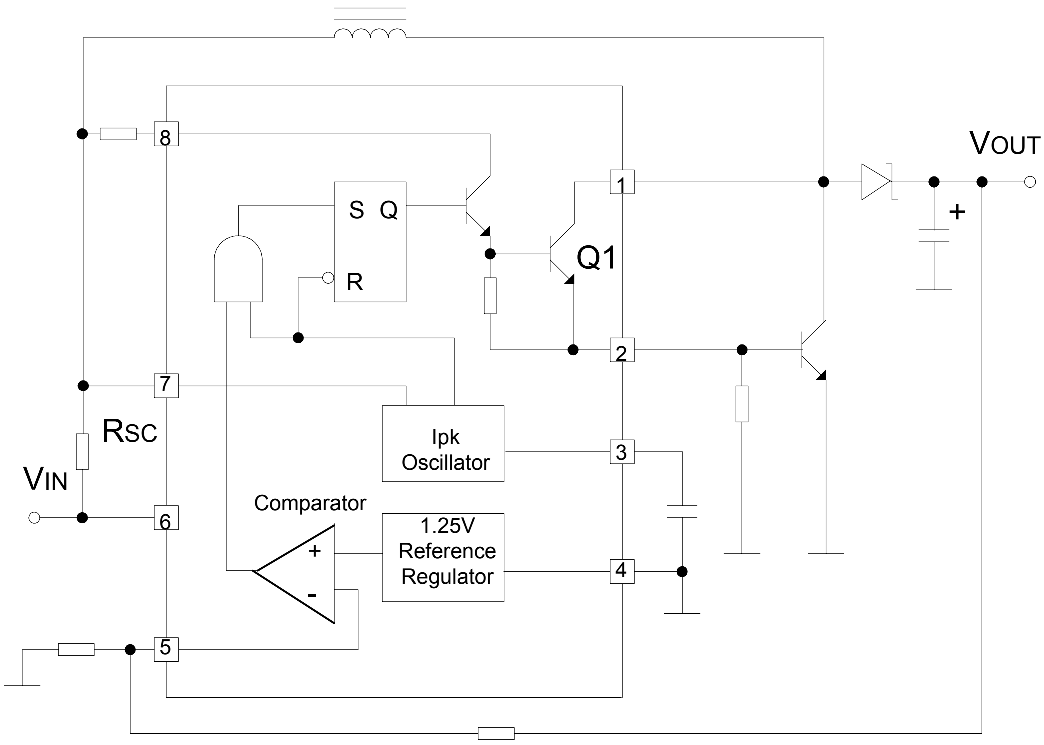
Test	Conditions	Value (Typ)	Unit
Line Regulation	V_{IN} = 4.5 to 6 V, I_O = 100 mA	3	mV
Load Regulation	V_{IN} = 5 V, I_O = 10 to 100 mA	22	mV
Output Ripple	V_{IN} = 5 V, I_O = 100 mA	500	mV
Efficiency	V_{IN} = 5 V, I_O = 100 mA	62.2	%
ISC	V_{IN} = 5 V, RLOAD = 0.1 Ω	0.91	A

Calculation

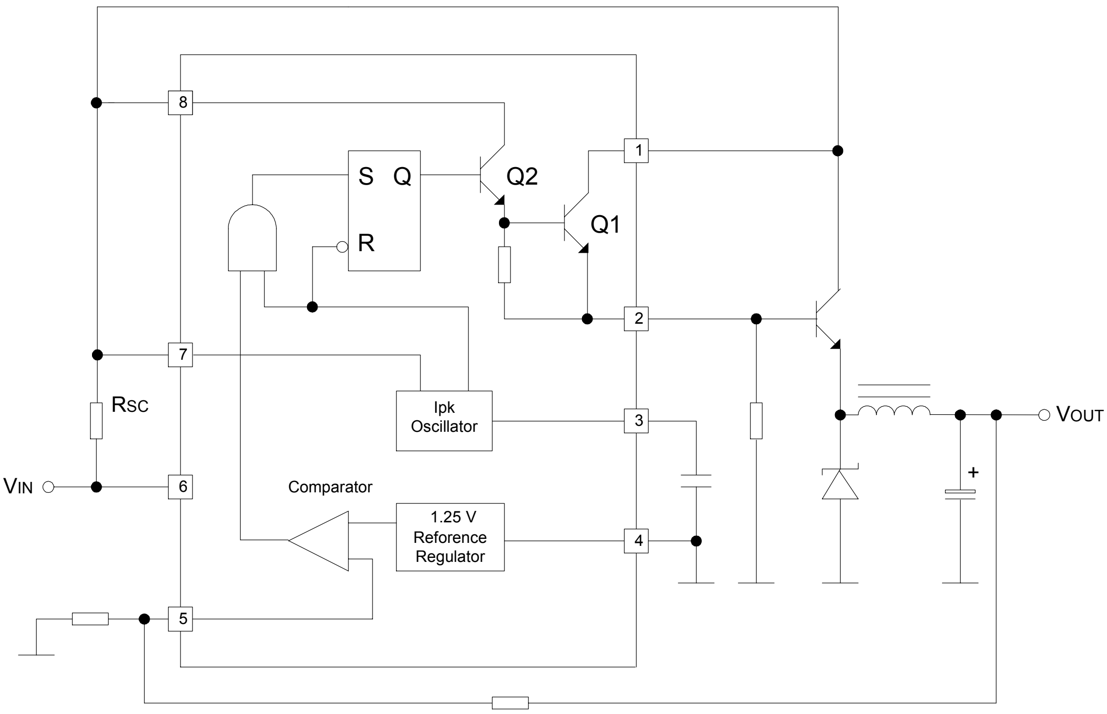
Parameter	Step-Up (Discontinuous mode)	Step-Down (Continuous mode)	Voltage Inverting (Discontinuous mode)
t_{on}/t_{off}	$\frac{V_{out}+V_F-V_{in(min)}}{V_{in(min)}-V_{sat}}$	$\frac{V_{out}+V_F}{V_{in(min)}-V_{sat}-V_{out}}$	$\frac{\lvert V_{out}\rvert+V_F}{V_{in}-V_{sat}}$
$(t_{on}+t_{off})max$	$1/f_{min}$	$1/f_{min}$	$1/f_{min}$
C_T	$4.5\times10^{-5}t_{on}$	$4.5\times10^{-5}t_{on}$	$4.5\times10^{-5}t_{on}$
$I_{PK(switch)}$	$2I_{out(max)}[(t_{on}/t_{off})+1]$	$2I_{out(max)}$	$2I_{out(max)}[(t_{on}/t_{off})+1]$
R_{SC}	$0.3/I_{PK(switch)}$	$0.3/I_{PK(switch)}$	$0.3/I_{PK(switch)}$
C_O	$\equiv\frac{I_{out}t_{on}}{V_{ripple(p-p)}}$	$\frac{I_{PK(switch)}(t_{on}+t_{off})}{8V_{ripple(p-p)}}$	$\equiv\frac{I_{out}t_{on}}{V_{ripple(p-p)}}$
L(min)	$\frac{V_{in(min)}-V_{sat}}{I_{PK(switch)}}t_{on(max)}$	$\frac{V_{in(min)}-V_{sat}-V_{out}}{I_{PK(switch)}}t_{on(max)}$	$\frac{V_{in(min)}-V_{sat}}{I_{PK(switch)}}t_{on(max)}$

NOTES:
V_{sat} = 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, $\lvert V_{out}\rvert = 1.25(1+R_2/R_1)$
I_{out} = Desired output current
fmin = Minimum desired output switching frequency at the selected values of Vin and Io
V_{ripple} = Desired peak to peak output ripple voltage. In practice, the calculated capacitor value will and to be increased due to its equivalent series resistance and board layout. The ripple voltage should be kept to a low value since it will directly affect the line and load regulation.

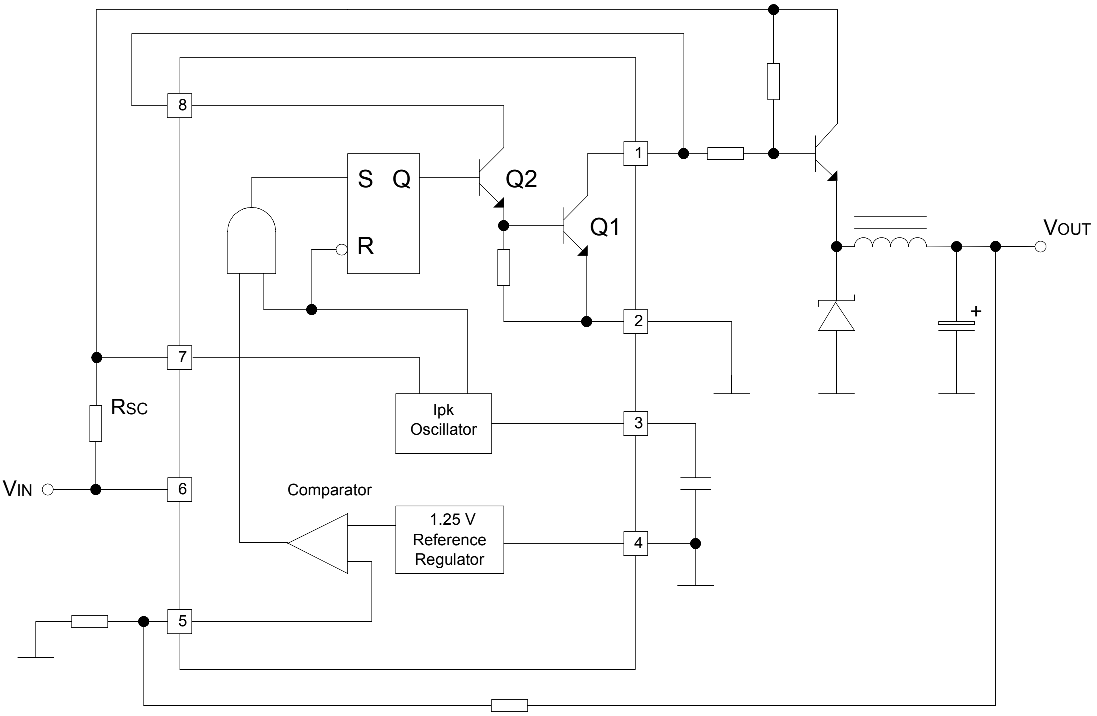
Step-up With External NPN Switch



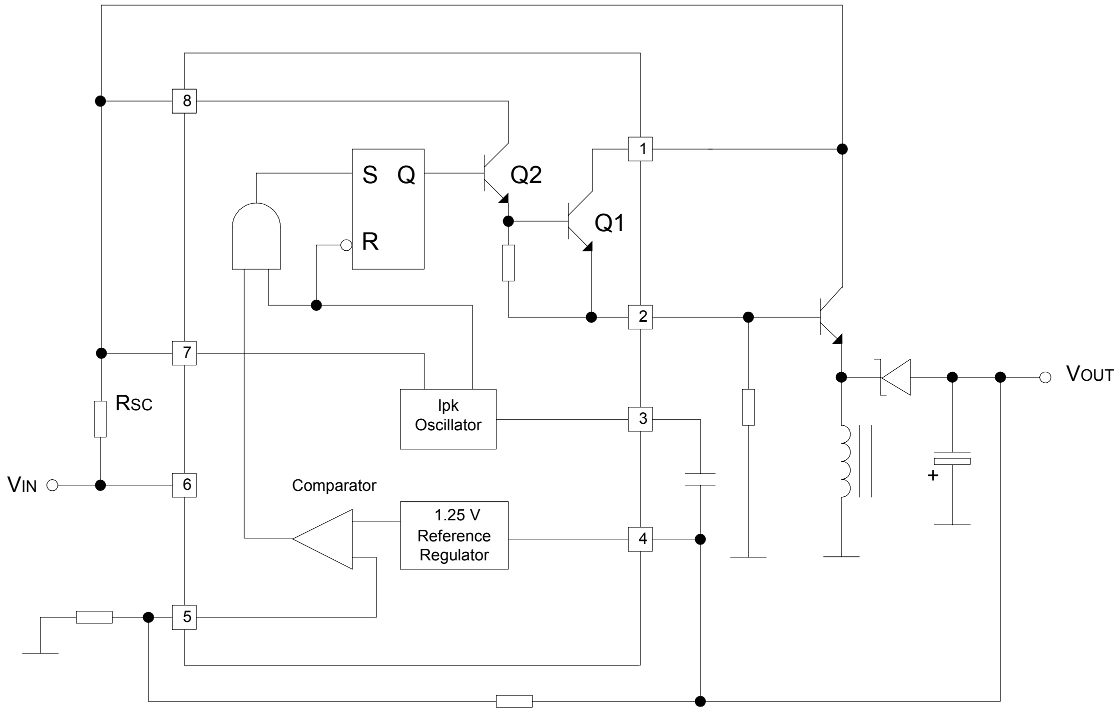
Step-down With External NPN Switch



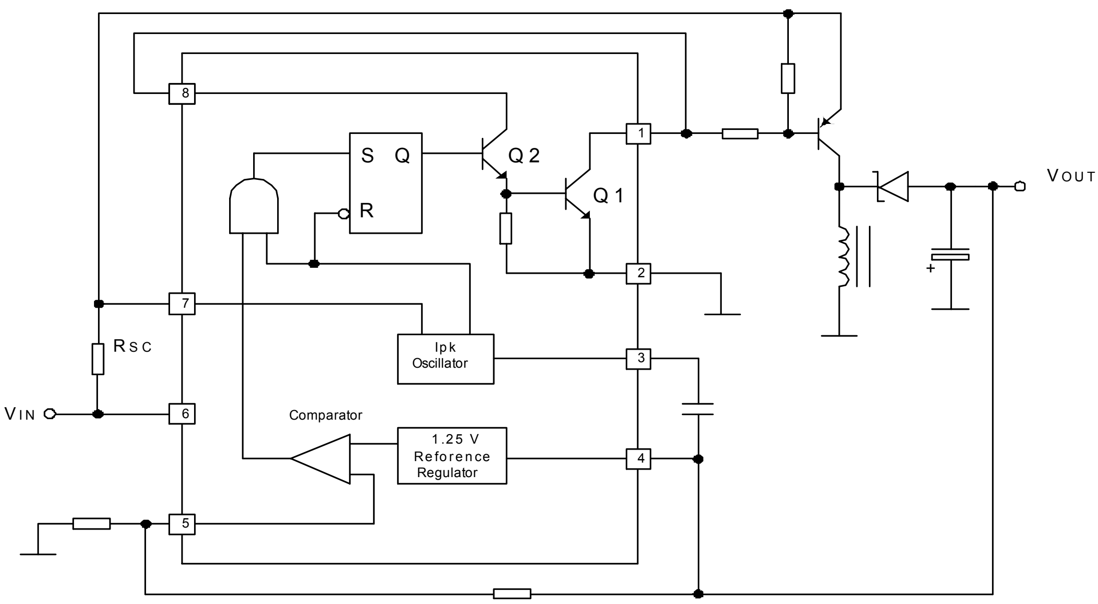
Step-down With External PNP Switch



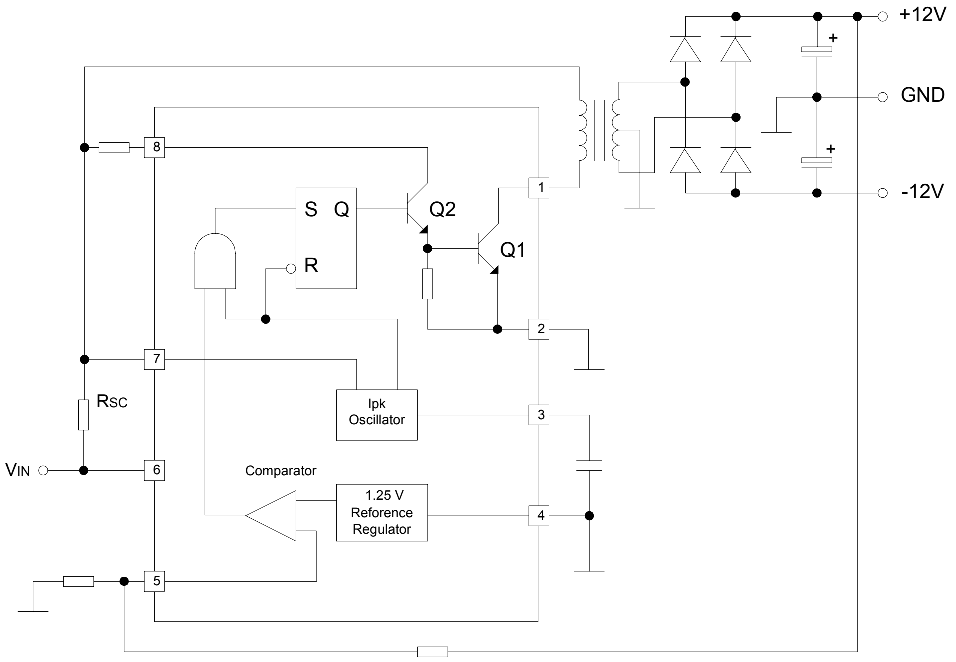
Voltage Inverting With External NPN Switch



Voltage Inverting With External PNP Saturated Switch



Dual Output Voltage



Higher Output Power, Higher Input Voltage