

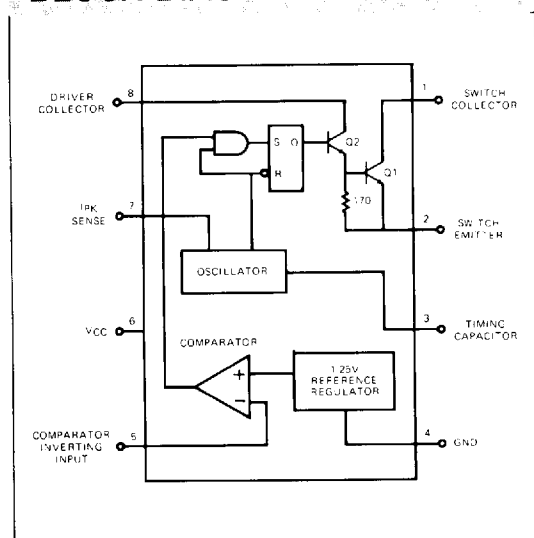
DC-DC CONVERTER CONTROL CIRCUITS

IP35063, IP33063, IP34063

DESCRIPTION

The IP34063 series of control circuits contains all the functions required to implement DC-DC converters. Included are internal voltage reference, comparator, controlled duty cycle oscillator with current limit circuit, driver, and high current output switch. This series was specifically designed to be incorporated in Step-Down (Buck) and Step-Up (Boost) applications with a minimum number of external components.

BLOCK DIAGRAM

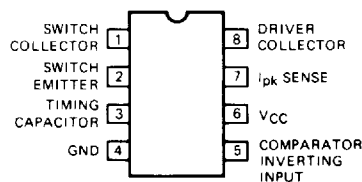


FEATURES

- Operation from 2.5 to 40V input
- Low standby current
- Current limiting
- Output switch current of 1.5A
- Output voltage adjustable from 1.25 to 40V
- Operating frequency from 100Hz to 100kHz
- Direct replacement for MC34063/MC34063A series

CONNECTIONS

(Top View)



N, J and D (150) Package

IP35063, IP33063, IP34063

DC-DC CONVERTER CONTROL CIRCUITS

ABSOLUTE MAXIMUM RATINGS

T=57-11

Power Supply Voltage	+40V	Power Dissipation at $T_A = +25^\circ\text{C}$ (Note 1)	
Comparator Input Voltage Range	-0.3 to +40V	Ceramic Package	1.25W
Switch Collector Voltage	40V	Plastic Package	1.0W
Switch Emitter Voltage	40V	Operating Junction Temperature	
Switch Collector to Emitter Voltage	40V	Ceramic Package	+150°C
Driver Collector Voltage	40V	Plastic Package	+125°C
Switch Current	1.5A	Operating Ambient Temperature Range	
		IP35063	-55°C to +125°C
		IP33063	-40°C to +85°C
		IP34063	0°C to +70°C
		Storage Temperature Range	-65°C to +150°C

Absolute maximum ratings are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The electrical characteristics provide conditions for actual device operation.

Note 1. Derate at 10mW/°C for ambient temperatures above +25°C.

ELECTRICAL CHARACTERISTICS

($V_{CC} = 5.0\text{V}$, unless otherwise specified)

Parameters	Test Conditions	Min	Typ	Max	Units
Oscillator					
Charging Current	$5.0\text{V} \leq V_{CC} \leq 40\text{V}$	20	35	50	μA
Discharge Current	$5.0\text{V} \leq V_{CC} \leq 40\text{V}$	150	200	250	μA
Voltage Swing			0.5		V _{pp}
Discharge to Charge Current Ratio	$I_{pk}(\text{sense}) = V_{CC}$		6.0		
Current Limit Sense Voltage	$I_{chg} = I_{dischg}$	250	300	350	mV
Output Switch					
Saturation Voltage, Darlington Connection	$I_{SW} = 1.0\text{A}$	•	1.0	1.3	V
Saturation Voltage	$I_{SW} = 1.0\text{A}; I_C(\text{Driver}) = 50\text{mA}, (\text{Forced } \beta = 20)$	•	0.45	0.7	V
DC Current Gain	$I_{SW} = 1.0\text{A}; V_{CE} = 5.0\text{V}$	35	120		
Collector Off-State Current	$V_{CE} = 40\text{V}$		10		nA
Comparator					
Threshold Voltage		•	1.18	1.25	1.32 V
Threshold Voltage Line regulation	$3.0\text{V} \leq V_{CC} \leq 40\text{V}$	•	0.04	0.2	mV/V
Input Bias Current	$V_{IN} = 0\text{V}$	•	40	400	nA
Total Device					
Supply Current	$5.0\text{V} \leq V_{CC} \leq 40\text{V}, C_T = 0.001\mu\text{F}$				
	$I_{pk}(\text{Sense}) = V_{CC}, V_{PIN 5} > V_{th}$ PIN 2 = Gnd, Remaining Pins Open	•	2.4	3.5	mA

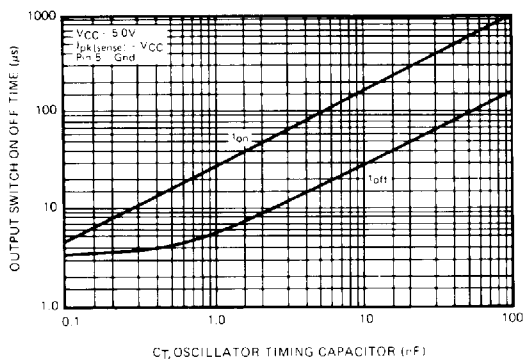
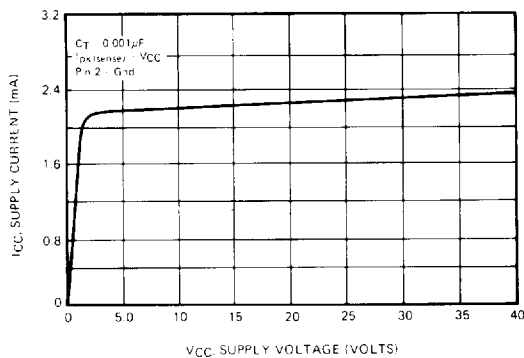
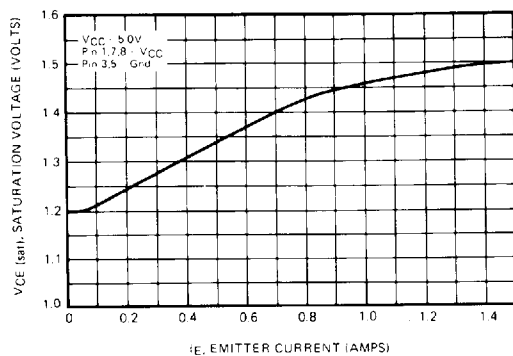
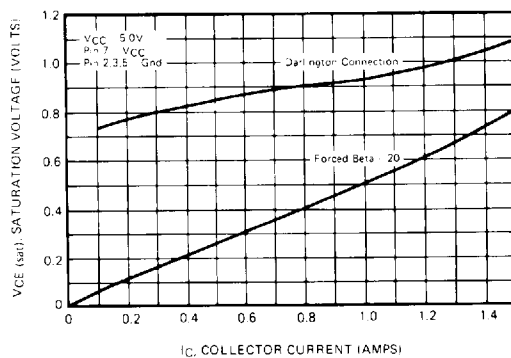
The • denotes the specifications which apply over the full operating temperature range, all others apply at $T_j = 25^\circ\text{C}$ unless otherwise specified.



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DC-DC CONVERTER CONTROL CIRCUITS**TYPICAL PERFORMANCE CHARACTERISTICS**

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**Output Switch On-Off Time
vs. Oscillator Timing Capacitor****Standby Supply Current
vs. Supply Voltage****Emitter-Follower Configuration
Output Switch Saturation Voltage
vs. Emitter Current****Common-Emitter Configuration
Output Switch Saturation Voltage
vs. Collector Current**

DC-DC CONVERTER CONTROL CIRCUITS

DESIGN FORMULA TABLE

T-57-11

Calculation	Step-down	Step-up
$\frac{t_{ON}}{t_{OFF}}$	$\frac{V_{OUT} + V_F}{V_{IN(MAX)} - V_{SAT} - V_{OUT}}$	$\frac{V_{OUT} + V_F - V_{IN(MIN)}}{V_{IN(MIN)} - V_{SAT}}$
$(t_{ON} + t_{OFF})_{MAX}$	$\frac{1}{f_{MIN}}$	$\frac{1}{f_{MIN}}$
C_T	$4 \times 10^{-5} t_{ON}$	$4 \times 10^{-5} t_{ON}$
$I_{pk}(\text{switch})$	$2 I_{OUT(MAX)}$	$2 I_{OUT(MAX)} \frac{t_{ON} + t_{OFF}}{t_{OFF}}$
R_{SC}	$0.33 / I_{pk}(\text{switch})$	$0.33 / I_{pk}(\text{switch})$
$L_{(MIN)}$	$\frac{V_{IN(MAX)} - V_{SAT} - V_{OUT}}{I_{pk}(\text{switch})} t_{ON(MAX)}$	$\frac{V_{IN(MIN)} - V_{SAT}}{I_{pk}(\text{switch})} t_{ON(MAX)}$
C_O	$\frac{I_{pk}(\text{switch}) (t_{ON} + t_{OFF})}{8 V_{ripple(p-p)}}$	$\frac{I_{OUT} t_{ON}}{V_{ripple}}$

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

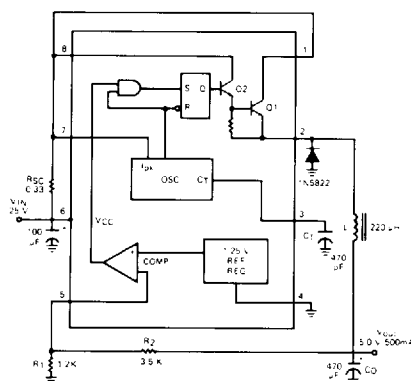
V_F = Forward voltage drop of the ringback rectifier.

The following power supply characteristics must be chosen.

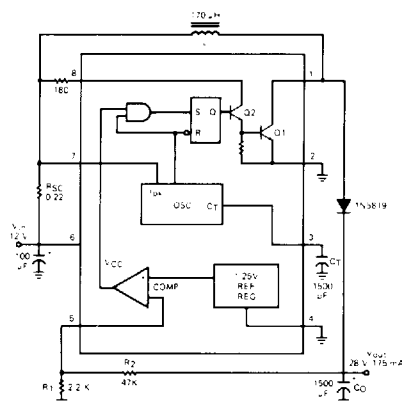
- V_{IN} — Nominal input voltage. If this voltage is not constant, then use $V_{IN(MAX)}$ for step-down and $V_{IN(MIN)}$ for step-up converter.
- V_{OUT} — Desired output voltage, $V_{OUT} = 1.25 \left(1 + \frac{R_2}{R_1} \right)$.
- I_{OUT} — Desired output current.
- f_{MIN} — Minimum desired output switching frequency at the selected values for V_{IN} and I_O .
- $V_{ripple(p-p)}$ — Desired peak-to-peak output ripple voltage. In practice, the calculated value will need to be increased due to the capacitor's 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.

APPLICATIONS INFORMATION

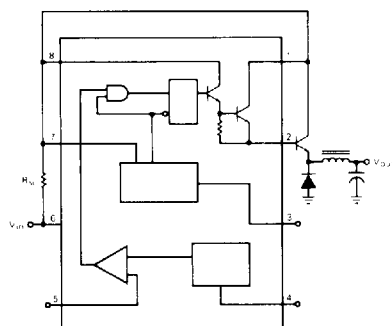
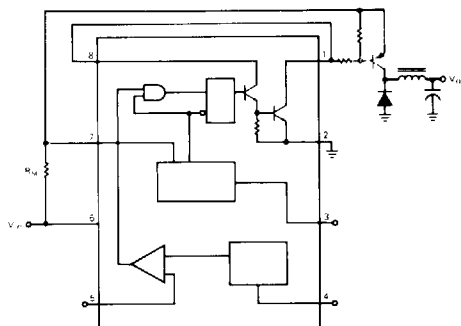
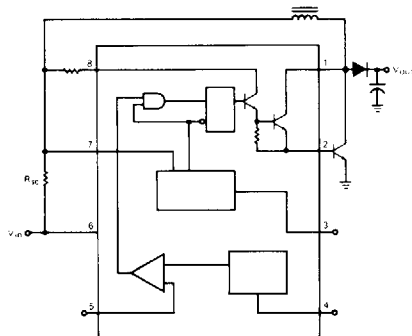
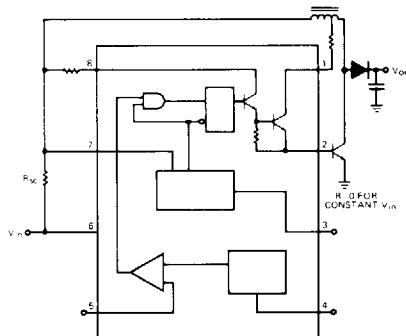
Step-Down Converter



Step-Up Converter



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DC-DC CONVERTER CONTROL CIRCUITS**APPLICATIONS INFORMATION (CONTINUED)****T-57-11**External Current Boost Connections For I_C Peak Greater Than 1.5 A**2****Step-Down, External NPN Switch****Step-Down, External PNP Saturated Switch****Step-Up, External NPN Switch****Step-Up, External NPN Saturated Switch****ORDER INFORMATION****Part Number**

IP35063J
IP33063D
IP33063J
IP33063N
IP34063D
IP34063J
IP34063N

Temperature Range

-55°C to +125°C
-40°C to +85°C
-40°C to +85°C
-40°C to +85°C
0°C to +70°C
0°C to +70°C
0°C to +70°C

Package

8 Pin Ceramic DIP
8 Pin Plastic (150) SOIC
8 Pin Ceramic DIP
8 Pin Plastic DIP
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8 Pin Ceramic DIP
8 Pin Plastic DIP

