



WS34063A

DC TO DC CONVERTOR CONTROLLER

The WS34063 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, drive and a high current output switch. This series was specifically designed to be incorporated in step-up, step-down and voltage-inverting applications with a minimum number of external components.

8 DIP

8 SOP



PIN:

1. Switch Collector
2. Switch Emitter
3. Timing Capacitor
4. GND
5. Comparator Inverting Input
6. VCC
7. IPK Sense
8. Driver Collector

FEATURES

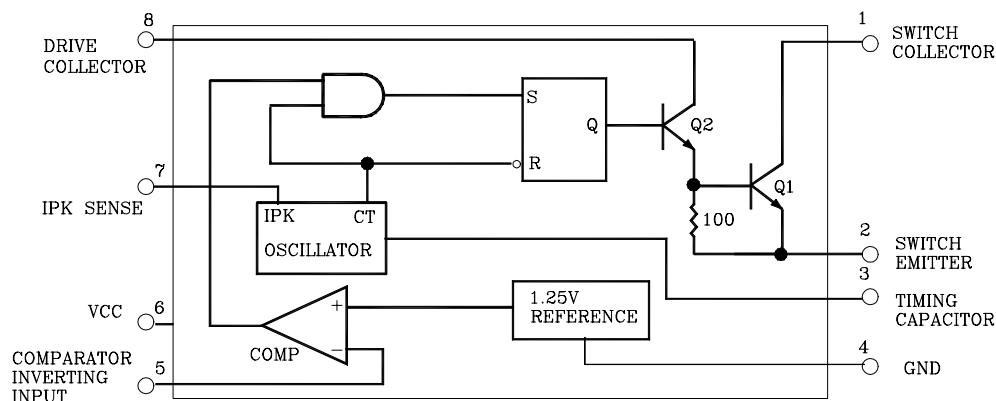
- Operation from 3 to 40V input
- Low standby current
- Current limiting
- Output switch current to 1.5A
- Precision 2% reference

ORDERING INFORMATION

Device	Operating temperature	Package
WS34063 AP	0 ~ +70°C	8 DIP
WS34063 AD	0 ~ +70°C	8 SOP

- Output - voltage adjustable
- Frequency of operation from 100Hz to 100KHz

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	40	Vdc
Comparator Input Voltage Range	V_{IR}	-0.3 ~ +40	Vdc
Switch Collector Voltage	$V_{C(SW)}$	40	Vdc
Switch Emitter Voltage	$V_{E(SW)}$	40	Vdc
Switch Collector to Emitter Voltage	$V_{CE(SW)}$	40	Vdc
Driver Collector Voltage	$V_{C(drive)}$	40	Vdc
Drive Collector Current (Note 1)	$I_{C(drive)}$	100	mA
Switch Current	I_{sw}	1.5	A
Operating Junction Temperature	T_J	+150	°C
Operating Ambient Temperature Range	T_A	0 to +70	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

ELECTRICAL CHARACTERISTICS(V_{CC} = 5.0V. T_a = T_{low} to T_{high}, unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
OSCILLATOR						
Frequency	fosc	V _{PIN5} =0V, C _T =1.0nF, T _A =25°C	24	33	42	KHz
Charging Current	I _{chg}	V _{CC} =5 to 40V, T _A =25°C	24	35	42	μ A
Discharge Current	I _{dischg}	V _{CC} =5 to 40V, T _A =25°C	140	220	260	μ A
Discharge To Charge Current Ratio	I _{dischg} /I _{chg}	Pin7 to V _{CC} , T _A =25°C	5.2	6.5	7.5	-
Current Limit Sense Voltage	V _{IPK(sense)}	I _{chg} = I _{dischg} , T _A =25°C	250	300	350	mV
OUTPUT SWITCH(NOTE 2)						
Saturation Voltage , Darlington Connection	V _{CE(sat)}	I _{sw} =1.0A, Pins1,8 connected	-	1.0	1.3	V
Saturation Voltage , Darlington Connection	V _{CE(sat)}	I _{sw} =1.0A, R _{PIN8} =82 Ω to V _{cc} , Forced β ≥20	-	0.45	0.7	V
DC Current Gain	h _{FE}	I _{sw} =1.0A, V _{CE} = 5.0V, T _A =25°C	50	75	-	-
Collector Off- State Current	I _{C(off)}	V _{CE} =40V	-	40	100	μ A
COMPARATOR						
Threshold Voltage	V _{TH}	T _A =25°C T _A =T _{low} to T _{high}	1.225 1.21	1.25 -	1.275 1.29	V
Threshold Voltage Line Regulation	Regline	V _{CC} = 3 to 40V		1.4	5.0	mV
Input Bias Current	I _{IB}	V _{IN} =0V		-20	-400	nA
TOTAL DEVICE						
Supply Current	I _{CC}	V _{CC} =5 to 40V, C _T =1.0nF, Pin7=V _{cc} , V _{PIN5} >V _{th} Pin 2 =GND, remaining pins open	-	-	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.

FIGURE 1.OUTPUT SWITCH ON-OFF TIME versus OSCILLATOR TIMING CAPACITOR

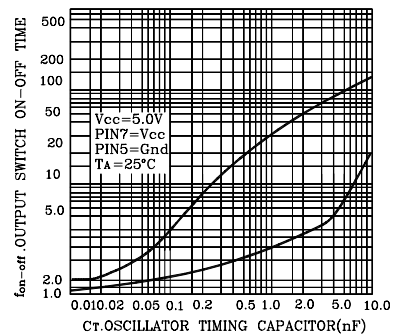


FIGURE 2.TIMING CAPACITOR WAVEFORM

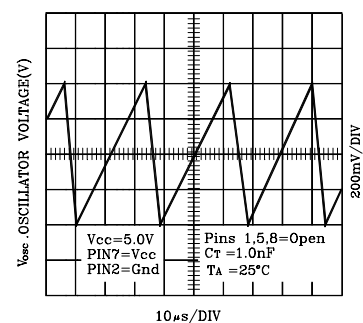


FIGURE 3.EMITTER FOLLOWER CONFIGURATION OUTPUT SATURATION VOLTAGE versus EMITTER CURRENT

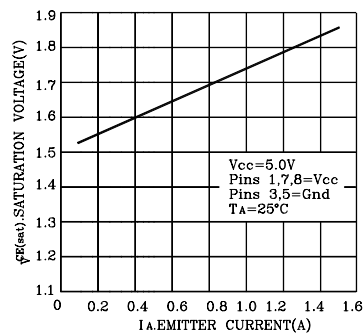


FIGURE 4.COMMON EMITTER CONFIGURATION OUTPUT SWITCH SATURATION VOLTAGE versus COLLECTOR CURRENT

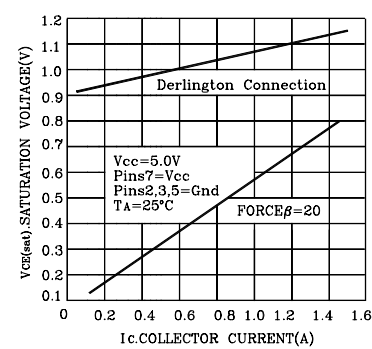


FIGURE 5.CURRENT LIMIT SENSE VOLTAGE versus TEMPERATURE

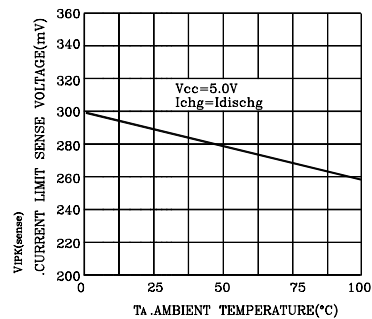


FIGURE 6.STANDBY SUPPLY CURRENT versus SUPPLY VOLTAGE

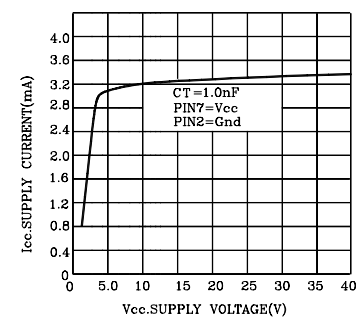
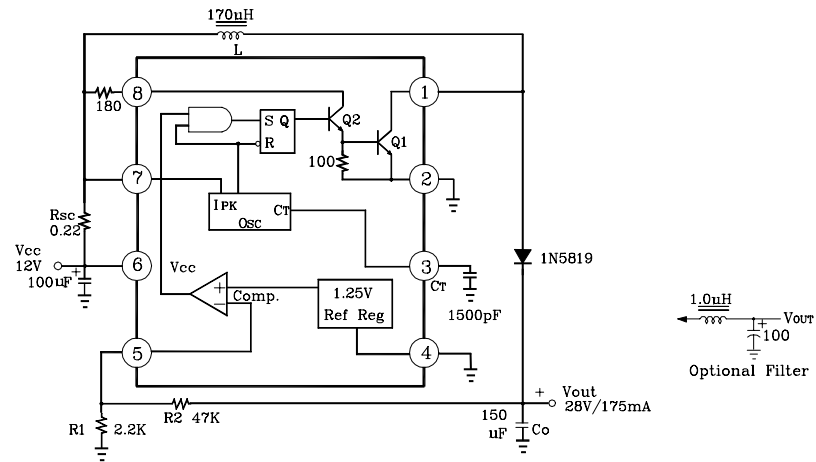


FIGURE 1.STEP-UP CONVERTER

FIGURE 2.EXTERNAL CURRENT BOOST CONNECTIONS FOR I_c PEAK GREATER THAN 1.5A

2a.EXTERNAL NPN SWITCH

2b.EXTERNAL NPN SATURATED SWITCH

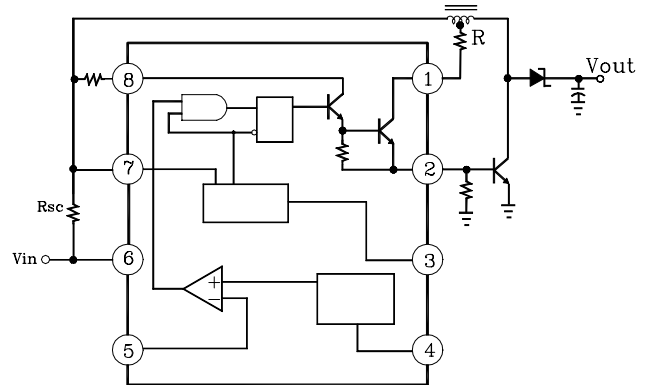
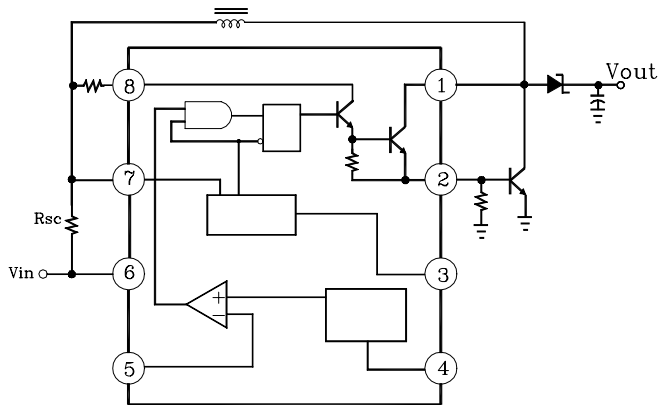
Note: $R \rightarrow 0$ for constant V_{in}

FIGURE 3.STEP-DOWN CONVERTER

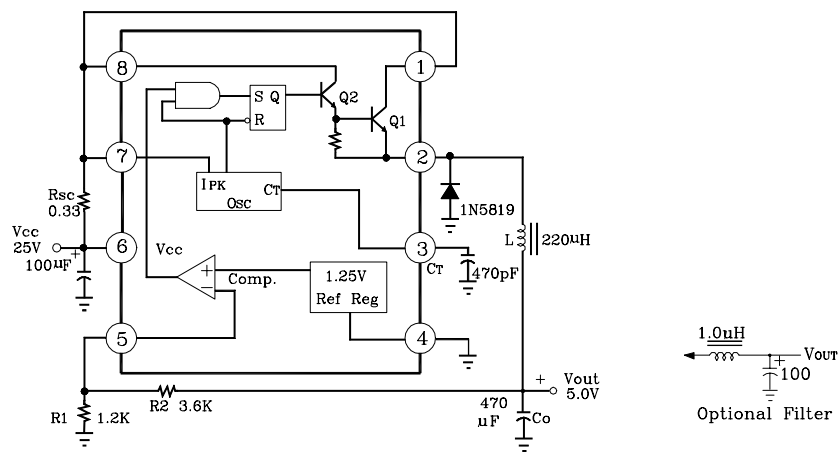


FIGURE 4.EXTERNAL CURRENT BOOST CONNECTIONS FOR Ic PEAK GREATER THAN 1.5A
4a.EXTERNAL NPN SWITCH 4b.EXTERNAL NPN SWITCH

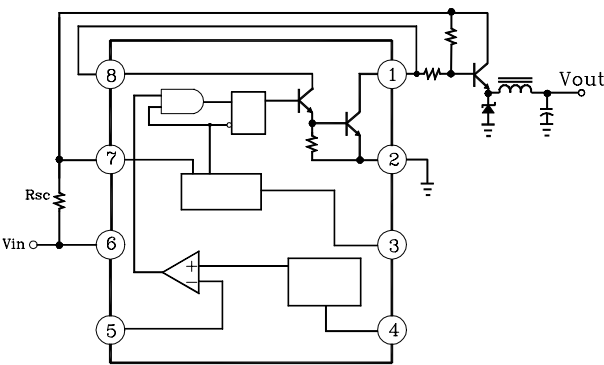
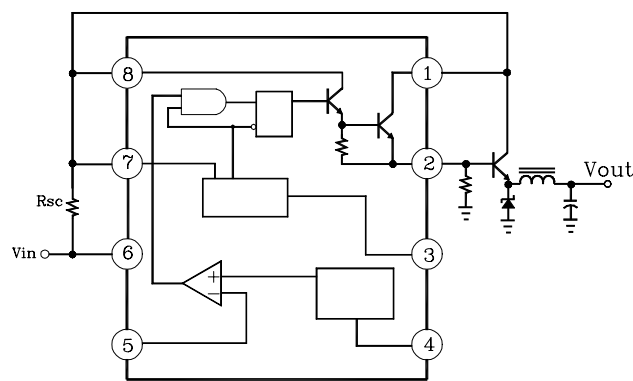


FIGURE 5.VOLTAGE INVERTING CONVERTER

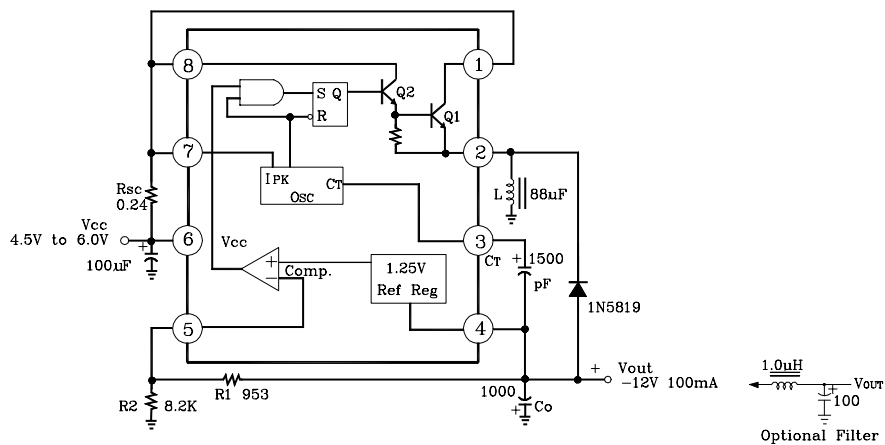


FIGURE 6.EXTERNAL CURRENT BOOST CONNECTIONS FOR I_c PEAK GREATER THAN 1.5A
6a.EXTERNAL NPN SWITCH **6b.EXTERNAL NPN SATURATED SWITCH**

6a.EXTERNAL NPN SWITCH

6b.EXTERNAL NPN SATURATED SWITCH

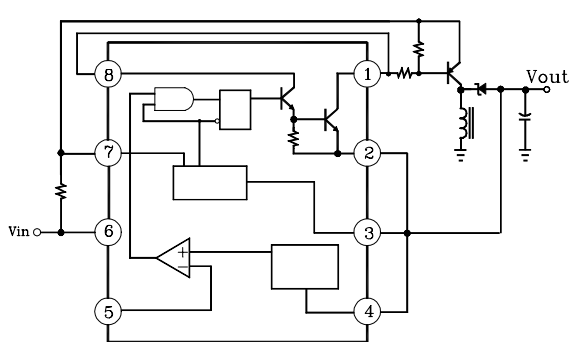
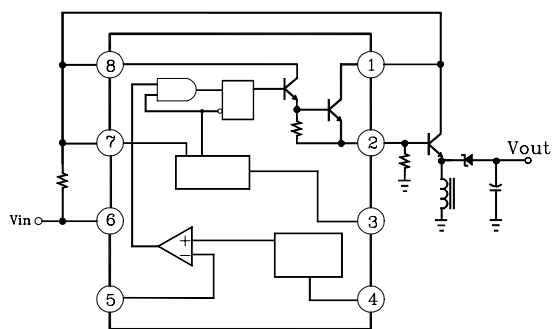


TABLE: DESIGN FORMULA

Calculation	Step-Up	Step-Down	Voltage-Inverting
ton toff	$\frac{V_{out}+V_F-V_{in(min)}}{V_{CC(min)}-V_{sat}-V_{out}}$	$\frac{V_{OUT}+V_F}{V_{CC(min)}-V_{sat}-V_{out}}$	$\frac{ V_{out} +V_F}{V_{CC}+V_{sat}}$
(ton+toff) max	$\frac{1}{f \text{ min}}$	$\frac{1}{f \text{ min}}$	$\frac{1}{f \text{ min}}$
C _T	4.0×10 ⁻⁵ ton	4.0×10 ⁻⁵ ton	4.0×10 ⁻⁵ ton
I _{pk} (switch)	$2I_{out(max)}\left(\frac{ton}{toff}+1\right)$	2I _{out} (max)	$2I_{out(max)}\left(\frac{ton}{toff}+1\right)$
R _{sc}	0.3/I _{pk} (switch)	0.3/I _{pk} (switch)	0.3/I _{pk} (switch)
L (min)	$\left(\frac{V_{in(min)}-V_{sat}}{I_{pk}(switch)}\right) : ton(max)$	$\left(\frac{V_{in(min)}-V_{sat}-V_{out}}{I_{pk}(switch)}\right) ton(max)$	$\left(\frac{V_{in(min)}-V_{sat}}{I_{pk}(switch)}\right) ton(max)$
Co	$\left(\frac{I_{outton}}{V_{ripple(pp)}}\right)$	$\left(\frac{I_{pk}(switch)(ton+toff)}{8V_{ripple(pp)}}\right)$	$\left(\frac{I_{outton}}{V_{ripple(pp)}}\right)$

TERMS AND DEFINITIONS

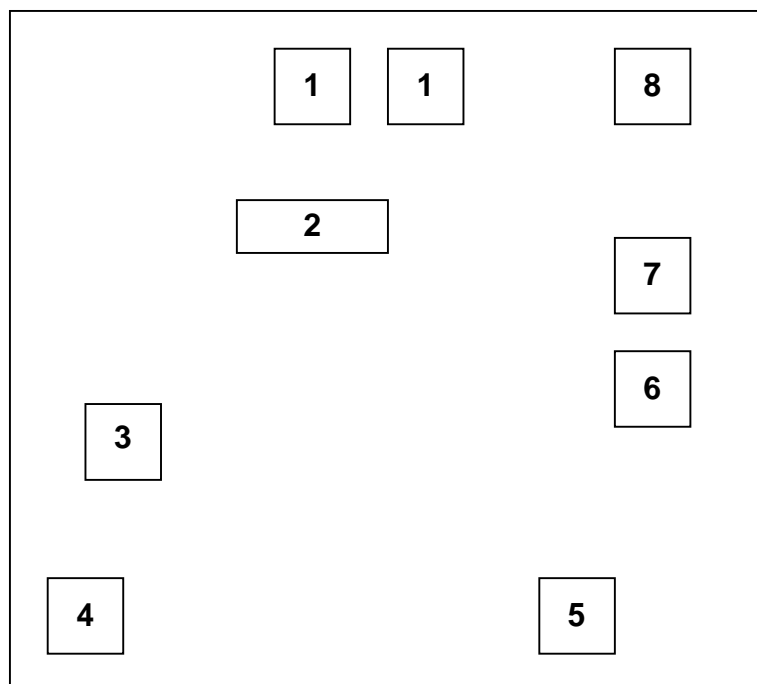
- ◆ V_{sat} = Saturation Voltage of the output switch.
- ◆ V_F = Forward Voltage drop of the rectifier.

The following power supply characteristics must be chosen:

- ◆ V_{in} = Normal input voltage
- ◆ V_{out}: Desired Output voltage, $|V_{out}| = 1.25 \left(1 + \frac{R2}{R1}\right)$
- ◆ 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 capacitor value will need 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.

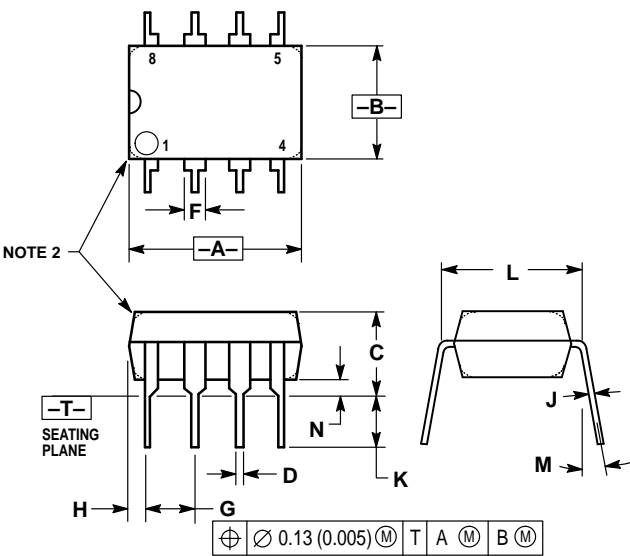
PAD LOCATION WS34063A (NEW DESIGN)



Chip Size: 1.72X1.82 mm

PAD No.	PAD NAME
1	Switch Collector *1
2	Switch Emitter *1
3	Timing Capacitor
4	GND
5	Comparator Inverting Input
6	V _{CC}
7	I _{PK} Sense
8	Driver Collector

*1: Two wires must be connected to 1 and 2 pin



- NOTES:
- 1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
 - 2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
 - 3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	10°		10°	
N	0.76	1.01	0.030	0.040

Attention: M=10°