



# 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.

### FEATURES

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

8 DIP

8 SOP



PIN:

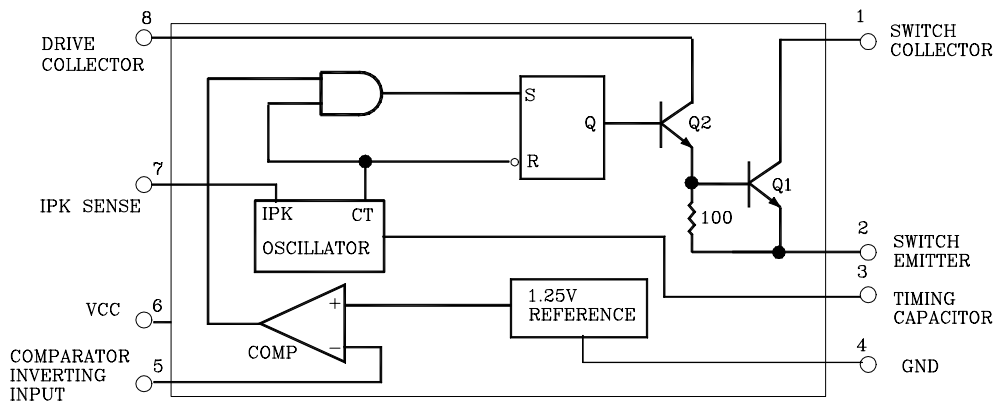
1. Switch Collector
2. Switch Emitter
3. Timing Capacitor
4. GND
5. Comparator Inverting Input
6. VCC
7. IPK Sense
8. Driver Collector

### 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
<b>OSCILLATOR</b>						
Frequency	$f_{osc}$	$V_{PIN5}=0V, C_T=1.0nF, T_A=25^\circ C$	24	33	42	KHz
Charging Current	$I_{chg}$	$V_{CC}=5$ to $40V, T_A=25^\circ C$	24	35	42	$\mu A$
Discharge Current	$I_{dischg}$	$V_{CC}=5$ to $40V, T_A=25^\circ C$	140	220	260	$\mu A$
Discharge To Charge Current Ratio	$I_{dischg}/I_{chg}$	Pin7 to $V_{CC}, T_A=25^\circ C$	5.2	6.5	7.5	-
Current Limit Sense Voltage	$V_{IPK(sense)}$	$I_{chg} = I_{dischg}, T_A=25^\circ C$	250	300	350	mV
<b>OUTPUT SWITCH(NOTE 2)</b>						
Saturation Voltage , Darlington Connection	$V_{CE(sat)}$	$I_{sw}=1.0A, P_{in1,8}$ connected	-	1.0	1.3	V
Saturation Voltage , Darlington Connection	$V_{CE(sat)}$	$I_{sw}=1.0A, R_{PIN8}=82 \Omega$ to $V_{CC}$ , Forced $\beta \leq 20$	-	0.45	0.7	V
DC Current Gain	$h_{FE}$	$I_{sw}=1.0A, V_{CE} = 5.0V, T_A=25^\circ C$	50	75	-	-
Collector Off- State Current	$I_{C(off)}$	$V_{CE}=40V$	-	40	100	$\mu A$
<b>COMPARATOR</b>						
Threshold Voltage	$V_{TH}$	$T_A=25^\circ C$ $T_A=T_{low}$ 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
<b>TOTAL DEVICE</b>						
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

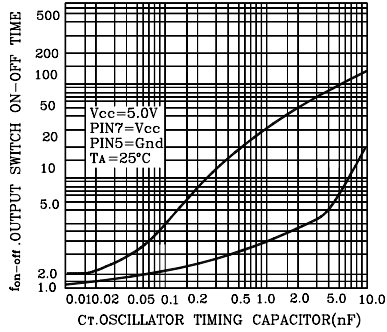


FIGURE 2. TIMING CAPACITOR WAVEFORM

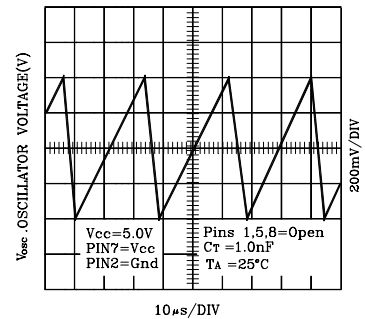


FIGURE 3. EMITTER FOLLOWER CONFIGURATION OUTPUT SATURATION VOLTAGE versus EMITTER CURRENT

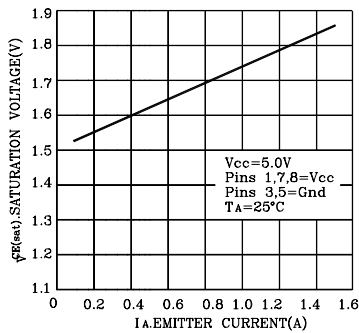


FIGURE 4. COMMON EMITTER CONFIGURATION OUTPUT SWITCH SATURATION VOLTAGE versus COLLECTOR CURRENT

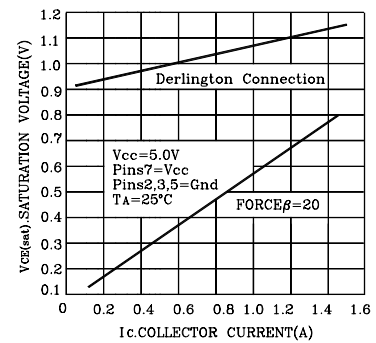


FIGURE 5. CURRENT LIMIT SENSE VOLTAGE versus TEMPERATURE

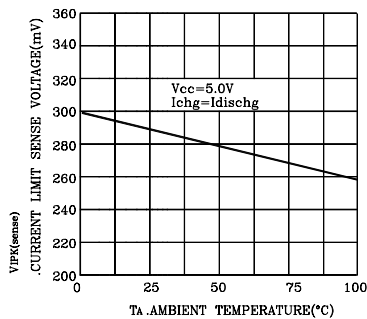


FIGURE 6. STANDBY SUPPLY CURRENT versus SUPPLY VOLTAGE

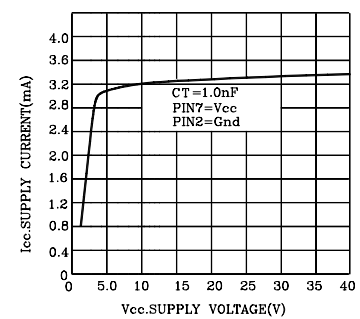


FIGURE 1.STEP-UP CONVERTER

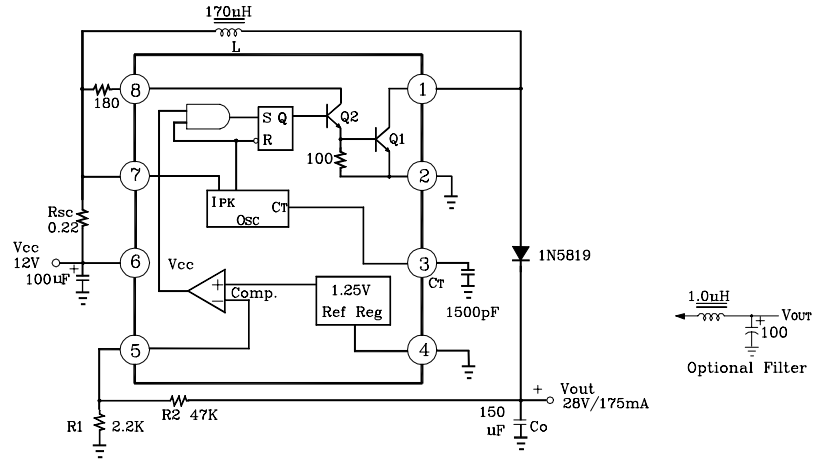
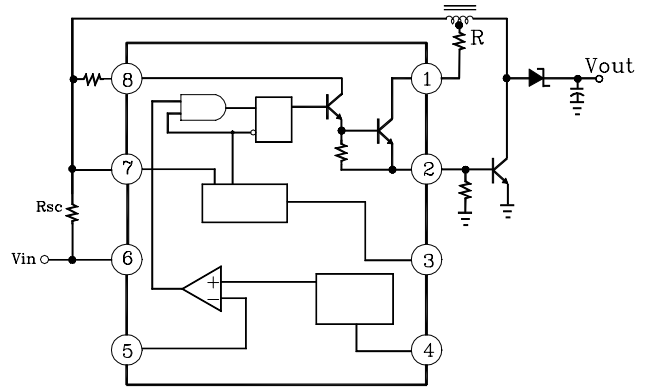
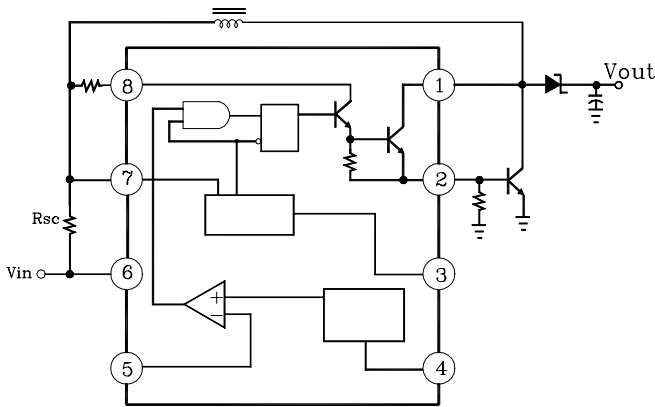


FIGURE 2.EXTERNAL CURRENT BOOST CONNECTIONS FOR Ic PEAK GREATER THAN 1.5A

2a.EXTERNAL NPN SWITCH

2b.EXTERNAL NPN SATURATED SWITCH



Note:R → 0 for constant Vin





**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 <sub>T</sub>	4.0×10 <sup>-5</sup> ton	4.0×10 <sup>-5</sup> ton	4.0×10 <sup>-5</sup> ton
I <sub>pk</sub> (switch)	2I <sub>out</sub> (max) $\left(\frac{ton}{toff} + 1\right)$	2I <sub>out</sub> (max)	2I <sub>out</sub> (max) $\left(\frac{ton}{toff} + 1\right)$
R <sub>sc</sub>	0.3/I <sub>pk</sub> (switch)	0.3/I <sub>pk</sub> (switch)	0.3/I <sub>pk</sub> (switch)
L (min)	$\left(\frac{V_{in(min)} - V_{sat}}{I_{pk}(switch)}\right) \cdot ton(max)$	$\left(\frac{V_{in(min)} - V_{sat} - V_{out}}{I_{pk}(switch)}\right) \cdot ton(max)$	$\left(\frac{V_{in(min)} - V_{sat}}{I_{pk}(switch)}\right) \cdot ton(max)$
Co	$\left(\frac{I_{out}ton}{V_{ripple}(pp)}\right)$	$\left(\frac{I_{pk}(switch)(ton + toff)}{8V_{ripple}(pp)}\right)$	$\left(\frac{I_{out}ton}{V_{ripple}(pp)}\right)$

**TERMS AND DEFINITIONS**

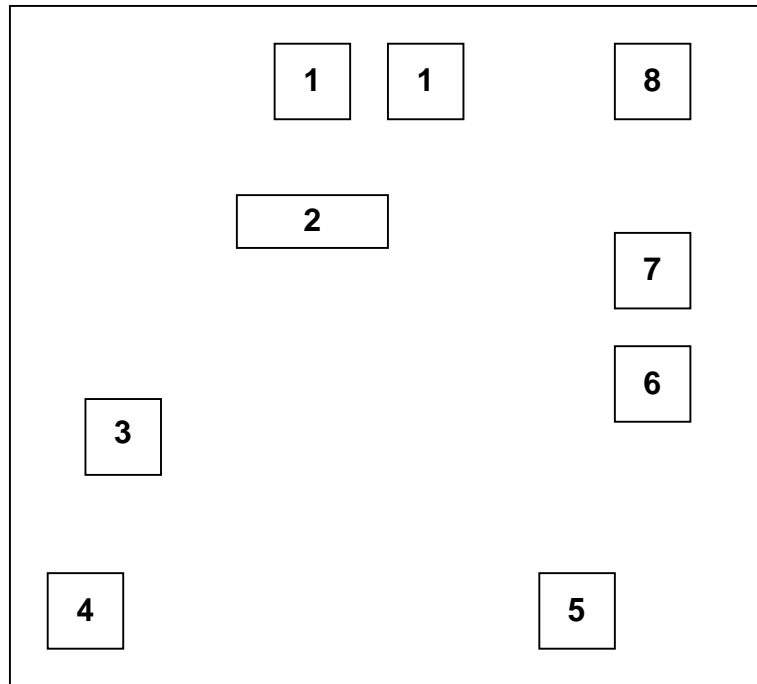
- ◆ V<sub>sat</sub> = Saturation Voltage of the output switch.
- ◆ V<sub>F</sub> = Forward Voltage drop of the rectifier.

The following power supply characteristics must be chosen:

- ◆ V<sub>in</sub> = Normal input voltage
- ◆ V<sub>out</sub>: Desired Output voltage,  $|V_{out}| = 1.25 \left(1 + \frac{R2}{R1}\right)$
- ◆ I<sub>out</sub> : Desired output current.
- ◆ f<sub>min</sub> : Minimum desired output switching frequency at the selected values for V<sub>in</sub> and I<sub>o</sub>.
- ◆ V<sub>ripple</sub>(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**

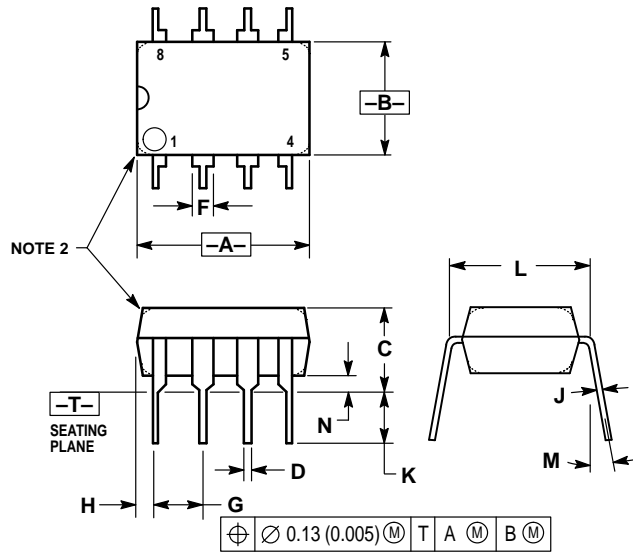
<b>PAD No.</b>	<b>PAD NAME</b>
1	Switch Collector *1
2	Switch Emitter *1
3	Timing Capacitor
4	GND
5	Comparator Inverting Input
6	V <sub>CC</sub>
7	I <sub>PK</sub> Sense
8	Driver Collector

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



# WS34063A

# DC TO DC CONVERTER CONTROLLER



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°	
N	0.76	1.01	0.030	0.040

**Attention: M=10°**