

34063

DATASHEET

Specification Revision History:

Version	Date	Description
V1.0	2019/04	New
V1.1	2021/06	Modify Ordering Information
V1.2	2025/02	Modify Ordering Information
V1.3	2025/03	Add application precautions and overall typesetting.

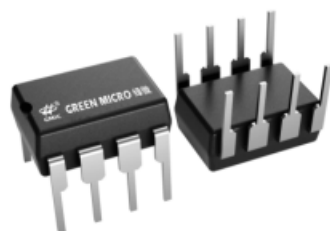
DESCRIPTION

The MC34063A 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 specifically designed to be incorporated in Step-Down and Step-Up and Voltage-Inverting applications with a minimum number of external components. Refer to Application Notes AN920A/D and AN954/D for additional design information.

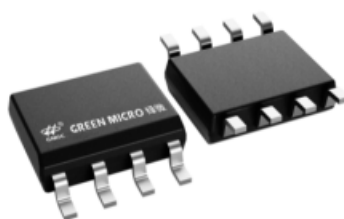
FEATURES

- 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

The appearance of the product



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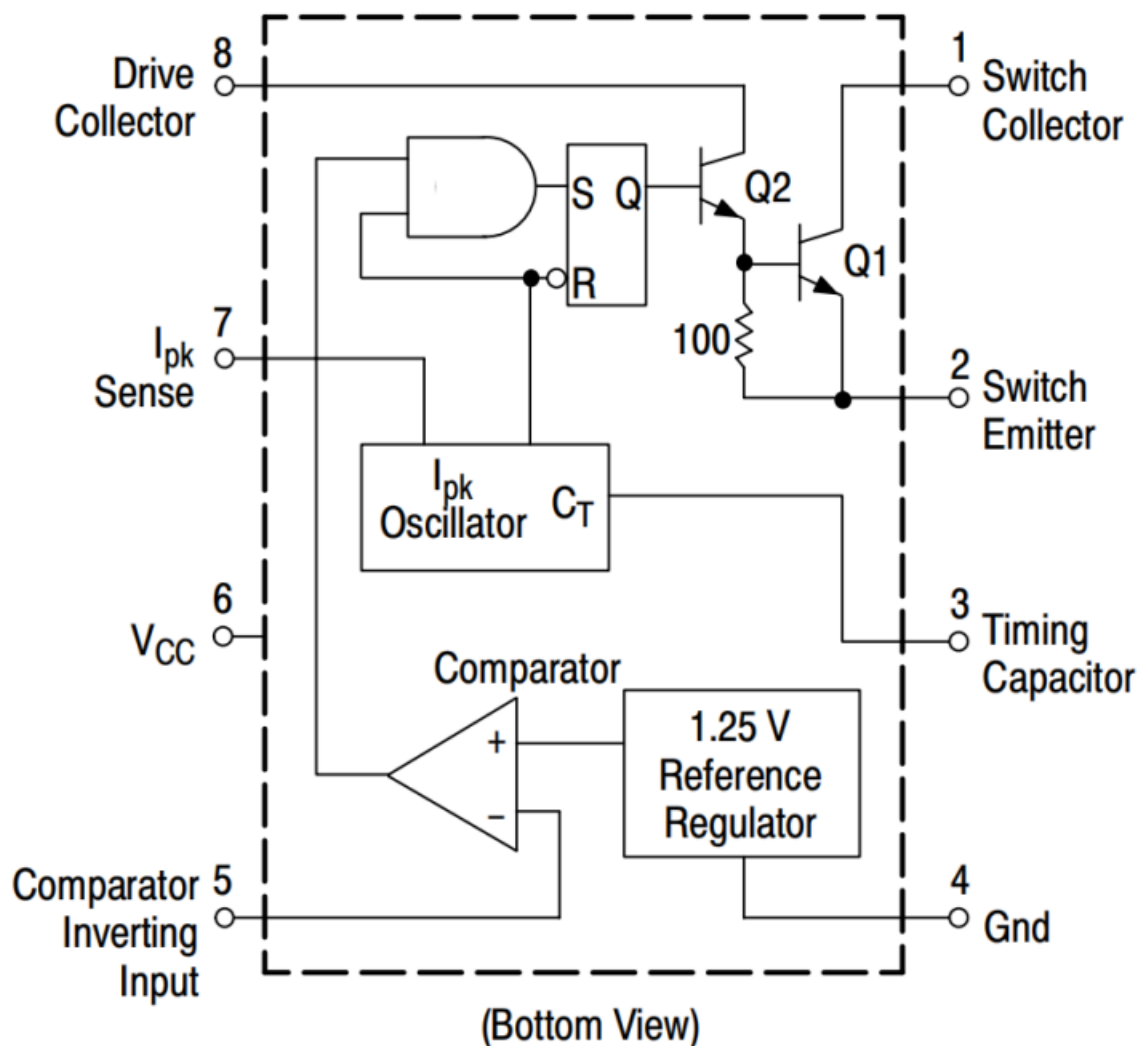


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Ordering Information

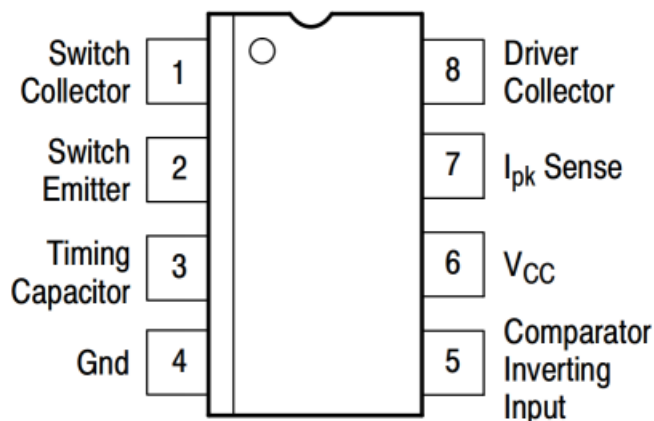
Product Model	Package Type	Marking	Packing	Packing Qty
MC34063N(GMIC)	DIP-8	34063 126	TUBE	2000PCS/BOX
MC34063DR(GMIC)	SOP-8	34063 126	REEL	2500PCS/REEL
MC34063(GMIC)	DIP-8	34063 26	TUBE	2000PCS/BOX
MC34063(GMIC)	SOP-8	34063 26	REEL	2500PCS/REEL

Representative Schematic Diagram



This device contains 51 active transistors.

PIN CONNECTIONS



(Top View)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Supply Voltage	V _{CC}	40	V _{dc}
Comparator Input Voltage Range	V _{IR}	-0.3 to +40	V _{dc}
Switch Collector Voltage	V _C (switch)	40	V _{dc}
Switch Emitter Voltage (V _P in 1 = 40 V)	V _E (switch)	40	V _{dc}
Switch Collector to Emitter Voltage	V _{CE} (switch)	40	V _{dc}
Driver Collector Voltage	V _C (driver)	40	V _{dc}
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, P1 Suffix T _A = 25. °C		1.25	W
Thermal Resistance	P _D R _{θJA}	100	°C/W
SOIC Package, D Suffix T _A = 25. °C	P _D R _{θJA}	625	W
Thermal Resistance		160	°C/W
Operating Junction Temperature	T _J	+150	°C
Operating Ambient Temperature Range MC34063A		0 to +70	
MC33063AV	T _A	-40 to +125	°C
MC33063A		-40 to +85	
Storage Temperature Range	T _{stg}	-65 to +150	°C

- Maximum package power dissipation limits must be observed.
- ESD data available upon request.

ELECTRICAL CHARACTERISTICS (V_{CC} = 5.0 V, T_A = T_{low} to T_{high}[Note 3.], unless otherwise specified.)

Characteristics	Symbol	Min	Typ	Max	Unit
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OSCILLATOR

Frequency (V _{Pin 5} = 0 V, CT = 1.0 nF, TA = 25°C)	fosc	24	33	42	kHz
Charge Current (V _{CC} = 5.0 V to 40 V, TA = 25°C)	I _{chg}	24	35	42	μA
Discharge Current (V _{CC} = 5.0 V to 40 V, TA = 25°C)	I _{dischg}	140	220	260	μA
Discharge to Charge Current Ratio (Pin 7 to V _{CC} , TA = 25°C)	I _{dischg} /I _{chg}	5.2	6.5	7.5	–
Current Limit Sense Voltage (I _{chg} = I _{dischg} , TA = 25°C)	V _{ipk(sense)}	250	300	350	mV

OUTPUT SWITCH (Note 4.)

Saturation Voltage, Darlington Connection (ISW = 1.0 A, Pins 1, 8 connected)	V _{CE(sat)}	–	1.0	1.3	V
Saturation Voltage (Note 5.) (ISW = 1.0 A, R _{Pin 8} = 82 Ω to V _{CC} , Forced β ≈ 20)	V _{CE(sat)}	–	0.45	0.7	V
DC Current Gain (ISW = 1.0 A, V _{CE} = 5.0 V, TA = 25°C)	h _{FE}	50	75	–	–
Collector Off-State Current (V _{CE} = 40 V)	I _{C(off)}	–	0.01	100	μA

COMPARATOR

Threshold Voltage TA = 25°C	V _{th}	1.225	1.25	1.275	V
TA = T _{low} to T _{high}		1.21	–	1.29	
Threshold Voltage Line Regulation (V _{CC} = 3.0 V to 40 V)	Reg line		1.4	5.0	mV
MC33063A, MC34063A		–	1.4	6.0	
MC33363AV		–			
Input Bias Current (V _{in} = 0 V)	I _{IB}	–	–20	–400	nA

TOTAL DEVICE

Supply Current (V _{CC} = 5.0 V to 40 V, CT = 1.0 nF, Pin 7 = V _{CC} , V _{Pin 5} > V _{th} , Pin 2 = Gnd, remaining pins open)	I _{CC}	–	–	4.0	mA
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3. T_{low} = 0°C for MC34063A, –40°C for MC33063A, AV T_{high} = +70°C for MC34063A, +85°C for MC33063A, +125°C for MC33063AV

4. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible.

5. 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 for it 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:

$$\text{Forced } \beta \text{ of output switch: } \frac{I_{C \text{ output}}}{I_{C \text{ driver}} - 7.0 \text{ mA}^*} \geq 10$$

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

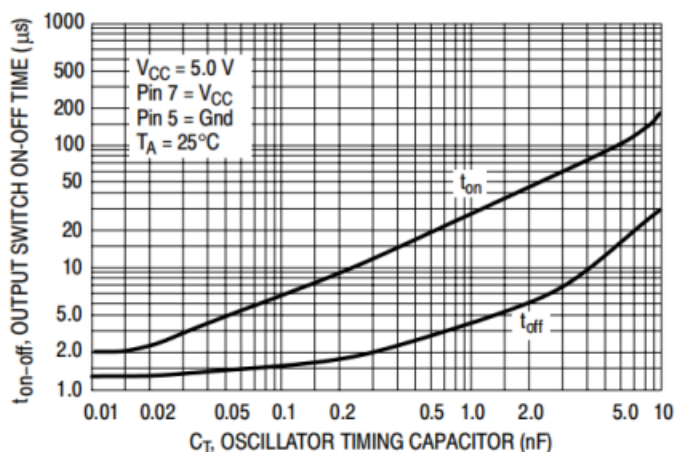


Figure 1. Output Switch On-Off Time versus Oscillator Timing Capacitor

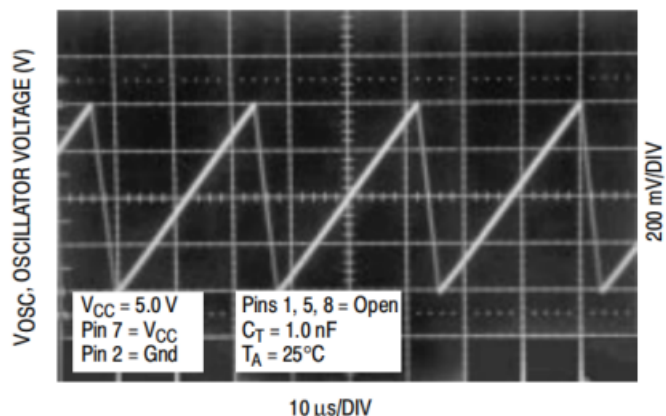


Figure 2. Timing Capacitor Waveform

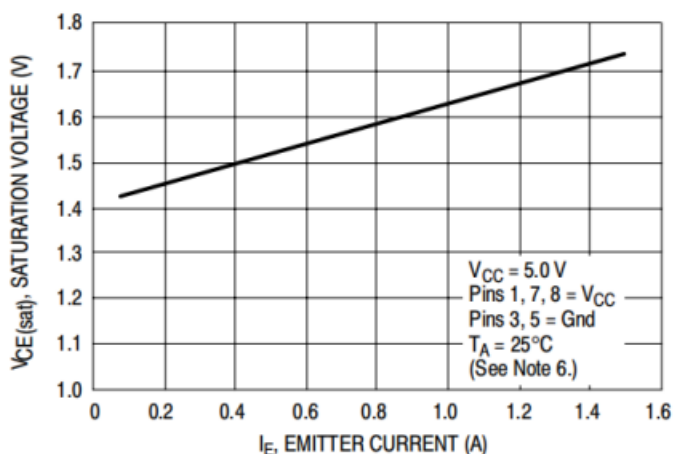


Figure 3. Emitter Follower Configuration Output Saturation Voltage versus Emitter Current

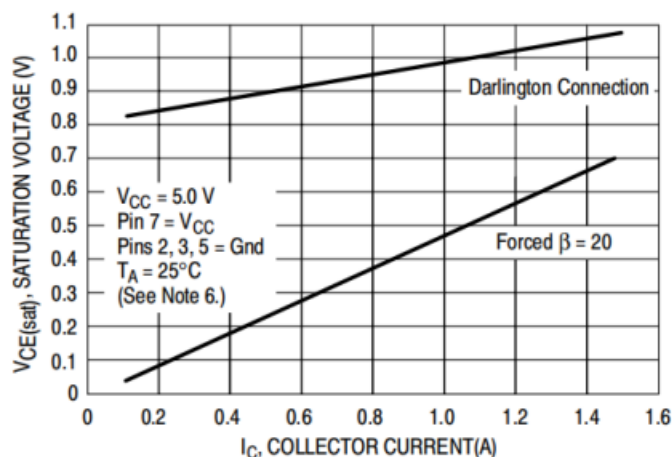


Figure 4. Common Emitter Configuration Output Switch Saturation Voltage versus Collector Current

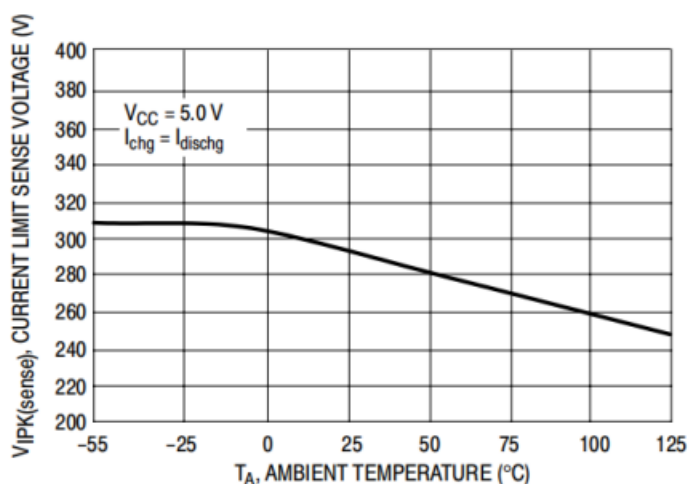


Figure 5. Current Limit Sense Voltage versus Temperature

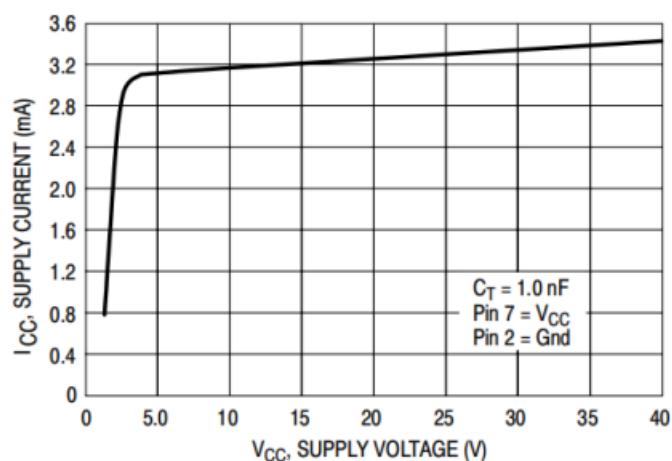
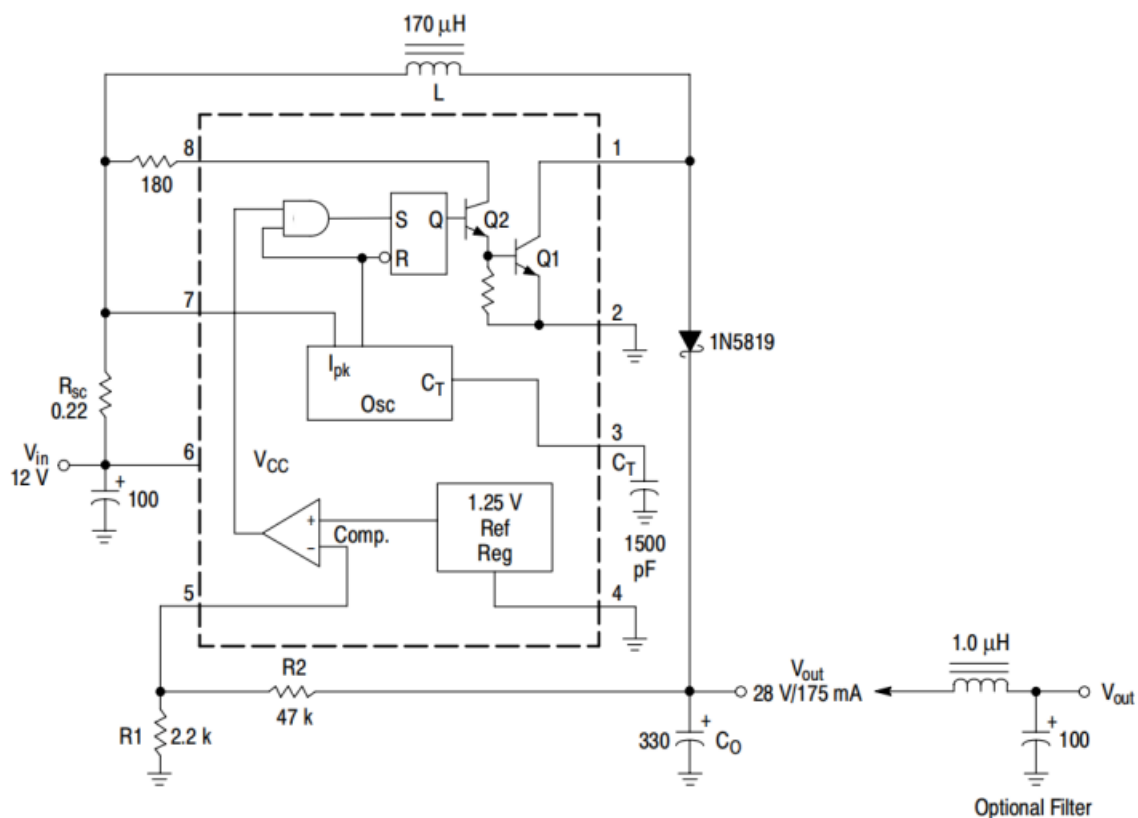


Figure 6. Standby Supply Current versus Supply Voltage

6. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible.



Test	Conditions	Results
Line Regulation	$V_{in} = 8.0\text{ V to }16\text{ V}, I_O = 175\text{ mA}$	$30\text{ mV} = \pm 0.05\%$
Load Regulation	$V_{in} = 12\text{ V}, I_O = 75\text{ mA to }175\text{ mA}$	$10\text{ mV} = \pm 0.017\%$
Output Ripple	$V_{in} = 12\text{ V}, I_O = 175\text{ mA}$	400 mVpp
Efficiency	$V_{in} = 12\text{ V}, I_O = 175\text{ mA}$	87.7%
Output Ripple With Optional Filter	$V_{in} = 12\text{ V}, I_O = 175\text{ mA}$	40 mVpp

Figure 7. Step-Up Converter

Test	Conditions	Results
Line Regulation	$V_{in} = 15\text{ V to } 25\text{ V}, I_O = 500\text{ mA}$	$12\text{ mV} = \pm 0.12\%$
Load Regulation	$V_{in} = 25\text{ V}, I_O = 50\text{ mA to } 500\text{ mA}$	$3.0\text{ mV} = \pm 0.03\%$
Output Ripple	$V_{in} = 25\text{ V}, I_O = 500\text{ mA}$	120 mVpp
Short Circuit Current	$V_{in} = 25\text{ V}, R_L = 0.1\ \Omega$	1.1 A
Efficiency	$V_{in} = 25\text{ V}, I_O = 500\text{ mA}$	83.7%
Output Ripple With Optional Filter	$V_{in} = 25\text{ V}, I_O = 500\text{ mA}$	40 mVpp

Figure 9. Step-Down Converter

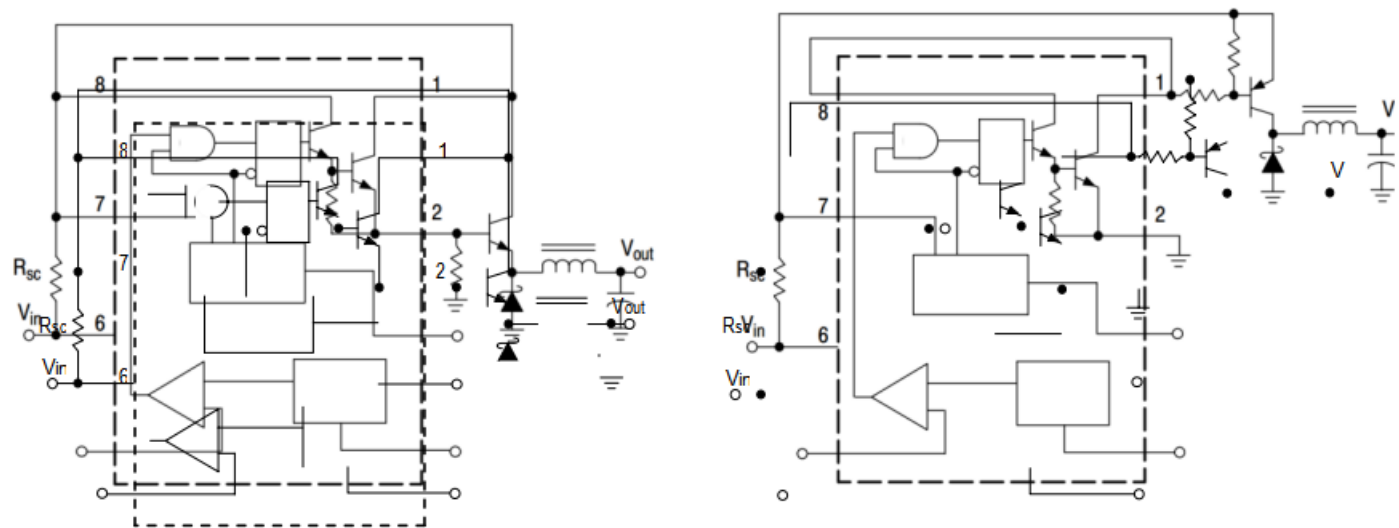
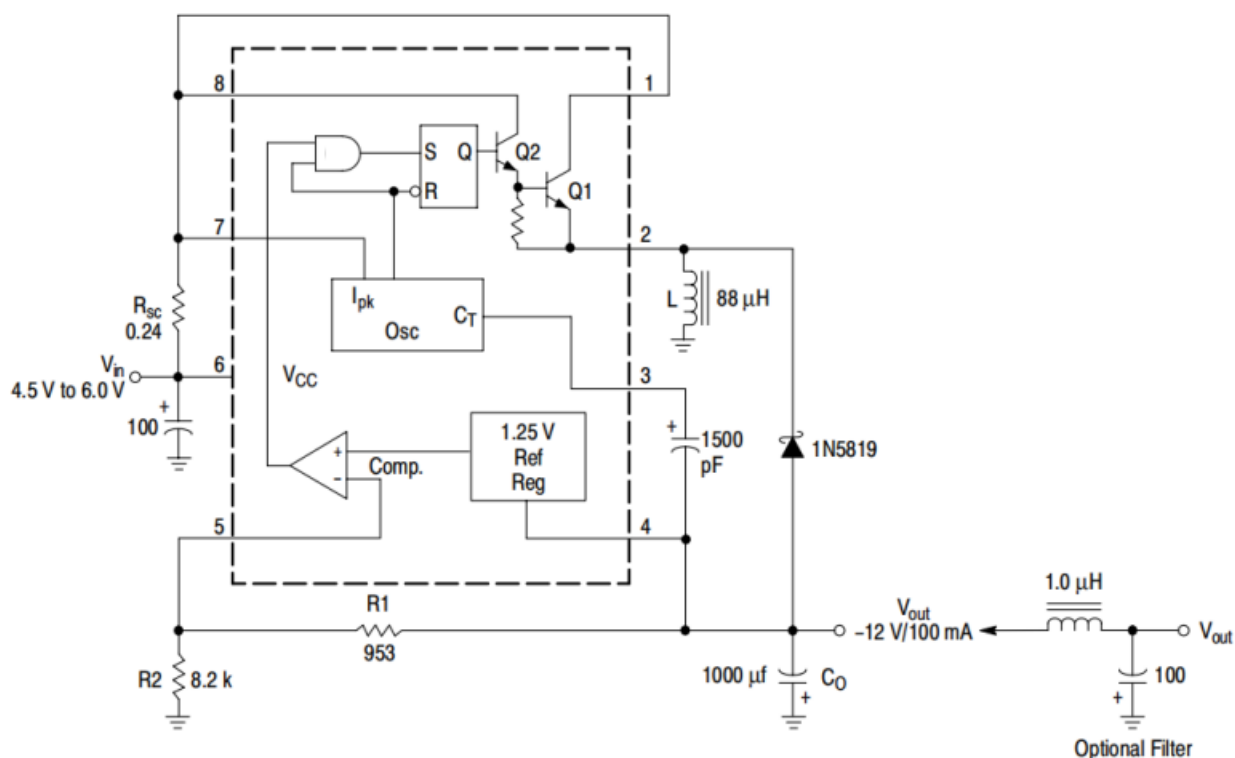


Figure 10. External Current Boost Connections for I_C Peak Greater than 1.5 A

10a. External NPN Switch

10b. External PNP Saturated Switch



Test	Conditions	Results
Line Regulation	$V_{in} = 4.5 \text{ V to } 6.0 \text{ V}$, $I_O = 100 \text{ mA}$	$3.0 \text{ mV} = \pm 0.012\%$
Load Regulation	$V_{in} = 5.0 \text{ V}$, $I_O = 10 \text{ mA to } 100 \text{ mA}$	$0.022 \text{ V} = \pm 0.09\%$
Output Ripple	$V_{in} = 5.0 \text{ V}$, $I_O = 100 \text{ mA}$	500 mVpp
Short Circuit Current	$V_{in} = 5.0 \text{ V}$, $R_L = 0.1 \Omega$	910 mA
Efficiency	$V_{in} = 5.0 \text{ V}$, $I_O = 100 \text{ mA}$	62.2%
Output Ripple With Optional Filter	$V_{in} = 5.0 \text{ V}$, $I_O = 100 \text{ mA}$	70 mVpp

Figure 11. Voltage Inverting Converter

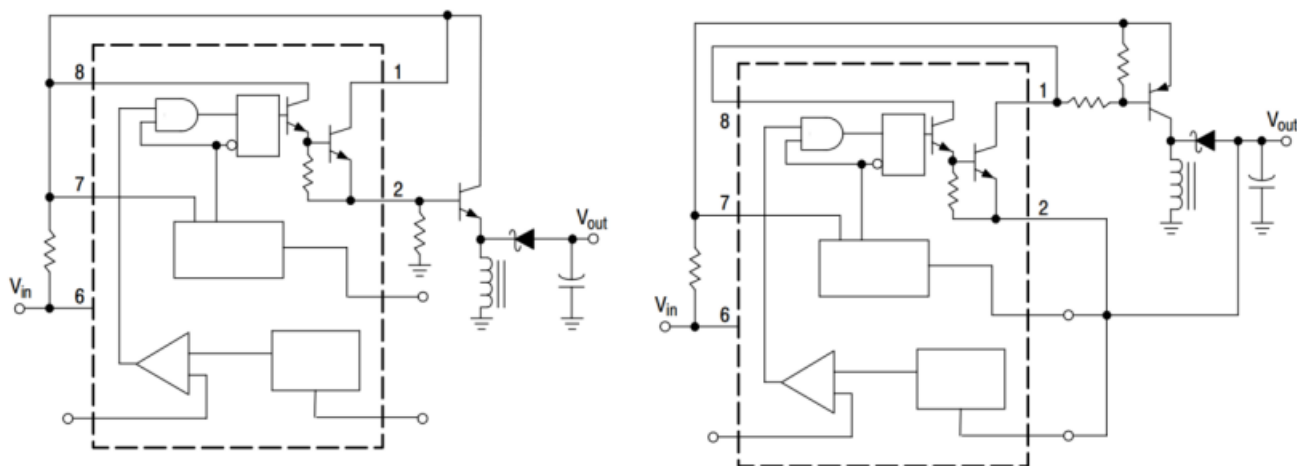


Figure 12. External Current Boost Connections for I_C Peak Greater than 1.5 A

12a. External NPN Switch

12b. External PNP Saturated Switch

Calculation	Step-Up	Step-Down	Voltage-Inverting
ton/t off	$\frac{V_{out} + V_F - V_{in(min)}}{V_{in(min)} - V_{sat}}$	$\frac{V_{out} + V_F}{V_{in(min)} - V_{sat} - V_{out}}$	$\frac{ V_{out} + V_F}{V_{in} - V_{sat}}$
(ton + t off)	$\frac{1}{f}$	$\frac{1}{f}$	$\frac{1}{f}$
t off	$\frac{t_{on} + t_{off}}{\frac{t_{on}}{t_{off}} + 1}$	$\frac{t_{on} + t_{off}}{\frac{t_{on}}{t_{off}} + 1}$	$\frac{t_{on} + t_{off}}{\frac{t_{on}}{t_{off}} + 1}$
ton	(ton + t off) - t off	(ton + t off) - t off	(ton + t off) - t off
CT	4.0 x 10 ⁻⁵ ton	4.0 x 10 ⁻⁵ ton	4.0 x 10 ⁻⁵ ton
Ip _{pk} (switch)	$2I_{out(max)} \left(\frac{t_{on}}{t_{off}} + 1 \right)$	2I _{out} (max)	$2I_{out(max)} \left(\frac{t_{on}}{t_{off}} + 1 \right)$
R _{sc}	0.3/Ip _{pk} (switch)	0.3/Ip _{pk} (switch)	0.3/Ip _{pk} (switch)
L(min)	$\left(\frac{(V_{in(min)} - V_{sat})}{I_{pk}(switch)} \right) t_{on(max)}$	$\left(\frac{(V_{in(min)} - V_{sat} - V_{out})}{I_{pk}(switch)} \right) t_{on(max)}$	$\left(\frac{(V_{in(min)} - V_{sat})}{I_{pk}(switch)} \right) t_{on(max)}$
CO	$9 \frac{I_{out} t_{on}}{V_{ripple(pp)}}$	$\frac{I_{pk}(switch)(t_{on} + t_{off})}{8V_{ripple(pp)}}$	$9 \frac{I_{out} t_{on}}{V_{ripple(pp)}}$

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_{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 of V_{in} and I_O.

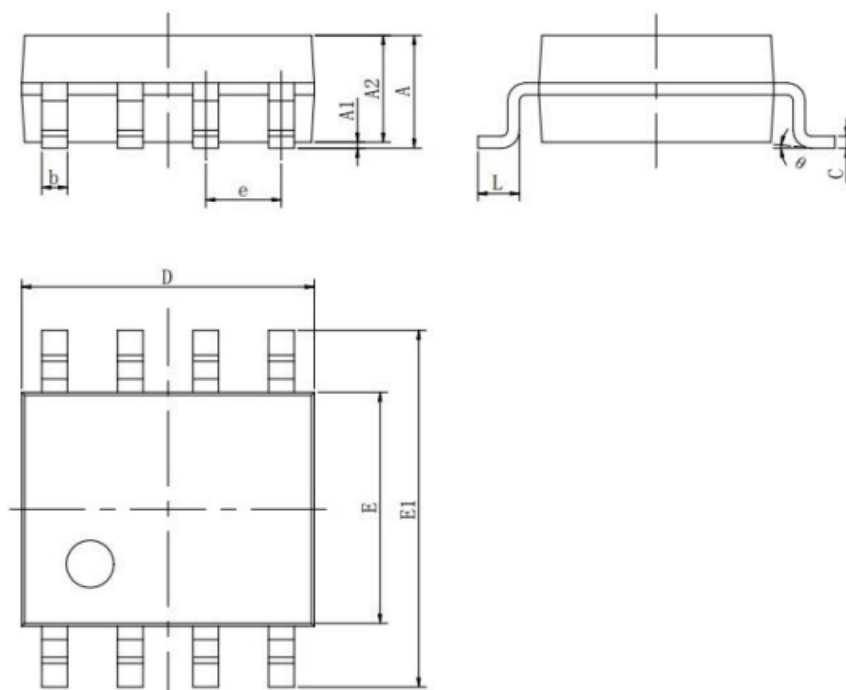
V_{ripple(pp)} – Desired peak-to-peak output ripple voltage. In practice, the calculated capacitor value will need to be increased due to its equivalent series resistance and board layout. The ripple voltage should be kept to a low value since it will directly affect the line and load regulation.

NOTE: For further information refer to Application Note AN920A/D and AN954/D.

Outline Dimensions

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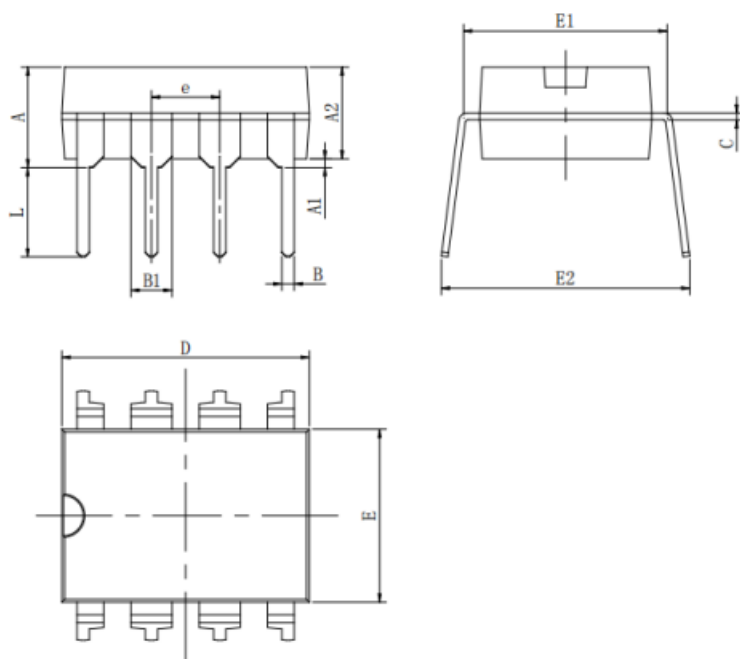
Unit : mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.800	0.053	0.071
A1	0.050	0.250	0.004	0.010
A2	1.250	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
C	0.170	0.250	0.006	0.010
D	4.780	5.000	0.185	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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Unit:mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.380	0.570	0.015	0.022
B1	1.524(BSC)		0.060(BSC)	
C	0.204	0.360	0.008	0.014
D	9.000	9.400	0.354	0.370
E	6.200	6.600	0.244	0.260
E1	7.320	7.920	0.288	0.312
e	2.540(BSC)		0.100(BSC)	
L	3.000	3.600	0.118	0.142
E2	8.400	9.000	0.331	0.354

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