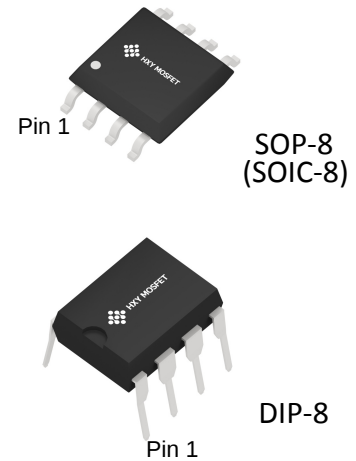




General Description

The MC33063ADR2G is a monolithic control circuit containing the primary functions required for DC-to-DC converters. This device consists of an internal temperature compensated reference (1.25V), comparator, controlled duty cycle oscillator with an active current limit circuit, driver and high current output switch. The IC is specifically designed to be used in Step-Down and Step-Up and Voltage-Inverting applications with a minimum number of external components.

The MC33063ADR2G is available in DIP-8 and SOP-8(SOIC-8) package.



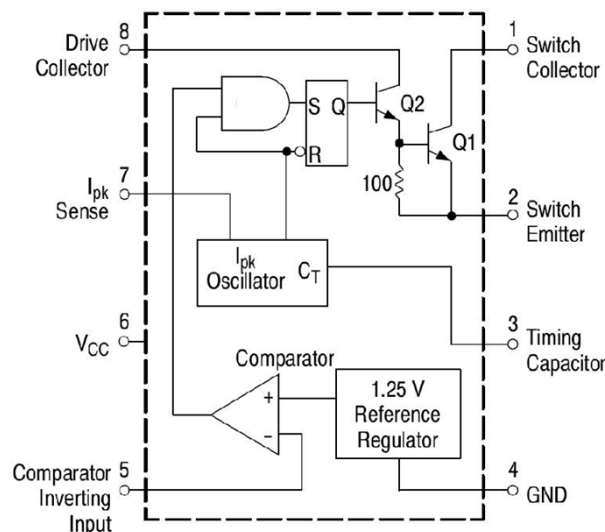
Features

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

Applications

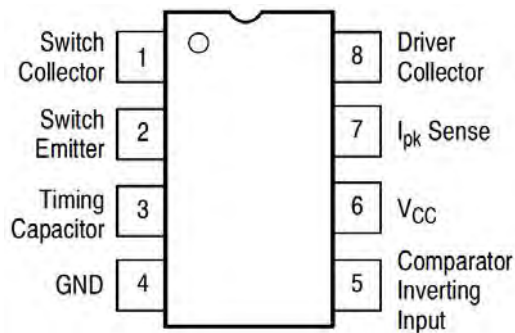
- Battery Chargers
- NICs / Switches / Hubs
- ADSL Modems
- Negative Voltage Power Supplies

Functional Block Diagram





Pin Configuration



Pin Description

Pin Number	Pin Name	Function Description	Pin Number	Pin Name	Function Description
1	SC	Switch collector	5	FB	Comparator inverting input
2	SE	Switch emitter	6	V _{CC}	Input voltage
3	CT	Timing capacitor	7	I _{pk}	I _{pk} sense
4	GND	Ground	8	DC	Drive collector

Absolute Maximum Ratings (Ta=25°C)

Parameter Name		Symbol	Value	Unit
Power Supply Voltage		V _{CC}	40	V
Comparator Input Voltage Range		V _{IR}	-0.3~40	V
Switch Collector Voltage		V _C (switch)	40	V
Switch Emitter Voltage (VPin1=40V)		V _E (switch)	40	V
Switch Collector to Emitter Voltage		V _{CE} (switch)	40	V
Driver Collector Voltage		V _C (drive)	40	V
Driver Collector Current		I _C (drive)	100	mA
Switch Current		I _{SW}	1.5	A
Power Dissipation	DIP-8	P _D	1.25	W
	SOP-8(SOIC-8)		625	mW
Operating Ambient Temperature Range		T _a	-0~70	°C
Storage Temperature Range		T _{stg}	-65~150	°C

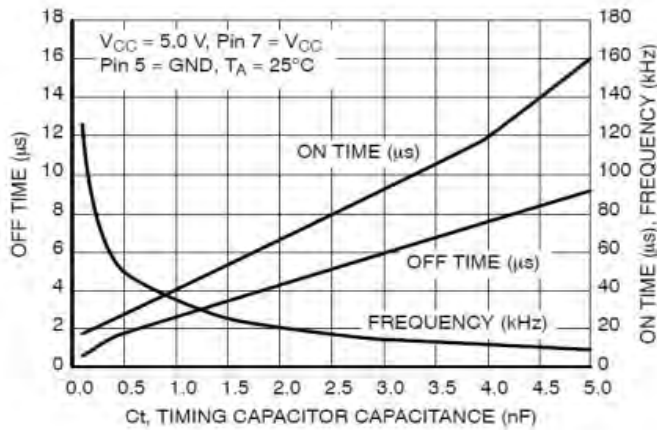


Electrical Characteristics (Unless otherwise noted ,Vcc=5.0V, Ta=0~70°C)

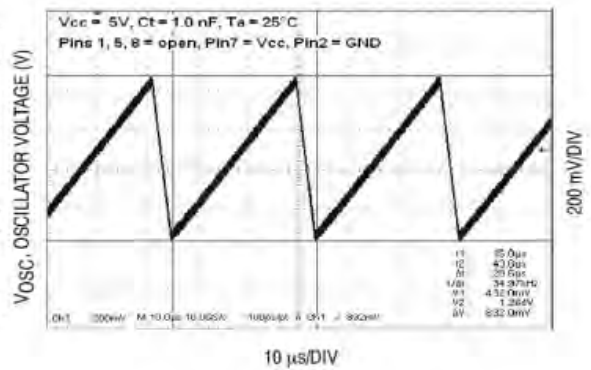
Parameter Name	Symbol	Min	Typ	Max	Unit
OSCILLATOR					
Frequency (Vpin5=0V, CT=1.0nF, Ta=25°C)	fosc	24	33	42	kHz
Charge Current (Vcc=5.0~40V, Ta=25°C)	Ichg	24	35	42	μA
Discharge Current (Vcc=5.0~40V, Ta=25°C)	Idischg	140	220	260	μA
Discharge to Charge Current Ratio (Pin7 to Vcc, Ta=25°C)	Idischg/Ichg	5.2	6.5	7.5	
Current limit Sense Voltage (Ichg=Idischg, Ta=25°C)	Vipk(sense)	250	300	350	mA
OUTPUT SWITCH					
Saturation Voltage, Darlington Connection (ISW=1.0A, Pins 1,8 Connected)	V _{CE(sat)}		1.0	1.3	V
Saturation Voltage, Darlington Connection (ISW=1.0A, Rpin 8=82Ω to Vcc, Forced β ≈ 20)	V _{CE(sat)}		0.45	0.7	V
DC Current Gain (ISW=1.0A, VCE=5.0V, Ta=25°C)	hFE	50	75		
Collector Off-State Current (VCE=40V)	Ic(off)		0.01	100	μA
COMPARATOR					
Threshold Voltage (Ta=25°C)	Vth	1.225	1.25	1.275	V
Threshold Voltage (Ta=0~70°C)		1.21		1.29	
Threshold Voltage Line Regulation (Vcc=3.0~40V)	Regline		1.4	5.0	mV
Input Bias Current (Vin=0V)	I _{IB}		-20	-400	nA
TOTAL DEVICE					
Supply Current (Vcc=5.0~40V, CT=1.0nF, Pin7=Vcc, Vpin5>Vth, pin2=Gnd, Remaining Pins Open)	Icc			4.0	mA



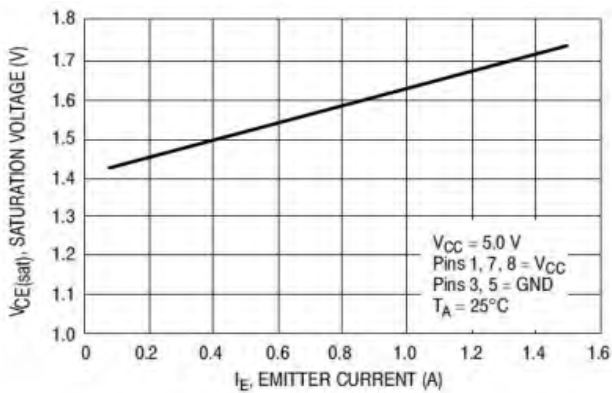
Characteristics Curves



Oscillator Frequency

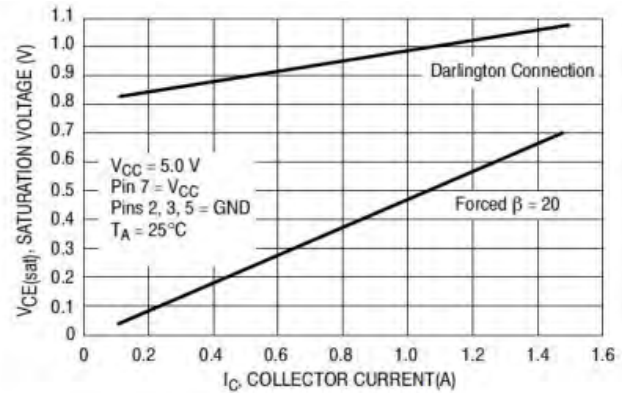


Timing Capacitor Waveform



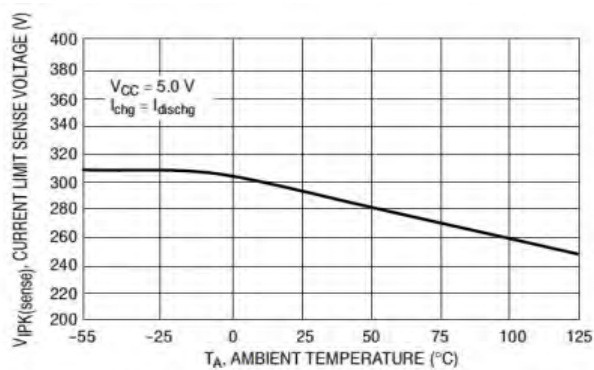
Emitter Follower Configuration Output

Saturation Voltage Versus Emitter Current

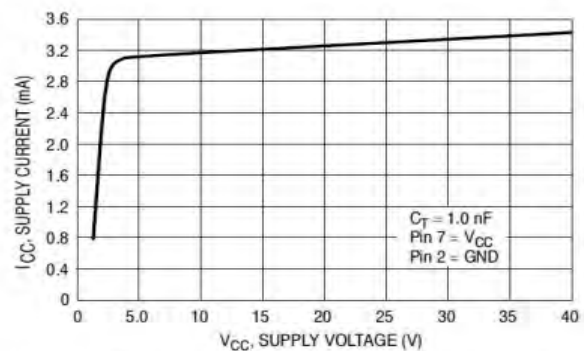


Common Emitter Configuration Output

Switch Saturation Voltage Versus Collector Current



Current Limit Sense Voltage Versus Temperature

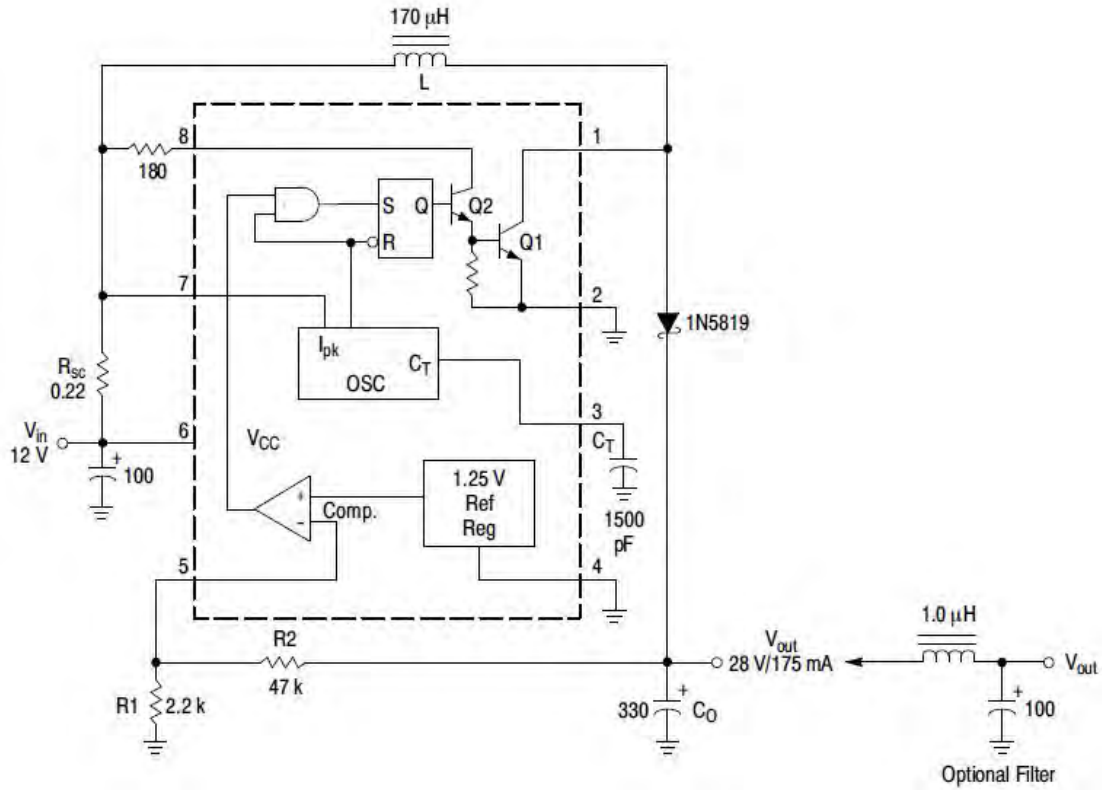


Standby Supply Current Versus Supply Voltage



Typical Application

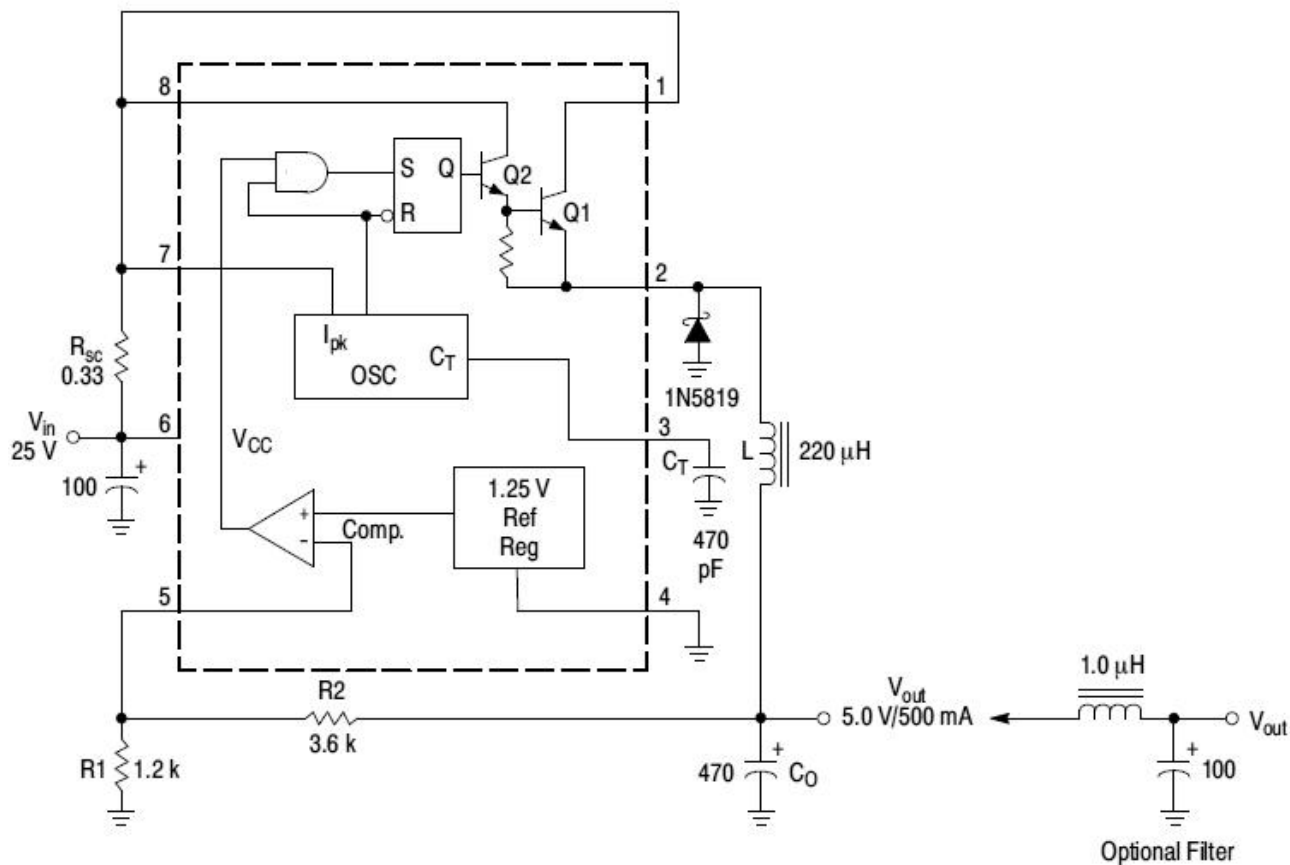
1. Step-Up Converter



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



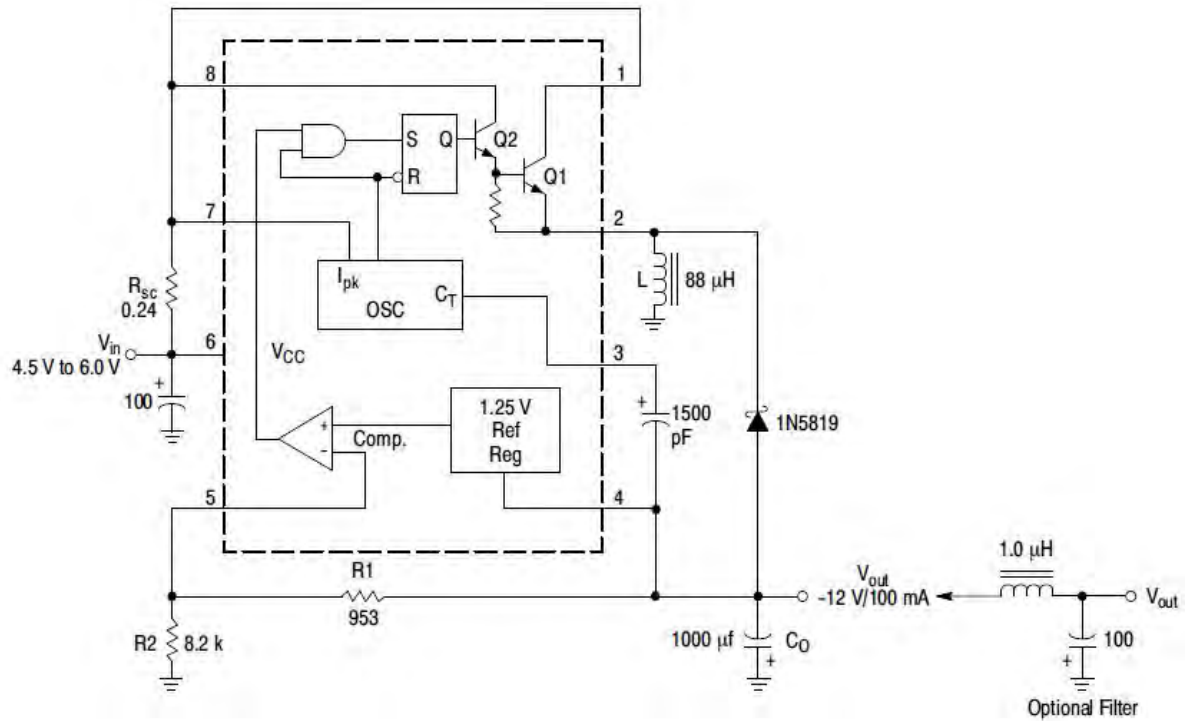
2. Step-Down Converter



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



3. Voltage Inverting Converter



Test	Conditions	Results
Line Regulation	$V_{in}=4.5V\sim6.0V$, $I_o=100mA$	$3.0mV=\pm0.012\%$
Load Regulation	$V_{in}=5.0V$, $I_o=10mA\sim100mA$	$0.022V=\pm0.09\%$
Output Ripple	$V_{in}=5.0V$, $I_o=100mA$	$500mV_{pp}$
Short Circuit Current	$V_{in}=5.0V$, $R_L=0.1\Omega$	$910mA$
Efficiency	$V_{in}=5.0V$, $I_o=100mA$	62.2%
Output Ripple With Optional Filter	$V_{in}=5.0V$, $I_o=100mA$	$70mV_{pp}$



Application Information

Calculation	Step-Up	Step-Down	Voltage-Inverting
t_{on}/t_{off}	$\frac{V_{out} + V_F - V_{in(min)}}{V_{in(min)} - V_{sat}}$	$\frac{V_{out} + V_F}{V_{in(min)} - V_{sat} - V_{out}}$	$\frac{ V_{out} + V_F}{V_{in} - V_{sat}}$
$(t_{on} + t_{off})$	$\frac{1}{f}$	$\frac{1}{f}$	$\frac{1}{f}$
t_{off}	$\frac{t_{on} + t_{off}}{\frac{t_{on}}{t_{off}} + 1}$	$\frac{t_{on} + t_{off}}{\frac{t_{on}}{t_{off}} + 1}$	$\frac{t_{on} + t_{off}}{\frac{t_{on}}{t_{off}} + 1}$
t_{on}	$(t_{on} + t_{off}) - t_{off}$	$(t_{on} + t_{off}) - t_{off}$	$(t_{on} + t_{off}) - t_{off}$
C_T	$4.0 \times 10^{-5} t_{on}$	$4.0 \times 10^{-5} t_{on}$	$4.0 \times 10^{-5} t_{on}$
$I_{pk(switch)}$	$2I_{out(max)} \left(\frac{t_{on}}{t_{off}} + 1 \right)$	$2I_{out(max)}$	$2I_{out(max)} \left(\frac{t_{on}}{t_{off}} + 1 \right)$
R_{sc}	$0.3/I_{pk(switch)}$	$0.3/I_{pk(switch)}$	$0.3/I_{pk(switch)}$
$L_{(min)}$	$\left(\frac{(V_{in(min)} - V_{sat})}{I_{pk(switch)}} \right) t_{on(max)}$	$\left(\frac{(V_{in(min)} - V_{sat} - V_{out})}{I_{pk(switch)}} \right) t_{on(max)}$	$\left(\frac{(V_{in(min)} - V_{sat})}{I_{pk(switch)}} \right) t_{on(max)}$
C_O	$9 \frac{I_{out} t_{on}}{V_{ripple(pp)}}$	$\frac{I_{pk(switch)} (t_{on} + t_{off})}{8V_{ripple(pp)}}$	$9 \frac{I_{out} t_{on}}{V_{ripple(pp)}}$

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_{in} — Nominal input voltage

V_{out} — Desired output voltage , $|V_{out}| = 1.25 \times (1 + \frac{R2}{R1})$

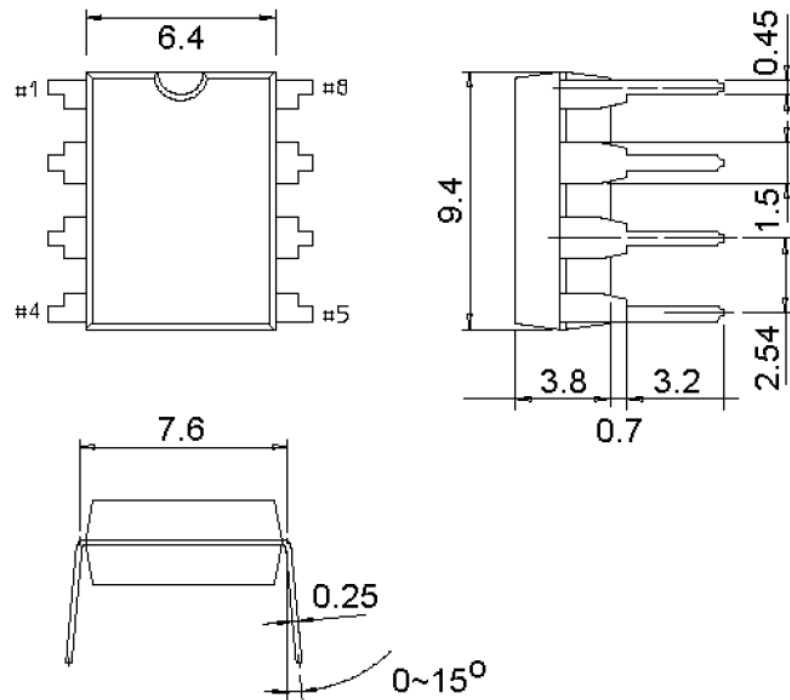
I_{out} — Desired output current

f_{min} — Minimum desired output switching frequency at the selected values of V_{in} and I_o

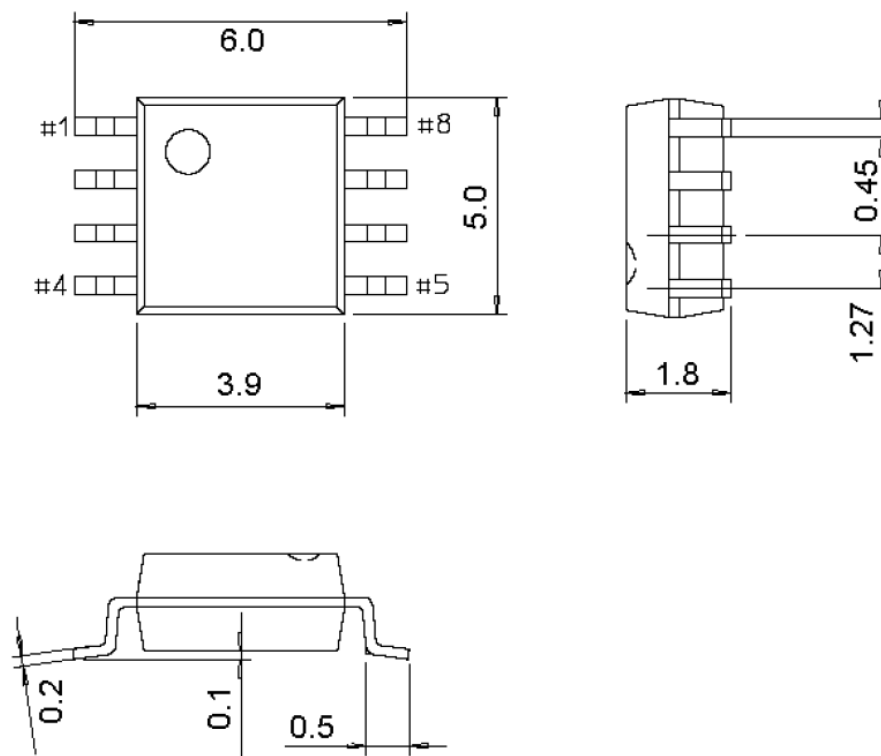
$V_{ripple(pp)}$ — Desired peak-to-peak output ripple voltage. In practice, the calculated capacitor value will need to be increased due to its equivalent series resistance and board layout. The ripple voltage should be kept to a low value since it will directly affect the line and load regulation.



DIP-8



SOP-8(SOIC-8)





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