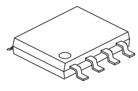
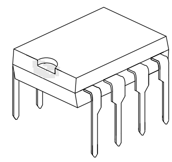
General Description

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.



SOP-8



DIP-8

The MC33063ADR2G is available in DIP8 and SOP-8 package.

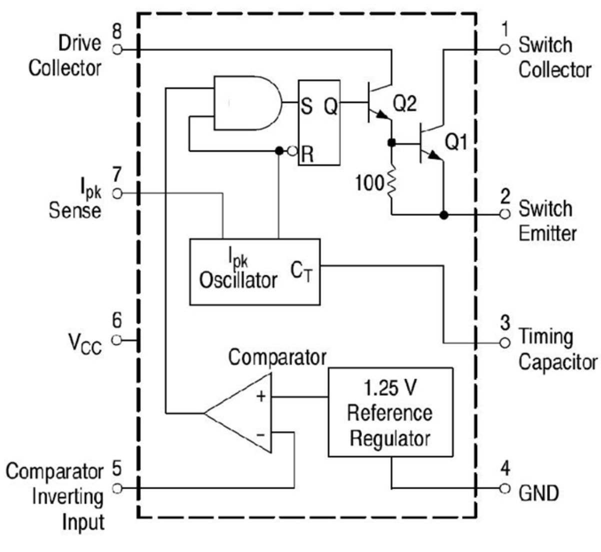
Features

- 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

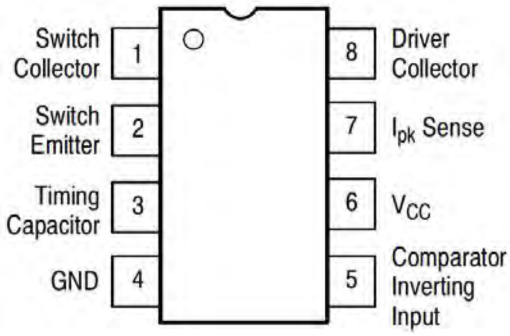
Applications

- 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	Ipk	Ipk sense
4	GND	Ground	8	DC	Drive collector

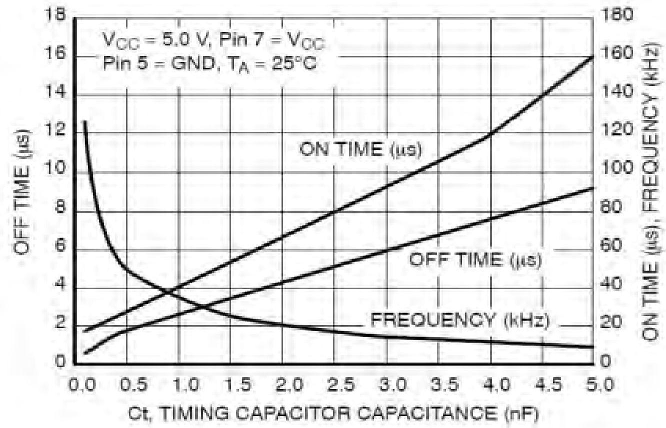
Absolute Maximum Ratings (Ta=25°C)

Parameter Name		Symbol	Value	Unit
Power Supply Voltage		Vcc	40	V
Comparator Input Voltage Range		V_{IR}	-0.3~40	V
Switch Collector Voltage		Vc(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		Vc(drive)	40	V
Driver Collector Current		Ic(drive)	100	mA
Switch Current		I_{SW}	1.5	A
Power Dissipation	DIP-8	P_D	1.25	W
	SOP-8		625	mW
Operating Ambient Temperature Range		Ta	-0~70	℃
Storage Temperature Range		Tstg	-65~150	℃

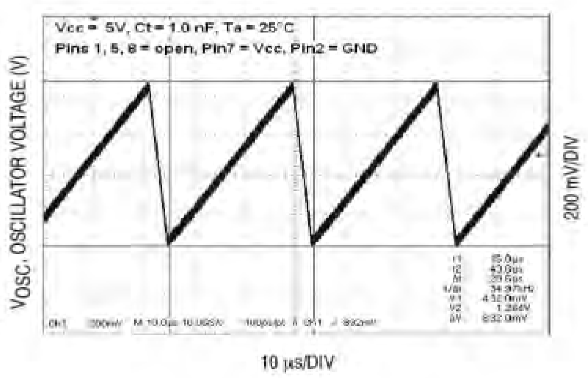
Electrical Characteristics (Unless otherwise noted ,Vcc=5.0V, Ta=0~70°C)

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

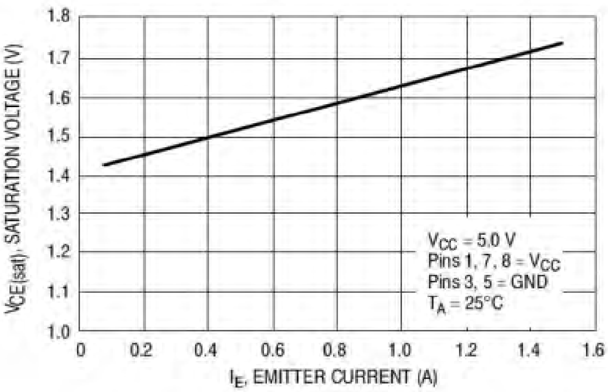
Characteristics Curves



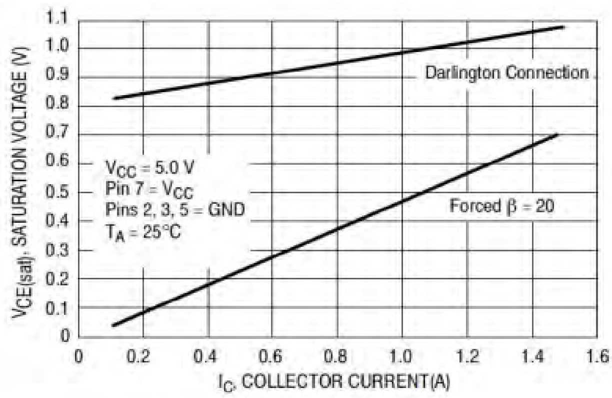
Oscillator Frequency



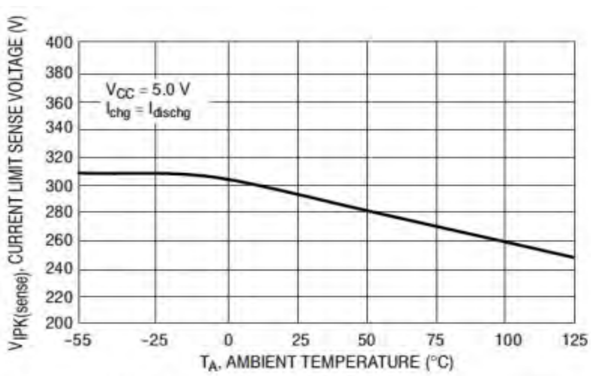
Timing Capacitor Waveform



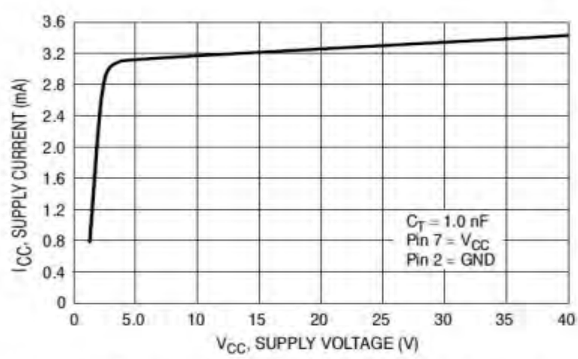
Emitter Follower Configuration Output Saturation Voltage Versus Emitter Current



Common Emitter Configuration Output Switch Saturation Voltage Versus Collector Current



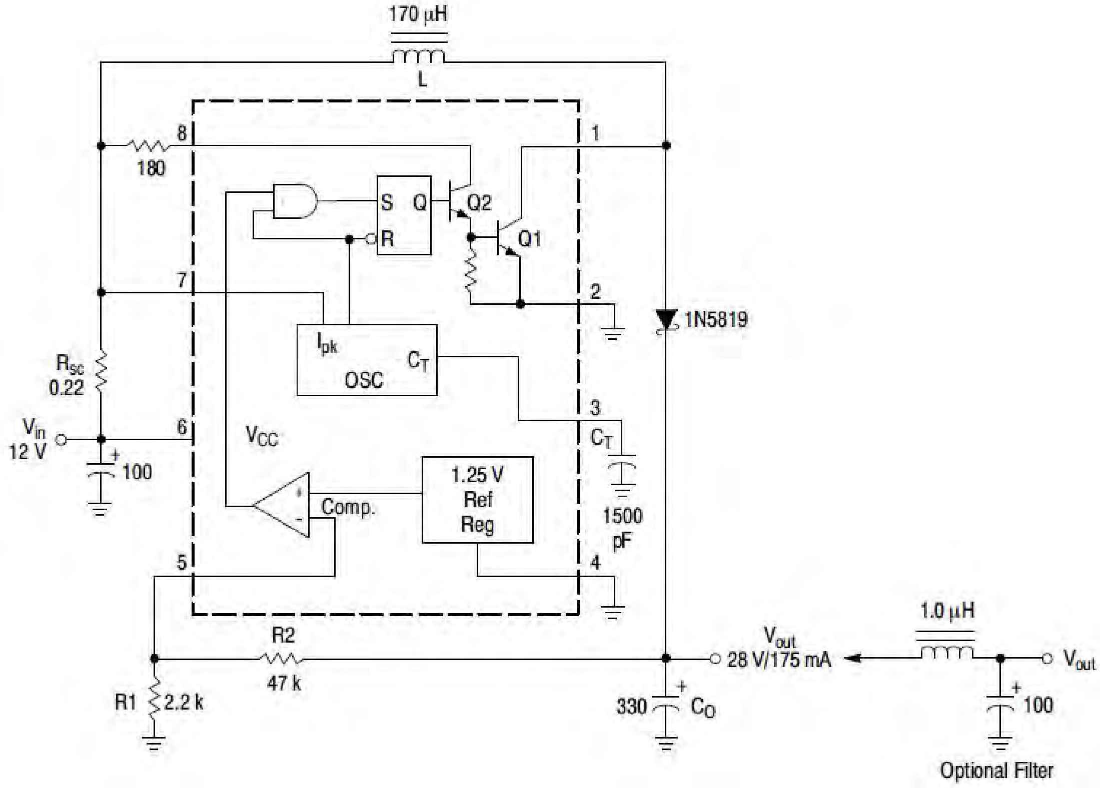
Current Limit Sense Voltage Versus Temperature



Standby Supply Current Versus Supply Voltage

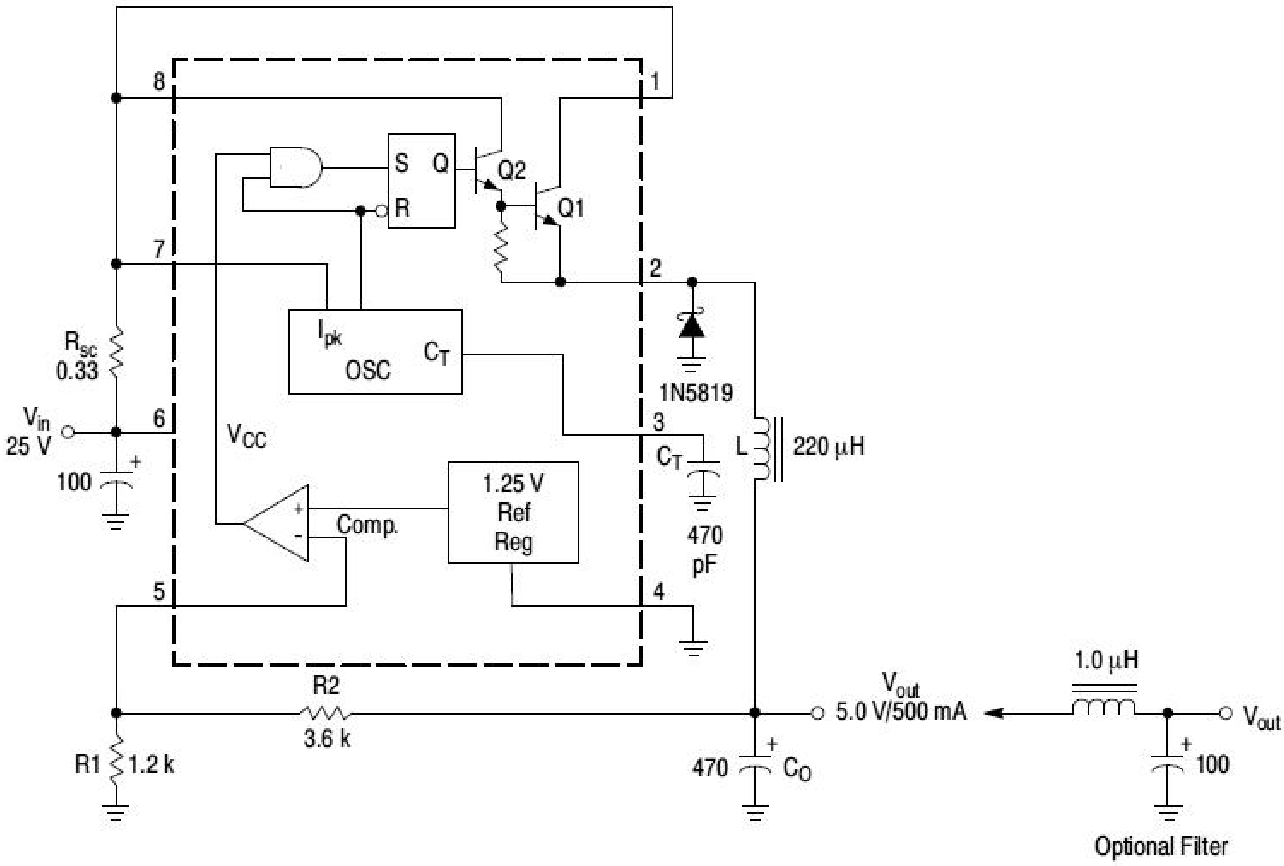
Typical Application

1. Step-Up Converter



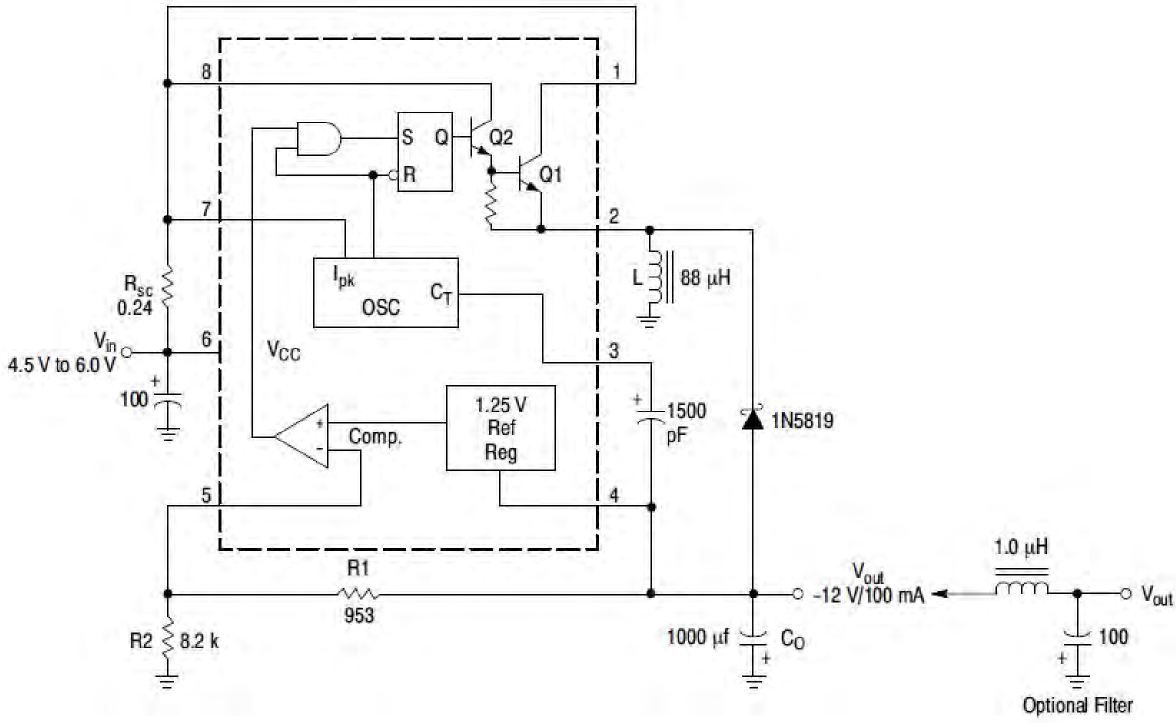
Test	Conditions	Results
Line Regulation	Vin=8.0V~16V, Io=175mA	30mV=±0.05%
Load Regulation	Vin=12V,Io=75mA~175mA	10mV=±0.017%
Output Ripple	Vin=12V, Io=175mA	400mVpp
Efficiency	Vin=12V, Io=175mA	87.7%
Output Ripple With Optional Filter	Vin=12V, Io=175mA	40mVpp

2. Step-Down Converter



Test	Conditions	Results
Line Regulation	Vin=15V~25V, Io=500mA	12mV=±0.12%
Load Regulation	Vin=25V,Io=50mA~500mA	3.0mV=±0.03%
Output Ripple	Vin=25V, Io=500mA	120mVpp
Short Circuit Current	Vin=25V,R_L=0.1Ω	1.1A
Efficiency	Vin=25V, Io=500mA	83.7%
Output Ripple With Optional Filter	Vin=25V, Io=500mA	40mVpp

3. Voltage Inverting Converter



Test	Conditions	Results
Line Regulation	Vin=4.5V~6.0V, Io=100mA	3.0mV=±0.012%
Load Regulation	Vin=5.0V,Io=10mA~100mA	0.022V=±0.09%
Output Ripple	Vin=5.0V, Io=100mA	500mVpp
Short Circuit Current	Vin=5.0V,R_L=0.1Ω	910mA
Efficiency	Vin=5.0V, Io=100mA	62.2%
Output Ripple With Optional Filter	Vin=5.0V, Io=100mA	70mVpp

Application Information

Calculation	Step-Up	Step-Down	Voltage-Inverting
t_{on}/t_{off}	$\frac{V_{out} + V_F - V_{in(min)}}{V_{in(min)} - V_{sat}}$	$\frac{V_{out} + V_F}{V_{in(min)} - V_{sat} - V_{out}}$	$\frac{\lvert V_{out}\rvert + V_F}{V_{in} - V_{sat}}$
$(t_{on} + t_{off})$	$\frac{1}{f}$	$\frac{1}{f}$	$\frac{1}{f}$
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	$9\frac{I_{out} t_{on}}{V_{ripple(pp)}}$	$\frac{I_{pk(switch)}(t_{on} + t_{off})}{8V_{ripple(pp)}}$	$9\frac{I_{out} t_{on}}{V_{ripple(pp)}}$

Vsat = Saturation voltage of the output switch

V_F = Forward voltage drop of the output rectifier

The following power supply characteristics must be chosen:

Vin — Nominal input voltage

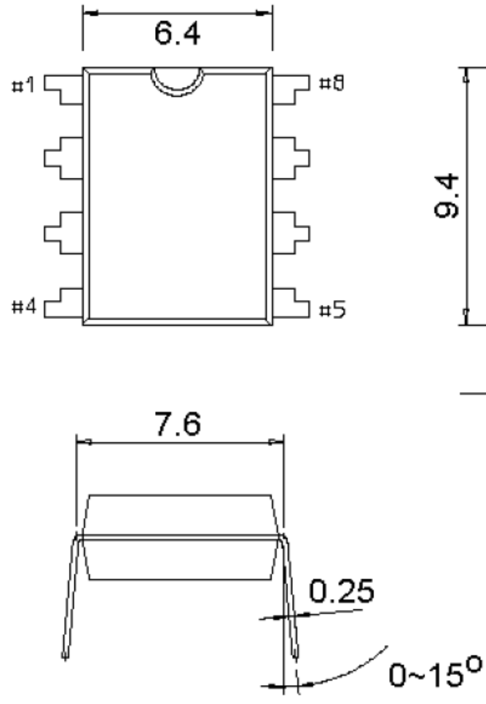
Vout — Desired output voltage , $|Vout| = 1.25 \times (1 + \frac{R2}{R1})$

Iout — Desired output current

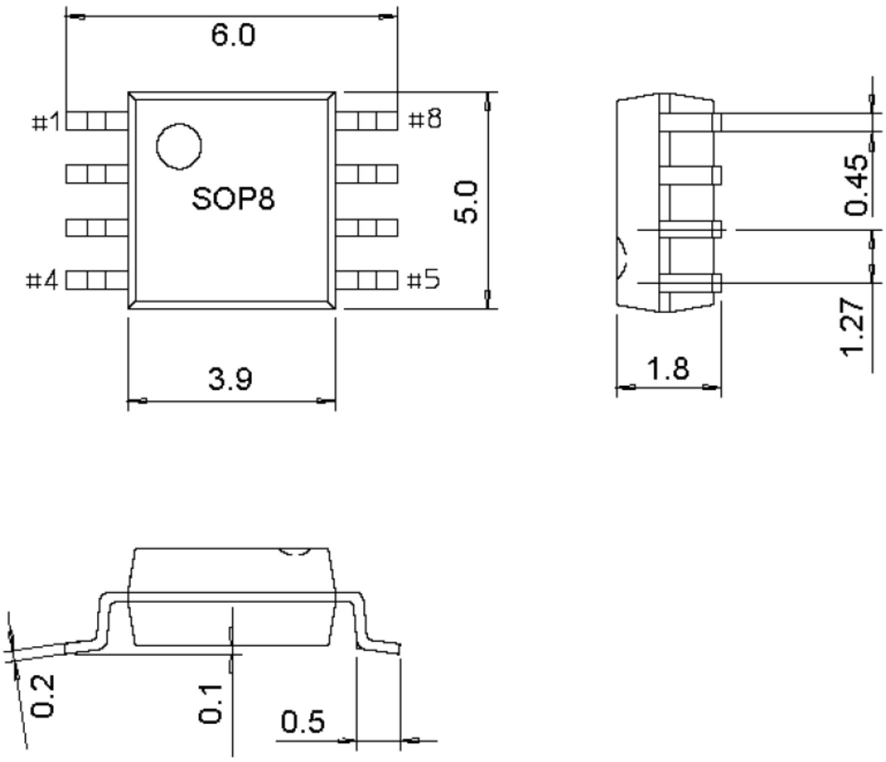
fmin — Minimun desired output switching frequency at the selected values of Vin and Io

Vripple(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


6.4
#1
#8
#4
#5
9.4
0.45
1.5
2.54
3.8
3.2
0.7
7.6
0.25
0~15°

SOP-8


6.0
#1
#8
SOP8
#4
#5
5.0
3.9
0.45
1.27
1.8
0.2
0.1
0.5

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