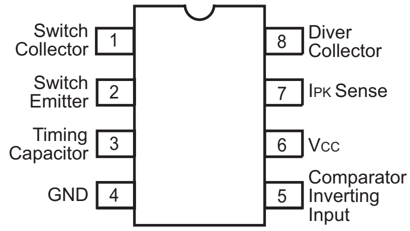
DESCRIPTION

The MC34063A is a monolithic control circuit containing the primary functions required for DC-to-DC converters. The device consists of an internal temperature compensated reference, comparator, controlled duty cycle oscillator with an active current limit circuit, driver and high current output switch. MC34063A is specifically designed to be incorporated in Step-Down, Step-Up and Voltage-Inverting applications with a minimum number of external components.

PIN CONFIGURATION



(Top View)

FEATURES

- Operation from -0.3V to 40V Input
- Low Standby Current
- Current Limiting
- Output Switch Current to 1.5A
- Output Voltage Adjustable
- Frequency Operation to 42kHz
- Precision 2% Reference

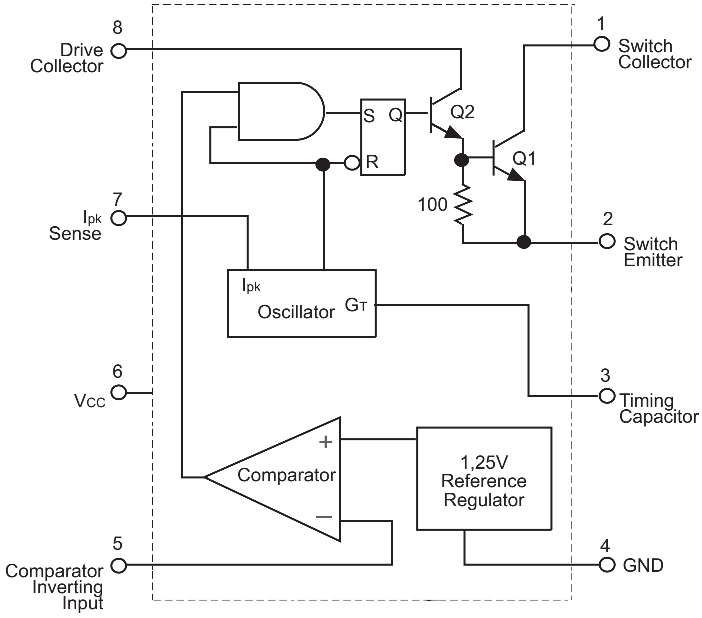
APPLICATION

- DC-DC Converter

ORDERING INFORMATION

Temperature Range	Package		Orderable Device	Package Qty
0°C to +70°C	SOP8L	Pb-Free	MC34063ADG	75Units/Tube
	SOP8L		MC34063ADRG	2500Units/Tape
	DIP8L		MC34063APG	50Units/Tube

SCHEMATIC DIAGRAM



(Bottom View)

Figure 1. Representative Schematic Diagram

ABSOLUTE MAXIMUM RATINGS

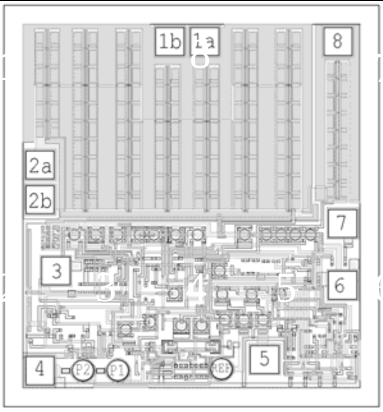
Parameter		Symbol	Value	Unit
Power Supply Voltage		V_{CC}	40	V
Comparator Input Voltage Range		V_{IR}	−0.3 to +40	V
Switch Collector Voltage		$V_{C(switch)}$	40	V
Switch Emitter Voltage (V_{Pin1} = 40 V)		$V_{E(switch)}$	40	V
Switch Collector to Emitter Voltage		$V_{CE(switch)}$	40	V
Driver Collector Voltage		$V_{C(driver)}$	40	V
Driver Collector Current (Note 1)		$I_{C(driver)}$	100	mA
Switch Current		I_{SW}	1.5	A
Power Dissipation, T_A = 25°C	D Package	P_D	625	mW
	P Package		1.25	W
Thermal Resistance, T_A = 25°C	D Package	$R_{\theta JA}$	160	°C/W
	P Package		100	
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

(Vcc = 5.0V, T_A=0 to +70°C, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OSCILLATOR						
Frequency	f_{osc}	V_{Pin5}=0V, C_T=1.0nF, T_A= 25°C	24	33	42	kHz
Charge Current	I_{chg}	V_{CC} = 5.0V to 40V, T_A = 25°C	24	33	42	μA
Discharge Current	I_{dischg}	V_{CC} = 5.0V to 40V, T_A = 25°C	140	200	260	μA
Discharge to Charge Current Ratio	I_{dischg}/I_{chg}	Pin7 to V_{CC}, T_A=25°C	5.2	6.2	7.5	
Current Limit Sense Voltage	$V_{lpk(sense)}$	I_{chg} = I_{dischg}, T_A = 25°C	250	300	350	mV
OUTPUT SWITCH (Note 3)						
Saturation Voltage, Darlington Connection	$V_{CE(sat)}$	I_{SW} = 1.0A, Pins 1, 8 connected		1.0	1.3	V
Saturation Voltage,	$V_{CE(sat)}$	I_{SW} = 1.0A, Forced β = 20 $R_{Pin\ 8}$ = 82Ω to V_{CC}		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	μA
COMPARATOR						
Threshold Voltage	V_{th}	T_A = 25°C	1.225	1.25	1.275	V
		T_A = T_{low} to T_{high}	1.21		1.29	
Threshold Voltage Line Regulation	Reg_{line}	V_{CC} = 3.0V 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} = 5.0V to 40V, C_T = 10nF, V_{pin7} = V_{CC}, V_{Pin5} > V_{th}, Pin 2 = GND, Remaining pins open		2.5	4.0	mA

CHIP APPEARANCE



CHIP SIZE			1,18 × 1,27 mm
CHIP THICKNESS			460 ± 20 µm
BONDING PAD DIMENSION	1a 1b	SWITCH COLLECTOR	90 × 90 µm
	2a 2b	SWITCH EMITTER	90 × 90 µm
	3	TIMING CAPACITOR	90 × 90 µm
	4	GROUND	90 × 90 µm
	5	COMPARATOR INVERTING INPUT	90 × 90 µm
	6	Vcc	90 × 90 µm
	7	Ipk SENCE	90 × 90 µm
	8	DRIVER COLLECTOR	90 × 90 µm
SCRIBE LINE WIDTH			96 µm
TOP METAL			Al
BACK METAL			–
WAFER SIZE			100 mm

TYPICAL PERFORMANCE CHARACTERISTICS

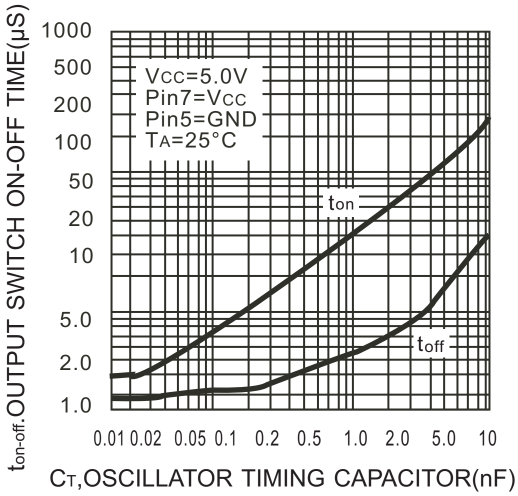


Figure 2. Output Switch On−Off Time vs. Oscillator Timing Capacitor

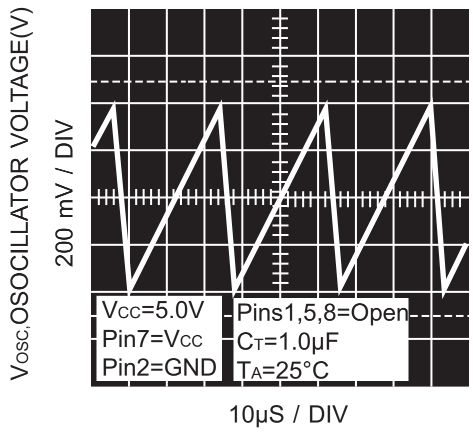


Figure 3. Timing Capacitor Waveform

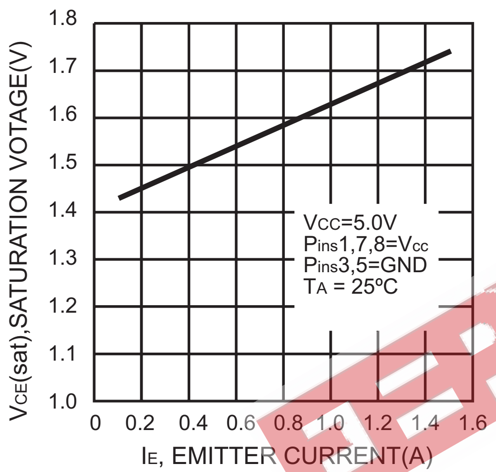


Figure 4. Emitter Follower Configuration Output Saturation Voltage vs. Emitter Current

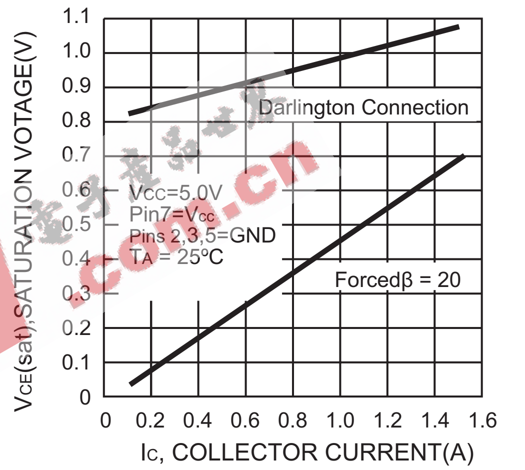


Figure 5. Common Emitter Configuration Output Switch Saturation Voltage vs. Collector Current

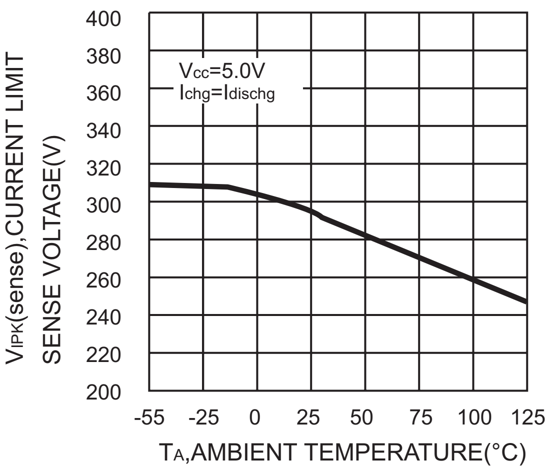


Figure 6. Current Limit Sense Voltage vs. Temperature

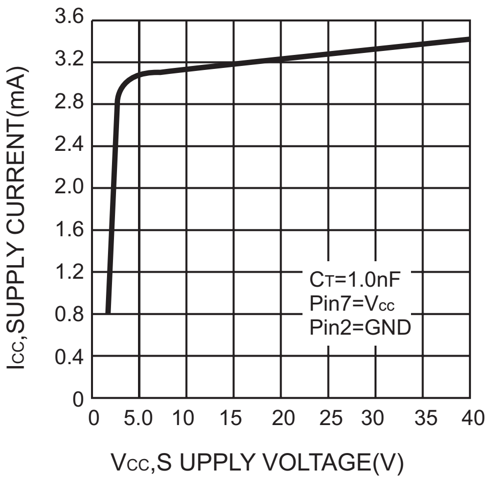


Figure 7. Standby Supply Current vs. Supply Voltage

TYPICAL APPLICATION

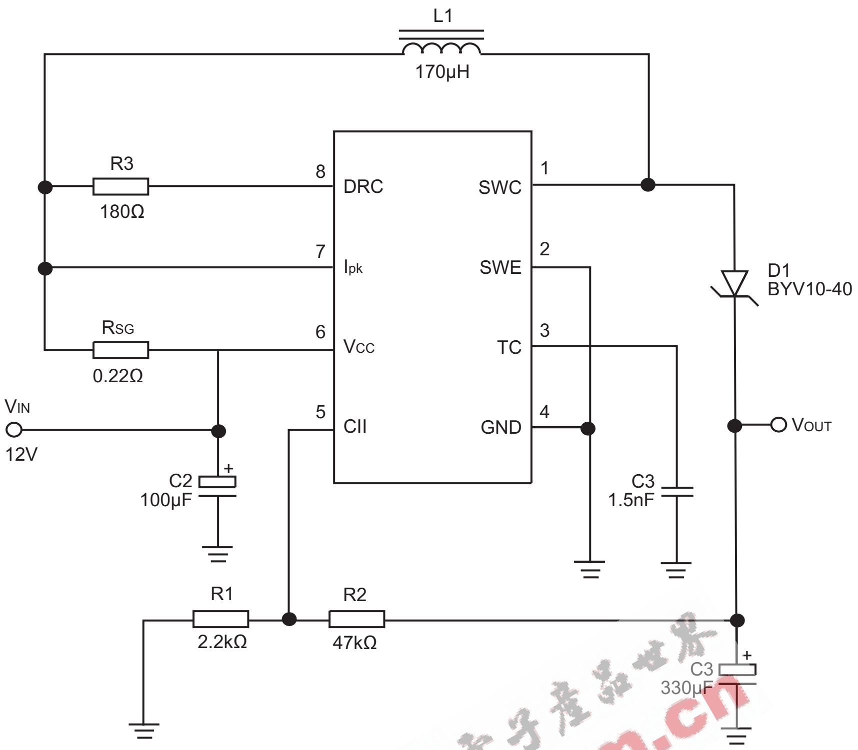


Figure 8. Step−Up Converter

For V_{OUT}=28V

Parameter	**Test Conditions**	**Result(Typ)**	**Unit**
Line Regulation	V_{IN} = 8 to 16 V, I_O = 175 mA	30	mV
Load Regulation	V_{IN} = 12 V, I_O = 75 to 175 mA	10	mV
Output Ripple	V_{IN} = 12 V, I_O = 175 mA	300	mV
Efficiency	V_{IN} = 12 V, I_O = 175 mA	89	%

TYPICAL APPLICATION(CONTINUED)

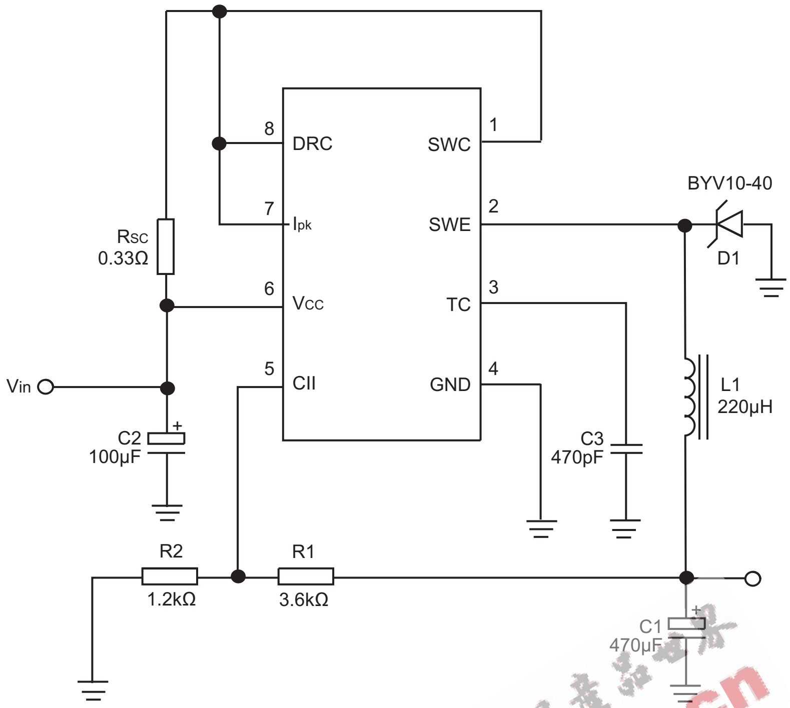


Figure 9. Step−Down Converter

For V_{OUT} = 5V

Parameter	Test Conditions	Result(Typ)	Unit
Line Regulation	V_{IN} = 15 to 25 V, I_O = 500 mA	5	mV
Load Regulation	V_{IN} = 25 V, I_O = 50 to 500mA	30	mV
Output Ripple	V_{IN} = 25 V, I_O = 500 mA	100	mV
Efficiency	V_{IN} = 25 V, I_O = 500mA	80	%
I_{SC}	V_{IN} = 25 V, R_{load} = 0.1 Ω	1.2	A

TYPICAL APPLICATION(CONTINUED)

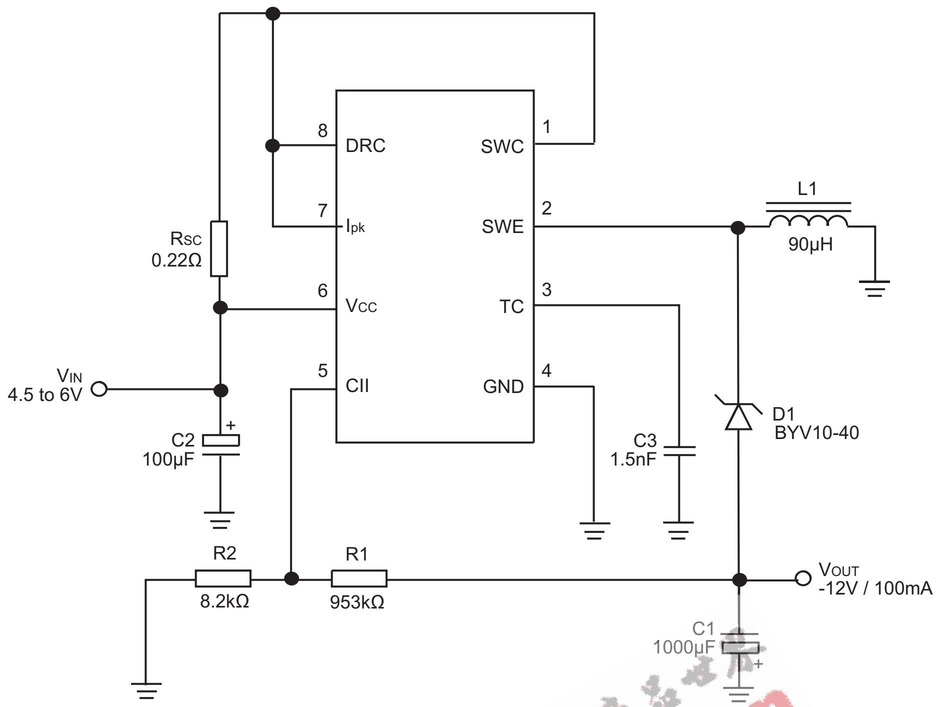


Figure 10. Voltage Inverting Converter

For V_{OUT} = -12V

Patameter	Test Conditions	Result(Typ)	Unit
Line Regulation	V_{IN} = 4.5 to 6 V, I_O = 100 mA	15	mV
Load Regulation	V_{IN} = 5 V, I_O = 10 to 100mA	20	mV
Output Ripple	V_{IN} = 5 V, I_O = 100 mA	230	mV
Efficiency	V_{IN} = 5 V, I_O = 100mA	58	%
I_{SC}	V_{IN} = 5 V, R_{load} = 0.1 Ω	0.9	A

TYPICAL APPLICATION(CONTINUED)

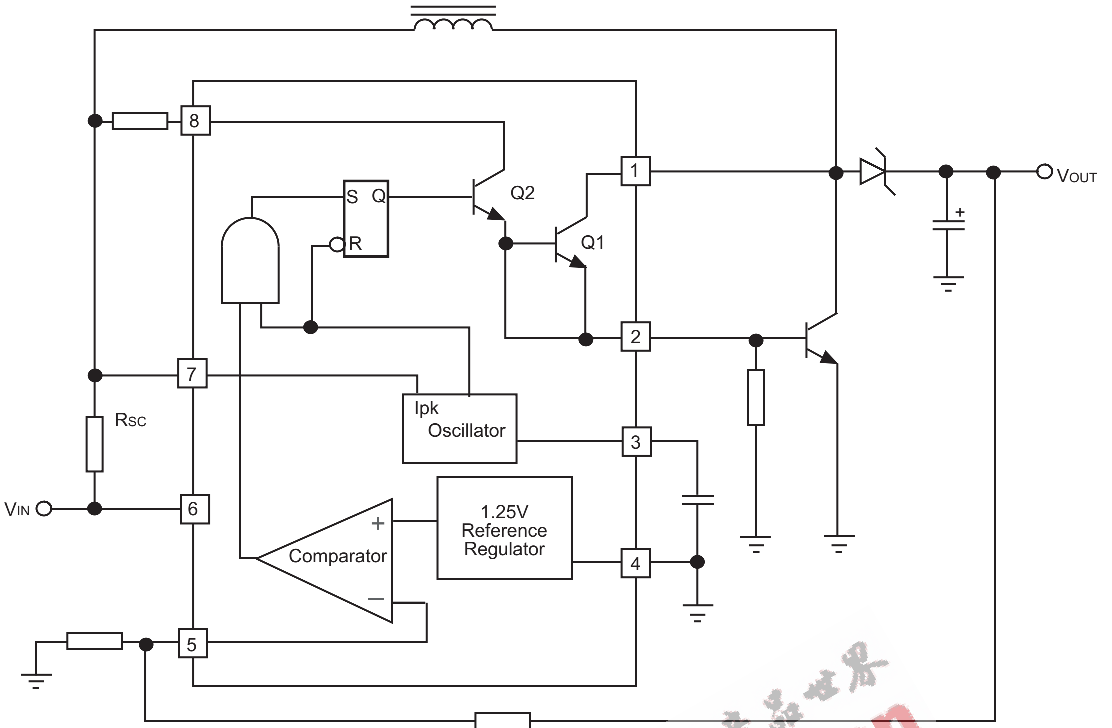


Figure 11. Step-up with External NPN Switch

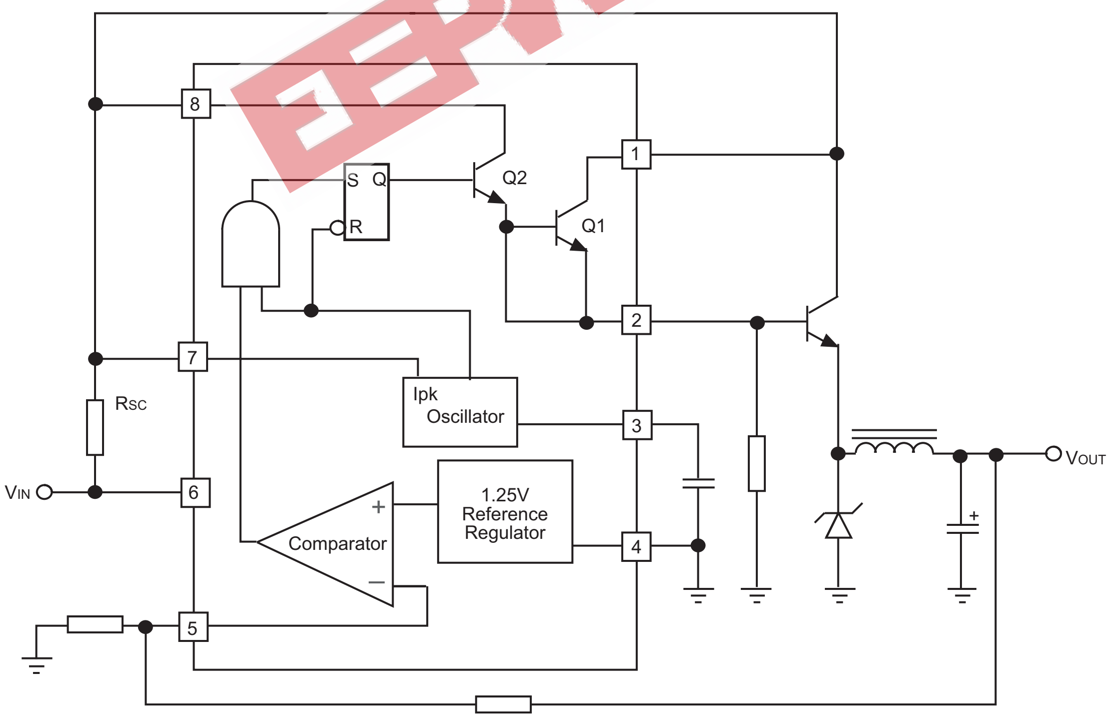


Figure 12. Step-down with External NPN Switch

TYPICAL APPLICATION(CONTINUED)

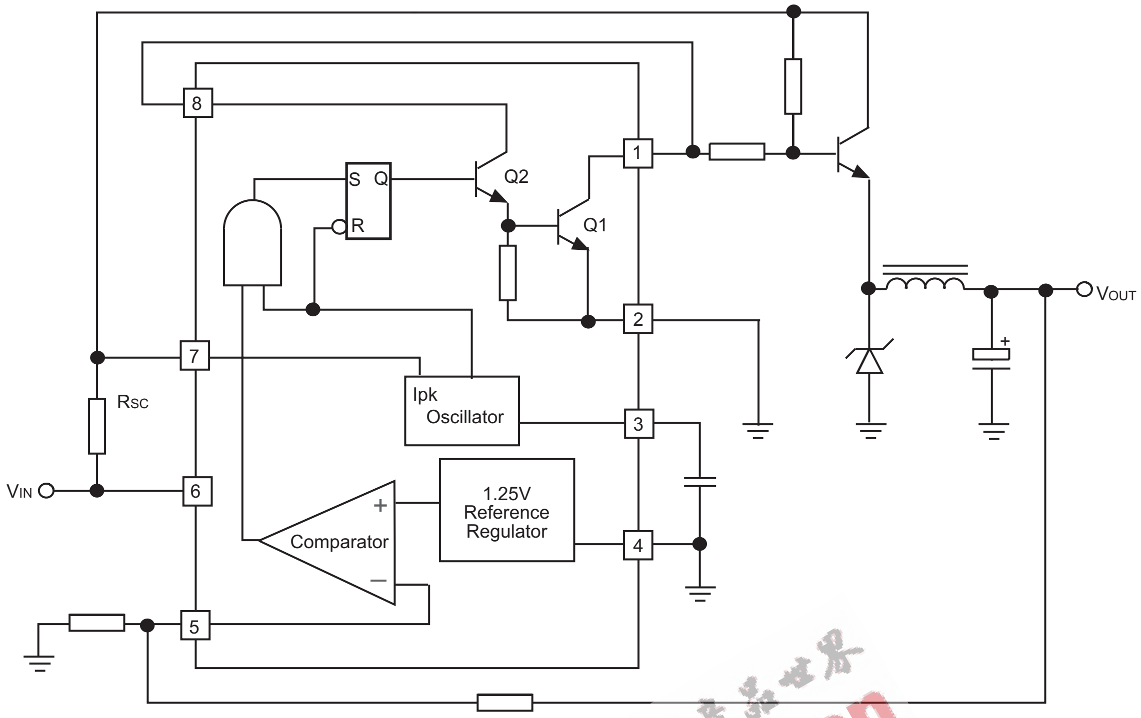


Figure 13. Step-down with External PNP Switch

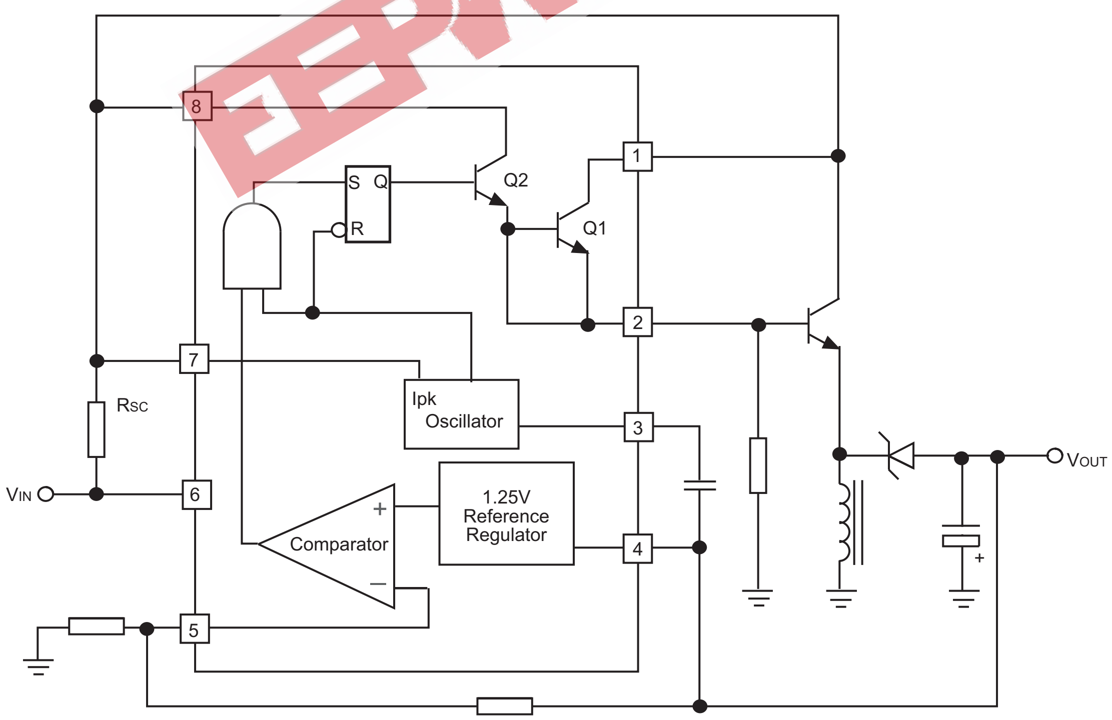


Figure 14. Voltage Inverting with External NPN Switch

TYPICAL APPLICATION(CONTINUED)

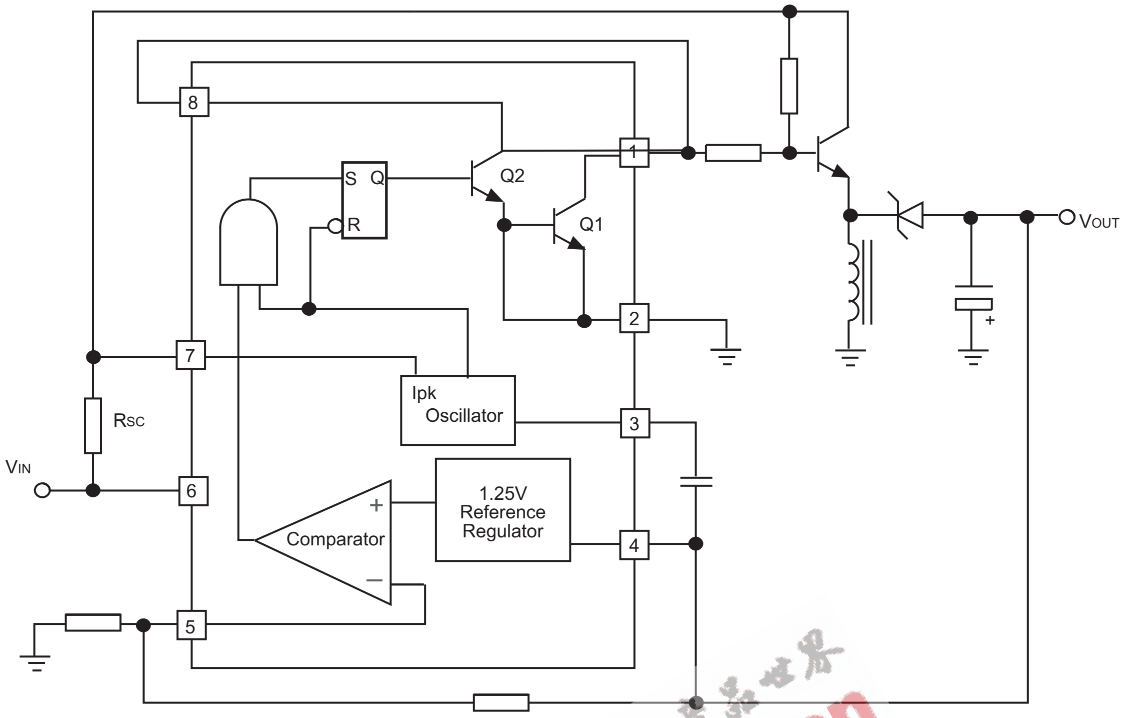


Figure 15. Voltage Inverting with External PNP Saturated Switch

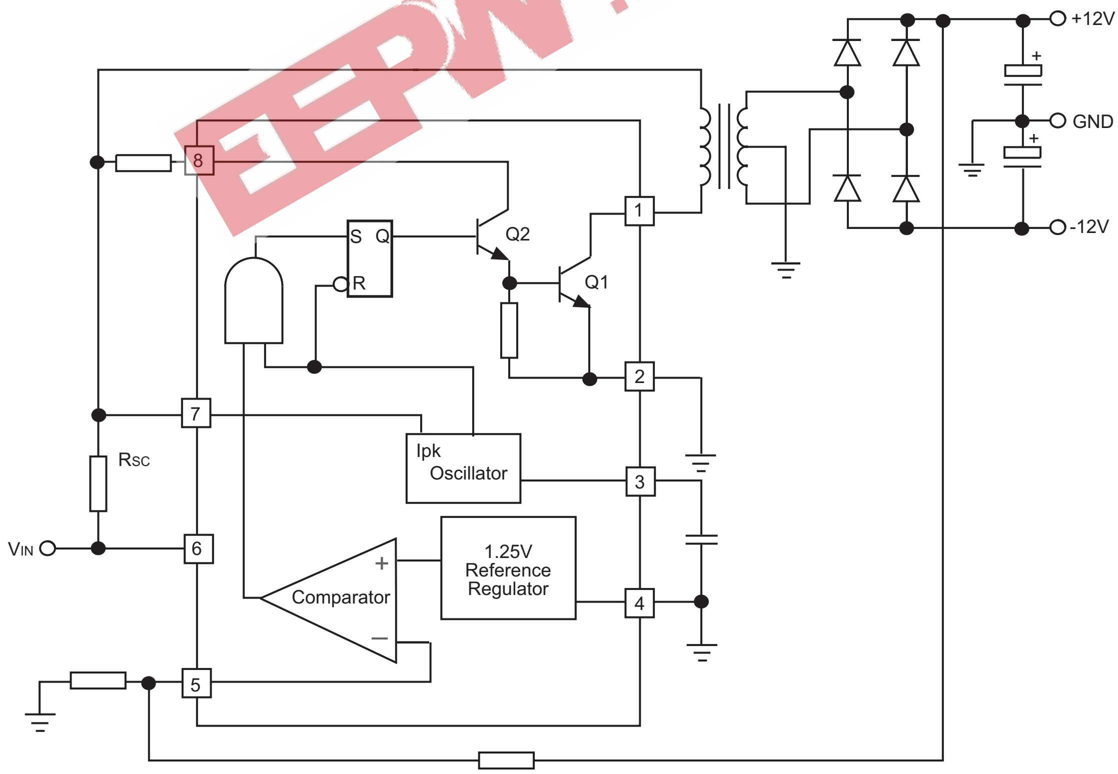


Figure 16. Dual Output Voltage

TYPICAL APPLICATION(CONTINUED)

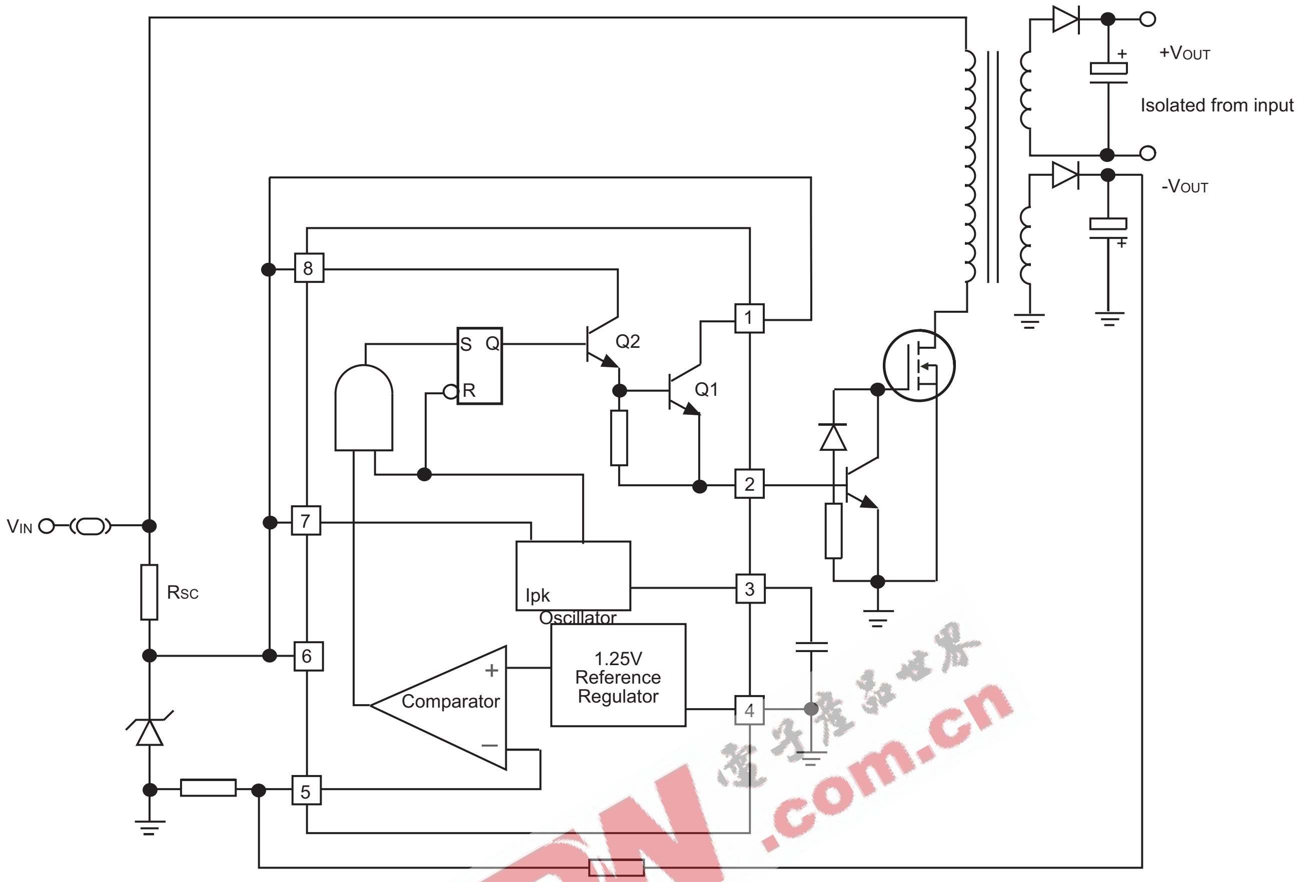


Figure 17. Higher Output Power, Higher Input Voltage

CALCULATION

Table 1 Design Formula Table

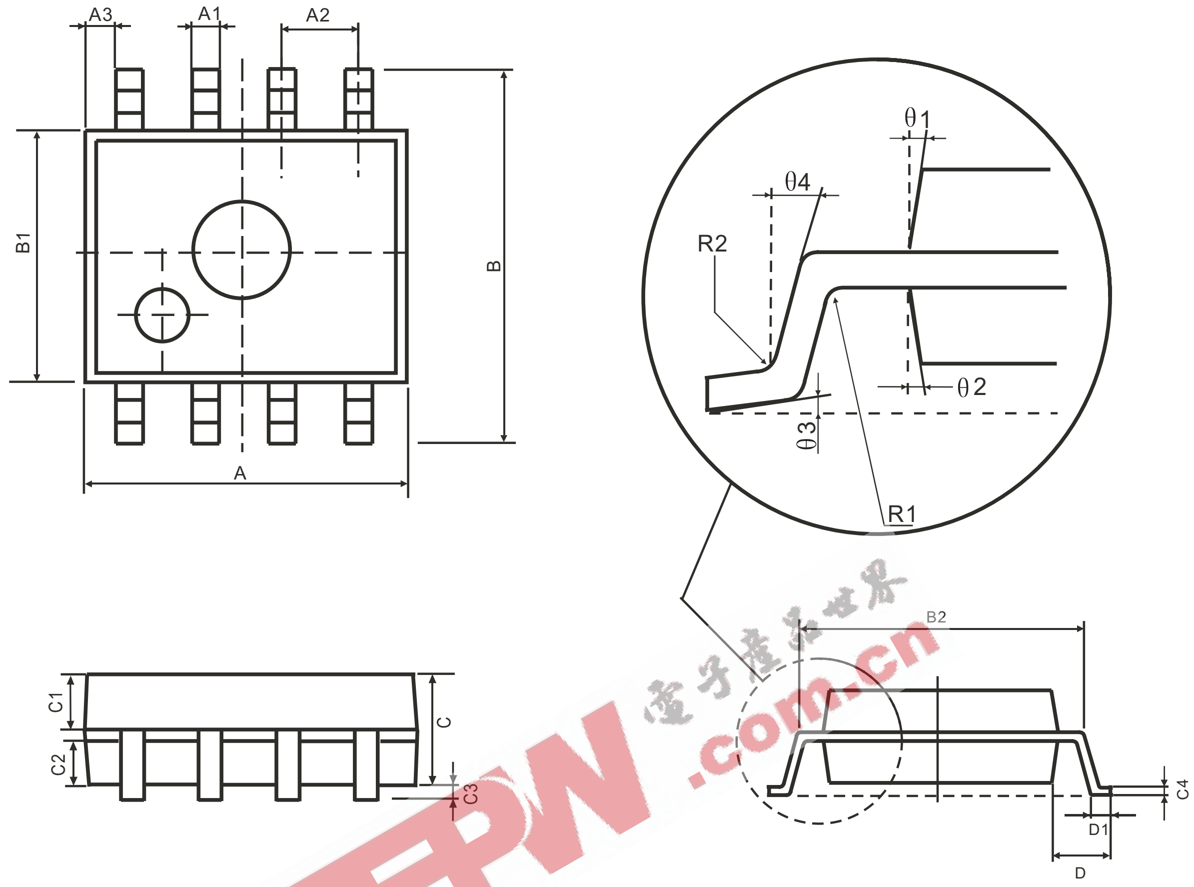
Calculation	Step-Up	Step-Down	Voltage-Inverting
t_{on}/t_{off}	$\frac{V_{out} + V_F - V_{in(min)}}{V_{in(min)} - V_{sat}}$	$\frac{V_{out} + V_F}{V_{in(min)} - V_{sat} - V_{out}}$	$\frac{\lvert V_{out}\rvert + V_F}{V_{in} - V_{sat}}$
$(t_{on}+t_{off})_{max}$	$\frac{1}{f}$	$\frac{1}{f}$	$\frac{1}{f}$
t_{off}	$\frac{t_{on} + t_{off}}{t_{on}/t_{off} + 1}$	$\frac{t_{on} + t_{off}}{t_{on}/t_{off} + 1}$	$\frac{t_{on} + t_{off}}{t_{on}/t_{off} + 1}$
t_{on}	$(t_{on} + t_{off}) - t_{off}$	$(t_{on} + t_{off}) - t_{off}$	$(t_{on} + t_{off}) - t_{off}$
C_T	$4.0\times10^{-5}\,t_{on}$	$4.0\times10^{-5}\,t_{on}$	$4.0\times10^{-5}\,t_{on}$
$I_{pk(switch)}$	$2I_{out(max)}\left(\frac{t_{on}}{t_{off}} + 1\right)$	$2I_{out(max)}$	$2I_{out(max)}\left(\frac{t_{on}}{t_{off}} + 1\right)$
R_{SC}	$\frac{0.3}{I_{PK(switch)}}$	$\frac{0.3}{I_{PK(switch)}}$	$\frac{0.3}{I_{PK(switch)}}$
$L_{(min)}$	$\frac{(V_{in(min)} - V_{sat})}{I_{pk(switch)}}\,t_{on(max)}$	$\frac{(V_{in(min)} - V_{sat} - V_{out})}{I_{pk(switch)}}\,t_{on(max)}$	$\frac{(V_{in(min)} - V_{sat})}{I_{pk(switch)}}\,t_{on(max)}$
C_O	$\approx \frac{I_{out}t_{on}}{V_{ripple(p-p)}}$	$\frac{I_{pk(switch)}(t_{on} + t_{off})}{8V_{ripple(p-p)}}$	$\approx \frac{I_{out}t_{on}}{V_{ripple(p-p)}}$

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:

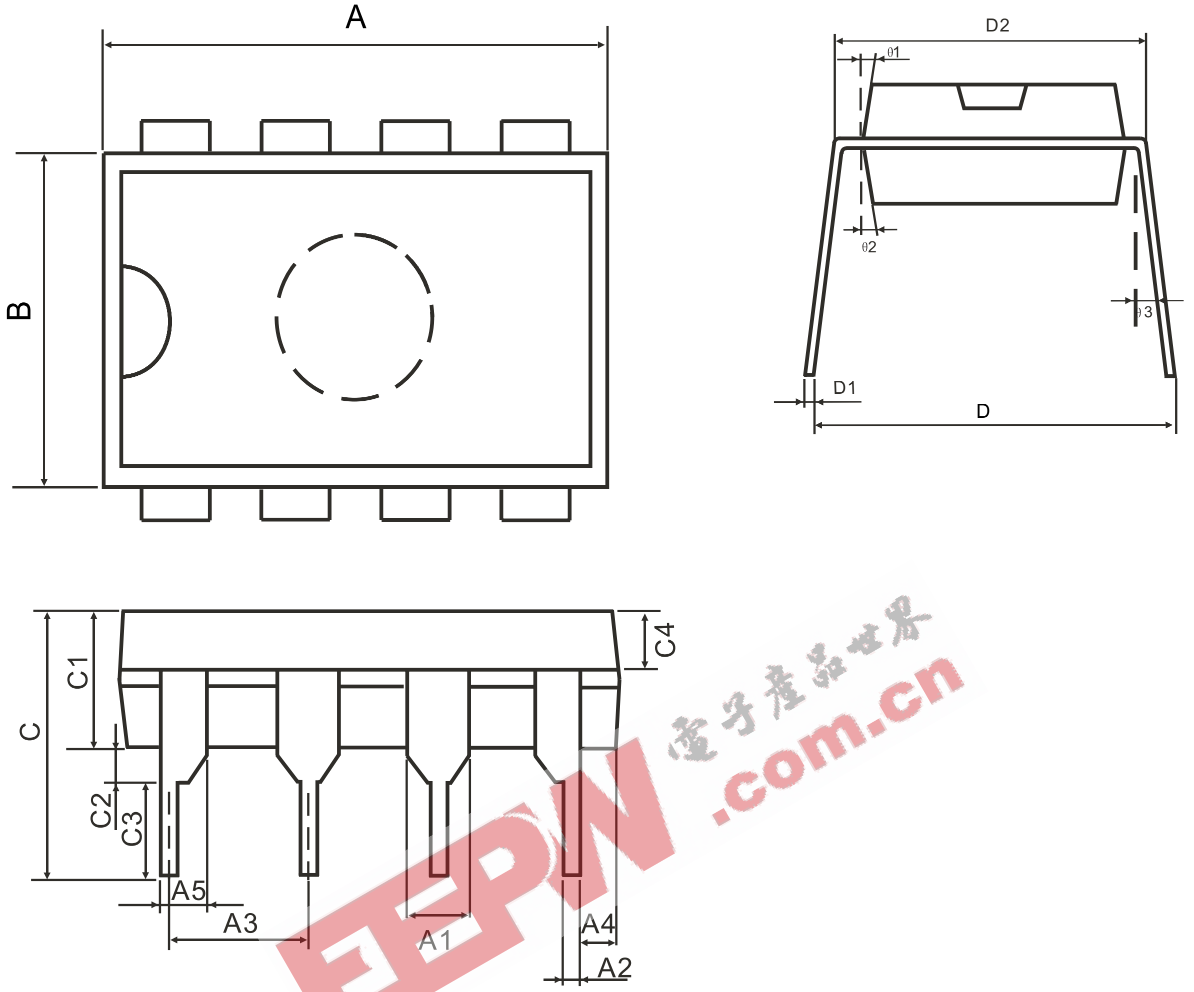
V_{in}=Nominal input voltage.
V_{out}=Desired output voltage. $\lvert V_{out}\rvert$ =1.25(1+R2/R1)
I_{out}=Desired output current.
fmin=Minimum desired output switching frequency at the selected values of V_{in} and I_o
Vripple(pp)=Desired peak-to-peak output ripple voltage.In pritice,the calculated capacitor value will need to be increased due to its equivalent series resistance and board layout. The ripple should be kept to a low value since it will directiy affect the line and load regulation.

PHYSICAL DIMENSIONS
SOP8L



Symbol	Dimension(mm)		Symbol	Dimension(mm)	
	Min	Max		Min	Max
A	4.95	5.15	C3	0.05	0.20
A1	0.37	0.47	C4	0.20(TYP)	
A2	1.27(TYP)		D	1.05(TYP)	
A3	0.41(TYP)		D1	0.40	0.60
B	5.80	6.20	R1	0.07(TYP)	
B1	3.80	4.00	R2	0.07(TYP)	
B2	5.0(TYP)		θ1	17°(TYP)	
C	1.30	1.50	θ2	13°(TYP)	
C1	0.55	0.65	θ3	4°(TYP)	
C2	0.55	0.65	θ4	12°(TYP)	

DIP8L



Symbol	Dimension(mm) Min	Dimension(mm) Max	Symbol	Dimension(mm) Min	Dimension(mm) Max
A	9.30	9.50	C2	0.5(TYP)	
A1	1.524(TYP)		C3	3.3(TYP)	
A2	0.39	0.53	C4	1.57(TYP)	
A3	2.54(TYP)		D	8.20	8.80
A4	0.66(TYP)		D1	0.20	0.35
A5	0.99(TYP)		D2	7.62	7.87
B	6.3	6.5	θ1	8°(TYP)	
C	7.20(TYP)		θ2	8°(TYP)	
C1	3.30	3.50	θ3	5°(TYP)	