Features

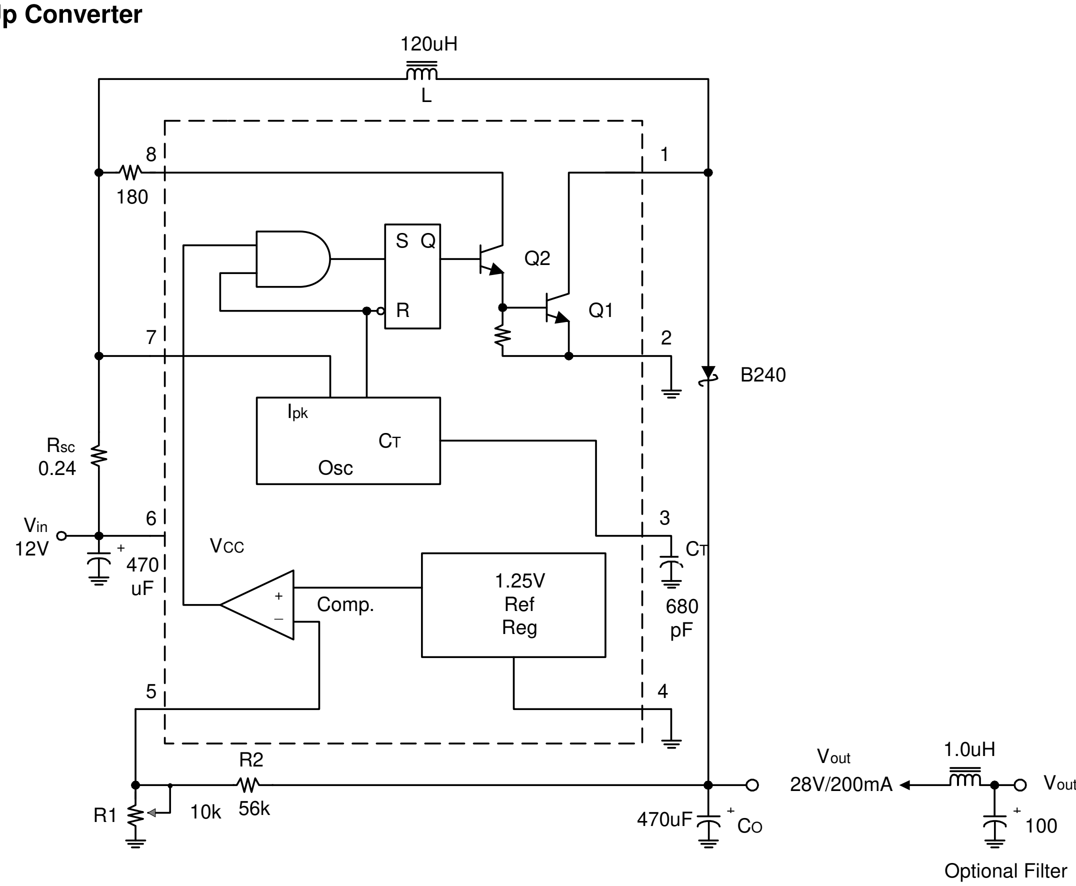
- Operation from 3.0V to 40V Input
- Low Standby Current
- Current Limiting
- Output Switch Current to 1.6A
- Output Voltage Adjustable
- Frequency Operation to 100 kHz
- Precision 2% Reference
- Lead Free packages: SOP-8L and PDIP-8L (Note 1)
- SOP-8L: Available in "Green" Molding Compound (No Br, Sb)
- Lead Free Finish/RoHS Compliant (Note 2)

Description

The AP34063 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 is specifically designed for incorporating in Step-Down and Step-Up and Voltage-Inverting applications with a minimum number of external components.

Application Circuit

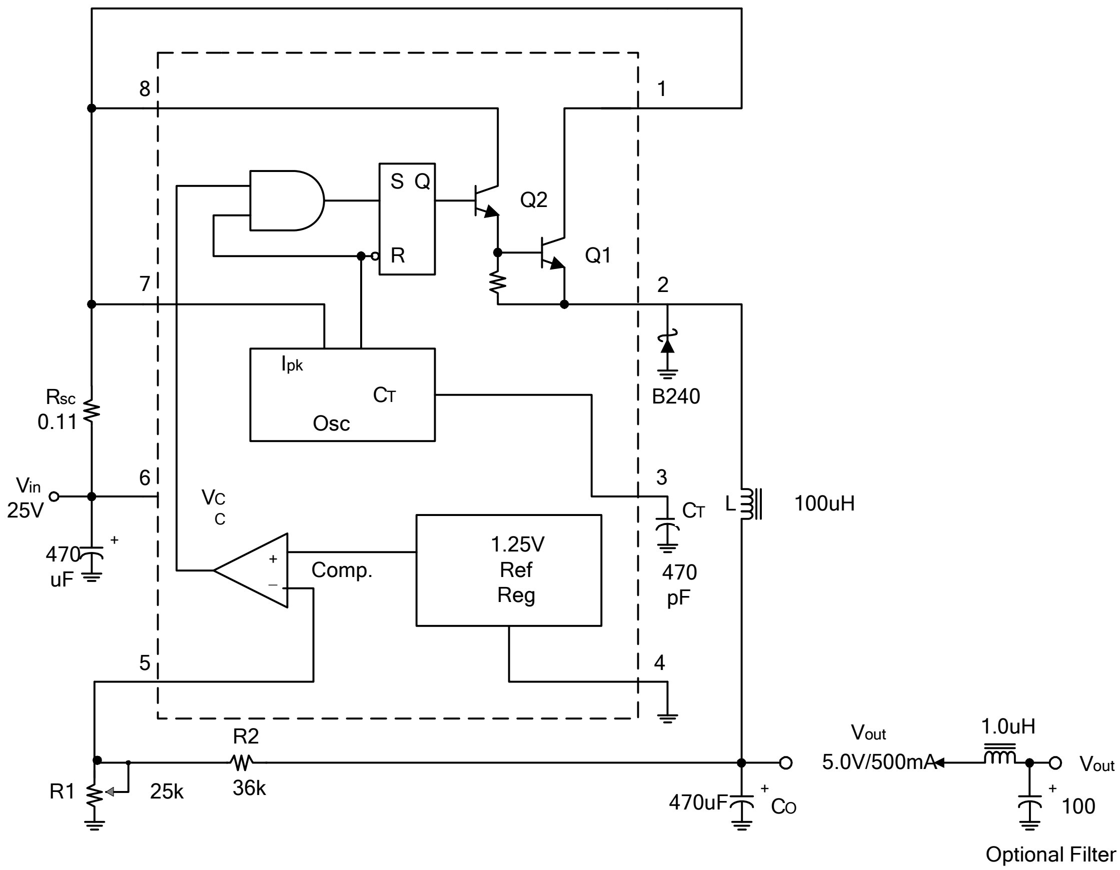
(1) Step-Up Converter



Test	Conditions	Results
Line Regulation	V_{in} = 9V to 12V, I_O = 200mA	20mV = ±0.035%
Load Regulation	V_{in} = 12V, I_O = 50mA to 200mA	15mV = ±0.035%
Output Ripple	V_{in} = 12V, I_O = 200mA	500mV$_{PP}$
Efficiency	V_{in} = 12V, I_O = 200mA	80%

Application Circuit (Continued)

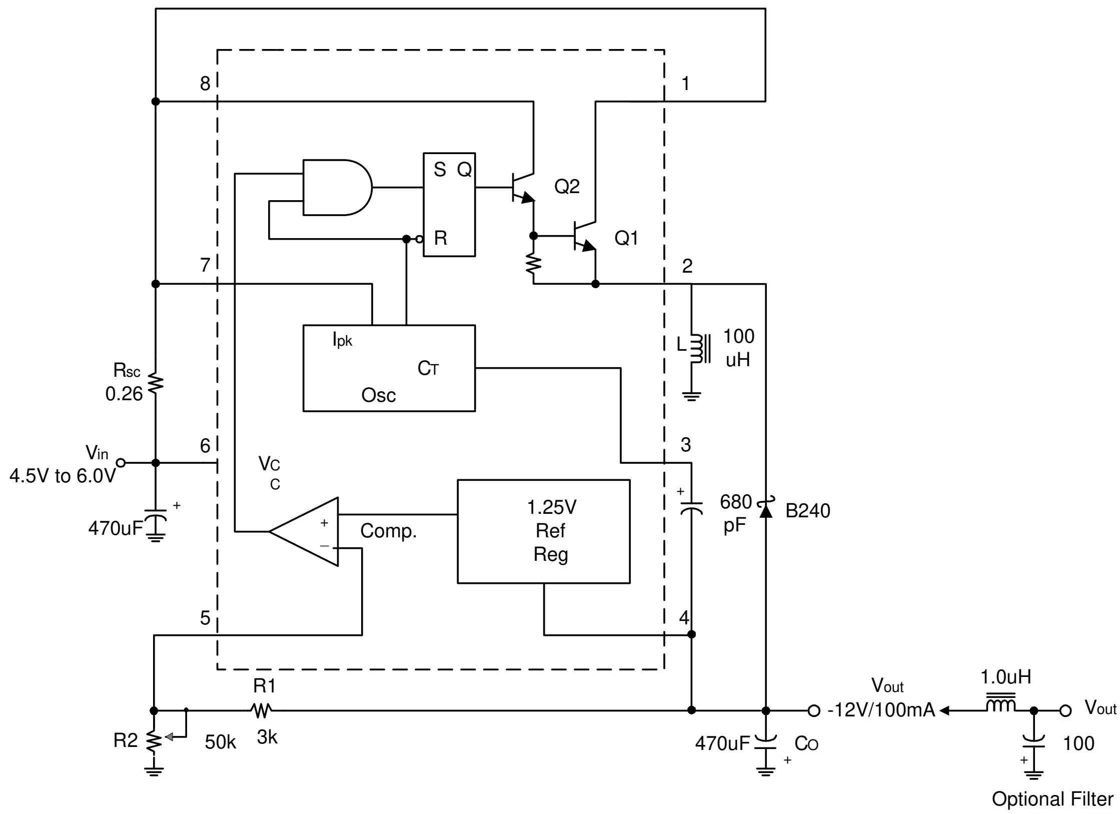
(2) Step-Down Converter



Test	Conditions	Results
Line Regulation	V_{in} = 12V to 24V, I_O = 500mA	20mV = ±0.2%
Load Regulation	V_{in} = 24V, I_O = 50mA to 500mA	5mV = ±0.05%
Output Ripple	V_{in} = 24V, I_O = 500mA	160mV$_{PP}$
Efficiency	V_{in} = 24V, I_O = 500mA	82%

Application Circuit (Continued)

(3) Voltage Inverting Converter



Test	Conditions	Results
Line Regulation	V_{in} = 4.5V to 6.0V, I_O = 100mA	20mV = ±0.08%
Load Regulation	V_{in} = 5.0V, I_O = 20mA to 100mA	30mV = ±0.12%
Output Ripple	V_{in} = 5.0V, I_O = 100mA	500mV_{PP}
Efficiency	V_{in} = 5.0V, I_O = 100mA	60%

Ordering Information

AP 34063 XX X - X

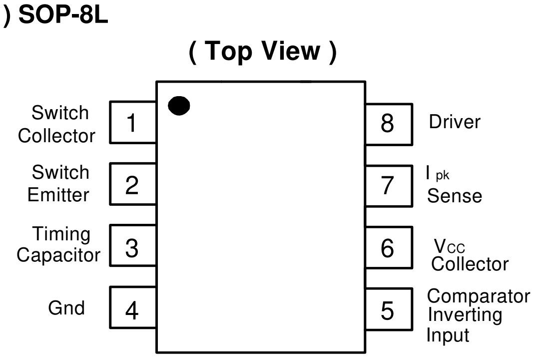
Package	Lead Free	Packing
S8 : SOP-8L	L : Lead Free (Note 1)	U : Tube
N8 : PDIP-8L	G : Green	13 : Tape & Reel

Device	Package Code	Packaging (Note 3)	Tube		13" Tape and Reel	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix
AP34063S8L-13	S8	SOP-8L	NA	NA	2500/Tape & Reel	-13
AP34063S8G-13	S8	SOP-8L	NA	NA	2500/Tape & Reel	-13
AP34063N8L-U	N8	PDIP-8L	60	- U	NA	NA

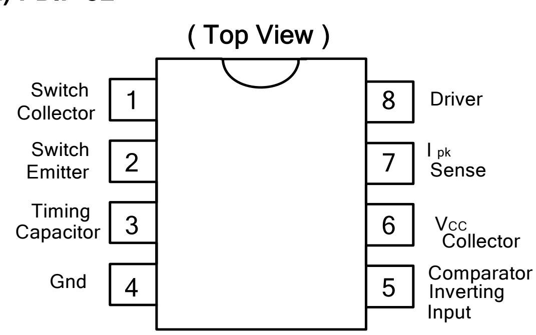
Notes:
1. PDIP-8L is available in "Lead Free" product only.
2. EU Directive 2002/95/EC (RoHS). All applicable RoHS exemptions applied. Please visit our website at http://www.diodes.com/products/lead_free.html.
3. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf.

Pin Assignment

(1) SOP-8L



(2) PDIP-8L



Maximum Ratings

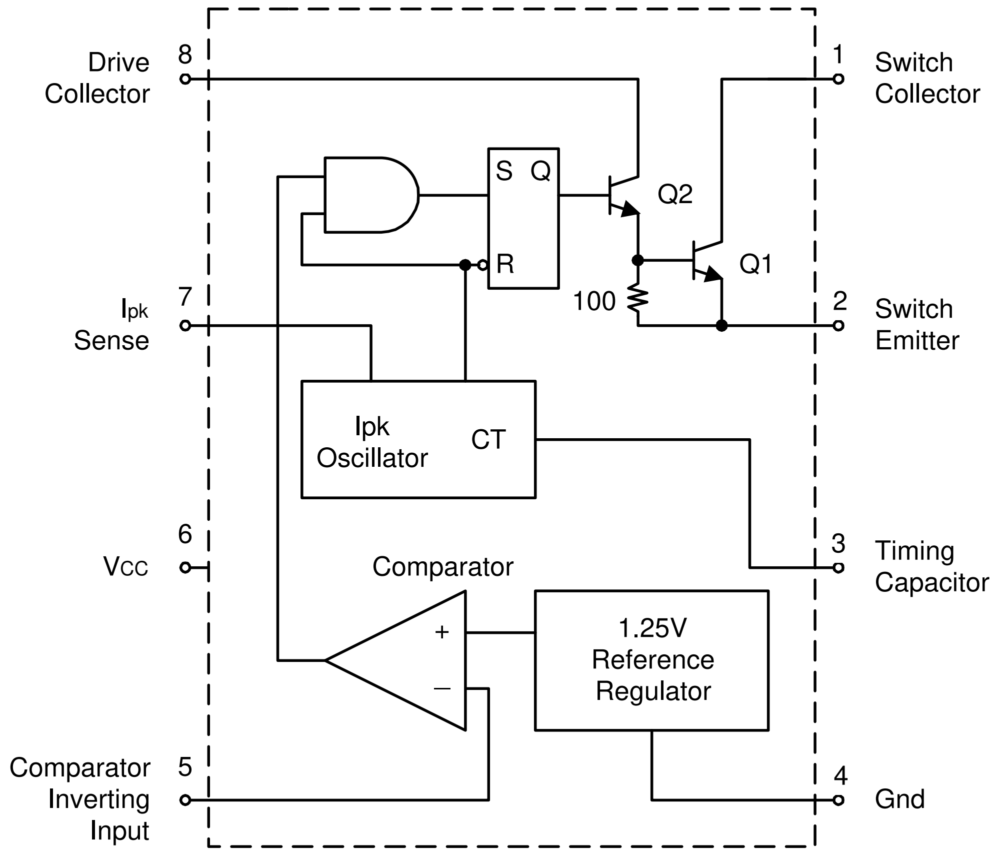
Symbol	Parameter		Value	Unit
V_{CC}	Power Supply Voltage		40	V
V_{IR}	Comparator Input Voltage Range		-0.3 ~ +40	V
$V_{C\ (switch)}$	Switch Collector Voltage		40	V
$V_{E\ (switch)}$	Switch Emitter Voltage (V_{Pin} 1 = 40V)		40	V
$V_{CE\ (switch)}$	Switch Collector to Emitter Voltage		40	V
$V_{C\ (driver)}$	Driver Collector Voltage		40	V
$I_{C\ (driver)}$	Driver Collector Current		100	mA
I_{SW}	Switch Current		1.6	A
P_D	Power Dissipation and Thermal Characteristics	SOP: T_A = 25°C	600	mW
		PDIP: T_A = 25°C	1.25	W
θ_{JA}		Thermal Resistance	160	°C/W
T_{MJ}	Maximum Junction Temperature		+150	°C
T_{OP}	Operating Junction Temperature Range		0 ~ +105	°C
T_{stg}	Storage Temperature Range		-65 ~ +150	°C

Notes: 4. Maximum package power dissipation limits must be observed.
5. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible.

Electrical Characteristics (V_{CC} = 5.0V, unless otherwise specified)

Symbol	Characteristics	Min	Typ.	Max	Unit
OSCILLATOR					
f_{osc}	Frequency (V_{Pin} 5 = 0V, C_T = 1.0nF, T_A = 25°C)	24	33	42	kHz
I_{chg}	Charge Current (V_{CC} = 5.0V to 40V, T_A = 25°C)	24	30	42	μA
I_{dischg}	Discharge Current (V_{CC} = 5.0V to 40V, T_A = 25°C)	140	200	260	μA
I_{dischg} / I_{chg}	Discharge to Charge Current Ratio (Pin 7 to V_{CC}, T_A = 25°C)	5.2	6.5	7.5	-
$V_{ipk\ (sense)}$	Current Limit Sense Voltage (I_{chg} = I_{dischg}, T_A = 25°C)	300	400	450	mV
OUTPUT SWITCH (Note 3)					
$V_{CE\ (sat)}$	Saturation Voltage, Darlington Connection (I_{SW} = 1.0A, Pins 1,8 connected)	-	1.0	1.3	V
$V_{CE\ (sat)}$	Saturation Voltage, Darlington Connection (I_{SW} = 1.0A, ID = 50mA, Forced ß ≈ 20)	-	0.45	0.7	V
h_{FE}	DC Current Gain (I_{SW} = 1.0A, V_{CE} = 5.0V, T_A = 25°C)	50	75	-	-
$I_{C\ (off)}$	Collector Off-State Current (V_{CE} = 40V)	-	0.01	100	μA
COMPARATOR					
V_{th}	Threshold Voltage	-	-	-	V
-	T_A = 25°C	1.225	1.25	1.275	-
-	T_A = 0°C ~ 70°C	1.21	-	1.29	-
Reg_{line}	Threshold Voltage Line Regulation (V_{CC} = 3.0V to 40V)	-	1.4	6.0	mV
TOTAL DEVICE					
I_{CC}	Supply Current (V_{CC} = 5.0V to 40V, C_T =1.0nF, Pin 7 = V_{CC}, $V_{Pin\ 5}$ > V_{th} Pin 2 = Gnd, remaining pins open)	-	-	3.5	mA

Representative Schematic Diagram



(Bottom View)

Typical Performance Characteristics

Figure 1. Vce(sat) versus Ie

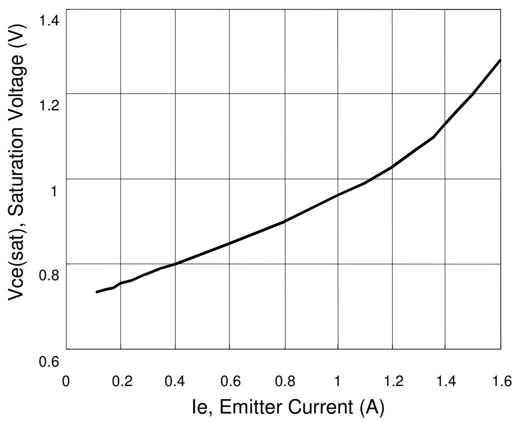


Figure 2. Reference Voltage versus Temp.

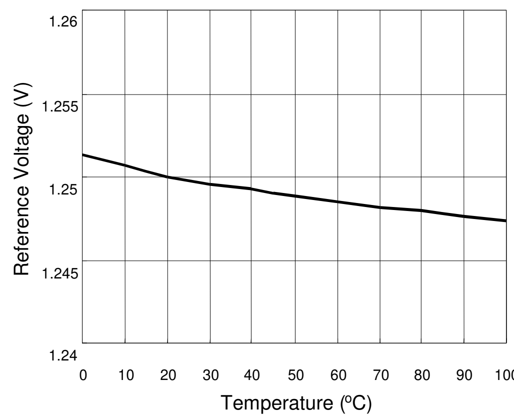


Figure 3. Current Limit Sense Voltage versus Temperature

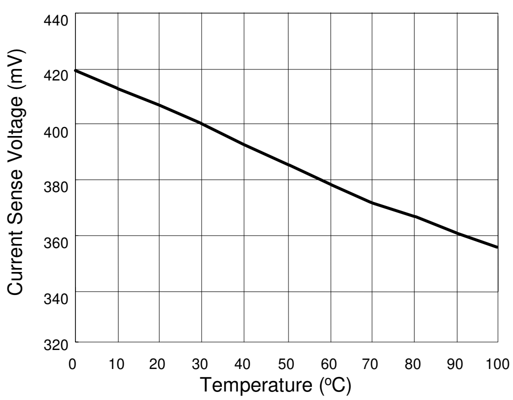


Figure 4. Standby Supply Current versus Supply Voltage

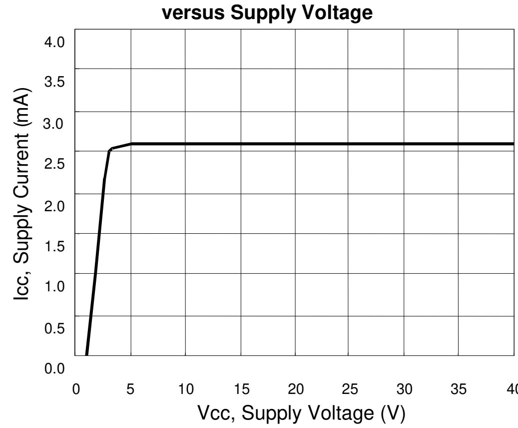


Figure 5. Emitter Follower Configuration Output Saturation Voltage vs. Emitter Current

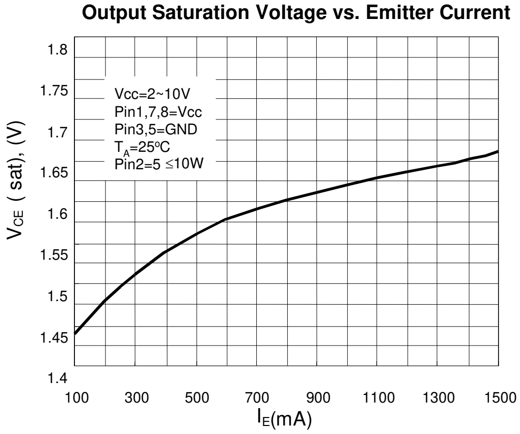
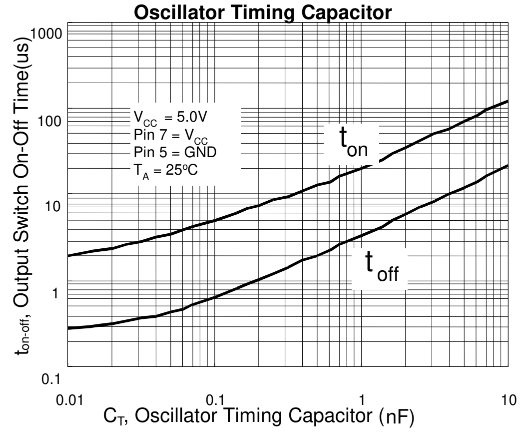


Figure 6.Output Switch On-Off Time versus Oscillator Timing Capacitor



Design Formula Table

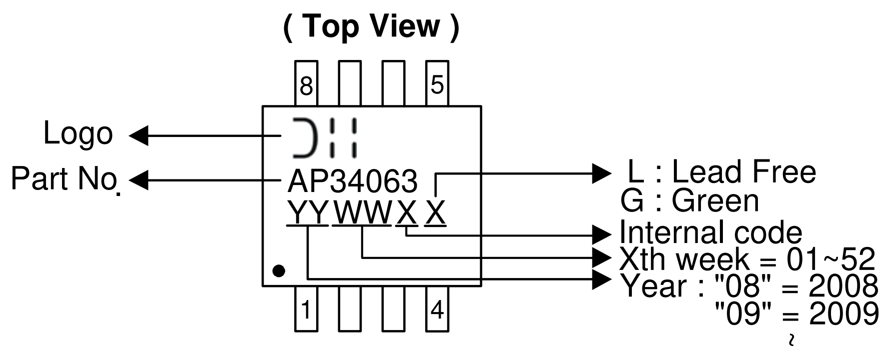
Calculation	Step-Up	Step-Down	Voltage-Inverting
t_{on} / t_{off}	$\frac{V_{out} + V_F - V_{in\,(min)}}{V_{in\,(min)} - V_{sat}}$	$\frac{V_{out} + V_F}{V_{in(min)} - V_{sat} - V_{out}}$	$\frac{\lvert V_{out} \rvert + V_F}{V_{in} - V_{sat}}$
$(t_{on} + t_{off})$	$1/f$	$1/f$	$1/f$
t_{off}	$\frac{t_{on} + t_{off}}{\frac{t_{on}}{t_{off}} + 1}$	$\frac{t_{on} + t_{off}}{\frac{t_{on}}{t_{off}} + 1}$	$\frac{t_{on} + t_{off}}{\frac{t_{on}}{t_{off}} + 1}$
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)	$2I_{out\,(max)} (t_{on} / t_{off} + 1)$	$2I_{out\,(max)}$	$2I_{out\,(max)} (t_{on} / t_{off} + 1)$
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	$9 \frac{I_{out}\, t_{on}}{V_{ripple\,(pp)}}$	$\frac{I_{pk\,(switch)} (t_{off} + t_{on})}{8V_{ripple\,(pp)}}$	$9 \frac{I_{out}\, t_{on}}{V_{ripple\,(pp)}}$

V_{sat} = Saturation voltage of the output switch.
V_F = Forward voltage drop of the output rectifier.

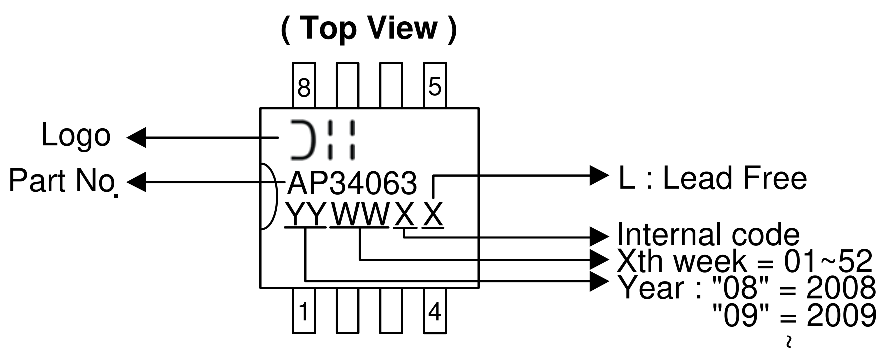
The following power supply characteristics must be chosen:
V_{in} - Nominal input voltage.
V_{out} - Desired output voltage, $|V_{out}| = 1.25 (1+R2/R1)$
I_{out} - Desired output current.
f_{min} - Minimum desired output switching frequency at the selected values of V_{in} and I_o.
$V_{ripple(pp)}$ - 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.

Marking Information

(1) **SOP-8L**

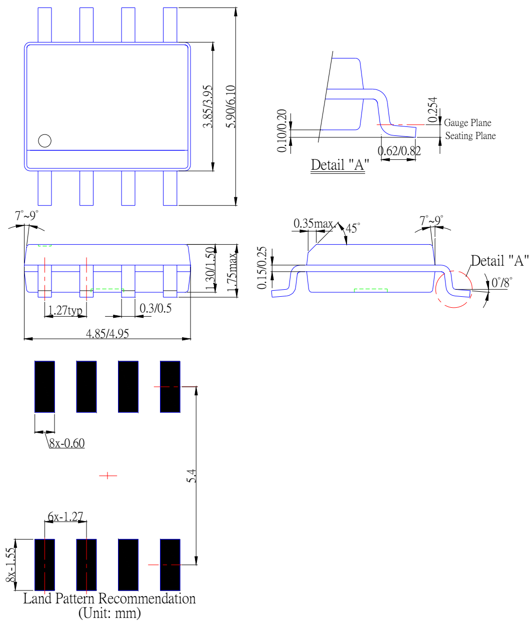


(2) **PDIP-8L**



Package Information (All Dimensions in mm)

(1) SOP-8L



(2) PDIP-8L