Universal DC to DC Converter

◆ DESCRIPTION

The MT34063 is designed for the applications which require DC - DC converters. It can be operated in a wide input range from 3.0V to 40V and has the controlled duty cycle oscillator, driver and high current output switch.

Also, with the internal temperature compensation circuit, the MT34063 provides an internally trimmed precision 2% reference voltage of 1.25V. These features make the MT34063 suitable for step-up, step-down and voltage–inverting applications.

The M34063 is available in the 8-Pin Plastic SOIC and 8-Pin Plastic DIP packages.

◆ FEATURES

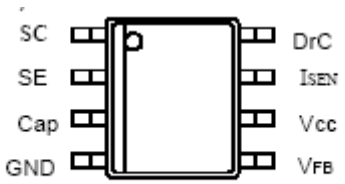
- Output switch current up to 1.5A
- Wide supply voltage range 3.0V to 40V
- 100kHz operational frequency
- Low standby current
- Adjustable Output Voltage
- Internally trimmed 2% 1.25V Reference Voltage
- Direct pin-to-pin replacement for industrial product MC34063A.

◆ APPLICATIONS

- Adaptors
- Battery chargers
- Mother Board

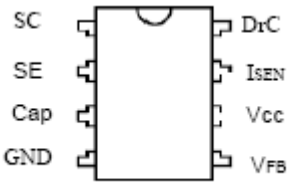
◆ PIN CONFIGURATIONS

SOP-8 (Top View)



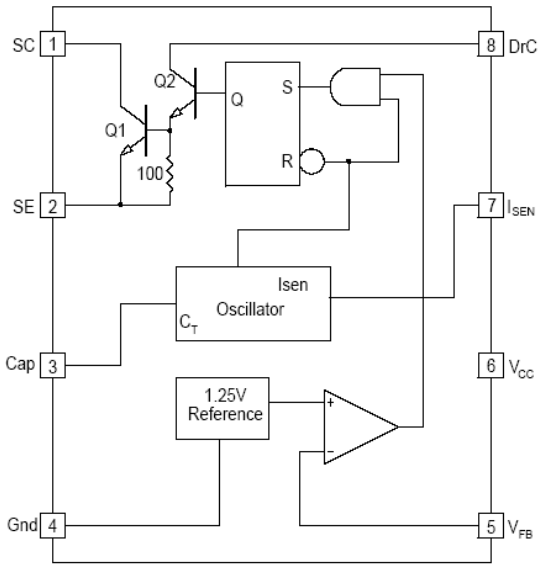
MT34063M

DIP-8 (Top View)



MT34063T

◆ BLOCK DIAGRAM



Pin Assignment Descriptions	
Pin 1 : SC - Switch Collector Pin	Pin 8 : DrC- Driver Collector
Pin 2 : SE - Switch Emitter	Pin 7 : I_{SEN}- I Peak Sense
Pin 3 : Cap - Oscillator Timing Capacitor	Pin 6 : V_{CC}- Power Supply
Pin 4 : GND - Ground	Pin 5 : V_{FB}- Comparator inverting input

◆ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Maximum	Unit
Supply voltage	V_{CC}	40	V
Thermal resistance junction to ambient SOP-8 DIP-8	θ_{JA}	 150 95	 °C/W °C/W
Junction temperature	T_J	150	°C
Storage temperature range	T_{STG}	-65 to 150	°C
Operating temperature	T_{OPR}	0 to 70	°C

Note:

Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of the specified terminal.

◆ ORDERING INFORMATION

Device	Package		T_A (°C)	Note
MT34063M	M	SOP-8	0 to 70	
MT34063T	T	DIP-8	0 to 70	

◆ POWER DISSIPATION TABLE

Package	θ_{JA} (°C /W)	Df(mW/°C) $T_A \geq 25$°C	$T_A \leq 25$°C Power rating(mW)	T_A=70°C Power rating(mW)	T_A= 85°C Power rating (mW)
M	150	6.06	833	533.3	433.3
T	95	10.53	1316	842	684

Note :

1. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown
2. T_j: Junction Temperature Calculation:
   $T_J = T_A + (P_D \times \theta_{JA})$,
   The θ_{JA} numbers are guidelines for the thermal performance of the device/PC-board system
   All of the above assume no ambient airflow
3. θ_{Ja}: Thermal Resistance-Junction to Ambient, D_F: Derating factor, P_O: Power consumption.

◆ RECOMMENDED OPERATING CONDITIONS

V_{CC} = 5.0 V, $T_A = T_{LOW}$ to T_{HIGH} unless otherwise specified

Parameter	Symbol	Operating Conditions			Unit
		Min.	Typ.	Max.	
Comparator Input Voltage	V_{FB}	-0.3 to +40			V
Switch Collector Voltage	$V_{C(switch)}$	-		40	V
Switch Emitter Voltage (V_{Pin1}=40V)	$V_{E(switch)}$	-		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
Timing Capacitor (connected to Cap pin)	C_T	-	1	-	nF
Operating Ambient Temperature Range	T_A	0 to +70			°C

Note 1: Maximum package power dissipation limits must be observed.

◆ ELECTRICAL CHARACTERISTICS

V_{cc} = 5.0 V, T_A = T_{low} to T_{high} unless otherwise specified

Parameter	Symbol	Test Conditions	Min.	Typ	Max.	Unit
OSCILLATOR						
Frequency	f_{OSC}	V_{Pin5} = 0 V, C_T = 1.0nF, T_A = 25 °C	24	33	45	KHz
Charge Current	I_{chg}	V_{CC} = 5.0 V to 40 V, T_A = 25°C	24	35	45	μA
Discharge Current	I_{dischg}	V_{CC} = 5.0 V to 40 V, T_A = 25°C	140	220	290	μA
Discharge to Charge Current Ratio	I_{dischg}/I_{chg}	Pin 7 to V_{CC}, T_A = 25°C	5.2	6.5	7.5	-
Current Limit Sense Voltage	V_{sense}	I_{chg} = I_{dischg}, T_A = 25°C	250	300	350	mV
OUTPUT SWITCH						
Saturation Voltage, Darlington Connection	$V_{CE(sat)}$	I_{SW} = 0.8 A, Pins 1, 8 connected	-	1.0	1.3	V
Saturation Voltage	$V_{CE(sat)}$	I_{SW} = 1.0 A, $R_{pin\ 8}$ = 82 Ω to V_{CC}, Forced β = 20	-	0.45	0.7	V
DC Current Gain	h_{FE}	I_{SW} = 1.0 A, V_{CE} = 5.0 V, T_A = 25°C	50	75	-	-
Collector Off–State Current	$I_{C(off)}$	V_{CE} = 40 V	-	0.01	100	μA
COMPARATOR						
Threshold Voltage	V_{th}	T_A = 25°C	1.225	1.25	1.275	V
		T_A =0°C to 70°C	1.21	-	1.29	
Threshold Voltage Line Regulation	Reg_{line}	V_{CC} = 3.0 V to 40 V	-	1.4	5.0	mV
Input Bias Current	I_{IB}	V_{FB} = 0 V	-	-20	-400	nA
TOTAL DEVICE						
Supply current	I_{CC}	V_{CC} = 5.0 V to 40 V, C_T = 1.0nF, Pin 7 = V_{CC}, V_{FB} > V_{th}, Pin 2= GND, remaining pins open	-	-	4.0	mA

◆ TYPICAL APPLICATIONS

Figure1. Step-Up Converter Application Circuit

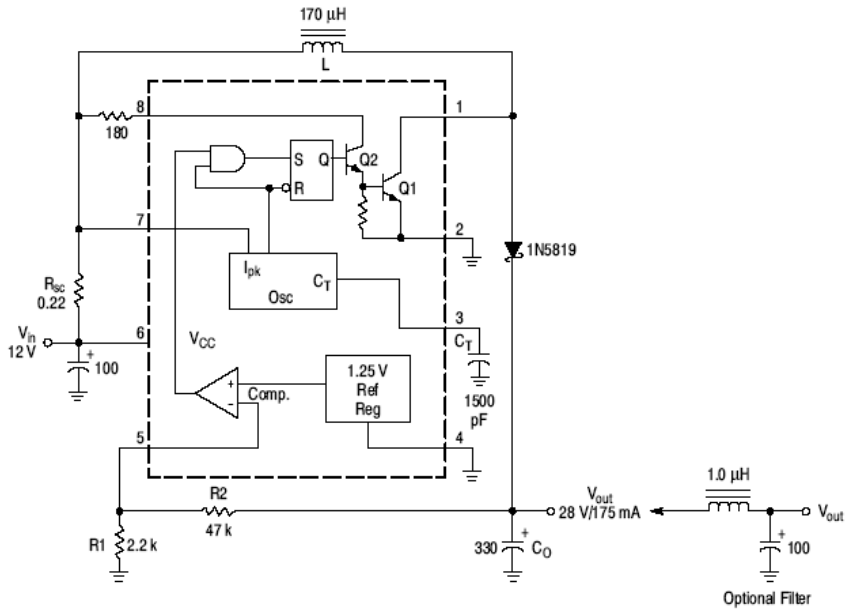
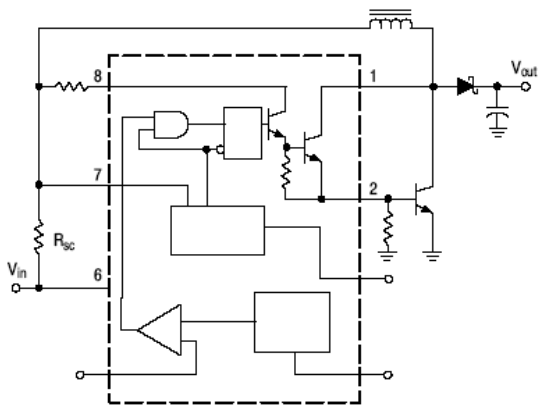


Figure2. External Current boost Connections for I_C Peak Greater than 1.5A

2.a External NPN Switch



2.b External NPN Saturated Switch

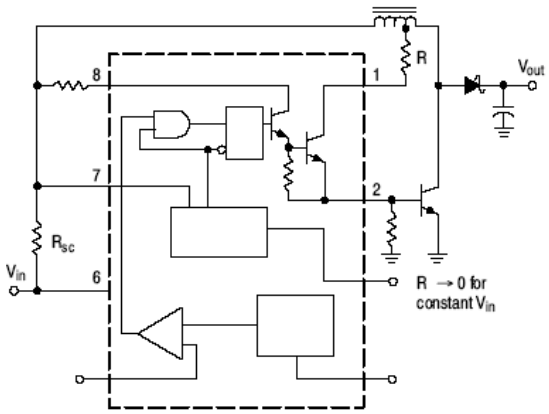


Figure3. Step-Down Converter Application Circuit

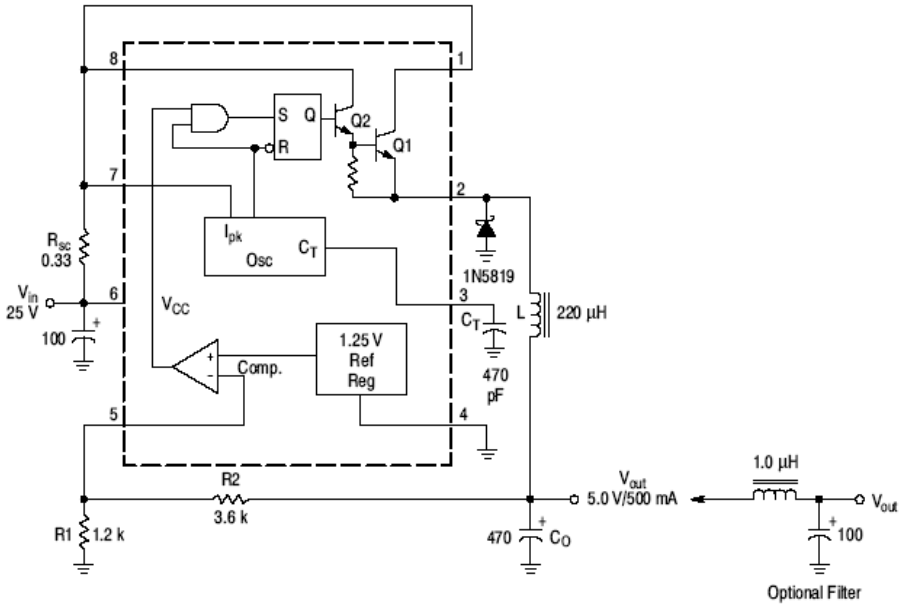
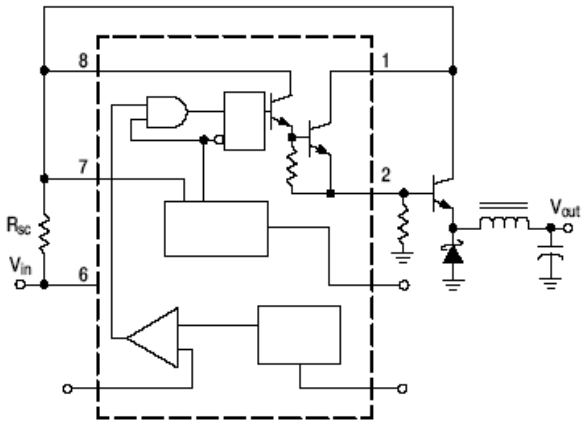


Figure4. External Current Boost Connections for I_C Peak Greater than 1.5 A

4a. External NPN Switch



4b. External Saturated Switch

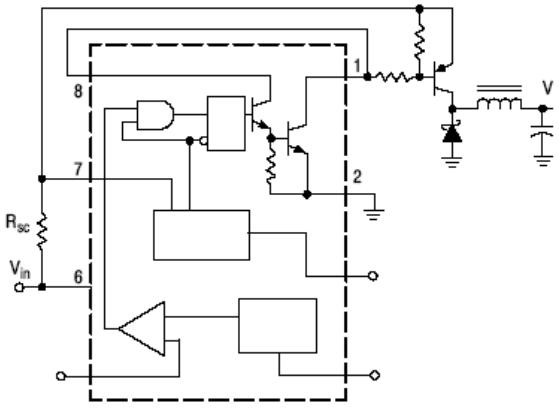


Figure5. Voltage Inverting Converter

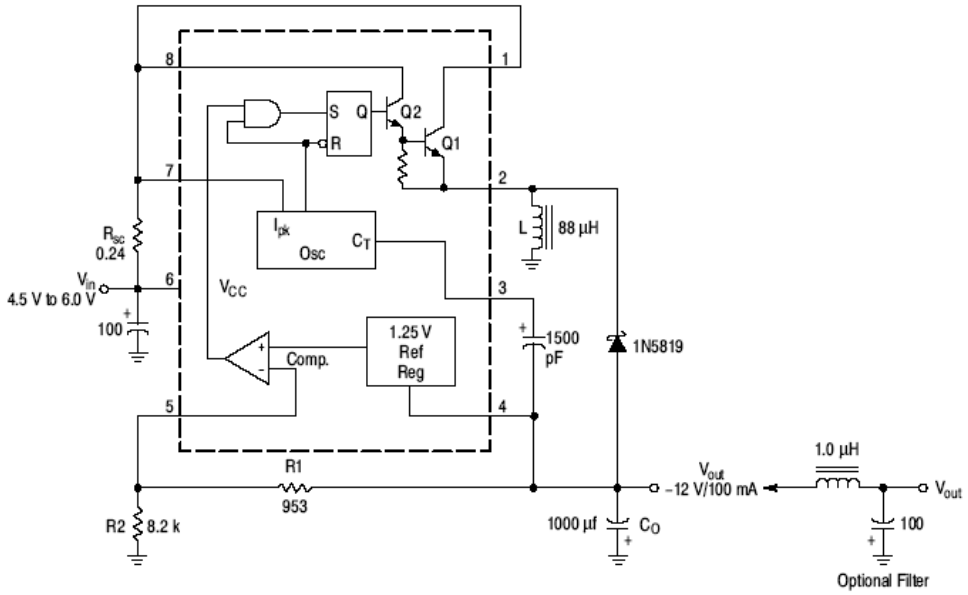
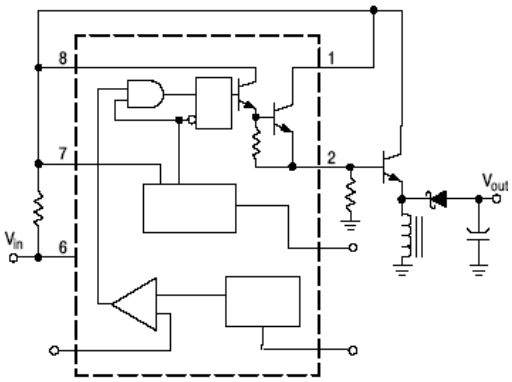
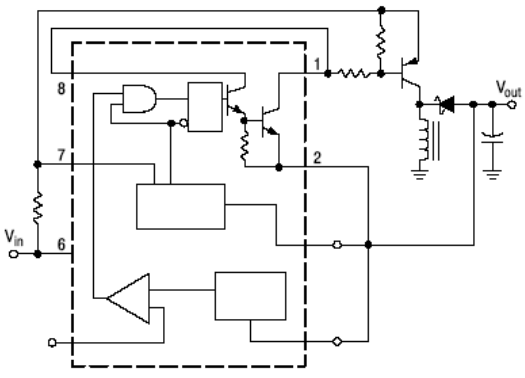


Figure6. External Current Boost Connections for I_C Peak Greater than 1.5 A

6a. External NPN Switch



6b. External NPN Saturated Switch



◆ TYPICAL DESIGN REFERENCE TABLE

Calculation	Step-Up	Step-Down	Voltage Inverting
t_{on} / t_{off}	$\frac{Vout + VF - Vin(min)}{Vin(min) - Vsat}$	$\frac{Vout + VF}{Vin(min) - Vsat - Vout}$	$\frac{\lvert Vout \rvert + VF}{Vin - Vsat}$
$t_{on} + t_{off}$	$\frac{1}{f}$	$\frac{1}{f}$	$\frac{1}{f}$
t_{off}	$\frac{ton + toff}{ton / toff + 1}$	$\frac{ton + toff}{ton / toff + 1}$	$\frac{ton + toff}{ton / toff + 1}$
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}	$0.3/I_{pk(switch)}$	$0.3/I_{pk(switch)}$	$0.3/I_{pk(switch)}$
$L_{(min)}$	$(\frac{(V(min) - V(sat)}{Ipk(switch)}) t_{on(max)}$	$(\frac{(V(min) - V(sat) - Vout)}{Ipk(switch)}) t_{on(max)}$	$(\frac{(V(min) - V(sat)}{Ipk(switch)}) t_{on(max)}$
C_O	$9 \frac{Iout \quad ton}{V \quad ripple(pp)}$	$\frac{Ipk(switch) (ton + toff)}{8V \quad ripple(pp)}$	$9 \frac{Iout \quad ton}{V \quad ripple(pp)}$

V_F: Forward Voltage drop of the output rectifier

V_{sat}: Saturation voltage of the output switch.

The following power supply characteristics must be chosen:

V_{in} - Nominal input voltage

V_{out} - Desired output voltage, $|V_{out}| = 1.25(1 + R1/R2)$

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.

Application concerns:

To get the best regulation performance, Low ESR capacitors at V_{out} are suggested.

◆ TYPICAL PERFORMANCE CHARACTERISTICS

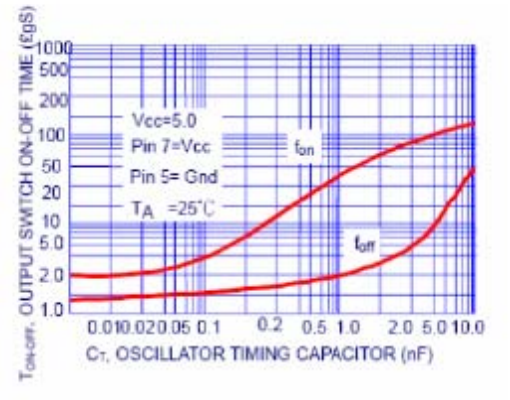


Figure 1. Output Switch On-Off time Oscillator Timing

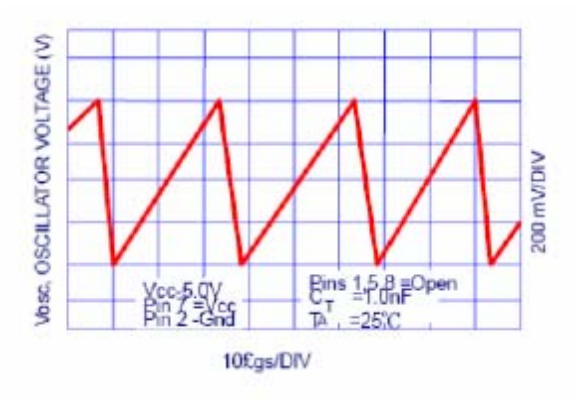


Figure 2. Timing Capacitor Waeform

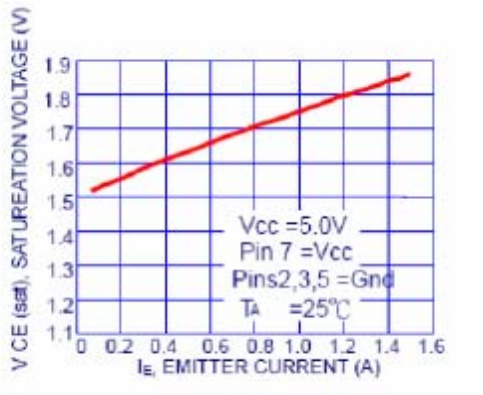


Figure 3. Emitter Follower Configuration Output Saturation Voltage versus Emitter Current

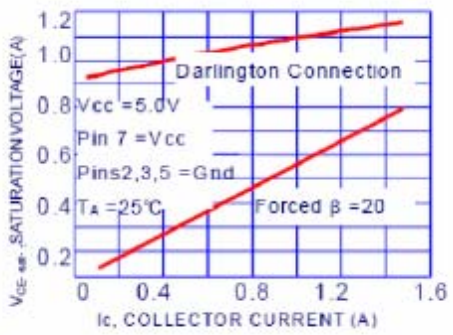


Figure 4. Common Emitter Configuration Output Switch Saturation Voltage versus Collector Current

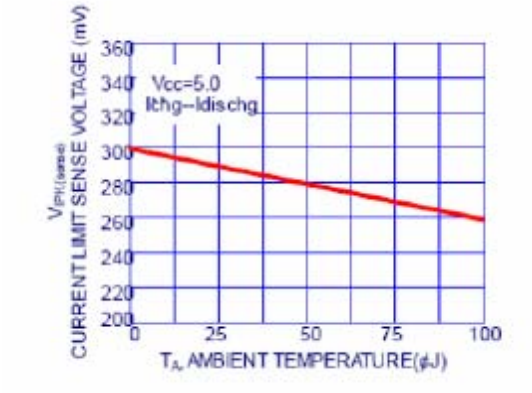


Figure 5. Current Limit Sense Voltage versus Temperature

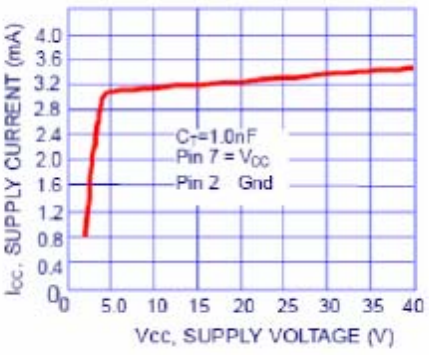
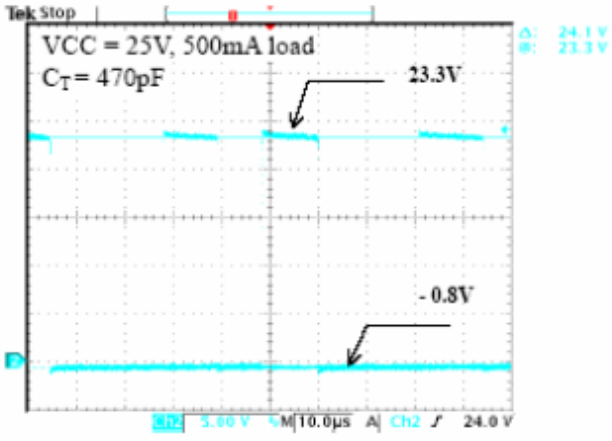
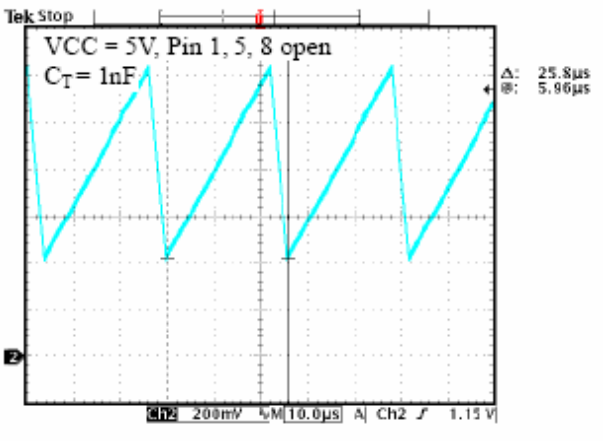


Figure 6. Standby supply Current versus supply Voltage

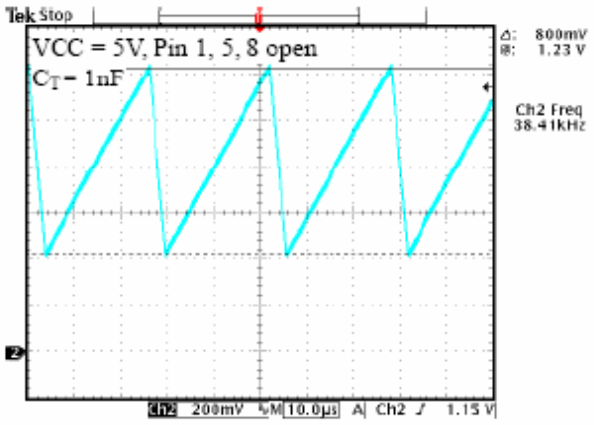
◆ CHARACTERIZATION CURVES



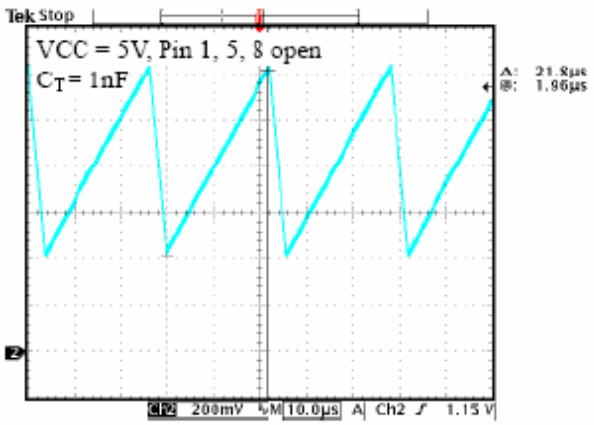
SE pin (PIN # 2)waveform on 5V step down converter



Cap pin (PIN # 3)waveform



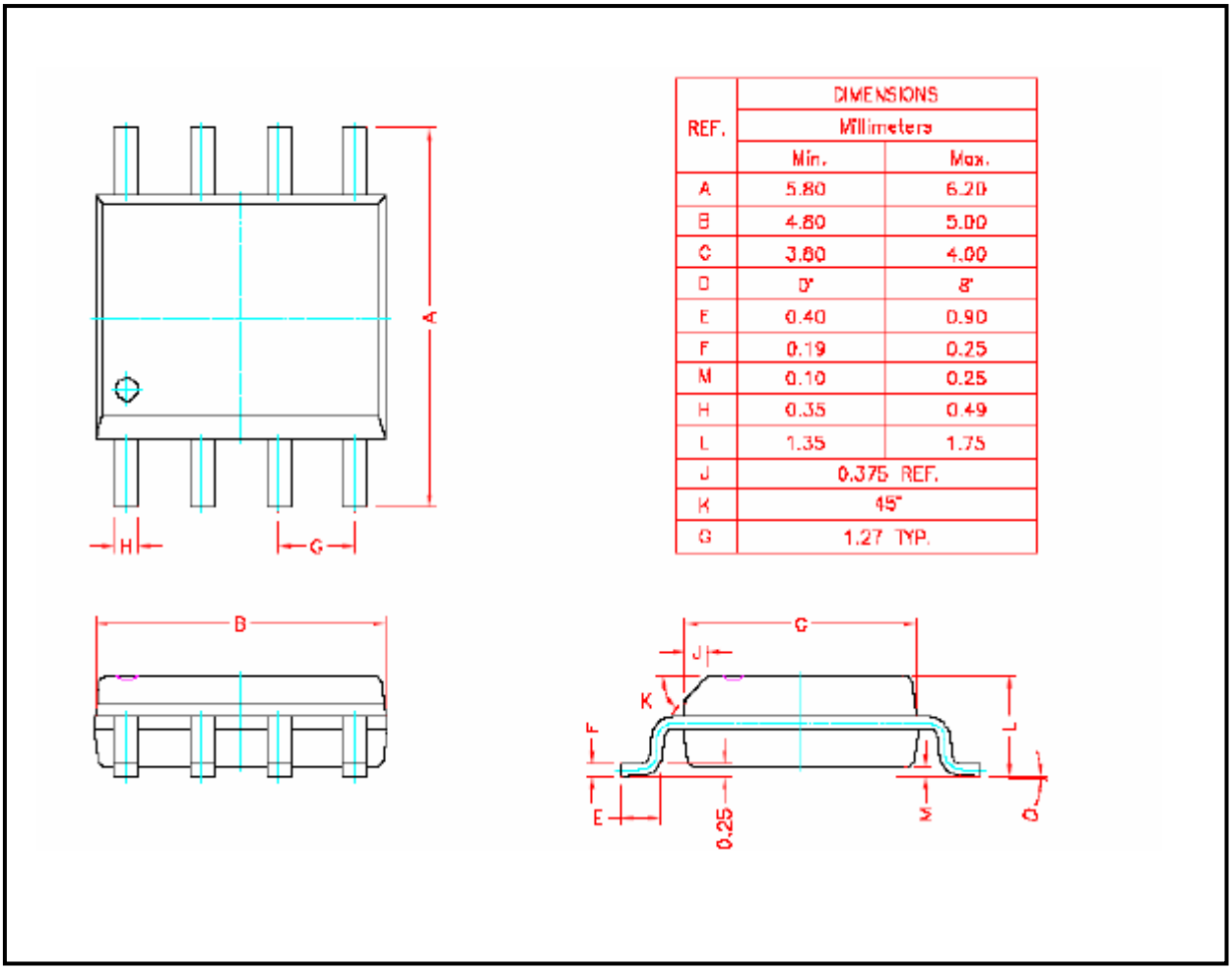
Cap pin (PIN # 3)waveform



Cap pin (PIN # 3)waveform

◆ PHYSICAL DIMENSIONS

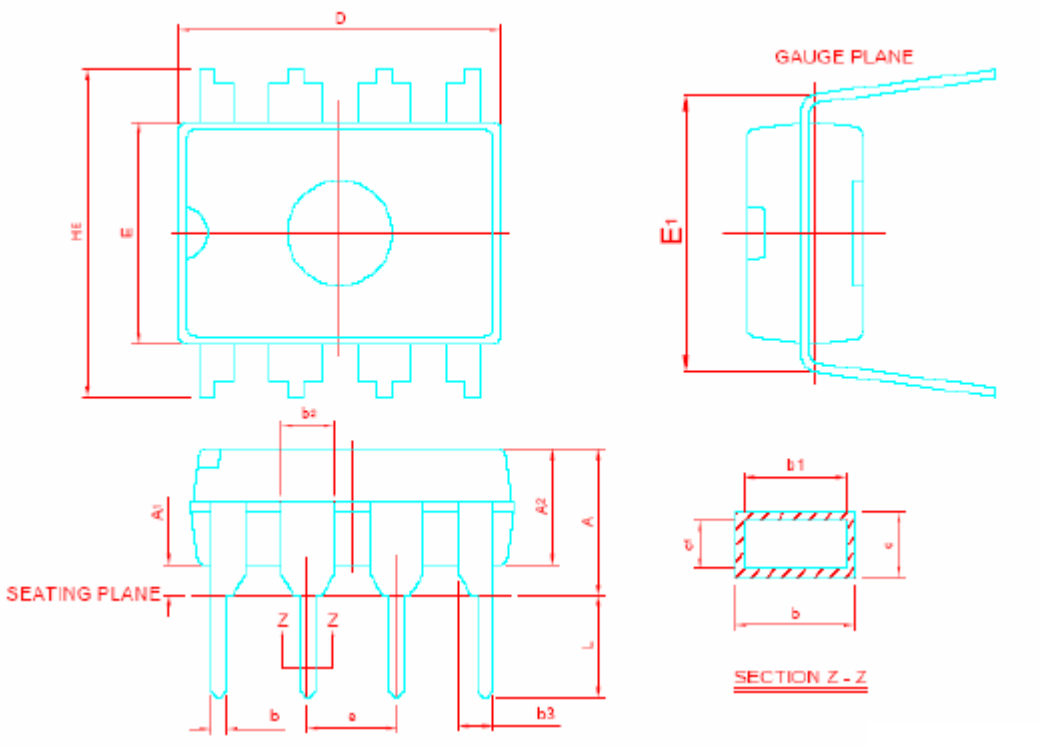
8-Pin Plastic S.O.I.C. (M)



REF.	DIMENSIONS Millimeters	
	Min.	Max.
A	5.80	6.20
B	4.80	5.00
C	3.80	4.00
D	0°	8°
E	0.40	0.90
F	0.19	0.25
M	0.10	0.25
H	0.35	0.49
L	1.35	1.75
J	0.375 REF.	
K	45°	
G	1.27 TYP.	

◆ PHYSICAL DIMENSIONS

8-Pin Plastic DIP (T)



REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	—	5.334	c1	0.203	0.279
A1	0.381	—	D	9.017	10.16
A2	2.921	4.953	E	6.096	7.112
b	0.356	0.559	E1	7.620	8.255
b1	0.356	0.508	e	2.540 BSC	
b2	1.143	1.778	H_E	—	10.92
b3	0.762	1.143	L	2.921	3.810
c	0.203	0.356			