KODENSHI AUK

SN34063x

DC/DC Converter Controller

Description

The SN34063 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 was specifically designed to be incorporated in Step-Down and Step-Up and Voltage-Inverting applications with a minimum number of external components.

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

▲ Marking Information

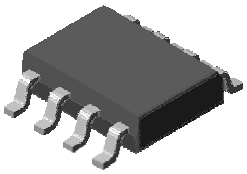
SN34063 (1)
YYWW (2)

(1)Device Code
(2)Year & Week Code

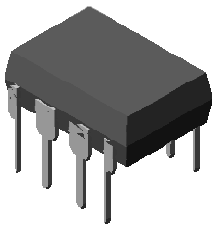
Ordering Information

Type NO.	Marking	Package Code
SN34063	S34063	SOP-8
SN34063P	S34063	DIP-8

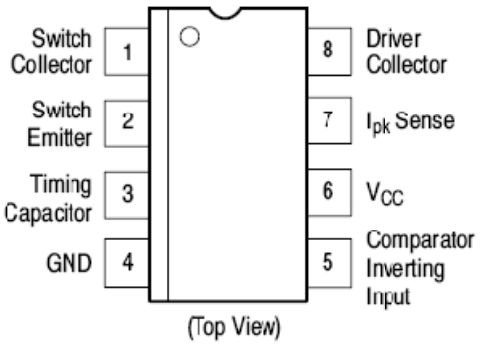
Pin Connection



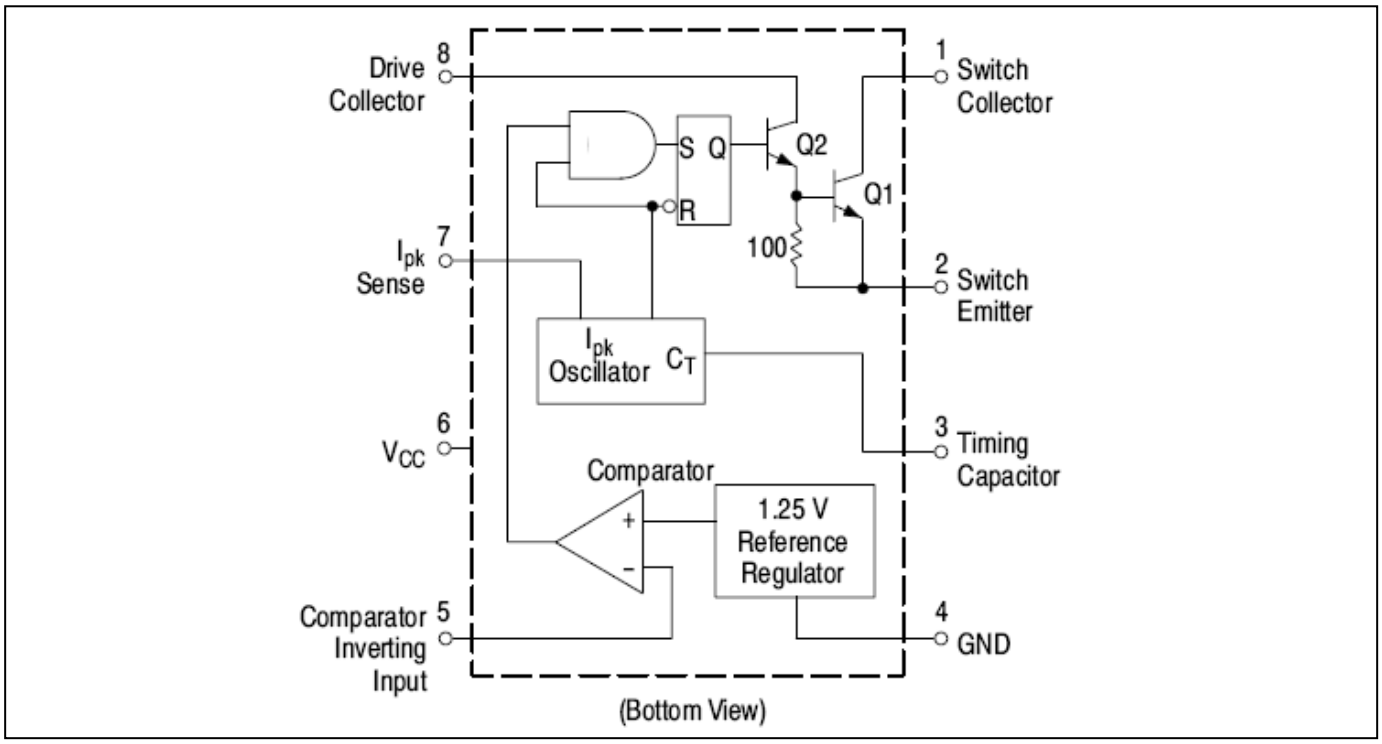
SOP-8



DIP-8



Block Diagram



Absolute Maximum Ratings

[Ta=25℃]

Characteristic	Symbol	Rating	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 (Vpin 1 = 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	P_D	500	mW
Operating Junction Temperature	T_J	+150	℃
Operating Ambient Temperature Range	T_A	-40~+85	℃
Storage Temperature Range	T_{stg}	-65~+150	℃

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

Electrical Characteristics

(V_{CC} = 5.0 V, T_A = -40℃ to +85℃, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit
OSCILLATOR					
Frequency ($V_{Pin\ 5}$ = 0 V, C_T = 1.0 nF, T_A = 25°C)	f_{osc}	24	33	42	kHz
Charge Current (V_{CC} = 5.0 V to 40 V, T_A = 25°C)	I_{chg}	24	33	42	uA
Discharge Current (V_{CC} = 5.0 V to 40 V, T_A = 25°C)	I_{dischg}	140	200	260	uA
Discharge to Charge Current Ratio (Pin 7 to V_{CC}, T_A = 25°C)	I_{dischg}/I_{chg}	5.2	6.2	7.5	-
Current Limit Sense Voltage (I_{chg} = I_{dischg}, T_A = 25°C)	$V_{Ipk(sense)}$	250	300	350	mV
OUTPUT SWITCH (Note 2)					
Saturation Voltage, Darlington Connection (I_{SW} = 1.0 A, Pins 1, 8 connected)	$V_{CE(sat)}$	-	1.0	1.3	V
Saturation Voltage (Note 3) (I_{SW} = 1.0 A, $R_{Pin\ 8}$ = 82Ω to V_{CC}, Forced β= 20)	$V_{CE(sat)}$	-	0.45	0.7	V
DC Current Gain (I_{SW} = 1.0 A, V_{CE} = 5.0 V, T_A = 25°C)	h_{FE}	50	120	-	-
Collector Off − State Current (V_{CE} = 40 V)	$I_{C(off)}$	-	0.01	100	uA
COMPARATOR					
Threshold Voltage T_A = 25°C T_A = -40°C to +85°C	V_{th}	 1.225 1.210	 1.25 1.25	 1.275 1.290	V
Threshold Voltage Line Regulation (V_{CC} = 3.0 V to 40 V)	Regline	-	1.4	5.0	mV
Input Bias Current (V_{IN} = 0 V)	I_{IB}	-	-40	-400	nA
TOTAL DEVICE					
Supply Current (V_{CC} = 5.0 V to 40 V, C_T = 1.0 nF, Pin 7 = V_{CC}, $V_{Pin\ 5}$ > V_{th}, Pin 2 = GND, remaining pins open)	I_{CC}	-	2.5	4.0	mA

Note 2 : Maximum package power dissipation limits must be observed.

Note 3 : If the output switch is driven into hard saturation (Non−Darlington configuration) at low switch currents(≤ 300 mA) and high driver currents (≥ 30 mA), it may take up to 2.0us for it to come out of saturation. This condition will shorten the off time at frequencies ≥ 30 kHz, and is magnified at high temperatures. This condition does not occur with a Darlington configuration, since the output switch cannot saturate. If a Non−Darlington configuration is used, the following output drive condition is recommended:

$$\text{Forced ß of output switch} : \frac{\text{IC output}}{\text{IC driver} - 7.0\text{mA}} \geq 10$$

* The 100Ω resistor in the emitter of the driver device requires about 7.0 mA before the output switch conducts.

Electrical Characteristic Curves

Fig.1 C_T vs. t_{On}-t_{Off}

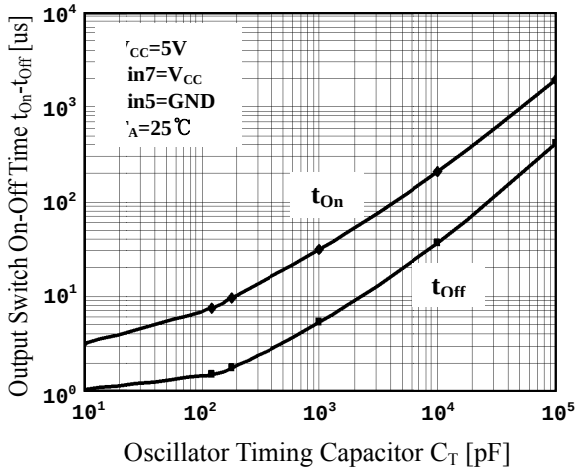


Fig.2 Timing Capacitor Waveform

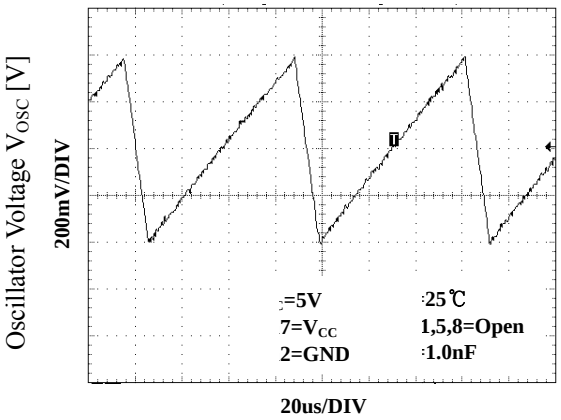


Fig.3 I_E vs. $V_{CE(sat)}$

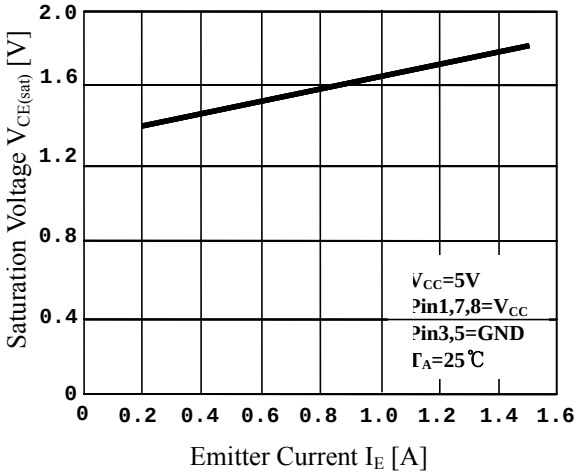


Fig.4 I_C vs. $V_{CE(sat)}$

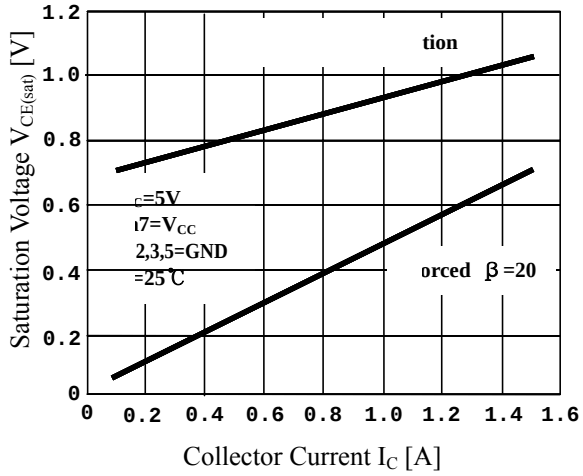


Fig.5 T_A vs. $V_{IPK(sense)}$

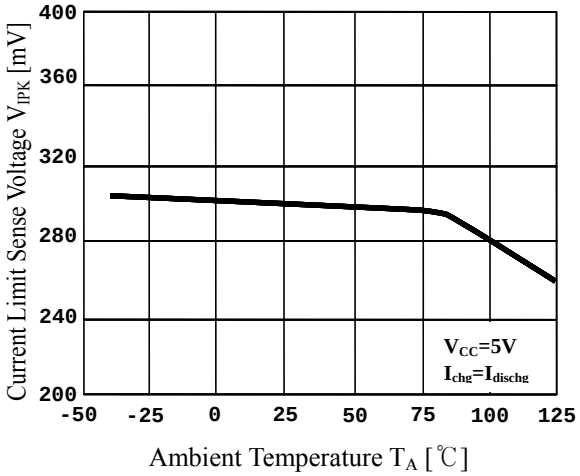
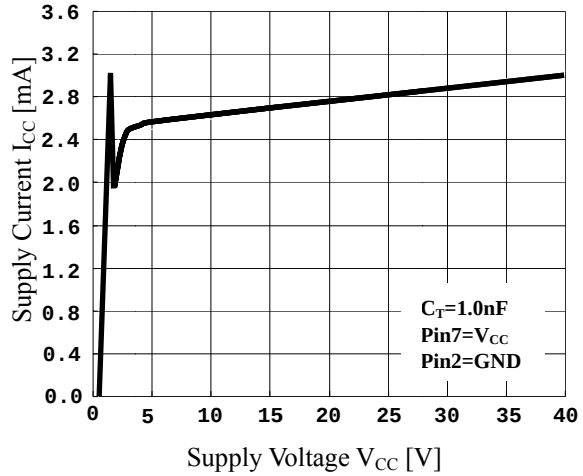


Fig.6 V_{CC} vs. I_{CC}



Typical Application Circuit

Step Up Converter

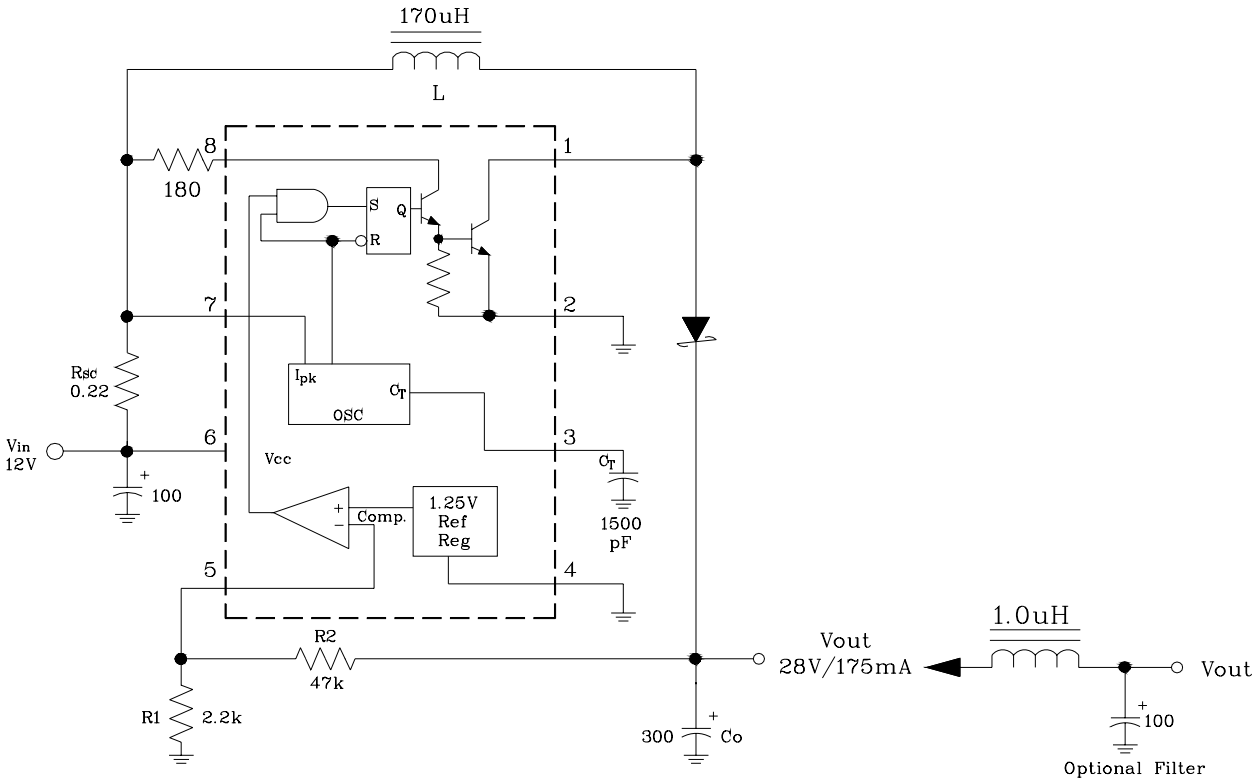


Fig.7 Step Up Converter

Test Condition

Test	Condition	Value (Typ)	Unit
Line Regulation	V_{IN}=8.0V to 16V, I_O=175mA	30	mV
Load Regulation	V_{IN}=12V, I_O=75mA~175mA	10	mV
Output Ripple	V_{IN}=12V, I_O=175mA	300	mV
Efficiency	V_{IN}=12V, I_O=175mA	89	%

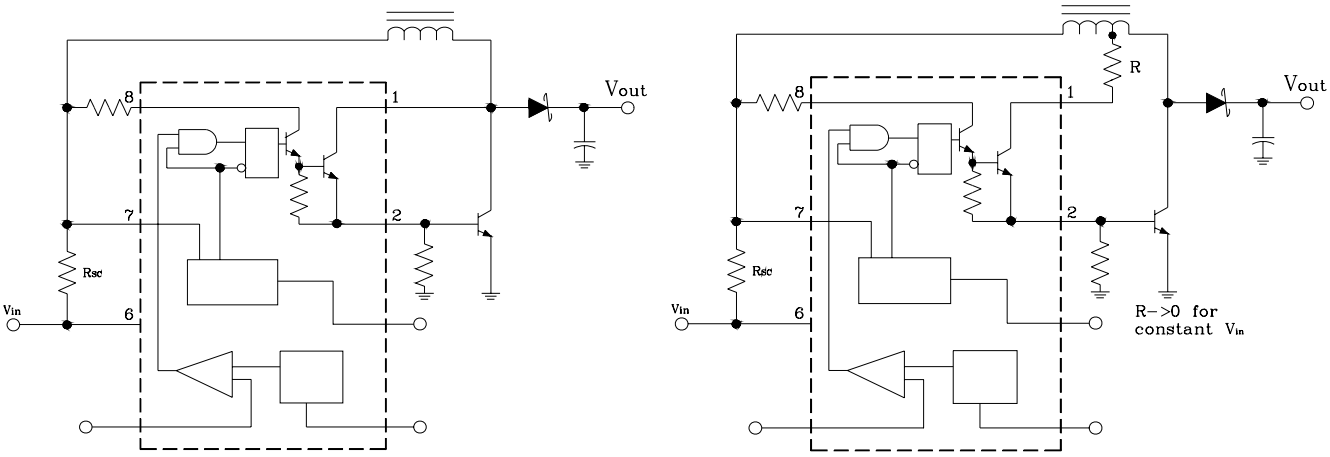


Fig.8 External Current Boost Connections for IC Peak Greater than

8-a. External NPN **8-b. External NPN Saturated**

Typical Application Circuit

Step Down Converter

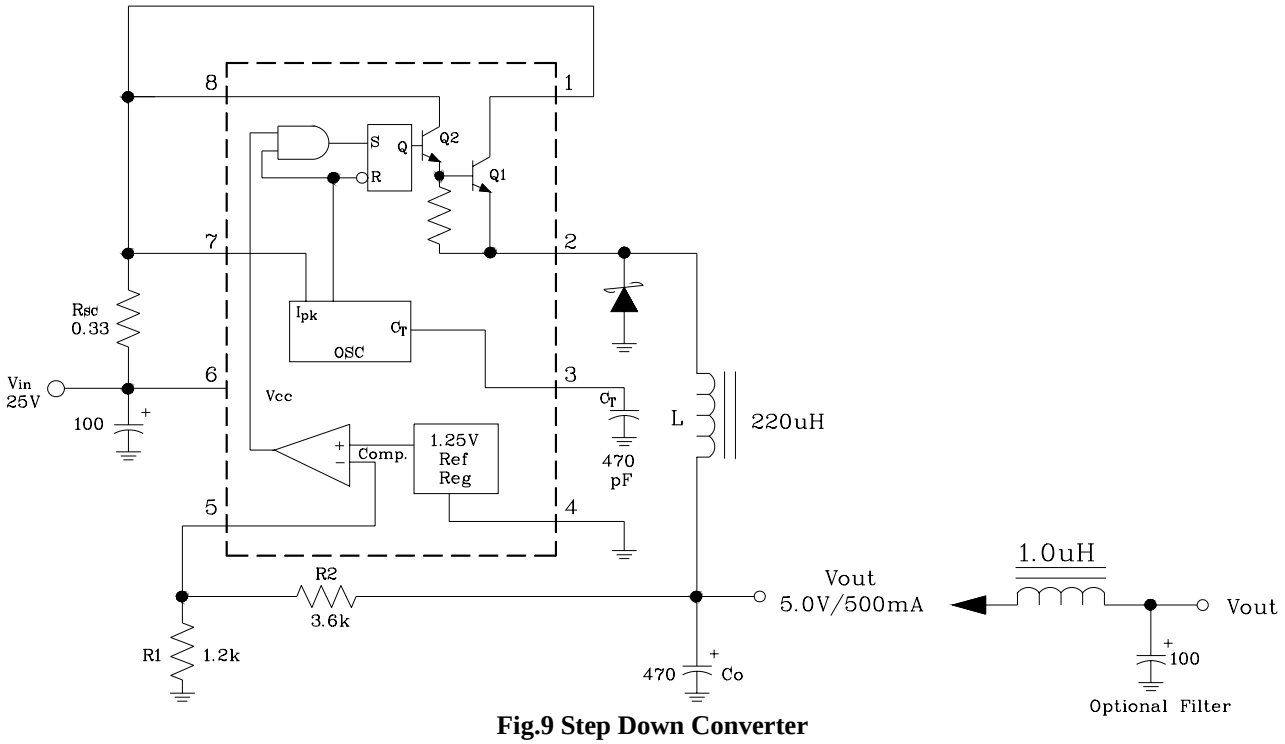


Fig.9 Step Down Converter

Test Condition

Test	Condition	Value (Typ)	Unit
Line Regulation	V_{IN}=15V to 25V, I_O=500mA	5	mV
Load Regulation	V_{IN}=25V, I_O=50mA~500mA	30	mV
Output Ripple	V_{IN}=25V, I_O=500mA	100	mV
Efficiency	V_{IN}=25V, I_O=500mA	80	%
Short Circuit Current	V_{IN}=25V, R_{LOAD}=0.1Ω	1.2	A

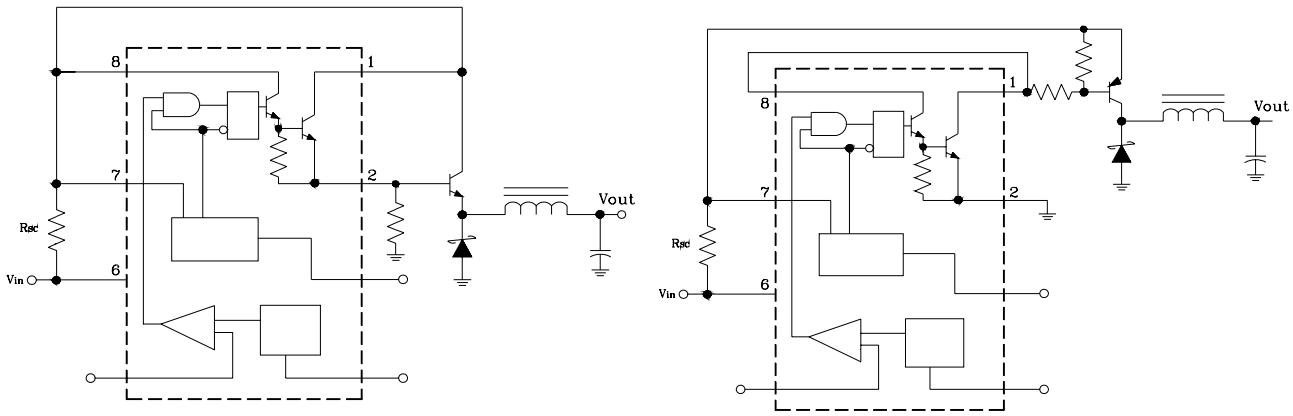


Fig.10 External Current Boost Connections for IC Peak Greater than

10-a. External NPN **10-b. External NPN Saturated**

Typical Application Circuit

Voltage Inverting Converter

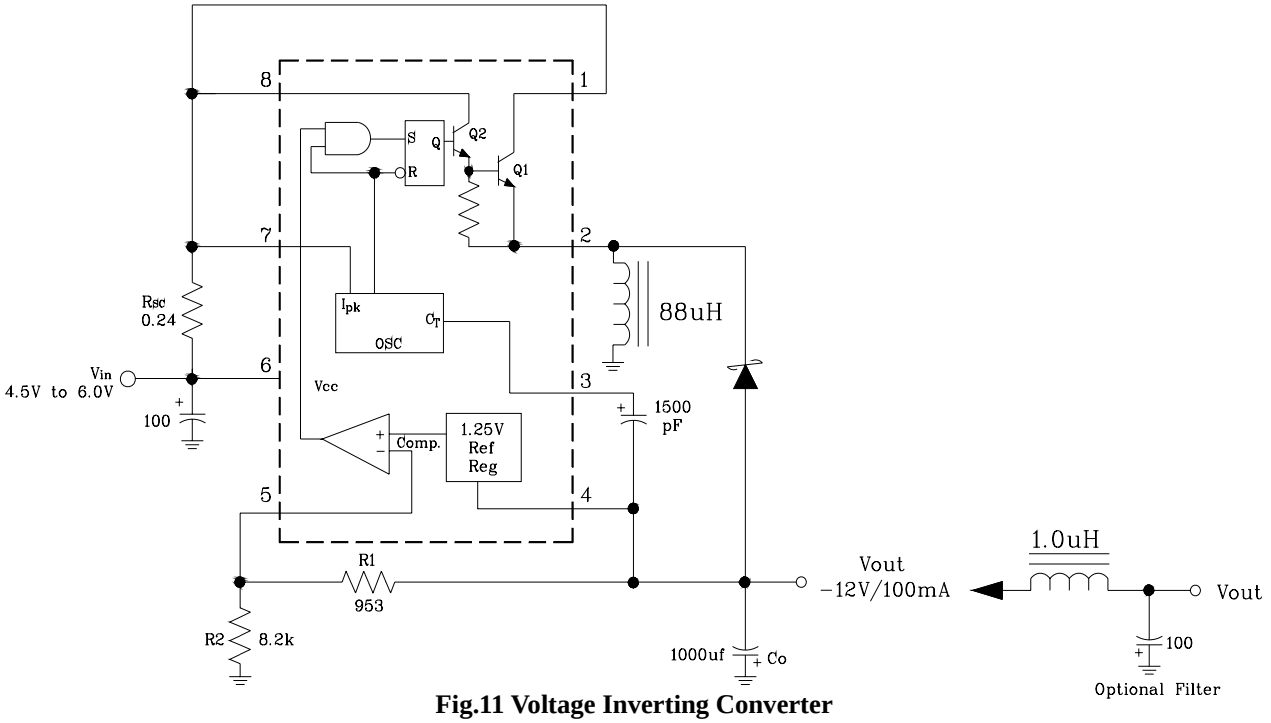


Fig.11 Voltage Inverting Converter

Test Condition

Test	Condition	Value (Typ)	Unit
Line Regulation	V_{IN}=4.5V to 6.0V, I_O=100mA	15	mV
Load Regulation	V_{IN}=5.0V, I_O=10mA~100mA	20	mV
Output Ripple	V_{IN}=5.0V, I_O=100mA	280	mV
Efficiency	V_{IN}=5.0V, I_O=100mA	58	%
Short Circuit Current	V_{IN}=5.0V, R_{LOAD}=0.1Ω	0.9	A

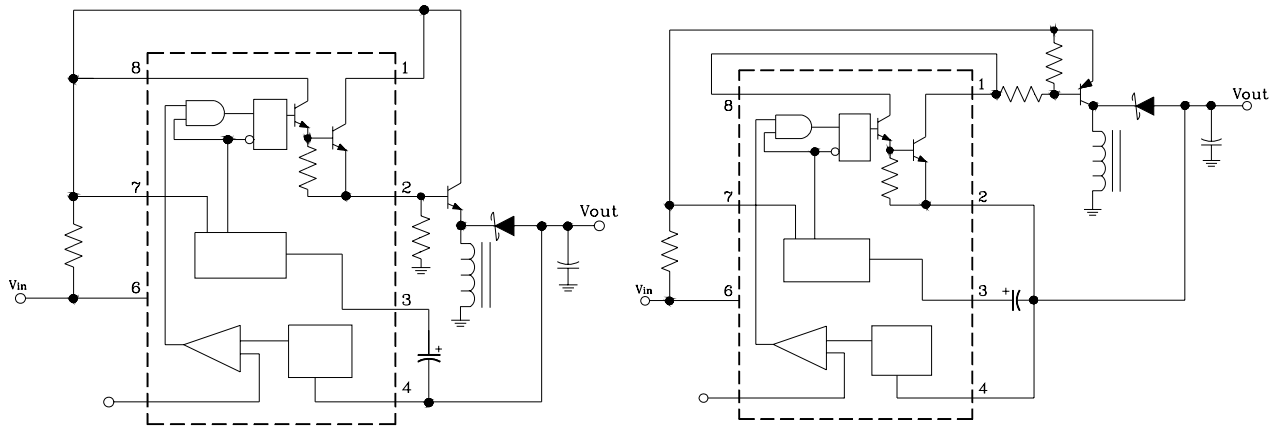


Fig.12 External Current Boost Connections for IC Peak Greater than

12-a. External NPN **12-b. External NPN Saturated**

Calculation

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	$4.0\times10^{-5} t_{ON}$	$4.0\times10^{-5} t_{ON}$	$4.0\times10^{-5} t_{ON}$
$I_{PK(switch)}$	$2I_{OUT(max)}(\frac{t_{ON}}{t_{OFF}} + 1)$	$2I_{OUT(max)}$	$2I_{OUT(max)}(\frac{t_{ON}}{t_{OFF}} + 1)$
R_{SC}	$0.3/I_{PK(switch)}$	$0.3/I_{PK(switch)}$	$0.3/I_{PK(switch)}$
$L_{(min)}$	$(\frac{V_{IN(min)} - V_{sat}}{I_{PK(switch)}}) \times t_{ON(max)}$	$(\frac{V_{IN(min)} - V_{sat} - V_{OUT}}{I_{PK(switch)}}) \times t_{ON(max)}$	$(\frac{V_{IN(min)} - V_{sat}}{I_{PK(switch)}}) \times t_{ON(max)}$
C_O	$9\frac{I_{OUT} t_{ON}}{V_{ripple(pp)}}$	$\frac{I_{PK(switch)}(t_{ON} + t_{OFF})}{8V_{ripple(pp)}}$	$9\frac{I_{OUT} t_{ON}}{V_{ripple(pp)}}$

Note

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.

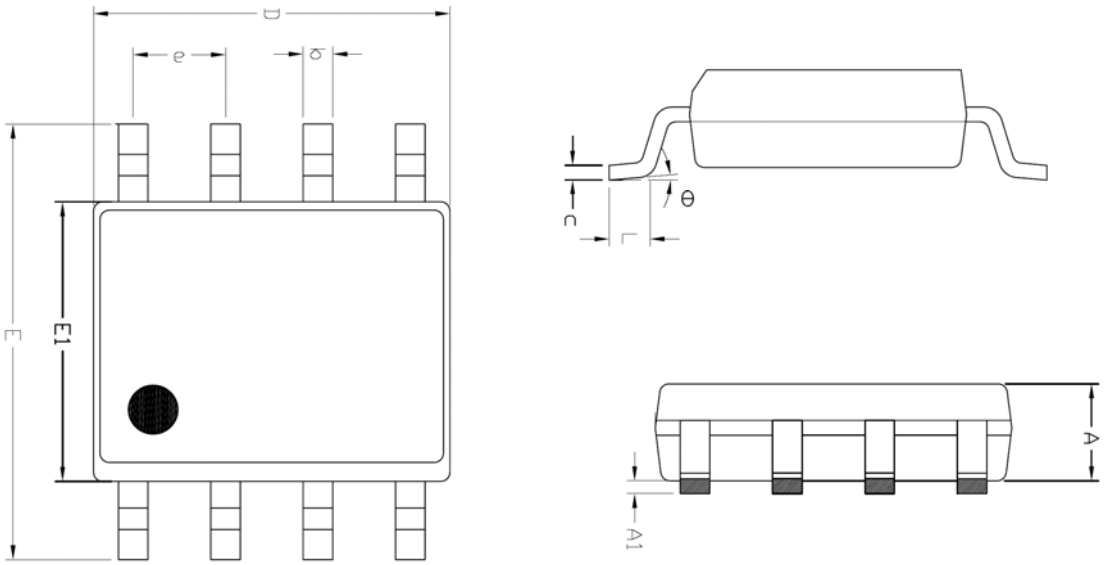
V_{OUT} − Desired output voltage, $\lvert V_{OUT} \rvert = 1.25 \times (1 + R2/R1)$

I_{OUT} − Desired output current.

f_{min} − Minimum desired output switching frequency at the selected values of Vin and IO.

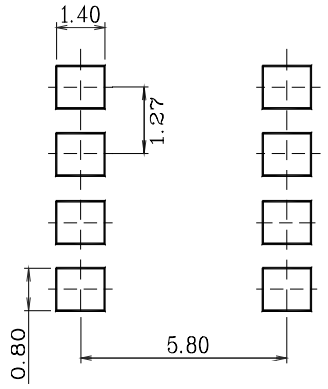
$V_{ripple(pp)}$ − Desired peak−to−peak output ripple voltage. In practice, the calculated capacitor value will need to be increased due to its equivalent series resistance and board layout. The ripple voltage should be kept to a low value since it will directly affect the line and load regulation.

Outline Dimension (Unit : mm) [SOP-8]

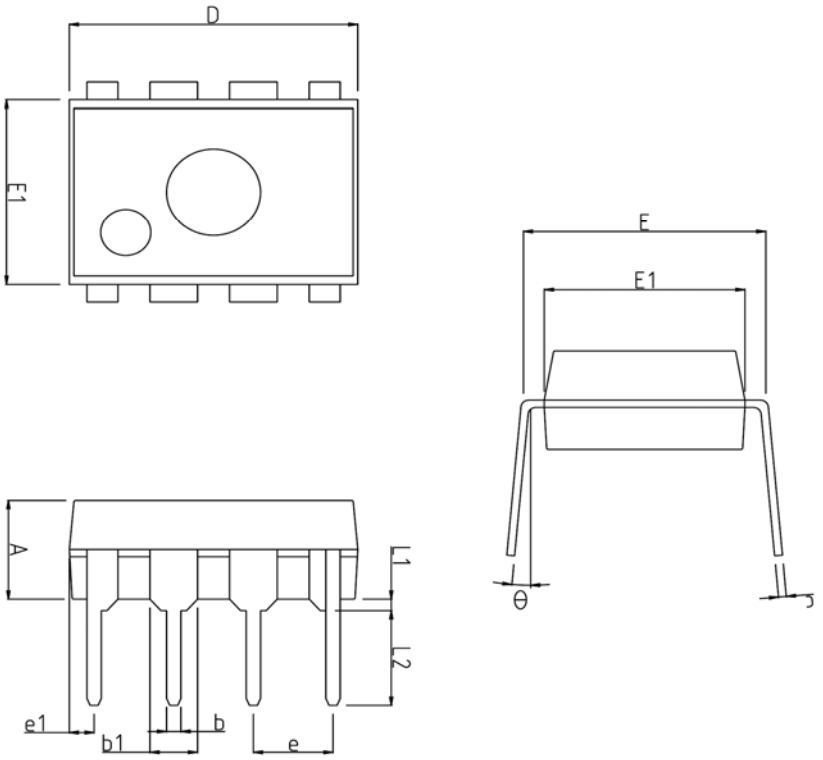


SYMBOL	MILLIMETER(mm)			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	1.245	—	1.445	
A1	0.125	0.175	0.275	
b	0.320	0.420	0.520	
c	0.170	0.220	0.270	
D	4.802	4.902	5.002	
E	5.870	6.020	6.170	
E1	3.761	3.861	3.961	
e	1.270 BSC			
L	0.462	0.562	0.662	
θ	0 °	—	8 °	

※ Recommend PCB solder land (Unit : mm)



Outline Dimension (Unit : mm) [DIP-8]



SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	3.20	3.40	3.60	
b	0.36	0.46	0.56	
b1	1.42	1.52	1.62	
c	0.20	0.25	0.35	
D	9.00	9.20	9.40	
E	7.37	7.62	7.87	
E1	6.20	6.40	6.60	
e	2.54 TYP			
e1	0.79 TYP			
L1	0.33	–	–	
L2	3.00	3.30	3.60	
θ	0°	–	15°	

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