Versatile DC/DC Converter

FEATURES

- Operates from 3V to 30V input voltage
- Internal 2A peak current switch.
- Continuous output current of 1.5A
- Bootstrapped driver.
- High-side current sense capability.
- High efficiency (up to 90%).
- Internal ±2% reference.
- Low quiescent current at 1.6mA.
- Operating frequency from 100Hz to 100KHz.

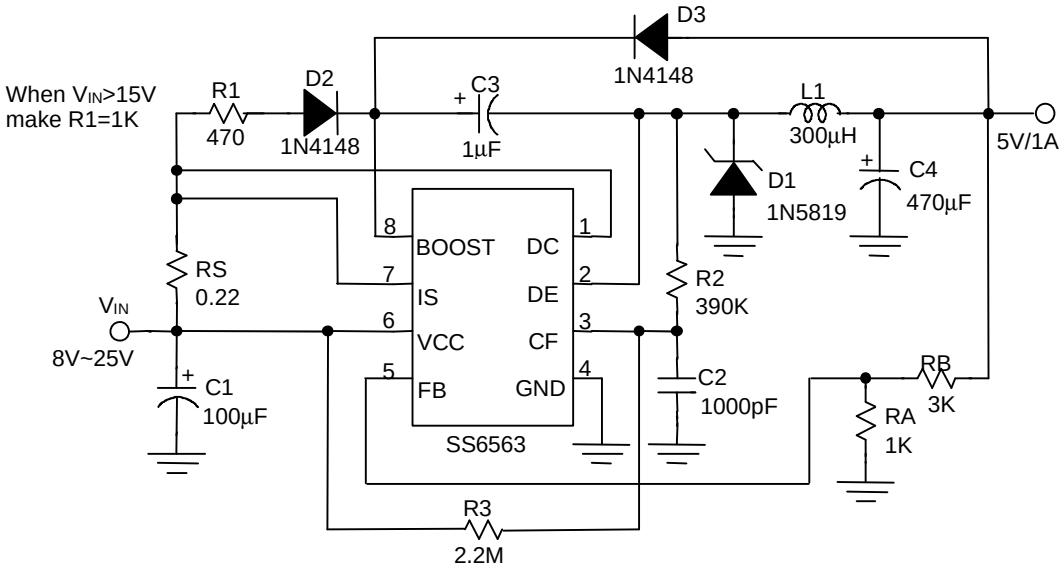
APPLICATIONS

- Constant Current Source for Battery Chargers.
- Saver for Cellular phones.
- Step-Down DC/DC Converter Module.

DESCRIPTION

The SS6563 is a monolithic control circuit that provides the primary functions required for DC to DC converters and high-side-sensed constant current sources. The device consists of an internal temperature compensated reference, comparator, controlled duty-cycle oscillator with an active current-sense circuit, bootstrapped driver, and high-current output switch. This device is specifically designed to construct a constant current source for battery chargers with a minimum number of external components. A bootstrapped driver can drive the NPN output switch to saturation for higher efficiency and less heat dissipation. The SS6563 can deliver 1.5A continuous current without requiring a heat sink.

TYPICAL APPLICATION CIRCUIT



Line Regulation	V_{IN} = 10V~20V @ I_O=1A	40mV
Load Regulation	V_{IN} = 15V, @ I_O=100mA~1A	20mV
Short Circuit Current	V_{IN} =15V, @ R_L = 0.1Ω	1.3A

Step-Down Converter

ORDERING INFORMATION

SS6563-CXXX

- Packing
  - TR: Tape and reel
  - TB: Tubes
- Package type
  - N: PDIP-8 (only available in tubes)
  - S: SO-8

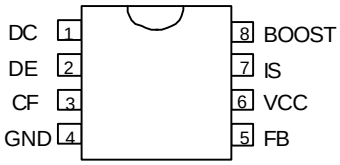
Example: SS6563CSTR

→ in SO-8 package shipped in tape and reel

PIN CONFIGURATION

PDIP-8, SO-8

TOP VIEW



ABSOLUTE MAXIMUM RATINGS

Supply Voltage 30V

Comparator Input Voltage Range ..... -0.3V~30V

Switch Collector Voltage 30V

Switch Emitter Voltage 30V

Switch Collector to Emitter Voltage 30V

Driver Collector Voltage 30V

Switch Current 2A

Power Dissipation and Thermal Characteristics

DIP Package

Ta= 25°C 1.0W

Thermal Resistance ..... 100°C/W

SO Package

Ta= 25°C 625mW

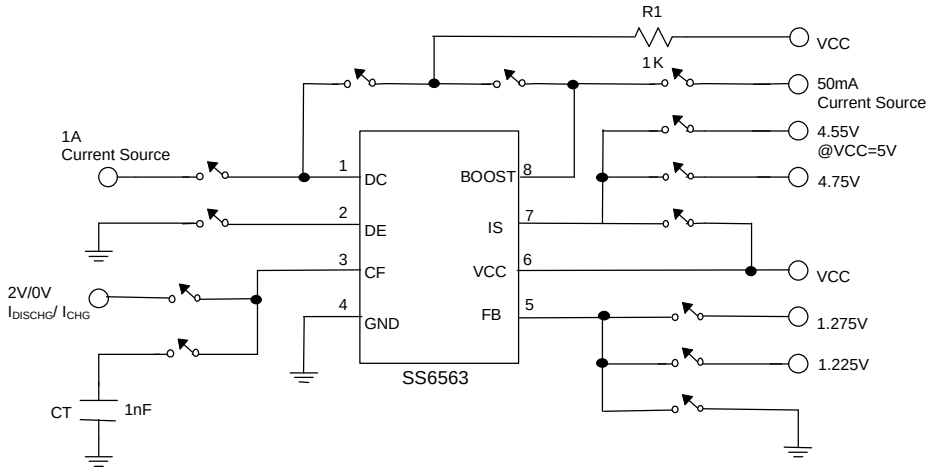
Thermal Resistance ..... 160°C/W

Operating Junction Temperature ..... 125°C

Operating Ambient Temperature Range ..... 0~70°C

Storage Temperature Range ..... - 65°C ~ 150°C

TEST CIRCUIT



ELECTRICAL CHARACTERISTICS (VCC= 5V, TA=25°C, unless otherwise specified.)

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Oscillator						
Charging Current	5.0V≤VCC≤30V	I_{CHG}	10	25	40	µA
Discharge Current	5.0V≤VCC≤30V	I_{DISCHG}	100	150	200	µA
Voltage Swing	PIN 3	V_{OSC}		0.6		V
Discharge to Charge Current Ratio	V_{IS} =VCC	I_{DISCHG} / I_{CHG}		6.0		
Current Limit Sense Voltage	$I_{CHG}=I_{DISCHG}$	VCC – V_{IS}	250	300	350	mV
Output Switch						
Saturation Voltage, Emitter Follower Connection	I_{DE}=1.0A; V_{BOOST} =V_{DC} = VCC	$V_{CE(SAT)}$		1.5	1.8	V
Saturation Voltage	I_{DC}=1.0A; I_{BOOST} =50mA, (Forced β≅20)	$V_{CE\ (SAT)}$		0.4	0.7	V
DC Current Gain	I_{SC} =1.0A; V_{CE}=5.0V	h_{FE}	35	120		
Collector Off-State Current	V_{CE}=30V	$I_{C(OFF)}$		10		nA

ELECTRICAL CHARACTERISTICS (VCC= 5V, TA=25°C, unless otherwise specified.)

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Comparator						
Threshold Voltage	T_A=25°C 0°C ≤ T_A ≤ 70°C	V_{FB}	1.225 1.21	1.25	1.275 1.29	V V
Threshold Voltage Line Regulation	3.0V≤VCC≤30V	REG_{LINE}		0.1	0.3	mV/V
Input Bias Current	V_{IN}=0V	I_{IB}		0.4	1	μA
Supply Current	V_{IS} =VCC, pin 5>V_{FB} 5.0V≤ VCC ≤30V C_T=1nF PIN 2=GND Remaining pins open	I_{CC}		1.6	3	mA

TYPICAL PERFORMANCE CHARACTERISTICS

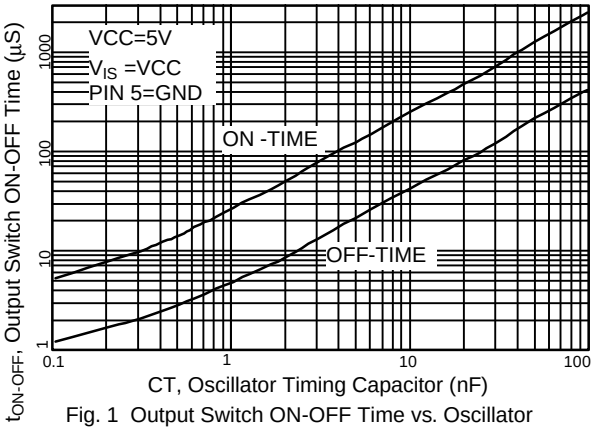


Fig. 1 Output Switch ON-OFF Time vs. Oscillator Timing Capacitor

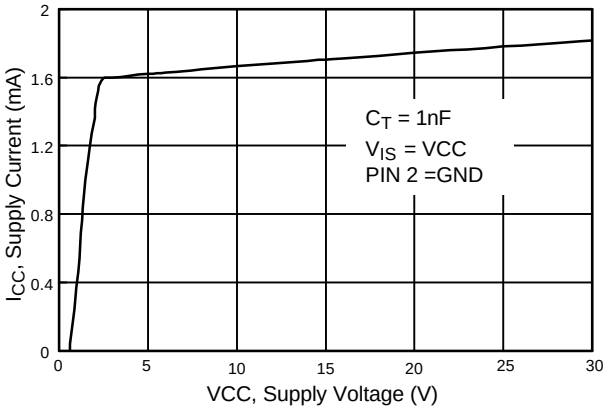


Fig. 2 Standby Supply Current vs. Supply Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

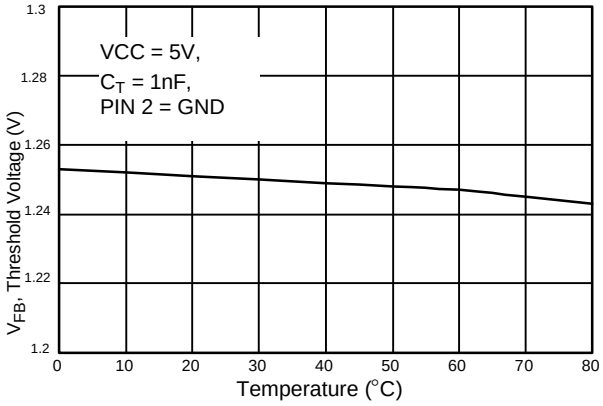


Fig. 3 V_{FB}, Threshold Voltage vs. Temperature

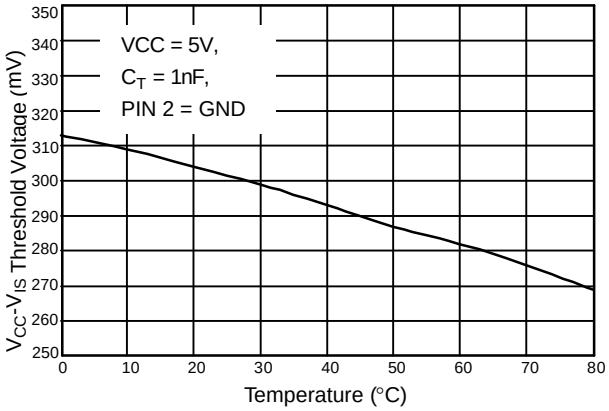


Fig. 4 I_S Threshold Voltage vs. Temperature

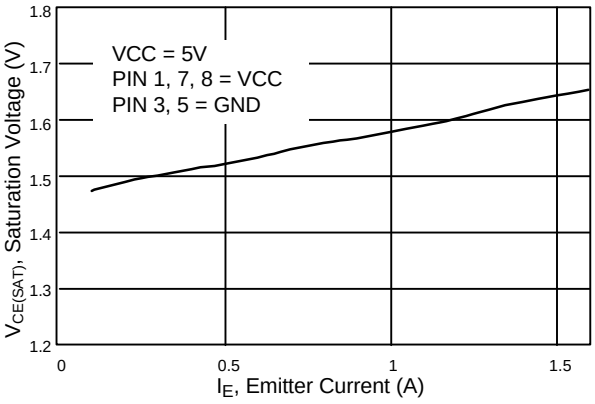


Fig. 5 Emitter Follower Configuration Output Switch Saturation Voltage vs. Emitter Current

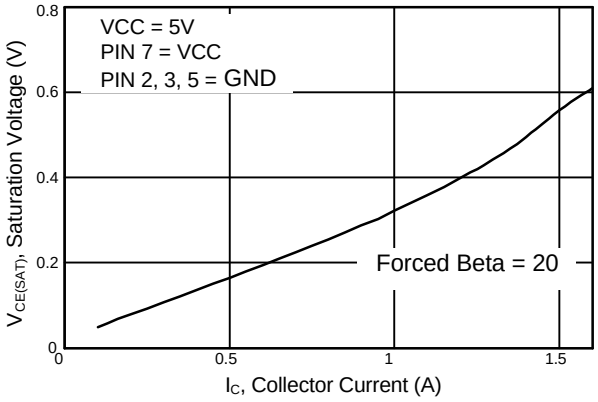
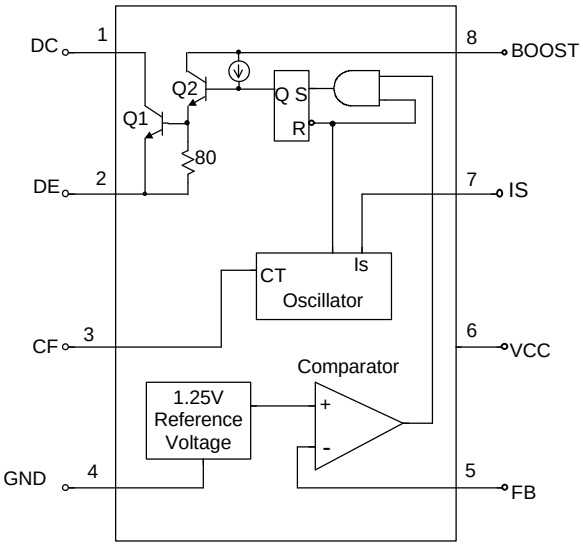


Fig. 6 Common Emitter Configuration Output Switch Saturation Voltage vs. Collector Current

BLOCK DIAGRAM



PIN DESCRIPTIONS

PIN 1: DC - The collector of the switch - 2A.

PIN 2: DE - Darlington switch emitter.

PIN 3: CF - Oscillator timing capacitor.

PIN 4: GND - Power ground.

PIN 5: FB - Feedback comparator inverting input.

PIN 6: VCC - Power supply input.

PIN 7: IS - Highside current sense input. VCC - V_{IS}=300mV.

PIN 8: BOOST - Bootstrapped driver collector.

APPLICATION INFORMATION

DESIGN FORMULA TABLE

CALCULATION	STEP-DOWN	STEP-UP
$\frac{t_{ON}}{t_{OFF}}$	$\frac{V_{OUT} + V_F}{V_{IN(MIN)} - V_{SAT} - V_{OUT}}$	$\frac{V_{OUT} + V_F - V_{IN(MIN)}}{V_{IN(MIN)} - V_{SAT}}$
$(t_{ON} + t_{OFF})_{MAX}$	$\frac{1}{F_{MIN}}$	$\frac{1}{F_{MIN}}$
C_T	$4x10^{-5}t_{ON}$	$4 \times 10^{-5}t_{ON}$
$I_{C\ (SWITCH)}$	$2I_{OUT(MAX)}$	$2I_{OUT(MAX)}\ (\frac{t_{ON} + t_{OFF}}{t_{OFF}})$
RS	$0.3/I_{C(SWITCH)}$	$0.3/\ I_{C\ (SWITCH)}$
L(MIN)	$(\frac{V_{IN(MIN)} - V_{SAT} - V_{OUT}}{I_{C(SWITCH)}})t_{ON(MAX)}$	$(\frac{V_{IN(MIN)} - V_{SAT}}{I_{C(SWITCH)}})t_{ON(MAX)}$
Co	$\frac{I_{C(SWITCH)}\ (t_{ON} + t_{OFF})}{8V_{RIPPLE(P-P)}}$	$\frac{I_{OUT}\ t_{ON}}{V_{RIPPLE(P-P)}}$

V_{SAT} = Saturation voltage of the output switch.
V_F = Forward voltage of the ringback rectifier

The following power supply characteristics must be chosen:

V_{IN} - Nominal input voltage.

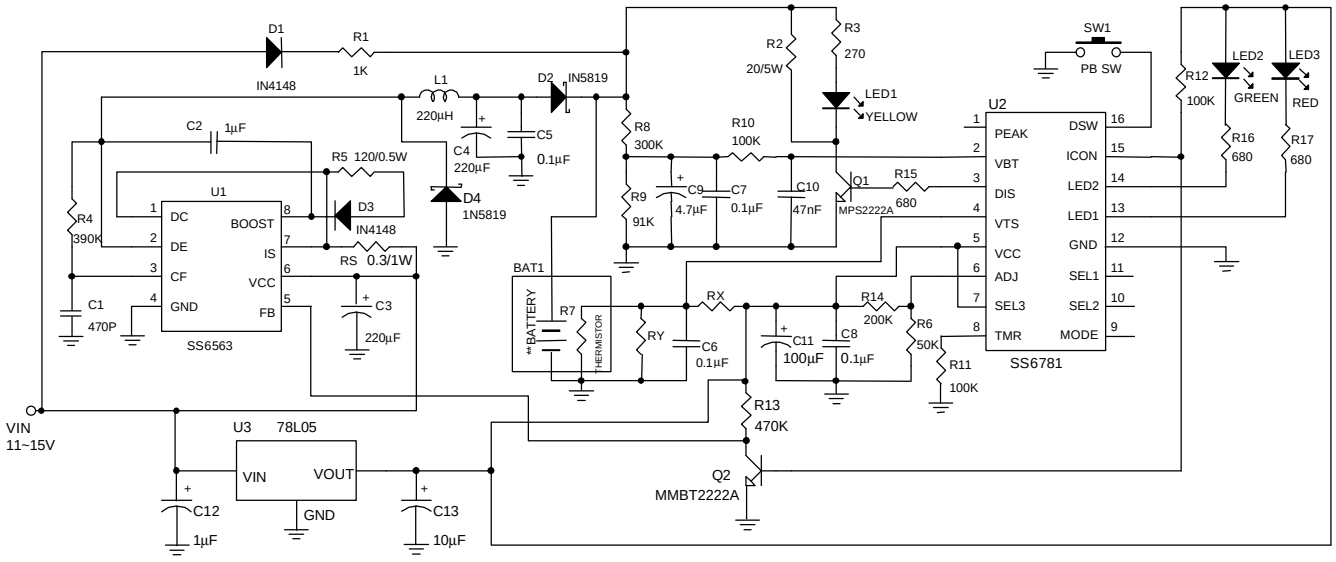
V_{OUT} - Desired output voltage, V_{OUT} = 1.25 (1 + RB/RA)

I_{OUT} - Desired output current.

F_{MIN} - Minimum desired switching frequency at selected values for V_{IN} and I_{OUT}.

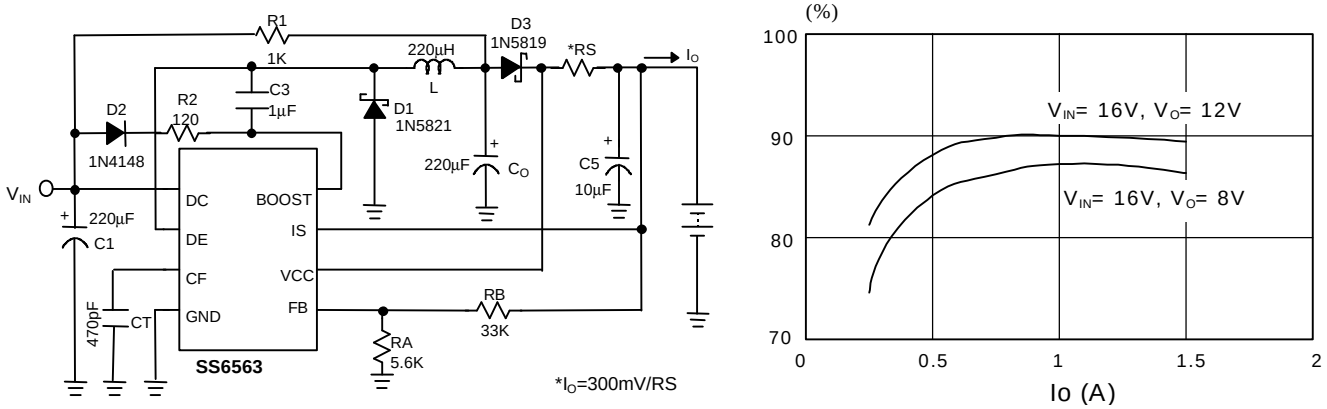
$V_{RIPPLE\ (P-P)}$ - Desired peak-to-peak output ripple voltage. In practice, the calculated value will need to be increased due to the capacitor equivalent series resistance and board lay-out. The ripple voltage should be kept to a low value since it will directly affect the line and load regulation.

APPLICATION EXAMPLES



**3~5 NiMH/NiCd cells.
Note: Charge Current=0.3/RS Ampere
Safety Timer: 80min

Fig. 1 Battery Charger Circuit for Fluctuating Charging Current Applications



Efficiency vs Output Current

Fig. 2 Battery Charge Circuit

APPLICATION EXAMPLES (Continued)

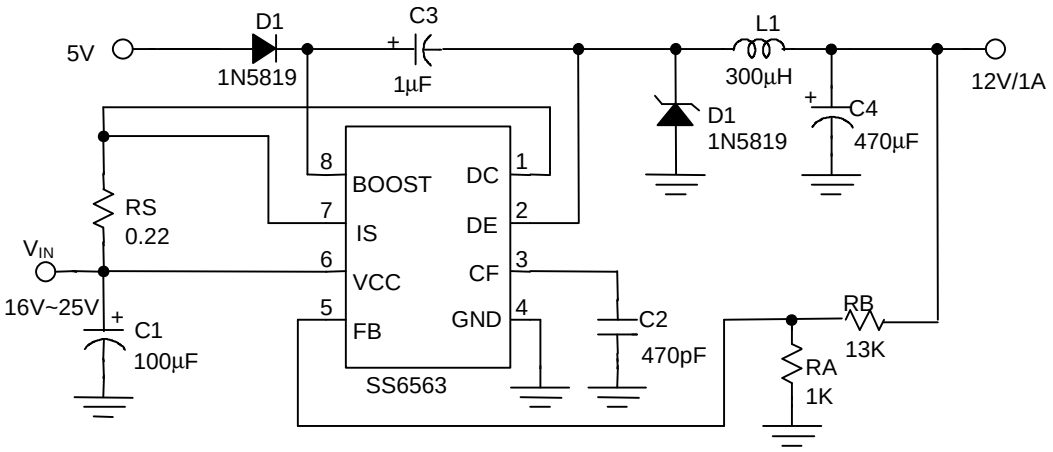
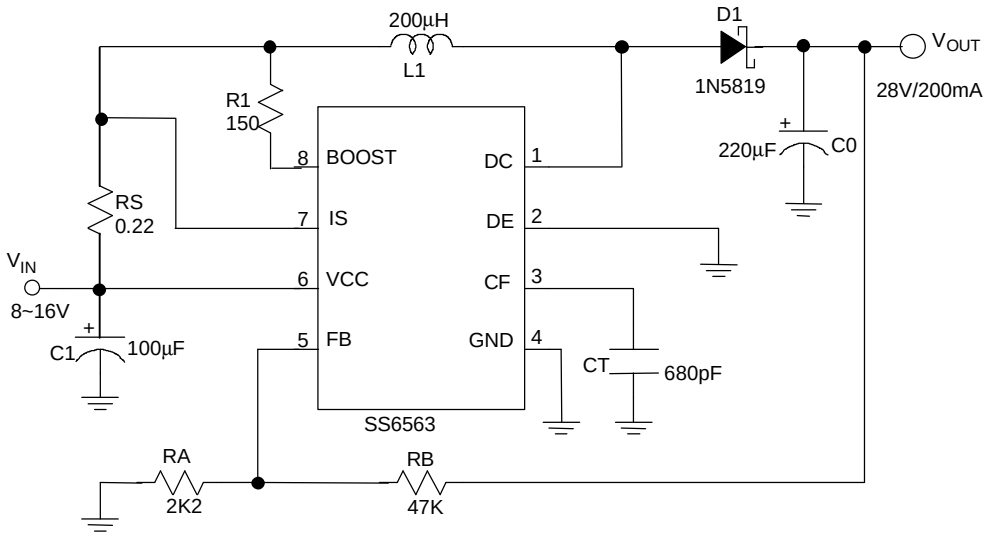


Fig. 3 Step-Down Converter with External 5V Bootstrap



Line Regulation	V_{IN} = 8V~16V @ I_O=200mA	100mV
Load Regulation	V_{IN} = 12V, @ I_O=80mA~200mA	40mV

Fig. 4 Step-Up Converter

APPLICATION EXAMPLES (Continued)

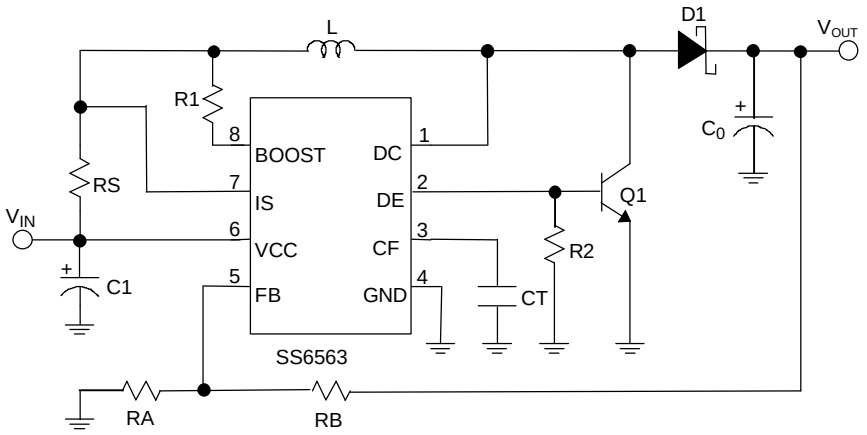
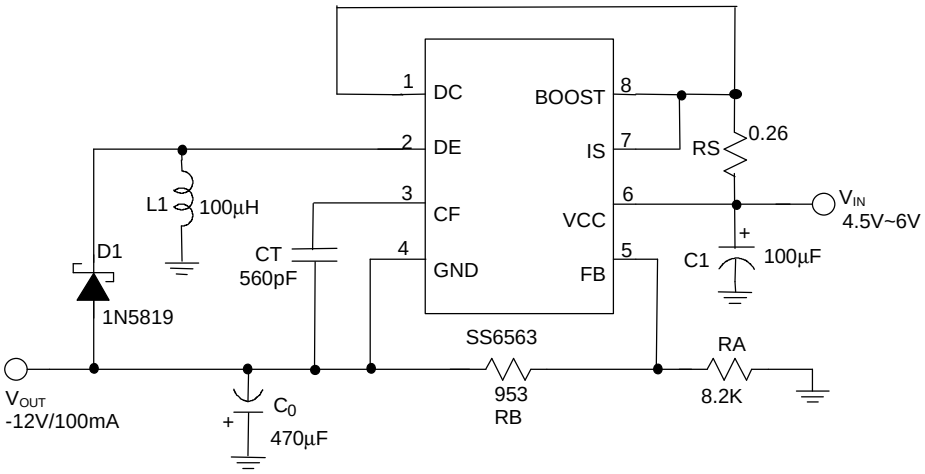


Fig. 5 Step-Up Converter with External NPN Switch

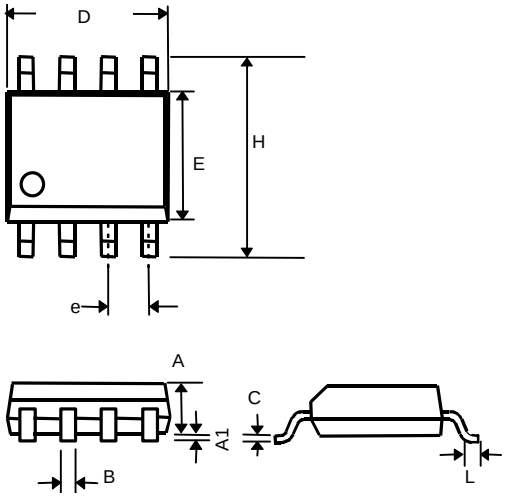


Line Regulation	V_{IN} = 4.5V~6V @ I_O=100mA	20mV
Load Regulation	V_{IN} = 5V, @ I_O=10mA~100mA	100mV

Fig. 6 Inverting Converter

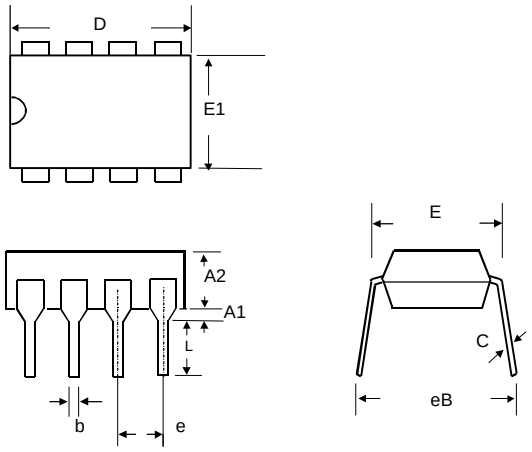
PHYSICAL DIMENSIONS

8 LEAD PLASTIC SO (unit: mm)



SYMBOL	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.33	0.51
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27(TYP)	
H	5.80	6.20
L	0.40	1.27

8 LEAD PLASTIC DIP (unit: mm)



SYMBOL	MIN	MAX
A1	0.381	—
A2	2.92	4.96
b	0.35	0.56
C	0.20	0.36
D	9.01	10.16
E	7.62	8.26
E1	6.09	7.12
e	2.54 (TYP)	
eB	—	10.92
L	2.92	3.81