

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 $\pm 2\%$ reference.
- Low quiescent current at 1.6mA.
- Operating frequency from 100Hz to 100KHz.

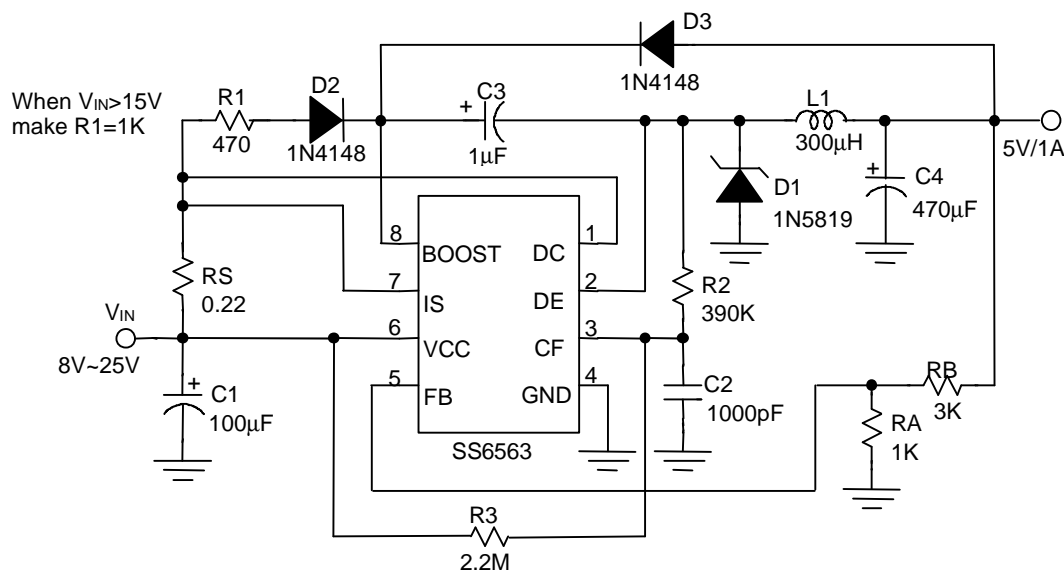
APPLICATIONS

- 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

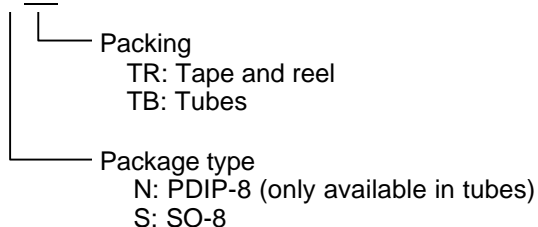


Line Regulation	$V_{IN} = 10V \sim 20V @ I_o = 1A$	40mV
Load Regulation	$V_{IN} = 15V, @ I_o = 100mA \sim 1A$	20mV
Short Circuit Current	$V_{IN} = 15V, @ R_L = 0.1\Omega$	1.3A

Step-Down Converter

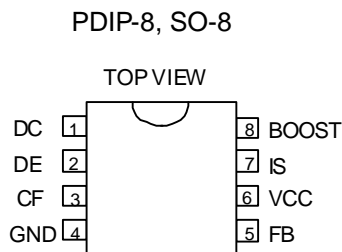
ORDERING INFORMATION

SS6563-CXXX



Example: SS6563CSTR

→ in SO-8 package shipped in tape and reel

PIN CONFIGURATION

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

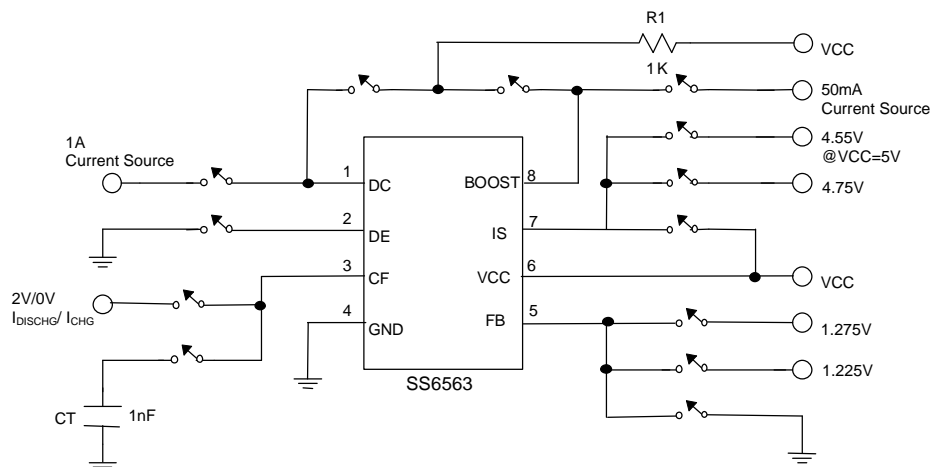
Power Dissipation and Thermal Characteristics
DIP Package

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	TA=25°C	V _{FB}	1.225	1.25	1.275	V
	0°C ≤ TA ≤ 70°C		1.21		1.29	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

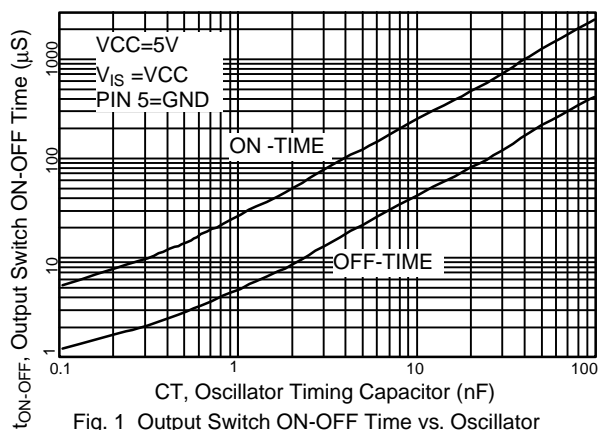
TYPICAL PERFORMANCE CHARACTERISTICS


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

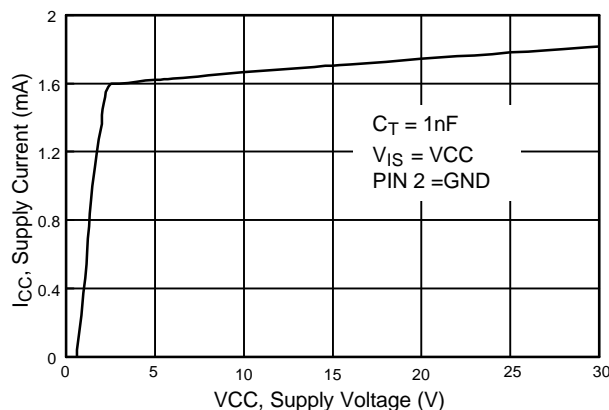


Fig. 2 Standby Supply Current vs. Supply Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

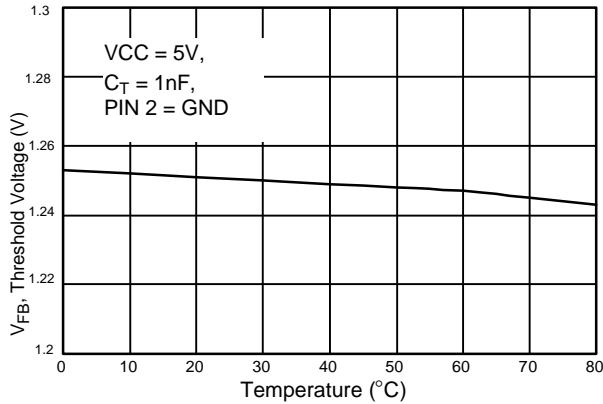


Fig. 3 V_{FB} , Threshold Voltage vs. Temperature

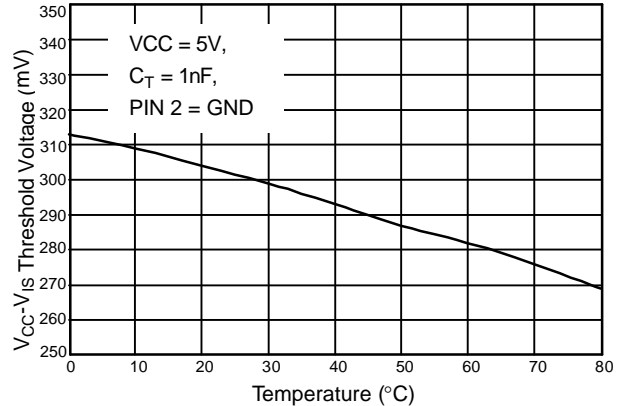


Fig. 4 I_S Threshold Voltage vs. Temperature

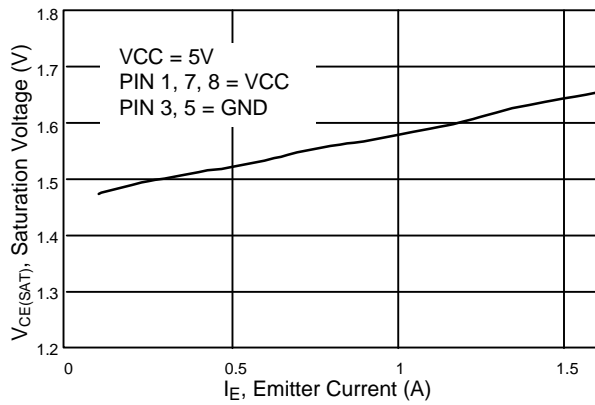


Fig. 5 Emitter Follower Configuration Output Switch Saturation Voltage vs. Emitter Current

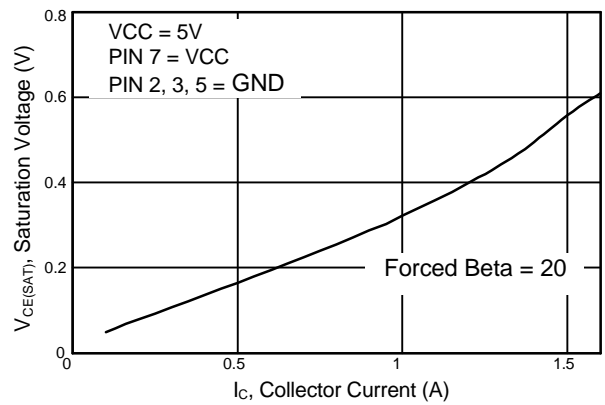
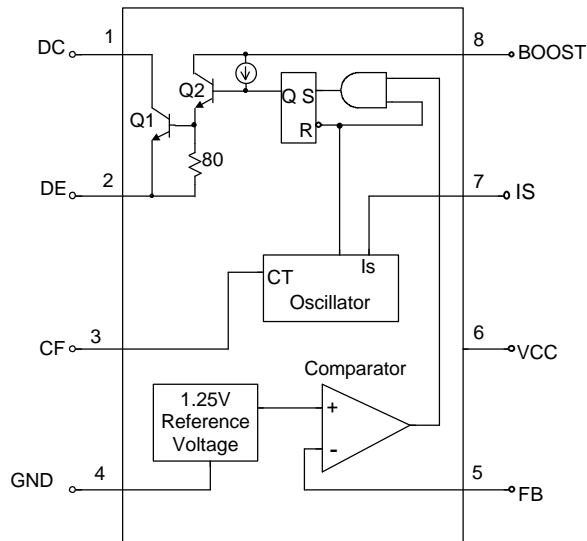


Fig. 6 Common Emitter Configuration Output Switch Saturation Voltage vs. Collector Current

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	$4 \times 10^{-5} t_{ON}$	$4 \times 10^{-5} t_{ON}$
$I_C (SWITCH)$	$2I_{OUT(MAX)}$	$2I_{OUT(MAX)} \left(\frac{t_{ON} + t_{OFF}}{t_{OFF}} \right)$
RS	$0.3/I_C(SWITCH)$	$0.3/ I_C (SWITCH)$
L(MIN)	$\left(\frac{V_{IN(MIN)} - V_{SAT} - V_{OUT}}{I_C(SWITCH)} \right) t_{ON(MAX)}$	$\left(\frac{V_{IN(MIN)} - V_{SAT}}{I_C(SWITCH)} \right) t_{ON(MAX)}$
Co	$\frac{I_C(SWITCH) (t_{ON} + t_{OFF})}{8 V_{RIPPLE(P-P)}}$	$\frac{I_{OUT} t_{ON}}{V_{RIPPLE(P-P)}}$

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

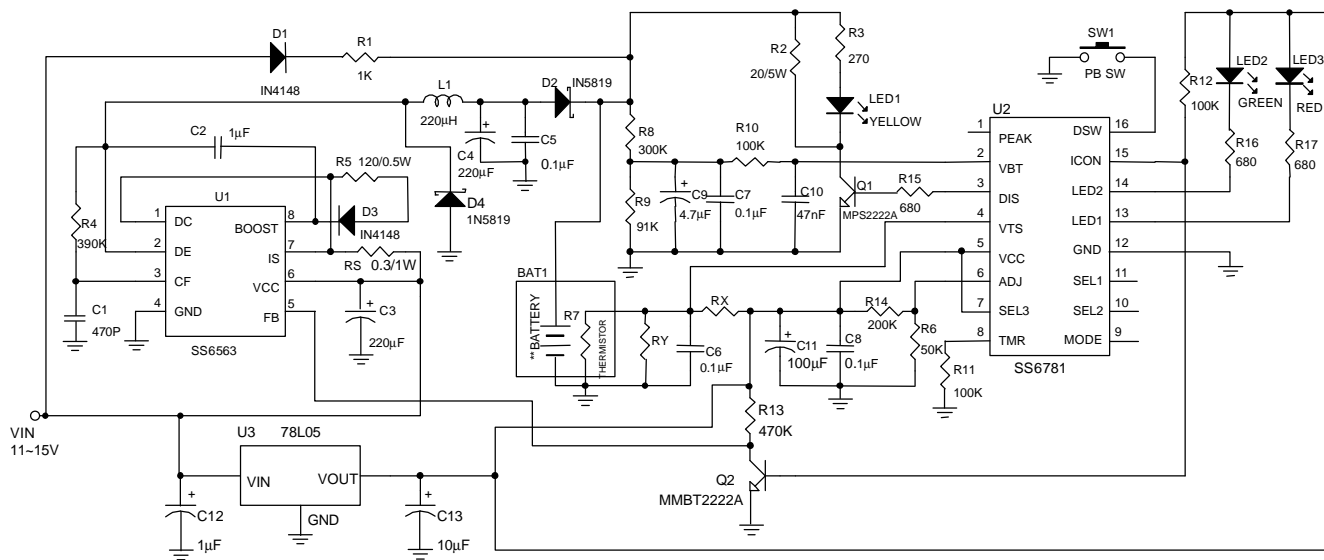
The following power supply characteristics must be chosen:

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 layout. 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

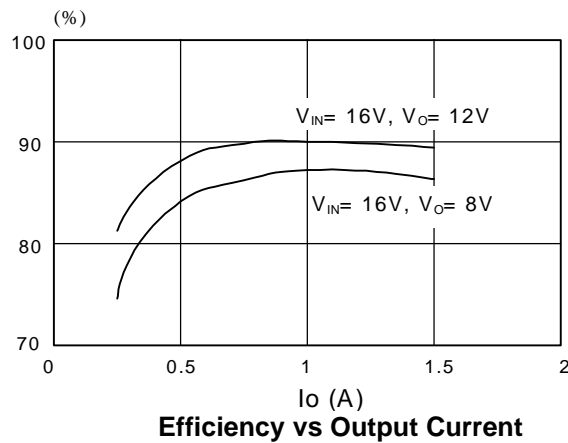
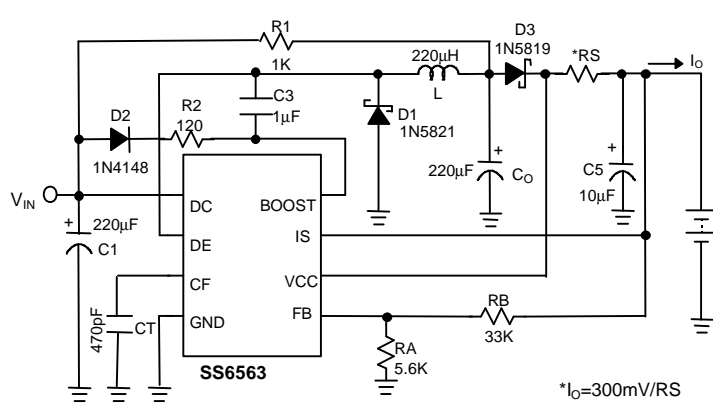
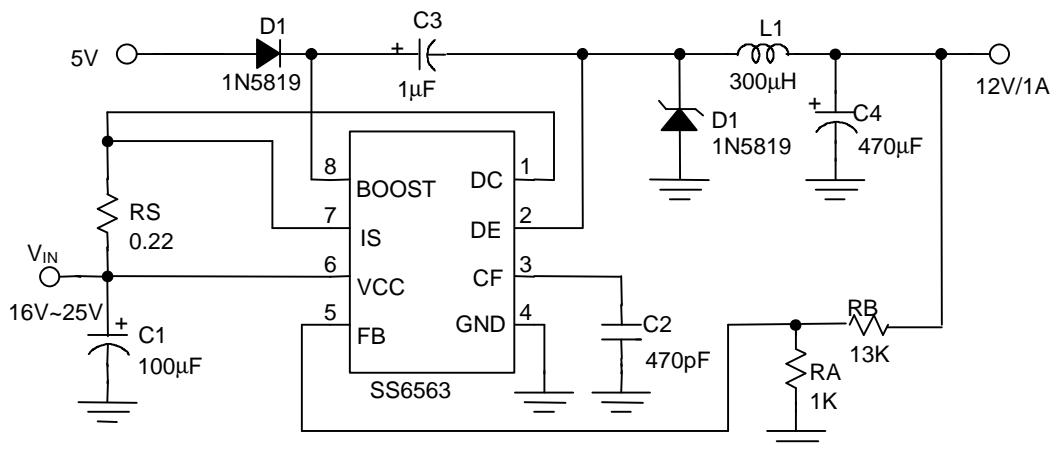
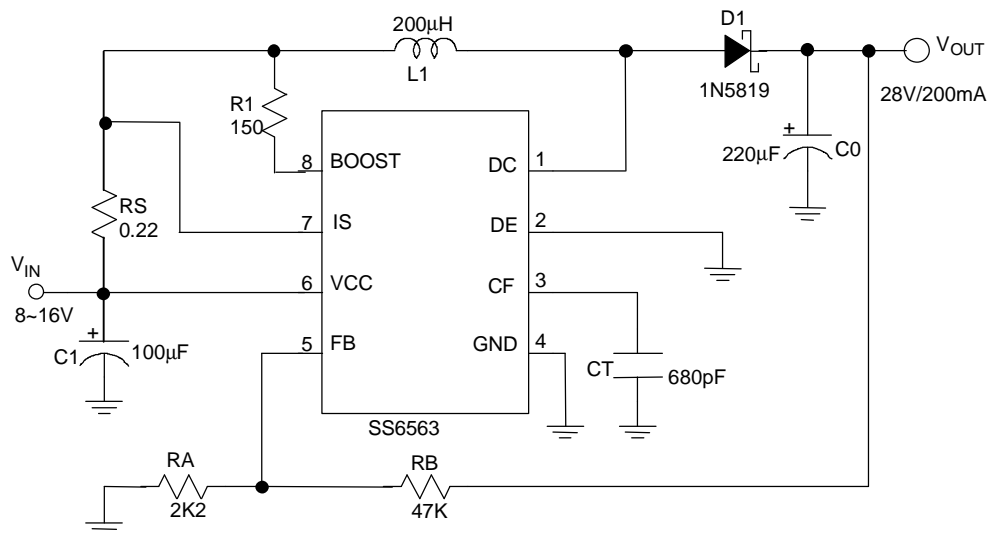
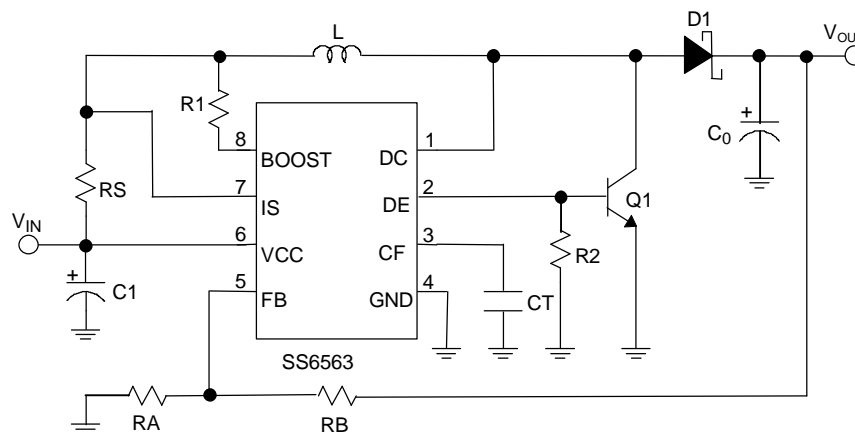
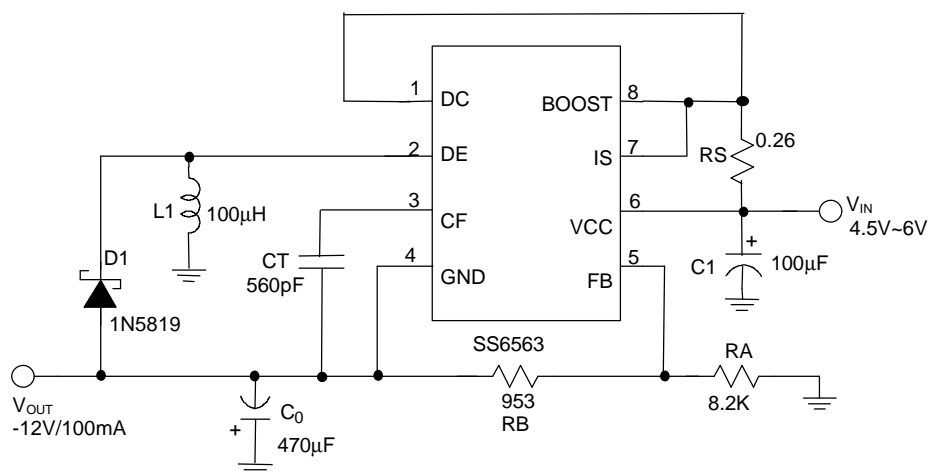


Fig. 2 Battery Charge Circuit

APPLICATION EXAMPLES (Continued)

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


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

Fig. 4 Step-Up Converter

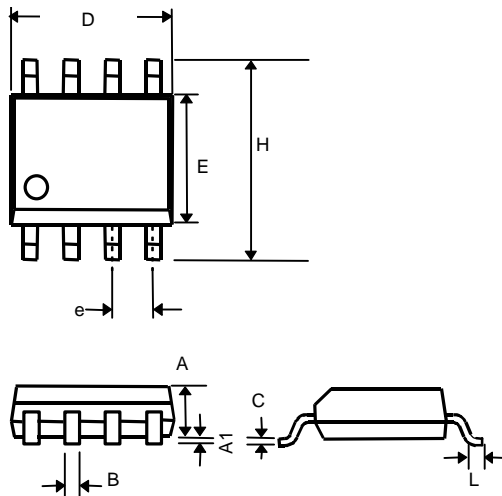
APPLICATION EXAMPLES (Continued)

Fig. 5 Step-Up Converter with External NPN Switch


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

Fig. 6 Inverting Converter

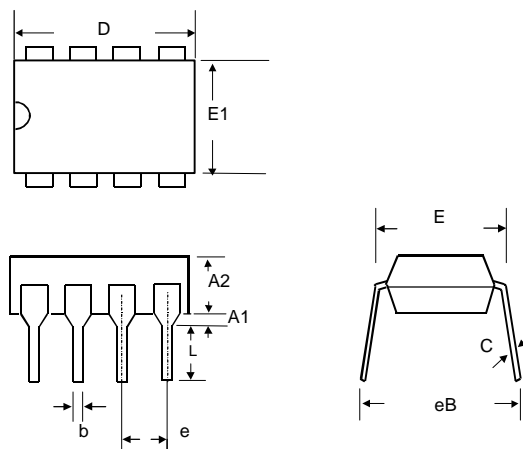
PHYSICAL DIMENSIONS

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

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