



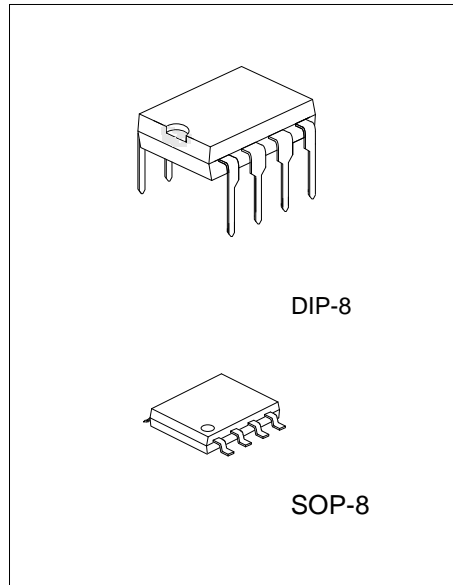
3563

CMOS IC

HIGH-EFFICIENCY DC/DC CONVERTER

DESCRIPTION

The UTC 3563 is a monolithic control circuit containing the primary functions required for DC to DC converters and high-side-sensed constant current source. 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. Bootstrapped driver can drive the NPN output switch to saturation for higher efficiency and less heat dissipation.



FEATURES

- * 3V to 30V input voltage operation.
- * Internal 2A peak current switch.
- * 1.5A continuous output current.
- * Bootstrapped driver.
- * High side current sense capability.
- * High efficiency (up to 90%)
- * Internal $\pm 2\%$ reference.
- * Low quiescent current at 1.6mA.
- * Frequency operation from 100Hz to 100KHz

ORDERING INFORMATION

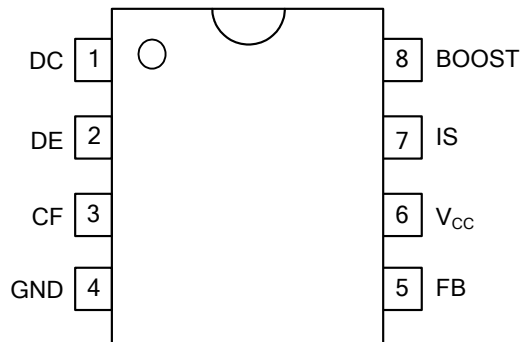
Ordering Number		Package	Packing
Lead Free	Halogen Free		
3563L-D08-T	3563G-D08-T	DIP-8	Tube
3563L-S08-R	3563G-S08-R	SOP-8	Tape Reel

<p>3563G-D08-T</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Green Package</p>	<p>(1) T: Tube, R: Tape Reel</p> <p>(2) D08: DIP-8, S08: SOP-8</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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MARKING

DIP-8	SOP-8
<p> 8 7 6 5 → Date Code UTC □ □ □ □ 3563 □ L: Lead Free G: Halogen Free □ □ □ □ → Lot Code 1 2 3 4 </p>	<p> 8 7 6 5 → Date Code UTC □ □ □ □ 3563 □ L: Lead Free G: Halogen Free □ □ □ □ → Lot Code 1 2 3 4 </p>

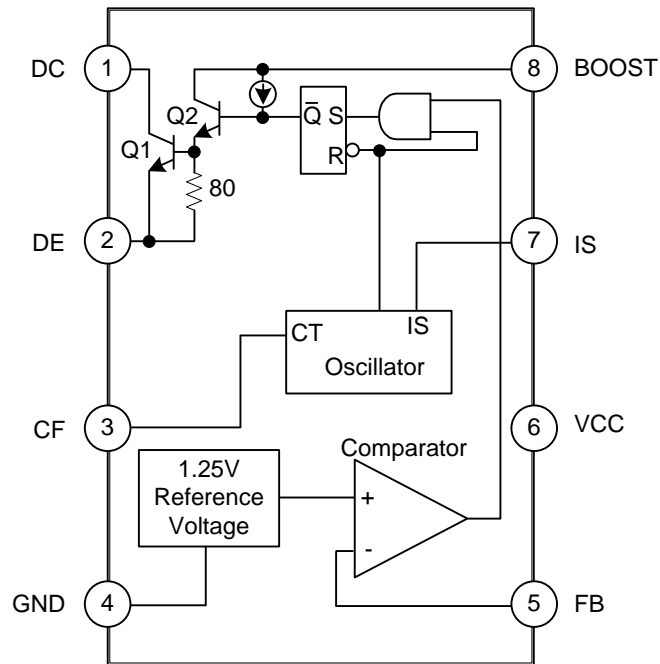
PIN CONFIGURATION



PIN DESCRIPTION

PIN	SYMBOL	DESCRIPTION
1	DC	2A switch collector
2	DE	Darlington switch emitter
3	CF	Oscillator timing capacitor
4	GND	Power ground
5	FB	Feedback comparator inverting input
6	V _{CC}	Power supply input
7	IS	Highside current sense input (V _{CC} -V _{IS} =300mV)
8	BOOST	Bootstrapped driver collector

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS (T_A=25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage		V _{CC}	30	V
Comparator input voltage range		V _I	-0.3 ~ +30	V
Switch collector voltage		V _{C(switch)}	30	V
Switch emitter Voltage		V _{E(switch)}	30	V
Switch collector to emitter voltage		V _{CE(switch)}	30	V
Driver collector Voltage		V _{C(driver)}	30	V
Switch current		I _{SW}	2	A
Power dissipation	DIP-8	P _D	1000	mW
	SOP-8		625	mW
Operating junction temperature		T _J	+125	°C
Operating ambient temperature range		T _A	-20 ~ +85	°C
Storage temperature range		T _{STG}	-65 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

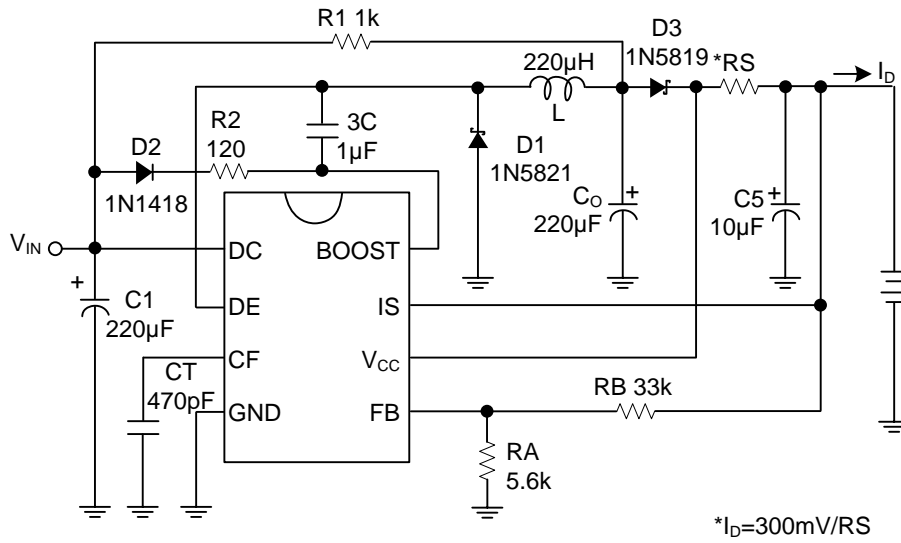
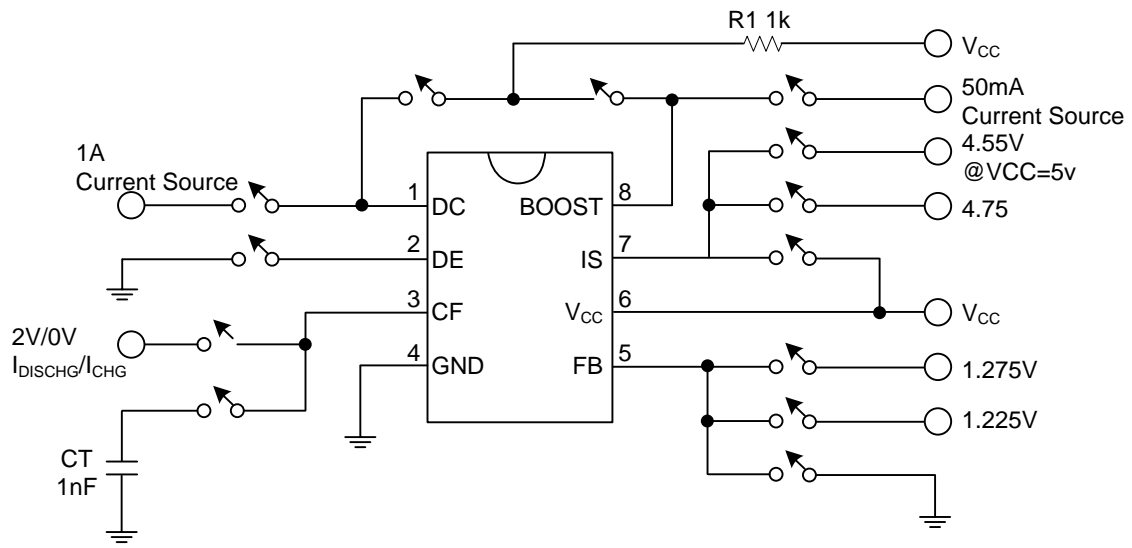
■ THERMAL RESISTANCES CHARACTERISTICS

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θ _{JA}	100	°C/W
Junction to Case	θ _{JC}	160	°C/W

■ ELECTRICAL CHARACTERISTICS (V_{CC}=5.0V, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Oscillator						
Charging Current	I _{CHG}	5V ≤ V _{CC} ≤ 30V	10	25	40	μA
Discharging Current	I _{DISCHG}	5V ≤ V _{CC} ≤ 30V	100	150	200	μA
Voltage Swing	V _{OSC}	PIN 3		0.6		V
Discharge to Charge Current Ratio	I _{DISCHG} / I _{CHG}	V _{IS} =V _{CC}		6.0		
Current limit Sense Voltage	V _{CC-VIS}	I _{CHG} =I _{DISCHG}	250	300	350	mV
Output Switch						
Saturation Voltage, Emitter Follower Connection	V _{CE(SAT)}	I _{DE} =1.0A, V _{BOOST} =V _{DC} =V _{CC}		1.5	1.8	V
Saturation Voltage	V _{CE(SAT)}	I _{DC} =1.0A, I _{BOOST} =50mA, (Forced β≈20)		0.4	0.7	V
DC Current Gain	h _{FE}	I _{SC} =1.0A, V _{CE} =5.0V	35	120		
Collector Off State Current	I _{C(OFF)}	V _{CE} =30V		10		nA
Comparator						
Threshold Voltage	V _{FB}	T _A =25°C	1.225	1.250	1.275	V
		0°C ≤ T _A ≤ 70°C	1.210	1.250	1.290	V
Threshold voltage Line Regulation	R _{EGLINE}	3V ≤ V _{CC} ≤ 30V		0.1	0.3	mV/V
Input Bias Current	I _{IB}	V _{IN} =0V		0.4	1.0	μA
Supply Current	I _{CC}	V _{IS} =V _{CC} , PIN 5 > V _{FB} , 5.0V ≤ V _{CC} ≤ 30V, C _T =1nF, PIN 2=GND, Remaining pins open		1.6	3.0	mA

■ TEST CIRCUIT



■ APPLICATION INFORMATION

Tabel 1. DESIGN FORMULA TABLE

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

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} : Norminal input voltage

V_{OUT} : Desired output voltage, $V_{OUT} = 1.25(1 + R_B/R_A)$

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

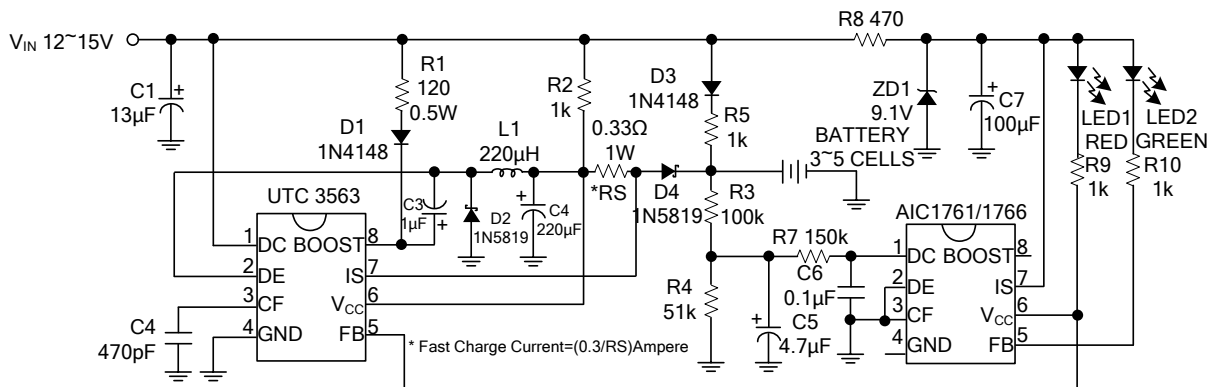
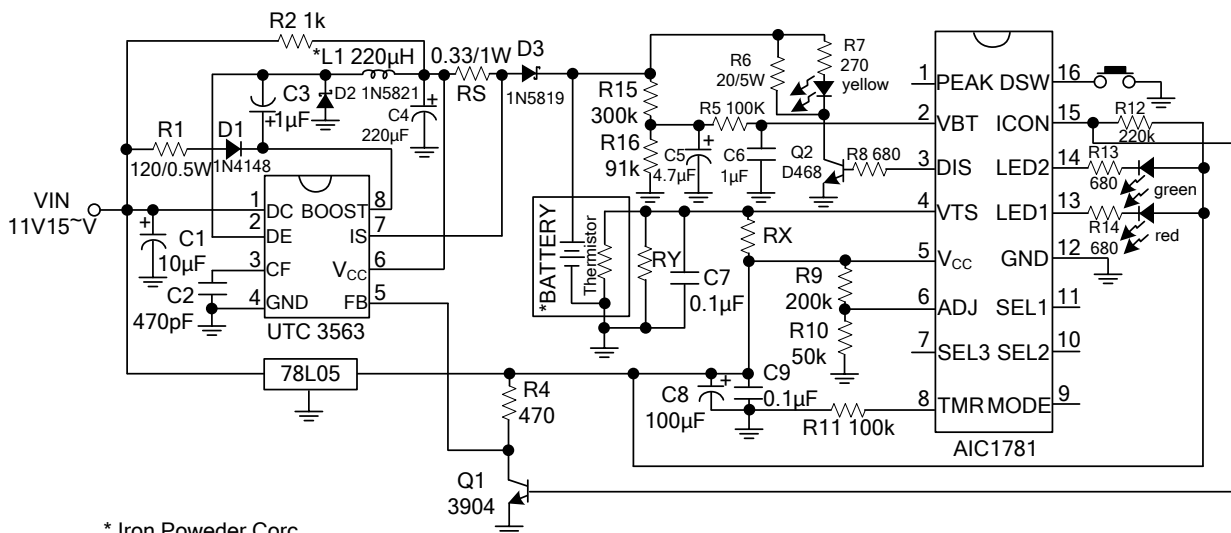


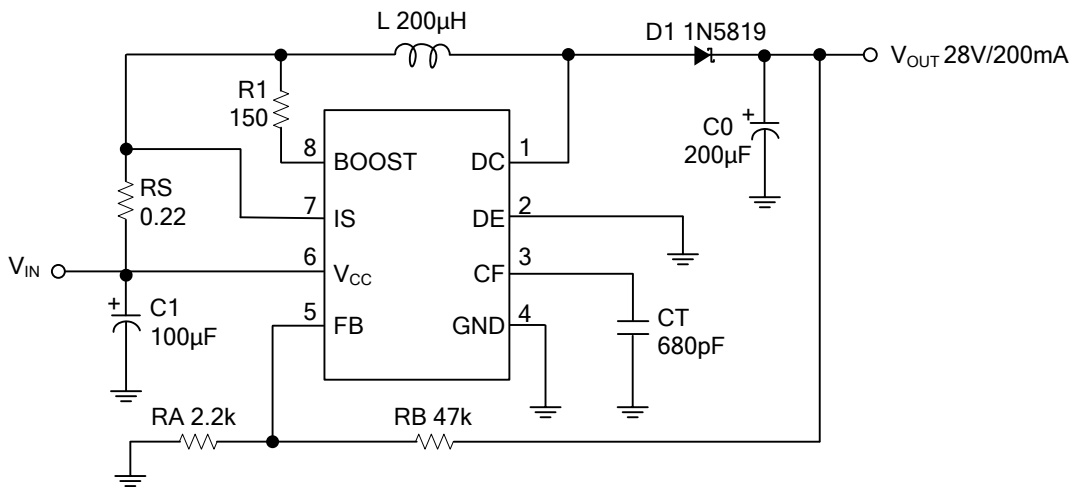
Fig. 1 Simplified Battery Charge Circuit for Ni-Cd/Ni-MH Battery



* Iron Powderd Corc
 ** 3~5 NiMH/NiCd Cells
 Note: Charge Current: 3.0V/RS Ampere
 Safety Timer=80 min.
 □ T/∅ t=1∅ /min.

Fig.2 Battery Charge Circuit for Fluctuating Charging Current Applications

■ APPLICATION EXAMPLES (Cont.)



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

Fig. 5 Step-Up Converter

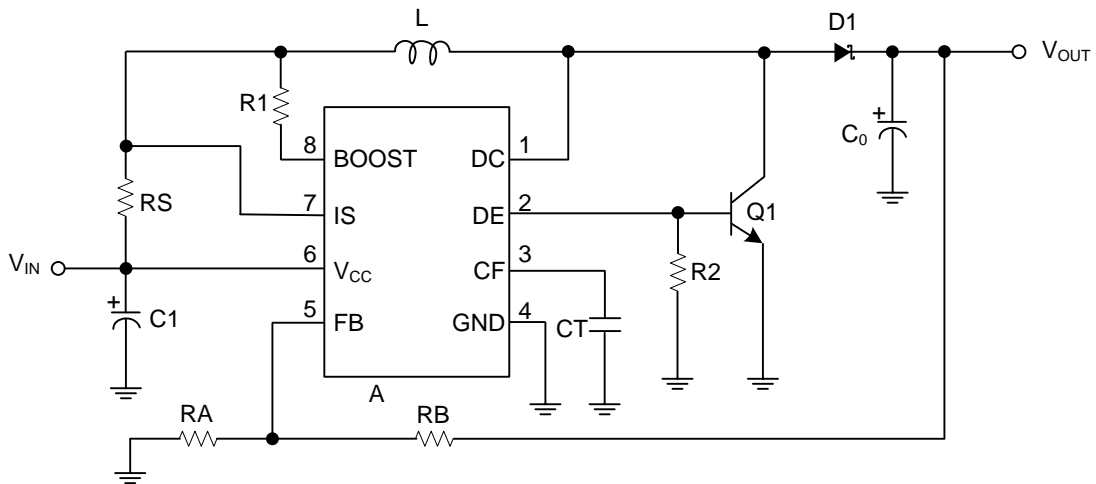
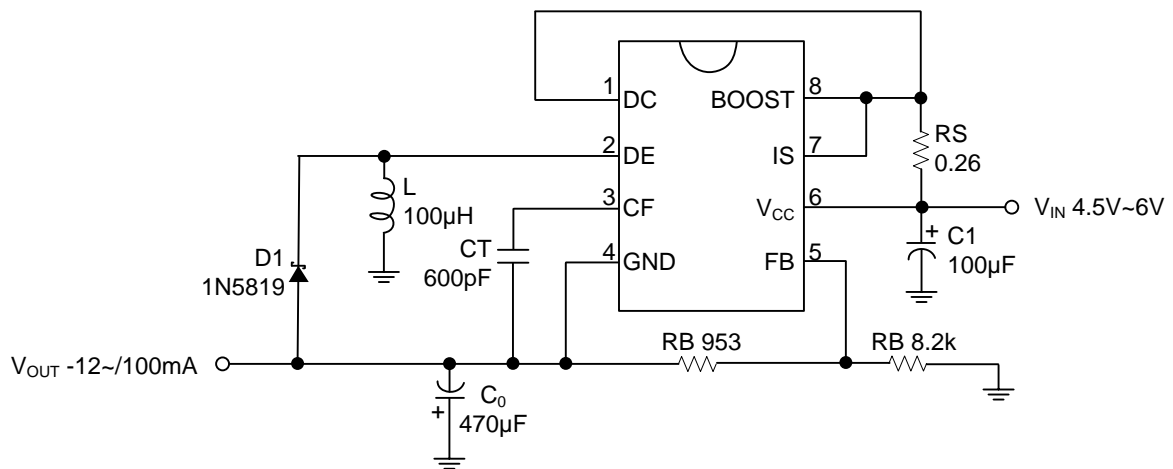


Fig. 6 Step-Up Converter with External NPN Switch

■ APPLICATION EXAMPLES (Cont.)

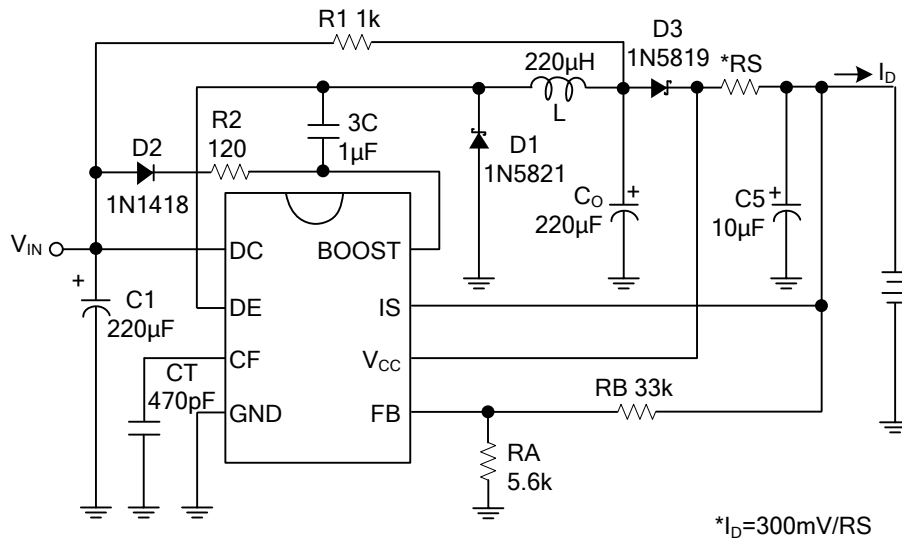


Line regulation: 20mV ($V_{IN}=4.5V\sim 6V$, @ $I_O=100mA$)

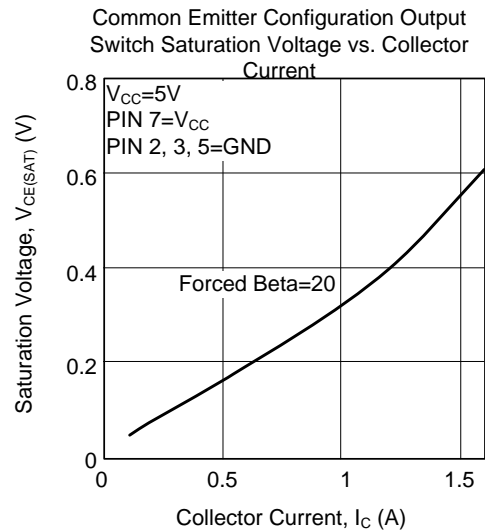
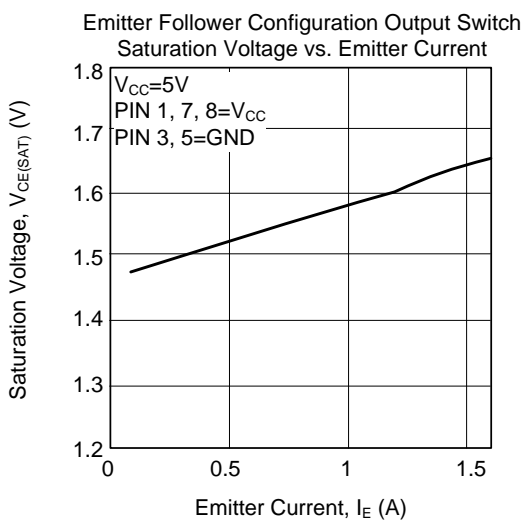
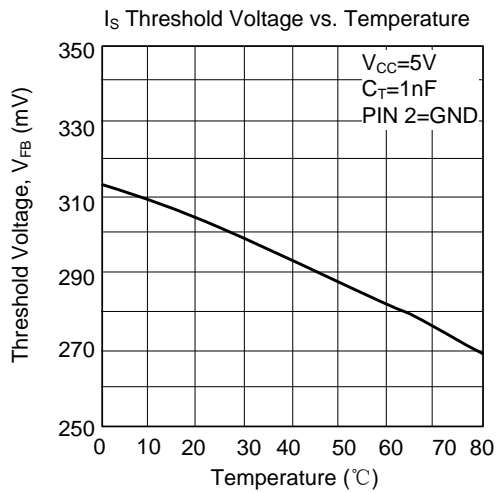
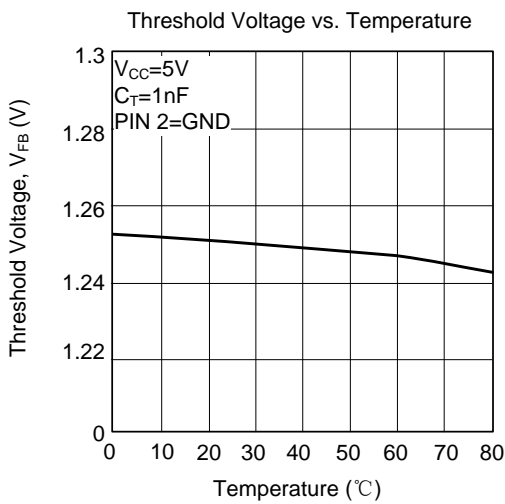
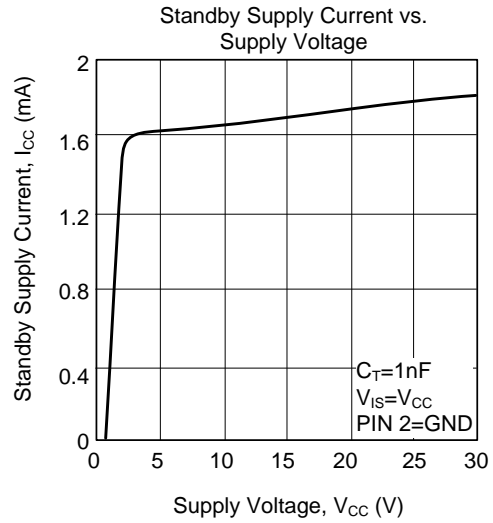
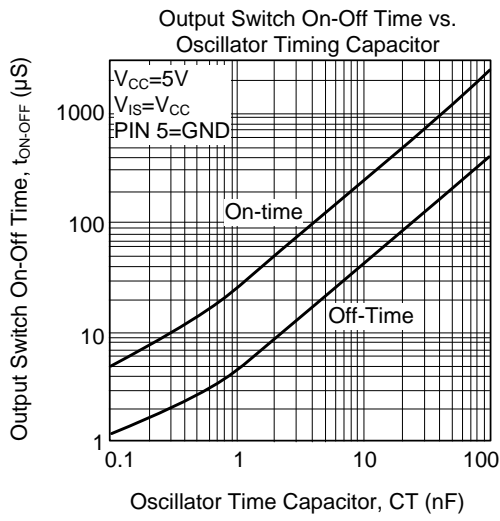
Load regulation: 100mV ($V_{IN}=5V$, @ $I_O=10mA\sim 100mA$)

Fig. 7 Inverting Converter

■ TYPICAL APPLICATION CIRCUIT



■ TYPICAL CHARACTERISTICS



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