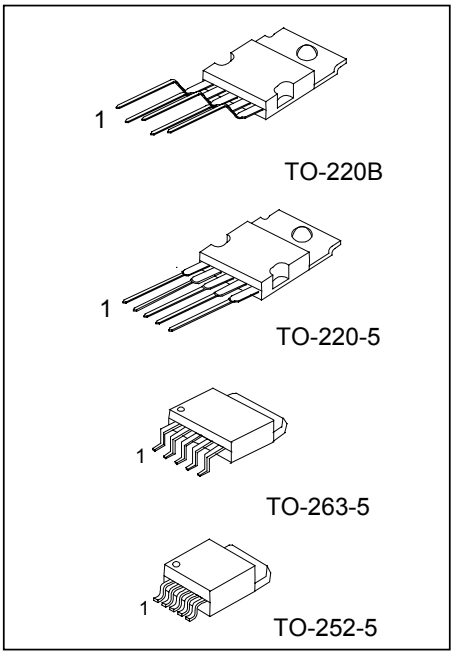
150KHz, 3A PWM STEP-DOWN DC/DC CONVERTER



*Pb-free plating product number: P3596L

DESCRIPTION

The UTC **P3596** series is a step-down switching regulator able to provide **3A** output current. The available output voltages are **3.3V, 5V, 12V, and an adjustable** output version.

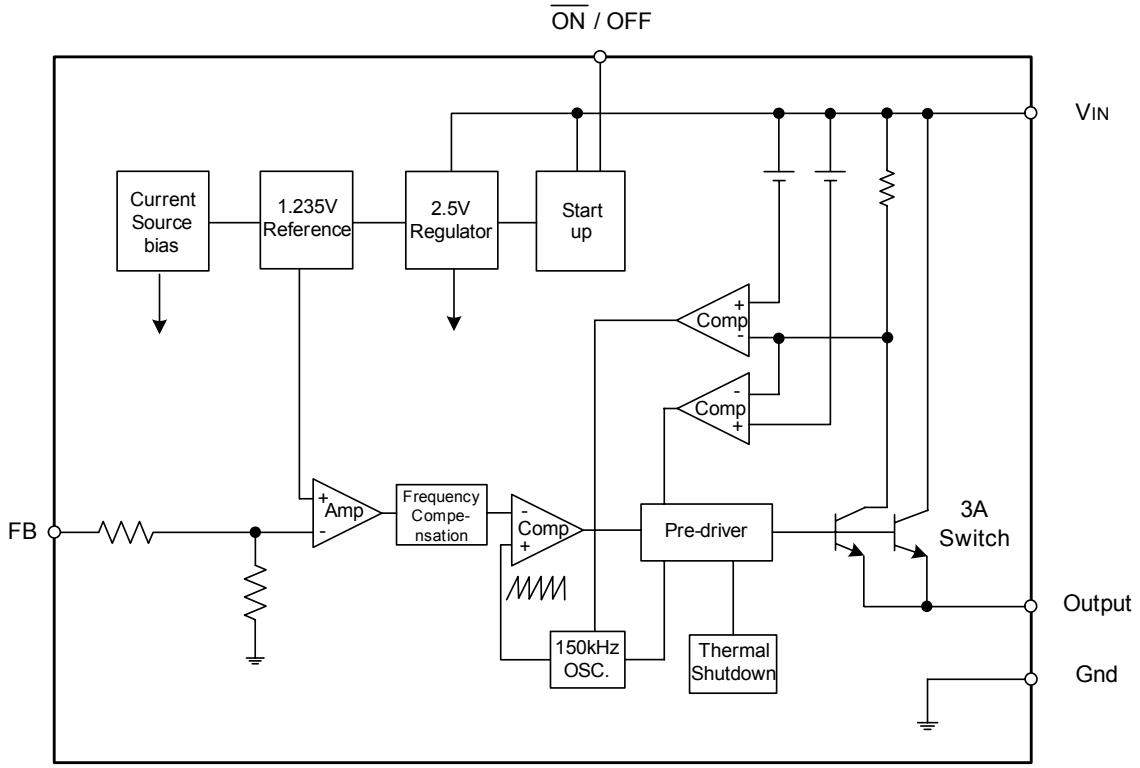
FEATURES

*Output load current: **3A**
*Adjustable version output voltage range, 1.23V ~ 37V±4%
*Operating voltage can be up to **40V**
*Low power standby mode
*High efficiency
*Internal current and thermal limit

PIN DESCRIPTION

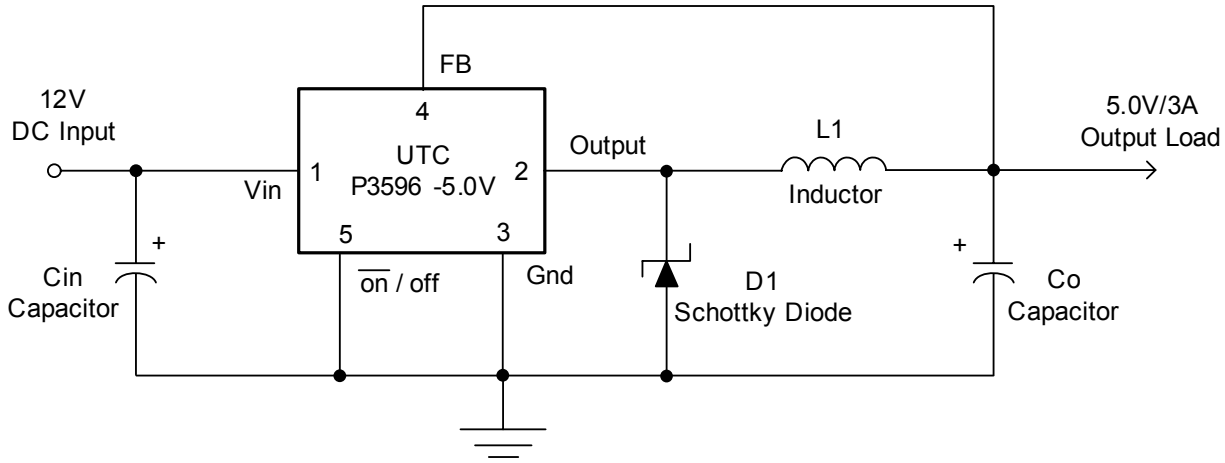
PIN NO.	PIN NAME	DESCRIPTION
1	Vin	Operating voltage input
2	Output	Switching output
3	GND	Circuit Ground
4	FB (Feedback)	Output voltage feedback control
5	SD (Shutdown)	ON/OFF shutdown

BLOCK DIAGRAM

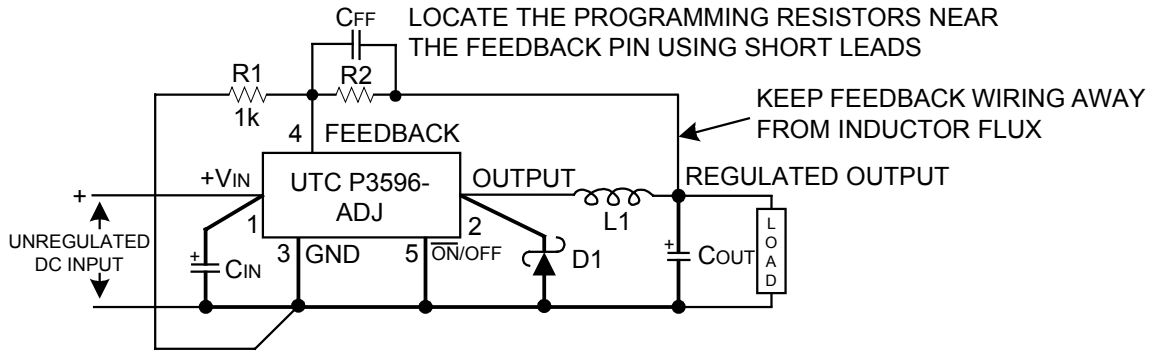


TYPICAL APPLICATION

(Fixed Output Voltage Versions)



ADJUSTABLE OUTPUT VOLTAGE VERSIONS



$$Vout \times \left(\frac{R1}{R1 + R2}\right) = Vref$$

$$Vout = Vref\left(1 + \frac{R2}{R1}\right)$$

Where Vref = 1.23V

$$R2 = R1\left(\frac{Vout}{Vref} - 1\right)$$

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Maximum Supply Voltage	Vcc	45	V
Operating Voltage	Vopr	4.5 ~ 40	V
$\overline{\text{ON/OFF}}$ Pin Input Voltage	$V_{\overline{ON/OFF}}$	-0.3 ~ +25	V
Feedback Pin Voltage	VFB	-0.3 ~ +25	V
Output Voltage to Ground (Steady State)	Vout	-1	V
Power Dissipation	PD	Internally limited	mW
Maximum Junction Temperature	Tj	+150	℃
Temperature Range	Topr	-40 ~ +125	℃
Storage Temperature Range	Tstg	-65 ~ +150	℃

ELECTRICAL CHARACTERISTICS

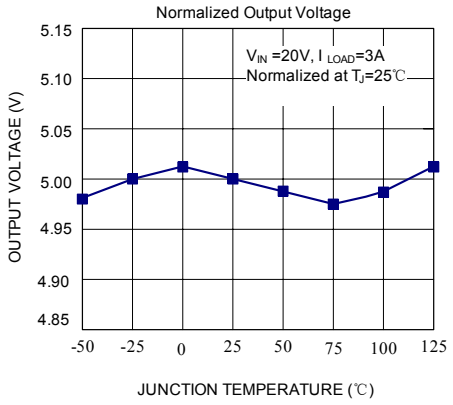
(T_j=25℃, V_{IN}=12V for the 3.3V, 5V, and Adjustable version and V_{IN}=24V for the 12V version, I_{LOAD}=500mA.)

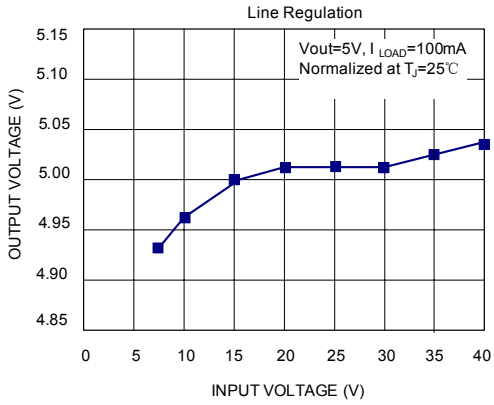
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	**3.3V**	V_{OUT}	4.75V≦V_{IN}≦40V, 0.2A≦I_{LOAD}≦3A	3.168	3.3	3.432	V
	5.0V		7V≦V_{IN}≦40V, 0.2A≦I_{LOAD}≦3A	4.8	5.0	5.2	V
	12V		15V≦V_{IN}≦40V, 0.2A≦I_{LOAD}≦3A	11.52	12.0	12.48	V
Efficiency	**3.3V**	η	V_{IN}=12V, I_{LOAD}=3A		73		%
	5.0V		V_{IN}=12V, I_{LOAD}=3A		80		%
	12V		V_{IN}=25V, I_{LOAD}=3A		90		%
UTC P3596-ADJ							
Feedback Voltage		V_{FB}	4.5V≦V_{IN}≦40V, 0.2A≦I_{LOAD}≦3A V_{OUT} programmed for 3V	1.193	1.230	1.267	V
Efficiency		η	V_{IN}=12V, V_{OUT}=3V, I_{LOAD}=3A		73		%
ALL OUTPUT VOLTAGE							
Feedback Bias Current		I_b	Adjustable Version Only, V_{FB}=1.3V		10	50	nA
Oscillator Frequency		f_o	(Note 1)	127	150	173	kHz
Saturation Voltage		V_{SAT}	I_{OUT}=3A (Note 2, 3)		1.16	1.4	V
Max Duty Cycle (ON) Min Duty Cycle (OFF)		DC	(Note 3) (Note 4)		100 0		%
Current Limit		I_{CL}	Peak Current (Notes 2, 3)	3.6	4.5	6.9	A
Output Leakage Current		I_L	Output=0V (Notes 2, 4)			50	μA
			Output=-1V (Note 5)		2	30	mA
Quiescent Current		I_Q	(Note 4)		5	10	mA
Standby Quiescent Current		I_{STBY}	ON/OFF pin=5V (OFF) (Note 5)		80	200	μA
ON/OFF CONTROL							
$\overline{ON}$/OFF Pin Logic Input Threshold Voltage		V_{IH} V_{IL}	Low (Regulator ON) High (Regulator OFF)	 2.0	1.3 1.3	0.6	V
$\overline{ON}$/OFF Pin Input Current		I_H	V_{LOGIC}=2.5V (Regulator OFF)		5	15	μA
		I_L	V_{LOGIC}=0.5V (Regulator ON)		0.02	5	μA

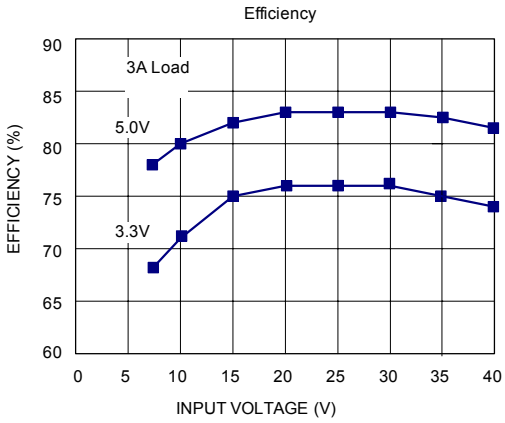
THERMAL DATA

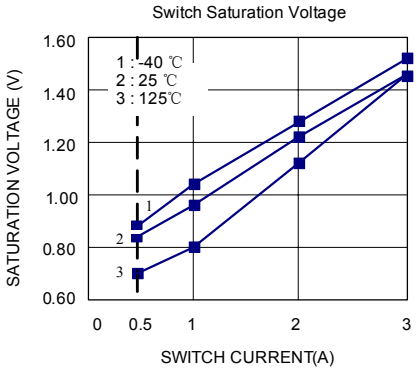
PARAMETER		SYMBOL	RATINGS	UNIT
Thermal Resistance Junction to Case	TO-220B	θ_{Jc}	3	℃/W
	TO-220-5		3	
	TO-263-5		4	
	TO-252-5		8	
Thermal Resistance Junction to Ambient	TO-220B	θ_{JA}	45	℃/W
	TO-220-5		45	
	TO-263-5		55	
	TO-252-5		90	

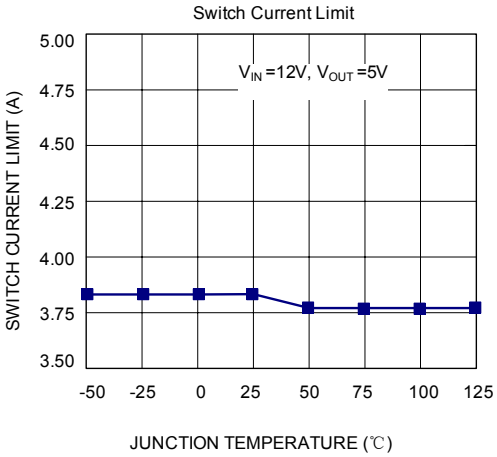
Note 1: The switching frequency is reduced when the second stage current limit is activated.
Note 2: No diode, inductor or capacitor connected to output pin.
Note 3: Feedback pin removed from output and connected to 0V to force the output transistor switch ON.
Note 4: Feedback pin removed from output and connected to 12V for the 3.3V, 5V, and the ADJ. version, and 15V for the 12V version, to force the output transistor switch OFF.
Note 5: V_{IN} = 40V

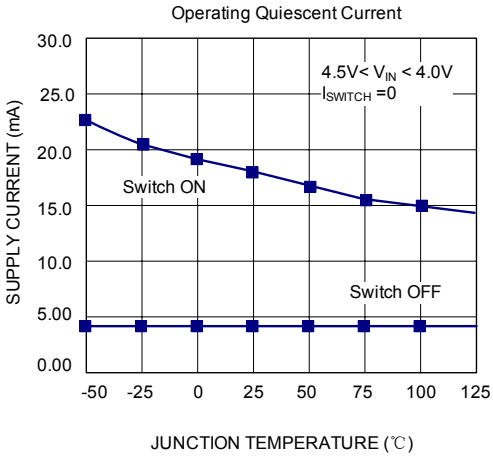

Normalized Output Voltage
V_{IN} =20V, I_{LOAD}=3A
Normalized at T_J=25℃
OUTPUT VOLTAGE (V)
5.15
5.10
5.05
5.00
4.95
4.90
4.85
-50 -25 0 25 50 75 100 125
JUNCTION TEMPERATURE (℃)


Line Regulation
Vout=5V, I_{LOAD}=100mA
Normalized at T_J=25℃
OUTPUT VOLTAGE (V)
5.15
5.10
5.05
5.00
4.95
4.90
4.85
0 5 10 15 20 25 30 35 40
INPUT VOLTAGE (V)

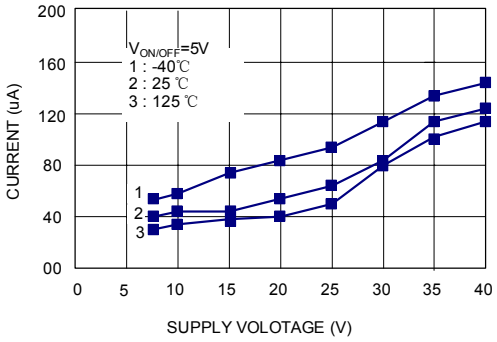

Efficiency
3A Load
5.0V
3.3V
EFFICIENCY (%)
90
85
80
75
70
65
60
0 5 10 15 20 25 30 35 40
INPUT VOLTAGE (V)


Switch Saturation Voltage
1 : -40 ℃
2 : 25 ℃
3 : 125℃
SATURATION VOLTAGE (V)
1.60
1.40
1.20
1.00
0.80
0.60
0 0.5 1 2 3
SWITCH CURRENT(A)

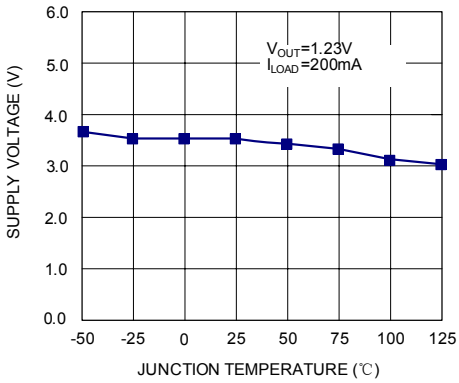

Switch Current Limit
V_{IN} =12V, V_{OUT} =5V
SWITCH CURRENT LIMIT (A)
5.00
4.75
4.50
4.25
4.00
3.75
3.50
-50 -25 0 25 50 75 100 125
JUNCTION TEMPERATURE (℃)


Operating Quiescent Current
4.5V< V_{IN} < 4.0V
I_{SWITCH} =0
Switch ON
Switch OFF
SUPPLY CURRENT (mA)
30.0
25.0
20.0
15.0
10.0
5.00
0.00
-50 -25 0 25 50 75 100 125
JUNCTION TEMPERATURE (℃)

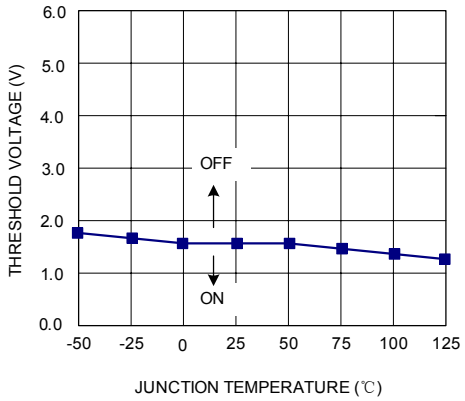
Shutdown Quiescent Current



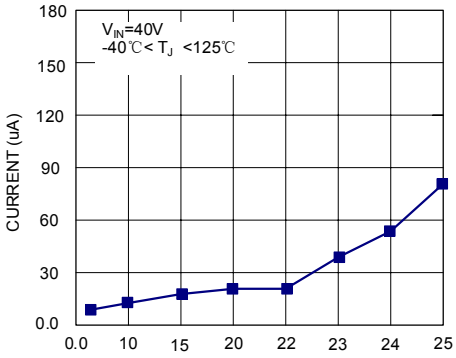
Minimum Operating Supply Voltage



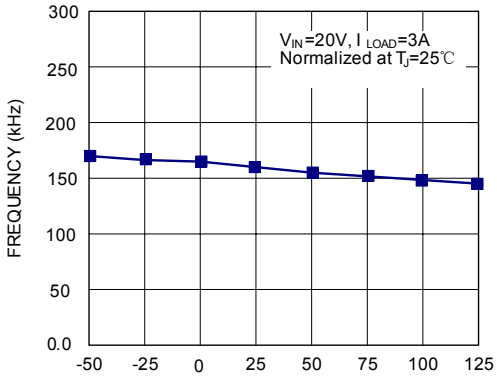
ON/OFF Threshold Voltage



ON/OFF Pin Current (Sinking)



Switch Frequency



Feedback Pin Bias Current