



P3596

LINEAR INTEGRATED CIRCUIT

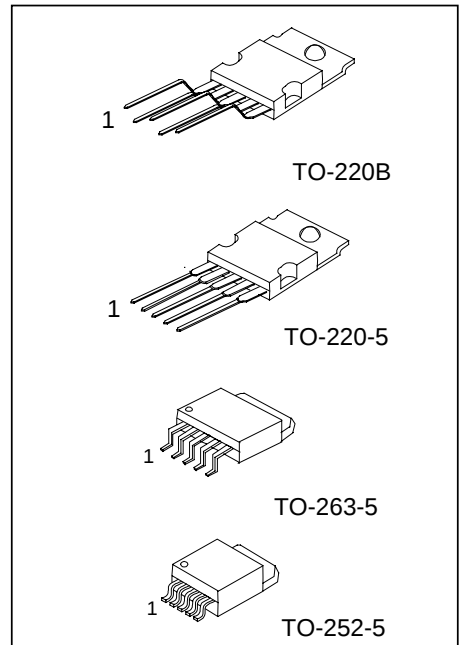
150KHZ, 3A PWM STEP-DOWN DC/DC CONVERTER

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** ($V_{in} \rightarrow 40V$)
- *Low power standby mode
- *High efficiency
- *Internal current and thermal limit



*Pb-free plating product number:P3596L

PIN DESCRIPTION

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

ORDERING INFORMATION

P3596□-□-□-□
(1) (2) (3) (4)

(1)		(2)		(3)		(4)	
Plating		Output Voltage		Package		Packing	
Type	Code	Vout	Code	Type	Code	Type	Code
Pb/Sn		12V	12	TO-252-5	TN5	Tape Reel	R
Pb-Free	L	5.0V	50	TO-220-5	TA5	Tube	T
		3.3V	33	TO-220B	TB5	Tube	T
		3.0V	30	TO-263-5	TQ5	Tape Reel	R
		Adj	AD				

The block diagram illustrates the internal architecture of the power management IC. Key components and their connections include:

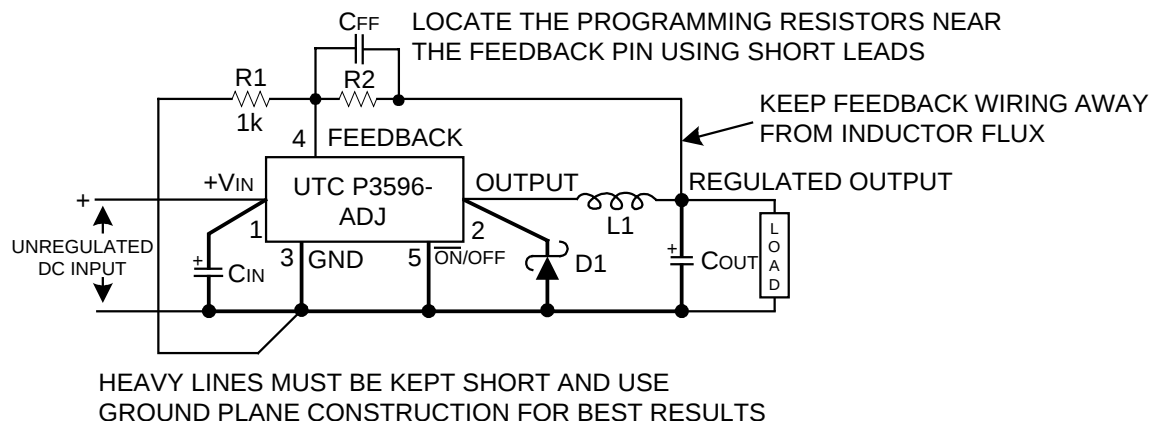
- Power Input:** VIN is connected to the top rail, and Gnd is connected to the bottom rail.
- Control and Biasing:**
 - Current Source bias:** Connected to the top rail and has a downward output arrow.
 - 1.235V Reference:** Connected to the top rail and provides a reference voltage to the **+ Amp** block.
 - 2.5V Regulator:** Connected to the top rail and provides a regulated 2.5V supply to the **Start up** block.
 - Start up:** Connected to the top rail and provides a start-up signal to the **- Comp** block.
- Feedback and Compensation:**
 - FB (Feedback):** Connected to the top rail, passes through a resistor, and is connected to the **-** input of the **+ Amp** block.
 - + Amp:** A fully differential amplifier with its non-inverting input (+) connected to the 1.235V reference and its inverting input (-) connected to the feedback node.
 - Frequency Compensation:** A block connected between the outputs of the **+ Amp** and **- Comp** blocks.
 - Comp:** A fully differential amplifier with its inverting input (-) connected to the output of the **+ Amp** and its non-inverting input (+) connected to the start-up signal. It includes a thermal shutdown input.
- Output Stage:**
 - Pre-driver:** Receives signals from the **- Comp** block and a **150kHz OSC.** (oscillator). It drives the gates of the **3A Switch** (a MOSFET).
 - 3A Switch:** A MOSFET that switches the load current from VIN to the **Output** terminal.
- Other Components:**
 - Comp1 and Comp2:** Two comparators that monitor the output voltage and provide feedback signals to the **- Comp** block.
 - Thermal Shutdown:** A block that monitors the device temperature and provides a shutdown signal to the **- Comp** block.

(Fixed Output Voltage Versions)

The diagram shows a buck converter circuit with the following components and connections:

- Input:** A 12V DC Input is connected to the Vin pin (pin 1) of the UTC P3596 -5.0V regulator. A Cin Capacitor is connected between the input and ground.
- Regulator:** The UTC P3596 -5.0V regulator is a 5-pin device. Pin 4 (FB) is connected to the output. Pin 2 (Output) is connected to the inductor. Pin 3 (Gnd) is connected to ground. Pin 5 (on / off) is connected to ground.
- Output Filter:** An inductor (L1) is connected between the regulator's output pin (pin 2) and the output node. A Schottky Diode (D1) is connected in parallel with the inductor, with its cathode to the output node and its anode to ground.
- Output:** The output node is connected to the output load (5.0V/3A Output Load). A Co Capacitor is connected between the output node and ground.

■ ADJUSTABLE OUTPUT VOLTAGE VERSIONS



$$V_{out} \times \left(\frac{R1}{R1 + R2} \right) = V_{ref}$$

$$V_{out} = V_{ref} \left(1 + \frac{R2}{R1} \right)$$

Where $V_{ref} = 1.23V$

$$R2 = R1 \left(\frac{V_{out}}{V_{ref}} - 1 \right)$$

■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Maximum Supply Voltage	V_{CC}	45	V
Operating Voltage	V_{OPR}	4.5 ~ 40	V
ON/OFF Pin Input Voltage	$V_{ON/OFF}$	-0.3 ~ +25	V
Feedback Pin Voltage	V_{FB}	-0.3 ~ +25	V
Output Voltage to Ground (Steady State)	V_{OUT}	-1	V
Power Dissipation	P_D	Internally limited	mW
Maximum Junction Temperature	T_J	+150	°C
Temperature Range	T_{OPR}	-40 ~ +125	°C
Storage Temperature Range	T_{STG}	-40 ~ +150	°C

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Thermal Resistance Junction to Case	TO-220B	3	°C/W
	TO-220-5	3	
	TO-263-5	4	
	TO-252-5	8	
Thermal Resistance Junction to Ambient	TO-220B	45	°C/W
	TO-220-5	45	
	TO-263-5	55	
	TO-252-5	90	

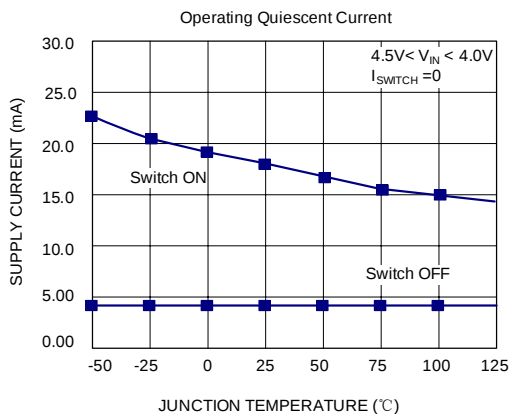
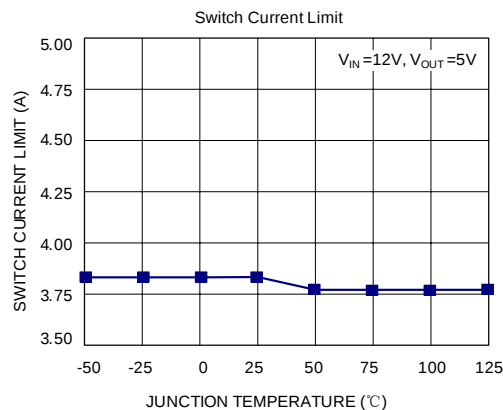
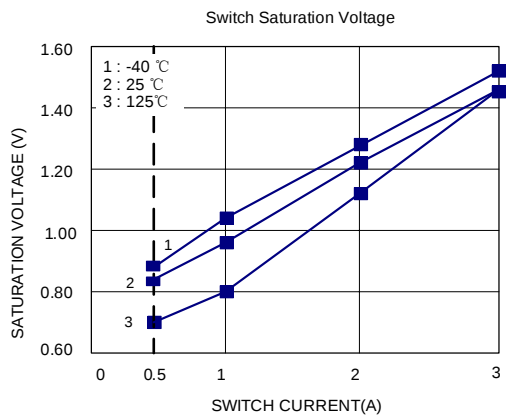
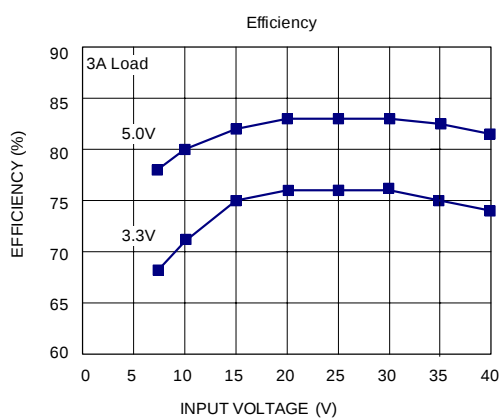
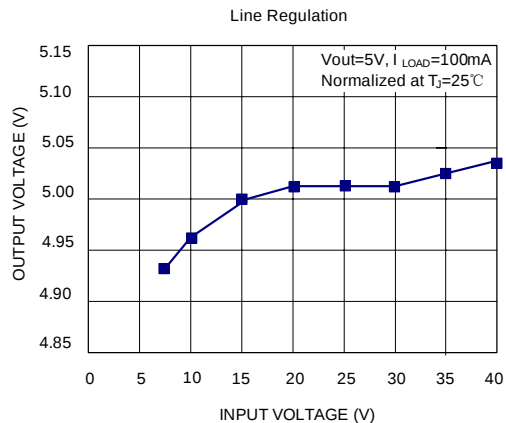
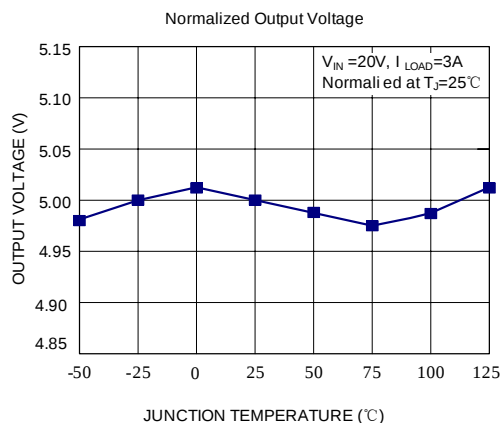
■ ELECTRICAL CHARACTERISTICS

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

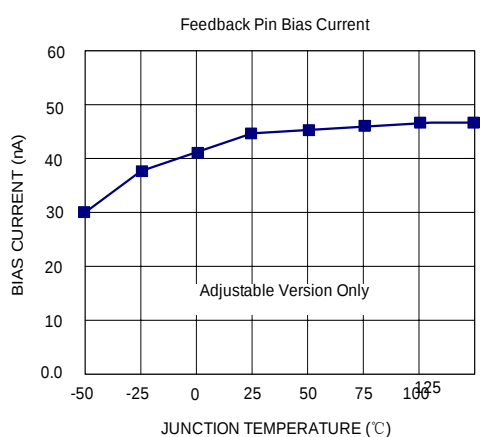
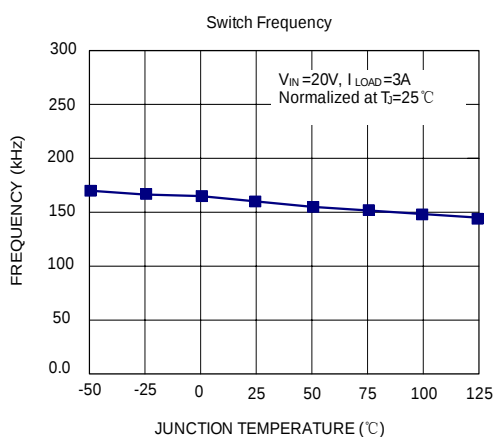
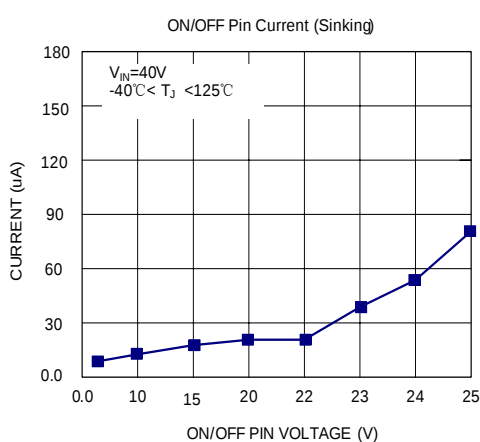
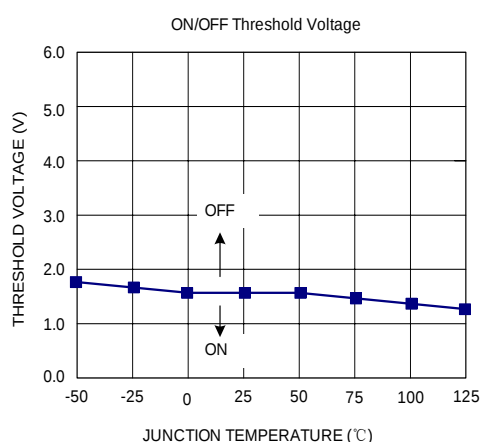
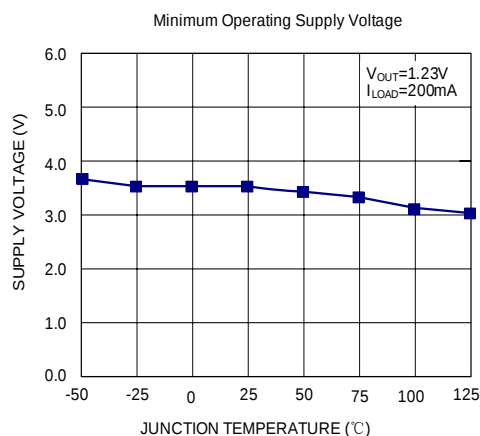
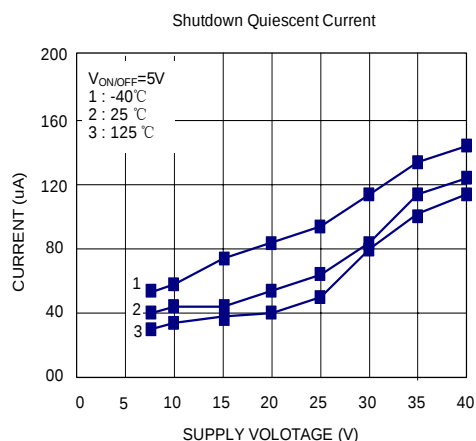
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	3.3V	V _{OUT}	4.75V ≤ V _{IN} ≤ 40V, 0.2A ≤ I _{LOAD} ≤ 3A	3.168	3.3	3.432	V
	5.0V		7V ≤ V _{IN} ≤ 40V, 0.2A ≤ I _{LOAD} ≤ 3A	4.8	5.0	5.2	V
	12V		15V ≤ V _{IN} ≤ 40V, 0.2A ≤ I _{LOAD} ≤ 3A	11.52	12.0	12.48	V
Efficiency	3.3V	η	V _{IN} =12V, 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)		DC	(Note 3)		100		%
Min Duty Cycle (OFF)			(Note 4)		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							
ON/OFF Pin Logic Input Threshold Voltage		V _{IH}	Low (Regulator ON)		1.3	0.6	V
		V _{IL}	High (Regulator OFF)	2.0	1.3		
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

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

■ TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS (cont.)



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