



P1596

LINEAR INTEGRATED CIRCUIT

150KHZ, 1.5A PWM BUCK DC/DC CONVERTER

DESCRIPTION

The UTC **P1596** series is a step-down switching regulator able to provide 1.5A output current. The available output voltages are 2.5V, 3.3V, 5V, 12V and an adjustable output version.

FEATURES

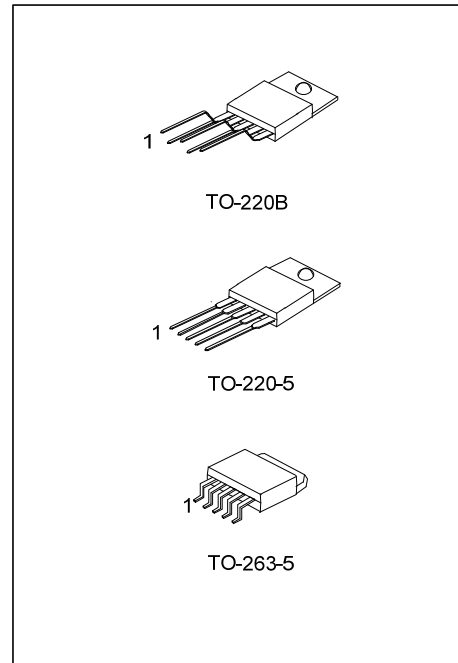
- * Output load current: 1.5A
- * Adjustable version output voltage range, 1.23V ~ 18V±4%
- * 150KHz ±15% fixed switching frequency
- * Voltage mode non-synchronous PWM control
- * Thermal-shutdown and current-limit protection
- * Operating voltage can be up to 24V
- * Low power standby mode
- * High efficiency
- * Internal current and thermal limit
- * Built-in switching transistor on chip

ORDERING INFORMATION

Ordering Number		Package	Packing
Normal	Lead Free Plating		
P1596-xx-TA5-T	P1596L-xx-TA5-T	TO-220-5	Tube
P1596-xx-TB5-T	P1596L-xx-TB5-T	TO-220B	Tube
P1596-xx-TQ5-R	P1596L-xx-TQ5-R	TO-263-5	Tape Reel
P1596-xx-TQ5-T	P1596L-xx-TQ5-T	TO-263-5	Tube

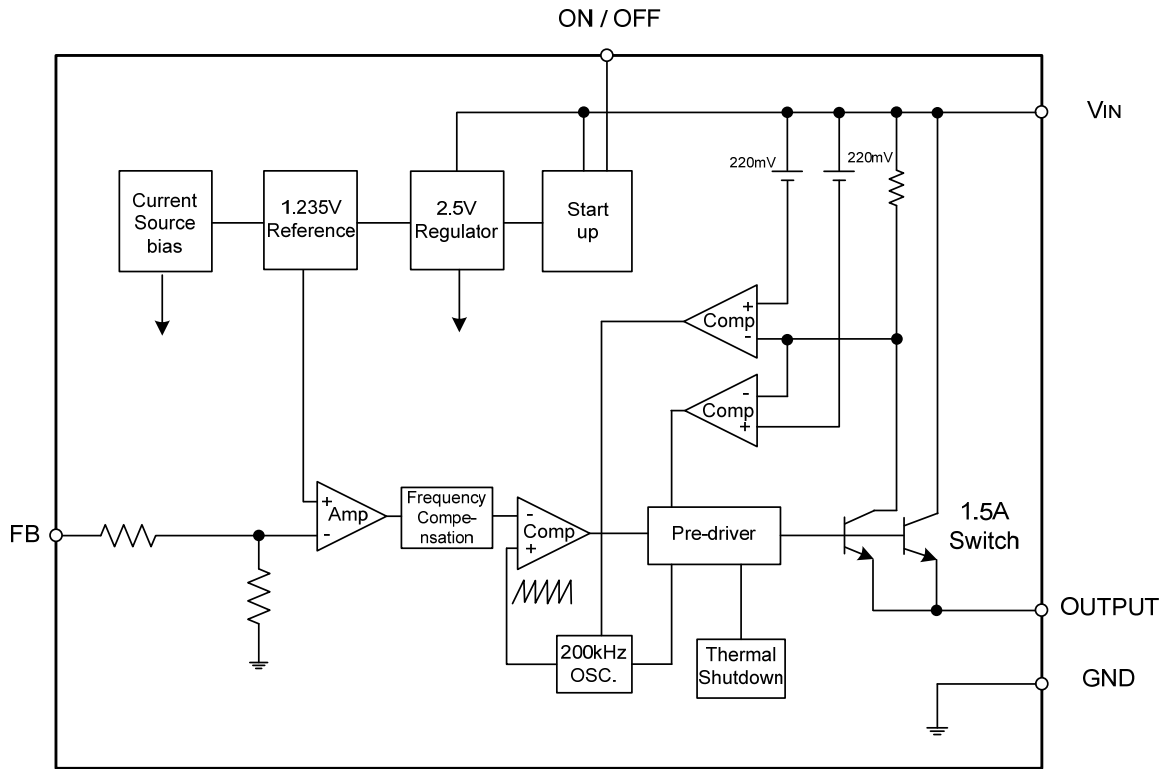
Note: xx: Output Voltage, refer to Marking Information.

<p>P1596L-xx-TA5-T</p> <p>(1)Packing Type (2)Package Type (3)Output Voltage Code (4)Lead Plating</p>	<p>(1) R: Tape Reel, T:Tube (2) TA5: TO-220-5, TB5: TO-220B, TQ5: TO-263-5 (3) xx: refer to Marking Information (4) L: Lead Free Plating, Blank: Pb/Sn</p>
--	--



*Pb-free plating product number: P1596L

■ BLOCK DIAGRAM



■ PIN DESCRIPTIONS

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

■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
TO-220-5	25:2.5V	
TO-220B	33:3.3V	
TO-263-5	50:5.0V	
	12:12V	
	AD:ADJ	

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Thermal Resistance Junction to Case	TO-220B	θ_{JC}	3	°C/W
	TO-220-5		3	
	TO-263-5		4	

■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Maximum Supply Voltage	V_{CC}	28	V
Operating Voltage	V_{OPR}	4.5 ~ 22	V
ON/OFF Pin Input Voltage	$V_{ON/OFF}$	-0.3 ~ +18	V
Feedback Pin Voltage	V_{FB}	-0.3 ~ +18	V
Output Voltage to Ground (Steady State)	V_{OUT}	-1	V
Power Dissipation	P_D	Internally limited	W
Operating Temperature	T_{OPR}	-40 ~ +125	°C
Storage Temperature	T_{STG}	-65 ~ +150	°C

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

■ ELECTRICAL CHARACTERISTICS

($T_J=25^\circ\text{C}$, $V_{IN}=12\text{V}$ for the 2.5V 3.3V, 5V, and Adjustable version and $V_{IN}=24\text{V}$ for the 12V version, $I_{LOAD}=500\text{mA}$.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT		
Output Voltage	2.5V	V_{OUT}	$3.8\text{V} \leq V_{IN} \leq 24\text{V}$, $0.2\text{A} \leq I_{LOAD} \leq 1.5\text{A}$		2.4	2.5	2.6	V
	3.3V		$4.75\text{V} \leq V_{IN} \leq 24\text{V}$, $0.2\text{A} \leq I_{LOAD} \leq 1.5\text{A}$		3.168	3.3	3.432	V
	5.0V		$7\text{V} \leq V_{IN} \leq 24\text{V}$, $0.2\text{A} \leq I_{LOAD} \leq 1.5\text{A}$		4.8	5.0	5.2	V
	12V		$15\text{V} \leq V_{IN} \leq 24\text{V}$, $0.2\text{A} \leq I_{LOAD} \leq 1.5\text{A}$		11.52	12	12.48	V
Efficiency	2.5V	η	$V_{IN}=12\text{V}$, $I_{LOAD}=1.5\text{A}$			73		%
	3.3V		$V_{IN}=12\text{V}$, $I_{LOAD}=1.5\text{A}$			73		%
	5.0V		$V_{IN}=12\text{V}$, $I_{LOAD}=1.5\text{A}$			80		%
	12V		$V_{IN}=24\text{V}$, $I_{LOAD}=1.5\text{A}$			72		%

UTC P1596-ADJ

Output Feedback	V_{FB}	$4.75\text{V} \leq V_{IN} \leq 24\text{V}$, $0.2\text{A} \leq I_{LOAD} \leq 1.5\text{A}$ V_{OUT} Programmed for 3V	1.193	1.23	1.267	V
Efficiency	η	$V_{IN}=12\text{V}$, $I_{LOAD}=1.5\text{A}$		78		%

ALL OUTPUT VOLTAGE

Feedback Bias Current	I_{BIAS}	Adjustable Version Only, $V_{FB}=1.3\text{V}$		-10	-50	nA
Oscillator Frequency	f_{OSC}	(Note 1)	127	150	173	KHz
Saturation Voltage	V_{SAT}	$I_{OUT}=2\text{A}$ (Note 2, 3)		1.25	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)	1.8	2.25	3.45	A
Output Leakage Current	I_L	Output=0V (Notes 2, 4)			-200	μA
		Output=-1V (Note 5)		-5		mA
Quiescent Current	I_Q	(Note 4)		5	10	mA
Standby Quiescent Current	I_{STBY}	ON/OFF Pin=5V (OFF) (Note 5)		70	150	μA

Note 1: The switching frequency is reduced when the second stage current limit is activated.

2: No diode, inductor or capacitor connected to output pin.

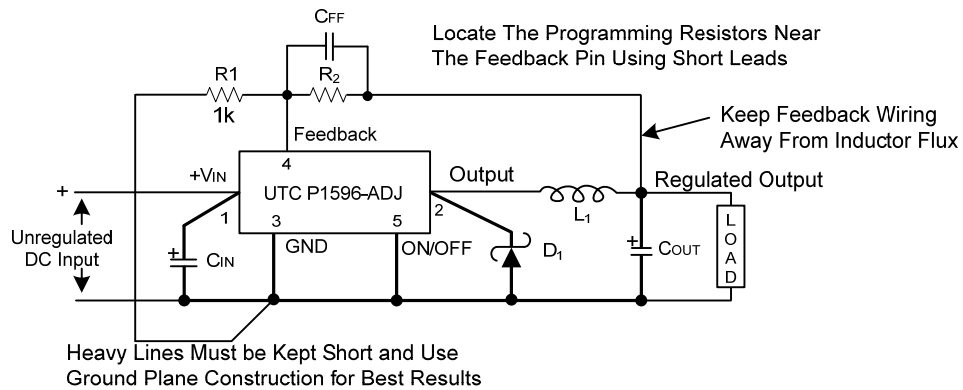
3: Feedback pin removed from output and connected to 0V to force the output transistor switch ON.

4: Feedback pin removed from output and connected to 12V for the 2.5V 3.3V, 5V, and the ADJ. version, and 15V for the 12V version, to force the output transistor switch OFF.

5: $V_{IN} = 24\text{V}$

TYPICAL APPLICATION

FOR ADJUSTABLE OUTPUT VOLTAGE VERSION



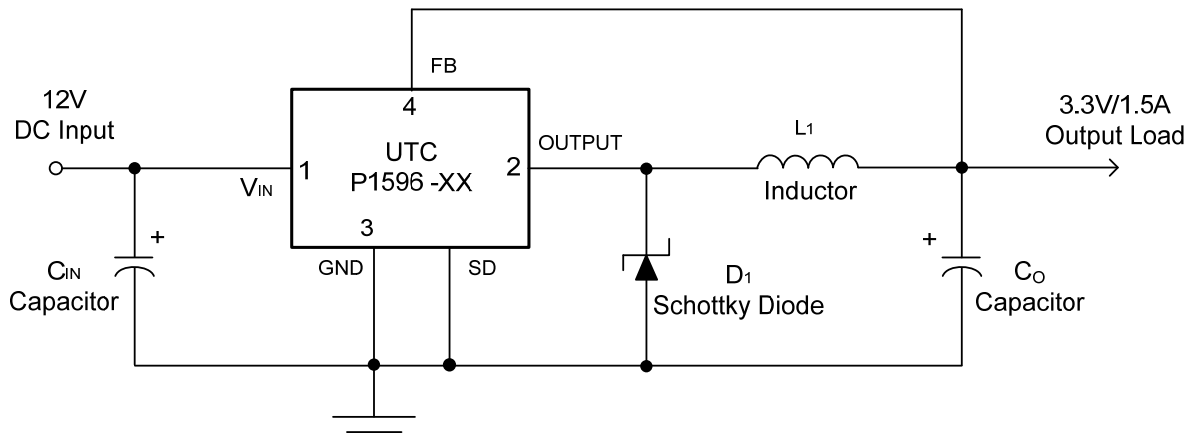
$$V_{OUT} \times (R_1 / (R_1 + R_2)) = V_{REF}$$

$$V_{OUT} = V_{REF} (1 + R_2 / R_1)$$

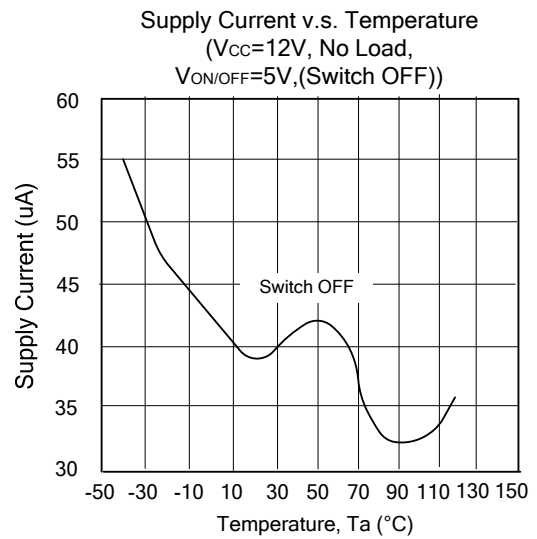
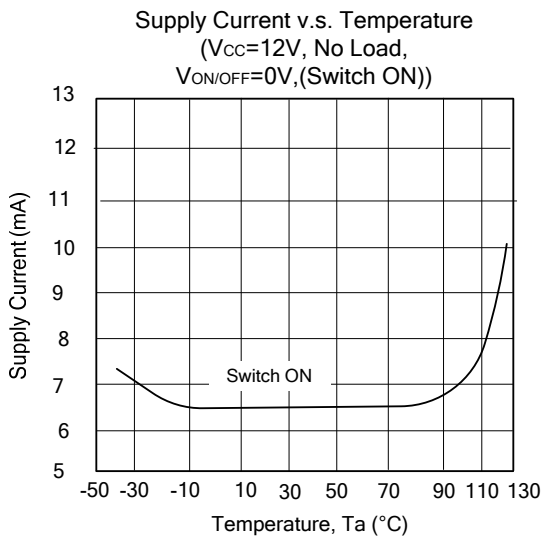
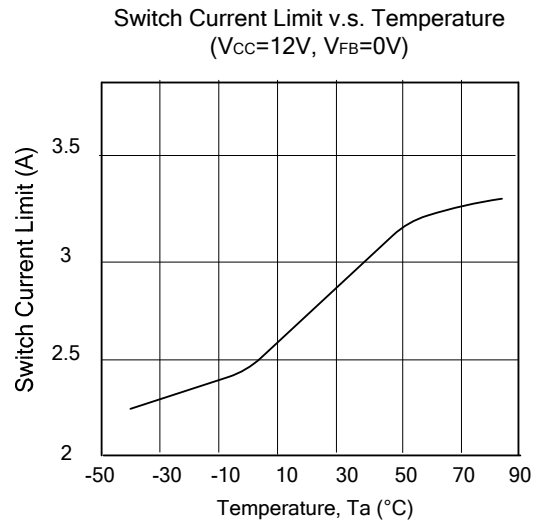
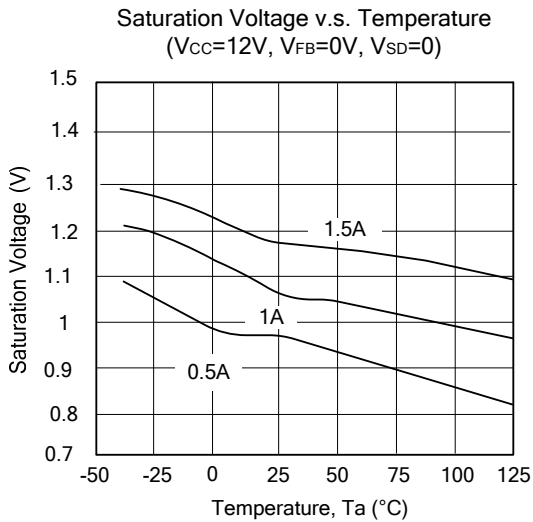
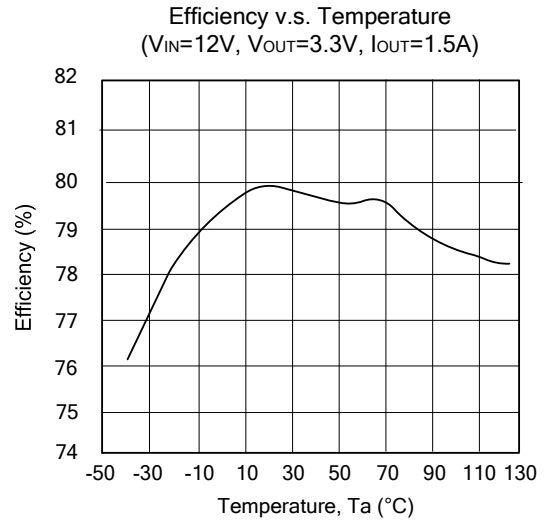
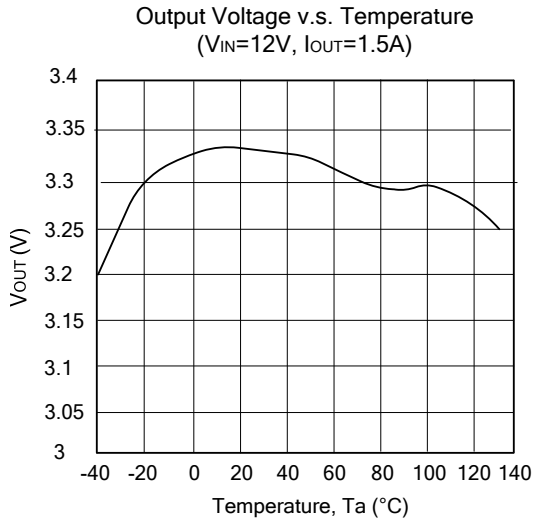
Where $V_{REF} = 1.23V$

$$R_2 = R_1 ((V_{OUT} / V_{REF}) - 1)$$

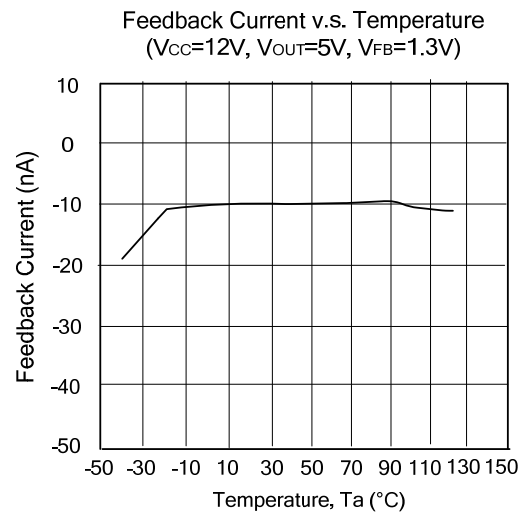
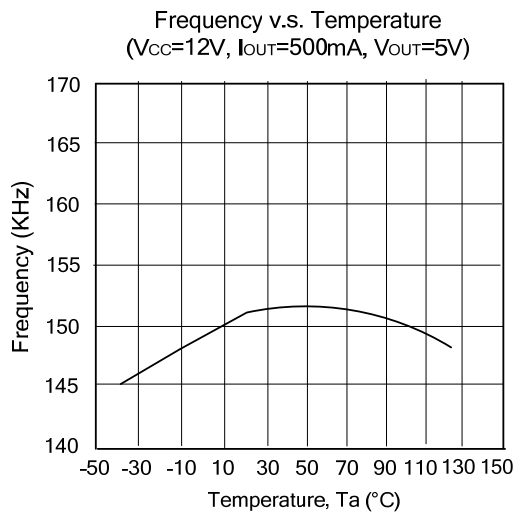
FOR FIXED OUTPUT VOLTAGE VERSIONS



TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.