



## P3596

## LINEAR INTEGRATED CIRCUIT

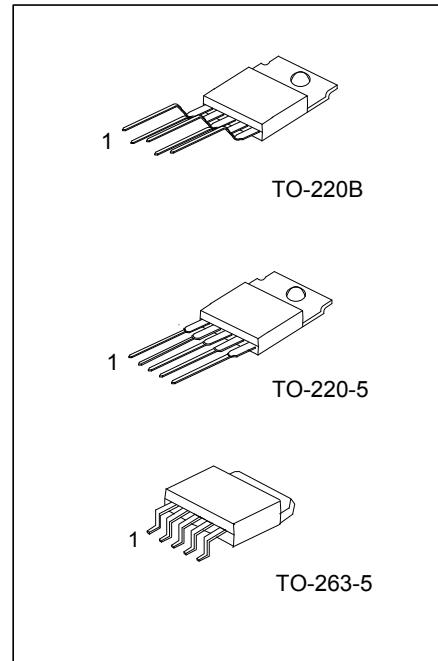
### 150KHZ, 3A PWM STEP-DOWN DC/DC CONVERTER

#### DESCRIPTION

The UTC **P3596** series is a step-down switching regulator able to provide 3A output current. The available output voltages are 2.5V, 3.3V, 5V, 12V, and an adjustable output version.

#### FEATURES

- \*Output load current: 3A
- \*Adjustable version output voltage range, 1.23V ~ 32V±4%
- \*Operating voltage can be up to 35V
- \*Low power standby mode
- \*High efficiency
- \*Internal current and thermal limit



#### ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
P3596L-xx-TB5-T	P3596G-xx-TB5-T	TO-220B	Tube
P3596L-xx-TA5-T	P3596G-xx-TA5-T	TO-220-5	Tube
P3596L-xx-TQ5-R	P3596G-xx-TQ5-R	TO-263-5	Tape Reel
P3596L-xx-TQ5-T	P3596G-xx-TQ5-T	TO-263-5	Tube

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

<p>P3596G-xx-TB5-T</p>	<ul style="list-style-type: none"> <li>(1) Packing Type</li> <li>(2) Package Type</li> <li>(3) Output Voltage Code</li> <li>(4) Green Package</li> </ul>	<ul style="list-style-type: none"> <li>(1) R: Tape Reel, T: Tube</li> <li>(2) TB5: TO-220B, TA5: TO-220-5, TQ5: TO-263-5</li> <li>(3) xx: refer to Marking Information</li> <li>(4) G: Halogen Free and Lead Free, L: Lead Free</li> </ul>
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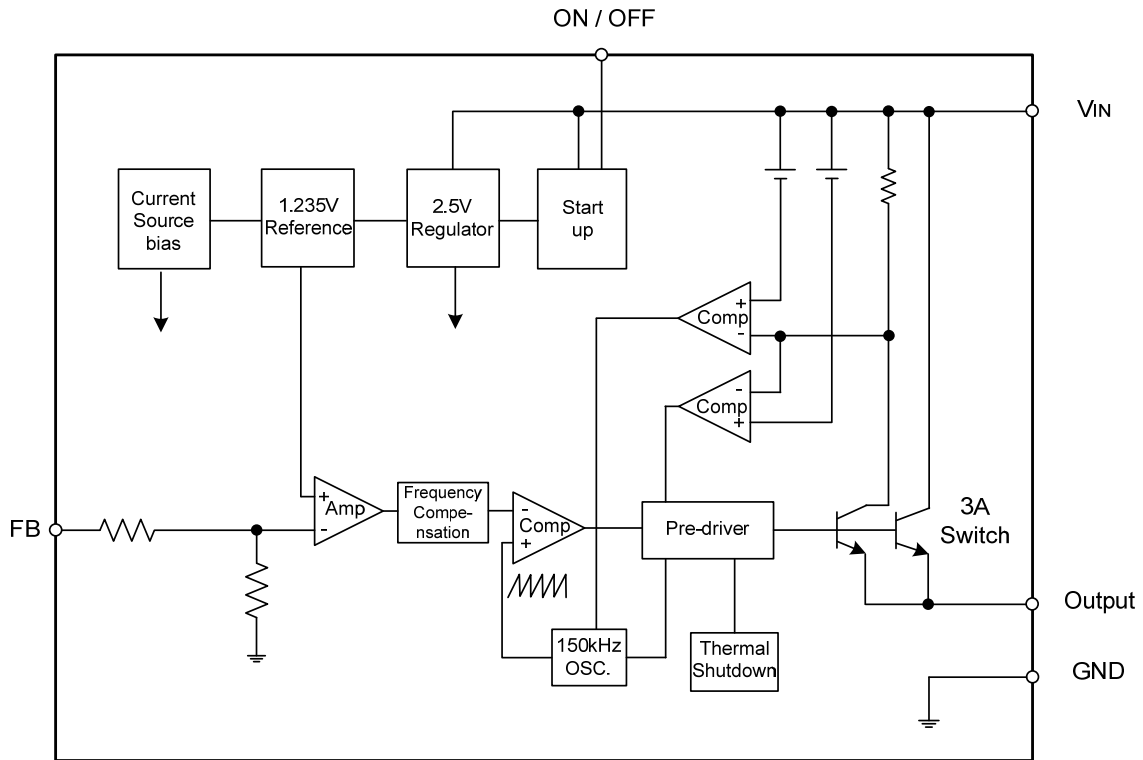
### MARKING INFORMATION

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

### PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	V <sub>IN</sub>	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



### ■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Maximum Supply Voltage	$V_{CC}$	40	V
Operating Voltage	$V_{OPR}$	4.5 ~ 35	V
ON/OFF Pin Input Voltage	$V_{ON/OFF}$	-0.3 ~ +20	V
Feedback Pin Voltage	$V_{FB}$	-0.3 ~ +20	V
Output Voltage to Ground (Steady State)	$V_{OUT}$	-1	V
Power Dissipation	$P_D$	Internally limited	mW
Junction Temperature	$T_J$	+150	°C
Ambient 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 could be permanently damaged.  
Absolute maximum ratings are stress ratings only and functional device operation is not implied.

### ■ THERMAL DATA

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

### ■ ELECTRICAL CHARACTERISTICS

( $T_J=25^\circ\text{C}$ ,  $V_{IN}=12\text{V}$  for the 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	$V_{OUT}$	$3.8\text{V} \leq V_{IN} \leq 35\text{V}$ , $0.2\text{A} \leq I_{LOAD} \leq 3\text{A}$	2.4	2.5	2.6	V
	3.3V			3.168	3.3	3.432	V
	5.0V			4.8	5.0	5.2	V
	12V			11.52	12.0	12.48	V
Efficiency	2.5V	$\eta$	$V_{IN}=12\text{V}$ , $I_{LOAD}=3\text{A}$		73		%
	3.3V				73		%
	5.0V				80		%
	12V				90		%

#### FOR P3596-ADJ

Feedback Voltage	$V_{FB}$	$4.5\text{V} \leq V_{IN} \leq 35\text{V}$ , $0.2\text{A} \leq I_{LOAD} \leq 3\text{A}$ $V_{OUT}$ programmed for 3V	1.193	1.230	1.267	V
Efficiency	$\eta$	$V_{IN}=12\text{V}$ , $V_{OUT}=3\text{V}$ , $I_{LOAD}=3\text{A}$		73		%

#### 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	$V_{SAT}$	$I_{OUT}=3\text{A}$ (Note 2, 3)		1.16	1.4	V
Duty Cycle	Min Max	DC		ON (Note 3)	100	%
				OFF (Note 4)	0	
Current Limit	$I_{LIMIT}$	Peak Current (Notes 2, 3)	3.6	4.5	6.9	A
Output Leakage Current	$I_{LEAK}$	Output=0V (Notes 2, 4)			50	$\mu\text{A}$
		Output=-1V, $V_{IN}=40\text{V}$		2	30	mA
Quiescent Current	$I_Q$	(Note 4)		5	10	mA
Standby Quiescent Current	$I_{STBY}$	ON/OFF pin=5V (OFF), $V_{IN}=40\text{V}$		80	200	$\mu\text{A}$

■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>ON/OFF CONTROL</b>							
ON/OFF Pin Logic Input Threshold Voltage	Low	$V_{IH}$	Regulator ON	0.6	1.3		V
	High	$V_{IL}$	Regulator OFF	2.0			
ON/OFF Pin Input Current		$I_H$	$V_{LOGIC}=2.5V$ (Regulator OFF)		5	15	$\mu A$
		$I_L$	$V_{LOGIC}=0.5V$ (Regulator ON)		0.02	5	$\mu A$

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

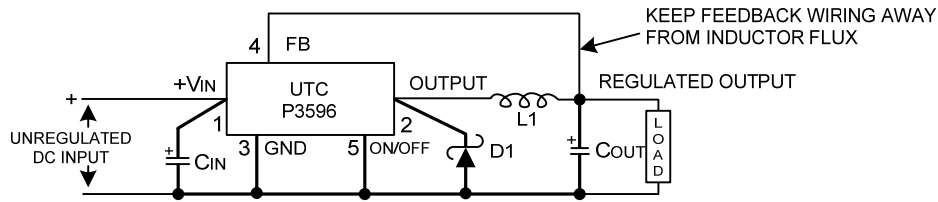
2.No diode, inductor or capacitor connected to output pin.

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 15V for the 12V version, and 12V for others to force the output transistor switch OFF.

## TYPICAL APPLICATION

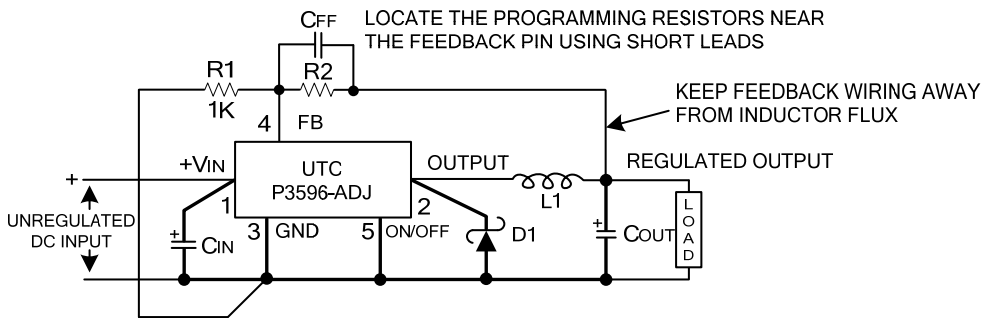
### For Fixed Versions



HEAVY LINES MUST BE KEPT SHORT AND USE GROUND PLANE CONSTRUCTION FOR BEST RESULTS

CIN: 470  $\mu$ F, 50V, Aluminum Electrolytic Nichicon "PL Series"  
 COUT: 220  $\mu$ F, 25V Aluminum Electrolytic, Nichicon "PL Series"  
 D1: 5A, 40V Schottky Rectifier, 1N5825  
 L1: 68  $\mu$ H, L38

### For Adjustable Version



HEAVY LINES MUST BE KEPT SHORT AND USE GROUND PLANE CONSTRUCTION FOR BEST RESULTS

$$V_{OUT} \times \left( \frac{R1}{R1 + R2} \right) = V_{REF}$$

$$V_{OUT} = V_{REF} \left( 1 + \frac{R2}{R1} \right)$$

Where  $V_{REF} = 1.23V$

$$R2 = R1 \left( \frac{V_{OUT}}{V_{REF}} - 1 \right)$$

- Note: 1. Select R1 to be approximately 1 K $\Omega$ , use a 1% resistor for best stability.  
 2. CIN: 470  $\mu$ F, 50V, Aluminum Electrolytic Nichicon "PL Series"  
 3. COUT: 220  $\mu$ F, 35V Aluminum Electrolytic, Nichicon "PL Series"  
 4. D1: 5A, 40V Schottky Rectifier, 1N5825  
 5. L1: 68  $\mu$ H, L38  
 6. R1: 1 K $\Omega$ , 1%  
 7. CFF: See Application Information Section

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