



P3596Q

LINEAR INTEGRATED CIRCUIT

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

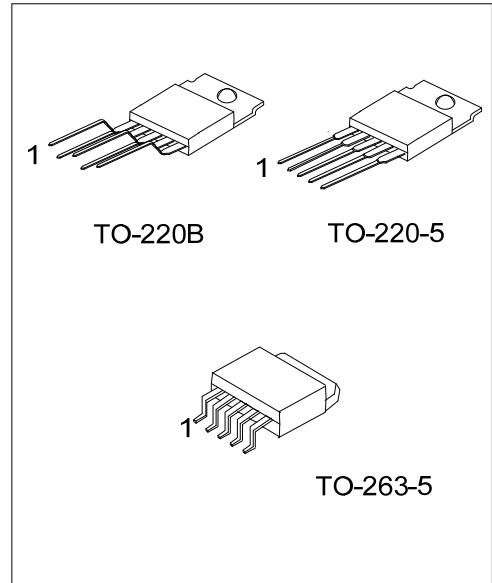
DESCRIPTION

The UTC **P3596Q** 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		
P3596QL-xx-TA5-T	P3596QG-xx-TA5-T	TO-220-5	Tube
P3596QL-xx-TB5-T	P3596QG-xx-TB5-T	TO-220B	Tube
P3596QL-xx-TQ5-T	P3596QG-xx-TQ5-T	TO-263-5	Tube
P3596QL-xx-TQ5-R	P3596QG-xx-TQ5-R	TO-263-5	Tape Reel

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

<p>P3596QG-xx-TA5-T</p> <p>(1)Packing Type (2)Package Type (3)Output Voltage Code (4)Green Package</p>	<p>(1) T: Tube, R: Tape Reel (2) TA5: TO-220-5, TB5: TO-220B, TQ5: TO-263-5, (3) xx: refer to Marking Information (4) G: Halogen Free and Lead Free, L: Lead Free</p>
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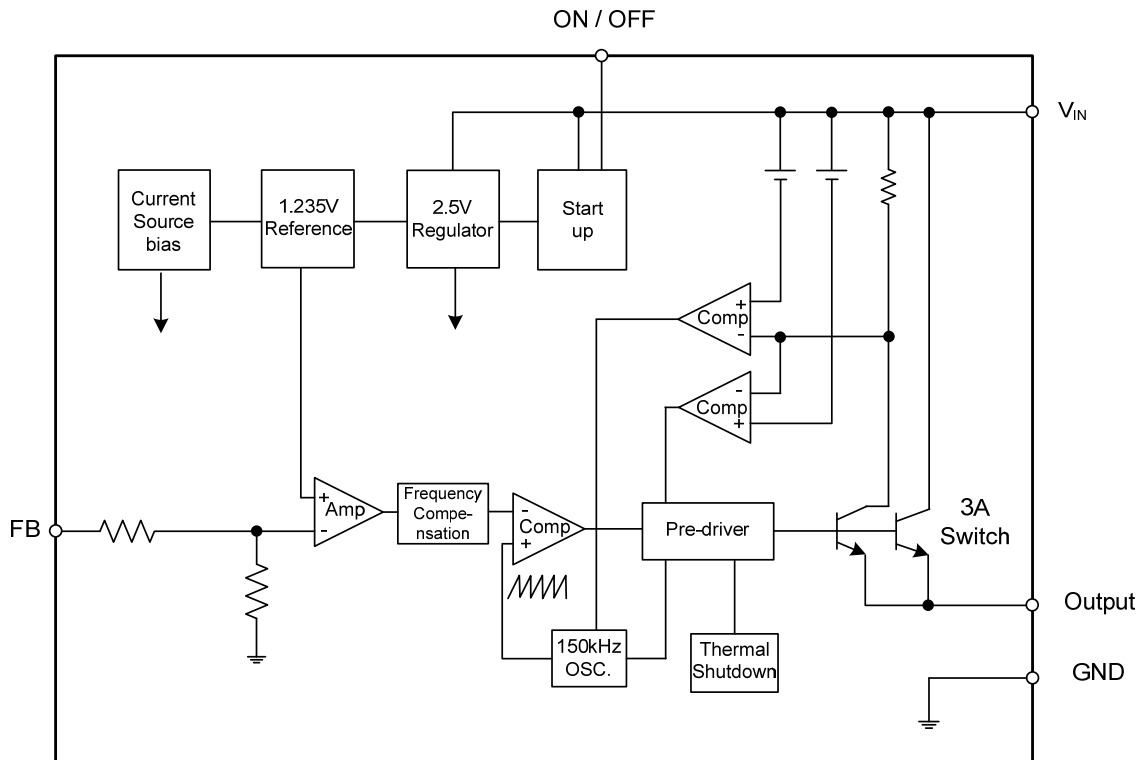
MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
TO-220B TO-220-5 TO-263-5	50:5.0V 12:12V AD:ADJ	<p>UTC P3596Q</p> <p>Lot Code ← → Date Code</p> <p>Voltage Code ← →</p> <p>1 2 3 4 5</p> <p>L: Lead Free G: Halogen Free</p>

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

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	θ_{JA}	45	°C/W
	TO-220-5			
	TO-263-5			
Junction to Case	TO-220B	θ_{JC}	3	°C/W
	TO-220-5			
	TO-263-5			

■ 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	5.0V	V_{OUT}	$7\text{V} \leq V_{IN} \leq 35\text{V}$, $0.2\text{A} \leq I_{LOAD} \leq 3\text{A}$	4.8	5.0	5.2	V
	12V			11.52	12.0	12.48	V
Efficiency	5.0V	η	$V_{IN}=12\text{V}$, $I_{LOAD}=3\text{A}$		80		%
	12V			$V_{IN}=24\text{V}$, $I_{LOAD}=3\text{A}$		90	
FOR P3596Q-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	η	$V_{IN}=12\text{V}$, $V_{OUT}=3\text{V}$, $I_{LOAD}=3\text{A}$		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	DC		ON (Note 3)	100		%
	Max			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	μA	
		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	μA	
Thermal Shutdown Threshold	T_{SD}			150		°C	

■ ELECTRICAL CHARACTERISTICS (Cont.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
ON/OFF CONTROL							
ON/OFF Pin Logic Input Threshold Voltage	Low	V_{IH}	Regulator ON	0.6	1.3		V
	High	V_{IL}	Regulator OFF	2.0			V
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

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

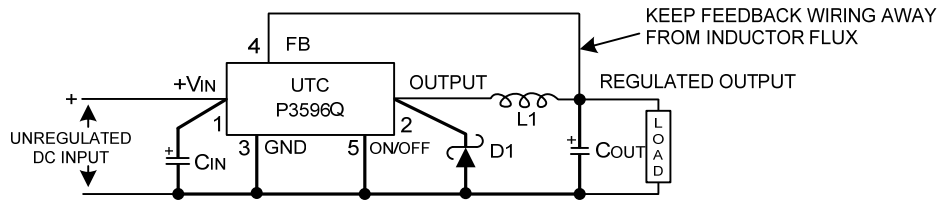
2.No diode, inductor or capacitor connected to output pin.

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

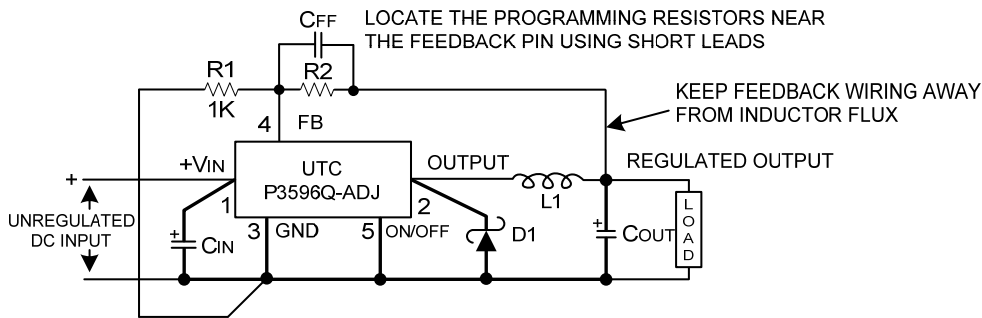
For Fixed Versions



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

- CIN: 470 μ F, 50V, Aluminum Electrolytic Nichicon "PL Series"
- COUT: 220 μ F, 25V Aluminum Electrolytic, Nichicon "PL Series"
- D1: 5A, 40V Schottky Rectifier, 1N5825
- L1: 68 μ 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 Ω , use a 1% resistor for best stability.
 2. CIN: 470 μ F, 50V, Aluminum Electrolytic Nichicon "PL Series"
 3. COUT: 220 μ F, 35V Aluminum Electrolytic, Nichicon "PL Series"
 4. D1: 5A, 40V Schottky Rectifier, 1N5825
 5. L1: 68 μ H, L38
 6. R1: 1 K Ω , 1%
 7. CFF: See Application Information Section

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