



## P3596

## LINEAR INTEGRATED CIRCUIT

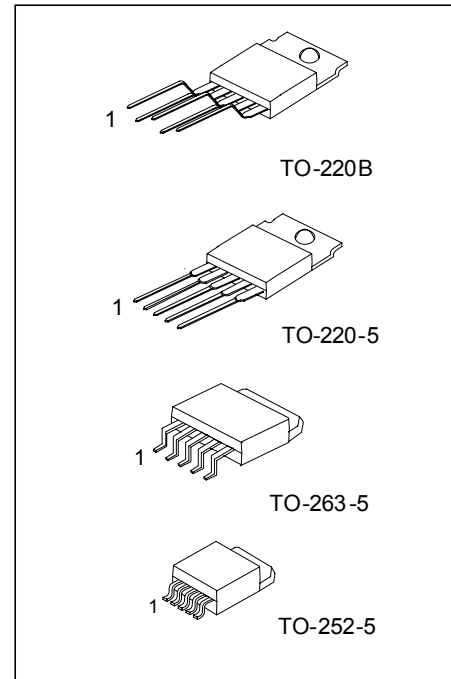
### 150KHZ, 3A PWM STEP-DOWN DC/DC CONVERTER

#### DESCRIPTION

The UTC **P3596** series is a step-down switching regulator able to provide **3A** output current. The available output voltages are **1.5V, 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



\*Pb-free plating product number:P3596L

#### ORDERING INFORMATION

Ordering Number		Package	Packing
Normal	Lead Free Plating		
P3596-xx-TA5-T	P3596L-xx-TA5-T	TO-220-5	Tube
P3596-xx-TB5-T	P3596L-xx-TB5-T	TO-220B	Tube
P3596-xx-TN5-R	P3596L-xx-TN5-R	TO-252-5	Tape Reel
P3596-xx-TN5-T	P3596L-xx-TN5-T	TO-252-5	Tube
P3596-xx-TQ5-R	P3596L-xx-TQ5-R	TO-263-5	Tape Reel
P3596-xx-TQ5-T	P3596L-xx-TQ5-T	TO-263-5	Tube

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

<p>P3596L-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, TN5: TO-252-5, TQ5: TO-263-5 (3) xx: refer to Marking Information (4) L: Lead Free Plating, Blank: Pb/Sn</p>
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## 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

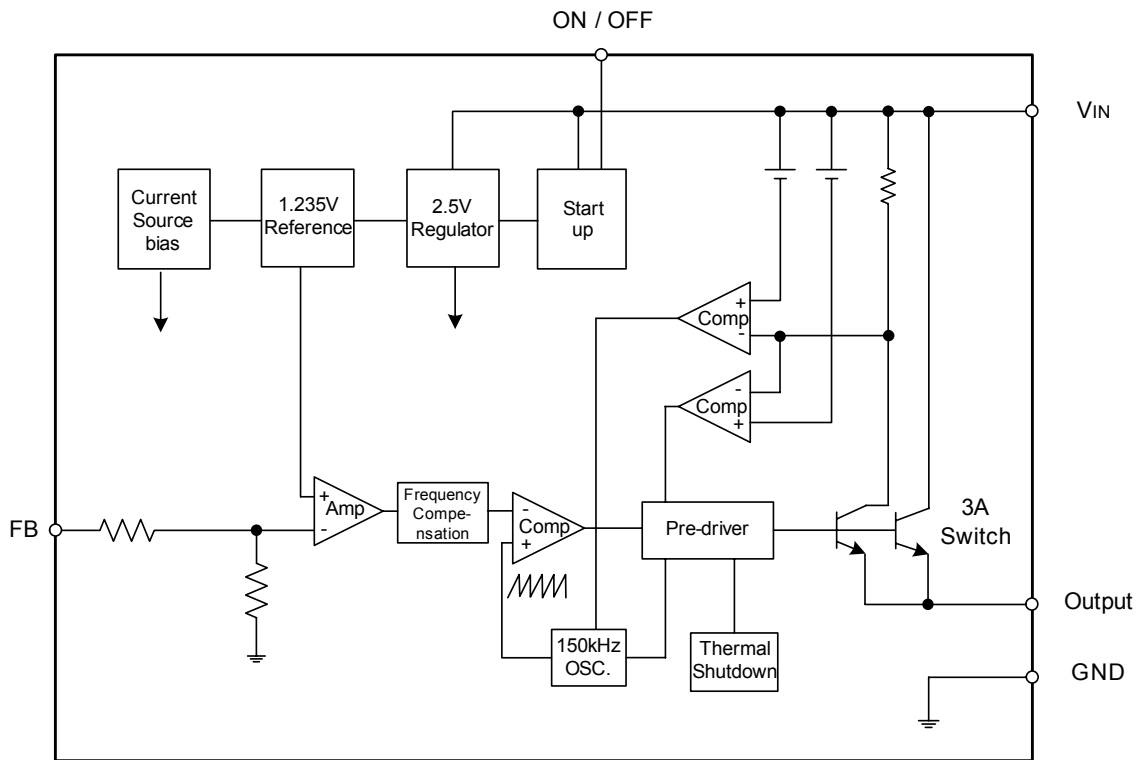
## MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
TO-220-5 TO-220B TO-252-5 TO-263-5	15:1.5V 25:2.5V 33:3.3V 50:5.0V 12:12V AD:ADJ	

## THERMAL DATA

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

■ 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
Maximum Junction Temperature	$T_J$	+150	
Temperature Range	$T_{OPR}$	-40 ~ +125	
Storage Temperature Range	$T_{STG}$	-65 ~ +150	

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.

### ■ 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	1.5V	2.8V $V_{IN}$ 35V, 0.2A $I_{LOAD}$ 3A	1.44	1.5	1.56	V
	2.5V	3.8V $V_{IN}$ 35V, 0.2A $I_{LOAD}$ 3A	2.4	2.5	2.6	V
	3.3V	4.75V $V_{IN}$ 35V, 0.2A $I_{LOAD}$ 3A	3.168	3.3	3.432	V
	5.0V	7V $V_{IN}$ 35V, 0.2A $I_{LOAD}$ 3A	4.8	5.0	5.2	V
	12V	15V $V_{IN}$ 35V, 0.2A $I_{LOAD}$ 3A	11.52	12.0	12.48	V
Efficiency	1.5V	$V_{IN}=12\text{V}$ , $I_{LOAD}=3\text{A}$		73		%
	2.5V	$V_{IN}=12\text{V}$ , $I_{LOAD}=3\text{A}$		73		%
	3.3V	$V_{IN}=12\text{V}$ , $I_{LOAD}=3\text{A}$		73		%
	5.0V	$V_{IN}=12\text{V}$ , $I_{LOAD}=3\text{A}$		80		%
	12V	$V_{IN}=24\text{V}$ , $I_{LOAD}=3\text{A}$		90		%

#### UTC P3596-ADJ

Feedback Voltage	$V_{FB}$	4.5V $V_{IN}$ 35V, 0.2A $I_{LOAD}$ 3A $V_{OUT}$ 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	DC ON (Note 3) OFF (Note 4)		100		%
	Max			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	$\mu\text{A}$

#### 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		
ON/OFF Pin Input Current		$I_H$	$V_{LOGIC}=2.5\text{V}$ (Regulator OFF)		5	$\mu\text{A}$
		$I_L$	$V_{LOGIC}=0.5\text{V}$ (Regulator ON)		0.02	$\mu\text{A}$

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

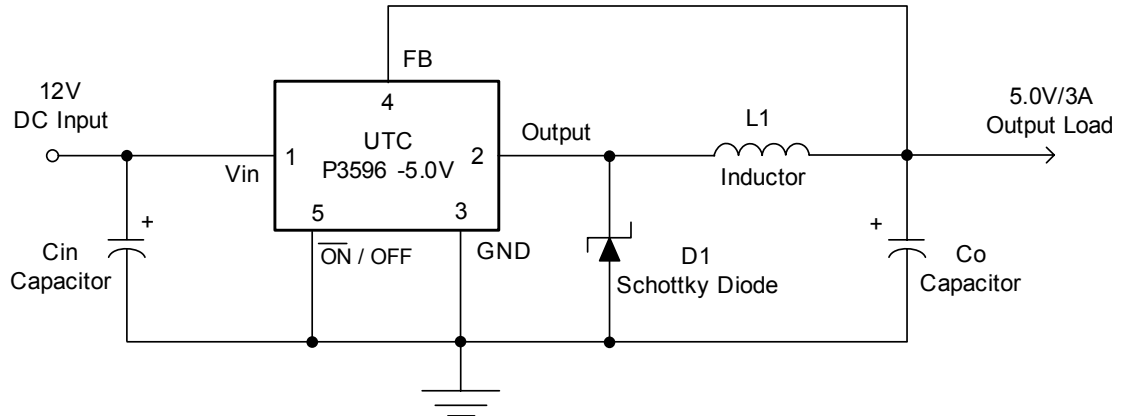
2. No diode, inductor or capacitor connected to output pin.

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

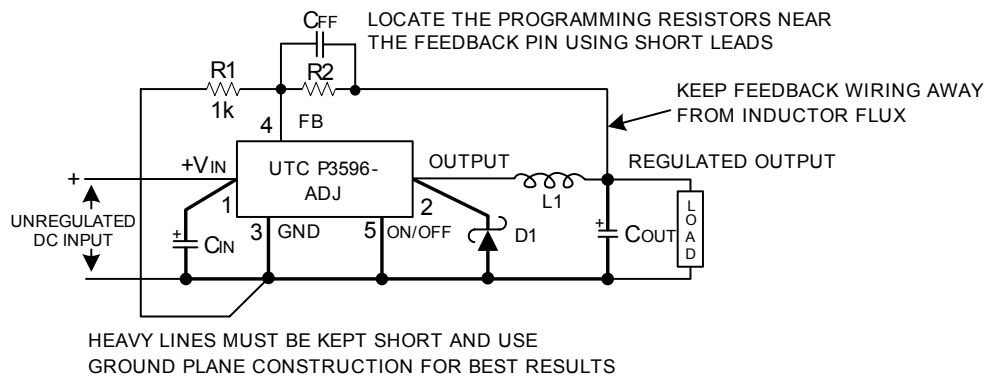
## ■ TYPICAL APPLICATION

### For Fixed Versions



Note: The DC input would be 15V for 12V version.

### For Adjustable Version



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

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

Where  $V_{REF} = 1.23V$

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

## TYPICAL CHARACTERISTICS

Fig. 1 Normalized Output Voltage

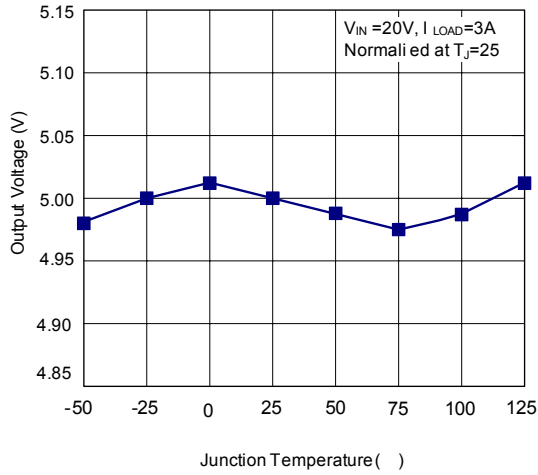


Fig. 2 Line Regulation

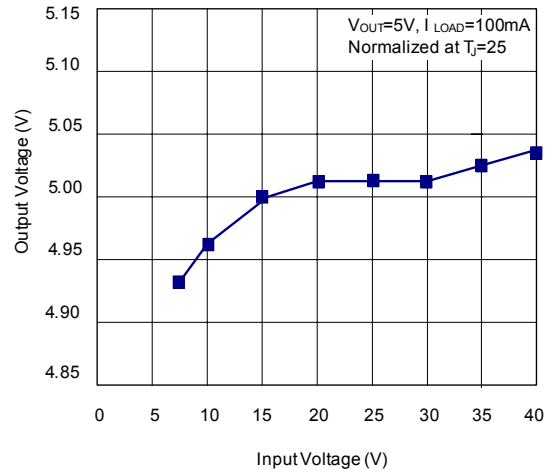


Fig. 3 Efficiency

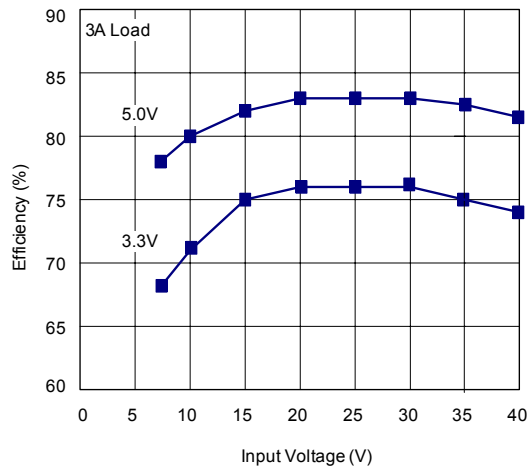


Fig. 4 Switch Saturation Voltage

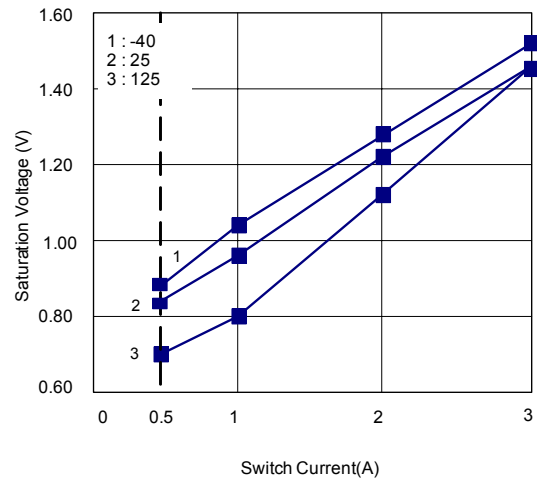


Fig. 5 Switch Current Limit

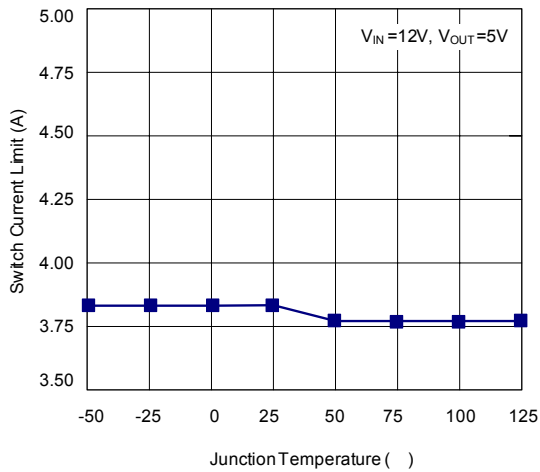
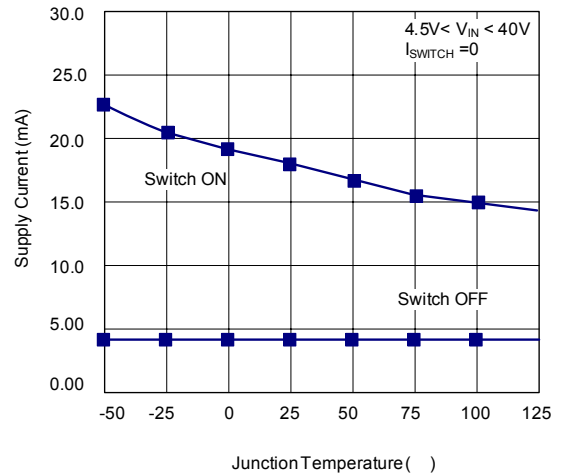


Fig. 6 Operating Quiescent Current



## TYPICAL CHARACTERISTICS (Cont.)

Fig. 7 Shutdown Quiescent Current

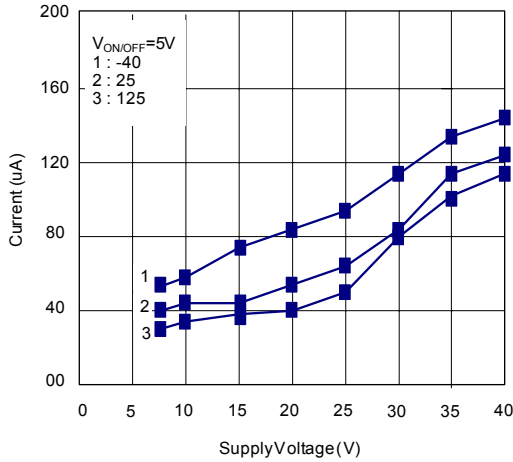


Fig. 8 Minimum Operating Supply Voltage

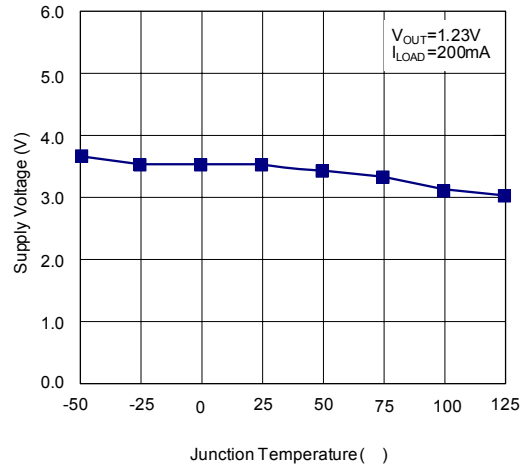


Fig. 9 ON/OFF Threshold Voltage

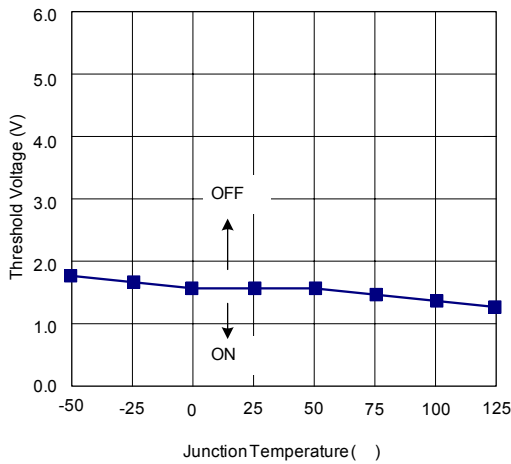


Fig. 10 ON/OFF Pin Current (Sinking)

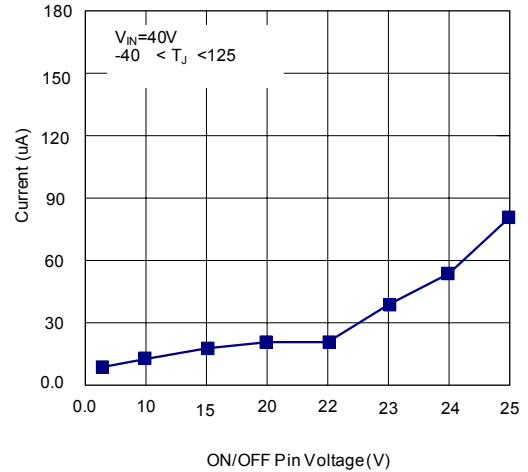


Fig. 11 Switch Frequency

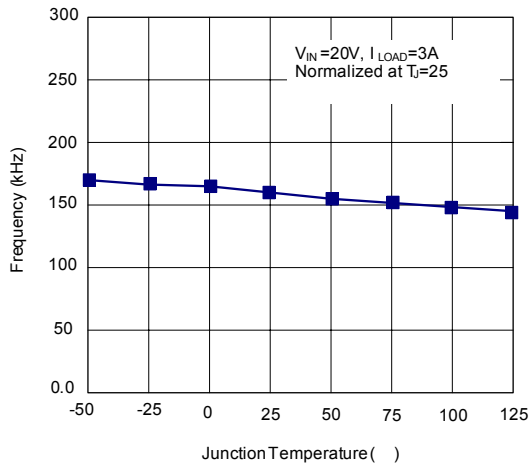
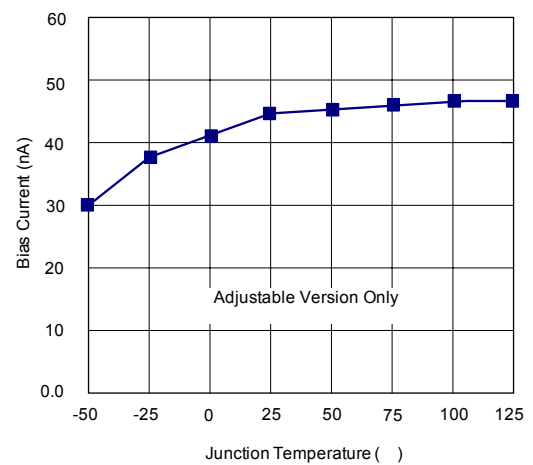


Fig. 12 Feedback Pin Bias Current



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