

# Precision, Micropower, 3V Series Voltage Reference in SOT23

## ABSOLUTE MAXIMUM RATINGS

(Voltages Referenced to GND)

$V_{IN}$ ,  $V_{OUT}$  ..... -0.3V to +6V

Output Short-Circuit Duration to GND or  $V_{IN}$  ..... Continuous

Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )

3-Pin SOT23 (derate 4.0mW/ $^\circ\text{C}$  above  $+70^\circ\text{C}$ ) ..... 320mW

Operating Temperature Range .....  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$

Junction Temperature .....  $+150^\circ\text{C}$

Storage Temperature Range .....  $-65^\circ\text{C}$  to  $+150^\circ\text{C}$

Lead Temperature (soldering, 10s) .....  $+300^\circ\text{C}$

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## ELECTRICAL CHARACTERISTICS

( $V_{IN} = 5\text{V}$ ;  $C_{OUT} = 47\text{nF}$ ,  $C_{IN} = 0.1\mu\text{F}$ ,  $I_{OUT} = 0$ ;  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise noted. Typical values are at  $T_A = +25^\circ\text{C}$ .) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>OUTPUT</b>						
Output Voltage	$V_{OUT}$	MAX6010A (0.2%), $T_A = +25^\circ\text{C}$	2.994	3.000	3.006	V
		MAX6010B (0.4%), $T_A = +25^\circ\text{C}$	2.988	3.000	3.012	
Output-Voltage Temperature Drift	$TCV_{OUT}$	(Note 2)		16	50	ppm/ $^\circ\text{C}$
Line Regulation	$\Delta V_{OUT}/\Delta V_{IN}$	$3.2\text{V} \leq V_{IN} \leq 5.5\text{V}$		50	350	$\mu\text{V/V}$
Load Regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	$0 \leq I_{OUT} \leq 7\text{mA}$		60	200	$\mu\text{V/mA}$
		$-1\text{mA} \leq I_{OUT} \leq 0$		0.25	10	$\mu\text{V}/\mu\text{A}$
Short-Circuit Current	$I_{SC}$	Sourcing to GND		20		mA
		Sinking from $V_{IN}$		15		
Dropout Voltage	$V_{IN} - V_{OUT}$	$I_{OUT} = 1\text{mA}$ (Note 3)		55	200	mV
Thermal Hysteresis		(Note 4)		210		ppm
<b>DYNAMIC CHARACTERISTICS</b>						
Noise Voltage	$e_{OUT}$	0.1Hz to 10Hz		100		$\mu\text{V}_{P-P}$
		10Hz to 10kHz		200		$\mu\text{V}_{RMS}$
Ripple Rejection	PSRR	$V_{IN} = 5\text{V} \pm 100\text{mV}$ ( $f \leq 2\text{kHz}$ ), $I_{OUT} = 1\text{mA}$		50		dB
Turn-On Settling Time	$t_R$	Settling to 0.1%, $C_{OUT} = 0.1\mu\text{F}$		700		$\mu\text{s}$
Capacitive-Load Stability Range	$C_{OUT}$	(Note 2)	1		1000	nF
<b>INPUT</b>						
Supply Voltage Range	$V_{IN}$	Guaranteed by line regulation test	3.2		5.5	V
Quiescent Supply Current	$I_{IN}$	$T_A = +25^\circ\text{C}$		3.6	5	$\mu\text{A}$
		$T_A = T_{MIN}$ to $T_{MAX}$		3.6	6	
Change in Quiescent Supply Current vs. Input Voltage	$\Delta I_{IN}/\Delta V_{IN}$	$3.2\text{V} \leq V_{IN} \leq 5.5\text{V}$		0.5	0.25	$\mu\text{A/V}$

**Note 1:** Devices are 100% production tested at  $T_A = +25^\circ\text{C}$  and are guaranteed by design from  $T_A = T_{MIN}$  to  $T_{MAX}$ .

**Note 2:** Not production tested. Guaranteed by design.

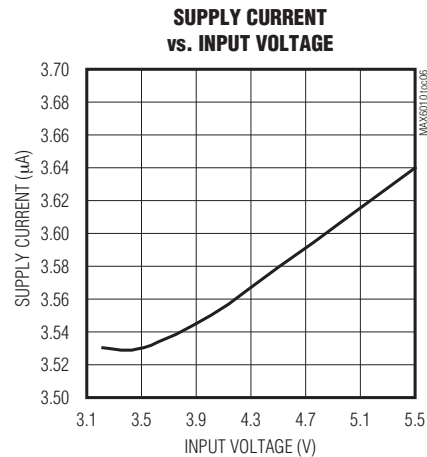
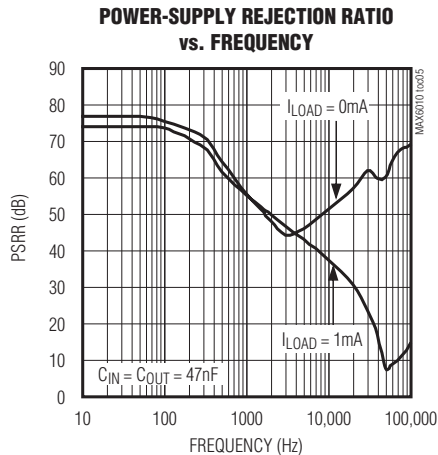
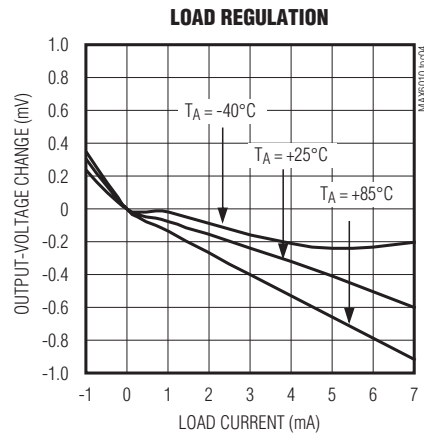
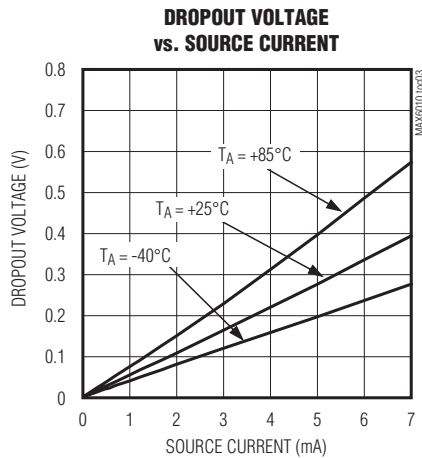
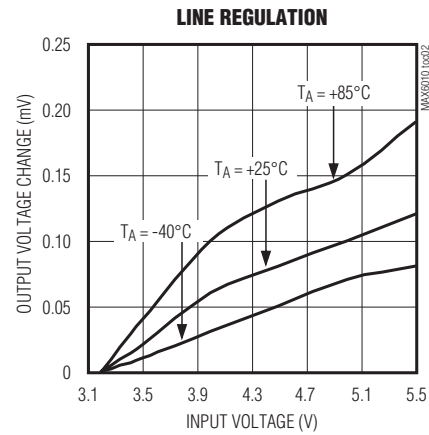
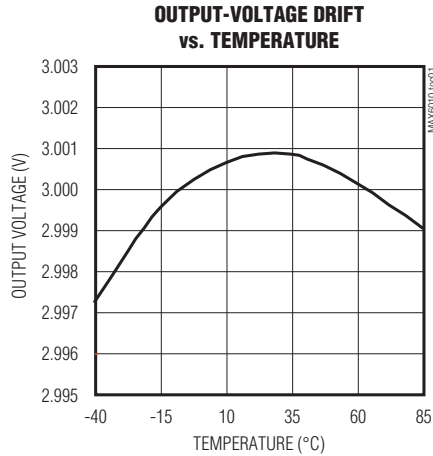
**Note 3:** Dropout voltage is the minimum input voltage at which  $V_{OUT}$  changes  $\leq 0.2\%$  from  $V_{OUT}$  at rated  $V_{IN}$  and is guaranteed by load regulation test.

**Note 4:** Thermal hysteresis is defined as the change in  $T_A = +25^\circ\text{C}$  output voltage before and after temperature cycling of the device (from  $T_A = T_{MIN}$  to  $T_{MAX}$ ). Initial measurement at  $T_A = +25^\circ\text{C}$  is followed by temperature cycling the device to  $T_A = +85^\circ\text{C}$  then to  $T_A = -40^\circ\text{C}$  and another measurement at  $T_A = +25^\circ\text{C}$  is compared to the original measurement at  $T_A = +25^\circ\text{C}$ .

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## Typical Operating Characteristics

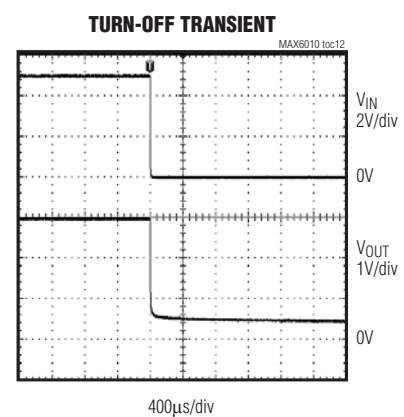
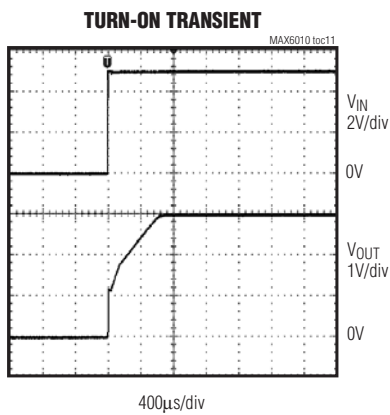
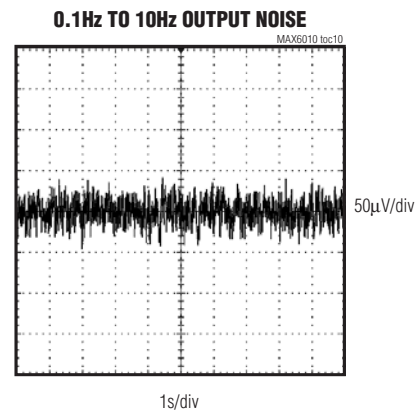
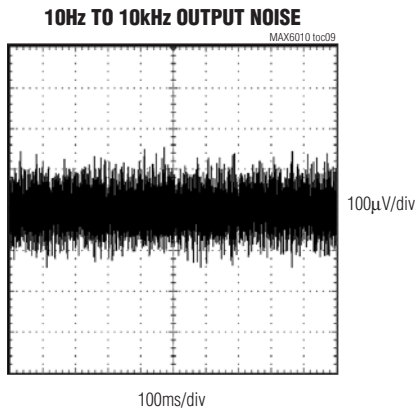
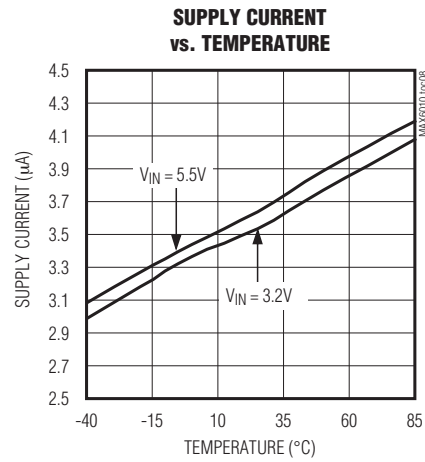
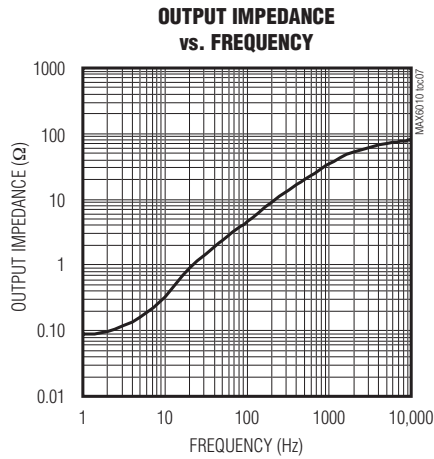
( $V_{IN} = 5V$ ,  $C_{IN} = 0.1\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)



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## Typical Operating Characteristics (continued)

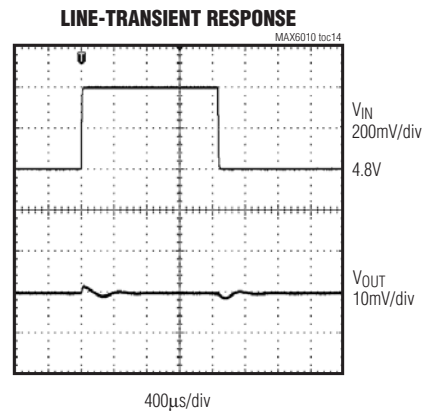
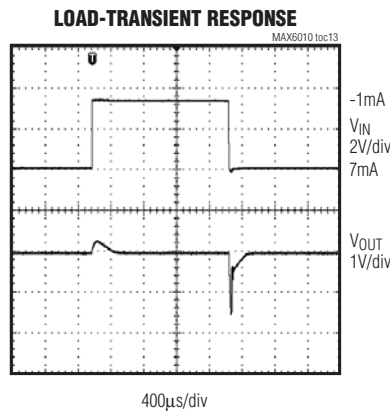
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## Typical Operating Characteristics (continued)

( $V_{IN} = 5V$ ,  $C_{IN} = 0.1\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)



## Detailed Description

The MAX6010 is a precision, low-noise, low-dropout, micropower, bandgap voltage reference in a SOT23 package. This three-terminal reference operates with an input voltage from 3.2V to 5.5V, and outputs 3V. The device sources up to 7mA with < 200mV of dropout voltage and requires only 5µA (max) supply current.

## Applications Information

### Output/Load Capacitance

The MAX6010 requires a minimum of 1nF load to maintain output stability.

The device remains stable for capacitive loads as high as 1µF. In applications where the load or the supply can experience step changes, a larger output capacitor reduces the amount of overshoot (or undershoot) and assists the circuit's transient response.

### Supply Current

The 5µA maximum supply current varies only 0.05µA/V with the supply voltage.

When the supply voltage is below the minimum-specified input voltage (as during turn-on), the device can draw up to 20µA beyond the nominal supply current.

## Pin Description

PIN	NAME	FUNCTION
1	IN	Supply Voltage Input
2	OUT	Reference Voltage Output. Bypass with at least 1nF to ground. (See the <i>Output/Load Capacitance</i> section.)
3	GND	Ground

The input voltage source must be capable of providing this current to ensure reliable turn-on.

### Turn-On Time

The MAX6010 typically turns on and settles to within 0.1% of the final value in 700µs. The turn-on time can increase with the device operating at the minimum dropout voltage and the maximum load.

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## Chip Information

PROCESS: BiCMOS

## Package Information

For the latest package outline information and land patterns, go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).

PACKAGE TYPE	PACKAGE CODE	DOCUMENT NO.
3 SOT23	U3-1	<a href="#">21-0051</a>

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