19-0458; Rev 1; 9/96

MAXIM

Low-Cost, Micropower, Precision, 3-Terminal, 1.2V Voltage Reference

General Description

The MAX6120 is the lowest-power 1.2V, precision, three-terminal voltage reference offered in a SOT23 package. Ideal for 3V battery-powered equipment where power conservation is critical, the MAX6120 is a low-power alternative to existing two-terminal shunt references. Unlike two-terminal references that throw away battery current and require an external series resistor, the MAX6120 has a 70µA maximum supply current (typically only 50µA) that is independent of the input voltage. This feature translates to maximum efficiency at all battery voltages.

The MAX6120 operates from a supply voltage as low as 2.4V, and initial accuracy is ±1% for the SOT23 package. Output voltage temperature coefficient is typically only 30ppm/°C, and is guaranteed to be less than 100ppm/°C in the SOT23 package. For a guaranteed output voltage temperature coefficient of less than 50ppm/°C, see the MAX6520 data sheet.

Applications

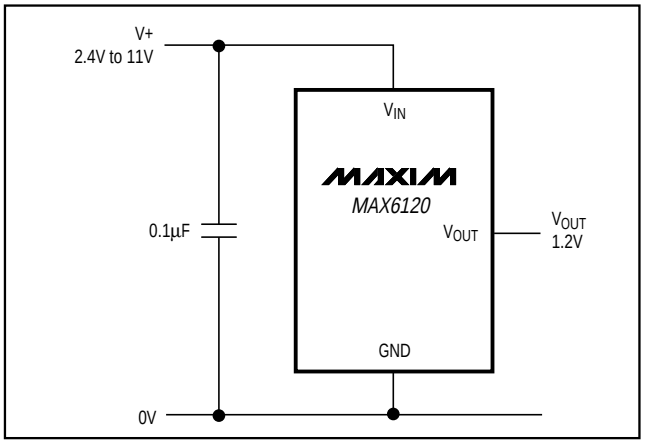
Battery-Powered Systems

Portable and Hand-Held Equipment

Data-Acquisition Systems

Instrumentation and Process Control

Typical Operating Circuit



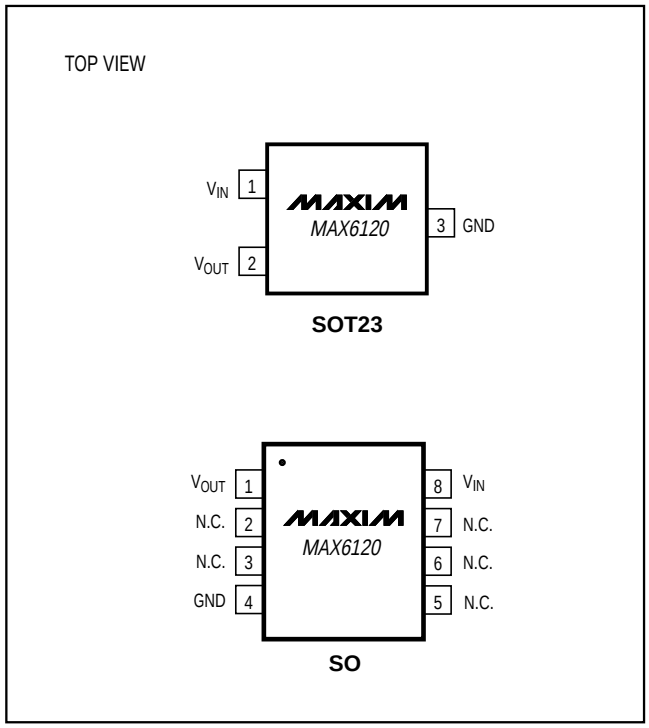
Features

- ♦ **3-Pin SOT23 Package**
- ♦ **Supply Current Independent of Input Voltage Over Temperature**
- ♦ **50µA Supply Current**
- ♦ **2.4V to 11V Input Voltage Range**
- ♦ **30ppm/°C Typical Tempco (SOT23)**
- ♦ **±1% Initial Accuracy (SOT23)**

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX6120ESA	-40°C to +85°C	8 SO
MAX6120EUR	-40°C to +85°C	3 SOT23-3

Pin Configurations



For free samples & the latest literature: http://www.maxim-ic.com, or phone 1-800-998-8800

Low-Cost, Micropower, Precision, 3-Terminal, 1.2V Voltage Reference

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{IN}) .....-0.3V to +12V
V_{OUT} .....-0.3V to (V_{IN} + 0.3V)
Output Short-Circuit Duration .....Continuous to Either Supply
Continuous Power Dissipation (T_A = +70°C)
SOT23 (derate 4mW/°C above +70°C) 320mW

Operating Temperature Range .....-40°C to +85°C
Storage Temperature Range.....-65°C to +160°C
Lead Temperature (soldering, 10sec) .....+300°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.

DC ELECTRICAL CHARACTERISTICS

(V_{IN} = 2.4V, I_{LOAD} = 0mA, T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Output Voltage	V_{OUT}	MAX6120EUR (SOT23)	T_A = +25°C	1.188	1.200	1.212	V
			T_A = T_{MIN} to T_{MAX} (Note 2)	1.176		1.224	V
Output Voltage Temperature Coefficient	TCV_{OUT}	MAX6120EUR (SOT23), T_A = T_{MIN} to T_{MAX} (Note 2)			30	100	ppm/°C
Output Voltage Noise	e_n	0.1Hz to 10Hz			10		µVp-p
		10Hz to 10kHz			400		
Line Regulation	V_{OUT}/V_{IN}	V_{IN} = 2.4V to 11V, T_A = T_{MIN} to T_{MAX} (Note 1)			2	30	µV/V
Load Regulation	V_{OUT}/I_{OUT}	I_{LOAD} = -50µA to 400µA (Note 1)			0.1	1	µV/µA
Quiescent Supply Current	I_Q	T_A = +25°C			50	58	µA
		T_A = T_{MIN} to T_{MAX} (Note 1)				70	
Change in Supply Current vs. Input Voltage	I_Q/V_{IN}	V_{IN} = 2.4V to 11V			1.5	5	µA/V
Short-Circuit Output Current	I_{SC}	V_{OUT} shorted to GND			4.3		mA
		V_{OUT} shorted to V_{IN}			400		µA

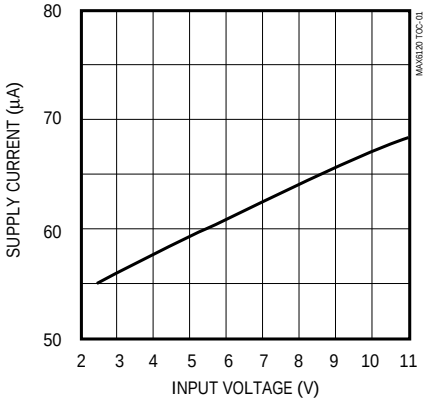
Note 1: Production testing done at T_A = +25°C, over temperature limits guaranteed by parametric correlation data.

Note 2: Contact factory for availability of a higher-grade, lower-TC option in a SOT23 package.

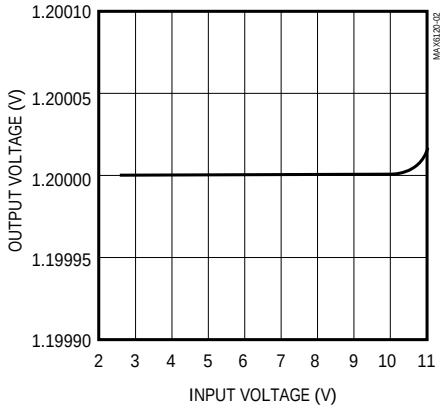
Typical Operating Characteristics

(V_{IN} = 3V, I_{LOAD} = 0mA, T_A = +25°C, unless otherwise noted.)

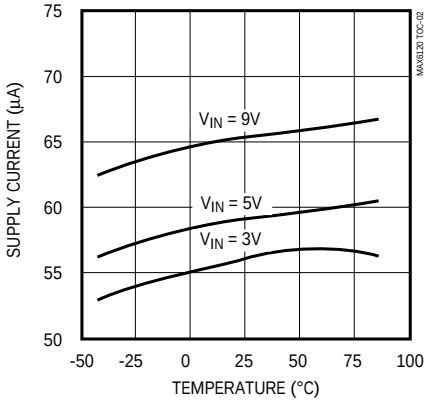
SUPPLY CURRENT vs. INPUT VOLTAGE



OUTPUT VOLTAGE vs. INPUT VOLTAGE



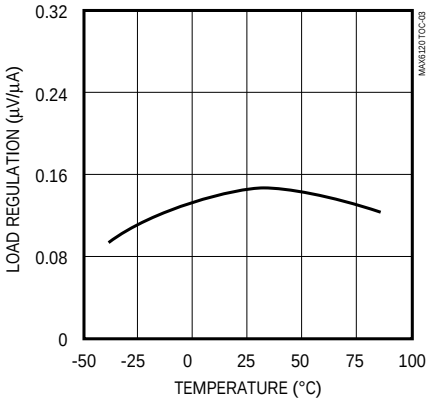
SUPPLY CURRENT vs. TEMPERATURE



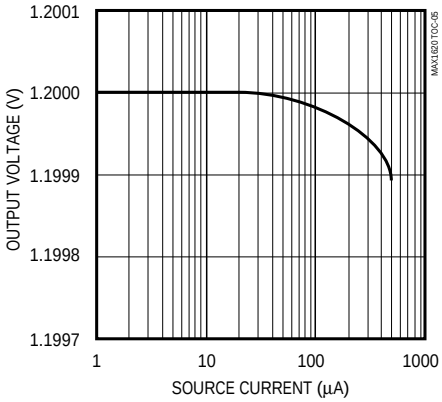
Typical Operating Characteristics (continued)

(V_{IN} = 3V, I_{LOAD} = 0mA, T_A = +25°C, unless otherwise noted.)

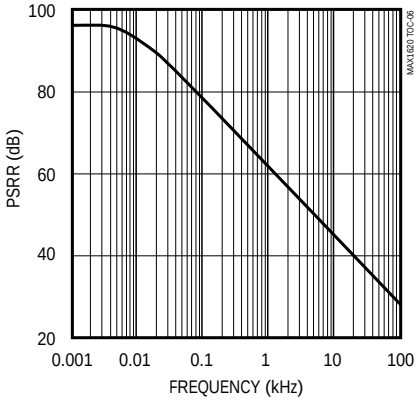
LOAD REGULATION vs. TEMPERATURE



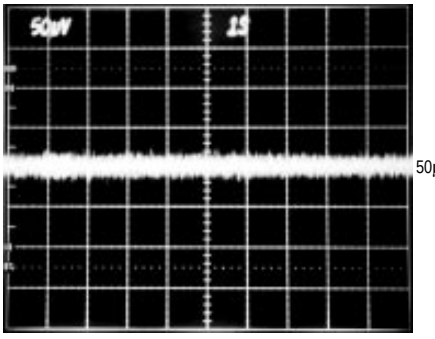
OUTPUT VOLTAGE vs. SOURCE CURRENT



POWER-SUPPLY REJECTION RATIO vs. FREQUENCY

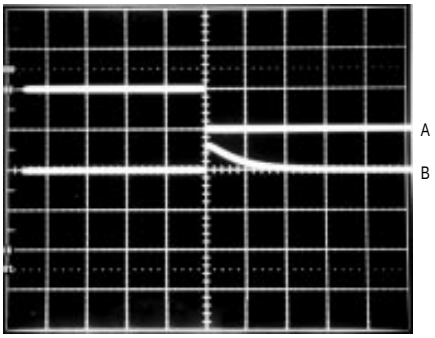


0.1Hz TO 100Hz NOISE



1µs/div

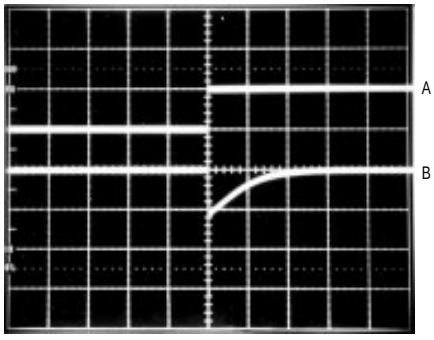
LOAD-TRANSIENT RESPONSE



10µs/div

A = OUTPUT CURRENT, 50µA/div, I_{LOAD} = 0µA TO -50µA
B = OUTPUT VOLTAGE, 100mV/div

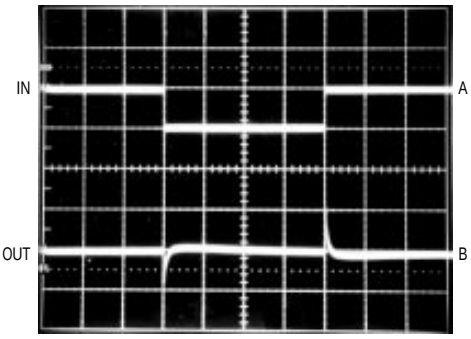
LOAD-TRANSIENT RESPONSE



10µs/div

A = OUTPUT CURRENT, 500µA/div, I_{LOAD} = 0µA TO 500µA
B = OUTPUT VOLTAGE, 100mV/div

LINE-TRANSIENT RESPONSE



5µs/div

A = INPUT VOLTAGE, 100mV/div, V_{IN} = 3V ± 50mV
B = OUTPUT VOLTAGE, 10mV/div

Low-Cost, Micropower, Precision, 3-Terminal, 1.2V Voltage Reference

Pin Description

PIN		NAME	FUNCTION
SOT23	SO		
1	8	V_{IN}	Input Voltage
2	1	V_{OUT}	Reference Output
3	4	GND	Ground
—	2, 3, 5, 6, 7	N.C.	No Connect—not internally connected

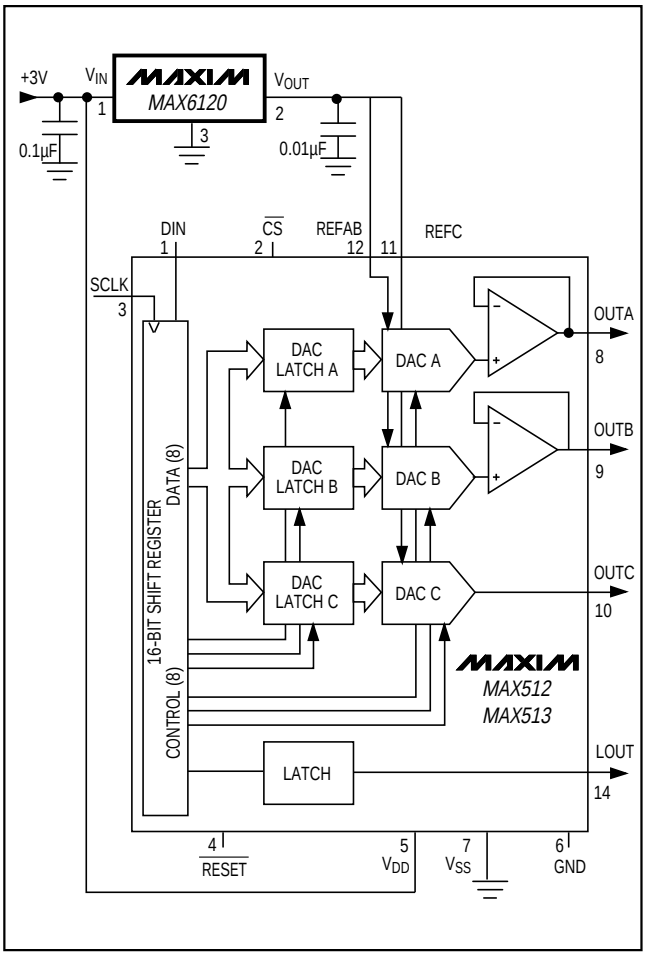


Figure 1. 3V, Triple, 8-Bit Serial DAC

Applications Information

Input Bypassing

For the best line-transient performance, decouple the input with a 0.1µF ceramic capacitor as shown in the *Typical Operating Circuit*. Locate the capacitor as close to the device pin as possible. Where transient performance is less important, no capacitor is necessary.

Output Bypass

The MAX6120 performs well without an output decoupling capacitor. If your application requires an output charge reservoir (e.g., to decouple the reference from the input of a DAC), then make sure that the total output capacitive load does not exceed 10nF.

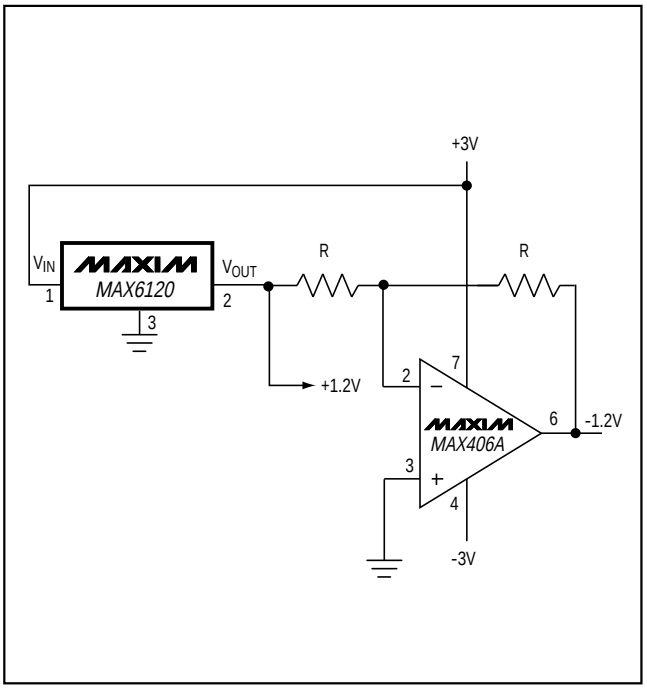
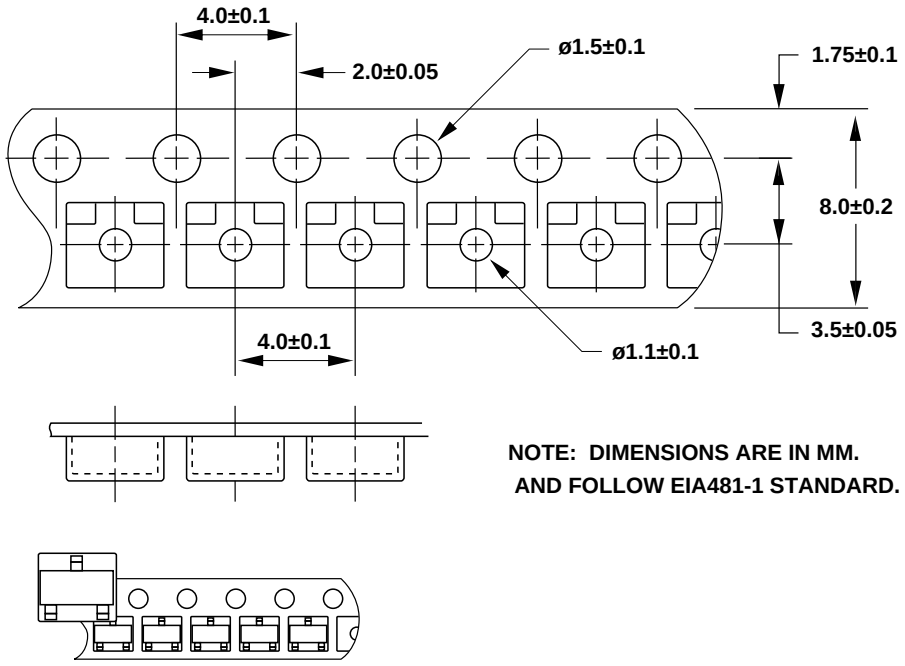


Figure 2. Low-Power ±1.2V Reference

Chip Information

TRANSISTOR COUNT: 39

Tape-and-Reel Information



NOTE: DIMENSIONS ARE IN MM.
AND FOLLOW EIA481-1 STANDARD.

MARKING INFORMATION†

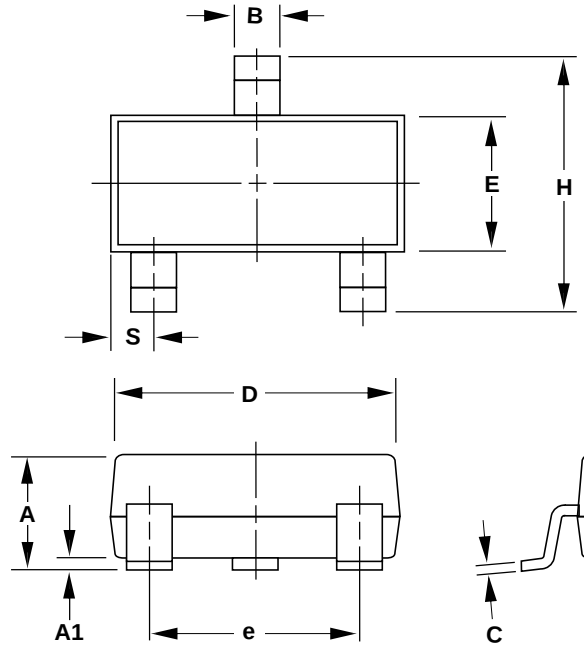
LOT SPECIFIC CODE

AY X X = MAX6120

†ICs MAY ALSO BE MARKED WITH FULL PART NAME: MAX6120

Low-Cost, Micropower, Precision, 3-Terminal, 1.2V Voltage Reference

Package Information



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.031	0.047	0.787	1.194
A1	0.001	0.005	0.025	0.127
B	0.014	0.022	0.356	0.559
C	0.0034	0.006	0.086	0.152
D	0.105	0.120	2.667	3.048
E	0.047	0.055	1.194	1.397
e	0.070	0.080	1.778	2.032
H	0.082	0.098	2.083	2.489
L	0.004	0.012	0.102	0.305
S	0.017	0.022	0.432	0.559
α	0°	8°	0°	8°

21-0051B

3-PIN SOT23-3 SMALL-OUTLINE TRANSISTOR PACKAGE

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