

**LOW TEMPCO VOLTAGE REFERENCE
1.23 VOLTS**

FEATURES

- Low drift 5ppm/°C
- Low dynamic impedance 0.6 Ω Typ.
- Operating current 50μA to 5mA
- Low power 60μW @ I_{in}=50μA
- Two terminal "Zener" operation
- Low output tolerance ±0.4%
- Low noise 5μV p-p Typ.
- Direct replacements for LM113, ICL8069, AD589, MP5010
- Low cost

APPLICATIONS

- A to D and D to A Converters
- Constant Current Source
- Digital Voltmeter
- Power Supply Monitor
- Precision Regulators

GENERAL DESCRIPTION

The ALPHA Semiconductor AS589 is a 2-terminal band-gap precision voltage reference, which provides a stable fixed output voltage of 1.23 volts. ALPHA Semiconductor's design, process, and precise on chip trimming enable us to achieve a low temperature coefficient as low as 5 ppm/°C and ±4% reference tolerance. The AS589 is an excellent choice for applications which are looking for low input current between 50μA to 5mA, low drift over temperature, low noise, low power, and low cost.

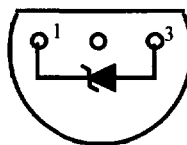
The AS589 is available in many versions. The AS589J, M, L, K grades are specified for 0°C to +70°C operation, in (TO- 52/92) packages, and the AS589 U, T and S grades are rated for -55°C to +125°C in metal can packages (TO-52).

ORDERING INFORMATION

PART NUMBER	MAX TEMPCO ppm/°C	PACKAGE TYPE	TEMP. RANGE
AS589JN	100	TO-92	COM.
AS589MH	10	TO-52	COM
AS589LH	25	TO-52	COM
AS589KH	50	TO-52	COM
AS589JH	100	TO-52	COM
AS589UH	25	TO-52	MIL
AS589TH	50	TO-52	MIL
AS589SH	25	TO-52	MIL

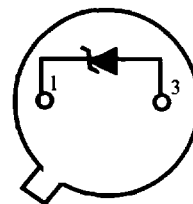
PIN CONNECTION

TO-92



Bottom View

TO-52



Bottom View

ABSOLUTE MAXIMUM RATINGS

Forward Current..... 10 mA
 Reverse Current 10 mA
 Max Power Dissipation 750 mW TO-52 Pkg.
 600 mW TO-92 Pkg.
 Operating Temperature MIL. TO-52 Pkg.
 COM. TO-92 Pkg.

Storage Temperature.....-65 to +200°C TO-52 Pkg.
 -65 to +150°C TO-92 Pkg.
 Lead Temperature.....+260°C

ELECTRICAL CHARACTERISTICS

Electrical Characteristics at $I_{in} = 500\mu A$, and $T_a = +25^\circ C$ unless otherwise noted.

Parameters	Conditions	AS589JN			AS589MH			AS589LH			AS589KH			Unites
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Output Voltage		1.22		1.25	1.22		1.25	1.22		1.25	1.22		1.25	V
Output Impedance			0.6	2		0.6	2		0.6	2		0.6	2	Ω
Noise Voltage	0.1Hz \leq f \leq 10Hz		5			5			5			5		μV p-p
Tempco	Note 1		3	100			10			25			50	ppm/ $^\circ C$
Turn-On Settling	0.1% of V out		15			15			15			15		μSec
Operating Current	Note 2	0.05		5	0.05		5	0.05		5	0.05		5	mA
Operating Temp. Range		0		70	0		70	0		70	0		70	$^\circ C$

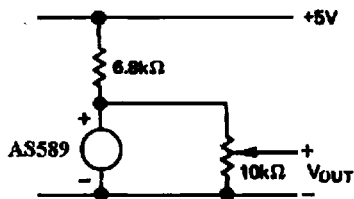
Parameters	Conditions	AS589JH			AS589UH			AS589TH			AS589SH			Unites
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Output Voltage		1.22		1.25	1.22		1.25	1.22		1.25	1.22		1.25	V
Output Impedance			0.6	2		0.6	2		0.6	2		0.6	2	Ω
Noise Voltage	0.1Hz \leq f \leq 10Hz		5			5			5			5		μV p-p
Tempco	Note 1			100			25			50			100	ppm/ $^\circ C$
Turn-On Settling	0.1% of V out		15			15			15			15		μSec
Operating Current	Note 2	0.05		5	0.05		5	0.05		5	0.05		5	mA
Operating Temp. Range		0		70	-55		125	-55		125	-55		125	$^\circ C$

Note 1: Three-point measurement guarantees the error band over the specified temperature range.

Note 2: Optimum performance is obtained at currents below 500 μA .

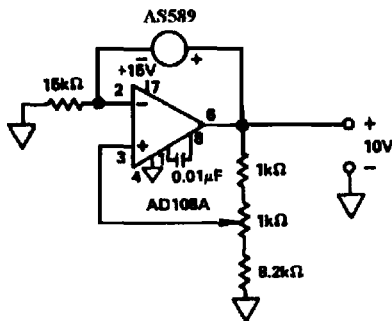
APPLICATION INFORMATION

The AS589 acts as a two terminal shunt-type regulator. This device provides a constant output current at a wide range of input current of 50 μ A to 50mA. The below figure is a simplified connection of output voltage of 1.2 or less. The minimum capacitor of 1000pF is required for additional filtering to provide lower noise.



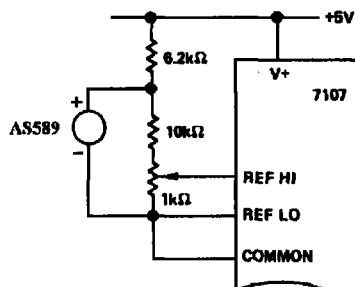
Basic Configuration for 1.2V or Less

The AS589 can be used as a building block to generate other values of reference voltage. The below figure shows the circuit design that produces a buffered 10V output. Total supply current is approx. 2mA.



Single-Supply Buffered 10V Reference

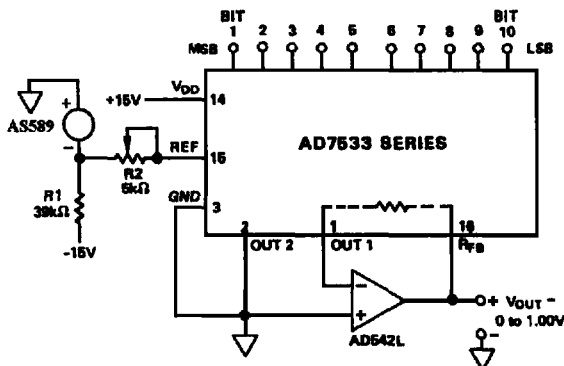
The AS589 low power operation makes it suitable for battery operated equipment. This device is ideal for use with a CMOS analog-to-digital converter as a reference. The below figure shows this device used with two common integrating type CMOS A/D converters.



With 7107 Panel Meter A/D

AS589 Used as Reference for CMOS A/D Converters

The A589 is also suitable to use with CMOS digital-to-analog converter. This figure shows the requirement of DAC in negative reference voltage in order to provide a positive output range. The below circuit shows AS589 supplying the -1.0V reference to multiplying DAC.



AS589 as Reference for 10-Bit CMOS DAC