



Precision Micropower Shunt Voltage Reference

FEATURES

- Low temperature coefficient, 50 ppm/°C
- Operating current range, 100µA to 5 mA
- Low power, 250 mW @ I_{in}=100 mA
- Two terminal "Zener" operation
- Small package: SOT - 23, TO-92, and SO-8
- Fixed reverse breakdown voltage 2.5 Volt
- No output capacitance required
- Output voltage tolerance ± 0.5%
- Similar replacement for LM4040

APPLICATIONS

- Constant Current Source
- Digital Voltmeter
- Power Supply Monitor
- Precision Regulators
- Battery-Powered Equipment
- Instrumentation
- Automotive Electronics
- Data Acquisition Systems
- Energy Management

GENERAL DESCRIPTION

The AS4040 is a two-terminal, temperature compensated, band-gap voltage reference, which provides a fixed 2.50V output for input currents between 100 µA to 5mA. The bandgap voltage (1.205) is independently laser trimmed from the output voltage to achieve a very low tempco, then the output voltage is laser trimmed to 2.50 volts. This trimming technique and the low tempco (A grade 50 ppm/ °C) thin film resistor process gives a very stable device over the full temperature range. The AS4040 is available in the sub-miniature (3mm × 1.3mm) SOT-23, SO-8 surface mount package, or TO-92 package. The operating temperature is -40°C to 85°C.

The ALPHA Semiconductor AS4040 advanced design eliminates the need for an external stabilized capacitor while insuring stability with any capacitive load, making them easy to use.

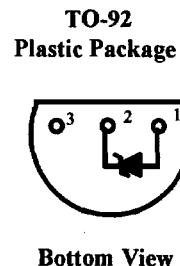
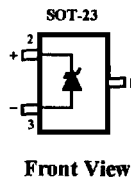
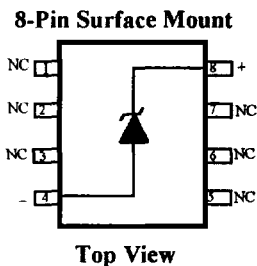
ORDERING INFORMATION

Part Number	Package Type
AS4040YN-X	TO-92
AS4040YS-X	SO-8
AS4040YM-X	SOT-23

1. For lower Tempco, consult factory

Y=	A=50ppm/°C	X=	1=0.5%
	B=100ppm/°C		2=1%
	C=150ppm/°C		3=2%

PIN CONNECTIONS



ABSOLUTE MAXIMUM RATINGS

Reverse Current	20mA
Forward Current	10mA
Storage Temperature	-65°C to +150°C
Lead Temperature	
M Package	+215°C
N Package	+260°C

Power Dissipation at 25°C	
M Package	75mW
N Package	550mW
Temperature Range	-40°C ≤ T _A ≤ +85°C

ELECTRICAL CHARACTERISTICS

Electrical Characteristics at I_{in} = 1000μA, and T_a = +25°C unless otherwise noted. **Boldface limits apply over temperature**

Parameters	Conditions	AS4040A-1			AS4040B-1			AS4040C-1			Units
		Min	Typ.	Max	Min	Typ.	Max	Min	Typ.	Max	
Output Voltage	I _R =100 μA		2.500			2.500			2.500		V
Reverse Breakdown tolerance	I _R =100 μA			±12 ±29			±12 ±29			±12 ±29	mV mV
Output impedance			0.60	2		0.60	2		0.60	2	Ω
Noise Voltage	0.1Hz ≤ f ≤ 10Hz		15			15			15		μV p-p
Tempco	Note 1			50			100			150	ppm/°C
Turn-on Setting	0.1% of V _{out}		30			30			30		μSec
Operating Current Range	Note 2	0.1		5	0.1		5	0.1		5	mA
Temp. Range		-40		85	-40		85	-40		85	°C
Parameters	Conditions	AS4040A-2			AS4040B-2			AS4040C-2			Units
		Min	Typ.	Max	Min	Typ.	Max	Min	Typ.	Max	
Output Voltage	I _R =100 μA		2.500			2.500			2.500		V
Reverse Breakdown tolerance	I _R =100 μA			±25 ±49			±25 ±49			±25 ±49	mV mV
Output impedance			0.60	2		0.60	2		0.60	2	Ω
Noise Voltage	0.1Hz ≤ f ≤ 10Hz		15			15			15		μV p-p
Tempco	Note 1			50			100			150	ppm/°C
Turn-on Setting	0.1% of V _{out}		30			30			30		μSec
Operating Current Range	Note 2	0.1		5	0.1		5	0.1		5	mA
Temp. Range		-40		85	-40		85	-40		85	°C
Parameters	Conditions	AS4040A-3			AS4040B-3			AS4040C-3			Units
		Min	Typ.	Max	Min	Typ.	Max	Min	Typ.	Max	
Output Voltage	I _R =100 μA		2.500			2.500			2.500		V
Reverse Breakdown tolerance	I _R =100 μA			±50 ±74			±50 ±74			±50 ±74	mV mV
Output impedance			0.60	2		0.60	2		0.60	2	Ω
Noise Voltage	0.1Hz ≤ f ≤ 10Hz		15			15			15		μV p-p
Tempco	Note 1			50			100			150	ppm/°C
Turn-on Setting	0.1% of V _{out}		30			30			30		μSec
Operating Current Range	Note 2	0.1		5	0.1		5	0.1		5	mA
Temp. Range		-40		85	-40		85	-40		85	°C

- Note:
- 1) Three-point measurement guarantees the error band over the specified temperature range.
 - 2) Optimum performance is obtained at currents below 1000 μ A.
 - 3) Limits are 100% production tested at 25°C. Limits over temperature are guaranteed through correlation using statistical quality control.

AS4040 Applications Hints

This device is designed for stable operation and has no need of an external capacitor between pin 4 and 8. The reference remains stable if a bypass capacitor is used.

SOT-23

The AS4040 in the SOT-23 package has a parasitic Schottky diode between pin 3 and pin 1. Pin 1 of SOT-23 must float or be connected to pin 3.

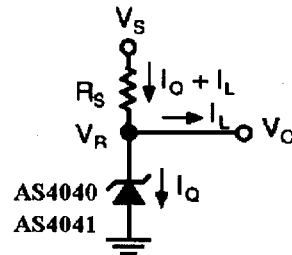
Conventional Shunt Regulator

In a conventional shunt regulator application (see Figure 1), an external series resistor (R_S) is connected between the supply voltage and the AS4040. R_S determines the current that flows through the load (I_L) and the reference (I_Q). Since load current and supply voltage may vary, R_S should be small enough to supply at least the minimum acceptable I_Q to the reference even when the supply voltage is at its minimum and the load current is at its maximum value. When the supply voltage is at its maximum and I_L is at its minimum, R_S should be large enough so that the current flowing through the AS4040-x.x is less than 15mA

R_S is determined by the supply voltage (V_S), the load and operating current (I_L and I_Q), reference's reverse breakdown voltage (V_R).

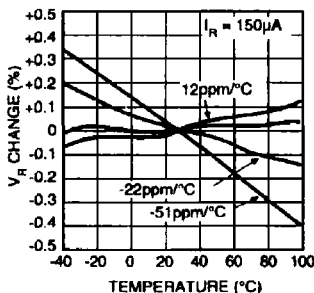
$$R_S = (V_S - V_R) / (I_L + I_Q)$$

Figure 1. AS4040 Fixed Shunt Regulator Application

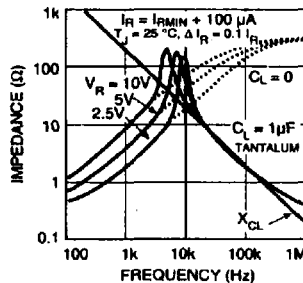


Typical Characteristics

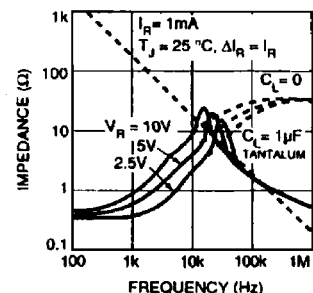
Temperature Drift for Different Average Temperature Coefficient



Output Impedance vs. Frequency

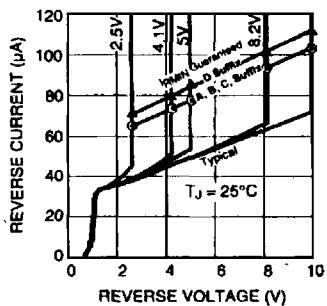


Output Impedance vs. Frequency

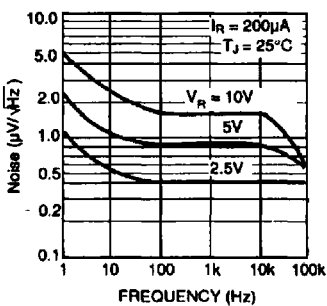


Typical Characteristics (Continued)

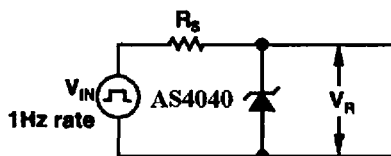
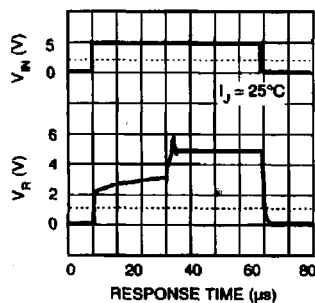
Reverse Characteristics and Minimum Operating Current



Noise Voltage vs. Frequency



AS4040 $R_s = 30k$



Test Circuit