Semiconductor Corporation

CS3902

+ 4.5V Precision Voltage Reference

Features

- Very High Accuracy: + 4.500V ± 0.4 mV
- Very Low Temperature Drift: ± 0.6 ppm / °C -55 °C to+125 °C
- Excellent Long-Term Stability: 25 ppm/1000 hours
- Excellent Line Regulation: 6 ppm/V Typ.
- Designed for use with CS5012, CS5014, CS5016, CS5101, and CS5102 A/D Converters
- 14 Pin Bottom-brazed DIP Package

General Description

The CS3902 is a precision voltage reference providing +4.500V from an input voltage of 11V to 22V. It offers very high accuracy without trimming and exhibits very low temperature drift: 1/50 LSB / °C at 16 bits. Long term stability of the CS3902 is excellent. The device is suitable for all Crystal Semiconductor Successive Approximation A/D Converters.

ORDERING INFORMATION:

Model	Initial Error	Thermal Drift	Temperature
CS3902-AC	800 µV	400 µV	-40 °C to +85 °C
CS3902-BC	400 µV	200 µV	-40 °C to +85 °C
CS3902-SC	800 µV	600 µV	-55 °C to +125 °C
CS3902-TC	400 µV	300 µV	-55 °C to +125 °C

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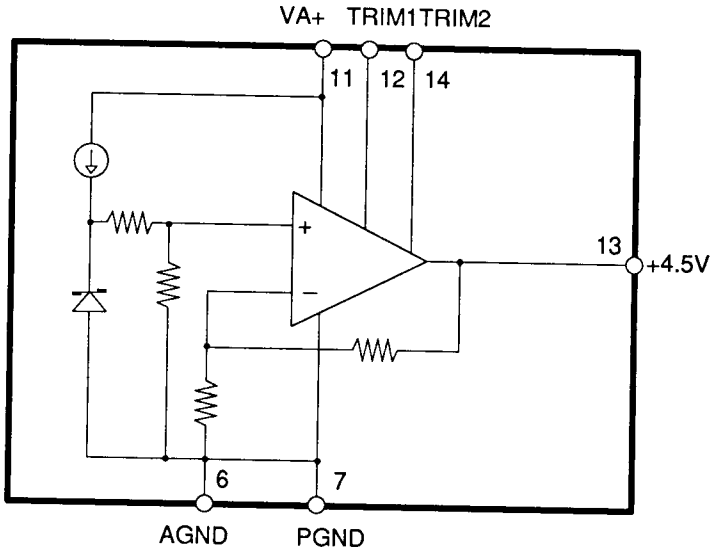

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ANALOG CHARACTERISTICS (VA+ = +15V, T_A = 25 °C, R_L = 10 kΩ unless otherwise specified)

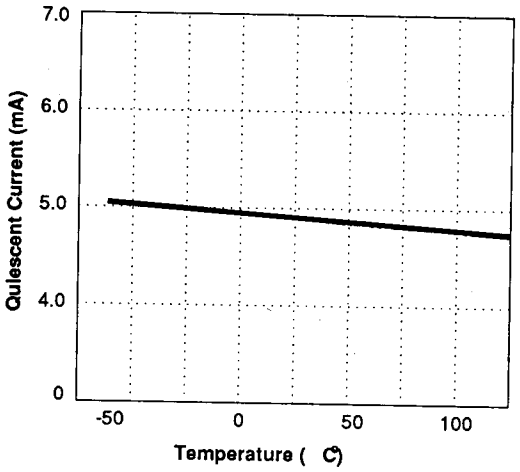
Parameter		CS3902A,B min	typ	max	CS3902S,T min	typ	max	Units
Specified Temperature Range		-40		85	-55		125	°C
Output Voltage		-	+ 4.5	-	-	+ 4.5	-	V
Output Voltage Errors								
Initial Error	-A,S	-	-	800	-	-	800	uV
	-B,T	-	-	400	-	-	400	uV
Warmup Drift		-	25	-	-	25	-	uV
T_{MIN} toT_{MAX} (Note 1)	-A,S	-	-	400	-	-	600	uV
	-B,T	-	-	200	-	-	300	uV
Long-Term Stability		-	25	-	-	25	-	ppm/1000 hrs
Noise (.1 - 10 Hz)		-	5	-	-	5	-	uVp-p
Output Drive		10	-	-	10	-	-	mA
Regulation Line		-	30	100	-	30	100	uV/V
Load		-	30	-	-	30	-	uV/mA
Output Adjustment Range (Note 2)		-	10	-	-	10	-	mV
Temperature coefficient		-	4	-	-	4	-	uV/° C/mV
Power Supply Currents		-	5	7	-	5	7	mA

ABSOLUTE MAXIMUM RATINGS (VA+ =+15V,T_A = 25 °C, R_L = 10 kΩ unless otherwise specified)

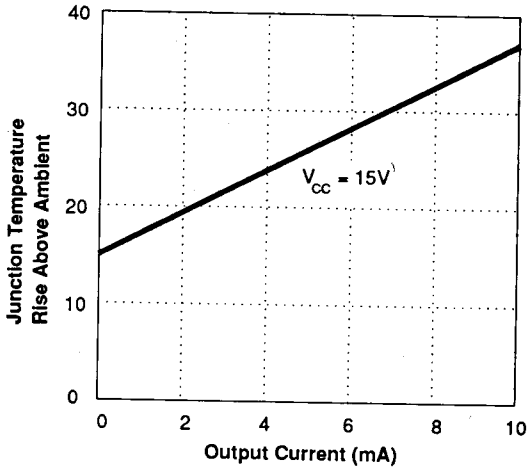
Parameter	CS3902A,B min	typ	max	CS3902S, T min	typ	max	Units
VA+	+ 11	-	+ 22	+ 11	-	+ 22	V
Operating Temperature	- 40	-	85	- 55	-	125	°C
Storage Temperature	- 65	-	150	- 65	-	150	°C
Short Circuit Protection	Continuous						-

Notes: 1. Using the box method the specified value is the maximum deviation from the output voltage at 25 °C over the specified operating temperature range.
2. Optional Fine Adjust for approximately ±10mV
3. The 4.5V output is unloaded.

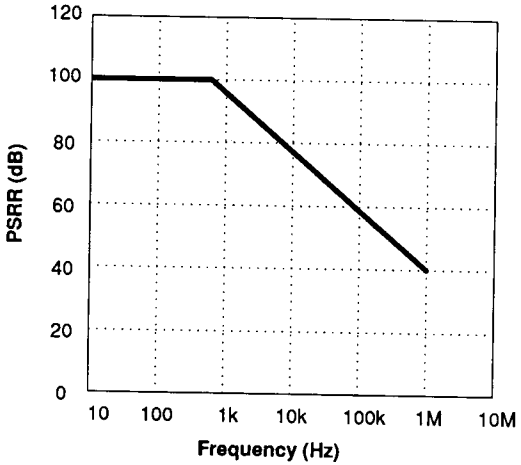
Specifications are subject to change without notice.



Quiescent Current vs. Temperature



Junction Temperature Rise vs. Output Current



PSRR vs. Frequency

Theory Of Operation

Figure 1 illustrates the internal configuration of the CS3902. An FET current source is used to bias a 6.3V zener diode. The zener voltage is divided by the resistor network R1 and R2. This voltage is then applied to the noninverting input of the operational amplifier which amplifies the voltage to produce a 4.500 V output. The gain is determined by the resistor elements R3 and R4: G =1 + R4/R3. The 6.3V zener diode is used because it is the most stable diode over time and temperature.

The current source provides a closely regulated zener current, which determines the slope of the reference's voltage vs. temperature function. By trimming the zener current a lower drift over temperature can be achieved. But since the voltage vs. temperature function is nonlinear, this method leaves a residual error over wide temperature ranges.

To remove this residual error, a nonlinear compenstion network of thermistors and resistors was developed. This proprietary network eliminates most of the nonlinearity in the voltage vs. temperature function. By then adjusting the slope, a very stable voltage over wide temperatuire range can be achieved. This network is less than 2% of the overall network resistance so it has a negligible effect on long term stability.

Application Information

Figure 2 shows the proper system connection of the CS3902 voltage reference. It is illustrated with the optional output trim potentiometer. Pay careful attention to the circuit layout to avoid noise pickup and voltage drops in the lines.

The CS3902 series voltage references have the ground terminal brought out on two pins (pin 6 and pin 7) which are connected together internally. This allows the user to achieve greater

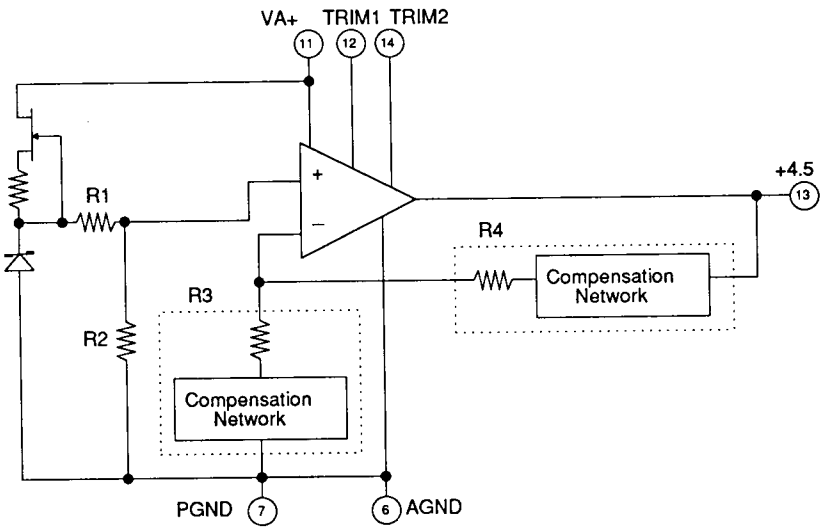


Figure 1. CS3902 Internal Configuration

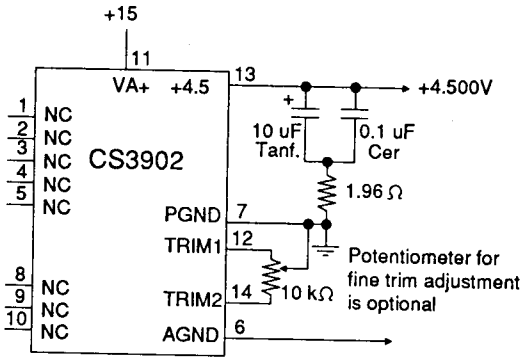


Figure 2. System Connection Diagram

accuracy when using a socket. Voltage references have a voltage drop across their power supply ground pin due to quiescent current flowing through the contact resistance. If the contact resistance was constant with time and temperature this voltage drop could be trimmed out. When the reference is plugged into a socket this source of error can be as high as 20 ppm. By connecting pin 7 to the power supply ground and pin 6 to a high impedance ground point in the measurement circuit the error due to the contact resistance can be eliminated. If the unit is soldered into place the contact resistance is sufficiently small that it doesn't affect performance.

See the application note "Voltage References for the CS501X/CS5101/CS5102/CS5126 Series of A/D converters" for discussion of the filtering components on the output of the CS3902.

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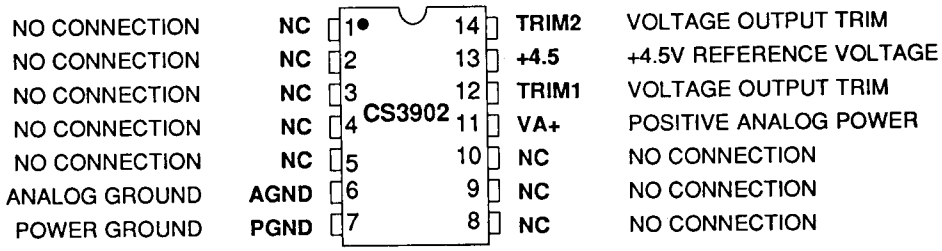
PIN DESCRIPTION



14 Pin Bottom-brazed 0.5" Wide DIP

Leads have 0.3" spacing; see back of Data Book for package dimensions.