Precision Voltage Reference

FEATURES

- ♦ Very High Accuracy: ±3 V Output, ±300 µV
- ♦ Extremely Low Drift: 0.73 ppm/°C (-55°C to +125°C)
- ♦ Low Warm-up Drift: 1 ppm Typical
- ♦ Excellent Stability: 6 ppm/1000 Hrs. Typical
- ♦ Excellent Line Regulation: 3 ppm/V Typical
- ♦ Hermetic 14-pin Ceramic DIP
- ♦ Military Processing Option

APPLICATIONS

- ♦ Precision A/D and D/A Converters
- ♦ Transducer Excitation
- ♦ Accurate Comparator Threshold Reference
- ♦ High Resolution Servo Systems
- ♦ Digital Voltmeters
- ♦ High Precision Test and Measurement Instruments

DESCRIPTION

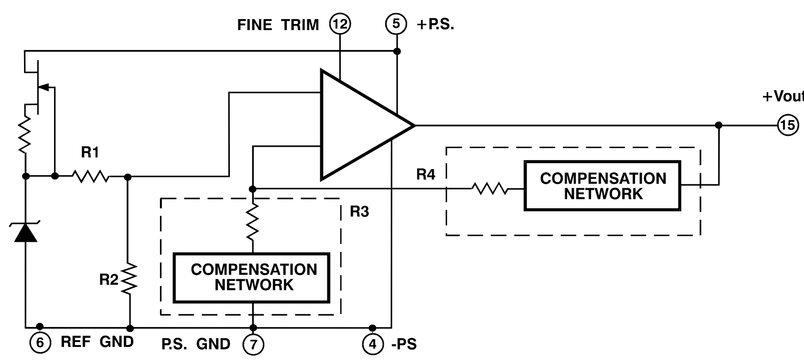
VRE117/119 Series Precision Voltage References provide ultrastable +3 V (VRE117), and ±3 V (VRE119) output with ±300 µV initial accuracy and temperature coefficient as low as 0.73 ppm/°C over the full military temperature range. This improvement in accuracy is made possible by a unique, proprietary multipoint laser compensation technique. Significant improvements have been made in other performance parameters as well, including initial accuracy, warm-up drift, line regulation, and long-term stability, making the VRE117/119 series the most accurate and stable 3 V reference available.

VRE117/119 devices are available in two operating temperature ranges, -25°C to +85°C and -55°C to +125°C, and two performance grades. All devices are packaged in 14-pin hermetic ceramic packages for maximum long-term stability. "M" versions are screened for high reliability and quality.

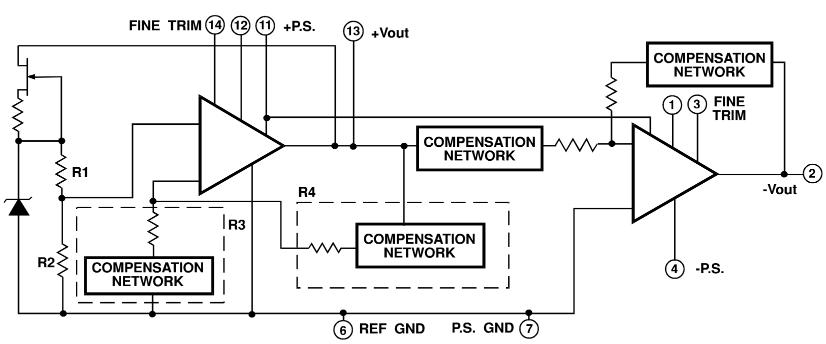
Superior stability, accuracy, and quality make these references ideal for precision applications such as A/D and D/A converters, high-accuracy test and measurement instrumentation, and transducer excitation.

Figure 1. BLOCK DIAGRAMS

VRE117



VRE119



SELECTION GUIDE

Model	Output (V)	Temperature Operating Range	Volt Deviation (MAX)
VRE117M VRE117MA	+3 +3	-55°C to +125°C -55°C to +125°C	±460μV ±400μV
VRE119C	±3	-25°C to +85°C	±400μV

Hermetic 14-pin Ceramic DIP
Package Style HC

1. CHARACTERISTICS AND SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

V_{PS} =±15V, T = +25°C, R_L = 10K Ω UNLESS OTHERWISE NOTED.

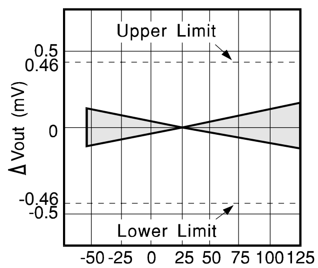
Model	VRE119C			VRE117M			VRE117MA			
Parameter	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Units**
ABSOLUTE MAXIMUM RATINGS										
Power Supply	±13.5		±22	*		*	*		*	V
Operating Temperature	-25		+85	-55		+125	-55		+125	ºC
Storage Temperature	-65		+150	*		*	*		*	ºC
Short Circuit Protection		Continuous			*			*		
OUTPUT VOLTAGE										
VRE117		+3.0			*			*		V
VRE119		±3.0			*			*		V
OUTPUT VOLTAGE ERRORS										
Initial Error			±360			±360			±300	μV
Warmup Drift		2			2			1		ppm
T_{MIN} - T_{MAX} (Note1)			400			460			400	μV
Long-Term Stability		6			*			*		ppm/1000hrs.
Noise (0.1 - 10Hz)		1.5			*			*		μVpp
OUTPUT CURRENT										
Range	±10			*			*			mA
REGULATION										
Line		3	10		*	*		*	*	ppm/V
Load		3			*			*		ppm/mA
OUTPUT ADJUSTMENT										
Range		5			*			*		mV
Temperature Coefficient		1			*			*		μV/ºC/mV
POWER SUPPLY CURRENT (Note 2)										
VRE117 ±PS		5	7		*	*		*	*	mA
VRE119 +PS		7	9		*	*		*	*	mA
VRE119 -PS		4	6		*	*		*	*	mA

NOTES:

- * Same as C Models.
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. The specified values are unloaded.

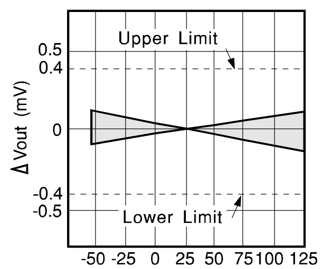
2. TYPICAL PERFORMANCE GRAPHS

V_{OUT} vs. TEMPERATURE



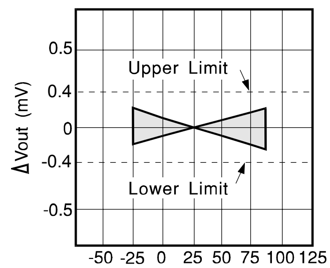
Temperature °C
VRE117M

V_{OUT} vs. TEMPERATURE



Temperature °C
VRE117MA

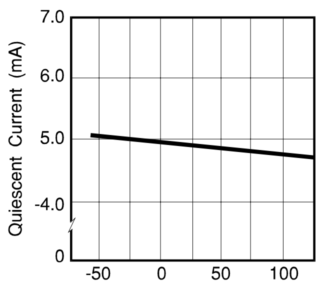
V_{OUT} vs. TEMPERATURE



Temperature °C
VRE119C

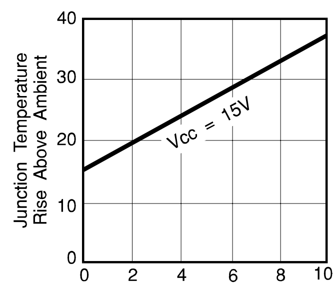
VRE117

QUIESCENT CURRENT VS. TEMP



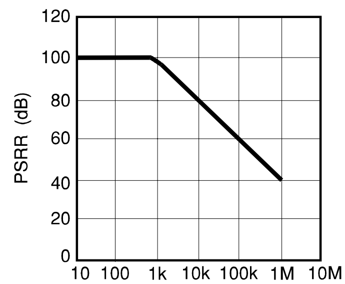
Temperature °C

JUNCTION TEMP. RISE VS. OUTPUT CURRENT



Output Current (mA)

PSRR VS. FREQUENCY

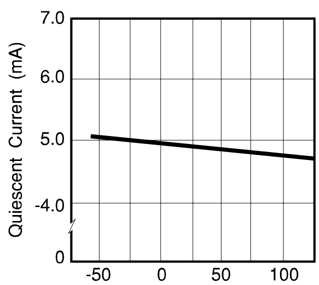


Frequency (Hz)

VRE119

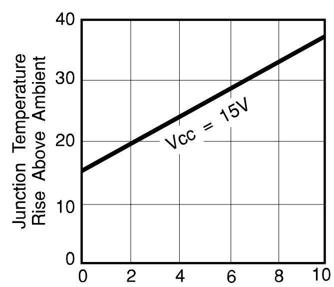
POSITIVE OUTPUT

QUIESCENT CURRENT VS. TEMP



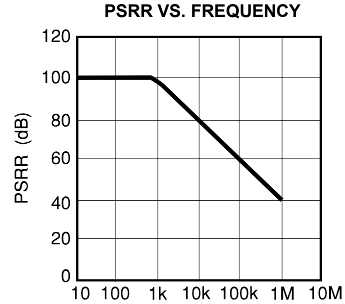
Temperature °C

JUNCTION TEMP. RISE VS. OUTPUT CURRENT



Output Current (mA)

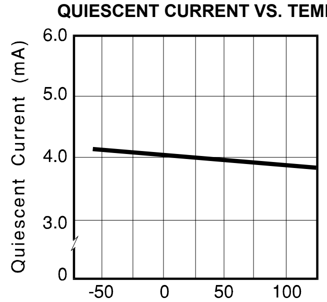
PSRR VS. FREQUENCY



Frequency (Hz)

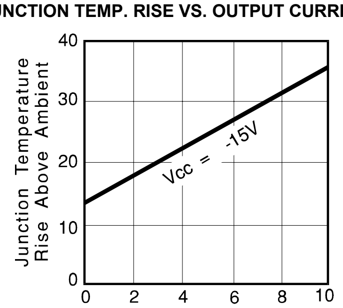
NEGATIVE OUTPUT

QUIESCENT CURRENT VS. TEMP



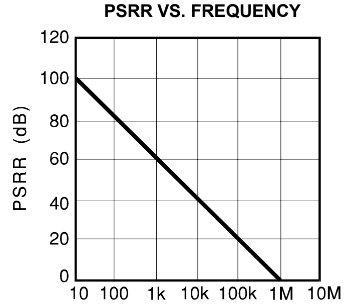
Temperature °C

JUNCTION TEMP. RISE VS. OUTPUT CURRENT



Output Current (mA)

PSRR VS. FREQUENCY



Frequency (Hz)

3. THEORY OF OPERATION

The following discussion refers to the block diagram in Figure 1. A FET current source is used to bias a 6.3 V 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 3 V output. The gain is determined by the resistor networks R3 and R4: G=1 + R4/R3. The 6.3 V 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.

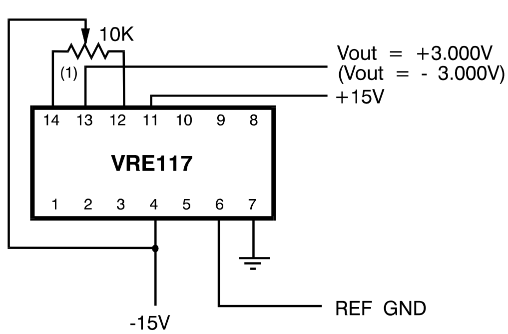
To remove this residual error, a nonlinear compensation network of thermistors and resistors is used in the VRE117/119 series references. This proprietary network eliminates most of the nonlinearity in the voltage vs. temperature function. By then adjusting the slope, The VRE117/119 series produces a very stable voltage over wide temperature ranges. This network is less than 2% of the overall network resistance so it has a negligible effect on long term stability.

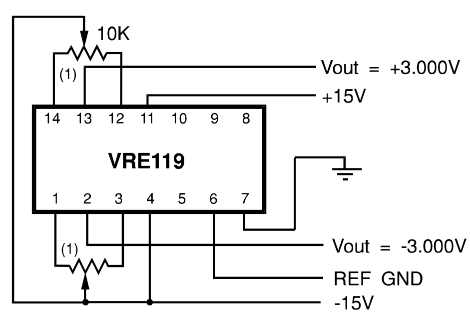
4. APPLICATION INFORMATION

The proper connection of the VRE117 series voltage reference with the optional trim resistors is shown below. When trimming the VRE119, the positive voltage should be trimmed first since the negative voltage tracks the positive side. Pay careful attention to the circuit layout to avoid noise pickup and voltage drops in the lines.

The VRE117/119 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 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 effect performance.

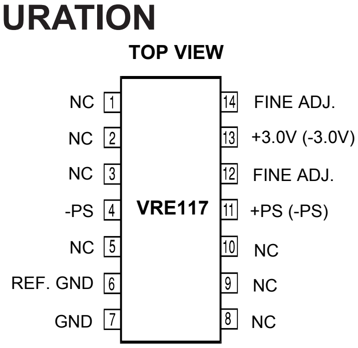
EXTERNAL CONNECTIONS

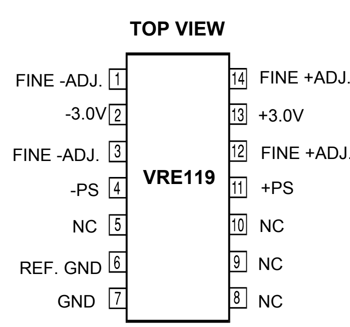




1. Optional Fine Adjust for approximately ±5mV.

PIN CONFIGURATION





CONTACTING CIRRUS LOGIC SUPPORT

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