VRE204

Precision Voltage Reference

FEATURES

- Very High Accuracy: +4.5 V Output, ±0.8 mV
- Extremely Low Drift: 1.48 ppm/°C (-55°C to +125°C)
- Excellent Stability: 6 ppm/1000 Hrs. Typical
- Excellent Line Regulation: 6 ppm/V Typical
- Wide Supply Range: +13.5 V to +22.0 V
- Hermetic 20-terminal Ceramic LCC
- Military Processing Available

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

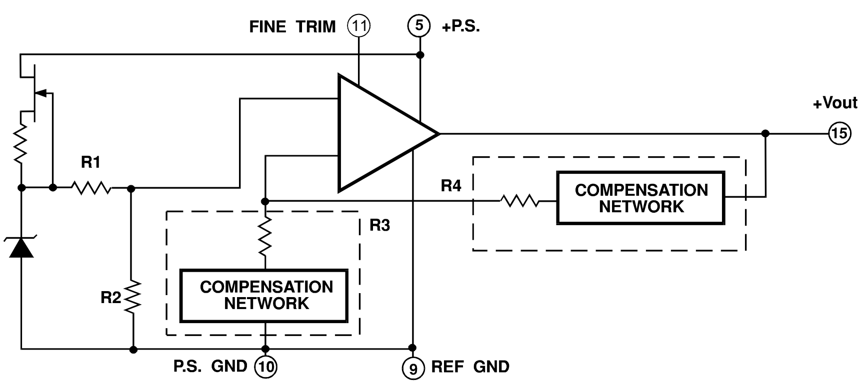
VRE204 Series Precision Voltage References provide ultrastable +4.5 V outputs with up to ±0.8 mV initial accuracy and temperature coefficient as low as 1.48 ppm/°C over the full military temperature range.

These references are specifically designed to be used with successive-approximation type Analog-to-Digital Converters (ADCs). Specify an ADC with exceptional temperature drift, which can only be as good as the external reference used. The VRE204 combined with the right ADC will provide the lowest drift data conversion obtainable.

The VRE204 series is available in the military operating temperature range -55°C to +125°C, and two performance grades. All devices are packaged in 20-terminal LCC ceramic packages for maximum long-term stability. These “M” versions are screened for high reliability and quality.

Superior stability, accuracy, and quality make the VRE204 ideal for all precision applications which may require a 4.5 V reference. High-accuracy test and measurement instrumentation, and transducer excitation are some other applications which can benefit from the high accuracy of the VRE204.

Figure 1. BLOCK DIAGRAM



SELECTION GUIDE

Model	Output (V)	Temperature Operating Range	Volt Deviation (MAX)
VRE204M	+4.5V	-55°C to +125°C	±0.69mV
VRE204MA	+4.5V	-55°C to +125°C	±0.60mV

20-terminal Ceramic LCC Package Style HD

1. CHARACTERISTICS AND SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

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

Model	M			MA			
Parameter	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Units**
ABSOLUTE MAXIMUM RATINGS							
Power Supply	+13.5		+22	*		*	V
Operating Temperature	-55		+125	*		*	ºC
Storage Temperature	-65		+150	*		*	ºC
Short Circuit Protection		Continuous			*		
OUTPUT VOLTAGE							
VRE204		+4.5			*		V
OUTPUT VOLTAGE ERRORS							
Initial Error			±890			±800	µV
Warmup Drift		2			1		ppm
T_{MIN} - T_{MAX} (Note1)			690			600	µV
Long-Term Stability		6			*		ppm/1000hrs.
Noise (0.1 - 10Hz)		3			*		µVpp
OUTPUT CURRENT							
Range	±10			*			mA
REGULATION							
Line		6	10		*	*	ppm/V
Load		3			*		ppm/mA
OUTPUT ADJUSTMENT							
Range		10			*		mV
Temperature Coefficient		4			*		µV/ºC/mV
POWER SUPPLY CURRENT (Note 2)							
VRE204 +PS		5	7		*	*	mA

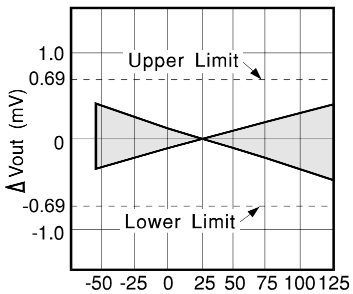
NOTES:

* Same as M 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.

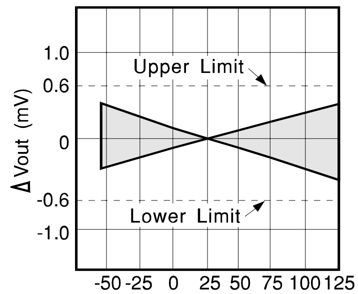
2. TYPICAL PERFORMANCE GRAPHS

V_{OUT} vs. TEMPERATURE



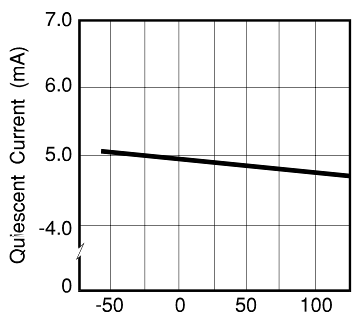
Temperature °C
VRE204M

V_{OUT} vs. TEMPERATURE



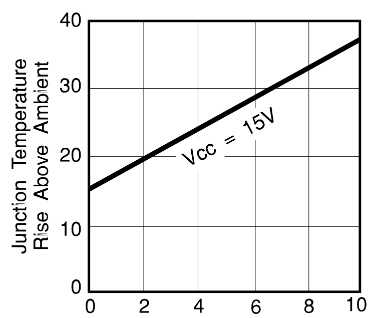
Temperature °C
VRE204MA

QUIESCENT CURRENT VS. TEMP



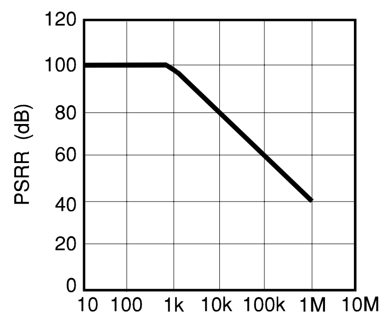
Temperature °C

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 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 4.5 V output. The gain is determined by the resistor networks R3 and R4: G=1 + R4/R3. The 6.3 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 references' 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 compensation technique is not well suited for wide temperature ranges.

A nonlinear compensation network of thermistors and resistors is used in the VRE series voltage references. This proprietary network eliminates most of the nonlinearity in the voltage vs. temperature function. By then adjusting the slope, the VRE204 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. By using highly stable resistors in our network, we produce a voltage reference that also has very good long term stability.