VRE205

Precision Voltage Reference

FEATURES

- Very High Accuracy: +5 V Output, ±0.8 mV
- Extremely Low Drift: 1.33 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 V
- Hermetic 20-terminal Ceramic LCC
- Military Processing Option

APPLICATIONS

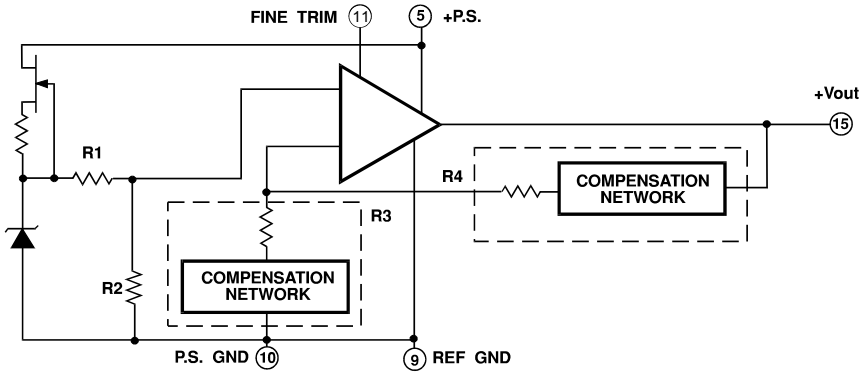
- Precision A/D and D/A Converters
- Transducer Excitation
- Accurate Comparator Threshold Reference
- High Resolution Servo Systems
- Digital Voltmeters
- High Precision Test and Measurement Instruments

DESCRIPTION

VRE205 Series Precision Voltage References provides ultrastable +5 V outputs with ±0.8 mV initial accuracy and temperature coefficient as low as 1.33 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 longterm stability, making the VRE205 series the most accurate and stable 5 V references available.

VRE205 series 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 20-terminal ceramic LCC packages for maximum long-term stability. “M” versions are screened for high reliability and quality.

Figure 1. BLOCK DIAGRAM



SELECTION GUIDE

Model	Output (V)	Temperature Operating Range	Volt Deviation (Max)
VRE205CA	+5V	-25°C to +85°C	0.4mV

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.

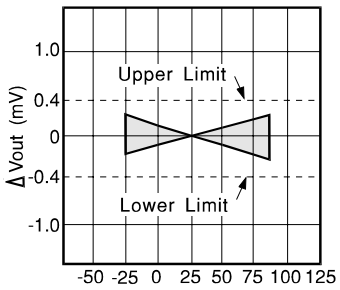
Model	CA			
Parameter	**Min**	**Typ**	**Max**	**Units**
ABSOLUTE MAXIMUM RATINGS				
Power Supply	+13.5		+22	V
Operating Temperature	-25		+85	ºC
Storage Temperature	-65		+150	ºC
Short Circuit Protection		Continuous		
OUTPUT VOLTAGE				
VRE205		+5		V
OUTPUT VOLTAGE ERRORS				
Initial Error			±800	µV
Warmup Drift		1		ppm
T_{MIN} - T_{MAX} (Note1)			400	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)				
VRE205 +PS		5	7	mA

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. The specified values are unloaded.

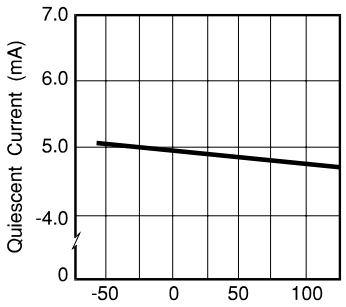
2. TYPICAL PERFORMANCE GRAPHS

V_{OUT} vs. TEMPERATURE



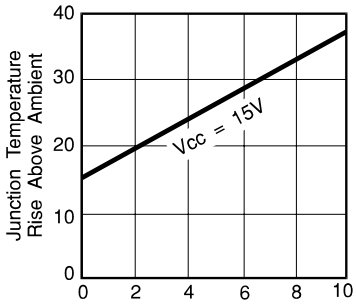
Temperature °C
VRE205CA

QUIESCENT CURRENT VS. TEMP



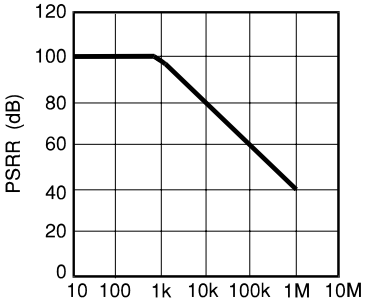
Temperature °C

JUNCTION TEMP. RISE VS. OUTPUT CURRENT



Output Current (mA)

PSRR VS. FREQUENCY



Frequency (Hz)

3. THEORY OF OPERATION

The following discussion refers to the schematic 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 5 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 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. 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 temperature ranges is produced. 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.