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

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

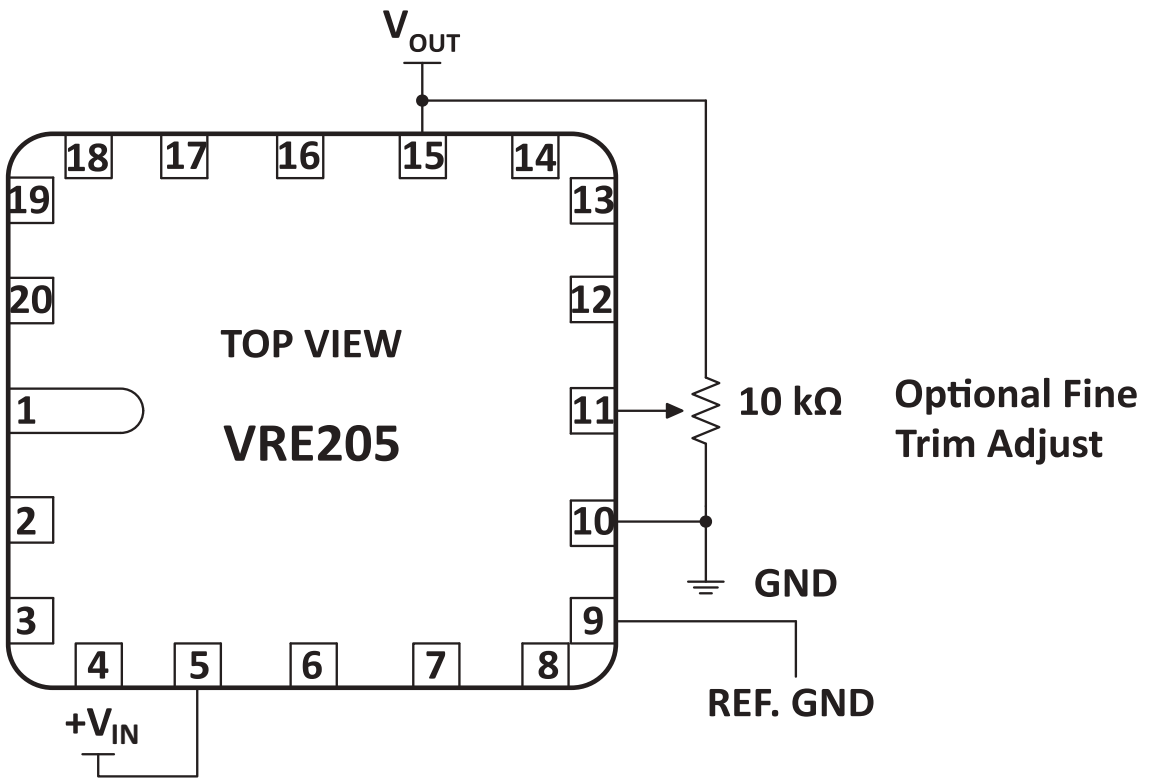
VRE205 Precision Voltage Reference provides ultrastable +5 V outputs with ±0.8 mV initial accuracy and temperature coefficient as low as 1.33 ppm/°C over the full military temperature range. This improvement in accuracy is made possible by a unique, proprietary multipoint laser compensation technique. 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 the most accurate and stable 5 V reference available.

SELECTION GUIDE

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

TYPICAL CONNECTION

Figure 1: Typical Connection



PIN DESCRIPTIONS

Pin Number	Name	Description
5	V_{IN}	The supply voltage connection.
9	REF_GND	Provided for accurate ground sensing. Internally connected to GND.
10	GND	Ground.
11	TRIM	Optional fine adjustment. Connect to a voltage divider between OUT and GND.
15	OUT	5 V output.

SPECIFICATIONS

V_{IN} = +15 V, T = 25°C, R_L = 10 kΩ unless otherwise noted.

ABSOLUTE MAXIMUM RATINGS

Parameter	Min	Typ	Max	Units
Power Supply	+13.5		+22	V
Operating Temperature	-25		+85	°C
Storage Temperature	-65		+150	°C
Short Circuit Protection		Continuous		

ELECTRICAL SPECIFICATIONS

Parameter	Min	Typ	Max	Units
Output Voltage		+5		V
Initial Error			±800	µV
Warmup Drift		1		ppm
T_{MIN} - T_{MAX} [1]			400	µV
Long-Term Stability		6		ppm/1000hrs
Noise (0.1 - 10Hz)		3		µVpp
Output Current	±10			mA
Line Regulation		6	10	ppm/V
Load Regulation		3		ppm/mA
Output Adjustment		10		mV
Temperature Coefficient		4		µV/°C/mV
Power Supply Current, +PS [2]		5	7	mA

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

TYPICAL PERFORMANCE GRAPHS

Figure 2: V_{OUT} vs. Temperature

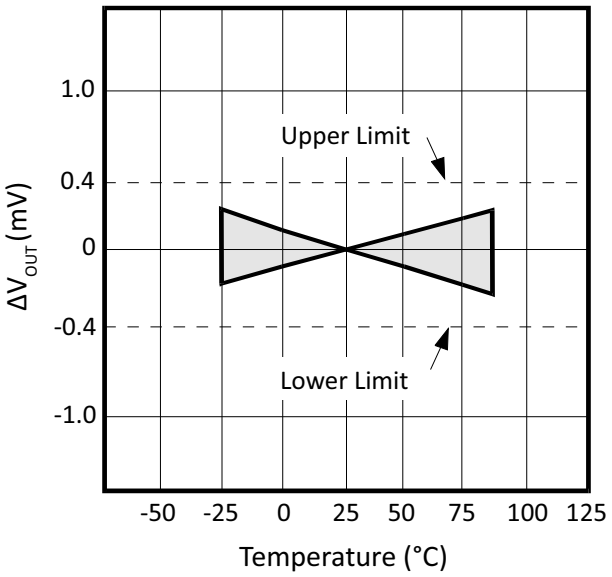


Figure 3: Power Supply Current vs. Temperature

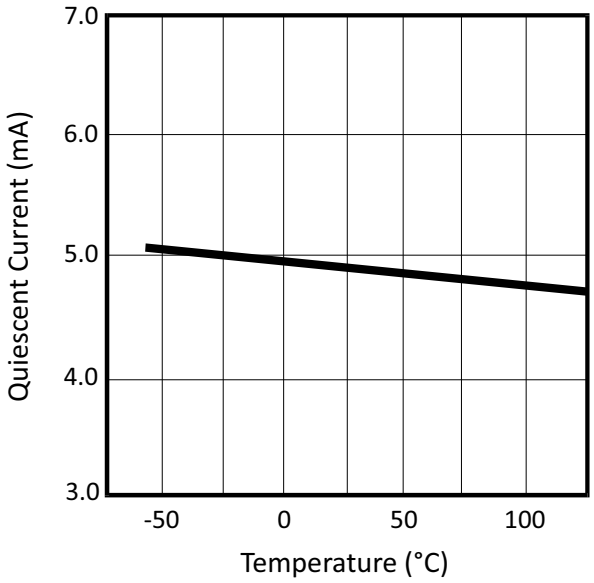


Figure 4: Junction Temp. Rise vs. Output Current

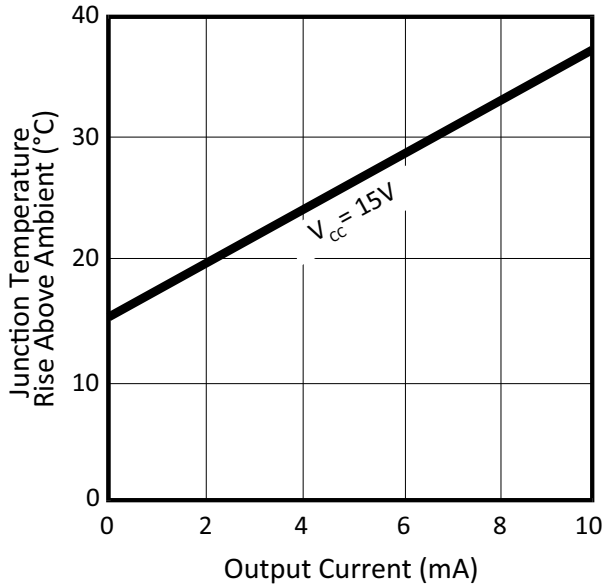
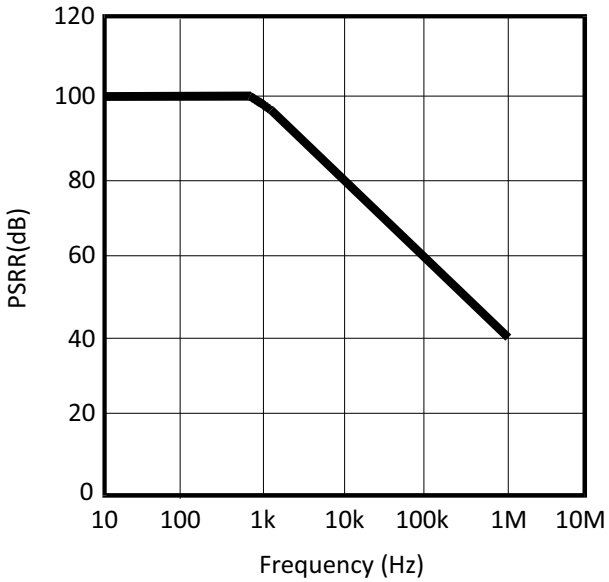
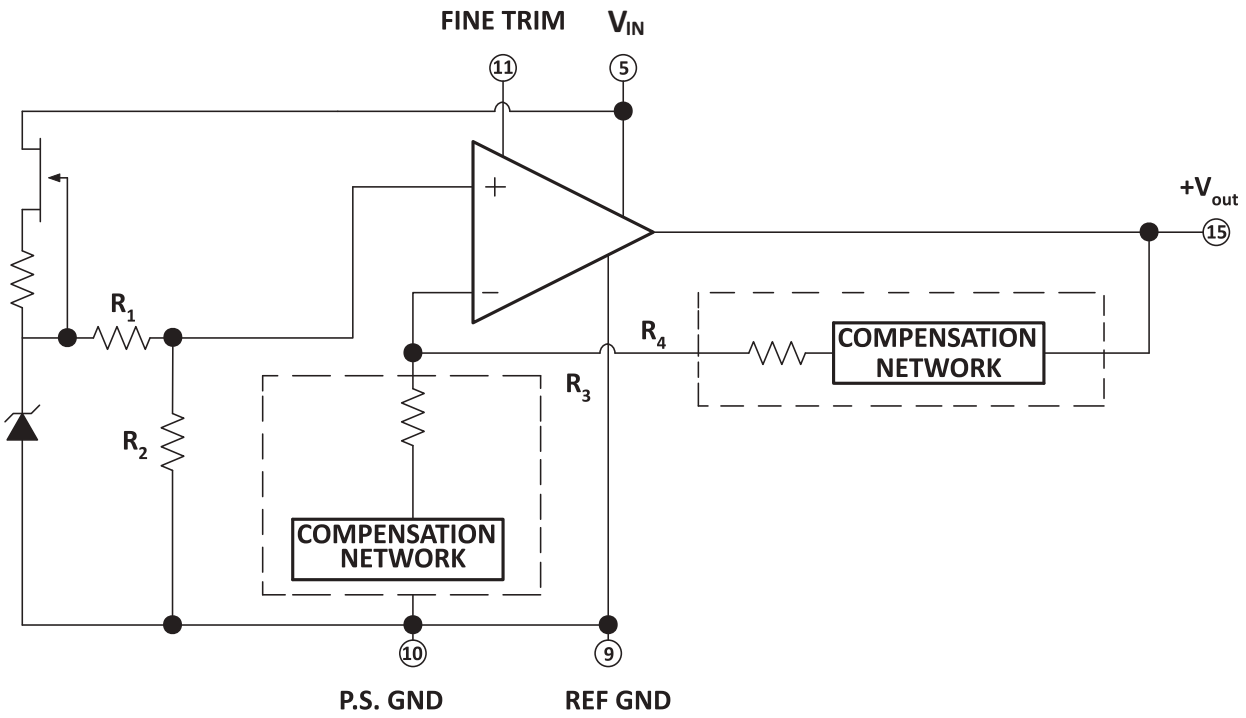


Figure 5: PSRR vs. Frequency



BLOCK DIAGRAM

Figure 6: Block Diagram



THEORY OF OPERATION

The following discussion refers to the schematic in Figure 6. 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.

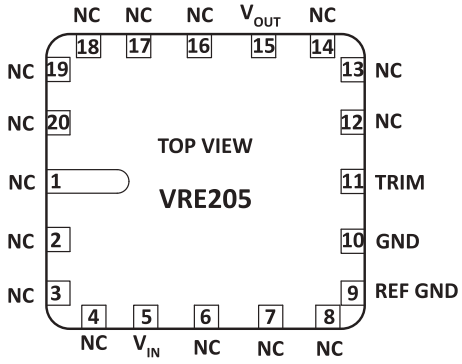
APPLICATION INFORMATION

The proper connection of the VRE205 series voltage references with the optional trim resistor is shown in figure 1. Pay careful attention to the circuit layout to avoid noise pickup and voltage drops in the lines.

The VRE205 series voltage references have the ground terminal brought out on two pins (pin 9 and pin 10) 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 10 to the power supply ground and pin 9 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 does not effect performance.

PIN CONFIGURATION

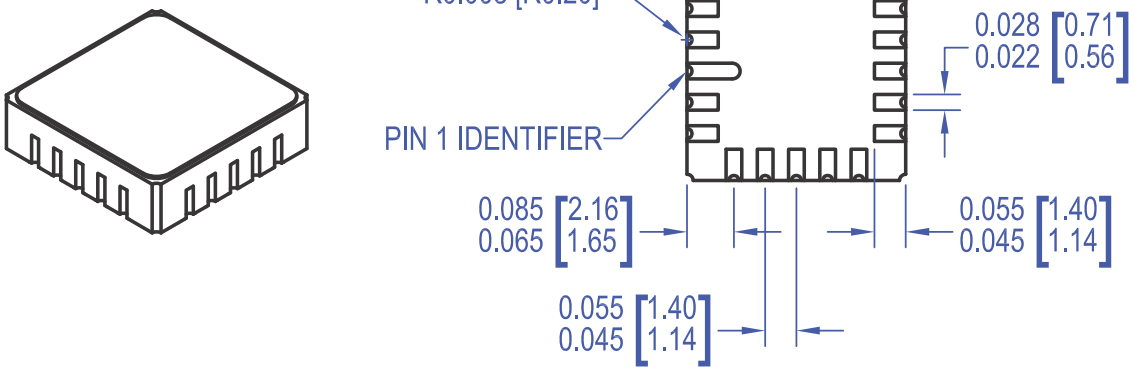
Figure 7: Pin Configuration

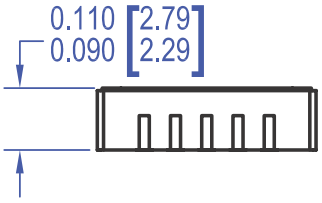


PACKAGE OPTIONS

Part Number	Apex Package Style	Description
VRE205CA	HD	20-Terminal Ceramic LDCC

PACKAGE STYLE HD





NOTES:
1. Dimensions are inches & [millimeters].
2. Bracketed alternate units are for reference only.
3. Contacts: Gold over Nickel plate.
4. Material: Alumina Ceramic substrate and cover.
5. Cover: Electroless Nickel plated.
6. Package weight: 0.024 oz. [0.680 g].

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