VRE210

Precision Voltage Reference

FEATURES

- Very High Accuracy: +10 V Output, ±0.5 mV
- Extremely Low Drift: 1.11 ppm/ºC (-55ºC to +125ºC)
- Low Warm-up Drift: 1 ppm Typical
- Excellent Stability: 6 ppm/1000 Hrs. Typical
- Excellent Line Regulation: 3 ppm/V Typical
- Hermetic 20-terminal Ceramic LCC Package
- Military Processing Option

APPLICATIONS

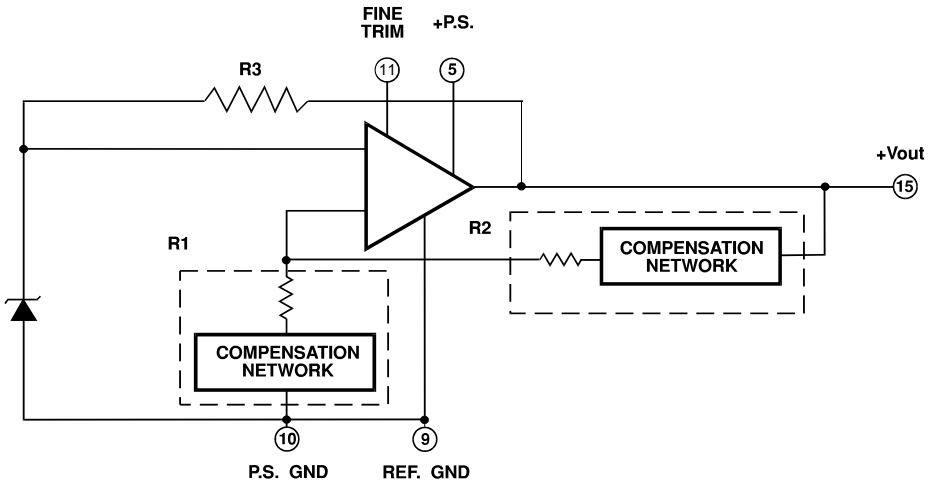
- Precision A/D and D/A Converters
- Transducer Excitation
- Accurate Comparator Threshold Reference
- High Resolution Servo Systems
- Digital Voltmeters
- High Precision Test and Measurement Instruments

DESCRIPTION

VRE210 Series Precision Voltage References provide ultrastable +10 V outputs with ±0.5 mV initial accuracy and temperature coefficient as low as 1.11 ppm/ºC 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 VRE210 series the most accurate and stable 10 V surface mount references available.

VRE210 devices are available in two operating temperature ranges, -25ºC to +85ºC and -55ºC to +125ºC, and two electrical 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)
VRE210CA	+10	-25ºC to +85ºC	±0.6mV
VRE210M	+10	-55ºC to +125ºC	±1.2mV
VRE210MA	+10	-55ºC to +125ºC	±1.0mV

20-terminal Ceramic LCC Package Style HD

1. CHARACTERISTICS AND SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

V_{PS} =+15V, T = +25ºC, R_L = 10KΩ Unless Otherwise Noted.

Model	VRE210CA			VRE210M			VRE210MA			
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										
VRE210		+10			*			*		V
OUTPUT VOLTAGE ERRORS										
Initial Error			±500			±1000			±800	µV
Warmup Drift		1			2			1		ppm
T_{MIN} - T_{MAX} (Note1)			600			1200			1000	µV
Long-Term Stability		6			*			*		ppm/1000hrs
Noise (0.1 - 10Hz)		6			*			*		µVpp
OUTPUT CURRENT										
Range	±10			*			*			mA
REGULATION										
Line		3	10		*	*		*	*	ppm/V
Load		3			*			*		ppm/mA
OUTPUT ADJUSTMENT										
Range		20			*			*		mV
Temperature Coefficient		4			*			*		mV/ºC/mV
POWER SUPPLY CURRENT (Note 2)										
VRE210 +PS		5	7		*	*		*	*	mA

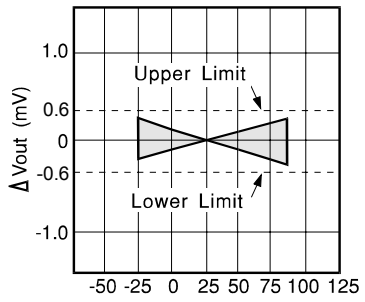
NOTES:

* Same as CA Models.

1. Using the box method, the specified value is the maximum deviation from the output voltage at 25ºC over the specified operating temperature range.
2. The specified values are unloaded.

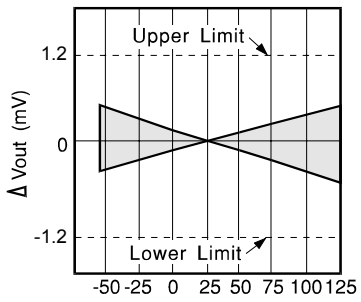
2. TYPICAL PERFORMANCE CURVES

V_{OUT} vs. TEMPERATURE



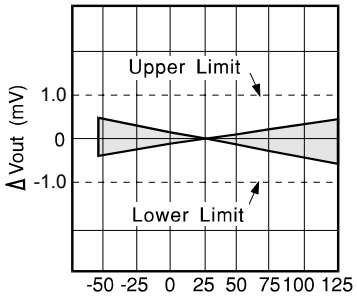
Temperature °C
VRE210CA

V_{OUT} vs. TEMPERATURE



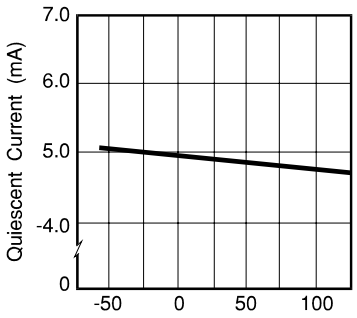
Temperature °C
VRE210M

V_{OUT} vs. TEMPERATURE



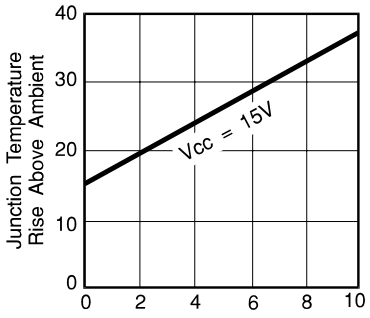
Temperature °C
VRE210MA

QUIESCENT CURRENT VS. TEMP



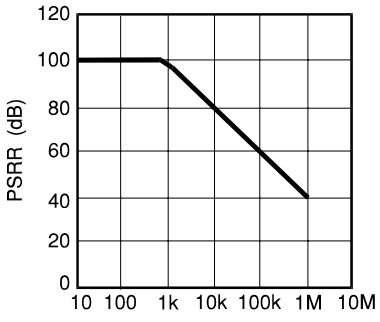
Temperature °C

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. In operation, approximately 6.3 volts is applied to the noninverting input of the op amp. The voltage is amplified by the op amp to produce a 10 V output. The gain is determined by the networks R1 and R2: G=1 + R2/R1. The 6.3V zener diode is used because it is the most stable diode over time and temperature.

The zener operating current is derived from the regulated output voltage through R3. This feedback arrangement provides a closely regulated zener current. This current 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 that 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, Thaler Corporation 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.