Precision Voltage Reference

FEATURES

- Very High Accuracy: +10 V Output, ±0.5 mV
- Extremely Low Drift: 0.6 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

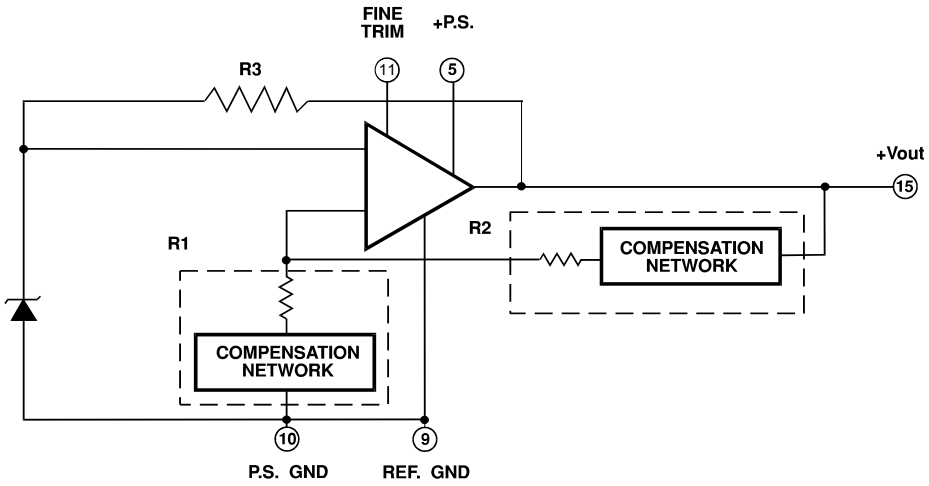
- Precision A/D and D/A Converters
- Transducer Excitation
- Accurate Comparator Threshold Reference
- High Resolution Servo Systems
- Digital Voltmeters
- High Precision Test and Measurement Instruments

DESCRIPTION

VRE210 Series Precision Voltage References provide ultrastable +10 V outputs with ±0.5 mV initial accuracy and temperature coefficient as low as 0.6 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)
VRE210C	+10	-25ºC to +85ºC	±0.8mV
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

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1. CHARACTERISTICS AND SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

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

Model	VRE210C			VRE210CA			VRE210M			VRE210MA			
Parameter	**Min**	**Typ**	**Max**	**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			±700			±500			±1000			±800	µV
Warmup Drift		2			1			2			1		ppm
T_{MIN} - T_{MAX} (Note1)			800			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

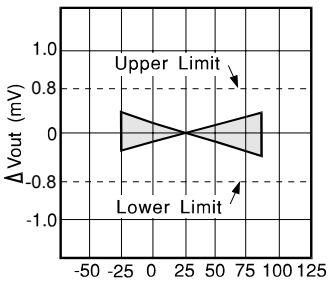
NOTES:

* Same as C 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.

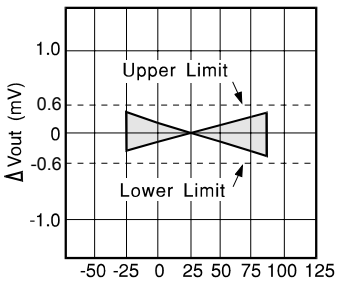
2. TYPICAL PERFORMANCE CURVES

V_{OUT} vs. TEMPERATURE



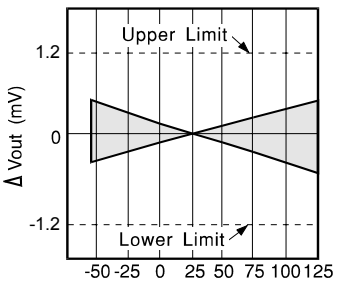
Temperature °C
VRE210C

V_{OUT} vs. TEMPERATURE



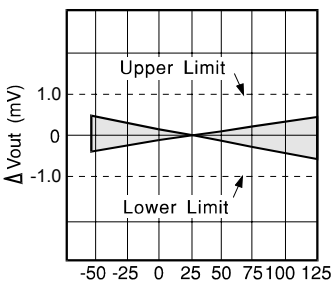
Temperature °C
VRE210CA

V_{OUT} vs. TEMPERATURE



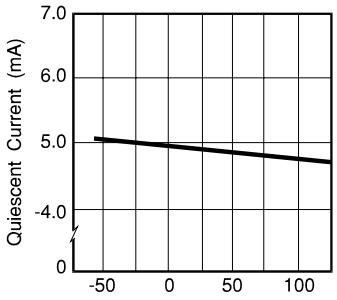
Temperature °C
VRE210M

V_{OUT} vs. TEMPERATURE



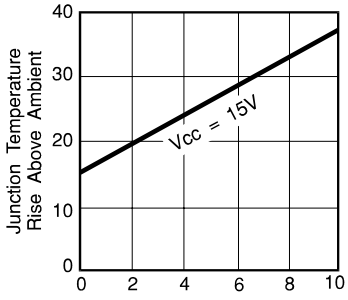
Temperature °C
VRE210MA

QUIESCENT CURRENT VS. TEMP



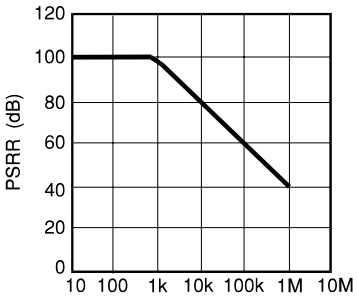
Temperature °C

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.

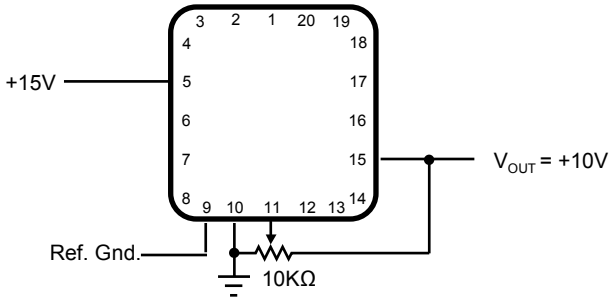
A nonlinear compensation network of thermistors and resistors that is used in the VRE series voltage references. This proprietary network eliminates most of the nonlinearity in the voltage vs. temperature function. By then adjusting the slope, Thaler Corporation produces a very stable voltage over wide 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.

4. APPLICATION INFORMATION

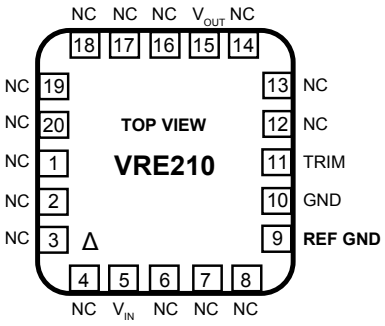
The proper connection of the VRE210 series voltage references with the optional trim resistor is shown below. Pay careful attention to the circuit layout to avoid noise pickup and voltage drops in the lines.

The VRE210 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.

EXTERNAL CONNECTIONS



PIN CONFIGURATION



CONTACTING CIRRUS LOGIC SUPPORT

For all Apex Precision Power product questions and inquiries, call toll free 800-546-2739 in North America.
For inquiries via email, please contact apex.support@cirrus.com.
International customers can also request support by contacting their local Cirrus Logic Sales Representative.
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