

**VRE10**

**FEATURES**

- ◆ Very High Accuracy: +10 V Output,  $\pm 0.3$  mV
- ◆ Extremely Low Drift: 0.5 ppm/°C (-55°C to +125°C)
- ◆ 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**

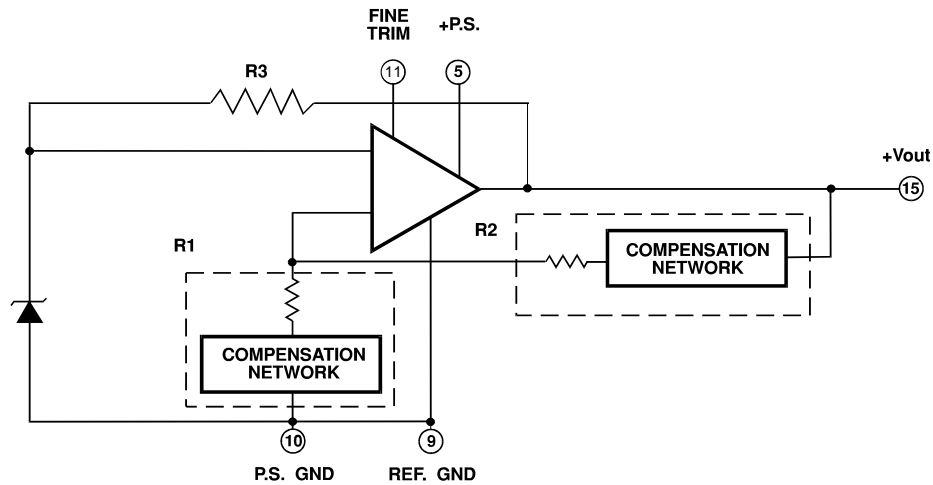
- ◆ Precision A/D and D/A Converters
- ◆ Transducer Excitation
- ◆ Accurate Comparator Threshold Reference
- ◆ High Resolution Servo Systems
- ◆ Digital Voltmeters
- ◆ High Precision Test and Measurement Instrumentation

**DESCRIPTION**

VRE210 is a precision 10 V output voltage reference with a temperature coefficient as low as 0.5 ppm/°C over the operating temperature range. It uses a multipoint laser compensation technique. Significant line and load regulation errors are eliminated. VRE210 is available in 20-terminal ceramic LCC packages.

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**BLOCK DIAGRAM**



**OPERATION GUIDE**

Model	Output (V)	Temp. Range (°C)	V <sub>Drift</sub> (mV)
VRE210C	40	-25°C to +85°C	$\pm 0.6$
VRE210CA	40	-25°C to +85°C	0.3
VRE210M	40	-55°C to +125°C	$\pm 0.5$
VRE210MA	40	-55°C to +125°C	$\pm 0.5$



20-terminal ceramic LCC package



## 1. CHARACTERISTICS AND CONDITIONS

### ELECTRICAL CHARACTERISTICS

V<sub>PS</sub> = 4.5V, T = +25°C, R<sub>L</sub> = 10KΩ Unless Otherwise Noted.

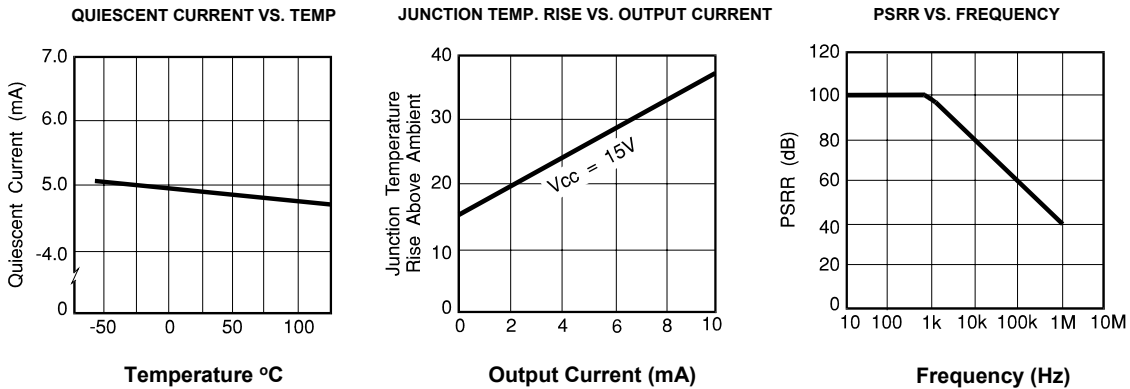
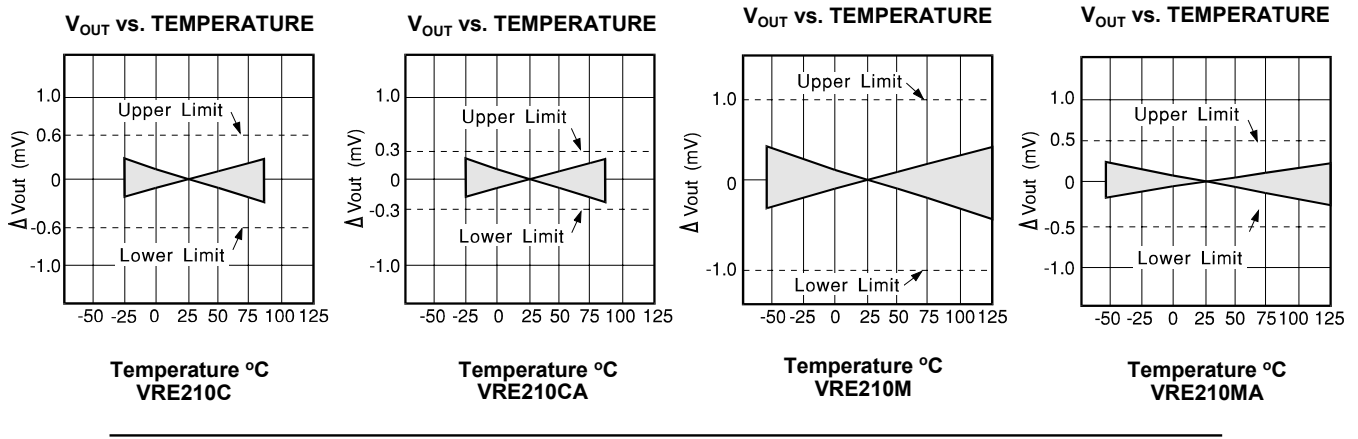
Model	VRE10C			VRE10CA			VRE10M			VRE10MA			Units
	Mn	Tp	Ma	Mn	Tp	Ma	Mn	Tp	Ma	Mn	Tp	Ma	
<b>OUTPUT VOLTAGE</b>													
Output Voltage	+13.5		±22	*		*	*		*	*		*	V
Operating Temperature	-25		+85	*		*	-55		+125	-55		+125	°C
Storage Temperature	-65		+150	*		*	*		*	*		*	°C
Short Circuit Protection	Continuous			*			*			*			
<b>OUTPUT VOLTAGE ERRORS</b>													
Initial Error			±500			±80			±800			±80	μV
Warmup Drift		2			1			2			1		ppm
T <sub>MIN</sub> - T <sub>MAX</sub> (Note1)			600			±80			±1000			500	μV
Temperature Drift		6			*			*			*		ppm/1000hrs
Noise (0.1 - 10Hz)		6			*			*			*		μp
<b>OUTPUT CURRENT</b>													
Output Current	±10			*			*			*			mA
<b>RESOLUTION</b>													
Resolution		3	10		*	*		*	*		*	*	ppm/V
Resolution		3			*			*			*		ppm/mA
<b>OUTPUT RESISTANCE</b>													
Output Resistance		20			*			*			*		mΩ
Temperature Coefficient		4			*			*			*		mV/°C/mV
<b>LOAD REGULATION (Note 2)</b>													
VRE10 PS		5	7		*	*		*	*		*	*	mA

#### NOTES:

\* Same as C Models.

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

## 2. THERMAL PERFORMANCE CURVES



## 3. THERMAL PERFORMANCE

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

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

Application Note

Thaler Corporation

ing the slope, Thaler Corporation produces a very stable voltage over wide temperature ranges. This network is less

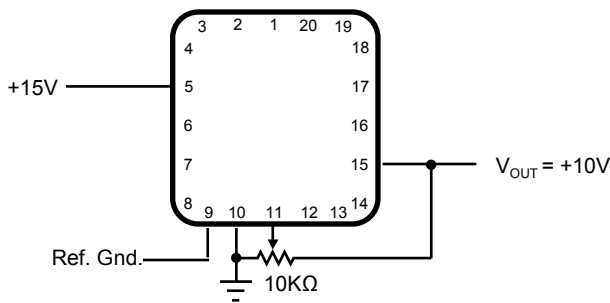


## 4. APPLICATION INFORMATION

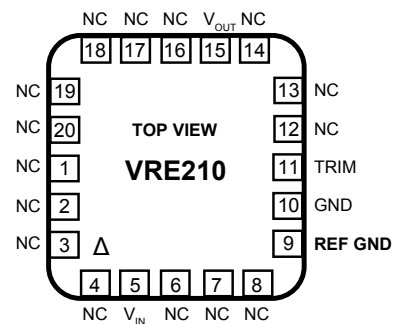
### Typical Applications

The VRE210 series voltage references have the ground terminal brought out on two pins (pin 9 and pin 10) which 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.

### TERMINAL CONNECTIONS



### PACK CONFIGURATION



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For all Apex Precision Power product questions and inquiries, call toll free 800-546-2739 in North America.

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