

# VRE125/127

## Precision High Temperature Reference Supplies



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### FEATURES

- WIDE OPERATING RANGE: -55°C to +200°C
- VERY HIGH ACCURACY: 5.000 V ±0.4 mV
- EXTREMELY LOW DRIFT: 0.6 mV (-55°C to +150°C)  
2.0 mV (-55°C to +200°C)
- EXCELLENT STABILITY: 6 ppm / 1000Hrs.
- EXCELLENT LINE REGULATION: 6 ppm / V Typ.
- HERMETIC 14-PIN DIP

### DESCRIPTION

VRE125 series references are designed to operate over an extremely wide temperature range (-55°C to +200°C) and still provide excellent accuracy. The VRE125 provides a +5V output and the VRE127 provides a ±5V output. All types are available in commercial (C suffix) and military (M suffix) models. They are hermetically sealed and are screened for high reliability and quality. Two accuracy grades (standard and A) are available in both models. The adjacent selector guide shows the limits of the most important parameters of the VRE125/127 series references.

The accuracy of the VRE125/127 series over temperature is achieved by using Thaler Corporation's patented multi-point compensation technique. The stability of the VRE125 series is enhanced by using a zener diode instead of a bandgap reference, which is typically used in 5V references. Zener diodes have better long term stability and don't suffer the significant shifts caused by temperature cycling that bandgap references do.

Other performance parameters, such as warm-up drift and long term stability are better than competitive models.

Superior stability, accuracy, and quality make these references ideal for high temperature applications such as A/D and D/A converter references.

### APPLICATIONS

- PRECISION A/D and D/A CONVERTERS
- ACCURATE COMPARATOR THRESHOLD VOLTAGE
- HIGH RESOLUTION SERVO SYSTEMS
- HIGH TEMPERATURE TEST and MEASUREMENT SYSTEMS
- TRANSDUCER EXCITATION
- GEOLOGICAL EQUIPMENT

### SELECTION GUIDE

Type	Output	Max. Volt Deviation (-55°C to +150°C)	Max. Volt Deviation (150°C to +200°C)	Initial Error (Max)
VRE125C	+5V	±0.9mV	±3.0mV	±0.8mV
VRE125CA	+5V	±0.6mV	±2.0mV	±0.4mV
VRE125M	+5V	±0.9mV	±3.0mV	±0.8mV
VRE125MA	+5V	±0.6mV	±2.0mV	±0.4mV
VRE127C	±5V	±0.9mV	±3.0mV	±0.8mV
VRE127CA	±5V	±0.6mV	±2.0mV	±0.4mV
VRE127M	±5V	±0.9mV	±3.0mV	±0.8mV
VRE127MA	±5V	±0.6mV	±2.0mV	±0.4mV

# ELECTRICAL SPECIFICATIONS

# VRE125/127

Vps = ±15V, T = 25°C, RL = 10KΩ unless otherwise noted.

MODEL	C			CA			M			MA			
PARAMETERS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
<b>ABSOLUTE MAXIMUM RATINGS</b>													
Power Supply	±13.5		±22	*		*	*		*	*		*	V
Operating Temperature	-55		200	*		*	*		*	*		*	°C
Storage Temperature	-65		150	*		*	*		*	*		*	°C
Short Circuit Protection	Continuous				*			*			*		
<b>OUTPUT VOLTAGE</b>													
VRE125		+5			*			*			*		V
VRE127		±5			*			*			*		V
<b>OUTPUT VOLTAGE ERRORS</b>													
Initial Error			0.8			0.4			0.8			0.4	mV
Warmup Drift <sup>(1)</sup>		2			1			2			1		ppm
-55°C to 150°C <sup>(3)</sup>			0.9			0.6			*		*		mV
150°C to 200°C			3.0			2.0			*		*		mV
Long-Term Stability		6			*			*			*		ppm/1000hr.
Noise (.1-10Hz)		3			*			*			*		μVpp
<b>OUTPUT CURRENT</b>													
Range	±10			*			*			*			mA
<b>REGULATION</b>													
Line		6	10		*	*		*	*		*	*	ppm/V
Load		3			*			*			*		ppm/mA
<b>OUTPUT ADJUSTMENT</b>													
Range		10			*			*			*		mV
Temperature Coefficient		4			*			*			*		μV/°C/mV
<b>POWER SUPPLY CURRENTS <sup>(2)</sup></b>													
VRE125 +PS		4	7		*	*		*	*		*	*	mA
VRE127 +PS		6	9		*	*		*	*		*	*	mA
VRE127 -PS		4	6		*	*		*	*		*	*	mA

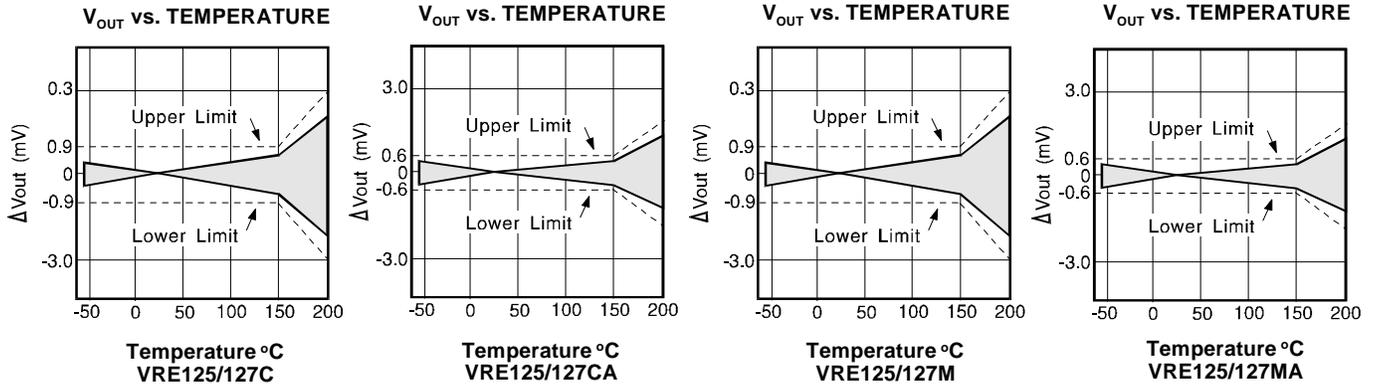
NOTES: \*Same as C Models.

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.

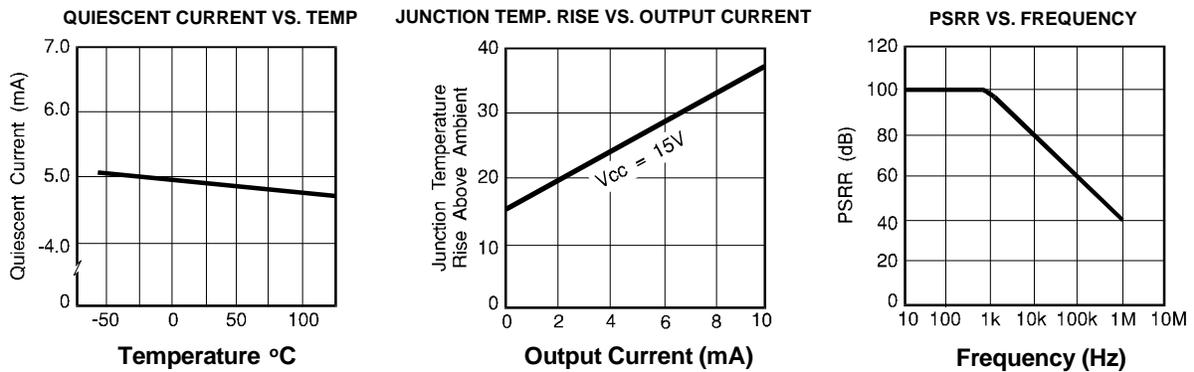
2. The specified values are unloaded.

3. Cone widening from 150 °C value to specified value.

# TYPICAL PERFORMANCE CURVES

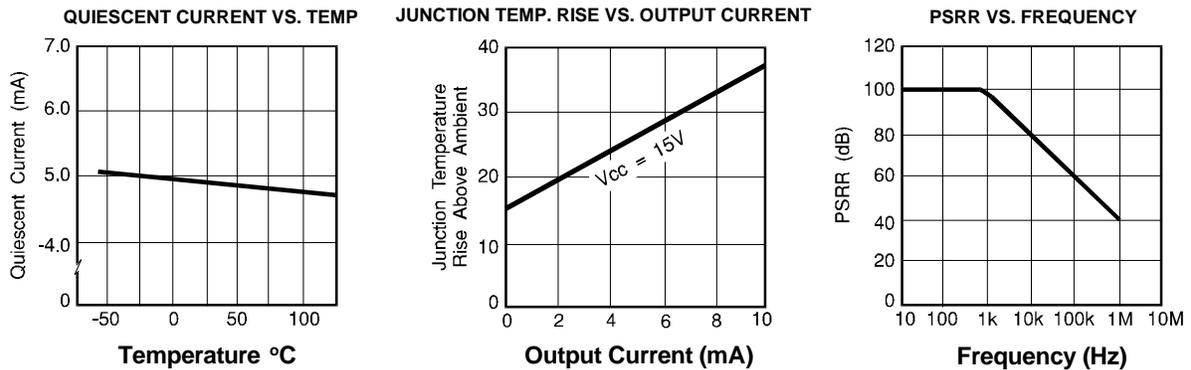


## VRE125

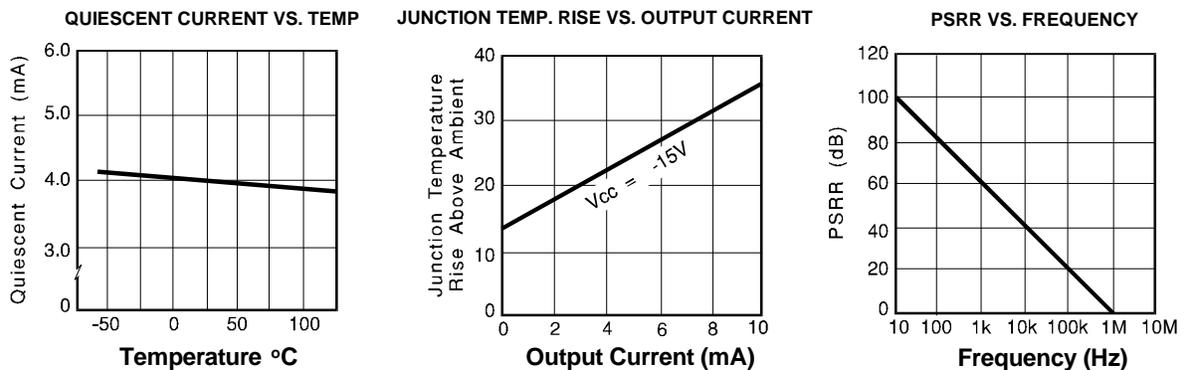


## VRE127

### POSITIVE OUTPUT



### NEGATIVE OUTPUT



# DISCUSSION OF PERFORMANCE

## THEORY OF OPERATION

The following discussion refers to the schematic below. A FET current source is used to bias a 6.3V 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 5.000V output. The gain is determined by the resistor networks R3 and R4:  $G=1 + R4/R3$ . The 6.3V 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 reference's 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 method leaves a residual error over wide temperature ranges.

To remove this residual error, Thaler has developed a nonlinear compensation network of thermistors and resistors that is used in the VRE series 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.

## APPLICATION INFORMATION

Figure 1 shows the proper connection of the VRE125 series voltage reference with the optional trim resistors. When trimming the VRE127, the positive voltage should be trimmed first since the negative voltage tracks the positive side. Pay careful attention to the circuit layout to avoid noise pickup and voltage drops in the lines.

When using precision voltage references at high temperatures it is best to keep them powered up. If the zener diode isn't powered up at high temperatures the junction will collect ions, and then when power is applied, the voltage will drift until the charge build up is depleted.

The VRE125 series voltage references have the ground terminal brought out on two pins (pin 6 and pin 7) 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 20ppm. By connecting pin 7 to the power supply ground and pin 6 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 doesn't effect performance.

### VRE125

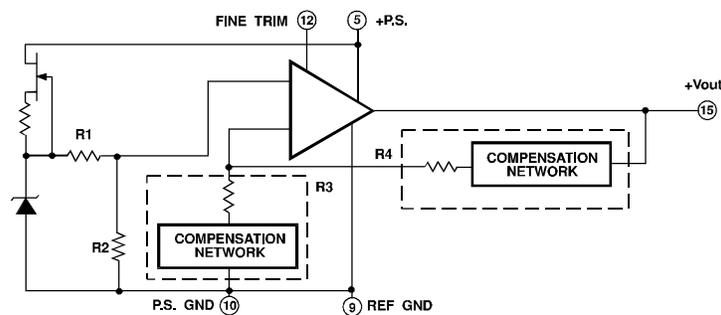


FIGURE 2

### VRE127

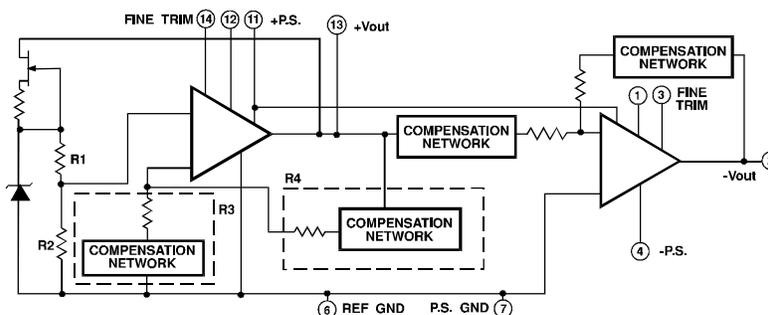
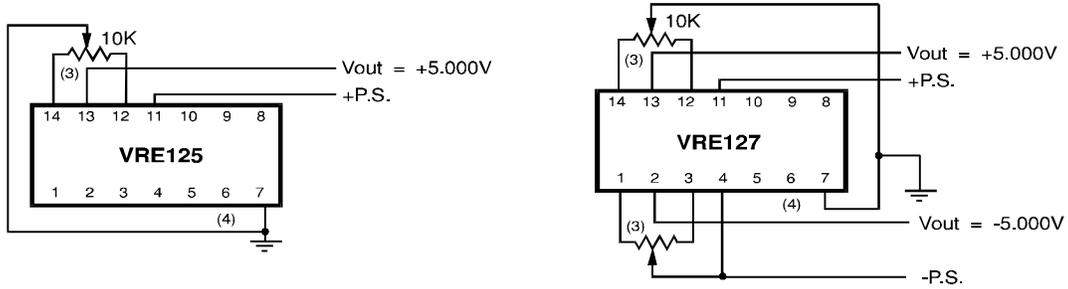


FIGURE 3

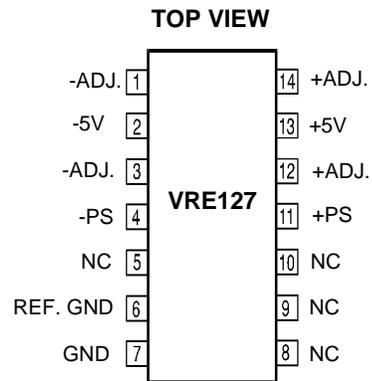
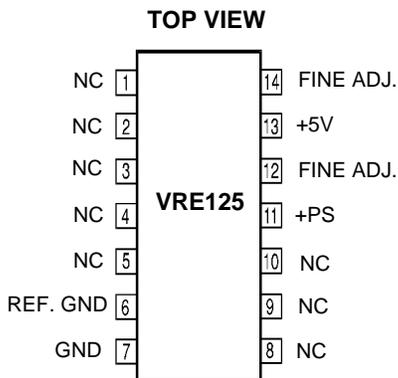
## EXTERNAL CONNECTIONS



**FIGURE 1**

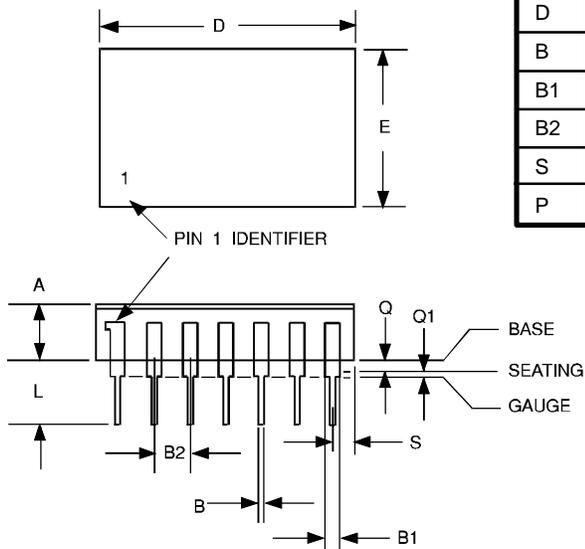
- 3. Optional Fine Adjust for approximately  $\pm 10\text{mV}$ . VRE127 center tap connects to -P.S.
- 4. Pin 6 is internally connected to Pin 7 and can be used as Ref. GND.

## PIN CONFIGURATION



## MECHANICAL

### 14-PIN HYBRID PACKAGE



DIM	INCHES		MILLIMETER		DIM	INCHES		MILLIMETER	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX
E	.480	.500	12.1	12.7	A	.120	.155	3.0	4.0
L	.195	.215	4.9	5.4	Q	.015	.035	0.4	0.9
D	.775	.805	19.7	20.4	Q1	N/A	.030	N/A	0.7
B	.016	.020	0.4	0.5	C	.009	.012	0.2	0.3
B1	.038	.042	0.9	1.0	G1	.290	.310	7.3	7.8
B2	.095	.105	2.4	2.6					
S	.085	.105	2.1	2.6					
P	.004	.006	0.10	0.15					