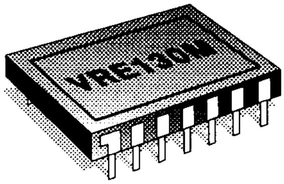
VRE130M/135M
Precision Reference Supplies



THALER CORPORATION • 10940 N. STALLARD PLACE • TUCSON, AZ 85737 • (602) 742-5572

FEATURES

- HIGH OUTPUT CURRENT: 60 mA at +125°C
- RADIATION HARDENED DESIGN
- HIGH ACCURACY: VRE130 - 10.000 V ±2.0 mV
  VRE135 - 15.000 V ±3.0 mV
- EXCELLENT LOAD REGULATION: 1 μV/60 mA
- MILITARY SCREENING
- LOW DRIFT: 1.5 ppm/°C

APPLICATIONS

- PRECISE CONTROL OF POWER SUPPLY
- RADIATION HARD EQUIPMENT
- TRANSDUCER EXCITATION
- HIGH RESOLUTION SERVO SYSTEMS

DESCRIPTION

The VRE130/135 series voltage references are high current, high stability references with a radiation hardened design. The VRE130M is a ±10 V reference with an initial accuracy of 2.0 mV. The VRE135M is a ±15 V reference with an initial accuracy of 3.0 mV. These references are short circuit protected and are guaranteed to drive 60 mA at 125°C through each output. The VRE130M is guaranteed to drift less than ±1.5 mV over the full military temperature range and the VRE135M is guaranteed to drift less than ±2.25 mV over the entire military temperature range. This is made possible by Thaler Corporation's patented nonlinear compensation technique. The VRE130 series references also utilizes a sense pin that eliminates voltage variations at the load due to current variations.

These references are available in a 14-pin ceramic DIP package. They are hermetically sealed and are screened for high reliability and quality.

Superior stability, accuracy, and high current capability make these references ideal for applications such as transducer excitation systems, servo systems and other applications requiring an accurate voltage and requiring more than the 10mA of current available from standard references.

The radiation hardened design, superior accuracy and the high current capability make the VRE130 series reference an excellent choice for many military applications.

SELECTION GUIDE

Type	Output	Package	Max. Volt Deviation (-55°C to +125°C)
VRE130M	±10V	DIP	1.5mV
VRE135M	±15V	DIP	2.25mV

VRE130DS REV. B SEPT.1991

SPECIFICATIONS
ELECTRICAL

VRE130/135 SERIES

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

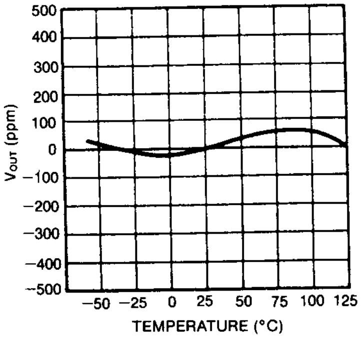
MODEL	130M						135M						
PARAMETERS	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**UNITS**
ABSOLUTE MAXIMUM RATINGS													
Power Supply	±14.5		±35				±21		±35				V
Operating Temperature	-55		125				-55		125				°C
Storage Temperature	-65		150				-65		150				°C
Short Circuit Protection	Continuous							*					
OUTPUT VOLTAGE		±10						±15					V
OUTPUT VOLTAGE ERRORS													
Initial Error (3)		0.5	2					1	5				mV
Warmup Drift		15	25					25	40				µV
Tmin - Tmax (1)			1.5						2.25				mV
Long-Term Stability		6						*					ppm/1000hrs.
Noise (.1-10Hz)		6						9					µVpp
OUTPUT CURRENT													
Range (25°C)	80						*						mA
Range (125°C)	60						*						mA
REGULATION													
Line		30	100					*	*				µV/V
Load (4)		30						*					µV/mA
OUTPUT ADJUSTMENT													
Range		10						*					mV
Temperature Coefficient		100						*					µV/°C/mV
POWER SUPPLY CURRENTS (2)													
		9	12					*	*				mA

NOTES: * Same as VRE130M

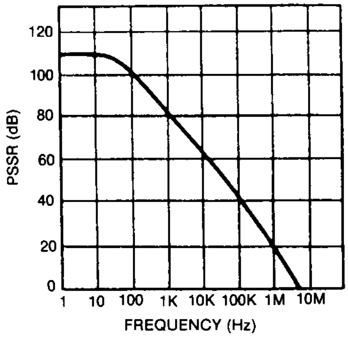
1. Using the box method, the specified value is the maximum deviation from the output voltage at 25°C over the specified operating temperature range.
2. The specified values are unloaded.
3. Optional Fine Adjust for approximately ±10mV.
4. 1 µV over entire load range at the sense pin.

TYPICAL PERFORMANCE CURVES

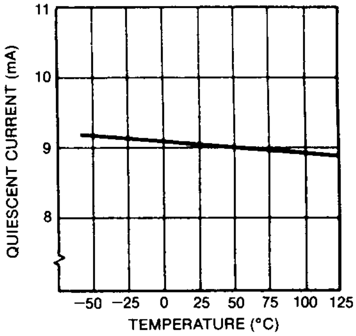
OUTPUT VOLTAGE DEVIATION VS TEMPERATURE



POWER SUPPLY REJECTION VS FREQUENCY

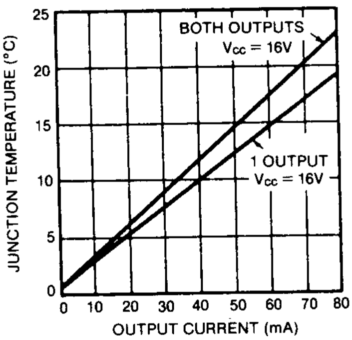


QUIESCENT CURRENT VS TEMPERATURE

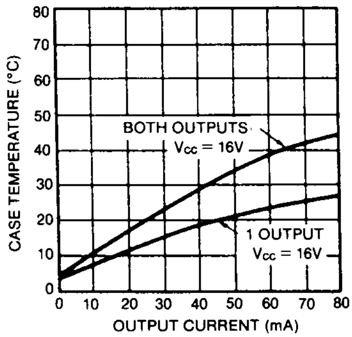


VRE130M

JUNCTION TEMPERATURE RISE ABOVE CASE TEMPERATURE VS OUTPUT CURRENT

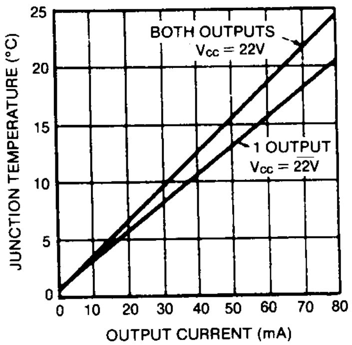


CASE TEMPERATURE RISE ABOVE AMBIENT VS OUTPUT CURRENT (130MD)

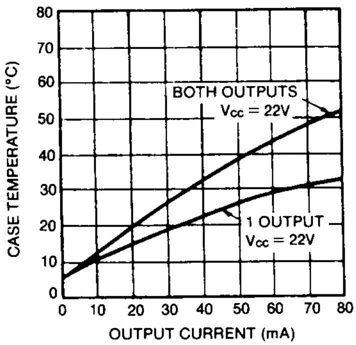


VRE135M

JUNCTION TEMPERATURE RISE ABOVE CASE VS OUTPUT CURRENT



CASE TEMPERATURE RISE ABOVE AMBIENT VS OUTPUT CURRENT (135MD)



VRE130DS REV. B SEPT.1991

DISCUSSION OF PERFORMANCE

THEORY OF OPERATION

The VRE130 series references have independent positive and negative circuits. The positive side can operate without power to the negative side and the negative side can operate without power to the positive side. This reduces the probability of both outputs failing when exposed to radiation.

The 6.3V zener diode is used in both the negative and the positive circuitry. The voltage from the zener diodes are then amplified by the op amps to obtain the desired output voltage at the sense pins. The zener diodes are biased from the outputs via the sense pins. This feedback method provides well regulated current through the zener diodes. By trimming the zener current slope the output voltage vs. temperature function is changed. Since this function is nonlinear, this compensation method leaves a residual temperature coefficient. Although other voltage reference manufacturers stop at this point, Thaler uses a proprietary nonlinear compensation technique to eliminate most of this residual voltage variation caused by changes in temperature. Thus, Thaler provides a more stable reference over wider temperature ranges.

Thaler Corporation has also used appropriate components and design procedures to harden the VRE130 series reference against radiation damage. The op amp used to drive the output stage is dieelectrically isolated instead of junction isolated. This reduces the probability of power supply current transients resulting from photocurrent excitation at the junctions within the op amp. It also eliminates the possibility of latchup caused by producing a regenerative fourth layer path caused by photocurrent of a transistor and its isolation diode.

The output stage has been designed to be radiation resistant and to function with radiation damage. The output stage has resistors in its junctions to limit photocurrents and uses transistors with small bases to minimize transistor damage. The output stage is designed to operate with degraded b and with increases in V_{BE} and V_{CE}, which would result from radiation damage.

APPLICATION INFORMATION

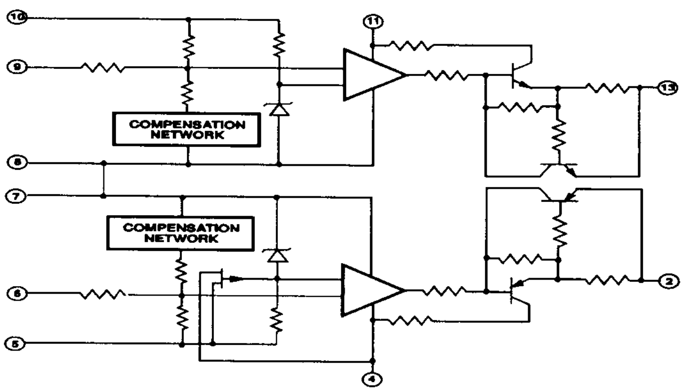
The proper connection of the VRE130 series references is shown below. In order for the VRE130 series voltage references to control the output voltage, the sense pins need to be connected to the output. The closer the sense pins are to the load, the more accurate the load regulation will be. In systems where the load varies, this is even more important because the voltage drops though the output lines vary with the load current. When the current is constant, this voltage drop can be trimmed out.

The trimpots are connected with the wiper arm to the adj input and the other potentiometer leads are connected to the sense input and the ground as shown below. These pots should be 10K-100K ohms. Trimming the output voltage will change the drift by approximately 0.01ppm/°C per mV of trimmed voltage. Any mismatch in TC between the two sections of the potentiometer will also effect drift. A high quality potentiometer with good mechanical stability, such as a cermet should be used. A potentiometer with a TC of 100ppm/°C is normally sufficient.

When the VRE130 series reference is connected, the negative and positive loads should have their grounds connected together as close as possible to avoid differences in ground potentials. To keep the ground potential between the load and the reference as small as possible, the return current from the loads should return to the system ground and the ground from the reference should be connected at the load as shown below. This minimizes the voltage difference between the reference ground and the load ground because the current flowing between these two points is the quiescent current of the reference instead of the load current.

Depending on the application, the self-heating and the junction temperature may be of concern. Graphs on the previous page contain information to assist in making these calculations.

EQUIVALENT SCHEMATIC



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EXTERNAL CONNECTIONS

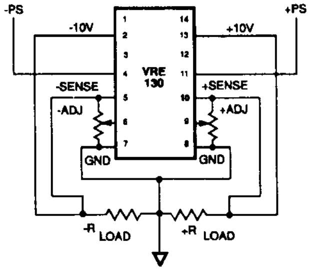
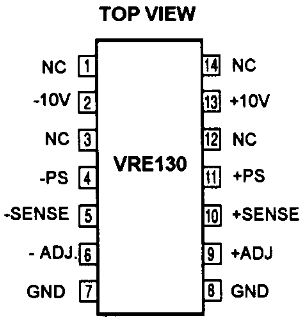
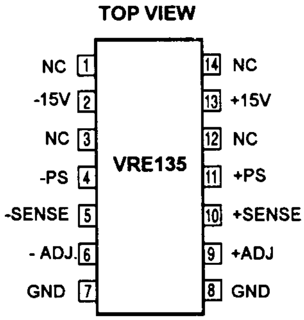


FIGURE 1

PIN CONFIGURATION

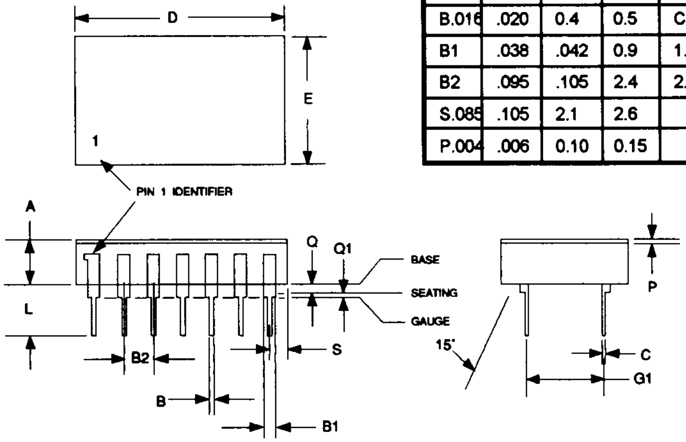




MECHANICAL

14-PIN HYBRID PACKAGE

	INCHES		MILLIMETER			INCHES		MILLIMETER	
DIM	MIN	MAX	MIN	MAX	DIM	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						



VRE130DS REV. B SEPT. 1991

SPECIFICATIONS

ELECTRICAL

VRE130 SERIES

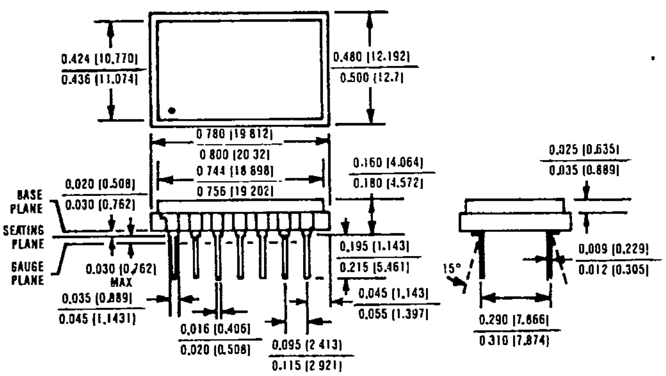
V_{PS} = ±15V, T = 25°C, R_L = 10KΩ unless otherwise noted.

MODEL	130MD			130MF			135MD			135MF			
PARAMETER	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**UNITS**
ABSOLUTE MAXIMUM RATINGS													
Power Supply	16		35	16		35	21		35	21		35	V
Operating Temperature	−55		125	−55		125	−55		125	−55		125	°C
Storage Temperature	−65		150	−65		150	−65		150	−65		150	°C
Short Circuit Protection	Continuously			Continuously			Continuously			Continuously			
OUTPUT VOLTAGE		10			10			15			15		V
OUTPUT VOLTAGE ERRORS													
Initial Error		2.0			2.0			3.0			3.0		μV
Warmup Drift		25			25			40			40		μV
T_{MIN} - T_{MAX} [1]			1.5			1.5			2.25			2.25	mV
Long-Term Stability		20			20			20			20		ppm/1000 hrs.
Noise (.1-10Hz)		20			20			30			30		μV_{PP}
OUTPUT CURRENT													
Range (25°C)	80			80			80			80			mA
Range (125°C)	60			60			60			60			mA
REGULATION													
Line		30	100		30	100		30	100		30	100	μV/V
Load [4]		30			30			30			30		μV/mA
OUTPUT ADJUSTMENT													
Range		10			10			10			10		mV
Temperature Coefficient		100			100			100			100		μV/°C/mV
POWER SUPPLY CURRENTS [2]		9	12		9	12		9	12		9	12	mA

NOTES:
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. Optional Fine Adjust for approximately ±10mV.
4. 1μV over entire load range at the sense pin.

MECHANICAL

14-PIN HYBRID PACKAGE



14-PIN FLAT PACKAGE