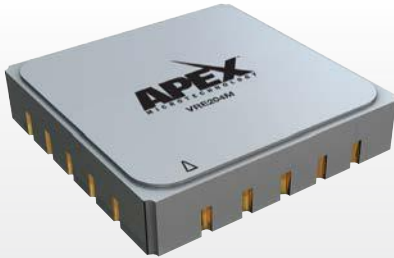




High-Precision, Ultra-Stable Voltage References

For Extended Temperature Range Applications (-55°C to +125°C)



20-LEAD CERAMIC LCC

Footprint 9mm X 9mm

FEATURES

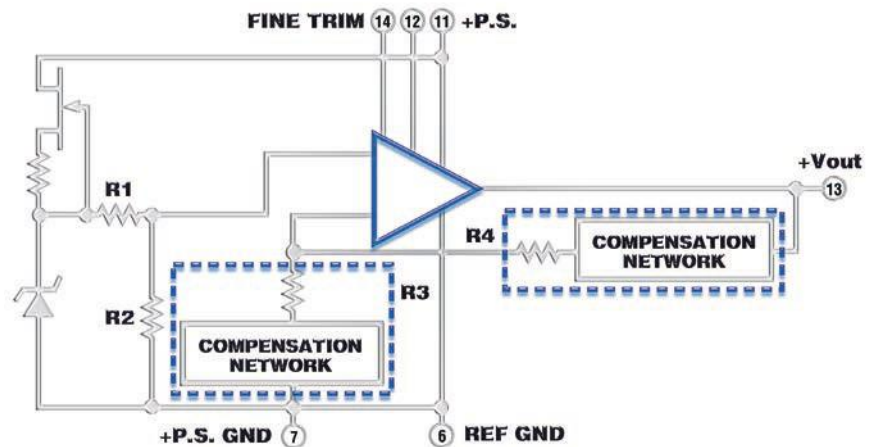
- Wide operating temperature range -55°C to +125°C
- Low temperature drift, high stability
- Active laser trimming delivers reliability
- Ceramic packaging

Product Overview

The Apex Microtechnology product family of precision voltage references (VREs) utilizes hybrid circuit designs that include all the necessary active and passive components on a ceramic substrate — no external circuitry is necessary, only the power needs to be supplied and the reference will provide a stable output voltage. These reference products perform with the highest accuracy and stability over both a wide temperature range and an extended period of time. This performance is achieved through the process of active laser trimming of a proprietary non-linear network of film resistors, and by functionally testing every single part over the full operational temperature range.

Operating Principles of High Precision, Stability

The operating principle at the foundation of the Apex VRE product family is based on a zener diode — the most stable diode over time and temperature. A current source supplies the zener diode, and the zener voltage is then amplified to the desired value by a regulation feedback loop consisting of an error amplifier and a resistor compensation network. The characteristic of the zener voltage vs temperature is highly non-linear. The initial precision and stability of the output voltage over temperature and time is highly dependent on the ability to compensate for this non-linearity of the zener voltage. This is particularly difficult to achieve over a wide temperature range such as -55°C to +125°C. Apex has solved this problem by using a proprietary network of non-linear and laser-trimmable film resistors in the amplifier compensation network. This network eliminates most of the non-linearity in the voltage vs temperature function.



THE VRE204 — A SIMPLIFIED SCHEMATIC

The operating principle is based on a 6.3 V zener diode, as shown in the diagram above. A nonlinear compensation network of thermistors and resistors is actively laser trimmed to eliminate most of the non-linearity in the voltage vs temperature function.

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Hybrid Manufacturing, Testing and Laser Trim

All voltage references are manufactured using a high quality, DLA MIL-PRF-38534 certified hybrid manufacturing process. The sourced building materials, such as ICs and small-signal components, are attached to the ceramic substrate alongside thick and thin film resistors and interconnected with gold ball wire bonds. The film resistors are trimmable, a key characteristic offered by the hybrid manufacturing process and crucial for making ultra precise voltage references capable of performing over an extended temperature range. After assembly is completed, the parts undergo an initial burn-in and electrical test sequence with the purpose of identifying early failures. Those parts with minor defects are re-worked and repaired.

Every functional part is then trimmed. The voltage references are powered up, and the output voltage is measured over the entire operating temperature range in comparison to the expected values. Data is collected for every single device tested and then proprietary software algorithms are used to drive the automatic lasers that trim the resistors. Every voltage reference needs to be trimmed differently with several iterations of this measure, and trim process is required until the voltage output meets the exacting specifications. Since these resistors are very stable, the voltage references also have very good long term stability.

After trimming is completed, the parts are sealed and undergo reliability testing that includes additional burn-in, temperature cycling, and acceleration tests. Fine and gross leak testing is also performed. In total, the highest graded parts spend up to one full day in trimming and seven days in reliability testing. This extensive testing procedure ensures that only functional devices are delivered to the customer and that every shipped part will have the specified voltage precision over the entire -55° to +125° C temperature range. Early failures should never be an issue. Commercial and industrial grade parts are also available and optimized for temperature ranges of 0° to +70° C, -25° to +85° C and -40° to +85° C.

The high quality and reliability provided by the hybrid manufacturing process, combined with ceramic packaging, makes these voltage references exceptionally well suited for equipment that operates in harsh outdoor environments:

- Environments with wide temperature swings
- Deep underground locations
- Airborne applications

Typical Applications

The key advantage of an Apex VRE is the precision they achieved over a very wide temperature range without the need for over-temperature control. This advantage, combined with their unparalleled stability over time, provides clear advantages to high-end equipment manufacturers, such as the ability to achieve high measurement sensitivity and increased time between needed equipment calibrations. Target applications include:

- Automatic test equipment
- Medical devices
- Industrial process monitoring
- Precision motor control
- Ultra sensitive seismic sensor systems
- Fuel injection systems
- Guidance systems
- Precision A/D or D/A conversion

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