

FEATURES

- Precision $\pm 0.2\%$ max initial accuracy
- Input voltage range 2.2V to 5.5V
- Dropout voltage 150mV max
- Output drive current 25mA
- Output voltage noise 25 μ Vp-p (0.1Hz to 10kHz)
- -40°C to +125°C and -55°C to +125°C operating temperature ranges
- 100% testing over temperature
- High-Rel process flow, burn-in, environmental, lot and ATE traceability
- Temperature coefficient 15 PPM/°C
- Supply current 46 μ A typical
- Humidity resistant CLCC package (-QL, /883)
- Tiny SOT-23 package (SE, SM)
- Pb-free RoHS compliant

ORDERING INFORMATION

| MODEL | TEMP. RANGE | PACKAGE |
|--------------|-----------------|---------|
| PVR-1510SE | -40°C to +125°C | SOT23-3 |
| PVR-1510SM | -55°C to +125°C | SOT23-3 |
| PVR-1510-QL | -55°C to +125°C | CLCC |
| PVR-1510/883 | -55°C to +125°C | CLCC |

PRODUCT OVERVIEW

The PVR-1510 from DATEL is a low dropout micropower bandgap voltage reference offered in either a tiny SOT-23-3 or a hermetic sealed ceramic LCC package. The fully hermetic package offered for the -QL and /883 versions are not affected by humidity, and are therefore more stable in environments where humidity is a concern. This precision reference operates from a single 2.2V to 5.5V supply and provides $\pm 0.2\%$ initial voltage accuracy. The PVR-1510 sources up to 25mA output current with a low 150mV maximum dropout voltage.

This reference is one in a family of precision voltage references from DATEL that ranges from 1.024 to 5.0 volts. With a temperature coefficient of 15 PPM/°C this reference allows a mere 1.5mV of drift at +125°C. This low TC drift along with the precision initial accuracy of 1.5mV

makes the PVR-1510 the reference of choice for precision data acquisition applications. Applications requiring a tighter TC over temperature may require the PVR-05xx series. For low power battery or solar applications, the PVR-1510 offers low supply current and low dropout voltage coupled with precision output voltage specifications.

DATEL offers these precision references as Enhanced Products that are qualified and 100% tested over the -40°C to +125°C and -55°C to +125°C military temperature range. Burn-in and environmental screening are also available as well as full temperature range test results recorded and stored by serial number.

Products are offered in military temperature grades as well as fully screened High-Reliability -QL and /883 models.

APPLICATIONS

- Precision A/D and D/A converters
- Battery and Solar powered management/monitoring
- MIL-STD/883 systems
- Defense/ aerospace applications
- Portable instruments
- Low power industrial/ High-Rel instrumentation
- Low voltage signal processing
- Micropower remote sensing

COMPLETE PRODUCT OFFERING

| Output Voltage | Vout Initial Accuracy | Temp Coefficient | Output Current | Minimum Supply Voltage | Maximum Supply Voltage | Maximum Supply Current | LTD Stability | Output Noise (Typ) | Package Type | Model Number |
|----------------|-----------------------|------------------|----------------|------------------------|------------------------|------------------------|---------------|--------------------|--------------|--------------|
| Volts | % Vout | ppm/°C | mA | Volts | Volts | μ A | PPM | μ VPP | | |
| 1.024 | 0.2 | 15 | 25 | 2.2 | 5.5 | 80 | 110 | 14 | SOT23-3 | PVR-1510SE |
| 1.25 | 0.08 | 5 | 7 | 3.5 | 16.5 | 180 | 50 | 4.5 | SOIC8 | PVR-0512SE |
| | 0.2 | 15 | 25 | 2.2 | 5.5 | 80 | 110 | 17 | SOT23-3 | PVR-1512SE |
| 1.5 | 0.2 | 15 | 25 | 2.2 | 5.5 | 80 | 110 | 20 | SOT23-3 | PVR-1515SE |
| 2.048 | 0.2 | 15 | 25 | 2.2 | 5.5 | 100 | 50 | 58 | SOT23-3 | PVR-1520SE |
| 2.5 | 0.04 | 5 | 7 | 3.5 | 16.5 | 180 | 50 | 4.5 | SOIC8 | PVR-0525SE |
| 2.5 | 0.2 | 15 | 25 | 2.6 | 5.5 | 80 | 110 | 37 | SOT23-3 | PVR-1525SE |
| 3 | 0.2 | 15 | 25 | 3.1 | 5.5 | 100 | 110 | 86 | SOT23-3 | PVR-1530SE |
| 3.3 | 0.2 | 15 | 25 | 3.4 | 5.5 | 100 | 50 | 95 | SOT23-3 | PVR-1533SE |
| 4.096 | 0.02 | 5 | 7 | 4.5 | 16.5 | 180 | 50 | 4.5 | SOIC8 | PVR-0540SE |
| | 0.2 | 15 | 25 | 4.2 | 5.5 | 80 | 110 | 56 | SOT23-3 | PVR-1540SE |
| 5.0 | 0.02 | 5 | 7 | 5.5 | 16.5 | 180 | 50 | 4.5 | SOIC8 | PVR-0550SE |

ABSOLUTE MAXIMUM RATINGS

| PARAMETERS | LIMITS | UNITS |
|------------------------------|------------------|-------|
| Vin to GND | -0.5 to +6.5 | Volts |
| Vout to GND | -0.5 to Vin +0.5 | Volts |
| Input voltage slew rate | 1 | V/μs |
| Continuous power dissipation | 99 | mW |
| Storage Temperature | -65 to +150 | °C |

FUNCTIONAL SPECIFICATIONS

(Typical at GND=0V, Vin = 3.0V, Iout = 0mA unless otherwise specified, Ta = +25°C)

| INPUT/OUTPUT | MIN. | TYP. | MAX. | UNITS |
|---|--------------------------------------|--------|------|--------|
| Vin | 2.2 | — | 5.5 | Volts |
| Iin +25°C | — | 45 | 82 | μA |
| Iin +125°C | — | — | 105 | μA |
| Line Regulation (2.6V to 5.5V) | — | 10 | 100 | μV/V |
| Dropout Voltage ¹ (Iout = 10mA) | — | 50 | 150 | mVolts |
| Output Voltage | — | 1.0240 | — | Volts |
| Output Voltage Accuracy ² | -0.2 | — | 0.2 | % |
| Output Voltage Temperature Coefficient ³ | — | 12 | 50 | ppm/°C |
| Load Regulation (sourcing: 0mA to 25mA) | — | 20 | 120 | μV/mA |
| Load Regulation (sinking: 0mA to -1mA) | — | 20 | — | μV/mA |
| Output Voltage Noise (0.1Hz to 10Hz) | — | 25 | — | μVp-p |
| Output Voltage Noise (10Hz to 1kHz) | — | 15 | — | μVRMS |
| Output Ripple Rejection (120Hz) | — | 70 | — | dB |
| Short Circuit Current ⁴ (+25°C) | — | 120 | — | mA |
| Turn on Settling Time ⁵ (±0.1% Vout) | — | 300 | — | μs |
| Stability (1000 hours, +25°C) | — | 100 | — | ppm |
| Thermal Hysteresis ⁶ | — | 100 | — | ppm |
| Operating Temp. Range: | | | | |
| SE Versions | -40 | — | +125 | °C |
| SM Versions | -55 | — | +125 | °C |
| -QL Versions | -55 | — | +125 | °C |
| /883 Versions | -55 | — | +125 | °C |
| Storage Temp. Range | -65 | — | +150 | °C |
| Package Type | | | | |
| SE, SM Versions | 3-pin SOT-23-3 | | | |
| -QL, /883 Versions | Ceramic Leadless Chip Carrier (CLCC) | | | |

APPLICATION NOTES

Micropower Operation

The PVR-1510 consumes very little power due to its proprietary bandgap technology. Low noise performance is achieved using optimized biasing techniques. Supply current is typically 45μA and noise in the 0.1Hz to 10Hz bandwidth is typically 25μVpp lending this device to precision, low noise portable applications such as handheld meters and instruments. Data Converters can utilize the PVR-1510 as a precision, low drift reference. Low power A/Ds and D/As will maximize their noise performance due to the PVR-1510's low-noise specification.

Noise Performance and Reduction

The recommended capacitive load range for the PVR-1510 is from 0.1μF to 10.0μF to ensure stability and best transient performance. Parallel 0.1μF and 10μF capacitors can be used to optimize performance as well. The noise specification stated in the Functional Specification tables is for 0.1μF capacitive load, and larger values will reduce the output noise level.

Humidity Susceptibility

Plastic mold compounds that are used to house ICs can absorb moisture. When these ICs are exposed to humidity the plastic package can undergo slight changes that will apply pressure to the internal die. These stresses placed on a precision reference can cause changes in its output voltage in the order of 100ppm. The fully hermetic package offered for the -QL and /883 versions are not affected by humidity, and are therefore more stable in environments where humidity is a concern.

Board Assembly Considerations

Bandgap references provide high accuracy and low temperature drift but some PC board assembly precautions are necessary. Normal output voltage shifts of 100μV to 4mV can be expected with Pb-free reflow profiles or wave solder on multilayer FR4 PC boards. Precautions should be taken to avoid excessive heat or extended exposure to high reflow or wave solder temperatures, this may reduce device initial accuracy.

Board Mounting Considerations

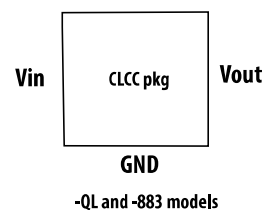
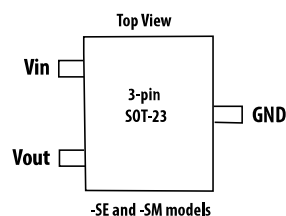
For applications requiring the highest accuracy, attention should be paid to the board mounting location of SE and SM devices. These models use a plastic SOIC package, which will subject the die to mild stresses when the Printed Circuit (PC) board is cooled or heated. Placing the device in areas subject to slight twisting may cause die stresses and consequently degradation of the reference voltage accuracy. It is preferred that the device near the edge of the shortest side as the axis of bending or in the center of the PCB where stresses due to flexing are reduced. Mounting the device in a cutout also minimizes flex. Mounting the device on flexprint or extremely thin PC material will likewise cause loss of reference accuracy.

NOTES

- Post reflow drift may shift up to 4.0mV following the +260°C peak temperature reflow.
- Dropout Voltage is the Vin - Vout differential voltage where Vout drops 1mV from Vin = nominal at +25°C
- Over the specified temperature range. TC is measured by the change in Vout divided by the temperature range (e.g. -55°C to +125°C = +180°C).
- Vout to GND.
- Cout = 1μF
- Thermal Hysteresis is the change of Vout measured at Ta = +25°C after the temperature has been cycled over its specified range (ΔTa). To calculate Thermal Hysteresis, an initial measurement is taken at Ta = +25°C. The temperature is then cycled and a second Vout measurement is taken at +25°C. Thermal Hysteresis is the difference between the initial Vout measurement and the second Vout measurement expressed in ppm. For ΔTa = +180°C, the device under test is cycled from +25°C to -55°C then to +125°C and finally back to +25°C.

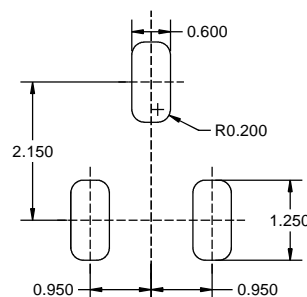
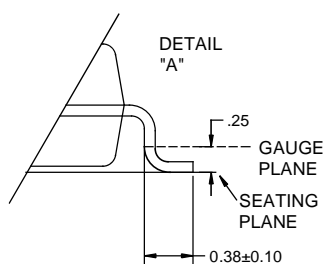
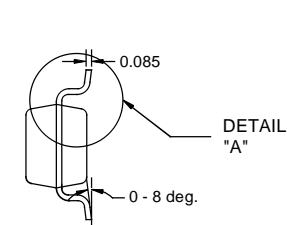
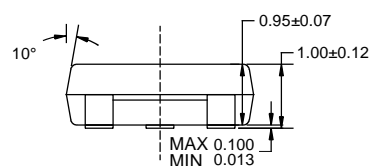
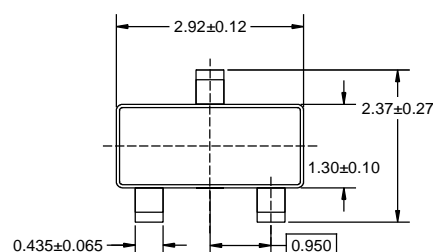
INPUT/OUTPUT CONNECTIONS

| PIN | PIN NAME | FUNCTION |
|-----|----------|--------------------------|
| 1 | Vin | Input Voltage |
| 2 | Vout | Voltage Reference Output |
| 3 | GND | Ground |



MECHANICAL DIMENSIONS

SOT23-3



Typical recommended land pattern