# PRECISION 5.0 VOLT LOW KNEE CURRENT VOLTAGE REFERENCE

**ZRC500**

**ISSUE 3 - MARCH 1998**

## DEVICE DESCRIPTION

The ZRC500 uses a bandgap circuit design to achieve a precision micropower voltage reference of 5.0 volts. The device is available in small outline surface mount packages, ideal for applications where space saving is important, as well as packages for through hole requirements.

The ZRC500 design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRC500 is recommended for operation between 25μA and 5mA and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to an absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

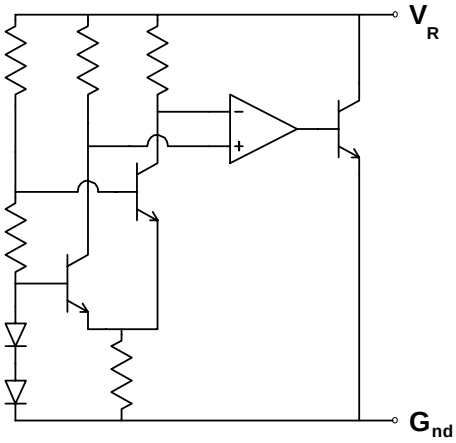
## FEATURES

- Small outline SOT23, SO8 and TO92 style packages
- No stabilising capacitor required
- Low knee current, 19μA typical
- Typical $T_C$ 30ppm/°C
- Typical slope resistance 0.4Ω
- ± 3%, 2% and 1% tolerance
- Industrial temperature range
- Operating current 25μA to 5mA
- Transient response, stable in less than 10μs
- Optional extended current range

## APPLICATIONS

- Battery powered and portable equipment.
- Instrumentation.
- Test equipment.
- Metering and measurement systems.

## SCHEMATIC DIAGRAM



# ZRC500

## ABSOLUTE MAXIMUM RATING

| | |
|---|---|
| Reverse Current | 25mA |
| Forward Current | 25mA |
| Operating Temperature | -40 to 85°C |
| Storage Temperature | -55 to 125°C |

**Power Dissipation ($T_{amb}$=25°C)**

| | |
|---|---|
| SOT23 | 330mW |
| E-Line, 3 pin (TO92) | 500mW |
| E-Line, 2 pin (TO92) | 500mW |
| SO8 | 625mW |

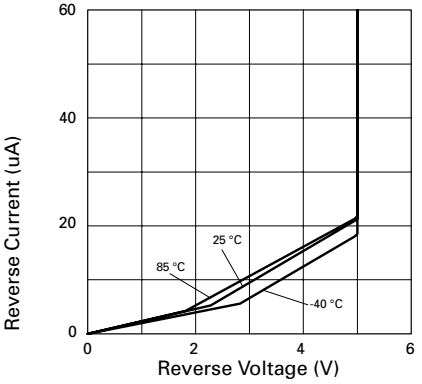
## ELECTRICAL CHARACTERISTICS
**TEST CONDITIONS (Unless otherwise stated) $T_{amb}$=25°C**

| SYMBOL | PARAMETER | CONDITIONS | LIMITS | | | TOL. % | UNITS |
|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | | |
| $V_R$ | Reverse Breakdown Voltage | $I_R$=150µA | 4.95<br>4.9<br>4.85 | 5.0<br>5.0<br>5.0 | 5.05<br>5.1<br>5.15 | 1<br>2<br>3 | V |
| $I_{MIN}$ | Minimum Operating Current | | | 19 | 25 | | µA |
| $I_R$ | Recommended Operating Current | | 0.025 | | 5 | | mA |
| $T_C$ † | Average Reverse Breakdown Voltage Temp. Co. | $I_{R(min)}$ to $I_{R(max)}$ | | 30 | 90 | | ppm/°C |
| $R_S$ § | Slope Resistance | | | 0.4 | 2 | | Ω |
| $Z_R$ | Reverse Dynamic Impedance | $I_R$ = 1mA<br>f = 100Hz<br>$I_{AC}$= 0.1 $I_R$ | | 0.3 | 0.8 | | Ω |
| $E_N$ | Wideband Noise Voltage | $I_R$= 150µA<br>f = 10Hz to 10kHz | | 105 | | | µV(rms) |

† $$T_C = \frac{(V_{R(max)} - V_{R(min)}) \times 1000000}{V_R \times (T_{(max)} - T_{(min)})}$$

Note: $V_{R(max)}$ - $V_{R(min)}$ is the maximum deviation in reference voltage measured over the full operating temperature range.

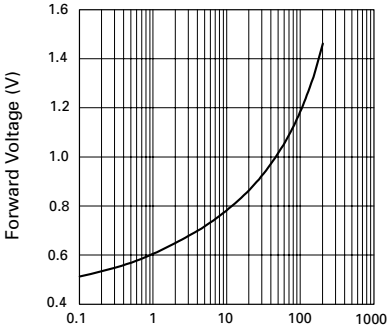
§ $$R_S = \frac{V_R \ Change(I_{R(min)} \ to \ I_{R(max)})}{I_{R(max)} - I_{R(min)}}$$



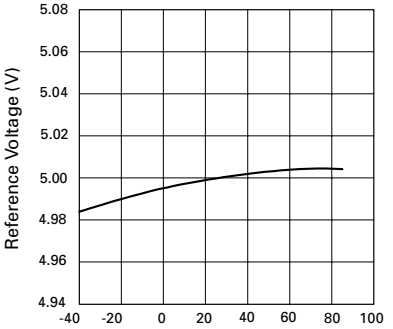
Reverse Characteristics

# ZRC500

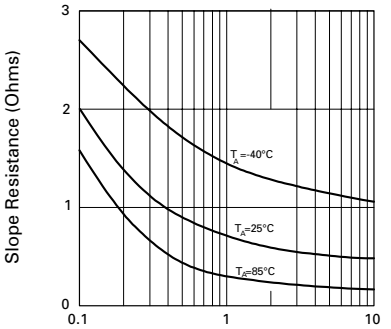
## TYPICAL CHARACTERISTICS



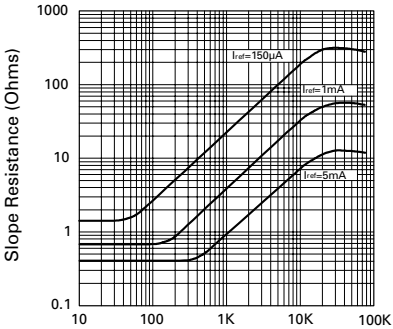

**Forward Characteristics**



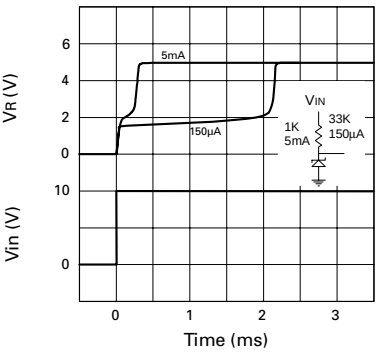

**Temperature Drift**



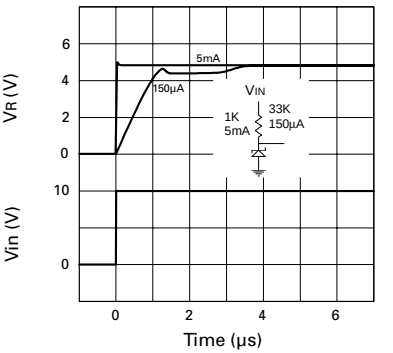

**Slope Resistance vs. Current**




**Slope Resistance vs. Frequency**



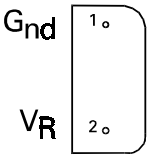

**Transient Response (Single Pulse)**




**Transient Response (Repetitive Pulse)**

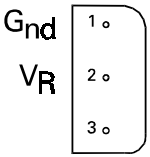
## CONNECTION DIAGRAMS

**E-Line, 2 pin Package Suffix – Y**



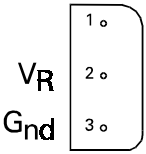

*Bottom View*

**E-Line, 3 pin,Rev Package Suffix – R**



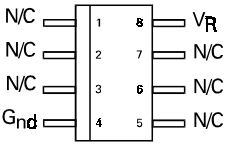

*Bottom View –*
*Pin 3 floating or connected to pin 1*

**E-Line, 3 pin Package Suffix – A**



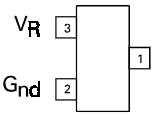

*Bottom View –*
*Pin 1 floating or connected to pin 3*

**SO8 Package Suffix – N8**




*Top View*

**SOT23 Package Suffix – F**




*Top View –*
*Pin 1 floating or connected to pin 2*

# ZRC500

## ORDERING INFORMATION

| Part No | Tol% | Package | Partmark |
|---|---|---|---|
| ZRC500A03 | 3 | E-Line • | ZRC50003 |
| ZRC500A02 | 2 | E-Line • | ZRC50002 |
| ZRC500A01 | 1 | E-Line • | ZRC50001 |
| ZRC500F03 | 3 | SOT23 | 50P |
| ZRC500F02 | 2 | SOT23 | 50T |
| ZRC500F01 | 1 | SOT23 | 50X |
| ZRC500N803 | 3 | SO8 | ZRC50003 |
| ZRC500N802 | 2 | SO8 | ZRC50002 |
| ZRC500N801 | 1 | SO8 | ZRC50001 |

| Part No | Tol% | Package | Partmark |
|---|---|---|---|
| ZRC500R03 | 3 | E-Line * | ZRC500R3 |
| ZRC500R02 | 2 | E-Line * | ZRC500R2 |
| ZRC500R01 | 1 | E-Line * | ZRC500R1 |
| ZRC500Y03 | 3 | E-Line † | ZRC50003 |
| ZRC500Y02 | 2 | E-Line † | ZRC50002 |
| ZRC500Y01 | 1 | E-Line † | ZRC50001 |

* E-Line 3 pin Reversed
† E-Line 2 pin
• E-Line 3 pin