

**Absolute Maximum Ratings** (Note 4) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Symbol           | Parameter                       | Rating        | Unit |
|------------------|---------------------------------|---------------|------|
| V <sub>KA</sub>  | Cathode Voltage                 | 40            | V    |
| I <sub>KA</sub>  | Continuous Cathode Current      | 150           | mA   |
| I <sub>REF</sub> | Reference Input Current         | -0.050 to +10 | mA   |
| T <sub>J</sub>   | Operating Junction Temperature  | +150          | °C   |
| T <sub>ST</sub>  | Storage Temperature             | -55 to +150   | °C   |
| P <sub>D</sub>   | Power Dissipation (Notes 5 & 6) | SOT23         | 330  |
|                  |                                 | SOT25         | 500  |
|                  |                                 |               | mW   |

Notes: 4. Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability. Unless otherwise stated voltages specified are relative to the ANODE pin.  
5. T<sub>J</sub>, max = +150°C  
6. Ratings apply to ambient temperature at +25°C.

**Recommended Operating Conditions** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Symbol          | Parameter                     | Min              | Max  | Unit |
|-----------------|-------------------------------|------------------|------|------|
| V <sub>KA</sub> | Cathode Voltage               | V <sub>REF</sub> | 36   | V    |
| I <sub>KA</sub> | Cathode Current               | 0.065            | 100  | mA   |
| T <sub>A</sub>  | Operating Ambient Temperature | -40              | +125 | °C   |

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Symbol                                 | Parameter                                                                 | Test Conditions                                                |                                           | Min   | Typ   | Max   | Unit |
|----------------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------|-------|-------|-------|------|
| V <sub>REF</sub>                       | Reference Voltage                                                         | V <sub>KA</sub> = V <sub>REF</sub> ,<br>I <sub>KA</sub> = 10mA | ZXRE250A                                  | 2.470 | 2.495 | 2.520 | V    |
|                                        |                                                                           |                                                                | ZXRE250B                                  | 2.482 | 2.495 | 2.507 | V    |
| V <sub>DEV</sub>                       | Deviation of Reference Voltage Over Full Temperature Range (Note 7)       | V <sub>KA</sub> = V <sub>REF</sub> ,<br>I <sub>KA</sub> = 10mA | T <sub>A</sub> = 0 to +70°C               | -     | 6     | 16    | mV   |
|                                        |                                                                           |                                                                | T <sub>A</sub> = -40 to +85°C             | -     | 14    | 34    | mV   |
|                                        |                                                                           |                                                                | T <sub>A</sub> = -40 to +125°C            | -     | 14    | 34    | mV   |
| $\frac{\Delta V_{REF}}{\Delta V_{KA}}$ | Ratio of the Change in Reference Voltage to the Change in Cathode Voltage | I <sub>KA</sub> = 10mA                                         | V <sub>KA</sub> = 10V to V <sub>REF</sub> | -     | -1.4  | -2.7  | mV/V |
|                                        |                                                                           |                                                                | V <sub>KA</sub> = 36V to 10V              | -     | -1    | -2    | mV/V |
| I <sub>REF</sub>                       | Reference Input Current                                                   | I <sub>KA</sub> = 10mA, R1 = 10KΩ, R2 = ∞                      |                                           | -     | 1     | 4     | μA   |
| ΔI <sub>REF</sub>                      | I <sub>REF</sub> Deviation Over Full Temperature Range (Note 7)           | I <sub>KA</sub> = 10mA, R1 = 10KΩ, R2 = ∞                      | T <sub>A</sub> = 0 to +70°C               | -     | 0.8   | 1.2   | μA   |
|                                        |                                                                           |                                                                | T <sub>A</sub> = -40 to +85°C             | -     | 0.8   | 2.5   | μA   |
|                                        |                                                                           |                                                                | T <sub>A</sub> = -40 to +125°C            | -     | 0.8   | 2.5   | μA   |
| I <sub>KA(MIN)</sub>                   | Minimum Cathode Current for Regulation                                    | V <sub>KA</sub> = V <sub>REF</sub>                             |                                           | -     | 40    | 65    | μA   |
| I <sub>KA(OFF)</sub>                   | Off-State Current                                                         | V <sub>KA</sub> = 36V, V <sub>REF</sub> = 0V                   |                                           | -     | 0.05  | 0.5   | μA   |
| Z <sub>KA</sub>                        | Dynamic Output Impedance (Note 8)                                         | V <sub>KA</sub> = V <sub>REF</sub> , f = 0Hz                   |                                           | -     | 0.2   | 0.5   | Ω    |
| θ <sub>JA</sub>                        | Thermal Resistance Junction to Ambient                                    | SOT23                                                          |                                           | -     | 380   | -     | °C/W |
|                                        |                                                                           | SOT25                                                          |                                           | -     | 250   | -     | °C/W |

Notes: 7. Deviation of V<sub>DEV</sub>, and ΔI<sub>REF</sub> are defined as the maximum variation of the values over the full temperature range.  
8. Derivation of Z<sub>KA</sub> on following page.

## Electrical Characteristics (cont.) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

The average temperature coefficient of the reference input voltage  $\alpha V_{REF}$  is defined as:

$$|\alpha V_{REF}| = \left( \frac{V_{DEV}}{V_{REF} @ 25^{\circ}\text{C}} \right) \times 10^6 \text{ ppm/}^{\circ}\text{C}$$

Where:

T<sub>2</sub> – T<sub>1</sub> = full temperature change.

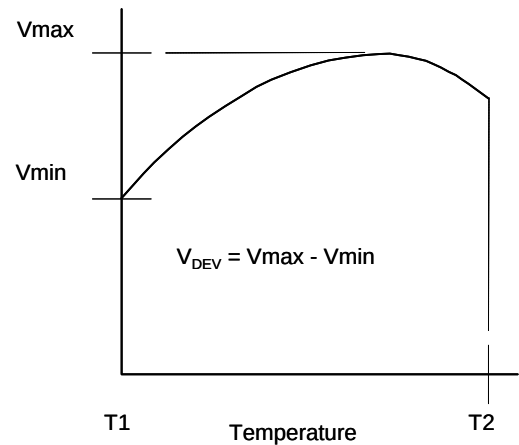
$\alpha V_{REF}$  can be positive or negative depending on whether the slope is positive or negative.

Note: 8. The dynamic output impedance,  $Z_z$ , is defined as:

$$|Z_{KA}| = \frac{\Delta V_{KA}}{\Delta I_{KA}}$$

When the device is programmed with two external resistors R1 and R2, the dynamic output impedance of the overall circuit, is defined as:

$$|Z'| = \frac{\Delta V}{\Delta I} \approx |Z_{KA}| \left( 1 + \frac{R1}{R2} \right)$$



## Test Circuits

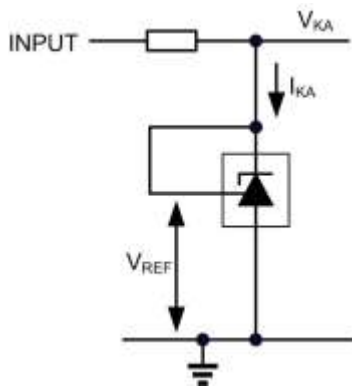


Figure 1 Test Circuit for V<sub>KA</sub> = V<sub>REF</sub>

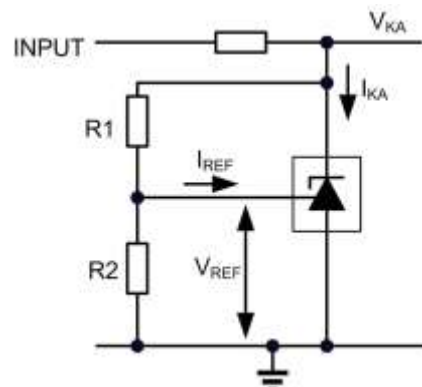


Figure 2 Test Circuit for V<sub>KA</sub> > V<sub>REF</sub>

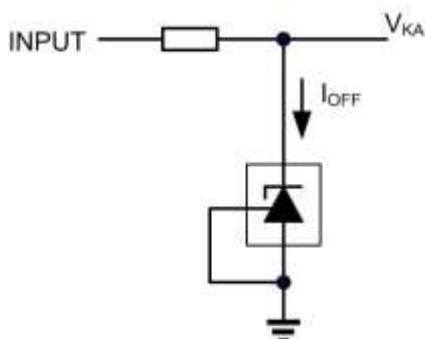
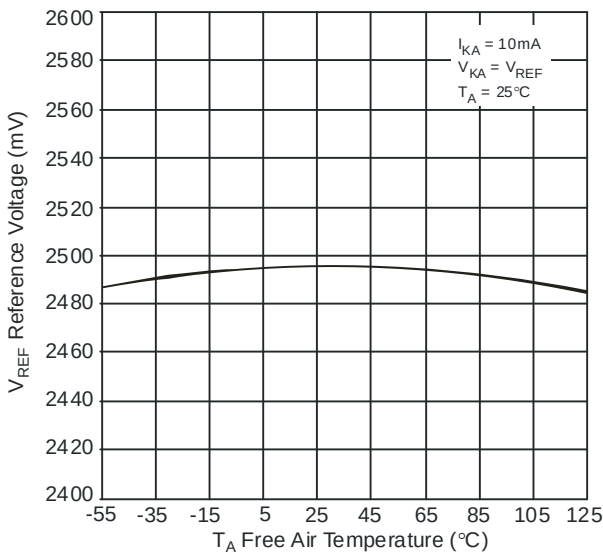
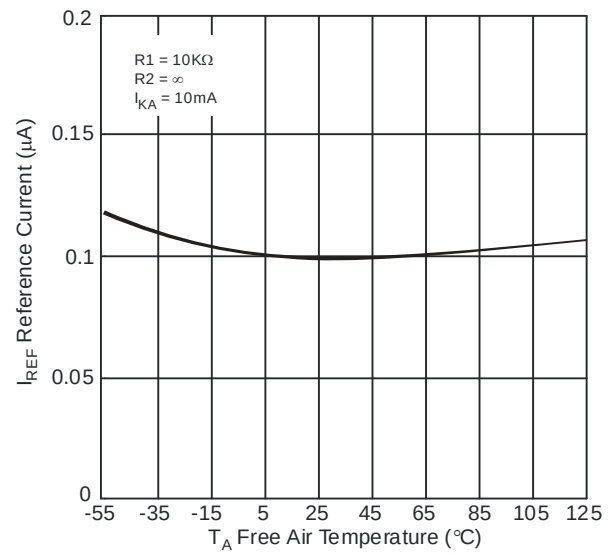


Figure 3 Test Circuit for I<sub>OFF</sub>

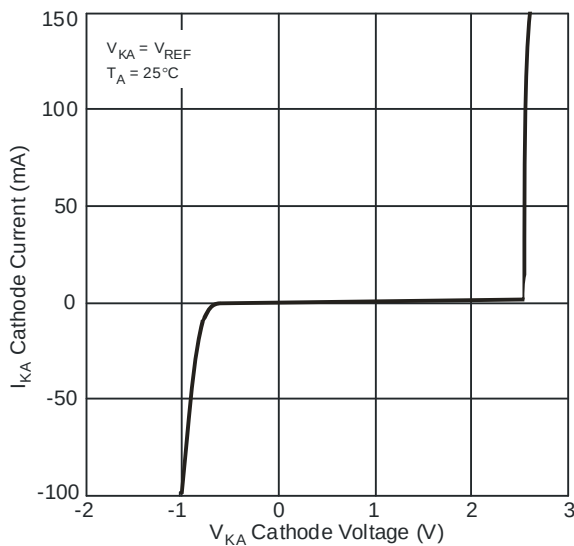
## Typical Performance Characteristics



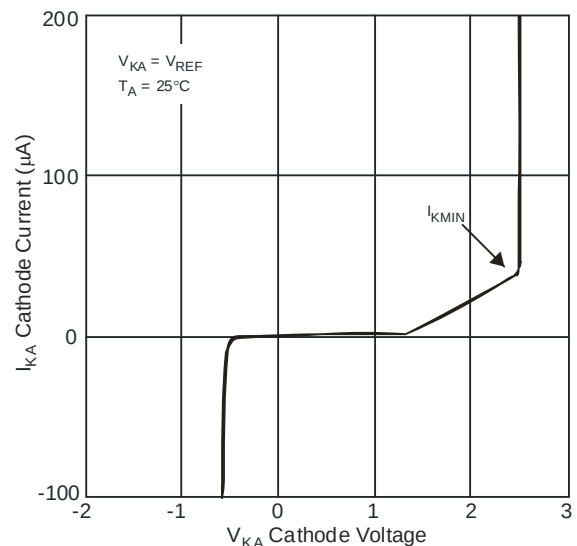
Reference Voltage vs. Free Air Temperature



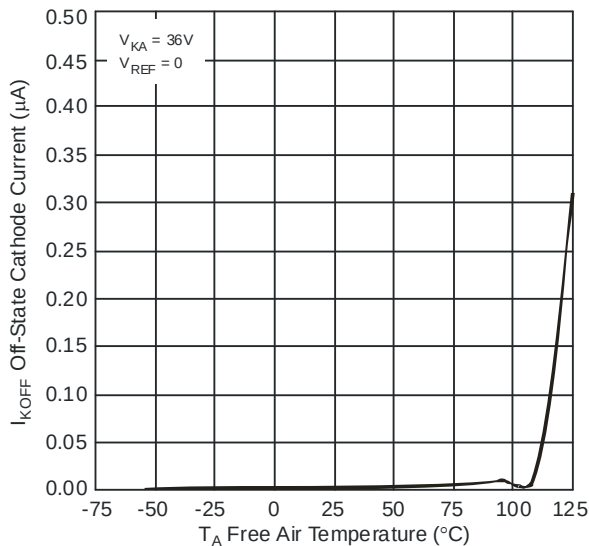
Reference Current vs. Free Air Temperature



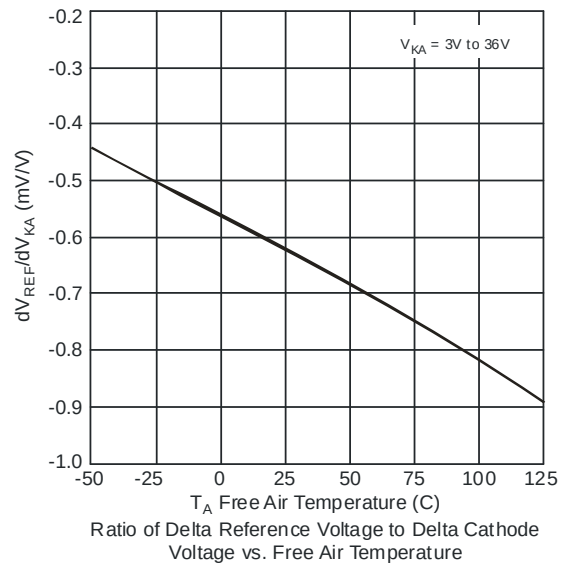
Cathode Current vs. Cathode Voltage



Cathode Current vs. Cathode Voltage

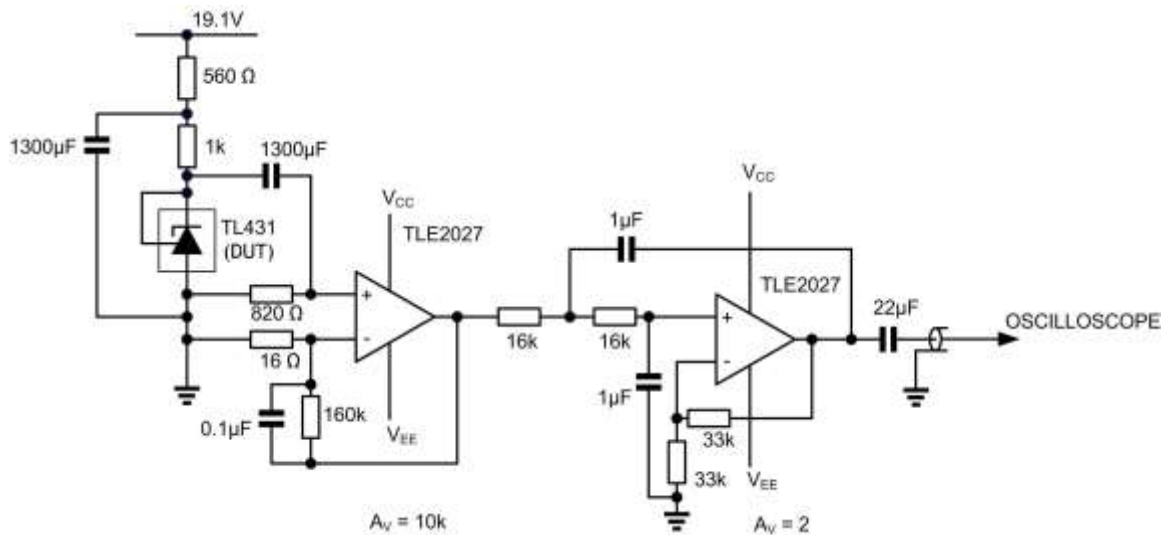
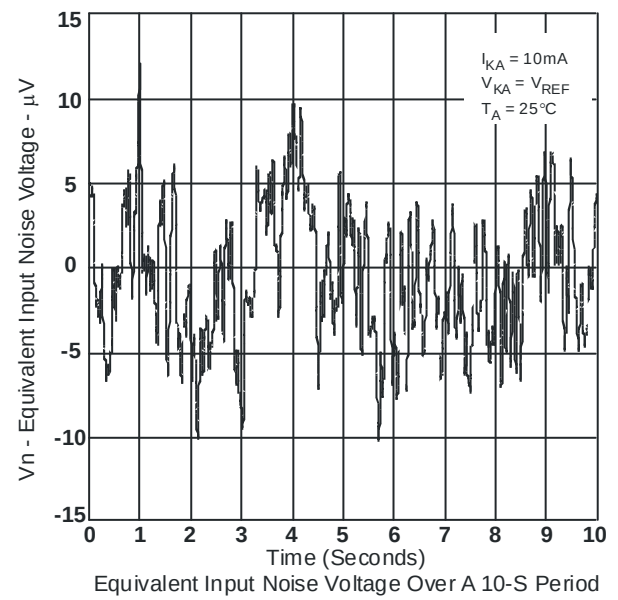
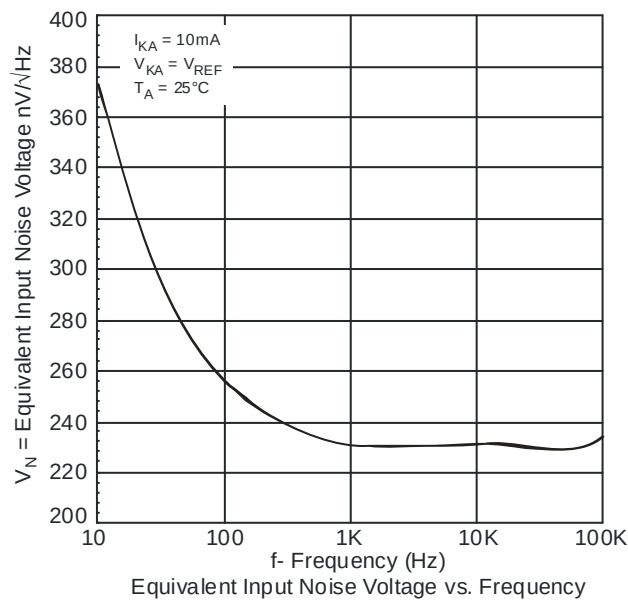


Off-State Cathode Current vs. Free Air Temperature



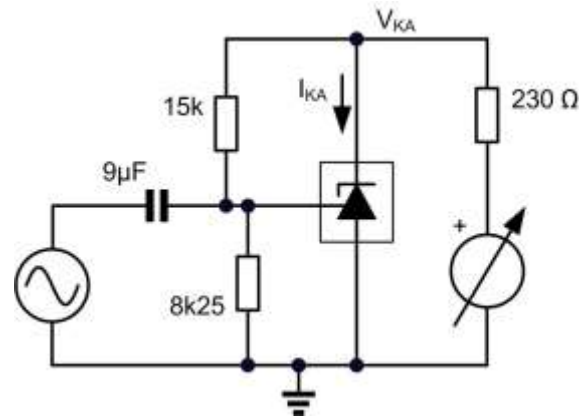
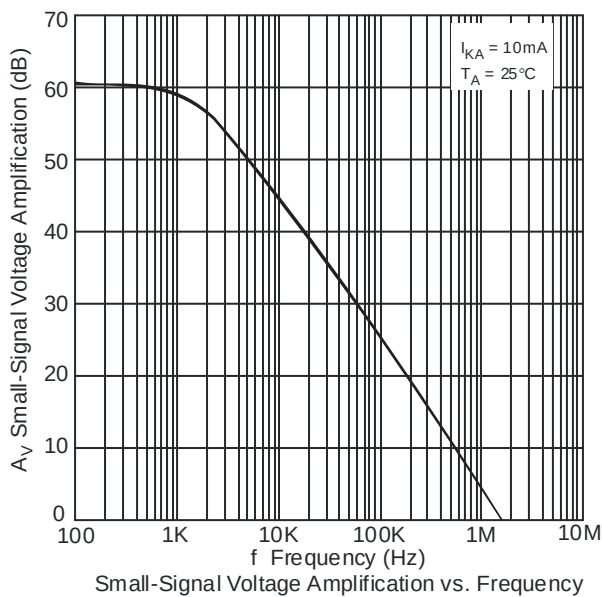
Ratio of Delta Reference Voltage to Delta Cathode Voltage vs. Free Air Temperature

**Typical Performance Characteristics** (Continued)

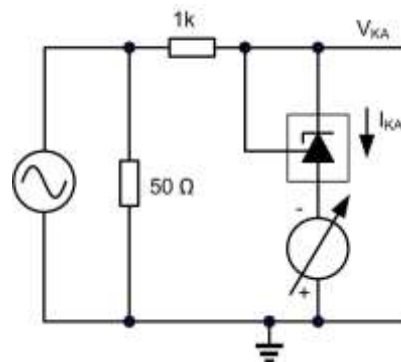
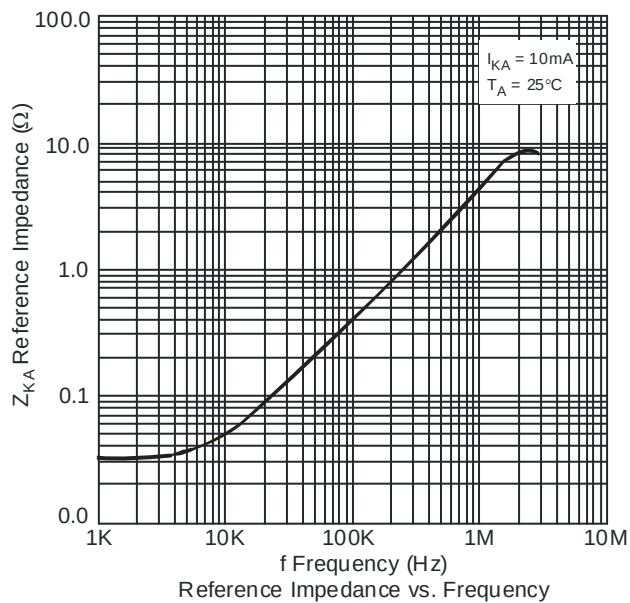


**Figure 4 Test Circuit for Noise Input Voltage**

## Typical Performance Characteristics (Cont.)

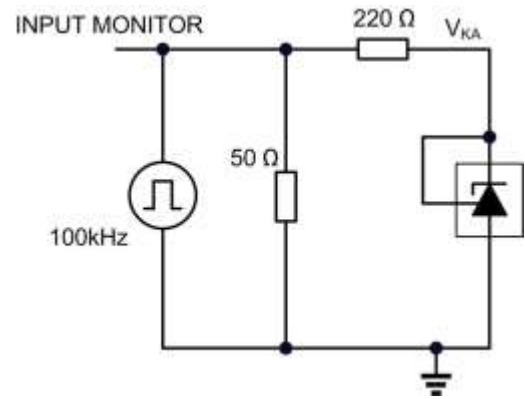
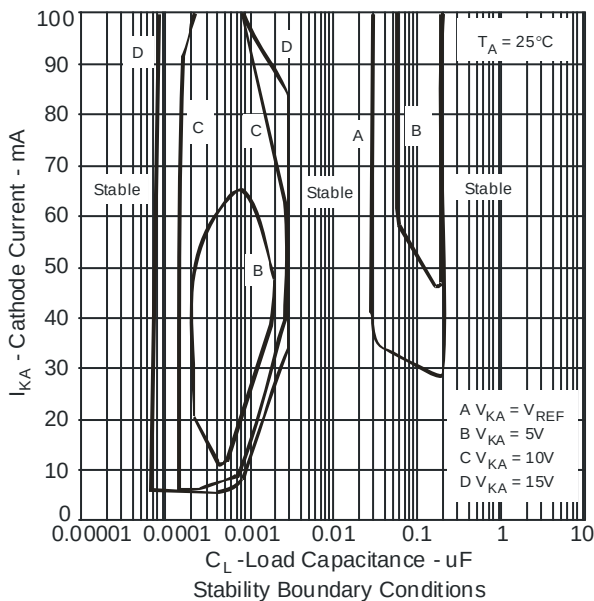
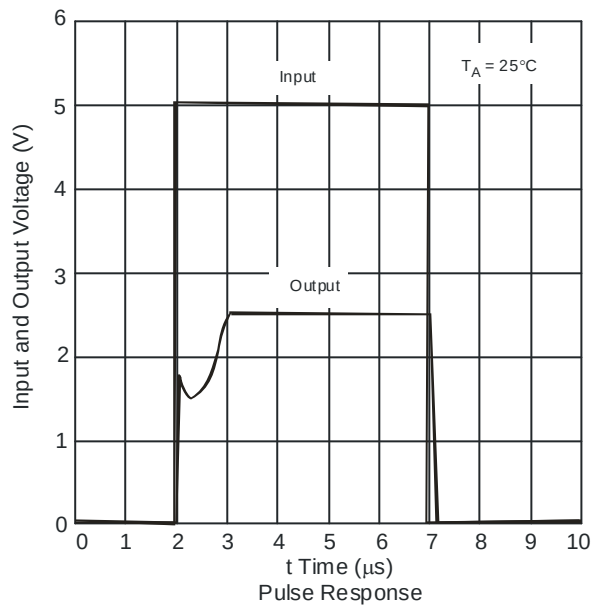


Test Circuit for Voltage Amplification

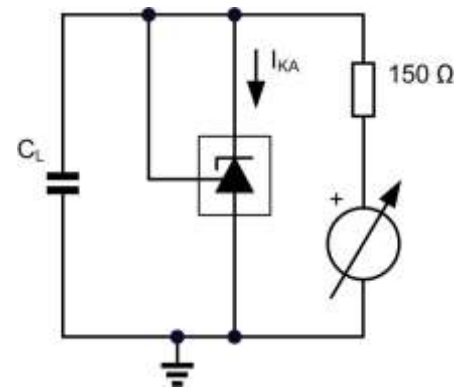


Test Circuit for Reference Impedance

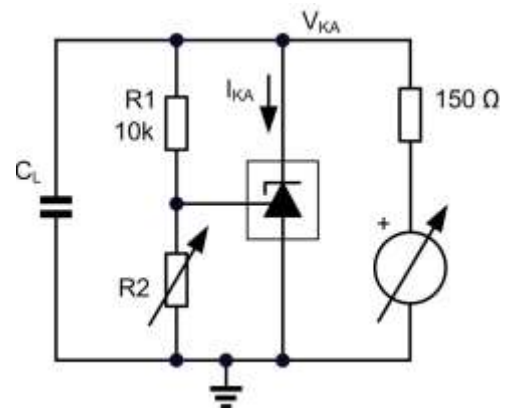
## Typical Performance Characteristics (Cont.)



Test Circuit for Pulse Response



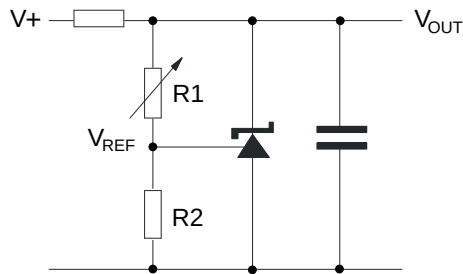
Test Circuit for Curve A



Test Circuit for Curves B, C, D

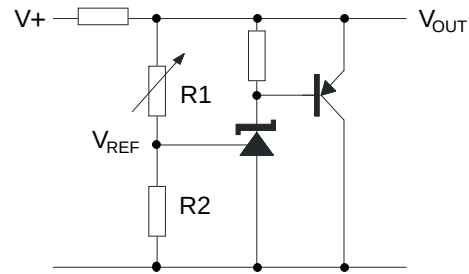
The device is stable under all conditions with a load capacitance not exceeding 50pF. The device is stable under all conditions with a load capacitance between 5nF and 20nF. The device is stable under all conditions with a load capacitance exceeding 300nF. With a cathode current not exceeding 5mA, the device is stable with any load capacitance.

## Application Information



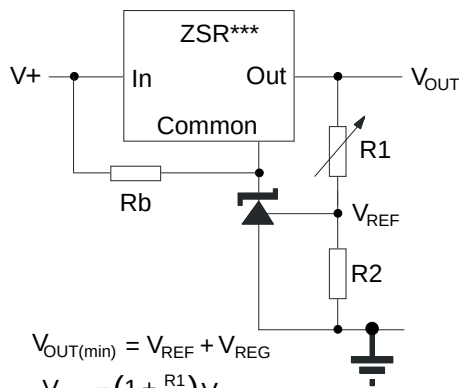
$$V_{OUT} = \left(1 + \frac{R1}{R2}\right) V_{REF}$$

**Shunt Regulator**



$$V_{OUT} = \left(1 + \frac{R1}{R2}\right) V_{REF}$$

**Higher Current  
Shunt Regulator**

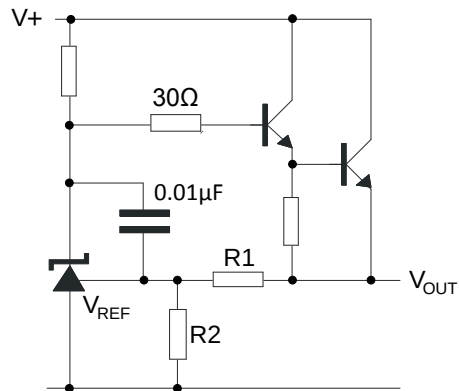


$$V_{OUT(min)} = V_{REF} + V_{REG}$$

$$V_{OUT} = \left(1 + \frac{R1}{R2}\right) V_{REF}$$

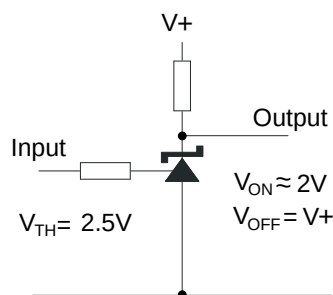
Rb - Optional to provide minimum cathode current

**Output Control of a Three  
Terminal Fixed Regulator**

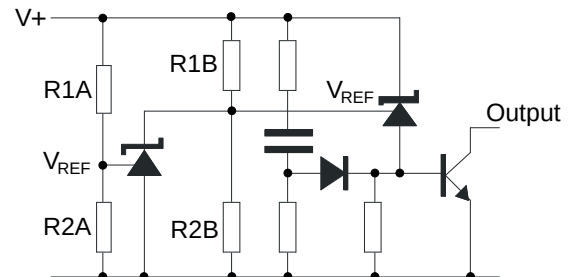


$$V_{OUT} = \left(1 + \frac{R1}{R2}\right) V_{REF}$$

**Series Regulator**



**Single Supply Comparator  
with Temperature  
Compensated Threshold**

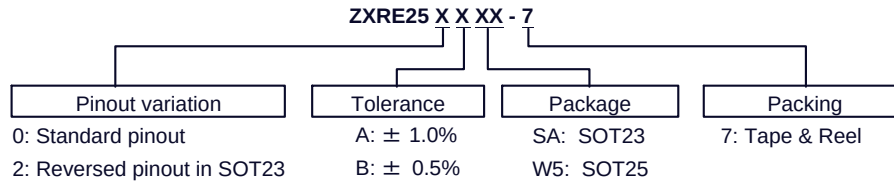


$$\text{Low Limit} = \left(1 + \frac{R1B}{R2B}\right) V_{REF}$$

$$\text{High Limit} = \left(1 + \frac{R1A}{R2A}\right) V_{REF}$$

**Over Voltage / Under  
Voltage Protection Circuit**

## Ordering Information



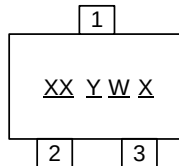
| Part Number<br>(Note 9) | Package<br>Code | Packaging | 7" Tape and Reel  |                    | Ammo Box |                    |
|-------------------------|-----------------|-----------|-------------------|--------------------|----------|--------------------|
|                         |                 |           | Quantity          | Part Number Suffix | Quantity | Part Number Suffix |
| ZXRE250A(B)SA-7         | SA              | SOT23     | 3,000/Tape & Reel | -7                 | NA       | NA                 |
| ZXRE250A(B)W5-7         | W5              | SOT25     | 3,000/Tape & Reel | -7                 | NA       | NA                 |
| ZXRE252A(B)SA-7         | SA              | SOT23     | 3,000/Tape & Reel | -7                 | NA       | NA                 |

Note: 9. Suffix (B) denotes ZXRE250B (0.5% tolerance) device.

## Marking Information

### (1) SOT23

( Top View )

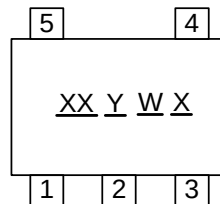


XX : Identification code  
Y : Year 0~9  
W : Week : A~Z : 1~26 week;  
a~z : 27~52 week; z represents  
52 and 53 week  
X : A~Z : Green

| Device     | Package | Identification Code |
|------------|---------|---------------------|
| ZXRE250ASA | SOT23   | DA                  |
| ZXRE250BSA | SOT23   | DB                  |
| ZXRE252ASA | SOT23   | FA                  |
| ZXRE252BSA | SOT23   | FB                  |

### (2) SOT25

( Top View )



XX : Identification code  
Y : Year 0~9  
W : Week : A~Z : 1~26 week;  
a~z : 27~52 week; z represents  
52 and 53 week  
X : A~Z : Green

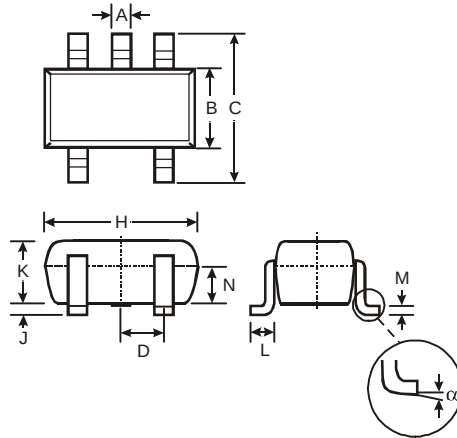
| Device     | Package | Identification Code |
|------------|---------|---------------------|
| ZXRE250AW5 | SOT25   | DA                  |
| ZXRE250BW5 | SOT25   | DB                  |



## Package Outline Dimensions

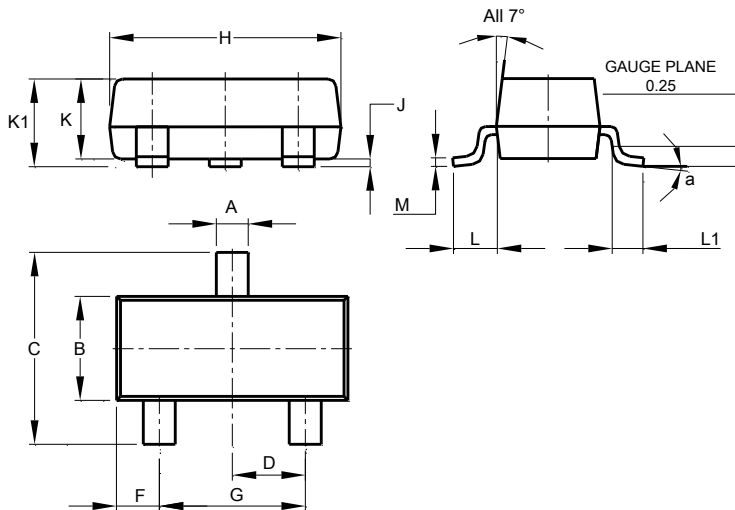
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### (1) Package type: SOT25



| SOT25                |       |      |      |
|----------------------|-------|------|------|
| Dim                  | Min   | Max  | Typ  |
| A                    | 0.35  | 0.50 | 0.38 |
| B                    | 1.50  | 1.70 | 1.60 |
| C                    | 2.70  | 3.00 | 2.80 |
| D                    | —     | —    | 0.95 |
| H                    | 2.90  | 3.10 | 3.00 |
| J                    | 0.013 | 0.10 | 0.05 |
| K                    | 1.00  | 1.30 | 1.10 |
| L                    | 0.35  | 0.55 | 0.40 |
| M                    | 0.10  | 0.20 | 0.15 |
| N                    | 0.70  | 0.80 | 0.75 |
| $\alpha$             | 0°    | 8°   | —    |
| All Dimensions in mm |       |      |      |

### (2) Package Types: SOT23

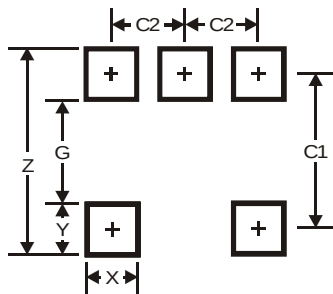


| SOT23                |       |       |       |
|----------------------|-------|-------|-------|
| Dim                  | Min   | Max   | Typ   |
| A                    | 0.37  | 0.51  | 0.40  |
| B                    | 1.20  | 1.40  | 1.30  |
| C                    | 2.30  | 2.50  | 2.40  |
| D                    | 0.89  | 1.03  | 0.915 |
| F                    | 0.45  | 0.60  | 0.535 |
| G                    | 1.78  | 2.05  | 1.83  |
| H                    | 2.80  | 3.00  | 2.90  |
| J                    | 0.013 | 0.10  | 0.05  |
| K                    | 0.890 | 1.00  | 0.975 |
| K1                   | 0.903 | 1.10  | 1.025 |
| L                    | 0.45  | 0.61  | 0.55  |
| L1                   | 0.25  | 0.55  | 0.40  |
| M                    | 0.085 | 0.150 | 0.110 |
| a                    | 8°    |       |       |
| All Dimensions in mm |       |       |       |

## Suggested Pad Layout

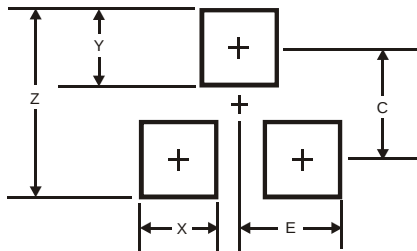
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### (1) Package type: SOT25



| Dimensions | Value (in mm) |
|------------|---------------|
| Z          | 3.20          |
| G          | 1.60          |
| X          | 0.55          |
| Y          | 0.80          |
| C1         | 2.40          |
| C2         | 0.95          |

### (2) Package Types: SOT23



| Dimensions | Value (in mm) |
|------------|---------------|
| Z          | 2.9           |
| X          | 0.8           |
| Y          | 0.9           |
| C          | 2.0           |
| E          | 1.35          |

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