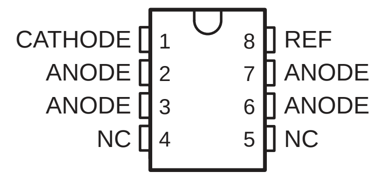
- **Equivalent Full-Range Temperature Coefficient . . . 30 ppm/°C**
- **0.2-Ω Typical Output Impedance**
- **Sink-Current Capability . . . 1 mA to 100 mA**
- **Low Output Noise**
- **Adjustable Output Voltage . . . $V_{ref}$ to 36 V**
- **Available in a Wide Range of High-Density Packages**

## description

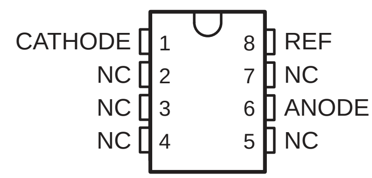
The TL431 and TL431A are three-terminal adjustable shunt regulators with specified thermal stability over applicable automotive, commercial, and military temperature ranges. The output voltage can be set to any value between $V_{ref}$ (approximately 2.5 V) and 36 V, with two external resistors (see Figure 17). These devices have a typical output impedance of 0.2 Ω. Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacements for Zener diodes in many applications, such as onboard regulation, adjustable power supplies, and switching power supplies.

The TL431C and TL431AC are characterized for operation from 0°C to 70°C, and the TL431I and TL431AI are characterized for operation from –40°C to 85°C.

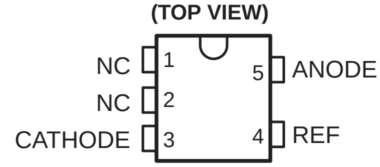
**D PACKAGE**
**(TOP VIEW)**




**P OR PW PACKAGE**
**(TOP VIEW)**

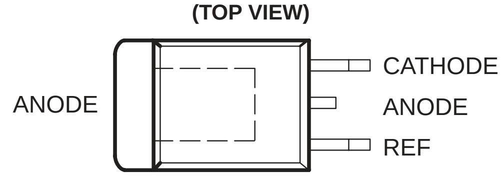



**DBV PACKAGE**
**(TOP VIEW)**

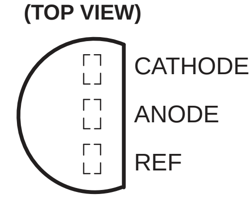



NC – No internal connection

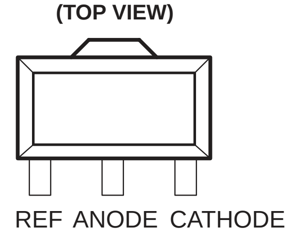
**KTP PACKAGE**
**(TOP VIEW)**




**LP PACKAGE**
**(TOP VIEW)**




**PK PACKAGE**
**(TOP VIEW)**

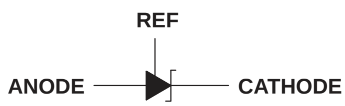


**AVAILABLE OPTIONS**

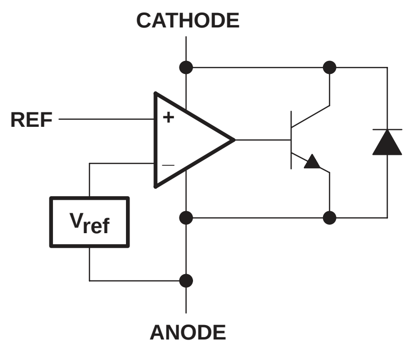
| $T_A$ | PACKAGED DEVICES | | | | | | |
|---|---|---|---|---|---|---|---|
| | SMALL-OUTLINE (D) | SOT-23 (DBV) | PLASTIC FLANGE MOUNT (KTP) | TO-226AA (LP) | PLASTIC DIP (P) | PLASTIC SHRINK SMALL-OUTLINE (PW) | SOT-89 (PK) |
| 0°C to 70°C | TL431CD<br>TL431ACD | TL431CDBVR | TL431CKTPR | TL431CLP<br>TL431ACLP | TL431CP<br>TL431ACP | TL431CPWR<br>TL431ACPWR | TL431CPKR |
| –40°C to 85°C | TL431ID<br>TL431AID | | | TL431ILP<br>TL431AILP | TL431IP<br>TL431AIP | | TL431IPKR |

The D, LP, and PW packages are available taped and reeled. The DBV, KTP, and PK packages are only available taped and reeled. Add the suffix R to device type (e.g., TL431CDR).

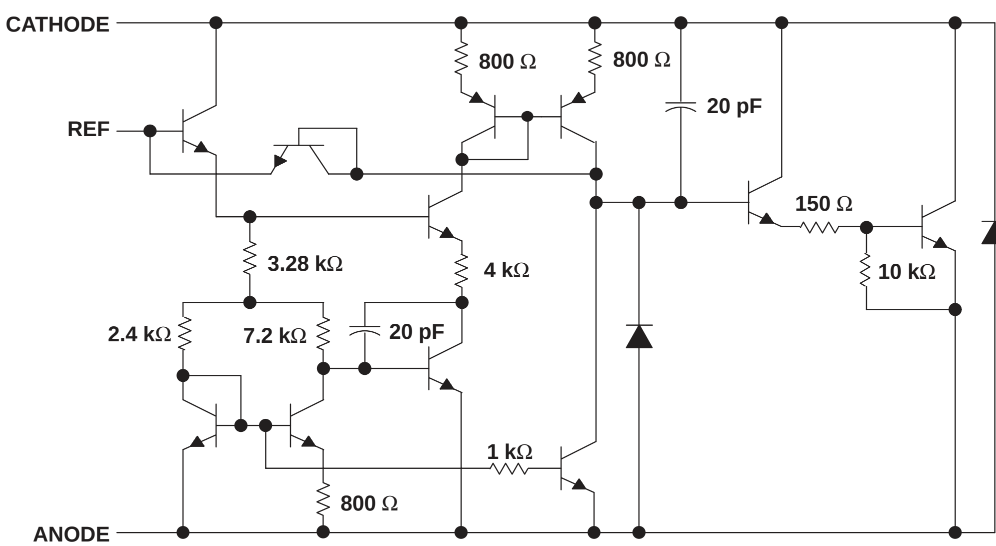
## symbol




## functional block diagram




## equivalent schematic†




† All component values are nominal.

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Cathode voltage, $V_{KA}$ (see Note 1) .......... 37 V
Continuous cathode current range, $I_{KA}$ .......... –100 mA to 150 mA
Reference input current range .......... –50 µA to 10 mA
Package thermal impedance, $\theta_{JA}$ (see Notes 2 and 3): D package .......... 97°C/W
DBV package .......... 206°C/W
KTP package .......... 28°C/W
LP package .......... 156°C/W
P package .......... 85°C/W
PK package .......... 52°C/W
PW package .......... 149°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds .......... 260°C
Storage temperature range, $T_{stg}$ .......... –65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. Voltage values are with respect to the anode terminal unless otherwise noted.
2. Maximum power dissipation is a function of $T_J$(max), $\theta_{JA}$, and $T_A$. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) – T_A)/\theta_{JA}$. Operating at the absolute maximum $T_J$ of 150°C can affect reliability.
3. The package thermal impedance is calculated in accordance with JESD 51-7.

## recommended operating conditions

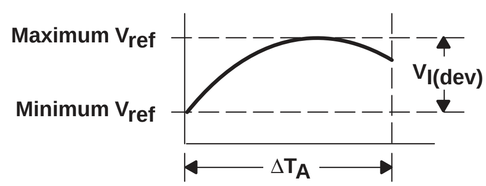
| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| Cathode voltage, $V_{KA}$ | | $V_{ref}$ | 36 | V |
| Cathode current, $I_{KA}$ | | 1 | 100 | mA |
| Operating free-air temperature range, $T_A$ | TL431C, TL431AC | 0 | 70 | °C |
| | TL431I, TL431AI | –40 | 85 | |

## electrical characteristics over recommended operating conditions, $T_A$ = 25°C (unless otherwise noted)

| PARAMETER | | TEST CIRCUIT | TEST CONDITIONS | | TL431C MIN | TL431C TYP | TL431C MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| $V_{ref}$ | Reference voltage | 2 | $V_{KA} = V_{ref}$, | $I_{KA}$ = 10 mA | 2440 | 2495 | 2550 | mV |
| $V_{I(dev)}$ | Deviation of reference voltage over full temperature range (see Figure 1) | 2 | $V_{KA} = V_{ref}$, $I_{KA}$ = 10 mA, $T_A$ = 0°C to 70°C | | | 4 | 25 | mV |
| $\frac{\Delta V_{ref}}{\Delta V_{KA}}$ | Ratio of change in reference voltage to the change in cathode voltage | 3 | $I_{KA}$ = 10 mA | $\Delta V_{KA}$ = 10 V – $V_{ref}$ | | –1.4 | –2.7 | $\frac{mV}{V}$ |
| | | | | $\Delta V_{KA}$ = 36 V – 10 V | | –1 | –2 | |
| $I_{ref}$ | Reference current | 3 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 2 | 4 | µA |
| $I_{I(dev)}$ | Deviation of reference current over full temperature range (see Figure 1) | 3 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞, $T_A$ = 0°C to 70°C | | | 0.4 | 1.2 | µA |
| $I_{min}$ | Minimum cathode current for regulation | 2 | $V_{KA} = V_{ref}$ | | | 0.4 | 1 | mA |
| $I_{off}$ | Off-state cathode current | 4 | $V_{KA}$ = 36 V, | $V_{ref}$ = 0 | | 0.1 | 1 | µA |
| $\lvert z_{KA} \rvert$ | Dynamic impedance (see Figure 1) | 1 | $I_{KA}$ = 1 mA to 100 mA, $V_{KA} = V_{ref}$, f ≤ 1 kHz | | | 0.2 | 0.5 | Ω |

The deviation parameters $V_{ref(dev)}$ and $I_{ref(dev)}$ are defined as the differences between the maximum and minimum values obtained over the recommended temperature range. The average full-range temperature coefficient of the reference voltage, $\alpha_{Vref}$, is defined as:

$$\left|\alpha_{Vref}\right| \left(\frac{ppm}{°C}\right) = \frac{\left(\frac{V_{I(dev)}}{V_{ref}\ at\ 25°C}\right) \times 10^6}{\Delta T_A}$$




where:
$\Delta T_A$ is the recommended operating free-air temperature range of the device.

$\alpha_{Vref}$ can be positive or negative, depending on whether minimum $V_{ref}$ or maximum $V_{ref}$, respectively, occurs at the lower temperature.

Example: maximum $V_{ref}$ = 2496 mV at 30°C, minimum $V_{ref}$ = 2492 mV at 0°C, $V_{ref}$ = 2495 mV at 25°C, $\Delta T_A$ = 70°C for TL431C

$$\left|\alpha_{Vref}\right| = \frac{\left(\frac{4\ mV}{2495\ mV}\right) \times 10^6}{70°C} \approx 23\ ppm/°C$$

Because minimum $V_{ref}$ occurs at the lower temperature, the coefficient is positive.

**Calculating Dynamic Impedance**

The dynamic impedance is defined as: $\left|z_{KA}\right| = \frac{\Delta V_{KA}}{\Delta I_{KA}}$

When the device is operating with two external resistors (see Figure 3), the total dynamic impedance of the circuit is given by:

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

**Figure 1. Calculating Deviation Parameters and Dynamic Impedance**

## electrical characteristics over recommended operating conditions, $T_A$ = 25°C (unless otherwise noted)

| PARAMETER | | TEST CIRCUIT | TEST CONDITIONS | | TL431I | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{ref}$ | Reference voltage | 2 | $V_{KA} = V_{ref}$, $I_{KA}$ = 10 mA | | 2440 | 2495 | 2550 | mV |
| $V_{I(dev)}$ | Deviation of reference voltage over full temperature range (see Figure 1) | 2 | $V_{KA} = V_{ref}$, $I_{KA}$ = 10 mA, $T_A$ = –40°C to 85°C | | | 5 | 50 | mV |
| $\frac{\Delta V_{ref}}{\Delta V_{KA}}$ | Ratio of change in reference voltage to the change in cathode voltage | 3 | $I_{KA}$ = 10 mA | $\Delta V_{KA}$ = 10 V – $V_{ref}$ | | –1.4 | –2.7 | mV/V |
| | | | | $\Delta V_{KA}$ = 36 V – 10 V | | –1 | –2 | |
| $I_{ref}$ | Reference current | 3 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 2 | 4 | µA |
| $I_{I(dev)}$ | Deviation of reference current over full temperature range (see Figure 1) | 3 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞, $T_A$ = –40°C to 85°C | | | 0.8 | 2.5 | µA |
| $I_{min}$ | Minimum cathode current for regulation | 2 | $V_{KA} = V_{ref}$ | | | 0.4 | 1 | mA |
| $I_{off}$ | Off-state cathode current | 4 | $V_{KA}$ = 36 V, $V_{ref}$ = 0 | | | 0.1 | 1 | µA |
| $\lvert z_{KA} \rvert$ | Dynamic impedance (see Figure 1) | 2 | $I_{KA}$ = 1 mA to 100 mA, $V_{KA} = V_{ref}$, f ≤ 1 kHz | | | 0.2 | 0.5 | Ω |

## electrical characteristics over recommended operating conditions, $T_A$ = 25°C (unless otherwise noted)

| PARAMETER | | TEST CIRCUIT | TEST CONDITIONS | | TL431AC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{ref}$ | Reference voltage | 2 | $V_{KA} = V_{ref}$, $I_{KA}$ = 10 mA | | 2470 | 2495 | 2520 | mV |
| $V_{I(dev)}$ | Deviation of reference voltage over full temperature range (see Figure 1) | 2 | $V_{KA} = V_{ref}$, $I_{KA}$ = 10 mA, $T_A$ = 0°C to 70°C | | | 4 | 25 | mV |
| $\frac{\Delta V_{ref}}{\Delta V_{KA}}$ | Ratio of change in reference voltage to the change in cathode voltage | 3 | $I_{KA}$ = 10 mA | $\Delta V_{KA}$ = 10 V – $V_{ref}$ | | –1.4 | –2.7 | mV/V |
| | | | | $\Delta V_{KA}$ = 36 V – 10 V | | –1 | –2 | |
| $I_{ref}$ | Reference current | 3 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 2 | 4 | µA |
| $I_{I(dev)}$ | Deviation of reference current over full temperature range (see Figure 1) | 3 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞, $T_A$ = 0°C to 70°C | | | 0.8 | 1.2 | µA |
| $I_{min}$ | Minimum cathode current for regulation | 2 | $V_{KA} = V_{ref}$ | | | 0.4 | 0.6 | mA |
| $I_{off}$ | Off-state cathode current | 4 | $V_{KA}$ = 36 V, $V_{ref}$ = 0 | | | 0.1 | 0.5 | µA |
| $\lvert z_{KA} \rvert$ | Dynamic impedance (see Figure 1) | 1 | $I_{KA}$ = 1 mA to 100 mA, $V_{KA} = V_{ref}$, f ≤ 1 kHz | | | 0.2 | 0.5 | Ω |

## electrical characteristics over recommended operating conditions, $T_A$ = 25°C (unless otherwise noted)

| PARAMETER | | TEST CIRCUIT | TEST CONDITIONS | | TL431AI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{ref}$ | Reference voltage | 2 | $V_{KA} = V_{ref}$, | $I_{KA}$ = 10 mA | 2470 | 2495 | 2520 | mV |
| $V_{I(dev)}$ | Deviation of reference voltage over full temperature range (see Figure 1) | 2 | $V_{KA} = V_{ref}$, $I_{KA}$ = 10 mA, $T_A$ = –40°C to 85°C | | | 5 | 50 | mV |
| $\frac{\Delta V_{ref}}{\Delta V_{KA}}$ | Ratio of change in reference voltage to the change in cathode voltage | 3 | $I_{KA}$ = 10 mA | $\Delta V_{KA}$ = 10 V – $V_{ref}$ | | –1.4 | –2.7 | $\frac{mV}{V}$ |
| | | | | $\Delta V_{KA}$ = 36 V – 10 V | | –1 | –2 | |
| $I_{ref}$ | Reference current | 3 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 2 | 4 | µA |
| $I_{I(dev)}$ | Deviation of reference current over full temperature range (see Figure 1) | 3 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞, $T_A$ = –40°C to 85°C | | | 0.8 | 2.5 | µA |
| $I_{min}$ | Minimum cathode current for regulation | 2 | $V_{KA} = V_{ref}$ | | | 0.4 | 0.7 | mA |
| $I_{off}$ | Off-state cathode current | 4 | $V_{KA}$ = 36 V, | $V_{ref}$ = 0 | | 0.1 | 0.5 | µA |
| $\lvert z_{KA} \rvert$ | Dynamic impedance (see Figure 1) | 2 | $I_{KA}$ = 1 mA to 100 mA, $V_{KA} = V_{ref}$, f ≤ 1 kHz | | | 0.2 | 0.5 | Ω |

## PARAMETER MEASUREMENT INFORMATION

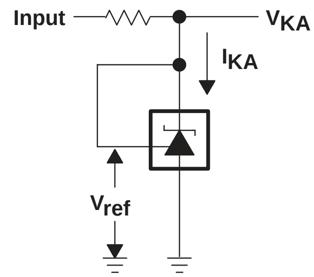
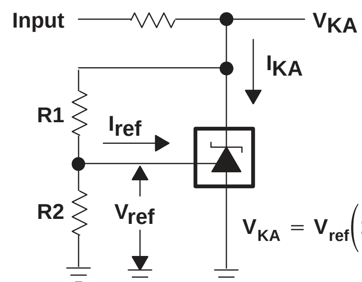



Figure 2. Test Circuit for $V_{KA} = V_{ref}$




$$V_{KA} = V_{ref}\left(1 + \frac{R1}{R2}\right) + I_{ref} \times R1$$

Figure 3. Test Circuit for $V_{KA} > V_{ref}$

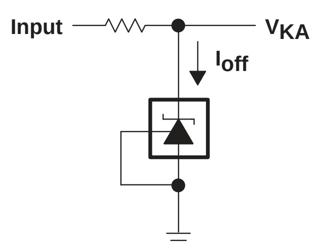



Figure 4. Test Circuit for $I_{off}$

## TYPICAL CHARACTERISTICS

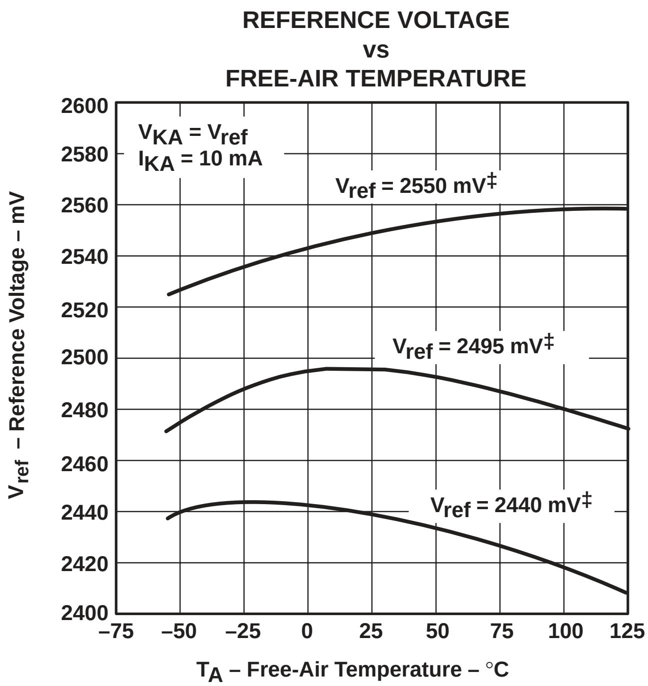
### Table 1. Graphs

| | FIGURE |
|---|---|
| Reference input voltage vs Free-air temperature | 5 |
| Reference input current vs Free-air temperature | 6 |
| Cathode current vs Cathode voltage | 7, 8 |
| Off-state cathode current vs Free-air temperature | 9 |
| Ratio of delta reference voltage to change in cathode voltage vs Free-air temperature | 10 |
| Equivalent input noise voltage vs Frequency | 11 |
| Equivalent input noise voltage over a 10-second period | 12 |
| Small-signal voltage amplification vs Frequency | 13 |
| Reference impedance vs Frequency | 14 |
| Pulse response | 15 |
| Stability boundary conditions | 16 |

### Table 2. Application Circuits

| | FIGURE |
|---|---|
| Shunt regulator | 17 |
| Single-supply comparator with temperature-compensated threshold | 18 |
| Precision high-current series regulator | 19 |
| Output control of a three-terminal fixed regulator | 20 |
| High-current shunt regulator | 21 |
| Crowbar circuit | 22 |
| Precision 5-V 1.5-A regulator | 23 |
| Efficient 5-V precision regulator | 24 |
| PWM converter with reference | 25 |
| Voltage monitor | 26 |
| Delay timer | 27 |
| Precision current limiter | 28 |
| Precision constant-current sink | 29 |

## TYPICAL CHARACTERISTICS†




‡ Data is for devices having the indicated value of $V_{ref}$ at $I_{KA}$ = 10 mA, $T_A$ = 25°C.

**Figure 5**

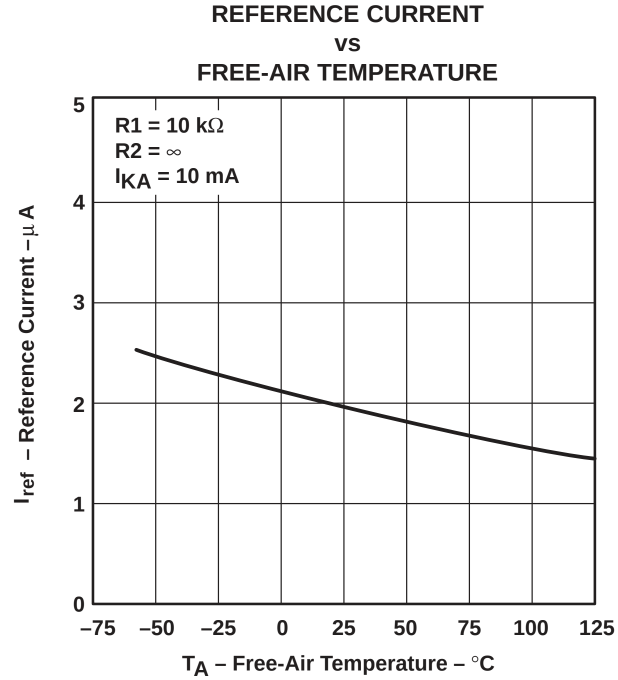



**Figure 6**

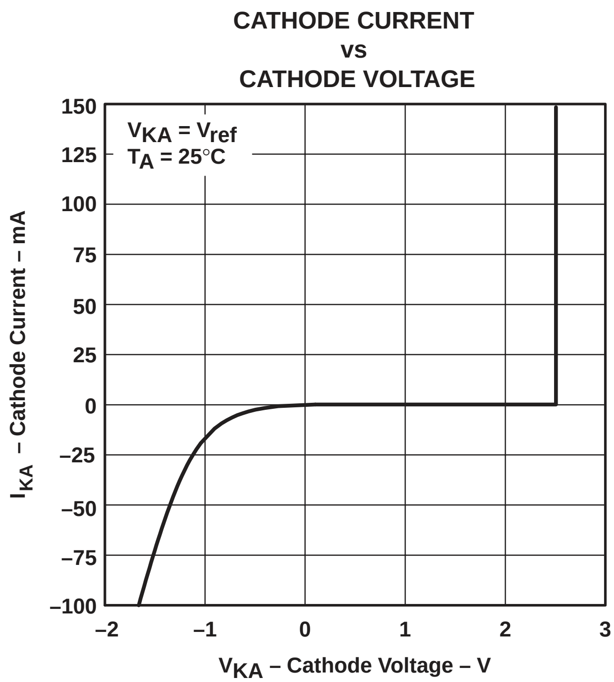



**Figure 7**

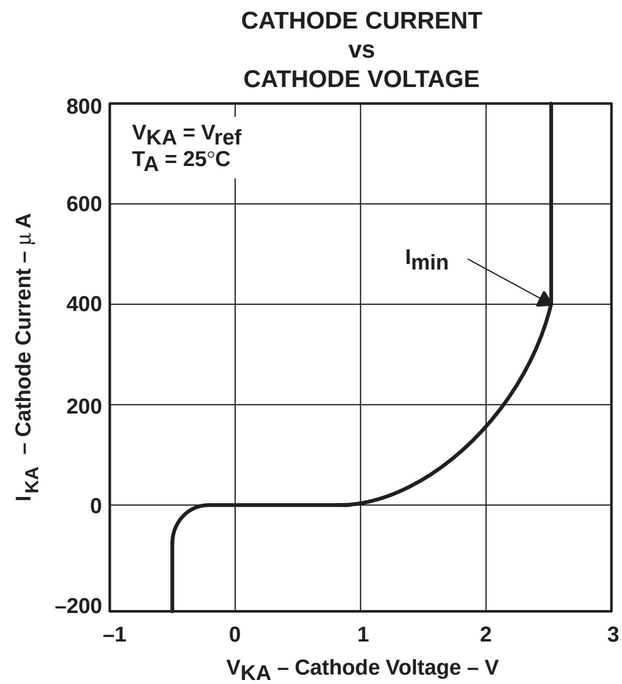



**Figure 8**

† Data at high and low temperatures are applicable only within the recommended operating free-air temperature ranges of the various devices.

## TYPICAL CHARACTERISTICS†

**OFF-STATE CATHODE CURRENT vs FREE-AIR TEMPERATURE**

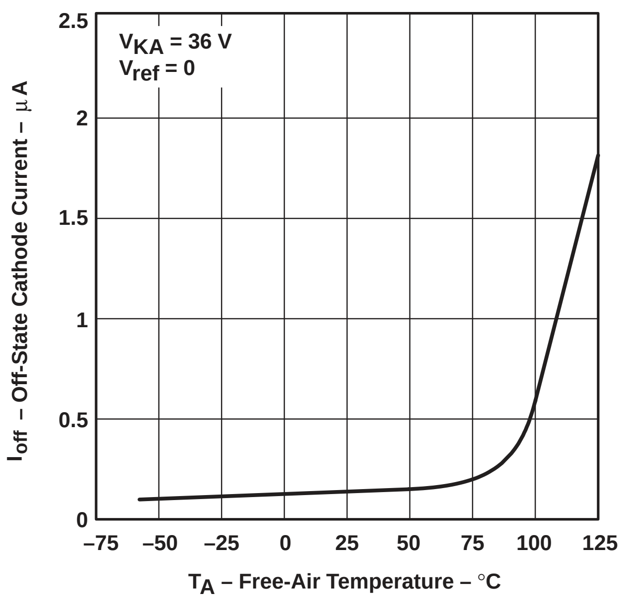



**Figure 9**

**RATIO OF DELTA REFERENCE VOLTAGE TO DELTA CATHODE VOLTAGE vs FREE-AIR TEMPERATURE**

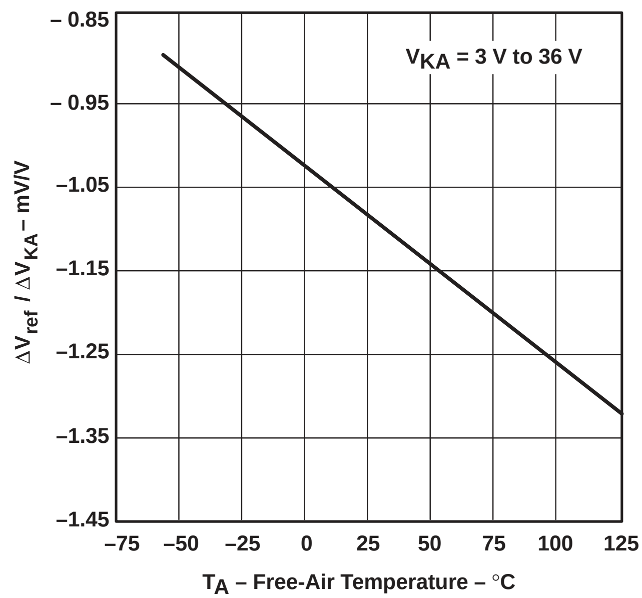



**Figure 10**

**EQUIVALENT INPUT NOISE VOLTAGE vs FREQUENCY**

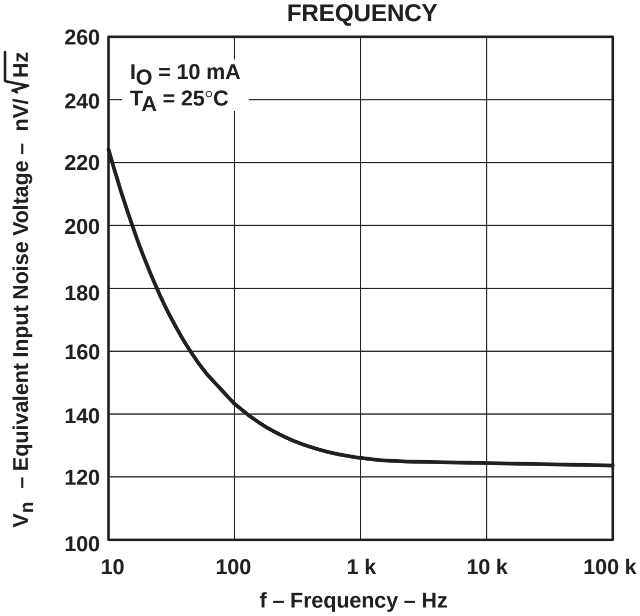
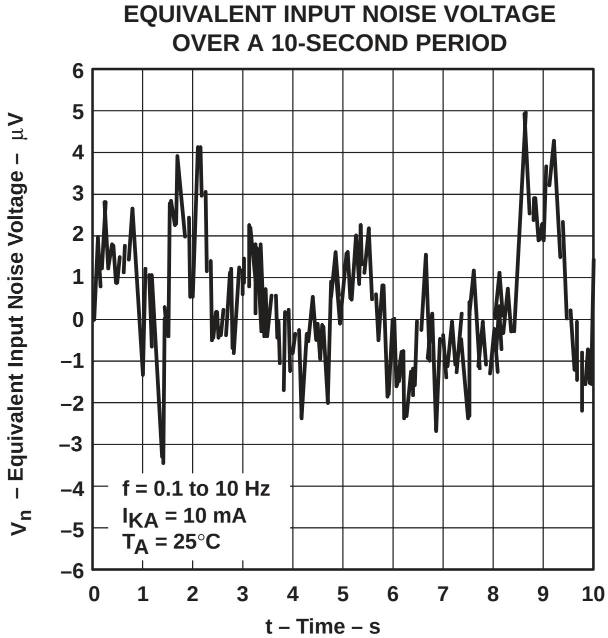



**Figure 11**

† Data at high and low temperatures are applicable only within the recommended operating free-air temperature ranges of the various devices.

## TYPICAL CHARACTERISTICS



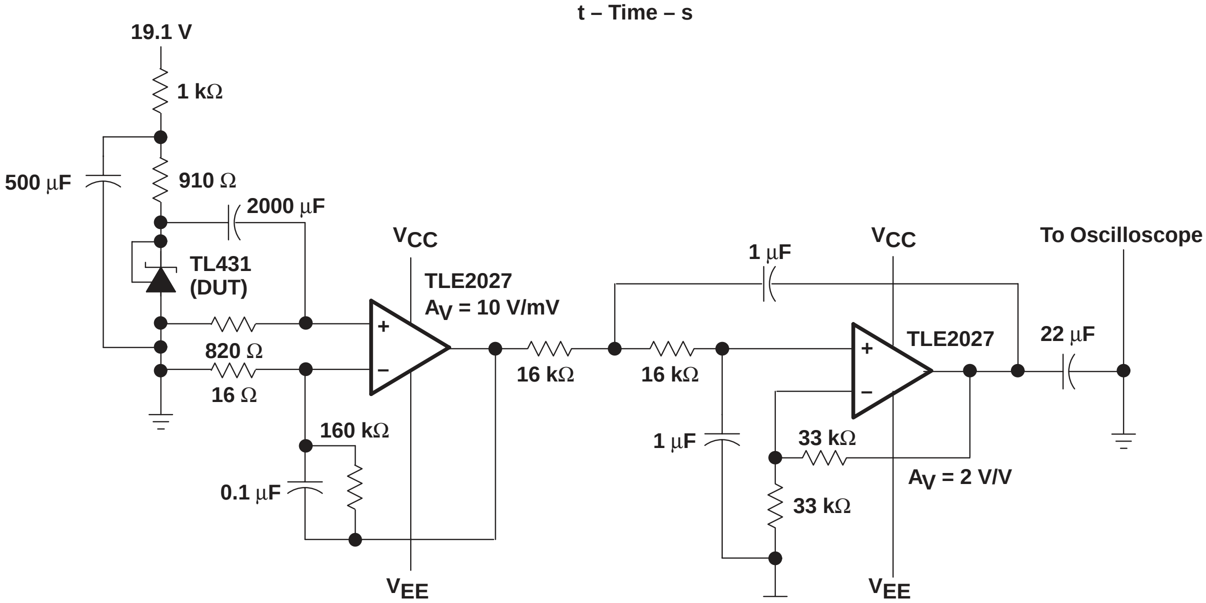
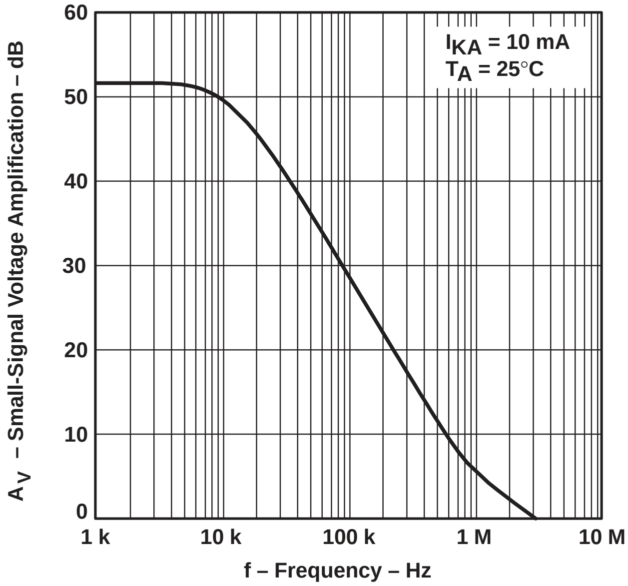
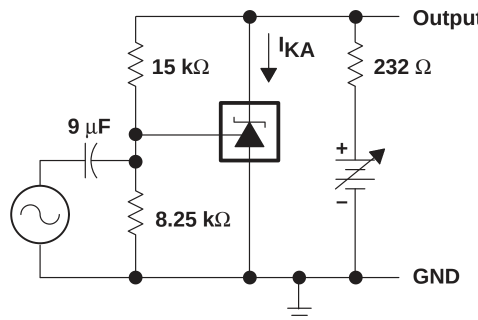




**Figure 12. Test Circuit for Equivalent Input Noise Voltage**

## TYPICAL CHARACTERISTICS

### SMALL-SIGNAL VOLTAGE AMPLIFICATION vs FREQUENCY

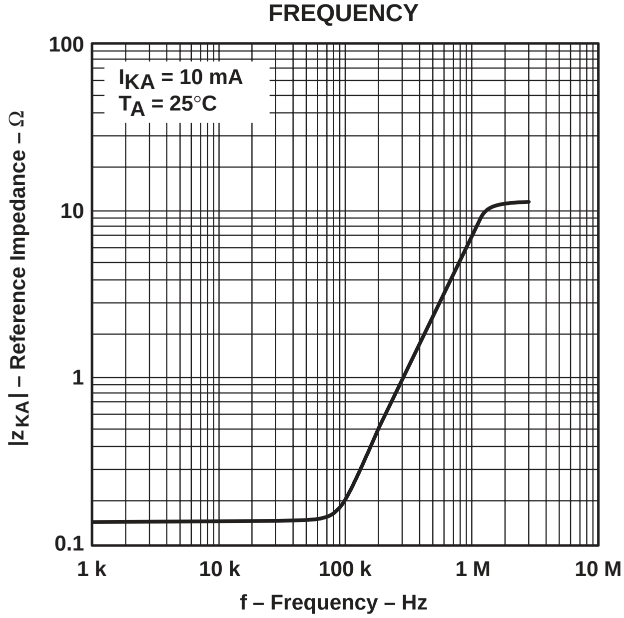


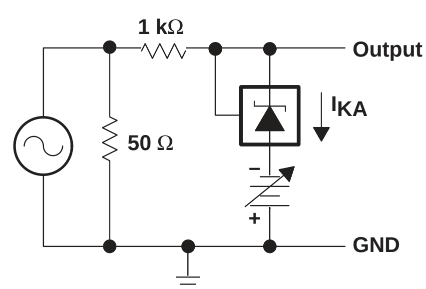




TEST CIRCUIT FOR VOLTAGE AMPLIFICATION

**Figure 13**

### REFERENCE IMPEDANCE vs FREQUENCY

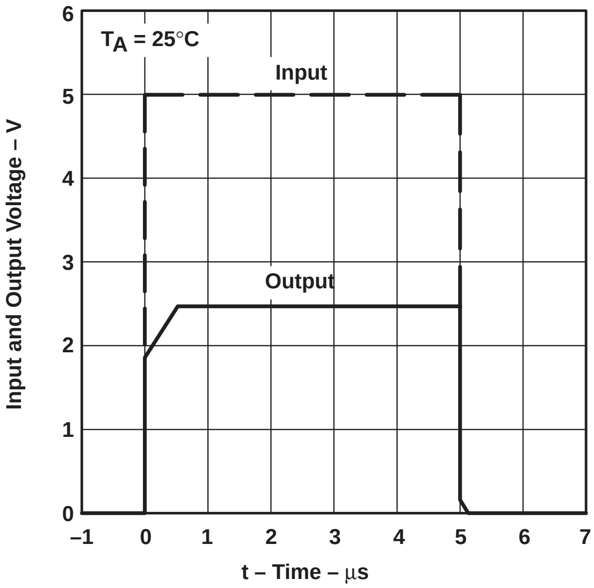


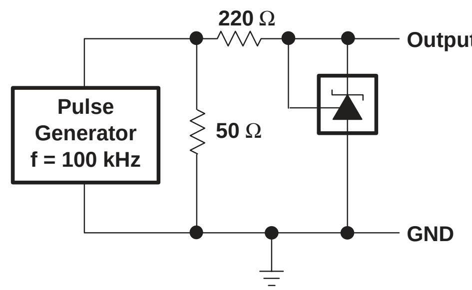




TEST CIRCUIT FOR REFERENCE IMPEDANCE

**Figure 14**

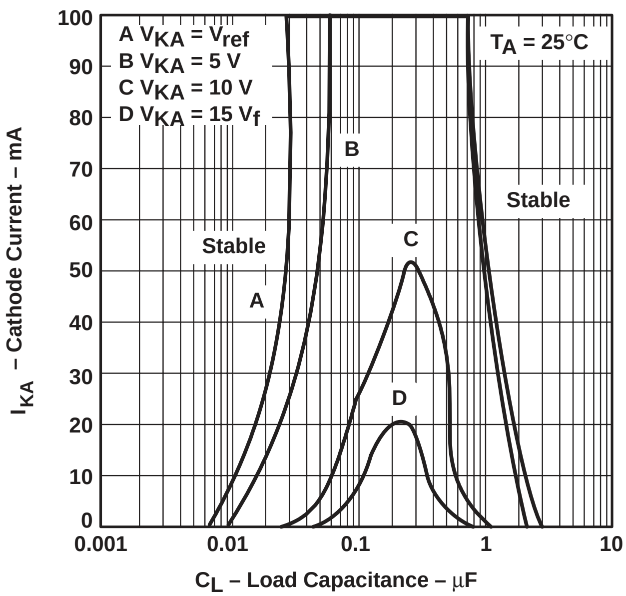
## TYPICAL CHARACTERISTICS



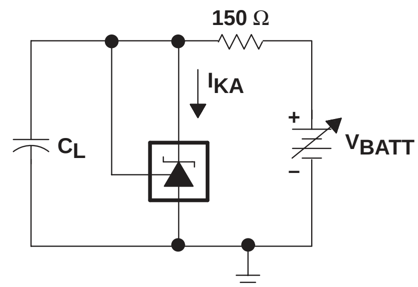




TEST CIRCUIT FOR PULSE RESPONSE

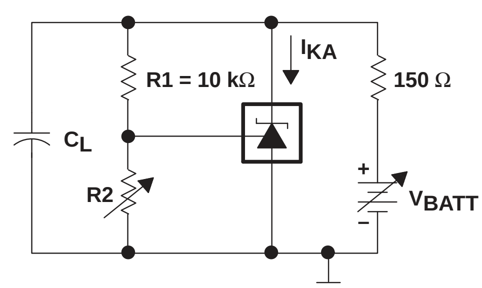
**Figure 15**




† The areas under the curves represent conditions that may cause the device to oscillate. For curves B, C, and D, R2 and V+ were adjusted to establish the initial $V_{KA}$ and $I_{KA}$ conditions with $C_L = 0$. $V_{BATT}$ and $C_L$ then were adjusted to determine the ranges of stability.



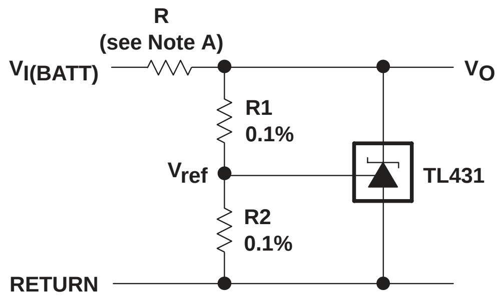

TEST CIRCUIT FOR CURVE A




TEST CIRCUIT FOR CURVES B, C, AND D

**Figure 16**

## APPLICATION INFORMATION




$$V_O = \left(1 + \frac{R1}{R2}\right)V_{ref}$$

NOTE A: R should provide cathode current ≥1 mA to the TL431 at minimum $V_{I(BATT)}$.

**Figure 17. Shunt Regulator**

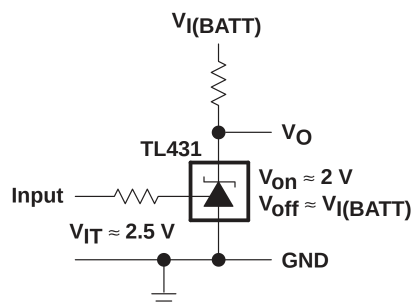
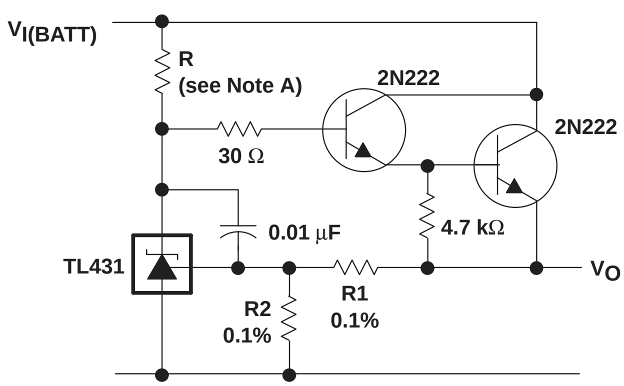



**Figure 18. Single-Supply Comparator With Temperature-Compensated Threshold**




$$V_O = \left(1 + \frac{R1}{R2}\right)V_{ref}$$

NOTE A: R should provide cathode current ≥1 mA to the TL431 at minimum $V_{I(BATT)}$.

**Figure 19. Precision High-Current Series Regulator**

## APPLICATION INFORMATION

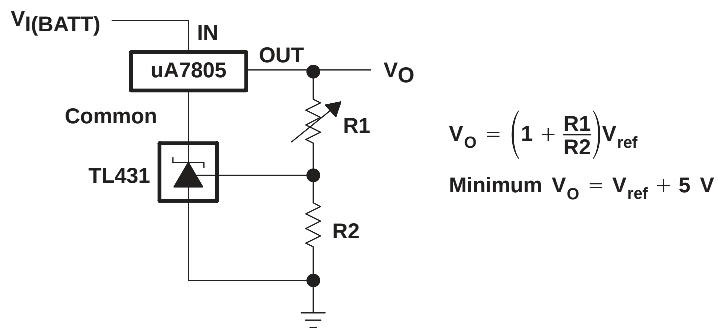



**Figure 20. Output Control of a Three-Terminal Fixed Regulator**

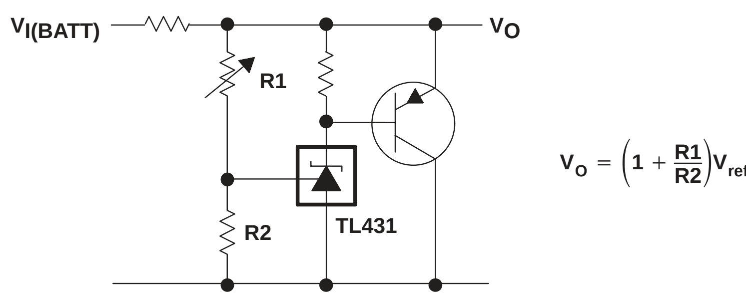
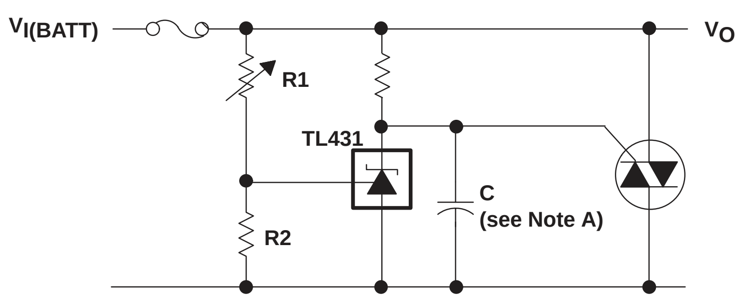



**Figure 21. High-Current Shunt Regulator**




NOTE A: Refer to the stability boundary conditions in Figure 16 to determine allowable values for C.

**Figure 22. Crowbar Circuit**

## APPLICATION INFORMATION

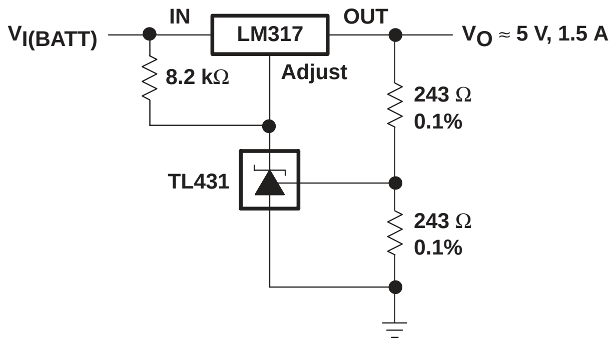
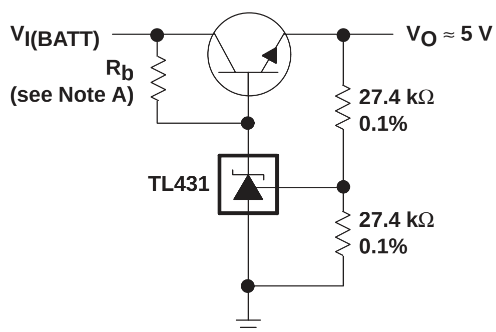



**Figure 23. Precision 5-V 1.5-A Regulator**




NOTE A: $R_b$ should provide cathode current ≥1 mA to the TL431.

**Figure 24. Efficient 5-V Precision Regulator**

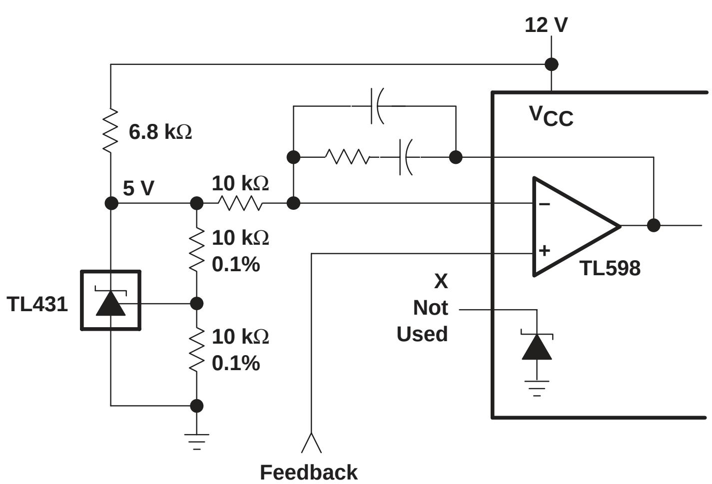
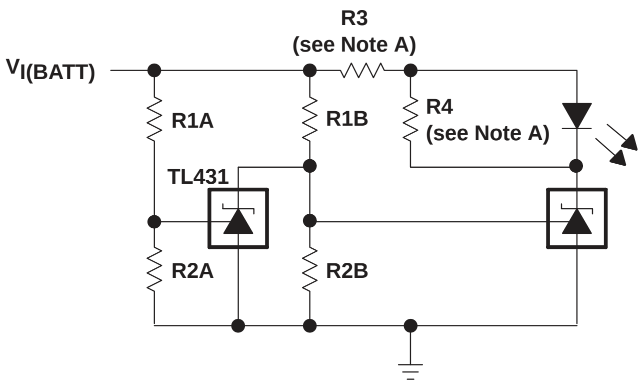



**Figure 25. PWM Converter With Reference**

## APPLICATION INFORMATION



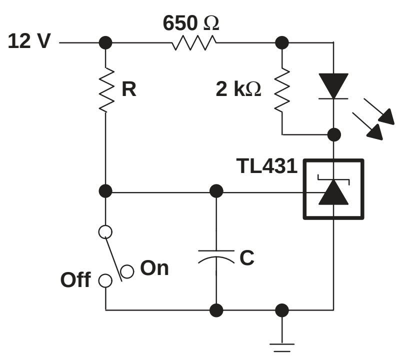

$$\text{Low Limit} = \left(1 + \frac{R1B}{R2B}\right)V_{ref}$$

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

**LED on When Low Limit < $V_{I(BATT)}$ < High Limit**

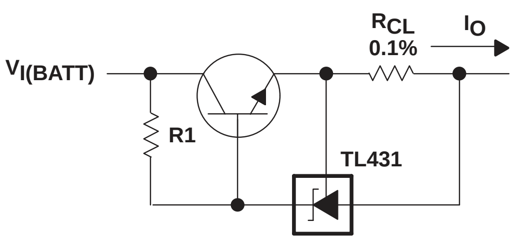
NOTE A: R3 and R4 are selected to provide the desired LED intensity and cathode current ≥1 mA to the TL431 at the available $V_{I(BATT)}$.

**Figure 26. Voltage Monitor**




$$\text{Delay} = R \times C \times I_n\left(\frac{12\ V}{12\ V - V_{ref}}\right)$$

**Figure 27. Delay Timer**




$$I_{out} = \frac{V_{ref}}{R_{CL}} + I_{KA}$$

$$R1 = \frac{V_{I(BATT)}}{\frac{I_O}{h_{FE}} + I_{KA}}$$

**Figure 28. Precision Current Limiter**

## APPLICATION INFORMATION

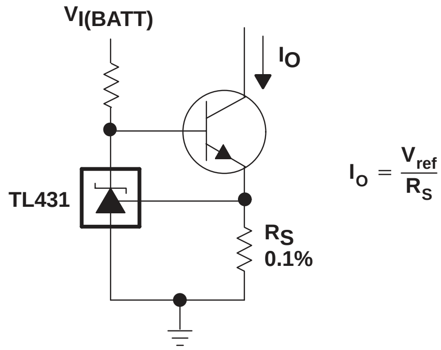



**Figure 29. Precision Constant-Current Sink**

## IMPORTANT NOTICE

# TL431, Adjustable Precision Shunt Regulator

DEVICE STATUS: ACTIVE

| PARAMETER NAME | TL431 |
|---|---|
| Vref (V) | 2.5 |
| IZ (min) (uA) | 1000 |
| VO (max) (V) | 36 |
| Tolerance (%) | 2 |
| VI (max) (V) | 36 |
| Temp Coeff (typ) (ppm/ degree C) | 30 |
| IZ (max) (mA) | 100 |

## FEATURES

Back to Top

- Equivalent Full-Range Temperature Coefficient...30 ppm/°C
- 0.2-Ω Typical Output Impedance
- Sink-Current Capability...1 mA to 100 mA
- Low Output Noise
- Adjustable Output Voltage...$V_{ref}$ to 36 V
- Available in a Wide Range of High-Density Packages

## DESCRIPTION

Back to Top

The TL431 and TL431A are three-terminal adjustable shunt regulators with specified thermal stability over applicable automotive, commercial, and military temperature ranges. The output voltage can be set to any value between $V_{ref}$ (approximately 2.5 V) and 36 V, with two external resistors (see Figure 17). These devices have a typical output impedance of 0.2 Ω. Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacements for Zener diodes in many applications, such as onboard regulation, adjustable power supplies, and switching power supplies.

The TL431C and TL431AC are characterized for operation from 0°C to 70°C, and the TL431I and TL431AI are characterized for operation from -40°C to 85°C.

TECHNICAL DOCUMENTS Back to Top

To view the following documents, Acrobat Reader 3.x is required.
To download a document to your hard drive, right-click on the link and choose 'Save'.

DATASHEET Back to Top

Full datasheet in Acrobat PDF: slvs005m.pdf (279 KB) (Updated: 10/04/2000)
Full datasheet in Zipped PostScript: slvs005m.psz (246 KB)

APPLICATION NOTES Back to Top

- PowerFLEX (TM) -- Surface-Mount Alternative For Through-Hole Power Packages (SZZA015 - Updated: 04/08/1999)

BLOCK DIAGRAMS Back to Top

- Desktop PC
- Notebook PC

SAMPLES Back to Top

| ORDERABLE DEVICE | PACKAGE | PINS | TEMP (ºC) | STATUS | DSCC NUMBER | SAMPLES |
|---|---|---|---|---|---|---|
| TL431CLP | LP | 3 | 0 TO 70 | ACTIVE | | Request Samples |
| TL431IPK | PK | 3 | -40 TO 85 | ACTIVE | | Request Samples |

PRICING/AVAILABILITY Back to Top

| ORDERABLE DEVICE | PACKAGE | PINS | TEMP (ºC) | STATUS | BUDGETARY PRICE US$/UNIT QTY=1000+ | PACK QTY | DSCC NUMBER | PRICING/AVAILABILITY |
|---|---|---|---|---|---|---|---|---|
| TL431CD | D | 8 | 0 TO 70 | ACTIVE | 0.27 | 75 | | Check stock or order |
| TL431CDBVR | DBV | 5 | 0 TO 70 | ACTIVE | 0.30 | 3000 | | Check stock or order |
| TL431CDR | D | 8 | 0 TO 70 | ACTIVE | 0.30 | 2500 | | Check stock or order |
| TL431CKTPR | KTP | 2 | 0 TO 70 | ACTIVE | 0.30 | 3000 | | Check stock or order |
| TL431CLP | LP | 3 | 0 TO 70 | ACTIVE | 0.30 | 1000 | | Check stock or order |
| TL431CLPB-TDJ | LP | 3 | S | OBSOLETE | | | | |
| TL431CLPM | LP | 3 | 0 TO 70 | ACTIVE | 0.30 | 2000 | | Check stock or order |
| TL431CLPR | LP | 3 | 0 TO 70 | ACTIVE | 0.33 | 2000 | | Check stock or order |
| TL431CP | P | 8 | 0 TO 70 | ACTIVE | 0.27 | 50 | | Check stock or order |
| | | | 0 TO | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| TL431CPK | PK | 3 | 70 | ACTIVE | 0.52 | 1000 | | Check stock or order |
| TL431CPS | PS | 8 | 0 TO 70 | ACTIVE | | | | Check stock or order |
| TL431CPSLE | PS | 8 | | OBSOLETE | | | | Replaced by TL431CPSR |
| TL431CPSR | PS | 8 | 0 TO 70 | ACTIVE | 0.67 | 2000 | | Check stock or order |
| TL431CPWLE | PW | 8 | | OBSOLETE | | | | Replaced by TL431CPWR |
| TL431CPWR | PW | 8 | 0 TO 70 | ACTIVE | 0.30 | 2000 | | Check stock or order |
| TL431ID | D | 8 | -40 TO 85 | ACTIVE | 0.42 | 75 | | Check stock or order |
| TL431IDBVR | DBV | 5 | -40 TO 85 | ACTIVE | 0.45 | 3000 | | Check stock or order |
| TL431IDR | D | 8 | -40 TO 85 | ACTIVE | 0.45 | 2500 | | Check stock or order |
| TL431ILP | LP | 3 | -40 TO 85 | ACTIVE | 0.42 | 1000 | | Check stock or order |
| TL431ILPM | LP | 3 | -40 TO 85 | OBSOLETE | | | | |
| TL431ILPR | LP | 3 | -40 TO 85 | ACTIVE | 0.45 | 2000 | | Check stock or order |
| TL431IP | P | 8 | -40 TO 85 | ACTIVE | 0.42 | 50 | | Check stock or order |
| TL431IPK | PK | 3 | -40 TO 85 | ACTIVE | 1.00 | 1000 | | Check stock or order |
| TL431MFKB | FK | 20 | -55 TO 125 | OBSOLETE | | | | |
| TL431MJG | JG | 8 | -55 TO 125 | OBSOLETE | | | | |
| TL431MJGB | JG | 8 | -55 TO 125 | OBSOLETE | | | | |

Table Data Updated on: 11/26/2000

PRODUCT FOLDER | PRODUCT INFO: FEATURES | DESCRIPTION | DATASHEETS | PRICING/AVAILABILITY | APPLICATION NOTES

PRODUCT SUPPORT: APPLICATIONS

# TL431A, Adjustable Precision Shunt Regulator

DEVICE STATUS: ACTIVE

| PARAMETER NAME | TL431A |
|---|---|
| Vref (V) | 2.5 |
| IZ (min) (uA) | 1000 |
| VO (max) (V) | 36 |
| Tolerance (%) | 1 |
| VI (max) (V) | 36 |
| Temp Coeff (typ) (ppm/ degree C) | 30 |
| IZ (max) (mA) | 100 |

## FEATURES

Back to Top

- Equivalent Full-Range Temperature Coefficient...30 ppm/°C
- 0.2-Ω Typical Output Impedance
- Sink-Current Capability...1 mA to 100 mA
- Low Output Noise
- Adjustable Output Voltage...$V_{ref}$ to 36 V
- Available in a Wide Range of High-Density Packages

## DESCRIPTION

Back to Top

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The TL431C and TL431AC are characterized for operation from 0°C to 70°C, and the TL431I and TL431AI are characterized for operation from -40°C to 85°C.

TECHNICAL DOCUMENTS

Back to Top

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Back to Top

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APPLICATION NOTES

Back to Top

- PowerFLEX (TM) -- Surface-Mount Alternative For Through-Hole Power Packages (SZZA015 - Updated: 04/08/1999)

PRICING/AVAILABILITY

Back to Top

| ORDERABLE DEVICE | PACKAGE | PINS | TEMP (ºC) | STATUS | BUDGETARY PRICE US$/UNIT QTY=1000+ | PACK QTY | PRICING/AVAILABILITY |
|---|---|---|---|---|---|---|---|
| TL431ACD | D | 8 | 0 TO 70 | ACTIVE | 0.33 | 75 | Check stock or order |
| TL431ACDR | D | 8 | 0 TO 70 | ACTIVE | 0.33 | 2500 | Check stock or order |
| TL431ACLP | LP | 3 | 0 TO 70 | ACTIVE | 0.33 | 1000 | Check stock or order |
| TL431ACLPM | LP | 3 | S | ACTIVE | 0.37 | 2000 | Check stock or order |
| TL431ACLPR | LP | 3 | 0 TO 70 | ACTIVE | 0.37 | 2000 | Check stock or order |
| TL431ACP | P | 8 | 0 TO 70 | ACTIVE | 0.33 | 50 | Check stock or order |
| TL431ACPS | PS | 8 | 0 TO 70 | ACTIVE | | | Check stock or order |
| TL431ACPW | PW | 8 | 0 TO 70 | OBSOLETE | | | |
| TL431ACPWR | PW | 8 | 0 TO 70 | ACTIVE | 0.33 | 2000 | Check stock or order |
| TL431AID | D | 8 | -40 TO 85 | ACTIVE | 0.42 | 75 | Check stock or order |
| TL431AIDR | D | 8 | -40 TO 85 | ACTIVE | 0.45 | 2500 | Check stock or order |
| TL431AILP | LP | 3 | -40 TO 85 | ACTIVE | 0.42 | 1000 | Check stock or order |
| TL431AILPR | LP | 3 | -40 TO 85 | ACTIVE | 0.45 | 2000 | Check stock or order |
| TL431AIP | P | 8 | -40 TO 85 | ACTIVE | 0.42 | 50 | Check stock or order |

Table Data Updated on: 11/26/2000