



**THE DATASHEET OF
AS431HMANTR-G1**



Description

The AS431H is a three-terminal adjustable shunt regulator with guaranteed thermal stability over a full operation range. It features sharp turn-on characteristics, low temperature coefficient, and low output impedance, which make the AS431H an ideal substitute for Zener diodes in applications such as switching power supplies, chargers, and other adjustable regulators.

The output voltage of the AS431H can be set to any value between V_{REF} (2.495V) and the corresponding maximum cathode voltage (36V).

The AS431H precision reference is offered in two voltage tolerances: 0.5% and 1.0%.

This IC is available in two packages: TO92 (Ammo Packing) and SOT23.

Features

- Programmable Precise Output Voltage from 2.495V to 36V
- High Stability under Capacitive Load
- Low Temperature Deviation: 5mV Typical
- Low Equivalent Full-range Temperature Coefficient with 20PPM/°C Typical
- Sink Current Capacity from 0.5mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125°C
- Lead-Free Packages, Available in "Green" Molding Compound: SOT23, TO92 (Ammo Packing)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](mailto:contact@diodes.com) or your local Diodes representative. <https://www.diodes.com/quality/product-definitions/>**

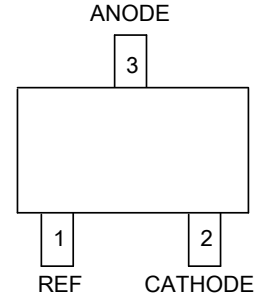
Applications

- Chargers
- Voltage adapters
- Switching power supplies
- Graphic cards
- Precision voltage references

Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
 2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

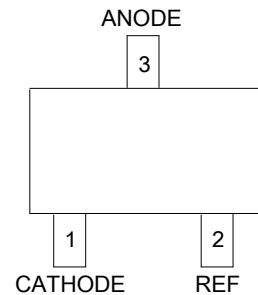
Pin Assignments

(Top View)



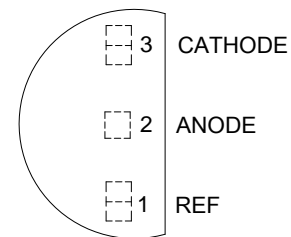
SOT23
(Normal Pin-out)

(Top View)



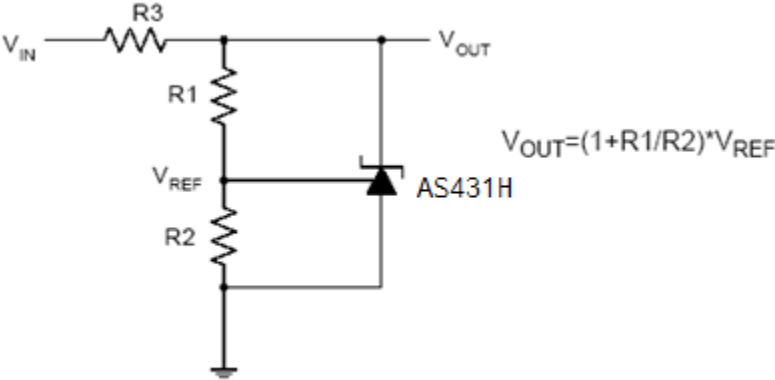
SOT23
(Mirror Pin-out)

(Top View)

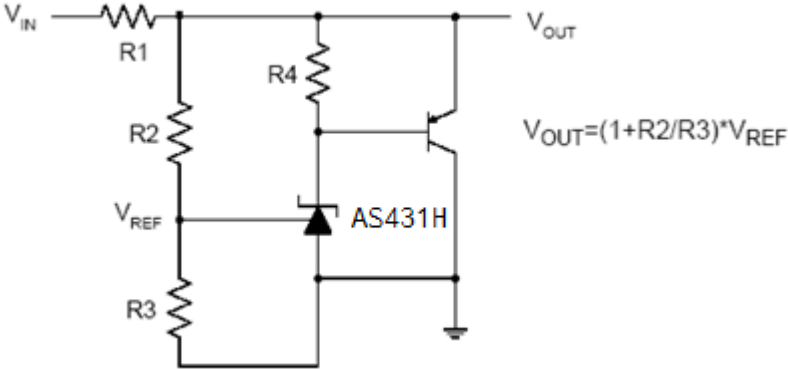


TO92 (Ammo Packing)

Typical Applications Circuit

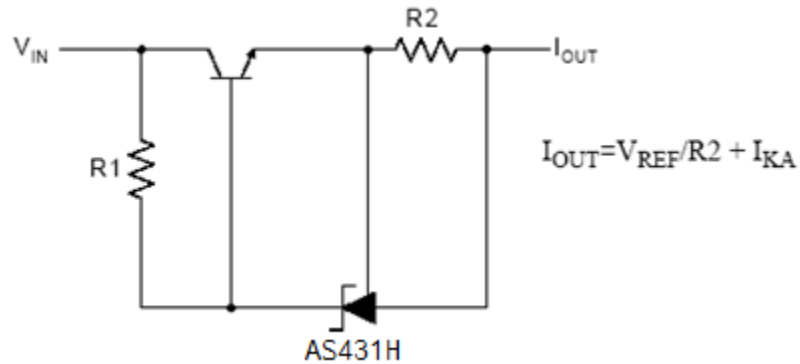


Shunt Regulator

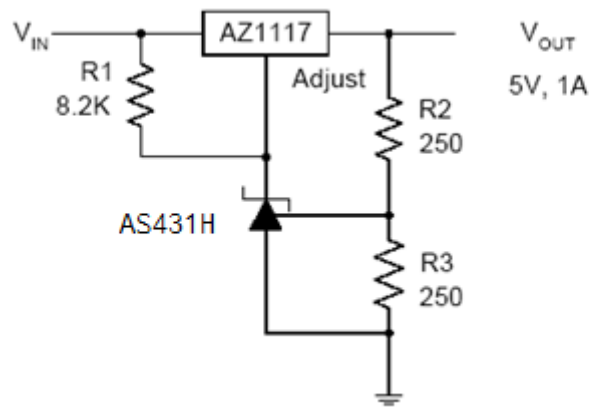


High Current Shunt Regulator

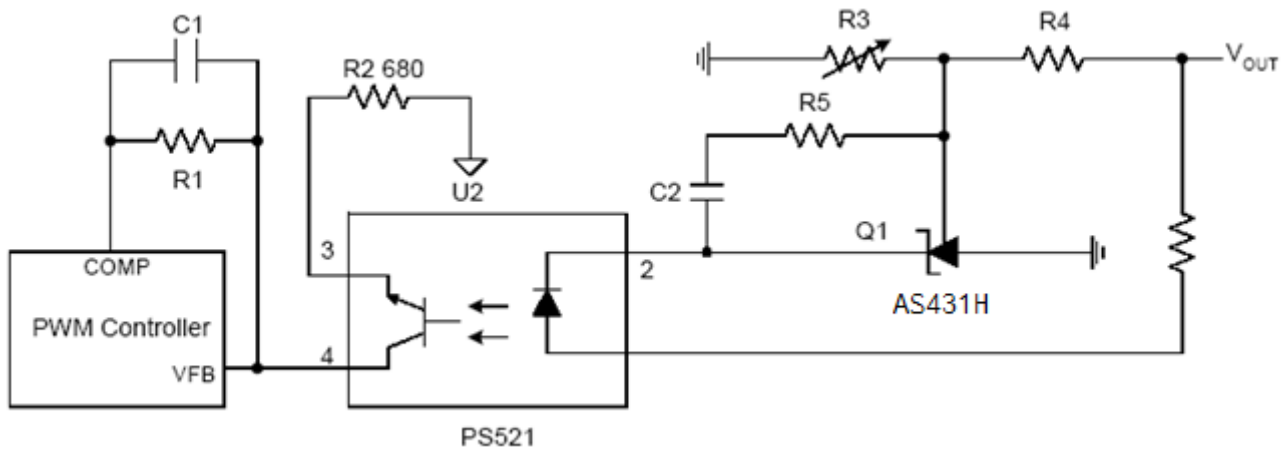
Typical Applications Circuit (continued)



Current Source or Current Limit

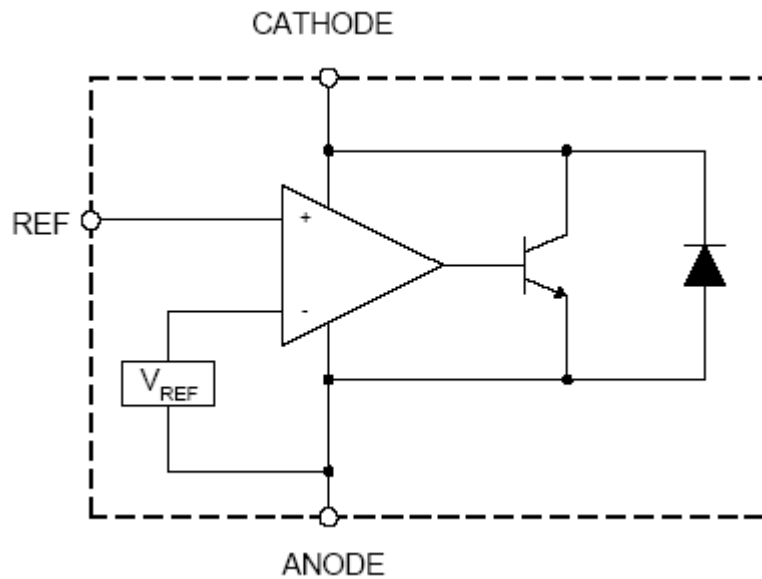


Precision 5V 1A Regulator



PWM Converter with Reference

Functional Block Diagram



Absolute Maximum Ratings (Note 4)

| Symbol | Parameter | Rating | | Unit |
|---------------|------------------------------------|---------------------|-----|------|
| V_{KA} | Cathode Voltage | 40 | | V |
| I_{KA} | Cathode Current Range (Continuous) | -100 to 150 | | mA |
| I_{REF} | Reference Input Current Range | 10 | | mA |
| θ_{JA} | Thermal Resistance | SOT23 | 380 | °C/W |
| | | TO92 (Ammo Packing) | 165 | |
| T_J | Junction Temperature | +150 | | °C |
| T_{STG} | Storage Temperature Range | -65 to +150 | | °C |
| ESD | ESD (Human Body Model) | 2000 | | V |

Note: 4. Stresses greater than 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 Ratings" for extended periods may affect device reliability.

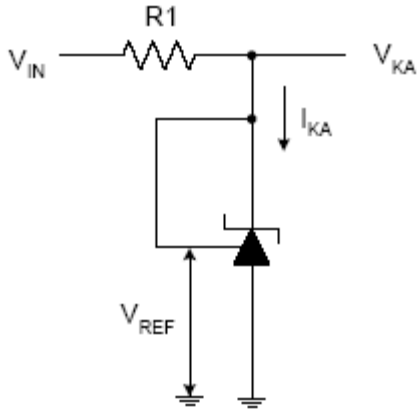
Recommended Operating Conditions

| Symbol | Parameter | Min | Max | Unit |
|----------|-------------------------------------|-----------|------|------|
| V_{KA} | Cathode Voltage | V_{REF} | 36 | V |
| I_{KA} | Cathode Current | 0.5 | 100 | mA |
| T_A | Operating Ambient Temperature Range | -40 | +125 | °C |

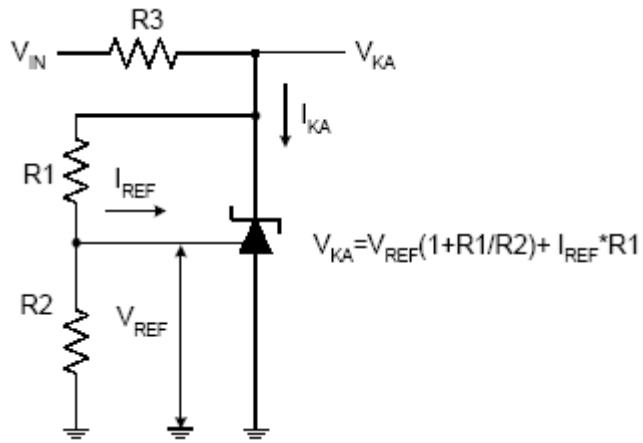
Electrical Characteristics (Operating Conditions: $T_A = +25^\circ\text{C}$, unless otherwise specified.)

| Symbol | Parameter | Test Circuit | Conditions | Min | Typ | Max | Unit | |
|--|---|--------------|---|---|-------|-------|--------------------|------|
| V_{REF} | Reference Voltage | 4 | $V_{KA} = V_{REF}, I_{KA} = 10\text{mA}$ | 2.483 | 2.495 | 2.507 | V | |
| | | | | 2.470 | 2.495 | 2.520 | | |
| ΔV_{REF} | Deviation of Reference Voltage Over Full Temperature Range | 4 | $V_{KA} = V_{REF}, I_{KA} = 10\text{mA}$ | 0 to $+70^\circ\text{C}$ | — | 5 | 8 | mV |
| | | | | -40 to $+85^\circ\text{C}$ | — | 5 | 14 | |
| | | | | -40 to $+125^\circ\text{C}$ | — | 5 | 16 | |
| $\frac{\Delta V_{REF}}{\Delta V_{KA}}$ | Ratio of Change in Reference Voltage to the Change in Cathode Voltage | 5 | $I_{KA} = 10\text{mA}$ | $\Delta V_{KA} = 10\text{V to } V_{REF}$ | — | -1.0 | -2.7 | mV/V |
| | | | | $\Delta V_{KA} = 36\text{V to } 10\text{V}$ | — | -0.5 | -2.0 | |
| I_{REF} | Reference Current | 5 | $I_{KA} = 10\text{mA}, R1 = 10\text{k}\Omega, R2 = \infty$ | — | 0.7 | 4 | μA | |
| ΔI_{REF} | Deviation of Reference Current Over Full Temperature Range | 5 | $I_{KA} = 10\text{mA}, R1 = 10\text{k}\Omega, R2 = \infty, T_A = -40$ to $+125^\circ\text{C}$ | — | 0.4 | 1.2 | μA | |
| I_{KA} (Min) | Minimum Cathode Current for Regulation | 4 | $V_{KA} = V_{REF}$ | — | 0.35 | 0.5 | mA | |
| I_{KA} (Off) | Off-state Cathode Current | 6 | $V_{KA} = 36\text{V}, V_{REF} = 0$ | — | 0.002 | 0.5 | μA | |
| Z_{KA} | Dynamic Impedance | 4 | $V_{KA} = V_{REF}, I_{KA} = 0.5$ to $100\text{mA}, f \leq 1.0\text{KHz}$ | — | 0.15 | 0.5 | Ω | |
| θ_{JC} | Thermal Resistance | — | SOT23 | — | 136 | — | $^\circ\text{C/W}$ | |
| | | | TO92 (Ammo Packing) | — | 80 | — | | |

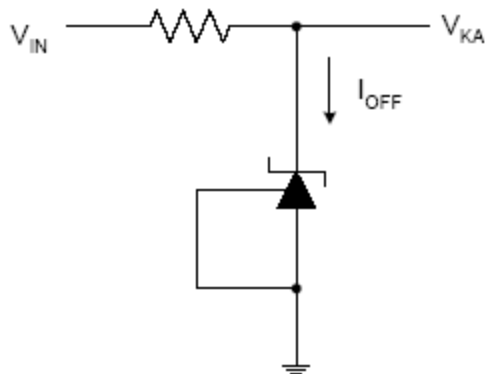
Electrical Characteristics (continued)



Test Circuit 4 for $V_{KA} = V_{REF}$



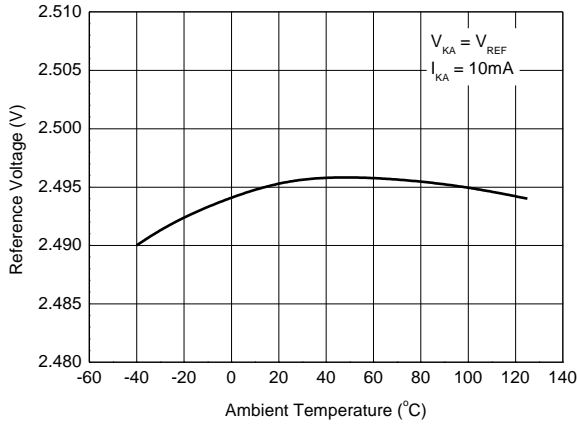
Test Circuit 5 for $V_{KA} > V_{REF}$



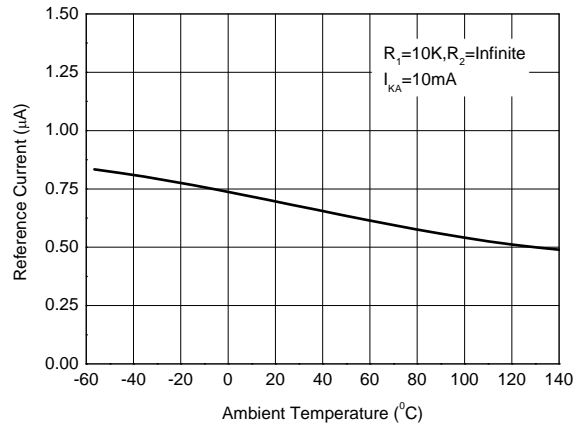
Test Circuit 6 for I_{OFF}

Performance Characteristics

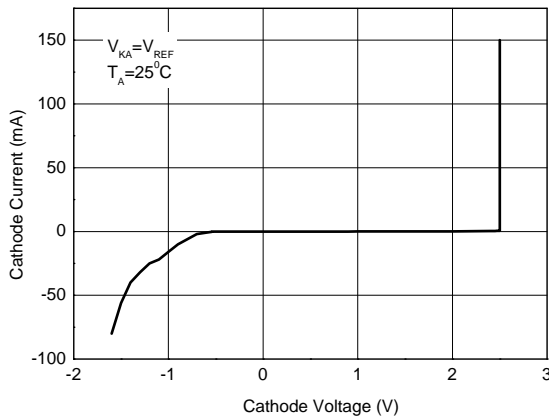
Reference Voltage vs. Ambient Temperature



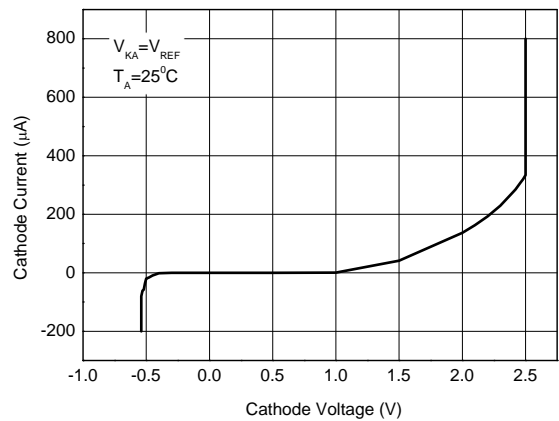
Reference Current vs. Ambient Temperature



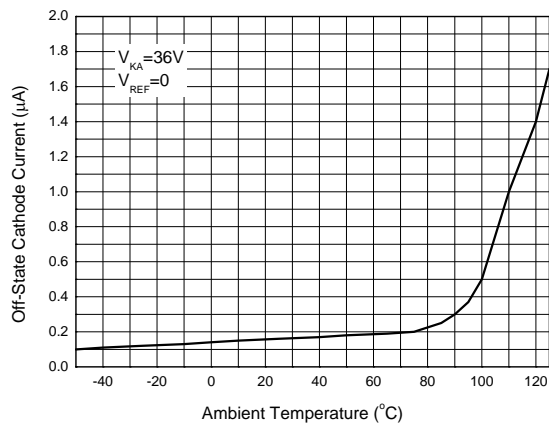
Cathode Current vs. Cathode Voltage



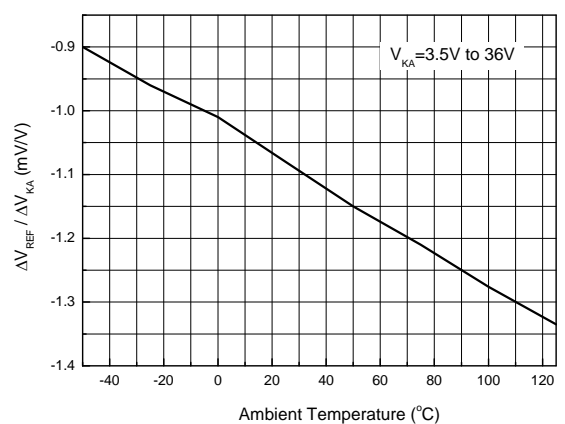
Cathode Current vs. Cathode Voltage



Off-State Cathode Current vs. Ambient Temperature

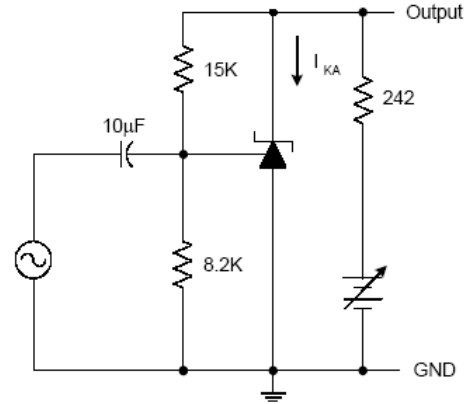
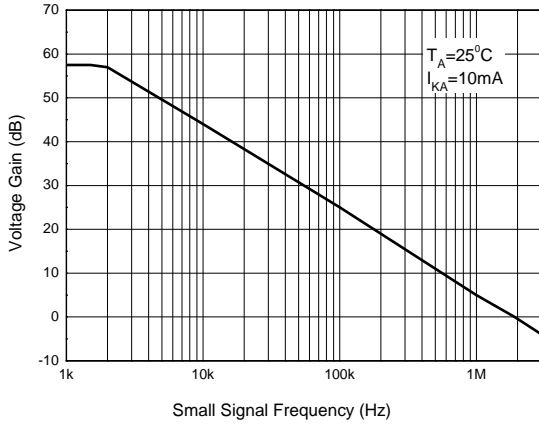


Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage

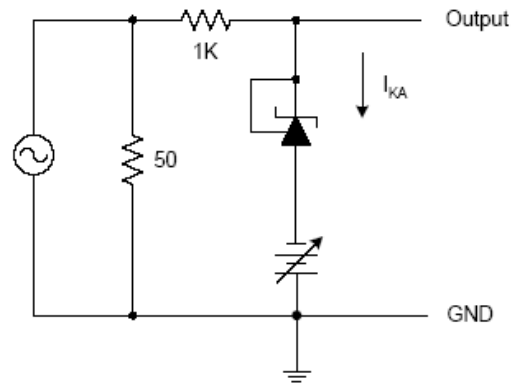
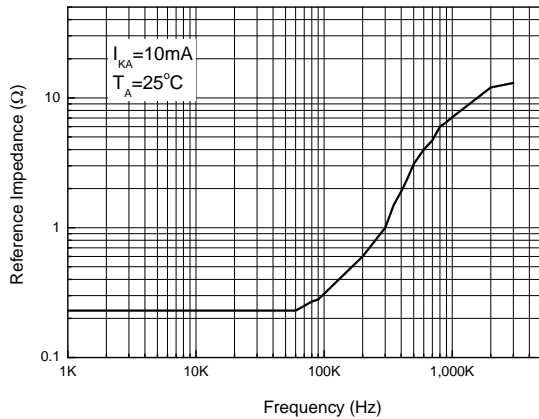


Performance Characteristics (continued)

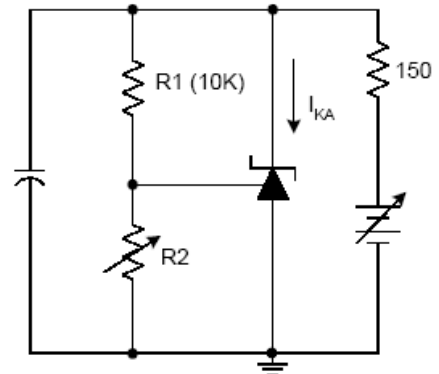
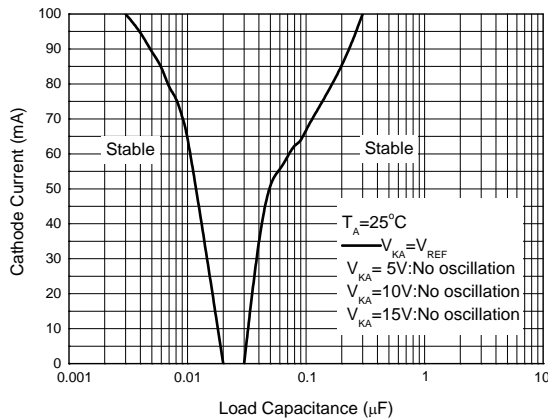
Small Signal Voltage Gain vs. Frequency



Reference Impedance vs. Frequency

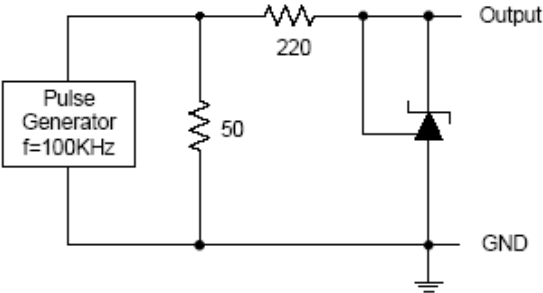
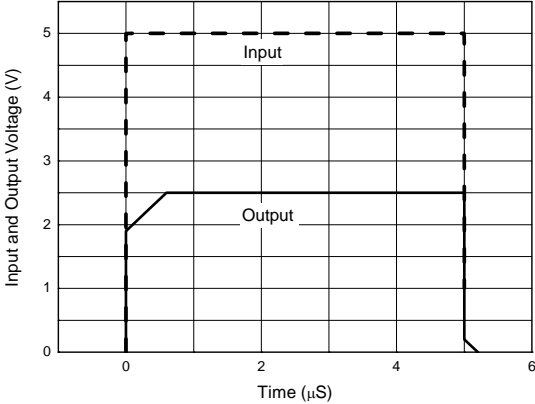


Stability Boundary Conditions vs. Load Capacitance

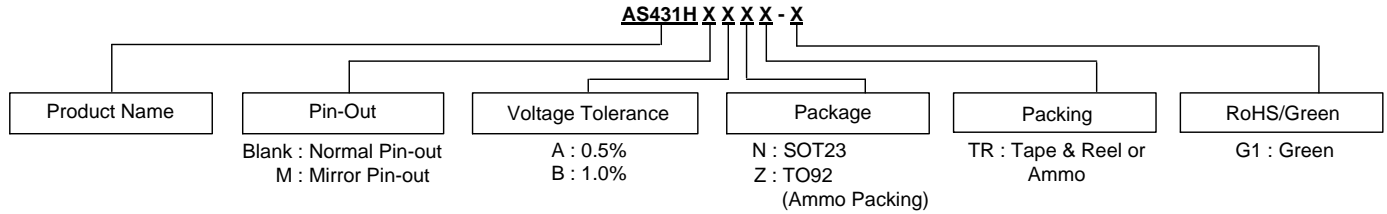


Performance Characteristics (continued)

Pulse Response of Input and Output Voltage



Ordering Information

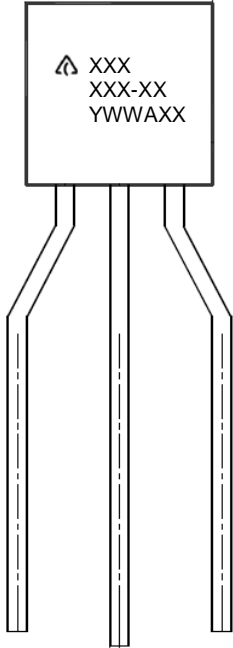


| Orderable Part Number | Package | Temperature Range | Pin-Out | Voltage Tolerance | Marking ID | Packing | |
|-----------------------|---------------------|-------------------|----------------|-------------------|------------|----------|-------------|
| | | | | | | Quantity | Carrier |
| AS431HANTR-G1 | SOT23 | -40 to +125°C | Normal Pin-out | 0.5% | GJA | 3,000 | Tape & Reel |
| AS431HBNTR-G1 | | | | 1.0% | GJB | 3,000 | Tape & Reel |
| AS431HMANTR-G1 | SOT23 | -40 to +125°C | Mirror Pin-out | 0.5% | GM5 | 3,000 | Tape & Reel |
| AS431HMBNTR-G1 | | | | 1.0% | GM6 | 3,000 | Tape & Reel |
| AS431HAZTR-G1 | TO92 (Ammo Packing) | -40 to +125°C | Normal Pin-out | 0.5% | 431HAZ-G1 | 2,000 | Ammo |
| AS431HBZTR-G1 | | | | 1.0% | 431HBZ-G1 | 2,000 | Ammo |

Marking Information

(1) TO92 (Ammo Packing)

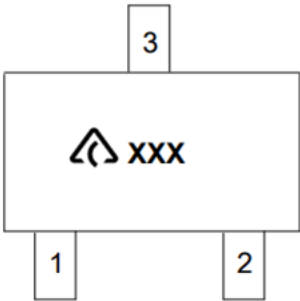
(Top View)



First and Second Line: Logo and Marking ID
(See Ordering Information)
Third Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: Internal Code.

(2) SOT23

(Top View)

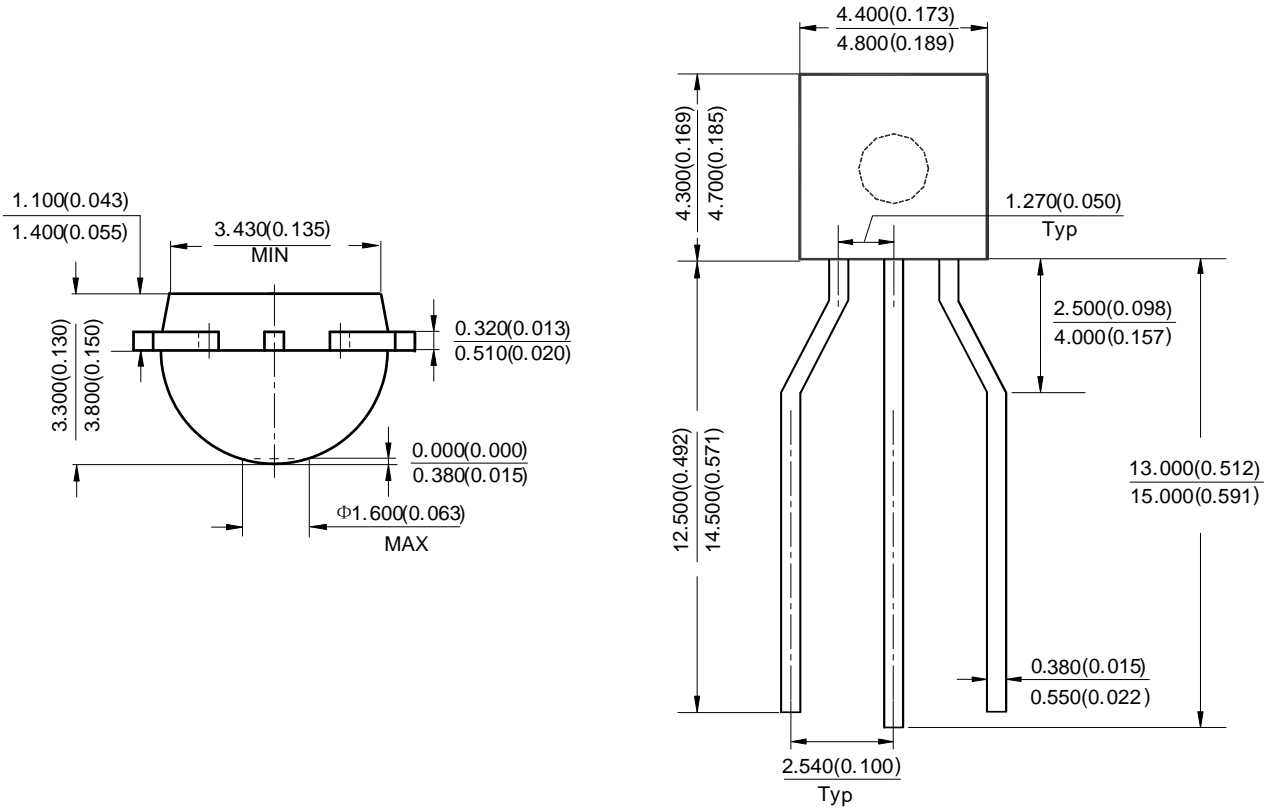


Logo : Logo
XXX: Marking ID (See Ordering Information)

Package Outline Dimensions (All dimensions in mm.)

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

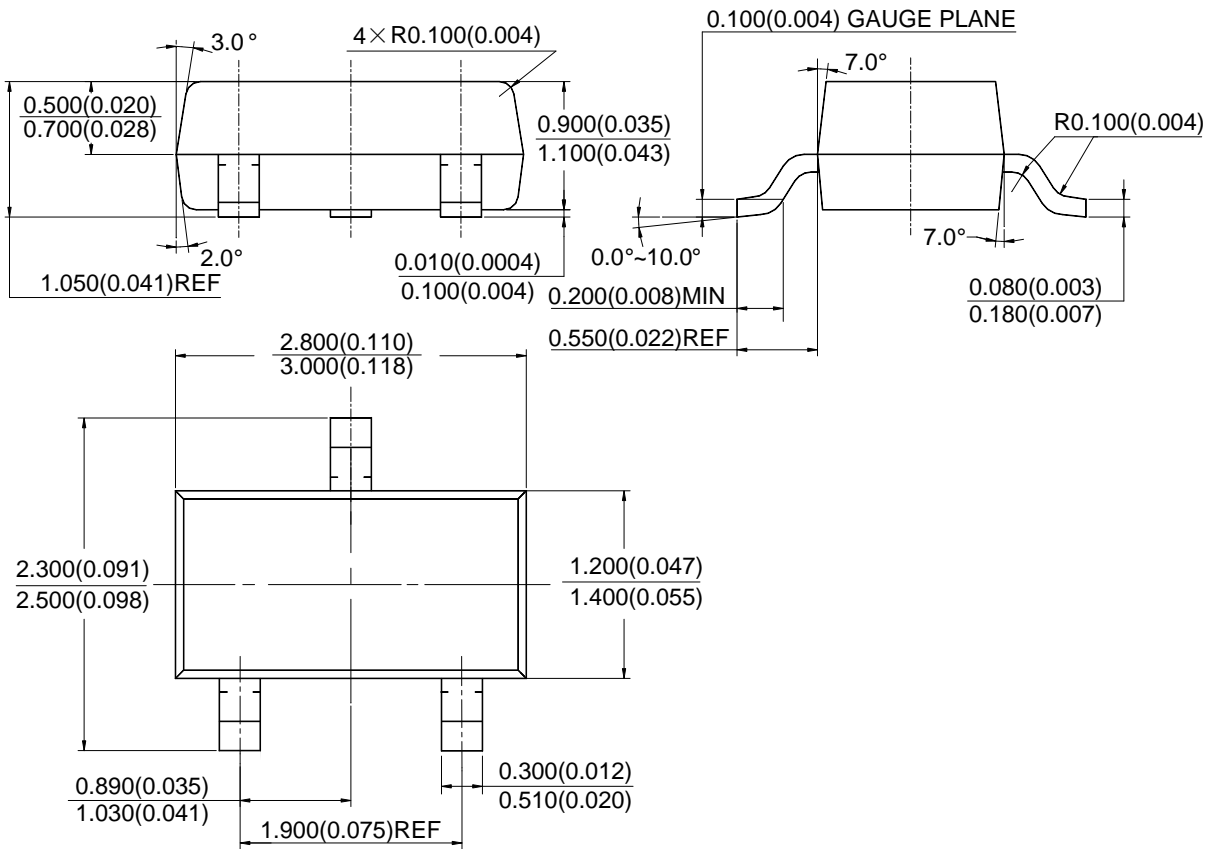
(1) T092 (Ammo Packing)



Package Outline Dimensions (All dimensions in mm.) (continued)

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

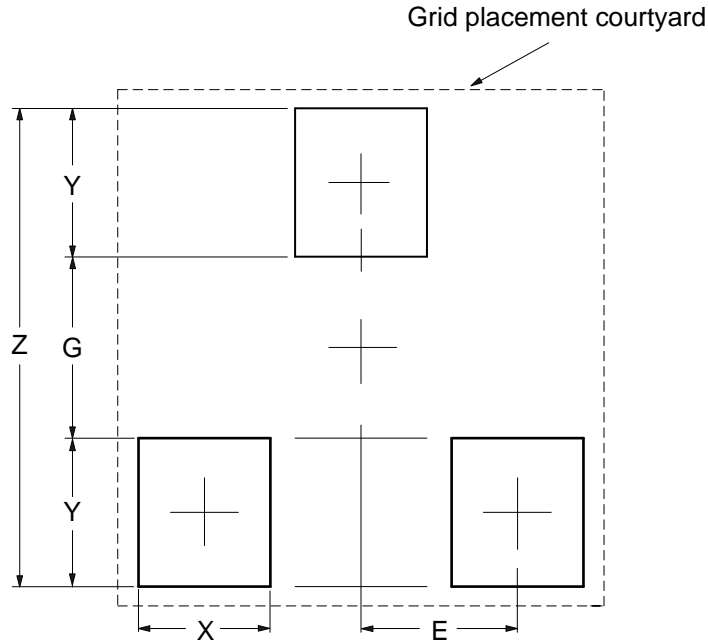
(2) SOT23



Suggested Pad Layout

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

(1) SOT23



| Dimensions | Z (mm)/(inch) | G (mm)/(inch) | X (mm)/(inch) | Y (mm)/(inch) | E (mm)/(inch) |
|------------|------------------|------------------|------------------|------------------|------------------|
| Value | 2.900/0.114 | 1.100/0.043 | 0.800/0.031 | 0.900/0.035 | 0.950/0.037 |

Mechanical Data

- Moisture Sensitivity: Level 3 per J-STD-020 for SOT23
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 (e3)
- Weight:
 - SOT23: 0.009 grams (Approximate)
 - TO92: 0.211 grams (Approximate)

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