

Adjustable Precision Shunt Regulator

General Description

The ME431 series ICs are three-terminal adjustable shunt regulators with guaranteed thermal stability over a full operation range. These ICs feature sharp turn-on characteristics, low temperature coefficient and low output impedance, which make them ideal substitutes for Zener diodes in applications such as switching power supply, charger and other adjustable regulators.

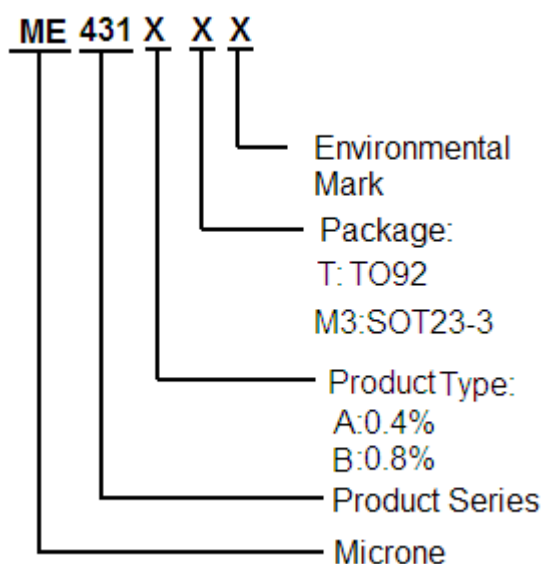
The ME431 voltage type is 40V. The output voltage can be set to any value between $V_{REF}(2.5V)$ and the corresponding maximum cathode voltage.

The ME431 precision reference is offered in two band gap tolerance: 0.4% and 0.8%.

Features

- Programmable Precise Output Voltage from 2.5V to 36V
- Very Accurate Reference Voltage: Typical 0.15%
- High Stability under Capacitive Load
- Low Temperature Deviation: Typical 4.5mV
- Low Equivalent Full-range Temperature Coefficient with 20PPM/°C Typical
- Low Dynamic Output Resistance: Typical 0.2Ω
- Sink Current Capacity from 1mA to 100 mA
- Low Output Noise
- Wide Operating Range of -40 to 125°C
- TO-92, SOT23-3 package

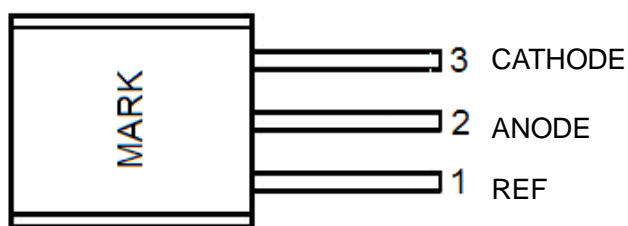
Selection Guide



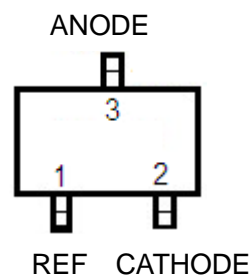
Typical Application

- Charger
- Voltage Adapter
- Switching Power Supply
- Graphic Card
- Precision Voltage Reference

PIN Configuration

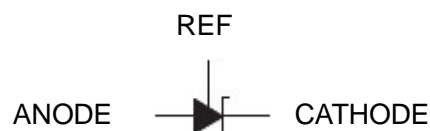
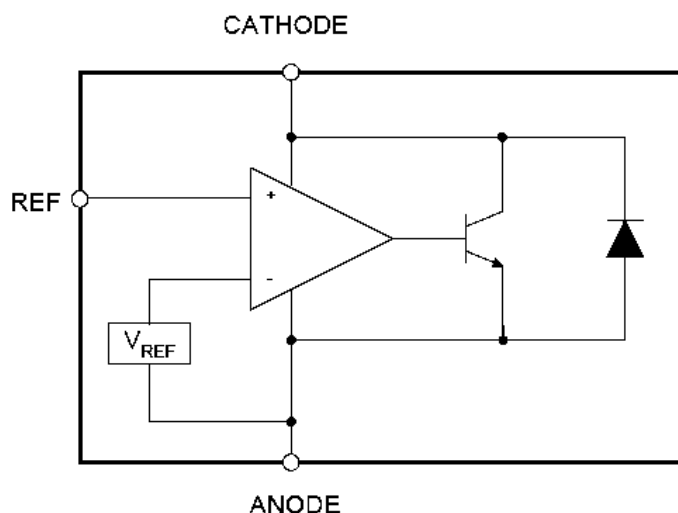


TO-92



SOT23-3

Block Diagram and symbol



Absolute Maximum Ratings

| PARAMETER | SYMBAL | RATING | UNIT |
|------------------------------------|---------------|---------------------|------|
| Cathode voltage | V_{KA} | 40 | V |
| Cathode current range (continuous) | I_{KA} | -100 to +150 | mA |
| Reference input current range | I_{REF} | 10 | mA |
| Power Dissipation | P_D | TO-92Package:770 | mW |
| | | SOT23-3 Package:370 | |
| Junction temperature | T_J | 160 | °C |
| Storage Temperature range | T_{STG} | -65~+150 | °C |
| Package thermal impedance | θ_{JA} | TO-92 package:150 | °C/W |
| | | SOT23-3 package:330 | |

Note: Use this IC within the stated maximum ratings. Operation beyond these limits may cause degrading or permanent damage to the device.

Recommended Operating Conditions

| Parameter | Symbol | Min | Max | Unit |
|-------------------------------------|----------|-----------|-----|------|
| Cathode Voltage | V_{KA} | V_{REF} | 36 | V |
| Cathode Current | I_{KA} | 1.0 | 100 | mA |
| Operating Ambient Temperature Range | | -40 | 125 | °C |

Electrical Characteristics ($T_A=25^{\circ}\text{C}$, unless otherwise noted)

| Parameter | Symbol | Conditions | Min | Typ. | Max | Unit | Test circuit |
|---|--|---|-------|------|-------|---------------|--------------|
| Reference voltage | V_{REF} | $V_{KA}=V_{REF}, I_{KA}=10\text{mA}$ | 2.490 | 2.50 | 2.510 | V | Fig.1 |
| | | | 2.480 | 2.50 | 2.520 | | |
| Deviation of reference voltage over-temperature | ΔV_{REF} | $V_{KA}=V_{REF}, I_{KA}=10\text{mA}$ | | 3 | 8 | mV | Fig.1 |
| | | 0 to 70°C | | | | | |
| | | -40 to 85°C | | 3 | 10 | | |
| Dynamic impedance | $ Z_{KA} $ | $V_{KA}=V_{REF}, I_{KA}=1 \text{ to } 100\text{mA}, f \leq 1.0\text{KHz}$ | - | 0.15 | 0.5 | Ω | Fig.1 |
| Minimum cathode current for regulation | $I_{KA}(\text{MIN})$ | $V_{KA}=V_{REF}$ | - | 0.4 | 1.0 | mA | Fig.1 |
| Ratio of change in reference voltage to the change in cathode voltage | $\frac{\Delta V_{REF}}{\Delta V_{KA}}$ | $I_{KA}=10\text{mA}$ | | -1.5 | -2.7 | mV/V | Fig.2 |
| | | $\Delta V_{KA}=10\text{V}$ to V_{REF} | - | | | | |
| | | $\Delta V_{KA}=36\text{V}$ to 10V | - | -1.0 | -2.0 | | |
| Reference current | I_{REF} | $I_{KA}=10\text{mA}, R1=10\text{K}\Omega, R2=\infty$ | | 1.0 | 4 | μA | Fig.2 |
| Deviation of reference over full temperature range | ΔI_{REF} | $I_{KA}=10\text{mA}, R1=10\text{K}\Omega, R2=\infty, T_A=40 \text{ to } 85^{\circ}\text{C}$ | | 0.1 | 1.2 | μA | Fig.2 |
| Off-state cathode current | $I_{KA}(\text{OFF})$ | $V_{KA}=36\text{V}, V_{REF}=0$ | | 0.05 | 1.0 | μA | Fig.3 |

Note: The dynamic impedance is defined as: $|Z_{KA}| = \Delta V_{KA} / \Delta I_{KA}$

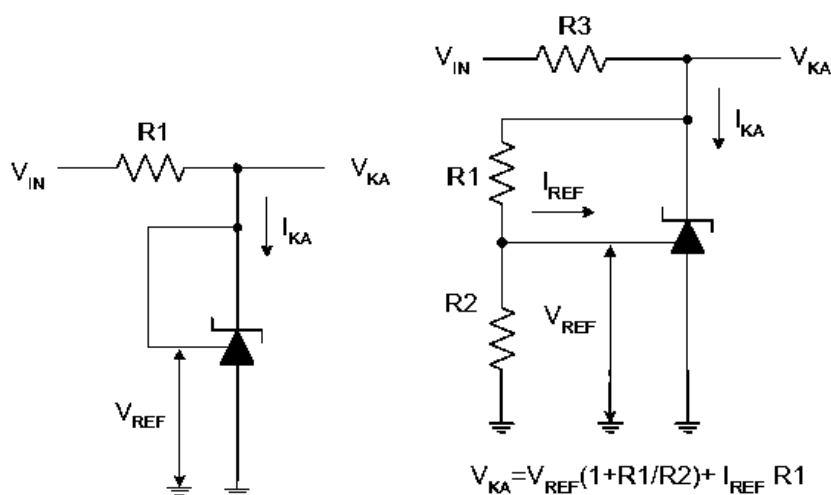


Fig.1: for $V_{KA} = V_{REF}$

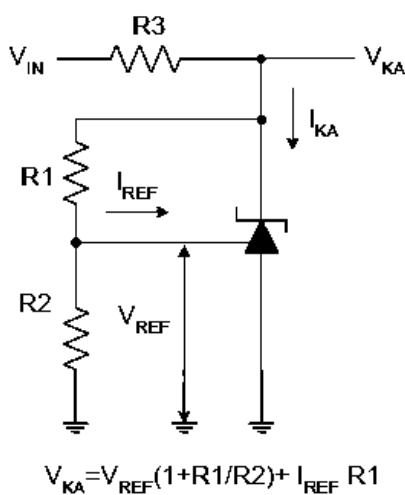


Fig.2: for $V_{KA} > V_{REF}$

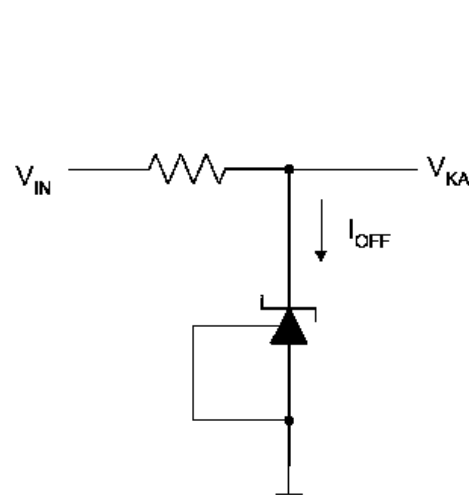
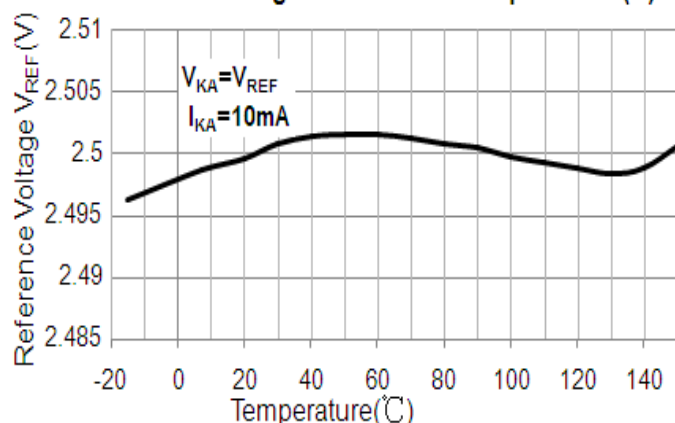


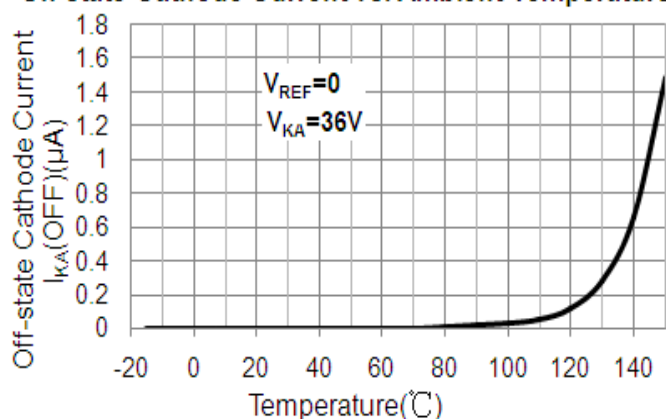
Fig.3: for I_{OFF}

Typical Performance Characteristics

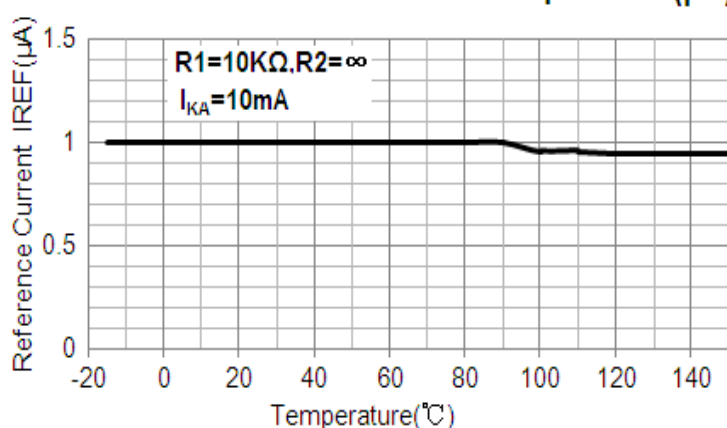
Reference Voltage vs. Ambient Temperature (V)



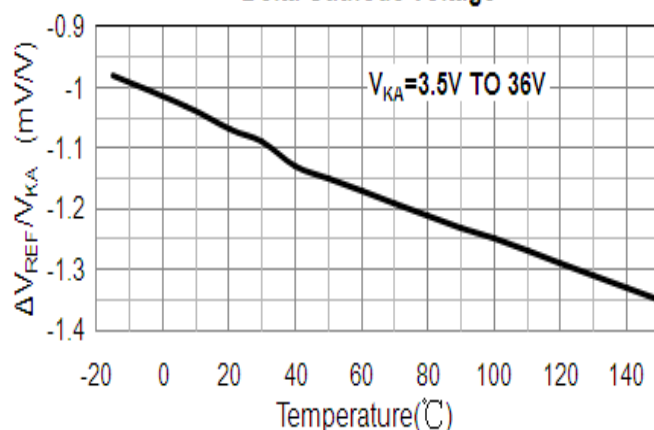
Off-state Cathode Current vs. Ambient Temperature



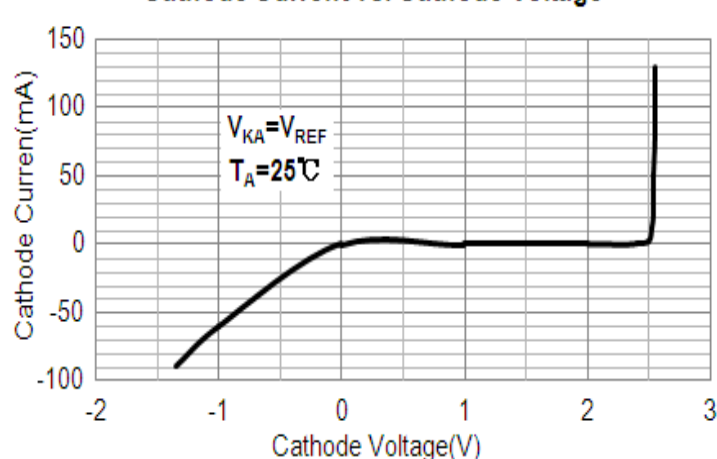
Reference Current vs. Ambient Temperature (μA)



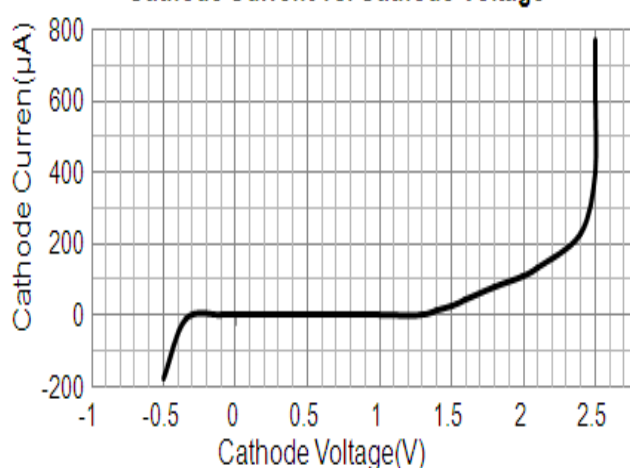
Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage



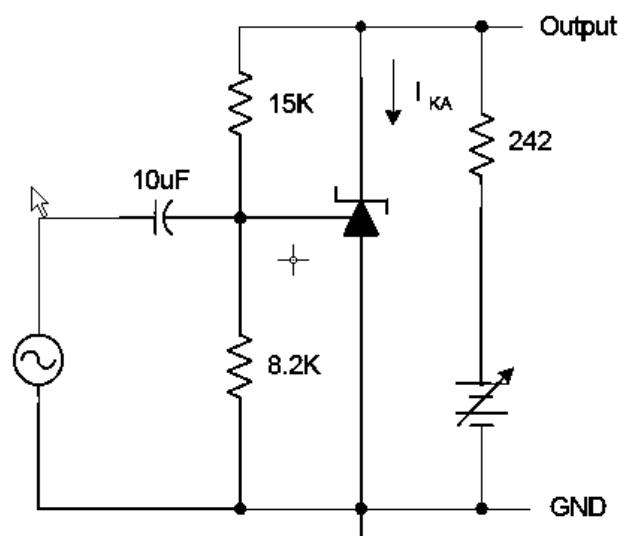
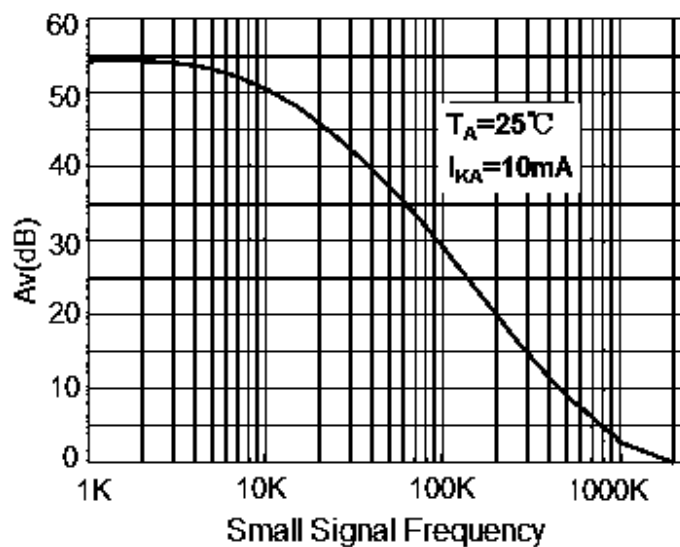
Cathode Current vs. Cathode Voltage



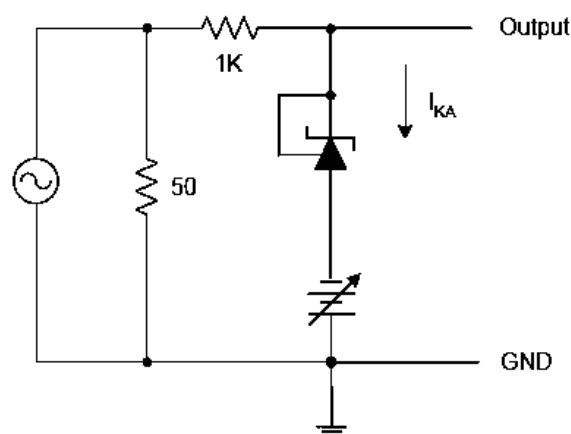
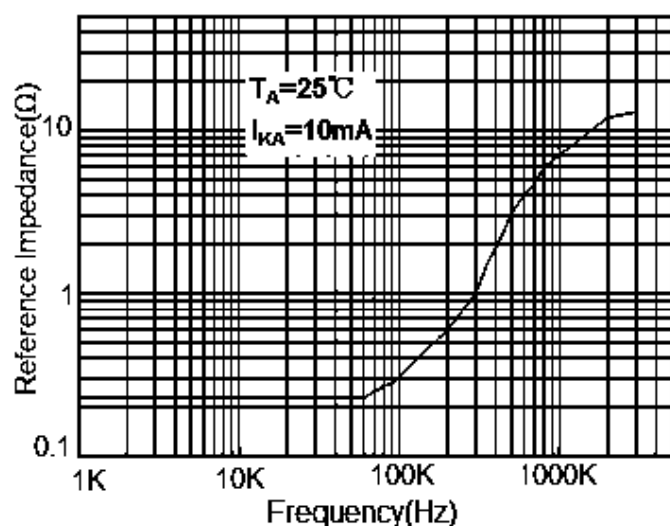
Cathode Current vs. Cathode Voltage



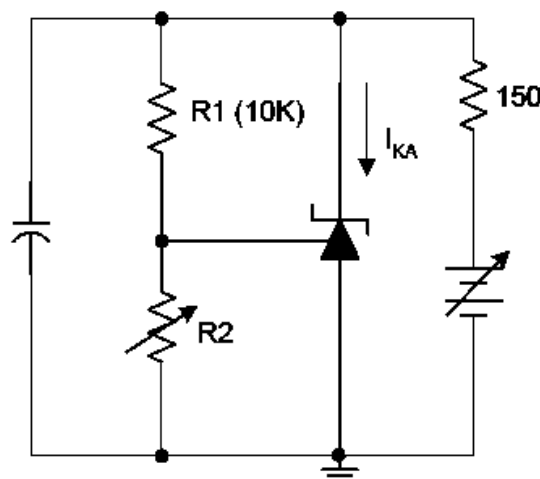
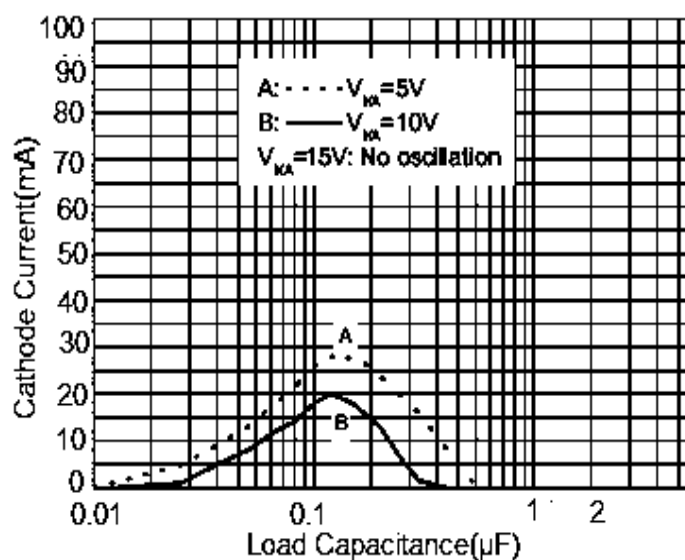
Small Signal Voltage Gain vs. Frequency



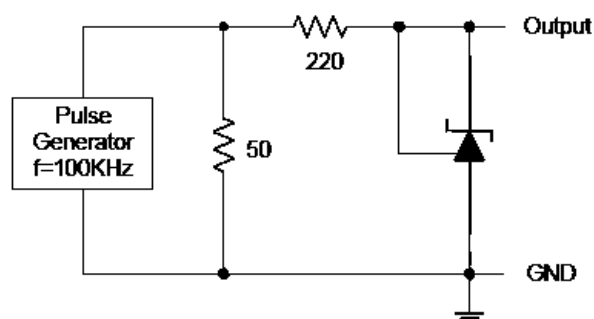
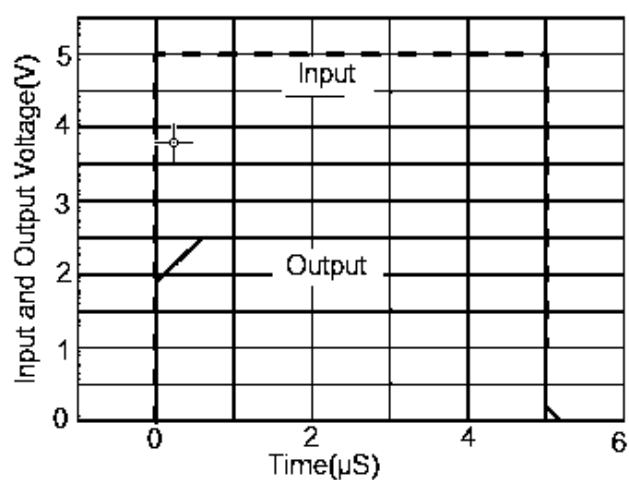
Reference Impedance vs. Frequency



Stability Boundary Conditions vs. Load Capacitance



Pulse Response of Input and Output Voltage



Typical Application

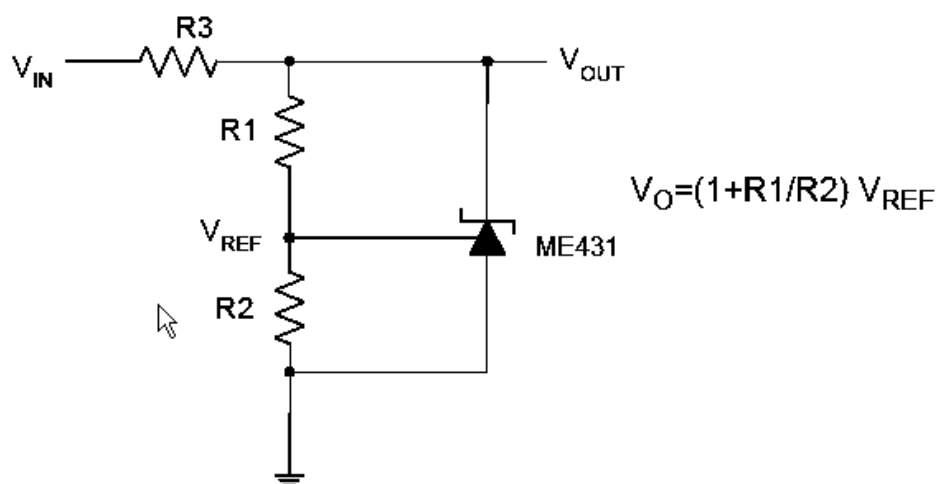


Fig.4: Shunt Regulator

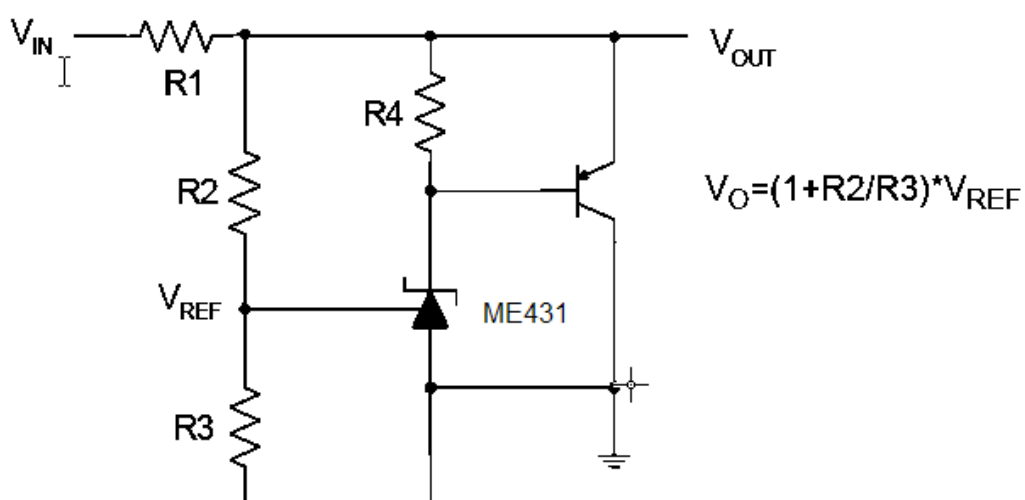


Fig.5: High Current Shunt Regulator

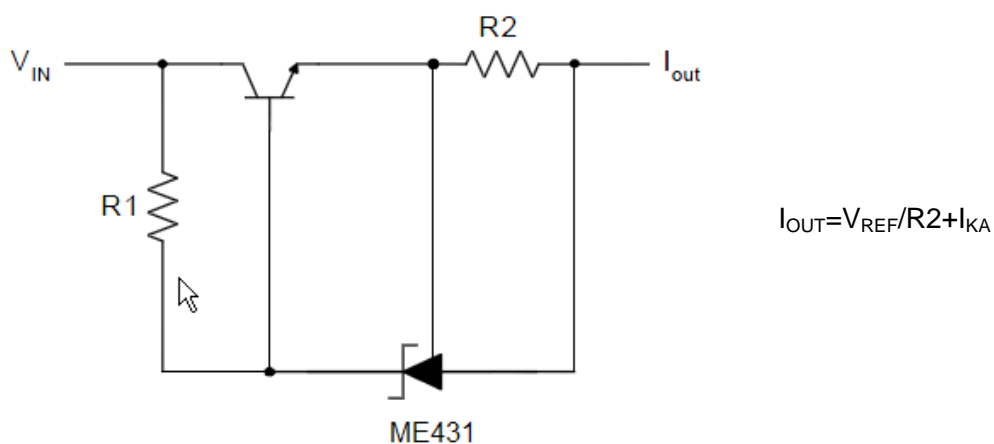


Fig.6: Current Source or Current Limit

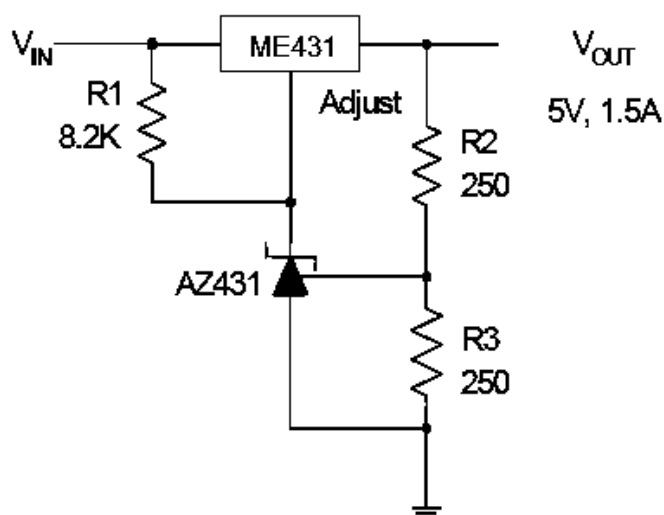
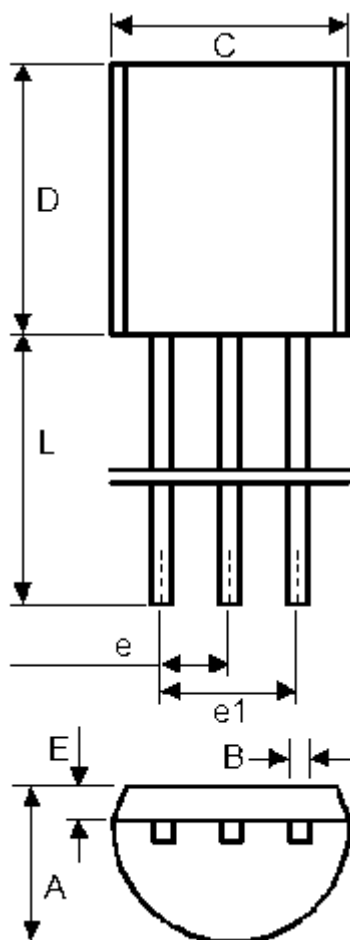


Fig.7: Precision 5V 1.5A Regulator

Packaging Type:

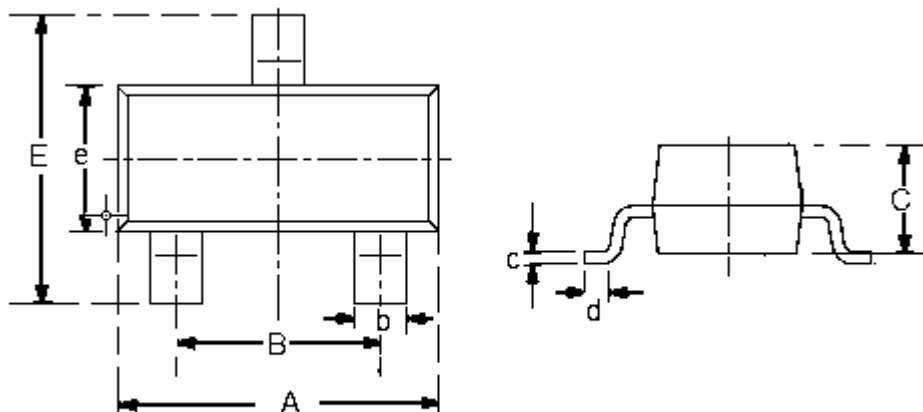
- TO-92



| | Min | Max | Min | Max |
|----|------|------|---------|--------|
| A | 3.4 | 3.8 | 0.13386 | 0.1496 |
| B | 0.3 | 0.5 | 0.0118 | 0.0197 |
| C | 4.4 | 4.8 | 0.1732 | 0.189 |
| D | 4.4 | 4.8 | 0.1732 | 0.189 |
| E | 0.9 | 1.5 | 0.0354 | 0.059 |
| e | 1.17 | 1.37 | 0.046 | 0.0539 |
| e1 | 2.39 | 2.69 | 0.094 | 0.1059 |
| L | 12 | 16 | 0.4724 | 0.6299 |

Packaging Type:

- SOT23-3



| DIM | Millimeters | | Inches | |
|-----|-------------|------|--------|--------|
| | Min | Max | Min | Max |
| A | 2.7 | 3.1 | 0.1063 | 0.122 |
| B | 1.7 | 2.1 | 0.0669 | 0.0827 |
| b | 0.35 | 0.5 | 0.0138 | 0.0197 |
| C | 1.0 | 1.2 | 0.0394 | 0.0472 |
| c | 0.1 | 0.25 | 0.0039 | 0.0098 |
| d | 0.2 | - | 0.0079 | - |
| E | 2.6 | 3.0 | 0.1023 | 0.1181 |
| e | 1.5 | 1.8 | 0.059 | 0.0708 |

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