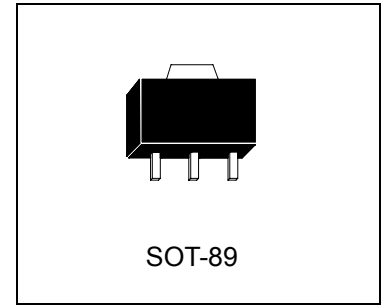


Adjustable Precision Shunt Regulators

TL431M3


Description

The TL431M3 series are three-terminal adjustable regulators with guaranteed thermal stability over applicable temperature range. The output voltage may be set to any value between V_{REF} (approximately 2.495 volts) and 36 volts with two external resistors. These devices have a typical dynamic output impedance of 0.15Ω . Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacement for zener diodes in many applications.

Features

- Programmable output voltage
- Temperature coefficient is 50ppm/°C typical
- Temperature compensated for operation over full temperature range
- Low output noise voltage
- Fast turn on response

Classification

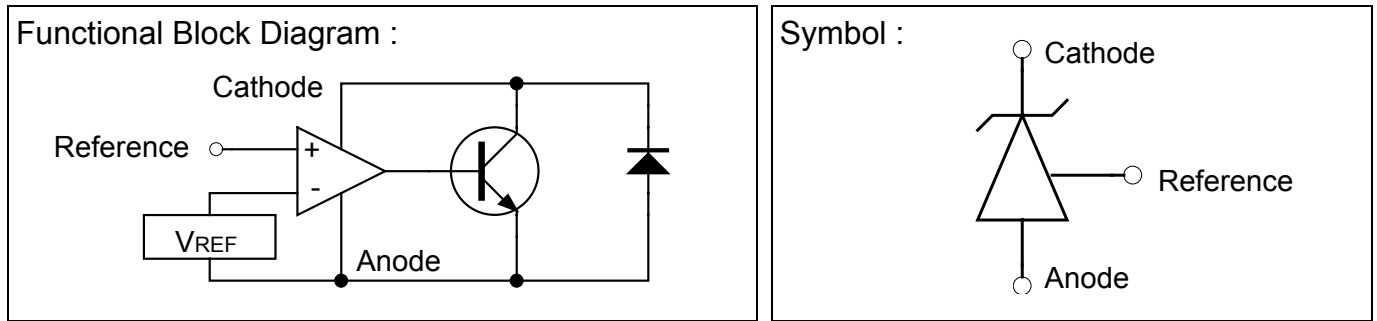
| Rank | A | B | C |
|-----------|------------------|----------------|----------------|
| V_{REF} | $2.495\pm 0.5\%$ | $2.495\pm 1\%$ | $2.495\pm 2\%$ |

Absolute Maximum Ratings

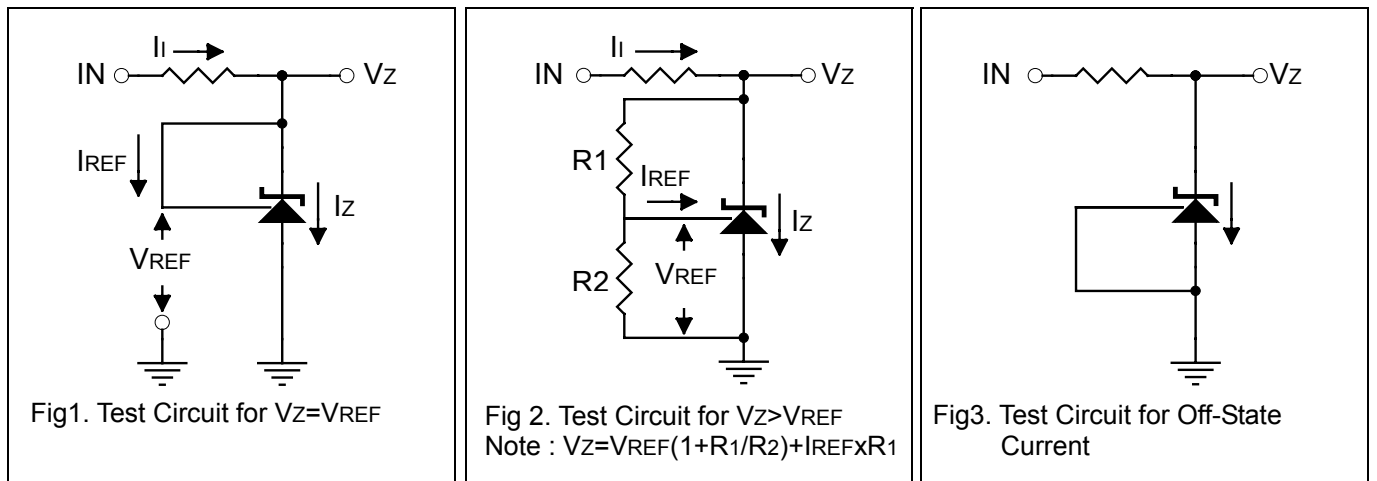
(Operating temperature range applies unless otherwise specified)

| Characteristics | Symbol | Value | Unit |
|------------------------------------|-----------|-----------|------|
| Cathode Voltage | V_{KA} | 36 | V |
| Cathode Current Range (Continuous) | I_K | -100~+150 | mA |
| Reference Input Current Range | I_{REF} | -0.05~+10 | mA |
| Power Dissipation | P_D | 1 | W |
| Operating Temperature Range | T_{opr} | -40~+85 | °C |
| Storage Temperature Range | T_{stg} | -65~+150 | °C |

Functional Block Diagram & Symbol



Test Circuits



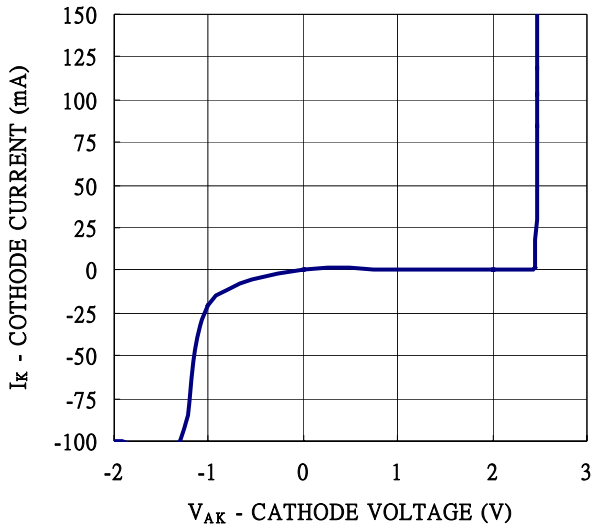
Electrical Characteristics ($T_a=25^\circ\text{C}$ unless otherwise specified)

| Characteristics | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|----------------------------------|--|-------|-------|-------|---------------|
| Reference Input Voltage TL431A TL431B TL431C | V_{REF} | $V_{KA}=V_{REF}, I_K=10\text{mA}$ | 2.483 | 2.495 | 2.507 | V |
| | | | 2.470 | 2.495 | 2.520 | |
| | | | 2.445 | 2.495 | 2.545 | |
| Deviation of Reference Input Voltage Over-Temperature (Note) | $V_{REF(\text{dev})}$ | $V_{KA}=V_{REF}, I_K=10\text{mA}$ $T_{\min} \leq T_a \leq T_{\max}$ | - | 4.5 | 17 | mV |
| Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage | $\Delta V_{REF} / \Delta V_{KA}$ | $I_K=10\text{mA}, \Delta V_{KA}=10\text{V} \sim V_{REF}$ | - | -1.0 | -2.7 | mV/ V |
| | | $I_K=10\text{mA}, \Delta V_{KA}=36\text{V} \sim 10\text{V}$ | - | -0.5 | -2.0 | |
| Reference Input Current | I_{REF} | $I_K=10\text{mA}, R_1=10\text{k}\Omega, R_2=\infty$ | - | 1.5 | 4 | μA |
| Deviation of Reference Input Current Over Full Temperature Range | $I_{REF(\text{dev})}$ | $I_K=10\text{mA}, R_1=10\text{k}\Omega, R_2=\infty, T_a=\text{Full Range}$ | - | 0.4 | 1.2 | μA |
| Minimum Cathode Current for Regulation | $I_{K(\text{min})}$ | $V_{KA}=V_{REF}$ | - | 0.45 | 1.0 | mA |
| Off-State Cathode Current | $I_{K(\text{off})}$ | $V_{KA}=36\text{V}, V_{REF}=0$ | - | 0.05 | 1.0 | μA |
| Dynamic impedance | $ Z_{KA} $ | $V_{KA}=V_{REF}, f \leq 1.0\text{KHz}$ $I_K=1$ to 100mA | - | 0.15 | 0.5 | Ω |

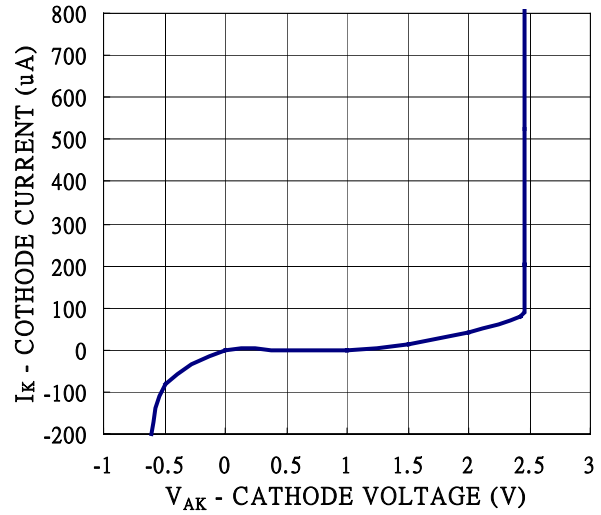
Note : $T_{\min}=0^\circ\text{C}, T_{\max}=70^\circ\text{C}$

Characteristic Curves

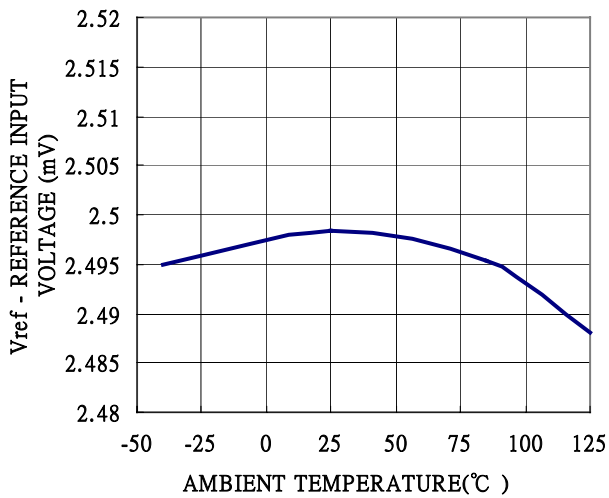
CATHODE CURRENT vs CATHODE VOLTAGE



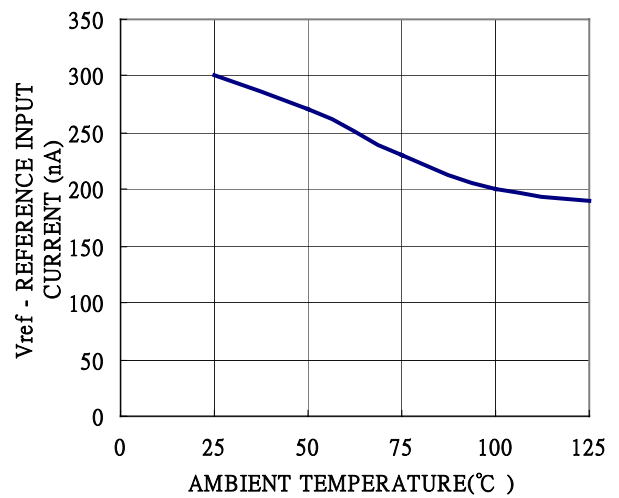
CATHODE CURRENT vs CATHODE VOLTAGE



REFERENCE INPUT VOLTAGE vs AMBIENT TEMPERATURE

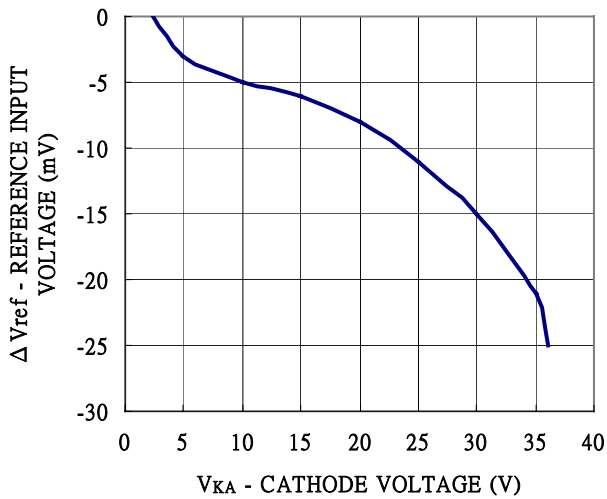


REFERENCE INPUT CURRENT vs AMBIENT TEMPERATURE

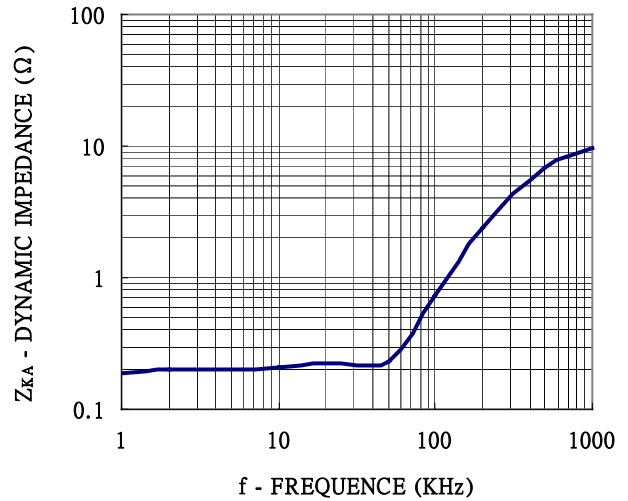


Characteristic Curves(Cont.)

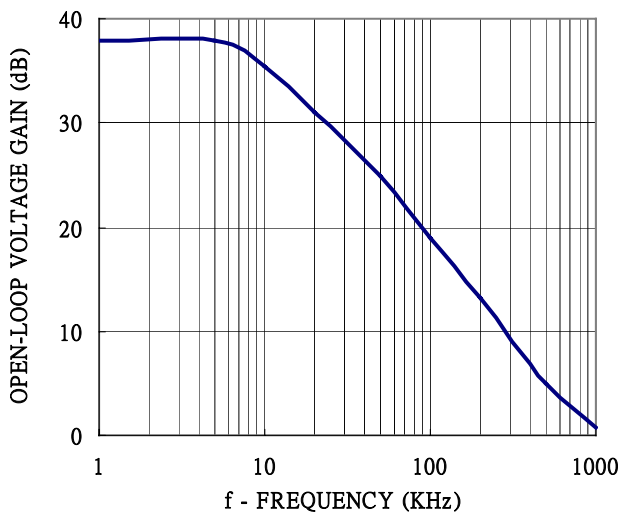
CATHODE VOLTAGE vs REFERENCE INPUT VOLTAGE



DYNAMIC IMPEDANCE vs FREQUENCY



OPEN-LOOP VOLTAGE GAIN vs FREQUENCY



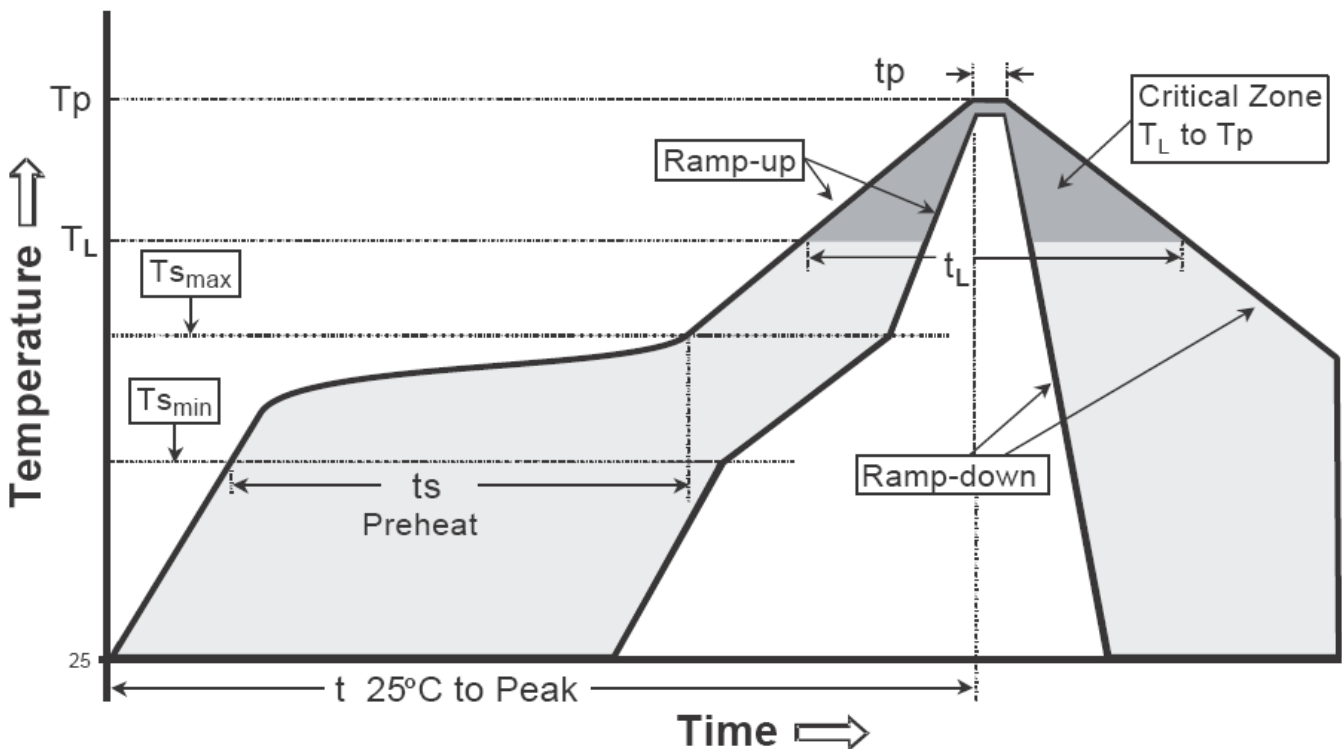
Ordering Information

| Device | Package | Shipping | Marking |
|---------|---------------------|------------------------|---------|
| TL431M3 | SOT-89 (Pb-free) | 1000 pcs / Tape & Reel | 431 |

Recommended wave soldering condition

| | | |
|-----------------|------------------|-----------------|
| Product | Peak Temperature | Soldering Time |
| Pb-free devices | 260 +0/-5 °C | 5 +1/-1 seconds |

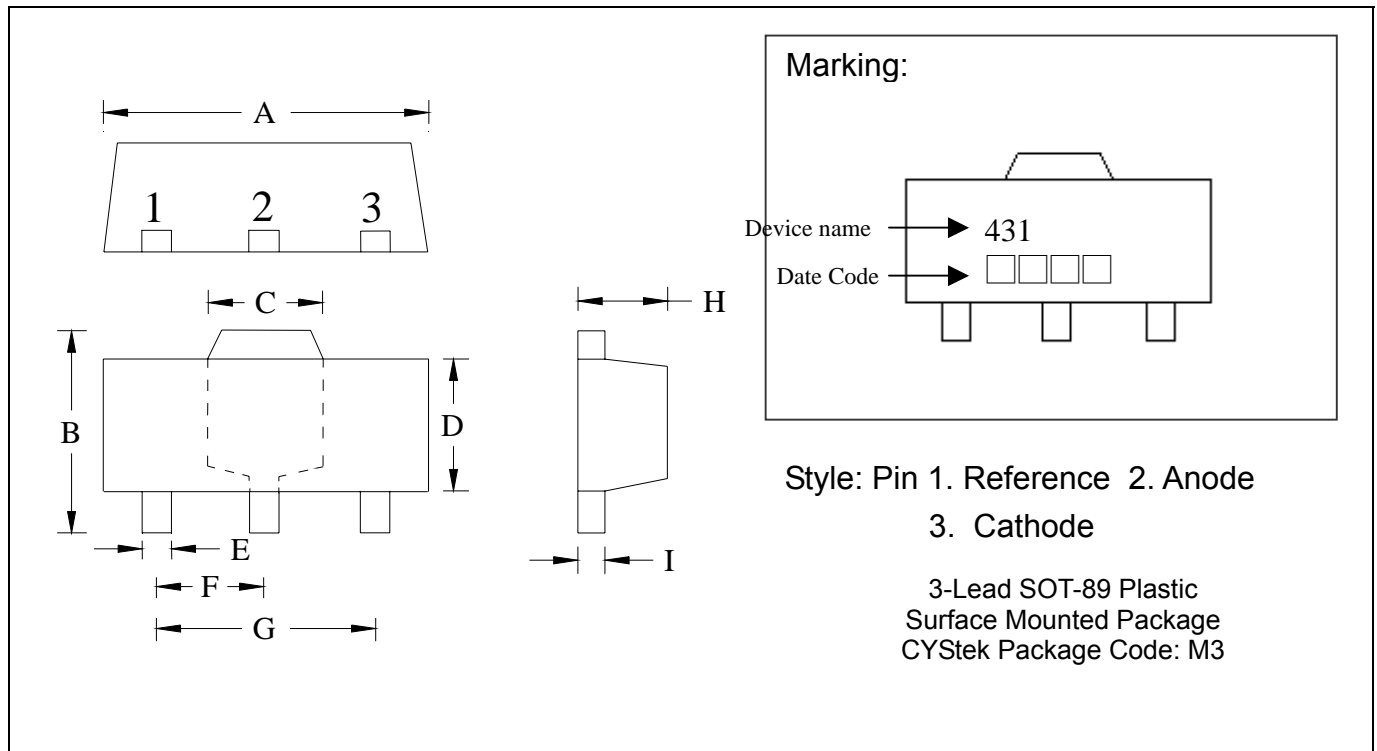
Recommended temperature profile for IR reflow



| Profile feature | Sn-Pb eutectic Assembly | Pb-free Assembly |
|--|-------------------------|------------------|
| Average ramp-up rate (Ts_max to Tp) | 3°C/second max. | 3°C/second max. |
| Preheat | | |
| -Temperature Min(Ts_min) | 100°C | 150°C |
| -Temperature Max(Ts_max) | 150°C | 200°C |
| -Time(ts_min to ts_max) | 60-120 seconds | 60-180 seconds |
| Time maintained above: | | |
| -Temperature (T_L) | 183°C | 217°C |
| - Time (t_L) | 60-150 seconds | 60-150 seconds |
| Peak Temperature(T_P) | 240 +0/-5 °C | 260 +0/-5 °C |
| Time within 5°C of actual peak temperature(tp) | 10-30 seconds | 20-40 seconds |
| Ramp down rate | 6°C/second max. | 6°C/second max. |
| Time 25 °C to peak temperature | 6 minutes max. | 8 minutes max. |

Note : All temperatures refer to topside of the package, measured on the package body surface.

SOT-89 Dimension



*: Typical

| DIM | Inches | | Millimeters | | DIM | Inches | | Millimeters | |
|-----|---------|--------|-------------|------|-----|--------|--------|-------------|-------|
| | Min. | Max. | Min. | Max. | | Min. | Max. | Min. | Max. |
| A | 0.1732 | 0.1811 | 4.40 | 4.60 | F | 0.0583 | 0.0598 | 1.48 | 1.527 |
| B | 0.1594 | 0.1673 | 4.05 | 4.25 | G | 0.1165 | 0.1197 | 2.96 | 3.04 |
| C | 0.0591 | 0.0663 | 1.50 | 1.70 | H | 0.0551 | 0.0630 | 1.40 | 1.60 |
| D | 0.0945 | 0.1024 | 2.40 | 2.60 | I | 0.0138 | 0.0161 | 0.35 | 0.41 |
| E | 0.01417 | 0.0201 | 0.36 | 0.51 | | | | | |

Notes: 1.Controlling dimension: millimeters.
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.
 3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

Material:

- Lead: 42 Alloy ; solder plating
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

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