Absolute Maximum Ratings

(Operating temperature range applies unless otherwise specified.)

| Parameter | Symbol | Value | Unit | | | | | |
|--|--------|-------------|------|--|--|--|--|--|
| Cathode Voltage | VKA | 37 | V | | | | | |
| Cathode Current Range (Continuous) | lka | -100 ~ +150 | mA | | | | | |
| Reference Input Current Range | IREF | -0.05 ~ +10 | mA | | | | | |
| Power Dissipation M, Z Suffix Package N Suffix Package | PD | 770 1000 | mW | | | | | |
| Operating Temperature Range | | | | | | | | |
| LM431xC | Topr | -25 ~ +85 | °C | | | | | |
| LM431xI | TOPR | -40 ~ +85 | °C | | | | | |
| Junction Temperature | TJ | 150 | °C | | | | | |
| Storage Temperature Range | TSTG | -65 ~ +150 | °C | | | | | |

Recommended Operating Conditions

| Parameter | Symbol | Min | Тур | Max | Unit |
|-----------------|--------|------|-----|-----|------|
| Cathode Voltage | VKA | VREF | - | 36 | V |
| Cathode Current | IKA | 1.0 | - | 100 | mA |

Electrical Characteristics

 $(T_A = +25^{\circ}C, \text{ unless otherwise specified})$

| Parameter | Cumbal | Canditions | | LM431A | | LM431B | | LM431C | | | Unit | | |
|---|-----------------------|--|--|--------|-------|--------|-------|--------|-------|-------|-------|-------|------|
| Parameter Symbol | | Conditions | | Min. | Тур. | Max. | Min. | Тур. | Max. | Min. | Тур. | Max. | Unit |
| Reference Input Voltage | VREF | VKA = VRI | EF, IKA =10mA | 2.450 | 2.500 | 2.550 | 2.470 | 2.495 | 2.520 | 2.482 | 2.495 | 2.508 | ٧ |
| Deviation of Reference Input Voltage Over- Temperature | ΔVREF/ ΔT | VKA=VREF, IKA=10mA T _{MIN} ≤T _A ≤T _{MAX} | | - | 4.5 | 17 | - | 4.5 | 17 | - | 4.5 | 17 | mV |
| Ratio of Change in | | | ΔV _K A=10V- V _{REF} | - | -1.0 | -2.7 | - | -1.0 | -2.7 | - | -1.0 | -2.7 | |
| Input Valtage I | IKA =10mA | ΔVKA=36V- 10V | - | -0.5 | -2.0 | - | -0.5 | -2.0 | - | -0.5 | -2.0 | mV/V | |
| Reference Input Current | IREF | IKA=10mA, R ₁ =10kΩ,R ₂ = ∞ | | - | 1.5 | 4 | - | 1.5 | 4 | - | 1.5 | 4 | μА |
| Deviation of Reference Input Current Over Full Temperature Range | ΔI _{REF} /ΔΤ | I _K A=10mA, R ₁ =10kΩ,R ₂ =∞ T _A =Full Range | | - | 0.4 | 1.2 | - | 0.4 | 1.2 | - | 0.4 | 1.2 | μА |
| Minimum Cathode Current for Regulation | IKA(MIN) | VKA=VREF | | 1 | 0.45 | 1.0 | - | 0.45 | 1.0 | - | 0.45 | 1.0 | mA |
| Off - Stage Cathode Current | IKA(OFF) | VKA=36V, VREF=0 | | - | 0.05 | 1.0 | - | 0.05 | 1.0 | - | 0.05 | 1.0 | μА |
| Dynamic Impedance | ZKA | VKA=VREI IKA=1 to 1 f ≥1.0kHz | , | - | 0.15 | 0.5 | - | 0.15 | 0.5 | - | 0.15 | 0.5 | Ω |

Note1

LM431xC: TMIN = -25 °C, TMAX = +85 °C
 LM431xI: TMIN = -40 °C, TMAX = +85 °C

Test Circuits

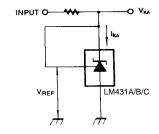


Figure 1. Test Circuit for VKA=VREF

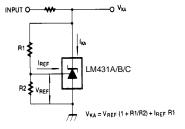


Figure 2. Test Circuit for VKA≥VREF

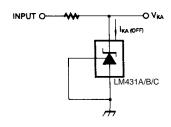


Figure 3. Test Circuit for IKA(OFF)

Typical Performance Characteristics

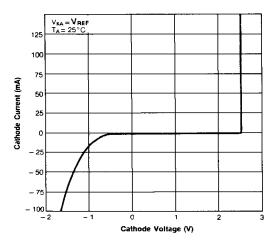


Figure 4. Cathode Current vs. Cathode Voltage

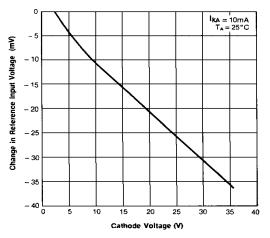


Figure 6. Change In Reference Input Voltage vs. Cathode Voltage

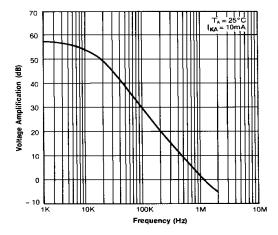


Figure 8. Small Signal Voltage Amplification vs. Frequency

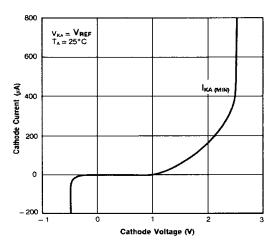


Figure 5. Cathode Current vs. Cathode Voltage

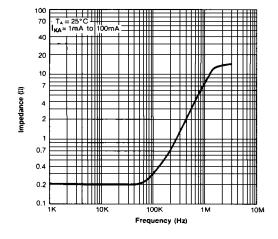


Figure 7. Dynamic Impedance Frequency

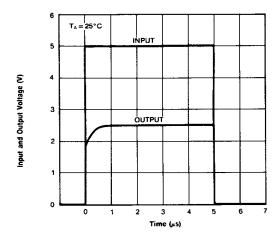


Figure 9. Pulse Response

Typical Performance Characteristics (Continued)

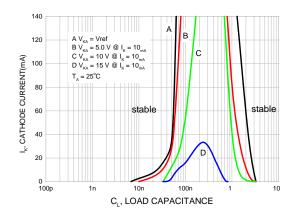


Figure 10. Stability Boundary Conditions

Typical Application

$$V_{O} = \left(1 + \frac{R_{1}}{R_{2}}\right) V_{ref}$$

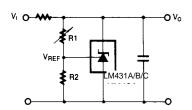


Figure 11. Shunt Regulator

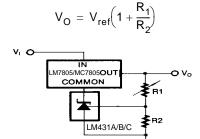


Figure 12. Output Control for Three-Ter minal Fixed Regulator

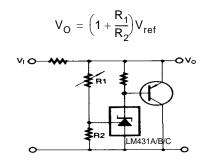


Figure 13. High Current Shunt Regulator

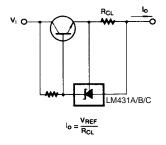


Figure 14. Current Limit or Current Source

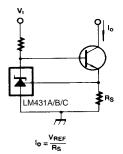


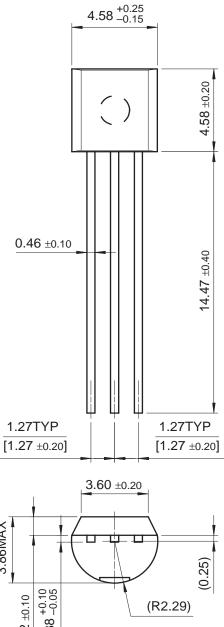
Figure 15. Constant-Current Sink

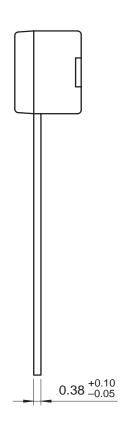
Mechanical Dimensions

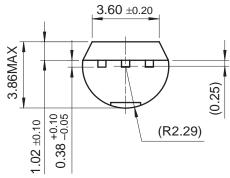
Package

Dimensions in millimeters

TO-92





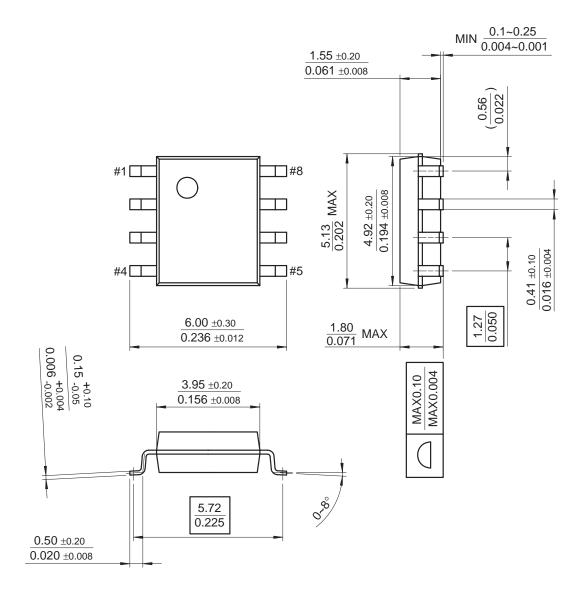


Mechanical Dimensions (Continued)

Package

Dimensions in millimeters

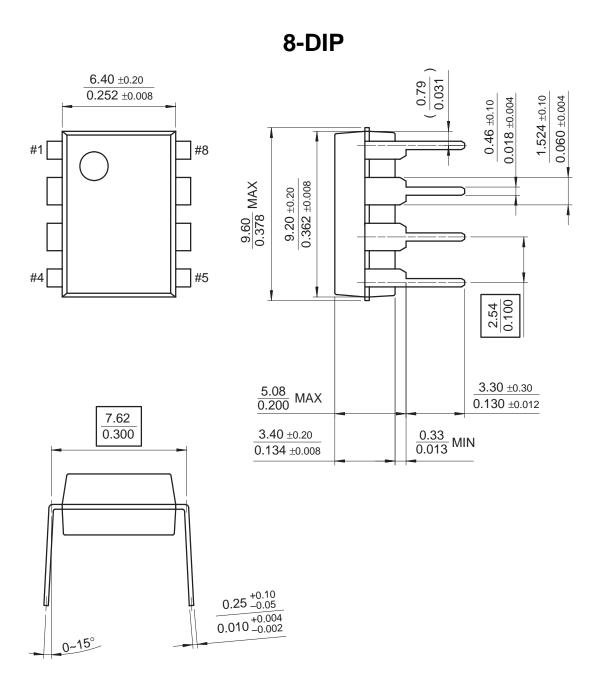
8-SOP



Mechanical Dimensions (Continued)

Package

Dimensions in millimeters



Ordering Information

| Product Number | Output Voltage Tolerance | Package | Operating Temperature |
|----------------|--------------------------|---------|-----------------------|
| LM431CCZ | 0.5% | TO-92 | |
| LM431CCM | 0.576 | 8-SOP | |
| LM431BCZ | 1% | TO-92 | |
| LM431BCM | 1 /0 | 8-SOP | -25 ~ +85°C |
| LM431ACN | | 8-DIP | |
| LM431ACZ | 2% | TO-92 | |
| LM431ACM | | 8-SOP | |
| LM431CIZ | 0.5% | TO-92 | |
| LM431CIM | 0.5% | 8-SOP | |
| LM431BIZ | 1% | TO-92 | -40 ~ +85°C |
| LM431BIM | 1 70 | 8-SOP | -40 ~ +00 C |
| LM431AIZ | 2% | TO-92 | |
| LM431AIM | 270 | 8-SOP | |

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

- Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
- A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

www.fairchildsemi.com