

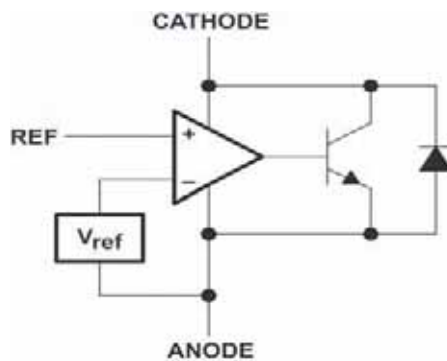
Description

The R431AS2 is a 3-terminal adjustable shunt regulator with guaranteed temperature stability over the entire temperature range of operation. The output voltage may be set at any level greater than 2.5V (VREF) up to 36V merely by selecting two external resistors that act as a voltage divided network. Due to the sharp turn-on characteristics this device is an excellent replacement for many zener diode applications.

Features

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

Representative Block Diagram

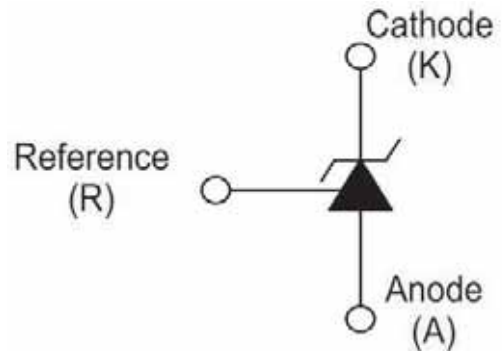


PACKAGE

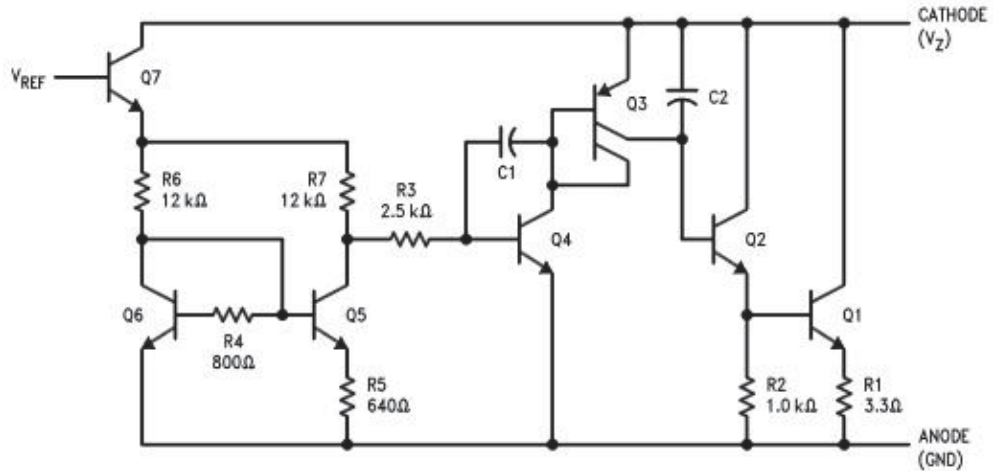
SOT-23:



Symbol



Representative Schematic Diagram



Absolute Maximum Ratings (Note 2)

Parameter	Value	Unit	
Storage Temperature Range	-65~150	°C	
Operating Temperature Range	-40~85	°C	
Infrared or Convection (10 sec.)	235	°C	
Cathode Voltage	37	V	
Continuous Cathode Current	-100~150	mA	
Reference Voltage	0.7	V	
Reference Input Current	10	mA	
Internal Power Dissipation (Notes 3, 4)	SOT-23 Package	0.28	W
Operating Conditions	Cathode Voltage	36	V
	Cathode Current	1~100	mA

Electrical Characteristics

T_A = 25°C unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
VREF	Reference Voltage	V _Z = VREF, I _I = 10 mA (±0.4%) (Figure 1)	2.483	2.495	2.508	V
VDEV	Deviation of Reference Input Voltage Over Temperature (Note 5)	V _Z = VREF, I _I = 10 mA, T _A = Full Range (Figure 1)		8.0	17	mV
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of the Change in Reference Voltage to the Change in Cathode Voltage	I _Z = 10 mA Figure 2)		-1.4	-2.7	mV/V
		V _Z from VREF to 10V V _Z from 10V to 36V		-1.0	-2.0	
IREF	Reference Input Current	R1 = 10 k , R2 = ∞ , I _I = 10 mA (Figure 2)		2.0	4.0	μA
IREF	Deviation of Reference Input Current over	R1 = 10 k , R2 = ∞ , I _I = 10 mA,		0.4	1.2	μA

	Temperature	TA = Full Range				
IZ(MIN)	Minimum Cathode Current for Regulation	VZ = VREF		0.4	1.0	mA
IZ(OFF)	Off-State Current	VZ = 36V, VREF = 0V (Figure 3)		0.3	1.0	uA
rZ	Dynamic Output Impedance	VZ = VREF, TL431AA, Frequency = 0 Hz (Figure 1)			0.75	
		VZ = VREF, TL431AB, TL431AC Frequency = 0 Hz (Figure 1)			0.50	

Note 2: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Electrical specifications do not apply when operating the device beyond its rated operating conditions.

Note 3: TJ Max = 150°C.

Note 4: Ratings apply to ambient temperature at 25°C. Above this temperature, derate the SOT-23 at 2.2 mW/°C.

Note 5: Deviation of reference input voltage, VDEV, is defined as the maximum variation of the reference input voltage over the full temperature range.

DC Test Circuits

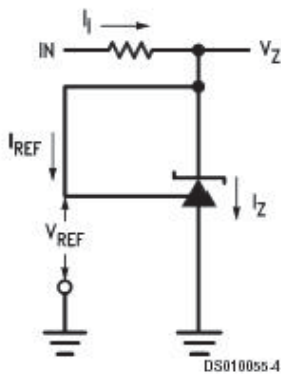
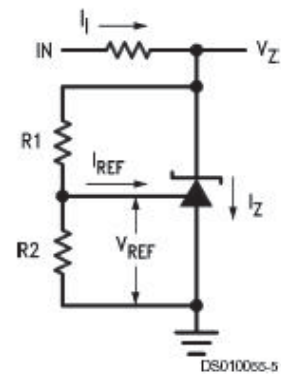


FIGURE 1. Test Circuit for $V_Z = V_{REF}$



Note: $V_Z = V_{REF} (1 + R1/R2) + I_{REF} \cdot R1$

FIGURE 2. Test Circuit for $V_Z > V_{REF}$

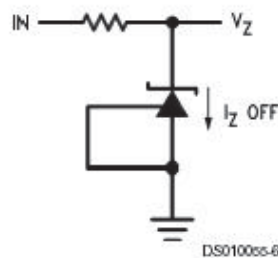
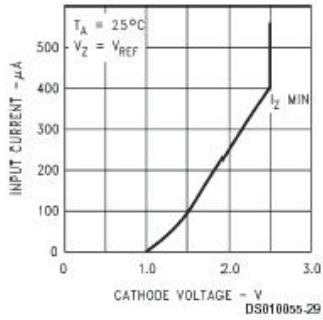


FIGURE 3. Test Circuit for Off-State Current

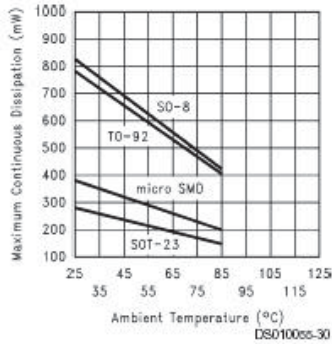
RATING AND CHARACTERISTICS CURVES (R431AS2)

Typical Performance Characteristics

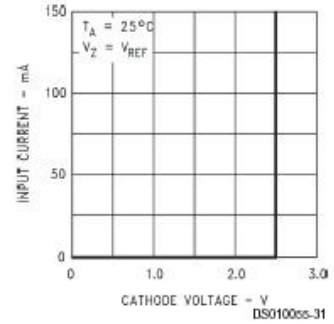
Input Current vs V_Z



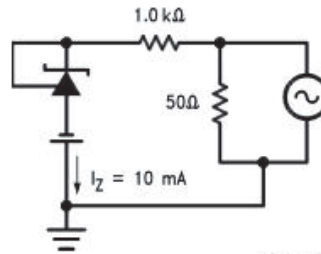
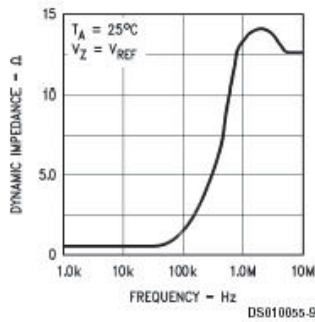
Thermal Information



Input Current vs V_Z

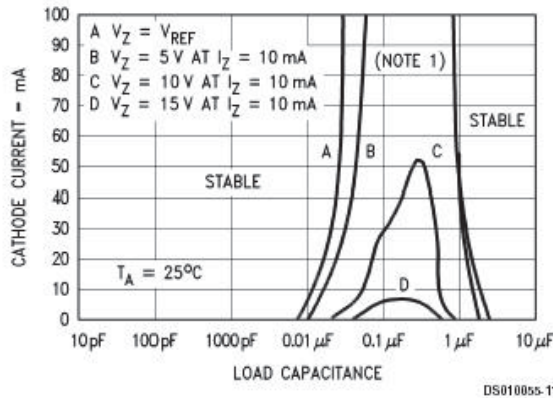


Dynamic Impedance vs Frequency



DS010055-10

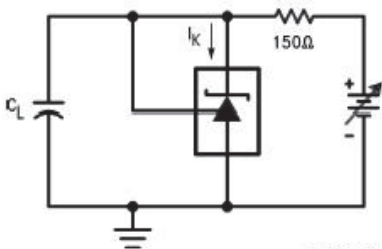
Stability Boundary Conditions



DS010055-11

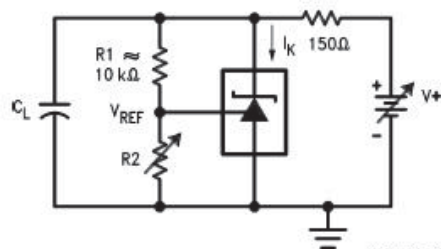
Note: The areas under the curves represent conditions that may cause the device to oscillate. For curves B, C, and D, R_2 and V^+ were adjusted to establish the initial V_Z and I_Z conditions with $C_L = 0$. V^+ and C_L were then adjusted to determine the ranges of stability.

Test Circuit for Curve A Above



DS010055-12

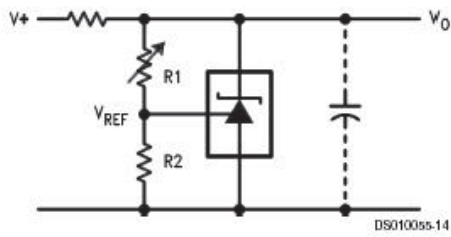
Test Circuit for Curves B, C and D Above



DS010055-13

Typical Applications

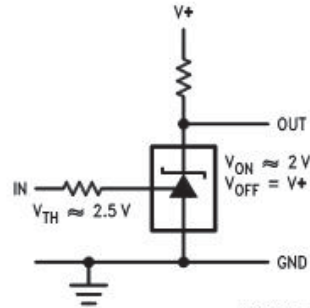
Shunt Regulator



DS010055-14

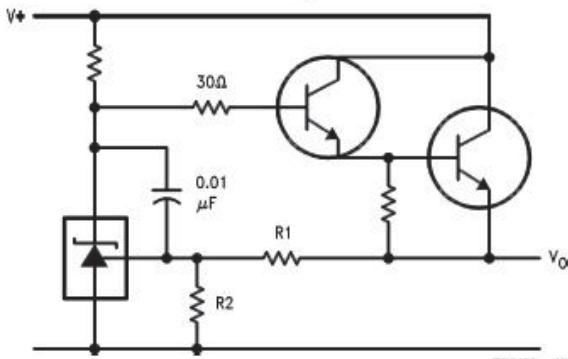
$$V_O \approx \left(1 + \frac{R1}{R2}\right) V_{REF}$$

Single Supply Comparator with Temperature Compensated Threshold



DS010055-15

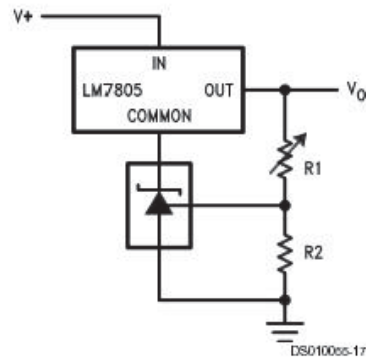
Series Regulator



DS010055-16

$$V_O \approx \left(1 + \frac{R1}{R2}\right) V_{REF}$$

Output Control of a Three Terminal Fixed Regulator

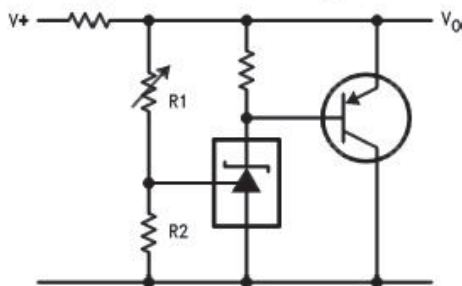


DS010055-17

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

$$V_{O \text{ MIN}} = V_{REF} + 5V$$

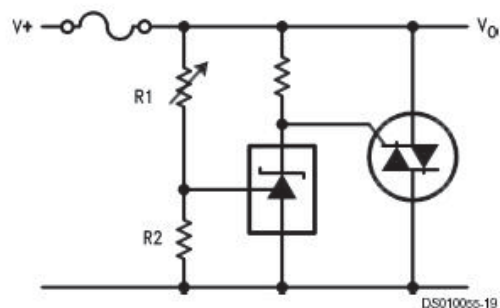
Higher Current Shunt Regulator



DS010055-18

$$V_O \approx \left(1 + \frac{R1}{R2}\right) V_{REF}$$

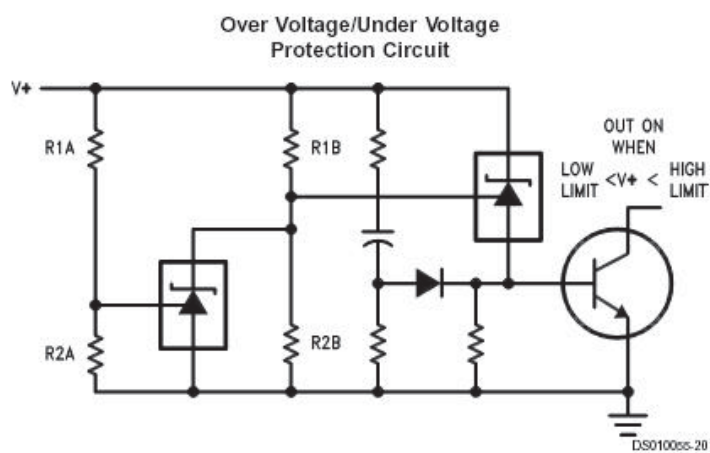
Crow Bar



DS010055-19

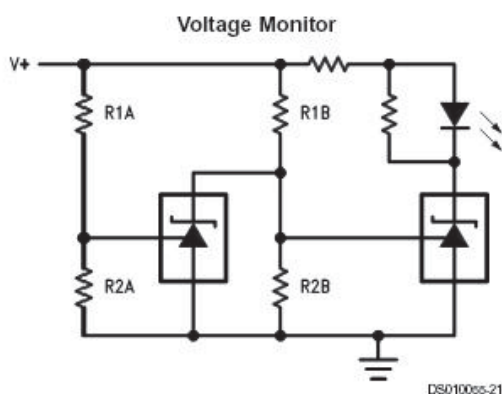
$$V_{LIMIT} \approx \left(1 + \frac{R1}{R2}\right) V_{REF}$$

Typical Applications (Continued)



$$\text{LOW LIMIT} \approx V_{\text{REF}} \left(1 + \frac{R1B}{R2B} \right) + V_{\text{BE}}$$

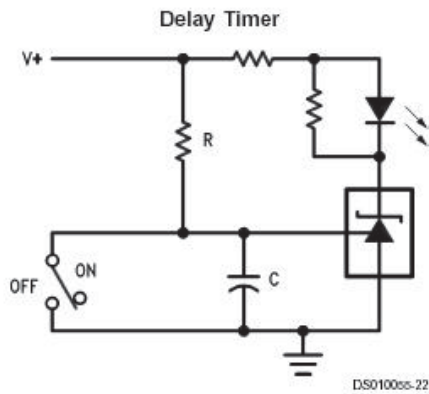
$$\text{HIGH LIMIT} \approx V_{\text{REF}} \left(1 + \frac{R1A}{R2A} \right)$$



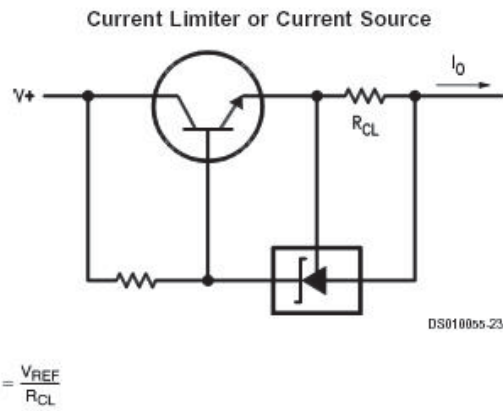
$$\text{LOW LIMIT} \approx V_{\text{REF}} \left(1 + \frac{R1B}{R2B} \right) \quad \text{LED ON WHEN LOW LIMIT} < V^+ < \text{HIGH LIMIT}$$

$$\text{HIGH LIMIT} \approx V_{\text{REF}} \left(1 + \frac{R1A}{R2A} \right)$$

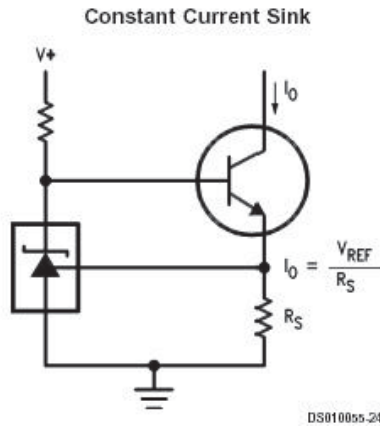
Typical Applications (Continued)



$$\text{DELAY} = R \cdot C \cdot \ln \frac{V^+}{(V^+) - V_{REF}}$$



$$I_o = \frac{V_{REF}}{R_{CL}}$$



$$I_o = \frac{V_{REF}}{R_S}$$

PACKAGING OF DIODE

REEL PACK

PACKAGE	PACKING CODE	REEL (EA)	BOX (EA)	BOX SIZE (mm)	CARTON SIZE (mm)	EA PER CARTON
SOT-23	-T	3,000	30,000	180*120*180	390*385*205	180,000

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