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XB431-LM

1 Features

- Low-Voltage Operation/Wide Adjust Range (1.24 V/30 V)
- 0.5% Initial Tolerance (XB431)
- Temperature Compensated for Industrial Temperature Range (39 PPM/°C for the XB431)
- Low Operation Current (55 µA)
- Low Output Impedance (0.25 Ω)
- Fast Turn-On Response
- Low Cost

2 Applications

- Shunt Regulator
- Series Regulator
- Current Source or Sink
- Voltage Monitor
- Error Amplifier
- 3-V Off-Line Switching Regulator
- Low Dropout N-Channel Series Regulator

3 Description

The XB431 are precision 1.24 V shunt regulators capable of adjustment to 30 V. Negative feedback from the cathode to the adjust pin controls the cathode voltage, much like a non-inverting op amp configuration (Refer to *Symbol and Functional Diagrams*). A two-resistor voltage divider terminated at the adjust pin controls the gain of a 1.24 V band-gap reference. Shorting the cathode to the adjust pin (voltage follower) provides a cathode voltage of a 1.24 V.

The XB431 have respective initial tolerances of 1.5%, 1%, and 0.5%, and functionally lend themselves to several applications that require zener diode type performance at low voltages. Applications include a 3 V to 2.7 V low drop-out regulator, an error amplifier in a 3 V off-line switching regulator and even as a voltage detector. These parts are typically stable with capacitive loads greater than 10 nF and less than 50 pF.

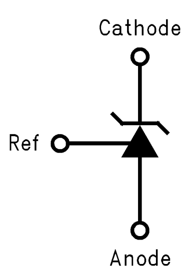
The XB431 provide performance at a competitive price.

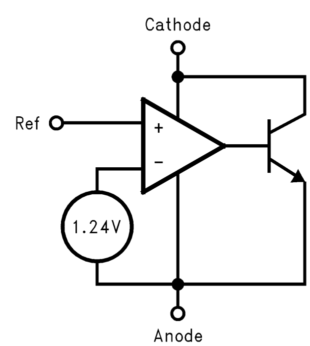
4 Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
XB431	SOT-23 (5)	2.90 mm x 1.60 mm
	TO-92 (3)	4.30 mm x 4.30 mm
	SOT-23 (3)	2.92 mm x 1.30 mm

(1) For all available packages, see the orderable addendum at the end of the datasheet.

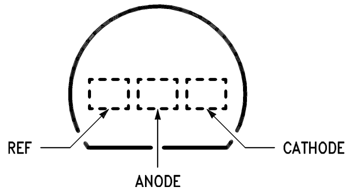
5 Symbol and Functional Diagrams



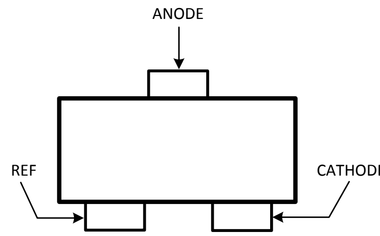


6 Pin Configurations and Functions

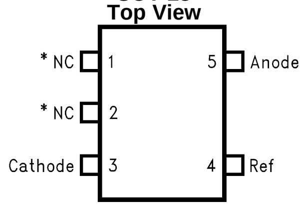
TO-92: Plastic Package
Top View



SOT-23
Top View



SOT-23
Top View



*Pin 1 is not internally connected.

*Pin 2 is internally connected to Anode pin. Pin 2 should be either floating or connected to Anode pin.

7 Specifications

7.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) (1)

		MIN	MAX	UNIT
Operating temperature	Industrial (XB431)	−40	85	°C
	Commercial (XB431)	0	70	
Lead temperature	TO-92 Package/SOT-23 -5,-3 Package (Soldering, 10 sec.)		265	
Internal power dissipation (2)	TO-92		0.78	W
	SOT-23-5, -3 Package		0.28	W
Cathode voltage			35	V
Continuous cathode current		−30	30	mA
Reference input current		−.05	3	

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) Ratings apply to ambient temperature at 25°C. Above this temperature, derate the TO-92 at 6.2 mW/°C, and the SOT-23-5 at 2.2 mW/°C. See derating curve in Operating Condition section.

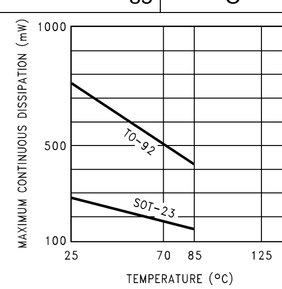
7.2 Handling Ratings

			MIN	MAX	UNIT
T_{stg}	Storage temperature range		−65	150	°C
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins (1)		2000	V

(1) The human body model is a 100 pF capacitor discharged through a 1.5kΩ resistor into each pin. The machine model is a 200 pF capacitor discharged directly into each pin. MIL-STD-883 3015.7.

7.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

		MIN	NOM	MAX	UNIT
Cathode voltage		V_{REF}		30	V
Cathode current		0.1		15	mA
Temperature	XB431	−40		85	°C
Derating Curve (Slope = $-1/R_{\theta JA}$)					

7.4 Thermal Information

THERMAL METRIC (1)		XB431 SOT-23 3 PINS	XB431 SOT-23 5 PINS	XB431 TO-92 3 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance (2)	455	455	161	°C/W

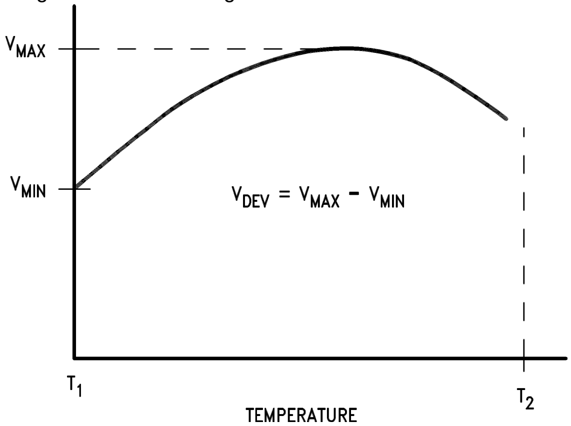
(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.
(2) $T_{J\ Max}$ = 150°C, $T_J = T_A + (R_{\theta JA}\ P_D)$, where P_D is the operating power of the device.

7.5 XB431 Electrical Characteristics

T_A = 25°C unless otherwise specified

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{REF}	Reference Voltage	$V_Z = V_{REF}$, I_Z = 10 mA *(See Figure 32)*	T_A = 25°C	1.222	1.24	1.258	V
			T_A = Full Range	1.21		1.27	
V_{DEV}	Deviation of Reference Input Voltage Over Temperature(1)	$V_Z = V_{REF}$, I_Z = 10 mA, T_A = Full Range *(See Figure 32)*			4	12	mV
$\frac{\Delta V_{REF}}{\Delta V_Z}$	Ratio of the Change in Reference Voltage to the Change in Cathode Voltage	I_Z = 10 mA *(see Figure 33)* V_Z from V_{REF} to 6 V R_1 = 10 kΩ, R_2 = ∞ and 2.6 kΩ			−1.5	−2.7	mV/V
I_{REF}	Reference Input Current	R_1 = 10 kΩ, R_2 = ∞ I_I = 10 mA *(see Figure 33)*			0.15	0.5	μA
$\propto I_{REF}$	Deviation of Reference Input Current over Temperature	R_1 = 10 kΩ, R_2 = ∞, I_I = 10 mA, T_A = Full Range *(see Figure 33)*			0.05	0.3	μA
$I_{Z(MIN)}$	Minimum Cathode Current for Regulation	$V_Z = V_{REF}$ *(see Figure 32)*			55	80	μA
$I_{Z(OFF)}$	Off-State Current	V_Z= 6 V, V_{REF} = 0 V *(see Figure 34)*			0.001	0.1	μA
r_Z	Dynamic Output Impedance(2)	$V_Z = V_{REF}$, I_Z = 0.1 mA to 15 mA Frequency = 0 Hz *(see Figure 32)*			0.25	0.4	Ω

(1) Deviation of reference input voltage, V_{DEV}, is defined as the maximum variation of the reference input voltage over the full temperature range. See the following:



The average temperature coefficient of the reference input voltage, $\propto V_{REF}$, is defined as:

$$\propto V_{REF}\ \frac{ppm}{°C} = \frac{\pm\left(\frac{V_{Max} - V_{Min}}{V_{REF}(\text{at } 25°C)}\right)10^6}{T_2 - T_1} = \frac{\pm\left(\frac{V_{DEV}}{V_{REF}(\text{at } 25°C)}\right)10^6}{T_2 - T_1}$$

Where: $T_2 - T_1$ = full temperature change. $\propto V_{REF}$ can be positive or negative depending on whether the slope is positive or negative.
Example: V_{DEV} = 6 mV, V_{REF} = 1240 mV, $T_2 - T_1$ = 125°C.

$$\propto V_{REF} = \frac{\left(\frac{6.0\text{ mV}}{1240\text{ mV}}\right)10^6}{125°C} = +39\text{ ppm} / °C$$

(2) The dynamic output impedance, r_Z, is defined as:

$$r_Z = \frac{\Delta V_Z}{\Delta I_Z}$$

When the device is programmed with two external resistors, R1 and R2, (see *Figure 33*), the dynamic output impedance of the overall circuit, r_Z, is defined as:

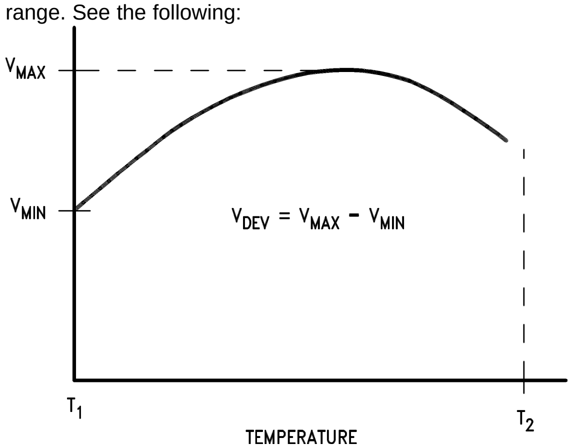
$$r_Z = \frac{\Delta V_Z}{\Delta I_Z} \cong \left[r_Z\left(1 + \frac{R1}{R2}\right)\right]$$

7.6 XB431 Electrical Characteristics

T_A = 25°C unless otherwise specified

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{REF}	Reference Voltage	$V_Z = V_{REF}$, I_Z = 10 mA *(See Figure 32)*	T_A = 25°C	1.222	1.24	1.258	V
			T_A = Full Range	1.202		1.278	
V_{DEV}	Deviation of Reference Input Voltage Over Temperature (1)	$V_Z = V_{REF}$, I_Z = 10 mA, T_A = Full Range *(See Figure 32)*			6	20	mV
$\frac{\Delta V_{REF}}{\Delta V_Z}$	Ratio of the Change in Reference Voltage to the Change in Cathode Voltage	I_Z = 10mA *(see Figure 33)* V_Z from V_{REF} to 6V R_1 = 10 kΩ, R_2 = ∞ and 2.6kΩ			−1.5	−2.7	mV/V
I_{REF}	Reference Input Current	R_1 = 10 kΩ, R_2 = ∞ I_I = 10 mA *(see Figure 33)*			0.15	0.5	µA
$\propto I_{REF}$	Deviation of Reference Input Current over Temperature	R_1 = 10 kΩ, R_2 = ∞, I_I = 10 mA, T_A = Full Range *(see Figure 33)*			0.1	0.4	µA
$I_{Z(MIN)}$	Minimum Cathode Current for Regulation	$V_Z = V_{REF}$*(see Figure 32)*			55	80	µA
$I_{Z(OFF)}$	Off-State Current	V_Z = 6 V, V_{REF} = 0V *(see Figure 34)*			0.001	0.1	µA
r_Z	Dynamic Output Impedance (2)	$V_Z = V_{REF}$, I_Z = 0.1 mA to 15 mA Frequency = 0 Hz *(see Figure 32)*			0.25	0.4	Ω

(1) Deviation of reference input voltage, V_{DEV}, is defined as the maximum variation of the reference input voltage over the full temperature range. See the following:



The average temperature coefficient of the reference input voltage, $\propto V_{REF}$, is defined as:

$$\propto V_{REF}\frac{ppm}{°C} = \frac{\pm\left(\frac{V_{Max}-V_{Min}}{V_{REF}(\text{at }25°C)}\right)10^6}{T_2-T_1} = \frac{\pm\left(\frac{V_{DEV}}{V_{REF}(\text{at }25°C)}\right)10^6}{T_2-T_1}$$

Where: $T_2 - T_1$ = full temperature change. $\propto V_{REF}$ can be positive or negative depending on whether the slope is positive or negative.
Example: V_{DEV} = 6 mV, V_{REF} = 1240 mV, $T_2 - T_1$ = 125°C.

$$\propto V_{REF} = \frac{\left(\frac{6.0\text{ mV}}{1240\text{ mV}}\right)10^6}{125°C} = +39\text{ ppm}/°C$$

(2) The dynamic output impedance, r_Z, is defined as:

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When the device is programmed with two external resistors, R1 and R2, (see *Figure 33*), the dynamic output impedance of the overall circuit, r_Z, is defined as:

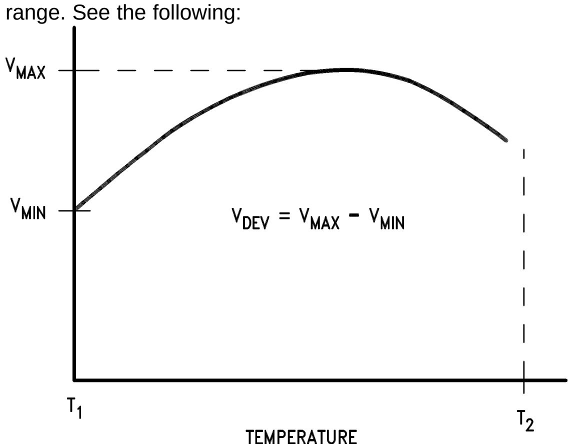
$$r_Z = \frac{\Delta V_Z}{\Delta I_Z} \cong \left[r_Z\left(1+\frac{R1}{R2}\right)\right]$$

7.7 XB431Electrical Characteristics

T_A = 25°C unless otherwise specified

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{REF}	Reference Voltage	$V_Z = V_{REF}$, I_Z = 10 mA *(See Figure 32)*	T_A = 25°C	1.228	1.24	1.252	V
			T_A = Full Range	1.221		1.259	
V_{DEV}	Deviation of Reference Input Voltage Over Temperature[(1)]	$V_Z = V_{REF}$, I_Z = 10 mA, T_A = Full Range *(See Figure 32)*			4	12	mV
$\frac{\Delta V_{REF}}{\Delta V_Z}$	Ratio of the Change in Reference Voltage to the Change in Cathode Voltage	I_Z = 10 mA *(see Figure 33)* V_Z from V_{REF} to 6 V R_1 = 10 kΩ, R_2 = ∞ and 2.6 kΩ			−1.5	−2.7	mV/V
I_{REF}	Reference Input Current	R_1 = 1 kΩ, R_2 = ∞ I_I = 10 mA *(see Figure 33)*			0.15	0.50	µA
$\propto I_{REF}$	Deviation of Reference Input Current over Temperature	R_1 = 10 kΩ, R_2 = ∞, I_I = 10 mA, T_A = Full Range *(see Figure 33)*			0.05	0.3	µA
$I_{Z(MIN)}$	Minimum Cathode Current for Regulation	$V_Z = V_{REF}$*(see Figure 32)*			55	80	µA
$I_{Z(OFF)}$	Off-State Current	V_Z = 6 V, V_{REF} = 0V *(see Figure 34)*			0.001	0.1	µA
r_Z	Dynamic Output Impedance[(2)]	$V_Z = V_{REF}$, I_Z = 0.1mA to 15mA Frequency = 0 Hz *(see Figure 32)*			0.25	0.4	Ω

(1) Deviation of reference input voltage, V_{DEV}, is defined as the maximum variation of the reference input voltage over the full temperature range. See the following:



The average temperature coefficient of the reference input voltage, $\propto V_{REF}$, is defined as:

$$\propto V_{REF}\ \frac{ppm}{°C} = \frac{\pm\left(\frac{V_{Max} - V_{Min}}{V_{REF}(\text{at } 25°C)}\right)10^6}{T_2 - T_1} = \frac{\pm\left(\frac{V_{DEV}}{V_{REF}(\text{at } 25°C)}\right)10^6}{T_2 - T_1}$$

Where: $T_2 - T_1$ = full temperature change. $\propto V_{REF}$ can be positive or negative depending on whether the slope is positive or negative.
Example: V_{DEV} = 6 mV, V_{REF} = 1240 mV, $T_2 - T_1$ = 125°C.

$$\propto V_{REF} = \frac{\left(\frac{6.0\text{ mV}}{1240\text{ mV}}\right)10^6}{125°C} = +39\text{ ppm}/°C$$

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$$r_Z = \frac{\Delta V_Z}{\Delta I_Z}$$

When the device is programmed with two external resistors, R1 and R2, (see Figure 33), the dynamic output impedance of the overall circuit, r_Z, is defined as:

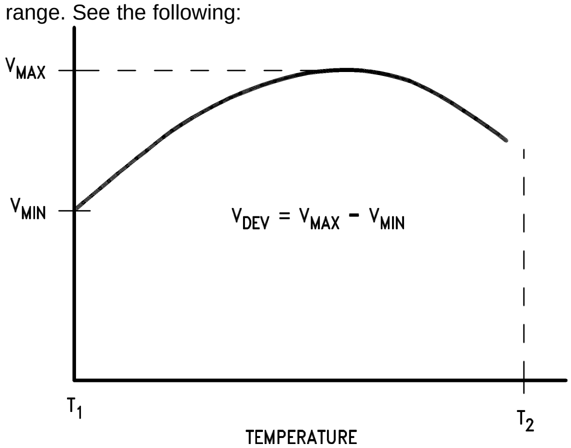
$$r_Z = \frac{\Delta V_Z}{\Delta I_Z} \cong \left[r_Z\left(1 + \frac{R1}{R2}\right)\right]$$

7.8 XB431 Electrical Characteristics

T_A = 25°C unless otherwise specified

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{REF}	Reference Voltage	$V_Z = V_{REF}$, I_Z = 10mA *(See Figure 32)*	T_A = 25°C	1.228	1.24	1.252	V
			T_A = Full Range	1.215		1.265	V
V_{DEV}	Deviation of Reference Input Voltage Over Temperature (1)	$V_Z = V_{REF}$, I_Z = 10mA, T_A = Full Range *(See Figure 32)*			6	20	mV
$\frac{\Delta V_{REF}}{\Delta V_Z}$	Ratio of the Change in Reference Voltage to the Change in Cathode Voltage	I_Z = 10mA *(see Figure 33)* V_Z from V_{REF} to 6 V R_1 = 10 kΩ, R_2 = ∞ and 2.6 kΩ			−1.5	−2.7	mV/V
I_{REF}	Reference Input Current	R_1 = 10 kΩ, R_2 = ∞ I_I = 10 mA *(see Figure 33)*			0.15	0.5	µA
$\propto I_{REF}$	Deviation of Reference Input Current over Temperature	R_1 = 10 kΩ, R_2 = ∞, I_I = 10 mA, T_A = Full Range *(see Figure 33)*			0.1	0.4	µA
$I_{Z(MIN)}$	Minimum Cathode Current for Regulation	$V_Z = V_{REF}$*(see Figure 32)*			55	80	µA
$I_{Z(OFF)}$	Off-State Current	V_Z = 6 V, V_{REF} = 0 V *(see Figure 34)*			0.001	0.1	µA
r_Z	Dynamic Output Impedance (2)	$V_Z = V_{REF}$, I_Z = 0.1 mA to 15 mA Frequency = 0 Hz *(see Figure 32)*			0.25	0.4	Ω

(1) Deviation of reference input voltage, V_{DEV}, is defined as the maximum variation of the reference input voltage over the full temperature range. See the following:



The average temperature coefficient of the reference input voltage, $\propto V_{REF}$, is defined as:

$$\propto V_{REF}\ \frac{ppm}{°C} = \frac{\pm\left(\frac{V_{Max} - V_{Min}}{V_{REF}(at\ 25°C)}\right)10^6}{T_2 - T_1} = \frac{\pm\left(\frac{V_{DEV}}{V_{REF}(at\ 25°C)}\right)10^6}{T_2 - T_1}$$

Where: $T_2 - T_1$ = full temperature change. $\propto V_{REF}$ can be positive or negative depending on whether the slope is positive or negative.
Example: V_{DEV} = 6 mV, V_{REF} = 1240 mV, $T_2 - T_1$ = 125°C.

$$\propto V_{REF} = \frac{\left(\frac{6.0\ mV}{1240\ mV}\right)10^6}{125°C} = +39\ ppm/°C$$

(2) The dynamic output impedance, r_Z, is defined as:

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When the device is programmed with two external resistors, R1 and R2, (see Figure 33), the dynamic output impedance of the overall circuit, r_Z, is defined as:

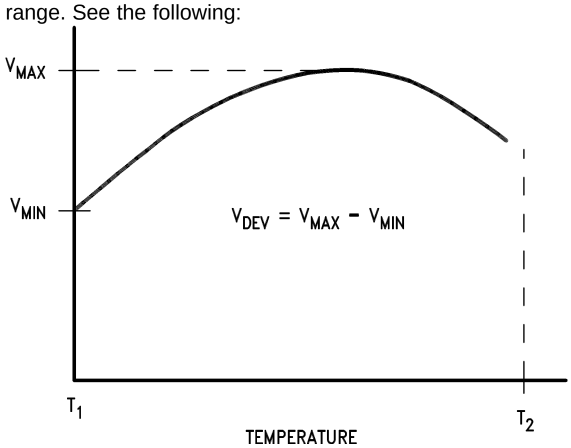
$$r_Z = \frac{\Delta V_Z}{\Delta I_Z} \cong \left[r_Z\left(1 + \frac{R1}{R2}\right)\right]$$

7.9 XB431 Electrical Characteristics

T_A = 25°C unless otherwise specified

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{REF}	Reference Voltage	$V_Z = V_{REF}$, I_Z = 10 mA *(See Figure 32)*	T_A = 25°C	1.234	1.24	1.246	V
			T_A = Full Range	1.227		1.253	V
V_{DEV}	Deviation of Reference Input Voltage Over Temperature (1)	$V_Z = V_{REF}$, I_Z = 10 mA, T_A = Full Range *(See Figure 32)*			4	12	mV
$\frac{\Delta V_{REF}}{\Delta V_Z}$	Ratio of the Change in Reference Voltage to the Change in Cathode Voltage	I_Z = 10 mA *(see Figure 33)* V_Z from V_{REF} to 6 V R_1 = 10 kΩ, R_2 = ∞ and 2.6 kΩ			−1.5	−2.7	mV/V
I_{REF}	Reference Input Current	R_1 = 10 kΩ, R_2 = ∞ I_I = 10 mA *(see Figure 33)*			0.15	0.50	µA
$\propto I_{REF}$	Deviation of Reference Input Current over Temperature	R_1 = 10 kΩ, R_2 = ∞, I_I = 10 mA, T_A = Full Range *(see Figure 33)*			0.05	0.3	µA
$I_{Z(MIN)}$	Minimum Cathode Current for Regulation	$V_Z = V_{REF}$*(see Figure 32)*			55	80	µA
$I_{Z(OFF)}$	Off-State Current	V_Z = 6 V, V_{REF} = 0V *(see Figure 34)*			0.001	0.1	µA
r_Z	Dynamic Output Impedance (2)	$V_Z = V_{REF}$, I_Z = 0.1mA to 15mA Frequency = 0 Hz *(see Figure 32)*			0.25	0.4	Ω

(1) Deviation of reference input voltage, V_{DEV}, is defined as the maximum variation of the reference input voltage over the full temperature range. See the following:



The average temperature coefficient of the reference input voltage, $\propto V_{REF}$, is defined as:

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Where: $T_2 - T_1$ = full temperature change. $\propto V_{REF}$ can be positive or negative depending on whether the slope is positive or negative.
Example: V_{DEV} = 6 mV, V_{REF} = 1240 mV, $T_2 - T_1$ = 125°C.

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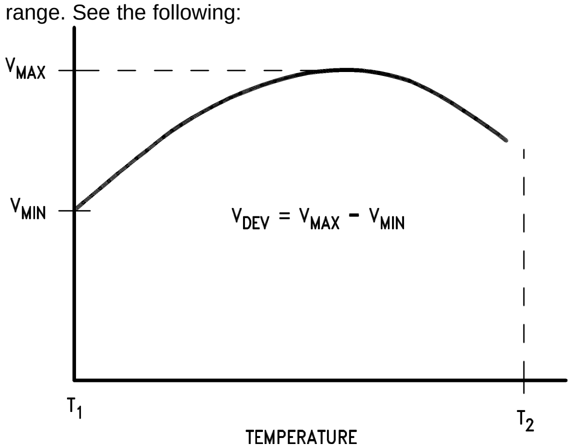
7.10 XB431 Electrical Characteristics

T_A = 25°C unless otherwise specified

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{REF}	Reference Voltage	$V_Z = V_{REF}$, I_Z = 10 mA *(See Figure 32)*	T_A = 25°C	1.234	1.24	1.246	V
			T_A = Full Range	1.224		1.259	V
V_{DEV}	Deviation of Reference Input Voltage Over Temperature [1]	$V_Z = V_{REF}$, I_Z = 10 mA, T_A = Full Range *(See Figure 32)*			6	20	mV
$\frac{\Delta V_{REF}}{\Delta V_Z}$	Ratio of the Change in Reference Voltage to the Change in Cathode Voltage	I_Z = 10 mA *(see Figure 33)* V_Z from V_{REF} to 6V R_1 = 10 kΩ, R_2 = ∞ and 2.6 kΩ			−1.5	−2.7	mV/V
I_{REF}	Reference Input Current	R_1 = 10 kΩ, R_2 = ∞ I_I = 10 mA *(see Figure 33)*			0.15	0.50	μA
$\propto I_{REF}$	Deviation of Reference Input Current over Temperature	R_1 = 10 kΩ, R_2 = ∞, I_I = 10 mA, T_A = Full Range *(see Figure 33)*			0.1	0.4	μA
$I_{Z(MIN)}$	Minimum Cathode Current for Regulation	$V_Z = V_{REF}$*(see Figure 32)*			55	80	μA
$I_{Z(OFF)}$	Off-State Current	V_Z = 6 V, V_{REF} = 0 V *(see Figure 34)*			0.001	0.1	μA
r_Z	Dynamic Output Impedance [2]	$V_Z = V_{REF}$, I_Z = 0.1 mA to 15 mA Frequency = 0 Hz *(see Figure 32)*			0.25	0.4	Ω

(1) Deviation of reference input voltage, V_{DEV}, is defined as the maximum variation of the reference input voltage over the full temperature range. See the following:



The average temperature coefficient of the reference input voltage, $\propto V_{REF}$, is defined as:

$$\propto V_{REF}\frac{ppm}{°C} = \frac{\pm\left(\frac{V_{Max}-V_{Min}}{V_{REF}(\text{at }25°C)}\right)10^6}{T_2-T_1} = \frac{\pm\left(\frac{V_{DEV}}{V_{REF}(\text{at }25°C)}\right)10^6}{T_2-T_1}$$

Where: $T_2 - T_1$ = full temperature change. $\propto V_{REF}$ can be positive or negative depending on whether the slope is positive or negative.
Example: V_{DEV} = 6 mV, V_{REF} = 1240 mV, $T_2 - T_1$ = 125°C.

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$$r_Z = \frac{\Delta V_Z}{\Delta I_Z}$$

When the device is programmed with two external resistors, R1 and R2, (see Figure 33), the dynamic output impedance of the overall circuit, r_Z, is defined as:

$$r_Z = \frac{\Delta V_Z}{\Delta I_Z} \cong \left[r_Z\left(1+\frac{R1}{R2}\right)\right]$$

7.11 Typical Performance Characteristics

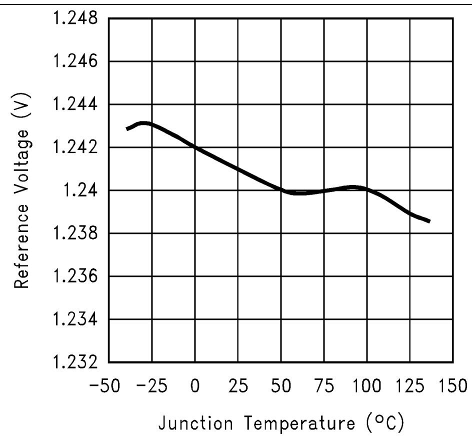


Figure 1. Reference Voltage vs. Junction Temperature

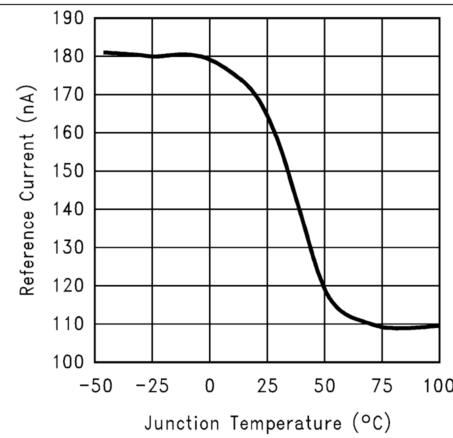


Figure 2. Reference Input Current vs. Junction Temperature

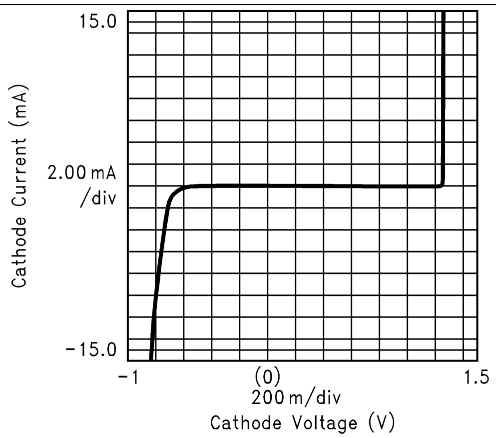


Figure 3. Cathode Current vs. Cathode Voltage 1

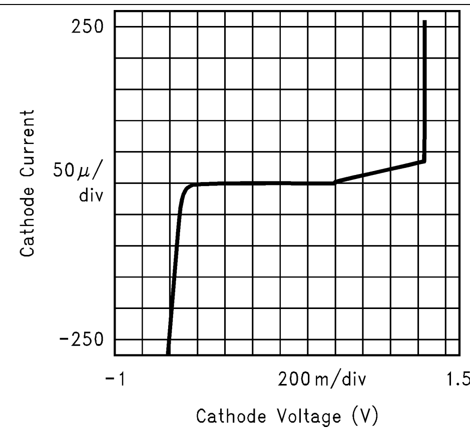


Figure 4. Cathode Current vs. Cathode Voltage 2

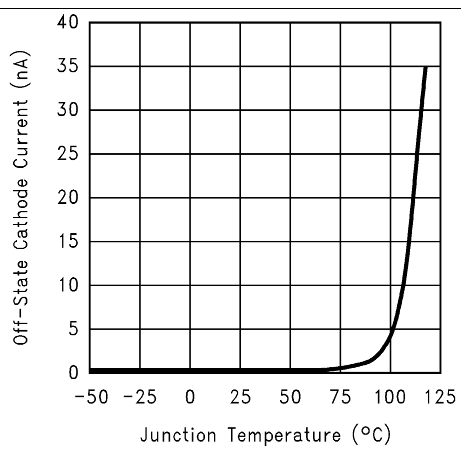


Figure 5. Off-State Cathode Current vs. Junction Temperature

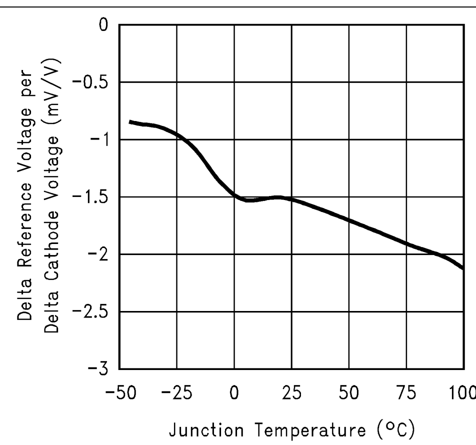


Figure 6. Delta Reference Voltage Per Delta Cathode Voltage vs. Junction Temperature

Typical Performance Characteristics (continued)

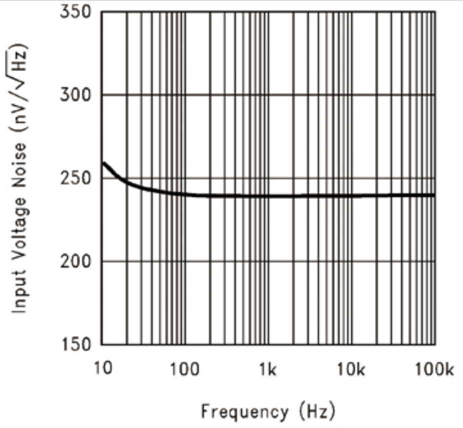


Figure 7. Input Voltage Noise vs. Frequency

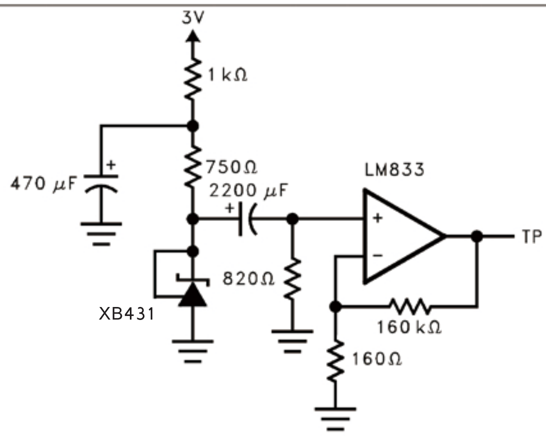


Figure 8. Test Circuit For Input Voltage Noise vs. Frequency

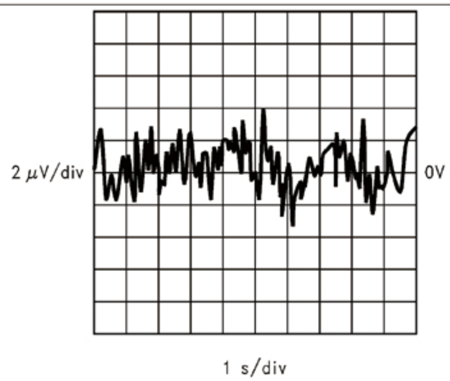
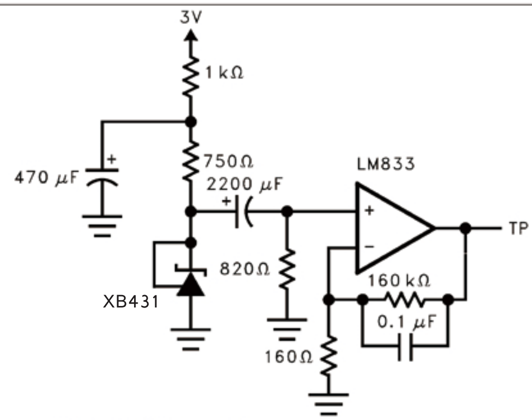


Figure 9. Low Frequency Peak To Peak Noise



BW = 0.1 Hz To 10 Hz

Figure 10. Test Circuit For Peak To Peak Noise

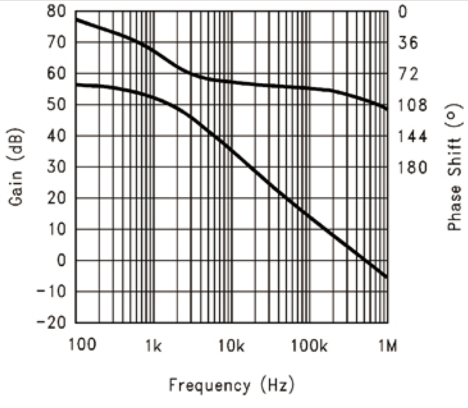


Figure 11. Small Signal Voltage Gain And Phase Shift vs. Frequency

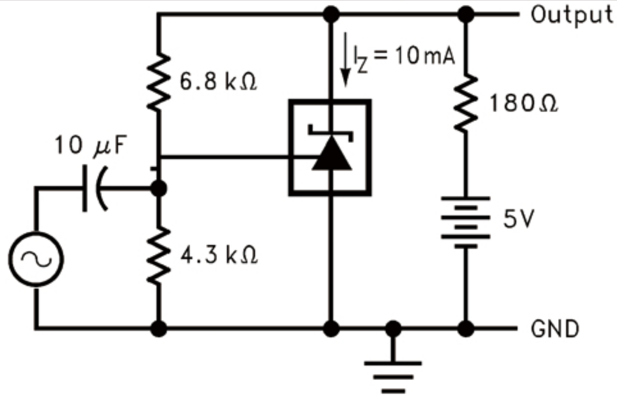


Figure 12. Test Circuit For Voltage Gain And Phase Shift vs. Frequency

Typical Performance Characteristics (continued)

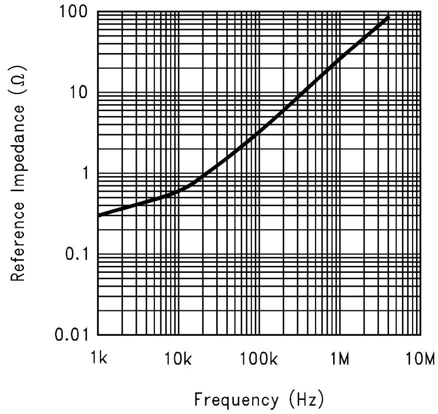


Figure 13. Reference Impedance vs. Frequency

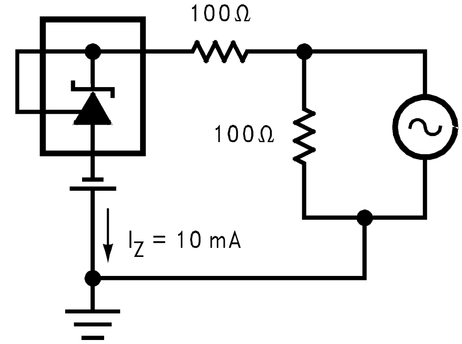


Figure 14. Test Circuit For Reference Impedance vs. Frequency

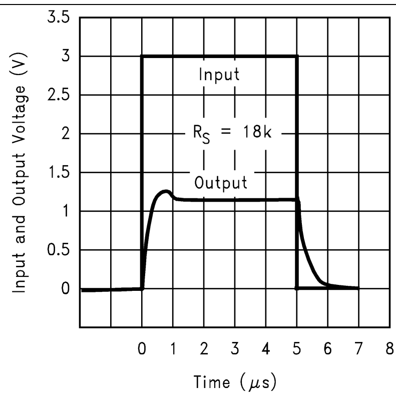


Figure 15. Pulse Response 1

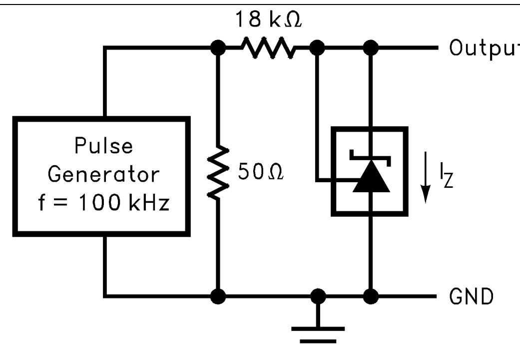


Figure 16. Test Circuit For Pulse Response 1

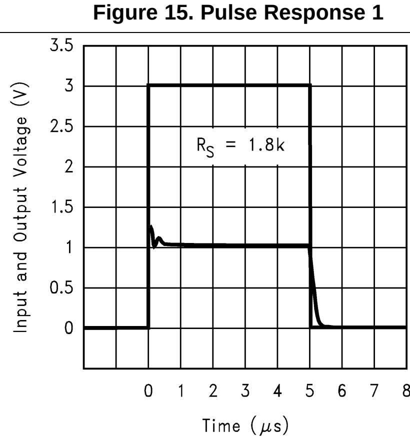


Figure 17. Pulse Response 2

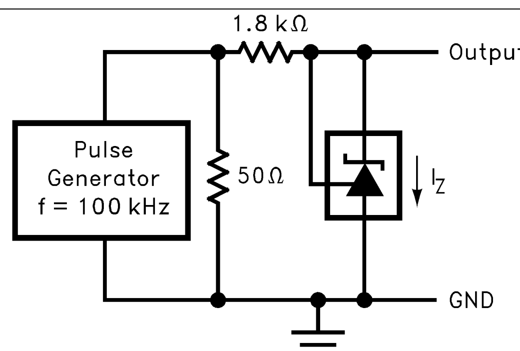


Figure 18. Test Circuit For Pulse Response 2

Typical Performance Characteristics (continued)

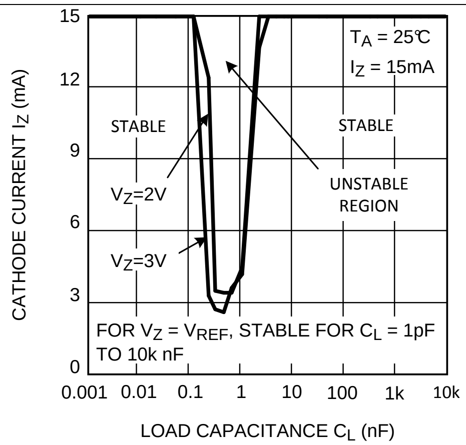


Figure 19. XB431 Stability Boundary Condition

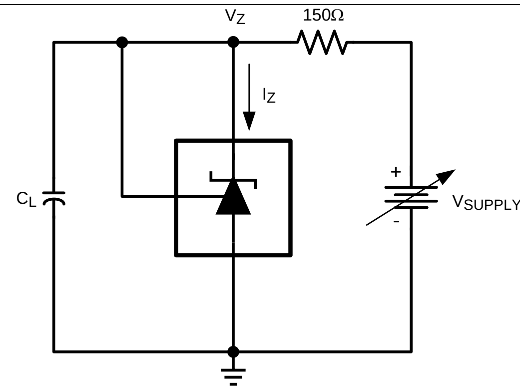


Figure 20. Test Circuit For $V_Z = V_{REF}$

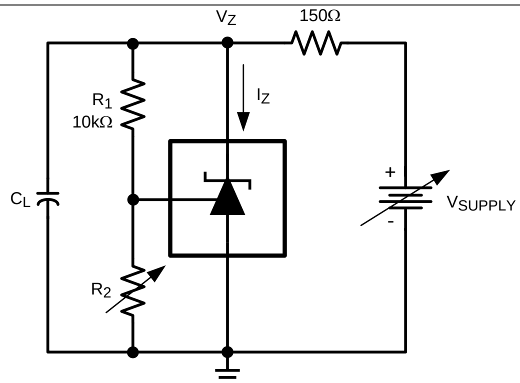
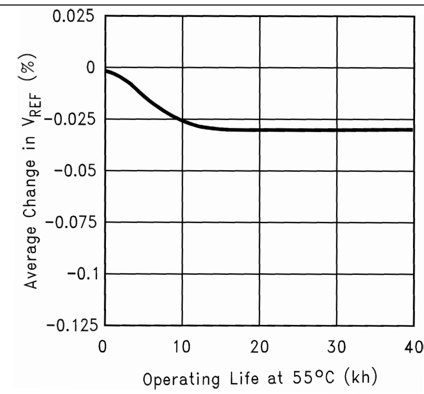


Figure 21. Test Circuit For V_Z = 2V, 3V

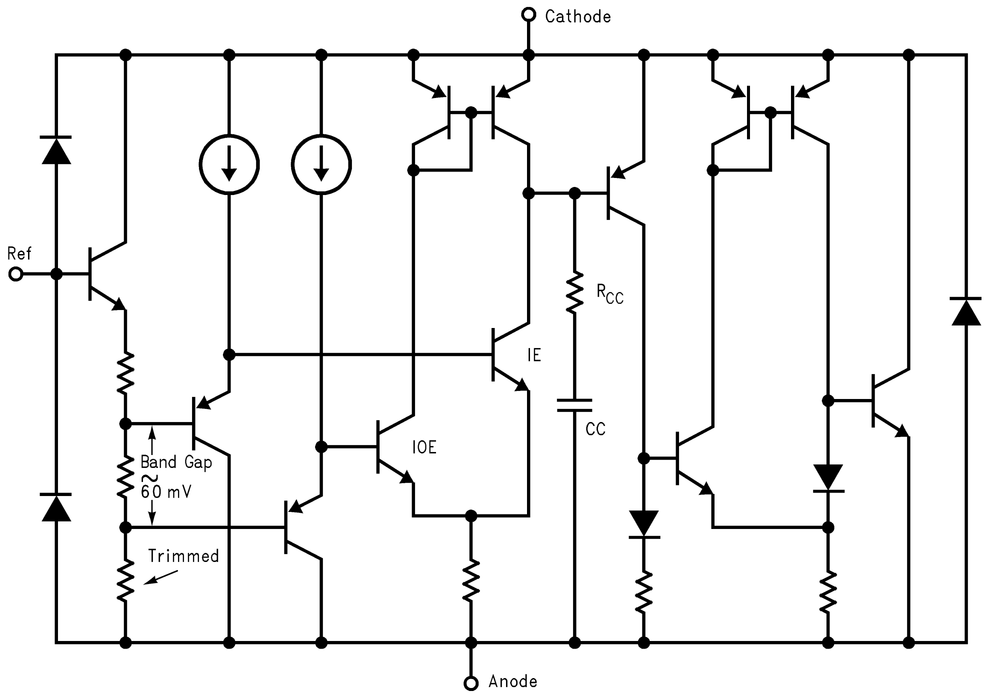


Extrapolated from life-test data taken at 125°C; the activation energy assumed is 0.7eV.

Figure 22. Percentage Change In V_{REF} vs. Operating Life At 55°C

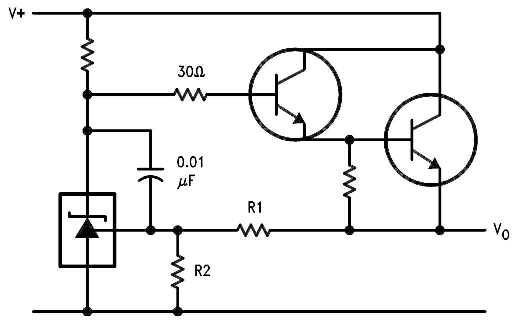
8 Detailed Description

8.1 Functional Block Diagram



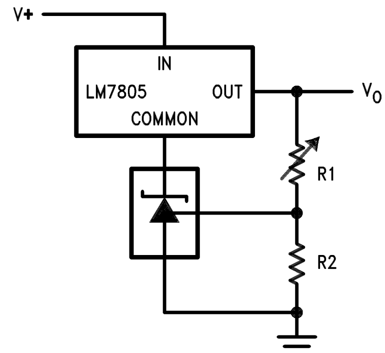
9 Application and Implementation

9.1 Typical Application



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

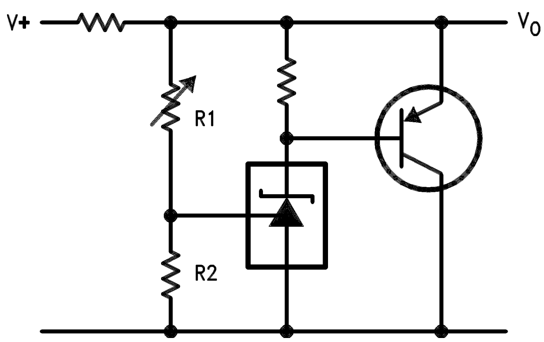
Figure 23. Series Regulator



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

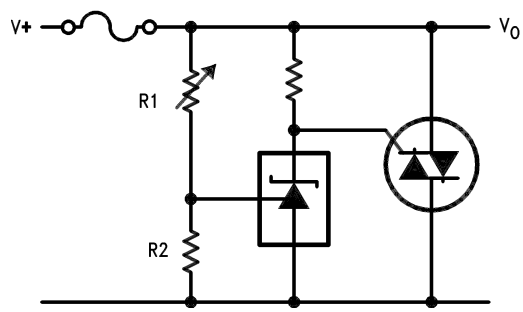
$$V_{O\,MIN} = V_{REF} + 5\ V$$

Figure 24. Output Control of a Three-Terminal Fixed Regulator



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

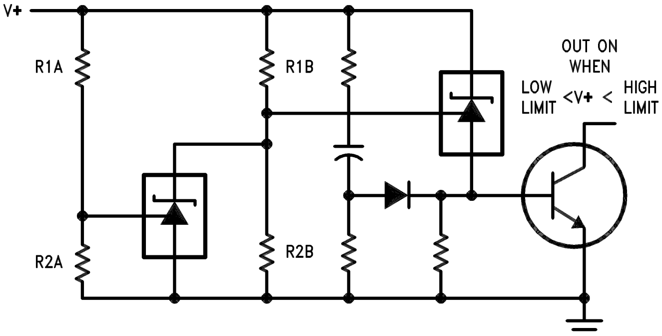
Figure 25. Higher Current Shunt Regulator



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

Figure 26. Crow Bar

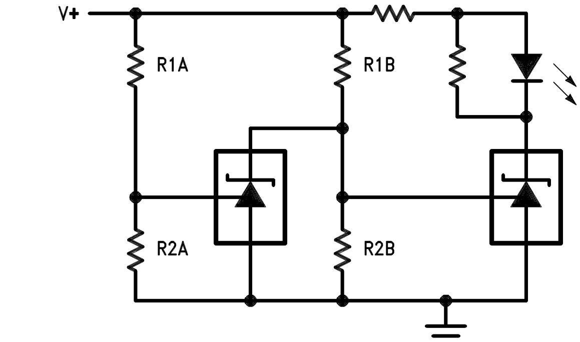
Typical Application (continued)



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

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

Figure 27. Overvoltage/Undervoltage Protection Circuit



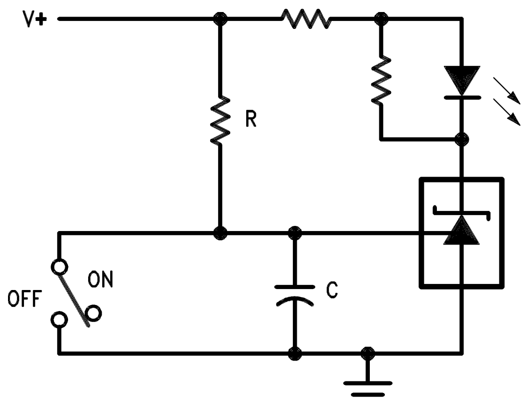
$$\text{LOW LIMIT} \approx V_{REF}\left(1+\frac{R1B}{R2B}\right)$$

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

LED ON WHEN

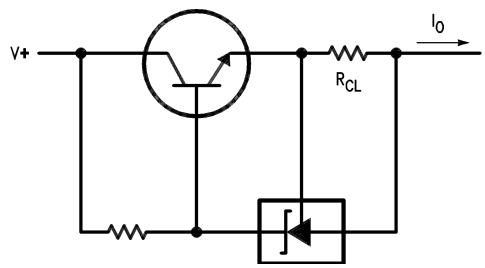
LOW LIMIT $<$ V^{+} $<$ HIGH LIMIT

Figure 28. Voltage Monitor



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

Figure 29. Delay Timer



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

Figure 30. Current Limiter or Current Source

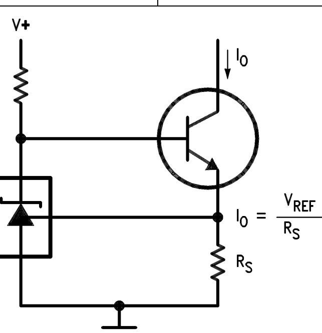
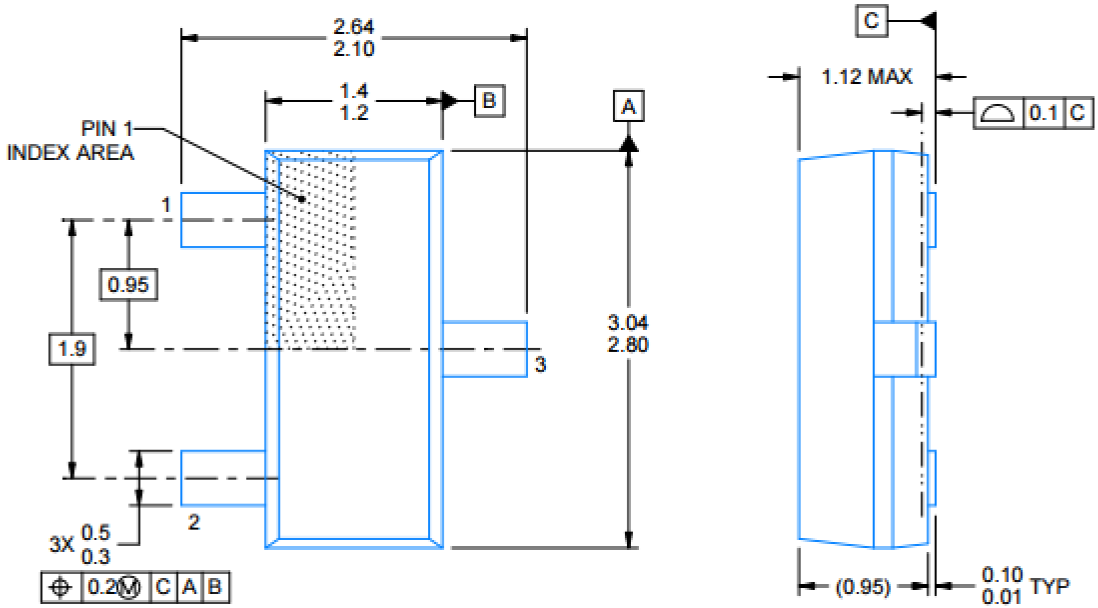
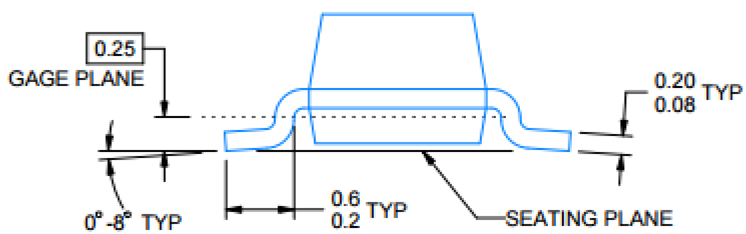


Figure 31. Constant Current Sink





以上信息仅供参考.如需帮助联系客服人员。谢谢 XINLUDA