

TL431, TL431A ADJUSTABLE PRECISION SHUNT REGULATORS

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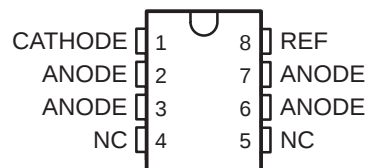
- Equivalent Full-Range Temperature Coefficient . . . 30 ppm/°C
- 0.2-Ω Typical Output Impedance
- Sink-Current Capability . . . 1 mA to 100 mA
- Low Output Noise
- Adjustable Output Voltage . . . V_{ref} to 36 V
- Available in a Wide Range of High-Density Packages

description

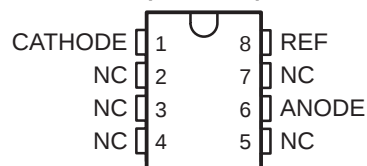
The TL431 and TL431A are three-terminal adjustable shunt regulators with specified thermal stability over applicable automotive, commercial, and military temperature ranges. The output voltage can be set to any value between V_{ref} (approximately 2.5 V) and 36 V, with two external resistors (see Figure 17). These devices have a typical output impedance of 0.2 Ω. Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacements for Zener diodes in many applications, such as onboard regulation, adjustable power supplies, and switching power supplies.

The TL431C and TL431AC are characterized for operation from 0°C to 70°C, and the TL431I and TL431AI are characterized for operation from -40°C to 85°C.

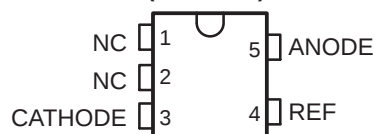
**D PACKAGE
(TOP VIEW)**



**P OR PW PACKAGE
(TOP VIEW)**

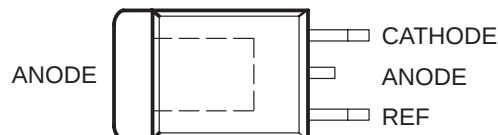


**DBV PACKAGE
(TOP VIEW)**

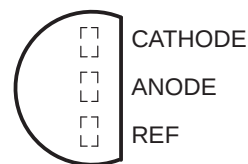


NC – No internal connection

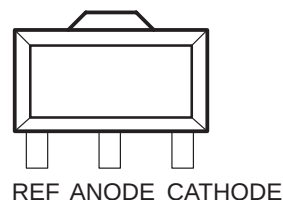
**KTP PACKAGE
(TOP VIEW)**



**LP PACKAGE
(TOP VIEW)**



**PK PACKAGE
(TOP VIEW)**



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

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TL431, TL431A

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AVAILABLE OPTIONS

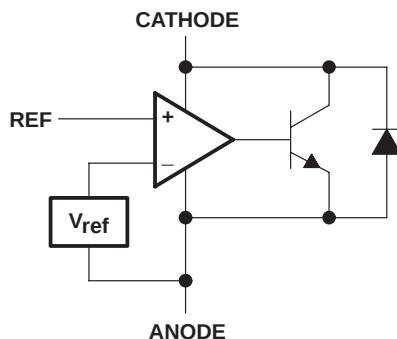
T _A	PACKAGED DEVICES						
	SMALL-OUTLINE (D)	SOT-23 (DBV)	PLASTIC FLANGE MOUNT (KTP)	TO-226AA (LP)	PLASTIC DIP (P)	PLASTIC SHRINK SMALL-OUTLINE (PW)	SOT-89 (PK)
0°C to 70°C	TL431CD TL431ACD	TL431CDBVR	TL431CKTPR	TL431CLP TL431ACLP	TL431CP TL431ACP	TL431CPWR TL431ACPWR	TL431CPKR
−40°C to 85°C	TL431ID TL431AID			TL431ILP TL431AILP	TL431IP TL431AIP		TL431IPKR

The D, LP, and PW packages are available taped and reeled. The DBV, KTP, and PK packages are only available taped and reeled. Add the suffix R to device type (e.g., TL431CDR).

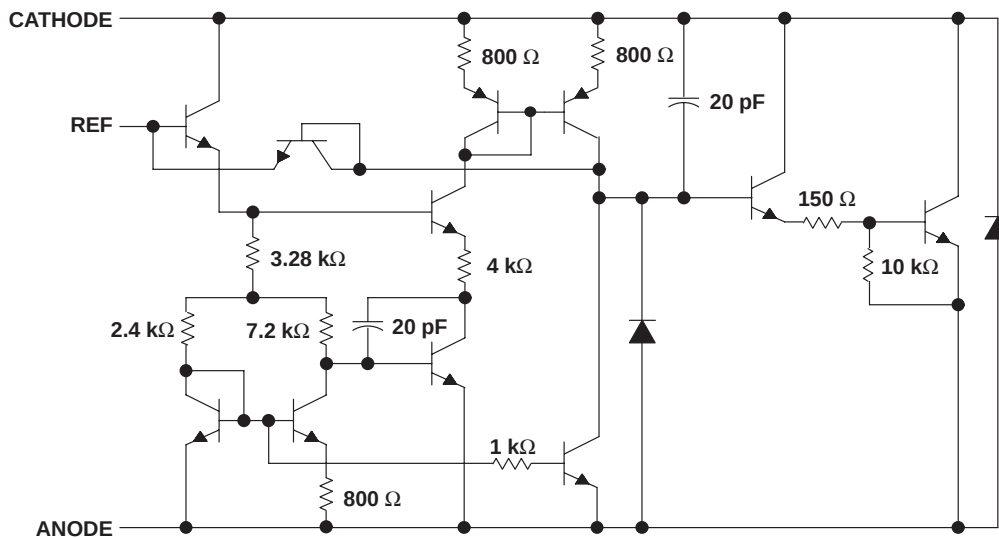
symbol



functional block diagram



equivalent schematic[†]



[†] All component values are nominal.

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Cathode voltage, V_{KA} (see Note 1)	37 V
Continuous cathode current range, I_{KA}	–100 mA to 150 mA
Reference input current range	–50 μ A to 10 mA
Package thermal impedance, θ_{JA} (see Notes 2 and 3):	
D package	97°C/W
DBV package	206°C/W
KTP package	28°C/W
LP package	156°C/W
P package	85°C/W
PK package	52°C/W
PW package	149°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C
Storage temperature range, T_{Stg}	–65°C to 150°C

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. Voltage values are with respect to the anode terminal unless otherwise noted.
 2. Maximum power dissipation is a function of $T_J(\text{max})$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

		MIN	MAX	UNIT
Cathode voltage, V_{KA}		V_{ref}	36	V
Cathode current, I_{KA}		1	100	mA
Operating free-air temperature range, T_A	TL431C, TL431AC	0	70	°C
	TL431I, TL431AI	–40	85	



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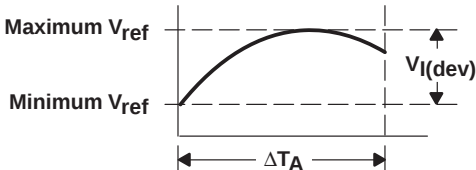
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electrical characteristics over recommended operating conditions, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CIRCUIT	TEST CONDITIONS		TL431C			UNIT
					MIN	TYP	MAX	
V _{ref}	Reference voltage	2	V _{KA} = V _{ref} , I _{KA} = 10 mA		2440	2495	2550	mV
V _{I(dev)}	Deviation of reference voltage over full temperature range (see Figure 1)	2	V _{KA} = V _{ref} , I _{KA} = 10 mA, T _A = 0°C to 70°C		4 25			mV
$\frac{\Delta V_{ref}}{\Delta V_{KA}}$	Ratio of change in reference voltage to the change in cathode voltage	3	I _{KA} = 10 mA	ΔV _{KA} = 10 V – V _{ref}	–1.4	–2.7	$\frac{\text{mV}}{\text{V}}$	
				ΔV _{KA} = 36 V – 10 V	–1	–2		
I _{ref}	Reference current	3	I _{KA} = 10 mA, R1 = 10 kΩ, R2 = ∞		2	4	μA	
I _{I(dev)}	Deviation of reference current over full temperature range (see Figure 1)	3	I _{KA} = 10 mA, R1 = 10 kΩ, R2 = ∞, T _A = 0°C to 70°C		0.4	1.2	μA	
I _{min}	Minimum cathode current for regulation	2	V _{KA} = V _{ref}		0.4	1	mA	
I _{off}	Off-state cathode current	4	V _{KA} = 36 V, V _{ref} = 0		0.1	1	μA	
z _{KA}	Dynamic impedance (see Figure 1)	1	I _{KA} = 1 mA to 100 mA, V _{KA} = V _{ref} , f ≤ 1 kHz		0.2	0.5	Ω	

The deviation parameters $V_{\text{ref}(\text{dev})}$ and $I_{\text{ref}(\text{dev})}$ are defined as the differences between the maximum and minimum values obtained over the recommended temperature range. The average full-range temperature coefficient of the reference voltage, $\alpha_{V_{\text{ref}}}$, is defined as:

$$|\alpha_{V_{\text{ref}}} (\text{ppm}/^\circ\text{C})| = \frac{\left(\frac{V_{I(\text{dev})}}{V_{\text{ref at } 25^\circ\text{C}}} \right) \times 10^6}{\Delta T_A}$$


where:

ΔT_A is the recommended operating free-air temperature range of the device.

$\alpha_{V_{\text{ref}}}$ can be positive or negative, depending on whether minimum V_{ref} or maximum V_{ref} , respectively, occurs at the lower temperature.

Example: maximum $V_{\text{ref}} = 2496\text{ mV}$ at 30°C , minimum $V_{\text{ref}} = 2492\text{ mV}$ at 0°C , $V_{\text{ref}} = 2495\text{ mV}$ at 25°C , $\Delta T_A = 70^\circ\text{C}$ for TL431C

$$|\alpha_{V_{\text{ref}}}| = \frac{\left(\frac{4\text{ mV}}{2495\text{ mV}} \right) \times 10^6}{70^\circ\text{C}} \approx 23\text{ ppm}/^\circ\text{C}$$

Because minimum V_{ref} occurs at the lower temperature, the coefficient is positive.

Calculating Dynamic Impedance

The dynamic impedance is defined as: $|z_{KA}| = \frac{\Delta V_{KA}}{\Delta I_{KA}}$

When the device is operating with two external resistors (see Figure 3), the total dynamic impedance of the circuit is given by:

$$|z'| = \frac{\Delta V}{\Delta I} \approx |z_{KA}| \left(1 + \frac{R1}{R2} \right)$$

Figure 1. Calculating Deviation Parameters and Dynamic Impedance

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electrical characteristics over recommended operating conditions, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CIRCUIT	TEST CONDITIONS		TL431I			UNIT
					MIN	TYP	MAX	
V _{ref}	Reference voltage	2	V _{KA} = V _{ref} , I _{KA} = 10 mA		2440	2495	2550	mV
V _{I(dev)}	Deviation of reference voltage over full temperature range (see Figure 1)	2	V _{KA} = V _{ref} , I _{KA} = 10 mA, T _A = −40°C to 85°C			5	50	mV
$\frac{\Delta V_{ref}}{\Delta V_{KA}}$	Ratio of change in reference voltage to the change in cathode voltage	3	I _{KA} = 10 mA	ΔV _{KA} = 10 V − V _{ref}	−1.4	−2.7	$\frac{\text{mV}}{\text{V}}$	
				ΔV _{KA} = 36 V − 10 V	−1	−2		
I _{ref}	Reference current	3	I _{KA} = 10 mA, R1 = 10 kΩ, R2 = ∞			2	4	μA
I _{I(dev)}	Deviation of reference current over full temperature range (see Figure 1)	3	I _{KA} = 10 mA, R1 = 10 kΩ, R2 = ∞, T _A = −40°C to 85°C			0.8	2.5	μA
I _{min}	Minimum cathode current for regulation	2	V _{KA} = V _{ref}			0.4	1	mA
I _{off}	Off-state cathode current	4	V _{KA} = 36 V, V _{ref} = 0			0.1	1	μA
z _{KA}	Dynamic impedance (see Figure 1)	2	I _{KA} = 1 mA to 100 mA, V _{KA} = V _{ref} , f ≤ 1 kHz			0.2	0.5	Ω

electrical characteristics over recommended operating conditions, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CIRCUIT	TEST CONDITIONS		TL431AC			UNIT
					MIN	TYP	MAX	
V _{ref}	Reference voltage	2	V _{KA} = V _{ref} , I _{KA} = 10 mA		2470	2495	2520	mV
V _{I(dev)}	Deviation of reference voltage over full temperature range (see Figure 1)	2	V _{KA} = V _{ref} , I _{KA} = 10 mA, T _A = 0°C to 70°C		4 25			mV
$\frac{\Delta V_{ref}}{\Delta V_{KA}}$	Ratio of change in reference voltage to the change in cathode voltage	3	I _{KA} = 10 mA	ΔV _{KA} = 10 V – V _{ref}	–1.4	–2.7	$\frac{\text{mV}}{\text{V}}$	
				ΔV _{KA} = 36 V – 10 V	–1	–2		
I _{ref}	Reference current	3	I _{KA} = 10 mA, R1 = 10 kΩ, R2 = ∞		2	4	μA	
I _{I(dev)}	Deviation of reference current over full temperature range (see Figure 1)	3	I _{KA} = 10 mA, R1 = 10 kΩ, R2 = ∞, T _A = 0°C to 70°C		0.8	1.2	μA	
I _{min}	Minimum cathode current for regulation	2	V _{KA} = V _{ref}		0.4	0.6	mA	
I _{off}	Off-state cathode current	4	V _{KA} = 36 V, V _{ref} = 0		0.1	0.5	μA	
z _{KA}	Dynamic impedance (see Figure 1)	1	I _{KA} = 1 mA to 100 mA, V _{KA} = V _{ref} , f ≤ 1 kHz		0.2	0.5	Ω	



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electrical characteristics over recommended operating conditions, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CIRCUIT	TEST CONDITIONS		TL431AI			UNIT
					MIN	TYP	MAX	
V _{ref}	Reference voltage	2	V _{KA} = V _{ref} , I _{KA} = 10 mA		2470	2495	2520	mV
V _{I(dev)}	Deviation of reference voltage over full temperature range (see Figure 1)	2	V _{KA} = V _{ref} , I _{KA} = 10 mA, T _A = −40°C to 85°C			5	50	mV
$\frac{\Delta V_{ref}}{\Delta V_{KA}}$	Ratio of change in reference voltage to the change in cathode voltage	3	I _{KA} = 10 mA	ΔV _{KA} = 10 V − V _{ref}	−1.4	−2.7	$\frac{\text{mV}}{\text{V}}$	
				ΔV _{KA} = 36 V − 10 V	−1	−2		
I _{ref}	Reference current	3	I _{KA} = 10 mA, R1 = 10 kΩ, R2 = ∞			2	4	μA
I _{I(dev)}	Deviation of reference current over full temperature range (see Figure 1)	3	I _{KA} = 10 mA, R1 = 10 kΩ, R2 = ∞, T _A = −40°C to 85°C			0.8	2.5	μA
I _{min}	Minimum cathode current for regulation	2	V _{KA} = V _{ref}			0.4	0.7	mA
I _{off}	Off-state cathode current	4	V _{KA} = 36 V, V _{ref} = 0			0.1	0.5	μA
z _{KA}	Dynamic impedance (see Figure 1)	2	I _{KA} = 1 mA to 100 mA, V _{KA} = V _{ref} , f ≤ 1 kHz			0.2	0.5	Ω



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PARAMETER MEASUREMENT INFORMATION

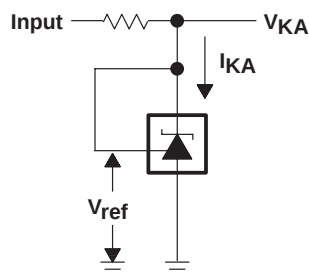


Figure 2. Test Circuit for $V_{KA} = V_{ref}$

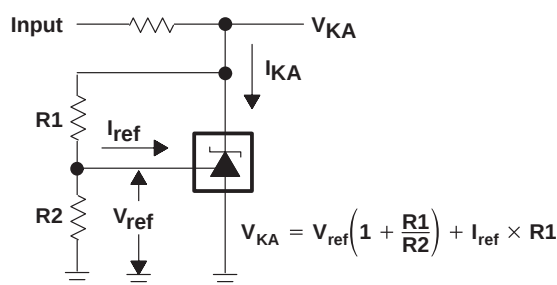


Figure 3. Test Circuit for $V_{KA} > V_{ref}$

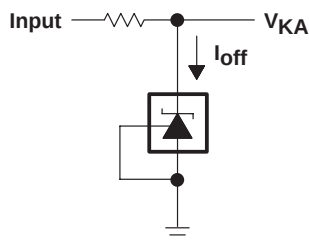


Figure 4. Test Circuit for I_{off}

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TYPICAL CHARACTERISTICS

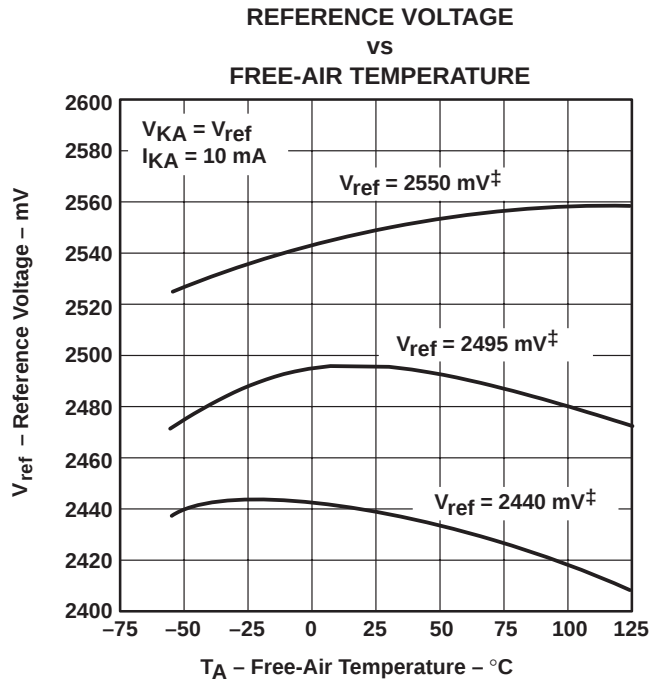
Table 1. Graphs

	FIGURE
Reference input voltage vs Free-air temperature	5
Reference input current vs Free-air temperature	6
Cathode current vs Cathode voltage	7, 8
Off-state cathode current vs Free-air temperature	9
Ratio of delta reference voltage to change in cathode voltage vs Free-air temperature	10
Equivalent input noise voltage vs Frequency	11
Equivalent input noise voltage over a 10-second period	12
Small-signal voltage amplification vs Frequency	13
Reference impedance vs Frequency	14
Pulse response	15
Stability boundary conditions	16

Table 2. Application Circuits

	FIGURE
Shunt regulator	17
Single-supply comparator with temperature-compensated threshold	18
Precision high-current series regulator	19
Output control of a three-terminal fixed regulator	20
High-current shunt regulator	21
Crowbar circuit	22
Precision 5-V 1.5-A regulator	23
Efficient 5-V precision regulator	24
PWM converter with reference	25
Voltage monitor	26
Delay timer	27
Precision current limiter	28
Precision constant-current sink	29

TYPICAL CHARACTERISTICS†



† Data is for devices having the indicated value of V_{ref} at $I_{KA} = 10 \text{ mA}$, $T_A = 25^\circ\text{C}$.

Figure 5

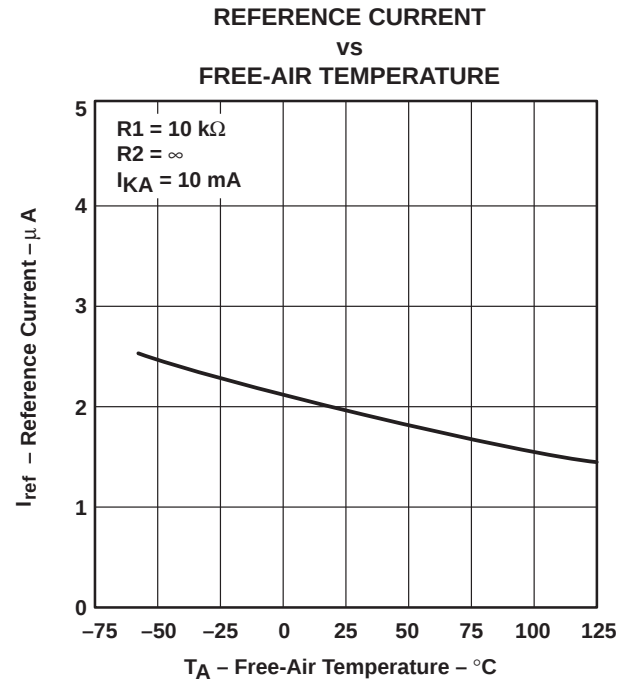


Figure 6

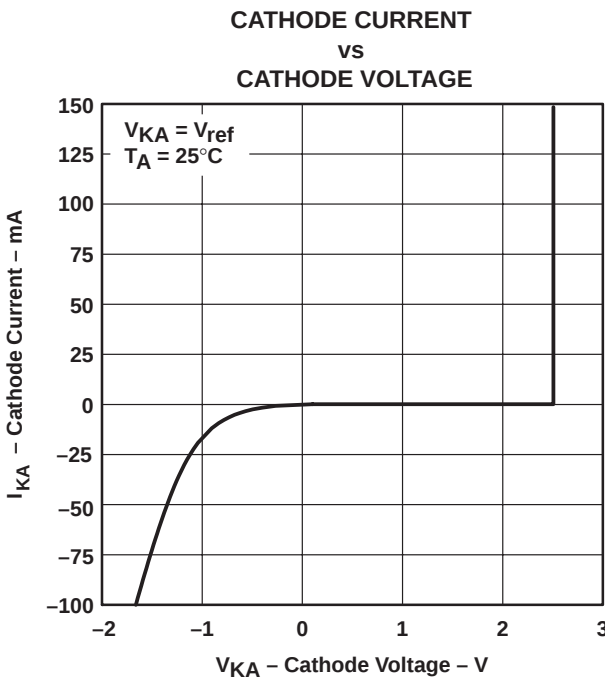


Figure 7

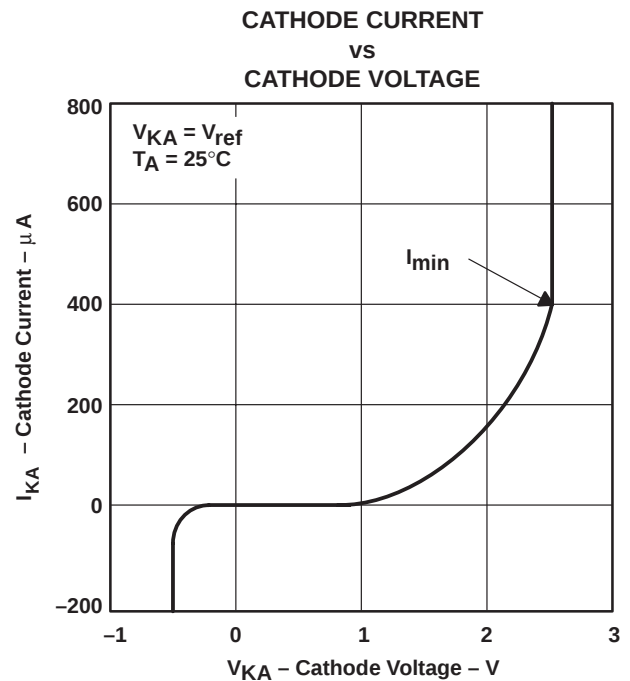


Figure 8

† Data at high and low temperatures are applicable only within the recommended operating free-air temperature ranges of the various devices.

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TYPICAL CHARACTERISTICS†

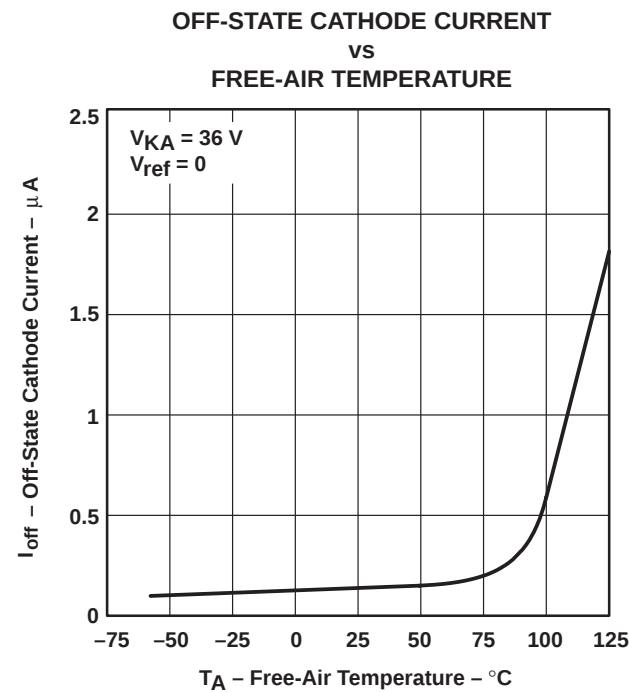


Figure 9

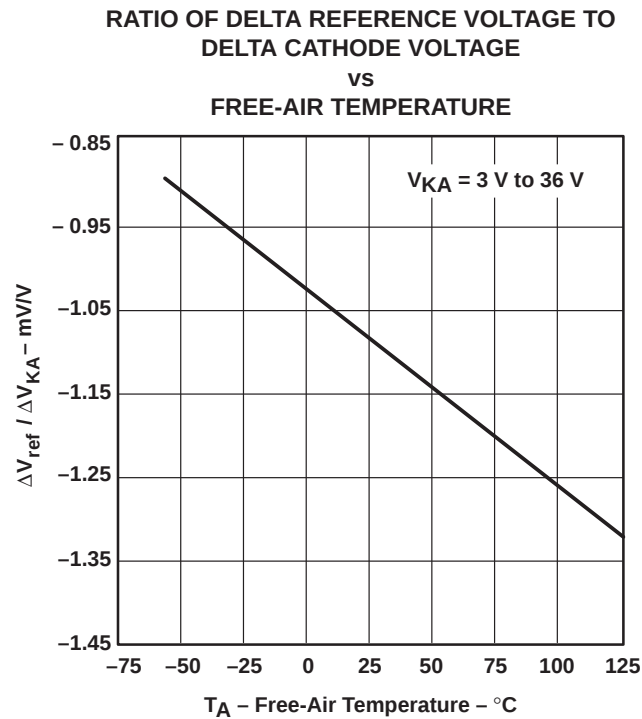


Figure 10

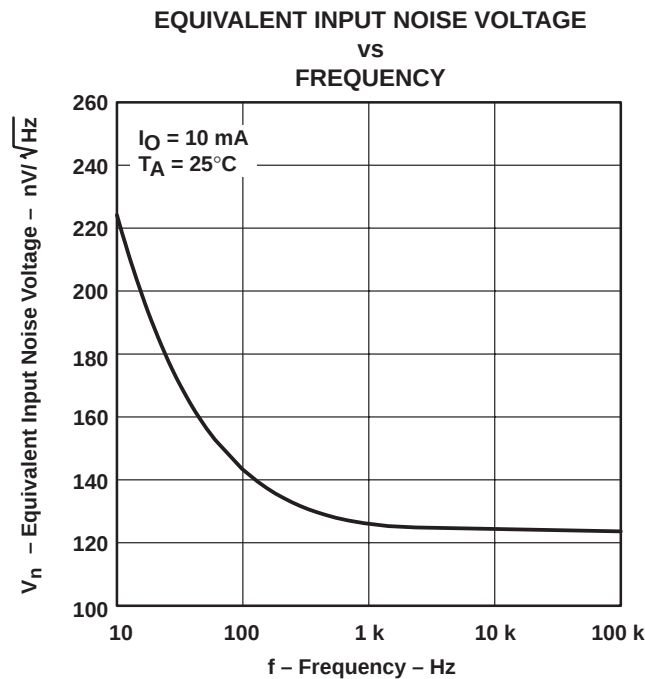


Figure 11

† Data at high and low temperatures are applicable only within the recommended operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

EQUIVALENT INPUT NOISE VOLTAGE
OVER A 10-SECOND PERIOD

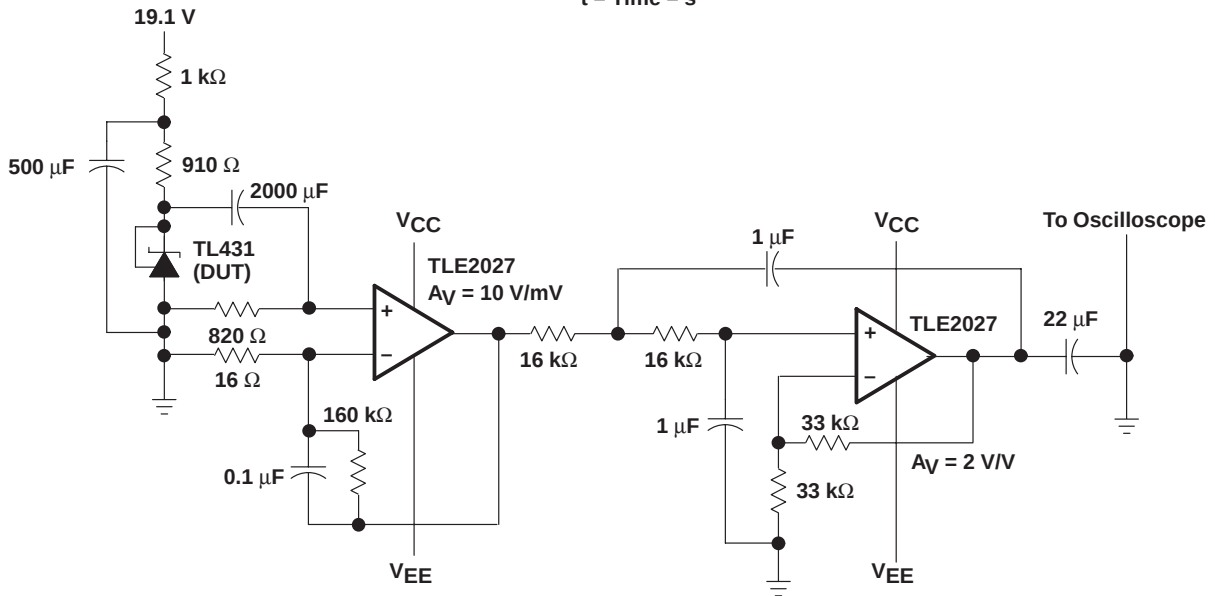
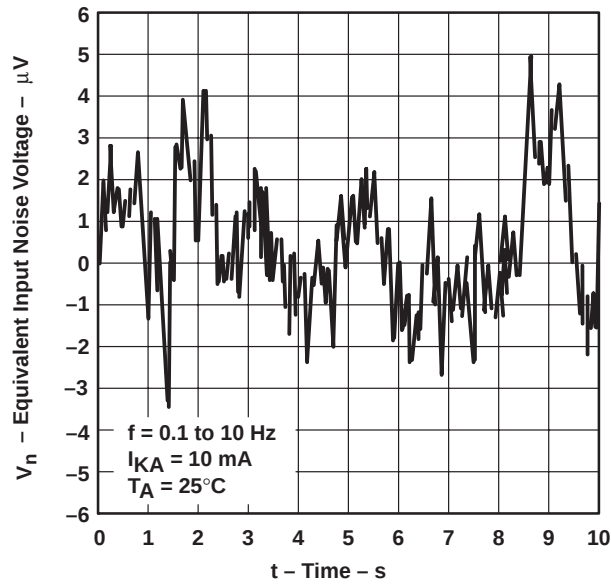


Figure 12. Test Circuit for Equivalent Input Noise Voltage

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TYPICAL CHARACTERISTICS

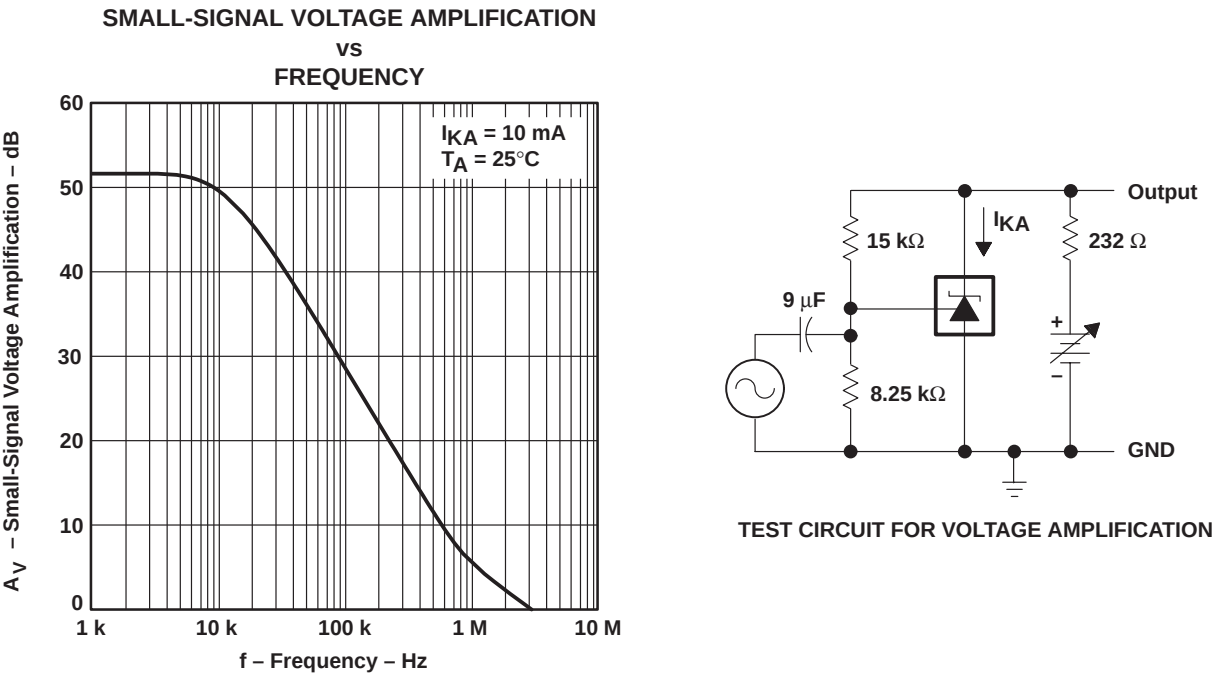


Figure 13

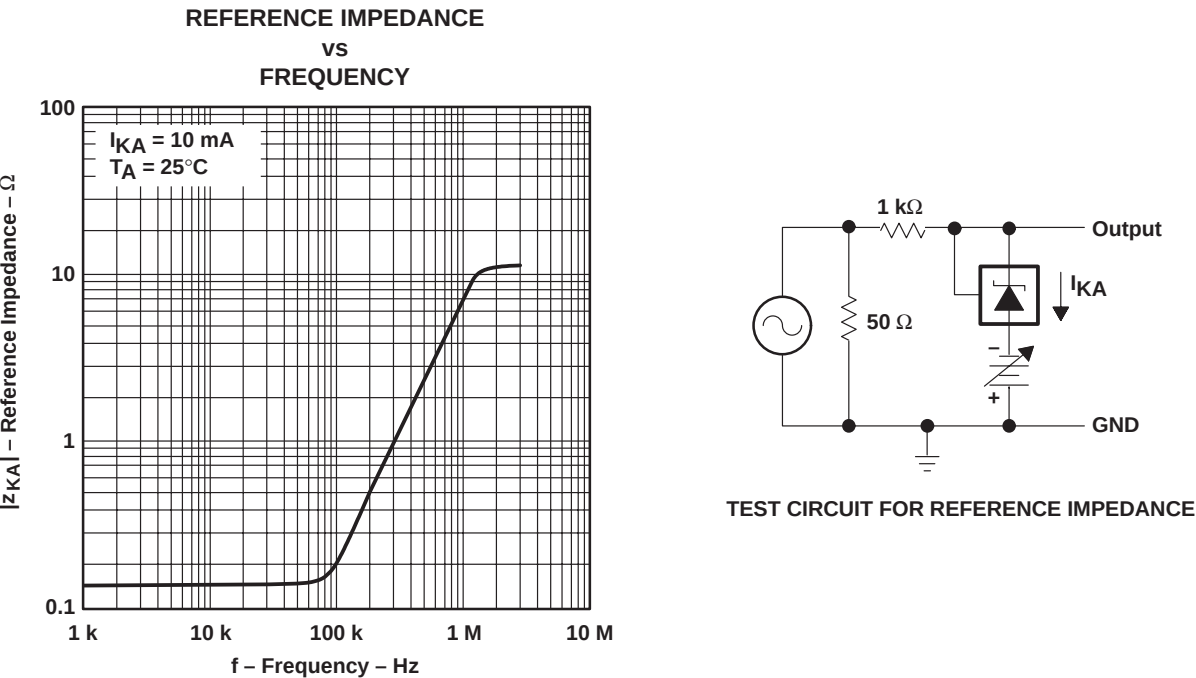


Figure 14

TYPICAL CHARACTERISTICS

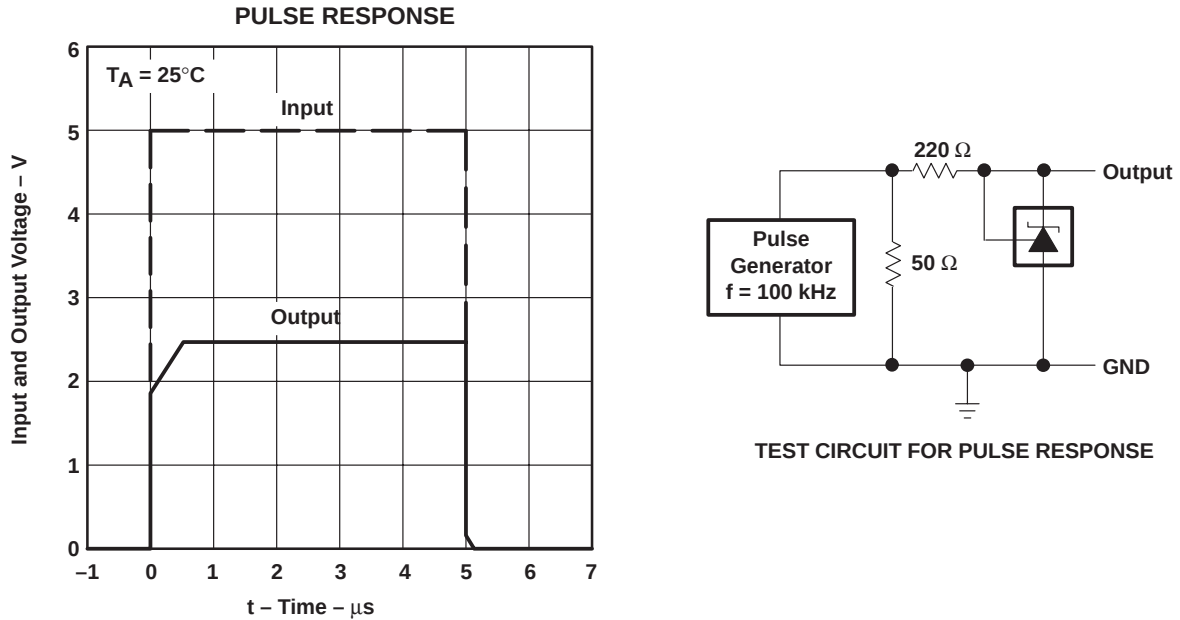


Figure 15

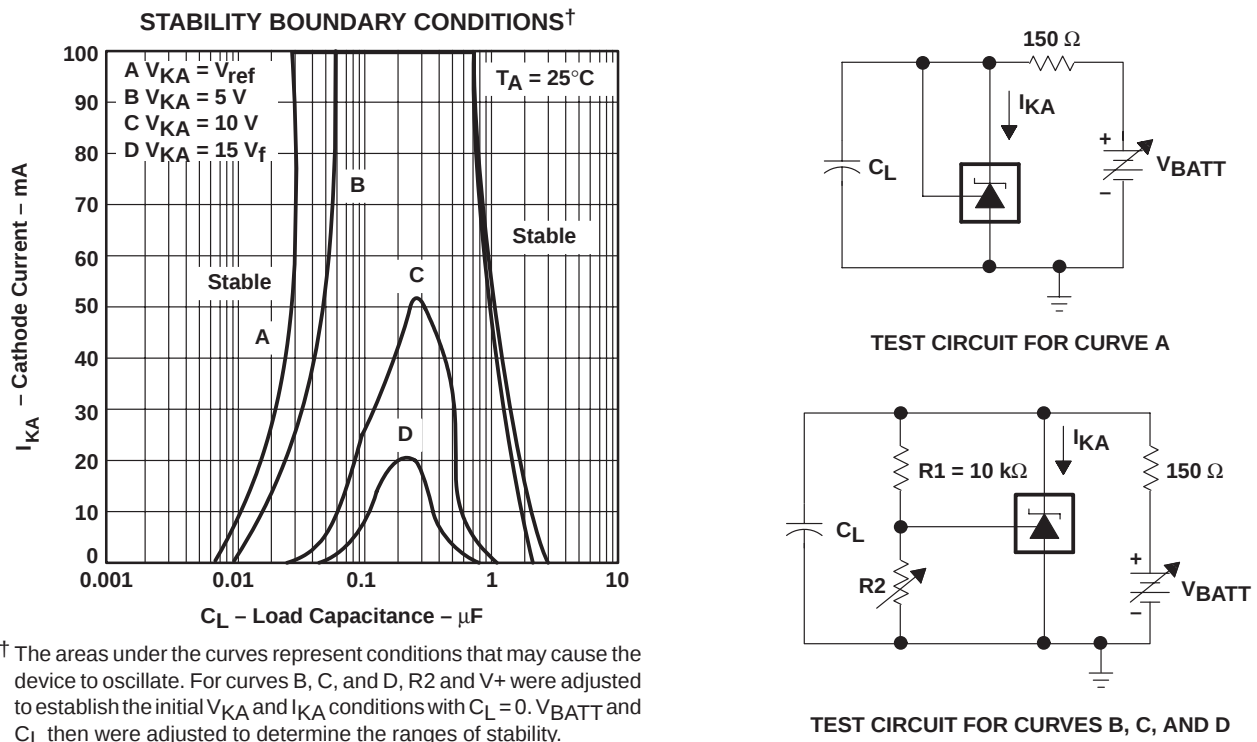


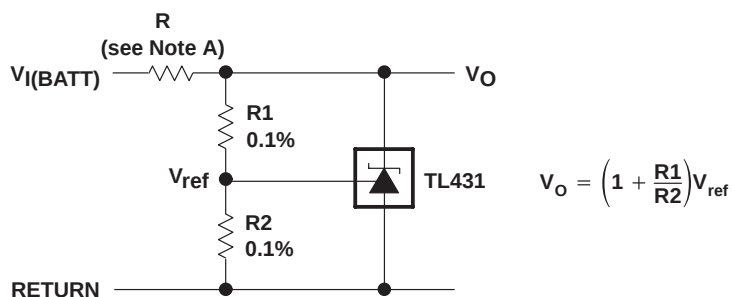
Figure 16

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APPLICATION INFORMATION



NOTE A: R should provide cathode current ≥ 1 mA to the TL431 at minimum $V_{I(BATT)}$.

Figure 17. Shunt Regulator

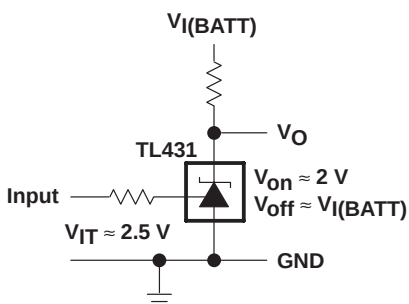
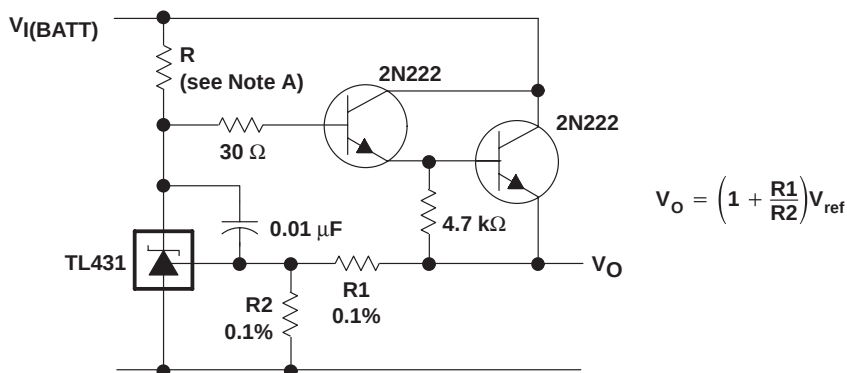


Figure 18. Single-Supply Comparator With Temperature-Compensated Threshold



NOTE A: R should provide cathode current ≥ 1 mA to the TL431 at minimum $V_{I(BATT)}$.

Figure 19. Precision High-Current Series Regulator

APPLICATION INFORMATION

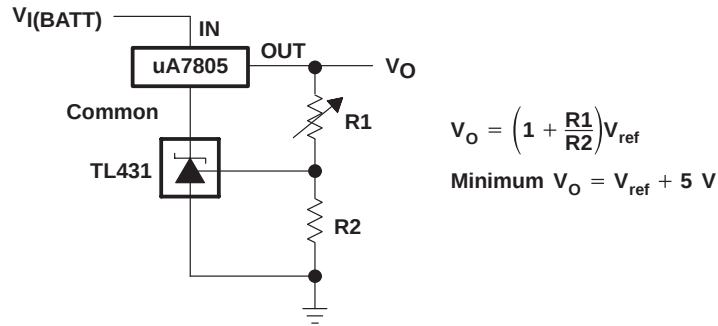


Figure 20. Output Control of a Three-Terminal Fixed Regulator

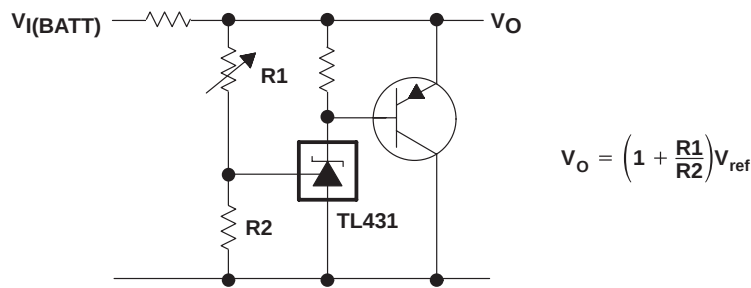
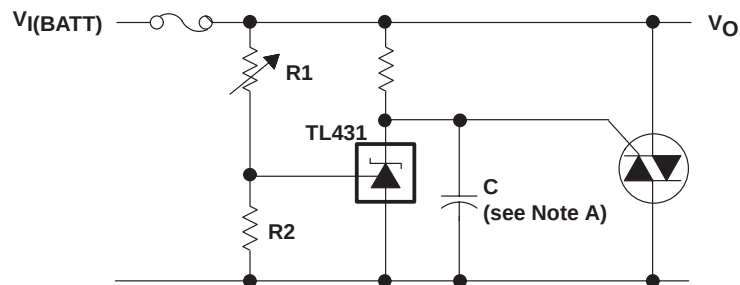


Figure 21. High-Current Shunt Regulator



NOTE A: Refer to the stability boundary conditions in Figure 16 to determine allowable values for C.

Figure 22. Crowbar Circuit

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APPLICATION INFORMATION

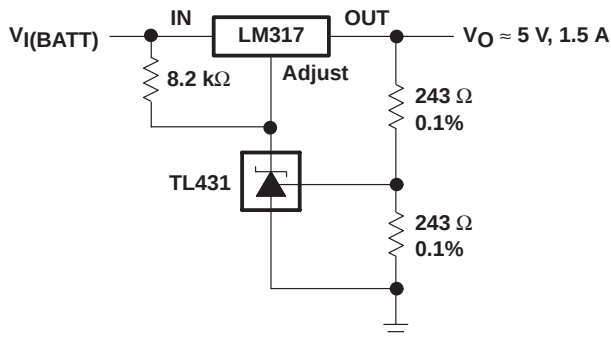
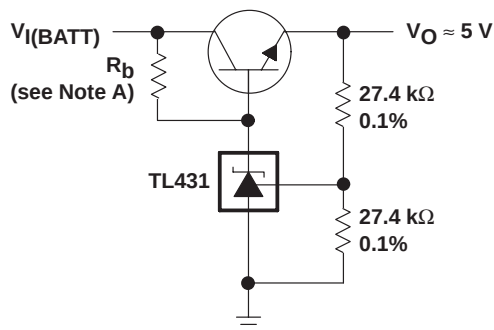


Figure 23. Precision 5-V 1.5-A Regulator



NOTE A: R_h should provide cathode current ≥ 1 mA to the TL431.

Figure 24. Efficient 5-V Precision Regulator

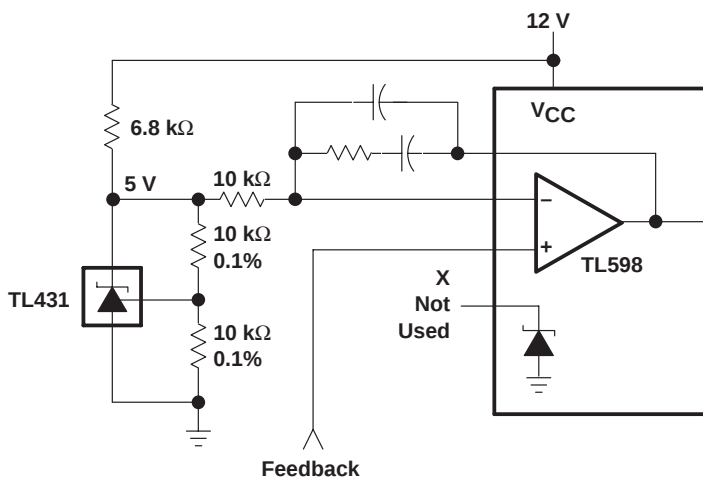
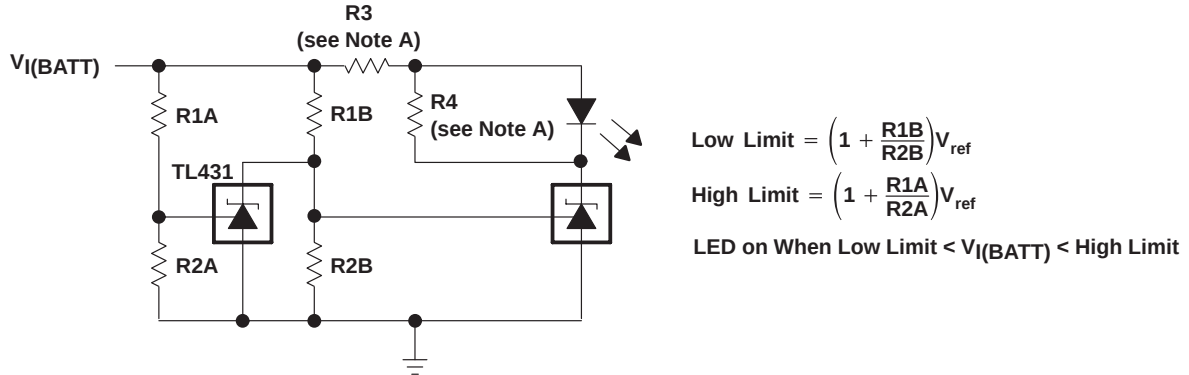


Figure 25. PWM Converter With Reference

APPLICATION INFORMATION



NOTE A: R3 and R4 are selected to provide the desired LED intensity and cathode current ≥ 1 mA to the TL431 at the available $V_{I(BATT)}$.

Figure 26. Voltage Monitor

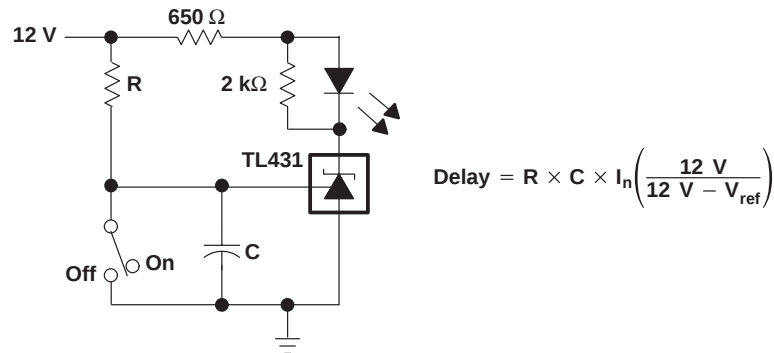


Figure 27. Delay Timer

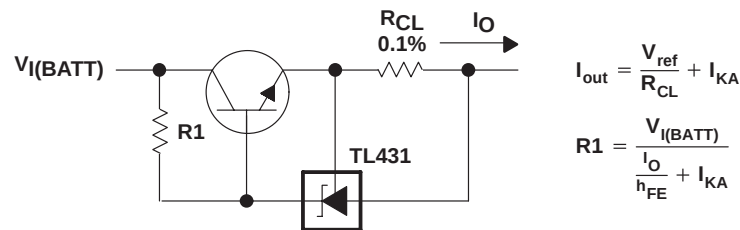


Figure 28. Precision Current Limiter

TL431, TL431A

ADJUSTABLE PRECISION SHUNT REGULATORS

SLVS005M – JULY 1978 – REVISED OCTOBER 2000

APPLICATION INFORMATION

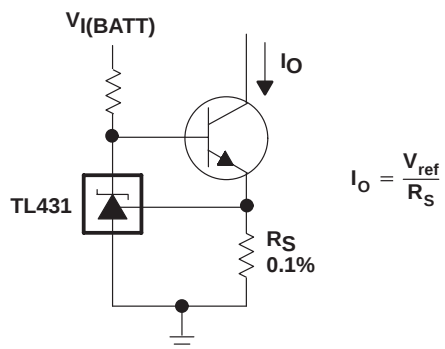


Figure 29. Precision Constant-Current Sink

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TL431, Adjustable Precision Shunt Regulator

DEVICE STATUS: **ACTIVE**

PARAMETER NAME	TL431
Vref (V)	2.5
IZ (min) (uA)	1000
VO (max) (V)	36
Tolerance (%)	2
VI (max) (V)	36
Temp Coeff (typ) (ppm/ degree C)	30
IZ (max) (mA)	100

FEATURES

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- Equivalent Full-Range Temperature Coefficient...30 ppm/ °C
- 0.2- Ω Typical Output Impedance
- Sink-Current Capability...1 mA to 100 mA
- Low Output Noise
- Adjustable Output Voltage... V_{ref} to 36 V
- Available in a Wide Range of High-Density Packages

DESCRIPTION

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The TL431 and TL431A are three-terminal adjustable shunt regulators with specified thermal stability over applicable automotive, commercial, and military temperature ranges. The output voltage can be set to any value between V_{ref} (approximately 2.5 V) and 36 V, with two external resistors (see Figure 17). These devices have a typical output impedance of 0.2 Ω . Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacements for Zener diodes in many applications, such as onboard regulation, adjustable power supplies, and switching power supplies.

The TL431C and TL431AC are characterized for operation from 0°C to 70°C, and the TL431I

and TL431AI are characterized for operation from -40°C to 85°C.

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- [PowerFLEX \(TM\) -- Surface-Mount Alternative For Through-Hole Power Packages](#) (SZZA015 - Updated: 04/08/1999)

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SAMPLES

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ORDERABLE DEVICE	PACKAGE	PINS	TEMP (°C)	STATUS	DSCC NUMBER	SAMPLES
TL431CLP	<u>LP</u>	3	0 TO 70	ACTIVE		Request Samples
TL431IPK	<u>PK</u>	3	-40 TO 85	ACTIVE		Request Samples

PRICING/AVAILABILITY

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ORDERABLE DEVICE	PACKAGE	PINS	TEMP (°C)	STATUS	BUDGETARY PRICE US\$/UNIT QTY=1000+	PACK QTY	DSCC NUMBER	PRICING/AVAILABILITY
TL431CD	<u>D</u>	8	0 TO 70	ACTIVE	0.27	75		Check stock or order
TL431CDBVR	<u>DBV</u>	5	0 TO 70	ACTIVE	0.30	3000		Check stock or order
TL431CDR	<u>D</u>	8	0 TO 70	ACTIVE	0.30	2500		Check stock or order
TL431CKTPR	<u>KTP</u>	2	0 TO 70	ACTIVE	0.30	3000		Check stock or order
TL431CLP	<u>LP</u>	3	0 TO 70	ACTIVE	0.30	1000		Check stock or order
TL431CLPB- TDJ	<u>LP</u>	3	S	OBSOLETE				
TL431CLPM	<u>LP</u>	3	0 TO 70	ACTIVE	0.30	2000		Check stock or order
TL431CLPR	<u>LP</u>	3	0 TO 70	ACTIVE	0.33	2000		Check stock or order
TL431CP	<u>P</u>	8	0 TO 70	ACTIVE	0.27	50		Check stock or order
			0 TO					

TL431CPK	<u>PK</u>	3	70	ACTIVE	0.52	1000		<u>Check stock or order</u>
TL431CPS	<u>PS</u>	8	0 TO 70	ACTIVE				<u>Check stock or order</u>
TL431CPSLE	<u>PS</u>	8		OBSOLETE				Replaced by TL431CPSR
TL431CPSR	<u>PS</u>	8	0 TO 70	ACTIVE	0.67	2000		<u>Check stock or order</u>
TL431CPWLE	<u>PW</u>	8		OBSOLETE				Replaced by TL431CPWR
TL431CPWR	<u>PW</u>	8	0 TO 70	ACTIVE	0.30	2000		<u>Check stock or order</u>
TL431ID	<u>D</u>	8	-40 TO 85	ACTIVE	0.42	75		<u>Check stock or order</u>
TL431IDBVR	<u>DBV</u>	5	-40 TO 85	ACTIVE	0.45	3000		<u>Check stock or order</u>
TL431IDR	<u>D</u>	8	-40 TO 85	ACTIVE	0.45	2500		<u>Check stock or order</u>
TL431ILP	<u>LP</u>	3	-40 TO 85	ACTIVE	0.42	1000		<u>Check stock or order</u>
TL431ILPM	<u>LP</u>	3	-40 TO 85	OBSOLETE				
TL431ILPR	<u>LP</u>	3	-40 TO 85	ACTIVE	0.45	2000		<u>Check stock or order</u>
TL431IP	<u>P</u>	8	-40 TO 85	ACTIVE	0.42	50		<u>Check stock or order</u>
TL431IPK	<u>PK</u>	3	-40 TO 85	ACTIVE	1.00	1000		<u>Check stock or order</u>
TL431MFKB	<u>FK</u>	20	-55 TO 125	OBSOLETE				
TL431MJG	<u>JG</u>	8	-55 TO 125	OBSOLETE				
TL431MJGB	<u>JG</u>	8	-55 TO 125	OBSOLETE				

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TL431A, Adjustable Precision Shunt Regulator

DEVICE STATUS: **ACTIVE**

PARAMETER NAME	TL431A
Vref (V)	2.5
IZ (min) (uA)	1000
VO (max) (V)	36
Tolerance (%)	1
VI (max) (V)	36
Temp Coeff (typ) (ppm/ degree C)	30
IZ (max) (mA)	100

FEATURES [▲Back to Top](#)

- Equivalent Full-Range Temperature Coefficient...30 ppm/ °C
- 0.2- Ω Typical Output Impedance
- Sink-Current Capability...1 mA to 100 mA
- Low Output Noise
- Adjustable Output Voltage... V_{ref} to 36 V
- Available in a Wide Range of High-Density Packages

DESCRIPTION [▲Back to Top](#)

The TL431 and TL431A are three-terminal adjustable shunt regulators with specified thermal stability over applicable automotive, commercial, and military temperature ranges. The output voltage can be set to any value between V_{ref} (approximately 2.5 V) and 36 V, with two external resistors (see Figure 17). These devices have a typical output impedance of 0.2 Ω . Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacements for Zener diodes in many applications, such as onboard regulation, adjustable power supplies, and switching power supplies.

The TL431C and TL431AC are characterized for operation from 0°C to 70°C, and the TL431I and TL431AI are characterized for operation from -40°C to 85°C.

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- [PowerFLEX \(TM\) -- Surface-Mount Alternative For Through-Hole Power Packages](#) (SZZA015 - Updated: 04/08/1999)

PRICING/AVAILABILITY[▲ Back to Top](#)

<u>ORDERABLE DEVICE</u>	<u>PACKAGE</u>	<u>PINS</u>	<u>TEMP (°C)</u>	<u>STATUS</u>	<u>BUDGETARY PRICE US\$/UNIT QTY=1000+</u>	<u>PACK QTY</u>	<u>PRICING/AVAILABILITY</u>
TL431ACD	<u>D</u>	8	0 TO 70	ACTIVE	0.33	75	Check stock or order
TL431ACDR	<u>D</u>	8	0 TO 70	ACTIVE	0.33	2500	Check stock or order
TL431ACLP	<u>LP</u>	3	0 TO 70	ACTIVE	0.33	1000	Check stock or order
TL431ACLPM	<u>LP</u>	3	S	ACTIVE	0.37	2000	Check stock or order
TL431ACLPR	<u>LP</u>	3	0 TO 70	ACTIVE	0.37	2000	Check stock or order
TL431ACP	<u>P</u>	8	0 TO 70	ACTIVE	0.33	50	Check stock or order
TL431ACPS	<u>PS</u>	8	0 TO 70	ACTIVE			Check stock or order
TL431ACPW	<u>PW</u>	8	0 TO 70	OBSOLETE			
TL431ACPWR	<u>PW</u>	8	0 TO 70	ACTIVE	0.33	2000	Check stock or order
TL431AID	<u>D</u>	8	-40 TO 85	ACTIVE	0.42	75	Check stock or order
TL431AIDR	<u>D</u>	8	-40 TO 85	ACTIVE	0.45	2500	Check stock or order
TL431AILP	<u>LP</u>	3	-40 TO 85	ACTIVE	0.42	1000	Check stock or order
TL431AILPR	<u>LP</u>	3	-40 TO 85	ACTIVE	0.45	2000	Check stock or order
TL431AIP	<u>P</u>	8	-40 TO 85	ACTIVE	0.42	50	Check stock or order

Table Data Updated on: 11/26/2000