TL431/TL432

ADJUSTABLE PRECISION SHUNT REGULATOR

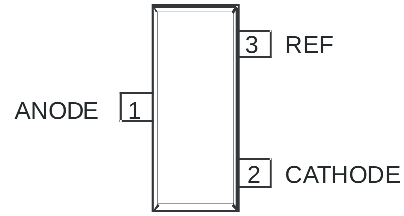
Description

The TL431 and TL432 are three terminal adjustable shunt regulators offering excellent temperature stability and output current handling capability up to 100mA. The output voltage may be set to any chosen voltage between 2.5 and 36 volts by selection of two external divider resistors.

The devices can be used as a replacement for zener diodes in many applications requiring an improvement in zener performance. Diodes' TL431 has the same electrical specifications as the industry standard '431 and is available in 2 grades with initial tolerances of 1% and 0.5% for the A and B grades respectively.

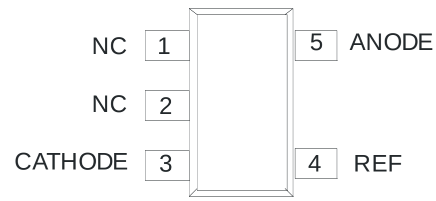
Pin Assignments

TL431
(Top View)



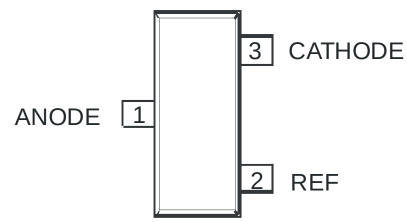
SOT23

(Top View)



SOT25

TL432
(Top View)



SOT23

Features

- Temperature range -40 to 125ºC
- Reference Voltage Tolerance at 25°C
  - TL431A: 2.495V ± 1.0%.
  - TL431B: 2.495V ± 0.5%
- Low Output Noise
- 0.2Ω Typical Output Impedance
- Sink Current Capability: 1mA to 100mA
- Adjustable Output Voltage: V_{REF} to 36V
- SOT23 and SOT25: Available in "Green" Molding Compound (No Br, Sb) and Lead Free Finish/ RoHS Compliant (Note 1)

Applications

- Opto-Coupler Linearisers
- Shunt Regulators
- Improved Zener
- Variable Reference

Notes: 1. EU Directive 2002/95/EC (RoHS). All applicable RoHS exemptions applied. Please visit our website at http://www.diodes.com/products/lead_free.html.

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Absolute Maximum Ratings (Note 2)

Symbol	Parameter		Rating	Unit
V_{KA}	Cathode Voltage		40	V
I_{KA}	Continuous Cathode Current		150	mA
I_{REF}	Reference Input Current		-0.050 to +10	mA
T_J	Operating Junction Temperature		+150	°C
T_{ST}	Storage Temperature		-55 to +150	°C
P_D	Power Dissipation (Notes 3, 4)	SOT23	330	mW
		SOT25	500	mW

Notes: 2. Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability. Unless otherwise stated voltages specified are relative to the ANODE pin.
3. T_J, max =150°C.
4. Ratings apply to ambient temperature at 25°C.

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{KA}	Cathode Voltage	V_{REF}	36	V
I_{KA}	Cathode Current	1	100	mA
T_A	Operating Ambient Temperature	-40	125	°C

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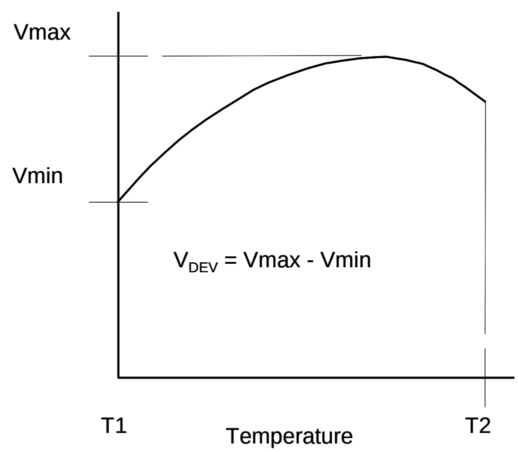
Electrical Characteristics (T_A = +25°C, unless otherwise noted)

Symbol	Parameter	Test Conditions		Min	Typ.	Max	Unit
V_{REF}	Reference voltage	$V_{KA} = V_{REF}$, I_{KA} = 10mA	TL431A	2.470	2.495	2.520	V
			TL431B	2.482	2.495	2.507	V
V_{DEV}	Deviation of reference voltage over full temperature range (Note 5)	$V_{KA} = V_{REF}$, I_{KA} = 10mA	T_A = 0 to 70 °C		6	16	mV
			T_A = -40 to 85 °C		14	34	mV
			T_A = -40 to 125 °C		14	34	mV
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of the change in reference voltage to the change in cathode voltage	I_{KA} = 10mA	V_{KA} = 10V to V_{REF}		-1.4	-2.7	mV/V
			V_{KA} = 36V to 10V		-1	-2	mV/V
I_{REF}	Reference input current	I_{KA} = 10mA, R1 = 10KΩ, R2 = ∞			1	4	µA
ΔI_{REF}	I_{REF} deviation over full temperature range (Note 5)	I_{KA} = 10mA, R1 = 10KΩ, R2 = ∞	T_A = 0 to 70 °C		0.8	1.2	µA
			T_A = -40 to 85 °C		0.8	2.5	µA
			T_A = -40 to 125 °C		0.8	2.5	µA
$I_{KA(MIN)}$	Minimum cathode current for regulation	$V_{KA} = V_{REF}$			0.4	0.7	mA
$I_{KA(OFF)}$	Off-state current	V_{KA} = 36V, V_{REF} = 0V			0.05	0.5	µA
$\lvert Z_{KA}\rvert$	Dynamic output impedance (Note 6)	$V_{KA} = V_{REF}$, f = 0Hz			0.2	0.5	Ω
θ_{JA}	Thermal Resistance Junction to Ambient	SOT23			380		°C/W
		SOT25			250		°C/W

Notes: 5. Deviation of V_{DEV}, and ΔI_{REF} are defined as the maximum variation of the values over the full temperature range.

The average temperature coefficient of the reference input voltage αV_{REF} is defined as:

$$\left|\alpha V_{REF}\right| = \frac{\left(\frac{V_{DEV}}{V_{REF}\ @\ 25^oC}\right) X\ 10^6}{T2 - T1}\ \text{ppm/}^oC$$



Where:
T2 – T1 = full temperature change.

αV_{REF} can be positive or negative depending on whether the slope is positive or negative.

Notes: 6. The dynamic output impedance, R_Z, is defined as:

$$\left|Z_{KA}\right| = \frac{\Delta V_{KA}}{\Delta I_{KA}}$$

When the device is programmed with two external resistors R1 and R2, the dynamic output impedance of the overall circuit, is defined as:

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

Test Circuits

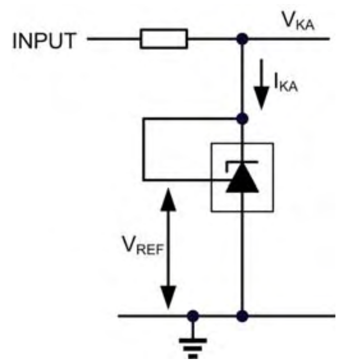


Figure 1. Test circuit for $V_{KA} = V_{REF}$

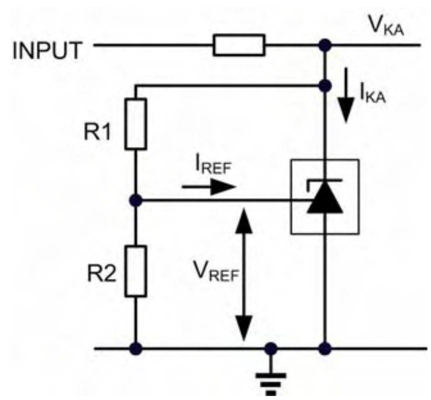


Figure 2. Test circuit for $V_{KA} > V_{REF}$

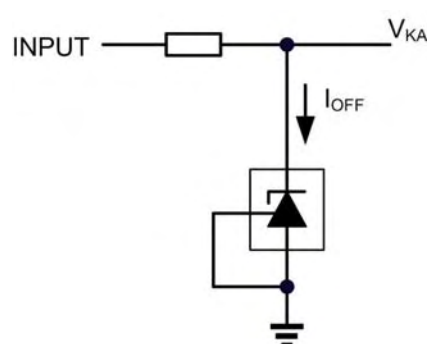
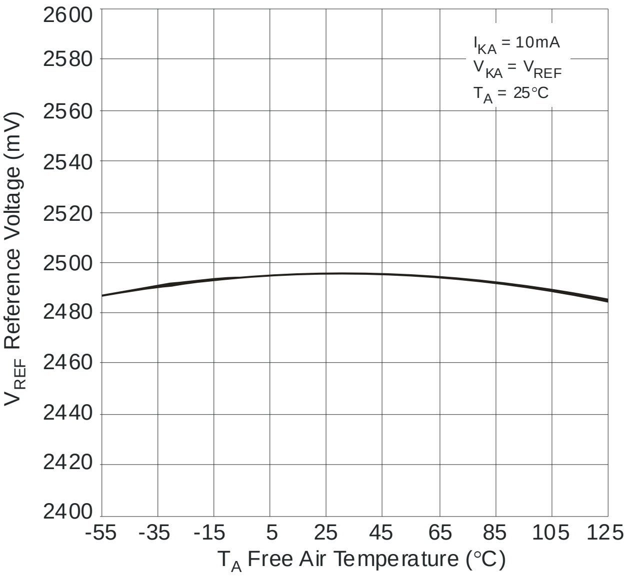
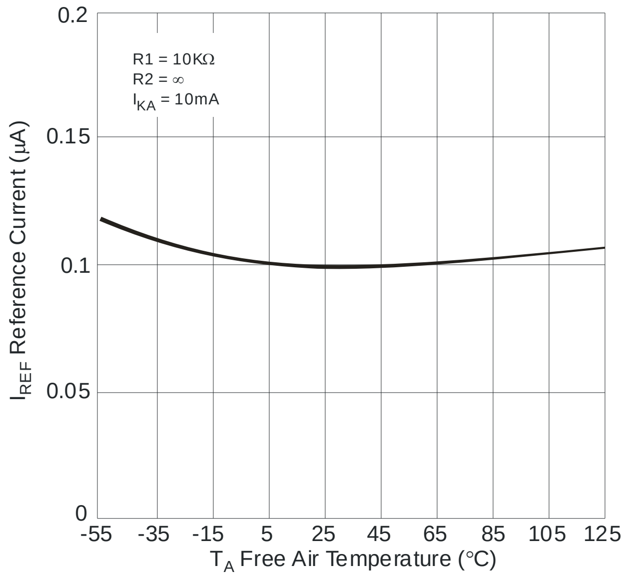


Figure 3. Test circuit for I_{OFF}

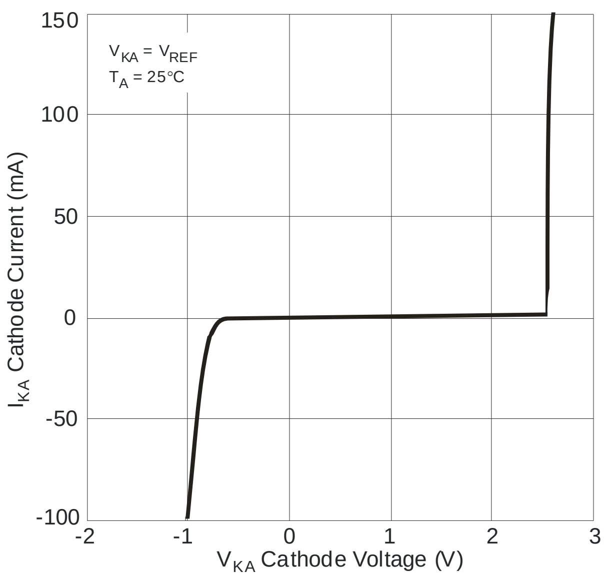
Typical Performance Characteristics



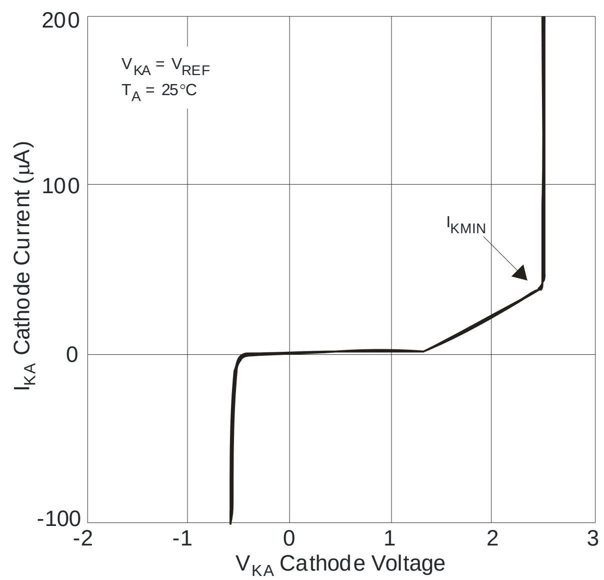
Reference Voltage vs. Free Air Temperature



Reference Current vs. Free Air Temperature

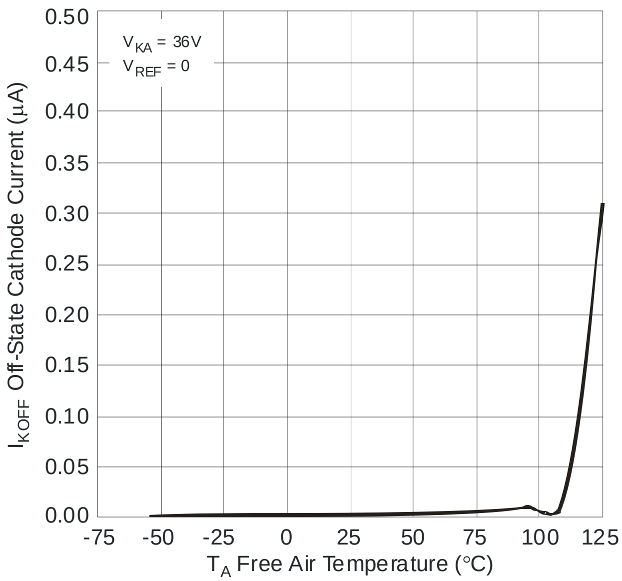


Cathode Current vs. Cathode Voltage

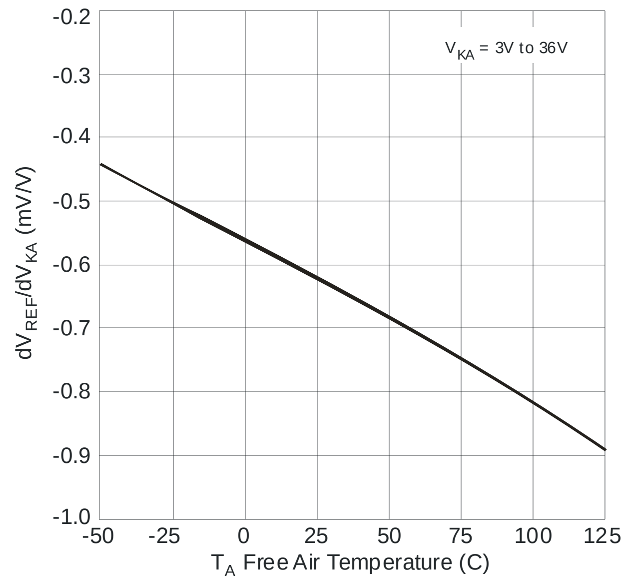


Cathode Current vs. Cathode Voltage

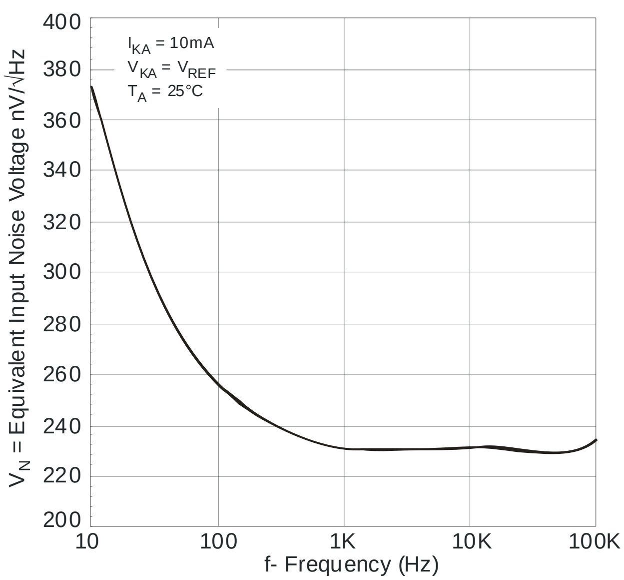
Typical Performance Characteristics (Continued)



Off-State Cathode Current vs. Free Air Temperature



Ratio of Delta Reference Voltage to Delta Cathode Voltage vs. Free Air Temperature



Equivalent Input Noise Voltage vs. Frequency

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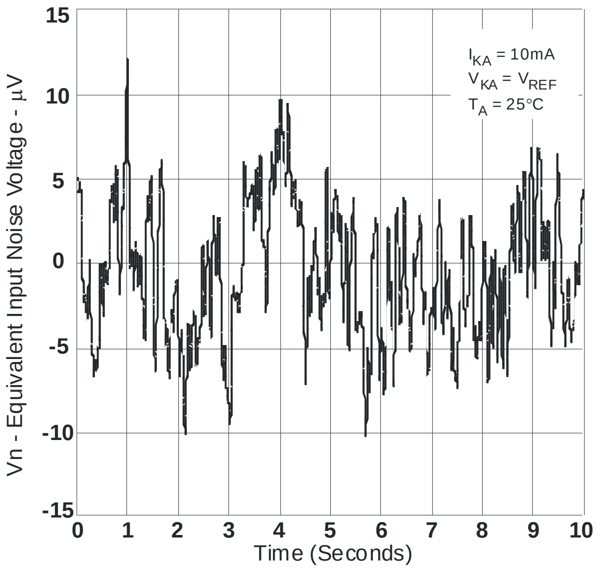
Typical Performance Characteristics (Continued)



Equivalent Input Noise Voltage Over A 10-S Period

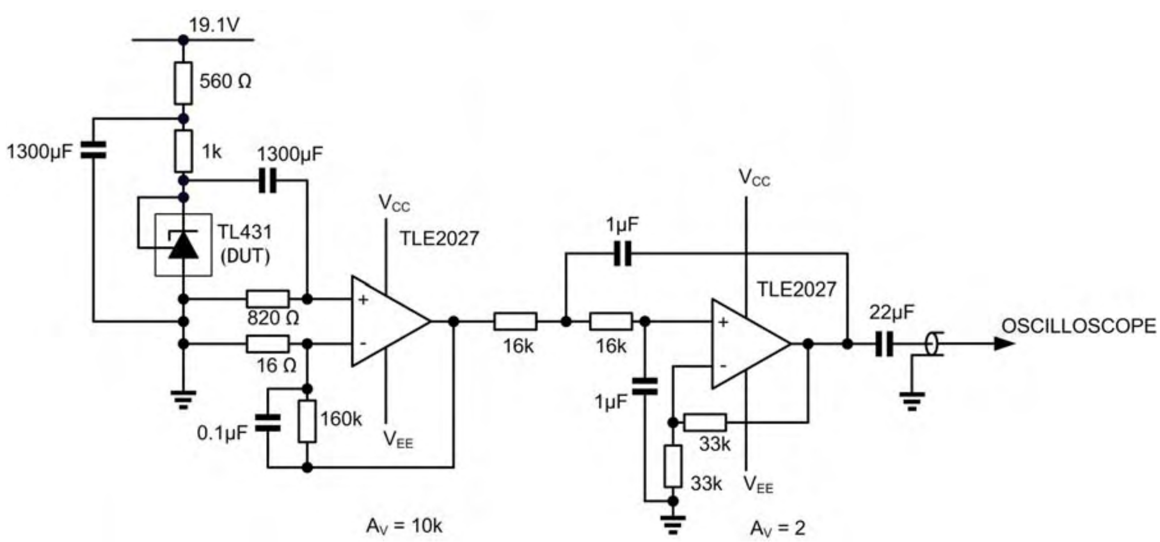


Figure 4. Test circuit for noise input voltage

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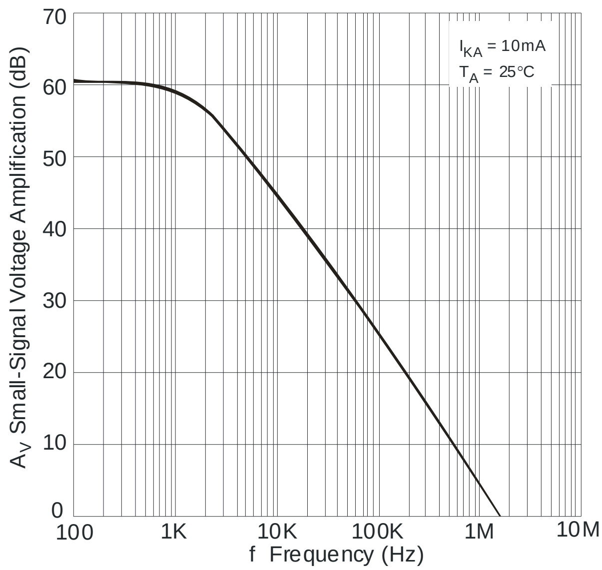
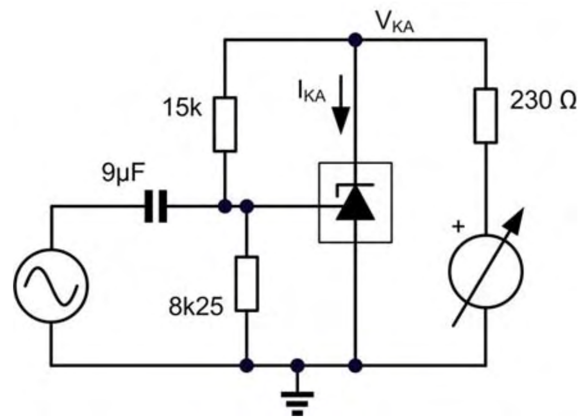
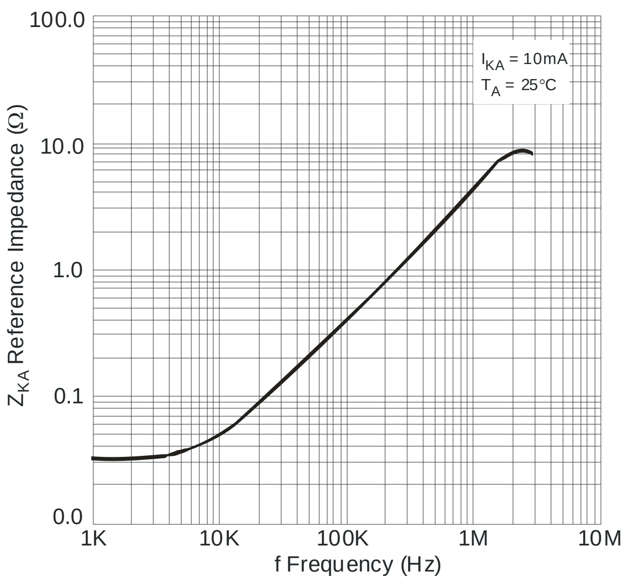
Typical Performance Characteristics (Continued)



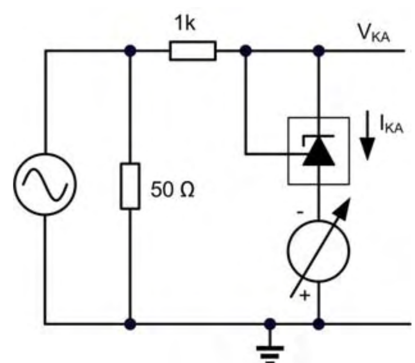
Small-Signal Voltage Amplification vs. Frequency



Test circuit for voltage amplification

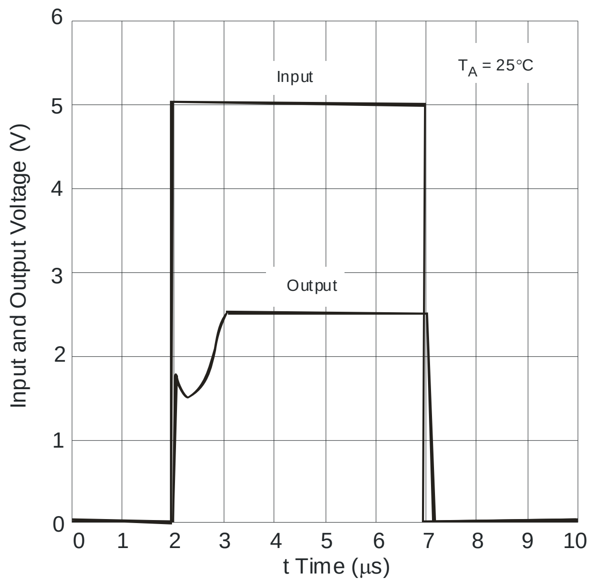


Reference Impedance vs. Frequency

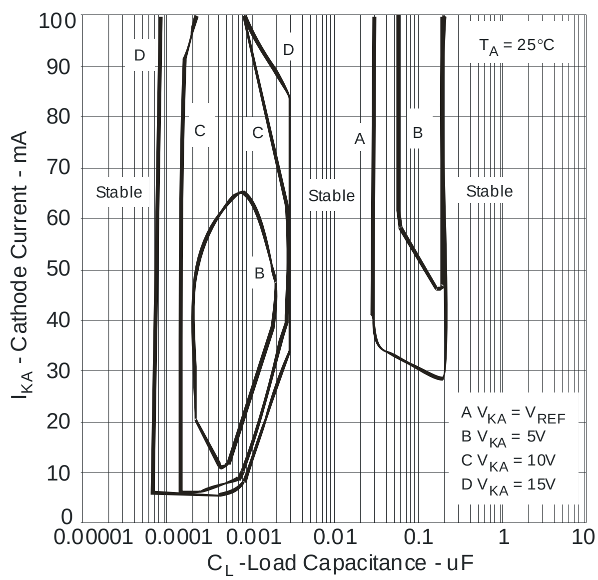


Test circuit for reference impedance

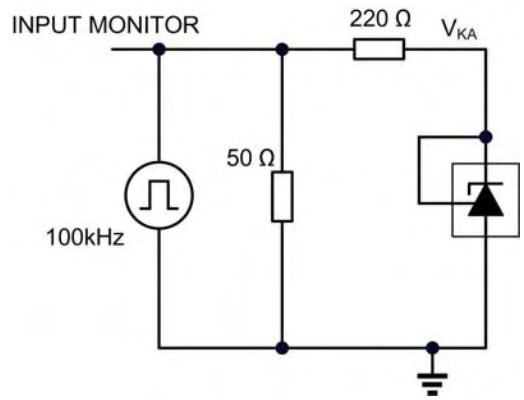
Typical Performance Characteristics (Continued)



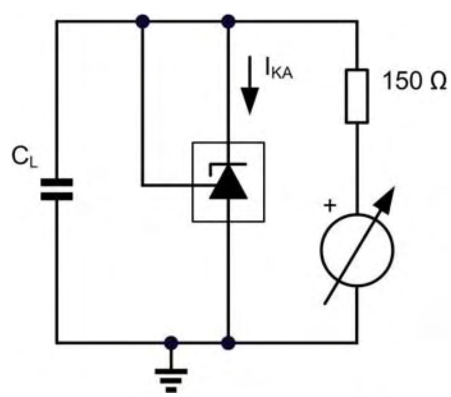
Pulse Response



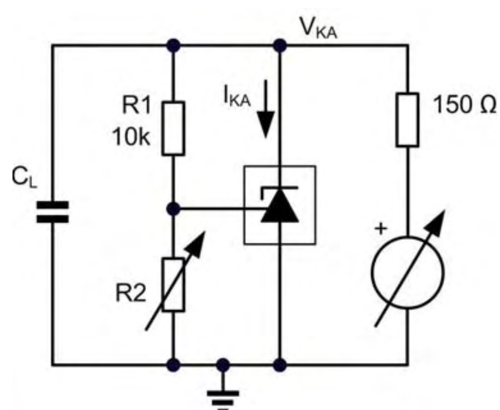
Stability Boundary Conditions



Test Circuit for Pulse Response



Test Circuit for Curve A



Test Circuit for Curves B, C, D

The device is stable under all conditions with a load capacitance not exceeding 50pF. The device is stable under all conditions with a load capacitance between 5nF and 20nF. The device is stable under all conditions with a load capacitance exceeding 300nF. With a cathode current not exceeding 5mA, the device is stable with any load capacitance.

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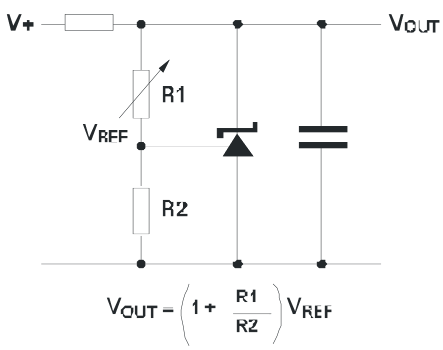
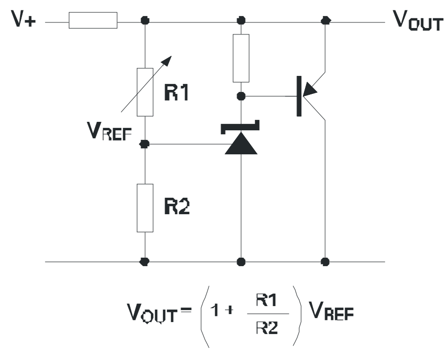
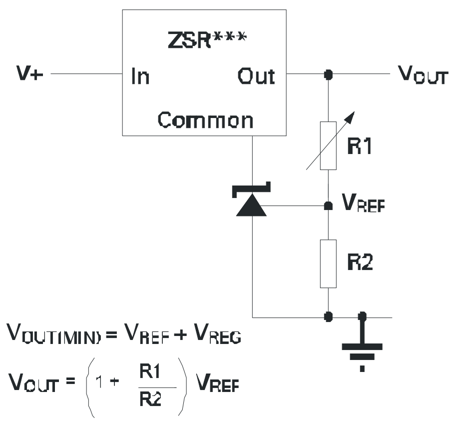
Applications Information



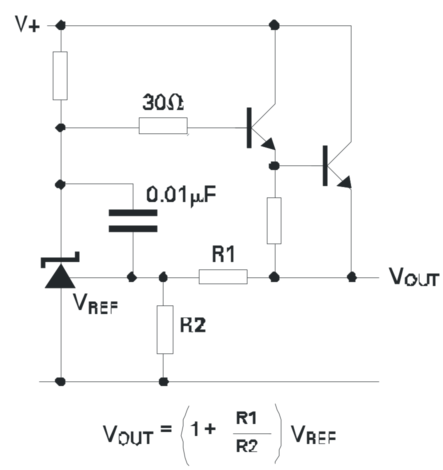
Shunt Regulator



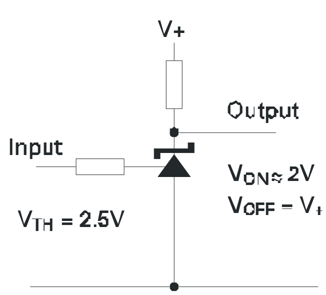
Higher Current Shunt Regulator



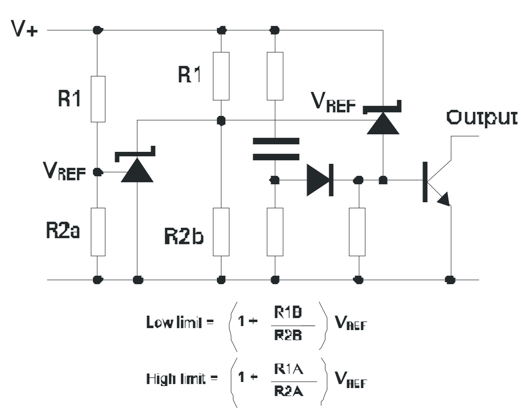
Output Control of a Three Terminal Fixed Regulator



Series Regulator



Single Supply Comparator with Temperature Compensated Threshold



Over Voltage / Under Voltage Protection Circuit

Ordering Information

TL43 X X XX - 7

Pinout variation	Tolerance	Package	Packing
1: Standard pinout	A: ±1.0%	SA: SOT23	7: Tape & Reel
2: Reversed pinout in SOT23	B: ±0.5%	W5: SOT25	

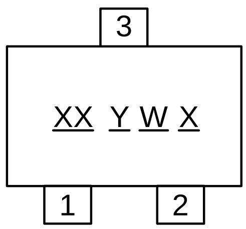
Device (Note 7)	Package Code	Packaging (Note 5)	7" Tape and Reel		Ammo Box	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix
TL431A(B)SA-7	SA	SOT23	3000/Tape & Reel	-7	NA	NA
TL431A(B)W5-7	W5	SOT25	3000/Tape & Reel	-7	NA	NA
TL432A(B)SA-7	SA	SOT23	3000/Tape & Reel	-7	NA	NA

Notes:
7. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf.
8. Suffix "B" denotes TL431B device.

Marking Information

(1) SOT23

(Top View)

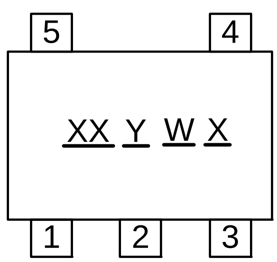


XX : Identification code
Y : Year 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents
52 and 53 week
X : A~Z : Green

Device	Package	Identification Code
TL431ASA	SOT23	AA
TL431BSA	SOT23	AB
TL432ASA	SOT23	BA
TL432BSA	SOT23	BB

(2) SOT25

(Top View)



XX : Identification code
Y : Year 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents
52 and 53 week
X : A~Z : Green

Device	Package	Identification Code
TL431AW5	SOT25	AA
TL431BW5	SOT25	AB

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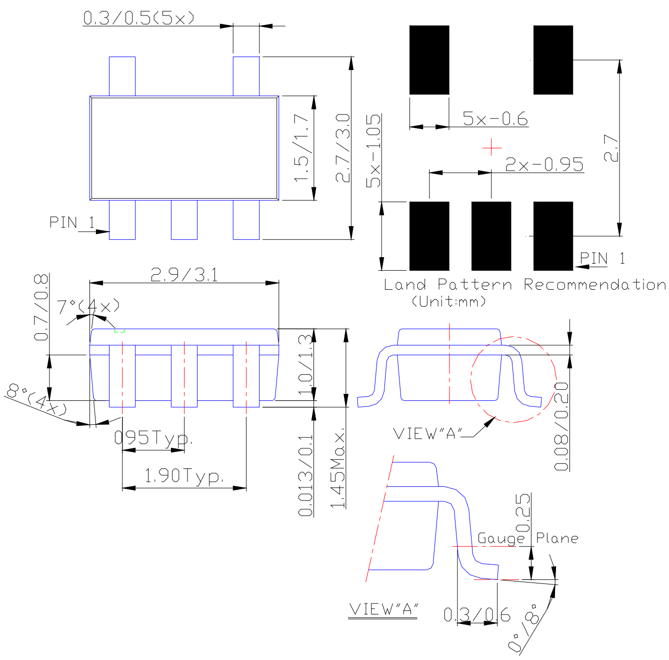
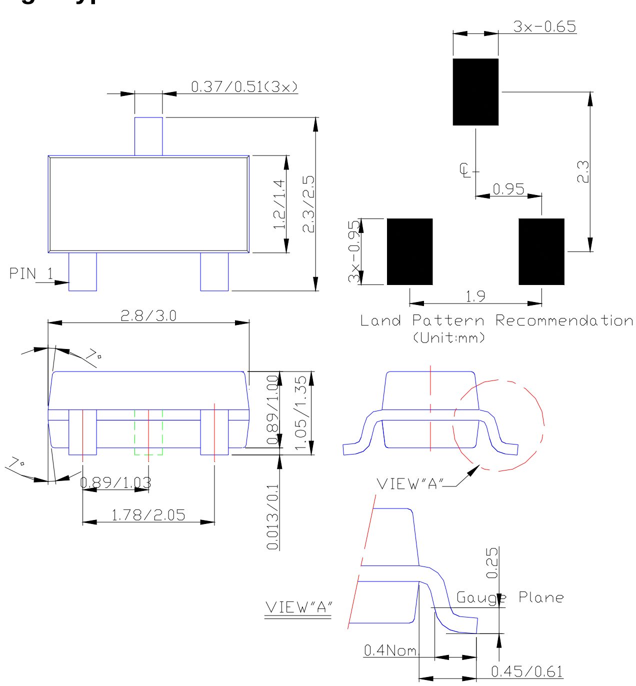
Package Outline Dimensions (All Dimensions in mm)

(1) Package type: SOT25



(2) Package Types: SOT23



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Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.

Как с нами связаться

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