

Low Voltage(1.24V) Adjustable Precision Shunt Regulator TL432/A/C

FEATURES

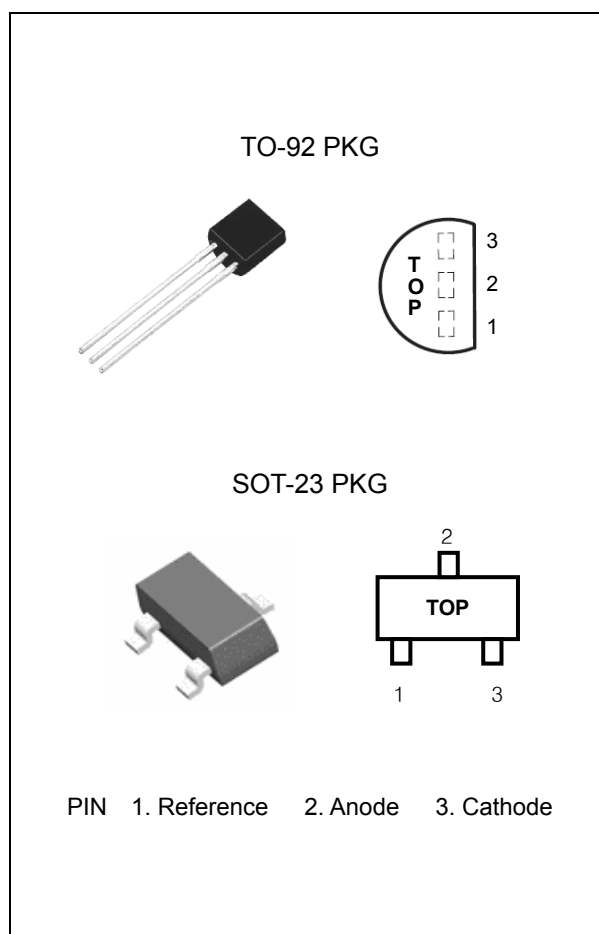
- Low Voltage Operation : 1.24 V
- Programmable Out Voltage to 18V
- Sink Current Capability of 1mA to 100mA
- Equivalent full range Temperature Coefficient of 50ppm/°C
- Temperature Compensated for operation over full rated operating Temperature Range
- Low Output Noise Voltage
- Moisture Sensitivity Level 3

APPLICATION

- Shunt Regulator
- Voltage Monitoring
- Current Source and Sink Circuits
- Analog & Digital Circuits Requiring Precision References
- Low Out Voltage (3.0V to 3.3V) Switching Power Supply Error Amplifier

DESCRIPTION

The TL432 is a three-terminal Shunt Voltage Reference providing a highly accuracy 1.24V band-gap reference with 0.5% and 1.0% tolerance. The TL432 thermal stability and wide operating current(100mA) makes is suitable for all variety of applications that are looking for a low cost solution with high performance. The TL432 is an ideal voltage reference in an isolated feed circuit for 3.0V to 3.3V switching mode power supplies.



PIN 1. Reference 2. Anode 3. Cathode

ORDERING INFORMATION

Device	Package
TL432TA	TO-92(Taping)
TL432SF	SOT-23 3L

* Refer to the page 2 for detailed ordering Information,

Absolute Maximum Ratings

(Full operating ambient temperature range applies unless otherwise noted.)

CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Cathode Voltage	V_{KA}	-	20	V
Cathode Current Range(Continuous)	I_K	-	100	mA
Reference Input Current Range	I_{REF}	-	3	mA
Junction Temperature Range	T_J	-40	150	°C
Operating Temperature Range	T_{OPR}	-40	125	°C
Storage Temperature Range	T_{STG}	-65	150	°C
Total Power Dissipation	P_D	770		mW

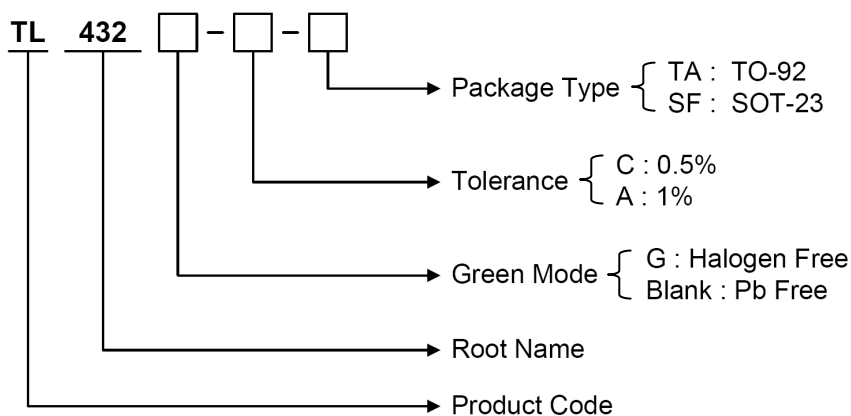
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RECOMMENDED OPERATING CONDITIONS

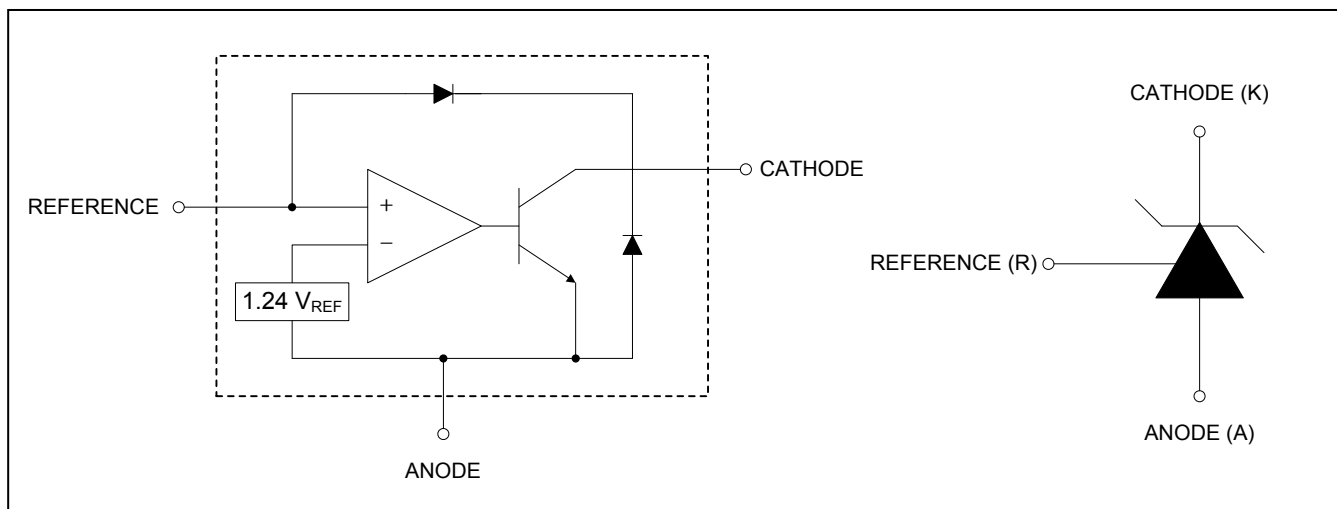
CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Cathode Voltage	V_{KA}	V_{REF}	18	V
Cathode Current	I_K	0.1	100	mA

Ordering Information

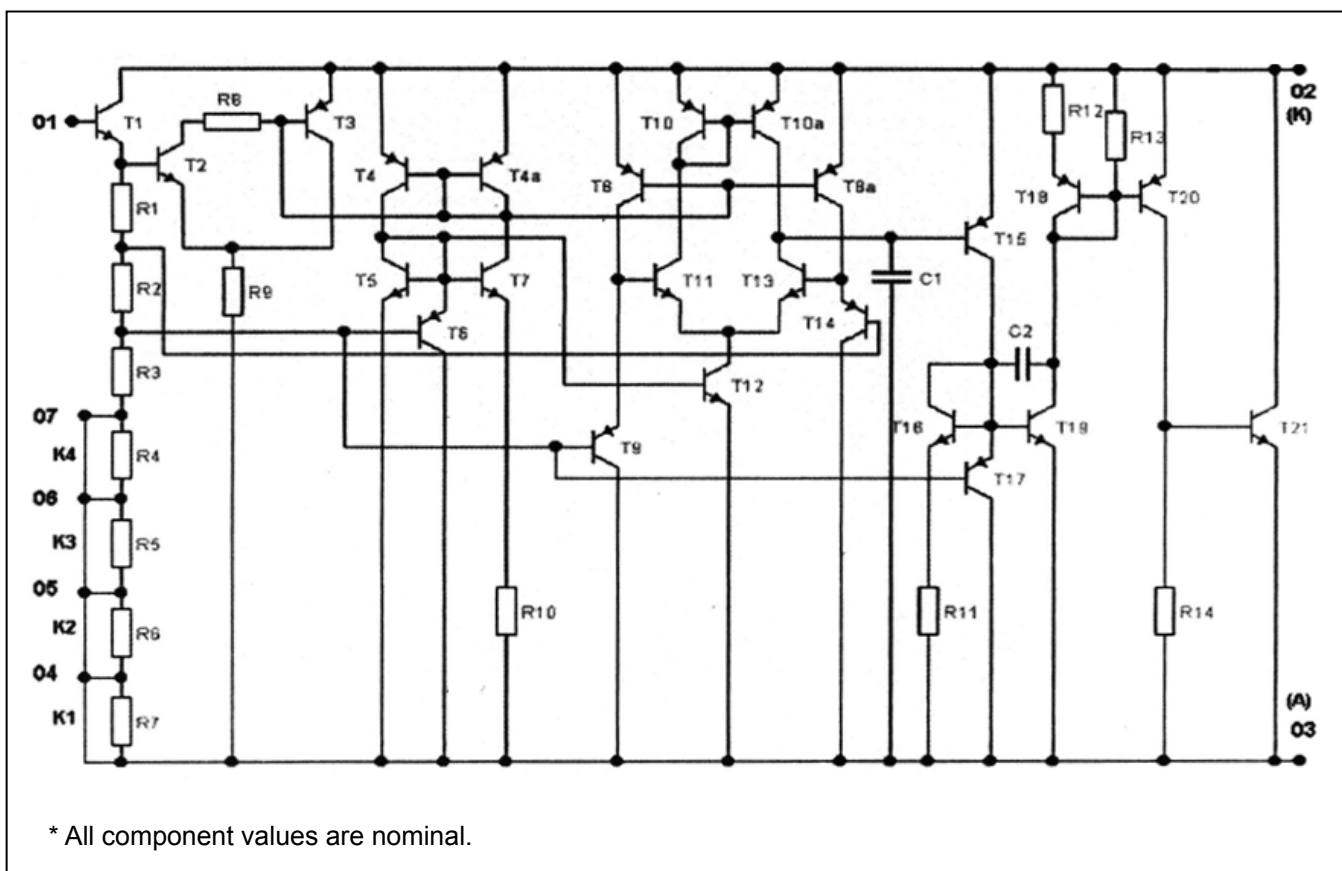
V_{REF}	Package	Tolerance	Order No.	Marking	Supplied As	Status
1.24V	TO-92	0.5%	TL432CTA	TL432-C	Tape	Active
		1%	TL432ATA	TL432-A	Tape	Active
	SOT-23	0.5%	TL432CSF	432	Reel	Active
			TL432GCSF	432	Reel	Contact us
		1%	TL432ASF	432	Reel	Active
			TL432GASF	432	Reel	Contact us



FUNCTION BLOCK DIAGRAM

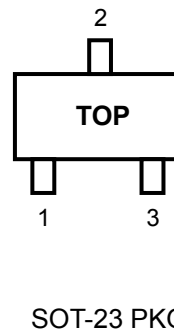
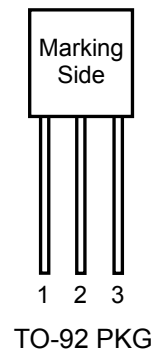


EQUIVALENT SCHEMATIC



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PIN CONFIGURATION



PIN DESCRIPTION

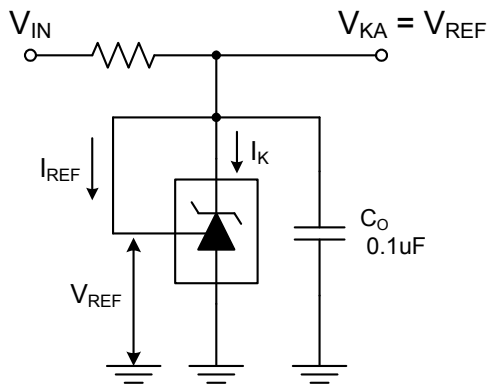
Pin No.	TO-92 / SOT-23	
	Name	Function
1	Reference	Reference Voltage
2	Anode	Ground
3	Cathode	Input Supply Voltage

TL432 ELECTRICAL CHARACTERISTICS

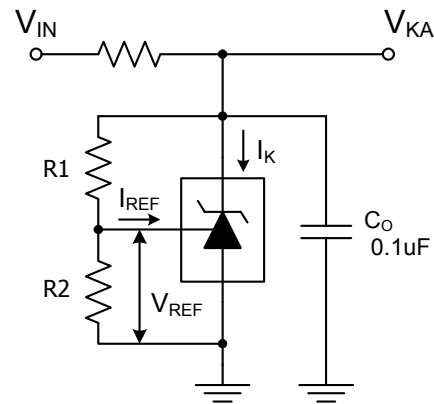
(T_A=25°C, unless otherwise specified)

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Reference Input Voltage	V _{REF}	V _{KA} =V _{REF} , I _K =10mA	TL432C	1.234	1.240	1.246	V
			TL432A	1.228	1.240	1.252	
Deviation of Reference Input Voltage	ΔV _{REF} /ΔT	V _{KA} = V _{REF} , I _K =10mA T _A =Full Range			15	25	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	ΔV _{REF} /ΔV _{KA}	V _{KA} = 1.25V to 14.5V			1.0	2.7	mV/V
Reference Input Current	I _{REF}	R1=10kΩ, R2=∞			0.25	0.5	uA
Deviation of Reference Input Current	ΔI _{REF} /ΔT	R1=10kΩ, R2=∞, T _A = Full Range			0.05	0.3	uA
Minimum Cathode Current for Regulation	I _{K(MIN)}	V _{KA} = V _{REF}			60	80	uA
Off-State Cathode Current	I _{K(OFF)}	V _{KA} =16V, V _{REF} =0			0.04	0.5	uA
Dynamic Impedance	Z _{KA}	V _{KA} = V _{REF} , I _K =0.1mA~100mA f ≤ 1kHz			0.2	0.4	Ω

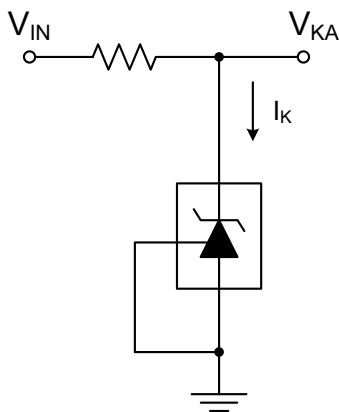
TEST CIRCUITS



< Fig 1. Test circuit for $V_{KA} = V_{REF}$ >



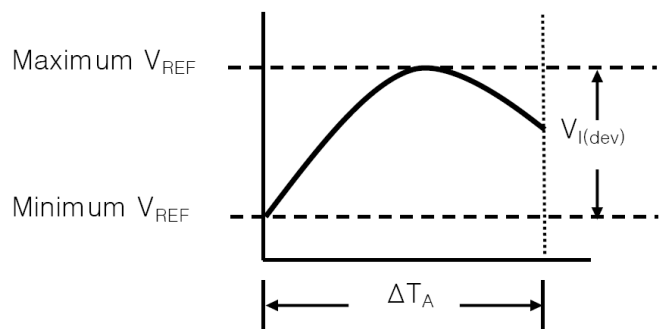
< Fig 2. Test circuit for $V_{KA} \geq V_{REF}$ >



< Fig 3. Test circuit for $I_{KA(OFF)}$ >

The deviation parameters $\Delta V_{REF}/\Delta T$ and $\Delta I_{REF}/\Delta T$ 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, αV_{REF} , is defined as :

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



Where :

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

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αV_{REF} can be positive or negative, depending on whether minimum V_{REF} or maximum V_{REF} , respectively, occurs at the lower temperature.

Example: Maximum $V_{REF}=1190\text{mV}$ at 30°C , maximum $V_{REF}=1262\text{mV}$ at 0°C , $V_{REF}=1241\text{mV}$ at 25°C ,
 $\Delta T_A=125^\circ\text{C}$ for TL432C.

$$|\alpha V_{REF}| = \frac{\left(\frac{72\text{mV}}{1241\text{mV}}\right) \times 10^6}{125^\circ\text{C}} \approx 46\text{ppm}/^\circ\text{C}$$

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

Calculating Dynamic Impedance

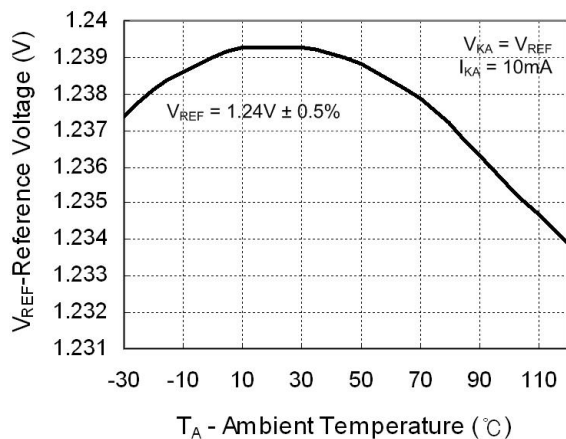
The dynamic impedance is defined as : $|Z_{KA}| = \frac{\Delta V_{KA}}{\Delta I_{KA}}$

When the device is operating with two external resistors, the total dynamic impedance of the circuit is given by:

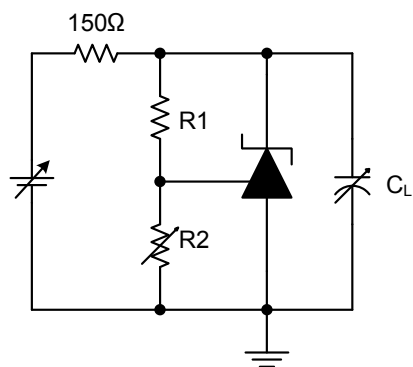
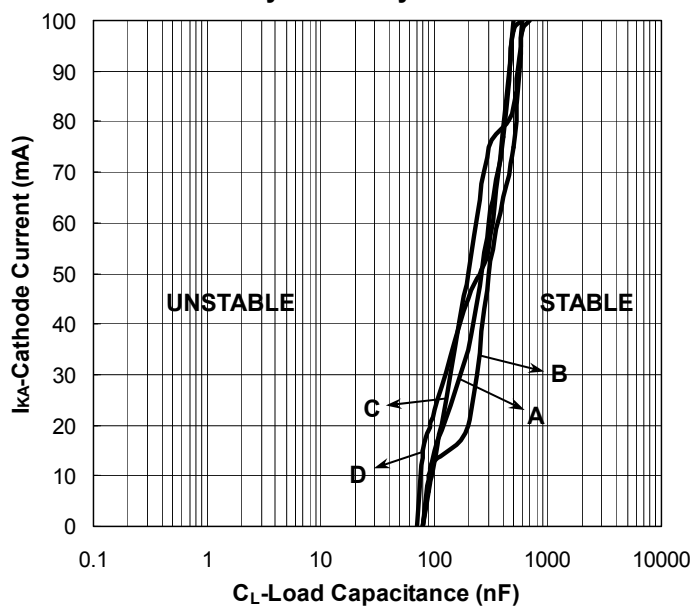
$$|Z'| = \frac{\Delta V}{\Delta I} \approx |Z_{KA}| (1 + R1/R2)$$

TYPICAL OPERATING CHARACTERISTICS

Reference Voltage vs. Junction Temperature



Stability Boundary Conditions



< Fig 4. Test Circuit >

- A $V_{KA}=V_{REF}$ $R1= 0\Omega$, $R2 = \infty$
- B $V_{KA}=5.0V$, $R1=10k\Omega$, $R2 = 3.3k\Omega$
- C $V_{KA}=10.0V$ $R1=10k\Omega$, $R2 = 1.42k\Omega$
- D $V_{KA}=15.0V$ $R1=10k\Omega$, $R2 = 900\Omega$