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/℃
- Temperature Compensated for operation over full rated operating Temperature Range
- Low Output Noise Voltage
- Moisture Sensitivity Level 3

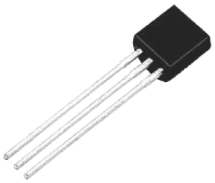
APPLICATION

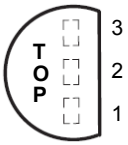
- Shunt Regulator
- Voltage Monitoring
- Current Source and Sink Circuits
- Analog & Digital Circuits Requiring Precision References
- Low Out Voltage (3.0V to 3.3V) Switching Power Supply Error Amplifier

DESCRIPSION

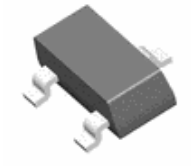
The TL432 is a three-terminal Shunt Voltage Reference providing a highly accuracy 1.24V band-gap reference with 0.5% and 1.0% tolerance. The TL432 thermal stability and wide operating current(100mA) makes is suitable for all variety of applications that are looking for a low cost solution with high performance.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

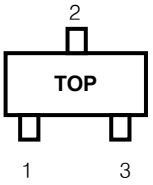
TO-92 PKG





SOT-23 PKG





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.)

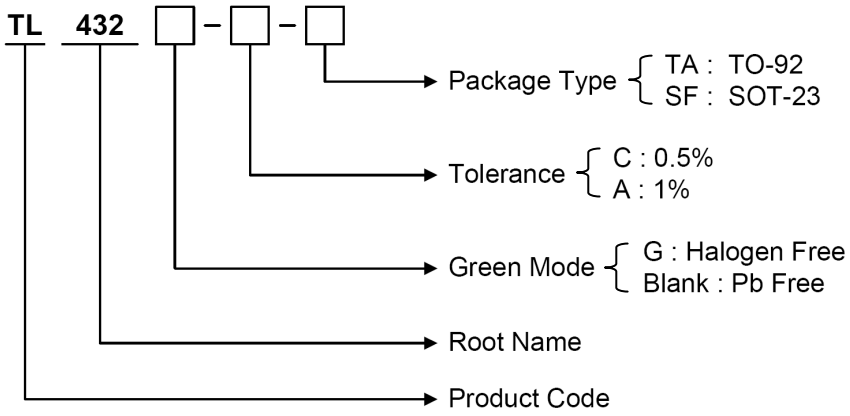
CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Cathode Voltage	V_{KA}	-	20	V
Cathode Current Range(Continuous)	I_K	-	100	mA
Reference Input Current Range	I_{REF}	-	3	mA
Junction Temperature Range	T_J	-40	150	℃
Operating Temperature Range	T_{OPR}	-40	125	℃
Storage Temperature Range	T_{STG}	-65	150	℃
Total Power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

RECOMMENDED OPERATING CONDITIONS

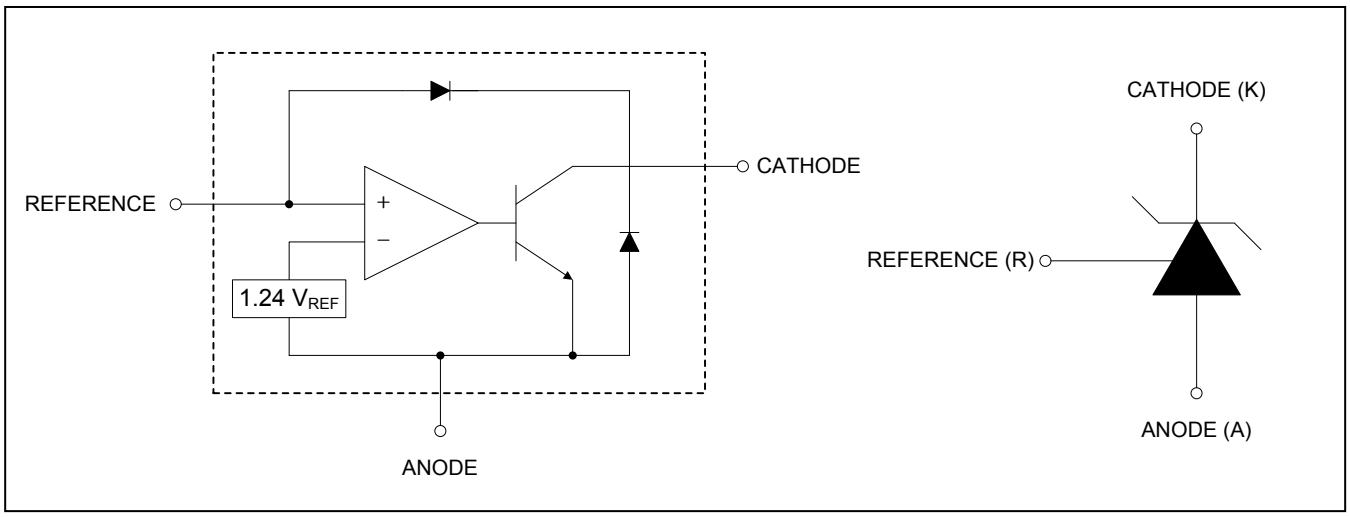
CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Cathode Voltage	V_{KA}	V_{REF}	18	V
Cathode Current	I_K	0.1	100	mA

Ordering Information

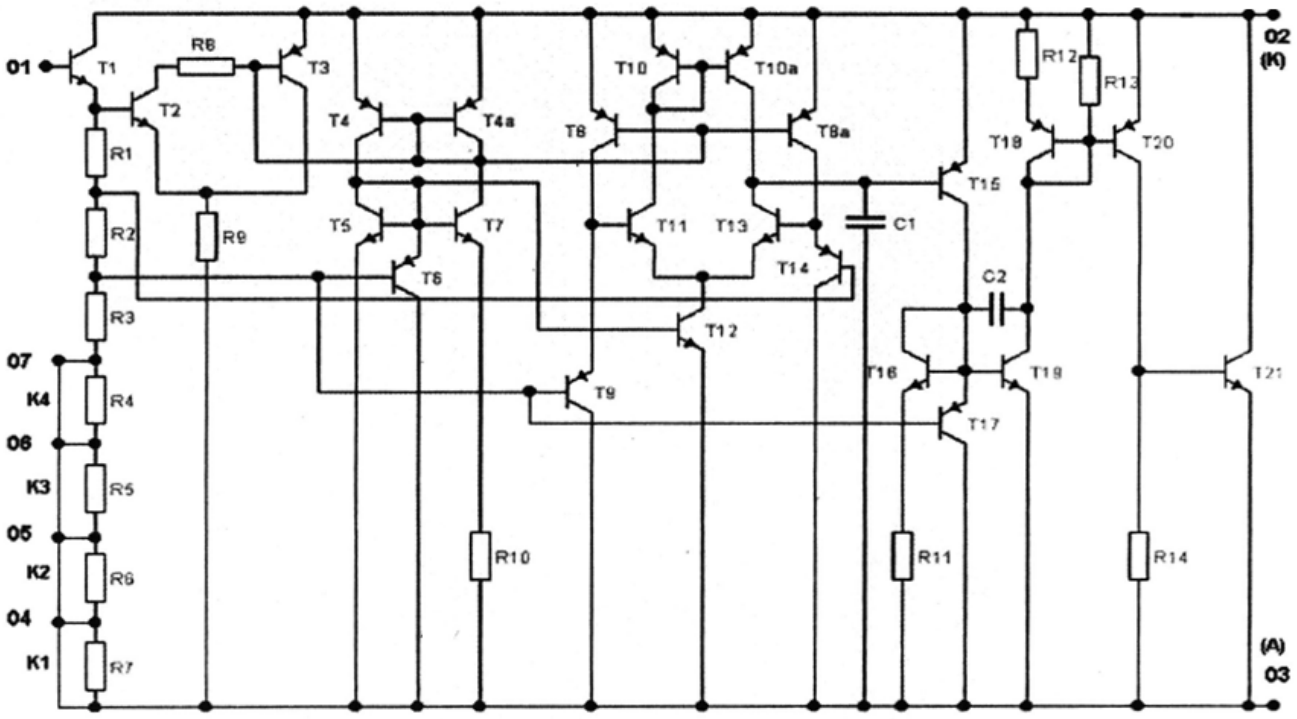
V_{REF}	Package	Tolerance	Order No.	Marking	Supplied As	Status
1.24V	TO-92	0.5%	TL432CTA	TL432-C	Tape	Active
		1%	TL432ATA	TL432-A	Tape	Active
	SOT-23	0.5%	TL432CSF	432	Reel	Active
			TL432GCSF	432	Reel	Contact us
		1%	TL432ASF	432	Reel	Active
			TL432GASF	432	Reel	Contact us



FUNCTION BLOCK DIAGRAM

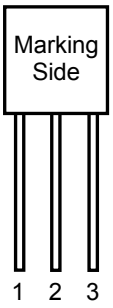


EQUIVALENT SCHEMATIC

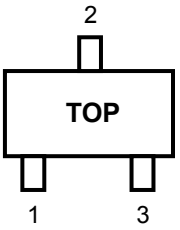


* All component values are nominal.

PIN CONFIGURATION



TO-92 PKG



SOT-23 PKG

PIN DESCRIPTION

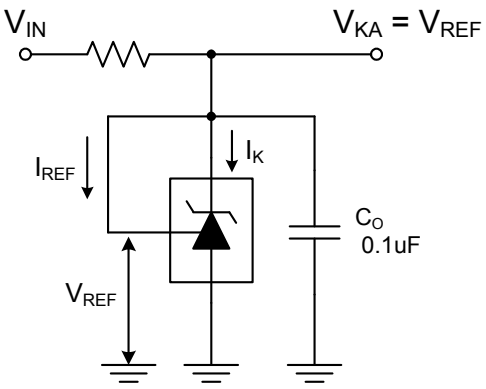
Pin No.	TO-92 / SOT-23	
	Name	Function
1	Reference	Reference Voltage
2	Anode	Ground
3	Cathode	Input Supply Voltage

TL432 ELECTRICAL CHARACTERISTICS

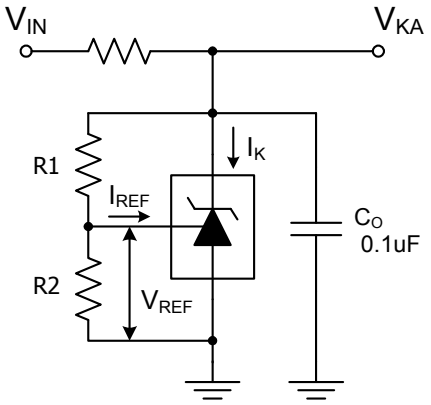
(T_A=25℃, unless otherwise specified)

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	$\Delta V_{REF}/\Delta T$	$V_{KA}=V_{REF}$, I_K=10mA T_A =Full Range			15	25	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\Delta V_{REF}/\Delta V_{KA}$	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	$\Delta I_{REF}/\Delta T$	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

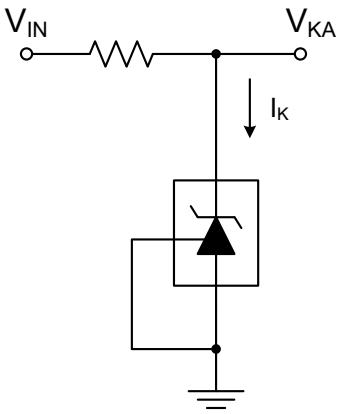
TEST CIRCUITS



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



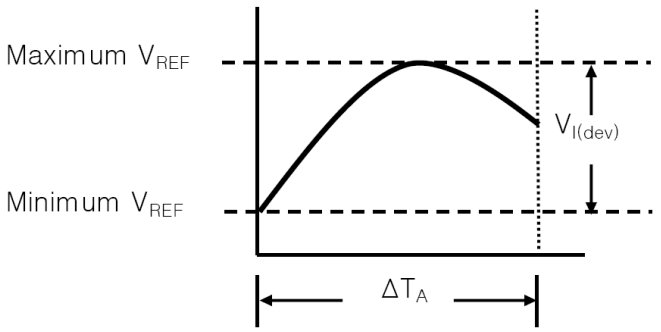
< Fig 2. Test circuit for $V_{KA} \geq V_{REF}$ >



< 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 :

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



Where :

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

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}=1190mV at 30℃, maximum V_{REF}=1262mV at 0℃, V_{REF}=1241mV at 25℃, ΔT_A=125℃ for TL432C.

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

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

Calculating Dynamic Impedance

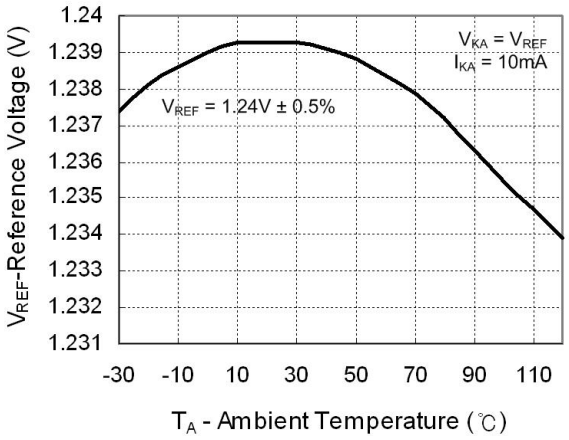
The dynamic impedance is defined as : $\left|Z_{KA}\right| = \frac{\Delta V_{KA}}{\Delta I_{KA}}$

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

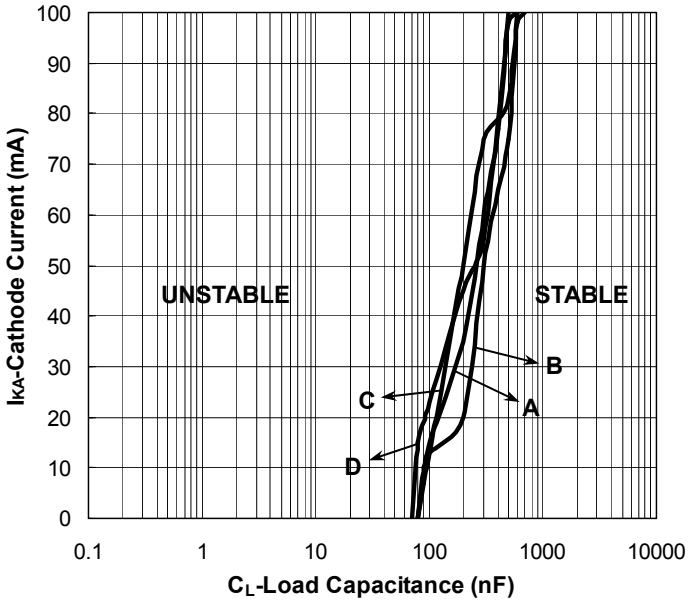
$$\left|Z'\right| = \frac{\Delta V}{\Delta I} \approx \left|Z_{KA}\right|(1 + R1/R2)$$

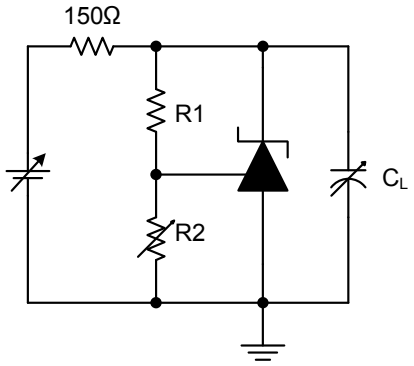
TYPICAL OPERATING CHARACTERISTICS

Reference Voltage vs. Junction Temperature



Stability Boundary Conditions





< Fig 4. Test Circuit >

A $V_{KA}=V_{REF}$ R1= 0Ω, R2 = ∞
B V_{KA}=5.0V, R1=10kΩ, R2 = 3.3kΩ
C V_{KA}=10.0V R1=10kΩ, R2 = 1.42kΩ
D V_{KA}=15.0V R1=10kΩ, R2 = 900Ω