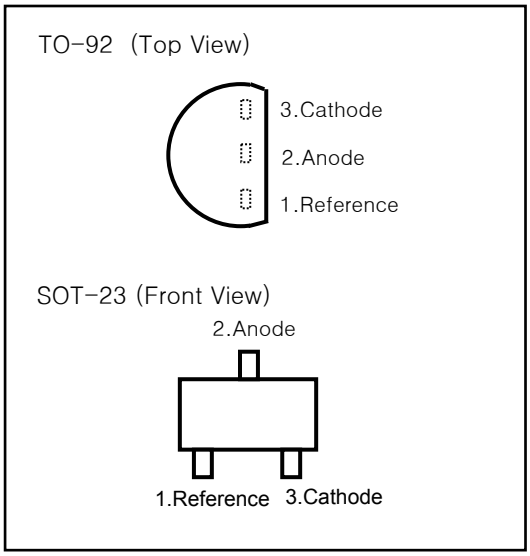
PROGRAMMABLE PRECISION REFERENCES

The TL432A is a three-terminal Shunt Voltage Reference providing a highly accurace 1.24 V, 1.25V bandgap reference with 1.0 % tolerance.

The TL432A 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 TL432A is an ideal voltage reference in an isolated feed circuit for 3.0V to 3.3V switching mode power supplies.



FEATURES

- Low Voltage Operation : 1.24 V
- Programmable Out Voltage to 15V
- Sink Current Capability of 1 mA to 100 mA
- Equivalent Full-Range Temperature Coefficient of 50 ppm/℃
- Temperature Compensated for Operation over Full Rated Operating Temperature Range
- Trimmed Bandgap to 5%

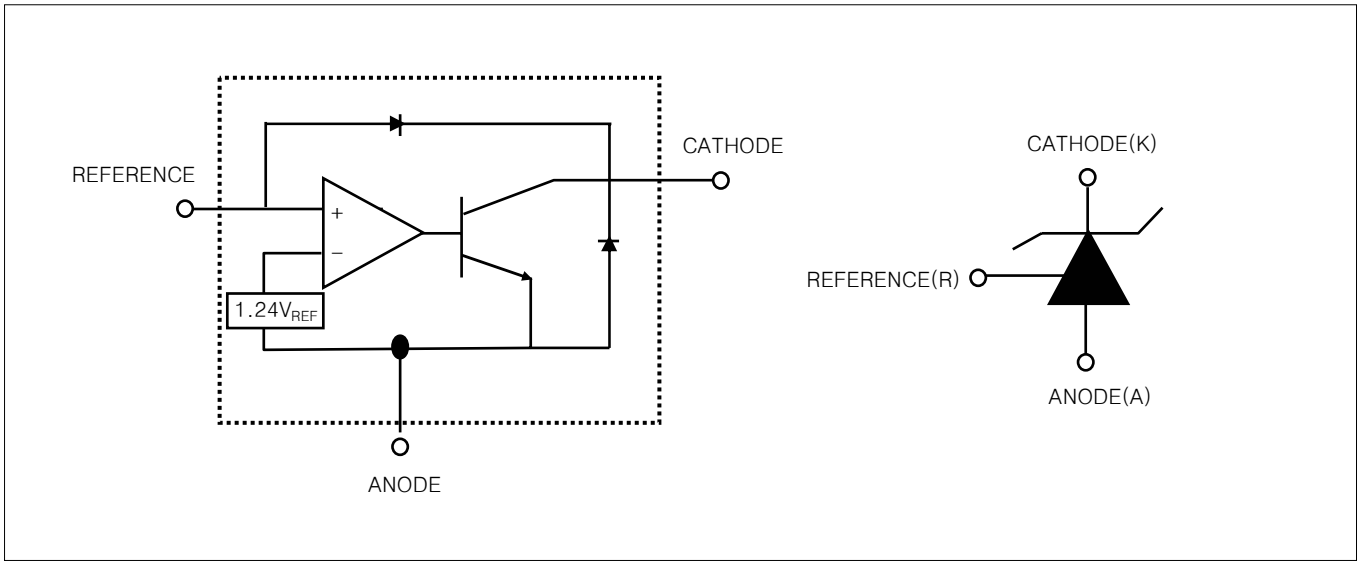
ORDERING INFORMATION

Device	Marking	Package
TL432-A	TL432-A	TO-92
TL432-C	TL432-C	
TL432-ASF	432	SOT-23
TL432-CSF		

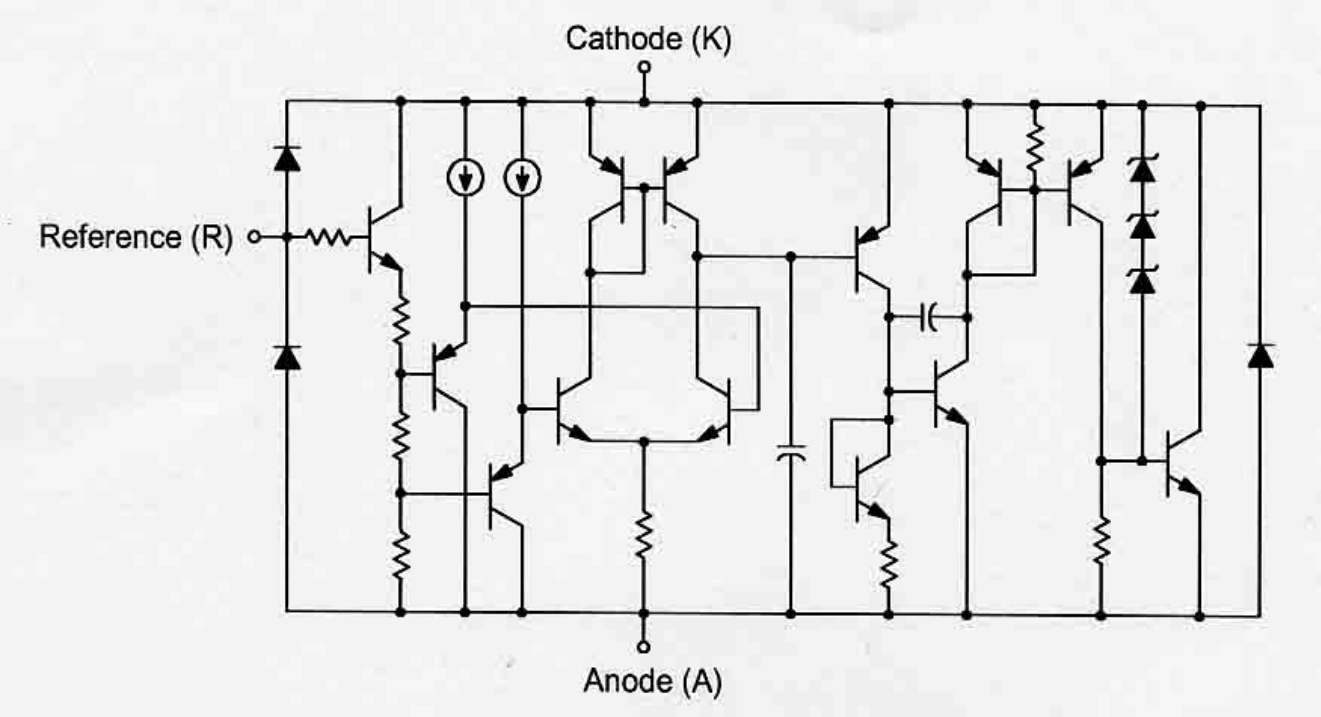
APPLICATION

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

FUNCTION BLOCK DIAGRAM



EQUIVALENT SCHEMATIC



All component values are nominal

RECOMMENDED OPERATING CONDITIONS

CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Cathode Voltage	V_{KA}	V_{REF}	15	V
Cathode Current	I_K	1	100	mA

DISSIPATION RATING TABLE1-FREE-AIR TEMPERATURE

Package	T_A=25℃	Derating Factor	T_A=70℃	T_A=85℃	T_A=125℃
	Power Rating	Above T_A=25℃	Power Rating	Power Rating	Power Rating
TO-92	770mW	6.2mW/℃	491mW	398mW	-
SOT-89	-	-	-	-	-
SOT-23	230mW	1.8mW/℃	149mW	122mW	-

ABSOLUTE MAXIMUM RATINGS

(Full Operating Ambient Temperature Range Applies Unless Otherwise Noted)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Cathode Voltage	V_{KA}	15	V
Continuous Cathode Current Range	I_{KA}	100	mA
Reference Input Current Range	I_{REF}	−0.05 ~ 3	mA
Junction Temperature	T_J	−40 ~ 150	℃
Operating Temperature	T_{OPR}	0 ~70	℃
Storage Temperature	T_{STG}	−65~+150	℃
Total Power Dissipation	P_D	770	mW

TL432A/C 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	TL432A	1.228	1.24	1.252	V
			TL432C	1.233		1.247	
Deviation of Reference Input Voltage Over Full Temperature Range	$\Delta V_{REF}/\Delta T$	$V_{KA}=V_{REF}$, I_K=10mA T_A=Full Range			10	25	mV
Ratio of Change in Reference Input Voltage to the Change in Cathod 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=∞			0.5	1	μA
Deviation of Reference Input Current Over Full Temperature Range	$\Delta I_{REF}/\Delta T$	R1=10kΩ, R2=∞, Ta = Full Range			0.05	0.3	μA
Minimum Cathode Current for Regulation	I_{KA}MIN	Vka=Vref			60	80	μA
Off-State Cathode Current	I_{KA}OFF	V_{KA}=15V, V_{REF}=0			0.04	0.5	μA
Dynamic Impedance	Z_{KA}	$V_{KA}=V_{REF}$, I_K=0.1mA~20mA, f≤1.0kHz			0.2	0.4	Ω

Fig. 1 Test Circuit for $V_{KA}=V_{REF}$

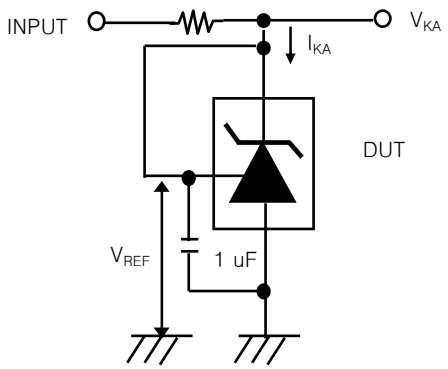


Fig. 2 Test Circuit for $V_{KA} \geq V_{REF}$

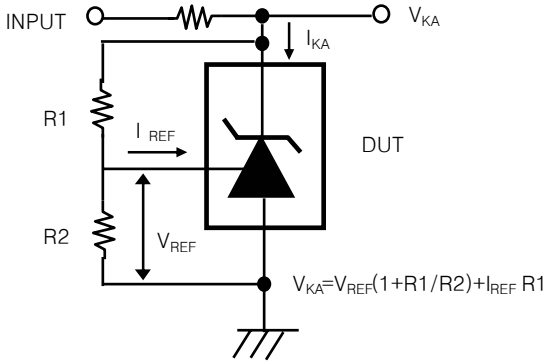
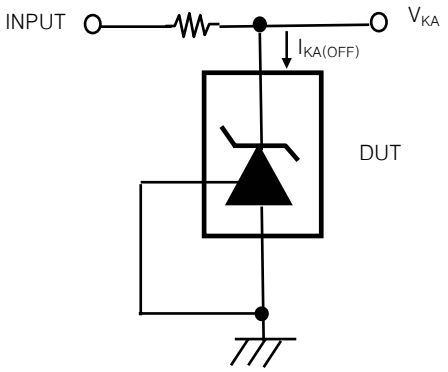
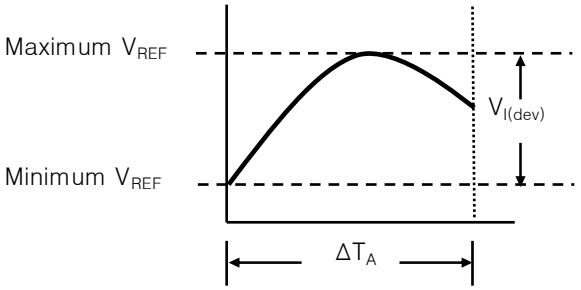


Fig. 3 Test Circuit for I_{KA} (off)



The deviation parameters $V_{REF(DEV)}$ and $I_{REF(DEF)}$ 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 :

$$|\alpha V_{REF}| \left(\frac{ppm}{℃}\right) = \frac{\left(\frac{V_{I(dev)}}{V_{REF}\text{at } 25℃}\right) x10^6}{\Delta T_A}$$



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}=1190㎷ at 30℃, maximum V_{REF}=1262㎷ at 0℃, V_{REF}=1241㎷ at 25℃, ΔT_A=125℃ for TL431C

$$|\alpha V_{REF}| = \frac{\left(\frac{7.2㎷}{1241㎷}\right) x10^6}{125℃} \approx 46PPM/℃$$

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

Calculating Dynamic Impedance $|Z_{KA}| = \frac{\Delta V_{KA}}{\Delta I_{KA}}$

The dynamic impedance is defined as :

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

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