Dual Adjustable Precision Shunt Regulator

FEATURES

- Low voltage operation (1.25V)
- Adjustable output voltage from $V_O = V_{REF}$ to 12V
- Wide operating current range from 55uA to 100mA
- Low dynamic output impedance 0.25Ω typ.
- ESD rating is 6kV (per MIL-STD 883D)

APPLICATIONS

- Linear Regulators
- Adjustable Supplies
- Switching Power Supplies
- Battery Operated Computers
- Instrumentation
- Computer Disk Drives

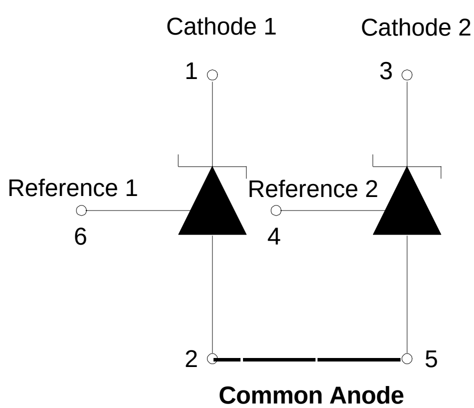
DESCRIPTION

The SS2432G consists of a pair of low-voltage adjustable shunt regulators with a guaranteed thermal stability over the applicable temperature range. The output voltage can be set to any value between V_{REF} (approximately 1.25V) to 12V with two external resistors (see application circuit). This device has a typical output impedance of 0.25 ohms. Active output circuitry provides very sharp turn-on characteristics, making this device an excellent replacement for Zener diodes in many applications.

The SS2432G is characterized for operation from 0°C to 105°C.

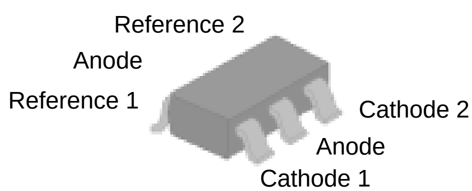
PIN CONFIGURATION

Pin 1 : Cathode 1
Pin 2 : Common Anode
Pin 3 : Cathode 2
Pin 4 : Reference 2
Pin 5 : Common Anode
Pin 6 : Reference 1



PACKAGE

The device is supplied in a SOT23-6 package.



Pb-free lead finish (second-level interconnect).

ABSOLUTE MAXIMUM RATINGS over ambient temp. range.

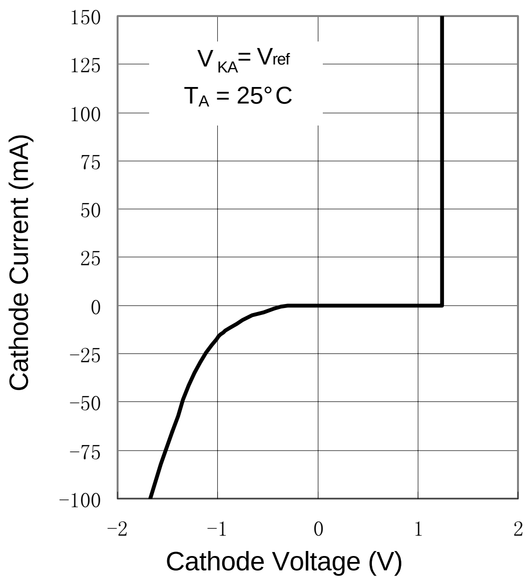
Parameter	Symbol	Maximum	Units
Cathode Voltage	V_{KA}	12	V
Continuous Cathode Current	I_{KA}	150	mA
Reference Current	I_{REF}	3	mA
Operating Junction Temperature	T_j	150	°C
Storage Temperature Range	T_{STG}	-45 to +150	°C
Thermal Resistance	θ_{JA}	160	°C/W
Lead Temperature (Soldering - std.lead finish)	T_{LEAD}	260°C/10 sec.	

ELECTRICAL CHARACTERISTICS (T_A =25°C)

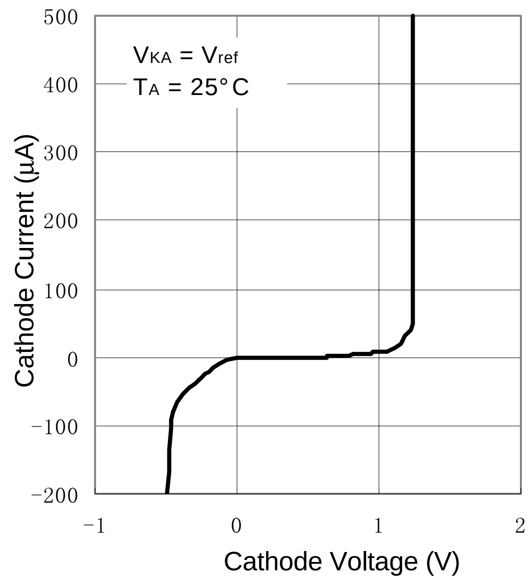
PARAMETER	SYMBOL	TEST CIRCUIT	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Reference voltage 1%	V_{ref}	1	$V_{KA} = V_{ref}$ I_{KA} = 10mA	1.228	1.240	1.252	V
Deviation of reference voltage over full temperature range	$V_{I(dev)}$	1	$V_{KA} = V_{ref}$, I_{KA} = 10mA T_A = full range		4	12	mV
Ratio of change in reference voltage to the change in cathode voltage	$\frac{\Delta V_{ref}}{\Delta V_{KA}}$	2	I_{KA} = 10mA, $\Delta V_{KA} = V_{ref}$ to 12V		-1.5	-2.7	mV/V
Reference current	Iref	2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞		0.15	0.5	µA
Deviation of reference current over full temperature range	$I_{I(dev)}$	2	I_{KA} = 10mA, R1 = 10kW, R2 = ∞ TA = full range		0.05	0.30	µA
Minimum cathode current for regulation	I_{min}	1	$V_{KA} = V_{ref}$		55	80	µA
Off-state cathode current	I_{off}	3	V_{KA} = 12V, V_{ref} = 0		0.001	0.1	µA
Dynamic impedance	$\lvert Z_{KA} \rvert$	1	I_{KA} = 100µA to 100mA, $V_{KA} = V_{ref}$ f ≤ 1kHz		0.25	0.4	Ω

TYPICAL PEFORMANCE CHARACTERISTICS

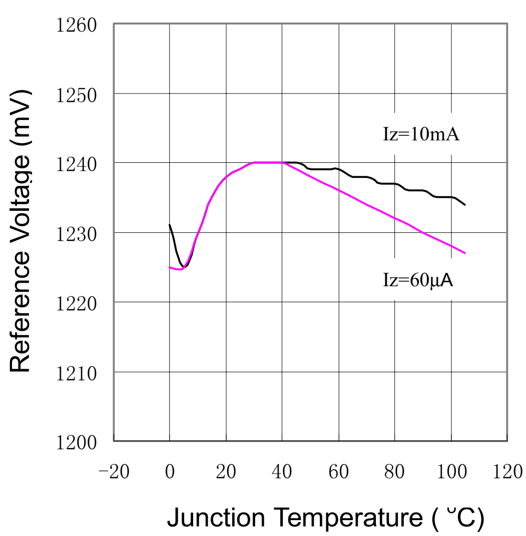
CATHODE CURRENT
Vs.
CATHODE VOLTAGE



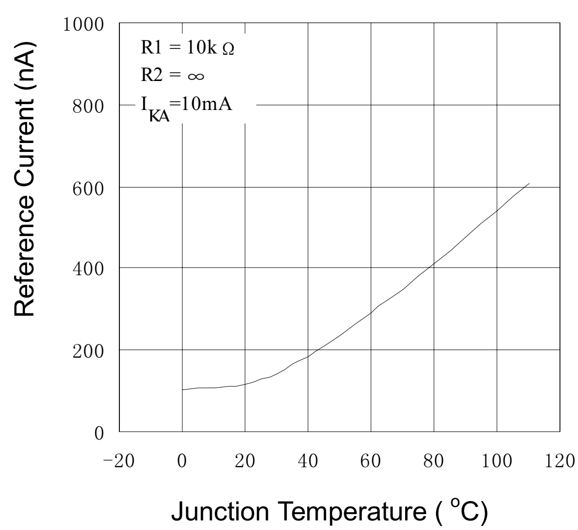
CATHODE CURRENT
Vs.
CATHODE VOLTAGE



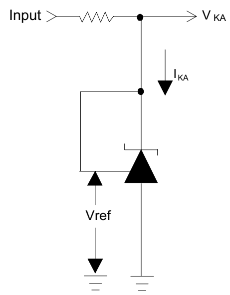
REFERENCE VOLTAGE
Vs.
JUNCTION TEMPERATURE

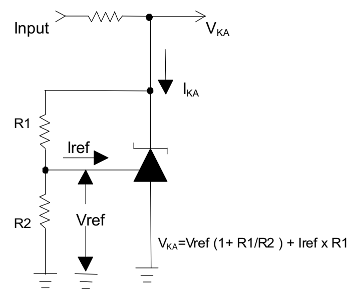


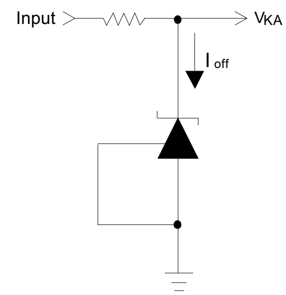
REFERENCE INPUT CURRENT
Vs.
JUNCTION TEMPERATURE



TEST CIRCUITS





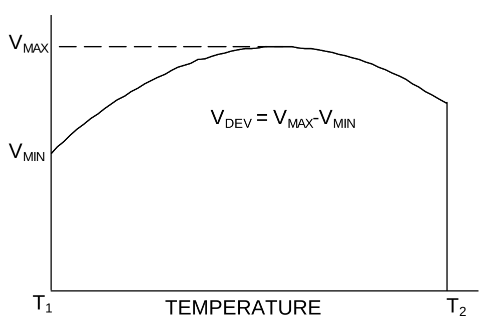


Test Circuit 1:
V_{KA} = Vref

Test Circuit 2:
V_{KA} > Vref

Test Circuit 3:
Off State Current

APPLICATION INFORMATION



Deviation of reference input voltage, V_{DEV}, is defined as the maximum variation of the reference input voltage over the full temperature range.

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

$$\Delta V_{REF}\frac{ppm}{°C} = \frac{\pm\left[\frac{V_{MAX} - V_{MIN}}{V_{REF}(at\ 25°C)}\right]10^6}{T2 - T1} = \frac{\pm\left[\frac{V_{DEV}}{V_{REF}(at\ 25°C)}\right]10^6}{T2 - T1}$$

Where:
T_2–T_1=full temperature change.
αV_{REF} can be positive or negative depending on whether the slope is positive or negative.
Example: V_{DEV}= 12.0mV, V_{REF}= 1240mV,
T_2–T_1= 105°C, slope is negative.

$$aV_{REF} = \frac{\left[\frac{12.0mV}{1240mV}\right]10^6}{105°C} = -92ppm/°C$$

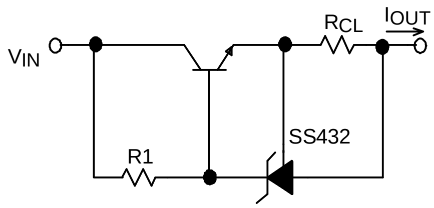
Note 4. The dynamic output impedance, R_Z, is defined as:

$$R_Z = \frac{\Delta V_Z}{\Delta I_Z}$$

When the device is programmed with two external resistors, R1 and R2, (see Fig. 2), the dynamic output impedance of the overall circuit, is defined as:

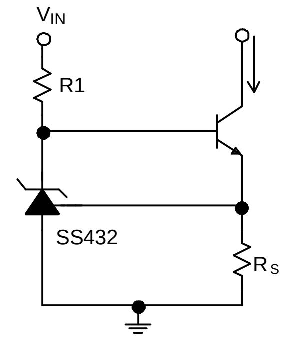
$$r_Z = \frac{\Delta V}{\Delta I} \cong R_Z\left[1 + \frac{R1}{R2}\right]$$

APPLICATION EXAMPLES



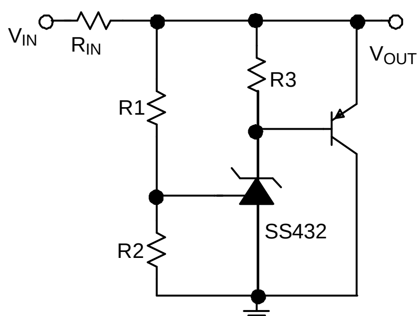
$I_{OUT}=V_{REF}/ R_{CL}$

Current Limiter or Current Source



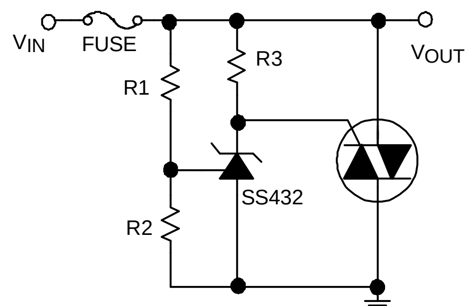
$I_{OUT}=V_{REF} /R_S$

Constant-Current Sink



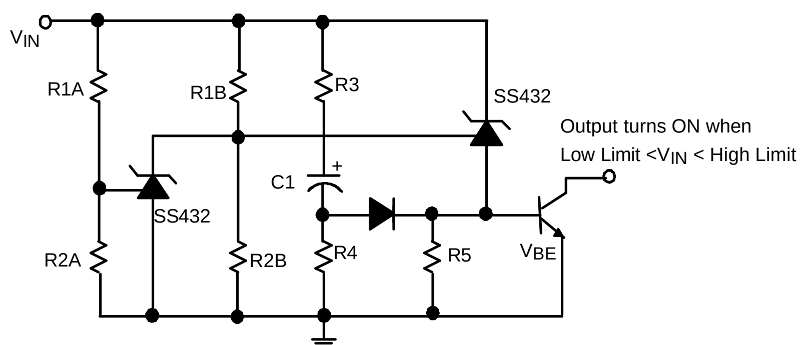
$V_{OUT} \cong (1+R1/R2) \times V_{REF}$

Higher-Current Shunt Regulator



$V_{LIMIT} \cong (1+R1/R2) \times V_{REF}$

Crow Bar

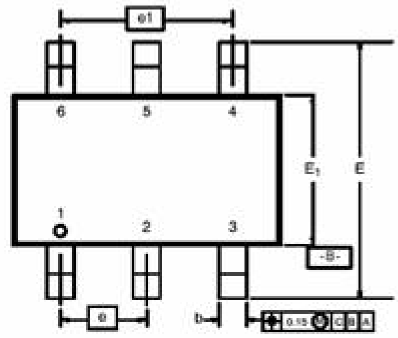


Low Limit $\cong V_{REF}$ (1+ R1B/ R2B)+ V_{BE}

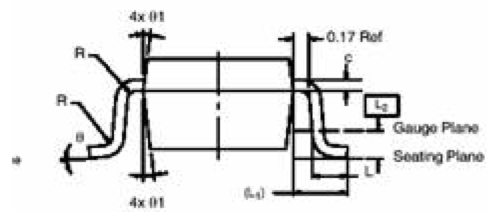
High Limit $\cong V_{REF}$ (1+ R1A/ R2A)

Over-Voltage/Under-Voltage Protection Circuit

PACKAGE DIMENSIONS



6-LEAD TSOP



Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.91	-	1.10	0.036	-	0.043
A_1	0.01	-	0.10	0.0004	-	0.004
A_2	0.90	-	1.00	0.035	0.038	0.039
b	0.30	0.32	0.45	0.012	0.013	0.018
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.95	3.05	3.10	0.116	0.120	0.122
E	2.70	2.85	2.98	0.106	0.112	0.117
E_1	1.55	1.65	1.70	0.061	0.065	0.067
e	1.00 BSC			0.0394 BSC		
e_1	1.90	2.00	2.10	0.075	0.080	0.085
L	0.35	-	0.50	0.014	-	0.020
L_1	0.60 Ref			0.024 Ref		
L_2	0.25 BSC			0.010 BSC		
R	0.10	-	-	0.004	-	-
θ	0°	4°	8°	0°	4°	8°
$θ_1$	7° Nom			7° Nom		
ECN: C-03247—Rev. G, 01-Sep-03 DWG: 5540						