Adjustable Precision Shunt Voltage References

Features

- Programmable Output Voltage Range of 1.24V to 18V
- Wide Operating Current Range of 100uA to 100mA
- Precision Voltage Reference :
  0.5% for COSTLVH431A
  1.0% for COSTLVH431M
  1.5% for COSTLVH431L
- 0.2Ω Typical Output Impedance
- Sharp Low Current Turn-On Characteristic
- -40°C to +125°C specifications
- Small Package: SOT23−3, SC70-3

Applications

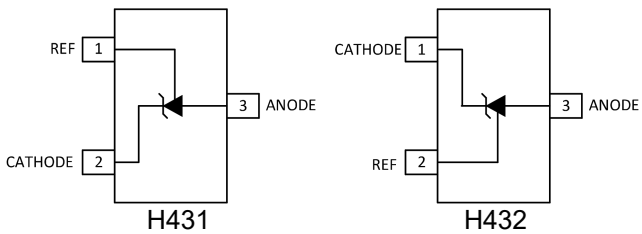
- Analog and Digital Circuits Requiring Precision References
- Zener Replacement
- Voltage Monitoring
- Battery Chargers
- Energy Management
- Adjustable Voltage / Current Referencing
- Comparator with Integrated Reference
- Secondary Side Regulation in Flyback SMPS

General Description

The COSTLVH431 and COSTLVH432 are adjustable precision voltage references with specified thermal stability over applicable industrial and commercial temperature ranges. Output voltage can be set to any value between VREF (1.24V) and 18V with two external resistors.

The COSTLVH431A, B and C series features reference accuracy of ±0.5%, ±1.0% and ±1.5%, respectively. These devices exhibit a sharp low current turn−on characteristic with a low dynamic impedance of 0.2Ω over an operating current range of 100μA to 100 mA. The combination of features makes this series an excellent replacement for zener diodes in numerous application circuits that require a precise reference voltage.

The COSTLVH432 device is identical to the COSTLVH431 device, but is offered with different pinouts for the 3-pin SOT23-3/SC70-3 packages.



Pin Diagram

Rev1.0

1. Pin Configuration and Functions

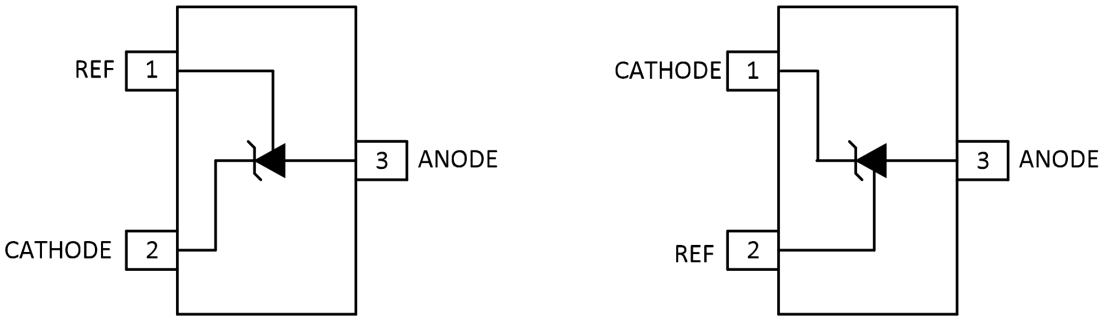


Figure 1. Pin Diagram (SOT23-3), Top View

Pin Description

Pin Name	Description	Pin Number	
		COSTLVH431	COSTLVH432
REF	Threshold relative to common anode	1	2
CATHODE	Shunt Current/Voltage input	2	1
ANODE	Common pin, normally connected to ground	3	3

2. Product Specification

2.1 Absolute Maximum Ratings (1)

Parameter	Min	Max	Unit
Cathode voltage (respect to anode terminal), V_{KA}		20	V
Cathode current, I_K	-100	100	mA
Reference current, I_{REF}		10	mA
Operating junction temperature, T_J	-40	+125	°C
Storage temperature, Tstg	-65	+150	°C

(1) Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

2.2 Thermal Data

Parameter	Rating	Unit
Package Thermal Resistance, $R_{\theta JA}$ (Juntion-to-Ambient)	206 (SOT23-3)	°C/W

2.3 Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Unit
Cathode voltage, V_{KA}	V_{REF}	-	18	V
Cathode current, I_K	0.05	-	50	mA
Operating ambient temperature	-40	-	+85	°C
Operating junction temperature	-40	-	+125	°C

2.4 Electrical Characteristics

(T_A=25 °C, I_K=10mA, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Reference Voltage	V_{REF}	$V_{KA}=V_{REF}$ COSTLVH43xA: 0.5% COSTLVH43xM: 1% COSTLVH43xL: 1.5% See Figure 2.1	1.234 1.227 1.222	1.24	1.246 1.253 1.258	V
Reference Input Voltage Deviation Over Temperature	ΔV_{REF}	T_A = -40°C to 125°C, COSTLVH43xA: 0.5% COSTLVH43xM: 1% COSTLVH43xL: 1.5% $V_{KA}=V_{REF}$	-26.7 -32.8 -39.0	0	+26.7 +32.8 +39.0	mV
Average Temperature Coefficient/	$\Delta V_{KA}/\Delta T$	$V_{KA}=V_{REF}$， T_A = -40°C to 125°C	-	±20	±100	ppm/°C
Reference Terminal Current	I_{REF}	R1=10kΩ，R2=open, See Figure 2.2	-	0.15	0.4	μA
Reference Input Current Deviation Over Temperature	ΔI_{REF}	R1=10 kΩ，R2=open, T_A = -40°C to 125°C See Figure 2.2	-	0.1	0.4	μA

Minimum Cathode Current for Regulation	$I_{K(min)}$	$V_{KA}=V_{REF}$, See Figure 2.1	-	90	200	μA
Off-State Cathode Current	$I_{K(off)}$	V_{KA}=18V, V_{REF}=0 See Figure 2.3	-	0.04	0.1	μA
Dynamic Impedace	$\|Z_{KA}\|$	$V_{KA}=V_{REF}$, I_K=0.1mA to 50mA f ≤ 1kHz, See Figure 2.1	-	0.2	0.4	Ω

2.5 Testing Circuits

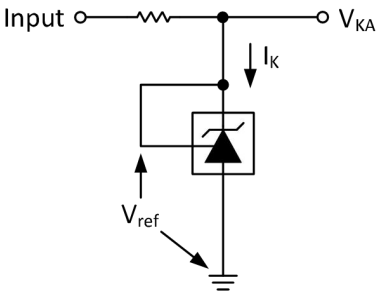
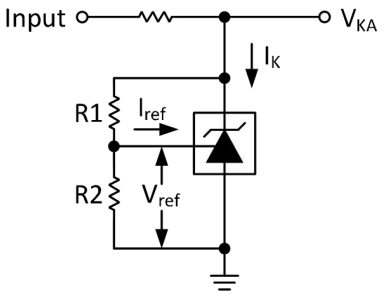


Figure 2.1 Test Circuit for $V_{KA}=V_{REF}$



$V_{KA} = V_{ref} (1+ R1/R2) + I_{ref} \times R1$

Figure 2.2 Test Circuit for $V_{KA}>V_{REF}$

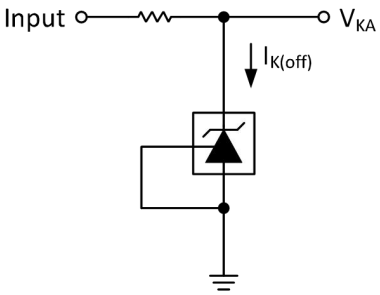


Figure 2.3 Test Circuit for $I_{K(off)}$

3. Typical Applications

COSTLVH43x is a higher voltage counterpart to COSTLV43x, with cathode voltage adjustable from 1.24V to 18V, making this part an excellent replacement for zener diodes for a wide range of end equipment in industrial, auto, telecom and computing.

COSTLVH43x consists of an internal reference and amplifier that outputs a sink current base on the difference between the reference pin and the virtual internal pin. When operated with enough voltage headroom (≥1.24V) and cathode current I_k (>100 μA ($I_{K(min)}$)), COSTLVH43x forces the reference pin to 1.24V. Figure 3.1 shows a closed loop application with COSTLVH431 as a shunt regulator.

To not exceed the maximum cathode current, be sure that the supply voltage is current limited. Also, limit the current being driven into the REF pin, as not to exceed its absolute maximum rating. Figure 3.2 shows a high current shunt regulator version with COSTLVH43x.

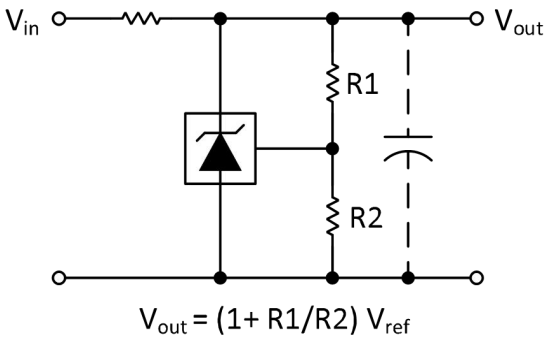


Figure 3.1 Shunt Regulator

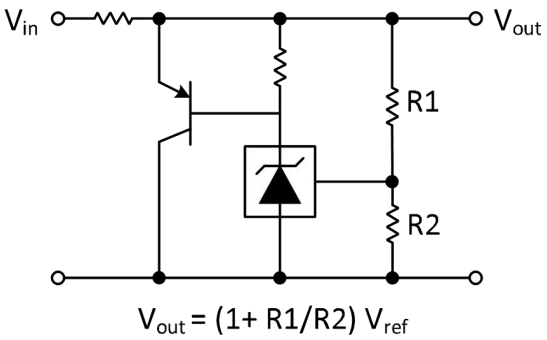


Figure 3.2 High Current Shunt Regulator

Figure 3.3 shows the COSTLVH43x used as a voltage reference and compensated error amplifier controlling the feedback loop of an isolated output line powered switching regulator. The output voltage is programmed to 3.3V by the resistors values selected for R1 and R2. The minimum output voltage that can be programmed with this circuit is 2.64V, and is limited by the sum of the reference voltage (1.24V) and the forward drop of the opto-coupler light emitting diode (1.4V). Capacitor C1 provides loop compensation.

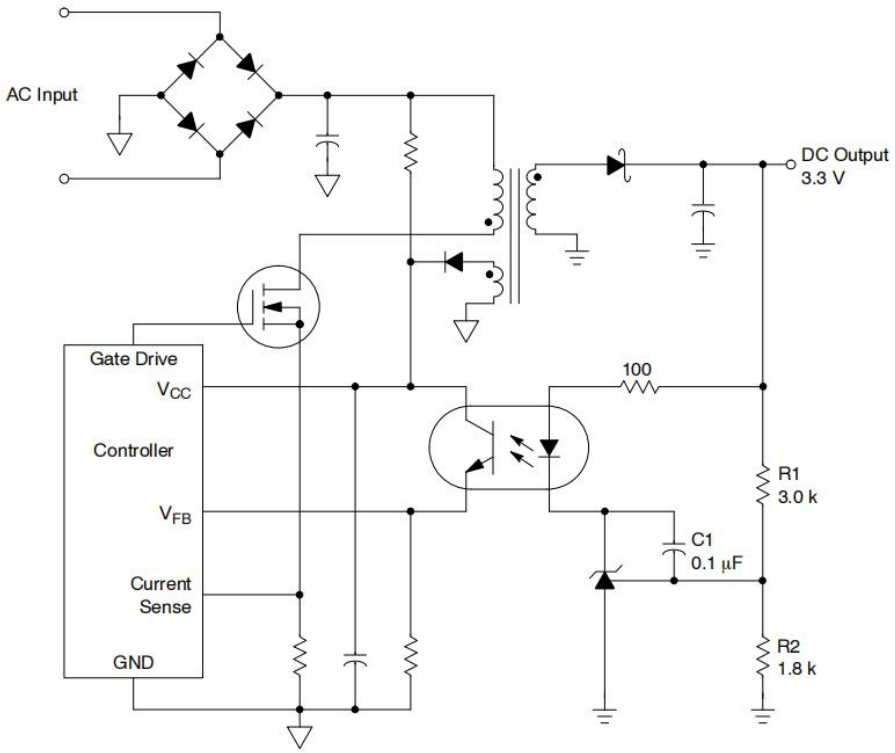
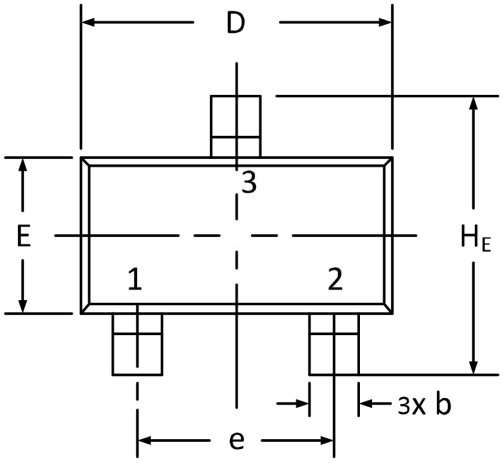


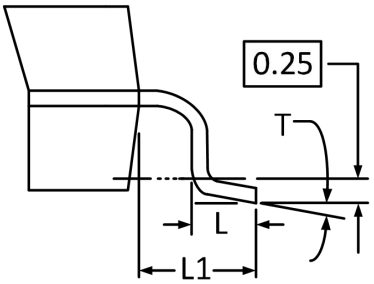
Figure 3.3 Isolated Flyback Supply with COSTLVH43x as Voltage Reference and Error Amplifier

4. Package Information

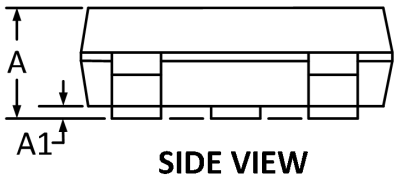
4.1 SOT23-3 (Package Outline Dimensions)



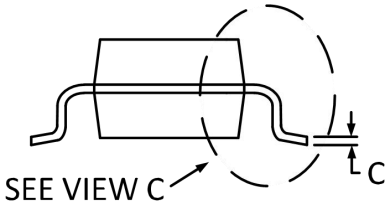
TOP VIEW



VIEW C



SIDE VIEW



END VIEW

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.039	0.044
A1	0.01	0.06	0.10	0.000	0.002	0.004
b	0.37	0.44	0.50	0.015	0.017	0.020
c	0.08	0.14	0.20	0.003	0.006	0.008
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.080
L	0.30	0.43	0.55	0.012	0.017	0.022
L1	0.35	0.53	0.69	0.014	0.021	0.027
H_E	2.10	2.40	2.64	0.083	0.094	0.104
T	0°	---	10°	0°	---	10°

5. Ordering Information

Model	Order Number	Package	Package Option	Marking Information
COSTLVH431A	COSTLVH431A	SOT-23-3	Tape and Reel, 4000	H431
COSTLVH431M	COSTLVH431M	SOT-23-3	Tape and Reel, 4000	H431
COSTLVH431L	COSTLVH431L	SOT-23-3	Tape and Reel, 4000	H431
COSTLVH432A	COSTLVH432A	SOT-23-3	Tape and Reel, 4000	H432
COSTLVH432M	COSTLVH432M	SOT-23-3	Tape and Reel, 4000	H432
COSTLVH432L	COSTLVH432L	SOT-23-3	Tape and Reel, 4000	H432