

Features

- Reference Voltage Tolerance at 25°C
 - 0.5% (Grade B)
- Operation from -40°C to 125°C
- 0.2-Ω Typical Output Impedance
- Sink Current Capability: 1 mA to 80 mA
- Adjustable Output Voltage: V_{REF} to 36 V
- Recommend TPR433B-S and TPR434B-S for Open-Loop Applications

Applications

- Power
- LED Lighting
- Current Sensing
- Instrumentation
- Industry

Description

The TPR431 and TPR432 are adjustable shunt voltage references with guaranteed temperature stability over the operating temperature range. The device temperature range is extended from -40 °C up to +125 °C. The output voltage can be set to any value between 2.5 and 36 V with two external resistors. The TPR431 operates with a wide current range from 1 to 80 mA with a typical dynamic impedance of 0.2 Ω.

Typical Application Circuit

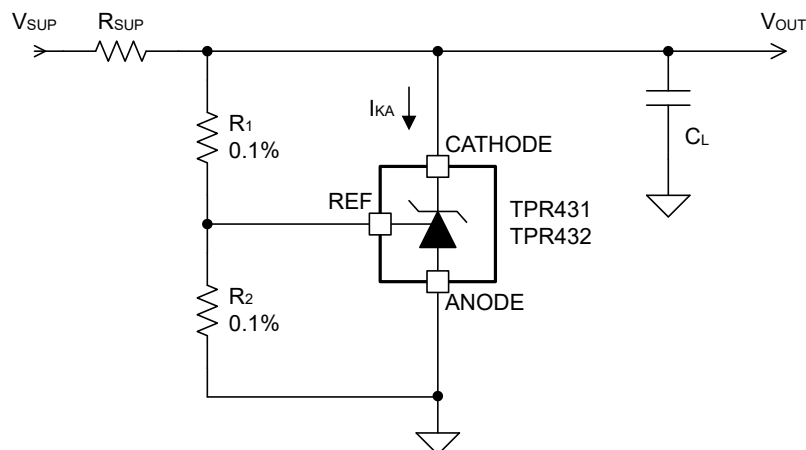


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Product Family Table

Order Number	Grade	Voltage Tolerance	Package
TPR431B-S3TR	B	0.5%	SOT23G-3
TPR432B-S3TR	B	0.5%	SOT23G-3

Revision History

Date	Revision	Notes
2021-06-12	Rev.A.0	Initial Version.
2021-11-01	Rev.A.1	1. Added New Product TPR432. 2. Added Tape and Reel Information.
2024-06-06	Rev.A.2	1. Removed Grade A Part Number. 2. Added Alternative Part Number for Open-Loop Application in Features 3. Added Typical Application Circuit 4. Added Pin Description 5. Added Figure 5 and Figure 6 in Typical Performance Characteristics

Pin Configuration and Functions

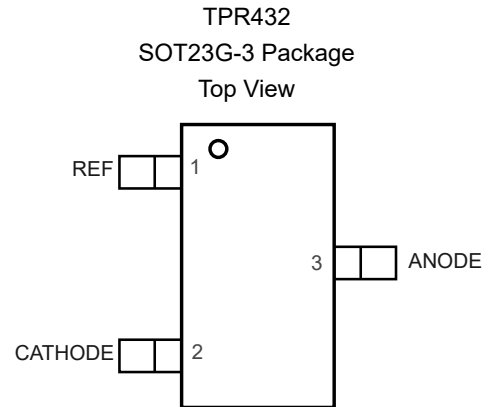
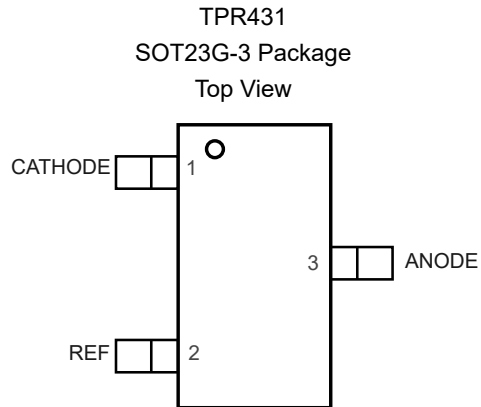


Table 1. Pin Functions: TPR431 and TPR432

Pin Number		Pin Name	I/O	Description
TPR431	TPR432			
3	3	ANODE	O	Common ANODE pin. Suggest connect this pin to the ground directly.
1	2	CATHODE	I/O	CATHODE pin. The input of the shunt current/voltage.
2	1	REF	I	REF threshold pin.

Specifications

Absolute Maximum Ratings

Parameter		Min	Max	Unit
Cathode Voltage			37	V
Continuous Cathode Current		−100	150	mA
Reference Input Current			10	mA
T _J	Maximum Junction Temperature	−40	150	°C
T _A	Operating Temperature Range	−40	125	°C
T _{STG}	Storage Temperature Range	−65	150	°C
T _L	Lead Temperature (Soldering 10 sec)		260	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime

ESD, Electrostatic Discharge Protection

Parameter		Condition	Minimum Level	Unit
HBM	Human Body Model ESD	ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±2	kV
CDM	Charged Device Model ESD	ANSI/ESDA/JEDEC JS-002 ⁽²⁾	±1	kV

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

Recommended Operating Conditions

Parameter		Min	Max	Unit
V _{KA}	Cathode Voltage	V _{REF}	36	V
I _{KA}	Cathode Current	1	80	mA

Thermal Information

Package Type	θ _{JA}	θ _{JC}	Unit
SOT23G-3	400	120	°C/W

Electrical Characteristics

All test conditions: $T_A = +25^{\circ}\text{C}$, unless otherwise noted.

Parameter		Conditions	Min	Typ	Max	Unit
V_{REF}	Reference Voltage	$V_{KA} = V_{REF}$, $I_{KA} = 10\text{ mA}$, B grade, 0.5% Initial Accuracy	2.483	2.495	2.507	V
V_{DEV}	Reference Input Voltage Deviation over Temperature Range	$V_{KA} = V_{REF}$, $I_{KA} = 10\text{ mA}$, $T_A = -40\text{ to }85^{\circ}\text{C}$		5	15	mV
		$V_{KA} = V_{REF}$, $I_{KA} = 10\text{ mA}$, $T_A = -40\text{ to }125^{\circ}\text{C}$		11	30	mV
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of the Change in Reference Voltage to the Change in Cathode Voltage	$I_{KA} = 10\text{ mA}$, $V_{KA} = 10\text{ V to }V_{REF}$	-1.5	0.3	1.5	mV/V
		$I_{KA} = 10\text{ mA}$, $V_{KA} = 36\text{ V to }10\text{ V}$	-1	0.1	1	mV/V
I_{REF}	Reference Input Current	$I_{KA} = 10\text{ mA}$, $R1 = 10\text{ K}$, $R2\text{ Open}$		1	4	μA
ΔI_{REF}	I_{REF} Deviation over Full Temperature Range	$I_{KA} = 10\text{ mA}$, $R1 = 10\text{ K}$, $R2\text{ Open}$, $T_A = -40\text{ to }125^{\circ}\text{C}$		0.1	1	μA
$I_{KA(MIN)}$	Minimum Cathode Current for Regulation	$V_{KA} = V_{REF}$		0.4	1	mA
$I_{KA(OFF)}$	Off-state Current	$V_{KA} = 36\text{ V}$, $V_{REF} = 0\text{ V}$		0.2		μA
$ Z_{KA} $	Dynamic Output Impedance	$V_{KA} = V_{REF}$, $f \leq 1\text{ kHz}$, $I_{KA} = 1\text{ mA to }80\text{ mA}$		0.2		Ω

Typical Performance Characteristics

All test conditions: $T_A = +25^{\circ}\text{C}$, unless otherwise noted.

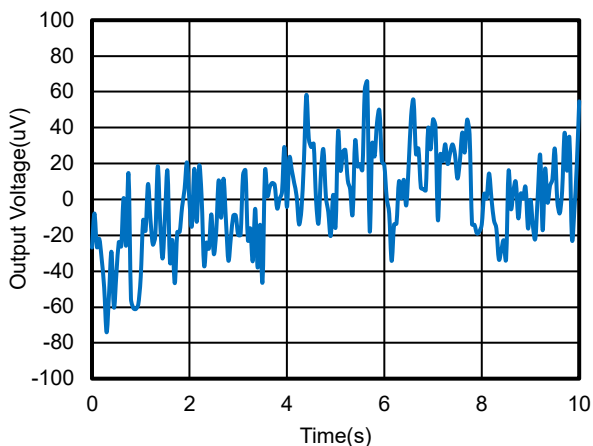


Figure 1. 0.1 to 10-Hz Output Voltage Noise



Figure 2. Gain and Phase vs. Frequency

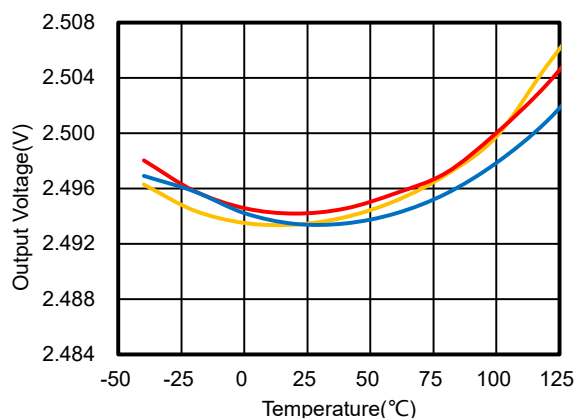
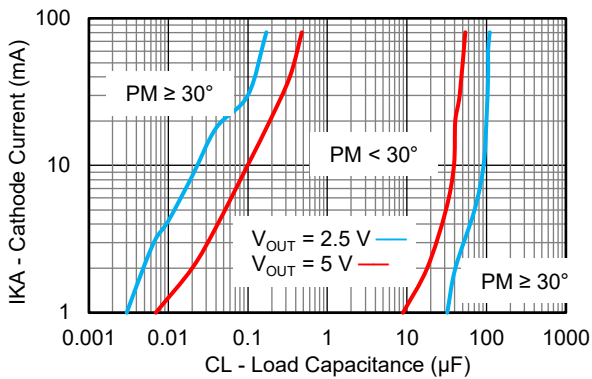


Figure 3. Reference Voltage vs. Temperature

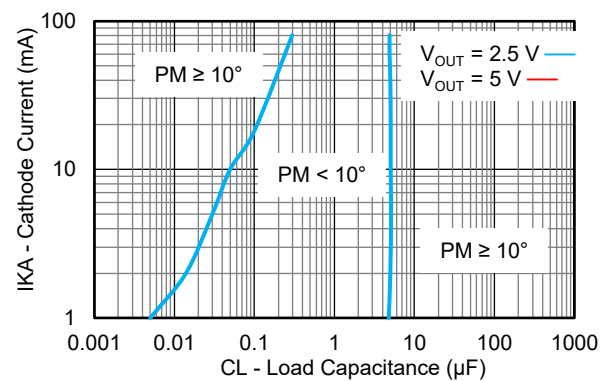


Figure 4. Pulse Response



The areas within the boundary represent application conditions that may cause the phase margin (PM) < 30°. $V_{OUT} \geq 10$ V, all current and all capacitance conditions have $\geq 30^\circ$ phase margin.

Figure 5. Stability Boundary Conditions



The areas within the boundary represent application conditions that may cause the phase margin (PM) < 10°. $V_{OUT} \geq 5$ V, all current and all capacitance conditions have $\geq 10^\circ$ phase margin.

Figure 6. Stability Boundary Conditions

Detailed Description

Overview

The TPR431 and TPR432 are adjustable shunt voltage references with guaranteed temperature stability over the operating temperature range. The device temperature range is extended from $-40\text{ }^{\circ}\text{C}$ up to $+125\text{ }^{\circ}\text{C}$. The output voltage can be set to any value between 2.5 and 36 V with two external resistors. The TPR431 operates with a wide current range from 1 to 80 mA with a typical dynamic impedance of $0.2\text{ }\Omega$.

Functional Block Diagram

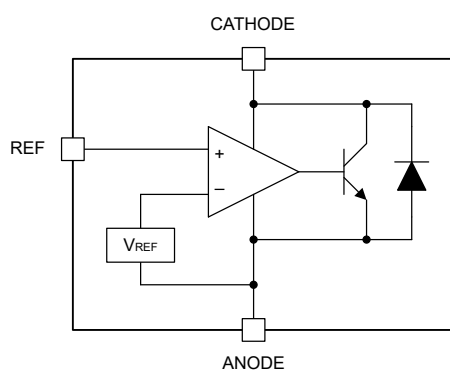
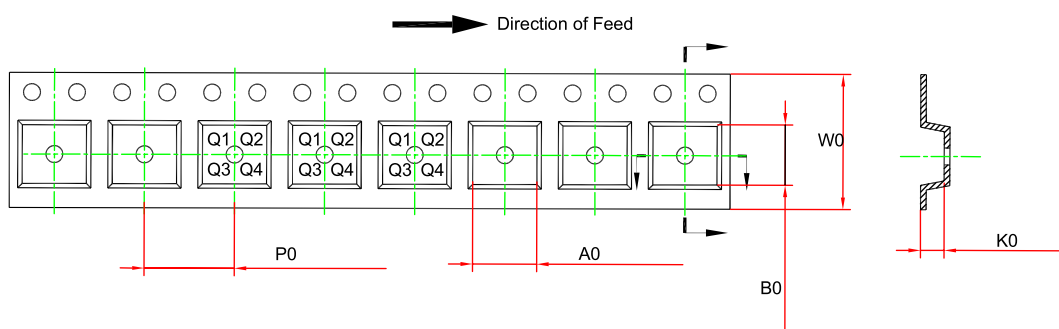
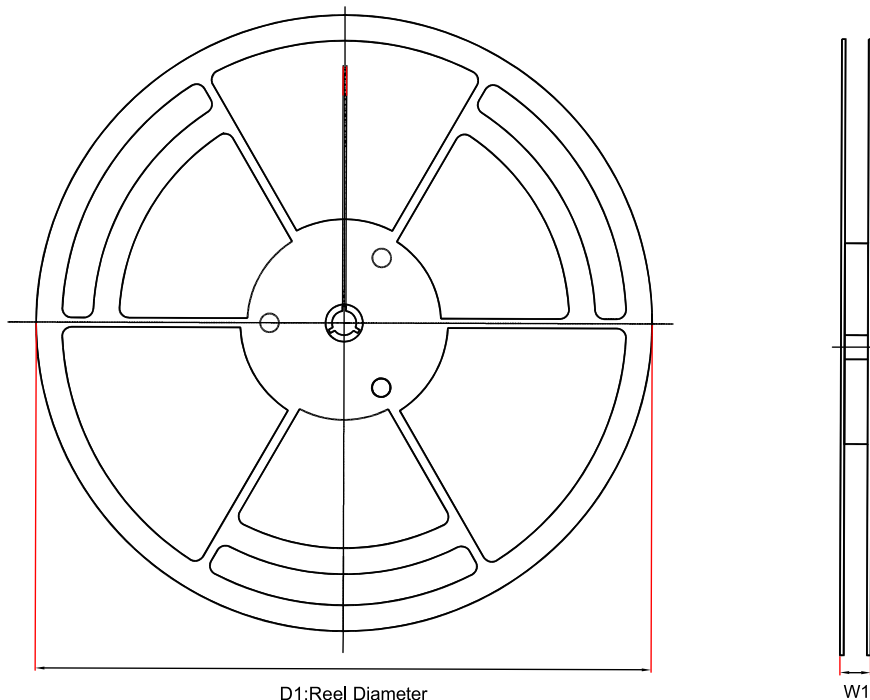


Figure 7. Functional Block Diagram

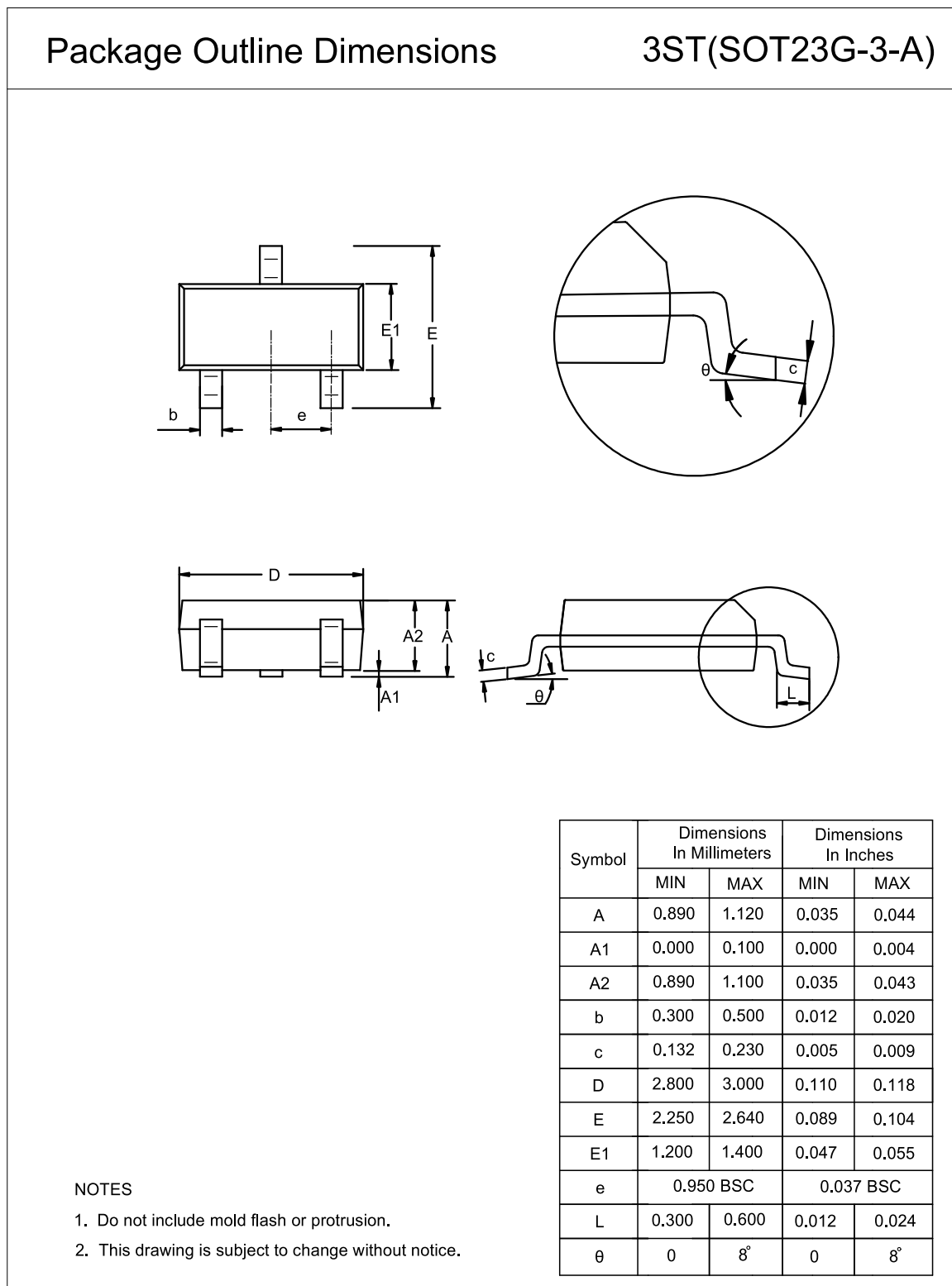
Tape and Reel Information



Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPR431B-S3TR	SOT23G-3	178	12.1	3.15	2.77	1.22	4.0	8.0	Q3
TPR432B-S3TR	SOT23G-3	178	12.1	3.15	2.77	1.22	4.0	8.0	Q3

Package Outline Dimensions

SOT23G-3



Order Information

Order Number	Junction Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPR431B-S3TR	-40 to 125°C	SOT23G-3	R31	MSL3	Tape and Reel, 3000	Green
TPR432B-S3TR	-40 to 125°C	SOT23G-3	R32	MSL3	Tape and Reel, 3000	Green

Green: 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

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