



Rev. 2.0.1

GENERAL DESCRIPTION

The SPX431A is a three-terminal adjustable shunt voltage regulator providing a highly accurate bandgap reference.

The SPX431A acts as an open-loop error 2.5V amplifier with temperature а compensation reference. The SPX431A has thermal stability, wide operating current of 150mA and broad temperature range of -40°C to 125°C, making it suitable for a variety of applications which require a low-cost, high performance solution The SPX431A tolerance of 0.5% is proven to be sufficient to overcome all other errors in the system to virtually eliminate the need for trimming in the power supply manufacturer's assembly line and contribute a significant cost savings. The output voltage may be adjusted to any value between VREF and 36 volts with two external resistors.

The SPX431A is available in RoHS compliant lead free TO-92 and SOT-89 packages.

The SPX431A product is obsolete.

APPLICATIONS

- Charger
- Switching Power Supplies
- Graphic Cards
- Monitors, VCRs, TVs

FEATURES

- 0.5% Precise Output Voltage
 - Adjustable up to 36V
- Wide Operating Current
 - 1mA to 150mA
- Low Temperature Coefficient at 30ppm/°C
- Extended Temperature Range – -40°C to +125°C
- **Improved Replacement for TL431**
- RoHS Compliant, Lead Free TO-92 and SOT-89 Packages

TYPICAL APPLICATION DIAGRAM







ABSOLUTE MAXIMUM RATINGS

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

Cathode-Anode Reverse Breakdown Volt. V _{KA}				
Operating Cathode Current (cont.) IKA150mA				
Reference Input Current Range I _{REF} 10mA				
Power Dissipation SOT-89-TO-92 (Cont. 25°C) P _D 770mW				
Junction Temperature				
Storage Temperature T _{STG} 65°C to 150°C				
ESD Rating (HBM - Human Body Model) 2kV				

OPERATING RATINGS

ELECTRICAL SPECIFICATIONS

Specifications with standard type are for an Operating Ambient Temperature of $T_A = 25$ °C only; limits applying over the full Operating Ambient Temperature range are denoted by a "•". Minimum and Maximum limits are guaranteed through test, design, or statistical correlation. Typical values represent the most likely parametric norm at $T_A = 25$ °C, and are provided for reference purposes only.

Parameter	Min.	тур.	Max.	Units		Conditions
Reference Voltage	2.493	2.503	2.515	V		Test circuit 1 Vĸa=VREF, Iĸa=10mA
ΔV_{REF} with temperature T_{C}		4.5	8	mV		Test circuit 1 $V_{KA}=V_{REF}, I_{KA}=10mA, 0^{\circ}C \leq T_{A} \leq 70^{\circ}C$
ΔV_{REF} with temperature T_{C}		4.5	0 16	mV	0.	Test circuit 1 V _{KA} =V _{REF} , I _{KA} =10mA
Ratio of change in VREF to	-2.7	-1.0	de la	mV/V		Test circuit 2 $V_{REF} \leq \Delta V_{KA} \leq 10V, I_{KA}=10mA$
Cathode Voltage $\Delta V_{REF} / \Delta V_{KA}$	-2	-0.4			3	Test circuit 2 10V $\leq \Delta V_{KA} \leq 36V$, I _{KA} =10mA
Reference Input Current IREF		0.7	4	μA		Test circuit 2 Iĸa=10mA, R1=10kΩ, R2=∞
I_{REF} Temperature Deviation ΔI_{REF}		0.4	1.2	μA	\$	Test circuit 2 Iĸa=10mA, R1=10kΩ, R2=∞
$\begin{array}{l} \mbox{Minimum } I_{\mbox{KA}} \mbox{ for Regulation} \\ I_{\mbox{KA}(\mbox{MIN})} \end{array}$		0.4	1	mA		Test circuit 1 V _{KA} =V _{REF}
Off State Leakage $I_{\text{KA(OFF)}}$		40	250	nA		Test circuit 3 V _{KA} =0, V _{REF} =36V
Dynamic Outout Impedance Z_{KA}		0.15	0.5	Ω		Test circuit 1 fz≤1KHz, Iĸ₄=1 to 100mA



BLOCK DIAGRAM



Fig. 3: SPX431A Pin Assignment

ORDERING INFORMATION

Part Number	Temperature Range	Package	Packing Quantity	Note 1	Note 2
SPX431AM1-L/TR	-40°C≤T₄≤+125°C	SOT-89	2.5K/Tape & Reel	RoHS Compliant Lead Free	
SPX431AN-L/TR	-40°C≤T _A ≤+125°C	TO-92	2K/Tape & Reel	RoHS Compliant Lead Free	Ammo Pack

Note: The SPX431AM1-L/TR and SPX431AN-L/TR part numbers are obsolete. For more information about part numbers, as well as the most up-to-date ordering information and additional information on environmental rating, go to <u>www.maxlinear.com/SPX431A</u>.



TYPICAL PERFORMANCE CHARACTERISTICS

All data taken at $T_A = 25$ °C, unless otherwise specified - Schematic and BOM from Application Information section of this datasheet.





Fig. 8: Δ Reference Voltage to Δ Cathode Voltage Ratio



Precision Adjustable Shunt Regulator





Precision Adjustable Shunt Regulator





SPX431A

TYPICAL APPLICATION SCHEMATICS



 $V_{OUT} = (1 + R1/R2)V_{REF}$

Fig. 23: Single Supply Comparator with Temperature Compensated Threshold



Precision Adjustable Shunt Regulator

TEST CIRCUITS

TEST CIRCUIT 1

Test circuit for $V_{KA} = V_{REF}$





SPX431A

PACKAGE SPECIFICATION

SOT-89

Unit: mm (inch)



Drawing No.: POD-00000174 Revision: A



Precision Adjustable Shunt Regulator

TO-92

Unit: mm (inch)



NOTE : 1. JEDEC : TO-92.

Drawing No.: POD-00000173 Revision: A



REVISION HISTORY

Revision	Date	Description
2.0.1	11/08/22	Updated: Note under the "Ordering Information" table. "SOT-89" POD. "TO-92" POD. Removed: In the "Ordering Information" table, "Marking" column.
2.0.0	04/15/09	Reformat of Datasheet Updated ordering part numbers Updated application and block diagram
	Clare a	Reformat of Datasheet Updated ordering part numbers Updated application and block diagram
MAXLI	NEAR	Corporate Headquarters: 5966 La Place Court Suite 100 Carlsbad, CA 92008 Tel.:+1 (760) 692-0711 Fax: +1 (760) 444-8598 www.maxlinear.com



The content of this document is furnished for informational use only, is subject to change without notice, and should not be construed as a commitment by MaxLinear, Inc. MaxLinear, Inc. assumes no responsibility or liability for any errors or inaccuracies that may appear in the informational content contained in this guide. Complying with all applicable copyright laws is the responsibility of the user. Without limiting the rights under copyright, no part of this document may be reproduced into, stored in, or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), or for any purpose, without the express written permission of MaxLinear, Inc

Maxlinear, Inc. does not recommend the use of any of its products in life support applications where the failure or malfunction of the product can reasonably be expected to cause failure of the life support system or to significantly affect its safety or effectiveness. Products are not authorized for use in such applications unless MaxLinear, Inc. receives, in writing, assurances to its satisfaction that: (a) the risk of injury or damage has been minimized; (b) the user assumes all such risks; (c) potential liability of MaxLinear, Inc. is adequately protected under the circumstances

MaxLinear, Inc. may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from MaxLinear, Inc., the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

MaxLinear, the MaxLinear logo, any MaxLinear trademarks (MxL, Full-Spectrum Capture, FSC, G.now, AirPHY, Puma, and AnyWAN), and the MaxLinear logo on the products sold are all property of MaxLinear, Inc. or one of MaxLinear's subsidiaries in the U.S.A. and other countries. All rights reserved. Other company trademarks and product names appearing herein are the property of their respective owners

© 2022 MaxLinear, Inc. All rights reserved.