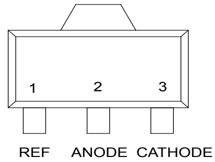
SPX431LJ

Low Voltage Adjustable Precision Shunt Regulator

Features

- Wide Programmable Precise Output Voltage from 1.24V to 18V
- High Stability under Capacitive Load
- Low Temperature Deviation: 3mV Typical
- Low Equivalent Full-Range Temperature Coefficient: 20PPM/^{o}C Typical
- Low Dynamic Output Resistance: 0.05Ω Typical
- High Sink Current Capacity from 55µA to 100 mA
- Low Output Noise
- Wide Operating Range of -40 to 125^{o}C
- Available in RoHS Compliant, Lead Free Packaging

M1 Package
(SOT-89)



Applications

- Graphics Card
- PC Motherboard
- Voltage Adapter
- Switching Power Supply
- Charger

General Description

The SPX431LJ series ICs are low voltage three-terminal adjustable regulators with guaranteed thermal stability over a full operation range. These ICs feature sharp turn-on characteristics, low temperature coefficient and low output impedance, which make them ideal substitutes for Zener diodes in applications such as switching power supply, charger, motherboard and other adjustable regulators. The output voltage can be set to any value between 1.24V and 18V with two external resistors. The SPX431LJ precision reference is offered in two bandgap tolerances: 0.5% and 1%. These ICs are available in TO-92 and SOT-89 packages.

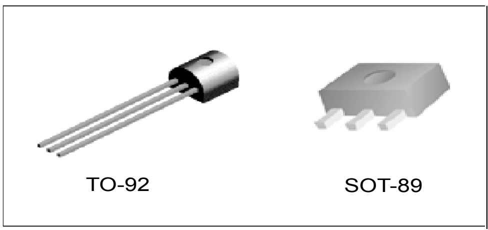


Figure 1. Package Types of SPX431LJ

Pin Configuration

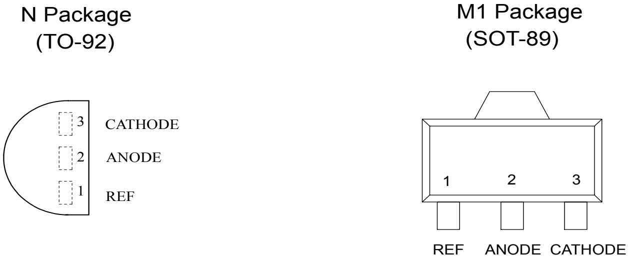


Figure 2. Pin Configuration of SPX431LJ (Top View)

Functional Block Diagram

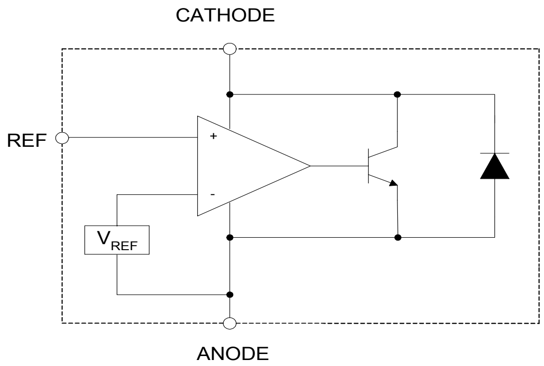


Figure 3. Functional Block Diagram of SPX431LJ

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value		Unit
Cathode Voltage	V_{KA}	20		V
Cathode Current Range (Continuous)	I_{KA}	-100 to 100		mA
Reference Input Current Range	I_{REF}	10		mA
Power Dissipation	P_D	TO-92, SOT-89 Package	770	mW
Storage Temperature Range	T_{STG}	-65 to 150		^oC
Package Thermal Impedance	Q_{JA}	TO-92	130	$^oC/W$
		SOT-89	100	

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only , and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Cathode Voltage	V_{KA}	V_{REF}	18	V
Cathode Current	I_{KA}	0.1	100	mA
Operating Ambient Temperature Range		-40	125	^oC

Electrical Characteristics

(Typical and limits apply for T_J=25^{o}C unless otherwise noted.)

Parameter		Test Circuit	Symbol	Conditions		Min	Typ	Max	Unit
Reference Voltage	0.5%	4	V_{REF}	$V_{KA}=V_{REF}$, I_{KA}=10mA		1.234	1.240	1.246	V
	1%					1.228	1.240	1.252	
Deviation of Reference Voltage Over-Temperature		4	ΔV_{REF}	$V_{KA}=V_{REF}$ I_{KA}=10mA	0^oC to 70^oC		2	10	mV
					-40^oC to 85^oC		3	10	
Ratio of Change in V_{REF} to the Change in Cathode Voltage		5	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	I_{KA}=10mA, ΔV_{KA}:V_{REF} to 16V			-0.5	-1.5	mV/V
Reference Input Current		5	I_{REF}	I_{KA}=10mA, R1=10KΩ, R2=∞			0.15	0.4	µ A
Deviation of Reference Current Over Full Temperature Range		5	ΔI_{REF}	I_{KA}=10mA, R1=10KΩ, R2=∞ T_A=-40 to 85^{o}C			0.1	0.4	µ A
Minimum Cathode Current for Regulation		4	I_{KA} (MIN)	$V_{KA}=V_{REF}$			55	80	µ A
Off-State Cathode Current		6	I_{KA} (OFF)	V_{REF}=0, V_{KA}=18V			0.04	0.10	µ A
				V_{KA}=6, V_{REF}=0			0.01	0.05	
Dynamic Impedance		4	Z_{KA}	$V_{KA}=V_{REF}$, I_{KA}=1 to 100mA f ≤ 1.0kHz			0.05	0.15	Ω

Electrical Characteristics (Continued)

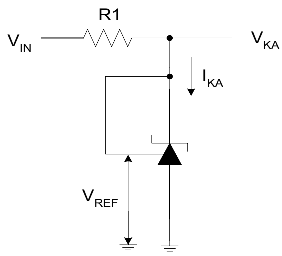


Figure 4. Test Circuit 4 for V_{KA}=V_{REF}

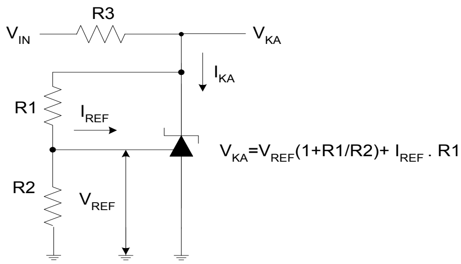


Figure 5. Test Circuit 5 for V_{KA}>V_{REF}

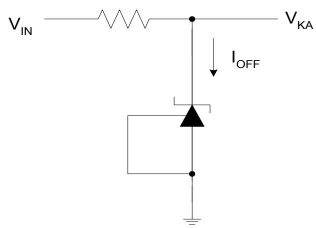


Figure 6. Test Circuit 6 for I_{OFF}

Typical Performance Characteristics

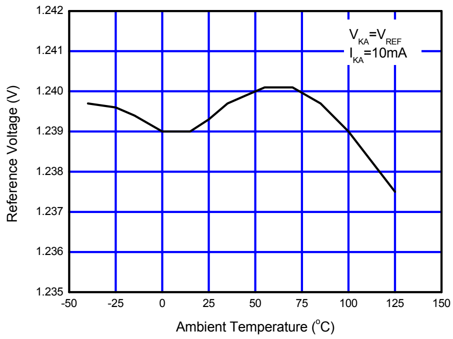


Figure 7. Reference Voltage vs. Ambient Temperature

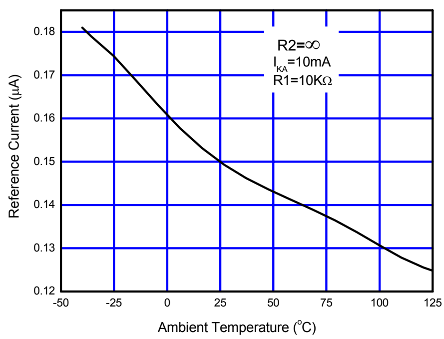


Figure 8. Reference Current vs. Ambient Temperature

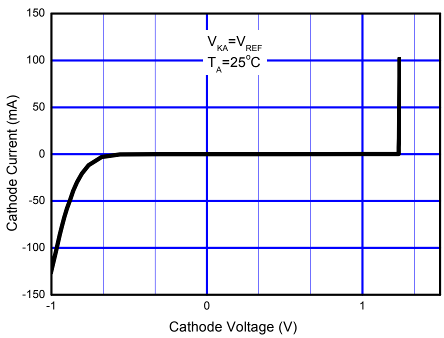


Figure 9. Cathode Current vs. Cathode Voltage

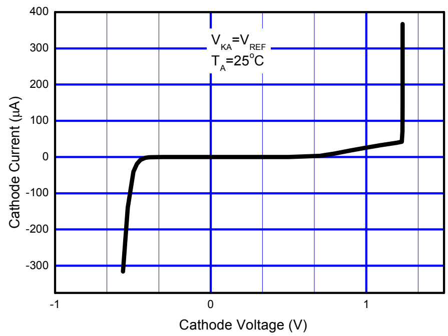


Figure 10. Current vs. Cathode Voltage

Typical Performance Characteristics (Continued)

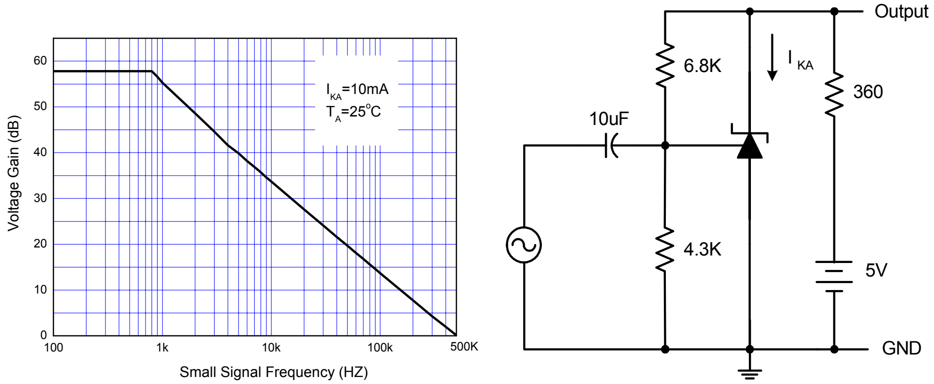


Figure 11. Small Signal Voltage Gain vs. Frequency

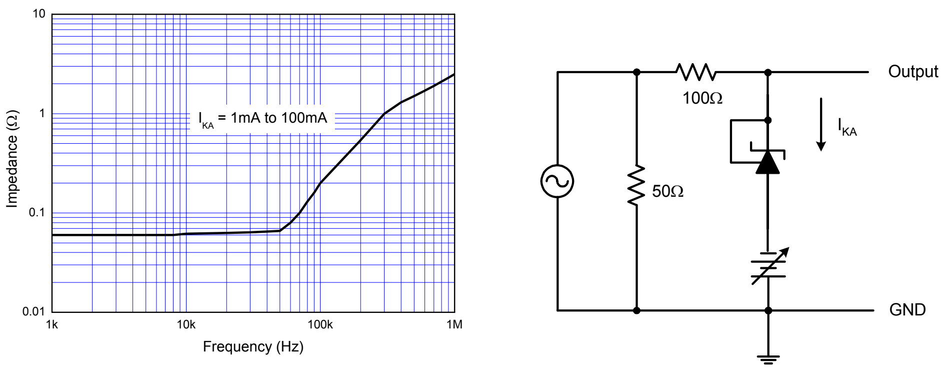
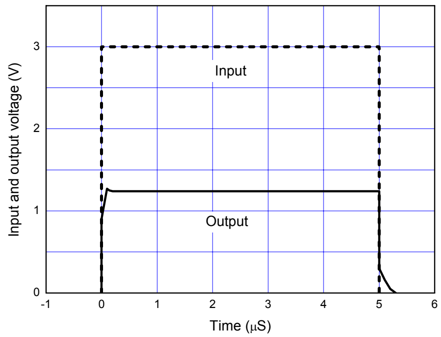


Figure 12. Dynamic Impedance vs. Frequency

Typical Performance Characteristics (Continued)



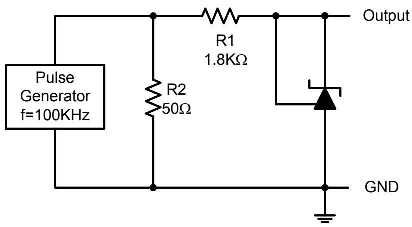


Figure 13. Pulse Response of Input and Output Voltage

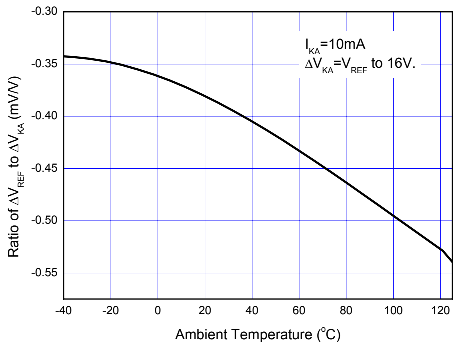


Figure 14. Ratio of Delta Reference Voltage to the Ratio of Cathode Voltage vs. Ambient Temperature

Typical Applications

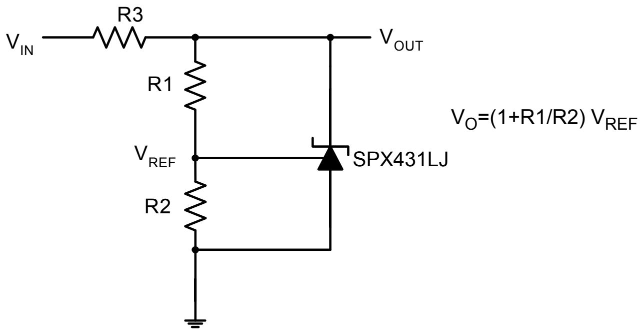


Figure 15. Shunt Regulator

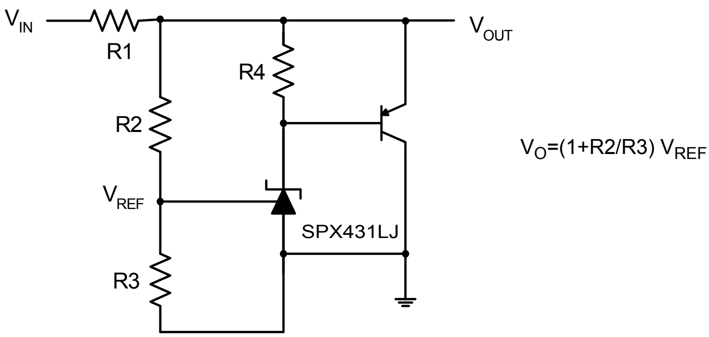


Figure 16. High Current Shunt Regulator

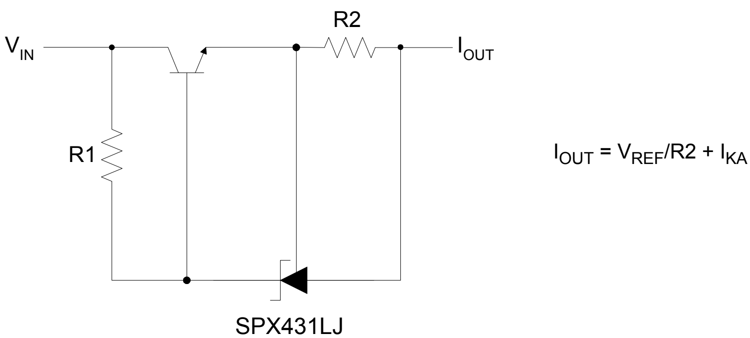


Figure17. Current Source or Current Limit

Typical Application (Continued)

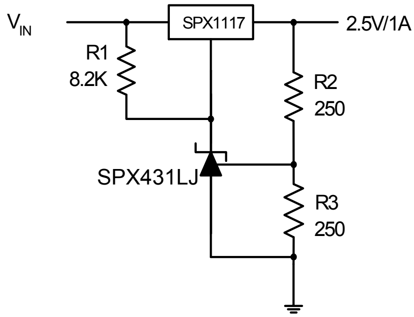


Figure18. Precision 2.5-V 1A Regulator

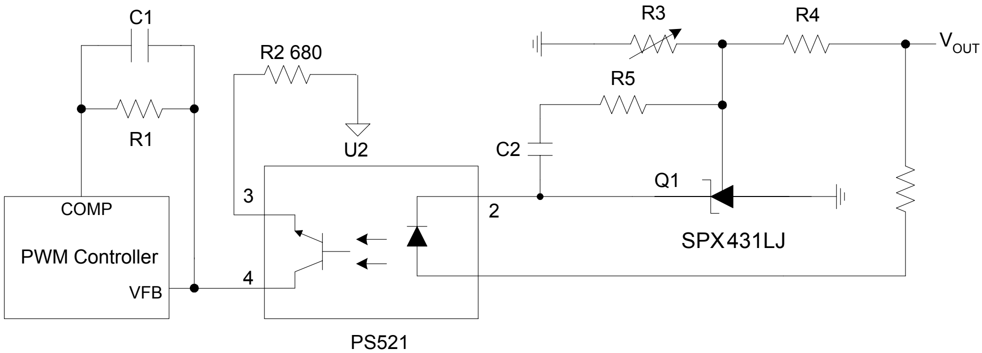
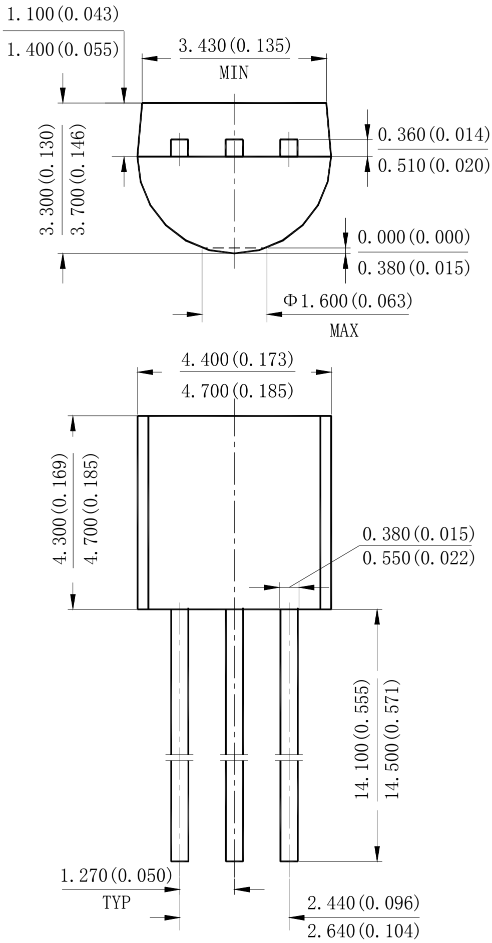


Figure 19. PWM Converter with Reference

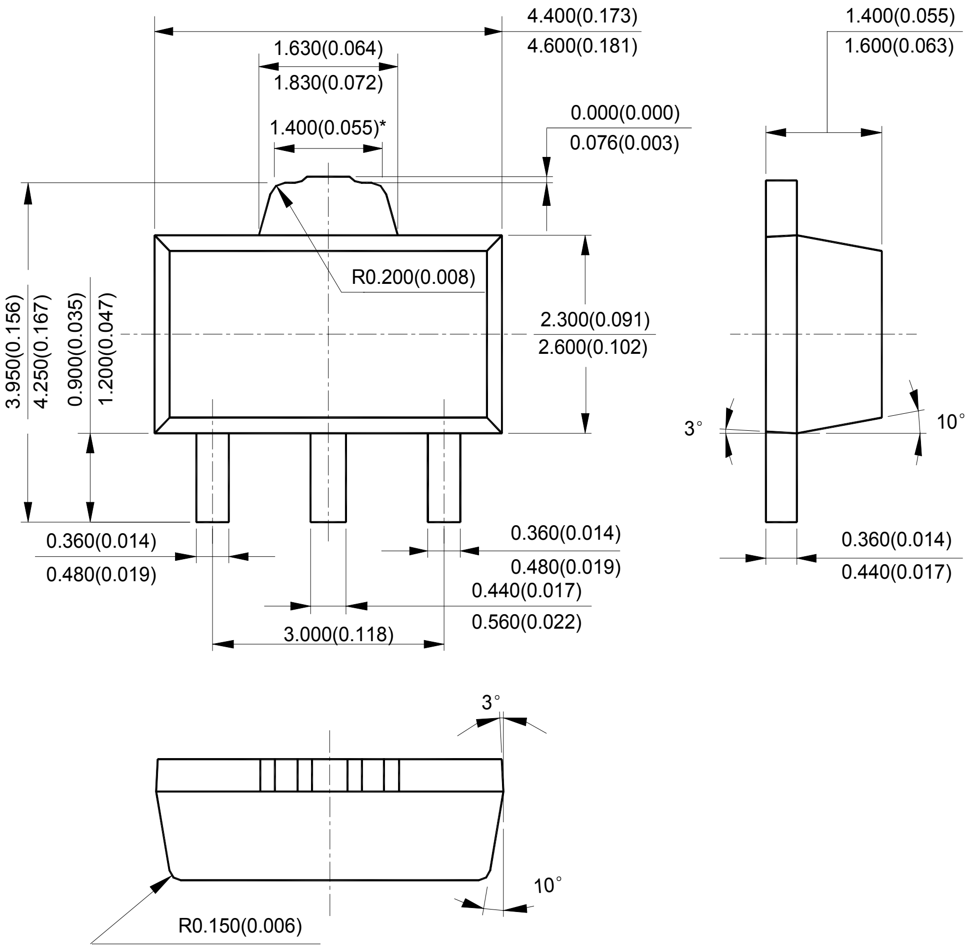
Mechanical Dimensions

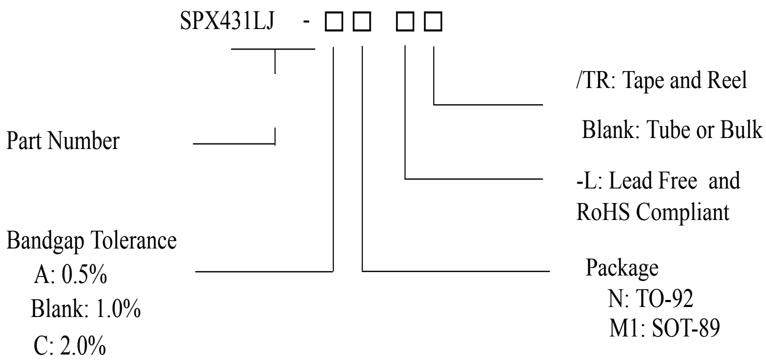
TO-92 **Unit: mm (inch)**



Mechanical Dimensions (Continued)

SOT-89 **Unit: mm(inch)**





Part Number	Temperature Range	Voltage Tolerance	Output Voltage	Package	Pin Count	Packing Type
SPX431LJAM1-L/TR	-40ºC to +125ºC	0.5%	Adj	SOT-89	3	1,000/TR
SPX431LJM1-L/TR	-40ºC to +125ºC	1.0%	Adj	SOT-89	3	1,000/TR
SPX431LJCM1-L/TR	-40ºC to +125ºC	2.0%	Adj	SOT-89	3	1,000/TR
SPX431LJAN-L/TR	-40ºC to +125ºC	0.5%	Adj	TO-92	3	2,000/AMMO
SPX431LJN-L/TR	-40ºC to +125ºC	1.0%	Adj	TO-92	3	2,000/AMMO
SPX431LJCN-L/TR	-40ºC to +125ºC	2.0%	Adj	TO-92	3	2,000/AMMO

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