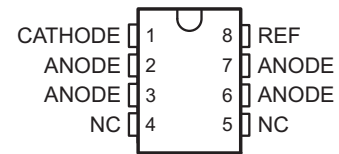


# Programmable Precision Reference

## LR431XD

### DESCRIPTION

The LR431 is a three-terminal adjustable regulator with a guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between  $V_{ref}$  (approximately 2.5V) and 36V with two external resistors. It provides very wide applications, including shunt regulator, series regulator, switching regulator, voltage reference and others.

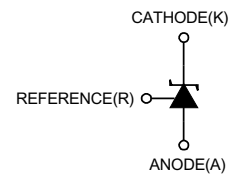
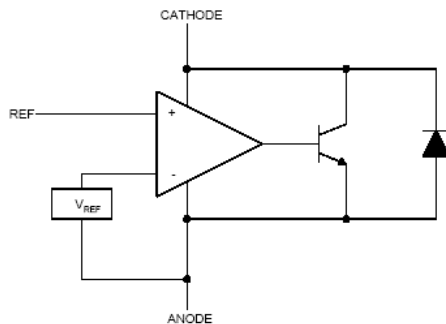


SOP-8

### FEATURES

- Programmable output Voltage to 36V.
- Low dynamic output impedance  $0.2\Omega$
- Sink current capability of 1 to 100mA.
- Equivalent full-range temperature coefficient of  $50\text{ppm}/^\circ\text{C}$  typical for operation over full rated operating temperature range.
- We declare that material of product compliance with ROHS requirements.
- ESD: HBM 4000V

### BLOCK DIAGRAM



**ABSOLUTE MAXIMUM RATINGS** (Operating temperature range applies unless otherwise specified)

PARAMETER	SYMBOL	VALUE	UNIT
Cathode Voltage	V <sub>KA</sub>	36	V
Cathode Current Range(Continuous)	I <sub>KA</sub>	-100 ~ +150	mA
Reference Input Current Range	I <sub>ref</sub>	-0.05 ~ +10	mA
Operating Junction Temperature	T <sub>j</sub>	150	°C
Operating Ambient Temperature	T <sub>opr</sub>	-40 ~ +125	°C
Storage Temperature Temperature	T <sub>stg</sub>	-65 ~ +150	°C

**RECOMMENDED OPERATING CONDITIONS**

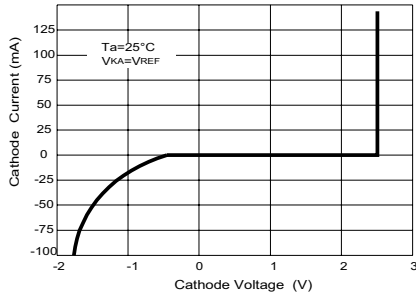
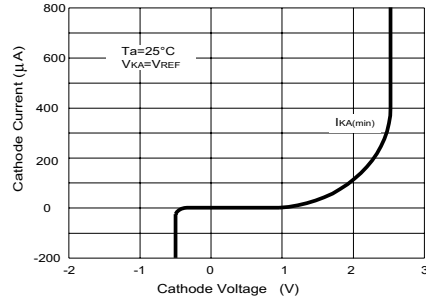
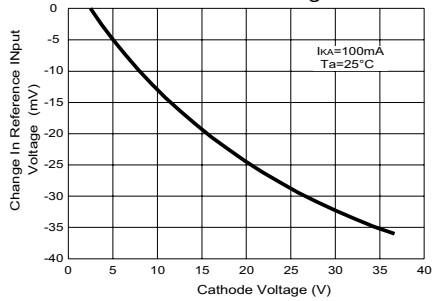
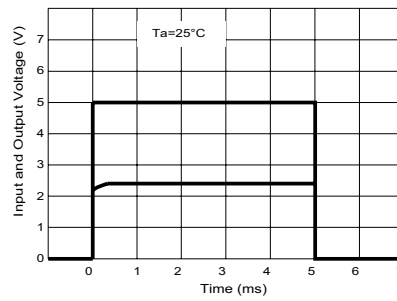
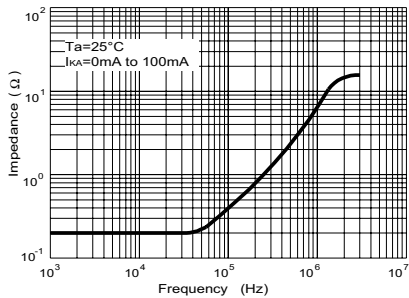
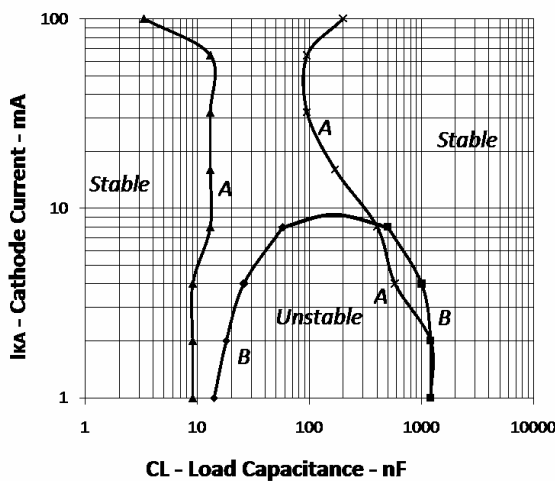
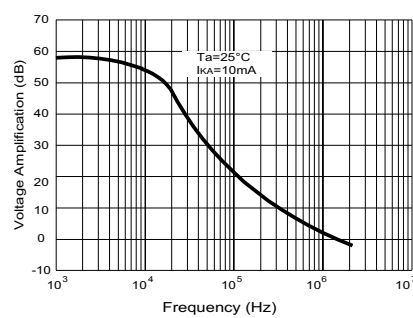
PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Cathode Voltage	V <sub>KA</sub>	V <sub>REF</sub>		36	V
Cathode Current	I <sub>KA</sub>	0.5		100	mA

**ELECTRICAL CHARACTERISTICS**(T<sub>a</sub>=25°C, unless otherwise specified)

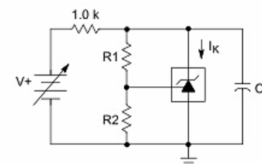
Characteristic	Symbol	Test conditions	MIN	TYP	MAX	UNIT	
Reference Input Voltage 1	V <sub>ref</sub>	V <sub>KA</sub> =V <sub>REF</sub> , I <sub>KA</sub> =10mA	2.488	2.50	2.512	V	
			2.475	2.50	2.525		
Deviation of reference Input Voltage Over temperature	ΔV <sub>ref</sub>	V <sub>KA</sub> =V <sub>REF</sub> , I <sub>KA</sub> =10mA T <sub>MIN</sub> ≤T <sub>A</sub> ≤T <sub>MAX</sub>		4.5	25	mV	
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	ΔV <sub>ref</sub> /ΔV <sub>KA</sub>	I <sub>KA</sub> =10mA	ΔV <sub>KA</sub> =10V~V <sub>REF</sub>		-1.0	-2.7	mV/V
			ΔV <sub>KA</sub> =36V~10V		-0.5	-2.0	
Reference Input Current	I <sub>ref</sub>	I <sub>KA</sub> =10mA, R1=10kΩ, R2=∞		1	2	μA	
Deviation of Reference Input Current Over Full Temperature Range	ΔI <sub>ref</sub> /ΔT	I <sub>KA</sub> =10mA, R1=10kΩ, R2=∞, T <sub>A</sub> =full Temperature		0.2	0.4	μA	
Minimum cathode current for regulation	I <sub>KA</sub> (min)	V <sub>KA</sub> =V <sub>REF</sub>		0.3	0.5	mA	
Off-state cathode Current	I <sub>KA</sub> (OFF)	V <sub>KA</sub> =36V, V <sub>REF</sub> =0		0.05	0.5	μA	
Dynamic Impedance	Z <sub>KA</sub>	V <sub>KA</sub> =V <sub>REF</sub> , I <sub>KA</sub> =1 to 100mA f≤1.0kHz		0.15	0.5	Ω	

**CLASSIFICATION OF V<sub>ref</sub> AND PACKAGE**

Device	LR431AD	LR431BD
Rank	0.5%	1%
Range(V)	2.487~2.512	2.475~2.525
Marking	L431AD	L431BD
Package	SOP-8	SOP-8

**TYPICAL PERFORMANCE CHARACTERISTICS**
**Fig 1 Cathode Current Vs Cathode Voltage**

**Fig 2 Cathode Current Vs Cathode Voltage**

**Fig 3 Change in Reference Input Voltage Vs Cathode voltage**

**Fig 4 Pulse Response**

**Fig 5 Dynamic Impedance Vs Frequency**

**Fig 6 Small Signal Voltage Amplification Vs Frequency**

**Fig7.Stability Boundary Conditions(Ta=25 ° C)**

Note:The region C is not unstable when test current is above 1mA,


**Fig8.Test Circuit for Fig7**

Unstable region	VKA(V)	R1(KΩ)	R2(KΩ)
A	Vref	0	∞
B	5	10	10
C	10	30	10

### TEST CIRCUIT

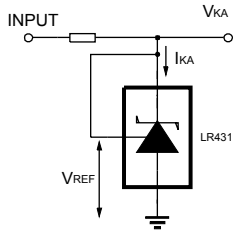


Fig9 Test Circuit For  $V_{KA}=V_{REF}$

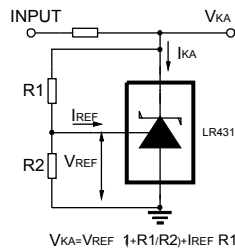


Fig10 Test Circuit for  $V_{KA} \geq V_{REF}$

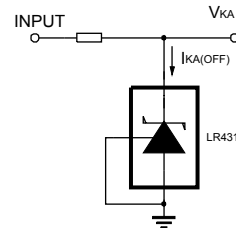


Fig11 Test Circuit For  $I_{KA(OFF)}$

### APPLICATION CIRCUIT

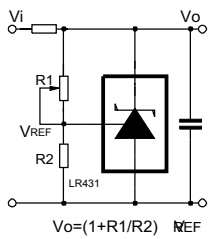


Fig12 Shutdown Regulator

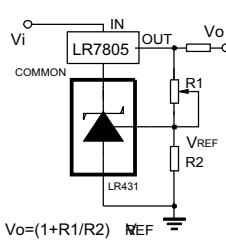


Fig13 Output Control of a Three-Terminal Fixed Regulator

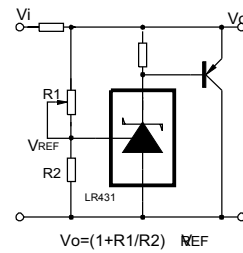


Fig14 Higher-current Shunt Regulator

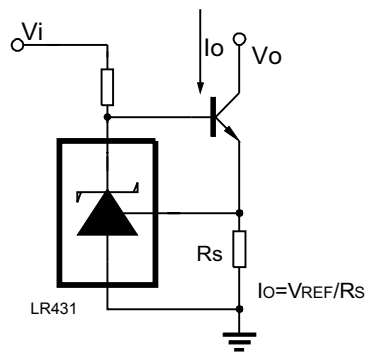


Fig15 Constant-current Sink

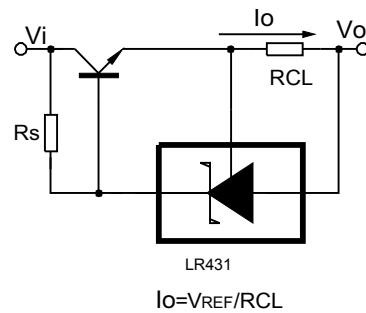
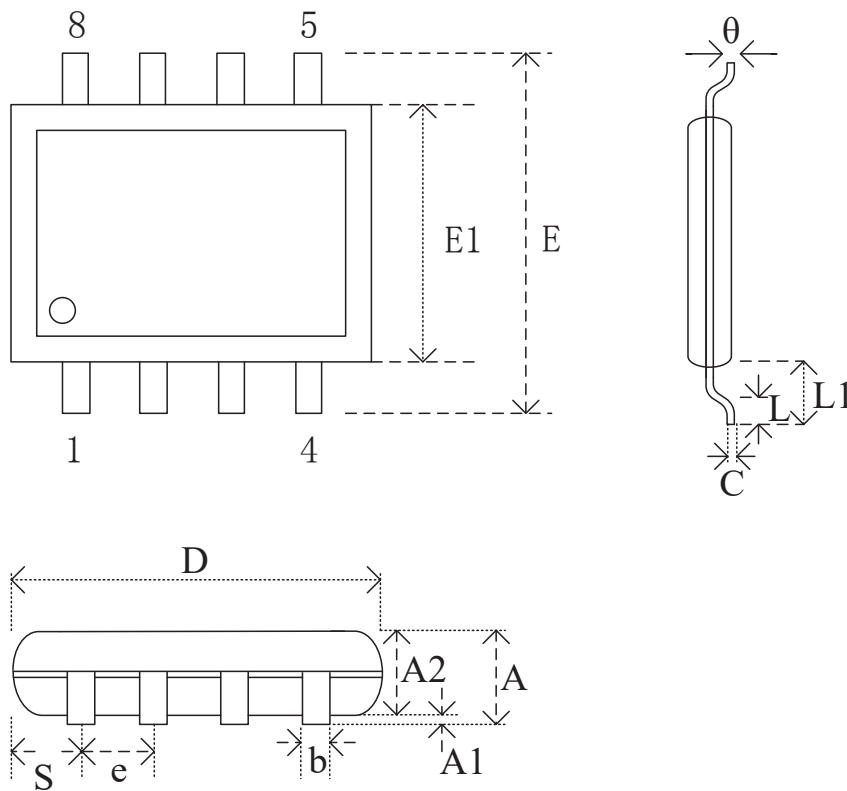


Fig16 Current Limiting or Current Source

**Package 8-Pin SOP 150-mil**

**Dimensions**

Symbol		A	A1	A2	b	C	D	E	E1	e	L	L1	S	$\theta$
Unit														
mm	Min		0.10	1.35	0.36	0.15	4.77	5.80	3.80		0.46	0.85	0.41	0
	Nom		0.15	1.45	0.41	0.20	4.90	5.99	3.90	1.27	0.66	1.05	0.54	5
	Max	1.75	0.20	1.55	0.51	0.25	5.03	6.20	4.00		0.86	1.25	0.67	8
Inch	Min		0.004	0.053	0.014	0.006	0.188	0.228	0.150		0.018	0.033	0.016	0
	Nom		0.006	0.057	0.016	0.008	0.193	0.236	0.154	0.05	0.026	0.041	0.021	5
	Max	0.069	0.008	0.061	0.020	0.010	0.198	0.244	0.158		0.034	0.049	0.026	8