Low Noise XFET Voltage References with Current Sink and Source Capability

Data Sheet

ADR431-EP/ADR434-EP/ADR435-EP

FEATURES

- Low noise (0.1 Hz to 10.0 Hz): 3.5 µV p-p at 2.5 V_O typical (ADR431-EP)
- No external capacitor required
- Low temperature coefficient
  - 5 ppm/°C maximum (ADR431-EP)
  - 3 ppm/°C maximum (ADR434-EP/ADR435-EP)
- Load regulation: 15 ppm/mA maximum
- Line regulation: 20 ppm/V maximum
- Wide supply voltage operating range: 4.5 V to 18 V (ADR431-EP)
- High output source and sink current: +10 mA and −10 mA

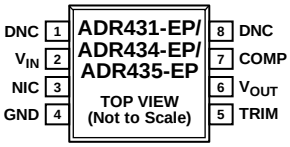
ENHANCED PRODUCT FEATURES

- Supports defense and aerospace applications, aerospace qualified electronic component (AQEC) standard
- Military temperature range: −55°C to +125°C
- Controlled manufacturing baseline
- One assembly and test site
- One fabrication site
- Enhanced product change notification
- Qualification data available on request

APPLICATIONS

- Precision data acquisition systems
- High resolution data converters
- Optical control circuits
- Precision instruments

PIN CONFIGURATION



NOTES
1. NIC = NOT INTERNALLY CONNECTED. THIS PIN IS NOT CONNECTED INTERNALLY.
2. DNC = DO NOT CONNECT. DO NOT CONNECT TO THIS PIN.

09218-001

Figure 1. 8-Lead SOIC_N (R-8)

GENERAL DESCRIPTION

The ADR431-EP/ADR434-EP/ADR435-EP are XFET® voltage references featuring low noise, high accuracy, and low temperature drift performance. Using Analog Devices, Inc., patented temperature drift curvature correction and eXtra implanted junction FET (XFET) technology, voltage change vs. temperature nonlinearity in the ADR431-EP/ADR434-EP/ADR435-EP is minimized.

The XFET references operate at lower current (800 µA) and lower supply voltage headroom (2 V) than buried Zener references. Buried Zener references require more than 5 V headroom for operation. The ADR431-EP/ADR434-EP/ADR435-EP XFET references are optimal low noise solutions for 5 V systems.

The ADR431-EP/ADR434-EP/ADR435-EP have the capability to source up to +10 mA of output current and sink up to −10 mA. They also come with a trim terminal to adjust the output voltage over a 0.5% range without compromising performance.

The ADR431-EP/ADR434-EP/ADR435-EP are available in an 8-lead narrow SOIC package and are specified over the military temperature range of −55°C to +125°C.

Additional application and technical information can be found in the ADR430/ADR431/ADR433/ADR434/ADR435 data sheet.

Table 1. Selection Guide

Model	Output Voltage (V)	Accuracy (mV)	Temperature Coefficient (ppm/°C)
ADR431T-EP	2.500	±1.0	5
ADR434T-EP	4.096	±1.5	3
ADR435T-EP	5.000	±2.0	3

Rev. B

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REVISION HISTORY

5/2017—Rev. A to Rev. B

Deleted ADR439 ..... Throughout
Added Pin Configuration and Function Descriptions Section, Figure 2; Renumbered Sequentially, and Table 7 7
Changes to Typical Performance Characteristics Section 8

8/2010—Rev. 0 to Rev. A

Added ADR431-EP ..... Throughout
Added ADR435-EP ..... Throughout
Changes to Ordering Guide 8

7/2010—Revision 0: Initial Version

SPECIFICATIONS

ADR431-EP ELECTRICAL CHARACTERISTICS

V_{IN} = 4.5 V to 18 V, I_L = 0 mA, T_A = 25°C, unless otherwise noted.

Table 2.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
OUTPUT VOLTAGE	V_O		2.499	2.500	2.501	V
INITIAL ACCURACY	V_{OERR}				±1.0 ±0.04	mV %
TEMPERATURE COEFFICIENT	TCV_O	−55°C < T_A < +125°C		1.5	5	ppm/°C
LINE REGULATION	$\Delta V_O/\Delta V_{IN}$	−55°C < T_A < +125°C		5	20	ppm/V
LOAD REGULATION	$\Delta V_O/\Delta I_L$	I_L = 0 mA to 10 mA, V_{IN} = 5 V, −55°C < T_A < +125°C I_L = −10 mA to 0 mA, V_{IN} = 5 V, −55°C < T_A < +125°C			15 15	ppm/mA ppm/mA
QUIESCENT CURRENT	I_{IN}	No load, −55°C < T_A < +125°C		580	800	µA
VOLTAGE NOISE	e_N p-p	0.1 Hz to 10.0 Hz		3.5		µV p-p
VOLTAGE NOISE DENSITY	e_N	1 kHz		80		nV/√Hz
TURN ON SETTLING TIME	t_R	C_L = 0 µF		10		µs
LONG-TERM STABILITY[1]	ΔV_O	1000 hours		40		ppm
OUTPUT VOLTAGE HYSTERESIS	V_{O_HYS}			20		ppm
RIPPLE REJECTION RATIO	RRR	f_{IN} = 1 kHz		−70		dB
SHORT CIRCUIT TO GND	I_{SC}			40		mA
SUPPLY VOLTAGE OPERATING RANGE	V_{IN}		4.5		18	V
SUPPLY VOLTAGE HEADROOM	$V_{IN} - V_O$		2			V

[1] The long-term stability specification is noncumulative. The drift in subsequent 1000 hour periods is significantly lower than in the first 1000 hour period.

ADR434-EP ELECTRICAL CHARACTERISTICS

V_{IN} = 6.1 V to 18 V, I_L = 0 mA, T_A = 25°C, unless otherwise noted.

Table 3.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
OUTPUT VOLTAGE	V_O		4.0945	4.096	4.0975	V
INITIAL ACCURACY	V_{OERR}				±1.5 ±0.04	mV %
TEMPERATURE COEFFICIENT	TCV_O	−55°C < T_A < +125°C		1	3	ppm/°C
LINE REGULATION	$\Delta V_O/\Delta V_{IN}$	−55°C < T_A < +125°C		5	20	ppm/V
LOAD REGULATION	$\Delta V_O/\Delta I_L$	I_L = 0 mA to 10 mA, V_{IN} = 7 V, −55°C < T_A < +125°C I_L = −10 mA to 0 mA, V_{IN} = 7 V, −55°C < T_A < +125°C			15 15	ppm/mA ppm/mA
QUIESCENT CURRENT	I_{IN}	No load, −55°C < T_A < +125°C		595	800	µA
VOLTAGE NOISE	e_N p-p	0.1 Hz to 10.0 Hz		6.25		µV p-p
VOLTAGE NOISE DENSITY	e_N	1 kHz		100		nV/√Hz
TURN ON SETTLING TIME	t_R	C_L = 0 µF		10		µs
LONG-TERM STABILITY[1]	ΔV_O	1000 hours		40		ppm
OUTPUT VOLTAGE HYSTERESIS	V_{O_HYS}			20		ppm
RIPPLE REJECTION RATIO	RRR	f_{IN} = 1 kHz		−70		dB
SHORT CIRCUIT TO GND	I_{SC}			40		mA
SUPPLY VOLTAGE OPERATING RANGE	V_{IN}		6.1		18	V
SUPPLY VOLTAGE HEADROOM	$V_{IN} - V_O$		2			V

[1] The long-term stability specification is noncumulative. The drift in subsequent 1000 hour periods is significantly lower than in the first 1000 hour period.

ADR435-EP ELECTRICAL CHARACTERISTICS

V_{IN} = 7.0 V to 18 V, I_L = 0 mA, T_A = 25°C, unless otherwise noted.

Table 4.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
OUTPUT VOLTAGE	V_O		4.998	5.000	5.002	V
INITIAL ACCURACY	V_{OERR}				±2.0	mV
					±0.04	%
TEMPERATURE COEFFICIENT	TCV_O	−55°C < T_A < +125°C		1	3	ppm/°C
LINE REGULATION	$\Delta V_O/\Delta V_{IN}$	−55°C < T_A < +125°C		5	20	ppm/V
LOAD REGULATION	$\Delta V_O/\Delta I_L$	I_L = 0 mA to 10 mA, V_{IN} = 8 V, −55°C < T_A < +125°C			15	ppm/mA
		I_L = −10 mA to 0 mA, V_{IN} = 8 V, −55°C < T_A < +125°C			15	ppm/mA
QUIESCENT CURRENT	I_{IN}	No load, −55°C < T_A < +125°C		620	800	µA
VOLTAGE NOISE	e_N p-p	0.1 Hz to 10.0 Hz		8		µV p-p
VOLTAGE NOISE DENSITY	e_N	1 kHz		115		nV/√Hz
TURN ON SETTLING TIME	t_R	C_L = 0 µF		10		µs
LONG-TERM STABILITY[1]	ΔV_O	1000 hours		40		ppm
OUTPUT VOLTAGE HYSTERESIS	V_{O_HYS}			20		ppm
RIPPLE REJECTION RATIO	RRR	f_{IN} = 1 kHz		−70		dB
SHORT CIRCUIT TO GND	I_{SC}			40		mA
SUPPLY VOLTAGE OPERATING RANGE	V_{IN}		7.0		18	V
SUPPLY VOLTAGE HEADROOM	$V_{IN} - V_O$		2			V

[1] The long-term stability specification is noncumulative. The drift in subsequent 1000 hour periods is significantly lower than in the first 1000 hour period.

ABSOLUTE MAXIMUM RATINGS

T_A = 25°C, unless otherwise noted.

Table 5.

Parameter	Rating
Supply Voltage	20 V
Output Short-Circuit Duration to GND	Indefinite
Storage Temperature Range	−65°C to +125°C
Operating Temperature Range	−55°C to +125°C
Junction Temperature Range	−65°C to +150°C
Lead Temperature, Soldering (60 sec)	300°C

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

THERMAL RESISTANCE

θ_{JA} is specified for the worst-case conditions, that is, a device soldered in a circuit board for surface-mount packages.

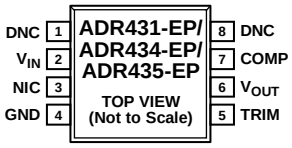
Table 6. Thermal Resistance

Package Type	θ_{JA}	θ_{JC}	Unit
8-Lead SOIC_N (R-8)	130	43	°C/W

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS



NOTES
1. NIC = NOT INTERNALLY CONNECTED. THIS PIN IS NOT CONNECTED INTERNALLY.
2. DNC = DO NOT CONNECT. DO NOT CONNECT TO THIS PIN.

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Figure 2. Pin Configuration

Table 7. Pin Function Descriptions

Pin No.	Mnemonic	Description
1, 8	DNC	Do Not Connect. Do not connect to this pin.
2	V_{IN}	Input Voltage Connection.
3	NIC	Not Internally Connected. This pin is not connected internally.
4	GND	Ground.
5	TRIM	Output Voltage Trim.
6	V_{OUT}	Output Voltage.
7	COMP	Compensation Input. Connect a series resistor capacitor network from COMP to V_{OUT} to reduce overall noise.

TYPICAL PERFORMANCE CHARACTERISTICS

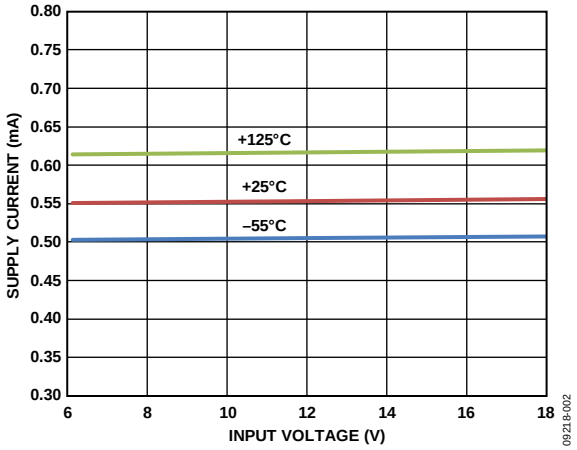

Figure 3. Supply Current vs. Input Voltage at Various Temperatures

OUTLINE DIMENSIONS

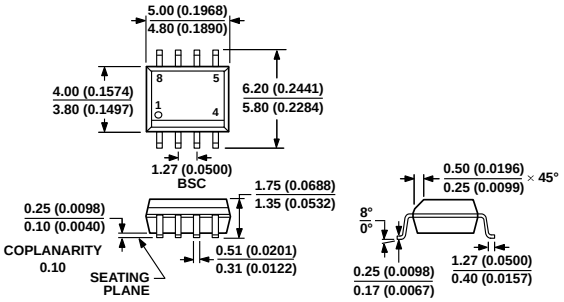

Figure 4. 8-Lead Standard Small Outline Package [SOIC_N]
Narrow Body
(R-8)
Dimensions shown in millimeters and (inches)

ORDERING GUIDE

Model[1]	Output Voltage (V)	Initial Accuracy, ± (mV)	Initial Accuracy, ± (%)	Temperature Coefficient Package (ppm/°C)	Temperature Range	Package Description	Package Option	Ordering Quantity
ADR431TRZ-EP	2.500	1.0	0.04	5	−55°C to +125°C	8-Lead SOIC_N	R-8	98
ADR431TRZ-EP-R7	2.500	1.0	0.04	5	−55°C to +125°C	8-Lead SOIC_N	R-8	1,000
ADR434TRZ-EP	4.096	1.5	0.04	3	−55°C to +125°C	8-Lead SOIC_N	R-8	98
ADR434TRZ-EP-R7	4.096	1.5	0.04	3	−55°C to +125°C	8-Lead SOIC_N	R-8	1,000
ADR435TRZ-EP	5.000	2.0	0.04	3	−55°C to +125°C	8-Lead SOIC_N	R-8	98
ADR435TRZ-EP-R7	5.000	2.0	0.04	3	−55°C to +125°C	8-Lead SOIC_N	R-8	1,000

[1] Z = RoHS Compliant Part.