



Ultraprecision, Low Noise, 2.048 V/2.500 V/ 3.00 V/5.00 V XFET® Voltage References

ADR420/ADR421/ADR423/ADR425

FEATURES

Low noise (0.1 Hz to 10 Hz)

ADR420: 1.75 μ V p-p

ADR421: 1.75 μ V p-p

ADR423: 2.0 μ V p-p

ADR425: 3.4 μ V p-p

Low temperature coefficient: 3 ppm/°C

Long-term stability: 50 ppm/1,000 hours

Load regulation: 70 ppm/mA

Line regulation: 35 ppm/V

Low hysteresis: 40 ppm typical

Wide operating range

ADR420: 4 V to 18 V

ADR421: 4.5 V to 18 V

ADR423: 5 V to 18 V

ADR425: 7 V to 18 V

Quiescent current: 0.5 mA maximum

High output current: 10 mA

Wide temperature range: -40°C to +125°C

APPLICATIONS

Precision data acquisition systems

High resolution converters

Battery-powered instrumentation

Portable medical instruments

Industrial process control systems

Precision instruments

Optical network control circuits

PIN CONFIGURATION

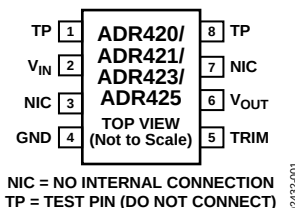


Figure 1. 8-Lead SOIC, 8-Lead MSOP

GENERAL DESCRIPTION

The ADR42x are a series of ultraprecision, second-generation eXtra implanted junction FET (XFET) voltage references featuring low noise, high accuracy, and excellent long-term stability in SOIC and MSOP footprints.

Patented temperature drift curvature correction technique and XFET technology minimize nonlinearity of the voltage change with temperature. The XFET architecture offers superior accuracy and thermal hysteresis to the band gap references. It also operates at lower power and lower supply headroom than the buried Zener references.

The superb noise and the stable and accurate characteristics of the ADR42x make them ideal for precision conversion applications such as optical networks and medical equipment. The ADR42x trim terminal can also be used to adjust the output voltage over a $\pm 0.5\%$ range without compromising any other performance. The ADR42x series voltage references offer two electrical grades and are specified over the extended industrial temperature range of -40°C to +125°C. Devices have 8-lead SOIC or 30% smaller, 8-lead MSOP packages.

ADR42x PRODUCTS

Table 1.

Model	Output Voltage (V _O)	Initial Accuracy		Temperature Coefficient (ppm/°C)
		mV	%	
ADR420	2.048	1, 3	0.05, 0.15	3, 10
ADR421	2.50	1, 3	0.04, 0.12	3, 10
ADR423	3.00	1.5, 4	0.04, 0.13	3, 10
ADR425	5.00	2, 6	0.04, 0.12	3, 10

Rev. G

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One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700
Fax: 781.461.3113
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www.analog.com

ADR420/ADR421/ADR423/ADR425

ADR421 ELECTRICAL SPECIFICATIONS

@ $V_{IN} = 5.0\text{ V}$ to 15.0 V , $T_A = 25^\circ\text{C}$, unless otherwise noted.

Table 3.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage, A Grade	V_O		2.497	2.500	2.503	V
Initial Accuracy	V_{OERR}		-3		+3	mV
			-0.12		+0.12	%
Output Voltage, B Grade	V_O		2.499	2.500	2.501	V
Initial Accuracy	V_{OERR}		-1		+1	mV
			-0.04		+0.04	%
Temperature Coefficient, A Grade	TCV_O	$-40^\circ\text{C} < T_A < +125^\circ\text{C}$		2	10	ppm/ $^\circ\text{C}$
Temperature Coefficient, B Grade				1	3	ppm/ $^\circ\text{C}$
Supply Voltage Headroom	$V_{IN} - V_O$		2			V
Line Regulation	$\Delta V_O / \Delta V_{IN}$	$V_{IN} = 5\text{ V to }18\text{ V}$ $-40^\circ\text{C} < T_A < +125^\circ\text{C}$		10	35	ppm/V
Load Regulation	$\Delta V_O / \Delta I_{LOAD}$	$I_{LOAD} = 0\text{ mA to }10\text{ mA}$ $-40^\circ\text{C} < T_A < +125^\circ\text{C}$			70	ppm/mA
Quiescent Current	I_{IN}	No load $-40^\circ\text{C} < T_A < +125^\circ\text{C}$		390	500	μA
					600	μA
Voltage Noise	e_N p-p	0.1 Hz to 10 Hz		1.75		$\mu\text{V p-p}$
Voltage Noise Density	e_N	1 kHz		80		nV/ $\sqrt{\text{Hz}}$
Turn-On Settling Time	t_R			10		μs
Long-Term Stability	ΔV_O	1,000 hours		50		ppm
Output Voltage Hysteresis	V_{O_HYS}			40		ppm
Ripple Rejection Ratio	RRR	$f_{IN} = 10\text{ kHz}$		75		dB
Short Circuit to GND	I_{SC}			27		mA

ABSOLUTE MAXIMUM RATINGS

These ratings apply at 25°C, unless otherwise noted.

Table 6.

Parameter	Rating
Supply Voltage	18 V
Output Short-Circuit Duration to GND	Indefinite
Storage Temperature Range R, RM Packages	–65°C to +150°C
Operating Temperature Range ADR42x	–40°C to +125°C
Junction Temperature Range R, RM Packages	–65°C to +150°C
Lead Temperature (Soldering, 60 sec)	300°C

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

Table 7.

Package Type	θ_{JA} ¹	Unit
8-Lead MSOP (RM)	190	°C/W
8-Lead SOIC (R)	130	°C/W

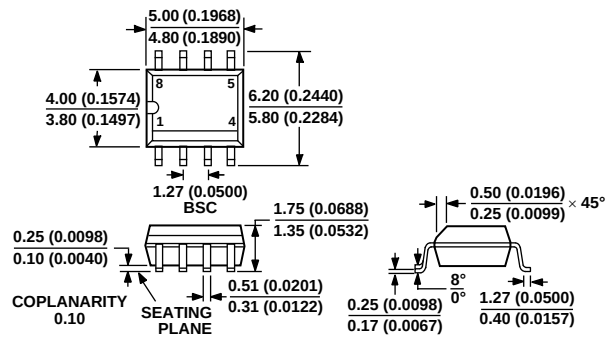
¹ θ_{JA} is specified for the worst-case conditions, that is, θ_{JA} is specified for devices soldered in the circuit board for surface-mount packages.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

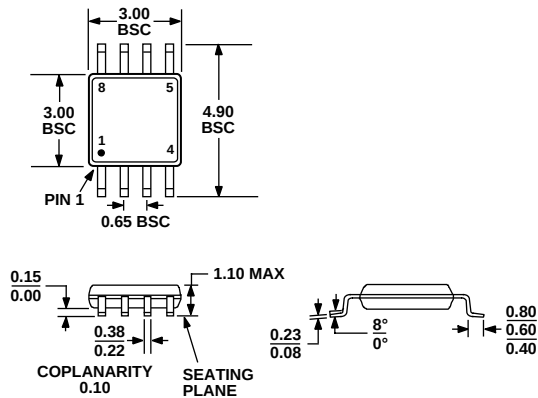


OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MS-012-AA
 CONTROLLING DIMENSIONS ARE IN MILLIMETERS; INCH DIMENSIONS
 (IN PARENTHESES) ARE ROUNDED-OFF MILLIMETER EQUIVALENTS FOR
 REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN

Figure 52. 8-Lead Standard Small Outline Package [SOIC_N]
 Narrow Body
 (R-8)
 Dimensions shown in millimeters and (inches)



COMPLIANT TO JEDEC STANDARDS MO-187-AA

Figure 53. 8-Lead Mini Small Outline Package [MSOP]
 (RM-8)
 Dimensions shown in millimeters

ADR420/ADR421/ADR423/ADR425

ORDERING GUIDE

Model	Temp Range (°C)	Package Description	Package Option	Top Mark	Output Voltage (Vo)	Initial Accuracy		Temp Co. (ppm/°C)
ADR420AR	–40 to +125	SOIC_N	R-8	ADR420	2.048	3	0.15	10
ADR420AR-REEL7	–40 to +125	SOIC_N	R-8	ADR420	2.048	3	0.15	10
ADR420ARZ ¹	–40 to +125	SOIC_N	R-8	ADR420	2.048	3	0.15	10
ADR420ARZ-REEL7 ¹	–40 to +125	SOIC_N	R-8	ADR420	2.048	3	0.15	10
ADR420ARM	–40 to +125	MSOP	RM-8	R4A	2.048	3	0.15	10
ADR420ARM-REEL7	–40 to +125	MSOP	RM-8	R4A	2.048	3	0.15	10
ADR420ARMZ ¹	–40 to +125	MSOP	RM-8	L0C	2.048	3	0.15	10
ADR420ARMZ-REEL7 ¹	–40 to +125	MSOP	RM-8	L0C	2.048	3	0.15	10
ADR420BR	–40 to +125	SOIC_N	R-8	ADR420	2.048	1	0.05	3
ADR420BR-REEL7	–40 to +125	SOIC_N	R-8	ADR420	2.048	1	0.05	3
ADR420BRZ ¹	–40 to +125	SOIC_N	R-8	ADR420	2.048	1	0.05	3
ADR420BRZ-REEL7 ¹	–40 to +125	SOIC_N	R-8	ADR420	2.048	1	0.05	3
ADR421AR	–40 to +125	SOIC_N	R-8	ADR421	2.50	3	0.12	10
ADR421AR-REEL7	–40 to +125	SOIC_N	R-8	ADR421	2.50	3	0.12	10
ADR421ARZ ¹	–40 to +125	SOIC_N	R-8	ADR421	2.50	3	0.12	10
ADR421ARZ-REEL7 ¹	–40 to +125	SOIC_N	R-8	ADR421	2.50	3	0.12	10
ADR421ARM	–40 to +125	MSOP	RM-8	R5A	2.50	3	0.12	10
ADR421ARM-REEL7	–40 to +125	MSOP	RM-8	R5A	2.50	3	0.12	10
ADR421ARMZ ¹	–40 to +125	MSOP	RM-8	R06	2.50	3	0.12	10
ADR421ARMZ-REEL7 ¹	–40 to +125	MSOP	RM-8	R06	2.50	3	0.12	10
ADR421BR	–40 to +125	SOIC_N	R-8	ADR421	2.50	1	0.04	3
ADR421BR-REEL7	–40 to +125	SOIC_N	R-8	ADR421	2.50	1	0.04	3
ADR421BRZ ¹	–40 to +125	SOIC_N	R-8	ADR421	2.50	1	0.04	3
ADR421BRZ-REEL7 ¹	–40 to +125	SOIC_N	R-8	ADR421	2.50	1	0.04	3
ADR423AR	–40 to +125	SOIC_N	R-8	ADR423	3.00	4	0.13	10
ADR423AR-REEL7	–40 to +125	SOIC_N	R-8	ADR423	3.00	4	0.13	10
ADR423ARZ ¹	–40 to +125	SOIC_N	R-8	ADR423	3.00	4	0.13	10
ADR423ARZ-REEL7 ¹	–40 to +125	SOIC_N	R-8	ADR423	3.00	4	0.13	10
ADR423ARM	–40 to +125	MSOP	RM-8	R6A	3.00	4	0.13	10
ADR423ARM-REEL7	–40 to +125	MSOP	RM-8	R6A	3.00	4	0.13	10
ADR423BR	–40 to +125	SOIC_N	R-8	ADR423	3.00	1.5	0.04	3
ADR423BR-REEL7	–40 to +125	SOIC_N	R-8	ADR423	3.00	1.5	0.04	3
ADR423ARMZ ¹	–40 to +125	MSOP	RM-8	R0U	3.00	4	0.13	10
ADR423ARMZ-REEL7 ¹	–40 to +125	MSOP	RM-8	R0U	3.00	4	0.13	10
ADR423BRZ ¹	–40 to +125	SOIC_N	R-8	ADR423	3.00	1.5	0.04	3
ADR423BRZ-REEL7 ¹	–40 to +125	SOIC_N	R-8	ADR423	3.00	1.5	0.04	3
ADR425AR	–40 to +125	SOIC_N	R-8	ADR425	5.00	6	0.12	10
ADR425AR-REEL7	–40 to +125	SOIC_N	R-8	ADR425	5.00	6	0.12	10
ADR425ARZ ¹	–40 to +125	SOIC_N	R-8	ADR425	5.00	6	0.12	10
ADR425ARZ-REEL7 ¹	–40 to +125	SOIC_N	R-8	ADR425	5.00	6	0.12	10
ADR425ARM	–40 to +125	MSOP	RM-8	R7A	5.00	6	0.12	10
ADR425ARM-REEL7	–40 to +125	MSOP	RM-8	R7A	5.00	6	0.12	10
ADR425ARMZ ¹	–40 to +125	MSOP	RM-8	R0V	5.00	6	0.12	10
ADR425ARMZ-REEL7 ¹	–40 to +125	MSOP	RM-8	R0V	5.00	6	0.12	10
ADR425BR	–40 to +125	SOIC_N	R-8	ADR425	5.00	2	0.04	3
ADR425BR-REEL7	–40 to +125	SOIC_N	R-8	ADR425	5.00	2	0.04	3
ADR425BRZ ¹	–40 to +125	SOIC_N	R-8	ADR425	5.00	2	0.04	3
ADR425BRZ-REEL7 ¹	–40 to +125	SOIC_N	R-8	ADR425	5.00	2	0.04	3

¹ Z = Pb-free part.