



**ANALOG
DEVICES**

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 μV p-p

ADR421: 1.75 μV p-p

ADR423: 2.0 μV p-p

ADR425: 3.4 μV p-p

Low temperature coefficient: 3 ppm/°C

Long-term stability: 50 ppm/1000 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

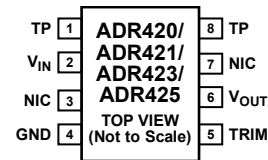
Optical network control circuits

ADR42x PRODUCTS

Table 1.

Model	Output Voltage, V_{OUT} (V)	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

PIN CONFIGURATION



NIC = NO INTERNAL CONNECTION
TP = TEST PIN (DO NOT CONNECT)

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.

ADR423 ELECTRICAL SPECIFICATIONS

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

Table 4.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
OUTPUT VOLTAGE	V_{OUT}					
A Grade			2.996	3.000	3.004	V
B Grade			2.9985	3.000	3.0015	V
INITIAL ACCURACY	V_{OUTERR}					
A Grade			-4		+4	mV
			-0.13		+0.13	%
B Grade			-1.5		+1.5	mV
			-0.04		+0.04	%
TEMPERATURE COEFFICIENT	TCV_{OUT}	$-40^\circ\text{C} < T_A < +125^\circ\text{C}$				
A Grade				2	10	ppm/ $^\circ\text{C}$
B Grade			1	3	ppm/ $^\circ\text{C}$	
SUPPLY VOLTAGE HEADROOM	$V_{IN} - V_{OUT}$		2			V
LINE REGULATION	$\Delta V_{OUT}/\Delta V_{IN}$	$V_{IN} = 5\text{ V to }18\text{ V}$, $-40^\circ\text{C} < T_A < +125^\circ\text{C}$		10	35	ppm/V
LOAD REGULATION	$\Delta V_{OUT}/\Delta I_L$	$I_L = 0\text{ mA to }10\text{ mA}$, $-40^\circ\text{C} < T_A < +125^\circ\text{C}$			70	ppm/mA
QUIESCENT CURRENT	I_{IN}	No load $-40^\circ\text{C} < T_A < +125^\circ\text{C}$		390	500	μA
						600
VOLTAGE NOISE	e_N p-p	0.1 Hz to 10 Hz		2		$\mu\text{V p-p}$
VOLTAGE NOISE DENSITY	e_N	1 kHz		90		nV/ $\sqrt{\text{Hz}}$
TURN-ON SETTLING TIME	t_R			10		μs
LONG-TERM STABILITY	ΔV_{OUT}	1000 hours		50		ppm
OUTPUT VOLTAGE HYSTERESIS	V_{OUT_HYS}			40		ppm
RIPPLE REJECTION RATIO	RRR	$f_{IN} = 1\text{ kHz}$		-75		dB
SHORT CIRCUIT TO GND	I_{SC}			27		mA

ADR420/ADR421/ADR423/ADR425

ADR425 ELECTRICAL SPECIFICATIONS

$V_{IN} = 7.0\text{ V to }15.0\text{ V}$, $T_A = 25^\circ\text{C}$, unless otherwise noted.

Table 5.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
OUTPUT VOLTAGE	V_{OUT}					
A Grade			4.994	5.000	5.006	V
B Grade			4.998	5.000	5.002	V
INITIAL ACCURACY	V_{OUTERR}					
A Grade			-6		+6	mV
			-0.12		+0.12	%
B Grade			-2		+2	mV
			-0.04		+0.04	%
TEMPERATURE COEFFICIENT	TCV_{OUT}	$-40^\circ\text{C} < T_A < +125^\circ\text{C}$				
A Grade				2	10	ppm/ $^\circ\text{C}$
B Grade				1	3	ppm/ $^\circ\text{C}$
SUPPLY VOLTAGE HEADROOM	$V_{IN} - V_O$		2			V
LINE REGULATION	$\Delta V_O / \Delta V_{IN}$	$V_{IN} = 7\text{ V to }18\text{ V}$, $-40^\circ\text{C} < T_A < +125^\circ\text{C}$		10	35	ppm/V
LOAD REGULATION	$\Delta V_O / \Delta I_L$	$I_L = 0\text{ mA to }10\text{ mA}$, $-40^\circ\text{C} < T_A < +125^\circ\text{C}$			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		3.4		$\mu\text{V p-p}$
VOLTAGE NOISE DENSITY	e_N	1 kHz		110		$\text{nV}/\sqrt{\text{Hz}}$
TURN-ON SETTLING TIME	t_R			10		μs
LONG-TERM STABILITY	ΔV_O	1000 hours		50		ppm
OUTPUT VOLTAGE HYSTERESIS	V_{O_HYS}			40		ppm
RIPPLE REJECTION RATIO	RRR	$f_{IN} = 1\text{ kHz}$		-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	-65°C to +150°C
Operating Temperature Range	-40°C to +125°C
Junction Temperature Range	-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.

THERMAL RESISTANCE

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.

Table 7.

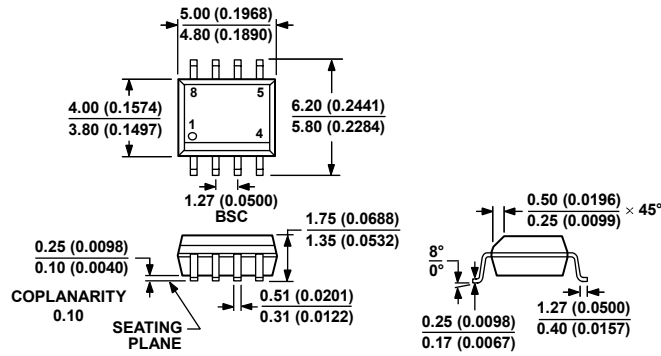
Package Type	θ_{JA}	Unit
8-Lead MSOP (RM)	190	°C/W
8-Lead SOIC (R)	130	°C/W

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.

OUTLINE DIMENSIONS

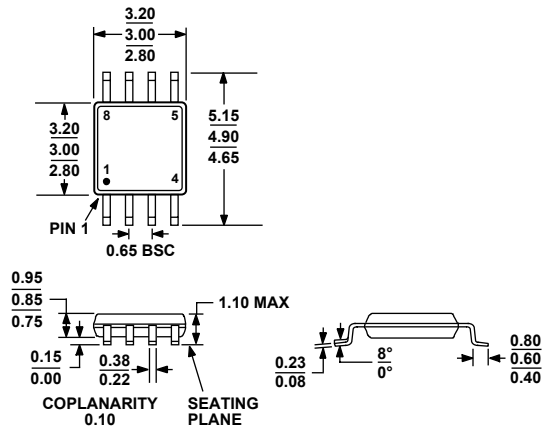


COMPLIANT TO JEDEC STANDARDS MS-012-AA
 CONTROLLING DIMENSIONS ARE IN MILLIMETERS; INCH DIMENSIONS
 (IN PARENTHESES) ARE ROUNDED-OFF MILLIMETER EQUIVALENTS FOR
 REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN.

012407-A

Figure 51. 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 52. 8-Lead Mini Small Outline Package [MSOP]
 (RM-8)

Dimensions shown in millimeters

ADR420/ADR421/ADR423/ADR425

ORDERING GUIDE

Model	Output Voltage, V _{OUT} (V)	Initial Accuracy		Temperature Coefficient (ppm/°C)	Temperature Range	Package Description	Package Option	Branding
		mV	%					
ADR420AR	2.048	3	0.15	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR420AR-REEL7	2.048	3	0.15	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR420ARZ ¹	2.048	3	0.15	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR420ARZ-REEL7 ¹	2.048	3	0.15	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR420ARM	2.048	3	0.15	10	-40°C to +125°C	8-Lead MSOP	RM-8	R4A
ADR420ARM-REEL7	2.048	3	0.15	10	-40°C to +125°C	8-Lead MSOP	RM-8	R4A
ADR420ARMZ ¹	2.048	3	0.15	10	-40°C to +125°C	8-Lead MSOP	RM-8	LOC
ADR420ARMZ-REEL7 ¹	2.048	3	0.15	10	-40°C to +125°C	8-Lead MSOP	RM-8	LOC
ADR420BR	2.048	1	0.05	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR420BR-REEL7	2.048	1	0.05	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR420BRZ ¹	2.048	1	0.05	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR420BRZ-REEL7 ¹	2.048	1	0.05	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR421AR	2.50	3	0.12	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR421AR-REEL7	2.50	3	0.12	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR421ARZ ¹	2.50	3	0.12	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR421ARZ-REEL7 ¹	2.50	3	0.12	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR421ARM	2.50	3	0.12	10	-40°C to +125°C	8-Lead MSOP	RM-8	R5A
ADR421ARM-REEL7	2.50	3	0.12	10	-40°C to +125°C	8-Lead MSOP	RM-8	R5A
ADR421ARMZ ¹	2.50	3	0.12	10	-40°C to +125°C	8-Lead MSOP	RM-8	R06
ADR421ARMZ-REEL7 ¹	2.50	3	0.12	10	-40°C to +125°C	8-Lead MSOP	RM-8	R06
ADR421BR	2.50	1	0.04	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR421BR-REEL7	2.50	1	0.04	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR421BRZ ¹	2.50	1	0.04	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR421BRZ-REEL7 ¹	2.50	1	0.04	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR423AR	3.00	4	0.13	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR423AR-REEL7	3.00	4	0.13	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR423ARZ ¹	3.00	4	0.13	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR423ARZ-REEL7 ¹	3.00	4	0.13	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR423ARM	3.00	4	0.13	10	-40°C to +125°C	8-Lead MSOP	RM-8	R6A
ADR423ARM-REEL7	3.00	4	0.13	10	-40°C to +125°C	8-Lead MSOP	RM-8	R6A
ADR423BR	3.00	1.5	0.04	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR423BR-REEL7	3.00	1.5	0.04	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR423ARMZ ¹	3.00	4	0.13	10	-40°C to +125°C	8-Lead MSOP	RM-8	R0U
ADR423ARMZ-REEL7 ¹	3.00	4	0.13	10	-40°C to +125°C	8-Lead MSOP	RM-8	R0U
ADR423BRZ ¹	3.00	1.5	0.04	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR423BRZ-REEL7 ¹	3.00	1.5	0.04	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR425AR	5.00	6	0.12	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR425AR-REEL7	5.00	6	0.12	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR425ARZ ¹	5.00	6	0.12	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR425ARZ-REEL7 ¹	5.00	6	0.12	10	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR425ARM	5.00	6	0.12	10	-40°C to +125°C	8-Lead MSOP	RM-8	R7A
ADR425ARM-REEL7	5.00	6	0.12	10	-40°C to +125°C	8-Lead MSOP	RM-8	R7A
ADR425ARMZ ¹	5.00	6	0.12	10	-40°C to +125°C	8-Lead MSOP	RM-8	R7A#
ADR425ARMZ-REEL7 ¹	5.00	6	0.12	10	-40°C to +125°C	8-Lead MSOP	RM-8	R7A#
ADR425BR	5.00	2	0.04	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR425BR-REEL7	5.00	2	0.04	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR425BRZ ¹	5.00	2	0.04	3	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADR425BRZ-REEL7 ¹	5.00	2	0.04	3	-40°C to +125°C	8-Lead SOIC_N	R-8	

¹ Z = RoHS Compliant Part. # denotes RoHS-compliant product may be top or bottom marked.