Single-Supply, Rail-to-Rail Low Power FET-Input Op Amp

AD822

FEATURES

- True single-supply operation
  - Output swings rail-to-rail
  - Input voltage range extends below ground
  - Single-supply capability from 3 V to 36 V
  - Dual-supply capability from ±1.5 V to ±18 V
- High load drive
  - Capacitive load drive of 350 pF, G = +1
  - Minimum output current of 15 mA
- Excellent ac performance for low power
  - 800 µA maximum quiescent current per amplifier
  - Unity-gain bandwidth: 1.8 MHz
  - Slew rate of 3 V/µs
- Good dc performance
  - 800 µV maximum input offset voltage
  - 2 µV/°C typical offset voltage drift
  - 25 pA maximum input bias current
- Low noise
  - 13 nV/√Hz @ 10 kHz
  - No phase inversion

APPLICATIONS

- Battery-powered precision instrumentation
- Photodiode preamps
- Active filters
- 12-bit to 14-bit data acquisition systems
- Medical instrumentation
- Low power references and regulators

CONNECTION DIAGRAM

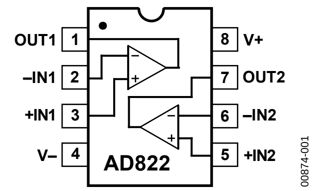


Figure 1. 8-Lead PDIP (N Suffix); 8-Lead MSOP (RM Suffix); and 8-Lead SOIC_N (R Suffix)

GENERAL DESCRIPTION

The AD822 is a dual precision, low power FET input op amp that can operate from a single supply of 3 V to 36 V or dual supplies of ±1.5 V to ±18 V. It has true single-supply capability with an input voltage range extending below the negative rail, allowing the AD822 to accommodate input signals below ground in the single-supply mode. Output voltage swing extends to within 10 mV of each rail, providing the maximum output dynamic range.

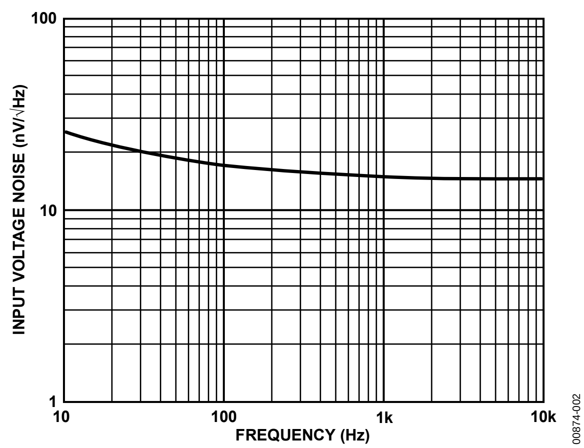


Figure 2. Input Voltage Noise vs. Frequency

Offset voltage of 800 µV maximum, offset voltage drift of 2 µV/°C, input bias currents below 25 pA, and low input voltage noise provide dc precision with source impedances up to a gigaohm. The 1.8 MHz unity-gain bandwidth, –93 dB THD at 10 kHz, and 3 V/µs slew rate are provided with a low supply current of 800 µA per amplifier.

The AD822 drives up to 350 pF of direct capacitive load as a follower and provides a minimum output current of 15 mA. This allows the amplifier to handle a wide range of load conditions. Its combination of ac and dc performance, plus the outstanding load drive capability, results in an exceptionally versatile amplifier for the single-supply user.

The AD822 is available in two performance grades. The A grade and B grade are rated over the industrial temperature range of −40°C to +85°C.

The AD822 is offered in three varieties of 8-lead packages: PDIP, MSOP, and SOIC_N.

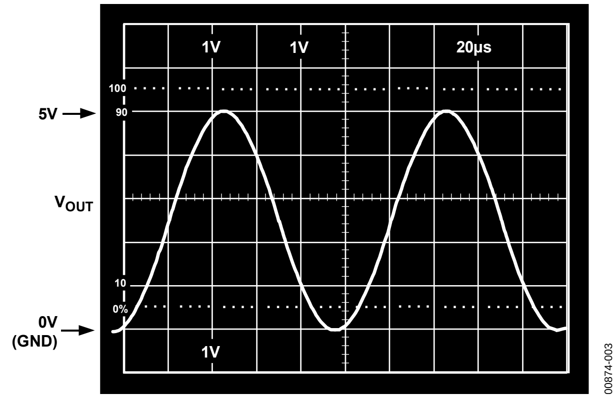


Figure 3. Gain-of-2 Amplifier; V_S = 5 V, 0 V, V_{IN} = 2.5 V Sine Centered at 1.25 V, R_L = 100 Ω

SPECIFICATIONS

V_S = 0 V, 5 V @ T_A = 25°C, V_{CM} = 0 V, V_{OUT} = 0.2 V, unless otherwise noted.

Table 1.

		A Grade			B Grade			
Parameter	**Conditions**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
DC PERFORMANCE								
Initial Offset			0.1	0.8		0.1	0.4	mV
Maximum Offset Over Temperature			0.5	1.2		0.5	0.9	mV
Offset Drift			2			2		μV/°C
Input Bias Current	V_{CM} = 0 V to 4 V		2	25		2	10	pA
At T_{MAX}			0.5	5		0.5	2.5	nA
Input Offset Current			2	20		2	10	pA
At T_{MAX}			0.5			0.5		nA
Open-Loop Gain	V_{OUT} = 0.2 V to 4 V							
	R_L = 100 kΩ	500	1000		500	1000		V/mV
T_{MIN} to T_{MAX}		400			400			V/mV
	R_L = 10 kΩ	80	150		80	150		V/mV
T_{MIN} to T_{MAX}		80			80			V/mV
	R_L = 1 kΩ	15	30		15	30		V/mV
T_{MIN} to T_{MAX}		10			10			V/mV
NOISE/HARMONIC PERFORMANCE								
Input Voltage Noise								
f = 0.1 Hz to 10 Hz			2			2		μV p-p
f = 10 Hz			25			25		nV/√Hz
f = 100 Hz			21			21		nV/√Hz
f = 1 kHz			16			16		nV/√Hz
f = 10 kHz			13			13		nV/√Hz
Input Current Noise								
f = 0.1 Hz to 10 Hz			18			18		fA p-p
f = 1 kHz			0.8			0.8		fA/√Hz
Harmonic Distortion	R_L = 10 kΩ to 2.5 V							
f = 10 kHz	V_{OUT} = 0.25 V to 4.75 V		−93			−93		dB
DYNAMIC PERFORMANCE								
Unity-Gain Frequency			1.8			1.8		MHz
Full Power Response	V_{OUT} p-p = 4.5 V		210			210		kHz
Slew Rate			3			3		V/μs
Settling Time								
To 0.1%	V_{OUT} = 0.2 V to 4.5 V		1.4			1.4		μs
To 0.01%	V_{OUT} = 0.2 V to 4.5 V		1.8			1.8		μs
MATCHING CHARACTERISTICS								
Initial Offset				1.0			0.5	mV
Maximum Offset Over Temperature				1.6			1.3	mV
Offset Drift			3			3		μV/°C
Input Bias Current				20			10	pA
Crosstalk @ f = 1 kHz	R_L = 5 kΩ		−130			−130		dB
Crosstalk @ f = 100 kHz	R_L = 5 kΩ		−93			−93		dB
INPUT CHARACTERISTICS								
Input Voltage Range[1], T_{MIN} to T_{MAX}		−0.2		+4	−0.2		+4	V
Common-Mode Rejection Ratio (CMRR)	V_{CM} = 0 V to 2 V	66	80		69	80		dB
T_{MIN} to T_{MAX}	V_{CM} = 0 V to 2 V	66			66			dB

Parameter	Conditions	A Grade Min	A Grade Typ	A Grade Max	B Grade Min	B Grade Typ	B Grade Max	Unit
Input Impedance								
Differential			$10^{13}\|\|0.5$			$10^{13}\|\|0.5$		Ω||pF
Common Mode			$10^{13}\|\|2.8$			$10^{13}\|\|2.8$		Ω||pF
OUTPUT CHARACTERISTICS								
Output Saturation Voltage[2]								
$V_{OL} - V_{EE}$	I_{SINK} = 20 μA		5	7		5	7	mV
T_{MIN} to T_{MAX}				10			10	mV
$V_{CC} - V_{OH}$	I_{SOURCE} = 20 μA		10	14		10	14	mV
T_{MIN} to T_{MAX}				20			20	mV
$V_{OL} - V_{EE}$	I_{SINK} = 2 mA		40	55		40	55	mV
T_{MIN} to T_{MAX}				80			80	mV
$V_{CC} - V_{OH}$	I_{SOURCE} = 2 mA		80	110		80	110	mV
T_{MIN} to T_{MAX}				160			160	mV
$V_{OL} - V_{EE}$	I_{SINK} = 15 mA		300	500		300	500	mV
T_{MIN} to T_{MAX}				1000			1000	mV
$V_{CC} - V_{OH}$	I_{SOURCE} = 15 mA		800	1500		800	1500	mV
T_{MIN} to T_{MAX}				1900			1900	mV
Operating Output Current		15			15			mA
T_{MIN} to T_{MAX}		12			12			mA
Capacitive Load Drive			350			350		pF
POWER SUPPLY								
Quiescent Current, T_{MIN} to T_{MAX}			1.24	1.6		1.24	1.6	mA
Power Supply Rejection	V+ = 5 V to 15 V	66	80		70	80		dB
T_{MIN} to T_{MAX}		66			70			dB

[1] This is a functional specification. Amplifier bandwidth decreases when the input common-mode voltage is driven in the range (V+ − 1 V) to V+. Common-mode effort voltage is typically less than 5 mV with the common-mode voltage set at 1 V below the positive supply.
[2] $V_{OL} - V_{EE}$ is defined as the difference between the lowest possible output voltage (V_{OL}) and the negative voltage supply rail (V_{EE}). $V_{CC} - V_{OH}$ is defined as the difference between the highest possible output voltage (V_{OH}) and the positive supply voltage (V_{CC}).

V_S = ±5 V @ T_A = 25°C, V_{CM} = 0 V, V_{OUT} = 0 V, unless otherwise noted.

Table 2.

Parameter	Conditions	A Grade Min	A Grade Typ	A Grade Max	B Grade Min	B Grade Typ	B Grade Max	Unit
DC PERFORMANCE								
Initial Offset			0.1	0.8		0.1	0.4	mV
Maximum Offset Over Temperature			0.5	1.5		0.5	1	mV
Offset Drift			2			2		μV/°C
Input Bias Current	V_{CM} = −5 V to +4 V		2	25		2	10	pA
At T_{MAX}			0.5	5		0.5	2.5	nA
Input Offset Current			2	20		2	10	pA
At T_{MAX}			0.5			0.5		nA
Open-Loop Gain	V_{OUT} = −4 V to +4 V							
	R_L = 100 kΩ	400	1000		400	1000		V/mV
T_{MIN} to T_{MAX}		400			400			V/mV
	R_L = 10 kΩ	80	150		80	150		V/mV
T_{MIN} to T_{MAX}		80			80			V/mV
	R_L = 1 kΩ	20	30		20	30		V/mV
T_{MIN} to T_{MAX}		10			10			V/mV
NOISE/HARMONIC PERFORMANCE								
Input Voltage Noise								
f = 0.1 Hz to 10 Hz			2			2		μV p-p
f = 10 Hz			25			25		nV/√Hz
f = 100 Hz			21			21		nV/√Hz
f = 1 kHz			16			16		nV/√Hz
f = 10 kHz			13			13		nV/√Hz
Input Current Noise								
f = 0.1 Hz to 10 Hz			18			18		fA p-p
f = 1 kHz			0.8			0.8		fA/√Hz
Harmonic Distortion	R_L = 10 kΩ							
f = 10 kHz	V_{OUT} = ±4.5 V		−93			−93		dB
DYNAMIC PERFORMANCE								
Unity-Gain Frequency			1.9			1.9		MHz
Full Power Response	V_{OUT} p-p = 9 V		105			105		kHz
Slew Rate			3			3		V/μs
Settling Time								
to 0.1%	V_{OUT} = 0 V to ±4.5 V		1.4			1.4		μs
to 0.01%	V_{OUT} = 0 V to ±4.5 V		1.8			1.8		μs
MATCHING CHARACTERISTICS								
Initial Offset				1.0			0.5	mV
Maximum Offset Over Temperature				3			2	mV
Offset Drift			3			3		μV/°C
Input Bias Current				25			10	pA
Crosstalk @ f = 1 kHz	R_L = 5 kΩ		−130			−130		dB
Crosstalk @ f = 100 kHz	R_L = 5 kΩ		−93			−93		dB
INPUT CHARACTERISTICS								
Input Voltage Range[1], T_{MIN} to T_{MAX}		−5.2		+4	−5.2		+4	V
Common-Mode Rejection Ratio (CMRR)	V_{CM} = −5 V to +2 V	66	80		69	80		dB
T_{MIN} to T_{MAX}	V_{CM} = −5 V to +2 V	66			66			dB
Input Impedance								
Differential			10^{13}‖0.5			10^{13}‖0.5		Ω‖pF
Common Mode			10^{13}‖2.8			10^{13}‖2.8		Ω‖pF

Parameter	Conditions	A Grade Min	A Grade Typ	A Grade Max	B Grade Min	B Grade Typ	B Grade Max	Unit
OUTPUT CHARACTERISTICS								
Output Saturation Voltage[2]								
$V_{OL} – V_{EE}$	I_{SINK} = 20 µA		5	7		5	7	mV
T_{MIN} to T_{MAX}				10			10	mV
$V_{CC} – V_{OH}$	I_{SOURCE} = 20 µA		10	14		10	14	mV
T_{MIN} to T_{MAX}				20			20	mV
$V_{OL} – V_{EE}$	I_{SINK} = 2 mA		40	55		40	55	mV
T_{MIN} to T_{MAX}				80			80	mV
$V_{CC} – V_{OH}$	I_{SOURCE} = 2 mA		80	110		80	110	mV
T_{MIN} to T_{MAX}				160			160	mV
$V_{OL} – V_{EE}$	I_{SINK} = 15 mA		300	500		300	500	mV
T_{MIN} to T_{MAX}				1000			1000	mV
$V_{CC} – V_{OH}$	I_{SOURCE} = 15 mA		800	1500		800	1500	mV
T_{MIN} to T_{MAX}				1900			1900	mV
Operating Output Current		15			15			mA
T_{MIN} to T_{MAX}		12			12			mA
Capacitive Load Drive			350			350		pF
POWER SUPPLY								
Quiescent Current, T_{MIN} to T_{MAX}			1.3	1.6		1.3	1.6	mA
Power Supply Rejection	V_{SY} = ±5 V to ±15 V	66	80		70	80		dB
T_{MIN} to T_{MAX}		66			70			dB

[1] This is a functional specification. Amplifier bandwidth decreases when the input common-mode voltage is driven in the range (V+ – 1 V) to V+. Common-mode effort voltage is typically less than 5 mV with the common-mode voltage set at 1 V below the positive supply.

[2] $V_{OL} – V_{EE}$ is defined as the difference between the lowest possible output voltage (V_{OL}) and the negative voltage supply rail (V_{EE}). $V_{CC} – V_{OH}$ is defined as the difference between the highest possible output voltage (V_{OH}) and the positive supply voltage (V_{CC}).

V_S = ±15 V @ T_A = 25°C, V_{CM} = 0 V, V_{OUT} = 0 V, unless otherwise noted.

Table 3.

Parameter	Conditions	A Grade Min	A Grade Typ	A Grade Max	B Grade Min	B Grade Typ	B Grade Max	Unit
DC PERFORMANCE								
Initial Offset			0.4	2		0.3	1.5	mV
Maximum Offset Over Temperature			0.5	3		0.5	2.5	mV
Offset Drift			2			2		µV/°C
Input Bias Current	V_{CM} = 0 V		2	25		2	12	pA
	V_{CM} = −10 V		40			40		pA
At T_{MAX}	V_{CM} = 0 V		0.5	5		0.5	2.5	nA
Input Offset Current			2	20		2	12	pA
At T_{MAX}			0.5			0.5		nA
Open-Loop Gain	V_{OUT} = −10 V to +10 V							
	R_L = 100 kΩ	500	2000		500	2000		V/mV
T_{MIN} to T_{MAX}		500			500			V/mV
	R_L = 10 kΩ	100	500		100	500		V/mV
T_{MIN} to T_{MAX}		100			100			V/mV
	R_L = 1 kΩ	30	45		30	45		V/mV
T_{MIN} to T_{MAX}		20			20			V/mV
NOISE/HARMONIC PERFORMANCE								
Input Voltage Noise								
f = 0.1 Hz to 10 Hz			2			2		µV p-p
f = 10 Hz			25			25		nV/√Hz
f = 100 Hz			21			21		nV/√Hz
f = 1 kHz			16			16		nV/√Hz
f = 10 kHz			13			13		nV/√Hz
Input Current Noise								
f = 0.1 Hz to 10 Hz			18			18		fA p-p
f = 1 kHz			0.8			0.8		fA/√Hz
Harmonic Distortion	R_L = 10 kΩ							
f = 10 kHz	V_{OUT} = ±10 V		−85			−85		dB
DYNAMIC PERFORMANCE								
Unity-Gain Frequency			1.9			1.9		MHz
Full Power Response	V_{OUT} p-p = 20 V		45			45		kHz
Slew Rate			3			3		V/µs
Settling Time								
to 0.1%	V_{OUT} = 0 V to ±10 V		4.1			4.1		µs
to 0.01%	V_{OUT} = 0 V to ±10 V		4.5			4.5		µs
MATCHING CHARACTERISTICS								
Initial Offset				3			2	mV
Maximum Offset Over Temperature				4			2.5	mV
Offset Drift			3			3		µV/°C
Input Bias Current				25			12	pA
Crosstalk @ f = 1 kHz	R_L = 5 kΩ		−130			−130		dB
Crosstalk @ f = 100 kHz	R_L = 5 kΩ		−93			−93		dB
INPUT CHARACTERISTICS								
Input Voltage Range[1], T_{MIN} to T_{MAX}		−15.2		+14	−15.2		+14	V
Common-Mode Rejection Ratio (CMRR)	V_{CM} = −15 V to +12 V	70	80		74	90		dB
T_{MIN} to T_{MAX}	V_{CM} = −15 V to +12 V	70			74			dB
Input Impedance								
Differential			10^{13}‖0.5			10^{13}‖0.5		Ω‖pF
Common Mode			10^{13}‖2.8			10^{13}‖2.8		Ω‖pF

Parameter	Conditions	A Grade Min	A Grade Typ	A Grade Max	B Grade Min	B Grade Typ	B Grade Max	Unit
OUTPUT CHARACTERISTICS								
Output Saturation Voltage[2]								
$V_{OL} - V_{EE}$	$I_{SINK} = 20\ \mu A$		5	7		5	7	mV
T_{MIN} to T_{MAX}				10			10	mV
$V_{CC} - V_{OH}$	$I_{SOURCE} = 20\ \mu A$		10	14		10	14	mV
T_{MIN} to T_{MAX}				20			20	mV
$V_{OL} - V_{EE}$	$I_{SINK} = 2$ mA		40	55		40	55	mV
T_{MIN} to T_{MAX}				80			80	mV
$V_{CC} - V_{OH}$	$I_{SOURCE} = 2$ mA		80	110		80	110	mV
T_{MIN} to T_{MAX}				160			160	mV
$V_{OL} - V_{EE}$	$I_{SINK} = 15$ mA		300	500		300	500	mV
T_{MIN} to T_{MAX}				1000			1000	mV
$V_{CC} - V_{OH}$	$I_{SOURCE} = 15$ mA		800	1500		800	1500	mV
T_{MIN} to T_{MAX}				1900			1900	mV
Operating Output Current		20			20			mA
T_{MIN} to T_{MAX}		15			15			mA
Capacitive Load Drive			350			350		pF
POWER SUPPLY								
Quiescent Current, T_{MIN} to T_{MAX}			1.4	1.8		1.4	1.8	mA
Power Supply Rejection	$V_{SY} = \pm 5$ V to ± 15 V	70	80		70	80		dB
T_{MIN} to T_{MAX}		70			70			dB

[1] This is a functional specification. Amplifier bandwidth decreases when the input common-mode voltage is driven in the range (V+ − 1 V) to V+. Common-mode effort voltage is typically less than 5 mV with the common-mode voltage set at 1 V below the positive supply.
[2] $V_{OL} - V_{EE}$ is defined as the difference between the lowest possible output voltage (V_{OL}) and the negative voltage supply rail (V_{EE}). $V_{CC} - V_{OH}$ is defined as the difference between the highest possible output voltage (V_{OH}) and the positive supply voltage (V_{CC}).

V_S = 0 V, 3 V @ T_A = 25°C, V_{CM} = 0 V, V_{OUT} = 0.2 V, unless otherwise noted.

Table 4.

Parameter	Conditions	Typ	Unit
DC PERFORMANCE			
Initial Offset		0.2	mV
Maximum Offset Over Temperature		0.5	mV
Offset Drift		1	μV/°C
Input Bias Current	V_{CM} = 0 V to 2 V	2	pA
At T_{MAX}		0.5	nA
Input Offset Current		2	pA
At T_{MAX}		0.5	nA
Open-Loop Gain	V_{OUT} = 0.2 V to 2 V		
T_{MIN} to T_{MAX}	R_L = 100 kΩ	1000	V/mV
T_{MIN} to T_{MAX}	R_L = 10 kΩ	150	V/mV
T_{MIN} to T_{MAX}	R_L = 1 kΩ	30	V/mV
NOISE/HARMONIC PERFORMANCE			
Input Voltage Noise			
0.1 Hz to 10 Hz		2	μV p-p
f = 10 Hz		25	nV/√Hz
f = 100 Hz		21	nV/√Hz
f = 1 kHz		16	nV/√Hz
f = 10 kHz		13	nV/√Hz
Input Current Noise			
f = 0.1 Hz to 10 Hz		18	fA p-p
f = 1 kHz		0.8	fA/√Hz
Harmonic Distortion	R_L = 10 kΩ to 1.5 V		
f = 10 kHz	V_{OUT} = ±1.25 V	−92	dB
DYNAMIC PERFORMANCE			
Unity-Gain Frequency		1.5	MHz
Full Power Response	V_{OUT} p-p = 2.5 V	240	kHz
Slew Rate		3	V/μs
Settling Time			
to 0.1%	V_{OUT} = 0.2 V to 2.5 V	1	μs
to 0.01%		1.4	μs
MATCHING CHARACTERISTICS			
Offset Drift		2	μV/°C
Crosstalk @ f = 1 kHz	R_L = 5 kΩ	−130	dB
Crosstalk @ f = 100 kHz	R_L = 5 kΩ	−93	dB
INPUT CHARACTERISTICS			
Common-Mode Rejection Ratio (CMRR), T_{MIN} to T_{MAX}	V_{CM} = 0 V to 1 V	74	dB
Input Impedance			
Differential		10^{13}‖0.5	Ω‖pF
Common Mode		10^{13}‖2.8	Ω‖pF

Parameter	Conditions	Typ	Unit
OUTPUT CHARACTERISTICS			
Output Saturation Voltage[1]			
$V_{OL} - V_{EE}$	$I_{SINK} = 20\ \mu A$	5	mV
$V_{CC} - V_{OH}$	$I_{SOURCE} = 20\ \mu A$	10	mV
$V_{OL} - V_{EE}$	$I_{SINK} = 2\ mA$	40	mV
$V_{CC} - V_{OH}$	$I_{SOURCE} = 2\ mA$	80	mV
$V_{OL} - V_{EE}$	$I_{SINK} = 10\ mA$	200	mV
$V_{CC} - V_{OH}$	$I_{SOURCE} = 10\ mA$	500	mV
Capacitive Load Drive		350	pF
POWER SUPPLY			
Quiescent Current, T_{MIN} to T_{MAX}		1.24	mA
Power Supply Rejection, T_{MIN} to T_{MAX}	$V_{SY} = 3\ V$ to $15\ V$	80	dB

[1] $V_{OL} - V_{EE}$ is defined as the difference between the lowest possible output voltage (V_{OL}) and the negative voltage supply rail (V_{EE}). $V_{CC} - V_{OH}$ is defined as the difference between the highest possible output voltage (V_{OH}) and the positive supply voltage (V_{CC}). Specifications are T_{MIN} to T_{MAX}.

ABSOLUTE MAXIMUM RATINGS

Table 5.

Parameter	Rating
Supply Voltage	±18 V
Internal Power Dissipation	
8-Lead PDIP (N)	Observe derating curves
8-Lead SOIC_N (R)	Observe derating curves
8-Lead MSOP (RM)	Observe derating curves
Input Voltage	((V+) + 0.2 V) to −(20 V + (V+))
Output Short-Circuit Duration	Indefinite
Differential Input Voltage	±30 V
Storage Temperature Range (N)	−65°C to +125°C
Storage Temperature Range (R, RM)	−65°C to +150°C
Operating Temperature Range	
A Grade and B Grade	−40°C to +85°C
Lead Temperature (Soldering, 60 sec)	260°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, a device soldered in a circuit board for surface-mount packages.

Table 6. Thermal Resistance

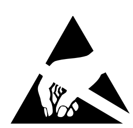
Package Type	θ_{JA}	Unit
8-lead PDIP (N)	90	°C/W
8-lead SOIC_N (R)	160	°C/W
8-lead MSOP (RM)	190	°C/W

MAXIMUM POWER DISSIPATION

The maximum power that can be safely dissipated by the AD822 is limited by the associated rise in junction temperature. For plastic packages, the maximum safe junction temperature is 145°C. If these maximums are exceeded momentarily, proper circuit operation is restored as soon as the die temperature is reduced. Leaving the device in the overheated condition for an extended period can result in device burnout. To ensure proper operation, it is important to observe the derating curves shown in Figure 27.

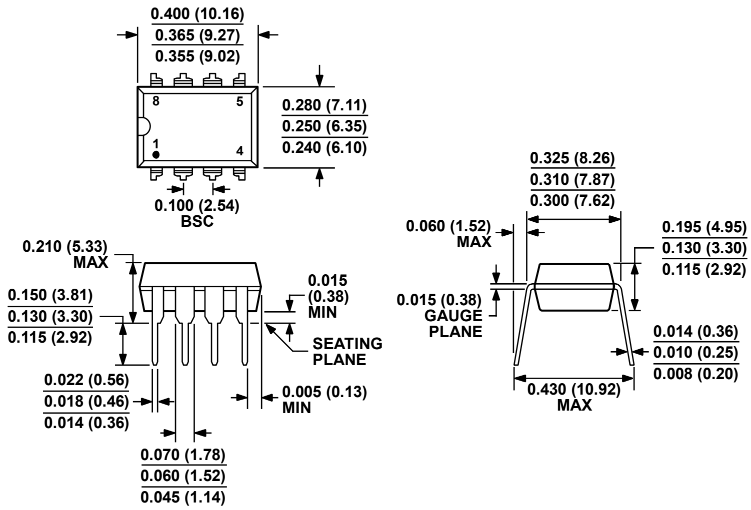
While the AD822 is internally short-circuit protected, this may not be sufficient to guarantee that the maximum junction temperature is not exceeded under all conditions. With power supplies ±12 V (or less) at an ambient temperature of 25°C or less, if the output node is shorted to a supply rail, then the amplifier is not destroyed, even if this condition persists for an extended period.

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

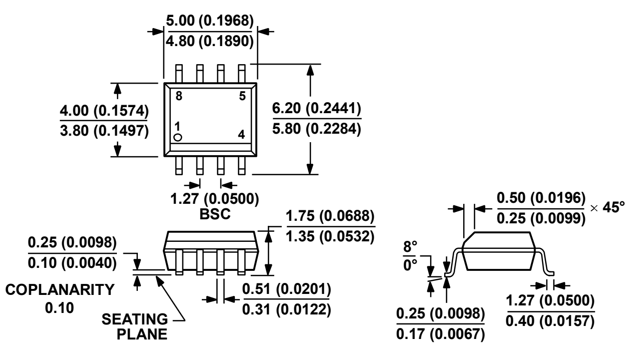


COMPLIANT TO JEDEC STANDARDS MS-001

CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETER DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN.
CORNER LEADS MAY BE CONFIGURED AS WHOLE OR HALF LEADS.

070606-A

Figure 52. 8-Lead Plastic Dual In-Line Package [PDIP]
Narrow Body
(N-8)
Dimensions shown in inches and (millimeters)

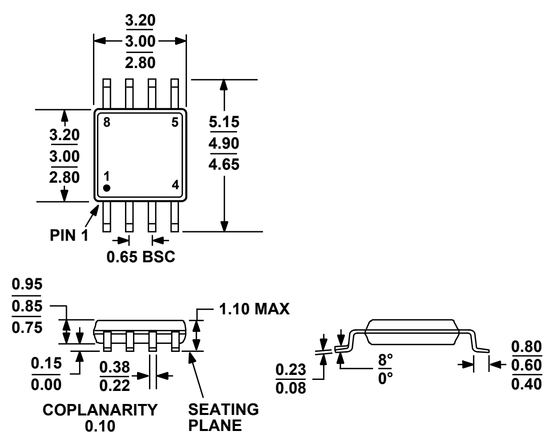


COMPLIANT TO JEDEC STANDARDS MS-012-AA

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 53. 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 54. 8-Lead Mini Small Outline Package [MSOP]
(RM-8)
Dimensions shown in millimeters

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option	Branding
AD822AN	−40°C to +85°C	8-Lead PDIP	N-8	
AD822ANZ[1]	−40°C to +85°C	8-Lead PDIP	N-8	
AD822AR	−40°C to +85°C	8-Lead SOIC_N	R-8	
AD822AR-REEL	−40°C to +85°C	8-Lead SOIC_N	R-8	
AD822AR-REEL7	−40°C to +85°C	8-Lead SOIC_N	R-8	
AD822ARZ[1]	−40°C to +85°C	8-Lead SOIC_N	R-8	
AD822ARZ-REEL[1]	−40°C to +85°C	8-Lead SOIC_N	R-8	
AD822ARZ-REEL7[1]	−40°C to +85°C	8-Lead SOIC_N	R-8	
AD822ARM-R2	−40°C to +85°C	8-Lead MSOP	RM-8	B4A
AD822ARM-REEL	−40°C to +85°C	8-Lead MSOP	RM-8	B4A
AD822ARMZ-R2[1]	−40°C to +85°C	8-Lead MSOP	RM-8	#B4A
AD822ARMZ-REEL[1]	−40°C to +85°C	8-Lead MSOP	RM-8	#B4A
AD822BR	−40°C to +85°C	8-Lead SOIC_N	R-8	
AD822BR-REEL	−40°C to +85°C	8-Lead SOIC_N	R-8	
AD822BR-REEL7	−40°C to +85°C	8-Lead SOIC_N	R-8	
AD822BRZ[1]	−40°C to +85°C	8-Lead SOIC_N	R-8	
AD822BRZ-REEL[1]	−40°C to +85°C	8-Lead SOIC_N	R-8	
AD822BRZ-REEL7[1]	−40°C to +85°C	8-Lead SOIC_N	R-8	

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