Data Sheet

MAX74822

5V, CMOS, Rail-to-Rail, General-Purpose Amplifiers

FEATURES

- Single-supply operation: 2.7V to 5.5V
- Low supply current: 45µA/amplifier
- Wide bandwidth: 1MHz
- No phase reversal
- Low input bias current: 4pA
- Unity gain stable
- Rail-to-rail input and output

APPLICATIONS

- ASIC input or output amplifiers
- Sensor interfaces
- Piezoelectric transducer amplifiers
- Medical instrumentation
- Mobile communications
- Audio outputs
- Portable systems

GENERAL DESCRIPTION

The MAX74822 is a dual rail-to-rail input and output, single-supply amplifier featuring very low supply current and 1MHz bandwidth. All are guaranteed to operate from a 2.7V single supply as well as a 5V supply. The MAX74822 provides 1MHz bandwidth at a low current consumption of 45µA per amplifier.

Very low input bias currents enable the MAX74822 to be used for integrators, photodiode amplifiers, piezoelectric sensors, and other applications with high source impedance. The supply current is only 45µA per amplifier, ideal for battery operation.

Rail-to-rail inputs and outputs are useful to designers buffering ASICs in single-supply systems. The MAX74822 is optimized to maintain high gains at lower supply voltages, which makes it useful for active filters and gain stages.

The MAX74822 is specified over the extended industrial temperature range (–40°C to +125°C). The MAX74822 dual is available in an 8-lead MSOP package.

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TABLE OF CONTENTS

SPECIFICATIONS

Table 1. 5.0V Specifications

(V_S = 5.0V, V_{CM} = 2.5V, T_A = 25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}			1	5	mV
		−40°C ≤ T_A ≤ +125°C		7		mV
Input Bias Current	I_B			4	40	pA
		−40°C ≤ T_A ≤ +125°C		1000		pA
Input Offset Current	I_{OS}			1	30	pA
		−40°C ≤ T_A ≤ +125°C		500		pA
Input Voltage Range			0		5	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0V to 5V	60	80		dB
		−40°C ≤ T_A ≤ +125°C		38		dB
Large Signal Voltage Gain	A_{VO}	R_L = 100kΩ, V_O = 0.5V to 2.2V	97	101		dB
		−40°C ≤ T_A ≤ +125°C		66		dB
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40°C ≤ T_A ≤ +125°C		4		µV/°C
Bias Current Drift	$\Delta I_B/\Delta T$	−40°C ≤ T_A ≤ +125°C		2000		fA/°C
Offset Current Drift	$\Delta I_{OS}/\Delta T$	−40°C ≤ T_A ≤ +125°C		25		fA/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L = 1mA	4.9	4.965		V
	V_{OH}	−40°C ≤ T_A ≤ +125°C		4.875		V
Output Voltage Low	V_{OL}	I_L = 1mA		25	100	mV
		−40°C ≤ T_A ≤ +125°C		125		mV
Output Current	I_{OUT}	V_{OUT} = V_S − 1V		30		mA
	I_{SC}			±60		mA
Closed-Loop Output Impedance	Z_{OUT}	f = 200kHz, A_V = 1		45		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 2.5V to 6V	65	76		dB
		−40°C ≤ T_A ≤ +125°C		60		dB
Supply Current/Amplifier	I_{SY}	V_O = 0V		45	65	µA
		−40°C ≤ T_A ≤ +125°C		85		µA

(V_S = 5.0V, V_{CM} = 2.5V, T_A = 25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 100kΩ	0.45	0.92		V/µs
Full Power Bandwidth	BW_P	1% distortion		70		kHz
Settling Time	t_S	To 0.1% (1V step)		6		µs
Gain Bandwidth Product	GBP			1000		kHz
Phase Margin	Φ_M			67		Degrees
NOISE PERFORMANCE						
Voltage Noise Density	e_n	f = 1kHz		42		nV/√Hz
		f = 10kHz		38		nV/√Hz
Current Noise Density	i_n			<0.1		pA/√Hz

ABSOLUTE MAXIMUM RATINGS

T_A = 25°C unless otherwise specified.

Table 2. Absolute Maximum Ratings

PARAMETER	RATING
Supply Voltage (V_S)	6V
Input Voltage	GND to V_S
Differential Input Voltage[1]	±6V
Input Current (Indefinite)	±10mA
Input Current (Duration < 1sec)	±100mA
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, 60sec)	300°C

[1] For supplies less than 6V, the differential input voltage is equal to ±VS.

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

Thermal performance is directly linked to PCB design and operating environment. Careful attention to PCB thermal design is required. θ_{JA} is specified for the worst-case conditions, that is, a device soldered in a circuit board for surface-mount packages and measured using a standard 4-layer board, unless otherwise specified. θ_{JC} is the junction-to-case thermal resistance.

Table 3. Thermal Resistance

PACKAGE TYPE	θ_{JA}	θ_{JC}	UNIT
8-Lead MSOP (RM)	142	45	°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

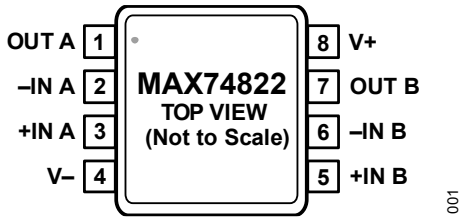

Figure 1. 8-Lead MSOP (RM Suffix)

Pin Function Descriptions

Table 4. Pin Descriptions

PIN	NAME	DESCRIPTION
1	OUT A	Output, Channel A.
2	−IN A	Inverting Input, Channel A.
3	+IN A	Noninverting Input, Channel A.
4	V−	Negative Supply Voltage.
5	+IN B	Noninverting Input, Channel B.
6	−IN B	Inverting Input, Channel B.
7	OUT B	Output, Channel B.
8	V+	Positive Supply Voltage.

TYPICAL PERFORMANCE CHARACTERISTICS

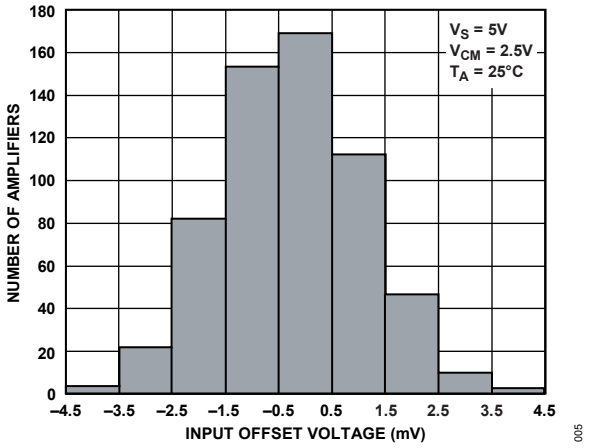

Figure 2. Input Offset Voltage Distribution

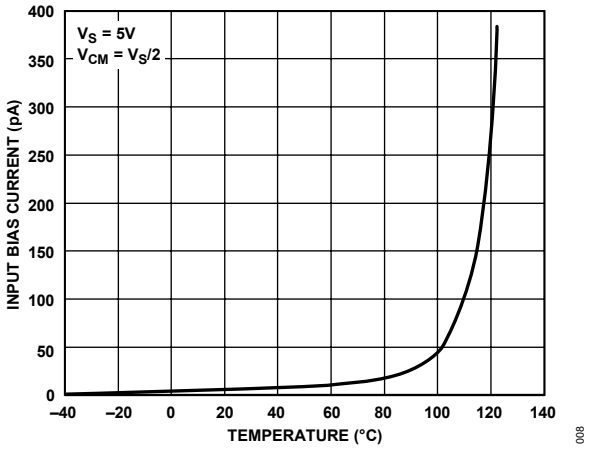

Figure 3. Input Bias Current vs. Temperature

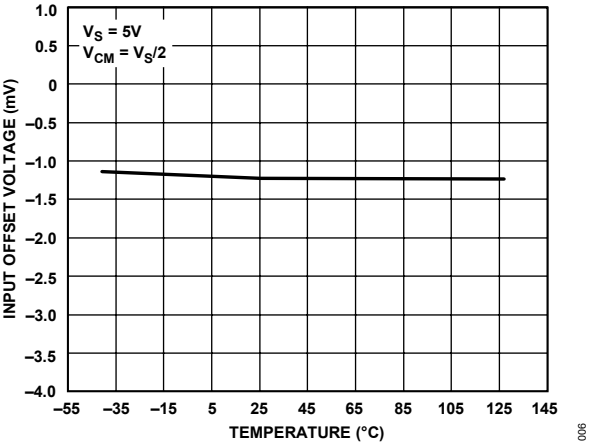

Figure 4. Input Offset Voltage vs. Temperature

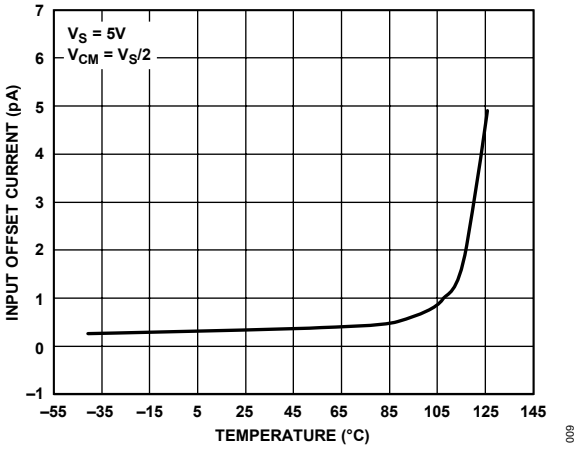

Figure 5. Input Offset Current vs. Temperature

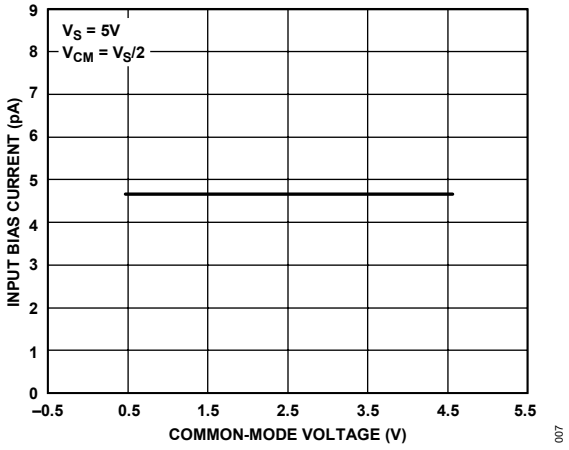

Figure 6. Input Bias Current vs. Common-Mode Voltage

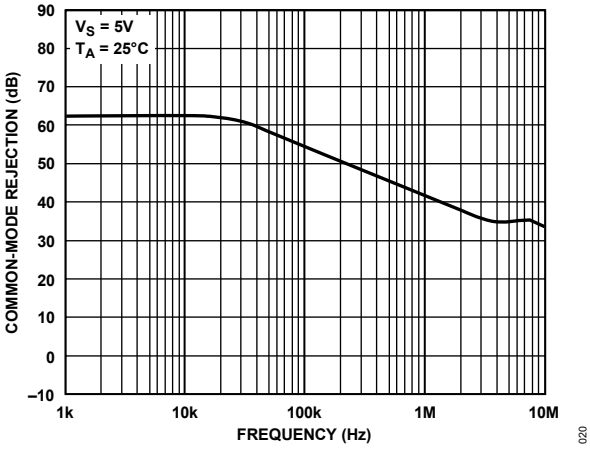

Figure 7. Common-Mode Rejection vs. Frequency

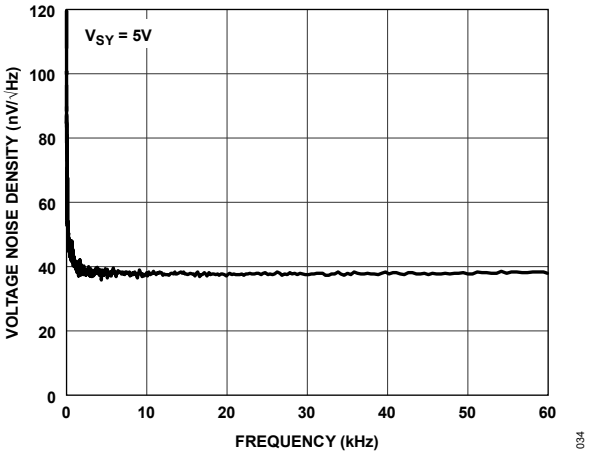

Figure 8. Voltage Noise Density vs. Frequency

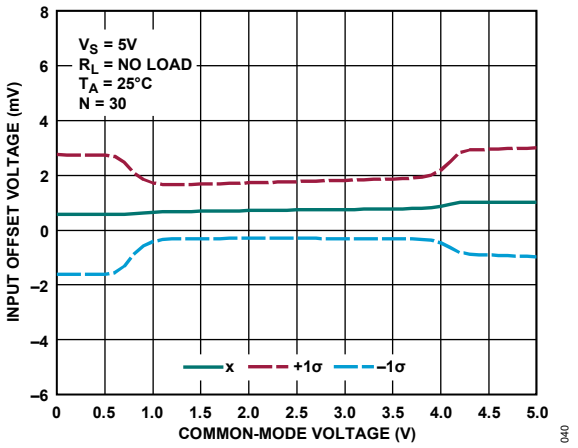

Figure 9. Input Offset Voltage vs. Common-Mode Voltage

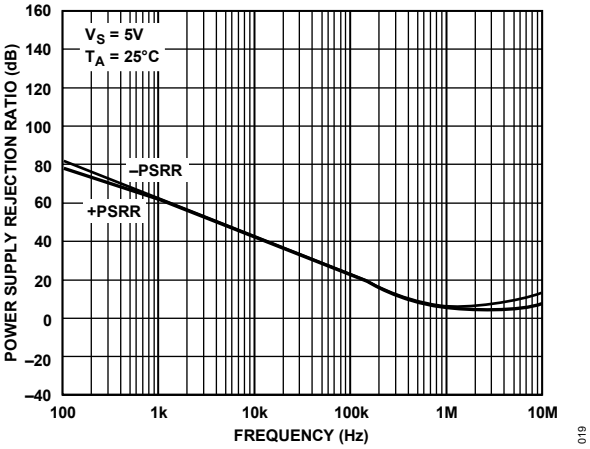

Figure 10. Power Supply Rejection Ratio vs. Frequency

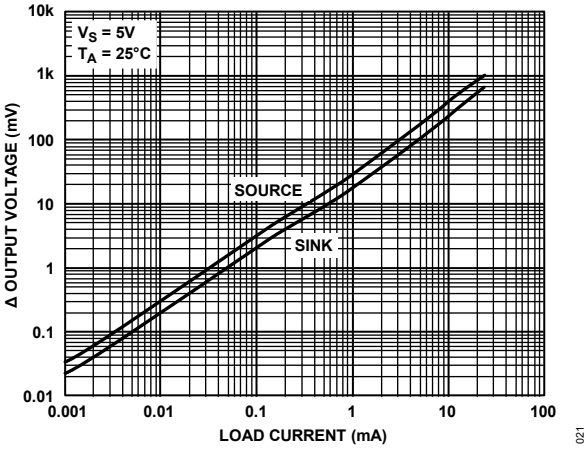

Figure 11. Output Voltage to Supply Rail vs. Load Current

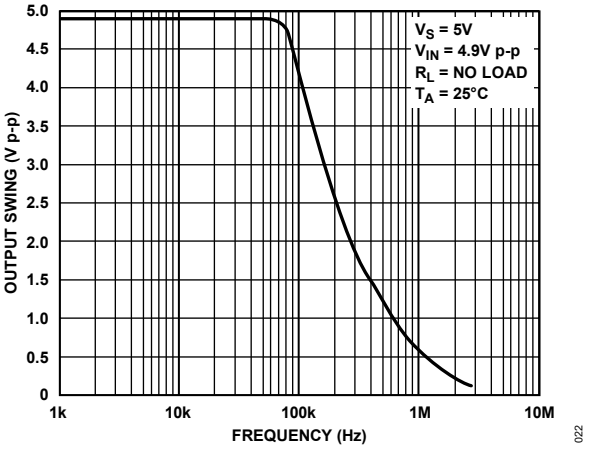

Figure 12. Closed-Loop Output Voltage Swing vs. Frequency

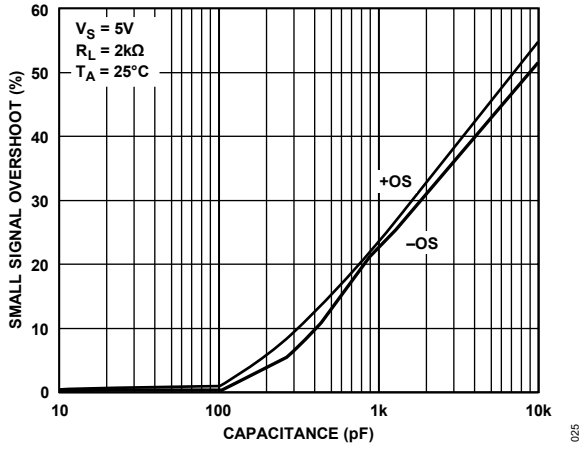

Figure 13. Small Signal Overshoot vs. Load Capacitance

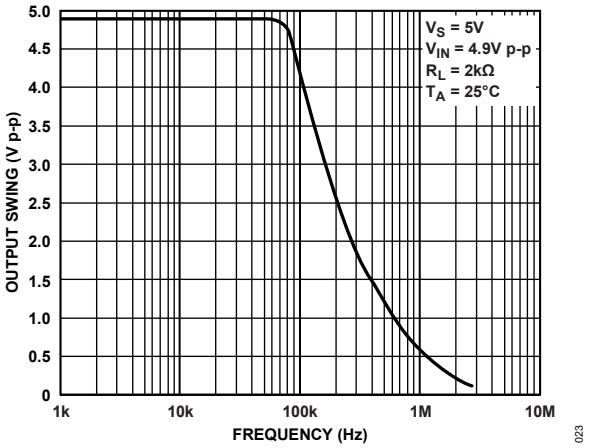

Figure 14. Closed-Loop Output Voltage Swing vs. Frequency

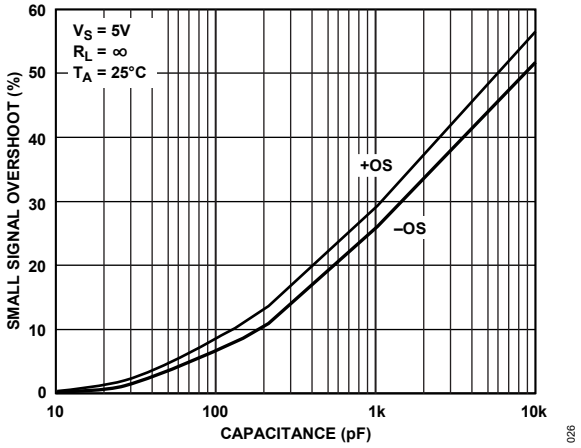

Figure 15. Small Signal Overshoot vs. Load Capacitance

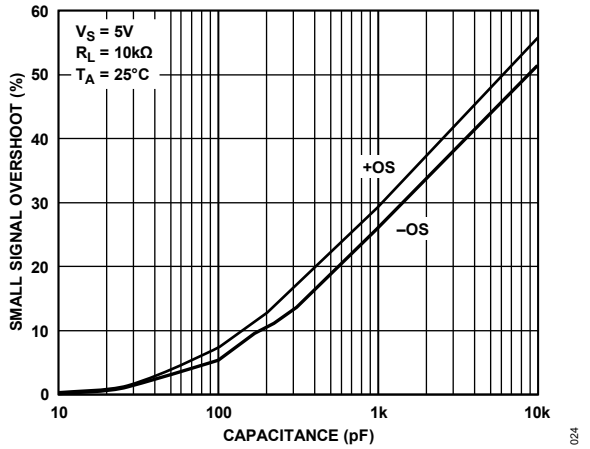

Figure 16. Small Signal Overshoot vs. Load Capacitance

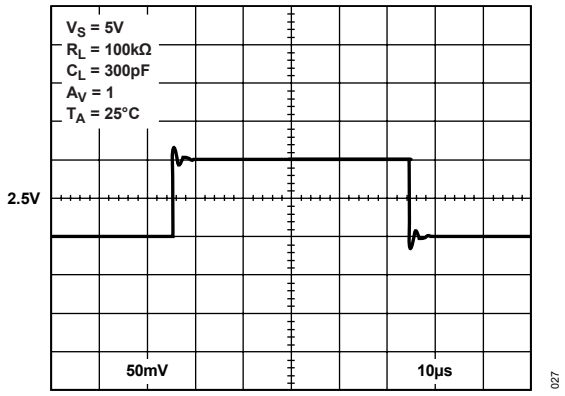

Figure 17. Small Signal Transient Response

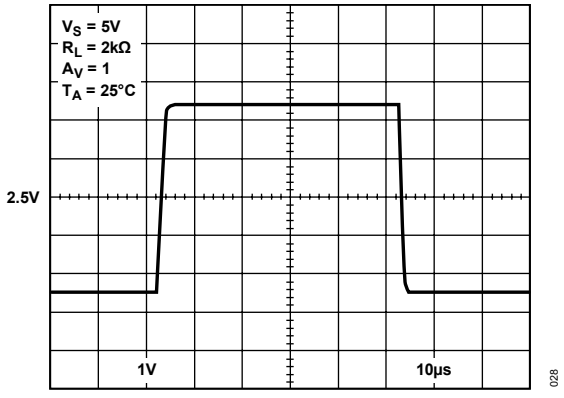

Figure 18. Large Signal Transient Response

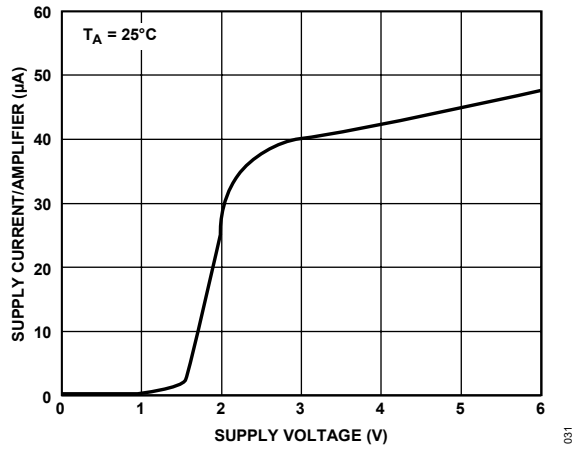

Figure 19. Supply Current per Amplifier vs. Supply Voltage

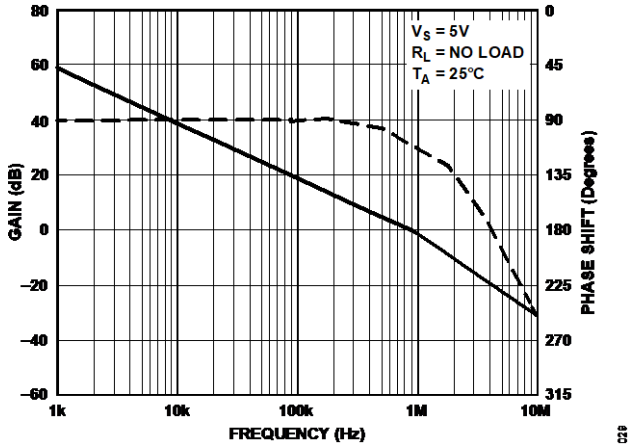

Figure 20. Open-Loop Gain and Phase vs. Frequency

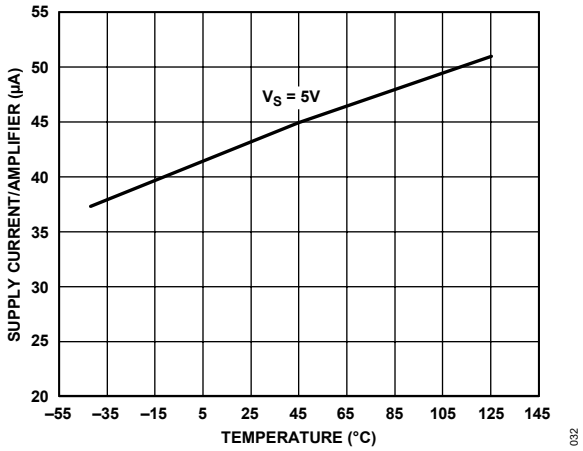

Figure 21. Supply Current per Amplifier vs. Temperature

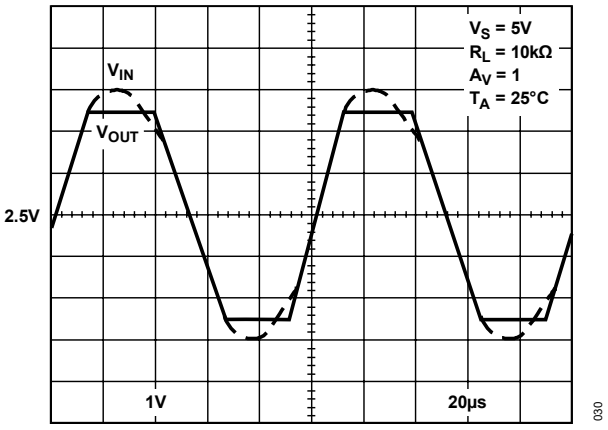

Figure 22. No Phase Reversal

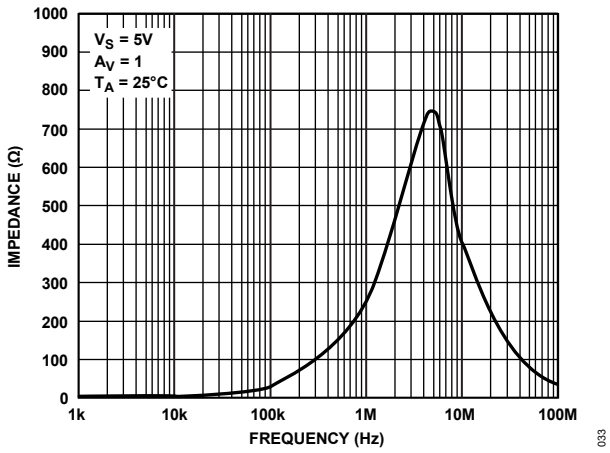

Figure 23. Closed-Loop Output Impedance vs. Frequency

THEORY OF OPERATION

Lower Supply Current for 1MHz Gain Bandwidth

The MAX74822 typically uses 45µA of current per amplifier, which is much less than the 200µA to 700µA used in earlier generation parts with similar performance. This makes the MAX74822 a good choice for upgrading portable designs for longer battery life. Alternatively, additional functions and performance can be added at the same current drain.

Higher Output Current

At 5V single supply, the short-circuit current is typically 60mA. Even 1V from the supply rail, the MAX74822 amplifier can provide a 30mA output current, sourcing, or sinking.

APPLICATIONS INFORMATION

Maximum Power Dissipation

The maximum power the MAX74822 can safely dissipate is limited by the associated rise in junction temperature. For plastic packages, the maximum safe junction temperature is 150°C. If this maximum temperature is exceeded, reduce the die temperature to restore proper circuit operation. Leaving the device in the overheated condition for an extended period of time can result in device burnout. To ensure proper operation, it is important to observe the specifications shown in the *Absolute Maximum Ratings* and *Thermal Resistance* sections.

OUTLINE DIMENSIONS

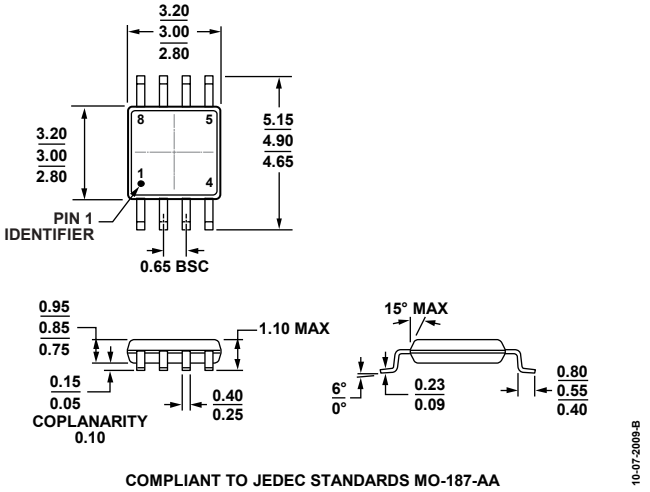

Figure 24.8-Lead Mini Small Outline Package [MSOP] (RM-8) Dimensions shown in millimeters

ORDERING GUIDE

Table 5. Ordering Guide

MODEL[1]	TEMPERATURE RANGE	PACKAGE DESCRIPTION	PACKAGE QUANTITY	PACKAGE OPTION	MARKING CODE
MAX74822ARMZ	−40°C to +125°C	8-Lead MSOP		RM-8	A6Y
MAX74822ARMZ-R7	−40°C to +125°C	8-Lead MSOP		RM-8	A6Y
MAX74822ARMZ-RL	−40°C to +125°C	8-Lead MSOP	Reel, 3000	RM-8	A6Y

[1] Z = RoHS Compliant Part.

REVISION HISTORY

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	10/25	Initial release	—