Data Sheet

MAX74825

5V, Low Power, CMOS, Rail-to-Rail Input/Output, Operational Amplifier

FEATURES

- Single-supply operation: 2.7V to 5.5V
- Low supply current: 50µA
- Wide bandwidth: 1MHz
- No phase reversal
- Low input currents: 5pA
- 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 MAX74825 is a rail-to-rail input and output, single-supply amplifier featuring very low supply current and 1MHz bandwidth. The MAX74825 provides 1MHz bandwidth at a low current consumption of 50µA.

Very low input-bias current allows use of the MAX74825 in integrators, photodiode amplifiers, piezoelectric sensors, and other high source impedance applications. The supply current is only 50µA, which is ideal for battery operation.

Rail-to-rail input and output help designers to buffer application-specific integrated circuits (ASICs) in single-supply systems. The MAX74825 maintains high gains at lower supply voltages, which makes it useful for active filters and gain stages.

The MAX74825 operates over the extended industrial temperature range (–40°C to +125°C). The MAX74825 is available in **5-lead [SOT-23] (RJ-5)** package.

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REVISION HISTORY

8/2026—Revision 0: Initial Version

SPECIFICATIONS

Electrical Characteristics

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

Table 1. 5.0V Specifications

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}			1	7	mV
		−40°C ≤ T_A ≤ +125°C		8		mV
Input Bias Current	I_B			5	60	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	40	48		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	86	92		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 ≤ +85°C		100		fA/°C
		−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
		−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
Short-Circuit Current	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	I_{SY}	V_O = 0V		50	70	µA
		−40°C ≤ T_A ≤ +125°C		85		µA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 100kΩ, C_L = 200pF	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

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
Temperature	
Storage Range	−65°C to +150°C
Operating Range	−40°C to +125°C
Junction Range	−65°C to +150°C
Lead (Soldering, 60sec)	300°C

[1] For supplies less than 6V, the differential input voltage is equal to $\pm V_S$.

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 printed circuit board (PCB) design and operating environment. Careful attention to PCB thermal design is required.

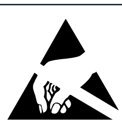
θ_{JA} is the natural convection junction-to-ambient thermal resistance measured in a one cubic foot sealed enclosure.

θ_{JC} is the junction-to-case thermal resistance.

Table 3. Thermal Resistance

PACKAGE TYPE	θ_{JA}	θ_{JC}	UNIT
5-Lead [SOT-23] (RJ-5)	190	92	°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

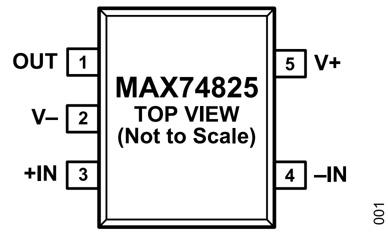


Figure 1. 5-Lead [SOT-23]

Table 4. Pin Function Descriptions

PIN NUMBER	MNEMONIC	DESCRIPTION
1	OUT	Output Channel.
2	V−	Negative Supply Voltage.
3	+IN	Noninverting Input Channel.
4	−IN	Inverting Input Channel.
5	V+	Positive Supply Voltage.

TYPICAL PERFORMANCE CHARACTERISTICS

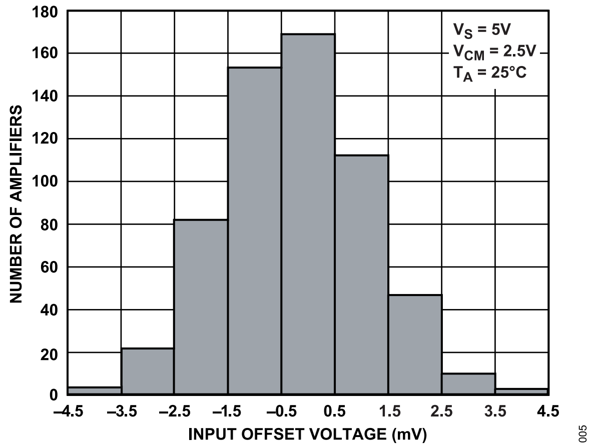


Figure 2. Input Offset Voltage Distribution

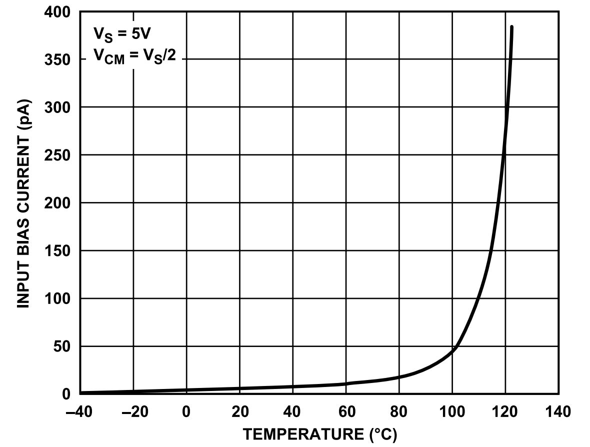


Figure 5. Input Bias Current vs. Temperature

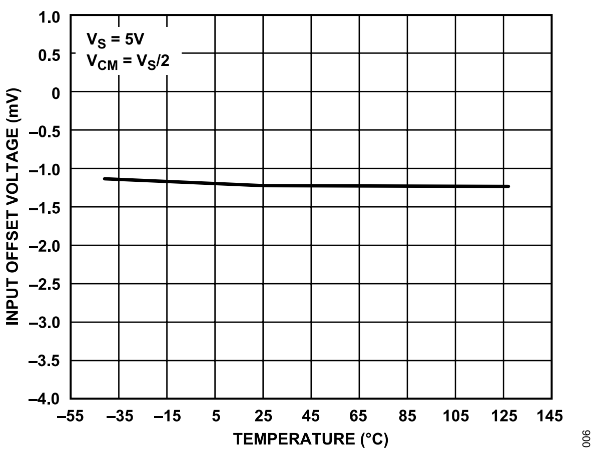


Figure 3. Input Offset Voltage vs. Temperature

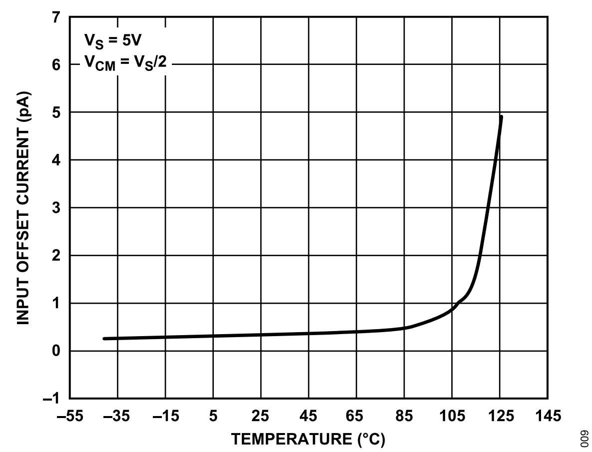


Figure 6. Input Offset Current vs. Temperature

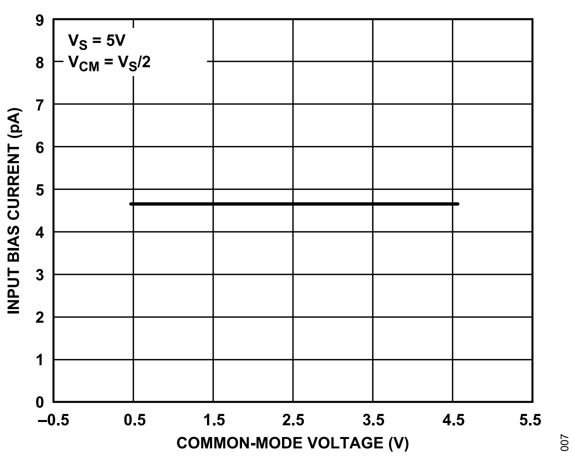


Figure 4. Input Bias Current vs. Common-Mode Voltage

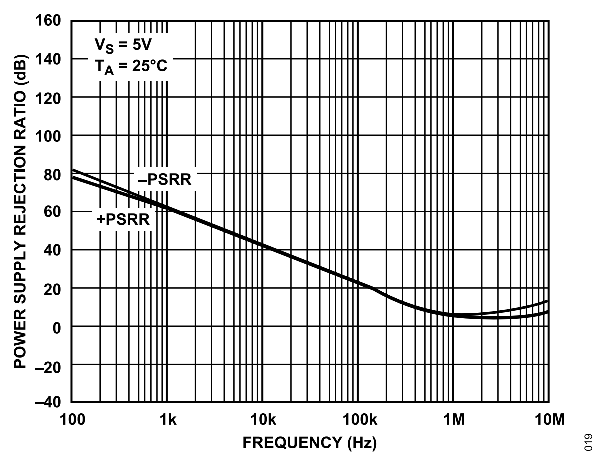


Figure 7. Power-Supply Rejection Ratio vs. Frequency

TYPICAL PERFORMANCE CHARACTERISTICS

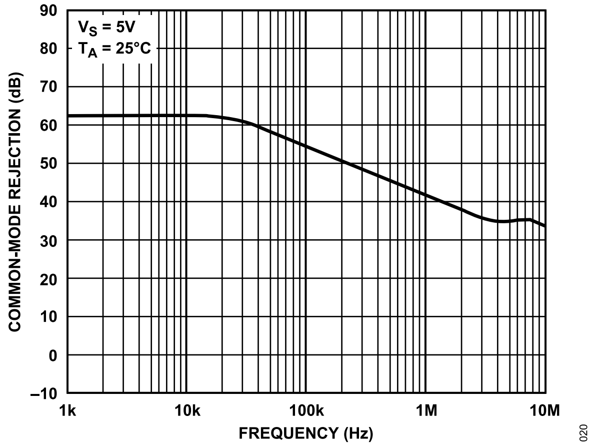


Figure 8. Common-Mode Rejection vs. Frequency

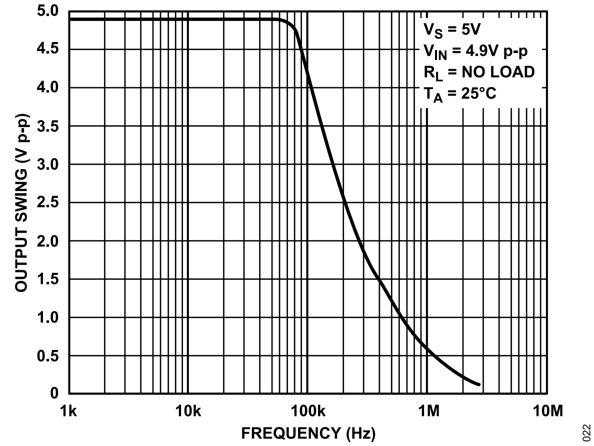


Figure 11. Closed-Loop Output Voltage Swing vs. Frequency

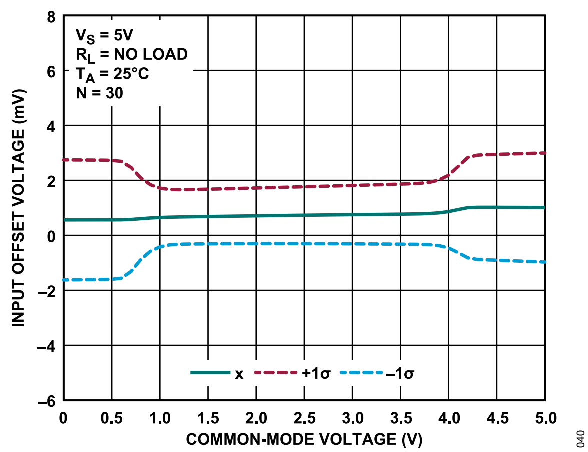


Figure 9. Input Offset Voltage vs. Common-Mode Voltage

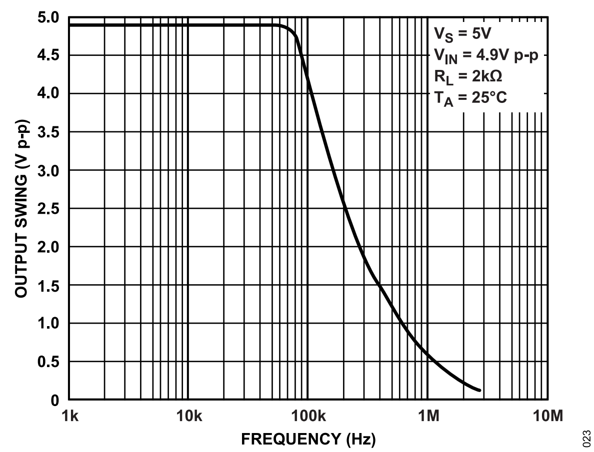


Figure 12. Closed-Loop Output Voltage Swing vs. Frequency

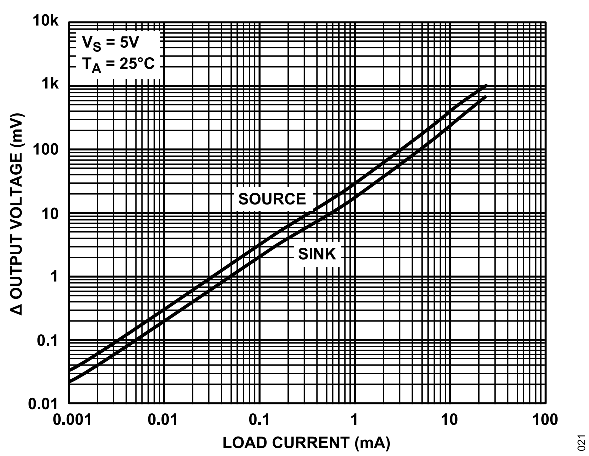


Figure 10. Output Voltage to Supply Rail vs. Load Current

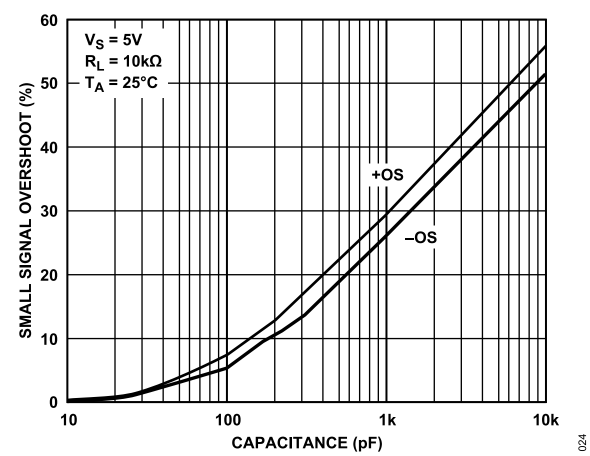


Figure 13. Small Signal Overshoot vs. Load Capacitance

TYPICAL PERFORMANCE CHARACTERISTICS

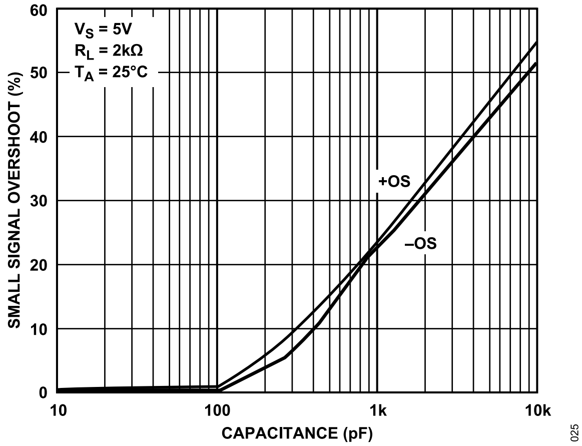


Figure 14. Small Signal Overshoot vs. Load Capacitance

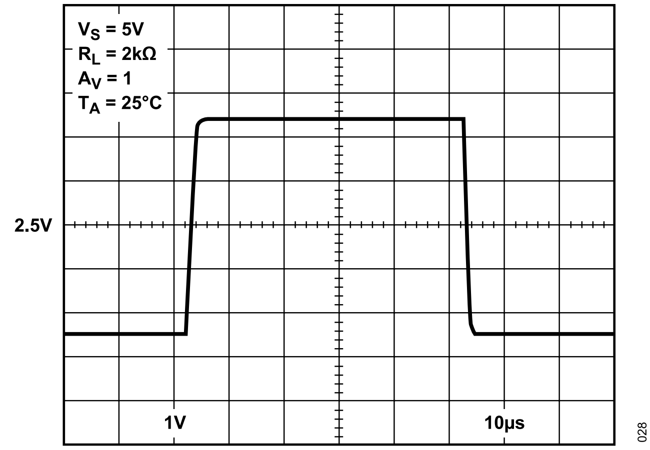


Figure 17. Large Signal Transient Response

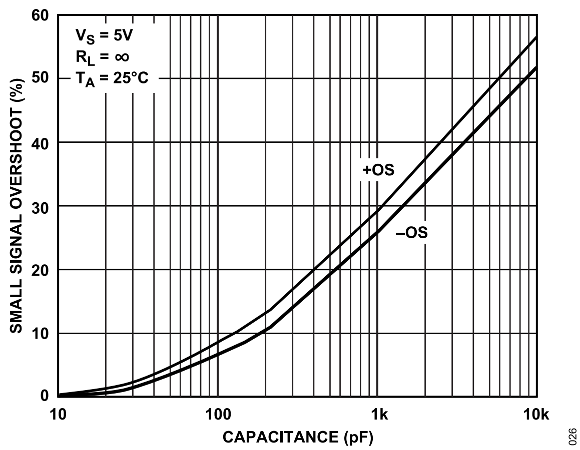


Figure 15. Small Signal Overshoot vs. Load Capacitance

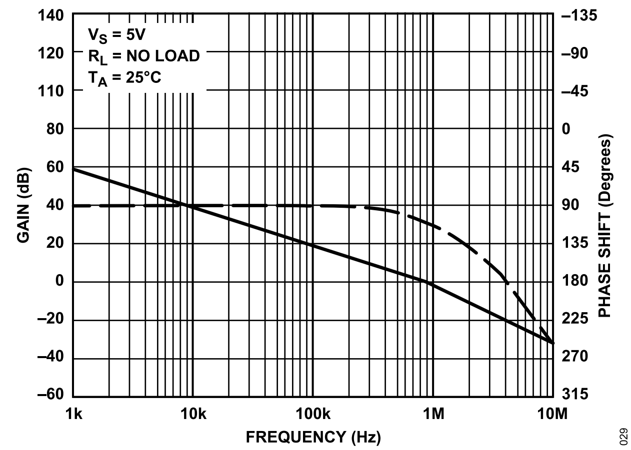


Figure 18. Open-Loop Gain and Phase vs. Frequency

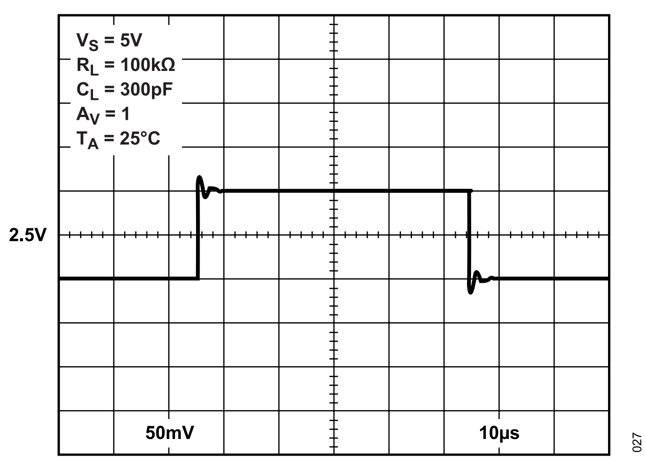


Figure 16. Small Signal Transient Response

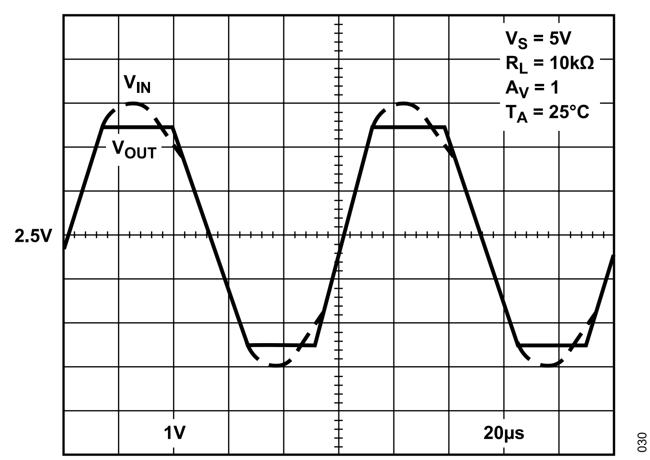


Figure 19. No Phase Reversal

TYPICAL PERFORMANCE CHARACTERISTICS

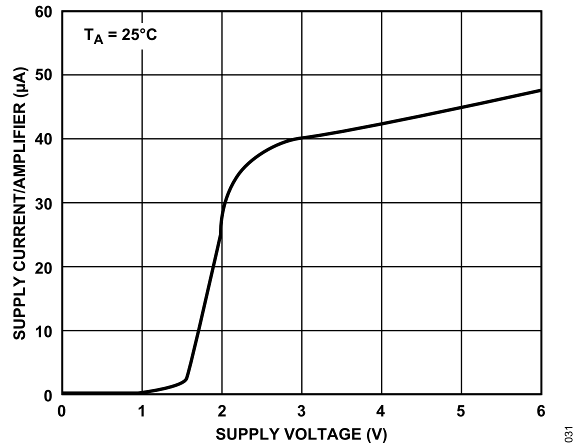


Figure 20. Supply Current vs. Supply Voltage

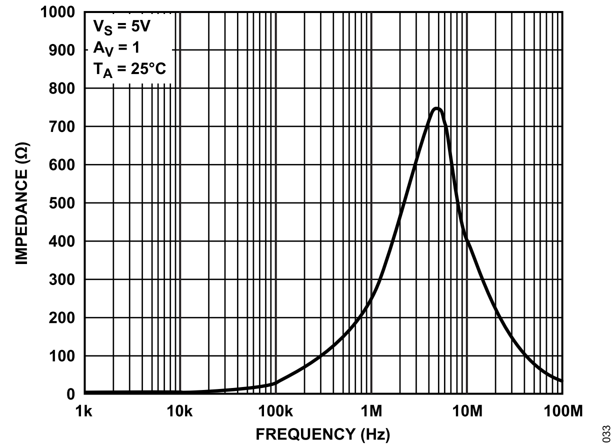


Figure 22. Closed-Loop Output Impedance vs. Frequency

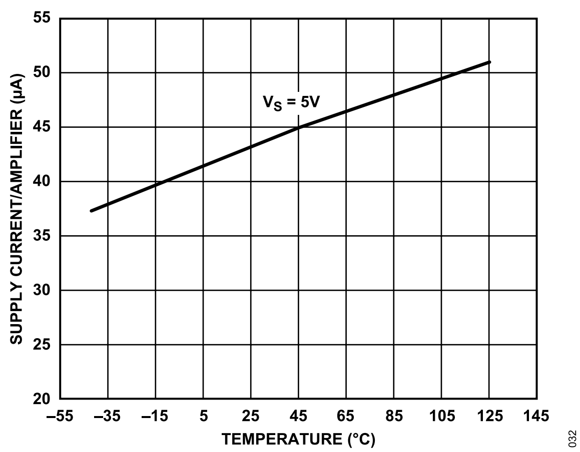


Figure 21. Supply Current vs. Temperature

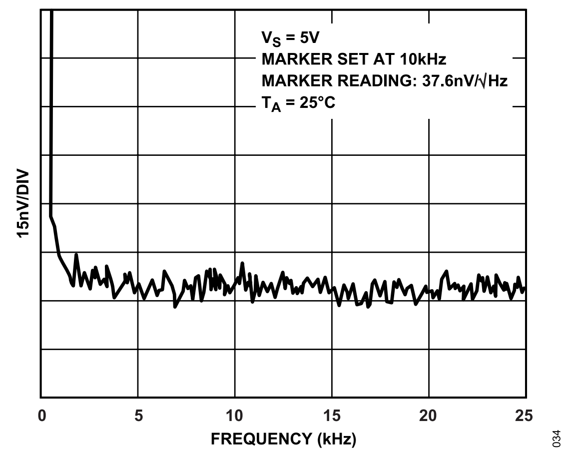


Figure 23. Voltage Noise

THEORY OF OPERATION

Lower Supply Current for 1MHz Gain Bandwidth

The MAX74825 typically uses 50µA of current, which is much less than the 200µA to 700µA that earlier generation parts with similar performance use. This makes the MAX74825 a good choice for upgrading portable designs to achieve longer battery life. Alternatively, designers can add additional functions and improve performance at the same current drain.

Higher Output Current

With a 5V single supply, the MAX74825 typically draws 60µA of short-circuit current. Even at 1V from the supply rail, the MAX74825 can source or sink a 30mA of output current.

APPLICATIONS INFORMATION

Photodiode Application

The MAX74825 has very high impedance with an input bias current typically around 5pA. This characteristic enables the MAX74825 operational amplifier (op amp) to support photodiode applications and other applications that require high input impedance. Note that the MAX74825 exhibits significant voltage offset, which capacitive coupling or software calibration can remove.

Figure 24 shows a photodiode or current measurement application. The design limits the feedback resistor to 10MΩ to avoid excessive output offset. In addition, the MAX74825 does not need a resistor on the noninverting input to cancel bias current offset because the bias current-related output offset is not significant compared to the voltage offset contribution. For best performance, follow the standard high impedance layout techniques listed here:

- Shielding the circuit.
- Cleaning the circuit board.
- Putting a trace connected to the noninverting input around the inverting input.
- Using separate analog and digital power supplies.

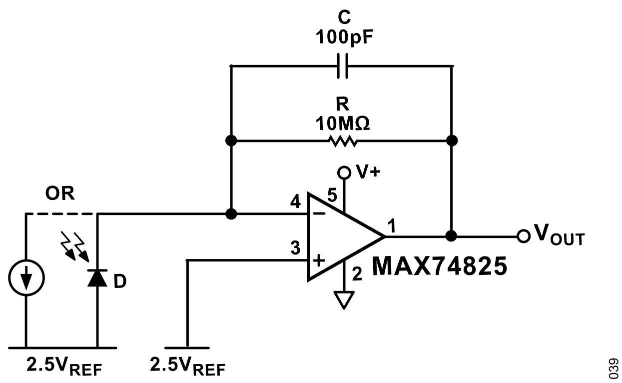


Figure 24. High Input Impedance Application—Photodiode Amplifier

OUTLINE DIMENSIONS

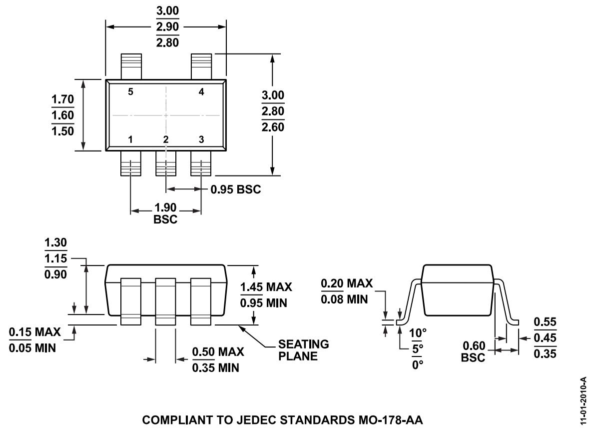


Figure 25. 5-Lead Small Outline Transistor Package [SOT-23] (RJ-5) Dimensions shown in millimeters

Updated: August 06, 2026

Ordering Guide

MODEL[1]	TEMPERATURE RANGE	PACKAGE DESCRIPTION	PACKING QUANTITY	PACKAGE OPTION	MARKING CODE
MAX74825ARTZ-R7	−40°C to +125°C	5-Lead [SOT23]	Reel7, 3000	RJ-5	A7S
MAX74825ARTZ-RL	−40°C to +125°C	5-Lead [SOT-23]	Reel, 10000	RJ-5	A7S

[1] Z = RoHS Compliant Part.