



FEATURES

- Low input offset voltage: 125 μV (maximum)
- Low input offset voltage drift
 - 0.4 $\mu\text{V}/^\circ\text{C}$ (typical)
 - 2.7 $\mu\text{V}/^\circ\text{C}$ (maximum)
- Ultralow supply current: 500 μA per amplifier
- Fully specified at $V_s = 3\text{ V}, 5\text{ V}, \pm 5\text{ V}$
- High speed performance
 - 3 dB bandwidth: 105 MHz
 - Slew rate: 160 $\text{V}/\mu\text{s}$
 - Settling time to 0.1%: 35 ns
- Rail-to-rail outputs
- Input common-mode range: $-V_s - 0.1\text{ V}$ to $+V_s - 1\text{ V}$
- Low noise: 5.9 $\text{nV}/\sqrt{\text{Hz}}$ at 100 kHz; 0.6 $\text{pA}/\sqrt{\text{Hz}}$ at 100 kHz
- Low distortion: -102 dBc/-126 dBc HD2/HD3 at 100 kHz
- Low input bias current: 470 nA (typical)
- Small packaging
 - 8-lead MSOP

ENHANCED PRODUCT FEATURES

- Supports defense and aerospace applications (AQEC standard)
- Extended industrial temperature range (-55°C to $+125^\circ\text{C}$)
- Controlled manufacturing baseline
- 1 assembly/test site
- 1 fabrication site
- Enhanced product change notification
- Qualification data available upon request

APPLICATIONS

- High resolution, high precision analog-to-digital converter (ADC) drivers
- Battery-powered instrumentation
- Micropower active filters
- Portable point of sales terminals
- Active radio frequency identification (RFID) readers
- Photomultipliers
- ADC reference buffers

GENERAL DESCRIPTION

The ADA4805-2-EP is a high speed voltage feedback, rail-to-rail output amplifier with an exceptionally low quiescent current of 500 μA , making it ideal for low power, high resolution data conversion systems. Despite being low power, this amplifier provides excellent overall performance. It offers a high bandwidth of 105 MHz at a gain of +1, a high slew rate of 160 $\text{V}/\mu\text{s}$, and a low input offset voltage of 125 μV (maximum).

TYPICAL APPLICATIONS CIRCUIT

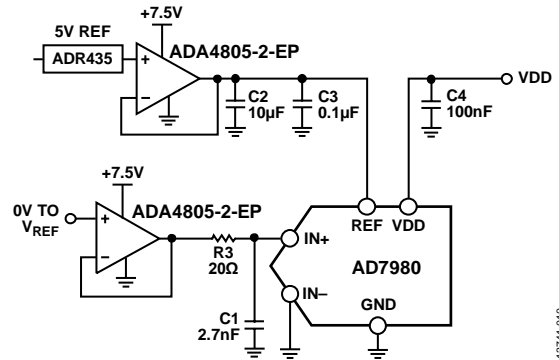


Figure 1. Driving the AD7980 with the ADA4805-2-EP

The Analog Devices, Inc., proprietary extra fast complementary bipolar (XFCB) process allows both low voltage and low current noise (5.9 $\text{nV}/\sqrt{\text{Hz}}$, 0.6 $\text{pA}/\sqrt{\text{Hz}}$). The ADA4805-2-EP operates over a wide range of supply voltages from $\pm 1.5\text{ V}$ to $\pm 5\text{ V}$, as well as single 3 V and 5 V supplies, making it ideal for high speed, low power instruments.

The ADA4805-2-EP is available in an 8-lead MSOP package and is rated to work over the extended industrial temperature range of -55°C to $+125^\circ\text{C}$. Additional application and technical information can be found in the ADA4805-1/ADA4805-2 data sheet.

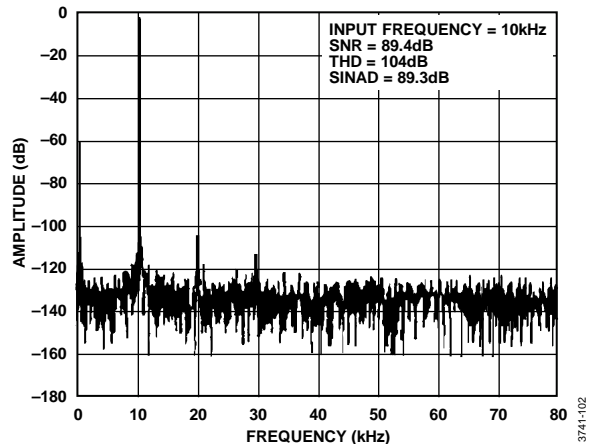


Figure 2. FFT Plot for the Circuit Configuration in Figure 1

Table 1. Complementary ADCs to the ADA4805-2-EP

| Product | ADC Power (mW) | Throughput (MSPS) | Resolution (Bits) | SNR (dB) |
|---------|----------------|-------------------|-------------------|----------|
| AD7982 | 7.0 | 1 | 18 | 98 |
| AD7984 | 10.5 | 1.33 | 18 | 98.5 |
| AD7980 | 4.0 | 1 | 16 | 91 |
| AD7685 | 10 | 0.25 | 16 | 88 |

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REVISION HISTORY

4/16—Revision 0: Initial Version

SPECIFICATIONS

±5 V SUPPLY

$V_S = \pm 5\text{ V}$ at $T_A = 25^\circ\text{C}$; $R_F = 0\ \Omega$ for $G = +1$; otherwise, $R_F = 1\ \text{k}\Omega$; $R_L = 2\ \text{k}\Omega$ to ground; unless otherwise noted. All specifications are per amplifier.

Table 2.

| Parameter | Test Conditions/Comments | Min | Typ | Max | Unit |
|--|---|-------|-----------|-------|------------------------------|
| DYNAMIC PERFORMANCE | | | | | |
| –3 dB Bandwidth | $G = +1, V_{OUT} = 0.02\text{ V p-p}$ | | 120 | | MHz |
| | $G = +1, V_{OUT} = 2\text{ V p-p}$ | | 40 | | MHz |
| Bandwidth for 0.1 dB Flatness | $G = +1, V_{OUT} = 0.02\text{ V p-p}$ | | 18 | | MHz |
| Slew Rate | $G = +1, V_{OUT} = 2\text{ V step}$ | | 190 | | V/ μs |
| | $G = +2, V_{OUT} = 4\text{ V step}$ | | 250 | | V/ μs |
| Settling Time to 0.1% | $G = +1, V_{OUT} = 2\text{ V step}$ | | 35 | | ns |
| | $G = +2, V_{OUT} = 4\text{ V step}$ | | 78 | | ns |
| NOISE/DISTORTION PERFORMANCE | | | | | |
| Harmonic Distortion, HD ₂ /HD ₃ ¹ | $f_C = 20\ \text{kHz}, V_{OUT} = 2\text{ V p-p}$ | | –114/–140 | | dBc |
| | $f_C = 100\ \text{kHz}, V_{OUT} = 2\text{ V p-p}$ | | –102/–128 | | dBc |
| | $f_C = 20\ \text{kHz}, V_{OUT} = 4\text{ V p-p}, G = +1$ | | –109/–143 | | dBc |
| | $f_C = 100\ \text{kHz}, V_{OUT} = 4\text{ V p-p}, G = +1$ | | –93/–130 | | dBc |
| | $f_C = 20\ \text{kHz}, V_{OUT} = 4\text{ V p-p}, G = +2$ | | –113/–142 | | dBc |
| | $f_C = 100\ \text{kHz}, V_{OUT} = 4\text{ V p-p}, G = +2$ | | –96/–130 | | dBc |
| Input Voltage Noise | $f = 100\ \text{kHz}$ | | 5.2 | | nV/ $\sqrt{\text{Hz}}$ |
| Input Voltage Noise 1/f Corner Frequency | | | 8 | | Hz |
| 0.1 Hz to 10 Hz Voltage Noise | | | 44 | | nV rms |
| Input Current Noise | $f = 100\ \text{kHz}$ | | 0.7 | | pA/ $\sqrt{\text{Hz}}$ |
| DC PERFORMANCE | | | | | |
| Input Offset Voltage | | | 13 | 125 | μV |
| Input Offset Voltage Drift ² | T_{MIN} to T_{MAX} | | 0.4 | 2.7 | $\mu\text{V}/^\circ\text{C}$ |
| Input Bias Current | | | 550 | 800 | nA |
| Input Offset Current | | | 2.1 | 25 | nA |
| Open-Loop Gain | $V_{OUT} = -4.0\text{ V to }+4.0\text{ V}$ | 107 | 111 | | dB |
| INPUT CHARACTERISTICS | | | | | |
| Input Resistance | | | | | |
| Common Mode | | | 50 | | M Ω |
| Differential Mode | | | 260 | | k Ω |
| Input Capacitance | | | 1 | | pF |
| Input Common-Mode Voltage Range | | –5.1 | | +4 | V |
| Common-Mode Rejection Ratio | $V_{IN, CM} = -4.0\text{ V to }+4.0\text{ V}$ | 103 | 130 | | dB |
| OUTPUT CHARACTERISTICS | | | | | |
| Output Overdrive Recovery Time (Rising/Falling Edge) | $V_{IN} = +6\text{ V to }-6\text{ V}, G = +2$ | | 95/100 | | ns |
| Output Voltage Swing | $R_L = 2\ \text{k}\Omega$ | –4.98 | | +4.98 | V |
| Short-Circuit Current | Sinking/sourcing | | 85/73 | | mA |
| Linear Output Current | <1% THD at 100 kHz, $V_{OUT} = 2\text{ V p-p}$ | | ± 58 | | mA |
| Capacitive Load Drive | 30% overshoot | | 15 | | pF |
| POWER SUPPLY | | | | | |
| Operating Range | | 2.7 | | 10 | V |
| Quiescent Current per Amplifier | | | 570 | 625 | μA |
| Power Supply Rejection Ratio | | | | | |
| Positive | $+V_S = 3\text{ V to }5\text{ V}, -V_S = -5\text{ V}$ | 100 | 119 | | dB |
| Negative | $+V_S = 5\text{ V}, -V_S = -3\text{ V to }-5\text{ V}$ | 100 | 122 | | dB |

¹ f_C is the fundamental frequency.

² Guaranteed, but not tested.

5 V SUPPLY

$V_S = 5\text{ V}$ at $T_A = 25^\circ\text{C}$; $R_F = 0\ \Omega$ for $G = +1$; otherwise, $R_F = 1\ \text{k}\Omega$; $R_L = 2\ \text{k}\Omega$ to midsupply; unless otherwise noted. All specifications are per amplifier.

Table 3.

| Parameter | Test Conditions/Comments | Min | Typ | Max | Unit |
|---|--|------|-----------|------|------------------------------|
| DYNAMIC PERFORMANCE | | | | | |
| -3 dB Bandwidth | $G = +1, V_{OUT} = 0.02\text{ V p-p}$ | | 105 | | MHz |
| | $G = +1, V_{OUT} = 2\text{ V p-p}$ | | 35 | | MHz |
| Bandwidth for 0.1 dB Flatness | $G = +1, V_{OUT} = 0.02\text{ V p-p}$ | | 20 | | MHz |
| Slew Rate | $G = +1, V_{OUT} = 2\text{ V step}$ | | 160 | | V/ μs |
| | $G = +2, V_{OUT} = 4\text{ V step}$ | | 220 | | V/ μs |
| Settling Time to 0.1% | $G = +1, V_{OUT} = 2\text{ V step}$ | | 35 | | ns |
| | $G = +2, V_{OUT} = 4\text{ V step}$ | | 82 | | ns |
| NOISE/DISTORTION PERFORMANCE | | | | | |
| Harmonic Distortion, HD2/HD3 ¹ | $f_C = 20\ \text{kHz}, V_{OUT} = 2\text{ V p-p}$ | | -114/-135 | | dBc |
| | $f_C = 100\ \text{kHz}, V_{OUT} = 2\text{ V p-p}$ | | -102/-126 | | dBc |
| | $f_C = 20\ \text{kHz}, G = +2, V_{OUT} = 4\text{ V p-p}$ | | -107/-143 | | dBc |
| | $f_C = 100\ \text{kHz}, G = +2, V_{OUT} = 4\text{ V p-p}$ | | -90/-130 | | dBc |
| Input Voltage Noise | $f = 100\ \text{kHz}$ | | 5.9 | | nV/ $\sqrt{\text{Hz}}$ |
| Input Voltage Noise 1/f Corner | | | 8 | | Hz |
| 0.1 Hz to 10 Hz Voltage Noise | | | 54 | | nV rms |
| Input Current Noise | $f = 100\ \text{kHz}$ | | 0.6 | | pA/ $\sqrt{\text{Hz}}$ |
| DC PERFORMANCE | | | | | |
| Input Offset Voltage | | | 9 | 125 | μV |
| Input Offset Voltage Drift ² | T_{MIN} to T_{MAX} | | 0.4 | 2.7 | $\mu\text{V}/^\circ\text{C}$ |
| Input Bias Current | | | 470 | 720 | nA |
| Input Offset Current | | | 0.4 | | nA |
| Open-Loop Gain | $V_{OUT} = 1.25\text{ V to }3.75\text{ V}$ | 105 | 109 | | dB |
| INPUT CHARACTERISTICS | | | | | |
| Input Resistance | | | 50 | | M Ω |
| Common Mode | | | 260 | | k Ω |
| Differential Mode | | | 1 | | pF |
| Input Capacitance | | | | | |
| Input Common-Mode Voltage Range | | -0.1 | | +4 | V |
| Common-Mode Rejection Ratio | $V_{IN, CM} = 1.25\text{ V to }3.75\text{ V}$ | 103 | 133 | | dB |
| OUTPUT CHARACTERISTICS | | | | | |
| Overdrive Recovery Time (Rising/Falling Edge) | $V_{IN} = -1\text{ V to }+6\text{ V}, G = +2$ | | 130/145 | | ns |
| Output Voltage Swing | $R_L = 2\ \text{k}\Omega$ | 0.02 | | 4.98 | V |
| Short-Circuit Current | Sinking/sourcing | | 73/63 | | mA |
| Linear Output Current | <1% THD at 100 kHz, $V_{OUT} = 2\text{ V p-p}$ | | ± 47 | | mA |
| Capacitive Load Drive | 30% overshoot | | 15 | | pF |
| POWER SUPPLY | | | | | |
| Operating Range | | 2.7 | | 10 | V |
| Quiescent Current per Amplifier | | | 500 | 520 | μA |
| Power Supply Rejection Ratio | | | | | |
| Positive | $+V_S = 1.5\text{ V to }3.5\text{ V}, -V_S = -2.5\text{ V}$ | 100 | 120 | | dB |
| Negative | $+V_S = 2.5\text{ V}, -V_S = -1.5\text{ V to }-3.5\text{ V}$ | 100 | 126 | | dB |

¹ f_C is the fundamental frequency.

² Guaranteed, but not tested.

3 V SUPPLY

$V_S = 3\text{ V}$ at $T_A = 25^\circ\text{C}$; $R_F = 0\ \Omega$ for $G = +1$; otherwise, $R_F = 1\ \text{k}\Omega$; $R_L = 2\ \text{k}\Omega$ to midsupply; unless otherwise noted. All specifications are per amplifier.

Table 4.

| Parameter | Test Conditions/Comments | Min | Typ | Max | Unit |
|--|---|------|-----------|------|------------------------------|
| DYNAMIC PERFORMANCE | | | | | |
| -3 dB Bandwidth | $G = +1, V_{OUT} = 0.02\text{ V p-p}$ | | 95 | | MHz |
| | $G = +1, V_{OUT} = 1\text{ V p-p}, +V_S = 2\text{ V}, -V_S = -1\text{ V}$ | | 30 | | MHz |
| Bandwidth for 0.1 dB Flatness | $G = +1, V_{OUT} = 0.02\text{ V p-p}$ | | 35 | | MHz |
| Slew Rate | $G = +1, V_{OUT} = 1\text{ V step}, +V_S = 2\text{ V}, -V_S = -1\text{ V}$ | | 85 | | V/ μs |
| Settling Time to 0.1% | $G = +1, V_{OUT} = 1\text{ V step}$ | | 41 | | ns |
| NOISE/DISTORTION PERFORMANCE | | | | | |
| Harmonic Distortion, HD2/HD3 ¹ | $f_c = 20\text{ kHz}, V_{OUT} = 1\text{ V p-p}, +V_S = 2\text{ V}, -V_S = -1\text{ V}$ | | -123/-143 | | dBc |
| | $f_c = 100\text{ kHz}, V_{OUT} = 1\text{ V p-p}, +V_S = 2\text{ V}, -V_S = -1\text{ V}$ | | -107/-133 | | dBc |
| Input Voltage Noise | $f = 100\text{ kHz}$ | | 6.3 | | nV/ $\sqrt{\text{Hz}}$ |
| Input Voltage Noise 1/f Corner | | | 8 | | Hz |
| 0.1 Hz to 10 Hz Voltage Noise | | | 55 | | nV rms |
| Input Current Noise | $f = 100\text{ kHz}$ | | 0.8 | | pA/ $\sqrt{\text{Hz}}$ |
| DC PERFORMANCE | | | | | |
| Input Offset Voltage | | | 7 | 125 | μV |
| Input Offset Voltage Drift ² | T_{MIN} to T_{MAX} | | 0.4 | 2.7 | $\mu\text{V}/^\circ\text{C}$ |
| Input Bias Current | | | 440 | 690 | nA |
| Input Offset Current | | | 0.5 | | nA |
| Open-Loop Gain | $V_{OUT} = 1.1\text{ V to }1.9\text{ V}$ | 100 | 107 | | dB |
| INPUT CHARACTERISTICS | | | | | |
| Input Resistance | | | 50 | | M Ω |
| Common Mode | | | 260 | | k Ω |
| Differential Mode | | | 1 | | pF |
| Input Capacitance | | | | | |
| Input Common-Mode Voltage Range | | -0.1 | | +2 | V |
| Common-Mode Rejection Ratio | $V_{IN,CM} = 0.5\text{ V to }2\text{ V}$ | 89 | 117 | | dB |
| OUTPUT CHARACTERISTICS | | | | | |
| Output Overdrive Recovery Time (Rising/Falling Edge) | $V_{IN} = -1\text{ V to }+4\text{ V}, G = +2$ | | 135/175 | | ns |
| Output Voltage Swing | $R_L = 2\ \text{k}\Omega$ | 0.02 | | 2.98 | V |
| Short-Circuit Current | Sinking/sourcing | | 65/47 | | mA |
| Linear Output Current | <1% THD at 100 kHz, $V_{OUT} = 1\text{ V p-p}$ | | ± 40 | | mA |
| Capacitive Load Drive | 30% overshoot | | 15 | | pF |
| POWER SUPPLY | | | | | |
| Operating Range | | 2.7 | | 10 | V |
| Quiescent Current per Amplifier | | | 470 | 495 | μA |
| Power Supply Rejection Ratio | | | | | |
| Positive | $+V_S = 1.5\text{ V to }3.5\text{ V}, -V_S = -1.5\text{ V}$ | 96 | 119 | | dB |
| Negative | $+V_S = 1.5\text{ V}, -V_S = -1.5\text{ V to }-3.5\text{ V}$ | 96 | 125 | | dB |

¹ f_c is the fundamental frequency.

² Guaranteed, but not tested.

ABSOLUTE MAXIMUM RATINGS

Table 5.

| Parameter | Rating |
|--------------------------------------|--|
| Supply Voltage | 11 V |
| Power Dissipation | See Figure 3 |
| Common-Mode Input Voltage | $-V_S - 0.7\text{ V}$ to $+V_S + 0.7\text{ V}$ |
| Differential Input Voltage | $\pm 1\text{ V}$ |
| Storage Temperature Range | -65°C to $+125^\circ\text{C}$ |
| Operating Temperature Range | -55°C to $+125^\circ\text{C}$ |
| Lead Temperature (Soldering, 10 sec) | 300°C |
| Junction Temperature | 150°C |

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

θ_{JA} is specified for the worst case conditions, that is, θ_{JA} is specified for a device soldered in a circuit board for surface-mount packages. Table 6 lists the θ_{JA} for the ADA4805-2-EP.

Table 6. Thermal Resistance

| Package Type | θ_{JA} | Unit |
|--------------|---------------|---------------------------|
| 8-Lead MSOP | 123.8 | $^\circ\text{C}/\text{W}$ |

MAXIMUM POWER DISSIPATION

The maximum safe power dissipation for the ADA4805-2-EP is limited by the associated rise in junction temperature (T_J) on the die. At approximately 150°C , which is the glass transition temperature, the properties of the plastic change. Even temporarily exceeding this temperature limit may change the stresses that the package exerts on the die, permanently shifting the parametric performance of the ADA4805-2-EP. Exceeding a junction temperature of 175°C for an extended period of time can result in changes in silicon devices, potentially causing degradation or loss of functionality.

The power dissipated in the package (P_D) is the sum of the quiescent power dissipation and the power dissipated in the die due to the ADA4805-2-EP output load drive.

The quiescent power dissipation is the voltage between the supply pins (V_S) multiplied by the quiescent current (I_S).

$$P_D = \text{Quiescent Power} + (\text{Total Drive Power} - \text{Load Power})$$

$$P_D = (V_S \times I_S) + \left(\frac{V_S}{2} \times \frac{V_{OUT}}{R_L} \right) - \frac{V_{OUT}^2}{R_L}$$

RMS output voltages must be considered. If R_L is referenced to $-V_S$, as in single-supply operation, the total drive power is $V_S \times I_{OUT}$. If the rms signal levels are indeterminate, consider the worst case, when $V_{OUT} = V_S/4$ for R_L to midsupply.

$$P_D = (V_S \times I_S) + \frac{(V_S/4)^2}{R_L}$$

In single-supply operation with R_L referenced to $-V_S$, worst case is $V_{OUT} = V_S/2$.

Airflow increases heat dissipation, effectively reducing θ_{JA} . Also, more metal directly in contact with the package leads and exposed pad from metal traces, through holes, ground, and power planes reduces θ_{JA} .

Figure 3 shows the maximum safe power dissipation in the package vs. the ambient temperature on a JEDEC standard, 4-layer board. θ_{JA} values are approximations.

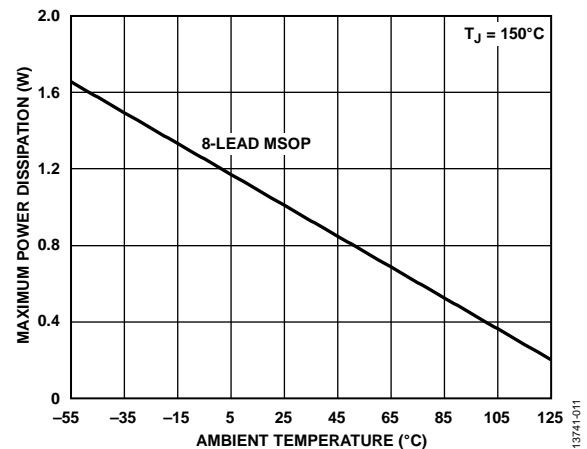


Figure 3. Maximum Power Dissipation vs. Temperature for a 4-Layer Board

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

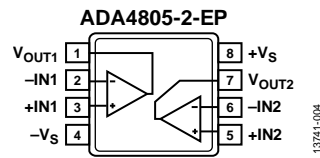


Figure 4. 8-Lead MSOP Pin Configuration

Table 7. Pin Function Descriptions

| Pin No. | Mnemonic | Description |
|---------|------------|-----------------------|
| 1 | V_{OUT1} | Output 1. |
| 2 | $-IN1$ | Inverting Input 1. |
| 3 | $+IN1$ | Noninverting Input 1. |
| 4 | $-V_S$ | Negative Supply. |
| 5 | $+IN2$ | Noninverting Input 2. |
| 6 | $-IN2$ | Inverting Input 2. |
| 7 | V_{OUT2} | Output 2. |
| 8 | $+V_S$ | Positive Supply. |

TYPICAL PERFORMANCE CHARACTERISTICS

$R_L = 2\text{ k}\Omega$, unless otherwise noted. When $G = +1$, $R_F = 0\ \Omega$.

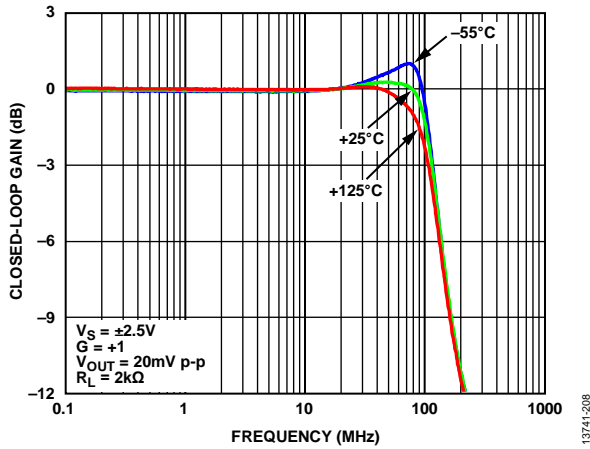


Figure 5. Small Signal Frequency Response for Various Temperatures

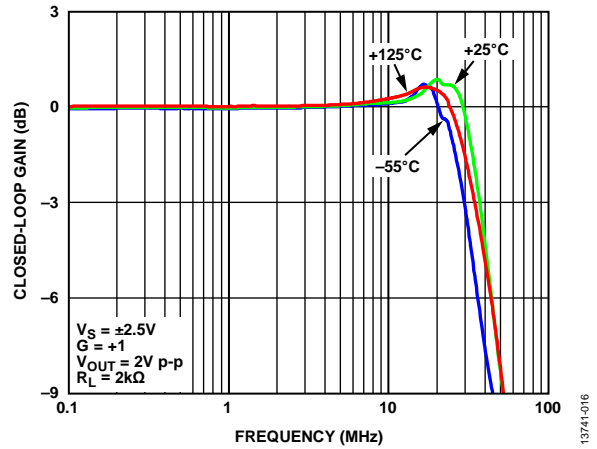


Figure 8. Large Signal Frequency Response for Various Temperatures

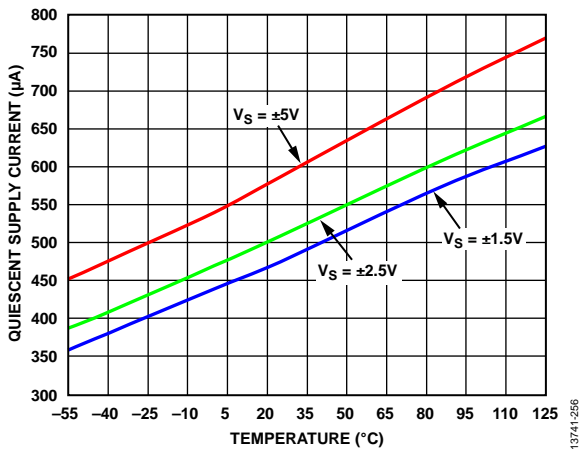


Figure 6. Quiescent Supply Current vs. Temperature for Various Supplies

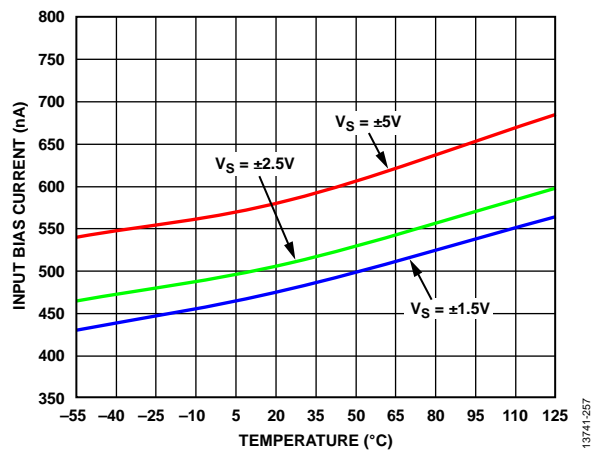


Figure 9. Input Bias Current vs. Temperature for Various Supplies

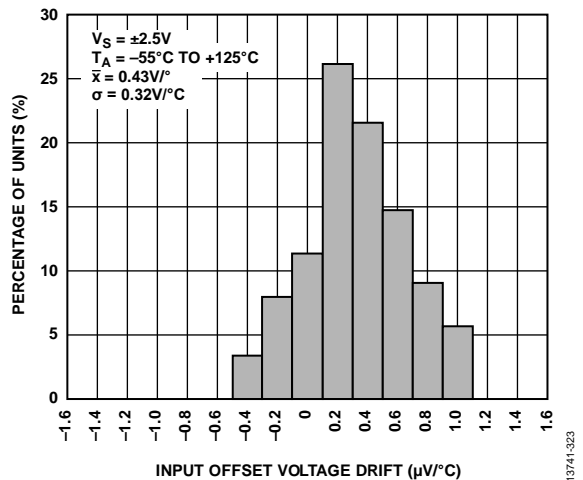


Figure 7. Input Offset Voltage Drift Distribution

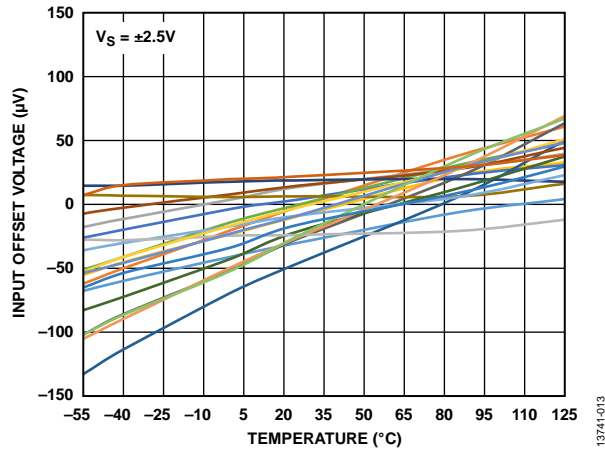
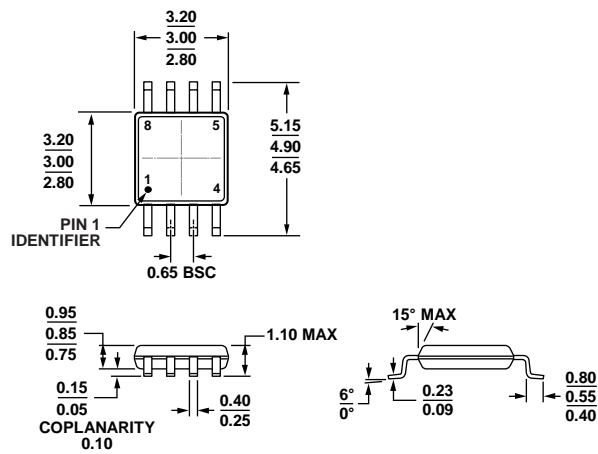


Figure 10. Input Offset Voltage vs. Temperature

OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-187-AA

Figure 11. 8-Lead Mini Small Outline Package [MSOP] (RM-8)

Dimensions shown in millimeters

10-07-2009-B

ORDERING GUIDE

| Model ¹ | Temperature Range | Package Description | Package Option | Branding |
|--------------------|-------------------|--|----------------|----------|
| ADA4805-2TRMZ-EP | -55°C to +125°C | 8-Lead Mini Small Outline Package [MSOP] | RM-8 | Y5W |
| ADA4805-2TRMZ-EPR7 | -55°C to +125°C | 8-Lead Mini Small Outline Package [MSOP] | RM-8 | Y5W |

¹ Z = RoHS Compliant Part.



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

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- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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