



## Low-Noise, High-Precision, JFET-Input, OPERATIONAL AMPLIFIER

### FEATURES

- **OFFSET:** 250 $\mu$ V (max)
- **DRIFT:** 1 $\mu$ V/ $^{\circ}$ C
- **LOW NOISE:** 4.5nV/ $\sqrt{\text{Hz}}$  at 1kHz
- **BANDWIDTH:** 18MHz
- **SLEW RATE:** 22V/ $\mu$ s
- **BIAS CURRENT:** 3pA
- **QUIESCENT CURRENT:** 4.5mA/Ch
- **WIDE SUPPLY RANGE:**  $\pm$ 4V to  $\pm$ 18V
- **SINGLE PACKAGES:** MSOP-8, SO-8
- **DUAL PACKAGES:** SO-8 PowerPAD

### APPLICATIONS

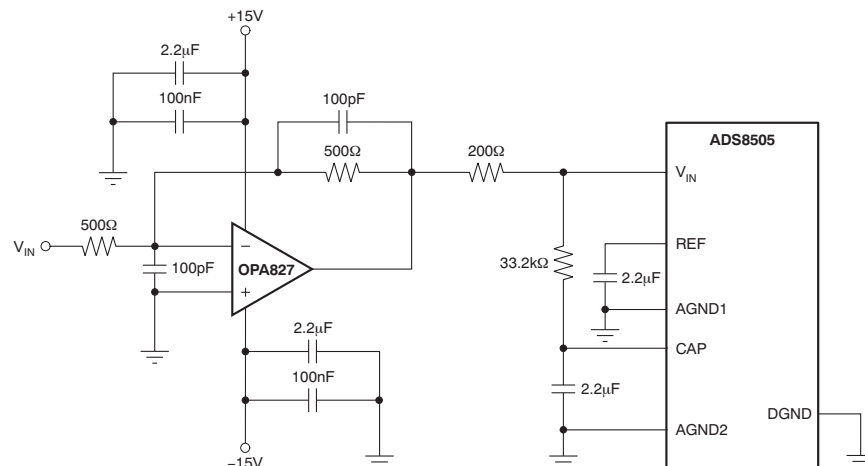
- **PRECISION  $\pm$ 10V INPUT FRONT-ENDS**
- **TRANSIMPEDANCE AMPLIFIERS**
- **INTEGRATORS**
- **ACTIVE FILTERS**
- **A/D CONVERTER DRIVERS**
- **DAC OUTPUT BUFFERS**
- **HIGH-PERFORMANCE AUDIO**
- **PROCESS CONTROL**
- **TEST EQUIPMENT**
- **MEDICAL EQUIPMENT**

### DESCRIPTION

The OPA827 series of JFET operational amplifiers combines outstanding dc precision with excellent ac performance. It offers 100 $\mu$ V of offset, very low drift (1 $\mu$ V/ $^{\circ}$ C) over temperature, low bias currents, and very low flicker noise of 400nV<sub>PP</sub> (0.1Hz to 10Hz). It operates over a very wide supply voltage range of  $\pm$ 4V to  $\pm$ 18V on a low 4.5mA supply current. A dual version is also available for the OPA827 family.

Excellent ac characteristics, such as 18MHz gain bandwidth (GBW) and 22V/ $\mu$ s slew rate, and precision dc characteristics make the OPA827 series well-suited for a wide range of applications such as 16- to 18-bit data acquisition systems, transimpedance (I/V-conversion) amplifiers, filters, precision  $\pm$ 10V front ends, and professional audio applications.

The single version (OPA827) is available in both MSOP-8 and standard SO-8 surface-mount packages. The dual version (OPA2827) is available in the SO-8 PowerPAD for increased power dissipation capability. All versions are specified from  $-40^{\circ}$ C to  $+125^{\circ}$ C.



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This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### PACKAGE/ORDERING INFORMATION<sup>(1)</sup>

PRODUCT	PACKAGE-LEAD	PACKAGE DESIGNATOR	PACKAGE MARKING
<b>Standard Grade</b>			
OPA827A	SO-8	D	OPA827A
	MSOP-8	DGK	TBD
OPA2827A	SO-8 PowerPAD	DDA	TBD
<b>High Grade</b>			
OPA827I	SO-8	D	OPA827
	MSOP-8	DGK	TBD
OPA2827I	SO-8 PowerPAD	DDA	TBD

(1) For the most current package and ordering information see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).

### ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

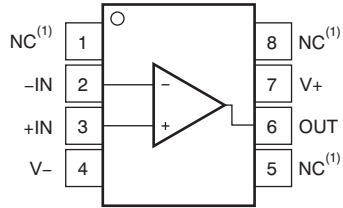
Over operating free-air temperature range (unless otherwise noted)

	VALUE	UNIT
Supply Voltage	±20	V
Signal Input Terminals		
Voltage <sup>(2)</sup>	(V <sub>-</sub> ) -0.7 to (V <sub>+</sub> ) +0.7	V
Current <sup>(2)</sup>	±10	mA
Differential Input Voltage	TBD	V
Output Short-Circuit <sup>(3)</sup>	Continuous	
Operating Temperature	-55 to +125	°C
Storage Temperature	-65 to +150	°C
Junction Temperature	+150	°C

- (1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not supported.
- (2) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.7V beyond the supply rails should be current-limited to 10mA or less.
- (3) Short-circuit to ground, one amplifier per package.

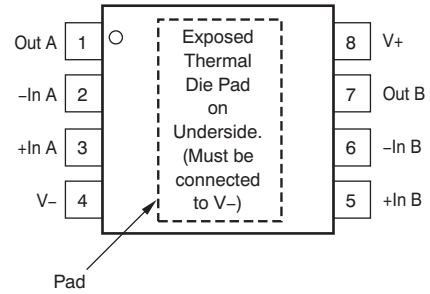
**PIN ASSIGNMENTS**

**OPA827**  
**SO-8, MSOP-8**  
**(TOP VIEW)**



(1) NC denotes no internal connection.

**OPA2827**  
**SO-8 PowerPAD**  
**(TOP VIEW)**



**PRODUCT PREVIEW**

**ELECTRICAL CHARACTERISTICS:  $V_S = \pm 4V$  to  $\pm 18V$**

**BOLDFACE** limits apply over the specified temperature range,  $T_A = -40^\circ C$  to  $+125^\circ C$ .

At  $T_A = +25^\circ C$ ,  $R_L = 10k\Omega$  connected to  $V_S/2$ , and  $V_{OUT} = V_S/2$ , unless otherwise noted.

PARAMETER	CONDITIONS	Standard Grade OPA827A, OPA2827A			High Grade OPA8271, OPA28271 <sup>(1)</sup>			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
<b>OFFSET VOLTAGE</b>								
Input Offset Voltage	$V_{OS}$ $V_{CM} = 0V, V_S = \pm 15V$		TBD	250		TBD	TBD	$\mu V$
Drift vs Time	$dV_{OS}/dT$		1	3.5		TBD	TBD	$\mu V/^\circ C$
vs Power Supply	PSRR		$\pm 0.2$			$\pm 0.2$		$\mu V/month$
Over Temperature	$V_S = \pm 4V$ to $\pm 18V, V_{CM} = 0V$ $V_S = \pm 4V$ to $\pm 18V, V_{CM} = 0V$		TBD	10		TBD	TBD	$\mu V/V$
Channel Separation, dc			TBD	30		TBD	TBD	$\mu V/V$
<b>INPUT BIAS CURRENT</b>								
Input Bias Current	$I_B$		$\pm 3$	TBD		$\pm 3$	TBD	$\mu A$
Over Temperature			TBD	TBD		TBD	TBD	$\mu A$
Input Offset Current	$I_{OS}$		$\pm 3$	TBD		$\pm 3$	TBD	$\mu A$
<b>NOISE</b>								
Input Voltage Noise:								
f = 0.1Hz to 10Hz	$e_n$	$V_S = \pm 18V, V_{CM} = 0V$		0.4		0.4		$\mu V_{PP}$
Input Voltage Noise Density:								
f = 1kHz	$e_n$	$V_S = \pm 18V, V_{CM} = 0V$		4.5		4.5		$nV/\sqrt{Hz}$
f = 10kHz	$e_n$	$V_S = \pm 18V, V_{CM} = 0V$		4.5		4.5		$nV/\sqrt{Hz}$
Input Current Noise Density:								
f = 1kHz	$i_n$	$V_S = \pm 18V, V_{CM} = 0V$		TBD		TBD		$fA/\sqrt{Hz}$
<b>INPUT VOLTAGE RANGE</b>								
Common-Mode Voltage Range	$V_{CM}$		(V-) +2.5		(V+) -2.5	(V-) +2.5		(V+) -2.5
Common-Mode Rejection Ratio	CMRR	$(V-) +2.5V < V_{CM} < (V+) -2.5V$	108			TBD		dB
Over Temperature			TBD			TBD		dB
<b>INPUT IMPEDANCE</b>								
Differential				$10^{13} \parallel TBD$		$10^{13} \parallel TBD$		$\Omega \parallel pF$
Common-Mode				$10^{13} \parallel 7$		$10^{13} \parallel 7$		$\Omega \parallel pF$
<b>OPEN-LOOP GAIN</b>								
Open-Loop Voltage Gain	$A_{OL}$	$R_L = 2k\Omega,$ $(V-) +2.75V < V_O < (V+) -2.1V$	114	120		TBD	TBD	dB
Over Temperature		$R_L = 2k\Omega,$ $(V-) +2.75V < V_O < (V+) -2.1V$	108	TBD		TBD	TBD	dB
<b>FREQUENCY RESPONSE</b>								
Gain-Bandwidth Product	GBW	$C_L = 100pF$		18		18		MHz
Slew Rate	SR	$G = +1$		22		22		V/ $\mu s$
Settling Time, 0.1%	$t_s$	4V Step, $G = +1$		TBD		TBD		ns
0.01% (16-bit)		4V Step, $G = +1$		TBD		TBD		ns
Overload Recovery Time		$V_{IN} \cdot Gain > V_S$		TBD		TBD		$\mu s$
Total Harmonic Distortion + Noise	THD+N	$G = +1, f = 1kHz$		TBD		TBD		%

(1) Shaded cells indicate different specifications from low-grade version of device.

PRODUCT PREVIEW

**ELECTRICAL CHARACTERISTICS:  $V_S = \pm 4V$  to  $\pm 18V$  (continued)**

**BOLDFACE** limits apply over the specified temperature range,  $T_A = -40^\circ\text{C}$  to  $+125^\circ\text{C}$ .  
 At  $T_A = +25^\circ\text{C}$ ,  $R_L = 10\text{k}\Omega$  connected to  $V_S/2$ , and  $V_{OUT} = V_S/2$ , unless otherwise noted.

PARAMETER	CONDITIONS	Standard Grade OPA827A, OPA2827A			High Grade OPA8271, OPA28271 <sup>(1)</sup>			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
<b>OUTPUT</b>								
Voltage Output Swing from Rail	$R_L = 2\text{k}\Omega$ , $A_{OL} > 114\text{dB}$	(V-) +2.75		(V+) -2.1	(V-) +2.75		(V+) -2.1	V
<b>Over Temperature</b>	<b><math>R_L = 2\text{k}\Omega</math>, <math>A_{OL} &gt; 108\text{dB}</math></b>	<b>(V-) +2.75</b>		<b>(V+) -2.1</b>	<b>(V-) +2.75</b>		<b>(V+) -2.1</b>	<b>V</b>
Output Current $I_{OUT}$	$ V_S - V_{OUT}  < 1.5V$		30			30		mA
Short-Circuit Current $I_{SC}$			$\pm 40$			$\pm 40$		mA
Capacitive Load Drive $C_{LOAD}$			TBD			TBD		pF
<b>POWER SUPPLY</b>								
Specified Voltage $V_S$		$\pm 4$		$\pm 18$	$\pm 4$		$\pm 18$	V
Quiescent Current (per amplifier) $I_Q$	$I_{OUT} = 0V$		4.5	TBD		4.5	TBD	mA
<b>Over Temperature</b>				<b>TBD</b>			<b>TBD</b>	<b>mA</b>
<b>TEMPERATURE RANGE</b>								
Specified Range		-40		+125	-40		+125	$^\circ\text{C}$
Operating Range		-55		+125	-55		+125	$^\circ\text{C}$
Thermal Resistance $\Theta_{JA}$								
SO-8, MSOP-8			150			150		$^\circ\text{C/W}$
SO-8 PowerPAD			TBD			TBD		$^\circ\text{C/W}$

(1) **Shaded cells** indicate different specifications from low-grade version of device.

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
OPA827AID	PREVIEW	SOIC	D	8	75	TBD	Call TI	Call TI
POPA827AID	PREVIEW	SOIC	D	8	1500	TBD	Call TI	Call TI

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

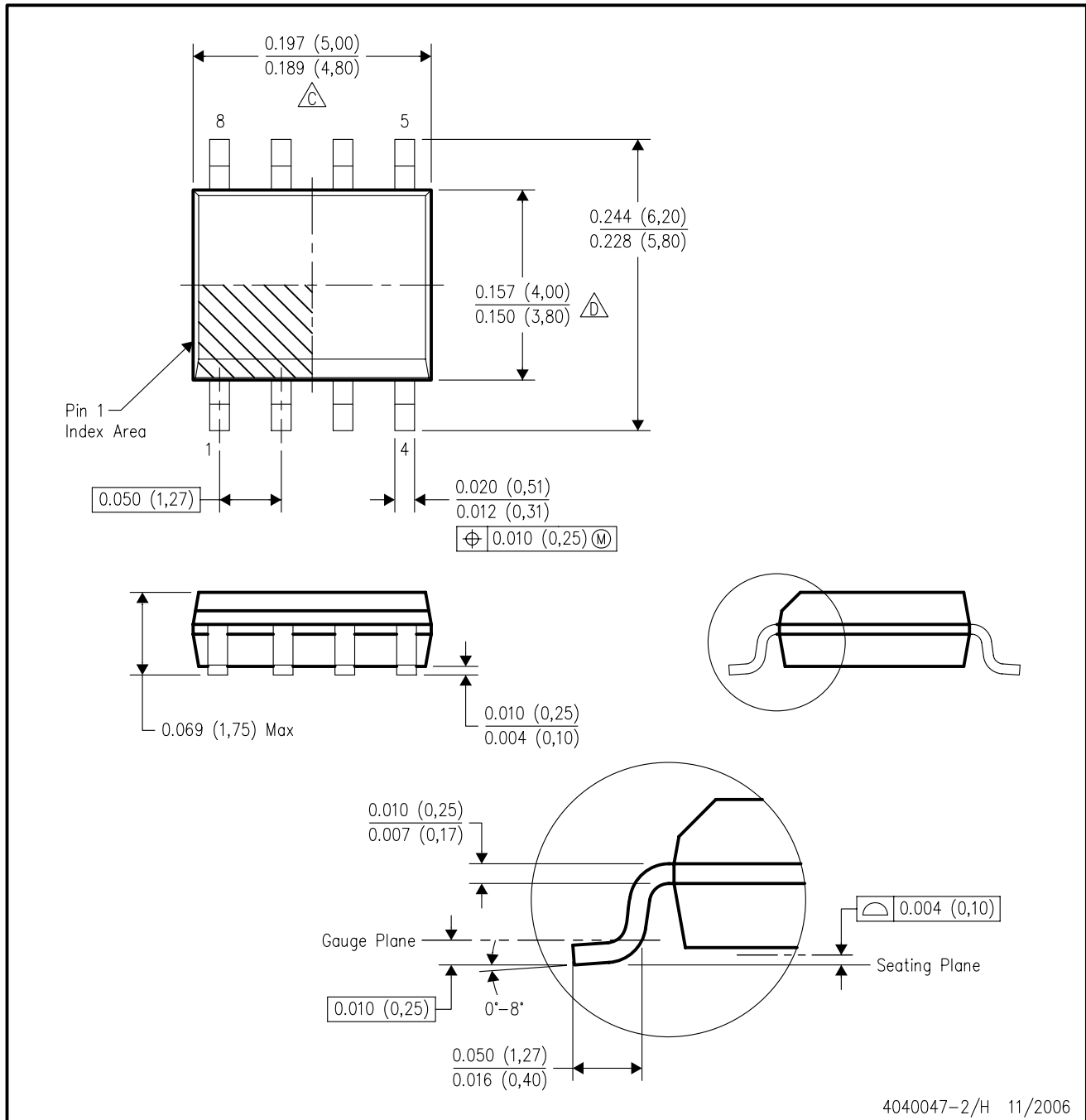
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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D (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
  - $\triangle D$  Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AA.

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Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>	Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
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Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>	Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
Low Power Wireless	<a href="http://www.ti.com/lpw">www.ti.com/lpw</a>	Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
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