

# OPAx130 Low-Power, Precision FET-Input Operational Amplifiers

## 1 Features

- Low quiescent current: 530 $\mu$ A/amp
- Low offset voltage: 1mV max
- High open-loop gain: 123dB ( $R_L = 10k\Omega$ )
- High CMRR: 90dB min
- FET input:  $I_B = 20pA$  max
- Excellent bandwidth: 1MHz
- Wide supply range:  $\pm 2.25V$  to  $\pm 18V$
- Single, dual, and quad versions

## 2 Applications

- [Data acquisition \(DAQ\)](#)
- [Flow transmitter](#)
- [Lab and field instrumentation](#)
- [Electrocardiogram \(ECG\)](#)

## 3 Description

The OPA130, OPA2130, and OPA4130 (OPAx130) series of FET-input op amps combine precision dc performance with low quiescent current. Single, dual, and quad versions have identical specifications for maximum design flexibility. OPAx130 are designed for general-purpose, portable, and battery operated applications, especially with high source impedance.

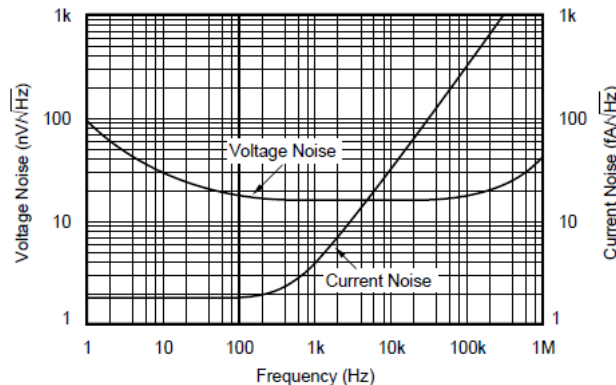
OPAx130 op amps are easy to use and free from phase inversion and overload problems often found in common FET-input op amps. Input cascode circuitry provides excellent common-mode rejection and maintains low input bias current over the wide input voltage range of the amplifier. OPAx130 series op amps are stable in unity gain and provide excellent dynamic behavior over a wide range of load conditions, including high load capacitance. Dual and quad designs feature completely independent circuitry for lowest crosstalk and freedom from interaction, even when overdriven or overloaded.

Single and dual versions are available in an 8-pin SOIC surface-mount package. The quad version is available in a 14-pin SOIC surface-mount package. All devices are specified for  $-40^\circ C$  to  $+85^\circ C$  operation.

### Device Information

PART NUMBER	CHANNELS	PACKAGE <sup>(1)</sup>
OPA130	Single	D (SOIC, 8)
OPA2130	Dual	D (SOIC, 8)
OPA4130	Quad	D (SOIC, 14)

(1) For more information, see [Section 9](#).



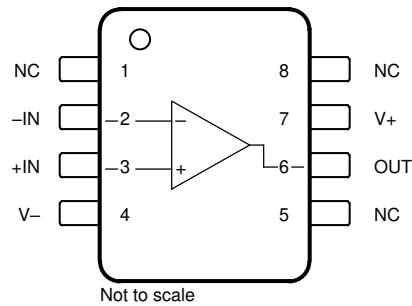
Input Voltage and Current Noise Spectral Density vs Frequency



## Table of Contents

<b>1 Features</b> .....	1	<b>6 Application and Implementation</b> .....	11
<b>2 Applications</b> .....	1	6.1 Application Information.....	11
<b>3 Description</b> .....	1	6.2 Typical Application.....	11
<b>4 Pin Configuration and Functions</b> .....	3	<b>7 Device and Documentation Support</b> .....	12
<b>5 Specifications</b> .....	5	7.1 Receiving Notification of Documentation Updates....	12
5.1 Absolute Maximum Ratings.....	5	7.2 Support Resources.....	12
5.2 Recommended Operating Conditions.....	5	7.3 Trademarks.....	12
5.3 Thermal Information - OPA130.....	6	7.4 Electrostatic Discharge Caution.....	12
5.4 Thermal Information - OPA2130.....	6	7.5 Glossary.....	12
5.5 Thermal Information - OPA4130.....	6	<b>8 Revision History</b> .....	12
5.6 Electrical Characteristics.....	7	<b>9 Mechanical, Packaging, and Orderable Information</b> ..	13
5.7 Typical Characteristics.....	8		

## 4 Pin Configuration and Functions

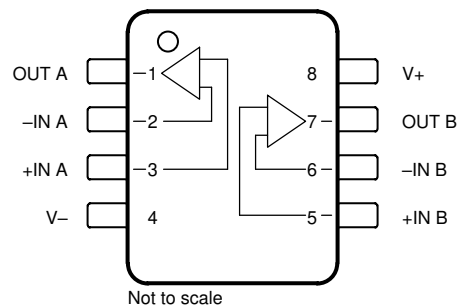


**Figure 4-1. OPA130 D Package, 8-Pin SOIC (Top View)**

**Table 4-1. Pin Functions: OPA130**

PIN		TYPE	DESCRIPTION
NAME	NO.		
+IN	3	Input	Noninverting input, channel A
-IN	2	Input	Inverting input, channel A
NC	1, 5	—	Do not connect these pins <sup>(1)</sup>
NC	8	—	No internal connection. Float this pin.
OUT	6	Output	Output
V+	7	Power	Positive (highest) power supply
V-	4	Power	Negative (lowest) power supply

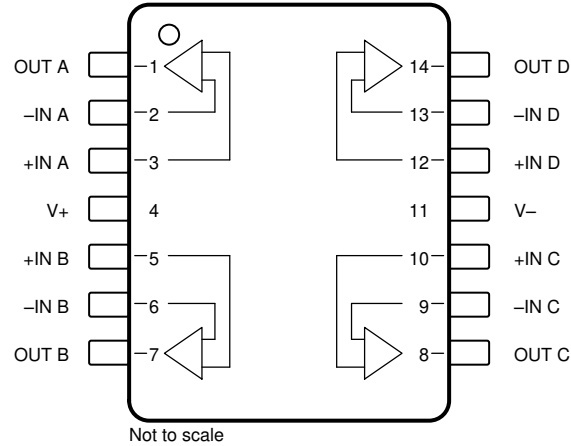
(1) Existing layouts for the OPA130 D package before revision B of this data sheet do not need to be redesigned.



**Figure 4-2. OPA2130 D Package, 8-Pin SOIC (Top View)**

**Table 4-2. Pin Functions: OPA2130**

PIN		TYPE	DESCRIPTION
NAME	NO.		
+IN A	3	Input	Noninverting input, channel A
+IN B	5	Input	Noninverting input, channel B
-IN A	2	Input	Inverting input, channel A
-IN B	6	Input	Inverting input, channel B
OUT A	1	Output	Output, channel A
OUT B	7	Output	Output, channel B
V+	8	Power	Positive (highest) power supply
V-	4	Power	Negative (lowest) power supply



**Figure 4-3. OPA4130 D Package, 14-Pin SOIC (Top View)**

**Table 4-3. Pin Functions: OPA4130**

PIN		TYPE	DESCRIPTION
NAME	NO.		
+IN A	3	Input	Noninverting input, channel A
+IN B	5	Input	Noninverting input, channel B
+IN C	10	Input	Noninverting input, channel C
+IN D	12	Input	Noninverting input, channel D
-IN A	2	Input	Inverting input, channel A
-IN B	6	Input	Inverting input, channel B
-IN C	9	Input	Inverting input, channel C
-IN D	13	Input	Inverting input, channel D
OUT A	1	Output	Output, channel A
OUT B	7	Output	Output, channel B
OUT C	8	Output	Output, channel C
OUT D	14	Output	Output, channel D
V+	4	Power	Positive (highest) power supply
V-	11	Power	Negative (lowest) power supply

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		MIN	MAX	UNIT
V <sub>S</sub>	Supply voltage, (V+) – (V–)	Dual supply	±18	V
		Single supply	36	
	Input voltage <sup>(2)</sup>	(V–) – 0.5	(V+) + 0.5	V
	Input current <sup>(2)</sup>		±10	mA
I <sub>SC</sub>	Output short-circuit <sup>(3)</sup>	Continuous		
T <sub>A</sub>	Operating temperature	–40	125	°C
T <sub>J</sub>	Junction temperature		150	°C
T <sub>stg</sub>	Storage temperature	–40	125	°C

- (1) Operation outside the *Absolute Maximum Ratings* may cause permanent device damage. *Absolute Maximum Ratings* do not imply functional operation of the device at these or any other conditions beyond those listed under *Recommended Operating Conditions*. If used outside the *Recommended Operating Conditions* but within the *Absolute Maximum Ratings*, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.
- (2) Input pins are diode-clamped to the power-supply rails. Input signals that can swing more than 0.5V beyond the supply rails must be current limited to 10mA or less.
- (3) Short-circuit to ground, one amplifier per package.

### 5.2 Recommended Operating Conditions

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

		MIN	NOM	MAX	UNIT	
V <sub>S</sub>	Supply voltage, (V+) – (V–)	Dual supply	±2.25	±15	±18	V
		Single supply	4.5	30	36	
T <sub>A</sub>	Ambient temperature	–40	25	85	°C	

### 5.3 Thermal Information - OPA130

THERMAL METRIC <sup>(1)</sup>		OPA130	UNIT
		D (SOIC)	
		8 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	150	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	74	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	62	°C/W
$\Psi_{JT}$	Junction-to-top characterization parameter	19.7	°C/W
$\Psi_{JB}$	Junction-to-board characterization parameter	54.8	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	°C/W

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

### 5.4 Thermal Information - OPA2130

THERMAL METRIC <sup>(1)</sup>		OPA2130	UNIT
		D (SOIC)	
		8 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	150	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	52.3	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	63.5	°C/W
$\Psi_{JT}$	Junction-to-top characterization parameter	10.7	°C/W
$\Psi_{JB}$	Junction-to-board characterization parameter	62.4	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	°C/W

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

### 5.5 Thermal Information - OPA4130

THERMAL METRIC <sup>(1)</sup>		OPA4130	UNIT
		D (SOIC)	
		14 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	110	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	56	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	53	°C/W
$\Psi_{JT}$	Junction-to-top characterization parameter	19	°C/W
$\Psi_{JB}$	Junction-to-board characterization parameter	46	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	°C/W

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

## 5.6 Electrical Characteristics

at  $T_A = 25^\circ\text{C}$ ,  $V_S = \pm 15\text{V}$ ,  $R_L = 10\text{k}\Omega$  connected to midsupply, and  $V_{CM} = V_{OUT} = \text{midsupply}$  (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
<b>OFFSET VOLTAGE</b>							
$V_{OS}$	Input offset voltage				$\pm 0.2$	$\pm 1$	mV
$dV_{OS}/dT$	Input offset voltage drift	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$			$\pm 2$	$\pm 10$	$\mu\text{V}/^\circ\text{C}$
PSRR	Power-supply rejection ratio	$V_S = \pm 2.25\text{V}$ to $\pm 18\text{V}$			$\pm 2$	$\pm 20$	$\mu\text{V}/\text{V}$
<b>INPUT BIAS CURRENT</b>							
$I_B$	Input bias current <sup>(1)</sup>	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$			$\pm 5$	$\pm 20$	pA
				See Typical Characteristics			
$I_{OS}$	Input offset current <sup>(1)</sup>				$\pm 2$	$\pm 20$	pA
<b>NOISE</b>							
$e_n$	Input voltage noise density	$f = 10\text{Hz}$			30		nV/ $\sqrt{\text{Hz}}$
		$f = 100\text{Hz}$			18		
		$f = 1\text{kHz}$			16		
		$f = 10\text{kHz}$			16		
$I_n$	Input current noise density	$f = 1\text{kHz}$			4		fA/ $\sqrt{\text{Hz}}$
<b>INPUT VOLTAGE</b>							
$V_{CM}$	Common-mode voltage			$(V-) + 2$		$(V+) - 3.5$	V
CMRR	Common-mode rejection ratio	$-13\text{V} \leq V_{CM} \leq 11.5\text{V}$		90	105		dB
<b>INPUT IMPEDANCE</b>							
	Differential				$10^{13} \parallel 5$		$\Omega \parallel \text{pF}$
	Common-mode	$-13\text{V} \leq V_{CM} \leq 11.5\text{V}$			$10^{13} \parallel 4.3$		
<b>OPEN-LOOP GAIN</b>							
$A_{OL}$	Open-loop voltage gain	$-13.8\text{V} \leq V_O \leq 13\text{V}$ , $R_L = 10\text{k}\Omega$		114	123		dB
		$-13\text{V} \leq V_O \leq 12\text{V}$ , $R_L = 2\text{k}\Omega$		104	110		
<b>FREQUENCY RESPONSE</b>							
GBW	Gain bandwidth product				1		MHz
SR	Slew rate				2		V/ $\mu\text{s}$
	Settling time	10V step, $G = 1$		0.1%	5.5		$\mu\text{s}$
				0.01%	7		
THD+N	Total harmonic distortion plus noise	$f = 1\text{kHz}$ , $G = 1$ , $V_O = 3.5V_{\text{rms}}$			0.0003%		
	Overload recovery time	$G = 1$ , $V_{IN} = \pm 15\text{V}$			2		$\mu\text{s}$
<b>OUTPUT</b>							
$V_O$	Voltage output	$R_L = 10\text{k}\Omega$	Positive	$(V+) - 2$	$(V+) - 1.5$	$(V-) + 1.2$	V
			Negative	$(V-) + 1$	$(V-) + 1.2$		
		$R_L = 2\text{k}\Omega$	Positive	$(V+) - 3$	$(V+) - 2.5$		
			Negative	$(V-) + 1.5$	$(V-) + 2$		
$I_{SC}$	Short-circuit current				$\pm 18$		mA
$C_{LOAD}$	Capacitive load drive	Stable operation			See Typical Characteristics		
<b>POWER SUPPLY</b>							
$I_Q$	Quiescent current (per amplifier)	$I_O = 0\text{mA}$			$\pm 530$	$\pm 650$	$\mu\text{A}$

(1) High-speed test at  $T_J = 25^\circ\text{C}$ .

## 5.7 Typical Characteristics

at  $T_A = +25^\circ\text{C}$ ,  $V_S = \pm 15\text{V}$ ,  $R_L = 10\text{k}\Omega$  connected to midsupply, and  $V_{CM} = \text{midsupply}$  (unless otherwise noted)

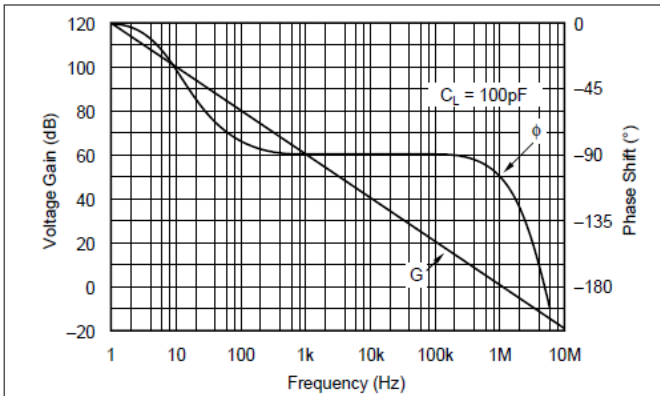


Figure 5-1. Open-Loop Gain and Phase vs Frequency

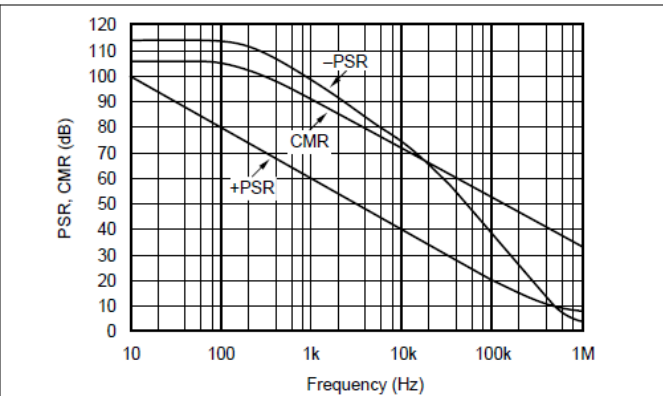


Figure 5-2. Power Supply and Common-Mode Rejection vs Frequency

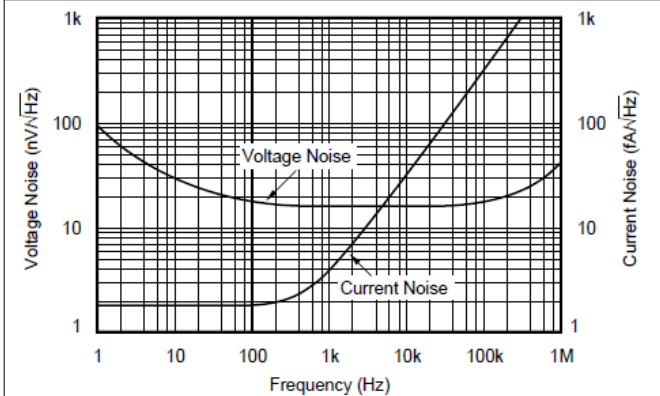


Figure 5-3. Input Voltage and Current Noise Spectral Density vs Frequency

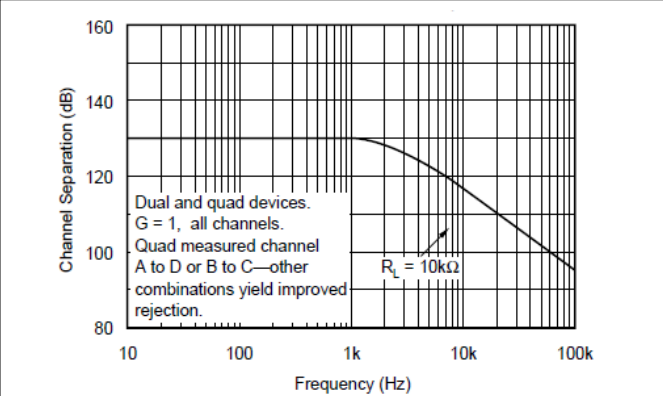


Figure 5-4. Channel Separation vs Frequency

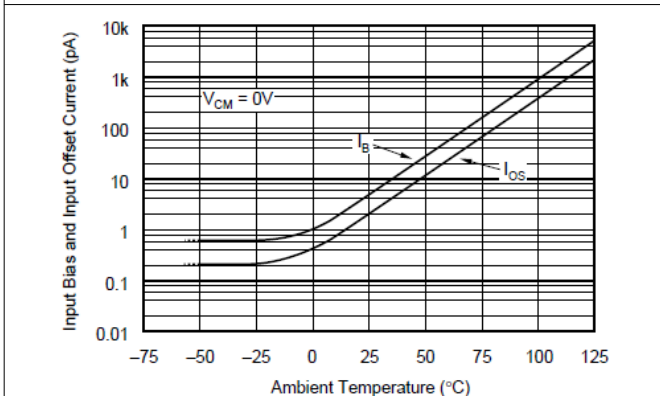


Figure 5-5. Input Bias and Input Offset Current vs Temperature

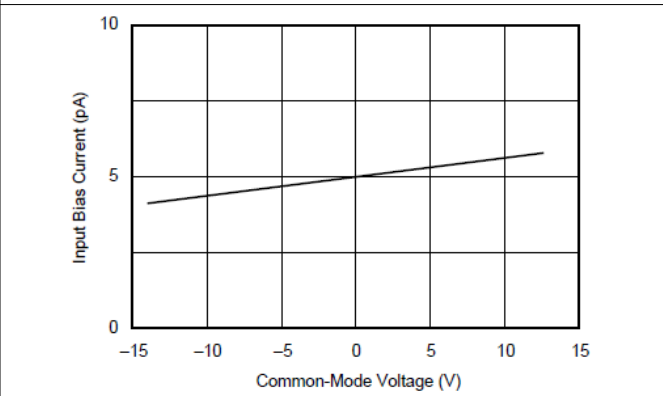
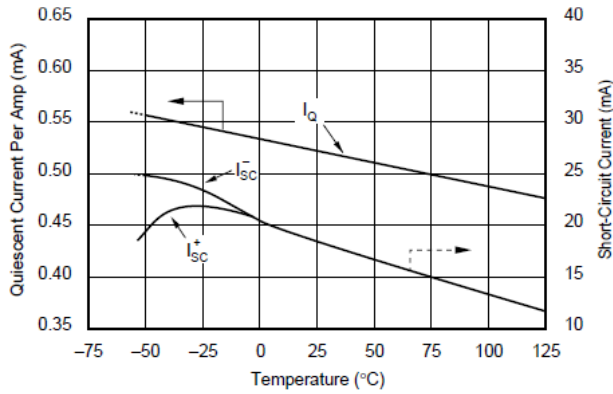


Figure 5-6. Input Bias Current vs Input Common-Mode Voltage

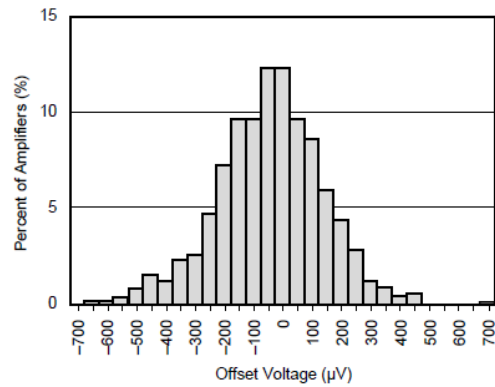


### 5.7 Typical Characteristics (continued)

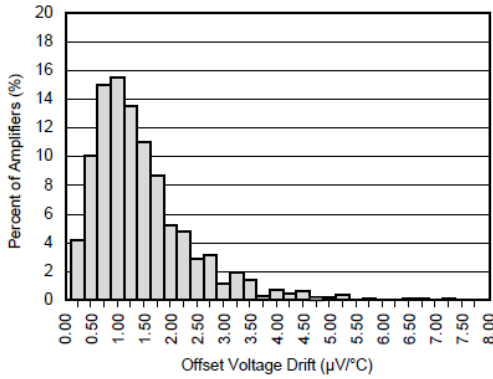
at  $T_A = +25^\circ\text{C}$ ,  $V_S = \pm 15\text{V}$ ,  $R_L = 10\text{k}\Omega$  connected to midsupply, and  $V_{CM} = \text{midsupply}$  (unless otherwise noted)



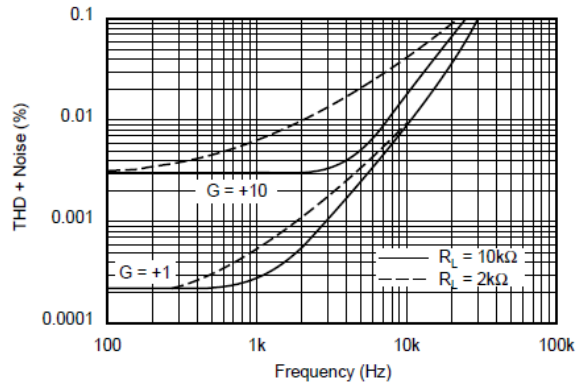
**Figure 5-7. Quiescent Current and Short-Circuit Current vs Temperature**



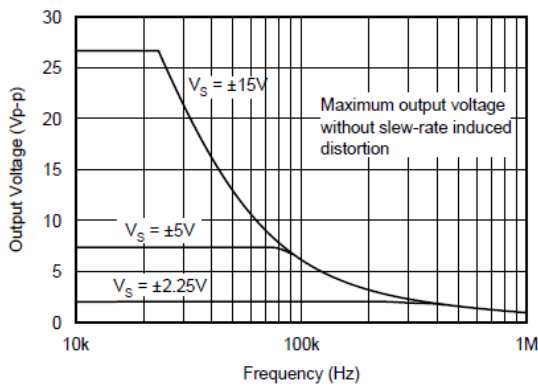
**Figure 5-8. Offset Voltage Production Distribution**



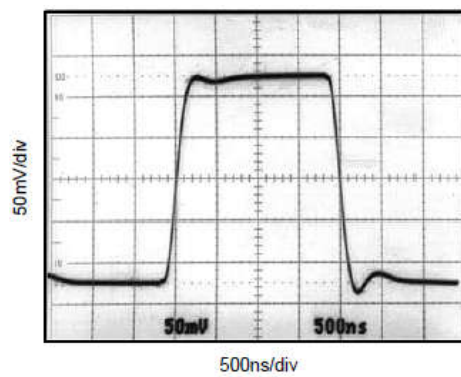
**Figure 5-9. Offset Voltage Drift Production Distribution**



**Figure 5-10. Total Harmonic Distortion + Noise vs Frequency**



**Figure 5-11. Maximum Output Voltage vs Frequency**

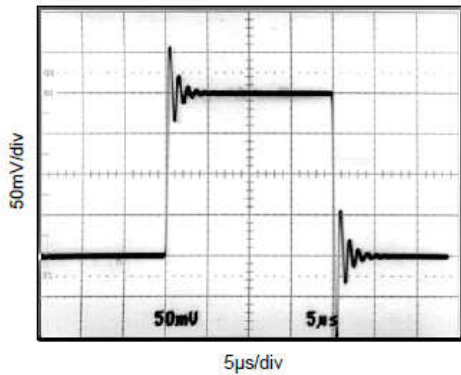


$G = 1$ ,  $C_L = 100\text{pF}$

**Figure 5-12. Small-Signal Step Response**

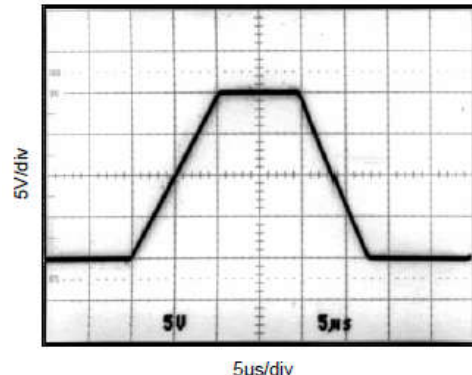
## 5.7 Typical Characteristics (continued)

at  $T_A = +25^\circ\text{C}$ ,  $V_S = \pm 15\text{V}$ ,  $R_L = 10\text{k}\Omega$  connected to midsupply, and  $V_{CM} = \text{midsupply}$  (unless otherwise noted)



$G = 1$ ,  $C_L = 1000\text{pF}$

Figure 5-13. Small-Signal Step Response



$G = 1$ ,  $C_L = 100\text{pF}$

Figure 5-14. Large-Signal Step Response

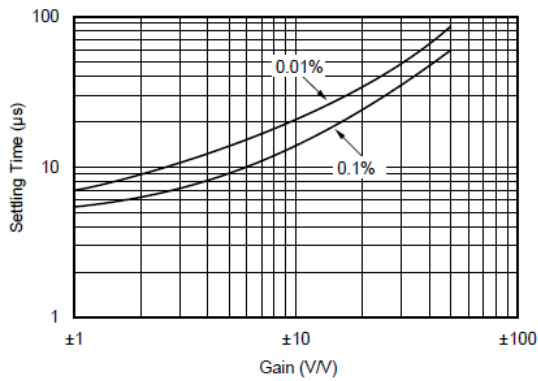


Figure 5-15. Settling Time vs Gain

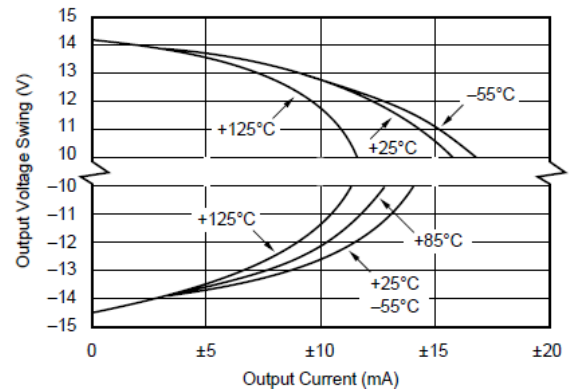


Figure 5-16. Output Voltage Swing vs Output Current

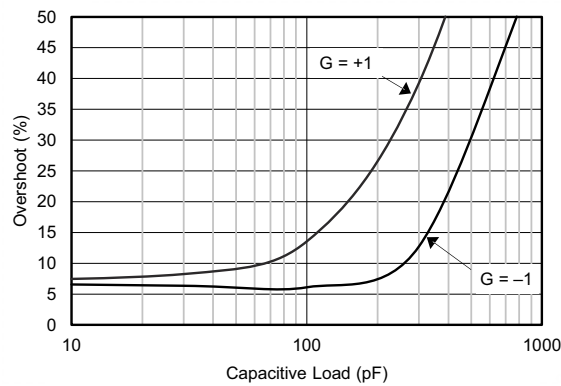


Figure 5-17. Small-Signal Overshoot vs Load Capacitance

## 6 Application and Implementation

### Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

### 6.1 Application Information

The OPAx130 series of op amps are unity-gain stable and an excellent choice for a wide range of general-purpose applications. Bypass power supply pins with 10nF ceramic capacitors or larger.

The OPAx130 op amps are free from unexpected output phase-reversal common with FET op amps. Many FET-input op amps exhibit phase-reversal of the output when the input common-mode voltage range is exceeded. This can occur in voltage-follower circuits, causing serious problems in control loop applications. The OPAx130 series of op amps are free from this undesirable behavior. All circuitry is completely independent in dual and quad versions, and normal behavior can be expected when one amplifier in a package is overdriven or short-circuited.

#### 6.1.1 Operating Voltage

The OPAx130 op amps operate with power supplies from  $\pm 2.25\text{V}$  to  $\pm 18\text{V}$  with excellent performance. Although specifications are production tested with  $\pm 15\text{V}$  supplies, most behavior remains unchanged throughout the full operating voltage range. See [Section 5.7](#) for parameters that vary significantly with operating voltage.

#### 6.1.2 Offset Voltage Trim

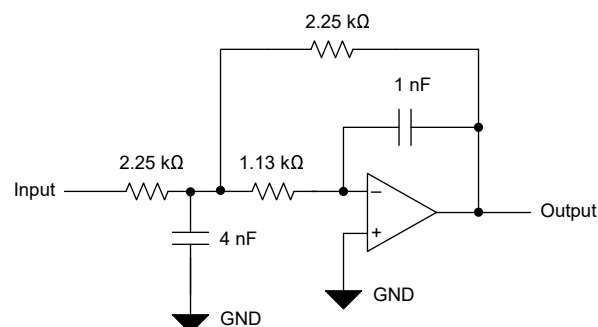
The offset voltage of the OPAx130 amplifiers is laser trimmed and usually requires no user adjustment. The OPAx130 provide less than  $\pm 1\text{mV}$  of input offset voltage and less than  $10\mu\text{V}/^\circ\text{C}$  of input offset voltage drift over the operating temperature range.

#### 6.1.3 Input Bias Current

[Figure 5-5](#) shows that the input bias current of the OPAx130 is approximately 5pA at room temperature and increases with temperature.

Input stage cascode circuitry allows the input bias current to remain virtually unchanged throughout the full input common-mode range of the OPAx130. See also [Figure 5-6](#).

### 6.2 Typical Application



**Figure 6-1. Second-Order Low-Pass Filter**

## 7 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

### 7.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](http://ti.com). Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 7.2 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

### 7.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.  
All trademarks are the property of their respective owners.

### 7.4 Electrostatic Discharge Caution



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.

### 7.5 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 8 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

<b>Changes from Revision A (March 2006) to Revision B (May 2024)</b>	<b>Page</b>
• Updated the numbering format for tables, figures, and cross-references throughout document.....	1
• Deleted DIP packages from data sheet.....	1
• Updated open-loop gain to match <i>Electrical Characteristics</i> in <i>Features</i> .....	1
• Added <i>Applications</i> .....	1
• Updated pin diagrams, added pin function tables, and moved all to new <i>Pin Configuration and Functions</i> .....	3
• Updated input voltage in <i>Absolute Maximum Ratings</i> .....	5
• Added input current and related footnote to <i>Absolute Maximum Ratings</i> .....	5
• Added <i>Recommended Operating Conditions</i> and <i>Thermal Information</i> .....	5
• Changed format of <i>Electrical Characteristics</i> to latest standard.....	7
• Updated nominal conditions in the header of <i>Electrical Characteristics</i> .....	7
• Deleted channel separation specification.....	7
• Updated common-mode voltage.....	7
• Updated common-mode rejection ratio and common-mode input impedance test conditions.....	7
• Changed differential input impedance from 10 <sup>13</sup> Ω    1pF to 10 <sup>13</sup> Ω    5pF.....	7
• Changed common-mode input impedance from 10 <sup>13</sup> Ω    3pF to 10 <sup>13</sup> Ω    4.3pF.....	7
• Updated open loop voltage gain MIN and TYP values for R <sub>L</sub> = 10kΩ and R <sub>L</sub> = 2kΩ.....	7
• Updated settling time test condition.....	7
• Moved voltage output negative MIN values to MAX values.....	7
• Changed capacitive load drive specification from 10nF to See <i>Typical Characteristics</i> .....	7

---

- Deleted note 1 from *Electrical Characteristics* ..... 7
- Deleted Figure 5-7, *A<sub>OL</sub>, CMR, PSR vs Temperature* ..... 8
- Updated Figure 5-17, *Small-Signal Overshoot vs Load Capacitance* ..... 8
- Updated text in *Offset Voltage Trim* ..... 11
- Changed Figure 1, *OPA130 Offset Voltage Trim Circuit*, to Figure 6-1, *Second-Order Low-Pass Filter* ..... 11

---

## 9 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

## PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
OPA130UA	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 125	(O130, OPA) 130UA	<a href="#">Samples</a>
OPA130UA/2K5	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 125	(O130, OPA) 130UA	<a href="#">Samples</a>
OPA2130UA	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 125	(2130UA, OPA)	<a href="#">Samples</a>
OPA2130UA/2K5	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 125	(2130UA, OPA)	<a href="#">Samples</a>
OPA4130UA	ACTIVE	SOIC	D	14	50	RoHS & Green	NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA4130UA	<a href="#">Samples</a>
OPA4130UA/2K5	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA4130UA	<a href="#">Samples</a>

(1) 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.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
OPA130UA/2K5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
OPA2130UA/2K5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
OPA4130UA/2K5	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1



**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
OPA130UA/2K5	SOIC	D	8	2500	356.0	356.0	35.0
OPA2130UA/2K5	SOIC	D	8	2500	356.0	356.0	35.0
OPA4130UA/2K5	SOIC	D	14	2500	356.0	356.0	35.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
OPA130UA	D	SOIC	8	75	506.6	8	3940	4.32
OPA2130UA	D	SOIC	8	75	506.6	8	3940	4.32
OPA4130UA	D	SOIC	14	50	506.6	8	3940	4.32

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  -  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



D0008A

# PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

NOTES:

- Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed  $.006$  [0.15] per side.
- This dimension does not include interlead flash.
- Reference JEDEC registration MS-012, variation AA.

# EXAMPLE BOARD LAYOUT

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON .005 INCH [0.125 MM] THICK STENCIL  
SCALE:8X

4214825/C 02/2019

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2024, Texas Instruments Incorporated