

OPAx130 Low-Power, Precision FET-Input Operational Amplifiers

1 Features

- Low quiescent current: 530 μ 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.

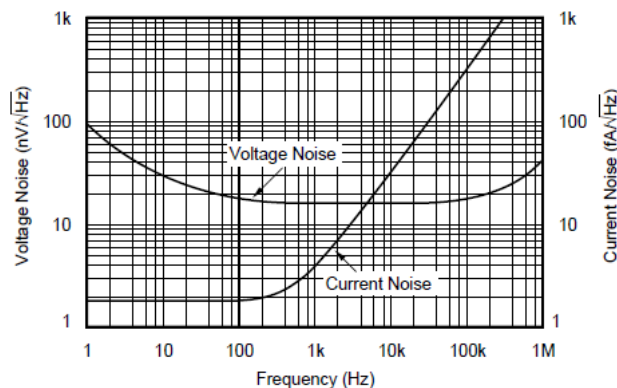
OPAx130 op amps are easy to use and free from phase inversion and overload problems often found in common FET-input op amps. Input cascode circuitry provides excellent common-mode rejection and maintains low input bias current over the wide input voltage range of the amplifier. OPAx130 series op amps 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 ⁽¹⁾
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



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4 Pin Configuration and Functions

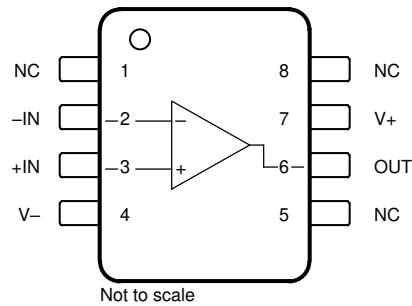


Figure 4-1. OPA130 D Package, 8-Pin SOIC (Top View)

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 ⁽¹⁾
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.

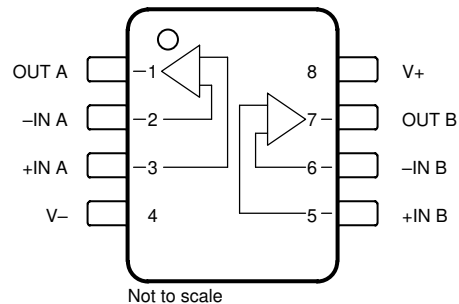


Figure 4-2. OPA2130 D Package, 8-Pin SOIC (Top View)

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

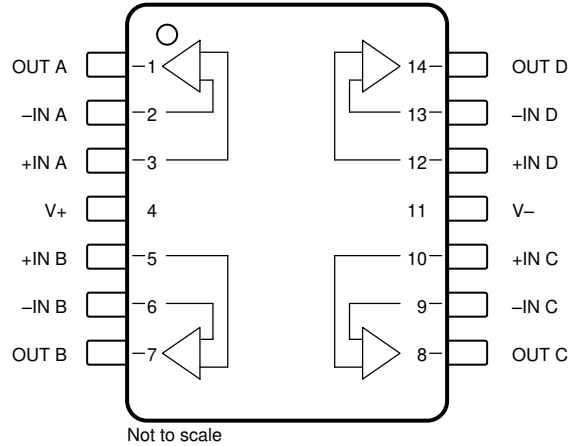


Figure 4-3. OPA4130 D Package, 14-Pin SOIC (Top View)

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)⁽¹⁾

		MIN	MAX	UNIT
V _S	Supply voltage, (V+) – (V–)	Dual supply	±18	V
		Single supply	36	
	Input voltage ⁽²⁾	(V–) – 0.5	(V+) + 0.5	V
	Input current ⁽²⁾	±10		mA
I _{SC}	Output short-circuit ⁽³⁾	Continuous		
T _A	Operating temperature	–40	125	°C
T _J	Junction temperature			150
T _{stg}	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 _S	Supply voltage, (V+) – (V–)	Dual supply	±2.25	±15	±18	V
		Single supply	4.5	30	36	
T _A	Ambient temperature	–40	25	85	°C	

5.3 Thermal Information - OPA130

THERMAL METRIC ⁽¹⁾		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
Ψ_{JT}	Junction-to-top characterization parameter	19.7	°C/W
Ψ_{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 ⁽¹⁾		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
Ψ_{JT}	Junction-to-top characterization parameter	10.7	°C/W
Ψ_{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 ⁽¹⁾		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
Ψ_{JT}	Junction-to-top characterization parameter	19	°C/W
Ψ_{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
OFFSET VOLTAGE							
V_{OS}	Input offset voltage				± 0.2	± 1	mV
dV_{OS}/dT	Input offset voltage drift	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$			± 2	± 10	$\mu\text{V}/^\circ\text{C}$
PSRR	Power-supply rejection ratio	$V_S = \pm 2.25\text{V}$ to $\pm 18\text{V}$			± 2	± 20	$\mu\text{V}/\text{V}$
INPUT BIAS CURRENT							
I_B	Input bias current ⁽¹⁾				± 5	± 20	pA
		$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$			See <i>Typical Characteristics</i>		
I_{OS}	Input offset current ⁽¹⁾				± 2	± 20	pA
NOISE							
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/ $\sqrt{\text{Hz}}$
INPUT VOLTAGE							
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
INPUT IMPEDANCE							
	Differential				$10^{13} \parallel 5$		$\Omega \parallel \text{pF}$
	Common-mode	$-13\text{V} \leq V_{CM} \leq 11.5\text{V}$			$10^{13} \parallel 4.3$		
OPEN-LOOP GAIN							
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		
FREQUENCY RESPONSE							
GBW	Gain bandwidth product				1		MHz
SR	Slew rate				2		V/ μs
	Settling time	10V step, $G = 1$	0.1%		5.5		μs
			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		μs
OUTPUT							
V_O	Voltage output	$R_L = 10\text{k}\Omega$	Positive	$(V+) - 2$	$(V+) - 1.5$		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				± 18		mA
C_{LOAD}	Capacitive load drive	Stable operation			See <i>Typical Characteristics</i>		
POWER SUPPLY							
I_Q	Quiescent current (per amplifier)	$I_O = 0\text{mA}$			± 530	± 650	μA

(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)

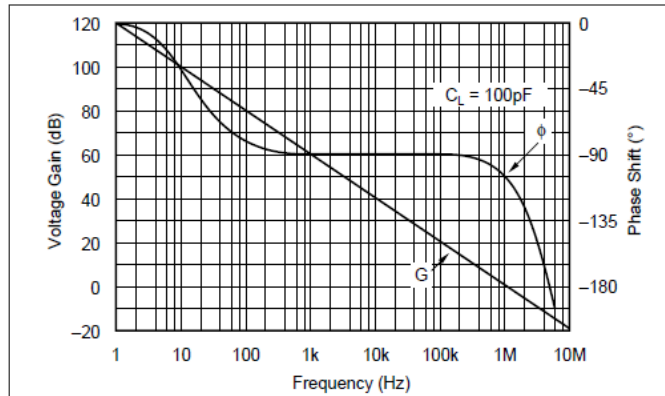


Figure 5-1. Open-Loop Gain and Phase vs Frequency

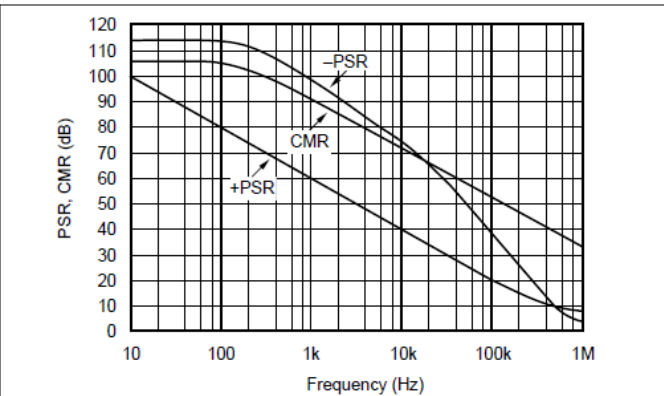


Figure 5-2. Power Supply and Common-Mode Rejection vs Frequency

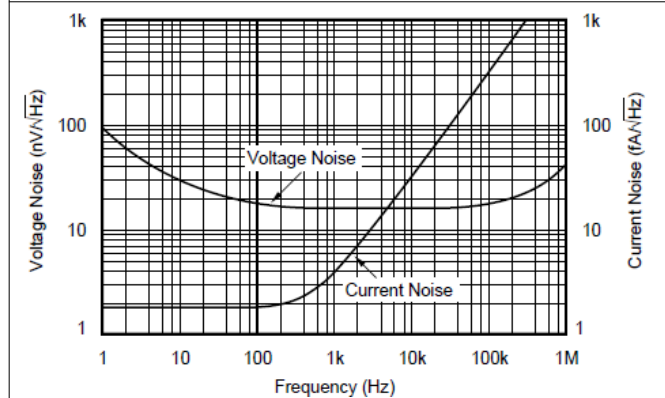


Figure 5-3. Input Voltage and Current Noise Spectral Density vs Frequency

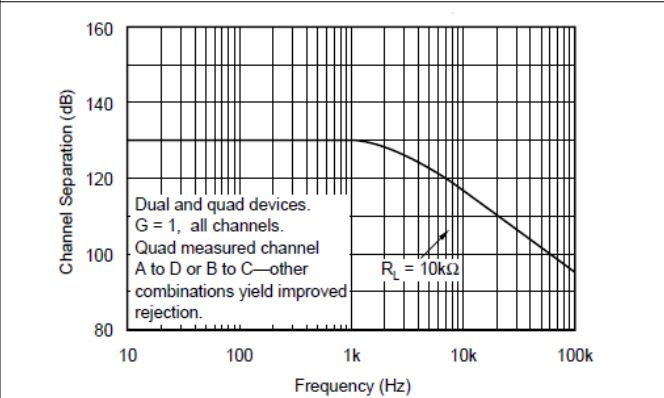


Figure 5-4. Channel Separation vs Frequency

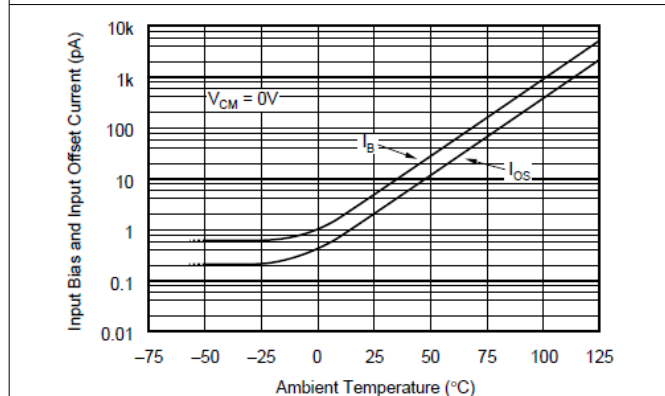


Figure 5-5. Input Bias and Input Offset Current vs Temperature

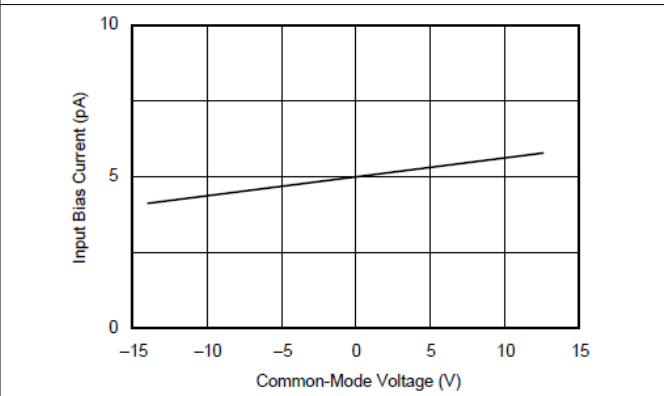


Figure 5-6. Input Bias Current vs Input Common-Mode Voltage

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)

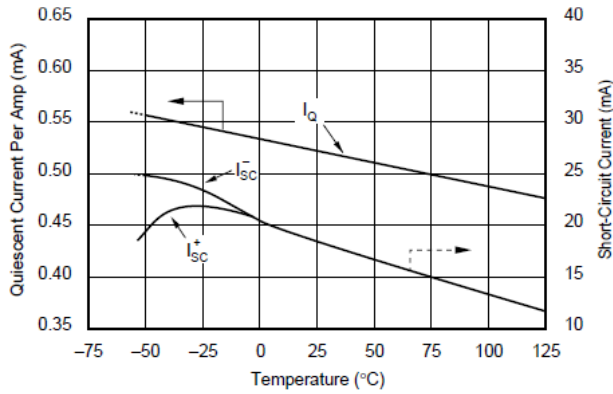


Figure 5-7. Quiescent Current and Short-Circuit Current vs Temperature

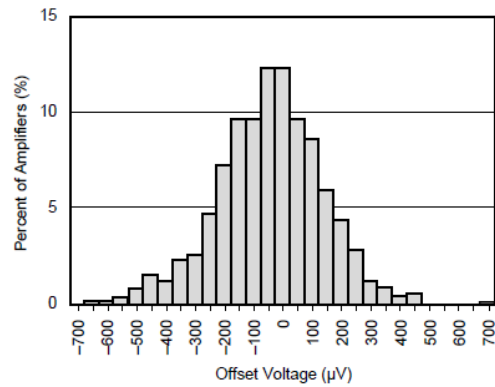


Figure 5-8. Offset Voltage Production Distribution

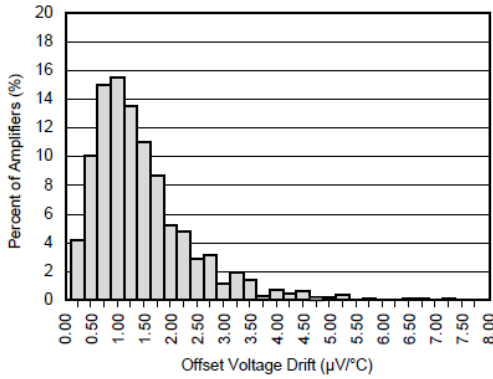


Figure 5-9. Offset Voltage Drift Production Distribution

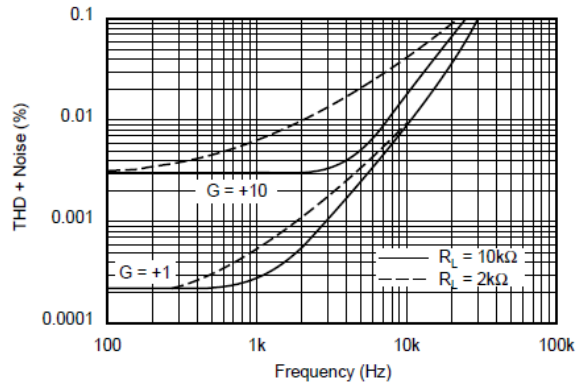


Figure 5-10. Total Harmonic Distortion + Noise vs Frequency

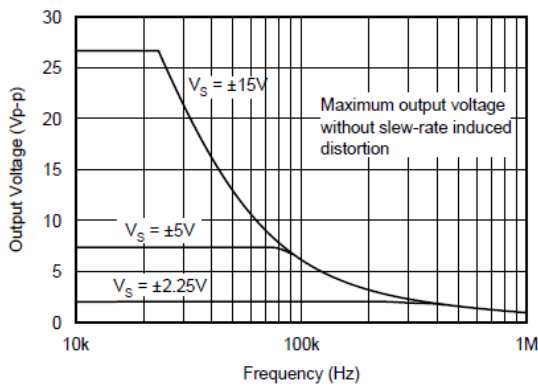
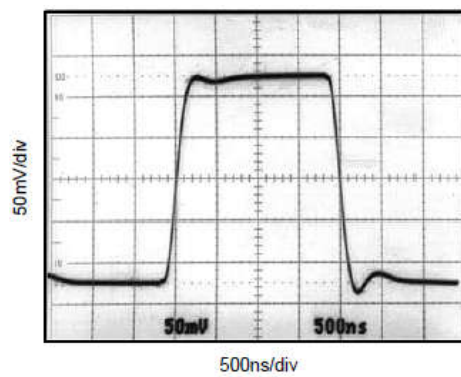


Figure 5-11. Maximum Output Voltage vs Frequency

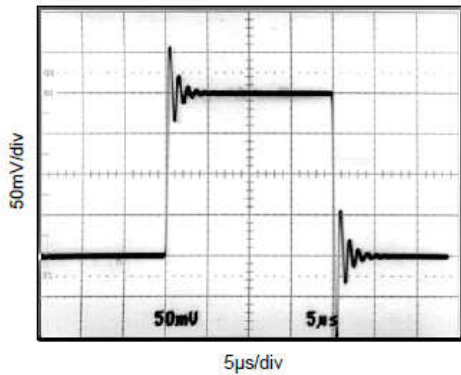


$G = 1$, $C_L = 100\text{pF}$

Figure 5-12. Small-Signal Step Response

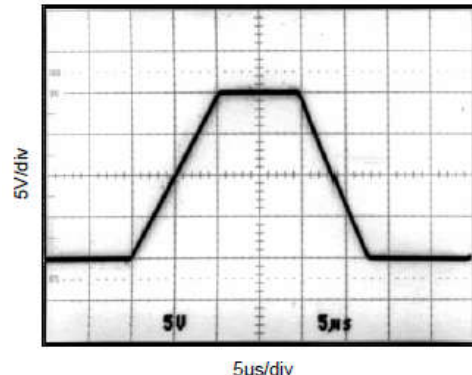
5.7 Typical Characteristics (continued)

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

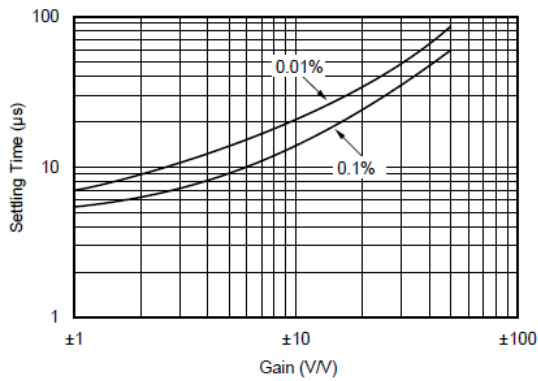


Figure 5-15. Settling Time vs Gain

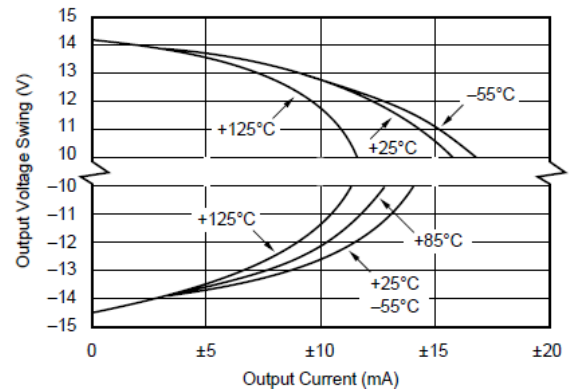


Figure 5-16. Output Voltage Swing vs Output Current

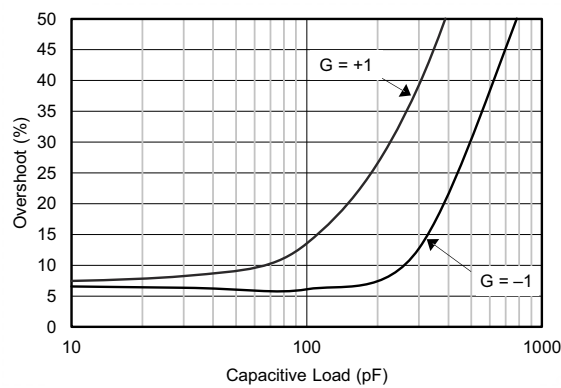


Figure 5-17. Small-Signal Overshoot vs Load Capacitance

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

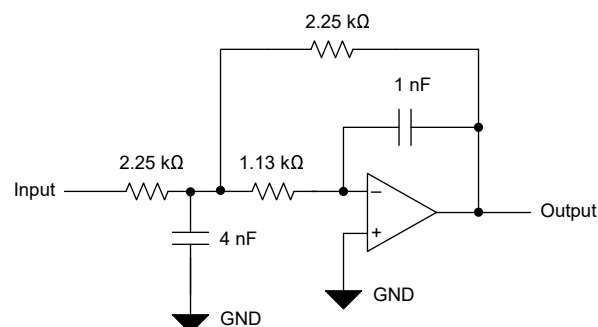


Figure 6-1. Second-Order Low-Pass Filter

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. 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.

Changes from Revision A (March 2006) to Revision B (May 2024)	Page
• 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 $10^{13}\Omega \parallel 1\text{pF}$ to $10^{13}\Omega \parallel 5\text{pF}$	7
• Changed common-mode input impedance from $10^{13}\Omega \parallel 3\text{pF}$ to $10^{13}\Omega \parallel 4.3\text{pF}$	7
• Updated open loop voltage gain MIN and TYP values for $R_L = 10\text{k}\Omega$ and $R_L = 2\text{k}\Omega$	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_{OL}, 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	Samples
OPA130UA/2K5	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 125	OPA 130UA	Samples
OPA2130UA	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 125	(2130UA, OPA)	Samples
OPA2130UA/2K5	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 125	OPA 2130UA	Samples
OPA4130UA	ACTIVE	SOIC	D	14	50	RoHS & Green	NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA4130UA	Samples
OPA4130UA/2K5	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU-DCC	Level-3-260C-168 HR	-40 to 85	OPA4130UA	Samples

(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.

OBSELETE: 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.

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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



4211283-3/E 08/12

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - 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.
 - 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.

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