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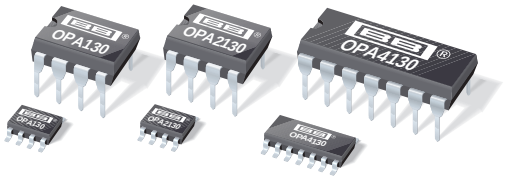


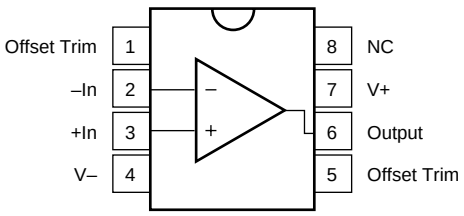
OPA130
OPA2130
OPA4130

Low Power, Precision
FET-INPUT OPERATIONAL AMPLIFIERS

FEATURES

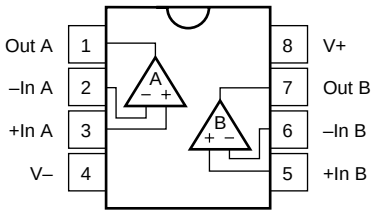
- LOW QUIESCENT CURRENT: 530μA/amp
- LOW OFFSET VOLTAGE: 1mV max
- HIGH OPEN-LOOP GAIN: 120dB min
- HIGH CMRR: 90dB min
- FET INPUT: I_B = 20pA max
- EXCELLENT BANDWIDTH: 1MHz
- WIDE SUPPLY RANGE: ±2.25 to ±18V
- SINGLE, DUAL, AND QUAD VERSIONS

OPA130



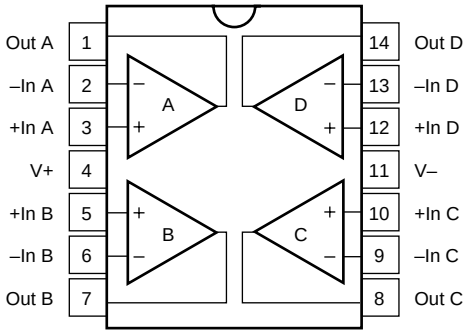
8-Pin DIP, SO-8

OPA2130



8-Pin DIP, SO-8

OPA4130



14-Pin DIP
SO-14

DESCRIPTION

The OPA130 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. They are ideal for general-purpose, portable, and battery operated applications, especially with high source impedance.

OPA130 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 its wide input voltage range. OPA130 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 8-pin DIP and SO-8 surface-mount packages. Quad is available in 14-pin DIP and SO-14 surface-mount packages. All are specified for –40°C to +85°C operation.

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SBOS053

SPECIFICATIONS

At T_A = +25°C, V_S = ±15V, and R_L = 10kΩ, unless otherwise noted.

PARAMETER	CONDITION	OPA130PA, UA OPA2130PA, UA OPA4130PA, UA MIN	TYP	MAX	UNITS
OFFSET VOLTAGE					
Input Offset Voltage			±0.2	±1	mV
vs Temperature[1]	Operating Temperature Range		±2	±10	µV/°C
vs Power Supply	V_S = ±2.25V to ±18V		2	20	µV/V
Channel Separation (dual and quad)			0.3		µV/V
INPUT BIAS CURRENT[2]					
Input Bias Current	V_{CM} = 0V		+5	±10	pA
vs Temperature			See Typical Curve		
Input Offset Current	V_{CM} = 0V		±2	±20	pA
NOISE					
Input Voltage Noise					
Noise Density, f = 10Hz			30		nV/√Hz
f = 100Hz			18		nV/√Hz
f = 1kHz			16		nV/√Hz
f = 10kHz			16		nV/√Hz
Current Noise Density, f = 1kHz			4		fA/√Hz
INPUT VOLTAGE RANGE					
Common-Mode Voltage Range, Positive		(V+)–2	(V+)–1.5		V
Negative		(V–)+2	(V–)+1.2		V
Common-Mode Rejection	V_{CM} = –13V to +13V	90	105		dB
INPUT IMPEDANCE					
Differential			10^{13} || 1		Ω || pF
Common-Mode	V_{CM} = –13V to +13V		10^{13} || 3		Ω || pF
OPEN-LOOP GAIN					
Open-loop Voltage Gain	V_O = –13.8V to +13V	120	135		dB
	R_L = 2kΩ, V_O = –13V to +12V	120	135		dB
FREQUENCY RESPONSE					
Gain-Bandwidth Product			1		MHz
Slew Rate			2		V/µs
Settling Time: 0.1%	G = 1, 10V Step, C_L = 100pF		5.5		µs
0.01%	G = 1, 10V Step, C_L = 100pF		7		µs
Overload Recovery Time	G = 1, V_{IN} = ±15V		2		µs
Total Harmonic Distortion + Noise	1kHz, G = 1, V_O = 3.5Vrms		0.0003		%
OUTPUT					
Voltage Output, Positive		(V+)–2	(V+)–1.5		V
Negative		(V–)+1.2	(V–)+1		V
Positive	R_L = 2kΩ	(V+)–3	(V+)–2.5		V
Negative	R_L = 2kΩ	(V–)+2	(V–)+1.5		V
Short-Circuit Current			±18		mA
Capacitive Load Drive (Stable Operation)			10		nF
POWER SUPPLY					
Specified Operating Voltage			±15		V
Operating Voltage Range		±2.25		±18	V
Quiescent Current (per amplifier)	I_O = 0		±530	±650	µA
TEMPERATURE RANGE					
Operating Range		–40		+85	°C
Storage		–40		+125	°C
Thermal Resistance, θ_{JA}					
8-Pin DIP			100		°C/W
SO-8 Surface-Mount			150		°C/W
14-Pin DIP			80		°C/W
SO-14 Surface-Mount			110		°C/W

NOTES: (1) Guaranteed by wafer test. (2) High-speed test at T_J = 25°C.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V+ to V–	36V
Input Voltage	(V–) –0.7V to (V+) +0.7V
Output Short-Circuit[1]	Continuous
Operating Temperature	–40°C to +125°C
Storage Temperature	–40°C to +125°C
Junction Temperature	150°C
Lead Temperature (soldering, 10s)	300°C

NOTE: (1) Short-circuit to ground, one amplifier per package.

PACKAGE/ORDERING INFORMATION

PRODUCT	PACKAGE	PACKAGE DRAWING NUMBER[1]	TEMPERATURE RANGE
Single			
OPA130PA	8-Pin Plastic DIP	006	–40°C to +85°C
OPA130UA	SO-8 Surface-Mount	182	–40°C to +85°C
Dual			
OPA2130PA	8-Pin Plastic DIP	006	–40°C to +85°C
OPA2130UA	SO-8 Surface-Mount	182	–40°C to +85°C
Quad			
OPA4130PA	14-Pin Plastic DIP	010	–40°C to +85°C
OPA4130UA	SO-14 Surface-Mount	235	–40°C to +85°C

NOTE: (1) For detailed drawing and dimension table, please see end of data sheet, or Appendix C of Burr-Brown IC Data Book.

ELECTROSTATIC DISCHARGE SENSITIVITY

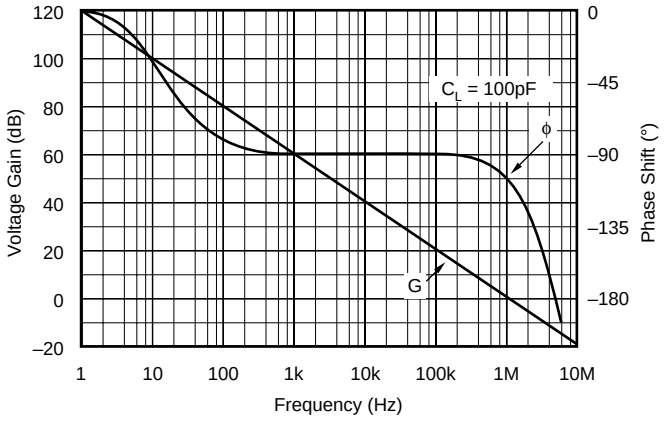
This integrated circuit can be damaged by ESD. Burr-Brown recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

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.

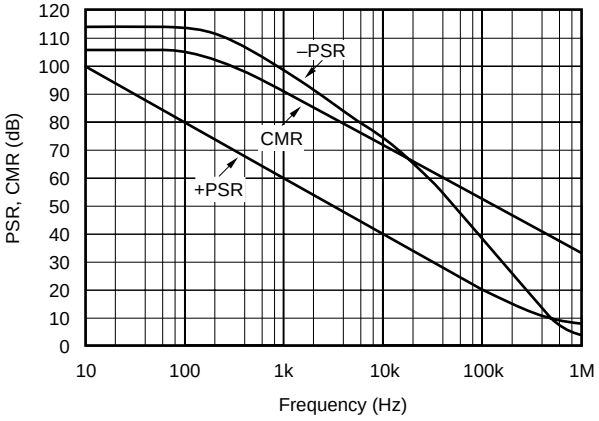
TYPICAL PERFORMANCE CURVES

At T_A = +25°C, V_S = ±15V, and R_L = 10kΩ, unless otherwise noted.

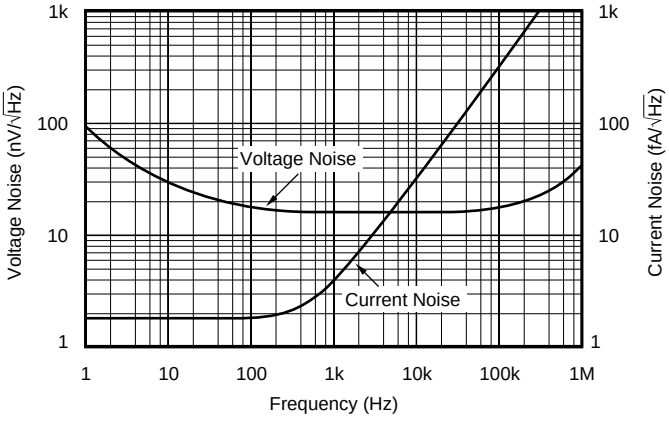
OPEN-LOOP GAIN/PHASE vs FREQUENCY



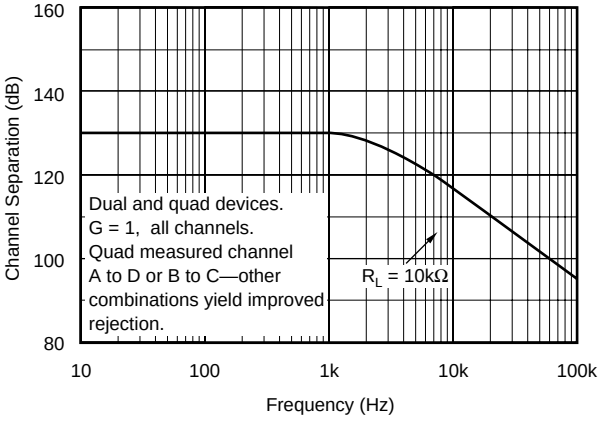
POWER SUPPLY AND COMMON-MODE REJECTION vs FREQUENCY



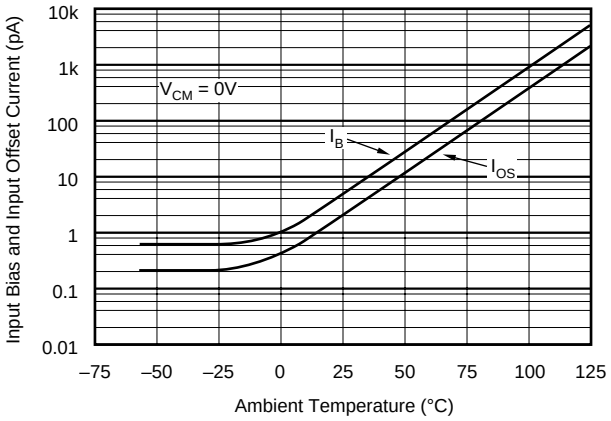
INPUT VOLTAGE AND CURRENT NOISE SPECTRAL DENSITY vs FREQUENCY



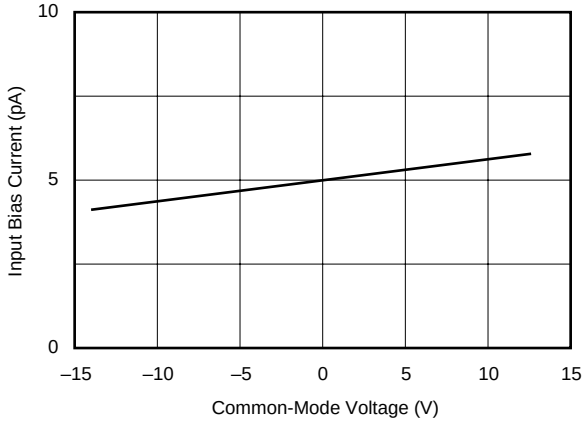
CHANNEL SEPARATION vs FREQUENCY



INPUT BIAS AND INPUT OFFSET CURRENT vs TEMPERATURE



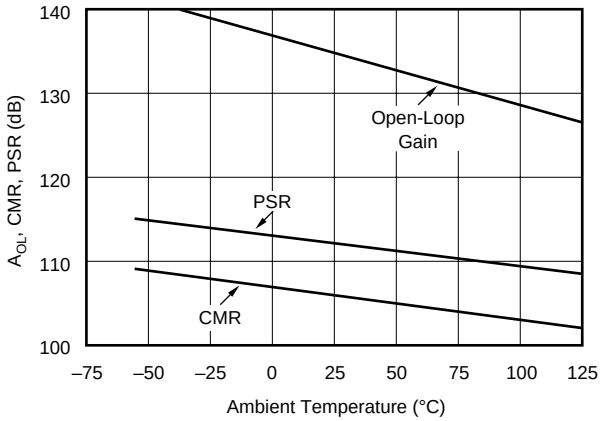
INPUT BIAS CURRENT vs INPUT COMMON-MODE VOLTAGE



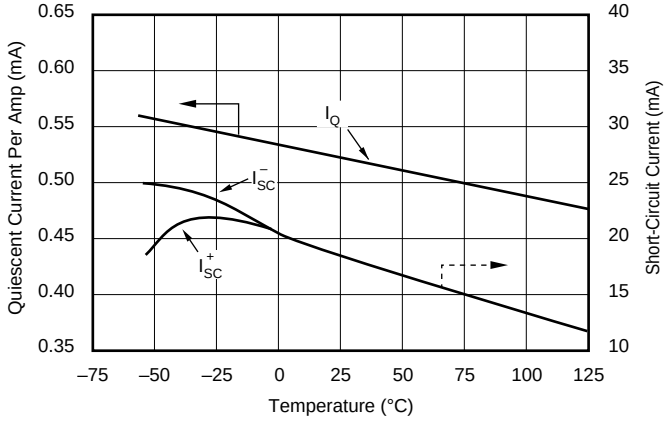
TYPICAL PERFORMANCE CURVES (CONT)

At T_A = +25°C, V_S = ±15V, and R_L = 10kΩ, unless otherwise noted.

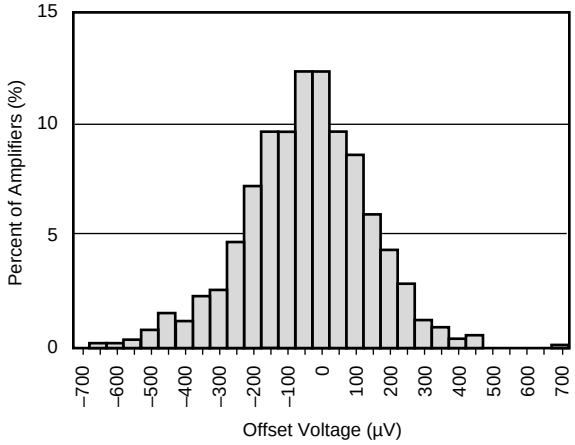
A_{OL}, CMR, PSR vs TEMPERATURE



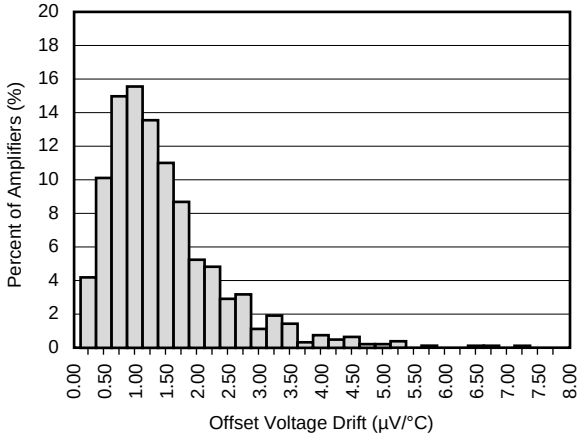
QUIESCENT CURRENT AND SHORT-CIRCUIT CURRENT vs TEMPERATURE



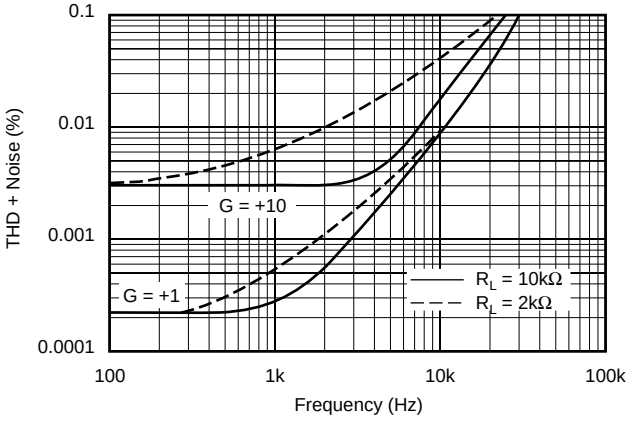
OFFSET VOLTAGE PRODUCTION DISTRIBUTION



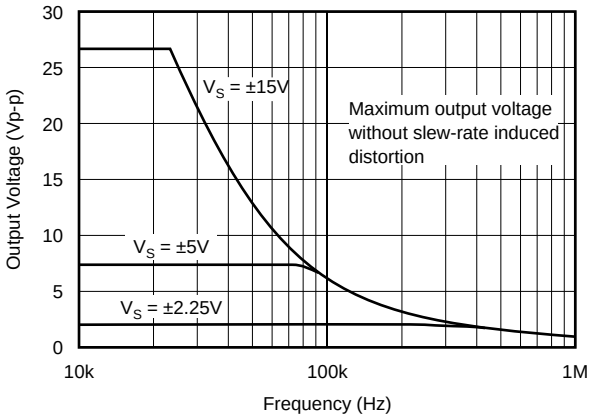
OFFSET VOLTAGE DRIFT PRODUCTION DISTRIBUTION



TOTAL HARMONIC DISTORTION + NOISE vs FREQUENCY



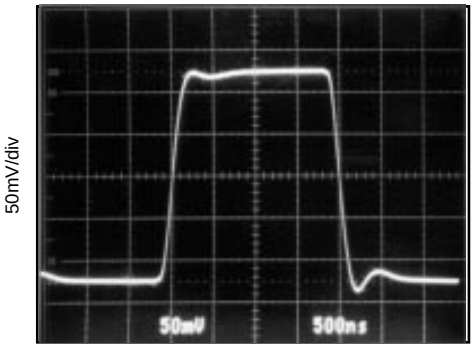
MAXIMUM OUTPUT VOLTAGE vs FREQUENCY



TYPICAL PERFORMANCE CURVES (CONT)

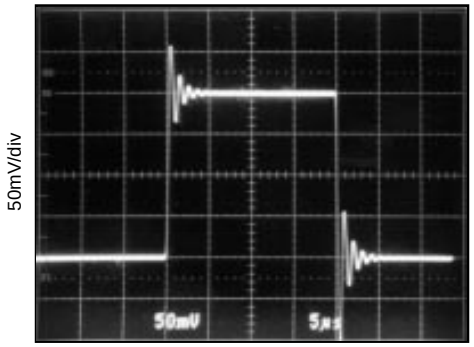
At T_A = +25°C, V_S = ±15V, and R_L = 10kΩ, unless otherwise noted.

SMALL-SIGNAL STEP RESPONSE
G =1, C_L = 100pF



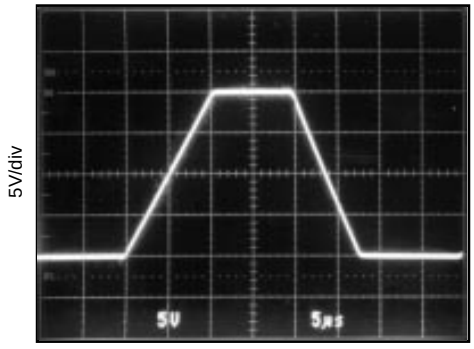
500ns/div

SMALL-SIGNAL STEP RESPONSE
G = 1, C_L = 1000pF



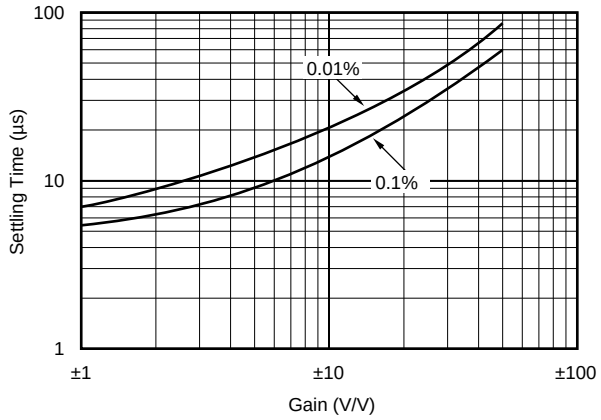
5µs/div

LARGE-SIGNAL STEP RESPONSE
G = 1, C_L = 100pF

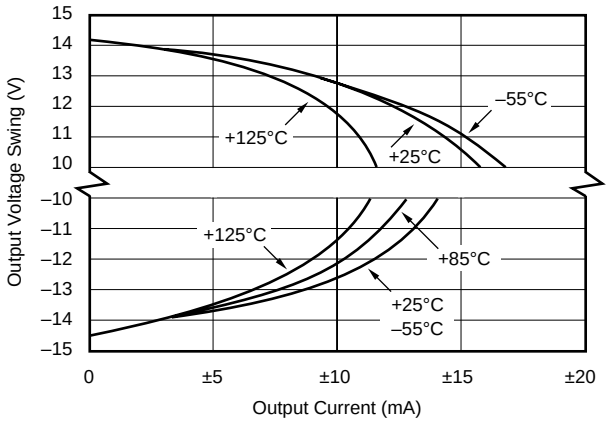


5µs/div

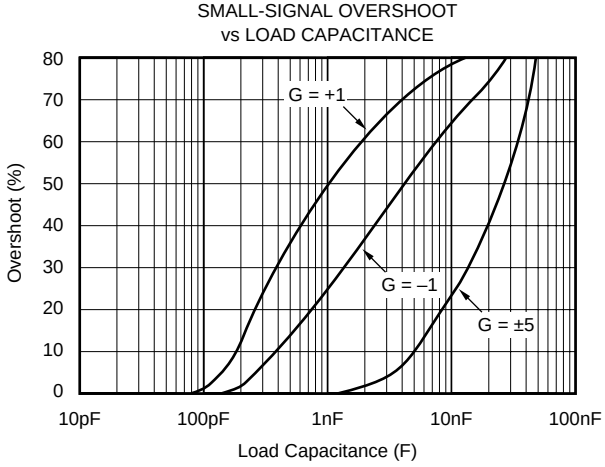
SETTLING TIME vs GAIN



OUTPUT VOLTAGE SWING vs OUTPUT CURRENT



SMALL-SIGNAL OVERSHOOT
vs LOAD CAPACITANCE



APPLICATIONS INFORMATION

OPA130 series op amps are unity-gain stable and suitable for a wide range of general-purpose applications. Power supply pins should be bypassed with 10nF ceramic capacitors or larger.

OPA130 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. OPA130 series op amps are free from this undesirable behavior. All circuitry is completely independent in dual and quad versions, assuring normal behavior when one amplifier in a package is overdriven or short-circuited.

OPERATING VOLTAGE

OPA130 series op amps operate with power supplies from ±2.25V to ±18V with excellent performance. Although specifications are production tested with ±15V supplies, most behavior remains unchanged throughout the full operating voltage range. Parameters which vary significantly with operating voltage are shown in the typical performance curves.

OFFSET VOLTAGE TRIM

Offset voltage of OPA130 series amplifiers is laser trimmed and usually requires no user adjustment. The OPA130 (single op amp version) provides offset voltage trim connections on pins 1 and 5. Offset voltage can be adjusted by connecting a potentiometer as shown in Figure 1. This adjustment should be used only to null the offset of the op amp, not to adjust system offset or offset produced by the signal source. Nulling offset that is not produced by the amplifier will change the offset voltage drift behavior of the op amp.

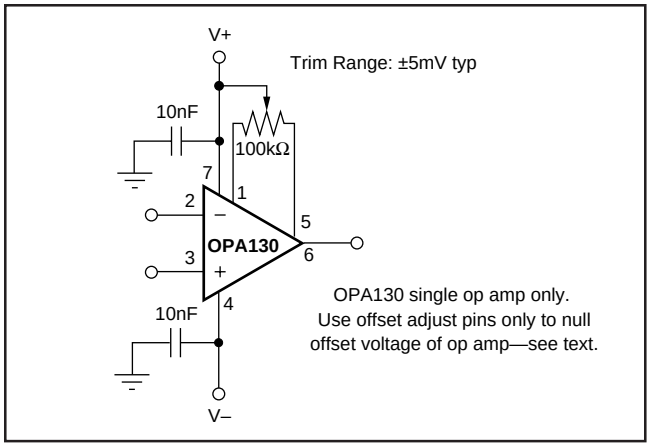


FIGURE 1. OPA130 Offset Voltage Trim Circuit.

INPUT BIAS CURRENT

The input bias current is approximately 5pA at room temperature and increases with temperature as shown in the typical performance curve “Input Bias Current vs Temperature.”

Input stage cascode circuitry assures that the input bias current remains virtually unchanged throughout the full input common-mode range of the OPA130. See the typical performance curve “Input Bias Current vs Common-Mode Voltage.”

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