Low-Power, High-Precision Operational Amplifier

FEATURES

- Supply Current 600μA Max
- OP-07 Type Performance
  - Offset Voltage 25μV Max
  - Offset Voltage Drift 0.6μV/°C Max
- Very Low Bias Current 100pA Max
- Very Low Offset Current 100pA Max
- Low Noise 0.5μVp-p
- Common Mode Rejection Ratio 114dB Min

APPLICATIONS

- Replaces OP-07 While Saving Power
- Precision Instrumentation
- Charge Integrators
- Wide Dynamic Range Logarithmic Amplifiers
- Light Meters
- Low Frequency Active Filters
- Thermocouple Amplifiers

DESCRIPTION

The OP-97 is a low-power precision amplifier that provides OP-07 performance while drawing less than 1/6 the OP-07 supply current. Offset voltage is 10μV and drift with temperature is 0.2μV/°C.

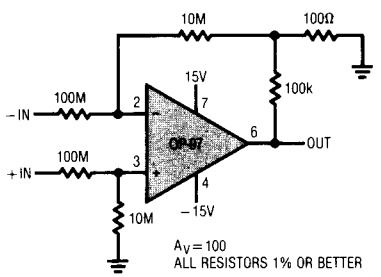
The OP-97 performance is improved over OP-07 performance in several areas. Bias and offset currents remain in the picoampere levels over the full military temperature range. Common mode voltage rejection and power supply rejection are also improved.

The OP-97 conforms to the OP-07 pinout with the null potentiometer connected between pins 1 and 8 with the wiper to V^+. The OP-97 will upgrade circuit designs using 725, OP-05, OP-07 and OP-12 amplifiers.

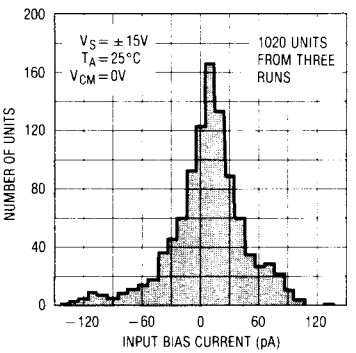
For applications requiring improved price and/or performance refer to the LT1012 and LT1097 datasheets.

Protected by U.S. patents 4,575,685 and 4,775,884

Instrumentation Amplifier with ± 100V Common Mode Range



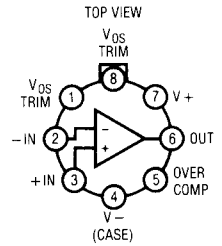
Typical Distribution of Input Bias Current



ABSOLUTE MAXIMUM RATINGS

Supply Voltage ..... ±20V
Differential Input Current (Note 1) ..... ±10mA
Input Voltage ..... ±20V
Output Short Circuit Duration ..... Indefinite
Operating Temperature Range
OP-97A ..... –55°C to 125°C
OP-97E ..... –40°C to 85°C
Storage Temperature Range
All Devices ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec.) ..... 300°C

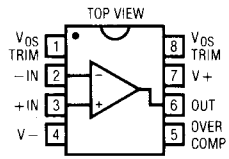
PACKAGE/ORDER INFORMATION



H PACKAGE
8-LEAD TO-5 METAL CAN

ORDER PART NUMBER

OP-97AH
OP-97EH



J8 PACKAGE
8-LEAD CERAMIC DIP

N8 PACKAGE
8-LEAD PLASTIC DIP

OP-97AJ8
OP-97EJ8
OP-97EN8

ELECTRICAL CHARACTERISTICS $V_S = \pm 15V$, $V_{CM} = 0V$, $T_A = 25°C$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	OP-97A/E MIN	OP-97A/E TYP	OP-97A/E MAX	UNITS
V_{OS}	Input Offset Voltage			10	25	μV
$\frac{\Delta V_{OS}}{\Delta Time}$	Long Term Offset Voltage Stability			0.3		μV/Month
I_{OS}	Input Offset Current			30	100	pA
I_B	Input Bias Current			±30	±100	pA
e_n	Input Noise Voltage	0.1Hz to 10Hz		0.5		μVp-p
	Input Noise Voltage Density	f_o = 10Hz (Note 3) f_o = 1000Hz (Note 4)		17 14	30 22	nV/√Hz nV/√Hz
i_n	Input Noise Current Density	f_o = 10Hz		20		fA/√Hz
A_{VOL}	Large Signal Voltage Gain	$V_O = \pm 10V$; $R_L = 2k\Omega$	300	2000		V/mV
CMRR	Common Mode Rejection Ratio	$V_{CM} = \pm 13.5V$	114	132		dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 2V$ to $\pm 20V$	114	132		dB
	Input Voltage Range	(Note 2)	±13.5	±14.0		V
V_{OUT}	Output Voltage Swing	$R_L = 10k\Omega$	±13	±14		V
SR	Slew Rate		0.1	0.2		V/μs
	Differential Input Resistance	(Note 5)	30			MΩ
	Closed-Loop Bandwidth	A_{VCL} = +1 (Note 5)	0.4	0.9		MHz
I_S	Supply Current			380	600	μA
V_S	Supply Voltage	Operating Range	±2	±15	±20	V

ELECTRICAL CHARACTERISTICS

$V_S = \pm 15V$, $V_{CM} = 0V$, $-40°C \le T_A \le 85°C$ for the OP-97E and $-55°C \le T_A \le 125°C$ for the OP-97A unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		OP-97A/E MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage		●		25	60	μV
TCV_{OS}	Average Temperature Coefficient of V_{OS}		●		0.2	0.6	μV/°C
I_{OS}	Input Offset Current		●		60	250	pA
TCI_{OS}	Average Temperature Coefficient of I_{OS}		●		0.4	2.5	pA/°C
I_B	Input Bias Current	OP-97A OP-97E	● ●		±60 ±60	±600 ±250	pA pA
TCI_B	Average Temperature Coefficient of I_B	OP-97A OP-97E	● ●		0.4 0.4	6.0 2.5	pA/°C pA/°C
A_{VOL}	Large Signal Voltage Gain	$V_O = \pm 10V$; $R_L = 2k\Omega$	●	200	1000		V/mV
CMRR	Common Mode Rejection Ratio	$V_{CM} = \pm 13.5V$	●	108	128		dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 2.5V$ to $\pm 20V$	●	108	126		dB
	Input Voltage Range	(Note 2)	●	±13.5	±14.0		V
V_{OUT}	Output Voltage Swing	$R_L = 10k\Omega$	●	±13	±14		V
SR	Slew Rate	(Note 6)	●	0.05	0.15		V/μs
I_S	Supply Current		●		400	800	μA
V_S	Supply Voltage	Operating Range	●	±2.5	±15	±20	V

The ● denotes the specifications which apply over the full operating temperature range.

Note 1: Differential input voltages greater than 1V will cause excessive current to flow through the input protection diodes unless limiting resistance is used.

Note 2: Guaranteed by CMRR test.

Note 3: 10Hz noise voltage density is sample tested. Devices 100% tested for noise are available on request.

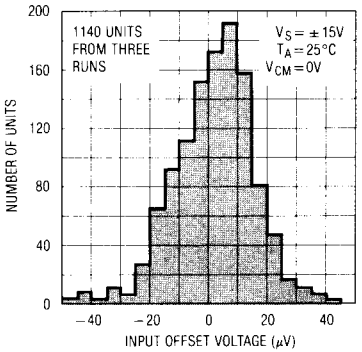
Note 4: Sample tested.

Note 5: Guaranteed by design.

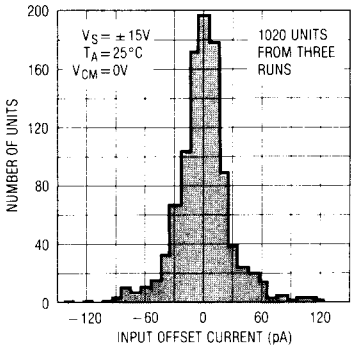
Note 6: Guaranteed by design and correlation to 25°C limit.

TYPICAL PERFORMANCE CHARACTERISTICS

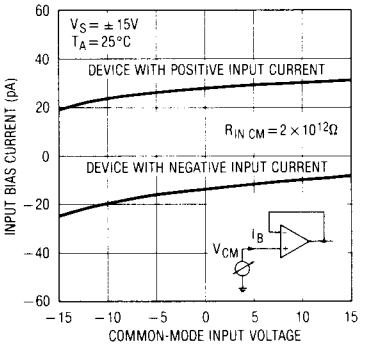
Typical Distribution of Input Offset Voltage



Typical Distribution of Input Offset Current

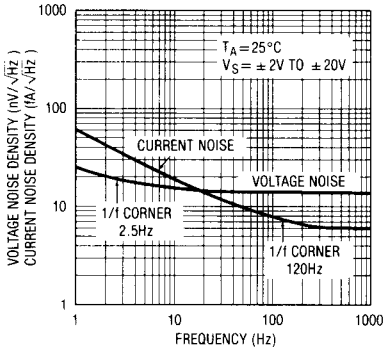


Input Bias Current Over Common Mode Range

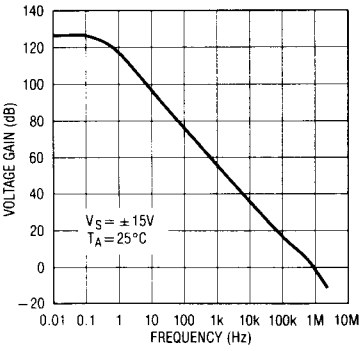


TYPICAL PERFORMANCE CHARACTERISTICS

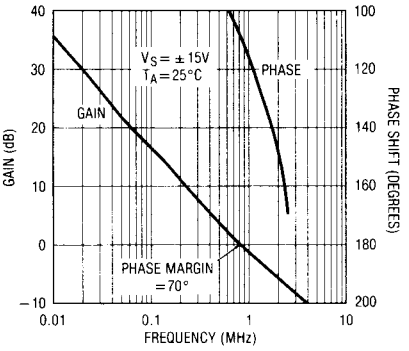
Noise Spectrum



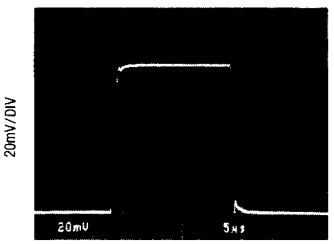
Voltage Gain vs Frequency



Gain, Phase Shift vs Frequency

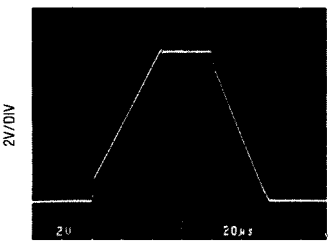


Small Signal Transient Response



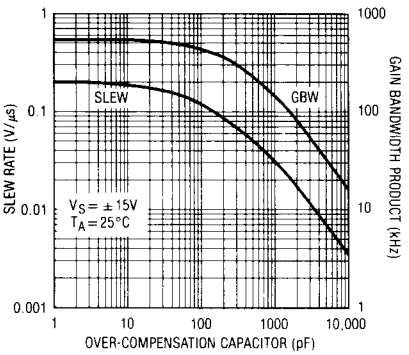
A_V = +1, C_{LOAD} = 100pF, 5µs/DIV

Large Signal Transient Response

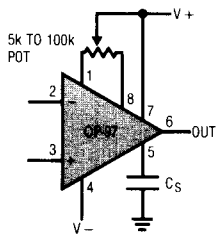


A_V = +1, 20µs/DIV

Slew Rate, Gain Bandwidth Product vs Over-Compensation Capacitor

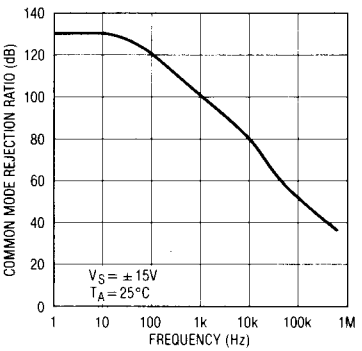


Optional Offset Nulling and Over-Compensation Circuits

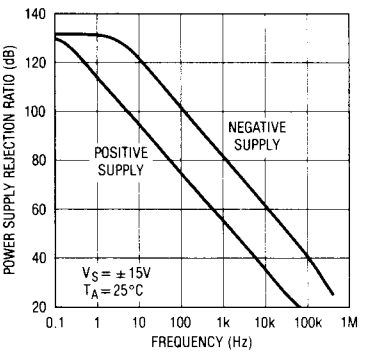


WITH A 5k TO 100k POTENTIOMETER, INPUT OFFSET VOLTAGE CAN BE ADJUSTED OVER A ±800µV RANGE. THE OVER-COMPENSATION CAPACITOR, C_S, CAN BE USED TO IMPROVE CAPACITIVE LOAD HANDLING CAPABILITY, NARROW NOISE BANDWIDTH, OR STABILIZE CIRCUITS WITH GAIN IN THE FEEDBACK LOOP.

Common Mode Rejection vs Frequency



Power Supply Rejection vs Frequency



Please see Linear Technology Databook for package descriptions.

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IM/GP 1289 20K REV 0