Low Power, High Precision Operational Amplifier

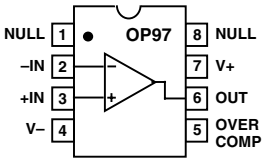
OP97

FEATURES

Low Supply Current: 600 μA Max
OP07 Type Performance
Offset Voltage: 20 μV Max
Offset Voltage Drift: 0.6 μV/°C Max
Very Low Bias Current
25°C: 100 pA Max
–55°C to +125°C: 250 pA Max
High Common-Mode Rejection: 114 dB Min
Extended Industrial Temperature Range: –40°C to +85°C

PIN CONNECTIONS

8-Lead PDIP (P Suffix)
8-Lead SOIC (S Suffix)



GENERAL DESCRIPTION

The OP97 is a low power alternative to the industry-standard OP07 precision amplifier. The OP97 maintains the standards of performance set by the OP07 while utilizing only 600 μA supply current, less than 1/6 that of an OP07. Offset voltage is an ultralow 25 μV, and drift over temperature is below 0.6 μV/°C. External offset trimming is not required in the majority of circuits.

Improvements have been made over OP07 specifications in several areas. Notable is bias current, which remains below 250 pA over the full military temperature range. The OP97 is ideal for use in precision long-term integrators or sample-and-hold circuits that must operate at elevated temperatures.

Common-mode rejection and power supply rejection are also improved with the OP97, at 114 dB minimum over wider ranges of common-mode or supply voltage. Outstanding PSR, a supply range specified from ±2.25 V to ±20 V and the OP97's minimal power requirements combine to make the OP97 a preferred device for portable and battery-powered instruments.

The OP97 conforms to the OP07 pinout, with the null potentiometer connected between Pins 1 and 8 with the wiper to V+. The OP97 will upgrade circuit designs using 725, OP05, OP07, OP12, and 1012 type amplifiers. It may replace 741-type amplifiers in circuits without nulling or where the nulling circuitry has been removed.

REV. E

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OP97–SPECIFICATIONS

ELECTRICAL CHARACTERISTICS (@ V_S = ±15 V, V_{CM} = 0 V, T_A = 25°C, unless otherwise noted.)

Parameter	Symbol	Conditions	OP97E Min	OP97E Typ	OP97E Max	OP97F Min	OP97F Typ	OP97F Max	Unit
Input Offset Voltage	V_{OS}			10	25		30	75	µV
Long-Term Offset Voltage Stability	ΔV_{OS}/Time			0.3			0.3		µV/Month
Input Offset Current	I_{OS}			30	100		30	150	pA
Input Bias Current	I_B			±30	±100		±30	±150	pA
Input Noise Voltage	e_n p-p	0.1 Hz to 10 Hz		0.5			0.5		µV p-p
Input Noise Voltage Density	e_n	f_O = 10 Hz[1]		17	30		17	30	nV/$\sqrt{Hz}$
		f_O = 1000 Hz[2]		14	22		14	22	nV/$\sqrt{Hz}$
Input Noise Current Density	i_n	f_O = 10 Hz		20			20		fA/$\sqrt{Hz}$
Large-Signal Voltage Gain	A_{VO}	V_O = ±10 V; R_L = 2 kΩ	300	2000		200	2000		V/mV
Common-Mode Rejection	CMR	V_{CM} = ±13.5 V	114	132		110	132		dB
Power-Supply Rejection	PSR	VS = ±2 V to ±20 V	114	132		110	132		dB
Input Voltage Range[3]	IVR		±13.5	±14.0		±13.5	±14.0		V
Output Voltage Swing	V_O	R_L = 10 kΩ	±13	±14		±13	±14		V
Slew Rate	SR		0.1	0.2		0.1	0.2		V/µs
Differential Input Resistance[4]	R_{IN}		30			30			MΩ
Closed-Loop Bandwidth	BW	A_{VCL} = 1	0.4	0.9		0.4	0.9		MHz
Supply Current	I_{SY}			380	600		380	600	µA
Supply Voltage	V_S	Operating Range	±2	±15	±20	±2	±15	±20	V

NOTES
[1]10 Hz noise voltage density is sample tested. Devices 100% tested for noise are available on request.
[2]Sample tested.
[3]Guaranteed by CMR test.
[4]Guaranteed by design.

Specifications subject to change without notice.

ELECTRICAL CHARACTERISTICS (@ V_S = ±15 V, V_{CM} = 0 V, –40°C ≤ T_A ≤ +85°C for the OP97E/F, unless otherwise noted.)

Parameter	Symbol	Conditions	OP97E Min	OP97E Typ	OP97E Max	OP97F Min	OP97F Typ	OP97F Max	Unit
Input Offset Voltage	V_{OS}			25	60		60	200	µV
Average Temperature Coefficient of V_{OS}	TCV_{OS}	S-Package		0.2	0.6		0.3	2.0	µV/°C
							0.3		
Input Offset Current	I_{OS}			60	250		80	750	pA
Average Temperature Coefficient of I_{OS}	TCI_{OS}			0.4	2.5		0.6	7.5	pA/°C
Input Bias Current	I_B			±60	±250		±80	±750	pA
Average Temperature Coefficient of I_B	TCI_B			0.4	2.5		0.6	7.5	pA/°C
Large Signal Voltage Gain	A_{VO}	V_O = 10 V; R_L = 2 kΩ	200	1000		150	1000		V/mV
Common-Mode Rejection	CMR	V_{CM} = ±13.5 V	108	128		108	128		dB
Power Supply Rejection	PSR	V_S = ±2.5 V to ±20 V	108	126		108	128		dB
Input Voltage Range*	IVR		±13.5	±14.0		±13.5	±14.0		V
Output Voltage Swing	V_O	R_L = 10 kΩ	±13	±14		±13	±14		V
Slew Rate	SR		0.05	0.15		0.05	0.15		V/µs
Supply Current	I_{SY}			400	800		400	800	µA
Supply Voltage	V_S	Operating Range	±2.5	±15	±20	±2.5	±15	±20	V

*Guaranteed by CMR test.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS[1]

Supply Voltage . . . . . ±20 V
Input Voltage[2] . . . . . ±20 V
Differential Input Voltage[3] . . . . . ±1 V
Differential Input Current[3] . . . . . ±10 mA
Output Short-Circuit Duration . . . . . Indefinite
Operating Temperature Range
OP97E, OP97F (P, S) . . . . . –40°C to +85°C
Storage Temperature Range . . . . . –65°C to +150°C
Junction Temperature Range . . . . . –65°C to +150°C
Lead Temperature (Soldering, 60 sec) . . . . . 300°C

Package Type	θ_{JA}[4]	θ_{JC}	Unit
8-Lead PDIP (P)	103	43	°C/W
8-Lead SOIC (S)	158	43	°C/W

NOTES
[1]Absolute maximum ratings apply to both DICE and packaged parts, unless otherwise noted.
[2]For supply voltages less than ±20 V, the absolute maximum input voltage is equal to the supply voltage.
[3]The OP97's inputs are protected by back-to-back diodes. Current-limiting resistors are not used in order to achieve low noise. Differential input voltages greater than 1 V will cause excessive current to flow through the input protection diodes unless limiting resistance is used.
[4]θ_{JA} is specified for worst-case mounting conditions, i.e., θ_{JA} is specified for device in socket for PDIP package; θ_{JA} is specified for device soldered to printed circuit board for SOIC package.

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option*
OP97EP	–40°C to +85°C	8-Lead PDIP	N-8
OP97FP	–40°C to +85°C	8-Lead PDIP	N-8
OP97FS	–40°C to +85°C	8-Lead SOIC	R-8
OP97FS-REEL	–40°C to +85°C	8-Lead SOIC	R-8
OP97FS-REEL7	–40°C to +85°C	8-Lead SOIC	R-8

*For outline information, see Package Information section.

CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the OP97 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.