Next Generation OP07, Ultralow Offset Voltage Operational Amplifier

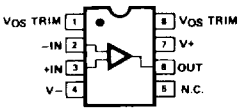
OP77

FEATURES

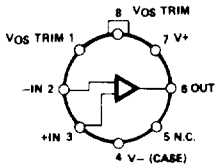
Outstanding Gain Linearity
Ultrahigh Gain: 5000 V/mV min
Low V_{OS} Over Temperature: 60 μV max
Excellent TCV_{OS}: 0.3 μV/°C max
High PSRR: 3 μV/V max
Low Power Consumption: 60 mW max
Fits OP07, 725, 108A/308A, 741 Sockets
Available in Die Form

PIN CONFIGURATIONS

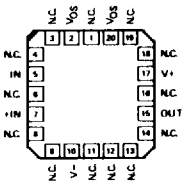
Epoxy Mini-DIP
(P Suffix)
8-Pin Hermetic DIP
(Z Suffix)
8-Pin SO
(S Suffix)



TO-99 (J Suffix)



OP77BRC/883 LCC
(RC Suffix)



NC = NO CONNECT

GENERAL DESCRIPTION

The OP77 significantly advances the state-of-the-art in precision op amps. The OP77's outstanding gain of 10,000,000 or more is maintained over the full ±10 V output range. This exceptional gain-linearity eliminates incorrectable system nonlinearities common in previous monolithic op amps, and provides superior performance in high closed-loop-gain applications. Low initial V_{OS} drift and rapid stabilization time, combined with only 50 mW power consumption, are significant improvements over previous designs. These characteristics, plus the exceptional TCV_{OS} of 0.3 μV/°C maximum and the low V_{OS} of 25 μV maximum, eliminates the need for V_{OS} adjustment and increases system accuracy over temperature.

PSRR of 3 μV/V (110 dB) and CMRR of 1.0 μV/V maximum virtually eliminate errors caused by power supply drifts and common-mode signals. This combination of outstanding characteristics makes the OP77 ideally suited for high-resolution instrumentation and other tight error budget systems.

This product is available in six standard grades and five standard packages: the TO-99 can, the 8-pin mini-DIP in ceramic, SO or epoxy, and the 20-contact LCC.

The OP77 is a direct or upgrade replacement for the OP07, 05, 725, or 108A op amps. 741-types can be replaced by eliminating the V_{OS} adjust pot. For higher precision performance refer to OP177.

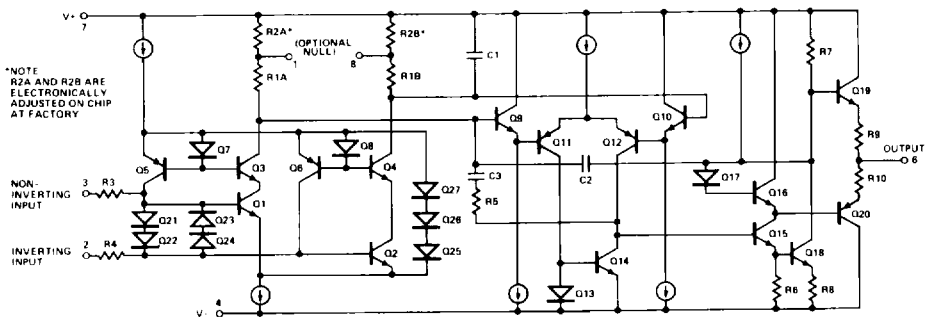


Figure 1. Simplified Schematic

OP77–SPECIFICATIONS

ELECTRICAL CHARACTERISTICS (@ V_S = ±15 V, T_A = +25°C, unless otherwise noted.)

Parameter	Symbol	Conditions	OP77A Min	OP77A Typ	OP77A Max	OP77B Min	OP77B Typ	OP77B Max	Units
Input Offset Voltage	V_{OS}			10	25		20	60	μV
Long-Term Input Offset Voltage Stability	$\Delta V_{OS}/Time$	(Note 1)		0.2			0.2		μV/Mo
Input Offset Current	I_{OS}			0.3	1.5		0.3	2.8	nA
Input Bias Current	I_B		0.2	1.2	2.0	0.2	1.2	2.8	nA
Input Noise Voltage	e_n p-p	0.1 Hz to 10 Hz[2]		0.35	0.6		0.35	0.6	μV p-p
		f_O = 10 Hz[2]		10.3	18.0		10.3	18.0	μV p-p
Input Noise Voltage Density	e_n	f_O = 100 Hz[2]		10.0	13.0		10.0	13.0	V/√Hz
		f_O = 1000 Hz[2]		9.6	11.0		9.6	11.0	V/√Hz
Input Noise Current	i_n p-p	0.1 Hz to 10 Hz[2]		14	30		14	30	pA p-p
		f_O = 10 Hz[2]		0.32	0.80		0.32	0.80	pA p-p
Input Noise Current Density	i_n	f_O = 100 Hz[2]		0.14	0.23		0.14	0.23	pA/√Hz
		f_O = 1000 Hz[2]		0.12	0.17		0.12	0.17	pA/√Hz
Input Resistance Differential-Mode	R_{IN}	(Note 3)	26	15		18.5	45		MΩ
Input Resistance-Common-Mode	R_{INCM}			200			200		GΩ
Input Voltage Range	IVR		±13	±14		±13	±14		V
Common Mode Rejection Ratio	CMRR	V_{CM} = ±13 V		0.1	1.0		0.1	1.0	μV/V
Power Supply Rejection Ratio	PSRR	V_S = ±3 V to ±18 V		0.7	3		0.7	3	μV/V
Large-Signal Voltage Gain	A_{VO}	R_L ≥ 2 kΩ, VO = ±10 V	5000	12000		2000	8000		V/mV
Output Voltage Swing	V_O	R_L ≥ 10 kΩ	±13.5	±14.0		±13.5	±14.0		V
		R_L ≥ 2 kΩ	±12.5	±13.0		±12.5	±13.0		V
		R_L ≥ 1 kΩ	±12.0	±12.5		±12.0	±12.5		V
Slew Rate	SR	R_L ≥ 2 kΩ[2]	0.1	0.3		0.1	0.3		V/μs
Closed-Loop Bandwidth	BW	A_{VCL} = +1[2]	0.4	0.6		0.4	0.6		MHz
Open-Loop Output Resistance	R_O			60			60		Ω
Power Consumption	P_d	V_S = ±15 V, No Load		50	60		50	60	mW
		V_S = ±3 V, No Load		3.5	4.5		3.5	4.5	mW
Offset Adjustment Range		R_P = 20 kΩ		±3			±3		mV

NOTES
[1]Long-Term Input Offset Voltage Stability refers to the averaged trend line of V_{OS} vs. time over extended periods after the first 30 days of operation. Excluding the initial hour of operation, changes in V_{OS} during the first 30 operating days are typically 2.5 μV.
[2]Sample tested.
[3]Guaranteed by design.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS[1]

Supply Voltage ..... ±22 V
Differential Input Voltage ..... ±30 V
Input Voltage[2] ..... ±22 V
Output Short-Circuit Duration ..... Indefinite
Storage Temperature Range
J, Z, and RC Packages ..... 65°C to +150°C
P Package ..... 65°C to +125°C
Operating Temperature Range
OP77A, OP77B (J, Z, RC) ..... 55°C to +125°C
OP77E, OP77F (J, Z) ..... 25°C to +85°C
OP77E, OP77F, OP77G (P, S) ..... 0°C to +70°C
OP77H (P, S) ..... –40°C to +85°C
Junction Temperature (T_J) ..... 65°C to +150°C
Lead Temperature (Soldering, 60 sec) ..... +300°C

Package Type	θ_{JA}[3]	θ_{JC}	Units
TO-99 (J)	150	18	°C/W
8-Pin Hermetic DIP (Z)	148	16	°C/W
8-Pin Plastic DIP (P)	103	43	°C/W
20-Contact LCC (RC, TC)	98	38	°C/W
8-Pin SO (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 ±22 V, the absolute maximum input voltage is equal to the supply voltage.
[3]θ_{JA} is specified for worst case mounting conditions, i.e., θ_{JA} is specified for device in socket for TO, cerdip, P DIP, and LCC packages; θ_{JA} is specified for device soldered to printed circuit board for SO package.

ORDERING GUIDE[1]

Model	Temperature Range	Package Option[2]
OP77AJ[3]	55°C to +125°C	TO-99
OP77AZ[3]	-55°C to +125°C	8-Pin Cerdip
OP77EJ	25°C to +85°C	TO-99
OP77EZ	25°C to +85°C	8-Pin Cerdip
OP77EP	0°C to +70°C	8-Pin Plastic DIP
OP77BJ	-55°C to +125°C	TO-99
OP77BRC/883C	-55°C to +125°C	20-Contact LCC
OP77FJ	-25°C to +85°C	TO-99
OP77FZ	-25°C to +85°C	8-Pin Cerdip
OP77FP	0°C to +70°C	8-Pin Plastic DIP
OP77GP	0°C to +70°C	8-Pin Plastic DIP
OP77GS[4]	0°C to +70°C	8-Pin SO
OP77GS-REEL	0°C to +70°C	8-Pin SO
OP77GS-REEL7[4]	0°C to +70°C	8-Pin SO
OP77HS[4]	-40°C to +85°C	8-Pin SO
OP77HS-REEL	-40°C to +85°C	8-Pin SO
OP77HS-REEL7[4]	-40°C to +85°C	8-Pin SO

NOTES
[1]Burn-in is available on commercial and industrial temperature range parts in Cerdip, Plastic DIP, and TO-can packages.
[2]For outline information see Package Information section.
[3]For devices processed in total compliance to MIL-STD-883, add /883 after part number. Consult factory for 883 data sheet.
[4]For availability and burn-in information on SO and PLCC packages, contact your local sales office.