# Ultralow Offset Voltage Operational Amplifier

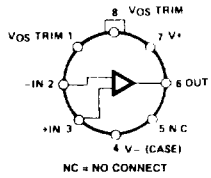
# OP07

**FEATURES**

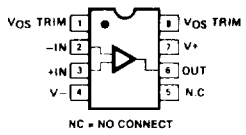
- Low $V_{OS}$: 25 μV max
- Low $V_{OS}$ Drift: 0.6 μV/°C max
- Ultra-Stable vs Time: 1.0 μV/Month max
- Low Noise: 0.6 μV p-p max
- Wide Input Voltage Range: ±14 V
- Wide Supply Voltage Range: ±3 V to ±18 V
- Fits 725, 108A/308A, 741, AD510 Sockets
- 125°C Temperature-Tested Dice
- Available in Die Form

**PIN CONNECTIONS**

**TO-99 (J Suffix)**




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




## GENERAL DESCRIPTION

The OP07 has very low input offset voltage (25 μV max for OP07A) which is obtained by trimming at the wafer stage. These low offset voltages generally eliminate any need for external nulling. The OP07 also features low input bias current (±2 nA for OP07A) and high open-loop gain (300 V/mV for OP07A). The low offsets and high open-loop gain make the OP07 particularly useful for high-gain instrumentation applications.

The wide input voltage range of ±13 V minimum combined with high CMRR of 110 dB (OP07A) and high input impedance provides high accuracy in the noninverting circuit configuration. Excellent linearity and gain accuracy can be maintained even at high closed-loop gains.

Stability of offsets and gain with time or variations in temperature is excellent. The accuracy and stability of the OP07, even at high gain, combined with the freedom from external nulling have made the OP07 a new industry standard for instrumentation and military applications.

The OP07 is available in five standard performance grades. The OP07A and the OP07 are specified for operation over the full military range of −55°C to +125°C; the OP07E is specified for operation over the 0°C to +70°C range, and OP07C and D over the −40°C to +85°C temperature range.

The OP07 is available in hermetically-sealed TO-99 metal can or ceramic 8-pin mini-DIP, and in epoxy 8-pin mini-DIP. It is a direct replacement for 725, 108A, and OP05 amplifiers; 741-types may be directly replaced by removing the 741's nulling potentiometer. The OP207, a dual OP07, is available for applications requiring close matching of two OP07 amplifiers. For improved specifications, see the OP77/OP177.

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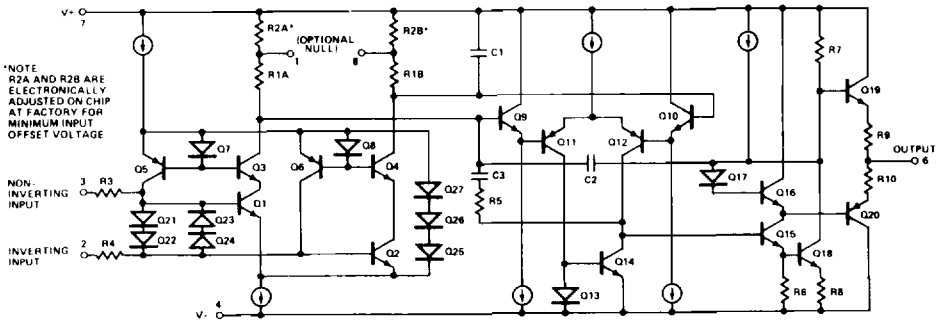


*Figure 1. Simplified Schematic*

# OP07–SPECIFICATIONS

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

| Parameter | Symbol | Conditions | OP07A Min | OP07A Typ | OP07A Max | OP07 Min | OP07 Typ | OP07 Max | Units |
|---|---|---|---|---|---|---|---|---|---|
| Input Offset Voltage | $V_{OS}$ | (Note 1) | | 10 | 25 | | 30 | 75 | µV |
| Long-Term Input Offset Voltage Stability | $\Delta V_{OS}$/Time | (Note 2) | | 0.2 | 1.0 | | 0.2 | 1.0 | µV/Month |
| Input Offset Current | $I_{OS}$ | | | 0.3 | 2.0 | | 0.4 | 2.8 | nA |
| Input Bias Current | $I_B$ | | | ±0.7 | ±2.0 | | ±1.0 | ±3.0 | nA |
| Input Noise Voltage | $e_{np-p}$ | 0.1 Hz to 10 Hz[3] | | 0.35 | 0.6 | | 0.35 | 0.6 | µV p-p |
| Input Noise Voltage Density | $e_n$ | $f_O$ = 10 Hz[3] | | 10.3 | 18.0 | | 10.3 | 18.0 | nV/√Hz |
| | | $f_O$ = 100 Hz[3] | | 10.0 | 13.0 | | 10.0 | 13.0 | nV/√Hz |
| | | $f_O$ = 1000 Hz[3] | | 9.6 | 11.0 | | 9.6 | 11.0 | nV/√Hz |
| Input Noise Current | $i_{np-p}$ | 0.1 Hz to 10 Hz[3] | | 14 | 30 | | 14 | 30 | pA p-p |
| Input Noise Current Density | $i_n$ | $f_O$ = 10 Hz[3] | | 0.32 | 0.80 | | 0.32 | 0.80 | pA/√Hz |
| | | $f_O$ = 100 Hz[3] | | 0.14 | 0.23 | | 0.14 | 0.23 | pA/√Hz |
| | | $f_O$ = 1000 Hz[3] | | 0.12 | 0.17 | | 0.12 | 0.17 | pA/√Hz |
| Input Resistance Differential-Mode | $R_{IN}$ | (Note 4) | 30 | 80 | | 20 | 60 | | 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 | 110 | 126 | | 110 | 126 | | dB |
| Power Supply Rejection Ratio | PSRR | $V_S$ = ±3 V to ±18 V | | 4 | 10 | | 4 | 10 | µV/V |
| Large-Signal Voltage Gain | $A_{VO}$ | $R_L$ ≥ 2 kΩ, $V_O$ = ±10 V | 300 | 500 | | 200 | 500 | | V/mV |
| | | $R_L$ ≥ 500 Ω, $V_O$ = ±0.5 V, $V_S$ = ±3 V[4] | 150 | 400 | | 150 | 400 | | V/mV |
| Output Voltage Swing | $V_O$ | $R_L$ ≥ 10 kΩ | ±12.5 | ±13.0 | | ±12.5 | ±13.0 | | V |
| | | $R_L$ ≥ 2 kΩ | ±12.0 | ±12.8 | | ±12.0 | ±12.8 | | V |
| | | $R_L$ ≥ 1 kΩ | ±10.5 | ±12.0 | | ±10.5 | ±12.0 | | V |
| Slew Rate | SR | $R_L$ ≥ 2 kΩ[3] | 0.1 | 0.3 | | 0.1 | 0.3 | | V/µs |
| Closed-Loop Bandwidth | BW | $A_{VCL}$ = +1[3] | 0.4 | 0.6 | | 0.4 | 0.6 | | MHz |
| Open-Loop Output Resistance | $R_O$ | $V_O$ = 0, $I_O$ = 0 | | 60 | | | 60 | | Ω |
| Power Consumption | $P_d$ | $V_S$ = ±15 V, No Load | | 75 | 120 | | 75 | 120 | mW |
| | | $V_S$ = ±3 V, No Load | | 4 | 6 | | 4 | 6 | mW |
| Offset Adjustment Range | | $R_P$ = 20 kΩ | | ±4 | | | ±4 | | mV |

NOTES
[1]OP07A grade $V_{OS}$ is measured approximately one minute after application of power. For all other grades $V_{OS}$ is measured approximately 0.5 seconds after application of power.
[2]Long-term input offset voltage stability refers to the averaged trend line of $V_{OS}$ vs. time over expended 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 µs – refer to typical performance curves. Parameter is sample tested.
[3]Sample tested.
[4]Guaranteed by design.

Specifications subject to change without notice.

### ORDERING GUIDE[1]

| Model | $V_{OS}$ max ($T_A$ = +25°C) | Temperature Range | Package Option[2] |
|---|---|---|---|
| OP07AJ/883C | 25 µV | 55°C to +125°C | TO-99 |
| OP07AZ[3] | 25 µV | 55°C to +125°C | 8-Pin Cerdip |
| OP07EJ | 75 µV | 25°C to +85°C | TO-99 |
| OP07EZ | 75 µV | 25°C to +85°C | 8-Pin Cerdip |
| OP07EP | 75 µV | 25°C to +85°C | 8-Pin Plastic DIP |
| OP07J/883C | 75 µV | 55°C to +125°C | TO-99 |
| OP07Z[3] | 75 µV | 55°C to +125°C | 8-Pin Cerdip |
| OP07CJ | 150 µV | 40°C to +85°C | TO-99 |
| OP07CZ | 150 µV | 40°C to +85°C | 8-Pin Cerdip |
| OP07CP | 150 µV | -40°C to +85°C | 8-Pin Plastic DIP |
| OP07CS | 150 µV | -40°C to +85°C | 8-Pin SO |
| OP07CS-REEL | 150 µV | 40°C to +85°C | 8-Pin SO |
| OP07CS-REEL7[4] | 150 µV | -40°C to +85°C | 8-Pin SO |
| OP07DJ | 150 µV | 40°C to +85°C | TO-99 |
| OP07DZ | 150 µV | 40°C to +85°C | 8-Pin Cerdip |
| OP07DP | 150 µV | 40°C to +85°C | 8-Pin Plastic DIP |

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 packages, contact your local sales office.

### 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 and Z Packages ..... 65°C to +150°C
P Package ..... 65°C to +125°C
Operating Temperature Range
OP07A, OP07 ..... -55°C to +125°C
OP07E ..... 0°C to +70°C
OP07C, OP07D ..... 40°C to +85°C
Lead Temperature (Soldering, 60 sec) ..... +300°C
Junction Temperature ($T_J$) ..... +150°C

| Package Type | $\theta_{JA}$[3] | $\theta_{JC}$ | 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 |
| 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]$\theta_{JA}$ is specified for worst case mounting conditions, i.e., $\theta_{JA}$ is specified for device in socket for TO, cerdip, P-DIP, and LCC packages; $\theta_{JA}$ is specified for device soldered to printed circuit board for SO package.