



**1.0 SCOPE**

This specification covers the detail requirements for an ultra-low-offset voltage operational amplifier.

It is highly recommended that this data sheet be used as a baseline for new military or aerospace spec control drawings.

**1.2 Part Number.** The complete part numbers per Table I of this specification follow:

| <u>Device</u> | <u>Part Number</u> | <u>Package</u> |
|---------------|--------------------|----------------|
| A             | OP-77AJ/883        | J              |
| B             | OP-77BJ/883        | J              |
| A             | OP-77AZ/883        | Z              |
| B             | OP-77BZ/883        | Z              |
| B             | OP-77BRC/883       | RC             |

**1.2.3 Case Outline.**

| <u>Letter</u> | <u>Case Outline (Lead finish per MIL-M-38510)</u> |
|---------------|---|
| J             | 8-lead metal can (TO-99)                          |
| Z             | 8-lead ceramic dual-in-line package (CERDIP)      |
| RC            | 20-contact hermetic leadless chip carrier (LCC)   |

**1.3 Absolute Maximum Ratings.** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

|  |   |
|--|---|
| Supply Voltage.....                            | $\pm 22\text{V}$                            |
| Internal Power Dissipation.....                | 500mW                                       |
| Differential Input Voltage.....                | $\pm 30\text{V}$                            |
| Input Voltage (Note 1).....                    | $\pm 22\text{V}$                            |
| Output Short-Circuit Duration.....             | Indefinite                                  |
| Storage Temperature Range.....                 | $-65^\circ\text{C}$ to $+150^\circ\text{C}$ |
| Lead Temperature (Soldering, 60 sec).....      | $+300^\circ\text{C}$                        |
| Operating Temperature Range.....               | $-55^\circ\text{C}$ to $+125^\circ\text{C}$ |
| DICE Junction Temperature Range ( $T_J$ )..... | $-65^\circ\text{C}$ to $+150^\circ\text{C}$ |

**NOTES:**

1. For supply voltages less than  $\pm 22\text{V}$ , the absolute maximum input voltage is equal to the supply voltages.

## Thermal Characteristics:

Thermal Resistance, TO-99 (J) package:

Junction-to-Case ( $\theta_{JC}$ ) = 45°C/W MAX

Junction-to-Ambient ( $\theta_{JA}$ ) = 150°C/W MAX

Thermal Resistance, CERDIP (Z) package:

Junction-to-Case ( $\theta_{JC}$ ) = 26°C/W MAX

Junction-to-Ambient ( $\theta_{JA}$ ) = 119°C/W MAX

Thermal Resistance, LCC (RC) package:

Junction-to-Case ( $\theta_{JC}$ ) = 35°C/W MAX

Junction-to-Ambient ( $\theta_{JA}$ ) = 110°C/W MAX

**TABLE 1**

$V_S = \pm 15V$ ;  $R_S = 50\Omega$ ;  $V_{CM} = 0V$ ;  $T_A = 25^\circ C$  unless otherwise specified.

| Characteristics              | Symbol     | Special Conditions                       | OP-77/883  |      |            |      | Units            |
|------------------------------|------------|--|------------|------|------------|------|------------------|
|                              |            |  | LIMITS A   |      | LIMITS B   |      |                  |
|                              |            |  | Min        | Max  | Min        | Max  |                  |
| Input Offset Voltage         | $V_{OS}$   |  | --         | 25   | --         | 60   | $\mu V$          |
|                              |            | $-55^\circ C \leq T_A \leq +125^\circ C$ | --         | 60   | --         | 120  | $\mu V$          |
| Average Offset Voltage Drift | $TCV_{OS}$ | $-55^\circ C \leq T_A \leq +125^\circ C$ | --         | 0.3  | --         | 0.6  | $\mu V/^\circ C$ |
| Input Offset Current         | $I_{OS}$   |  | --         | 1.5  | --         | 2.8  | nA               |
|                              |            | $-55^\circ C \leq T_A \leq +125^\circ C$ | --         | 2.2  | --         | 4.5  | nA               |
| Input Bias Current           | $I_B$      |  | -0.2       | 2.0  | -0.2       | 2.8  | nA               |
|                              |            | $-55^\circ C \leq T_A \leq +125^\circ C$ | -0.2       | 4.0  | -0.2       | 6.0  | nA               |
| Output Voltage Swing         | $V_O$      | $R_L \geq 10k\Omega$                     | $\pm 13.5$ | --   | $\pm 13.5$ | --   | V                |
|                              |            | $R_L \geq 2k\Omega$                      | $\pm 12.5$ | --   | $\pm 12.5$ | --   | V                |
|                              |            | $R_L \geq 1k\Omega$                      | $\pm 12.0$ | --   | $\pm 12.0$ | --   | V                |
|                              |            | $R_L \geq 2k\Omega$                      | $\pm 12.0$ | --   | $\pm 12.0$ | --   | V                |
|                              |            | $-55^\circ C \leq T_A \leq +125^\circ C$ |            |      |            |      |                  |
| Supply Current               | $I_{SY}$   | No Load                                  | --         | 2.0  | --         | 2.0  | mA               |
|                              |            | No Load, $V_S = \pm 3V$                  | --         | 0.75 | --         | 0.75 | mA               |
| Power Dissipation            | $P_d$      | No Load                                  | --         | 60   | --         | 60   | mW               |
|                              |            | No Load                                  | --         | 75   | --         | 75   | mW               |
|                              |            | $-55^\circ C \leq T_A \leq +125^\circ C$ |            |      |            |      |                  |
|                              |            | No Load, $V_S = \pm 3V$                  | --         | 4.5  | --         | 4.5  | mW               |
| Slew Rate                    | SR         | $R_L \geq 2k\Omega, C_L = 50pF$          | 0.1        | --   | 0.1        | --   | $V/\mu s$        |
| Common-Mode Rejection        | CMR        | $V_{CM} = I_{VR} = \pm 13V$              | 120        | --   | 116        | --   | dB               |
|                              |            | $V_{CM} = I_{VR} = \pm 13V$              | 120        | --   | 110        | --   | dB               |
|                              |            | $-55^\circ C \leq T_A \leq +125^\circ C$ |            |      |            |      |                  |
| Input Voltage Range (Note 1) | IVR        |  | $\pm 13$   | --   | $\pm 13$   | --   | V                |
|                              |            | $-55^\circ C \leq T_A \leq +125^\circ C$ | $\pm 13$   | --   | $\pm 13$   | --   | V                |

12 OPERATIONAL AMPLIFIERS

**TABLE 1 (Continued)**

$V_S = \pm 15V$ ;  $R_S = 50\Omega$ ;  $V_{CM} = 0V$ ;  $T_A = 25^\circ C$  unless otherwise specified.

| Characteristics                     | Symbol                       | Special Conditions   | OP-77/883 |     |          |     | Units      |
|-------------------------------------|------------------------------|--|-----------|-----|----------|-----|------------|
|                                     |                              |  | LIMITS A  |     | LIMITS B |     |            |
|                                     |                              |  | Min       | Max | Min      | Max |            |
| <b>Power Supply Rejection Ratio</b> | PSRR                         | $V_S = \pm 3V$ to $\pm 18V$<br>$V_S = \pm 3V$ to $\pm 18V$<br>$-55^\circ C \leq T_A \leq +125^\circ C$                     | --        | 3   | --       | 3   | $\mu V/V$  |
| <b>Input Noise Voltage (Note 2)</b> | $e_n$                        | $f_O = 1Hz$ to $100Hz$   | --        | 150 | --       | 150 | $nV_{RMS}$ |
| <b>Input Noise Current (Note 2)</b> | $i_n$                        | $f_O = 1Hz$ to $100Hz$   | --        | 8   | --       | 8   | $pA_{RMS}$ |
| <b>Open-Loop Voltage Gain</b>       | $A_{VO}$                     | $R_L \geq 2k\Omega$ , $V_O = \pm 10V$<br>$R_L \geq 2k\Omega$ , $V_O = \pm 10V$<br>$-55^\circ C \leq T_A \leq +125^\circ C$ | 5000      | --  | 2000     | --  | $V/mV$     |
| <b>Small-Signal Bandwidth</b>       | BW                           | $A_{VCL} = +1$   | 0.4       | --  | 0.4      | --  | MHz        |
| <b>Input Offset Adjustment</b>      | $V_{OSadj+}$<br>$V_{OSadj-}$ | $R_p = 20k\Omega$<br>$R_p = 20k\Omega$   | 0.5       | --  | 0.5      | --  | mV         |
| <b>Output Short Circuit</b>         | $I_{SC}^+$<br>$I_{SC}^-$     |  | --        | 65  | --       | 65  | mA         |
|                                     |                              |  | -65       | --  | -65      | --  | mA         |

**NOTES:**

1. IVR is defined as the  $V_{CM}$  range used for the CMR test.
2. This parameter is 100% tested.

**TABLE 2**

**OP-77/883**

**Electrical Test Requirements  
For Class B Devices**

| MIL-STD-883<br>Test Requirements               | Subgroups (see Table 3) |
|--|-------------------------|
| Interim Electrical<br>Parameters (pre Burn-In) | 1                       |
| Final Electrical Test<br>Parameters            | 1*, 2, 3, 4, 5, 6       |
| Group A Test Requirements                      | 1, 2, 3, 4, 5, 6, 7, 8  |

\* PDA applies to Subgroup 1 only.  
No other Subgroups are included in PDA.  
 $V_{OS}$  is excluded from PDA calculation.

**TABLE 3**

**Group A Inspection**

$V_S = \pm 15V$ ;  $R_S = 50\Omega$ ;  $V_{CM} = 0V$ ;  $T_A = T_J$  unless otherwise specified.

| Subgroup                           | Symbol          | Special Conditions              | OP-77/883  |      |            |      | Units     |
|------------------------------------|-----------------|---------------------------------|------------|------|------------|------|-----------|
|                                    |                 |                                 | LIMITS A   |      | LIMITS B   |      |           |
|                                    |                 |                                 | Min        | Max  | Min        | Max  |           |
| Subgroup 1<br>$T_A = +25^\circ C$  | $I_{OS}$        |                                 | --         | 1.5  | --         | 2.8  | nA        |
|                                    | $I_B$           |                                 | -0.2       | 2.0  | -0.2       | 2.8  | nA        |
|                                    | CMR             | $V_{CM} = \pm 13V$              | 120        | --   | 116        | --   | dB        |
|                                    | PSRR            | $V_S = \pm 3V, \pm 18V$         | --         | 3.0  | --         | 3.0  | $\mu V/V$ |
|                                    | $A_{VO}$        | $R_L = 2k\Omega, V_O = \pm 10V$ | 5000       | --   | 2000       | --   | V/mV      |
|                                    | $V_O$           | $R_L = 10k\Omega$               | $\pm 13.5$ | --   | $\pm 13.5$ | --   | V         |
|                                    |                 | $R_L = 2k\Omega$                | $\pm 12.5$ | --   | $\pm 12.5$ | --   | V         |
|                                    |                 | $R_L = 1k\Omega$                | $\pm 12.0$ | --   | $\pm 12.0$ | --   | V         |
|                                    | $P_d$           | No Load                         | --         | 60   | --         | 60   | mW        |
|                                    |                 | No Load, $V_S = \pm 3V$         | --         | 4.5  | --         | 4.5  | mW        |
|                                    | $V_{OS}^{adj+}$ | $R_p = 20k\Omega$               | 0.5        | --   | 0.5        | --   | mV        |
|                                    | $V_{OS}^{adj-}$ | $R_p = 20k\Omega$               | --         | -0.5 | --         | -0.5 | mV        |
|                                    | $I_{SC}^+$      |                                 | --         | 65   | --         | 65   | mA        |
| $I_{SC}^-$                         |                 | -65                             | --         | -65  | --         | mA   |           |
| Subgroup 2<br>$T_A = +125^\circ C$ | $I_{OS}$        |                                 | --         | 2.2  | --         | 4.5  | nA        |
|                                    | $I_B$           |                                 | -0.2       | 4.0  | -0.2       | 6.0  | nA        |
|                                    | CMR             | $V_{CM} = \pm 13V$              | 120        | --   | 110        | --   | dB        |
|                                    | PSRR            | $V_S = \pm 3V, \pm 18V$         | --         | 3.0  | --         | 5.0  | $\mu V/V$ |
|                                    | $A_{VO}$        | $R_L = 2k\Omega, V_O = \pm 10V$ | 2000       | --   | 1000       | --   | V/mV      |
|                                    | $V_O$           | $R_L = 2k\Omega$                | $\pm 12$   | --   | $\pm 12$   | --   | V         |

**TABLE 3**

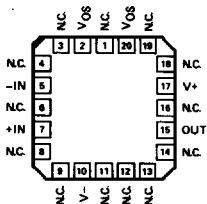
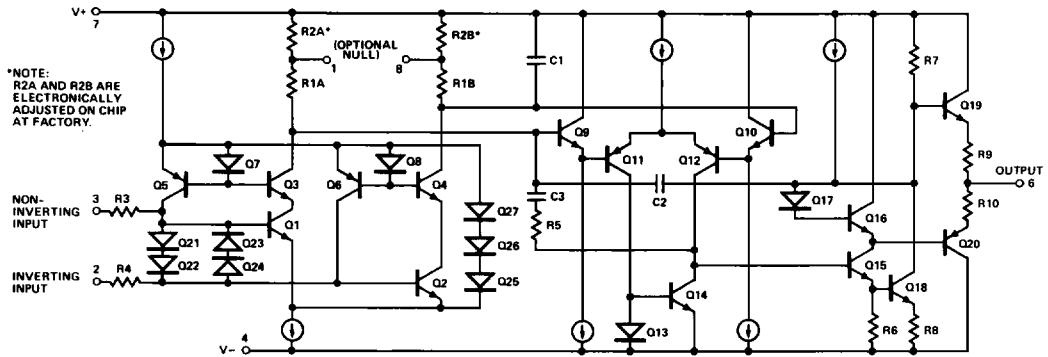
**Group A Inspection (Continued)**

$V_S = \pm 15V$ ;  $R_S = 50\Omega$ ;  $V_{CM} = 0V$ ;  $T_A = T_J$  unless otherwise specified.

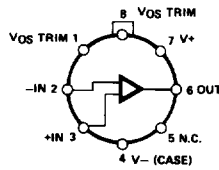
| Subgroup   | Symbol   | Special Conditions           | OP-77/883 |     |          |     | Units            |
|--|--|------------------------------|-----------|-----|----------|-----|------------------|
|  |  |                              | LIMITS A  |     | LIMITS B |     |                  |
|  |  |                              | Min       | Max | Min      | Max |                  |
| Subgroup 2<br>$T_A = +125^\circ$<br>(Continued)        | $P_d$  | No Load                      | --        | 75  | --       | 75  | mW               |
| Subgroup 3<br>$T_A = -55^\circ C$                      | All Tests, Limits and Conditions are the same as for Subgroup 2. |                              |           |     |          |     |                  |
| Subgroup 4<br>$T_A = +25^\circ C$                      | $V_{OS}$   |                              | --        | 25  | --       | 60  | $\mu V$          |
| Subgroup 5<br>$T_A = +125^\circ C$                     | $V_{OS}$   |                              | --        | 60  | --       | 120 | $\mu V$          |
| Subgroup 6<br>$T_A = -55^\circ C$                      | $V_{OS}$   |                              | --        | 60  | --       | 120 | $\mu V$          |
| Subgroup 7<br>$T_A = +25^\circ C$                      | BW   | $A_{VCL} = +1$               | 0.4       | --  | 0.4      | --  | MHz              |
|  | SR   | $R_L = 2k\Omega, C_L = 50pF$ | 0.1       | --  | 0.1      | --  | $V/\mu s$        |
| Subgroup 8<br>$-55^\circ C \leq T_A \leq +125^\circ C$ | $TCV_{OS}$   |                              | --        | 0.3 | --       | 0.6 | $\mu V/^\circ C$ |

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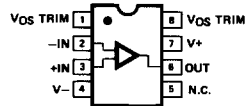
## 3.2.1 Simplified Schematic and Pin Connections.



**OP-77BRC/883**  
LCC  
(RC-Suffix)



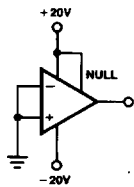
**TO-99**  
(J-Suffix)



**8-PIN HERMETIC DIP**  
(Z-Suffix)

**3.2.4 Microcircuit Group Assignment.** This microcircuit is covered by microcircuit group 61.

**4.2 Life Test/Burn-In Circuit.**



**J AND Z PACKAGES**