



**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)	I <sub>VR</sub>		$\pm 13$	--	$\pm 13$	--	V
		$-55^\circ C \leq T_A \leq +125^\circ C$	$\pm 13$	--	$\pm 13$	--	V

**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 $\pm 18V$ $V_S = \pm 3V$ to $\pm 18V$ $-55^\circ C \leq T_A \leq +125^\circ C$	--	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>	$A_{VO}$	$R_L \geq 2k\Omega$ , $V_O = \pm 10V$ $R_L \geq 2k\Omega$ , $V_O = \pm 10V$ $-55^\circ C \leq T_A \leq +125^\circ C$	5000	--	2000	--	$V/mV$
<b>Small-Signal Bandwidth</b>	BW	$A_{VCL} = +1$	0.4	--	0.4	--	MHz
<b>Input Offset Adjustment</b>	$V_{OSadj+}$ $V_{OSadj-}$	$R_p = 20k\Omega$ $R_p = 20k\Omega$	0.5	--	0.5	--	mV
<b>Output Short Circuit</b>	$I_{SC+}$ $I_{SC-}$		--	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 Test Requirements	Subgroups (see Table 3)
Interim Electrical Parameters (pre Burn-In)	1
Final Electrical Test 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 $T_A = +25^\circ C$	$I_{OS}$		--	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 $T_A = +125^\circ C$	$I_{OS}$		--	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**

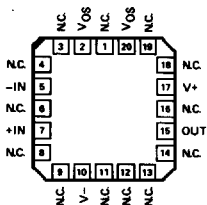
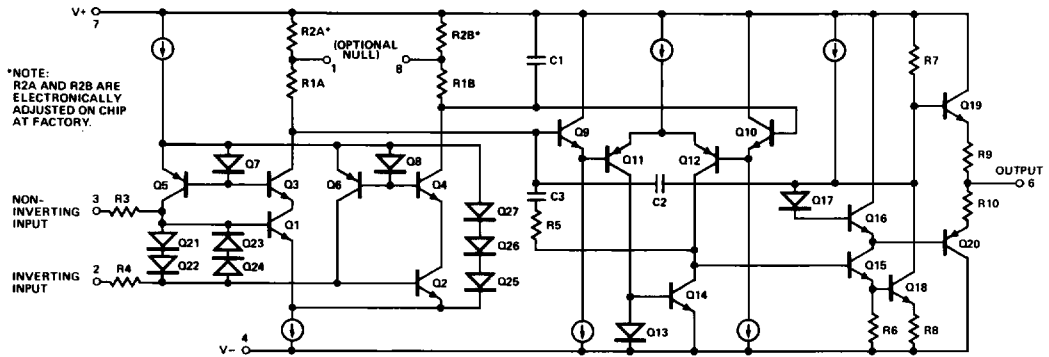
**Group A Inspection (Continued)**

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

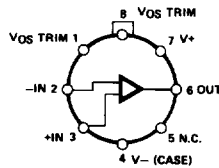
Subgroup	Symbol	Special Conditions	OP-77/883				Units
			LIMITS A		LIMITS B		
			Min	Max	Min	Max	
Subgroup 2 $T_A = +125^\circ$ (Continued)	$P_d$	No Load	--	75	--	75	mW
Subgroup 3 $T_A = -55^\circ C$	All Tests, Limits and Conditions are the same as for Subgroup 2.						
Subgroup 4 $T_A = +25^\circ C$	$V_{OS}$		--	25	--	60	$\mu V$
Subgroup 5 $T_A = +125^\circ C$	$V_{OS}$		--	60	--	120	$\mu V$
Subgroup 6 $T_A = -55^\circ C$	$V_{OS}$		--	60	--	120	$\mu V$
Subgroup 7 $T_A = +25^\circ C$	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 $-55^\circ C \leq T_A \leq +125^\circ C$	$TCV_{OS}$		--	0.3	--	0.6	$\mu V/^\circ C$

# OP-77

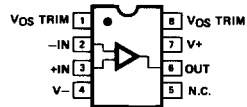
## 3.2.1 Simplified Schematic and Pin Connections.



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



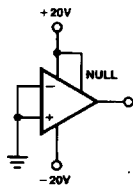
**TO-99**  
(J-Suffix)



**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**