



Ultra-Precision Operational Amplifier

ANALOG DEVICES INC 65E D OP-177

1.1 Scope. This specification covers the detail requirements for an ultra-precision 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 1 of this specification follow:

Device	Part Number	Package
A	OP-177AZ/883	Z
B	OP-177BZ/883	Z
B	OP-177BRC/883	RC

1.2.3 Case Outline.

Letter	Case Outline (Lead finish per MIL-M-38510)
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	-65°C to $+150^\circ\text{C}$
Lead Temperature (soldering, 60 sec)	$+300^\circ\text{C}$
Operating Temperature Range	-55°C to $+125^\circ\text{C}$
DICE Junction Temperature (T_J)	$+150^\circ\text{C}$

NOTES:

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

1.5 Thermal Characteristics:

Thermal Resistance, CERDIP (Z) package:

Junction-to-Case (Θ_{JC}) = 26°C/W MAX
 Junction-to-Ambient (Θ_{JA}) = 119°C/W MAX

Thermal Resistance, LCC (RC) package:

Junction-to-Case (Θ_{JC}) = 35°C/W MAX
 Junction-to-Ambient (Θ_{JA}) = 110°C/W MAX

12 OPERATIONAL AMPLIFIERS

TABLE 1

$V_S = +15V$; $R_S = 500\Omega$; $T_A = +25^\circ C$ unless otherwise specified.

Characteristic	Symbol	Special Conditions	OP-177/883				Units
			LIMITS A		LIMITS B		
			Min	Max	Min	Max	
Input Offset Voltage	V_{OS}	$-55^\circ C \leq T_A \leq +125^\circ C$	--	10	--	25	μV
			--	20	--	55	
Average Offset Voltage Drift	TCV_{OS}	$-55^\circ C \leq T_A \leq +125^\circ C$	--	0.1	--	0.3	$\mu V/^\circ C$
Input Offset Current	I_{OS}	$-55^\circ C \leq T_A \leq +125^\circ C$	--	1.0	--	1.5	nA
			--	1.5	--	2.0	
Input Bias Current	I_B	$-55^\circ C \leq T_A \leq +125^\circ C$	-0.2	1.5	-0.2	2.0	nA
			-0.2	4.0	-0.2	4.0	
Output Voltage Swing	V_O	$R_L \geq 10k\Omega$	± 13.5	--	± 13.5	--	V
		$R_L \geq 2k\Omega$	± 12.5	--	± 12.5	--	
		$R_L \geq 1k\Omega$	± 12.0	--	± 12.0	--	
		$R_L \geq 2k\Omega$	± 12.0	--	± 12.0	--	
Supply Current	I_{SY}	No Load	--	2.0	--	2.0	mA
		No Load, $V_S = \pm 3V$	--	0.75	--	0.75	
Power Dissipation	P_d	No Load	--	60	--	60	mW
		No Load	--	75	--	75	
		$-55^\circ C \leq T_A \leq +125^\circ C$ 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	--	$V/\mu s$

TABLE 1

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Characteristic	Symbol	Special Conditions	OP-177/883				Units
			LIMITS A		LIMITS B		
			Min	Max	Min	Max	
Common-Mode Rejection	CMR	$V_{CM} = I_{VR} = \pm 13V$	130	--	130	--	dB
		$V_{CM} = I_{VR} = \pm 13V$ $-55^\circ C \leq T_A \leq +125^\circ C$	120	--	120	--	
Input Voltage Range (Note 1)	IVR		± 13	--	± 13	--	V
		$-55^\circ C \leq T_A \leq +125^\circ C$	± 13	--	± 13	--	
Power Supply Rejection Ratio	PSRR	$V_S = \pm 3V$ to $\pm 18V$	120	--	115	--	dB
		$V_S = \pm 3V$ to $\pm 18V$ $-55^\circ C \leq T_A \leq +125^\circ C$	120	--	110	--	
Input Noise Voltage (Note 2)	e_n	$f_O = 1Hz$ to $100Hz$	--	150	--	150	nV_{RMS}
Input Noise Current (Note 2)	i_n	$f_O = 1Hz$ to $100Hz$	--	8	--	8	pA_{RMS}
Open Loop Voltage Gain	A_{VO}	$R_L \geq 2k\Omega$, $V_O = \pm 10V$	5000	--	5000	--	V/mV
		$R_L \geq 2k\Omega$, $V_O = \pm 10V$ $-55^\circ C \leq T_A \leq +125^\circ C$	2000	--	2000	--	
Small-Signal Bandwidth	BW	$A_{VCL} = +1$	0.4	--	0.4	--	MHz
Input Offset Adjustment	V_{OSadj+} V_{OSadj-}	$R_P = 20k\Omega$	0.5	--	0.5	--	mV
		$R_P = 20k\Omega$	--	-0.5	--	-0.5	

TABLE 1

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$V_S = +15V$; $R_S = 500\Omega$; $T_A = +25^\circ C$ unless otherwise specified.

Characteristic	Symbol	Special Conditions	OP-177/883				Units
			LIMITS A		LIMITS B		
			Min	Max	Min	Max	
Output Short Circuit	I_{SC}^+		--	65	--	65	mA
	I_{SC}^-		-65	--	-65	--	

NOTES:

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

TABLE 2

OP-177/883

**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.

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TABLE 3

Group A Inspection

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

Characteristic Symbol	Special Conditions	OP-177/883				Units	
		Limits A		Limits B			
		MIN	MAX	MIN	MAX		
Subgroup 1. $T_A = +25^\circ C$	I_{OS}	--	1.0	--	1.5	nA	
	I_B	-0.2	1.5	-0.2	2.0	nA	
	CMR	$V_{CM} = \pm 13V$	130	--	130	--	dB
	PSRR	$V_S = \pm 3V$ to $\pm 18V$	120	--	115	--	dB
	A_{VO}	$R_L = 2k\Omega$, $V_O = \pm 10V$	5000	--	5000	--	V/mV
	V_O	$R_L \geq 10k\Omega$	± 13.5	--	± 13.5	--	V
		$R_L \geq 2k\Omega$	± 12.5	--	± 12.5	--	
		$R_L \geq 1k\Omega$	± 12.0	--	± 12.0	--	
	P_d	No Load	--	60	--	60	mW
		No Load, $V_S = \pm 3V$	--	4.5	--	4.5	
	V_{OSadj+}	$R_p = 20k\Omega$	0.5	--	0.5	--	mV
	V_{OSadj-}	$R_p = 20k\Omega$	--	-0.5	--	-0.5	mV
	I_{SC}^+		--	65	--	65	mA
I_{SC}^-		-65	--	-65	--	mA	

TABLE 3

ANALOG DEVICES INC

Group A Inspection

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

Characteristic Symbol	Special Conditions	OP-177/883				Units
		Limits A		Limits B		
		MIN	MAX	MIN	MAX	
Subgroup 2. $T_A = +125^\circ C$						
I_{OS}		--	1.5	--	2.0	nA
I_B		-0.2	4.0	-0.2	4.0	nA
CMR	$V_{CM} = \pm 13V$	120	--	120	--	dB
PSRR	$V_S = \pm 3V$ to $\pm 18V$	120	--	110	--	dB
A_{VO}	$R_L \geq 2k\Omega$, $V_O = \pm 10V$	2000	--	2000	--	V/mV
V_O	$R_L \geq 2k\Omega$	± 12	--	± 12	--	V
P_d	No Load	--	75	--	75	mW
Subgroup 3. $T_A = -55^\circ C$	All Tests, Limits and Conditions are the same as Subgroup 2.					
Subgroup 4. $T_A = +25^\circ C$	V_{OS}	--	10	--	25	μV
Subgroup 5. $T_A = +125^\circ C$	V_{OS}	--	20	--	55	μV
Subgroup 6. $T_A = -55^\circ C$	V_{OS}	--	20	--	55	μV

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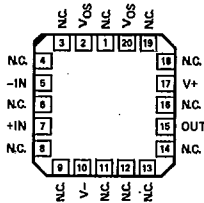
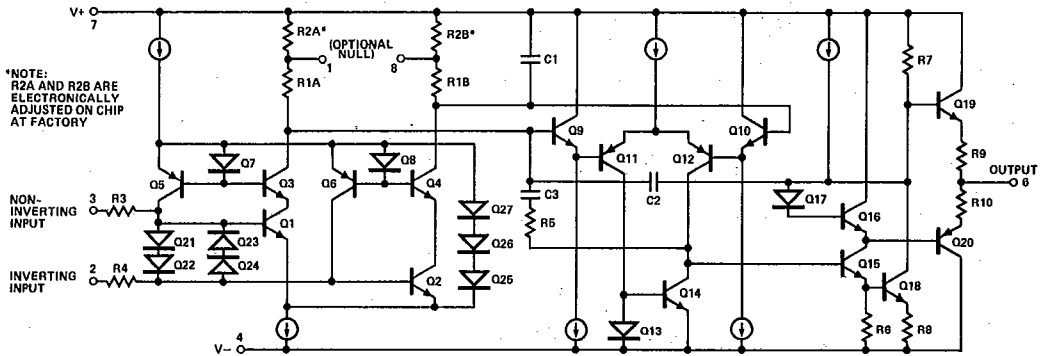
TABLE 3

Group A Inspection

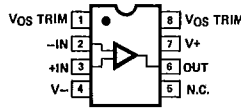
 $V_S = \pm 15V$; $R_S = 50\Omega$; $V_{CM} = 0V$; $T_A = T_J$ unless otherwise specified.

Characteristic Symbol	Special Conditions	OP-177/883				Units	
		Limits A		Limits B			
		MIN	MAX	MIN	MAX		
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/ μs
Subgroup 8. $-55^\circ C \leq T_A \leq +125^\circ C$	TCV_{OS}		--	0.1	--	0.3	$\mu V/^\circ C$

3.2.1 Simplified Schematic and Pin Connections



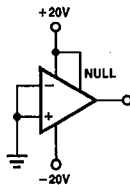
LCC
(RC-Suffix)



8-PIN
HERMETIC DIP
(Z-Suffix)

3.2.4 Microcircuit Group Assignment. This microcircuit is covered by microcircuit group 49.

4.2 Life Test/Burn-In Circuit



Z PACKAGE