ANALOG DEVICES

Dual Low-Power Operational Amplifier (Single or Dual Supply)

OP-221

1.0 SCOPE

This specification covers the detail requirements for a monolithic dual 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:

Device	Part Number	Package
A	OP-221AJ/883	J
A	OP-221AZ/883	Z

1.2.3 Case Outline.

Letter	Case Outline (Lead finish per MIL-M-38510)
J	8-lead metal can (TO-99)
Z	8-lead ceramic dual-in-line package (CERDIP)

1.3 Absolute Maximum Ratings. (T_A = 25°C, unless otherwise noted)

Supply Voltage ..... ±18V
Power Dissipation 500mW
Differential Input Voltage ..... Supply Voltage or ±30V
Input Voltage ..... Supply Voltage
Output Short-Circuit Duration ..... Indefinite
Operating Temperature Range ..... -55°C to +125°C
Storage Temperature Range ..... -65°C to +150°C
Lead Temperature (Soldering, 60 sec) ..... +300°C
DICE Junction Temperature Range (T_J) ..... -65°C to +150°C

1.5 Thermal Characteristics:

Thermal Resistance, TO-99 (J) package:
Junction-to-Case (Θ_{JC}) = 45°C/W MAX
Junction-to-Ambient (Θ_{JA}) = 150°C/W MAX

Thermal Resistance, CERDIP (Z) package:
Junction-to-Case (Θ_{JC}) = 26°C/W MAX
Junction-to Ambient (Θ_{JA}) = 119°C/W MAX

TABLE 1

V_S = ±15V; R_S = 50Ω; T_A = 25°C unless otherwise specified.

Characteristics	Symbol	Special Conditions	OP-221/883 LIMITS A Min	Max	Units
Input Offset Voltage	V_{OS}	V_S = ±2.5V to ±15V	–	150	μV
		V_S = ±2.5V to ±15V -55°C ≤ T_A ≤ +125°C	–	300	μV
Input Offset Current (Note 1)	I_{OS}	V_S = ±2.5V to ±15V	–	3.0	nA
		V_S = ±2.5V to ±15V -55°C ≤ T_A ≤ +125°C	–	5.0	nA
Input Bias Current (Note 1)	I_B	V_S = ±2.5V to ±15V	–	±80	nA
		V_S = ±2.5V to ±15V -55°C ≤ T_A ≤ +125°C	–	±100	nA
Large-Signal Voltage Gain	A_{VO}	V_O = ±10V, R_L ≥ 10kΩ	1500	–	V/mV
		V_O = ±10V, R_L ≥ 10kΩ -55°C ≤ T_A ≤ +125°C	1000	–	V/mV
Output Voltage Swing	V_O	R_L ≥ 10kΩ V+ = 5V, V- = 0V	0.7 to 4.1	–	V
		R_L ≥ 10kΩ V+ = 5V, V- = 0V -55°C ≤ T_A ≤ +125°C	0.8 to 3.8	–	V
		R_L ≥ 10kΩ	±13.8	–	V
		R_L ≥ 10kΩ -55°C ≤ T_A ≤ +125°C	±13.5	–	V
Supply Current (Both Amplifiers)	I_{SY}	V_S = ±2.5V, V_O = 0V	–	550	μA
		V_S = ±2.5V, V_O = 0V -55°C ≤ T_A ≤ +125°C	–	650	μA
		V_O = 0V	–	800	μA
		V_O = 0V -55°C ≤ T_A ≤ +125°C	–	900	μA

TABLE 1 (Continued)

V_S = ±15V; R_S = 50Ω; T_A = 25°C unless otherwise specified.

Characteristics	Symbol	Special Conditions	OP-221/883 LIMITS A Min	Max	Units
Power Dissipation (Both Amplifiers) (Note 2)	P_d	V_S = ±2.5V, V_O = 0V	–	2.75	mW
		V_S = ±2.5V, V_O = 0V -55°C ≤ T_A ≤ +125°C	–	3.25	mW
		V_O = 0V	–	24	mW
		V_O = 0V -55°C ≤ T_A ≤ +125°C	–	27	mW
Input Voltage Range (Note 3)	IVR	V+ = 5V, V- = 0V	0 to 3.5	–	V
		V+ = +5V, V- = 0V -55°C ≤ T_A ≤ +125°C	0 to 3.2	–	V
			-15 to 13.5	–	V
		-55°C ≤ T_A ≤ +125°C	-15 to 13.2	–	V
Common-Mode Rejection	CMR	V+ = 5V, V- = 0V V_{CM} = 0V to 3.5V	90	–	dB
		V+ = 5V, V- = 0V V_{CM} = 0V to 3.2V -55°C ≤ T_A ≤ +125°C	85	–	dB
		V_{CM} = -15V to 13.5V	95	–	dB
		V_{CM} = -15V to 13.2V -55°C ≤ T_A ≤ +125°C	90	–	dB
Power Supply Rejection Ratio	PSRR	V_S = ±2.5V to ±15V	–	10	µV/V
		V_S = ±2.5V to ±15V -55°C ≤ T_A ≤ +125°C	–	18	µV/V
		V- = 0V, V+ = 5V to 30V	–	18	µV/V
		V- = 0V, V+ = 5V to 30V -55°C ≤ T_A ≤ +125°C	–	32	µV/V

TABLE 1 (Continued)

V_S = ±15V; R_S = 50Ω; T_A = 25°C unless otherwise specified.

Characteristics	Symbol	Special Conditions	OP-221/883 LIMITS A Min	Max	Units
Input Offset Voltage Match	ΔV_{OS}		--	200	µV
		-55°C ≤ T_A ≤ +125°C	--	400	µV
Average Noninverting Bias Current	I_B^+		--	±80	nA
		-55°C ≤ T_A ≤ +125°C	--	±100	nA
Noninverting Input Offset Current	I_{OS}^+		--	±5.0	nA
		-55°C ≤ T_A ≤ +125°C	--	±7.0	nA
Common-Mode Rejection Match	ΔCMR	V_{CM} = -15V to 13.5V	92	--	dB
		V_{CM} = -15V to 13.2V, -55°C ≤ T_A ≤ +125°C	87	--	dB
Power Supply Rejection Ratio Match	ΔPSRR	V_S = ±2.5V to ±15V	--	14	µV/V
		V_S = ±2.5V to ±15V, -55°C ≤ T_A ≤ +125°C	--	26	µV/V

NOTES:
1. I_B and I_{OS} are measured at V_{CM} = 0V.
2. P_d is derived from I_{SY} by the relationship $P_d = V_S * I_{SY}$.
3. IVR is defined as the V_{CM} range used for the CMR test.

TABLE 2

OP-221/883

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

* PDA applies to Subgroup 1 only.
No other Subgroups are included in PDA.

TABLE 3

Group A Inspection

V_S = ±15V; R_S = 50Ω; T_A = T_J unless otherwise specified.

Subgroup	Symbol	Special Conditions	OP-221/883 LIMITS A Min	Max	Units
Subgroup 1	V_{OS}	V_S = ±2.5V, ±15V	–	150	μV
T_A = +25°C	I_{OS}	V_S = ±2.5V, ±15V; V_{CM} = 0V	–	3.0	nA
	I_B	V_S = ±2.5V, ±15V; V_{CM} = 0V	–	±80	nA
	CMR	V+ = 5V, V- = 0V V_{CM} = 0V, 3.5V	90	–	dB
		V_{CM} = -15V, 13.5V	95	–	dB
	PSRR	V_S = ±2.5V, ±15V	–	10	μV/V
		V+ = 5V, 30V; V- = 0V	–	18	μV/V
	I_{SY}	V_S = ±2.5V, V_O = 0V	–	550	μA
		V_O = 0V	–	800	μA
	ΔV_{OS}		–	200	μV
	I_B^+		–	±80	nA
	I_{OS}^+		–	±5.0	nA
	ΔCMR	V_{CM} = -15V, 13.5V	92	–	dB
	ΔPSRR	V_S = ±2.5V, ±15V	–	14	μV/V

TABLE 3

Group A Inspection (Continued)

V_S = ±15V; R_S = 50Ω; T_A = T_J unless otherwise specified.

Subgroup	Symbol	Special Conditions	OP-221/883 LIMITS A Min	Max	Units
Subgroup 2	V_{OS}	V_S = ±2.5V, ±15V	--	300	µV
T_A = +125°C	I_{OS}	V_S = ±2.5V, ±15V; V_{CM} = 0V	--	5.0	nA
	I_B	V_S = ±2.5V, ±15V; V_{CM} = 0V	--	±100	nA
	CMR	V+ = 5V, V- = 0V V_{CM} = 0V, 3.2V	85	--	dB
		V_{CM} = -15V, 13.2V	90	--	dB
	PSRR	V_S = ±2.5V, ±15V	--	18	µV/V
		V+ = 5V, 30V; V- = 0V	--	32	µV/V
	I_{SY}	V_S = ±2.5V, V_O = 0V	--	650	µA
		V_O = 0V	--	900	µA
	ΔV_{OS}		--	400	µV
	I_B^+		--	±100	nA
	I_{OS}^+		--	±7.0	nA
	ΔCMR	V_{CM} = -15V, 13.2V	87	--	dB
	ΔPSRR	V_S = ±2.5V, ±15V	--	26	µV/V
Subgroup 3 T_A = -55°C		All Tests, Limits and Conditions are the same as for Subgroup 2.			

TABLE 3

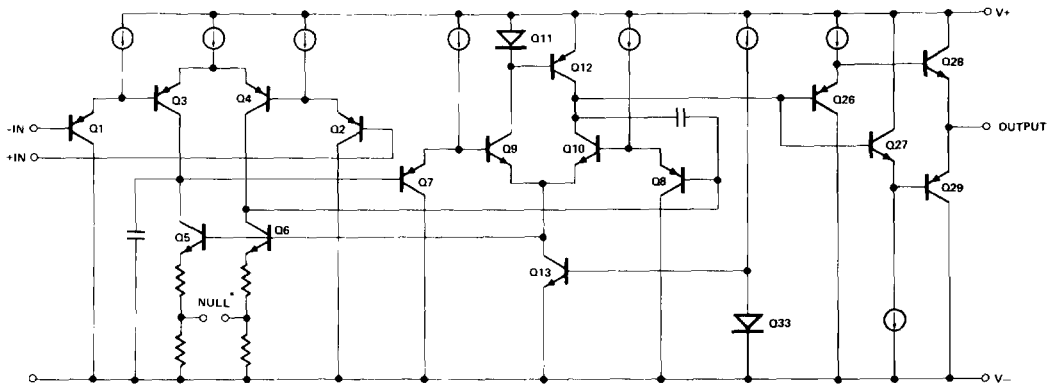
Group A Inspection (Continued)

V_S = ±15V; R_S = 50Ω; T_A = T_J unless otherwise specified.

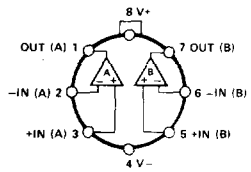
Subgroup	Symbol	Special Conditions	OP-221/883 LIMITS A Min	Max	Units
Subgroup 4		V+ = 5V, V- = 0V	0.7 to	--	V
	V_O	R_L = 10kΩ	4.1		
T_A = +25°C		R_L = 10kΩ	±13.8	--	V
	A_{VO}	V_O = ±10V, R_L = 10kΩ	1500	--	V/mV
Subgroup 5	V_O	V+ = 5V, V- = 0V	0.8 to	--	V
		R_L = 10kΩ	3.8		
T_A = +125°C		R_L = 10kΩ	±13.5	--	V
	A_{VO}	V_O = ±10V, R_L = 10kΩ	1000	--	V/mV
Subgroup 6 T_A = -55°C		All Tests, Limits and Conditions are the same as for Subgroup 5.			

3.2.1 Simplified Schematic and Pin Connections.

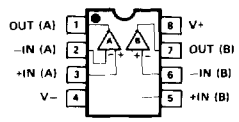
(Each Amplifier)



*ACCESSIBLE IN CHIP FORM ONLY



TO-99
(J-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.