



# Programmable Micropower Operational Amplifier

**OP22**

## 1.0 SCOPE

This specification documents the detail requirements for space qualified product manufactured on Analog Devices, Inc.'s QML certified line per MIL-PRF-38535 Level V except as modified herein.

The manufacturing flow described in the STANDARD SPACE LEVEL PRODUCTS PROGRAM brochure is to be considered a part of this specification. <http://www.analog.com/aerospace>

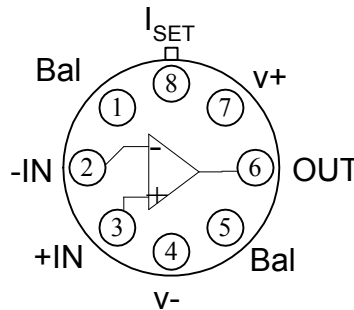
This data sheet specifically details the space grade version of this product. A more detailed operational description and a complete data sheet for commercial product grades can be found at [www.analog.com/OP22](http://www.analog.com/OP22)

## 2.0 Part Number. The complete part number(s) of this specification follow:

<u>Part Number</u>	<u>Description</u>
<b>OP22-903J</b>	Programmable Micropower Operational Amplifier

## 2.1 Case Outline.

<u>Letter</u>	<u>Descriptive designator</u>	<u>Case Outline (Lead Finish per MIL-PRF-38535)</u>
J	MACY1-X8	8-Lead metal can (TO)



**OP22 TO-99 (J)**

Figure 1 - Terminal connections.

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

Supply Voltage .....	$\pm 18\text{V}$
Power Dissipation .....	500mW
Differential Input Voltage .....	$\pm 30\text{V}$
Input Voltage .....	Supply Voltage
Operating Temperature Range .....	$-55^\circ\text{C}$ to $+125^\circ\text{C}$
Storage Temperature Range .....	$-65^\circ\text{C}$ to $+150^\circ\text{C}$
Lead Temperature (Soldering, 60 sec.) .....	$+300^\circ\text{C}$
Dice Junction Temperature ( $T_J$ ) .....	$-65^\circ\text{C}$ to $+150^\circ\text{C}$

**3.1 Thermal Characteristics:**

Thermal Resistance, TO-99 (J) Package  
 Junction-to-Case ( $\Theta_{JC}$ ) =  $45^\circ\text{C/W}$  Max  
 Junction-to-Ambient ( $\Theta_{JA}$ ) =  $150^\circ\text{C/W}$  Max

**4.0 Electrical Table:**

TABLE I						
Parameter See notes at end of table	Symbol	Conditions Note 1	Sub- group	Limit Min	Limit Max	Units
Input Offset Voltage	$V_{OS}$		1 2, 3		300 400	$\mu\text{V}$
Input Offset Current	$I_{OS}$		1 2, 3		1 1	nA
Input Bias Current	$I_B$	$I_{SET} = 1\mu\text{A}$	1, 2, 3		$\pm 5$	
		$I_{SET} = 10\mu\text{A}$	1, 2, 3		$\pm 30$	
Input Voltage Range (Note 2)	IVR		1 2, 3	-15 -15	13.5 13.2	V
		$V_- = 0\text{V}, V_+ = 5\text{V}$	1 2, 3	0 0	3.5 3.2	
Common-Mode Rejection	CMR		1 2, 3 2, 3	100 80 90		dB
		$I_{SET} = 1\mu\text{A}$				
		$I_{SET} = 10\mu\text{A}$				
Power Supply Rejection Ratio (Note 3) (No Load)	PSRR	$V_S = \pm 1.5\text{V}, \pm 15\text{V}$ Or $V_- = 0\text{V}, V_+ = 3\text{V}$ to $30\text{V}$	1 2, 3		6 10	$\mu\text{V/V}$
Output Voltage Swing	$V_O$	$V_S = \pm 1.5\text{V}, R_L = 100\text{K}\Omega,$ $I_{SET} = 1\mu\text{A}$	1 2, 3	$\pm 0.8$ $\pm 0.65$		V
		$V_S = \pm 1.5\text{V}, R_L = 10\text{K}\Omega,$ $I_{SET} = 10\mu\text{A}$	1 2, 3	$\pm 0.8$ $\pm 0.65$		
		$R_L = 100\text{K}\Omega, I_{SET} = 1\mu\text{A}$	1 2, 3	$\pm 14.0$ $\pm 13.6$		
		$R_L = 10\text{K}\Omega, I_{SET} = 10\mu\text{A}$	1 2, 3	$\pm 14.0$ $\pm 13.6$		
Large-Signal Voltage Gain	$A_{VO}$	$V_O = \pm 10\text{V}, R_L = 100\text{K}\Omega,$ $I_{SET} = 1\mu\text{A}$	1 2, 3	1000 200		V/mV
		$V_O = \pm 10\text{V}, R_L = 10\text{K}\Omega,$ $I_{SET} = 10\mu\text{A}$	1 2, 3	1000 500		

Parameter See notes at end of table	Symbol	Conditions Note 1	Sub-group	Limit Min	Limit Max	Units
Supply Current	I <sub>SY</sub>	V <sub>S</sub> = ±1.5V, I <sub>SET</sub> = 1µA	1 2, 3		12.5 14	µA
		I <sub>SET</sub> = 1µA	1 2, 3		17 18	
		V <sub>S</sub> = ±1.5V, I <sub>SET</sub> = 10µA	1 2, 3		125 140	
		I <sub>SET</sub> = 10µA	1 2, 3		170 180	

NOTES:

- 1 V<sub>S</sub> = ±15V, R<sub>S</sub> = 50Ω, V<sub>CM</sub> = 0V, I<sub>SET</sub> = 1µA or 10µA, Unless otherwise specified.
- 2 IVR is defined as the V<sub>CM</sub> range used for the CMR test.
- 3 V<sub>CM</sub> = 1.5V for Single Supply Test

4.1 Electrical Test Requirements:

Table II	
Test Requirements	Subgroups (in accordance with MIL-PRF-38535, Table III)
Interim Electrical Parameters	1
Final Electrical Parameters	1, 2, 3, 4, 5, 6 <u>1/</u> <u>2/</u>
Group A Test Requirements	1, 2, 3, 4, 5, 6
Group C end-point electrical parameters	1 <u>2/</u>
Group D end-point electrical parameters	1
Group E end-point electrical parameters	1

- 1/ PDA applies to Subgroup 1. Delta's excluded from PDA.
- 2/ See Table III for delta parameters. See table I for conditions.

**4.2 Table III. Burn-in test delta limits.**

Table III				
TEST TITLE	BURN-IN ENDPOINT	LIFETEST ENDPOINT	DELTA LIMIT	UNITS
V <sub>OS</sub> <u>1/</u>	300	375	±75	μV
I <sub>B</sub> <u>1/</u>	5	6.5	1.5	nA
I <sub>B</sub> <u>2/</u>	30	36	6.0	nA

1/ I<sub>SET</sub> = 1μA      2/ I<sub>SET</sub> = 10μA

**5.0 Life Test/Burn-In Circuit:**

- 5.1 HTRB is not applicable for this drawing.
- 5.2 Burn-in is per MIL-STD-883 Method 1015 test condition B.
- 5.3 Steady state life test is per MIL-STD-883 Method 1005.

Rev	Description of Change	Date
A	Initiate	July 24, 2000
B	Update web address	Feb. 18, 2002
C	Update web address. Add note 1 to VOS on Table III. Delete BI circuits.	May 29, 2003
D	Update package offering.	Oct. 10, 2007
E	Update header/footer & add to 1.0 scope description.	Feb. 15, 2008