Very Low-Noise Quad Operational Amplifier

OP470

1.0 SCOPE

This specification documents the detailed requirements for Analog Devices space qualified die including die qualification as described for Class K in MIL-PRF-38534, Appendix C, Table C-II except as modified herein.

The manufacturing flow described in the STANDARD DIE PRODUCTS PROGRAM brochure at http://www.analog.com/marketSolutions/militaryAerospace/pdf/Die_Broc.pdf is to be considered a part of this specification.

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/OP470

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

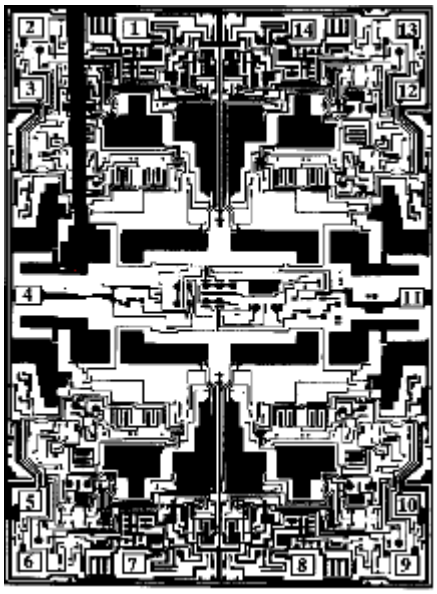
Part Number	Description
OP470-000C	Very Low-Noise Quad Operational Amplifier
OP470R000C	Radiation Tested Very Low-Noise Quad Operational Amplifier

3.0 Die Information

3.1 Die Dimensions

Die Size	Die Thickness	Bond Pad Metalization
106 mil x 163 mil	19 mil ± 2 mil	Al/Cu

3.2 Die Picture



1. OUT A
2. -IN A
3. +IN A
4. $+V_{CC}$
5. +IN B
6. -IN B
7. OUT B
8. OUT C
9. -IN C
10. +IN C
11. $-V_{CC}$
12. +IN D
13. -IN D

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3.3 Absolute Maximum Ratings 1/

Supply Voltage (V_{CC})	±18V dc
Differential Input Voltage 2/	±1V dc
Differential Input Current 2/	±25mA
Input Voltage	Supply Voltage
Output Short Circuit Duration	Continuous
Storage Temperature Range	-65°C to +150°C
Ambient Operating Temperature Range	-55°C to +125°C
Junction Temperature (T_J)	+150°C

Absolute Maximum Ratings Notes:

1/ Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability.

2/ The inputs are protected by back-to-back diodes. Current limiting resistors are not used in order to achieve low noise performance. If the differential input voltage exceeds ±1V, the input current should be limited to ±25mA.

4.0 Die Qualification

In accordance with class-K version of MIL-PRF-38534, Appendix C, Table C-II, except as modified herein.

(a) Qual Sample Size and Qual Acceptance Criteria – 10/0

(b) Qual Sample Package – DIP

(c) Pre-screen electrical test over temperature performed post-assembly prior to die qualification.

Table I - Dice Electrical Characteristics

Parameter	Symbol	Conditions 1/	Limit Min	Limit Max	Units
Input Offset Voltage	V_{IO}			±0.4	mV
Input Offset Current	I_{IO}	V_{CM} = 0V		±10	nA
Input Bias Current	I_{IB}	V_{CM} = 0V		±25	nA
Large-Signal Voltage Gain	A_{VS}	V_O = ±10V, R_L = 10kΩ	1000		V/mV
		V_O = ±10V, R_L = 2kΩ	500		
Output Voltage Swing	V_{OP}	R_L = 2kΩ	±12		V
Supply Current 2/	I_S	No Load		11	mA
Input Voltage Range	IVR		±11		V
Common-Mode Rejection	CMR	V_{CM} = IVR	110		dB
Power Supply Rejection Ratio	PSRR	V_{CC} = ±4.5V to ±18V		1.8	μV/V

Table I Notes:

1/ V_{CC} = ±15V, R_S = 50Ω, and T_A = +25°C, unless otherwise specified.

2/ I_S limit equals the total of all amplifiers.

Table II - Electrical Characteristics for Qual Samples						
Parameter	**Symbol**	**Conditions 1/**	**Sub-groups**	**Limit Min**	**Limit Max**	**Units**
Input Offset Voltage	V_{IO}		1		±0.4	mV
			2, 3		±0.6	
		M, D, L. R 3/	1		±0.6	
Input Offset Current	I_{IO}	V_{CM} = 0V	1		±10	nA
			2, 3		±20	
		M, D, L. R 3/	1		±50	
Input Bias Current	I_{IB}	V_{CM} = 0V	1		±25	
			2, 3		±50	
		M, D, L. R 3/	1		±500	
Large-Signal Voltage Gain	A_{VS}	V_O = ±10V, R_L = 10kΩ	4	1000		V/mV
			5, 6	750		
		M, D, L. R 3/	4	100		
		V_O = ±10V, R_L = 2kΩ	4	500		
			5, 6	400		
Output Voltage Swing 4/	V_{OP}	R_L = 2kΩ	4, 5, 6	±12		V
Supply Current 2/	I_S	No Load	1, 2, 3		11	mA
		M, D, L. R 3/	1		11	
Slew Rate 4/	SR	A_{VCL} = ±21, R_L = 10kΩ	7	1.4		V/µs
Input Voltage Range 4/	IVR		1, 2, 3	±11		V
Common-Mode Rejection 4/	CMR	V_{CM} = IVR	1	110		dB
			2, 3	100		
Power Supply Rejection Ratio 4/	PSRR	V_{CC} = ±4.5V to ±18V	1		1.8	µV/V
			2, 3		5.6	

Table II Notes:

1/ V_{CC} = ±15V, R_S = 50Ω, unless otherwise specified.
2/ I_S limit equals the total for all amplifiers.
3/ Devices tested at 100Krad irradiation.
4/ Parameter not tested post irradiation.

Table III - Life Test Endpoint and Delta Parameter (Product is tested in accordance with Table II with the following exceptions)								
Parameter	Symbol	Sub-groups	Post Burn In Limit		Post Life Test Limit		Life Test Delta	Units
			Min	Max	Min	Max		
Input Offset Voltage	V_{IO}	1		±0.4		±0.5	0.1	mV
		2, 3		±0.6		±0.8		
Input Bias Current	I_{IB}	1		±25		±30	5	nA
		2, 3		±50		±60		
Input Offset Current	I_{IO}	1		±10		±20		nA
		2, 3		±20		±40		

5.0 Life Test/Burn-In Information

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

Rev	Description of Change	Date
A	Initiate	20-DEC-01
B	Update web address. Add radiation part number and limits.	17-APR-03
C	Corrected Die Pad Numbering	11-Apr-07
D	Update 1.0 Scope description.	8-Aug-07
E	Update header/footer & add to 1.0 Scope description.	Mar. 3, 2008
F	Add Junction Temperature (T_J)...+150°C to 3.3 Absolute Maximum Ratings	April 3, 2008
G	Updated Section 4.0c note to indicate pre-screen temp testing being performed	6-JUN-2009
H	Updated fonts and sizes to ADI standards	3-Oct-2011