



Quad Low-Offset, Low-Power Operational Amplifier

OP400

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/OP400

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

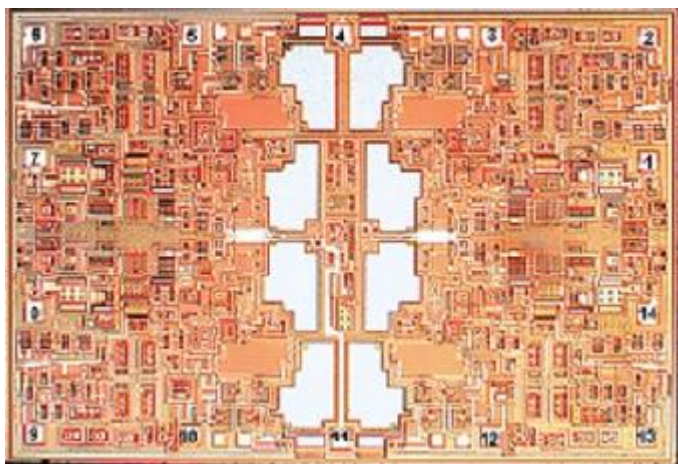
| <u>Part Number</u> | <u>Description</u> |
|--------------------|--|
| OP400-000C | Quad Low-Offset, Low-Power Operational Amplifier |

3.0 Die Information

3.1 Die Dimensions

| Die Size | Die Thickness | Bond Pad Metalization |
|-------------------|--------------------|-----------------------|
| 181 mil x 123 mil | 19 mil \pm 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
14. OUT D

ASD0012517

Rev. G

Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Specifications subject to change without notice. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices. Trademarks and registered trademarks are the property of their respective companies.

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700 www.analog.com
Fax: 781.326.8703 © 2011 Analog Devices, Inc. All rights reserved.

3.3 Absolute Maximum Ratings ^{1/}

| | |
|-------------------------------------|-----------------------------------|
| Supply Voltage (V_{CC})..... | $\pm 20V$ |
| Differential Input Voltage..... | $\pm 30V$ |
| Input Voltage..... | Supply Voltage |
| Output Short-Circuit Duration..... | Continuous |
| Storage Temperature Range | $-65^{\circ}C$ to $+150^{\circ}C$ |
| Junction Temperature (T_J)..... | $+150^{\circ}C$ |
| Operating Temperature Range..... | $-55^{\circ}C$ to $+125^{\circ}C$ |

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.

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} | | -150 | +150 | μV |
| Input Offset Current | I_{IO} | $V_{CM} = 0V$ | -1 | +1 | nA |
| Input Bias Current | $\pm I_{IB}$ | $V_{CM} = 0V$ | -3 | +3 | nA |
| Input Voltage Range | IVR | | ± 12 | | V |
| Common Mode Rejection Ratio | CMRR | $V_{CM} = IVR$ | 120 | | dB |
| Power Supply Rejection Ratio | PSRR | $V_S = \pm 3V$ to $\pm 18V$ | | 1.8 | $\mu V/V$ |
| Supply Current ^{2/} | I_{SY} | No Load | | 2.9 | mA |
| Large Signal Voltage Gain | A_{VS} | $V_{OUT} = \pm 10V, R_L = 2k\Omega$ | 1500 | | V/mV |
| Output Voltage Swing | V_{OP} | $R_L = 2k\Omega$ | ± 11 | | V |

Table I Notes:

- ^{1/} $V_S = \pm 15V, T_A = 25^{\circ}C$, unless otherwise specified.
- ^{2/} I_{SY} limit = total all four 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 | -150 | +150 | μV |
| | | | 2, 3 | -270 | +270 | |
| Input Offset Current | I_{IO} | $V_{CM} = 0V$ | 1 | -1 | +1 | nA |
| | | | 2, 3 | -2.5 | +2.5 | |
| Input Bias Current | $\pm I_{IB}$ | $V_{CM} = 0V$ | 1 | -3 | +3 | nA |
| | | | 2, 3 | -5 | +5 | |
| Input Voltage Range | IVR | | 1, 2, 3 | ± 12 | | V |
| Common Mode Rejection Ratio | CMRR | $V_{CM} = IVR$ | 1 | 120 | | dB |
| | | | 2, 3 | 115 | | |
| Power Supply Rejection Ratio | PSRR | $V_S = \pm 3V$ to $\pm 18V$ | 1 | | 1.8 | $\mu V/V$ |
| | | | 2, 3 | | 3.2 | |
| Supply Current 2/ | I_{SY} | No Load | 1 | | 2.9 | mA |
| | | | 2, 3 | | 3.1 | |
| Large Signal Voltage Gain | A_{VS} | $V_{OUT} = \pm 10V, R_L = 2k\Omega$ | 4 | 1500 | | V/mV |
| | | | 5, 6 | 1000 | | |
| Output Voltage Swing | $+V_{OP}$ | $R_L = 2k\Omega$ | 4, 5, 6 | ± 11 | | V |
| Average Input Offset Voltage Drift | TCV_{IO} | $-55^\circ C \leq T_A \leq +125^\circ C$ | 8 | | 1.2 | $\mu V/^\circ C$ |

Table II Notes:

1/ $V_S = \pm 15V$, unless otherwise specified.

2/ I_{SY} limit = total all four amplifiers.

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 Min | Post Burn In Limit Max | Post Life Test Limit Min | Post Life Test Limit Max | Life Test Delta | Units |
|----------------------|--------------|------------|------------------------|------------------------|--------------------------|--------------------------|-----------------|---------|
| Input Offset Voltage | V_{IO} | 1 | | ± 225 | | ± 300 | ± 75 | μV |
| | | 2, 3 | | | | ± 420 | | |
| Input Bias Current | $\pm I_{IB}$ | 1 | | ± 5 | | ± 7 | ± 2 | nA |
| | | 2, 3 | | | | ± 9 | | |
| Input Offset Current | I_{IO} | 1 | | ± 2 | | ± 2.5 | | nA |
| | | 2, 3 | | | | ± 4.5 | | |

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 | 08-JAN-02 |
| B | Update web address. Table III; add “post” to Burn-in and Life Test title. | 17-APR-03 |
| C | Update the 1.0 Scope Description. | 9-JUL-07 |
| D | Update header/footer & add to scope description. | 13-FEB-08 |
| E | Add Junction Temperature (T _J)...+150°C to 3.3 Absolute Max. Ratings | March 31, 2008 |
| F | Updated Section 4.0c note to indicate pre-screen temp testing being performed. | 5-JUN-2009 |
| G | Removed extra markings on die Topographic picture | 24-AUG-2011 |
| | | |
| | | |