**ANALOG DEVICES**

# High speed, low power, operational amplifier

# AD847

## 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/AD847

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

| Part Number | Description |
|---|---|
| **AD847-703Q** | High speed, low power, operational amplifier |
| **AD847-713Q** | Radiation Tested, High speed, low power, operational amplifier |

### 2.1  Case Outline.

| Letter | Descriptive designator | Case Outline (Lead Finish per MIL-PRF-38535) |
|---|---|---|
| Q | GDIP1-T8 | 8-Lead ceramic dual-in-line package (CERDIP) |
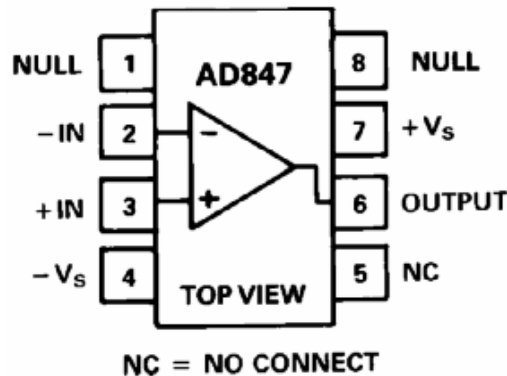


Figure 1 - Terminal connections.

**3.0** **Absolute Maximum Ratings**. ($T_A = 25°C$, unless otherwise noted)

Supply voltage ............................................................................................... $\pm18$ V

Differential input voltage ................................................................................ $\pm6$V

Input common mode voltage ............................................................................ $\pm V_S$

Operating temperature range............................................................... -55°C to +125°C

Storage temperature range ................................................................. -65°C to +150°C

Power dissipation ($P_D$) ...................................................................................... 1.1W

Lead temperature (soldering, 10 seconds) ........................................................ +300°C

Thermal resistance, junction-to-case ($\theta_{JC}$) ........................................... See MIL-STD-1835

Thermal resistance, junction-to-ambient ($\theta_{JA}$) ......................................... 110°C/W

Junction temperature ($T_J$) ......................................................................... +175°C

**4.0** **Electrical Table**: See notes at end of table

| | | | | | | |
|---|---|---|---|---|---|---|
| <div align="center">**Table I**</div> | | | | | | |
| Parameter | Symbol | Conditions 1/ | Sub-group | 2/ Min | 2/ Max | Units |
| Input offset voltage | $V_{IO}$ | | 1 | | $\pm1.0$ | mV |
| | | | 2, 3 | | $\pm4.0$ | |
| Input bias current | $I_B$ | $V_S = \pm5V, \pm15V$ | 1 | | 5.0 | $\mu$A |
| | | | 2, 3 | | 7.5 | |
| Input offset current | $I_{IO}$ | | 1 | | $\pm300$ | nA |
| | | | 2, 3 | | $\pm400$ | |
| Common mode input voltage range 3/ | IVR | | 1, 2, 3 | | $\pm2.5$ | V |
| | | $V_S = \pm15V$ | 1, 2, 3 | | $\pm12$ | |
| Open loop gain | AVO | $V_{OUT} = \pm2.5V, R_L = 500\Omega$ | 1 | 2.0 | | V/mV |
| | | | 2, 3 | 1.0 | | |
| | | $V_{OUT}=\pm10V, R_L=1k\Omega, V_S=\pm15V$ | 1 | 3.0 | | |
| | | | 2, 3 | 1.5 | | |
| Common mode rejection ratio | CMRR | $V_{CM} = \pm2.5V$ | 1 | 80 | | dB |
| | | $V_{CM} = \pm12V, V_S = \pm15V$ | 1 | 80 | | |
| | | | 2, 3 | 75 | | |
| Output current 4/ | $I_{OUT}$ | $V_{OUT} = \pm2.5V$ | 4 | 13 | | mA |
| | | $V_{OUT} = \pm10V, V_S = \pm15V$ | 4 | 20 | | |
| Output voltage swing | $+V_{OUT}$ | $R_L = 500\Omega$ | 1 | 3.0 | | V |
| | | | 2, 3 | 2.5 | | |
| | | $R_L = 150\Omega$ | 1 | 2.5 | | |
| | | $V_S = \pm15V, R_L = 1k\Omega$ | 1, 2, 3 | 12 | | |
| | | $V_S = \pm15V, R_L = 500\Omega$ | 1 | 10 | | |
| | $-V_{OUT}$ | $R_L = 500\Omega$ | 1 | -3.0 | | |
| | | | 2, 3 | -2.5 | | |
| | | $R_L = 150\Omega$ | 1 | -2.5 | | |
| | | $V_S = \pm15V, R_L = 1k\Omega$ | 1, 2, 3 | -12 | | |
| | | $V_S = \pm15V, R_L = 500\Omega$ | 1 | -10 | | |
| Quiescent power supply current | $I_{CC}$ | | 1 | | 5.7 | mA |
| | | | 2, 3 | | 7.8 | |
| | | $V_S = \pm15V$ | 1 | | 6.3 | |
| | | | 2, 3 | | 8.4 | |
| Power supply rejection ratio | PSRR | $V_S = \pm5V$ to $\pm15V$ | 1 | 75 | | dB |
| | | | 2, 3 | 72 | | |
| Differential input resistance 4/ | $R_{IN}$ | $V_S = \pm5V, \pm15V$ | 4 | 80 | | $k\Omega$ |

## Table I

| Parameter | Symbol | Conditions 1/ | Sub-group | 2/ Min | 2/ Max | Units |
|---|---|---|---|---|---|---|
| Slew rate 6/ 4/ | +SR | $V_{OUT}$ = -2.5V to +2.5V, $R_L$ = 500Ω, $A_V$ =1V/V, | 4 | 120 | | V/μS |
| | | Measured from 10% to 90% | 5, 6 | 90 | | |
| | -SR | $V_{OUT}$ = +2.5V to -2.5V, $R_L$ = 500Ω, $A_V$ =1V/V, | 4 | 90 | | |
| | | Measured from 10% to 90% | 5, 6 | 65 | | |
| | +SR | $V_{OUT}$ = -5V to +5V, $R_L$ = 1KΩ, $V_S$ = ±15V | 4 | 200 | | |
| | | Measured from 10% to 90% | 5, 6 | 130 | | |
| | -SR | $V_{OUT}$ = +5V to -5V, $R_L$ = 1KΩ, $V_S$ = ±15V | 4 | 145 | | |
| | | Measured from 10% to 90% | 5, 6 | 120 | | |
| Gain bandwidth product 4/ | GBWP | $V_{OUT}$ = ±100mV, $R_L$ - 500Ω | 4 | 25 | | MHz |
| | | $V_{OUT}$ = ±100mV, $R_L$ = 1KΩ, VS = ±15V | | 40 | | |
| Full power bandwidth 4/ | FPBW | $V_{PK}$ = 2.5V, $R_L$ = 500Ω | 4 | 5.7 | | |
| | | $V_{PK}$ = 10V, $R_L$ = 1KΩ, $V_S$ = ±15V | | 2.8 | | |
| Closed loop stable gain 4/ | CLSG | $R_L$ = 1KΩ, $V_S$ = ±5V, ±15V | 4, 5, 6 | 1.0 | | V/V |
| Rise time 4/ 8/ | $r_r$ | $V_{OUT}$ = 0V to +200mV, $A_V$ = +1, $R_L$ =- 1KΩ, $V_S$ = ±15V | 4, 5, 6 | | 10 | nS |
| | $t_f$ | $V_{OUT}$ = 0V to -200mV, $A_V$ = +1, $R_L$ =- 1KΩ, $V_S$ = ±15V | 4, 5, 6 | | 10 | |
| Settling time 4/ | $t_s$ | $A_V$ = -1V/V, 10V step at 0.1% of the fixed value, $R_L$ = 1KΩ | | | 150 | |
| | | $A_V$ = -1V/V, 10V step at 0.01% of the fixed value, $R_L$ = 1KΩ | | | 200 | |
| Overshoot 4/ | +OS | $V_{OUT}$ = 0V to +200mV, $A_V$ = +1, $R_L$ = 1KΩ, $V_S$ = ±15V | 4 | | 30 | % |
| | -OS | $V_{OUT}$ = 0V to -200mV, $A_V$ = +1, $R_L$ = 1KΩ, $V_S$ = ±15V | 4 | | 30 | |

TABLE I NOTES:

1/ Unless otherwise specified for dc tests, $V_S$ = ±5V, $R_S$ < 100Ω, $R_L$ > 100kΩ, $V_{OUT}$ = 0V, and $C_L$ ≤ 10pF. Unless otherwise specified for ac tests, $A_V$ = ±1 V/V, $R_L$ = 1kΩ, and $C_L$ = 10pF.

2/ The limiting terms "min" (minimum) and "max" (maximum) shall be considered to apply to magnitudes only. Negative current shall be defined as conventional current flow out of a device terminal.

3/ This parameter is guaranteed by CMRR test.

4/ If not tested, shall be guaranteed to the limits specified in table I herein.

5/ Quiescent power consumption is based on quiescent supply current test maximum (no load at the output).

6/ Slew rate test limits are guarantee after 5 minutes of warm-up.

7/ Full power bandwidth = $SR/(2\pi V_{PK})$.

8/ Rise and fall times measured between 10% and 90% point.

# AD847

## 4.1 Electrical Test Requirements:

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

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

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

<table>
<tr><th colspan="5">Table III</th></tr>
<tr><td>TEST TITLE</td><td>BURN-IN ENDPOINT</td><td>LIFETEST ENDPOINT</td><td>DELTA LIMIT</td><td>UNITS</td></tr>
<tr><td>$V_{OS}$</td><td>±1</td><td>±1.5</td><td>±0.5</td><td>mV</td></tr>
<tr><td>$\pm I_B$</td><td>5</td><td>7.5</td><td>2.5</td><td>μA</td></tr>
<tr><td>$I_{IO}$</td><td>±300</td><td>±500</td><td>±200</td><td>nA</td></tr>
</table>

## 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 20, 2000 |
| B | Update web address | Feb. 7, 2002 |
| C | Update web address. Delete Burn-In circuit. | June 20, 2003 |
| D | Update header/footer & add to 1.0 scope description. | Feb. 25, 2008 |
| | | |
| | | |
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