

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. <u>http://www.analog.com/aerospace</u>

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 NumberDescriptionAD847-703QHigh speed, low power, operational amplifierAD847-713QRadiation 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.

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Rev. D

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3.0	Absolute Maximum Ratings. ($T_A = 25^{\circ}C$, unless otherwise noted)					
	Supply voltage					
	Differential input voltage	±6V				
	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 (θ_{JC})	See MIL-STD-1835				
	Thermal resistance, junction-to-ambient (θ_{JA})					
	Junction temperature (T _J)					

4.0	Electrical	Table:	See notes at end of table
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Table I						
Parameter	Symbol	Conditions 1/	Sub-	2/	2/	Units
	5	_	group	Min	Max	
Input offset voltage	V _{IO}		1		±1.0	mV
			2, 3		±4.0	
Input bias current	IB	$V_{\rm S} = \pm 5 V, \ \pm 15 V$	1		5.0	μΑ
			2, 3		7.5	
Input offset current	I _{IO}		1		±300	nA
			2, 3		±400	
Common mode input voltage	IVR		1, 2, 3		±2.5	V
range <u>3/</u>		$V_{\rm S} = \pm 15 \rm V$	1, 2, 3		±12	
Open loop gain	AVO	$V_{OUT} = \pm 2.5 V, R_L = 500 \Omega$	1	2.0		V/mV
			2, 3	1.0		
		$V_{OUT}=\pm 10V, R_L=1k\Omega, V_S=\pm 15V$	1	3.0		
			2, 3	1.5		
Common mode rejection ratio	CMRR	$V_{CM} = \pm 2.5 V$	1	80		dB
		$V_{CM} = \pm 12V, V_{S} = \pm 15V$	1	80		
			2, 3	75		
Output current $4/$	I _{OUT}	$V_{OUT} = \pm 2.5 V$	4	13		mA
		$V_{OUT} = \pm 10V, V_S = \pm 15V$	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		
		$V_{\rm S} = \pm 15 V, R_{\rm L} = 1 k \Omega$	1, 2, 3	12		
		$V_{\rm S} = \pm 15 V, R_{\rm L} = 500 \Omega$	1	10		
	-V _{OUT}	$R_L = 500\Omega$	1	-3.0		
			2, 3	-2.5		
		$R_L = 150\Omega$	1	-2.5		
		$V_{\rm S} = \pm 15 V, R_{\rm L} = 1 k \Omega$	1, 2, 3	-12		
		$V_{\rm S} = \pm 15 V, R_{\rm L} = 500 \Omega$	1	-10		
Quiescent power supply current	I _{CC}		1		5.7	mA
			2, 3		7.8	
		$V_{\rm S} = \pm 15 V$	1		6.3	
			2, 3		8.4	
Power supply rejection ratio	PSRR	$V_{\rm S} = \pm 5V$ to $\pm 15V$	1	75		dB
			2, 3	72		
Differential input resistance $4/$	R _{IN}	$V_S = \pm 5V, \pm 15V$	4	80		kΩ

		Table I				
Parameter	Symbol	Conditions <u>1/</u>	Sub- group	<u>2/</u> Min	<u>2/</u> Max	Units
Slew rate <u>6/ 4/</u>	+SR	$V_{OUT} = -2.5V$ to $+2.5V$, $R_L = 500\Omega$, $A_V = 1V/V$,	4	120		V/µS
		Measured from 10% to 90%	5,6	90		
	-SR	$V_{OUT} = +2.5V \text{ to } -2.5V, R_L = 500\Omega, A_V = 1V/V,$	4	90		
		Measured from 10% to 90%	5,6	65		
	+SR	$V_{OUT} = -5V$ to $+5V$, $R_L = 1K\Omega$, $V_S = \pm 15V$	4	200		
		Measured from 10% to 90%	5,6	130		
	-SR	$V_{OUT} = +5V$ to $-5V$, $R_L = 1K\Omega$, $V_S = \pm 15V$	4	145		
		Measured from 10% to 90%	5,6	120		
Gain bandwidth product $4/$	GBWP	$V_{OUT} = \pm 100 \text{mV}, R_{L} - 500 \Omega$	4	25		MHz
		$V_{OUT} = \pm 100 \text{mV}, R_{L} = 1 \text{K}\Omega, \text{VS}$ $= \pm 15 \text{V}$		40		
Full power bandwidth <u>4/</u>	FPBW	$V_{PK} = 2.5 V, R_L = 500 \Omega$	4	5.7		
		$V_{PK} = 10V, R_L = 1K\Omega, V_S = \pm 15V$		2.8		
Closed loop stable gain $\frac{4}{}$	CLSG	$R_L = 1K\Omega, V_S = \pm 5V, \pm 15V$	4, 5, 6	1.0		V/V
Rise time <u>4/</u> <u>8/</u>	r _r	$V_{OUT} = 0V$ to +200mV, $A_V = +1$, $R_L = -1K\Omega$, $V_S = \pm 15V$	4, 5, 6		10	nS
	t _f	$V_{OUT} = 0V$ to -200 mV, $A_V = +1$, $R_L = -1K\Omega$, $V_S = \pm 15V$	4, 5, 6		10	
Settling time $4/$	t _s	$A_V = -1V/V$, 10V step at 0.1% of the fixed value, $R_I = 1K\Omega$			150	
		$A_V = -1V/V$, 10V step at 0.01% of the fixed value, $R_I = 1K\Omega$			200]
Overshoot <u>4/</u>	+OS	$V_{OUT} = 0V$ to +200mV, $A_V = +1$, $R_L = 1K\Omega$, $V_S = \pm 15V$	4		30	%
	-OS	$V_{OUT} = 0V$ to -200mV, $A_V = +1$, $R_I = 1K\Omega$, $V_S = \pm 15V$	4		30	

TABLE I NOTES:

- <u>1</u>/ Unless otherwise specified for dc tests, $V_S = \pm 5V$, $R_S < 100\Omega$, $R_L > 100k\Omega$, $V_{OUT} = 0V$, and $C_L \le 10pF$. Unless otherwise specified for ac tests, $A_V = \pm 1 V/V$, $R_L = 1k\Omega$, 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.
- <u>4/</u> 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).
- $\underline{6/}$ Slew rate test limits are guarantee after 5 minutes of warm-up.
- <u>7/</u> Full power bandwidth = SR/($2\pi V_{PK}$).
- <u>8/</u> Rise and fall times measured between 10% and 90% point.

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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				

<u>1/</u> 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	BURN-IN	LIFETEST	DELTA			
TITLE	ENDPOINT	ENDPOINT	LIMIT	UNITS		
V _{OS}	±1	±1.5	±0.5	mV		
$\pm I_B$	5	7.5	2.5	μΑ		
I _{IO}	±300	±500	± 200	nA		

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.

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Rev	Description of Change	Date
Α	Initiate	July 20, 2000
В	Update web address	Feb. 7, 2002
С	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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