HA-2500/883

Precision High Slew Rate Operational Amplifier

September 2004

Features

- **This Circuit is Processed in Accordance to MIL-STD-883 and is Fully Conformant Under the Provisions of Paragraph 1.2.1.**
- **High Slew Rate . . . . . .25V/μs (Min) 30V/μs (Typ)**
- **Wide Power Bandwidth . . . . . 350kHz (Min)**
- **High Input Impedance . . . . . 25MΩ (Min) 50MΩ (Typ)**
- **Low Offset Current . . . . . 25nA (Max) 10nA (Typ)**
- **Low Quiescent Current . . . . . 6mA (Max)**
- **Fast Settling Time (0.1% of 10V Step) . . . . 330ns (Typ)**
- **High Gain Bandwidth Product . . . . . 12MHz (Typ)**
- **Internally Compensated For Unity Gain Stability**

Applications

- **Data Acquisition Systems**
- **RF Amplifiers**
- **Video Amplifiers**
- **Signal Generators**
- **Pulse Amplification**

Description

HA-2500/883 is a monolithic operational amplifier which is optimized to deliver excellent slew rate, bandwidth, and settling time specifications. The outstanding dynamic features of this internally compensated device are complemented with low offset voltage and offset current.

This dielectrically isolated amplifier is ideally suited for applications such as data acquisition, RF, video, and pulse conditioning circuits. Guaranteed slew rates of ±25V/μs minimum make it an excellent component in fast, accurate data acquisition and pulse amplification designs. To insure compliance, all devices are 100% tested for AC performance characteristics over the full temperature limits.

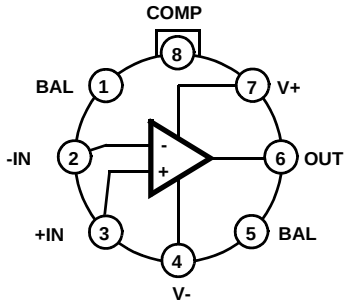
A typical 12MHz gain bandwidth product and 500kHz full power bandwidth make this device well suited to RF and video applications. With guaranteed offset voltages of 5mV plus external offset adjust flexibility and low offset current, this amplifier is particularly useful in signal conditioning designs.

Part Number Information

PART NUMBER	TEMP. RANGE (^{o}C)	PACKAGE	PKG. NO.
HA2-2500/883	-55 to 125	8 Pin Can	T8.C

Pinout

HA-2500/883
(METAL CAN)
TOP VIEW



Spec Number **511002-883**
FN3734.3

Absolute Maximum Ratings

Voltage Between V+ and V- Terminals 40V
Differential Input Voltage 15V
Voltage at Either Input Terminal . . . . . V+ to V-
Peak Output Current 50mA
ESD Rating . . . . . <2000V

Operating Conditions

Temperature Range . . . . . -55^oC to 125^oC
Supply Voltage . . . . . ±15V
$V_{INCM} \leq 1/2$ (V+ - V-)
$R_L \geq 2k\Omega$

Thermal Information

Thermal Resistance (Typical, Note 1)	θ_{JA}	θ_{JC}
Metal Can Package	$160^oC/W$	$75^oC/W$

Package Power Dissipation Limit at 75^oC for $T_J \leq 175^oC$
Metal Can Package 625mW
Package Power Dissipation Derating Factor Above 75^oC
Metal Can Package . . . . . $6.3mW/^oC$
Maximum Junction Temperature . . . . . 175^oC
Maximum Storage Temperature Range . . . . . -65^oC to 150^oC
Maximum Lead Temperature (Soldering 10s) . . . . . 300^oC

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

1. θ_{JA} is measured with the component mounted on a low effective thermal conductivity test board in free air. See Tech Brief TB379 for details.

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: $V_{SUPPLY} = \pm15V$, $R_{SOURCE} = 100\Omega$, $R_{LOAD} = 500k\Omega$, $V_{OUT} = 0V$, Unless Otherwise Specified.

PARAMETER	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMP (^oC)	MIN	MAX	UNITS
Input Offset Voltage	V_{IO}	$V_{CM} = 0V$	1	25	-5	5	mV
			2, 3	125, -55	-8	8	mV
Input Bias Current	$+I_B$	$V_{CM} = 0V$, $+R_S = 100k\Omega$, $-R_S = 100\Omega$	1	25	-200	200	nA
			2, 3	125, -55	-400	400	nA
	$-I_B$	$V_{CM} = 0V$, $+R_S = 100\Omega$, $-R_S = 100k\Omega$	1	25	-200	200	nA
			2, 3	125, -55	-400	400	nA
Input Offset Current	I_{IO}	$V_{CM} = 0V$, $+R_S = 100k\Omega$, $-R_S = 100k\Omega$	1	25	-25	25	nA
			2, 3	125, -55	-50	50	nA
Common Mode Range	+CMR	V+ = 5V, V- = -25V	1	25	+10	-	V
			2, 3	125, -55	+10	-	V
	-CMR	V+ = 25V, V- = -5V	1	25	-	-10	V
			2, 3	125, -55	-	-10	V
Large Signal Voltage Gain	$+A_{VOL}$	$V_{OUT} = 0V$ and $+10V$, $R_L = 2k\Omega$	4	25	20	-	kV/V
			5, 6	125, -55	15	-	kV/V
	$-A_{VOL}$	$V_{OUT} = 0V$ and $-10V$, $R_L = 2k\Omega$	4	25	20	-	kV/V
			5, 6	125, -55	15	-	kV/V
Common Mode Rejection Ratio	+CMRR	$\Delta V_{CM} = +10V$, V+ = +5V, V- = -25V, $V_{OUT} = -10V$	1	25	80	-	dB
			2, 3	125, -55	80	-	dB
	-CMRR	$\Delta V_{CM} = -10V$, V+ = +25V, V- = -5V, $V_{OUT} = +10V$	1	25	80	-	dB
			2, 3	125, -55	80	-	dB

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Tested at: V_{SUPPLY} = ±15V, R_{SOURCE} = 100Ω, R_{LOAD} = 500kΩ, V_{OUT} = 0V, Unless Otherwise Specified.

PARAMETER	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMP (^{o}C)	MIN	MAX	UNITS
Output Voltage Swing	$+V_{OUT}$	R_L = 2kΩ	4	25	10	-	V
			5, 6	125, -55	10	-	V
	$-V_{OUT}$	R_L = 2kΩ	4	25	-	-10	V
			5, 6	125, -55	-	-10	V
Output Current	$+I_{OUT}$	V_{OUT} = -10V	4	25	10	-	mA
			5, 6	125, -55	7.5	-	mA
	$-I_{OUT}$	V_{OUT} = +10V	4	25	-	-10	mA
			5, 6	125, -55	-	-7.5	mA
Quiescent Power Supply Current	$+I_{CC}$	V_{OUT} = 0V, I_{OUT} = 0mA	1	25	-	6	mA
			2, 3	125, -55	-	6.5	mA
	$-I_{CC}$	V_{OUT} = 0V, I_{OUT} = 0mA	1	25	-6	-	mA
			2, 3	125, -55	-6.5	-	mA
Power Supply Rejection Ratio	+PSRR	ΔV_{SUP} = 10V, V+ = +20V, V- = -15V, V+ = +10V, V- = -15V	1	25	80	-	dB
			2, 3	125, -55	80	-	dB
	-PSRR	ΔV_{SUP} = 10V, V+ = +15V, V- = -20V, V+ = +15V, V- = -10V	1	25	80	-	dB
			2, 3	125, -55	80	-	dB
Offset Voltage Adjustment	$+V_{IO}$Adj	Note 2	1	25	V_{IO}-1	-	mV
			2, 3	125, -55	V_{IO}-1	-	mV
	$-V_{IO}$Adj	Note 2	1	25	V_{IO}+1	-	mV
			2, 3	125, -55	V_{IO}+1	-	mV

NOTE:

2. Offset adjustment range is [V_{IO}(Measured) ±1mV] minimum referred to output. This test is for functionality only to assure adjustment through 0V.

TABLE 2. ECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: V_{SUPPLY} = ±15V, R_{SOURCE} = 50Ω, R_{LOAD} = 2kΩ, C_{LOAD} = 50pF, A_{VCL} = +1V/V, Unless Otherwise Specified.

PARAMETER	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMP (^{o}C)	MIN	MAX	UNITS
Slew Rate	+SR	V_{OUT} = -5V to +5V, 25% ≤ +SR ≤ 75%	7	25	25	-	V/µs
			8A, 8B	125, -55	20	-	V/µs
	-SR	V_{OUT} = +5V to -5V, 75% ≥ -SR ≥ 25%	7	25	25	-	V/µs
			8A, 8B	125, -55	20	-	V/µs

TABLE 2. ECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Tested at: V_{SUPPLY} = ±15V, R_{SOURCE} = 50Ω, R_{LOAD} = 2kΩ, C_{LOAD} = 50pF, A_{VCL} = +1V/V, Unless Otherwise Specified.

PARAMETER	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMP (^{o}C)	MIN	MAX	UNITS
Rise and Fall Time	t_r	V_{OUT} = 0 to +200mV, 10% ≤ t_r ≤ 90%	7	25	-	50	ns
			8A, 8B	125, -55	-	60	ns
	t_f	V_{OUT} = 0 to -200mV, 10% ≤ t_f ≤ 90%	7	25	-	50	ns
			8A, 8B	125, -55	-	60	ns
Overshoot	+OS	V_{OUT} = 0 to +200mV	7	25	-	40	%
			8A, 8B	125, -55	-	50	%
	-OS	V_{OUT} = 0 to -200mV	7	25	-	40	%
			8A, 8B	125, -55	-	50	%

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Characterized at: V_{SUPPLY} = ±15V, R_{LOAD} = 2kΩ, C_{LOAD} = 50pF, Unless Otherwise Specified.

PARAMETER	SYMBOL	CONDITIONS	NOTES	TEMP (^{o}C)	MIN	MAX	UNITS
Differential Input Resistance	R_{IN}	V_{CM} = 0V	3	25	25	-	MΩ
Full Power Bandwidth	FPBW	V_{PEAK} = 10V	3, 4	25	350	-	kHz
Minimum Closed Loop Stable Gain	CLSG	R_L = 2kΩ, C_L = 50pF	3	-55 to 125	1	-	V/V
Quiescent Power Consumption	PC	V_{OUT} = 0V, I_{OUT} = 0mA	3, 5	-55 to 125	-	195	mW

NOTES:

3. Parameters listed in Table 3 are controlled via design or process parameters and are not directly tested at final production. These parameters are lab characterized upon initial design release, or upon design changes. These parameters are guaranteed by characterization based upon data from multiple production runs which reflect lot to lot and within lot variation.
4. Full Power Bandwidth guarantee based on Slew Rate measurement using FPBW = Slew Rate/($2\pi V_{PEAK}$).
5. Quiescent Power Consumption based upon Quiescent Supply Current test maximum. (No load on outputs.)

TABLE 4. ELECTRICAL TEST REQUIREMENTS

MIL-STD-883 TEST REQUIREMENTS	SUBGROUPS (SEE TABLES 1 AND 2)
Interim Electrical Parameters (Pre Burn-In)	1
Final Electrical Test Parameters	1 (Note 6), 2, 3, 4, 5, 6, 7, 8A, 8B
Group A Test Requirements	1, 2, 3, 4, 5, 6, 7, 8A, 8B
Groups C and D Endpoints	1

NOTE:

6. PDA applies to Subgroup 1 only.

Die Characteristics

DIE DIMENSIONS:

57 x 65 x 19 milss
1450 x 1650 x 483μm

METALLIZATION:

Type: Al, 1% Cu
Thickness: 16kÅ ± 2kÅ

GLASSIVATION:

Type: Nitride (Si3N4) over Silox (SiO2, 5% Phos.)
Silox Thickness: 12kÅ ± 2kÅ
Nitride Thickness: 3.5kÅ ± 1.5kÅ

WORST CASE CURRENT DENSITY:

$0.3 \times 10^5 A/cm^2$

SUBSTRATE POTENTIAL (Powered Up):

Unbiased

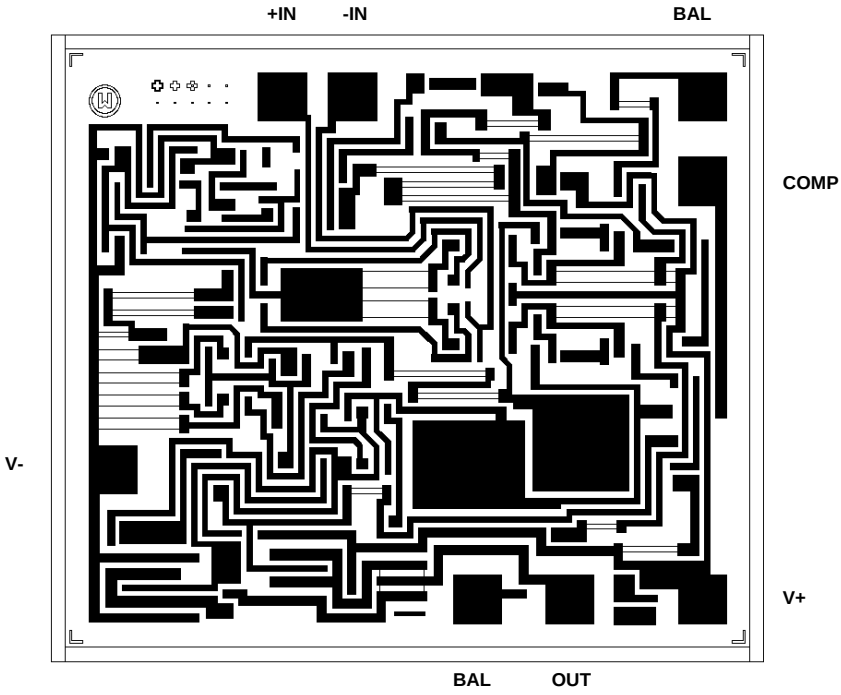
TRANSISTOR COUNT:

HA-2500/883: 40

PROCESS: Bipolar Dielectric Isolation

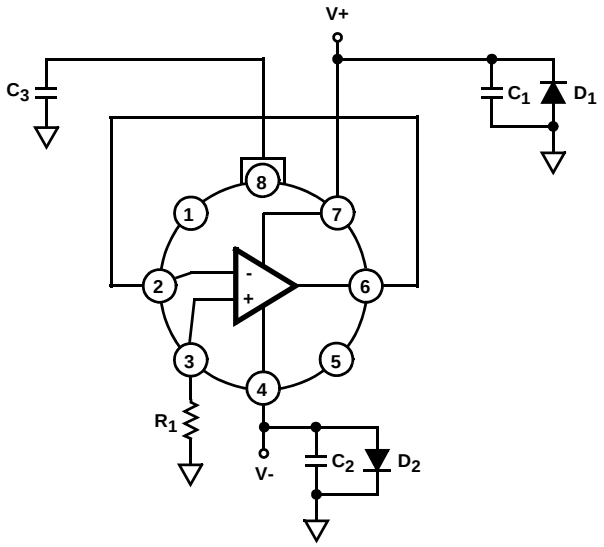
Metallization Mask Layout

HA-2500/883



Burn-In Circuits

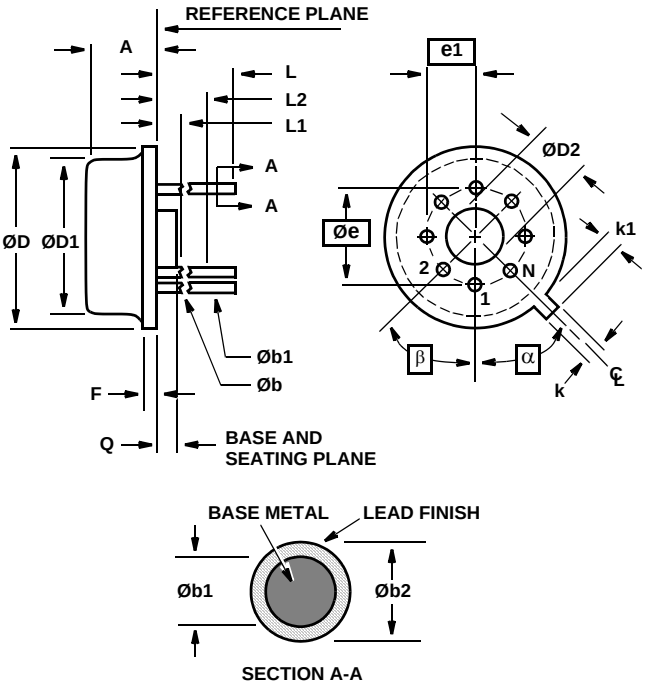
HA2-2500/883 METAL CAN



NOTES:

R_1 = 1MΩ, ±5%, 1/4W (Min)
C_1 = C_2 = 0.01μF/Socket (Min) or 0.1μF/Row (Min)
C_3 = 0.01μF/Socket (10%)
D_1 = D_2 = 1N4002 or Equivalent/Board
|(V+) - (V-)| = 30V

Metal Can Packages (Can)



T8.C **MIL-STD-1835 MACY1-X8 (A1)**
8 LEAD METAL CAN PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.165	0.185	4.19	4.70	-
Øb	0.016	0.019	0.41	0.48	1
Øb1	0.016	0.021	0.41	0.53	1
Øb2	0.016	0.024	0.41	0.61	-
ØD	0.335	0.375	8.51	9.40	-
ØD1	0.305	0.335	7.75	8.51	-
ØD2	0.110	0.160	2.79	4.06	-
e	0.200 BSC		5.08 BSC		-
e1	0.100 BSC		2.54 BSC		-
F	-	0.040	-	1.02	-
k	0.027	0.034	0.69	0.86	-
k1	0.027	0.045	0.69	1.14	2
L	0.500	0.750	12.70	19.05	1
L1	-	0.050	-	1.27	1
L2	0.250	-	6.35	-	1
Q	0.010	0.045	0.25	1.14	-
α	45^o BSC		45^o BSC		3
β	45^o BSC		45^o BSC		3
N	8		8		4

Rev. 0 5/18/94

NOTES:

1. (All leads) Øb applies between L1 and L2. Øb1 applies between L2 and 0.500 from the reference plane. Diameter is uncontrolled in L1 and beyond 0.500 from the reference plane.
2. Measured from maximum diameter of the product.
3. α is the basic spacing from the centerline of the tab to terminal 1 and β is the basic spacing of each lead or lead position (N -1 places) from α, looking at the bottom of the package.
4. N is the maximum number of terminal positions.
5. Dimensioning and tolerancing per ANSI Y14.5M - 1982.
6. Controlling dimension: INCH.