

July 1994

### 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 (HA-2520/883) . . . . . 100V/μs (Min)  
120V/μs (Typ)
- Wide Power Bandwidth (HA-2520/883) . . 1.5MHz (Min)
- Wide Gain Bandwidth (HA-2520/883) . . . . 10MHz (Min)  
20MHz (Typ)
- High Input Impedance (HA-2520/883) . . . . 50MΩ (Min)  
100MΩ (Typ)
- Low Offset Current (HA-2520/883) . . . . . 25nA (Min)  
10nA (Typ)
- Fast Settling (0.1% of 10V Step) . . . . . 200ns (Typ)
- Low Quiescent Supply Current . . . . . 6mA (Max)

### Applications

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

### Description

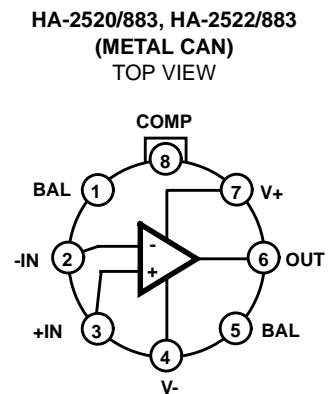
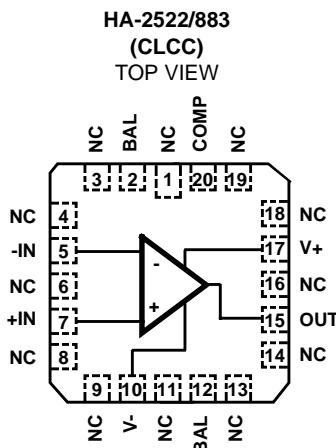
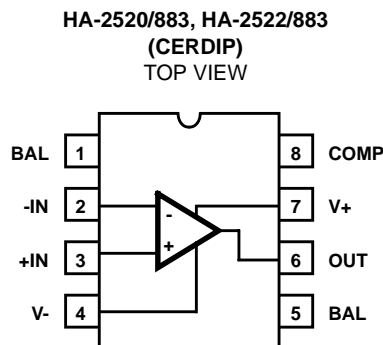
Description The HA-2520/883 and HA-2522/883 are monolithic operational amplifiers which deliver an unsurpassed combination of specifications for slew rate, bandwidth and settling time. These dielectrically isolated amplifiers are designed for closed loop gains of 3 or greater without external compensation. In addition, these high performance components also provide low offset current and high input impedance.

The 100V/μs (min) slew rate (80V/μs for HA-2522/883) and fast settling time of these amplifiers make them ideal components for pulse amplification and data acquisition designs. To insure compliance with slew rate and transient response specifications, all devices are 100% tested for AC performance characteristics over full temperature. These devices are valuable components for RF and video circuitry requiring wideband operation. For accurate signal conditioning designs, the HA-2520/883's superior dynamic specifications are complemented by 25nA (max) offset current (50nA for HA-2522/883) and offset voltage adjust capability.

### Ordering Information

PART NUMBER	TEMPERATURE RANGE	PACKAGE
HA2-2520/883	-55°C to +125°C	8 Pin Can
HA2-2522/883	-55°C to +125°C	8 Pin Can
HA4-2522/883	-55°C to +125°C	20 Lead Ceramic LCC
HA7-2520/883	-55°C to +125°C	8 Lead CerDIP
HA7-2522/883	-55°C to +125°C	8 Lead CerDIP

### Pinouts



## Specifications HA-2520/883, HA-2522/883

### 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
Junction Temperature	+175°C
Storage Temperature Range	-65°C to +150°C
ESD Rating	<2000V
Lead Temperature (Soldering 10s)	+300°C

### Thermal Information

Thermal Resistance	$\theta_{JA}$	$\theta_{JC}$
CerDIP Package	115°C/W	28°C/W
Ceramic LCC Package	75°C/W	23°C/W
Metal Can Package	160°C/W	75°C/W
Package Power Dissipation Limit at +75°C for $T_J \leq +175^\circ\text{C}$		
CerDIP Package	870mW	
Ceramic LCC Package	1.33W	
Metal Can Package	625mW	
Package Power Dissipation Derating Factor Above +75°C		
CerDIP Package	8.7mW/°C	
Ceramic LCC Package	13.3mW/°C	
Metal Can Package	6.3mW/°C	

*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.*

### Operating Conditions

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

**TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS**

Device Tested at:  $V_{SUPPLY} = \pm 15V$ ,  $R_{SOURCE} = 100\Omega$ ,  $R_{LOAD} = 500k\Omega$ ,  $V_{OUT} = 0V$ , Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	HA-2520/883		HA-2522/883		UNITS
					MIN	MAX	MIN	MAX	
Input Offset Voltage	$V_{IO}$	$V_{CM} = 0V$	1	+25°C	-8	8	-10	10	mV
			2, 3	+125°C, -55°C	-10	10	-14	14	mV
Input Bias Current	+ $I_B$	$V_{CM} = 0V$ , $+R_S = 100k\Omega$ , $-R_S = 100\Omega$	1	+25°C	-200	200	-250	250	nA
			2, 3	+125°C, -55°C	-400	400	-500	500	nA
	- $I_B$	$V_{CM} = 0V$ , $+R_S = 100\Omega$ , $-R_S = 100k\Omega$	1	+25°C	-200	200	-250	250	nA
			2, 3	+125°C, -55°C	-400	400	-500	500	nA
Input Offset Current	$I_{IO}$	$V_{CM} = 0V$ , $+R_S = 100k\Omega$ , $-R_S = 100k\Omega$	1	+25°C	-25	25	-50	50	nA
			2, 3	+125°C, -55°C	-50	50	-100	100	nA
Common Mode Range	+CMR	$V+ = 5V$ , $V- = -25V$	1	+25°C	+10	-	+10	-	V
			2, 3	+125°C, -55°C	+10	-	+10	-	V
	-CMR	$V+ = 25V$ , $V- = -5V$	1	+25°C	-	-10	-	-10	V
			2, 3	+125°C, -55°C	-	-10	-	-10	V
Large Signal Voltage Gain	+ $A_{VOL}$	$V_{OUT} = 0V$ and +10V, $R_L = 2k\Omega$	4	+25°C	10	-	7.5	-	kV/V
			5, 6	+125°C, -55°C	7.5	-	5	-	kV/V
	- $A_{VOL}$	$V_{OUT} = 0V$ and -10V, $R_L = 2k\Omega$	4	+25°C	10	-	7.5	-	kV/V
			5, 6	+125°C, -55°C	7.5	-	5	-	kV/V
Common Mode Rejection Ratio	+CMRR	$\Delta V_{CM} = +10V$ , $V+ = +5V$ , $V- = -25V$ , $V_{OUT} = -10V$	1	+25°C	80	-	74	-	dB
			2, 3	+125°C, -55°C	80	-	74	-	dB
	-CMRR	$\Delta V_{CM} = -10V$ , $V+ = +25V$ , $V- = -5V$ , $V_{OUT} = +10V$	1	+25°C	80	-	74	-	dB
			2, 3	+125°C, -55°C	80	-	74	-	dB
Output Voltage Swing	+ $V_{OUT}$	$R_L = 2k\Omega$	4	+25°C	10	-	10	-	V
			5, 6	+125°C, -55°C	10	-	10	-	V
	- $V_{OUT}$	$R_L = 2k\Omega$	4	+25°C	-	-10	-	-10	V
			5, 6	+125°C, -55°C	-	-10	-	-10	V

## Specifications HA-2520/883, HA-2522/883

**TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)**

Device Tested at:  $V_{SUPPLY} = \pm 15V$ ,  $R_{SOURCE} = 100\Omega$ ,  $R_{LOAD} = 500k\Omega$ ,  $V_{OUT} = 0V$ , Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	HA-2520/883		HA-2522/883		UNITS
					MIN	MAX	MIN	MAX	
Output Current	+I <sub>OUT</sub>	V <sub>OUT</sub> = -10V	4	+25°C	10	-	10	-	mA
			5, 6	+125°C, -55°C	7.5	-	7.5	-	mA
	-I <sub>OUT</sub>	V <sub>OUT</sub> = +10V	4	+25°C	-	-10	-	-10	mA
			5, 6	+125°C, -55°C	-	-7.5	-	-7.5	mA
Quiescent Power Supply Current	+I <sub>CC</sub>	V <sub>OUT</sub> = 0V, I <sub>OUT</sub> = 0mA	1	+25°C	-	6	-	6	mA
			2, 3	+125°C, -55°C	-	6.5	-	7	mA
	-I <sub>CC</sub>	V <sub>OUT</sub> = 0V, I <sub>OUT</sub> = 0mA	1	+25°C	-6	-	-6	-	mA
			2, 3	+125°C, -55°C	-6.5	-	-7	-	mA
Power Supply Rejection Ratio	+PSRR	$\Delta V_{SUP} = 10V$ , V <sub>+</sub> = +20V, V <sub>-</sub> = -15V, V <sub>+</sub> = +10V, V <sub>-</sub> = -15V	1	+25°C	80	-	74	-	dB
			2, 3	+125°C, -55°C	80	-	74	-	dB
	-PSRR	$\Delta V_{SUP} = 10V$ , V <sub>+</sub> = +15V, V <sub>-</sub> = -20V, V <sub>+</sub> = +15V, V <sub>-</sub> = -10V	1	+25°C	80	-	74	-	dB
			2, 3	+125°C, -55°C	80	-	74	-	dB
Offset Voltage Adjustment	+V <sub>IOAdj</sub>	Note 1	1	+25°C	V <sub>IO-1</sub>	-	V <sub>IO-1</sub>	-	mV
			2, 3	+125°C, -55°C	V <sub>IO-1</sub>	-	V <sub>IO-1</sub>	-	mV
	-V <sub>IOAdj</sub>	Note 1	1	+25°C	V <sub>IO+1</sub>	-	V <sub>IO+1</sub>	-	mV
			2, 3	+125°C, -55°C	V <sub>IO+1</sub>	-	V <sub>IO+1</sub>	-	mV

NOTE:

- Offset adjustment range is [V<sub>IO</sub>(Measured) ±1mV] minimum referred to output. This test is for functionality only to assure adjustment through 0V.

**TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS**

Device Tested at:  $V_{SUPPLY} = \pm 15V$ ,  $R_{SOURCE} = 50\Omega$ ,  $R_{LOAD} = 2k\Omega$ ,  $C_{LOAD} = 50pF$ ,  $A_{VCL} = +3V/V$ , Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	HA-2520/883		HA-2522/883		UNITS
					MIN	MAX	MIN	MAX	
Slew Rate	+SR	V <sub>OUT</sub> = -5V to +5V 25% ≤ +SR ≤ 75%	7	+25°C	100	-	80	-	V/μs
			8A, 8B	+125°C, -55°C	84	-	60	-	V/μs
	-SR	V <sub>OUT</sub> = +5V to -5V 75% ≥ -SR ≥ 25%	7	+25°C	100	-	80	-	V/μs
			8A, 8B	+125°C, -55°C	84	-	60	-	V/μs
Rise and Fall Time	T <sub>R</sub>	V <sub>OUT</sub> = 0 to +200mV 10% ≤ T <sub>R</sub> ≤ 90%	7	+25°C	-	50	-	50	ns
			8A, 8B	+125°C, -55°C	-	55	-	60	ns
	T <sub>F</sub>	V <sub>OUT</sub> = 0 to -200mV 10% ≤ T <sub>F</sub> ≤ 90%	7	+25°C	-	50	-	50	ns
			8A, 8B	+125°C, -55°C	-	55	-	60	ns
Overshoot	+OS	V <sub>OUT</sub> = 0 to +200mV	7	+25°C	-	40	-	50	%
			8A, 8B	+125°C, -55°C	-	45	-	60	%
	-OS	V <sub>OUT</sub> = 0 to -200mV	7	+25°C	-	40	-	50	%
			8A, 8B	+125°C, -55°C	-	45	-	60	%

## Specifications HA-2520/883, HA-2522/883

**TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS**

Device Characterized at:  $V_{SUPPLY} = \pm 15V$ ,  $R_{LOAD} = 2k\Omega$ ,  $C_{LOAD} = 50pF$ ,  $A_V \geq 3$ ,  $C_{COMP} = 0pF$ , Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	HA-2520/883		HA-2522/883		UNITS
					MIN	MAX	MIN	MAX	
Differential Input Resistance	$R_{IN}$	$V_{CM} = 0V$	1	+25°C	50	-	40	-	MΩ
Full Power Bandwidth	GBWP	$V_O = 200mV, f_O = 10kHz$	1	+25°C	10	-	10	-	MHz
		$V_O = 200mV, f_O = 1MHz$	1	+25°C	10	-	10	-	MHz
Full Power Bandwidth	FPBW	$V_{PEAK} = 10V$	1, 2	+25°C	1.6	-	1.2	-	MHz
Minimum Closed Loop Stable Gain	CLSG	$R_L = 2k\Omega, C_L = 50pF$	1	-55°C to +125°C	+3	-	+3	-	V/V
Quiescent Power Consumption	PC	$V_{OUT} = 0V, I_{OUT} = 0mA$	1, 3	-55°C to +125°C	-	195	-	210	mW

**NOTES:**

- 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.
- Full Power Bandwidth guarantee based on Slew Rate measurement using  $FPBW = \text{Slew Rate} / (2\pi V_{PEAK})$ .
- 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 1), 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:**

- PDA applies to Subgroup 1 only.

## Die Characteristics

### DIE DIMENSIONS:

67 x 57 x 19 mils  $\pm$  1 mils  
 1700 x 1440 x 483 $\mu$ m  $\pm$  25.4 $\mu$ m

### METALLIZATION:

Type: Al, 1% Cu  
 Thickness: 16k $\text{\AA}$   $\pm$  2k $\text{\AA}$

### GLASSIVATION:

Type: Nitride (Si<sub>3</sub>N<sub>4</sub>) over Silox (SiO<sub>2</sub>, 5% Phos.)  
 Silox Thickness: 12k $\text{\AA}$   $\pm$  2k $\text{\AA}$   
 Nitride Thickness: 3.5k $\text{\AA}$   $\pm$  1.5k $\text{\AA}$

### WORST CASE CURRENT DENSITY:

0.26 x 10<sup>5</sup> A/cm<sup>2</sup>

### SUBSTRATE POTENTIAL (Powered Up):

Unbiased

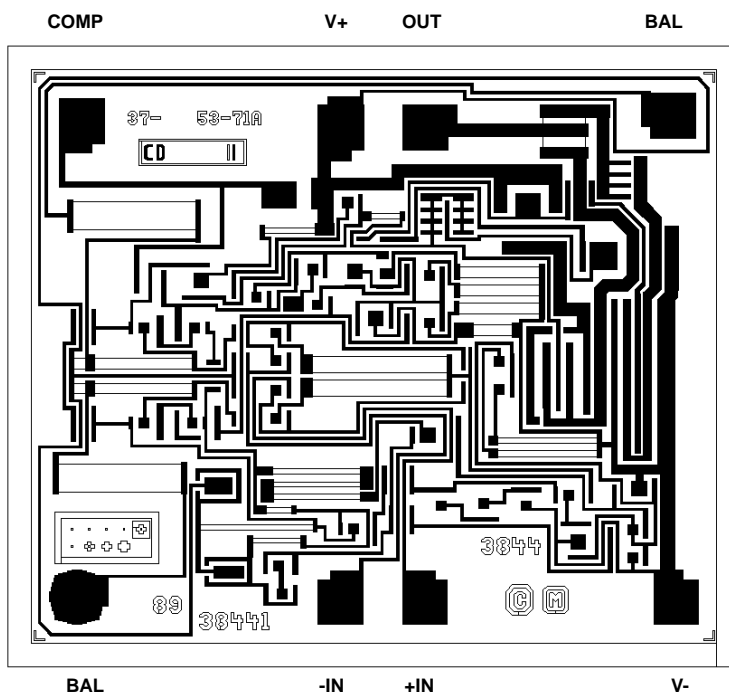
### TRANSISTOR COUNT:

HA-2520/883: 40  
 HA-2522/883: 40

**PROCESS:** Bipolar Dielectric Isolation

## Metallization Mask Layout

HA-2520/883, HA-2522/883



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