

## Monolithic, Wideband, High Slew Rate, High Output Current Buffer

October 26, 2004

### Features

- This Circuit is Processed in Accordance to MIL-STD-883 and is Fully Conformant Under the Provisions of Paragraph 1.2.1.
- Voltage Gain ( $R_L = 1k\Omega$ ).....0.98 (Min)  
0.995 (Typ)  
  
( $R_L = 100\Omega$ ) .....0.96 (Min)  
0.971 (Typ)
- High Input Impedance .....1.5M $\Omega$  (Min)  
3M $\Omega$  (Typ)
- Low Output Impedance..... 5 $\Omega$  (Max)  
3 $\Omega$  (Typ)
- Very High Slew Rate .....1000V/ $\mu$ s (Min)  
1300V/ $\mu$ s (Typ)
- Wide Small Signal Bandwidth.....110MHz (Typ)
- High Output Current ..... 100mA (Min)
- High Pulsed Output Current ..... 400mA (Max)
- Monolithic Dielectric Isolation Construction
- Replaces Hybrid LH0002

### Applications

- Line Driver
- Data Acquisition
- 110MHz Buffer
- High Power Current Booster
- High Power Current Source
- Sample and Holds
- Radar Cable Driver
- Video Products

### Description

The HA-5002/883 is a monolithic, wideband, high slew rate, high output current, buffer amplifier.

Utilizing the advantages of the Harris Dielectric Isolation technologies, the HA-5002/883 current buffer offers 1300V/ $\mu$ s slew rate typically and 1000V/ $\mu$ s minimum with 110MHz of bandwidth. The  $\pm 100$ mA minimum output current capability is enhanced by a 3 $\Omega$  output impedance.

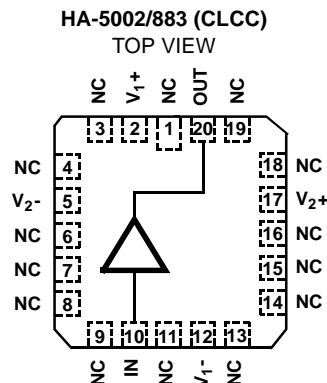
The monolithic HA-5002/883 will replace the hybrid LH0002 with corresponding performance increases. These characteristics range from the 3M $\Omega$  (typ) input impedance to the increased output voltage swing. Monolithic design technologies have allowed a more precise buffer to be developed with more than an order of magnitude smaller gain error. The voltage gain is 0.98 guaranteed minimum with a 1k $\Omega$  load and 0.96 minimum with a 100 $\Omega$  load.

The HA-5002/883 will provide many present hybrid users with a higher degree of reliability and at the same time increase overall circuit performance.

### Ordering Information

PART NUMBER	TEMPERATURE RANGE	PACKAGE
HA4-5002/883	-55°C to +125°C	20 Lead Ceramic LCC

### Pinout



**Absolute Maximum Ratings**

Voltage Between V+ and V- Terminals . . . . . 44V  
 Input Voltage . . . . . Equal to Supplies  
 Peak Output Current (50ms On, 1s Off) . . . . . ±400mA  
 Junction Temperature (T<sub>J</sub>) . . . . . +175°C  
 Storage Temperature Range . . . . . -65°C to +150°C  
 ESD Rating . . . . . <4000V  
 Lead Temperature (Soldering 10s) . . . . . +300°C

**Thermal Information**

Thermal Resistance  $\theta_{JA}$   $\theta_{JC}$   
 Ceramic LCC Package . . . . . 80°C/W 30°C/W  
 Package Power Dissipation Limit at +75°C for T<sub>J</sub> ≤ +175°C  
 Ceramic LCC Package . . . . . 1.54W  
 Package Power Dissipation Derating Factor Above +75°C  
 Ceramic LCC Package . . . . . 15.4mW/°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.

NOTES:

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

**Operating Conditions**

Operating Temperature Range . . . . . -55°C to +125°C  $R_L \geq 100\Omega$   
 Operating Supply Voltage . . . . . ±12V to ±15V

**TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS**

Device Tested at: V<sub>SUPPLY</sub> = ±12V and ±15V, R<sub>SOURCE</sub> = 50Ω, C<sub>LOAD</sub> ≤ 10pF, V<sub>IN</sub> = 0V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	LIMITS		UNITS
					MIN	MAX	
Input Offset Voltage	V <sub>IO1</sub>	V <sub>SUP</sub> = ±15V	1	+25°C	-20	20	mV
			2, 3	+125°C, -55°C	-30	30	mV
	V <sub>IO2</sub>	V <sub>SUP</sub> = ±12V	1	+25°C	-20	20	mV
			2, 3	+125°C, -55°C	-30	30	mV
Input Bias Current	I <sub>B1</sub>	V <sub>SUP</sub> = ±15V, R <sub>S</sub> = 1kΩ	1	+25°C	-7	7	μA
			2, 3	+125°C, -55°C	-10	10	μA
	I <sub>B2</sub>	V <sub>SUP</sub> = ±12V, R <sub>S</sub> = 1kΩ	1	+25°C	-7	7	μA
			2, 3	+125°C, -55°C	-10	10	μA
Voltage Gain 1	+AV <sub>1</sub>	V <sub>SUP</sub> = ±12V, R <sub>L</sub> = 1kΩ, V <sub>IN</sub> = 10V	1	+25°C	0.98	-	V/V
			2, 3	+125°C, -55°C	0.98	-	V/V
	-AV <sub>1</sub>	V <sub>SUP</sub> = ±12V, R <sub>L</sub> = 1kΩ, V <sub>IN</sub> = -10V	1	+25°C	0.98	-	V/V
			2, 3	+125°C, -55°C	0.98	-	V/V
Voltage Gain 2	+AV <sub>2</sub>	V <sub>SUP</sub> = ±12V, R <sub>L</sub> = 100Ω, V <sub>IN</sub> = 10V	1	+25°C	0.96	-	V/V
	-AV <sub>2</sub>	V <sub>SUP</sub> = ±12V, R <sub>L</sub> = 100Ω, V <sub>IN</sub> = -10V	1	+25°C	0.96	-	V/V
Voltage Gain 3	+AV <sub>3</sub>	V <sub>SUP</sub> = ±15V, R <sub>L</sub> = 100Ω, V <sub>IN</sub> = 10V	1	+25°C	0.96	-	V/V
	-AV <sub>3</sub>	V <sub>SUP</sub> = ±15V, R <sub>L</sub> = 100Ω, V <sub>IN</sub> = -10V	1	+25°C	0.96	-	V/V
Voltage Gain 4	+AV <sub>4</sub>	V <sub>SUP</sub> = ±15V, R <sub>L</sub> = 1kΩ, V <sub>IN</sub> = +10V	1	+25°C	0.99	-	V/V
			2, 3	+125°C, -55°C	0.99	-	V/V
	-AV <sub>4</sub>	V <sub>SUP</sub> = ±15V, R <sub>L</sub> = 1kΩ, V <sub>IN</sub> = -10V	1	+25°C	0.99	-	V/V
			2, 3	+125°C, -55°C	0.99	-	V/V

## HA-5002/883

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

Device Tested at:  $V_{SUPPLY} = \pm 12V$  and  $\pm 15V$ ,  $R_{SOURCE} = 50\Omega$ ,  $C_{LOAD} \leq 10pF$ ,  $V_{IN} = 0V$ , Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	LIMITS		UNITS	
					MIN	MAX		
Output Voltage Swing	+V <sub>OUT1</sub>	$V_{SUP} = \pm 15V$ , $R_L = 100\Omega$ , $V_{IN} = +15V$	1	+25°C	10	-	V	
			2, 3	+125°C, -55°C	10	-	V	
	-V <sub>OUT1</sub>	$V_{SUP} = \pm 15V$ , $R_L = 100\Omega$ , $V_{IN} = -15V$	1	+25°C	-	-10	V	
			2, 3	+125°C, -55°C	-	-10	V	
	+V <sub>OUT2</sub>	$V_{SUP} = \pm 15V$ , $R_L = 1k\Omega$ , $V_{IN} = +15V$	1	+25°C	10	-	V	
			2, 3	+125°C, -55°C	10	-	V	
	-V <sub>OUT2</sub>	$V_{SUP} = \pm 15V$ , $R_L = 1k\Omega$ , $V_{IN} = -15V$	1	+25°C	-	-10	V	
			2, 3	+125°C, -55°C	-	-10	V	
	+V <sub>OUT3</sub>	$V_{SUP} = \pm 12V$ , $R_L = 1k\Omega$ , $V_{IN} = +12V$	1	+25°C	10	-	V	
			2, 3	+125°C, -55°C	10	-	V	
	-V <sub>OUT3</sub>	$V_{SUP} = \pm 12V$ , $R_L = 1k\Omega$ , $V_{IN} = -12V$	1	+25°C	-	-10	V	
			2, 3	+125°C, -55°C	-	-10	V	
Output Current	+I <sub>OUT1</sub>	$V_{SUP} = \pm 15V$ , $V_{OUT} = +10V$	1	+25°C	100	-	mA	
			2, 3	+125°C, -55°C	100	-	mA	
	-I <sub>OUT1</sub>	$V_{SUP} = \pm 15V$ , $V_{OUT} = -10V$	1	+25°C	-	-100	mA	
			2, 3	+125°C, -55°C	-	-100	mA	
	+I <sub>OUT2</sub>	$V_{SUP} = \pm 12V$ , $V_{OUT} = +10V$	1	+25°C	100	-	mA	
			2, 3	+125°C, -55°C	100	-	mA	
	-I <sub>OUT2</sub>	$V_{SUP} = \pm 12V$ , $V_{OUT} = -10V$	1	+25°C	-	-100	mA	
			2, 3	+125°C, -55°C	-	-100	mA	
	Power Supply Rejection Ratio	+PSRR <sub>1</sub>	$\Delta V_{SUP} = \pm 5V$ , $V_+ = +20V, V_- = -15V$ , $V_+ = +10V, V_- = -15V$	1	+25°C	54	-	dB
				2, 3	+125°C, -55°C	54	-	dB
		-PSRR <sub>1</sub>	$\Delta V_{SUP} = \pm 5V$ , $V_+ = +15V, V_- = -20V$ , $V_+ = +15V, V_- = -10V$	1	+25°C	54	-	dB
				2, 3	+125°C, -55°C	54	-	dB
+PSRR <sub>2</sub>		$\Delta V_{SUP} = \pm 5V$ , $V_+ = +17V, V_- = -12V$ , $V_+ = +7V, V_- = -12V$	1	+25°C	54	-	dB	
			2, 3	+125°C, -55°C	54	-	dB	
-PSRR <sub>2</sub>		$\Delta V_{SUP} = \pm 5V$ , $V_+ = +12V, V_- = -17V$ , $V_+ = +12V, V_- = -7V$	1	+25°C	54	-	dB	
			2, 3	+125°C, -55°C	54	-	dB	

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

Device Tested at:  $V_{SUPPLY} = \pm 12V$  and  $\pm 15V$ ,  $R_{SOURCE} = 50\Omega$ ,  $C_{LOAD} \leq 10pF$ ,  $V_{IN} = 0V$ , Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	LIMITS		UNITS
					MIN	MAX	
Power Supply Current	+ICC <sub>1</sub>	$V_{SUP} = \pm 15V$ , $V_{OUT} = 0V$	1	+25°C	-	10	mA
			2, 3	+125°C, -55°C	-	10	mA
	-ICC <sub>1</sub>	$V_{SUP} = \pm 15V$ , $V_{OUT} = 0V$	1	+25°C	-10	-	mA
			2, 3	+125°C, -55°C	-10	-	mA
	+ICC <sub>2</sub>	$V_{SUP} = \pm 12V$ , $V_{OUT} = 0V$	1	+25°C	-	10	mA
			2, 3	+125°C, -55°C	-	10	mA
-ICC <sub>2</sub>	$V_{SUP} = \pm 12V$ , $V_{OUT} = 0V$	1	+25°C	-10	-	mA	
		2, 3	+125°C, -55°C	-10	-	mA	

**TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS**

Table 2 Intentionally Left Blank. See AC Specifications in Table 3

**TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS**

Device Characterized at:  $V_{SUPPLY} = \pm 15V$  or  $\pm 12V$ ,  $R_{LOAD} = 1k\Omega$ ,  $C_{LOAD} \leq 10pF$ , Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	LIMITS		UNITS
					MIN	MAX	
Input Resistance	R <sub>IN1</sub>	$V_{SUP} = \pm 15V$	1	+25°C	1.5	-	MΩ
	R <sub>IN2</sub>	$V_{SUP} = \pm 12V$	1	+25°C	1.5	-	MΩ
Slew Rate	+SR <sub>1</sub>	$V_{SUP} = \pm 15V$ , $V_{OUT} = -5V$ to +5V	1	+25°C	1000	-	V/μs
				+125°C, -55°C	1000	-	V/μs
	-SR <sub>1</sub>	$V_{SUP} = \pm 15V$ , $V_{OUT} = +5V$ to -5V	1	+25°C	1000	-	V/μs
				+125°C, -55°C	1000	-	V/μs
	+SR <sub>2</sub>	$V_{SUP} = \pm 12V$ , $V_{OUT} = -5V$ to +5V	1	+25°C	1000	-	V/μs
				+125°C, -55°C	1000	-	V/μs
-SR <sub>2</sub>	$V_{SUP} = \pm 12V$ , $V_{OUT} = +5V$ to -5V	1	+25°C	1000	-	V/μs	
			+125°C, -55°C	1000	-	V/μs	
Rise and Fall Time	T <sub>R</sub>	$V_{SUP} = \pm 15V$ or $\pm 12V$ , $V_{OUT} = 0$ to +500mV	1, 2	+25°C	-	10	ns
			1, 2	+125°C, -55°C	-	10	ns
	T <sub>F</sub>	$V_{SUP} = \pm 15V$ or $\pm 12V$ , $V_{OUT} = 0$ to -500mV	1, 2	+25°C	-	10	ns
			1, 2	+125°C, -55°C	-	10	ns

**TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)**

Device Characterized at:  $V_{SUPPLY} = \pm 15V$  or  $\pm 12V$ ,  $R_{LOAD} = 1k\Omega$ ,  $C_{LOAD} \leq 10pF$ , Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	LIMITS		UNITS
					MIN	MAX	
Overshoot	+OS	$V_{SUP} = \pm 12V$ or $\pm 15V$ , $V_{OUT} = 0$ to $+500mV$	1	+25°C	-	30	%
				+125°C, -55°C	-	30	%
	-OS	$V_{SUP} = \pm 12V$ or $\pm 15V$ , $V_{OUT} = 0$ to $-500mV$	1	+25°C	-	30	%
				+125°C, -55°C	-	30	%
Quiescent Power Consumption	PC <sub>1</sub>	$V_{SUP} = \pm 15V$ , $V_{IN} = 0V$ , $I_{OUT} = 0mA$	1, 3	+25°C	-	300	mW
				+125°C, -55°C	-	300	mW
	PC <sub>2</sub>	$V_{SUP} = \pm 12V$ , $V_{IN} = 0V$ , $I_{OUT} = 0mA$	1, 3	+25°C	-	240	mW
				+125°C, -55°C	-	240	mW
Output Resistance	R <sub>OUT1</sub>	$V_{SUP} = \pm 12V$	1	+25°C	-	5	Ω
	R <sub>OUT2</sub>	$V_{SUP} = \pm 12V$	1	+25°C	-	5	Ω

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.
- Measured between 10% and 90% points.
- 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 TABLE 1)
Interim Electrical Parameters (Pre Burn-In)	1
Final Electrical Test Parameters	1 (Note 1), 2, 3
Group A Test Requirements	1, 2, 3
Groups C and D Endpoints	1

NOTE:

- PDA applies to Subgroup 1 only.

**Die Characteristics**

**DIE DIMENSIONS:**

81 x 80 x 19 mils ± 1 mils  
 2050 x 2030 x 483µm ± 25.4µm

**METALLIZATION:**

Type: Al, 1% Cu  
 Thickness: 20kÅ ± 2kÅ

**GLASSIVATION:**

Type: Nitride  
 Thickness: 7kÅ ± 0.7kÅ

**WORST CASE CURRENT DENSITY:**

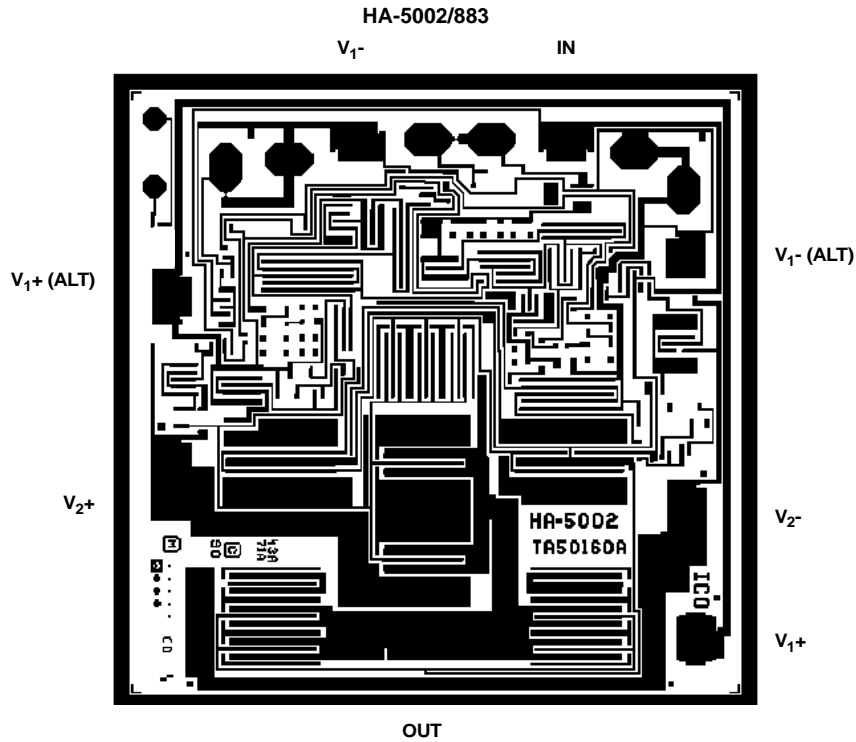
0.7 x 10<sup>5</sup> A/cm<sup>2</sup> at 3.6mA

**SUBSTRATE POTENTIAL (Powered Up): V1-**

**TRANSISTOR COUNT: 27**

**PROCESS: Bipolar Dielectric Isolation**

**Metallization Mask Layout**



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