HARRIS SEMICONDUCTOR

HA-5320/883

July 1994

High Speed Precision Sample and Hold Amplifier

Features

- **This Circuit is Processed in Accordance to MIL-STD-883 and is Fully Conformant Under the Provisions of Paragraph 1.2.1.**
- **Gain, DC ..... 2 x 10^6 V/V (Typ)**
- **Acquisition Time ..... 1.0µs (0.01%) (Typ)**
- **Droop Rate ..... 0.08µV/µs (+25°C) (Typ)**
  17µV/µs (Full Temperature) (Typ)
- **Aperture Time ..... 25ns (Typ)**
- **Hold Step Error ..... 1.0mV (Typ)**
- **Internal Hold Capacitor**
- **Fully Differential Input**
- **TTL Compatible**

Applications

- **High Bandwidth Precision Data Acquisition Systems**
- **Inertial Navigation and Guidance Systems**
- **Ultrasonics**
- **SONAR / RADAR**
- **Digital to Analog Converter Deglitcher**

Description

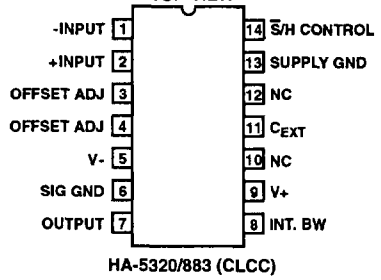
The HA-5320/883 was designed for use in precision, high speed data acquisition systems.

The circuit consists of an input transconductance amplifier capable of providing large amounts of charging current, a low leakage analog switch, and an output integrating amplifier. The analog switch sees virtual ground as its load; therefore, charge injection on the hold capacitor is constant over the entire input/output voltage range. The pedestal voltage resulting from this charge injection can be adjusted to zero by use of the offset adjust inputs. The device includes a hold capacitor. However, if improved droop rate is required at the expense of acquisition time, additional hold capacitance may be added externally.

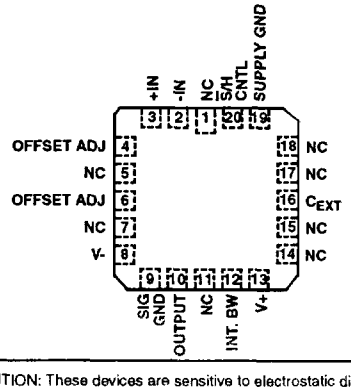
This monolithic device is manufactured using the Harris Dielectric Isolation Process, minimizing stray capacitance and eliminating SCR's. This allows higher speed and latch-free operation. For further information, please see Application Note AN538.

Pinouts

HA-5320/883 (CERDIP)
TOP VIEW



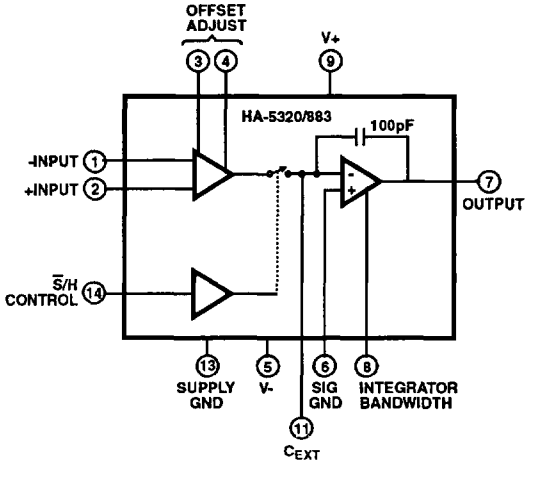
HA-5320/883 (CLCC)
TOP VIEW



Ordering Information

PART NUMBER	TEMPERATURE RANGE	PACKAGE
HA1-5320/883	-55°C to +125°C	14 Lead CerDIP
HA4-5320/883	-55°C to +125°C	20 Lead Ceramic LCC

Functional Diagram



7 SAMPLE AND HOLD AMPLIFIERS

CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper I.C. Handling Procedures.

Spec Number **511096-883**
File Number **2927.3**

Absolute Maximum Ratings

Voltage Between V+ and V- Terminals 40V
Differential Input Voltage 24V
Digital Input Voltage (S/H Pin) ..... +8V, -15V
Output Current, Continuous (Note 1) ..... ±20mA
Storage Temperature Range ..... -65°C to +150°C
Junction Temperature ..... +175°C
Lead Temperature (Soldering 10s) ..... +300°C
ESD Classification ..... <2000V

Thermal Information

Thermal Resistance	θ_{JA}	θ_{JC}
CerDIP Package	66°C/W	16°C/W
Ceramic LCC Package	57°C/W	9°C/W

Package Power Dissipation at +75°C
CerDip Package 1.5W
Ceramic LCC Package 1.75W
Package Power Dissipation Derating Factor Above +75°C
CerDip Package ..... 15mW/°C
Ceramic LCC Package ..... 17mW/°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 ..... $-55°C \le T_A \le +125°C$
Operating Supply Voltage ($\pm V_S$) ..... ±15V
Analog Input Voltage ..... ±10V
Logic Level Low (V_{IL}) ..... 0V to 0.8V
Logic Level High (V_{IH}) ..... 2.0V to 5.0V

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: V+ = +15V; V- = -15V; V_{IL} = 0.8V (Sample); V_{IH} = 2.0V (Hold); C_H = Internal = 100pF; Signal GND = Supply GND, Unless Otherwise Specified

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUP	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Input Offset Voltage	V_{IO}		1	+25°C	-1	+1	mV
			2, 3	+125°C, -55°C	-2	+2	mV
Input Bias Current	$+I_B$		1	+25°C	-200	+200	nA
			2, 3	+125°C, -55°C	-200	+200	nA
	$-I_B$		1	+25°C	-200	+200	nA
			2, 3	+125°C, -55°C	-200	+200	nA
Input Offset Current	I_{IO}		1	+25°C	-100	+100	nA
			2, 3	+125°C, -55°C	-100	+100	nA
Open Loop Voltage Gain	$+A_{VS}$	R_L = 1kΩ, V_{OUT} = +10V	1	+25°C	120	-	dB
			2, 3	+125°C, -55°C	110	-	dB
	$-A_{VS}$	R_L = 1kΩ, V_{OUT} = -10V	1	+25°C	120	-	dB
			2, 3	+125°C, -55°C	110	-	dB
Common Mode Rejection Ratio	+CMRR	V+ = 10V, V- = -20V, V_{OUT} = -5V, $V_{S/H}$ = -4.2V, V_{GND} = -5V	1	+25°C	80	-	dB
			2, 3	+125°C, -55°C	80	-	dB
	-CMRR	V+ = 20V, V- = -10V, V_{OUT} = +5V, $V_{S/H}$ = 5.8V, V_{GND} = +5V	1	+25°C	80	-	dB
			2, 3	+125°C, -55°C	80	-	dB
Output Current	$+I_O$	V_{OUT} = +10V	1	+25°C	10	-	mA
			2, 3	+125°C, -55°C	10	-	mA
	$-I_O$	V_{OUT} = -10V	1	+25°C	-10	-	mA
			2, 3	+125°C, -55°C	-10	-	mA

CAUTION: These devices are sensitive to electronic discharge. Proper IC handling procedures should be followed.

Spec Number **511096-883**

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Tested at: V+ = +15V; V- = -15V; V_{IL} = 0.8V (Sample); V_{IH} = 2.0V (Hold); C_H = Internal ≈ 100pF; Signal GND = Supply GND, Unless Otherwise Specified

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUP	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Output Voltage Swing	$+V_{OP}$	R_L = 1kΩ	1	+25°C	10	-	V
			2, 3	+125°C, -55°C	10	-	V
	$-V_{OP}$	R_L = 1kΩ	1	+25°C	-	-10	V
			2, 3	+125°C, -55°C	-	-10	V
Power Supply Current	$+I_{CC}$	V_{OUT} = 0V, I_{OUT} = 0mA	1	+25°C	-	13	mA
			2, 3	+125°C, -55°C	-	13	mA
	$-I_{CC}$	V_{OUT} = 0V, I_{OUT} = 0mA	1	+25°C	-13	-	mA
			2, 3	+125°C, -55°C	-13	-	mA
Power Supply Rejection Ratio	+PSRR	V+ = 14.5V, 15.5V V- = -15V, -15V	1	+25°C	80	-	dB
			2, 3	+125°C, -55°C	80	-	dB
	-PSRR	V+ = +15V, +15V, V- = -14.5V, -15.5V	1	+25°C	65	-	dB
			2, 3	+125°C, -55°C	65	-	dB
Digital Input Current	I_{INL}	V_{IN} = 0V	1	+25°C	-	4	µA
			2, 3	+125°C, -55°C	-	10	µA
	I_{INH}	V_{IN} = 5V	1	+25°C	-	0.1	µA
			2, 3	+125°C, -55°C	-	0.1	µA
Digital Input Voltage	V_{IL}		1	+25°C	-	0.8	V
			2, 3	+125°C, -55°C	-	0.8	V
	V_{IH}		1	+25°C	2.0	-	V
			2, 3	+125°C, -55°C	2.0	-	V
Output Voltage Droop Rate	V_D	V_{OUT} = 0V	2	+125°C	-	100	µV/µs

NOTE:

1. Internal power dissipation may limit output current below 20mA.

TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS

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

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

PARAMETER	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Hold Mode Feedthrough	V_{HMF}	V_{IN} = 10V_{P-P}, 100kHz	1	+25°C	-	3	mV
Hold Step Error	V_{ERROR}	V_{IH} = 3.5V, V_{IL} = 0V, T_{RISE} (V_{IL} to V_{IH}) = 10ns	1	+25°C	-11	11	mV
Sample Mode Noise Voltage	$E_{N(SAMPLE)}$	DC to 10MHz, $V_{S/H}$ = 0V, R_{LOAD} = 2kΩ	1	+25°C	-	200	μV_{RMS}
Hold Mode Noise Voltage	$E_{N(HOLD)}$	DC to 10MHz, $V_{S/H}$ = 5V, R_{LOAD} = 2kΩ	1	+25°C	-	200	μV_{RMS}
Input Capacitance	C_{IN}	$V_{S/H}$ = 0V	1	+25°C	-	5	pF
Input Resistance	R_{IN}	$V_{S/H}$ = 0V, Delta V_{IN} = 20V	1	+25°C	1	-	MΩ
Slew Rate	+SR	C_L = 50pF, R_L = 2kΩ, V_{OUT} = -5V to +5V Step 10%, 90% pts	1	+25°C	30	-	V/µs
	-SR	C_L = 50pF, R_L = 2kΩ, V_{OUT} = +5V to -5V Step 10%, 90% pts	1	+25°C	30	-	V/µs
Rise and Fall Times	T_R	C_L = 50pF, R_L = 2kΩ, V_{OUT} = 0V to +200mV Step 10%, 90% pts	1	+25°C	-	150	ns
	T_F	C_L = 50pF, R_L = 2kΩ, V_{OUT} = 0V to -200mV Step 10%, 90% pts	1	+25°C	-	150	ns
Overshoot	+OS	C_L = 50pF, R_L = 2kΩ, V_{OUT} = 0V to +200mV Step	1	+25°C	-	25	%
	-OS	C_L = 50pF, R_L = 2kΩ, V_{OUT} = 0V to -200mV Step	1	+25°C	-	25	%
0.1% Acquisition Time	T_{ACQ} 0.1%	C_L = 50pF, R_L = 2kΩ, V_{OUT} = 0V to 10V Step	1	+25°C	-	1.2	µs

NOTE:

1. The parameters listed in this table are controlled via design or process parameters and are not directly tested. These parameters are characterized upon initial design release and upon design changes which would affect these characteristics.

TABLE 4. ELECTRICAL TEST REQUIREMENTS

MIL-STD-883 TEST REQUIREMENTS	SUBGROUPS (SEE TABLE 1)
Interim Electrical Parameters (Pre Burn-In)	-
Final Electrical Test Parameters	1(Note 1), 2, 3
Group A Test Requirements	1, 2, 3
Groups C and D Endpoints	1

NOTE:

1. PDA applies to Subgroup 1 only. No other subgroups are included in PDA.

Die Characteristics

DIE DIMENSIONS:
92 x 152 x 19 ± 1mils

METALLIZATION:
Type: Al, 1% Cu
Thickness: 16kÅ ± 2kÅ

GLASSIVATION:
Type: Nitride (Si_3N_4) over Silox (SiO_2, 5% Phos)
Silox Thickness: 12kÅ ± 2kÅ
Nitride Thickness: 3.5kÅ ± 1.5kÅ

WORST CASE CURRENT DENSITY:
1.742×10^5 A/cm^2

TRANSISTOR COUNT: 184

SUBSTRATE POTENTIAL: V-

Metallization Mask Layout

HA-5320/883