HARRIS SEMICONDUCTOR

HA-5340/883

High Speed, Low Distortion, Precision Monolithic Sample and Hold Amplifier

June 1994

Features

- This Circuit is Processed in Accordance to MIL-STD-883 and is Fully Conformant Under the Provisions of Paragraph 1.2.1.
- Fast Acquisition Time (0.01%) 900ns
- Fast Hold Mode Settling Time (0.01%) 300ns
- Low Distortion (Hold Mode) . . . . . -72dBc (Typ) (V_{IN} = 200kHz, Fs = 450kHz, $5V_{p-p}$)
- Bandwidth Minimally Affected By External C_H
- Fully Differential Analog Inputs
- Built-in 135pF Hold Capacitor
- Pin Compatible with HA-5320

Applications

- High Bandwidth Precision Data Acquisition Systems
- Inertial Navigation and Guidance Systems
- Ultrasonics
- SONAR
- RADAR

Description

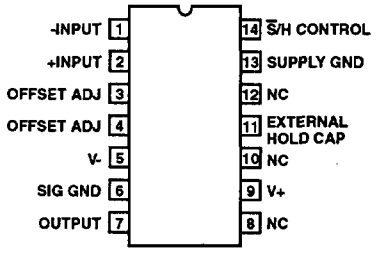
The HA-5340/883 combines the advantages of two sample/hold architectures to create a new generation of monolithic sample/hold. High amplitude, high frequency signals can be sampled with very low distortion being introduced. The combination of exceptionally fast acquisition time and specified/characterized hold mode distortion is an industry first. Additionally, the AC performance is only minimally affected by additional hold capacitance.

To achieve this level of performance, the benefits of an integrating output stage have been combined with the advantages of a buffered hold capacitor. To the user this translates to a front-end stage that has high bandwidth due to charging only a small capacitive load and an output stage with constant pedestal error which can be nulled out using the offset adjust pins. Since the performance penalty for additional hold capacitance is low, the designer can further minimize pedestal error and droop rate without sacrificing speed.

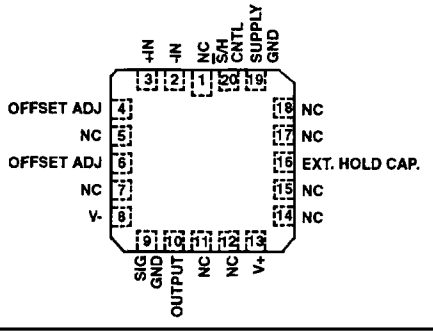
Low distortion, fast acquisition, and low droop rate are the result, making the HA-5340/883 the obvious choice for high speed, high accuracy sampling systems.

Pinouts

HA-5340/883 (CERDIP)
TOP VIEW



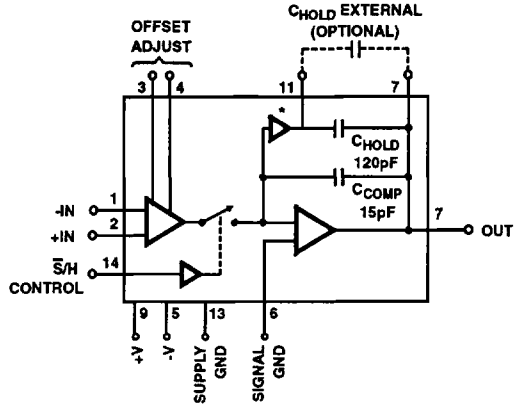
HA-5340/883 (CLCC)
TOP VIEW



Ordering Information

PART NUMBER	TEMPERATURE RANGE	PACKAGE
HA1-5340/883	-55°C to +125°C	14 Lead CerDIP
HA4-5340/883	-55°C to +125°C	20 Lead Ceramic LCC

Functional Diagram



NOTE: Buffer acts as a buffer in sample mode, acts as a closed switch in hold mode.

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

Spec Number **511117-883**
File Number **2452.1**

Absolute Maximum Ratings

Voltage Between V+ and V- Terminals 36V
Differential Input Voltage 24V
Digital Input Voltage (S/H Pin) . . . . . +8V, -6V
Output Current, Continuous . . . . . ±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	68°C/W	17°C/W
Ceramic LCC Package	68°C/W	18°C/W

Package Power Dissipation at +75°C
CerDip Package 1.5W
Ceramic LCC Package 1.5W
Package Power Dissipation Derating Factor Above +75°C
CerDip Package . . . . . 15mW/°C
Ceramic LCC Package . . . . . 15mW/°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 ≤ T_A ≤ +125°C
Operating Supply Voltage (±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 ELECTICAL PERFORMANCE CHARACTERISTICS

Device Tested at: V+ = +15V; V- = -15V; V_{IL} = 0.8V (Sample); V_{IH} = 2.0V (Hold); C_H = Internal = 135pF; 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	-1.5	1.5	mV
			2, 3	+125°C, -55°C	-3	3	mV
Input Bias Current	$+I_B$		1	+25°C	-350	350	nA
			2, 3	+125°C, -55°C	-350	350	nA
	$-I_B$		1	+25°C	-350	350	nA
			2, 3	+125°C, -55°C	-350	350	nA
Input Offset Current	I_{IO}		1	+25°C	-350	350	nA
			2, 3	+125°C, -55°C	-350	350	nA
Open Loop Voltage Gain	$+A_{VS}$	R_L = 2kΩ, C_L = 60pF, V_{OUT} = +10V	1	+25°C	110	-	dB
			2, 3	+125°C, -55°C	100	-	dB
	$-A_{VS}$	R_L = 2kΩ, C_L = 60pF, V_{OUT} = -10V	1	+25°C	110	-	dB
			2, 3	+125°C, -55°C	100	-	dB
Common Mode Rejection Ratio	+CMRR	V+ = 5V, V- = -25V, V_{OUT} = -10V, $V_{\overline{S}/H}$ = -9.2V	1	+25°C	72	-	dB
			2, 3	+125°C, -55°C	72	-	dB
	-CMRR	V+ = 25V, V- = -5V, V_{OUT} = +10V, $V_{\overline{S}/H}$ = 10.8V	1	+25°C	72	-	dB
			2, 3	+125°C, -55°C	72	-	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
Output Voltage Swing	$+V_{OP}$	R_L = 2kΩ, C_L = 60pF	1	+25°C	10	-	V
			2, 3	+125°C, -55°C	10	-	V
	$-V_{OP}$	R_L = 2kΩ, C_L = 60pF	1	+25°C	-	-10	V
			2, 3	+125°C, -55°C	-	-10	V

TABLE 1. DC ELECTICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Tested at: V+ = +15V; V- = -15V; V_{IL} = 0.8V (Sample); V_{IH} = 2.0V (Hold); C_H = Internal = 135pF; Signal GND = Supply GND, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUP	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Power Supply Current	$+I_{CC}$	V_{OUT} = 0V, I_{OUT} = 0mA	1	+25°C	-	25	mA
			2, 3	+125°C, -55°C	-	25	mA
	$-I_{CC}$	V_{OUT} = 0V, I_{OUT} = 0mA	1	+25°C	-25	-	mA
			2, 3	+125°C, -55°C	-25	-	mA
Power Supply Rejection Ratio	+PSRR	V+ = 13.5V, 16.5V V- = -15V, -15V	1	+25°C	75	-	dB
			2, 3	+125°C, -55°C	75	-	dB
	-PSRR	V+ = +15V, +15V, V- = -13.5V, -16.5V	1	+25°C	75	-	dB
			2, 3	+125°C, -55°C	75	-	dB
Digital Input Current	I_{INL}	V_{IN} = 0V	1	+25°C	-	40	µA
			2, 3	+125°C, -55°C	-	40	µA
	I_{INH}	V_{IN} = 5V	1	+25°C	-	40	µA
			2, 3	+125°C, -55°C	-	40	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	-	95	µV/µs

TABLE 2. AC ELECTICAL PERFORMANCE CHARACTERISTICS

Device Tested at: V+ = +15V; V- = -15V; V_{IL} = 0.8V (Sample); V_{IH} = 2.0V (Hold); C_H = Internal = 135pF; - Input Tied to Output, Signal GND = Supply GND, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUP	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Hold Step Error	V_{ERROR}	V_{IL} = 0V, V_{IH} = 4.0V, $t_{RISE}(V_{S/H})$ = 15ns	4	+25°C	-50	50	mV
Rise Time & Fall Time	T_R	C_L=60pF, R_L=2kΩ, A_V = +1, V_{OUT} = 0V to +200mV Step 10%, 90%pts	4	+25°C	-	50	ns
			5, 6	+125°C, -55°C	-	50	ns
	T_F	C_L = 60pF, R_L = 2kΩ, A_V = +1, V_{OUT} = 0V to -200mV Step 10%, 90%pts	4	+25°C	-	50	ns
Overshoot	+OS	C_L = 60pF, R_L = 2kΩ, A_V = +1, V_{OUT} = 0V to +200mV Step	4	+25°C	-	60	%
			5, 6	+125°C, -55°C	-	60	%
	-OS	C_L = 60pF, R_L = 2kΩ, A_V = +1, V_{OUT} = 0V to -200mV Step	4	+25°C	-	60	%
			5, 6	+125°C, -55°C	-	60	%
Slew Rate	+SR	C_L = 60pF, R_L = 2kΩ, A_V = +1, V_{OUT} = 0V to +10V Step, 25%, 75% pts	4	+25°C	40	-	V/µs
			5, 6	+125°C, -55°C	40	-	V/µs
	-SR	C_L = 60pF, R_L = 2kΩ, A_V = +1, V_{OUT} = 0V to -10V Step, 25%. 75% pts	4	+25°C	40	-	V/µs
			5, 6	+125°C, -55°C	40	-	V/µs

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

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

PARAMETER	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Hold Mode Feedthrough	V_{HMF}	V_{IN} = 20V_{P-P}, 200kHz	1	+25°C	-	-70	dB
Sample Mode Noise Voltage	$E_{n(SAMPLE)}$	DC to 10MHz, $V_{S/H}$ = 0V, R_{LOAD} = 2K	1	+25°C	-	335	μV_{RMS}
Hold Mode Noise Voltage	$E_{n(HOLD)}$	DC to 10MHz, $V_{S/H}$ = 5V, R_{LOAD} = 2K	1	+25°C	-	100	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
0.1% Acquisition Time	T_{ACQ} 0.1%	C_L = 60pF, R_L = 2K, V_{OUT} = 0V to 10V Step	1	+25°C	-	600	ns
Total Harmonic Distortion Hold Mode	$THD_{200K(HOLD)}$	F_S = 450kHz, V_{IN} = 20V_{P-P}, 200kHz	1	+25°C	-	-50	dBc
	$THD_{500K(HOLD)}$	F_S = 450kHz, V_{IN} = 5V_{P-P}, 500kHz	1	+25°C	-	-47	dBc
Total Harmonic Distortion Sample Mode	$THD_{200K(SAMPLE)}$	V_{IN} = 20V_{P-P}, 200kHz	1	+25°C	-	-60	dBc
	$THD_{500K(SAMPLE)}$	V_{IN} = 5V_{P-P}, 500kHz	1	+25°C	-	-49	dBc

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 TABLES 1 AND 2)
Interim Electrical Parameters (Pre Burn-In)	-
Final Electrical Test Parameters	1(Note 1), 2, 3, 4, 5, 6
Group A Test Requirements	1, 2, 3, 4, 5, 6
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:
84 x 139 x 19mils

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

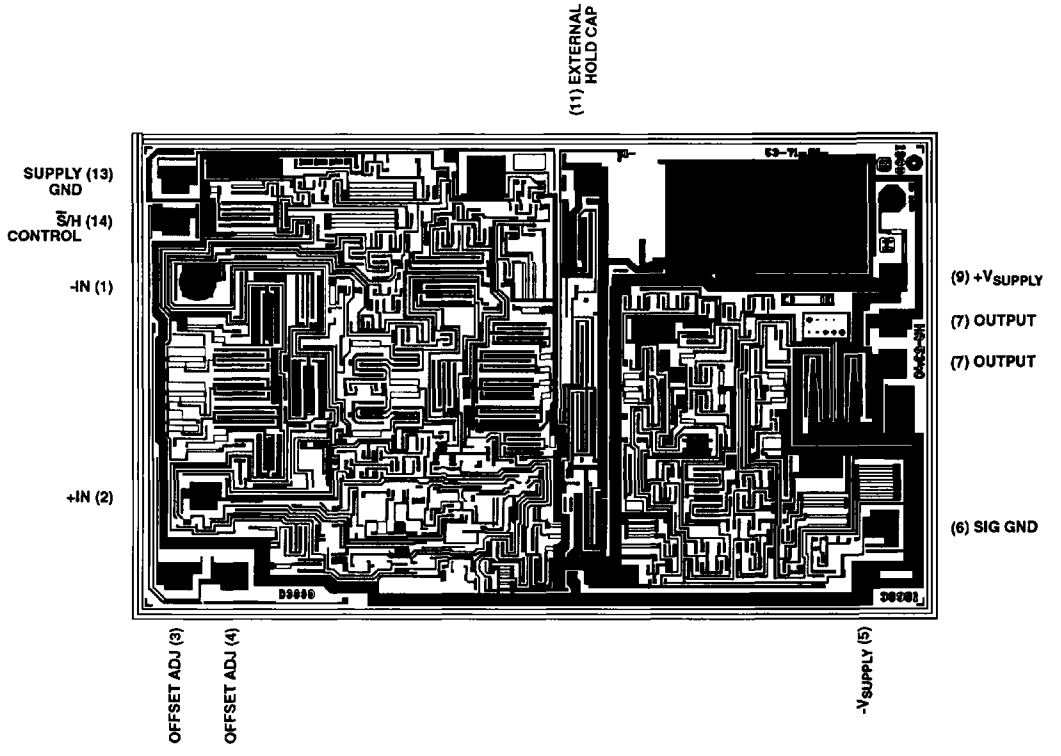
GLASSIVATION:
Type: Nitride (Si_3N_4) over Silox (SiO_2, 5% Phos)
Silox Thickness: 12kÅ ± 2.0kÅ
Nitride Thickness: 3.5kÅ ± 1.5kÅ

DIE ATTACH:
Material: Gold Silicon Eutectic Alloy
Temperature:Ceramic DIP - 460°C (Max)
Ceramic LCC - 420°C (Max)

WORST CASE CURRENT DENSITY:
5.33×10^4 A/cm^2

Metallization Mask Layout

HA-5340/883



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