HARRIS SEMICONDUCTOR

HFA1110/883

750MHz, Low Distortion Unity Gain, Closed Loop Buffer

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.**
- **Fixed Gain of +1**
- **Wide -3dB Bandwidth ..... 750MHz (Typ)**
- **Very Fast Slew Rate..... 1250V/μs (Typ)**
- **Low Differential Gain and Phase ... 0.04%/0.025 Deg.**
- **Low Distortion (HD3, 30MHz) ..... -80dBc (Typ)**
- **Excellent Gain Flatness (to 100MHz)... ±0.03dB (Typ)**
- **Excellent Gain Accuracy.....0.99V/V (Typ)**
- **High Output Current ..... 60mA (Typ)**

Applications

- **Video Switching and Routing**
- **Pulse and Video Amplifiers**
- **Wideband Amplifiers**
- **RF/IF Signal Processing**
- **Flash A/D Driver**
- **Medical Imaging Systems**

Description

The HFA1110/883 is a unity gain, closed loop buffer which achieves a high degree of gain accuracy, wide bandwidth, and low distortion. Manufactured on Harris' proprietary complementary bipolar UHF-1 process, the HFA1110/883 also offers very fast slew rates, and high output current.

Component and composite video systems will also benefit from this buffer's performance, as indicated by the excellent gain flatness, and 0.04%/0.025 Degree Differential Gain/Phase specifications (R_L = 75Ω).

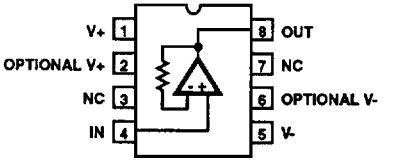
For buffer applications desiring a standard op amp pinout, or selectable gain (-1, +1, +2), please refer to the HFA1112/883 and HFA1113/883 (featuring programmable output clamps) datasheets.

Ordering Information

PART NUMBER	TEMPERATURE RANGE	PACKAGE
HFA1110MJ/883	-55°C to +125°C	8 Lead CerDIP

Pinout

HFA1110/883
(CERDIP)
TOP VIEW



3 OPERATIONAL AMPLIFIERS

CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper I.C. Handling Procedures.
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Spec Number 511083-883
File Number 3620.1

Absolute Maximum Ratings

Voltage Between V+ and V- 12V
Voltage at Input Terminal ..... V+ to V-
Output Current (50% Duty Cycle) ..... ±55mA
Junction Temperature ..... +175°C
ESD Rating ..... <2000V
Storage Temperature Range ..... $-65°C \le T_A \le +150°C$
Lead Temperature (Soldering 10s) ..... +300°C

Thermal Information

Thermal Resistance	θ_{JA}	θ_{JC}
CerDIP Package	115°C/W	30°C/W

Maximum Package Power Dissipation at +75°C
CerDIP Package 0.87W
Package Power Dissipation Derating Factor above +75°C
CerDIP Package ..... 8.7mW/°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 Supply Voltage ($\pm V_S$) ..... ±5V $R_L \ge 50\Omega$
Operating Temperature Range ..... $-55°C \le T_A \le +125°C$

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: V_{SUPPLY} = ±5V, R_{SOURCE} = 0Ω, R_L = 100Ω, V_{OUT} = 0V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Output Offset Voltage	V_{OS}	V_{CM} = 0V	1	+25°C	-25	25	mV
			2, 3	+125°C, -55°C	-40	40	mV
Power Supply Rejection Ratio	PSRRP	ΔV_{SUP} = ±1.25V V+ = 6.25V, V- = -5V V+ = 3.75V, V- = -5V	1	+25°C	39	-	dB
			2, 3	+125°C, -55°C	35	-	dB
	PSRRN	ΔV_{SUP} = ±1.25V V+ = 5V, V- = -6.25V V+ = 5V, V- = -3.75V	1	+25°C	39	-	dB
			2, 3	+125°C, -55°C	35	-	dB
Input Current	I_{BSP}	V_{CM} = 0V	1	+25°C	-40	40	µA
			2, 3	+125°C, -55°C	-65	65	µA
Input Current Common Mode Rejection	CMS_{IBP}	ΔV_{CM} = ±2V V+ = 3V, V- = -7V V+ = 7V, V- = -3V	1	+25°C	-	40	µA/V
			2, 3	+125°C, -55°C	-	50	µA/V
Input Resistance	R_{IN}	Note 1	1	+25°C	25	-	kΩ
			2, 3	+125°C, -55°C	20	-	kΩ
Gain ($V_{OUT} = 2V_{P-P}$)	A_{VP1}	V_{IN} = -1V to +1V	1	+25°C	0.980	1.020	V/V
			2, 3	+125°C, -55°C	0.975	1.025	V/V
Output Voltage Swing	V_{OP100}	R_L = 100Ω, V_{IN} = +3.3V	1	+25°C	3	-	V
			2, 3	+125°C, -55°C	2.5	-	V
	V_{ON100}	R_L = 100Ω, V_{IN} = -3.3V	1	+25°C	-	-3	V
			2, 3	+125°C, -55°C	-	-2.5	V
Output Voltage Swing	V_{OP50}	R_L = 50Ω, V_{IN} = +3.3V	1, 2	+25°C, +125°C	2.5	-	V
			3	-55°C	1.5	-	V
	V_{ON50}	R_L = 50Ω, V_{IN} = -3.3V	1, 2	+25°C, +125°C	-	-2.5	V
			3	-55°C	-	-1.5	V

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Tested at: V_{SUPPLY} = ±5V, R_{SOURCE} = 0Ω, R_L = 100Ω, V_{OUT} = 0V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Output Current	$+I_{OUT}$	Note 2	1, 2	+25°C, +125°C	50	-	mA
			3	-55°C	30	-	mA
	$-I_{OUT}$	Note 2	1, 2	+25°C, +125°C	-	-50	mA
			3	-55°C	-	-30	mA
Quiescent Power Supply Current	I_{CC}	R_L = 100Ω	1	+25°C	14	26	mA
			2, 3	+125°C, -55°C	-	33	mA
	I_{EE}	R_L = 100Ω	1	+25°C	-26	-14	mA
			2, 3	+125°C, -55°C	-33	-	mA

NOTES:

1. Guaranteed from Input Common Mode Rejection Test, by: $R_{IN} = 1/CMS_{IBP}$
2. Guaranteed from V_{OUT} Test with R_L = 50Ω, by: $I_{OUT} = V_{OUT}/50Ω$.

TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS

Table 2 Intentionally Left Blank.

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Characterized at: V_{SUPPLY} = ±5V, R_L = 100Ω, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
-3dB Bandwidth	BW	$V_{OUT} = 200mV_{P-P}$	1	+25°C	350	-	MHz
Gain Flatness	GF30	f ≤ 30MHz $V_{OUT} = 200mV_{P-P}$	1	+25°C	-	±0.025	dB
	GF50	f ≤ 50MHz $V_{OUT} = 200mV_{P-P}$	1	+25°C	-	±0.055	dB
	GF100	f ≤ 100MHz $V_{OUT} = 200mV_{P-P}$	1	+25°C	-	±0.08	dB
Slew Rate	+SR	$V_{OUT} = 5V_{P-P}$	1, 2	+25°C	800	-	V/µs
	-SR	$V_{OUT} = 5V_{P-P}$	1, 2	+25°C	800	-	V/µs
Rise & Fall Time	T_R	$V_{OUT} = 0.5V_{P-P}$	1, 2	+25°C	-	1	ns
	T_F	$V_{OUT} = 0.5V_{P-P}$	1, 2	+25°C	-	1	ns
Overshoot	+OS	$V_{OUT} = 0.5V_{P-P}$	1, 3	+25°C	-	30	%
	-OS	$V_{OUT} = 0.5V_{P-P}$	1, 3	+25°C	-	30	%

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Characterized at: V_{SUPPLY} = ±5V, R_L = 100Ω, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	LIMITS		UNITS
					MIN	MAX	
2nd Harmonic Distortion	HD2(30)	f = 30MHz, $V_{OUT} = 2V_{P-P}$	1	+25°C	-	-55	dBc
	HD2(50)	f = 50MHz, $V_{OUT} = 2V_{P-P}$	1	+25°C	-	-45	dBc
	HD2(100)	f = 100MHz, $V_{OUT} = 2V_{P-P}$	1	+25°C	-	-35	dBc
3rd Harmonic Distortion	HD3(30)	f = 30MHz, $V_{OUT} = 2V_{P-P}$	1	+25°C	-	-65	dBc
	HD3(50)	f = 50MHz, $V_{OUT} = 2V_{P-P}$	1	+25°C	-	-60	dBc
	HD3(100)	f = 100MHz, $V_{OUT} = 2V_{P-P}$	1	+25°C	-	-40	dBc

NOTES:

1. 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.
2. Measured between 10% and 90% points.
3. For 600ps input transition times. Overshoot decreases as input transition times increase, as shown in the Typical Performance Curve.

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:

1. PDA applies to Subgroup 1 only.

Die Characteristics

DIE DIMENSIONS:
63 x 44 x 19 mils ± 1 mils
1600 x 1130 x 483µm ± 25.4µm

METALLIZATION:
Type: Metal 1: AlCu(2%)/TiW
Thickness: Metal 1: 8kÅ ±0.4kÅ
Type: Metal 2: AlCu(2%)
Thickness: Metal 2: 16kÅ ±0.8kÅ

GLASSIVATION:
Type: Nitride
Thickness: 4kÅ ±0.5kÅ

WORST CASE CURRENT DENSITY:
2.0×10^5 A/cm^2 at 47.5mA

TRANSISTOR COUNT: 52

SUBSTRATE POTENTIAL (Powered Up): Floating (Recommend Connection to V-)

Metallization Mask Layout

HFA1110/883