

Output Clamping,

850MHz Current Feedback Amplifier

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.
- User Programmable Output Voltage Clamps
- Low Distortion (HD3, 30MHz) -84dBc (Typ)
- Wide -3dB Bandwidth 850MHz (Typ)
- Very High Slew Rate 2300V/ μ s (Typ)
- Fast Settling (0.1%) 11ns (Typ)
- Excellent Gain Flatness (to 50MHz) 0.05dB (Typ)
- High Output Current 65mA (Typ)
- Fast Overdrive Recovery <1ns (Typ)

Applications

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

Description

The HFA1130/883 is a high speed, wideband current feedback amplifier featuring programmable output clamps. Built with Harris' proprietary complementary bipolar UHF-1 process, it is the fastest monolithic amplifier available from any semiconductor manufacturer.

This amplifier is the ideal choice for high frequency applications requiring output limiting, especially those needing ultra fast overdrive recovery times. The output clamp function allows the designer to set the maximum positive and negative output levels, thereby protecting later stages from damage or input saturation. The sub-nanosecond overdrive recovery time quickly returns the amplifier to linear operation following an overdrive condition.

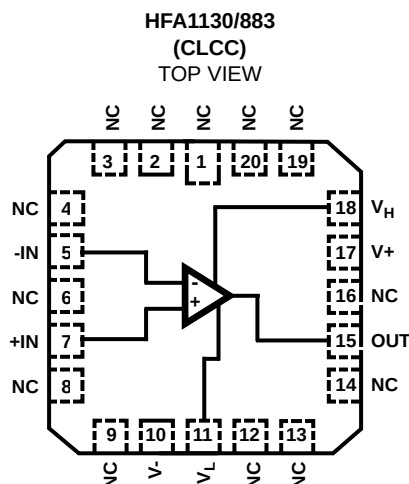
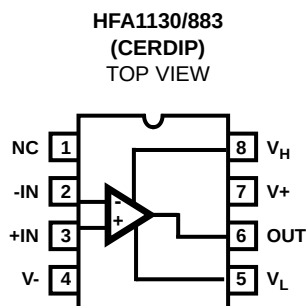
The HFA1130/883's wide bandwidth, fast settling characteristic, and low output impedance, coupled with the output clamping ability, make this amplifier ideal for driving fast A/D converters.

Component and composite video systems will also benefit from this amplifier's performance, as indicated by the excellent gain flatness, and 0.03%/0.05 Degree Differential Gain/Phase specifications ($R_L = 75\Omega$).

Ordering Information

PART NUMBER	TEMPERATURE RANGE	PACKAGE
HFA1130MJ/883	-55°C to +125°C	8 Lead CerDIP
HFA1130ML/883	-55°C to +125°C	20 Lead Ceramic LCC

Pinouts



Specifications HFA1130/883

Absolute Maximum Ratings

Voltage Between V+ and V-	12V
Differential Input Voltage	5V
Voltage at Either Input Terminal	V+ to V-
Voltage at V _H or V _L Terminal	(V+) + 2V to (V-) - 2V
Output Current (50% Duty Cycle)	±55mA
Junction Temperature	+175°C
ESD Rating	< 2000V
Storage Temperature Range	-65°C ≤ T _A ≤ +150°C
Lead Temperature (Soldering 10s)	+300°C

Thermal Information

Thermal Resistance	θ _{JA}	θ _{JC}
CerDIP Package	115°C/W	30°C/W
Ceramic LCC Package	75°C/W	23°C/W
Maximum Package Power Dissipation at +75°C		
CerDIP Package	0.87W	
Ceramic LCC Package	1.33W	
Package Power Dissipation Derating Factor above +75°C		
CerDIP Package	8.7mW/°C	
Ceramic LCC Package	13.3mW/°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 Supply Voltage (±V _S)	±5V	R _L ≥ 50Ω
Operating Temperature Range	-55°C ≤ T _A ≤ +125°C	

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: V_{SUPPLY} = ±5V, A_V = +1, R_F = 510Ω, R_{SOURCE} = 0Ω, R_L = 100Ω, V_{OUT} = 0V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	LIMITS		UNITS
					MIN	MAX	
Input Offset Voltage	V _{IO}	V _{CM} = 0V	1	+25°C	-6	6	mV
			2, 3	+125°C, -55°C	-10	10	mV
Common Mode Rejection Ratio	CMRR	ΔV _{CM} = ±2V V+ = 3V, V- = -7V V+ = 7V, V- = -3V	1	+25°C	40	-	dB
			2, 3	+125°C, -55°C	38	-	dB
Power Supply Rejection Ratio	PSRRP	ΔV _{SUP} = ±1.25V V+ = 6.25V, V- = -5V V+ = 3.75V, V- = -5V	1	+25°C	45	-	dB
			2, 3	+125°C, -55°C	42	-	dB
	PSRRN	ΔV _{SUP} = ±1.25V V+ = 5V, V- = -6.25V V+ = 5V, V- = -3.75V	1	+25°C	45	-	dB
			2, 3	+125°C, -55°C	42	-	dB
Non-Inverting Input (+IN) Current	I _{BSP}	V _{CM} = 0V	1	+25°C	-40	40	μA
			2, 3	+125°C, -55°C	-65	65	μA
+IN Current Common Mode Sensitivity	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
+IN Resistance	+R _{IN}	Note 1	1	+25°C	25	-	kΩ
			2, 3	+125°C, -55°C	20	-	kΩ
Inverting Input (-IN) Current	I _{BSN}	V _{CM} = 0V	1	+25°C	-50	50	μA
			2, 3	+125°C, -55°C	-75	75	μA
-IN Current Common Mode Sensitivity	CMS _{IBN}	ΔV _{CM} = ±2V V+ = 3V, V- = -7V V+ = 7V, V- = -3V	1	+25°C	-	7	μA/V
			2, 3	+125°C, -55°C	-	10	μA/V
-IN Current Power Supply Sensitivity	PPSS _{IBN}	ΔV _{SUP} = ±1.25V V+ = 6.25V, V- = -5V V+ = 3.75V, V- = -5V	1	+25°C	-	15	μA/V
			2, 3	+125°C, -55°C	-	27	μA/V
	NPSS _{IBN}	ΔV _{SUP} = ±1.25V V+ = 5V, V- = -6.25V V+ = 5V, V- = -3.75V	1	+25°C	-	15	μA/V
			2, 3	+125°C, -55°C	-	27	μA/V
Output Voltage Swing	V _{OP100}	A _V = -1 R _L = 100Ω V _{IN} = 3.5V V _{IN} = -3V	1	+25°C	3	-	V
			2, 3	+125°C, -55°C	2.5	-	V
	V _{ON100}	A _V = -1 R _L = 100Ω V _{IN} = +3.5V V _{IN} = +3V	1	+25°C	-	-3	V
			2, 3	+125°C, -55°C	-	-2.5	V

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TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Tested at: $V_{SUPPLY} = \pm 5V$, $A_V = +1$, $R_F = 510\Omega$, $R_{SOURCE} = 0\Omega$, $R_L = 100\Omega$, $V_{OUT} = 0V$, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS		GROUP A SUBGROUPS	TEMPERATURE	LIMITS		UNITS
						MIN	MAX	
Output Voltage Swing	V _{OP50}	A _V = -1 R _L = 50Ω	V _{IN} = -3V	1, 2	+25°C, +125°C	2.5	-	V
			V _{IN} = -2V	3	-55°C	1.5	-	V
	V _{ON50}	A _V = -1 R _L = 50Ω	V _{IN} = +3V	1, 2	+25°C, +125°C	-	-2.5	V
			V _{IN} = +2V	3	-55°C	-	-1.5	V
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
Clamp Accuracy	V _{HCLMP}	A _V = -1, V _{IN} = -2V V _H = 1V		1	+25°C	-125	125	mV
				2, 3	+125°C, -55°C	-200	200	mV
	V _{LCLMP}	A _V = -1, V _{IN} = +2V V _L = -1V		1	+25°C	-125	125	mV
				2, 3	+125°C, -55°C	-200	200	mV
Clamp Input Current	V _{HBIAS}	V _H = 1V		1	+25°C	-	200	μA
				2, 3	+125°C, -55°C	-	300	μA
	V _{LBIAS}	V _L = -1V		1	+25°C	-200	-	μA
				2, 3	+125°C, -55°C	-300	-	μA

NOTES:

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

TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS

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TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Characterized at: $V_{SUPPLY} = \pm 5V$, $A_V = +2$, $R_F = 360\Omega$, $R_L = 100\Omega$, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	LIMITS		UNITS
					MIN	MAX	
-3dB Bandwidth	BW(-1)	$A_V = -1$, $R_F = 430\Omega$ $V_{OUT} = 200mV_{P-P}$	1	+25°C	300	-	MHz
	BW(+1)	$A_V = +1$, $R_F = 510\Omega$ $V_{OUT} = 200mV_{P-P}$	1	+25°C	550	-	MHz
	BW(+2)	$A_V = +2$, $V_{OUT} = 200mV_{P-P}$	1	+25°C	350	-	MHz
Gain Flatness	GF30	$A_V = +2$, $R_F = 510\Omega$, $f \leq 30MHz$ $V_{OUT} = 200mV_{P-P}$	1	+25°C	-	± 0.04	dB
	GF50	$A_V = +2$, $R_F = 510\Omega$, $f \leq 50MHz$ $V_{OUT} = 200mV_{P-P}$	1	+25°C	-	± 0.10	dB
	GF100	$A_V = +2$, $R_F = 510\Omega$, $f \leq 100MHz$, $V_{OUT} = 200mV_{P-P}$	1	+25°C	-	± 0.30	dB

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TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Characterized at: $V_{SUPPLY} = \pm 5V$, $A_V = +2$, $R_F = 360\Omega$, $R_L = 100\Omega$, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	LIMITS		UNITS
					MIN	MAX	
Slew Rate	+SR(+1)	$A_V = +1$, $R_F = 510\Omega$ $V_{OUT} = 5V_{P-P}$	1, 2	+25°C	1200	-	V/ μ s
	-SR(+1)	$A_V = +1$, $R_F = 510\Omega$ $V_{OUT} = 5V_{P-P}$	1, 2	+25°C	1100	-	V/ μ s
	+SR(+2)	$A_V = +2$, $V_{OUT} = 5V_{P-P}$	1, 2	+25°C	1650	-	V/ μ s
	-SR(+2)	$A_V = +2$, $V_{OUT} = 5V_{P-P}$	1, 2	+25°C	1500	-	V/ μ s
Rise and Fall Time	T_R	$A_V = +2$, $V_{OUT} = 0.5V_{P-P}$	1, 2	+25°C	-	1	ns
	T_F	$A_V = +2$, $V_{OUT} = 0.5V_{P-P}$	1, 2	+25°C	-	1	ns
Overshoot	+OS	$A_V = +2$, $V_{OUT} = 0.5V_{P-P}$	1, 3	+25°C	-	25	%
	-OS	$A_V = +2$, $V_{OUT} = 0.5V_{P-P}$	1, 3	+25°C	-	20	%
Settling Time	TS(0.1)	$A_V = +2$, $R_F = 510\Omega$ $V_{OUT} = 2V$ to $0V$, to 0.1%	1	+25°C	-	20	ns
	TS(0.05)	$A_V = +2$, $R_F = 510\Omega$ $V_{OUT} = 2V$ to $0V$, to 0.05%	1	+25°C	-	33	ns
2nd Harmonic Distortion	HD2(30)	$A_V = +2$, $f = 30MHz$ $V_{OUT} = 2V_{P-P}$	1	+25°C	-	-48	dBc
	HD2(50)	$A_V = +2$, $f = 50MHz$ $V_{OUT} = 2V_{P-P}$	1	+25°C	-	-45	dBc
	HD2(100)	$A_V = +2$, $f = 100MHz$ $V_{OUT} = 2V_{P-P}$	1	+25°C	-	-35	dBc
3rd Harmonic Distortion	HD3(30)	$A_V = +2$, $f = 30MHz$ $V_{OUT} = 2V_{P-P}$	1	+25°C	-	-65	dBc
	HD3(50)	$A_V = +2$, $f = 50MHz$ $V_{OUT} = 2V_{P-P}$	1	+25°C	-	-60	dBc
	HD3(100)	$A_V = +2$, $f = 100MHz$ $V_{OUT} = 2V_{P-P}$	1	+25°C	-	-40	dBc

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.
- For 200ps input transition times. Overshoot decreases as input transition times increase, especially for $A_V = +1$. Please refer to Performance Curves.

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:

63 x 44 x 19 mils $\pm$ 1 mils

1600 x 1130 x 483 μ m $\pm$ 25.4 μ m

METALLIZATION:

Type: Metal 1: AlCu(2%)/TiW

Thickness: Metal 1: 8k $\text{\AA}$ $\pm$ 0.4k $\text{\AA}$

Type: Metal 2: AlCu(2%)

Thickness: Metal 2: 16k $\text{\AA}$ $\pm$ 0.8k $\text{\AA}$

GLASSIVATION:

Type: Nitride

Thickness: 4k $\text{\AA}$ $\pm$ 0.5k $\text{\AA}$

WORST CASE CURRENT DENSITY:

2.0 x 10⁵ A/cm² at 47.5mA

TRANSISTOR COUNT: 52

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

Metallization Mask Layout

