

July 1994

## 850MHz Current Feedback Amplifier

### Features

- This Circuit is Processed in Accordance to MIL-STD-883 and is Fully Conformant Under the Provisions of Paragraph 1.2.1.
- Low Distortion (HD3, 30MHz) ..... -84dBc (Typ)
- Wide -3dB Bandwidth ..... 850MHz (Typ)
- Very High Slew Rate ..... 2300V/ $\mu$ s (Typ)
- Fast Settling (0.1%) ..... 11ns (Typ)
- Excellent Gain Flatness (to 50MHz) ..... 0.05dB (Typ)
- High Output Current ..... 65mA (Typ)
- Fast Overdrive Recovery ..... <10ns (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 HFA1100/883 is a high speed, wideband, fast settling current feedback amplifier. Built with Harris' proprietary, complementary bipolar UHF-1 process, it is the fastest monolithic amplifier available from any semiconductor manufacturer.

The HFA1100/883's wide bandwidth, fast settling characteristic, and low output impedance, make this amplifier ideal for driving fast A/D converters.

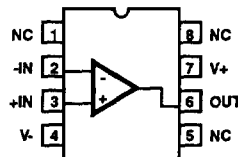
Component and composite video systems will also benefit from this amplifier's performance, as indicated by the excellent gain flatness, and 0.03%/0.05 Deg. Differential Gain/Phase specifications ( $R_L = 75\Omega$ ).

### Ordering Information

PART NUMBER	TEMPERATURE RANGE	PACKAGE
HFA1100MJ/883	-55°C to +125°C	8 Lead CerDIP

### Pinout

HFA1100/883  
(CERDIP)  
TOP VIEW



# Specifications HFA1100/883

## Absolute Maximum Ratings

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

## Thermal Information

Thermal Resistance	$\theta_{JA}$	$\theta_{JC}$
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 V <sub>SUPPLY</sub> (±V <sub>S</sub> ) .....	±5V	R <sub>L</sub> ≥ 50Ω
Operating Temperature Range .....	-55°C ≤ T <sub>A</sub> ≤ +125°C	

**TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS**

Device Tested at: V<sub>SUPPLY</sub> = ±5V, A<sub>V</sub> = +1, R<sub>F</sub> = 510Ω, R<sub>SOURCE</sub> = 0Ω, R<sub>L</sub> = 100Ω, V<sub>OUT</sub> = 0V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	LIMITS		UNITS
					MIN	MAX	
Input Offset Voltage	V <sub>IO</sub>	V <sub>CM</sub> = 0V	1	+25°C	-6	6	mV
			2, 3	+125°C, -55°C	-10	10	mV
Common Mode Rejection Ratio	CMRR	ΔV <sub>CM</sub> = ±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 <sub>SUPPLY</sub> = ±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 <sub>SUPPLY</sub> = ±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 <sub>BSP</sub>	V <sub>CM</sub> = 0V	1	+25°C	-40	40	μA
			2, 3	+125°C, -55°C	-65	65	μA
+IN Current Common Mode Sensitivity	CMS <sub>IBP</sub>	ΔV <sub>CM</sub> = ±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 <sub>IN</sub>	Note 1	1	+25°C	25	-	kΩ
			2, 3	+125°C, -55°C	20	-	kΩ
Inverting Input (-IN) Current	I <sub>BSN</sub>	V <sub>CM</sub> = 0V	1	+25°C	-50	50	μA
			2, 3	+125°C, -55°C	-75	75	μA
-IN Current Common Mode Sensitivity	CMS <sub>IBN</sub>	ΔV <sub>CM</sub> = ±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 <sub>IBN</sub>	ΔV <sub>SUPPLY</sub> = ±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 <sub>IBN</sub>	ΔV <sub>SUPPLY</sub> = ±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 <sub>OP100</sub>	A <sub>V</sub> = -1 R <sub>L</sub> = 100Ω	1	+25°C	3	-	V
			2, 3	+125°C, -55°C	2.5	-	V
	V <sub>ON100</sub>	A <sub>V</sub> = -1 R <sub>L</sub> = 100Ω	1	+25°C	-	-3	V
			2, 3	+125°C, -55°C	-	-2.5	V

**3**  
OPERATIONAL AMPLIFIERS

## Specifications HFA1100/883

**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	$V_{OP50}$	$A_V = -1$ $R_L = 50\Omega$	$V_{IN} = -3V$	1, 2	+25°C, +125°C	2.5	-	V
			$V_{IN} = -2V$	3	-55°C	1.5	-	V
	$V_{ON50}$	$A_V = -1$ $R_L = 50\Omega$	$V_{IN} = +3V$	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	$I_{CC}$	$R_L = 100\Omega$		1	+25°C	14	26	mA
				2, 3	+125°C, -55°C	-	33	mA
	$I_{EE}$	$R_L = 100\Omega$		1	+25°C	-26	-14	mA
				2, 3	+125°C, -55°C	-33	-	mA

**NOTES:**

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

**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:  $V_{SUPPLY} = \pm 5V$ ,  $A_V = +2$ ,  $R_F = 360\Omega$ ,  $R_L = 100\Omega$ , 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	-	$\pm 0.04$	dB
	GF50	$A_V = +2$ , $R_F = 510\Omega$ , $f \leq 50MHz$ $V_{OUT} = 200mV_{P-P}$	1	+25°C	-	$\pm 0.10$	dB
	GF100	$A_V = +2$ , $R_F = 510\Omega$ , $f \leq 100MHz$ $V_{OUT} = 200mV_{P-P}$	1	+25°C	-	$\pm 0.30$	dB

## Specifications HFA1100/883

**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/ $\mu$ s
	-SR(+1)	$A_V = +1$ , $R_F = 510\Omega$ , $V_{OUT} = 5V_{P-P}$	1, 2	+25°C	1100	-	V/ $\mu$ s
	+SR(+2)	$A_V = +2$ , $V_{OUT} = 5V_{P-P}$	1, 2	+25°C	1650	-	V/ $\mu$ s
	-SR(+2)	$A_V = +2$ , $V_{OUT} = 5V_{P-P}$	1, 2	+25°C	1500	-	V/ $\mu$ 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.

**3**  
**OPERATIONAL AMPLIFIERS**

**Die Characteristics**

**DIE DIMENSIONS:**

63 x 44 x 19 mils  $\pm$  1 mils  
1600 $\mu$ m x 1130 $\mu$ m x 483 $\mu$ m  $\pm$  25.4 $\mu$ m

**METALLIZATION:**

Type: Metal 1: AlCu(2%)/TiW      Type: Metal 2: AlCu(2%)  
Thickness: Metal 1: 8k $\text{\AA}$   $\pm$  0.4k $\text{\AA}$       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 10<sup>5</sup> A/cm<sup>2</sup> at 47.5mA

**TRANSISTOR COUNT: 52**

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

**Metallization Mask Layout**

