

## PRELIMINARY

June 1994

## Dual, High Speed, Low Power, Video Closed Loop Buffer

### 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 For Closed-Loop Gains of +1, -1 or +2 Without Use of External Resistors
- Standard Operational Amplifier Pinout
- Low Supply Current . . . . . 5.9mA/Op Amp (Typ)
- Excellent Gain Accuracy . . . . . 0.99V/V (Typ)
- Wide -3dB Bandwidth . . . . . 340MHz (Typ)
- Fast Slew Rate . . . . . 1155V/ $\mu$ s (Typ)
- High Input Impedance . . . . . 1M $\Omega$  (Typ)
- Excellent Gain Flatness (to 50MHz) . . . .  $\pm$ 0.02dB (Typ)
- Fast Overdrive Recovery . . . . . <10ns (Typ)

### Applications

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

### Description

The HFA1212/883 is a dual closed loop Buffer featuring user programmable gain and high speed performance. Manufactured on Harris' proprietary complementary bipolar UHF-1 process, this device offers wide -3dB bandwidth of 340MHz, very fast slew rate, excellent gain flatness and high output current.

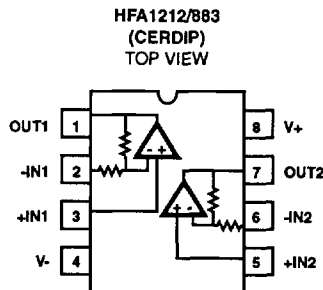
A unique feature of the pinout allows the user to select a voltage gain of +1, -1, or +2, without the use of any external components. Gain selection is accomplished via connections to the inputs, as described in the "Application Information" section. The result is a more flexible product, fewer part types in inventory, and more efficient use of board space.

Compatibility with existing op amp pinouts provides flexibility to upgrade low gain amplifiers, while decreasing component count. Unlike most buffers, the standard pinout provides an upgrade path should a higher closed loop gain be needed at a future date.

### Ordering Information

| PART NUMBER   | TEMPERATURE RANGE | PACKAGE       |
|---------------|-------------------|---------------|
| HFA1212MJ/883 | -55°C to +125°C   | 8 Lead CerDIP |

### Pinout



## Specifications HFA1212/883

### Absolute Maximum Ratings

|   |                                 |
|---|---------------------------------|
| Voltage Between V+ and V- .....               | 12V                             |
| Voltage at Either Input Terminal .....        | V+ to V-                        |
| Output Current (Note 1) .....                 | Short Circuit Protected         |
| Output Current (50% Duty Cycle, Note 1) ..... | 60mA                            |
| 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                                    | θ <sub>JA</sub> | θ <sub>JC</sub> |
| 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>SOURCE</sub> = 0Ω, R<sub>L</sub> = 100Ω, V<sub>OUT</sub> = 0V, Unless Otherwise Specified.

| PARAMETERS  | SYMBOL            | CONDITIONS   | GROUP A<br>SUBGROUPS | TEMPERATURE   | LIMITS |     | UNITS |
|---|-------------------|--|----------------------|---------------|--------|-----|-------|
|   |                   |  |                      |               | MIN    | MAX |       |
| Output Offset<br>Voltage                                | V <sub>OS</sub>   | V <sub>CM</sub> = 0V   | 1                    | +25°C         | -10    | 10  | mV    |
|   |                   |  | 2, 3                 | +125°C, -55°C | -20    | 20  | mV    |
| Channel-to-Channel<br>Output Offset<br>Voltage Mismatch | ΔV <sub>OS</sub>  | V <sub>CM</sub> = 0V   | 1                    | +25°C         | -15    | 15  | mV    |
|   |                   |  | 2, 3                 | +125°C, -55°C | -30    | 30  | mV    |
| Common Mode<br>Rejection Ratio                          | CMRR              | ΔV <sub>CM</sub> = ±1.8V<br>V+ = 3.2V, V- = -6.8V<br>V+ = 6.8V, V- = -3.2V | 1                    | +25°C         | 42     | -   | dB    |
|   |                   |  | 2                    | +125°C        | 39     | -   | dB    |
|   |                   | 3  | -55°C                | 39            | -      | dB  |       |
| Power Supply<br>Rejection Ratio                         | PSRRP             | ΔV <sub>SUPPLY</sub> = ±1.8V<br>V+ = 6.8V, V- = -5V<br>V+ = 3.2V, V- = -5V | 1                    | +25°C         | 45     | -   | dB    |
|   |                   |  | 2                    | +125°C        | 42     | -   | dB    |
|   |                   | 3  | -55°C                | 42            | -      | dB  |       |
|   | PSRRN             | ΔV <sub>SUPPLY</sub> = ±1.2V<br>V+ = 6.2V, V- = -5V<br>V+ = 3.8V, V- = -5V | 1                    | +25°C         | 45     | -   | dB    |
|   |                   |  | 2                    | +125°C        | 42     | -   | dB    |
|   |                   | 3  | -55°C                | 42            | -      | dB  |       |
| Non-Inverting Input<br>(+IN) Current                    | I <sub>BSP</sub>  | V <sub>CM</sub> = 0V   | 1                    | +25°C         | -15    | 15  | μA    |
|   |                   |  | 2, 3                 | +125°C, -55°C | -25    | 25  | μA    |
| Channel-to-Channel<br>+IN Current<br>Mismatch           | ΔI <sub>BSP</sub> | V <sub>CM</sub> = 0V   | 1                    | +25°C         | -15    | 15  | μA    |
|   |                   |  | 2, 3                 | +125°C, -55°C | -25    | 25  | μA    |

## Specifications HFA1212/883

**TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)**

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

| PARAMETERS                             | SYMBOL           | CONDITIONS   | GROUP A<br>SUBGROUPS | TEMPERATURE   | LIMITS        |           | UNITS      |   |
|--|------------------|--|----------------------|---------------|---------------|-----------|------------|---|
|  |                  |  |                      |               | MIN           | MAX       |            |   |
| +IN Current Common<br>Mode Sensitivity | $CMS_{IBP}$      | $\Delta V_{CM} = \pm 1.8V$<br>$V_+ = 3.2V, V_- = -6.8V$<br>$V_+ = 6.8V, V_- = -3.2V$ | 1                    | +25°C         | -             | 1.25      | $\mu A/V$  |   |
|  |                  |  | 2                    | +125°C        | -             | 2.85      | $\mu A/V$  |   |
|  |                  | 3  | -55°C                | -             | 2.85          | $\mu A/V$ |            |   |
| +IN Resistance                         | $+R_{IN}$        | Note 2   | 1                    | +25°C         | 800           | -         | k $\Omega$ |   |
|  |                  |  | 2, 3                 | +125°C, -55°C | 350           | -         | k $\Omega$ |   |
| Gain                                   | $A_{VP1}$        | $A_V = +1$<br>$V_{IN} = -1V$ to +1V  | 1                    | +25°C         | 0.98          | 1.02      | V/V        |   |
|  |                  |  | 2, 3                 | +125°C, -55°C | 0.975         | 1.025     | V/V        |   |
|  | $A_{VM1}$        | $A_V = -1$<br>$V_{IN} = -1V$ to +1V  | 1                    | +25°C         | -0.98         | -1.02     | V/V        |   |
|  |                  |  | 2, 3                 | +125°C, -55°C | -0.975        | -1.025    | V/V        |   |
|  | $A_{VP2}$        | $A_V = +2$<br>$V_{IN} = -1V$ to +1V  | 1                    | +25°C         | 1.96          | 2.04      | V/V        |   |
|  |                  |  | 2, 3                 | +125°C, -55°C | 1.95          | 2.05      | V/V        |   |
| Channel-to-Channel<br>Gain Mismatch    | $\Delta A_{VP1}$ | $A_V = +1$<br>$V_{IN} = -1V$ to +1V  | 1                    | +25°C         | -0.02         | 0.02      | V/V        |   |
|  |                  |  | 2, 3                 | +125°C, -55°C | -0.025        | 0.025     | V/V        |   |
|  | $\Delta A_{VM1}$ | $A_V = -1$<br>$V_{IN} = -1V$ to +1V  | 1                    | +25°C         | -0.025        | 0.025     | V/V        |   |
|  |                  |  | 2, 3                 | +125°C, -55°C | -0.025        | 0.025     | V/V        |   |
|  | $\Delta A_{VP2}$ | $A_V = +2$<br>$V_{IN} = -1V$ to +1V  | 1                    | +25°C         | -0.04         | 0.04      | V/V        |   |
|  |                  |  | 2, 3                 | +125°C, -55°C | -0.05         | 0.05      | V/V        |   |
| Output Voltage<br>Swing                | $V_{OP100}$      | $A_V = -1$<br>$R_L = 100\Omega$  | $V_{IN} = -3.2V$     | 1             | +25°C         | 3         | -          | V |
|  |                  |  | $V_{IN} = -3V$       | 2, 3          | +125°C, -55°C | 2.8       | -          | V |
|  | $V_{ON100}$      | $A_V = -1$<br>$R_L = 100\Omega$  | $V_{IN} = +3.2V$     | 1             | +25°C         | -         | -3         | V |
|  |                  |  | $V_{IN} = +3V$       | 2, 3          | +125°C, -55°C | -         | -2.8       | V |
| Output Voltage<br>Swing                | $V_{OP50}$       | $A_V = -1$<br>$R_L = 50\Omega$   | $V_{IN} = -2.7V$     | 1             | +25°C         | 2.5       | -          | V |
|  |                  |  | $V_{IN} = -2.25V$    | 2             | +125°C        | 2.0       | -          | V |
|  |                  |  | $V_{IN} = -2.25V$    | 3             | -55°C         | 1.4       | -          | V |
|  | $V_{ON50}$       | $A_V = -1$<br>$R_L = 50\Omega$   | $V_{IN} = +2.7V$     | 1             | +25°C         | -         | -2.5       | V |
|  |                  |  | $V_{IN} = +2.25V$    | 2             | +125°C        | -         | -2.0       | V |
|  |                  |  | $V_{IN} = +2.25V$    | 3             | -55°C         | -         | -1.4       | V |

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**TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)**

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

| PARAMETERS                     | SYMBOL      | CONDITIONS        | GROUP A SUBGROUPS | TEMPERATURE   | LIMITS |      | UNITS     |
|--------------------------------|-------------|-------------------|-------------------|---------------|--------|------|-----------|
|                                |             |                   |                   |               | MIN    | MAX  |           |
| Output Current                 | + $I_{OUT}$ | Note 3            | 1                 | +25°C         | 50     | -    | mA        |
|                                |             |                   | 2                 | +125°C        | 40     | -    | mA        |
|                                |             |                   | 3                 | -55°C         | 28     | -    | mA        |
|                                | - $I_{OUT}$ | Note 3            | 1                 | +25°C         | -      | -50  | mA        |
|                                |             |                   | 2                 | +125°C        | -      | -40  | mA        |
|                                |             |                   | 3                 | -55°C         | -      | -28  | mA        |
| Quiescent Power Supply Current | $I_{CC}$    | $R_L = 100\Omega$ | 1                 | +25°C         | 5.6    | 6.1  | mA/Op Amp |
|                                |             |                   | 2, 3              | +125°C, -55°C | 5.2    | 6.5  | mA/Op Amp |
|                                | $I_{EE}$    | $R_L = 100\Omega$ | 1                 | +25°C         | -6.1   | -5.6 | mA/Op Amp |
|                                |             |                   | 2, 3              | +125°C, -55°C | -6.5   | -5.2 | mA/Op Amp |

**NOTES:**

- Output is short circuit protected to ground. Brief short circuits to ground will not degrade reliability, however continuous (100% duty cycle) output current must not exceed 30mA for maximum reliability.
- Guaranteed from +IN Common Mode Rejection Test, by:  $+R_{IN} = 1/CMS_{IBP}$ .
- 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.

**TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS**

Table 3 Intentionally Left Blank.

**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:**

69 x 92 x 19 mils ± 1 mils  
 1750 x 2330 x 483µm ± 25.4µm

**METALLIZATION:**

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

**GLASSIVATION:**

Type: Nitride  
 Thickness: 4kÅ ± 0.5kÅ

**WORST CASE CURRENT DENSITY:**

TBD

**TRANSISTOR COUNT:** 150

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

**Metallization Mask Layout**

