HARRIS Semiconductor

# HFA1245/883

**PRELIMINARY**

Juen 1994

## Dual, High Speed, Low Power, Video Operational Amplifier with Output Disable

### Features

- **This Circuit is Processed in Accordance to MIL-STD-883 and is Fully Conformant Under the Provisions of Paragraph 1.2.1.**
- **Low Supply Current. . . . . 5.9mA (Typ)**
- **Wide -3dB Bandwidth . . . . . 530MHz (Typ)**
- **High Slew Rate. . . . . 1050V/μs (Typ)**
- **Excellent Gain Flatness (to 50MHz) . . . . ±0.11dB (Typ)**
- **Excellent Differential Gain . . . . . 0.02% (Typ)**
- **Excellent Differential Phase . . . . . 0.03 Deg. (Typ)**
- **High Output Current . . . . . 60mA (Typ)**
- **Individual Output Enable/Disable**
- **Output Enable / Disable Time . . . . . 160ns/20ns (Typ)**

### Applications

- **Multiplexed Flash A/D Driver**
- **RGB Multiplexers and Preamps**
- **Video Switching and Routing**
- **Pulse and Video Amplifiers**
- **Wideband Amplifiers**
- **Hand Held and Miniaturized RF Equipment**
- **Battery Powered Communications**

### Description

The HFA1245/883 is a dual high speed, low power current feedback amplifier built with Harris' proprietary complementary bipolar UHF-1 process.

This amplifier features individual TTL/CMOS compatible disable controls, which when pulled low, reduce the supply current and force the output into a high impedance state. This allows easy implementation of simple, low power video switching and routing systems. Component and composite video systems also benefit from this op amp's excellent gain flatness, and good differential gain and phase specifications.

Multiplexed A/D applications will also find the HFA1245/883 useful as the A/D driver/multiplexer.

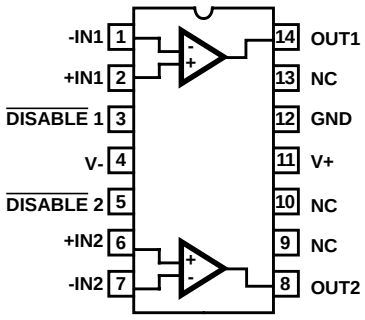
The HFA1245/883 is a low power, high performance upgrade for the popular HA5022/883.

### Ordering Information

| PART NUMBER | TEMPERATURE RANGE | PACKAGE |
|---|---|---|
| HFA1245MJ/883 | -55°C to +125°C | 14 Lead CerDIP |

### Pinout

**HFA1245/883**
**(CERDIP)**
TOP VIEW




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





Spec Number **511112-883**
File Number **3743**

## Absolute Maximum Ratings

Voltage Between V+ and V- . . . . . 12V
Differential Input Voltage . . . . . 5V
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$^{o}$C
ESD Rating . . . . . > 2000V
Storage Temperature Range . . . . . -65$^{o}$C ≤ $T_A$ ≤ +150$^{o}$C
Lead Temperature (Soldering 10s) . . . . . +300$^{o}$C

## Thermal Information

| Thermal Resistance | $\theta_{JA}$ | $\theta_{JC}$ |
|---|---|---|
| CerDIP Package | 75$^{o}$C/W | 20$^{o}$C/W |

Maximum Package Power Dissipation at +75$^{o}$C
CerDIP Package . . . . . 1.33W
Package Power Dissipation Derating Factor above +75$^{o}$C
CerDIP Package . . . . . 13.3mW/$^{o}$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 $V_{SUPPLY}$ ($\pm V_S$) . . . . . ±5V  $R_L \geq 50\Omega$
Operating Temperature Range . . . . . -55$^{o}$C ≤ $T_A$ ≤ +125$^{o}$C

**TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS**

Device Tested at: $V_{SUPPLY}$ = ±5V, $A_V$ = +1, $R_F$ = 560Ω, $R_{SOURCE}$ = 0Ω, $R_L$ = 100Ω, $V_{OUT}$ = 0V, $\overline{DIS}$ = Floated, Unless Otherwise Specified.

| PARAMETERS | SYMBOL | CONDITIONS | GROUP A SUBGROUPS | TEMPERATURE | LIMITS MIN | LIMITS MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Input Offset Voltage | $V_{IO}$ | $V_{CM}$ = 0V | 1 | +25$^{o}$C | -5 | 5 | mV |
| | | | 2, 3 | +125$^{o}$C, -55$^{o}$C | -10 | 10 | mV |
| Channel-to-Channel Input Offset Voltage Mismatch | $\Delta V_{IO}$ | $V_{CM}$ = 0V | 1 | +25$^{o}$C | -7.5 | 7.5 | mV |
| | | | 2, 3 | +125$^{o}$C, -55$^{o}$C | -15 | 15 | mV |
| Common Mode Rejection Ratio | CMRR | $\Delta V_{CM}$ = ±1.8V<br>V+ = 3.2V, V- = -6.8V<br>V+ = 6.8V, V- = -3.2V | 1 | +25$^{o}$C | 45 | - | dB |
| | | | 2 | +125$^{o}$C | 42 | - | dB |
| | | $\Delta V_{CM}$ = ±1.2V<br>V+ = 3.8V, V- = -6.2V<br>V+ = 6.2V, V- = -3.8V | 3 | -55$^{o}$C | 42 | - | dB |
| Power Supply Rejection Ratio | PSRRP | $\Delta V_{SUPPLY}$ = ±1.8V<br>V+ = 6.8V, V- = -5V<br>V+ = 3.2V, V- = -5V | 1 | +25$^{o}$C | 48 | - | dB |
| | | | 2 | +125$^{o}$C | 45 | - | dB |
| | | $\Delta V_{SUPPLY}$ = ±1.2V<br>V+ = 6.2V, V- = -5V<br>V+ = 3.8V, V- = -5V | 3 | -55$^{o}$C | 45 | - | dB |
| | PSRRN | $\Delta V_{SUPPLY}$ = ±1.8V<br>V+ = 5V, V- = -6.8V<br>V+ = 5V, V- = -3.2V | 1 | +25$^{o}$C | 48 | - | dB |
| | | | 2 | +125$^{o}$C | 45 | - | dB |
| | | $\Delta V_{SUPPLY}$ = ±1.2V<br>V+ = 5V, V- = -6.2V<br>V+ = 5V, V- = -3.8V | 3 | -55$^{o}$C | 45 | - | dB |
| Non-Inverting Input (+IN) Current | $I_{BSP}$ | $V_{CM}$ = 0V | 1 | +25$^{o}$C | -15 | 15 | µA |
| | | | 2, 3 | +125$^{o}$C, -55$^{o}$C | -25 | 25 | µA |
| Channel-to-Channel +IN Current Mismatch | $\Delta I_{BSP}$ | $V_{CM}$ = 0V | 1 | +25$^{o}$C | -15 | 15 | µA |
| | | | 2, 3 | +125$^{o}$C, -55$^{o}$C | -25 | 25 | µA |
| +IN Current Common Mode Sensitivity | $CMS_{IBP}$ | $\Delta V_{CM}$ = ±1.8V<br>V+ = 3.2V, V- = -6.8V<br>V+ = 6.8V, V- = -3.2V | 1 | +25$^{o}$C | - | 1.25 | µA/V |
| | | | 2 | +125$^{o}$C | - | 2.85 | µA/V |
| | | $\Delta V_{CM}$ = ±1.2V<br>V+ = 3.8V, V- = -6.2V<br>V+ = 6.2V, V- = -3.8V | 3 | -55$^{o}$C | - | 2.85 | µA/V |

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

Device Tested at: $V_{SUPPLY}$ = ±5V, $A_V$ = +1, $R_F$ = 560Ω, $R_{SOURCE}$ = 0Ω, $R_L$ = 100Ω, $V_{OUT}$ = 0V, $\overline{DIS}$ = Floated, Unless Otherwise Specified.

| PARAMETERS | SYMBOL | CONDITIONS | GROUP A SUBGROUPS | TEMPERATURE | LIMITS MIN | LIMITS MAX | UNITS |
|---|---|---|---|---|---|---|---|
| +IN Resistance | $+R_{IN}$ | Note 2 | 1 | +25°C | 800 | - | kΩ |
| | | | 2, 3 | +125°C, -55°C | 350 | - | kΩ |
| +IN Current Power Supply Sensitivity | $PPSS_{IBP}$ | $\Delta V_{SUPPLY}$ = ±1.8V<br>V+ = 6.8V, V- = -5V<br>V+ = 3.2V, V- = -5V | 1 | +25°C | - | 1 | µA/V |
| | | | 2 | +125°C | - | 3 | µA/V |
| | | $\Delta V_{SUPPLY}$ = ±1.2V<br>V+ = 6.2V, V- = -5V<br>V+ = 3.8V, V- = -5V | 3 | -55°C | - | 3 | µA/V |
| | $NPSS_{IBP}$ | $\Delta V_{SUPPLY}$ = ±1.8V<br>V+ = 5V, V- = -6.8V<br>V+ = 5V, V- = -3.2V | 1 | +25°C | - | 1 | µA/V |
| | | | 2 | +125°C | - | 3 | µA/V |
| | | $\Delta V_{SUPPLY}$ = ±1.2V<br>V+ = 5V, V- = -6.2V<br>V+ = 5V, V- = -3.8V | 3 | -55°C | - | 3 | µA/V |
| Inverting Input (-IN) Current | $I_{BSN}$ | $V_{CM}$ = 0V | 1 | +25°C | -7.5 | 7.5 | µA |
| | | | 2, 3 | +125°C, -55°C | -25 | 25 | µA |
| Channel-to-Channel -IN Current Mismatch | $\Delta I_{BSN}$ | $V_{CM}$ = 0V | 1 | +25°C | -10 | 10 | µA |
| | | | 2, 3 | +125°C, -55°C | -30 | 30 | µA |
| -IN Current Common Mode Sensitivity | $CMS_{IBN}$ | $\Delta V_{CM}$ = ±1.8V<br>V+ = 3.2V, V- = -6.8V<br>V+ = 6.8V, V- = -3.2V | 1 | +25°C | - | 6 | µA/V |
| | | | 2 | +125°C | - | 8 | µA/V |
| | | $\Delta V_{CM}$ = ±1.2V<br>V+ = 3.8V, V- = -6.2V<br>V+ = 6.2V, V- = -3.8V | 3 | -55°C | - | 8 | µA/V |
| -IN Current Power Supply Sensitivity | $PPSS_{IBN}$ | $\Delta V_{SUPPLY}$ = ±1.8V<br>V+ = 6.8V, V- = -5V<br>V+ = 3.2V, V- = -5V | 1 | +25°C | - | 5 | µA/V |
| | | | 2 | +125°C | - | 8 | µA/V |
| | | $\Delta V_{SUPPLY}$ = ±1.2V<br>V+ = 6.2V, V- = -5V<br>V+ = 3.8V, V- = -5V | 3 | -55°C | - | 8 | µA/V |
| | $NPSS_{IBN}$ | $\Delta V_{SUPPLY}$ = ±1.8V<br>V+ = 5V, V- = -6.8V<br>V+ = 5V, V- = -3.2V | 1 | +25°C | - | 5 | µA/V |
| | | | 2 | +125°C | - | 8 | µA/V |
| | | $\Delta V_{SUPPLY}$ = ±1.2V<br>V+ = 5V, V- = -6.2V<br>V+ = 5V, V- = -3.8V | 3 | -55°C | - | 8 | µA/V |
| Output Voltage Swing | $V_{OP100}$ | $A_V$ = -1, $R_L$ = 100Ω, $V_{IN}$ = -3.2V | 1 | +25°C | 3 | - | V |
| | | $A_V$ = -1, $R_L$ = 100Ω, $V_{IN}$ = -3V | 2, 3 | +125°C, -55°C | 2.8 | - | V |
| | $V_{ON100}$ | $A_V$ = -1, $R_L$ = 100Ω, $V_{IN}$ = +3.2V | 1 | +25°C | - | -3 | V |
| | | $A_V$ = -1, $R_L$ = 100Ω, $V_{IN}$ = +3V | 2, 3 | +125°C, -55°C | - | -2.8 | V |

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

Device Tested at: $V_{SUPPLY}$ = ±5V, $A_V$ = +1, $R_F$ = 560Ω, $R_{SOURCE}$ = 0Ω, $R_L$ = 100Ω, $V_{OUT}$ = 0V, $\overline{DIS}$ = Floated, Unless Otherwise Specified.

| PARAMETERS | SYMBOL | CONDITIONS | GROUP A SUBGROUPS | TEMPERATURE | LIMITS MIN | LIMITS MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Output Voltage Swing | $V_{OP50}$ | $A_V$ = -1, $R_L$ = 50Ω, $V_{IN}$ = -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, $R_L$ = 50Ω, $V_{IN}$ = +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 |
| 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 | $I_{CC}$ | $R_L$ = 100Ω | 1 | +25°C | 5.6 | 6.1 | mA/Op Amp |
| | | | 2, 3 | +125°C, -55°C | 5.2 | 6.5 | mA/Op Amp |
| | $I_{EE}$ | $R_L$ = 100Ω | 1 | +25°C | -6.1 | -5.6 | mA/Op Amp |
| | | | 2, 3 | +125°C, -55°C | -6.5 | -5.2 | mA/Op Amp |
| Disabled Power Supply Current | $DISI_{CC}$ | $R_L$ = 100Ω, $V_{\overline{DIS}}$ = 0V | 1 | +25°C | - | 4 | mA/Op Amp |
| | | | 2, 3 | +125°C, -55°C | - | 4.25 | mA/Op Amp |
| | $DISI_{EE}$ | $R_L$ = 100Ω, $V_{\overline{DIS}}$ = 0V | 1 | +25°C | -4 | - | mA/Op Amp |
| | | | 2, 3 | +125°C, -55°C | -4.25 | - | mA/Op Amp |
| Disabled Output Leakage Current | DOLC | $V_{\overline{DIS}}$ = 0V, $V_{IN}$ = ±2.5V, $V_{OUT}$ = ∓ 2.5V | 1 | +25°C | -10 | 10 | µA |
| | | | 2, 3 | +125°C, -55°C | -10 | 10 | µA |
| $\overline{\text{Disable}}$ Input Current | DILLC | $V_{\overline{DIS}}$ = 0V | 1 | +25°C | - | 200 | µA |
| | | | 2, 3 | +125°C, -55°C | - | 200 | µA |
| | DILHC | $V_{\overline{DIS}}$ = 5V | 1 | +25°C | - | 15 | µA |
| | | | 2, 3 | +125°C, -55°C | - | 15 | µA |
| $\overline{\text{Disable}}$ Input Logic Levels | DILLV | | 1 | +25°C | - | 0.8 | V |
| | | | 2, 3 | +125°C, -55°C | - | 0.8 | V |
| | DILHV | | 1, 2 | +25°C, +125°C | 2.0 | - | V |
| | | | 3 | -55°C | 2.4 | - | V |

NOTES:

1. 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.
2. Guaranteed from +IN Common Mode Rejection Test, by: $+R_{IN} = 1/CMS_{IBP}$ .
3. 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**

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:

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

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

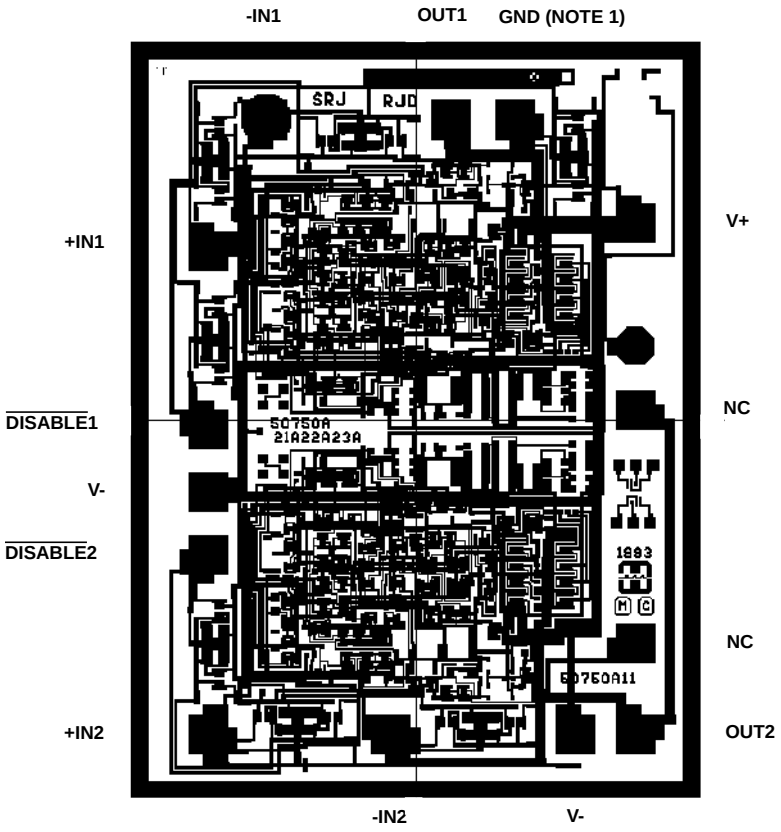
**WORST CASE CURRENT DENSITY:** TBD

**TRANSISTOR COUNT:** 150

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

## Metallization Mask Layout

**HFA1245/883**




NOTE:

1. This is an optional GND pad. Users may set a GND reference, via this pad, to ensure the TTL compatibility of the $\overline{\text{DISABLE}}$ inputs when using asymmetrical supplies (e.g. V+ = 10V, V- = 0V). See the “Application Information” section for details.