HARRIS SEMICONDUCTOR

HA-2529/883

Uncompensated, High Slew Rate High Output Current, Operational 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.**
- **High Slew Rate..... 135V/μs (Min) 150V/μs (Typ)**
- **High Output Current .....±30mA (Min)**
- **High Gain-Bandwidth Product ..... 15MHz (Min) 20MHz(Typ)**
- **Wide Power Bandwidth.....2.1MHz (Min)**
- **High Input Impedance.....50MΩ (Min) 130MΩ (Typ)**
- **Low Offset Current .....25nA (Max) 5nA (Typ)**
- **Fast Settling (10V Step to 0.1%).....200ns (Typ)**
- **Low Quiescent Supply Current ..... 6mA (Max)**

Applications

- **Data Acquisition Systems**
- **RF Amplifiers**
- **Video Amplifiers**
- **Signal Generators**
- **Pulse Amplification**

Description

The HA-2529/883 is a monolithic operational amplifier which typifies excellence of design. With a design based on years of experience coupled with the reliable dielectric isolation process, these amplifiers provide an outstanding combination of DC and AC parameters at closed loop gains of 3 or greater without external compensation.

The HA-2529/883 offers 135V/μs (min) slew rate and fast settling time (200ns typ), while consuming a mere 6mA (max) quiescent supply current, making these amplifiers ideal components for video circuitry and data acquisition designs. With 15MHz minimum gain-bandwidth product combined with 7.5kV/V minimum open loop gain, the HA-2529/883 is an ideal component for demanding signal conditioning designs. These devices provide ±30mA (min) output current drive with an output voltage swing of ±10V (min), making then suited for pulse amplifier and RF amplifier components.

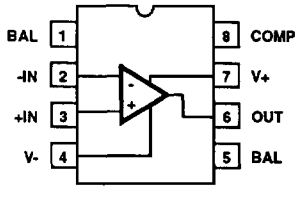
HA-2529/883 will upgrade a system presently using the HA-2520/22/883 or EHA-2520/22/883 in regards to output current, slew rate, offset voltage drift, and offset current drift. To insure compliance with slew rate and transient response specifications, all devices are 100% tested for AC performance characteristics over full temperature.

Ordering Information

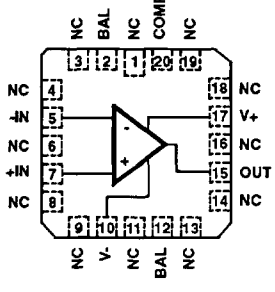
PART NUMBER	TEMPERATURE RANGE	PACKAGE
HA2-2529/883	-55°C to +125°C	8 Pin Can
HA4-2529/883	-55°C to +125°C	20 Lead Ceramic LCC
HA7-2529/883	-55°C to +125°C	8 Lead CerDIP

Pinouts

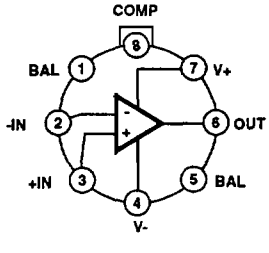
HA-2529/883 (CERDIP) TOP VIEW



HA-2529/883 (CLCC) TOP VIEW



HA-2529/883 (METAL CAN) TOP VIEW



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

Spec Number **511025-883**

File Number **3736**

Absolute Maximum Ratings

Voltage Between V+ and V- Terminals 40V
Differential Input Voltage. 15V
Voltage at Either Input Terminal . . . . . V+ to V-
Peak Output Current 50mA
Junction Temperature . . . . . +175°C
Storage Temperature Range . . . . . -65°C to +150°C
ESD Rating. . . . . <2000V
Lead Temperature (Soldering 10s) . . . . . +300°C

Thermal Information

Thermal Resistance	θ_{JA}	θ_{JC}
CerDIP Package	115°C/W	28°C/W
Ceramic LCC Package	75°C/W	23°C/W
Metal Can Package	160°C/W	75°C/W

Package Power Dissipation Limit at +75°C for $T_J \leq +175°C$
CerDIP Package 870mW
Ceramic LCC Package 1.33W
Metal Can Package 625mW
Package Power Dissipation Derating Factor Above +75°C
CerDIP Package . . . . . 8.7mW/°C
Ceramic LCC Package . . . . . 13.3mW/°C
Metal Can Package . . . . . 6.3mW/°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 Temperature Range . . . . . -55°C to +125°C $V_{INCM} \leq 1/2$ (V+ - V-)
Operating Supply Voltage . . . . . ±15V $R_L \geq 500\Omega$

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: $V_{SUPPLY} = \pm15V$, $R_{SOURCE} = 100\Omega$, $R_{LOAD} = 500k\Omega$, $V_{OUT} = 0V$, 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°C	-5	5	mV
			2, 3	+125°C, -55°C	-8	8	mV
Input Bias Current	$+I_B$	$V_{CM} = 0V$, $+R_S = 100k\Omega$, $-R_S = 100\Omega$	1	+25°C	-200	200	nA
			2, 3	+125°C, -55°C	-400	400	nA
	$-I_B$	$V_{CM} = 0V$, $+R_S = 100\Omega$, $-R_S = 100k\Omega$	1	+25°C	-200	200	nA
			2, 3	+125°C, -55°C	-400	400	nA
Input Offset Current	I_{IO}	$V_{CM} = 0V$, $+R_S = 100k\Omega$, $-R_S = 100k\Omega$	1	+25°C	-25	25	nA
			2, 3	+125°C, -55°C	-50	50	nA
Common Mode Range	+CMR	V+ = 5V, V- = -25V	1	+25°C	+10	-	V
			2, 3	+125°C, -55°C	+10	-	V
	-CMR	V+ = 25V, V- = -5V	1	+25°C	-	-10	V
			2, 3	+125°C, -55°C	-	-10	V
Large Signal Voltage Gain	$+A_{VOL}$	$V_{OUT} = 0V$ and $+10V$, $R_L = 2k\Omega$	4	+25°C	10	-	kV/V
			5, 6	+125°C, -55°C	7.5	-	kV/V
	$-A_{VOL}$	$V_{OUT} = 0V$ and $-10V$, $R_L = 2k\Omega$	4	+25°C	10	-	kV/V
			5, 6	+125°C, -55°C	7.5	-	kV/V
Common Mode Rejection Ratio	+CMRR	$\Delta V_{CM} = +10V$, V+ = +5V, V- = -25V, $V_{OUT} = -10V$	1	+25°C	83	-	dB
			2, 3	+125°C, -55°C	80	-	dB
	-CMRR	$\Delta V_{CM} = -10V$, V+ = +25V, V- = -5V, $V_{OUT} = +10V$	1	+25°C	83	-	dB
			2, 3	+125°C, -55°C	80	-	dB
Output Voltage Swing	$+V_{OUT}$	$R_L = 2k\Omega$	4	+25°C	10	-	V
			5, 6	+125°C, -55°C	10	-	V
	$-V_{OUT}$	$R_L = 2k\Omega$	4	+25°C	-	-10	V
			5, 6	+125°C, -55°C	-	-10	V

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Tested at: V_{SUPPLY} = ±15V, R_{SOURCE} = 100Ω, R_{LOAD} = 500kΩ, V_{OUT} = 0V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Output Current	$+I_{OUT}$	V_{OUT} = -10V	4	+25°C	30	-	mA
			5, 6	+125°C, -55°C	20	-	mA
	$-I_{OUT}$	V_{OUT} = +10V	4	+25°C	-	-30	mA
			5, 6	+125°C, -55°C	-	-20	mA
Quiescent Power Supply Current	$+I_{CC}$	V_{OUT} = 0V, I_{OUT} = 0mA	1	+25°C	-	6	mA
			2, 3	+125°C, -55°C	-	7	mA
	$-I_{CC}$	V_{OUT} = 0V, I_{OUT} = 0mA	1	+25°C	-6	-	mA
			2, 3	+125°C, -55°C	-7	-	mA
Power Supply Rejection Ratio	+PSRR	ΔV_{SUP} = 10V, V+ = +20V, V- = -15V, V+ = +10V, V- = -15V	1	+25°C	80	-	dB
			2, 3	+125°C, -55°C	80	-	dB
	-PSRR	ΔV_{SUP} = 10V, V+ = +15V, V- = -20V, V+ = +15V, V- = -10V	1	+25°C	80	-	dB
			2, 3	+125°C, -55°C	80	-	dB
Offset Voltage Adjustment	$+V_{IO}$Adj	Note 1	1	+25°C	V_{IO}-1	-	mV
			2, 3	+125°C, -55°C	V_{IO}-1	-	mV
	$-V_{IO}$Adj	Note 1	1	+25°C	V_{IO}+1	-	mV
			2, 3	+125°C, -55°C	V_{IO}+1	-	mV

NOTE:

1. Offset adjustment range is [V_{IO}(Measured) ±1mV] minimum referred to output. This test is for functionality only to assure adjustment through 0V.

TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: V_{SUPPLY} = ±15V, R_{SOURCE} = 50Ω, R_{LOAD} = 2kΩ, C_{LOAD} = 50pF, A_{VCL} = +3V/V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Slew Rate	+SR	V_{OUT} = -5V to +5V, 25% ≤ +SR ≤ 75%	7	+25°C	135	-	V/µs
			8A, 8B	+125°C, -55°C	125	-	V/µs
	-SR	V_{OUT} = +5V to -5V, 75% ≥ -SR ≥ 25%	7	+25°C	135	-	V/µs
			8A, 8B	+125°C, -55°C	125	-	V/µs
Rise and Fall Time	T_R	V_{OUT} = 0 to +200mV, 10% ≤ T_R ≤ 90%	7	+25°C	-	45	ns
			8A, 8B	+125°C, -55°C	-	50	ns
	T_F	V_{OUT} = 0 to -200mV, 10% ≤ T_F ≤ 90%	7	+25°C	-	45	ns
			8A, 8B	+125°C, -55°C	-	50	ns
Overshoot	+OS	V_{OUT} = 0 to +200mV	7	+25°C	-	40	%
			8A, 8B	+125°C, -55°C	-	40	%
	-OS	V_{OUT} = 0 to -200mV	7	+25°C	-	40	%
			8A, 8B	+125°C, -55°C	-	40	%

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Characterized at: V_{SUPPLY} = ±15V, R_{LOAD} = 2kΩ, C_{LOAD} = 50pF, C_{COMP} = 0pF, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	LIMITS		UNITS
					MIN	MAX	
Differential Input Resistance	R_{IN}	V_{CM} = 0V	1	+25°C	50	-	MΩ
Gain Power Bandwidth	GBWP	V_O = 200mV, $f_O \geq$ 10kHz	1	+25°C	15	-	MHz
Full Power Bandwidth	FPBW	V_{PEAK} = 10V	1, 2	+25°C	2.1	-	MHz
Minimum Closed Loop Stable Gain	CLSG	R_L = 2kΩ, C_L = 50pF	1	-55°C to +125°C	±3	-	V/V
Output Resistance	R_{OUT}	Open Loop	1	+25°C	-	60	Ω
Power Consumption	PC	V_{OUT} = 0V, I_{OUT} = 0mA	1, 3	-55°C to +125°C	-	210	mW

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. Full Power Bandwidth guarantee based on Slew Rate measurement using FPBW = Slew Rate/($2\pi V_{PEAK}$).
3. Quiescent Power Consumption based upon Quiescent Supply Current test maximum. (No load on outputs.)

TABLE 4. ELECTRICAL TEST REQUIREMENTS

MIL-STD-883 TEST REQUIREMENTS	SUBGROUPS (SEE TABLES 1 AND 2)
Interim Electrical Parameters (Pre Burn-In)	1
Final Electrical Test Parameters	1 (Note 1), 2, 3, 4, 5, 6, 7, 8A, 8B
Group A Test Requirements	1, 2, 3, 4, 5, 6, 7, 8A, 8B
Groups C and D Endpoints	1

NOTE:

1. PDA applies to Subgroup 1 only.

Die Characteristics

DIE DIMENSIONS:
67 x 57 x 19 ± 1 mils
1700 x 1440 x 483µm ± 25.4µm

METALLIZATION:
Type: Al, 1% Cu
Thickness: 16kÅ ± 2kÅ

GLASSIVATION:
Type: Nitride (Si3N4) over Silox (SiO2, 5% Phos.)
Silox Thickness: 12kÅ ± 2kÅ
Nitride Thickness: 3.5kÅ ± 1.5kÅ

WORST CASE CURRENT DENSITY:
0.78×10^5 A/cm^2

SUBSTRATE POTENTIAL (Powered Up):
Unbiased

TRANSISTOR COUNT: 40

PROCESS: Bipolar Dielectric Isolation

Metallization Mask Layout

HA-2529/883