

HA-2541/883

Wideband, Fast Settling, Unity Gain Stable, 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.
- Unity Gain Bandwidth 40MHz (Min)

- Fast Settling Time (0.1%) 90ns (Typ)
- Power Bandwidth..... 3MHz (Min) 4MHz (Typ)
- Output Voltage Swing ±10V (Min)
- Unity Gain Stability
- Monolithic Bipolar Dielectric Isolation Construction

Applications

- Pulse and Video Amplifiers
- Wideband Amplifiers
- High Speed Sample and Hold Circuits
- Fast, Precise D/A Converters
- High Speed A/D Input Buffer

Description

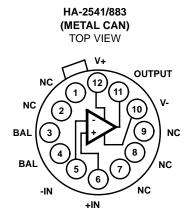
The HA-2541/883 is the first unity gain stable monolithic operational amplifier to achieve 40MHz unity gain bandwidth. A major addition to the Intersil series of high speed, wideband op amps, the HA-2541/883 is designed for video and pulse applications requiring stable amplifier response at low closed loop gains.

The uniqueness of the HA-2541/883 is that its slew rate and bandwidth characteristics are specified at unity gain. Historically, high slew rate, wide bandwidth and unity gain stability have been incompatible features for a monolithic operational amplifier. But features such as $250V/\mu s$ slew rate and 40MHz unity gain bandwidth clearly show that this is not the case for the HA-2541/883. These features, along with 90ns settling time to 0.1%, make this product an excellent choice for high speed data acquisition systems.

Ordering Information

PART NUMBER	TEMPERATURE RANGE	PACKAGE
HA2-2541/883	-55°C to +125°C	12 Pin Can

Pinout



CASE TIED TO V-

Absolute Maximum Ratings

Voltage Between V+ and V- Terminals
Voltage at Either Input Terminal
Peak Output Current (< 10% Duty Cycle)
Junction Temperature (T _J) +175°C
Storage Temperature Range65°C to +150°C
ESD Rating
Lead Temperature (Soldering 10s)+300°C

Thermal Information

Thermal Resistance Metal Can Package	θ _{JA} 65ºC/W	
Package Power Dissipation Limit at +75°C fo	r T _J ≤ +175 ⁰	°C
Metal Can Package		1.54W
Package Power Dissipation Derating Factor A	Above +75°	C
Metal Can Package	1	15.4mW/ ^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 Temperature Range	5°C to +125°C	$V_{INCM} \le 1/2 (V+ - V-)$
Operating Supply Voltage	$\pm 12V$ to $\pm 15V$	$R_L \ge 1k\Omega$

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: $V_{SUPPLY} = \pm 15V$, $R_{SOURCE} = 100\Omega$, $R_{LOAD} = 100k\Omega$, $V_{OUT} = 0V$, Unless Otherwise Specified.

			GROUP A		LIN		
PARAMETERS	SYMBOL	CONDITIONS	SUBGROUPS	TEMPERATURE	MIN	MAX	UNITS
Input Offset Voltage	e V _{IO} V _{CM} = 0V		1	+25°C	-2	2	mV
			2, 3	+125°C, -55°C	-6	6	mV
Input Bias Current	+I _B	$V_{CM} = 0V,$	1	+25°C	-35	35	μΑ
		+R _S = 1.1kΩ, -R _S = 100Ω	2, 3	+125°C, -55°C	-50	50	μΑ
	-I _B	$V_{CM} = 0V,$	1	+25°C	-35	35	μΑ
		+R _S = 100Ω, -R _S = 1.1kΩ	2, 3	+125°C, -55°C	-50	50	μΑ
Input Offset Current	I _{IO}	$V_{CM} = 0V,$	1	+25°C	-7	7	μΑ
		$+\dot{R}_{S} = 1.1 k\Omega,$ $-R_{S} = 1.1 k\Omega$	2, 3	+125°C, -55°C	-9	9	μΑ
Common Mode	+CMR	V+ = 5V, V- = -25V	1	+25°C	10	-	V
Range			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	+A _{VOL}	$V_{OUT} = 0V$ and +10V,	4	+25°C	10	-	kV/V
Gain		$R_L = 1k\Omega$	5, 6	+125°C, -55°C	5	-	kV/V
	-A _{VOL}	$V_{OUT} = 0V$ and -10V,	4	+25°C	10	-	kV/V
		$R_L = 1k\Omega$	5, 6	+125°C, -55°C	5	-	kV/V
Common Mode	+CMRR	$\Delta V_{CM} = +10V,$	1	+25°C	70	-	dB
Rejection Ratio		V+ = +5V, V- = -25V, V _{OUT} = -10V	2, 3	+125°C, -55°C	70	-	dB
	-CMRR	$\Delta V_{CM} = -10V,$	1	+25°C	70	-	dB
	V+ = +25V, V- = -5V, V _{OUT} = +10V	2, 3	+125°C, -55°C	70	-	dB	
Output Voltage	+V _{OUT}	$R_L = 1k\Omega$	1	+25°C	10	-	V
Swing			2, 3	+125°C, -55°C	10	-	V
	-V _{OUT}	$R_L = 1k\Omega$	1	+25°C	-	-10	V
			2, 3	+125°C, -55°C	-	-10	V

			GROUP A		LIMITS		
PARAMETERS	SYMBOL	CONDITIONS	SUBGROUPS	TEMPERATURE	MIN	MAX	UNITS
Output Current	+I _{OUT}	V _{OUT} = -10V	1	+25°C	10	-	mA
			1, 3	+125ºC, -55ºC	10	-	mA
	-I _{OUT}	V _{OUT} = +10V	1	+25°C	-	-10	mA
			1, 3	+125°C, -55°C	-	-10	mA
Quiescent Power	+I _{CC}	$V_{OUT} = 0V, I_{OUT} = 0mA$	1	+25°C	-	39	mA
Supply Current			2, 3	+125°C, -55°C	-	39	mA
	-I _{CC}	$V_{OUT} = 0V, I_{OUT} = 0mA$	1	+25°C	-39	-	mA
			2, 3	+125°C, -55°C	-39	-	mA
Power Supply	+PSRR	$\Delta V_{SUP} = 10V,$	1	+25°C	70	-	dB
Rejection Ratio		V+ = +5V, V- = -15V, V+ = +15V, V- = -15V	2, 3	+125°C, -55°C	70	-	dB
	-PSRR	$\Delta V_{SUP} = 10V,$	1	+25°C	70	-	dB
		V+ = +15V, V- = -5V, V+ = +15V, V- = -15V	2, 3	+125°C, -55°C	70	-	dB
Offset Voltage	+V _{IO} Adj	Note 1	1	+25°C	V _{IO} -1	-	mV
Adjustment	-V _{IO} Adj	Note 1	1	+25°C	V _{IO} +1	-	mV

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Tested at: $V_{SUPPLY} = \pm 15V$, $R_{SOURCE} = 100\Omega$, $R_{LOAD} = 100k\Omega$, $V_{OUT} = 0V$, Unless Otherwise Specified.

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

Table 2 Intentionally Left Blank. See A.C. Specifications in Table 3

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Characterized at: $V_{SUPPLY} = \pm 15V$, $R_{LOAD} = 1k\Omega$, $C_{LOAD} = 10pF$, $A_V = 1V/V$, Unless Otherwise Specified.

					LIN	IITS	
PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	MIN	MAX	UNITS
Differential Input Resistance	R _{IN}	$V_{CM} = 0V$	1	+25°C	40	-	kΩ
Unity Gain Bandwidth	UGBW	V _O = 90mV	1	+25°C	40	-	MHz
Slew Rate	+SR	$V_{OUT} = -3V$ to $+3V$	1	+25°C	200	-	V/µs
	-SR	$V_{OUT} = +3V \text{ to } -3V$	1	+25°C	200	-	V/µs
Full Power Bandwidth	FPBW	V _{PEAK} = 10V	1, 2	+25°C	3	-	MHz
Minimum Closed Loop Stable Gain	CLSG	$R_L = 1k\Omega, C_L = 10pF$	1	-55°C to +125°C	1	-	V/V
Rise and Fall Time	Τ _R	$V_{OUT} = 0V$ to +200mV	1, 4	+25°C	-	20	ns
	Τ _F	$V_{OUT} = 0V \text{ to } -200\text{mV}$	1, 4	+25°C	-	20	ns

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Characterized at: $V_{SUPPLY} = \pm 15V$, $R_{LOAD} = 1k\Omega$, $C_{LOAD} = 10$ pF, $A_V = 1V/V$, Unless Otherwise Specified.

					LIM	ITS	
PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	MIN	MAX	UNITS
Overshoot	+OS	$V_{OUT} = 0V$ to +200mV	1	+25°C	-	50	%
	-OS	$V_{OUT} = 0V \text{ to } -200\text{mV}$	1	+25°C	-	50	%
Output Resistance	R _{OUT}	Open Loop	1	+25°C	-	25	Ω
Quiescent Power Consumption	PC	$V_{OUT} = 0V, I_{OUT} = 0mA$	1, 3	-55°C to +125°C	-	1.17	W

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.)

4. Measured between 10% and 90% points.

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, 4, 5, 6
Group A Test Requirements	1, 2, 3, 4, 5, 6
Groups C and D Endpoints	1

NOTE:

1. PDA applies to Subgroup 1 only.

Die Characteristics

DIE DIMENSIONS:

80 x 90 x 19 mils \pm 1 mils 2020 x 2280 x 483 μm \pm 25.4 μm

METALLIZATION:

Type: Al, 1% Cu Thickness: 16kÅ ± 2kÅ

GLASSIVATION:

Type: Nitride(Si3N4) over Silox (SiO2, 5% Phos.) Silox Thickness: $12k\mathring{A} \pm 2k\mathring{A}$ Nitride Thickness: $3.5k\mathring{A} \pm 1.5k\mathring{A}$

WORST CASE CURRENT DENSITY:

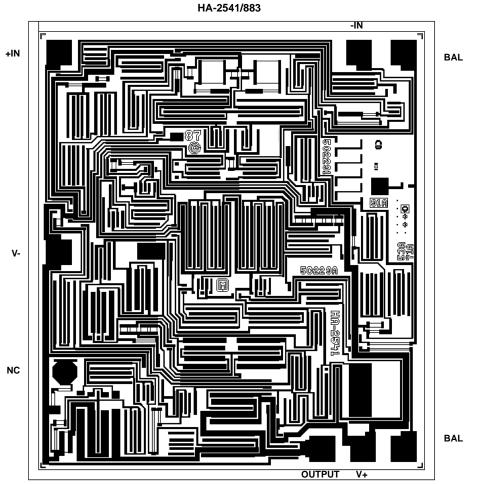
 $5.3 \times 10^4 \text{ A/cm}^2$

SUBSTRATE POTENTIAL (Powered Up): V-

TRANSISTOR COUNT: 41

PROCESS: Bipolar Dielectric Isolation

Metallization Mask Layout



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