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)**
- **High Slew Rate . . . . . 200V/µs (Min) 250V/µs (Typ)**
- **Low Offset Voltage . . . . . 2mV (Max)**
- **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.

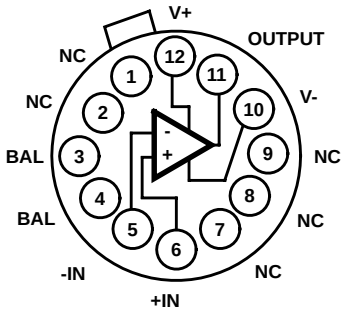
The uniqueness of the HA-2541/883 is that its slew rate and bandwidth characteristics are specified at unity gain. Historically, high slew rate, wide bandwidth and unity gain stability have been incompatible features for a monolithic operational amplifier. But features such as 250V/µs slew rate and 40MHz 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

HA-2541/883
(METAL CAN)
TOP VIEW



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Spec Number **511026-883**
File Number **3698**

Absolute Maximum Ratings

Voltage Between V+ and V- Terminals 35V
Differential Input Voltage 6V
Voltage at Either Input Terminal . . . . . V+ to V-
Peak Output Current (< 10% Duty Cycle) 50mA
Junction Temperature (T_J) . . . . . +175^{o}C
Storage Temperature Range . . . . . -65^{o}C to +150^{o}C
ESD Rating . . . . . <2000V
Lead Temperature (Soldering 10s) . . . . . +300^{o}C

Thermal Information

Thermal Resistance	θ_{JA}	θ_{JC}
Metal Can Package	65^{o}C/W	34^{o}C/W

Package Power Dissipation Limit at +75^{o}C for $T_J \leq$ +175^{o}C
Metal Can Package 1.54W
Package Power Dissipation Derating Factor Above +75^{o}C
Metal Can Package . . . . . 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 . . . . . -55^{o}C to +125^{o}C
Operating Supply Voltage . . . . . ±12V to ±15V

$V_{INCM} \leq$ 1/2 (V+ - V-)
$R_L \geq 1k\Omega$

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: V_{SUPPLY} = ±15V, R_{SOURCE} = 100Ω, R_{LOAD} = 100kΩ, 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^{o}C	-2	2	mV
			2, 3	+125^{o}C, -55^{o}C	-6	6	mV
Input Bias Current	$+I_B$	V_{CM} = 0V, $+R_S$ = 1.1kΩ, $-R_S$ = 100Ω	1	+25^{o}C	-35	35	µA
			2, 3	+125^{o}C, -55^{o}C	-50	50	µA
	$-I_B$	V_{CM} = 0V, $+R_S$ = 100Ω, $-R_S$ = 1.1kΩ	1	+25^{o}C	-35	35	µA
			2, 3	+125^{o}C, -55^{o}C	-50	50	µA
Input Offset Current	I_{IO}	V_{CM} = 0V, $+R_S$ = 1.1kΩ, $-R_S$ = 1.1kΩ	1	+25^{o}C	-7	7	µA
			2, 3	+125^{o}C, -55^{o}C	-9	9	µA
Common Mode Range	+CMR	V+ = 5V, V- = -25V	1	+25^{o}C	10	-	V
			2, 3	+125^{o}C, -55^{o}C	10	-	V
	-CMR	V+ = 25V, V- = -5V	1	+25^{o}C	-	-10	V
			2, 3	+125^{o}C, -55^{o}C	-	-10	V
Large Signal Voltage Gain	$+A_{VOL}$	V_{OUT} = 0V and +10V, R_L = 1kΩ	4	+25^{o}C	10	-	kV/V
			5, 6	+125^{o}C, -55^{o}C	5	-	kV/V
	$-A_{VOL}$	V_{OUT} = 0V and -10V, R_L = 1kΩ	4	+25^{o}C	10	-	kV/V
			5, 6	+125^{o}C, -55^{o}C	5	-	kV/V
Common Mode Rejection Ratio	+CMRR	ΔV_{CM} = +10V, V+ = +5V, V- = -25V, V_{OUT} = -10V	1	+25^{o}C	70	-	dB
			2, 3	+125^{o}C, -55^{o}C	70	-	dB
	-CMRR	ΔV_{CM} = -10V, V+ = +25V, V- = -5V, V_{OUT} = +10V	1	+25^{o}C	70	-	dB
			2, 3	+125^{o}C, -55^{o}C	70	-	dB
Output Voltage Swing	$+V_{OUT}$	R_L = 1kΩ	1	+25^{o}C	10	-	V
			2, 3	+125^{o}C, -55^{o}C	10	-	V
	$-V_{OUT}$	R_L = 1kΩ	1	+25^{o}C	-	-10	V
			2, 3	+125^{o}C, -55^{o}C	-	-10	V

TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

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

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

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

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Characterized at: V_{SUPPLY} = ±15V, R_{LOAD} = 1kΩ, C_{LOAD} = 10pF, A_V = 1V/V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	LIMITS		UNITS
					MIN	MAX	
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 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 = 1kΩ, C_L = 10pF	1	-55°C to +125°C	1	-	V/V
Rise and Fall Time	T_R	V_{OUT} = 0V to +200mV	1, 4	+25°C	-	20	ns
	T_F	V_{OUT} = 0V to -200mV	1, 4	+25°C	-	20	ns

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

Device Characterized at: V_{SUPPLY} = ±15V, R_{LOAD} = 1kΩ, C_{LOAD} = 10pF, A_V = 1V/V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	LIMITS		UNITS
					MIN	MAX	
Overshoot	+OS	V_{OUT} = 0V to +200mV	1	+25°C	-	50	%
	-OS	V_{OUT} = 0V to -200mV	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 ± 1 mils
2020 x 2280 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:
5.3×10^4 A/cm^2

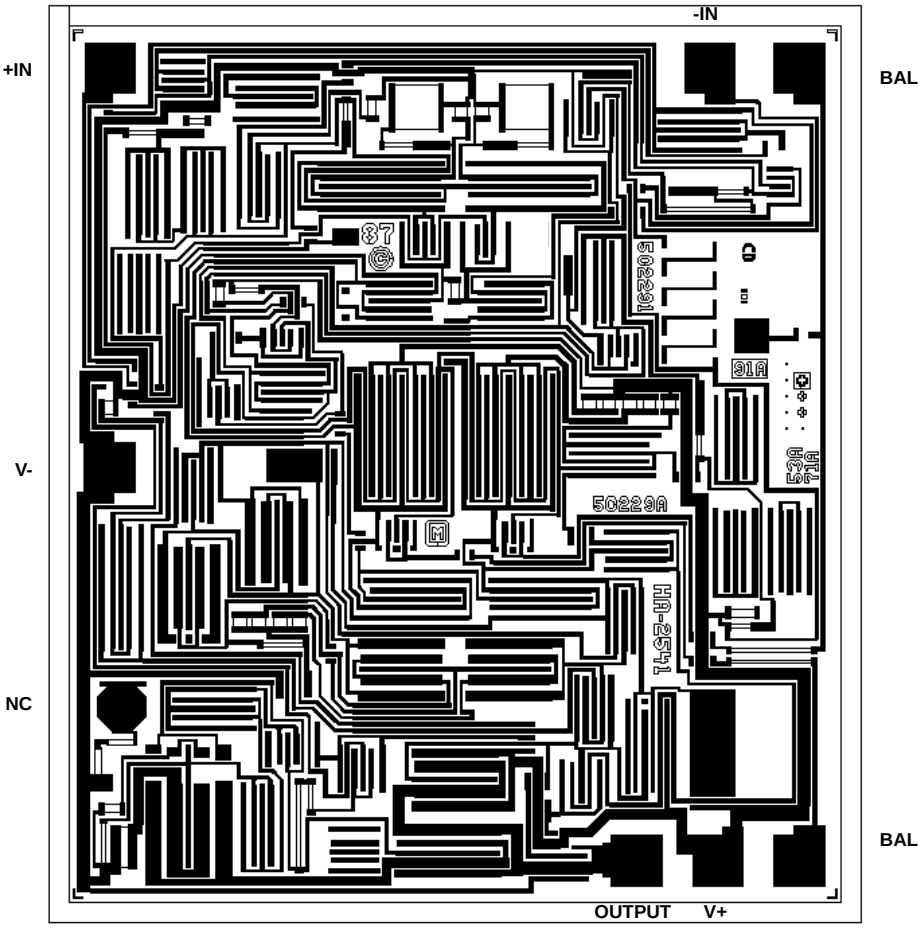
SUBSTRATE POTENTIAL (Powered Up): V-

TRANSISTOR COUNT: 41

PROCESS: Bipolar Dielectric Isolation

Metallization Mask Layout

HA-2541/883



All Intersil semiconductor products are manufactured, assembled and tested under **ISO9000** quality systems certification.