October 11, 2004 FN3735.3

Uncompensated, High Slew Rate Operational Amplifier

The HA-2520/883 is a monolithic operational amplifier which delivers an unsurpassed combination of specifications for slew rate, bandwidth and settling time. This dielectrically isolated amplifier is designed for closed loop gains of 3 or greater without external compensation. In addition, this high performance component also provides low offset current and high input impedance.

The 100V/µs (min) slew rate and fast settling time of this amplifier make it ideal for pulse amplification and data acquisition designs. To insure compliance with slew rate and transient response specifications, the device is 100% tested for AC performance characteristics over full temperature. This device is a valuable component for RF and video circuitry requiring wideband operation. For accurate signal conditioning designs, the HA-2520/883's superior dynamic specifications are complemented by 25nA (max) offset current and offset voltage adjust capability.

Part Number Information

PART NUMBER	TEMP. RANGE (^{o}C)	PACKAGE	PKG. NO.
HA2-2520/883	-55^{o}C to +125^{o}C	8 Pin Can	T8.C

Applications

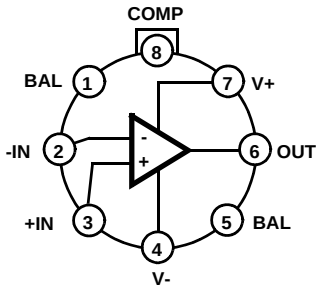
- Data Acquisition Systems
- RF Amplifiers
- Video Amplifiers
- Signal Generators
- Pulse Amplification

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 . . . . . .100V/µs (Min) 120V/µs (Min)
- Wide Power Bandwidth . . . . . 1.5MHz (Min)
- Wide Gain Bandwidth. . . . . .10MHz (Min) 20MHz (Typ)
- High Input Impedance . . . . . 50MΩ (Min) 100MΩ (Typ)
- Low Offset Current . . . . . 25nA (Min) 10nA (Typ)
- Fast Settling (0.1% of 10V Step) . . . . . 200ns (Typ)
- Low Quiescent Supply Current . . . . . 6mA (Max)

Pinout

HA-2520/883
(METAL CAN)
TOP VIEW



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^{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	160^{o}C/W	75^{o}C/W

Package Power Dissipation Limit at +75^{o}C for $T_J \leq +175^{o}$C
Metal Can Package 625mW
Package Power Dissipation Derating Factor Above +75^{o}C
Metal Can Package . . . . . 6.3mW/^{o}C

Operating Conditions

Operating Temperature Range . . . . . -55^{o}C to +125^{o}C
Operating Supply Voltage . . . . . ±15V

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

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.

NOTE:

1. θ_{JA} is measured with the component mounted on a low effective thermal conductivity test board in free air. See Tech Brief TB379 for details.

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	HA-2520/883 MIN	HA-2520/883 MAX	UNITS
Input Offset Voltage	V_{IO}	$V_{CM} = 0V$	1	+25^{o}C	-8	8	mV
			2, 3	+125^{o}C, -55^{o}C	-10	10	mV
Input Bias Current	$+I_B$	$V_{CM} = 0V$, $+R_S = 100k\Omega$, $-R_S = 100\Omega$	1	+25^{o}C	-200	200	nA
			2, 3	+125^{o}C, -55^{o}C	-400	400	nA
	$-I_B$	$V_{CM} = 0V$, $+R_S = 100\Omega$, $-R_S = 100k\Omega$	1	+25^{o}C	-200	200	nA
			2, 3	+125^{o}C, -55^{o}C	-400	400	nA
Input Offset Current	I_{IO}	$V_{CM} = 0V$, $+R_S = 100k\Omega$, $-R_S = 100k\Omega$	1	+25^{o}C	-25	25	nA
			2, 3	+125^{o}C, -55^{o}C	-50	50	nA
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, $R_L = 2k\Omega$	4	+25^{o}C	10	-	kV/V
			5, 6	+125^{o}C, -55^{o}C	7.5	-	kV/V
	$-A_{VOL}$	$V_{OUT} = 0V$ and -10V, $R_L = 2k\Omega$	4	+25^{o}C	10	-	kV/V
			5, 6	+125^{o}C, -55^{o}C	7.5	-	kV/V
Common Mode Rejection Ratio	+CMRR	$\Delta V_{CM} = +10V$, V+ = +5V, V- = -25V, $V_{OUT} = -10V$	1	+25^{o}C	80	-	dB
			2, 3	+125^{o}C, -55^{o}C	80	-	dB
	-CMRR	$\Delta V_{CM} = -10V$, V+ = +25V, V- = -5V, $V_{OUT} = +10V$	1	+25^{o}C	80	-	dB
			2, 3	+125^{o}C, -55^{o}C	80	-	dB
Output Voltage Swing	$+V_{OUT}$	$R_L = 2k\Omega$	4	+25^{o}C	10	-	V
			5, 6	+125^{o}C, -55^{o}C	10	-	V
	$-V_{OUT}$	$R_L = 2k\Omega$	4	+25^{o}C	-	-10	V
			5, 6	+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} = 500kΩ, V_{OUT} = 0V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	HA-2520/883 MIN	HA-2520/883 MAX	UNITS
Output Current	$+I_{OUT}$	V_{OUT} = -10V	4	+25°C	10	-	mA
			5, 6	+125°C, -55°C	7.5	-	mA
	$-I_{OUT}$	V_{OUT} = +10V	4	+25°C	-	-10	mA
			5, 6	+125°C, -55°C	-	-7.5	mA
Quiescent Power Supply Current	$+I_{CC}$	V_{OUT} = 0V, I_{OUT} = 0mA	1	+25°C	-	6	mA
			2, 3	+125°C, -55°C	-	6.5	mA
	$-I_{CC}$	V_{OUT} = 0V, I_{OUT} = 0mA	1	+25°C	-6	-	mA
			2, 3	+125°C, -55°C	-6.5	-	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:

2. 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	HA-2520/883 MIN	HA-2520/883 MAX	UNITS
Slew Rate	+SR	V_{OUT} = -5V to +5V, 25% ≤ +SR ≤ 75%	7	+25°C	100	-	V/µs
			8A, 8B	+125°C, -55°C	84	-	V/µs
	-SR	V_{OUT} = +5V to -5V, 75% ≥ -SR ≥ 25%	7	+25°C	100	-	V/µs
			8A, 8B	+125°C, -55°C	84	-	V/µs
Rise and Fall Time	T_R	V_{OUT} = 0 to +200mV, 10% ≤ T_R ≤ 90%	7	+25°C	-	50	ns
			8A, 8B	+125°C, -55°C	-	55	ns
	T_F	V_{OUT} = 0 to -200mV, 10% ≤ T_F ≤ 90%	7	+25°C	-	50	ns
			8A, 8B	+125°C, -55°C	-	55	ns
Overshoot	+OS	V_{OUT} = 0 to +200mV	7	+25°C	-	40	%
			8A, 8B	+125°C, -55°C	-	45	%
	-OS	V_{OUT} = 0 to -200mV	7	+25°C	-	40	%
			8A, 8B	+125°C, -55°C	-	45	%

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Characterized at: V_{SUPPLY} = ±15V, R_{LOAD} = 2kΩ, C_{LOAD} = 50pF, $A_V \geq 3$, C_{COMP} = 0pF, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	HA-2520/883		UNITS
					MIN	MAX	
Differential Input Resistance	R_{IN}	V_{CM} = 0V	1	+25°C	50	-	MΩ
Full Power Bandwidth	GBWP	V_O = 200mV, f_O = 10kHz	1	+25°C	10	-	MHz
		V_O = 200mV, f_O = 1MHz	1	+25°C	10	-	MHz
Full Power Bandwidth	FPBW	V_{PEAK} = 10V	1, 2	+25°C	1.6	-	MHz
Minimum Closed Loop Stable Gain	CLSG	R_L = 2kΩ, C_L = 50pF	1	-55°C to +125°C	+3	-	V/V
Quiescent Power Consumption	PC	V_{OUT} = 0V, I_{OUT} = 0mA	1, 3	-55°C to +125°C	-	195	mW

NOTES:

3. 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.
4. Full Power Bandwidth guarantee based on Slew Rate measurement using FPBW = Slew Rate/($2\pi V_{PEAK}$).
5. 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 4), 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:

6. PDA applies to Subgroup 1 only.

Die Characteristics

DIE DIMENSIONS:

67 x 57 x 19 mils ± 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:

0.26×10^5 A/cm^2

SUBSTRATE POTENTIAL (Powered Up):

Unbiased

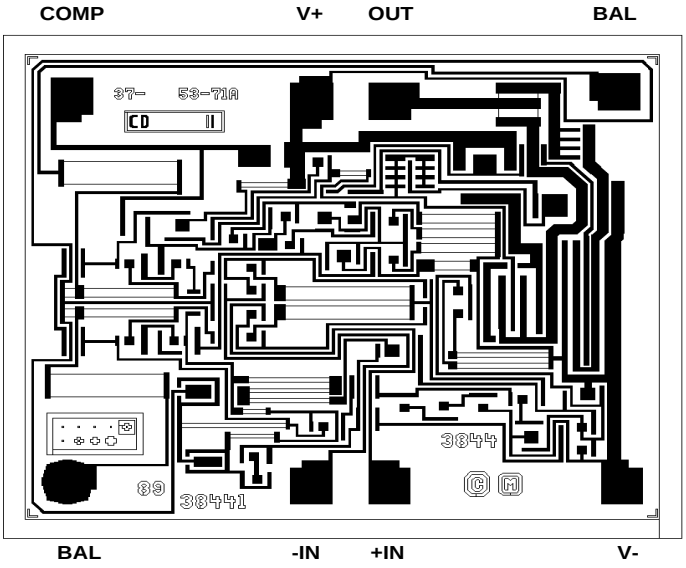
TRANSISTOR COUNT:

HA-2520/883: 40

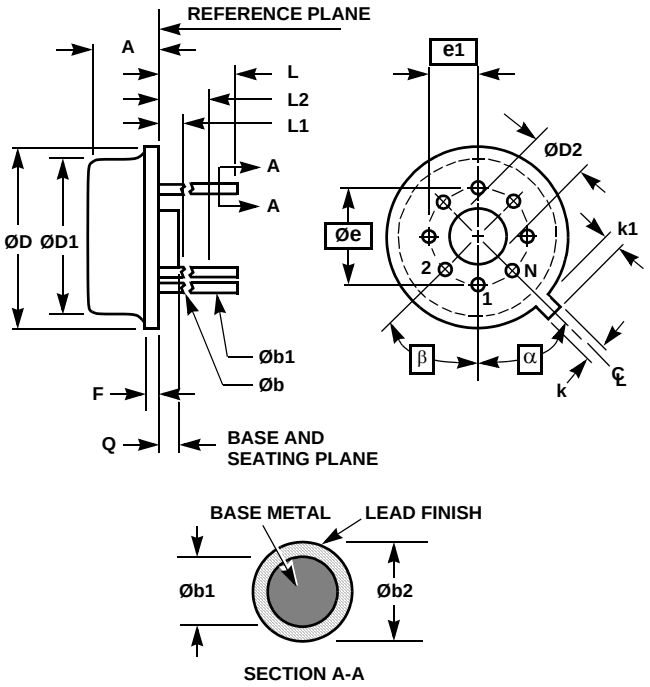
PROCESS:

Bipolar Dielectric Isolation

Metallization Mask Layout



Metal Can Packages (Can)



NOTES:

1. (All leads) Øb applies between L1 and L2. Øb1 applies between L2 and 0.500 from the reference plane. Diameter is uncontrolled in L1 and beyond 0.500 from the reference plane.
2. Measured from maximum diameter of the product.
3. α is the basic spacing from the centerline of the tab to terminal 1 and β is the basic spacing of each lead or lead position (N -1 places) from α, looking at the bottom of the package.
4. N is the maximum number of terminal positions.
5. Dimensioning and tolerancing per ANSI Y14.5M - 1982.
6. Controlling dimension: INCH.

T8.C MIL-STD-1835 MACY1-X8 (A1)
8 LEAD METAL CAN PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.165	0.185	4.19	4.70	-
Øb	0.016	0.019	0.41	0.48	1
Øb1	0.016	0.021	0.41	0.53	1
Øb2	0.016	0.024	0.41	0.61	-
ØD	0.335	0.375	8.51	9.40	-
ØD1	0.305	0.335	7.75	8.51	-
ØD2	0.110	0.160	2.79	4.06	-
e	0.200 BSC		5.08 BSC		-
e1	0.100 BSC		2.54 BSC		-
F	-	0.040	-	1.02	-
k	0.027	0.034	0.69	0.86	-
k1	0.027	0.045	0.69	1.14	2
L	0.500	0.750	12.70	19.05	1
L1	-	0.050	-	1.27	1
L2	0.250	-	6.35	-	1
Q	0.010	0.045	0.25	1.14	-
α	45^o BSC		45^o BSC		3
β	45^o BSC		45^o BSC		3
N	8		8		4

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