HA-2602/883

Wideband, High Impedance Operational Amplifier

April 2002

Features

- **This Circuit is Processed in Accordance to MIL-STD-883 and is Fully Conformant Under the Provisions of Paragraph 1.2.1.**
- **High Input Impedance . . . . . 40MΩ (Min) 500MΩ (Typ)**
- **High Slew Rate . . . . . .4V/μs (Min) 7V/μs (Typ)**
- **Low Input Bias Current . . . . . 25nA (Max) 1nA (Typ)**
- **Low Input Offset Current. . . . . 5mV (Max)**
- **Wide Unity Gain Bandwidth . . . . . 12MHz (Typ)**
- **Output Short Circuit Protection**

Applications

- **Video Amplifier**
- **Pulse Amplifier**
- **High-Q Active Filters**
- **High Speed Comparators**
- **Low Distortion Oscillators**

Description

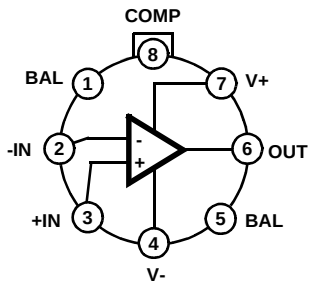
The HA-2602/883 is an internally compensated bipolar operational amplifier that features very high input impedance coupled with wideband AC performance. The high resistance of the input stage is complemented by low offset voltage (5mV max at +25^{o}C) and low bias and offset current (25nA max at +25^{o}C) to facilitate accurate signal processing. Offset voltage can be reduced further by means of an external nulling potentiometer. The 4V/μs minimum slew rate at +25^{o}C and the minimum open loop gain of 80kV/V at +25^{o}C enables the HA-2602/883 to perform high gain amplification of fast, wideband signals. These dynamic characteristics, coupled with fast settling times, make these amplifiers ideally suited to pulse amplification designs as well as high frequency or video applications. The frequency response of the amplifier can be tailored to exact design requirements by means of an external bandwidth control capacitor. Other high performance designs such as high gain, low distortion audio amplifiers, high-Q and wideband active filters and high speed comparators, are excellent uses of this part.

Ordering Information

PART NUMBER	TEMPERATURE RANGE	PACKAGE
HA2-2602/883	-55^{o}C to +125^{o}C	8 Pin Can

Pinout

HA-2602/883
(METAL CAN)
TOP VIEW



Spec Number **511005-883**
FN3700.1

Absolute Maximum Ratings

Voltage Between V+ and V- Terminals 40V
Differential Input Voltage 12V
Voltage at Either Input Terminal . . . . . V+ to V-
Peak Output Current . . . . . Full Short Circuit Protection
Junction Temperature (T_J) . . . . . +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}
Metal Can Package	160°C/W	75°C/W

Package Power Dissipation Limit at +75°C for $T_J \leq +175°C$
Metal Can Package 625mW
Package Power Dissipation Derating Factor Above +75°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.

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.

Operating Conditions

Operating Temperature Range . . . . . -55°C to +125°C
Operating Supply Voltage . . . . . ±15V

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

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	HA-2602/883 MIN	HA-2602/883 MAX	UNITS
Input Offset Voltage	V_{IO}	$V_{CM} = 0V$	1	+25°C	-5	5	mV
			2, 3	+125°C, -55°C	-7	7	mV
Input Bias Current	$+I_B$	$V_{CM} = 0V$, $+R_S = 100k\Omega$, $-R_S = 100\Omega$	1	+25°C	-25	25	nA
			2, 3	+125°C, -55°C	-60	60	nA
	$-I_B$	$V_{CM} = 0V$, $+R_S = 100\Omega$, $-R_S = 100k\Omega$	1	+25°C	-25	25	nA
			2, 3	+125°C, -55°C	-60	60	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	-60	60	nA
Common Mode Range	+CMR	V+ = +4V, V- = -26V	1	+25°C	11	-	V
			2, 3	+125°C, -55°C	11	-	V
	-CMR	V+ = +26V, V- = -4V	1	+25°C	-	-11	V
			2, 3	+125°C, -55°C	-	-11	V
Large Signal Voltage Gain	$+A_{VOL}$	$V_{OUT} = 0V$ and +10V, $R_L = 2k\Omega$	4	+25°C	80	-	kV/V
			5, 6	+125°C, -55°C	60	-	kV/V
	$-A_{VOL}$	$V_{OUT} = 0V$ and -10V, $R_L = 2k\Omega$	4	+25°C	80	-	kV/V
			5, 6	+125°C, -55°C	60	-	kV/V
Common Mode Rejection Ratio	+CMRR	$\Delta V_{CM} = +10V$, V+ = +5V, V- = -25V, $V_{OUT} = -10V$	1	+25°C	74	-	dB
			2, 3	+125°C, -55°C	74	-	dB
	-CMRR	$\Delta V_{CM} = -10V$, V+ = +25V, V- = -5V, $V_{OUT} = +10V$	1	+25°C	74	-	dB
			2, 3	+125°C, -55°C	74	-	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	HA-2602/883 MIN	HA-2602/883 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	-	3.7	mA
			2, 3	+125°C, -55°C	-	4.0	mA
	$-I_{CC}$	V_{OUT} = 0V, I_{OUT} = 0mA	1	+25°C	-3.7	-	mA
			2, 3	+125°C, -55°C	-4.0	-	mA
Power Supply Rejection Ratio	+PSRR	ΔV_{SUP} = ±5V, V+ = +10V, V- = -15V, V+ = +20V, V- = -15V	1	+25°C	74	-	dB
			2, 3	+125°C, -55°C	74	-	dB
	-PSRR	ΔV_{SUP} = ±5V, V+ = +15V, V- = -10V, V+ = +15V, V- = -20V	1	+25°C	74	-	dB
			2, 3	+125°C, -55°C	74	-	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} = +1V/V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	HA-2602/883 MIN	HA-2602/883 MAX	UNITS
Slew Rate	+SR	V_{OUT} = -5V to +5V	7	+25°C	4	-	V/µs
			8A, 8B	+125°C, -55°C	3	-	V/µs
	-SR	V_{OUT} = +5V to -5V	7	+25°C	4	-	V/µs
			8A, 8B	+125°C, -55°C	3	-	V/µs
Rise and Fall Time	T_R	V_{OUT} = 0 to +200mV, 10% ≤ T_R ≤ 90%	7	+25°C	-	60	ns
			8A, 8B	+125°C, -55°C	-	70	ns
	T_F	V_{OUT} = 0 to -200mV, 10% ≤ T_F ≤ 90%	7	+25°C	-	60	ns
			8A, 8B	+125°C, -55°C	-	70	ns

TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: $V_{SUPPLY} = \pm15V$, $R_{SOURCE} = 50\Omega$, $R_{LOAD} = 2k\Omega$, $C_{LOAD} = 50pF$, $A_{VCL} = +1V/V$, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	TEMPERATURE	HA-2602/883		UNITS
					MIN	MAX	
Overshoot	+OS	V_{OUT} = 0 to +200mV	7	+25°C	-	40	%
			8A, 8B	+125°C, -55°C	-	50	%
	-OS	V_{OUT} = 0 to -200mV	7	+25°C	-	40	%
			8A, 8B	+125°C, -55°C	-	50	%

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Characterized at: $V_{SUPPLY} = \pm15V$, $R_{LOAD} = 2k\Omega$, $C_{LOAD} = 50pF$, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	HA-2602/883		UNITS
					MIN	MAX	
Differential Input Resistance	R_{IN}	V_{CM} = 0V	1	+25°C	40	-	MΩ
Full Power Bandwidth	FPBW	V_{PEAK} = 10V	1, 2	+25°C	50	-	kHz
Minimum Closed Loop Stable Gain	CLSG	$R_L = 2k\Omega$, $C_L = 50pF$	1	-55°C to +125°C	1	-	V/V
Output Short Circuit Current	$+I_{SC}$	V_{OUT} = 1V, $R_L = 10\Omega$	1	+25°C	-	50	mA
			1	+125°C	-	45	mA
			1	-55°C	-	60	mA
	$-I_{SC}$	V_{OUT} = -1V, $R_L = 10\Omega$	1	+25°C	-50	-	mA
			1	+125°C	-45	-	mA
			1	-55°C	-60	-	mA
Quiescent Power Consumption	PC	V_{OUT} = 0V, I_{OUT} = 0mA	1, 3	-55°C to +125°C	-	120	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:
69 x 56 x 19 mils ± 1 mils
1750 x 1420 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:
$3.9 \times 10^4 A/cm^2$

SUBSTRATE POTENTIAL (Powered Up): Unbiased

TRANSISTOR COUNT:
HA-2602/883: 140

PROCESS: Bipolar Dielectric Isolation

Metallization Mask Layout

HA-2602/883