HA-5111/883

Low Noise, High Performance Uncompensated Operational Amplifier

January 1989

Features

- This Circuit is Processed in Accordance to Mil-Std-883 and is Fully Conformant Under the Provisions of Paragraph 1.2.1.
- Low Noise Voltage Density @ 1kHz .. 4.5nV/$\sqrt{Hz}$ Max
- Low Noise Current Density @ 1kHz .... 3pA/$\sqrt{Hz}$ Max
- Wide Gain Bandwidth Product .... 70MHz Min 100MHz Typ
- High Slew Rate .... 40V/µs Min 60V/µs Typ
- High Gain (Full Temp) .... 100kV/V Min (Room Temp) .... 1MV/V Typ
- High CMRR/PSRR (Full Temp) .... 80dB Min
- High Output Drive Capability (Full Temp) 25mA

Applications

- High Quality Audio Preamplifiers
- High Q Active Filters
- Low Noise Function Generators
- Low Distortion Oscillators
- Low Noise Comparators

Description

The HA-5111/883 is a dielectrically isolated operational amplifier featuring superb high speed and low noise performance. This amplifier has guaranteed noise voltage density of 4.5nV/$\sqrt{Hz}$ (max) at 1kHz and guaranteed noise current density of 3pA/$\sqrt{Hz}$ at 1kHz. The HA-5111/883 has a minimum gain bandwidth product of 70MHz while maintaining slew rates of 40V/µs minimum and 60V/µs typical.

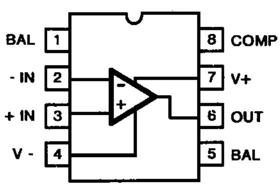
The D.C. characteristics of the HA-5111/883 assure accurate performance by having a high open loop gain of typically 1MV/V at room temperature, or 100kV/V over the full temperature range. The 3mV (max) offset voltage is externally adjustable and has typical offset drift less than 3µV/°C.

The HA-5111/883 is ideal for audio applications, especially low-level signal amplifiers such as microphone, tape head, and preamplifiers. Additionally, it is well suited for low distortion oscillators, low noise function generators, and high Q filters.

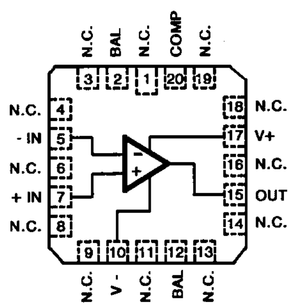
The HA-5111/883 has guaranteed operation from -55°C to +125°C, is available in Ceramic Mini-DIP, TO-99 Metal Can and 20 pin Ceramic LCC packages.

Pinouts

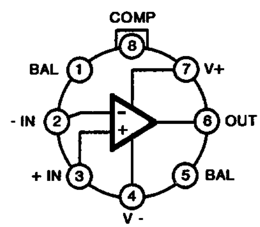
HA7-5111/883 (CERAMIC MINI-DIP)
TOP VIEW



HA4-5111/883 (CERAMIC LCC)
TOP VIEW



HA2-5111/883 (METAL CAN)
TOP VIEW



Absolute Maximum Ratings

Voltage Between V+ and V- Terminals 40V
Differential Input Voltage 7V
Voltage at Either Input Terminal .... V+ to V-
Input Current 25mA
Output Short Circuit Duration .... Indefinite
Junction Temperature (T_J) .... +175°C
Storage Temperature Range .... -65°C to +150°C
ESD Rating .... <2000V
Lead Temperature (Soldering 10 sec) .... +275°C

CAUTION: Absolute maximum ratings are limiting values, applied individually beyond which the serviceability of the circuit may be impaired. Functional operability under any of these conditions is not necessarily implied.

Thermal Information

Thermal Resistance	θ_{ja}	θ_{jc}
Ceramic DIP Package	82°C/W	27°C/W
Ceramic LCC Package	74°C/W	20°C/W
Metal Can Package	121°C/W	36°C/W

Package Power Dissipation Limit at +75°C for $T_J \leq$ +175°C
Ceramic DIP Package 1.22W
Ceramic LCC Package 1.35W
Metal Can Package 830mW

Package Power Dissipation Derating Factor Above +75°C
Ceramic DIP Package .... 12.2mW/°C
Ceramic LCC Package .... 13.5mW/°C
Metal Can Package .... 8.3mW/°C

Recommended Operating Conditions

Operating Temperature Range .... -55°C to +125°C
Operating Supply Voltage .... ±5V to ±15V
$V_{INcm} \leq 1/2$ (V+ - V-)
$R_L \geq 500\Omega$

TABLE 1. D.C. ELECTRICAL PERFORMANCE CHARACTERISTICS

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

D.C. PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUP	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Input Offset Voltage	V_{IO}	V_{CM} = 0V	1	+25°C	-3	3	mV
			2, 3	+125°C, -55°C	-4	4	mV
Input Bias Current	$+I_B$	V_{CM} = 0V $+R_S$ = 100kΩ $-R_S$ = 100Ω	1	+25°C	-200	200	nA
			2, 3	+125°C, -55°C	-325	325	nA
	$-I_B$	V_{CM} = 0V $+R_S$ = 100Ω $-R_S$ = 100kΩ	1	+25°C	-200	200	nA
			2, 3	+125°C, -55°C	-325	325	nA
Input Offset Current	I_{IO}	V_{CM} = 0V $+R_S$ = 100kΩ $-R_S$ = 100kΩ	1	+25°C	-75	75	nA
			2, 3	+125°C, -55°C	-125	125	nA
Common Mode Range	+CMR	V+ = 3V V- = -27V	1	+25°C	12	-	V
			2, 3	+125°C, -55°C	12	-	V
	-CMR	V+ = 27V V- = -3V	1	+25°C	-	-12	V
			2, 3	+125°C, -55°C	-	-12	V
Large Signal Voltage Gain	$+A_{VOL}$	V_{OUT} = 0V and +10V R_L = 2kΩ	4	+25°C	100	-	kV/V
			5, 6	+125°C, -55°C	100	-	kV/V
	$-A_{VOL}$	V_{OUT} = 0V and -10V R_L = 2kΩ	4	+25°C	100	-	kV/V
			5, 6	+125°C, -55°C	100	-	kV/V
Common Mode Rejection Ratio	+CMRR	ΔV_{CM} = +10V +V = +5V -V = -25V V_{OUT} = -10V	1	+25°C	80	-	dB
			2, 3	+125°C, -55°C	80	-	dB
	-CMRR	ΔV_{CM} = -10V +V = +25V -V = -5V V_{OUT} = +10V	1	+25°C	80	-	dB
			2, 3	+125°C, -55°C	80	-	dB

CAUTION: This device is sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.

TABLE 1. D.C. ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

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

D.C. PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUP	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Output Voltage Swing	$+V_{OUT1}$	R_L = 2kΩ	1	+25°C	12	-	V
			2, 3	+125°C, -55°C	12	-	V
	$-V_{OUT1}$	R_L = 2kΩ	1	+25°C	-	-12	V
			2, 3	+125°C, -55°C	-	-12	V
	$+V_{OUT2}$	V_{SUPPLY} = ±18V R_L = 600Ω	1	+25°C	15	-	V
			2, 3	+125°C, -55°C	15	-	V
	$-V_{OUT2}$	V_{SUPPLY} = ±18V R_L = 600Ω	1	+25°C	-	-15	V
			2, 3	+125°C, -55°C	-	-15	V
Output Current	$+I_{OUT}$	V_{OUT} = -15V V_{SUPPLY} = ±18V	1	+25°C	25	-	mA
			2, 3	+125°C, -55°C	25	-	mA
	$-I_{OUT}$	V_{OUT} = +15V V_{SUPPLY} = ±18V	1	+25°C	-	-25	mA
			2, 3	+125°C, -55°C	-	-25	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	mA
	$-I_{CC}$	V_{OUT} = 0V I_{OUT} = 0mA	1	+25°C	-6	-	mA
			2, 3	+125°C, -55°C	-6	-	mA
Power Supply Rejection Ratio	+PSRR	ΔV_{SUP} = 10V +V = +10V, -V = -15V +V = +20V, -V = -15V	1	+25°C	80	-	dB
			2, 3	+125°C, -55°C	80	-	dB
	-PSRR	ΔV_{SUP} = 10V +V = +15V, -V = -10V +V = +15V, -V = -20V	1	+25°C	80	-	dB
			2, 3	+125°C, -55°C	80	-	dB
Offset Voltage Adjustment	$+V_{IO}Adj$	Note 6	1	+25°C	V_{IO}-1	-	mV
			2, 3	+125°C, -55°C	V_{IO}-1	-	mV
	$-V_{IO}Adj$	Note 6	1	+25°C	V_{IO}+1	-	mV
			2, 3	+125°C, -55°C	V_{IO}+1	-	mV

TABLE 2. A.C. ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Tested at: Supply Voltage = ±15V, R_{SOURCE} = 50Ω, R_{LOAD} = 2kΩ, C_{LOAD} = 50pF, A_{VCL} = +10V/V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	GROUP A SUBGROUP	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNITS
Slew Rate	+SR	V_{OUT} = -5V to +5V	4	+25°C	40	-	V/µs
	-SR	V_{OUT} = +5V to -5V	4	+25°C	40	-	V/µs

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

Device Characterized at: Supply Voltage = ±15V, R_{LOAD} = 2kΩ, C_{LOAD} = 50pF, A_V = +10V/V, Unless Otherwise Specified.

PARAMETERS	SYMBOL	CONDITIONS	NOTES	TEMPERATURE	LIMITS MIN	MAX	UNITS
Differential Input Resistance	R_{IN}	V_{CM} = 0V	1	+25°C	250	-	kΩ
Low Frequency Peak-to-Peak Noise	E_{np-p}	0.1Hz to 10Hz	1	+25°C	-	0.2	μV_{p-p}
Input Noise Voltage Density	E_n	R_S = 20Ω, f_o = 1000Hz	1, 5	+25°C	-	4.5	$nV/\sqrt{Hz}$
Input Noise Current Density	I_n	R_S = 2MΩ, f_o = 1000Hz	1, 5	+25°C	-	3	$pA/\sqrt{Hz}$
Gain Bandwidth Product	GBWP	V_O = 100mV, f_o = 10kHz	1	+25°C	70	-	MHz
		V_O = 100mV, f_o = 1MHz	1	+25°C	70	-	MHz
Full Power Bandwidth	FPBW	V_{PEAK} = 10V	1, 2	+25°C	630	-	kHz
Minimum Closed Loop Stable Gain	CLSG	R_L = 2kΩ, C_L = 50pF	1	-55°C to +125°C	+10	-	V/V
Rise & Fall Time	T_R	V_{OUT} = 0V to +200mV	1, 4	+25°C	-	60	ns
	T_F	V_{OUT} = 0V to -200mV	1, 4	+25°C	-	60	ns
Overshoot	+OS	V_{OUT} = 0V to +200mV	1	+25°C	-	40	%
	+OS	V_{OUT} = 0V to +200mV	1	+25°C	-	40	%
Output Resistance	R_{OUT}	Open Loop	1	+25°C	-	150	Ω
Quiescent Power Consumption	PC	V_{OUT} = 0V, I_{OUT} = 0mA	1, 3	-55°C to +125°C	-	180	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.)
4. Measured between 10% and 90% points.
5. Input Noise Voltage Density and Input Noise Current Density is sample tested on every lot.
6. Offset adjustment range is [$V_{IO\ (Measured)}$ ± 1mV] minimum referred to output. This test is for functionality only to assure adjustment through 0V.

TABLE 4. ELECTRICAL TEST REQUIREMENTS

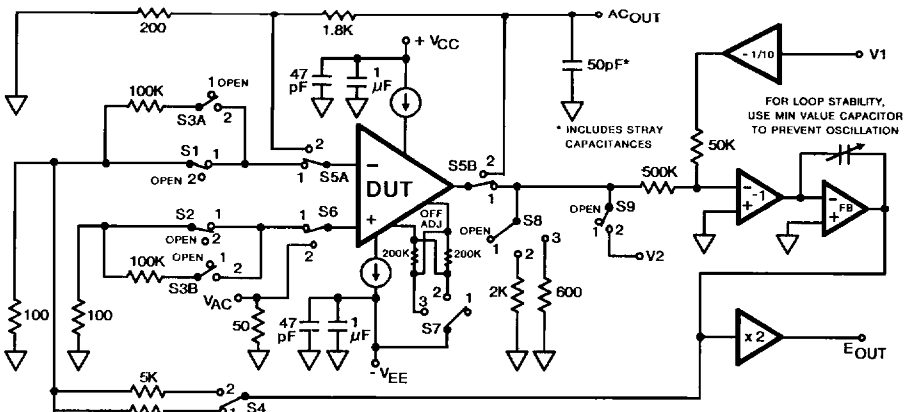
MIL-STD-883 TEST REQUIREMENTS	SUBGROUPS (SEE TABLES 1 & 2)
Interim Electrical Parameters (Pre Burn-in)	1
Final Electrical Test Parameters	1*, 2, 3, 4, 5, 6
Group A Test Requirements	1, 2, 3, 4, 5, 6
Groups C & D Endpoints	1

* PDA applies to Subgroup 1 only.

3

OP AMPs & COMPARATORS

Test Circuit (Applies To Tables 1, 2 And 3)

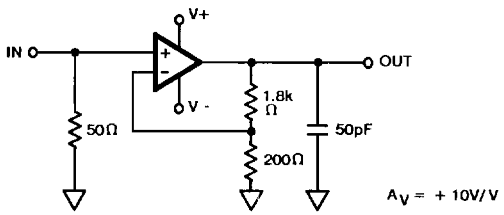


ALL RESISTORS = ± 1% (Ω)
ALL CAPACITORS = ± 10%

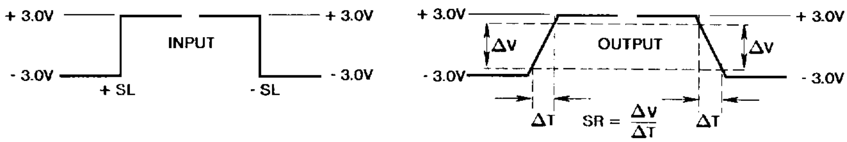
For Detailed Information, Refer to HA-5111/883 Test Tech Brief

Test Waveforms

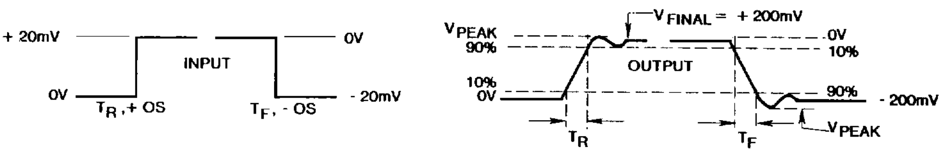
SIMPLIFIED TEST CIRCUIT (Applies To Tables 2 And 3)



SLEW RATE WAVEFORMS



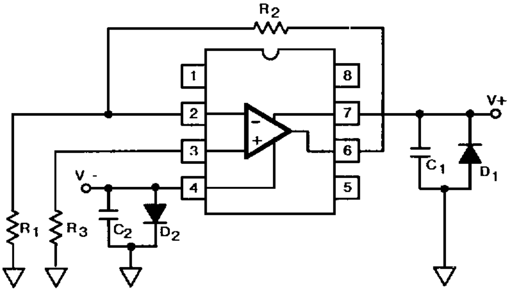
OVERSHOOT, RISE/FALL TIME WAVEFORMS



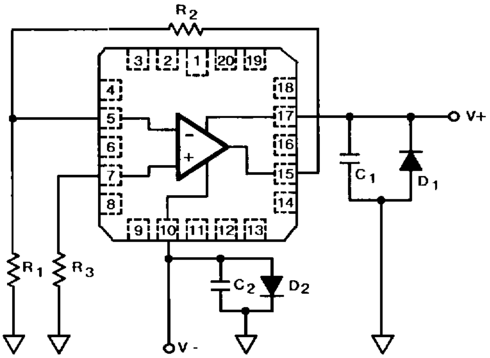
Note: Measured on both positive and negative transitions.
Capacitance at compensation pin should be minimized.

Burn-In Circuits

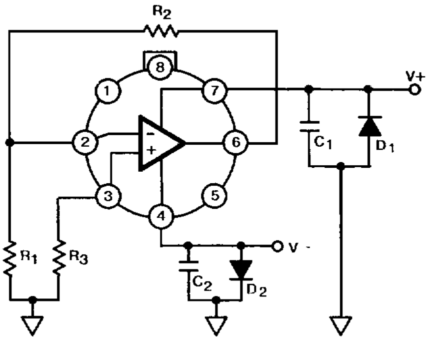
HA7-5111/883 CERAMIC DIP



HA4-5111/883 CERAMIC LCC



HA2-5111/883 (TO-99) METAL CAN



NOTES:

$R_1 = R_3$ = 1kΩ, ±5%, 1/4W (Min)

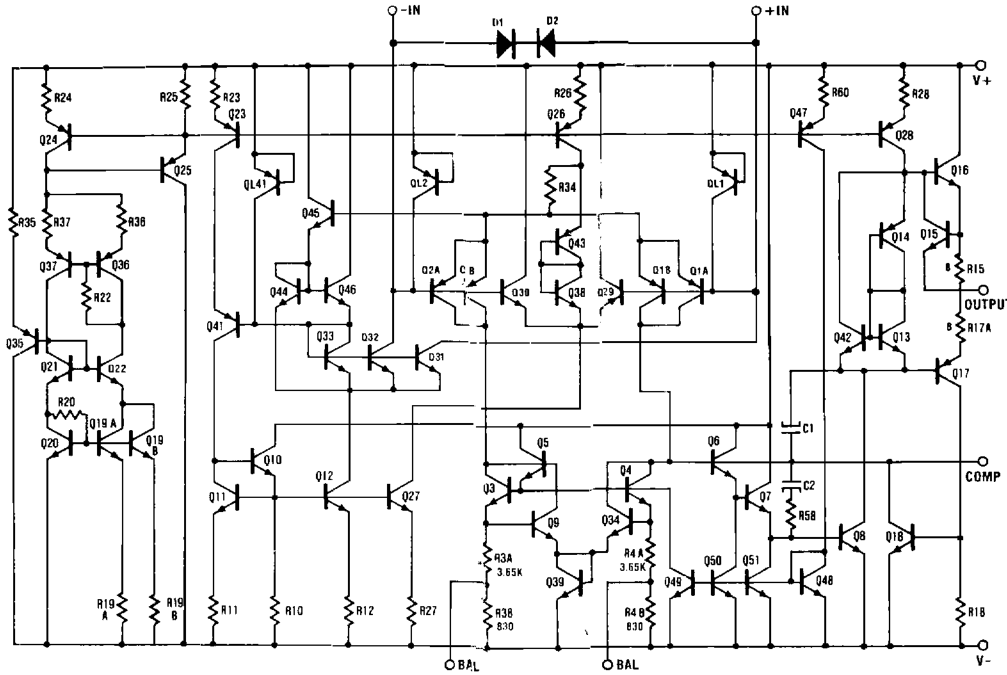
R_2 = 10kΩ, ±5%, 1/4W (Min)

$C_1 = C_2$ = 0.01μF/Socket (Min) or 0.1μF/Row (Min)

$D_1 = D_2$ = IN4002 or Equivalent/Board

$|(V+) - (V-)|$ = 30V

Schematic Diagram



Die Characteristics

DIE DIMENSIONS:
68.9 x 69.3 x 19 mils
(1750 x 1760 x 483 μm)

METALLIZATION:
Type: Aluminum
Thickness: 16kÅ ± 2kÅ

WORST CASE CURRENT DENSITY:
1.38 x 10^5A/cm^2 at 30mA

SUBSTRATE POTENTIAL (POWERED UP): V-

GLASSIVATION:
Type: Nitride
Thickness: 7kÅ ± 0.7kÅ

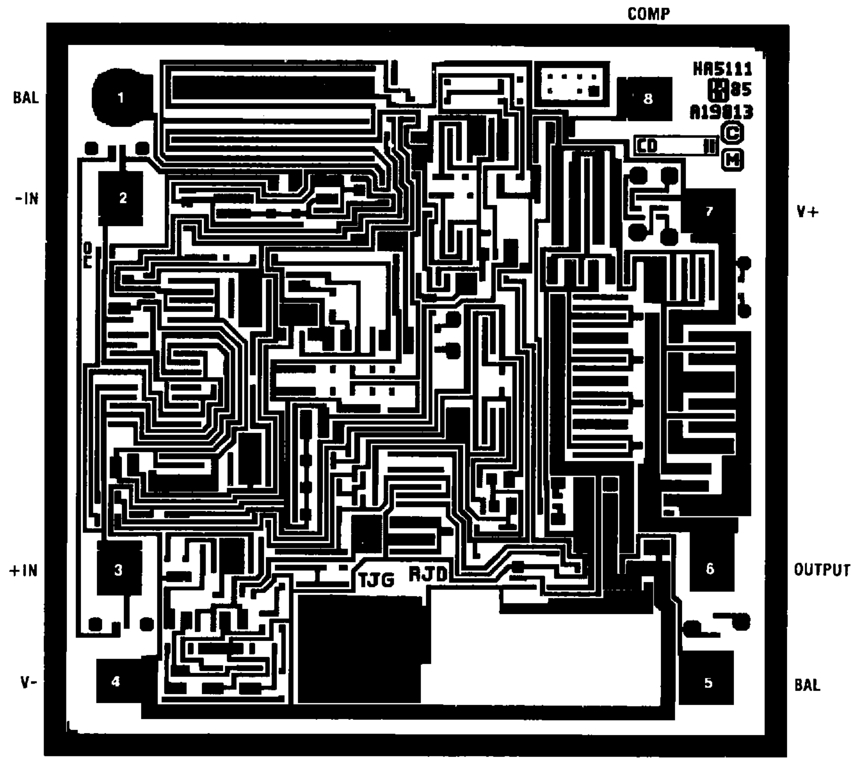
TRANSISTOR COUNT: 54

PROCESS: HFSB Bipolar Dielectric Isolation

DIE ATTACH:
Material: Gold/Silicon Eutectic Alloy
Temperature: Ceramic DIP — 460°C (Max)
Ceramic LCC — 420°C (Max)
Metal Can — 420°C (Max)

Metallization Mask Layout

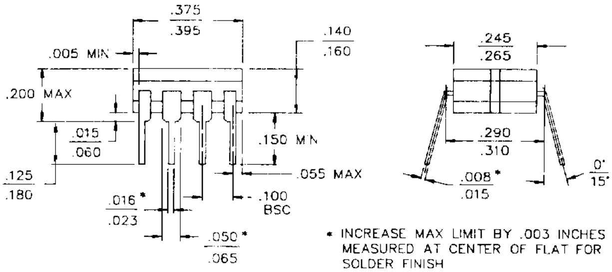
HA-5111/883



NOTE: Pin Numbers Correspond to Ceramic Mini-DIP and Metal Can Packages Only.

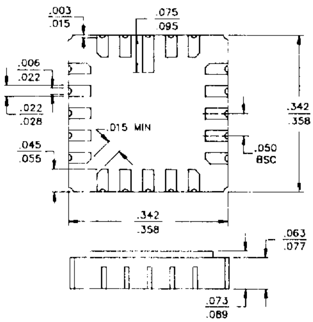
Packaging †

8 PIN CERAMIC DIP



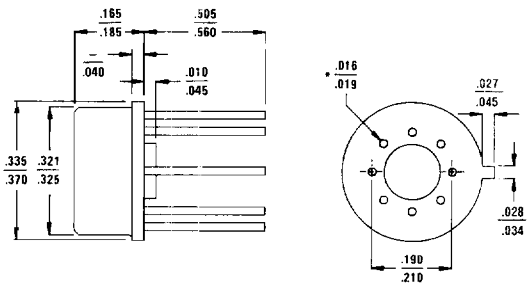
LEAD MATERIAL: Type B
LEAD FINISH: Type A
PACKAGE MATERIAL: Ceramic, 90% Alumina
PACKAGE SEAL:
Material: Glass Frit
Temperature: 450°C ± 10°C
Method: Furnace Seal
INTERNAL LEAD WIRE:
Material: Aluminum
Diameter: 1.25 Mil
Bonding Method: Ultrasonic
COMPLIANT OUTLINE: 38510 D-4

20 PAD CERAMIC LCC



PAD MATERIAL: Type C
PAD FINISH: Type A
FINISH DIMENSION: Type A
PACKAGE MATERIAL: Ceramic, 90% Al_2O_3
PACKAGE SEAL:
Material: Gold/Tin (80/20)
Temperature: 320°C ± 10°C
Method: Furnace Braze
INTERNAL LEAD WIRE:
Material: Aluminum
Diameter: 1.25 Mil
Bonding Method: Ultrasonic
COMPLIANT OUTLINE: 38510 C-2

8 PIN TO-99 METAL CAN



LEAD MATERIAL: Type A
LEAD FINISH: Type C
PACKAGE MATERIAL: Kovar Header with Nickel Can
PACKAGE SEAL:
Material: No Seal Material
Temperature: Room Temperature
Method: Resistance Weld
INTERNAL LEAD WIRE:
Material: Aluminum
Diameter: 1.25 Mil
Bonding Method: Ultrasonic Bonded
COMPLIANT OUTLINE: 38510 A-1

*Dimension Maximum Limits Are Increased by 0.003 inches for Solder Dip Finish

NOTE: All Dimensions are $\frac{\text{Min}}{\text{Max}}$, Dimensions are in inches.

† Mil-M-38510 Compliant Materials, Finishes, and Dimensions.

HARRIS

HA-5111

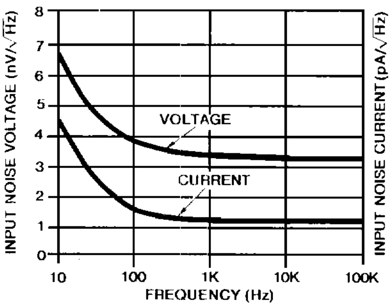
DESIGN INFORMATION

Low Noise, High Performance Uncompensated Operational Amplifier

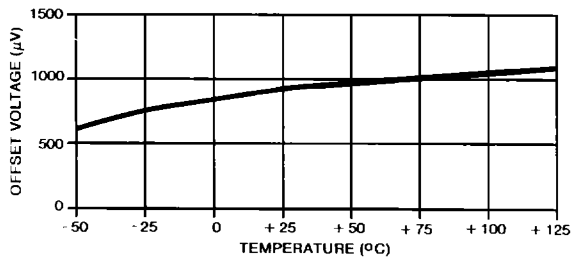
The information contained in this section has been developed through characterization by Harris Semiconductor and is for use as application and design aid only. These characteristics are not 100% tested and no product guarantee is implied.

Typical Performance Curves Unless Otherwise Specified: $V\pm = \pm15V$, $T_A = +25^oC$

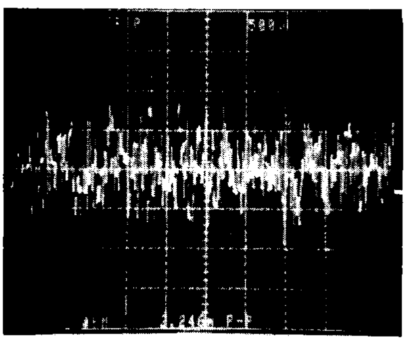
HA-5111 NOISE SPECTRUM



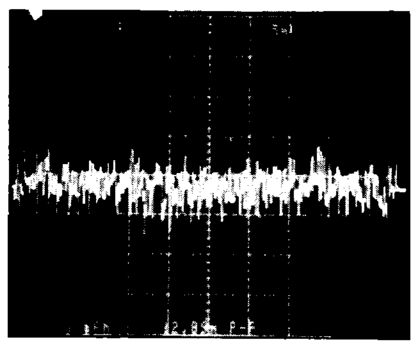
OFFSET VOLTAGE vs. TEMPERATURE



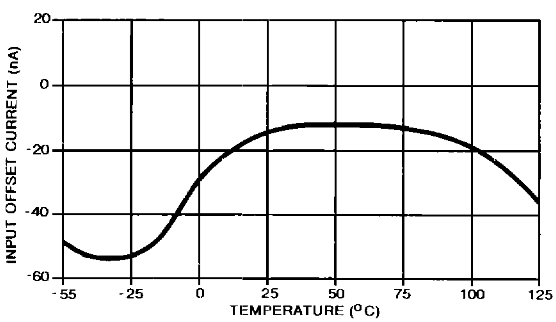
PEAK-TO-PEAK NOISE 0.1Hz TO 10Hz
A_V = 25,000, V_{CC} = ±15V
(0.09µV_{p-p} RTI)



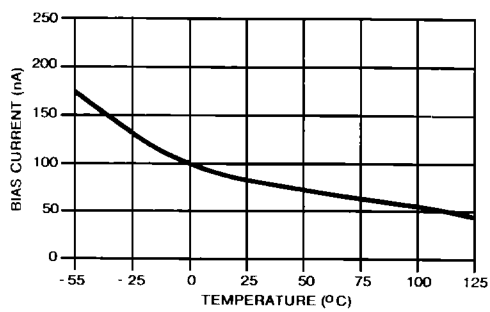
PEAK-TO-PEAK TOTAL NOISE 0.1Hz TO 1MHz
A_V = 25,000, V_{CC} = ±15V
(12.89mV_{p-p} RTO or 0.52µV_{p-p} RTI)



INPUT OFFSET CURRENT vs. TEMPERATURE



INPUT BIAS CURRENT vs. TEMPERATURE

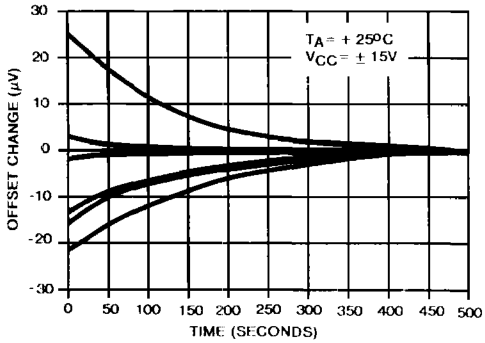


DESIGN INFORMATION (Continued)

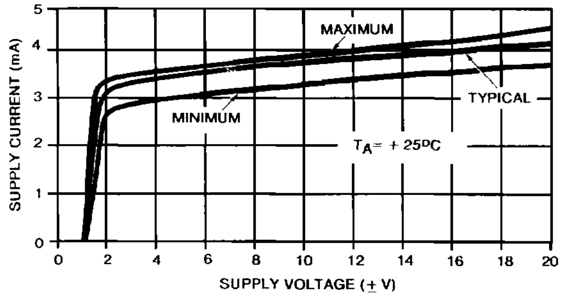
The information contained in this section has been developed through characterization by Harris Semiconductor and is for use as application and design aid only. These characteristics are not 100% tested and no product guarantee is implied.

Typical Performance Curves Unless Otherwise Specified: V± = ±15V, T_A = +25°C

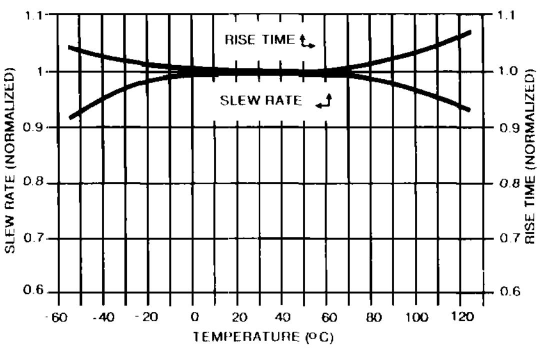
INPUT OFFSET WARMUP DRIFT vs. TIME
(Normalized to Zero Final Value)
(Six Representative Units)



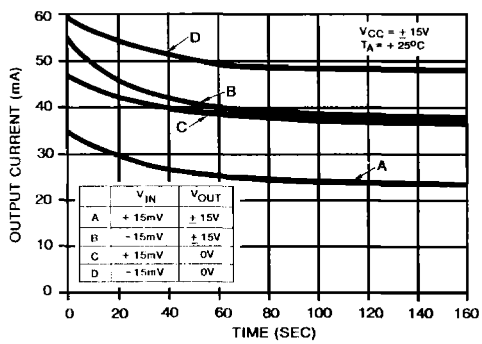
SUPPLY CURRENT vs. SUPPLY VOLTAGE



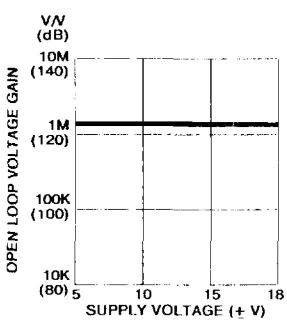
SLEW RATE/RISE TIME vs. TEMPERATURE
R_L = 2K, C_L = 50pF, V_{CC} = ±15V



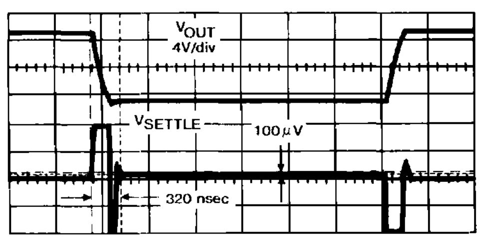
SHORT CIRCUIT CURRENT vs. TIME



D.C. OPEN LOOP VOLTAGE GAIN vs. SUPPLY VOLTAGE



HA-5111 SETTLING WAVEFORM
1.5ms/DIV.



DESIGN INFORMATION (Continued)

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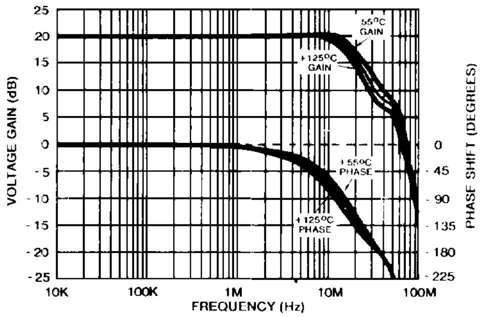
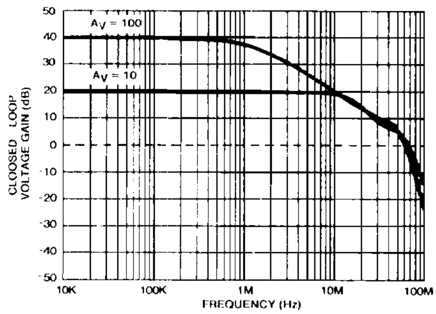
Typical Performance Curves Unless Otherwise Specified: $V\pm = \pm15V$, $T_A = +25^oC$

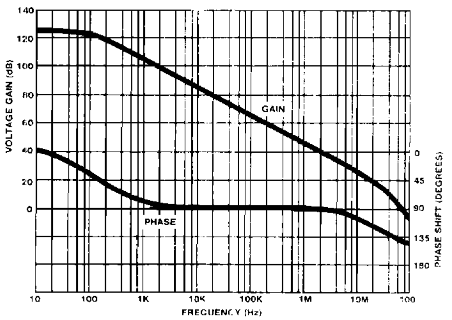
HA-5111 CLOSED LOOP GAIN AND PHASE AT HIGH AND LOW TEMPERATURE
(Typical Response of One Amplifier)
$V_{CC} = \pm15V$, $A_V = 10V/V$, $R_L = 2K$, $C_L = 50pF$



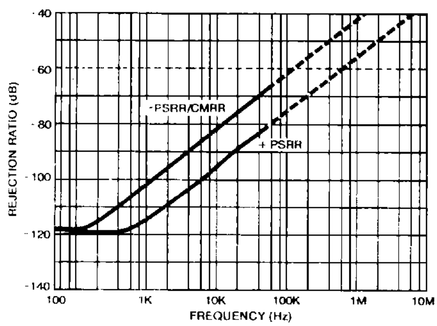
HA-5111 CLOSED LOOP VOLTAGE GAIN vs. FREQUENCY AT DIFFERENT CLOSED LOOP GAINS
$T_A = +25^oC$, $V_{CC} = \pm15V$, $A_V = 100, 10V/V$, $R_L = 2K$, $C_L = 50pF$



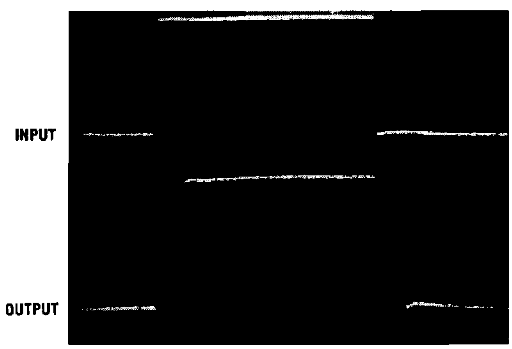
OPEN LOOP GAIN/PHASE vs. FREQUENCY



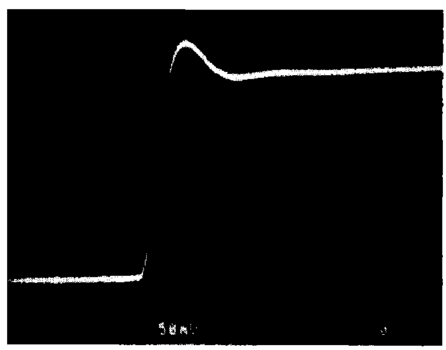
HA-5111 REJECTION RATIOS vs. FREQUENCY
$T_A = +25^oC$, $V_{CC} = \pm15V$



SLEW RATE WAVEFORM
$V_{OUT} = \pm3V$, $A_V = +10$, $R_L = 2k\Omega$, $C_L = 50pF$
Timescale = 200ns/Div., Scale: Input = 0.2V/Div., Output = 2V/Div.



SMALL SIGNAL WAVEFORM
Rise Time and Overshoot
V_{OUT} = 0V to +200mV, $A_V = +10$, $R_L = 2K$, $C_L = 50pF$
Timescale = 50ns/Div.



DESIGN INFORMATION (Continued)

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Applications Information

OPERATION AT ±5V SUPPLY

The HA-5111 performs well at V_{CC} = ±5V exhibiting typical characteristics as listed below:

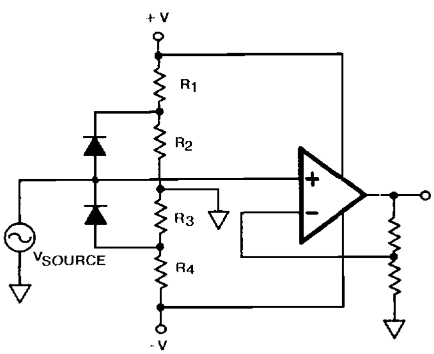
I_{CC}	3.7	mA
V_{IO}	0.5	mV
I_{BIAS}	56	nA
A_{VOL} (V_O = ±3V)	106	KV/V
V_{OUT}	3.7	V
I_{OUT}	13	mA
CMRR (ΔV_{CM} = ±2.5V)	90	dB
PSRR (ΔV_{CC} = 0.5V)	90	dB
GBW (5111)	100	MHz
Slew Rate (5111)	40	V/μs

INPUT PROTECTION

The HA-5111 has built-in back-to-back protection diodes which will limit the differential input voltage to approximately 7V. If the HA-5111 will be used in conditions where that voltage may be exceeded, then current limiting resistors must be used. No more than 25mA should be allowed to flow in the HA-5111 input.

OUTPUT SATURATION

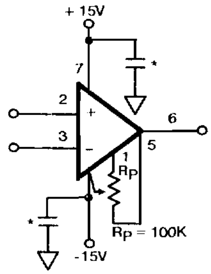
When an operational amplifier is overdriven, output devices can saturate and and sometimes take a long time to recover. Saturation can be avoided (sometimes) by using circuits such as:



If saturation cannot be avoided the HA-5111 recovers from a 25% overdrive in about 6.5μs (see photo).

OFFSET ADJUSTMENT

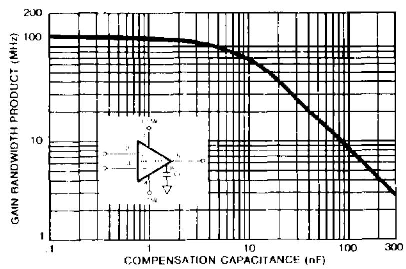
The following is the recommended V_{IO} adjust configuration:



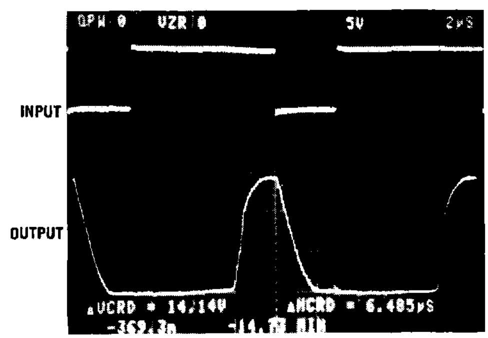
* Proper decoupling is always recommended, 0.1μF high quality capacitors should be at or vary near the device's supply pins.

COMPENSATION

An external compensation capacitor can be used with the HA-5111 connected between pin 8 and ground (or V-, V+ not recommended). A plot of gain bandwidth product vs. compensation capacitor has been included as a design aid. The capacitor should be a high frequency type mounted near the device leads to minimize parasitics.



Top: Input
Bottom: Output, 5V/Div., 2μs/Div.



Output is overdriven negative, recovers after 6μs.

DESIGN INFORMATION (Continued)

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TYPICAL PERFORMANCE CHARACTERISTICS

Device Characterized at: Supply Voltage = ±15V, R_L = 2kΩ, C_L = 50pF, A_{VCL} = 10V/V Unless Otherwise Specified.

PARAMETERS	CONDITIONS	TEMP	TYPICAL	DESIGN LIMITS	UNITS
Offset Voltage	V_{CM} = 0V	+25°C	0.8	Table 1	mV
Offset Voltage Average Drift	Versus Temperature	-55°C to +125°C	3	7	µV/°C
Offset Current Average Drift	Versus Temperature	-55°C to +125°C	100	250	pA/°C
Input Bias Current	V_{CM} = 0V	+25°C	65	Table 1	nA
Input Offset Current	V_{CM} = 0V	+25°C	35	Table 1	nA
Differential Input Resistance	V_{CM} = 0V	+25°C	500	Table 3	kΩ
Peak-to-Peak Noise Voltage at Various Bandwidths	0.1Hz to 10Hz	+25°C	0.09	Table 3	μV_{p-p}
	0.1Hz to 100Hz	+25°C	0.14	0.3	μV_{p-p}
	0.1Hz to 1kHz	+25°C	0.47	1.0	μV_{p-p}
	10Hz to 1MHz	+25°C	2.76	4.0	μV_{p-p}
Input Noise Voltage Density	f_O = 10Hz	+25°C	5.4	9	$nV/\sqrt{Hz}$
	f_O = 100Hz	+25°C	3.4	5.5	$nV/\sqrt{Hz}$
	f_O = 1kHz	+25°C	3.2	Table 3	$nV/\sqrt{Hz}$
Input Noise Current Density	f_O = 10Hz	+25°C	6	20	$pA/\sqrt{Hz}$
	f_O = 100Hz	+25°C	1.5	5	$pA/\sqrt{Hz}$
	f_O = 1kHz	+25°C	0.52	Table 3	$pA/\sqrt{Hz}$
Large Signal Voltage Gain	V_{OUT} = ±10V	-55°C	400K	Table 1	V/V
		+25°C	1M	Table 1	V/V
		+125°C	1M	Table 1	V/V
Slew Rate	V_{OUT} = ±5V	-55°C to +125°C	±60	±40	V/µs
Full Power Bandwidth	Note 2, V_{peak} = 10V	-55°C to +125°C	1.6	0.63	MHz
Rise and Fall Times	V_{OUT} = ±200mV	-55°C to +125°C	30	80	ns
Overshoot	V_{OUT} = ±200mV	-55°C to +125°C	20	45	%
Settling Time	To 0.1% for 10V Step	+25°C	0.5	1.0	µs
	To 0.01% for 10V Step	+25°C	0.6	1.5	µs
Output Short Circuit Current	t <10 Seconds, V_{OUT} = ±15V	+25°C	±35	±50	mA
Output Resistance	Open Loop	+25°C	110	Table 3	Ω
Supply Current	No Load	+25°C	4.3	Table 1	mA
Minimum Supply Voltage	Functional Operation Only, Other Parameters Will Vary	+25°C	±4	±5	V