HA-2620

100MHz, High Input Impedance, Very Wideband, Uncompensated Operational Amplifier

The HA-2620 is a bipolar operational amplifier (op amp) that features very high input impedance (500MΩ) coupled with wideband AC performance. The high resistance of the input stage is complemented by low offset voltage (0.5mV) and low bias and offset current (1nA) to facilitate accurate signal processing. Input offset can be reduced further by means of an external nulling potentiometer. The 100MHz gain bandwidth product (HA-2620 is stable for closed loop gains greater than 5), 35V/µs slew rate, and 150kV/V open loop gain enable the HA-2620 to perform high-gain amplification of very fast, wideband signals. These dynamic characteristics, coupled with fast settling times, make this amplifier ideally suited to pulse amplification designs and high frequency (such as video) applications. The frequency response of the amplifier can be tailored to exact design requirements by means of an external bandwidth control capacitor connected from the COMP pin to GND.

In addition to its application in pulse and video amplifier designs, HA-2620 is suited to other high performance designs such as high-gain low distortion audio amplifiers, high-Q and wideband active filters, and high-speed comparators. For more information, see Application Note AN519.

Related Literature

For a full list of related documents, visit our website:

- HA-2620 device pages

Features

- Gain bandwidth product ($A_V \geq 5$): 100MHz
- High input impedance: 500MΩ
- Low input bias current: 1nA
- Low input offset current: 1nA
- Low input offset voltage: 3mV
- High gain: 150kV/V
- Slew rate: 35V/µs
- Output short-circuit protection
- Compensation pin for unity gain capability

Applications

- Video and RF amplifiers
- Pulse amplifiers
- Audio amplifiers and filters
- High-Q active filters
- High speed comparators
- Low distortion oscillators

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1. Overview

1.1 Typical Applications

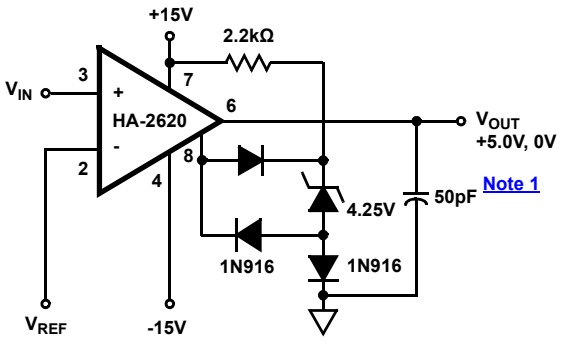


Figure 1. High Input Impedance Comparator

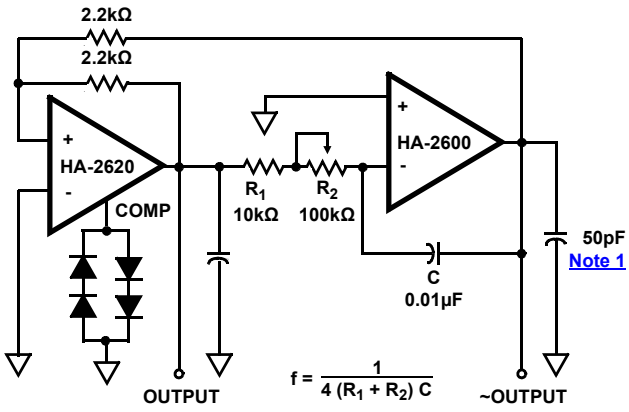


Figure 2. Function Generator

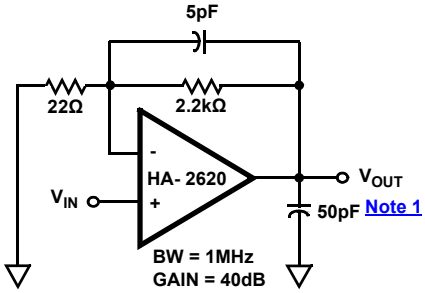
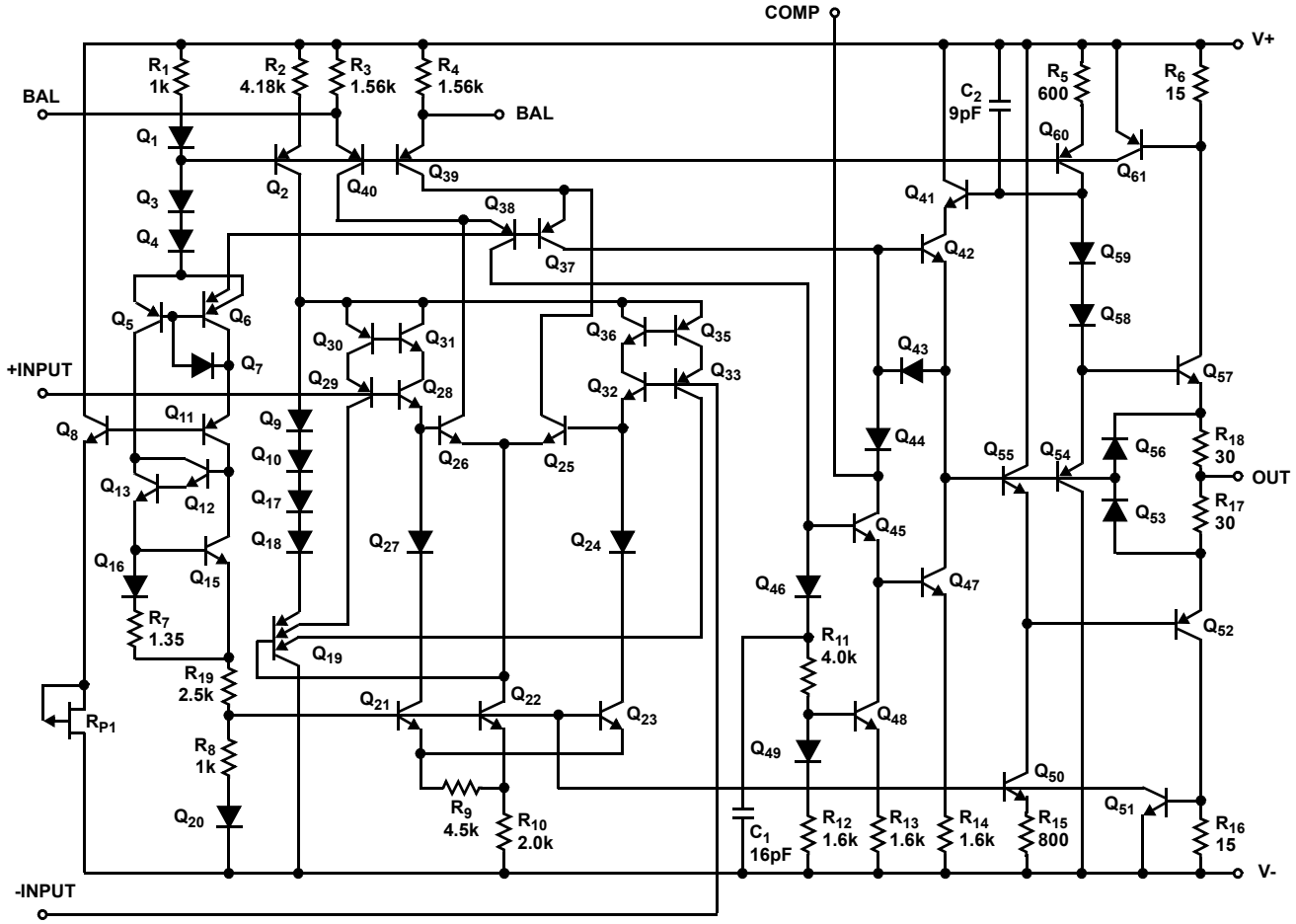


Figure 3. Video Amplifier

Note:
1. A small load capacitance of at least 30pF (including stray capacitance) is recommended to prevent possible high frequency oscillations.

1.2 Schematic Diagram

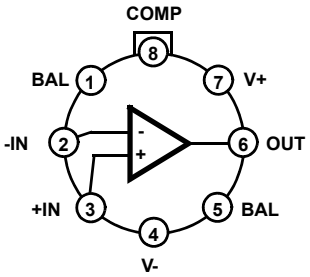


1.3 Ordering Information

Part Number	Part Marking	Temp. Range (°C)	Package	Pkg. Dwg. #
HA2-2620-2	HA2- 2620-2	-55 to 125	8 Pin Metal Can	T8.C

1.4 Pin Configuration

Metal Can
Top View



2. Specifications

2.1 Absolute Maximum Ratings

Parameter	Minimum	Maximum	Unit
Supply Voltage (Between V+ and V- Terminals)		45	V
Differential Input Voltage		12	V
Peak Output Current		Full Short-Circuit Protection	

CAUTION: Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions can adversely impact product reliability and result in failures not covered by warranty.

2.2 Thermal Information

Thermal Resistance (Typical)	θ_{JA} (°C/W)	θ_{JC} (°C/W)
Metal Can Package (Note 2)	165	80

Note:
2. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Parameter	Minimum	Maximum	Unit
Maximum Junction Temperature (Hermetic Package)		+175	°C
Maximum Storage Temperature Range	-65	+150	°C
Maximum Lead Temperature (Soldering 10s)		300	°C

2.3 Recommended Operation Conditions

Parameter	Minimum	Maximum	Unit
Ambient Temperature	-55	+125	°C

2.4 Electrical Specifications

V_{SUPPLY} = ±15V, Unless Otherwise Specified

Parameter	Temperature (°C)	Min	Typ	Max	Unit
Input Characteristics					
Offset Voltage (Note 4)	25	-	0.5	4	mV
	Full	-	2	6	mV
Average Offset Voltage Drift	Full	-	5	-	µV/°C
Bias Current	25	-	1	15	nA
	Full	-	10	35	nA
Offset Current	25		1	15	nA
	Full	-	5	35	nA
Differential Input Resistance (Note 3)	25	65	500	-	MΩ
Input Noise Voltage Density (f = 1kHz)	25	-	11	-	nV/$\sqrt{Hz}$
Input Noise Current Density (f = 1kHz)	25	-	0.16	-	pA/$\sqrt{Hz}$
Common-Mode Range	Full	±11	±12	-	V
Transfer Characteristics					
Large Signal Voltage Gain (Notes 5, 6)	25	100	150	-	kV/V
	Full	70	-	-	kV/V
Common-Mode Rejection Ratio (Note 7)	Full	80	100	-	dB
Minimum Stable Gain	25	5	-	-	V/V
Gain Bandwidth Product (Notes 5, 8, 9)	25	-	100	-	MHz

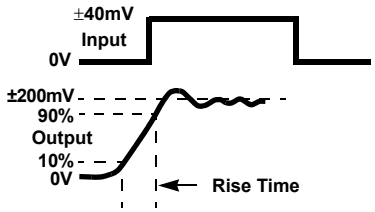
V_{SUPPLY} = ±15V, Unless Otherwise Specified **(Continued)**

Parameter	Temperature (°C)	Min	Typ	Max	Unit
Output Characteristics					
Output Voltage Swing (Note 5)	Full	±10	±12	-	V
Output Current (Note 6)	25	±15	±22	-	mA
Full Power Bandwidth (Notes 5, 6, 10, 14)	25	400	600	-	kHz
Transient Response (Note 9)					
Rise Time (Notes 5, 10, 11)	25	-	17	45	ns
Slew Rate (Notes 5, 10, 11, 13)	25	±25	±35	-	V/µs
Power Supply Characteristics					
Supply Current	25	-	3	3.7	mA
Power Supply Rejection Ratio (Note 12)	Full	80	90	-	dB

Notes:

3. This parameter value is assured by design calculations.
4. Offset may be externally adjusted to zero.
5. R_L = 2kΩ.
6. V_{OUT} = ±10V.
7. V_{CM} = ±10V.
8. V_{OUT} < 90mV.
9. 40dB Gain.
10. See Transient Response Test Circuits and Waveforms.
11. A_V = 5 (The HA-2620 family is not stable at unity gain without external compensation).
12. ΔV_S = ±5V.
13. V_{OUT} = ±5V.
14. Full power bandwidth assured by slew rate measurement: $FPBW = \frac{\text{Slew Rate}}{2\pi V_{PEAK}}$.

2.5 Test Circuits and Waveforms



Note: Measured on both positive and negative transitions from 0V to +200mV and 0V to -200mV at output.

Figure 4. Transient Response

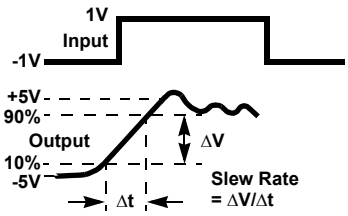


Figure 5. Slew Rate

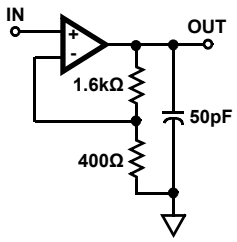
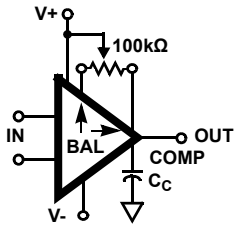


Figure 6. Slew Rate and Transient Response



NOTE: Tested Offset Adjustment is $|V_{OS}$ + 1mV| minimum referred to output. Typical range is ±10mV with R_T = 100kΩ.

Figure 7. Suggested V_{OS} Adjustment and Compensation Hook-Up

3. Typical Performance Curves

V_S = ±15V, T_A = 25°C, Unless Otherwise Specified

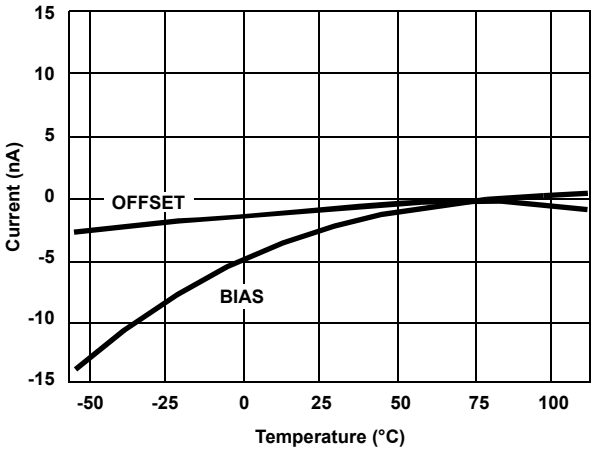


Figure 8. Input Bias Current and Offset Current vs Temperature

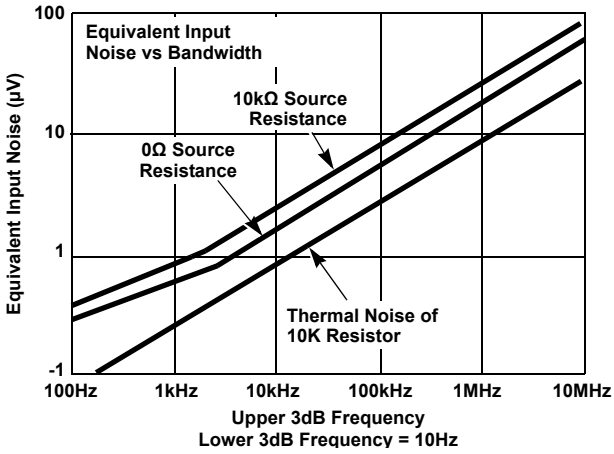


Figure 9. Broadband Noise Characteristics

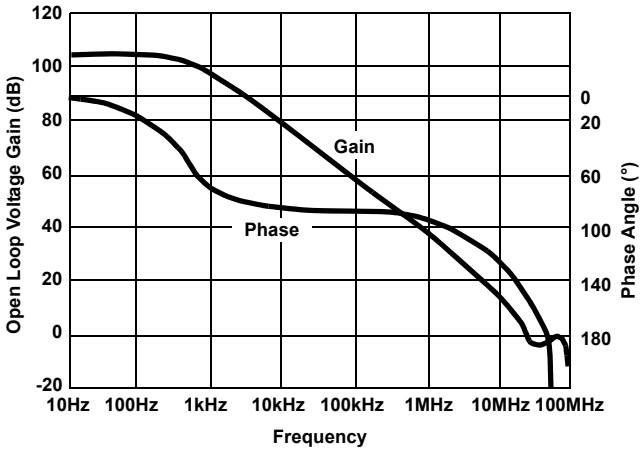


Figure 10. Open Loop Frequency Response

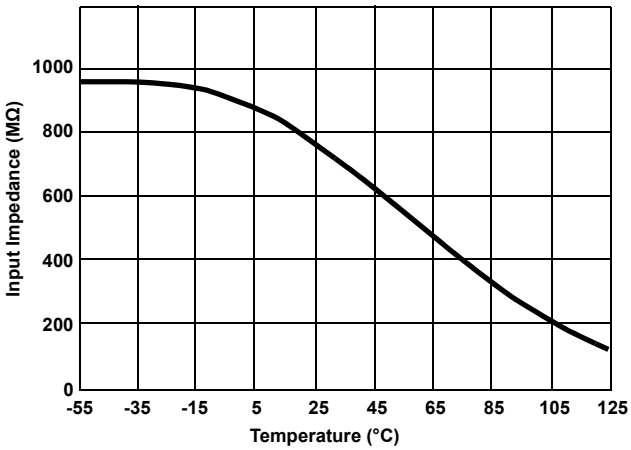


Figure 11. Input Impedance vs Temperature, 100Hz

V_S = ±15V, T_A = 25°C, Unless Otherwise Specified **(Continued)**

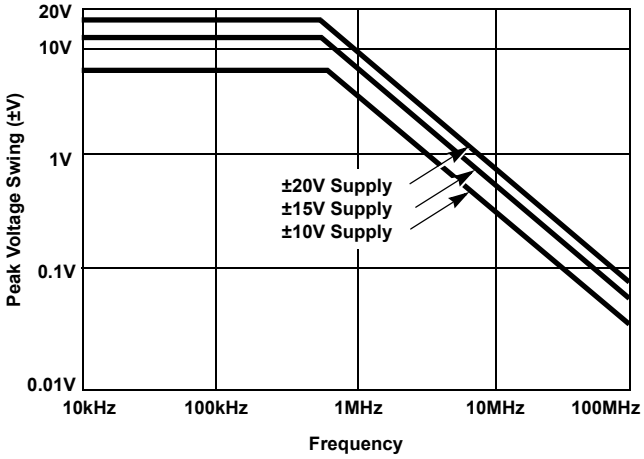
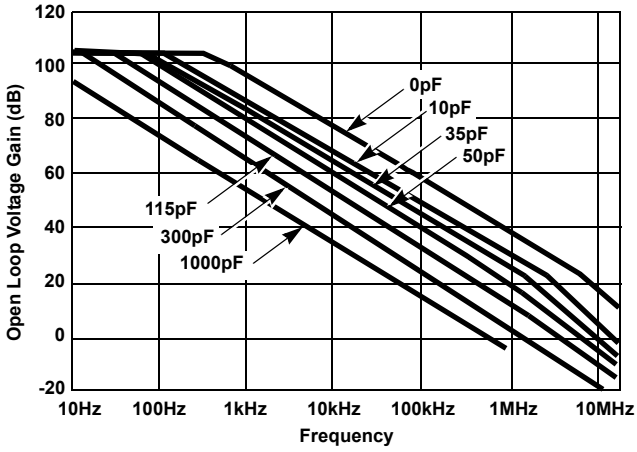


Figure 12. Output Voltage Swing vs Frequency



Note: External Compensation is required for closed loop gain < 5. If external compensation is used, also connect 100pF capacitor from output to ground.

Figure 13. Open Loop Frequency Response for Various Values of Capacitors from COMP. PIN to GND

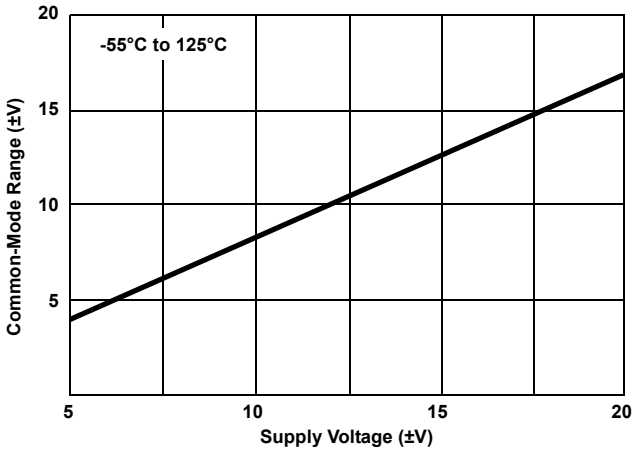


Figure 14. Common-Mode Voltage Range vs Supply Voltage

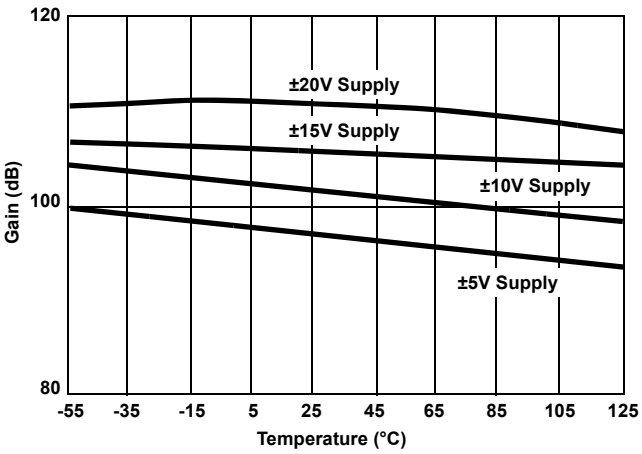


Figure 15. Open Loop Voltage Gain vs Temperature

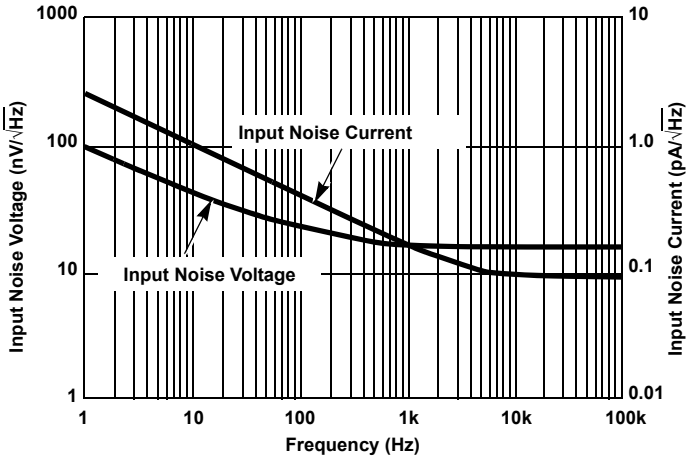
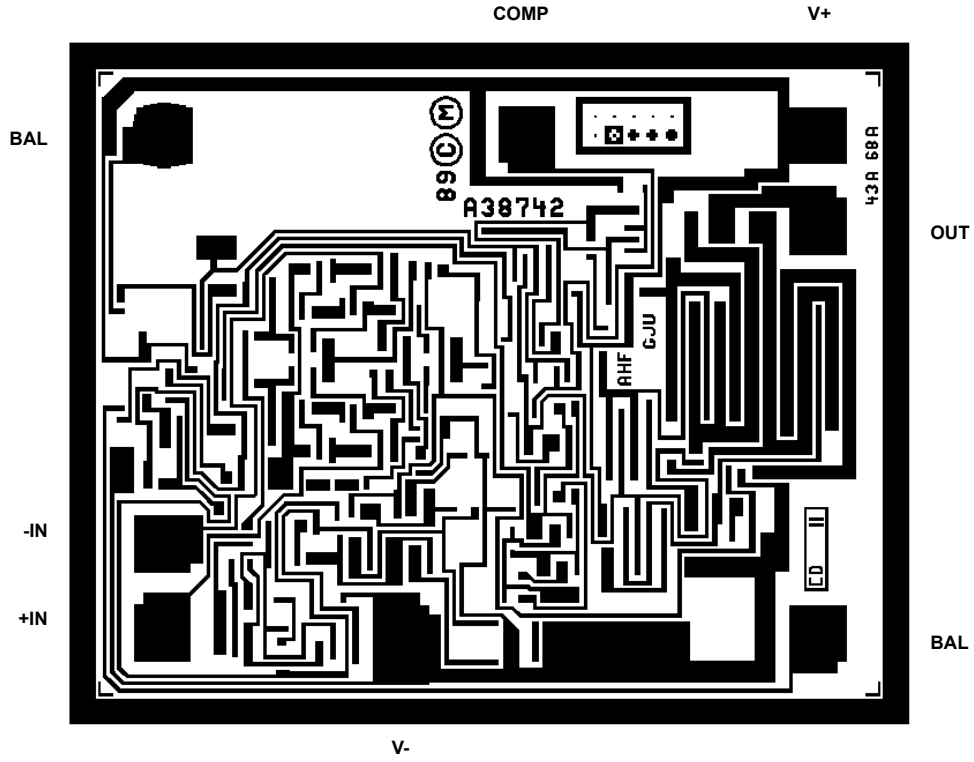


Figure 16. Noise Density vs Frequency

4. Die Characteristics

Process	Bipolar Dielectric Isolation
Substrate Potential (Powered Up)	Unbiased
Transistor Count	140

4.1 Metallization Mask Layout

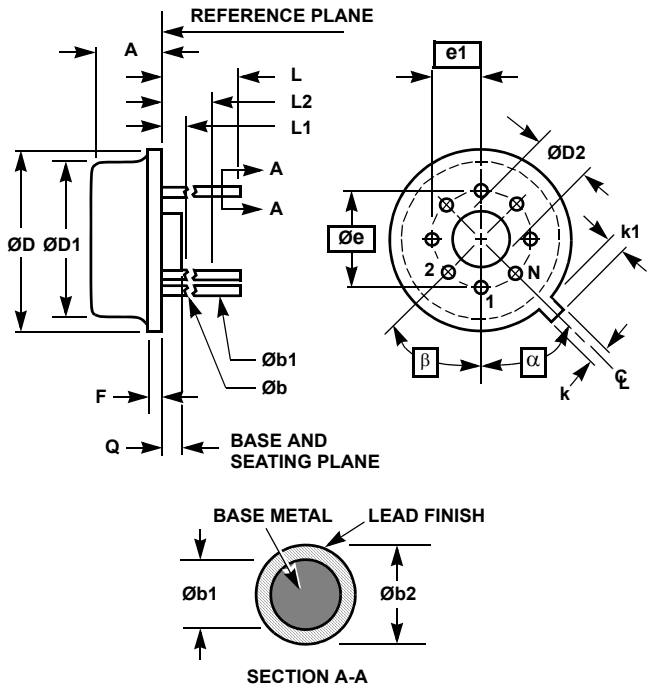


5. Revision History

Rev.	Date	Description
9.00	Mar.21.19	Applied New template and formatting. Removed HA-2625 information from datasheet. Added Revision History. Updated Disclaimer.

6. Package Outline Drawing

For the most recent package outline drawing, see T8.C.



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	45º BSC		45º BSC		3
β	45º BSC		45º BSC		3
N	8		8		4

Rev. 0 5/18/94

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