

750MHz, Low Distortion Unity Gain, Closed Loop Buffer

The HFA1110 is a unity gain closed loop buffer that achieves -3dB bandwidth of 750MHz, while offering excellent video performance and low distortion. Manufactured on Intersil's proprietary complementary bipolar UHF-1 process, the HFA1110 also offers very fast slew rate, and high output current. It is one more example of Intersil's intent to enhance its leadership position in products for high speed signal processing applications.

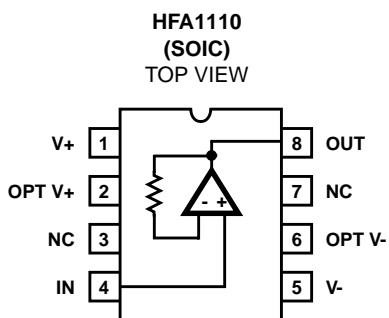
The HFA1110's settling time of 11ns to 0.1%, low distortion and ability to drive capacitive loads make it an ideal flash A/D driver.

The HFA1110 is an enhanced, pin compatible upgrade for the AD9620, AD9630, CLC110, EL2072, BUF600 and BUF601.

For buffer applications requiring a standard op amp pinout, or selectable gain (-1, +1, +2), see the HFA1112 data sheet. For output limiting see the HFA1113 data sheet.

For military grade product please refer to the HFA1110/883 data sheet.

Pinout



Pin Descriptions

| NAME | PIN NUMBER | DESCRIPTION |
|--------|------------|--------------------------|
| V+ | 1 | Positive Supply |
| Opt V+ | 2 | Optional Positive Supply |
| NC | 3 | No Connection |
| IN | 4 | Input |
| V- | 5 | Negative Supply |
| Opt V- | 6 | Optional Negative Supply |
| NC | 7 | No Connection |
| OUT | 8 | Output |

Features

- Wide -3dB Bandwidth. 750MHz
- Very Fast Slew Rate. 1300V/μs
- Fast Settling Time (0.2%) 7ns
- High Output Current. 60mA
- Fixed Gain of +1
- Gain Flatness (100MHz) 0.03dB
- Differential Phase 0.025 Degrees
- Differential Gain 0.04%
- 3rd Harmonic Distortion (50MHz). -80dBc
- 3rd Order Intercept (100MHz) 30dBm

Applications

- Video Switching and Routing
- RF/IF Processors
- Driving Flash A/D Converters
- High-Speed Communications
- Impedance Transformation
- Line Driving
- Radar Systems

Ordering Information

| PART NUMBER (BRAND) | TEMP. RANGE (°C) | PACKAGE | PKG. NO. |
|---------------------|--|-----------|----------|
| HFA1110IB (H1110I) | -40 to 85 | 8 Ld SOIC | M8.15 |
| HFA1110EVAL | High Speed Buffer DIP Evaluation Board | | |

HFA1110

Absolute Maximum Ratings

Voltage Between V+ and V-12V
 DC Input Voltage V_{SUPPLY}
 Output Current60mA

Operating Conditions

Temperature Range -40°C to 85°C

Thermal Information

Thermal Resistance (Typical, Note 1) θ_{JA} (°C/W)
 SOIC Package 158
 Maximum Junction Temperature (Plastic Package)150°C
 Maximum Storage Temperature Range -65°C to 150°C
 Maximum Lead Temperature (Soldering 10s) 300°C
 (SOIC - Lead Tips Only)

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:

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

Electrical Specifications $V_{SUPPLY} = \pm 5V, R_L = 100\Omega$, Unless Otherwise Specified

| PARAMETER | TEST CONDITIONS | TEMP (°C) | MIN | TYP | MAX | UNITS |
|-------------------------------------|-----------------------------|-----------|-------|------------|-------|------------------|
| INPUT CHARACTERISTICS | | | | | | |
| Output Offset Voltage (Note 2) | | 25 | - | 8 | 25 | mV |
| | | Full | - | - | 35 | mV |
| Output Offset Voltage Drift | | Full | - | 10 | - | $\mu V/^\circ C$ |
| PSRR | | 25 | 39 | 45 | - | dB |
| | | Full | 35 | - | - | dB |
| Input Noise Voltage (Note 2) | 100kHz | 25 | - | 14 | - | nV/\sqrt{Hz} |
| Input Noise Current (Note 2) | 100kHz | 25 | - | 51 | - | pA/\sqrt{Hz} |
| Input Bias Current (Note 2) | | 25 | - | 10 | 40 | μA |
| | | Full | - | - | 65 | μA |
| Input Resistance | | 25 | 25 | 50 | - | k Ω |
| Input Capacitance | | 25 | - | 2 | - | pF |
| TRANSFER CHARACTERISTICS | | | | | | |
| Gain | $V_{OUT} = 2V_{P-P}$ | 25 | 0.980 | 0.990 | 1.02 | V/V |
| | | Full | 0.975 | - | 1.025 | V/V |
| DC Non-Linearity (Note 2) | $\pm 2V$ Full Scale | 25 | - | 0.003 | - | % |
| OUTPUT CHARACTERISTICS | | | | | | |
| Output Voltage (Note 2) | | 25 | 3.0 | 3.3 | - | $\pm V$ |
| | | Full | 2.5 | 3.0 | - | $\pm V$ |
| Output Current (Note 2) | $R_L = 50\Omega$ | 25, 85 | 50 | 60 | - | mA |
| | | -40 | 35 | 50 | - | mA |
| POWER SUPPLY CHARACTERISTICS | | | | | | |
| Supply Voltage Range | | Full | 4.5 | - | 5.5 | $\pm V$ |
| Supply Current (Note 2) | | 25 | - | 21 | 26 | mA |
| | | Full | - | - | 33 | mA |
| AC CHARACTERISTICS | | | | | | |
| -3dB Bandwidth (Note 2) | $V_{OUT} = 0.2V_{P-P}$ | 25 | - | 750 | - | MHz |
| Slew Rate | $V_{OUT} = 5V_{P-P}$ | 25 | - | 1300 | - | V/ μs |
| Full Power Bandwidth (Note 2) | $V_{OUT} = 4V_{P-P}$ | 25 | - | 150 | - | MHz |
| Gain Flatness (Note 2) | To 100MHz | 25 | - | ± 0.03 | - | dB |
| | To 30MHz | 25 | - | ± 0.01 | - | dB |
| Linear Phase Deviation (Note 2) | DC to 100MHz | 25 | - | ± 0.3 | - | Degrees |
| 2nd Harmonic Distortion (Note 2) | 50MHz, $V_{OUT} = 2V_{P-P}$ | 25 | - | -60 | - | dBc |
| 3rd Harmonic Distortion (Note 2) | 50MHz, $V_{OUT} = 2V_{P-P}$ | 25 | - | -80 | - | dBc |
| 3rd Order Intercept (Note 2) | 100MHz | 25 | - | 30 | - | dBm |

Electrical Specifications $V_{SUPPLY} = \pm 5V, R_L = 100\Omega$, Unless Otherwise Specified (Continued)

| PARAMETER | TEST CONDITIONS | TEMP (°C) | MIN | TYP | MAX | UNITS |
|-----------------------------------|---|-----------|-----|-------|-----|---------|
| -1dB Gain Compression | 100MHz | 25 | - | 14 | - | dBm |
| Reverse Gain (S_{12} , Note 2) | 100MHz, $V_{OUT} = 1V_{P-P}$ | 25 | - | -60 | - | dB |
| TRANSIENT RESPONSE | | | | | | |
| Rise Time | $V_{OUT} = 0.5V$ Step | 25 | - | 0.5 | - | ns |
| Overshoot (Note 2) | $V_{OUT} = 1.0V$ Step, Input Signal Rise/Fall = 1ns | 25 | - | 2.5 | - | % |
| 0.2% Settling Time (Note 2) | $V_{OUT} = 1V$ to 0V | 25 | - | 7 | - | ns |
| 0.1% Settling Time (Note 2) | $V_{OUT} = 1V$ to 0V | 25 | - | 11 | - | ns |
| Overdrive Recovery Time | | 25 | - | 15 | - | ns |
| Differential Gain | 3.58MHz, $R_L = 75\Omega$ | 25 | - | 0.04 | - | % |
| Differential Phase | 3.58MHz, $R_L = 75\Omega$ | 25 | - | 0.025 | - | Degrees |

NOTE:

- See Typical Performance Curves for more information.

Application Information

PC Board Layout

The frequency performance of this amplifier depends a great deal on the amount of care taken in designing the PC board.

The use of low inductance components such as chip resistors and chip capacitors is strongly recommended, while a solid ground plane is a must!

Attention should be given to decoupling the power supplies. A large value (10 μ F) tantalum in parallel with a small value chip (0.1 μ F) capacitor works well in most cases.

Terminated microstrip signal lines are recommended at the input and output of the device. Output capacitance, such as that resulting from an improperly terminated transmission line will degrade the frequency response of the amplifier and may cause oscillations. In most cases, the oscillation can be avoided by placing a resistor (R_S) in series with the output. See the "Recommended R_S vs Load Capacitance" graph for specific recommendations.

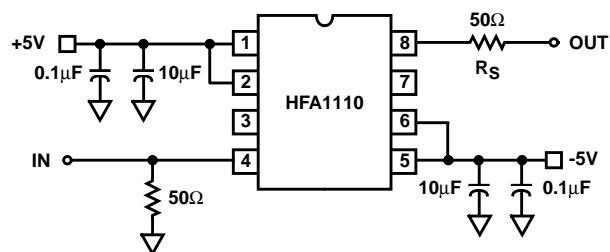
An example of a good high frequency layout is the Evaluation Board shown below.

Evaluation Board

An evaluation board is available for the HFA1110 (part number HFA1110EVAL). Please contact your local sales office for information.

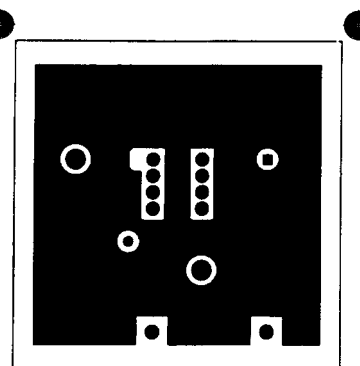
The layout and schematic of the board are shown here:

NOTE: The SOIC version may be evaluated in the DIP board by using a SOIC-to-DIP adapter such as Aries Electronics Part Number 08-350000-10.

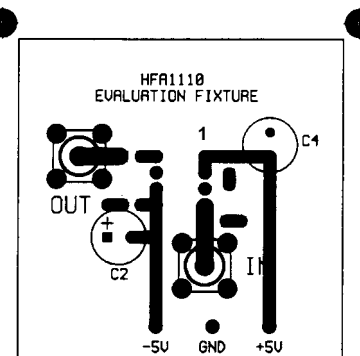


SCHEMATIC DIAGRAM

BOTTOM LAYOUT



TOP LAYOUT



Typical Performance Curves $V_{SUPPLY} = \pm 5V$, $T_A = 25^\circ C$, $R_L = 100\Omega$, Unless Otherwise Specified

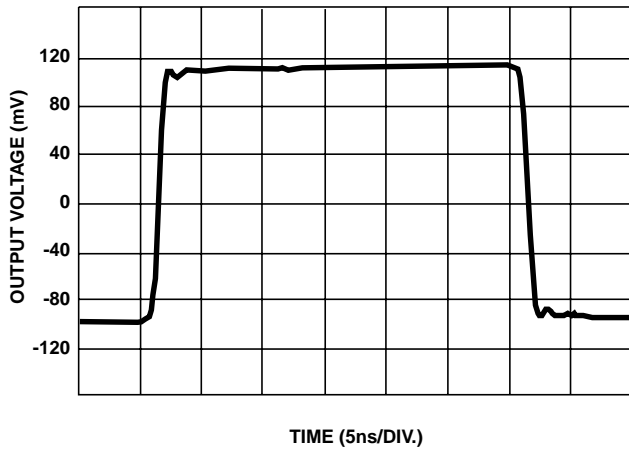


FIGURE 1. SMALL SIGNAL PULSE RESPONSE



FIGURE 2. LARGE SIGNAL PULSE RESPONSE

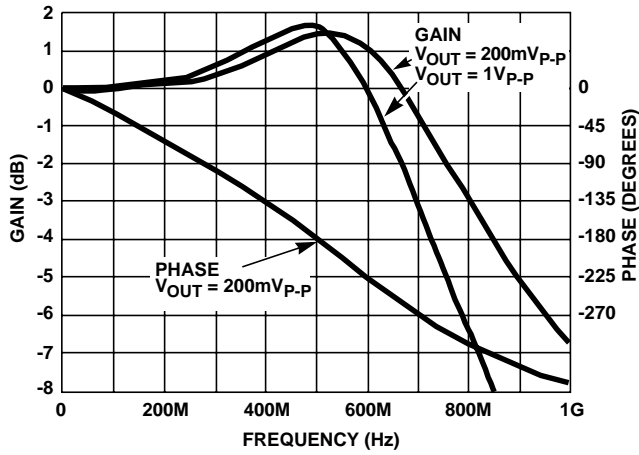


FIGURE 3. FREQUENCY RESPONSE

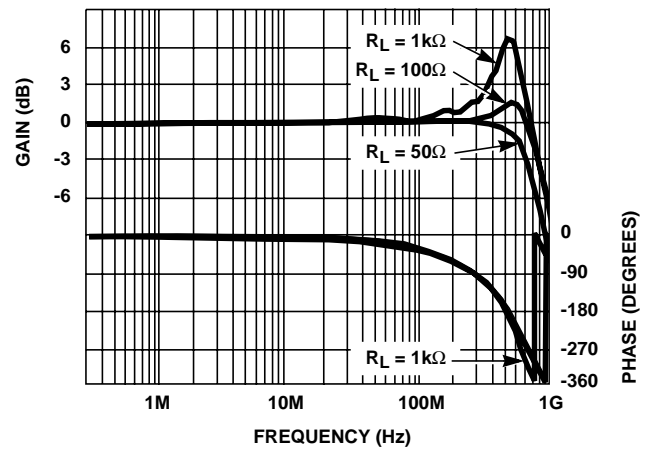


FIGURE 4. FREQUENCY RESPONSE FOR VARIOUS LOAD RESISTORS

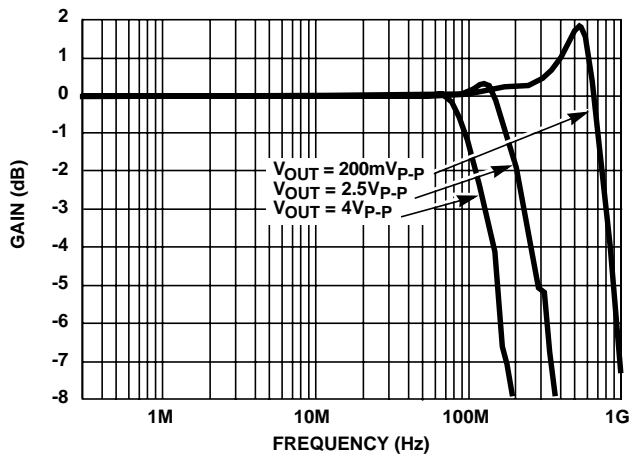


FIGURE 5. FREQUENCY RESPONSE FOR VARIOUS OUTPUT VOLTAGES

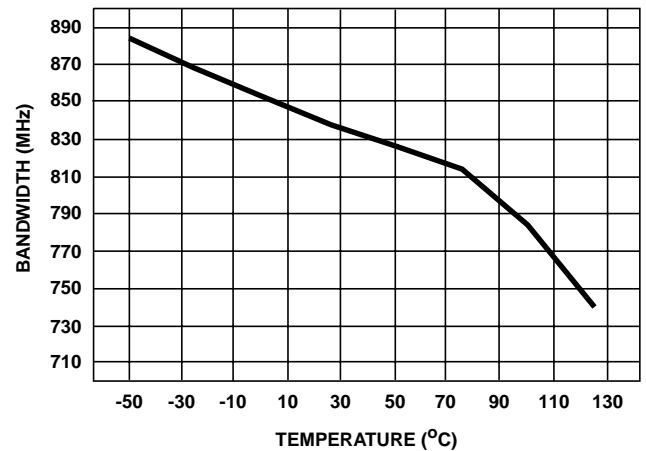


FIGURE 6. -3dB BANDWIDTH vs TEMPERATURE

Typical Performance Curves $V_{SUPPLY} = \pm 5V$, $T_A = 25^\circ C$, $R_L = 100\Omega$, Unless Otherwise Specified (Continued)

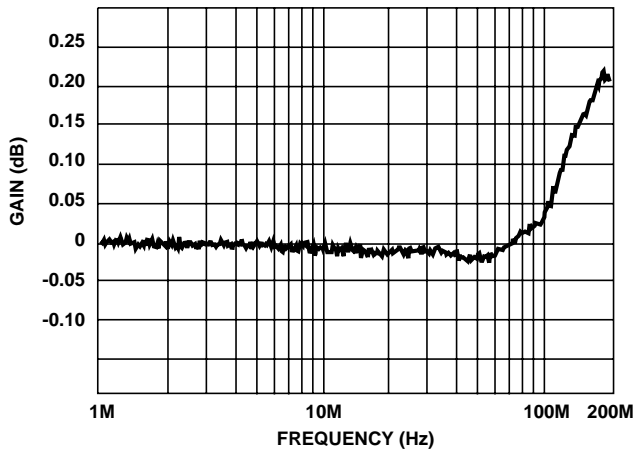


FIGURE 7. GAIN FLATNESS

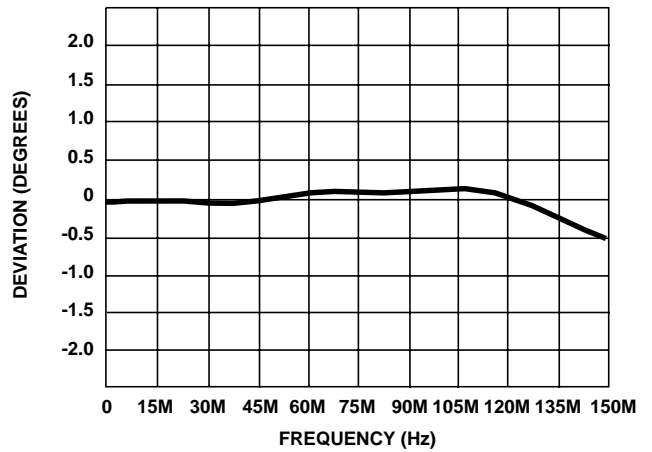


FIGURE 8. DEVIATION FROM LINEAR PHASE

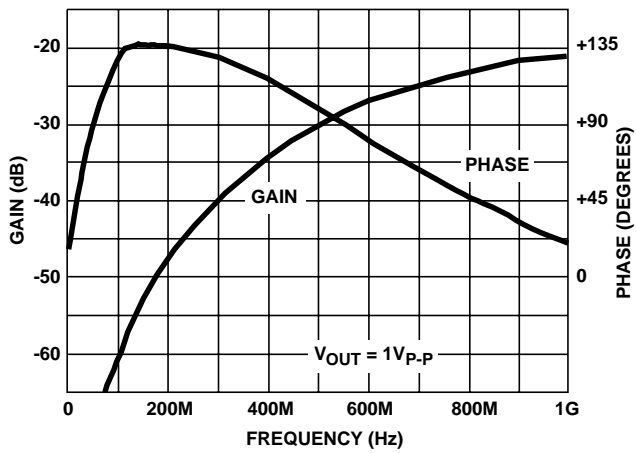


FIGURE 9. REVERSE GAIN AND PHASE (S_{12})

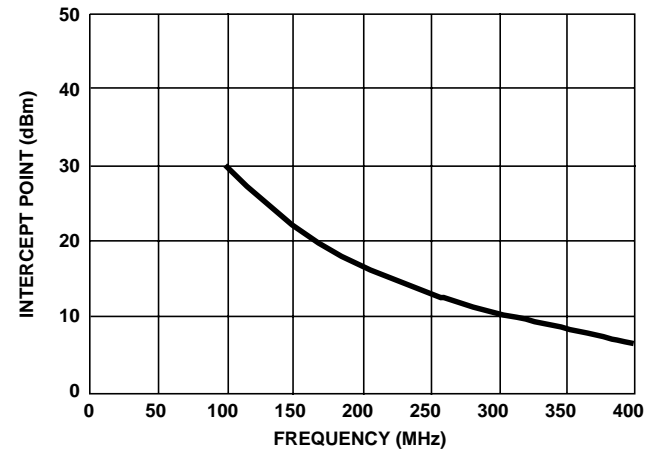


FIGURE 10. TWO-TONE, THIRD ORDER INTERMODULATION INTERCEPT

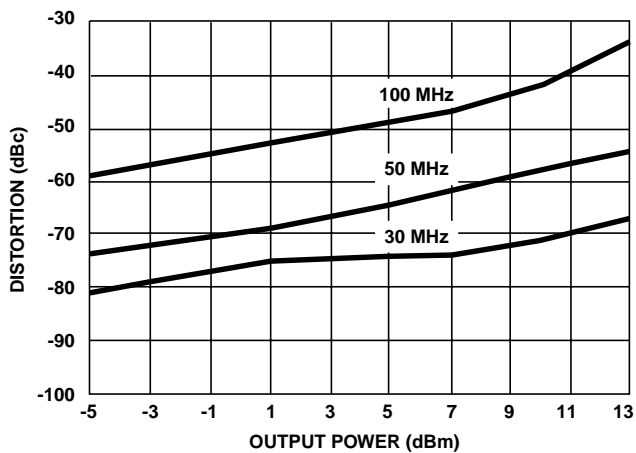


FIGURE 11. SECOND HARMONIC DISTORTION vs P_{OUT}

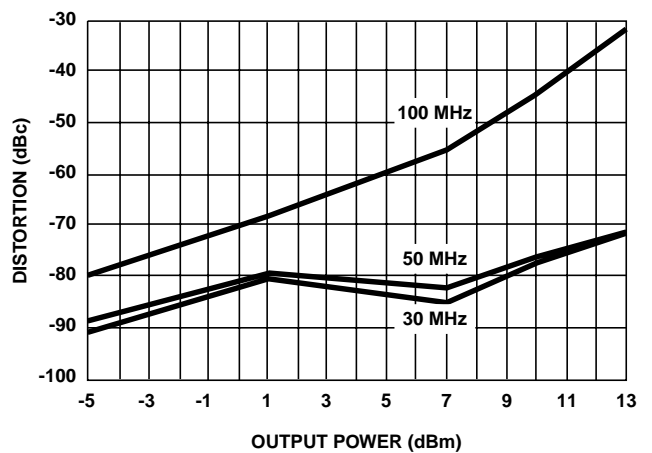


FIGURE 12. THIRD HARMONIC DISTORTION vs P_{OUT}

Typical Performance Curves $V_{SUPPLY} = \pm 5V$, $T_A = 25^\circ C$, $R_L = 100\Omega$, Unless Otherwise Specified (Continued)

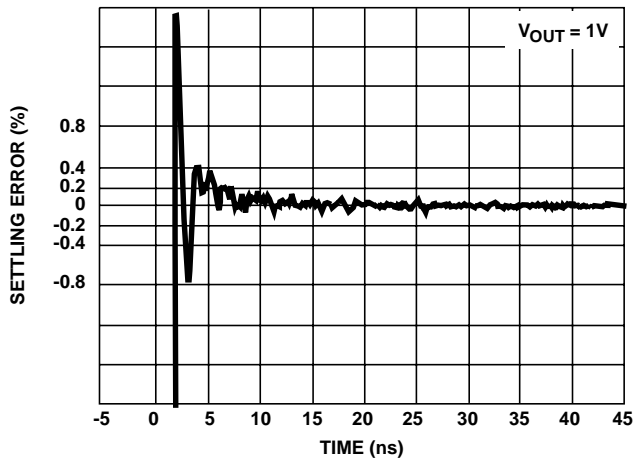


FIGURE 13. SETTLING RESPONSE

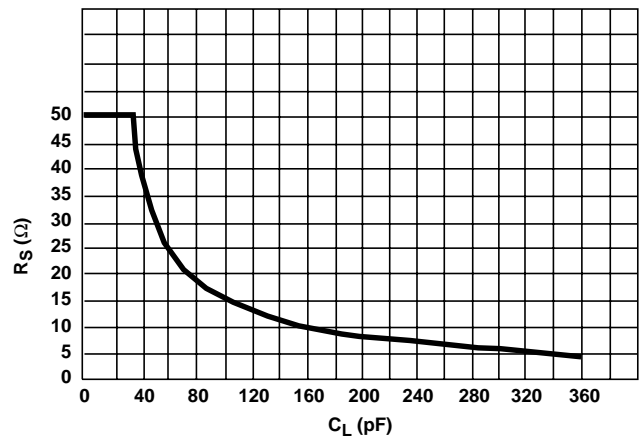


FIGURE 14. RECOMMENDED SERIES OUTPUT RESISTOR vs C_{LOAD}

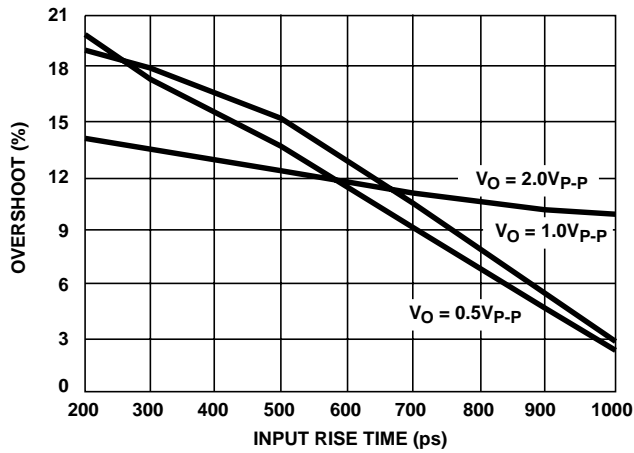


FIGURE 15. OVERSHOOT vs INPUT RISE TIME

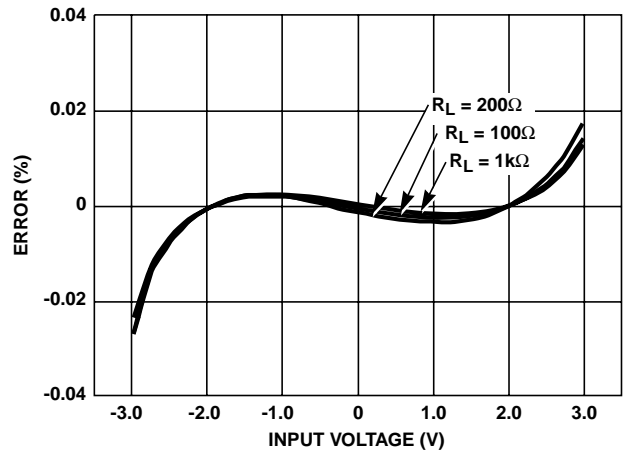


FIGURE 16. INTEGRAL LINEARITY ERROR

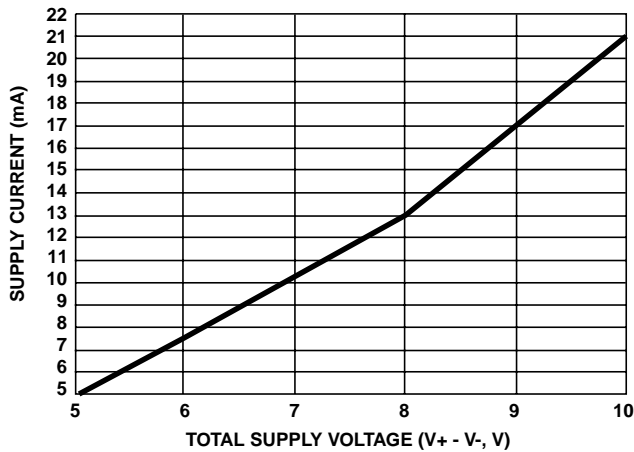


FIGURE 17. SUPPLY CURRENT vs SUPPLY VOLTAGE

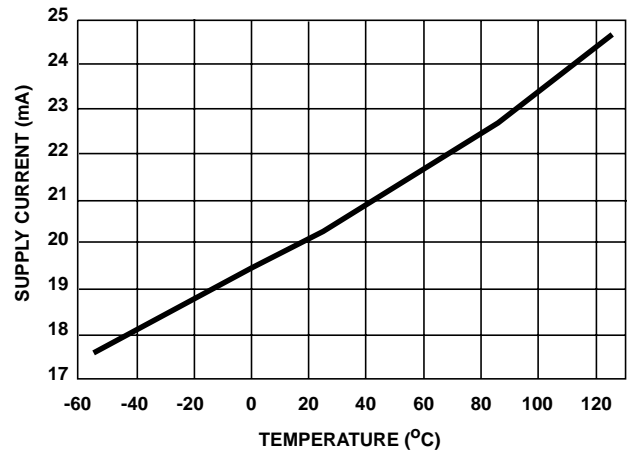


FIGURE 18. SUPPLY CURRENT vs TEMPERATURE

Typical Performance Curves $V_{SUPPLY} = \pm 5V$, $T_A = 25^\circ C$, $R_L = 100\Omega$, Unless Otherwise Specified (Continued)

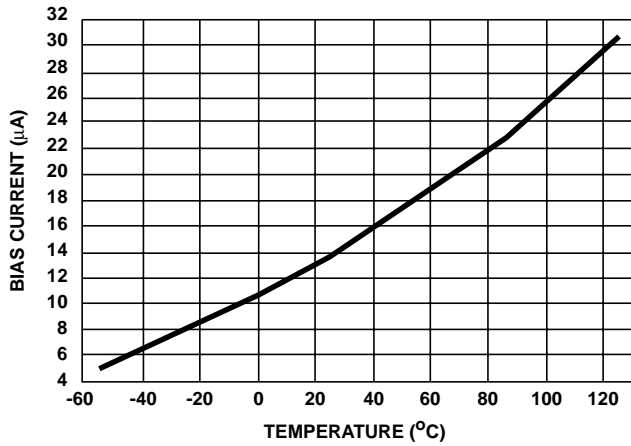


FIGURE 19. BIAS CURRENT vs TEMPERATURE

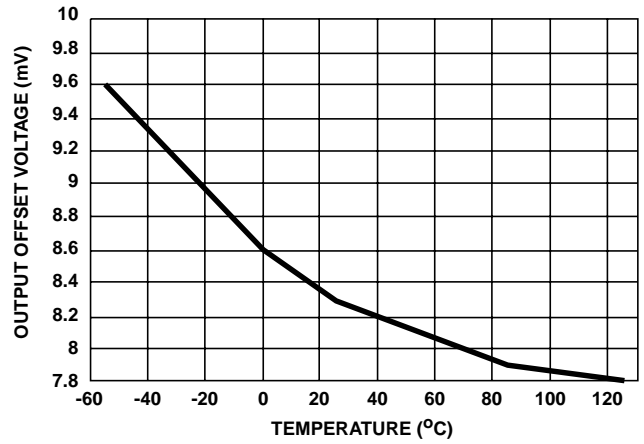


FIGURE 20. OFFSET VOLTAGE vs TEMPERATURE

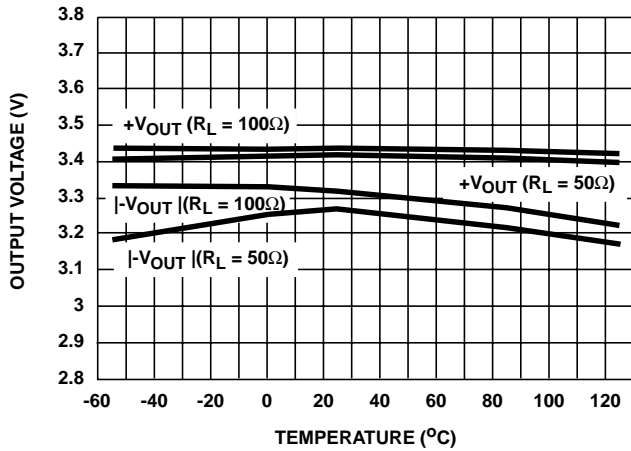


FIGURE 21. OUTPUT VOLTAGE vs TEMPERATURE

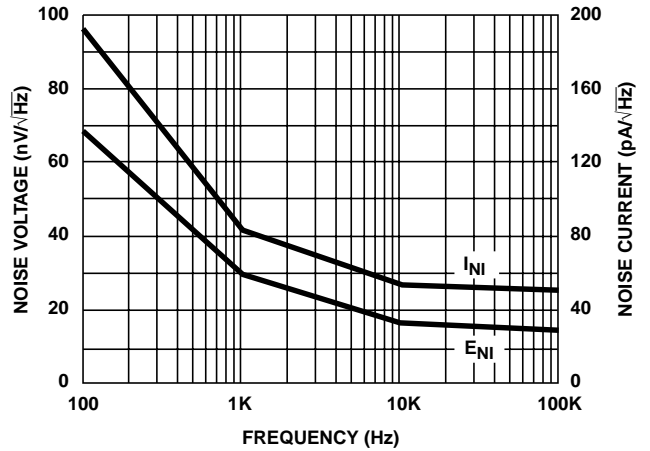


FIGURE 22. INPUT NOISE vs FREQUENCY

Die Characteristics

DIE DIMENSIONS:

63 mils x 44 mils x 19 mils
1600µm x 1130µm x 483µm

METALLIZATION:

Type: Metal 1: AlCu(2%)/TiW
Thickness: Metal 1: 8kÅ ±0.4kÅ
Type: Metal 2: AlCu(2%)
Thickness: Metal 2: 16kÅ ±0.8kÅ

PASSIVATION:

Type: Nitride
Thickness: 4kÅ ±0.5kÅ

TRANSISTOR COUNT:

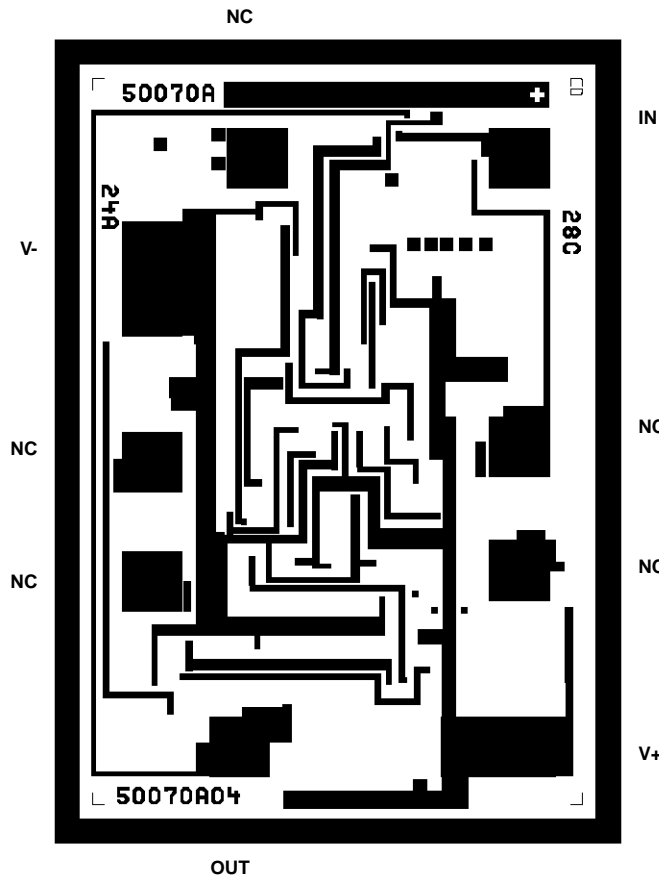
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SUBSTRATE POTENTIAL (POWERED UP):

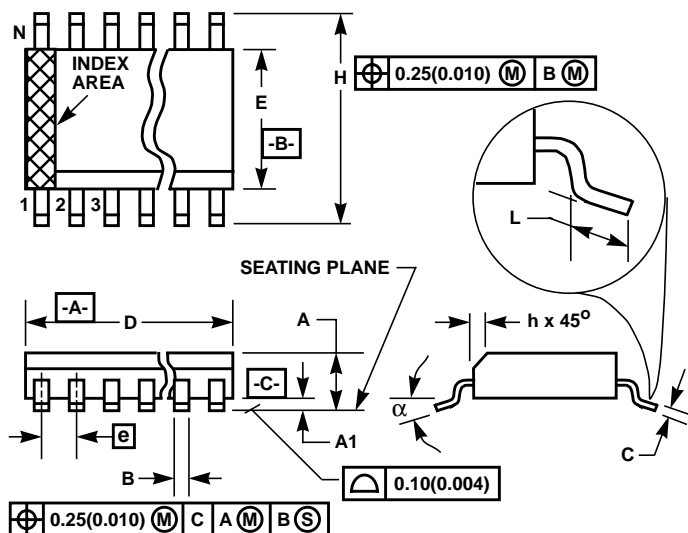
Floating (Recommend Connection to V-)

Metallization Mask Layout

HFA1110



Small Outline Plastic Packages (SOIC)



M8.15 (JEDEC MS-012-AA ISSUE C) 8 LEAD NARROW BODY SMALL OUTLINE PLASTIC PACKAGE

| SYMBOL | INCHES | | MILLIMETERS | | NOTES |
|----------|-----------|--------|-------------|------|-------|
| | MIN | MAX | MIN | MAX | |
| A | 0.0532 | 0.0688 | 1.35 | 1.75 | - |
| A1 | 0.0040 | 0.0098 | 0.10 | 0.25 | - |
| B | 0.013 | 0.020 | 0.33 | 0.51 | 9 |
| C | 0.0075 | 0.0098 | 0.19 | 0.25 | - |
| D | 0.1890 | 0.1968 | 4.80 | 5.00 | 3 |
| E | 0.1497 | 0.1574 | 3.80 | 4.00 | 4 |
| e | 0.050 BSC | | 1.27 BSC | | - |
| H | 0.2284 | 0.2440 | 5.80 | 6.20 | - |
| h | 0.0099 | 0.0196 | 0.25 | 0.50 | 5 |
| L | 0.016 | 0.050 | 0.40 | 1.27 | 6 |
| N | 8 | | 8 | | 7 |
| α | 0° | 8° | 0° | 8° | - |

NOTES:

- Symbols are defined in the "MO Series Symbol List" in Section 2.2 of Publication Number 95.
- Dimensioning and tolerancing per ANSI Y14.5M-1982.
- Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion and gate burrs shall not exceed 0.15mm (0.006 inch) per side.
- Dimension "E" does not include interlead flash or protrusions. Interlead flash and protrusions shall not exceed 0.25mm (0.010 inch) per side.
- The chamfer on the body is optional. If it is not present, a visual index feature must be located within the crosshatched area.
- "L" is the length of terminal for soldering to a substrate.
- "N" is the number of terminal positions.
- Terminal numbers are shown for reference only.
- The lead width "B", as measured 0.36mm (0.014 inch) or greater above the seating plane, shall not exceed a maximum value of 0.61mm (0.024 inch).
- Controlling dimension: MILLIMETER. Converted inch dimensions are not necessarily exact.

Rev. 0 12/93

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