Semiconductor

September 1998 File Number 2944.6

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 Harris' proprietary complementary bipolar UHF-1 process, the HFA1110 also offers very fast slew rate, and high output current. It is one more example of Harris' 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.

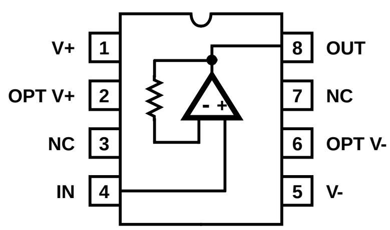
The HFA1110 is an enhanced, pin compatible upgrade for the AD9620, AD9630, CLC110, EL2072, BUF600 and BUF601.

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 datasheet.

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

Pinout

HFA1110
(SOIC)
TOP VIEW



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 (^{o}C)	PACKAGE	PKG. NO.
HFA1110IB (H1110I)	-40 to 85	8 Ld SOIC	M8.15
HFA1110EVAL	High Speed Buffer DIP Evaluation Board		

CAUTION: These devices are sensitive to electrostatic discharge; follow proper IC Handling Procedures.

Absolute Maximum Ratings

Voltage Between V+ and V- 12V
DC Input Voltage . . . . V_{SUPPLY}
Output Current 60mA

Operating Conditions

Temperature Range . . . . -40°C to 85°C

Thermal Information

Thermal Resistance (Typical, Note 1)	θ_{JA} (°C/W)	θ_{JC} (°C/W)
SOIC Package	158	N/A

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:

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

Electrical Specifications

V_{SUPPLY} = ±5V, R_L = 100Ω, 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	-	μV/°C
PSRR		25	39	45	-	dB
		Full	35	-	-	dB
Input Noise Voltage (Note 2)	100kHz	25	-	14	-	nV/√Hz
Input Noise Current (Note 2)	100kHz	25	-	51	-	pA/√Hz
Input Bias Current (Note 2)		25	-	10	40	μA
		Full	-	-	65	μA
Input Resistance		25	25	50	-	kΩ
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)	±2V Full Scale	25	-	0.003	-	%
OUTPUT CHARACTERISTICS						
Output Voltage (Note 2)		25	3.0	3.3	-	±V
		Full	2.5	3.0	-	±V
Output Current (Note 2)	R_L = 50Ω	25, 85	50	60	-	mA
		-40	35	50	-	mA
POWER SUPPLY CHARACTERISTICS						
Supply Voltage Range		Full	4.5	-	5.5	±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} = ±5V, R_L = 100Ω, 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 = 75Ω	25	-	0.04	-	%
Differential Phase	3.58MHz, R_L = 75Ω	25	-	0.025	-	Degrees

NOTE:

2. 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 (10µF) tantalum in parallel with a small value chip (0.1µF) capacitor works well in most cases.

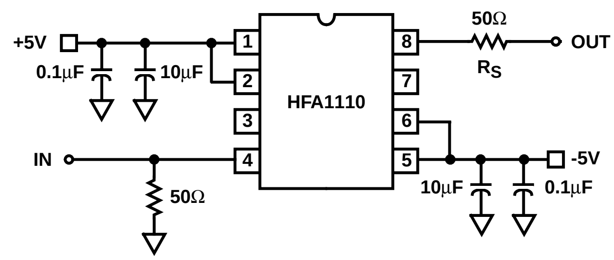
Terminated microstrip signal lines are recommended at the input and output of the device. Output capacitance, such as that resulting from an improperly terminated transmission line will degrade the frequency response of the amplifier and may cause oscillations. In most cases, the oscillation can be avoided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

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

Evaluation Board

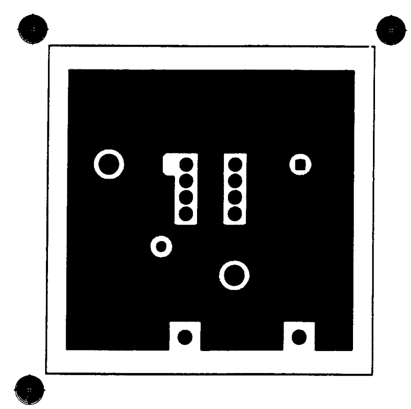
An evaluation board is available for the HFA1110 (part number HFA1110EVAL). Please contact your local sales office for information.

The layout and schematic of the board are shown here:

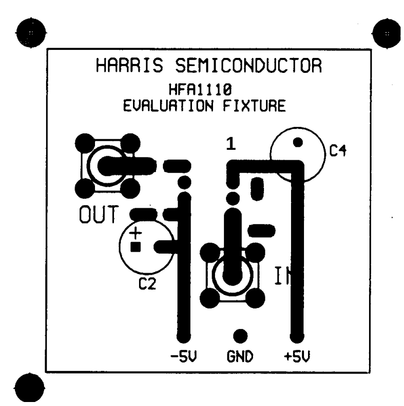


SCHEMATIC DIAGRAM

BOTTOM LAYOUT



TOP LAYOUT



Typical Performance Curves
V_{SUPPLY} = ±5V, T_A = 25°C, R_L = 100Ω, Unless Otherwise Specified

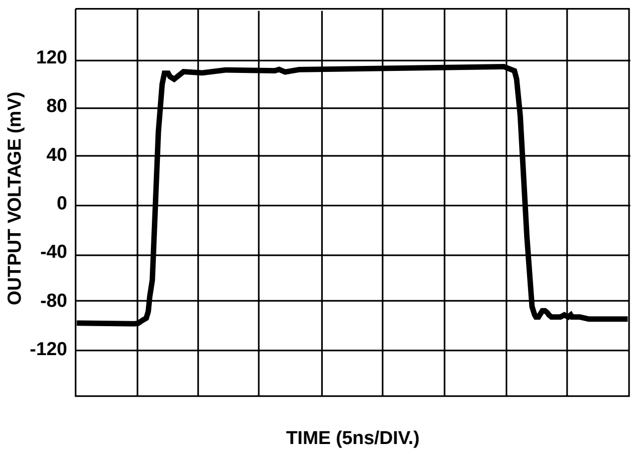


FIGURE 1. SMALL SIGNAL PULSE RESPONSE

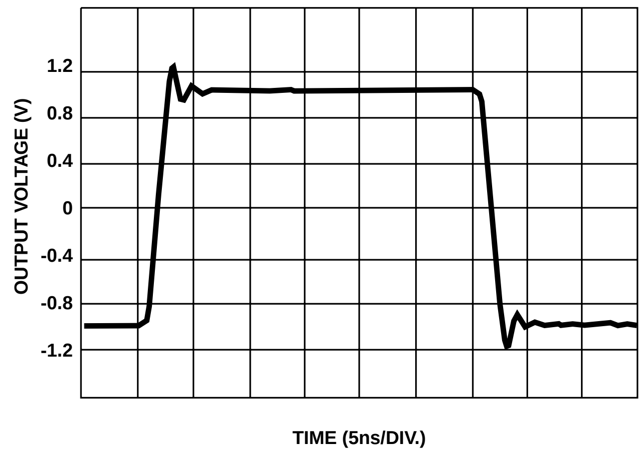


FIGURE 2. LARGE SIGNAL PULSE RESPONSE

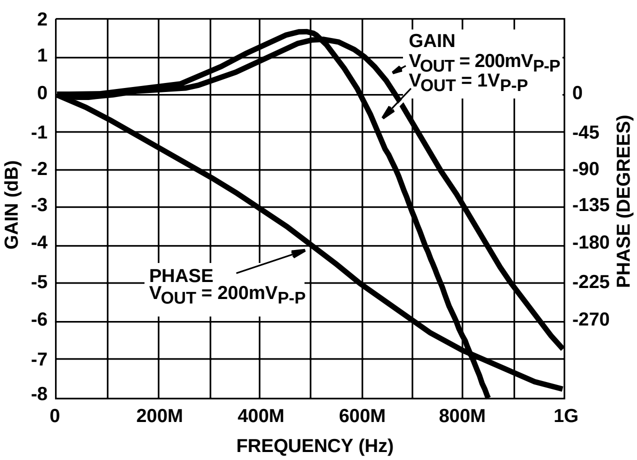


FIGURE 3. FREQUENCY RESPONSE

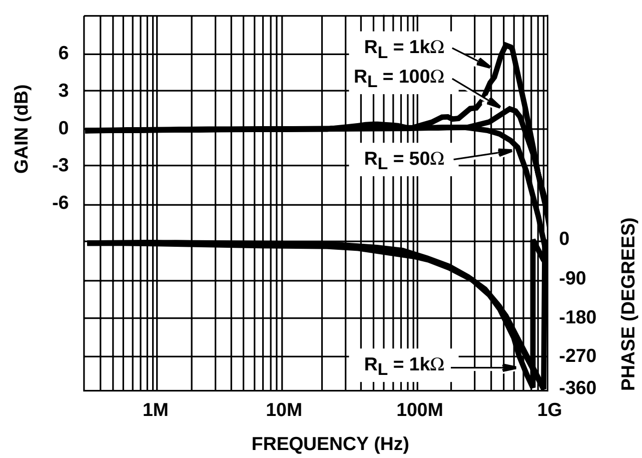


FIGURE 4. FREQUENCY RESPONSE FOR VARIOUS LOAD RESISTORS

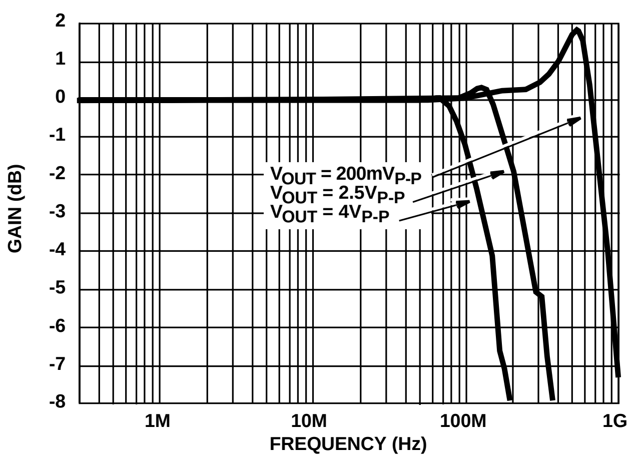


FIGURE 5. FREQUENCY RESPONSE FOR VARIOUS OUTPUT VOLTAGES

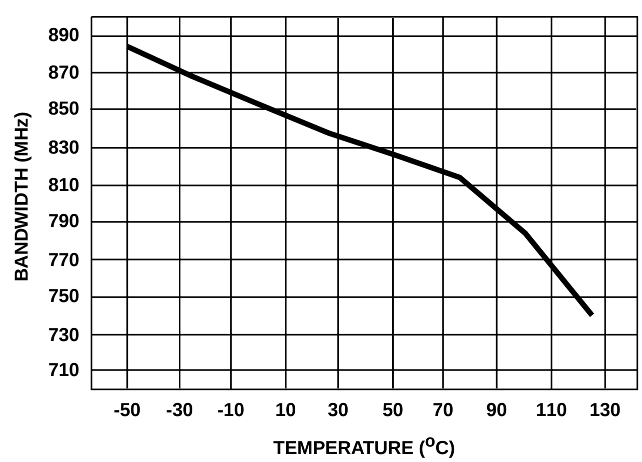


FIGURE 6. -3dB BANDWIDTH vs TEMPERATURE

Typical Performance Curves V_{SUPPLY} = ±5V, T_A = 25°C, R_L = 100Ω, Unless Otherwise Specified **(Continued)**

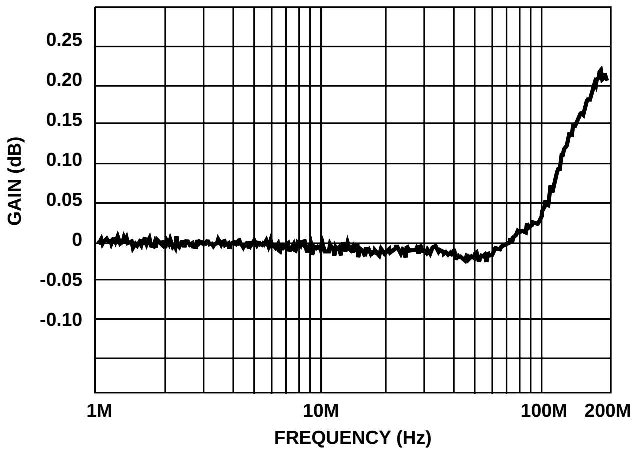


FIGURE 7. GAIN FLATNESS

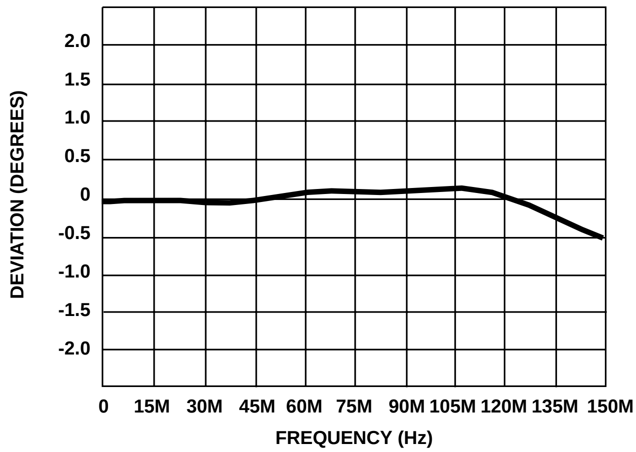


FIGURE 8. DEVIATION FROM LINEAR PHASE

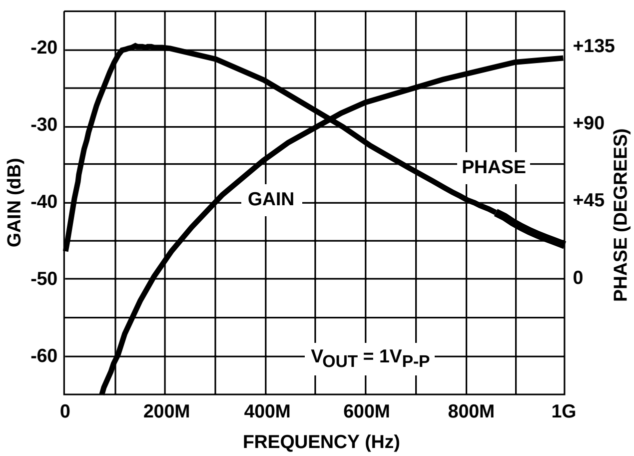


FIGURE 9. REVERSE GAIN AND PHASE (S_{12})

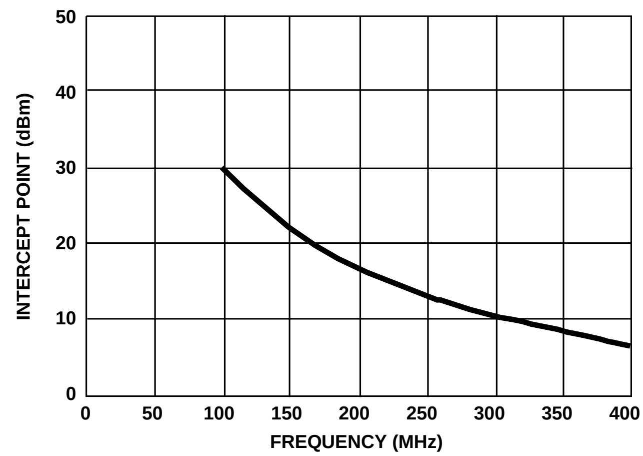


FIGURE 10. TWO-TONE, THIRD ORDER INTERMODULATION INTERCEPT

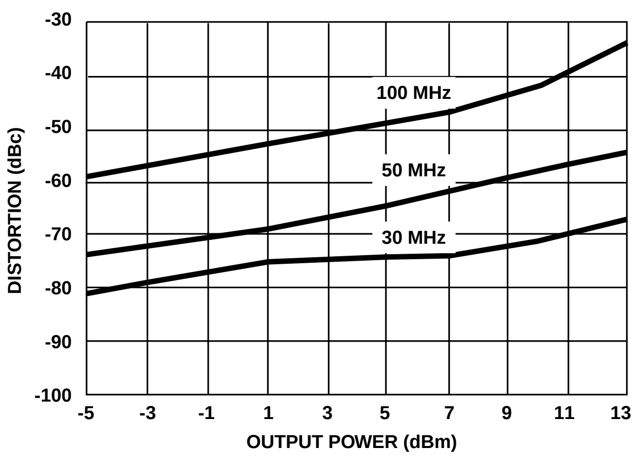


FIGURE 11. SECOND HARMONIC DISTORTION vs P_{OUT}

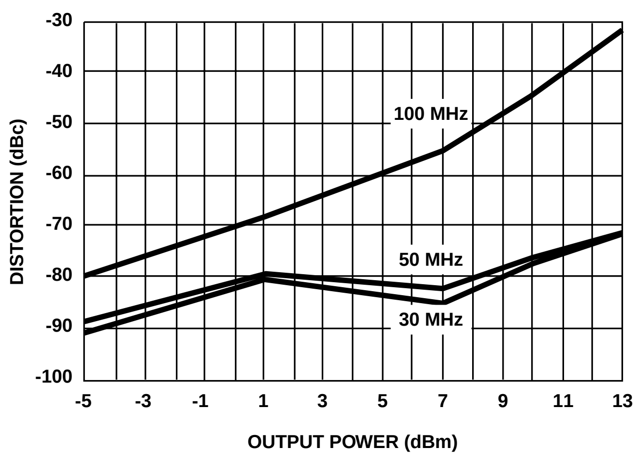


FIGURE 12. THIRD HARMONIC DISTORTION vs P_{OUT}

Typical Performance Curves V_{SUPPLY} = ±5V, T_A = 25°C, R_L = 100Ω, Unless Otherwise Specified **(Continued)**

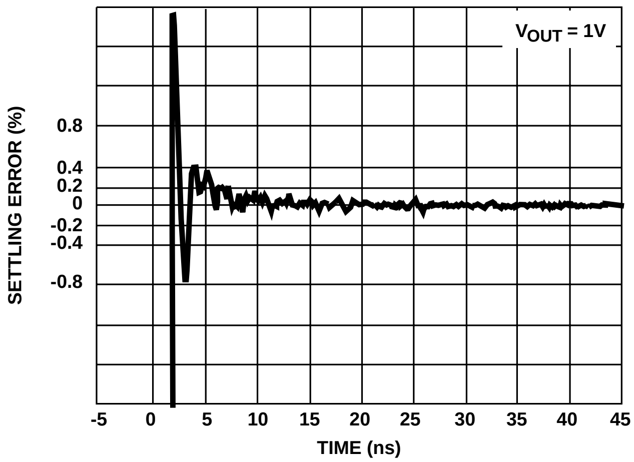


FIGURE 13. SETTLING RESPONSE

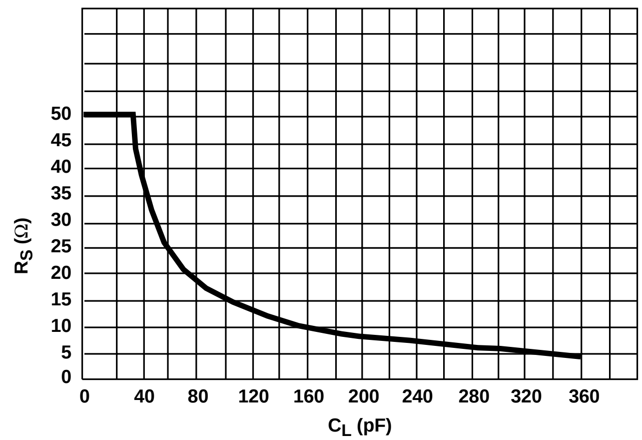


FIGURE 14. RECOMMENDED SERIES OUTPUT RESISTOR vs C_{LOAD}

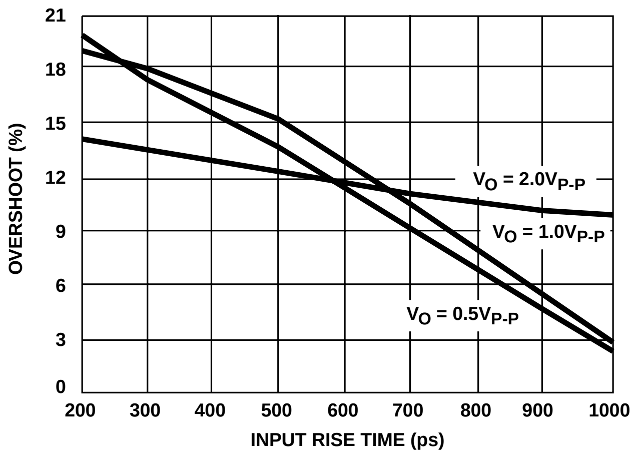


FIGURE 15. OVERSHOOT vs INPUT RISETIME

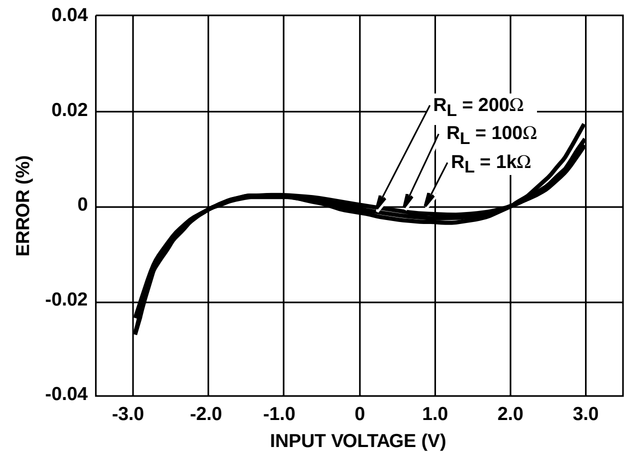


FIGURE 16. INTEGRAL LINEARITY ERROR

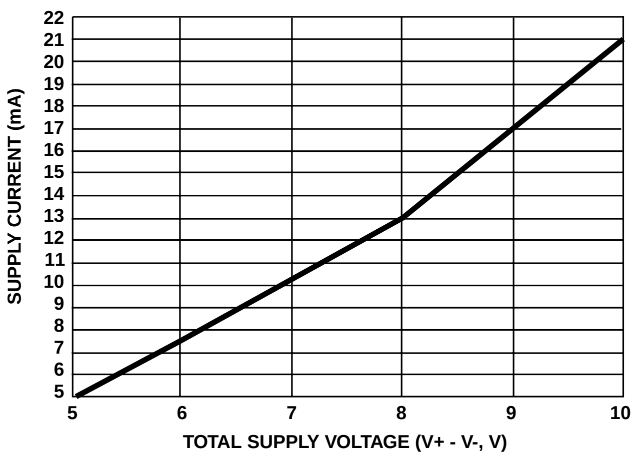


FIGURE 17. SUPPLY CURRENT vs SUPPLY VOLTAGE

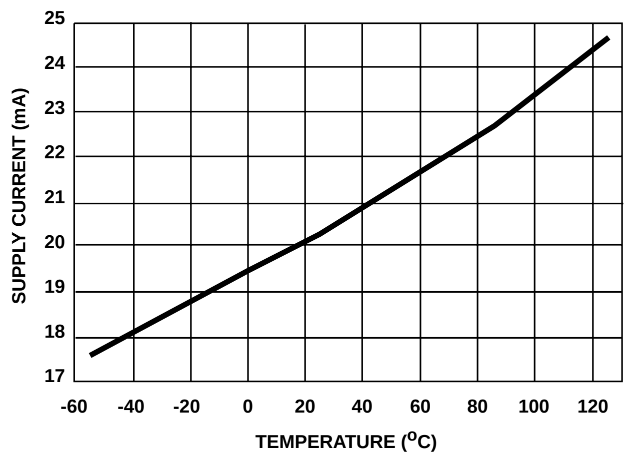


FIGURE 18. SUPPLY CURRENT vs TEMPERATURE

Typical Performance Curves $V_{SUPPLY} = \pm5V$, $T_A = 25^oC$, $R_L = 100\Omega$, Unless Otherwise Specified **(Continued)**

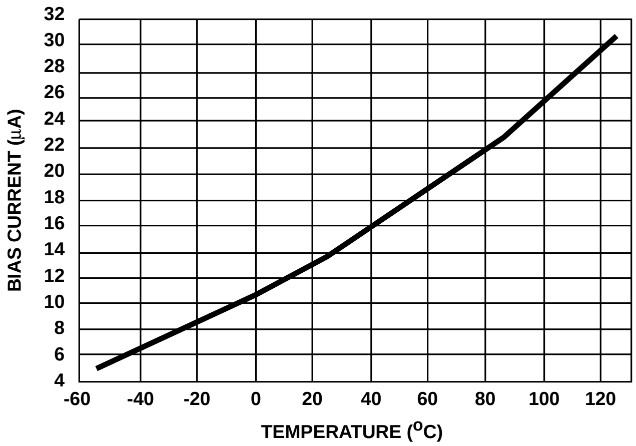


FIGURE 19. BIAS CURRENT vs TEMPERATURE

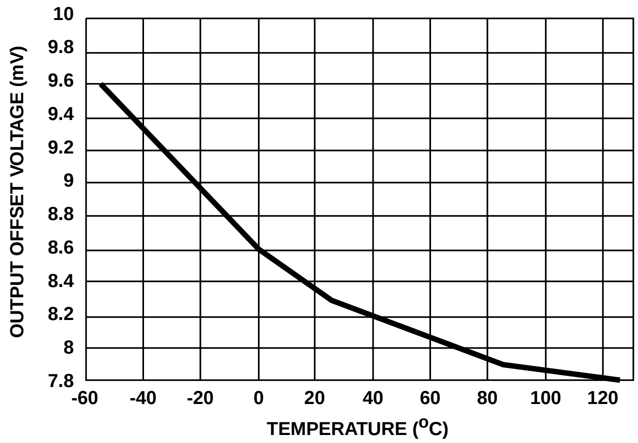


FIGURE 20. OFFSET VOLTAGE vs TEMPERATURE

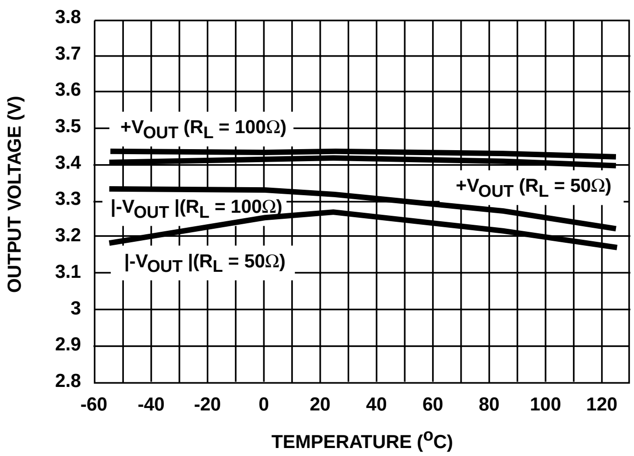


FIGURE 21. OUTPUT VOLTAGE vs TEMPERATURE

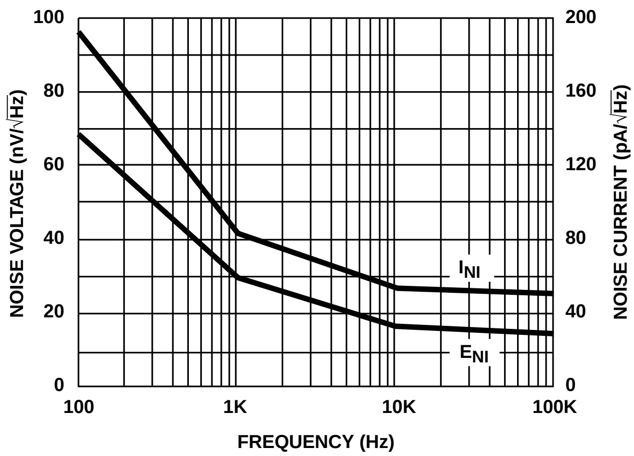


FIGURE 22. INPUT NOISE vs FREQUENCY

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:

52

SUBSTRATE POTENTIAL (Powered Up):

Floating (Recommend Connection to V-)

Metallization Mask Layout

HFA1110