

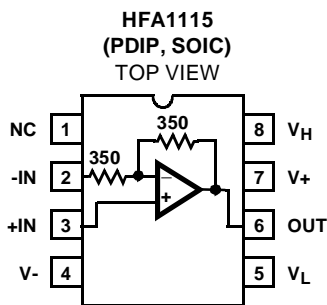
225MHz, Low Power, Output Limiting, Closed Loop Buffer Amplifier

The HFA1115 is a high speed closed loop Buffer featuring both user programmable gain and output limiting. Manufactured on Intersil's proprietary complementary bipolar UHF-1 process, the HFA1115 also offers a wide -3dB bandwidth of 225MHz, very fast slew rate, excellent gain flatness and high output current.

This buffer is the ideal choice for high frequency applications requiring output limiting, especially those needing ultra fast overload recovery times. The limiting function allows the designer to set the maximum positive and negative output levels, thereby protecting later stages from damage or input saturation. The HFA1115 also allows for voltage gains of +2, +1, and -1, without the use of external resistors. Gain selection is accomplished via connections to the inputs, as described in the "Application Information" text. The result is a more flexible product, fewer part types in inventory, and more efficient use of board space.

Compatibility with existing op amp pinouts provides flexibility to upgrade low gain amplifiers, while decreasing component count. Unlike most buffers, the standard pinout provides an upgrade path, should a higher closed loop gain be needed at a future date. For Military product, refer to the HFA1115/883 data sheet.

Pinout



Pin Descriptions

NAME	PIN NUMBER	DESCRIPTION
NC	1	No Connection
-IN	2	Inverting Input
+IN	3	Non-Inverting Input
V-	4	Negative Supply
V _L	5	Lower Output Limit
OUT	6	Output
V+	7	Positive Supply
V _H	8	Upper Output Limit

Features

- User Programmable Output Voltage Limiting
- High Input Impedance 1MΩ
- Differential Gain 0.02%
- Differential Phase 0.03 Degrees
- Wide -3dB Bandwidth (A_V = +2) 225MHz
- Very Fast Slew Rate (A_V = -1) 1135V/μs
- Low Supply Current 7.1mA
- High Output Current 60mA
- Excellent Gain Accuracy 0.99V/V
- User Programmable For Closed-Loop Gains of +1, -1 or +2 Without Use of External Resistors
- Fast Overdrive Recovery <1ns
- Standard Operational Amplifier Pinout

Applications

- Flash A/D Drivers
- Video Cable Drivers
- High Resolution Monitors
- Professional Video Processing
- Medical Imaging
- Video Digitizing Boards/Systems
- Battery Powered Communications

Ordering Information

PART NUMBER (BRAND)	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
HFA1115IP	-40 to 85	8 Ld PDIP	E8.3
HFA1115IB (H1115I)	-40 to 85	8 Ld SOIC	M8.15
HFA11XXEVAL	High Speed Op Amp DIP Evaluation Board		

Absolute Maximum Ratings

Voltage Between V+ and V- 11V
 DC Input Voltage V_{SUPPLY}
 Output Current (Note 2) Short Circuit Protected
 ESD Rating
 Human Body Model (Per MIL-STD-883 Method 3015.7) 600V

Operating Conditions

Temperature Range -40°C to 85°C
 Supply Voltage Range (Typical) 5V to 10V

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.

NOTES:

1. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.
2. Output is protected for short circuits to ground. Brief short circuits to ground will not degrade reliability, however, continuous (100% duty cycle) output current should not exceed 30mA for maximum reliability.

Electrical Specifications $V_{SUPPLY} = \pm 5V$, $A_V = +1$, $R_L = 100\Omega$, Unless Otherwise Specified

PARAMETER	TEST CONDITIONS	(NOTE 3) TEST LEVEL	TEMP. (°C)	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS							
Output Offset Voltage		A	25	-	2	10	mV
		A	Full	-	3	15	mV
Average Output Offset Voltage Drift		B	Full	-	22	70	$\mu V/^\circ C$
Common-Mode Rejection Ratio	$\Delta V_{CM} = \pm 1.8V$	A	25	42	45	-	dB
	$\Delta V_{CM} = \pm 1.8V$	A	85	40	44	-	dB
	$\Delta V_{CM} = \pm 1.2V$	A	-40	40	45	-	dB
Power Supply Rejection Ratio	$\Delta V_{PS} = \pm 1.8V$	A	25	45	49	-	dB
	$\Delta V_{PS} = \pm 1.8V$	A	85	43	48	-	dB
	$\Delta V_{PS} = \pm 1.2V$	A	-40	43	48	-	dB
Non-Inverting Input Bias Current		A	25	-	1	15	μA
		A	Full	-	3	25	μA
Non-Inverting Input Bias Current Drift		B	Full	-	30	80	nA/°C
Non-Inverting Input Bias Current Power Supply Sensitivity	$\Delta V_{PS} = \pm 1.25V$	A	25	-	0.5	1	$\mu A/V$
		A	Full	-	-	3	$\mu A/V$
Non-Inverting Input Resistance	$\Delta V_{CM} = \pm 1.8V$	A	25	0.8	1.1	-	M Ω
	$\Delta V_{CM} = \pm 1.8V$	A	85	0.5	1.4	-	M Ω
	$\Delta V_{CM} = \pm 1.2V$	A	-40	0.5	1.3	-	M Ω
Inverting Input Resistance		C	25	280	350	420	Ω
Input Capacitance		C	25	-	1.6	-	pF
Input Voltage Common Mode Range (Implied by V_{IO} CMRR and $+R_{IN}$ Tests)		A	25, 85	± 1.8	± 2.4	-	V
		A	-40	± 1.2	± 1.7	-	V
Input Noise Voltage Density (Note 4)	f = 100kHz	B	25	-	7	-	nV/ \sqrt{Hz}
Non-Inverting Input Noise Current Density (Note 4)	f = 100kHz	B	25	-	3.6	-	pA/ \sqrt{Hz}

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Electrical Specifications $V_{SUPPLY} = \pm 5V$, $A_V = +1$, $R_L = 100\Omega$, Unless Otherwise Specified (Continued)

PARAMETER	TEST CONDITIONS	(NOTE 3) TEST LEVEL	TEMP. (°C)	MIN	TYP	MAX	UNITS
TRANSFER CHARACTERISTICS							
Gain	$A_V = -1$	A	25	-0.98	-0.996	-1.02	V/V
		A	Full	-0.975	-1.000	-1.025	V/V
	$A_V = +1$	A	25	0.98	0.992	1.02	V/V
		A	Full	0.975	0.993	1.025	V/V
	$A_V = +2$	A	25	1.96	1.988	2.04	V/V
		A	Full	1.95	1.990	2.05	V/V
AC CHARACTERISTICS							
-3dB Bandwidth ($V_{OUT} = 0.2V_{P-P}$, Note 4)	$A_V = -1$	B	25	-	225	-	MHz
	$A_V = +1$, $+R_S = 620\Omega$	B	25	-	200	-	MHz
	$A_V = +2$	B	25	-	225	-	MHz
Full Power Bandwidth ($V_{OUT} = 5V_{P-P}$ at $A_V = +2/-1$, $4V_{P-P}$ at $A_V = +1$, Note 4)	$A_V = -1$	B	25	-	157	-	MHz
	$A_V = +1$, $+R_S = 620\Omega$	B	25	-	140	-	MHz
	$A_V = +2$	B	25	-	125	-	MHz
Gain Flatness (to 25MHz, $V_{OUT} = 0.2V_{P-P}$, Note 4)	$A_V = +1$, $+R_S = 620\Omega$	B	25	-	± 0.1	-	dB
	$A_V = +2$	B	25	-	± 0.04	-	dB
Gain Flatness (to 50MHz, $V_{OUT} = 0.2V_{P-P}$, Note 4)	$A_V = +1$, $+R_S = 620\Omega$	B	25	-	± 0.25	-	dB
	$A_V = +2$	B	25	-	± 0.1	-	dB
OUTPUT CHARACTERISTICS							
Output Voltage Swing (Note 4)	$A_V = -1$, $R_L = 100\Omega$	A	25	± 3.0	± 3.2	-	V
		A	Full	± 2.8	± 3.0	-	V
Output Current (Note 4)	$A_V = -1$, $R_L = 50\Omega$	A	25, 85	50	55	-	mA
		A	-40	28	42	-	mA
Output Short Circuit Current		B	25	-	90	-	mA
Output Resistance (Note 4)	DC, $A_V = +2$	B	25	-	0.07	-	Ω
Second Harmonic Distortion ($A_V = +2$, $V_{OUT} = 2V_{P-P}$)	10MHz	B	25	-	-50	-	dBc
	20MHz	B	25	-	-45	-	dBc
Third Harmonic Distortion ($A_V = +2$, $V_{OUT} = 2V_{P-P}$)	10MHz	B	25	-	-50	-	dBc
	20MHz	B	25	-	-45	-	dBc
TRANSIENT RESPONSE $A_V = +2$, Unless Otherwise Specified							
Rise and Fall Times ($V_{OUT} = 0.5V_{P-P}$, Note 4)	Rise Time	B	25	-	1.7	-	ns
	Fall Time	B	25	-	1.9	-	ns
Overshoot ($V_{OUT} = 0.5V_{P-P}$, V_{IN} $t_{RISE} = 2.5ns$)	+OS	B	25	-	0	-	%
	-OS	B	25	-	0	-	%
Slew Rate ($V_{OUT} = 5V_{P-P}$, $A_V = -1$)	+SR	B	25	-	1660	-	V/ μs
	-SR (Note 5)	B	25	-	1135	-	V/ μs
Slew Rate ($V_{OUT} = 4V_{P-P}$, $A_V = +1$, $+R_S = 620\Omega$)	+SR	B	25	-	1125	-	V/ μs
	-SR (Note 5)	B	25	-	800	-	V/ μs

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Electrical Specifications $V_{SUPPLY} = \pm 5V$, $A_V = +1$, $R_L = 100\Omega$, Unless Otherwise Specified (Continued)

PARAMETER	TEST CONDITIONS	(NOTE 3) TEST LEVEL	TEMP. (°C)	MIN	TYP	MAX	UNITS
Slew Rate ($V_{OUT} = 5V_{P-P}$, $A_V = +2$)	+SR	B	25	-	1265	-	V/ μ s
	-SR (Note 5)	B	25	-	870	-	V/ μ s
Settling Time ($V_{OUT} = +2V$ to 0V step, Note 4)	To 0.1%	B	25	-	23	-	ns
	To 0.05%	B	25	-	33	-	ns
	To 0.02%	B	25	-	45	-	ns
VIDEO CHARACTERISTICS							
Differential Gain	$f = 3.58MHz$, $A_V = +2$, $R_L = 150\Omega$	B	25	-	0.02	-	%
Differential Phase	$f = 3.58MHz$, $A_V = +2$, $R_L = 150\Omega$	B	25	-	0.03	-	Degrees
OUTPUT LIMITING CHARACTERISTICS $A_V = +2$, $V_H = +1V$, $V_L = -1V$, Unless Otherwise Specified							
Limit Accuracy (Note 4)	$V_{IN} = \pm 1.6V$, $A_V = -1$	A	Full	-125	-70	125	mV
Overdrive Recovery Time (Note 4)	$V_{IN} = \pm 1V$	B	25	-	0.8	-	ns
Negative Limit Range		B	25	-5.0 to +2.5			V
Positive Limit Range		B	25	-2.5 to +5.0			V
Limit Input Bias Current		A	Full	-	85	200	μ A
Limit Input Bandwidth		C	25	-	100	-	MHz
POWER SUPPLY CHARACTERISTICS							
Power Supply Range		C	25	4.5	-	5.5	$\pm V$
Power Supply Current (Note 4)		A	25	6.6	6.9	7.1	mA
		A	Full	-	7.1	7.3	mA

NOTE:

- Test Level: A. Production Tested; B. Typical or Guaranteed Limit Based on Characterization; C. Design Typical for Information Only.
- See Typical Performance Curves for more information.
- Slew rates are asymmetrical if the output swings below GND (e.g., a bipolar signal). Positive unipolar output signals have symmetric positive and negative slew rates comparable to the +SR specification. See the "Application Information" section, and the pulse response graphs for details.

Application Information

Relevant Application Notes

The following Application Notes pertain to the HFA1115:

- AN9653-Use and Application of Output Limiting Amplifiers
- AN9752-Sync Stripper and Sync Inserter for Composite Video

These publications may be obtained from Intersil's web site (<http://www.intersil.com>) or via our AnswerFax system.

HFA1115 Advantages

The HFA1115 features a novel design which allows the user to select from three closed loop gains, without any external components. The result is a more flexible product, fewer part types in inventory, and more efficient use of board space. Implementing a gain of 2, cable driver with this IC eliminates

the two gain setting resistors, which frees up board space for termination resistors.

Like most newer high performance amplifiers, the HFA1115 is a current feedback amplifier (CFA). CFAs offer high bandwidth and slew rate at low supply currents, but can be difficult to use because of their sensitivity to feedback capacitance and parasitics on the inverting input (summing node). The HFA1115 eliminates these concerns by bringing the gain setting resistors on-chip. This yields the optimum placement and value of the feedback resistor, while minimizing feedback and summing node parasitics. Because there is no access to the summing node, the PCB parasitics do not impact performance at gains of +2 or -1 (see "Unity Gain Considerations" for discussion of parasitic impact on unity gain performance).

The HFA1115's closed loop gain implementation provides better gain accuracy, lower offset and output impedance, and better distortion compared with open loop buffers.

Closed Loop Gain Selection

This “buffer” operates in closed loop gains of -1, +1, or +2, and gain selection is accomplished via connections to the ±inputs. Applying the input signal to +IN and floating -IN selects a gain of +1 (see next section for layout caveats), while grounding -IN selects a gain of +2. A gain of -1 is obtained by applying the input signal to -IN with +IN grounded through a 50Ω resistor.

The table below summarizes these connections:

GAIN (A _V)	CONNECTIONS	
	+INPUT (PIN 3)	-INPUT (PIN 2)
-1	50Ω to GND	Input
+1	Input	NC (Floating)
+2	Input	GND

Unity Gain Considerations

Unity gain selection is accomplished by floating the -Input of the HFA1115. Anything that tends to short the -Input to GND, such as stray capacitance at high frequencies, will cause the amplifier gain to increase toward a gain of +2. The result is excessive high frequency peaking, and possible instability. Even the minimal amount of capacitance associated with attaching the -Input lead to the PCB results in approximately 3dB of gain peaking. At a minimum this requires due care to ensure the minimum capacitance at the -Input connection.

TABLE 1. UNITY GAIN PERFORMANCE FOR VARIOUS IMPLEMENTATIONS

APPROACH	PEAK-ING (dB)	BW (MHz)	+SR/-SR (V/μs)	±0.1dB GAIN FLATNESS (MHz)
Remove Pin 2	2.5	400	1200/850	20
+R _S = 620Ω	0.6	170	1125/800	25
+R _S = 620Ω and Remove Pin 2	0	165	1050/775	65
Short Pins 2, 3	0	200	875/550	45
100pF cap. between pins 2, 3	0.2	190	900/550	19

Table 1 lists five alternate methods for configuring the HFA1115 as a unity gain buffer, and the corresponding performance. The implementations vary in complexity and involve performance trade-offs. The easiest approach to implement is simply shorting the two input pins together, and applying the input signal to this common node. The amplifier bandwidth drops from 400MHz to 200MHz, but excellent gain flatness is the benefit. Another drawback to this approach is that the amplifier input noise voltage and input offset voltage terms see a gain of +2, resulting in higher noise and output offset voltages. Alternately, a 100pF

capacitor between the inputs shorts them only at high frequencies, which prevents the increased output offset voltage but delivers less gain flatness.

Another straightforward approach is to add a 620Ω resistor in series with the positive input. This resistor and the HFA1115 input capacitance form a low pass filter which rolls off the signal bandwidth before gain peaking occurs. This configuration was employed to obtain the datasheet AC and transient parameters for a gain of +1.

Non-inverting Input Source Impedance

For best operation, the DC source impedance seen by the non-inverting input should be ≥50Ω. This is especially important in inverting gain configurations where the non-inverting input would normally be connected directly to GND.

Pulse Undershoot and Asymmetrical Slew Rates

The HFA1115 utilizes a quasi-complementary output stage to achieve high output current while minimizing quiescent supply current. In this approach, a composite device replaces the traditional PNP pulldown transistor. The composite device switches modes after crossing 0V, resulting in added distortion for signals swinging below ground, and an increased undershoot on the negative portion of the output waveform (see Figures 9, 13, and 17). This undershoot isn't present for small bipolar signals, or large positive signals. Another artifact of the composite device is asymmetrical slew rates for output signals with a negative voltage component. The slew rate degrades as the output signal crosses through 0V (see Figures 9, 13, and 17), resulting in a slower overall negative slew rate. Positive only signals have symmetrical slew rates as illustrated in the large signal positive pulse response graphs (see Figures 7, 11, and 15).

PC Board Layout

This amplifier's frequency response depends greatly on the 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 (0.1μF) chip capacitor works well in most cases.

Terminated microstrip signal lines are recommended at the input and output of the device. Capacitance directly on the output must be minimized, or isolated as discussed in the next section.

For unity gain applications, care must also be taken to minimize the capacitance to ground at the amplifier's inverting input. At higher frequencies this capacitance tends to short the -INPUT to GND, resulting in a closed loop gain which increases with frequency. This causes excessive high frequency peaking and potentially other problems as well.

An example of a good high frequency layout is the Evaluation Board shown in Figure 2.

Driving Capacitive Loads

Capacitive loads, such as an A/D input, or an improperly terminated transmission line degrade the amplifier's phase margin resulting in frequency response peaking and possible oscillations. In most cases, the oscillation can be avoided by placing a resistor (R_S) in series with the output prior to the capacitance.

Figure 1 details starting points for the selection of this resistor. The points on the curve indicate the R_S and C_L combinations for the optimum bandwidth, stability, and settling time, but experimental fine tuning is recommended. Picking a point above or to the right of the curve yields an overdamped response, while points below or left of the curve indicate areas of underdamped performance.

R_S and C_L form a low pass network at the output, thus limiting system bandwidth well below the amplifier bandwidth of 200MHz ($A_V = +1$). By decreasing R_S as C_L increases (as illustrated by the curves), the maximum bandwidth is obtained without sacrificing stability. In spite of this, bandwidth still decreases as the load capacitance increases. For example, at $A_V = +1$, $R_S = 50\Omega$, $C_L = 22\text{pF}$, the overall bandwidth is 185MHz, but the bandwidth drops to 50MHz at $A_V = +1$, $R_S = 15\Omega$, $C_L = 330\text{pF}$.

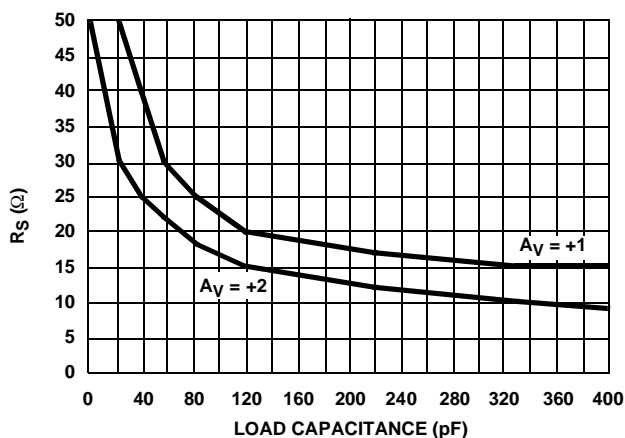


FIGURE 1. RECOMMENDED SERIES RESISTOR vs LOAD CAPACITANCE

Evaluation Board

The performance of the HFA1115 may be evaluated using the HFA11XX Evaluation Board, slightly modified as follows:

1. Remove the 510 Ω feedback resistor (R_2), and leave the connection open.
2. a. For $A_V = +1$ evaluation, remove the 510 Ω gain setting resistor (R_1), and leave pin 2 floating.
b. For $A_V = +2$, replace the 510 Ω gain setting resistor with a 0 Ω resistor to GND.

The layout and modified schematic of the board are shown in Figure 2.

To order evaluation boards (Part Number HFA11XXEVAL), please contact your local sales office.

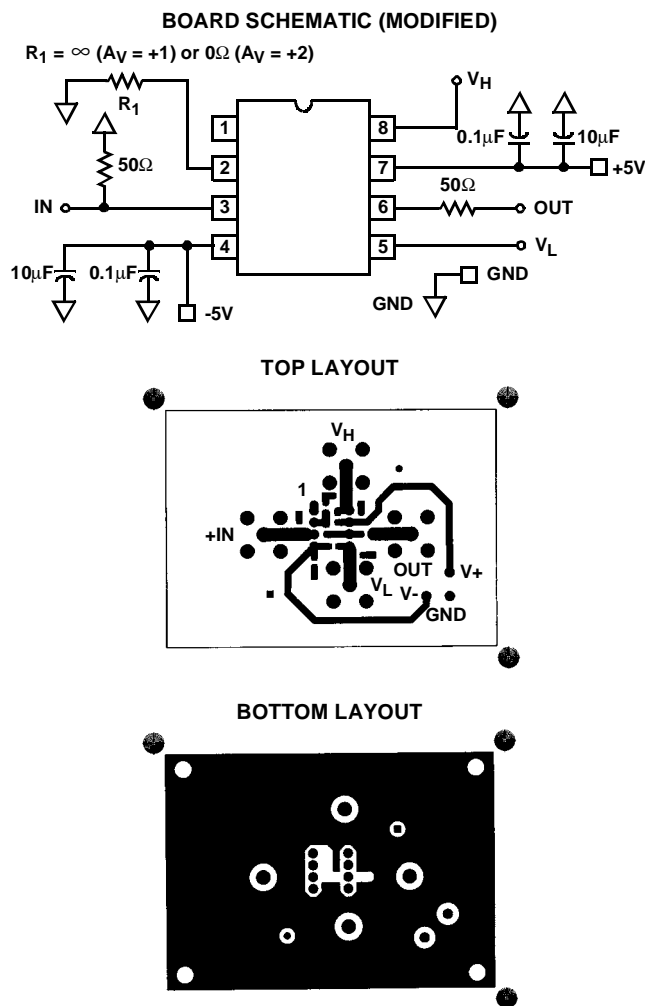


FIGURE 2. EVALUATION BOARD SCHEMATIC (AFTER MODIFICATION FOR BUFFER USE) AND LAYOUT

Limiting Operation

General

The HFA1115 features user programmable output clamps to limit output voltage excursions. Limiting action is obtained by applying voltages to the V_H and V_L terminals (pins 8 and 5) of the amplifier. V_H sets the upper output limit, while V_L sets the lower limit level. If the amplifier tries to drive the output above V_H , or below V_L , the clamp circuitry limits the output voltage at V_H or V_L (\pm the limit accuracy), respectively. The low input bias currents of the limit pins allow them to be driven by simple resistive divider circuits, or active elements such as amplifiers or DACs.

Limit Circuitry

Figure 3 shows a simplified schematic of the HFA1115 input stage, and the high limit (V_H) circuitry. As with all current feedback amplifiers, there is a unity gain buffer ($Q_{X1} - Q_{X2}$) between the positive and negative inputs. This buffer forces $-IN$ to track $+IN$, and sets up a slewing current of:

$$|SLEW| = (V_{-IN} - V_{OUT})/R_F + V_{-IN}/R_G$$

time, reducing the recovery time from 2.5ns to 0.5ns, based on the amplifier's normal propagation delay of 1.2ns.

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

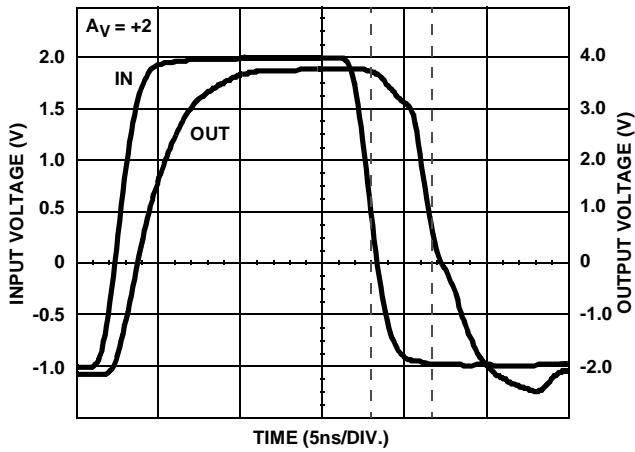


FIGURE 4. PULSE RESPONSE WITHOUT LIMITING

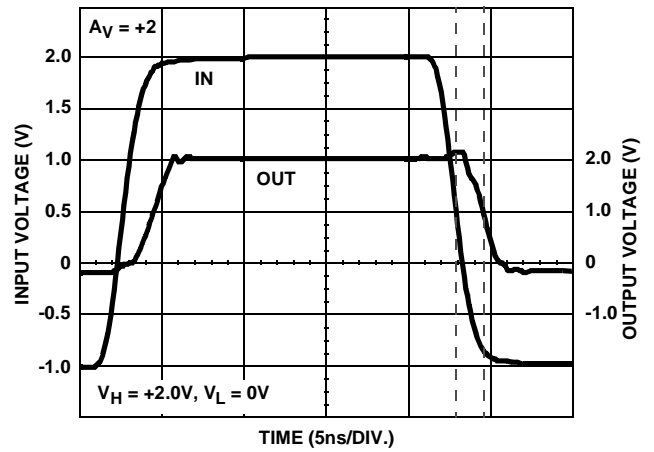


FIGURE 5. PULSE RESPONSE WITH LIMITING

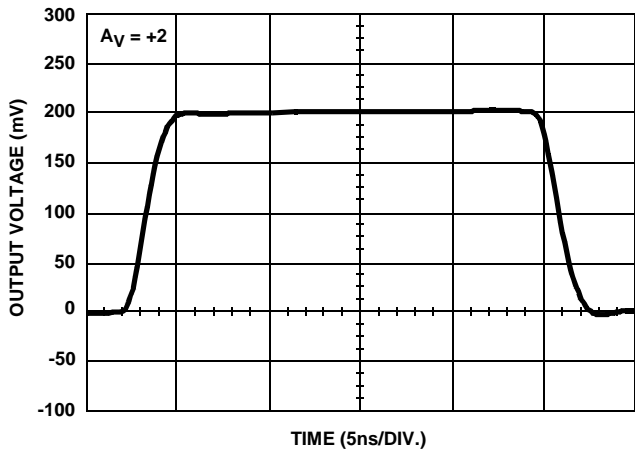


FIGURE 6. SMALL SIGNAL POSITIVE PULSE RESPONSE

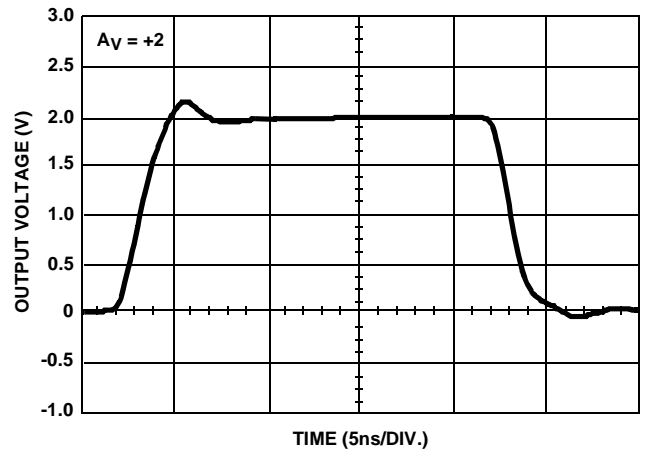


FIGURE 7. LARGE SIGNAL POSITIVE PULSE RESPONSE

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

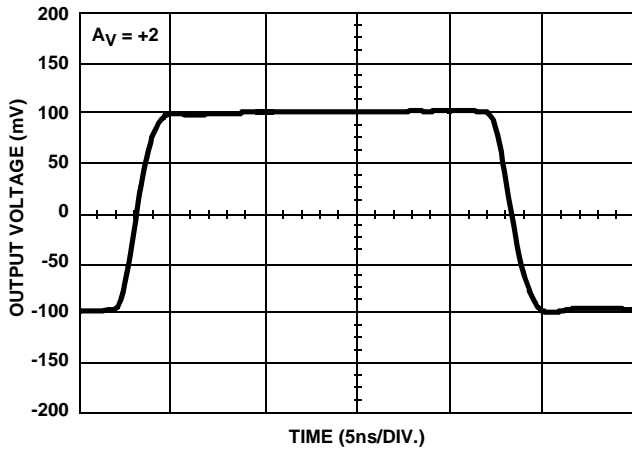


FIGURE 8. SMALL SIGNAL BIPOLAR PULSE RESPONSE

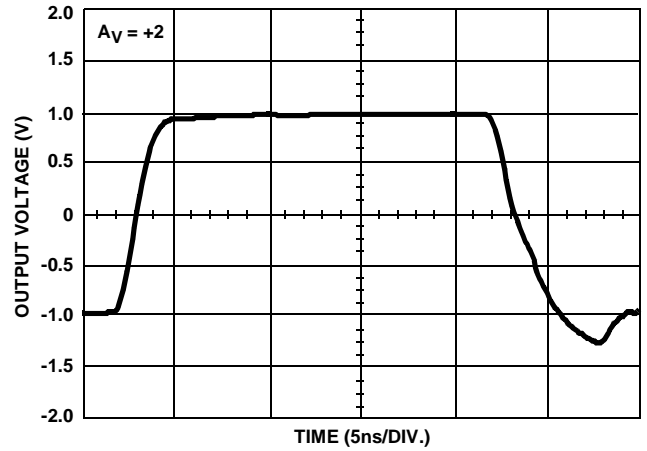


FIGURE 9. LARGE SIGNAL BIPOLAR PULSE RESPONSE

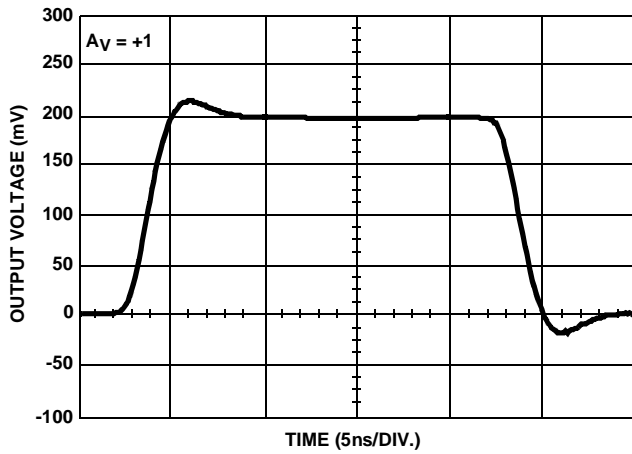


FIGURE 10. SMALL SIGNAL POSITIVE PULSE RESPONSE

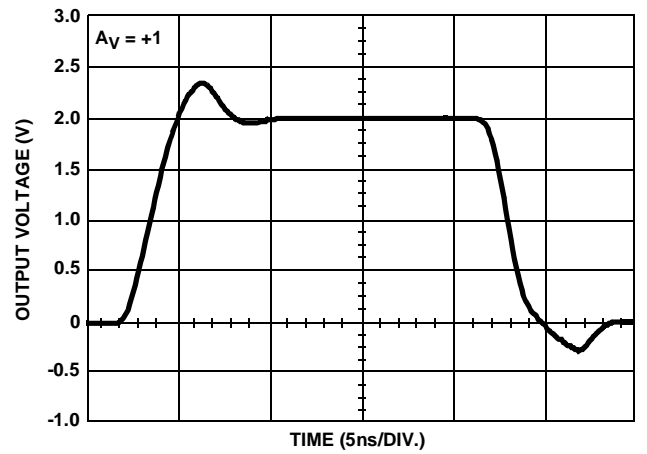


FIGURE 11. LARGE SIGNAL POSITIVE PULSE RESPONSE

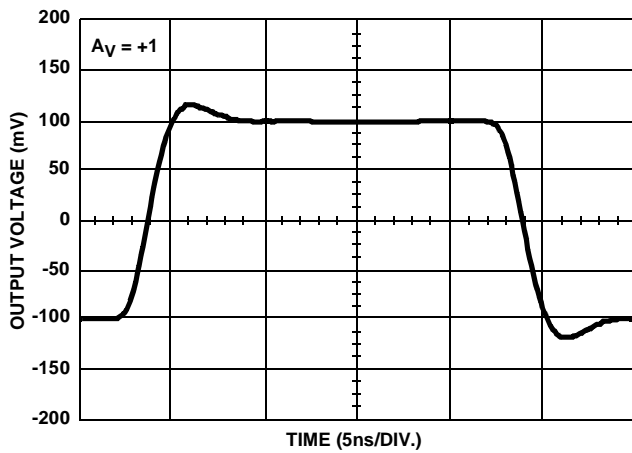


FIGURE 12. SMALL SIGNAL BIPOLAR PULSE RESPONSE

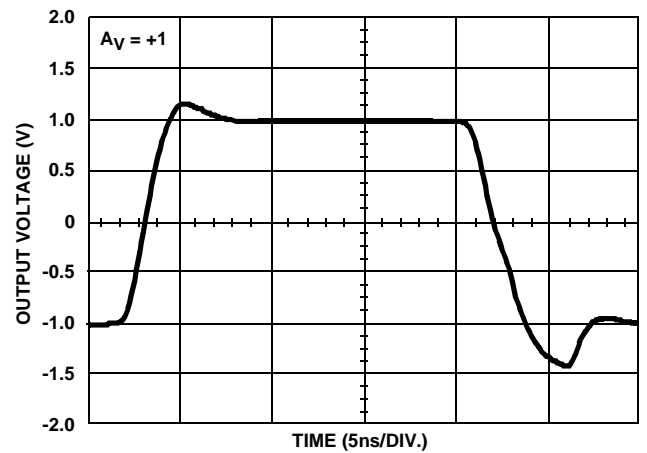


FIGURE 13. LARGE SIGNAL BIPOLAR PULSE RESPONSE

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

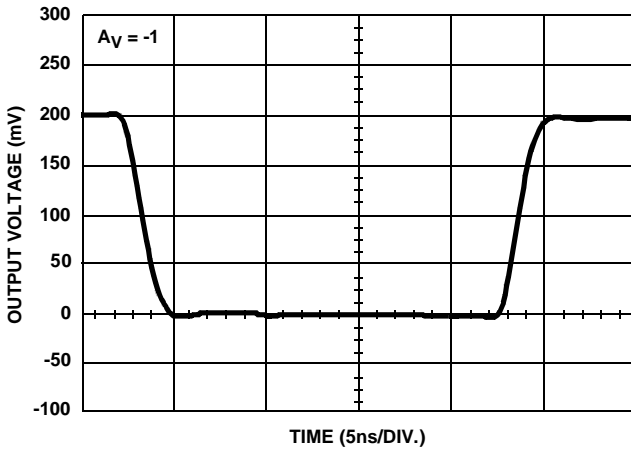


FIGURE 14. SMALL SIGNAL POSITIVE PULSE RESPONSE

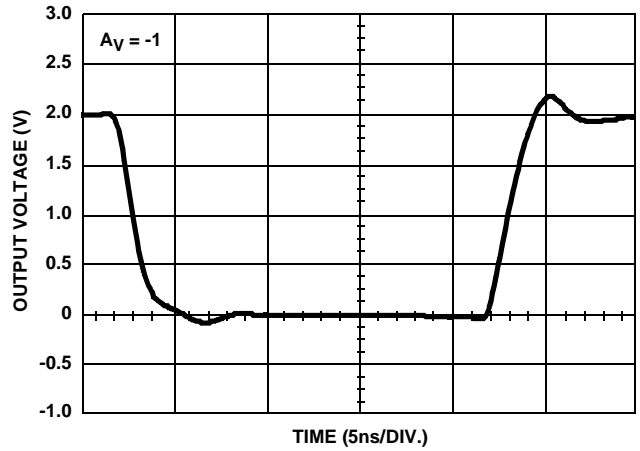


FIGURE 15. LARGE SIGNAL POSITIVE PULSE RESPONSE

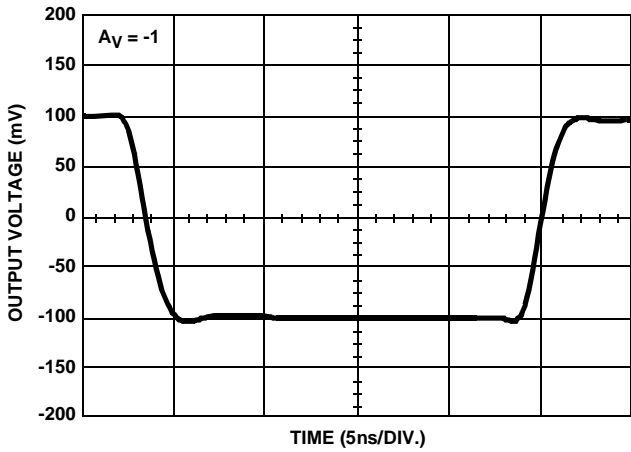


FIGURE 16. SMALL SIGNAL BIPOLAR PULSE RESPONSE

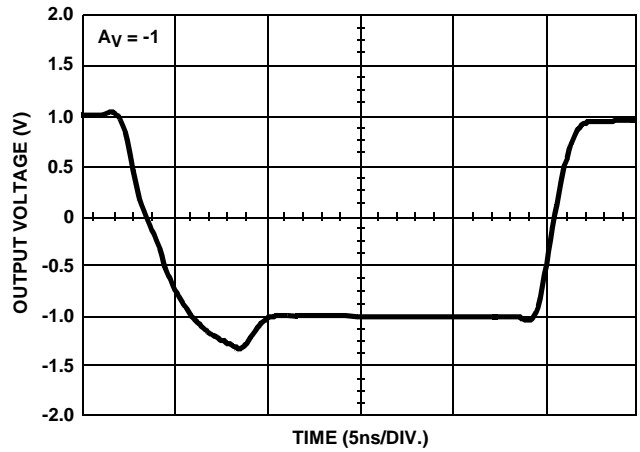


FIGURE 17. LARGE SIGNAL BIPOLAR PULSE RESPONSE

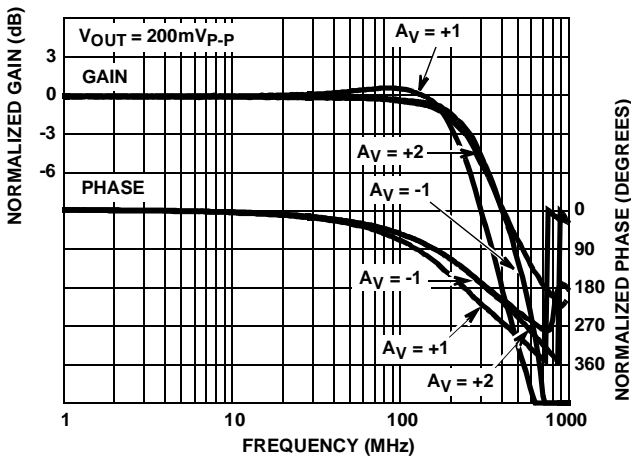


FIGURE 18. FREQUENCY RESPONSE

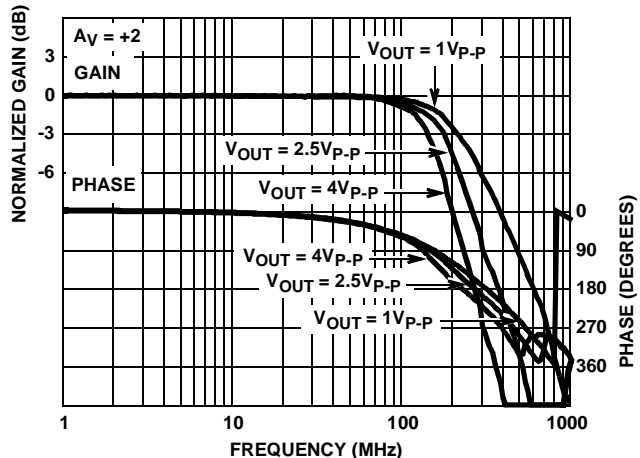


FIGURE 19. FREQUENCY RESPONSE FOR VARIOUS OUTPUT VOLTAGES

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

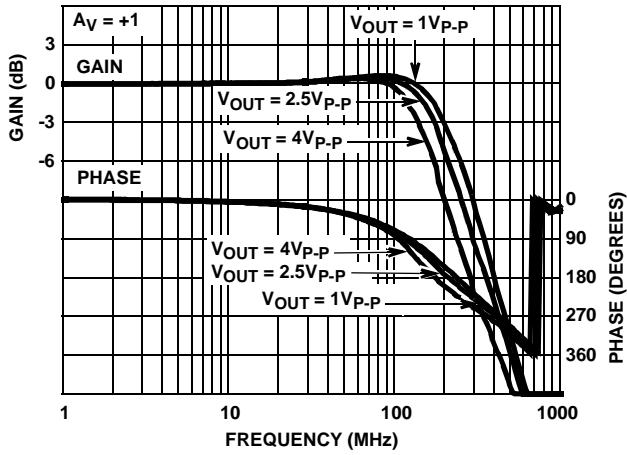


FIGURE 20. FREQUENCY RESPONSE FOR VARIOUS OUTPUT VOLTAGES

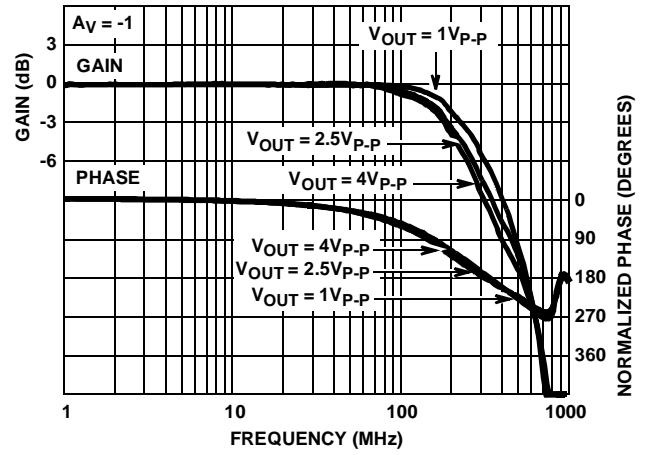


FIGURE 21. FREQUENCY RESPONSE FOR VARIOUS OUTPUT VOLTAGES

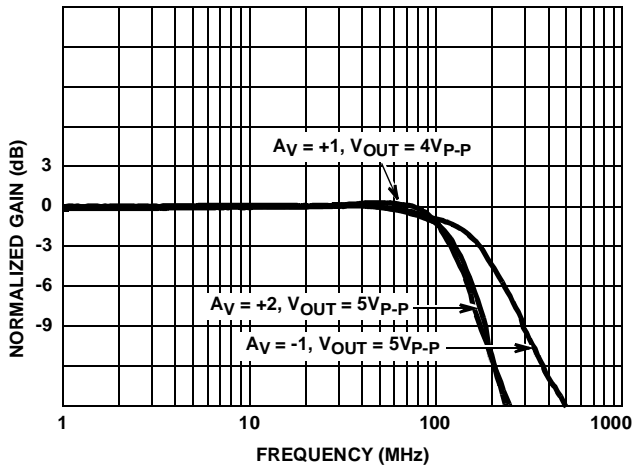


FIGURE 22. FULL POWER BANDWIDTH

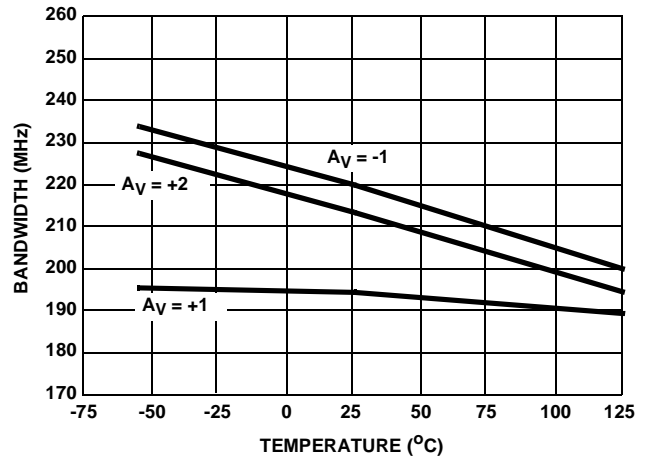


FIGURE 23. -3dB BANDWIDTH vs TEMPERATURE

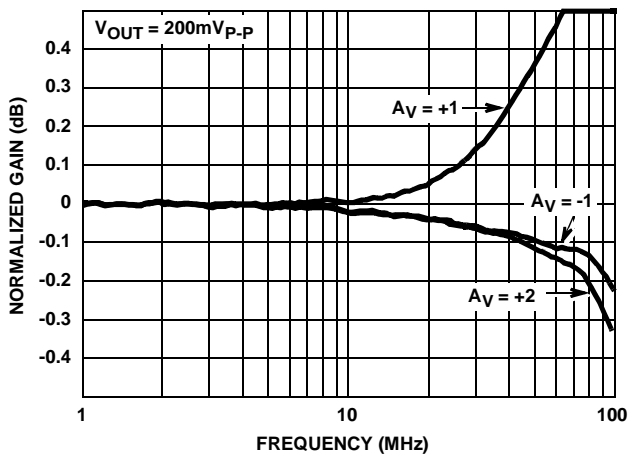


FIGURE 24. GAIN FLATNESS

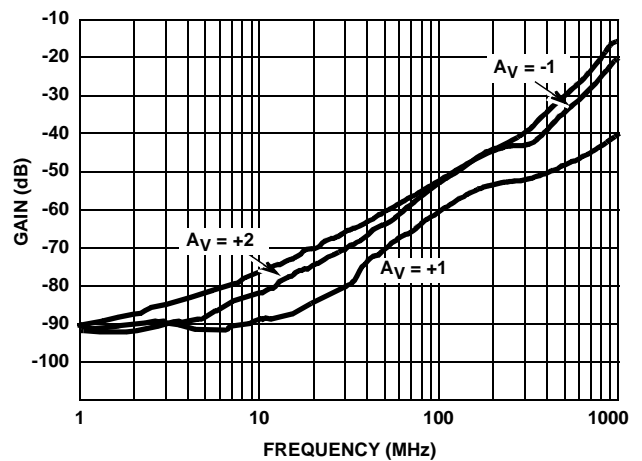


FIGURE 25. REVERSE ISOLATION (S_{12})

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

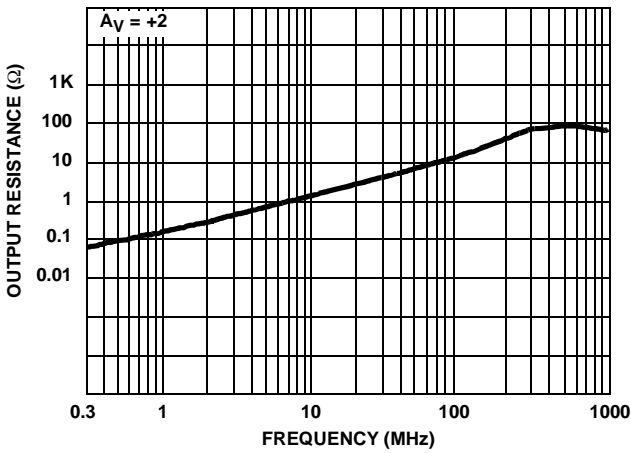


FIGURE 26. OUTPUT RESISTANCE

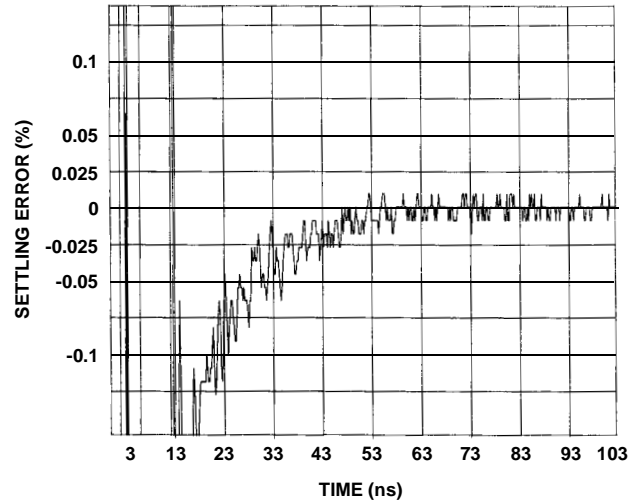


FIGURE 27. SETTLING TIME RESPONSE

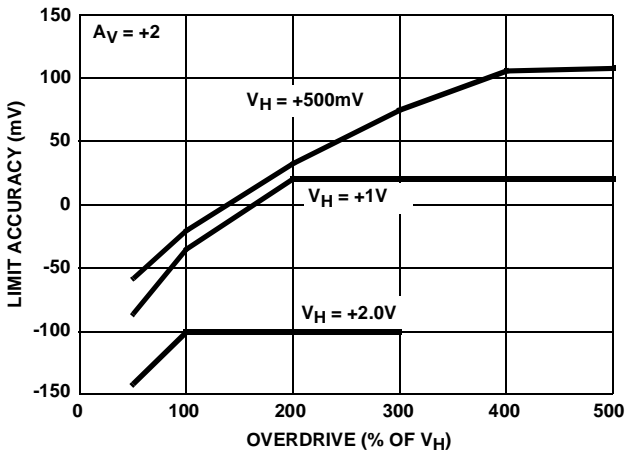


FIGURE 28. V_H LIMIT ACCURACY vs OVERDRIVE

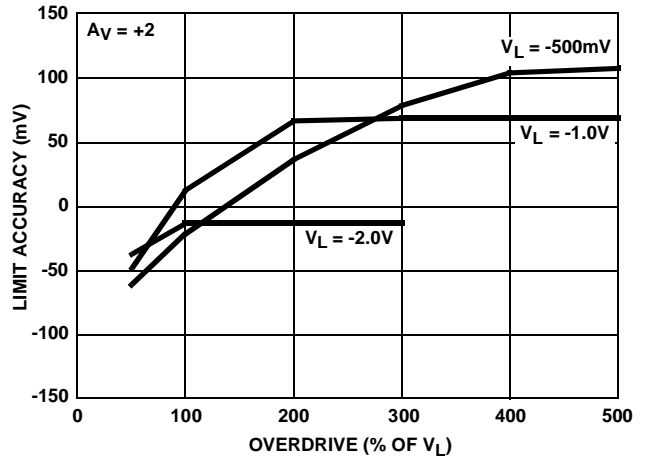


FIGURE 29. V_L LIMIT ACCURACY vs OVERDRIVE

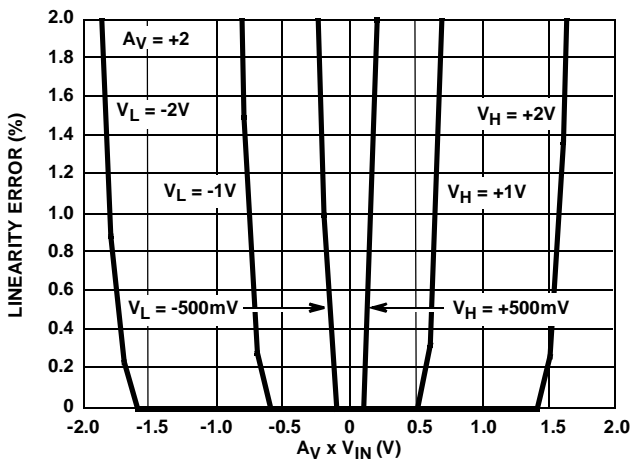


FIGURE 30. LINEARITY NEAR LIMIT VOLTAGE

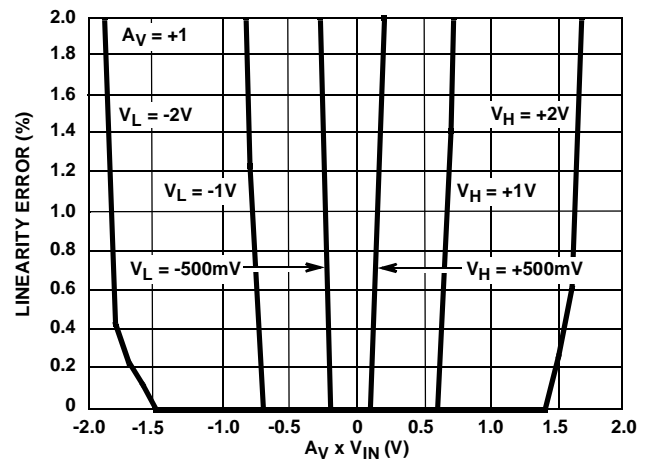


FIGURE 31. LINEARITY NEAR LIMIT VOLTAGE

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

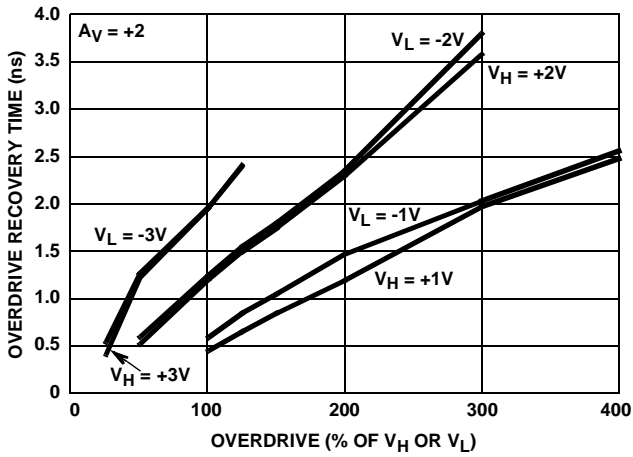


FIGURE 32. OVERDRIVE RECOVERY TIME vs OVERDRIVE

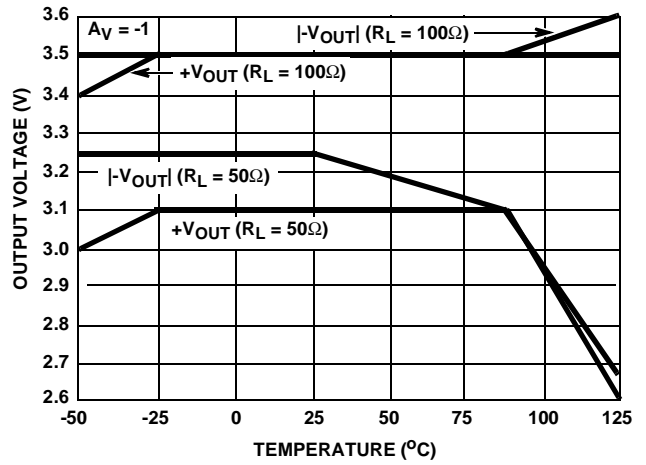


FIGURE 33. OUTPUT VOLTAGE vs TEMPERATURE

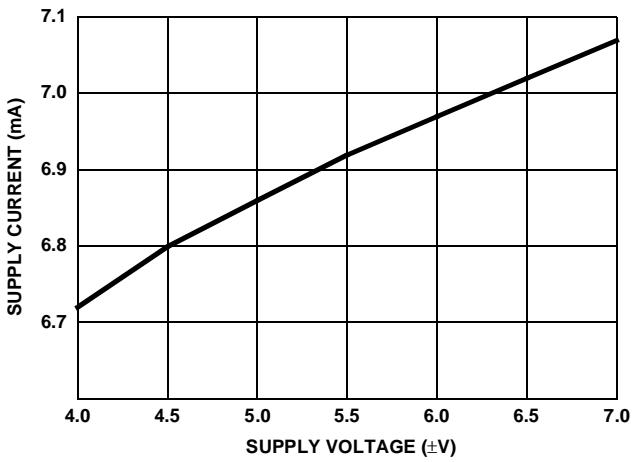


FIGURE 34. SUPPLY CURRENT vs SUPPLY VOLTAGE

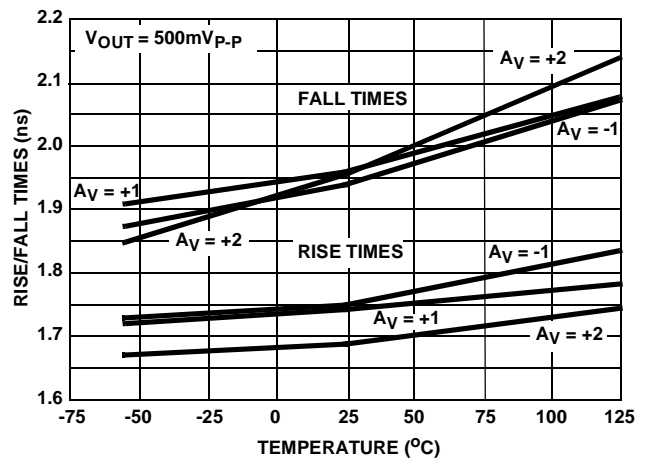


FIGURE 35. RISE AND FALL TIMES vs TEMPERATURE

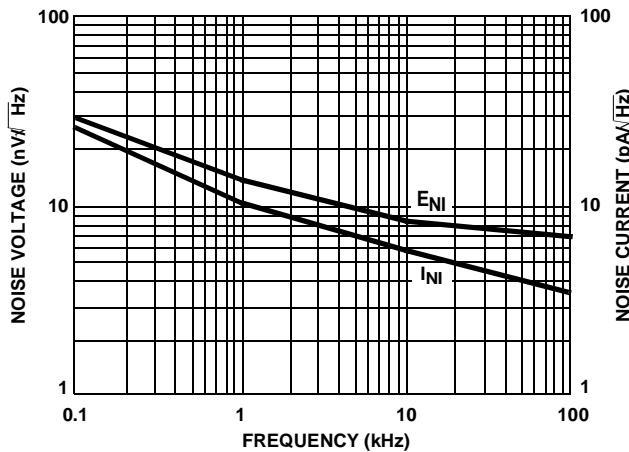


FIGURE 36. INPUT NOISE CHARACTERISTICS

Die Characteristics

DIE DIMENSIONS:

59 mils x 58.2 mils x 19 mils
 1500 μ m x 1480 μ m x 483 μ m

METALLIZATION:

Type: Metal 1: AlCu(2%)/TiW
 Thickness: Metal 1: 8k \AA \pm 0.4k \AA
 Type: Metal 2: AlCu(2%)
 Thickness: Metal 2: 16k \AA \pm 0.8k \AA

SUBSTRATE POTENTIAL (Powered Up):

Floating (Recommend Connection to V-)

PASSIVATION:

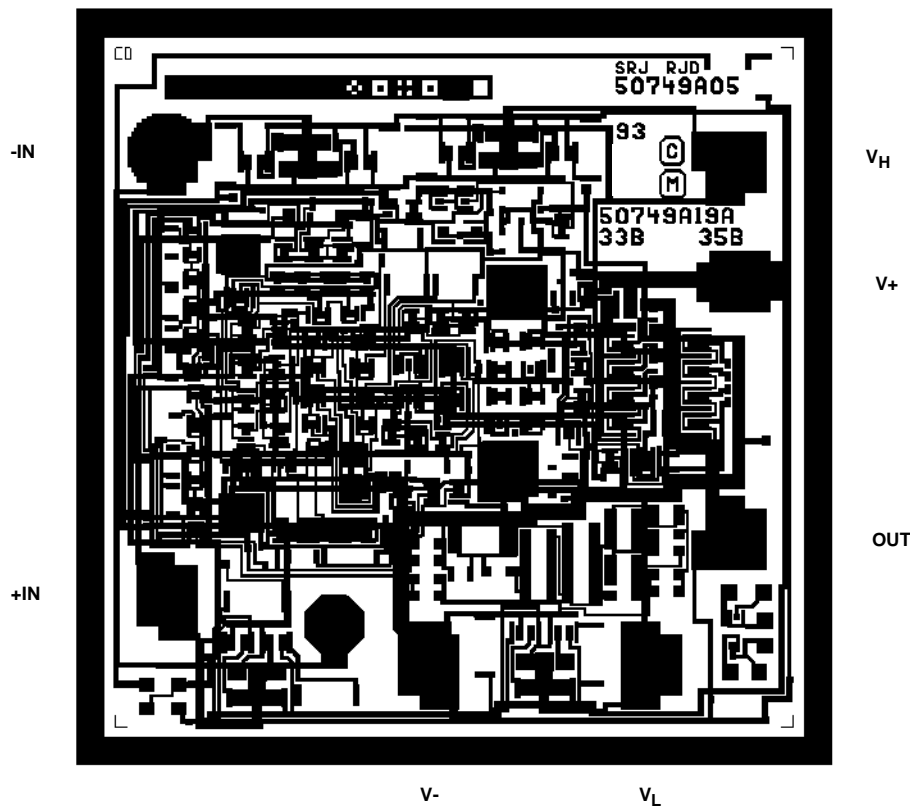
Type: Nitride
 Thickness: 4k \AA \pm 0.5k \AA

TRANSISTOR COUNT:

89

Metallization Mask Layout

HFA1115



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