Data Sheet | August 1, 2005 | FN2894.6

20MHz, High Slew Rate, Uncompensated, High Input Impedance, Operational Amplifiers

HA-2520/2525 comprise a series of operational amplifiers delivering an unsurpassed combination of specifications for slew rate, bandwidth and settling time. These dielectrically isolated amplifiers are controlled at close loop gains greater than 3 without external compensation. In addition, these high performance components also provide low offset current and high input impedance.

120V/μs slew rate and 200ns (0.2%) settling time of these amplifiers make them ideal components for pulse amplification and data acquisition designs. These devices are valuable components for RF and video circuitry requiring up to 20MHz gain bandwidth and 2MHz power bandwidth. For accurate signal conditioning designs the HA-2520/2525's superior dynamic specifications are complemented by 10nA offset current, 100MΩ input impedance and offset trim capability.

Ordering Information

PART NUMBER	TEMP. RANGE (^oC)	PACKAGE	PKG. DWG. #
HA7-2520-2	-55 to 125	8 Ld CERDIP	F8.3A
HA3-2525-5	0 to 75	8 Ld PDIP	E8.3
HA3-2525-5Z (See Note)	0 to 75	8 Ld PDIP (Pb-free)	E8.3
HA7-2525-5	0 to 75	8 Ld CERDIP	F8.3A

NOTE: Intersil Pb-free plus anneal products employ special Pb-free material sets; molding compounds/die attach materials and 100% matte tin plate termination finish, which are RoHS compliant and compatible with both SnPb and Pb-free soldering operations. Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.

Features

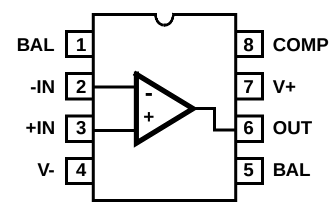
- High Slew Rate. 120V/μs
- Fast Settling 200ns
- Full Power Bandwidth. 2MHz
- Gain Bandwidth ($A_V \geq 3$) 20MHz
- High Input Impedance 100MΩ
- Low Offset Current 10nA
- Compensation Pin for Unity Gain Capability
- Pb-Free Plus Anneal Available (RoHS Compliant)

Applications

- Data Acquisition Systems
- RF Amplifiers
- Video Amplifiers
- Signal Generators

Pinout

HA-2520 (CERDIP)
HA-2525 (PDIP, CERDIP)
TOP VIEW



Absolute Maximum Ratings

Supply Voltage (Between V+ and V- Terminals) 40V
Differential Input Voltage 15V
Output Current 50mA

Operating Conditions

Temperature Range
HA-2520-2 . . . . -55^oC to 125^oC
HA-2525-5 . . . . 0^oC to 75^oC

Thermal Information

Thermal Resistance (Typical, Note 1)	θ_{JA} ($^oC/W$)	θ_{JC} ($^oC/W$)
PDIP Package	96	N/A
CERDIP Package	135	50

Maximum Junction Temperature (Hermetic Packages). . . . . . . 175^oC
Maximum Junction Temperature (Plastic Package) . . . . 150^oC
Maximum Storage Temperature Range . . . . -65^oC to 150^oC
Maximum Lead Temperature (Soldering 10s) . . . . 300^oC

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 $V_{SUPPLY} = \pm 15V$

PARAMETER	TEMP (^oC)	HA-2520-2			HA-2525-5			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
INPUT CHARACTERISTICS								
Offset Voltage	25	-	4	8	-	5	10	mV
	Full	-	-	11	-	-	14	mV
Offset Voltage Drift	Full	-	20	-	-	30	-	$\mu V/^oC$
Bias Current	25	-	100	200	-	125	250	nA
	Full	-	-	400	-	-	500	nA
Offset Current	25	-	10	25	-	20	50	nA
	Full	-	-	50	-	-	100	nA
Input Resistance (Note 2)	25	50	100	-	40	100	-	MΩ
Common Mode Range	Full	±10.0	-	-	±10.0	-	-	V
TRANSFER CHARACTERISTICS								
Large Signal Voltage Gain (Notes 3, 6)	25	10	15	-	7.5	15	-	kV/V
	Full	7.5	-	-	5	-	-	kV/V
Common Mode Rejection Ratio (Note 4)	Full	80	90	-	74	90	-	dB
Gain Bandwidth (Notes 2, 5)	25	10	20	-	10	20	-	MHz
Minimum Stable Gain	25	3	-	-	3	-	-	V/V
OUTPUT CHARACTERISTICS								
Output Voltage Swing (Note 3)	Full	±10.0	±12.0	-	±10.0	±12.0	-	V
Output Current (Note 6)	25	±10	±20	-	±10	±20	-	mA
Full Power Bandwidth (Notes 6, 11)	25	1.5	2.0	-	1.2	2.0	-	MHz
TRANSIENT RESPONSE ($A_V = +3$)								
Rise Time (Notes 3, 7, 8, 10)	25	-	25	50	-	25	50	ns
Overshoot (Notes 3, 7, 8, 10)	25	-	25	40	-	25	50	%
Slew Rate (Notes 3, 7, 10, 12)	25	±100	±120	-	±80	±120	-	V/μs
Settling Time (Notes 3, 7, 10, 12)	25	-	0.20	-	-	0.20	-	μs
POWER SUPPLY CHARACTERISTICS								
Supply Current	25	-	4	6	-	4	6	mA

Electrical Specifications $V_{SUPPLY} = \pm 15V$ **(Continued)**

PARAMETER	TEMP (^oC)	HA-2520-2			HA-2525-5			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Power Supply Rejection Ratio (Note 9)	Full	80	90	-	74	90	-	dB

NOTES:

2. This parameter value is based on design calculations.
3. $R_L = 2k\Omega$.
4. $V_{CM} = \pm 10V$.
5. $A_V > 10$.
6. $V_O = \pm 10.0V$.
7. $C_L = 50pF$.
8. $V_O = \pm 200mV$.
9. $\Delta V = \pm 5.0V$.
10. See Transient Response Test Circuits and Waveforms.
11. Full Power Bandwidth guaranteed based on slew rate measurement using: $FPBW = \frac{\text{Slew Rate}}{2\pi V_{PEAK}}$.
12. $V_{OUT} = \pm 5V$.

Test Circuits and Waveforms

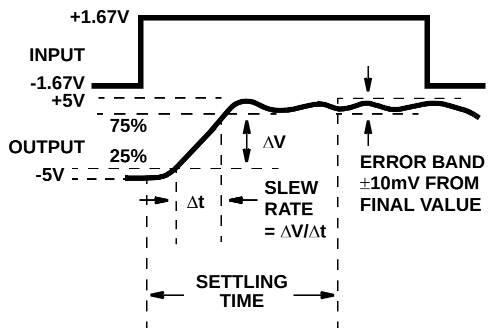
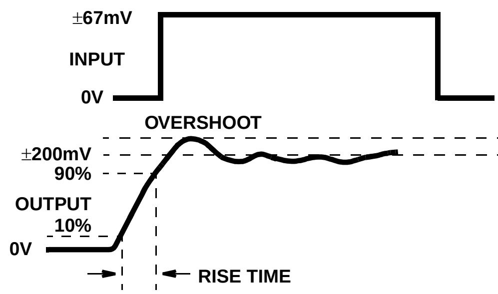


FIGURE 1. SLEW RATE AND SETTLING TIME



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

FIGURE 2. TRANSIENT RESPONSE

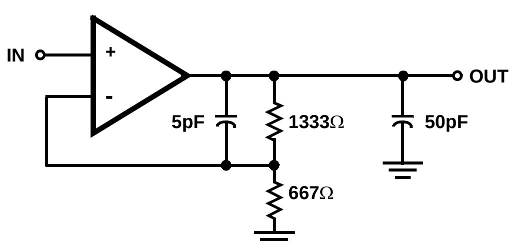
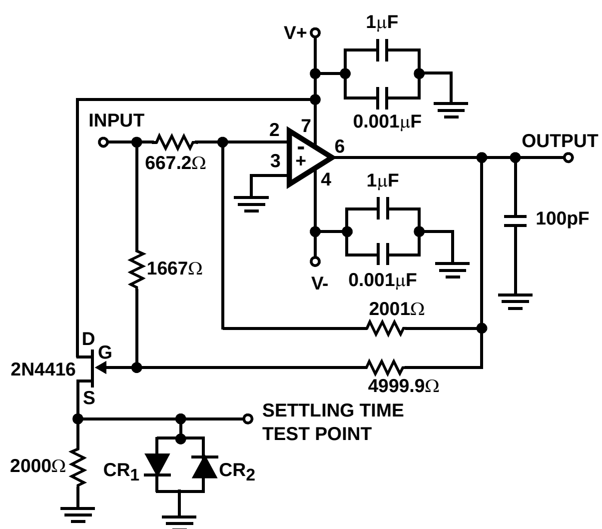


FIGURE 3. SLEW RATE AND TRANSIENT RESPONSE

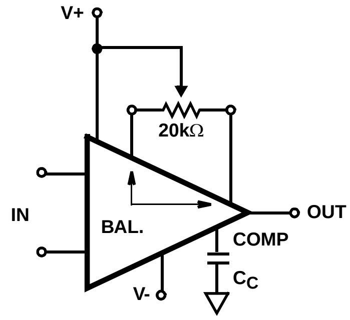


NOTES:

13. $A_V = -3$.
14. Feedback and summing resistor ratios should be 0.1% matched.
15. Clipping diodes CR_1 and CR_2 are optional. HP5082-2810 recommended.

FIGURE 4. SETTLING TIME TEST CIRCUIT

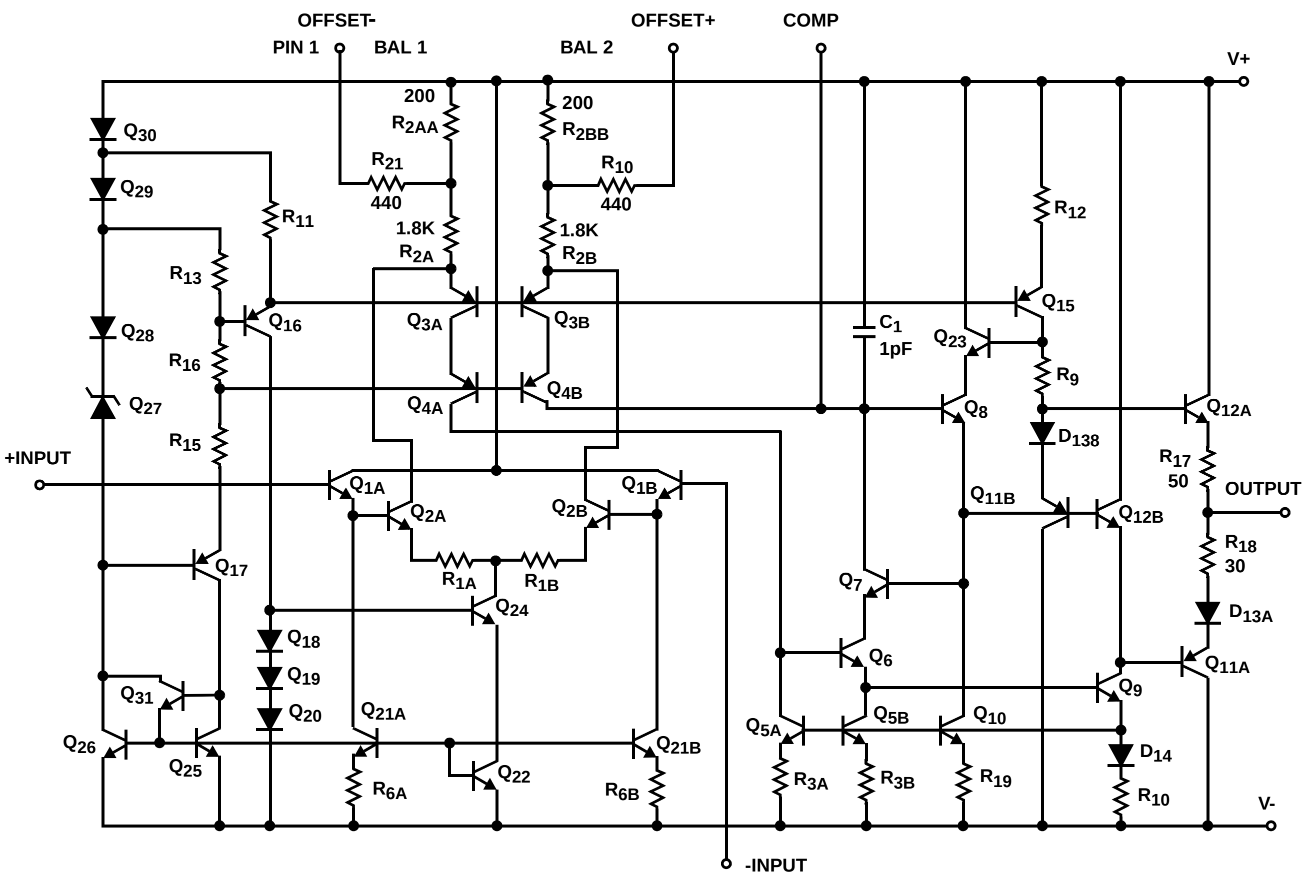
Test Circuits and Waveforms (Continued)



NOTE: Tested offset adjustment range is $|V_{OS} + 1mV|$ minimum referred to output. Typical ranges are ±20mV with R_T = 20kΩ.

FIGURE 5. SUGGESTED V_{OS} ADJUSTMENT AND COMPENSATION HOOK-UP

Schematic Diagram



Typical Application

Inverting Unity Gain Circuit

Figure 6 shows a Compensation Circuit for an inverting unity gain amplifier. The circuit was tested for functionality with supply voltages from ±4V to ±15V, and the performance as tested was: Slew Rate ≈ 120V/μs; Bandwidth ≈ 10MHz; and Settling Time (0.1%) ≈ 500ns. Figure 7 illustrates the amplifier's frequency response, and it is important to note that capacitance at pin 8 must be minimized for maximum bandwidth.

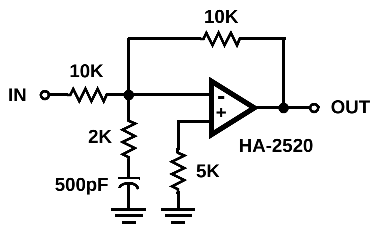


FIGURE 6. INVERTING UNITY GAIN CIRCUIT

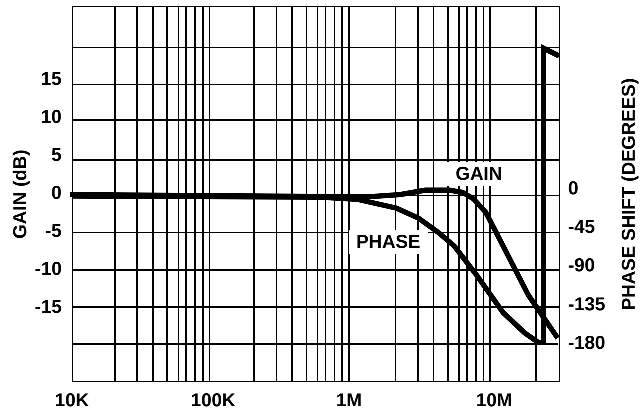


FIGURE 7. FREQUENCY RESPONSE FOR INVERTING UNITY GAIN CIRCUIT

Typical Performance Curves $V_S = \pm15V$, $T_A = 25^oC$, Unless Otherwise Specified

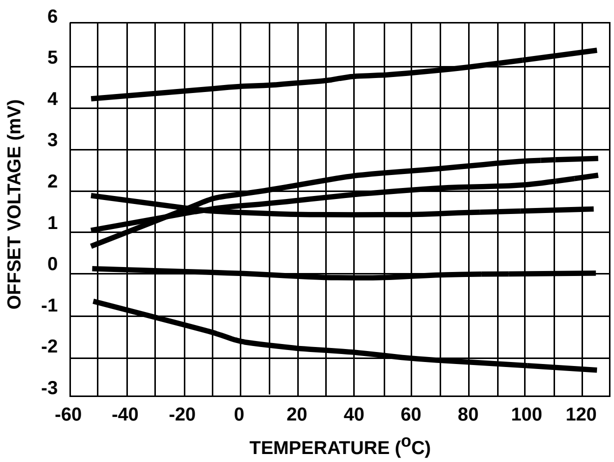


FIGURE 8. OFFSET VOLTAGE vs TEMPERATURE (6 TYPICAL UNITS FROM 3 LOTS)

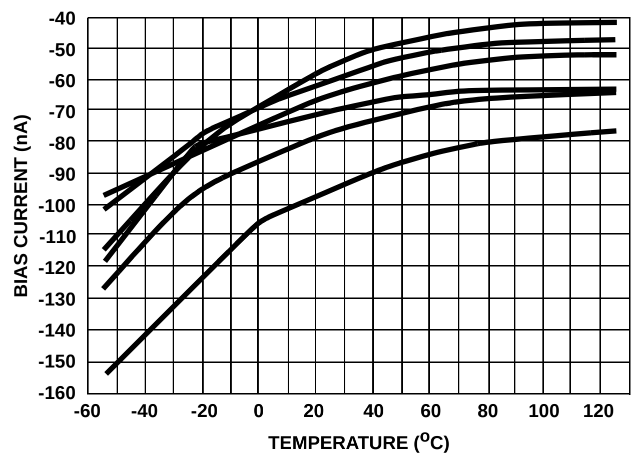


FIGURE 9. BIAS CURRENT vs TEMPERATURE (6 TYPICAL UNITS FROM 3 LOTS)

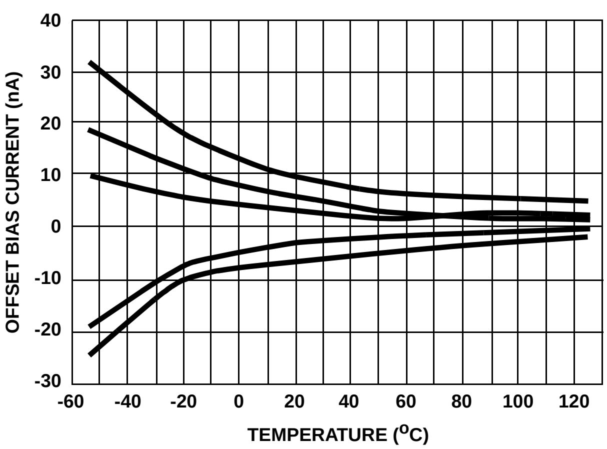


FIGURE 10. OFFSET CURRENT vs TEMPERATURE (5 TYPICAL UNITS FROM 3 LOTS)

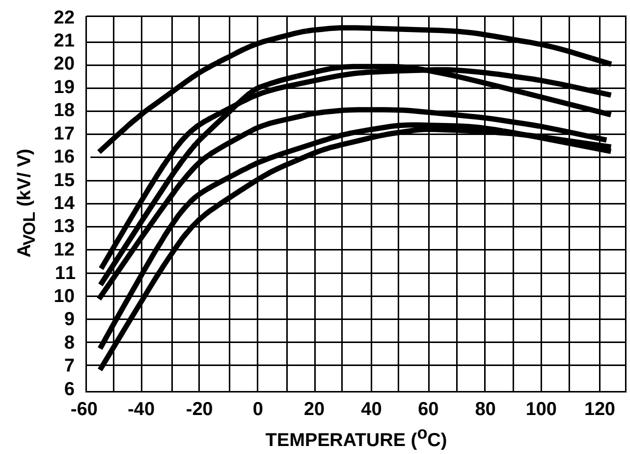


FIGURE 11. OPEN LOOP GAIN vs TEMPERATURE (6 TYPICAL UNITS FROM 3 LOTS)

Typical Performance Curves $V_S = \pm 15V$, $T_A = 25^oC$, Unless Otherwise Specified **(Continued)**

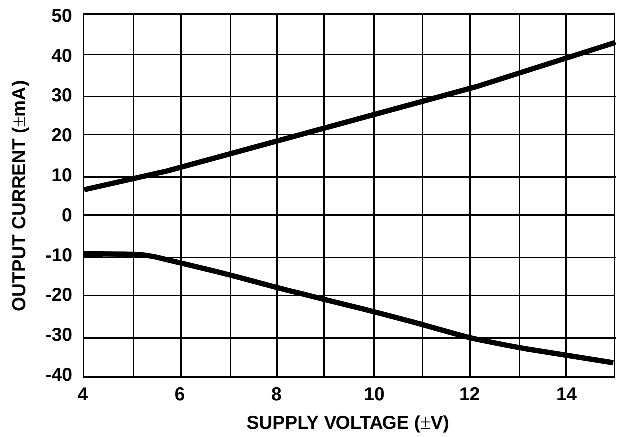


FIGURE 12. OUTPUT CURRENT vs SUPPLY VOLTAGE

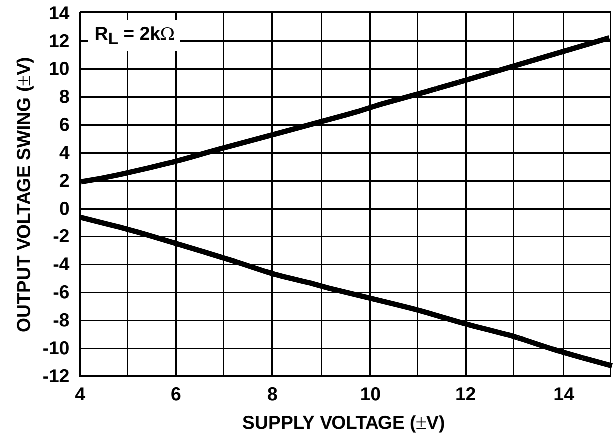


FIGURE 13. OUTPUT VOLTAGE SWING vs SUPPLY VOLTAGE

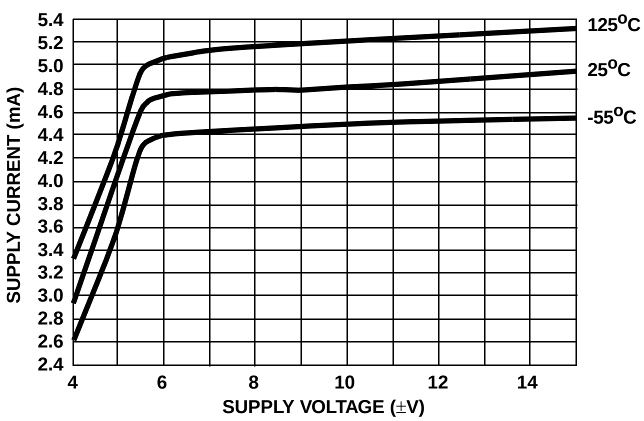


FIGURE 14. SUPPLY CURRENT vs SUPPLY VOLTAGE

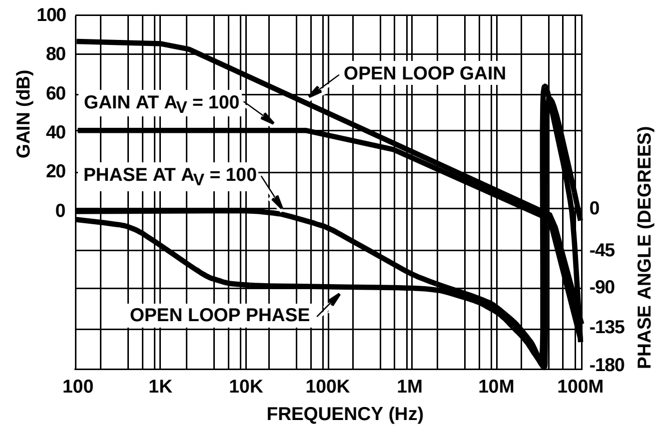


FIGURE 15. FREQUENCY RESPONSE

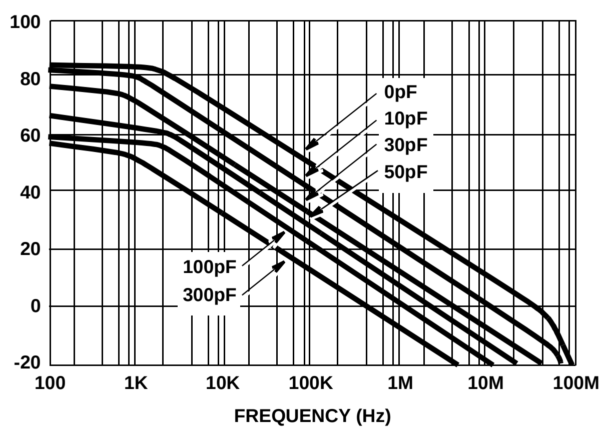


FIGURE 16. OPEN LOOP FREQUENCY RESPONSE FOR VARIOUS VALUES OF CAPACITORS FROM COMP PIN TO GROUND

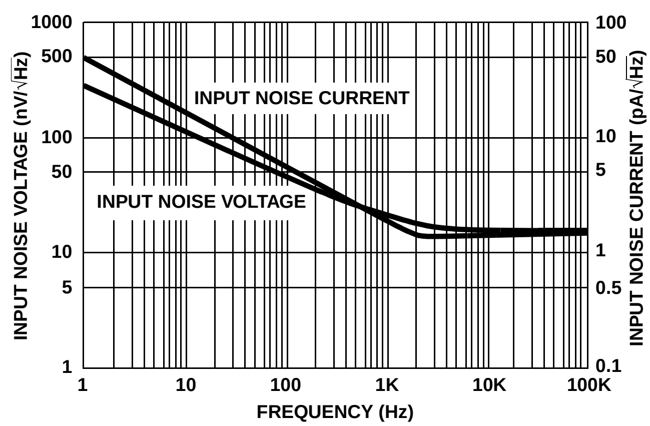


FIGURE 17. INPUT NOISE CHARACTERISTICS

Typical Performance Curves $V_S = \pm15V$, $T_A = 25^oC$, Unless Otherwise Specified **(Continued)**

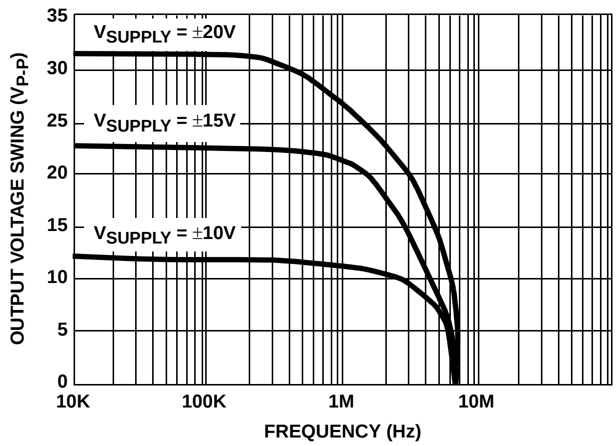


FIGURE 18. OUTPUT VOLTAGE SWING vs FREQUENCY

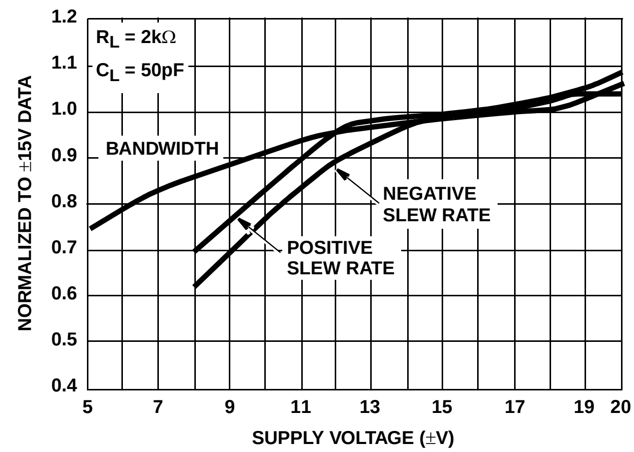


FIGURE 19. NORMALIZED AC PARAMETERS vs SUPPLY VOLTAGE

Die Characteristics

METALLIZATION:
Type: Al, 1% Cu
Thickness: 16kÅ ±2kÅ

SUBSTRATE POTENTIAL:
Unbiased

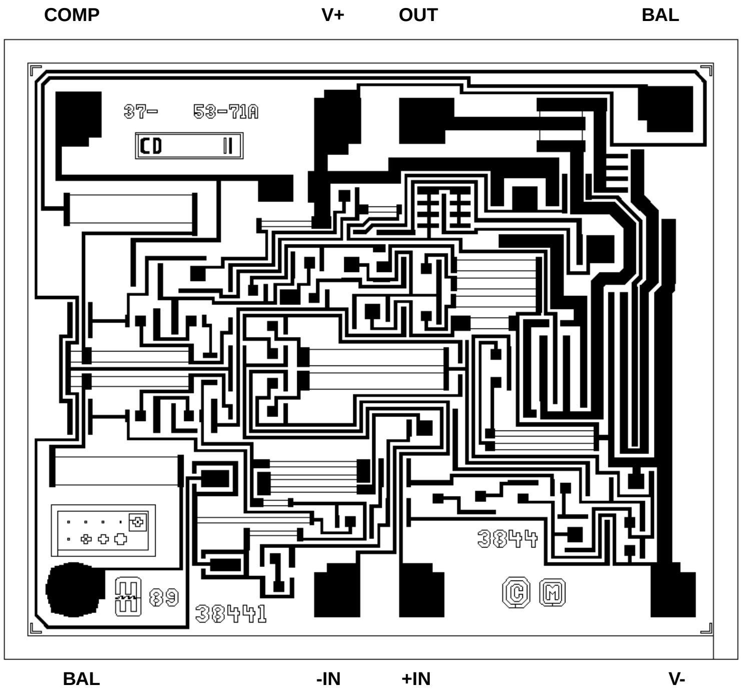
PASSIVATION:
Type: Nitride (Si_3N_4) over Silox (SiO_2, 5% Phos.)
Silox Thickness: 12kÅ ±2kÅ
Nitride Thickness: 3.5kÅ ±1.5kÅ

TRANSISTOR COUNT:
40

PROCESS:
Bipolar Dielectric Isolation

Metallization Mask Layout

HA-2520, HA-2525



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