

Rochester Electronics Manufactured Components

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All recreations are done with the approval of the OCM.

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceed the OCM data sheet.

Quality Overview

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-35835
 - Class Q Military
 - Class V Space Level
- Qualified Suppliers List of Distributors (QSLD)
 - Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OEM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

HA-2520, HA-2522, HA-2525

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

November 1996

Features

- High Slew Rate 120V/ μ s
- Fast Settling 200ns
- Full Power Bandwidth 2MHz
- Gain Bandwidth ($A_V \geq 3$) 20MHz
- High Input Impedance 100M Ω
- Low Offset Current 10nA

Applications

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

Description

HA-2520/2522/2525 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.

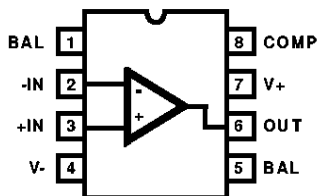
120V/ μ s slew rate and 200ns (0.2%) settling time of these amplifiers make them ideal components for pulse amplification and data acquisition designs. These devices are valuable components for RF and video circuitry requiring up to 20MHz gain bandwidth and 2MHz power bandwidth. For accurate signal conditioning designs the HA-2520/2522/2525's superior dynamic specifications are complemented by 10nA offset current, 100M Ω input impedance and offset trim capability. MIL-STD-883 product and data sheets are available upon request.

Ordering Information

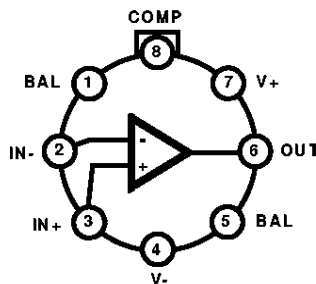
| PART NUMBER (BRAND) | TEMP. RANGE (°C) | PACKAGE | PKG. NO. |
|---------------------|------------------|-----------------|----------|
| HA2-2520-2 | -55 to 125 | 8 Pin Metal Can | T8.C |
| HA2-2522-2 | -55 to 125 | 8 Pin Metal Can | T8.C |
| HA2-2525-5 | 0 to 75 | 8 Pin Metal Can | T8.C |
| HA3-2525-5 | 0 to 75 | 8 Ld PDIP | E8.3 |
| HA4P2525-5 | 0 to 75 | 20 Ld PLCC | N20.35 |
| HA7-2520-2 | -55 to 125 | 8 Ld CERDIP | F8.3A |
| HA7-2522-2 | -55 to 125 | 8 Ld CERDIP | F8.3A |
| HA7-2525-5 | 0 to 75 | 8 Ld CERDIP | F8.3A |
| HA9P2525-5 (H25255) | 0 to 75 | 8 Ld SOIC | M8.15 |

Pinouts

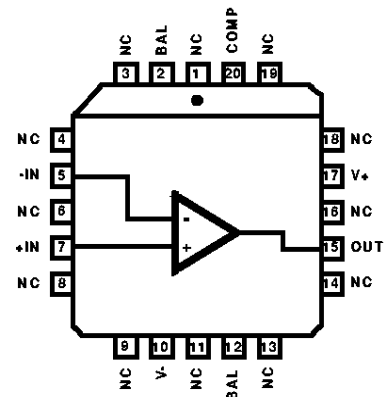
HA-2520/22 (CERDIP)
HA-2525 (PDIP, CERDIP, SOIC)
TOP VIEW



HA-2520/22/25
(METAL CAN)
TOP VIEW



HA-2525
(PLCC)
TOP VIEW



HA-2520, HA-2522, HA-2525

Absolute Maximum Ratings

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

Operating Conditions

| | |
|-------------------|----------------|
| Temperature Range | |
| HA-2520/2522-2 | -55°C to 125°C |
| HA-2525-5 | 0°C to 75°C |

Thermal Information

| | | |
|--|---|----------------------|
| Thermal Resistance (Typical, Note 1) | θ_{JA} (°C/W) | θ_{JC} (°C/W) |
| Metal Can Package | 165 | 80 |
| PDIP Package | 96 | N/A |
| CERDIP Package | 135 | 50 |
| PLCC Package | 74 | N/A |
| SOIC Package | 157 | N/A |
| Maximum Junction Temperature (Hermetic Packages) | 175°C | |
| Maximum Junction Temperature (Plastic Package) | 150°C | |
| Maximum Storage Temperature Range | -65°C to 150°C | |
| Maximum Lead Temperature (Soldering 10s) | 300°C (SOIC and PLCC - 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 $V_{SUPPLY} = \pm 15V$

| PARAMETER | TEMP (°C) | HA-2520-2 | | | HA-2522-2 | | | HA-2525-5 | | | UNITS |
|---|-----------|------------|------------|-----|------------|------------|-----|------------|------------|-----|------------------|
| | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| INPUT CHARACTERISTICS | | | | | | | | | | | |
| Offset Voltage | 25 | - | 4 | 8 | - | 5 | 10 | - | 5 | 10 | mV |
| | Full | - | - | 11 | - | - | 14 | - | - | 14 | mV |
| Offset Voltage Drift | Full | - | 20 | - | - | 25 | - | - | 30 | - | $\mu V/^\circ C$ |
| Bias Current | 25 | - | 100 | 200 | - | 125 | 250 | - | 125 | 250 | nA |
| | Full | - | - | 400 | - | - | 500 | - | - | 500 | nA |
| Offset Current | 25 | - | 10 | 25 | - | 20 | 50 | - | 20 | 50 | nA |
| | Full | - | - | 50 | - | - | 100 | - | - | 100 | nA |
| Input Resistance (Note 2) | 25 | 50 | 100 | - | 40 | 100 | - | 40 | 100 | - | M Ω |
| Common Mode Range | Full | ± 10.0 | - | - | ± 10.0 | - | - | ± 10.0 | - | - | V |
| TRANSFER CHARACTERISTICS | | | | | | | | | | | |
| Large Signal Voltage Gain (Notes 3, 6) | 25 | 10 | 15 | - | 7.5 | 15 | - | 7.5 | 15 | - | kV/V |
| | Full | 7.5 | - | - | 5 | - | -- | 5 | - | - | kV/V |
| Common Mode Rejection Ratio (Note 4) | Full | 80 | 90 | - | 74 | 90 | - | 74 | 90 | - | dB |
| Gain Bandwidth (Notes 2, 5) | 25 | 10 | 20 | - | 10 | 20 | - | 10 | 20 | - | MHz |
| Minimum Stable Gain | 25 | 3 | - | - | 3 | - | - | 3 | - | - | V/V |
| OUTPUT CHARACTERISTICS | | | | | | | | | | | |
| Output Voltage Swing (Note 3) | Full | ± 10.0 | ± 12.0 | - | ± 10.0 | ± 12.0 | - | ± 10.0 | ± 12.0 | - | V |
| Output Current (Note 6) | 25 | ± 10 | ± 20 | - | ± 10 | ± 20 | - | ± 10 | ± 20 | - | mA |
| Full Power Bandwidth (Notes 6, 11) | 25 | 1.5 | 2.0 | - | 1.2 | 2.0 | - | 1.2 | 2.0 | - | MHz |
| TRANSIENT RESPONSE ($A_V = +3$) | | | | | | | | | | | |
| Rise Time (Notes 3, 7, 8, 10) | 25 | - | 25 | 50 | - | 25 | 50 | - | 25 | 50 | ns |
| Overshoot (Notes 3, 7, 8, 10) | 25 | - | 25 | 40 | - | 25 | 50 | - | 25 | 50 | % |
| Slew Rate (Notes 3, 7, 10, 12) | 25 | ± 100 | ± 120 | - | ± 80 | ± 120 | - | ± 80 | ± 120 | - | V/ μs |
| Settling Time (Notes 3, 7, 10, 12) | 25 | - | 0.20 | - | - | 0.20 | - | - | 0.20 | - | μs |

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

| PARAMETER | TEMP (°C) | HA-2520-2 | | | HA-2522-2 | | | HA-2525-5 | | | UNITS |
|---------------------------------------|-----------|-----------|-----|-----|-----------|-----|-----|-----------|-----|-----|-------|
| | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| POWER SUPPLY CHARACTERISTICS | | | | | | | | | | | |
| Supply Current | 25 | - | 4 | 6 | - | 4 | 6 | - | 4 | 6 | mA |
| Power Supply Rejection Ratio (Note 9) | Full | 80 | 90 | - | 74 | 90 | - | 74 | 90 | - | dB |

NOTES:

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

Test Circuits and Waveforms

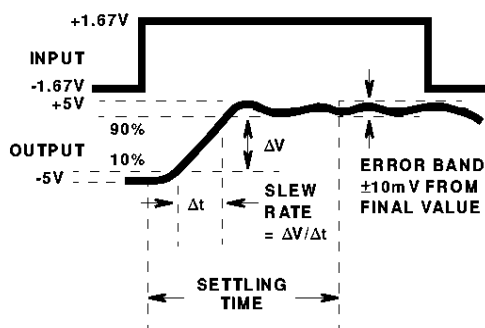
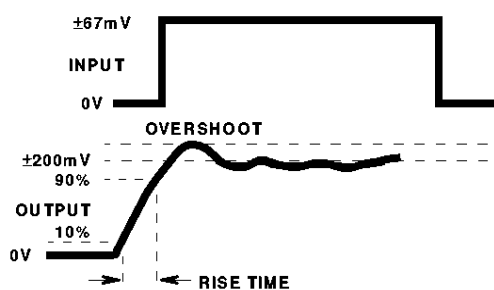


FIGURE 1. SLEW RATE AND SETTLING TIME



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

FIGURE 2. TRANSIENT RESPONSE

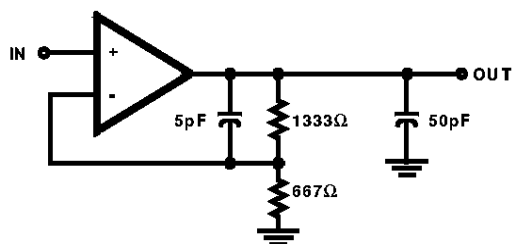
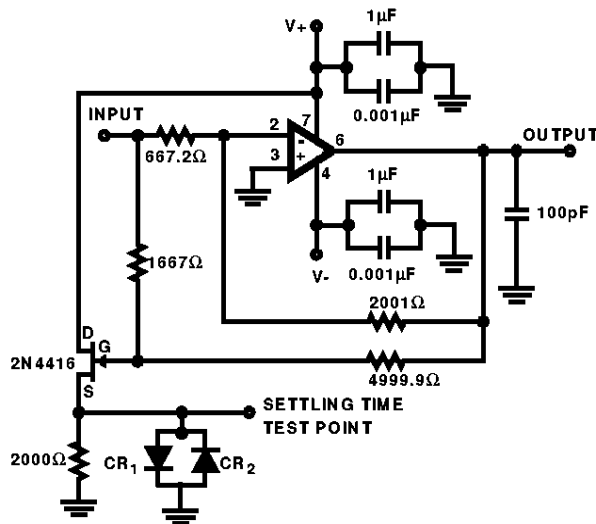


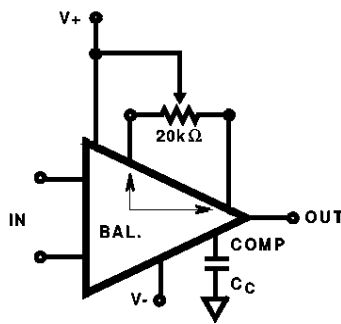
FIGURE 3. SLEW RATE AND TRANSIENT RESPONSE



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

FIGURE 4. SETTLING TIME TEST CIRCUIT

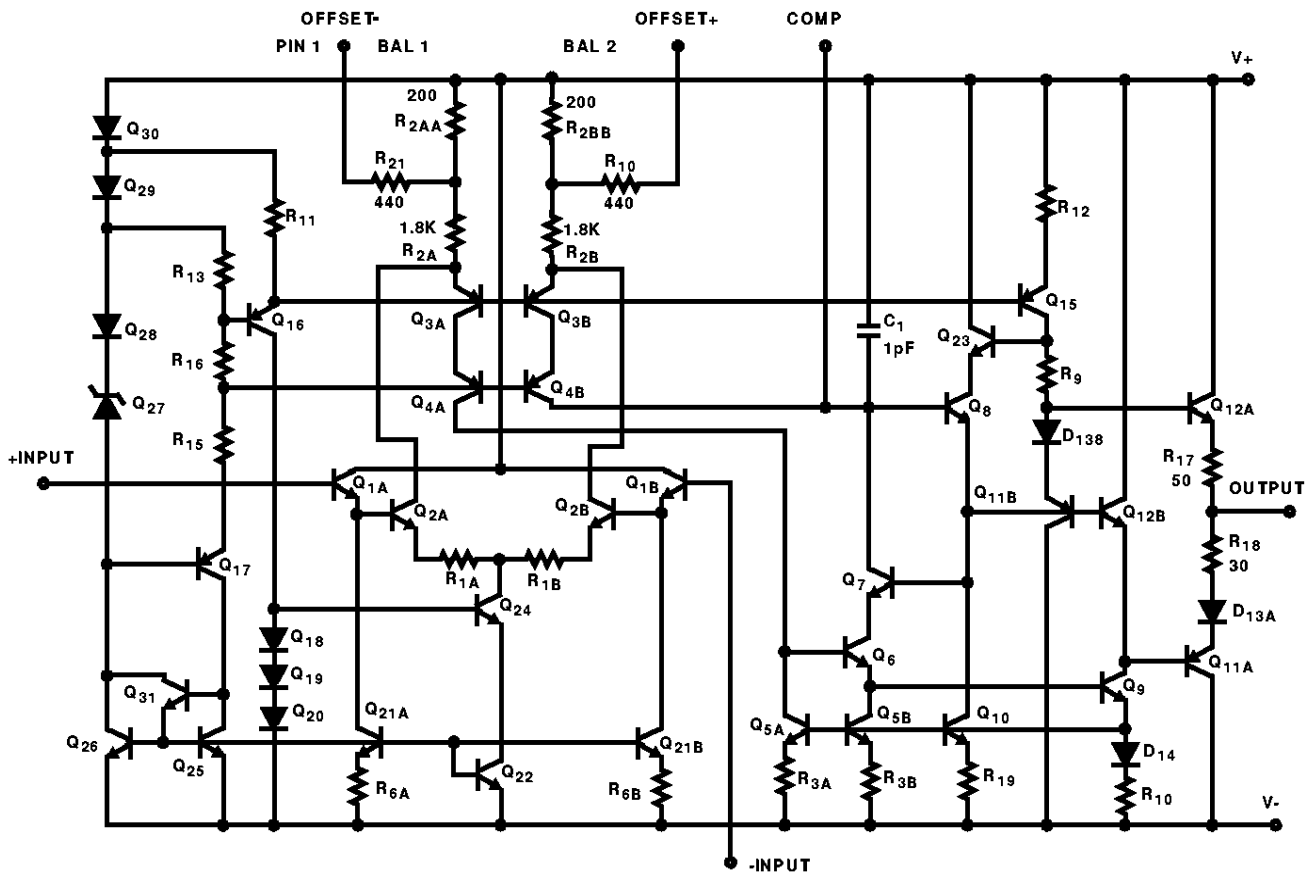
Test Circuits and Waveforms (Continued)



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

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 $\pm 4V$ to $\pm 15V$, and the performance as tested was: Slew Rate $\approx 120V/\mu s$; Bandwidth $\approx 10MHz$; and Settling Time (0.1%) $\approx 500ns$. 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.

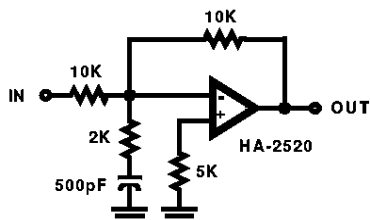


FIGURE 6. INVERTING UNITY GAIN CIRCUIT

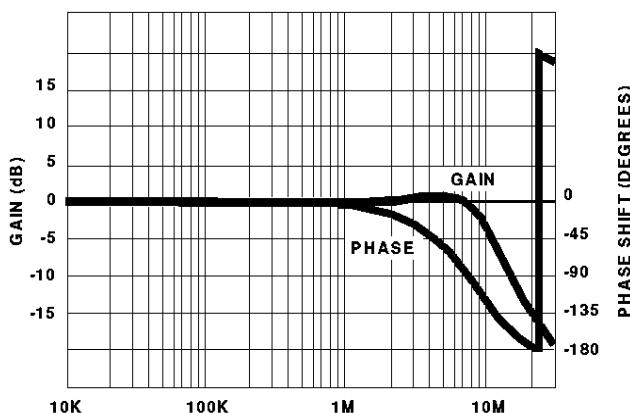


FIGURE 7. FREQUENCY RESPONSE FOR INVERTING UNITY GAIN CIRCUIT

Typical Performance Curves $V_S = \pm 15V, T_A = 25^\circ C$, Unless Otherwise Specified

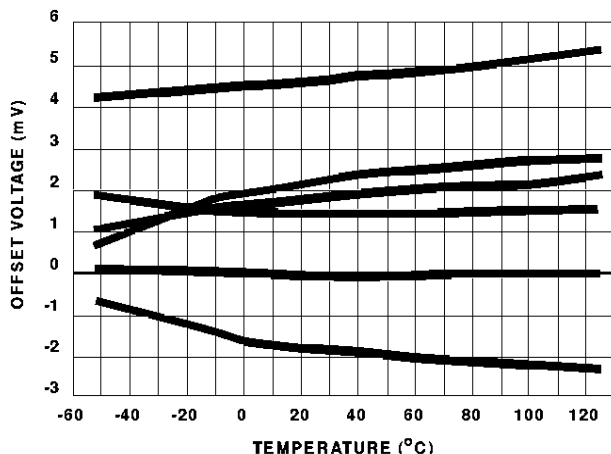


FIGURE 8. OFFSET VOLTAGE vs TEMPERATURE (6 TYPICAL UNITS FROM 3 LOTS)

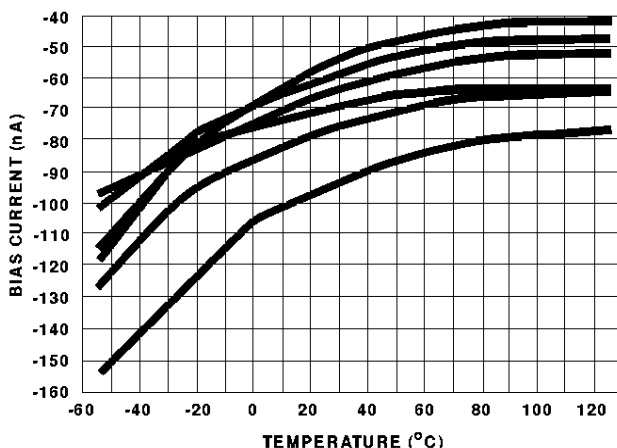


FIGURE 9. BIAS CURRENT vs TEMPERATURE (6 TYPICAL UNITS FROM 3 LOTS)

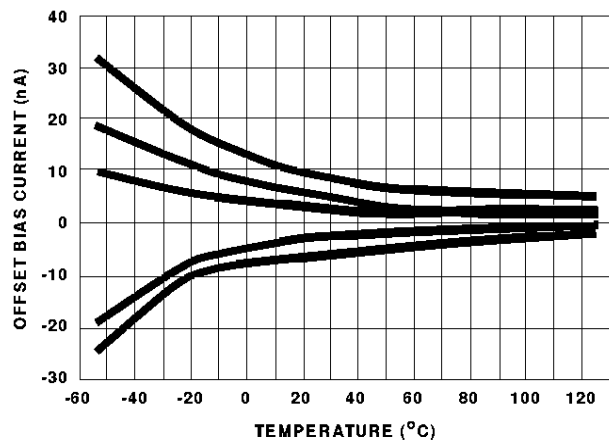


FIGURE 10. OFFSET CURRENT vs TEMPERATURE (5 TYPICAL UNITS FROM 3 LOTS)

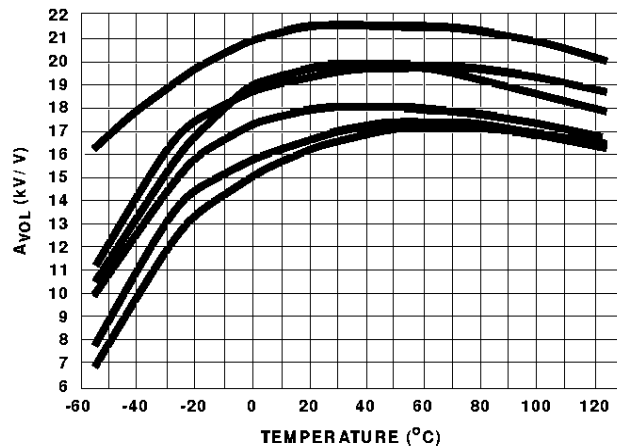


FIGURE 11. OPEN LOOP GAIN vs TEMPERATURE (6 TYPICAL UNITS FROM 3 LOTS)

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

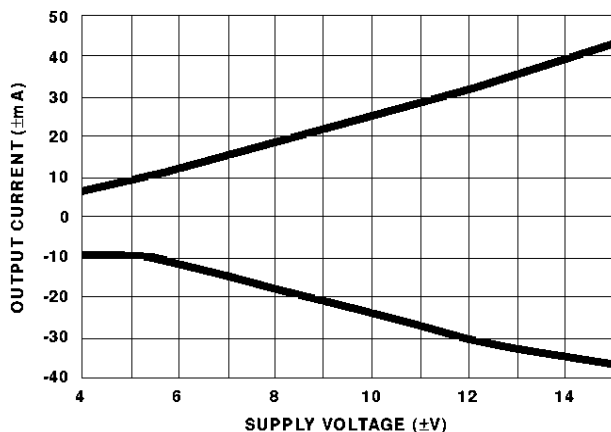


FIGURE 12. OUTPUT CURRENT vs SUPPLY VOLTAGE

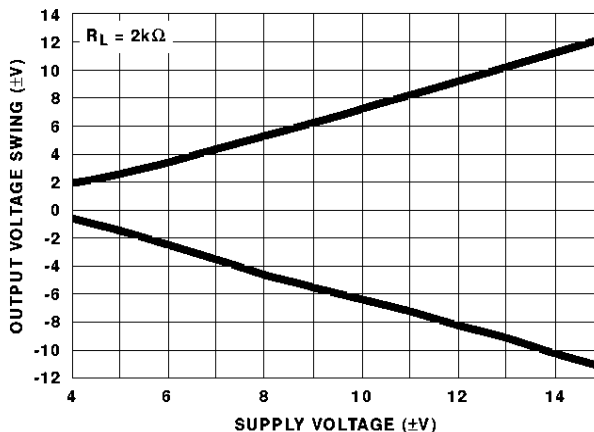


FIGURE 13. OUTPUT VOLTAGE SWING vs SUPPLY VOLTAGE

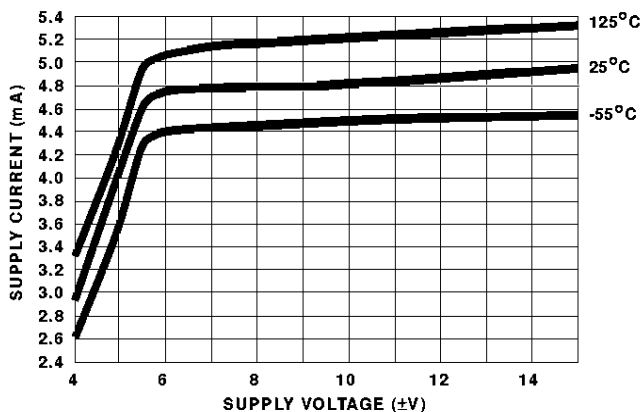


FIGURE 14. SUPPLY CURRENT vs SUPPLY VOLTAGE

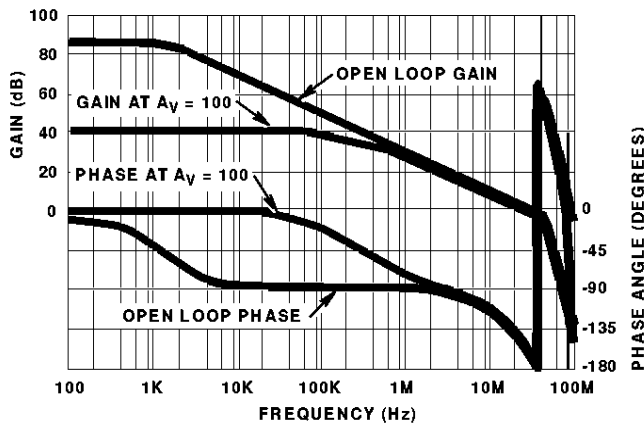


FIGURE 15. FREQUENCY RESPONSE

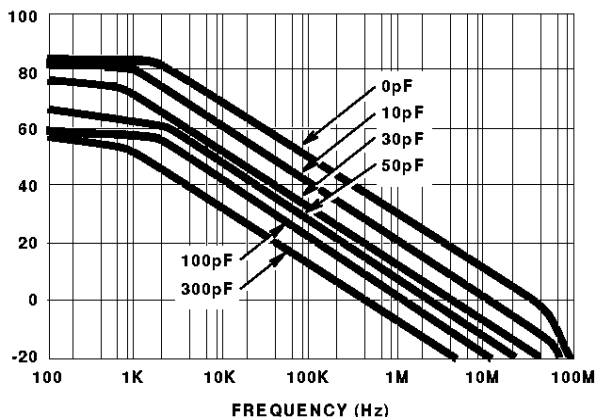


FIGURE 16. OPEN LOOP FREQUENCY RESPONSE FOR VARIOUS VALUES OF CAPACITORS FROM COMP PIN TO GROUND

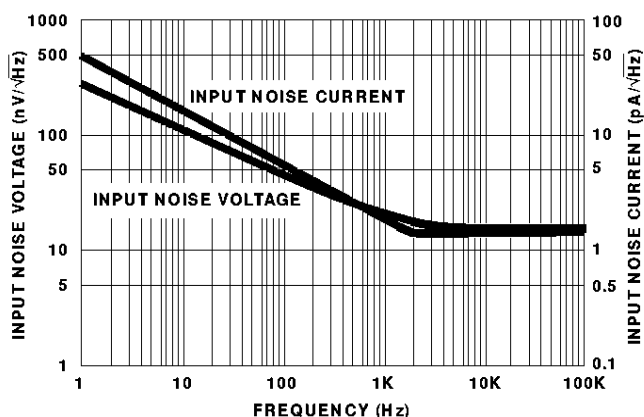


FIGURE 17. INPUT NOISE CHARACTERISTICS

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

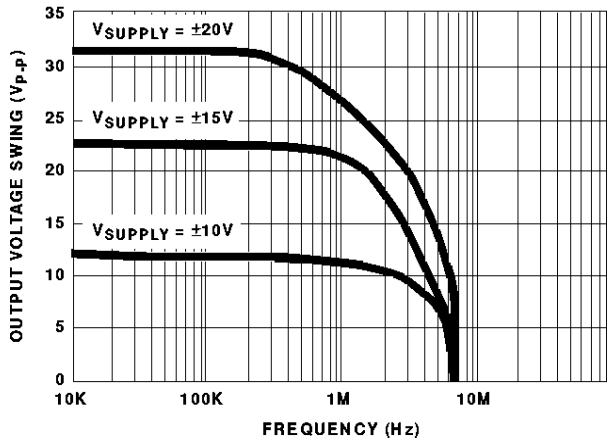


FIGURE 18. OUTPUT VOLTAGE SWING vs FREQUENCY

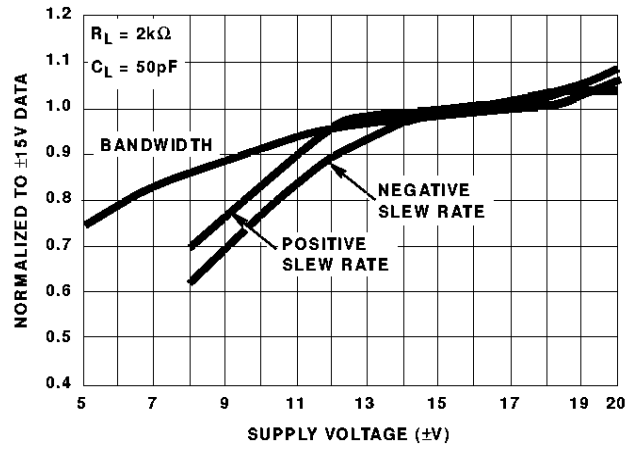


FIGURE 19. NORMALIZED AC PARAMETERS vs SUPPLY VOLTAGE

HA-2520, HA-2522, HA-2525

Die Characteristics

DIE DIMENSIONS:

67 mils x 57 mils x 19 mils
(1700 μ m x 1440 μ m x 483 μ m)

METALLIZATION:

Type: Al, 1% Cu
Thickness: 16k \AA \pm 2k \AA

SUBSTRATE POTENTIAL:

Unbiased

PASSIVATION:

Type: Nitride (Si₃N₄) over Silox (SiO₂, 5% Phos.)
Silox Thickness: 12k \AA \pm 2k \AA
Nitride Thickness: 3.5k \AA \pm 1.5k \AA

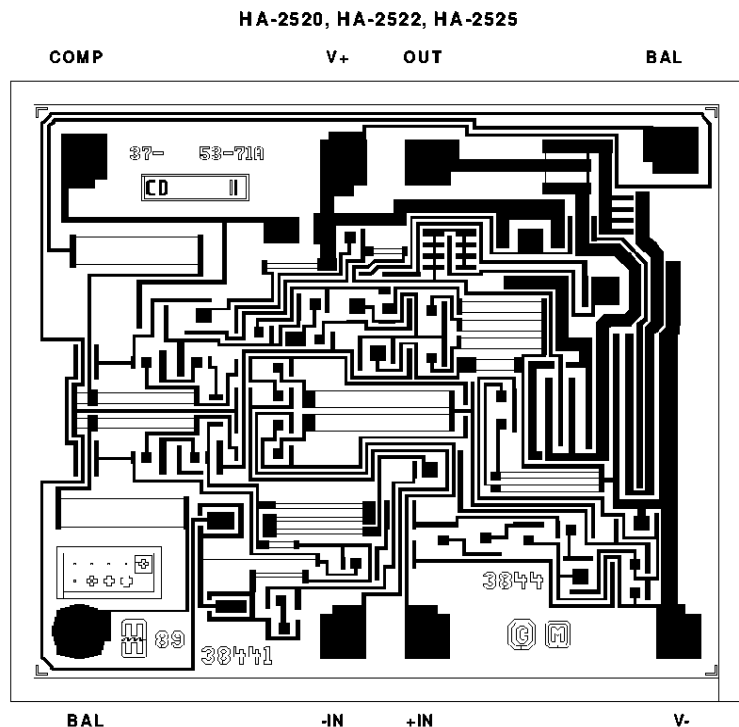
TRANSISTOR COUNT:

40

PROCESS:

Bipolar Dielectric Isolation

Metallization Mask Layout



All Harris Semiconductor products are manufactured, assembled and tested under **ISO9000** quality systems certification.

Harris Semiconductor products are sold by description only. Harris Semiconductor reserves the right to make changes in circuit design and/or specifications at any time without notice. Accordingly, the reader is cautioned to verify that data sheets are current before placing orders. Information furnished by Harris is believed to be accurate and reliable. However, no responsibility is assumed by Harris or its subsidiaries for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Harris or its subsidiaries.

Sales Office Headquarters

For general information regarding Harris Semiconductor and its products, call **1-800-4-HARRIS**

NORTH AMERICA

Harris Semiconductor
P. O. Box 883, Mail Stop 53-210
Melbourne, FL 32902
TEL: 1-800-442-7747
(407) 729-4984
FAX: (407) 729-5321

EUROPE

Harris Semiconductor
Mercure Center
100, Rue de la Fusee
1130 Brussels, Belgium
TEL: (32) 2.724.2111
FAX: (32) 2.724.22.05

ASIA

Harris Semiconductor PTE Ltd.
No. 1 Tannery Road
Cencon 1, #09-01
Singapore 1334
TEL: (65) 748-4200
FAX: (65) 748-0400

