

**OBSOLETE PRODUCT**  
See HA-2539

# HA-2839

## 600MHz, Very High Slew Rate Operational Amplifier

November 1996

### Features

- Low Supply Current . . . . . 13mA
- Very High Slew Rate . . . . . 625V/ $\mu$ s
- Open Loop Gain . . . . . 25kV/V
- Wide Gain-Bandwidth ( $A_V \geq 10$ ) . . . . . 600MHz
- Full Power Bandwidth . . . . . 10MHz
- Low Offset Voltage . . . . . 0.6mV
- Differential Gain/Phase . . . . . 0.03%/0.03 Degrees
- Enhanced Replacement for EL2039

### Applications

- Pulse and Video Amplifiers
- Wideband Amplifiers
- High Speed Sample-Hold Circuits
- RF Oscillators

### Description

The HA-2839 is a wideband, very high slew rate, operational amplifier featuring superior speed and bandwidth characteristics. Bipolar construction, coupled with dielectric isolation, delivers outstanding performance in circuits with a closed loop gain of 10 or greater.

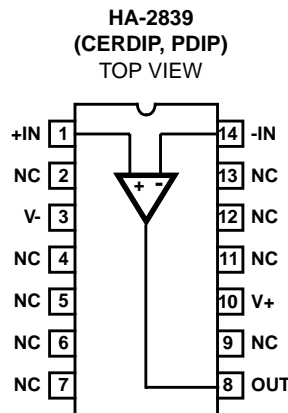
A 625V/ $\mu$ s slew rate and a 600MHz gain bandwidth product ensure high performance in video and RF amplifier designs. Differential gain and phase are a low 0.03% and 0.03 degrees respectively, making the HA-2839 ideal for video applications. A full  $\pm 10V$  output swing, high open loop gain, and outstanding AC parameters, make the HA-2839 an excellent choice for high speed Data Acquisition Systems.

The HA-2839 is available in commercial and industrial temperature ranges, and a choice of packages. For military grade product, refer to the HA-2839/883 data sheet.

### Part Number Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
HA1-2839-5	0 to 75	14 Ld CERDIP	F14.3
HA3-2839-5	0 to 75	14 Ld PDIP	E14.3
HA3-2839-9	-40 to 85	14 Ld PDIP	E14.3

### Pinout



NOTE: No Connection (NC) pins may be tied to a ground plane for better isolation and heat dissipation.

# HA-2839

## Absolute Maximum Ratings

Voltage Between V+ and V- Terminals .....	35V
Differential Input Voltage.....	6V
Output Current .....	50mA

## Operating Conditions

Temperature Range	
HA-2839-5.....	0°C to 75°C
HA-2839-9.....	-40°C to 85°C
Recommended Supply Voltage Range.....	±7V to ±15V

## Thermal Information

Thermal Resistance (Typical, Note 2)	$\theta_{JA}$ (°C/W)	$\theta_{JC}$ (°C/W)
CERDIP Package .....	95	40
PDIP Package .....	80	N/A
Maximum Internal Quiescent Power Dissipation (Note 1)		
Maximum Junction Temperature (Ceramic Package).....	175°C	
Maximum Junction Temperature (Plastic Package) .....	150°C	
Maximum Storage Temperature .....	-65°C to 150°C	
Maximum Lead Temperature (Soldering 10s).....	300°C	

*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:

- Maximum power dissipation with load conditions must be designed to maintain the maximum junction temperature below 175°C for ceramic packages and below 150°C for plastic packages.
- $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

## Electrical Specifications $V_{SUPPLY} = \pm 15V, R_L = 1k\Omega, C_L \leq 10pF$ , Unless Otherwise Specified

PARAMETER	TEMP. (°C)	HA-2839-5, -9			UNITS
		MIN	TYP	MAX	
<b>INPUT CHARACTERISTICS</b>					
Offset Voltage (Note 13)	25	-	0.6	2	mV
	Full	-	2	6	mV
Average Offset Voltage Drift	Full	-	20	-	$\mu V/^\circ C$
Bias Current (Note 13)	25	-	5	14.5	$\mu A$
	Full	-	8	20	$\mu A$
Offset Current	25	-	1	4	$\mu A$
	Full	-	-	8	$\mu A$
Input Resistance	25	-	10	-	k $\Omega$
Input Capacitance	25	-	1	-	pF
Common Mode Range	Full	±10	-	-	V
Input Noise Voltage (f = 1kHz, $R_{SOURCE} = 0\Omega$ , Note 13)	25	-	6	-	$nV/\sqrt{Hz}$
Input Noise Current (f = 1kHz, $R_{SOURCE} = 10k\Omega$ , Note 13)	25	-	6	-	$pA/\sqrt{Hz}$
<b>TRANSFER CHARACTERISTICS</b>					
Large Signal Voltage Gain (Note 3)	25	20	25	-	kV/V
	Full	15	20	-	kV/V
Common-Mode Rejection Ratio (Notes 4, 13)	Full	75	80	-	dB
Minimum Stable Gain	25	10	-	-	V/V
Gain Bandwidth Product (Notes 5, 12, 13)	25	-	600	-	MHz
<b>OUTPUT CHARACTERISTICS</b>					
Output Voltage Swing (Notes 3, 13)	Full	±10	-	-	V
Output Current (Notes 3, 13)	Full	±10	±20	-	mA
Output Resistance	25	-	30	-	$\Omega$
Full Power Bandwidth (Notes 3, 7)	25	8.7	10	-	MHz
Differential Gain (Notes 6, 11)	25	-	0.03	-	%
Differential Phase (Notes 6, 11)	25	-	0.03	-	Degrees
Harmonic Distortion (Notes 6, 13, 14)	25	-	-79	-	dBc

# HA-2839

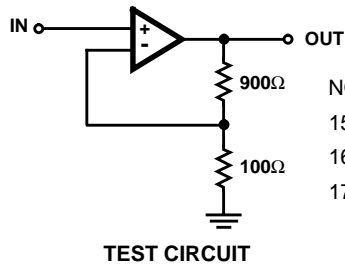
## Electrical Specifications $V_{SUPPLY} = \pm 15V$ , $R_L = 1k\Omega$ , $C_L \leq 10pF$ , Unless Otherwise Specified (Continued)

PARAMETER	TEMP. (°C)	HA-2839-5, -9			UNITS
		MIN	TYP	MAX	
<b>TRANSIENT RESPONSE</b> (Note 8)					
Rise Time	25	-	4	-	ns
Overshoot	25	-	20	-	%
Slew Rate (Notes 3, 10, 13)	25	550	625	-	V/ $\mu$ s
Settling Time: 10V Step to 0.1%	25	-	180	-	ns
<b>POWER REQUIREMENTS</b>					
Supply Current (Note 13)	Full	-	13	15	mA
Power Supply Rejection Ratio (Notes 9, 13)	Full	75	90	-	dB

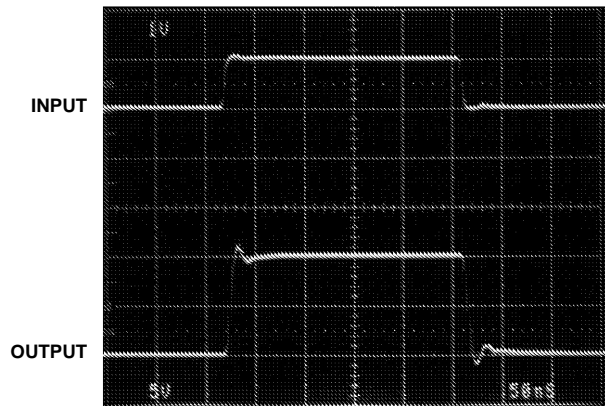
**NOTES:**

3.  $R_L = 1k\Omega$ ,  $V_O = \pm 10V$ , 0V to  $\pm 10V$  for slew rate.
4.  $V_{CM} = \pm 10V$ .
5.  $V_O = 90mV$ .
6.  $A_V = +10$ .
7. Full Power Bandwidth guaranteed based on slew rate measurement using:  $FPBW = \frac{\text{Slew Rate}}{2\pi V_{PEAK}}$ ,  $V_{PEAK} = 10V$ .
8. Refer to Test Circuit section of data sheet.
9.  $V_{SUPPLY} = \pm 10V$  to  $\pm 20V$ .
10. This parameter is not tested. The limits are guaranteed based on lab characterization, and reflect lot-to-lot variation.
11. Differential gain and phase are measured with a VM700A video tester, using a NTC-7 composite VITS.
12.  $A_V = +100$ .
13. See "Typical Performance Curves" for more information.
14.  $V_O = 2V_{P-P}$ ,  $f = 1MHz$ .

### Test Circuit and Waveforms

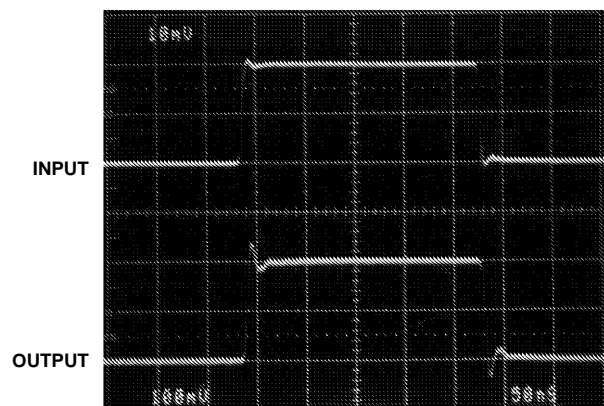


- NOTES:**
15.  $V_S = \pm 15V$ .
  16.  $A_V = +10$ .
  17.  $C_L < 10pF$ .



Input = 1V/Div.; Output = 5V/Div., 50ns/Div.

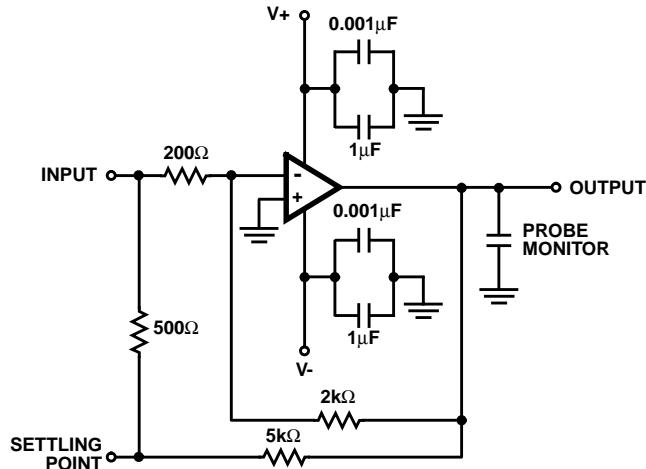
**LARGE SIGNAL RESPONSE**



Input = 10mV/Div.; Output = 100mV/Div., 50ns/Div.

**SMALL SIGNAL RESPONSE**

Test Circuit and Waveforms (Continued)



SETTLING TIME TEST CIRCUIT

NOTES:

18.  $A_V = -10$ .
19. Load Capacitance should be less than 10pF.
20. It is recommended that resistors be carbon composition and that feedback and summing network ratios be matched to 0.1%.
21. SETTILING POINT (Summing Node) capacitance should be less than 10pF. For optimum settling time results, it is recommended that the test circuit be constructed directly onto the device pins. A Tektronix 568 Sampling Oscilloscope with S-3A sampling heads is recommended as a settle point monitor.

Typical Performance Curves  $T_A = 25^\circ\text{C}$ ,  $V_{\text{SUPPLY}} = \pm 15\text{V}$ ,  $R_L = 1\text{k}\Omega$ ,  $C_L < 10\text{pF}$ , Unless Otherwise Specified

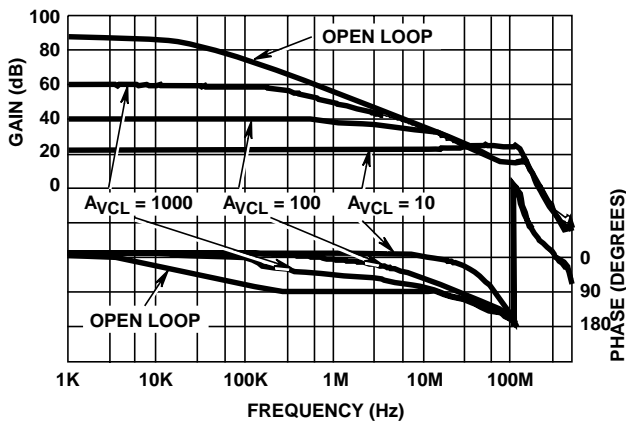


FIGURE 1. FREQUENCY RESPONSE FOR VARIOUS GAINS

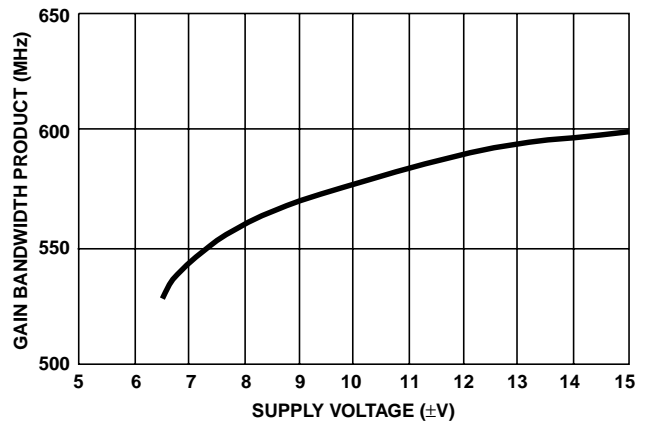


FIGURE 2. GAIN BANDWIDTH PRODUCT vs SUPPLY VOLTAGE

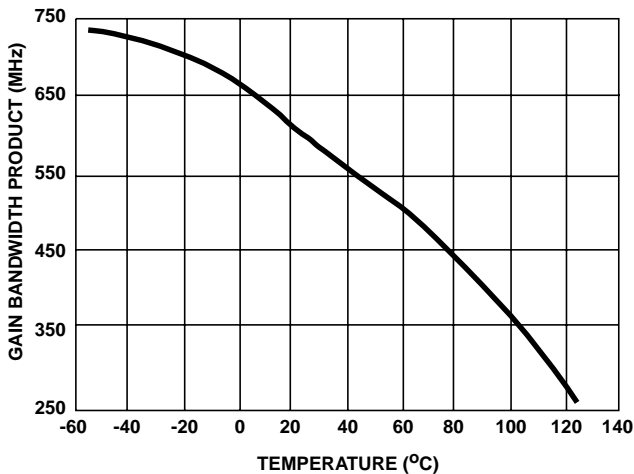


FIGURE 3. GAIN BANDWIDTH PRODUCT vs TEMPERATURE

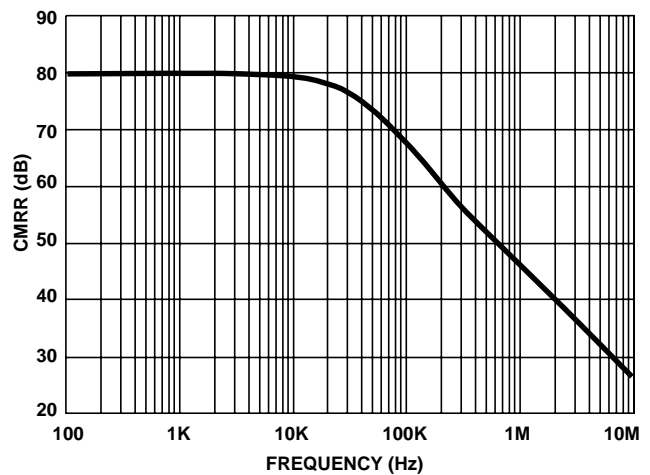


FIGURE 4. CMRR vs FREQUENCY

**Typical Performance Curves**  $T_A = 25^\circ\text{C}$ ,  $V_{\text{SUPPLY}} = \pm 15\text{V}$ ,  $R_L = 1\text{k}\Omega$ ,  $C_L < 10\text{pF}$ , Unless Otherwise Specified (Continued)

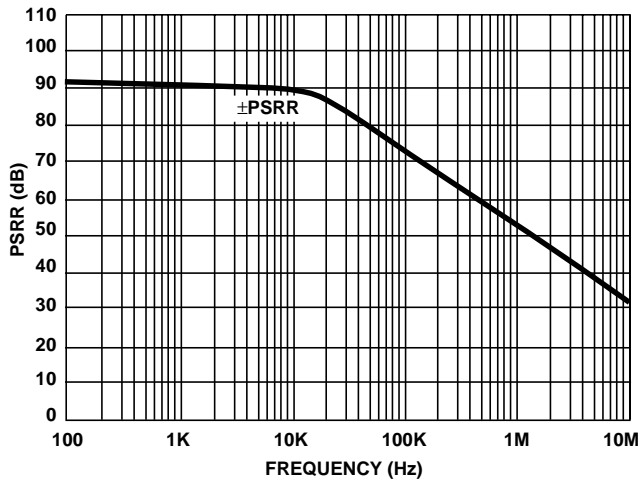


FIGURE 5. PSRR vs FREQUENCY

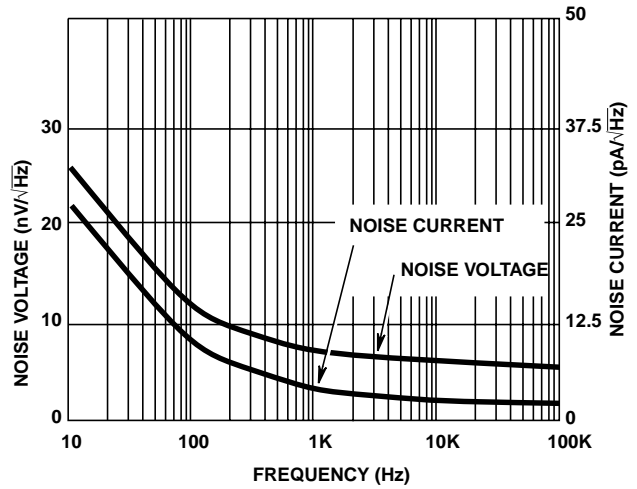


FIGURE 6. INPUT NOISE vs FREQUENCY

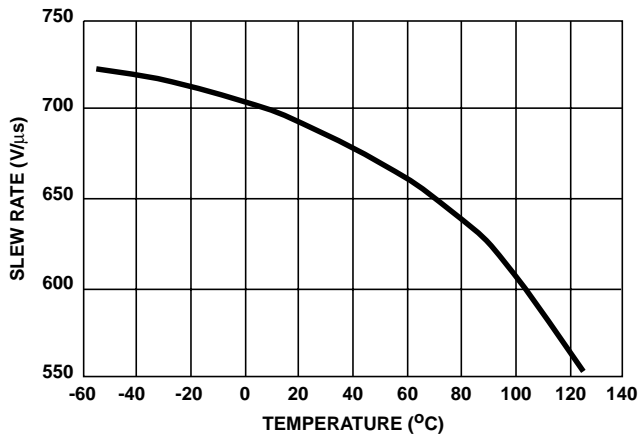


FIGURE 7. SLEW RATE vs TEMPERATURE

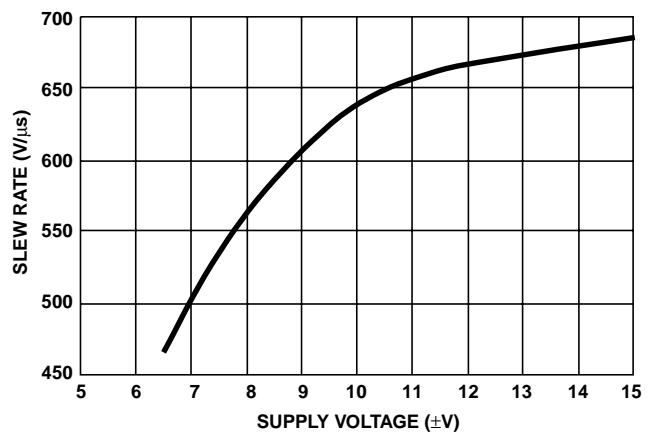


FIGURE 8. SLEW RATE vs SUPPLY VOLTAGE

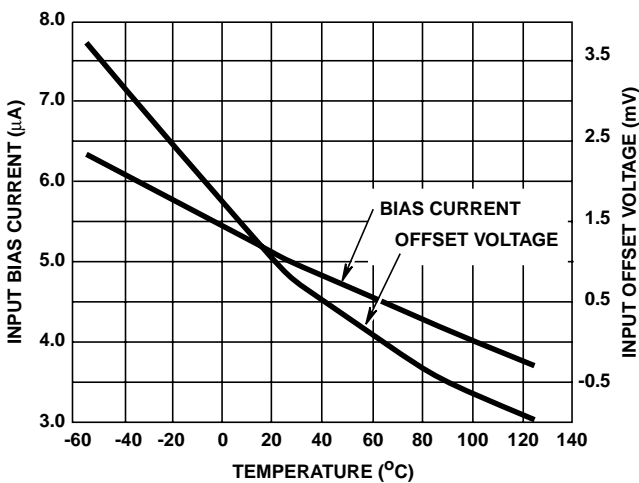


FIGURE 9. INPUT OFFSET VOLTAGE AND INPUT BIAS CURRENT vs TEMPERATURE

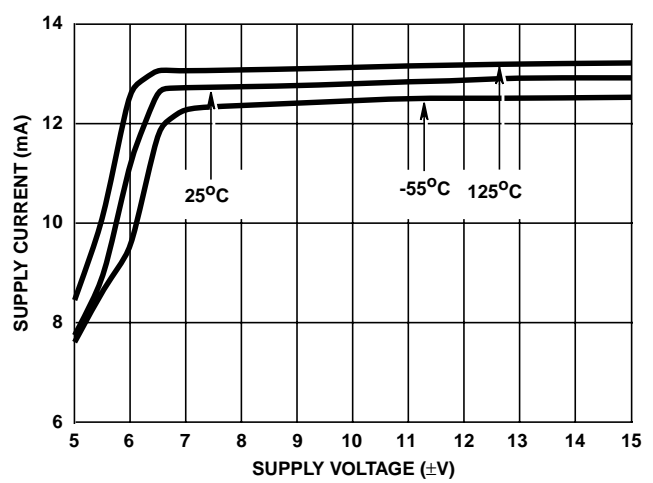


FIGURE 10. SUPPLY CURRENT vs SUPPLY VOLTAGE

**Typical Performance Curves**  $T_A = 25^\circ\text{C}$ ,  $V_{\text{SUPPLY}} = \pm 15\text{V}$ ,  $R_L = 1\text{k}\Omega$ ,  $C_L < 10\text{pF}$ , Unless Otherwise Specified (Continued)

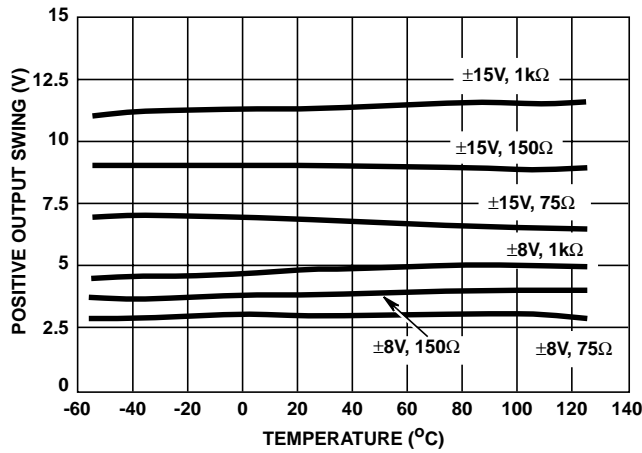


FIGURE 11. POSITIVE OUTPUT SWING vs TEMPERATURE

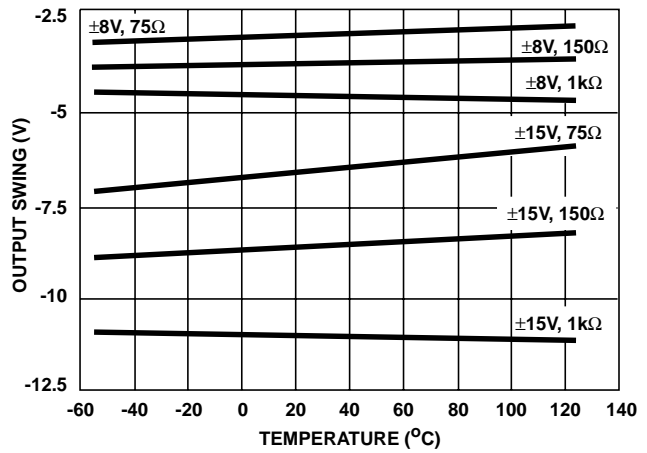


FIGURE 12. NEGATIVE OUTPUT SWING vs TEMPERATURE

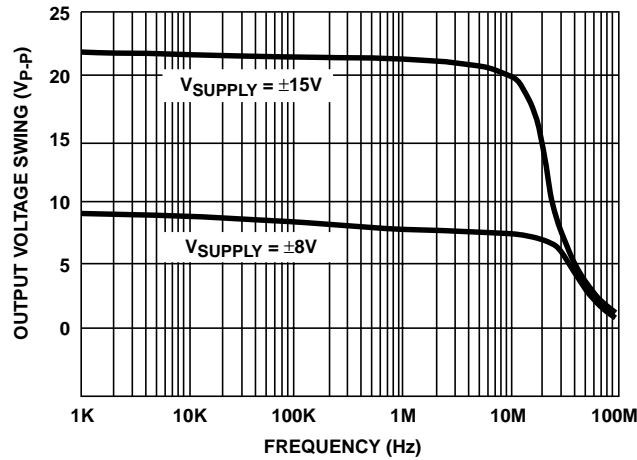


FIGURE 13. MAXIMUM UNDISTORTED OUTPUT SWING vs FREQUENCY

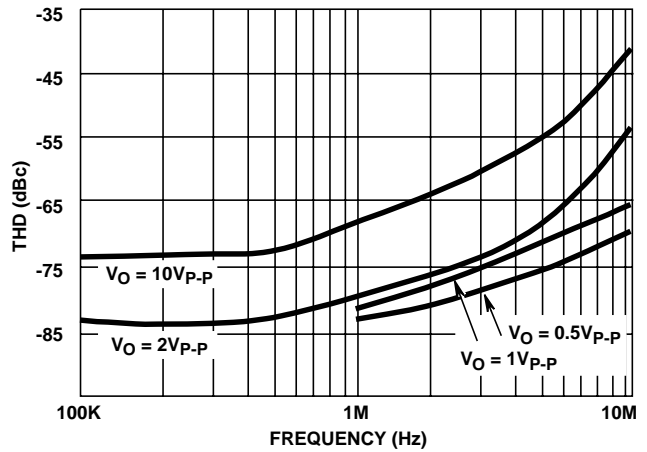


FIGURE 14. TOTAL HARMONIC DISTORTION vs FREQUENCY

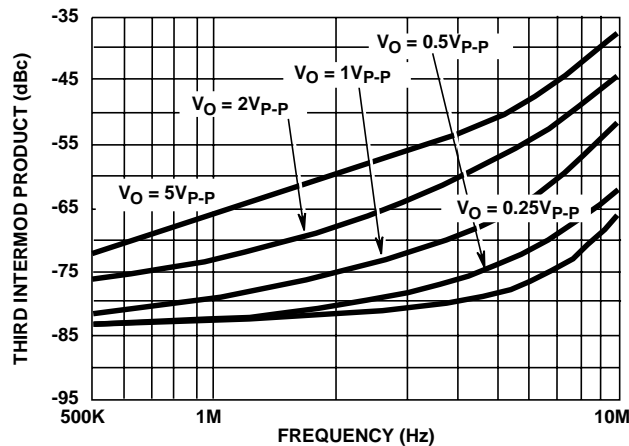


FIGURE 15. INTERMODULATION DISTORTION vs FREQUENCY (TWO TONE)

# HA-2839

## Die Characteristics

### DIE DIMENSIONS:

65 mils x 52 mils x 19 mils  
1650 $\mu$ m x 1310 $\mu$ m x 483 $\mu$ m

### METALLIZATION:

Type: Aluminum, 1% Copper  
Thickness: 16k $\text{\AA}$   $\pm$  2k $\text{\AA}$

### SUBSTRATE POTENTIAL

V-

### PASSIVATION:

Type: Nitride over Silox  
Silox Thickness: 12k $\text{\AA}$   $\pm$  2k $\text{\AA}$   
Nitride thickness: 3.5k $\text{\AA}$   $\pm$  1k $\text{\AA}$

### TRANSISTOR COUNT:

34

### PROCESS:

High Frequency Bipolar Dielectric Isolation

## Metallization Mask Layout

HA-2839

