

May 1999

### Features

- Input Limiting Voltage At 10.7MHz . . . . . 400 $\mu$ V
- Input Limiting Voltage At 4.5, 5.5MHz . . . . . 250 $\mu$ V
- Typical AM Rejection At 10.7MHz . . . . . 45dB
- Provision for Output from 3-Stage IF Amplifier Section
- Low Harmonic Distortion
- Quadrature Detection Permits Simplified Single-Coil Tuning
- Extremely Low AFC Voltage Drift Over Full Operating Temperature Range
- Minimum Number of External Components Required

### Applications

- FM IF Sound
- TV Sound IF

### Description

The CA2111A provides a multistage wideband amplifier-limiter, a quadrature detector, and an emitter-follower output stage. This device is designed for use in FM receivers and in the sound IF sections of TV receivers. In addition, an output terminal is provided which allows the use of the amplifier-limiter as a straight 60dB wideband amplifier.

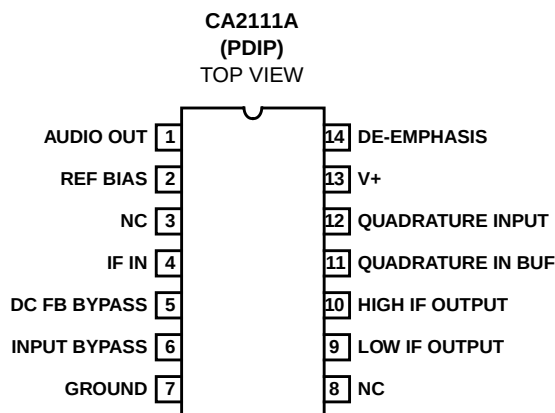
The amplifier-limiter features the excellent limiting characteristic of 3 cascaded differential amplifiers. The quadrature detector requires only one coil in the associated outboard circuit and therefore, tuning is a simple procedure.

A unique feature of the CA2111A is its exceptionally low AFC voltage drift over the full operating-temperature range.

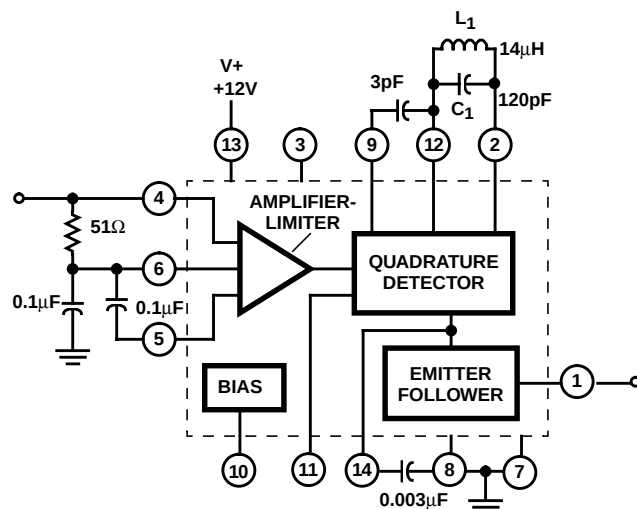
### Part Number Information

| PART NUMBER | TEMP. RANGE ( $^{\circ}$ C) | PACKAGE    | PKG. NO. |
|-------------|-----------------------------|------------|----------|
| CA2111AE    | -40 to 85                   | 14 Ld PDIP | E14.3    |

### Pinout



### Block Diagram



# CA2111A

## Absolute Maximum Ratings $T_A = 25^{\circ}\text{C}$

Supply Voltage ( $V_+$  to  $V_-$ ) . . . . . 16V

## Operating Conditions

Temperature Range . . . . .  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$

Supply Voltage Range (Typical) . . . . . 8V to 12V

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.  $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

## Thermal Information

Thermal Resistance (Typical, Note 1)

$\theta_{JA}$  ( $^{\circ}\text{C}/\text{W}$ )

PDIP Package . . . . . 150

Maximum Junction Temperature (Plastic Package) . . . . .  $150^{\circ}\text{C}$

Maximum Storage Temperature Range . . . . .  $-65^{\circ}\text{C}$  to  $150^{\circ}\text{C}$

Maximum Lead Temperature (Soldering 10s) . . . . .  $300^{\circ}\text{C}$

## Electrical Specifications $T_A = 25^{\circ}\text{C}$ Unless Otherwise Specified

| PARAMETER                        | SYMBOL            | TEST CONDITIONS        | MIN | TYP  | MAX | UNITS            |
|----------------------------------|-------------------|------------------------|-----|------|-----|------------------|
| Terminal 1 DC Voltage            | $V_1$             | $V_+ = 12\text{V}$     | -   | 5.4  | -   | V                |
|                                  |                   | $V_+ = 8\text{V}$      | -   | 3.7  | -   | V                |
| Terminals 4, 5, 6, 10 DC Voltage | $V_{4, 5, 6, 10}$ | $V_+ = 8\text{V}$      | -   | 1.35 | -   | V                |
| Terminals 2, 12 DC Voltage       | $V_{2, 12}$       | $V_+ = 8\text{V}$      | -   | 3.5  | -   | V                |
| Supply Current, Pin 13           | $I_{13}$          | $V_+ = 8\text{V}$      | -   | 14   | -   | mA               |
|                                  |                   | $V_+ = 12\text{V}$     | -   | 16   | -   | mA               |
| Amplifier Input Resistance       | $R_4$             | $f_O = 10.7\text{MHz}$ | -   | 7    | -   | $\text{k}\Omega$ |
| Amplifier Input Capacitance      | $C_4$             |                        | -   | 11   | -   | pF               |
| Detector Input Resistance        | $R_{12}$          |                        | -   | 70   | -   | $\text{k}\Omega$ |
| Detector Input Capacitance       | $C_{12}$          |                        | -   | 2.7  | -   | pF               |
| Amplifier Output Resistance      | $R_{10}$          |                        | -   | 60   | -   | $\Omega$         |
| Detector Output Resistance       | $R_1$             |                        | -   | 200  | -   | $\Omega$         |
| De-emphasis Resistance           | $R_{14}$          |                        | -   | 8.8  | -   | $\text{k}\Omega$ |

### DYNAMIC CHARACTERISTICS $f_O = 10.7\text{MHz}$ , $\Delta f = \pm 75\text{kHz}$ , $V_+ = 8\text{V}$ , FM Modulation Frequency = 400Hz, Source Resistance = 50 $\Omega$

|                                  |              |                                                    |   |     |     |                            |
|----------------------------------|--------------|----------------------------------------------------|---|-----|-----|----------------------------|
| Input Limiting Threshold Voltage | $V_{I(LIM)}$ |                                                    | - | 400 | 600 | $\mu\text{V}_{\text{RMS}}$ |
| AM Rejection                     | AMR          | $V_I = 10\text{mV}_{\text{RMS}}$ , 100% FM, 30% AM | - | 37  | -   | dB                         |
| Amplifier Voltage Gain           | $A_V$        | $V_I = 50\mu\text{V}_{\text{RMS}}$                 | - | 55  | -   | dB                         |
| Detector Recovered Audio Output  | $V_{O(AF)}$  | $V_I = 10\text{mV}_{\text{RMS}}$                   | - | 0.3 | -   | $\text{V}_{\text{RMS}}$    |
| Total Harmonic Distortion        | THD          | $V_I = 10\text{mV}_{\text{RMS}}$                   | - | 1   | -   | %                          |

### DYNAMIC CHARACTERISTICS $f_O = 10.7\text{MHz}$ , $\Delta f = \pm 75\text{kHz}$ , $V_+ = 12\text{V}$ , FM Modulation Frequency = 400Hz, Source Resistance = 50 $\Omega$

|                                  |              |                                                    |   |      |     |                            |
|----------------------------------|--------------|----------------------------------------------------|---|------|-----|----------------------------|
| Input Limiting Threshold Voltage | $V_{I(LIM)}$ |                                                    | - | 400  | 600 | $\mu\text{V}_{\text{RMS}}$ |
| AM Rejection                     | AMR          | $V_I = 10\text{mV}_{\text{RMS}}$ , 100% FM, 30% AM | - | 45   | -   | dB                         |
| Amplifier Voltage Gain           | $A_V$        | $V_I = 50\mu\text{V}_{\text{RMS}}$                 | - | 55   | -   | dB                         |
| Detector Recovered Audio Output  | $V_{O(AF)}$  | $V_I = 10\text{mV}_{\text{RMS}}$                   | - | 0.48 | -   | $\text{V}_{\text{RMS}}$    |
| Total Harmonic Distortion        | THD          | $V_I = 10\text{mV}_{\text{RMS}}$                   | - | 1    | -   | %                          |

### DYNAMIC CHARACTERISTICS $f_O = 4.5\text{MHz}$ , $\Delta f = \pm 25\text{kHz}$ , $V_+ = 12\text{V}$ , FM Modulation Frequency = 400Hz, Source Resistance = 50 $\Omega$

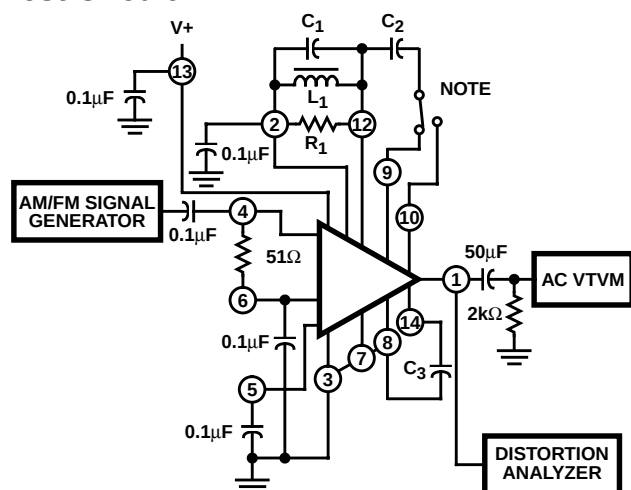
|                                  |              |                                                    |   |     |     |                            |
|----------------------------------|--------------|----------------------------------------------------|---|-----|-----|----------------------------|
| Input Limiting Threshold Voltage | $V_{I(LIM)}$ |                                                    | - | 250 | 400 | $\mu\text{V}_{\text{RMS}}$ |
| AM Rejection                     | AMR          | $V_I = 10\text{mV}_{\text{RMS}}$ , 100% FM, 30% AM | - | 36  | -   | dB                         |

## CA2111A

### Electrical Specifications $T_A = 25^{\circ}\text{C}$ Unless Otherwise Specified (Continued)

| PARAMETER                                                                                                                                                                   | SYMBOL              | TEST CONDITIONS                                    | MIN | TYP  | MAX | UNITS                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------------------------------|-----|------|-----|----------------------------|
| Amplifier Voltage Gain                                                                                                                                                      | $A_V$               | $V_I = 50\mu\text{V}_{\text{RMS}}$                 | -   | 60   | -   | dB                         |
| Detector Recovered Audio Output                                                                                                                                             | $V_{O(\text{AF})}$  | $V_I = 10\text{mV}_{\text{RMS}}$                   | -   | 0.72 | -   | $\text{V}_{\text{RMS}}$    |
| Total Harmonic Distortion                                                                                                                                                   | THD                 | $V_I = 10\text{mV}_{\text{RMS}}$                   | -   | 1.5  | -   | %                          |
| <b>DYNAMIC CHARACTERISTICS</b> $f_O = 5.5\text{MHz}$ , $\Delta f = \pm 50\text{kHz}$ , $V_+ = 12\text{V}$ , FM Modulation Frequency = 400Hz, Source Resistance = $50\Omega$ |                     |                                                    |     |      |     |                            |
| Input Limiting Threshold Voltage                                                                                                                                            | $V_{I(\text{LIM})}$ |                                                    | -   | 250  | 400 | $\mu\text{V}_{\text{RMS}}$ |
| AM Rejection                                                                                                                                                                | AMR                 | $V_I = 10\text{mV}_{\text{RMS}}$ , 100% FM, 30% AM | -   | 40   | -   | dB                         |
| Amplifier Voltage Gain                                                                                                                                                      | $A_V$               | $V_I = 50\mu\text{V}_{\text{RMS}}$                 | -   | 60   | -   | dB                         |
| Detector Recovered Audio Output                                                                                                                                             | $V_{O(\text{AF})}$  | $V_I = 10\text{mV}_{\text{RMS}}$                   | -   | 1.2  | -   | $\text{V}_{\text{RMS}}$    |
| Total Harmonic Distortion                                                                                                                                                   | THD                 | $V_I = 10\text{mV}_{\text{RMS}}$                   | -   | 3    | -   | %                          |

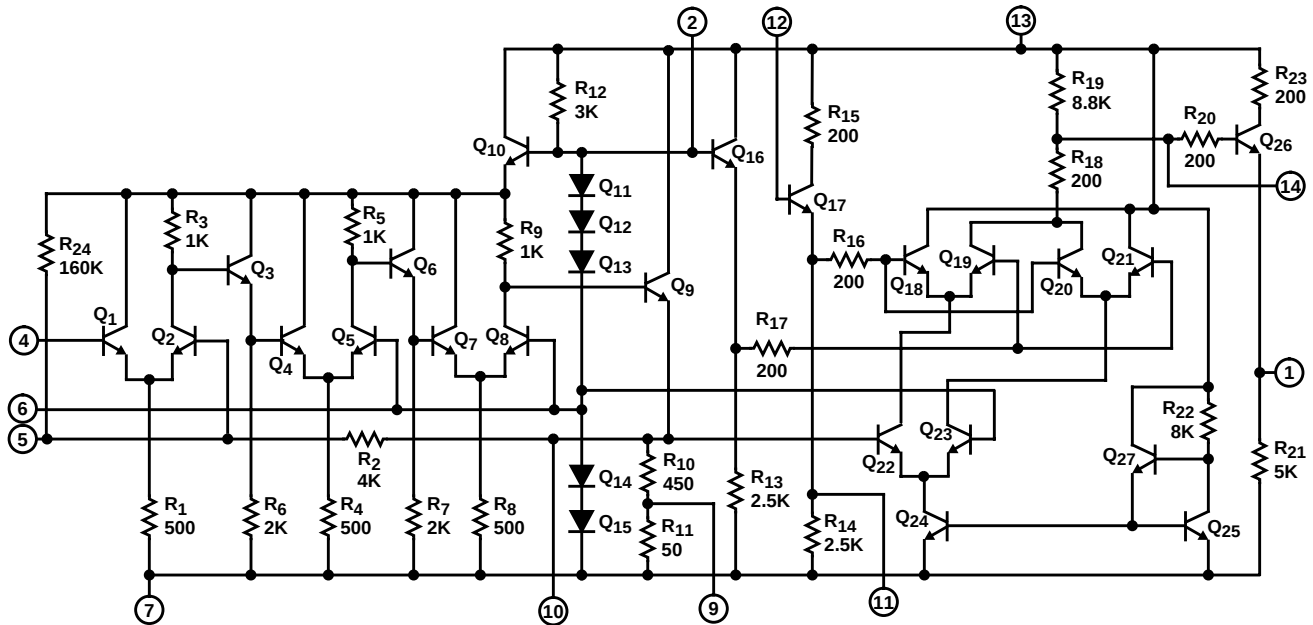
### Test Circuit



NOTE: Input to the quadrature coil can be from either terminal 9 or terminal 10. Terminal 9 is normally used because it lessens the possibility of overloads during tuning. The use of terminal 10 increases the limiting sensitivity significantly and has been used successfully in these tests.

| COMPONENT VALUES |               |       |                  |     |       |               | DETECTOR TRANSFER CHARACTERISTICS |            |
|------------------|---------------|-------|------------------|-----|-------|---------------|-----------------------------------|------------|
| $f$              | $L_1$         | $C_1$ | $R_1$            | $Q$ | $C_2$ | $C_3$         | UPPER PEAK                        | LOWER PEAK |
| MHz              | $\mu\text{H}$ | pF    | $\text{k}\Omega$ | -   | pF    | $\mu\text{F}$ | MHz                               | MHz        |
| 4.5              | 14            | 120   | 20               | 30  | 3     | 0.003         | 4.58                              | 4.42       |
| 5.5              | 8             | 100   | 20               | 30  | 3     | 0.003         | 5.63                              | 5.37       |
| 10.7             | 2             | 120   | 3.9              | 20  | 4.7   | 0.01          | 10.9                              | 10.5       |

# Schematic Diagram



## Typical Performance Curves

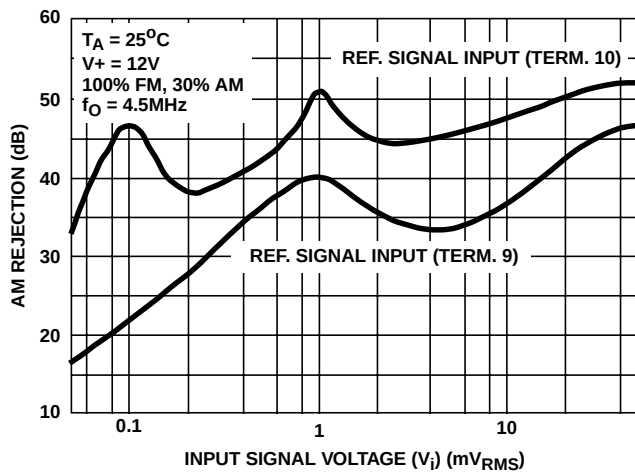


FIGURE 2. AM REJECTION vs INPUT VOLTAGE (AT 4.5MHz)

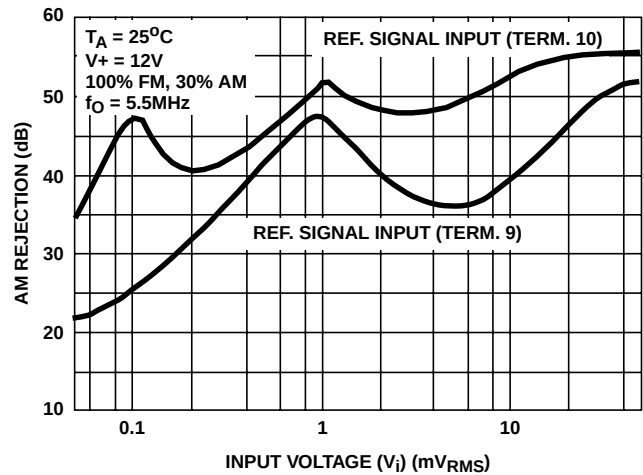


FIGURE 3. AM REJECTION vs INPUT VOLTAGE (AT 5.5MHz)

# Typical Performance Curves (Continued)

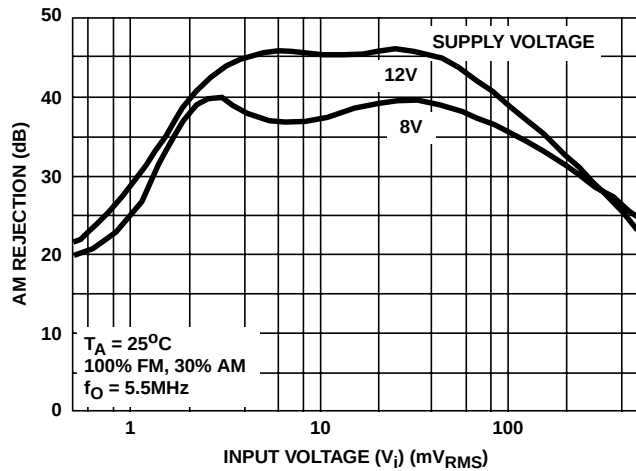


FIGURE 4. AM REJECTION vs INPUT VOLTAGE (AT 10.7MHz)

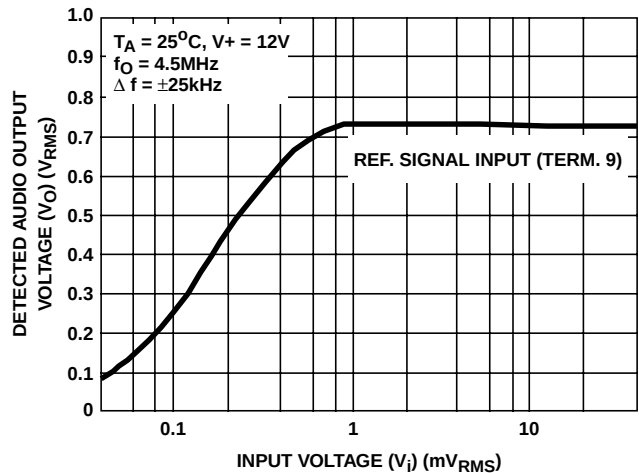


FIGURE 5. DETECTED AUDIO OUTPUT vs INPUT VOLTAGE (4.5MHz)

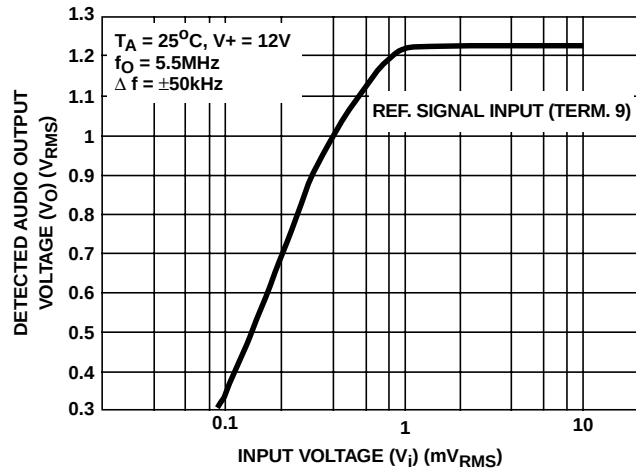


FIGURE 6. DETECTED AUDIO OUTPUT vs INPUT VOLTAGE (AT 5.5MHz)

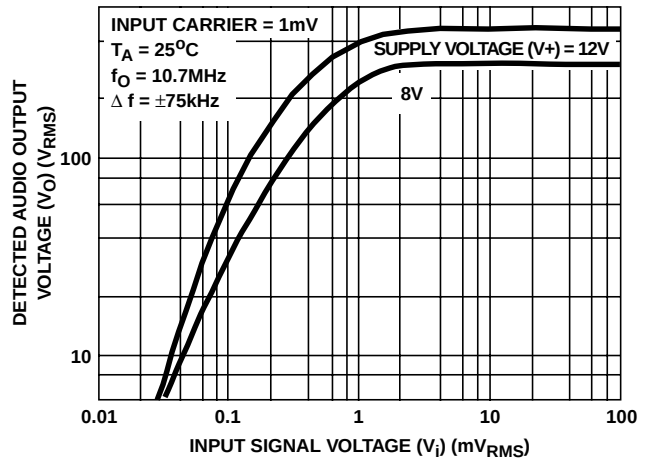


FIGURE 7. DETECTED AUDIO OUTPUT VOLTAGE vs INPUT VOLTAGE (AT 10.7MHz)

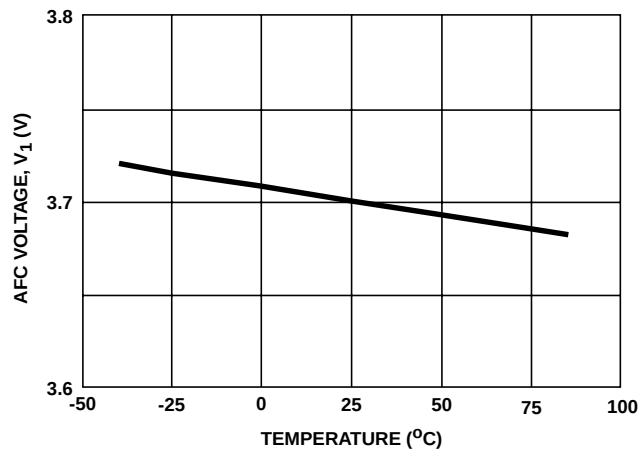


FIGURE 8. AFC VOLTAGE vs AMBIENT TEMPERATURE

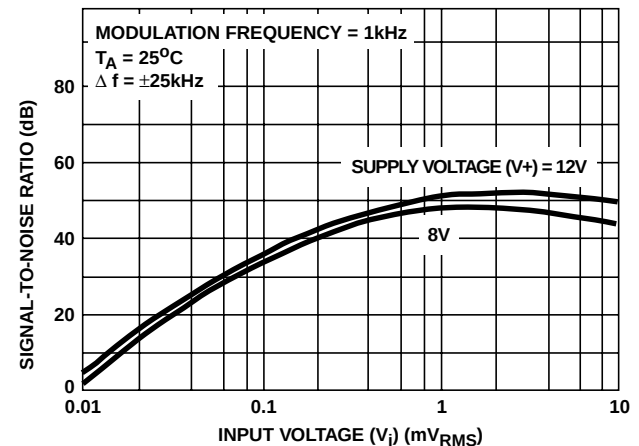


FIGURE 9. SIGNAL-TO-NOISE RATIO vs INPUT VOLTAGE