

## LOW VOLTAGE AUDIO POWER AMPLIFIER

### ■ GENERAL DESCRIPTION

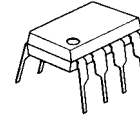
The NJM2113 is a audio power amplifier designed for telephone applications, such as in speakerphones.

Coupling capacitors to the speaker are not required, as it has differential speaker outputs. The closed loop gain is set with two external resistors. A CD pin permit powering down with muting the input signal.

### ■ FEATURES

- Wide Operating Voltage (2~16V)
- Low Operating Current (2.7mA Typ.)
- CD Input to Power Down the IC with Mute
- Low Power-Down Operating Current (72μA Typ.)
- Output Power Exceeds 250mW ( $V^+=6V, R_L=32\Omega$ )
- Gain Adjustable ( $G_{VD}=0\sim 43\text{dB}$ , Voice Band)
- Package Outline DMP8, DIP8, SIP8, SSOP8, VSP8, EMP8
- Bipolar Technology

### ■ PACKAGE OUTLINE



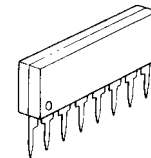
NJM2113D



NJM2113M



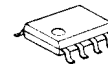
NJM2113V



NJM2113L



NJM2113R

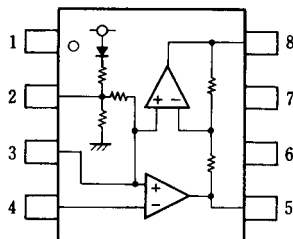


NJM2113E

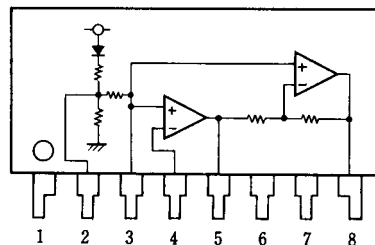
### ■ RECOMMENDED OPERATING CONDITIONS

- Load Impedance  $R_L$  8~200Ω
- Differential Gain  $G_{VD}$  0~43dB (5kHz bandwidth)
- Input Voltage at CD  $V_{CD}$  0~ $V^+V_{dc}$

### ■ PIN CONFIGURATION



NJM2113D  
NJM2113M  
NJM2113V  
NJM2113R

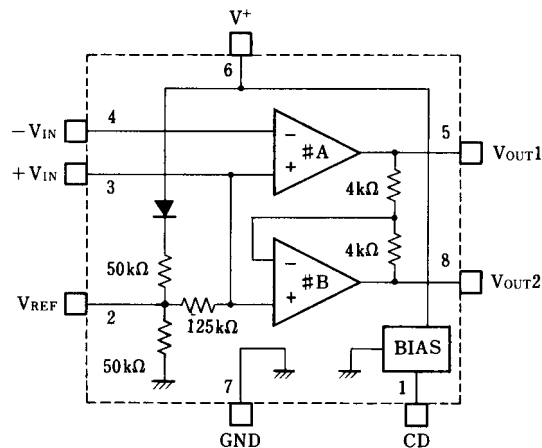


NJM2113L

### PIN FUNCTION

1. CD
2.  $V_{REF}$
3.  $+V_{IN}$
4.  $-V_{IN}$
5.  $V_{OUT1}$
6.  $V^+$
7. GND
8.  $V_{OUT2}$

### ■ BLOCK DIAGRAM



# NJM2113

## ■ ABSOLUTE MAXIMUM RATINGS

( Ta=25°C )

| PARAMETER                   | SYMBOL           | RATINGS   | UNIT |
|-----------------------------|------------------|---|------|
| Supply Voltage              | V <sup>+</sup>   | +18   | V    |
| Output Peak Current         | I <sub>OP</sub>  | ± 250   | mA   |
| Input Voltage Range         | V <sub>IN</sub>  | ( 1~4pin )-0.3 to V <sup>+</sup> +0.3<br>( 5,8pin )-0.3 to V <sup>+</sup> +0.3<br>( when Power-Down )             | V    |
| Power Dissipation           | P <sub>D</sub>   | ( DIP8 ) 500<br>( SIP8 ) 800<br>( DMP8 ) 500 ( note1 )<br>( SSOP8 ) 360 ( note1 )<br>( VSP8 ) 320<br>( EMP8 ) 300 | mW   |
| Operating Temperature Range | T <sub>opr</sub> | -20~+75   | °C   |
| Storage Temperature Range   | T <sub>stg</sub> | -40~+125  | °C   |

( note1 ) Mounted on PC Board

## ■ ELECTRICAL CHARACTERISTICS

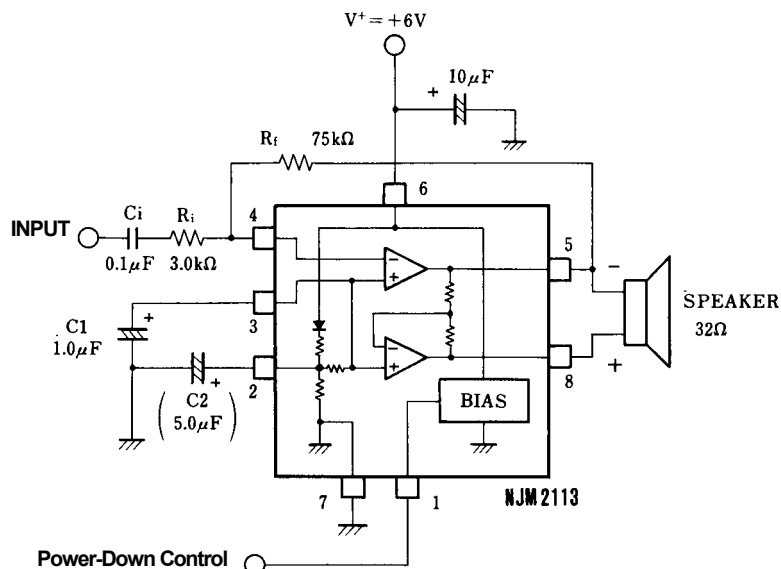
( V<sup>+</sup>=6V, Ta=25°C, unless otherwise specified )

| PARAMETER   | SYMBOL           | TEST CONDITION   | MIN.  | TYP.                | MAX.           | UNIT |
|---|------------------|--|-------|---------------------|----------------|------|
| Operating Current<br>( no signal )  | I <sub>CC1</sub> | V <sup>+</sup> =3.0V, R <sub>L</sub> =∞, 1pin=0.8V                                     | -     | 2.7                 | 4.0            | mA   |
|   | I <sub>CC2</sub> | V <sup>+</sup> =16.0V, R <sub>L</sub> =∞, 1pin=0.8V                                    | -     | 3.4                 | 5.0            | mA   |
|   | I <sub>CCD</sub> | V <sup>+</sup> =3.0V, R <sub>L</sub> =∞, 1pin=2.0V                                     | -     | 72                  | 100            | μA   |
| Open Loop Gain  | A <sub>V1</sub>  | Amplifier#A, f<100Hz   | 77    | 83                  | -              | dB   |
| Closed Loop Gain  | A <sub>V2</sub>  | Amplifier#B, f=1kHz, R <sub>L</sub> =32Ω   | -0.35 | 0                   | +0.35          | dB   |
| Output Power<br>( note2 )   | P <sub>O1</sub>  | V <sup>+</sup> =3.0V, R <sub>L</sub> =16Ω, THD≤10%                                     | 55    | -                   | -              | mW   |
|   | P <sub>O2</sub>  | V <sup>+</sup> =6.0V, R <sub>L</sub> =32Ω, THD≤10%                                     | 250   | -                   | -              | mW   |
|   | P <sub>O3</sub>  | V <sup>+</sup> =12.0V, R <sub>L</sub> =100Ω, THD≤10% ( note3 )                         | 400   | -                   | -              | mW   |
| Total Harmonic Distortion<br>( f=1kHz )   | THD1             | V <sup>+</sup> =6V, R <sub>L</sub> =32Ω, P <sub>O</sub> =125mW, G <sub>VD</sub> =34dB  | -     | 0.5                 | 1.0            | %    |
|   | THD2             | V <sup>+</sup> ≥3V, R <sub>L</sub> =8Ω, P <sub>O</sub> =20mW, G <sub>VD</sub> =12dB    | -     | 0.5                 | -              | %    |
|   | THD3             | V <sup>+</sup> ≥12V, R <sub>L</sub> =32Ω, P <sub>O</sub> =200mW, G <sub>VD</sub> =34dB | -     | 0.6                 | -              | %    |
| Power Supply Rejection Ratio<br>( V <sup>+</sup> =6.0V, ΔV <sup>+</sup> =3.0V ) | PSRR1            | C1=∞, C2=0.01μF, DC  | 50    | -                   | -              | dB   |
|   | PSRR2            | C1=0.1μF, C2=0, f=1kHz   | -     | 12                  | -              | dB   |
|   | PSRR3            | C1=1.0μF, C2=5.0μF, f=1kHz   | -     | 52                  | -              | dB   |
| Mute Attenuation  | MAT              | f=1kHz~20kHz, 1pin=2.0V  | -     | 70                  | -              | dB   |
| Output Voltage<br>( R <sub>f</sub> =75kΩ, DC )                                  | V <sub>O1</sub>  | V <sup>+</sup> =3.0V, R <sub>L</sub> =16Ω  | 1.00  | 1.18                | 1.25           | V    |
|   | V <sub>O2</sub>  | V <sup>+</sup> =6.0V   | -     | 2.68                | -              | V    |
|   | V <sub>O3</sub>  | V <sup>+</sup> =12.0V  | -     | 5.71                | -              | V    |
| Output High Level   | V <sub>OH</sub>  | I <sub>OUT</sub> =-75mA, V <sup>+</sup> =2.0~16.0V                                     | -     | V <sup>+</sup> -1.1 | -              | V    |
| Output Low Level  | V <sub>OL</sub>  | I <sub>OUT</sub> =75mA, V <sup>+</sup> =2.0~16.0V                                      | -     | 0.21                | -              | V    |
| Output DC Offset  | ΔV <sub>O</sub>  | R <sub>f</sub> =75kΩ, R <sub>L</sub> =32Ω, 5pin~8pin                                   | -30   | 0                   | +30            | mV   |
| Input Bias Current<br>Equivalent Resistance                                     | I <sub>B</sub>   | 4pin   | -     | -30                 | -200           | nA   |
|   | R <sub>HIN</sub> | 3pin   | 100   | 150                 | 220            | kΩ   |
|   | R <sub>REF</sub> | 2pin   | 18    | 25                  | 40             | kΩ   |
| CD Input Voltage H  | V <sub>CDH</sub> | 1pin   | 2.0   | -                   | V <sup>+</sup> | V    |
| CD Input Voltage L  | V <sub>CDL</sub> | 1pin   | 0.0   | -                   | 0.8            | V    |
| CD Input Resistance   | R <sub>CD</sub>  | V <sub>CD</sub> =16.0V, 1pin   | 50    | 75                  | 175            | kΩ   |

( note2 ) NJM2113M, NJM2113V : At on PC Board

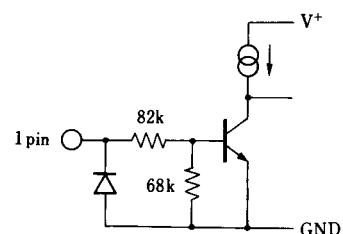
( note3 ) Not specified for NJM2113V, NJM2113R

## ■ APPLICATION CIRCUIT

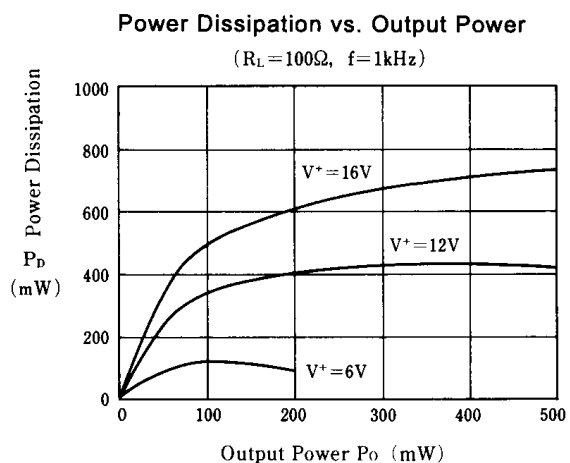
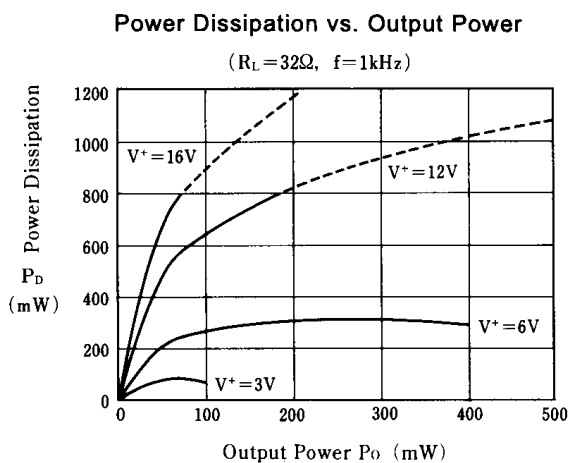
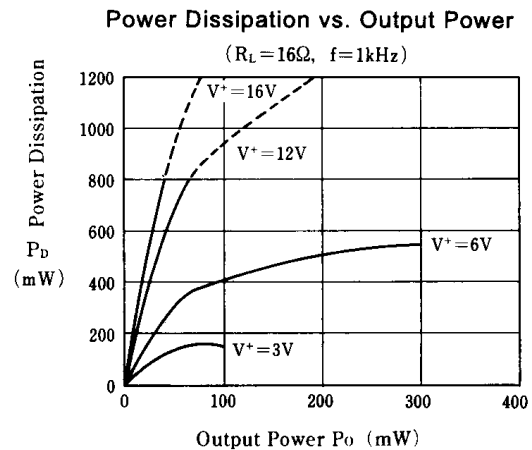
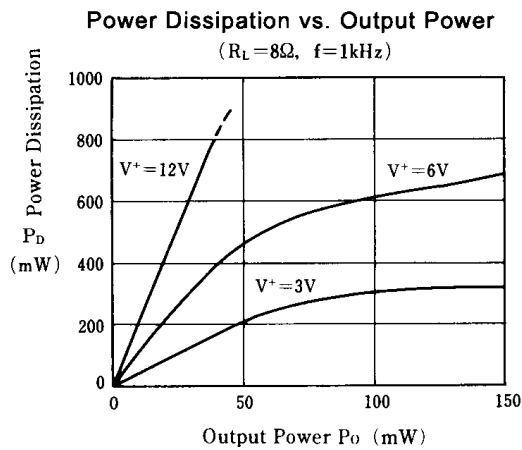
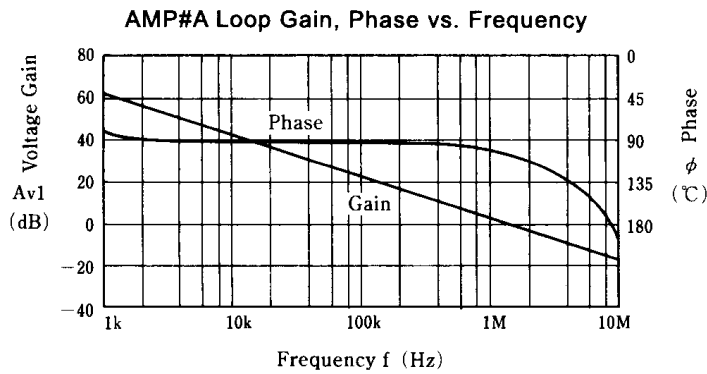


( note )

1. The NJM2113 is active mode during the CD terminal is Low level ( $<0.8V$ ) and it is stand-by mode during the CD terminal is High level ( $>2.0V$ )
2. C1 and C2 improve power supply rejection ratio.  
In case of C1 is enough large, C2 is unnecessary.
3. Please note that the C1 and C2 make slow power rise up to the NJM2113 regardless the external power supply condition.
4. Input current flow on the internal resistor shown in the equivalent circuit of CD terminal.
5. No snubber resistor and capacitor are required normally.  
But the snubber resistor and capacitor are required if the NJM2113 oscillates by Condition of PCB layout, stray capacitor and speaker wire length.



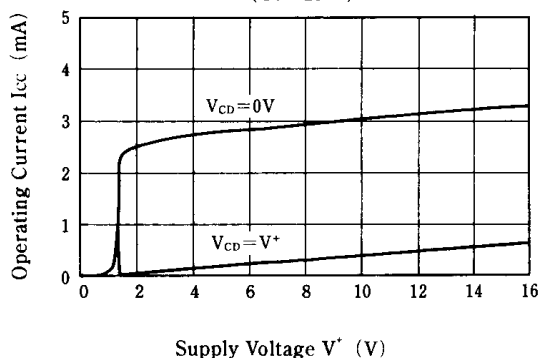
## ■ TYPICAL CHARACTERISTICS



## ■ TYPICAL CHARACTERISTICS

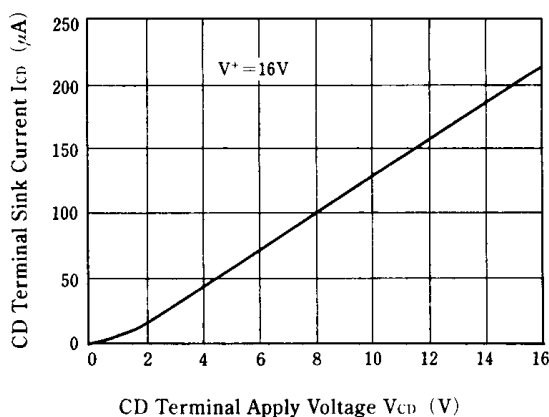
Operating Current vs. Supply Voltage

( $T_a=25^\circ\text{C}$ )



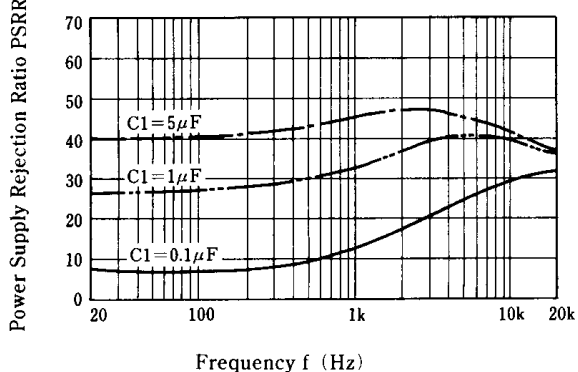
CD Terminal Sink Current vs. Apply Voltage

$V^+=16\text{V}$



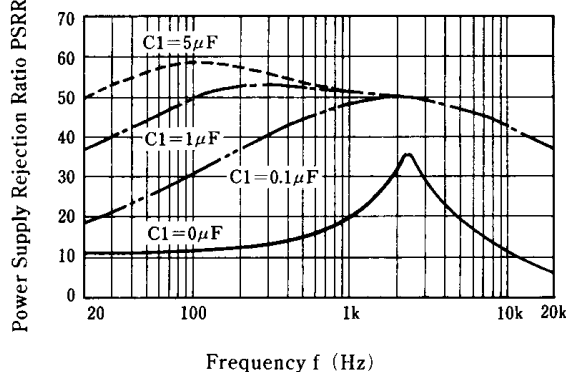
Power Supply Rejection Ratio vs. Frequency

( $C_2=0\mu\text{F}$ )



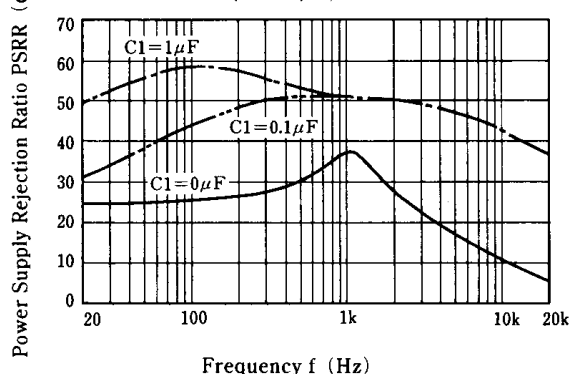
Power Supply Rejection Ratio vs. Frequency

( $C_2=1\mu\text{F}$ )



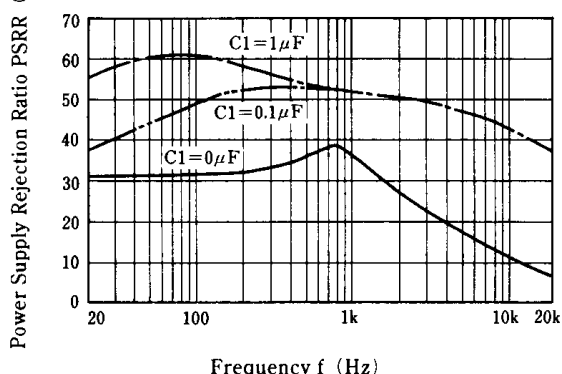
Power Supply Rejection Ratio vs. Frequency

( $C_2=5\mu\text{F}$ )

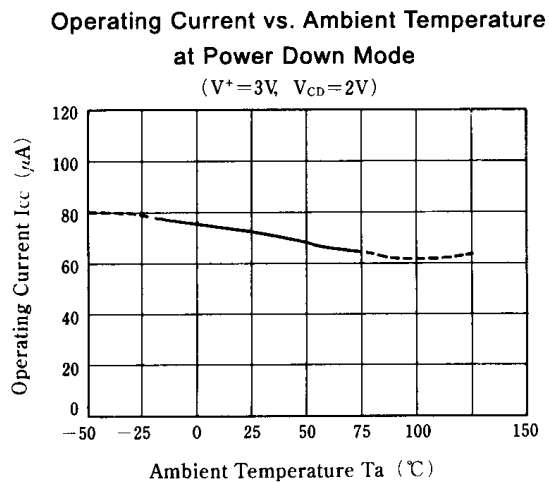
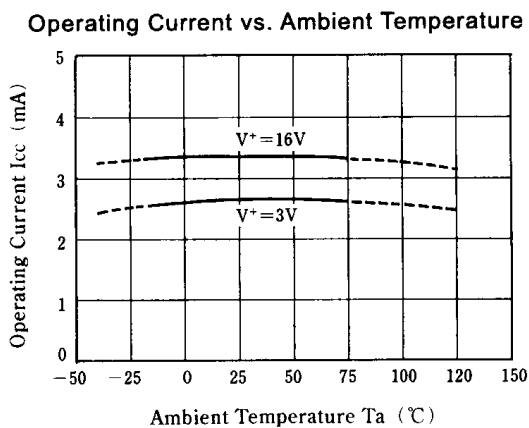
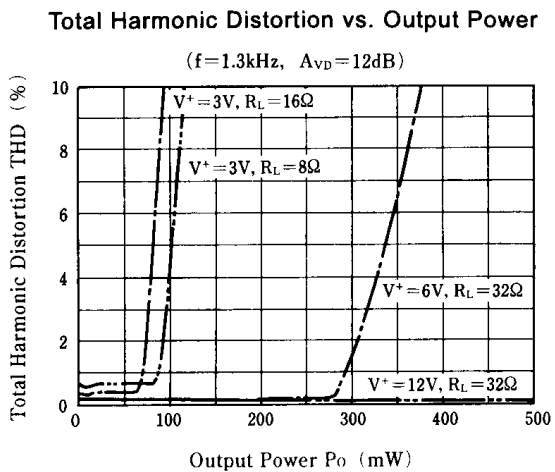
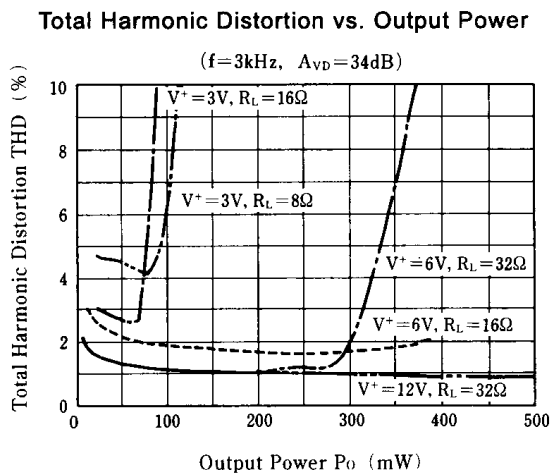
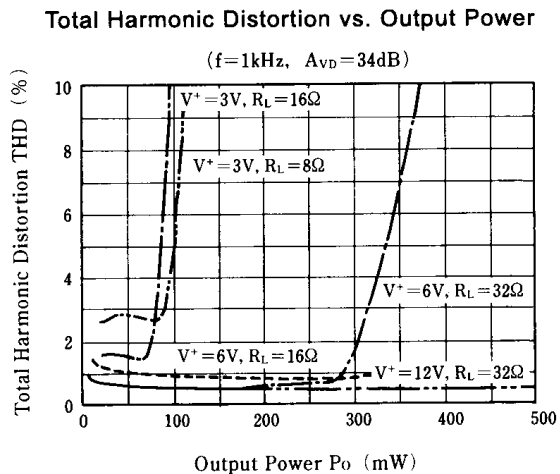


Power Supply Rejection Ratio vs. Frequency

( $C_2=10\mu\text{F}$ )



## ■ TYPICAL CHARACTERISTICS



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