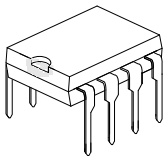
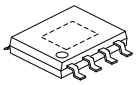
# LM4880

**CMOS IC**

# DUAL 250mW AUDIO POWER AMPLIFIER WITH SHUTDOWN MODE



DIP-8



HSOP-8

## ■ DESCRIPTION

The UTC LM4880 is a dual audio power amplifier capable of delivering typically 250mW per channel of continuous average power to an 8Ω load with 0.1% THD+N using a 5V power supply.

The UTC LM4880 features an externally controlled, low-power consumption shutdown mode, as well as an internal thermal shutdown protection mechanism.

The unity-gain stable UTC LM4880 can be configured by external gain-setting resistors.

## ■ FEATURES

* No bootstrap capacitors or snubber circuits are necessary
* Unity-gain stable
* External gain configuration capability

## ■ APPLICATIONS

* Personal Computers
* CD-ROM Players
* Headphone Amplifier

## ■ ORDERING INFORMATION

| Ordering Number | | Package | Packing |
|---|---|---|---|
| Lead Free | Halogen Free | | |
| LM4880L-D08-T | LM4880G-D08-T | DIP-8 | Tube |
| LM4880L-SH2-R | LM4880G-SH2-R | HSOP-8 | Tape Reel |
| LM4880L-SH2-T | LM4880G-SH2-T | HSOP-8 | Tube |

LM4880L-D08-T

(1)Packing Type

(2)Package Type

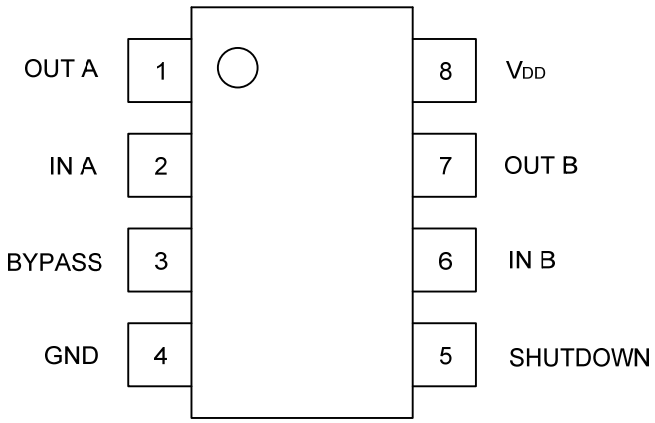
(3)Lead Free

(1) R: Tape Reel, T: Tube

(2) D08: DIP-8, SH2: HSOP-8

(3) G: Halogen Free, L: Lead Free

## ■ PIN CONFIGURATION




## ■ PIN DESCRIPTION

| PIN NO | PIN NAME | I/O | DESCRIPTION |
|---|---|---|---|
| 1 | OUT A | O | Channel A output |
| 2 | IN A | I | Channel A audio input |
| 3 | BYPASS | I | Connect to internal voltage divider for middle supply bias |
| 4 | GND | | Ground |
| 5 | SHUTDOWN | I | Shutdown mode control input, high active, place LM4880 into shutdown mode, when held high |
| 6 | IN B | I | Channel B audio input |
| 7 | OUT B | O | Channel B output |
| 8 | $V_{DD}$ | | Supply voltage |

## ■ ABSOLUTE MAXIMUM RATINGS (Note 2)

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Supply Voltage | $V_{DD}$ | 6.0 | V |
| Input Voltage | $V_{IN}$ | -0.3 ~ $V_{DD}$+0.3 | V |
| ESD Susceptibility (Note 3) | ESD | 3500 | V |
| ESD Susceptibility (Note 4) | | 250 | V |
| Power Dissipation (Note 5) | $P_D$ | Internally limited | |
| Junction Temperature | $T_J$ | 150 | ℃ |
| Operating Temperature | $T_{OPR}$ | -40 ~ +85 | ℃ |
| Storage Temperature | $T_{STG}$ | -65 ~ +150 | ℃ |

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Absolute Maximum Ratings indicate limits beyond which damage may occur. Operating ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. Electrical Characteristics state DC and AC electrical specifications under particular test conditions which guarantee specific performance limits. This assumes that the device is within the operating ratings. Specifications are not guaranteed for parameters where no limit is given, however, the typical value is a good indication of device performance.
3. Human body model, 100 pF discharged through a 1.5 kΩ resistor.
4. Machine model, 220 pF ~ 240 pF discharged through all pins.
5. The maximum power dissipation must be derated at elevated temperatures and is dictated by $T_{JMAX}$, $\theta_{JA}$, and the ambient temperature $T_A$. The maximum allowable power dissipation is $P_{DMAX} = (T_{JMAX} - T_A) / \theta_{JA}$ or the number given in the Absolute Maximum Ratings, whichever is lower. For the UTC LM4880, $T_{JMAX}$ = 15℃, and the typical junction-to-ambient thermal resistance is 170℃/W for SOP-8 package and 107℃/W for DIP-8 package.

## ■ THERMAL DATA

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Junction to Ambient | DIP-8 | $\theta_{JA}$ | 107 | ℃/W |
| | HSOP-8 | | 42.3 | |
| Junction to Case | DIP-8 | $\theta_{JC}$ | 37 | ℃/W |
| | HSOP-8 | | 12 | |

## ■ OPERATING RATINGS

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Supply Voltage | $V_{DD}$ | 2.7 ~ 5.5 | V |
| Temperature Range ($T_{MIN} \le T_A \le T_{MAX}$) | $T_A$ | -40 ~ +85 | ℃ |

## ■ ELECTRICAL CHARACTERISTICS (Note 1,2)

($T_A$=25℃, the following specifications apply for $V_{DD}$=5V, f=1kHz unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| Supply Voltage | $V_{DD}$ | | | 2.7 | | 5.5 | V |
| Quiescent Power Supply Current | $I_{DD}$ | $V_{IN}$=0V, $I_{OUT}$=0A | | | 3.6 | 6.0 | mA |
| Shutdown Current | $I_{SHDN}$ | $V_{PIN5}$=$V_{DD}$ | | | 0.7 | 5 | μA |
| Output Offset Voltage | $V_{O(OFF)}$ | $V_{IN}$=0V | | | 5 | 50 | mV |
| Output Power | $P_{OUT}$ | THD=0.1%(MAX), f=1KHz | $R_L$=8Ω | 200 | 250 | | mW |
| | | | $R_L$=32Ω | | 85 | | mW |
| | | THD+N=10%, f=1KHz | $R_L$=8Ω | | 325 | | mW |
| | | | $R_L$=32Ω | | 110 | | mW |
| Total Harmonic Distortion + Noise | THD+N | $R_L$=8Ω, $P_{OUT}$=200mW, f=1KHz | | | 0.03 | | % |
| | | $R_L$=32Ω, $P_{OUT}$=75mW, f=1KHz | | | 0.02 | | % |
| Power Supply Rejection Ratio | PSRR | $C_B$=1.0μF, $V_{RIPPLE}$=200m$V_{RMS}$, f=100Hz | | | 50 | | dB |

Notes: 1. All voltages are measured with respect to the ground pin, unless otherwise specified.

2. Absolute Maximum Ratings indicate limits beyond which damage may occur. Operating ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. Electrical Characteristics state DC and AC electrical specifications under particular test conditions which guarantee specific performance limits. This assumes that the device is within the operating ratings. Specifications are not guaranteed for parameters where no limit is given, however, the typical value is a good indication of device performance.

## ■ TYPICAL APPLICATION

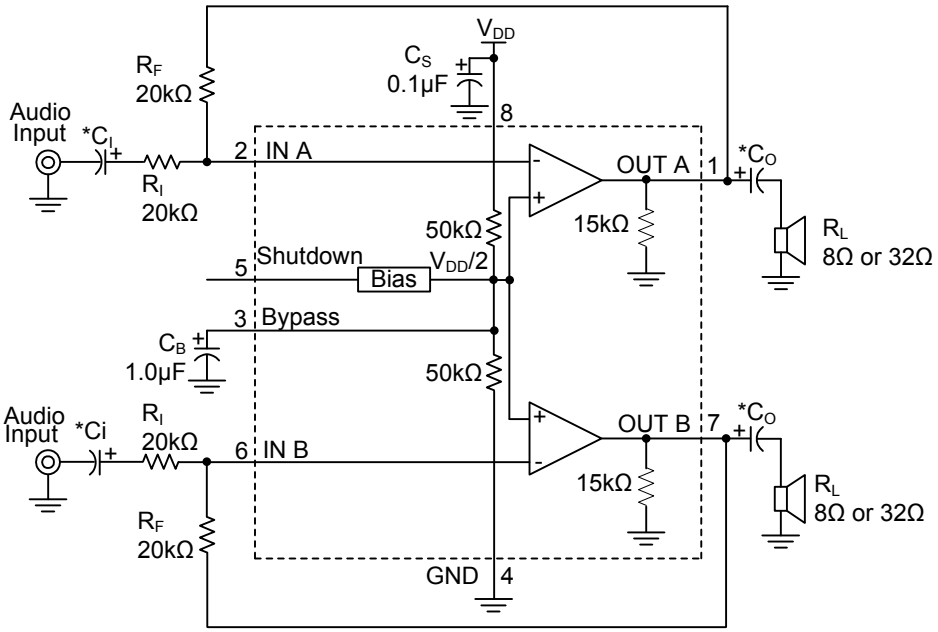



Fig. 1 Typical Audio Amplifier Application Circuit

## ■ EXTERNAL COMPONENTS DESCRIPTION (Fig. 1)

| COMPONENTS | | FUNCTIONAL DESCRIPTION |
|---|---|---|
| 1. | $R_I$ | Inverting input resistance which sets the closed-loop gain in conjunction with RF. This resistor also forms a high pass filter with $C_I$ at $f_C = 1/(2\pi R_I C_I)$. |
| 2. | $C_I$ | Input coupling capacitor which blocks the DC voltage at the amplifier's input terminals. Also creates a high pass filter with $R_I$ at $f_C = 1/(2\pi R_I C_I)$. |
| 3. | $R_F$ | Feedback resistance which sets closed-loop gain in conjunction with $R_I$. |
| 4. | $C_S$ | Supply bypass capacitor which provides power supply filtering. |
| 5. | $C_B$ | Bypass pin capacitor which provides half-supply filtering. |
| 6. | $C_O$ | Output coupling capacitor which blocks the DC voltage at the amplifier's output. Forms a high pass filter with $R_L$ at $f_O = 1/(2\pi R_L C_O)$. |

## ■ AUTOMATIC SHUTDOWN CIRCUIT

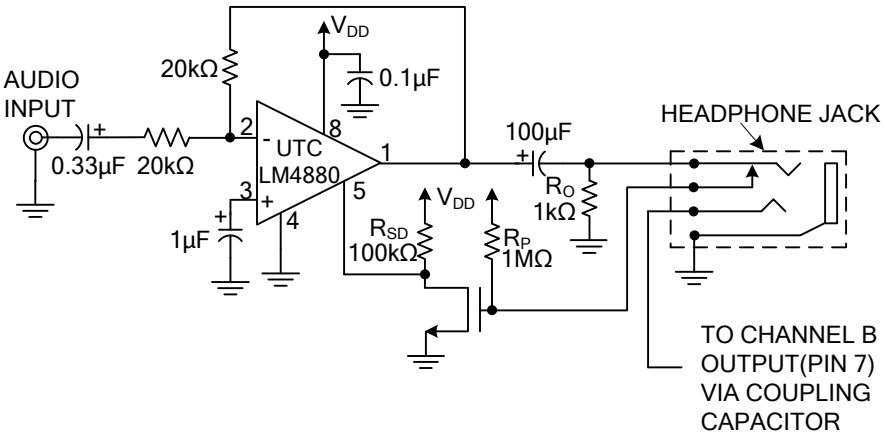



Fig. 2 Automatic Shutdown Circuit

## ■ AUTOMATIC SWITCHING CIRCUIT

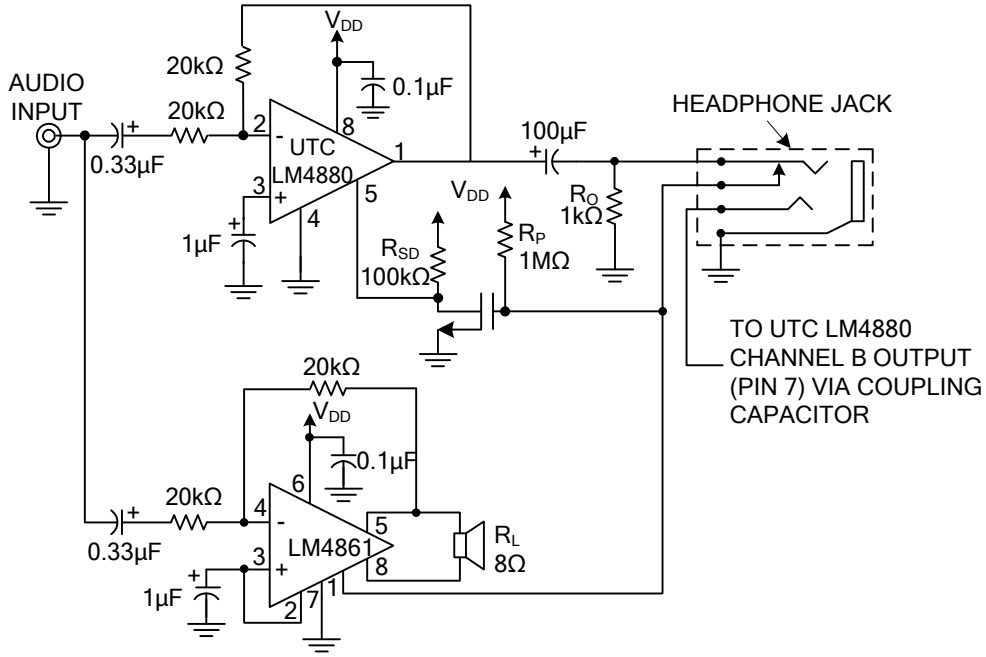
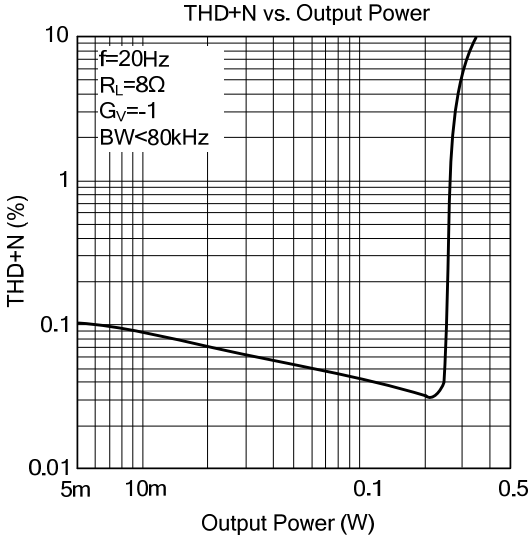


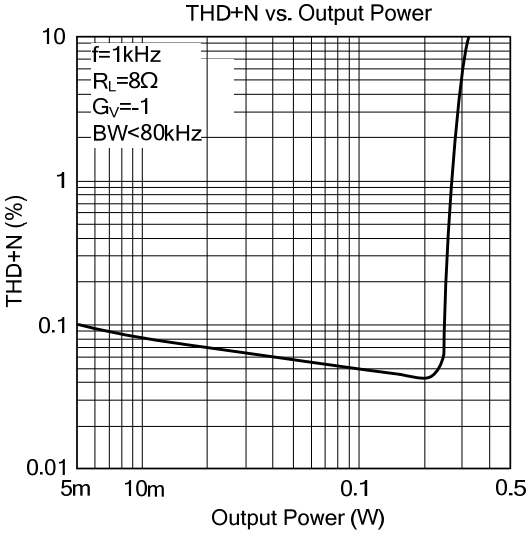

Fig. 3 Automatic Switching Circuit

## ■ TYPICAL CHARACTERISTICS

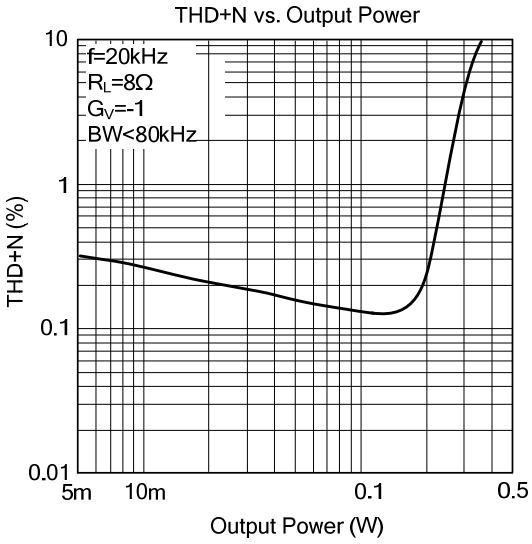
THD+N vs. Output Power



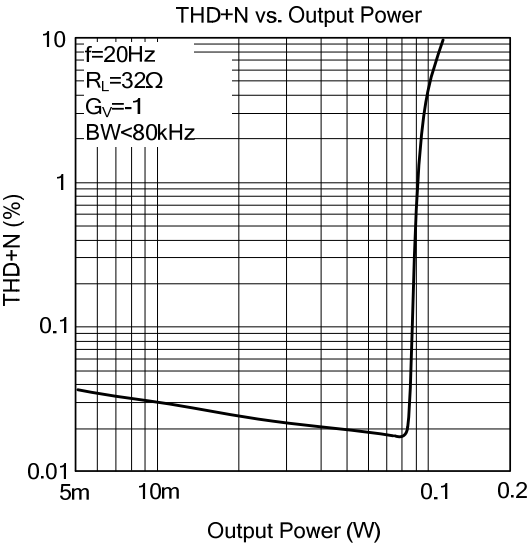

THD+N vs. Output Power



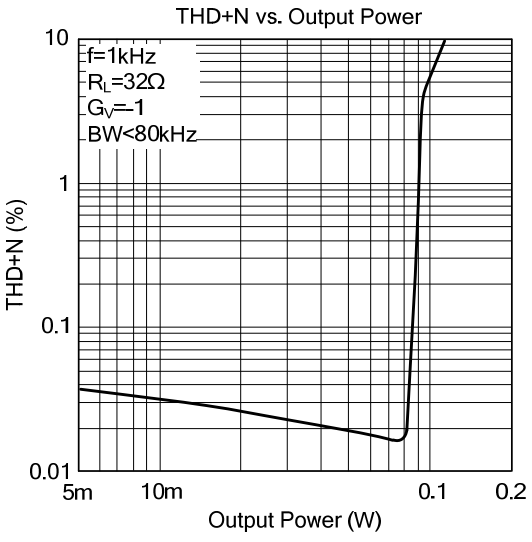

THD+N vs. Output Power



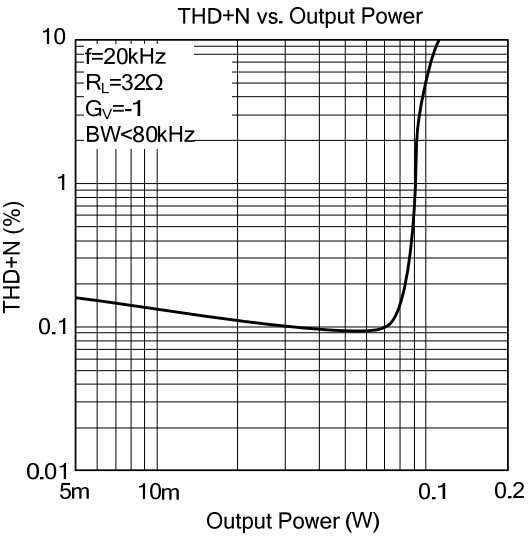

THD+N vs. Output Power




THD+N vs. Output Power

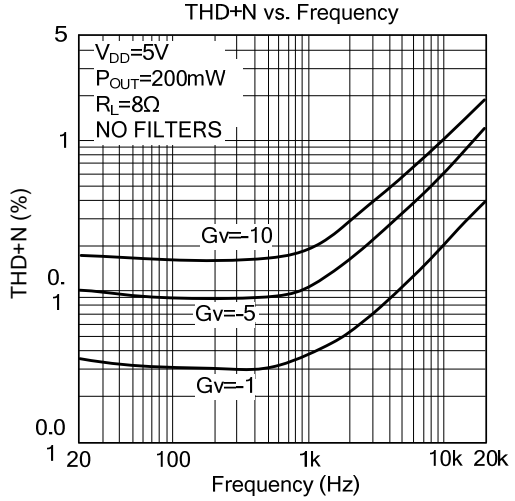



THD+N vs. Output Power

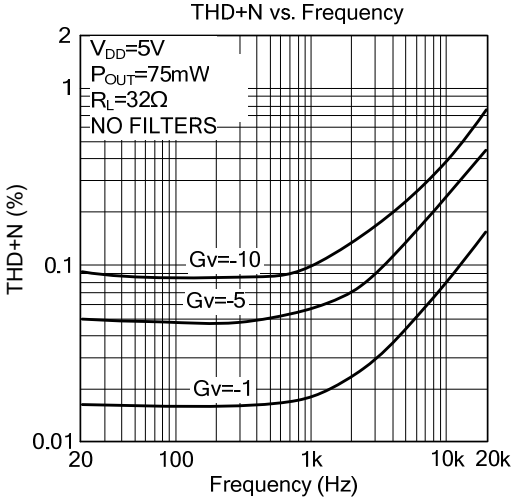


## ■ TYPICAL CHARACTERISTICS(Cont.)

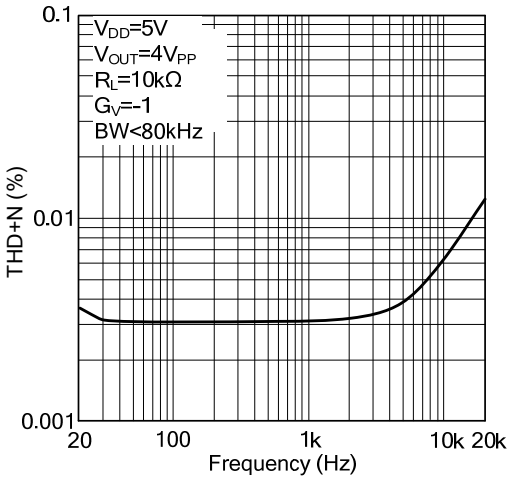
THD+N vs. Frequency



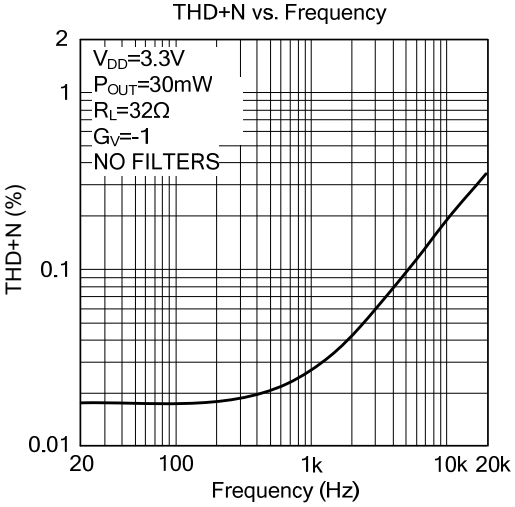

THD+N vs. Frequency



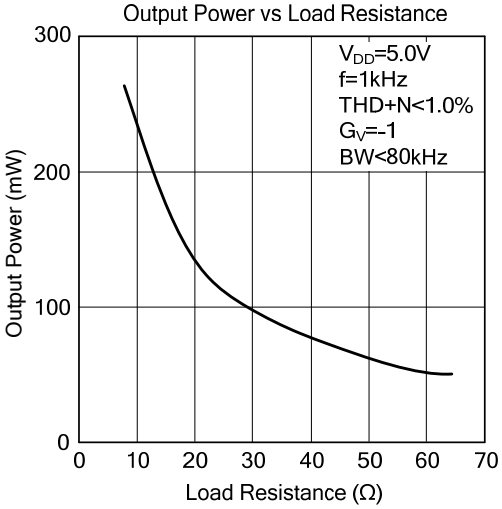

THD+N vs. Frequency



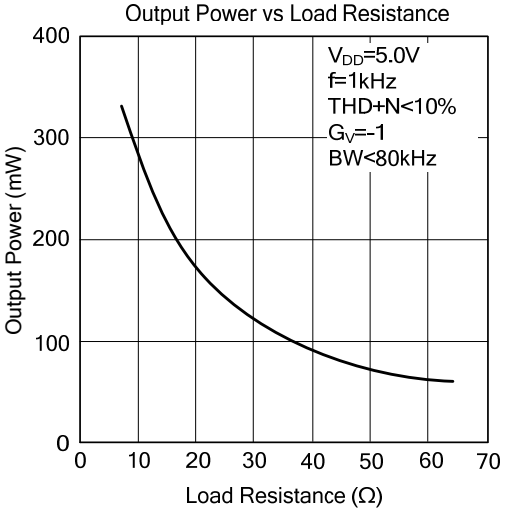

THD+N vs. Frequency



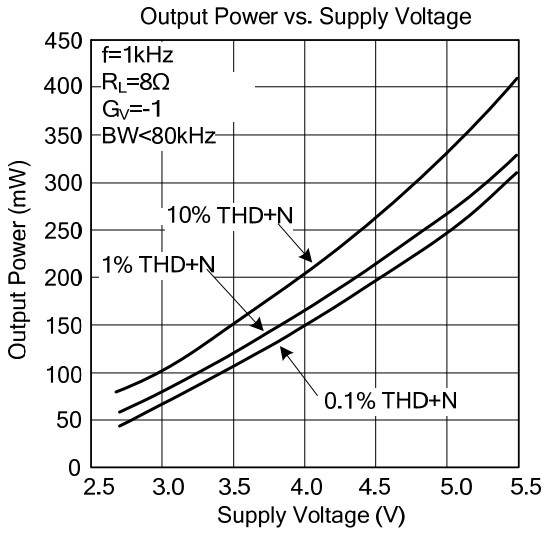

Output Power vs Load Resistance

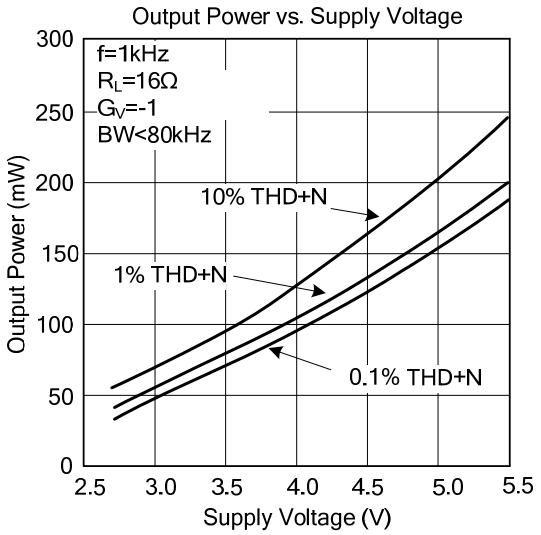


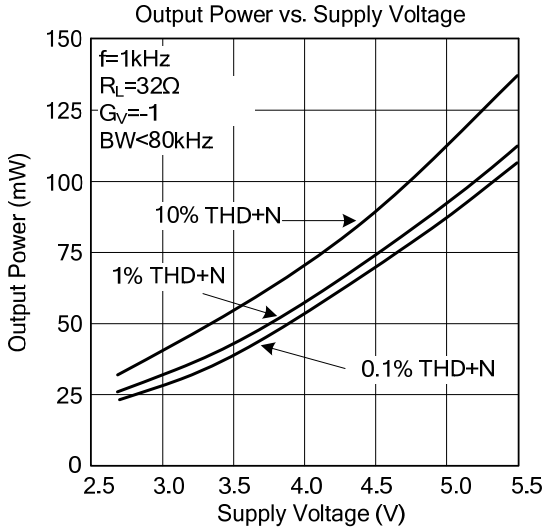

Output Power vs Load Resistance

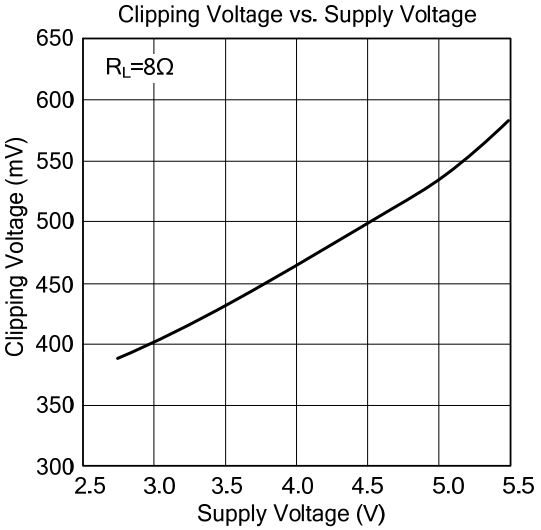


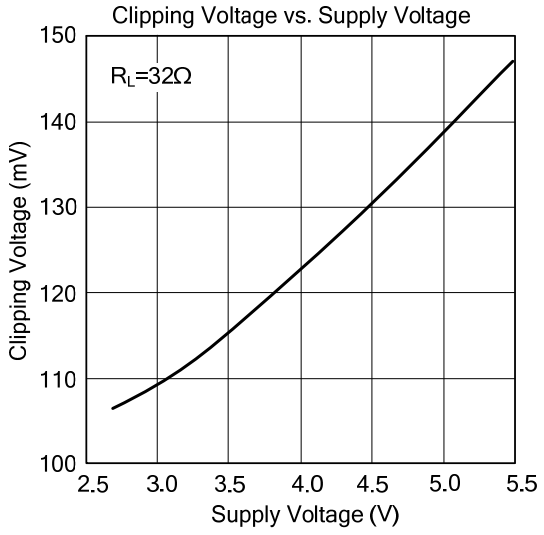
## ■ TYPICAL CHARACTERISTICS(Cont.)

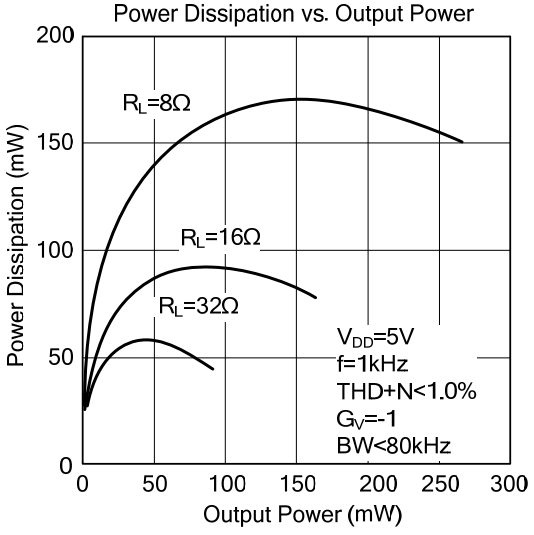


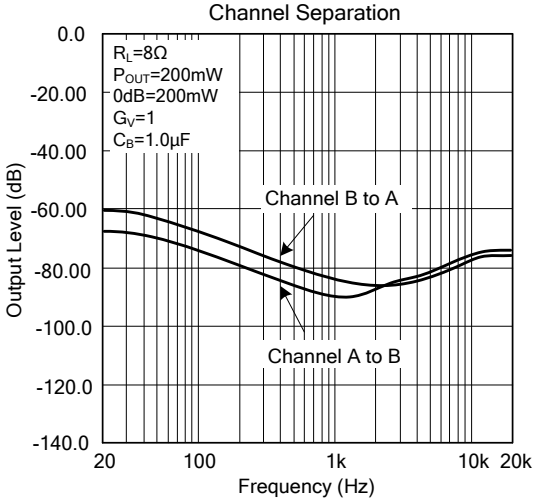



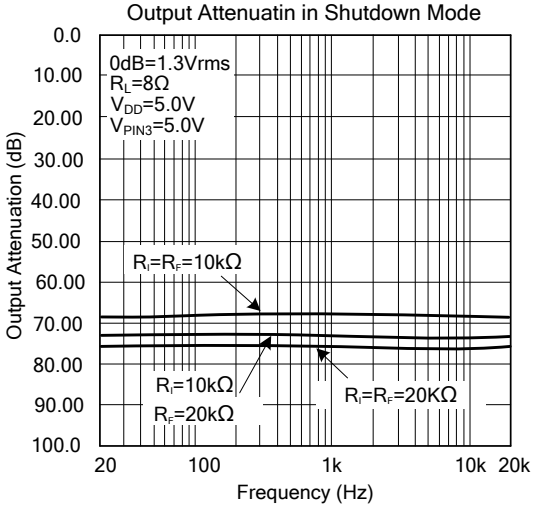



## ■ TYPICAL CHARACTERISTICS(Cont.)

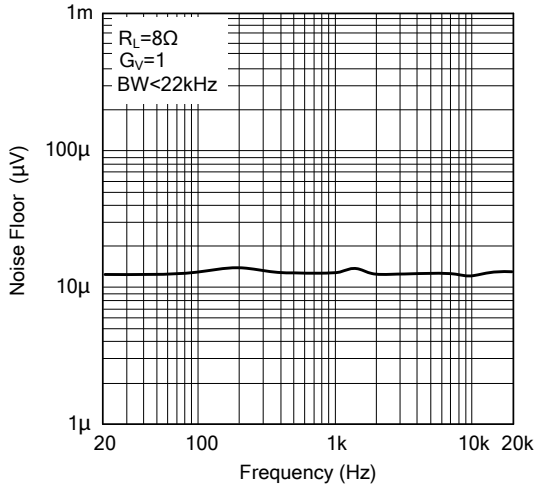
Channel Separation



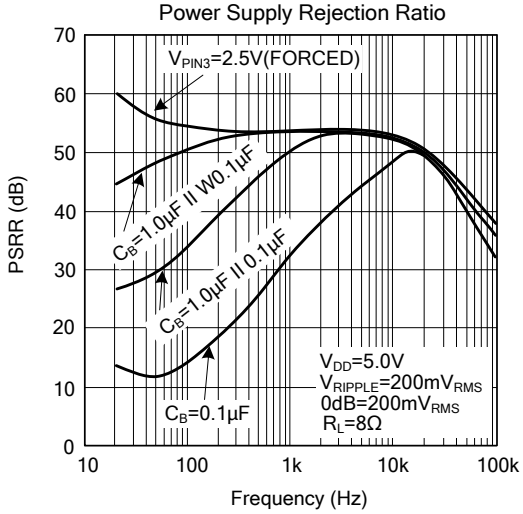

Output Attenuatin in Shutdown Mode



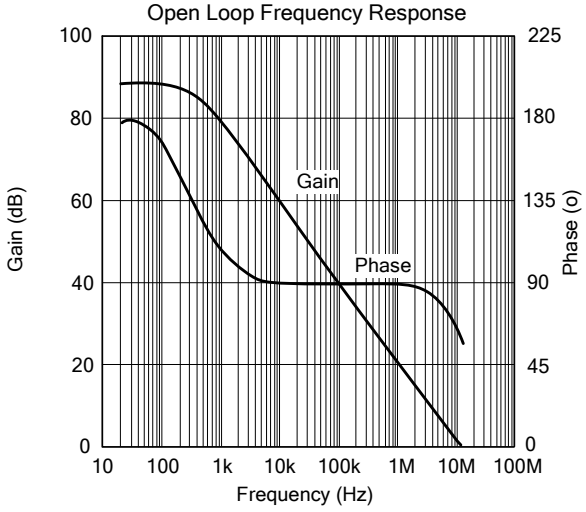

Noise Floor



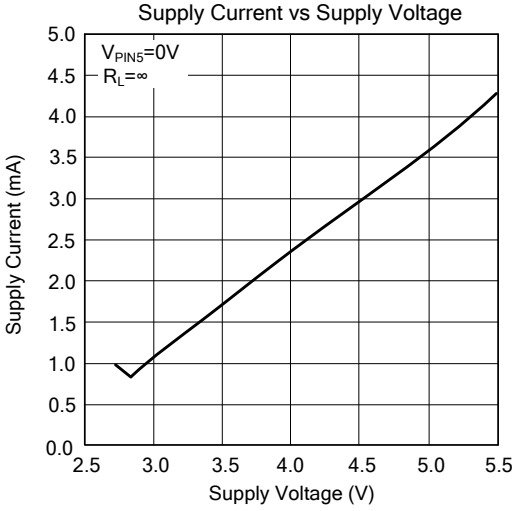

Power Supply Rejection Ratio




Open Loop Frequency Response

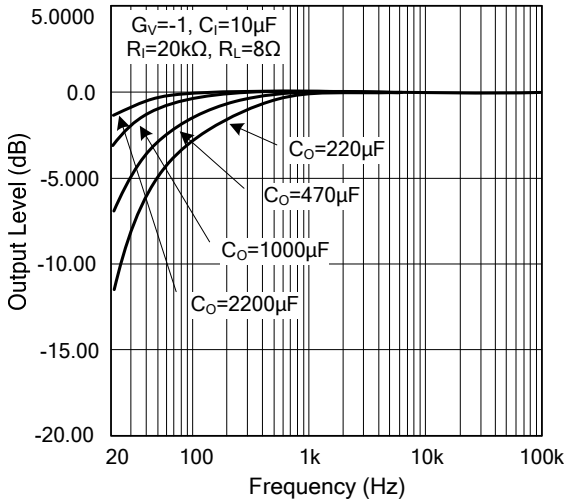



Supply Current vs Supply Voltage

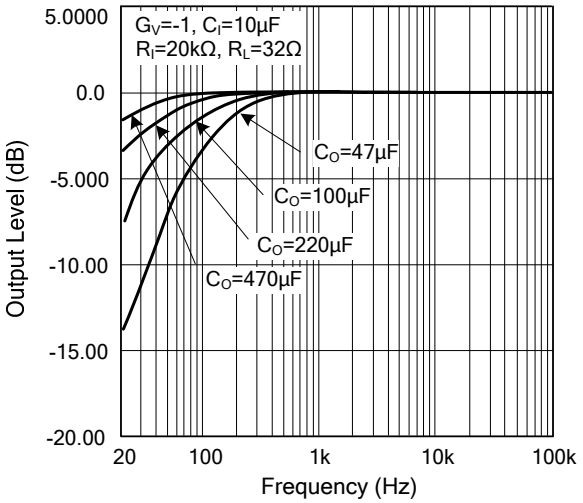


## ■ TYPICAL CHARACTERISTICS(Cont.)

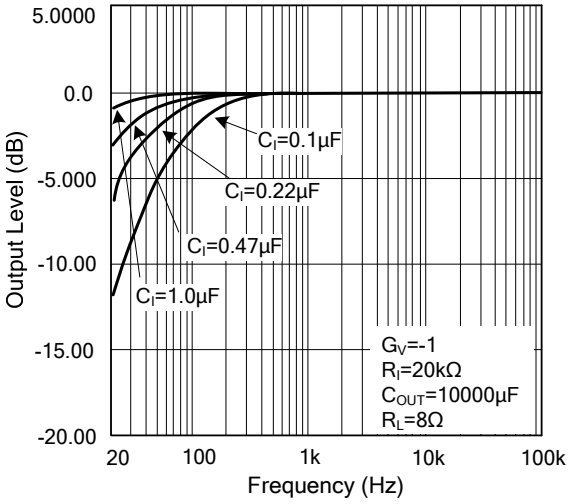
Frequency Response vs. Output Capacitor Size



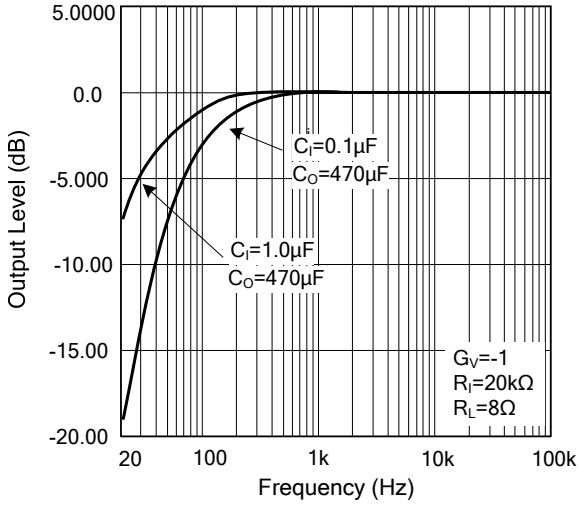

Frequency Response vs. Output Capacitor Size




Frequency Response vs Input Capacitor Size




Typical Application Frequency Response




Typical Application Frequency Response