MAX98307/MAX98308

3.3W Mono Class DG Multilevel Audio Amplifier

General Description

The MAX98307/MAX98308 fully differential mono Class DG multilevel power amplifiers with an integrated inverting charge-pumps offer highly efficient, high-power audio solutions for portable applications.

Class DG multilevel (patent pending) modulation extends the dynamic range of the output signal by employing a charge pump generated negative rail as needed to extend the supply voltage.

The ICs combine Maxim's active emissions limiting edge rate and overshoot control circuitry with multilevel output modulation to greatly reduce EMI. These features eliminate the need for output filtering as compared to traditional Class D devices, reducing component count and cost.

The MAX98307's 16-pin TQFN package features an adjustable gain set by external resistors. The MAX98308's space-saving 12-bump WLP package features an internally fixed gain of 8.5dB, 11.5dB, 14.5dB, 17.5dB, and 20.5dB set by a single gain input. Both devices operate over the extended -40°C to +85°C temperature range.

Applications

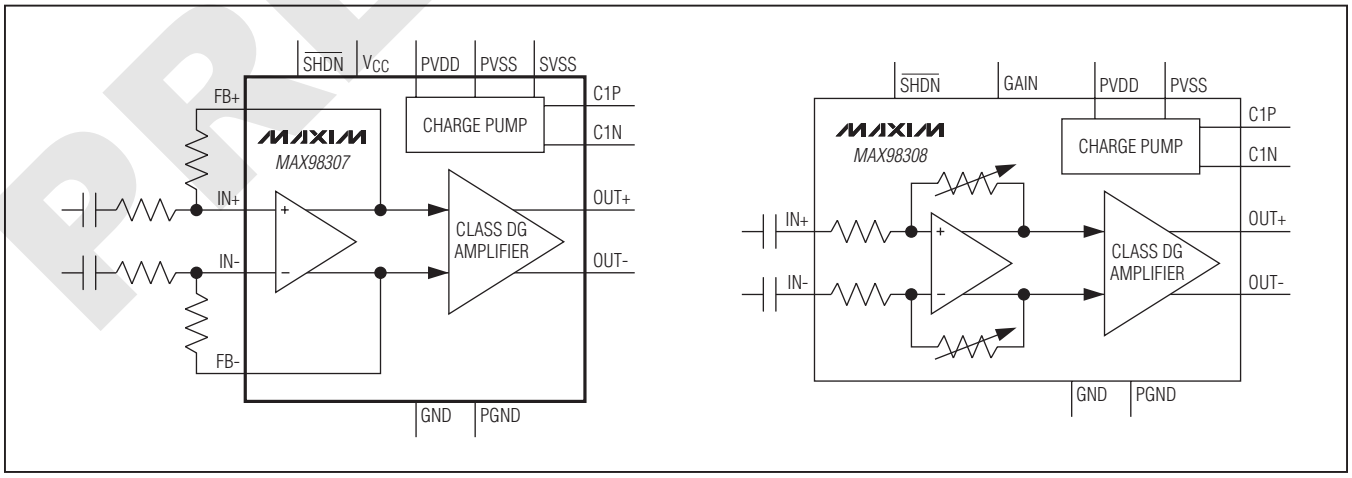
Cellular Phones	VoIP Phones
Smart Phones	Portable Audio
Notebook Computers	Tablet PCs

Benefits and Features

- **High Efficiency Combined with High Output Power**
  - ✧ **Class DG Multilevel Modulation Ensures Maximum Efficiency Over Wide Output Power Range**
- **Improves Battery Life**
  - ✧ **Low 1.85mA Quiescent Current**
- **High Output Power at 1% THD+N**
  - ✧ **1.54W at V_{PVDD} = 3.6V, 8Ω + 68µH Load**
  - ✧ **2.85W at V_{PVDD} = 5V, 8Ω + 68µH Load**
- **High Output Power at 10% THD+N**
  - ✧ **1.77W at V_{PVDD} = 3.6V, 8Ω + 68µH Load**
  - ✧ **3.3W at V_{PVDD} = 5V, 8Ω + 68µH Load**
- **84% Efficiency (V_{PVDD} = 3.6V, at 500mW Output)**
- **Active Emissions Limiting and Class DG Multilevel Output Modulation Eliminates EMI Output Filtering Requirement**
- **Integrated Charge Pump and High Efficiency Results in Small Solution Size**
- **Excellent RF Immunity**
- **Click-and-Pop Suppression**
- **Thermal and Overcurrent Protection**
- **Low-Current Shutdown Mode**

***Ordering Information* appears at end of data sheet.**

Simplified Block Diagrams



For related parts and recommended products to use with this part, refer to ***www.maxim-ic.com/MAX98307.related***.

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

3.3W Mono Class DG Multilevel Audio Amplifier

Charge-Pump Capacitor Selection

Use capacitors with an equivalent series resistance (ESR) less than 50mΩ for optimum performance. Low-ESR ceramic capacitors minimize the output resistance of the charge pump. For best performance over the extended temperature range, select capacitors with an X7R dielectric and a rated voltage of at least 6.3V.

Charge-Pump Flying Capacitor

The value of the charge-pump flying capacitor affects the load regulation and output resistance of the charge pump. A charge-pump flying capacitor value that is too small (less than 1µF) degrades the amplifier's ability to provide sufficient current drive. Increasing the value of this flying capacitor and decreasing the ESR improves load regulation and reduces the charge-pump output impedance, which improves the output power and efficiency of the amplifier. A 4.7µF or greater value, low ESR capacitor is recommended.

Charge-Pump Hold Capacitor

The charge-pump hold capacitor value and ESR directly affect the ripple at the charge-pump rail PVSS. Increasing the charge-pump hold capacitor value reduces output ripple. Likewise, decreasing the ESR of this capacitor reduces both ripple and output resistance. A 10µF or greater value, low ESR capacitor is recommended.

Layout and Grounding

Proper layout and grounding are essential for optimum performance. Good grounding improves audio performance and prevents switching noise from coupling into the audio signal.

Use wide, low-resistance output traces. As load impedance decreases, the current drawn from the device increases. At higher current, the resistance of the output traces decrease the power delivered to the load. For example, if 2W is delivered from the device output to an 8Ω load through 100mΩ of total speaker trace, 1.97W is delivered to the speaker. If power is delivered through 10mΩ of total speaker trace, 1.998W is delivered to the speaker. Wide output, supply, and ground traces also improve the power dissipation of the device.

The ICs are inherently designed for excellent RF immunity. For best performance, add ground fills around all signal traces on top or bottom PCB planes.

Thermal Considerations

Class DG multilevel amplifiers provide much better efficiency and thermal performance than a comparable Class AB or Class G amplifiers. However, the system's thermal performance must be considered with realistic expectations and include consideration of many parameters. This section examines Class DG multilevel amplifiers using general examples to illustrate good design practices.

MAX98307 (TQFN) Applications Information

The exposed pad is the primary route of keeping heat away from the IC. With a bottom-side exposed pad, the PCB and its copper becomes the primary heatsink for the Class DG multilevel amplifier. Solder the exposed pad to a large copper polygon. Add as much copper as possible from this polygon to any adjacent pin on the amplifier as well as to any adjacent components, provided these connections are at the same potential. These copper paths must be as wide as possible. Each of these paths contributes to the overall thermal capabilities of the system.

The copper polygon to which the exposed pad is attached should have multiple vias to the opposite side of the PCB. Make this polygon as large as possible within the system's constraints for signal routing.

MAX98308 (WLP) Applications Information

For the latest application details on WLP construction, dimensions, tape carrier information, PCB techniques, bump-pad layout, and recommended reflow temperature profile, as well as the latest information on reliability testing results, refer to Maxim Application Note 1891: Wafer-Level Packaging (WLP) and Its Applications.

Ordering Information

PART	GAIN SET	PIN-PACKAGE
MAX98307ETE+	External	16 TQFN-EP*
MAX98308EWC+**	Internal	12 WLP

Note: *All devices operate over the -40°C to +85°C temperature range.*

+Denotes a lead(Pb)-free/RoHS-compliant package.

**EP = Exposed pad.*

***Future product–contact factory for availability.*