

PRODUCT BRIEF

Mono Class D Audio Codec Subsystem with Ground Referenced Headphone Amplifiers, Earpiece Driver, and Audio DSP

1.0 General Description

The LM49352 is a high performance mixed signal audio subsystem. The LM49352 includes a high quality stereo DAC, a high quality stereo ADC, a stereo headphone amplifier, which supports True Ground operation, a low EMI Class D loudspeaker amplifier, and an earpiece speaker amplifier. It combines advanced audio processing, conversion, mixing, and amplification in the smallest possible footprint while extending the battery life of feature rich portable devices.

The LM49352 features dual bi-directional I²S or PCM audio interfaces and an I²C compatible interface for control. The stereo DAC path features an SNR of 103dB with 24-bit 48 kHz input. The headphone amplifier delivers 65mW_{RMS} (typ) to a 32Ω single-ended stereo load with less than 1% distortion (THD+N) when HP_V_{DD} = 2.8V. The loudspeaker amplifier delivers up to 970mW into an 8Ω load with less than 1% distortion when LS_V_{DD} = 4.2V.

The LM49352 employs advanced techniques to extend battery life, to reduce controller overhead, to speed development time, and to eliminate click and pop artifacts. Boomer audio power amplifiers are designed specifically for mobile devices and require minimal PCB area and external components.

Notice: This document is not a full datasheet. For more information regarding this product or to order samples please contact your local National Semiconductor sales office or visit <http://www.national.com/support/dir.html>

2.0 Applications

- Smart Phones
- Mobile Phones and VOIP Phones
- Portable GPS Navigator and Portable Gaming Devices
- Portable DVD/CD/AAC/MP3/MP4 Players
- Digital Cameras/Camcorders

3.0 Key Specifications

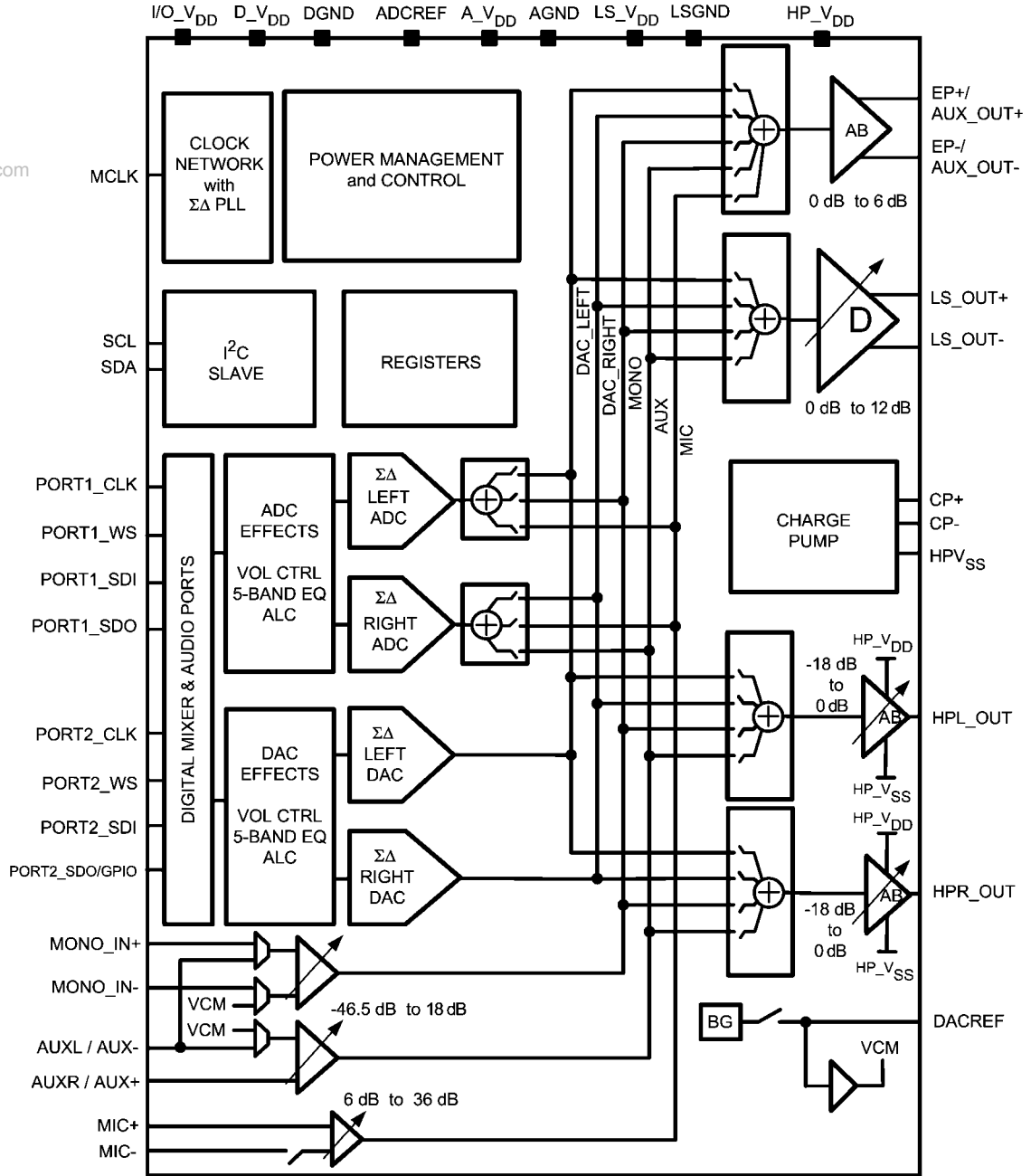
- Class D Amplifier Efficiency 93% (typ)
- P_{EP} at A_V_{DD} = 3.3V, Stereo 32Ω, 1% THD 58mW (typ)
- P_{HP} at HP_V_{DD} = 2.8V, Stereo 32Ω, 1% THD 65mW/ch (typ)
- P_{LS} at LS_V_{DD} = 5V, 8Ω, 1% THD 1.4W (typ)

- P_{LS} at LS_V_{DD} = 4.2V, 8Ω, 1% THD 970mW (typ)
- P_{LS} at LS_V_{DD} = 3.3V, 8Ω, 1% THD 590mW (typ)
- SNR (Stereo DAC at 48kHz) 103dB (typ)
- PSRR at 217 Hz, A_V_{DD} = 3.3V, (HP from AUX) 90dB (typ)

4.0 Features

- Ultra efficient, spread spectrum Class D loudspeaker amplifier that operates at 93% efficiency
- Low voltage, true ground headphone amplifier operation
- High performance 103dB SNR stereo DAC
- High performance 97dB SNR stereo ADC
- Up to 96kHz stereo audio playback
- Up to 48kHz stereo recording
- Dual bidirectional I²S or PCM compatible audio interfaces
- Read/write I²C compatible control interface
- Flexible digital mixer with sample rate conversion
- Sigma-delta PLL clock network that supports system clocks up to 50MHz including 13MHz, 19.2MHz, and 26MHz
- Dual stereo 5 band parametric equalizers
- Cascadable DSP effects that allow stereo 10 band parametric equalization
- ALC/Limiter/Compressor on both DAC and ADC paths
- Dedicated Earpiece Speaker Amplifier
- Stereo auxiliary inputs and mono differential input
- Differential microphone input with single-ended option
- Automatic level control for digital audio inputs, mono differential input, microphone input, and stereo auxiliary inputs
- Flexible audio routing from input to output
- 16 Step volume control for microphone with 2dB steps
- 32 Step volume control for auxiliary inputs in 1.5dB steps
- 4 Step volume control for class D loudspeaker amplifier
- 8 Step volume control for headphone amplifier
- Micro-power shutdown mode
- Available in the 3.3 x 3.3 mm 36 bump micro SMD package

5.0 LM49352 Overview

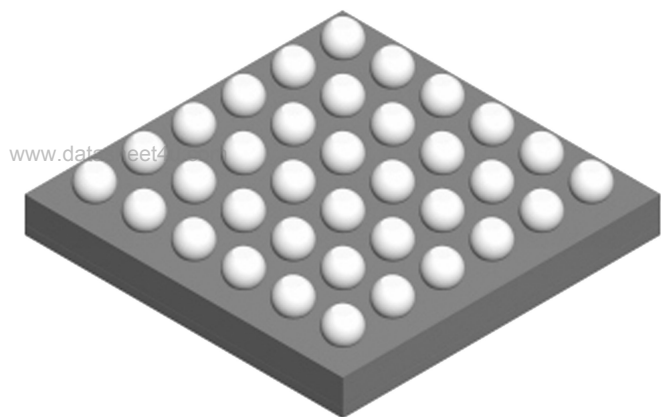


30072777

FIGURE 1. LM49352 Block Diagram

6.0 Connection Diagrams

36 Bump micro SMD

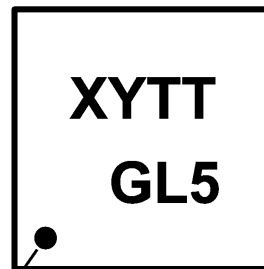


www.data-sheet4.com

Order Number LM49352RL
See NS Package Number RLA36MMA

30072711

36 Bump micro SMD Marking

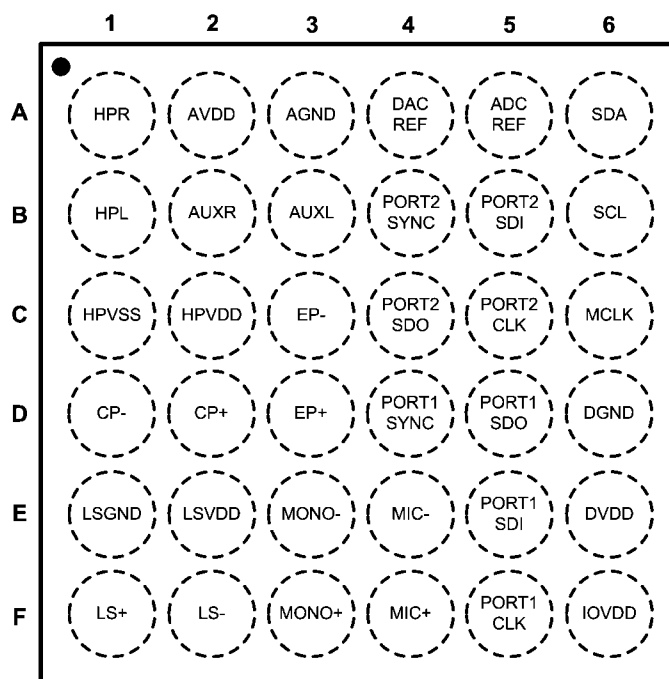


Pin A1

300727q7

Top View
XY — Date Code
TT — Die Traceability
G — Boomer
L5 — LM49352RL

LM49352RL Pinout Diagram



30072710

Top View (Bump Side Down)

Ordering Information

Order Number	Package	Package DWG #	Transport Media	MSL Level	Green Status
LM49352RL	36 Bump micro SMDxt	RLA36MMA	250 units on tape and reel	1	RoHS and no Sb/Br
LM49352RLX	36 Bump micro SMDxt	RLA36MMA	3000 units on tape and reel	1	RoHS and no Sb/Br

Notes

For more National Semiconductor product information and proven design tools, visit the following Web sites at:

Products		Design Support	
Amplifiers	www.national.com/amplifiers	WEBENCH® Tools	www.national.com/webench
Audio	www.national.com/audio	App Notes	www.national.com/appnotes
Clock and Timing	www.national.com/timing	Reference Designs	www.national.com/refdesigns
Data Converters	www.national.com/adc	Samples	www.national.com/samples
Interface	www.national.com/interface	Eval Boards	www.national.com/evalboards
LVDS	www.national.com/lvds	Packaging	www.national.com/packaging
Power Management	www.national.com/power	Green Compliance	www.national.com/quality/green
Switching Regulators	www.national.com/switchers	Distributors	www.national.com/contacts
LDOs	www.national.com/ldo	Quality and Reliability	www.national.com/quality
LED Lighting	www.national.com/led	Feedback/Support	www.national.com/feedback
Voltage Reference	www.national.com/vref	Design Made Easy	www.national.com/easy
PowerWise® Solutions	www.national.com/powerwise	Solutions	www.national.com/solutions
Serial Digital Interface (SDI)	www.national.com/sdi	Mil/Aero	www.national.com/milaero
Temperature Sensors	www.national.com/tempsensors	SolarMagic™	www.national.com/solarmagic
Wireless (PLL/VCO)	www.national.com/wireless	Analog University®	www.national.com/AU

THE CONTENTS OF THIS DOCUMENT ARE PROVIDED IN CONNECTION WITH NATIONAL SEMICONDUCTOR CORPORATION ("NATIONAL") PRODUCTS. NATIONAL MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE ACCURACY OR COMPLETENESS OF THE CONTENTS OF THIS PUBLICATION AND RESERVES THE RIGHT TO MAKE CHANGES TO SPECIFICATIONS AND PRODUCT DESCRIPTIONS AT ANY TIME WITHOUT NOTICE. NO LICENSE, WHETHER EXPRESS, IMPLIED, ARISING BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT.

TESTING AND OTHER QUALITY CONTROLS ARE USED TO THE EXTENT NATIONAL DEEMS NECESSARY TO SUPPORT NATIONAL'S PRODUCT WARRANTY. EXCEPT WHERE MANDATED BY GOVERNMENT REQUIREMENTS, TESTING OF ALL PARAMETERS OF EACH PRODUCT IS NOT NECESSARILY PERFORMED. NATIONAL ASSUMES NO LIABILITY FOR APPLICATIONS ASSISTANCE OR BUYER PRODUCT DESIGN. BUYERS ARE RESPONSIBLE FOR THEIR PRODUCTS AND APPLICATIONS USING NATIONAL COMPONENTS. PRIOR TO USING OR DISTRIBUTING ANY PRODUCTS THAT INCLUDE NATIONAL COMPONENTS, BUYERS SHOULD PROVIDE ADEQUATE DESIGN, TESTING AND OPERATING SAFEGUARDS.

EXCEPT AS PROVIDED IN NATIONAL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, NATIONAL ASSUMES NO LIABILITY WHATSOEVER, AND NATIONAL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY RELATING TO THE SALE AND/OR USE OF NATIONAL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS PRIOR WRITTEN APPROVAL OF THE CHIEF EXECUTIVE OFFICER AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

Life support devices or systems are devices which (a) are intended for surgical implant into the body, or (b) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.

National Semiconductor and the National Semiconductor logo are registered trademarks of National Semiconductor Corporation. All other brand or product names may be trademarks or registered trademarks of their respective holders.

Copyright© 2009 National Semiconductor Corporation

For the most current product information visit us at www.national.com



National Semiconductor Americas Technical Support Center
Email: support@nsc.com
Tel: 1-800-272-9959

National Semiconductor Europe Technical Support Center
Email: europe.support@nsc.com

National Semiconductor Asia Pacific Technical Support Center
Email: ap.support@nsc.com

National Semiconductor Japan Technical Support Center
Email: jpn.feedback@nsc.com