

PRODUCT BRIEF

Class G Headphone Amplifier with I²C Volume Control

General Description

The LM48824 is a Class G, ground-referenced stereo headphone amplifier designed for portable devices. The LM48824 features National's ground-referenced architecture, which eliminates the large DC blocking capacitors required by traditional headphone amplifiers, saving board space and minimizing system cost.

The LM48824 takes advantage of National's patent-pending Class G architecture offering power savings compared to a traditional Class AB headphone amplifier. Additionally, output noise is improved by common-mode sensing that corrects for any differences between the amplifier ground and the potential at the headphone return terminal, minimizing noise created by any ground mismatches.

A high output impedance mode allows the LM48824's outputs to be driven by an external source without degrading the signal. Other features include flexible power supply requirements, differential inputs for improved noise rejection, a low power (2.5µA) shutdown mode, and a 32-step I²C volume control with mute function.

The LM48824's superior click and pop suppression eliminates audible transients on power-up/down and during shutdown. The LM48824 is available in an ultra-small 16-bump, 0.4mm pitch micro SMD package (1.69mm x 1.69mm)

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>

Key Specifications

- Quiescent Power Supply Current at 3.6V 0.9mA (typ)
- Output Power/channel at $V_{DD} = 3.6V$
 $R_L = 16\Omega$, THD+N $\leq 1\%$ 37mW (typ)
- Output Power/channel at $V_{DD} = 3.6V$
 $R_L = 32\Omega$, THD+N $\leq 1\%$ 29mW (typ)
- PSRR at 217Hz 100dB (typ)
- Shutdown current 2.5µA (typ)

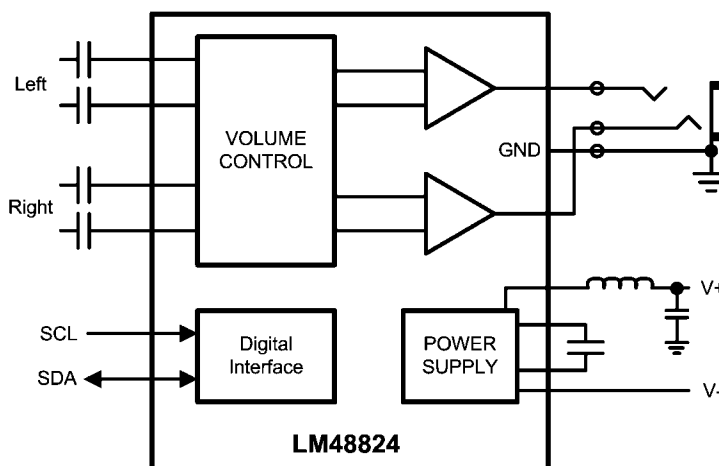
Features

- Class G Power Savings
- Ground Referenced Headphone Outputs – Eliminates Output Coupling Capacitors
- Common-Mode Sense
- I²C Volume and Mode Control
- High Output Impedance in Shutdown
- Differential Inputs
- Advanced Click-and-Pop Suppression
- Low Supply Current
- Low THD mode option

Applications

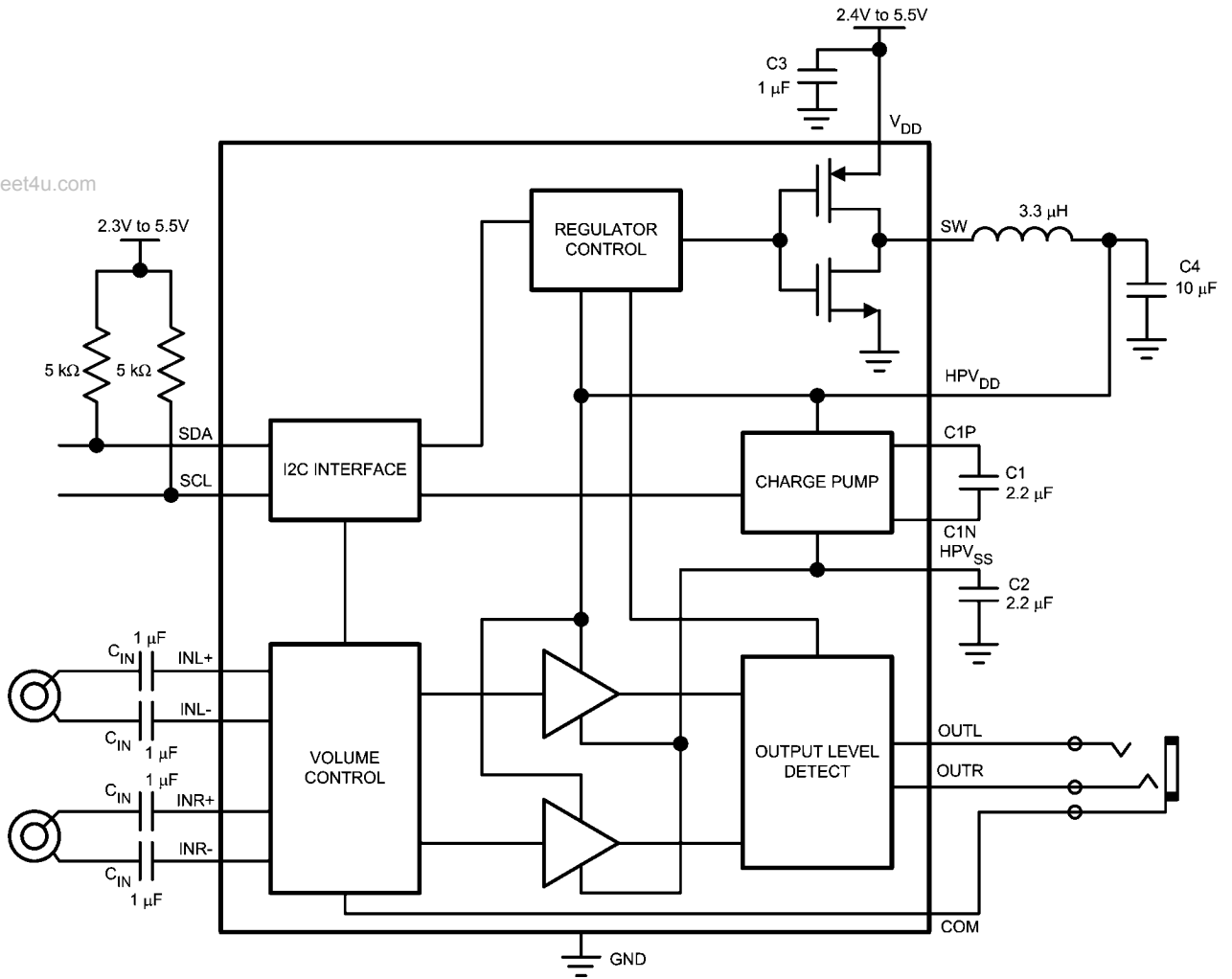
- Mobile Phones, PDAs, MP3 Players
- Portable Electronic Devices, Notebook PCs

Simplified Block Diagram



30089221

Typical Application

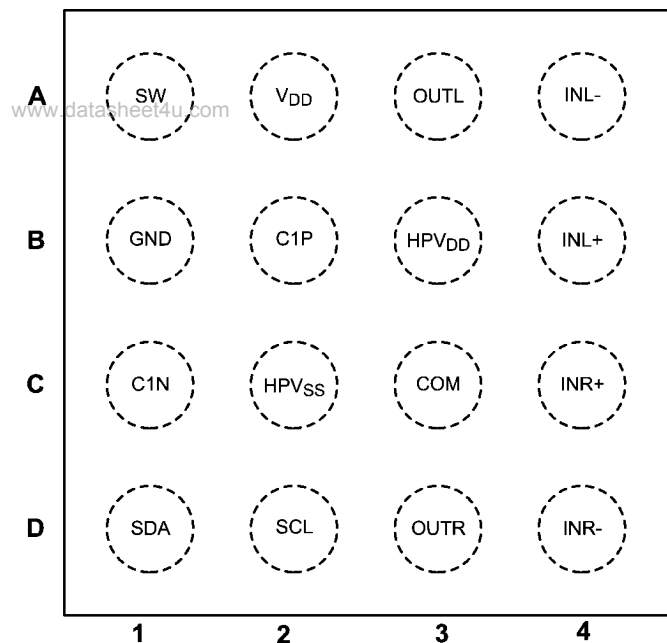


30089270

FIGURE 1. Typical Audio Amplifier Application Circuit

Connection Diagrams

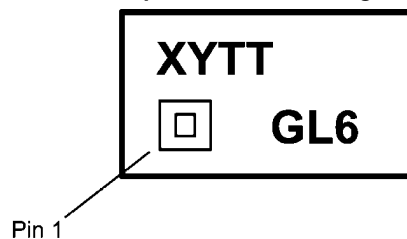
TM Package
1.7mm x 1.7mm x 0.6mm



Top View
Order Number LM48824TM
See NS Package Number TMD16DDA

30089220

16-Bump micro SMD Marking



30089217

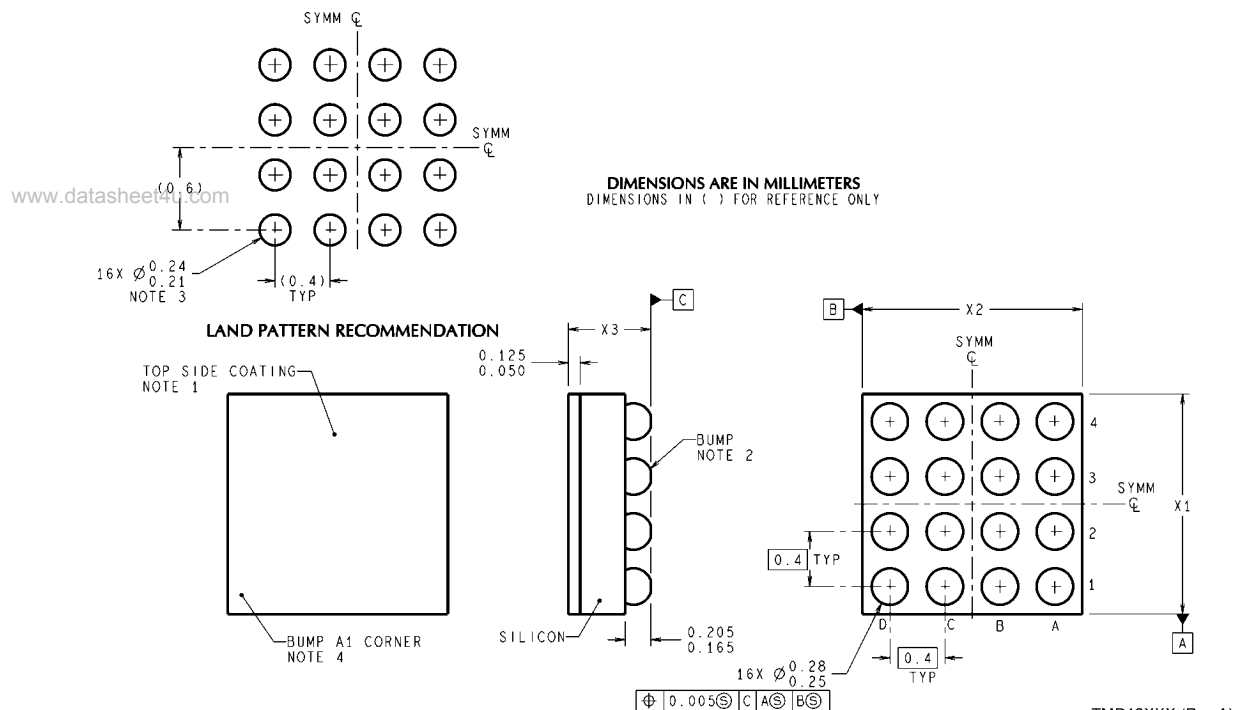
Top View
XY = Date code
TT = Die traceability
G = Boomer Family
L6 = LM48824TM

Ordering Information

Order Number	Package	Package DWG #	Transport Media	MSL Level	Green Status
LM48824TM	16 Bump micro SMD	TMD16DDA	250 units on tape and reel	1	NOPB
LM48824TMX	16 Bump micro SMD	TMD16DDA	3000 units on tape and reel	1	NOPB

Physical Dimensions

inches (millimeters) unless otherwise noted



16 – Bump micro SMD
Order Number LM48824TM
NS Package Number TMD16DDA
X1 = 1690 μ m X2 = 1690 μ m X3 = 600 μ m

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