LM49151 Boomer® Audio Power Amplifier Series PRODUCT BRIEF Mono Class D Audio Subsystem with Earpiece Driver, Ground Referenced Headphone Amplifiers, Speaker Protection and No Clip with Clip Control

Check for Samples: LM49151

FEATURES

- **E²S class D amplifier**
- **Ground referenced outputs — eliminates output coupling capacitors**
- **I²C programmable No Clip Function with Clip Control**
- **Voltage limiter speaker protection**
- **I²C volume and mode Control**
- **Ear Piece Amplifier**
- **Advanced click-and-pop suppression**
- **Low supply current**
- **Micro-power shutdown**
- **20-bump micro SMD package**

APPLICATIONS

- **Mobile Phones**
- **PDAs**
- **Notebook PCs**
- **Portable Electronics Devices**
- **MP3 Players**

DESCRIPTION

The LM49151 is a fully integrated audio subsystem designed for portable handheld applications such as cellular phones. The LM49151 combines a 1.25W mono E²S class D amplifier, 125mW Class AB earpiece driver, 42mW/channel stereo ground referenced headphone drivers, volume control, input mixer/multiplexer, and speaker protection into a single device.

The LM49151 class D speaker amplifier features National's unique Automatic Level Control (ALC) that provides both a I²C programmable no-clip feature with Clip Controls and speaker protection. The E²S (Enhanced Emission Suppression) class D amplifier features a patented, ultra low EMI PWM architecture that significantly reduces RF emissions while preserving audio quality and efficiency while delivering 1.25W into an 8Ω load with <1% THD+N with a 5V supply. The 42mW/channel headphone drivers feature National's ground referenced architecture that creates a ground-referenced output from a single supply, eliminating the need for bulky and expensive DC-blocking capacitors, saving space and minimizing system cost.

The LM49151 features separate volume controls for the loudspeaker and headphone inputs. Mode selection, shutdown control, and volume are controlled through an I²C compatible interface. The LM49151's superior click and pop suppression eliminates audible transients on power-up/down and during shutdown.

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

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Table 1. Key Specifications

		VALUE	UNIT
Output Power at V_{DD} = 3.3V THD+N ≤ 1%	LS Mode, R_L = 8Ω	520	mW (typ)
	HP Mode, R_L = 32Ω	40	
Output Power at V_{DD} = 5V THD+N ≤ 1%	LS Mode, R_L = 8Ω	1.25	W (typ)
	HP Mode, R_L = 32Ω	42	mW (typ)
Output Offset	LS Mode 15	6	mV (typ)
	HP Mode 15	2	

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Typical Application

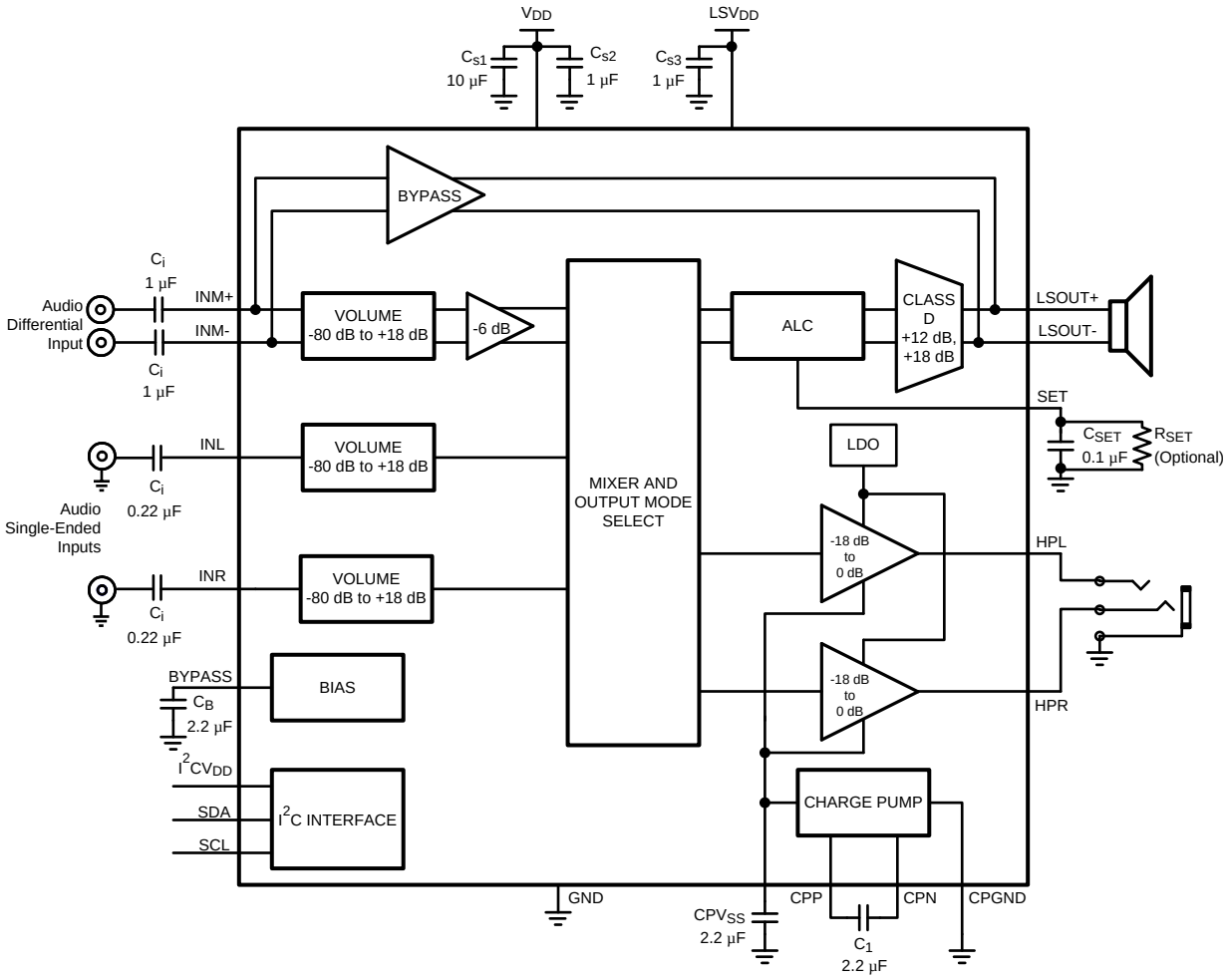


Figure 1. Typical Audio Amplifier Application Circuit

Connection Diagram

20 Bump micro SMD Package

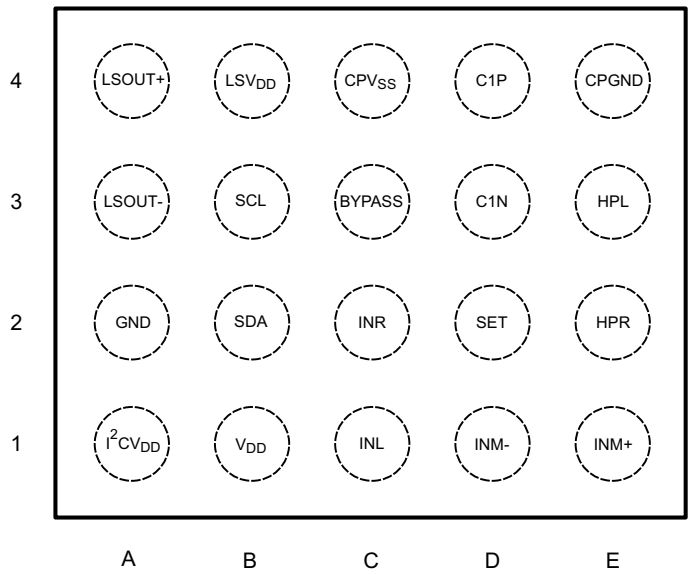


Figure 2. Top View

Top Markings

Figure 3. Top View
XY - Date Code
TT - Die Traceability
G- Boomer
L7 - LM49151TL

Table 2. Bump Descriptions

Bump	Name	Description
A1	I^2CV_{DD}	I^2C Power Supply
A2	GND	Ground
A3	LSOUT-	Inverting Loudspeaker Output
A4	LSOUT+	Non-Inverting Loudspeaker Output
B1	V_{DD}	Analog Power Supply
B2	SDA	I^2C Data Input
B3	SCL	I^2C Clock Input
B4	LSV_{DD}	Loudspeaker Power Supply
C1	INL	Left Channel Input
C2	INR	Right Channel Input
C3	BYPASS	Mid-Rail Supply Bypass
C4	CPV_{SS}	Charge Pump Output
D1	INM-	Mono Channel Inverting Input

Table 2. Bump Descriptions (continued)

Bump	Name	Description
D2	SET	ALC Timing Control
D3	CPN	Charge Pump Flying Capacitor - Negative Terminal
D4	CPP	Charge Pump Flying Capacitor - Positive Terminal
E1	INM+	Mono Channel Non-Inverting Input
E2	HPR	Right Channel Headphone Amplifier Output
E3	HPL	Left Channel Headphone Amplifier Output
E4	CPGND	Charge Pump Ground

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
LM49151TL/NOPB	ACTIVE	DSBGA	YZR	20	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	
LM49151TLX/NOPB	ACTIVE	DSBGA	YZR	20	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	

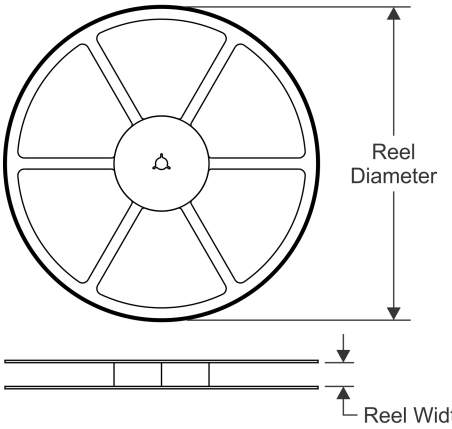
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

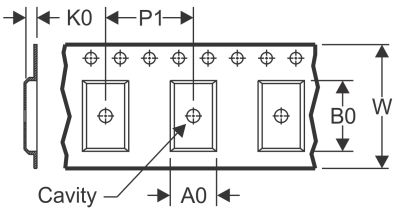
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

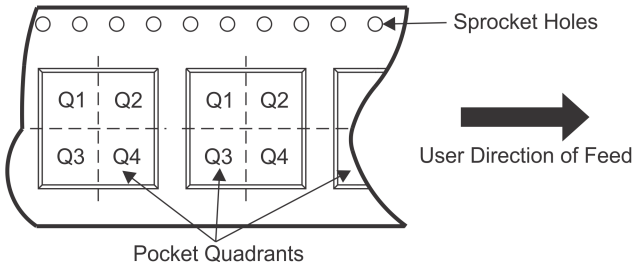


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

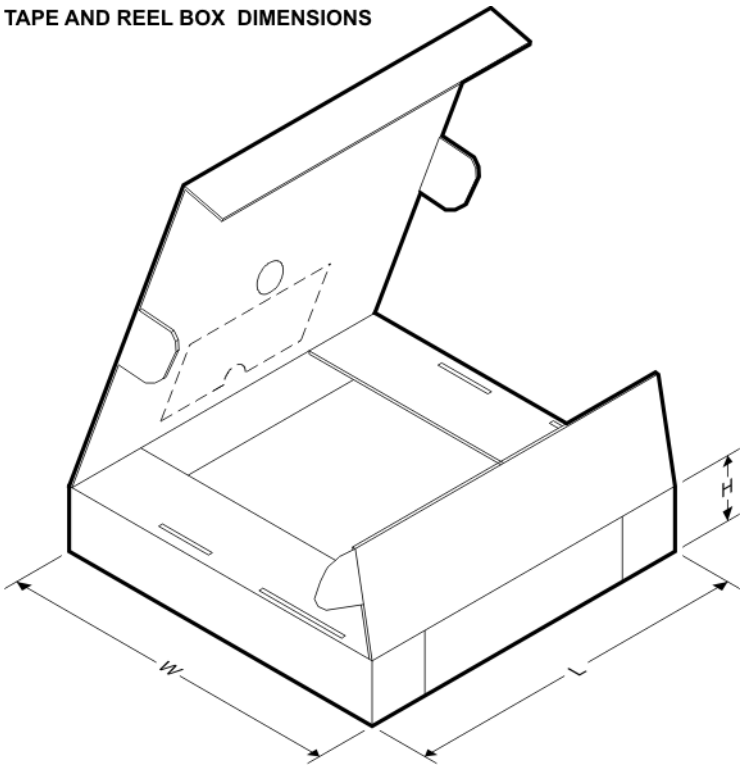
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM49151TL/NOPB	DSBGA	YZR	20	250	178.0	8.4	2.34	2.85	0.76	4.0	8.0	Q1
LM49151TLX/NOPB	DSBGA	YZR	20	3000	178.0	8.4	2.34	2.85	0.76	4.0	8.0	Q1

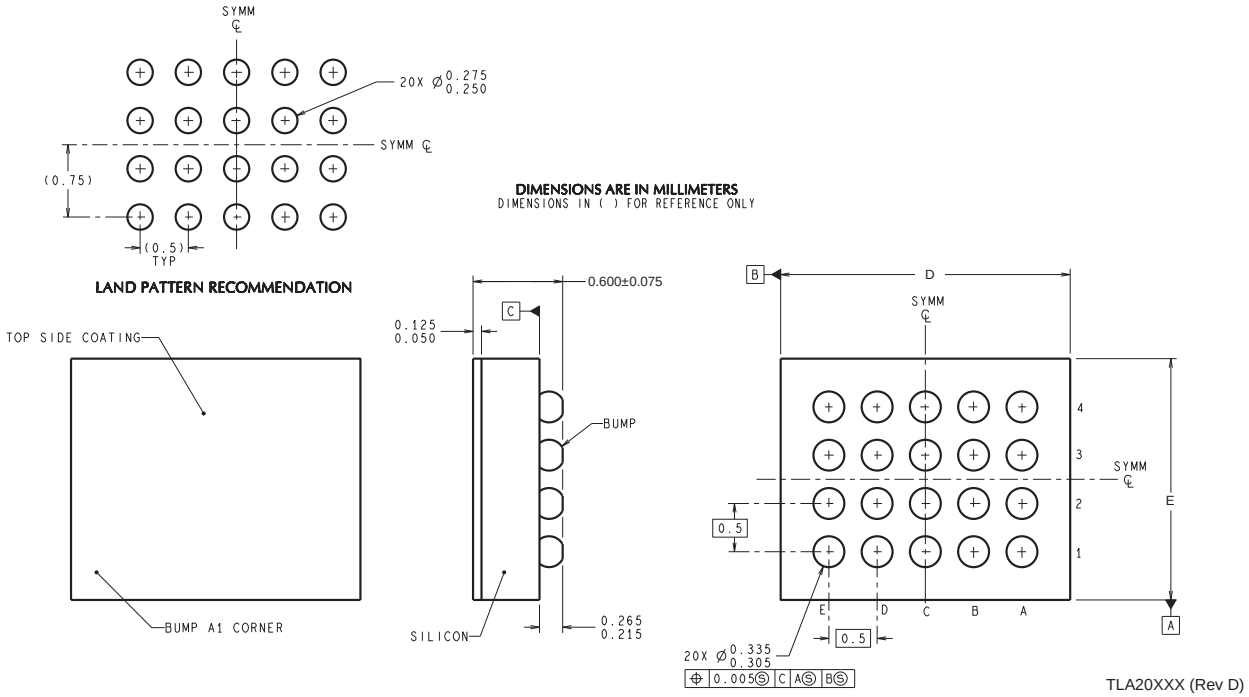
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM49151TL/NOPB	DSBGA	YZR	20	250	203.0	190.0	41.0
LM49151TLX/NOPB	DSBGA	YZR	20	3000	206.0	191.0	90.0

YZR0020



D: Max = 2.621 mm, Min = 2.52 mm

E: Max = 2.187 mm, Min =2.087 mm

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NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
B. This drawing is subject to change without notice.

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