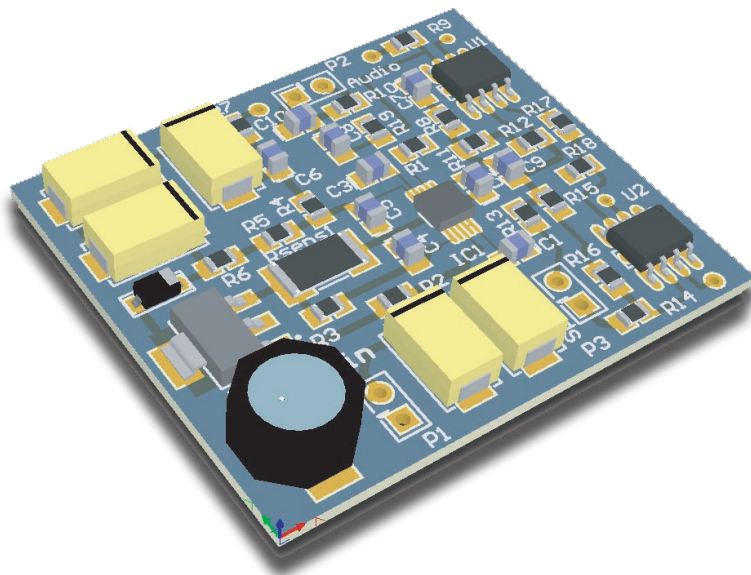


Piezo-Ceramic Audio Amplifiers

sonitron[®] *PAA-StepUpBTL-01*

Appnote PAA-StepUpBTL-01 Amplifier



March 2010

Sonitron n.v.
R&D department

Appnote PAA-StepUpBTL-01 Amplifier

To go loud is to amplify the input signal to a large Voltage peak to peak swing of maximum 60Vpp. Tuned on the SPS piezo speakers the "StepUpBTL" piezo audio amplifier is designed for a very loud audio sound in a room.

The creation of a 60Vpp swing derives from a stable DC power source of 30 V DC.

The boostconverter circuit is designed to a minimum surface with a maximum variety at the input source. A variation of the input voltage between 5V and 25V gives at the end a stable 30VDC to power the opamps with efficient power consumption.

The amplifier circuit is a perfect balance between power consumption and space design. The Bridge Tied Load amplifier topology makes it possible to swing the signal to 60Vpp.

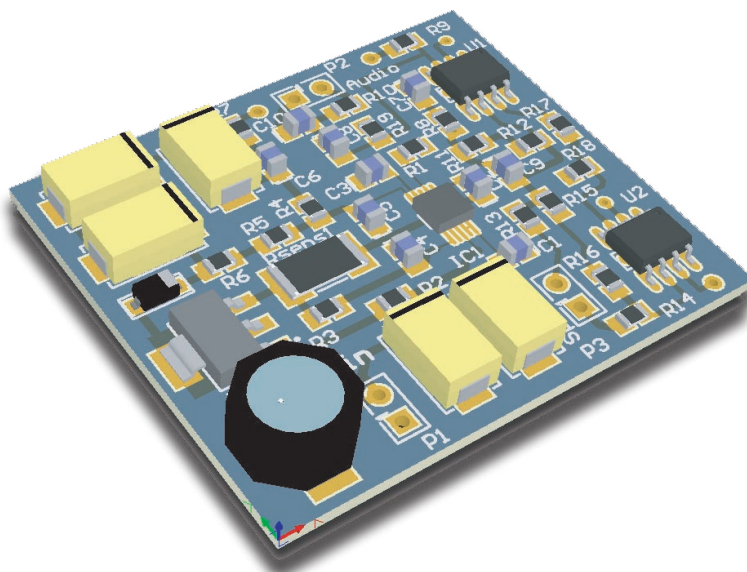
Specifications:

- Input voltage 5V to 25V
- Fixed amplification ratio +/- 90
- Output Audio Signal: Max 60 Vpp
- Dimensions: 35mm on 40mm

Boost converter + Amplifier

- DC-DC- converter: Max 669
=> output: 30 Vdc
- Amplifier circuit: OPA 551
=> "Bridge tied load configuration"

- **Ideal:** **+input:** 9Vdc
 +output: 40Vpp



Specifications:

This Piezo-amplifier consists out of two electronic circuits.

The Step Up Converter

The Bridge Tied Load

MAXIM
1.8V to 28V Input, PWM Step-Up
Controllers in μMAX

General Description
The MAX668/MAX669 constant-frequency, pulse-width modulating (PWM), non-isolated DC-DC controllers are designed for a wide range of DC-DC conversion applications including step-up, step-down, boost, and isolated output configurations. Power levels of 20W or more can be converted with conversion efficiencies of over 90%. The 1.8V to 28V input voltage range supports a wide range of battery and AC-powered loads. An advanced DC-DC design features low standby current (typical), adjustable operating frequency (100kHz to 500kHz), soft-start, and a 5VTC input allowing the MAX668/MAX669 oscillator to be locked to an external clock. DC-DC conversion efficiency is combined with a low 100mV current-sense voltage as well as with Maxim's proprietary Life Mode™ control scheme. The controller operates in PWM mode at medium and heavy loads for lowest noise and optimum efficiency, then switches to burst mode with reduced inductor current to reduce operating current and maximize efficiency under light loads. A logic-level shutdown input is also included, reducing supply currents to 3.5μA.

Features

- 1.8V Minimum Start-Up Voltage (MAX668)
- Wide Input Voltage Range (1.8V to 28V)
- True 10-Pin μMAX Package
- Current-Mode PWM and Idle Mode™ Operation
- Efficiency Over 90%
- Adjustable 100kHz to 500kHz Oscillator or 5VTC Input
- 200mA Standby Current
- Logic-Level Shutdown
- Soft-Start

Applications

- Cellular Telephones
- Telecom Hardware
- LANs and Network Systems
- POS Systems

Ordering Information

PART	TEMP RANGE	PACKAGE
MAX668UB	-40°C to +85°C	10 μMAX
MAX669UB	-40°C to +85°C	10 μMAX

MAX668 is a trademark of Maxim Integrated Products.

Typical Operating Circuit

Pin Configuration

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

The heart of the Step Up Converter is the Max688 from MAXIM. The IC is configured in the high-voltage non-bootstrapped mode and is used as a non-isolated power supply.

The input voltage can vary from 5V DC to 25V DC.

The output is set to 30 VDC and can deliver +/- 500mA.

Datasheet:

<http://datasheets.maxim-ic.com/en/ds/MAX668-MAX669.pdf>

The Bridge Tied Load circuit is powered by 30V. The IC OPA551 Burr- Brown product from Texas Instruments is used for the high voltage amplification.

A Bridge Tied Load circuit is a technique to create a larger output voltage swing than that is possible with one amplifier. A second amplifier inverts the signal and the load (SPS-speaker) is connected between the two outputs (BTL = Bridge-Tied-Load)

Note that, each amplifier sees the half of the load impedance and hereby double the current, thereby doubling the dissipation within the amplifier.

Datasheet: <http://focus.ti.com/lit/ds/symlink/opa551.pdf>

Burr-Brown Products
from Texas Instruments

OPA551
OPA552

DESCRIPTION - JULY 1988 - REVISED OCTOBER 2003

High-Voltage, High-Current OPERATIONAL AMPLIFIERS

FEATURES

- WIDE SUPPLY RANGE: ±4V to ±50V
- HIGH OUTPUT CURRENT: 200mA Continuous
- LOW NOISE: 14nV/√Hz
- FULLY PROTECTED: Thermal Shutdown, Output Current Limited
- THERMAL SHUTDOWN INDICATOR
- WIDE OUTPUT SWING: 2V From Rail
- FAST SLEW RATE: OPA551: 150μA OPA552: 240μA
- WIDE BANDWIDTH: OPA551: 3MHz OPA552: 12MHz
- PACKAGES: DIP-8, SO-8, or DPAK-7

DESCRIPTION

The OPA551 and OPA552 are low cost op amps with high-voltage (50V) and high-current (200mA) capability. The OPA551 is unity-gain stable and features high slew rate (15V/μs) and wide bandwidth (3MHz). The OPA552 is optimized for gain of 1 or greater, and often higher speed with a slew rate of 24V/μs and a bandwidth of 12MHz. Both are available in high-voltage, high-current, and low-noise versions. These low-noise, monolithic integrated circuits provide excellent low-level accuracy along with high output swing. High performance is maintained in the amplifier range to the specified limits.

The OPA551 and OPA552 are internally protected against over-temperature conditions and current overload. The thermal shutdown indicator "flag" provides a current output to alert the user when thermal shutdown has occurred.

The OPA551 and OPA552 are available in DIP-8 and SO-8 packages, as well as a DPAK-7 surface-mount plastic power package. They are specified for operation over the extended industrial temperature range, -40°C to +125°C.

APPLICATIONS

- TELEPHONY
- TEST EQUIPMENT
- AUDIO AMPLIFIERS
- TRANSDUCER EXCITATION
- SERVO DRIVERS

Circuit Diagrams:

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and their associated risks appears at the end of this data sheet.

TEXAS INSTRUMENTS
www.ti.com

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The first amplifier is set as a non-inverting amplifier with amplification ratio A and the second amplifier is a unity inverting amplifier -A

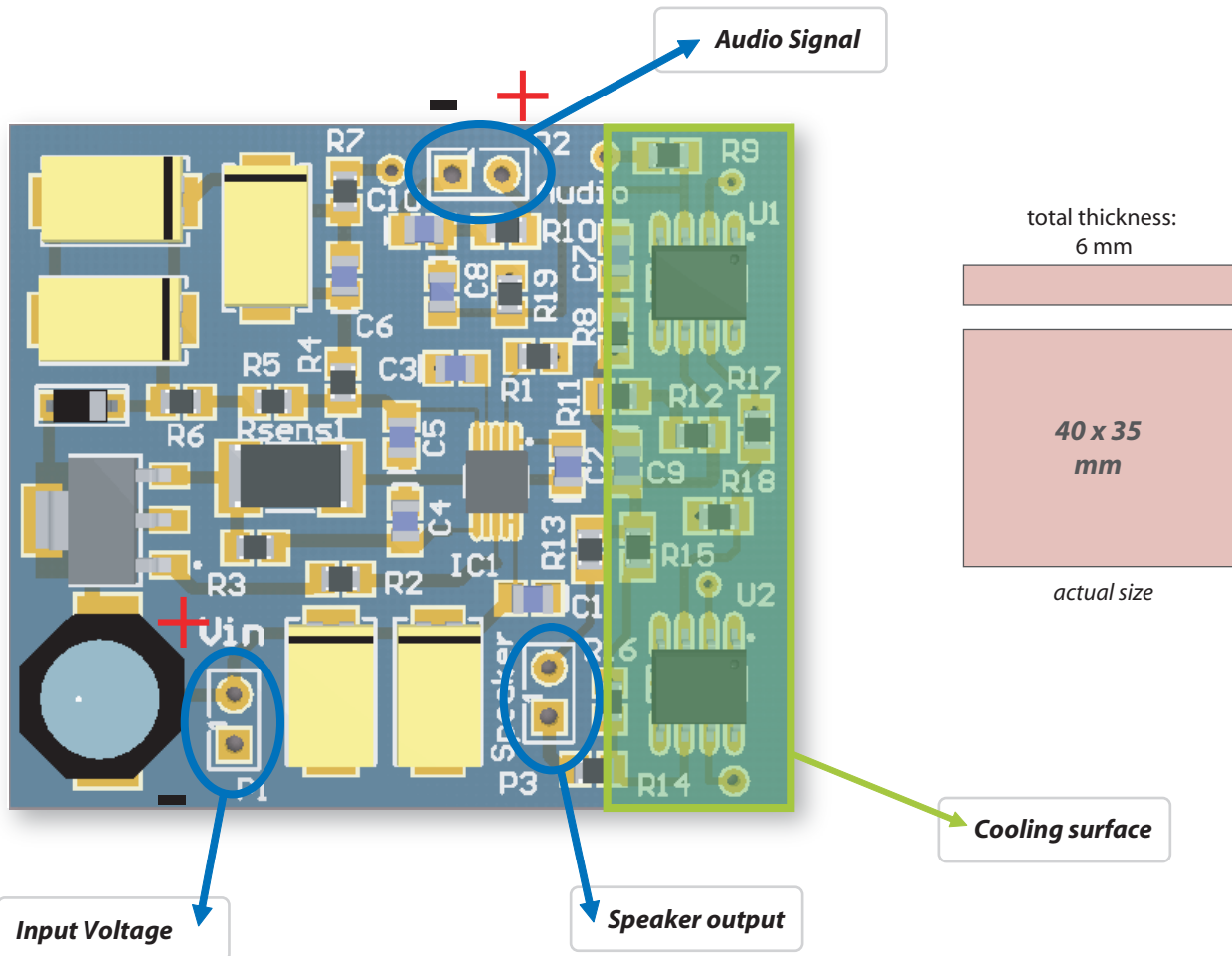
Total amplification of input signal that the load will see is:

Values in the design: $R_f = 2M$ and $R_{in} = 43K \Rightarrow A = 46,51$

Total amplification ratio is set by +/-90

$$A_{tot} = 1 + \frac{R_f}{R_{in}} - (-A)$$

Dimensions



Controlling Power dissipation

The end amplifier IC's can become hot if the Piezo Audio Amplifier is used for a long time at 60Vpp or in saturation mode. A proper cooling has to be foreseen in such cases.

A Small band of the "Gap Pad VO Soft" 1.5 mm thickness from The Bergquist Company can be used to cool down the Integrated Circuits.

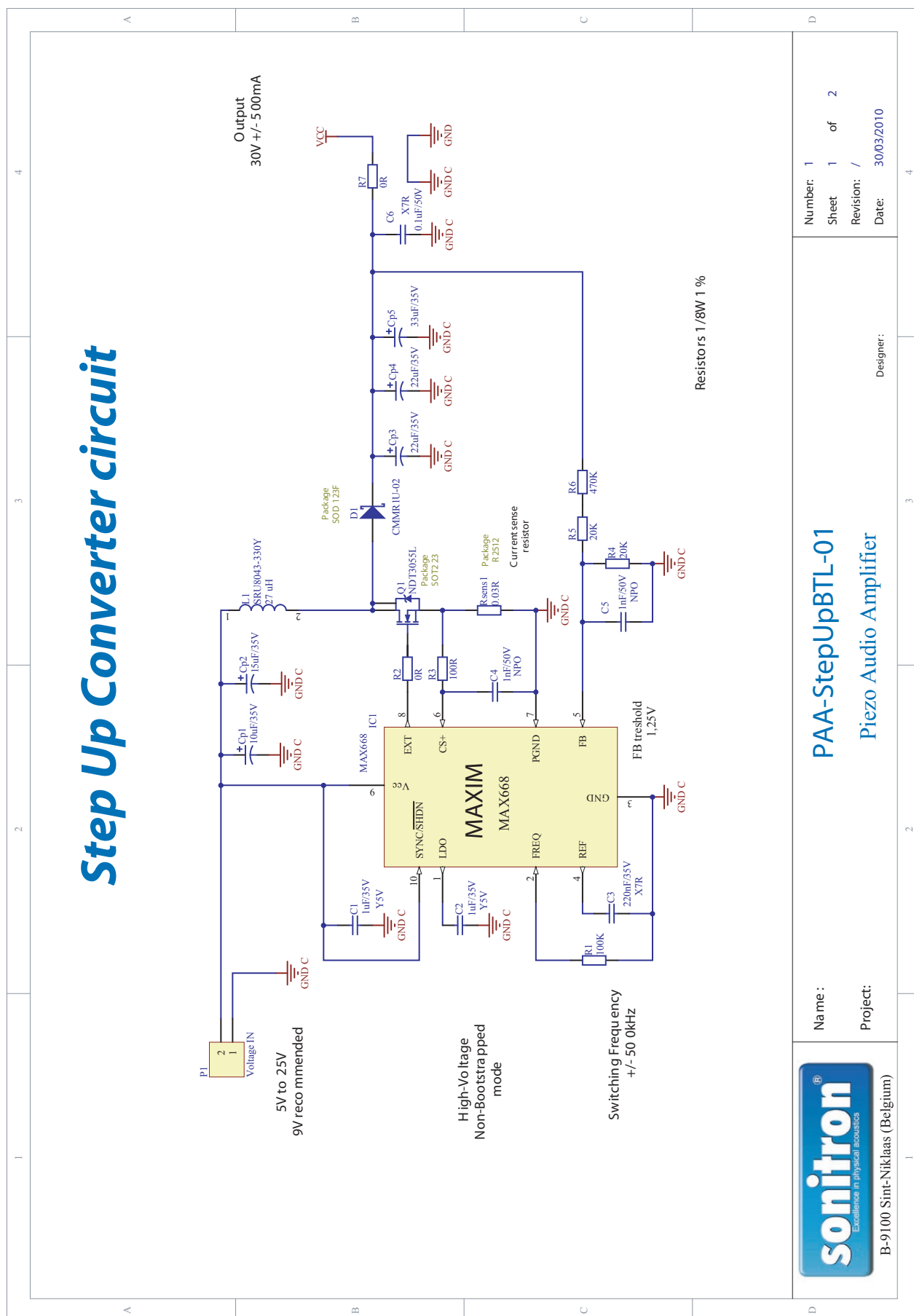
http://www.bergquistcompany.com/thermal_materials/gap_pad/gap-pad-VOSoft.htm

Recommendations

Input voltage of 9 Vdc and an output voltage swing of 40Vpp.

The output voltage swing is controlled by the input audio signal. For an output of $\pm 40V_{pp}$ the input audio signal must be $\pm 0,5V_{pp}$.

Step Up Converter circuit



Resistors 1/8W 1 %

sonitron®
Excellence in physical acoustics

B-9100 Sint-Niklaas (Belgium)

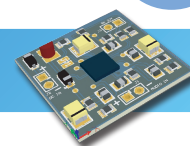
PAA-StepUpBTL-01

Piëzo Audio Amplifier

Designer :

Number: 2
Sheet 2 of 2
Revision:
Date: 30/03/2010

PIEZO AUDIO AMPLIFIERS



INTRODUCTION

The **P**iezo **A**udio **A**mplifiers-series are a total solution to drive piezoceramic sound components. A range of different PCB sizes, amplifier topologies and maximum voltage peak to peak outputs, cover a wide solution to piezo audio amplification.

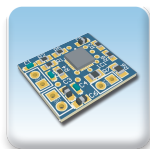
Piezo audio amplifiers are designed to handle capacitive loads and have the possibility to deliver large voltages peak to peak over the complete audio frequency range.

The heart of a piezo audio component is a ceramic piezo stone that interacts when it feels a certain voltage difference. An increase of a voltage peak to peak will have a larger piezo deformation and results in a larger sound output.

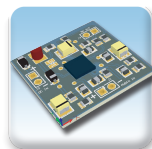
The PAA-series give a quality amplifier solution where a quality sound is needed.

GENERAL OVERVIEW PAA SERIES

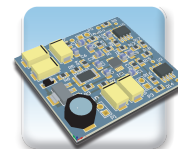
Model	PAA-MAX9788-01	PAA-LM4960-02	PAA-StepUpBTL-01
Measurements PCB(mm)	14x16.5mm	25x25mm	40x35mm
Voltage input (V)	5V	5V	5V-25V
MAX Capacitance Piezo Speaker	1µF	600nF	1µF
Max Voltage Output Vpp	20Vpp	24Vpp	60Vpp
Voltage Topology	Integrated step up converter	Integrated step up converter	Step up converter
Amplifier classification	Class G	Class AB	Class AB
Used amplifier configuration	Fully Differential	Bridge Tied Load	Bridge Tied Load
Average current consumption of speaker and amplifier (mA)	15mA	85mA	40mA-400mA (2 Watt)



PAA-MAX9788-01



PAA-LM4960SQ-02



PAA-StepUpBTL-01

For more information see the Sonitron Catalogue 2010
 Piezo Audio Amplifiers Page 103 - 111 (or click the link below)

<http://cde.cerosmedia.com/piezo-buzzer-transducer-alarm-siren-speaker-amplif/1N4bbf4084e44f9012.cde/page/102>

Piezo Speakers & Piezo Audio Amplifiers

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