

# Piezoceramic Speakers

# sonitron<sup>®</sup>

Excellence in physical acoustics

RoHS  
compliant



SPS-2220-03

SPS-3530-03

SPS-4640-03

SPS-8770-03



SPS-8770  
UW



SCS-series



SPS-27-01



APPLICATIONS

## Catalogue 2006

Piezoceramic audible components

**TUV  
CERT**

DIN EN ISO 9001:2000  
Zertifikat: 01 100 010603

From crystals to sound

## INTRODUCTION

Founded by Mr. Hugo Michiels in 1977, Sonitron have become the leading European manufacturer of piezoceramic audible components. Continuous research, intensive development and specialist know-how have resulted in a wide range of high quality and reliable products from the smallest and most cost effective buzzer to highly sophisticated alarms. This allows Sonitron to meet the needs of many applications, such as industrial, medical, consumer and military.

Our SPS multimedia flat speakers are the result of ten years intensive research and development work. Distortion is very low and sound reproduction is excellent.

Clarity of sound is superior to any other speaker because of the very fast response time of the piezo membrane for higher harmonics in the sound signal. In this catalogue an important section is provided to explain how the speakers can be best integrated into your electronics.

Today there are several IC circuits available on the market that simplify the realization of drive signal amplifiers. The slim line profile and improved technology of the Sonitron SPS piezo speakers should guarantee an important added value to your application !

In this catalogue you will find the smallest speaker in the world reproducing from 700 Hz up to 15 kHz with a square dimensions of 20 mm, a thickness of 1 mm and a power consumption of only a few milliamps. With its extremely good voice clarity it is definitely the new speaker generation for mobile phones...

Sonitron remains at the forefront of development of advanced products based on smart materials.

We thank our customers and sales network throughout the world for the confidence shown in our company and products. They can be assured of our continuous efforts to generate "excellence in physical acoustics", creating an added value to your application.

SONITRON is ISO 9001:2000 certified by TÜV Rheinland.




Dr. Hugo R. Michiels  
President  
SONITRON N.V.



Family range of Sonitron products

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**SCS-17 / SCS-24 / SCS-32**

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# COMPANY ORGANISATION

Sonitron manufactures their products in Belgium and sells them through an international network of distributors and representatives.

Our distributors and representatives give excellent sales and technical service.

They provide our customers with price quotations, samples, catalogues, technical assistance,...

Please check the distributors and representatives list to look for your nearest contact person at

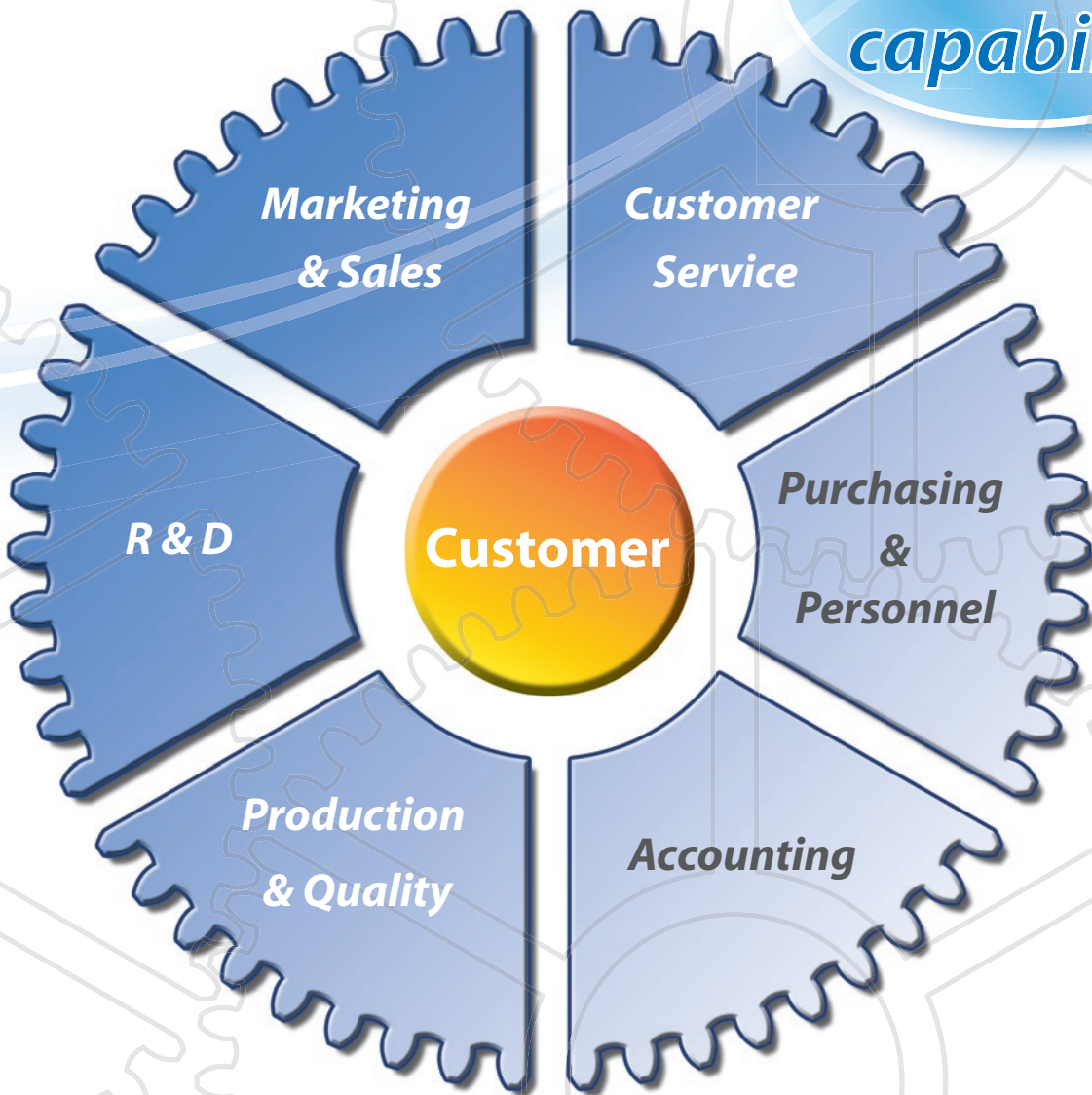
<http://www.sonitron.be/index.cfm?pageID=2519>

However, if there is no distributor or representative in your country or should you require more detailed information, do not hesitate to contact our headquarter in Belgium.

Send your request to [sales@sonitron.be](mailto:sales@sonitron.be) or [info@sonitron.be](mailto:info@sonitron.be). We will be pleased to help you !

**Sonitron has the following departments to assist you...**

**Total  
in-house  
capability**



# MODELS ON REQUEST

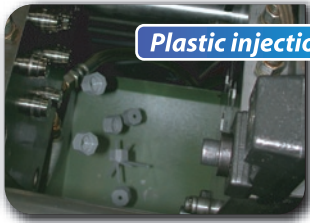
Continuous research, intensive development and specialist know-how have resulted in a wide range of high quality and reliable products, from the smallest and most cost effective buzzer to highly sophisticated alarms. This allows Sonitron to meet the needs of many different applications within the industrial, consumer, medical and military industry.

Ongoing investments in the in-house disciplines enable Sonitron to maintain their market reputation and being your first choice supplier of audible components and application support in acoustic technology.

Our future activities will be focused not only on research and development of new applications and products, but also on the development of buzzers or speakers for special customer requests. Our engineers will carefully study your application and give their support for the realisation of your audio-project with Sonitron products. Please send your request on [sales@sonitron.be](mailto:sales@sonitron.be) or [info@sonitron.be](mailto:info@sonitron.be). We will be pleased to help you further !

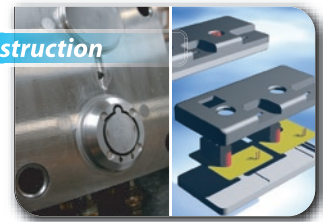


# KNOW-HOW AND EQUIPMENT



**Plastic injection**

Sonitron studied the use of numerous plastic materials for buzzer housings, resulting in the use of the highest quality materials. Sonitron has a fully automated plastic injection department, which guarantees full of all the dimensions and acoustic properties of the housings of our products.



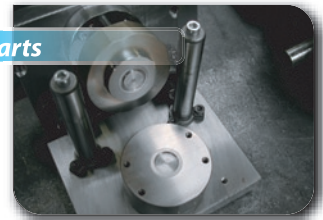
**Mould development and construction**

Sonitron develop and produce themselves the mouldings for the plastic housings and pin terminals used in their buzzers. This in-house knowledge and expertise in moulding technology enables Sonitron to manufacture customized products.



**CNC milling machine**

The fully automatic Milling Station with 5 axis is used to create new prototypes and plastic injection moulds. A continuous milling productivity is guaranteed due to the 16 load tool exchanger.



**Pressing and cutting metal parts**

Sonitron develop specially shaped and formed membranes for use in their products. These membranes are produced in-house, enabling to maintain the high quality in large quantities, required for mass production of membranes with specific resonant frequencies.



**Pick & place machine**

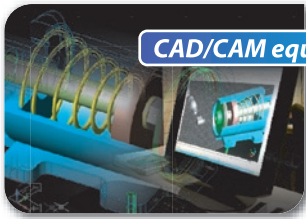
The electronic circuits produced and incorporated in Sonitron's acoustic components are designed in-house and are fully automatically realised with the latest surface mount and soldering equipment.



**Automatic gluing**

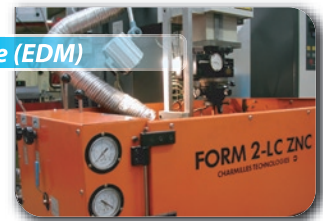
As the process of gluing the ceramic onto the membrane is of essential importance for the reproduction of the requested frequency, Sonitron developed special gluing equipment. This equipment enables full control of perfect adhesion between the piezo disc and the membrane.

# KNOW-HOW AND EQUIPMENT



**CAD/CAM equipment**

The latest software programs and computing technologies are used for the in-house 3D-design of PC-boards, metal parts, moulds and automation equipment.



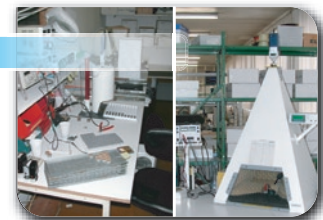
**Electronic discharge machine (EDM)**

The electronic discharge machine makes it possible to create very complex shapes. With this equipment, Sonitron is able to construct the moulds for special designs.



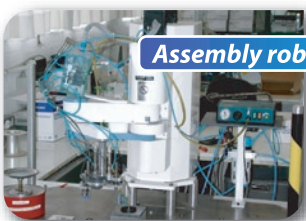
**Test & measurement equipment**

The anechoic room provides acoustic isolation from all background noises. The real time audio analyser can measure each type individually for frequency response, harmonic distortion and phase shift. All parameters such as dB(A), frequency, supply voltage are programmable. A printed copy of specific measurement reports is obtainable upon request.



**Final quality control**

Final testing of Sonitron's products is done in a special pyramid shaped sound absorption environment, avoiding reflection and standing wave patterns. This method guarantees very accurate SPL measurements.



**Assembly robot**

This multifunctional programmable assembling robot is ideal for automation of Sonitron's production.



**Ultrasonic equipment**

This equipment is used for ultrasonic gluing of plastic parts to obtain very strong watertight sealing.



APPLICATION FIELDS FOR PIEZOCERAMIC SPEAKERS



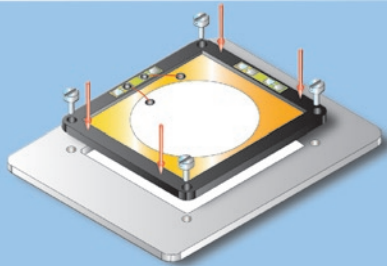
# APPLICATION FIELDS

ACCESS CONTROL  
 ADVERTISING MESSAGE EQUIPMENT  
 AGRICULTURAL EQUIPMENT  
 AIRCRAFTS  
 ANSWERING MACHINE  
 ASSEMBLING EQUIPMENT  
 AUTOMATIC DOORS  
 AUTOMATIC GUIDED VEHICLES  
 AUTOMATION EQUIPMENT  
 AUTOMOBILES  
 BATTERY LOADERS  
 BOATS  
 BUS  
 CABLE TESTER  
 CAR-WASH  
 CENTRAL HEATING CONTROL PANELS  
 CLEANING MACHINES  
 CONSTRUCTION MACHINES  
 COOLING MACHINES  
 COPIERS  
 DIVING EQUIPMENT  
 DOOR ACCESS  
 DOORBELL  
 ELEVATORS  
 EMBARKATION DEVICE  
 EMERGENCY STOP  
 ENTERTAINMENT SYSTEM  
 FIRE DETECTORS  
 FORKLIFT  
 GAS DETECTORS  
 GAS SENSOR  
 GAS STATION  
 GOLF CARTS  
 HELMETS  
 HIGH PRESSURE CLEANERS  
 HIGHWAY TOLL CARD SYSTEM  
 HOOTER FOR BLIND PEOPLE  
 HOSPITAL MESSAGE SYSTEM  
 INDUSTRIAL EQUIPMENT  
 INDUSTRIAL WASHING MACHINES  
 INSTRUMENTATION  
 INTERCOM SYSTEMS

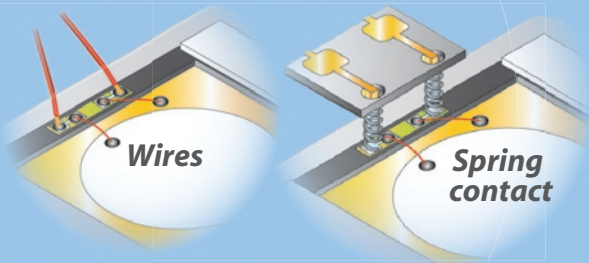
METAL DETECTOR GATE  
 METAL DETECTORS  
 METRO DOORS  
 MILITARY EQUIPMENT  
 MILITARY VEHICLE  
 MINING EQUIPMENT  
 MONITORING & TEST EQUIPMENT  
 MOTORCYCLES  
 MOVING STAIRCASE  
 MOBILE PHONE  
 NURSE CALL SYSTEM  
 PASSENGER INFORMATION SYSTEM  
 PETROL STATION  
 PIPELINE MONITORING  
 PROCESS CONTROL  
 PUBLIC MESSAGE SYSTEMS  
 PUBLIC TELEPHONES  
 PUMP STATIONS  
 PUMP STEERING  
 RADAR CONTROL DEVICE  
 RAILWAY DOOR SYSTEM  
 RUNWAY LIGHTING  
 SAFETY SYSTEMS  
 SATELLITE SYSTEM  
 SECURITY DEVICES  
 SECURITY GATES (WALK THROUGH)  
 SECURITY SYSTEMS  
 SIGNAL EQUIPMENT  
 PROCESS CONTROL EQUIPMENT  
 SURVEYANCE EQUIPMENT  
 TOWER WAGGON  
 TRACTORS  
 TRAFFIC EQUIPMENT  
 TRAINS  
 TRANSMISSION SYSTEMS  
 TRANSPONDER  
 TRUCKS  
 UNDERGROUND  
 UTILITY METERS  
 VEHICLE ACCESS CONTROL  
 VENDING-MACHINES  
 WEATHER CONTROL STATION

# KEY QUESTIONS FOR SPEAKER DETERMINATION

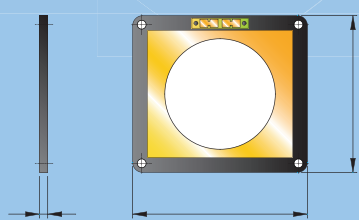
**1. Mounting method:**  
glued, screws, pins, ultrasonic ?



**2. Connection method:**  
wires, pressure spring contacts, solder pads ?



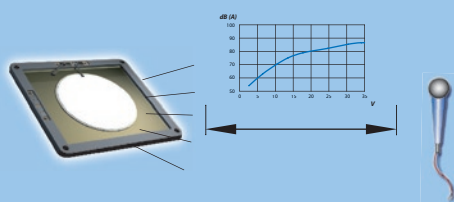
**3. Maximum dimensions (in mm):**  
length, width, thickness ?



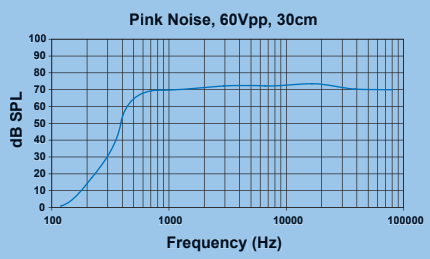
**4. Supply voltage:** battery or mains supply ?



**5. SPL – dB @ 1 meter ?**



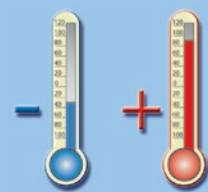
**6. Operating frequency range ?**



**7. Type of audio signal ?** Speech, Music,...



**8. Temperature range in °C ?**



# sonitron® PRODUCT SELECTION GUIDE

## BUZZERS & TRANSDUCERS

### STANDARD SERIES >



**Dimensions overview**  
(in mm)

- Round  $\phi \times H$   
 $\phi 36.5 \times 26$
- Square  $\sphericalangle 38 \times 26$

### SMA-SERIES >



- SMA-13  $\sphericalangle 14 \times 6.5$
- SMA-17  $\sphericalangle 17.5 \times 8.5$
- SMA-21  $\sphericalangle 21 \times 9.5$
- SMA-24  $\sphericalangle 24 \times 15.5$
- SMA-30  $\sphericalangle 30 \times 10.5$

### SMAT-SERIES >



- SMAT-13  $\sphericalangle 14 \times 6.5$
- SMAT-17  $\sphericalangle 17.5 \times 8.5$
- SMAT-21  $\sphericalangle 21 \times 9.5$
- SMAT-24  $\sphericalangle 24 \times 15.5$
- SMAT-30  $\sphericalangle 30 \times 10.5$

### SMB-SERIES >



- SMB-17  $\sphericalangle 18.6 \times 9.7$
- SMB-32  $\sphericalangle 33.5 \times 9.7$

### SMAC-SERIES >



- SMAC-25  $\phi 26.5 \times 18$

For more information!

See BUZZERS & TRANSDUCERS Catalogue

## PIEZOCERAMIC SPEAKERS

### SPS-SERIES >

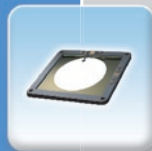
**Dimensions overview**  
(in mm)

SPS-2220-03  $\sphericalangle \times H$



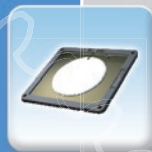
20x22x1

SPS-3530-03



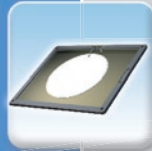
43.5x39x2

SPS-4640-03



50x43.6x2

SPS-8770-03



87x70x2

### SPECIALS >

SPS 8770-UW  
Underwater speaker



90x87x10

SPS-27-01



$\phi 27 \times 4.15$

### SCS-SERIES >



- SCS-17  $\sphericalangle 18.6 \times 9.7$
- SCS-24  $\sphericalangle 25 \times 9.7$
- SCS-32  $\sphericalangle 33.5 \times 9.7$

## ALARMS & SIRENS

### SAS-SERIES >

**Dimensions overview**  
(in mm)

SAS-2835  $\phi \times H$



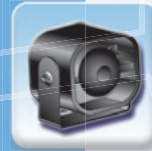
$\phi 56 \times 63$

SAS(T)-2154



$\phi 54 \times 19.6$

SAS-325A-6



108x85x69

SAS-87  
SAS-87-  
12V-IS



$\phi 110 \times 45$

SAS-RL72



47x39x23

SAS-RH72



47x39x23

SAS-81



75x70x51

For more information!

See ALARMS & SIRENS Catalogue

## **RoHS** (RESTRICTION OF HAZARDOUS SUBSTANCES)

I herewith declare that as from october 1, 2005, all of our products are in compliance with the new directive 2002/95/EC (restricting hazardous materials).

We confirm that none of our buzzers (SMA, SMAT, SMAC, panel/standard series), speakers (SCS and SPS series) or alarms (SAS series) contain any of the following substances:

- mercury (Hg)
- cadmium (Cd)
- hexavalent chromium (Cr (VI))
- polybrominated biphenyls (PBB)
- polybrominated diphenyl ethers (PBDE)
- lead



Sonitron N.V. cannot be held responsible for any deviations in raw materials or components used in their products.

Additional information or reports can be supplied after written and motivated request, provided it does not concern classified unreleased production information and subject to cost calculation when information is requested from third parties.



Dr. Hugo Michiels  
President  
SONITRON N.V.

## SPS-SERIES (SONITRON Polymer/metal Speakers)



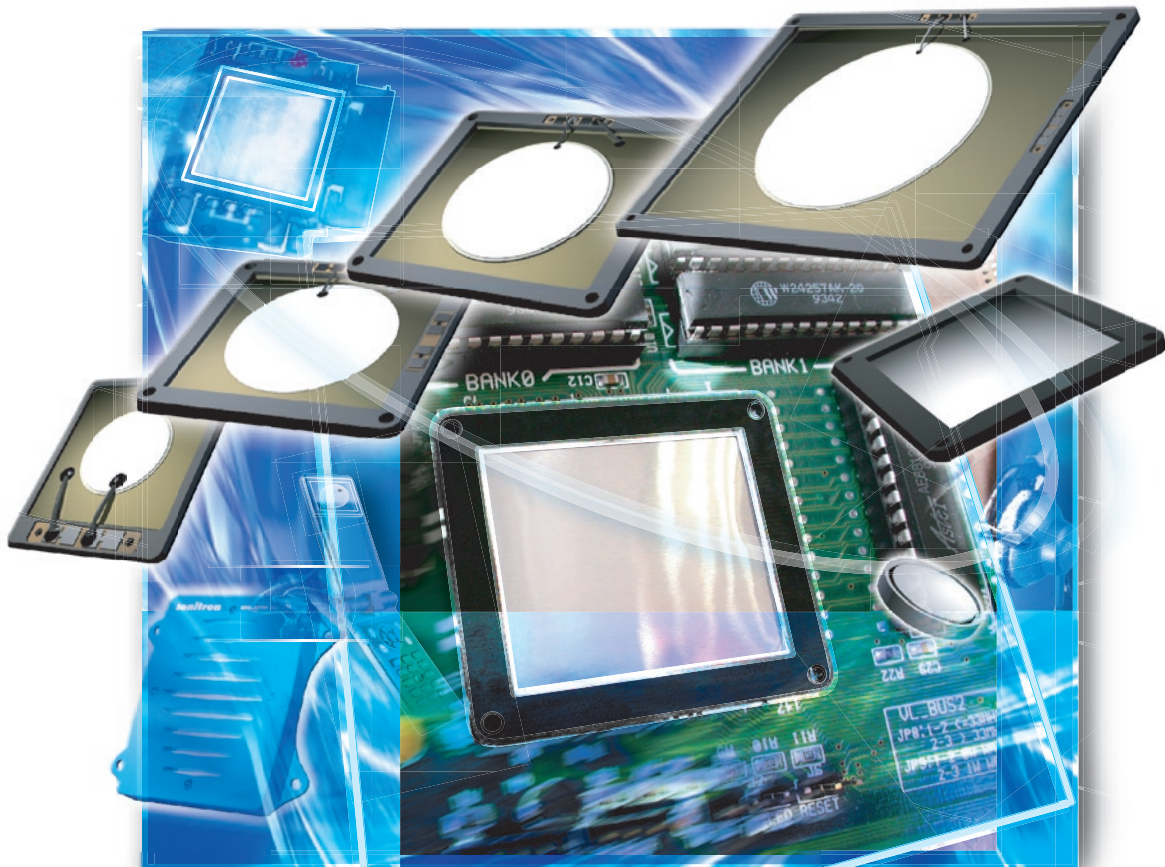
### INTRODUCTION

Based on the in-house expertise in vibration characteristics of piezoceramic material and micro-acoustics, Sonitron successfully developed the SPS-series piezoceramic speakers for industrial, multimedia and automotive applications. The SPS-series is based on a completely new principle of piezoceramics and a composite polymer/metal membrane. The composite polymer/metal membrane reduces unwanted resonance peaks to provide a more even frequency response than can be achieved with conventional designs. High sound quality and low distortion guarantee perfect reproduction of music and speech.

Piezoceramic speakers offer a faster response than conventional magnet speakers because of their lower mass (no voice coil). Magnet speakers are less efficient than piezo speakers because of the losses via the voice coil. Piezoceramic speakers also feature a low weight and low energy consumption relative to their sound output levels. They do not generate an electromagnetic field, making it easier for designers to ensure that their products meet EMC requirements and regulations.

Sonitron's SPS speakers have a very flat design and are delivered with an open front. They can be used in difficult environmental conditions and applications because of resistance of the front to water, humidity, vibrations and dust.

The described models are released for applications such as mobile phone, PDA, flat LCD computer screens and computer monitors, consumer products, car audio, instrumentation, portable devices, public address systems, paging systems, etc.



# ADVANTAGES & APPLICATIONS

## ADVANTAGES :

- very flat and solid construction
- dust, water- and shockproof
- resistant to temperature variations
- broad frequency range in small size
- combined use as speaker/micro
- no electro-magnetic field (EMC)
- little energy required at low frequencies
- less current consumption needed in the leads to the speaker
- 60% higher acoustic output for smaller speakers compared to electrodynamic speakers
- low weight
- low distortion
- high impedance
- can be driven directly by IC

## APPLICATIONS :

- home equipment & domotics
- communication equipment
- talking buzzer & door bell
- computer equipment
- cars, busses and trains
- vending machines
- multimedia equipment
- industrial equipment
- portable voice recorders
- paging systems
- public address systems
- instrumentation
- mobile phone
- car audio system



## GENERAL OVERVIEW *SPS-SERIES*

Model	Frequency range	Maximum. SPL @ 1m	Operating voltage
<i>SPS-2220-03</i>	700-20 kHz	85 dB*	1 to 24 Vpp
<i>SPS-3530-03</i>	700-20 kHz	81 dB	5 to 60 Vpp
<i>SPS-4640-03</i>	400-20 kHz	83 dB	5 to 60 Vpp
<i>SPS-8770-03</i>	200-20 kHz	84 dB	5 to 60 Vpp
<i>SPS-8770-UW</i>	600-20 kHz	90 dB	5 to 60 Vpp
<i>SPS-27-01</i>	200-20 kHz	105 dB**	5 to 40 Vpp

\* @10 cm

\*\* artificial ear B&K type 4153






# SPS-2220-03



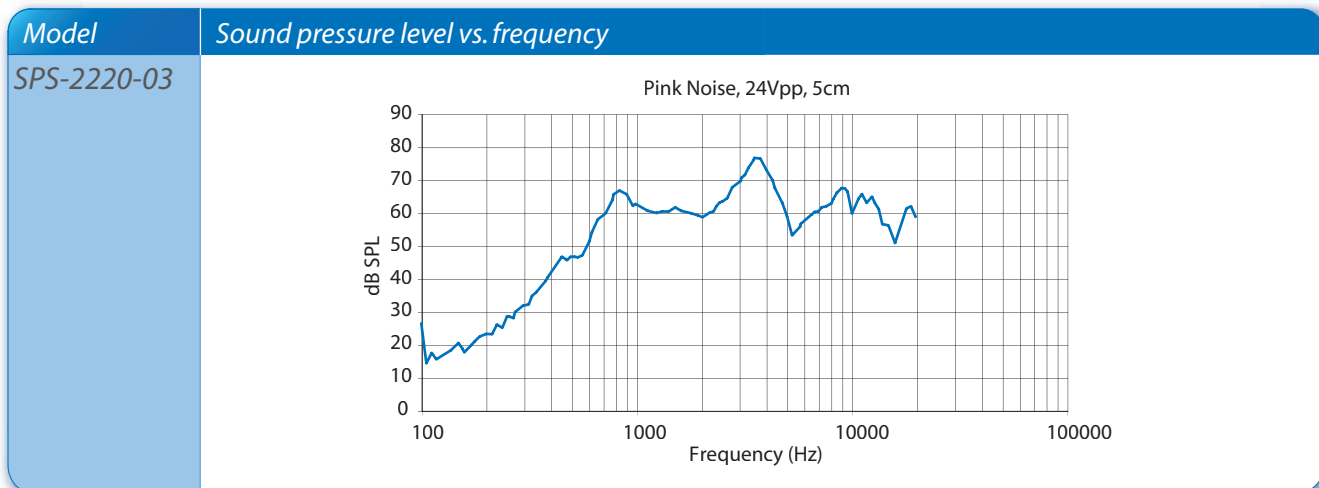
Sonitron's latest slim line profile speaker, the SPS-2220-03, is the result of ten years intensive research and development work. With a thickness of only 1 mm and dimensions of 20x22 mm this small multifunctional speaker/microphone is ideal for use in GPS, MP3, camera's, mobile phones,... It is distortion free and has excellent sound reproduction. Considering its extremely good voice clarity it definitely is the new speaker generation for the mobile phone industry.

## SPECIFICATIONS

Frequency Range :	700 Hz-20 kHz	
Max SPL @ 10 cm, 24Vpp: (average at 4-point)	85 dB	
Distortion (%THD): (80dB at 5 cm, average at 4-point)	≤1%	
Sensitivity: (SPL @ 10cm for 1Vrms, average at 4-point : 800Hz, 1kHz, 1.5kHz, 2kHz)	63 dB	
Capacitance (+/- 20%):	70 nF	
Impedance @ 1kHz (+/-20%):	2.16 kohm	
Operating Voltage:	1Vpp-24Vpp	
Weight:	0.4g	
Operating Temperature:	-20°C to 60°C	
Storage Temperature:	-40°C to 60°C	
Case material:	PBT	
Standard color:	Black	

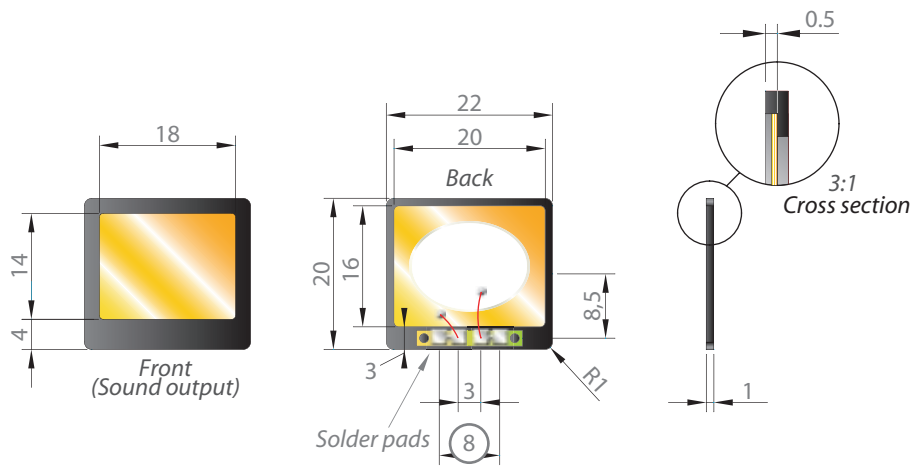
speaker mounted on plexi plate of 5 x 5cm in closed box of 40 x 15 x 5cm

## FREQUENCY RESPONSE



**DIMENSIONS** (all dimensions are in mm)

**SPS-2220-03**



Tolerance: +/- 0.2mm

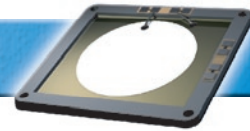


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# SPS-3530-03



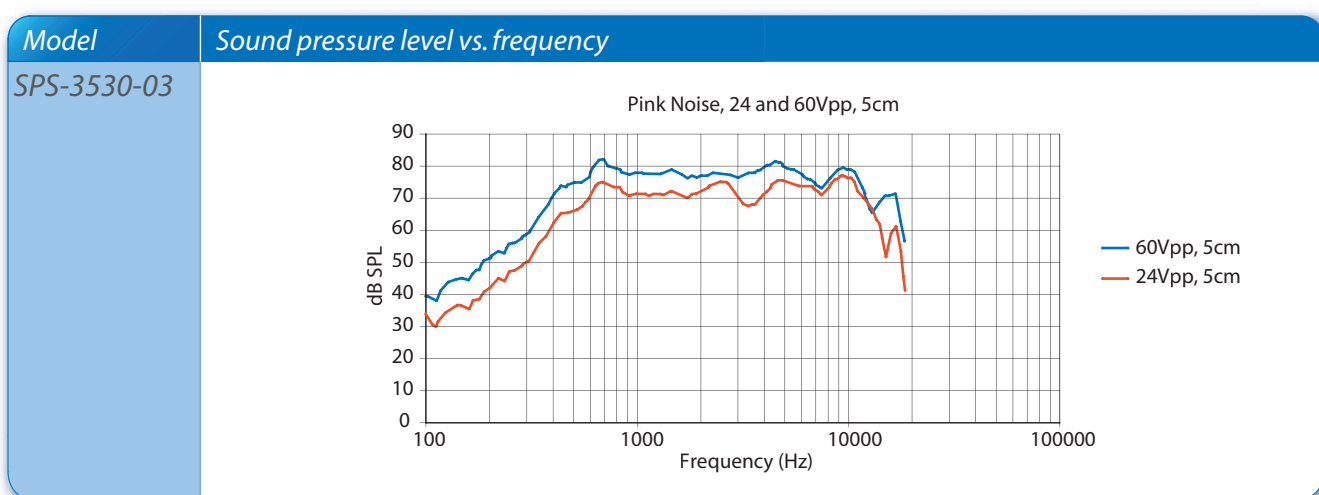
The electronics industry still is a very demanding industry which requires more and more flat and small components. Therefore Sonitron developed this new flat piezoceramic speaker. With a thickness of only 2 mm and dimensions of 39x43.5 mm, this small multifunctional speaker/microphone is ideal for use in portable electronic devices (PDA, GPS, MP3,...), notebooks and consumer products.

## SPECIFICATIONS

Frequency Range :	700 Hz - 20 kHz	
Max SPL @ 1 m, 60 Vpp: (average at 4-point)	81 dB	
Distortion (%THD): (80dB @ 5 cm, average @ 4-point)	≤1.5%	
Sensitivity: (SPL @ 10cm for 1Vrms, average @ 4-point : 800Hz, 1kHz, 1.5kHz, 2kHz)	73 dB	
Capacitance (+/- 20%):	220 nF	
Impedance @ 1kHz (+/-20%):	603 ohm	
Operating Voltage:	5-60 Vpp	
Weight:	2.4g	
Operating Temperature:	-20°C to 60°C	
Storage Temperature:	-40°C to 60°C	
Case material:	PBT	
Standard color:	Black	

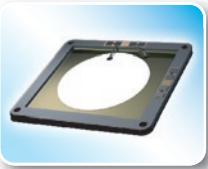
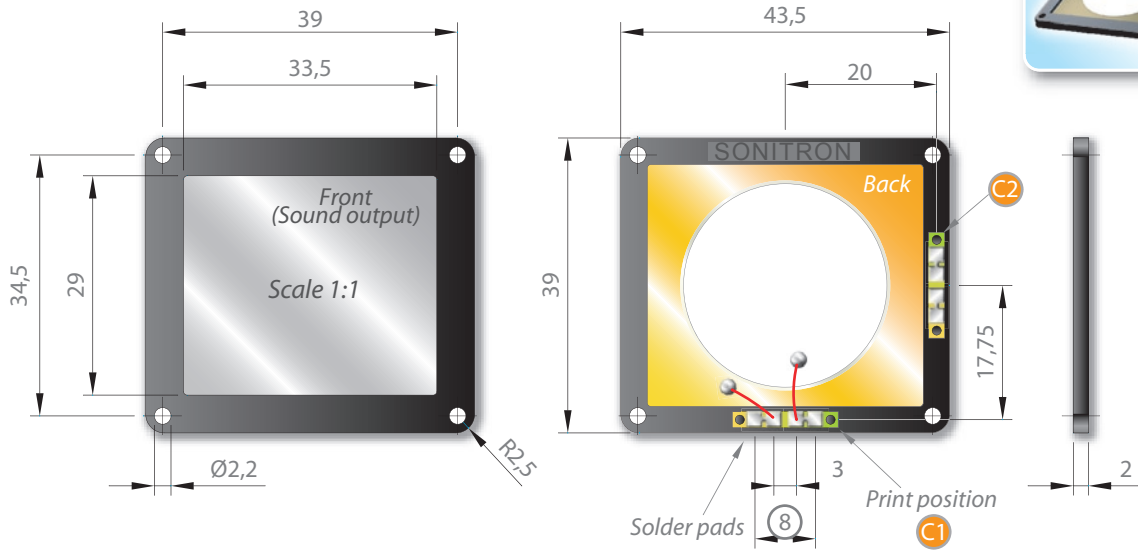
speaker mounted in closed box of 40 x 15 x 5cm

## FREQUENCY RESPONSE



**DIMENSIONS** (all dimensions are in mm)

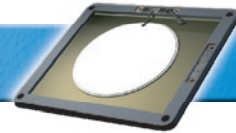
**SPS-3530-03**



Tolerance: +/- 0.2mm



## SPS-4640-03



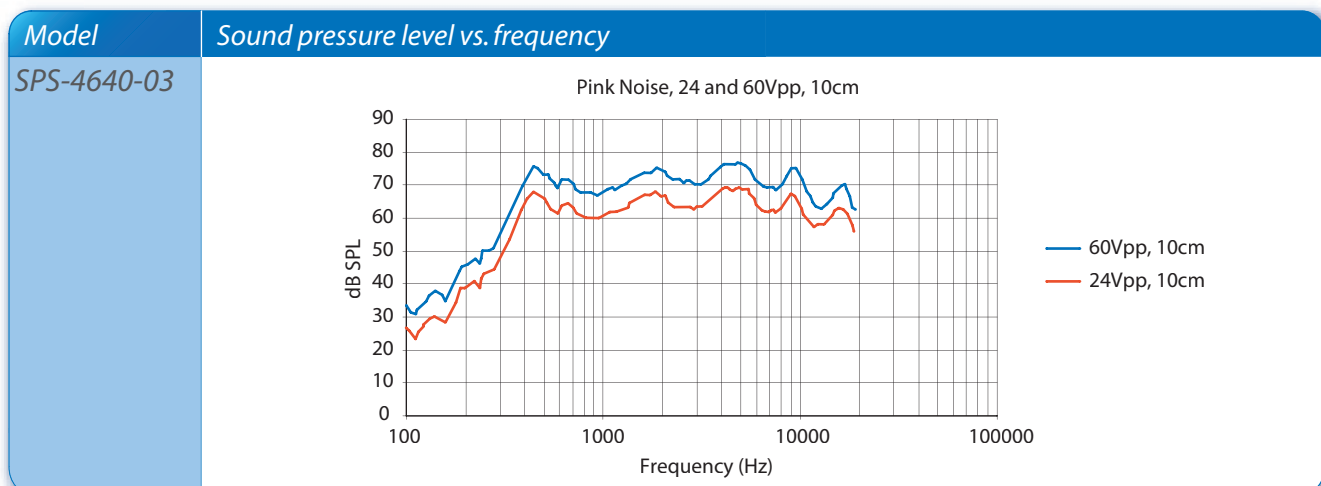
The electronics industry still is a very demanding industry which requires more and more flat and small components. Therefore Sonitron developed this new flat piezoceramic speaker. With a thickness of only 2 mm and dimensions of 43.6x50 mm this small multifunctional speaker/microphone is ideal for use in portable electronic devices (PDA, GPS, MP3,...), notebooks and consumer products.

## SPECIFICATIONS

Frequency Range :	400 Hz - 20 kHz	
Max SPL @ 1 m, 60 Vpp: (average @ 4-point)	83 dB	
Distortion (%THD): (80dB @ 5 cm, average @ 4-point)	≤1.5%	
Sensitivity: (SPL @ 10cm for 1Vrms, average @ 4-point : 800Hz, 1kHz, 1.5kHz, 2kHz)	72 dB	
Capacitance (+/- 20%):	225 nF	
Impedance @ 1kHz (+/-20%):	680 ohm	
Operating Voltage:	5-60 Vpp	
Weight:	2.8g	
Operating Temperature:	-20°C to 60°C	
Storage Temperature:	-40°C to 60°C	
Case material:	PBT	
Standard color:	Black	

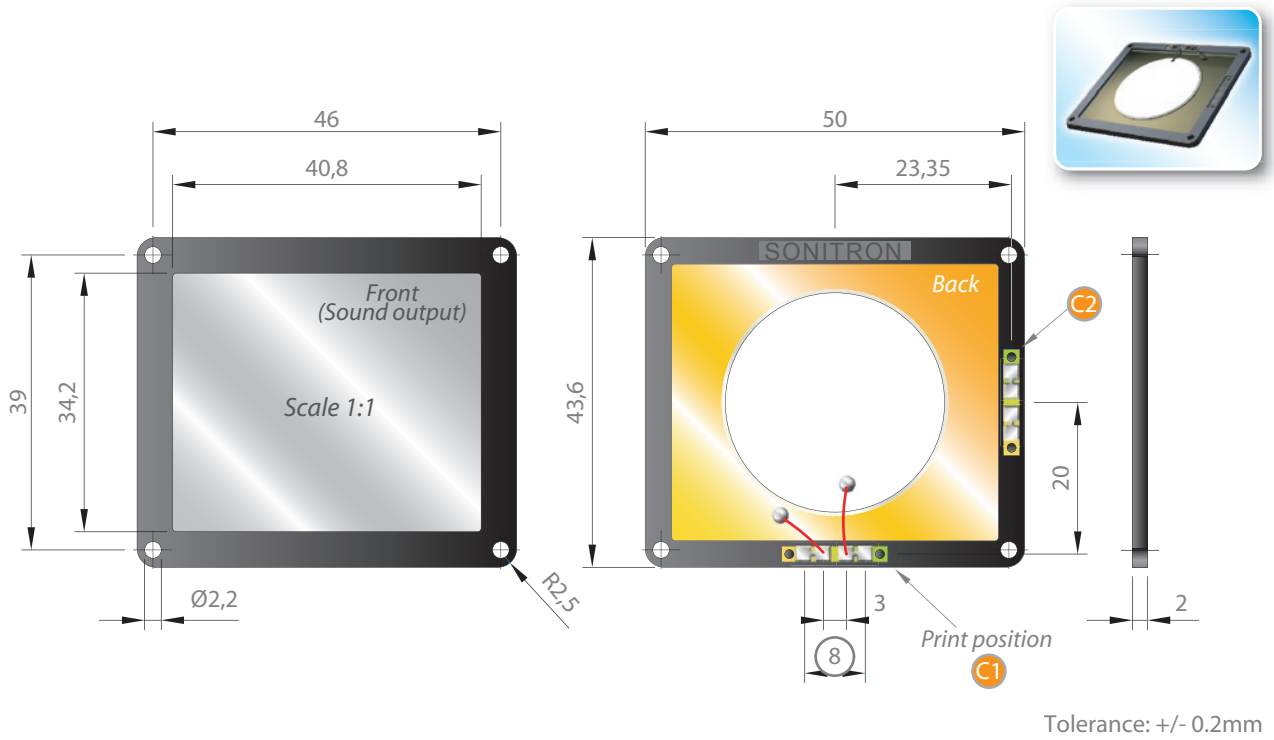
speaker mounted in closed box of 40 x 15 x 5cm

## FREQUENCY RESPONSE



**DIMENSIONS** (all dimensions are in mm)

**SPS-4640-03**



## SPS-8770-03



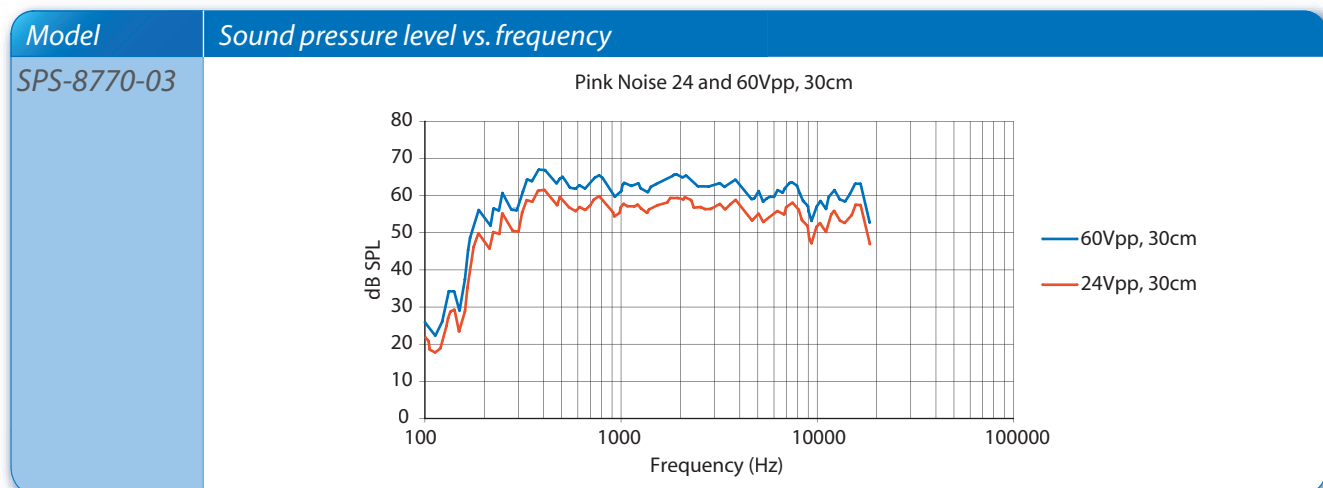
The SPS-8770-03 is the largest version of our piezo speakers, with a thickness of only 2 mm. This model is extremely suitable for flat devices when high sound output and broad frequency range are required. Low weight and easy mounting requirements are the extreme advantages of this speaker. Compared with conventional designs the speaker also has less current consumption.

## SPECIFICATIONS

Frequency Range :	200 Hz - 20 kHz	
Max SPL @ 1 m, 60 Vpp: (average @ 4-point)	84 dB	
Distortion (%THD): (80dB @ 5 cm, average @ 4-point)	≤1.5%	
Sensitivity: (SPL @ 10cm for 1Vrms, average @ 4-point : 800Hz, 1kHz, 1.5kHz, 2kHz)	74 dB	
Capacitance (+/- 20%):	580 nF	
Impedance @ 1kHz (+/-20%):	266 ohm	
Operating Voltage:	5-60 Vpp	
Weight:	7.3g	
Operating Temperature:	-20°C to 60°C	
Storage Temperature:	-40°C to 60°C	
Case material:	PBT	
Standard color:	Black	

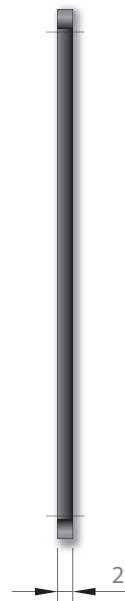
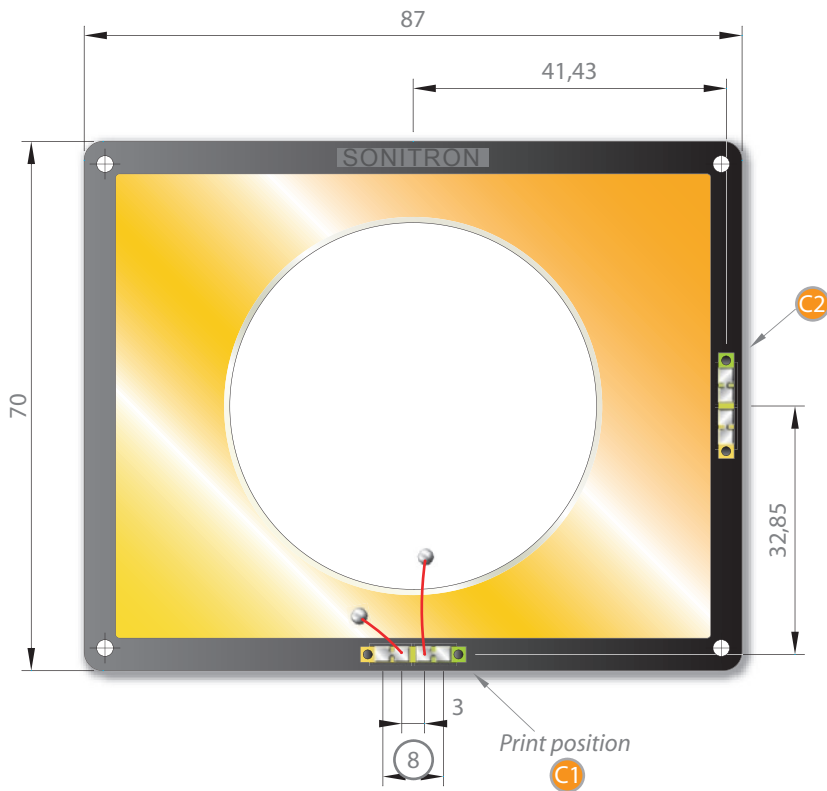
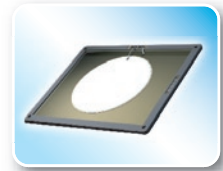
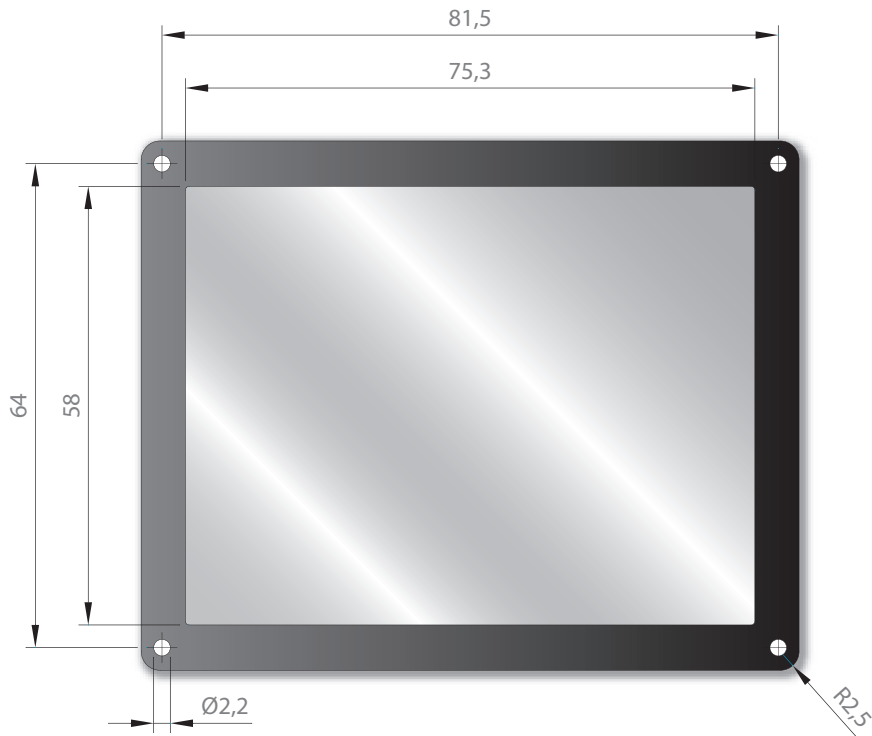
speaker mounted in closed box of 40 x 15 x 5cm

## FREQUENCY RESPONSE



**DIMENSIONS** (all dimensions are in mm)

**SPS-8770-03**



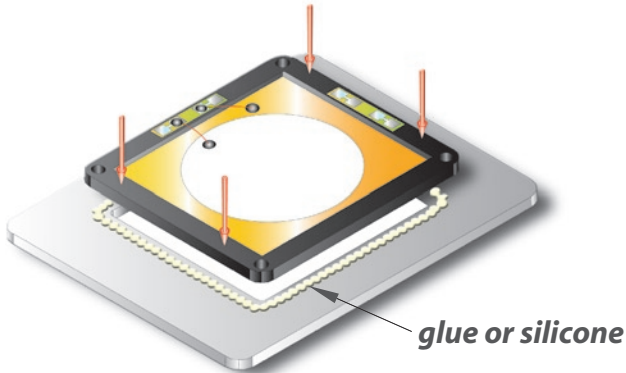
Tolerance: +/- 0.2mm



# MOUNTING INSTRUCTIONS FOR SPS-SPEAKERS

The SPS speakers can be mounted in several different ways. The mounting methods, illustrated below, are recommended to mount all the SPS speaker models. Please keep in mind that not too much mechanical stress is placed on the frame of the piezoceramic speaker after mounting.

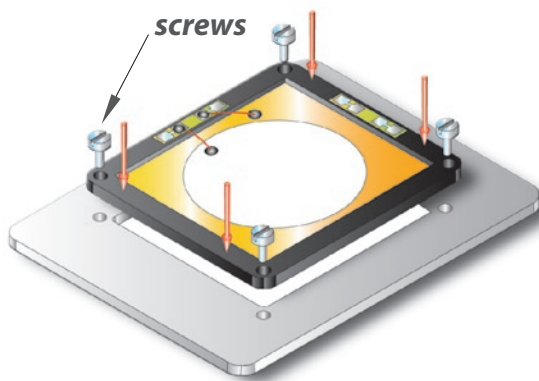
**Mounted with glue or silicone**



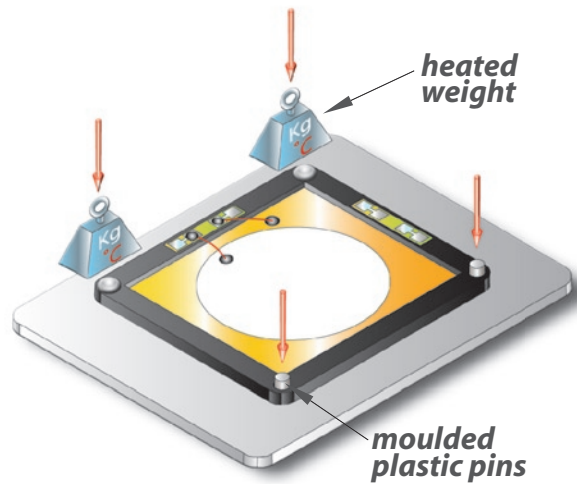
**Mounted with slot groove**



**Mounted with screws**



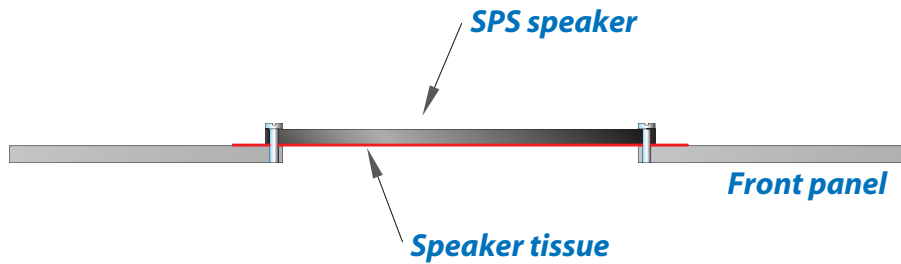
**Plastic deformation method (Ultrasonic)**



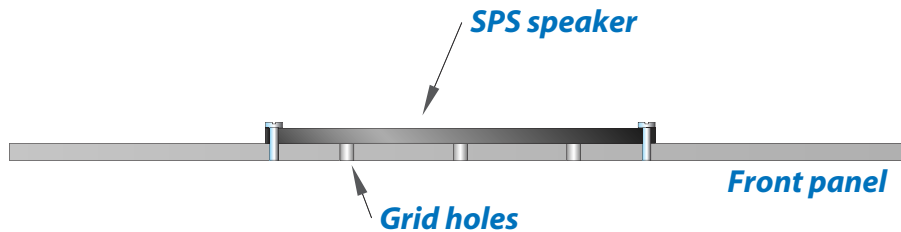
**Other methods...**

**Please also read the mounting instructions on P.43 of the addendum.**

**Speaker tissue**



**Front holes**

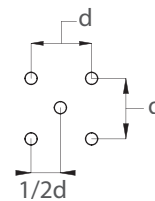


Front holes of

- 1 mm Ø for model SPS-2220-03
- 2 mm Ø for model SPS-3530-03
- 2 mm Ø for model SPS-4640-03
- 2 mm Ø for model SPS-8770-03

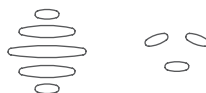
Distance front holes

- d=3 mm for model SPS-2220-03
- d=5 mm for model SPS-3530-03
- d=5 mm for model SPS-4640-03
- d=10 mm for model SPS-S8770-03



\*Other designs of the hole pattern (grids) are also suitable. (SPS-2220-03, SPS-3530-03)

grid examples



## SPS-8770-UW



### INTRODUCTION



Based on the in-house expertise in vibration characteristics of piezoceramic material and microacoustics, Sonitron successfully developed the first flat piezoceramic speaker for underwater applications. This speaker is based on a completely new principle of piezoceramics and composite metal/polymer layer. The composite membrane reduces unwanted resonance peaks to provide a

more even frequency response than can be achieved with conventional designs.

### ADVANTAGES & APPLICATIONS

#### ADVANTAGES :

- Light but solid construction
- Easily mountable
- Small dimensions
- IP68: dust tight, totally protected against dust. Protected against long periods of immersion under pressure.

#### APPLICATIONS :

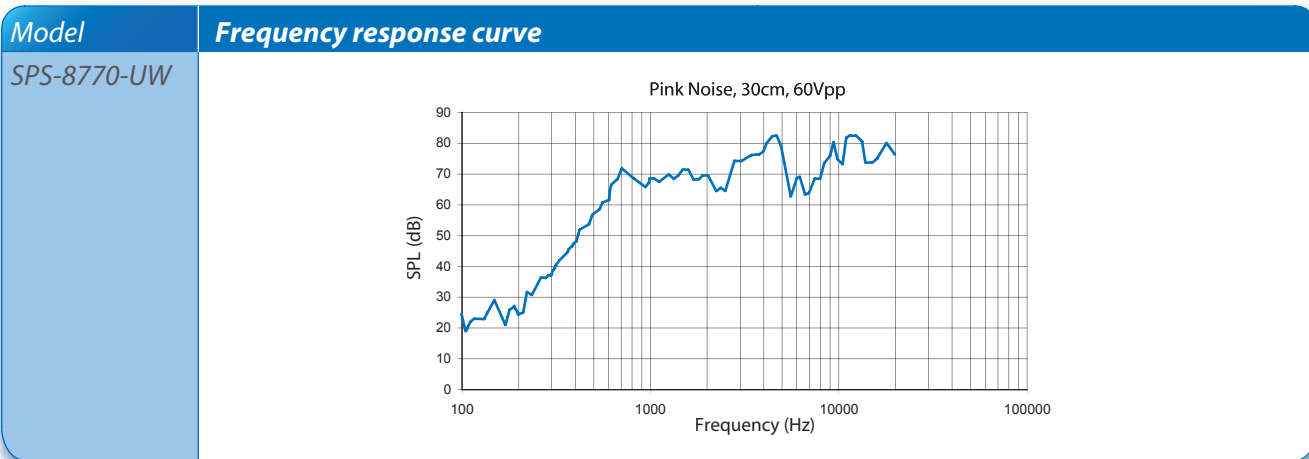
- Diving communications
- Swimming pool music
- Instruction in underwater training, and or during surf training
- Warning signals
- Shark alerts
- Boat alarms
- Outdoor applications
- Carwash
- Fridges
- Whirlpools
- Bathroom
- Etc,...

### SPECIFICATIONS

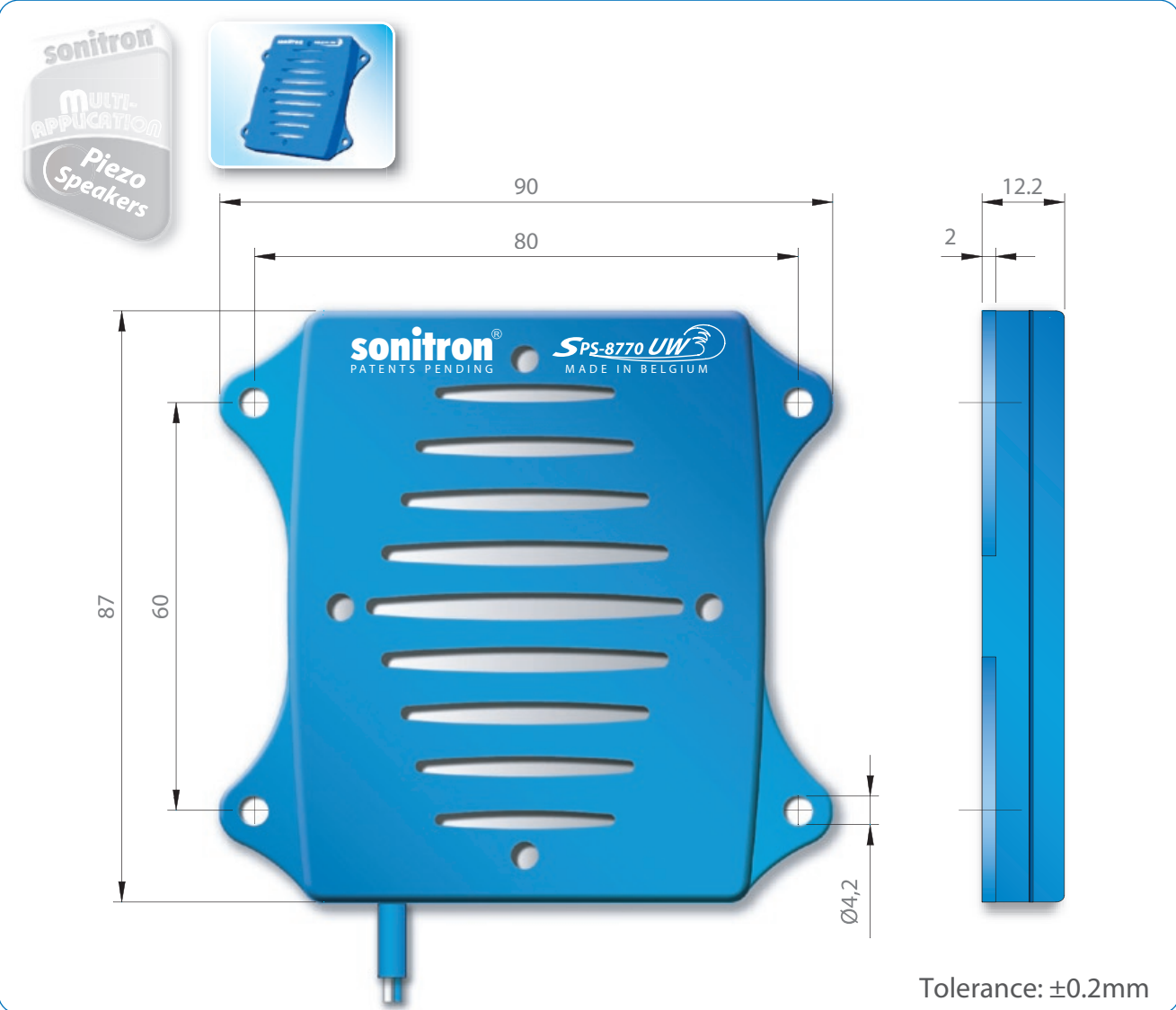
Operating voltage:	5 to 60Vpp
Frequency range:	600 Hz-20 kHz
Max. SPL @1m: (60Vpp input, average @ 4-point)	90 dB
Distortion (%THD): (80dB @ 1m, average @ 4-point)	<3.5%
Terminals:	50 cm cable, other lengths on request
Operating temperature:	-20°C to +70°C
Storage temperature:	-40°C to +85 °C
Case material:	ABS (UL rating: 94 HB)
Case color:	blue
Weight:	42g
Capacitance (±20%):	660nF
Impedance @1kHz (±20%):	220 ohm



## FREQUENCY RESPONSE



## DIMENSIONS (All dimensions are in mm)



Information furnished by Sonitron N.V. is believed to be accurate and reliable. Specifications are subject to change without prior notice. No patent rights or licenses described herein are implied or granted to any third party. The use of Sonitron products as critical components in life support systems, is not authorised without the explicit written approval of Sonitron N.V.

## SPS-27-01



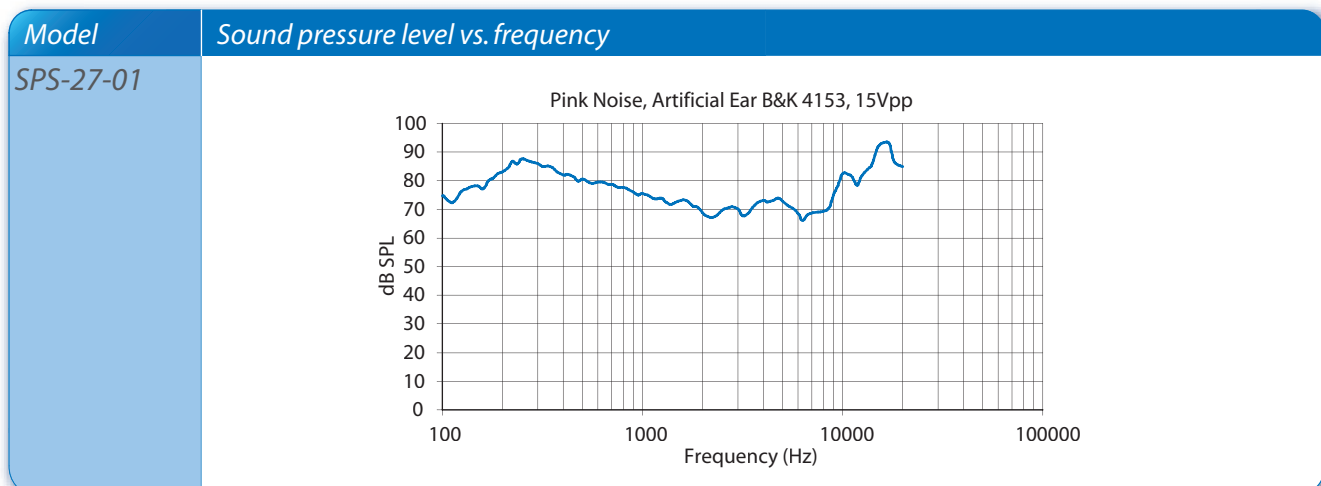
The SPS-27-01 is a compact full range piezoceramic speaker, especially developed for headphone applications. This unique concept combines a flat frequency response and low distortion with a very broad frequency range. Its round design makes it very easy to mount in every application. Excellent sound reproduction and extreme low weight are guaranteed.

## SPECIFICATIONS

Frequency Range :	Full range	
*Max SPL, 20 Vpp: (average @ 4-point)	105 dB*	
Distortion (%THD): (for 80 dB, frequencies 200 Hz - 20 kHz)	<0.4%	
Capacitance (±20%):	100 nF	
Impedance @ 1kHz (±20%):	1600 ohm	
Operating Voltage:	5-40 Vpp	
Weight:	2.1g	
Operating Temperature:	-20°C to 60°C	
Storage Temperature:	-40°C to 60°C	
Case material:	PBT	
Standard color:	Grey	

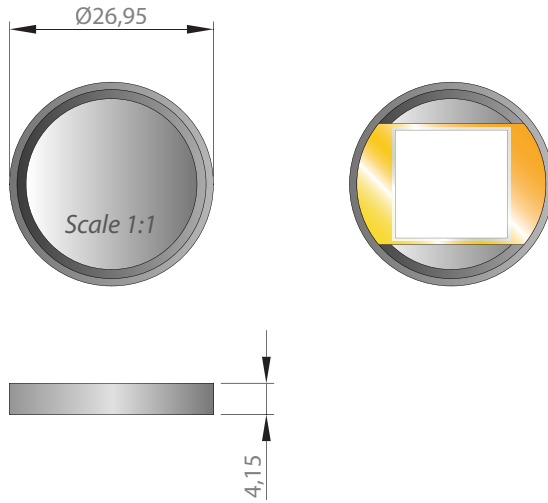
\*Measurements performed using artificial ear B&K type 4153

## FREQUENCY RESPONSE



**DIMENSIONS** (all dimensions are in mm)

**SPS-27-01**

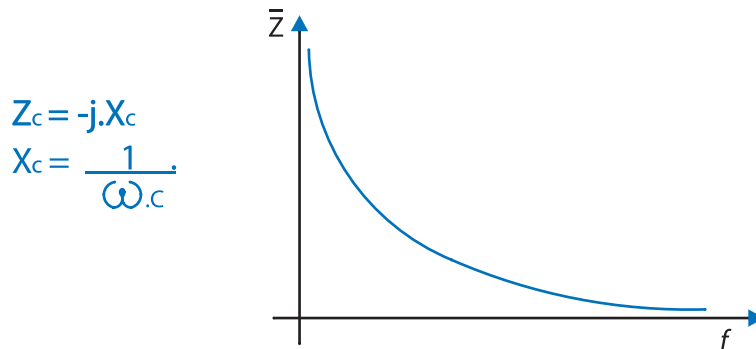


Tolerance: +/- 0.2mm



## IMPEDANCE

The impedance of the piezo speakers is a capacitive reactance and follows an asymptotic function.



The typical impedance values ( $\pm 20\%$ ) for frequencies of 100 Hz up to 20 kHz of our speakers are as follows:

Model	SPS-2220-03	SPS-3530-03	SPS-4640-03	SPS-8770-03
Capacitance ( $\pm 20\%$ )	70 nF	220 nF	225 nF	580 nF
Z @ 100 Hz	22360 ohm	5714 ohm	6210 ohm	2314 ohm
Z @ 1 kHz	2162 ohm	603 ohm	680 ohm	266 ohm
Z @ 2 kHz	1183 ohm	311 ohm	360 ohm	133 ohm
Z @ 5 kHz	497 ohm	127 ohm	143 ohm	54 ohm
Z @ 10 kHz	245 ohm	65 ohm	73 ohm	28 ohm
Z @ 15 kHz	168 ohm	43 ohm	49 ohm	19 ohm
Z @ 20 kHz	125 ohm	32 ohm	37 ohm	14 ohm

## PRODUCT CODIFICATION

SPS ↓ Sonitron Polymer/metal Speaker	2220-03 3530-03 4640-03 8770-03 8770-UW 27-01 ↓ <b>UW:</b> underwater speaker	C1 or C2 C1 or C2 C1 or C2 ↓ <b>C1:</b> Position of solder pads <b>C2:</b> Position of solder pads (see dimensions)
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## LIST OF AVAILABLE PRODUCT TYPES

SPS-2220-03	SPS-3530-03-C1 SPS-3530-03-C2	SPS-4640-03-C1 SPS-4640-03-C2	SPS-8770-03-C1 SPS-8770-03-C2	SPS-8770-UW	SPS-27-01
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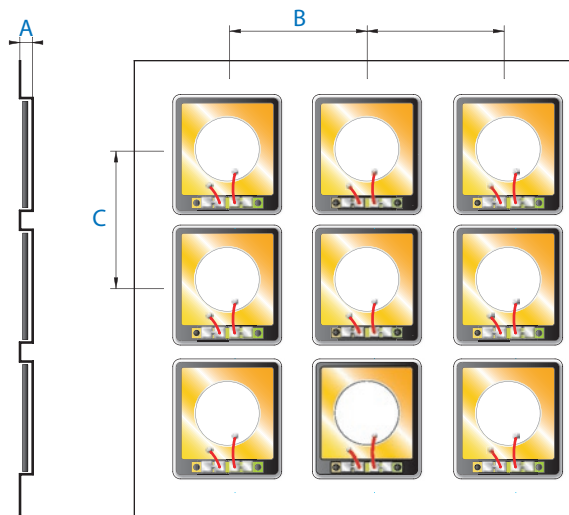
## PACKAGING

The SPS 2220-03/3530-03/4640-03/8770-03 are packed in trays (245 L x 245 W) and sold in boxes with dimensions of 250 L x 250 W x 125 H.

Number	SPS-2220-03	SPS-3530-03	SPS-4640-03	SPS-8770-03	SPS-27-01
per tray	81	25	16	6	49
per box	(81x70) 5670	(25x40) 1000	(16x40) 640	(6x40) 240	(49x25) 1225

Dimensions of the tray and position of the SPS-speakers 2022-03/3035-03/4640-03/8770-03/SPS-27-01 are illustrated below:

- SPS-2220-03    A=1.5 mm  
                  B=26 mm  
                  C=26 mm
- SPS-3530-03    A=3 mm  
                  B=47.5 mm  
                  C=47.5 mm
- SPS-4640-03    A=3 mm  
                  B=60 mm  
                  C=60 mm
- SPS-8770-03    A=3 mm  
                  B=78 mm  
                  C=120 mm
- SPS-27-01        A=5 mm  
                  B=33 mm  
                  C=33 mm





## SCS-SERIES (SONITRON Ceramic Speakers)



### INTRODUCTION

Introduced as the first models of Sonitron's piezoceramic speakers, the SCS-series are still being used for numerous applications.

Good sound quality and limited distortion guarantee a clear reproduction of multiple tones, speech and music. The piezo speaker has 60% more net sound output per membrane surface than the electro-dynamic speaker in function of the average current drain and average sound pressure level. These loudspeakers are extremely reliable, have a robust design and can be used in difficult environmental conditions and applications because of resistance of the front to water, humidity, vibrations and dust.

The SCS-speaker can be mounted by soldering the SMD pads onto the PCB.

For a pin-version, the pins can be soldered onto the PCB. Extra stability against vibration is achieved by screwing the housing onto the application.



## GENERAL OVERVIEW SCS-SERIES

Model	Frequency range	Peak frequency SPL	Operating voltage
SCS-17	1500 - 8000 Hz	2200 Hz - 92 dB 5000 Hz - 91 dB	5 to 30 Vpp
SCS-24	1000 - 8000 Hz	800 Hz - 68 dB 1600 Hz - 95 dB 4000 Hz - 87 dB	5 to 30 Vpp
SCS-32	500 - 8000 Hz	650 Hz - 85 dB 2700 Hz - 100 dB 3700 Hz - 88 dB 7500 Hz - 80 dB	5 to 30 Vpp



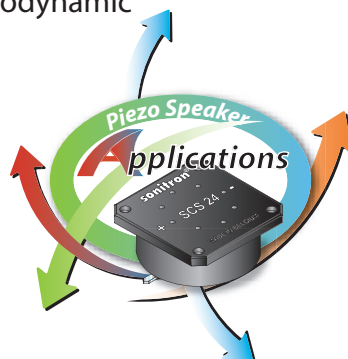
## ADVANTAGES & APPLICATIONS

### ADVANTAGES:

- very flat and solid construction
- dust, water- and shockproof front panel
- resistant to temperature variations
- broad frequency range in small size
- combined use as speaker/microphone
- no electromagnetic field (EMC)
- little energy required at low frequencies
- less current consumption needed in the leads to the speaker
- 60% higher acoustic output in smaller speakers compared to electrodynamic speakers
- low weight
- high impedance
- can be driven directly by IC

### APPLICATIONS:

- home equipment & domotics
- communication equipment
- home monitoring equipment
- talking buzzer & door bell
- computer equipment
- vending machines
- electronic wheelchair
- medical equipment
- multimedia equipment
- industrial equipment
- flight instrumentation
- portable voice recorders
- paging systems
- instrumentation



## SPECIFICATIONS

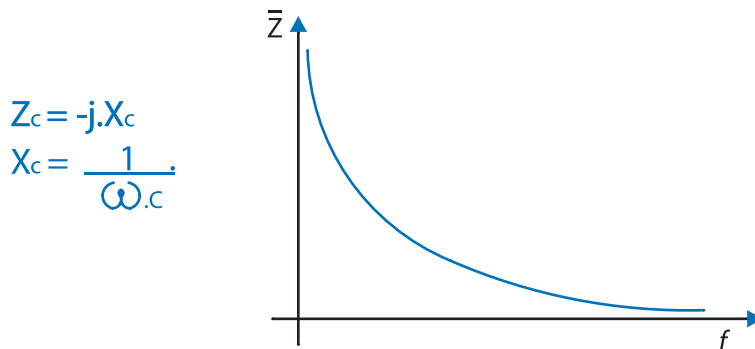
Operating temperature:	-20°C to +60°C
Storage temperature:	-40°C to +60°C
Case material:	ABS (UL rating: 94 HB) for pin-versions), PPS (UL rating: 94 V0/5V) for SMD-versions)
Standard colour of case:	Black

Model	Frequency range	Peak frequency SPL	Capacitance ±20%	Operating voltage	Impedance @ 1KHz ±20%	Weight
SCS-17	1500 - 8000 Hz	2200 Hz - 92 dB 5000 Hz - 91 dB	20 nF	5 to 30 Vpp	7957 ohm	1.7 g
SCS-24	1000 - 8000 Hz	800 Hz - 68 dB 1600 Hz - 95 dB 4000 Hz - 87 dB	37 nF	5 to 30 Vpp	4300 ohm	4 g
SCS-32	500 - 8000 Hz	650 Hz - 85 dB 2700 Hz - 100 dB 3700 Hz - 88 dB 7500 Hz - 80 dB	66 nF	5 to 30 Vpp	2400 ohm	5.9 g

All measurements are made in free air @30 cm using a 30 Vpp sine wave.  
The speakers were mounted in a box with dimensions 40x15x5 cm.

## IMPEDANCE

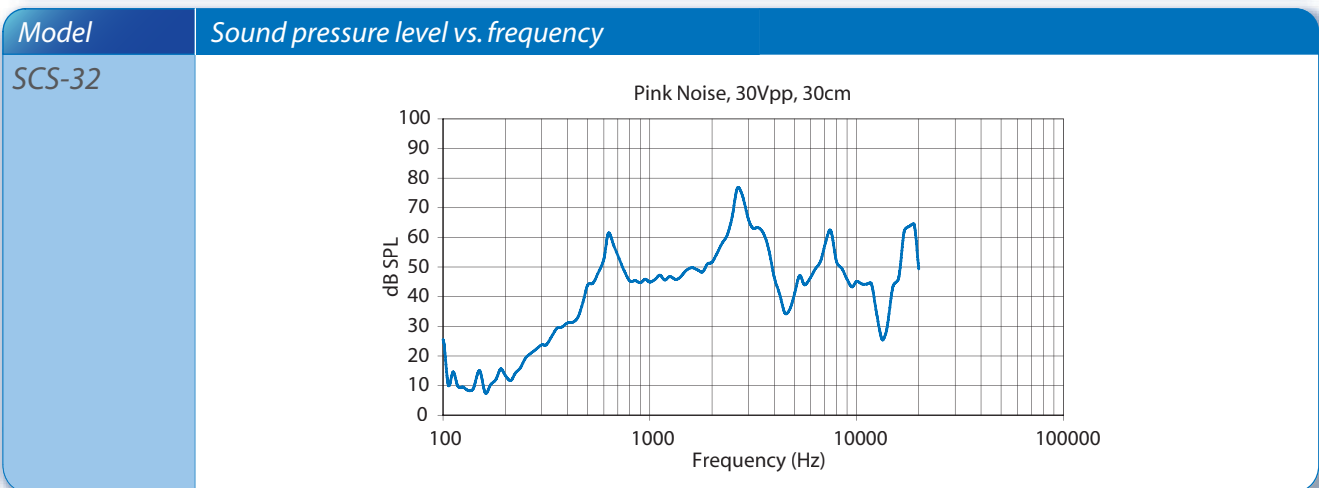
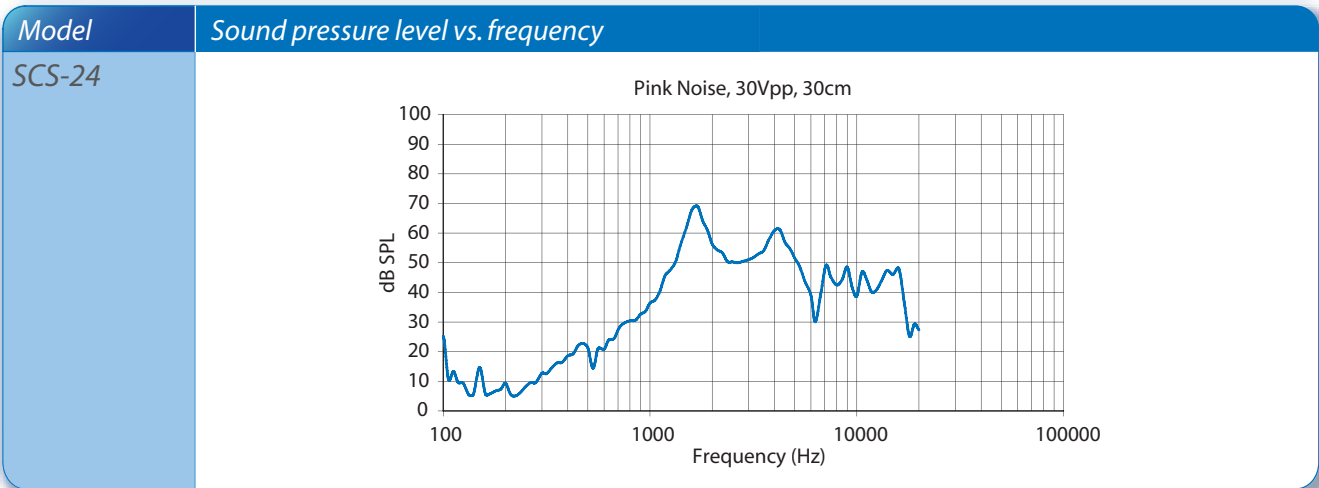
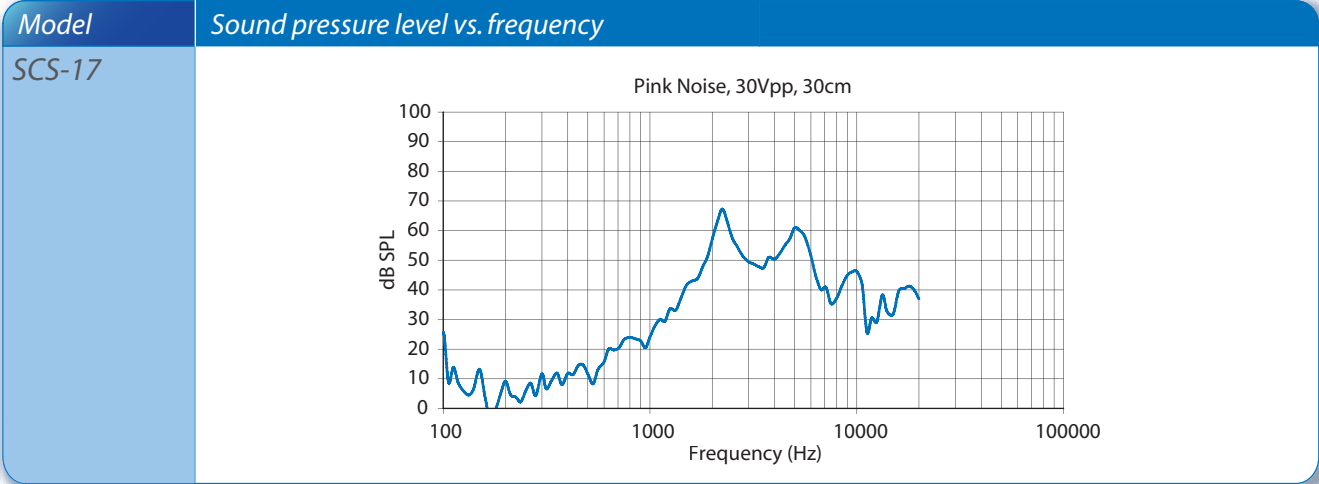
The impedance of the piezo speakers is a capacitive reactance and follows an asymptotic function.



The typical impedance values (± 20%) for frequencies of 100 Hz up to 20 kHz of our speakers are as follows:

Model	SCS-17	SCS-24	SCS-32
Capacitance (±20%)	20 nF	37 nF	66 nF
Z (0.1 kHz)	79577 ohm	43000 ohm	24114 ohm
Z (1 kHz)	7957 ohm	4300 ohm	2411 ohm
Z (2 kHz)	3978 ohm	2150 ohm	1205 ohm
Z (5 kHz)	1591 ohm	860 ohm	482 ohm
Z (10 kHz)	795 ohm	430 ohm	241 ohm
Z (15 kHz)	530 ohm	286 ohm	161 ohm
Z (20 kHz)	397 ohm	215 ohm	121 ohm

**FREQUENCY RESPONSE**

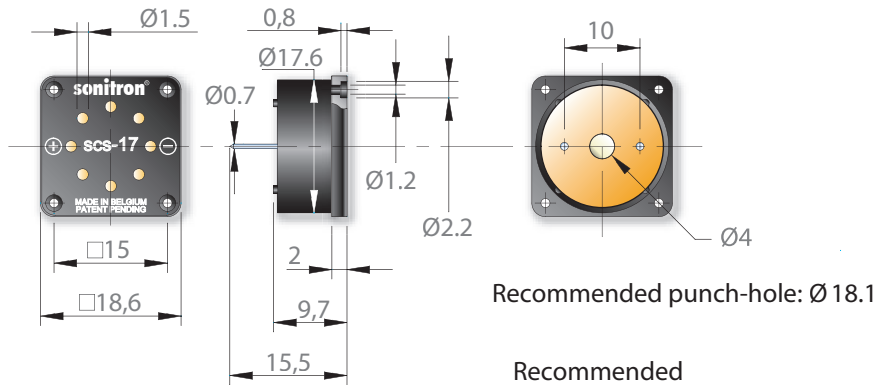


Pink noise measurements made in free air.  
 The speakers were mounted in a box with dimensions 40x15x5 cm.

**DIMENSIONS** (All dimensions are in mm)

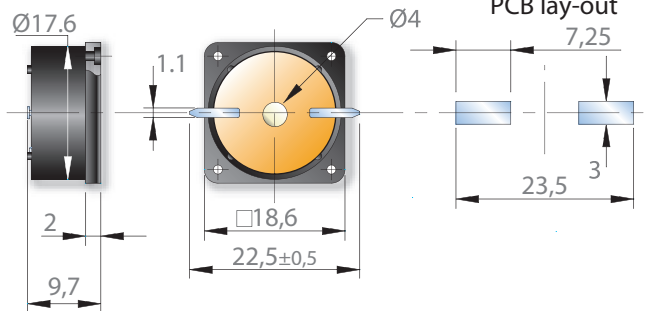
**SCS-17-P10**

**Pin-version**  
(case in ABS)



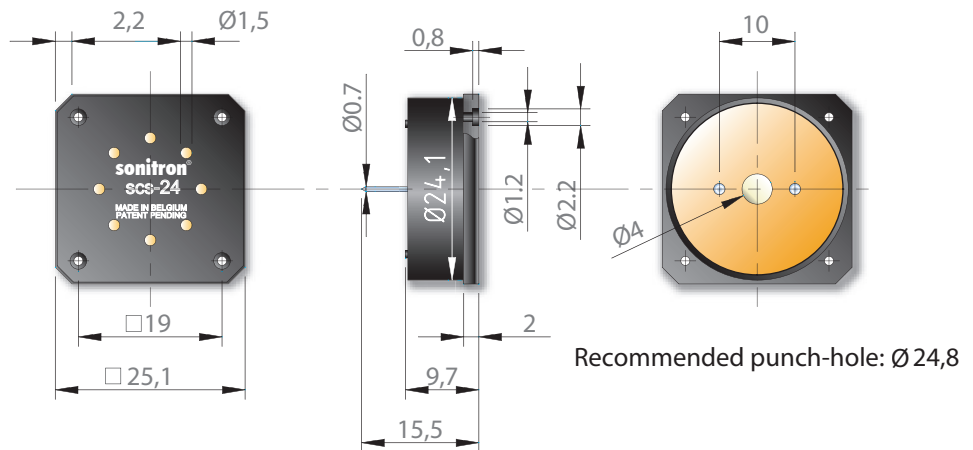
**SCS-17-S**

**SMD-version**  
(case in PPS)



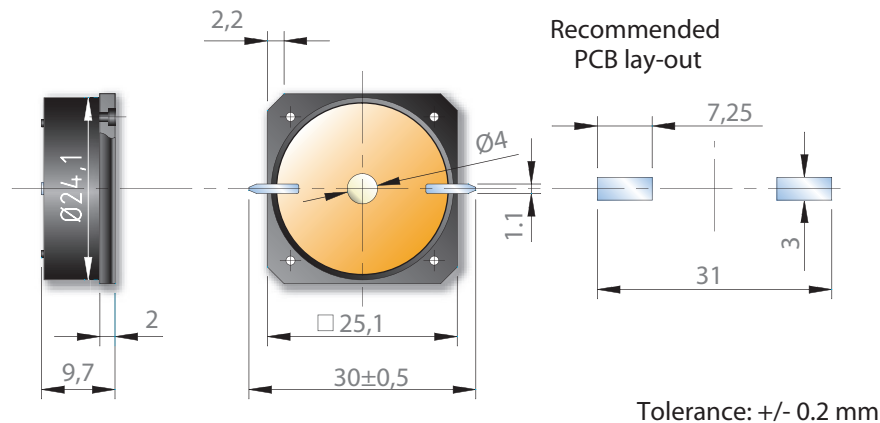
**SCS-24-P10**

**Pin-version**  
(case in ABS)



**SCS-24-S**

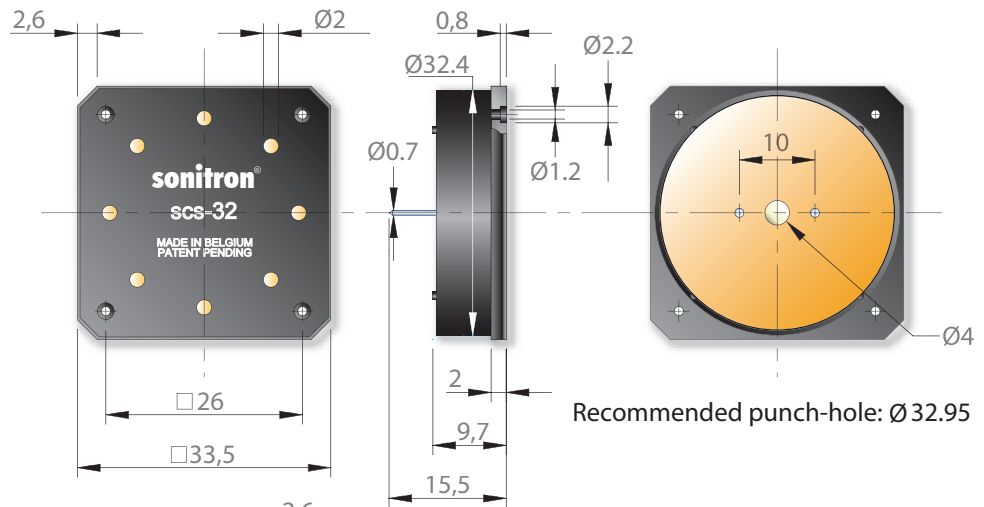
**SMD-version**  
(case in PPS)



**DIMENSIONS** (All dimensions are in mm)

**SCS-32-P10**

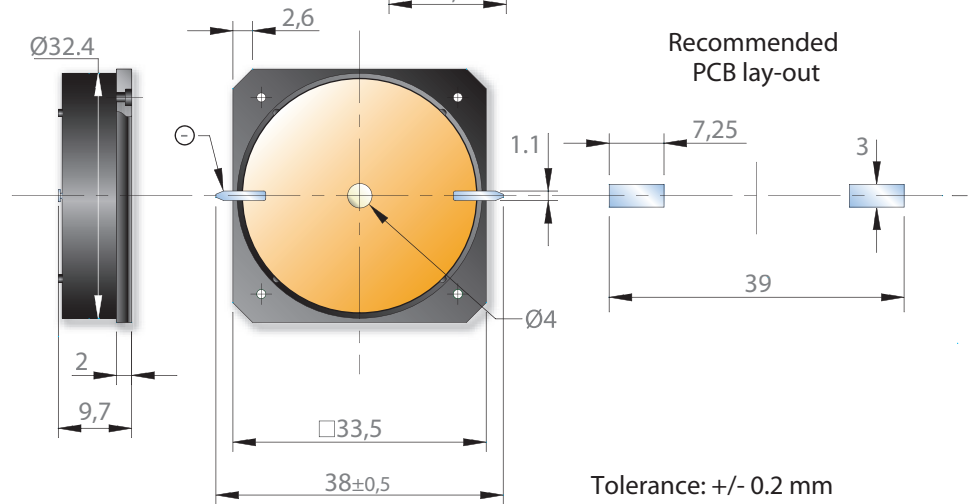
**Pin-version**  
(case in ABS)



Recommended punch-hole:  $\varnothing 32.95$

**SCS-32-S**

**SMD-version**  
(case in PPS)



Recommended PCB lay-out

Tolerance:  $\pm 0.2$  mm



## PRODUCT CODIFICATION

<p>SCS</p> <p>↓</p> <p>Sonitron Ceramic Speaker</p>	<p>SCS-17 SCS-24 SCS-32</p> <p>↓</p> <p>Square diameter (mm)</p>	<p>P S</p> <p>↓</p> <p>P: Pin distance (mm) S: SMD-connection</p>
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## LIST OF AVAILABLE PRODUCT TYPES

SCS-17-P10 SCS-17-S	SCS-24-P10 SCS-24-S	SCS-32-P10 SCS-32-S
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## PACKAGING

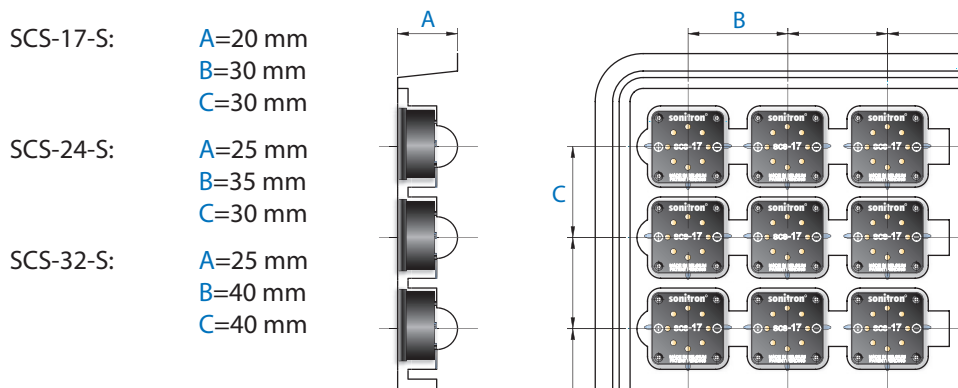
All speakers with through hole pins, are packed on a polystyrene board (245 L x 245 W) and sold in boxes with dimensions of 250 L x 250 W x 125 H.

Number	SCS-17 P10	SCS-24 P10	SCS-32 P10
per board	100	81	49
per box	(5x100) 500	(5x81) 405	(5x49) 245

All SMD models are packed in trays (245 L x 245 W) and sold in boxes with dimensions of 250 L x 250 W x 125 H.

Number	SCS-17-S	SCS-24-S	SCS-32-S
per board	49	42	25
per box	(7x49) 343	(5x42) 210	(6x25) 150

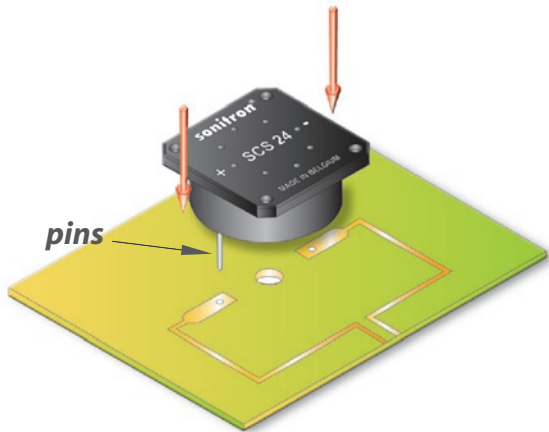
Dimensions of the tray and position of the SMD components of the models SCS-17-S, SCS-24-S and SCS-32-S are illustrated below:



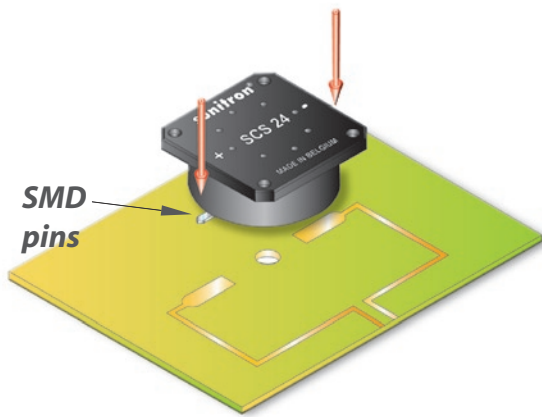
# MOUNTING INSTRUCTIONS FOR SCS-SPEAKERS

The SCS speakers can be mounted in several different ways. The recommended mounting methods illustrated below are the best ways to mount all the SCS speaker models.

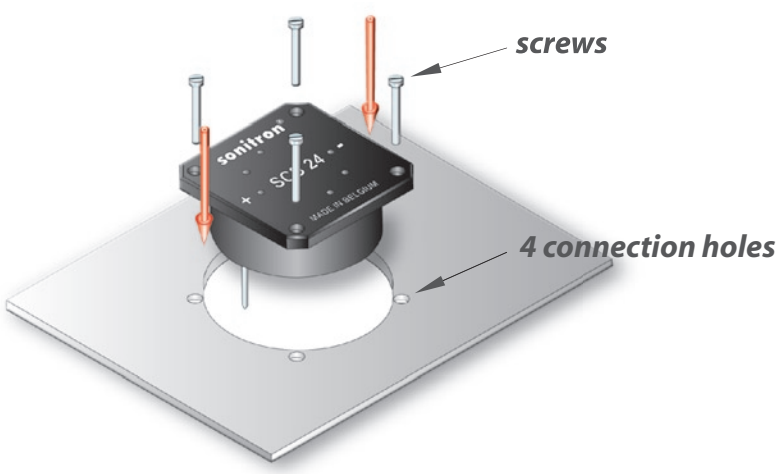
**Soldered with pins on the PCB**



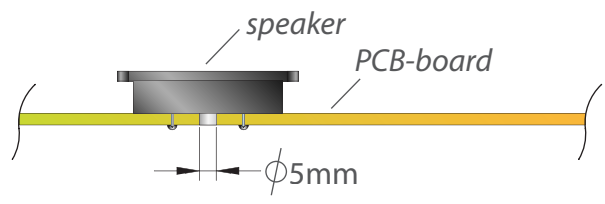
**SMD soldered on the PCB**



**Panel mounting, secured with 4 screws**



When mounted on a PC-board, a central hole in the PC-board of minimum 5 mm diameter is recommended.



**Other methods...**

**Please also read the mounting instructions on P.43 of the addendum.**



# ***ADDENDUM***



*CONSIDERATIONS ABOUT SOUND*

*MOUNTING RECOMMENDATIONS*

*EXPECTED LIFE TIME*

*WARRANTY AND DELIVERY CONDITIONS*

*APPLICATION NOTES*

## CONSIDERATIONS ABOUT SOUND

### **Loudness**

The loudness of a sound perceived by the human ear at a certain location depends on several factors, such as: distance from the source, frequency of the sound, strength of the source, ear sensitivity, conditions of the air etc.

### **Frequency**

The human ear is more sensitive to frequencies between 2000 and 5000 Hz. This is why the operating frequency of alerting piezo buzzers is essentially chosen for this range. The human ear has a logarithmically response to sound pressure, of which the unity is expressed in decibels (dB). The sound pressure level is measured with an audiometer: an instrument developed in order to give an objective indication of sound pressure.

### **Sound pressure level and distance from the source**

In a free progressive spherical sound wave the sound pressure drops by 6 dB each time the measuring distance is doubled. This condition only exists a number of wavelengths away from the source and if the source radiates spherical waves.

### **Sound character**

The character of a sound is determined by the harmonic content, the amplitude relation between the harmonics for a steady signal when the signal varies the rate of attack and decay, and the presence of resonance.

### **Pulsating sounds**

The human ear is particularly sensitive to changes in condition. Switching on and off a sound makes it more attention-getting than a continuous sound of the same frequency. Shifting the frequency in a rapid rate produces a similar effect.

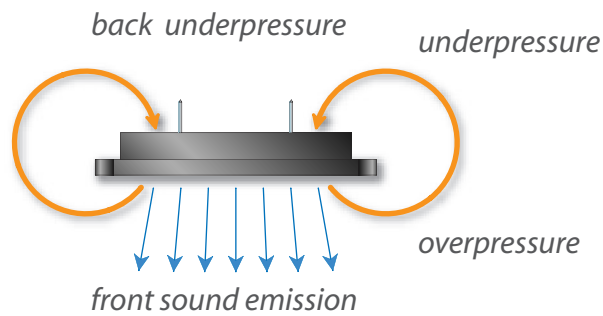
### **Pulsating frequency**

When a pulsed sound source is placed in a reverberant room, reflections tend to fill up the pauses between the pulses. In a large, highly reverberant room, longer pauses are necessary to produce the desired effect: a slow pulsing sound source should be used.

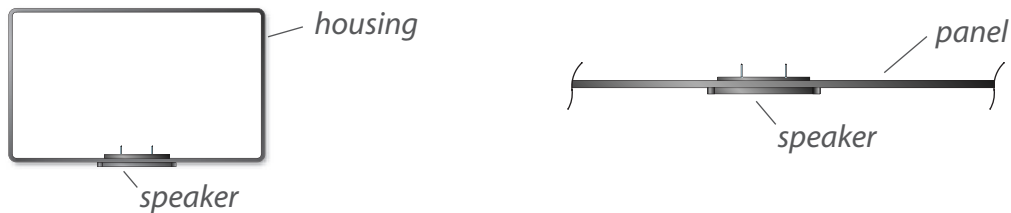
## MOUNTING RECOMMENDATIONS

Important note:

Piezoceramic speakers produce sound by the forward and backward movement of a flat membrane. During this movement the membrane creates an air pressure wave in front and at the backside of the membrane. A forward movement will create a slight overpressure at the frontside and a slight underpressure at the backside and vice versa. It is therefore important that the front and backside are acoustically isolated from each other to avoid air pressure cancellation and consequently a serious reduction of the sound output.



When a speaker is mounted in a panel or in the wall of a housing, the front side is acoustically isolated from the backside.



## Expected life time: general remarks

- Please contact our customer service for information and recommendations before making life time tests at exceeding voltages the earlier mentioned levels per series.
- Sonitron reserve the right to make modifications without pre-announcement to their materials, raw materials, specifications, configurations and prices.
- Applications in this catalogue are indicative and it is the responsibility of the customer to make the necessary tests with our products in order to meet the required specifications.
- If you need further information concerning product selection, performances, life time expectations and environmental situations, please contact us.
- The use of Sonitron products as critical components in life support systems, is not authorised without the explicit written approval of Sonitron.
- If our products are used as a critical components, we recommend a model especially adapted to meet the customers' special test requirements.

## WARRANTY AND DELIVERY CONDITIONS

Our products are warranted during one year after date of shipment.

In case products are returned for quality control, the products must be sent to the factory with the following information:

- Samples of the defective pieces
- Name & address of the customer
- Application description
- Invoice-number
- Copy of the inspection sheet delivered in box
- Copy of the written complaint from the customer

and accompanied by our QD1 document, which will be sent to you immediately after registration of your complaint. This document should be duly completed, so that we have sufficient details about the problem in order to deal with the matter swiftly.

The products must be used according to the working instructions and conditions specified in this catalogue. Return shipments will only be accepted for quality control, if the products have not been physically changed, damaged or opened. They will only be accepted if all the required information is available.

## APPLICATION NOTE: PAA-LM4960SQ-01 (SPS Speaker Driver)



The PAA-LM4960SQ-01 is especially developed to drive all Piezoceramic Speaker models (SPS-2220-03, SPS-3530-03, SPS-4640-03, SPS-8770-03, SP-27-01, SCS-17/24/32). This solution consists of a fully integrated (integrated step-up dc/dc converter, amplifier) piezoceramic speaker amplifier : the LM4960SQ from National Semiconductor. For a datasheet of the LM4960 : <http://cache.national.com/ds/LM/LM4960.pdf>.

The PAA-LM4960SQ-01 is a very compact solution (38mm x 24mm), able to accept power from a standard 9V battery or wall adapter with a wide supply voltage range (see . Electrical Characteristics). The audio connection can be made via the on board RCA phono jack, the speaker connection via a standard pitch jumper. The circuit is protected against reverse polarisation and short circuits on the ceramic speaker output.

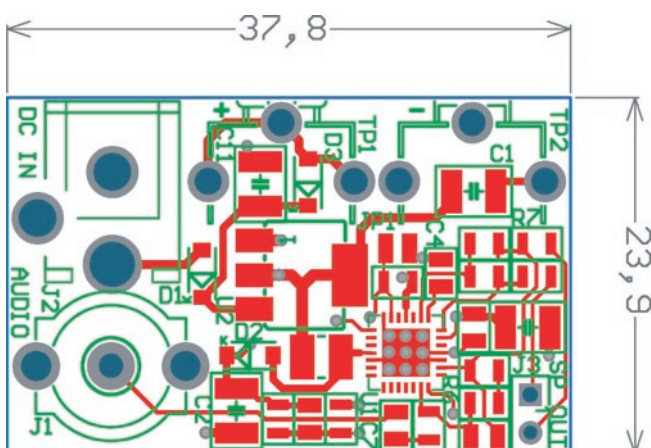
### Absolute Maximum Ratings

- Supply voltage : 20VDC (applied via Wall Adapter input)
- Maximum Load Capacitance : 800nF
- Power Dissipation : Internally Limited
- Audio Input Voltage : -0,3V...5,3V

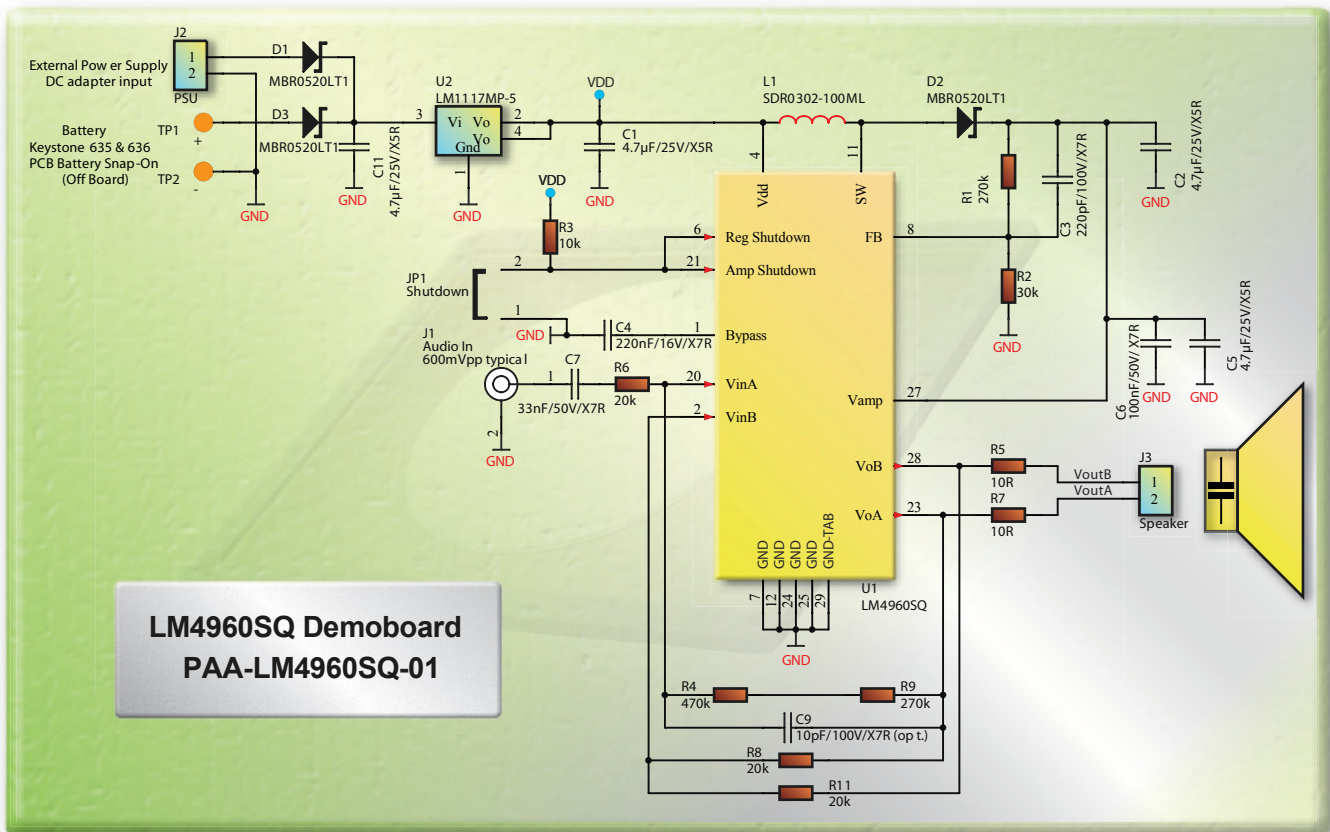
### Electrical Characteristics

- Supply Voltage : 7...20VDC (wall adapter input, 12VDC recommended)
- Max. Load Capacitance : 800nF + 20 ohm
- Speaker drive voltage 24Vpp (typical)
- Audio input signal : 600mVpp typical
- Quiescent supply current : 45mA
- Total Harmonic Distortion : typical < 1%

### Board Layout



**SCHEMATICS**



## APPLICATION NOTE: HIGH POWER PIEZO AUDIO AMPLIFIER

The following design is especially developed for driving piezo speakers. The design is built around the high-voltage high-current OPA544 audio amplifier. By using two audio amplifiers in full bridge configuration, the output signal doubles in amplitude and can reach up to 120Vpp. Any audio device with a line out of 1Vrms can be used as audio source. The design is very small in dimensions and fits in every application.

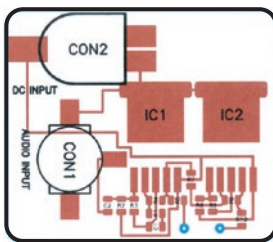
### Absolute Maximum Ratings

- Supply voltage : 70VDC (applied via Wall Adapter input)
- Max. output current: 4A at room temperature
- Power Dissipation : Thermal shutdown circuitry
- Audio Input Voltage : -0,7V...Vcc + 0.7V

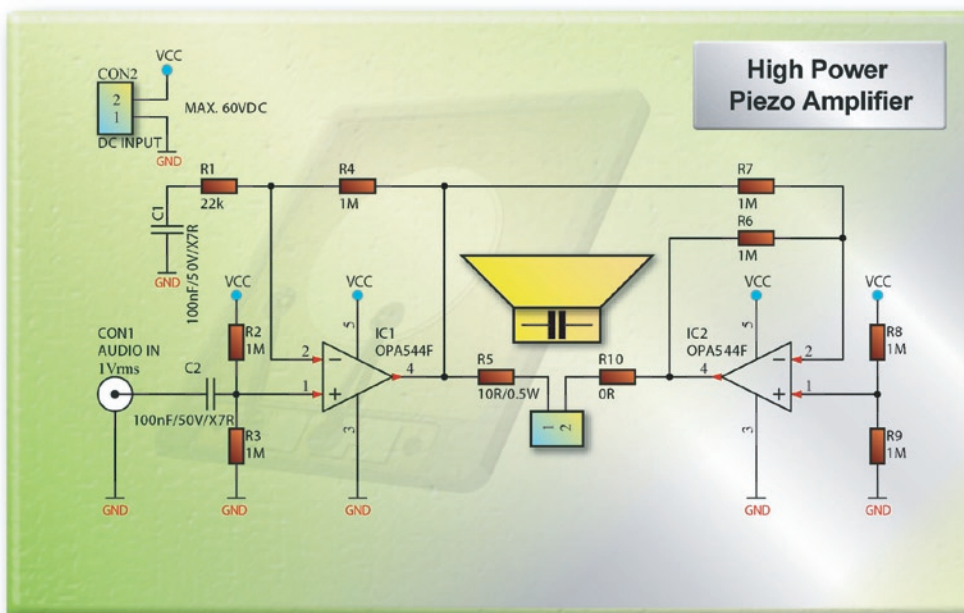
### Electrical Characteristics

- Supply Voltage : 20...70VDC, 48VDC recommended
- Output current: Min. 2A
- Audio input signal : 1Vrms typical
- Quiescent supply current : 12mA typical
- Slew rate: 8Vrms

### Board Layout



### SCHEMATICS



## Automatic Speaker/Microphone switch + (pre)amplifier

Sonitron's piezoceramic speakers are ideal for use in multifunctional applications (speaker/microphone combination), because of the high sensitivity of the speaker membrane when used as microphone. They can be used in highly integrated equipment, such as GSM, PDA, portable games,... where voice commands could be an added value to meet customer's requirements. The principle starts from an audio detector, which senses if there's an audio input signal present or not. If not, the speaker is used as microphone. If yes, normal speaker operation is automatically selected.

### Absolute Maximum Ratings

- Supply voltage : 20 VDC (applied via Wall Adapter input)
- Max. load capacitance: 800 nF
- Power Dissipation : Internally limited
- Audio Input Voltage : -0.3 V...Vcc + 5.3 V

### Electrical Characteristics

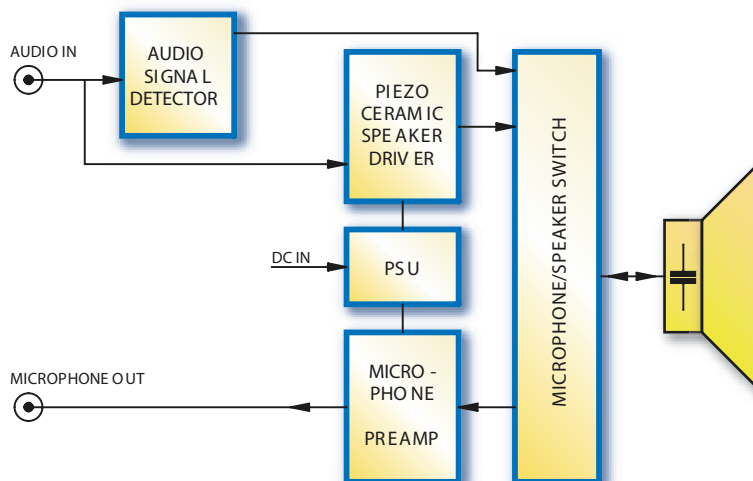
- Supply Voltage : 7...20 VDC (wall adapter input, 12 VDC recommended)
- Speaker drive voltage: 24 Vpp
- Audio input signal : 600 mVpp typical
- Quiescent supply current : 20 mA (microphone), 70 mA (speaker)
- Total harmonic distortion: typical <1%

### Microphone sensitivity of Sonitron's speakers

Model	SPS-2220-03	SPS-3530-03	SPS-4640-03	SPS-8770-03
Sensitivity	6.8 mV/Pa	2.6 mV/Pa	2.8 mV/Pa	3.01 mV/Pa

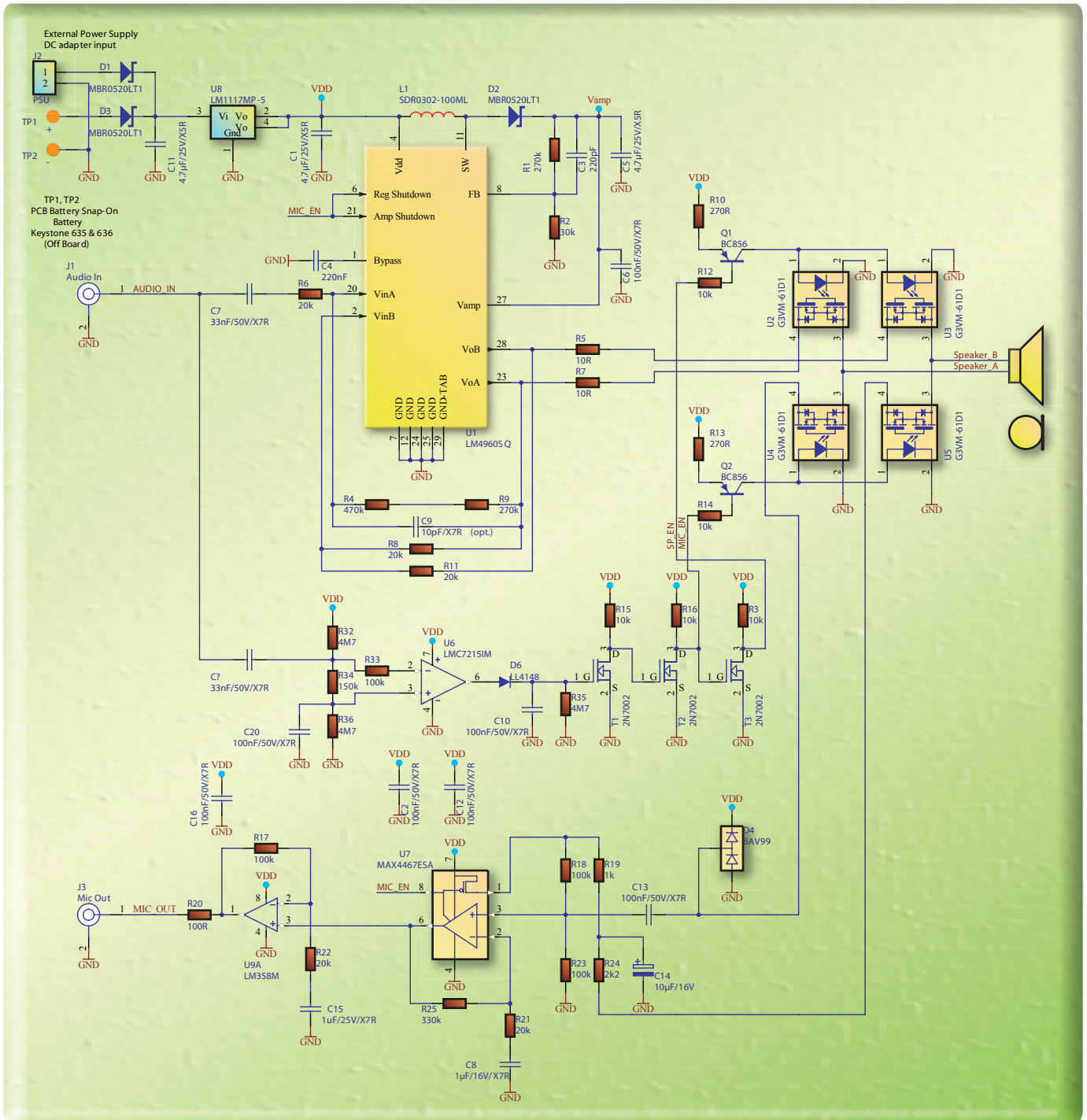
(Measured with a 1kHz/94dB signal)

### SCHEMATICS





**Automatic Speaker/Microphone switch + (pre)amplifier**



## Blind power dissipation in a piezoceramic load (for a sine wave)

The power dissipation in an electro-dynamic speaker depends on the resistance of the drive coil. In our comparison, the power dissipated in an electrodynamic speaker with  $\varnothing$  68 mm and  $16\Omega$  impedance @ 2V is:

$$\frac{V^2}{R} = \frac{4}{16} = 0,25 \text{ W}$$

The power dissipation in a piezo capacitive load, not in resonance, is:

$$P = \underbrace{\frac{c \cdot V^2 \cdot \omega \cdot \cos \varphi}{2}}_{\text{capacitive power}} + \underbrace{\frac{c \cdot V^2 \cdot \omega \cdot D_F}{2}}_{\text{power dissipated in ceramic}} = \frac{c \cdot V^2 \cdot \omega}{2} \cdot (\cos \varphi + D_F)$$

- $D_F$ : Dissipation factor of the ceramic material
- $c$ : Capacitance of speaker
- $\omega$ :  $2\pi f$
- $V$ : Drive voltage
- $\cos \varphi$ : The phase angle between current consumption and voltage (in a capacitor is this angle  $90^\circ$  before in phase, thus  $\cos \varphi = 0$ )

In theory, the capacitive power is zero. The power dissipated in the ceramic disc of the speaker depends strongly on the dissipation factor of  $D_F$  of the used ceramic. The  $D_F$  is a measure of the dielectric losses in the material, defined as the tangent of the loss angle or the ratio of parallel resistance to parallel reactance, expressed in percent and measured at 1 kHz. This dissipation factor can vary from 0,4% up to 2% for the most typical ceramics available.

Our speakers are not used at resonance. Consequently the power dissipated mainly depends on the  $D_F$  and is very low or near zero.

The power dissipation of the piezo speaker can be considered as a blind power drain. The amplifier must deliver the total power needed to drive the circuit. Thus the total power drain of the piezo speaker is the drain of the amplifier, needed to deliver the blind power for the speaker, the power dissipated in the ceramics (due to the dissipation factor) and the power dissipated in the isolation resistor  $R_{ISO}$ .

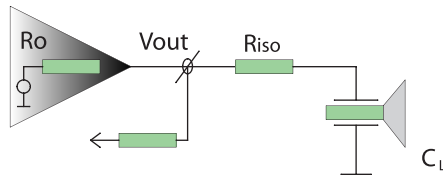
## THE IMPORTANCE OF THE ISOLATION RESISTOR ( $R_{ISO}$ )

Amplifiers feeding capacitive loads can be stabilised in order to avoid oscillation at  $180^\circ$  degrees phase shift at certain feedback conditions.

There are many ways to stabilise an amplifier in combination with a capacitive load, but a small resistor  $R_{ISO}$  is very effective and easy to design-in. By adding an isolation resistor  $R_{ISO}$  in series with the amplifier output and the capacitive load of the speaker  $C_L$ , we improve the gain and phase margin over the entire frequency range.

By adding a  $R_{ISO}$  we create:

1. an extra  $F_{zero}$  (Fz) in the transfer function
2. we reduce the frequency of the pole with an output load in the transfer function



**$F_p$ :** At this frequency, the poles are represented by -45 degrees phase shift with -45 degrees per decade slope, extending this line with 0 degree and -90 degrees horizontal lines.

$$F_p = \frac{1}{2\pi C_L (R_o + R_{ISO})}$$

**$F_z$ :** At this frequency, the phase for zero is represented by a +45 degrees phase shift at the frequency of zero with +45 degrees per decade slope, extending this line with 0 degree and +90 degrees horizontal lines.

$$F_z = \frac{1}{2\pi C_L R_{ISO}}$$

The  $F_z$  in the transfer function is the product of  $R_{ISO}$  and  $C_L$ . The phase improvement is:

$$\Delta \theta: \tan^{-1} (2\pi \cdot UGBW \cdot R_{ISO} \cdot C_L)$$

- $\Delta \theta$  = improvement in phase margin
- UGBW = unity gain bandwidth frequency
- $R_{ISO}$  = isolation resistor
- $C_L$  = capacitive load of the speaker

## BUZZERS & TRANSDUCERS

STANDARD SERIES >



SMA-SERIES >



SMAT-SERIES >



SMAC-SERIES >



SMB-SERIES >



See **BUZZERS & TRANSDUCERS** Catalogue

FOR MORE INFORMATION !

## PIEZOCERAMIC SPEAKERS

SPS-SERIES >

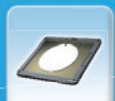
SPS-2220-03



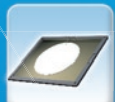
SPS-3530-03



SPS-4640-03



SPS-8770-03



SPS-27-01



SCS-SERIES >



SCS-17

SCS-24

SCS-32

SPECIALS >

SPS 8770-UW  
Underwater speaker



## ALARMS & SIRENS

SAS-SERIES >



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# sonitron®

Excellence in physical acoustics

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