NEW PRODUCT HIGHLIGHT

Audio Buzzers

February 20, 2025

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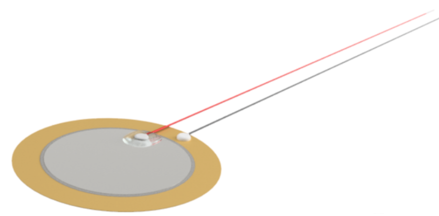
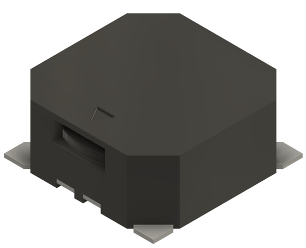
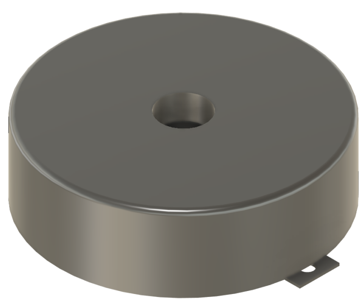
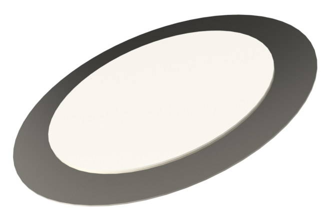
Announcement

In the ever-evolving world of acoustic signaling devices, PUI Audio stands at the forefront, introducing 11 new buzzers, including lead-free options. These new products combine high sound pressure levels (SPL) and temperature resilience to address a diverse range of application needs, particularly where sustainability is critical. Buzzers are essential for providing immediate auditory feedback or alerts across various industries and everyday situations. Key application scenarios include alerts for household appliances, security systems, user-input confirmation, automotive safety warnings, healthcare equipment, industrial machine diagnostics, and consumer electronic devices.









Indicators

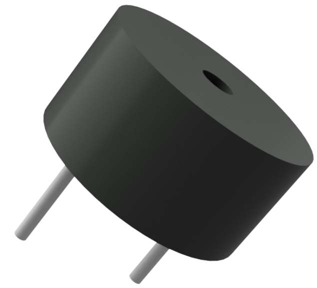
Transducers

Benders

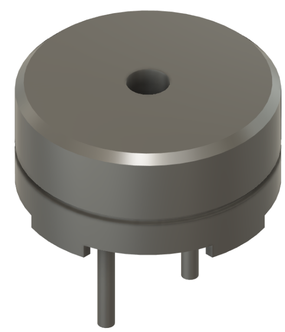
New Product Specifications

Part Name	Type	Frequency	SPL	Voltage	Current	Size	Mounting Type
AI-1231-TWT-4	ELECTROMAGNETIC Indicator	3100Hz	83dB	5V	30mA	12MM Round	Through Hole
AI-2435-TT-HT	PIEZO Indicator	3500Hz	100dB	12V	20mA	23.5MM Round	High Temperature Through Hole
SMI-0927-S-3V	ELECTROMAGNETIC Indicator	2700Hz	82dB	3V	40mA	8.5MM SQUARE	SURFACE MOUNT
AT-0927-TT-5V	ELECTROMAGNETIC Transducer	2730Hz	85dB	5V	80mA	9MM Round	Through Hole
AT-1052-T	PIEZO Transducer	5.2KHz	75dB	5Vp-p	5mA	10MM Round	Through Hole
AT-2240-TT-4	PIEZO Transducer	4000Hz	85dB	3Vp-p	6mA	22MM Round	Through Hole
AT-2441-T-HT-LW95	PIEZO Transducer	4100Hz	90dB	10Vp-p	12mA	24MM Round	High Temperature Lead Wire
ABLF2053B	Lead-Free Bender	5.3KHz	-	40Vpp	-	20mm	Brass
ABLF2061A	Lead-Free Bender	6.1KHz	-	30Vpp	-	20mm	Alloy
ABLF2733A	Lead-Free Bender	3.3KHz	-	30Vpp	-	27mm	Alloy
ABLF3529B-LW100	Lead-Free Bender	2.9KHz	-	30Vpp	-	35mm	Leads

Buzzers Introduction



An Audio Indicator : If your application requires a simple beep, ring or tone, an indicator is a perfect choice which has a built-in oscillator to produce specific tones and sound and just needs a supply voltage.



An Audio Transducer is simply an Electro-Acoustic Transducer which transforms AC voltages to sound pressure waves. It contains no electronics to generate its own audible tone. An external circuit is required to drive transducers to their maximum potential, offering flexibility and customization for various applications.

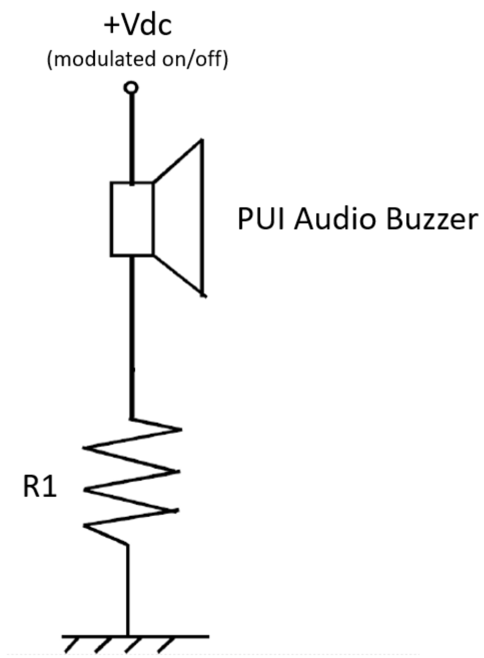
Consequently, its frequency and sound output levels are completely dependent on the frequency, voltage level and other characteristics of the signal applied to its terminals.
The piezo transducer consists of a brass and ceramic disc in a tuned enclosure (Helmholtz Chamber) which not only provides mechanical support and electrical connection but also acoustically amplifies the sound being generated by the disc.
The brass and ceramic disc assembly has piezoelectric characteristics. That is, the application of a DC voltage causes this assembly to flex in one particular direction. Reversing the polarity of the voltage forces the assembly to flex in the opposite direction. An AC voltage applied thus causes the assembly to flex back and forth with the frequency of the applied voltage, much like the cone on the loudspeaker, generating an audible sound.
In applications where high efficiency, low current drain, light weight, resistance to cleaning solvents and long life are required; the audio transducer may directly replace a small loudspeaker.

Drive Circuit for Buzzers

A well-designed drive circuit ensures the buzzer operates at peak efficiency and produces the desired acoustic output. PUI Audio offers comprehensive documentation and support to assist engineers in designing optimal drive circuits tailored to their specific requirements. There are various ways to drive buzzers, as explained below.

Indicators

Audio Indicators do not require external drive circuitry; a supply voltage at the rated voltage of the indicator is sufficient to power the device. Audio Indicators may be controlled by modulating the voltage supply. A current limiting resistor may be placed in series with the Audio Indicator to prevent damage to the indicator or the rest of the system. Typical values are below 100 Ω but may depend on the application.



Drive Circuit for Buzzers

A well-designed drive circuit ensures the buzzer operates at peak efficiency and produces the desired acoustic output. To achieve the highest sound pressure level (SPL) from the transducer, it is recommended to drive the transducer with a 50% duty cycle, 0V-VPK square wave, where VPK is equal to the rated voltage of the transducer. Half-rectified sine waves may also be used to create softer, less harsh tones, but the SPL will decrease. The drive circuit for an Audio Transducer depends on the driving signal's available current and voltage levels. Suppose the signal has sufficient current and voltage to drive the transducer. In that case, it can be connected directly to a DC voltage supply to control the sound output by modulating the positive voltage supply on/off rate. However, designing a separate drive circuit is recommended if the available current output is limited.

Drive circuit for Electromagnetic Transducers

A typical design includes a NPN transistor (Figure 1) in a low-side drive configuration. In this configuration, the transistor is connected between the ground and the transducer, and the signal is applied to the transistor's base. The transistor switches the current flow to the transducer, allowing the transducer to produce sound at the switching frequency. R1 is used to limit any current spikes, preventing damage to the microcontroller GPIO pin. When designing a drive circuit for an electromechanical audio transducer, it is important to consider the power dissipation of the drive transistor, particularly if it is a

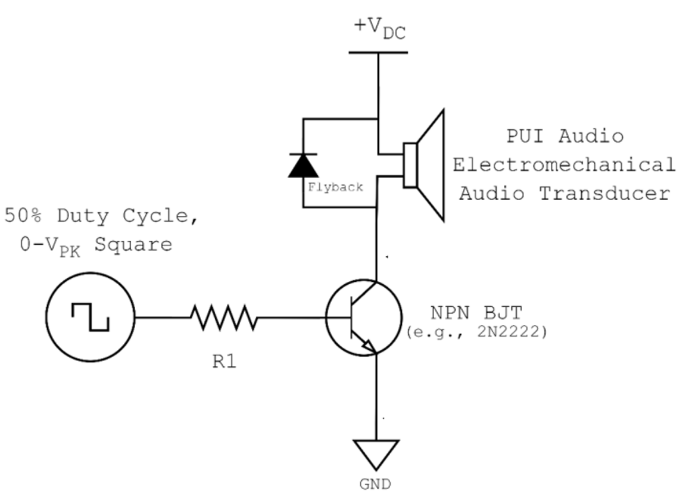


Figure1: Option 1 using a transistor.

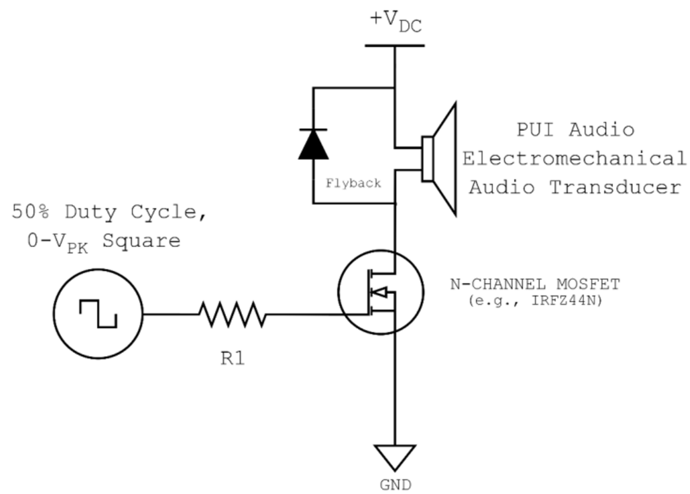


Figure 2: Option 2 using a MOSFET for efficiency improvement.

Using a MOSFET (shown in Figure 2 above) instead of a BJT in circuits prioritizing efficiency can provide positive results. MOSFETs have a significantly lower on-resistance than BJTs, resulting in lower power dissipation and higher efficiency. Additionally, MOSFETs typically have a higher input impedance than BJTs, making them easier to drive from current-restricted sources such as microcontrollers.

Drive circuit for Piezoelectric Transducers

If the transducer is driven below its resonant frequency, then the piezoelectric material may be considered a purely capacitive load; to begin the audio output, the drive circuit must supply a charge to the piezoelectric element in the transducer, then remove the charge to cause movement in the opposite direction. The resulting sound will be at the frequency at which charge is applied and removed from the transducer by the drive circuit.

When operating at or near the transducer's resonant frequency, the piezoelectric transducer has a small resistive element that appears electrically in parallel with the capacitance of the transducer (generally no more than 100 Ω). The drive circuit must have an adequate current supply to ensure the rated voltage of the transducer is dropped across its resistive element under regular operation.

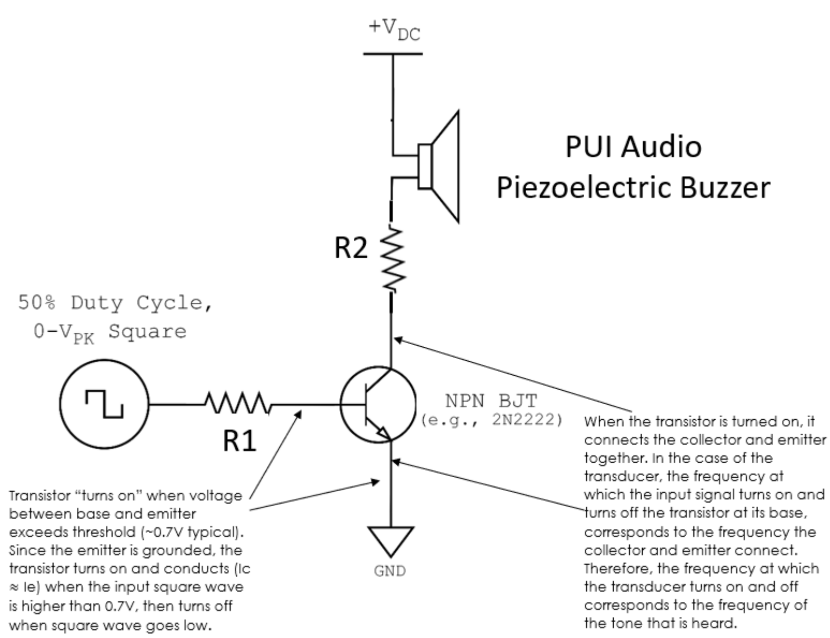


Figure3: Drive Circuit for Piezoelectric transducer using a transistor

R2 provides an additional resistive element in series with the transducer to ensure sufficient current dissipation for the transducer when operating outside of resonance and not appearing as having a resistive element. An additional resistance may be placed in parallel across the piezoelectric buzzer to allow for any stored charges to dissipate when the transistor switch is open. This may improve performance and reliability in designs.

Specific values for resistors will depend on the application and circuit design, though a typical value is between 100-1k ohms.

A diode is typically used in place of the parallel resistor for magnetic circuits; since the buzzer has an internal resistive element, any stored energy will dissipate immediately when the switch is open, and the diode protects the voltage rail from any feedback.

Due to its high impedance and piezoelectric property, a piezoelectric buzzer can also be directly driven from an integrated circuit (IC) (shown in Figure 4). However, for stable sound production and IC protection, it is advisable to insert a resistor in series between the IC output and the piezoelectric buzzer. Resistor value should be such that it does not exceed the maximum current rating of IC.

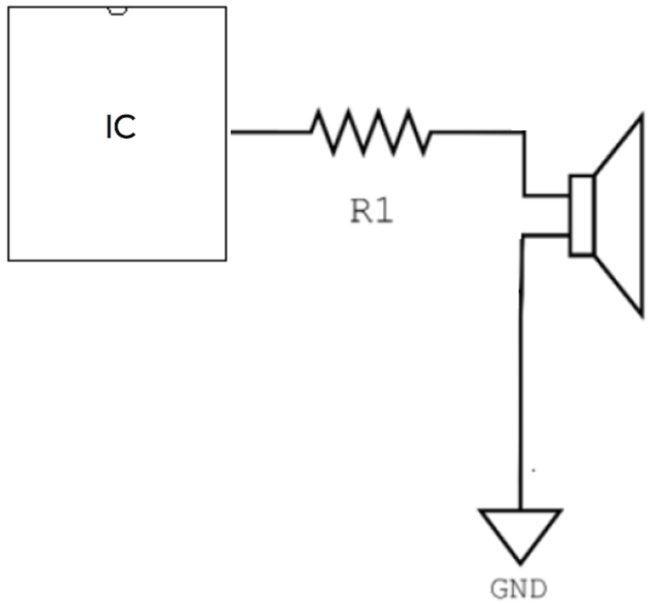


Figure4: Drive Circuit for Piezoelectric transducer using an IC

Predicting SPL

Regardless of the driving circuit, any design starts with an output requirement that generates the appropriate circuitry. Estimating the SPL output of an audio transducer is a challenging task, as the characteristics of the transducer and the way sound pressure waves propagate from the source are heavily influenced by the acoustic environment and the waveform utilized.

All PUI Audio transducers have been specified based on a specific voltage level, waveform input, mounting surface, and testing environment. This allows for a reasonable approximation of the SPL output. When the drive levels are within the device's specified limits, and a square wave input is used, the transducer's output at a specific input level can be estimated using Equation 1:

Equation 1

Approximating SPL for Specific Voltage

$$\boldsymbol{SPL_x = SPL_0 + 20 * \log_{10}\left(\frac{V_X}{V_0}\right)}$$

Where: SPL_X = SPL at desired voltage (V_x)

SPL_0 = SPL at rated voltage (V_0)

EXAMPLE 1

For a transducer that has an SPL of 90 dBA minimum at 3.3 kHz, 10 cm away, with a 10 VP-P square wave input. If the minimum required output is 96 dBA at the same distance and input type, we can use Equation 1 to find the required input:

Given:

$SPL_0 = 90$

$SPL_X = 96$

$V_0 = 10$

$\Delta dB = SPL_x - SPL_0 = \boldsymbol{6dB}$

Substituting into Equation 1:

$$V_X = V_0 * 10^{\frac{\Delta dB}{20}} = V_0 * 10^{\frac{6dB}{20}} \cong \boldsymbol{20V_{PP}}$$

Therefore, the required value for V_X to achieve 96dBA at 10cm is $20V_{PP}$. The SPL dBA output is directly proportional to the input signal, increasing by 6 dBA for each doubling of the input signal. It's important to note that this approximation is subject to the acoustic environment in which the device is tested. However, by carefully testing and correlating the operating environment with the specification test conditions, a fudge factor can be developed to adjust predicted results to real-life measurements. It's also worth mentioning that a square wave input to the transducer produces about 3 dB higher SPL output than a sine wave of equal peak-to-peak magnitude and frequency. Different waveforms will produce varying SPL and tone quality outputs.

CONCLUSION

Many different drive circuits can be used to provide various SPL outputs and overall efficiencies. The applied waveform can be shaped, frequency-shifted, or amplitude-modulated to achieve the desired tone quality, and an estimation of SPL output can be made for certain strictly defined measuring conditions. However, one should always keep in mind that SPL measurement and prediction are complicated by the fact that the environment in which the device is measured greatly influences the measurement.

With these innovative offerings, PUI Audio continues to be a leading player in the field of acoustic solutions, providing engineers with the tools they need to create reliable and attention-grabbing auditory notifications in their designs.

Additional products at:

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