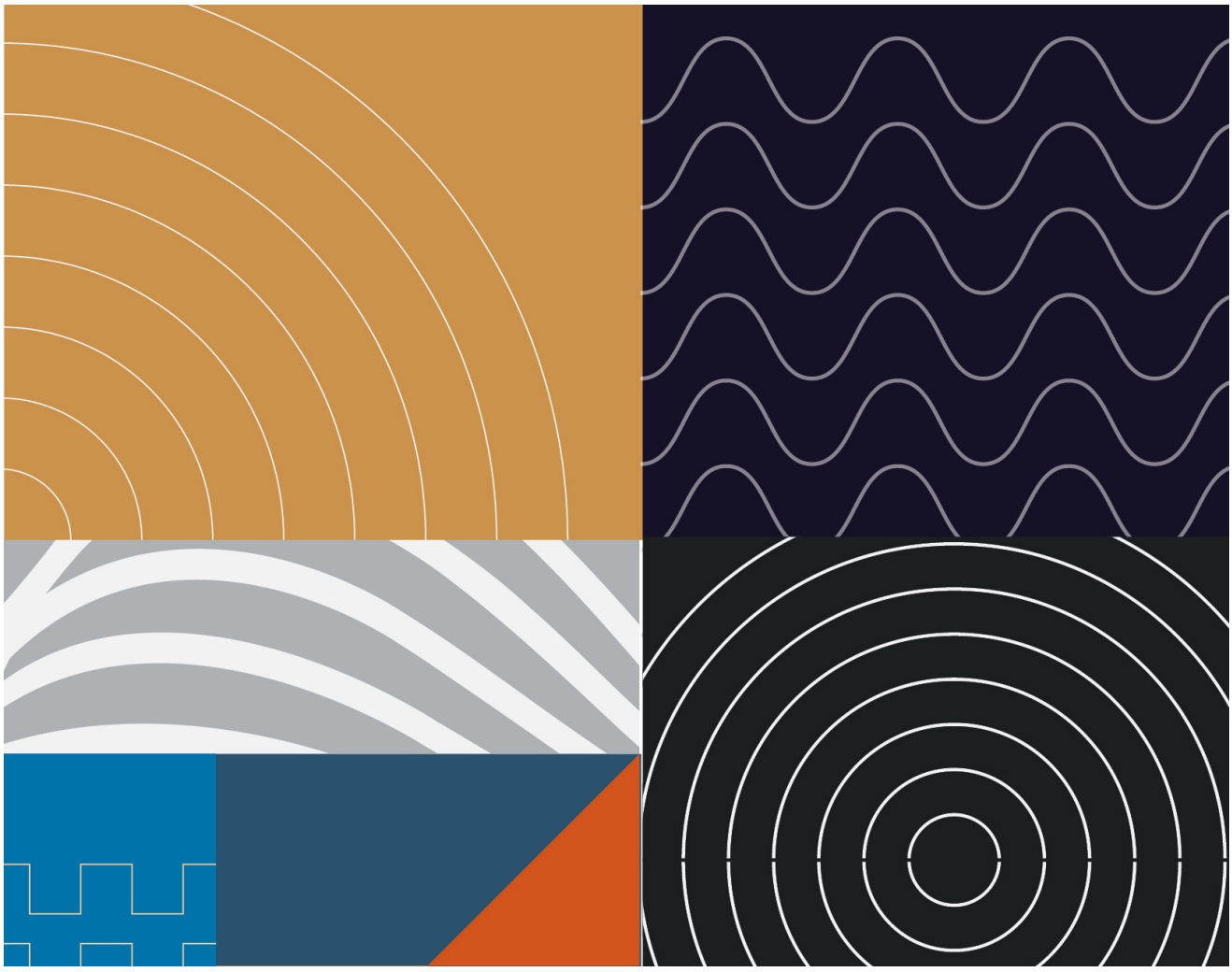
NEW PRODUCT INTRODUCTION
SEPTEMBER 2023

Buzzers Expansion



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Announcement

In the ever-evolving world of acoustic signaling devices, PUI Audio stands at the forefront, introducing five new buzzers - two indicators and three transducers, ranging from 12mm to 55mm, including one surface mount transducer, bring together high sound pressure levels (SPL), and temperature resilience to cater to a diverse range of applications. Buzzers are essential for providing immediate auditory feedback or alerts in a wide range of 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.

New Audio Indicators

AI-3232-TWF-LW160 is a internally driven piezoelectric indicator that operates on 12V DC. Its true innovation lies in its unique drive IC and material composition. The resonant effect, combined with a precisely designed chamber, elevates its sound output to an impressive 116dB! This makes it the perfect choice for applications where an exceptionally loud and attention-grabbing signal is required. Notably, this component is not only RoHS and REACH compliant but also meets qualifications for POPS (Persistent Organic Pollutants), TSCA (Toxic Substance Control Act), and CA PROP65 (California Proposition), aligning with the most stringent environmental and safety standards.

AI-1223-TWT-5V-7

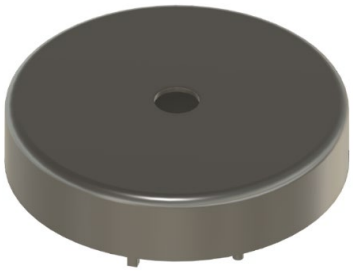
For applications requiring a smaller form factor and internal drive capability, the 12mm Buzzer AI-1223-TWT-5V-7 stands out as a versatile choice. Operating on 5V DC, this audio buzzer emits a sound output of 90dB and features a wide temperature range up to 105°C. Its robust design ensures reliability in challenging environments, and it can function as an indicator in various settings.

SMT-1227-T

A 12mm surface mount piezoelectric transducer engineered for very high-temperature environments up to 120°C. Operating on a 3Vp-p external drive and drawing only 5mA, this compact buzzer boasts an impressive SPL and remarkably short response time. Its ability to withstand elevated temperatures makes it ideal for applications where reliability under harsh conditions is essential.

AT-3033-TT-R

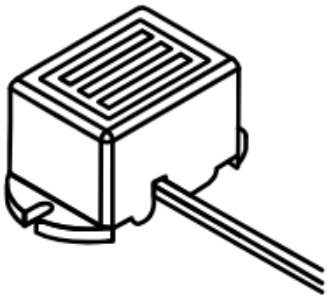
Measuring 30mm in width and 7.5mm in height, this compact Piezo transducer offers a high 90dB SPL, making it versatile for a wide range of applications. With a rated voltage of 10 Vp-p, you can trust that it is engineered for optimum performance even in harsh environments up to 85°C. Drawing just 10mA at its rated voltage, it is not only powerful but also energy-efficient, making it ideal for applications where power consumption is a concern.



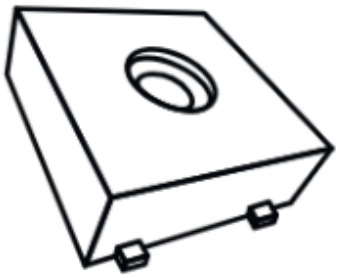
AT-5532-TF-HT-LW190

With a maximum voltage of 60 Vp-p for 10 minutes, the piezo transducer AT-5532-TF-HT-LW190 delivers an output SPL of 110dB and performs reliably within temperatures ranging from -40°C to 85°C. The preinstalled lead wires simplify installation in almost any environment. Additionally, this buzzer is IP66/67 rated according to IEC 60529 Edition 2.2.2013.

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.

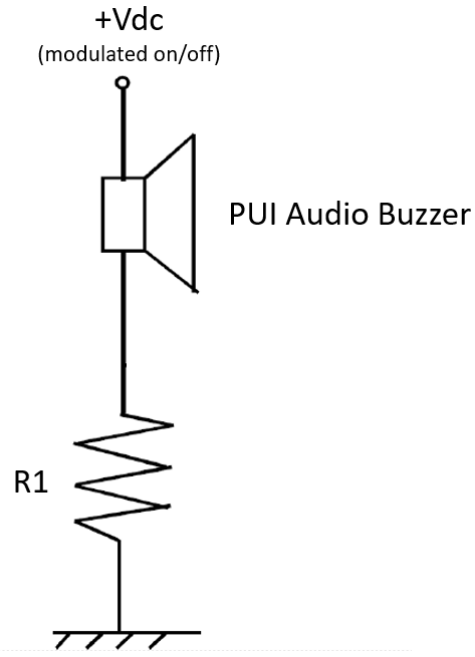
Consequently, its frequency and sound output levels are completely dependent on the frequency, voltage level and other characteristics of the signal applied to its terminals.
The transducer consists of a brass and ceramic disc in a housing which not only provides mechanical support and electrical connection 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.



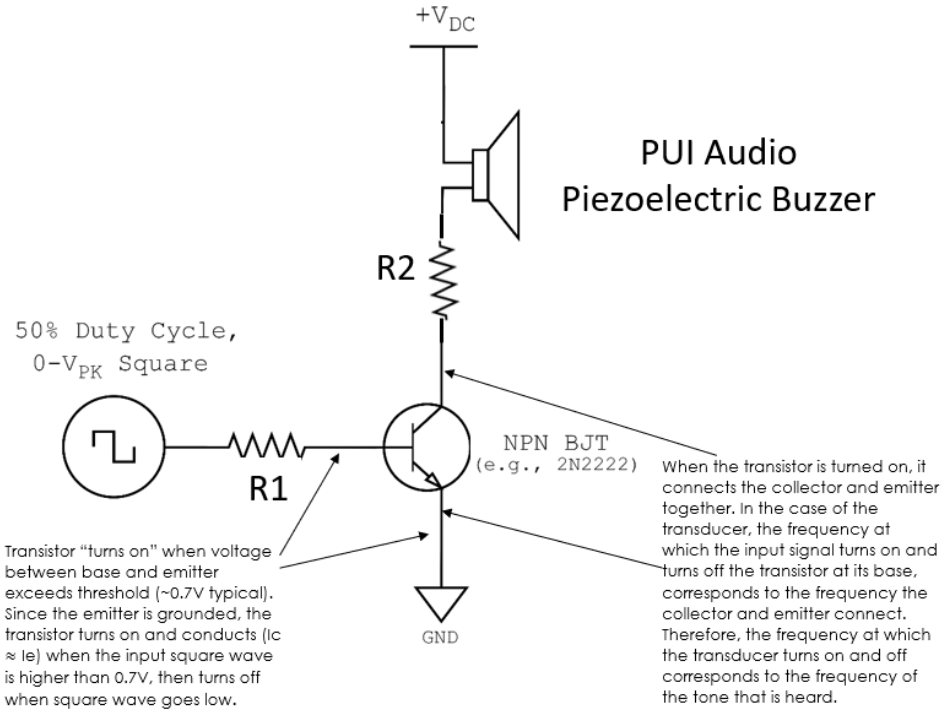
Drive circuit for Piezoelectric Transducers

(AT-3033-TT-R, SMT-1227-T, AT-5532-TF-HT-LW190)

The drive circuit for a Piezoelectric 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 for design flexibility and compatibility with microcontroller GPIO pins (which typically cannot supply adequate current for an audio transducer).

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 actuator (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.



A typical drive circuit includes a fast-switching transistor in a low-side drive configuration. In this configuration, the transistor is connected between the system ground and the transducer, and the driving signal is applied to the transistor's base. The transistor switches the current flow (provided by +VDC) to the transducer at the rate of the signal present at the transistor base, allowing the transducer to produce sound at the switching frequency. R1 limits any current spikes, preventing damage to the microcontroller GPIO pin. At the same time, R2 provides an additional resistive element in series with the transducer to ensure sufficient voltage across the transducer when operating below resonance.

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

The AT-3033-TT-R 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.