FAQ

Q. Please give me an example of the drive circuit for a Piezoelectric Sounder or a Piezoelectric Diaphragm (External Drive Type).

Q. Please give me an example of the drive circuit for a Piezoelectric Buzzer or a Piezoelectric Sounder (Self Drive Type).

Q. Please tell me a current consumption by a Piezoelectric Sounder (External Drive Type).

Q. Does a Piezoelectric Sounder (Eternal Drive Type) have polarity?

Q. Is there any problem with using a Piezoelectric Sounder (External Drive Type) at a frequency other than that used to obtain the specified sound pressure level?

Q. Can a Piezoelectric Sounder (External Drive Type) intended to be driven at 4 kHz in order to obtain the specified sound pressure level is driven at 2 kHz, and the sound pressure increased as well?

Q. Please tell me how to replace an Electromagnetic Buzzer with a Piezoelectric Sounder (External Drive Type).

Q. Please tell me the soldering conditions for a Piezoelectric Sounder or a Buzzer.

Q. Please tell me the maximum input voltage that can be applied to a Diaphragm.

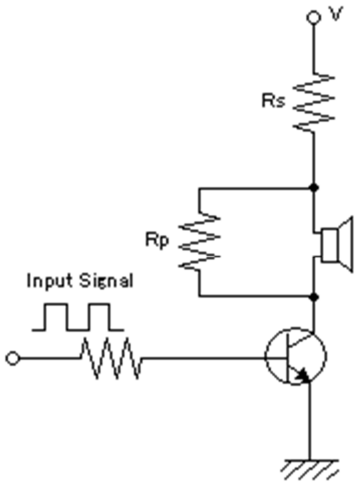
Q. Please tell me the thickness of the lead wires used on a Piezoelectric Sound Component.

Q. Can I wash a piezoelectric sound component? Also, do you make moisture proof and water proof products?

Please give me an example of the drive circuit for a Piezoelectric Sounder or a Piezoelectric Diaphragm (External Drive Type).

external drive type piezoelectric sounder or a piezoelectric diaphragm emits sound when an AC voltage is applied to both terminals of the product. Examples of typical drive circuits are broadly divided into case 1 where a transistor circuit is used and case 2 where the product is driven directly from a microcomputer.

Case 1: Transistor Circuit

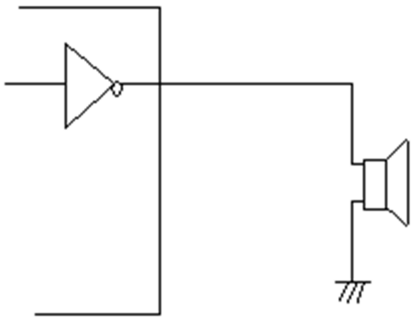


Example of a drive circuit for a piezoelectric sounder and a piezoelectric diaphragm (external drive type)
in the case where a transistor circuit is used

The higher the value of the voltage applied to V, the higher becomes the sound pressure of the piezoelectric sound component. Consequently, this drive method is widely used in cases where a power supply voltage that is higher than the drive voltage for the microcomputer can be obtained. Please refer to the following supplementary notes regarding the components shown in the circuit diagram.

- Rp in the diagram is necessary for discharging the charge accumulated in the piezoelectric sound component, so be sure to use it. Also, if necessary, use Rs for volume adjustment.
- The transistor functions as a buffer for protecting the IC from back electromotive force generated by the piezoelectric sound component. Also, in order to protect the transistor itself, consider connecting a Zener diode in parallel with the piezoelectric sound component and Rp if necessary.
- In the diagram, the piezoelectric sound component and the resistors are connected between the collector of the transistor and V. However, these components can be installed between the emitter of the transistor and GND instead.
- A FET can be used instead of the transistor.

Case 2: Driven directly from a microcomputer.



Example of a drive circuit for a piezoelectric sounder or a piezoelectric diaphragm in the case
where the sounder or diaphragm is driven directly from a microcomputer

A piezoelectric sound component has high impedance and is a voltage-driven device, so it can be driven directly from an IC.
Please refer to the following supplementary notes regarding the components shown in the circuit diagram.

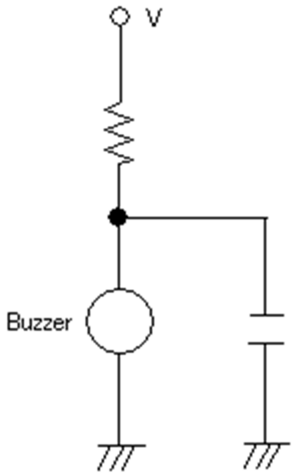
- In order to protect the IC from back electromotive force generated by a piezoelectric sound component, consider connecting a Zener diode in parallel with the piezoelectric sound component and Rp if necessary.
- Design the circuit in such a way that a DC voltage is not applied to the piezoelectric sound component for a long period.

Please give me an example of the drive circuit for a Piezoelectric Buzzer or a Piezoelectric Sounder (Self Drive Type).

Piezoelectric buzzer is an integrated unit consisting of a combination of a piezoelectric diaphragm with a feedback electrode, and a drive circuit. In contrast, a piezoelectric sounder (self drive type) consists of only a piezoelectric diaphragm with a feedback electrode. It is used in combination with an external drive circuit.
The drive circuit for both of the above is a simple circuit consisting of one transistor and three resistors. When a DC voltage V is applied to the drive circuit, the oscillation conditions in the circuit are satisfied in the vicinity of the resonant frequency. As a result, the piezoelectric diaphragm is driven at the oscillation frequency, causing it to emit a sound.

Regarding the drive circuit for a piezoelectric sounder (self drive type), we set a standard circuit for each product. For details, please refer to our catalog.

When you add a series resistor between the DC voltage V and the piezoelectric buzzer in order to adjust the sound pressure of the buzzer, insert a capacitor (of about 1 mF) in parallel with the piezoelectric buzzer. This is effective for preventing irregular oscillation.



Please tell me a current consumption by a Piezoelectric Sounder (External Drive Type).

In contrast to an electromagnetic buzzer which is driven by a current flowing through a built-in electromagnet coil, a piezoelectric sound component is driven by a voltage applied to piezoelectric ceramic. Consequently, it features much lower current consumption than that of an electromagnetic buzzer.

The current consumption (excluding that of the peripheral circuit) by a piezoelectric sounder (external drive type) can be calculated simply from the theoretical equation below.

Average value of current (theoretical value)

When the charging and discharging times of a piezoelectric sounder (external drive type) are significantly smaller than the length of one period of the input signal, the average value of the current which flows into the piezoelectric sounder (external drive type) during a half period can be calculated from the following equation.

$$I_{AVG.} = \frac{2Q}{T} = 2CVf$$

Q: Charge accumulated in the piezoelectric sounder, T: Length of one period of the drive signal (=1/f),
C: Electrostatic capacitance of the piezoelectric sounder, V: Drive voltage, f: Frequency of the drive signal

Calculated value of the consumption current

The average value of the current flowing through the piezoelectric sounder (external excited type), calculated using the above equation for each part No., is shown in the table below.

Calculated value of current consumption for each part No.

[mA]

Part No.	Electrostatic capacitance [nF]	Drive frequency [kHz]	Drive voltage (square wave)		
			3Vp-p	5Vp-p	12Vp-p
PKLCS1212E4001-R1	25	4	0.6	1.0	2.4
PKLCS1212E40A1-R1	25	4	0.6	1.0	2.4
PKLCS1212E2000-R1	32	2	0.4	0.6	1.5
PKLCS1212E20A0-R1	32	2	0.4	0.6	1.5
PKM13EPYH4000-A0	5.5	4	0.1	0.2	0.5
PKM13EPYH4002-B0	5.5	4	0.1	0.2	0.5
PKM17EPP-2002-B0	34	2	0.4	0.7	1.6
PKM17EPPH4001-B0	7	4	0.2	0.3	0.7
PKM17EPPH4002-B0	7	4	0.2	0.3	0.7
PKM17EWH2001	40	2	0.5	0.8	1.9
PKM17EWH4000	9.5	4	0.2	0.4	0.9
PKM22EPH2001	17	2	0.2	0.3	0.8
PKM22EPH2002	17	2	0.2	0.3	0.8
PKM22EPH2003	17	2	0.2	0.3	0.8
PKM22EPPH2001-B0	19	2	0.2	0.4	0.9
PKM22EPPH2002-B0	19	2	0.2	0.4	0.9
PKM22EPPH4001-B0	12	4	0.3	0.5	1.2
PKM22EPPH4002-B0	12	4	0.3	0.5	1.2
PKM22EPPH4005-B0	12	4	0.3	0.5	1.2
PKM22EPPH4007-B0	12	4	0.3	0.5	1.2
PKM22EPPH4012-B0	12	4	0.3	0.5	1.2
PKM22EPTH2001-B0	19	2	0.2	0.4	0.9
PKM33EPH1201C	40	1.2	0.3	0.5	1.2
PKM33EPH1202C	40	1.2	0.3	0.5	1.2
PKM34EWH1101C	40	1.1	0.3	0.4	1.1
PKM34EWH1201C	32	1.2	0.2	0.4	0.9
PKM44EWH1001C	68	1	0.4	0.7	1.6

(*) The electrostatic capacitance is the center value, the tolerance is ±30%, and PKLCS is a reference value.

Does a Piezoelectric Sounder (Eternal Drive Type) have polarity?

Provided that you use the product within the range of the maximum input voltage specified for each product, there is no need to take account of the electrical polarity.
Note, however, that there are some products whose polarity is specified in order to prevent deterioration of the piezoelectric properties of the product.

(Example) Piezoelectric Sounder: PKM17EPP-2002-B0

Is there any problem with using a Piezoelectric Sounder (External Drive Type) at a frequency other than that used to obtain the specified sound pressure level?

A piezoelectric sounder (external drive type) is designed to produce sound at a stable sound pressure when it is driven at the frequency used to obtain the specified sound pressure, however it will also produce sound at other frequencies as well. Consequently, it can produce not only a single sound but also melodies and other complex sounds, enabling it to be used in such applications as operation confirmation sounds, alarms, melodies, and pseudo sounds.

However, there are cases in which the sound pressure level becomes very small depending upon the drive frequency, although this will also depend upon the frequency characteristics of sound pressure level of each product, so check and evaluate the product before using it.

Can a Piezoelectric Sounder (External Drive Type) intended to be driven at 4 kHz in order to obtain the specified sound pressure level is driven at 2 kHz, and the sound pressure increased as well?

A piezoelectric sounder (external drive type) is a voltage-driven type. In order to increase the sound pressure, it is necessary to raise the input voltage. However, generally it is not easy to increase the input voltage to the drive circuit. Accordingly, the sound pressure can be raised by changing the duty ratio of the input voltage without changing the input voltage. (Regarding the duty ratio, refer to Fig.1.)

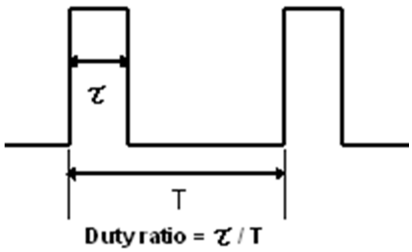


Fig.1 Duty ratio

When a piezoelectric sounder intended to be driven at 4 kHz in order to obtain the specified sound pressure is to be driven at 2 kHz, change the duty ratio of the input signal from 50% to 25%. Taking our piezoelectric sounder PKM13EPYH4002-B0 as an example, this will cause the sound pressure to rise by approximately 10 dB. (Refer to Fig.2 and Fig.3.)

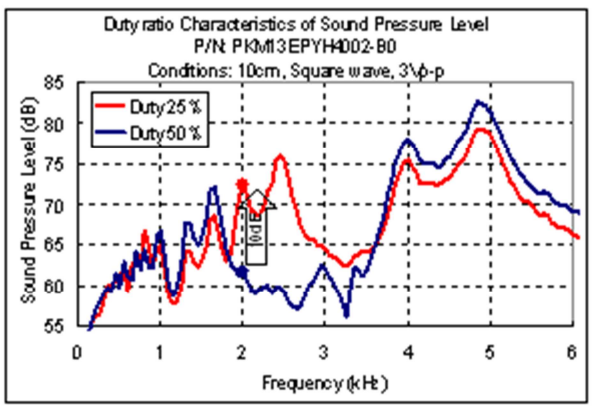


Fig.2 Difference between the frequency characteristics of sound pressure level for duty ratios of 25% and 50%

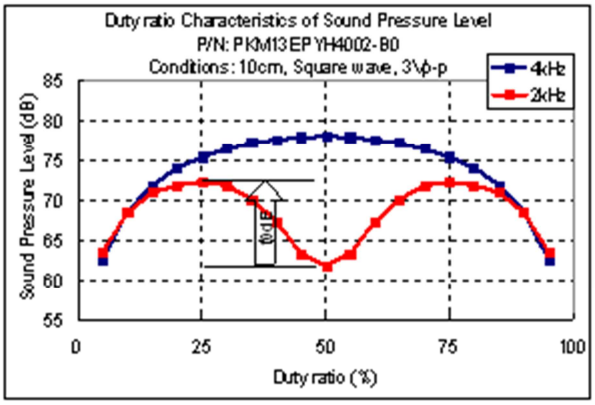


Fig.3 Relationship between the sound pressure and the duty ratio for input signals of 2 kHz and 4 kHz

Because the 4 kHz sound, which is the second harmonic sound at a duty ratio of 25%, is combined with the 2 kHz sound, the sound pressure rises. This result depends upon the frequency characteristics of sound pressure level of the piezoelectric sounder, so the value of the increase in sound pressure will differ according to the type of product. Also, if the duty ratio is changed, a frequency component that is different from the input signal will be used, so the tone will change. It is necessary to check this point while listening to the sound.

Please tell me how to replace an Electromagnetic Buzzer with a Piezoelectric Sounder (External Drive Type).

A general drive circuit for an electromagnetic buzzer that does not have a built-in drive circuit is shown in Fig.1.

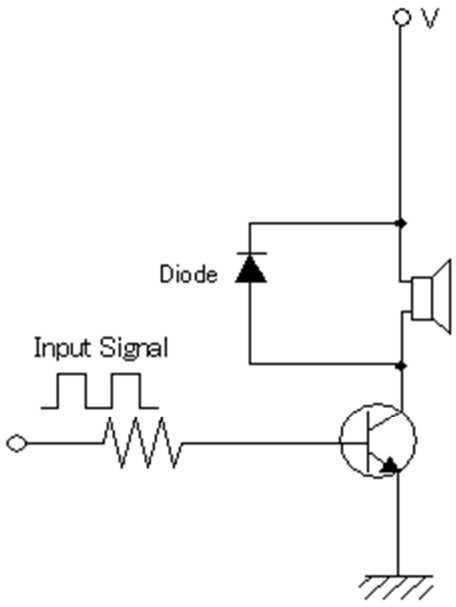


Fig.1 Example of a drive circuit for an electromagnetic buzzer

You cannot produce a sound from a piezoelectric sounder by simply replacing an electromagnetic buzzer with a piezoelectric sounder in this circuit. It is necessary to replace the diode (used for suppressing spike current) with a resistor. Also, if necessary please study the addition of the series resistor and Zener diodes shown in Fig.2 for protecting the transistor from back electromotive force generated by the piezoelectric sound component.

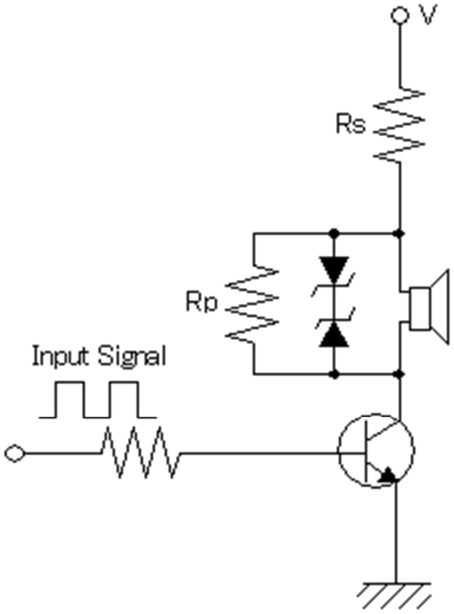


Fig.2 Example of additional drive circuit

Because a piezoelectric sounder has high impedance and is also voltage-driven, it can be driven directly from an IC. Consequently, the configuration of the drive circuit itself can also be simplified.

Please refer
Q. Please give me an example of the drive circuit for a piezoelectric sounder or a piezoelectric diaphragm (external drive type)

After the change in the drive circuit has been completed, select a piezoelectric sounder that has an appropriate performance. When selecting the piezoelectric sounder, take into account the following points.

- Carry out a comparative study of the drive frequency and the sound pressure level.
- Carry out a study of the product size, pitch, and so on. Mounting conditions
  (Reflow soldering cannot be used on a lead type piezoelectric sounder.)
- Current Consumption
  In contrast to an electromagnetic buzzer which is driven by current flowing through a built-in electromagnetic coil, a piezoelectric sounder is driven by a voltage applied to piezoelectric ceramic, so it consumes much less current than an electromagnetic buzzer.

Please tell me the soldering conditions for a Piezoelectric Sounder or a Buzzer.

The soldering conditions of a piezoelectric sounder are as follows.

- Soldering Iron
  - Lead terminals are immersed up to 1.5mm from components body in soldering bath of +260+/-5 degrees C for 10+/-1.0 seconds.
  - Lead terminal is directly contacted with the tip of soldering iron of +350+/-0.5 seconds
- Reflow
  (Lead type piezoelectric sounder cannot withstand reflow soldering.)

When melted solder touches to the base of lead terminal, a part of plastic case shall be melted and it may cause electrical failure. Use a single-sided PCB.

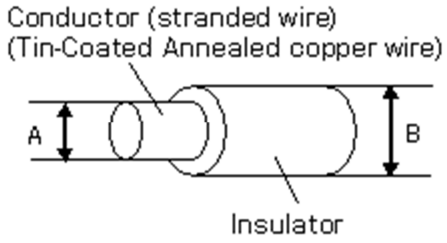
Please tell me the maximum input voltage that can be applied to a Diaphragm.

Regarding a piezoelectric diaphragm, basically the maximum input voltage is not specified. The maximum input voltage to a piezoelectric diaphragm is affected by the specifications and fixing method of the product, and also by the frequency, and so on, of the input signal. In the case of a typical product listed in the catalog, generally a voltage of around 30 Vp-p can be applied without problem.

Please tell me the thickness of the lead wires used on a Piezoelectric Sound Component.

The following table shows the UL and size of typical lead wires used on Murata's piezoelectric sound components.

	Rating		Conductor (stranded wire) (Tin-Coated Annealed copper wire)		Insulator
UL style No.	**Temperature (˚ C)**	**Voltage (V)**	**AWG**	**O.D. A (mm)**	**O.D. B (mm)**
UL1007	80	300	28	0.38	1.18
			32	0.24	0.54
UL1571/UL1685	80	30	30	0.30	0.70
			28	0.38	0.88
			32	0.24	0.54
UL3302	105	30	30	0.30	0.70
			28	0.38	0.88



Can I wash a piezoelectric sound component? Also, do you make moisture proof and water proof products?

Our piezoelectric sound components are not hermetically sealed, so you cannot wash them.

We have a lineup of water proof piezoelectric sound components. The electrode surface of the diaphragm of these components is coated with resin. Note, however, that depending upon the environment in which they are used, it may not always be possible to guarantee performance. Please contact us for details.