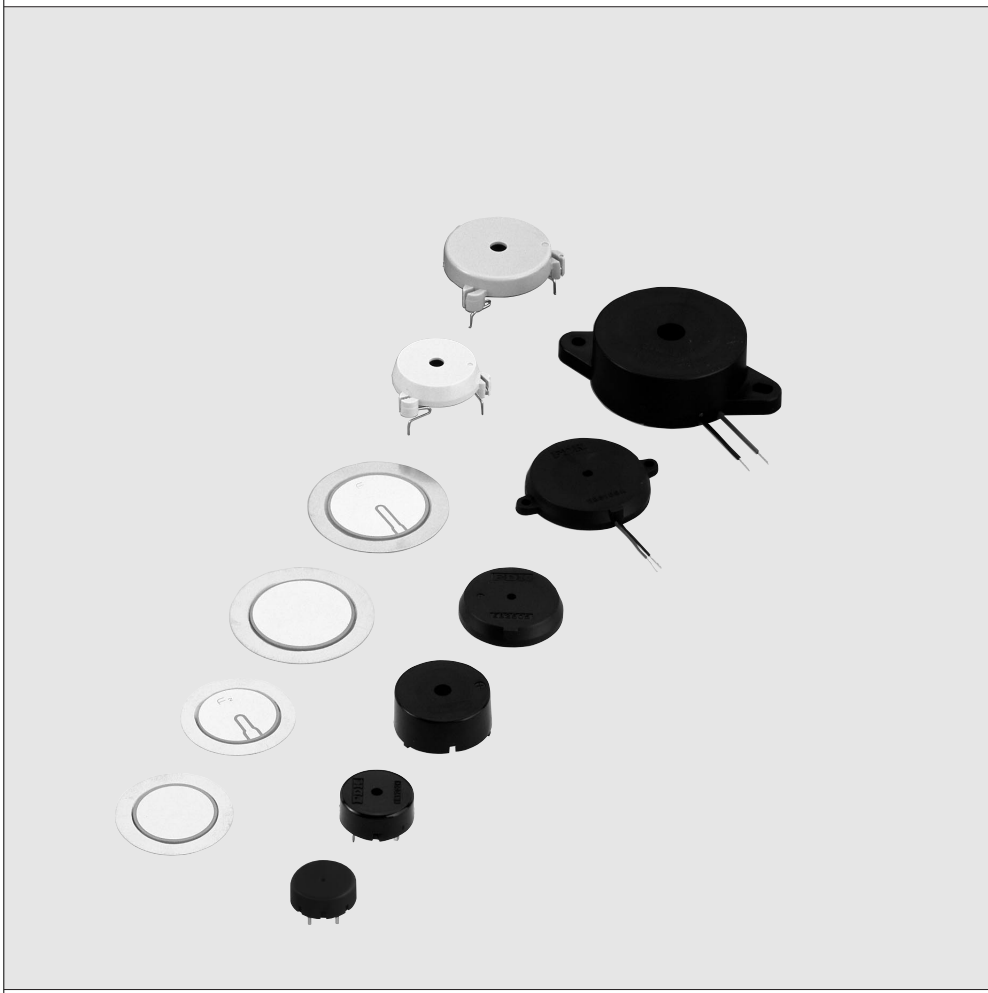
KE11021-1312-005

FDK

PIEZOCERAMIC BUZZERS



Contents

FDK CORPORATION

■ Introduction

FDK piezoceramic buzzers generate sound through the bending vibrations of a thin metal plate adhered to a piezoceramic disc. These buzzers feature a low power consumption, a safe, spark-free and non-contact structure, and a small size and light weight for an easy mounting to printed circuit boards. As a result, an increasing number of piezoceramic buzzers are now used to generate an artificial voice in combination with voice synthesizing ICs. To produce high-quality piezoceramic buzzers, FDK has capitalized on many years of piezoceramics production and outstanding ceramic processing technologies and thin film forming techniques. By adding a sophisticated audio know-how to this manufacturing expertise, FDK offers a large array of electronic tone generating products, such as piezoceramic diaphragms, sounders and buzzers, to meet loud sound outputs, wide frequency ranges, and many other requirements.

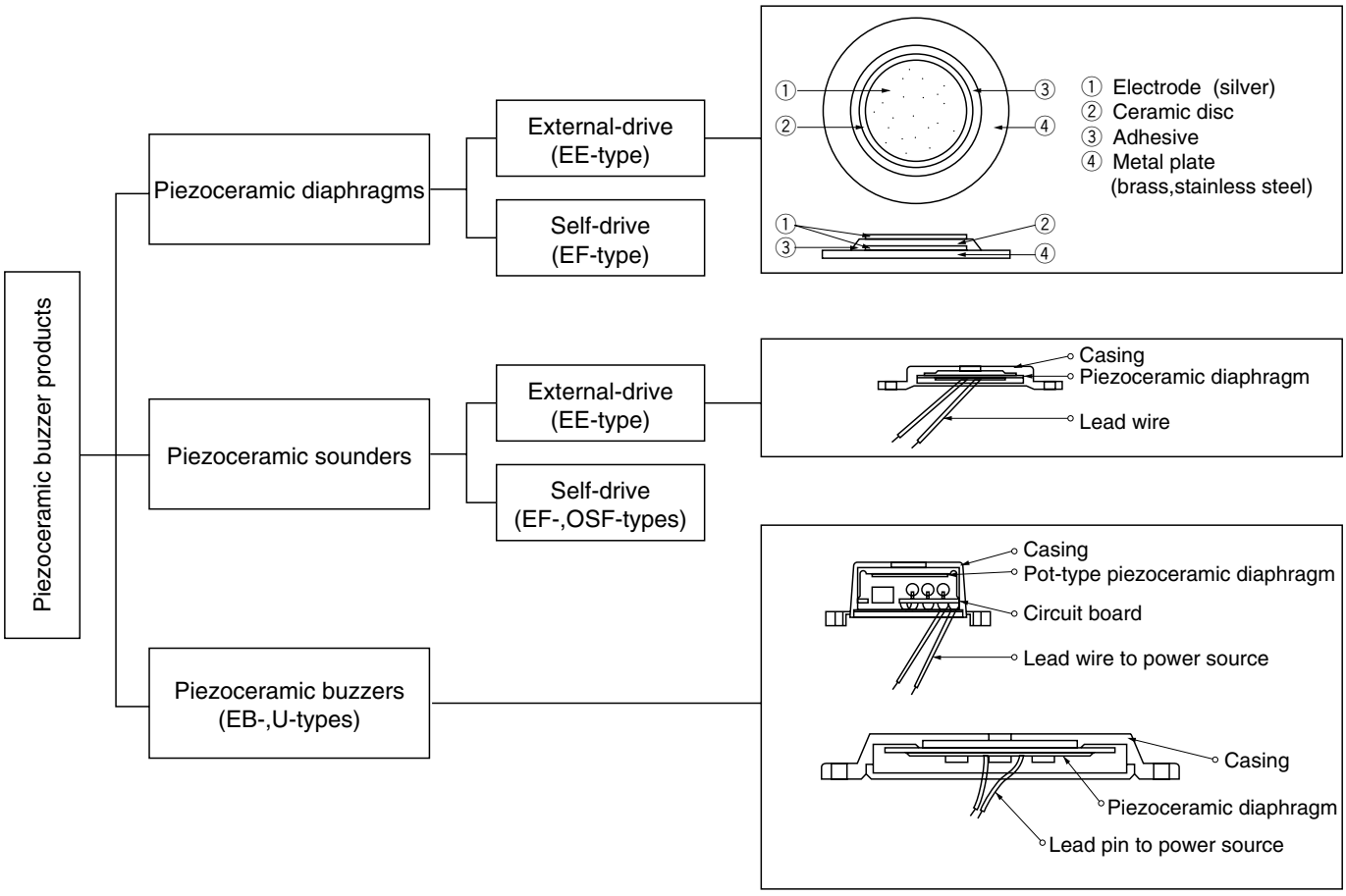
Features

- Use of high-performance piezoceramic elements to meet loud sound volume and wide frequency range needs.
- High quality achieved by integrated in-house production, from piezoceramic materials to buzzers.
- Clear, pleasant electronic tone.
- Reliable, effective operation in a wide variety of equipment and ambient conditions.
- A wide, convenient selection from elements to complete buzzer products.

Applications

- **Consumer electronic appliances**: Refrigerators, microwave ovens, washing machines, electric fans, VCRs, air conditioners, bath heaters, sewing machines
- **Clocks and toys**: Digital clocks and watches, alarm clocks, calculators, game machines, greeting cards
- **Office equipment**: Photocopiers, typewriters, cash registers, personal computers, facsimiles
- **Automotive instruments**: Speed alarms; reverse drive buzzers; light, oil, battery, seatbelt check sounders, keyless entry
- **Safety and security equipment**: Fire alarms, burglar alarms, gas leakage alarms
- **Other electronic equipment**: Vending machines, automatic controllers, bicycle horns, telephones, cameras

■ Makeup of piezoceramic buzzer products



※Please refer to page 17 for the difference between external-drive type and self-drive type.

■ Piezoceramic diaphragms

●How piezoceramic diaphragms are named

E E ② 0 A — 6 3 A
① ② ③ ④ ⑤

①EE: External-drive type
EF: Self-drive type
②Outer diameter of metal plate in mm
③Shape code
④Resonant frequency in 0.1 kHz
⑤Terminal code

●External-drive type diaphragm rating

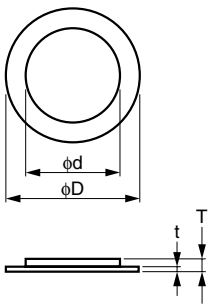
Parts number	Electrical characteristics					Dimensions (mm)				Shape	Metal plate material	Weight (g)
	Resonant frequency (kHz)	Resonant resistance (Ω max.)	Capacitance (pF)	Max. input voltage (Vp-p max.)	Rated working temperature range (°C)	Metal plate outer diameter (φD)	Piezoceramic element outer diameter (φd)	Total thickness (T)	Metal plate thickness (t)			
EE13A-70A	7.0±0.5	400	10,000±30%	30	–20 to +60	13	9	0.22	0.1	Ⓐ	Brass	0.2
EE20A-63A	6.3±0.6	300	10,000±30%	30	–20 to +60	20	14	0.43	0.2	Ⓐ	Brass	0.8
EE27A-39A	3.9±0.5	200	20,000±30%	30	–20 to +60	27	19	0.48	0.25	Ⓐ	Brass	1.6
EE35A-30A	3.0±0.5	200	32,000±30%	30	–20 to +60	35	25	0.58	0.3	Ⓐ	Brass	3.4

●Self-drive type diaphragm rating

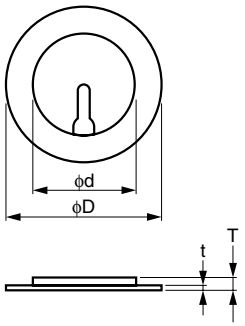
Parts number	Electrical characteristics					Dimensions (mm)				Shape	Metal plate material	Weight (g)
	Resonant frequency (kHz)	Resonant resistance (Ω max.)	Capacitance (pF)	Max. input voltage (Vp-p max.)	Rated working temperature range (°C)	Metal plate outer diameter (φD)	Piezoceramic element outer diameter (φd)	Total thickness (T)	Metal plate thickness (t)			
EF27A-41A	4.1±0.5	300	18,000±30%	30	–20 to +60	27	19	0.48	0.25	Ⓑ	Brass	1.6
EF35A-30A	3.0±0.5	200	30,000±30%	30	–20 to +60	35	25	0.58	0.3	Ⓑ	Brass	3.4

●Shapes

Ⓐ External-drive type



Ⓑ Self-drive type



■ Piezoceramic sounders

●How sounders are named

[EE- and EF-types]

E E	② ④	○ ○	K	—	③ ⑦	F	① ① ⓪	③ V
①	②	③	④		⑤	⑥	⑦	⑧

①EE: External-drive type
EF: Self-drive type
②Outer diameter of casing in mm
③Height: Approx. height in mm when mounted
④Shape code
⑤Oscillating frequency in 0.1 kHz
⑥Terminal code
⑦Lead wire length: Length in mm from external surface of casing (omitted when lead pins)
⑧Rated input voltage: Voltage for measuring of output sound pressure;for operating voltage, refer to max. input voltage.

[OSF-type]

O S F	⑥ S	—	② ①	D
①	②		③	④

①Piezoceramic sounder: General name for OSF-type sounders
②Shape code
③Dimensions: Outer diameter of diaphragm in mm
④Series code

●External-drive type sounder rating

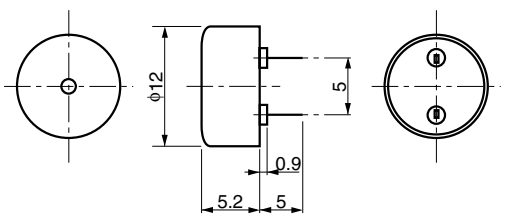
(Measurement condition: 25°C±2°C, 45~60% RH)

Parts number	Electrical characteristics				Shapes and structures					Weight (g)
	Output sound pressure (dB min.) (Measurement condition)	Capacitance (pF)	Max input voltage (Vp-p max.)	Rated working temperature range (°C)	Dimensions (mm) Outer diameter	Height	Shape	Terminal	Casing color	
EE1205K-40R-5V	67 (4.096Hz square wave 5Vp-p, 10cm)	6,000±30% (1kHz)	25	–20 ~ +60	ϕ12	5.2	Ⓐ	Lead pin	Black	0.6
EE1403K-39YB60-5V	65 (3.9kHz square wave 5Vp-p, 10cm)	9,000±30% (1kHz)	25	–20 to +60	ϕ14.8	3.5	Ⓑ	Lead wire	Black	0.5
EE1707K-40R-3V	73 (4,096Hz square wave 3Vp-p, 10cm)	9,000±30% (1kHz)	30	–20 to +70	ϕ17	8	Ⓒ	Lead pin	Black	1.3
EE2108K-40R-3V	75 (4,096Hz square wave 3Vp-p, 10cm)	14,000±30% (1kHz)	30	–20 to +70	ϕ21	8.2	Ⓓ	Lead pin	Black	2.2
EE2115K-28R-12V	85 (2.8kHz square wave 12Vp-p, 10cm)	20,000±30% (1kHz)	30	–30 to +85	ϕ21 (24.5)	9	Ⓔ	Lead pin	Black	2.2
EE24K-37F110-3V	75 (4,096Hz square wave 3Vp-p, 10cm)	10,000±30% (1kHz)	30	–20 to +60	ϕ24	4.5	Ⓕ	Lead pin	Black	2.3
EE3314K-10R-12V	75 (1kHz square wave 12Vp-p, 10cm)	56,000±30% (120Hz)	30	–20 to +70	ϕ33.5	14	Ⓖ	Lead wire	Black	5.2
EE3406K-10R-60V	80 (1kHz square wave 30Vp-p, 1m	38,000±30% (120Hz)	60	–20 to +70	ϕ34	6.3	Ⓗ	Lead pin	Black	5.3

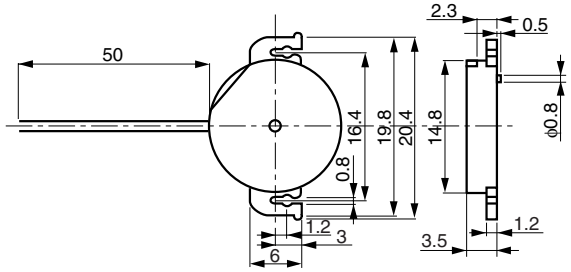
Although rated power supply voltage is shown at the end of parts number, refer to the column of maximum input voltage for operation securing voltage.

●External-drive type sounder shapes

Ⓐ **EE1205K-40R-5V**



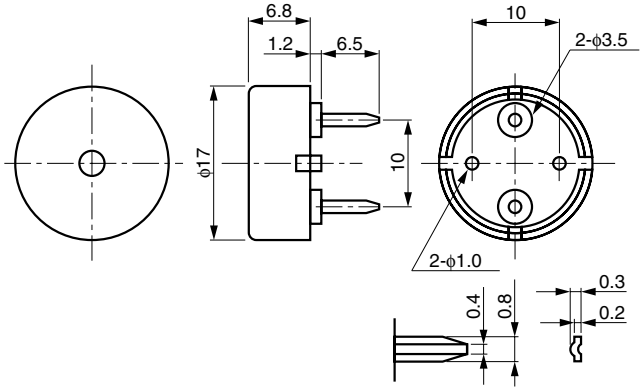
Ⓑ **EE1403K-39YB60-5V**



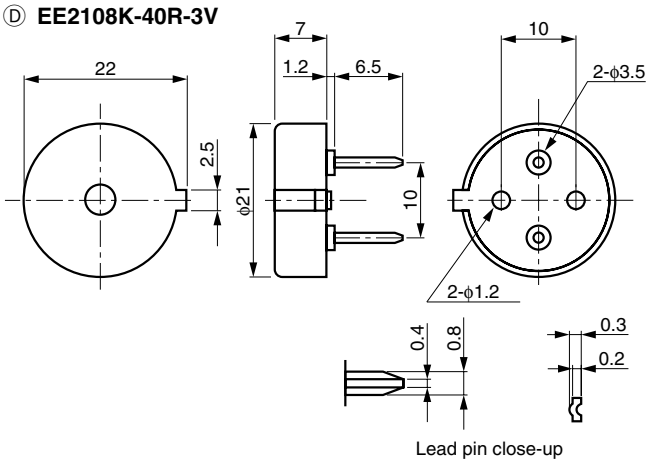
●External-drive type sounder shapes

Unit=mm

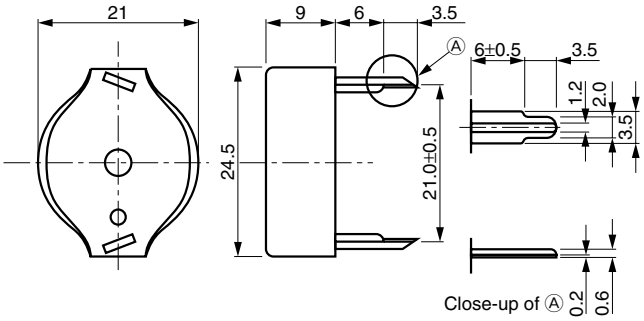
Ⓒ **EE1707K-40R-3V**



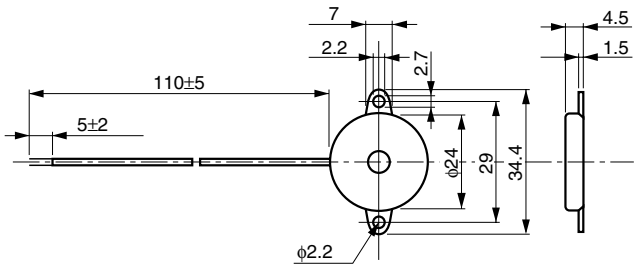
Ⓓ **EE2108K-40R-3V**



Ⓔ **EE2115K-28R-12V**

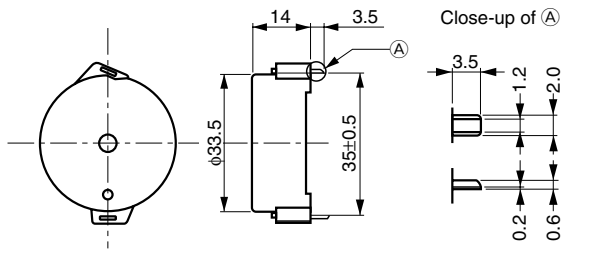


Ⓕ **EE24K-37F110-3V**

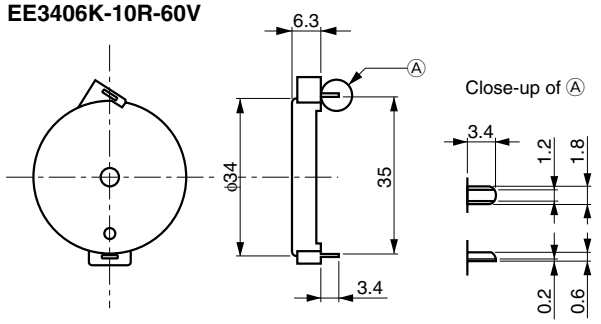


Recommended sclew fixing torque
M2 round headed small screw: 2.0 kg fcm max.

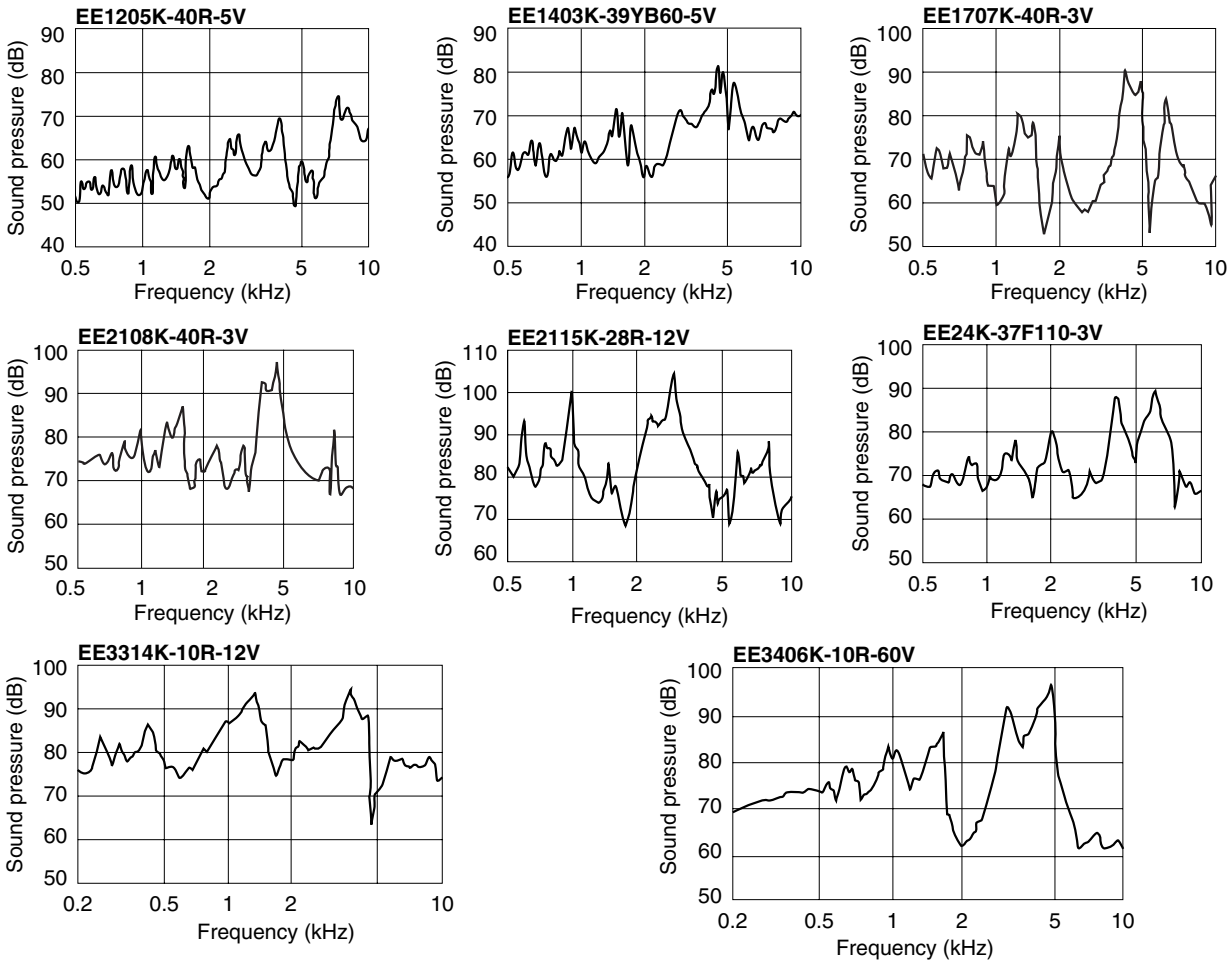
Ⓖ **EE3314K-10R-12V**



Ⓗ **EE3406K-10R-60V**

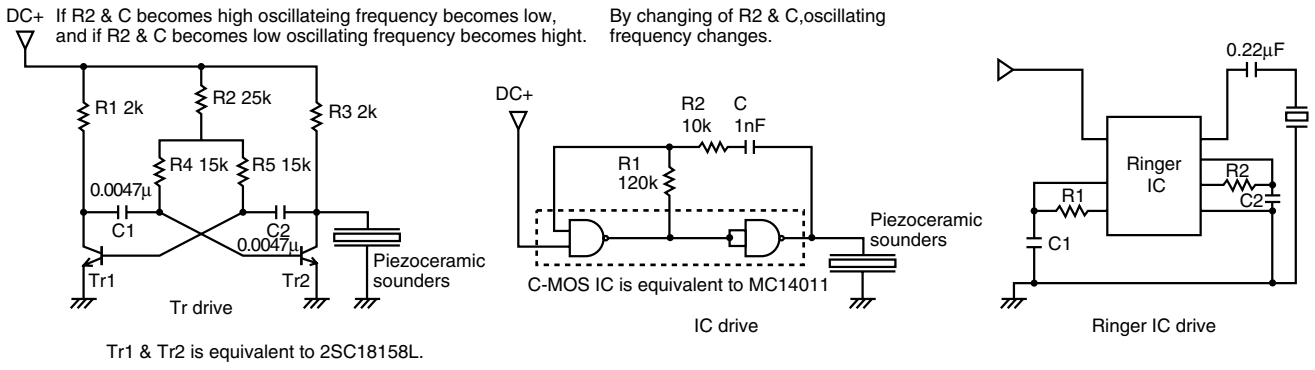


●External-drive type sounders: sound pressure vs. frequency



Input: square wave, rated voltage (30 Vpp for EE3406K-10R-60V)
Measuring distance: 10 cm (1 m for EE3406K-10R-60V)

●Example of recommended external-drive type sounder circuit



●Self-drive type sounder rating

(Measurement condition: 25°C±2°C, 45~60% RH)

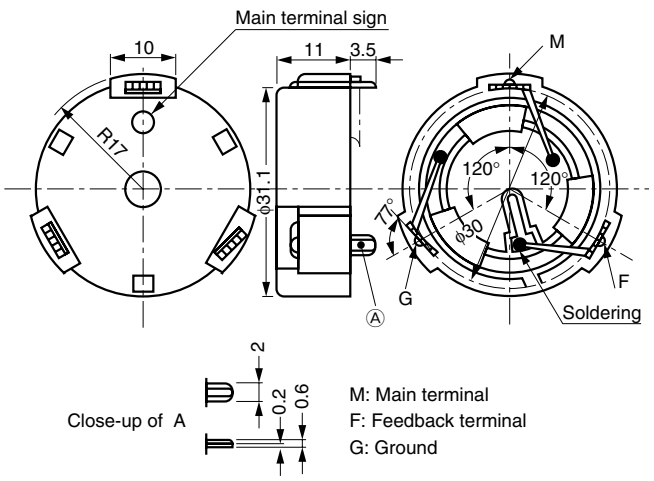
Parts number	Electrical characteristics							Shapes and structures					Weight (g)
	Oscillation sound	Output sound pressure (dB min.) (Measurement condition)	Oscillating (kHz)	Current Consumption (mA max.)	Rated power supply voltage (VDC)	Operating voltage (VDC)	Rated working temperature range (°C)	Dimensions (mm) Outer diameter	Dimensions (mm) Height	Shape	Terminal	Casing color	
EF3114K-30S-12V	Continuous	75 (12VDC, 1m)	3.0±0.5	10	12	3 to18	–20 to +60	ϕ31.1	11	Ⓐ	Lead pin	Black	5.1
OSF2-27B	Continuous	77 (12VDC, 1m)	3.3±0.4	10	12	6 to20	–20 to +70	ϕ28.5	15	Ⓒ	Lead pin	Ivory	3.3
OSF4-27B	Continuous	75 (12VDC, 1m)	2.9±0.5	10	12	6 to18	–20 to +70	ϕ28.5	13.5	Ⓑ	Lead pin	Ivory	3.6
OSF5-32B	Continuous	90 (24VDC, 1m)	2.5±0.5	30	24	15 to33	–20 to +70	ϕ33.5	14	Ⓑ	Lead pin	Black	5
OSF6-21D	Continuous	70 (12DVC, 1m)	3.7±0.5	10	12	3 to18	–20 to +70	ϕ22.5	12	Ⓑ	Lead pin	Gray	1.7
OSF6S-21D	Continuous	73 (12VDC, 1m)	3.6±0.5	10	12	3 to18	–20 to +70	ϕ22.5	12	Ⓓ	Lead pin	Gray	1.8

Above data were obtained by measurement using FDK's test circuits.
Please refer to each product specification about circuit and components.

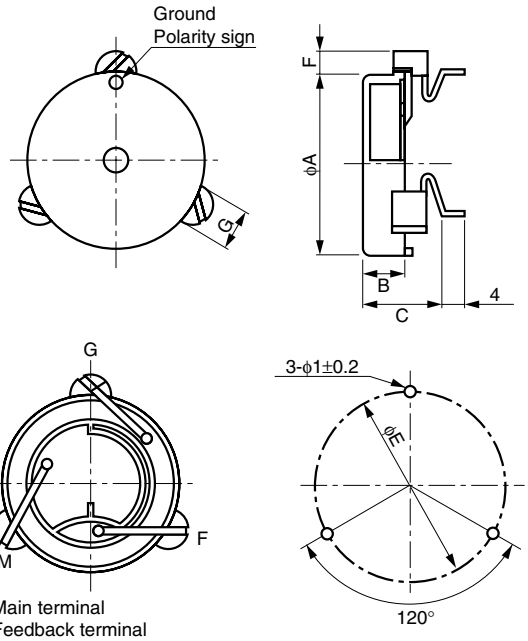
●Self-drive type sounder shapes

Unit=mm

Ⓐ **EF3114K-30S-12V**



Ⓑ **OSF4-27B, OSF5-32B, OSF6-21D**



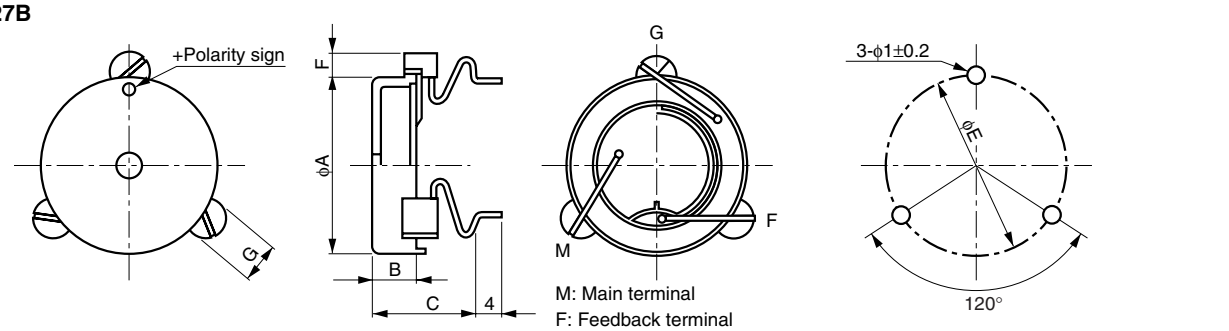
Recommended hole positions on printed circuit board

Parts number	ϕA	B	C	ϕE	F	G
OSF4-27B	28.5	7.5	13.5	30	3.75	6
OSF5-32B	33.5	8	14	35	3.75	6
OSF6-21D	22.5	6	12	23	2.5	5

The OSF6-21D case has the same shape as that of OSF6S-21D

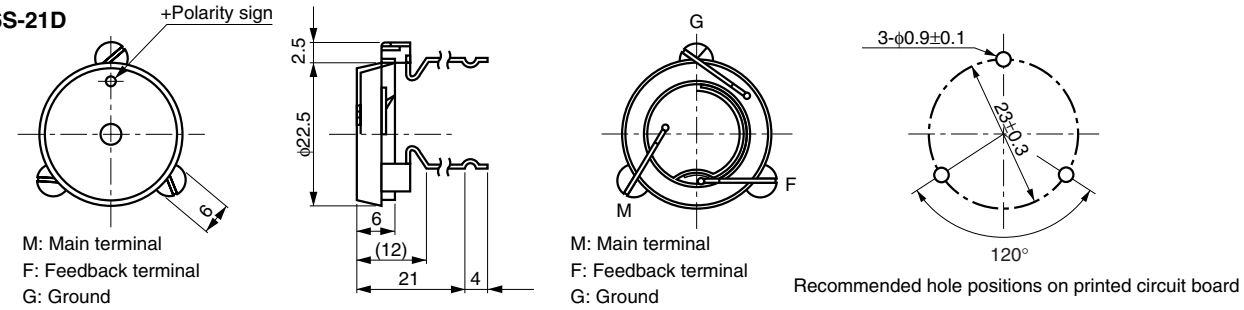
Unit=mm

Ⓒ **OSF2-27B**

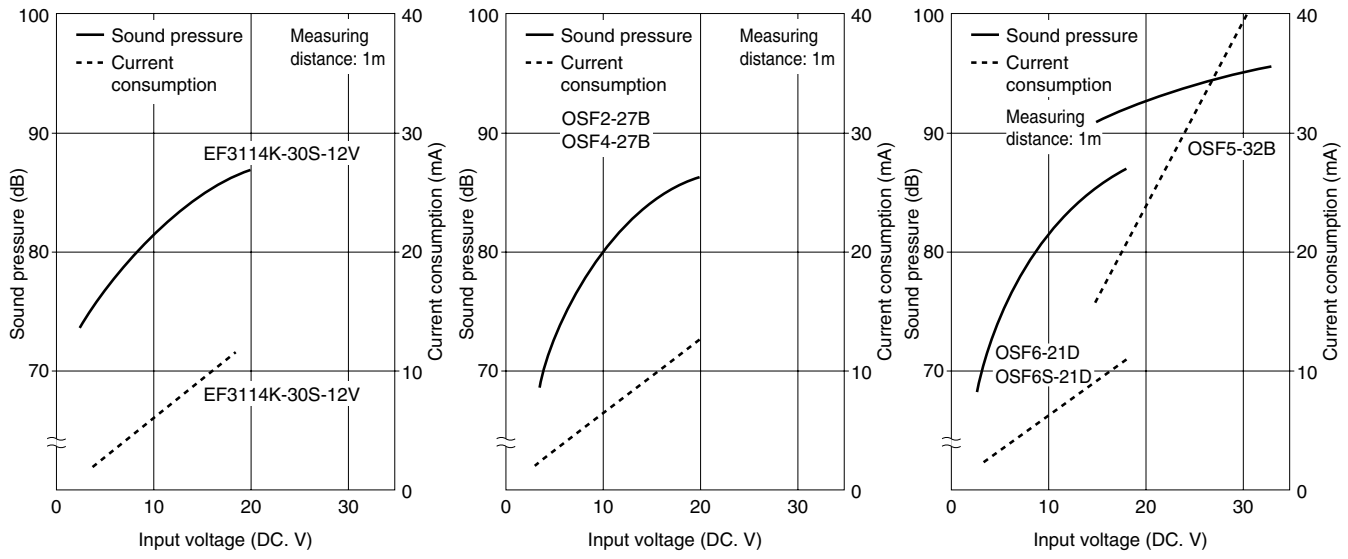


Parts No. \ Dimensions	ϕA	B	C	ϕE	F	G
OSF2-27B	28.5	6	15	30	3.75	6

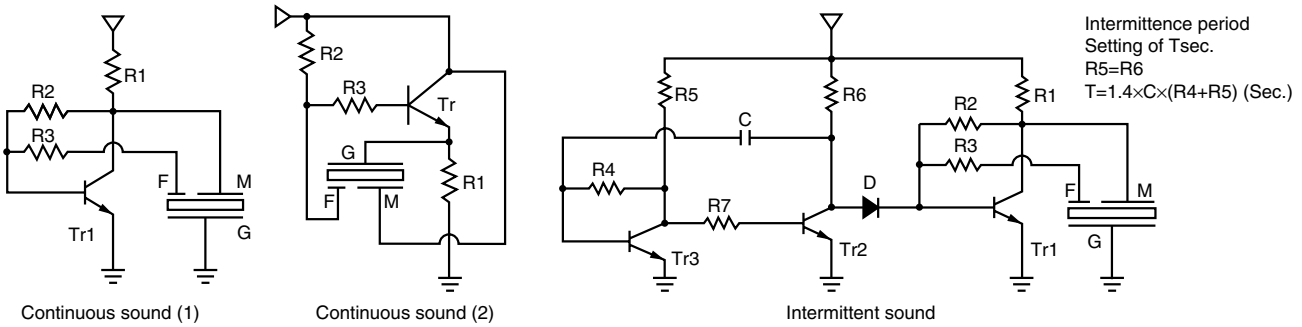
Ⓓ **OSF6S-21D**



●Self-drive type sounders: sound pressure vs. input voltage



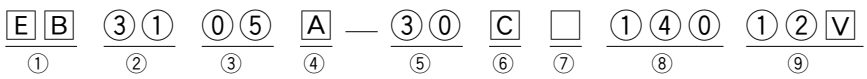
●Example of recommended self-drive type sounder circuit



■ Piezoceramic buzzers (EB-type)

●How buzzers are named

[EB-type]



①Piezoceramic buzzer: General name for EB-type buzzers
②Outer dimensions: Approx. outer diameter of casing in mm
③Height: Approx. height in mm when mounted
④Shape code
⑤Oscillating frequency in 0.1 kHz
⑥Oscillation sound: C(continuous sound), I (intermittent sound)
⑦Special specification· · ·K: washable
⑧Lead wire length: Length in mm from external surface of casing (omitted when lead pins)
⑨Rated power supply voltage· · ·Voltage for measuring of sound pressure etc.; for operation securing voltage, refer to operating voltage column.

●EB-type buzzer rating

(Measurement condition: 25°C±2°C, 45~60% RH)

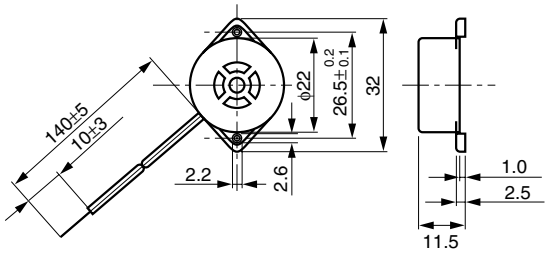
Parts number	Electrical characteristics							Shapes and structures					Weight (g)
	Oscillation Sound	Sound pressure (dB min.) (Distance:m)	Oscillating frequency (kHz)	Current consumption (mA max.)	Rated power supply voltage (DC.V)	Operating voltage (DC.V)	Rated working temperature range (°C)	Dimensions (mm) Outer diameter	Dimensions (mm) Height	Shape	Terminal	Casing color	
EB20A-35CW140-12V	Continuous	70(0.3)	3.5±0.5	4	12	2.4to20	–10to+60	φ22	11.5	Ⓐ	Lead wire	Black	4.2
EB20E-35C-12V	Continuous	70(0.3)	3.5±0.5	4	12	2.4to20	–20to+60	φ23	12	Ⓑ	Lead pin	Black	3.1
EB20Z-32C-9V	Continuous	80(0.3)	3.2±0.5	15	9	2.4to12	–10to+80	φ23	12.5	Ⓒ	Lead pin	Black	4.4
EB2210A-38C-12V	Continuous	75(0.3)	3.8±0.5	10	12	2.4to24	–10to+60	φ22.6	9.5	Ⓓ	Lead pin	Black	2.5
EB2210B-38C-12V	Continuous	75(0.3)	3.8±0.5	10	12	2.4to24	–30to+80	φ22.6	9.5	Ⓓ	Lead pin	Black	2.5
EB23A-30C-12V	Continuous	75(0.3)	3.0±0.5	8	12	2.4to32	–20to+60	φ23.5	13.5	Ⓔ	Lead pin	Black	3.2
EB23B-30C140-12V	Continuous	75(0.3)	3.0±0.5	8	12	2.4to32	–40to+60	φ23.5	13.5	Ⓕ	Lead wire	Black	3.0
EB2505A-31C-12V	Continuous	70(0.3)	3.1±0.5	8	12	3to20	–20to+70	φ25	5	Ⓖ	Lead pin	Black	1.9
※EB2505A-31CK-12V	Continuous	70(0.3)	3.1±0.5	8	12	3to20	–20to+70	φ25	5	Ⓗ	Lead pin	Black	2.0
EB2509A-27C-12V	Continuous	70(0.3)	2.7±0.5	15	12	2.4to20	–20to+70	φ25.5	9.1	Ⓘ	Lead pin	Black	3.2
EB30B-31C-9V	Continuous	70(1.0)	3.1±0.5	12	9	2.4to32	–20to+60	φ31.5	19.5	Ⓙ	Lead pin	Black	7.4
EB30D-31C150-9V	Continuous	70(1.0)	3.1±0.5	12	9	2.4to32	–20to+60	φ31.5	19.5	Ⓚ	Lead wire	Black	8.3
EB3105A-30C140-12V	Continuous	70(0.3)	3.0±0.5	8	12	2.4to15	–20to+60	φ31	5	Ⓛ	Lead wire	Black	3.9
EB3105A-30C-12V	Continuous	70(0.3)	3.0±0.5	8	12	2.4to15	–20to+60	φ31	5	Ⓜ	Lead pin	Black	4.9
EB3120A-35C150-12V	Continuous	90(1.0)	3.5±0.5	15	12	3to20	–20to+80	φ31.5	19.5	Ⓚ	Lead wire	Blue	9.5
EB4015A-30C150-9V	Continuous	80(1.0)	3.0±0.5	15	9	3to12	–20to+60	φ40	15.5	Ⓝ	Lead wire	Black	13.1
EB4015B-28C150-24V	Continuous	85(1.0)	2.8±0.5	20	24	3to28	–20to+60	φ40	15.5	Ⓝ	Lead wire	Black	13.7
EB4015C-30C150-24V	Continuous	90(1.0)	3.0±0.5	20	24	3to28	–20to+60	φ40	15.5	Ⓝ	Lead wire	Black	13.7
EB4015C-30C-24V	Continuous	90(1.0)	3.0±0.5	20	24	3to28	–20to+60	φ40	15.5	Ⓞ	Lead pin	Black	13.7

※ The condition where the “anti-liquid seal” on the sound hole is removed.

●EB-type buzzer shapes

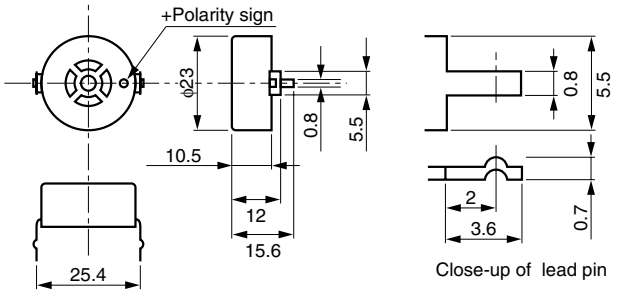
Unit=mm

Ⓐ **EB20A-35CW140-12V**

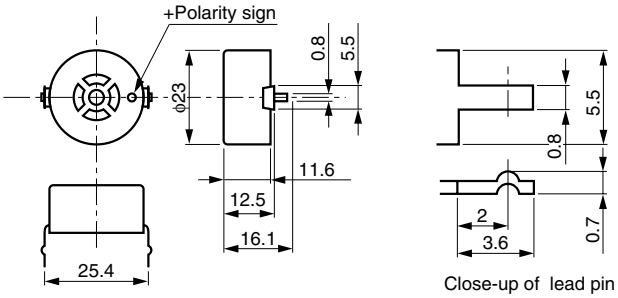


Recommended screw fixing torque
M2 round headed small screw: 0.5kgfcm max.
Lead wire Red(+),White(−)

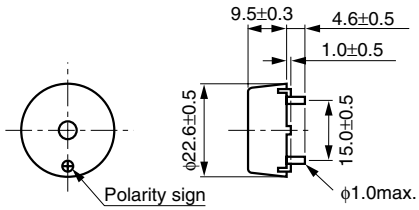
Ⓑ **EB20E-35C-12V**



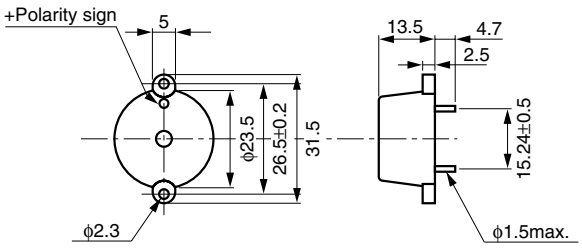
Ⓒ **EB20Z-32C-9V**



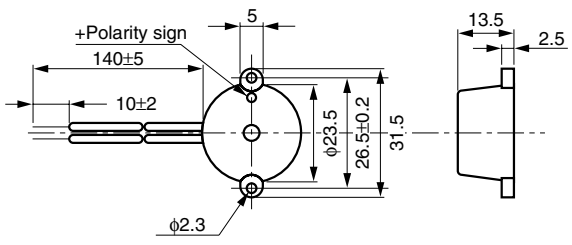
Ⓓ **EB2210A-38C-12V**



Ⓔ **EB23A-30C-12V**



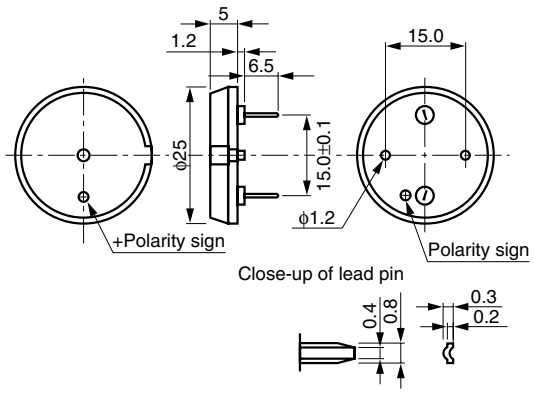
Ⓕ **EB23B-30C140-12V**



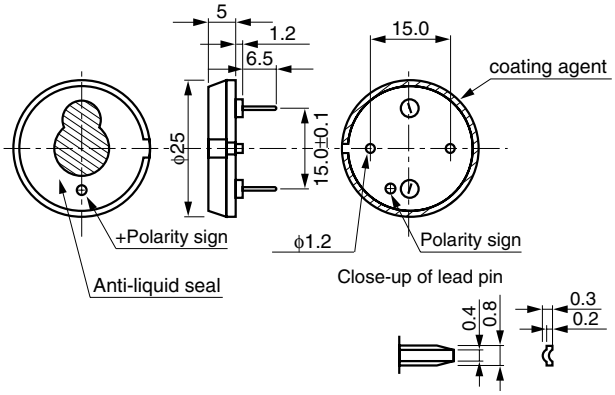
Recommended screw fixing torque
M2 round headed small screw: 0.5kgfcm max.
Lead wire Red(+),Black(−)

Unit=mm

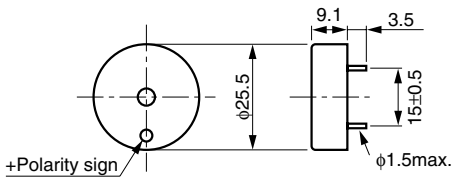
Ⓖ **EB2505A-31C-12V**



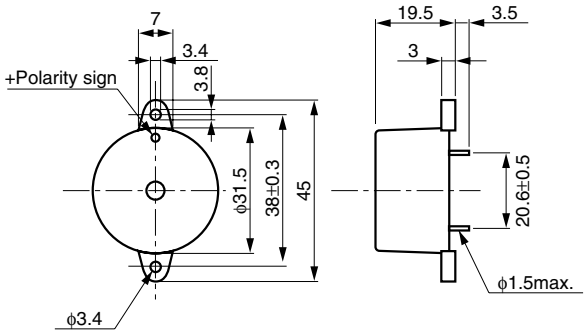
Ⓗ **EB2505A-31CK-12V**



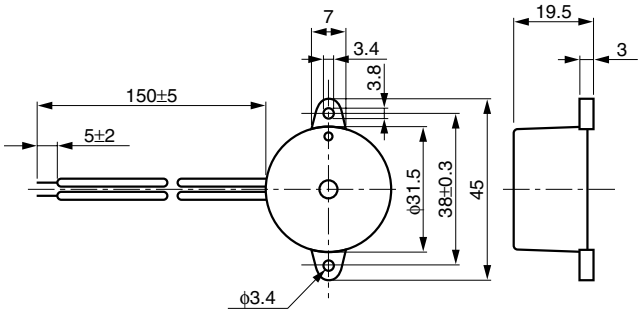
Ⓘ **EB2509A-27C-12V**



Ⓙ **EB30B-31C-9V**

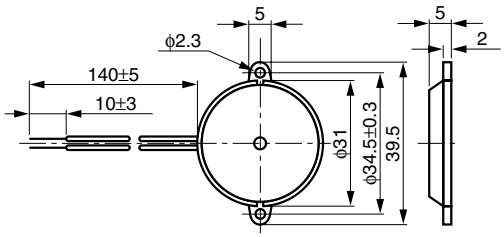


Ⓚ **EB30D-31C150-9V or EB3120A-35C150-12V**



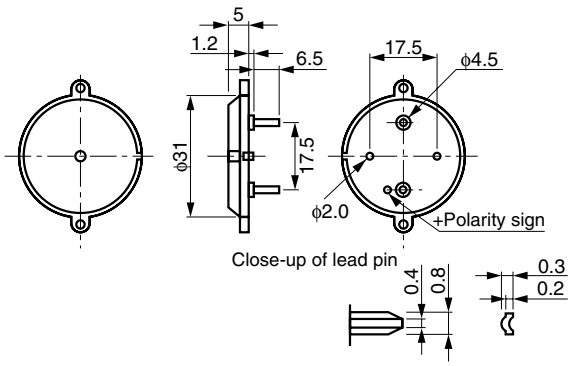
Recommended screw fixing torque
M3 round headed small screw: 3.0kgfcm max.
Lead wire Red(+),Black(−)

Ⓛ **EB3105A-30C140-12V**

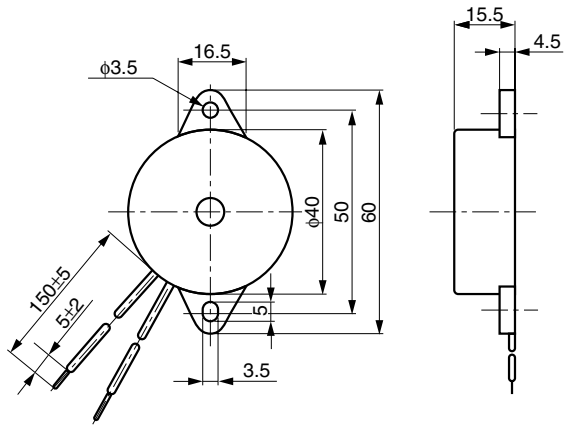


Recommended screw fixing torque
M2 round headed small screw: 0.5kgfcm max.
Lead wire Red(+),Black(−)

Ⓜ **EB3105A-30C-12V**

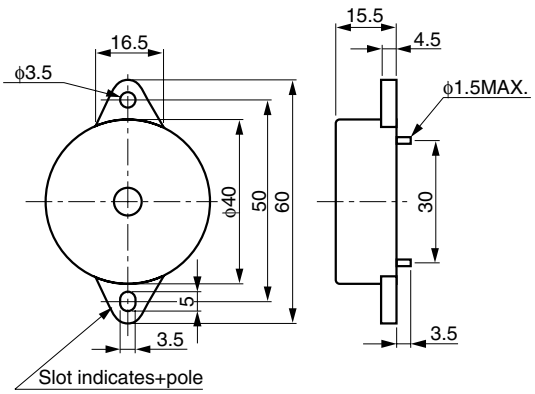


Ⓝ **EB4015A or EB4015B or EB4015C**



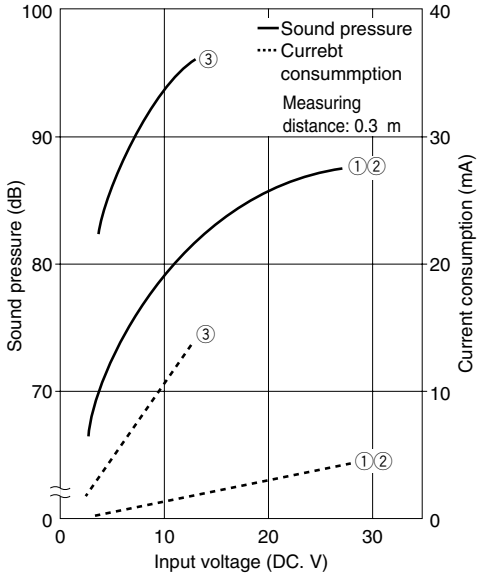
Recommended screw fixing torque
M3 round headed small screw: 3.0kgfcm max.
Lead wire Red(+),Black(−)

Ⓞ **EB4015C**

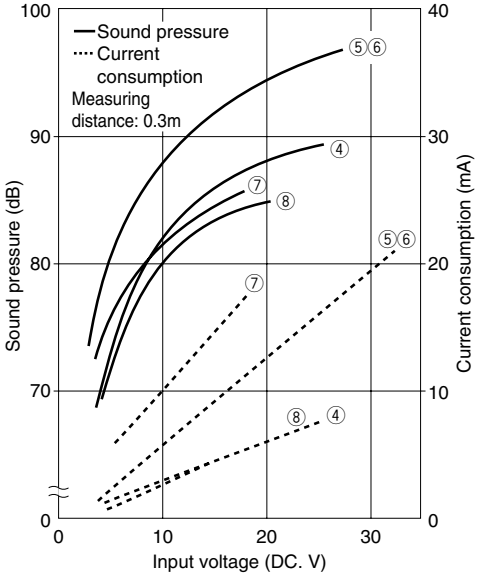


●EB-type buzzers: sound pressure vs. input voltage

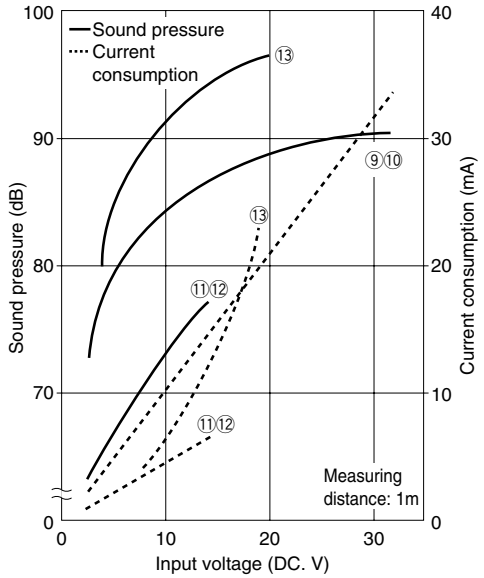
①EB20A-35CW140-12V
②EB20E-35C-12V
③EB20Z-32C-9V



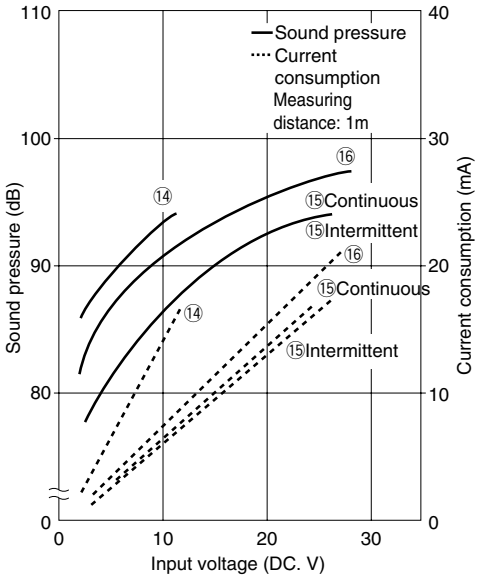
④EB2210A-38C-12V ⑥EB23B-30C140-12V
⑤EB23A-30C-12V ⑦EB2509A-27C-12V
⑧EB2505A-31C-12V, EB2505A-31CK-12V



⑨EB30B-31C-9V ⑫EB3105A-30C-12V
⑩EB30D-31C150-9V ⑬EB3120A-35C150-12V
⑪EB3105A-30C140-12V



⑭EB4015A
⑮EB4015B
⑯EB4015C



●EB2505A-31CK-12V washable type

Washing method

Buzzers of this model is wet-washable. For washing by other methods, please consult our engineers.

Resistance to solvents

EB2505A-31CK-12V buzzers have the following solvent-resistance characteristics. If you are planning to use solvents other than those listed below, please consult our engineers.

Solvent-resistance test conditions

Dipped in solder pot (at 245±5°C for 8 sec.)

⬇

Immersed in solvent (for 30 minutes)

⬇

Dried (at 60°C for 30 minutes)

⬇

Standard reliability test (refer to P.19)

Test results

Solvent	Result
Pure water	○
Isopropyl alcohol (IPA)	○
Toluene	○
Isopropyl alcohol + toluene (1:1)	○
Chlorosen	○
Methanol	×
Methylenechloride	×
Trichloroethylene	×

○ : Satisfactory

× : Unsatisfactory

After washing, remove the “anti-liquid seal” before reuse.

■ Piezoceramic buzzers (U-type)

●Information on product naming

[U-type]

U	②	—	⑤	⓪	R	D_1	D_2	H	①	②	V
①	②		③		④			⑤	⑥		

① Generic symbol for U-type piezoceramic buzzers
② Shape number
③ Dimensions: Outer diameter of diaphragm (mm)
④ Oscillation sounds: R (continuous sounds), D_1 (short intermittent sounds), D_2 (long intermittent sounds)
⑤ Symbol indicating the presence of a horn
⑥ Rated power supply voltage:Voltage for measuring of sound pressure etc.; for operation securing voltage, refer to operating voltage column.

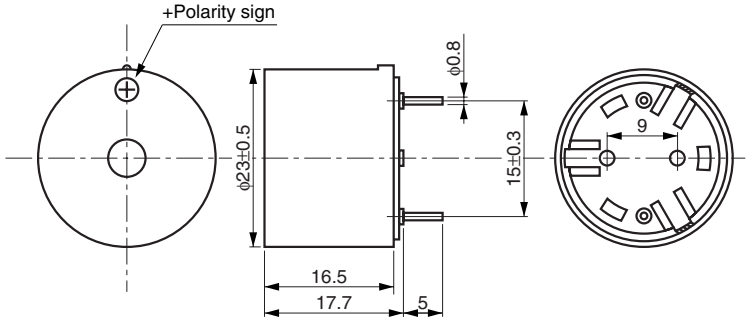
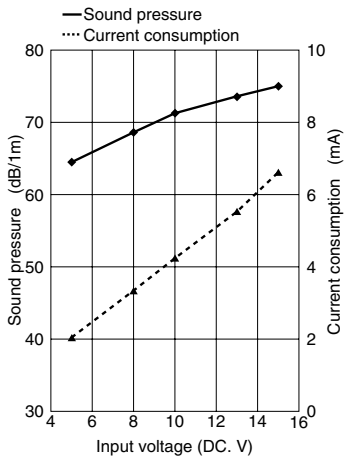
●U-type buzzer rating

(Measurement condition: 25°C±2°C, 45~60% RH)

Parts number	Electrical characteristics							Shapes and structures					Weight (g)
	Oscillation sound	Sound pressure (dB min.) (Distance:m)	Oscillating frequency (kHz)	Current consumption (mA max)	Rated power supply voltage (DC.V)	Operating voltage (DC.V)	Rated working temperature range (°C)	Dimensions (mm) Outer diameter	Dimensions (mm) Height	Shape	Terminal	Casing color	
U4B-21RM-1	Continuous	72(1.0)	2.85±0.4	10	13	5 to15	–20 to + 70	ϕ23	18	Ⓣ	Soldered terminal	Black	4

Intermitting period: 10 Hz±30% (short intermittent)
2 Hz±30% (long intermittent)
※Heat resistance of U2 will be up to +85°C

●U-type buzzer shapes

Abbre. name	Shape Unit = mm	Input voltage characteristics
U4	Ⓣ 	

■ How to use piezoceramic buzzers

Piezoceramic diaphragms have a simple structure consisting of a piezoceramic disc (piezoceramic element) adhered to a thin metal (or plastic) plate. When a voltage is charged in the polarization direction, the piezoceramic element contracts, and expands when voltage is charged in the reverse direction. The quick contraction-expansion motions of the piezoceramic element cause the elastic disk underneath to vibrate and generate sound waves. (See Fig 1)

●How the piezoceramic diaphragm generates sound

The piezoceramic diaphragm generates sound by either the external-drive or the self-drive oscillation technique.

Oscillation mode	Oscillating frequency	Features
External-drive Fig. 2 (a)	Operation at any frequency	Easy generation of sound by nonstable multivibrator circuit (see recommended circuit example on page 4).
Self-drive Fig. 2 (b)	Resonance at frequency corresponding to minimum acoustic impedance of diaphragm	Derives loud sound output through positive feedback oscillation circuit (see recommended circuit example on page 6).

●How piezoceramic diaphragms are supported

Piezoceramic diaphragms are placed in casings equipped with a resonator, to obtain a required sound output. These diaphragms are supported inside the casings by either the nodal-circular support or peripheral support technique, and should be attached to the support by an elastic adhesive such as a silicone agent.

Supporting method	Features
Nodal-circular support Fig. 3 (a)	●Allows a virtually free and unrestricted vibration, and thus closely reproduces the acoustic impedance characteristics of the diaphragm. ●Provides a greater strength against mechanical stress and more stable sound performance. ●Particularly suitable for a loud sound volume generation.
Peripheral support Fig. 3 (b)	●Used to lower the resonance frequency of the piezoceramic diaphragm by suppressing the peripheral vibrations. ●May not have enough strength to resist the mechanical stress at the support area.

●Design of the resonator

The piezoceramic diaphragm cannot produce a loud sound volume only by a nodal-circular or peripheral support, and it is necessary to tune the diaphragm to the air acoustic impedance, a job done by the resonator (see Figure 4, cavity v). The resonator is designed according to the equation below.

$$fcav = \frac{c}{2\pi}\sqrt{\frac{\pi a^2}{(16a/3\pi+t)d^2\,\pi h}} \quad \text{(Hz)}$$

fcav: Resonance frequency of cavity (Hz)
c: Speed of sound $(331+0.6T)\times 10^3$ (mm/sec)
T: Temperature
a: Radius of sound hole (mm)
d: Radius of supporting ring (mm)
h: Height of cavity (mm)
t: Thickness of sound hole (mm)

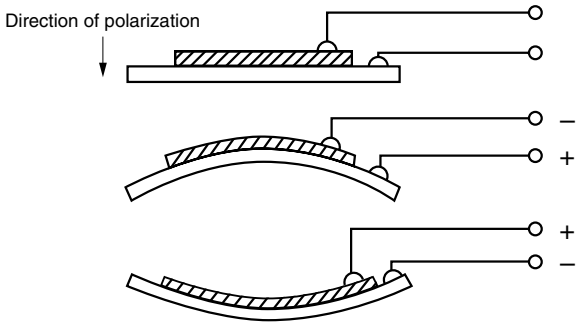


Fig. 1: Distortion of diaphragm

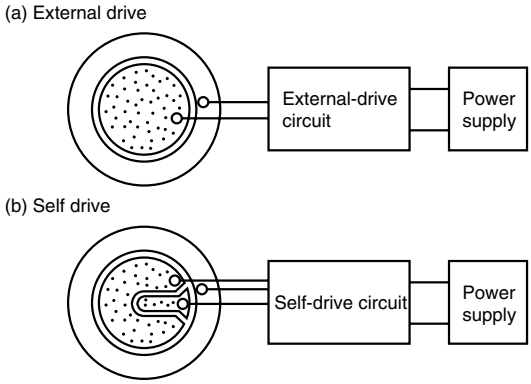


Fig. 2: Method of sound generation

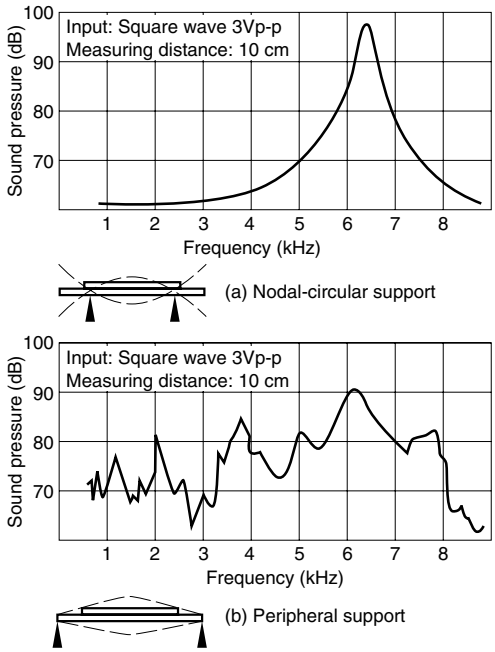


Fig. 3: Supporting method

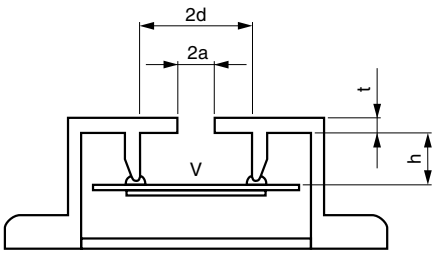
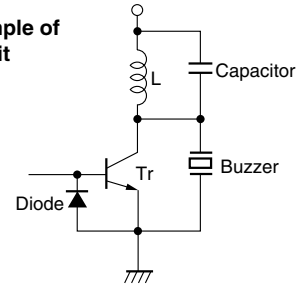


Fig. 4: Resonator for piezoceramic diaphragm

●Booster coil

When the generated sound is less audible due to muffling by the casing, a booster coil is used to amplify the sound (see the righthand figure for an example of a circuit with a booster coil). Given the rise time and breaking time, t sec., of the switching of the transistor by a voltage output from an LSI or other components, a counter voltage is generated in proportion to the coil inductance L and 1/t. Since this counter voltage has a Vp-p several times greater than the power supply voltage, a proportionally greater sound pressure is obtained. In some cases, a capacitor and a diode are included in the circuit to absorb surge current and thus protect the transistor.

Example of circuit



■ Piezoceramic buzzer measurement method

●Standard measurement conditions

Temperature: 25±2°C Humidity: 45—60% RH

●Electrical characteristics

1) Resonant frequency and resonant resistance
   Measured by an impedance analyzer
2) Capacitance
   Measured by a universal bridge or LCR meter (measured between poles at 1 kHz)

●Acoustic characteristics of piezoceramic sounders and buzzers

The oscillating frequency, current consumption and sound pressure are measured by the measuring instruments shown below.

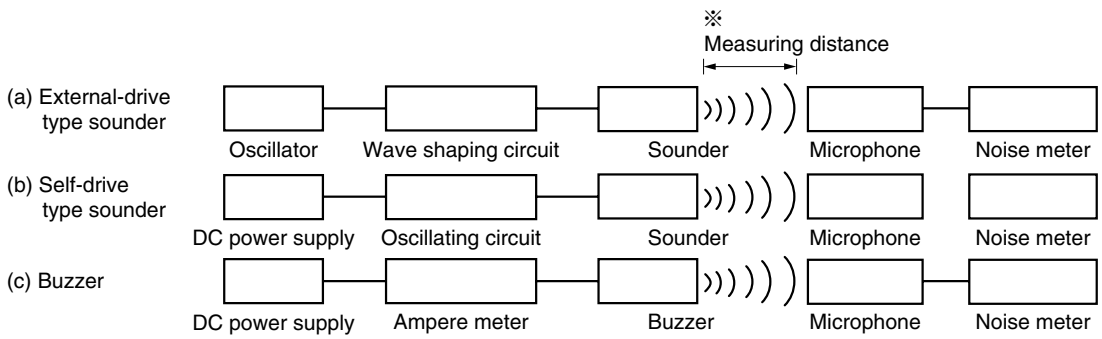


Fig. 1: Measuring formats for acoustic characteristics

In the measuring test, sounders and buzzers are placed as follows:

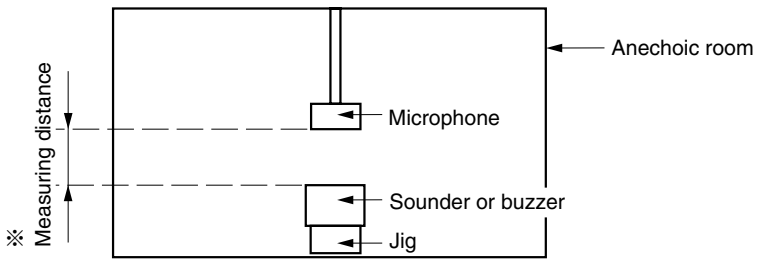


Fig. 2: Sounder and buzzer placement for measurement

※Measuring distance

◯Piezoceramic sounder (self vibration and separate vibration types)
After measuring the sound pressure level from 10 cm away, the measured value is converted according to the rated distance of each sounder model.

◯Piezoceramic buzzer
After measuring the sound pressure level from 5 cm or 10 cm away, the measured value is converted according to the rated distance of each buzzer model.

●Conversion of sound pressure by distance

The sound pressure values shown in this catalog are not directly comparable because of different measuring distances. Therefore, the following conversion equation should be used for any comparison.

B = A + 20 log (La/Lb)

A: Sound pressure value at measuring distance of La

B: Sound pressure value at measuring distance of Lb

The relationship between an increase in measuring distance and a lowering of sound pressure can be estimated by consulting the table below.

Distance increase	2 times	3 times	4 times	5 times	6 times	7 times	8 times	9 times	10 times
Sound pressure drop (dB)	– 6.02	– 9.54	– 12.04	– 13.98	– 15.56	– 16.90	– 18.06	– 19.08	– 20.00

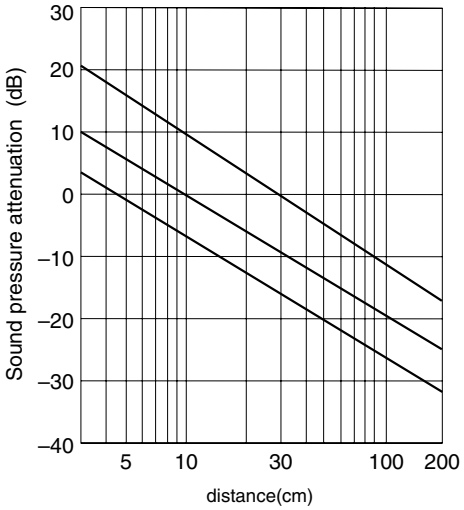


Fig. 3: Distance-sound presssure conversion chart

■ Standard conditions for reliability tests

●High-temperature placement

The product is subjected to its upper limit operation temperature (t_2) for 500 hours.

●Low-temperature placement

The product is subjected to its lower limit operation temperature (t_1) for 500 hours.

●High-temperature and high-humidity placement

The product is placed in a 60°C, 90—95% RH condition for 500 hours, during which the ON-OFF operation is checked every 30 minutes.

●Temperature cycle

One cycle consists of one hour of the t_1 routine and one hour of the t_2 routine, and a total of 24 cycles are imposed.

●Vibration

The product is shaken for two hours in the same direction for a total of six hours in three directions, at a frequency of 10-55-10 Hz, an amplitude of 1.5 mm, and a sweep time of one minute.

●Shock

The product is dropped three times continuously in the same direction under a gravitational force of 100G, for a total of nine drops in three directions.

After the completion of each test, the product is left under room temperature for 24 hours, and then undergoes standard tests; the measured values, i.e., the value of oscillating frequency, current consumption, or sound pressure, should not deviate by more than ±10% from the initial measurement values.

⚠Caution

1. When mounting and handling

(1) To prevent malfunctions, install the piezoceramic buzzer or sounder so that it does not come into contact with other componets on its side or top surface.

(2) Do not block the sound opening of the buzzer or sounder. Maintain a distance of at least 10mm between the sound opening and any surrounding object. Also, do not cover the sound opening with an adhesive tape or the like. If the sound hole is blocked, the buzzer or sounder may exhibit abnormal oscillation or stop functioning.

(3) The sound pressure of the buzzer or sounder may be measured after, but not before, it is installed in the host equipment. When determining the installation position, make sure that adverse acoustic impedance does not exist in the installation area. If acoustic impedance exists, the buzzer or sounder may exhibit abnormal oscillation or stop functioning.

(4) When securing the buzzer or sounder with screws, tighten the screws within the specified torque range. Use pan-headed screws and washers so the buzzer or souder casing will not be deformed. A deformed casing may cause the buzzer or the sounder to exhibit abnormal oscillation or stop functioning.

(5) When stripping a lead wire, do not cut the conductive line inside the coating, thereby ensuring the sound will be properly generated. Use a stripper suitable for the diameter of the lead wire.

(6) Do not apply strong force to the pins before they are soldered. If the pins are bent or cut due to excessive force, the buzzer or sounder may not generate sound.

(7) Do not use the wrong polarity. If the buzzer or sounder is improperly connected, the internal circuit may break down when electricity is applied.

(8)Use the buzzer or sounder within the operation voltage range. A higher voltage may damage the diaphragm and other componets or cause a fire. With a lower voltage, the sound may not be produced.

(9) Do not apply a DC current to the piezoceramic sounder. Otherwise, silver migration may occur, which will lower the insulation resistance and cause the sounder to stop functioning.

(10) Use a low-impedance (not more than 100 Ω) power supply for the buzzer; otherwise, the buzzer may exhibit abnormal oscillation or stop functioning.

(11) Do not interpose a resistance in series between the buzzer and the power supply, else the buzzer may exhibit abnormal oscillation or stop functioning. If the interposition of a resistance is necessary to adjust the sound volume, insert a capacitor of approximately 1 μF in parallel, not in series, as shown in Figure 1.

(12) Do not use the buzzer or sounder in a corrosive ambience, such as an ambience containing sulfur hydrides. Otherwise, a normal sound may not be generated due to corrosion of the componetnts and diaphragm.

(13) When washing, be sure that a solvent or the vapor of a solvent does not infiltrate the buzzer or the sounder, thereby preventing deterioration and damage by the solvent trapped inside the casing.

(14) Do not drop the buzzer or sounder. When subjected to a mechanical shock, the sounder may accumulate a high voltage inside its piezoelectric elements, resulting in an electric shock to anyone who touches it. Also if such a sounder is connected to a circuit, it may damage transistors and/or other electronic components.
Sounders which may have accidentally been subjected to a mechanical shock can be made safe by shorting them between the poles. Then check the sound pressure, tone and appearance before use.

(15) Take special protective measures to prevent deterioration and breakdowns, whenever the buzzers or sounders are stored in the following unfriendly areas:

① Dusty places
② Hot or frosty places
③ Areas exposed to sunlight
④ Moist places
⑤ Humid places
⑥ Areas exposed to solvents or their vapor

(16) When operating the buzzer or sounder outdoors, protect it from moisture to ensure normal operation.

(17) When soldering on diaphragms, use a solder containing 2% silver and finish each sodering job within 1 second at a soldering temperature of 300±10°C. If the solder does not contain silver, diaphragm performance may be adversely affected.
When soldering buzzers and sounders having lead pins, complete each soldering job manually within 3 seconds at a sodering temperature of 300—320°C Moreover, in the case of the EE1205K, EE1707K, EE2108K, EB2505A and EB3105A models, manually complete each soldering job within 5 seconds at 260±5°C.

(18) To protect an LSI from a counter voltage of the sounder, which may be caused by an external mechanical shock, connect a Zener diode or varister in parallel to the LSI, as shown in Figure 2.

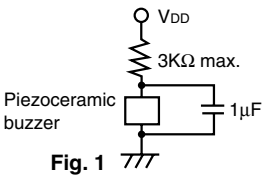


Fig. 1

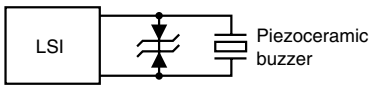


Fig. 2

2. When storing

To prevent deterioration and/or breakdowns, do not store buzzers and sounders in the following places:

① Dusty places
② Hot or frosty places
③ Areas exposed to sunlight
④ Places with leaking or infiltrating water
⑤ Humid places
⑥ Areas exposed to solvents or their vapor
⑦ Areas exposed to corrosive gases, such as H_2S

3. Other precautions

① To maintain the initial performance and safety standard of the buzzer or sounder, do not disassemble, repair or modify it.
② The products contain the lead so that the disposal of industrial wastes has to be required.

FDK Web Site
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