Embedded Systems Project Report

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KNOCK LOCK

INTRODUCTION

Overview

Knock Lock is a device that allows you to make your own secret locking mechanism to keep unwanted guests out of your space.

Components

1. Arduino
2. Switch
3. 3 LEDs (Red, Yellow, Green)
4. 22 Ohm Resistors (3)
5. 1 Mega Ohm Resistor (1)
6. 10 Kilo Ohm Resistor (1)
7. 100µF Capacitor (1)
8. Servo Motor

Mechanism

The piezo is used as an input device. When plugged into 5V, the sensor detects vibrations that are read by the Arduino's analog inputs. A high value resistor (1-megohm) is used as a reference to ground for this setup.

Then the piezo is pressed flat against a solid surface that can vibrate, the Arduino can sense how intense a knock is. Using this information we can check to see if a number of knocks fall in an acceptable range. The code tracks the number of knocks to see if they match the settings.

A switch locks the motor in place. The LEDs provide a status: a red LED indicates the box is locked, a green LED indicates the box is unlocked, and a yellow LED indicates that a valid knock has been received.

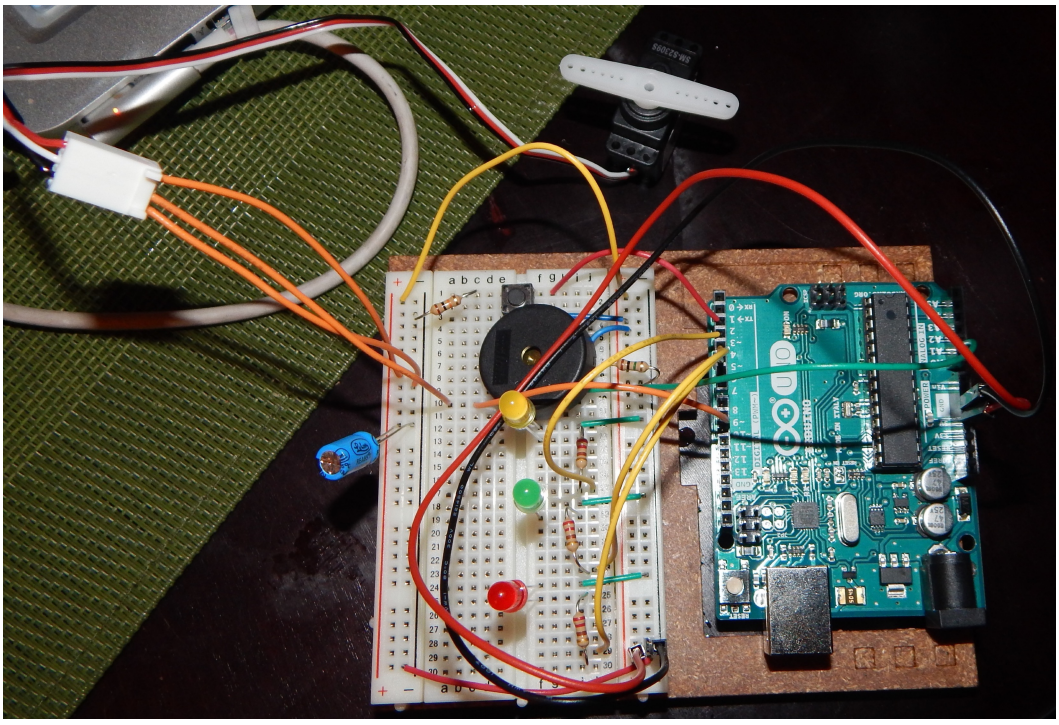
HARDWARE

Building the circuit

The power and ground are connected to both sides of the bread board. On end of the push button is connected to 5V while the other is connected to ground through a 10-kilohm resistor. This junction is the connected to digital pin 2 on the Arduino.

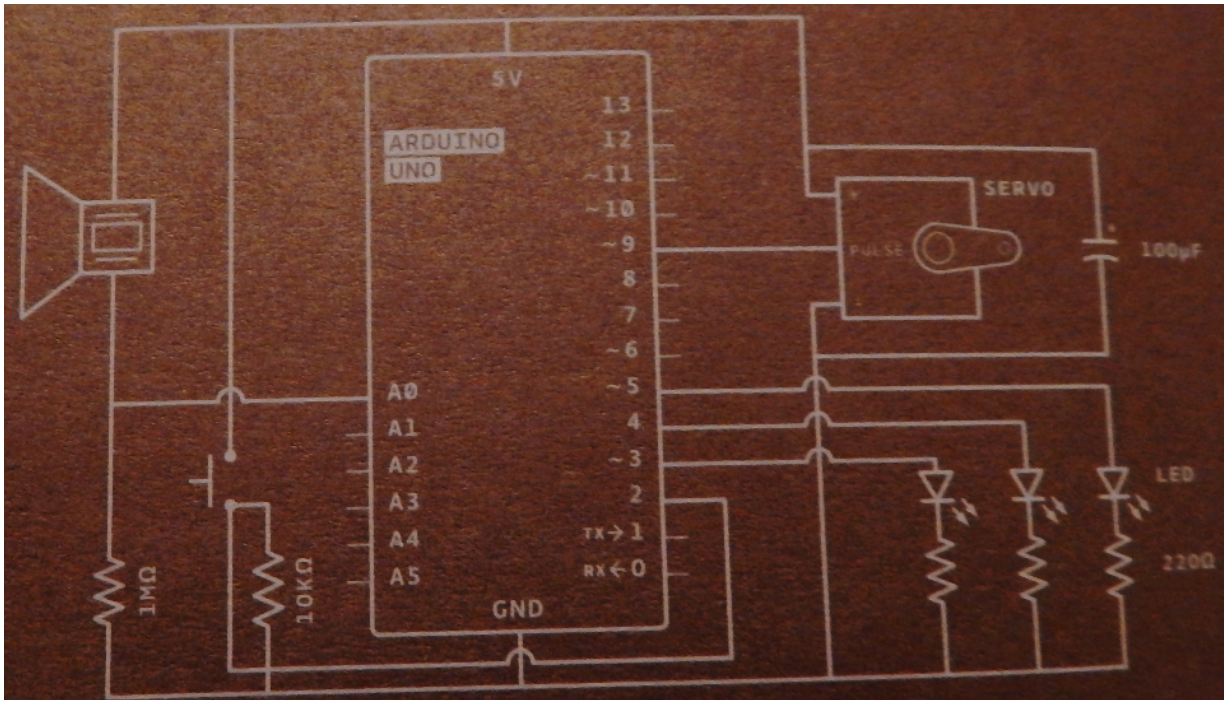
One wire of the piezo is attached to power while the other end is wired to Analog Pin 0 on the Arduino. A 1-megohm resistor is placed between ground and the other wire, A resistor of this magnitude is used because lower resistor value will result in the piezo being less sensitive to vibrations.

The cathode of the LEDs are wired to ground and a 220-ohm resistor is connected in series with the anodes. Through the resistors, the yellow LED is connected to the Arduino's digital pin 3, the green LED is connected to the Arduino's digital pin 4 and the red LED is connected to the Arduino's digital pin 5.



KNOCK LOCK

The red wire of the servo motor is connected to power and the black wire is connected to ground. A 100µF electrolytic capacitor is placed across power and ground to smooth out any irregularities in voltage. The servo's data wire is connected to pin 9 on the Arduino.



KNOCK LOCK

SOFTWARE

The Code

The Servo library is imported to create an instance to use the motor.

```
#include <Servo.h>
Servo myServo;
```

Constants to name the inputs

```
const int piezo = A0;
const int switchPin = 2;
const int yellowLed = 3;
const int greenLed = 4;
const int redLed = 5;
```

Variables to hold values from switch and piezo

```
int knockVal;
int switchVal;
```

Constants to be used as thresholds for the knock maximum and minimum levels

```
const int quietKnock = 10;
const int loudKnock = 100;
```

The locked variable is used to determine if the lock is engaged or not. A boolean is a data type that can be true (T) or false (0). We begin with the mechanism unlocked. The last global variable will hold the number of valid knocks received.

KNOCK LOCK

```
boolean locked = false;
int numberOfKnocks = 0;
```

In setup() the servo is attached to pin 9 and the LED pins are set as outputs while pins are set as inputs.

```
void setup() {
  // put your setup code here, to run once:
  myServo.attach(9);
  pinMode(yellowLed, OUTPUT);
  pinMode(redLed, OUTPUT);
  pinMode(greenLed, OUTPUT);
  pinMode(switchPin, INPUT);
  Serial.begin(9600);
```

Serial Communication is initialized with the computer to monitor the knock volume, the current state of the lock and how many more knocks are left. The green LED is turned on, the servo is moved to the unlocked position and the current status is printed to the serial monitor indicating the circuit is in the unlocked position.

```
  digitalWrite(greenLed, HIGH);
  myServo.write(0);
  Serial.println("The box is unlocked!");
}
```

In loop(), check to see if the box is locked or not. This determines what happens in the rest of the program. If it is locked the switch value is read.

```
void loop() {
  // put your main code here, to run repeatedly:
  if(locked == false) {
    switchVal = digitalRead(switchPin);
```

If the switch is closed (it has been pressed), the locked variable is changed to true, indicating that the lock is engaged. The green LED is turned off and the red LED is turned ON. This gives visual feedback on the status of the lock. The servo is moved into the lock position and a message is printed out to the serial monitor indicating that the box is now locked. A delay is added so the lock has enough time to move into place.

```
    if(switchVal == HIGH) {
      locked = true;
      digitalWrite(greenLed, LOW);
      digitalWrite(redLed, HIGH);
      myServo.write(90);
      Serial.println("The box is locked!");
      delay(1000);
    }
  }
```

If the locked variable is true, and the lock is engaged, the value of the vibration of the piezo is read and stored in knockVal.

```
  if(locked == true) {
    knockVal = analogRead(piezo);
```

This statement checks to see if there have been fewer than three valid knocks and there is some vibration on the sensor. If these are both true, check to see if this current knock is valid or not and increment the numberOfKnocks variable. This is where the custom function checkForKnocks() is called. After checking the function, print out the number of knocks still needed.

```
    if(numberOfKnocks < 3 && knockVal > 0) {
      if(checkForKnock(knockVal) == true) {
        numberOfKnocks++;
      }
      Serial.print(3-numberOfKnocks);
```

```
      Serial.println(" more knocks to go");
    }
```

Check if there have been three or more valid knocks. If so, the locked variable is changed to false and the servo is moved to the unlocked position. Wait for a few milliseconds to let it start moving, and change the status of the green and red LEDs. Print out a status message to the serial monitor, indicating that the box is unlocked.

```
    if(numberOfKnocks >= 3) {
      locked = false;
      myServo.write(0);
      delay(20);
      digitalWrite(greenLed, HIGH);
      digitalWrite(redLed, LOW);
      Serial.println("The box is unlocked!");
    }
  }
}
```

This function checks a number (knockVal) to see if it is valid or not.

```
boolean checkForKnock(int value) {
```

Check to see if value is grater than the quiet knock and less than the loud knock

```
  if(value > quietKnock && value < loudKnock) {
```

If the value falls between those two values then blink the yellow LED once and print the value of the knock to the serial monitor

```
    digitalWrite(yellowLed, HIGH);
    delay(50);
```

```
    digitalWrite(yellowLed, LOW);
    Serial.print("Valid knock of value ");
    Serial.println(value);
    return true;
```

If value is either too quiet or too loud, print it out to the serial monitor and return false.

```
  } else {
    Serial.print("Bad knock value ");
    Serial.println(value);
    return false;
  }
}
```

CONCLUSION

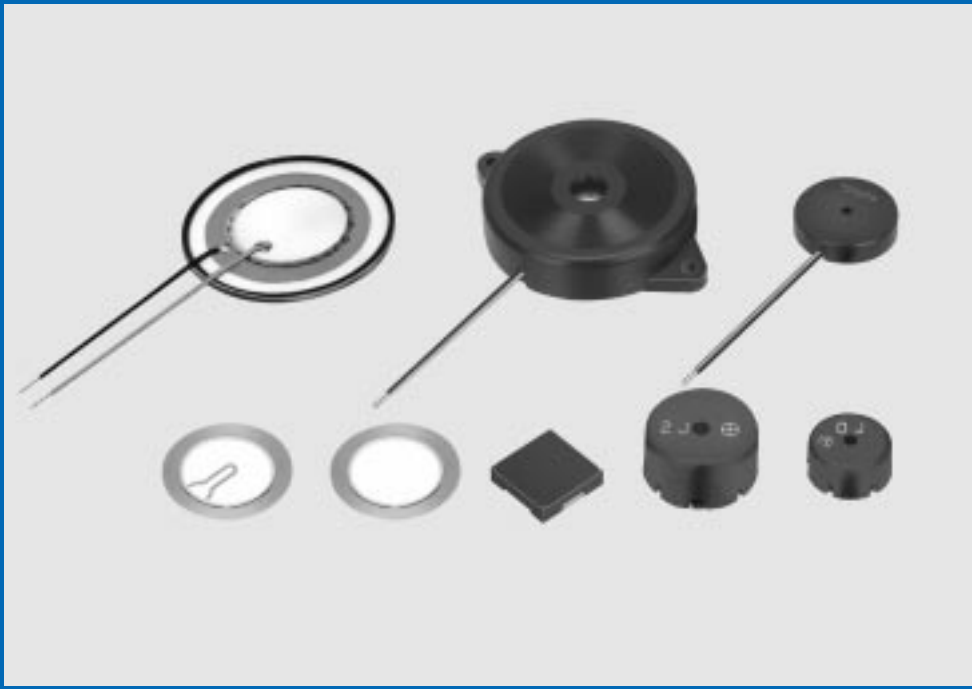
How To Use the Knock Lock

1. When the Arduino is plugged in, a green LED light turns on and the servo moves to the unlocked position.
2. The serial monitor prints “The box is unlocked!”
3. You can click the switch to lock the box.
4. As you knock the piezo will register each knock, although not all knocks are recognized as valid.
5. The yellow LED will flash when a knock is registered as valid. and the serial monitor will indicate how many knocks are left to unlock the box.
6. When the right number of locks have been reached, the red light will turn off, the green light will turn on, the servo will move 90 degrees and the serial monitor will indicate that the lock is disengaged.

Please read CAUTION and Notice in this catalog for safety. This catalog has only typical specifications. Therefore you are requested to approve our product specification or to transact the approval sheet for product specification, before your ordering.

Piezoelectric Sound Components

PIEZOELECTRIC SOUND COMPONENTS



GLOBAL PART NUMBERS
JUNE 2001

muRata Innovator in Electronics
Murata
Manufacturing Co., Ltd.

Cat.No.P37E-17

Please read CAUTION and Notice in this catalog for safety. This catalog has only typical specifications. Therefore you are requested to approve our product specification or to transact the approval sheet for product specification, before your ordering.

CONTENTS

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Part Numbering — 2

Application Matrix — 5

1 **Piezoelectric Diaphragms** — 6

External Drive Type — 6

Self Drive Type — 7

● Piezoelectric Diaphragms Notice — 8

2 **Piezoelectric Sounders External Drive Pin Type** — 9

3 **Piezoelectric Sounders External Drive Pin Type Taping** — 15

4 **Piezoelectric Sounders External Drive Lead Wire Type** — 17

5 **Piezoelectric Sounders External Drive SMD Type** — 19

Piezoelectric Sounders (External Drive) Circuit/Notice — 21

6 **Piezoelectric Ringers (PIEZORINGER®)** — 22

Pin Type — 23

Lead Wire Type — 23

● Piezoelectric Ringers (PIEZORINGER®) Notice — 25

7 **Piezoelectric Sounders Self Drive Pin Type** — 26

● Piezoelectric Sounders (Self Drive) Notice — 27

8 **Piezoelectric Buzzers** — 28

Pin Type — 29

Lead Wire Type — 29

● Piezoelectric Buzzers Notice — 30

9 **Piezoelectric Receiver** — 31

● Piezoelectric Receiver Circuit/Notice — 33

10 **Piezoelectric Speakers (CERAMITONE®)** — 34

● Piezoelectric Speakers (CERAMITONE®) Notice — 36

Package — 37

● Part Numbering (The structure of the "Global Part Numbers" that have been adopted since June 2001 and the meaning of each code are described herein. If you have any questions about details, inquire at your usual Murata sales office or distributor.)

Piezoelectric Sounders/Piezoelectric Buzzers/Piezoelectric Ringers(PIEZORINGER®)

(Global Part Number) PK M 13 E P Y -40 00 P -A0

❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽ ❾ ❿

❶Product ID

Product ID	
PK	Piezoelectric Sound Components

❷Product

Code	Product
M	Sounder, Ringer
B	Buzzer

❸Outer Dimensions

Expressed by two figures in mm.

Ex.)

Code	Outer Dimensions
13	ø12.6mm

❹Drive

Code	Drive
E	External-Drive
S	Self-Drive

❺Outer Electrode Style

Code	Outer Electrode Style
P	Pin Type
W	Lead Wire Type

❻Structure

Code	Structure
T	Standing Type
P	Flat Type Auto-assemble
Y	Flat Type/Available for Taping
C	Flat Type/Semi-auto-assemble

❼Oscillating Frequency Type

Code	Oscillating Frequency Type
-40	A hyphen (-) plus two-digit figures express Oscillating Frequency type.

If there is no decimal point, the decimal point is omitted.

❽Individual Specification Code

Code	Individual Specification Code
00	Two digits express specific specification in characteristics.

❾Special Quality Guarantee

Code	Special Quality Guarantee
P	Post Plated Terminal
—	Omitted

❿Packaging

Code	Packaging
-B0	Bulk
-A0	Radial Taping
-M0	Magazine

Radial taping or magazine are not available for all types.
Please contact us.

SMD Piezoelectric Sounder

(Global Part Number) PK LCS 1212 E 40 01 -R1

❶ ❷ ❸ ❹ ❺ ❻ ❼

❶Product ID

Product ID	
PK	Piezoelectric Sound Components

❷Product

Code	Product
LCS	SMD Sounder

❸Dimensions

Code	Outer Dimensions
1212	□12mm

❹Drive

Code	
E	External Drive

❺Oscillating Frequency Type

Code	
40	A hyphen (-) plus two-digit figures express Oscillating Frequency type.

❻Individual Specification Code

Code	Individual Specification Code
01	Two digit express specific specification in characteristics.

❼Packaging

Code	Packaging
-R1	Plastic taping

SMD Piezoelectric Receiver

(Global Part Number) **PK** ❶ **LCD** ❷ **1212** ❸ **E** ❹ **10** ❺ **00** ❻ **-R1** ❼

❶Product ID

Product ID	
PK	Piezoelectric Sound Components

❷Product

Code	Product
LCD	SMD Receiver

❸Dimensions

Code	Outer Dimensions
1212	□12mm

❹Drive

Code	
R	Receiver

❺Oscillating Frequency Type

Code	
10	A hyphen (-) plus two-digit figures express Oscillating Frequency type.

❻Individual Specification Code

Code	Individual Specification Code
00	Two digit express specific specification in characteristics.

❼Packaging

Code	Packaging
-R1	Plastic taping

Piezoelectric Diaphragms

(Global Part Number) 7 N B -31R2 DM -1R5 [ ] A 10

❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽ ❾

❶Product ID(1)

Product ID(1)	Ceramic Material
7	A2

❷Product(2)

Product ID(2)	Metal Plate Material
B	Brass
N	Nickel Alloy
M	Ni Plated Iron
S	SUS

❸Product

Code	Product
B	Piezoelectric Diaphragms

❹Metal Plate Diameter

Code	Metal Plate Diameter
-31R2	A hyphen (-) plus four-digit alphanumerics express metal plate outer dimensions. A decimal point is expressed by the capital letter "**R**".

If there is no decimal point, the decimal point code is omitted.

❺Form of Piezoelectric Style

Code	Form of Piezoelectric Style
DM	Two digits express shape of ceramics.

For an Ag electrode, this digit remains blank, the corresponding code is omitted.

❻Resonant Frequency Type

Code	Resonant Frequency (kHz)
-1R5	A hyphen (-) and three-digit alphanumerics express resonant frequency. A decimal point is expressed by the capital letter "**R**".

If there is no decimal point, the decimal point is omitted.

❼With Feedback Electrode

Code	With Feedback Electrode
C	With Feedback Electrode
—	without Feedback Electrode

❽Product Specification

Code	Product Specification
A	With lead
—	No lead (omitted)

❾Individual Specification Code

Code	Individual Specification Code
10	These digits express a lead length, lead number, and presence/absence of a connector.

If the product has no individual specification, the corresponding code is omitted.

Piezoelectric Speakers (CERAMITONE®)

(Global Part Number) VS B 35 E W -07 01 B

❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽

❶Product ID

Product ID	
VS	Piezoelectric Speakers

❷Product

Code	Product
B	Piezoelectric Diaphragms

❸Outer Dimensions

Code	Outer Dimensions
35	ø35mm
50	ø50mm

❹Drive

Code	Drive
E	External Drive

❺Outer Electrode Style

Code	Outer Electrode Style
W	Lead Wire Type

❻Resonant Frequency Type

Code	Resonant Frequency
-03	1st Resonant Freqeuncy : 300Hz
-07	1st Resonant Freqeuncy : 700Hz

❼Individual Specification Code

Code	Individual Specification Code
01	Characteristics, Style, others

❽Numbers of Ceramic

Code	Numbers of Ceramic
B	Two Elements (The code is omitted when element is one.)

Application Matrix

		Application / Part Number	Telephone	Watch	Clock	Medical Equipment	Gas Alarm	Camera	Toy	Bar Code Scanner	Type-Writer	Printer	Note-PC PDA	DVD-Player	Micro-Wave Oven	Air Conditioner	Fan Heater
Piezoelectric Diaphragm	External Drive Type	7BB-12-9		●	●	●		●	●				●				
		7BB-15-6			●	●		●	●				●				
		7BB-20-3	●	●	●	●			●	●							
		7BB-20-4	●	●	●	●		●	●	●							
		7BB-20-6			●	●		●	●				●				
		7BB-20-6A0			●	●			●				●				
		7BB-27-4	●		●	●			●	●							
		7BB-27-4A0	●		●	●			●	●							
		7BB-35-3	●		●				●	●							
		7BB-35-3A0	●		●				●	●							
		7BB-41-2	●														
		7BB-41-2A0	●														
		7BB-50M-1	●														
		7SB-20-7		●	●	●		●					●				
	Self Drive Type	7BB-20-6C	●					●	●								
		7BB-20-6CA0	●					●	●								
		7BB-27-3C	●				●		●								
		7BB-27-4C	●				●		●	●							
		7BB-27-4CA0	●				●		●	●							
		7BB-35-3C	●				●			●							
		7BB-35-3CA0	●				●			●							
		7BB-41-20	●														
		7BB-41-2CA0	●														
		7NB-27-2C	●														
		7NB-27-3C	●				●										
		7NB-27-4C	●				●										
		7SB-34R7-3C					●										
Piezoelectric Sounder	External Drive Type	PKM13EPY-4000-A0	●		●	●		●	●	●	●	●	●	●		●	●
		PKM13EPY-4002-B0	●		●	●		●	●	●	●	●	●	●	●	●	●
		PKM17EPP-2002-B0	●		●	●			●	●	●	●		●	●	●	●
		PKM17EPP-4001-B0	●		●	●			●	●	●	●		●	●	●	●
		PKM17EPT-4001-B0							●		●	●		●	●	●	●
		PKM17EW-2001	●		●	●		●	●	●	●	●	●	●		●	
		PKM22EP-2001							●		●	●		●	●	●	●
		PKM22EPP-2001-B0	●		●	●			●		●	●		●	●	●	●
		PKM22EPP-4001-B0	●		●	●			●		●	●		●	●	●	●
		PKM22EPP-4005-B0	●		●	●			●		●	●		●	●	●	●
		PKM22EPP-4007-B0	●		●	●			●		●	●		●	●	●	●
		PKM22EPT-2001-B0							●		●	●		●	●	●	●
		PKM22EPT-4001-B0							●		●	●		●	●	●	●
		PKM17EW-4000	●		●	●		●	●	●	●	●	●	●		●	
		PKLCS1212E4001-R1	●			●		●	●	●	●	●	●			●	
	Self Drive Type	PKM24SP-3805	●				●		●						●	●	●
		PKM30SPT-2001-B0							●			●	●		●		
		PKM30SPT-2501-B0							●			●	●				
Piezoelectric Buzzer		PKB24SPC-3601-B0	●			●			●		●	●	●	●		●	●
		PKB24SW-3301	●		●				●		●	●	●		●	●	●
		PKB30SPC-2001-B0	●				●		●		●	●	●		●	●	●
		PKB30SPC-3001-B0	●				●		●		●	●	●		●	●	●
Piezoelectric Ringer		PKM33EP-1201C	●														
		PKM34EW-1101C	●														
		PKM34EW-1201C	●														
		PKM44EP-0901	●														
		PKM44EW-1001C	●														
Piezoelectric Receiver		PKLCD1212R1000-R1	●														
Piezoelectric Speaker		VSB35EW-0701B	●						●								
		VSB50EW-0301B	●						●								

There are various applications besides above table.

Fire Alarm, Burglar Alarm, Laundry Machine, Bath, Interphone, Chime, Pager, Back Buzzer, ME Instruments, Measuring Instruments, Vending Machine, Calculator, Automobile, Communication Radio, Hemadynamometer, Thermometer, Running meter, Facsimile, Audio timer, Automatic Controlling Devices.

Piezoelectric Sound Components

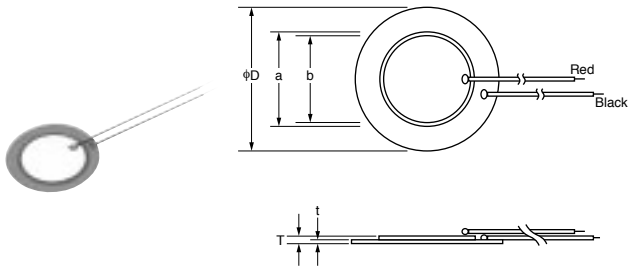
Piezoelectric Diaphragms

■ Features

1. Low power consumption.
2. No contacts therefore, no noise and highly reliable.

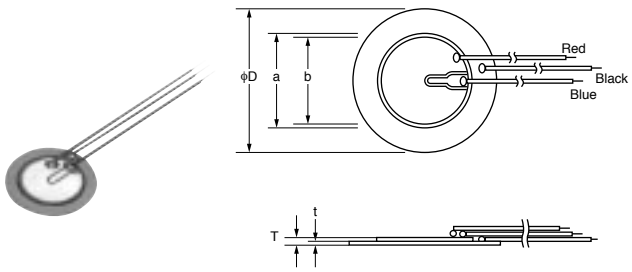
■ Applications

- Telephone ringers.
- Various office equipment such as PPCs, printers and keyboards.
- Various home appliances such as microwave ovens.
- Confirmation sound of various audio equipment.



External Drive Type

Part Number	Resonant Frequency (kHz)	Resonant Impedance (ohm)	Capacitance (nF)	Plate Size dia D (mm) (dia)	Element Size a (mm) (dia)	Electrode Size b (mm) (dia)	Thickness T (mm)	Plate Thickness t (mm)	Plate Material
7BB-12-9	9.0 ±1.0kHz	1000 max.	8 ±30% [1kHz]	12.0	9.0	8.0	0.22	0.10	Brass
7BB-15-6	6.0 ±1.0kHz	350 max.	10 ±30% [1kHz]	15.0	10.0	9.0	0.22	0.10	Brass
7BB-20-3	3.6 ±0.6kHz	500 max.	20 ±30% [1kHz]	20.0	14.0	12.8	0.22	0.10	Brass
7BB-20-6	6.3 ±0.6kHz	350 max.	10 ±30% [1kHz]	20.0	14.0	12.8	0.42	0.20	Brass
7BB-20-6A0	6.3 ±0.6kHz	1000 max.	10 ±30% [1kHz]	20.0	14.0	12.8	0.42	0.20	Brass (with Lead Wire)
7BB-27-4	4.6 ±0.5kHz	200 max.	20 ±30% [1kHz]	27.0	19.7	18.2	0.54	0.30	Brass
7BB-27-4A0	4.6 ±0.5kHz	300 max.	20 ±30% [1kHz]	27.0	19.7	18.2	0.54	0.30	Brass (with Lead Wire)
7BB-35-3	2.8 ±0.5kHz	200 max.	30 ±30% [1kHz]	35.0	25.0	23.0	0.53	0.30	Brass
7BB-35-3A0	2.8 ±0.5kHz	200 max.	30 ±30% [1kHz]	35.0	25.0	23.0	0.53	0.30	Brass (with Lead Wire)
7BB-41-2	2.2 ±0.3kHz	250 max.	30 ±30% [1kHz]	41.0	25.0	23.0	0.63	0.40	Brass
7BB-41-2A0	2.2 ±0.3kHz	300 max.	30 ±30% [1kHz]	41.0	25.0	23.0	0.63	0.40	Brass (with Lead Wire)
7BB-50M-1	1.0 ±0.3kHz	1200 max.	28 ±30% [120Hz]	50.0	25.0	23.0	0.44	0.20	Nickel-Plated Brass
7SB-20-7	7.2 ±0.8kHz	350 max.	10 ±30% [1kHz]	20.0	14.0	12.8	0.42	0.20	Stainless



Self Drive Type

Part Number	Resonant Frequency (kHz)	Resonant Impedance (ohm)	Capacitance (nF)	Plate Size dia D (mm) (dia)	Element Size a (mm) (dia)	Electrode Size b (mm) (dia)	Thickness T (mm)	Plate Thickness t (mm)	Plate Material
7BB-20-6C	6.3 ±0.6kHz	500 max.	8.5 ±30% [1kHz]	20.0	14.0	12.8	0.42	0.20	Brass
7BB-20-6CA0	6.3 ±0.6kHz	800 max.	8.5 ±30% [1kHz]	20.0	14.0	12.8	0.42	0.20	Brass (with Lead Wire)
7BB-27-3C	3.0 ±0.5kHz	300 max.	35 ±30% [1kHz]	27.0	19.7	18.2	0.27	0.15	Brass
7BB-27-4C	4.6 ±0.5kHz	200 max.	18 ±30% [1kHz]	27.0	19.7	18.2	0.54	0.30	Brass
7BB-27-4CA0	4.6 ±0.5kHz	350 max.	18 ±30% [1kHz]	27.0	19.7	18.2	0.54	0.30	Brass (with Lead Wire)
7BB-35-3C	2.8 ±0.5kHz	200 max.	26 ±30% [1kHz]	35.0	25.0	23.0	0.53	0.30	Brass
7BB-35-3CA0	2.8 ±0.5kHz	200 max.	26 ±30% [1kHz]	35.0	25.0	23.0	0.53	0.30	Brass (with Lead Wire)
7BB-41-2C	2.2 ±0.3kHz	250 max.	24 ±30% [1kHz]	41.0	25.0	23.0	0.63	0.40	Brass
7BB-41-2CA0	2.2 ±0.3kHz	350 max.	24 ±30% [1kHz]	41.0	25.0	23.0	0.63	0.40	Brass (with Lead Wire)
7NB-27-2C	2.2 ±0.5kHz	300 max.	37 ±30% [120Hz]	27.0	19.7	18.2	0.22	0.10	Iron Nickel Alloy
7NB-27-3C	3.0 ±0.5kHz	300 max.	24 ±30% [1kHz]	27.0	19.7	18.2	0.32	0.15	Iron Nickel Alloy
7NB-27-4C	3.8 ±0.5kHz	300 max.	19 ±30% [1kHz]	27.0	19.7	18.2	0.42	0.20	Iron Nickel Alloy
7SB-34R7-3C	3.1 ±0.3kHz	150 max.	24 ±30% [1kHz]	34.7	25.0	23.4	0.50	0.25	Stainless

■ Node Diameter

Part Number	Node Diameter (mm)
7BB-20-6C	φ13.5
7BB-27-4C	φ17.5
7BB-35-3C	φ22.5
7BB-41-2C	φ26.5

• Sound diaphragm without feedback electrode also have the same node diameters.

1

Piezoelectric Diaphragms Notice

■ Notice (Soldering and Mounting)

1. Applying load on the center area of the diaphragm may cause clack in the ceramic element. When the diaphragm is supported by edge, the load should be only applied around edge.
2. Please consult with Murata or Murata representative, in case of soldering on the component.

■ Notice (Handling)

1. Please do not touch the component with bare hand because electrode may be corroded.
2. The component may be damaged if mechanical stress over this specification is applied.
3. Please pay attention to protect operating circuit from surge voltage provided by something of force such as falling, shock and temperature changing.
4. If DC voltage is applied to the component, silver migration may occur. Please pay full attention not to subject the component to DC voltage for long periods.
5. The resistor should be used as shown in Fig. A. A suitable resistance value should be chosen, preferably 1kΩ to 2kΩ. Instead of this measure, a diode may also be applied as shown in Fig. B.

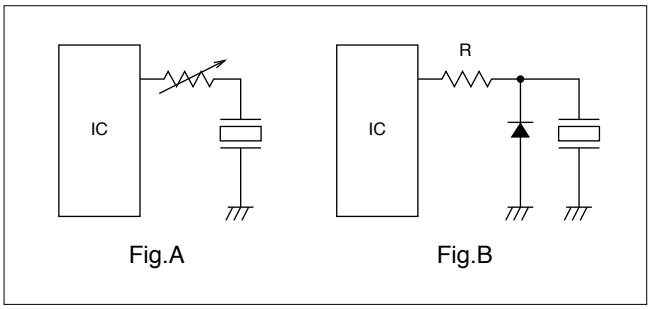


Fig.A Fig.B

6.Please pay enough attention not to pull lead wire too much because wire may be broken or soldering point may come off.

Piezoelectric Sound Components

Piezoelectric Sounders External Drive Pin Type

Now, microcomputers are widely used for microwave ovens, air conditioners, cars, toys, timers, and other alarm equipment. Externally driven piezoelectric sounders are used in digital watches, electronic calculators, telephones and other equipment. They are driven by a signal (ex, 2048Hz or 4096Hz) from an LSI and provide melodious sound.

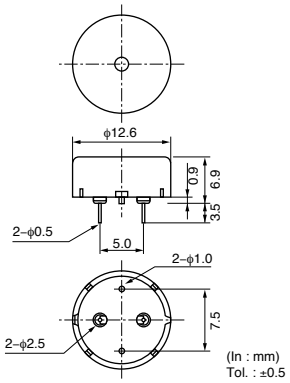
■ Features

1. Low power consumption.
2. No contacts therefore, no noise and highly reliable.

■ Applications

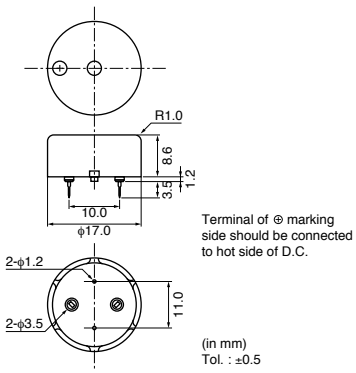
- Telephone ringers.
- Various office equipment such as PPCs, printers and keyboards.
- Various home appliances such as microwave ovens.
- Confirmation sound of various audio equipment.

PKM13EPY-4002-B0



(In : mm)
Tol. : ±0.5

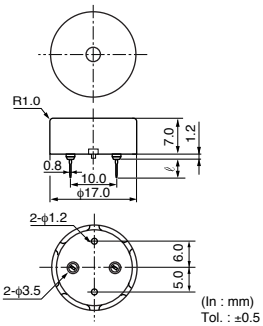
PKM17EPP-2002-B0



Terminal of ⊕ marking side should be connected to hot side of D.C.

(in mm)
Tol. : ±0.5

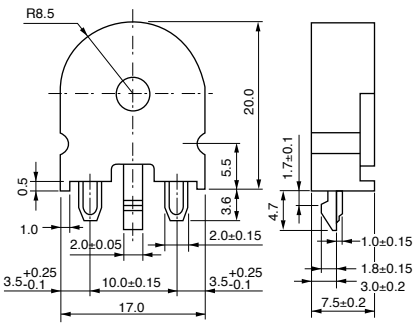
PKM17EPP-4001-B0



(In : mm)
Tol. : ±0.5

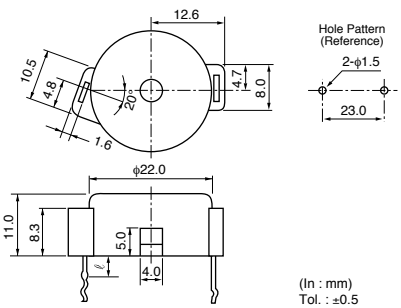
Part Number	ℓ
PKM17EPP-4001-B0	6.5
PKM17EPP-4002-B0	3.5

PKM17EPT-4001-B0



(In : mm)
Tol. : ±0.5

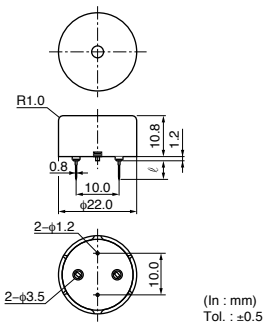
PKM22EP-2001



(In : mm)
Tol. : ±0.5

Part Number	ℓ
PKM22EP-2001	4.0
PKM22EP-2002	8.0
PKM22EP-2003	12.0

PKM22EPP-2001-B0



(In : mm)
Tol. : ±0.5

Part Number	ℓ
PKM22EPP-2001-B0	6.5
PKM22EPP-2002-B0	3.5

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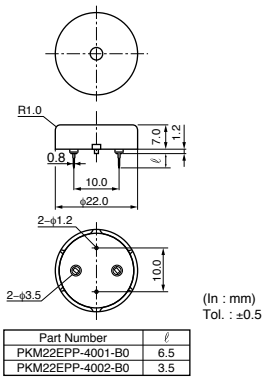
2

PKM22EPP-4001-B0



(In : mm)
Tol. : ±0.5

Part Number	ℓ
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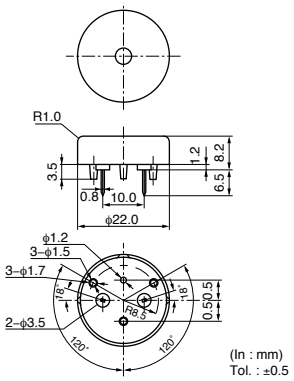
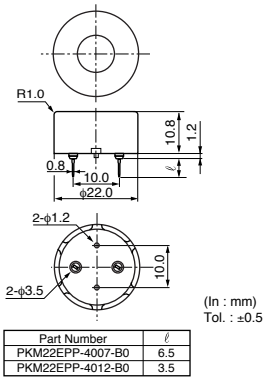
PKM22EPP-4002-B0	3.5

PKM22EPP-4005-B0



(In : mm)
Tol. : ±0.5

PKM22EPP-4007-B0



(In : mm)
Tol. : ±0.5

Part Number	ℓ
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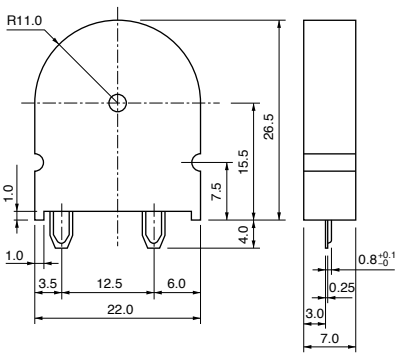
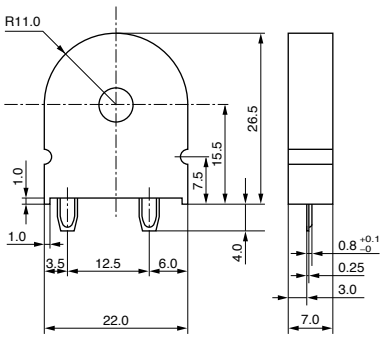
PKM22EPP-4012-B0	3.5

PKM22EPT-2001-B0



(in mm)
Tol.:±0.5

PKM22EPT-4001-B0



(In : mm)
Tol. : ±0.5

Part Number	Sound Pressure Level (dB)	Sound Pressure Level(Ref. only) (dB)	Operating Voltage Range (Vp-p)	Capacitance (nF)	Operating Temp. Range	Storage Temp. Range
PKM13EPY-4002-B0	70 min. [3Vp-p,4kHz,square wave,10cm]	70 min. [1Vrms,4kHz,sine wave,10cm]	25 max.	5.5 ±30% [1kHz]	-20 to +70°C	-30 to +80°C
PKM17EPP-2002-B0	70 min. [3Vo-p,2kHz,square wave,10cm]	70 min. [1Vrms,2kHz,sine wave,10cm]	25 Vo-p max. [with polarity]	34 ±30% [120Hz]	-20 to +70°C	-30 to +80°C
PKM17EPP-4001-B0	72 min. [3Vp-p,4kHz,square wave,10cm]	72 min. [1Vrms,4kHz,sine wave,10cm]	25 max.	7 ±30% [1kHz]	-20 to +70°C	-30 to +80°C
PKM17EPT-4001-B0	75 min. [3Vp-p,4kHz,square wave,10cm]	75 min. [1Vrms,4kHz,sine wave,10cm]	25 max.	9.5 ±30% [1kHz]	-20 to +70°C	-30 to +80°C
PKM22EP-2001	75 min. [3Vp-p,2kHz,square wave,10cm]	75 min. [1Vrms,2kHz,sine wave,10cm]	25 max.	17 ±30% [120Hz]	-20 to +70°C	-30 to +80°C
PKM22EPP-2001-B0	70 min. [3Vp-p,2kHz,square wave,10cm]	70 min. [1Vrms,2kHz,sine wave,10cm]	25 max.	19 ±30% [120Hz]	-20 to +70°C	-30 to +80°C
PKM22EPP-4001-B0	75 min. [3Vp-p,4kHz,square wave,10cm]	75 min. [1Vrms,4kHz,sine wave,10cm]	25 max.	12 ±30% [1kHz]	-20 to +70°C	-30 to +80°C
PKM22EPP-4005-B0	75 min. [3Vp-p,4kHz,square wave,10cm]	75 min. [1Vrms,4kHz,sine wave,10cm]	25 max.	12 ±30% [1kHz]	-20 to +70°C	-30 to +80°C
PKM22EPP-4007-B0	85 min. [3Vp-p,4kHz,square wave,10cm]	85 min. [1Vrms,4kHz,sine wave,10cm]	25 max.	12 ±30% [1kHz]	-20 to +70°C	-30 to +80°C

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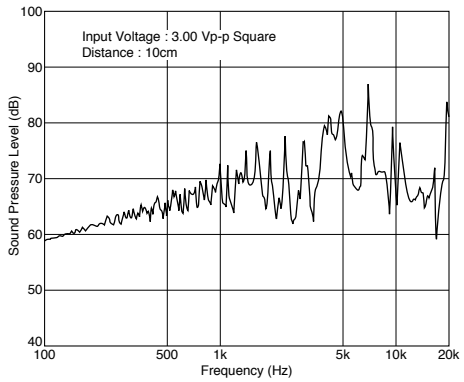
Part Number	Sound Pressure Level (dB)	Sound Pressure Level(Ref. only) (dB)	Operating Voltage Range (Vp-p)	Capacitance (nF)	Operating Temp. Range	Storage Temp. Range
PKM22EPT-2001-B0	70 min. [3Vp-p,2kHz,square wave,10cm]	70 min. [1Vrms,2kHz,sine wave,10cm]	25 max.	19 ±30% [120Hz]	-20 to +70°C	-30 to +80°C
PKM22EPT-4001-B0	85 min. [3Vp-p,4kHz,square wave,10cm]	85 min. [1Vrms,4kHz,sine wave,10cm]	25 max.	10 ±30% [1kHz]	-20 to +70°C	-30 to +80°C

■ Freq. Response (Square Wave 3Vp-p, 10cm)

PKM13EPY-4002-B0



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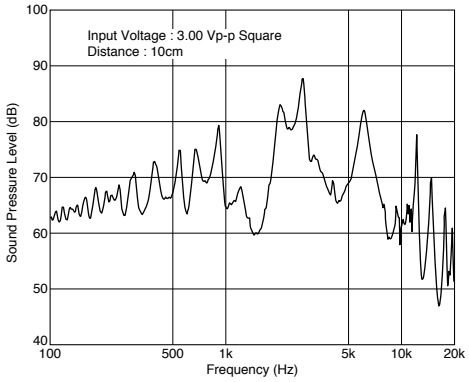

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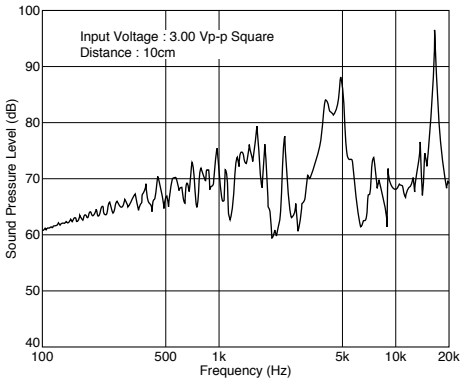

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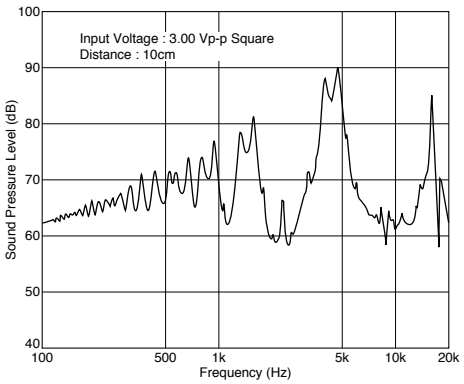

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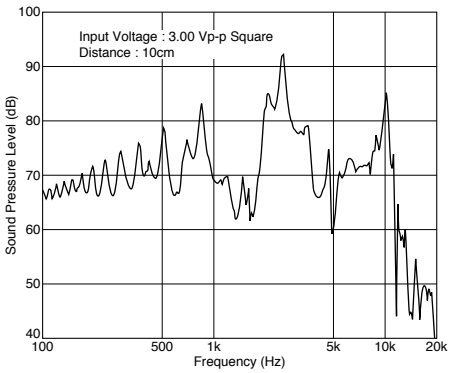

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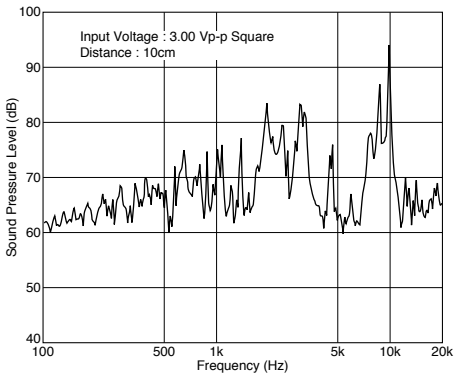

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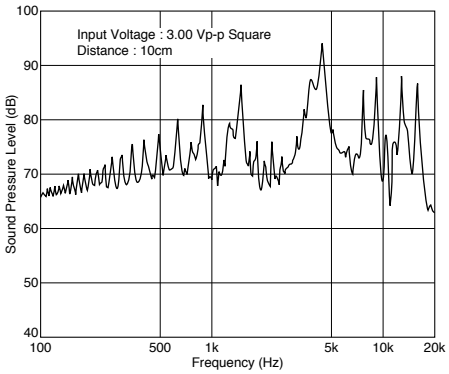
■ Freq. Response (Square Wave 3Vp-p, 10cm)

PKM22EPP-4001-B0



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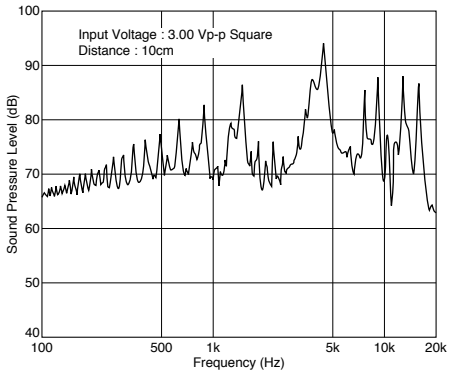

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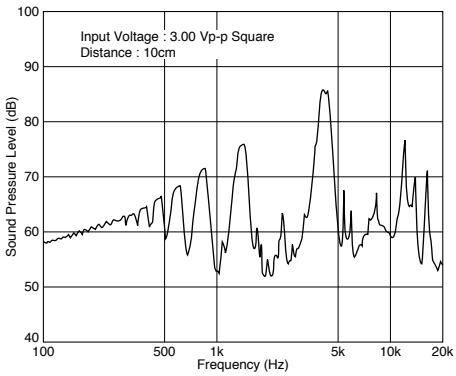

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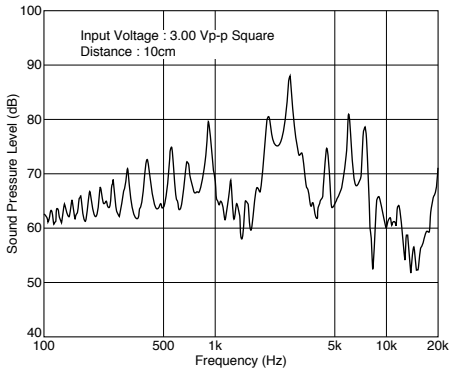

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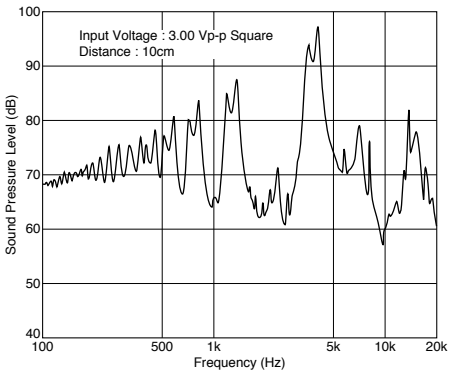
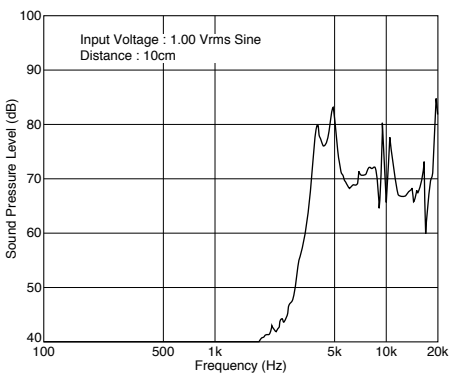


■ Freq. Response (Sine Wave 1Vrms, 10cm)

PKM13EPY-4002-B0



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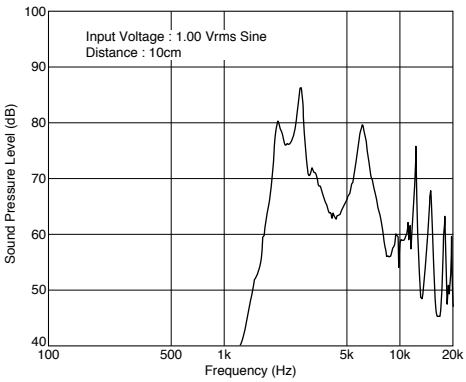

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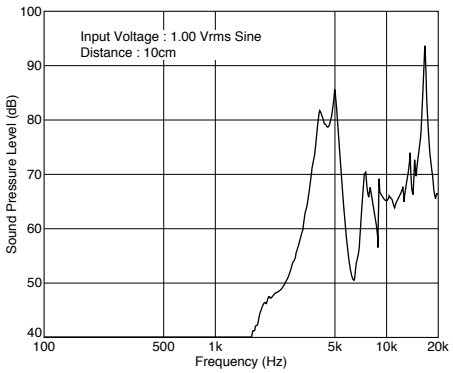
■ Freq. Response (Sine Wave 1Vrms, 10cm)

PKM17EPP-4001-B0



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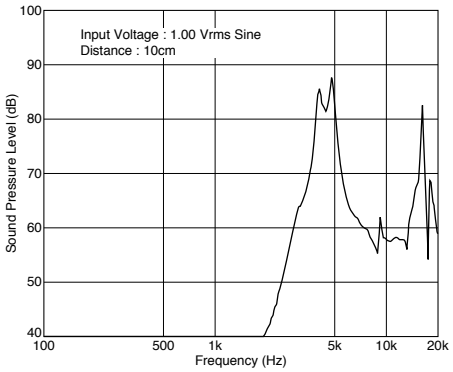

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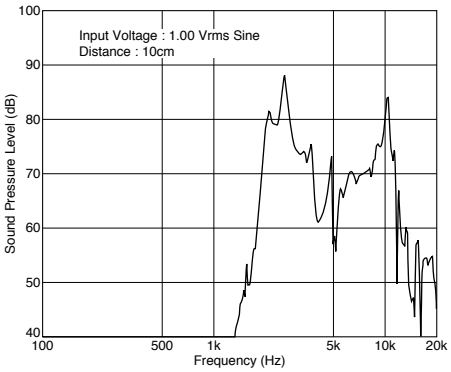

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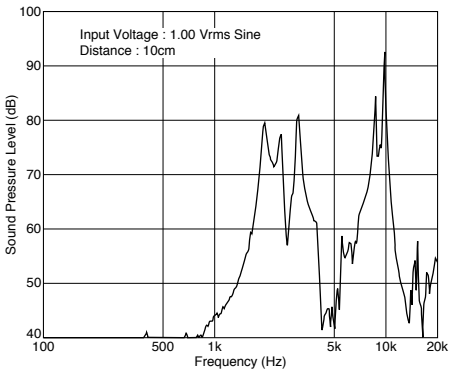

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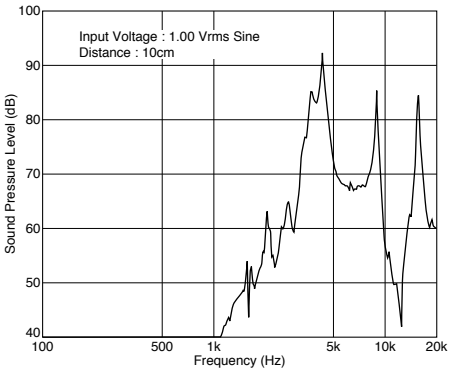

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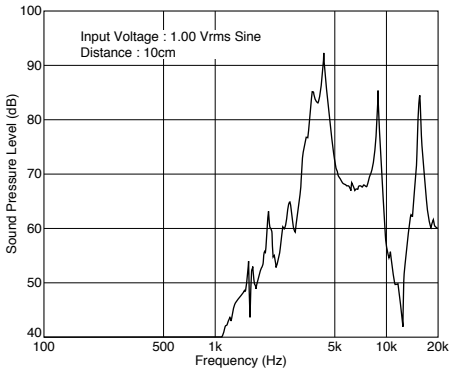

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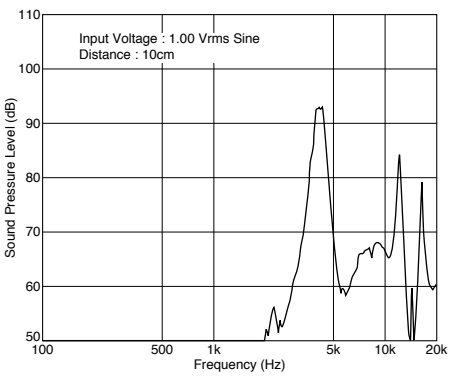

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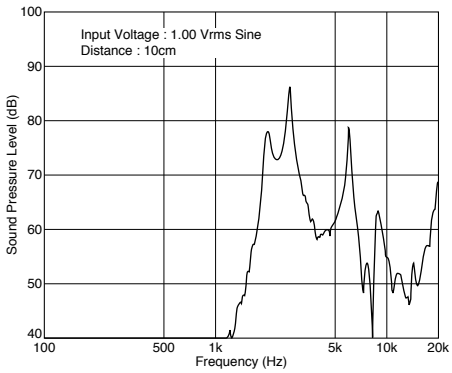

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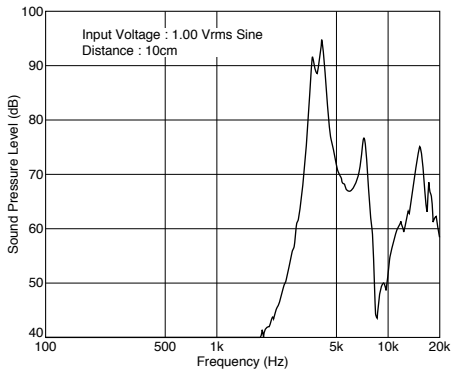
■ Freq. Response (Sine Wave 1Vrms, 10cm)

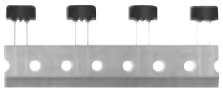
PKM22EPT-4001-B0

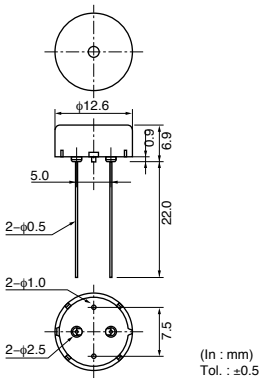


Piezoelectric Sound Components

Piezoelectric Sounders External Drive Pin Type Taping

Taking advantage of extensive automatic insertion designing technology and materials experience, Murata has developed standard taping type piezoelectric sounder.
This Murata technology supports labor and cost saving activities.



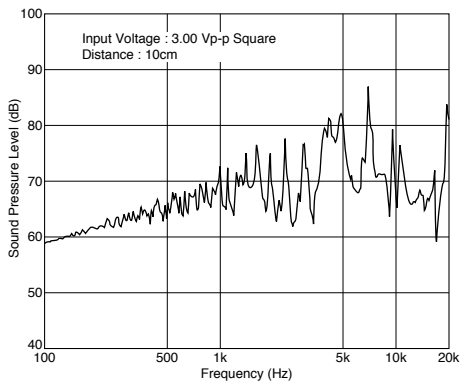


■ Features

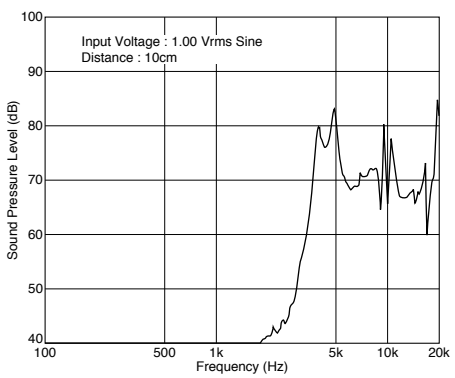
1. High and stable mountability.
2. Ammo packaging.
3. Minimum quantity (order in sets only) : 500pcs.

Part Number	Sound Pressure Level (dB)	Sound Pressure Level(Ref. only) (dB)	Operating Voltage Range (Vp-p)	Capacitance (nF)	Operating Temp. Range	Storage Temp. Range
PKM13EPY-4000-A0	70 min. [3Vp-p,4kHz,square wave,10cm]	70 min. [1Vrms,4kHz,sine wave,10cm]	25 max.	5.5 ±30% [1kHz]	-20 to +70°C	-30 to +80°C

■ Freq. Response (Square Wave 3Vp-p, 10cm)



■ Freq. Response (Sine Wave 1Vrms, 10cm)



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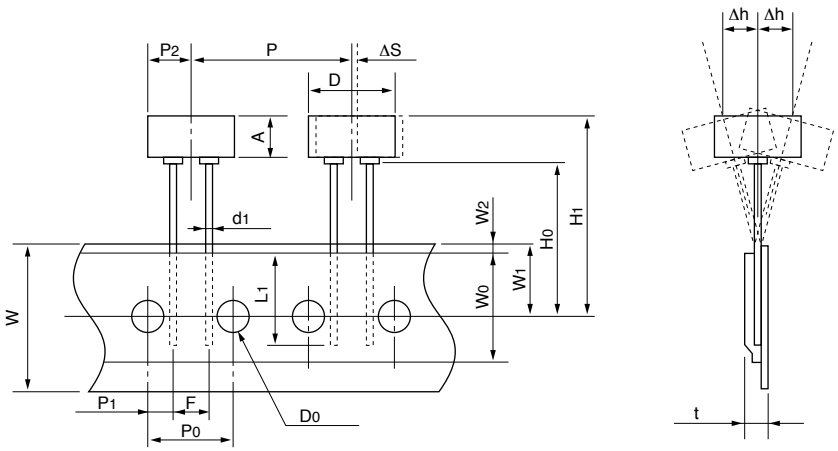
■ Taping Dimension



Item	Code	Nominal value	Tol.	Remarks
Width of Diameter	D	ø12.6	±0.5	
Height of Component	A	6.9	±0.5	
Dimensions of Terminal	d_1	ø0.5	±0.1	
Lead length under The Hold down Tape	L_1	8.0 min.	—	
Pitch of Component	P	25.4	±0.5	
Pitch of Sprocket	P_0	12.7	±0.2	Tolerance for Pitches 10×P_0=127±2mm
Length from Hole Center to Lead	P_1	3.85	±0.7	
Length from Hole Center to Component Center	P_2	6.35	±0.7	
Lead Spacing	F	5.0	±0.5	
Slant to The Forward or Backward	Δh	0	±1.0	360° : 1mm max.
Width of Carrier Tape	W	18.0	±0.5	
Width of Hold down Tape	W_0	12.5 min.	—	Hold down tape does not exceed the carrier tape.
Position of Sprocket Hole	W_1	9.0	±0.5	
Gap of Hold Down Tape and Carrier Tape	W_2	2.0 max.	—	
Distance Between The Center of Sprocket Hole and Lead Stopper	H_0	18.0	±0.5	
Total Height of Component	H_1	26.0 max.	—	
Diameter of Sprocket Hole	D_0	ø4.0	±0.2	
Total Thickness of Tape	t	0.6	±0.2	
Body Tilt	ΔS	0	±1.0	

(in mm)

Piezoelectric Sound Components

Piezoelectric Sounders External Drive Lead Wire Type

Now, microcomputers are widely used for microwave ovens, air conditioners, cars, toys, timers, and other alarm equipment. Externally driven piezoelectric sounders are used in digital watches, electronic calculators, telephones and other equipment. They are driven by a signal (ex, 2048Hz or 4096Hz) from an LSI and provide melodious sound.

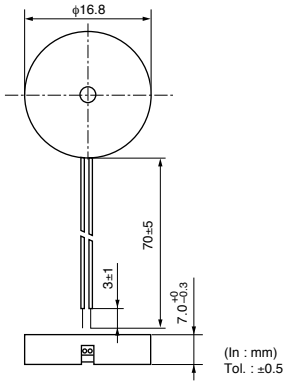
■ Features

1. Low power consumption.
2. No contacts therefore, no noise and highly reliable.

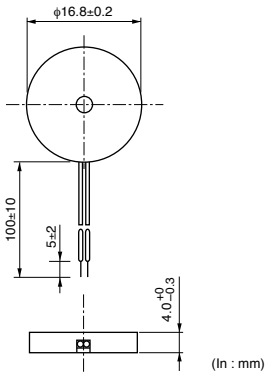
■ Applications

- Telephone ringers.
- Various office equipment such as PPCs, printers and keyboards.
- Various home appliances such as microwave ovens.
- Confirmation sound of various audio equipment.

PKM17EW-2001



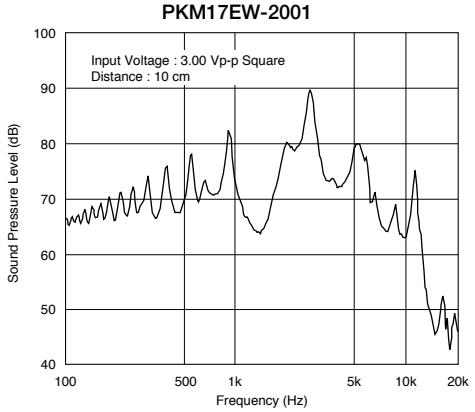
PKM17EW-4000



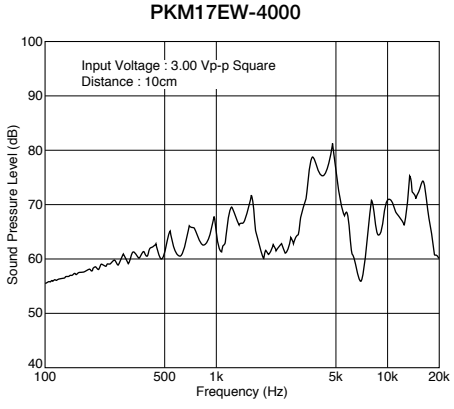
Part Number	Sound Pressure Level (dB)	Sound Pressure Level(Ref. only) (dB)	Operating Voltage Range (Vp-p)	Capacitance (nF)	Operating Temp. Range	Storage Temp. Range
PKM17EW-2001	72 min. [3Vp-p,2kHz,square wave,10cm]	70 min. [1Vrms,2kHz,sine wave,10cm]	7 max.	40 ±30% [120Hz]	-20 to +70°C	-30 to +80°C
PKM17EW-4000	75 min. [3Vp-p,4kHz,square wave,10cm]	70 min. [1Vrms,4kHz,sine wave,10cm]	25 max.	9.5 ±30% [1kHz]	-20 to +70°C	-30 to +80°C

■ Freq. Response (Square Wave 3Vp-p, 10cm)

PKM17EW-2001



PKM17EW-4000



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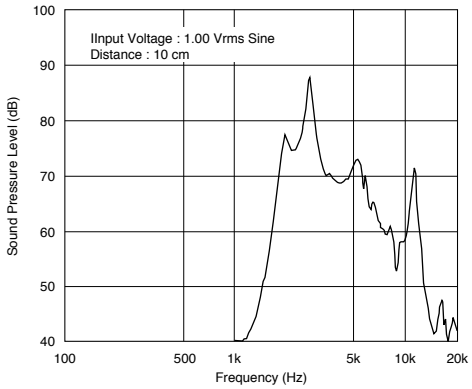
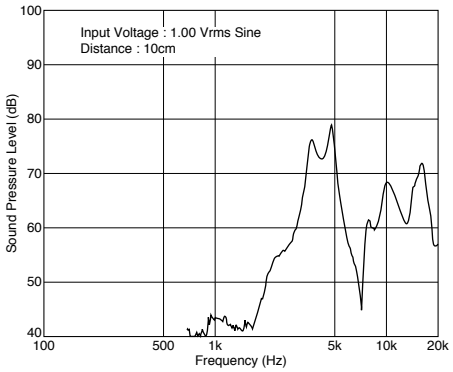
■ Freq. Response (Sine Wave 1Vrms, 10cm)

PKM17EW-2001



PKM17EW-4000

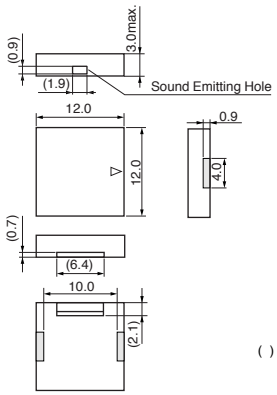


4

Piezoelectric Sound Components

Piezoelectric Sounders External Drive SMD Type

Taking advantage of extensive acoustic and mechanical designing technology and high performance ceramics, Murata has developed SMD piezoelectric sounder that suites thin, high-density design of electronic equipment.

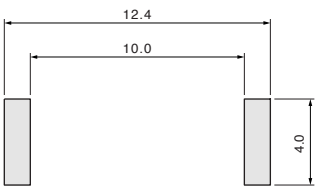


■ Features

1. High S.P.L. and clear sound.
2. Reflowable.
3. Tape & Reel supply.
4. Minimum quantity (order in sets only):1,000 pcs.

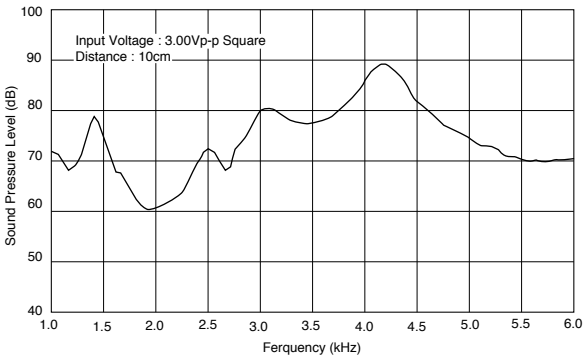
Part Number	Sound Pressure Level (dB)	Operating Voltage Range (Vp-p)	Operating Temp. Range	Storage Temp. Range
PKLCS1212E4001-R1	75 min. [3Vp-p,4kHz,square wave,10cm]	25 max.	-20 to +70°C	-30 to +80°C

■ Standard Land Pattern Dimensions



(in mm)

■ Freq. Response (Square Wave 3Vp-p, 10cm)



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5

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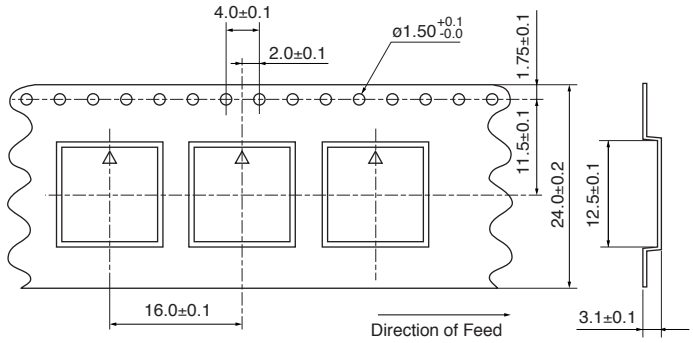
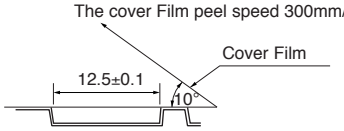
■ Taping Dimension

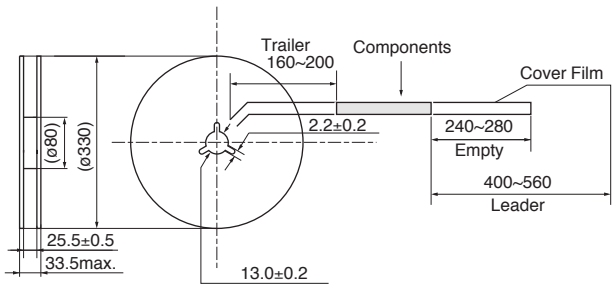
Dimensions of Carrier Tape



The cover Film peel strength force 0.1~0.7N
The cover Film peel speed 300mm/min.



Dimensions of Reel



(in mm)

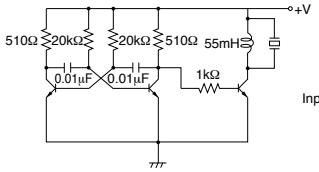
5

Piezoelectric Sounders (External Drive) Circuit/Notice

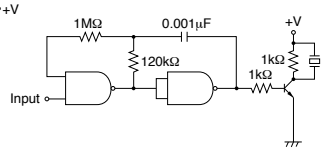
■ Circuit

The following are examples of externally driven circuits.
(1) Unstable multi-vibrator using Tr.
(2) Circuits using inverters or NAND gates.

(1)



(2)



■ Notice (Soldering and Mounting)

Washing of the component is not acceptable, because it is not sealed.

■ Notice (Handling)

1. The component may be damaged if mechanical stress over this specification is applied.
2. Please pay attention to protect operating circuit from surge voltage provided by something of force such as falling, shock and temperature changing.
3. If DC voltage is applied to the component, silver migration may occur. Please pay full attention not to subject the component to DC voltage for long periods.
4. The resistor should be used as shown in Fig. A. A suitable resistance value should be chosen, preferably 1kΩ to 2kΩ. Instead of this measure, a diode may also be applied as shown in Fig. B.

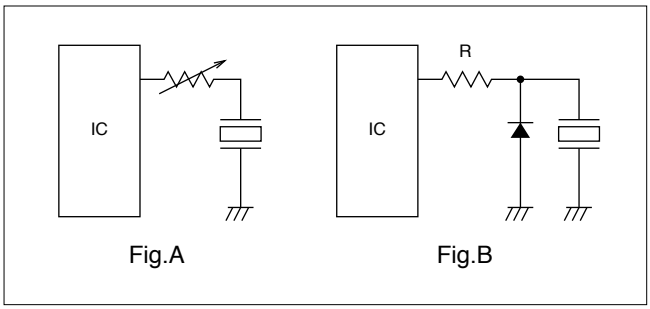


Fig.A Fig.B

5. Please pay enough attention not to pull lead wire too much because wire may be broken or soldering point may come off.

Piezoelectric Sound Components

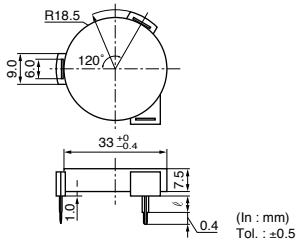
Piezoelectric Ringers (PIEZORINGER®)

As the result of rapid development of ICs in telephones, demand for piezoelectric sounder as telephone ringers has also rapidly increased. To effectively satisfy this rising demand, Murata provides a suitable piezoelectric sounder called "PIEZORINGER", with the following features.

■ Features

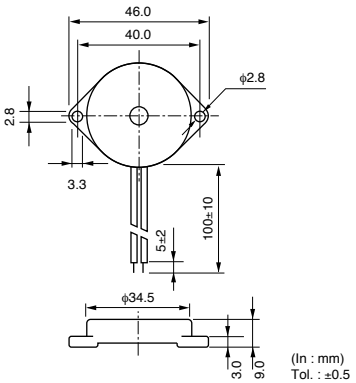
1. Extremely clear sound.
2. Since it is voltage driven, the power consumption is quite negligible.
3. It can be driven directly from ICs.
4. Extremely thin and light.

PKM33EP-1201C

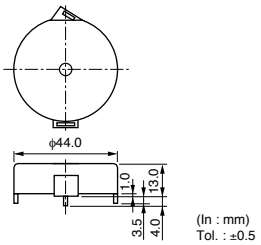


Part Number	ℓ
PKM33EP-1201C	5.0
PKM33EP-1202C	0

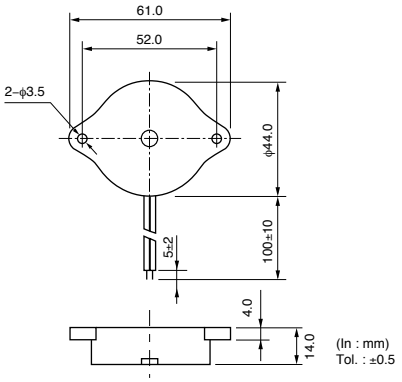
PKM34EW-1101C/1201C



PKM44EP-0901



PKM44EW-1001C



Pin Type

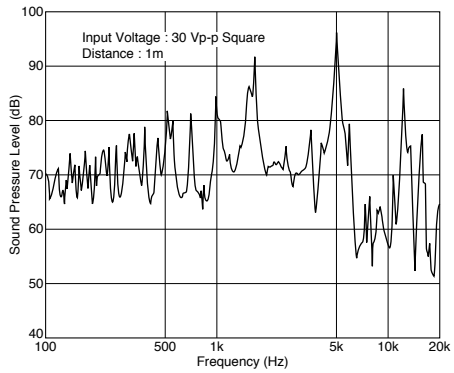
Part Number	Sound Pressure Level (dB)	Sound Pressure Level(Ref. only) (dB)	Operating Voltage Range (Vp-p)	Capacitance (nF)	Operating Temp. Range	Storage Temp. Range
PKM33EP-1201C	68 min. [30Vp-p,1.2kHz,square wave,1m]	65 min. [1Vrms,1.2kHz,sine wave,10cm]	40 max.	40 ±30% [120Hz]	-20 to +70°C	-30 to +80°C
PKM44EP-0901	70 min. [30Vp-p,1kHz,square wave,1m]	60 min. [1Vrms,1kHz,sine wave,10cm]	40 max.	68 ±30% [120Hz]	-20 to +70°C	-30 to +80°C

Lead Wire Type

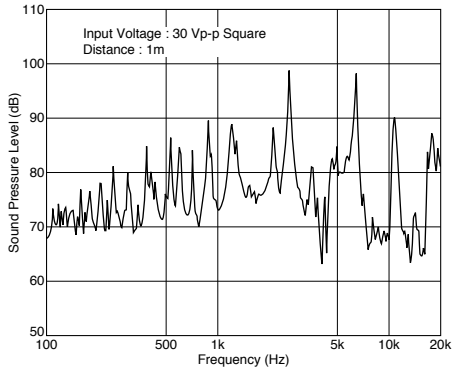
Part Number	Sound Pressure Level (dB)	Sound Pressure Level(Ref. only) (dB)	Operating Voltage Range (Vp-p)	Capacitance (nF)	Operating Temp. Range	Storage Temp. Range
PKM34EW-1101C	70 min. [30Vp-p,1.1kHz,square wave,1m]	60 min. [1Vrms,1.1kHz,sine wave,10cm]	40 max.	40 ±30% [120Hz]	-20 to +70°C	-30 to +80°C
PKM34EW-1201C	70 min. [30Vp-p,1.2kHz,square wave,1m]	60 min. [1Vrms,1.2kHz,sine wave,10cm]	60 max.	32 ±30% [120Hz]	-20 to +70°C	-30 to +80°C
PKM44EW-1001C	75 min. [30Vp-p,1kHz,square wave,1m]	70 min. [1Vrms,1kHz,sine wave,10cm]	30 max.	68 ±30% [120Hz]	-20 to +70°C	-30 to +80°C

■ Freq. Response (Square Wave 30Vp-p, 1m)

PKM33EP-1201C



PKM44EP-0901



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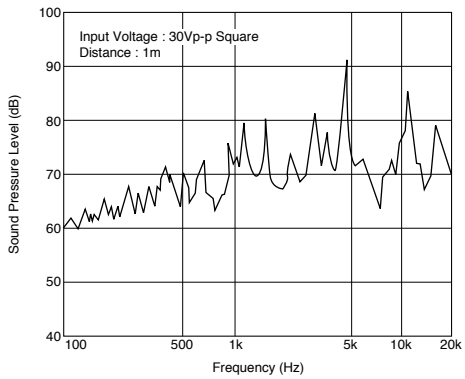
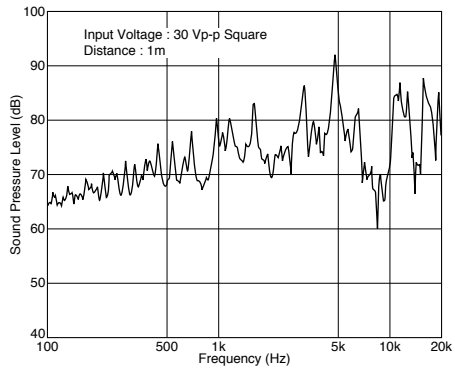


PKM34EW-1201C



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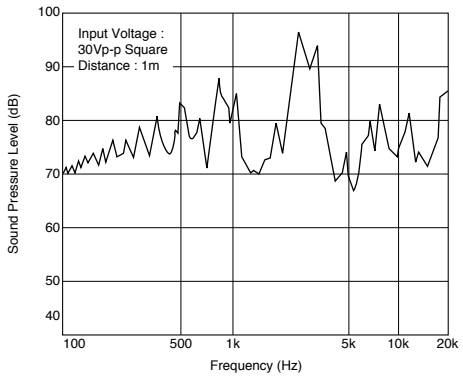
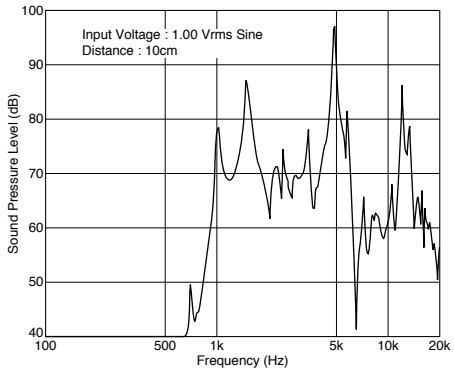
■ Freq. Response (Square Wave 30Vp-p, 1m)

PKM44EW-1001C



■ Freq. Response (Sine Wave 1Vrms, 10cm)

PKM33EP-1201C



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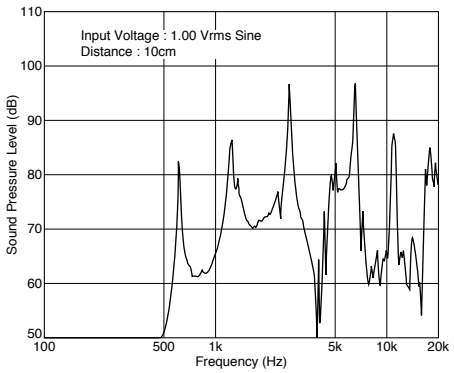

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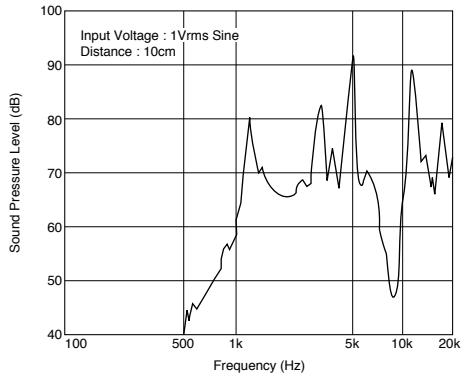

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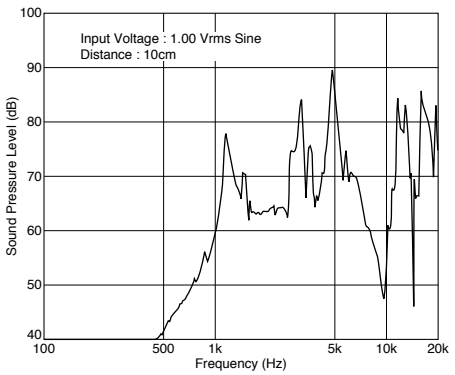

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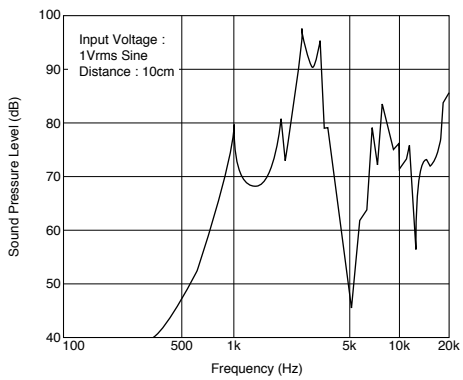


6

Piezoelectric Ringers (PIEZORINGER®) Notice

■ Notice (Soldering and Mounting)

Washing of the component is not acceptable, because it is not sealed.

■ Notice (Handling)

1. The component may be damaged if mechanical stress over this specification is applied.
2. Please pay attention to protect operating circuit from surge voltage provided by something of force such as falling, shock and temperature changing.
3. If DC voltage is applied to the component, silver migration may occur. Please pay full attention not to subject the component to DC voltage for long periods.
4. The resistor should be used as shown in Fig. A. A suitable resistance value should be chosen, preferably 1kΩ to 2kΩ. Instead of this measure, a diode may also be applied as shown in Fig. B.

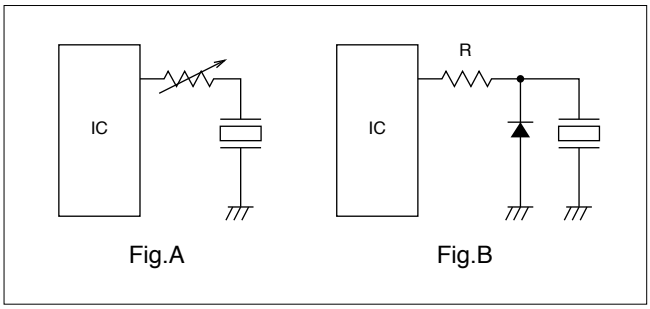


Fig.A Fig.B

5. Please pay enough attention not to pull lead wire too much because wire may be broken or soldering point may come off.

Piezoelectric Sound Components

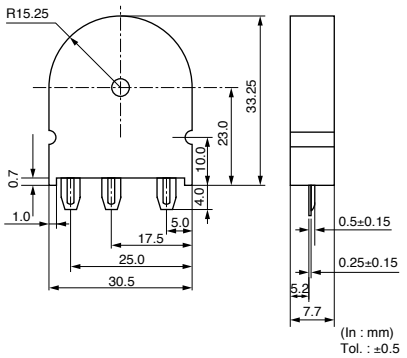
Piezoelectric Sounders Self Drive Pin Type

Piezoelectric sounder self drive type requires only simple circuit and DC power supply. Since this type uses resonant system, it is also available for alarms which need large sound volume.

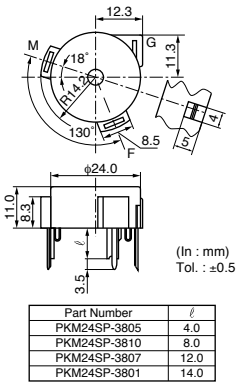
■ Applications

- Gas alarms, burglar alarms, smoke detectors.
- Air conditioners, Microwave ovens, washing machines and other home-electronic appliance controlled by microcomputer.
- Bicycles, toys, game machines.

PKM30SPT-2001/2501



PKM24SP-3805



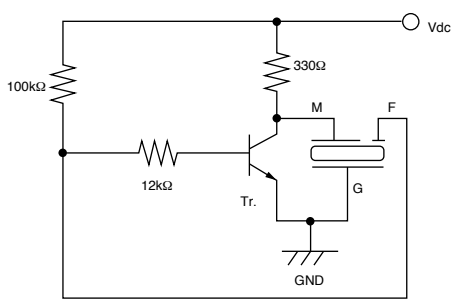
Part Number	ℓ
PKM24SP-3805	4.0
PKM24SP-3810	8.0
PKM24SP-3807	12.0
PKM24SP-3801	14.0

Part Number	Sound Pressure Level (dB)	Oscillating Frequency (kHz)	Current Consumption (mA)	Operating Voltage Range (Vdc)	Operating Temp. Range	Storage Temp. Range
PKM24SP-3805	90 min. [12Vdc,10cm]	3.8 ±0.4kHz [12Vdc]	12 max. [12Vdc]	3.0 to 20.0	-20 to +70°C	-30 to +80°C
PKM30SPT-2001-B0	75 min. [12Vdc,10cm]	2.0 ±0.3kHz [12Vdc]	20 max. [12Vdc]	3.0 to 20.0	-20 to +70°C	-30 to +80°C
PKM30SPT-2501-B0	75 min. [12Vdc,10cm]	2.5 ±0.3kHz [12Vdc]	20 max. [12Vdc]	3.0 to 20.0	-20 to +70°C	-30 to +80°C

7

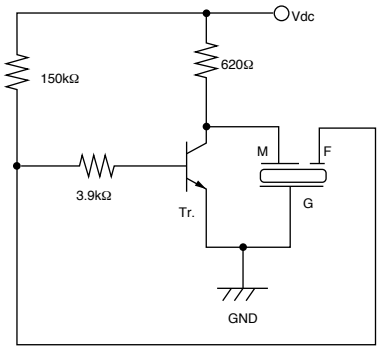
■ Standard Circuit Examples

PKM30SPT-2001/2501



Tr: 2SC1815Y or equivalent

PKM24SP-3805



Tr: 2SC1815Y or equivalent

Piezoelectric Sounders (Self Drive) Notice

■ Notice (Soldering and Mounting)

1. Washing of the component is not acceptable, because it is not sealed.
2. Please do not cover the hole with tape or other obstacle as this will produce irregular oscillation.
3. There should not be any obstacle within 15mm from top of the component as this will produce irregular oscillation.

■ Notice (Handling)

1. The component may be damaged if mechanical stress over this specification is applied.
2. Please pay attention to protect operating circuit from surge voltage provided by something of force such as falling, shock and temperature changing.
3. If DC voltage is applied to the component, silver migration may occur. Please pay full attention not to subject the component to DC voltage for long periods.
4. The standard self-driven circuits utilizes transistor switching. The circuit constants shown in the table below are optimally chosen to maintain stable oscillation. So please follow it when you design a circuit.

Piezoelectric Sound Components

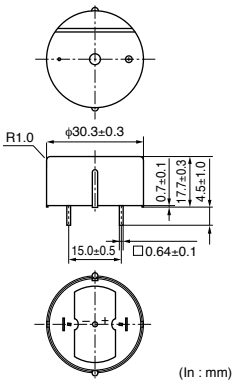
Piezoelectric Buzzers

This is unified piezoelectric sounder which has piezoelectric diaphragm of 3 terminals connected to self drive circuit, and it easily generates sound with only a DC power supply (DC3.0-20V). Using suitably designed resonant system, this type can be used where large sound volumes are needed.

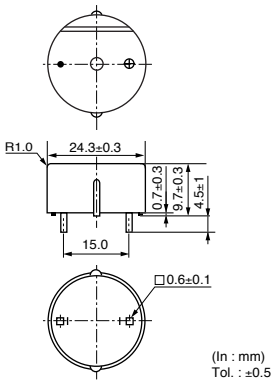
■ Applications

- Gas alarms, burglar alarms.
- Air conditioners, microwave ovens and various types of microcomputer controlled home-electronic appliances.
- Automobile speed alarms, navigators, car stereos and other automobile equipment.
- Toys, games, and other simple electronic devices such as teaching aids.

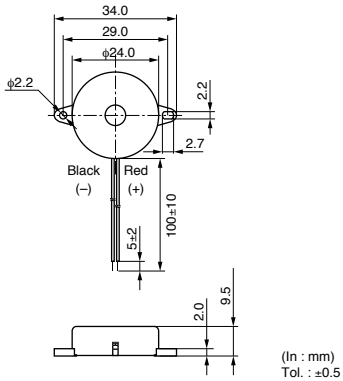
PKB30SPC-2001/3001



PKB24SPC-3601



PKB24SW-3301



8

Pin Type

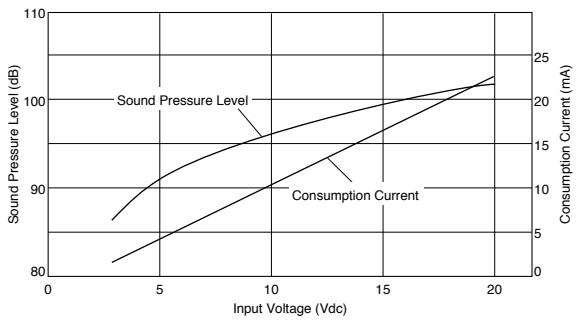
Part Number	Sound Pressure Level (dB)	Oscillating Frequency (kHz)	Current Consumption (mA)	Operating Voltage Range (Vdc)	Operating Temp. Range	Storage Temp. Range
PKB30SPC-2001-B0	92 min. [12Vdc,10cm]	2.0 ±0.4kHz [12Vdc]	15 max. [12Vdc]	3.0 to 15.0	-20 to +70°C	-30 to +80°C
PKB30SPC-3001-B0	92 min. [12Vdc,10cm]	2.7 ±0.4kHz [12Vdc]	15 max. [12Vdc]	3.0 to 15.0	-20 to +70°C	-30 to +80°C
PKB24SPC-3601-B0	90 min. [12Vdc,10cm]	3.6 ±0.5kHz [12Vdc]	16 max. [12Vdc]	3.0 to 15.0	-20 to +70°C	-30 to +80°C

Lead Wire Type

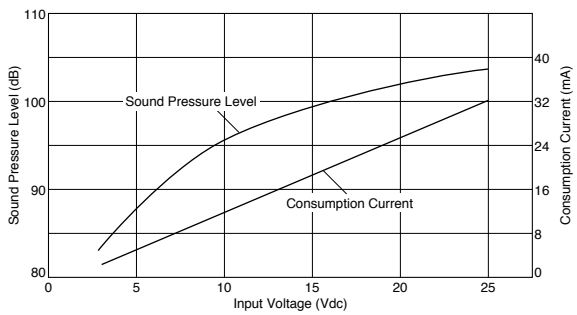
Part Number	Sound Pressure Level (dB)	Oscillating Frequency (kHz)	Current Consumption (mA)	Operating Voltage Range (Vdc)	Operating Temp. Range	Storage Temp. Range
PKB24SW-3301	80 min. [12Vdc,10cm]	3.3 ±0.5kHz [12Vdc]	12 max. [12Vdc]	3.0 to 20.0	-20 to +70°C	-30 to +80°C

■ Voltage-Sound Pressure Level/Voltage-Consumption Current

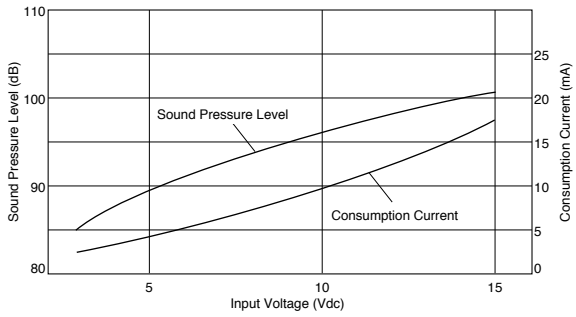
PKB30SPC-2001



PKB30SPC-3001



PKB24SPC-3601



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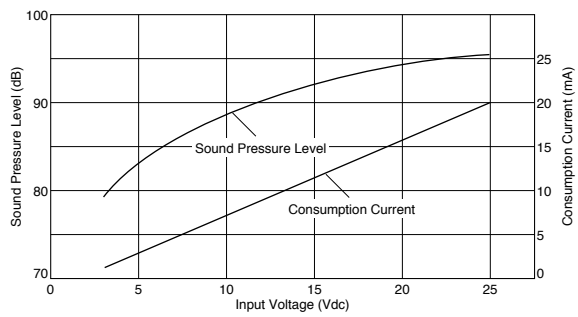


8

Piezoelectric Buzzers Notice

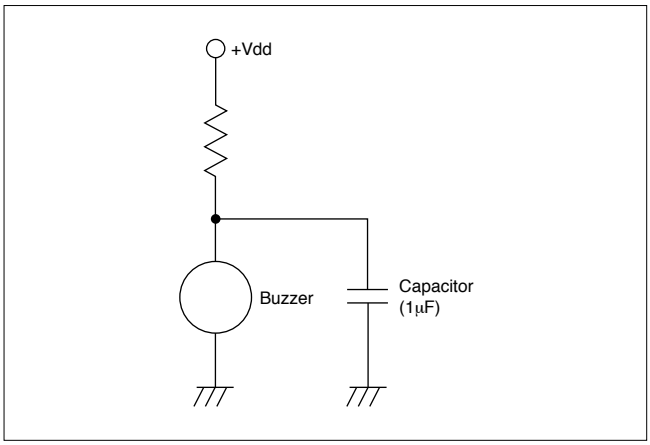
■ Notice (Soldering and Mounting)

1. Washing of the component is not acceptable, because it is not sealed.
2. Please do not cover the hole with tape or other obstacle as this will produce irregular oscillation.
3. There should not be any obstacle within 15mm from top of the component as this will produce irregular oscillation.

■ Notice (Handling)

1.The component may be damaged if mechanical stress over this specification is applied.

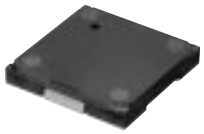
2.Resistors should not be connected in series to the power supply as this will produce irregular oscillation. When resistor is necessary to control sould volume, use capacitor (1μF) parallel with the buzzer together.

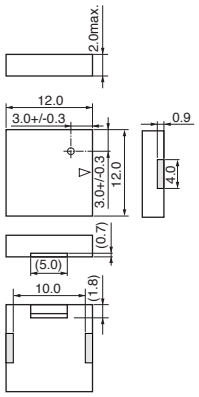


Piezoelectric Sound Components

Piezoelectric Receiver

Taking advantage of extensive acoustic, mechanical designing technology and high performance ceramics, Murata has developed SMD piezoelectric receiver. This Murata technology supports labor and cost saving activities.





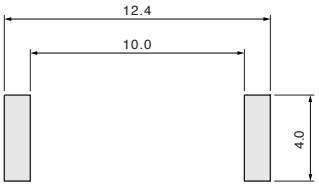
( ) : Ref. only
Tol. ±0.2
in mm

■ Features

1. Thin shape, light weight.
2. Low current consumption and good matching impedance for a voltage drive.
3. Reflowable.
4. Tape & Reel supply.
5. Minimum quantity (order in sets only):1,500 pcs.

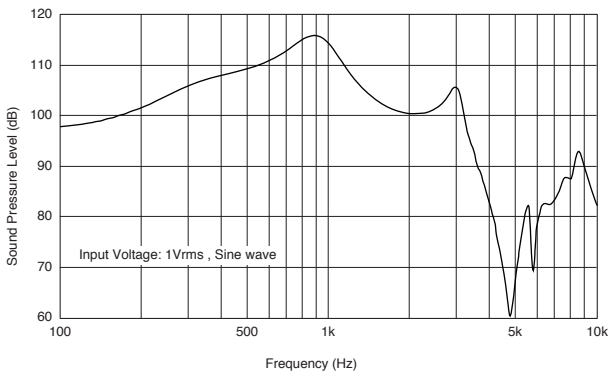
Part Number	Sound Pressure Level(1) (dB)	Sound Pressure Level(2) (dB)	Operating Voltage Range (Vp-p)	Operating Temperature Range	Storage Temperature Range
PKLCD1212R1000-R1	106.0 +4.0/-2.5 [at 300Hz]	114.0 +2.5/-4.0 [at 1kHz]	7 max.	-20 to +70°C	-30 to +80°C

■ Standard Land Pattern Dimensions



(in mm)

■ Freq. Response (Sine Wave 1Vrms)



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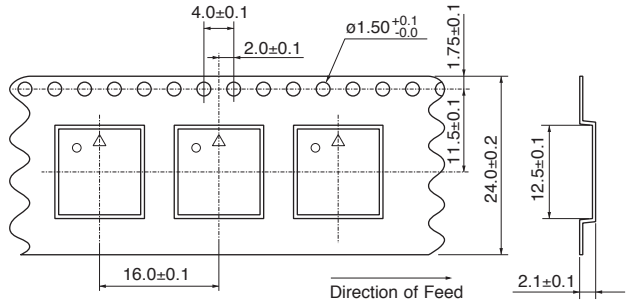
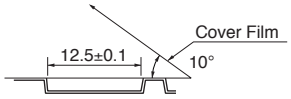
■ Taping Dimension

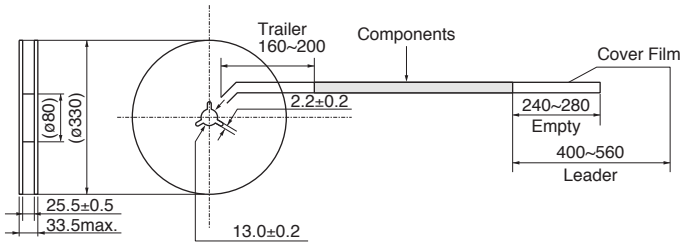
Dimensions of Carrier Tape



The cover film peel strength force 0.1 to 0.7N
The cover film peel speed 300mm/min.



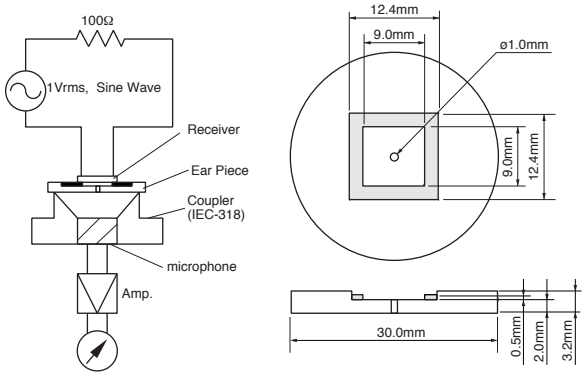
Dimensions of Reel



(in mm)

Piezoelectric Receiver Circuit/Notice

■ Circuit



■ Notice (Soldering and Mounting)

Washing of the component is not acceptable, because it is not sealed.

■ Notice (Handling)

1. The component may be damaged if mechanical stress over this specification is applied.
2. Please pay attention to protect operating circuit from surge voltage provided by something of force such as falling, shock and temperature changing.
3. If DC voltage is applied to the component, silver migration may occur. Please pay full attention not to subject the component to DC voltage for long periods.
4. Please pay attention to the hand set design. Sound pressure level - frequency characteristics are affected by the hand set design. (Blocking the sound emitting hole or air dumping hole may degrade S.P.L. -frequency characteristics. To dispose other components or obstacle close to the holes may also affect the characteristics.)

Piezoelectric Sound Components

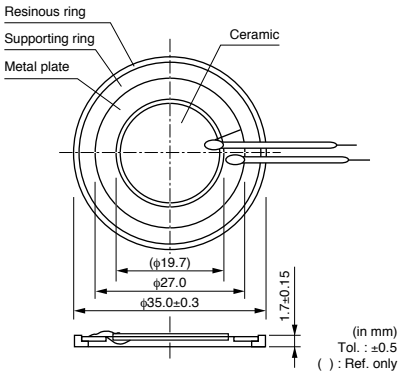
Piezoelectric Speakers (CERAMITONE®)

As voice synthesizing techniques with ICs and LSIs are rapidly progressed, human voice synthesizing devices are put into practical use for portable calculators, clocks, vending machines, translating machines and so forth. In order to meet the demand, Murata has developed.
Piezoelectric Speaker best suited for making synthesized voice or melody.

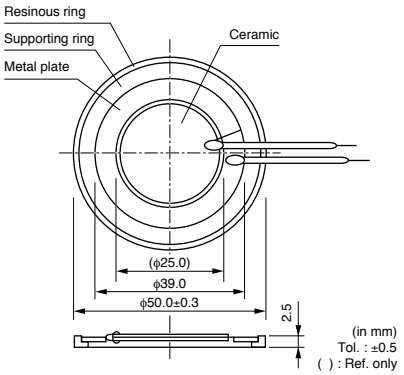
■ Features

1. High efficiency compared with conventional electromagnetic type speakers.
2. Ultra-thin and light-weight.
3. High impedance with less power consumption.
4. No electric noise, because they have no mechanical contacts.
5. Direct drive by IC is available.

VSB35EW-0701B



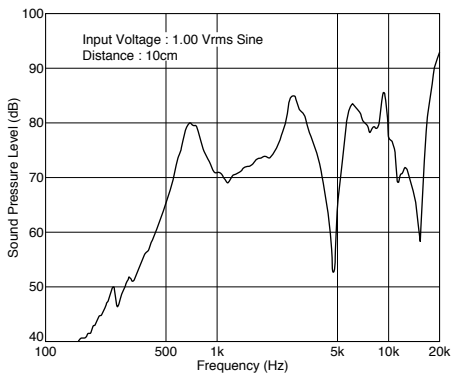
VSB50EW-0301B



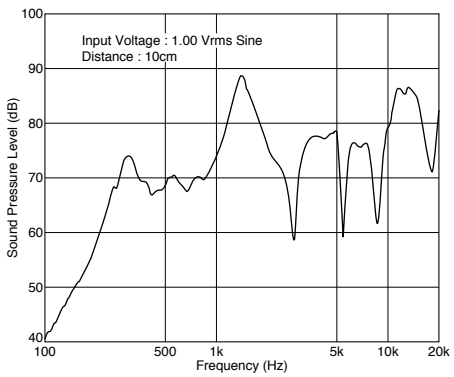
Part Number	Oscillating Frequency Range	Resonant Frequency (Hz)	Impedance (ohm)	Capacitance (nF)	Maximum Input (mW)	Operating Temperature Range	Storage Temperature Range
VSB35EW-0701B	600Hz to 20kHz	950 ±150Hz[Lowest]	600[1kHz]	340 ±35%[120Hz]	75	-20 to +70°C	-30 to +80°C
VSB50EW-0301B	250Hz to 20kHz	400 ±150Hz[Lowest]	300[1kHz]	600 ±35%[120Hz]	150	-20 to +70°C	-30 to +80°C

■ Freq. Response (Sine Wave 1Vrms, 10cm)

VSB35EW-0701B



VSB50EW-0301B



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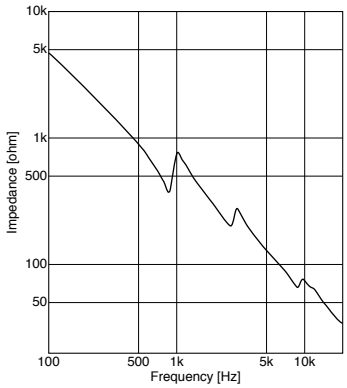
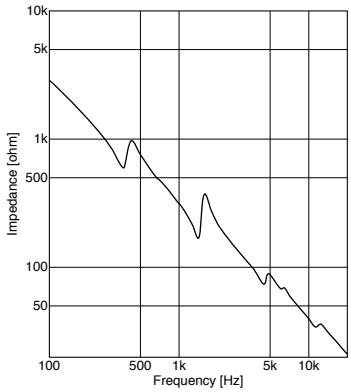
■ Impedance-Frequency Characteristics

VSB35EW-0701B



VSB50EW-0301B



Piezoelectric Speakers (CERAMITONE®) Notice

■ Notice (Soldering and Mounting)

1. Applying load on the center area of the speaker may cause clack in the ceramic element. When the speaker is supported by edge, the load should be only applied around edge.
2. Washing of the component is not acceptable, because it is not sealed.

■ Notice (Handling)

1. Please do not touch the component with bare hand because electrode may be corroded.
2. The component may be damaged if mechanical stress over this specification is applied.
3. Please pay attention to protect operating circuit from surge voltage provided by something of force such as falling, shock and temperature changing.
4. If DC voltage is applied to the component, silver migration may occur. Please pay full attention not to subject the component to DC voltage for long periods.
5. The resistor should be used as shown in Fig. A. A suitable resistance value should be chosen, preferably 1kΩ to 2kΩ. Instead of this measure, a diode may also be applied as shown in Fig. B.

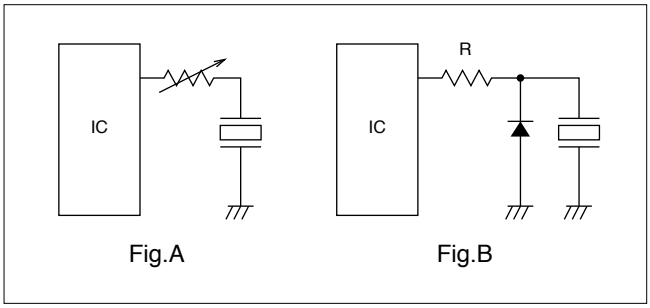


Fig.A Fig.B

6.Please pay enough attention not to pull lead wire too much because wire may be broken or soldering point may come off.

Package

■ Minimum Quantity (pcs.)

Products Name	Part Number	Minimum Quantity (pcs.)			
		ø330mmReel	Bulk (Box)	Ammo Pack	Magazine
● Piezoelectric Diaphragms					
External Drive Type	**7BB-12-9**		5120		
	7BB-15-6		8000		
	7BB-20-3		3000		
	7BB-20-4		2400		
	7BB-20-6		1800		
	7BB-20-6A0		600		
	7BB-27-4		1500		
	7BB-27-4A0		600		
	7BB-35-3		800		
	7BB-35-3A0		400		
	7BB-41-2		400		
	7BB-41-2A0		250		
	7BB-50M-1		600		
	7SB-20-7		1800		
Self Drive Type	**7BB-20-6C**		1800		
	7BB-20-6CA0		600		
	7BB-27-3C		2400		
	7BB-27-4C		1500		
	7BB-27-4CA0		600		
	7BB-35-3C		800		
	7BB-35-3CA0		400		
	7BB-41-2C		600		
	7BB-41-2CA0		250		
	7NB-27-2C		3000		
	7NB-27-3C		3000		
	7NB-27-4C		3000		
	7SB-34R7-3C		1600		
● Piezoelectric Sounders					
External Drive Type	**PKM13EPY-4000-A0**			500	
	PKM13EPY-4002-B0		330		
	PKM17EPP-2002-B0		200		
	PKM17EPP-4001-B0		200		
	PKM17EPT-4001-B0		180		70*
	PKM17EW-2001		250		
	PKM22EP-2001		360		
	PKM22EPP-2001-B0		750		
	PKM22EPP-4001-B0		900		
	PKM22EPP-4005-B0		750		
	PKM22EPP-4007-B0		750		
	PKM22EPT-2001-B0		300		75*
	PKM22EPT-4001-B0		300		
	PKM17EW-4000		500		
	PKLCS1212E4001-R1	1000			
Self Drive Type	**PKM24SP-3805**		360		
	PKM30SPT-2001-B0		70		
	PKM30SPT-2501-B0		70		
● Piezoelectric Buzzers	**PKB24SPC-3601-B0**		650		
	PKB24SW-3301		200		
	PKB30SPC-2001-B0		80		
	PKB30SPC-3001-B0		80		
● Piezoelectric Ringers (PIEZORINGER®)	**PKM33EP-1201C**		300		
	PKM34EW-1101C		25		
	PKM34EW-1201C		25		
	PKM44EP-0901		160		
	PKM44EW-1001C		25		
● Piezoelectric Receiver	**PKLCD1212R1000-R1**	1500			
● Piezoelectric Speakers (CERAMITONE®)	**VSB35EW-0701B**		160		
	VSB50EW-0301B		80		

*The last two digits are changed to M0.

⚠Note:

1. Export Control
   〈For customers outside Japan〉
   Murata products should not be used or sold for use in the development, production, stockpiling or utilization of any conventional weapons or mass-destructive weapons (nuclear weapons, chemical or biological weapons, or missiles), or any other weapons.
   〈For customers in Japan〉
   For products which are controlled items subject to the “Foreign Exchange and Foreign Trade Law” of Japan, the export license specified by the law is required for export.
2. Please contact our sales representatives or product engineers before using our products listed in this catalog for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property, or when intending to use one of our products for other applications than specified in this catalog.
   ① Aircraft equipment
   ② Aerospace equipment
   ③ Undersea equipment
   ④ Power plant equipment
   ⑤ Medical equipment
   ⑥ Transportation equipment (vehicles, trains, ships, etc.)
   ⑦ Traffic signal equipment
   ⑧ Disaster prevention / crime prevention equipment
   ⑨ Data-processing equipment
   ⑩ Application of similar complexity and/or reliability requirements to the applications listed in the above
3. Product specifications in this catalog are as of January 2002. They are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before your ordering. If there are any questions, please contact our sales representatives or product engineers.
4. Please read CAUTION and Notice in this catalog for safety. This catalog has only typical specifications. Therefore you are requested to approve our product specification or to transact the approval sheet for product specification, before your ordering.
5. Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or third party's intellectual property rights and other related rights in consideration of your using our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.
6. None of ozone depleting substances (ODS) under the Montreal Protocol is used in manufacturing process of us.

Murata Manufacturing Co., Ltd.

http://www.murata.co.jp/products/

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