

Overview

KEMET's piezoelectric ceramics ND series are disc-shaped piezoceramics that use original high-performance piezoelectric materials.

These products are based on the principle of the piezoelectric effect that generates a charge in response to pressure and an inverse piezoelectric effect that generates strain in response to voltage.

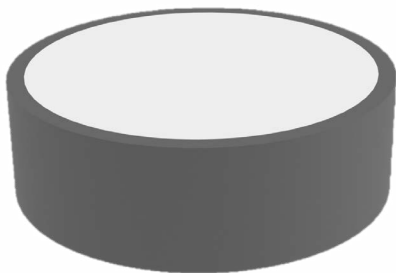
Applications

- Vibratory feeder
- Ultrasonic cleaning machine
- Ultrasonic levitation
- Ultrasonic flow and level meter
- Ultrasonic distance sensor
- Load sensor, impact sensor

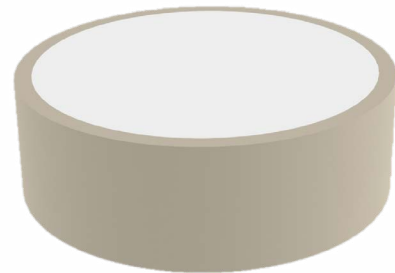
Benefits

- N6 material has a high coupling coefficient, high Q_m , and low $\tan\delta$, suitable for high power applications
- N21 material has a high coupling coefficient and a large g -constant, suitable for sensing applications
- Operating temperature range from -20°C to $+60^{\circ}\text{C}$
- RoHS/REACH compliant

ND****N6



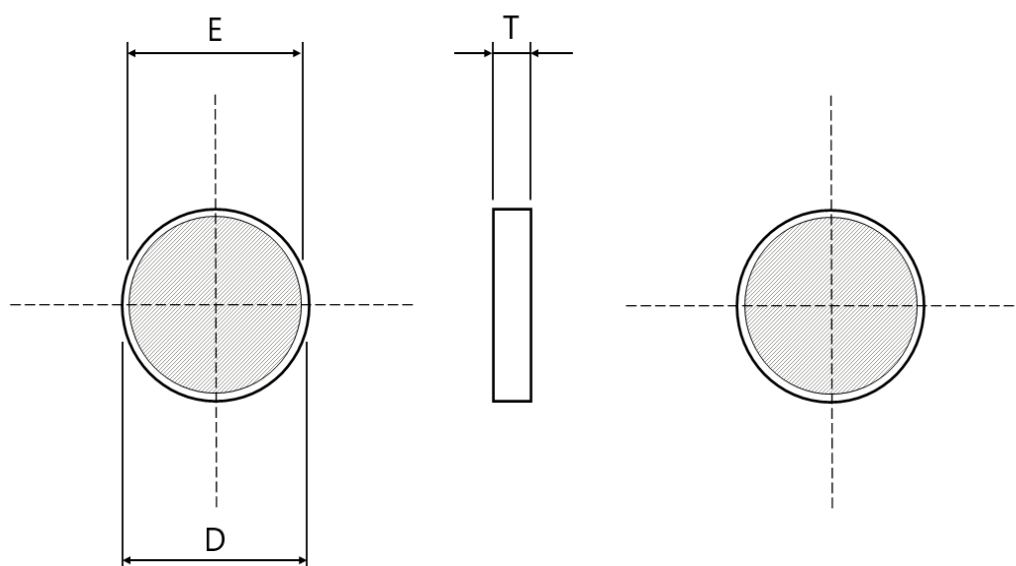
ND****N21



Ordering Information

| ND | 10 | X3 | N21 |
|--------|--|--------------------------|--|
| Series | Ceramic Outer Diameter (mm) | Thickness Dimension (mm) | Ceramic Material Name |
| ND | 10 = \varnothing 10 mm 18 = \varnothing 18 mm | X2 = 2 mm X3 = 3 mm | N6 = N6 material N21 = N21 material |

Dimensions in mm



| Part Number | Diameter D (mm) | Thickness T (mm) | Electrode Diameter E (mm) ¹ |
|-------------|-----------------|------------------|--|
| ND10X2N6 | 10 ±0.1 | 2 ±0.1 | 9.2 |
| ND10X3N6 | 10 ±0.1 | 3 ±0.1 | 9.2 |
| ND18X2N6 | 18 ±0.1 | 2 ±0.1 | 17.5 |
| ND18X3N6 | 18 ±0.1 | 3 ±0.1 | 17.5 |
| ND10X2N21 | 10 ±0.1 | 2 ±0.1 | 9.2 |
| ND10X3N21 | 10 ±0.1 | 3 ±0.1 | 9.2 |
| ND18X2N21 | 18 ±0.1 | 2 ±0.1 | 17.5 |
| ND18X3N21 | 18 ±0.1 | 3 ±0.1 | 17.5 |

¹ Electrode diameter for reference value only. Values not guaranteed.

Environmental Compliance

All KEMET Piezoceramics are RoHS and REACH Compliant.

Article 33(1) of the REACH Regulation states that manufacturers and importers of articles (products) are required to notify their customers of the presence of any Substances of Very High Concern (SVHC) in their products exceeding 0.1% by weight and provide instructions on safe use of the product.

KEMET Corporation reports regarding the Article 33(1) of REACH Regulation as follows:

1. Applicable Product:

Piezoceramics (ND Series).

2. Report for content of REACH SVHC list:

The product(s) above contain a substance by more than 0.1wt% per product weight that was published in the 8th update of the REACH SVHC substances (December 19, 2012).

3. Regarding safety of the piezoelectric ceramics :

The piezoceramics that is used in this product becomes ceramic by sintering powder containing PZT as a main ingredient. It is chemically stable, with minimum risks toward the human body or environment within the intended use of the product. Please note that risks could occur in the case of inhalation or accidental oral uptake of powder ceramics.

4. Technical product information on the piezoceramics:

The manufacturing technique of the “piezoceramics” whose main ingredient is Lead Titanium Zirconium Oxide (PZT) has been established, and there is no alternative material that can exhibit superior performance than PZT at this moment. Please note that the piezoceramics is listed as an exempt on RoHS (2011/65/EU) Annex III (7c.1).

5. Responsibility of the piezoceramics manufacturers:

Piezoceramics manufacturers report information regarding PZT containment in their products to the customers to obey the article 33 of the REACH regulation.



Performance Characteristics

Characteristics of Piezoelectric Ceramic Materials

| Item | | N6 Material | N21 Material |
|------------------------------------|------------------------------|--|--|
| Relative Dielectric Constants | $\epsilon_{33}^T/\epsilon_0$ | 1,400 | 1,800 |
| | $\epsilon_{11}^T/\epsilon_0$ | 1,350 | 2,000 |
| Dielectric Loss | $\tan\delta$ | 0.3% | 2.0% |
| Frequency Constants | N_1 (Radial) | 2,160 Hz·m | 1,960 Hz·m |
| | N_2 (Lengthwise) | 1,600 Hz·m | 1,410 Hz·m |
| | N_3 (Longitudinal) | 1,510 Hz·m | 1,310 Hz·m |
| | N_4 (Thickness) | 1,960 Hz·m | 1,940 Hz·m |
| | N_5 (Share) | 970 Hz·m | 860 Hz·m |
| Electromechanical Coupling Factors | K_r | 55% | 62% |
| | K_{31} | 34% | 38% |
| | K_{33} | 68% | 73% |
| | K_t | 55% | 52% |
| | K_{15} | 71% | 77% |
| Piezoelectric Constants | d_{31} | -133×10^{-12} m/V | -198×10^{-12} m/V |
| | d_{33} | 302×10^{-12} m/V | 417×10^{-12} m/V |
| | d_{15} | 419×10^{-12} m/V | 711×10^{-12} m/V |
| | g_{31} | -10.4×10^{-3} Vm/N | -12.1×10^{-3} Vm/N |
| | g_{33} | 23.5×10^{-3} Vm/N | 25.4×10^{-3} Vm/N |
| | g_{15} | 45.1×10^{-3} Vm/N | 41.0×10^{-3} Vm/N |
| Compliances | S_{11}^E | 12.7×10^{-12} m ² /N | 16.5×10^{-12} m ² /N |
| | S_{33}^E | 15.4×10^{-12} m ² /N | 19.9×10^{-12} m ² /N |
| | Y_{33}^E | 6.5×10^{10} N/m ² | 5.0×10^{10} N/m ² |
| | Y_{11}^E | 7.9×10^{10} N/m ² | 6.1×10^{10} N/m ² |
| Poisson's Ratio | δ | 0.32 | 0.34 |
| Mechanical Quality Factor | Qm | 1,500 | 75 |
| Curie Temperature | Tc | 325°C | 330°C |
| Density | ρ | 7.77 | 7.82 |
| Temperature Coefficient | Tk(fr) (-20°C to +20°C) | 200 ppm/°C | -340 ppm/°C |
| | Tk(fr) (+20°C to +60°C) | 100 ppm/°C | -175 ppm/°C |
| | Tk(C) (-20°C to +20°C) | 2,200 ppm/°C | 3,800 ppm/°C |
| | Tk(C) (+20°C to +60°C) | 4,300 ppm/°C | 4,700 ppm/°C |
| Aging Rate | fr | 0.3%/10 Years | 0.1%/10 Years |
| | C | -1%/10 Years | -2%/10 Years |

Each material constant may change due to the influence of the product shape.

Table 1 – Ratings & Part Number Reference

| Part Number | Radial Resonance Frequency (kHz) | Capacitance (pF) | Operating Temperature Range | Weight (g) |
|-------------|----------------------------------|------------------|-----------------------------|------------|
| ND10X2N6 | 216 ±5% | 480 ±20% | -20°C to +60°C | 1.2 |
| ND10X3N6 | 207 ±5% | 320 ±20% | -20°C to +60°C | 1.8 |
| ND18X2N6 | 120 ±5% | 1,610 ±20% | -20°C to +60°C | 4.0 |
| ND18X3N6 | 120 ±5% | 1,080 ±20% | -20°C to +60°C | 6.0 |
| ND10X2N21 | 196 ±5% | 590 ±20% | -20°C to +60°C | 1.2 |
| ND10X3N21 | 190 ±5% | 400 ±20% | -20°C to +60°C | 1.8 |
| ND18X2N21 | 109 ±5% | 2,000 ±20% | -20°C to +60°C | 4.0 |
| ND18X3N21 | 109 ±5% | 1,370 ±20% | -20°C to +60°C | 6.0 |

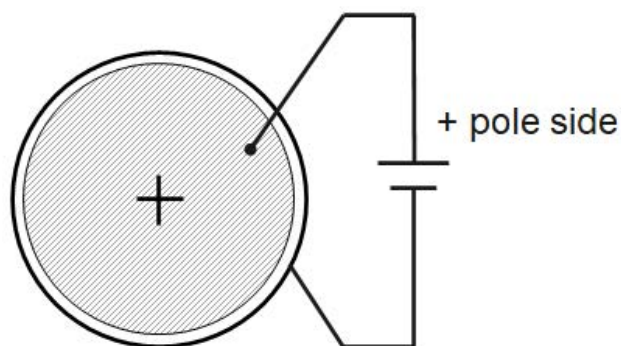
Packaging

| Part Type | Packaging Type | Pieces per Box |
|-----------|----------------|----------------|
| ND | Vacuum Bag | 1 |

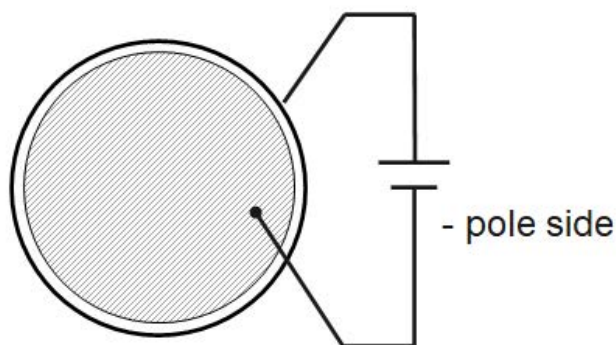
Handling Precautions

Polarity Display

+ is displayed on the + pole side of the polarization treatment.



No sign is displayed on the - pole side of the polarization treatment.



Export Control

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.

For customers outside Japan

Piezoelectric Transducers 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.