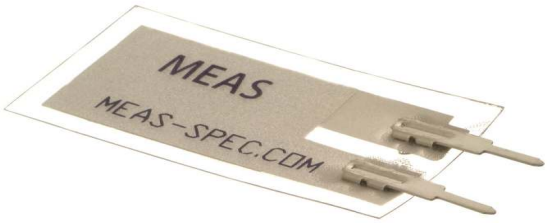
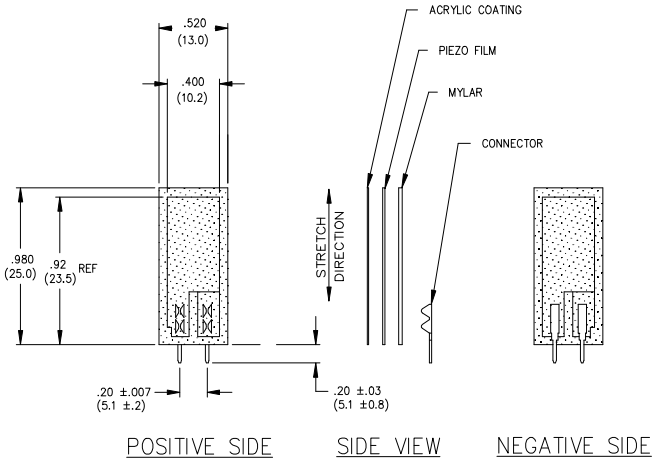
# LDT with Crimps Vibration Sensor/Switch

Piezo Film Sensors
High Sensativity
AC Coupled
Laminated
Robust



**The LDT0-028K** is a flexible component comprising a 28 µm thick piezoelectric PVDF polymer film with screen-printed Ag-ink electrodes, laminated to a 0.125 mm polyester substrate, and fitted with two crimped contacts. As the piezo film is displaced from the mechanical neutral axis, bending creates very high strain within the piezopolymer and therefore high voltages are generated. When the assembly is deflected by direct contact, the device acts as a flexible "switch", and the generated output is sufficient to trigger MOSFET or CMOS stages directly. If the assembly is supported by its contacts and left to vibrate "in free space" (with the inertia of the clamped/free beam creating bending stress), the device will behave as an accelerometer or vibration sensor. Adding mass, or altering the free length of the element by clamping, can change the resonant frequency and sensitivity of the sensor to suit specific applications. Multi-axis response can be achieved by positioning the mass off center. The LDTM-028K is a vibration sensor where the sensing element comprises a cantilever beam loaded by an additional mass to offer high sensitivity at low frequencies.

## dimensions

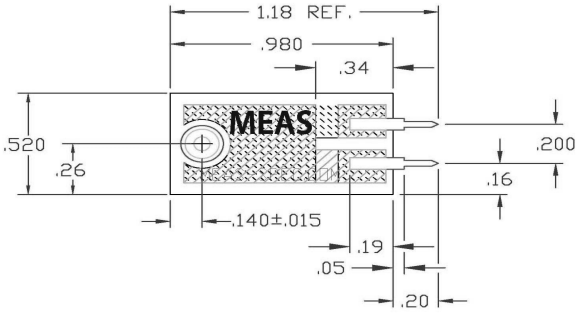


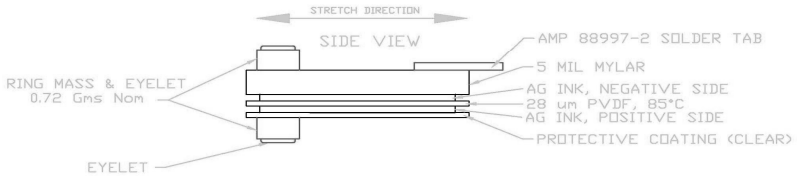

## FEATURES

- Solder Tab Connection
- Both No Mass & With Mass Version
- Withstands High Impact
- Operating Temperature: 0ºC to 85ºC
- Storage Temperature: -40ºC to 85 ºC
- Higher Temperature Version up to 125 ºC available on a Custom Basis

## APPLICATIONS

- Vibration Sensing in Washing Machine
- Low Power Wakeup Switch
- Low Cost Vibration Sensing
- Car Alarms
- Body Movement
- Security Systems



# LDT with Crimps Vibration Sensor/Switch

## examples of properties

Four different experiments serve to illustrate the various properties of this simple but versatile component.

### Experiment #1

**LDT0 as Vibration Sensor** - with the crimped contacts pushed through a printed-circuit board, the LDT0 was soldered carefully in place to anchor the sensor. A charge amplifier was used to detect the output signal as vibration from a shaker table was applied (using a charge amplifier allows a very long measurement time constant and thus allows the "open-circuit" voltage response to be calculated). Small masses (approximately 0.26g increments) were then added to the tip of the sensor, and the measurement repeated. Results are shown in Table 1 and the overlaid plots in Fig. 1. Without adding mass, the LDT0 shows a resonance around 180 Hz. Adding mass to the tip reduces the resonance frequency and increases "baseline" sensitivity.

**LDT0 Sensitivity: Effect of Added Mass**
**(Figure 1)**

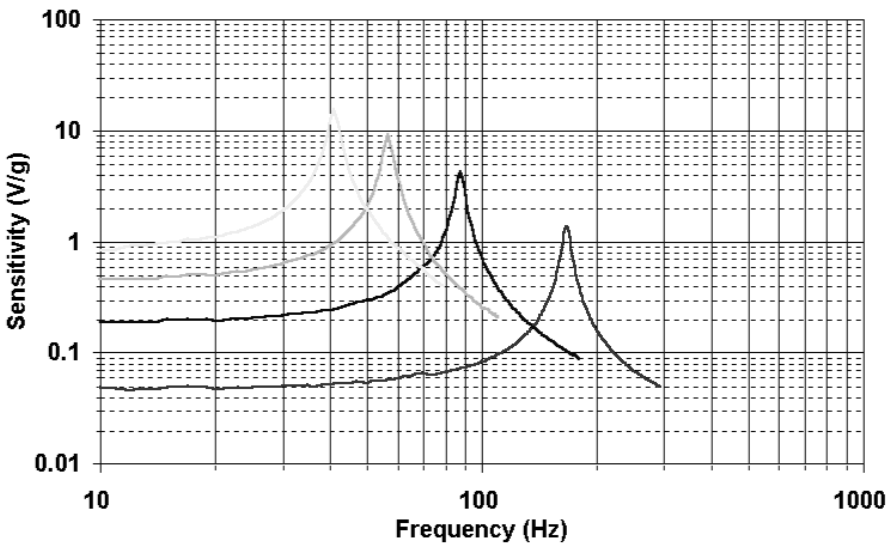


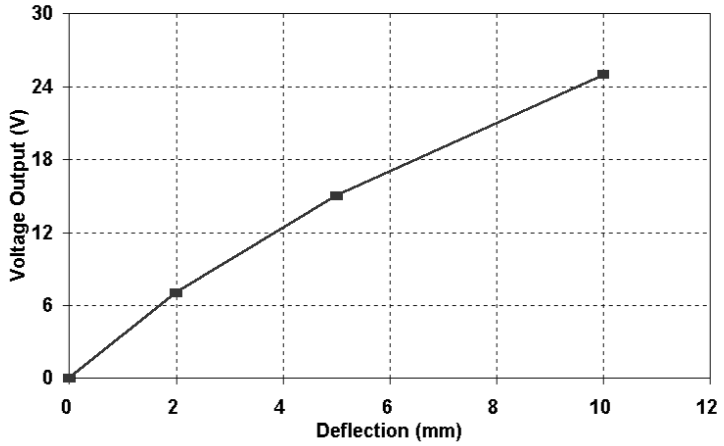

**TABLE 1: LDT0 as Vibration Sensor (see Fig 1)**

| Added Mass | Baseline Sensitivity | Sensitivity at Resonance | Resonant Frequency | +3 Db Frequency |
|---|---|---|---|---|
| 0 | 50 mV/g | 1.4 V/g | 180 Hz | 90 Hz |
| 1 | 200 mV/g | 4 V/g | 90 Hz | 45 Hz |
| 2 | 400 mV/g | 8 V/g | 60 Hz | 30 Hz |
| 3 | 800 mV/g | 16 V/g | 40 Hz | 20 Hz |

### Experiment #2

**LDT0 as Flexible Switch** - using a charge amplifier to obtain "open-circuit" voltage sensitivity, the output was measured for controlled tip deflections applied to the sensor (supported by its crimped contacts as described above). 2 mm deflection was sufficient to generate about 7 V. Voltages above 70V could be generated by bending the tip of the sensor through 90° (see Table 2, Fig. 2).

**LDT0: Voltage Output vs Tip deflection**
**(Figure 2)**



## examples of Properties (continued)

**TABLE 2: LDT0 as Flexible Switch (see Fig 2)**

| Tip Deflection | Charge Output | o/c Voltage Output |
|---|---|---|
| 2 mm | 3.4 nC | 7 V |
| 5 mm | 7.2 nC | 15 V |
| 10 mm | 10 - 12 nC | 20 - 25 V |
| max (90E) | > 30 nC | > 70 V |

**Experiment #3**

**LDT0 Electrical Frequency Response** - when the source capacitance of around 480 pF is connected to a resistive input load, a high-pass filter characteristic results. Using an electronic noise source to generate broad-band signals, the effect of various load resistances was measured and the -3 dB point of the R-C filter determined (see Table 3, Fig. 3).

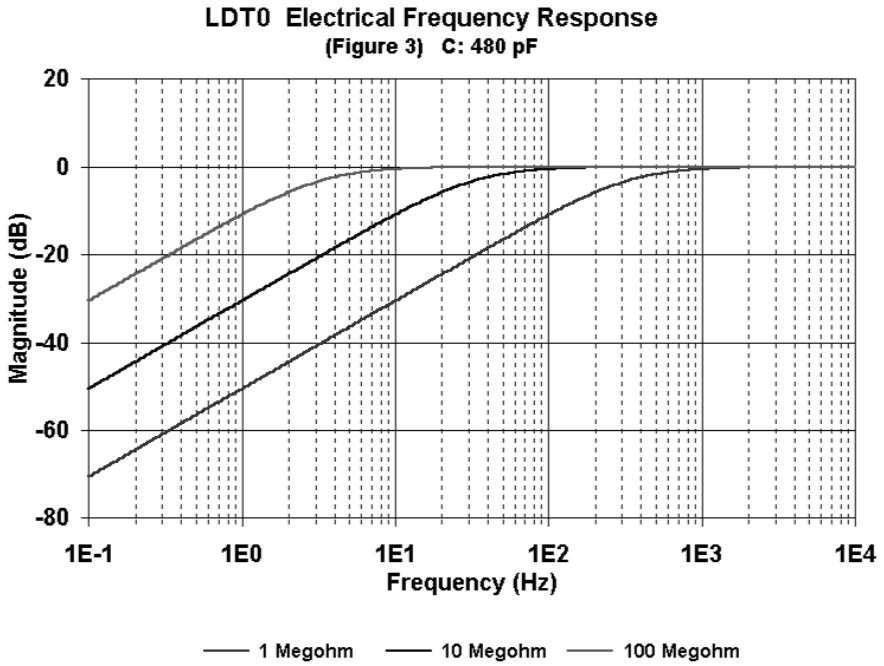



**TABLE 3: LDT0 Electrical Frequency Response (see Fig 3) (480 pF source capacitance)**

| Load Resistance | -3 db Frequency |
|---|---|
| 1 Megohm | 330 Hz |
| 10 Megohm | 33 Hz |
| 100 Megohm | 3.3 Hz |

**Experiment #4**
**LDT0 Clamped at Different Lengths** - using simple clamping fixture, the vibration sensitivity was measured (as in (1) above) as the clamp was moved to allow different "free" lengths to vibrate. The sensor may be "tuned" to suit specific frequency response requirements (see Table 4, Fig. 4).

LDT0: Resonant Freq vs Clamped Length
(Figure 4)

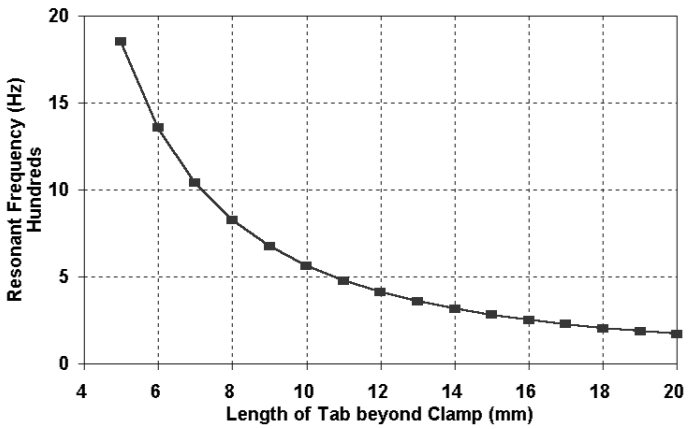



**TABLE 4: LDT0 Clamped at Different Lengths (See Fig. 4)**

| Length Beyond Clamp | Resonant Frequency | Settling Time (5 cyc) |
|---|---|---|
| 20 mm (no clamp) | 180 Hz | 28 msec |
| 16 mm | 250 Hz | 20 msec |
| 11 mm | 500 Hz | 10 msec |
| 7 mm | 1000 Hz | 5 msec |

The information in this sheet has been carefully reviewed and is believed to be accurate; however, no responsibility is assumed for inaccuracies. Furthermore, this information does not convey to the purchaser of such devices any license under the patent rights to the manufacturer. Measurement Specialties, Inc. reserves the right to make changes without further notice to any product herein. Measurement Specialties, Inc. makes no warranty, representation or guarantee regarding the suitability of its product for any particular purpose, nor does Measurement Specialties, Inc. assume any liability arising out of the application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Typical parameters can and do vary in different applications. All operating parameters must be validated for each customer application by customer's technical experts. Measurement Specialties, Inc. does not convey any license under its patent rights nor the rights of others.

## ordering information

| Description | Part Number |
|---|---|
| LDT0-028K | 1002794-0 |
| LDTM-028K | 1005447-1 |

North America

Measurement Specialties, Inc.
1000 Lucas Way
Hampton, VA 23666
Sales and Customer Service
Tel: +1-800-745-8008 or
+1-757-766-1500
Fax: +1-757-766-4297
Technical Support
Email: piezo@meas-spec.com

Europe

MEAS Deutschland GmbH
Hauert 13
44227 Dortmund
Germany
Sales and Customer Service
Tel: +49 (0)231 9740 21
Technical Support
Tel: +49 (0)6074 862822
Email: piezoeurope@meas-spec.com

Asia

Measurement Specialties (China), Ltd.
No. 26 Langshan Road
Shenzhen High-Tech Park (North)
Nanshan District
Shenzhen, China 518107
Sales and Customer Service
Tel: +86 755 3330 5088
Technical Support
Email: piezo@meas-spec.com

## DEALER / REVENDEDOR

Brazil and South America / Brasil e América do Sul

Metrolog Controles de Medição


**Address / Endereço:**

Rua Sete de Setembro, 2656
13560-181 - São Carlos - SP
Brazil / Brasil

**Phone / Telefone:**

+55 (16) 3371-0112
+55 (16) 3372-7800

**Internet:**

www.metrolog.net
metrolog@metrolog.net


**www.metrolog.net**