

PIEZOELECTRIC SINGLE-CRYSTAL MATERIALS

# PIN-PMN-PT Single Crystal

**High piezoelectric response with elevated temperature capability for advanced transducer systems**

PIN-PMN-PT (PIMNT) single crystals combine strong piezoelectric and electromechanical performance with elevated transition and Curie temperature ranges. Multiple cuts, poling configurations and processed geometries support ultrasonic, sensing, actuation and advanced research programs.

## KEY FEATURES

- High piezoelectric response
- Elevated temperature capability
- (001) and (011) cut availability
- Custom dimensions and geometries
- Fine-ground or polished surfaces
- Silver and gold electrode options



## TYPICAL APPLICATIONS

### Medical Ultrasound

Advanced imaging transducers

### NDT & Ultrasonics

Inspection and acoustic sensing

### Sensors

High-response detection

### Actuators

Precision electromechanical motion

### Advanced R&D

Prototype and evaluation

# PIN-PMN-PT Single Crystal

PRODUCT DATASHEET

SPECIFICATION RANGES - (001)-CUT / <001>-POLED

### TYPE I

Lower PT-content range with high piezoelectric performance and elevated temperature capability.

### TYPE II

Higher PT-content range with high coupling and a higher Curie-temperature specification range.

| Property                                   | Unit              | Type I     | Type II     |
|--------------------------------------------|-------------------|------------|-------------|
| PT content                                 | -                 | Lower PT   | Higher PT   |
| Relative dielectric constant, $\epsilon_r$ | -                 | 4000-5000  | 4500-6500   |
| Dielectric loss, $\tan\delta$              | %                 | <0.8       | <0.9        |
| Piezoelectric constant $d_{33}$            | pC/N              | 1200-1600  | 1500-2200   |
| Piezoelectric constant $d_{32}$            | pC/N              | -(600-900) | -(700-1000) |
| Electromechanical coupling factor $k_{33}$ | -                 | 0.88-0.92  | 0.89-0.94   |
| Phase transition temperature $T_{rt}$      | °C                | 115-130    | 100-120     |
| Curie temperature $T_c$                    | °C                | 150-175    | 170-210     |
| Coercive field $E_c$                       | kV/cm             | 4.5-5.5    | 5.0-6.0     |
| Mechanical Quality Factor $Q_m$            | -                 | ~200       | ~180        |
| Density                                    | g/cm <sup>3</sup> | 8.12       | 8.12        |

~ indicates approximate value

### INTERPRETATION NOTE

Values shown are specification ranges intended for preliminary material selection. Final order specifications and acceptance criteria are subject to quotation and technical agreement. Performance can depend on composition, crystallographic orientation, poling configuration, geometry, processing and test conditions.

## (011)-Cut Is Also a Core Commercial Configuration

Main (011)-cut performance, including piezoelectric constants  $d_{32}$  and  $d_{15}$ , is provided on Page 3.

(011)-CUT SPECIFICATION RANGES

## Main performance for common (011)-cut configurations

| Property                                                       | Type I       | Type II      |
|----------------------------------------------------------------|--------------|--------------|
| Dielectric constant, $\epsilon_r$                              | 2500-3600    | 3500-6000    |
| Piezoelectric constant $d_{33}$ (pC/N)                         | 900-1200     | 1200-2000    |
| Piezoelectric constant $d_{32}$ (pC/N)                         | -(1100-1400) | -(1400-2200) |
| Piezoelectric constant $d_{15}$ , $P/(01-1)$ (pC/N)            | 2000-3300    | 3000-4500    |
| Piezoelectric constant $g_{15}$ , $P/(01-1)$ ( $10^{-3}$ Vm/N) | 45-55        | 55-65        |
| Piezoelectric constant $d_{15}$ , $P/(11-1)$ (pC/N)            | 3000-4500    | 4000-6500    |
| Piezoelectric constant $g_{15}$ , $P/(11-1)$ ( $10^{-3}$ Vm/N) | 45-55        | 55-65        |
| Electromechanical coupling factor $k_{32}$                     | 0.87-0.90    | 0.88-0.93    |
| Curie temperature $T_c$ (°C)                                   | 150-175      | 170-200      |

| AVAILABLE FORMS & PROCESSING |                                     |
|------------------------------|-------------------------------------|
| Cuts                         | (001), (011)                        |
| Forms                        | Plates, wafers, rings, rods, custom |
| Length                       | 1-70 mm                             |
| Width                        | 1-30 mm                             |
| Thickness                    | 0.1-10 mm                           |
| Surface                      | Fine ground, polished               |
| Electrodes                   | Silver, gold                        |

Mechanical Quality Factor  $Q_m$  is listed in the (001)-cut performance table on Page 2.

RFQ CHECKLIST

## Information for faster technical review

|                       |                                                           |
|-----------------------|-----------------------------------------------------------|
| Material / Grade      | PIN-PMN-PT (PIMNT); Type I / Type II / Recommend          |
| Cut / Poling          | (001), (011); specify direction or request recommendation |
| Geometry / Dimensions | Plate, wafer, ring, rod or custom; include tolerances     |
| Surface / Electrode   | Fine ground or polished; none, silver or gold             |
| Quantity / Volume     | Prototype quantity and expected production volume         |
| Application           | Ultrasound, NDT, sensor, actuator, R&D; or other          |
| Drawing               | Attach when available                                     |

Specification ranges are intended for material selection; final order specifications and acceptance criteria are subject to technical agreement.