

PHYSIK INSTRUMENTE

Piezo Technology Applications in MedTech & Industry



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Overview

Company Presentation

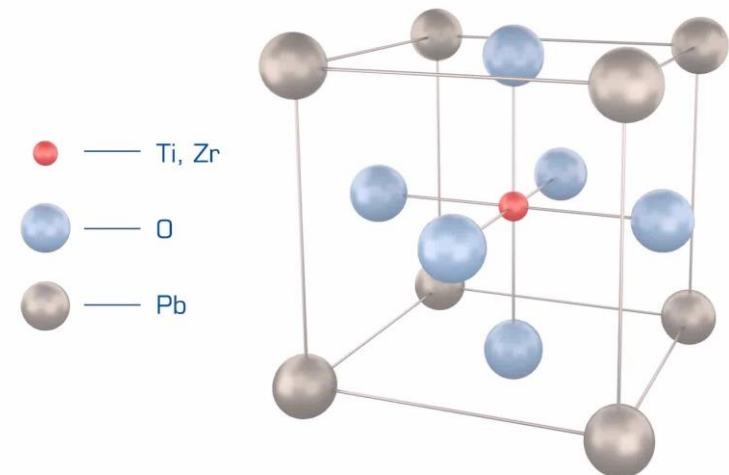
Piezo Technology - How can we help?

Our markets & Applications



The Magic Behind Piezo Technology

- Precise – picometer resolution
- Dynamic - microsecond response time
- Powerful - kilonewton force
- Energy efficient – no energy at rest
- Compact - mm and sub- mm size
- Bi-directional - sensor and actuator

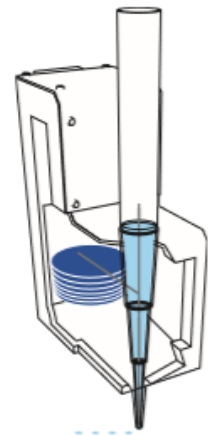


PIEZO TECHNOLOGY

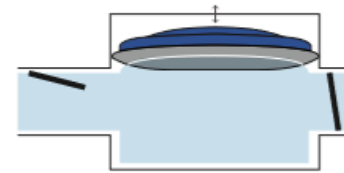


What's Possible?

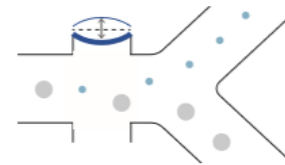
Numerous Functions – With the nature of Piezo Technology



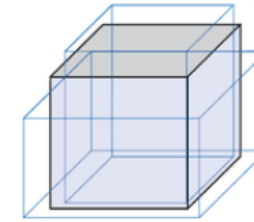
Dosing



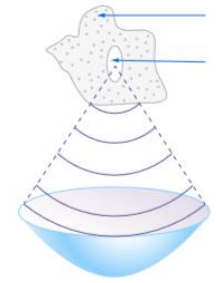
Pumping



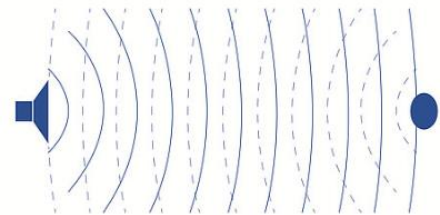
Sorting



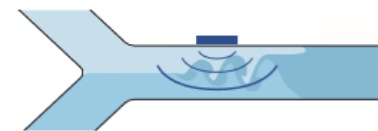
Positioning



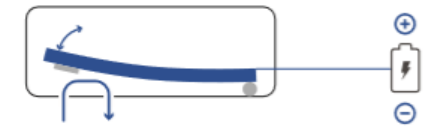
Manipulating



Sensing



Mixing



Regulating

PIEZO
TECHNOLOGY



Our Ambitious

IT'S
POSSIBLE



How Is It possible?

Standard Products

Dynamic



PICMA Piezo
Multilayer Actuators

Powerful



PICA Stack
Actuators

Energy Efficient



Piezo Components

Precise



Plug and Play Contacting

Compact



Miniaturized
Piezo Elements

Reliable



Ultrasonic
Transducers

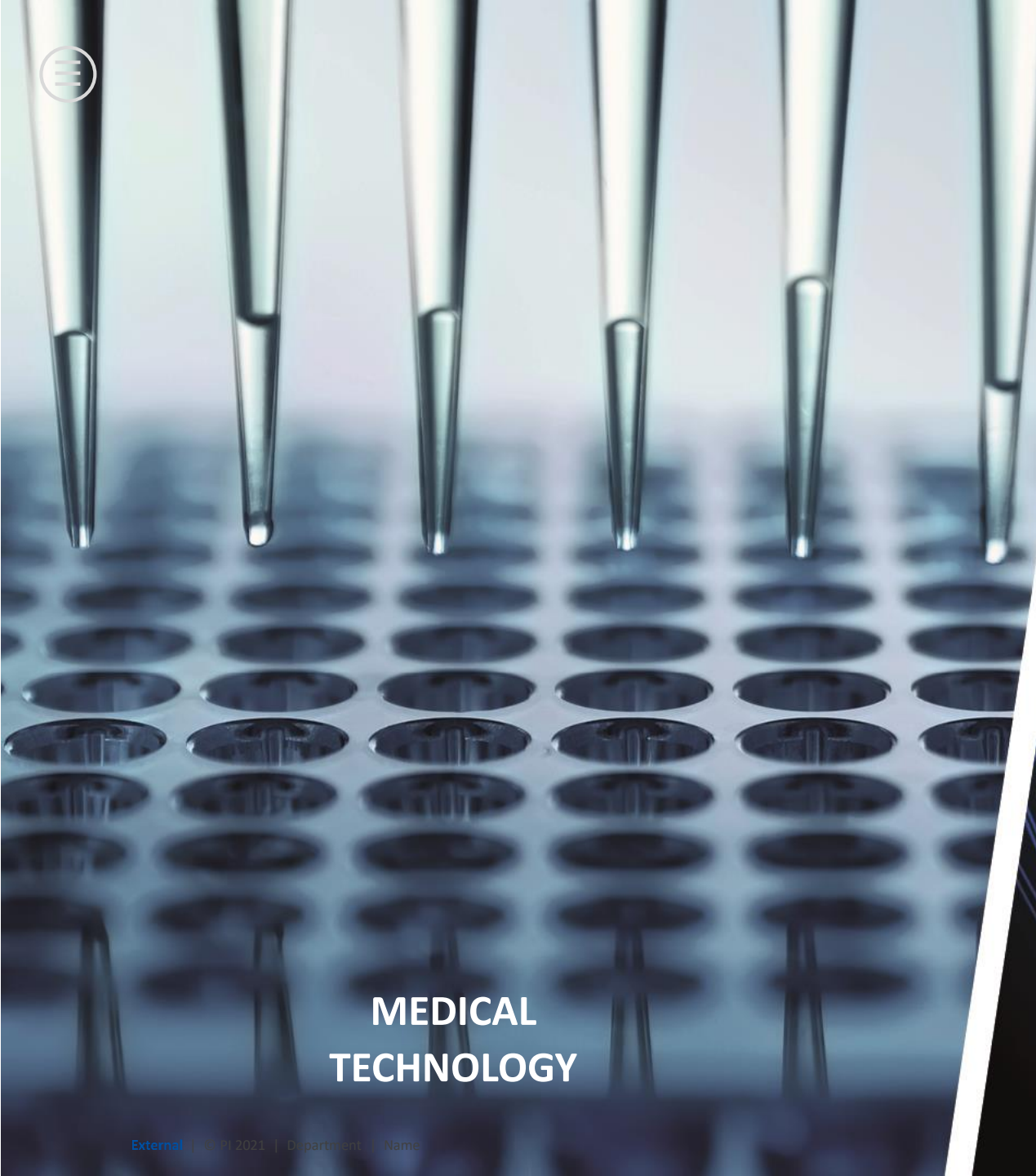
PIEZO TECHNOLOGY

Overview

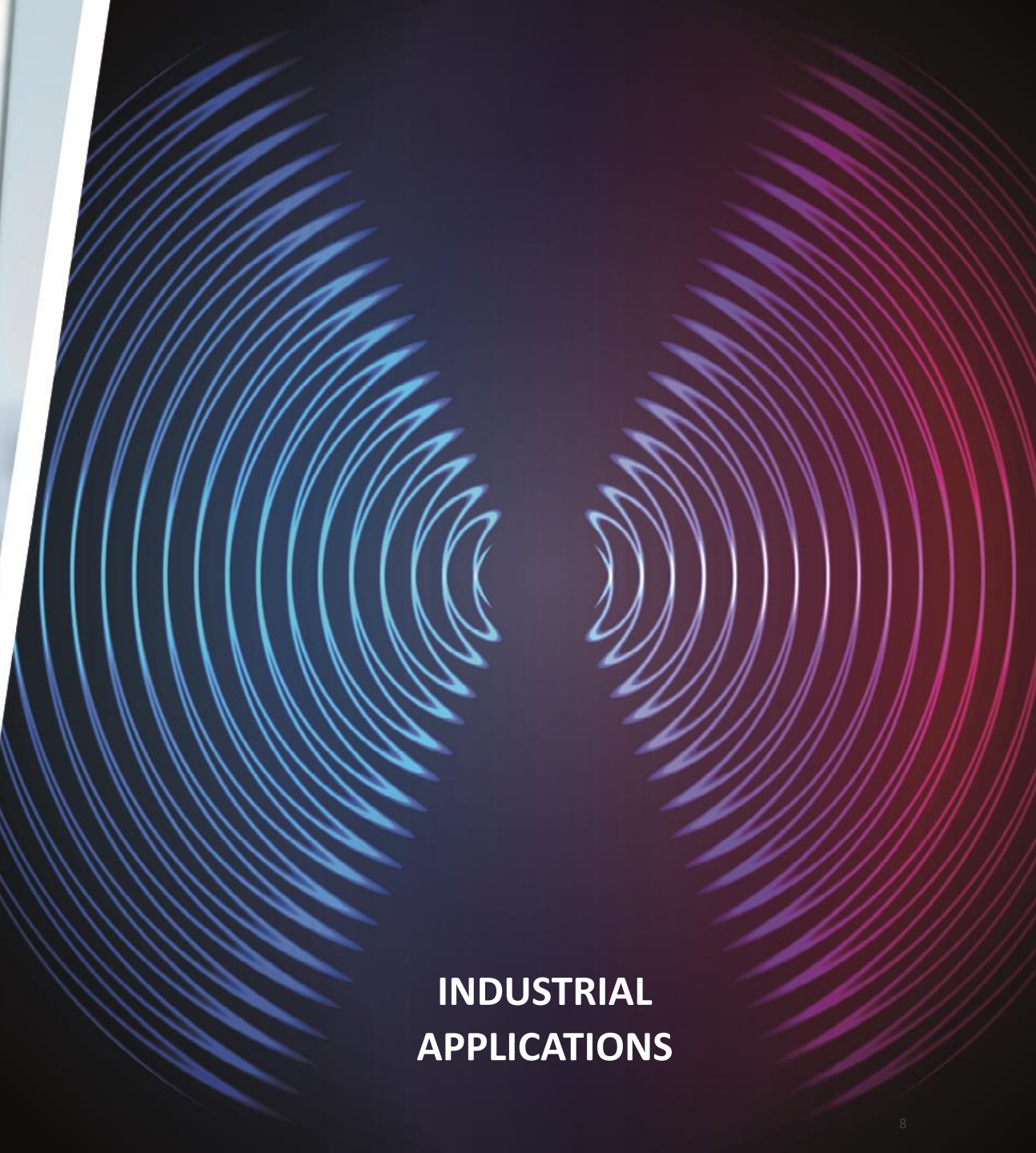
Company Presentation

Piezo Technology - How can we help?

Our markets & Applications



**MEDICAL
TECHNOLOGY**



**INDUSTRIAL
APPLICATIONS**



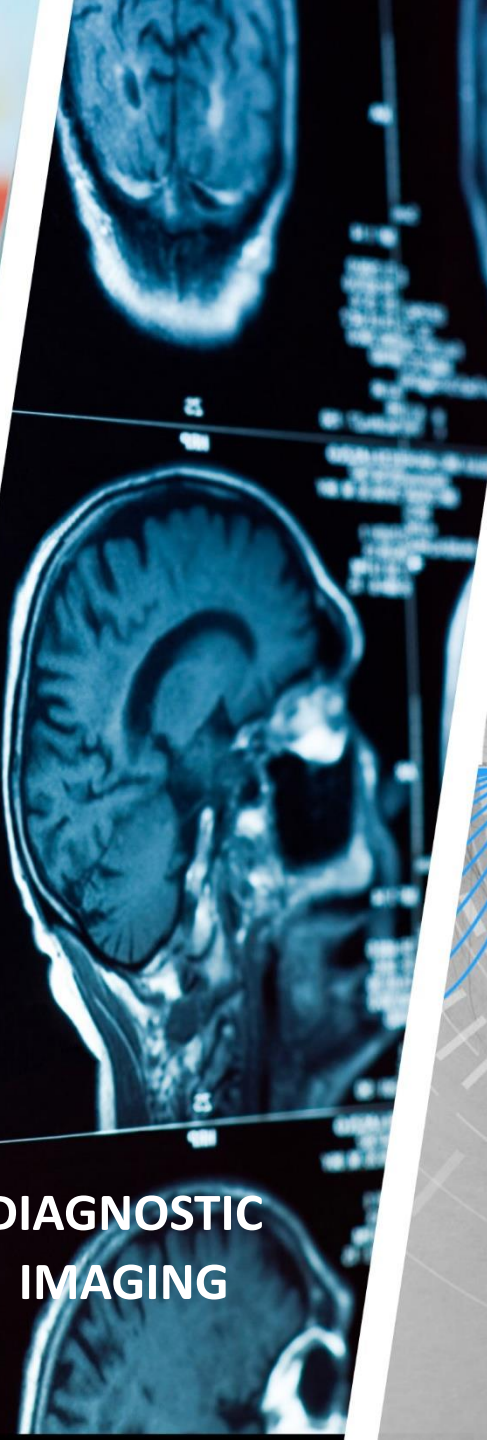
MICROFLUIDICS



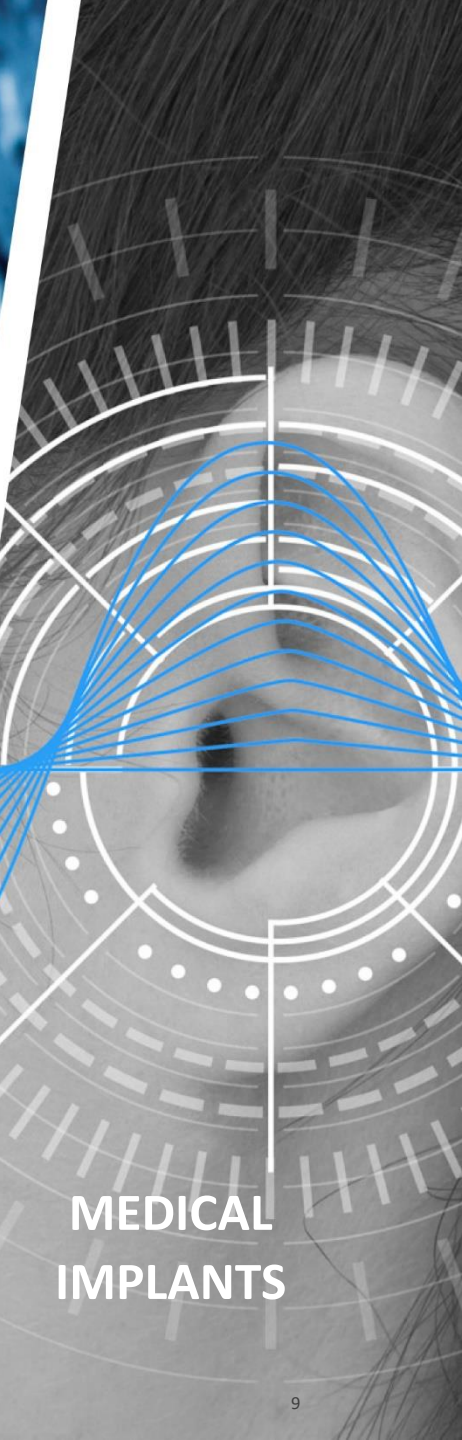
**THERAPEUTIC &
SURGICAL
INSTRUMENTS**



**MEDICAL
SENSORS**



**DIAGNOSTIC
IMAGING**



**MEDICAL
IMPLANTS**

Medical Technology

- Dynamic, reliable, and energy efficient piezo elements working as sensor or actuator
- Customized piezo elements with low operating voltage
- Various piezo geometries, e.g. miniaturized or with structured electrodes
- Plug-and-play transducers for medical smart metering
- Comprehensive assembling technology
- Manufacturing in cleanroom environment

+ Microfluidics

+ Medical Sensors

+ Therapeutic and Surgical Instruments

+ Diagnostic Imaging

+ Medical Implants

Expanding the Visual Field of Endoscopes

Application

- Smallest piezo tubes rotate optical fiber to enhance field of view in fiber scanning endoscopy
- Dynamic XY motion of segmented piezo tubes in mechanical resonance with 5 to 12 kHz
- Low operating voltages typically $< 50\text{ V}$
- Production of smallest piezo elements on the market with OD 0.45 mm, ID 0.2 mm



Customized piezo tubes with different electrode structures



Miniaturized components suitable for integration in endoscopes

Generating Minimally Invasive Ultrasound within the Body

Application

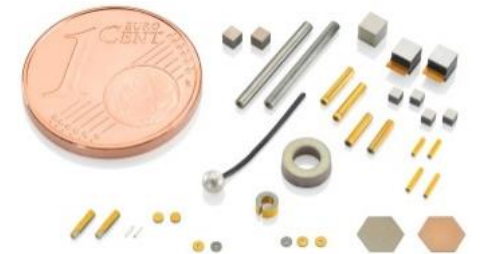
- Piezoelectric transducers project ultrasonic focus into the body to manipulate specific tissue areas
- Development of customized transducers, e.g. for high intensity focused ultrasound (HIFU)
- Assembling technology of curved phased arrays
- Manufacturing of sophisticated focus elements
- Production of smallest piezo elements on the market



Special Curved phased arrays for focus steering in xyz direction



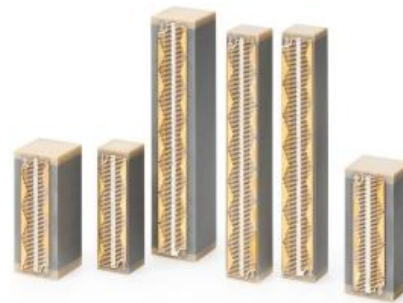
Customized focus bowl



Miniaturized piezo elements suitable for integration in catheters

Creating 3,000 Nanoliter Droplets per Second Application

- Handling of pico-liter liquid volumes even of highly viscous media and biological samples
- Contactless and contamination-free high-speed jet dispensing of perfect droplets
- Dynamic motion of piezo elements up to 3 kHz
- Low operating voltage
- Customized designs even for small construction spaces



PICMA piezo multilayer actuators for dynamic dosing



Customized piezo tubes with different electrode structures



FLUID METERING



SENSOR DEVICES



HYDRO ACOUSTICS



PRECISION DOSING



Industrial Applications

- Customized transducers for industrial automation, smart metering, and hydro acoustics
- Your solution – from piezo components to complete transducers
- Value-added designs and FEM simulation capabilities
- Comprehensive assembling technology including gluing, soldering, and housing
- Characterization of sound fields and transducer performance
- Manufacturing in cleanroom environment

+ Fluid Metering

+ Sensor Devices

+ Hydro Acoustics

+ Precision Dosing

+ Vibration Damping



Contactless Monitoring of Liquids and Gases

Application

- Customized piezo elements and transducers for smart metering, e.g. flow measurement, bubble and level detection
- Comprehensive assembling technology even for complete transducers
- Value-added designs and FEM simulation capabilities
- Plug-and-play devices with, e.g., flexible circuit boards
- Characterization of sound fields and transducer performance
- Manufacturing in clean room environment



Piezo components



Plug-and-play piezo components



Customized transducers for smart metering



Communicating Under Water Over Long Distances

Application

- Customized piezo components for hydroacoustic applications
- Large geometries up to 150 mm
- Various electrode materials and structures
- Assembling and contacting on demand
- Customized piezo arrays and composites



Customized piezo spheres
and hemispheres



Large tubes



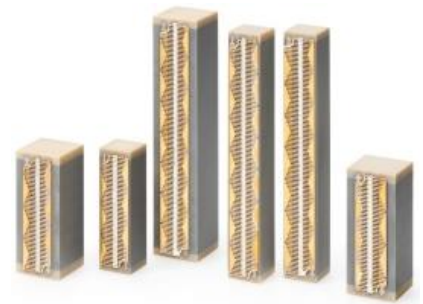
Phased array transducers
and composites



Ultrafast Dispensing of Adhesives and High Viscous Media

Application

- High-speed dispensing even of viscous media (solder paste, adhesions..)
- Precise handling of small liquid volumes down to the microliter range
- Contactless jet dispensing with reproducible conditions
- Low operating frequency
- Dosing frequencies up to 3 kHz
- Manufacturing in cleanroom environment



PICMA piezo multilayer actuators with low operation voltage



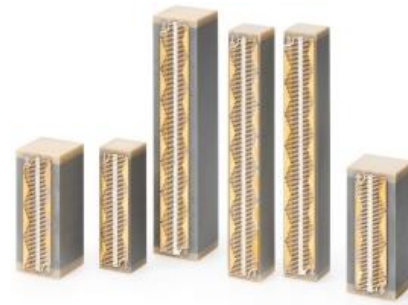
PICMA piezo multilayer actuators with optimized mechanical interface



Enabling 3D Printing with Different Materials

Application

- Powerful dispensing of highly viscous media such as polymers
- Customized PICMA piezo multilayer actuators with superior durability
- Piezo components with various geometries, electrode materials, and structures
- Comprehensive assembling technology
- Manufacturing in cleanroom environment



PICMA piezo multilayer actuators with low operation voltage



Piezo components



Vibration damping and cancellation of high loads

Application

- High load conditions in Semicon, Microscopy and Life Science
- Customized PICA actuators with special optimized durability
- Value adding assembling technology for customized mechanical, electrical and sensor interfaces
- Manufacturing in cleanroom environment



PICA Stack Piezo Actuators
High Forces, High Displacement



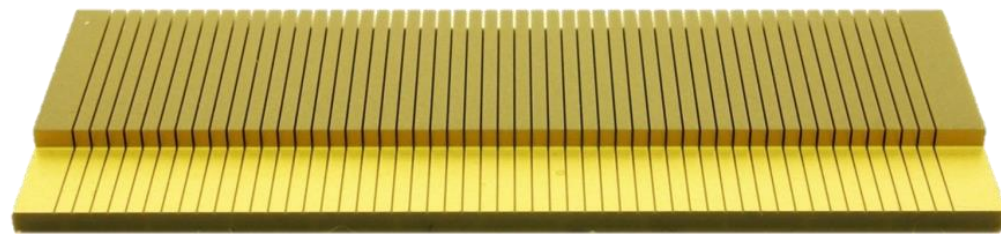
Customized PICA Stack Piezo Actuators with SGS and special mechanical interface



High-Performance Printing Using the Inkjet Process

Application

- Very high dynamic (x10kHz) dispensing of highly viscous fluids and inks with high image resolution
- Customized PICMA piezo multilayer actuators with superior durability
- Piezo components with various geometries, electrode materials and structures
- Sophisticated 3D “free-shape” material processing technology
- Manufacturing under clean room environment



Customized piezo multilayer
3D structured actuator array

PI

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