

PIEZOELECTRIC TRANSFORMERS FOR POWER CONVERSION

Tech ID: 33842 / UC Case 2025-062-0

PATENT STATUS

Patent Pending

BRIEF DESCRIPTION

The demand for miniaturized power electronics with increased efficiency and performance motivates the exploration of piezoelectric structures as alternative passive components; piezoelectric components store energy in mechanical compliance and inertia with extremely high quality factors and energy densities significantly greater than those of magnetics at small scales. Recent magnetic-less dc-dc converter designs based on single-port piezoelectric resonators (PRs) have demonstrated power stage efficiencies of 99% and PR power handling densities of up to 5.7 kW/cm³. While marking tremendous milestones, such performance has only been achieved in non-isolated dc-dc converters with mild (2:1) voltage conversion ratios, confining the utility of piezoelectric-based power conversion to a narrow subset of applications.

Piezoelectrics may be expanded to a broader set of applications through use of multi-port piezoelectric transformers (PTs), which offer the same advantages as PRs but with the added potential for galvanic isolation and inherent voltage transformation. The present invention overcomes standing performance shortcomings in isolated magnetic-less PT-based dc-dc converters, providing a framework for high-efficiency piezoelectric transformer (PT) designs (wherein isolated PTs serve as the primary passive components in isolated dc-dc converters). One of the proposed PT designs is validated in a dc-dc power converter prototype and demonstrates a peak efficiency of 97.5%. The measured performance represents a 17x reduction in loss ratio compared to previous isolated magnetic-less PT-based dc-dc converter designs, and expands the value of piezoelectrics to applications requiring isolation.

SUGGESTED USES

» Power converters, power management integrated circuits, impedance transformation, galvanic isolation

ADVANTAGES

- » 17x reduction in loss ratio compared to previous isolated magnetic-less PT-based dc-dc converter designs
- » Expands use of piezoelectrics as passive components to applications requiring isolation

CONTACT

Sabrina N. David
sabrina.david@berkeley.edu
tel: .



INVENTORS

» Boles, Jessica D.

OTHER INFORMATION

CATEGORIZED AS

- » **Energy**
- » Other
- » **Engineering**
- » Engineering
- » Other
- » **Sensors & Instrumentation**
- » Other

RELATED CASES

2025-062-0

RELATED MATERIALS

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Overtone Piezoelectric Resonator For Power Conversion](#)



University of California, Berkeley Office of Technology Licensing

2150 Shattuck Avenue, Suite 510, Berkeley, CA 94704

Tel: 510.643.7201 | Fax: 510.642.4566

ipira.berkeley.edu/ | otl-feedback@lists.berkeley.edu

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