Piezoelectric Resonators for Efficient Power Conversion

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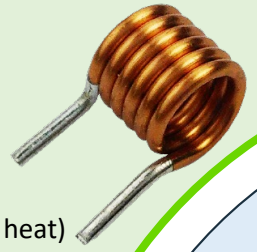
Introduction



Inductors, essential components in power conversion circuits, have many shortcomings due to their wire coil construction (right):

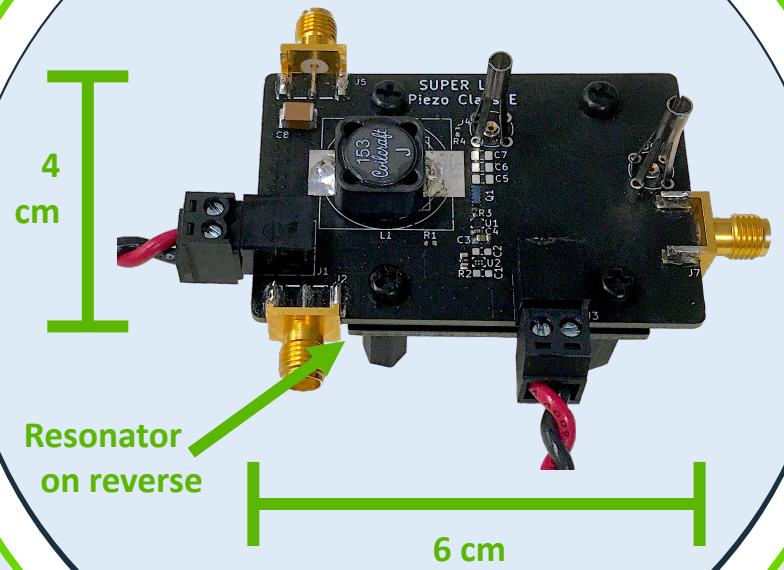
- Bulky form factor
- Large size
- Higher loss (less energy efficient, generate waste heat)

Piezoelectric resonators present a promising alternative:

- Planar form factor
- Reduced size
- Lower loss
- Higher power density

This poster outlines the design and performance of a Class E power converter using such a resonator in place of a traditional inductor-capacitor resonant network.

Class E Inverter with Piezoelectric Resonator



Materials And Methods

Piezoelectric materials generate voltage in response to mechanical stress and vice versa with very low loss

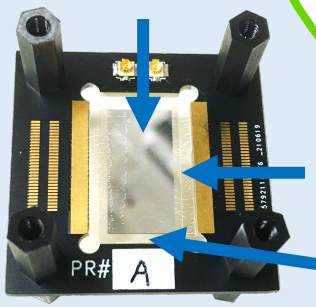
About the Class E inverter:

- DC-AC converter
- Low loss and highly efficient design

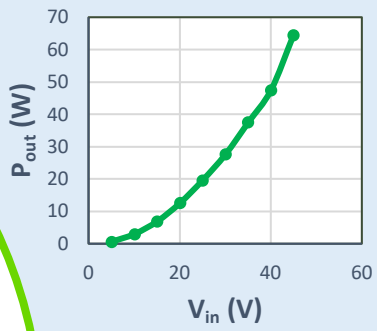
Applications:

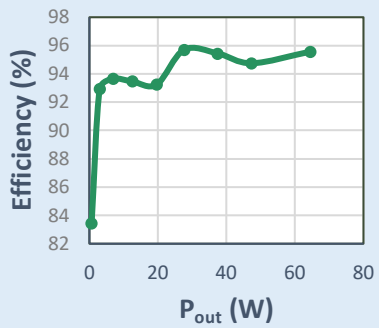
- Induction heating
- Wireless power transmission
- Communication

Class E inverter (center) built using resonator shown at right



Results





	Resonator	Comparable inductor
Working volume	100 mm^3	1,123 mm^3 (11.2x)
Loss	2.2 W	9.6 W (4.4x)

Converter performance:

- 50V maximum input voltage
- 64W maximum output power
- 96% peak efficiency

Conclusions

Piezoelectric resonators can enable power converters to be more power dense and efficient, factors which will be essential in our electrified future. Further discussion can be found in my paper, *Class E Power Amplifier with Piezoelectric Resonator Output Branch* (QR code at right), published through IEEE.