FRANÇAIS ENGLISH

cea leti

Piezo DC/DC Converter

PATENTS 21 PATENTS

An ultra-slim and lightweight converter for tomorrow's chargers

What it is

This CEA-Leti technology is based on a piezoelectric resonator: a disk made from lithium niobate. This material's unique properties allow it to temporarily store energy when it is subjected to a vibration. The device can be used in place of conventional inductors, whose copper coils store energy as a magnetic field.

This groundbreaking innovation is protected by 21 patents, covering both the conversion architecture and the manufacturing processes.

What it can do

This component is useful in any electrical conversion system:

- Chargers for consumer electronics (phones, laptops, displays, battery-powered hand-held tools, etc.)
- Aeronautics, drones, and satellites
- Electric vehicles
- Auxiliary systems for heavy vehicles, trains, etc.

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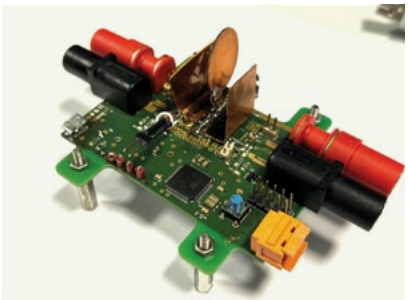
CARNOT Research for industrial innovation

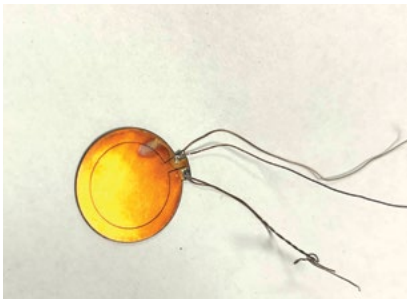
What makes it unique

Copper-coil inductors present disadvantages like their weight, potential for electrical breakdown at high voltages, increased losses at higher frequencies, limited power densities, and electromagnetic interference. CEA-Leti's device solves these problems, and offers added advantages:

- A monolithic piezoelectric component compatible with standard semiconductor manufacturing processes.
- Mass production for consumer applications, thanks to a reproducible, low-cost manufacturing process.
- Low losses for high efficiency and excellent voltage withstand capacity.
- Higher power capacities can be obtained by making the resonator disk larger or by stacking multiple disks.
- Enables very lightweight and thin power converters (chargers, power supplies).



▲ *6 MHz regulated power converter based on LNO piezoelectric material*



▲ *LNO piezoelectric resonator Ø18 mm × 0.5 mm*

Working with CEA-Leti

Companies of all types and sizes can partner with CEA-Leti to develop this technology for their chargers and power supplies, making them more slim and efficient. CEA-Leti partners benefit from the full range of CEA resources that contributed to this innovation, from the manufacture of resonators in a cleanroom to the development of the complete converter.
With expertise spanning all steps from materials to packaging, CEA-Leti can support its partners throughout the entire product development cycle.

Key figures

- Up to 1 kW per resonator
- Up to 5 kW per cm^3 of piezoelectric material

Scientific publications

- Marques, A., et al. (2025). *First 6 MHz 8-Phases Regulated LNO Based Piezoelectric DC-DC Converter.* IEEE SPEC.
- Breton, V., et al. (2023). *A New Isolated Topology of DC–DC Converter Based on Piezoelectric Resonators.* IEEE Transactions on Power Electronics, vol. 38 no. 8, pp. 10012-10025, doi: 10.1109/TPEL.2023.3276478.
- Touhami, M., et al. (2021). *Piezoelectric Materials for the DC-DC Converters Based on Piezoelectric Resonators.* IEEE COMPEL, pp. 1-8, doi: 10.1109/COMPEL52922.2021.9645999.

Interested in this technology?

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