Power Electronics Lab Update

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Outline

- Motivation
- Converter Topology
- Bench Results
- Next Steps

Motivation

Isolated DC-DC converters used in the lab's test rigs currently top out at 88% efficiency at rated load. This update covers a revised transformer winding that targets 94% while keeping the same footprint.

Converter Topology

The revised design keeps the full-bridge primary side unchanged and replaces the secondary winding with an interleaved layout.

$$\eta = \frac{P_{\text{out}}}{P_{\text{out}} + P_{\text{loss}}}$$

Interleaving halves the RMS current per winding segment, which is where most of the loss reduction comes from.

Primary turns	12
Secondary turns	6
Core	ETD49
Switching freq.	100 kHz

Bench Setup

- Electronic load swept 10–100% rated current
- Efficiency logged at 20 points per sweep
- Thermal camera on the transformer body

Full-load thermal images show a peak core temperature of 61°C, down from 79°C on the original winding.

Efficiency Curve

Efficiency rises steadily from light load and plateaus above 40% rated current, where interleaving pays off most.

- 20% load: 89.1%
- 50% load: 93.8%
- 80% load: 94.2%
- 100% load: 93.6%

Comparison

- Original winding
- Peak efficiency 88.3%
- Peak core temp 79°C

- Interleaved winding
- Peak efficiency 94.2%
- Peak core temp 61°C

Next Steps

- Repeat sweep at three ambient temperatures
- Move to a production-representative enclosure
- Draft the winding spec for the next board revision

Thank You

Questions and feedback welcome.

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