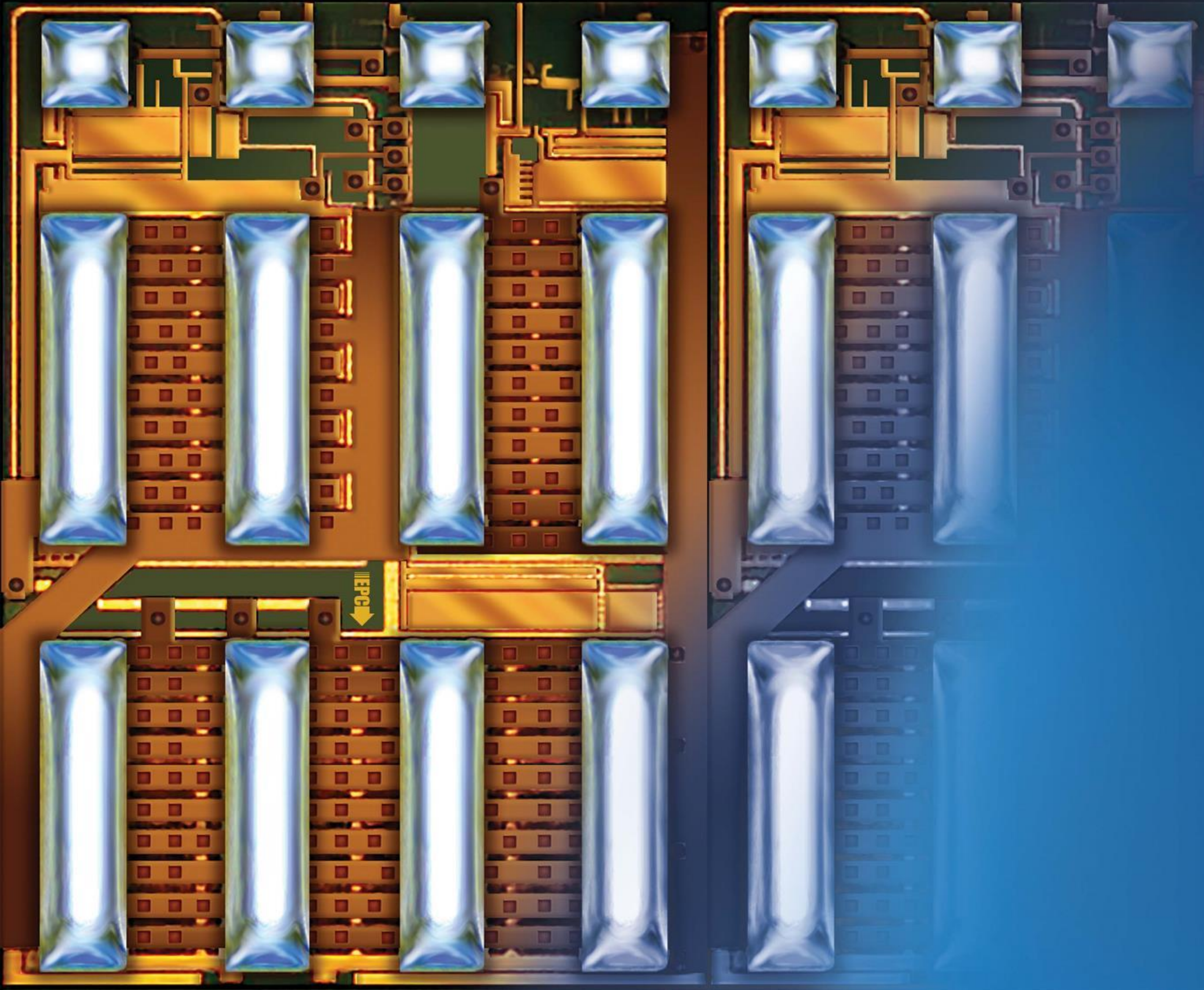


EPC9149 & EPC9174 Transformer Overview

EFFICIENT POWER CONVERSION

Specifications – EPC9149

Specification	Value	Units
Magnetizing Inductance	≈ 2.2	µH
Leakage Inductance	≈ 6.4	nH
Continuous Primary Current	21	A_{RMS}
Continuous Secondary Current	42‡	A_{RMS}
Primary turns	4	
Secondary turns	1	
Operating frequency	1	MHz
Construction	FR4 planar	
Series Resonant Capacitance	3.96	µF

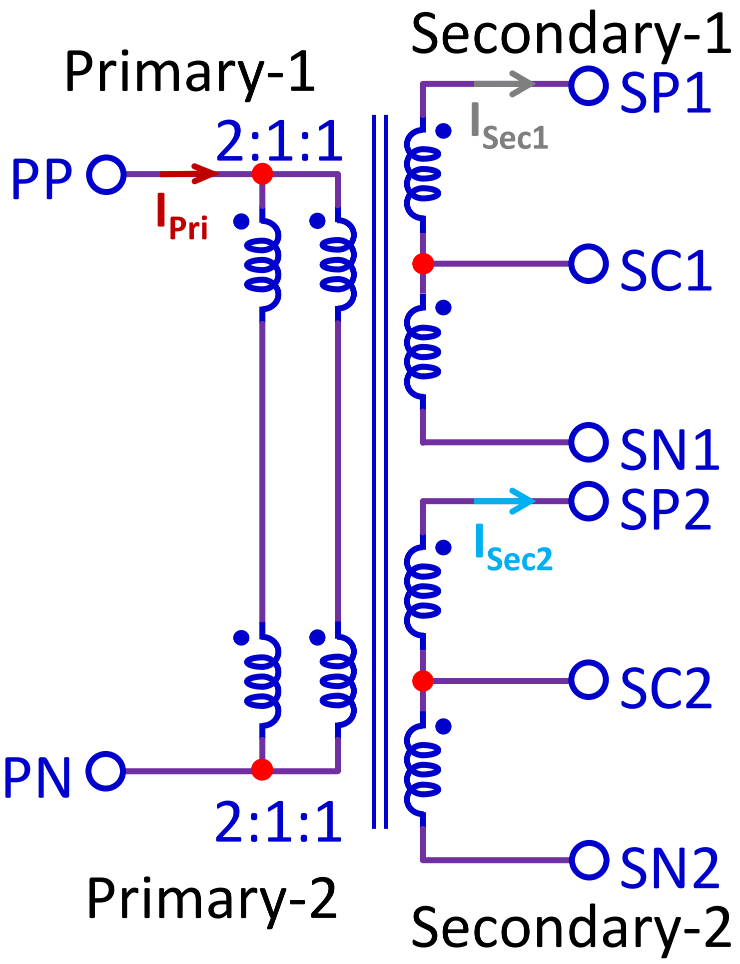
‡ Each half

Specifications – EPC9174

Specification	Value	Units
Magnetizing Inductance	≈ 1.8	µH
Leakage Inductance	≈ 6.4	nH
Continuous Primary Current	25	A_{RMS}
Continuous Secondary Current	50‡	A_{RMS}
Primary turns	4	
Secondary turns	1	
Operating frequency	1	MHz
Construction	FR4 planar	
Series Resonant Capacitance	3.96	µF

‡ Each half

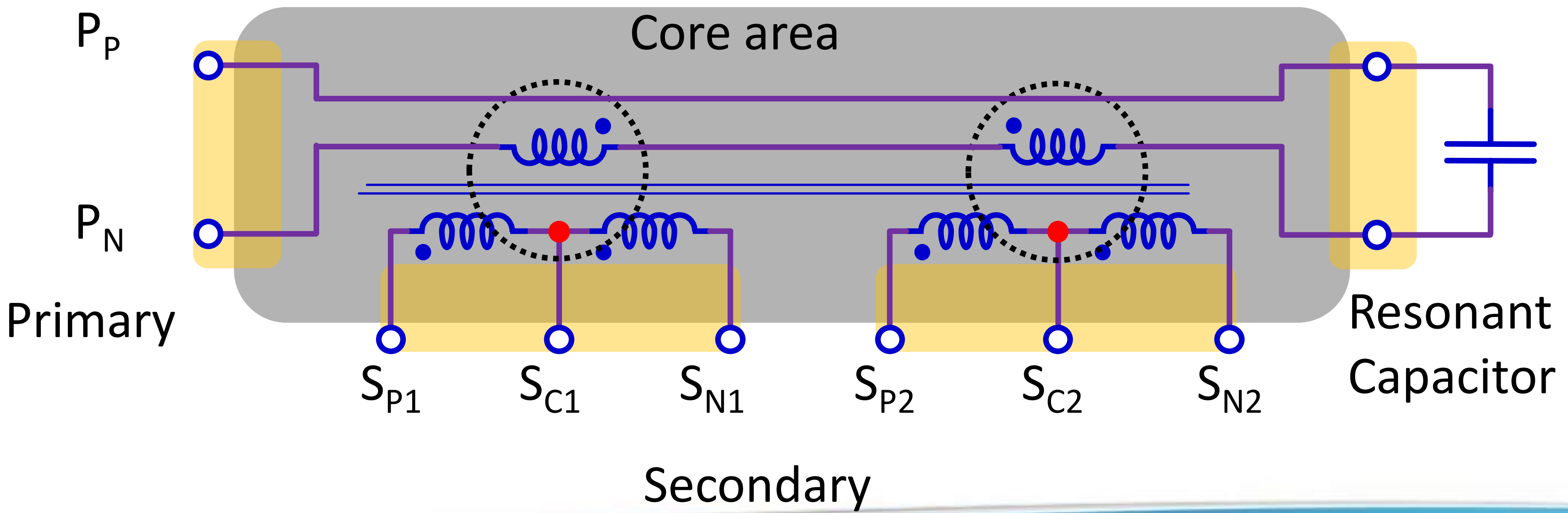
Transformer Schematic



Connection Overview

- Minimize power path losses
  - Primary side connection
  - Secondary bottom connection

Transformer connection locations

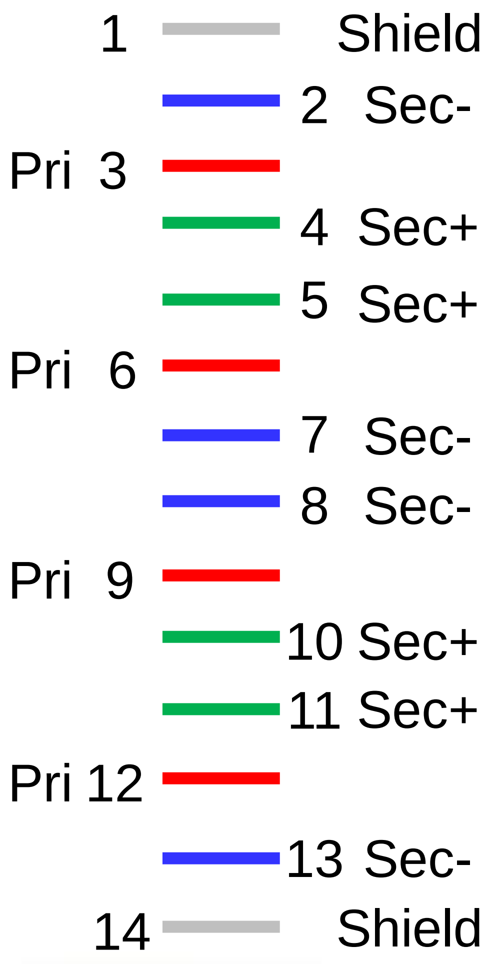


Layer Assignment & Details

*Image courtesy of Mohamed H. Ahmed from CPES at Virgina Tech, presented at PCIM 2019

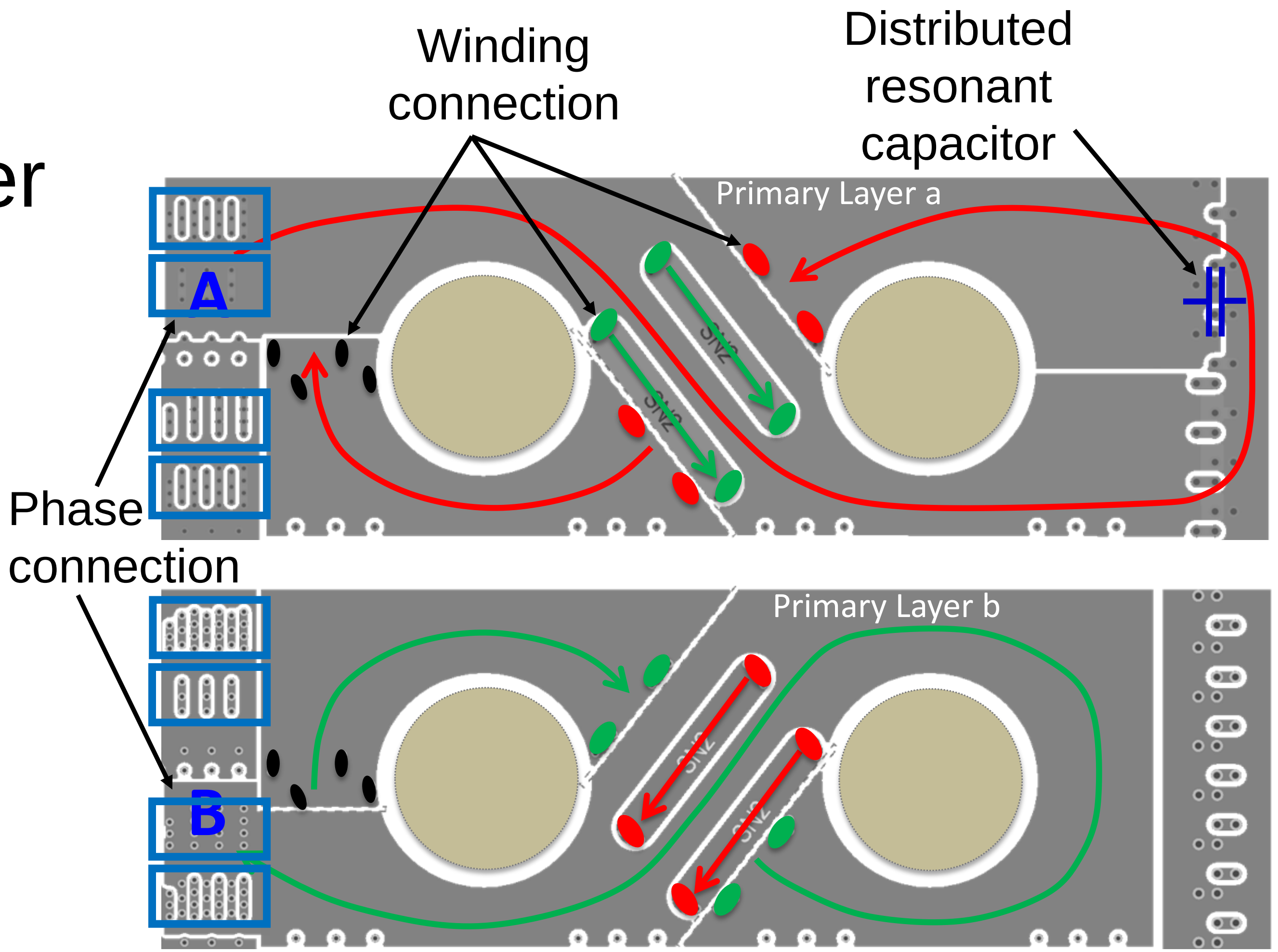
- 2 oz Copper thickness windings
- Interleaved windings for min. loss
- Low termination & via losses

Layer Stackup



Winding Details - Primary

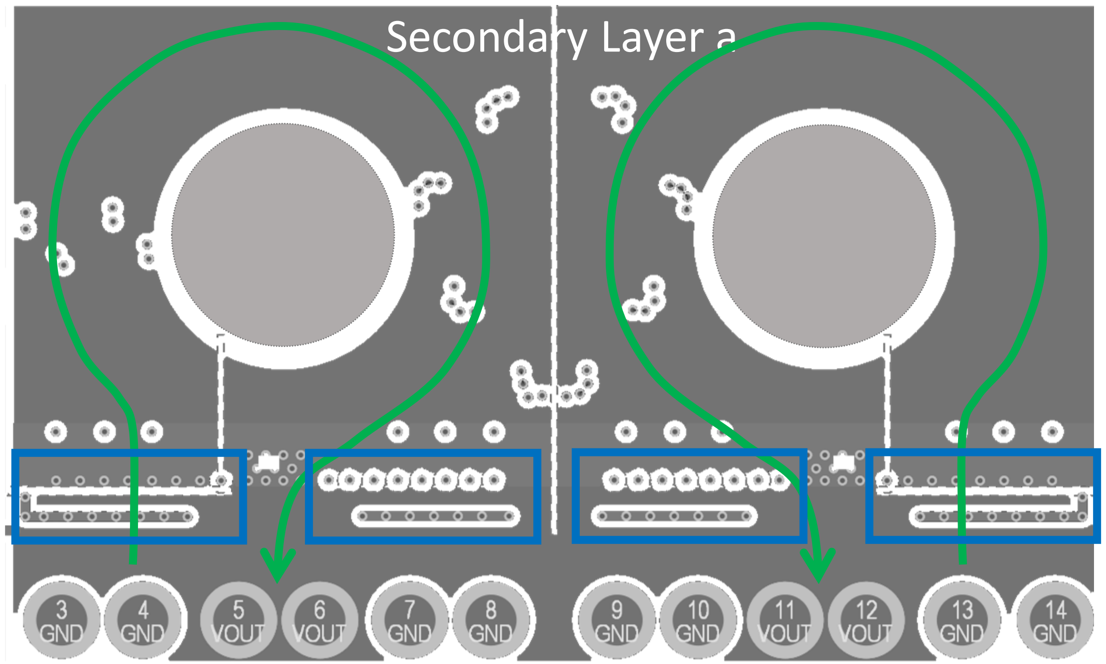
- Primary winding cross-over
- Opposite side resonant capacitor connection



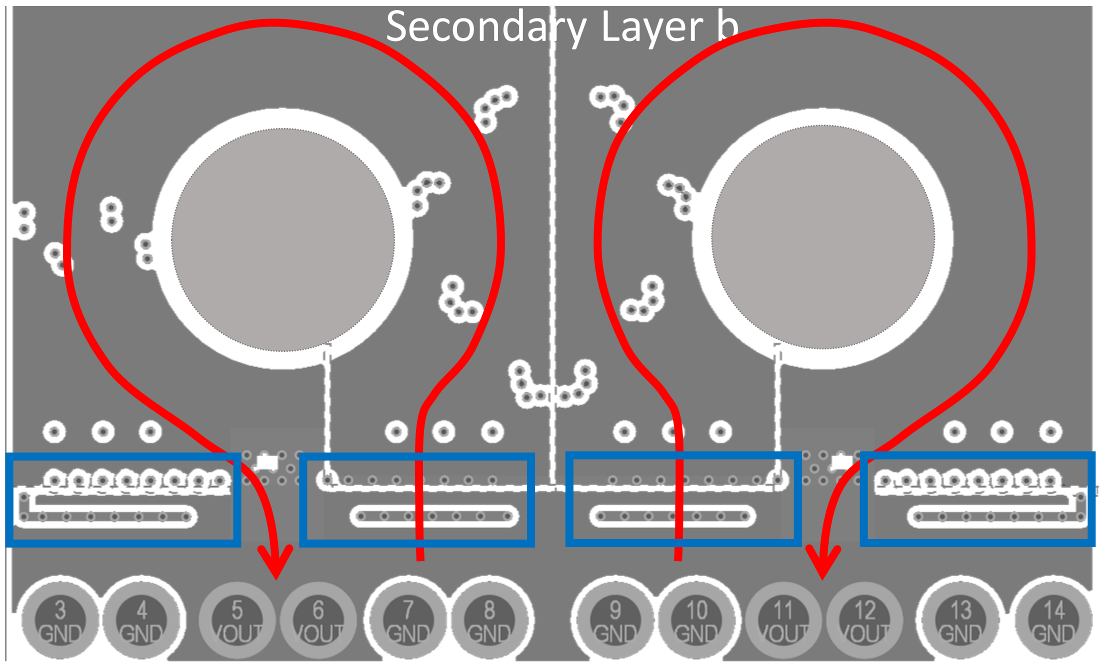
Primary winding design

Winding Details - Secondary

- Connections (FETs) part of winding
  - Eliminates leakage inductance



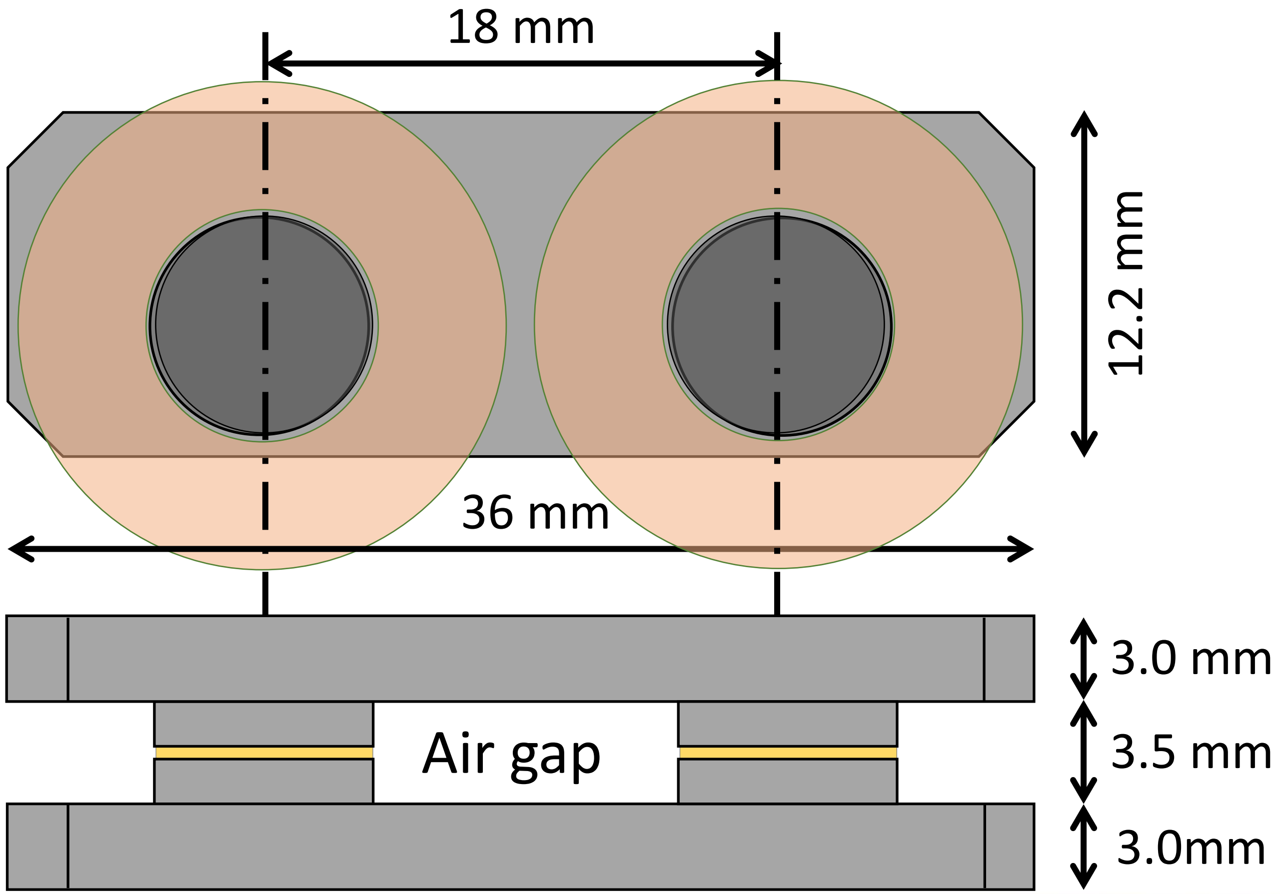
Positive Turns

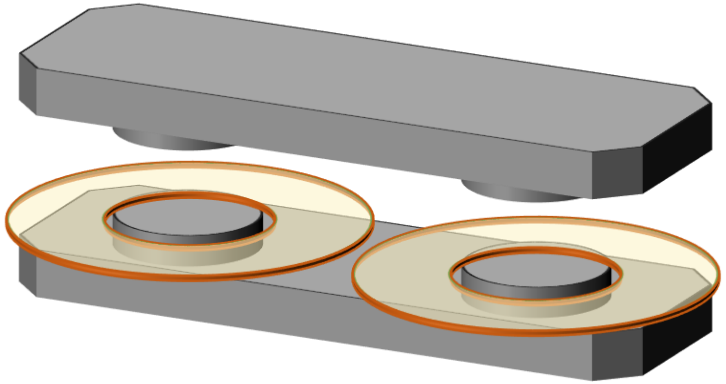


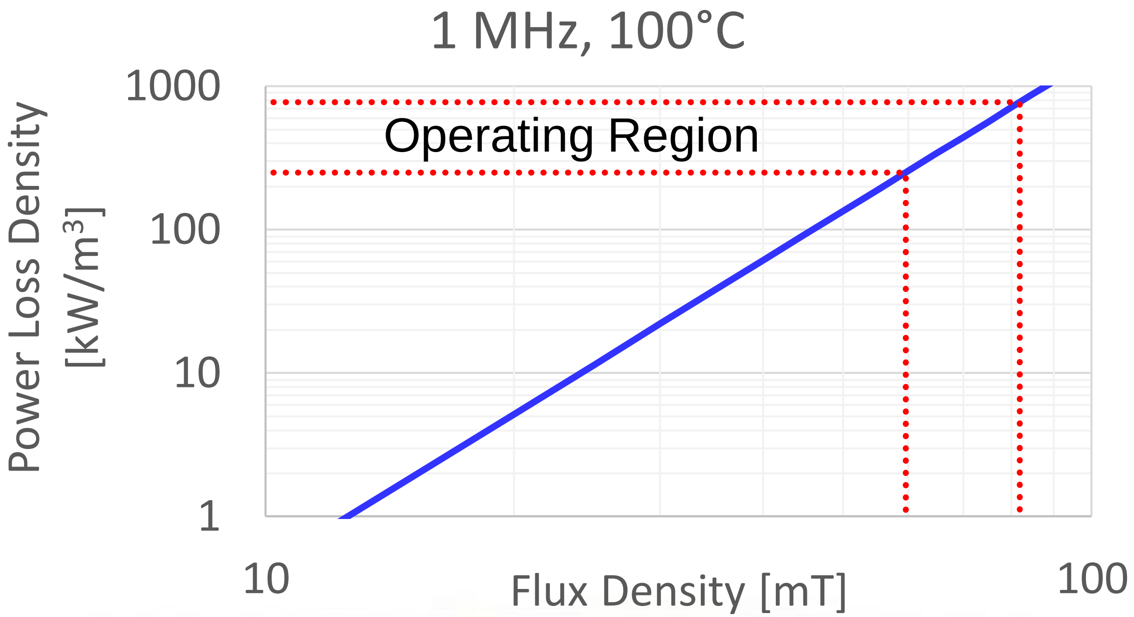
Negative Turns

Core Overview

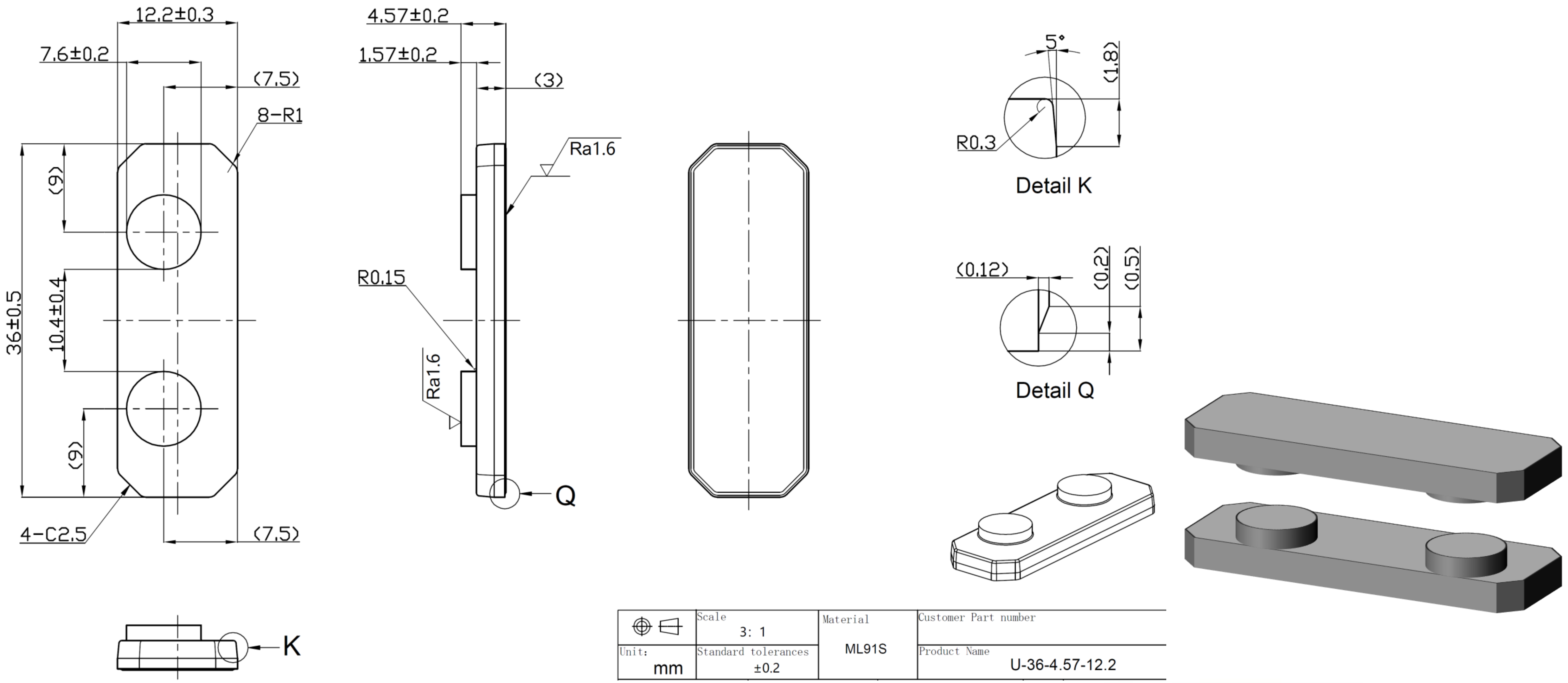
ML91S – Proterial (fka Hitachi metals): $\mu_c = 900$



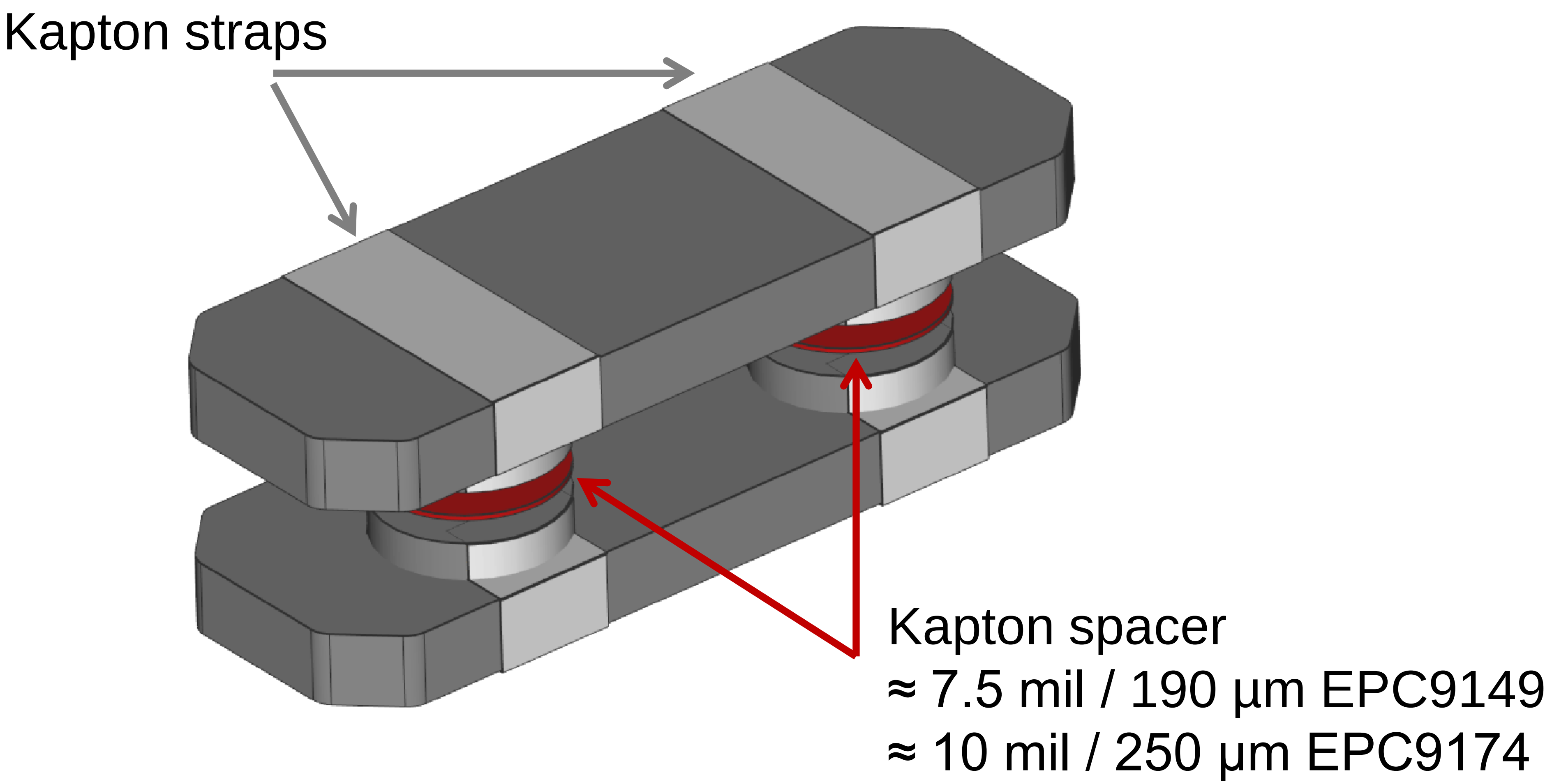




Core Drawing



Core Assembly



Estimated Loss Summary EPC9149

Operation at 1 kW

- Primary winding ≈ 2.6 W
- Secondary winding ≈ 2.1 W
- Core ≈ 1 W
- Actual losses may be higher

Exclusions:

- Proximity losses not calculated
- Fringing losses not calculated

Assumptions:

- Winding losses based on current density
- Core losses based on power loss density

Estimated Loss Summary EPC9174

Operation at 1.2 kW

- Primary winding ≈ 3.7 W
- Secondary winding ≈ 3.0 W
- Core ≈ 1.1 W
- Actual losses may be higher

Exclusions:

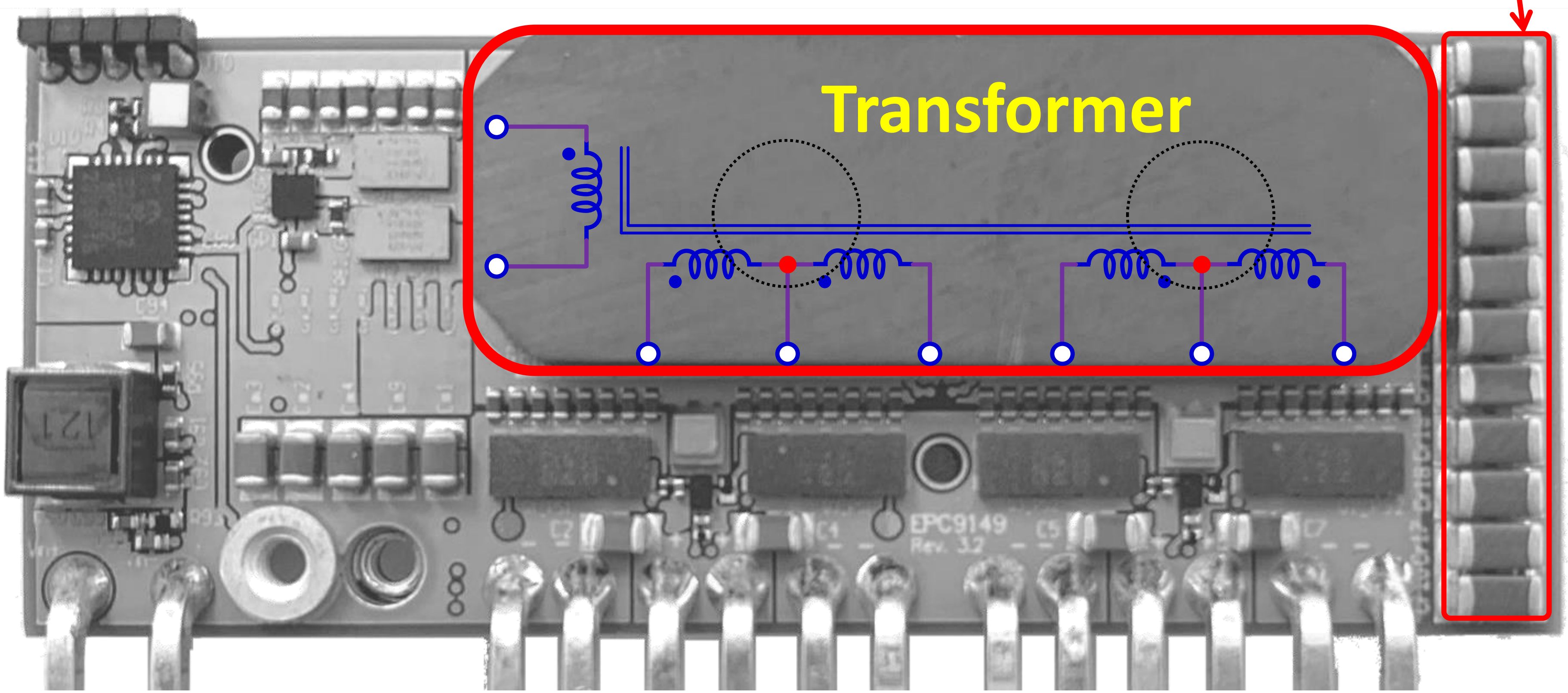
- Proximity losses not calculated
- Fringing losses not calculated

Assumptions:

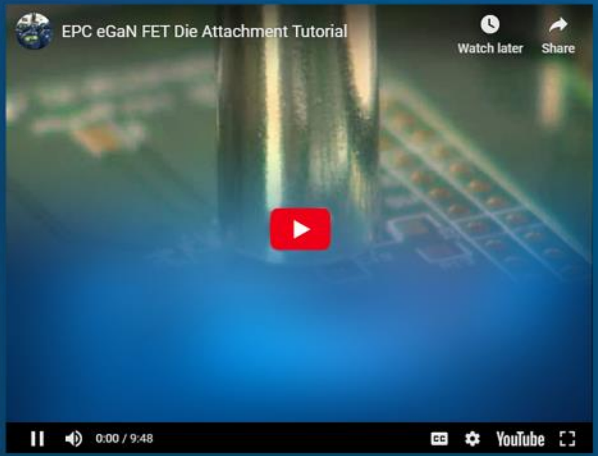
- Winding losses based on current density
- Core losses based on power loss density

Transformer Location on PCB

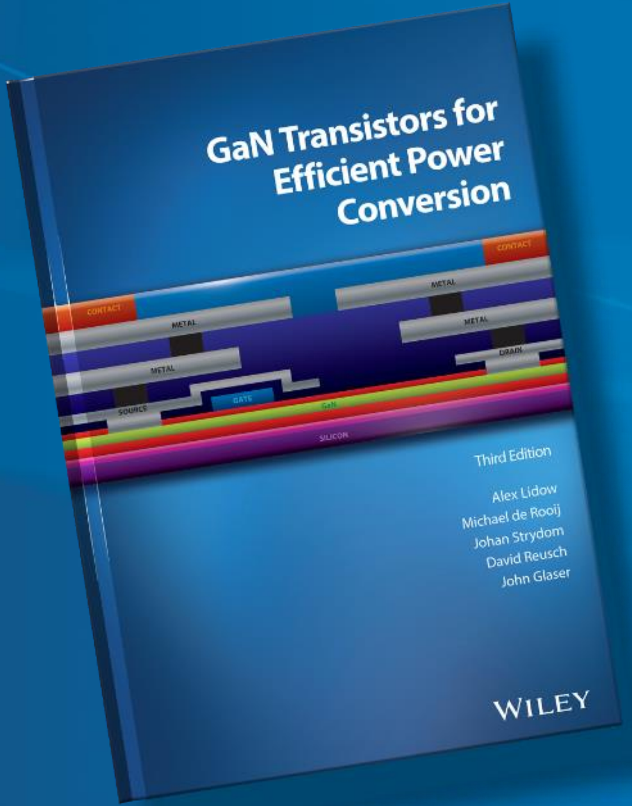
Resonant Capacitor Bank



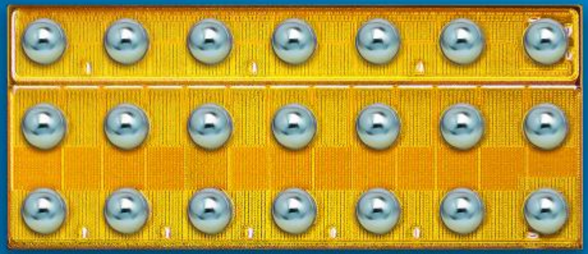
EPC
EFFICIENT POWER CONVERSION



How To GaN Video Series

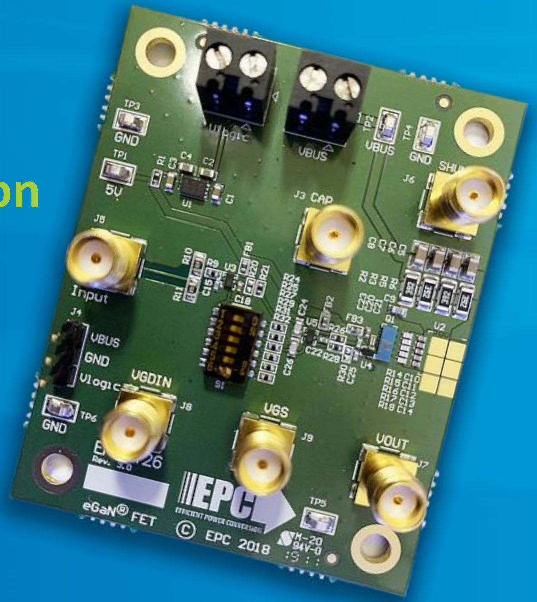


3rd Edition Textbook



eGaN® FETs and ICs

Evaluation Kits



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