Evaluation of ON-Chip Inductor and Transformer for Isolated Power-SoC

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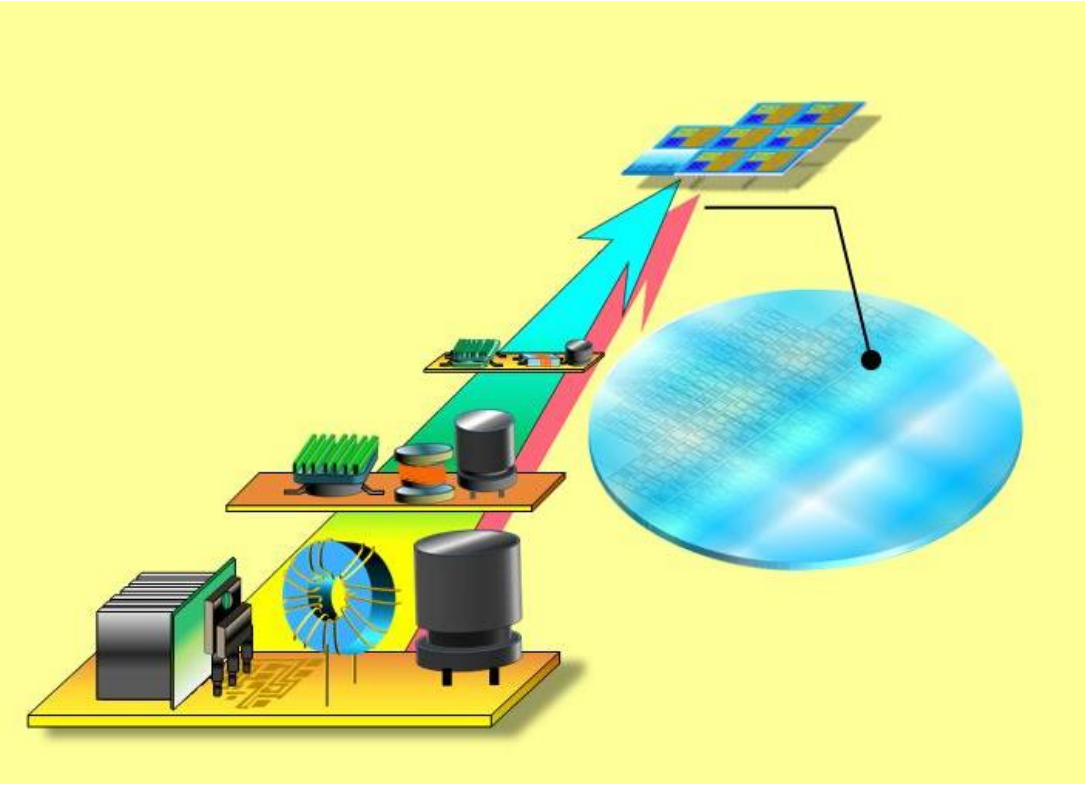
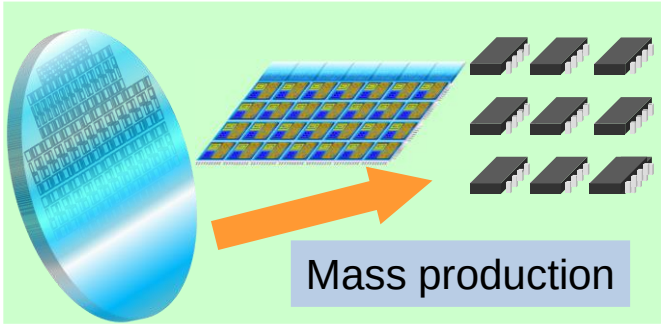
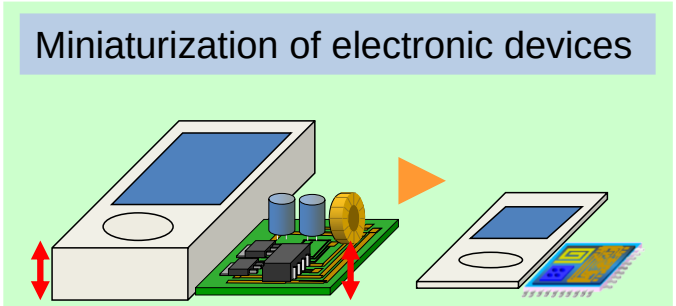
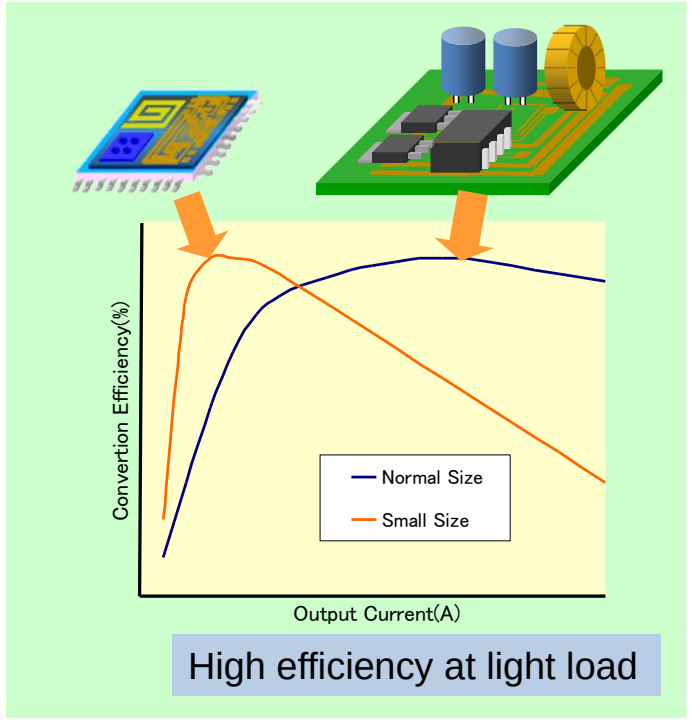
Introduction



Benefits of Miniaturization





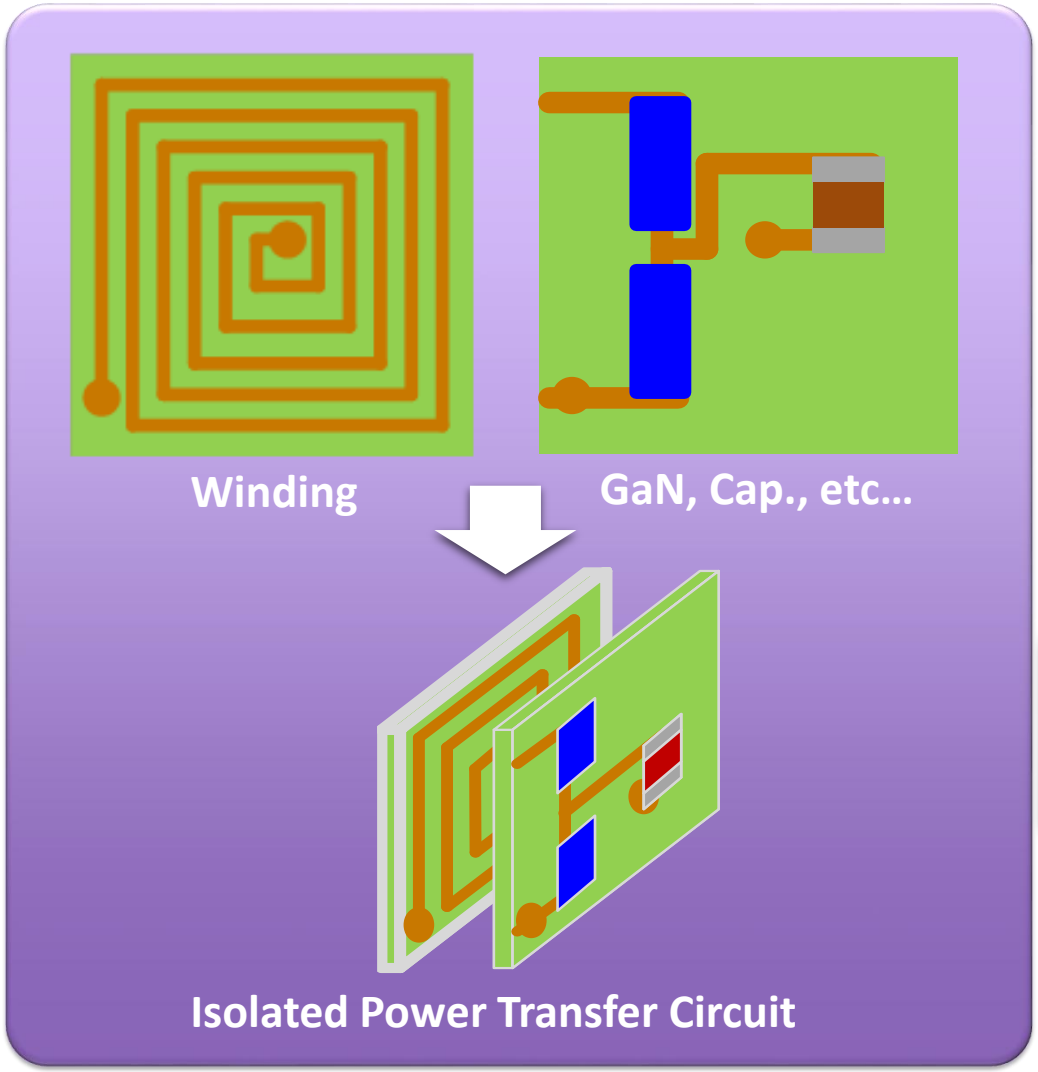


- Very High Frequency Switching→Problems of Magnetic Material (Ferrite, Thin Film)
- How to Isolation without Magnetic Material?

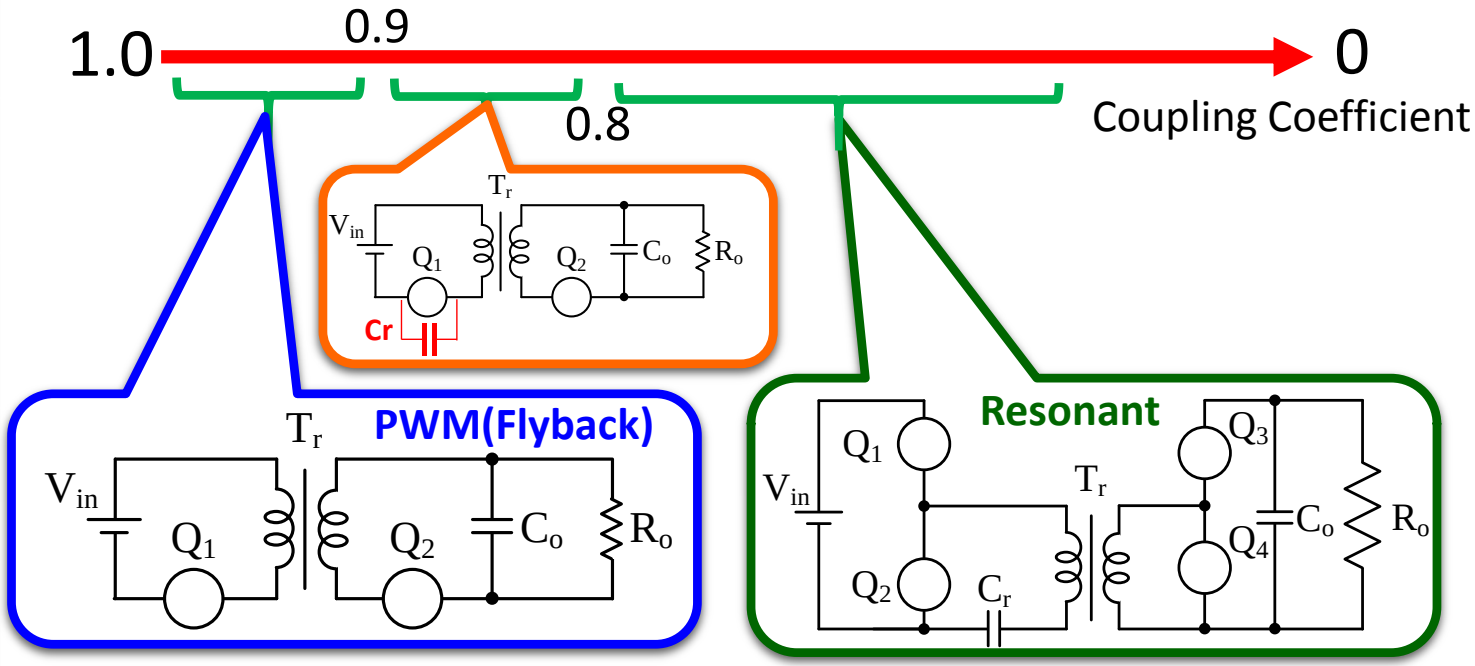
Isolated Power Transfer system based on Air Core Coil

1. Characteristics of Air Core Coil (Inductor) and Transformer
2. Consideration of Circuit Topology (Conventional PWM, Resonant)

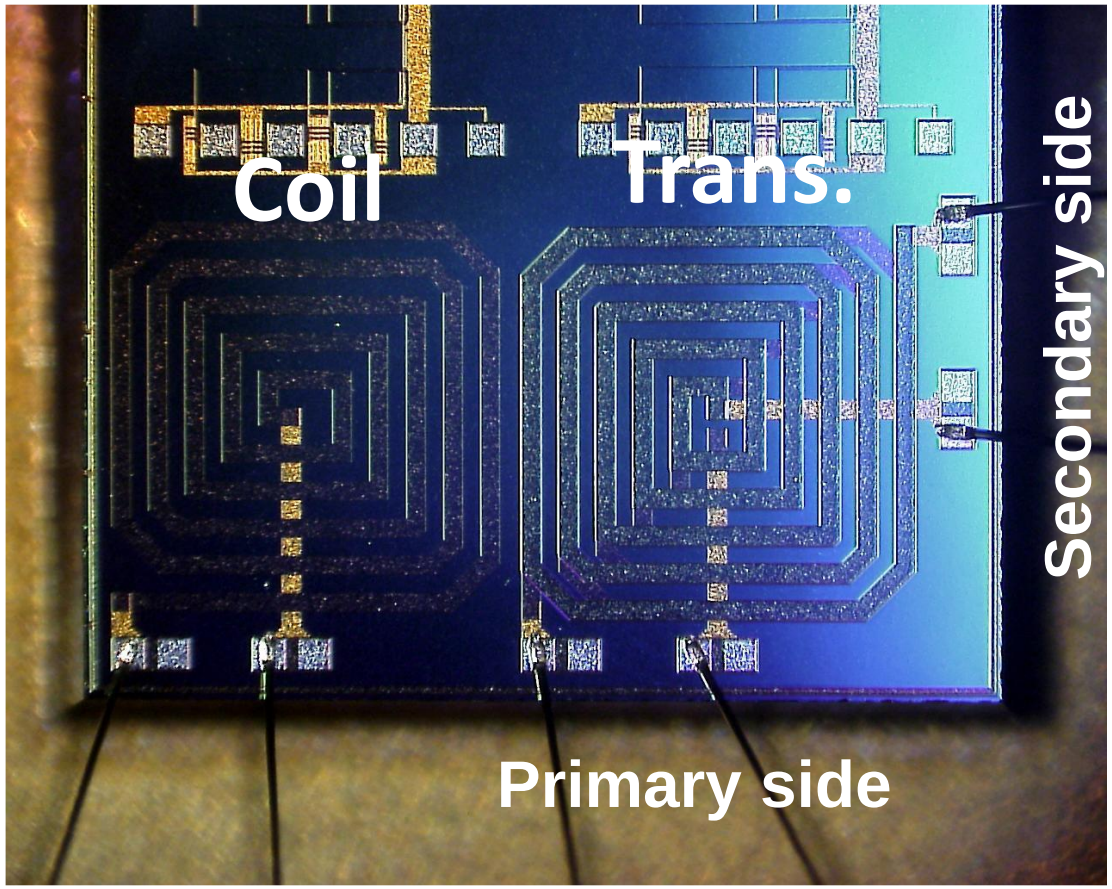
Concept of Isolated Power-SoC



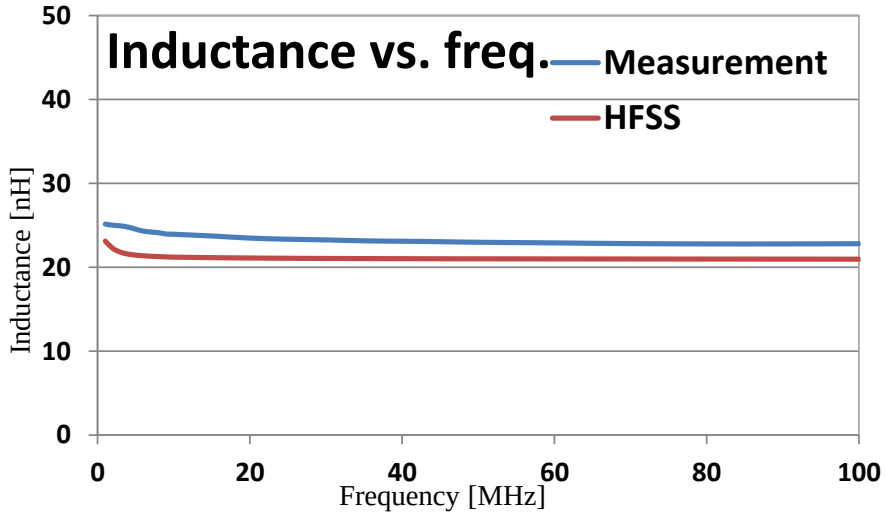
Circuit topology depends on coupling coefficient

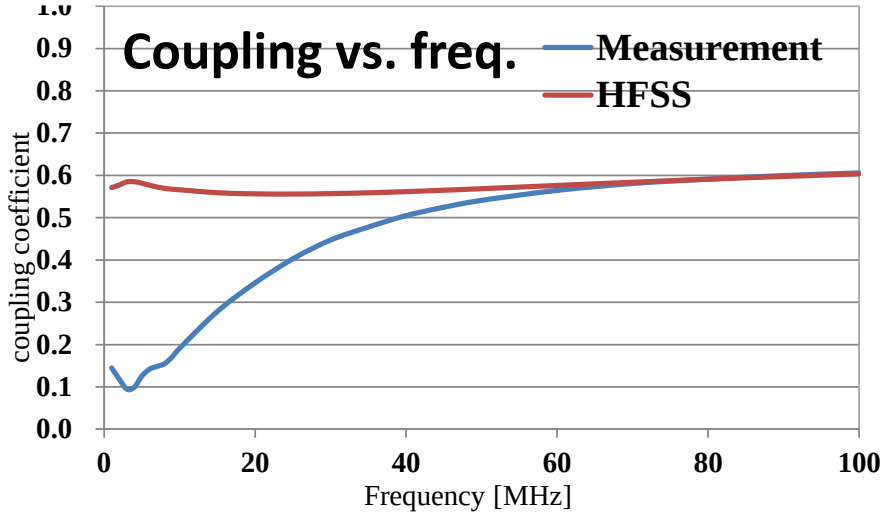


Air Core Inductor & Transformer



	Coil	Transformer
Size	1.05mm*1.05mm	1.05mm*1.05mm
Pattern Width	50um	50um
Turns	6	6
Thickness	1.7um	primary : 1.90um secondary : 0.77um
Coil Distance	–	0.95um



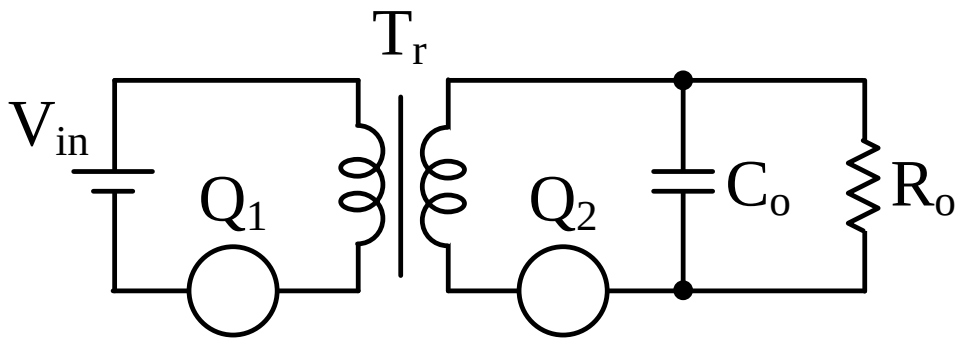


$$L = 4 \times W \times N^{2.5}\ [nH] \qquad R = 3 \times W \times N^{2.15} \times 10^{-5}\ [\Omega]$$

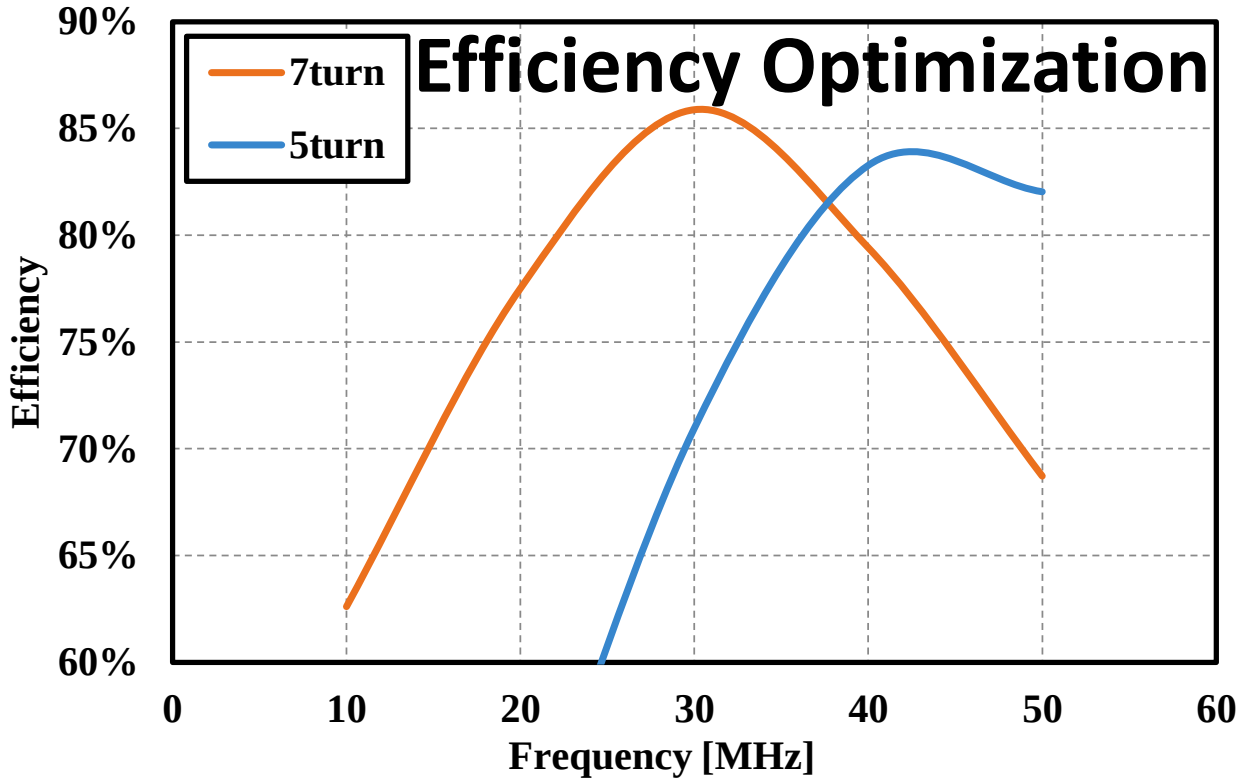
Input voltage : 5V, Output : 5V/0.1A

Switching frequency : 10-50MHz

Power Device : GaN-FET



Conventional Flyback converter



Conclusions

In this paper, the prototype on-chip coil and transformer are fabricated and evaluated. Moreover, the potential of the proposed contact-less isolated POL are simulated. As a result, the primary side inductance is 23nH, and the coupling coefficient of the transformer is 0.6. Moreover, the optimized simulated efficiency is 86% at switching frequency of 30MHz.