Fe-system magnetic flake composite planar inductor integrated for a SiP DC-to-DC converter (Invited e-poster)

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1. Abstract

- 0.5mm-high composite inductor offers 1~10 W solution in a 1~10 MHz range
- Ms=1.64 Tesla amorphous Fe-B-Si-C magnetic flake composite
- Planar toroidal inductor: Thinner than bulky ferrite inductors while thicker than sputter-deposited thin film inductors because of thick film composite of a high saturation moment magnetics.
- Integrated to a Buck converter module (1mm high, 6 MHz, 92%)

2. Objective

- Spec out converter performance
- Develop amorphous Fe-B-Si-C flake
- Design magnetic flake-aligned composite planar inductor
- Align magnetic flakes in inductor
- Examine inductor performance
- Examine SiP DC-to-DC converter performance

3. Fe-B-Si-C flake

- Saturation magnetization: 1.64 T (Fe-Si-B-C > Co-Fe-B-Si)
- Stress release annealing applied.

4. Magnetic flake alignment in inductor

- Aligned flakes along the flux line by physical force (Pressure is applied)

5. Buck converter efficiency

- Automatically optimize a number of phase (1 to 4 phase), depending on load.

6. Achieved performance

- Planar Inductor @6 MHz
  - Rated power: 5 W, Current: 1.4 A
  - Size: 3.0 (W) x 3.0(L) x 0.5 (H) mm³
  - L = 0.5 μH, R_DC<0.1 Ω, R_AC<2.0 Ω

- Buck Converter Module
  - Low profile : 1mm height
  - IN: 2.3~5.5 V, OUT: 0.6~3.3 V
  - Maximum Output Current : 1A
  - 6MHz switching frequency in PWM mode
  - Maximum efficiency : 92 % (3V/4V)
- Autonomous current share (1 to 4 phase) without external controller

Some More Details

- Flake & fabrication
- Inductor Performance
- Multi-phase converter performance
  - Will be published elsewhere

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