Power Micromodule with Embedded Inductor for DC-DC Buck Applications

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Abstract

- This poster presents a new development in power micromodules for low power DC-DC applications.
- This power module is a DC-DC buck converter for an input voltage range of 2.7V to 5.5V.
- The module is very small with lateral dimensions 3.2mm x 2.5mm x 1.6mm.

Introduction

- The market driven trend in power electronics is miniaturization of power supplies to achieve a higher power density and to increase the possibility for using such power circuits in portable electronic devices.
- Permanent increase of the switching frequency allows not only for miniaturization but also the integration of discrete components in the module.

Design

- The micromodule design is shown in the Fig. 1.

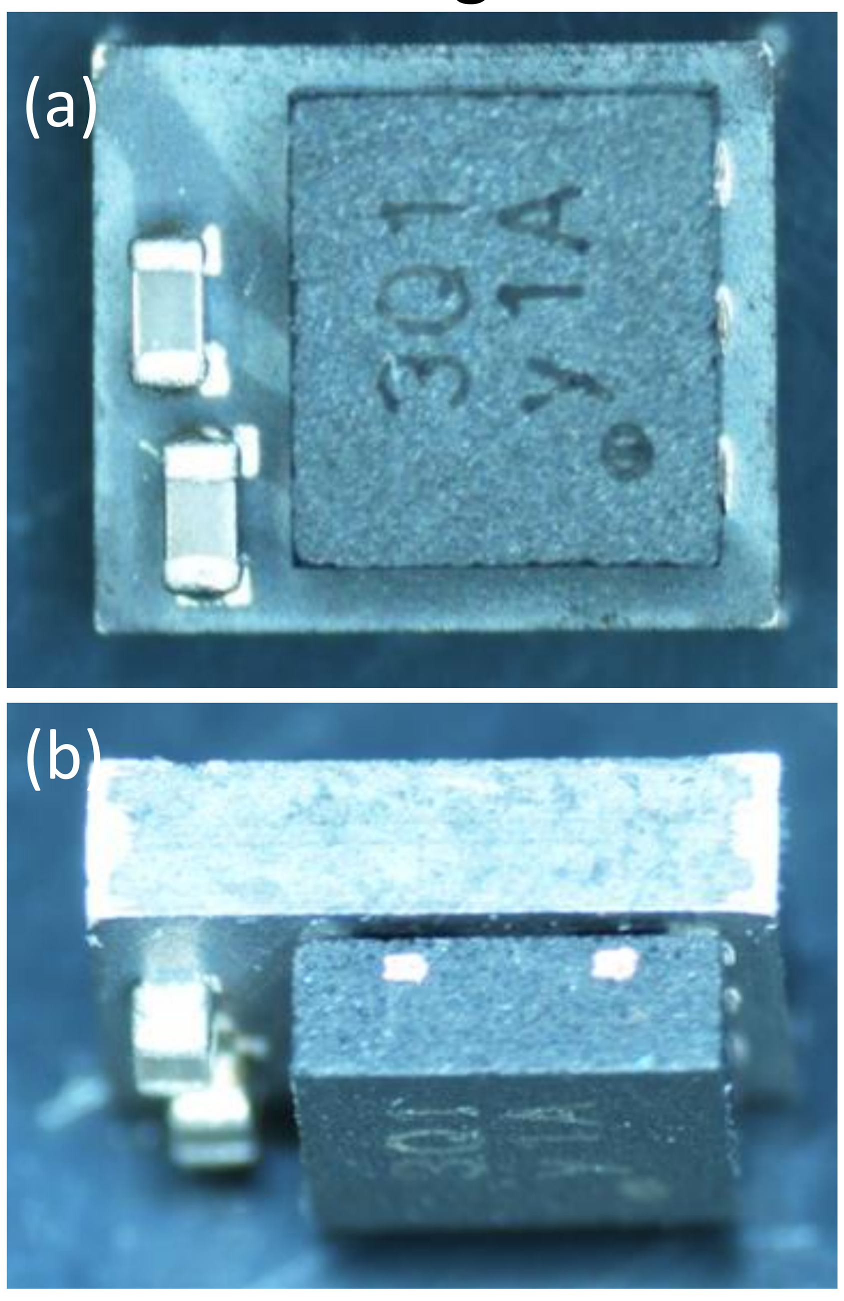

Fig.1: Design of power micromodule: top view (a) and lateral view (b)

- The micromodule is a step-down DC-DC converter for an input range of 2.7V – 5.5V.
- The output voltage is adjustable from 1.8V to 5V.

Design

- The switching frequency of the micromodule is 2.25MHz
- Maximum output current of module is 600mA.
- Within the package the IC, inductor, and input and output capacitors are integrated.
- For the fabrication, embedded inductor technology is applied.
- The inductor is both the substrate for the module and the inductor for the converter.
- The routing is realized through the embedded inductor and corner plating of the substrate (Fig. 2).
- Using this solution, the parasitics of the micromdule are significantly reduced.
- The embedded inductor has an inductance of 2µH
- The module is very small (EIA size 1210)

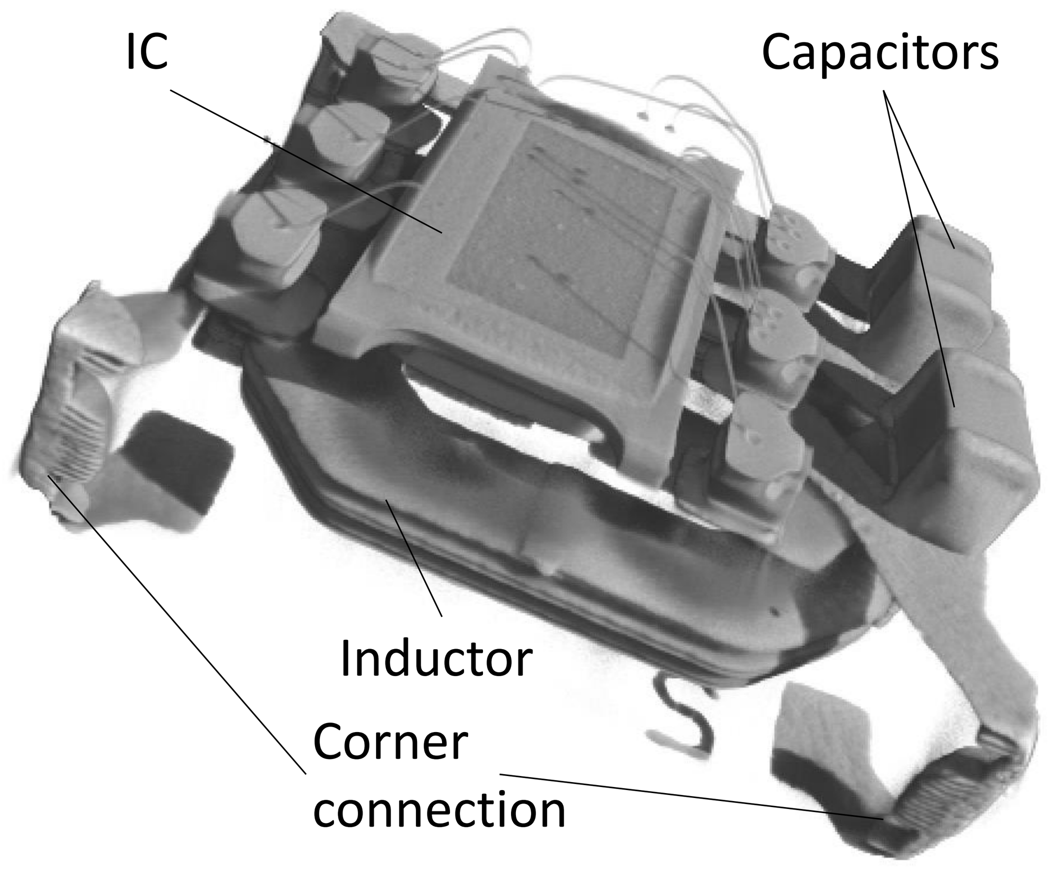

Fig.2: X-ray micrograph of completed micromodule

- Fig. 3 shows the pic configuration of the module

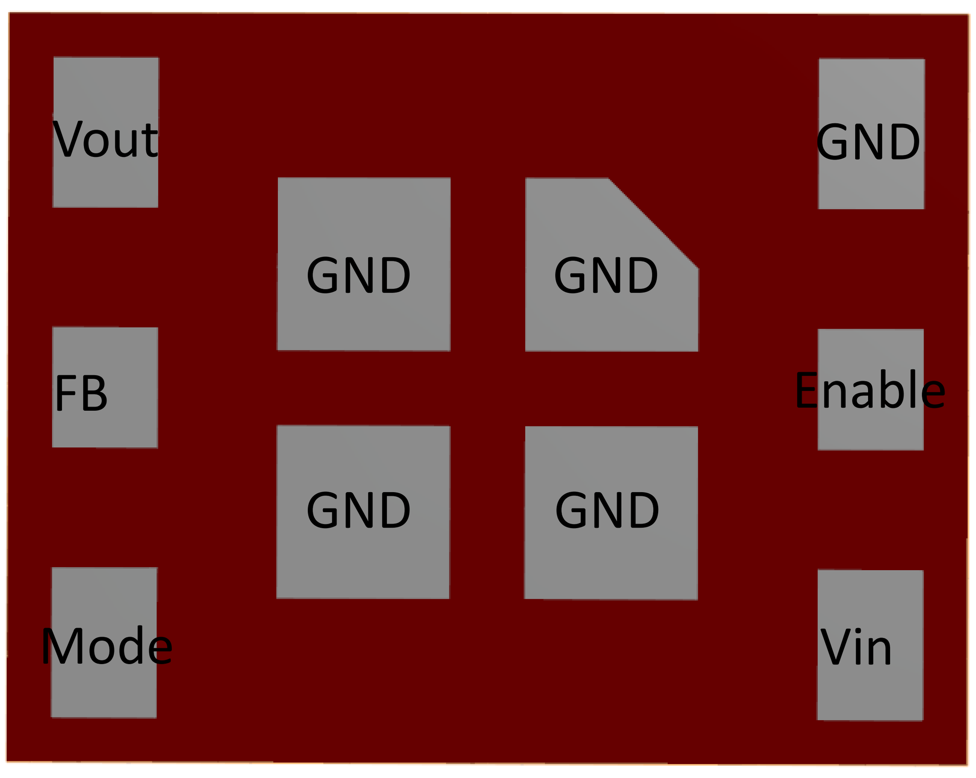

Fig.3: Pin configuration of the micromodule

Test Results

- Fig. 4 shows the efficiency measurements of the micromodule.
- Fig. 5 and Fig. 6 show the regulation properties of micromodule.

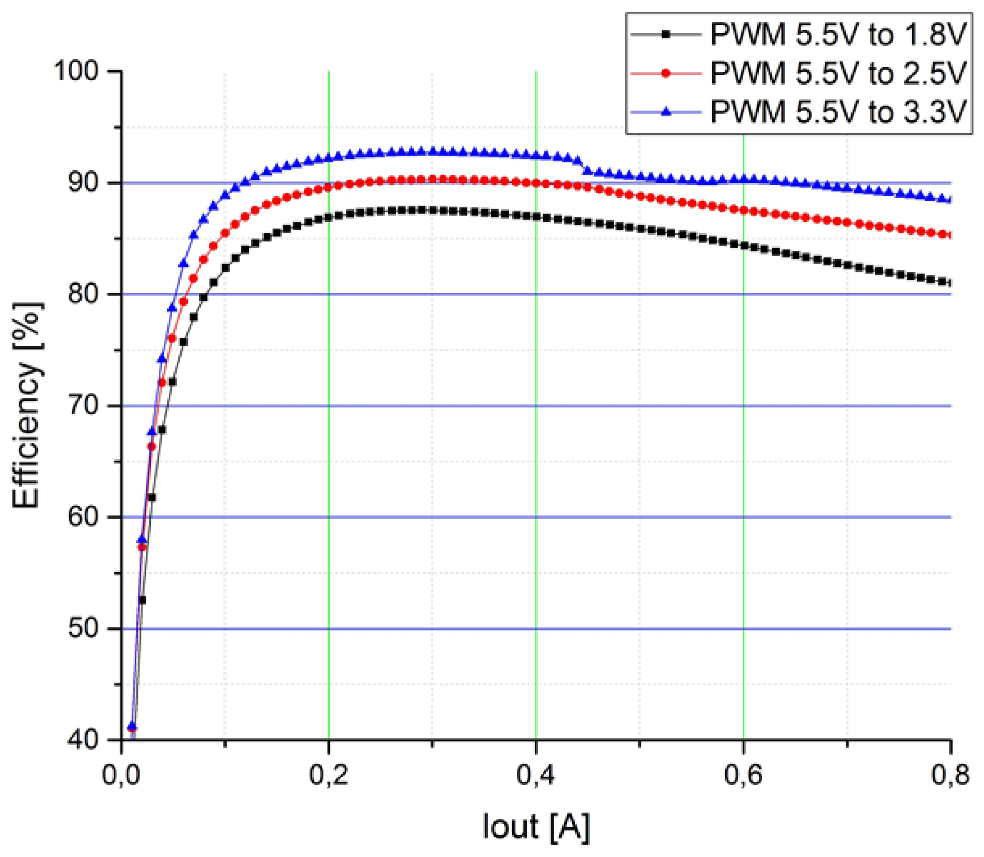

Fig.4: Efficiency characteristics of micromodule for input voltage of 5.5V at different output voltages

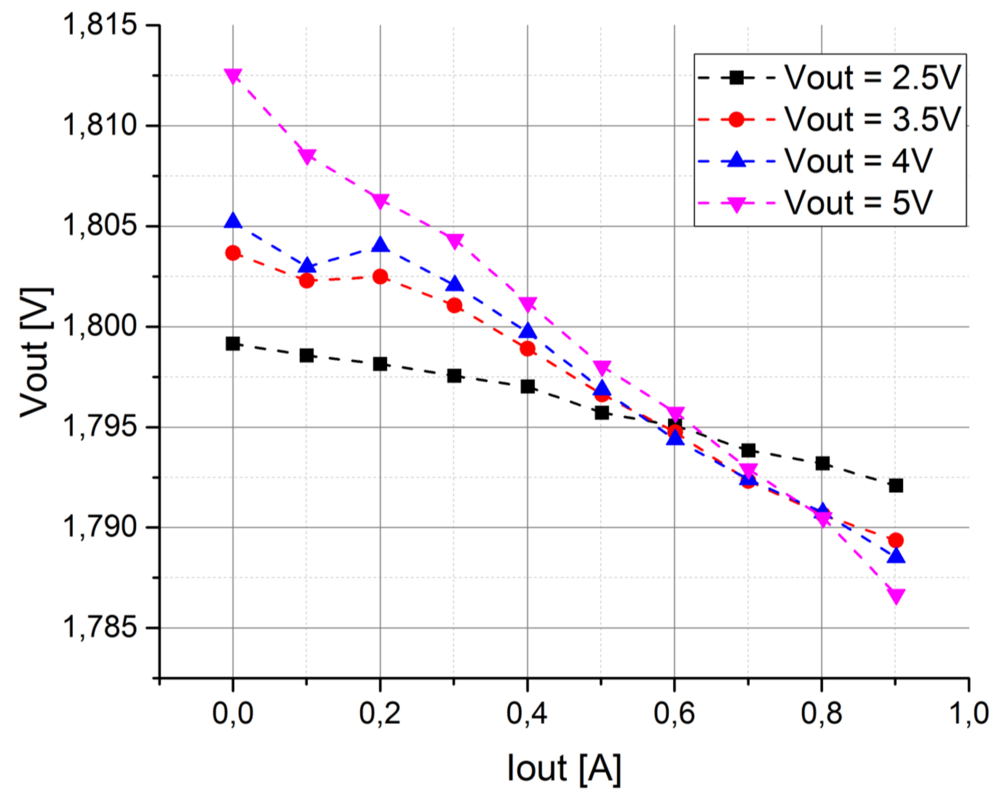

Fig.5: Output voltage vs. output current at different input voltages

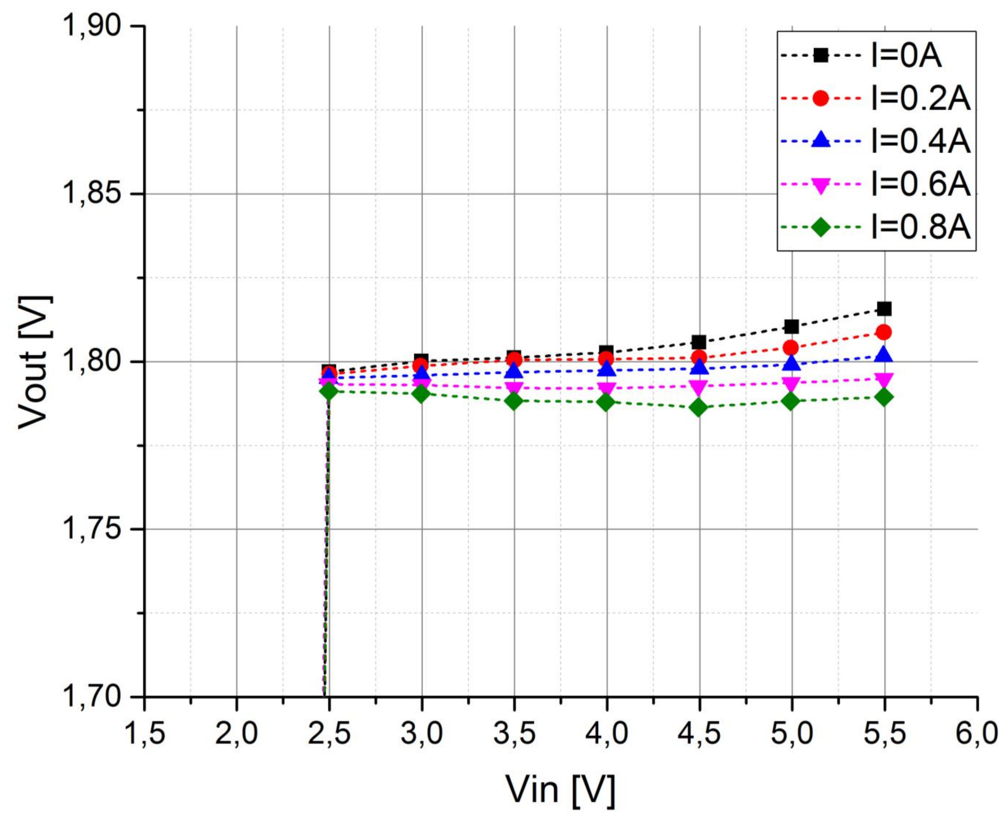

Fig.6: Output voltage vs. input voltage at different output currents

Conclusion

- Using corner plating, the micromodule's parasitics are significantly reduced.
- The micromodule shows the best performance in this class of modules.