Watercooled High-Power Micro-Converter

with 3D-printed micro cooler

Dissipating the high heat flux densities of electronic power modules and power devices with high power density is often a very difficult task. New possibilities arise when during the design of a circuit an active water cooling is included directly.

This example shows a DC/DC converter unit, which was developed as an application sample using 3D printed micro coolers.

Please contact us for more information or a quotation via

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Eureca Messtechnik GmbH as specialized in technical consulting, development and supply for OEM projects with the focus on cameras, optical measurement and thermoelectric cooling systems.

Our partner company IQ Evolution is an expert on the development and production of microcoolers for power electronics. Their 3D prin - ting manufacturing technique provides highest efficiency in the micrometer range for the smallest cooling structures.

Watercooled High-Power Micro-Converter

with 3D-printed micro cooler

IQ evolution GmbH

Dr.-Ing. Thomas Ebert

MADE IN GERMANY

IQ evolution GmbH

The „IQ-Thincoolers“ are produced by **SLM** procedure, the **S**elective **L**aser **M**elting.

The procedure is also known as LPBF (Laser Powder Bed Fusion).

IQ evolution refined this 3D-metal-printing process over more than 10 years, specially to the requirements of building micro structures.

Rapid Prototyping and complex mass production are both efficiently producible with this technology.

For more informations about the 3D-printing process please use our download-center:

http://iq-evolution.com/downloads_de/

All our products are covered by registered patents.

„IQ-Thincooler“,
straight connector

„IQ-Thincooler“,
angeld connector

Registered patents: US 9083138; US 12438336; EP 1672690; EP 2061078
Patent pending : EP 18156325

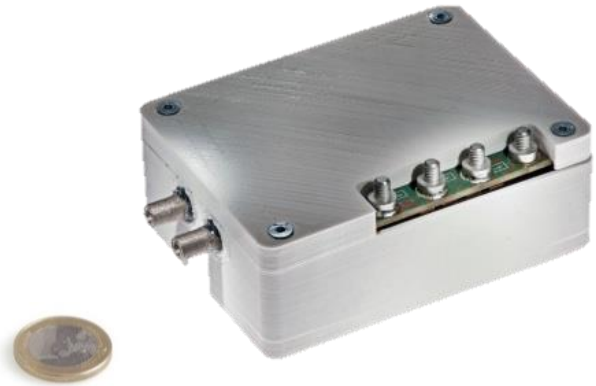
Application sample

In cooperation with the „Institut for power electronics and elelctrical drives“ of the RWTH-Aachen University, a DC / DC converter was developed as an application sample of the „IQ-Thincooler“.
By using the 3D printed micro coolers and take advantage of the miniaturizing potential, the partners created a impressive sample:

Discrete 1000-V-SiC-MOSFETs with Kelvin-Source:
- Wolfspeed C3M0065100K
- 65 mΩ
- Three times less switching losses

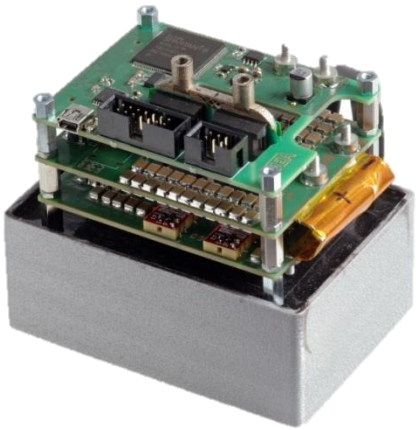
Sensor intergration:
- In- and Outlet voltage
- current phase

FPGA and MCU:
- loop controle
- PC communication
- without electrical connection to the power electronic



DC/DC-converter generations 1, 2 and 3

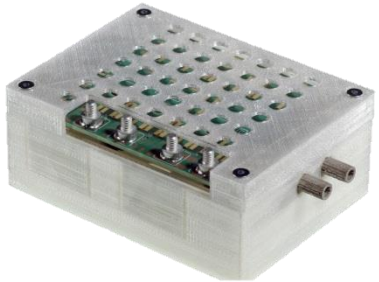
Generation 1



$P_{out,max}$= 19.8 kW

- 42,1 kW/l
- V_{in} = 400 V
- V_{out} = 800 V
- f_s = 400 kHz

Generation 2



$P_{out,max}$= 17.7 kW

- 55,3 kW/l
- V_{in} = 400 V
- V_{out} = 800 V
- f_s = 450 kHz

Generation 3

$P_{out,max}$= 20.6 kW

- 98,1 kW/l
- V_{in} = 400 V
- V_{out} = 800 V
- f_s = 450 kHz

„IQ-DC/DC Converter v.s. state of the art

Tame-Power converter:
250V / 700V, 15KW

Volume: 14,1 dm^3

Weight: 11kg

IQE / ISEA converter:
400V / 800V, 20KW

Volume: 0,25 dm^3 → Reduction: 56-times

Weight: 0,6kg → Reduction: 18-times

Source: Datasheet TAME-POWER TRONICO

Comparison true to scale

„IQ-Thincooler“, alternative designs

Due to the manufacturing procedure of 3D metal printing a lot of alternative designs are possible.

No special tools are necessary, the complexity of the parts causes no extra expences, only the size defines the costs.

Referenzen

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