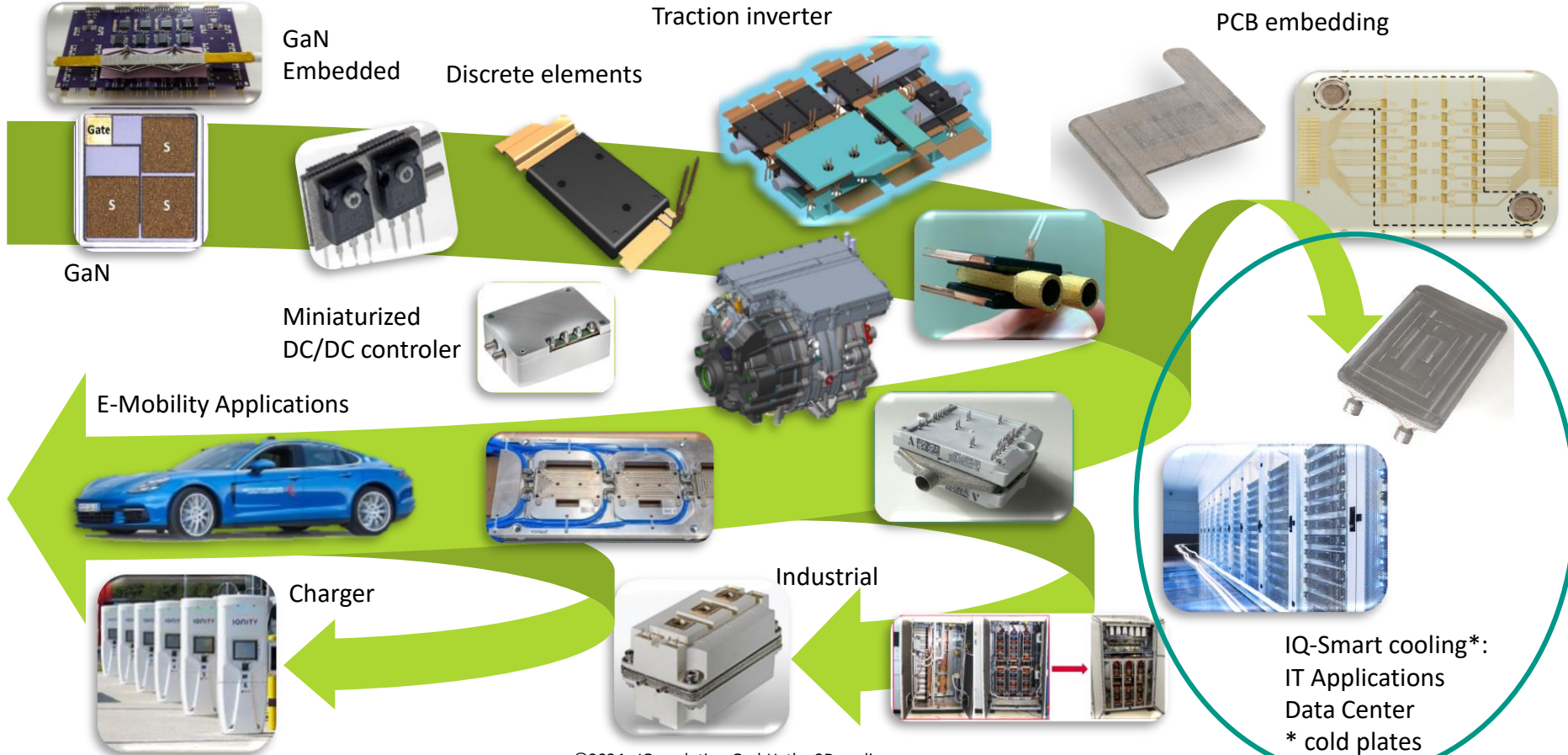


# 3D printed liquid cooled cold plates for direct to chip cooling

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# Where you can find IQ evolution 3D-printed metal cooler

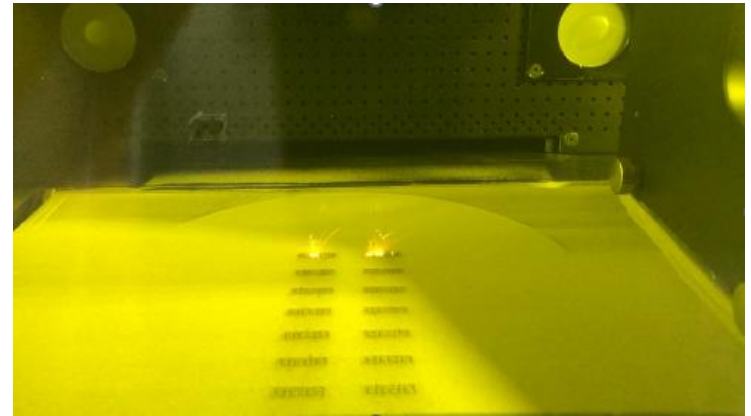


# The „printing“ process

- IQE has been developing and manufacturing microcoolers using metal 3D printing for almost 20 years.
- The metal powder is melted layer by layer with the laser beam.
- This enables the production of very thin radiators (from 0.8 mm) with low wall thicknesses.
- Complex internal structures can be manufactured directly in the closed housing.
- IQE has developed a concept that makes series production of several million components per year economically feasible.

## The „printing“ process

- Dividing the CAD model into 20µm/40µm layers
- Pre-processing of the individual layers (speed, laser power.....)
- Laser melting of the structures, which should subsequently be solid
- Subsequent cavities are not melted



## Sample: IQ-Smart 53-Alu (AlSi10Mg)

### Datasheet

#### Technical data:

Footprint of cooling area:

53mm x 53mm

Thickness for single side use:

4mm

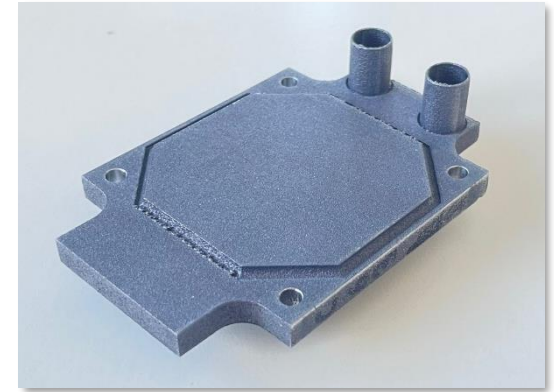
Weight:

56gr

Connectors:

Tube, diameter 10mm

(other diameter and angle on request)



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info@iq-evolution.com

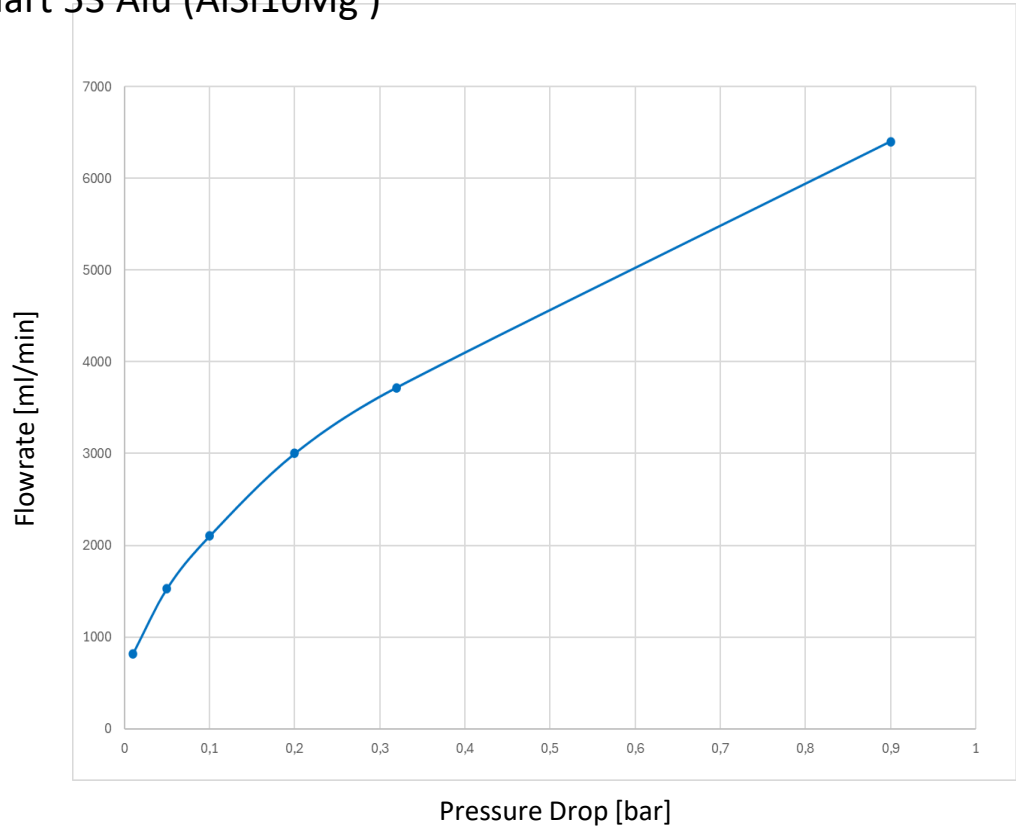
www.iq-evolution.com



## IQ-Smart 53 Alu (AlSi10Mg)

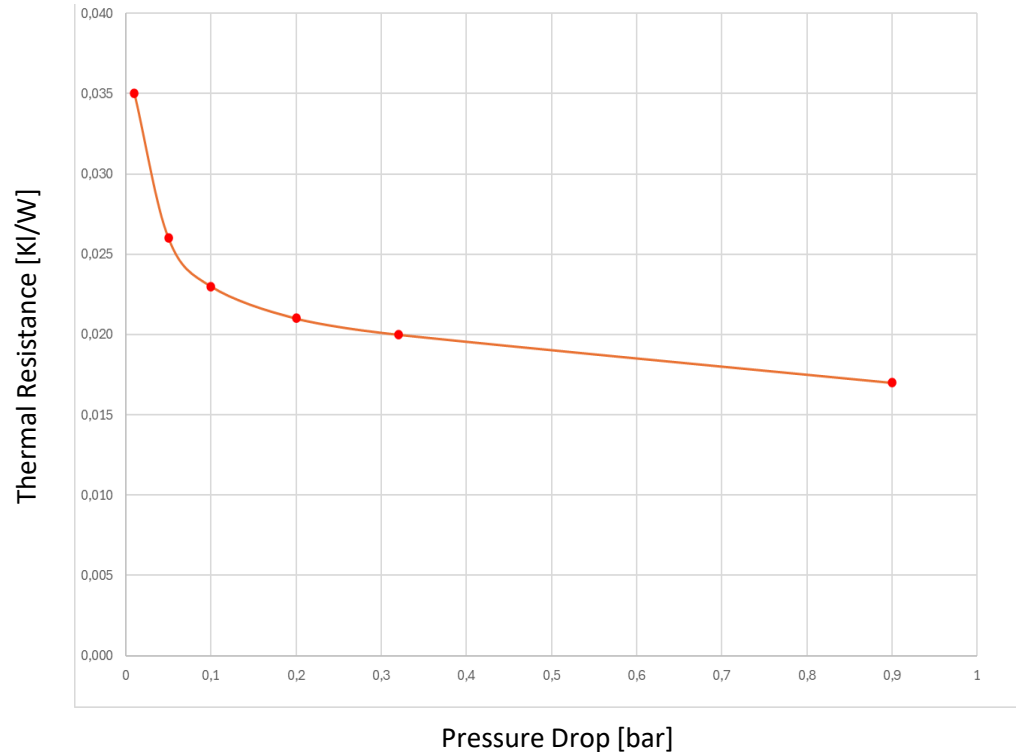
Pressure [bar]	Flowrate [ml/min]
0,01	820
0,05	1530
0,10	2100
0,20	3000
0,32	3720
0,90	6400

$T_{in}$  Fluid = 15°C



## IQ-Big 53 Alu (AlSi10Mg )

Pressure [bar]	Flowrate [ml/min]
0,01	0,035
0,05	0,026
0,10	0,023
0,20	0,021
0,32	0,020
0,90	0,017



$T_{in} \text{ Fluid} = 15^{\circ}\text{C}$

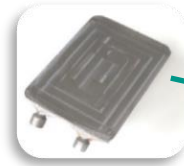
$dT_{in;surface} = 39,6^{\circ}\text{C}$

$\rightarrow T_{surface} @ 0,32\text{bar} = 54,6^{\circ}\text{C}$

## Technology: 3D printing of CPU / GPU cooler

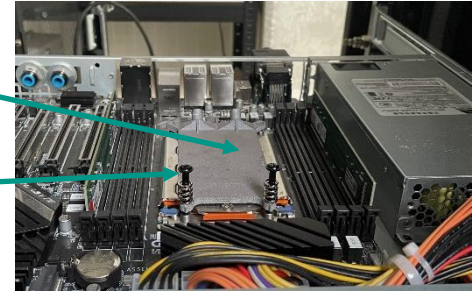
- Thin & ultra-low weight coolers
- Heat flux density of  $>240\text{W}/\text{cm}^2$
- Real life weight reduction of weight and volume
- 1HU server racks possible
- Cooling performance reduces Chip temperature
- Ready for cooling with water @  $60^\circ\text{C}$
- 3D-printed and ready for mass production
- No corrosion due to the using of stainless steel

IQ-ThinCooler

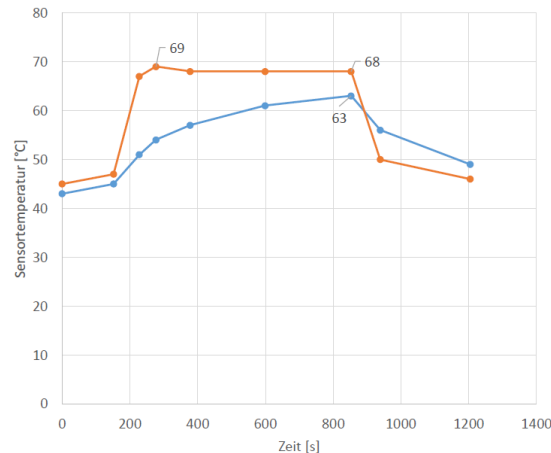


Screwed with thermal paste

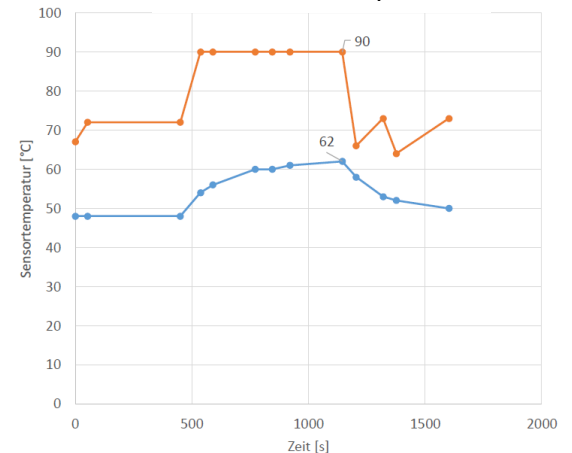
AMD Ryzen Threadripper PRO



Water inlet temp.  $25^\circ\text{C}$



Water inlet temp.  $60^\circ\text{C}$



Measured by

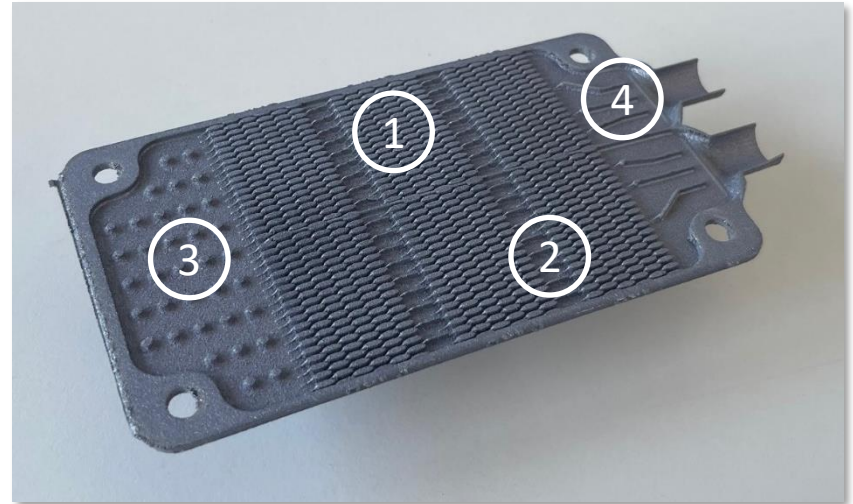


[www.zfw-stuttgart.com](http://www.zfw-stuttgart.com)

With 3D printing technology, various structures can be created within a closed housing:

1. Cooling structures for high heat flux density
2. Cooling structures for intermediate areas with lower heat flux density
3. Supporting structures for mechanical loads (e.g. contact pressure when screwing)
4. Leading structures for demand-oriented coolant distribution

IQ-Smart 62-Alu (AlSi10Mg)





The costs of the parts are mainly related to the duration of the whole process





The process duration consists of two kinds of times:

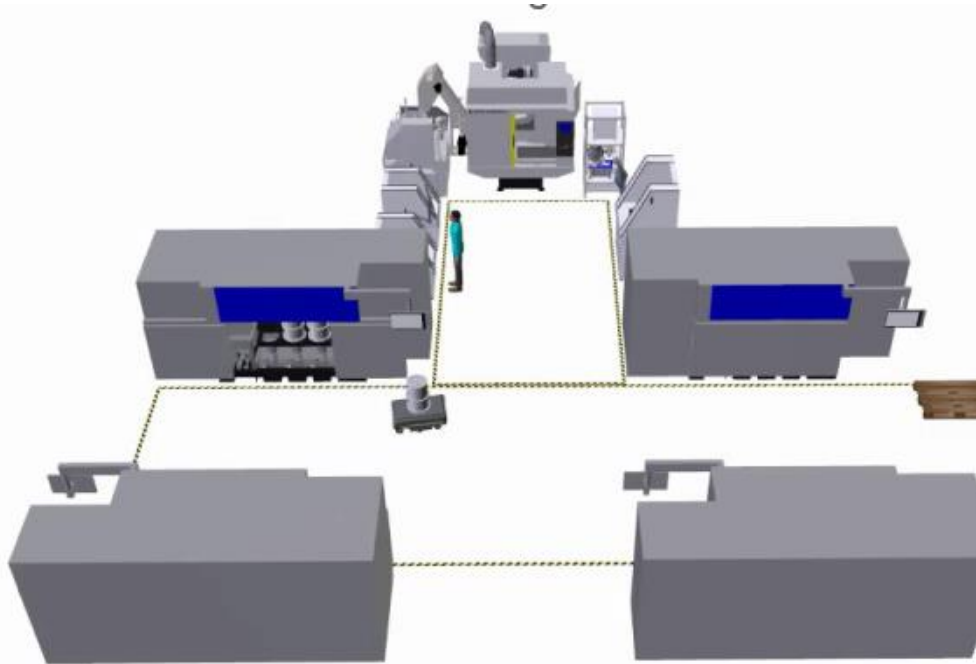
„Laser On“ Time

The more components,  
the longer the  
process takes

Powder application

Is only dependent on  
the number of layers,  
not on the  
number of components

- Building as many parts as possible at one „job“  ▪ Distributes the powder application time to the number of components
- Using multi Laser machines  ▪ Leaves the “Laser On” time short despite a lot of parts
- Only print what you really need to print  ▪ Leaves the „Laser On“ time short for every printed part
- Keep the time from job to job short  ▪ Running the printers in high automatic mode



- Smallest setup with 100.000 parts per month
- 3D-printer running fully automatically (24/7)
- Mechanical machining and testing by manual handling (one shift)
- Easily scalable by doubling the number of printers
- Further scaling by increasing the number of printers, multi-shift production and/or automation of the manual activities

- IQ Twin is manufactured, mechanically processed and tested every 90 seconds
- Estimated cost for  $\geq 25$  Mio pieces per year:  $< 10\text{€}$

In cooperation with LEWA Attendorn GmbH