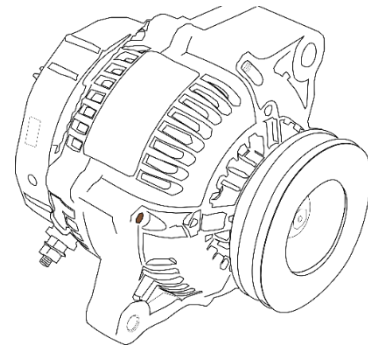




# PRESSFIT TECHNOLOGY

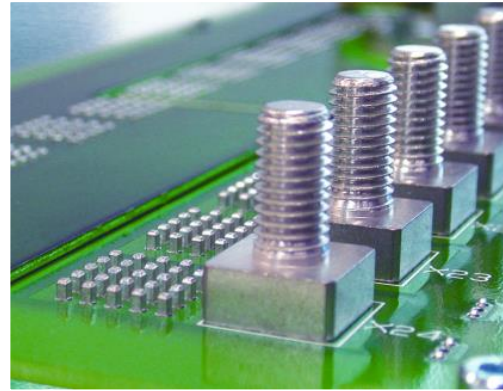
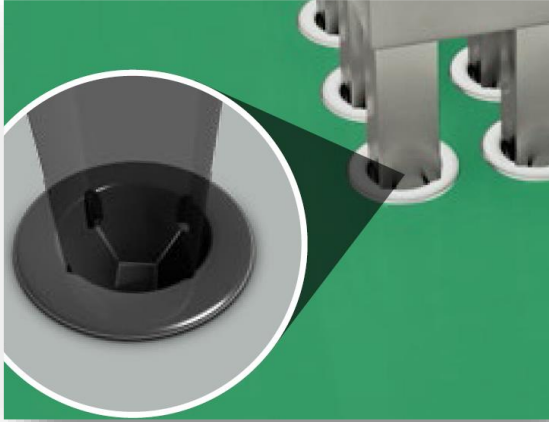
Mateusz Stępień, eiCan FAE

# Vibrations are everywhere

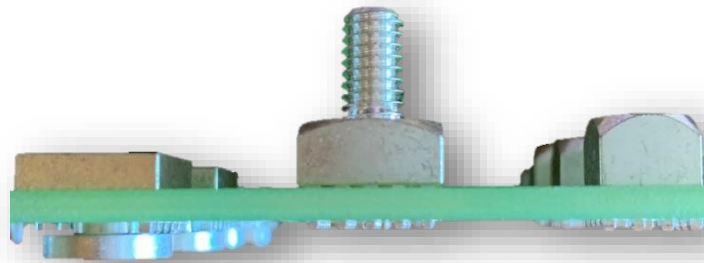


All pictures WE

## Press fit: how does it work ?



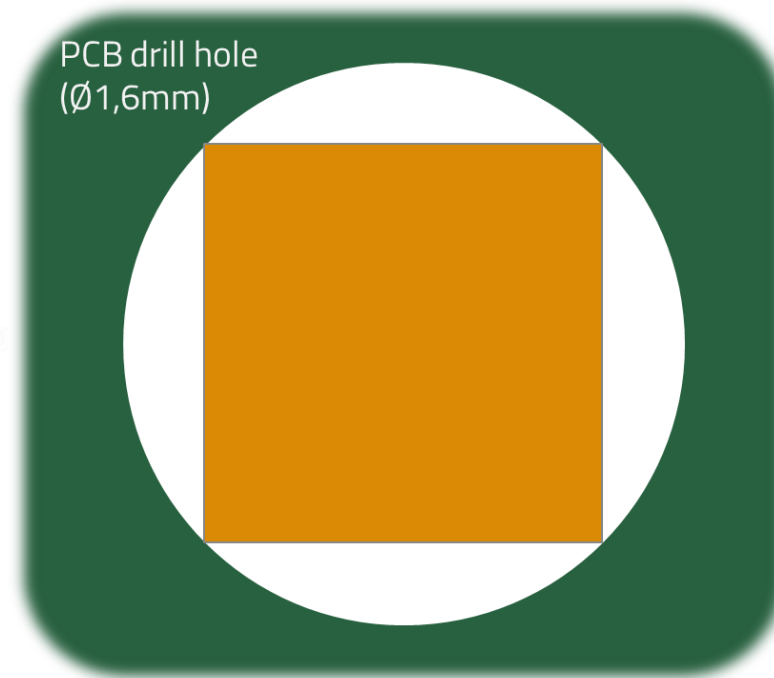
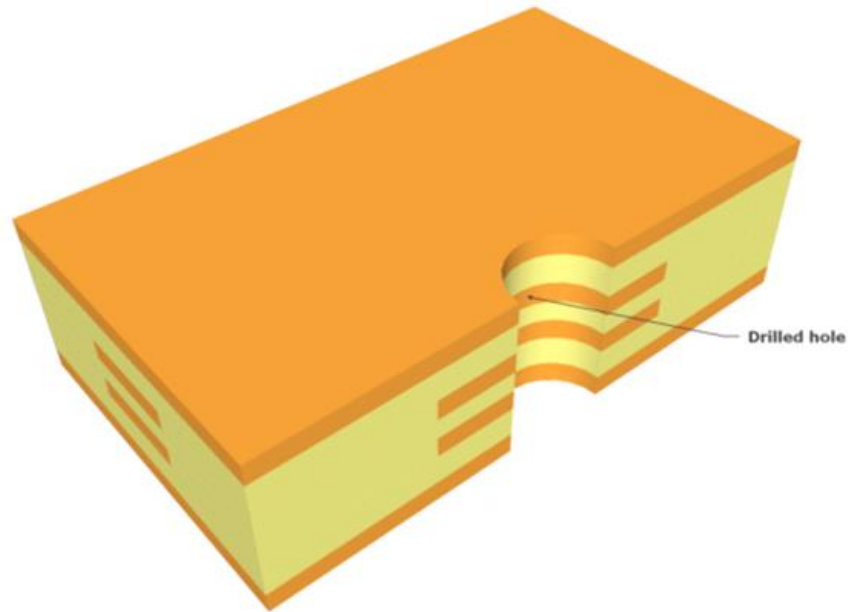
- solder free
- gastight
- powerful electrical connection



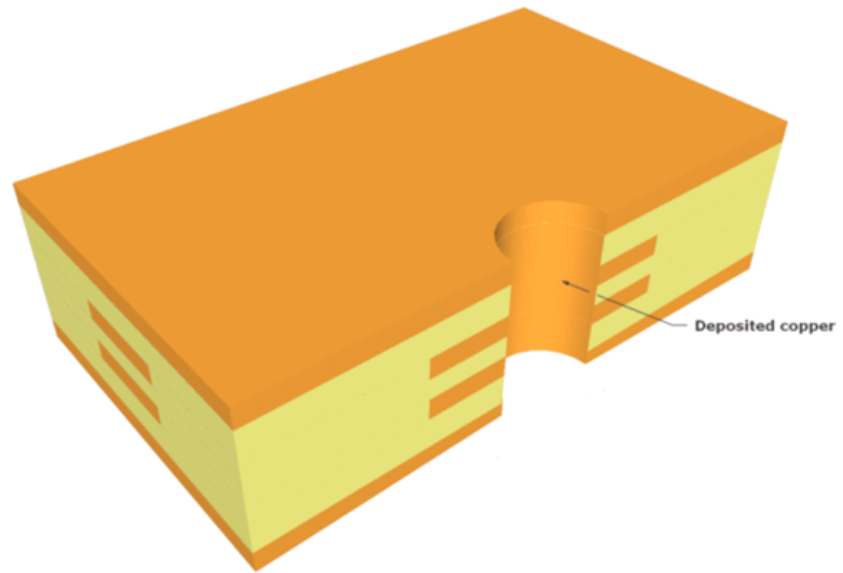
All pictures WE

# PRESSFIT: HOW DOES IT WORK ?

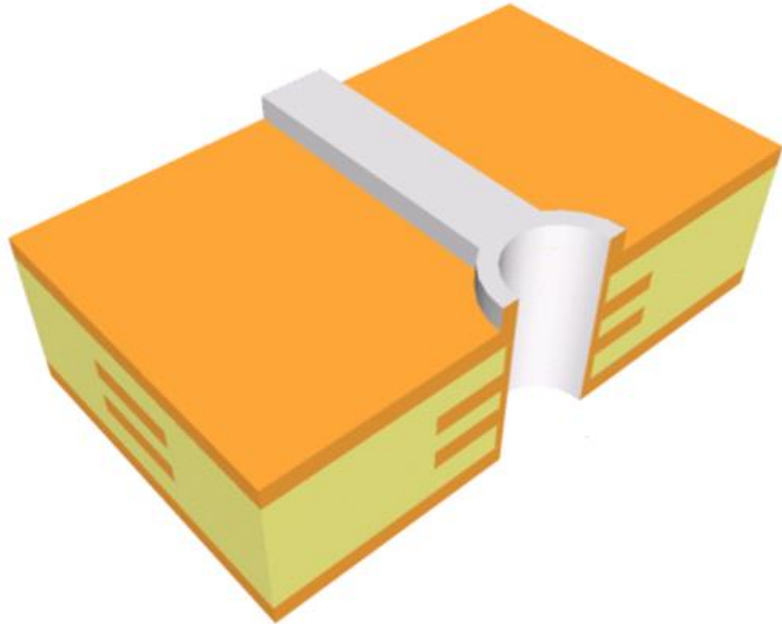
# Press fit: how does it work ?



## Press fit: how does it work ?



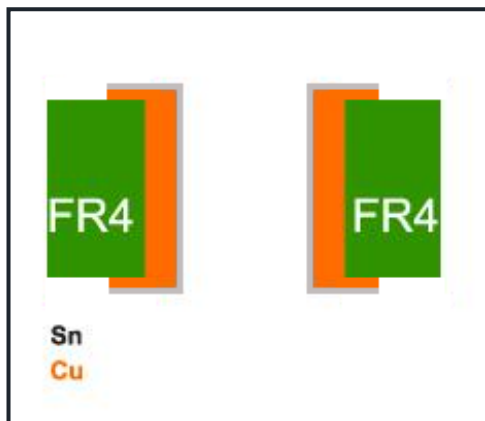
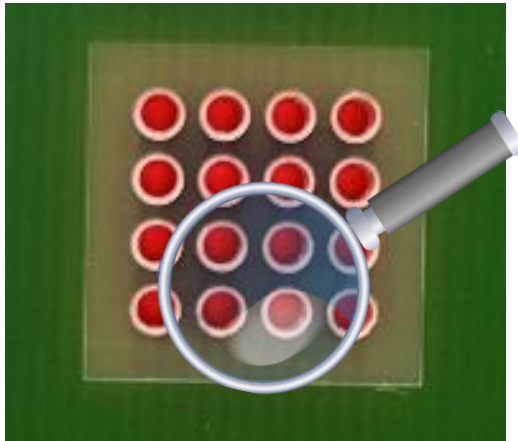
## Press fit: how does it work ?



Tin  $15\mu\text{m}$  (optimum  $2\mu\text{m}$ )

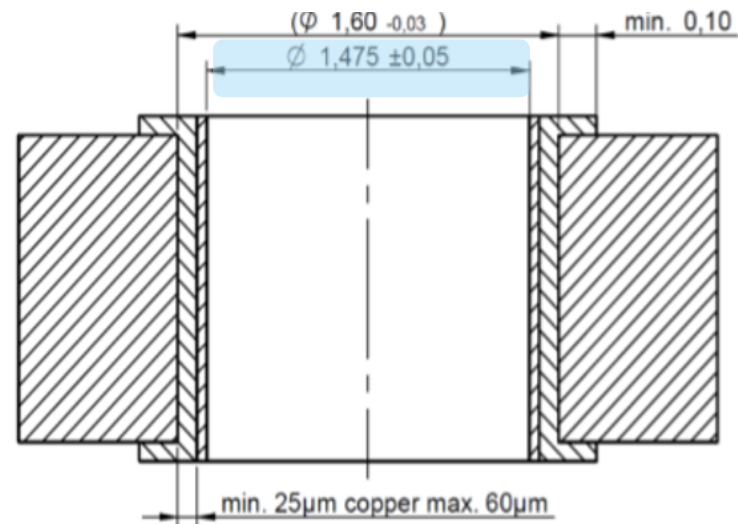
# Press fit: how does it work ?

PCB

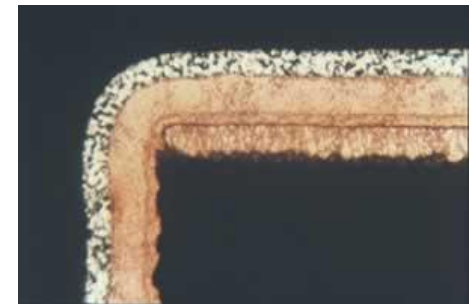


## Chemical tin

ENIG (NiAu)



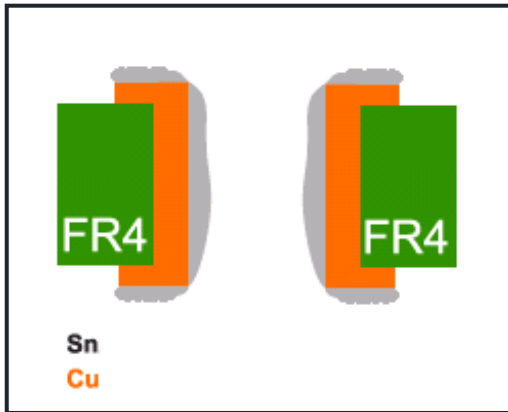
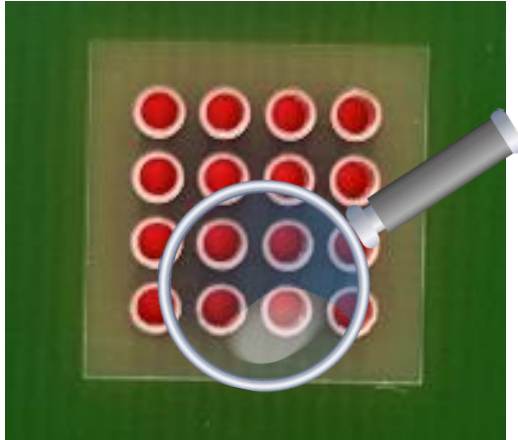
- 25 - 60 $\mu\text{m}$  Copper - optimum 30-40 $\mu\text{m}$
- max. 15 $\mu\text{m}$  Tin - optimum 2 $\mu\text{m}$



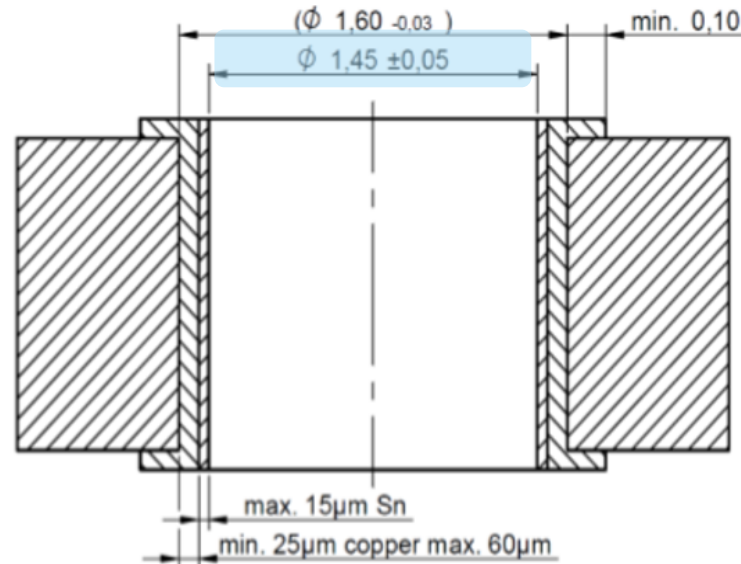
All pictures WE

# Press fit: how does it work ?

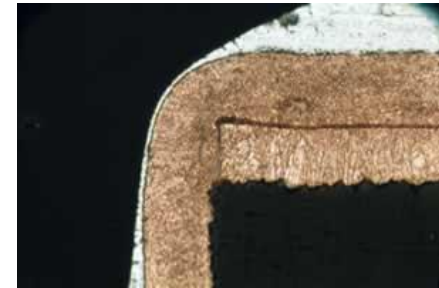
PCB



## HAL – Hot Air Levelling



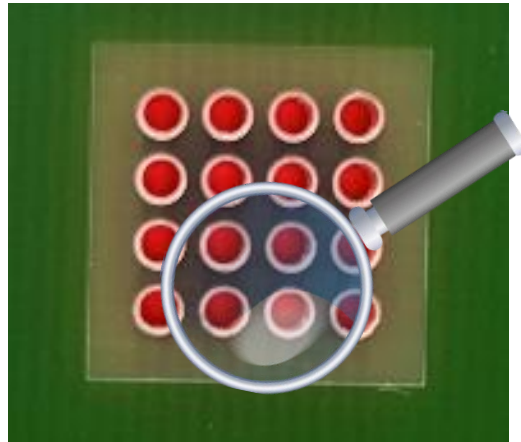
- 25 - 60µm Copper - optimum 30-40µm
- max. 15µm Tin - optimum 2µm



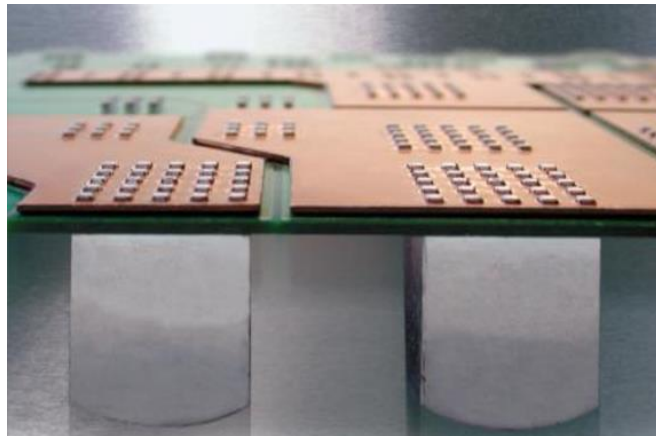
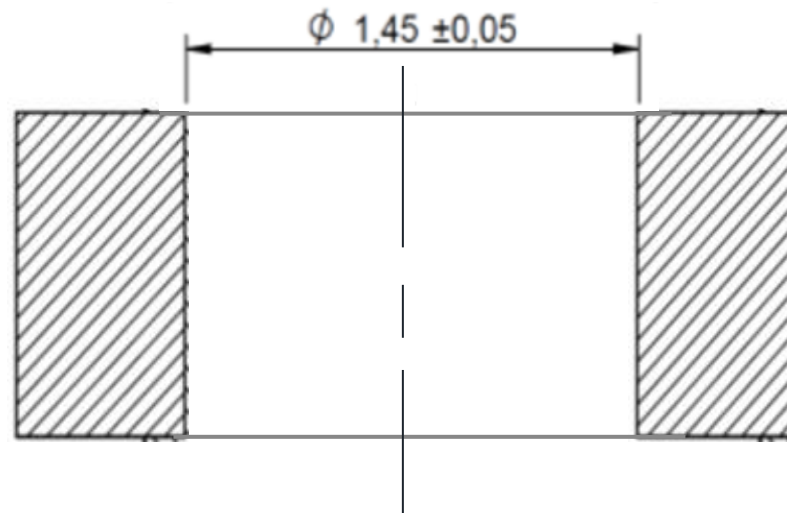
All pictures WE

# Press fit: how does it work ?

PCB

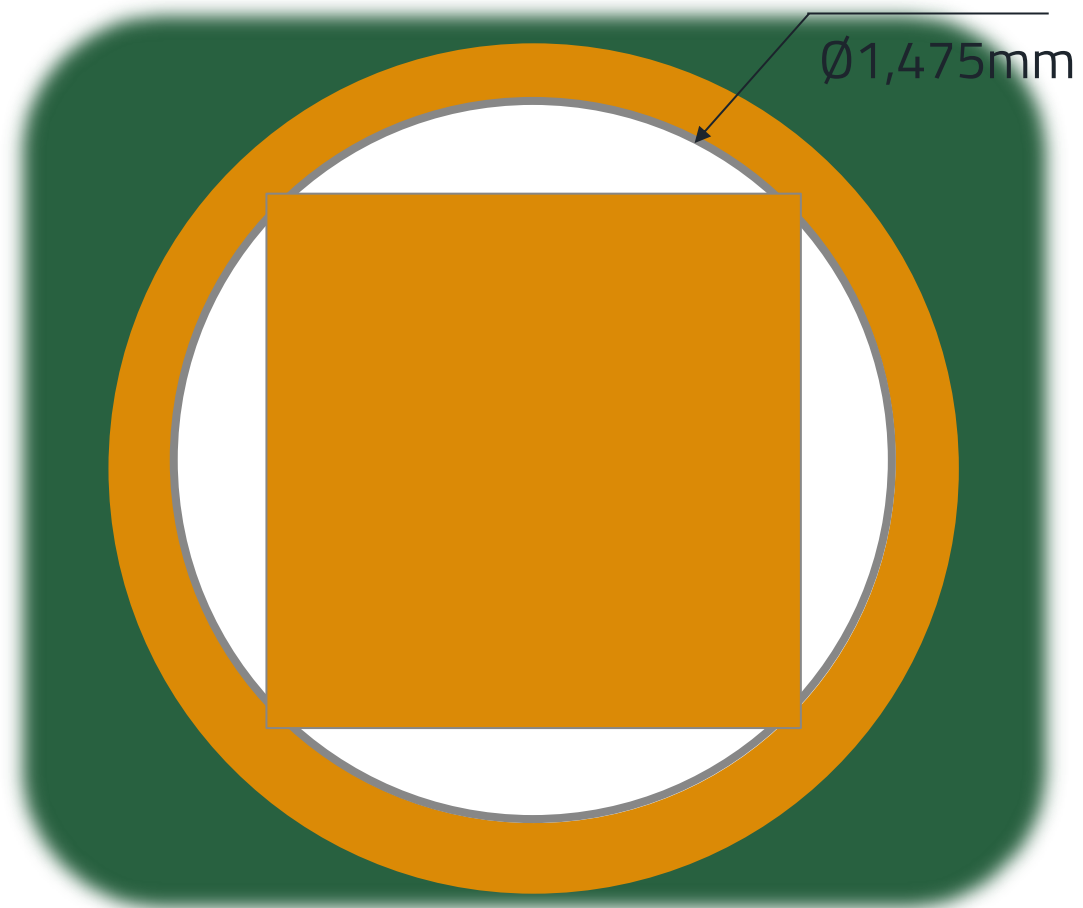


**Pure copper bar**  
**(Drill hole  $1,45 \pm 0,05$ )**

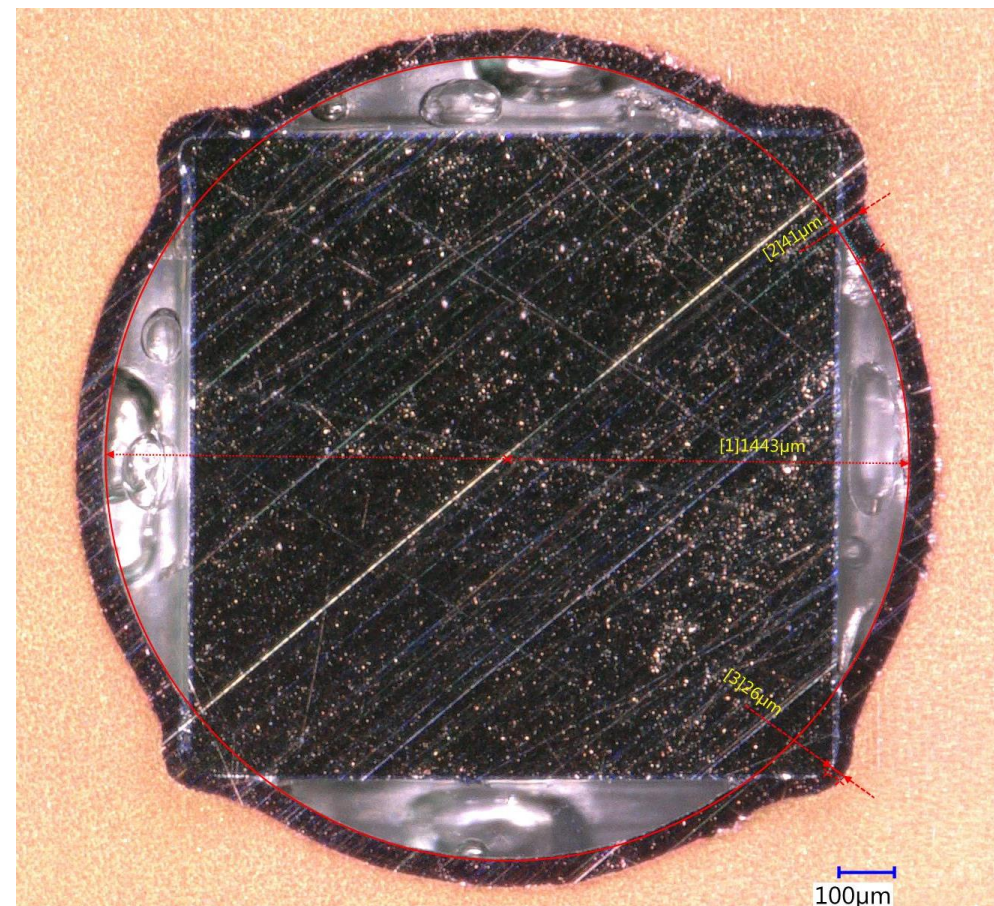


All pictures WE

## Press fit: how does it work ?

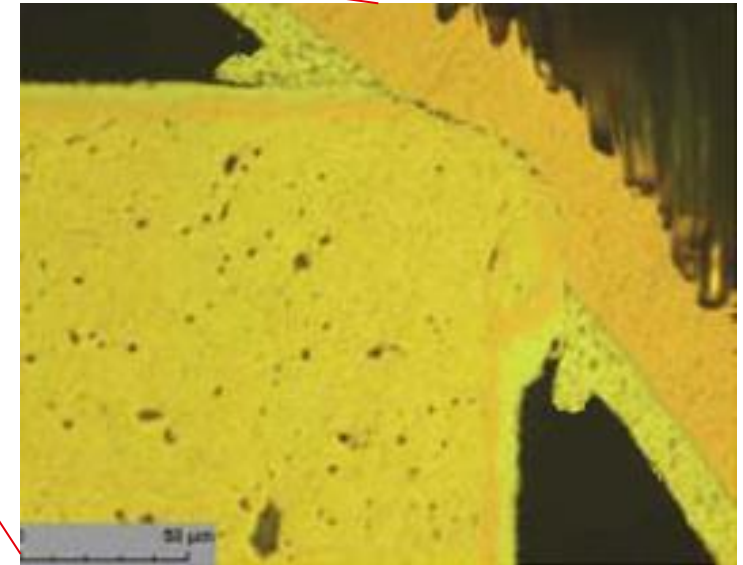
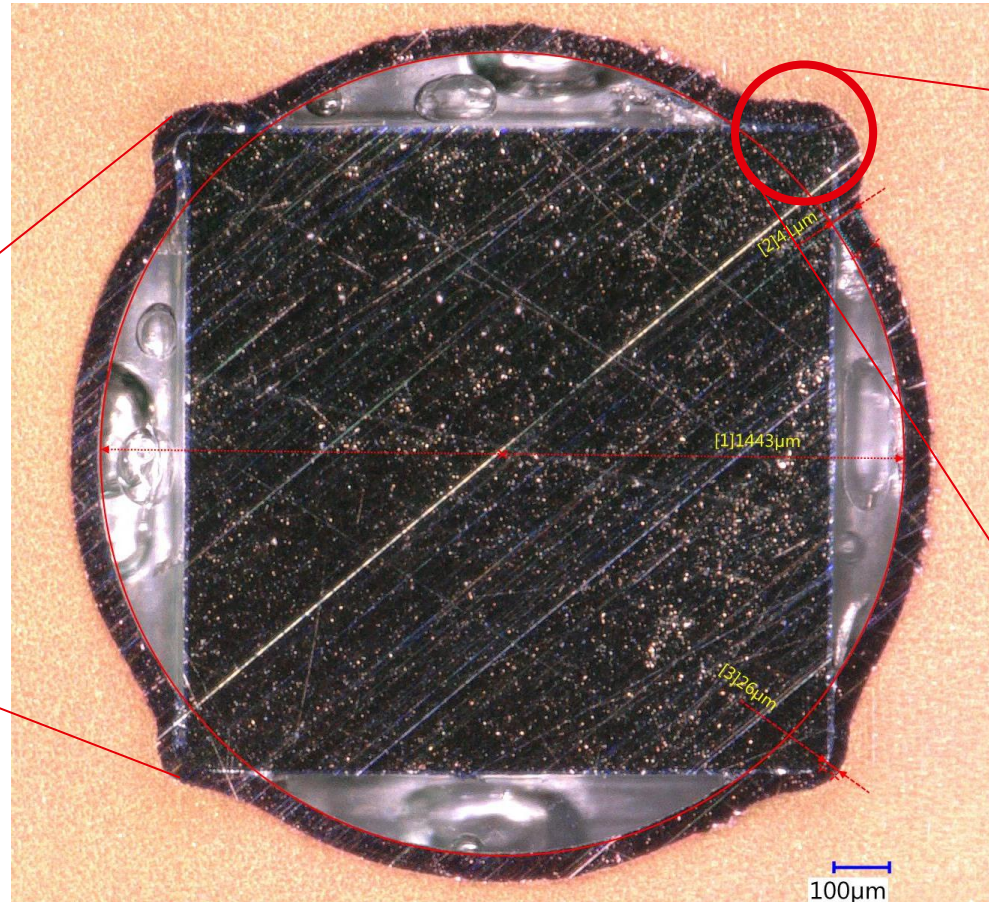
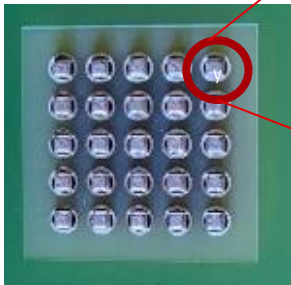


Values for chemical tin



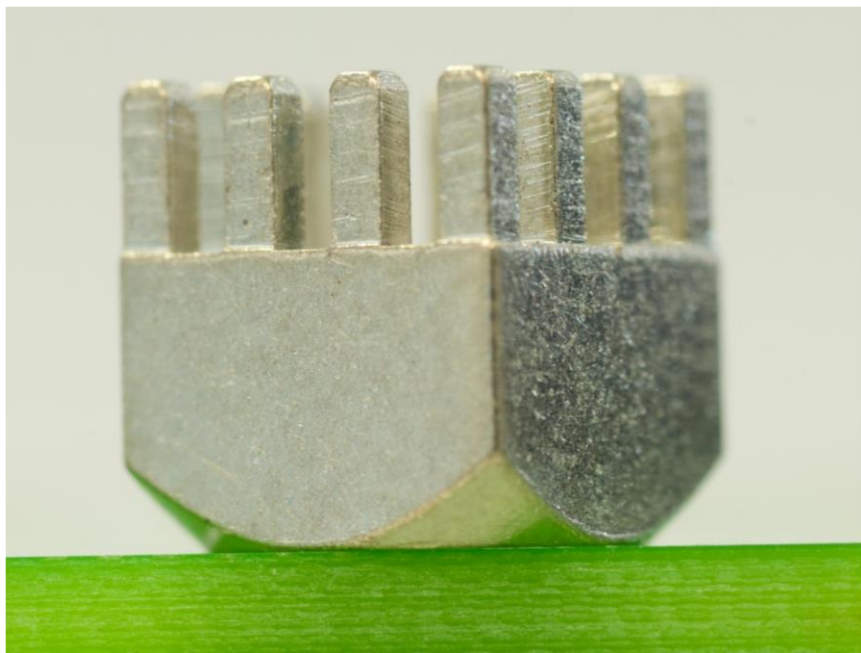
All pictures WE

# Press fit: how does it work ?

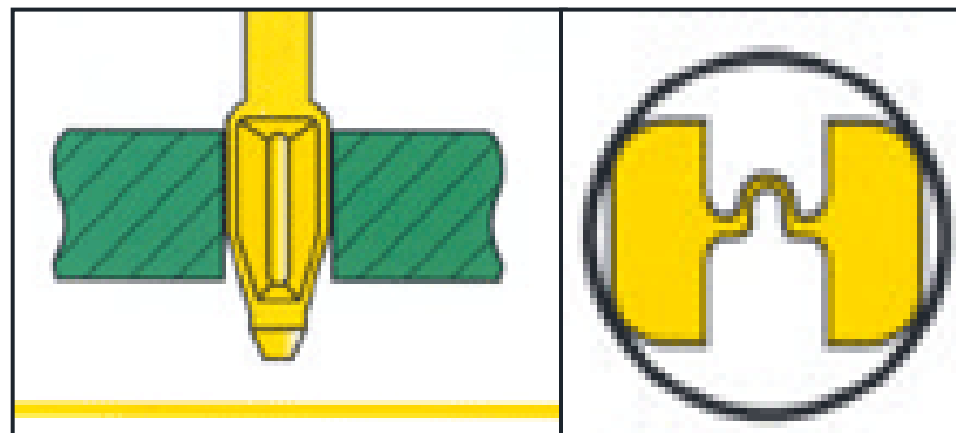
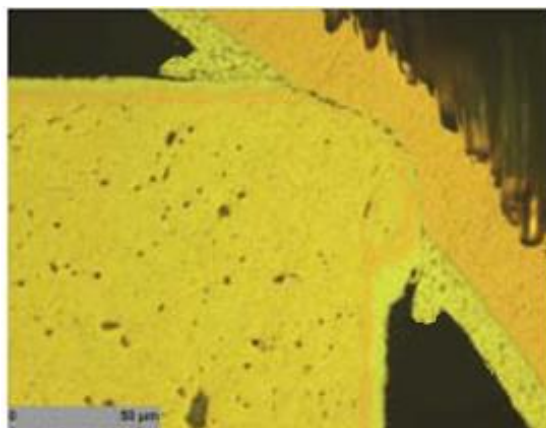
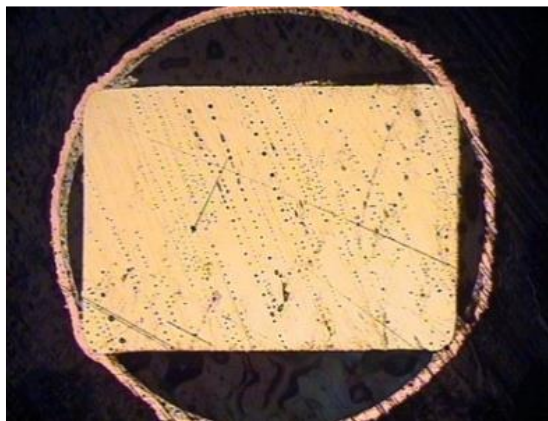


All pictures WE

# Press fit: different types

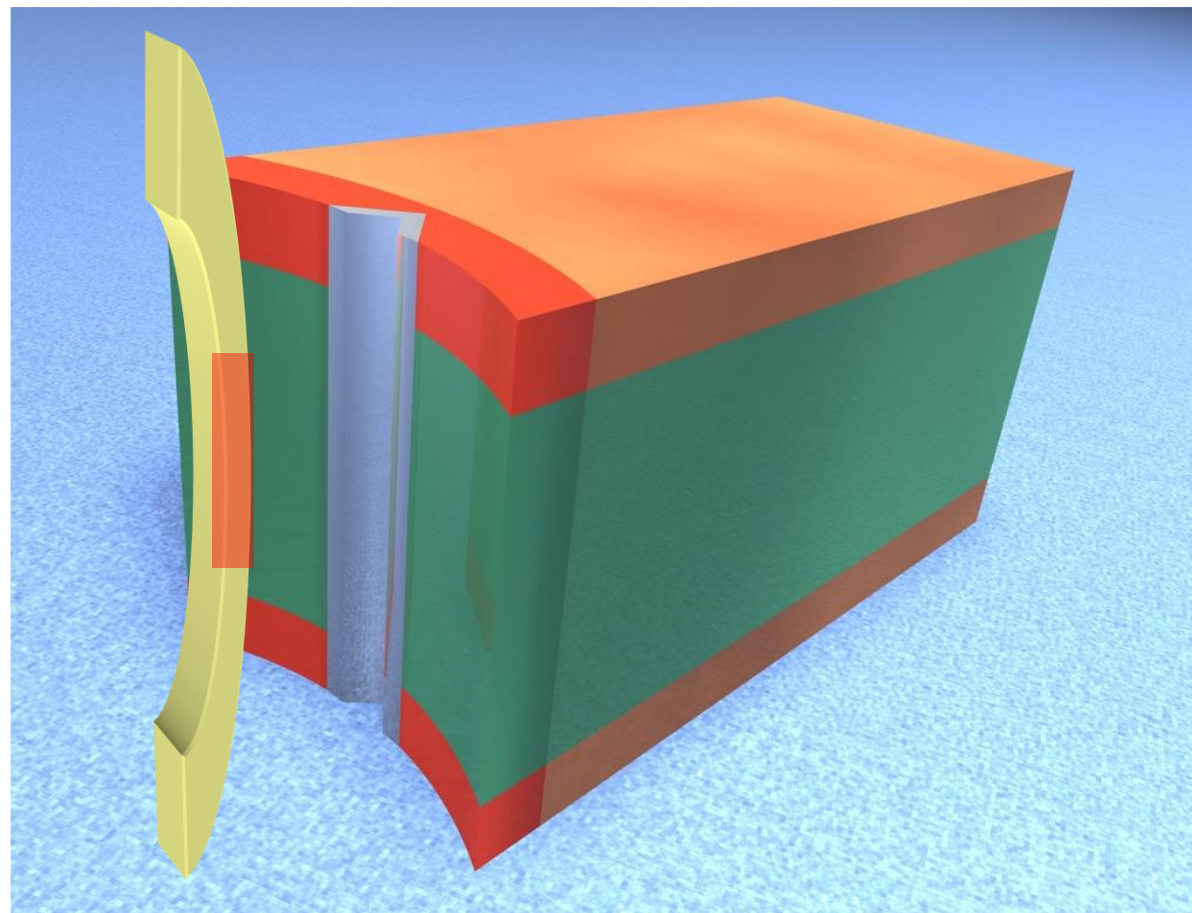
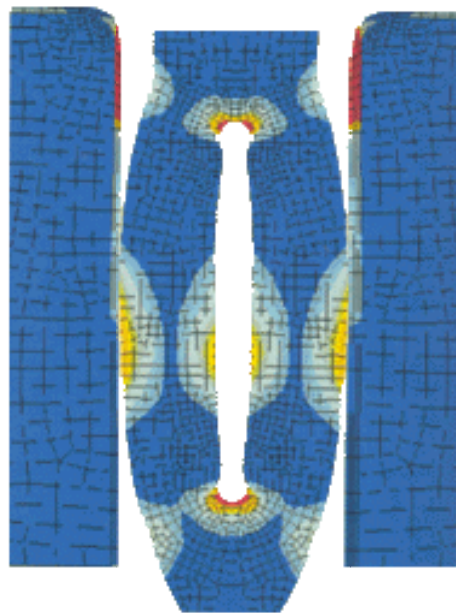


# Press fit: different types



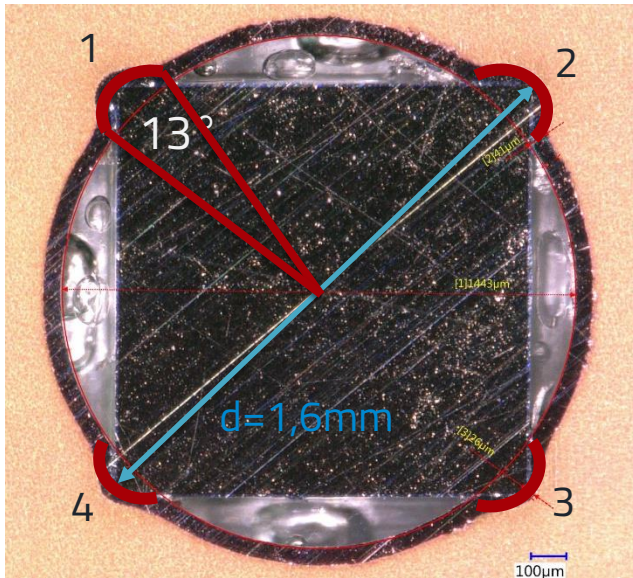
➤ Gastight coldwelding of connection area

# Press fit: different types



# Contact zone surface

- Contact surface

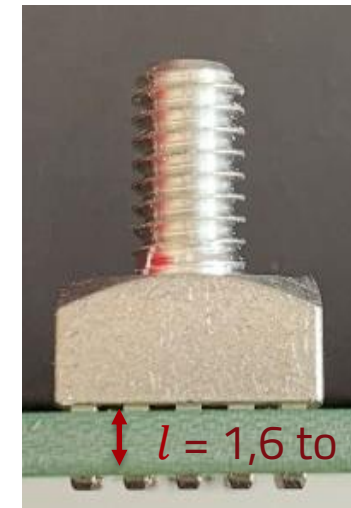
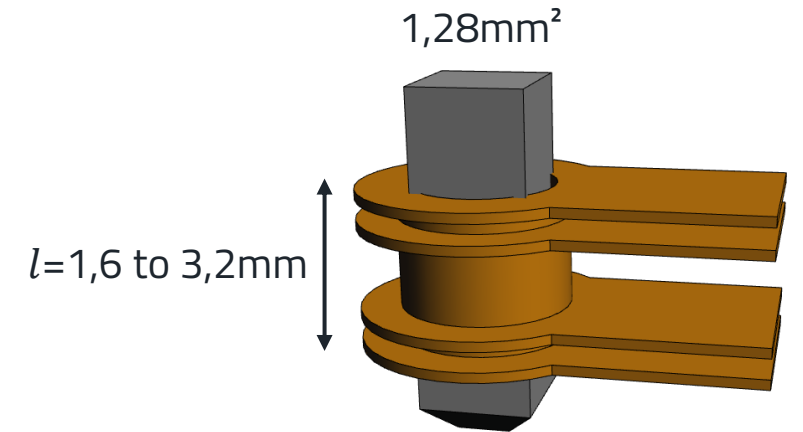


$$\text{pin cross section} = \left(\frac{1,6}{\sqrt{2}}\right)^2 = 1,28 \text{ mm}^2$$

$$\text{Contact surface} = \pi \cdot d \cdot \frac{13}{360} \cdot 4 \cdot l$$

$$1,16 \text{ mm}^2 < \text{Contact surface} < 2,32 \text{ mm}^2$$

- Contact area in the via  $\approx$  Cross section of a pin



All pictures WE

## Different types summary

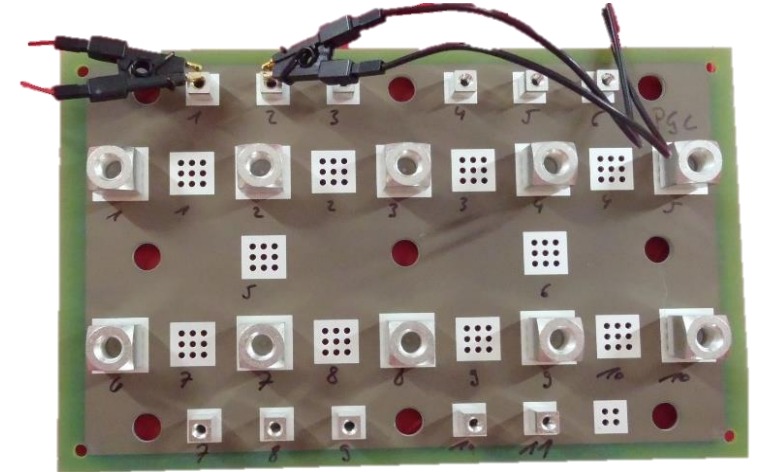
Feature	Solid Press-fit	Stamped Press-fit
Manufacturing Method	Machined or forged from solid metal; full cross-section.	Stamped from sheet metal and formed; features a flexible "compliant" zone.
Vibration Resistance	<b>High Retention:</b> Very high holding force, but rigid. Vibration energy is transferred directly to the PCB.	<b>High Damping:</b> The flexible zone acts as a shock absorber, protecting the PCB from mechanical stress.
Thermal Cycling	<b>Moderate:</b> Lack of elasticity can lead to contact loosening during extreme temperature fluctuations.	<b>Excellent:</b> Constant spring-like pressure maintains a gas-tight connection despite thermal expansion/contraction.
Current & Power	<b>Superior:</b> Larger metal mass and lower resistance make it ideal for high-power applications.	<b>Good:</b> Sufficient for most applications, but limited by the smaller effective cross-section of the formed zone.
Best For	<b>High-current terminals</b> , power electronics, and high mechanical pull-out force requirements.	<b>Signal connectors</b> , dense PCB layouts, automotive electronics, and high-vibration environments.

# HOW THIS IS CERTIFIED ?

# How this is certified

Electrical

Contact resistance measurement IEC60512-2-1	
Usual soldering power connector	Red cube
<20mΩ	<b>&lt;200μΩ</b>



- Less contact resistance gives less temperature rise

All pictures WE

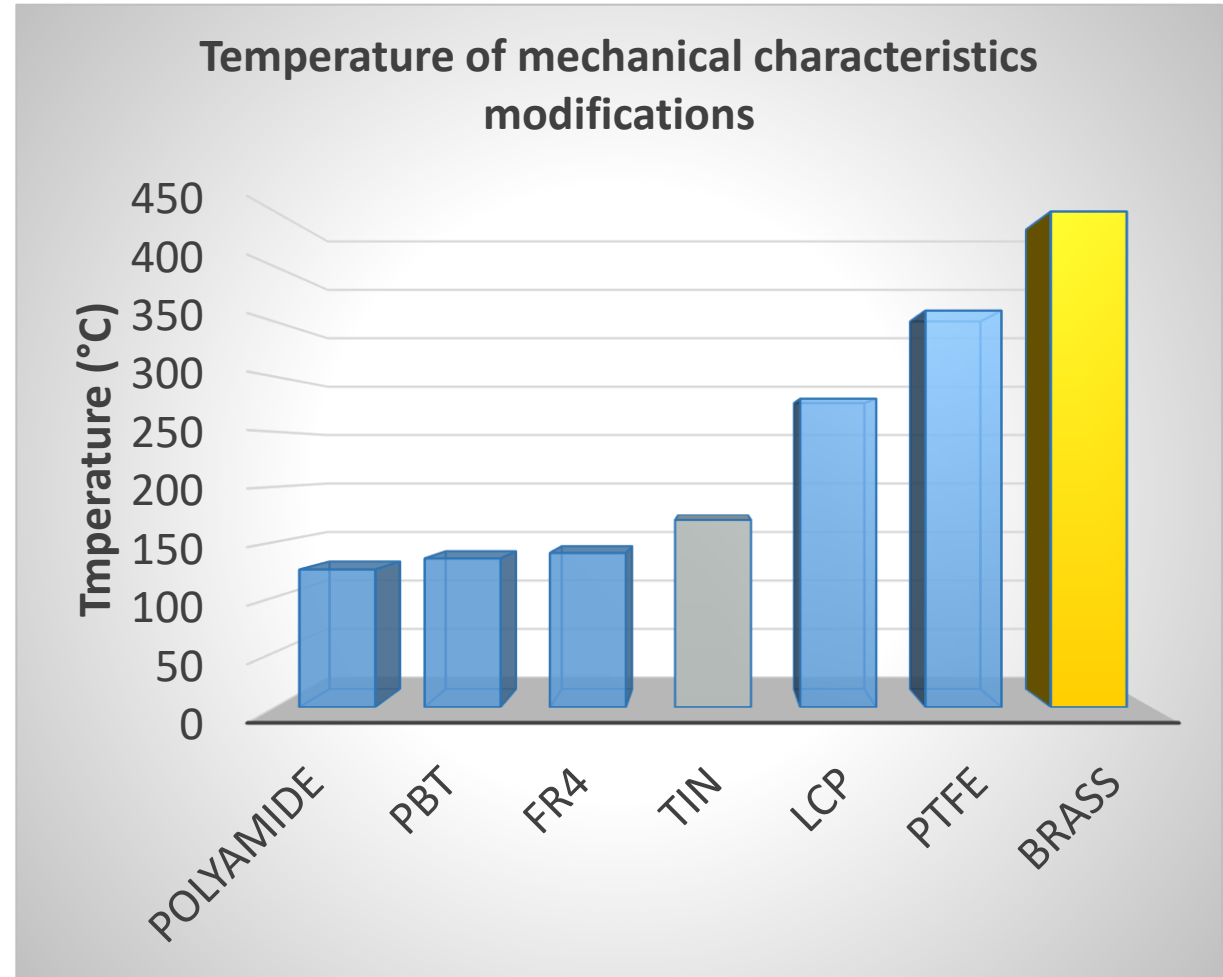
# How this is certified

Electrical

Temperature rise test IEC60512-2-5	
Usual power connector $\Delta T$	Red cube (ambient 25°C)
IEC/VDE max 45K UL max 30K	<b>Max 150°C</b>

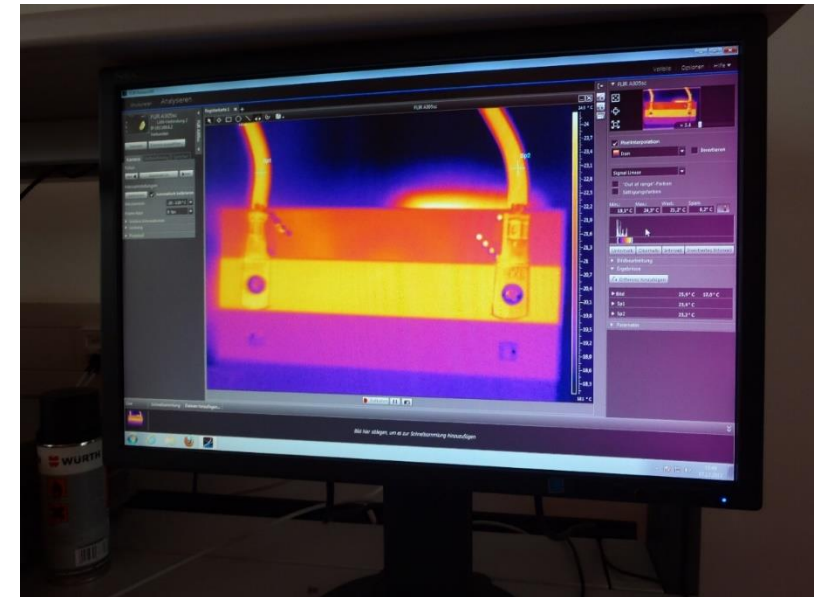
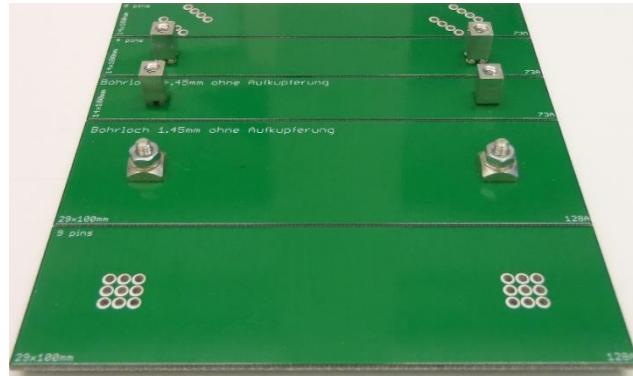


All pictures WE



# How this is certified

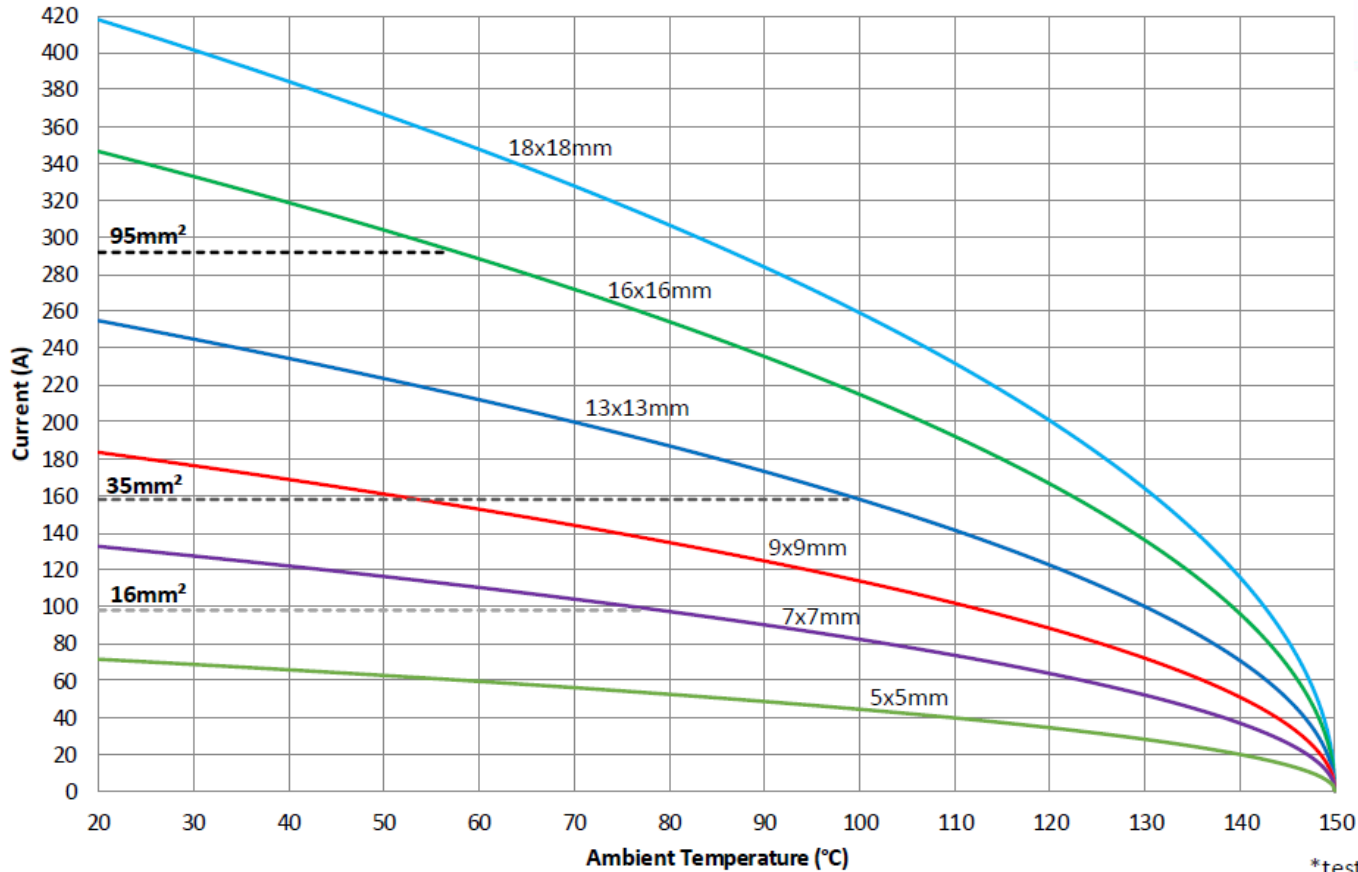
## Electrical



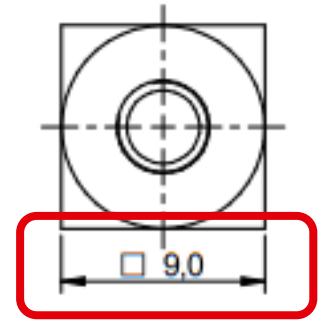
All pictures WE

# Derating curves

Derating Measurement for REDCUBE PRESS-FIT \*



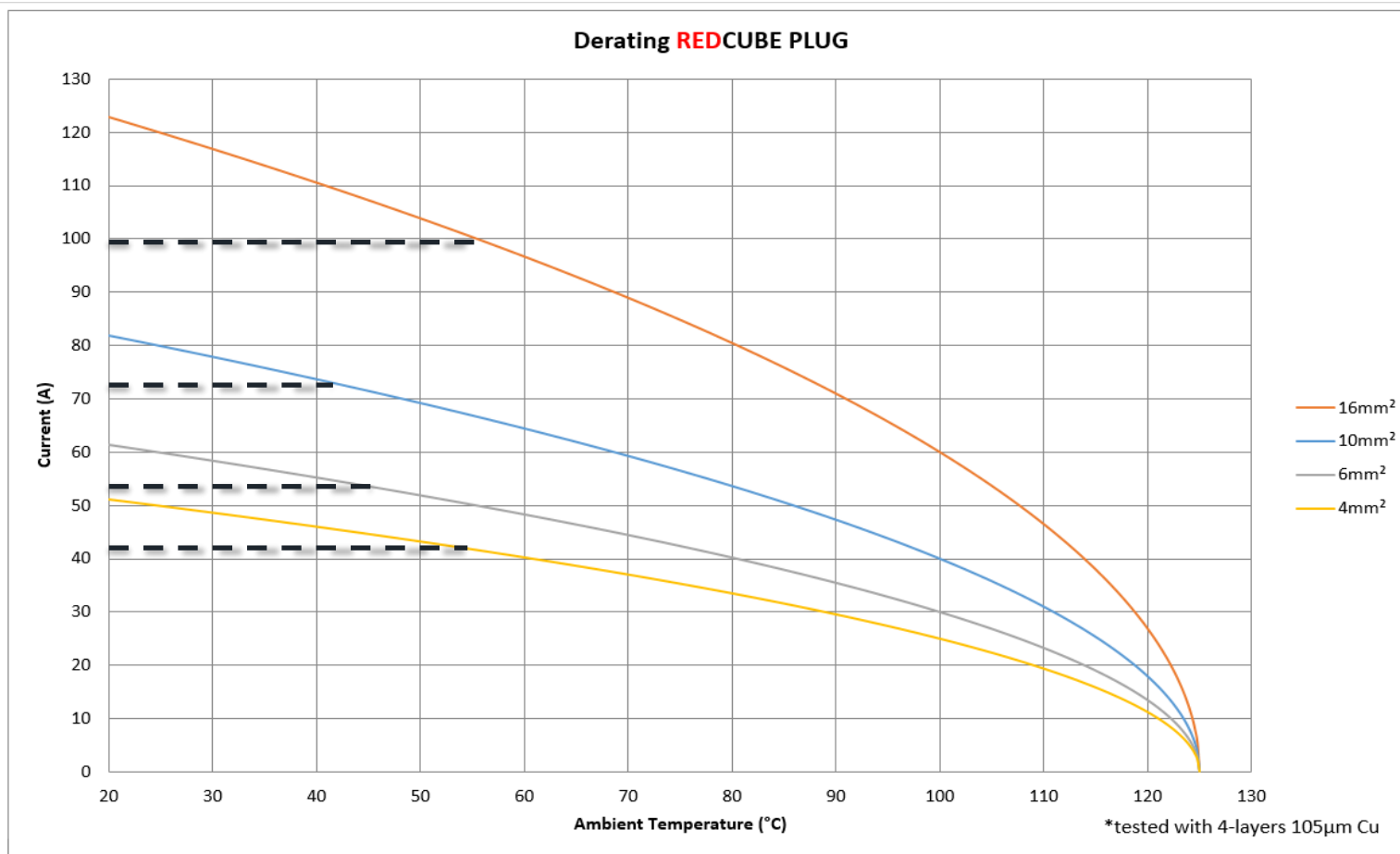
- 18x18mm
- 16x16mm
- 13x13mm
- 9x9mm
- 7x7mm
- 5x5mm
- - - - Cable 95mm<sup>2</sup>, I=292A
- - - - Cable 35mm<sup>2</sup>, I=158A
- - - - Cable 16mm<sup>2</sup>, I=98A



\*tested with 4-layers 105µm Cu



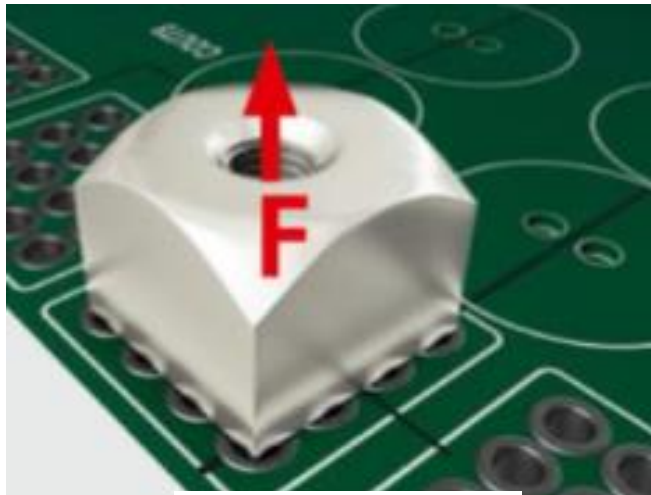
# Derating curves



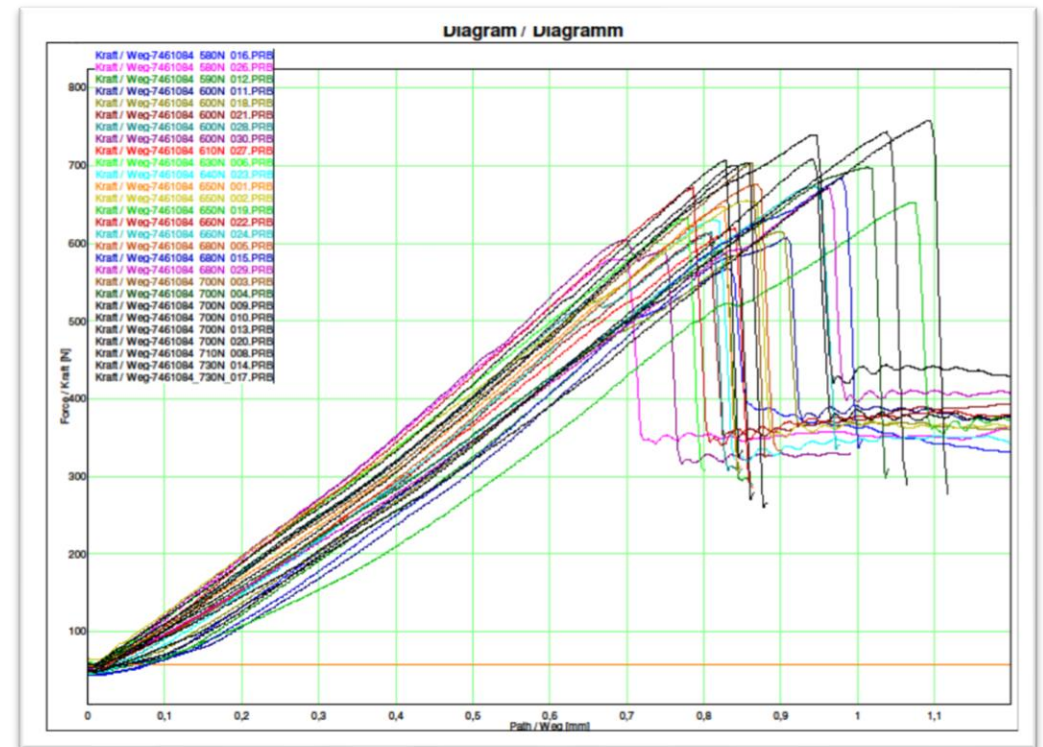
Pictures WE

# How this is certified

Pull-out test



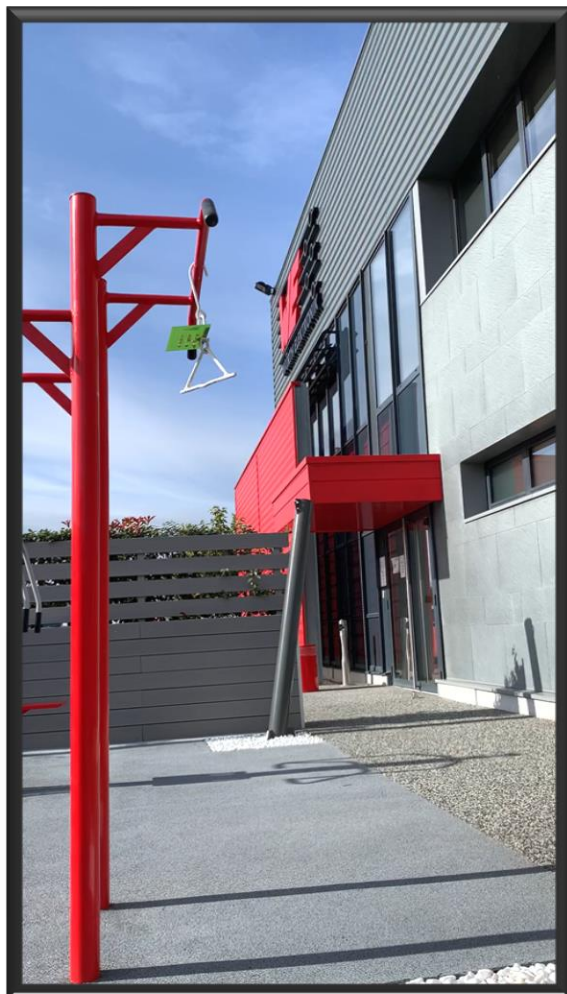
Extraction effort 10kg / pin with PCB 1,6mm



All pictures WE

# How this is certified

Pull-out test

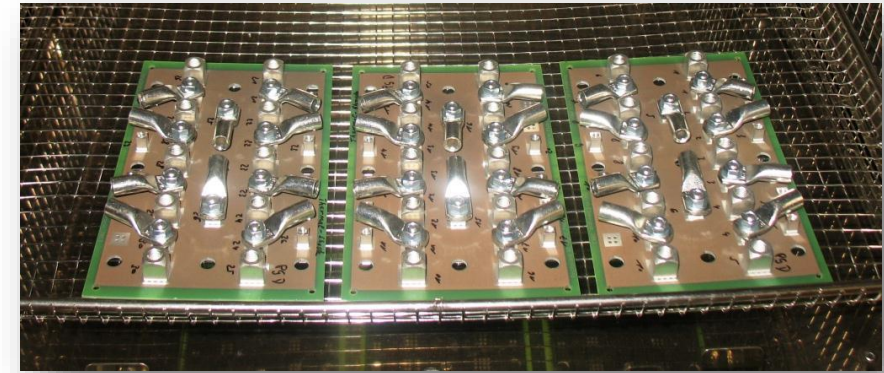


All pictures WE

# How this is certified

## Environnement

Thermal shock IEC60068-2-14		
Characteristics		Test
Usual	Red cube	
-20°C	<b>-55°C</b>	R <sub>c</sub> , pull force, torque
+65°C	<b>+150°C</b>	
96h	<b>1000h</b>	



Damp heat IEC60068-2-30		
Characteristics		Test
Usual	Red cube	
+40°C	<b>+65°C</b>	R <sub>c</sub> , pull force
	<b>+95% moisture</b>	
96h	<b>500h</b>	

All pictures WE

# How this is certified

## Environment

Salt spray IEC60068-2-52		
Characteristics		Test
Usual	Red cube	
	+40°C	R <sub>c</sub> , pull force, visual
	5% NaCl	
48h	<b>72h</b>	



Vibration test IEC60068-2-6		
Characteristics		Test
Usual	Red cube	
10-55Hz	<b>10-1500Hz</b>	R <sub>c</sub> , pull force
10-2000Hz	<b>12 cycles</b>	
<b>15mn</b>	<b>20mn /axis</b>	
3-10g	<b>15g</b>	

All pictures WE

# PRESSFIT: ASSEMBLY PROCESS

## Press-fit proces



All pictures WE

# Press-fit process

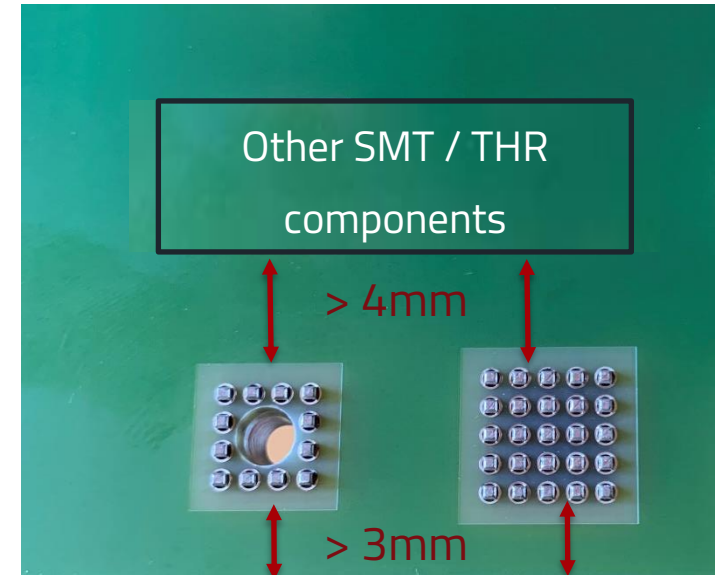
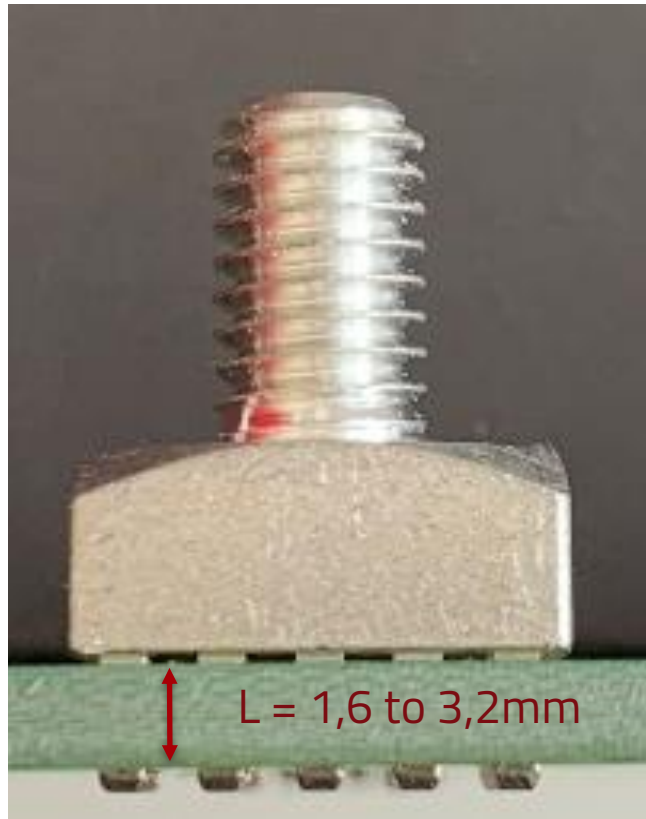
- Materiel needed:
  - PCB
  - Support
  - Base
  - Stamp
  - Press



All pictures WE

# Press-fit process

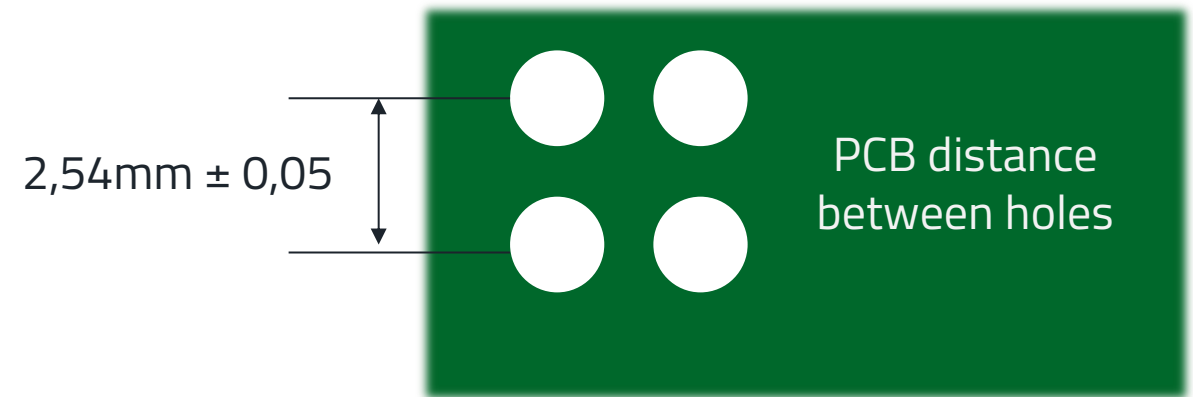
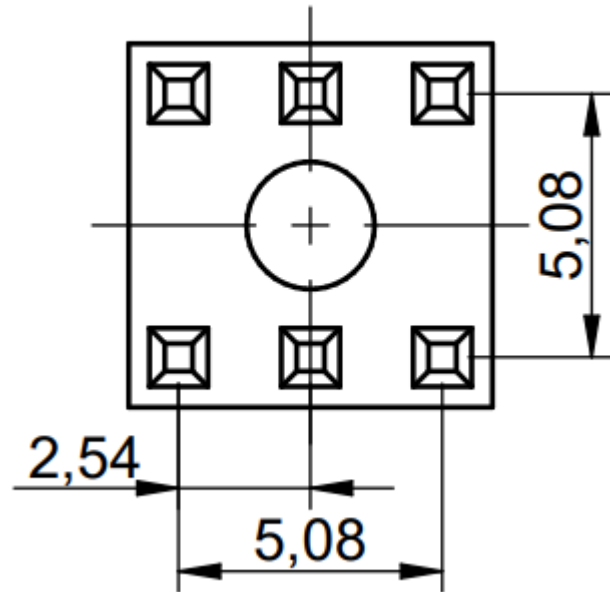
PCB



All pictures WE

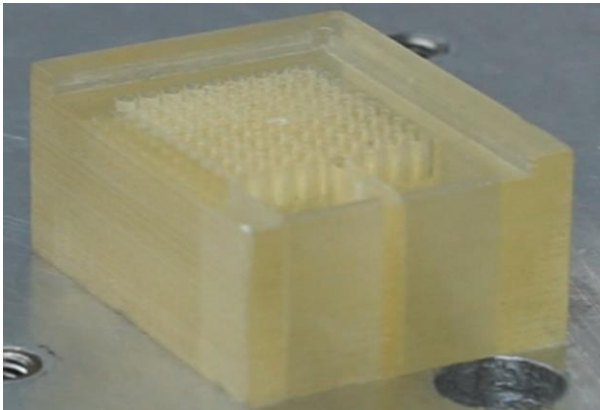
# Press-fit process

PCB

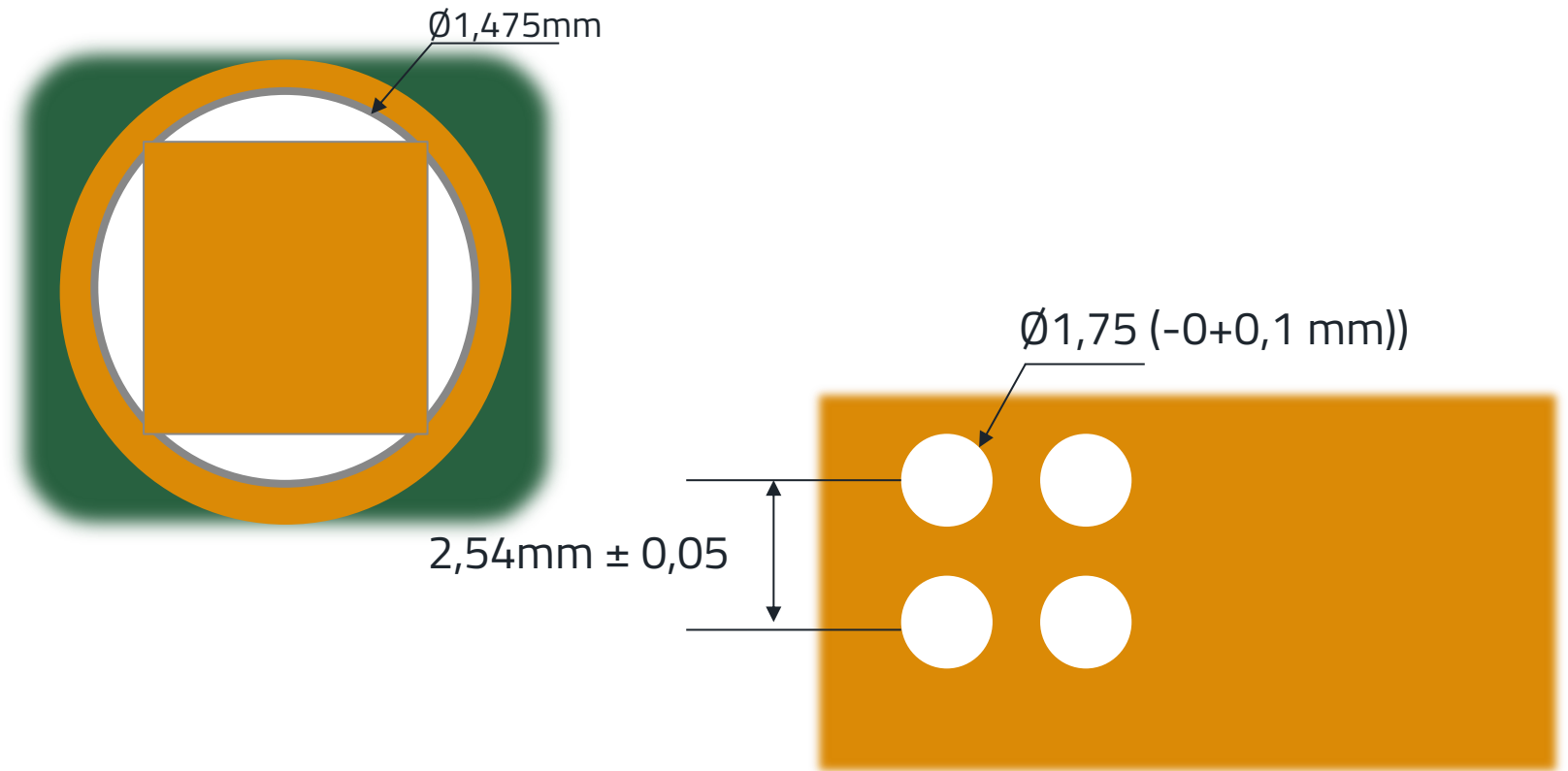


# Press fit process

3D printing prototype



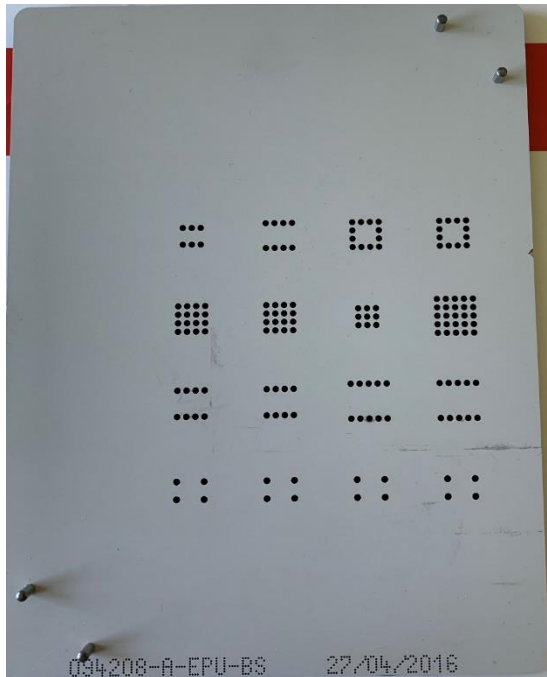
Support



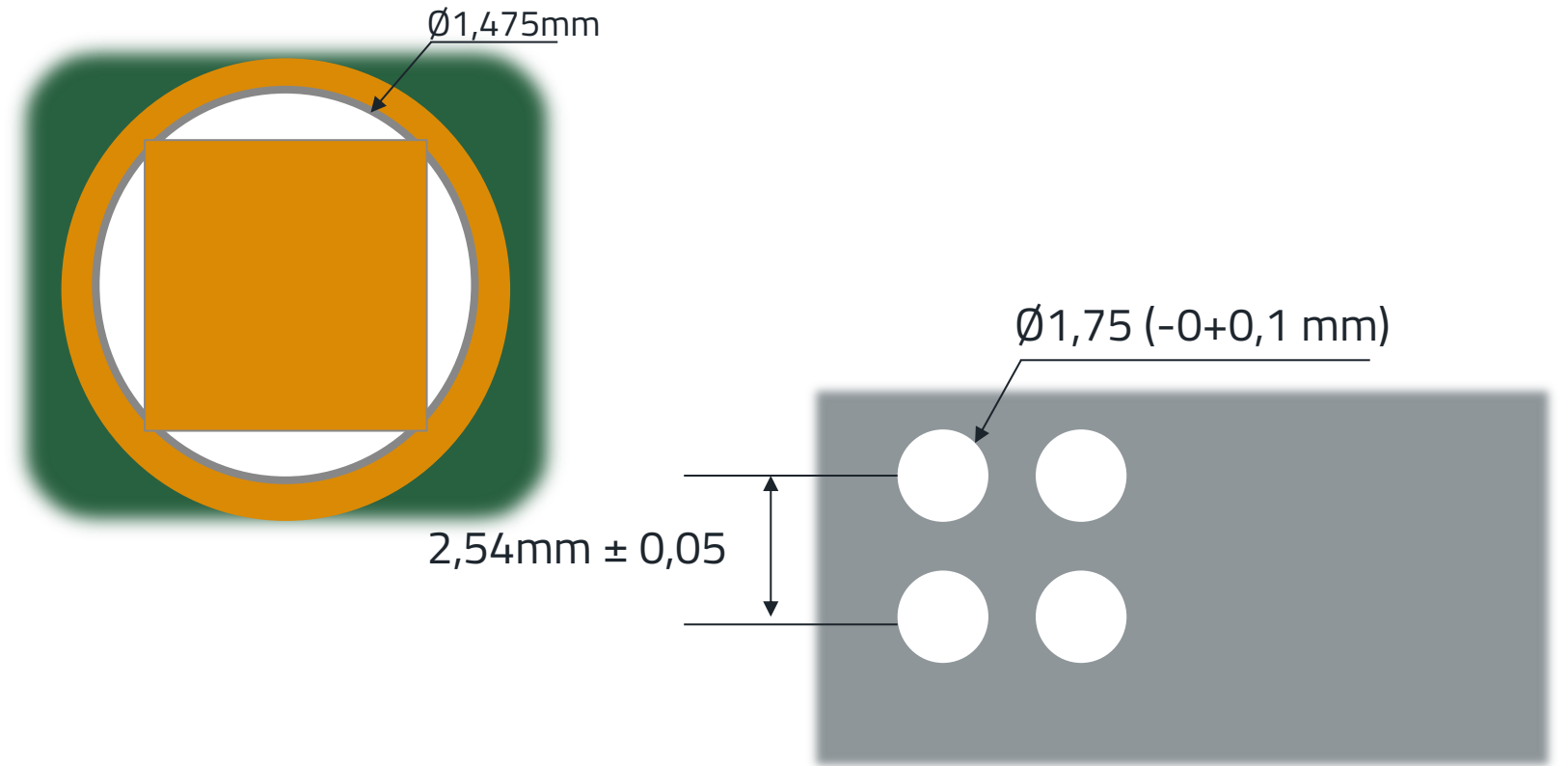
All pictures WE

# Press fit process

Metal final version



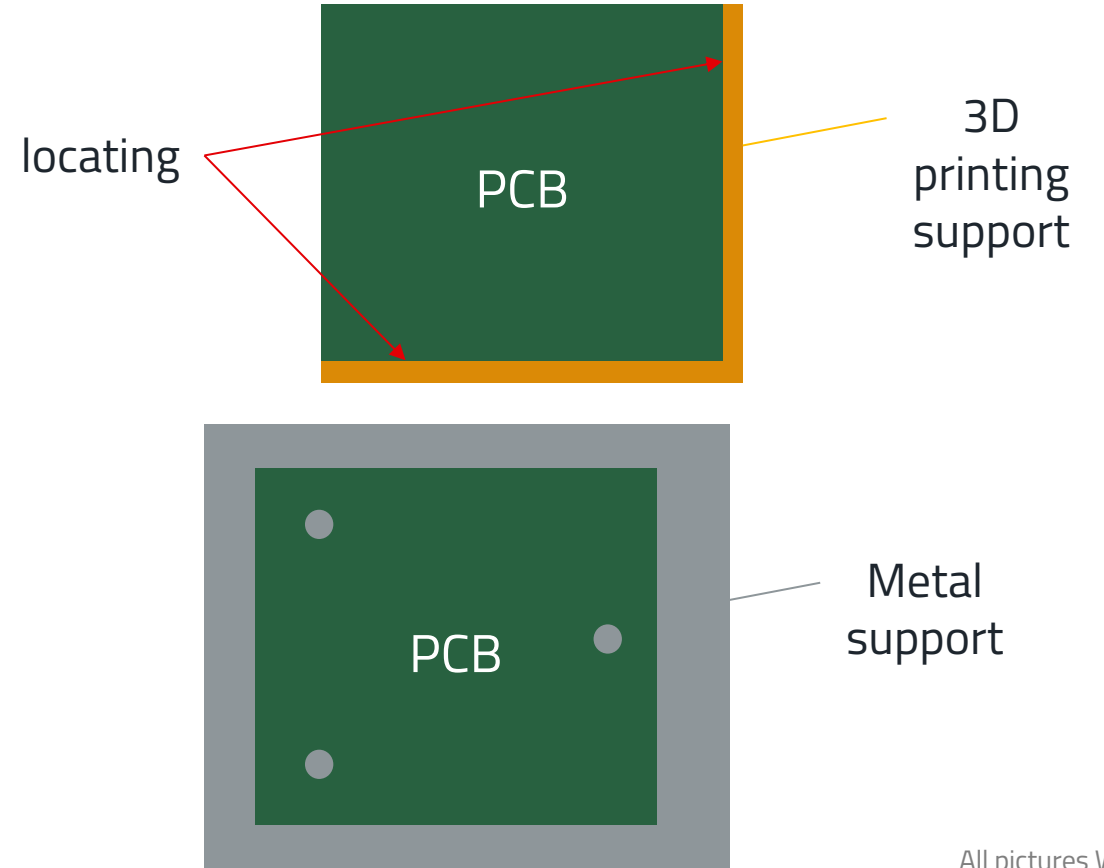
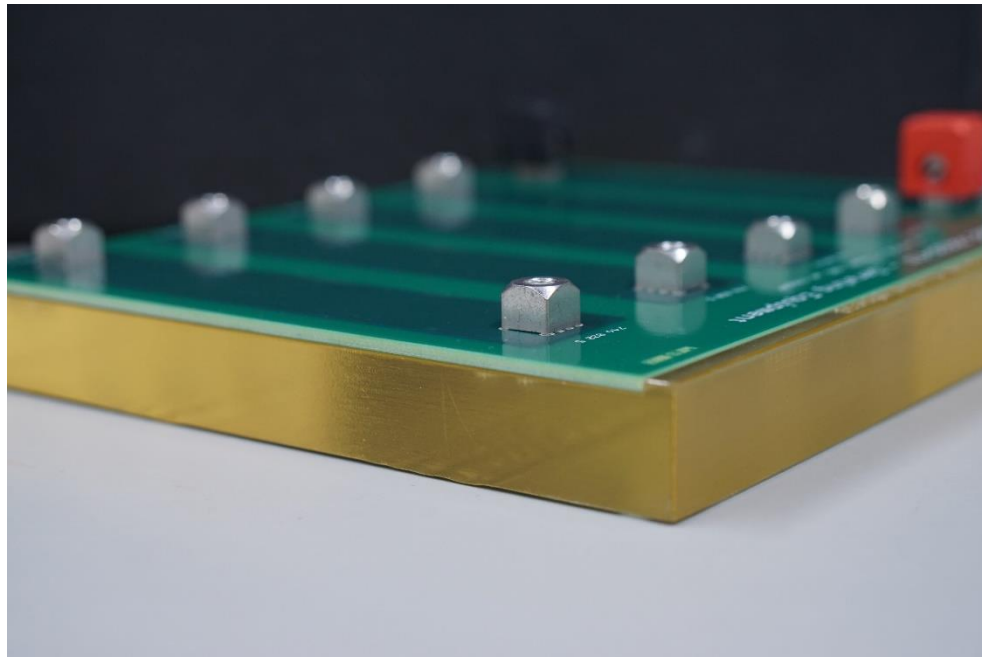
Support



All pictures WE

# Press fit process

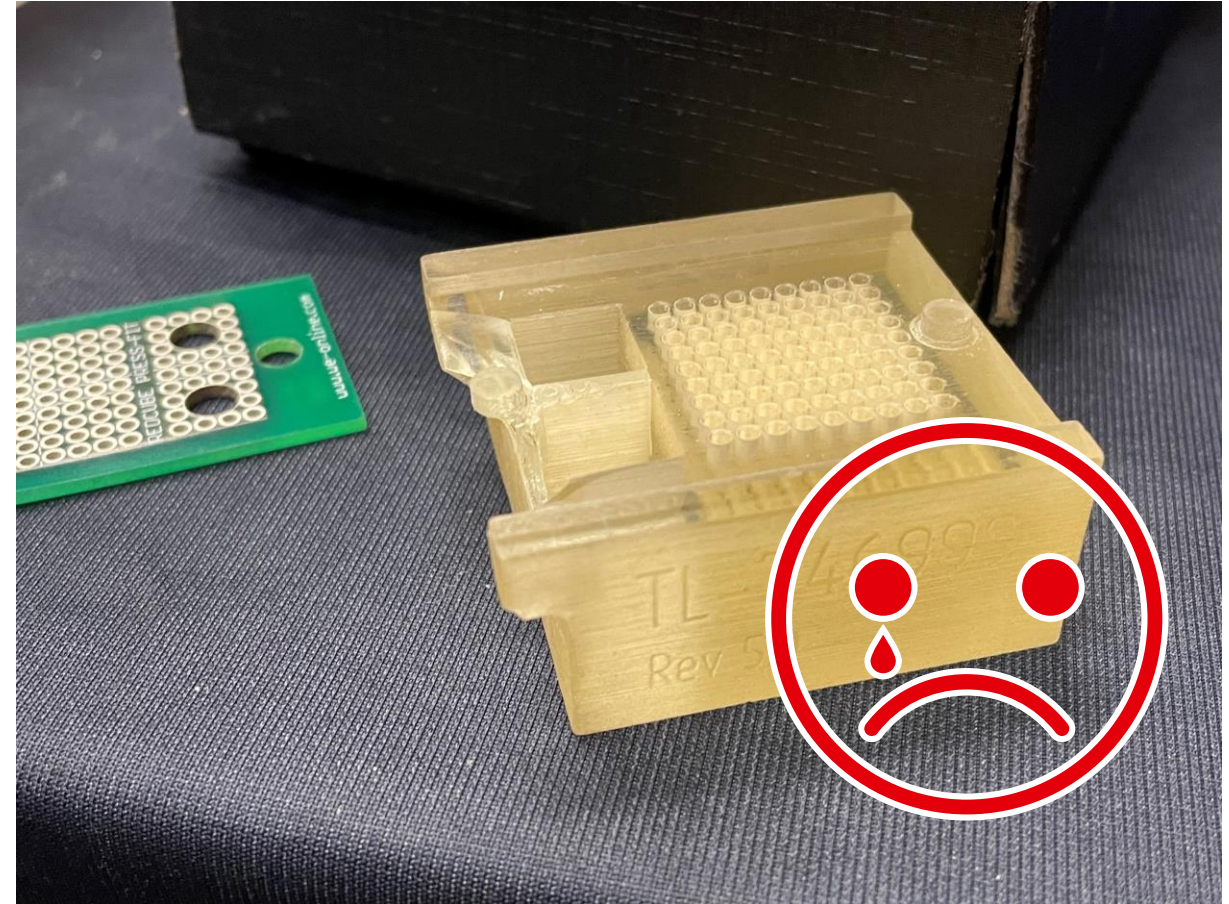
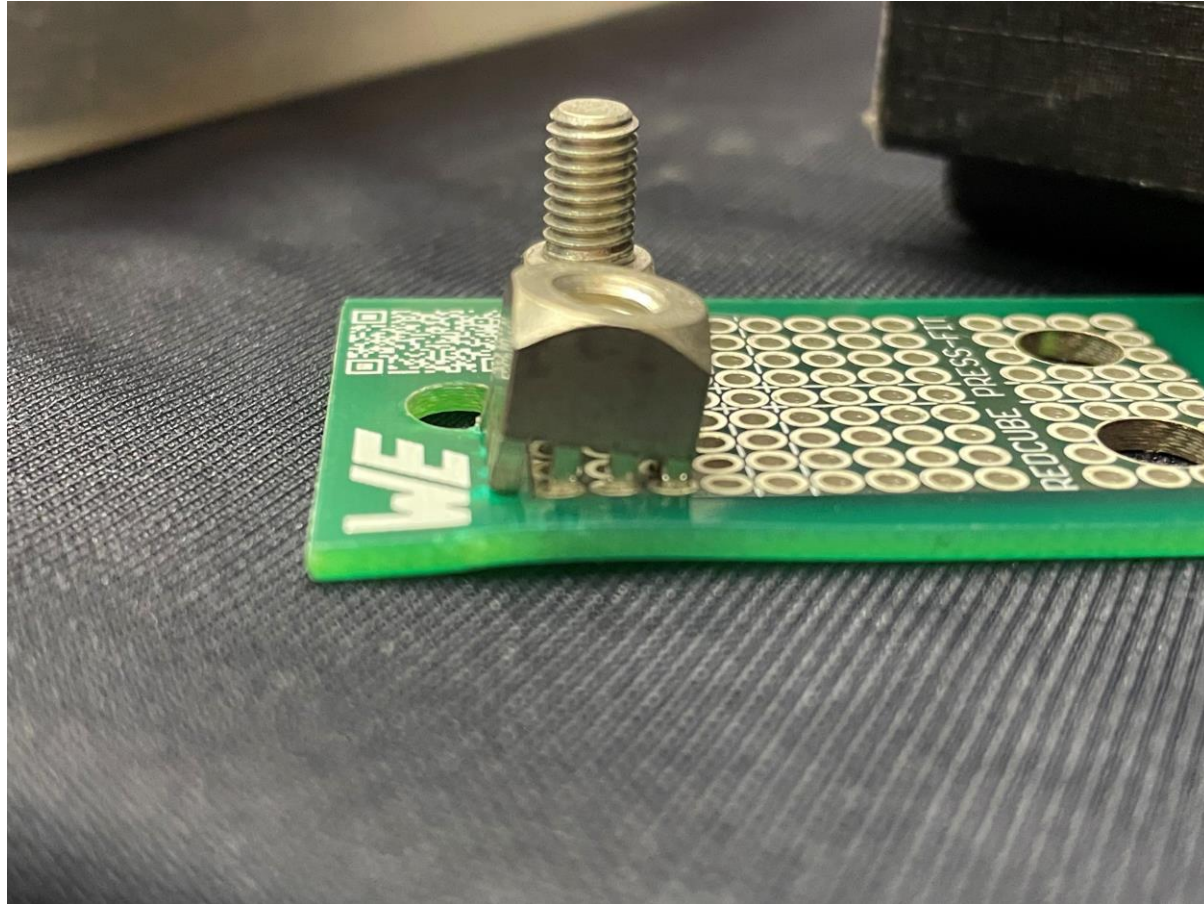
Support



All pictures WE

# Press fit process

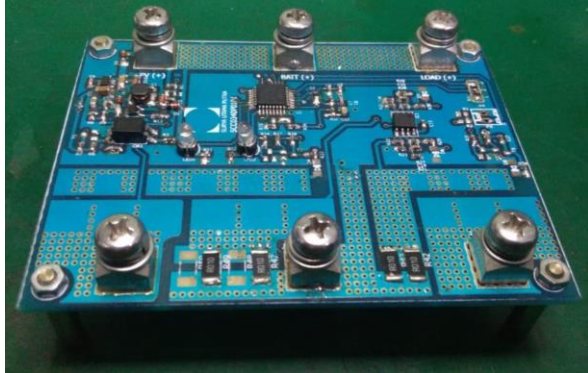
Support



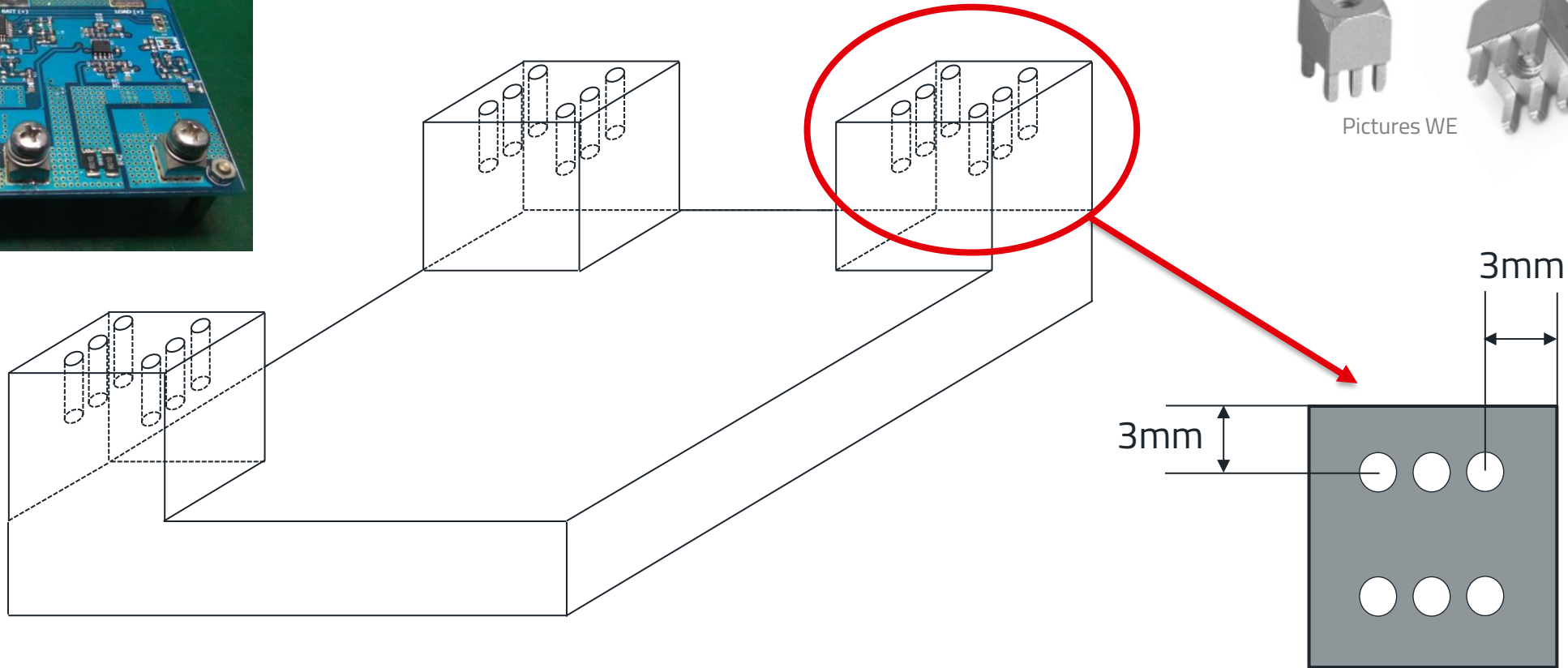
All pictures WE

# Press fit process

Support real case



Picture Solar

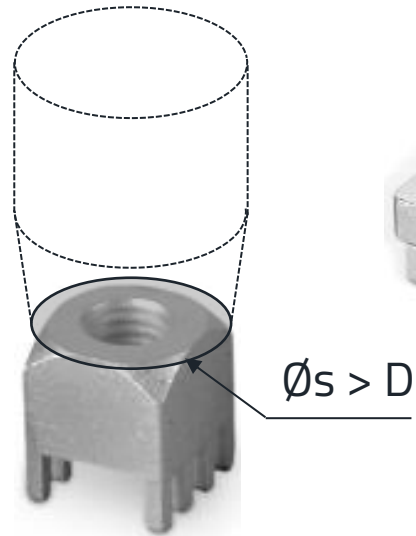


# Press fit process

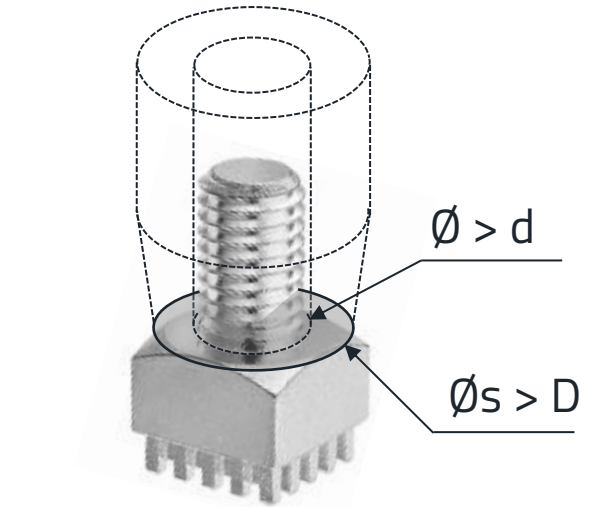
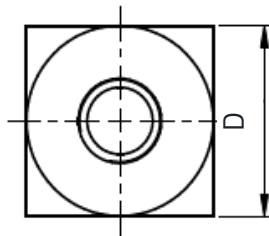
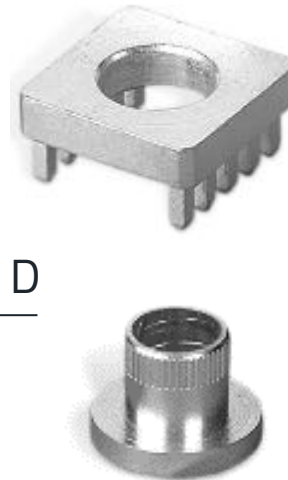
Stamp



$\varnothing_s$

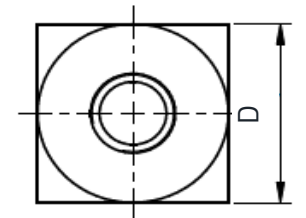
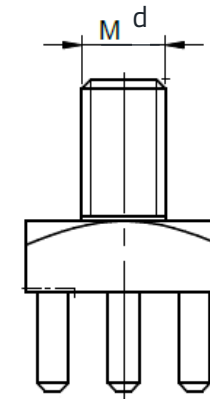


$\varnothing_s > D$



$\varnothing > d$

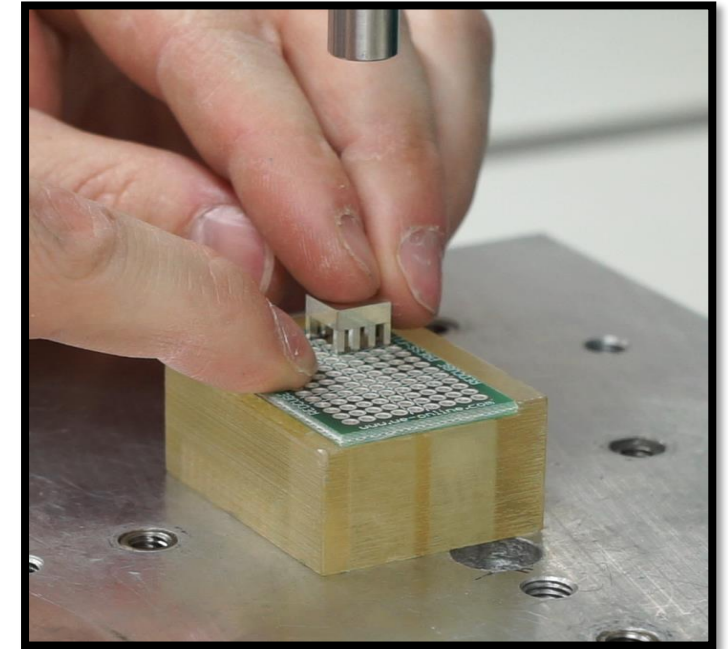
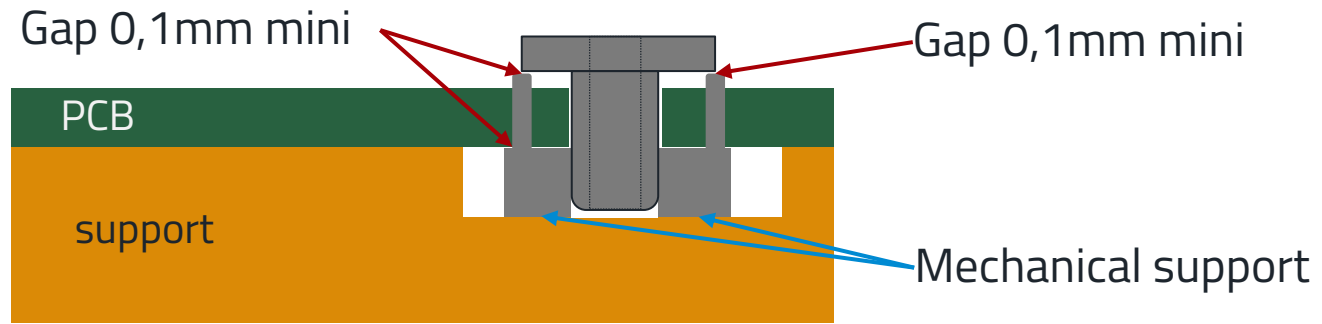
$\varnothing_s > D$



All pictures WE

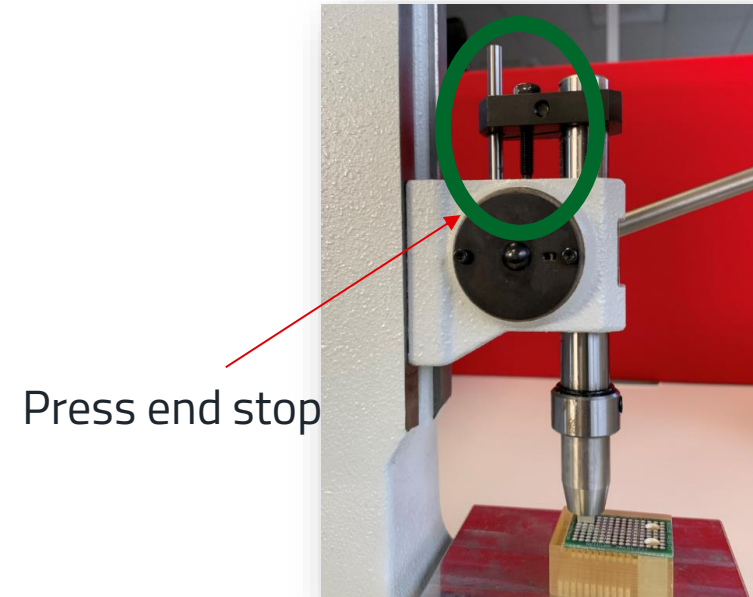
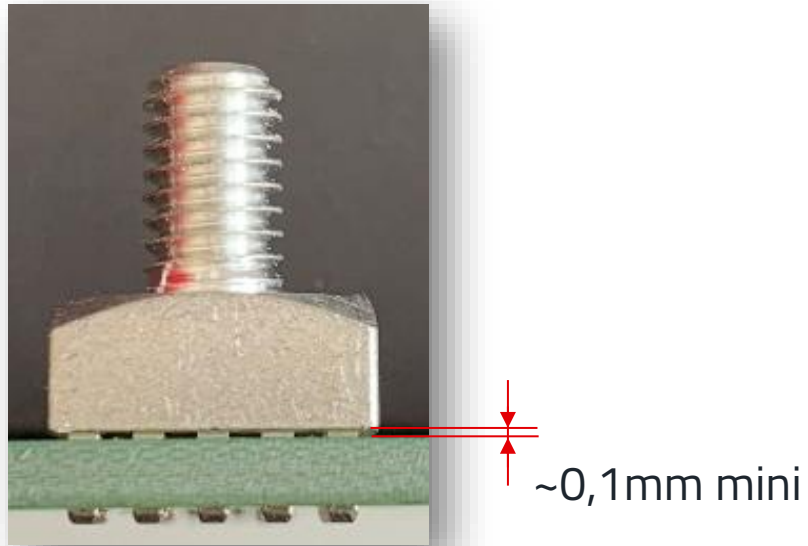
# Press fit process

Stamp



All pictures WE

# Press-fit process



Flat zone  
exceed PCB



- Insertion speed  $\approx$  100-250mm/mn
- Insertion done in 1 single time

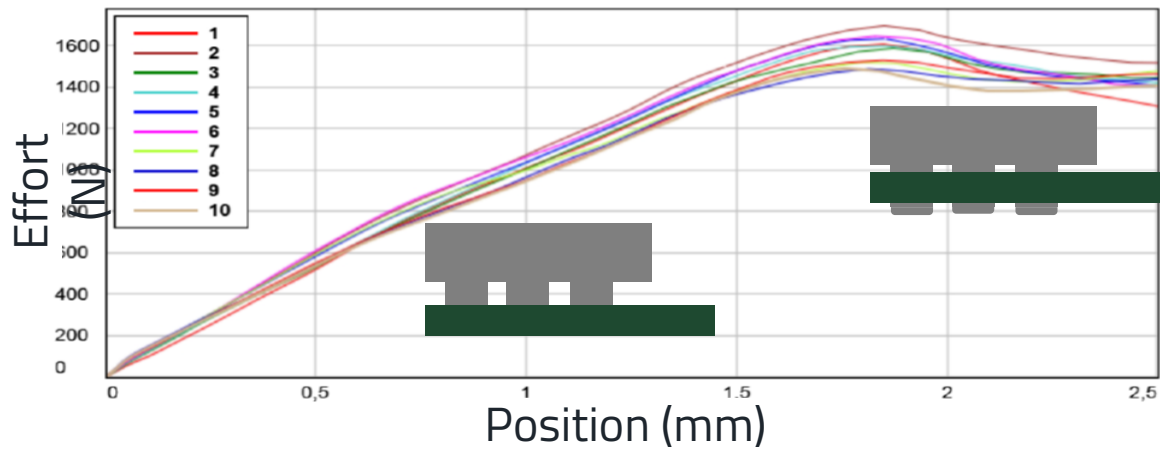
All pictures WE

# Press-fit process

Measurement by force

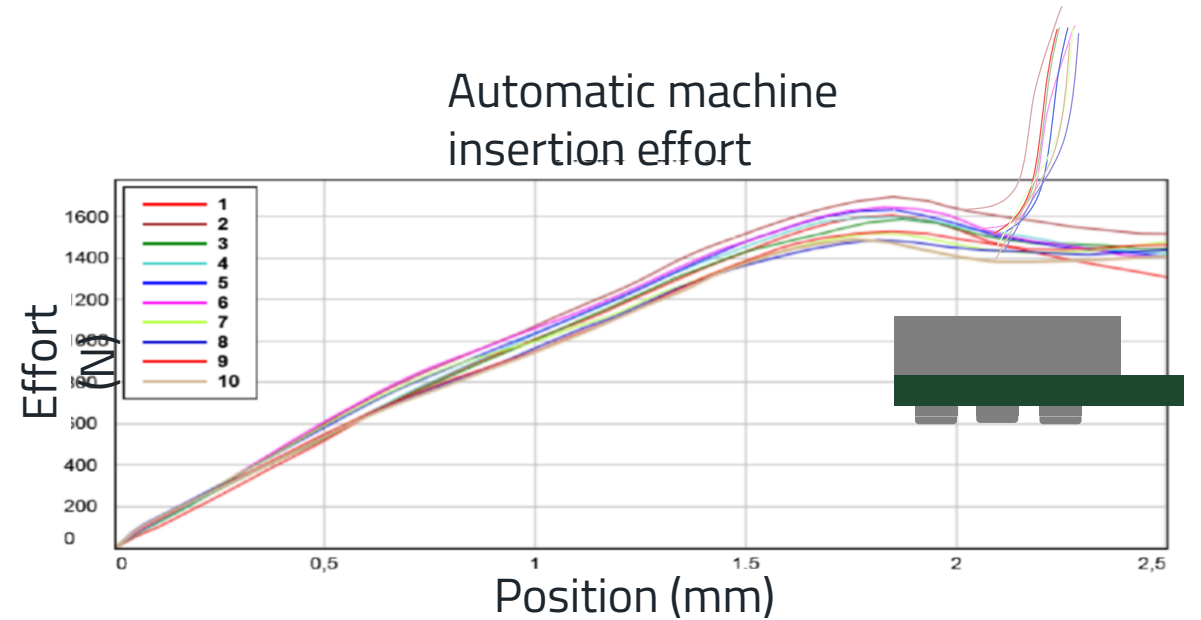
Classical automatic press measurement effort for a PCB of 1,6mm thickness

Automatic machine insertion effort

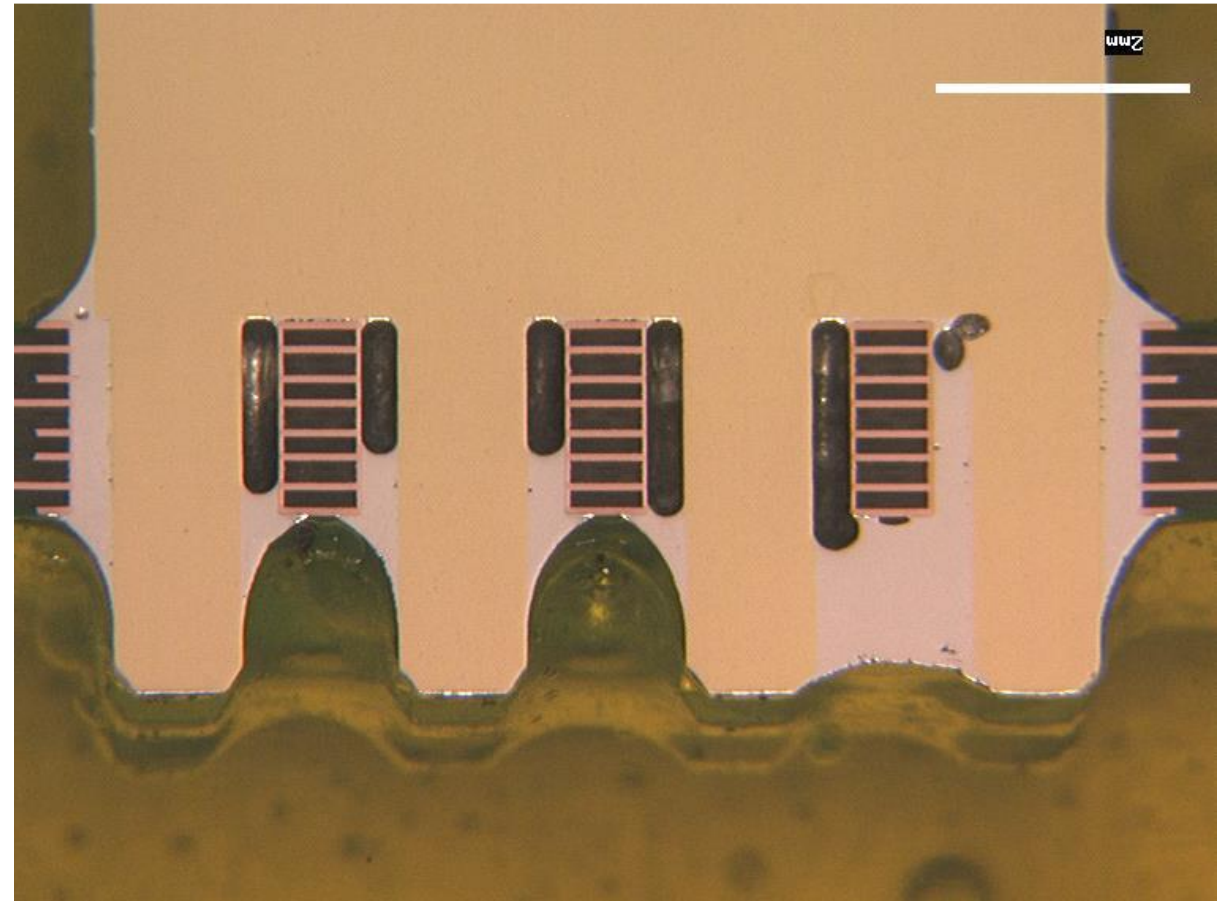
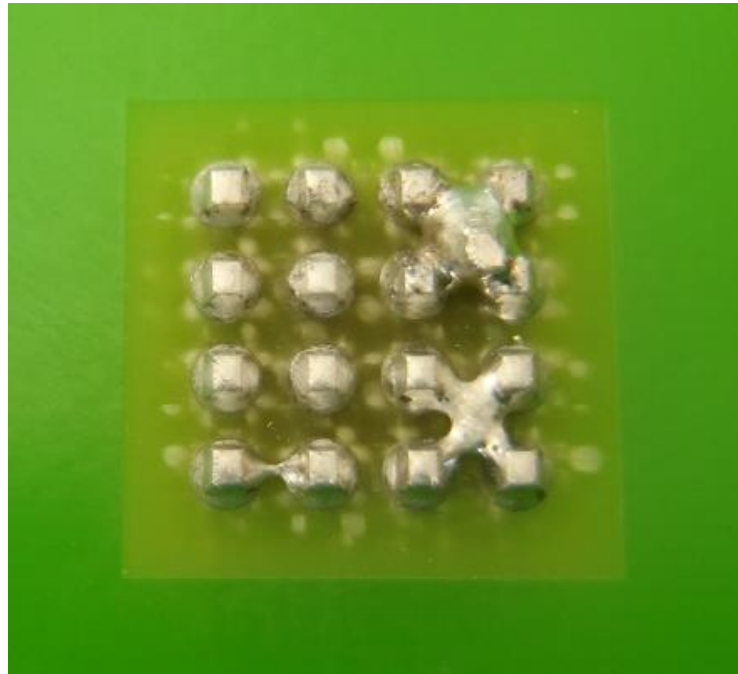


Possible press fit insertion process

Automatic machine insertion effort

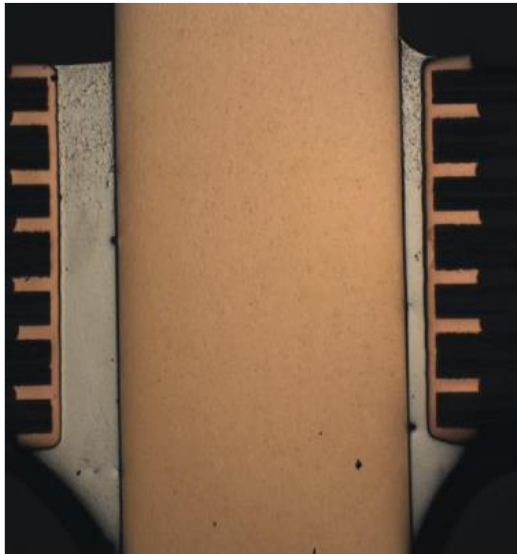


# Soldering press-fits?

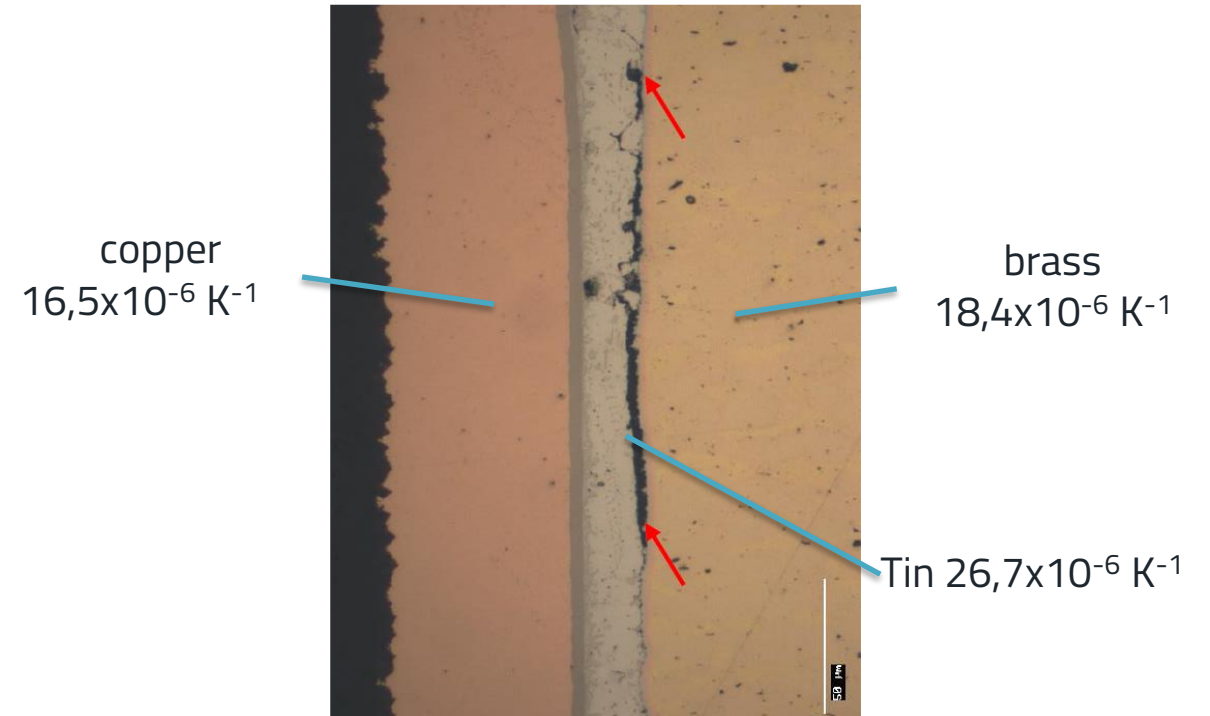


# Press fit process

- Do not solder press-fit after insertion



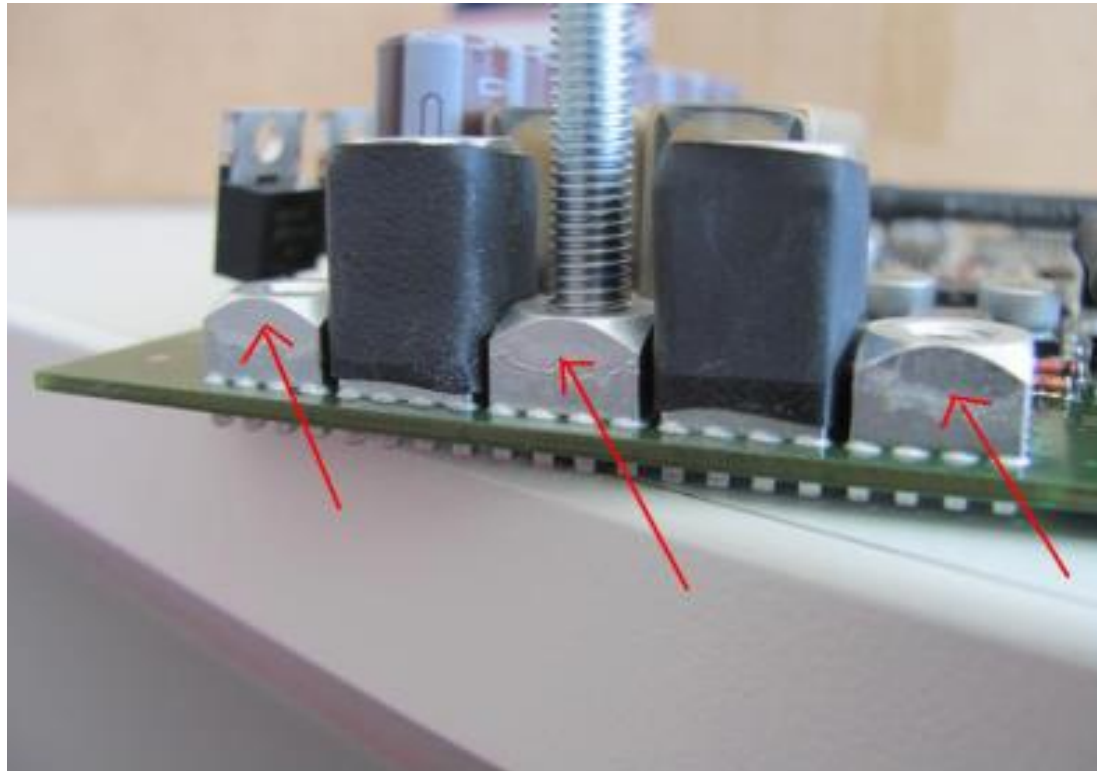
SMT THR redcubes



All pictures WE

## Press fit process

- Do not solder press-fit after insertion



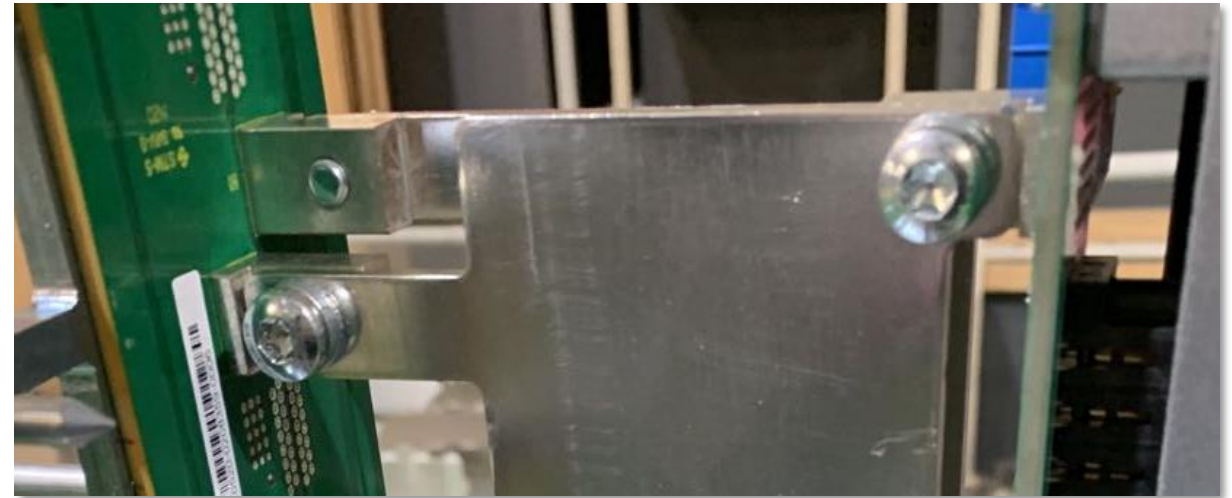
All pictures WE

## What to remember ?

- Press fit connection main characteristics:
  - Cold welding is the best connection: failure in Time Value up to 30-times better than soldered elements
  - $R_c < 200\mu\Omega \rightarrow$  less temperature rise
  - pull-out  $> 10\text{kg}$  /pin
  - gas tight connection
- Redcubes succeed tests in higher conditions than usual connectors
- Redcube is colder than PCB under current

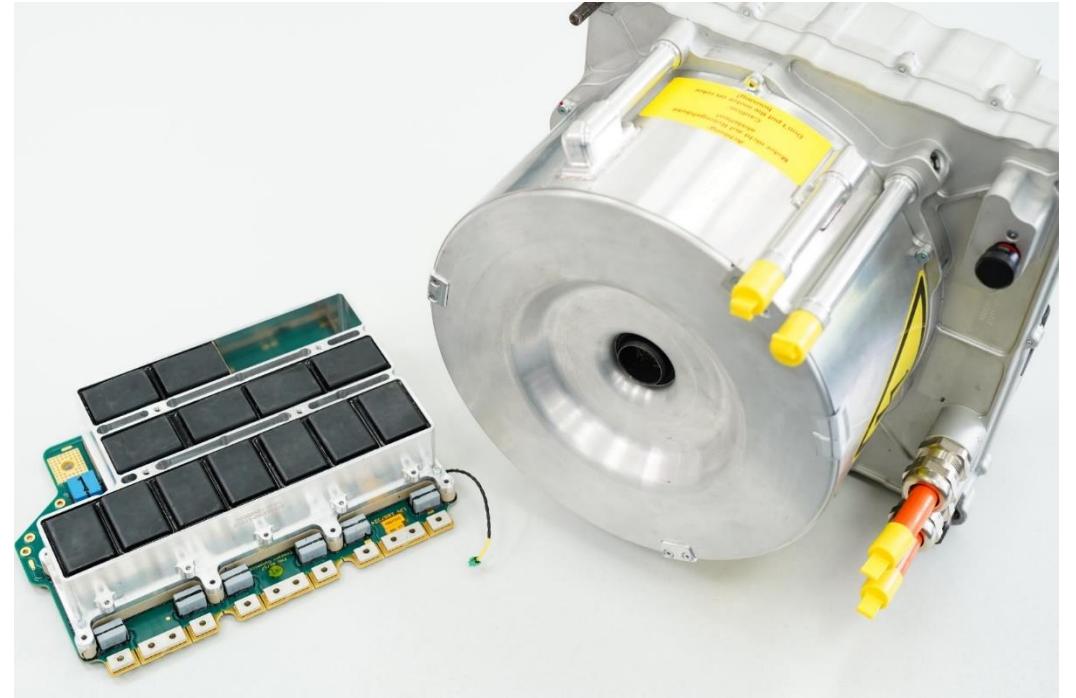
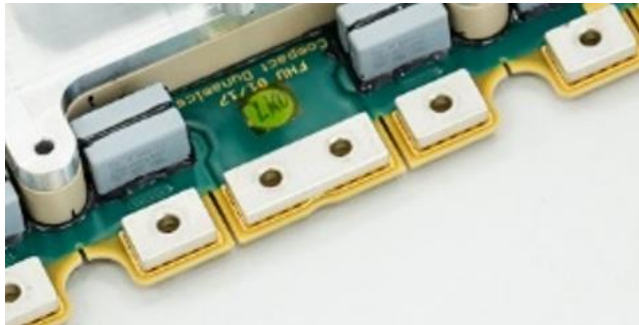
# APPLICATIONS

## Applications: copper bar



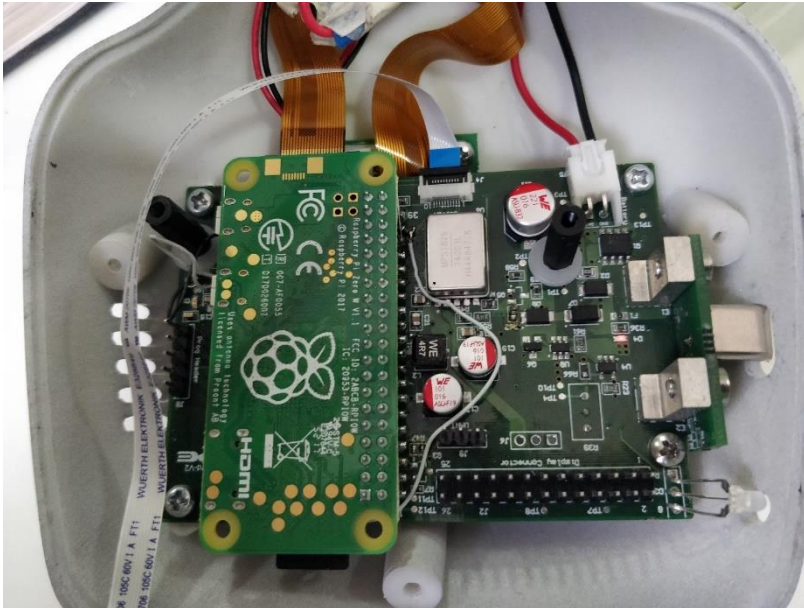
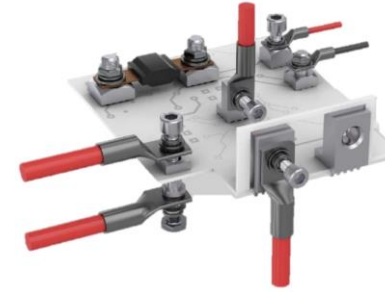
All pictures WE

# Applications: formula-e



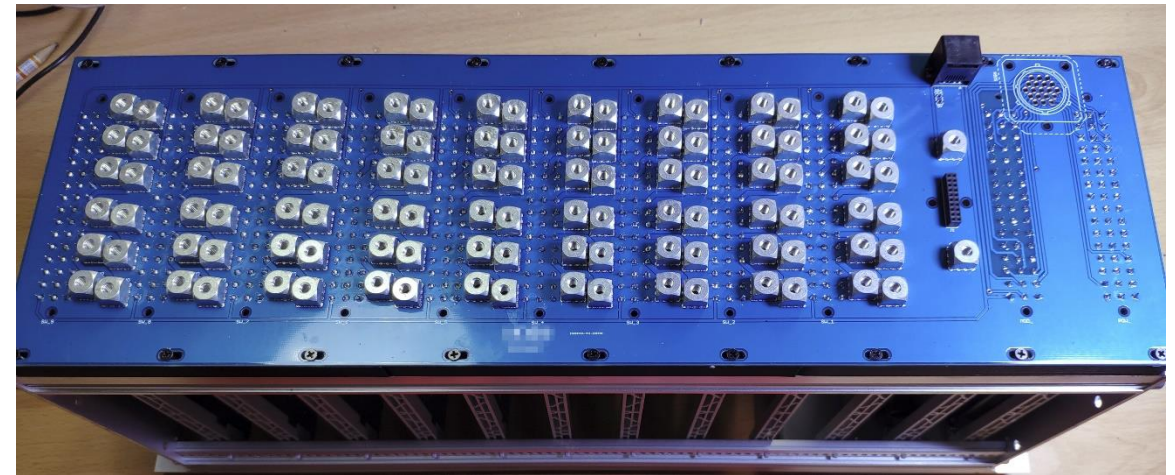
All pictures WE

# Press fit



Pictures WE

Perpendicular board to board



Pictures Polar



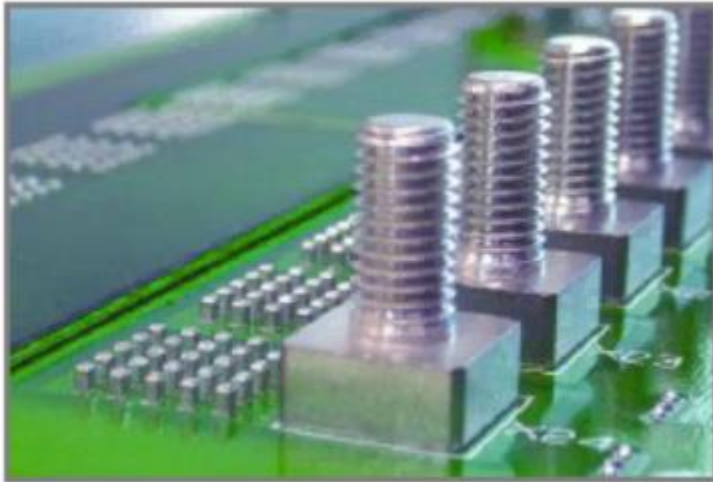
High power backplane

# Water tightness power battery



All pictures WE

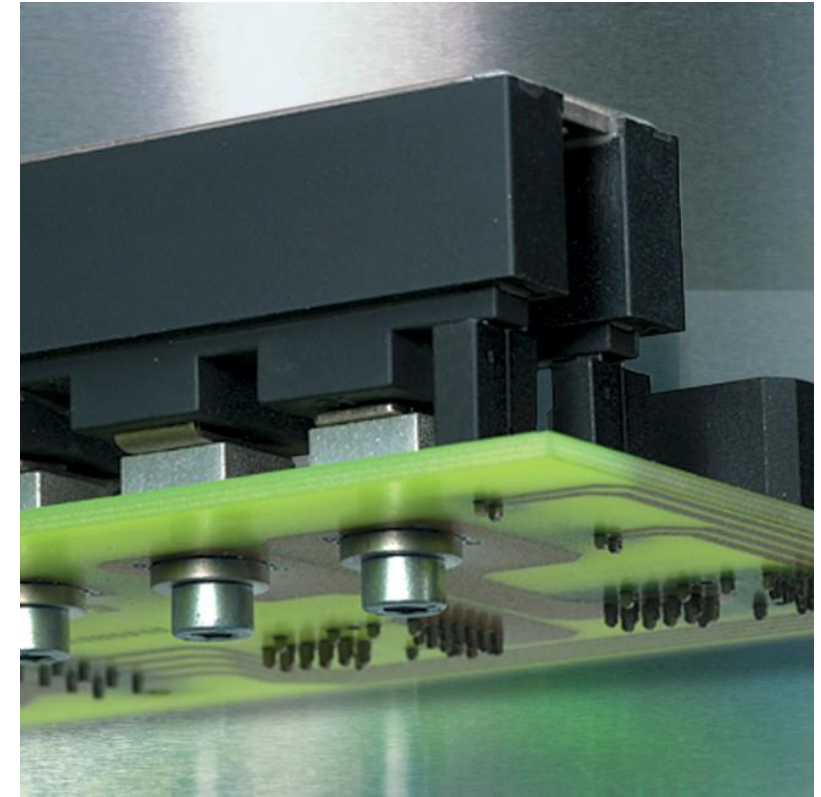
# Specific applications



Double sides mounting



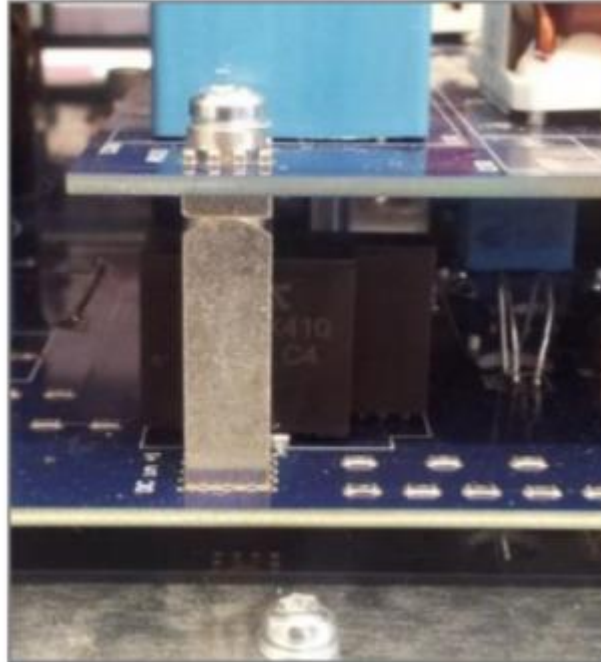
Laminated fuse



IGBT connection

All pictures WE

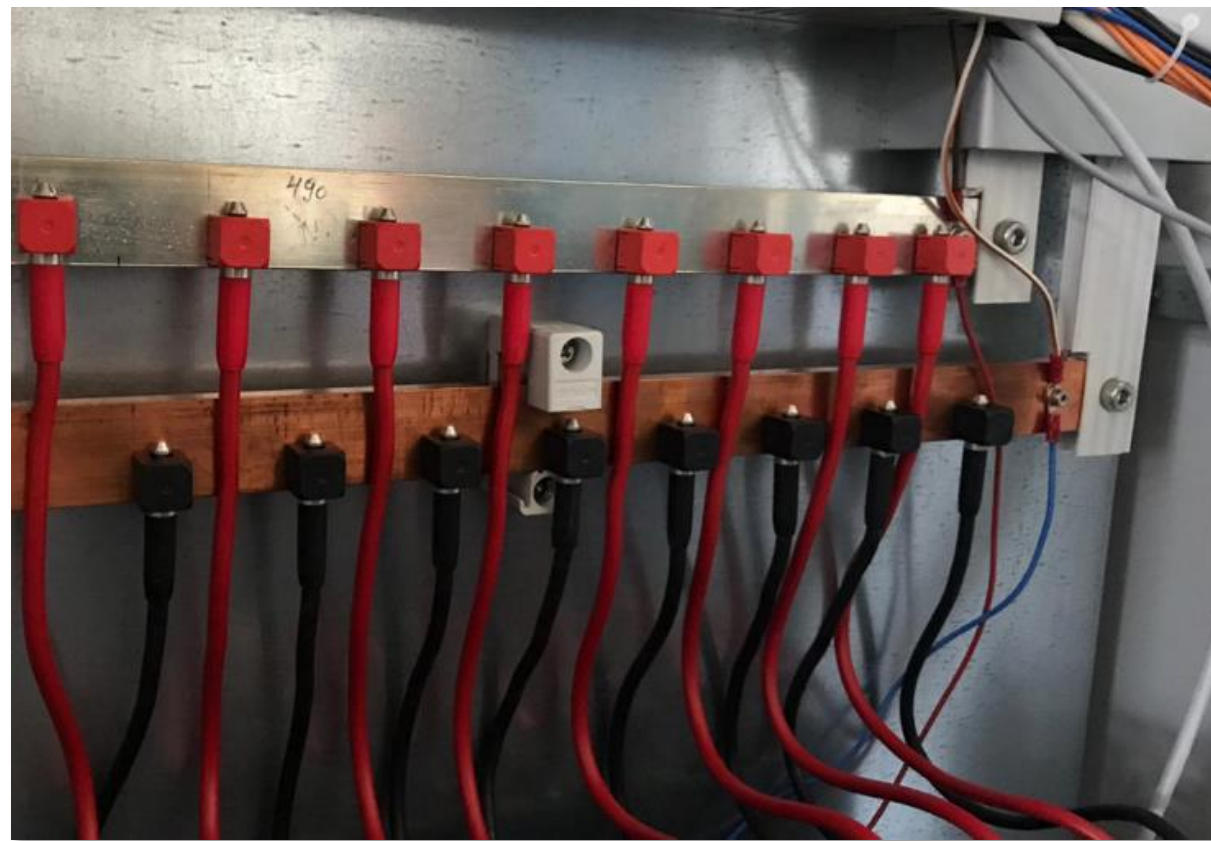
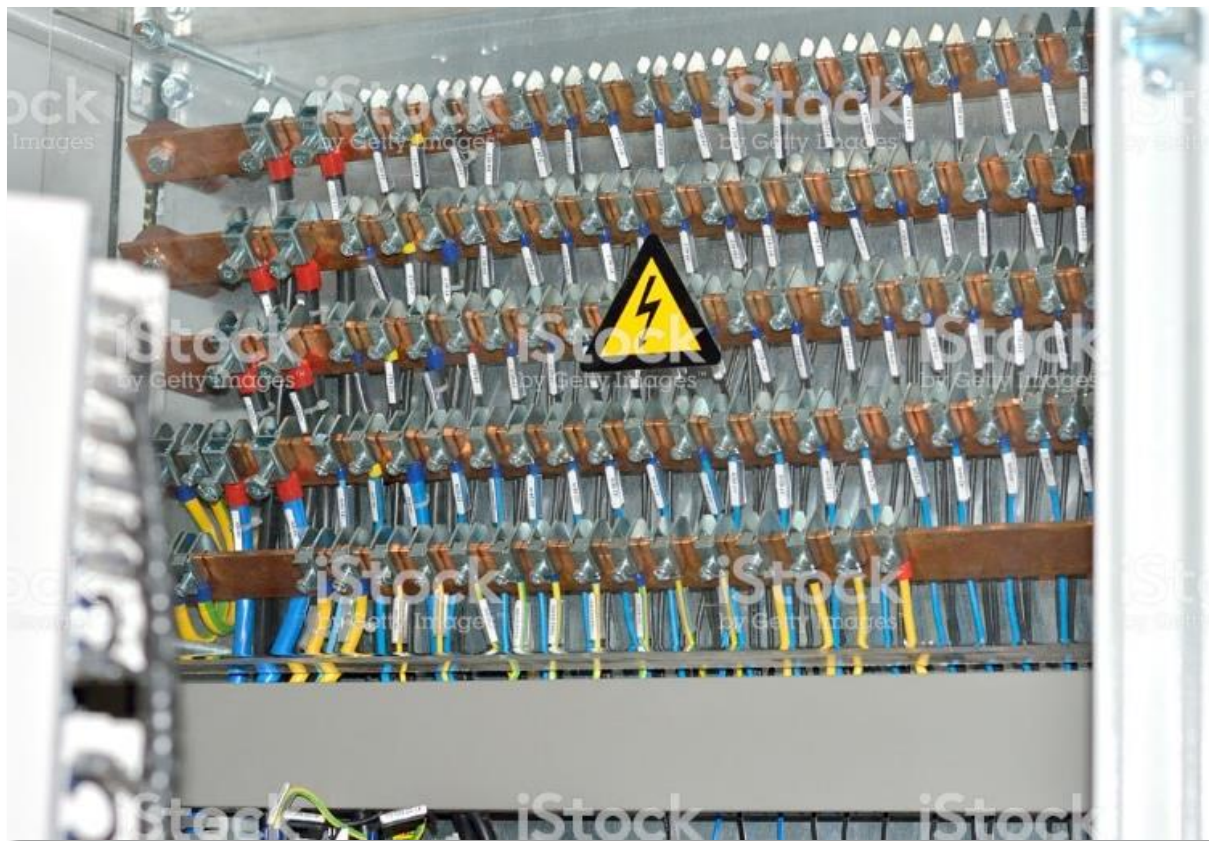
## Specific applications



High current board to board

All pictures WE

## Copper bar distribution



# Redcubes in the air



All pictures WE

