Press-fit for high current applications

Today's speaker:

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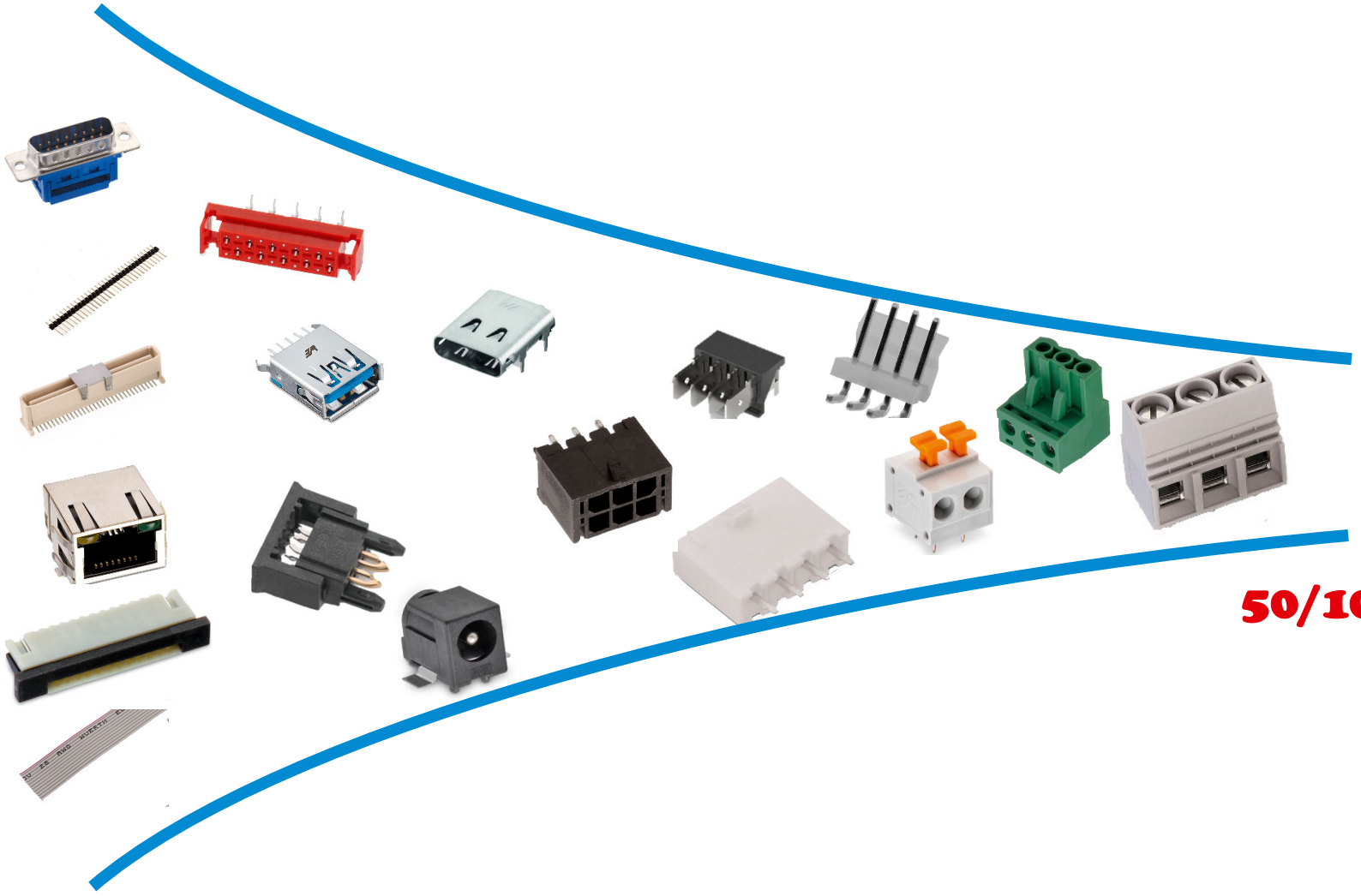
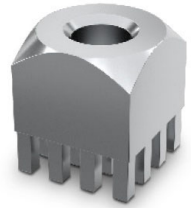
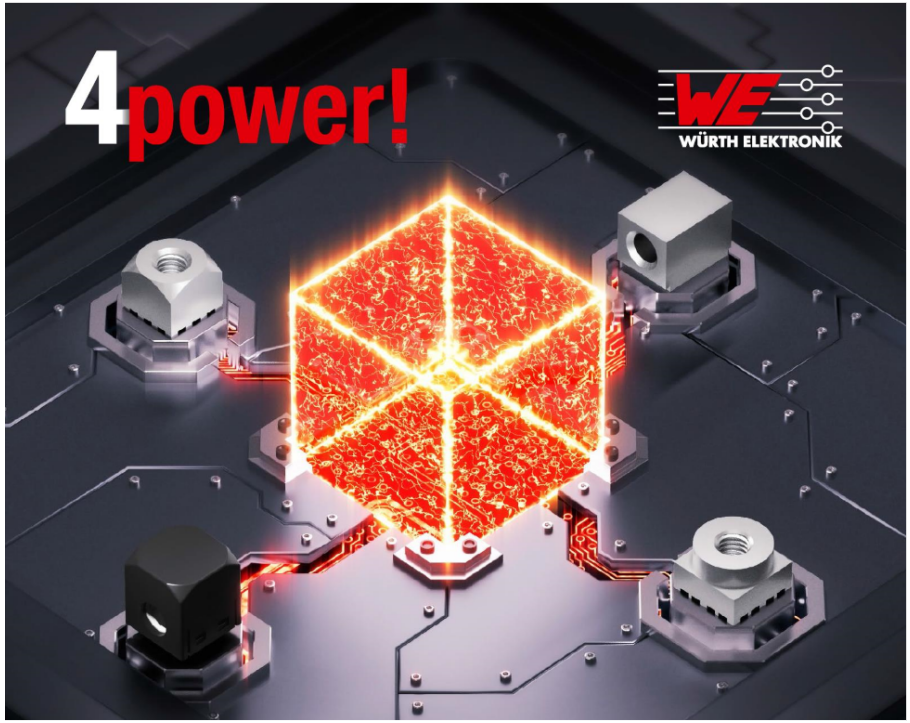


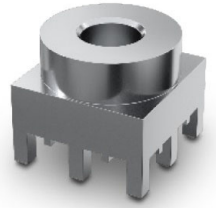
50/100A

Red cube global range

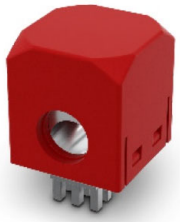


REDCUBE PRESS-FIT





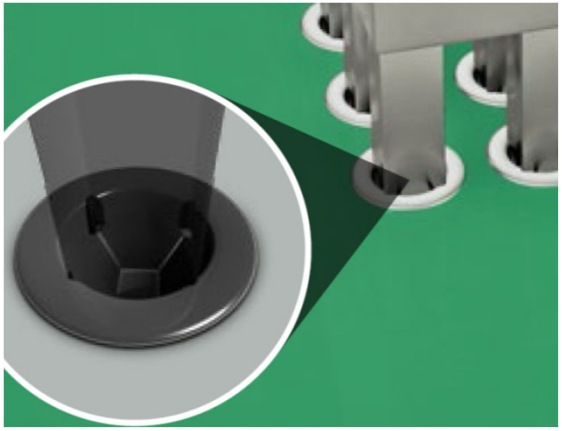
REDCUBE THR

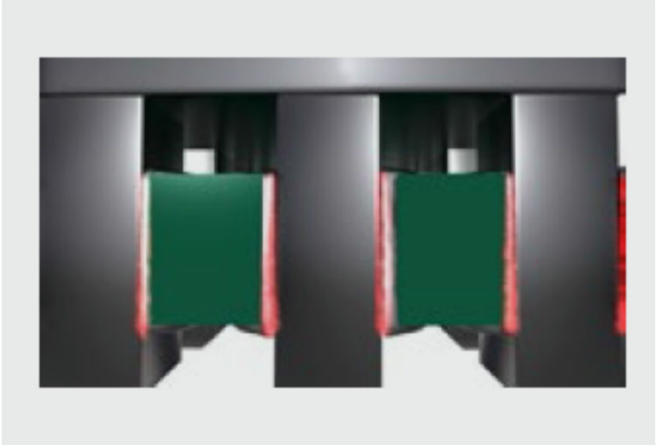


REDCUBE PLUG

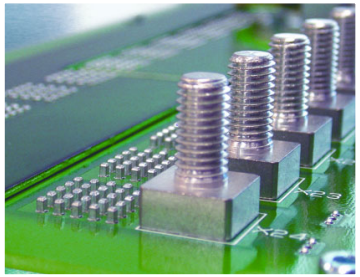
REDCUBE SMD

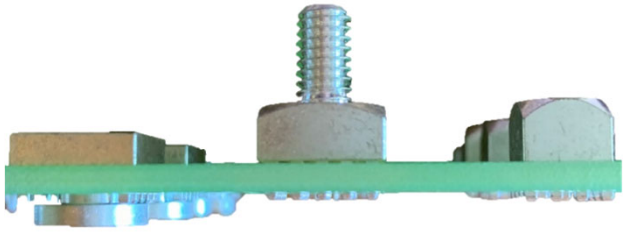
Press fit: how does it work ?



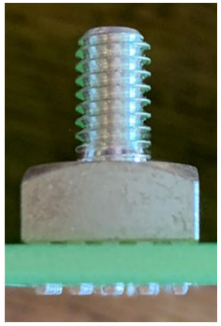


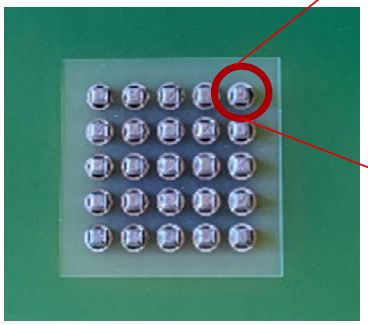
- solder free
- gastight
- Powerful electrical Connection

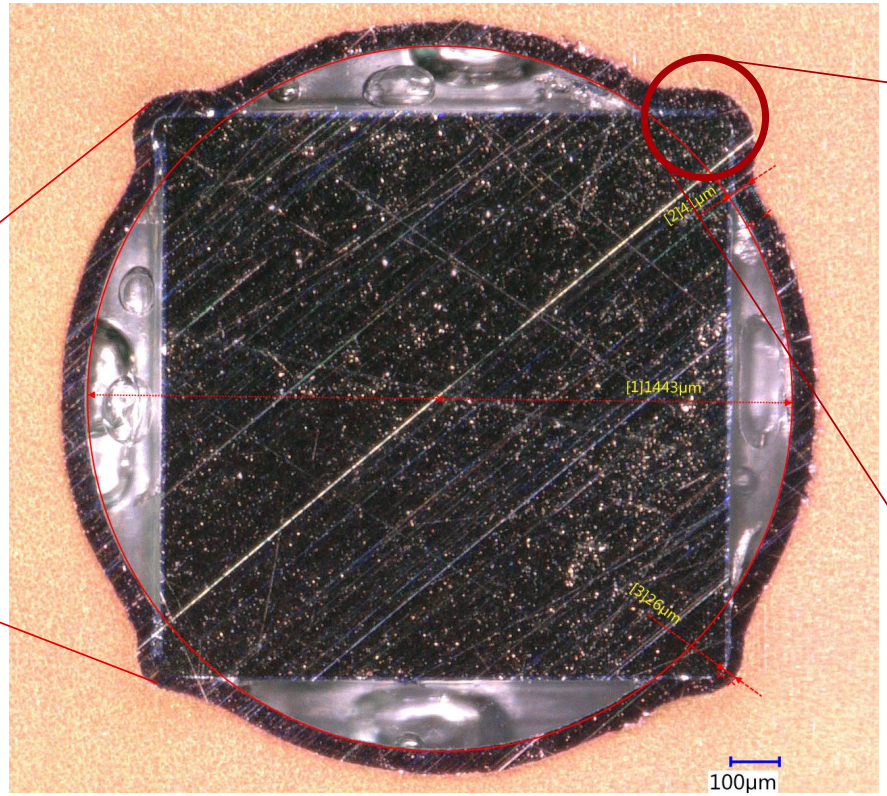


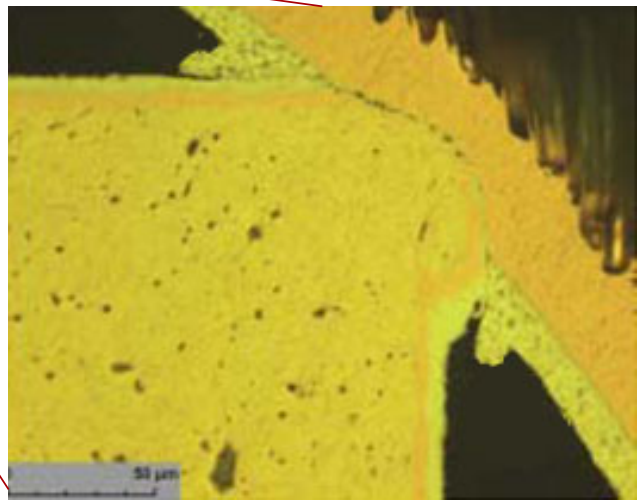


Press fit: how does it work ?

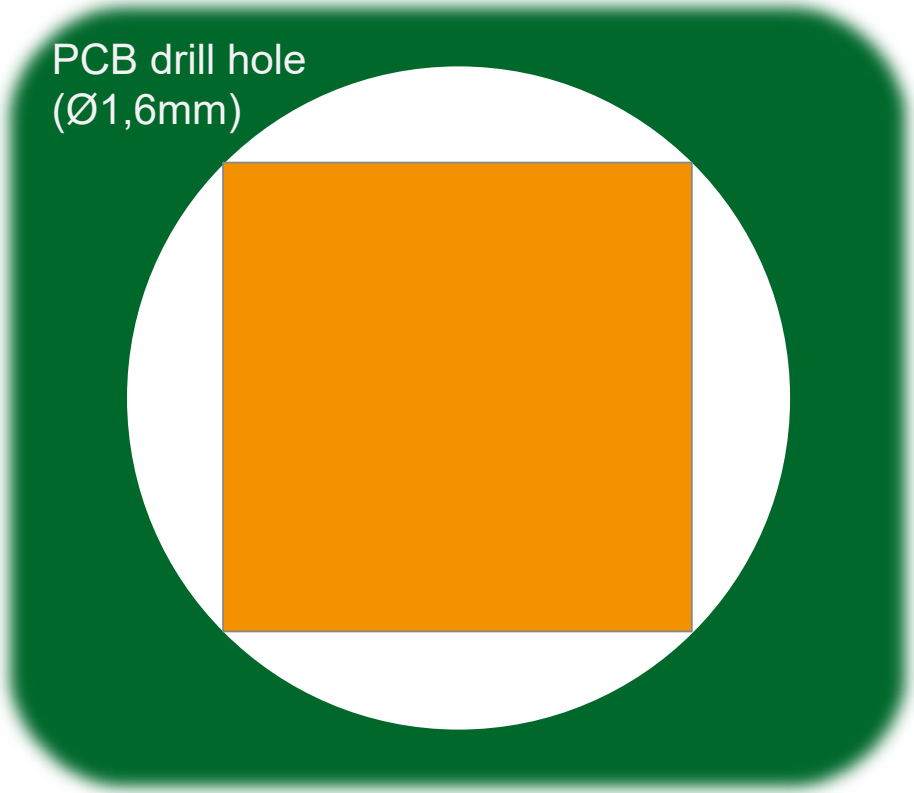




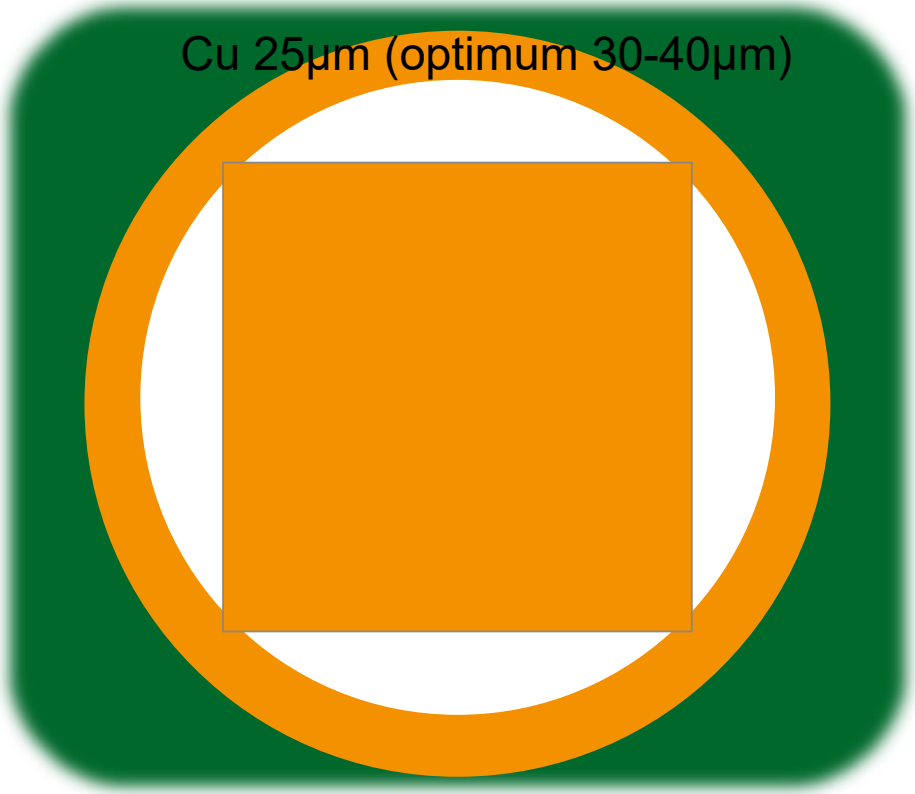




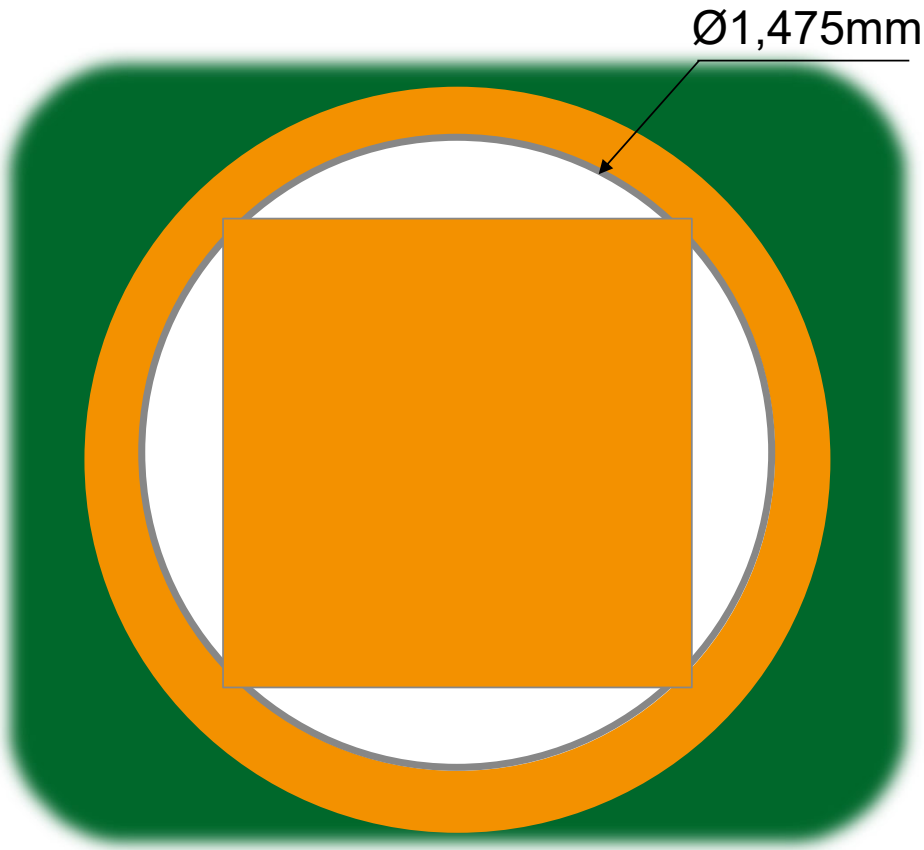
Press fit: how does it work ?

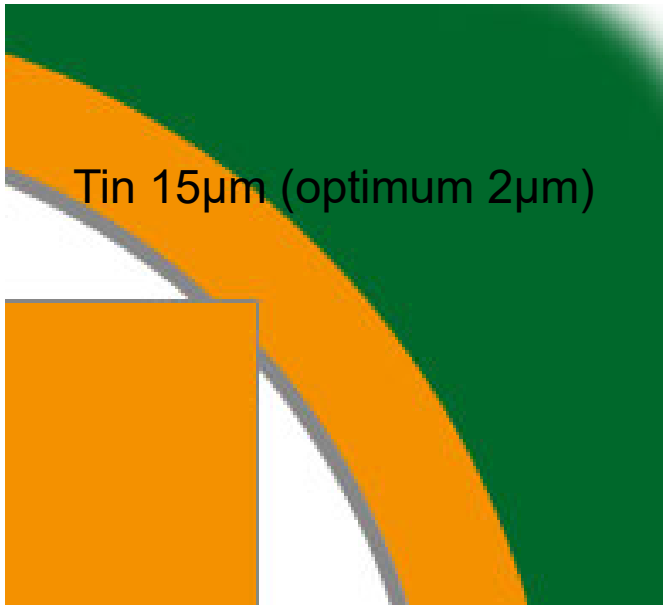


Press fit: how does it work ?



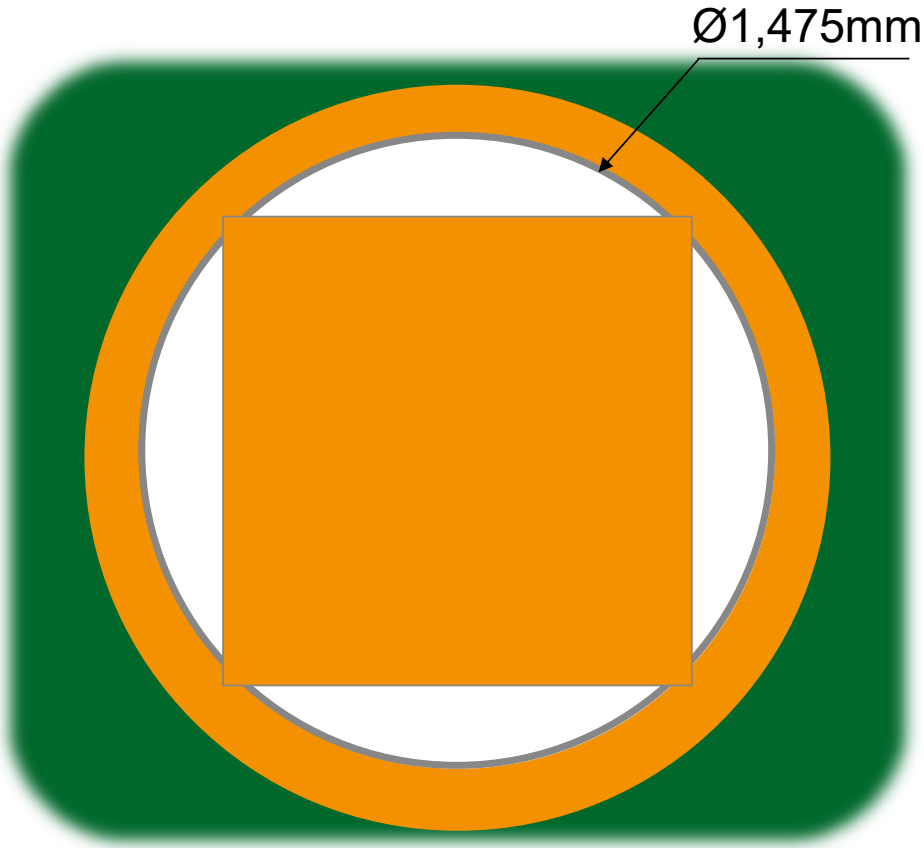
Press fit: how does it work ?

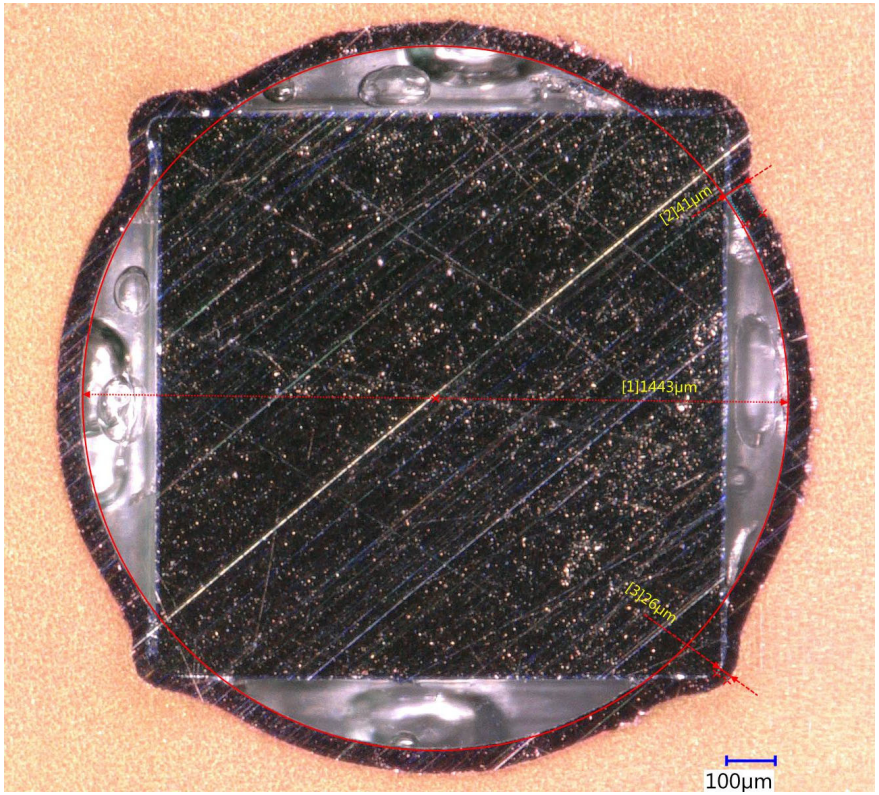




Values for chemical tin

Press fit: how does it work ?

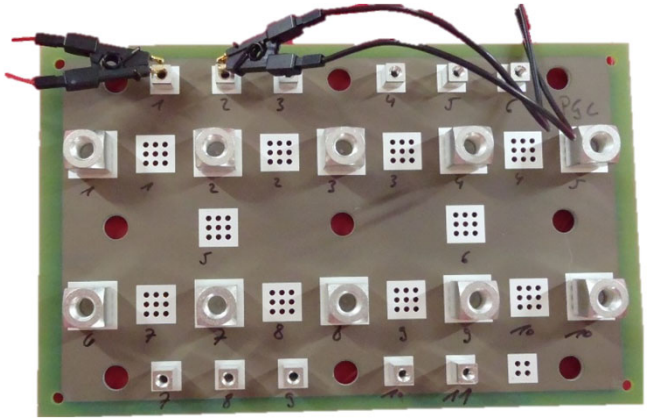




Values for chemical tin

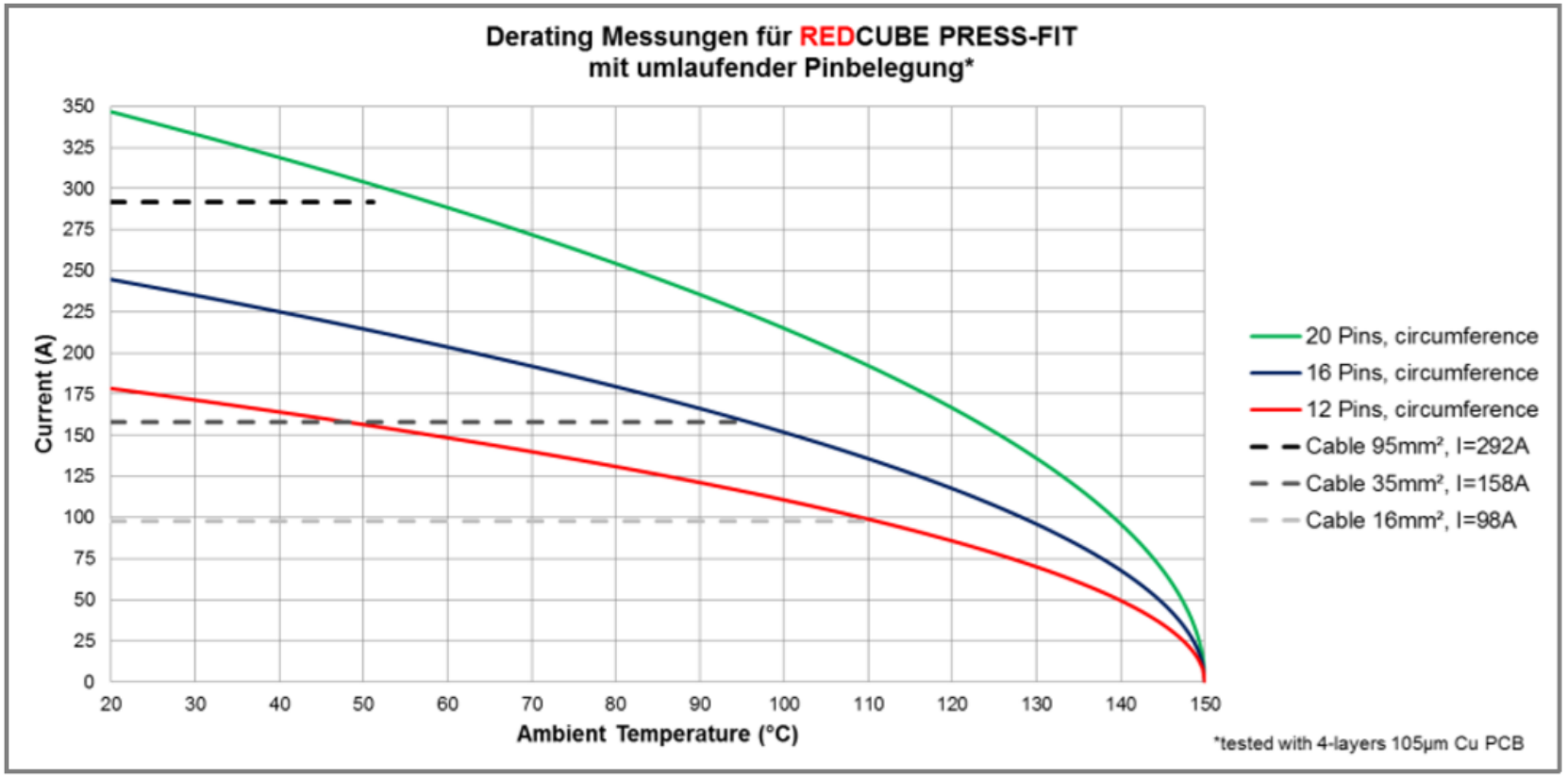
How this is certified: electrical

Contact resistance measurement *IEC60512-2-1*	
Usual soldering power connector	**Red cube**
<20mΩ	**<200µΩ**



➢Less contact resistance gives less temperature rise

Derating curves



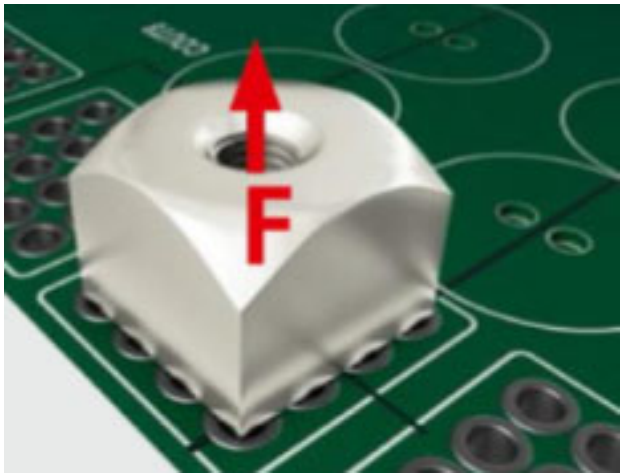
2 rows

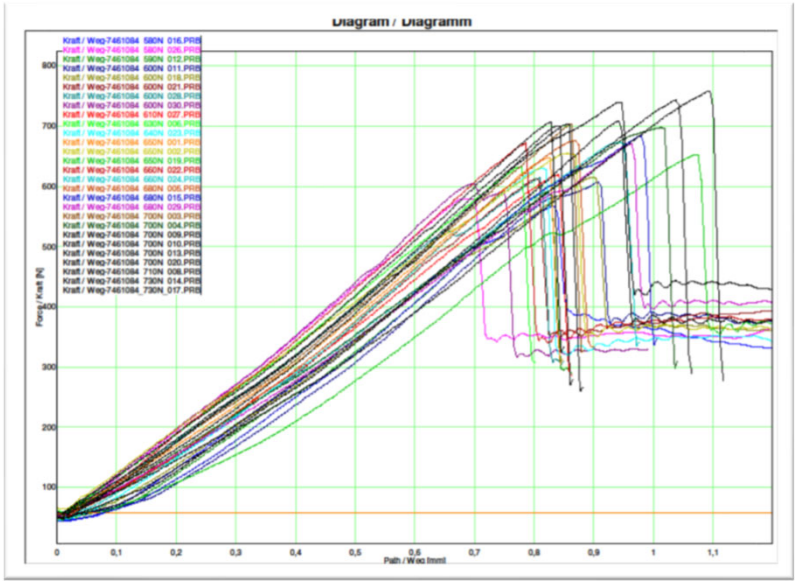
Circumference

Full

How this is certified: mechanical

Pull-out test

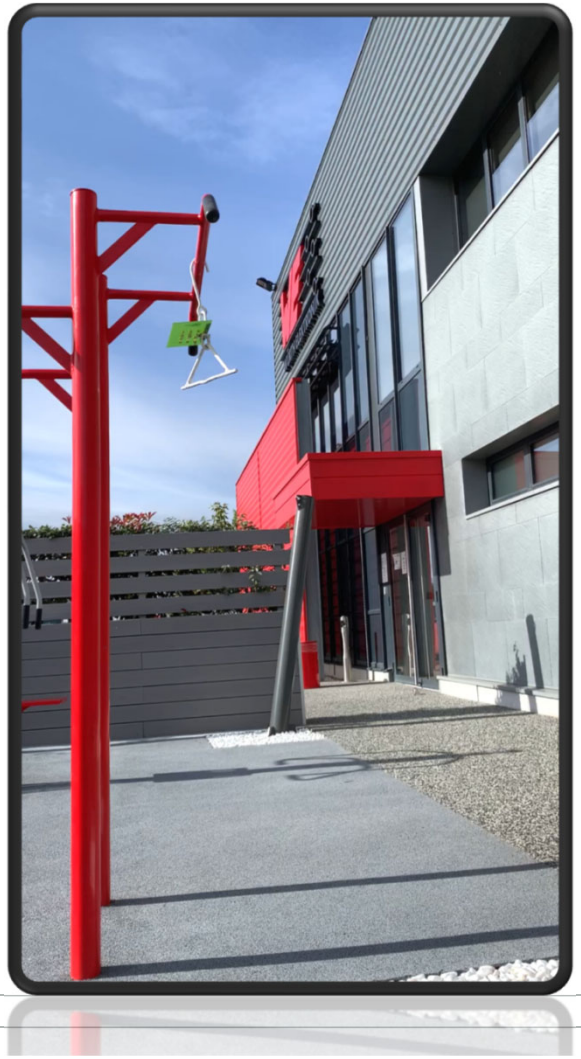




Extraction effort **10kg / pin**
with PCB 1,6mm

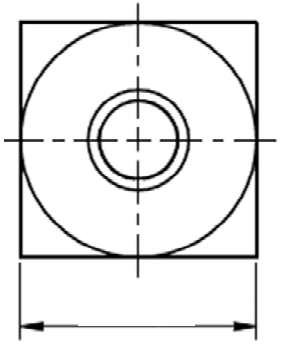
How this is certified: mechanical

Pull-out test



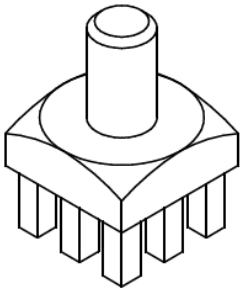
Design a power PCB with red cube: rule of thumb

$$width \approx x \cdot 3\,mm$$



$x\ mm$

$$thickness \approx \frac{I}{0{,}3}\ \mu m$$

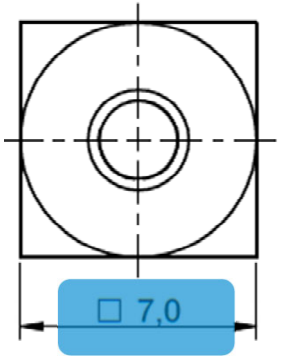


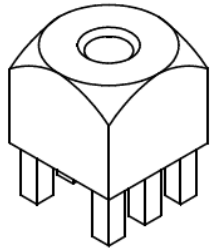
Properties	Test conditions		Value	Unit	Tol.
Rated Current	@ 20 °C	I_R	I	A	max.

Design a power PCB with red cube: some tips

$width \approx 21\ mm$

$thickness \approx 330\ \mu m$
4 or 5 layers of 70µm
or
3 layers of 105 µm



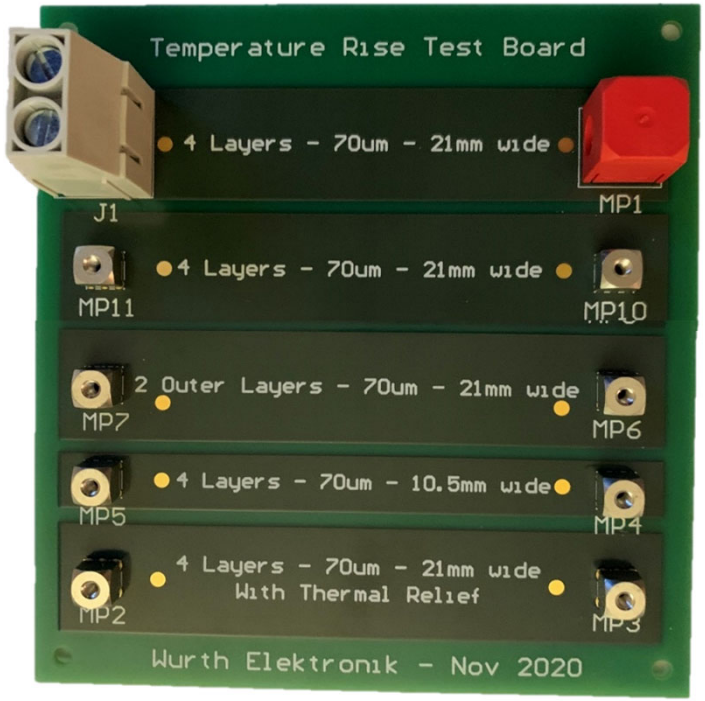


Properties	Test conditions		Value	Unit	Tol.
Rated Current	@ 20 °C	I_R	100	A	max.

Temperature rise tests

Test goal:

- Heat repartition
- Verify trace design
- Nb of layers influence

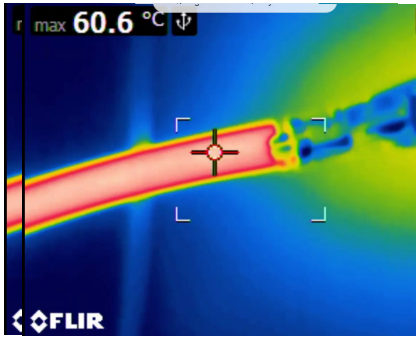


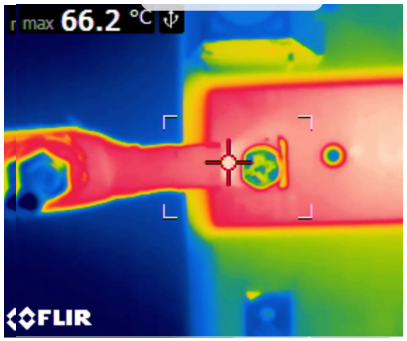
Temperature rise tests

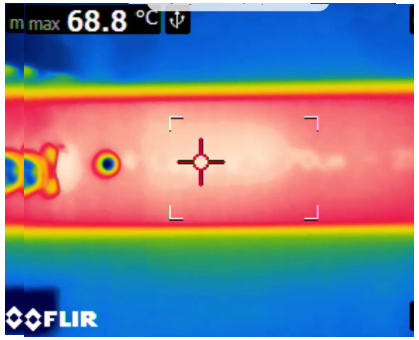
Working current 100A

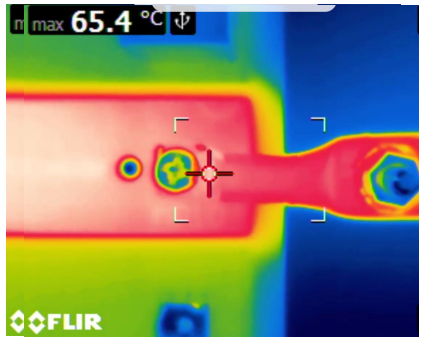
4 layers 70µm 21mm wide

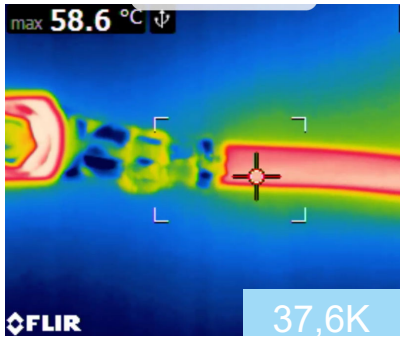
Ambiant Temp = 21°C



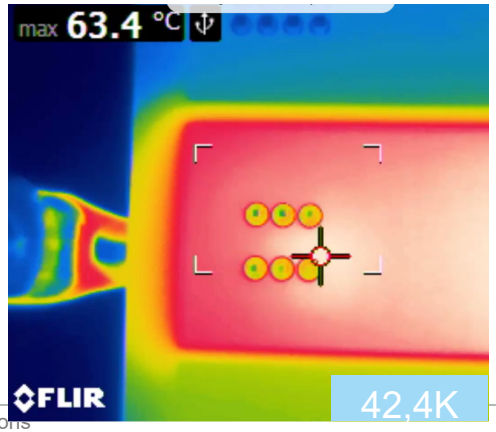


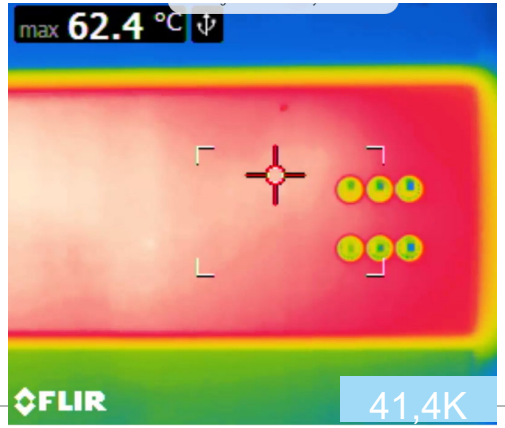






Bottom view





Temperature rise tests

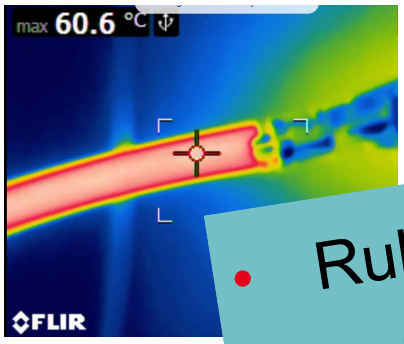
Working current 100A

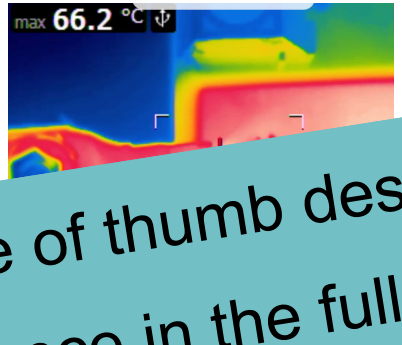
4 layers 70µm 21mm wide

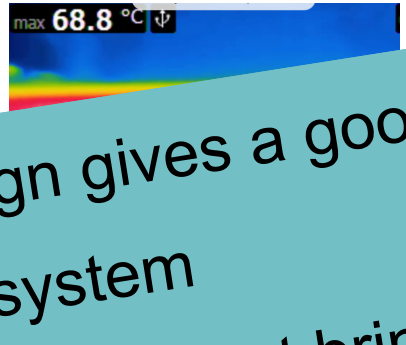
Ambiant Temp = 21°C

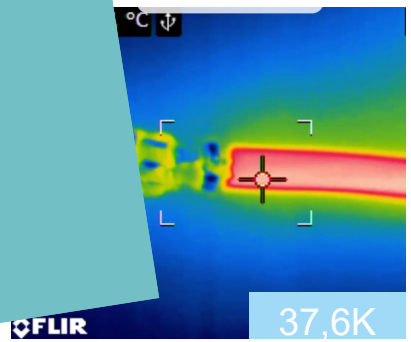
5,9mm²

- Rule of thumb design gives a good temperature balance in the full system
- Pressfit connection does not bring additional ΔT

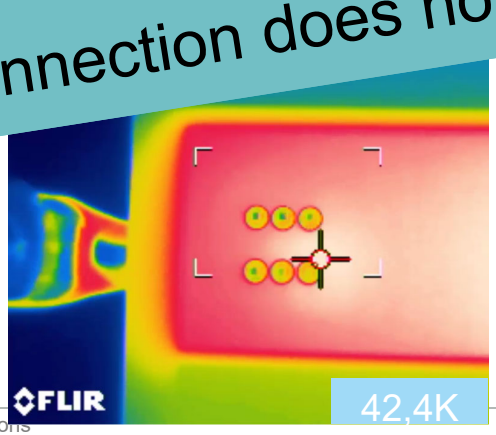


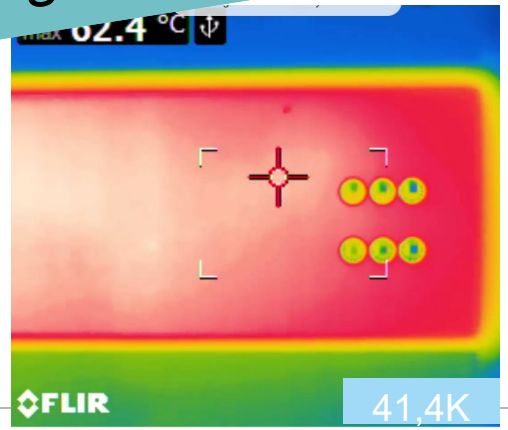






Bottom view





Temperature rise tests

Work

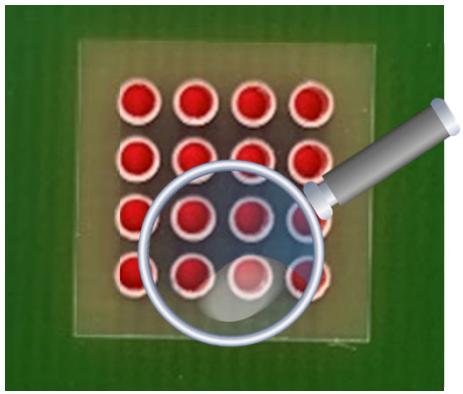
Worki

- Redcube is
  - small
  - high current
  - cooling down PCBs
- Rule of thumb high current design is a good approach
- Always check temperature with prototype test

Press-fit process

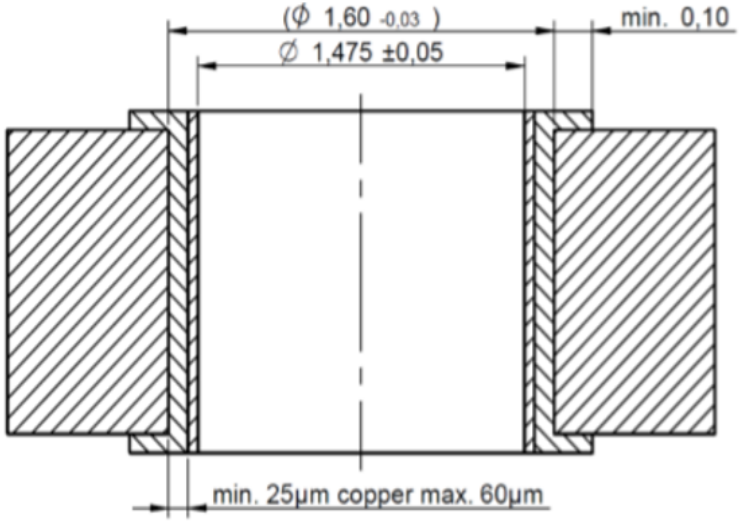
- **Materiel needed:**
  - PCB
  - Support
  - Base
  - Stamp
  - Press

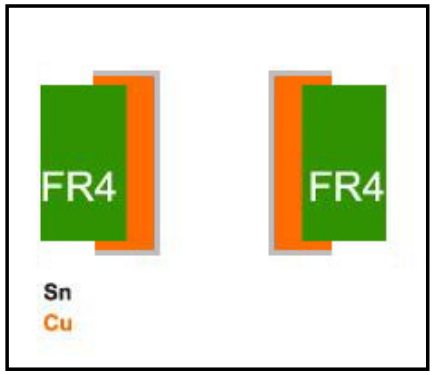
Press-fit process - PCB

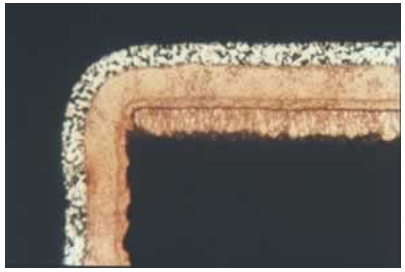


Chemical tin

ENIG (NiAu)

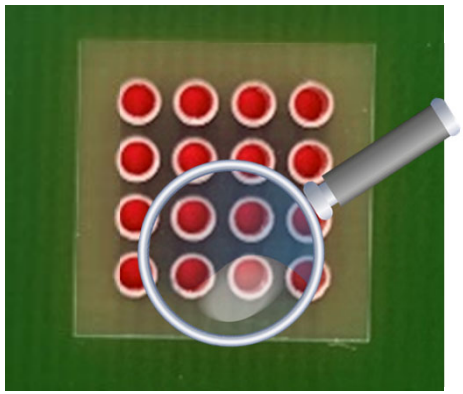




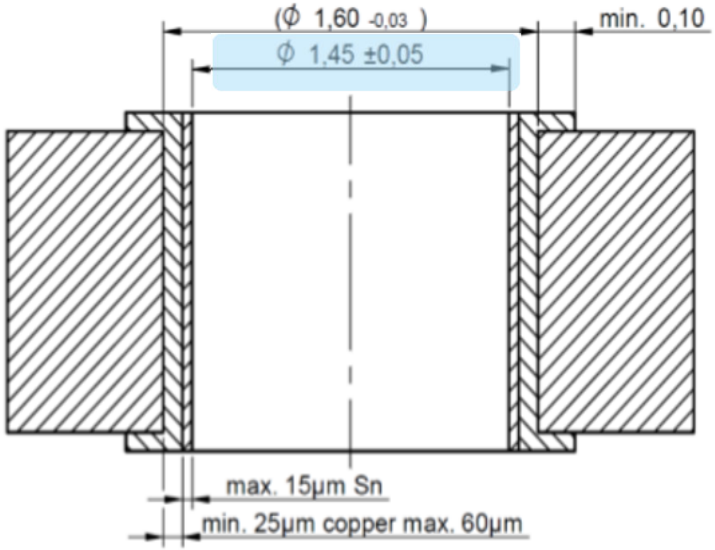


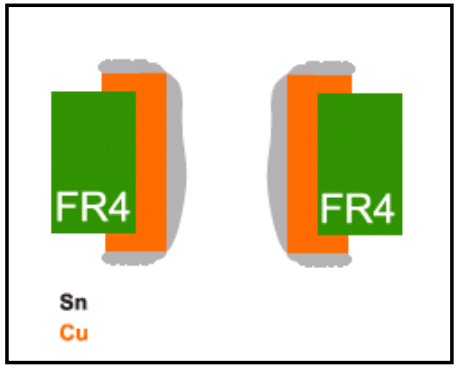
- *25 - 60µm Copper - optimum 30-40µm*
- *max. 15µm Tin - optimum 2µm*

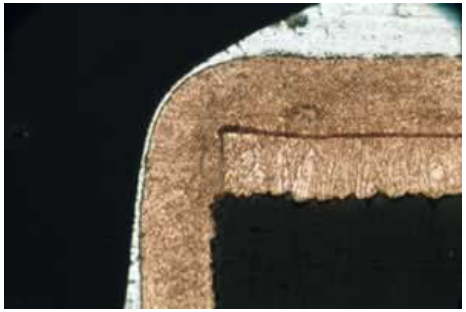
Press-fit process - PCB



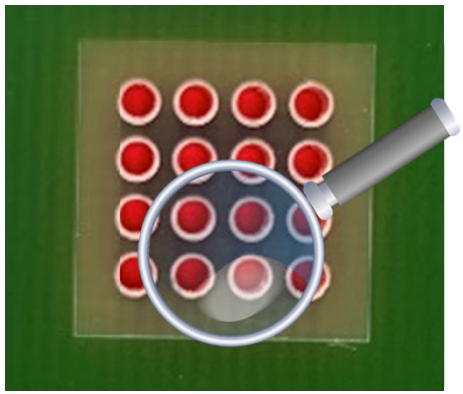
HAL – Hot Air Levelling

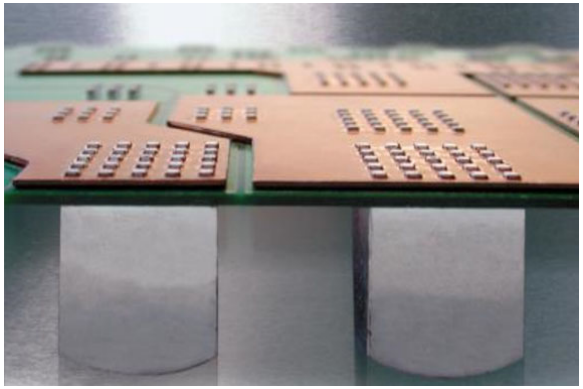




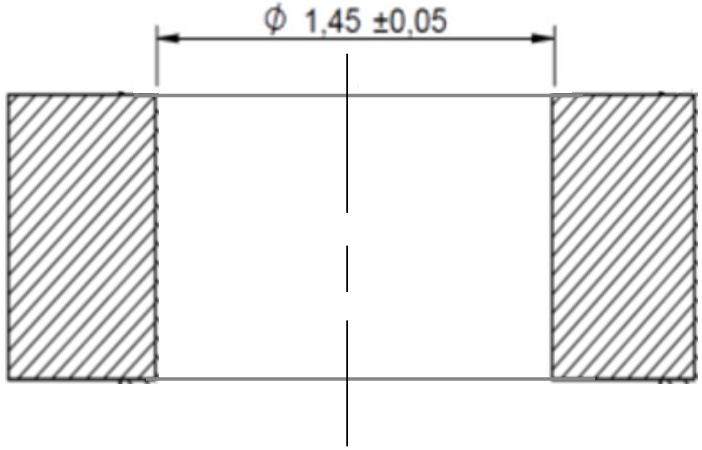


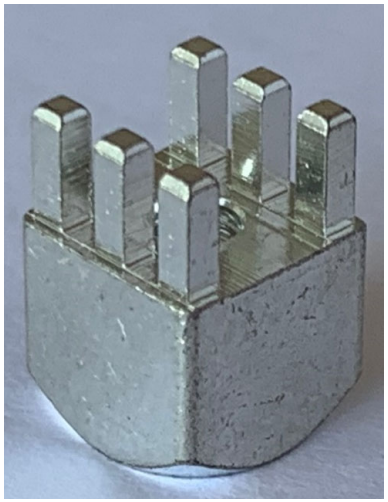
Press-fit process - PCB



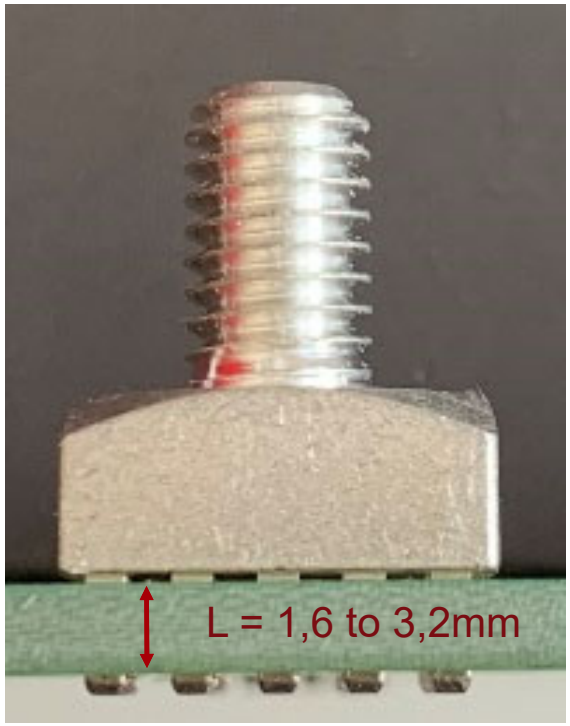


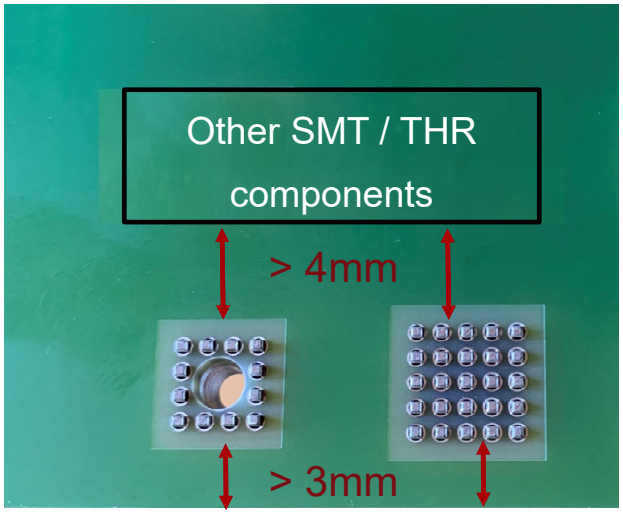
Pure copper bar (Drill hole 1,45 +-0,05)





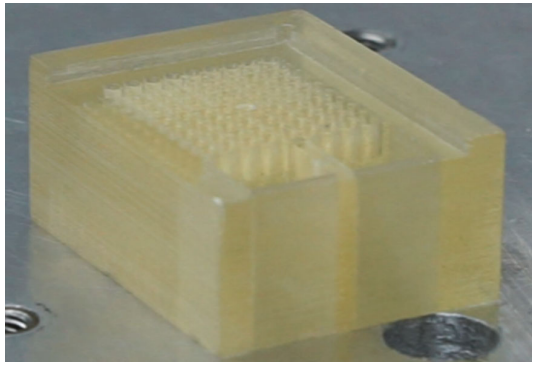
Press-fit process - PCB



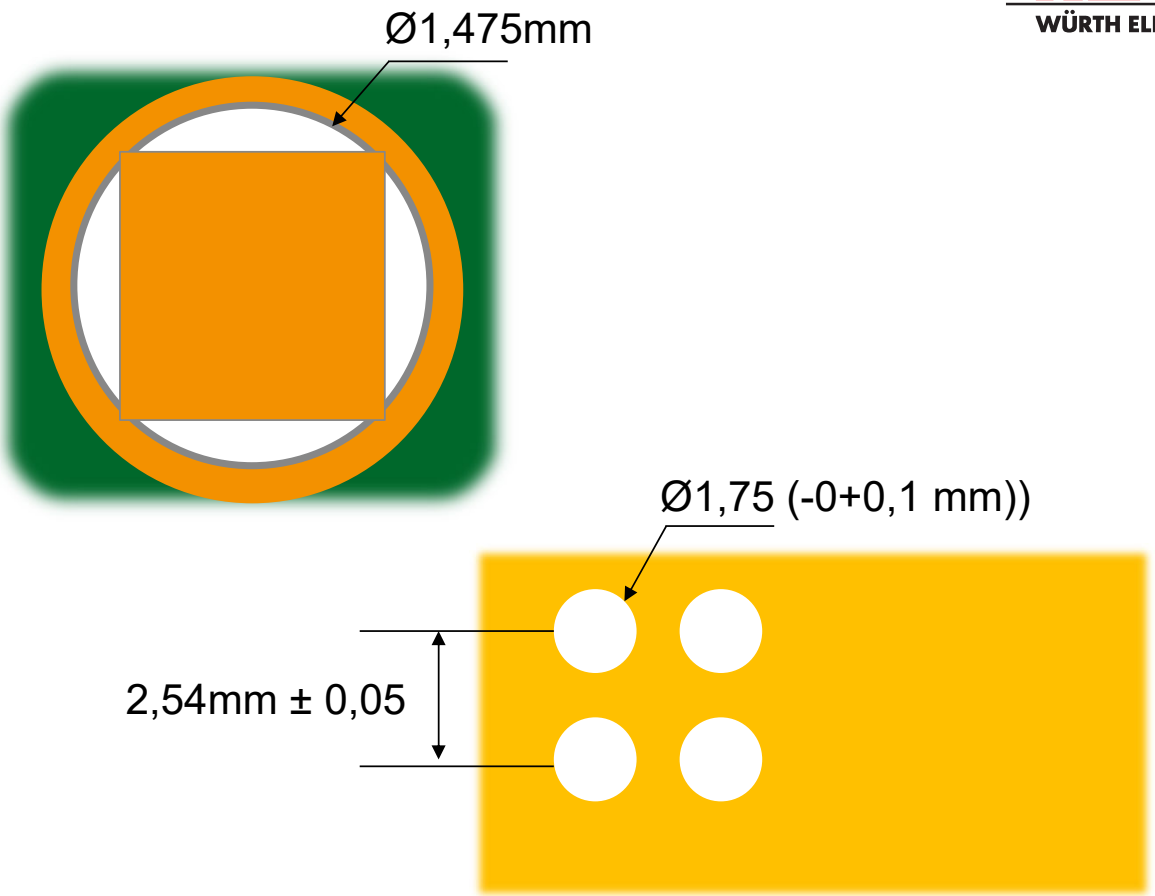


Press fit process: support

Support location

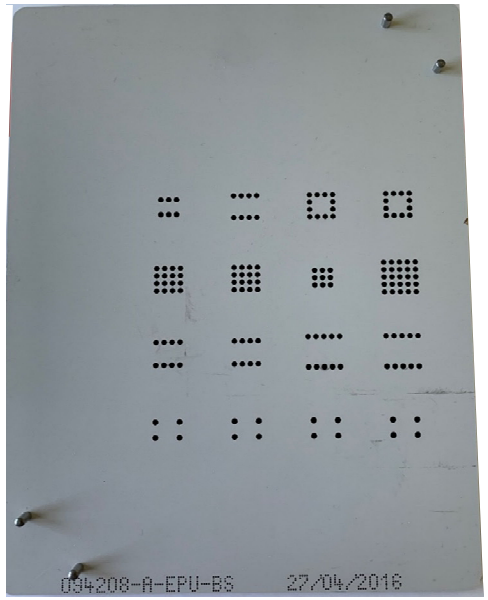


3D printing prototype

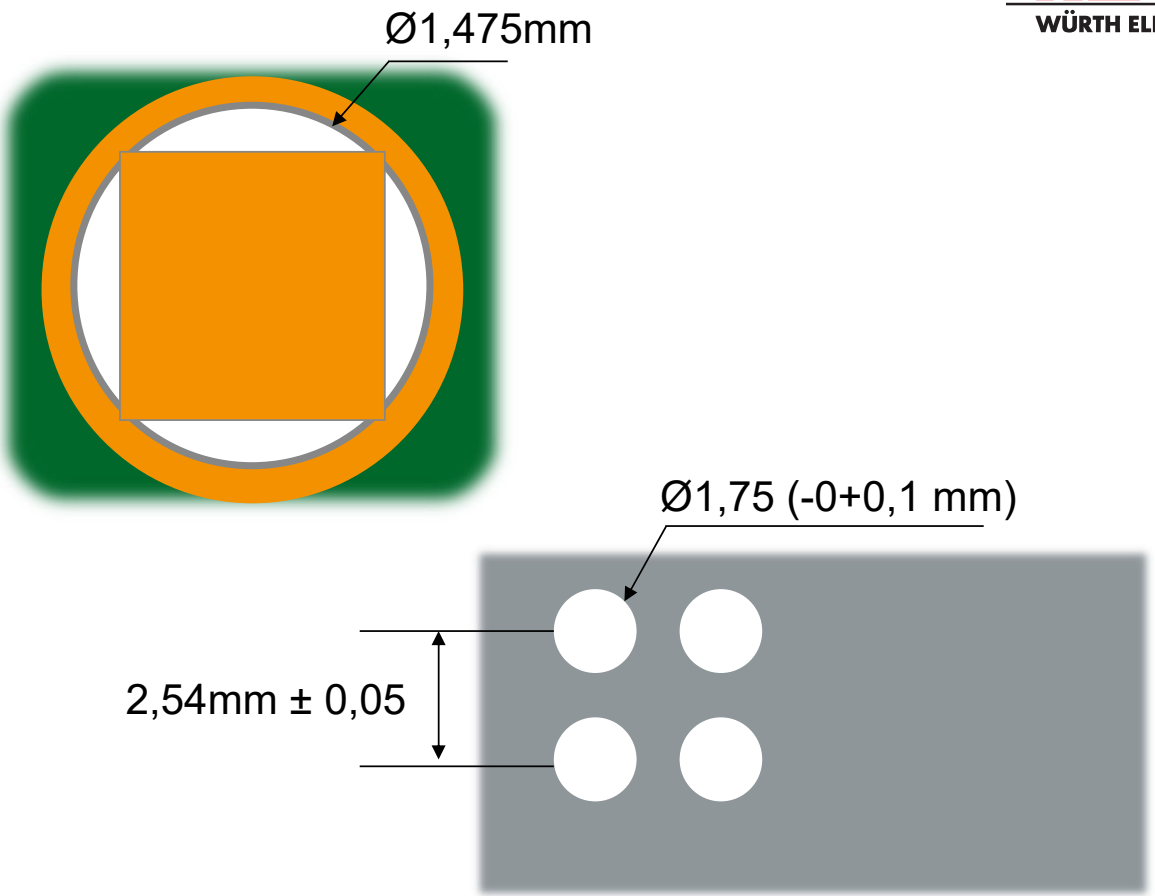


Press fit process: support

Support location

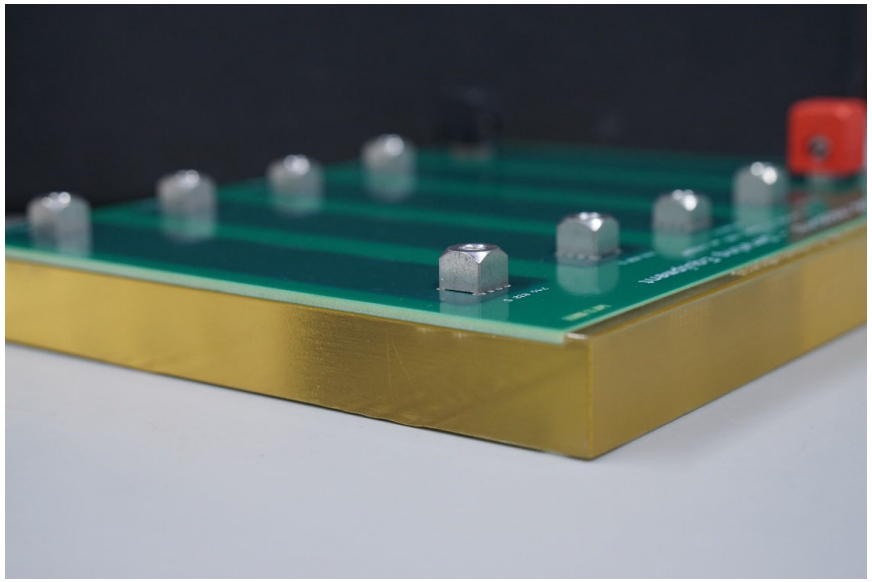


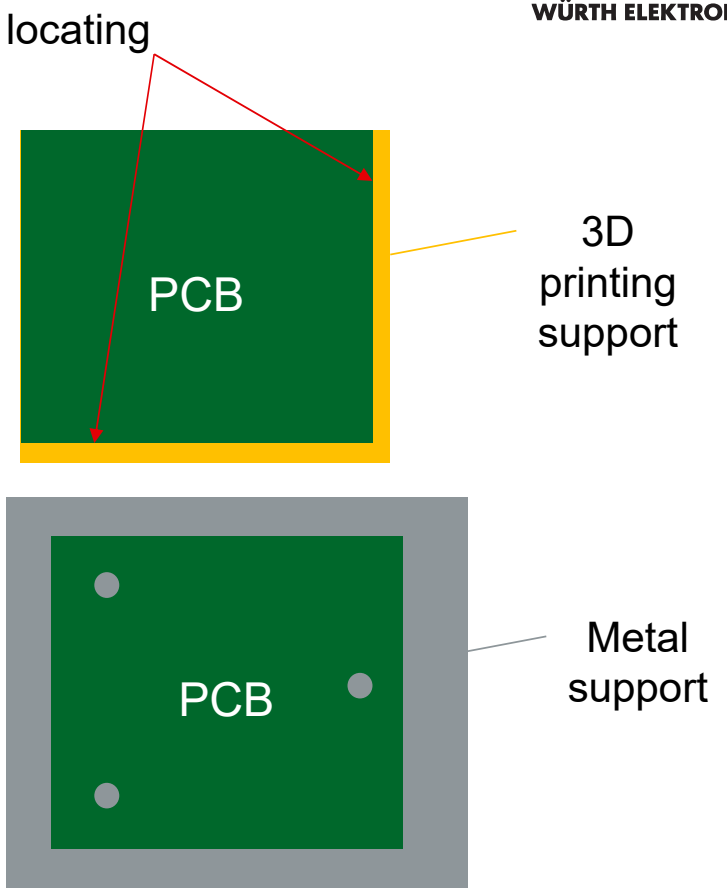
Metal final version



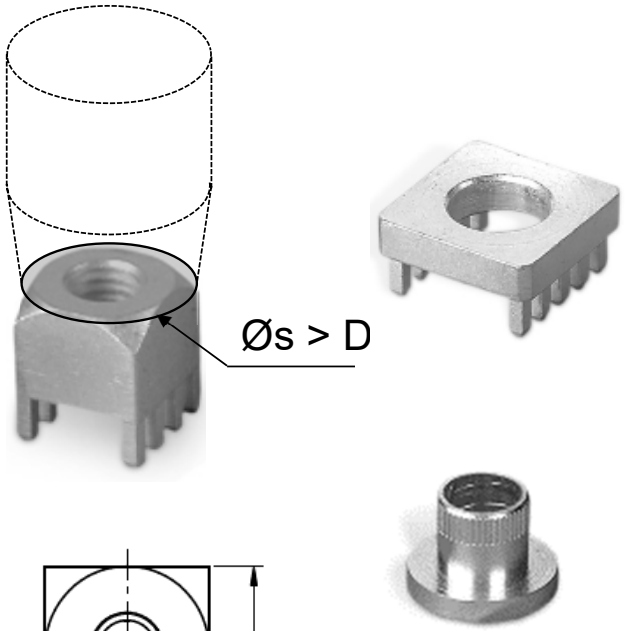
Press fit process: support

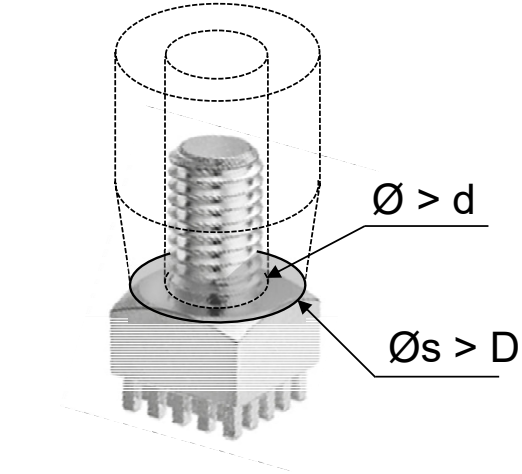
Support locating

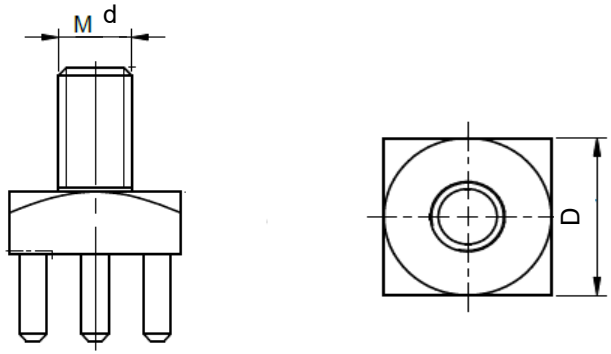




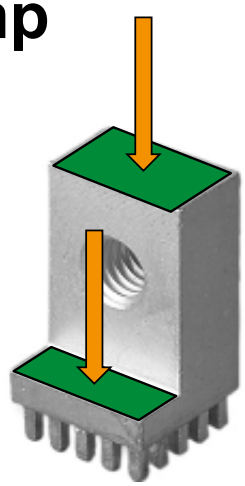
Press fit process: stamp

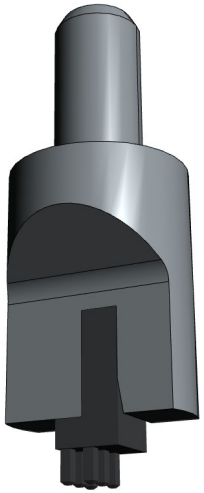


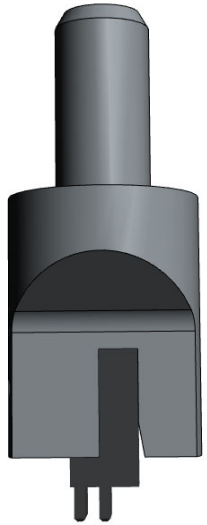




Press fit process: stamp



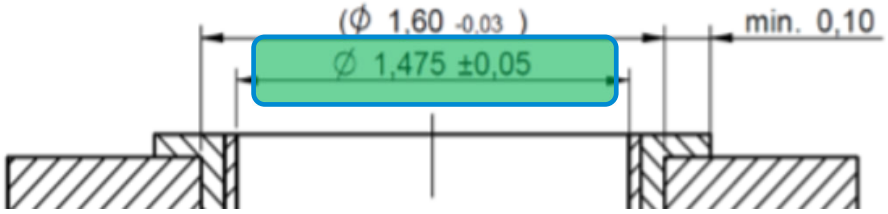




Insertion force – press dimensioning

PCB thickness (mm)	*Empirical press-in PCB insertion force per (N/pin) min / max*															
	Chemical tin						ENIG						HAL					
(mm)	Ø1,425		Ø1,475		Ø1,525		Ø1,425		Ø1,475		Ø1,525		Ø1,40		Ø1,45		Ø1,50	
1,6	120	220	80	160	40	130	140	250	100	200	60	170	140	250	100	200	50	170
2,4	170	330	110	240	60	200	200	400	130	300	70	250	200	400	130	300	70	250
3,2	220	460	140	340	80	280	260	500	170	420	80	360	260	500	170	420	80	360

Specification for chemical surfaces



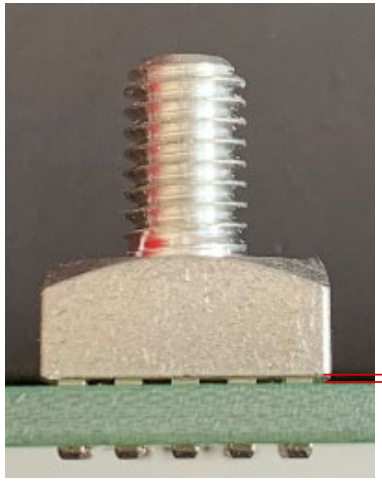
Insertion force – press dimensioning

PCB thickness (mm)	*Empirical press-in PCB insertion force per (N/pin) min / max*															
	Chemical tin						ENIG						HAL					
(mm)	Ø1,425		Ø1,475		Ø1,525		Ø1,425		Ø1,475		Ø1,525		Ø1,40		Ø1,45		Ø1,50	
1,6	120	220	80	160	40	130	140	250	100	200	60	170	140	250	100	200	50	170
2,4	170	330	110	240	60	200	200	400	130	300	70	250	200	400	130	300	70	250
3,2	220	460	140	340	80	280	260	500	170	420	80	360	260	500	170	420	80	360

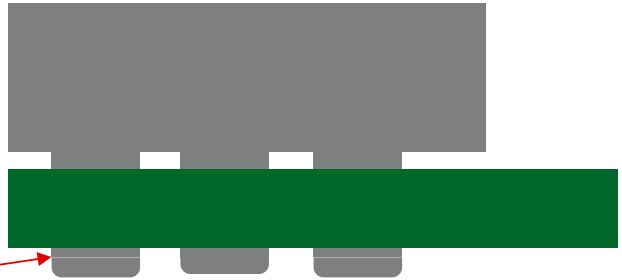
Example: redcube12 pins – PCB chemical tin thickness 3,2mm

→ 1,7 kN < press effort < 4 kN

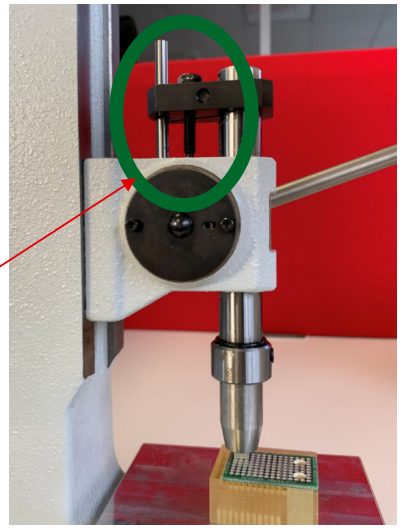
Press-fit process



0,1mm



Flat zone
exceed PCB



Press end stop

Insertion speed ≈ 100-250mm/mn
Insertion done in 1 single time