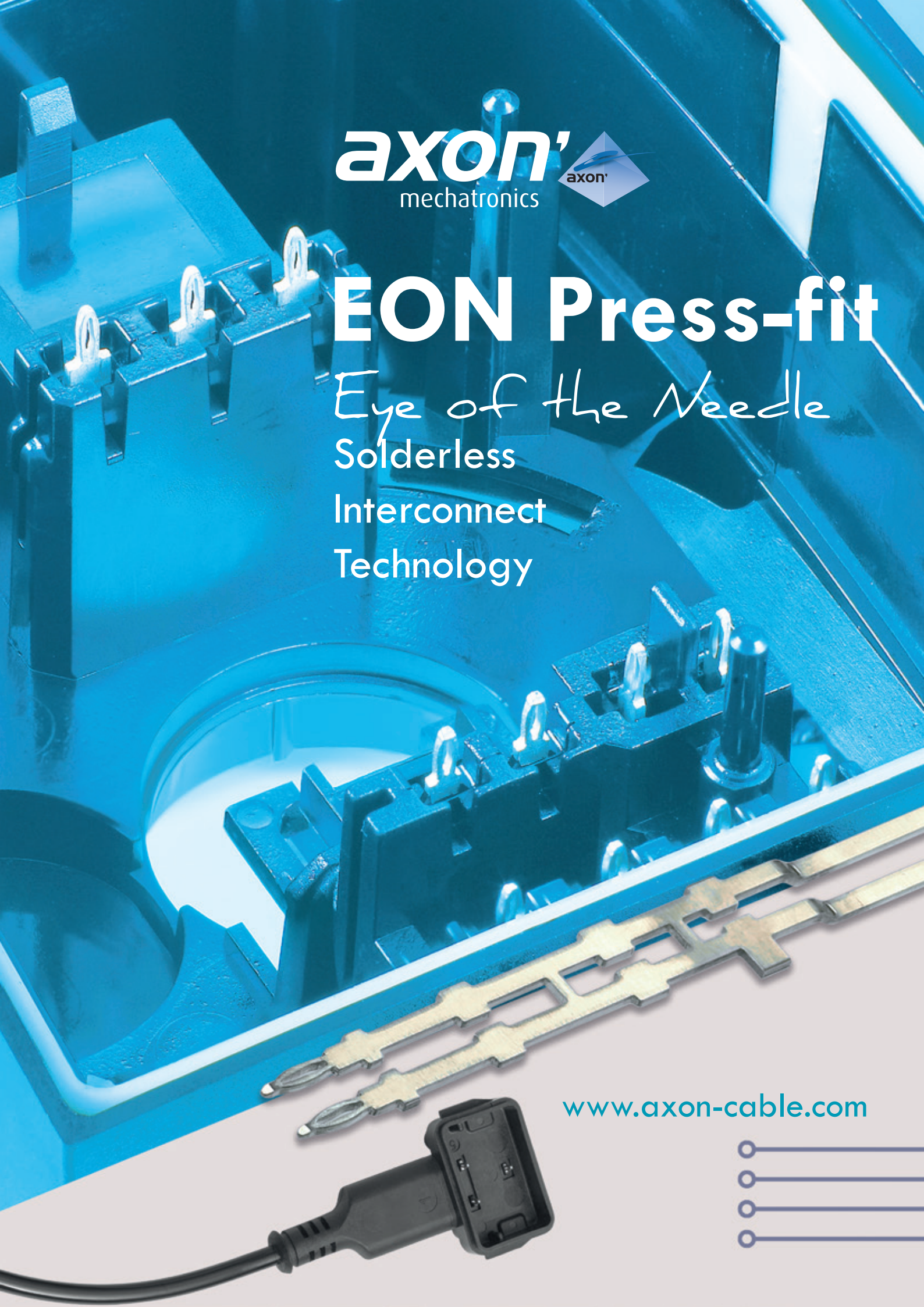
axon' mechatronics

EON Press-fit

Eye of the Needle

Solderless
Interconnect
Technology



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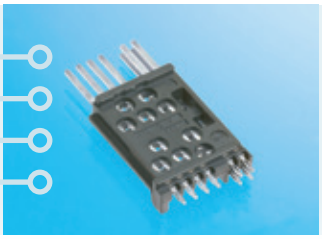
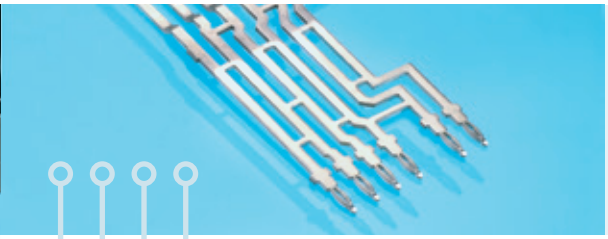
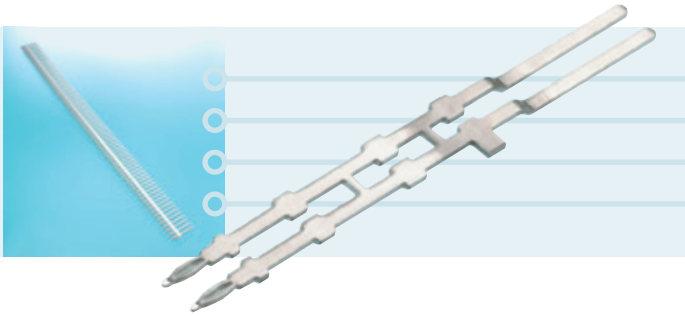






EON Press-fit

Eye of the Needle

Solderless interconnect technology

Content

Headquartered in France, the Axon' Group has signifiant sales and manufacturing footsprints in North America, Europe and Asia. The group has in-house expertise including plating, machining, lathing, electrostriction, stamping, assembling, molding/overmolding, mechatronics and cabling.

Axon' Mechatronics, part of the Axon' Group, is a renowned specialist in the development and manufacture of industrial connectors. The company offers a complete service including:

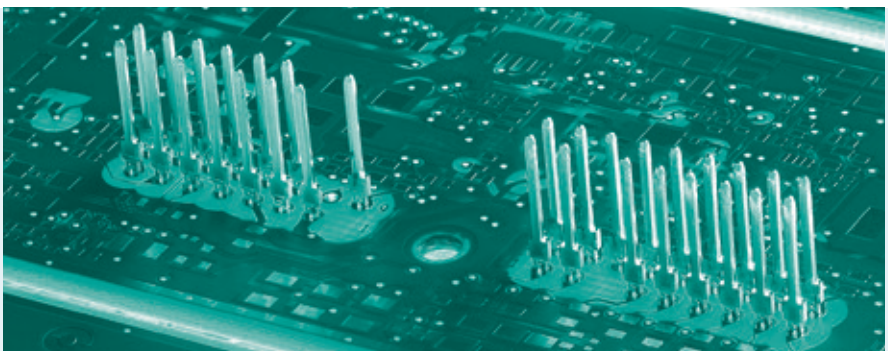
- **co-engineering and co-design:** connector development with dedicated engineers attentive to customer's specific requirements,
- **creation of production tools:** stamping tools, injection mold tools, assembly machines,
- production sites worldwide.

Solderless interconnect technology

Press-fit terminals

Stamped terminals to be inserted into the PCB.

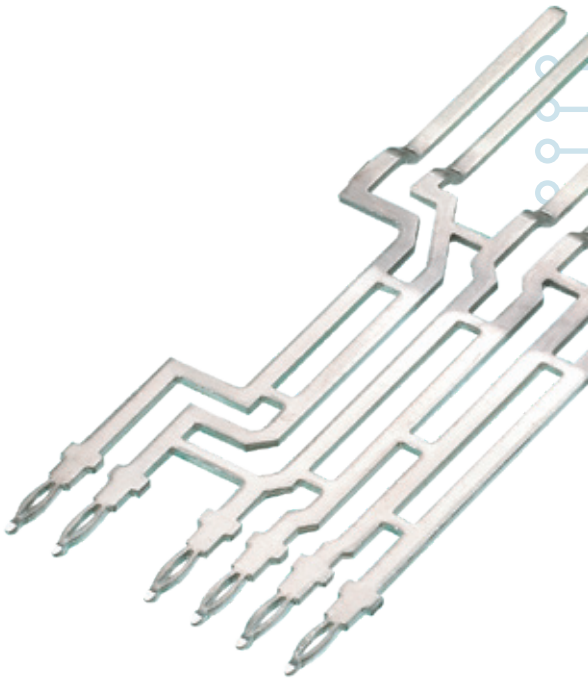
- Avoids additional soldering processes to save cost and increase productivity,
- Avoids thermal stress of a second reflow phase,
- Delivers high mechanical retention and excellent electrical contact,
- Materials:
  - CuSn6P - continuous temperature: 125°C,
  - CuNiSi - continuous temperature: 170°C,
  - CuMg - continuous temperature: 170°C,
  - Thicknesses - 0.63, 0.80 and 1.00 mm
- Can be packaged in reels: easy to handle for automated process.



Single press-fits inserted into a PCB

EON Press-fit

Eye of the Needle

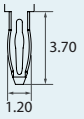
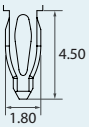
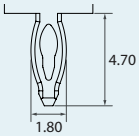
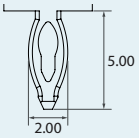


As a connection, Press-fit technology offers a favorable alternative to soldering. A Press-fit is a **stamped terminal** designed to be inserted into a plated-through hole (PTH) in a printed circuit board (PCB), in such a way that an electro-mechanical connection is established without soldering. EON Press-fit is qualified to the IEC 60352-5 standard but performances of Axon' Mechatronics press-fit terminals exceed the standard requirements, especially in terms of temperatures and environmental tests.

Press-fit main features

Qualified press-fit materials	Conductivity (%IACS at 20°C)	Operating temperature	Recommended PCB type
CuSn6P	16	125°C	Standard
CuNiSi	50	170°C	High Tg
CuMg	62		

Press-fit designs

Plating	Thickness (mm)	Dimensions (mm)	Shape	Plated hole diameter (mm)	Applications
0.8 to 1.8 µm electroplated matte Tin (Sn) on 1 µm to 2 µm Nickel (Ni) underlayer	0.63	0.63x1.20		1.00 +0.09 -0.06	Used for single press-fits inserted into a PCBA and overmolded housings & modules
		0.63x1.80		1.50 +0.09 -0.06	Mainly used for overmolded housings & modules (permissiveness)
	0.80	0.80x1.80		1.60 +0.09 -0.06	Used for single press-fits inserted into a PCBA and overmolded housings & modules
	1.00	1.00x2.00		1.80 +0.09 -0.06	

The four designs are patented.

PCB definition

Axon' Mechatronics press-fits comply with standard and High Tg PCBs.

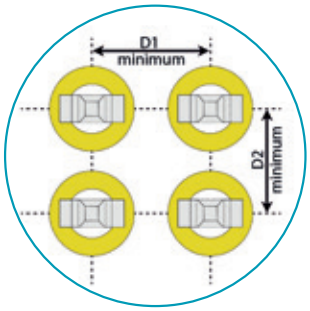
PCB specifications		
	Standard (Tg ≥ 130°C)	High Tg (Tg ≥ 180°C)
Thickness	1.60 mm	
PCB hole copper thickness	25 µm	
PCB trace copper thickness*	70 µm	130 µm
PCB trace width*	0.80 mm	3.50 mm

Qualified PCB Plating		Thickness min-max (µm)
Chemical Ni/Au	Ni	3.00 - 5.00
	Au	0.025 - 0.075
Chemical Sn		0.80 - 2.00
HAL (Hot Air Levelling TIN)		1.00 - 40.00

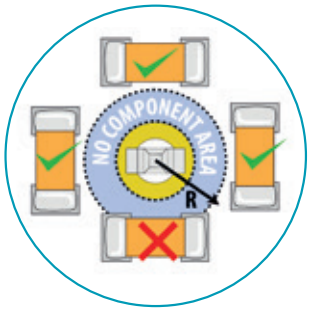
* The dimensions given here are those defined by Axon's for its tests.
The trace dimensions must be adapted to the customer's application.

Press-fit insertion rules: for better performance

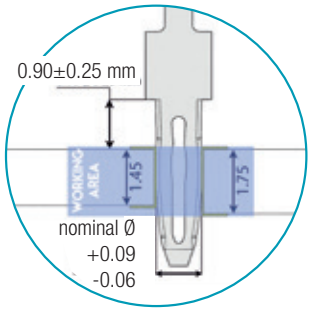
In order to get best performance using Axon' Mechatronics press-fits, we recommend following instructions for PCB design.



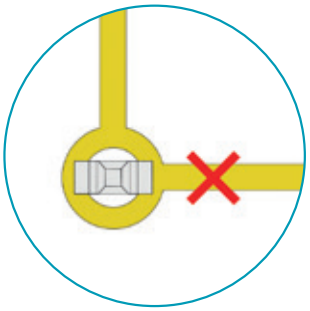
Minimum distances between 2 press-fits through hole center. D2 is given by the insertion head in automatic insertion machine (mechanical construction).



R : distance from the through hole center without any component top and bottom side.



Length of the contact surface of the press-fit.



No pattern in this direction.

Press-fit (mm)	R (mm)	D1 (mm)	D2 (mm)
0.63 x 1.20	2.50	2.50	2.20
0.63 x 1.80	3.00	3.00	2.54
0.80 x 1.80	3.00	3.00	2.54
1.00 x 2.00	-	-	-

Note: for specific applications (like press-fit inserted into connectors), the 0.90 ±0.25 mm specified distance between PCB and press-fit shoulder may be reviewed.

PLEASE CONTACT US FOR FURTHER INFORMATION.

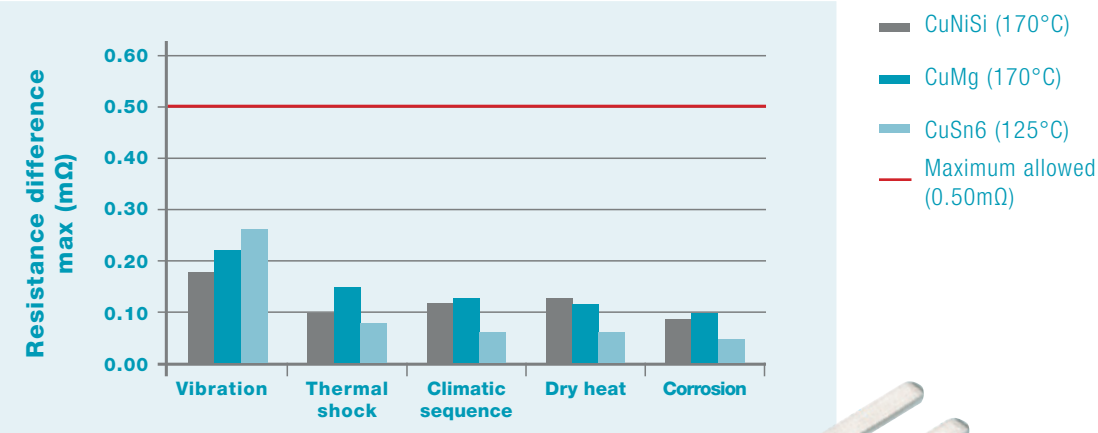
Contact resistance:
excellent ageing performance!

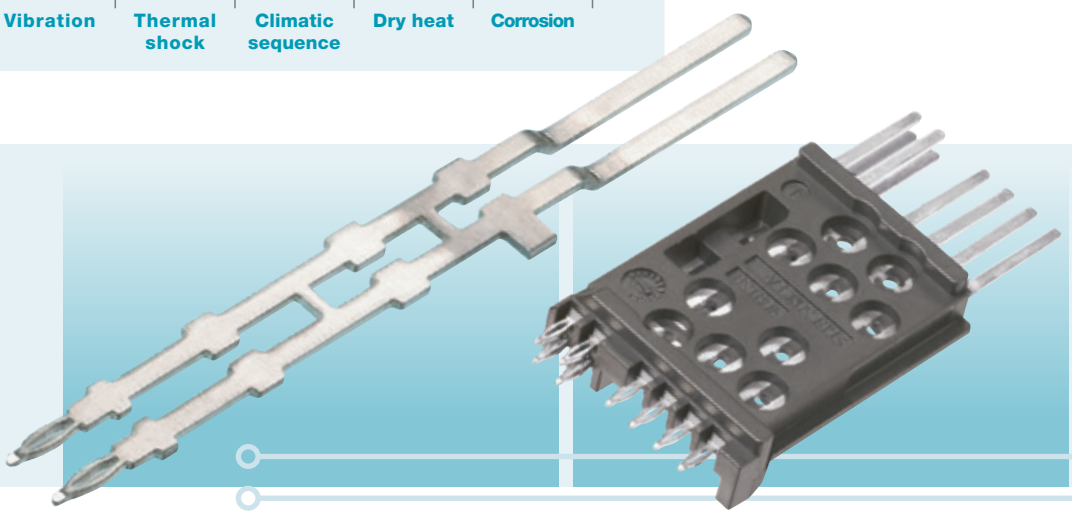
The five ageing tests are carried out one after each other on the same set of samples. For each of them, the electrical resistance is measured before and after the test, and the difference shall not exceed 0.50 mΩ.
All the press-fit types offered by Axon' Mechatronics achieve excellent performances.

TEST CONDITIONS			AGEING TESTS				
	Qualified press-fit materials	PCB type	Vibration (1)	Thermal shock (2)	Climatic sequence (3)	Dry heat (4)	Corrosion (5)
	CuSn6P	Standard	10 Hz to 500 Hz 15 mn each direction 12 cycles	-40°C to 125°C > 300 h 300 cycles	-40°C to 125°C 5 cycles of 24 hours	125°C / 1008 H	H2S: 100 ±20 10^{-9} VOL / VOL SO2: 500 ±100 10^{-9} VOL / VOL
	CuNiSi	High Tg		-40°C to 170°C > 300 h 300 cycles	-40°C to 170°C 5 cycles of 24 hours	170°C / 1008 H	
	CuMg						

Contact resistance evolution

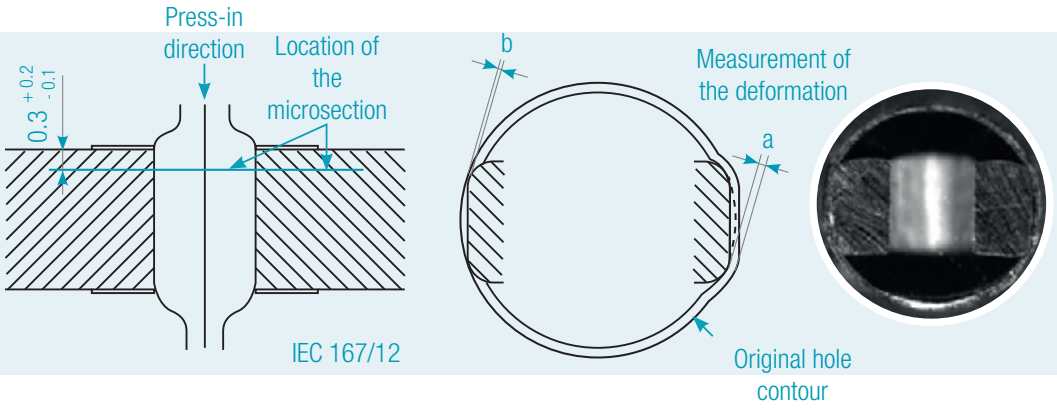
TEST RESULTS

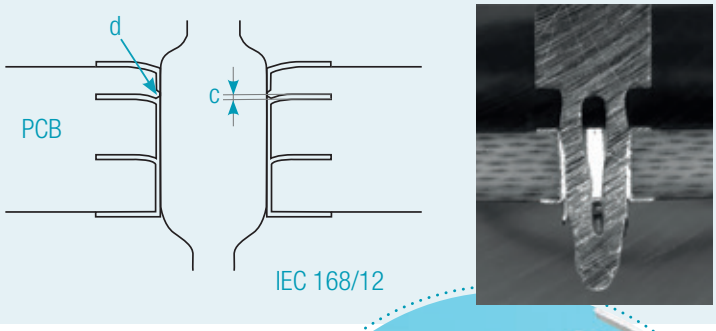


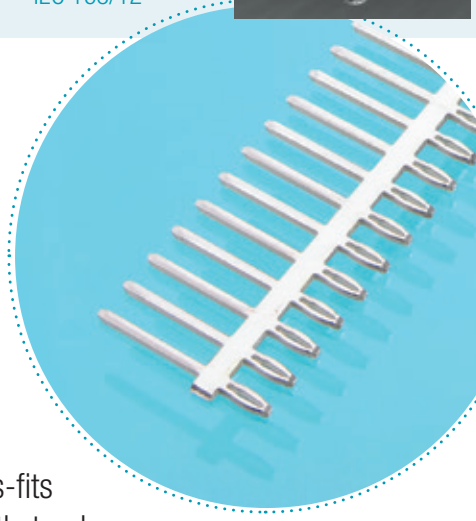


Cross section tests: what the IEC standard states

- The deformation "a" of the drilled hole contour in the plated through-hole shall be smaller than **70 µm**.
- The minimum remaining thickness "b" of the plating shall be more than **8 µm**. There shall b**e no cracks i**n the plating of the through-hole.
- The deformation "c" of the connected pattern to the plated through-hole shall not exceed **50 µm**.
- Neither the plating of the plated through-hole nor the conductor may have cracks "d".

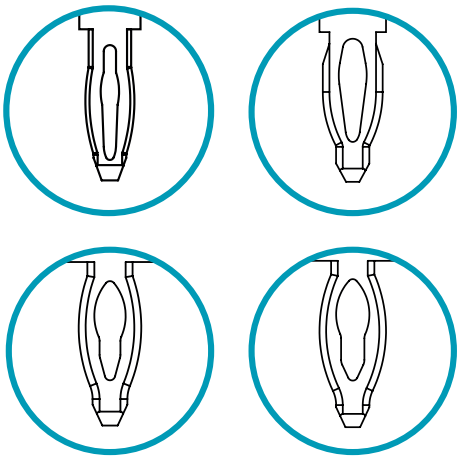






Overmolded press-fits with potting to withstand watertightness

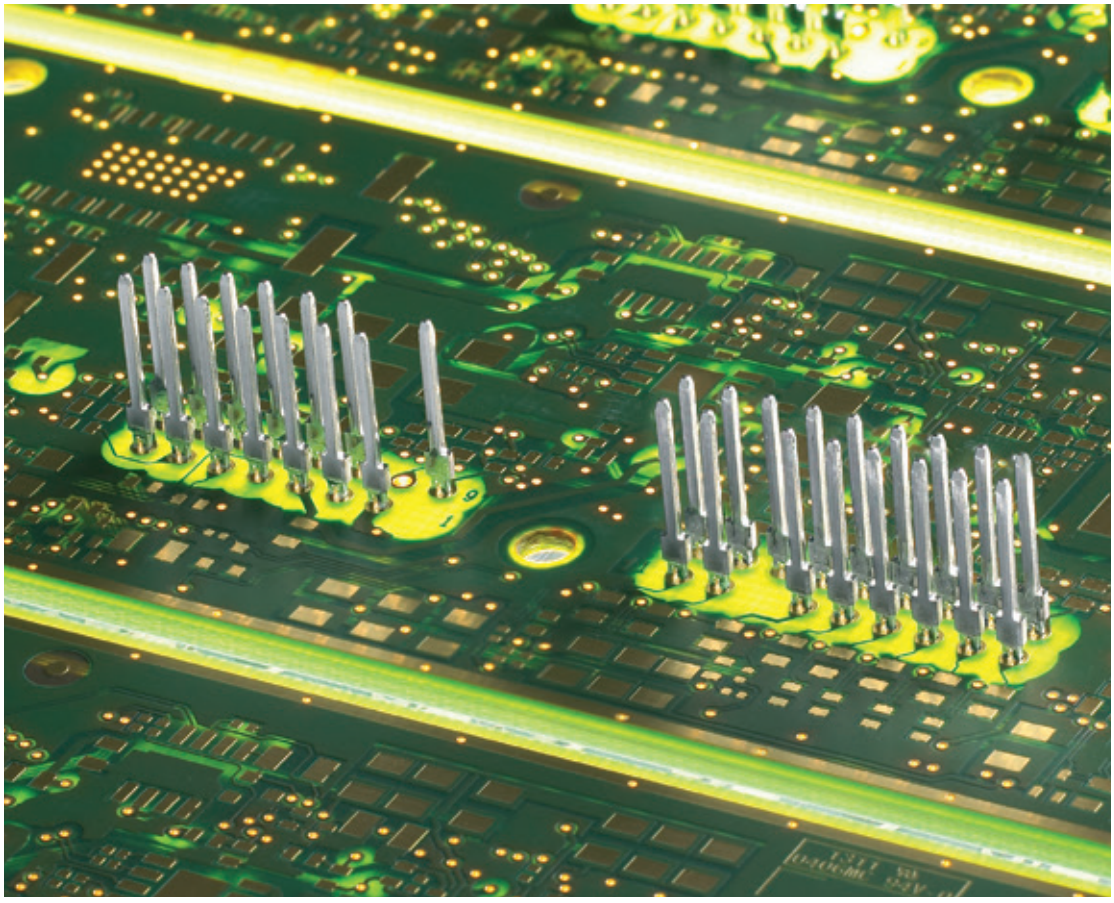
What Axon's press-fits achieve



- Low distortion of the PCB hole thanks to the 'Eye of the Needle' technology
- No cracks in the plating
- PCB hole plating remains thick
- Better values than those specified in the standard

	Measurement of the deformation		Deformation of the connected pattern	
Press-fit (mm)	**a**	**b**	**c**	**d**
IEC 60352	<70 µm	> 8 µm	< 40 µm	No crack
0.63 x 1.20	60	20	0	No crack
0.63 x 1.80	34	28	0	No crack
0.80 x 1.80	65	11	0	No crack
1.00 x 2.00	69	36	0	No crack

Press-fits inserted into a PCB



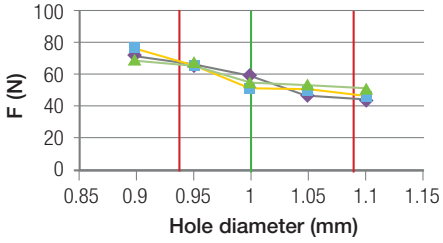
Push-in max force

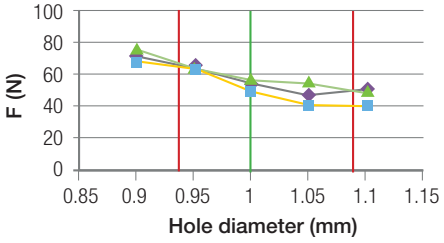
Press-fit material types

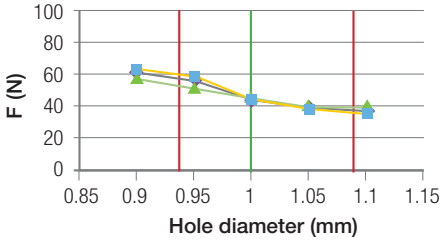
HAL
Ni/Au
Sn
Ø mini / maxi
Ø nominal

CuSn6P	CuNiSi	CuMg

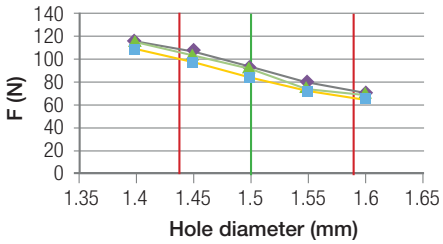
Single press-fit 0.63 x 1.20 mm

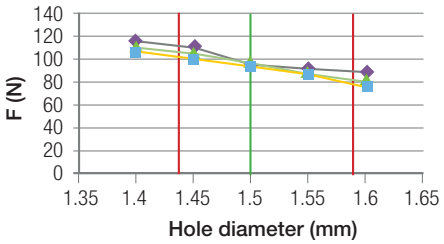


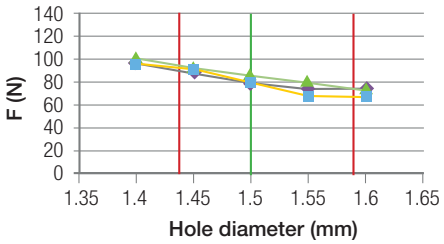




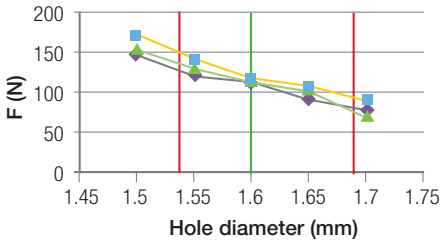
Single press-fit 0.63 x 1.80 mm

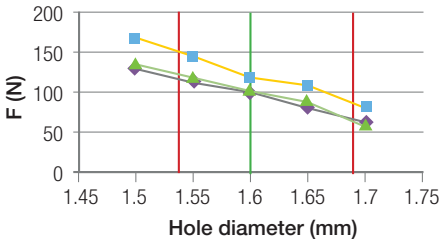


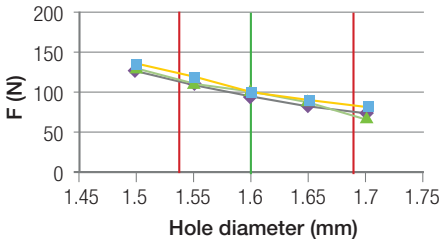




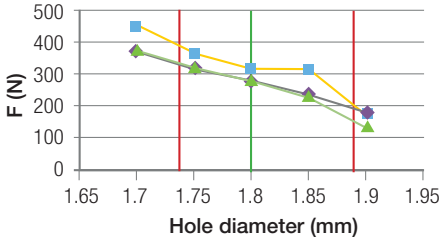
Single press-fit 0.80 x 1.80 mm

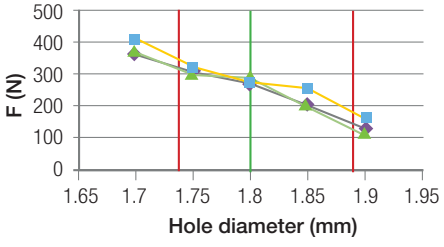


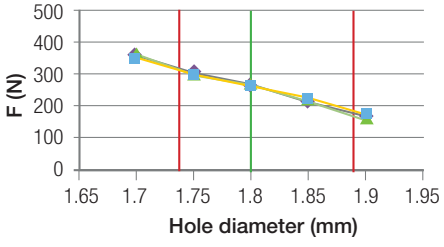


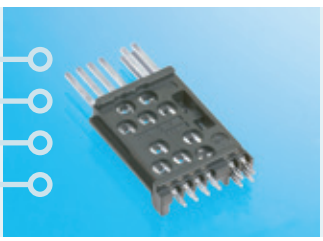


Double press-fit 1.00 x 2.00 mm









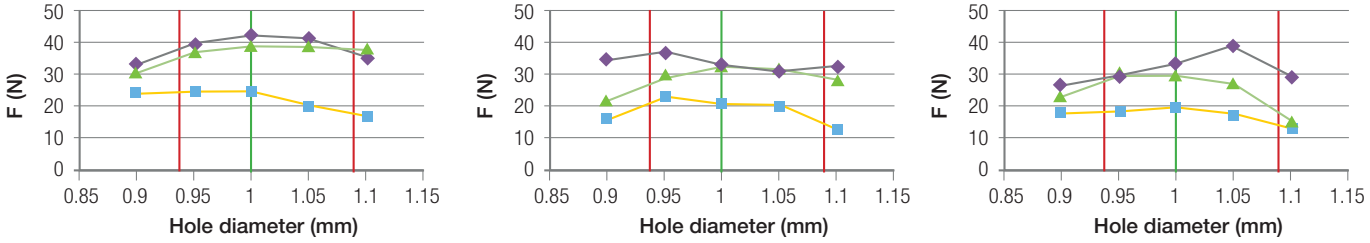
Push-out min force

Press-fit material types

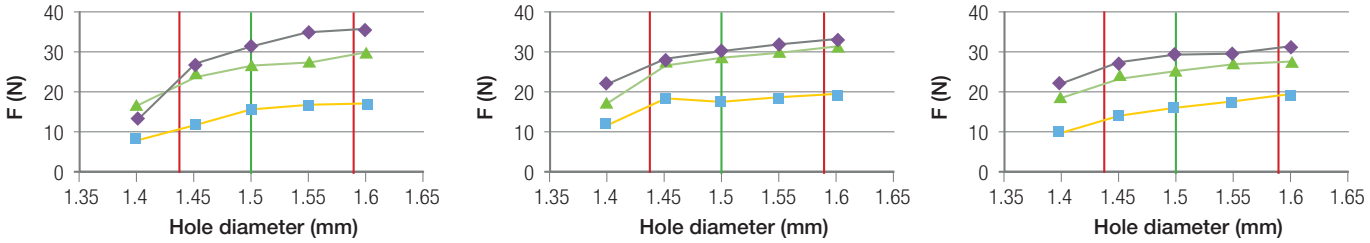
HAL
Ni/Au
Sn
Ø mini / maxi
Ø nominal

CuSn6P	CuNiSi	CuMg

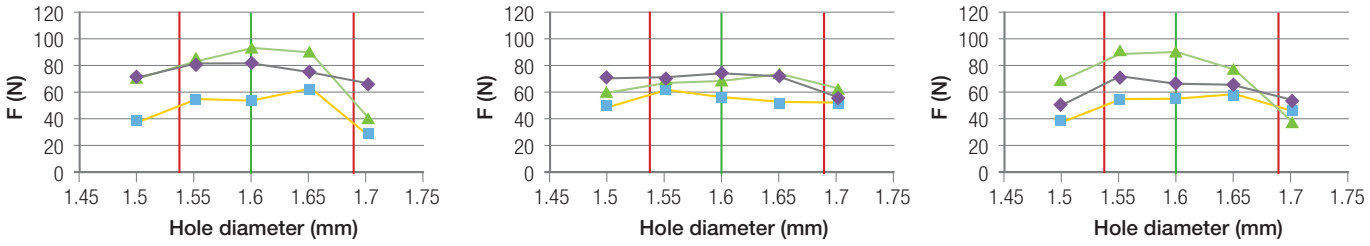
Single press-fit 0.63 x 1.20 mm



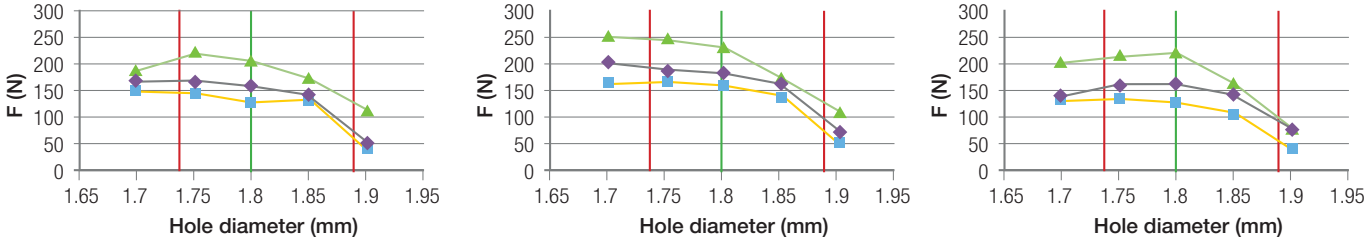
Single press-fit 0.63 x 1.80 mm

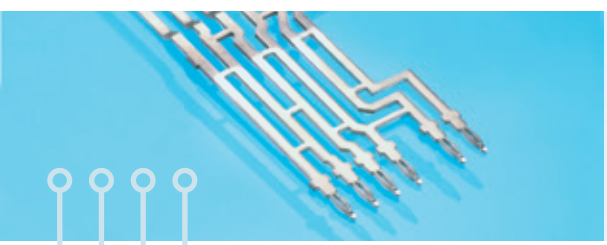


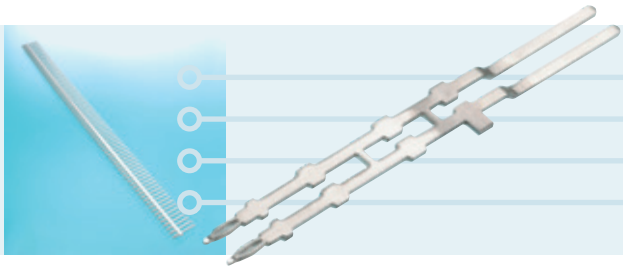
Single press-fit 0.80 x 1.80 mm



Double press-fit 1.00 x 2.00 mm

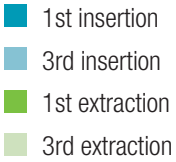






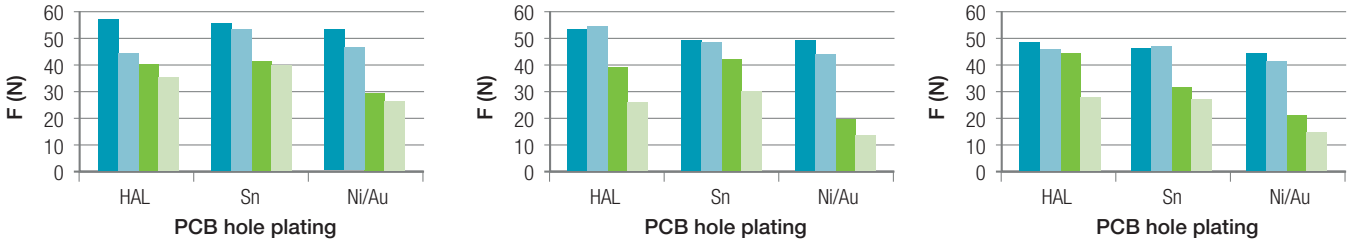
Terminal replacement

A damaged terminal can be replaced by a new press-fit three times into the same PCB hole. Below are presented the resulting insertion/extraction forces.

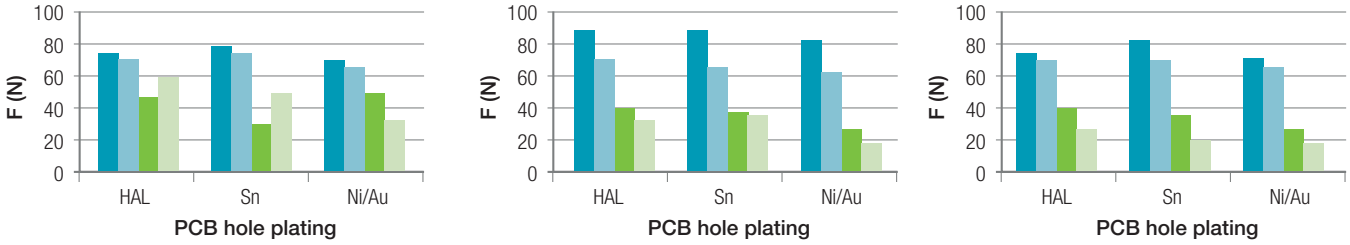


CuSn6P	CuNiSi	CuMg

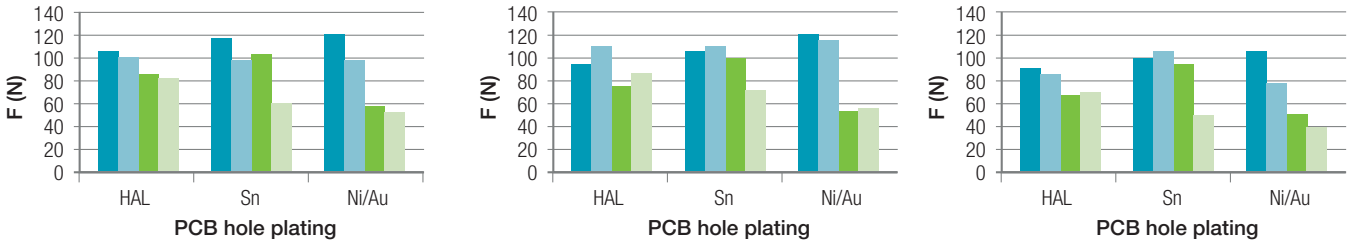
Single press-fit 0.63 x 1.20 mm



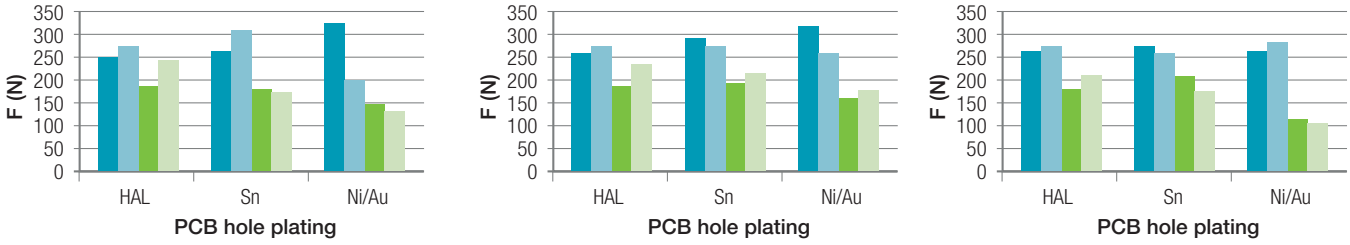
Single press-fit 0.63 x 1.80 mm



Single press-fit 0.80 x 1.80 mm

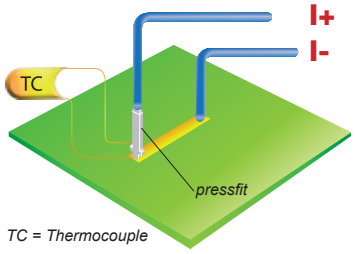


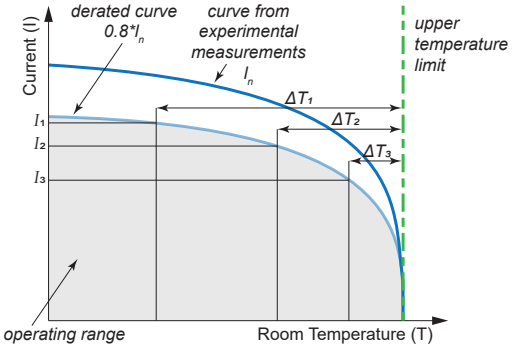
Double press-fit 1.00 x 2.00 mm



Current Carrying Capacity

The testing process is defined by standards such as IEC 60512-5-2. A full range of measurements is collected: temperature versus current applied.
A derated current-carrying capacity curve is calculated by a 20% reduction. During tests, a thermocouple is positioned as close as possible to the contact area between the PCB and the press-fit shape.

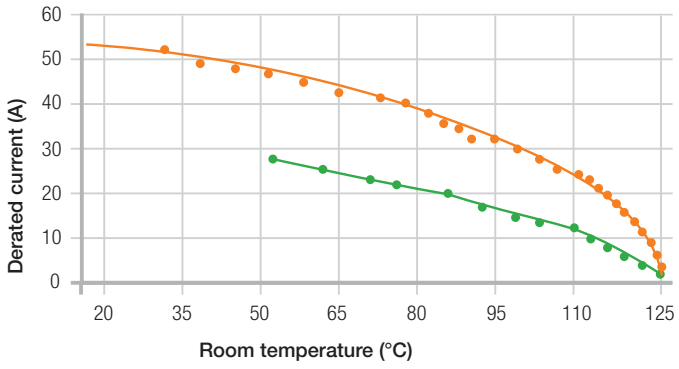




Current test conditions	
Current applied	2 A steps, from 2 A to 70 A
Duration	Each current step lasts 15 min after thermal stabilization
Break	Power supply cut off for 5 min between each step

Influence of PCB design

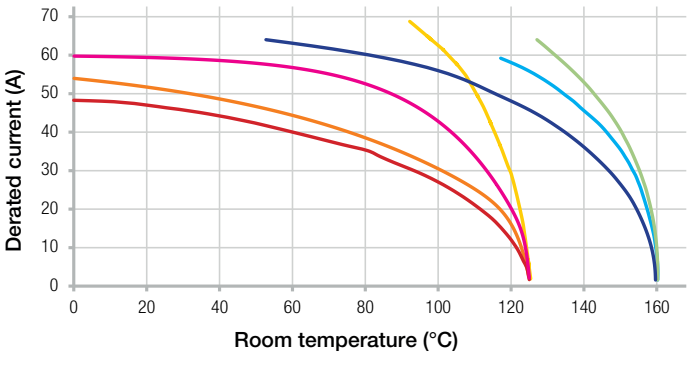
Comparison between standard and high Tg PCB



Current carrying capacity must always be considered in the context of the overall system. It is not a constant value, but rather decreases as the room temperature increases. It is influenced by the geometry and material of the components, the number of connections and the connection support.
The influence of PCB design is illustrated in the figure on the left, the derated curves shown were carried out for the same press-fit design and two types of PCB. In this case, the dimensions of the PCB traces strongly affect the current-carrying capacity of the system. This shows that particular attention must be paid to all the components.
The contact resistances between the PCB hole and the press-fit are given page 7.

Press-fit 0.80 x 1.80 - CuSn6 (single)
- Copper trace 130 µm x 3.50 mm
- Copper trace 70 µm x 0.80 mm

Current carrying capacity for qualified Axon' Mechatronics EON press-fits



The graph on the left shows operating current test results for Axon's EON press-fit with high Tg PCB, i.e. copper trace 130 µm x 3.50 mm.
The tests are carried out at a room temperature around 20°C. The graph shows multiple curves for two kinds of alloys CuNiSi and CuSn6. Following IEC 60512-5-2, current data have been derated by 20 %.

Press-fit CuSn6
- 0.63 x 1.20 (single)
- 0.63 x 1.80 (single)
- 0.80 x 1.80 (single)
- 1.00 x 2.00 (double)

Press-fit CuNiSi
- 0.63 x 1.20 (single)
- 0.63 x 1.80 (single)
- 0.80 x 1.80 (single)

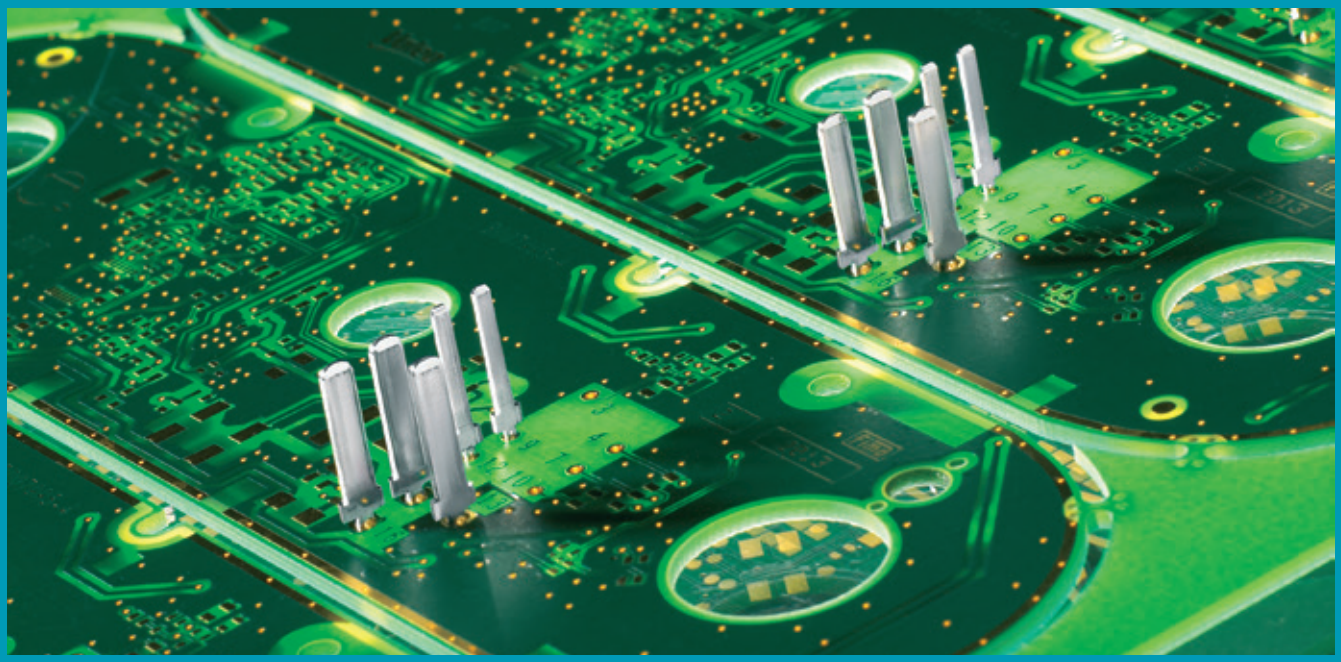
Lazpiur is a partner of Axon' Mechatronics.

Press-fit insertion machine

In some applications, the insertion of single pins replaces molded or overmolded connectors to reduce cost, weight and volume of the system.
In this case, the connector housing is moved into the finished product cover.

Axon' Mechatronics offers a wide range of semi-automatic and automatic insertion machines for inserting press-fit connections into the PCBA. These standalone or inline machines can be integrated into electronic PCB manufacturing processes.

To ensure optimum quality, our insertion machines integrate options to ensure good press-fit insertion such as vision and force monitoring sensors.

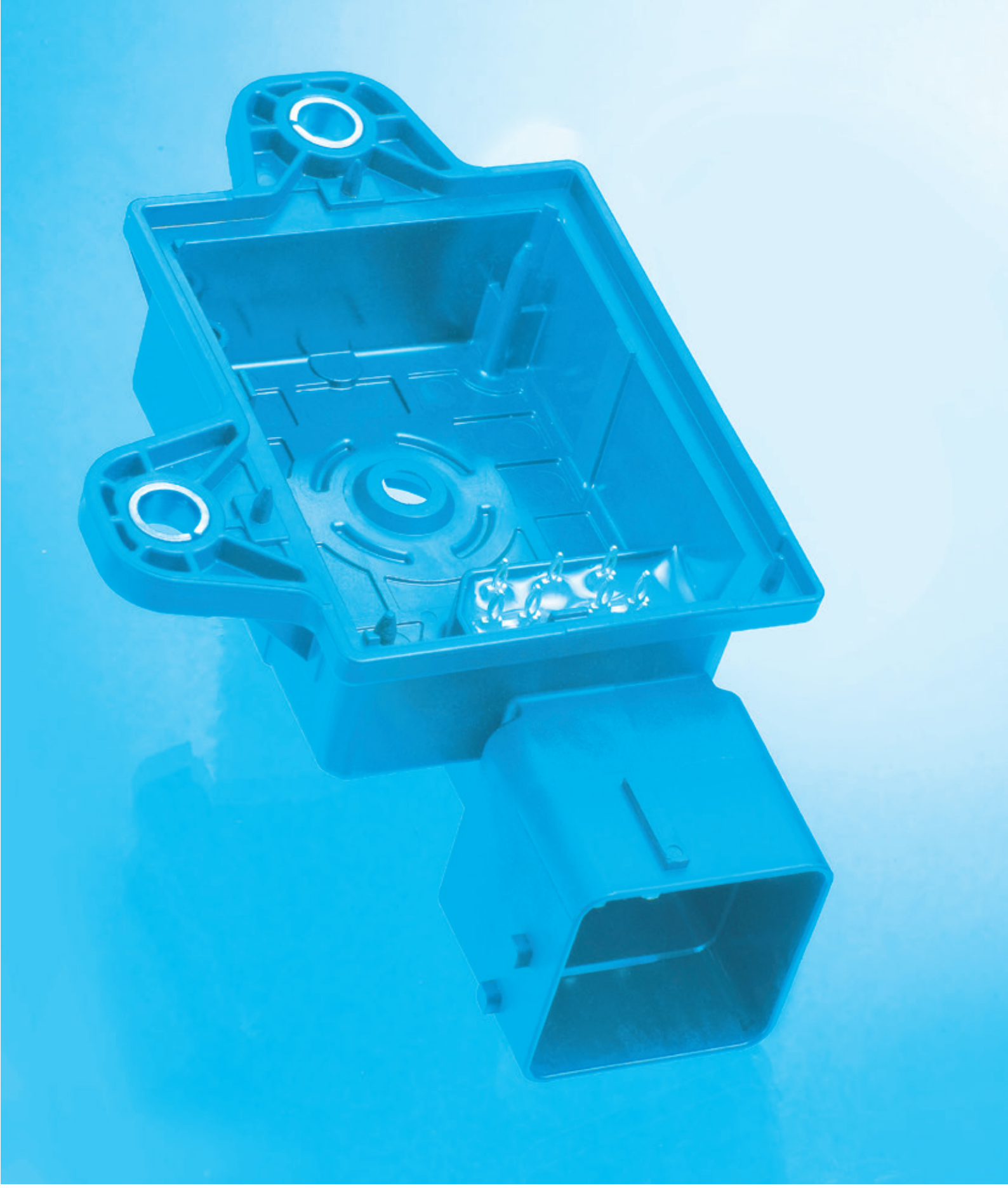


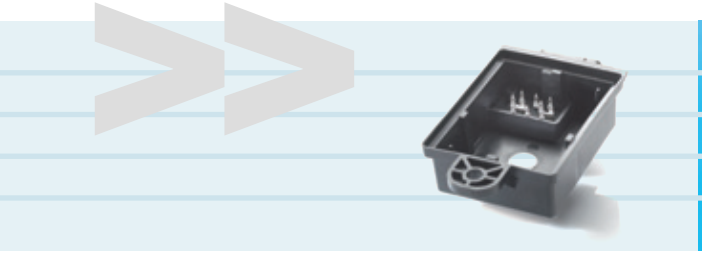
Applications

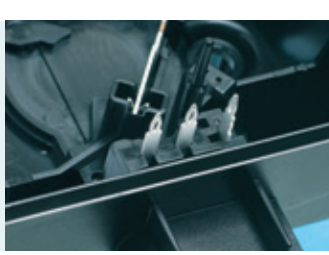
Axon' Mechatronics offers compliant pins for a wide range of applications in different industries.

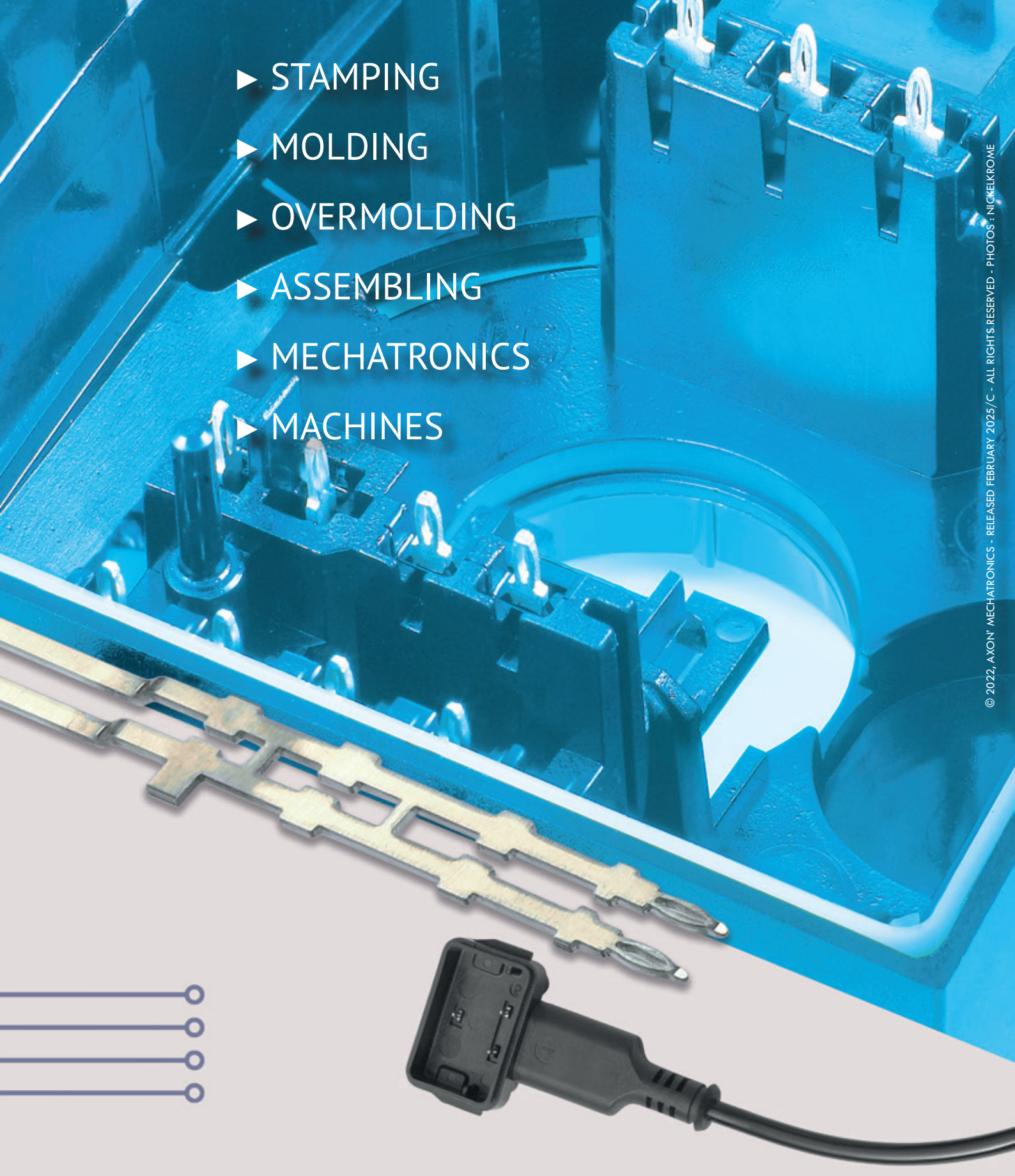
From inserted terminals onto PCB to stitched or overmolded connectors, our solderless solutions will find their applications into your demanding product.

Advantages of EON Compliant Pin Designs:
- Environmental compliance - lead-free plating,
- No separate soldering process necessary,
- Low thermal stress,
- Suitable for multilayer and double-sided PCBs,
- Reliable gas-tight connection, no corrosion,
- Reliable performance in vibration and shock,
- Connector can use standard plastic material for cost saving.









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