AT&S AT A GLANCE

AT&S is one of the world’s leading suppliers of high-value printed circuit boards and IC substrates
AT&S has the most advanced high-tech facility for mass production of HDI printed circuit boards in China, the centre of electronics manufacturing. Other plants, in Austria, India and Korea, concentrate on small and medium-sized batches for industrial and automotive customers.

AT&S uses problem-solving skills to add value
AT&S’s broad portfolio of technologies allows it to provide cutting edge, user-orientated solutions – from prototypes to printed circuit boards for rapid application in industrial manufacturing – acting as a one-stop-shop. This results in major reductions in product development lead times for customers, meaning that AT&S adds value for customers above and beyond the production of sophisticated printed circuit boards.

AT&S operates in attractive niche growth markets
AT&S is supporting all of the major trends in the electronics industry, including further miniaturisation, the internet of things, and wearables. It is these innovations that will drive growth and technological development in the future. AT&S also supplies the leading players in the supply industry for European premium car brands. Over 500 industrial customers rely on the solutions and products offered by AT&S, and the Group supplies the market and technology leaders in each sector.

AT&S cultivates the tradition of European engineering in a highly industrialised setting
The Group spends more than 5% of its annual revenues on research and development, enabling it to anticipate the applications of tomorrow. Highly qualified employees as well as numerous partnerships with universities and international research institutes ensure that these activities meet the required standards of excellence.

AT&S is committed to the highest quality standards
All of AT&S’s production facilities are certified in accordance with ISO 9001 and/or ISO/TS 16969. AT&S is one of only a handful of printed circuit board manufacturers that also has certification according to the EN ISO 13845 standard for medical products and the EN 9100 for the aerospace industry.

AT&S conforms to the latest international CSR standards
AT&S produces highly complex printed circuit boards with a minimal impact on people and the environment. Sustainability is a strategic priority for the Group, which achieves annual reductions in CO₂ emissions and consumption of fresh water. Creating sustainable solutions for customers is the central focus of AT&S’s activities.

VISION
AT&S FIRST CHOICE FOR ADVANCED APPLICATIONS

MISSION
WE SET THE HIGHEST QUALITY STANDARDS IN OUR INDUSTRY
WE INDUSTRIALIZE LEADING EDGE TECHNOLOGY
WE CARE ABOUT PEOPLE
WE REDUCE OUR ECOLOGICAL FOOTPRINT
WE CREATE VALUE
AT&S is one of the world’s leading manufacturers of high-end printed circuit boards for devices such as smartphones, tablets, digital cameras, etc. and is the first high-end IC substrate producer to manufacture computing products (notebooks, desktops, servers) in China. Its specialised skills and expertise, and innovative production technologies enable AT&S to meet its customers’ increasingly demanding technical requirements.

In its automotive business, AT&S activities focus principally on safety systems, entertainment, electromobility, weight reduction and future driver assistance systems for driverless cars. The product portfolio covers the full range of technologies used in the automobile industry. Virtually all of the major tier one European automotive component suppliers in the premium segment are AT&S customers.

AT&S’s industrial market comprises a large number of customers with an extremely wide range of technological requirements. A high degree of flexibility and the ability to adapt to new technical specifications are crucial success factors in this business.

APPLICATION AREAS

Today’s digital world would be nothing without printed circuit boards. They are the ‘brains’ of virtually all electronic appliances – smartphones, navigation systems, cameras, automotive electronics, aeronautics – and a large number of modern industrial and medical technologies. They are central to our everyday life.

MOBILES DEVICES & IC SUBSTRATES

AT&S is one of the world’s leading manufacturers of high-end printed circuit boards for devices such as smartphones, tablets, digital cameras, etc. and is the first high-end IC substrate producer to manufacture computing products (notebooks, desktops, servers) in China. Its specialised skills and expertise, and innovative production technologies enable AT&S to meet its customers’ increasingly demanding technical requirements.

MEDICAL

In medical applications, reductions in size and weight, and product reliability are the prime concern, especially for devices such as pacemakers and hearing aids. Here, our wealth of experience gained in the mobile devices business is an additional benefit to our customers.

AUTOMOTIVE

In its automotive business, AT&S activities focus principally on safety systems, entertainment, electromobility, weight reduction and future driver assistance systems for driverless cars. The product portfolio covers the full range of technologies used in the automobile industry. Virtually all of the major tier one European automotive component suppliers in the premium segment are AT&S customers.

ADVANCED PACKAGING

Advanced Packaging bundles the activities based on ECP® (Embedded Component Packaging) technology. ECP® is a patented AT&S packaging technology used to embed active and passive electronic components directly in the printed circuit board.
Flip Chip technology is the foundation for packaging high performance Integrated Circuits used in applications from consumer level smartphones, tablets and PCs to high performance graphics workstations, servers and IT infrastructure equipment. It is the best balance of performance, reliability and value for the high-density interconnect products leading the industry.

AT&S offers Flip Chip IC Packaging Substrates with:
- Buried via cores (reinforced)
- BU Film/SAP build-up process
- Micro bump C4 sites
- Single/multiple die C4 sites
- Surface mount chip passives
- BGA/LGA form-factors

Substrate-like PCBs (mSAP technology) are the next evolution of high-end HDI PCBs with higher density: Line/Space < 30 micron.

**mSAP - modified semi-additive process:**
In the conventional, subtractive process in printed circuit board production, a thick copper layer is patterned on a laminate using a photomask. Copper is then selectively stripped by etching (subtraction).

In the mSAP process, which allows smaller line/space widths, only a very thin copper layer is applied to the laminate and patterned using a photo mask. Another copper layer is then selectively plated onto the patterned areas.
The history of AT&S has been shaped by high density interconnect (HDI) printed circuit boards. In 1997 they were developed for mass production for the nascent mobile phone industry. Since then HDI printed circuit boards have found applications throughout the electronics industry, and their use was given additional impetus by the introduction of BGA/CSP components. AT&S offers the full range of technologies, from 4-layer laser to 6-n-6 HDI multilayer in all thicknesses.

**Special technologies offered by AT&S in connection with HDI:**
- Edge plating for shielding and ground connection
- Copper-filled microvias
- Stacked and staggered microvias
- Cavities, countersunk holes or depth milling
- Minimum track width and spacing in mass production around 50μm
- Low-halogen material in standard and high Tg range
- Low-DK Material for Mobile Devices
MULTILAYER PRINTED CIRCUIT BOARDS

Multilayer printed circuit boards came into the industry with the advent of SMD population. They are found almost everywhere, wherever electronics are in use – from aircraft to motorcycles, and storage power stations to photovoltaics. AT&S produces printed circuit boards in whatever numbers are required – from individual prototypes to small batches and mass production. The number of layers ranges from 4 to 28, with a maximum thickness of 3.2mm.

AT&S offers multilayer printed circuit boards with the following special technologies:
- Edge plating for shielding and ground connection
- High frequency base materials for applications up to 80 GHz
- Cavities, countersunk holes or depth milling
- Thick copper up to 105μm (inner and outer layers)
- 500μm thick copper inlays using HSMtec technology
- Controlled impedances (single, differential, etc.)

DOUBLE-SIDED PRINTED CIRCUIT BOARDS

Double-sided plated-through printed circuit boards are in use throughout the electronics sector, and more particularly in industrial and automotive applications. AT&S specialises in series production of double-sided printed circuit boards with thicknesses in the 0.1-3.2mm range.

AT&S offers double-sided plated-through printed circuit boards with the following special features:
- Edge plating for shielding and ground connection
- Metal core for high thermal conductivity
  (metal, copper or aluminium)
- Copper inlay for hotspot cooling
- Copper thickness of over 140μm

FLEXIBLE PRINTED CIRCUIT BOARDS

Flexible printed circuit boards are now in use throughout the electronics industry. The circuit board is generally installed bent, folded or twisted. Flexible printed circuit boards are primarily used to replace wiring and connectors, and to create configurations and complex geometries that would be impracticable with rigid printed circuit boards.

AT&S offers the following product range:
- Flexible printed circuit boards based on polyimide, from single-sided to multilayer flex
- For use in dynamic or static applications
- With SMD population and underfill
Semiflexible printed circuit boards differ from fully flexible ones in the materials used, as well as in the restricted bending radii and the limited number of bending cycles. Instead of polyimide, we use standard FR4 thin laminate materials as a more economical alternative in certain applications.

In semiflexible printed circuit boards, AT&S offers:
- Thin, double-sided FR4 materials
- Maximum of five bending cycles with a 5mm bending radius
- Cost effective flex-to-install solutions
- Soldering without pre-baking
- More stable construction, simplifying handling during assembly

Rigid-flexible printed circuit boards directly combine the advantages of flexible and rigid printed circuit boards. This combination of technologies brings the user a variety of advantages especially in terms of signal transmission, overall size, assembly and stability. AT&S produces this technology in three of its plants, allowing it to offer a wide range of products and expertise.

In rigid-flexible printed circuit boards, AT&S offers:
- Printed circuit boards with rigid areas, and flexible areas with reduced numbers of layers
- Combination of polyimide and FR4, or FR4 and thin laminate
- Rigid-flexible printed circuit boards, which connect rigid boards without the need for cables or connectors, resulting in better signal transmission
- With SMD population and underfill

Flexible printed circuit boards on aluminium

The use of LEDs in the automotive industry and in lighting in buildings has posed new challenges in the shape and design of printed circuit boards. When installing LEDs in front headlights, for example, the printed circuit board is bonded to an aluminium heat sink to which the LEDs are then attached. The printed circuit boards offered by AT&S have either one, two or three layers (HDI).

AT&S offers the following options:
- Aluminium or copper heat sinks
- Available with thermally conductive bonding material or prepreg (0.3-3.0 W/(m•K))
- Available in punched version, or routed
HDI RIGID-FLEX PRINTED CIRCUIT BOARDS

In response to market requirements, AT&S also offers mass production of its core HDI technology in combination with flexible printed circuit boards. To make this possible, AT&S has entered into a collaborative agreement with a world market leader in flexible circuit board technology.

In HDI rigid-flex, AT&S can offer the following features:
- Combination of HDI rigid and HDI flex layers
- Stacked and staggered microvias on all layers
- Halogen-free base material (medium Tg) and polyimide
- SMD population
- Mechanical assembly in or on the housing

INSULATED METAL SUBSTRATE (IMS) PRINTED CIRCUIT BOARDS

In the single side printed circuit board business, AT&S focuses on IMS boards. These are used primarily as heat sinks for LEDs and power components. To enable heat dissipation, the base material used has one side that is an aluminium or copper layer either 1.0mm or 1.6mm thick.

AT&S offers the following special features:
- Materials with prepreg or thermally conductive resins
- Thermal conductivity in the 0.35-8.0 W/(m•K) range
- Scored or routed versions
- White or black solder resist
- Based on highly reflective aluminium e.g. Alanod®
- Special surfaces are possible, such as ceramic surfaces
ECP® is the patented AT&S packaging technology used to embed active and passive electronic components directly in the inner layers of the printed circuit board. The technology is used to miniaturise circuits and reduce the space they require, and to increase reliability and product lives. In line with the general trend, printed circuit boards produced with ECP® technology are used in ever smaller, more efficient and more powerful devices, such as smartphones, tablets, digital cameras, and hearing aids.

**Advantages**
- Efficient circuit miniaturisation through component embedding
- Performance enhancement through integration of new functionalities
- Increases in reliability and product lives
- Enhanced signal quality through copper connection of the integrated components
- Cooling optimisation
- Compatibility with traditional SMT processes

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2.5D® TECHNOLOGY

The 2.5D® Technology is a patented AT&S technology for combining mechanical and electronic miniaturisation. It can be used to make cavities in the printed circuit board so that electronic components can be positioned lower, with the result that the complete assembly has a thinner profile. In addition to cavities, flex-to-install printed circuit boards with inner and outer flex layers are also possible. The use of polyimide-free base materials makes for extremely reliable printed circuit boards.

**Advantages**
- Cost advantages over conventional cavity and rigid-flex approaches as a result of the elimination of several process steps (e.g. stamping) and the use of standard printed circuit board materials (e.g. prepregs, RCC foils)
- Cavities of different depths on the same printed circuit board, and no restrictions on cavity shapes
- No restrictions on base materials, and use of state-of-the-art design rules
- Surfaces of cavities suitable for solder resist
- Different technologies can be combined (e.g. rigid-flex and cavity)
- UL approval for cavity and rigid-flex applications
GLOBAL PRESENCE

AT&S LOCATIONS AND COMPETENCES

- Production facilities in Europe and Asia
- Headquarters in Leoben, Austria
- Procurement centre in Hong Kong, China
- Design centre in Düren, Germany
- Sales network spanning three continents
- Approximately 10,000 staff

Each AT&S plant concentrates on a specific portfolio of technologies. The Austrian plants primarily supply the European market and increasingly the American one. In Europe, short lead times, special applications and closeness to customers are typically the most important considerations. The plants in Austria, India and Korea generally concentrate on small and medium-sized batches for industrial and automotive customers. In Shanghai, the focus is on large-volume production of HDI printed circuit boards for mobile communications customers, and increasingly also for the automotive industry. Since 2016, IC substrates have been mass-produced at the plant in Chongqing, China.

Shanghai and Leoben are major technology drivers within the AT&S Group thanks to their research and development facilities.

LEOBEN, AUSTRIA

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<td>• HDI Multilayer printed circuit boards</td>
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<td>• Rigid-flex printed circuit boards</td>
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<td>• ECP® (Embedded Component Packaging)</td>
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<td>• Printed circuit boards for high voltage applications</td>
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FEHRING, AUSTRIA

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| Opened: 1974 |

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<td>• Double-sided plated-through printed circuit boards</td>
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<td>• Flexible printed circuit boards</td>
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<td>• Metal core printed circuit boards</td>
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NANJANGUD, INDIA

| Staff: 1,100 |
| Opened: 1999 |

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CHONGQING, CHINA
- Staff: 2,400
- Opened: 2016

TECHNOLOGIES
Flip Chip IC Packaging Substrates with:
- Buried Via Cores (reinforced)
- BU Film/SAP build-up process
- Micro bump C4 sites
- Single/multiple die C4 sites
- Surface Mount Chip Passives
- BGA/LGA form-factors
- Substrate-like PCBs
  (mSAP=modified Semi-Additive Process)

CERTIFICATIONS
- ISO 9001:2008
- ISO/TS 16949:2009
- ISO 14001:2008
- OHSAS 18001:2007

SHANGHAI, CHINA
- Staff: 4,500
- Opened: 2002

TECHNOLOGIES
- HDI multilayer printed circuit boards
- Substrate-like PCBs
  (mSAP=modified Semi-Additive Process)
- HDI any-layer printed circuit boards

CERTIFICATIONS
- ISO 9001:2008
- ISO/TS 16949:2009
- ISO 14001:2004
- OHSAS 18001:2007
- Sony Green Partner Certificate
- Canon Green Partner Certificate
- UL Listing

ANSAN, KOREA
- Staff: 300
- Opened: 2006

TECHNOLOGIES
- Single and double-sided flexible printed circuit boards
- Flexible multilayer circuit boards
- Rigid-flex printed circuit boards
- Flexible printed circuit boards with metal reinforcement

CERTIFICATIONS
- ISO 9001:2008
- ISO/TS 16949:2009
- ISO 14001:2004
- OHSAS 18001:2007
- UL Listing
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<td>No.58, Chang He Road, Yuzui Town, Jiangbei District Chongqing 401133, P.R. China Tel.: +86 236 1856 0</td>
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<td>AT&amp;S India Private Limited 12A, Industrial Area, Nanjangud 571301 Karnataka, India Tel.: +91 8221 304000</td>
<td>AT&amp;S Korea Company Limited 289, Sinwon-ro, Danwon-gu, Ansan-City, Gyeonggi-do, South Korea Tel: +82 31 495 2277</td>
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<td>AT&amp;S Americas LLC 1735 North First Street, Suite 245 San Jose, CA 95112, USA Tel.: +1 408 573 1211 E-mail: <a href="mailto:sales@ats.net">sales@ats.net</a></td>
<td>AT&amp;S (Taiwan) Company Limited Shin Kong Manhattan Building, 14F, No.8, Sec.5, Xinyi Road, Taipei 11049, Taiwan Tel.: +886 2 87582354 E-mail: <a href="mailto:i.law@ats.net">i.law@ats.net</a></td>
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<tr>
<td>AT&amp;S Asia Pacific Limited 1617-19 16F, Tower 3 China Hong Kong City, 33 Canton Road Tsim Sha Tsui, Kowloon, Hong Kong Tel.: +852 3556 6800 E-mail: <a href="mailto:asiapacific@ats.net">asiapacific@ats.net</a></td>
<td>AT&amp;S Japan KK White Akasaka 8F, 5-4-13 Akasaka Minato-ku, Tokyo 107-0052, Japan Tel.: +81 3 3568 6866 E-mail: <a href="mailto:sales@ats.net">sales@ats.net</a></td>
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