AT&S makes advances in PCB, module and packaging technologies

AT&S is actively participating in key industry consortia to develop GaN processes and panel-level packaging. For years, AT&S has worked towards process and technology development to meet the challenges of continued miniaturization and the demand for better energy efficiency. In this context, the company is involved in various research and development programmes. One current example is the Horizon 2020 EU Research and Innovation programme, in which 11 key European actors are collaborating on the GaNonCMOS project. AT&S is also participating in the Panel-Level Packaging Consortium managed by Fraunhofer IZM.

Optimized energy efficiency with GaN

Over the next four years, the GaNonCMOS project consortium – including AT&S – intends to develop cost-effective and reliable GaN-based processes, components, modules and integration approaches. In particular, the project aims to exploit the energy-efficiency advantages of GaN (gallium nitride), targeting the production of several demonstrators with GaN power switches and CMOS drivers, as well as new magnetic core materials that will enable switching frequencies up to 200 MHz. Together with optimized embedded PCB technology, the developments should lead to new integrated power components for low-cost, high-reliability systems. Working alongside AT&S on this project are the University of Leuven, Epigan, Fraunhofer, IBM Research, IHP, Tyndall National Institute, PNO Innovation, Recom, NXP Semiconductors and X-FAB Semiconductor.

Advancing miniaturisation with panel-level packaging

The Panel-Level Packaging Consortium has also now been formed. It comprises international partners such as Intel, ASM Pacific, Hitachi Chemical, AT&S, Evatec, Nannium, Süss MicroTec, Unimicron, Brewer Science, Fujifilm Electronic Materials U.S.A., ShinEtsu, Mitsui Chemicals Tohcello and Semsysco. Together with Fraunhofer IZM as the development hub, the plan is to implement fan-out panel-level packaging (FOPLP), one of the newest packaging trends in microelectronics. FOPLP has a very high miniaturisation potential in both package volume and package density.
During the consortium’s two-year term, known technological elements in wafer-level packaging will be transferred to a large panel format. The technological basis for FOPLP is a reconfigured, moulded panel with embedded components and a thin-film redistribution layer, which together yield an SMD-compatible package. The main advantages of FOPLP are a very thin, substrateless package, low thermal resistance, and good RF characteristics. In addition, passive components such as capacitors, resistors, inductors and antenna structures can be integrated into the redistribution layer. This makes the technology suitable for creating multi-chip packages and System-in-Packages (SiPs).
NEWS FROM FINLAND

Aspocomp on the up

In 2017, net sales are expected to grow approximately 10 percent and the operating result to be better than in 2016. In 2016, net sales amounted to EUR 21.6 million and the operating result was 3 percent of net sales.

Key figures 10-12/2016 in brief

- Net sales: EUR 6.6 million (EUR 4.8 million 10-12/2015)
- EBITDA: EUR 1.1 million (-0.1)
- Operating result: EUR 0.8 million (-0.3)
- Earnings per share: EUR 0.19 (-0.01)

Key figures 2016 in brief

- Net sales: EUR 21.6 million (EUR 17.5 million 1-12/2015)
- EBITDA: EUR 1.8 million (0.0)
- Comparable operating result: EUR 0.7 million (-0.9)
- Operating result: EUR 0.7 million (-1.2)
- Earnings per share (EPS): EUR 0.16 (-0.16)
- Operational cash flow: EUR 0.1 million (-0.1)
- Order book at the end of period: EUR 2.4 million (0.7)

Net sales and earnings

October-December 2016: Fourth-quarter net sales amounted to EUR 6.6 million, a year-on-year increase of 39 percent. PCB demand generated by the development of the new generation of computer network systems picked up significantly towards the end of the year and was the main driver of growth in the fourth quarter.

The five largest customers accounted for 62 percent of net sales (49% 10-12/2015).
In geographical terms, 97 percent of net sales were generated in Europe (93%), 3 percent in Asia (3%) and 1 percent in North America (4%).

The operating result for the fourth quarter amounted to EUR 0.8 million (EUR -0.3 million 10-12/2015). Fourth-quarter comparable operating result was 12 percent of the net sales. In the fourth quarter, deliveries focused mainly on higher value-added products, improving profitability significantly.

Net financial expenses for the fourth quarter amounted to EUR 0.0 million (EUR 0.0 million 10-12/2015). Earnings per share were EUR 0.19 (EUR -0.01).

Financial year 2016: Net sales amounted to EUR 21.6 million, a year-on-year increase of 24 percent. The needs of automotive industry customers remained firm throughout the year and the entire customer segment doubled its sales compared to the previous year.

The five largest customers accounted for 53 percent of net sales (47% 1-12/2015). In geographical terms, 93 percent of net sales were generated in Europe (93%), 5 percent in Asia (5%) and 2 percent in North America (2%).

Operating result amounted to EUR 0.7 million (EUR -1.2 million 1-12/2015). The comparable operating result was EUR 0.7 million (EUR -0.9 million 1-12/2015, excluding the Teuva plant's shutdown costs). Profitability improved in the second half of the year as revenue grew and deliveries focused on higher value-added products.

Net financial expenses amounted to EUR 0.1 million (EUR 0.1 million). Earnings per share were EUR 0.16 (EUR -0.16).

Outlook for the future

A major share of Aspocomp’s net sales is generated by quick-turn deliveries and R&D series, and thus the company’s order book is short. The company’s aim is to systematically expand its services to cover the PCB needs of customers over the entire life cycle and thereby balance out variations in demand and the order book.

In 2017, net sales are expected to grow approximately 10 percent and the operating result to be better than in 2016. In 2016, net sales amounted to EUR 21.6 million and the operating result was 3 percent of net sales.
NEWS FROM GERMANY

Ruwel rebuilds.

After comprehensive and positive discussions with all local authorities and Unimicron, the manufacturer has decided to rebuild both innerlayer and outerlayer facilities in an industrial area in Geldern (Germany).

In the meantime, the procurement of Masslam has been organised and "the usual delivery performance will be achieved in March 2017".

This construction project will be implemented in two stages: In a first step, Unimicron Germany (previously under the name Ruwel) we will start the construction of the new innerlayer production facility. The aim is to start production again at the beginning of 2018. In a second step, the new outerlayer facility will be build, which completion scheduled for summer 2018.

"With this concept, we strongly emphasise the expansion to higher flexibility (small volumes, prototypes) and towards future, ambitious technological requirements (SBU, thick-copper, complex designs etc.)", adds Rico Schlüter, CTO at Unimicron Germany.

To keep approval efforts to an absolute minimum, Unimicron Germany will use production technologies, - equipment and process chemistry which was already in use in the current production. "We are absolutely convinced that due to this new overall concept, next to the support of our customers and suppliers, we will be optimally positioned for all our common future challenges", Mr Schlüter continues.
Sehr geehrte Newsletter-Leserinnen und -Leser,

jedes neue Elektronik-Design hat seine ganz speziellen Herausforderungen, die es zu meistern gilt. Sind es die vielen Bauelemente, die auf einem meist sehr begrenzten Raum zu platzieren sind, ist es die richtige Auswahl von Komponenten, wie z. B. dem Netzteil oder das Wissen über die ESD-Empfindlichkeit von Bauelementen, um nur einige zu nennen.


Dieses Jahr erwarten Sie folgende spannende Themen, die Ihr nächstes Layout bezogen auf Zeit, Entflechtung, Größe und Zuverlässigkeit positiv beeinflussen könnten.

- **3D-Druck in der Elektronikfertigung**
  Prof. Dr. Claus Emmelmann, LZN Laser Zentrum Nord GmbH

- **Proportionale Anschlussflächen - die Testergebnisse liegen vor!**
  Rainer Taube, TAUBE ELECTRONIC GmbH

- **Das schwächste Glied entscheidet – Die ESD-Bauteilempfindlichkeit nimmt beständig zu**
  Michael Günther, ESD Consult & Service

- **Zuverlässige Netzteile – reine Glückssache? Was Entwickler und Designer bei der Auswahl wissen sollten.**
Markus Rehm, IBR Ingenieurbüro Rehm

- Entwicklung und Integration von Hochleistungs-, Hochfrequenz-Antennenmodulen für die Bereiche Smart Home, Automotiv, Medizintechnik usw. (englisch)

- Schmaler, dünner, kleiner! Flex Schaltungen mit 25/25µm Strukturen und nur 170µm Dicke
Pascal Oberson, Optiprint AG

**Unser Countdown - Große Verlosung!** 9 8 7 6 5 4 3 2 1 ..... 

Die Monate bis zur FED-Konferenz am 21./22. September 2017 möchten wir nutzen, Ihnen einige Hintergrundinformationen über den Verband zu geben.

Beantworten Sie unsere monatliche Frage und nehmen Sie an der Verlosung teil!

**Frage 7**
An welchem Tag fand der PCB-Designer Tag zum ersten Mal statt?

Senden Sie uns Ihre Antwort bis 31.03.2017 per Mail an info@fed.de.

Unter allen Einsendern mit der korrekten Antwort verlosen wir die Teilnahme am 8. PCB-Designer Tag für eine Person.

**Teilnahmebedingungen:** Von der Verlosung ausgeschlossen sind alle Vorstands- und Beiratsmitglieder, sowie die Mitarbeiter der Geschäftsstelle und FED-Referenten. Der Rechtsweg ist ausgeschlossen. Der Gewinner wird per E-Mail benachrichtigt und erhält später eine Teilnahmebestätigung per E-Mail. Der Gewinn kann nicht bar ausgezahlt werden und ist nicht auf eine andere Person übertragbar.

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NEWS FROM THE UK

Institute of Circuit Technology Spring Seminar,
Meriden, UK, 14\textsuperscript{th} March 2017

There has long been debate over the exact location of the geographical centre of England, but the village of Meriden has traditionally laid claim to the title, and it offered an appropriate Midlands venue for the Institute of Circuit Technology 2017 Spring Seminar, which followed the Annual General Meeting of the Institute.

Introduced by ICT Treasurer \textbf{Chris Wall (r)}, the seminar programme commenced with a presentation from \textbf{Dr Tom Jones}, (below) Research Associate at Heriot-Watt University, who discussed the results of a research project carried out jointly with Merlin Circuit Technology to investigate how copper electrodeposition in via interconnects could be enhanced by megasonic acoustic agitation.

It had been demonstrated that, with megasonic-assisted plating, higher-aspect ratio via holes could be incorporated in high-layer-count multilayer builds, simplifying the construction and reducing the number of bonding and drilling operations required. In his 26-layer example, bonding operations had been reduced from six to four, and drilling operations from ten to six.

Megasonic agitation enabled higher limiting currents to be achieved, by reducing the Nernst diffusion layer thickness from the 600 micron to the 0.6 micron level, and gave greatly improved solution circulation within small holes, as Dr Jones illustrated with high-speed video of microbubbles penetrating into a high-aspect-ratio 40 micron through-hole. He showed a series of examples produced on his experimental set-up at Merlin PCB Technology, comparing the effects of no agitation, conventional air and panel agitation, and megasonic agitation, using for purposes of demonstration a conventional non-filling copper chemistry and both simple DC and reverse-pulse rectification. The megasonically agitated examples showing substantial improvements in throwing power.

But although megasonic plating assistance gave some clear benefits inside via holes, it could lead to some interesting but potentially undesirable surface effects. Dr Jones
explained how surface acoustic waves induced unwanted variations in plated copper topography, in the form of ridges on surfaces and ringlets around holes, with a pitch related to the wavelength of the megasonic agitation. The thickness variations had been shown to correspond with changes in grain structure resulting from alternate concentration and depletion of additives. These resonance effects could be overcome by acoustic modulation techniques, although the impact on plating enhancements had not yet been investigated.

There have been many presentations at ICT seminars related to the rapidly accelerating adoption of LED lighting in automotive, industrial, municipal and domestic applications, but these have generally concerned substrates and materials, with an emphasis on efficiency and thermal management. LED devices sold in Europe carry a “CE” marking - what does it signify, and what are the supplier’s responsibilities and obligations? LED expert Peter Dobromylski, Technical Sales Manager of LUX-TSI, unravelled the mysteries of CE marking compliance for LED lighting products.

He explained that “CE”, an abbreviation of Conformité Européene, was introduced in the 93/68/EEC Directive in 1993, as the basis for demonstrating that a product met minimum standards of safety and performance, ensuring protection of the end user and expected performance and reliability in normal use.

Quality of lighting, particularly in the workplace, was extremely important for the wellbeing and performance of the workforce, and Dobromylski described the effect of light on the circadian rhythm, a natural cycle regulating many physiological processes. He demonstrated the difference in the “flicker effect” between two nominally similar LED light bulbs, the “bad” example showing a distinct stroboscopic effect when a pencil was waved in front of it. The human eye had evolved to respond to natural light with a spectral peak at 555nm, but LED light had an additional peak at about 460nm, which was not visible and presented a photobiological hazard that required to be assessed during the CE certification process, and labelled for eye safety when a Risk Group 2 hazard was determined to exist.

For LED products for use in general lighting applications the route for CE marking was through self-certification, and involved a process of identifying the applicable directives, the conformity assessment and the relevant standards, ensuring that the product complied, identifying whether independent assessment was required, maintaining the technical document file, preparing the document of conformity, affixing the CE mark and supplying instructions.

Key directives were the Low Voltage Directive (LVD) - 2014/35/EU, the Electromagnetic Compatibility (EMC) Directive - 2014/30/EU, the Restriction of Hazardous Substances (ROHS) Directive - 2011/65/EC and the Eco Design Directive (ERP) - 2009/125/EC. Applicable standards were: Safety - IEC 62560 (Lamps), IEC 60598 (Luminaires), IEC 62031 (LED Modules) and IEC 61347 (Drivers, Ballasts and Gear). Photobiological - IEC 62471/62778 (LED Packages, LED Modules, Lamps and

Once the manufacturer was confident that the product met all the requirements, “Is it safe? Will it do the job? Will it deliver the savings I expect over life?” he could declare the conformance and apply the CE mark. It was stressed, however, that the self-certification process was not rigorously policed!

Jim Francey, Sales Manager Northern Europe for Optiprint AG, announced that a significant opportunity existed to use PCB technology as an alternative to systems based on low-temperature co-fired ceramic in future 5G cellular mobile communication networks, where it was it was expected that millimetre-wave radio architectures would be employed to ease “spectrum congestion” in current 4G and earlier configurations.

With reference to Optiprint’s collaboration in the FP7 MiWaveS project, he discussed the technology needed to satisfy interconnect and antenna requirements related to the use of PCB for access-point and wireless backhaul to provide mobile access up to 5 Gbps peak and 250 Mbps of typical data rate per user. The use of millimetre-wave radios and directive antennas in short-distance links would result in a reduced emitted power requirement, more efficient transmitter implementation and a better efficiency of the spectrum usage, as well as reducing people’s exposure to microwave radiation.

Organic, as opposed to ceramic, substrates offered an attractive solution for millimetre-wave hardware interconnect and antennae, with mature PCB fabrication and assembly technologies and numerous fabricators and assemblers, although from a PCB manufacturing perspective the effective distribution and propagation of signals in millimetre wavelengths placed critical demands on the choice and thickness of substrates and the dimensional and positional accuracy of PCB features: “It’s all about managing losses and maintaining consistency” and “Most of the loss in millimetre-wave is in the conductor”

Liquid crystal polymer had been recognised as a technology-enabling substrate, not only for its low-loss characteristics but because it was available both as thin non-reinforced laminates with low-profile copper, and as bond-plies for thermoplastic fusion bonding at 290°C. But laser-based metrology was necessary to quantify material movement at multiple process stages and maintain critical layer-to-layer registration. Likewise, LDI was the essential imaging technique.

Microstrip, stripline and co-planar waveguide transmission line technologies were all deployed in millimetre-wave PCB design, but increasingly designers were using substrate integrated waveguide (SIW) technology, which had the benefits of lower losses and component performance approaching that of conventional air-filled
waveguides, with the additional advantages of low radiation leakage and interference.

Francey showed examples of beam-switching Rotman Lens antennae which at 1GHz would be huge but were economically attractive at millimetre-wave frequencies, typically 75mm across, with the advantage of being planar and unobtrusive rather than in the form of a horn.

Component packaging technology was evolving to meet the needs of the millimetre-wave industry, and the embedded wafer-level ball grid array (eWLB) was now available for frequencies up to 86GHz. Flip-chipping of monolithic microwave integrated circuits (MMIC) was another promising technology for high performance millimetre-wave interconnects. For some MMIC devices like very high power amplifiers, designers had no option but to use bare-die, mounted in laser-machined recesses and gold-wire or gold-ribbon bonded, to minimise losses and inductance. Silver-based, rather than nickel-based conductor finishes were preferred to minimise losses: autocatalytic silver immersion gold gave good results and was wire-bondable.

In his summary, Francey reminded delegates that PCB technology was a viable and cost-effective alternative to low-temperature co-fired ceramic, but made it clear that fabricators would require a high level of expertise in thin-core processing and fine-line close-tolerance imaging and etching, together with the capability to manage variable material movement. He listed the facilities he considered essential for success: off-contact metrology, clean-room conditions, liquid resist with laser direct imaging, laser machining, automatic alignment systems for drilling, milling and routing, controlled-depth drilling and milling, and plasma treatment, together with the right systems to test and inspect. Above all, a culture for working with small-form, high-precision components.

Promising that this would be the final wrap-up of the MACFEST project, Professor Martin Goosey summarised the outcome of the Innovate UK supported project to develop new PCB solderable finishes deposited from ionic liquids, which had followed-on from the European Commission funded ASPIS project.

MACFEST had been a two year project that concluded at the end of 2016. Novel metal coating processes had been developed and the deposits evaluated as solderable finishes. Ionic liquid chemistries had been used to deposit good quality palladium and gold coatings onto conventional electroless nickel and the results had been very promising with good solderability and performance comparable to that of coatings deposited from aqueous chemistries.

The coatings developed in the MACFEST project also had the potential to reduce environmental impacts through the elimination of cyanide-based aqueous chemistries and to reduce the amount of palladium consumed, whilst meeting the requirements of the industry and current IPC standards and eliminating known reliability issues with nickel-palladium-gold coatings, for example black pad, brittle joints and void formation. Professor Goosey was currently looking at other funding
routes to take the project forward. The initial project was a relatively low Technology-Readiness-Level research project with much of the fundamental work done by the University of Leicester. There was a need to move towards larger scale trials in a working PCB fabricator environment. He was considering applying for Horizon 2020 funding as and when an appropriate call was available.

He reiterated the benefits of ICT’s Engagement in R&D Projects - a way for the ICT to be directly involved with the development of new technology, with benefits for members in gaining access to new developments and information, as well as being a source of additional income for the Institute.

Market analyst and ICT Council member Francesca Stern rounded off the proceedings with her review of the UK PCB industry for 2016 and outlook for 2017. Total UK PCB production in 2016 was £122M (slightly down on 2015 although imports had increased), categorised by technology: Multilayer 34%, HDI 17%, D/S PTH 17%, Rigid-Flex 13%, IMS 4%, Flex 3%, and by market sector: Industrial/Instrumentation 40%, Military and Government 15%, Civil Aerospace 12%, Communications 8%, Automotive 4.8%, Space 3.5%, Medical 2.4%.

The UK market for PCBs in 2016 was £174M, up from £168M in 2105, categorised by sector: Industrial/Instrumentation 40%, Military and Government 15%, Civil Aerospace 10%, Communications 6.3%, Automotive 4.2%, Medical 3.2%, Space 2.7%.

UK electronics production had been on a growth curve since the end of 2016, and this would likely continue until the end of 2017. By comparison, German year-on-year production had declined slightly but was forecast to return to positive growth during 2017.

Although the PCB business in the UK is these days a comparatively small and specialised industry, it is characterised by a very special camaraderie and sense of community. The membership of the ICT continues to grow and this seminar proved once more to be not only a platform for sharing knowledge and inspiring future developments, but equally an opportunity to renew acquaintances, make new ones, share industry news and gossip and build the network. As is usual, the network-building continued well into the evening...

I am grateful to Alun Morgan for kindly allowing me to use his photographs.

Pete Starkey
I-Connect007
March 2017

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IPC Supports EU Vote for Voluntary Conflict Minerals Requirements for Manufacturers

On March 16, 2017, the European Union (EU) Parliament voted to adopt regulations regarding the sourcing of conflict minerals in high risk zones. The regulations, which require supply chain due diligence self-certification of tin, tantalum and tungsten, their ores, and gold originating in conflict-affected and high-risk areas, are mandatory for smelters and importers of raw materials and voluntary for downstream manufacturers whose products contain these minerals.

IPC supports the EU approach which concentrates on upstream importers and smelters which are closest to the mines and thereby most able to assess whether the minerals are associated with the funding of violence, human rights abuses, and damages to the environment.

www.IPC.org
EIPC SPEeDNEWS

INTERNATIONAL DIARY 2017

ICT/NUKCG Annual Foundation Course in PCB Design and Manufacture
Merlin Circuit Ltd & Chester University
24th - 27th April 2017
www.instct.org

ECWC14
The 14th Electronic Circuits World Convention
Kintex, South Korea
25-27 April

KPCA Exhibition
Kintex, South Korea
25-27 April

ICT Annual Seminar
Black Country Museum, West Midlands, UK
9 May

FED PCB Designer Day
Würzburg, Germany
9 May

SMT Hybrid Packaging
Nürnberg, Germany
16-18 May

EIPC Summer Conference Birmingham
Bonus Programme: Visit & Dinner National Motorcycle Museum
Birmingham, Solihull, UK
1 & 2 June

JPCA Exhibition
Tokyo, Japan
7-9 June
FED Conference
Berlin, Germany
21 & 22 September

TPCA Exhibition
Taipei, Taiwan
25-27 October

EIPC @ Productronica 2017
Messe Munchen, Germany
14-17 November

HKPCA Exhibition
Shenzhen, China
6-8 December