ZVEI:
Die Elektroindustrie

Report

General Assembly 2019

Electronic Components and Systems Division
PCB and Electronic Systems Division

GENERAL MEETING OF THE ECS AND PCB-ES DIVISIONS

EXECUTIVE BOARD OF ECS DIVISION

CHAIRMAN GROUPS
Harting

DIVISIONAL GROUPS
Bronold
Scheer
Weyer
zur Verth
Weitzel

TECHNICAL AND MARKET
Enser
Garcia

ADVISORY COUNCIL

MANAGEMENT
Stoppok

EXECUTIVE BOARD OF PCB-ES DIVISION

CHAIRMAN
Weber

DIVISIONAL GROUPS
Schönherr
Moser
Velmeden

MANAGEMENT
Stoppok
Dr Weiß

GROUP SEMI-CONDUCTORS
zur Verth

Technical Group Integrated Circuits
Hilbig

Market Group
Garcia

Working Groups

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Schmidt-Rudloff

Design/ Development Benchmark Automotive
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GROUP PASSIVE COMPONENTS
Bronold

Market Group
Sauer

Technical Group
Paulwitz

GROUP ELECTROME-CHANICAL COMPONENTS
Scheer

Connectors Committee
Beneke

Technical Group
Beneke

Market Group
Steckling

Additive Manufacturing WG
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N. N.

Input and Protective Elements Committee
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Technical Group
Körber

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TECHNICAL GROUP WITH WORKING GROUPS
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Environment, Health and Safety in German Semiconductor Manufacturing
Dr Jantschak

Environment and Packaging
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TRACEABILITY
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GROUP ELECTRONIC SUBASSEMBLIES
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Working Groups

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Dr Stark

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Feiner

Ad-hoc Repair/Rework
Lauer

Services in EMS
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GROUP PRINTED CIRCUIT BOARDS
Moser

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Reliability of Printed Circuit Boards
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GROUP CERAMIC MICROCIRCUITS
Schönherr

Technical Group
Bechtold

Market Group
Schönherr

ZVEI:
Die Elektroindustrie

Report
Mitgliederversammlung 2019

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Chairman of the Electronic Components and Systems Division Philip F. W. Harting

Chairman of the Printed Circuit Boards and Electronics Systems Division Johann Weber

Dear members and friends of our divisions,

An eventful and rather turbulent past year has featured a whole series of exciting topics: the question of Brexit or no Brexit, sanctions in the US-Chinese trade dispute, and a young generation calling for answers to urgently needed climate protection with the "Fridays for Future" movement. As a company in the electronic components industry, our products, our solutions, and our employees are not just sideline spectators, but deliver solutions for the future that constitute the very backbone of the Internet of Things and Services. Networked worlds are based on our technologies. We manufacture them worldwide, and invest a great deal in research to develop and improve them.

Success doesn't happen by itself — and ours is based on experience, exchange, and the joint creation of framework conditions. To this end, we play an active role in the German Electrical and Electronic Manufacturers' Association (ZVEI), which provides us with a political home at association level. In our divisions, we are the first to learn about upcoming new laws and regulations, which enables us to use this information in our companies to formulate recommendations for action. Together we develop guidelines, form opinions, and advocate them to third parties. Essential aspects that ensure our important industry has a voice and is recognised.

We make the T in IoT!

The focus and objectives of our divisions' work, however, also repeatedly require us to conduct a review — as is the case with any good management system. And we have reflected on what we manufacturers of electronic components and systems as building blocks for industry stand for. We not only form the backbone of the electrical and electronics industry — hardly any product or process is conceivable without our products – but our innovative spirit also drives new developments and promotes social progress. The Internet of Things and Services is becoming a reality through our technologies: We make the T in IoT!

We express our will and aspirations to shape things through three guiding maxims:

1) We are an attractive industry and shape the future.

Ultimately, it is innovations that take us and our society into an exciting future. As an electronic components industry, we are committed to these innovations and drive them forward by identifying future issues in research and development and implementing them. A spirit of innovation at the cutting edge creates future-oriented and sustainable jobs, which enables us to attract specialists and talented employees as well as trainees and students to our fascinating industry and offer them a professional home.

2) We are the platform for market and technology expertise.

Our divisions offer opportunity for active exchange and collaboration. We focus on the fields of education, research, and science, areas in which the common interests of our industry lie. Our results and experiences are recorded in position papers and recommendations for action, which are of course also available to third parties. All members consider our reliable market statistics to be our special asset. They provide a valuable overview of important developments — services that only an association can offer, especially from the point of view of small and medium-sized enterprises.

3) We are the network.

Working and discussing topics together creates a sense of identity for all members. Everyone contributes to increasing the visibility of our industry through his or her actions and activities. As an electronic components industry, we team up and form partnerships with other associations, politicians, and stakeholders. In particular, this includes the development and implementation of rules, norms and standards that have a significant impact on our everyday lives.

Economic trends

Innovation and the constant quest for improvement are the best ingredients for the success of the electronics industry. The penetration of artificial intelligence solutions in an increasing number of production processes, as well as in areas of our lives, has resulted in a growing demand for microchips, printed circuit boards, and other components. As the backbone of the Internet of Things and Services, the electronic components industry is the focus of trade restrictions like no other industry. When we look back on the past year, therefore, it is not all positive.

In 2018, the global market for electronic components grew by almost 13 per cent to USD 653 billion. Semiconductors, which account for around 72 per cent of the total market, are driving this development. In regional terms, China has the highest growth rate with about 18 per cent, followed by the Americas with 15 per cent, EMEA with 11 per cent and Japan with 8 per cent. For the German market, a striking decline in growth from 11 to 3 per cent was registered from 2017 to 2018, attributable in particular to the trend in semiconductors.

The passive component markets, on the other hand, recorded the strongest growth of all component groups, with a robust increase of a good 15 per cent and sales of just under EUR 2.5 billion. This is due to the extremely strong demand for ceramic capacitors (MLCC) and chip resistors (SMD).

Impulses for everyday entrepreneurial life

Our general meetings and top-level talks are always a source of new topics and actions as well as inspiration for everyday entrepreneurial life. In his welcoming address to the general meeting in Leipzig, our president Michael Ziesemer emphasized that cars would not drive without electrical engineering and houses would not be habitable without heating. It is no coincidence, he continued, that our divisions, with their expertise in electronic components combined with the software and solutions offered, have the greatest leverage within the electrical and electronics industry. For this reason, we are addressing important trends, such as the challenges and opportunities of building a 5G grid, the opportunities and risks of electromobility, and the effects of direct current.

With his insightful and stimulating lecture, Professor Hüther fascinated our members and friends on the eve of the top-level talk in Oberursel. In the balancing act between rapidly increasing digitalisation and increasing trade barriers, he urged entrepreneurs to continue fighting for successful innovations and free markets. The topic of digitalisation — in the form of an application-oriented implementation concept — and an insider's view of Brexit rounded off the exciting top-level talk.

Trade fairs also provide important stimuli for innovation and exchange. As divisions, we therefore participate in two important trade fairs in particular. In the lively hustle and bustle of electronica, the world's leading trade fair and conference for electronic components, ZVEI not only offered its member companies and guests the opportunity for intensive exchange, but rather our forum at the PCB & Components Marketplace, with its many lectures and discussions, was an attraction for all experts and interested parties. And once again, our ZVEI industry evening was rated a highlight. At SMTconnect in Nuremberg, numerous presentations were also given, for example on successful solutions with ceramics, component cleanliness and the role of electronic components and systems as drivers of innovation and progress.

Our working groups and divisional groups

With their fascinating topics, our working and divisional groups offer space for opinion-forming and exchange, and are thus the heart of our specialist work.

Last year, the divisions raised awareness for technical cleanliness in particular. A second extended edition of the "Technical Cleanliness" guideline was produced, including, among other things, an online risk assessment tool, which determines the probability of failure of a product. The "Services in EMS" Initiative also features a newsletter, a redesigned website, and a Twitter campaign with a modern look. New formats are also being used in the Design Chain Initiative, which is open to all interested parties — and to make them more attractive, our conferences are held at member companies. In terms of content, a round table dealt with the modification of soldering parameters by Underwriter Laboratories (UL) in order to achieve a uniform regulation within the entire supply chain with reasonable transition periods in cooperation with EMS providers, PCB manufacturers and suppliers as well as UL. EMS Technology Days were also held for the first time. And these developed into real crowd-pullers with around 60 sales employees from ZVEI member companies. The main focus was on key topics and standard processes dealing with assembly issues, which were presented more or less first-hand by experts from member companies. The younger generation was also addressed: the ZVEI U40 Initiative offers an exchange platform designed to introduce younger employees to the association's work.

Last but not least, our technology roadmap is also fully geared to the next technological generation. From megatrends and regulatory influences to networked systems, the "Next Generation" roadmap takes an in-depth look at the specialist areas of our member companies, taking into account our target markets and the important instrument of research funding. Such a blaze of information for the industry can only be created jointly by the numerous members of our working groups who, in addition to their specialist knowledge, demonstrated an exceptionally high level of commitment to our roadmap. Only an association like ours can accomplish this. But take a look yourselves.

Acting together

Johann Weber concludes each of our meetings with the words, "We receive more in return from an association than we contribute". It is only when we stand together that we are strong and can achieve our goals. The key to this is your active commitment, your active participation in our events, and your preparation and follow-up work for our meetings and working sessions. Together, we have achieved a great deal in the past year. You can read all about it in this annual report.

We hope it makes interesting and stimulating reading! Please do not hesitate to contact us if you have any comments on the annual report and our association work, or suggestions regarding topics. After all, we are committed to constant improvement.

And this would not be possible without the dedication of our member companies' employees. We would like to thank you all very much for your tireless application in the working groups and panels of the ECS and PCB-ES Divisions. Our thanks also go to ZVEI's personnel, without whose valuable support our divisions would not be so successful.

Let us continue to work so well together and jointly promote the goals of our divisions. We look forward to doing so!

Yours

Philip Harting
Chairman of the Electronic Components and Systems Division

Johann Weber
Chairman of the Printed Circuit Boards and Electronics Systems Division

Electronic Components and Systems

Management's Report

Christoph Stoppok

Dr Marcus Dietrich

Trends in the electrical and electronics industry

In 2018, the global economy showed fairly dynamic growth of 3.8 per cent, which, according to the International Monetary Fund (IMF) forecast, will weaken slightly in the current year to an increase of 3.3 per cent. Geopolitical crises, trade conflicts, Brexit, high debts in Italy, or distortions in several emerging markets currently pose major challenges.

Germany is highly export oriented and is therefore particularly vulnerable where international trade disputes are concerned. Consequently, the majority of forecasts expect the German economy to grow by just 0.5 per cent this year. As far as the German electrical and electronics industry is concerned, the ZVEI expects moderate price-adjusted growth in production of around one per cent for 2019 — following a rise of two per cent in 2018.

For the domestic components industry, however, markets developed very positively last year. After a substantial double-digit market growth in all product groups of electronic components in 2017, the positive trend in the electronic components markets continued last year, albeit with sales growth in the mid-single-digit range. It remains to be seen how things will unfold in the current year — especially since the ZVEI currently forecasts only one per cent growth for the German electrical and electronics industry.

Innovations require technological progress

In the period under review, the lead markets of the electrical and electronics industry — such as Industry 4.0, mobility, energy, buildings, medicine, and cyber security — continued to gain in importance. The components industry, which is at the beginning of the value chain, plays a decisive role in this. Over the past half century, for instance, electronics has changed the world on an unprecedented scale, with no end in sight to the dynamic changes brought about by innovations. On the contrary: the more electronics and system technologies find their way into our products, processes, and services, the faster the wheel of innovation seems to turn.

This poses completely new challenges to management, executives, and specialists in our industry and working world. Accompanying and shaping this process is one of the major tasks of a modern association like ZVEI. ZVEI plays an active, sustainable, and successful role in the discussion of solutions.

Common identity and values for the ECS and PCB-ES Divisions

At the end of 2017, the executive board of the divisions decided to develop a common identity and set of values for our Electronic Components and Systems Division and Printed Circuit Boards and Electronic Systems Division. In the past one and a half years, for example, in the course of several workshops and meetings, not only was a common identity developed but also three guiding maxims which underscore the importance of our industry. "We are the T in IoT" briefly and concisely demonstrates the enormous importance of our industry in the digital change. In a further step, our common identity will be unveiled and communicated via the various media to members, and also to the entire E&E industry.

Top-level meeting of member company executives

This year's top meeting clearly demonstrated that we address all current topics of interest to our industry, and they are actively explored by experts. At the past CEO meeting, for instance, which took place in Oberursel im Taunus, we were once again able to welcome top-class guest speakers from the fields of business, politics, and research. Evening keynote speaker Professor Dr Michael Hüther, director and member of the executive board of the German Economic Institute, gave a lecture on "Digital transformation and exhausted globalization: Is the German success model in danger?" On the second day of the event, Professor Dr Roman Stöger, professor for strategic business management at Kufstein University of Applied Sciences, Austria, delivered a keynote entitled "Implementing digitalisation. Conclusion 1.0 in the New World". The lecture by Professor Dr Jacques Pelkmans, senior research fellow, Centre for European Policy Studies (CEPS), presenting the topic "Brexit — and now?", rounded off the programme. Lively discussions and exchanges with the lecturers completed this top-level talk.

Technology Roadmap 2025 "Next Generation"

The activities of the divisional groups and committees of our two divisions in the past reporting period were characterised by the extensive work preparing the new edition of the technology roadmap 2025 "Next Generation".

The electrical and electronics industry can look forward to a positive future with numerous business opportunities, with the roadmap identifying and highlighting the technical possibilities. Digitalisation and technology development are constantly accelerating, making a holistic overview of previous technologies necessary as well as an outlook on new developments, also in relation to their respective fields of application.

All aspects and trends of our industry are illuminated in six chapters — trends and regulations, technologies of components, materials and production, fields of application and development, innovations and outlook — with 18 subsections, comprising more than 400 pages. We would like to take this opportunity to thank the authors and all contributors to this in-depth publication for their hard work and dedication.

electronica and productronica — the world's leading trade fairs

The two most important trade fairs for our industry, productronica and electronica, currently reflect the importance and strength of our industry. electronica 2018, for example, registered a record attendance of approximately 80,000 participants from 50 different countries and had around 3,100 international exhibitors. Just like in previous years, this event was again used for panel discussions such as the presentation of the technology roadmap "Next Generation", but also for the joint press conference of the ECS / PCB-ES Divisions, attended by numerous trade journalists. The two chairmen of our divisions presented the current market development of the electronic components industry and the industry's key topics.

Board changes

Since last year, Dr Marcus Dietrich has strengthened the work of the board, succeeding Dr Rolf Winter. Dr Dietrich holds a doctorate in chemistry and has been in charge of the Passive Components Group, the Market Group and the Technical Group since October 2003. He is also responsible for the environmental protection policy of the components industry within the division. Furthermore, he has been Managing Director of the Power Capacitors Division since March 2012.

Thanks and recognition

We would like to thank all volunteers from the member companies who participated actively in the ZVEI last year and the years before. An industry association thrives on the commitment and involvement of its members. In such fast-moving and turbulent times, this is not a matter of course. A lot of the implemented initiatives were set in motion by our members. We are here to pursue such proposals and develop them together with you. Our ultimate goal is to ensure that the interests and ideas of our members succeed in the long term.

Semiconductor Components Group

Chairman
Stephan zur Verth

Structure and work of the Semiconductor Components Group

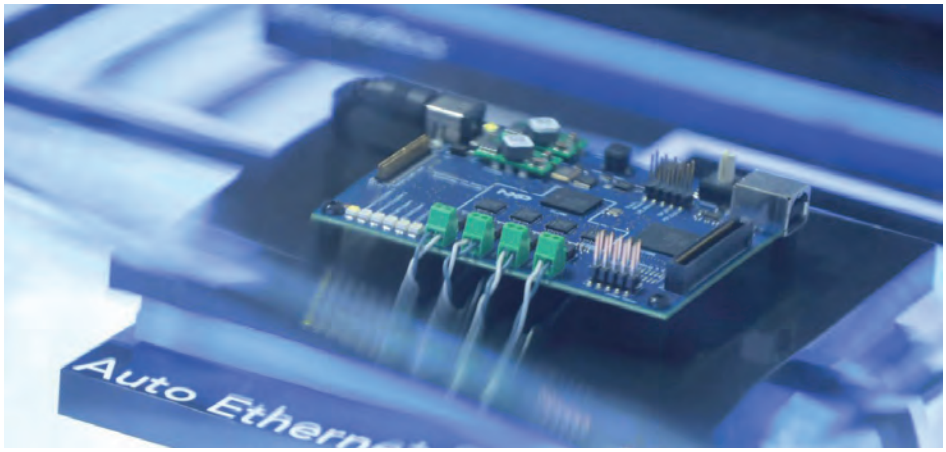
The Semiconductor Components Group comprises permanent working groups and ad-hoc working groups. There are permanent working groups for those topics for which cross-group and cross-divisional panels are continuously set up within the ZVEI and/or the European Semiconductor Industry Association (ESIA).

The Semiconductor Components Group acts as the representative voice of the semiconductor industry, communicating and optimising its social utility. It sees itself as a competence centre (e.g. market knowledge/market data, standards, new solutions, etc.), as an interface to other organisations and panels, etc. (for the exchange of information), as a solution-oriented platform for identifying common challenges and interests, as an open industrial group for all semiconductor manufacturers represented in Germany, and as an information base both externally and internally (ZVEI).

Four permanent working groups of the Semiconductor Components Group are currently organised around the topics of market, technology, and the environment. Ad-hoc working groups are set up on a temporary basis to focus on key topics in accordance with the work of the divisional groups. Industrial policy issues, especially education and research policy, belong to one of the main areas for ad-hoc working groups, and these are topics also addressed by the board working groups. Improved cooperation with partners along our industry's value chain, such as the automotive industry, for example, is another main area covered by ad-hoc working groups.

The Political Lobbying and Public Relations Working Group focuses on the problem that concerns of the semiconductor industry should not only be understood by experts, but also by ordinary citizens. This also involves improving the image and portrayal of the semiconductor industry and its products in society. The public needs to be shown how microelectronics has changed our lives. Then there is the goal of positioning issues politically that either support or hinder the semiconductor industry in its daily work.

The topic of promoting new talents is covered by the ad-hoc working group of the same name. Its goals are to improve today's negative engineering image — turning it from "electrical engineering equals electrosmog" to "electrical engineering equals energy efficiency/environmental technology"; to promote interest and fun in science and technology from an early age, and to support cross-curricular courses such as electrical engineering and physics. The working group regularly obtains an overview of existing activities and its members exchange their companies' own experiences in the area of promoting young talent. Moreover, the working group has set itself the goal of continuously supporting or initiating a project to promote young talent. In recent years, we have had the Microchip ABC initiative, which produced a cross-media presentation showing the development and manufacture of semiconductors designed to inspire enthusiasm in teenagers and young adults alike for our industry. Over the past two years, two YouTube videos have been produced, explaining microelectronics and its use as a key enabler.
The divisional group also conducts an annual design benchmarking for the automotive sector in which productivity and throughput are used as parameters for comparison. A white paper has been prepared with the aid of the benchmarking results. This can be downloaded from the ZVEI homepage.



Source: NXP Semiconductors Germany

Source: Continental Automotive

To maintain and expand the network between industry and research institutions, and to continuously receive information first-hand about the status of current research and development activities at university and institute level, the Semiconductor Components Group regularly invites representatives from these fields to give guest lectures at its meetings. Group meeting's including tours also take place externally, at Fraunhofer Institutes for example.

In addition, the divisional group offers interested semiconductor companies the opportunity to introduce themselves during the meetings and at the same time find out about the division's work within the ZVEI.

Source: Wonder Automotive Europe

The collaboration between the Semiconductor Components Group and the European association ESIA within the EECA has been established. With increasingly close links between the individual states and the European Union on the one hand and the supraregional positioning of the semiconductor industry on the other, it is becoming less and less possible to view semiconductor industry topics exclusively at national level, but instead more and more in cooperation with national and European industry representatives. Representatives from member companies of the Semiconductor Components Group have therefore played a major role in defining the activities of the European association and have worked intensively on improving European framework conditions for the semiconductor industry beyond the national possibilities. At the same time, these representatives report on activities and results at European level in the meetings of the divisional group and, if necessary, relay enquiries and proposals between the national and European associations.

The publication of a microelectronics trend analysis is now a tradition. The latest one, mapping market activity over a period of five years, was presented to the press in April 2019. The form of this analysis is unique as nothing comparable exists. The in-depth analysis of the semiconductor components sector again provides the advantage of superior knowledge in the very dynamic microelectronics market and the entire value chain associated with it. It examines future trends in the global semiconductor market and discusses the opportunities and risks for the German electronics industry. Microelectronics requirements for automotive electronics are treated as a special topic.

As is customary, the press conference on the semiconductor market took place in December 2018. The situation on the global, European, and German microelectronics markets was discussed. Similar to previous years, the conference received a very good response both in the German daily press and in the corresponding trade journals.

The global market for semiconductor components

Following the severe slump in 2001, the global semiconductor market experienced six years of growth at varying levels. Due to the financial and economic crisis, however, our industry experienced an unprecedented sharp downturn in sales in the fourth quarter of 2008 and the first quarter of 2009. Even though the first six months of 2008 had been very good, the year ended with a decline in sales of 2.8 per cent in USD terms. In the second quarter of 2009, the market began to recover and continued to do so at a hitherto unseen pace over the rest of the year. This caused the full year 2009 to fall by only 9 per cent, contrary to early performance forecasts. In 2010, the microelectronics industry returned to its former growth trajectory, increasing by almost 32 per cent to USD 298 billion. The market grew by 0.4 per cent in 2011, and contracted in 2012 by 2.7 per cent to almost USD 292 billion.

With an increase of 4.8 per cent in 2013 and growth of 9.9 per cent in 2014, the market climbed to almost USD 336 billion. After these two years of strong growth, the global semiconductor market shrank by 0.2 per cent to just over USD 335 billion in 2015, and then grew by 1.1 per cent to just under USD 339 billion in 2016. In 2017, the global semiconductor market showed the greatest growth since the turn of the millennium, increasing by 21.6 per cent to over USD 412 billion. Memory chips were the sales drivers, but even without this segment, the global market grew by 10 per cent. In 2018, the world market for semiconductors again grew at an above-average rate of 13.7 per cent, amounting to just under USD 470 billion.

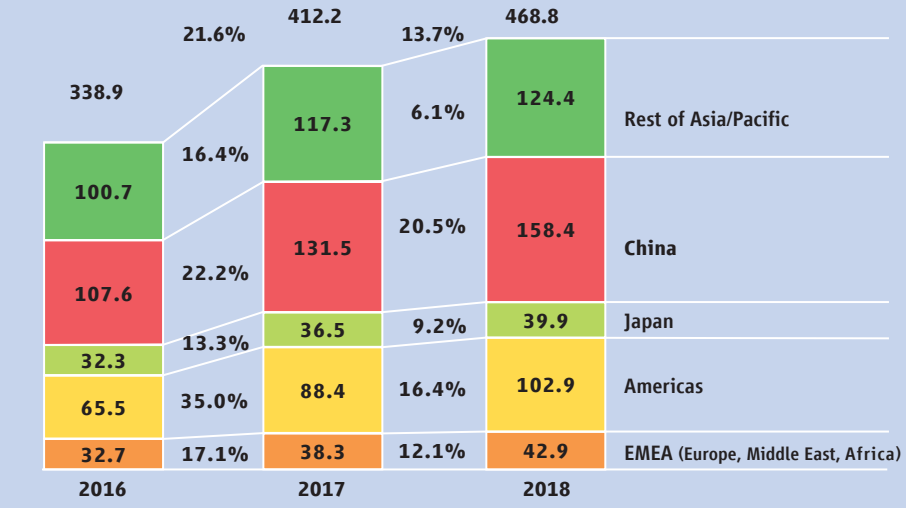
The various regions continue to develop very differently. After the slump in the years 2001 to 2004, the market for semiconductor components in the Americas seemed to stabilize from 2005 to 2012 with an average global market share of 17 per cent. After two particularly good years in 2013 and 2014 with growth rates of 13.1 and 12.7 per cent respectively, the market shrank by 0.8 per cent to just under USD 69 billion in 2015, and by 4.7 per cent to just over USD 65.5 billion in 2016. In 2017, however, the American semiconductor market grew 35 per cent faster than the semiconductor markets in all other regions to just under USD 88.5 billion. And in 2018, it grew by a very good 16.4 per cent to over USD 103 billion.

In EMEA (Europe), market performance in recent years has been roughly comparable to that in the US. Here, too, global market share has amounted to 15 per cent in recent years. The European microelectronics industry is more dependent than other sectors on automotive and industrial electronics. In the previous economic crisis, these segments were hit much harder than the rest, which is why the sales performance of semiconductors in Europe was significantly below that of the rest of the world. Global market share therefore fell to 13 per cent. Although automotive electronics managed to recover from 2010 to 2012, growth in Europe lagged behind that of the rest of the world. Europe's share thus fell to 10 per cent in 2015 and to just under 10 per cent in 2016. In 2017 and 2018, the European market grew by over 17.1 per cent and 12.1 per cent respectively, but remained below global growth of 21.6 per cent and 13.7 per cent respectively in those two years, resulting in a further loss of market share to just over 9 per cent.

Japan was also hit by a sharp decline in the microelectronics market in 2009. The country's global market share therefore dropped to 17 per cent. It was not able to recover in 2010 and 2011 either, which was, of course, also due to the catastrophe in Fukushima in 2011. Japan's share of the microelectronics market fell steadily from that point on until 2015; in 2016 its market share rose again to 9.5 per cent. These changes were driven by the exchange rate. In 2017 and 2018, Japan had the weakest market growth with 13.3 per cent and 9.2 per cent, respectively, thus again losing market share to a level well below 9 per cent.

Global market – semiconductor components 2016-2018

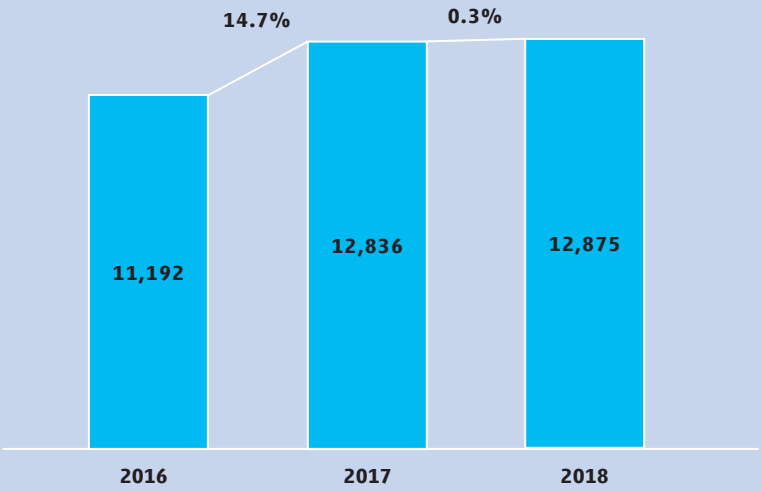
Regions by billion USD



Source: ZVEI

German market – semiconductor components 2016-2018

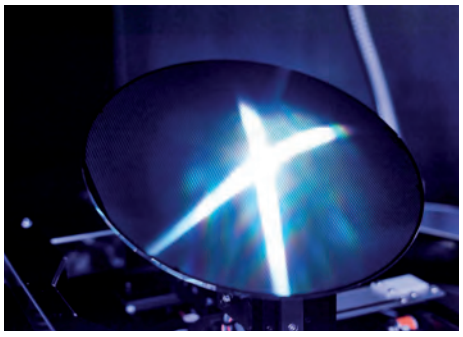
in million EUR



Source: ZVEI

In Asia, the trend that began in 2001 has continued to this day. Asia's global market share rose to over 60 per cent by 2018. China alone consumed almost 34 per cent of the world's total semiconductor production in 2018, more than a third, and therefore has a larger world market than any other region.

The division of the world market has thus shifted completely. Until 1999, the US market was by far the largest. In the meantime, Asia has assumed this role. In 2018, its share of the global market was 60.3 per cent, followed by the Americas with 22 per cent, EMEA with 9.2 per cent and Japan with 8.5 per cent.



Source: X-FAB Semiconductor Foundries

The German market for semiconductor components

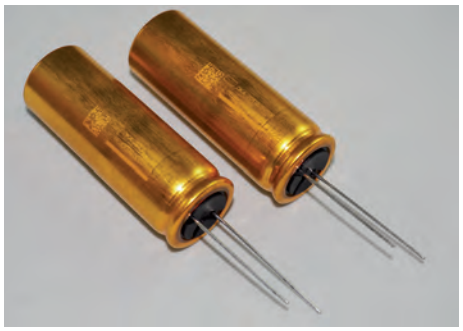
With growth of 0.3 per cent in EUR terms in 2018, the German semiconductor market did not perform as well as the market in EMEA (Europe), which grew by 7.1 per cent. The German semiconductor market has therefore grown much more slowly than the global semiconductor market, resulting in a loss of market share. In EUR terms, sales in the German semiconductor market in 2018 amounted to just under EUR 12.9 billion.

Fachgruppe Passive Bauelemente

Chairman
Ralph M. Bronold

The manufacturers of capacitors, inductors, EMC filters, and resistors are members of the Passive Components Group. Together, they address a wide range of topics in the field of passive components, such as the maintenance and ongoing optimisation of a market statistics database. By including their own statistical evaluations, detailed market trends at product and segment level for Germany, EMEA and at global level — via the World Statistics (WTS) — can be derived from the European Passive Components Statistics (EPC-eStat). The broad spectrum of participating member companies results in very representative and conclusive market information.

The Passive Components Group also provides an important platform for members to exchange



Source: Europe Chemi-Con

information on all issues relevant to the industry in the field of passive components. Information on technological, environmental or commercial issues, for instance, can be obtained at an early stage. This also explains members' active participation in numerous working groups and ad-hoc groups within the ZVEI.

Achievements of the Passive Components Group

The broad market coverage and existing expertise of the member firms enabled the realisation of extensive projects within the divisional group accompanied by positive results for the member companies.

Source: EBG Elektronische Bauelemente

Source: Vishay Electronic

New projects were initiated in the working groups and panels of the Electronic Components and Systems Division and existing key working areas were further intensified and expanded. This demonstrates that both small and medium-sized enterprises as well as large corporations can better assert their interests and do so more efficiently and purposefully by working out a common position in the association and presenting a uniform stance to the outside world. For example, it was possible to use the division's influential position to exchange information and form opinions at national and European level with ministries and the European Commission. The achievements of the Passive Components Group are detailed in the reports on the working groups of the Technical Group.

European activities

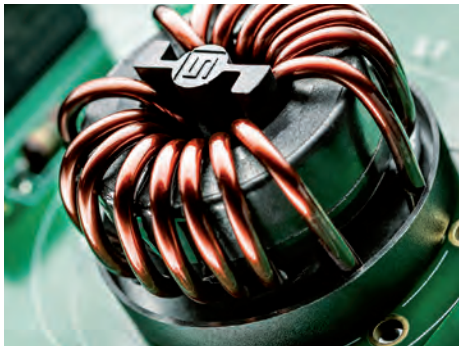
Due to the great importance of the European Economic Area for member companies of the Passive Components Group, there is an increasingly close interlinking of content with the EPCIA (European Passive Components Industry Association), through which the activities for the common world statistics, the WPTS (World Passive Component Trade Statistics), are coordinated. Many members of the divisional group are therefore also active in the EPCIA.

Key working areas

In addition to the continuous monitoring of market trends, the division's bodies and working groups again realised numerous cross-company tasks in concrete projects last year:

- **EPC-eStat**

The ZVEI's EDP-based statistics platform allows reporting companies easy access to detailed, representative market data on the product lines capacitors, inductors, EMC filters, and resistors, covering EMEA and Germany as well as customer industries — naturally in strict compliance with legal requirements. Sales and unit data is col-



Source: Schurter

lected quarterly. The user interface is available in German and English so the respondents can enter data in the language of their choice.

Market figures are also collected at global level for the reporting categories WRTS (resistors), WITS (inductors), and WCTS (capacitors). The information on the global market situation of passive components received from respondents in the USA, Japan, Europe, and the rest of the world is merged in common world statistics.

In addition, each quarter, the market shares for distribution, OEMs (original equipment manufacturers) and CEMs (contract equipment manufacturers), and the customer segments are statistically assessed in separate reporting categories, so that a comprehensive market survey is conducted for passive components at national, European, and global level for products and customer segments (EMEA).

Source: Panasonic Industry Europe

- **Product-related environmental protection**

Environment-related topics constitute an important part of the work of the Passive Components Group meetings. In addition to conflict minerals, the focus is on the European Commission directives and their national implementation, such as RoHS Recast (Restriction of the Use of Certain Hazardous Substances) and REACH (Registration, Evaluation, Authorisation of Chemicals). Representatives of the divisional group also actively participate in the following ad-hoc working groups and groups of the ZVEI:

- Substance Policy Working Group
- Environment and Packaging Working Group

Source: Rödl & Lorenzen

- **Passive Components Core Team**
  - Standardisation work regarding material composition data (e.g. IEC EN 62472)
  - Material data declaration
  - Environmental legislation

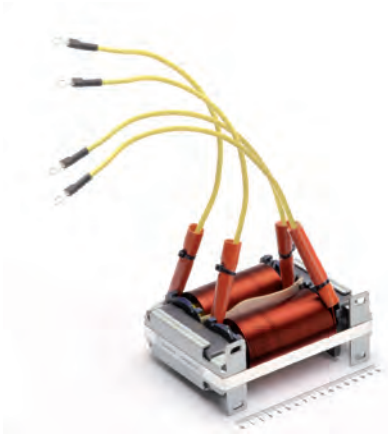
- **Marketing/public relations**
  - Publication of consolidated market data on passive components in specialist media
    The market figures for passive components determined by the common European e-statistics — the EPC-eStat — are published in aggregated form as graphs in the report to the general meeting of the ECS / PCB-ES Divisions.
  - "Passive Components in the Technology Roadmap" report
  - Technology Roadmap — Next Generation / Passive Components report
    Dr Jan Marien, Chairman of the Core Team Technology Roadmap Passive Components, presents the activities of the Technology Platform Working Group with regard to the creation of the new "Technology Roadmap — Next Generation". The chapter on "Passive components" with the respective subgroups (capacitors, resistors, inductors, EMC filters and SAW filters) has already been completed. During electronica 2018, there was a presentation of the contents by the authors, followed by a panel discussion at the well-attended PCB Market Place in Hall A1.

ZVEI Automotive Topics Platform – electronics, infrastructure, and software: active involvement by members of the divisional group

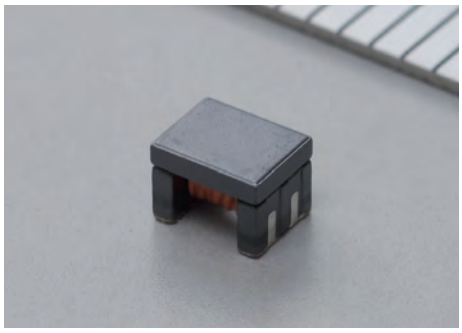
In the ZVEI Automotive Topics Platforms, members of the divisional group participate in the working groups

- Consumer Components for Automotive (Applications),
- High-temperature and Power Electronics,
- Functional Safety / ISO 26262,
- Zero Defect Strategy,
- Field Failure Analysis
- and Robustness Validation,

and actively support the individual key topics.



Source: Kaschke Components



Source: Murata Electronics Europe

The brochure entitled "Qualification of DC-Link Capacitors for Automotive Use" has already been produced by the working group on high-temperature and power electronics in cooperation with renowned capacitor manufacturers. Work is currently underway to update the brochure. Other capacitor technologies are also being used in the qualification considerations.

Moreover, the Passive Components Group is addressing important topics relating to quality management in the automotive sector.

Norms and standardisation

The field of norms and standardisation is a source of important content for the meetings and conferences of the Passive Components Group. Its representatives are actively represented, for example, in the following ZVEI bodies:

- ZVEI board working group on innovation policy
- Technical regulation and conformity assessment

Guest lectures in the Passive Components Group

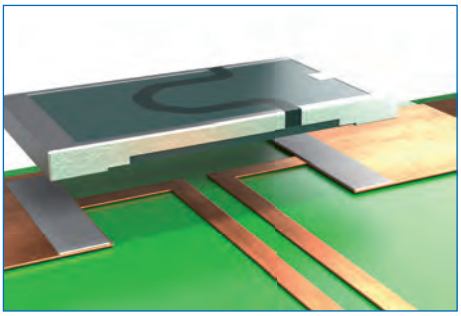
Market studies for passive components

Dr Milan Rosina, Jerome Azumar, and Marine Pelissier from Yole Développement gave lectures on Yole Développement and its range of market studies in the E&E industry. They also explained the possibilities of individual data collection and acquisition for the preparation of requested bespoke market studies for passive components.

Source: Sumida Components & Modules

Economic situation of the E&E industry

Dr Andreas Gontermann, Head of Economic Policy, Business Cycles and Markets, explained the current situation of the electrical and electronics industry at national, European, and international level. He discussed the long-term growth prospects of the E&E industry, presented the current economic situation in the USA, China, and the emerging markets, and finally explained the domestic market indicators such as exports, production, new orders, and employment figures.



Source: Isabellenhütte

Industry overview: market development passive components 2016–2018

Harald Sauer, Chairman of the Passive Components Market Group, presented trends in the industry for inductors, EMC filters, resistors, and capacitors for the EMEA region from 2016 to 2018. Overall, passive components markets performed very positively from 2016 to 2018 — in some cases with double-digit growth rates.

Report on the WPTS meeting 2018 in the USA

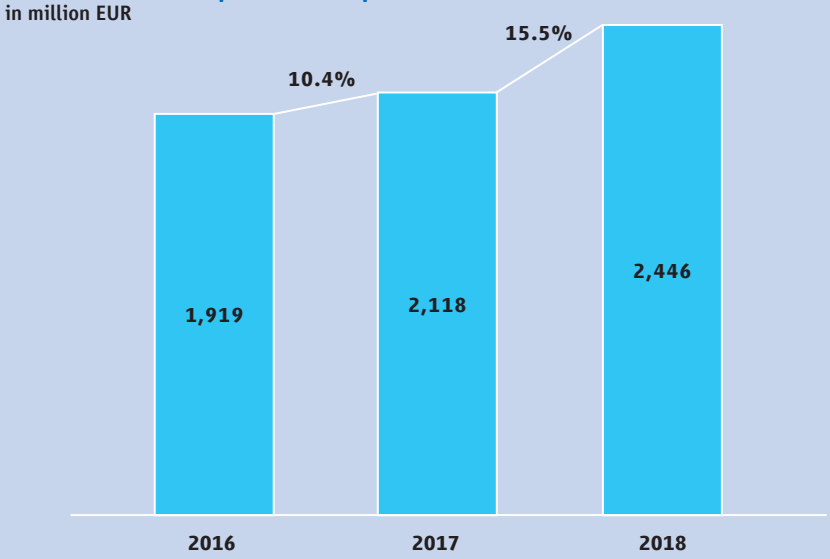
Ralph Lutsche, Chairman Europe for WITS (World Inductor Trade Statistics), and Harry Hassfurter, Chairman Europe for WRTS (World Resistor Trade Statistics) and WCTS (World Capacitor Trade Statistics), reported on the last WPTS meeting (World Passive Component Trade Statistics), which took place from 14 to 16 June 2018 in Georgia, Atlanta.

German market Performance in the product areas

The following market information is based on data from EPC-eStat, the common European e-statistics for passive components.

German market – passive components 2016-2018

in million EUR



Source: ZVEI

Looking back over the past three years, growth in the domestic markets for passive components (capacitors, inductors, EMC filters, and resistors) has increased each year.

The year 2016 already closed with an increase in sales of 5.3 per cent, followed by an increase of 10.4 per cent in 2017, which corresponds to sales of some EUR 2.1 billion. This positive trend was reinforced last year with growth in 2018 as high as 15.5 per cent and a market volume of just under EUR 2.5 billion.

ZVEI's market experts also expect a positive performance from the domestic market for capacitors and resistors in the current year. These expectations have so far been supported by the positive results of the first quarter of 2019 (YTY data) stemming from the e-statistics.

As of 2018, the Passive Components Market Group decided to base its portrayal of the global market exclusively on data from the world statistics for passive components (WPTS). This results in deviations from the figures given in previous publications.

Source: Frolyt Kondensatoren und Bauelemente

Global market

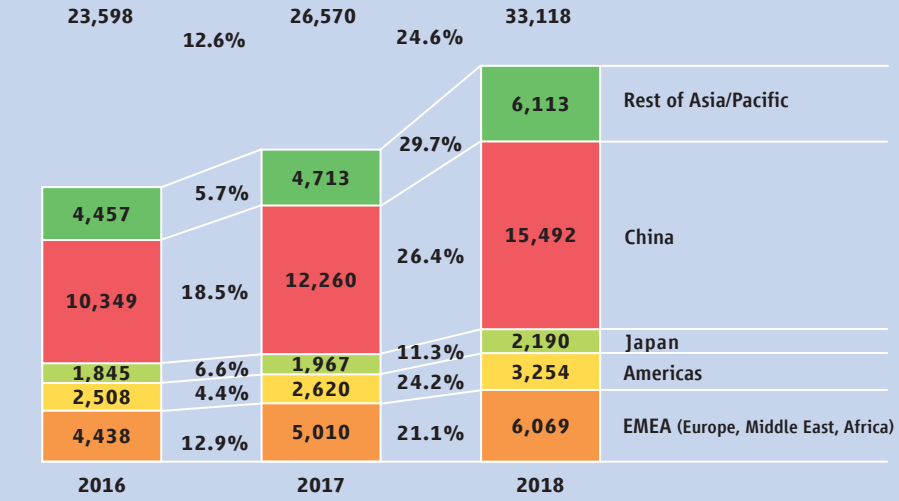
Looking at the development of the global market for passive components, 2018 saw a considerable increase in sales of 24.6 per cent over the previous year to USD 33.1 billion, while 2017 saw an increase in sales of "only" 12.6 per cent to USD 26.5 billion. This positive trend is due to the strong demand for ceramic capacitors (MLCC) and chip resistors (SMD).

The region with the largest share, China, which has been mapped as a separate region in the WPTS since 2017, recorded an increase of a good 26 per cent last year with a share of just under 47 per cent, corresponding to a sales volume of just under USD 15.5 billion. The rest of the Asia-Pacific region, which accounts for 18.5 per cent of the global market, recorded the greatest growth last year, with sales rising by almost 30 per cent to approximately USD 6.1 billion. This was followed by the EMEA region (18.3 per cent share) with sales of USD 6.0 billion, which corresponds to growth of a good 21 per cent (almost 16 per cent in EUR terms). The Americas ranked next, growing by some 24 per cent with sales amounting to USD 3.2 billion. Last year, this region accounted for 9.8 per cent of the global market. The Japan region, with a share of 6.6 per cent, continued to recover and closed 2018 with growth of 11.3 per cent, representing sales of just under USD 2.2 billion. However, it should be

Source: Vacuumschmelze

Global market – passive components 2016-2018

Regions by million USD



Source: ZVEI

pointed out that Japan posted a decline in sales of almost 19 per cent in 2015 compared to the previous year, and has been able to grow continuously since then.

The economic region Asia/Pacific and China — excluding Japan — was able to maintain its leading position in the world, and in 2018 accounted for a share of a good 65 per cent, with sales of almost USD 22 billion. Together with Japan, the sales of these three regions add up to a share of approximately 72 per cent of the global market in 2018.

When examining market statistics in EUR and USD terms, there are sometimes considerable differences between them. The corresponding chart in EUR terms for the global market is available in the middle of this annual report under "Market charts".

Source: Taiyo Yuden Europe

Source: TDK Electronics

Future key working areas and challenges

The Passive Components Group will continue to face and meet new challenges from the fields of technology, politics, industry, and the economy in the future. Having a strong lobby in national and international politics, we join forces for the benefit of our members and address their interests accordingly.

Electromechanical Components Group

Chairman
Jörg Scheer

Source: Eska Erich Schweizer

The Electromechanical Components Group represents the manufacturers of connectors and input and protective elements on the German market and the interests of around 65 member companies in the ECS Division of the ZVEI.

The divisional group sees itself as a network for exchange on all issues relevant to the industry, and as a mouthpiece for the primarily medium-sized member companies. The Electromechanical Components Group gains significance through technological competence and detailed knowledge of the relevant markets.

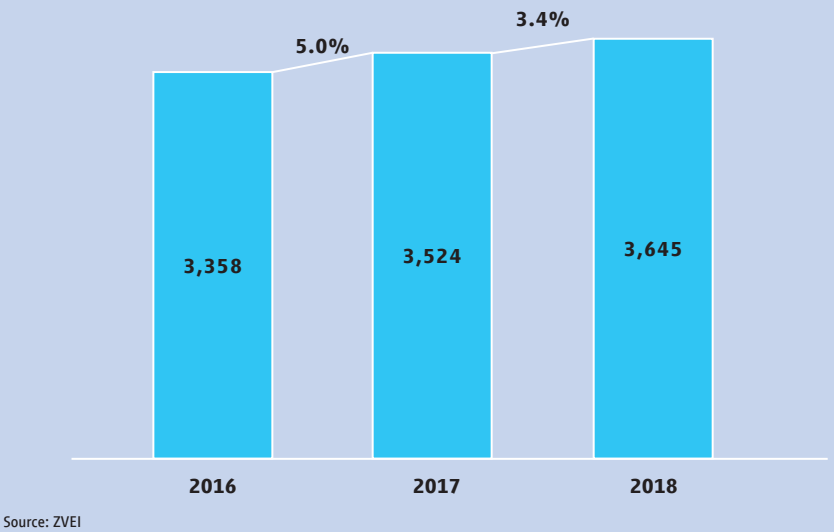
In line with this, the activities of the group and the two committees have focused on observing a dynamic market shaped by globalisation, and on technological aspects for recognising trends early on. As part of the ZVEI's comprehensive network, members of the divisional group benefit from the expertise available there.

Activities of the Electromechanical Components Group

Global economic trends in consumer markets as well as constantly advancing technical and non-technical influences shape our activities. The influence of electromobility, smart grids, or Industry 4.0/IoT, for example, are developments that will gather momentum in the future and require discussion in the divisional groups. The same applies to the numerous directives and

German market – electromechanical components 2016-2018

in million EUR



Source: ZVEI

Source: Code Mercenaries Hard- und Software

regulations from Brussels, which require active lobbying by the bodies of the division and the ZVEI. The members of the Electromechanical Components Group will play a constructive and sustainable role in this process. Considering the broad base of committed member companies in the field of electromechanical components and the high degree of networking within the ZVEI, these challenges will be accepted and the interests of the industry represented actively. With its technological expertise and close proximity to the market, the group will monitor and analyse the changes in the global competitive environment and then proactively engage in shaping it.

In addition to the application-oriented and macroeconomic lectures and discussions, the meetings and conferences cover topics on technological developments, standardisation or certification. Guest lectures on current topics round off the meetings, which are currently very well attended.

Source: Stäubli Electrical Connectors

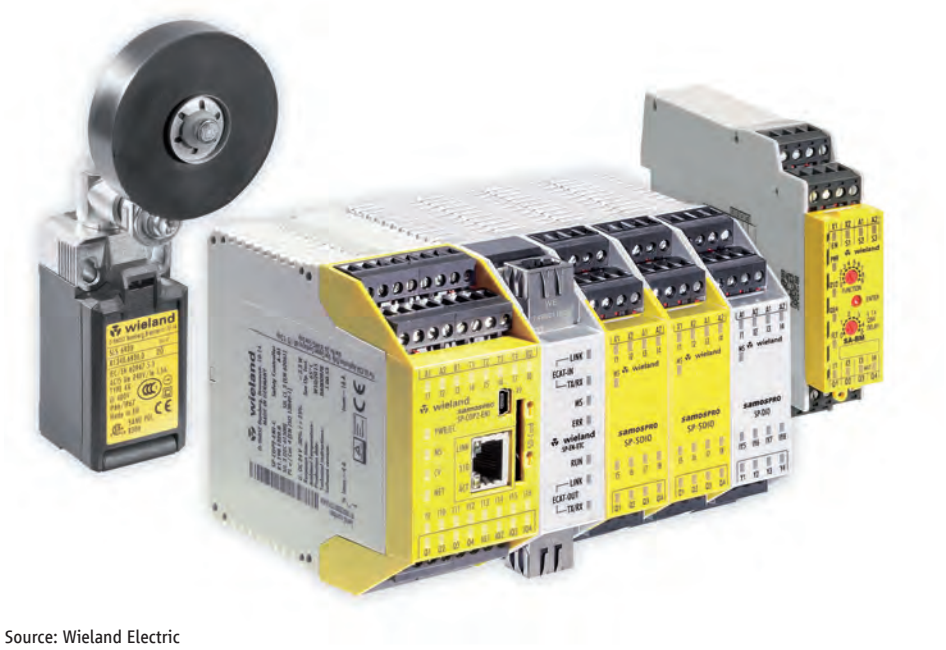
Source: Adels-Contact Elektrotechnische Fabrik

Connectors Committee
Chairman: Andre Beneke

Technology issues, environmental legislation, and market observations as well as the consequences that can be derived from these topics are the essential elements of the activities of the Connectors Committee. To this end, working groups provide input on the respective topics.

A brochure on connectors is published regularly by a core group of the Connectors Committee and they also provide content relating to connectors for the association's technology roadmap. The latter has now been revised and adapted accordingly for the new "Next Generation" technology roadmap.

Environmental issues also feature regularly in meetings of the committee. Discussions take place on RoHS exemptions, for example, or updates in the WEEE directive and their impact on connectors. Most notably, a core group was formed to further extend the RoHS exemption on lead in brass.



Source: Wieland Electric

Additive manufacturing of individual parts and products is gaining importance in many areas of industry, including connectors, and is enabling new business models. However, the suitability of materials, printing processes, and norms regarding the use of additively manufactured connectors is only limited. The Electromechanical Components Group has therefore set itself the task of highlighting and specifying the corresponding requirements in a concept paper.

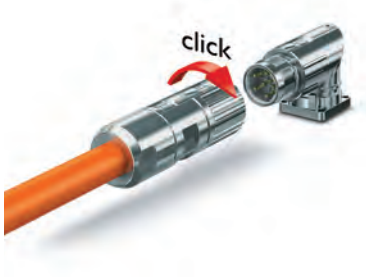
Another topic that constantly crops up is the CE marking or non-CE marking of connectors.

There is also a working group dealing with the requirements for the validation and processing of contacts. Topics ranging from contacts for low section cables to the standard on crimped connections are dealt with by the working group.

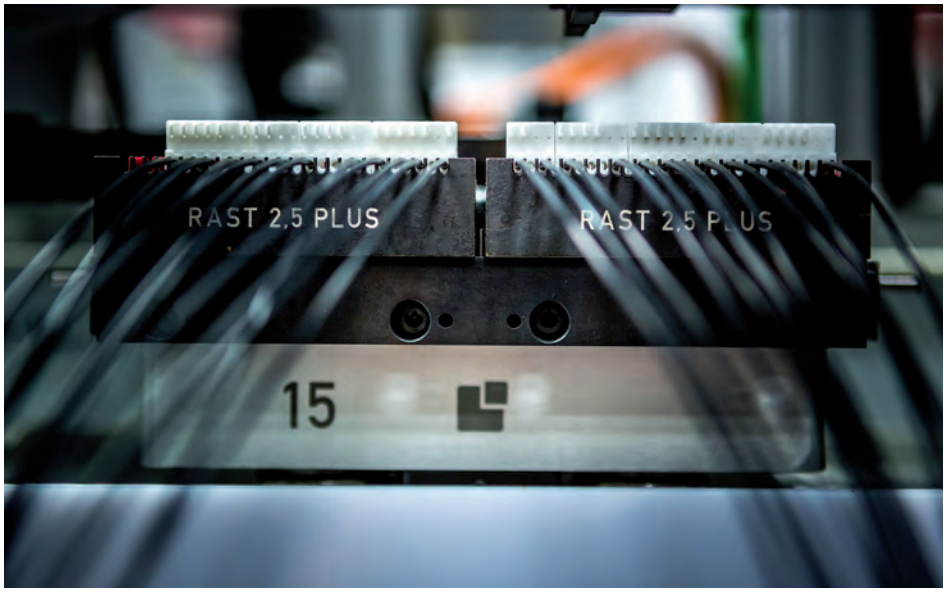
Following the endeavours of the ECS and PCB-ES Divisions to establish a common identity and values, the Connectors Committee is in the process of developing its own identity and clarifying the question: What should the Connectors Committee stand for? Based on the divisions' specific guiding maxims, the questions "Who are we?", "What do we want to achieve?" and "How do we want to achieve that?" are also being discussed and evaluated.

The connectors market

In the field of connectors, the year 2018 ended in Germany with total sales amounting to EUR 2.477 billion, which corresponds to growth of almost 3.5%.



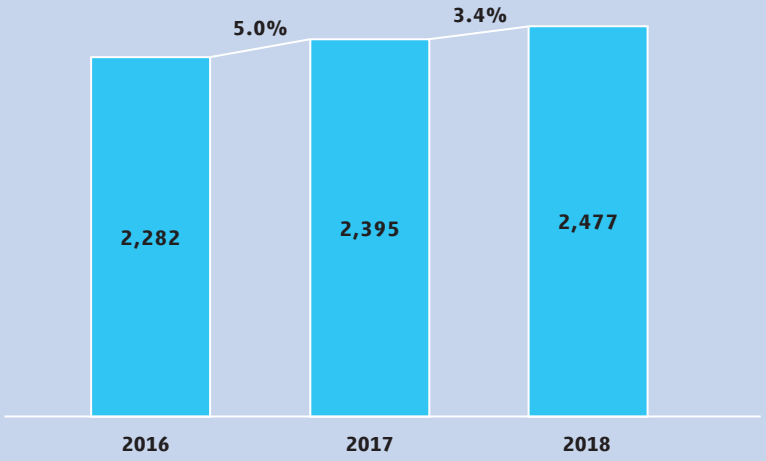
Source: Phoenix Contact



Source: Lumberg Holding

German market – connectors 2016-2018

in million EUR



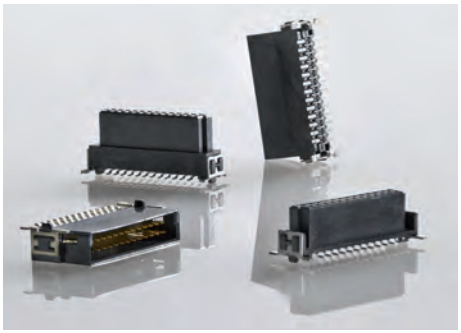
Source: ZVEI

Input and Protective Elements Committee Chairman: Guido Körber

The committee comprises manufacturers of products ranging from classic switches to sensors and from input components to keyboards and protective elements.

Source: Provertha Connectors, Cables & Solutions

Besides the classic topics of market, technology, and environmental legislation, the Input and Protective Elements Committee also deals with broader topics such as the fundamentals of modern corporate planning and social trends with their anticipated impact on our companies.
Unfortunately, it has not been possible recently to attract a sufficient number of participants to the meetings, so that these have had to be cancelled. Instead, the participants held telephone conferences to agree and decide on the next steps to take. One of the next conference calls will include discussions not only about an attractive tour of a company location, but also possible adjustments to the future agenda.



Source: MPE-Garry

Source: TE Connectivity Germany

Microsystems Technology Group – Sensors/Actuators

Chairman
Joachim Weitzel

The Internet of Things, Industry 4.0, Ambient Assisted Living — none of these applications would be possible without microsystems technology, because they require an image of the environment that is as precise as possible. Microsystem sensors are fundamental for this. The essential feature of microsystems technology is the integration of sensors, evaluation electronics, and actuators in a very compact space. The miniaturisation associated with this and the inclusion of software make microsystems technology a significant prerequisite for innovative system solutions in many application areas. It is a key technology, and its importance is constantly on the rise in many fields of application, including digitalisation, climate/energy, health, mobility, safety, and communications in particular.

The ZVEI member companies belonging to the Microsystems Technology Group represent to a large degree the spectrum of microsystems technology in Germany. In the pre-competitive environment, the divisional group's work aims to identify trends relevant to microsystems technology at an early stage, discuss any changes that may be emerging for the industry, and identify resulting courses of action in order, for example, to close looming technological gaps before they occur.

The divisional group seeks to highlight trends in microsystems technology and their impact on German industry.

Economic situation, market

In 2018, the German market for semiconductor-based sensors and actuators reached a volume of EUR 923 million. This corresponds to an increase of a good five per cent over the previous year.

Compared with 2017, the global market showed an increase in sales of 8.1 per cent to a market volume of just under USD 13.4 billion.

The key customer industries for sensors and actuators in Germany are industrial and automotive electronics. As far as industrial electronics is concerned, the increasing use of energy-efficient solutions is a driver. In automotive electronics, the increased use of complex safety and assistance systems plays a major role.
In the future, we will also see advances in the area of assistance systems for an ageing society that make use of microsystems technology.

Packaging and Assembly Technology Committee

N. N.

Packaging and assembly technology is of paramount importance for microsystems. Sensor/actuator technology differs considerably from most electronic systems in one unique respect: sensor/actuator components must be exposed to their surroundings and cannot be hermetically sealed off from their environment. This fact must be accommodated by means of specific packaging and assembly technology. At the same time, the processes used to manufacture this technology should be as economical as possible.

The Packaging and Assembly Technology Committee has been organising regular meetings of experts since 2007. They present the latest developments in packaging and assembly technology in specialist lectures.

The committee's work has been suspended for the time being, while the search for a new chairman is taking place.

Foundries for MEMS Initiative

Chairman: Uwe Schwarz

Small and medium-sized companies that are highly innovative in the field of microsystems technology often have to contend with the fact that they cannot realise their product ideas as silicon-based MEMS products. The main reason for this is frequently the lack of access to semiconductor manufacturing.

After a successful start in 2015, the Foundries for MEMS Initiative held a series of lectures entitled "Easy Access to MEMS — MEMS Foundries, the Better Solution?" at the international trade fair "Sensor+Test" in Nuremberg in 2017. With an international line-up, German, European, North American, and Chinese providers of services within the MEMS value-added chain demonstrated, among other things, the different types of foundries. The interpretation of the term "platform technology" was also discussed and debated in the lectures.

There are plans to hold this event again at the next "Sensor+Test".

Source: X-FAB Semiconductor Foundries

Medical Sensors Working Group

Chairman: Joachim Weitzel

Where and to what extent MEMS are used or will be used in medicine in the future is the subject of intense discussion by the Microsystems Technology Group. A new working group has been set up for this purpose. Having defined its objectives in several meetings, the working group has already started on their implementation. One of the main priorities here is to work out the specific boundary conditions for the use of microsystems in medical technology.

Since this initiative has also met with interest from other divisional groups, a workshop was held with companies outside the Microsystems Technology Group.

Robustness Validation for MEMS Working Group

Chairwoman: Saskia Dzubiella

The working group has produced a first version of the revised handbook. Work is currently underway to extend the robust-validation method to include a reliability assessment. This called for a new name: ARRA (Advanced Robustness Validation and Reliability Assessment). This extended methodology should enable different levels of validation (ARRA Level).
The draft of the revised manual is currently being worked on in more detail in further meetings.

The intention is to involve vehicle manufacturers as users before the manual is finalised. How and under what conditions this can be done is currently being determined within the working group.

Meaning of Sensor Technology for Germany Cross-Association Initiative

The initiative launched by the Microsystems Technology Group and encompassing more than nine associations is working intensively on explaining to politicians the importance of sensor technology for Germany as a centre of innovation.

In the 21st century, where data is called the engine of the economy, "data acquisition" by means of sensors is of enormous importance. The topics to be highlighted include the extent to which a wide variety of industries depend on high-performance sensor technology, and how powerful sensor technology is in Germany. A draft position paper has been prepared for this purpose and is currently being revised. The aim is to have the position paper completed by the end of the year.

Trends, developments, objectives

The main trends in the most important application areas of microsystems technology in Germany are outlined below.

- **Automotive electronics**

CO_2 reduction and the resulting decrease in fuel consumption in motor vehicles mean that microsystems are increasingly being used in the

powertrain (engine control system, transmission control, and electric drive). Driver assistance systems and vehicle-to-vehicle communication will contribute to optimising the flow of traffic. They require a variety of sensors (camera systems, radar systems, IR night vision systems). The desire for more safety in the vehicle (airbag, ESP) is also causing an increase in the number of microsystems.

- **Medical technology**

Microsystems technology solutions for implants as well as in diagnostics are becoming increasingly important. Wireless communication is expected to contribute to an intelligent system of optimised patient care and monitoring. The miniaturisation of "labs" (lab-on-a-chip) is well underway.

In addition, the importance of what is known as the "second health market" is steadily increasing. Everyone is now familiar with fitness bracelets and other useful devices that help people monitor their own fitness.

- **Safety technology**

The threat of terrorism has led to the electronic identification and authentication of individuals, documents, and goods. Cryptocontroller-based microsystems technology solutions are being developed or are being used for the first time, such as access control systems (smart cards), passports/ID cards (in future also with biometric data), Trusted Platform Modules (for secure authentication), and various RFID solutions for the unique identification of goods. Typical for the application is the realisation of an MST module in the tiniest of spaces (thickness of an RFID module in part <20 µm).

- **Logistics**

As indicated under "Safety technology", RFID modules are being used in an increasingly wide range of applications for unique identification. This involves the tamper-proof labelling of medicines, foods, and cigarettes through to animals for slaughter. Each application necessitates a specific MST module with its own specific packaging and assembly technology.

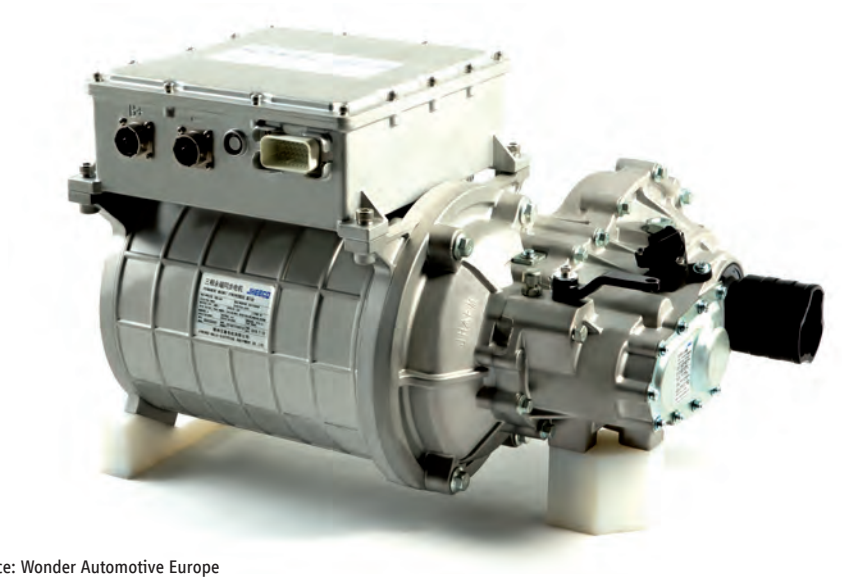
- **Telecommunications**

Mobile phones continue to evolve towards becoming people's "intelligent mobile assistants". The MST plays a central role here. Additional functions (x million pixel camera, navigation, network/internet access, organiser, health monitoring, authorised payment transactions, portable audio/video player) can only be realised by further compacted MST modules and require chip level packages and stacked devices as basic technologies.

- **Consumer electronics (including multimedia)**

The importance of this market segment seems to be diminishing in Germany parallel to the number of manufacturers of corresponding products, whereas at international level the number of microsystems applications in this market segment is considerably on the rise. The use of microsystems in the area of Human Machine Interface is of increasing importance, especially in games. Due to the small installation space,

Source: Continental Automotive



Source: Wonder Automotive Europe

similar requirements arise here as in the telecommunications sector.

- **Industrial electronics**

A wide range of applications for sensors is expected in the field of Industry 4.0. For example, new predictive maintenance methods require the extensive use of sensors.

There are also numerous new applications in the field of building installation and monitoring technology.

New fields of application for MST are also emerging in the fields of aerospace, measurement and control technology, and microoptics.

The following technological trends are expected in the coming years:

Microsystems will become self-sufficient, i.e. with their own power supply and wireless communication (e-grain, electronics dust).

In this context, the provision of suitable energy producers, energy management, and energy-efficient data transmission must be regarded as key technologies.

- Replacement of mechanical/hydraulic systems by microelectronic solutions: the wide variety of different application areas requires a broad technological spectrum that needs mastering.
- On-board diagnostic systems or the permanent monitoring of functions (sensor technology, wireless networks, integrated intelligent signal evaluation).
- Growing acceptance of multifunctional packages with the integration of sensor technology, semiconductor chips, passive components, antennae, and power supply with the packaging and assembly technology and backshell, including the mechanical mount.

Collaboration with other associations

The Microsystems Technology Group has been working intensively with the AMA Association for Sensors and Measurement in various fields for many years.

The Meaning of Sensor Technology Cross-Association Initiative is being carried out in cooperation with the AMA Association for Sensors and Measurement, DECHEMA Society for Chemical Engineering and Biotechnology, IVAM Microtechnology Network, microTEC Südwest, mst Netzwerk Rhein-Main, VDE Association for Electrical, Electronic and Information Technologies, Silicon Saxony, the Sensor Technology Cluster, and the Mechanical Engineering Industry Association.

Microsystems technology — sensor/actuator technology — is used today by German industry in many different sectors. A key success factor here is the existence of a broad network of expertise that can provide answers to the many and varied questions in the development, manufacture, and application of microsystems. The Microsystems Technology Group — Sensors/Actuators supports the process of condensing this network by providing a communication platform and working together on the “gaps” in this network.

European Semiconductor Industry Association (ESIA)

Director General
Hendrik Abma

Interest group representing manufacturers of semiconductor components in Europe
www.eusemiconductors.eu

President:
Jens Knut Fabrowsky
Executive Vice President of Automotive Electronics, Robert Bosch GmbH

Vice President:
Thierry Tingaud, Corporate Vice President, STMicroelectronics

Director General:
Hendrik Abma

Members:
14 companies, 5 national associations, 3 research institutes

The European semiconductor industry continues to defend the open, fair, and market-based principles of global competition. In recent years, protectionist tendencies have gained a foothold in capitals and are now taking their toll on the multilateral trading system. As walls are built higher and higher, technologies are more dependent than ever on increased communication: just look at Industry 4.0 or smart homes — the crux of the matter is always the exchange of information between the device and the environment. Highly disruptive technologies such as networked and automated mobility or artificial intelligence require a well thought out approach that takes into account all aspects of society. The ESIA, as the voice of the semiconductor industry in Europe, remains a platform for continuous dialogue between stakeholders — an association of experts — to address the industrial and societal challenges of our time.

Political strategies like "America First" or "Made in China 2025" are symptoms of a geopolitical loss of confidence. This focus on domestic issues is often at the expense of openness and international dialogue. These trends are reflected not least in some disproportionately large regional funding programmes, which go far beyond the funding of research and development. They undermine market-based principles to replace imports, something which could potentially lead to oversupply and reduce the industry's ability to innovate. Together with its international partners, ESIA has initiated an information exchange process that brings accountability and transparency to the issue of domestic subsidies. This topic will be addressed during a fourth workshop with governments and authorities in autumn 2019.

Encryption likewise threatens to influence global competitive conditions in favour of players with questionable intentions. ESIA seeks complete access to encryption products in markets around the world. For this purpose, it is necessary that semiconductor companies are represented in and have access to standardisation bodies. Moreover, the rules and procedures applied by these bodies must be transparent and non-discriminatory; they must comply with the rules of the World Trade Organisation (WTO) and should be open to all market participants at home and abroad. Such commonality is a prerequisite for ensuring cyber security in Europe and beyond, so that customers can trust the security of their device. ESIA will discuss this issue in more detail with government representatives from China, the EU, Japan, Korea, Taiwan, and the United States at a workshop later this year.

International customs classification continues to have priority in the European semiconductor industry. ESIA has sought to change the World Customs Organisation (WCO) nomenclature to include the new category of "semiconductor-based transducers". The proposal is well on track to being included in the WCO 2022 review cycle. Issues relating to export controls deserve special emphasis in 2019 — not least as the UK is leaving the European Union. ESIA continues to introduce relevant aspects to the current revision of the EU Dual-Use Regulation so that the reformed regulations provide the right control without being excessively restrictive.

Innovation is the European semiconductor industry's greatest asset, which is why companies invest heavily in research and development. However, in order to preserve ideas and promote their conception, Europe needs a framework that protects intellectual property through a high-quality, predictable, efficient, and affordable patent system. For this reason, ESIA is fighting on several fronts in Europe and worldwide to contain inappropriate patent litigation and to improve and ensure patent quality in cooperation with the United Nations (UN) agencies so that trade secrets enjoy a high level of protection. At international level, ESIA is consolidating its position as an agenda-setter in the fight against semiconductor counterfeiting, presenting new initiatives, and identifying areas where

action is needed. With regard to the situation in Europe, cooperation and exchange of information with institutions at EU and national level are of central importance in order to prevent the spread of counterfeiting. ESIA also reviews action plans and roadmaps, is actively involved in the enforcement of intellectual property rights, raises awareness among public and private stakeholders, and trains local customs officials.

In the environmental policy arena, ESIA wants to ensure that the semiconductor industry retains access to critical innovative materials. This includes a workable approach within the EU Chemicals Regulation REACH for a number of key substances used by the industry. Partly thanks to the participation of ESIA, a positive result was achieved in the restriction of NMP (1-methyl-2-pyrrolidone) in semiconductor manufacturing. In order to facilitate implementation in the field of NMP, ESIA has worked with EU institutions and downstream user sectors to produce a guideline. Likewise, some of the lead compounds were not submitted for approval. A major priority in 2019 will be the review of the list of potentially restricted substances under "RoHS 2". Work will continue within the UN Intergovernmental Panel on Climate Change (IPCC), with ESIA as the main author of the paper to improve greenhouse gas guidelines. Finally, the EU Regulation on Conflict Minerals is currently being implemented. An online transparency platform to help companies perform due diligence effectively is to be introduced in 2019.

Outlook

Over the past year, we have seen significant shifts in global order — from the emergence of new players to fractures in close-knit relationships that have lasted for decades. The European semiconductor industry, with its truly global supply chain, must find ways to navigate the new realities and protect its unique attribute: innovation. Nevertheless, over the past twelve months, ESIA has been able to demonstrate its importance and activities to ministers and international standard-setting bodies around the world. This year we will see the European Union shrink for the first time since its inception and elect its democratic representatives for the next five years amid turbulent debates and new threats. In such a situation, it is important for everyone involved in the semiconductor ecosystem that their voice is heard. A task that can be solved more easily in an association than alone. ESIA uses its united voice loudly and efficiently, and its audience listens. In the coming year, the challenges to achieving global competitive conditions will not diminish, and neither will the efforts of the European Semiconductor Industry Association to achieve such conditions.

European Passive Components Industry Association (EPCIA)

Source: Panasonic Industry Europe

European interest group representing manufacturers of passive components

President:
Ralph M. Bronold, TDK Electronics

Vice President:
Christophe Pottier, Murata Electronics Europe

Secretary:
Dr Marcus Dietrich, ZVEI

Members:
12 companies,
3 national associations
1 research institute

EPCIA's mission

"To represent and promote the common interests of passive components manufacturers active in Europe in order to ensure an open and transparent market for passive components in Europe as part of the global marketplace."

Source: TDK Electronics

Main focus of activities in 2018

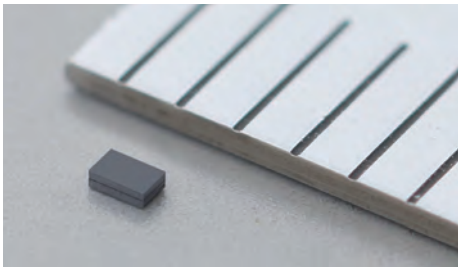
- Active participation of the member companies in EPC-eStat — the comprehensive European Passive Components Statistics
- Broadened and more intensive cooperation with the WPTS — World Passive Component Trade Statistics
- Publication of the newsletter "European Market for Passives"
- Monitoring and discussion of technology trends and standardisation issues
- Networking at European level
- Environmental legislation and lobbying
- Updating of the EPCIA homepage to improve our public profile
- Support of joint activities under the umbrella of the EECA
- Informative guest speeches from the environment of the E&E industry

With the aid of the common European statistics EPC-eStat and participation in the World Passive Component Trade Statistics, it was possible to make conclusions on the market development of passive components on an even broader international basis.

Source: Vishay Electronic

In close partnership with EECA/ESIA, the EPCIA aims to continue working on cross-market issues in order to better address common challenges. This will involve making the most of the opportunities offered by our cooperation with the ZVEI.

As the most important interest group representing producers of passive components active in Europe, the members have set themselves the goal of further strengthening and expanding the EPCIA. For instance, further research institutions in the field of passive components — such as universities — are to be enlisted to strengthen the EPCIA.



Source: Murata Electronics Europe

To find out more about the EPCIA, visit: http://www.eusemiconductors.eu/epcia/epcia-home

Source: Vacuumschmelze

PCB and Electronic Systems

Management's Report

Christoph Stoppok

Dr. Christoph Weiß

2018 was a good year for the companies within our industry. The markets for electronic assemblies, printed circuit boards, and ceramic microcircuits grew and are expected to move sideways in 2019. In addition to political conditions such as the trade dispute between China and the United States, Brexit and growing protectionism are further challenges this year. Energy and raw material costs in terms of material and components continue to be an issue. Opportunities for our member companies lie in products for digitalisation, industry 4.0, energy efficiency, 5G, e-mobility and smartifying cars, as well as products for the high-tech and safety-critical medical, military and aerospace sectors.

Trade fair presentation at electronica

Last year, our division was once again represented at electronica – the industry's leading trade fair. In addition to participating in the opening event and the opening press conference, we presented the market figures at a joint press conference of the PCB-ES and ECS Divisions. The two divisions set up their own trade fair office on site and organised an industry meeting for their members on the first evening of the trade fair. In cooperation with Messe Munich, we organised the PCB & Components Marketplace with a varied forum programme.

The topics discussed included the technology roadmap, successful solutions from the Ceramic Microcircuits Group, PCB market figures and a panel discussion on "Management of Supply Capability – Material, Allocation, Obsolescence" organised by the "Services in EMS" Initiative.

"Services in EMS" Initiative: High-profile presentation of the contents in innovative formats and media

The brochure published in 2017 by the "Services in EMS" Initiative regarding backstage services explores the fact that in addition to the three traditional pillars of EMS services, namely development, production, and after-sales service, a wide variety of processes must be performed and organised in the background. An EMS marketing team was set up to raise public awareness for this by using new formats and media. They redesigned the Internet presence (www.zvei.org/services-in-ems), published articles and started a Twitter campaign (quotations, live tweets). A special highlight was a moderated round-table panel discussion at electronica 2018 on "Management of Supply Capability - Material, Allocation, Obsolescence", which received very good feedback. They continue with their work this year, too.

EMS Technology Days – Sales:

A two-day event for EMS sales employees of ZVEI member companies was held for the first time in February. The event provided an overview of cross-sectional topics and standard processes dealing with assembly issues. More than 60 employees of the Electronic Subassemblies Group attended the event and listened to the speakers from the member companies. A sequel is planned for next year.

UL round table on new soldering parameters

Underwriters Laboratories (UL) has announced that UL approvals are no longer valid since the soldering parameters for assemblies, PCBs and their base materials, and solder masks have changed in practice.

A round table with all the member companies involved was therefore set up. The motivation and goal of this round table is to achieve uniform modification of the soldering parameters in the interests of our member companies, along the entire supply chain and with reasonable transition periods. Participants proactively engage in constructive dialogue with UL and have produced some initial results.

ZVEI U40 Initiative: platform for junior staff

Instigated by the Printed Circuit Boards Group, the ZVEI U40 Initiative was started as a platform for young professionals in the PCB-ES and ECS Divisions. The aim is to provide a stage for junior staff where they can speak their own language, formulate their own topics and goals, defend their own interests and build their own network, unperturbed by and independent of the beaten paths of the older generation. Ultimately, they should resume dialogue with long-serving, experienced employees. A kick-off meeting was held and sub-groups were formed to deal with different issues.

Trade fair presentation at SMTconnect

As in previous years, our division was present at SMTconnect with its own trade fair office. And this year, too, we organised our own trade fair forum. The first day focused on new developments presented by our members; topics of the second day included successful ceramic solutions introduced by the Ceramic Microcircuits Group,

an update on the component cleanliness guideline, and a presentation of the joint technology roadmap of the ECS/PCB-ES Divisions.

Results of the cross-sectional activities

Last year, the ZVEI Design Chain Initiative continued its efforts in identifying and defining all relationships pertaining to electronics design and in particular, the dependencies of the parties along the supply chain. The aim is to map the impact of design on electronic subassemblies and PCB packaging and assembly. A new event format was developed to present the topics of the initiative to a broader audience by holding one-day workshops hosted by different companies. The events were also open to non-members and were well received. The flood of information on electronics design is to be collected on an online platform. In addition to providing a comprehensive overview, the platform enables fast research and facilitates quick and easy updates of its contents.

The Component Cleanliness Working Group of the PCB-ES and ECS Divisions has also continued its work regarding technical cleanliness in the manufacture of electric, electronic and electromechanical components, circuit boards and electronic assemblies. Technical cleanliness in this context refers to particle contamination on components or assemblies, which can impair production processes and adversely affect their performance. The first conference on component cleanliness deserves special mention. The working group on component cleanliness presented its progress in updating the second edition of the guideline "Technical Cleanliness in Electrical Engineering" and its contents to 130 attendees. A special website on this topic has also been set up, providing the possibility of downloading the guideline and a risk assessment tool for calculating the probability of failure of an assembly. To access the website, go to: https://bauteilsauberkeit.zvei.org. In addition, several technical articles were published and lectures held at industry congresses.

The members of our divisional groups have actively helped to shape the technology roadmap of the PCB-ES/ECS Divisions, developing its contents in numerous discussion rounds, editorial teams, and meetings. In addition to current technologies, the roadmap presents trends and future-oriented developments.

As an overarching topic within the ZVEI, activities on the ZVEI traceability concept have been resumed, including the development of a phased traceability model (maturity model). A brief summary will also be drawn up to provide a quick overview and easy introduction to potential users of the traceability concept. New communication measures are also to be launched.

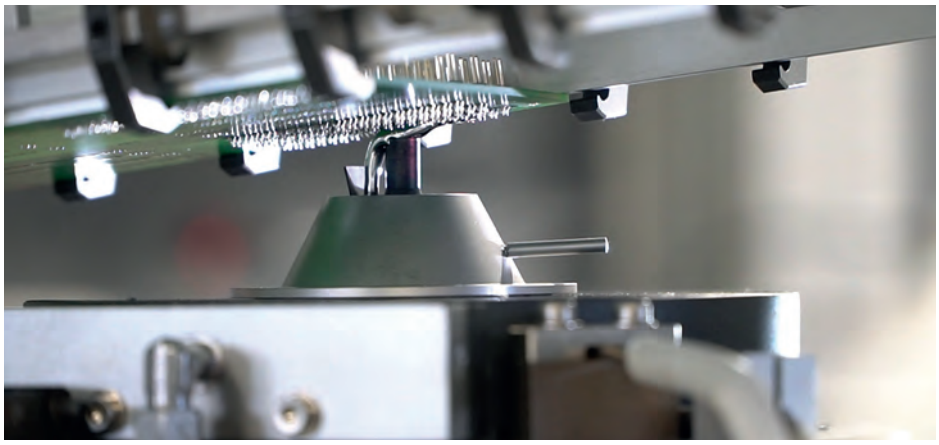
Last but not least, the Executive Board and Advisory Council of the PCB-ES and ECS Divisions developed a common identity. It addresses all key topics of the divisions' member companies relevant for their successful and future-oriented growth, and is to be propagated through different communication measures.

Thanks and recognition

We would like to thank all volunteers for their commitment. Thanks to the dynamism within our division and the many new projects and topics brought to our attention, the future looks exciting. This year, we will continue to implement them for the success of our members and the future of our industry.

Electronic Subassemblies Group

Chairman
Michael Velmeden



Source: Seho Systems

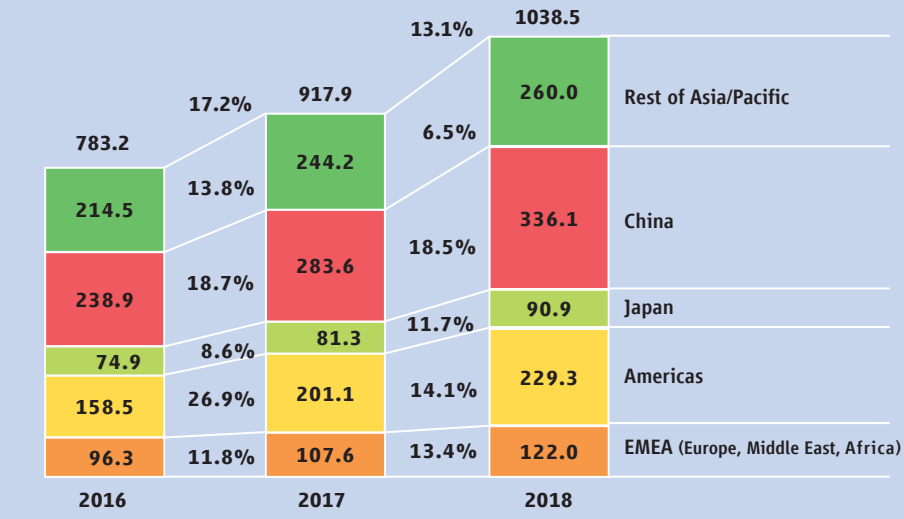
With around 80 member companies, the Electronic Subassemblies Group represents the manufacturers of electronic assemblies (including in-house manufacturers and EMS providers – electronic manufacturing services providers – and their suppliers). In addition to mainly medium-sized companies that focus on German-speaking markets, the group also counts some global players among its members.

Set up to inform about the capabilities and services provided by its 30 members, the "Services in EMS" Initiative published the brochure "EMS: Services backstage – Added Value under the Radar" in 2017. It shows that in addition to the three traditional EMS pillars, namely development, production, and after-sales service, further important supporting processes run backstage that must be organised. To raise awareness for these services, also by using new formats and media, an EMS marketing team was set up. They redesigned the Internet presence (www.zvei.org/services-in-ems), published articles and launched a Twitter campaign (quotations, live tweets). A special highlight was a moderated round-table panel discussion at electronica 2018 on "Management of Supply Capability - Material, Allocation, Obsolescence", which received very good feedback. They continue with their work this year, too.

The members of the Electronic Subassemblies Group will also continue to focus on the entire supply chain in the future, supporting each other with joint activities.

Global market – electronic assemblies 2016-2018

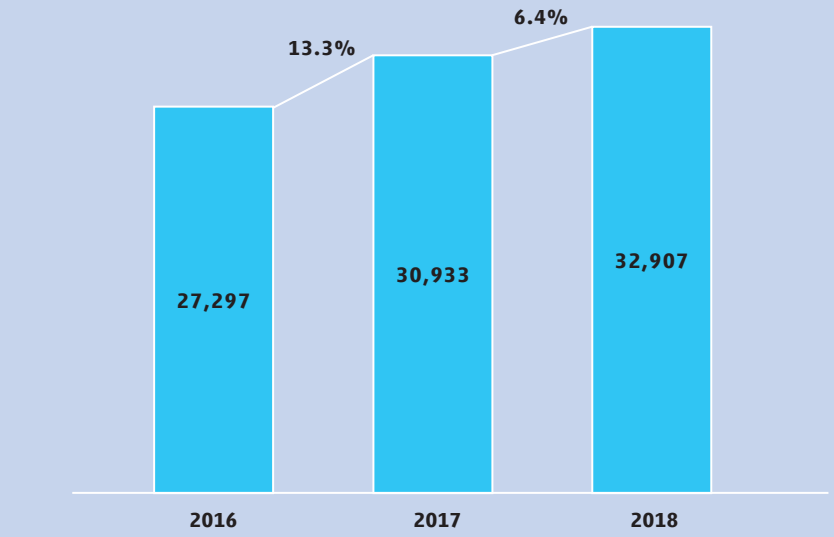
Regions by billion USD



Source: ZVEI

German market – electronic assemblies 2016-2018

in million EUR



Source: ZVEI

Market development

In 2018, the market for electro assemblies exceeded the trillion dollar mark for the first time and, after aboveaverage growth in 2017, grew again by 13.1 per cent with sales of USD 1,038 billion.

All regions worldwide show double-digit growth, led by China with 18.5 per cent. German market growth fell from 15.6 per cent in 2017 to 11.3 per cent in 2018. While the Japanese growth rate remained unchanged at 11.7 per cent, the American market was up by 14.1 per cent.

In EUR terms, sales growth in the electronics assembly industry is less pronounced due to the exchange rate ratio and stands at 8.1 per cent worldwide. Global sales amounted to EUR 879 billion in 2018. Sales in Germany stood at EUR 32.9 billion, up 6.4 per cent on 2017.

Key topics of member meetings

In the past year, the Electronic Subassemblies Group met twice to discuss and share information about current topics. Key topics included Supporting 4.0: Cobot and AIV on the Shop Floor, Smart Factory Solutions and Innovation Patterns, and the use of robots in electronics manufacturing.

The Technology & Test Engineering Working Group, chaired by Dr Wolfgang Stark, discussed current technology trends, developments and problems in the manufacture of electronic

Source: Christian Koenen

Source: cms electronics

assemblies. They explored topics such as RFID in PCBs, solar metallisation line: production in 1-second-cycles, the PCB-ES/ECS technology roadmap and electronic assemblies testing in the age of industry 4.0.

An editorial team of 15 people drew up the chapter about electronic assemblies for the technology roadmap of the ECS/PCB-ES Divisions, which covers the following main areas:

- Current requirements and challenges
- Electronic components
- Manufacture of electronic assemblies
- Assembly design
- Processes and technologies
- Test procedures
- Final assembly
- Traceability
- Industry 4.0, smart solutions, automation, use of robots

Last year, the Market Working Group, headed by Xaver Feiner, discussed the latest market developments, explored the German, European and global EMS market as well as the PCB market, and prepared the quarterly "Benchmark Electronic Assemblies" statistics. The "Annual Statistics for Electronic Assemblies" was again compiled this year, which is open for participation to all EMS/ODM/OEM companies from Germany, Austria and Switzerland (also known as "DACH" region). Other topics included the economic situation of the electrical and electronics industry, ZVEI market figures for components and assemblies, EMS/ODM/OEM market/technology developments: impact on SMT line assembly and the Kata Coaching management method.

The EMS Technology Days – Sales were another focal topic, providing EMS sales teams of ZVEI member companies an overview of major technical assembly-related topics by presenting interdisciplinary topics and standard processes. The aim was to deepen the technical expertise of EMS sales staff. With more than 60 participants, the event was very well attended. Thanks to the extremely positive feedback, the event will be repeated next year.

Printed Circuit Boards Group

Chairman
Walter Moser

In my report two years ago, I said that we will not feel the reverberations of Brexit and the fervent rejection of existing free trade agreements by the then new US presidency for several years. In fact, it is still unclear what form Brexit will take. However, the uncertainty about it is already taking its toll as is the increasingly fierce debate between China and the USA about punitive tariffs and customs restrictions. As a result of the closely linked international supply chains, more and more countries are being drawn into this futile power struggle. Ongoing discussions about current drive concepts in the automotive industry and tensions in international politics added further concerns to an already unstable outlook. As a result, many companies have taken a cautious 'wait-and-see' position. This slowdown significantly influenced the positive economic development during the first half year of 2018 and caused loss of momentum. The fall in demand continues to date.

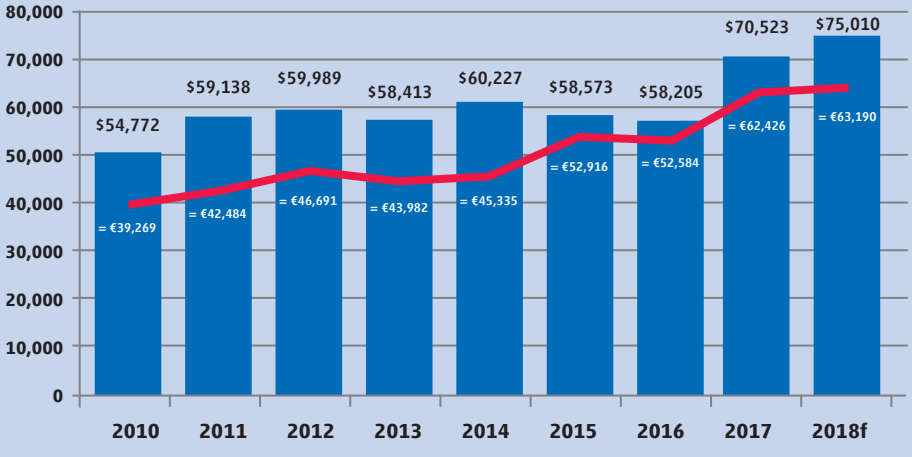
Another factor severely impacted last year's development. The shortage in electronic components was triggered by a combination of circumstances. Among other things, the substantial drop in MLCC prices has prompted many manufacturers not to invest in additional capacities, and then demand rose unexpectedly, especially from the automotive industry. The latter can be attributed in particular to the sharp increase in driver assistance system applications, but also to the continuing electrification of drives. The automotive industry now accounts for ten per cent of global electronics production. Around 35 per cent of a car's manufacturing costs can be attributed to electronics. This share is expected to increase to 50 per cent with the advancement of autonomous driving. At the beginning of the shortage, volumes were increased by hedging purchases, but the bottleneck also triggered shifts in requirements, which ultimately had a negative impact on demand. By contrast, the supply shortage for copper foil has eased again; however, prices remained at high levels as expected.

Global and European production development

Final production figures for 2018 are not yet available. Preliminary figures show a total global production of USD 75 billion, 93 per cent of which generated in Asia. The lion's share is held by China, which alone accounts for 50 per cent of world production.

Global PCB production 2010-2018

in USD and EUR

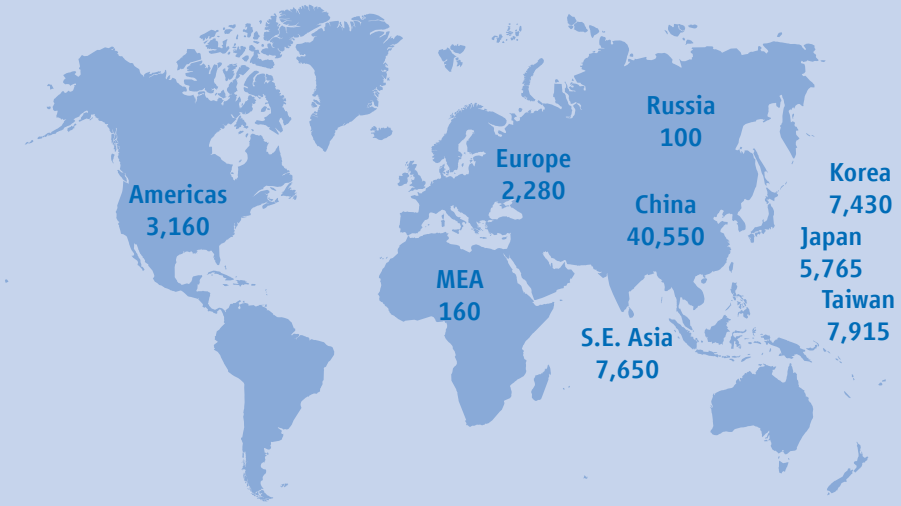


Sources: IPC

Source: Mektec Europe

The jump in sales of 20 per cent between 2016 and 2017 can be attributed to a new calculation methodology, which has become necessary, especially for flexible and rigid-flex circuit boards. According to Data4PCB, "flexible and rigid-flex circuit boards must be assembled at least partially by the PCB manufacturer due to their instability. In earlier years, printed circuit boards accounted for 20-30 per cent of the total value of flexible and rigid-flex PCBs. This figure was basically the same for all manufacturers and could thus easily be deducted. However, the percentage of populated boards has meanwhile increased significantly to 40 per cent for some companies or even higher. The decision was therefore taken to consider the total sales value including components from now on." Without this adjustment, PCB production would amount to roughly USD 62 billion in 2017.

PCB production 2018 in USD million

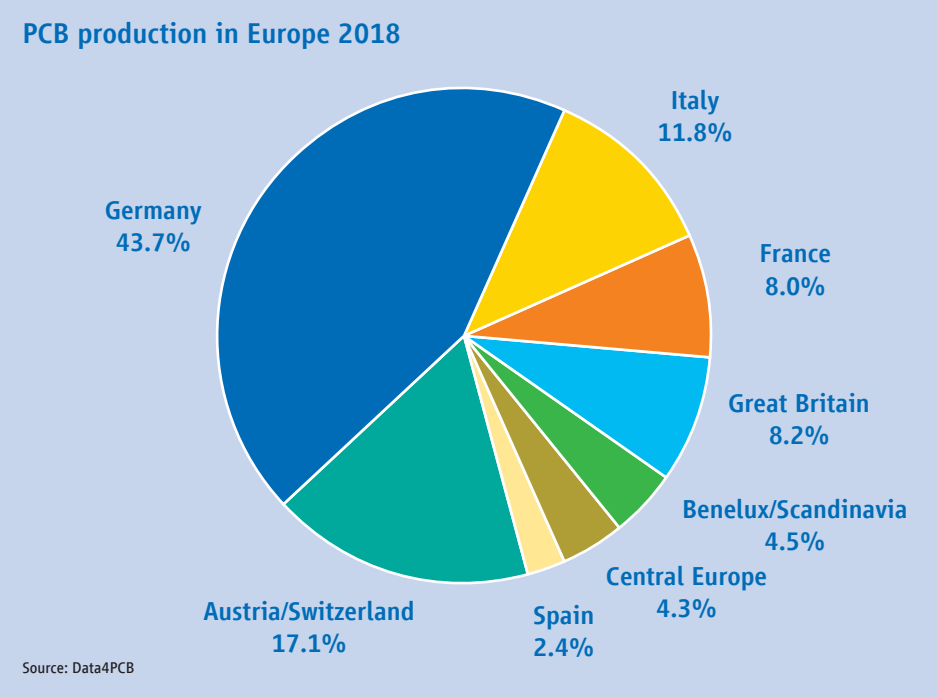


Source: Data4PCB

The ongoing tensions between the United States and China with ever new punitive tariffs have fuelled interest in alternative locations, heightening the focus on countries such as India, Thailand or Vietnam. Government programmes such as "Make in India" offer strong incentives for local investments. At the same time, the pressure on OEMs to increase local added value is mounting and being passed on to the supply chain. These relocations of production are mainly directed against strong Chinese competition, but will, of course, also have an impact on Europe.

It is not yet apparent who will emerge as a winner from this trade dispute. As always in such situations, there will most likely be mainly losers. In 2019, we will probably witness some exciting developments in this context.

Although there may be the occasional report of production being transferred back to Europe, large scale relocation is extremely unlikely to take place. Nonetheless, production in Europe grew by 4.8 per cent to EUR 1.921 billion. With EUR 1.17 billion, the "DACH" region (Germany, Austria, Switzerland) accounts for 60 per cent of the European market. Together with Italy, France, and Great Britain, these countries produce 89 per cent of the total European volume.



While the European PCB market grew by 4.8 per cent in 2018, production in Germany again went up by 6.5 per cent as in the previous year. Interestingly enough, even simple technologies such as non-plated through or double-sided circuit boards recorded growth rates. However, the trend towards more complex technologies is clearly recognisable when comparing the development of multilayer and HDI designs.

PCB production in Europe 2018

Summary	2012	2013	2014	2015	2016	2017	2018
Revenues (EUR million)	1,846	1,807	1,831	1,815	1,747	1,833	1,921
Staff	16,935	16,546	16,432	16,641	15,902	16,015	16,587
Number of companies by company size							
<€2 million	125	125	113	109	94	87	66
€2-10 million	116	104	99	98	98	92	84
€10-50 million	38	37	34	34	32	38	46
> €50 million	5	6	6	6	6	6	6
Total	284	272	252	247	230	223	202

Source: Data4PCB

The number of PCB manufacturers has decreased again this year by another 20 companies. The development of PCB technology requires profound knowledge on the part of the employees involved and constant as well as consistent advancement of processes. The resulting necessary investments combined with increasing price pressure represent too great a hurdle for some companies. In addition, the problem of a successor often remains unsolved for small businesses, leading to their closure. The number of companies with sales of less than EUR 2 million has declined the most.

PCB production in Europe

Changes	2017	2018	
	in EUR million	in EUR million	+/–%
non-PTH	60.4	63.0	+4.30%
PTH	341.1	363.1	+6.40%
Multilayer	752.2	767.0	+2.00%
HDI	230.5	251.9	+9.30%
Flex	196.3	205.1	+4.50%
Flex-rigid	149.2	155.5	+4.20%
Special types	103.1	115.2	+11.70%
Total	1,832.7	1,920.8	+4.80%
Staff	16,015	16,587	+3.60%

Source: Data4PCB

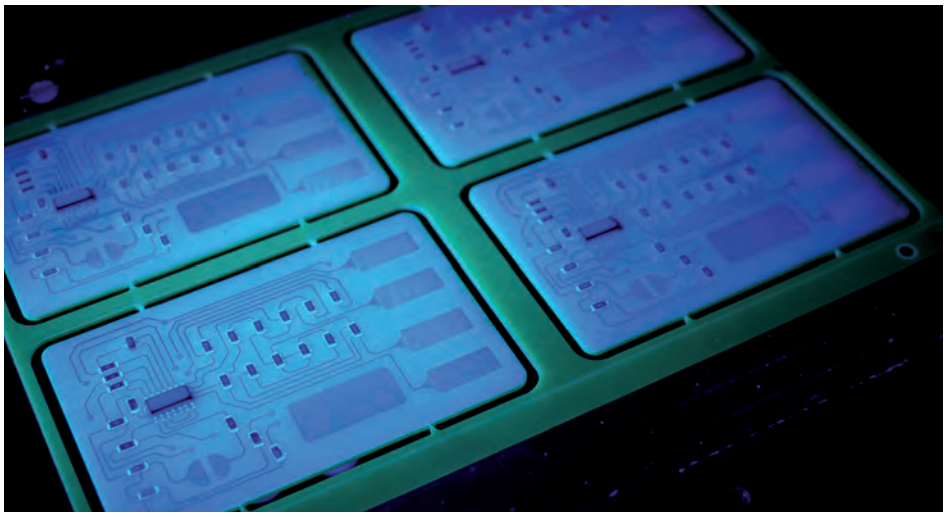
It is difficult to say how many of the European manufacturers have built up additional trading operations with partners from Asia. Experience in recent years has shown, however, that this combination often leads to in-house production coming to a total stop, leaving just the trading business in place.

Additional framework conditions

Any change in the framework conditions for circuit boards and the related supply chain may potentially have a significant impact on the economic success. The solder-limit subject has caused some unrest in the industry, with a lot of discussion surrounding the new requirement from Underwriters Laboratories (UL) questioning the certification of PCBs. According to UL, assemblies are exposed to additional stress by repeated reflow processes, which is not taken into account in most of the material specifications. The process suggested by UL would involve enormous additional expenses for PCB manufacturers and assemblers. In a joint initiative, ZVEI and FED managed to achieve a solution for already listed PCB UL construction types. These types will be "frozen" at a point of time to be determined and do not have to be retested. From a certain point in time, however, all new products will be certified according to the new multiple solder limits. Discussions on this topic must continue with the Printed Circuit Boards Group taking an active part in them. The aim is to find a satisfactory solution and conclude discussions until the next Standard Technical Panel meeting in San Diego in January 2020.

Although some of the points mentioned above may not seem very positive, there are also many promising aspects in which the PCB industry plays a key role. This is particularly true for technology development. Increasing miniaturisation is both a challenge and an opportunity. Rising

Source: Mektec Europe



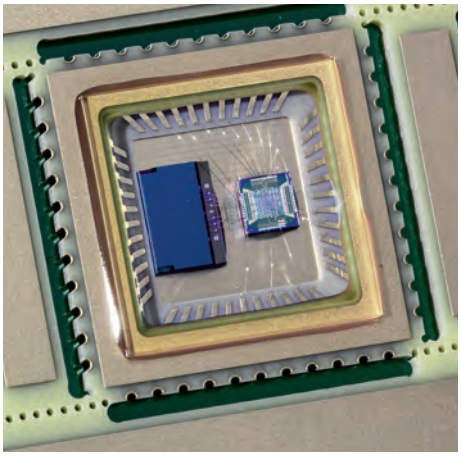
Source: Lackwerke Peters

HDI volumes reflect the trend towards finer structures. Driven by components on the one side and by necessary further weight and size reductions on the other side, we are currently witnessing a dynamic process that increasingly demands highly integrated solutions through to embedded components. Especially when it comes to highly sophisticated solutions, cooperation with European partners could bring a lot of advantages, which are all too often sacrificed to a short-term price advantage in Asia. I'm quoting myself here because I think you can't repeat it often enough: "The know-how and motivation of the European PCB industry is a factor which should not be underestimated and which is certainly an advantage for the continued existence of production in Europe in this critical global environment."

To maintain this position also in the future, we must devote a great deal of attention to promoting junior staff – not only in our companies but also at Association level. An initiative within the Printed Circuit Boards Group addresses this issue by establishing a platform for young professionals that invites young employees to contribute their ideas and actively participate in the division's work.

Within the scope of the division's work, the wide variety of working group activities and the commitment of the numerous volunteers involved from the member companies deserve special mention. They look into topics such as market analysis, design, manufacturing technology, environment/environmental protection, quality, PCB material data and reliability. In addition, members of the Printed Circuit Boards Group also successfully engage in cross-association working groups on component cleanliness and design chain, for example.

The ZVEI PCB Production Technology Working Group provided substantial input to the new technology roadmap that is currently being developed by the joint technology platform of the ECS/PCB-ES Divisions and which was presented at electronica in 2018. The roadmap outlines future industry developments in relation to current trends such as mobility and digitalisation. It also explores other topics such as base materials, painting/coating systems, surfaces, thermal management and integrated systems.



Source: KSG

The working groups and members of the Printed Circuit Boards Group are also active at trade fairs. At the PCB Marketplace at electronica 2018 and the Forum at SMT 2019, they discussed innovative base materials for new and challenging market requirements, presented current strategy concepts of small and medium-sized enterprises, and highlighted the need for a holistic understanding of sustainable design in electronics production along the entire production process.

A new joint round table was started between FED and ZVEI with the cooperation of base material, coatings, circuit board and assembly manufacturers to discuss UL soldering parameters. Its formation was triggered by the announcement of the certification body Underwriters Laboratories to introduce solder limits for PCB materials. The aim of the round table is to develop a joint recommendation to ensure the new UL requirement can be implemented in an orderly and proper manner. Underwriters Laboratories supports this process.

Our economic and political environment has not become easier, and the demands placed on our industry's employees will continue to rise. The voluntary work of many employees in working groups and projects is all the more remarkable against this backdrop. On my behalf and on behalf of the division's members, I would like to thank them and, of course, the active members of ZVEI.

Working groups within the Printed Circuit Boards Group

Production Technology

- Additive production technologies – 3D printing technologies
- Alternative drying methods for solder masks
- Requirements for PCB reliability
- Vacuum technology in production
- UL certification
- Customer-supplier relationship as an important element of manufacturing quality
- Increasing production capacities
- PCB fault analyses

Quality

- Recommendations for shipping documents
- Update of MSL recommendations
- Ionic contamination
- UL soldering parameters
- Exchange of experience regarding the introduction of new quality management systems, e.g. IATF 16949 (until 2015 ISO 9001)

PCB Reliability

- New temperature classes, standardisation
- CAF analyses, standardised test layout
- Acceleration of test procedures for determining the reliability of vias in printed circuit boards

Environmental Protection/Environment

- Permit management
- German Hazardous Incident Ordinance – new classifications
- REACH and Brexit
- German Commercial Waste Ordinance
- German Ordinance on facilities for handling substances that are hazardous to water (subtopic: AwSV)
- Waste disposal (subtopics: waste managers, electronic scrap, activities of the German Federal Environment Agency)
- Immission/air pollution control (subtopics: German Technical Instructions on Air Quality Control, exhaust air technology), approval and monitoring procedures (IE directive)
- Operational environmental protection and energy management systems
- Chemical control (subtopics: REACH, RoHS, CLP, material declaration, safety data sheets)

Market Analysis

- Smart Layer Manager control software for high-precision PCB processing
- Control systems for PCB drilling and milling – prepared for Industry 4.0
- Stencil technology – status and developments
- How can I sell PCB online?
- Where is PCB distribution heading to in times of digitalisation?
- Automation in PCB production
- Reliability of printed circuit boards
- Special analyses of PCB market trends

Ceramic Microcircuits Group

Chairman
Dirk Schönherr

The Ceramic Microcircuits Group coordinates the activities of the manufacturers of thick film, thin film, LTCC and DCB modules.

Promoting the intensive dialogue between the companies on technology and material developments for the production of ceramic microcircuits is one of its main objectives. In this context, special emphasis is given to the qualitative assessment of technological developments with regard to the ceramic microcircuit technologies: thin film, thick film, LTCC and DCB technology.

Discussions and debates on the market situation and the assessment of the European and worldwide market for ceramic microcircuits played a major role in the group meetings in 2018.

The established development and production locations in Germany are well positioned to keep pace with global competition in the coming years. No relocations from Germany took place in the reporting period.

In numerous new project launches, ceramic microcircuits as "successful ceramic solutions" competed effectively against potential substitution technologies. In the field of industrial applications, ceramic microcircuits followed the overall economic trend and grew by 7 per cent. On balance, the German market for ceramic microcircuits grew by 2.9 per cent in 2018.

Accounting for around 77 per cent, the automotive electronics segment was the main sales driver followed by industrial electronics with 18 per cent and telecommunications technology with 5 per cent. Although data for the consumer electronics and office/data technology market segments is recorded, it is considered to be insignificant for companies engaged in ceramic microcircuits technology.

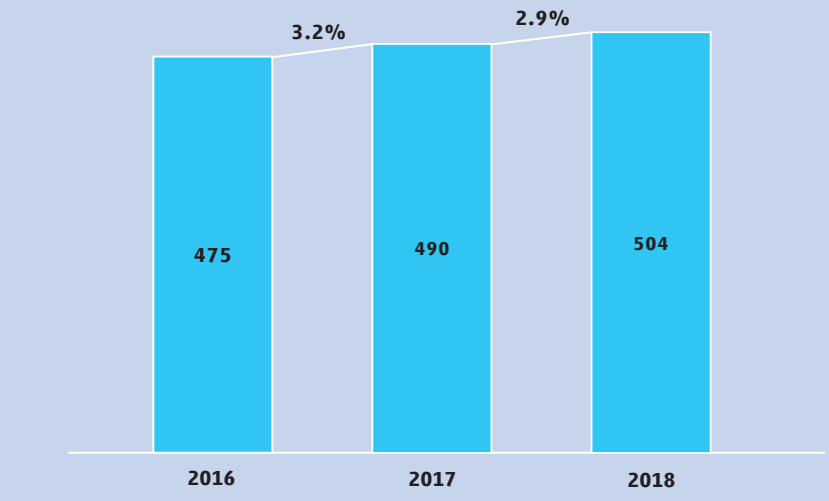
The "captive" market – mainly automotive electronics – dominates with a share of about 2/3 of the total ceramic microcircuits market.

On an annual average, around 2,000 employees worked in the member companies of the ZVEI.

For the year 2019, growth is forecast to slow down to a market volume of 2 to 2.5 per cent. Uncertainties exist with regard to expected sales in the target markets of automotive electronics. Sales in the field of industrial applications that focus on sensor technology, automation, and mechanical engineering are expected to continue to develop positively. Telecommunications applications also signal further positive market growth.

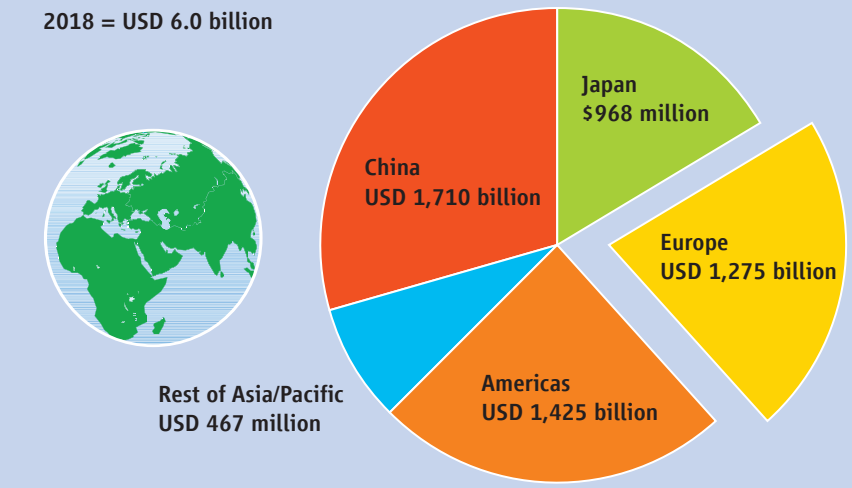
The European market for ceramic microcircuits grew by 4 per cent to around EUR 978 million in the 2018 reporting period compared to the previous year. Germany accounted for approx. 51 per cent of this growth and thus continues to lead the market.

German market – ceramic microcircuits 2016-2018
in million EUR



Source: ZVEI

Global market – ceramic microcircuits – 2018



Source: ZVEI

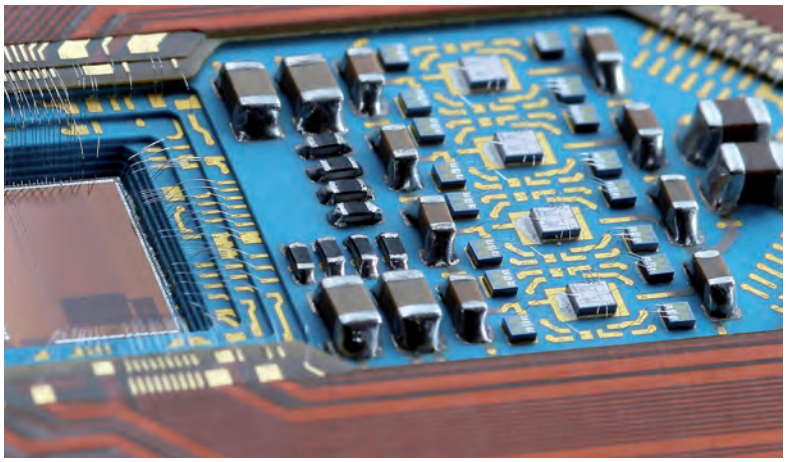
The world market for ceramic microcircuits can only be estimated due to limited sources and lack of market studies and is valued at approximately USD 5.6 billion.

Accounting for more than 50 per cent of total sales, thick film and LTCC ceramic substrates are the main sales drivers in the ceramic microcircuit segment from a technological viewpoint. DCB technology (Direct Copper Bonding on ceramic substrates) is gaining importance, now representing a 40 per cent share in the ceramic microcircuit market. With a share of 7.5 per cent, thin film technology has maintained its importance and remains a well-established player in ceramic microcircuit technology.

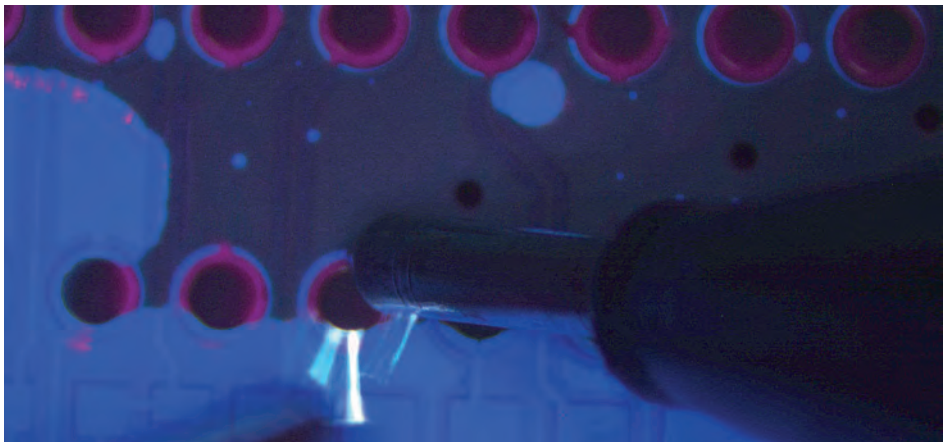
The development of market statistics also played a major role in the discussions among member companies in 2018. The availability of well-founded market figures and forecasts is considered to be paramount as they are key indicators for the companies' strategic planning. The Ceramic Microcircuits Group is actively involved in the division's market group.

With regard to their future viability, its member companies place great importance on engaging in direct dialogue – also with equipment manufacturers and material suppliers – and gaining information and knowledge about the latest trends and processes. The discussions confirmed that there is often no alternative to ceramic microcircuit technology when it comes to reliable electronic solutions. Thermally robust substrates are not only vital for the production of electronic systems in power electronics applications, the benefits of ceramic microcircuit substrates are also evident in numerous successful applications in the field of industrial automation and sensor technology.

The group's meetings provided the ideal platform for member companies to exchange information on technical developments in the field of material research and ceramic microcircuit manufacturing processes. To this end, they also sought direct contact to leading research institutes. At their invitation, we received a well-founded picture of R&D activities on site, some of which have a direct impact on the current business operations of the member companies. In addition to innovative packaging concepts, interest also focused on topics relating to packaging and assembly technology for microsystems based on ceramic microcircuit technology.



Source: Micro-Hybrid Electronic



Source: Lackwerke Peters

These possibilities of sharing information on site with manufacturers of process equipment and suppliers for microsystem/electronics manufacturing will be continued in the future at the members' request. In the interest of the member companies, relations with research institutions are to be intensified. The members consider the possibility of sharing expertise and knowledge within the group to be an important motivation for cooperation.

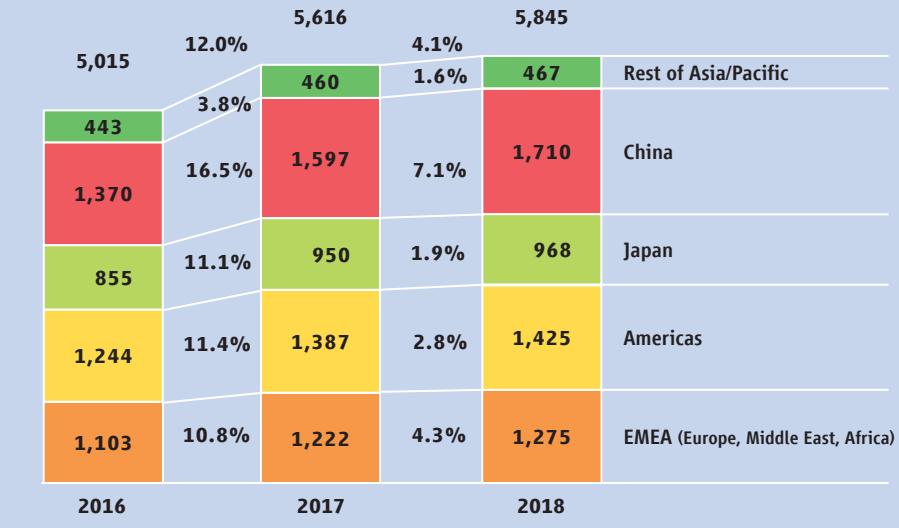
In 2018, the Ceramic Microcircuits Group also organised lecture forums during specialist trade fairs to present the numerous application benefits of ceramic microcircuits to potential users. The main purpose was to raise public awareness. Under the patronage of ZVEI, special lectures on ceramic microcircuit technologies and solutions were organised during trade fair events, which were well attended.

Be it as exhibitors, visitors or speakers at the numerous ZVEI panel discussions, the members of the Ceramic Microcircuits Group showed multifaceted commitment at different trade fairs such as SMTconnect, electronica, Sensor+Test and Compamed.

Members of the Ceramic Microcircuits Group were also involved in drawing up the technology roadmap developed by the Division's Technical Group and provided valuable input.

Global market – ceramic microcircuits 2016-2018

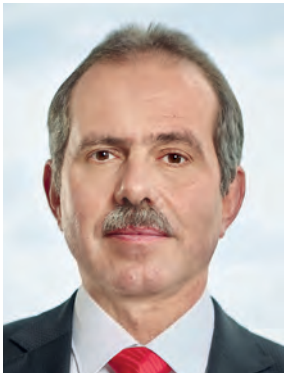
Regions by billion USD



Source: ZVEI

Cross-sectional topics of the ECS and PCB-ES Divisions

Technical Group



Chairman
Bernd Enser

The Technical Group (TG) is a common platform for two divisions – the ECS and the PCB-ES – and for the Automotive Topics Platform to discuss and exchange information about relevant topics. Among other things, its brief is to encourage in-depth discussions about all technological and environmental issues and trends and current topics of specific interest to the electronic component, PCB and assembly industries as well as to assist with technical matters. The TG additionally coordinates the main subjects of the divisional groups and also acts as the mirror committee in this capacity.

The TG currently has seven active working groups as well as various ad-hoc groups which deal with specific tasks. This approach allows key subjects of interest to base material and component manufacturers as well as electronic assemblies producers to be addressed by a single body – the Technical Group. A growing number of themed working groups have emerged in recent years which make use of the basic knowledge provided by the TG and process it in a specific way to suit their respective needs.

Publications are increasingly appearing online as the Internet of Things transforms the way we operate. So the Technical Group is working on solutions which can replace hard-copy versions of our publications in the near future. "ZVEI Connects" is a very useful tool that is already available internally. Further steps towards a complete online version are underway and will provide even more added value, particularly in terms of the search function.

The strength and expertise of this panel is underpinned by the high degree of representation and connectivity of all product groups represented by the two divisions. However, the Technical Group's work is not restricted entirely to ZVEI activities. At European level, the interests of member companies are additionally represented through contacts with European partner associations ORGALIME and EECA (European Electronic Component Manufacturers' Association) and by JEDEC (Solid State Technology Association) and SAE (Society of Automotive Engineers). It is thanks to this network that we are able to achieve our goal of representing the interests of members in the long-term and creating added value for them. The TG also provides a forum for a lively exchange of information with specific industries, for example the VDA (German Association of the Automotive Industry). At this point it is worth mentioning the most recently initiated cooperation with the "Market Group". Last year, in our bid to devise an overall policy for the two divisions, we worked on developing a streamlined approach which at least sets out the core subject areas in concrete terms. By taking a market-based approach to selecting these core subject areas, we aim to make the information that we provide to our member companies even more attractive.

Last year, numerous topics were again successfully supported by the Technical Group. Presenting the topics at diverse events and further improving the structure of the TG has enabled existing working groups to continue pursuing their commitments and inspired new colleagues

Source: Vishay Electronic

Source: Schurter

to get involved. Talks and very positive discussions held during the previous year have again demonstrated to us, and repeatedly confirmed, just how important the work of the Technical Group is perceived to be. I would like to thank everyone involved and especially the heads of the working groups for their exemplary teamwork.

As well as mentioning the well-established and very important subject areas, it is important in this context to draw attention to our latest publications. Following on from the PR work initiated last year to improve the level of awareness and acceptance of our publications, further discussions have now been held with other associations and market players. These discussions revealed not only that the extensive knowledge of our two divisions was highly valued, but also their willingness to share this knowledge and thus to support the entire electrical and electronics sector. Our task now is to continue pursuing "proven" practices as well being open to "new" ideas. The technology roadmap currently under development is a particularly good illustration of this approach. The new edition scheduled for release in autumn 2019 shows very vividly how technology and the market, and even the wider environment, can focus on the future together and above all, what our industry can gain from this approach.

Although our guideline on Traceability still comes under the "proven" category, over the years it has become clear that, here too, some adjustments and possible restructuring are required. Subjects such as "Digitalisation", "Industry 4.0" and standards such as "ISO 26262 – Functional Safety" present us with new challenges whilst at the same time demonstrating that we have already achieved a very high level of competence.

With regard to the previously mentioned technology roadmap, thanks to the efforts of all the divisional authors involved and the organisational support of colleagues within the ZVEI, we have succeeded in producing a comprehensive brochure which is available for download on the ZVEI website.

With the continuing support of the activities of the Automotive Topics Platform, the Technical Group has once again been able to demonstrate its commitment and expertise in this field. In this context, the Technical Group acts not only as a dynamic link between the technological base and market requirements; it also convincingly demonstrates our ability to address the entire range of subjects in a comprehensive and sustainable manner. This relates not only to the publications themselves, but especially to the very in-depth discussions with all those involved and the resulting raising of awareness. Several updates are on the agenda. For instance, next year the "PPAP – Production Part Approval Process" guideline is to be extensively updated to ensure that the processes and contents reflect the current situation. In addition to addressing core subject areas and dealing with them in a structured manner, we will continue to promote corresponding marketing activities. For this reason, PR work must remain at the forefront. The way we present the subject

may of course vary, but we will continue to organise themed days and attend trade fairs.

The following reports from the different subject areas illustrate how their work has been successfully implemented during the reporting period – thereby effectively representing the interests of the members. I can only recommend that you read the following pages, which provide an overview of the work carried out in our subject areas.

Environment and Packaging Working Group

Chairman: Klaus Kelm

Last year, the activities and work undertaken by the Environment and Packaging Working Group focussed largely on European environmental legislation. Numerous legislative initiatives from the European Commission called for intensive lobbying by members of the working group:

• Staff change

Since a change of employer had prompted Chairman of the Environment and Packaging Working Group Dr Michael Müller to step down as chair at the end of September 2018, Klaus Kelm from Murata Electronics Europe B.V. was elected new Chairman and Ralph Schimitzek from Robert Bosch as Vice-Chairman.

• REACH activities

A stakeholder consultation was held from March to April 2018 to discuss the identification of lead as a "substance of very high concern" (SVHC). Although this identification would not prohibit the use of lead, suppliers would have to notify customers of the presence of this substance in their products.

Members of the Environment and Packaging Working Group together with other company representatives and the ZVEI Main Office have prepared a position paper to counter the stated intention on the grounds that lead is already adequately regulated by specific laws. The position paper was submitted during the stakeholder consultation and sent to several member states in advance. Industry submissions were not taken into account by the Commission.

In the meantime, both lead compounds (lead oxide) and elemental lead have been included in the candidate list, which has repercussions on the use of lead-based solders and alloys (brass) in the electrical and electronics industry.

The position papers on the use and handling of lead oxides in glass and ceramics, first published in 2013, have been revised in consultation with JEITA and the ceramics and glass industry.

• RoHS

The RoHS Directive has special relevance for members of the Environment and Packaging Working Group. The spring meeting included a report from the cross-industry project to extend several RoHS exemptions that are essential for the member companies of the ECS Division in January 2020.

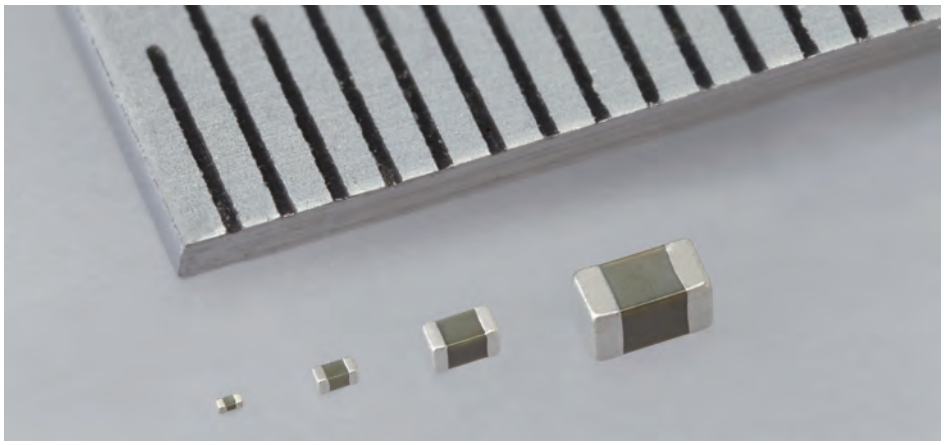
The extension applies to Pack 9 (exemptions 7c-II, 7c-IV, 8b, 15, 21, 29, 32 and 37) and came into effect in February 2019 after publication of the corresponding delegated act. The results correspond to the applications.

The RoHS Pack 15 project was launched in April 2018. Several members of the Environment and Packaging Working Group played an active role in the RoHS Pack 15 project, supporting the Substance Analysis Working Group and submitting contributions on Sb2O3, TBBP-A and beryllium as part of the consultation process.

With regard to the category 11 exemptions ('open scope') expiring in 2019, a task force is working on a position paper to distinguish between components/assemblies and an electronic device.

• Material Data Declaration in the electrical and electronics industry

The Environment and Packaging Working Group has already developed umbrella specifications which specify the material composition of different parts and components. These are used mainly by manufacturers who supply the automotive industry and prepare data in the IMDS. The IMDS Rec019 describes a means of declaring electronic assemblies. Last year, the section of the ZVEI website relating to the Material Data Declaration was revised and adapted in consultation with the IMDS Steering Committee. Guideline templates and examples showing material specifications within the electrical and electronics industry supply chain have been created and published on the ZVEI website, where they are available for download.



Source: Taiyo Yuden Europe

Environment, Health and Safety (EHS) in German Semiconductor Manufacturing Working Group

Chairman Dr Andreas Jantschak
Vice-Chairman Thomas Schön

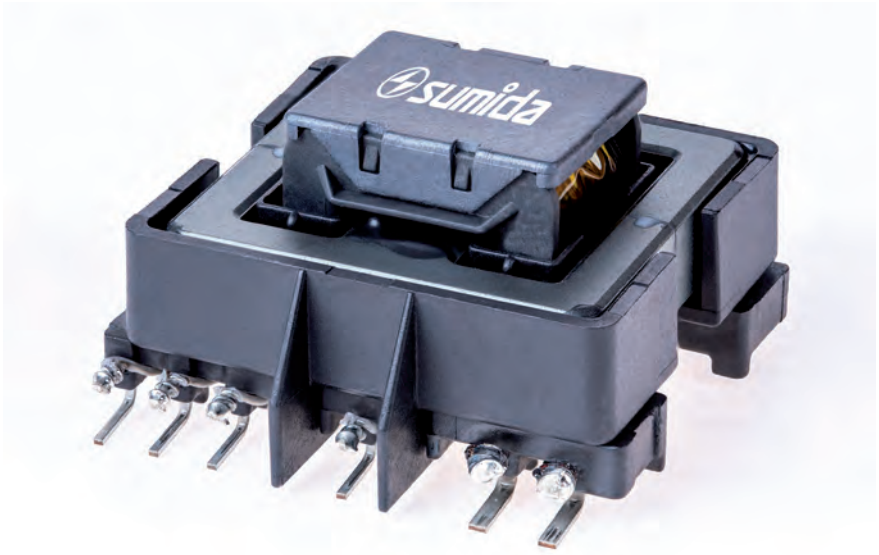
Within the Technical Group, the EHS in German Semiconductor Manufacturing Working Group – which represents virtually all semiconductor manufacturers with production facilities in Germany – reports on work, current projects and activities on the subject of environment, health and safety (EHS) in the workplace.

- **Core areas of activity are currently:**
  - EHS-related issues in semiconductor manufacturing
  - Legislative changes and adjustments in environmental protection and workplace safety of relevance to the semiconductor industry
  - Reports on EHS issues from other organisations: World Semiconductor Council (WSC), European Semiconductor Industry Association (ESIA), ZVEI Environment and Packaging Working Group, Substance Policy Working Group, etc.
  - PR work (authorities, BMU, UBA, ESIA etc.)

- **Core topics and innovations in environmental protection and workplace safety:**
  - F-Gas Regulation (EU) 517/2014
  - Abatement technologies for effective exhaust air treatment (PFCs, VOCs, acids and alkalis)
  - Developments in the recycling and waste market
  - ISO 45001 (OHSAS 18001)
  - Occupational safety, training and safety instructions
  - Changes to the German Hazardous Incident Ordinance (12th Ordinance on the Implementation of the Federal Immission Control Act – 12. BImSchV), implementation of the new Seveso-III Directive
  - Fire protection
  - Waste water legislation (German Waste Water Ordinance – AbwV)
  - Technical Instructions on Air Quality Control (TA Luft) – amendments and new requirements
  - German Ordinance on Facilities Handling Substances that are Hazardous to Water (AwSV)
  - Crisis management / emergency planning in semiconductor manufacturing
  - Risk assessments of psychological stress (German Safety and Health at Work Act – Arbeitsschutzgesetz § 5)
  - Chemicals management, REACH – special subjects of relevance to semiconductor production

- **Cooperative agreement between the ZVEI and the German Federal Environment Agency (UBA)**

Following the completion of the PFC voluntary commitment in 2010 and submission of the PFC final report to State Secretary Jürgen Becker at the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) at the end of 2011, the ZVEI concluded a cooperative agreement with the German Federal Environment Agency (UBA). In this agreement, semiconductor manufacturers in Germany declare their willingness to make annual emissions data available to the authorities – as in previous years – from 2011 onwards.



Source: Sumida Components & Modules

The UBA very much welcomes the fact that German semiconductor manufacturers have agreed to continue providing data on a voluntary basis. The close cooperation between the UBA and specialists from the ZVEI Environment, Health and Safety (EHS) in German Semiconductor Manufacturing Working Group has built up a level of trust in recent years that should pave the way for future work and discussions relating to other environmental issues and legislation (e.g. future waste water legislation or emissions directives for the semiconductor industry).

• Current status of PFC emissions

After far exceeding the requirements of the PFC voluntary commitment in 2010 (42% below the target), semiconductor manufacturers are continuing to work on limiting emissions from special production processes.

Despite rising manufacturing output in recent years, PFC emissions up to 2018 rose by only approx. 55 MTCE. The trend in emissions in recent years shows that German semiconductor manufacturers are continuing to focus on the economically viable avoidance and reduction of PFC emissions.

• F-Gas Regulation

The revised F-Gas Regulation seeks to gradually phase down the quantities of hydrofluorocarbons (HFCs) that can be placed on the EU market to 21 per cent of the 2009 to 2012 levels by 2030 by means of a quota system. The regulation exempts HFCs used in the semiconductor industry for etching or cleaning the CVD chamber (e.g. CH_2F_2, CHF_3, CH_3F) from this phase-down quota: The quantities used in the semiconductor industry for etching or cleaning the CVD chamber are therefore not included when calculating HFC quantities on the market. In order to take advantage of this exemption from the HFC phase-down, companies have been advised to register with the European Commission (EC) on the FGAS portal.

• Changes to the German Hazardous Incident Ordinance (12th Ordinance on the Implementation of the Federal Immission Control Act – 12. BImSchV), implementation of the new Seveso-III Directive

The new requirements of the Seveso-III Directive regarding the notification of the public now include, for example, an obligation for lower-tier companies and operational areas to also produce a major accident information brochure (basic obligation).

When planning new buildings and residential areas in the vicinity of establishments where dangerous substances are present in significant quantities (keywords: "usage worthy of protection"), care must be taken to ensure that appropriate distances are maintained. Semiconductor companies should engage with the authorities and local governments at an early stage to discuss planned construction projects. The interests of the production sites should be represented on the basis of existing approvals in any event.

Future production developments and expansions must also be taken into account. A further opportunity is planned this year for the major accident experts in this working group to discuss future developments and decisions.

- **Ordinance on Requirements for the Discharge of Waste Water into Waters (Waste Water Ordinance, AbwV) – Appendix 54a Production of semiconductor components**

The German Waste Water Ordinance together with its new Appendix 54a, which relates specifically to the semiconductor industry, has been under discussion with the relevant official bodies for several years. Discussions have focused primarily on establishing new limits, deciding on appropriate waste water analysis methods, defining terms and determining the technical capabilities of modern waste water treatment systems (state-of-the-art).

To shed more light on these issues, the working group has set up a task force which met with officials – representatives from the UBA and the Saxony Working Group on water issues of the Federal States and the Federal Government – at the ZVEI in Frankfurt on February 14, 2019 to exchange opinions. This constructive exchange cleared up unanswered questions on both sides regarding concentration limits for discharged metals such as osmium, tantalum, tungsten, silver and cadmium. As a result, the revision of Appendix 54 of the Waste Water Ordinance can enter the final phase, with industry approval.

In addition to these key topics, the working group also addressed a range of other subjects, including resource conservation (reducing the quantities of raw materials used, emissions, waste and waste water), effective cleaning and treatment systems for the exhaust gases generated specifically in the semiconductor industry, dealing with new statutory requirements of relevance to the companies and crisis and emergency management issues.

The latest requirements from the F-Gas Regulation, the impact of the German Waste Water Ordinance, Appendix 54 on future waste water discharge permits and the implementation of legally relevant provisions relating to risk assessment are currently under discussion. Psychological stress in the workplace has attracted increasing attention due to changing working conditions.

A further focus of the working group is to share experiences of the latest incidents and other EHS-related events. In this way, events and their impact on the German semiconductor industry can be recorded and possible solutions for avoiding critical incidents can be discussed.

This sharing of knowledge and experiences between industry experts has proved very useful and created a network based on trust between the members of the working group which has been consolidated in recent years. Furthermore, our working group is actively involved in networking with other ZVEI groups and international industry bodies. The common goal is to ensure that semiconductor manufacturing in Germany is safe for employees and the neighbourhood and to make a positive contribution to sustainable environmental protection at industry level.

Technology Platform Working Group

Chairman: Dr Andreas Lock

The Technology Platform Working Group is concerned with the interdisciplinary exchange of knowledge on various technological themes and developments in the industry. This working group has produced four roadmaps since 2002 which identify trends in different fields to guide companies operating in the electronics sector in a competitive global environment.

Since 2016, the working group, chaired by Dr Andreas Lock from Robert Bosch GmbH, has focused on revising and republishing the technology roadmap. The period under consideration has now been extended to 2025. The main emphasis was again placed on the chapters relating to the component manufacturers within the two divisions. Megatrends and application-driven trends, such as Industry 4.0 for example, have now been added to the brochure, and non-technical subjects such as business model innovations and process methods that have an influence on component development have also been taken into account. Now extending to well over 400 pages, the brochure provides information designed to give many readers insights into what tomorrow's world may, and in many cases certainly will, be like.

Component Cleanliness Working Group

Chairmen Dr Marc Nikolussi and Harald Hundt

Technical Cleanliness in Electrical Engineering: new calculation tool and new guideline

When the first edition of the ZVEI guideline on technical cleanliness was published in 2013, only part of the supply chain was confronted with the challenges of meeting technical cleanliness requirements. Now, technical cleanliness has become a standard quality feature for automotive electronics throughout the electronics industry supply chain.

Over the past six years, the ZVEI guideline has helped create a number of standards in the electronics industry. Extraction analysis is now established as the method of choice in this industry, results are generally presented based on a 1000 cm^2 reference surface area to enable comparability and finally, the supply chain has realised that statistical aspects must be included in discussions on technical cleanliness. Since it is now known that the results of technical cleanliness analyses can vary greatly, outlier rules must also be discussed and agreed between customer and supplier.

The ZVEI working group has also developed a risk assessment tool to determine the probability of an electrical short circuit caused by metallic particles on an assembled circuit board in order to assess the functional risk of electrical short circuits caused by metallic particles.

This published tool makes it possible for the first time to estimate the risk of an electrical short circuit caused by metallic particles and express it in ppm. It takes into account the individual layout of an assembled PCB, including the relevant potential clearances, as well as the individual metallic particle count determined for a product. The aim of the cleanliness analysis is to determine when the product is 'as clean as necessary', rather than 'as clean as possible', thereby avoiding unnecessary costs. You can find the calculation tool in the working group's new guideline, which was published in German and English at the end of 2018.

The working group is also paving the way for standards created in the German-speaking electronics industry to be observed and applied internationally. To this end, a "Technical Report" has been drawn up in cooperation with the DKE (German Commission for Electrical, Electronic and Information Technologies of DIN and VDE) based on the new and substantially extended guideline published in German and English at the end of 2018.

On 20 November 2018, the working group held its 1st symposium on "Technische Sauberkeit – Funktionssicherheit in der Elektroindustrie" (Technical cleanliness – functional safety in the electronics industry). With 130 participants and an accompanying micro-fair, the symposium was a resounding success which offered a wealth of networking opportunities and specialist input. Following the success of the inaugural symposium, it will be held again this year on 19 November 2019. More information can be found at https://zvei-services.de/zvei-akademie/seminare-zum-thema-qualitaet/technische-sauberkeit/ .

The working group will continue to play an active role in addressing topics relating to technical cleanliness in the electronics industry in the future. The online platform of the ZVEI working group on component cleanliness can be found at https://bauteilsauberkeit.zvei.org/. Here you can download the calculation tool and the new guideline in German and English free of charge.

Design Chain Working Group – a ZVEI initiative

Chairman Markus Biener
Vice-Chairman Arnold Wiemers

The Design Chain Working Group was set up by the ZVEI in 2012 with the aim of identifying and defining all relationships pertaining to electronics design and in particular, the dependencies of the parties involved in the chain. The design chain starts with the product idea (marketing) and does not end until the successful market introduction and evaluation of the products. Every link in this chain has some influence – either positive or negative – on the development costs and commercial viability of a circuit or device. Excessive or non-specific requirements, lack of awareness of the implications and lack of understanding of the essential procedural documentation, documents, data formats and many other factors determine the commercial viability of our devices. This affects not only the development costs, but as a consequence, our strength in the national and international market environment as well.

Source: Kaschke Components

To this end, the Design Chain Working Group has formed subgroups to ensure that the sub-areas and dependencies are comprehensively covered.

During a brainstorming session, a list of topics was drawn up which included more than 170 subtopics. To cope with the immense complexity of this issue, the groups compare and synchronise their work at regular intervals and discuss the interfaces and expectations that have been defined within the groups.

Due to the complexity of their findings and the different levels of knowledge required, the members of the Design Chain Working Group have found it helpful to present the results to potential users on two levels:
Level I = information level
Level 2 = specialist level

The aim of this approach is to give people who are not directly involved in the design process a quick and detailed overview of the requirements and dependencies without them having to acquire an in-depth knowledge of the individual sub-areas.

They will nevertheless find detailed answers to their questions and guidance on necessary or appropriate actions in other areas of the design chain commensurate with their level of responsibility.

This should pave the way for a better understanding of adjacent areas of work within the electronic systems development chain and thus lead to greater efficiency and success.

A flyer on this subject was published in 2014 (updated in 2016), which is available for download at (https://www.zvei.org/verband/fachverbaende/fachverband-pcb-and-electronic-systems/zvei-design-chain-fuer-elektronik-systeme-ein-ablaufplan-fuer-die-produktentwicklung/) or can be obtained by emailing trunz@zvei.org.

The working group has held regular public design seminars since 2018 (more information is available at https://www.zvei.org/verband/fachverbaende/fachverband-pcb-and-electronic-systems/zvei-design-chain-fuer-elektronik-systeme-ein-ablaufplan-fuer-die-produktentwicklung/).

Work is ongoing to flesh out the chosen themes with words and pictures.

The next step is to publish the results on a dedicated online platform. This will enable users to download individual subjects quickly and conveniently online.

Quality Working Group

Chairman Ingomar Trojok

The activities of this working group are underpinned by the basic principle that quality can be achieved only through close collaboration between all those involved in the supply chain. The Quality Working Group thus adheres to the core message set out in the ZVEI Zero Defect Strategy. This work is complemented by various panels of the Application Group Automotive, which are not listed here.

With regard to the certification of quality management systems, the IATF-16949 standard updated by the automotive manufacturers in 2016 and published under the auspices of the IATF (International Automotive Task Force) is now used industry-wide following a transition

Source: Europe Chemi-Con

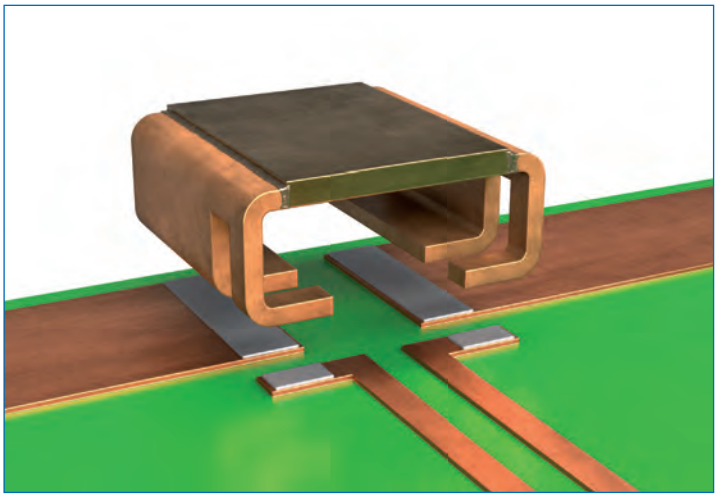
period. The working group identified differences between this standard and the ISO/TS 16949 previously used and notified the relevant VDA section accordingly. However, their concerns were not shared by the VDA. The working group then focused its activities on sharing experiences of using the new standard.

Working groups with close links to the Quality Working Group

PCN Methodology Working Group

Chairpersons: Dr Andreas Priebe,
Nicoleta Kortik, Wolfgang Ratering

Changes to electronic components in the automotive sector must be qualified by the manufacturer and customers must be informed by means of a "Process/Product Change Notification (PCN)". In many cases, the customer additionally approves a release. Unfortunately, the PCN process is not only costly, but often very cumbersome as well. To speed up and simplify this process, the PCN Methodology Working Group has compiled a Delta Qualification Matrix indicating the tests which should be carried out to ensure a coordinated assessment. Several other product groups have now been added to this matrix and the ZVEI PCN Guideline, a standardised notification form and explanatory training documents in the third revision are additionally available.
Preparations for the 4th revision have been completed and are now being implemented. It is scheduled for publication in the third quarter of 2019.



Source: Isabellenhütte

From the Technical Regulation and Conformity Assessment Working Group (TRC WG)

The TRC WG is concerned with conformity assessment, inspection, certification and accreditation, both in the sector regulated by law and the purely private sector. The activities of the working group located within the ZVEI Department for Technical Law and Standardisation are reported to the Technical Group.

As in previous years, the regulatory framework that applies to the entire electronics industry which includes the consensus-based view of standardisation offered by the "New Approach" directives received much attention, especially with regard to the important low voltage, EMC, radio equipment and machinery directives. The ZVEI supports a stronger role for standardisation in regulatory affairs. Technological megatrends such as the digitalisation of virtually all aspects of life are reflected in new regulatory approaches concerned with IT safety. These must be critically monitored to ensure that opportunities provided by new technology are appropriately portrayed and not stifled by bureaucratic overregulation. The TRC WG also monitors political developments and administrative processes such as the regulation and implementation of market surveillance and the Brexit process to ensure that the legitimate interests of the industry are constructively represented.

Market Group

Chairwoman Mónica García San Millán

Structure and work of the Market Group

The Market Group is one of the ECS and PCB-ES Divisions' cross-divisional panels; its members are market experts drawn from the following divisional groups:

- Electronic Subassemblies Group
- Electromechanical Components Group
  - Input and Protective Elements Committee
  - Connectors Committee
- Semiconductor Components Group
- Ceramic Microcircuits Group
- Printed Circuit Boards Group
- Microsystems Technology Group – Sensors/Actuators
- Passive Components Group

The Market Group panel gathers and processes market data which it makes available to the Association, i.e. to its members, as a service. This resource underpins the public relations work of the ZVEI when it comes to preparing press conferences, talks, interviews and lead articles.

The panel's main task is to prepare market tables with up-to-date market data on electronic components and assemblies. Bi-annual meetings attended by delegates from the above-mentioned divisional groups and committees ensure a robust and consistent database.

Conditions in the electronic components market

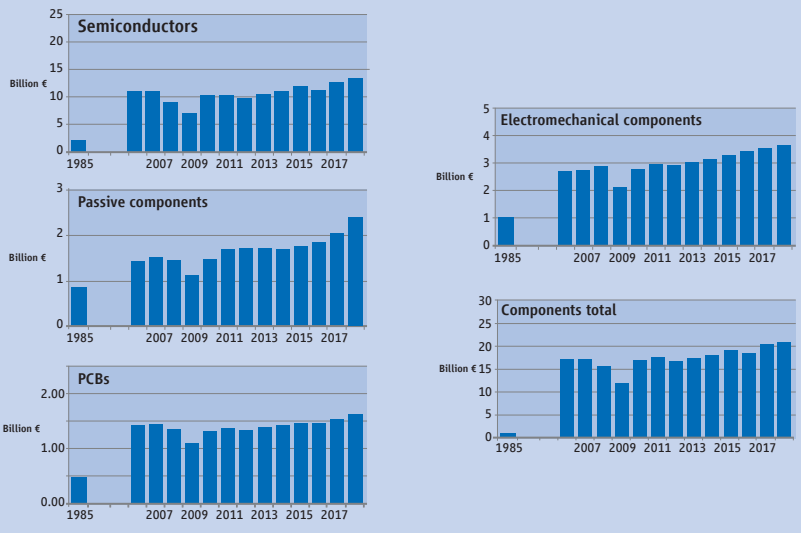
In 2018, real global economic growth (based on exchange rates) closed at plus 3.6 per cent; 0.1 per cent below the 2017 rate of 3.7 per cent (source: IMF). 2019 is expected to see a repeat of last year's weaker pace of growth. Accordingly, the International Monetary Fund (IMF) predicts growth of 3.3 per cent this year (IMF, Apr. 2019). The weaker economy has had a worldwide impact, especially in Europe and Asia, due to current international trade disputes which are adversely affecting consumer confidence and international finance markets. However, the International Monetary Fund predicts an economic upturn in 2020 and forecasts global economic growth of 3.6 per cent.

In Germany too, economic growth in 2018 was well below the 2017 rate. According to the IMF's calculations, in 2018 the German economy grew by 1.45 per cent compared with 2017. This year the German economy is expected to grow by only 0.75 per cent.

The real gross domestic product in the eurozone grew by 1.8 per cent last year compared with the previous year, following growth of 2.4 per cent in 2017. Eurozone GDP is expected to grow by 1.3 per cent in 2019.

In the wake of massive growth in the global electronic components market of just under 18 per cent in 2017, the global market grew by a further 13 per cent last year to USD 654 billion.

German market – electronic components development



Source: ZVEI

Source: Rödl & Lorenzen

Two regions – China and the Americas – were largely responsible for this further massive growth in the global electronic components market. Markets in all other regions also grew, although to a lesser extent.

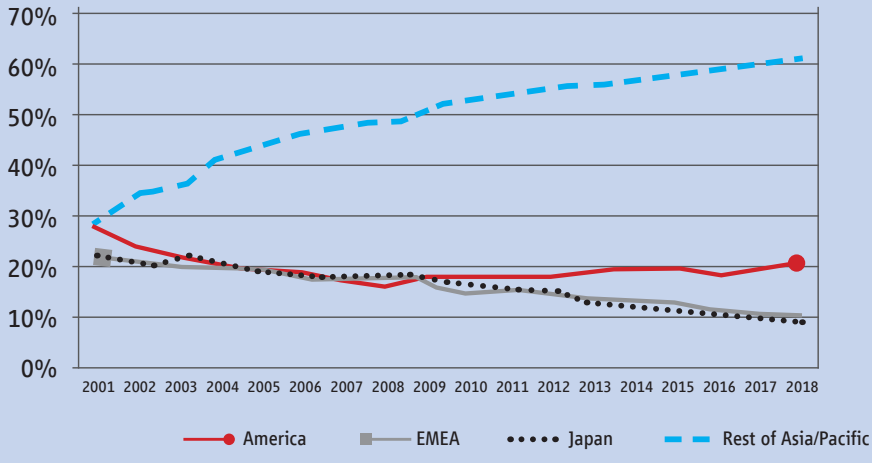
Following a massive increase of well over 18 per cent in 2017, the China region tops the charts for last year, again recording growth of around 18 per cent. Next comes the American region, recording growth of well over 15 per cent last year in the wake of a 28-per cent surge in 2017. Then the EMEA regions with 11 per cent growth, followed by Japan with a positive growth of 8 per cent in 2018. The remaining Asia-Pacific region also recorded positive growth of six per cent last year.

The Asia-Pacific region (remaining Asia-Pacific including China) also increased its global market share in 2018, by 61 per cent. In 2018, China alone recorded a global market share of well over 36 per cent – a 1.6 per cent increase compared with 2017. The market shares of the EMEA, Japan and the Americas were significantly lower, with each recording a share below 20 per cent (Americas: 19 per cent; EMEA: 10 per cent; Japan: 9 per cent).

The German market for electronic components (based on the euro) recorded positive growth in all product groups in 2018. On the euro basis, the market for passive components saw the strongest growth with sales up by 15.5 per cent, followed by electro-mechanical components (3.4

Global market – electronic components

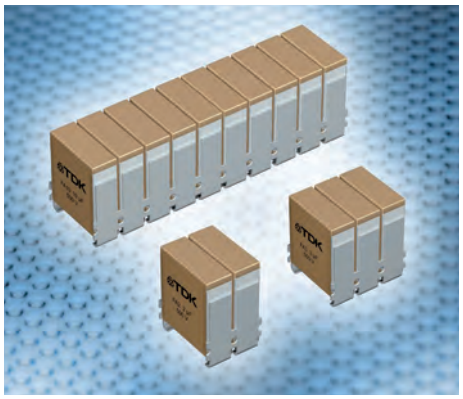
Development by region



Source: ZVEI

Source: Schurter

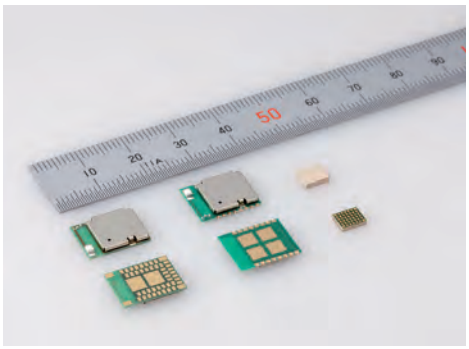
per cent), integrated circuits (2.9 per cent) and printed circuit boards (2.3 per cent). In 2018, the markets for semiconductor components recorded the lowest growth of all product groups at 0.3 per cent, having nonetheless grown by just under 15 per cent in 2017. This clearly illustrates the cyclical market behaviour of this product group.



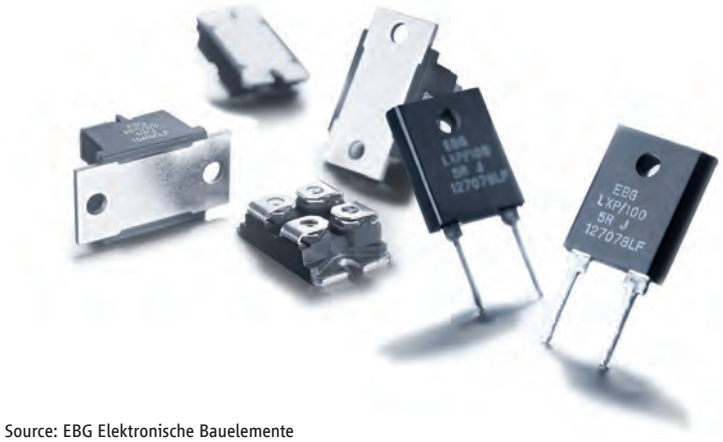
Source: TDK Electronics

Despite the slight change in semiconductor sales, they represented the largest product category in the overall market for electronic components in 2018 with a share of just over 61 per cent. However, the market share fell last year from just under 63 per cent in 2017 to just over 61 per cent due to zero growth in 2018.

The German market for electronic assemblies generated sales of EUR 32.9 billion last year; 1.56 times the value of the German market for electronic components of around EUR 21 billion. Overall, the German assembly market grew by 6.4 per cent in 2018 compared with 2017. The global market for electronic assemblies recorded 13 per cent growth – roughly equal to the global market for electronic components which grew by 12.8 per cent. The global market for electronic assemblies was worth USD 1038 billion in 2018; 1.58 times higher than the global market for electronic components.



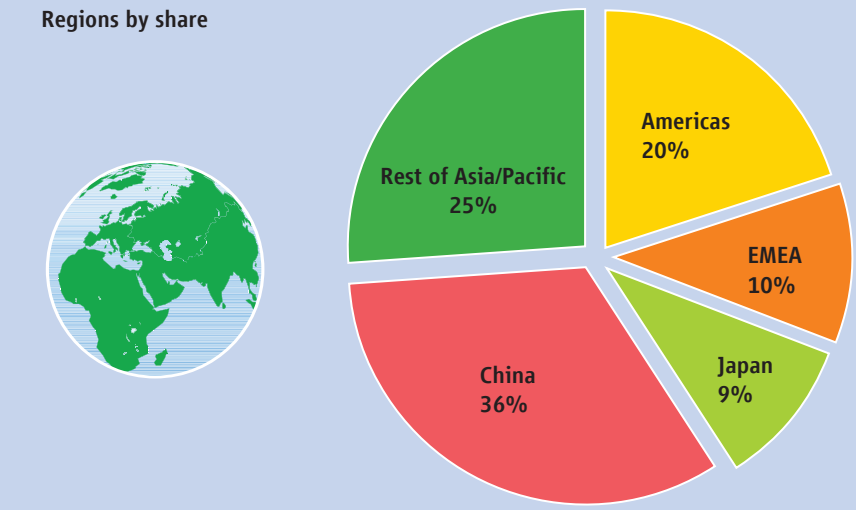
Source: Taiyo Yuden Europe



Source: EBG Elektronische Bauelemente

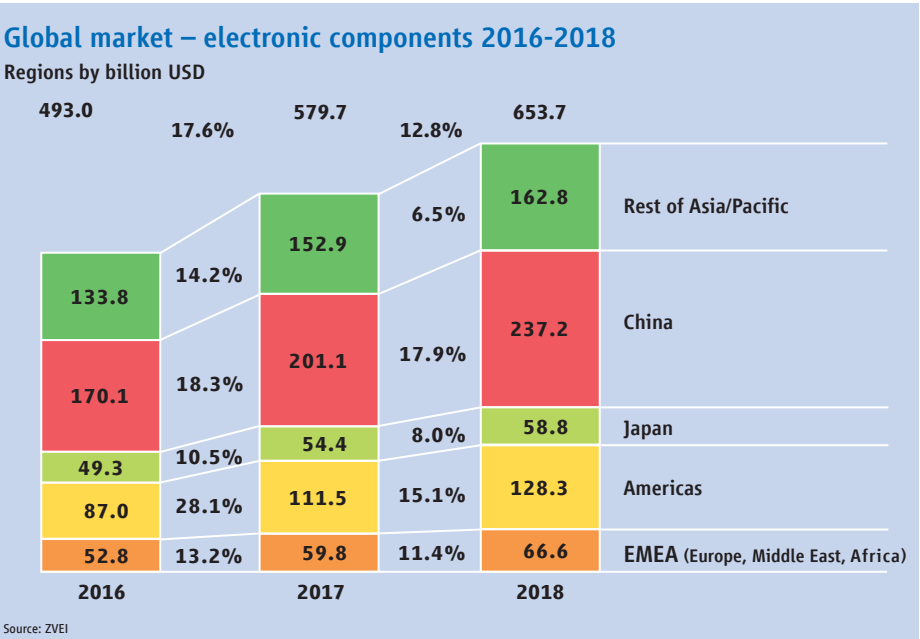
Market charts

Global market – electronic components 2018



Source: ZVEI

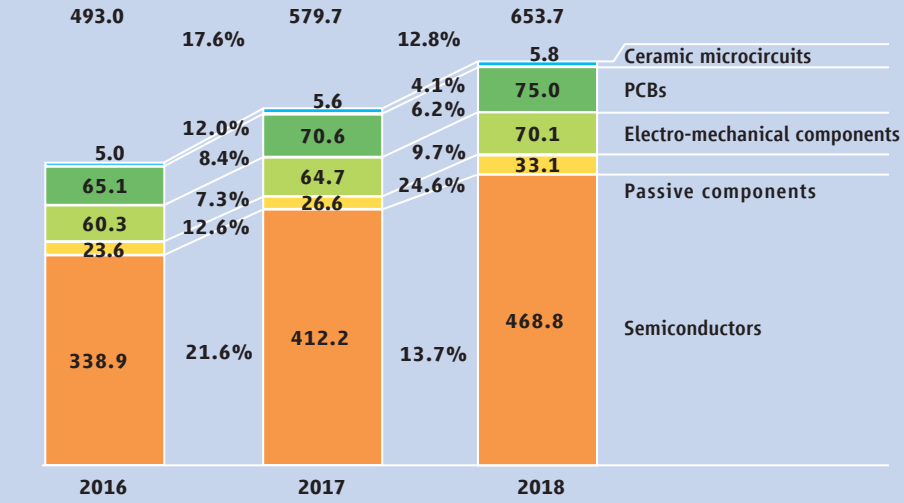
Global market – electronic components 2016-2018



Source: ZVEI

Global market – electronic components 2016-2018

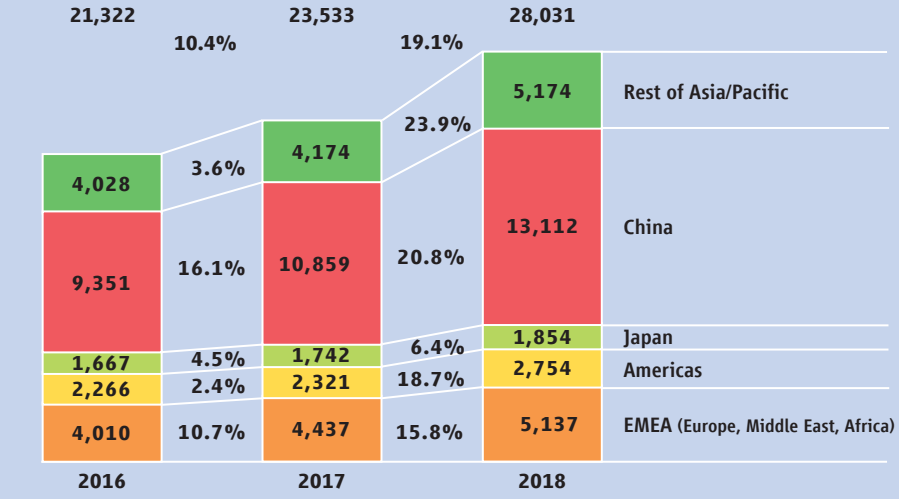
Products in billion USD



Source: ZVEI

Global market – passive components 2016-2018

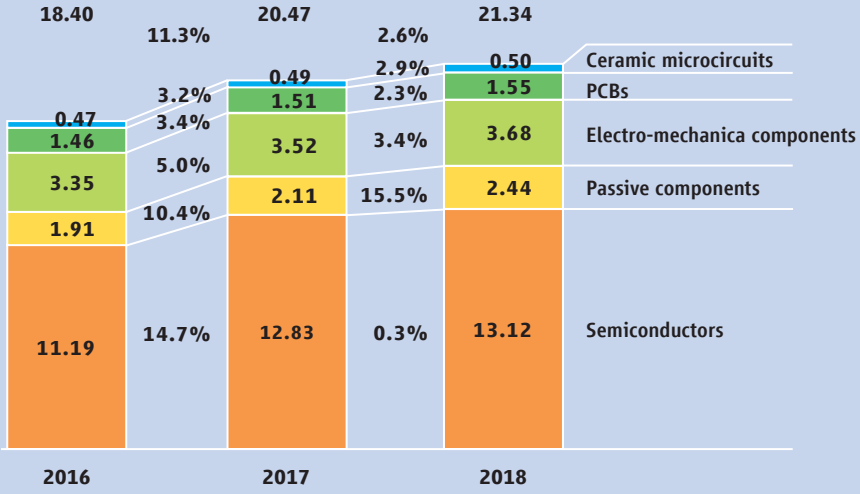
Regions by million EUR



Source: ZVEI

German market – electronic components 2016-2018

Products in billion EUR



Source: ZVEI

Identification and traceability in the electrical engineering and electronics industry

Chairman
Johann Weber

The importance of having a feasible traceability system for components, auxiliary materials, operating resources and processes is made clear almost on a daily basis by product recalls. It is vital to implement concepts along the value chain which ensure that beneficial information systems can be developed with little effort to help identify weak spots with speed and precision. Consistent, complete traceability concepts enable Industry 4.0 to be implemented in a more robust and secure manner. Furthermore, process optimisations can boost quality and efficiency.

The avoidance of liability claims and damage to a company's image is another factor. According to the German Product Liability Act, any company that places defective products on the market faces consequences. This affects all parties involved equally; even companies without fault can be held liable for several million euros – never mind the incalculable harm done to the company's image. Complete transparency throughout the entire supply chain is therefore the most important pillar for avoiding liability claims.

The ZVEI has devised a comprehensive complete traceability concept to guide and support users in search of a suitable scheme for introducing a traceability system. The core content includes definitions, cost-benefit analyses, data for traceability, technology for interfaces and practical examples. A labelling matrix for data transfer has also been developed, alongside recommendations for connecting equipment.

During a workshop on the future of the ZVEI traceability initiative attended by 30 participants from all sectors of the electronics industry, it was discussed how the added value and benefits of the ZVEI traceability concept could be further elaborated to reach a wider distribution. Special consideration is to be given to the varied requirements of different sectors, and the corresponding solutions, and thus to the possibility of scaling the design of the complete traceability system to reflect these requirements. In addition to extending the traceability concept, a phased traceability model (maturity model) is also being developed. A brief summary will also be drawn up to provide a quick overview and simple introduction to potential users of the traceability concept and enable the provision of data for Industry 4.0 – Internet of Things etc.

Benefits of the ZVEI traceability concept in brief:

- Transparent costs and processes
- Optimised company processes
- Increased overall efficiency
- Consistent data standard
- Process-wide standardised data interface
- Risk minimisation
- Quality and cost optimisation
- Avoidance of damage to public image
- Development of new customers and markets
- Comprehensive traceability provides a basis for digital transformation

Latest information:
www.zvei-traceability.de

Comprehensive Organisation Chart

Bodies of the ECS Division

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Ralph M. Bronold
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Jörg Scheer
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Joachim Weitzel
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Jürgen Weyer
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Advisory Council

Andre Beneke
Harting Electric GmbH & Co. KG

Guido Körber
Code Mercenaries Hard- und Software GmbH

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Promotion of New Talents WG
Rainer Schmidt-Rudloff
Infineon Technologies AG

Design/Development Benchmark Automotive WG
Hans-Peter Klose
Robert Bosch GmbH

Passive Components Group
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TDK Electronics AG

Market Group
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Taiyo Yuden Europe GmbH

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Additive Manufacturing WG

Dr Sascha Nolte
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Core Group RoHS Exemption 6c

N. N.

Microsystems Technology Group – Sensors/Actuators

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Foundries for MEMS WG

Uwe Schwarz
X-FAB Semiconductor Foundries GmbH

Significance of Sensor Technology for Germany Cross-Association Initiative

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Medical Sensors WG

Joachim Weitzel
Infineon Technologies AG

Packaging and Assembly Technology Committee

N. N.

Robustness Validation for MEMS WG

Saskia Dzubiella
Robert Bosch GmbH

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Michael Günther Zeyen
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Integrated Circuits
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Avnet EMG GmbH

Technology Task Force III
Dr Johann Gaus
Gaus Softwaretechnik GmbH

EMS Production/Manufacturers Task

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Semikron Elektronik GmbH & Co. KG

Editorial Task Force IV
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Phoenix Contact GmbH & Co. KG

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Walter Moser
AT&S Austria Technologie & Systemtechnik

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KSG Leiterplatten GmbH

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Achim Süß
KSG Leiterplatten GmbH

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Technical Group

Franz Bechtold
VIA Electronic GmbH

Market Group

Dirk Schönherr
Lust Hybrid-Technik GmbH

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Walter Moser
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Dirk Schönherr
Lust Hybrid-Technik GmbH

Michael Velmeden
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Artur Kreus
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Michael Pawellek
Elektroplan Engineering GmbH

Walter Süllau
Ilfa Feinstleitertechnik GmbH

Johann Weber
Zollner Elektronik AG

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A

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Advantest Europe GmbH, Böblingen
Agilent Technologies Deutschland GmbH, Böblingen
Amphenol-Tuchel Electronics GmbH, Heilbronn
AMS Sensors Germany GmbH, Jena
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Aptiv Services Deutschland GmbH, Wuppertal
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B

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Franz Binder GmbH & Co. Elektrische Bauelemente KG, Neckarsulm
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Code Mercenaries Hard- und Software GmbH, Schönefeld
Conec Elektronische Bauelemente GmbH, Lippstadt
Contact GmbH A Lapp Group Company, Stuttgart
Continental AG, Hannover
Continental Automotive GmbH, Regensburg
Conti Temic Microelectronic GmbH, Nürnberg
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D

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DuPont de Nemours GmbH, Neu-Isenburg

E

EAO GmbH, Essen
EBE Elektro-Bau-Elemente GmbH, Leinfelden-Echterdingen
EBG Elektronische Bauelemente GmbH, Kirchbad, Österreich
Electronic-Bauteile Görlitz GmbH, Görlitz
Elektrobit Automotive GmbH, Erlangen
Elmos Semiconductor AG, Dortmund
Elschukom Elektroschutzkomponentenbau GmbH, Veilsdorf
Enocean GmbH, Oberhaching
Escha Bauelemente GmbH, Halver
ESG Elektroniksystem-Logistik GmbH, Fürstenfeldbruck
Eska Erich Schweizer GmbH, Kassel
Euchner GmbH + Co. KG, Leinfelden-Echterdingen
Europe Chemi-Con (Deutschland) GmbH, Nürnberg

F

Fastron Gesellschaft für Elektronik und Bauelemente mbH, Feldkirchen/Westerham
Ferroxcube Deutschland GmbH, Elmshorn
FMB Technik GmbH, Sternenfels
Frolyt Kondensatoren und Bauelemente GmbH, Freiberg
FTCap GmbH, Husum

G

Globalfoundries Dresden Module Two LLC & Co. KG, Dresden

H

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Harting Deutschland GmbH & Co. KG, Minden
Harting Electric GmbH & Co. KG, Espelkamp
Harting Stiftung & Co. KG, Espelkamp
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Hella Innenleuchten-Systeme GmbH, Wembach
Heraeus Deutschland GmbH & Co. KG, Hanau
HI Kabelkonfektionierung GmbH, Beerfelden
Hirschmann Automation and Control GmbH, Neckartenzlingen
HIS Renewables GmbH, Beerfelden
Hotec Electronic Hollenberg GmbH, Tecklenburg-Brochterbeck
Huber + Suhner GmbH, Taufkirchen

I

IDT Europe GmbH, Dresden
Infineon Technologies AG, München
Inova Semiconductors GmbH, München
Intel GmbH, Feldkirchen bei München
Isabellenhütte Heusler GmbH & Co. KG, Dillenburg
ITT Cannon GmbH, Weinstadt

J

Johnson Electric Germany GmbH & Co. KG, Niederlassung Halver

K

Kaschke Components GmbH, Göttingen
Kemet Electronics GmbH, Landsberg
Kostal Kontakt Systeme GmbH, Dortmund
Kugler Maag Cie GmbH, Kornwestheim

L

Lear Corporation GmbH, Remscheid
Lear Corporation GmbH Werk Kronach, Kronach
Leopold Kostal GmbH & Co. KG, Lüdenscheid
Lumberg Holding GmbH & Co.KG, Schalksmühle

M

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Mahle International GmbH, Stuttgart
Marquardt GmbH, Rietheim-Weilheim
MCQ Tech GmbH, Blumberg
Melexis GmbH, Erfurt
Microtech GmbH Electronic, Teltow
Molex Connectivity GmbH, Bretten-Gölshausen
Molex Deutschland GmbH, Walldorf
MPE-Garry GmbH, Füssen
Murata Electronics Oy, Nürnberg
Murata Electronics Europe B.V. Germany Branch, Nürnberg

N

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NKL GmbH, Wolpertshausen
Nova Motum Services & Consulting GmbH, Berlin
NXP Semiconductors Germany GmbH, Hamburg, München

O

ODU GmbH & Co. KG, Mühldorf
ON Semiconductor Germany GmbH, München
Osram Opto Semiconductors GmbH, Regensburg

P

Panasonic Industry Europe GmbH, Haar
Pancon GmbH, Neu-Anspach
Panduit Europe Ltd., Frankfurt am Main
Phoenix Contact GmbH & Co. KG, Blomberg
Preh GmbH, Bad Neustadt a. d. Saale
Profichip GmbH, Herzogenaurach
Prosermo GmbH, Herzogenaurach
Provertha Connectors, Cables & Solutions GmbH, Pforzheim

Q

Qualcomm CDMA Technologies GmbH, München

R

Radiall GmbH, Rödermark
Rockwell Automation Germany GmbH & Co. KG, Wuppertal
Rödl & Lorenzen GmbH Elektrotechn. Spezialfabrik, Oberrot

S

Schaeffler Industrial Drives AG & Co. KG, Suhl
Schaffner Deutschland GmbH, Karlsruhe
Schaltbau GmbH, München
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Siba GmbH, Lünen
Siemens AG, München, Berlin, Erlangen, Karlsruhe
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Spinner GmbH Elektrotechnische Fabrik, München
Stäubli Electrical Connectors GmbH, Weil am Rhein
STMicroelectronics Application GmbH, Aschheim
Sumida AG, Obernzell
Sumida Components GmbH, Neumarkt/Opf.
Sumida Components & Modules GmbH, Obernzell

T

Taiyo Yuden Europe GmbH, Fürth
TDK Electronics AG, München
TDK Micronas GmbH, Freiburg
TDK Sensors AG & Co. KG, Berlin
TE Connectivity Germany GmbH, Bensheim
Telegärtner Karl Gärtner GmbH, Steinenbronn
Texas Instruments Deutschland GmbH, Freising
The Bergquist Company GmbH, Halstenbek
TTTech Germany GmbH, Ingolstadt, Wien
TUA Electronics AG, Oberriet, Schweiz
Turck Holding GmbH, Halver

V

Vacuumschmelze GmbH & Co. KG, Hanau
Vaillant Deutschland GmbH & Co. KG, Remscheid
Vancom GmbH & Co. KG, Landau
Vector Informatik GmbH, Stuttgart
Veoneer Germany GmbH, Dachau
Vishay Electronic GmbH, Landshut, Heide, Selb

W

Wago Kontakttechnik GmbH & Co. KG, Minden
Walter-Gebhardt Verwaltungs- und Beteiligungsgesellschaft mbH, Beerfelden
Walther Werke Ferdinand Walther GmbH, Eisenberg
Webasto SE, Stockdorf
Weco Contact GmbH, Hanau
Weidmüller Interface GmbH & Co. KG, Detmold
Hans Widmaier Fernmelde- und Feinwerktechnik, München
Wieland Electric GmbH, Bamberg
Wieland-Werke AG, Ulm
Wilhelm Sihn Jr. GmbH & Co. KG, Niefern-Öschelbronn
Wonder Automotive Europe GmbH, München

X

X-FAB Semiconductor Foundries GmbH, Erfurt

Z

Zeibina Kunststoff-Technik GmbH, Puschwitz
ZF Active Safety GmbH, Koblenz

PCB and Electronic Systems Division

A

ACD Elektronik GmbH, Achstetten
Aemtec GmbH, Berlin
ams Sensors Germany GmbH, Jena
APL Hofstetter PCB GmbH, Lörrach-Hauingen
ASM Assembly Systems GmbH & Co. KG, München
AT & S Austria Technologie & Systemtechnik AG, Leoben-Hinterberg, Österreich
ATG Luther & Maelzer GmbH, Wertheim
Atotech Deutschland GmbH, Berlin

B

Ba-Ti-Loy Gesellschaft für Lötmitteltechnik mbH, Balve
Becom Electronics GmbH, Hochstrass, Österreich
Binder Elektronik GmbH, Höpfingen-Waldstetten
Binder Introbest GmbH & Co. KG, Höpfingen-Waldstetten
Bühler electronic GmbH, Fredersdorf

C

Christian Koenen GmbH, Ottobrunn
Cicor Technologies, Bronschhofen, Schweiz
Cicorel SA, Boudry, Schweiz
CleanControlling GmbH, Emmingen-Liptingen
CMS Electronics gmbh, Klagenfurt, Österreich
Coates Screen Inks GmbH a member of Sun Chemical, Nürnberg

D

Dow Deutschland Anlagengesellschaft mbH, Schwalbach
Drews Electronic GmbH, Kamp-Lintfort
Drews Meß- und Regeltechnik GmbH, Mülheim an der Ruhr
Dyconex AG, Bassersdorf, Schweiz

E

Eldat GmbH, Königs Wusterhausen
Electronic Service Willms GmbH & Co. KG, Stolberg-Breinig
Elekonta Marek GmbH & Co. KG, Gerlingen
Eltroplan Engineering GmbH, Endingen
Enmech GmbH, Weinheim
Eolane SysCom GmbH, Berlin
Epsa Elektronik & Präzisionsbau Saalfeld GmbH, Saalfeld
ExCellTec GmbH, Karben

F

Fujitsu Technology Solutions GmbH, München

G

Göpel electronic GmbH, Jena
GPV Germany GmbH, Hildesheim
GTS Flexible Materials GmbH, Siegen

H

Hadimec AG, Mägenwil, Schweiz
Hartmetallwerkzeugfabrik Andreas Maier GmbH, Schwendi-Hörenhausen
Hasec Elektronik GmbH, Wutha-Farnroda
Herkules-Resotec Elektronik GmbH, Baunatal-Rengershausen
HE System Electronic GmbH & Co. KG, Veitsbronn
Heraeus Deutschland GmbH & Co. KG, Hanau
Hotoprint Elektronik GmbH & Co. KG, Lamspringe
HPTec GmbH, Ravensburg-Untereschach

I

IFM Datalink gmbh, Fürth
Iftest AG, Wettingen, Schweiz
Ilfa Feinstleitertechnik GmbH, Hannover
Impex Leiterplatten GmbH, St. Michael im Lungau, Österreich
Ingenieurbüro Edelbluth & Dauber, Worms
Ingenieurbüro Wolfgang Dietz, Dietingen
Insta GmbH, Lüdenscheid
Intec TIV Deutschland GmbH, Hemsbach

J

Jumatech GmbH, Eckental
Jumo GmbH & Co. KG, Fulda

K

Kathrein Sachsen GmbH, Mühlau
Kieback&Peter GmbH & Co. KG, Berlin
kolb Cleaning Technology GmbH, Willich
Kolektor Siegert GmbH, Cadolzburg
KRK Elektronik GmbH, Egelsbach
KSG Austria GmbH, Gars am Kamp, Österreich
KSG GmbH, Gornsdorf
Kubatronik Leiterplatten GmbH, Geislingen/Steige

L

Lackwerke Peters GmbH & Co.KG, Kempen
Lacroix Electronics GmbH, Willich
Laserjob GmbH, Fürstenfeldbruck
Lenze Operations GmbH, Aerzen
LFG Oertel, Gera
Lust Hybrid-Technik GmbH, Hermsdorf

M

MacDermid Enthone GmbH, Langenfeld
Maschinenfabrik Lauffer GmbH Co.KG, Horb
Mektec Europe GmbH, Weinheim
Mektec Europe Production GmbH, Weinheim
Mektec Europe Sales & Development GmbH, Weinheim
Melecs EWS GmbH, Siegendorf, Österreich
MEN Mikro Elektronik GmbH, Nürnberg
Micro-Hybrid Electronic GmbH, Hermsdorf
Miele & Cie. KG, Lehrte
ML&S GmbH & Co. KG, Greifswald
Murat Elektronik GmbH, Nürnberg
Mycronic GmbH, Garching

O

Orbotech SA, Brüssel Belgien
ORC Manufacturing Vertriebs GmbH, Radevormwald

P

Pill GmbH, Auenwald
Posalux GmbH, Neu-Isenburg
Productware GmbH, Dietzenbach
Profectus GmbH Electronic Solutions, Suhl

R

Reinhardt Microtech AG, Wangs, Schweiz
Reinhardt Microtech GmbH, Ulm
RHe Microsystems GmbH, Radeberg
Ritter Elektronik GmbH, Remscheid
Robert Bosch GmbH, Gerlingen-Schillerhöhe
Robert Bürkle GmbH, Freudenstadt
Rohde & Schwarz GmbH & Co. KG, München

S

S.C. Systronics S.R.L, Arad, Rumänien
Sanmina-SCI Germany GmbH, Gunzenhausen
Schmoll Maschinen GmbH, Rödermark
Schorisch Elektronik GmbH, Wentorf bei Hamburg
Schweizer Electronic AG, Schramberg
Seho Systems GmbH, Kreuzwertheim
Sieb & Meyer AG, Lüneburg
Siemens AG, München
Siemens Industry Software GmbH, Lindau
Smyczek GmbH, Verl
Solid Semecs GmbH, Uden, Niederlande
Sumida AG, Obernzell
Sunshine PCB GmbH, Remscheid
Swisstronics Contract Manufacturing AG, Bronschhofen, Schweiz

T

Test-OK BV, Rotterdam, Niederlande
TQ-Systems Durach GmbH, Durach
Turck Duotec GmbH, Halver

U

Ucamco NV, St.-Denijs-Westrem Belgien
Unimicron Germany GmbH, Geldern

V

Varioprint AG, Heiden, Schweiz
Ventec Central Europe GmbH, Kirchheimbolanden
VIA electronic GmbH, Hermsdorf
Viessmann Elektronik GmbH, Allendorf
Viscom AG, Hannover
Voigt electronic GmbH, Erfurt

W

Würth Elektronik GmbH & Co. KG, Niedernhall

Z

Zevac AG Zweigniederlassung Deutschland, Grasbrunn
Zollner Elektronik AG, Zandts

Publications

Publications list of the divisions	Medium
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