Position Paper

Consumer Components in Safe Automotive Applications

Topical summary in brief:

- Growing trend towards the use of "consumer components" in vehicles
- Truly different: automotive components and consumer components
- resulting emerging risks often remain unrecognized
- Automated and connected driving require a new level of cooperation across the supply chain
- VDA and ZVEI address this issue
- ZVEI updates Position Paper and Fact Sheet

Introduction

Increasing numbers of active and passive components not specifically designed for the automotive market and its mission profiles are being used in vehicles. Given that advanced driver assistance systems and safety functions are increasingly being introduced into the automotive value chain, any failing component in an associated electronic control unit in the vehicle could affect the application and endanger the health of any occupants or bystanders and even their lives. The resulting safety risk not only affects the companies involved but could also lead to direct personal consequences for the employees or managers responsible.

Purpose of ZVEI position paper

The suppliers of active and passive components organized in the ZVEI, as well as Tier1 suppliers, see the need to raise awareness regarding the increasing risks created when components not specifically developed for automotive applications are used within automobiles. The automotive supply chain needs a futureproof and safe foundation for collaboration. Close cooperation between OEMs, Tier1 suppliers and component manufacturers in development is needed to identify and minimize new risks in the value chain.

This position paper summarizes why the trend of increasing use of non-automotive components in automotive applications is inevitable. It highlights that modern automotive capable solutions depend on strengths that are already defined and established during the development of technology, packaging and components. These solutions are key to achieve targets for quality, reliability, lifetime performance, safety and security. Additionally, these solutions include “value-added support' such as IATF 16949 (the QM-System standard of the automotive industry), audits, closely controlled production and change management, failure analysis, long-term supply, and traceability, amongst others. These automotive specific product strengths and support services go far beyond the required basic chip functions and are based on a strong foundation of Tier1 and experienced automotive industry manufacturers. Their knowhow today contributes to the automotive quality and reliability we know and appreciate.

Today's ‘value-added support' for the automotive industry significantly exceeds consumer industry standards and requires additional effort, cost and inflexibility for the supplier.

Market environment

The automotive segment accounted for just under 12 percent of the global semiconductor market in 2021* and has limited appeal for specific research and development (R&D). It is therefore hardly surprising that many innovations desired in future vehicles will first be developed for larger market segments, such as consumer goods and computers, for which the required R&D can be justified.

Currently, both the automotive as well as the semiconductor market face significant changes. Car buyers expect new and more sophisticated consumer and safety applications that require complex and high-performance systems in the vehicle that previously did not exist. Examples of such applications include higher graphics capabilities in infotainment, dashboard and head-up systems, radar and camera-based driver assistance systems, autonomous driving, ‘car-to-X' technology, and more. Some of these leading-edge products are based on semiconductor and manufacturing technologies that cannot themselves be made compatible with automotive requirements and must be compensated for at the application level.

The semiconductor industry already invests more than 15 percent of sales in R&D and faces rapidly rising development costs for semiconductor devices and technologies. Requirements for functional, general and data security are increasing complexity and expense. Investments in software and development infrastructure are increasing disproportionately.

In the semiconductor industry, the trend continues that a new, smaller technology node is introduced every three to four years. The production complexity, e.g., the number of masks required and the resulting manufacturing costs, is increasing continuously. Technological progress makes it possible to integrate ever more complex modules with more functionality into one module. At the same time, the threshold for the minimum functional density of these components is also rising. Many digital components used in automobiles today, e.g., a large proportion of microcontrollers, no longer benefit from the latest technology generations because they do not achieve this minimum complexity. In addition, development costs increase by at least 50 percent with each technology node. Due to the relatively low number of units compared to the development costs, a reduction in the variety of components is recommended for the automotive market. Additional benefits of such consolidation also became visible in the 2020 to 2022 supply crisis.

Economic pressures and the desire for faster availability of differentiating functions are pushing standard components into today's automotive applications. The result is that components from a wide variety of markets are increasingly being used in vehicles.

Components developed specifically for automotive applications are different

Until now, automotive electronics have been developed using the 'top-down' method. OEMs defined their requirements and the partners in the value chain (from Tier1 to component suppliers) developed specific new products and services to meet these specifications. This was feasible because the number of applications and the complexity of the technologies and components were limited. Slower innovation speed and longer development cycles made this development possible.

* ZVEI-Mikroelektronik – Trendanalyse bis 2025 (Mikroelektronik – Trendanalyse bis 2025 (zvei.org))

Due to the unidirectional definition of requirements, few OEM experts are aware that today's components developed specifically for the automotive industry differ from those in other industries in many ways. To cope with the demanding environmental conditions in automobiles and to approach the zero-failure target, special measures and methods have been implemented for automotive components which, while not eliminating the risk of failures in vehicles, can minimize it to a large extent. As a result, because the component must be robust against higher voltages, stronger electrostatic discharges and higher temperatures, in addition to requirements regarding error correction and higher test specifications, chips have a comparatively larger size.

Production is more tightly controlled, testing and reliability burdens are higher, and change management is slower and more restrictive. There are more extensive expectations for failure analysis, audits, manufacturing, and subcontractor management, and ultimately expectations for long-term availability exceed typical semiconductor device cycles.

As a result, these components have higher manufacturing and R&D costs, productivity improvements are slower and more difficult to achieve, and production cycles are longer and less flexible. These high costs are unacceptable for standard components, where volumes for the automotive industry represent only a small portion of the total business. In fact, the constant commercial pressure in the automotive segment and the general margin situation of suppliers call into question whether all the specific expectations mentioned can be maintained.

In the Consumer Components in Safe Automotive Applications (CCSAA) working group, experienced component manufacturers in collaboration with Tier1 have published a Fact Sheet (www.zvei.org/ccsaa). This Fact Sheet identifies possible differences between “consumer” and automotive active and passive components in the areas of semiconductor and package technology, component development, validation, characterization, qualification, production, testing, as well as support throughout the component life cycle. It also highlights the potential resulting consequences. The fact sheet was updated together with this position paper in 2023.

Cooperation is necessary

Selecting standard components not specifically designed for automotive applications requires an awareness of potential gaps in development, manufacturing process and testing, as well as the resulting additional risks for failure. Desired mission profiles must be evaluated against the capabilities and limitations of available components. The best balance must be found between the ultimate application profile, electronic control unit and, component/technology performance, and external compensation measures. At the same time, state-of-the-art safety requirements must be met.

In September 2022, the VDA published a new revision of the "Guideline for situation and risk analysis in the use of components from the field of consumer electronics (CE) in vehicles". This guide refers to the ZVEI Fact Sheet. Like the ZVEI position paper, the VDA emphasizes the fact that OEMs, Tier1 and component manufacturers must communicate closely with each other at a very early stage of a project definition to identify potential differences between consumer components and components developed specifically for automotive and to jointly address the potential risks. Measures to reduce relevant, identified risks cannot always be taken at the component level. In many cases, therefore, measures are required at the application (Tier1) or system (OEM) level. These measures may include reducing requirements at the application or system level or accepting identified risks in order to enable innovations, for example. This coordination requires close and early communication and cooperation between all parties involved in a closed loop approach. Transparency enables extra effort in the supply chain to be applied at the most efficient point, while increasing the chance that vehicle safety requirements can be met through additional measures at system levels. At the end of the risk identification and minimization process, the residual risks are transparent to all stakeholders and must be accepted throughout the value chain.

Members of the ZVEI working group CCSAA

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ZVEI - Electro and Digital Industry Association

The ZVEI is committed to the common interests of the electro and digital industry in Germany and at the international level. Over 1,100 companies have opted for membership of the ZVEI. They employ around 90 percent of the employees and staff of the electrical industry in Germany. Its members include global players, medium-sized and family-owned companies. The sector has 879,000 employees in Germany. In 2021 the turnover was approximately Euro 200 billion.

One in three innovations in the manufacturing sector is based on solutions from the electrical and digital industry. Every year, the industry spends around 20 billion euros on research and development and more than six billion euros on investments.

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