ZVEI: Die Elektroindustrie

Position Paper

Consumer Components in Safe Automotive Applications

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German Electrical and Electronic Manufacturers' Association

Topical summary in brief:

- Increasing demand to use consumer grade semiconductors in vehicles
- Truly different: automotive semiconductors and consumer parts
- Resulting new and growing industry risks often unknown
- Automated driving vision requires new level of industry-wide cooperation
- Experienced automotive suppliers in ZVEI reach out to OEMs

More and more semiconductors that were not specifically developed for the automotive market and their use profiles are being used in vehicles. Given the fact that the automotive value chain increasingly introduces advanced driver assistance (ADAS) and safety functions into vehicles, any failing device in any relevant electronic control unit (ECU) within the car can impact the application and endanger human health or even life. The consequential safety risk impacts not only the involved companies but may also lead to direct, personal consequences for the responsible employee or manager.

Purpose of ZVEI position paper

Both, the semiconductor and passive component suppliers organized within the ZVEI see the need to raise awareness for the increasing risks when parts that were not specifically developed for automotive applications are used within the vehicle. The automotive supply chain needs a new futureproof and safe foundation for collaboration. The collaboration between Car OEMs, Tier1s and component suppliers during development needs to be reassessed and redefined to identify and mitigate those new risks along the value chain.

This position paper summarizes why the trend to increasingly design nonautomotive parts into automotive applications is inevitable and will further expand. It highlights that today's automotive capable solutions depend on strengths already determined during technology-, packaging- and/or product-development to reach quality, reliability, lifetime and safety targets. In addition the solutions include 'added-value support' like TS16949, audits, closely controlled production management, failure analysis, long term supply, traceability to just name a few. These automotive specific product strengths and support services go far beyond required chip functionality and are based on the strong foundation of experienced automotive component and Tier1 suppliers. Their skills today support the automotive quality and reliability we know and enjoy.

Today's automotive value support contrasts significantly with standards of the consumer industry causing unique efforts, costs and inflexibilities.

Market environment

Automotive in 2013 represented only 10 percent of the global semiconductor market and attracts a limited share of dedicated R&D. As such it is no surprise that many

innovations wanted in future vehicles are designed for larger market segments like consumer and computer that can justify the required R&D.

Today both the vehicle as well as the semiconductor market face significant changes. Car buyers want new and demanding consumer and safety applications requiring complex, high performing solutions in the vehicle that never existed before. Examples of such applications are higher graphics capabilities in Infotainment, cluster and head-up solutions, radar and camera advanced driver assistance systems (ADAS), Car-to-x technology, and many more. Some of those leading edge products are based on semiconductor and assembly technologies that cannot by themselves be made compatible with automotive requirements and need compensation on application level.

The semiconductor industry already spends more than 15 percent of revenue in R&D and faces dramatically rising product and technology development costs. Functional safety and security requirements add complexity and efforts. Investments in software and tool enablement are exploding.

In addition the semiconductor technology shrink curve that for decades has provided almost 'automatic' cost reductions has reached inflection points where smaller, later technology products of similar complexity are actually more costly than their predecessors. The consequence is that a rising demand from OEM and Tier1 for more and different components is exceeding the bandwidth of the consolidating semiconductor industry that will develop fewer and fewer products of substantially increasing complexity.

While a solution for many above described semiconductor challenges would be a strong consolidation of requirements on significantly fewer automotive focused products, the likely future is an even more fragmented market demand. Economic and performance pressures are driving standard products into today's commoditized standard automotive applications. The ultimate result will be that standard multi-market products will increasingly be designed into vehicles.

Components specifically developed for automotive applications are different

The historical automotive electronics development approach has been top down. OEMs defined their requirements and the partner along the value chain (from Tier1 to the component suppliers) developed specific new products and services to meet those given requirements. That was viable because the number of applications as well as technology and product complexity were limited, innovation speed and development cycle times were sufficiently slow.

Given the unidirectional requirements definition, very few OEM experts are fully aware that today semiconductor devices specifically developed for automotive are truly different in many ways. To mitigate the harsh Automotive environment and to approach the zero defect vision, specific measures and methods were implemented for Automotive components that cannot fully eliminate, but largely mitigate the risk of fails in vehicles. Consequently, the silicon is larger due to higher voltage, higher electrostatic discharge (ESD), higher temperature, error correction and higher test coverage targets.

Production is more stringent, test and reliability stresses are more extensive, change management is slower and more restrictive, there are more extensive

expectations regarding failure analysis, audit, fab and sub-supplier management and finally product life cycles/availability expectations exceed substantially the typical semiconductor product cycles.

As a result these components carry higher product and R&D costs, productivity improvements are slower and more difficult to accomplish, the production cycle times are longer and less flexible. All those burdens are not acceptable for standard components where the automotive quantities represent only a small share of the overall business. In fact the constant commercial pressure in the automotive segment and the overall margin situation of automotive suppliers is questioning whether all above special expectations are sustainable.

ZVEI invitation to collaborate

OEMs have already understood that they 'need to compromise' when they want certain differentiating and innovative features in the vehicle that end consumers nowadays expect. However, the partners in the value chain need to commonly agree upon a more fundamental change in the development process moving from the historical top-down to a closed loop communication and collaboration flow among all involved partners. That is the only safe way to recognize and consider technical and commercial limitations of the semiconductor device.

Instead of 'compromising' best practices for certain products or applications, all partners along the automotive value chain together should transform current standard practices into a new collaboration that maximizes transparency and flexibility along the value chain to ensure quality, safety and reliability of vehicles.

The ZVEI represents many relevant key component and Tier1 suppliers that for decades have been committed to the automotive market. Those companies have developed a deep understanding of the quality requirements and best practices/ processes that have enabled high quality vehicles to be manufactured for decades. That comprehensive skill set within the ZVEI is the perfect foundation for process/technology focused collaboration between all partners of the automotive value chain. There is actually already a broad foundation of technical guidelines created by the ZVEI that will be beneficial in the process.

Selecting standard components not specifically developed for Automotive requires awareness of the potential gaps in design, process and test and the resulting additional risks for incidents and field failures.

Initial application profiles need to be assessed vs. capabilities and limitations of available products. Commonly the best balance between final application mission profile, ECU and component/technology capabilities and incremental measures needs to be found while ensuring that the safety state-of-the-art targets are satisfied. The evaluation of incremental measures and resulting costs will also help to find the most viable implementation and best balance of needed efforts between component supplier, Tier1 and CarOEM who are all impacted by the new hard- and software complexity levels. Transparency allows conscious decisions to flexibly balance efforts along the value chain, increasing the chance that vehicle needs can be met by additional

measures on the system level even if some of the basic electronics components are substantially less Automotive capable and provide less of the added value support that historically were deemed necessary. At the end of the risk identification and mitigation process, potentially remaining risks will be transparent to all parties and need to be accepted across the value chain.

Future 'smarter and faster' added value support best practices need to accomplish the automotive application needs of quality, reliability, lifetime and safety while efficiently coping with the spectrum from available consumer to 'classical' automotive components. The ZVEI is convinced that the strong commitment to the automotive markets, the decades of process and best practice optimization of the existing key suppliers will make a difference to find solutions for the largest challenge that this industry has seen in the last several decades. Collaboration will strengthen the foundation and prepare the automotive supplier community to provide new attractive and safe vehicle functionality for the user.

Members of the ZVEI working group 'Consumer Components for Automotive Applications' for the development of this position paper:

Analog Devices GmbH
EPCOS AG
Freescale Halbleiter Deutschland GmbH
Infineon Technologies AG
Keller Consulting Engineering Services
Mektec Europe GmbH
NXP Semiconductors Germany GmbH
OptE GP Consulting
Robert Bosch GmbH
Sanmina-SCI Germany GmbH
STMicroelectronics Application GmbH

ZVEI - German Electrical and Electronic Manufacturers' Association

The 'ZVEI - German Electrical and Electronic Manufacturers' Association' promotes the industry's joint economic, technological and environmental policy interests on a national, European and global level. The ZVEI represents more than 1,600 companies, mostly small and medium-sized enterprises (SMEs). The sector has 841,000 employees in Germany plus 665,000 employees all over the world. In 2013 the turnover was approximately Euro 167 billion.

The electrical and electronics industry is the most innovative and the second largest industry sector in Germany. Every third innovation in Germany's manufacturing sector stems from solutions of this sector. 20 percent of all industrial R&D spending come from this industry.

ZVEI - German Electrical and Electronic Manufacturers' Association
Platform Automotive
Lyoner Strasse 9
60528 Frankfurt am Main, Germany
Telephone: +49 69 6302-276
Fax: +49 69 6302-407
E-mail: zvei-be@zvei.org
www.zvei.org

Contact:

Dr. Stefan Gutschling