

## **ESD Association**

by Reinhold Gaertner

March 3, 2011

### **Computers on Wheels, Sensitive to Electrostatic Effects**

With current fuel prices, the mind set of people regarding large vehicles and SUVs with unlimited need of fuel has changed quite a bit. The request for fuel saving cars, hybrid cars, and even completely electric cars is getting louder. These types of vehicles need a number of electronic control units (ECU) for more efficient engine management, fuel saving operation, battery operation and the like. Not only will power management require increased electronics in the car, safety features (ABS, air bags, distance control, etc.) and the "luxury features" like internet access will also increase this demand. Additionally, hydraulic units (like those in the steering wheel) in past automotive design will be done electronically. Vehicles are now evolving into computers on wheels which can be used to travel from A to B with high speed, high comfort and of course high safety. The electronic parts of this "driving" computer are getting smaller and smaller and more sensitive to electrostatic effects – but their reliability must be maintained.

Protection against electrostatic discharge (ESD) can be realized to a certain extent on the semiconductor itself. This on-chip protection is guaranteeing safe handling at the ECU manufacturer in a ESD protected area (EPA) having basic ESD protective measures. These manufacturers are following international standards like ANSI/ESD S20.20 or IEC 61340-5-1 so that even very sensitive parts can safely be handled.

The ECU will then be implemented in the vehicle, or certain parts of it (like door modules), at the car manufacturer or their direct suppliers. These assembly lines often have no or very limited ESD handling measures. Therefore the ECU must possess a much higher robustness against ESD. There is always a debate as to what the right (voltage) level of protection is and what the right test to guarantee this robustness is. Is it more efficient to make the semiconductor devices themselves more robust or to increase the protection on-board? Resistors and capacitors that are needed for performance or electromagnetic compatibility (EMC) are common measures. Extra protective elements like transient voltage suppression (TVS) diodes are of course an excellent choice but could affect the performance. They are considered additional elements to be placed on board for assembly, which is a source of failure the manufacturer wants to avoid, and of course they add extra cost to the ECU and therefore the car.

All of these possibilities have advantages and disadvantages depending on the specific application, cost pressure, and expertise of the board designer. In the past, automotive suppliers and original equipment manufacturers (OEMs) did not discuss this topic in an effective way. The challenge for the next generation of cars will be to develop the right ESD protection needed at the best price, the most efficient way, and with the highest reliability. Therefore the dialogue between the car manufacturer, the ECU designer, and the semiconductor manufacturer (who has started the discussion of the ESD topic) must be expanded to avoid ESD problems in the field.

Written by Reinhold Gaertner, Infineon Technologies, EOS/ESD Association Board of Directors.