CAN transceivers in automotive applications - interfaces to a harsh environment

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Because of the ever-increasing demand for information exchange in modern vehicles; for example the rain sensor needs to communicate to the dashboard control module, the air conditioning system has to talk to the seat module, the steering assist module wants to exchange information with the vehicle dynamics system, and the door electronics require communication to the vehicle alarm system; conventional parallel interfaces between the various control modules producing a wire harness as thick as your arm are no longer viable from an economic and technical point of view. In order to prevent this, the automotive industry and all European companies have decided to implement data communications using the serial 2-wire CAN (Controller Area Network) bus.

Infineon Technologies AG recognised this trend and soon developed micro controller with an implemented CAN protocol machine on the market.
The "Automotive Power" department at Infineon Technologies AG began development of bus transceivers about 4 years ago. These transceivers are the link between the protocol unit (e.g. the CAN controller) and the physical transmission medium (bus cable).
But more than that, the transceivers have additional tasks.
On the one hand transceiver works as line driver to provide the required current to transmit the message threw the physical network, because in larger networks driver currents up to several tenth mA are required.
Secondly the transceiver has to detect several bus failures (e.g. shorts) as well as interference pulses which can influence the CAN message coming from external sources are masked out to ensure communication (fault tolerant low speed CAN as well as the new high speed CAN transceiver generation).
But the most important task of a bus transceiver is to protect **the** micro controller **against external influences by de-coupling the micro controller from the harsh signals or high voltage spikes which can occur on the bus lines.**

Normal Network Operation

Normal Network Operation means standard usage in typical applications.
Here we find today mainly to different supply voltages in automotive and industrial systems:

12V (14V) Supply 24V(28V) Supply

In both systems the typical bus voltage is according to ISO11898 5V, but due to external influences the bus voltage could be at other values also and than the micro controller would be destroyed if it would be connected direct to the bus lines.

Possible external influences:

1. High Voltage Pulses due to electro magnetic injection (EMI):
   From external sources (e.g. radio sender) the wiring harness could absorb power up to 5W. This leads to voltage pulses on the bus lines in the range of 20 to 30V for several milliseconds. The transceiver now has to reduce the voltage at RxD, TxD to the typical bus voltage of 5V.
   Without the transceiver device, the increased voltage would be direct at the RxD, TxD pins of the micro controller.

2. High Voltage Pulses due to switching noise:
   In this case, high voltage peaks could occur by switching of high current loads, which could be coupled into the CAN bus threw the wiring harness.
   This leads to very short, but also very high pulses up to several kV for just some nanoseconds.