Galvanic-isolated CAN FD transceivers

Analog Devices and Texas Instruments offer galvanic-isolated transceivers for CAN FD networks. These components comply with ISO 11898-2:2016.

Galvanic-isolated transceiver avoid the destroying of micro-controllers with on-chip CAN controllers in systems with high-voltage parts (Source: Adobe Stock)

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In many non-automotive applications with long networks galvanic-isolated transceivers are required. In such long networks, connected devices can have differences in local earth potential. Additionally, different supplies may power the devices. But also in electrical-powered vehicles there is an increasing demand on isolating high-energy components from the low-power ECU (electronic control unit) circuitry. Therefore, in some Classical CAN as well as CAN FD networks bus-signals as well as power-lines needs to be isolated.

This can be achieved by different methods. External optocouplers or transformers are widely in use. In order to reduce the number of physical interface components, semiconductor manufacturers have launched since some years CAN transceivers with on-chip isolation circuitry. Recently, Analog Devices and Texas Instruments have improved their galvanic-isolated CAN transceivers to meet the requirements of ISO 11898-2:2016 regarding the new symmetry parameters. The ISO standard specifies two sets of symmetry parameters. Depending on the network design, you can achieve data-phase bit-rates of 2 Mbit/s respectively 5 Mbit/s or more. If your requirement regarding the temperature range is not challenging, you can run your CAN FD network at bit-rates up to 12 Mbit/s. But temperatures below 0 °C limit the transmission speed in the data-phase dramatically.

Besides the network topology, the cable selection is critical depending on the impedance over the specified temperature range. CiA has released the CiA 601-6 CAN FD cable recommendation. The most suitable topology is a bus-line with very short stubs. The sample-point setting in the data-phase is an important issue to achieve a high bitrate in the data-phase. The CiA 601-3 recommendations give some guidelines for an optimized sample-point setting including the secondary sample-point. The offered galvanic-isolated CAN transceivers conform to the improved set of symmetry parameter set. The products by Analog Devices specify a minimum of 50 ns and maximum of 91,6 ns for the loop-delay symmetry. This is better than what ISO 11898-2:2016 requires (120 ns minimum and 220 ns maximum). The loop-delay symmetry of the Texas Instruments product is typically 150 ns.

Products by Analog Devices

The galvanic-isolated transceiver by Analog Devices employs the iCoupler technology to combine a 2-channel isolator and a transceiver into a single small outline integrated circuit (SOIC) surface-mount package. This technology is based on on-chip dc/dc converters. The launched transceivers (ADM3050E, ADM3055E/57E, and ADM3056E) feature a 5-kV respectively 5,7-kV RMS (rootmeans- spare) bus-signal isolation voltage. They provide the usual protection circuitry for ±40-V on the bus-lines as well as over-temperature and permanent dominant busstates.

The chips also provide an extended common-mode range of ±25 V. The CAN FD connectable devices must add protection against harsh operating environments while also should be as small as possible. To reduce board space and the design effort needed to meet the system-level ESD standards. Therefore, the introduced transceivers provide protection circuitry on chip for the CAN_H and CAN_L pins. Wiring accidently high-voltage to bus-lines is frequently made mistake in production lines. Supplies can also be short-circuited by accidental damage to the cables while the system is operating. Accounting for inductive kickback and switching effects, the bus lines are protected with up to nominal 24-V supplies.

The signal lines can withstand a continuous supply short with respect to GND2 or between the bus lines without damage. In cases, in which the TXD input pin is allowed to float – to prevent bus traffic interruption – the TXD input channel has an internal pull-up to the VDD1 pin. The pull-up holds the transceiver in the recessive state. The transceivers also feature a dominant timeout. A TXD line shorted to ground or malfunctioning CAN controller are examples of how a single-node can indefinitely prevent further bus traffic. The dominant timeout limits how long the transceiver can transmit in the dominant state. When the TXD pin is presented with a logical high, normal TXD functionality is restored.

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