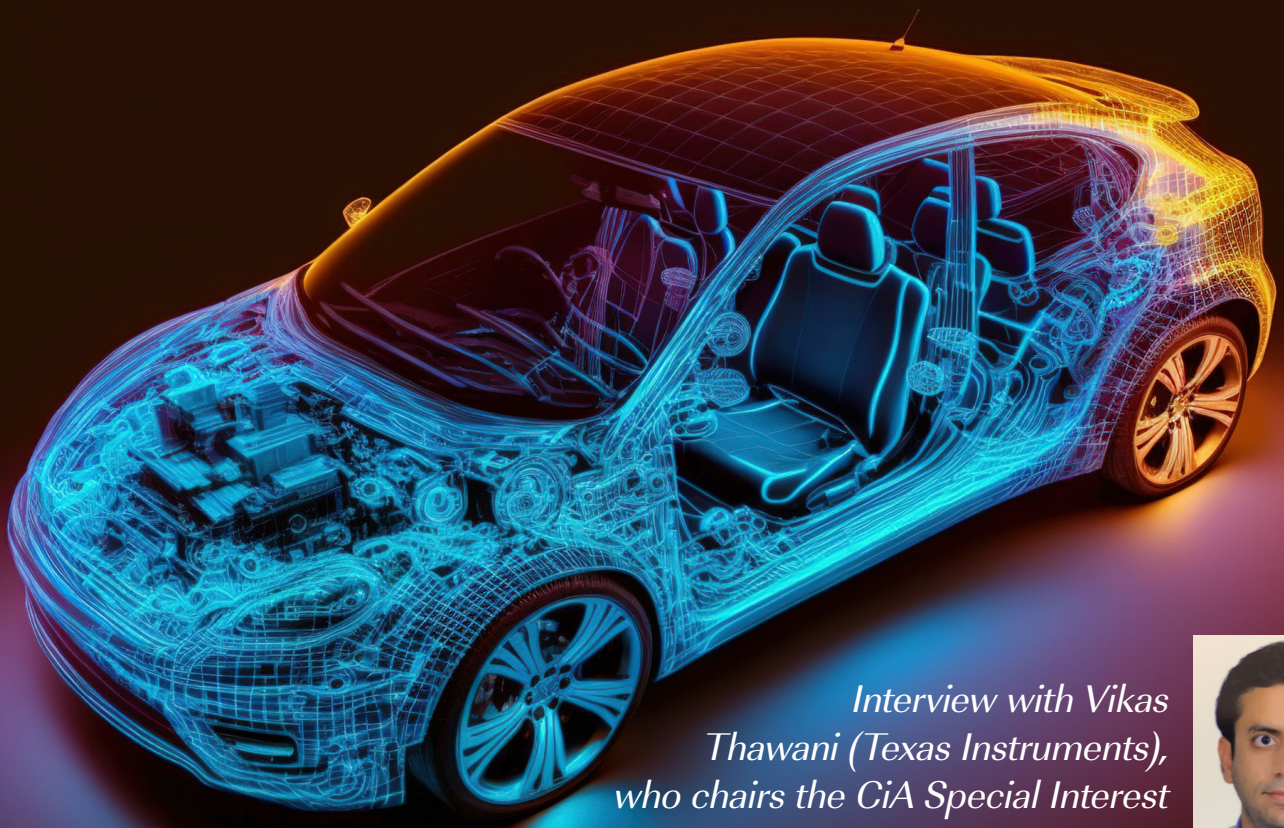
Mixing 3,3-V and 5-V transceivers is possible



Interview with Vikas Thawani (Texas Instruments), who chairs the CiA Special Interest Group (SIG) 3,3-V CAN transceivers. The SIG has been established end of 2023.

Q What are the objectives of the CiA SIG 3,3-V CAN transceiver?

A The ISO 11898-2 CAN physical layer standard, is based on a 5-V main supply for CAN transceivers. In many applications, the micro-controller unit (MCU) supply voltage is 3,3 V, while a CAN transceiver demands a 5-V supply, thus requiring a 5-V low-drop (LDO) regulator. The ability to directly run a CAN transceiver off of the MCU's 3,3-V rail saves printed circuit board space and bill-of-materials cost by eliminating the LDO regulator. The CiA SIG 3,3-V CAN transceivers aims to specify 3,3-V CAN transceivers allowing multiple-end applications to use 3,3-V CAN transceivers.

Q Are 3,3-V CAN transceivers also suitable for automotive applications?

A Yes, 3,3-V CAN transceivers are suitable for automotive applications, especially with vehicle architectures evolving and MCU's moving to 3,3-V inputs and outputs. Texas Instruments (TI) recently released automotive-qualified EMC-certified (IEC 62228-3) 3,3-V CAN FD (flexible data-rate) transceivers, the TCAN3403-Q1 and the TCAN3404-Q1. We believe that these components will be able to meet system-level electromagnetic compatibility (EMC) requirements.

Q But some CAN experts have doubts to meet EMC requirements of the automotive industry, when using 3,3-V CAN transceivers.

A The TCAN3403-Q1 and the TCAN3404-Q1 meet the strict EMC standard governed by IEC 62228-3 under pure 3,3-V network and mixed 3,3-V CAN/5-V CAN two-node conditions. TI is also driving the SIG 3,3-V CAN transceiver and discussing the work needed to alleviate the concerns about 3,3-V CAN transceivers meeting vehicle-level EMC requirements.

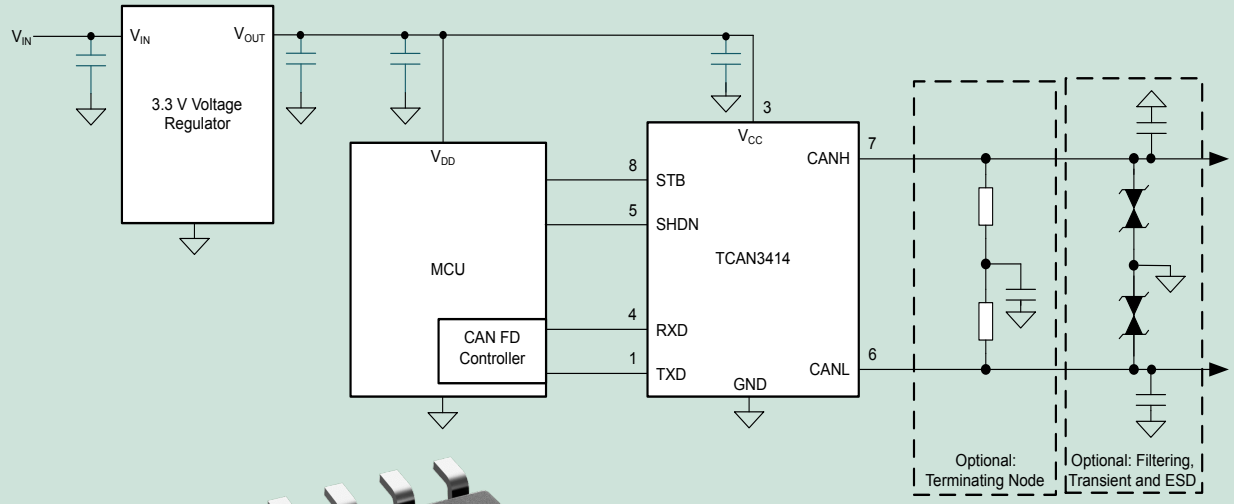
Q TI is already offering 3,3-V CAN transceivers. What is needed to increase the acceptance?

A Most automotive original equipment manufacturers (OEMs) want the component specifications to meet the ISO 11898-2 CAN physical layer standard. But since the current standard does not include specifications for 3,3-V CAN transceivers, market adoption for 3,3-V CAN transceivers has been slow. This led to the formation of a SIG within the CiA, led by TI, to work on 3,3-V CAN transceiver specifications into the standard. Once standardized, market adoption for 3,3-V CAN transceivers in automotive applications will increase.

Q What are the first results regarding the interoperability of 3,3-V and 5-V CAN transceivers within a single network?

A TI tested an eight-node linear bus topology and demonstrated that 3,3-V CAN transceivers do interoperate with 5-V CAN transceivers on the same network. This mixed network performance of bit-width distortion for various combinations of transmitter nodes and receiver nodes in the network is very similar to a pure 5-V CAN transceiver ▷

TCAN3413 and TCAN3414 – 3,3-V transceivers



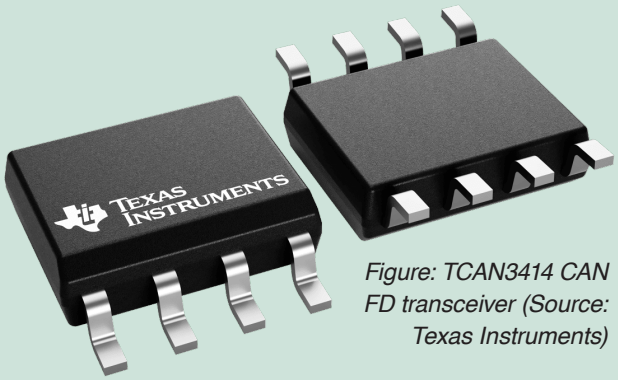


Figure: TCAN3414 CAN FD transceiver (Source: Texas Instruments)

The TCAN3413 and TCAN3414 CAN FD transceivers comply with the physical medium attachment (PMA) sub-layer requirements specified in the ISO 11898-2:2016 standard. They have certified electromagnetic compatibility (EMC) operation for use with CAN CC (classic) and CAN FD networks. The transceivers support bit rates up to 5 Mbit/s; in not challenging network topologies they can run up to 8 Mbit/s. The TCAN3413 includes internal logic level translation through the VIO pin. Allowing the direct interface of the transceiver I/O to 1,8-V, 2,5-V, or 3,3-V logic levels. These components support a low-power standby mode, and a wake-up over CAN, which is compliant with the wake-up pattern (WUP) specified in ISO 11898-2:2016. The transceivers include thermal-shutdown (TSD), TXD-dominant time-out (DTO), supply undervoltage detection, and a ±58-V bus fault protection. The components have a defined fail-safe behavior in supply undervoltage or floating pin scenarios. They are available in SOIC-8, VSON-8, and space-saving small footprint SOT-23 packages.

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network. TI has earlier-generation 3,3-V CAN transceivers, the SN65HVD233/4/5-Q1 components – which designers have used in automotive applications and mixed networks for many years.

Q Which new application fields for 3,3-V CAN transceivers do you expect in non-automotive applications?

A TI had two component families (TCAN330/2/4/7 and SN65HVD233/4/5) of 3,3-V CAN transceivers in the market, and recently released a non-automotive 3,3-V CAN transceiver family that includes the TCAN3413 and the TCAN3414. Existing two generations of 3,3-V CAN transceivers have been extensively used in factory automation, grid infrastructure, building automation, industrial transport, and motor-drive applications.

Q What are the intended applications for 3,3-V CAN transceivers in automotive applications?

A In automotive applications, a 3,3-V CAN transceiver will fit in any electronic control unit (ECU), where currently a 5-V supply rail for the CAN transceiver and 3,3-V supply rail for the MCU are used. Examples include body electronics and advanced driver assistance systems (ADAS).

Q In which direction, TI will improve its current 3,3-V CAN transceivers?

A TI plans to first specify the 3,3-V CAN FD transceiver through the CiA association to drive adoption of automotive 3,3-V CAN FD transceivers, and follow it up with 3,3-V CAN SIC (signal improvement capability) and possibly 3,3-V CAN SIC XL (extended data-field length) transceivers in the future. ◀

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