Interviews with providers: CAN SIC transceivers

(Source: Adobe Stock)

CAN SIC (signal improvement capability) transceivers can be used in Classical CAN, CAN FD, and CAN XL networks, reduce signal ringing, improve achievable bit rates, and provide more design flexibility regarding topology. Four semiconductor manufacturers answered questions about their CAN SIC transceivers.

As new functions have entered the modern vehicles, the need for increased data exchange pushed Classical CAN networking systems beyond their limits. CAN FD enables bit rates from 500 kbit/s up to 5 Mbit/s. Despite the benefits, the CAN FD technology is hindered by the signal ringing stemming from the signal reflection. Considering the network topology, this effectively limits the technology to 2 Mbit/s for many networks, restricting them to highly linear topologies. Thus, wiring harnesses need to avoid long cable stubs, which results in more convoluted harness routes around the vehicle, adding cost and weight.

The CAN SIC technology overcomes these signal integrity issues by actively improving the CAN signal and using of stricter timing. As a result, OEMs (original equipment manufacturers) can encounter more freedom in the design of their networks and on the location of ECUs (electronic control unit). Associated benefits include shorter cables, less weight, and fewer connectors. The SIC technology also enables bit rates higher than 5 Mbit/s on multi-node networks. Thus, CAN FD is expected to support a higher range of applications at a relatively low-cost point.

The CAN SIC transceivers are specified in the CiA 601-4 document developed by CAN in Automation (CiA) members. There are two implementations available: one suppresses the ringing when transmitting; the other filters the ringing when receiving. CiA 601-4 also specifies additional requirements for HS-PMA (high-speed physical media attachment) implementations compliant with ISO 11898-1:2015 and ISO 11898-2:2016. These aim to reduce differential and common-mode ringing on the CAN_H and CAN_L wires, especially for the transition from the dominant to recessive state. The HS-PMA implementations with additional signal improvement functionalities support communication in the presence of defined unterminated wire stubs without requiring configuration, for example the bit-rate settings. Furthermore, CiA 601-4 specifies the EMC (electromagnetic compatibility) tests for HS-PMA implementations with additional signal improvement functionalities.

Provider interviews

Teun Hulmann (NXP), Johann Pries (Infineon), and Wes Ray (Texas Instruments) answered five questions about the availability and features of their CAN SIC transceivers.

Teun Hulman (NXP)

Johan Pries (Infineon)

Wes Ray (Texas Instruments)

Q Has your company CAN SIC (signal improvement capability) transceivers in its portfolio? If yes, how many and how are these named?

Teun Hulman: NXP has released its first CAN SIC transceiver family for mass production in 2020. In the meantime, the TJA146x has been widely adopted among OEMs and Tier1s and is the first CAN SIC transceiver to be on the road in a vehicle.

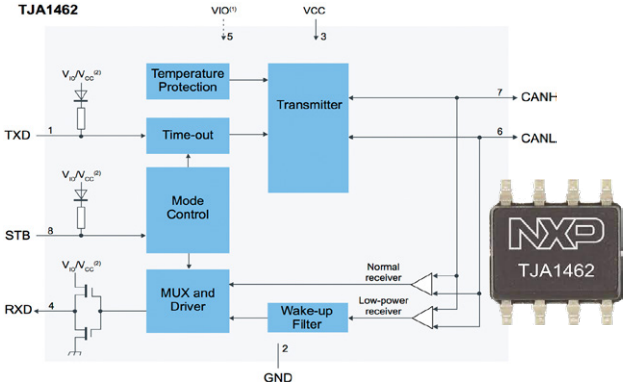

Figure 1: The TJA1462 transceivers are available in SO8 package (Source: NXP)

Product	Low-power mode	Vio pin (3,3 V to 5 V)	Package	Automotive grade
TJA1462AT(K)	Stand-by	Yes	SO8 (HVSON8)	Grade 1
TJA1462BT(K)	Stand-by	No	SO8 (HVSON8)	Grade 1
TJA1463AT(K)	Sleep	Yes	SO14 (HVSON14)	Grade 1
TJR1462AT(K)	Stand-by	Yes	SO8 (HVSON8)	Grade 0
TJR1462BT(K)	Stand-by	No	SO8 (HVSON8)	Grade 0
TJR1463AT(K)	Sleep	Yes	SO14 (HVSON14)	Grade 0

Table 1: NXP's CAN SIC transceivers with features (Source: NXP)

The family as shown in Table 1 is the first wave of NXP's CAN SIC components, combining a strong signal improvement technology with reliable performance. It consists of two stand-by transceivers and a sleep-mode transceiver, plus variants supporting higher temperature Grade-0 applications. NXP is currently expanding its portfolio, having multiple CAN SIC products with additional features in development.

Johan Pries: These are the TLE9371SJ and TLE9371VSJ transceivers.

Wes Ray: Yes, we have both 8-pin (TCAN1462-Q1) and 14-pin (TCAN1463-Q1) standard CAN SIC transceivers available today via our website. A dual CAN SIC device (TCAN1466-Q1) will sample soon. TI continues to invest in additional CAN SIC products with more news on that subject coming soon. TI also wrote a technical white paper about the signal improvement capability of CAN FD transceivers.

Figure 2: The TLE9371SJ transceivers are available in DSO-8 package (Source: Infineon)

Q Which maximal bit rate is achievable with the corresponding SIC transceiver? Are there some-features, which are not offered by other providers?

Teun Hulman: An extension of the maximum bit rate of CAN FD transceivers has been claimed in the past, even with the possibility of going up to 8 Mbit/s with standard CAN FD devices. For CAN FD transceivers, which are only fulfilling the bit timing requirements of ISO 11898-2:2016 standard, the speed limit is essentially 5 Mbit/s in a point-to-point link (a discussion of this has been published in an earlier CAN Newsletter article).

The TJA146x CAN SIC family improves upon the bit timing performance – tightening it significantly – and with this, it guarantees bit rates up to 8 Mbit/s under all worst cases conditions. This does not take into account topology effects, which are a separate factor for the achievable bit rate.

The TJA146x CAN SIC transceivers are fully compliant to the CiA 601-4 specification and all CAN SIC related compliance tests, such as C&S IOPT Test and IBEE Zwickau CAN SIC EMC test. Furthermore, NXP includes full CAN FD backwards compatibility by fully guaranteeing all aspects of the CAN FD protocol arbitration and error frame detection under all circum-stances, including during SIC phases like active recessive.

Johan Pries: Up to 8 Mbit/s.

Wes Ray: Support up to 8 Mbit/s. We offer the world's smallest, automotive CAN FD and CAN SIC devices with our SOT packaging. Customers can retain the device package leads and retain smaller footprints than VSON packaging.

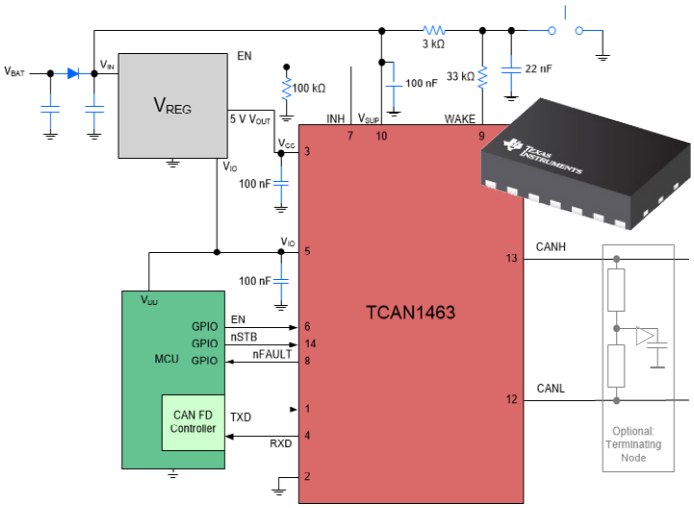

Figure 3: Simplified schematics of the 14-pin TCAN1463-Q1 transceivers (Source: Texas Instruments)

Q The SIC transceiver features are specified in the CiA 601-4. Does your company require some improvements of the specification?

Teun Hulman: With CAN SIC being more and more adopted into the market, there might be a need for a standardized definition of how to conduct a topology assessment. This would support network owners in having a unified approach and common reference to make sure their networks can operate reliably, also in mixed-vendor networks.

Johan Pries: No.

Wes Ray: Not at this time. However, we are closely monitoring global OEM adoption and testing requirements and may request updates as adoption progresses globally.

Q CAN in Automation (CiA) organizes plugfests to test CAN components and devices as well as their interoperability. Is there a need to test the CAN SIC transceiver features?

Teun Hulman: It is important for CAN SIC solutions to ensure full compatibility with the CAN FD protocol. As a result, all arbitration and error handling scenarios need to be fulfilled under all conditions, not only on a single-device level, but also in a mixed-vendor network. Plugfests would be a good opportunity to test compatibility of CAN SIC devices to the CAN FD protocol, such as arbitration and error handling.

These tests could be combined with worst-case timing criteria, which would also be able to give insight into topology effects. However, this will not replace the need for topology simulations, able to show worst case corner-case effects, to provide conclusions about achievable bit rate and signal integrity in real topologies.

Johan Pries: No, we see no need for this. It is covered by the C&S IOPT test.

Wes Ray: The standard C&S IOPT and emissions testing is sufficient for OEM / Tier 1 use in our opinion; however, we understand the value and encourage them and we will always support plugfests if we can.

Q Does your company plan to provide CAN SIC XL transceivers? If yes, when are they to expect?

Teun Hulman: NXP has developed its first proof of concept silicon for a CAN SIC XL transceiver. This transceiver was first showcased at the CiA plugfest in 2021, demonstrating CAN XL bit rates up to 20 Mbit/s in complex networks.

Companies background

NXP: The global semiconductor company creates solutions enabling secure connections for a smarter world. Headquartered in Netherlands, the round 29 000-employees team works on technologies for automotive connectivity and electrification, 5G edge computing, Industry 4.0, safely-connected lifestyles, smart cities, and smart homes. The company's history started as Motorola semiconductor development group (USA) in 1949. Rebranded to Philips in 1991, it developed its first CAN/LIN transceiver for in-vehicle networking. This year, the manufacturer celebrates 15 years as NXP.

Infineon: The Germany-based, worldwide semiconductor provider was founded in 1999, when the semiconductor operations of its parent company Siemens were spun off. In April 2020 the manufacturer bought Cypress Semiconductor (USA). With 56 R&D (research and development) locations and 20 manufacturing sites worldwide, Infineon employs circa 50 280 people around the globe. The company aims to make life easier, safer, and greener by linking the real world to the digital one. Thus, it develops solutions for efficient energy management, smart mobility, and secure, seamless communications.

Texas Instruments: Founded in Dallas (Texas, USA) the company designing, manufacturing, testing, and selling analog and embedded semiconductors claims to have been a pioneer in the transition of the world from vacuum tubes to transistors and then to integrated circuits (ICs). It engages about 31 000 people in the 15 manufacturing locations worldwide. The goal is to create a better world by making electronics more affordable through semiconductors. The provider's semiconductors should help their customers to create applications for industrial, automotive, personal electronics, communications equipment, and enterprise systems markets. of

NXP's CAN XL transceiver is currently in development and more details can be made available for customers on request.

Johan Pries: It is planned, yes, but we have no expected date.

Wes Ray: Yes, TI is investing in both CAN FD SIC and CAN XL technologies. Our development for CAN XL is active. TI will continue to monitor the market needs for this next generation technology and will develop our CAN XL portfolio accordingly. More detailed information can be provided to customers upon request. ◀

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