Case Study

ROHM Develops Additional Product Families to Promote CXPI Leveraging Keysight's CXPI Bus Analyzer for Design Evaluation

LIN is more widely used in automobile bodies to control side mirrors, electric seats, door locks, etc. because it is less expensive and fast enough for such applications, which do not require such high reliability and quick responses as CAN can offer. On the contrary, point-to-point communication through wire harnesses is still used for HMIs (human-machine interfaces) to control windshield wipers, lights, and steering wheel switches, which need instant responses, because LIN is too poor in its response time and reliability to realize multiplex communication.

The Society of Automotive Engineers of Japan, Inc. (JSAE) established the CXPI (Clock Extension Peripheral Interface) standard to solve LIN's issues. The JSAE aims to make CXPI an international standard by having it reviewed by the SAE (Society of Automotive Engineers) and ISO (International Organization for Standardization). The standard improves response time and reliability to allow multiplex communication with HMIs, aiming to further reduce automobile weight by reducing the weight of wire harnesses, and consequently lowering fuel consumption.

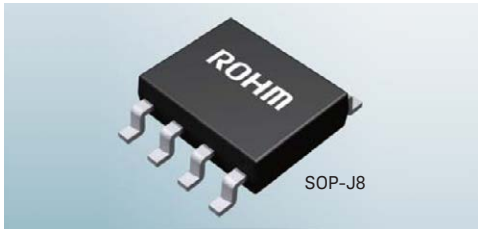
In September 2015, ROHM Co., Ltd. (ROHM) announced the industry's first CXPI transceiver IC, the BD41000FJ-C (Figure 1). ROHM has been proactively developing derived products by taking advantage of the launch of its transceiver ICs ahead of those of its competitors. Keysight's CXPI bus analyzer played an active role in supporting ROHM in its design evaluations. We interviewed ROHM representatives on their efforts made to popularize CXPI and the benefits of using CXPI bus analyzers.

The goal is to "promptly launch the product families that will propel the popularization of the CXPI standard"

Today, a Tier 1 company needs to procure necessary components such as transceivers, microcontrollers, and power circuits individually and design ECUs on its own when adopting CXPI, which cost more to design and might create psychological barriers.

ROHM has already commercialized transceiver ICs, which is one of ROHM's advantages. ROHM aims to make it easy for Tier 1 companies to develop products, and contribute to the market's adoption of CXPI by promptly launching products that have built-in components such as microcontrollers, power supply circuits, intelligent power devices (IPDs), and motor drivers.

For example, CXPI communication involves a master and slave, each of which comprises a transceiver, microcontroller, and other necessary components. According to the basic concepts of CXPI, CXPI may not need a microcontroller if the slave has the transceiver handle some key communication processes. Removing microcontrollers from slaves can reduce the number of components in a module, which should lower the hurdle for Tier 1 companies and other companies to adopt CXPI.



[Features]

- Compliant with CXPI standard
- BAT pin: 40 V
- BUS pin: -27 V to 40 V IEC 61000-4-2 (150 pF / 330 Ω): ±8 kV
- Low standby power consumption in sleep mode: Typ. 3 µA
- Master/slave switching function
- Transmit data (TXD) dominant time-out function
- Communication speed: 20 kbps (max.)
- Various built-in fail-safe functions
- Package: SOP-J8 (JEDEC standard)

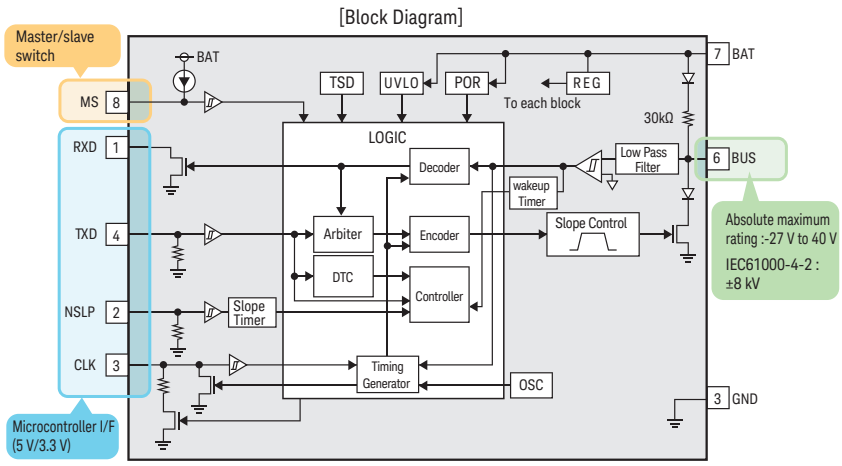


Figure 1. Industry's first CXPI transceiver IC, BD41000FJ-C and its features (courtesy of ROHM)

KEYSIGHT TECHNOLOGIES

The integrity of the design evaluation environment is the key to high reliability and prompt product launch

When actualizing a transceiver that has no microcontroller, verification of the communication functions built into the transceiver is required to confirm that the slave appropriately responds to signals from a master. In addition to verification during normal operation, it is essential to test error handling in case of unexpected communications, and a representative of ROHM (all quotes below are from representatives of ROHM) said of this, "It is a hard task that accounts for 80 to 90% of all the verification work."

"Sometimes, it takes almost a week to just go through all the test patterns," because hundreds of error patterns are to be tested. It is necessary, however, for ROHM, the leading company in the CXPI market, to ensure high reliability, and it is also essential in popularizing the CXPI standard. Also, the specifications are sometimes revised and changed even while development is going on. Therefore, "it is important to be able to establish an efficient work environment because the verification process has to completely restart if even just one line of code is edited."

ROHM faced an even harder challenge, due to the fact that proper evaluation of designs required that the master should send an appropriate error signal in terms of the communication protocol and that the associated time-domain waveform should also be appropriate. Monitoring both the protocol and time-domain waveforms can ensure that the evaluation of designs is conducted using appropriate error patterns.

Unfortunately, however, there was no way to confirm the transmission of an appropriate error signal by monitoring the transmitted signals in real time. "In order to confirm that the signals for evaluation sent to the slave are correct, there are only two choices, namely, manually analyzing the log data, or reading binary data through the time-domain waveforms randomly captured with a general-purpose oscilloscope. It takes hours sometimes, and our productivity is terribly low."

Keysight's CXPI bus analyzer ensures appropriateness and streamlines design evaluation

To achieve both high reliability and prompt product launch, ROHM chose Keysight's InfiniiVision oscilloscope-based CXPI bus analyzer (Figure 2). "We could not have ensured an efficient, appropriate design evaluation environment without Keysight's oscilloscope with the CXPI protocol analysis function built in."

"Its capability of triggering on specific errors or specific frames under the protocol makes it easy to check whether the master is sending an appropriate error signal." Also, "the bus analyzer can trigger a signal based on a specific protocol message, and check the message along with the corresponding time-domain waveform." The bus analyzer makes it possible to check the appropriateness of the signals for evaluation in real time and ensure their appropriateness.

The same analyzer can confirm the appropriateness of slave responses, which is one of the primary test items. "Such items include the protocol / time-domain waveforms of the signals between a master and slave, and time-domain waveforms between a slave IC and external devices. We would like to check timing correlations after synchronizing timing when a digital I/F is built in, in the future." This test environment ensures the robustness of the evaluation system and allows users to perform design verification using a very large number of test patterns, which increases productivity.

Additional comments: "The Zone Trigger function, which shows the waveforms of signals that go through a specific area (zone) on the display or those that don't, is also useful for CXPI signal analysis." "When we developed the transceiver, we had no tool to capture the faulty waveforms that intermittently occurred, and therefore we couldn't understand what was happening. The Zone Trigger function would have been very useful."

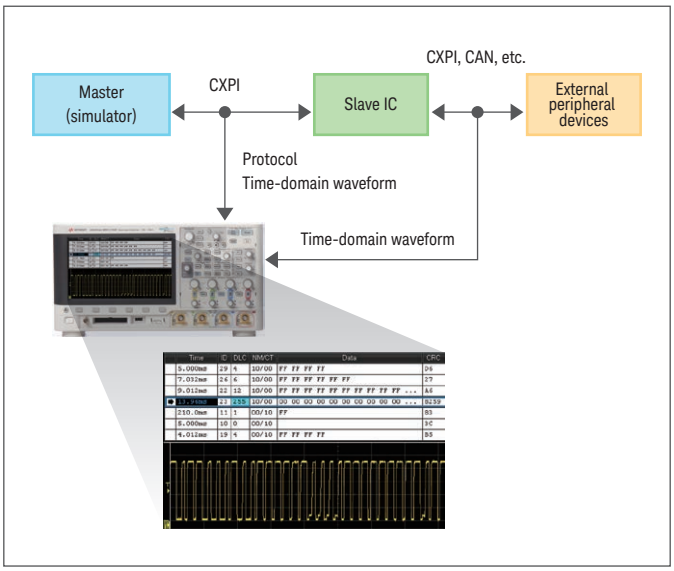


Figure 2. Design verification system for master-slave communication with a CXPI bus analyzer using the InfiniiVision 3000T X-series oscilloscope

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