Application Brief

System Basis Chips (SBCs) 101: A Beginner's Guide to CAN and LIN SBCs

Leo Smith

Introduction

A system-basis chip (SBC), in the simplest form, is a semiconductor that integrates Controller Area Network (CAN) or Local Interconnect Network (LIN) transceivers with power-management elements. A power-management element can be a low-dropout regulator (LDO), a DC/DC converter, or both.

An SBC can help reduce the elements and transceiver footprint, especially when an application requires additional power or has layout constraints. TI SBCs can also reduce energy consumption in a system, which extends battery life and reduces power dissipation.

Before discussing SBCs, this document discusses CAN or LIN transceivers. Both transceivers are bus interfaces that provide communication between various nodes across a cable for the respective technologies. The transceiver takes single-ended information from processor A and converts the information to a differential signal that is transmitted across a cable. The receiving transceiver takes the differential signal, converts the information back to single ended, and sends the information to processor B for further action.

Although there are basic CAN and LIN transceivers on the market, it is possible to enhance the transceivers by increasing protection while reducing design complexity, space and cost. These features can often include bus-fault protection, electrostatic discharge protection, and the ability to send and receive data to the processor through a 1.8V to 3.3V or 5V input/output (also known as V_{IO}).

For automotive and industrial designers, the high level of integration and increased reliability of SBCs enable lighter and lower-cost designs for any system that uses CAN or LIN, and a voltage regulator.

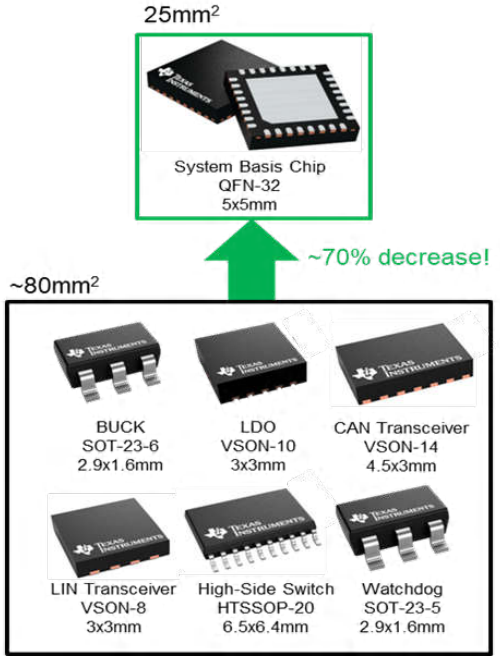

Figure 1. Size comparison of Integrated SBC Blocks

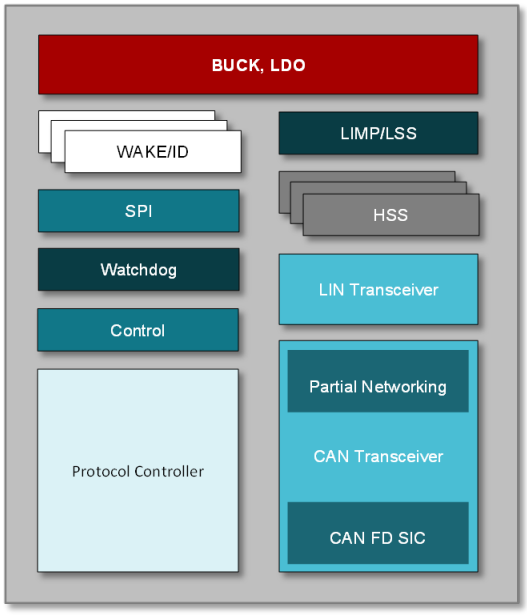

Figure 2. Generic SBC Block Diagram

There are three main categories of SBCs, based on the level of integration:

- **General-purpose** SBCs include a CAN or LIN transceiver and a low dropout regular (LDO) to power other components in the system. This type of SBC can also include Serial Peripheral Interface (SPI) or pin control for configuration from the host processor or microcontroller. Other features included can be a base Watchdog timer and a WAKE pin. (see Wake Up Methods for CAN SBCs)
- **Mid-range** SBCs integrate more features to further reduce the PCB size. These features include power regulators, high-side switches, additional WAKE pins, a LIMP pin and a configurable Watchdog timer. Mid-range SBCs have a CAN or LIN transceiver or a combination of both, as well as the ability to add additional CAN or LIN tranceiver devices via TI's channel expansion feature. (see Application Note: "Increasing CAN/LIN Channels using Channel Expansion) The power regulators include DC/DC BUCK converters or LDOs (or both) that can each individually support ≥ 100mA.
- **Advanced** SBCs offer special system functionalities that can upgrade an existing design. These SBCs have a CAN transceiver and power regulators. But this also integrates a SPI controller, CAN controller, Inter-Integrated Circuit (I2C) controller, or General-Purpose Input Output (GPIO) controller into the same SBC package to give the user more flexibility to communicate from various low voltage protocols to the CAN bus.

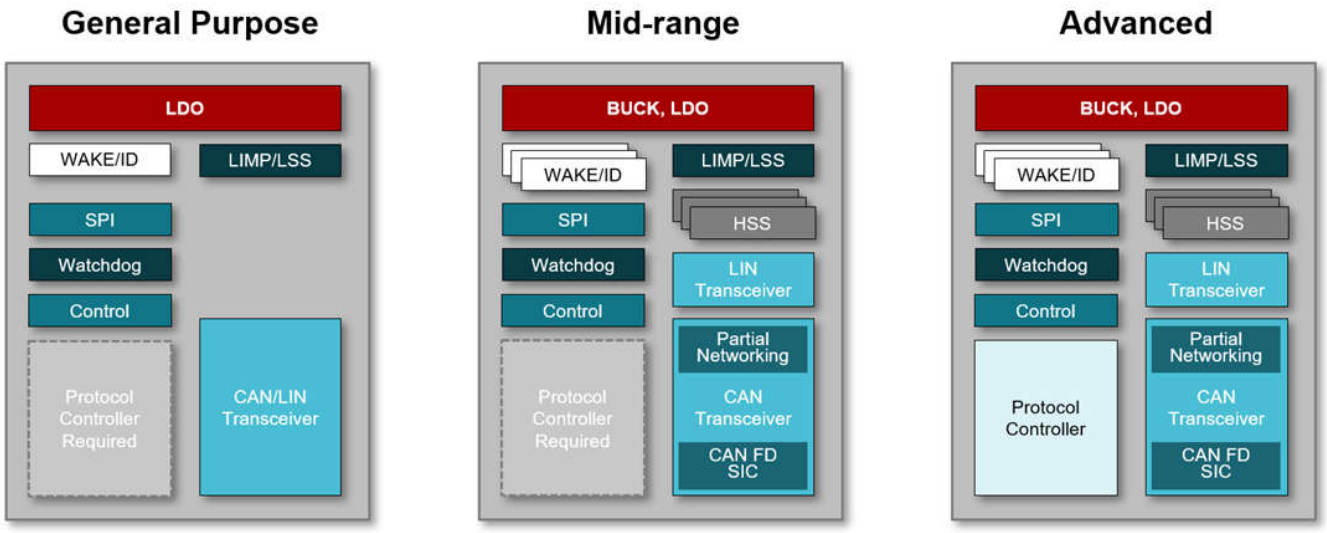

Figure 3. Generic SBC Categories

Additional Considerations

- Texas Instruments, *Featured System Basis Chips (SBCs)*, selection guide.
- Texas Instruments, *Understanding LDO Performance in the TCAN4550-Q1*, application note.
- Texas Instruments, *Wake Up Methods for CAN SBCs*, application note.
- Texas Instruments, *Increasing CAN/LIN Channels using Channel Expansion*, application note.
- Texas Instruments, *Explore the Non-Speed-Related Benefits of CAN FD*, technical article.
- Texas Instruments, *CAN, LIN, & SBC Overview Videos*, video series.

Trademarks

All trademarks are the property of their respective owners.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale, TI’s General Quality Guidelines, or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Last updated 10/2025