

Enhancing Wireless Bluetooth Communication for Smart Meters with Multiplexers



In today's rapidly evolving Internet of Things (IoT) landscape, the ability for clients and business operators to send and receive information remotely is essential. Smart meters equipped with Bluetooth® connectivity allow owners, customers, and operators to exchange information with heating, gas, water, and electric meters without needing a physical connection. Integrating Bluetooth technology into smart meter designs enables real-time monitoring of energy usage, analysis of historical data to identify trends, and remote access to information and alerts through mobile devices like smart phones.

To facilitate efficient communication among various devices in a smart meter design, the UART (Universal Asynchronous Receiver-Transmitter) protocol is a commonly used standard for data transmission. UART popularity stems from the simplicity, low cost, ease of integration, and low energy consumption. However, challenges can arise when designing smart meter systems that require affordable designs. Using a smart meter microcontroller (MCU) with multiple UART communication ports can be expensive and complicate the design.

A cost-effective method for expanding a single UART port on a microcontroller (MCU) is to use an analog multiplexer. A 2:1 multiplexer facilitates UART data communication between the MCU of a smart meter and an optical transceiver module, while also enabling direct communication with UART Bluetooth devices, such as the CC2340BLE. System designers and operators can leverage the control logic of the 2:1 multiplexer to switch the MCU UART port between the optical transceiver module and a Bluetooth device like the CC2340BLE. This design enhances the functionality of smart meter systems by incorporating wireless Bluetooth communication technology, while also simplifying the overall system design and reducing costs.

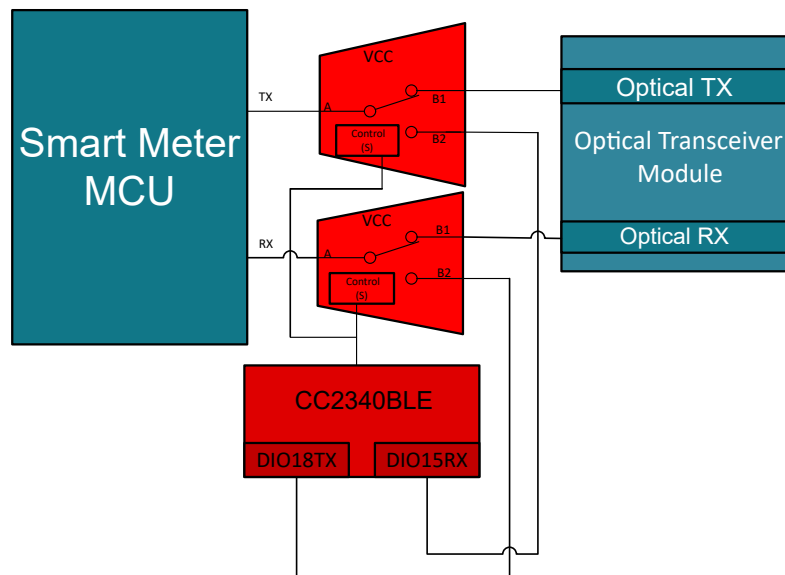


Figure 1. Expanding UART Port of Smart Meter MCU Using Two 2:1 Multiplexers

Design Considerations

- UART is a communication method that uses two wires: one for transmitting data (the transmitter) and the other for receiving data (the receiver). As a result, designers can use either two 1-channel multiplexers or one 2-channel multiplexer and if a single UART device needs to communicate with two other UART devices, designers require 2:1 multiplexers to manage the connections effectively.
- UART voltage levels on the MCU side are 3.3V and 5V. Designers must select multiplexers rated to operate at these voltage levels.
- UART data rates can reach a maximum of approximately 5Mbps. Therefore, multiplexers with a bandwidth of at least 15MHz must be able to pass the data without any issues. The majority of TI's analog switch and multiplexer portfolio surpasses the 15MHz bandwidth specification.

Table 1. Table Needs a Title

Part Number	VCC Range (V)	Configuration	Bandwidth(MHz)
SN74LVC1G3157	1.65 to 5.5	2:1 1-channel	340
TMUX1219	1.08 to 5.5	2:1 1-channel	250
TS5A23157	1.8 to 5.5	2:1 2-channel	220

References

- Texas Instruments: [UART over Bluetooth® Low Energy demo](#)
- Texas Instruments: [What Analog Switch/Multiplexer should I use for UART Applications? \[FAQ\]](#)

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