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MAXLINEAR

Signaling Common Mode Voltage Operating Range

Application Note

Introduction

RS-485 is a standard for serial communication used in industrial and commercial applications due to its robustness and ability to communicate over long distances. One of the key aspects of RS-485 communication is the handling of common mode voltage

RS-485 Differential Signaling

RS-485 employs differential signaling, meaning that only the voltage difference between the VA and VB lines conveys the information. The common mode or absolute voltage of the wires is disregarded, which provides RS-485 with strong immunity to most noisy electromagnetic interference.

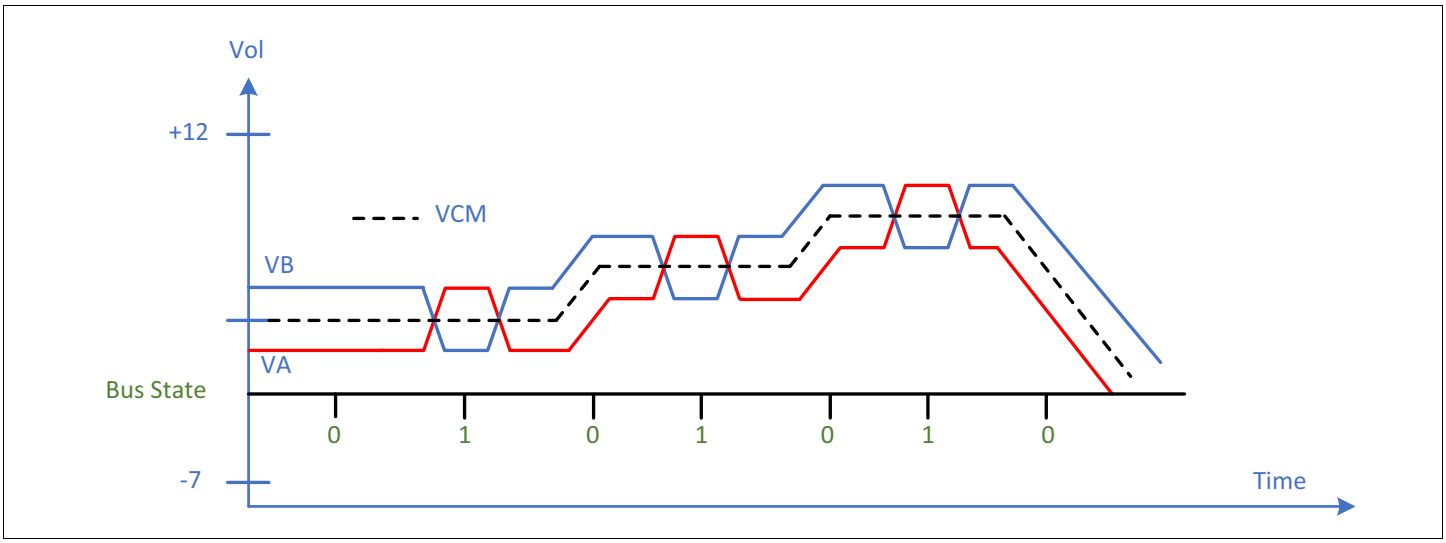

Figure 1: RS-485 Differential Signaling

Common Mode Voltage and Offset

Common mode voltage refers to the voltage level present on both the positive (A) and negative (B) lines of a differential pair relative to a common reference point, typically ground. In RS-485 communication, this common mode voltage is crucial as it can impact the reliability and integrity of data transmission. Common mode offset, on the other hand, can occur due to nearby equipment with high current transients (such as electric motors or welding tools) or improper grounding practices, causing deviations between the sending and receiving nodes. Despite these variations in common mode voltage, RS-485 drivers and receivers must be capable of accurately transmitting and receiving differential signals

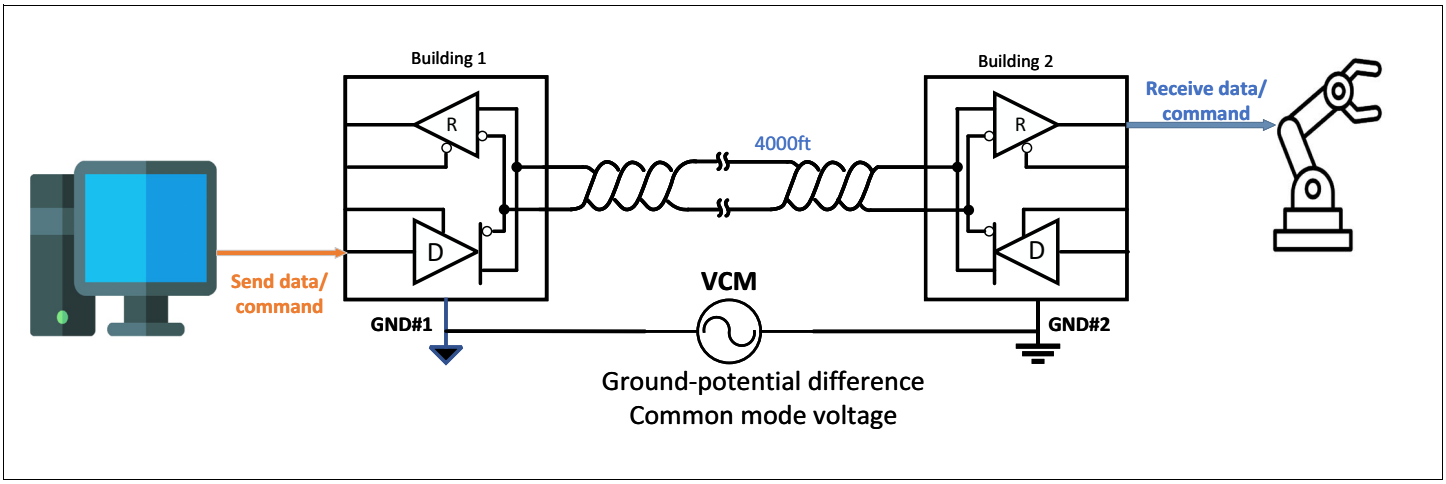

Figure 2: Common Mode Voltage and Offset

Driver and Receiver Design for Common Mode Offset

In the driver side, the driver is designed to generate a symmetrical difference output signal (1.5V) between VA and VB even when the network has an offset voltage.

In the receiver side, the receiver needs to detect the voltage difference between A and B when both lines are offset from the local supply rails.

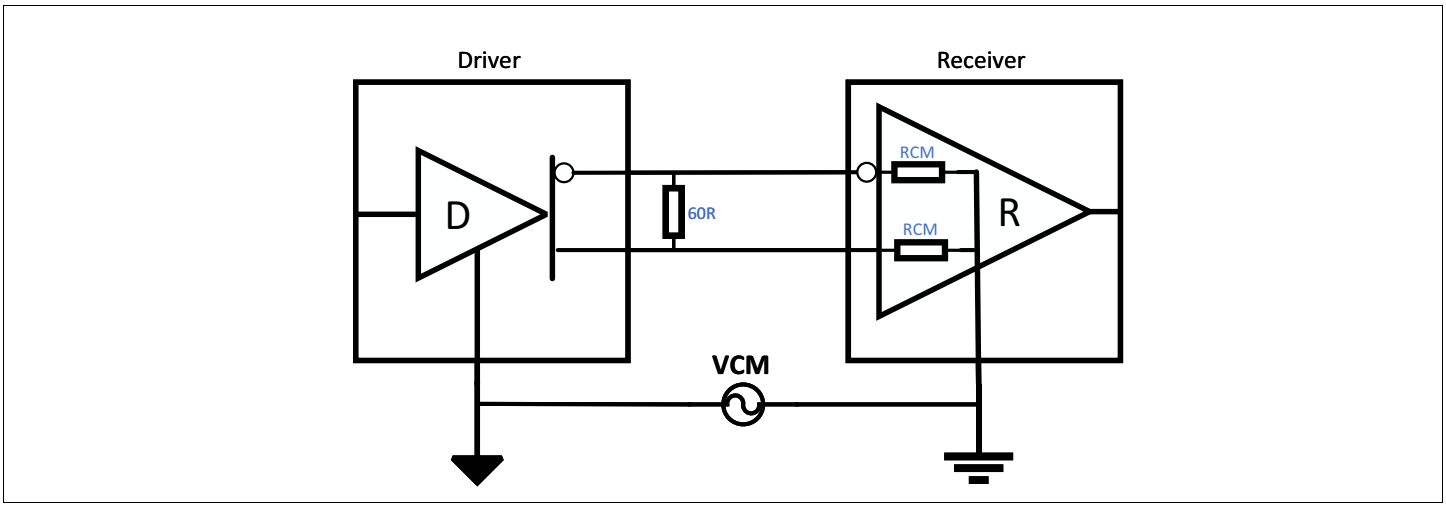

Figure 3: Driver and Receiver Design for Common Mode Offset

Common Mode Voltage Range

However, there are limits to the common mode voltage range that transceivers can handle while still operating effectively. The RS-485 standard specifies a common mode voltage range from -7V to +12V. All MaxLinear RS-485 transceivers are designed to operate within this range for both driver and receiver functions. Additionally, MaxLinear offers several models with an extended operational range from -15V to +15V, and -20V to +20V for more demanding conditions. For further details, visit the MaxLinear website.

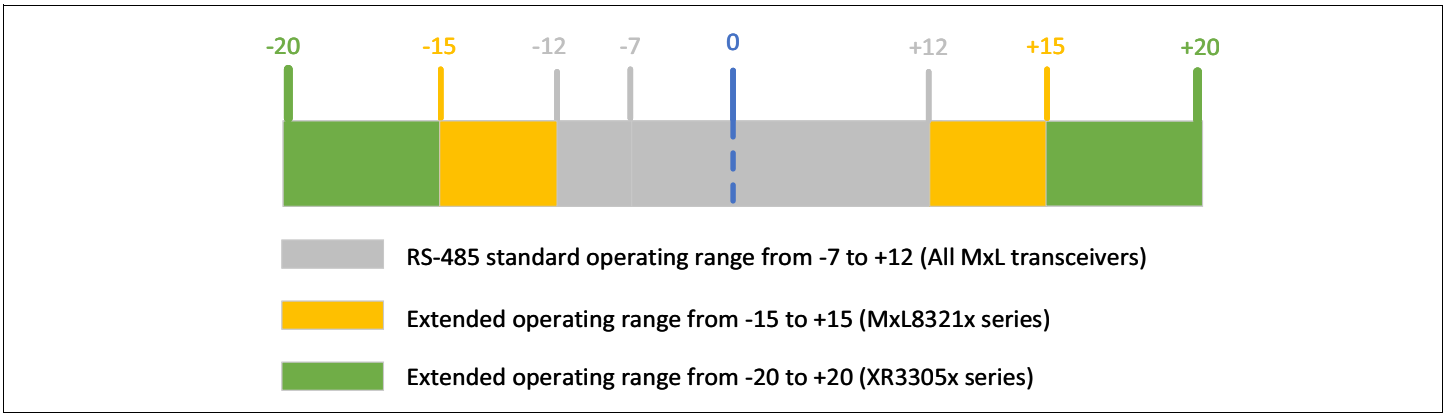

Figure 4: Common Mode Voltage Range

Conclusions

Understanding and managing common mode voltage is essential for reliable RS-485 communication. Adhering to the specified voltage ranges and choosing the most appropriate transceiver ensure robust and accurate data transmission. Maxlinear offers wide range of transceivers with both standard and extended common mode voltage specifications, allowing you to select the best option for your specific application needs.

MaxLinear, Inc.
5966 La Place Court, Suite 100
Carlsbad, CA 92008
Tel.:+1 (760) 692-0711
Fax: +1 (760) 444-8598

www.maxlinear.com