How to Isolate the RS-485 System

1 Introduction

The RS-485 standard communication is established 20 years ago by Telecommunication Industry Association (TIA) and Electronic Industry Association (EIA), has been widely adopted and applied in a variety of programs. The RS-485 can communicate reliably over 1000 meters because it uses twisted-pair structure to send differential signals.

Those are suitable for motor control, factory automation, power grid infrastructure and other high voltage and low voltage need to isolate the nodes of the RS-485 system. Isolating the RS-485 system can protect the circuit and the operator. Isolating the RS-485 system can prevent the noise generated by the ground loop from affecting communication, thus preventing interference with the RS-485 bus communication. This article provides different solutions for different RS-485 nodes and provides use schemes.

2 Signal Isolation

There are usually two ways to isolate the RS-485 system. The first is a digital isolator and RS-485 transceiver solution. In this solution, enable (RE, DE), transmit (D) and receive (R) signals are isolated by digital isolators, such as the CA-IS3741 device between MCU and RS-485 transceiver. Fig. 1 shows an example of a solution using the CA-IS3741 device and RS-485 transceiver. The advantage of this split solution is the flexibility to choose the best transceiver for application. However, because this is a multi-chip scheme, the external circuit requirements are higher, and the PCB board requires a larger space.

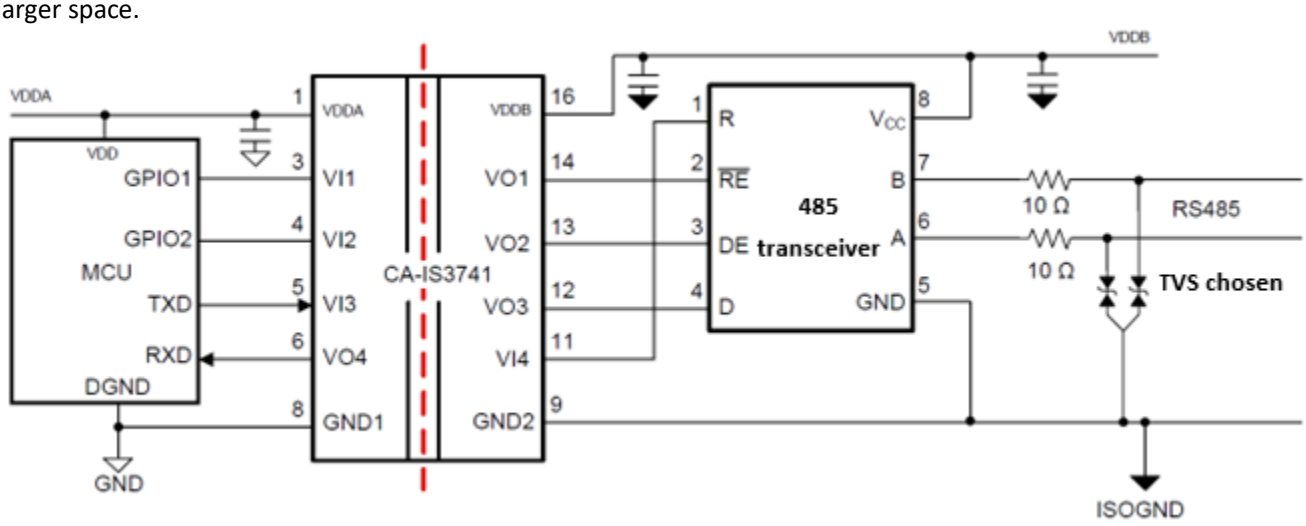

Fig. 1 CA-IS3741+RS-485 Transceiver Solution

The second is to use an integration solution that integrates digital isolator and RS-485 transceiver together. The CA-IS3082WE device is a half-duplex RS-485 interface isolation chip. Compliant with TIA/EIA-485-A standard, the CA-IS3082WE device is a highly reliable isolated half-duplex RS-485 transceiver with high electromagnetic immunity and low radiation characteristics. The CA-IS3082WE device has a fail-safe function, in the receiving state, if the input is open or short-circuited, the receiver side outputs low level. The high insulation capability helps prevent noise and surges from the data bus or other circuits from entering the local ground, and thus interfering with or damaging sensitive circuits. High CMTI capability is expected to ensure correct transmission of digital signals. The CA-IS3082WE device is packaged in 16-pin widebody SOIC package and supports insulated voltage withstand up to 2.5kV$_{RMS}$. The advantage of this solution is that it requires less PCB space and less peripheral circuitry. Fig. 2 shows the application circuit of the RS-485 integrated isolation scheme CA-IS3082. See the specification for more information.

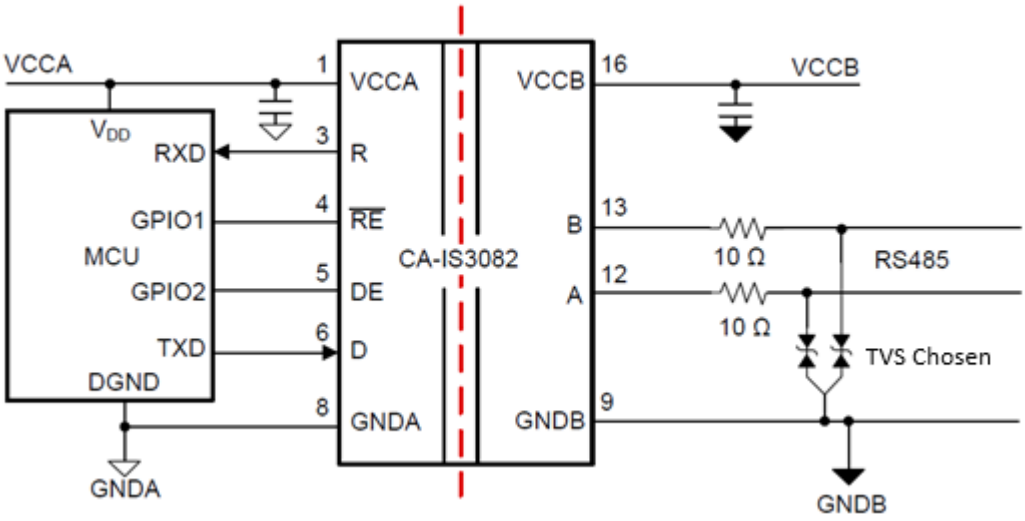

Fig. 2 CA-IS3082WE Solution

3 RS485 Isolation with Power Supply

The two isolation solutions described above both require an isolated power to supply. The isolation scheme of CA-IS3092 integrates the isolation power supply and interface isolation chip together. The CA-IS3092W device is an isolated RS-485 transceiver with integrated isolated power supply, featuring high electromagnetic immunity and low radiation characteristics. The mode is half-duplex. The high insulation capability helps prevent noise and surges from the data bus or other circuits from entering the local ground, and thus interfering with or damaging sensitive circuits. High CMTI capability ensures correct transmission of digital signals. The CA-IS3092W solution has the advantage of eliminating isolation power supply and reducing PCB board size, making it easier for applications to pass safety certification.

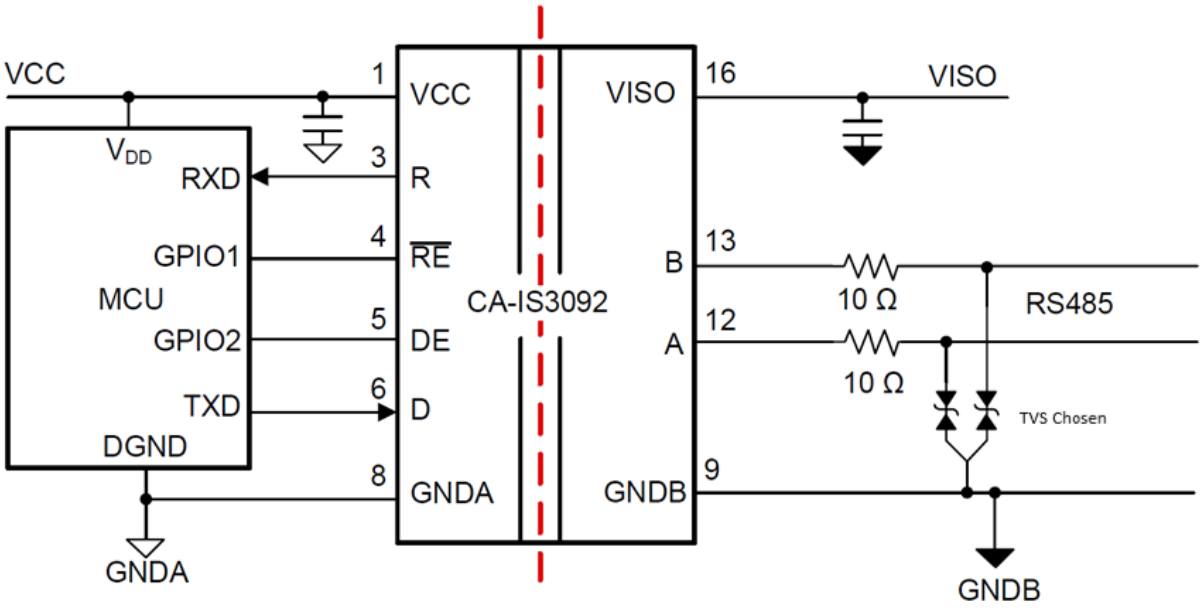

Fig. 3 CA-IS3092W Isolation Solution Recommended Circuit

4 Conclusion

There are many RS-485 isolation solutions and the specific selection can be made according to the actual use. The use of the CA-IS3741+RS-485 transceiver solution can flexibly choose RS-485 transceiver, the CA-IS3082WE solution requires fewer peripherals to achieve RS-485 isolation with higher reliability. The CA-IS3092W isolation solution integrates the isolation power supply and has a maximum power output capability of 0.5W, providing a more convenient option for RS-485 isolation.

5 Version Information

Version	Date	State Description
Ver1.0	Apr. 2022	Initial version

6 Important Statement

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