How to Build the Isolated RS485/RS422 Solution

1 Introduction

The RS485/RS422 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 RS485/RS422 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 system, and the communication between high voltage and low voltage need to isolate the nodes of the RS485/RS422 system. Isolating the RS485/RS422 system can protect the circuit and the operator. Isolating the RS485/RS422 system can prevent the noise generated by the ground loop from affecting communication, thus preventing interference with the RS485/RS422 bus communication. This article provides different solutions for different RS485/RS422 nodes and provides use schemes.

2 Signal Isolation

The following uses the CA-IS3082W/WX, CA-IS2082B, CA-IS3105W and CA-IF4805HS devices as examples to describe how to build RS485 isolation. Combined with the CA-IS3092W device, a higher-integrated use scheme is proposed.

Traditional isolated RS485 solution is the solution for the digital isolator and the RS485 transceiver. In this solution, enable (RE, DE), transmit (DI) and receive (RO) signals are isolated by the digital isolator, such as the CA-IS3741HW device between MCU and the RS485 transceiver.

Fig. 1 shows an example of a solution using the CA-IS3741HW device and the CA-IF4805HS transceiver. The advantage of this split solution is the flexibility to choose the best transceiver for application. The CA-IS3105W device can be used as the secondary side power supply for the CA-IS3741HW device because both sides of the isolator need power supply. However, because this is a multi-chip scheme, the external circuit requirements are higher, and the PCB board requires a larger space.

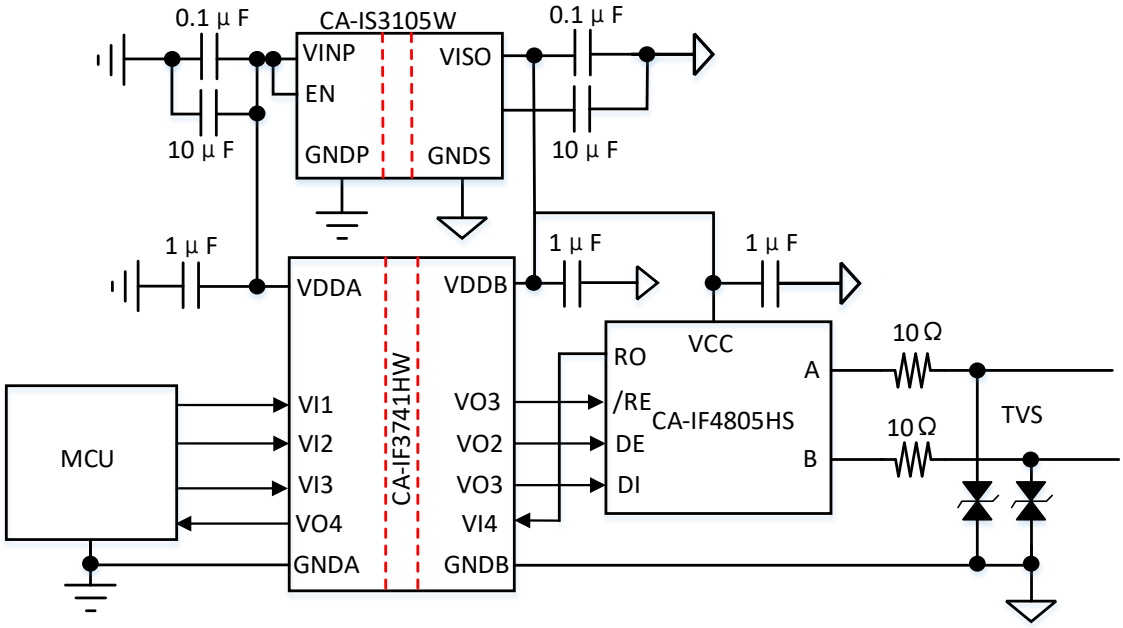

Fig. 1 CA-IS3741HW+CA-IF4805HS+CA-IS3105W Transceiver Solution

The CA-IS3082W/WX and CA-IS2082B devices are highly reliable isolated half-duplex RS485 transceivers with high electromagnetic immunity and low radiation characteristics.

The CA-IS3082W/WX and CA-IS2082B devices provide failure protection. The CA-IS3082W/WX and CA-IS2082B devices have high insulation capabilities that help prevent noises 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-IS3082W/WX device is packaged in 16-pin widebody SOIC package and supports insulated voltage withstand up to 5kV$_{RMS}$. The CA-IS2082B device is packaged in SSOP16 package and supports insulated voltage withstand up to 3.75kV$_{RMS}$. The advantage of this solution is that it requires less PCB space and less peripheral circuitry. Fig. 2 shows the application circuit of the RS485 integrated isolation scheme CA-IS3082W/WX and CA-IS2082B. See the specification for more information.

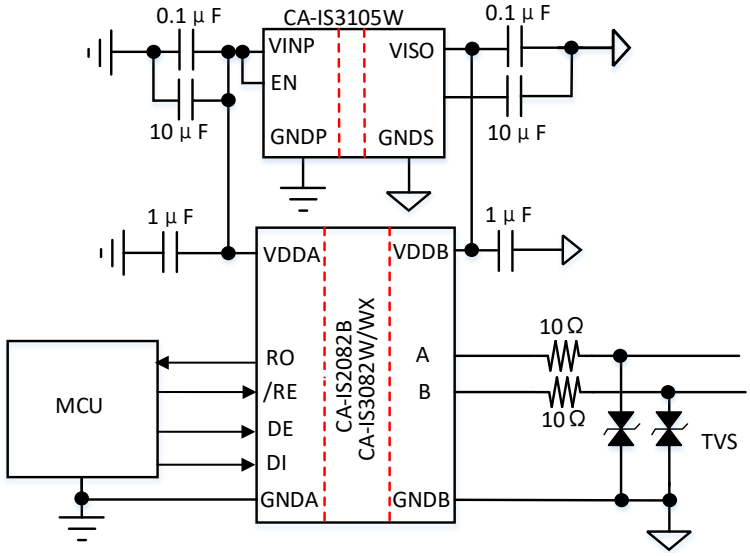

Fig. 1 CA-IS3082/CA-IS2082+CA-IS3105W Solution

3 RS485 Isolation with Integrated Power Supply

The CA-IS3082W/WX, CA-IS2082B devices require isolated power supply for the secondary side, and the CA-IS3105W device with SOIC16-W package requires more space. Therefore, using the CA-IS3092W device can reduce the scheme area.

The isolation scheme of the CA-IS3092W device integrates the isolation power supply, digital isolation chip and RS485 interface chip. The CA-IS3092W device has high electromagnetic immunity and low radiation characteristics. The mode is half-duplex. The high insulation capability of the CA-IS3092W device helps prevent noises 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.

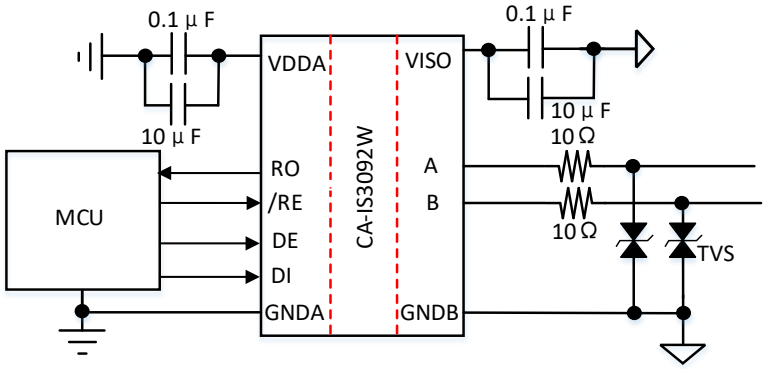

Fig. 2 CA-IS3092W Isolation Solution

4 Recommended Solution Combination Table

Isolated Power Supply	Isolated RS485/RS22 Interface Chip	Rate (Mbps)	Half/Full Duplex	Note	Fully Integrated Scheme	Note
CA-IS3105W	CA-IS3080W	0.5	Full		CA-IS3090W	0.5Mbps, (SOIC16-W)
CA-IS3105W	CA-IS3080W	0.5	Full		CA-IS3090T	0.5Mbps, (SOIC20-T)
CA-IS3105W	CA-IS3082W	0.5	Half		CA-IS3092W	0.5Mbps, (SOIC16-W)
CA-IS3105W	CA-IS3086W	10	Full		CA-IS3096W	10Mbps, (SOIC16-W)
CA-IS3105W	CA-IS3086W	10	Full		CA-IS3096T	10Mbps, (SOIC20-T)
CA-IS3105W	CA-IS3088W	10	Half		CA-IS3098W	10Mbps, (SOIC16-W)
CA-IS3105W	CA-IS3082WX	0.5	Half		-	-
CA-IS3105W	CA-IS3088WX	10	Half		-	-
CA-IS3105W	CA-IS2082B	5	Half	SSOP16		

Isolated Power Supply	RS485/RS22 Interface Chip	Digital Isolator	Rate (Mbps)	Half/Full Duplex	Note	Fully Integrated Scheme	Note
CA-IS3105W	CA-IF4805 HS/HM/HD	CA-IS3741HW	0.5	Half		CA-IS3092W	-
CA-IS3105W	CA-IF4820 HS/HM/HD	CA-IS3741HW	20	Half		CA-IS3098W	10Mbps (SOIC16-W)
CA-IS3105W	CA-IF4850 HS/HM/HD	CA-IS3741HW	50	Half	50Mbps	-	-
CA-IS3105W	CA-IF4805 FS/FM/FD	CA-IS3741HW	0.5	Full		CA-IS3090W	0.5Mbps (SOIC16-W)
CA-IS3105W	CA-IF4820 FS/FM/FD	CA-IS3741HW	0.5	Full		CA-IS3096W	10Mbps (SOIC16-W)
CA-IS3105W	CA-IF4805 FS/FM/FD	CA-IS3741HW	0.5	Full		CA-IS3090T	0.5Mbps (SOIC20-T)
CA-IS3105W	CA-IF4820 FS/FM/FD	CA-IS3741HW	20	Full		CA-IS3096T	10Mbps (SOIC20-T)
CA-IS3105W	CA-IF4850 FS/FM/FD	CA-IS3741HW	50	Full	50Mbps	-	-
CA-IS3105W	CA-IF4888 FS/FM/FD	CA-IS3741HW	0.5	Half	Polarity Correction Function	-	-

5 Conclusion

Using the CA-IS374x series digital isolator chip, the CA-IF48xx series RS485/RS422 interface chip and the CA-IS3105W isolation power supply chip can realize discrete isolated RS485/RS422 interface isolation.

The CA-IS3082W/WX and CA-IS2082B with Chipanalog's CA-IS3105W isolation power supply chip can realize RS485 isolation, which has higher reliability.

The CA-IS309x series isolation solutions integrate isolation power supply and have a maximum power output capacity of 0.5W, providing a more convenient option for RS485 isolation.

6 Version Information

Version	Date	State Description
Ver1.0	July.2021	Initial version

7 Important Statement

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