

Application Note Preview

Isolated RS-485 Reference Design

This design note presents the reference designs of isolated RS-485 nodes, utilizing bus voltages of 3.3V and 5V. Various transceivers are used to satisfy the requirements for low, medium, and high data rates, as well as to accommodate the need for half- and full duplex operation. Table 1 lists the family of isolated RS-485 transceivers from Texas Instruments.

Table 1. Isolated RS-485 Transceivers

Device	Transmission	Data Rate [Mbps]	Rise Time [ns] (typical)	Primary Supply Voltage Range [V]	Secondary Supply Voltage Range [V]
ISO3082	Half-duplex	0.2	900	3.15 – 5.5	4.5 – 5.5
ISO15		1	185	3.15 – 3.6	3.15 – 3.6
ISO3088		20	7	3.15 – 5.5	4.5 – 5.5
ISO3080	Full-duplex	0.2	900	3.15 – 5.5	4.5 – 5.5
ISO35		1	185	3.15 – 3.6	3.15 – 3.6
ISO3086		20	7	3.15 – 5.5	4.5 – 5.5

Signal-Path Isolation

All transceivers present a 1/8 unit load to the bus, possess 4kV peak isolation voltage, and have a typical transient immunity of 50kV/us. While the ISO15 and ISO35 (orange shaded) operate from a 3.3V nominal supply on both, the primary and the secondary side, the transceivers of the ISO308x family allow for mixed supply operation. This is of particular advantage for applications operating in harsh industrial environments, because the 3.3V on the primary side enables the connection to low-volt micro controllers for power preservation, while the 5V on the secondary side maintains a high signal-to-noise ratio when driving signals across long distances.

Power Supply Isolation

Modern isolated power supplies are available as small, surface mount modules. They often include the transformer driver, the actual isolation transformer, and the rectifier network. Sophisticated DC-DC modules, such as the RSZ-3.33.3HP (3.3Vin / 3.3Vout) and RSZ-3.305HP (3.3Vin / 5Vout), even include a linear regulator with its associated bypass- and output capacitors, while providing short-circuit protection and a solid 2kV isolation voltage.

Noise and Transient Suppression

For effective transient protection a low-capacitive transient voltage suppressor (TVS), such as PSM712, is recommended. The device provides 600W surge capability, 75 pF of capacitance, and up to 40kV ESD protection, while its stand-off voltages cover the RS-485 common-mode range of -7V to +12V.

It is also suggested to implement additional noise filtering to the signal paths between the node controller and the single-ended side of the transceiver through simple R-C low-pass filters. The filter component values should be calculated such that $R_F \times C_F = 0.032 / f_S$, with f_S being the highest signal frequency of interest.

System Diagrams

Figure 1 shows the system diagram for a 3.3V / 5V half-duplex network node using ISO3082 for signal isolation and RSZ-3.305HP for power isolation, and Figure 2 shows the system diagram for a 3.3V / 3.3V full-duplex network node using ISO35 for signal isolation and RSZ-3.33.3HP for power isolation.

References

For more specific information on devices presented in this design note please refer to one of the following links:

- For isolated RS-485 transceivers see www.ti.com
- For isolated DC-to-DC modules see www.recom-power.com, or www.recom-international.com
- For transient voltage suppressors see www.protekdevices.com

Application Note Preview

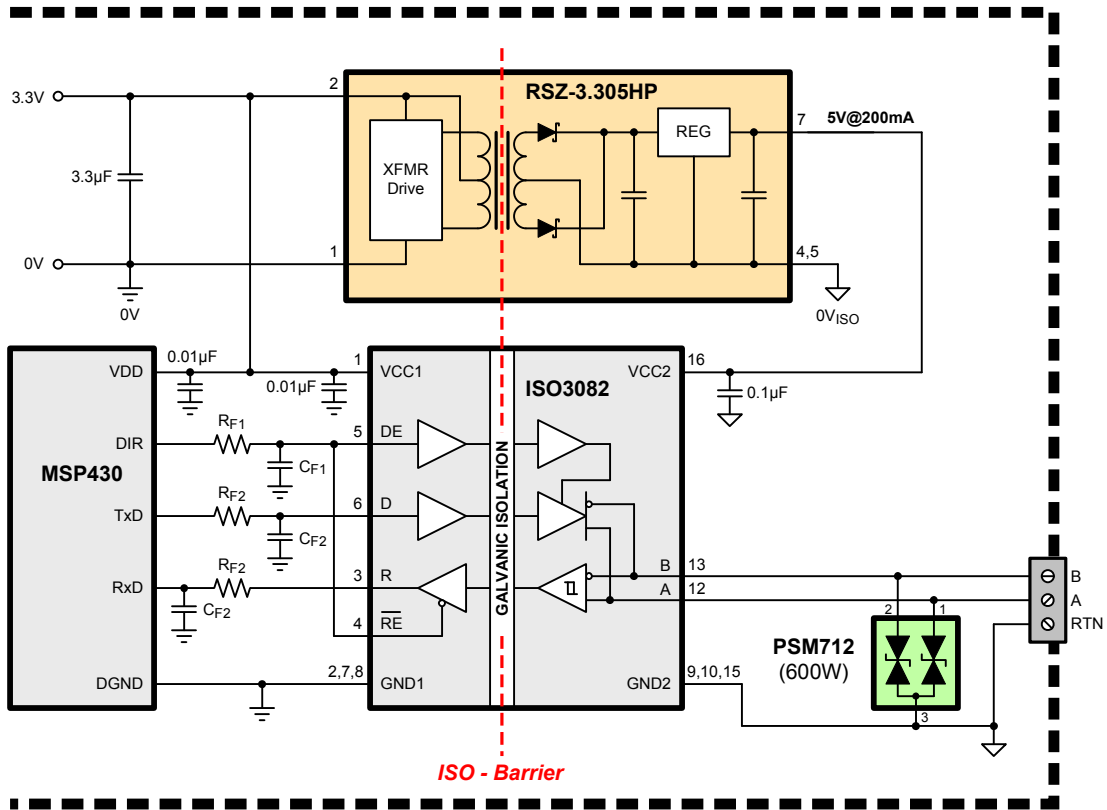


Figure 1. 2kV Isolated RS-485 node for 200 kbps, half-duplex operation

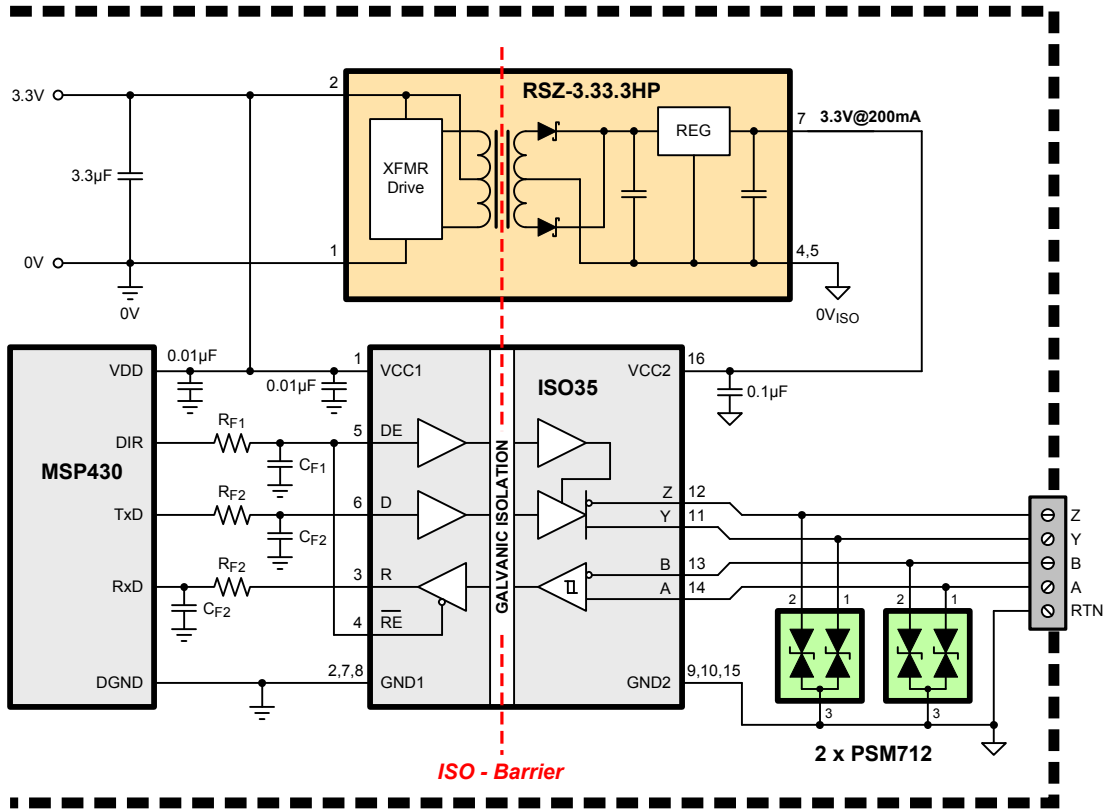


Figure 2. 2kV Isolated RS-485 node for 1 Mbps, full-duplex operation