

# Isolated RS-485 Transceiver Reference Design

Anthony Viviano

## ABSTRACT

This design note presents the reference designs of isolated RS-485 nodes using isolated RS-485 transceivers and a transformer driver, [SN6505B](#). [Table 1](#) lists featured [isolated RS-485 transceivers](#) from Texas Instruments.

**Table 1. Isolated RS-485 Transceivers**

Device	Transmission	Data Rate [Mbps]	Maximum Transient Isolation Voltage [Vrms]	Primary-Supply Voltage Range [V]	Secondary-Supply Voltage Range [V]	Package Size [mm]
<a href="#">ISO1500</a>	Half-duplex	1	3000	1.71 to 5.5	4.5 to 5.5	4.90 x 3.90
<a href="#">ISO1410</a>		0.5	5000	1.71 to 5.5	3.0 to 5.5	10.30 x 7.50
<a href="#">ISO1430</a>		12	5000	1.71 to 5.5	3.0 to 5.5	10.30 x 7.50
<a href="#">ISO1450</a>		50	5000	1.71 to 5.5	3.0 to 5.5	10.30 x 7.50
<a href="#">ISO1412</a>	Full-duplex	0.5	5000	1.71 to 5.5	3.0 to 5.5	10.30 x 7.50
<a href="#">ISO1432</a>		12	5000	1.71 to 5.5	3.0 to 5.5	10.30 x 7.50
<a href="#">ISO1452</a>		50	5000	1.71 to 5.5	3.0 to 5.5	10.30 x 7.50

## Contents

1	Design .....	2
2	References .....	3

## List of Figures

1	Half-duplex isolated RS-485 node.....	2
2	Full-duplex isolated RS-485 node .....	3

## List of Tables

1	Isolated RS-485 Transceivers.....	1
---	-----------------------------------	---

## Trademarks

All trademarks are the property of their respective owners.

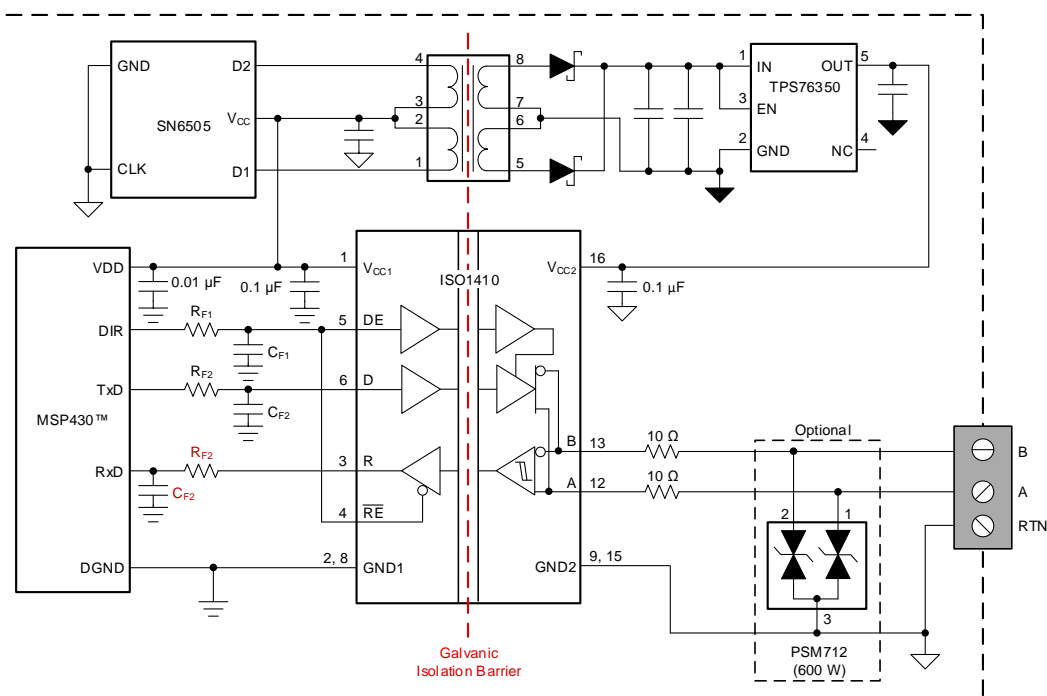
## 1 Design

All ISO14xx and ISO1500 transceivers use TI's [capacitive based isolation technology](#) to provide reliable high voltage isolation for the RS-485 transmit, receive, and enable signals. The ISO14xx family is Profibus compliant to support a larger differential voltage at 5-V bus-side supply to ensure reliable communication in noisy industrial environments. The ISO1500 is a small solution size option with lowered isolation specifications, ideal for isolating ground loops in long distance communication. The wide primary side supply voltage of ISO14xx and ISO1500 provide the option to interface directly with low-voltage microcontrollers to conserve power, whereas the 5 V option on the secondary side maintains a high signal-to-noise ratio of the bus signals. These transceivers all present 1/8 unit load to the bus for support of up to 256 nodes and have a typical common mode transient immunity of 100 kV/us.

The push-pull transformer driver SN6505B paired with an external transformer and optional rectifying LDO create an isolated power supply to power the isolated transceiver. The SN6505B device allows a maximum of 5 W of power to systems that need isolated power for multiple devices and alternatively [SN6501](#) can be used for up to 1.5 W of output power. This solution provides a compact, efficient, and low noise solution for creating an isolated power supply.

The ISO14xx family has robust EMC protection integrated into the device capable of 30 kV HBM ESD, 16 kV IEC ESD, and 4 kV IEC EFT. To further enhance the transient protection, a low-capacitive transient voltage suppressor (TVS), such as PSM712, is optional. The device provides a 600 W surge capability, 75 pF of capacitance, and up to 40 kV ESD protection, while its stand-off voltages cover the RS-485 common-mode range of -7 V to +12 V. Implementation of 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 is recommended. Calculate the filter component values such that  $R_F \times C_F = 0.032 / f_S$  with  $f_S$  being the highest signal frequency of interest.

[Figure 1](#) shows the system diagram for a half-duplex isolated RS-485 node using ISO1410 for signal isolation and SN6505B with transformer for power isolation. [Figure 2](#) shows the system diagram for a full-duplex isolated RS-485 node using ISO1412 for signal isolation and SN6505B with transformer for power isolation.



**Figure 1. Half-duplex isolated RS-485 node**

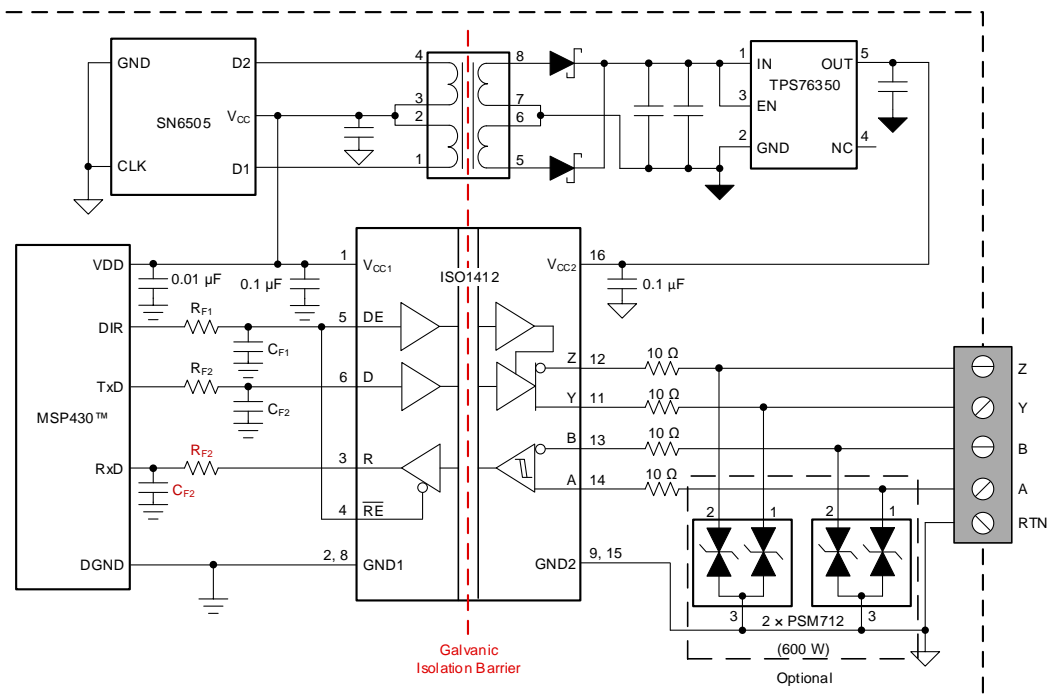


Figure 2. Full-duplex isolated RS-485 node

## 2 References

Refer to these references for more information on the devices listed in this application report:

- [TI's isolated RS-485 portfolio](#)
- [How to isolate signal and power for an RS-485 system](#)
- [How to isolate RS-485 for smallest size and highest reliability](#)
- [Isolated RS-485 with integrated signal and power reference design](#)

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to TI's Terms of Sale ([www.ti.com/legal/termsofsale.html](http://www.ti.com/legal/termsofsale.html)) or other applicable terms available either on [ti.com](http://ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2019, Texas Instruments Incorporated