SP3491: FAQ

Sipex Part: SP3491
Date: Oct30, 2006

The customer used the SP3491EN in several products, and only recently had problems with one design. The configuration is a RS422 multi-drop network with up to 16 nodes. The RS422 line is terminated with a 100 ohm resistor in each end. When the transmission from one node is completed, the TX is tri-stated. It seems like the tri-state Tx is interpreted as a high level signal by some of the receivers and as a low level signal by others. These cause errors in the data transmission (first bit corrupted). The nodes do not have a ground connection to each other, the SP3491EN power supply is galvanic insulated.

Questions:

(1) Is it normal that an SP3491EN receiver, with open input (pin 11 and 12) may have a random "1" or "0" output (pin2)?
(2) Do you have any suggestions how to solve my problem? May my problem be a matter of grounding strategy?

Answers:

(1) The SP3491 is equipped with a failsafe feature that defines the receiver output state for the condition you have described. When the bus is open or tri-stated, the failsafe circuitry forces the receiver output to a high state. The SP3491 also has 25mV of input hysteresis that should prevent it from chattering as long as the noise is below this threshold voltage. The receiver enable pin could be held low when the bus is in the tri-state condition.
(2) The problem could be a ground issue. We recommend the grounds between the two nodes be connected. Your question is important and critical to proper operation. Yes, the signal (or logic) ground lines should be connected. While it is a differential balanced system the transceiver circuits each have a dedicated ground that they have to operate at. If for example one side of the system ground exceeds the common mode input voltage range of the other side there would be no headroom for signal swing and errors would occur. Optical coupled systems are different because the signals are converted to light pulses. This is done specifically to eliminate the ground connection between two RS485 nodes for galvanic isolation. In these systems the optical detector that proceeds the RS485 receiver does not require a signal ground because it is detecting light. The optical pulses are not electrical signals. The ground for each RS485 node is generated locally and the received light pulses are converted locally to electrical signals that are referenced to their own local ground.

Here is a link to application note ANI 12 on an isolated RS485 interface design. There may be useful information for this issue: http://www.sipex.com/products/pdf/Isolated_RS485.pdf

There is also attached a diagram in the next Q&A item showing the recommended ground connections for this type of data transmission system to limit ground currents.

Question:

Should RS-485 configurations have some resistance between logic and chassis ground to avoid excess ground-loop currents?

Answer:

All 422- and 485-compliant system configurations should use a solid ground connection so that both receivers and drivers can talk error free. The figure below shows how to make this connection and recommends adding some resistance between logic and chassis ground to avoid excess ground-loop currents. Logic ground does not have any resistance in its path from the driver or receiver. A potential problem might exist, especially during transients, when a high-voltage potential between the remote grounds could develop. Therefore, some resistance between them is recommended.

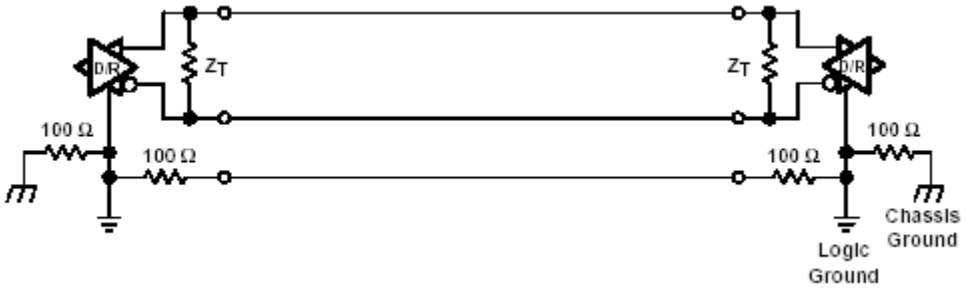

Diagram: Differential Transceiver Ground Connections

