How Robust is Your High Fault Tolerant RS-485?

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Not all Fault Tolerance Transceivers are Created Equal

High fault tolerant RS-485/RS-422 transceivers are available from several manufacturers today. These transceivers are designed for improved performance in noisy industrial environments and offer an increased tolerance to system faults. Many high fault tolerant transceivers, including the XR33x5x family from MaxLinear, claim their analog bus pins can withstand direct shorts up to ±60V. However, there are no fault tolerant tests, procedures, or conditions stated in the data sheets of these "robust" transceivers. Interrupted data communication during a fault condition is tolerable, but if your RS-485 can't withstand ±60V under real-world conditions, the resulting field failures can be costly. 12 different RS-485 high fault tolerant transceivers have been tested using three different techniques. This paper summarizes the test results to see how many transceivers hold up to their fault tolerant claims.

Introduction

RS-485/RS-422 data communication applications such as industrial control networks utilize 24V and even 48V power supplies. Installation wiring faults, ground voltage faults and even direct shorts are potential field failures in these systems. A transceiver with a ±60V fault tolerance provides adequate tolerance and protection for both 24V and 48V systems.

Multiple vendors offer ±60V fault tolerant RS-485 transceivers, many even offer ±70V and ±80V tolerance levels. There are no fault tolerant tests, procedures, or conditions stated in the data sheets of these "robust" transceivers. So just how "robust" is your fault tolerant RS-485?

To answer this question, 12 different RS-485 high fault tolerant transceivers were put to the test. Two tests actually:

- Transient Fault Voltage Test
- Sweep Voltage Test

Transient Fault Voltage Test

A transient fault voltage was applied to the driver output pins (Y/Z) at 5V increments. Vcc = VL = 5V; DI = H. Point of failure was recorded. Test was repeated with DI = L.

Sweep Voltage Test

The driver output pins (Y/Z) were connected to a power supply. Vcc = VL = 5V; DI = H. The voltage was slowly swept from 0V to 80V, then repeated from 0V to -80V. Point of failure was recorded. Test was repeated with DI = L.

Table 1 below shows a summary of those tests along with the published fault tolerance value listed in each product's data sheet. The Sweep Voltage test was less demanding on the transceiver; most of the tested devices passed this test. The Transient Fault Voltage Test put the device into conditions that better resembled those found in real-life applications. Of the parts tests, the MaxLinear XR33x5x devices were the only ones that passed this test. Refer to the MaxLinear application note ANI-23 for more detail.

Conclusion

Not all ±60V transceivers are created equal. Protect your systems by using a truly robust RS-485/RS-422 high fault tolerant transceiver like those from MaxLinear.

For More Information

- Download the product data sheets: XR33053 XR33152 XR33156 XR33158
- Review the Fault Tolerant Testing Application Note: ANI-23

Vendor	Device	Fault Tolerance Claim (±V)	Transient Fault Test Summary (±V)	Sweep Voltage Test Summary (±V)
MaxLinear	XR33152	60	61	70
	XR33156	60	61	70
	XR33158	60	61	70
	XR33053	60	61	70
Vendor A	1	60	45	60
	2	60	55	60
Vendor B	1	60	25	60
	2	60	35	60
Vendor C	1	70	65	70
Vendor D	1	80	70	70
	2	80	65	70
	3	80	70	80

Figure 1: Fault Tolerance Test Results

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