Dual Protocol Applications

Programmable vs Standard Transceivers

Abstract

The dwindling desire for versatility in Dual Protocol (DP) applications supporting RS-485 and RS-232 signaling raises the question whether dual protocol transceivers still provide advantages over dedicated RS-485 and RS-232 transceivers. This tech brief compares three designs for a single-channel RS-485 and a triple channel RS-232 dual protocol interface configuration.

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1.   Programmable Dual Protocol Transceivers

The ISL3333 is one of the most versatile dual protocol transceivers in the industry. It includes two interface ports, each of which is configurable for one full-duplex RS-485 transceiver or two RS-232 transceivers. With features like the programmable selection of speed grades (20Mbps, 460kbps, 115kbps), the individual enable/disable function for drivers and receivers, as well as Loopback and Shutdown modes, the ISL3333 is an excellent universal dual protocol transceiver.

Many industrial interface modules use two ISL3333 devices to allow for a wider range of interface configurations. The use of two of these flagship devices requires two quadruple UARTS (or QUARTS), to drive the many configurations, ranging from four RS-485 transceivers up to eight RS-232 transceivers, and anything in between. Figure 1 shows the range of possible configurations.
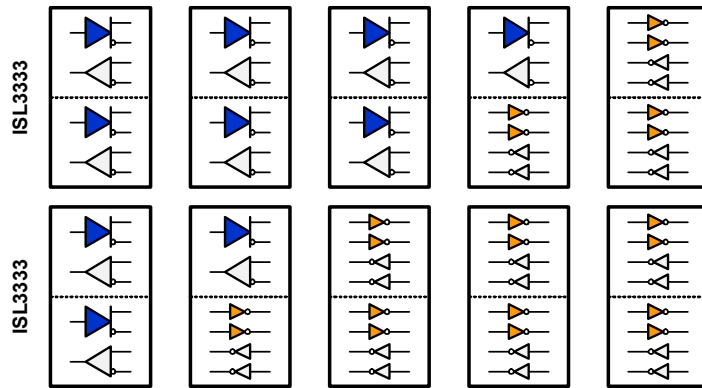

Figure 1. Possible Configurations of an Interface Module Using Two ISL3333 Devices

An odd configuration, but also the most commonly used, is that of one RS-485 and three RS-232 channels shown in Figure 2. Here, module vendors seem to resort to hardwiring most of the configuration pins, so that an entire port plus charge pump circuitry is wasted in the RS-485 mode operating transceiver, while another RS-232 channel remains unused in the RS-232 mode operating device.
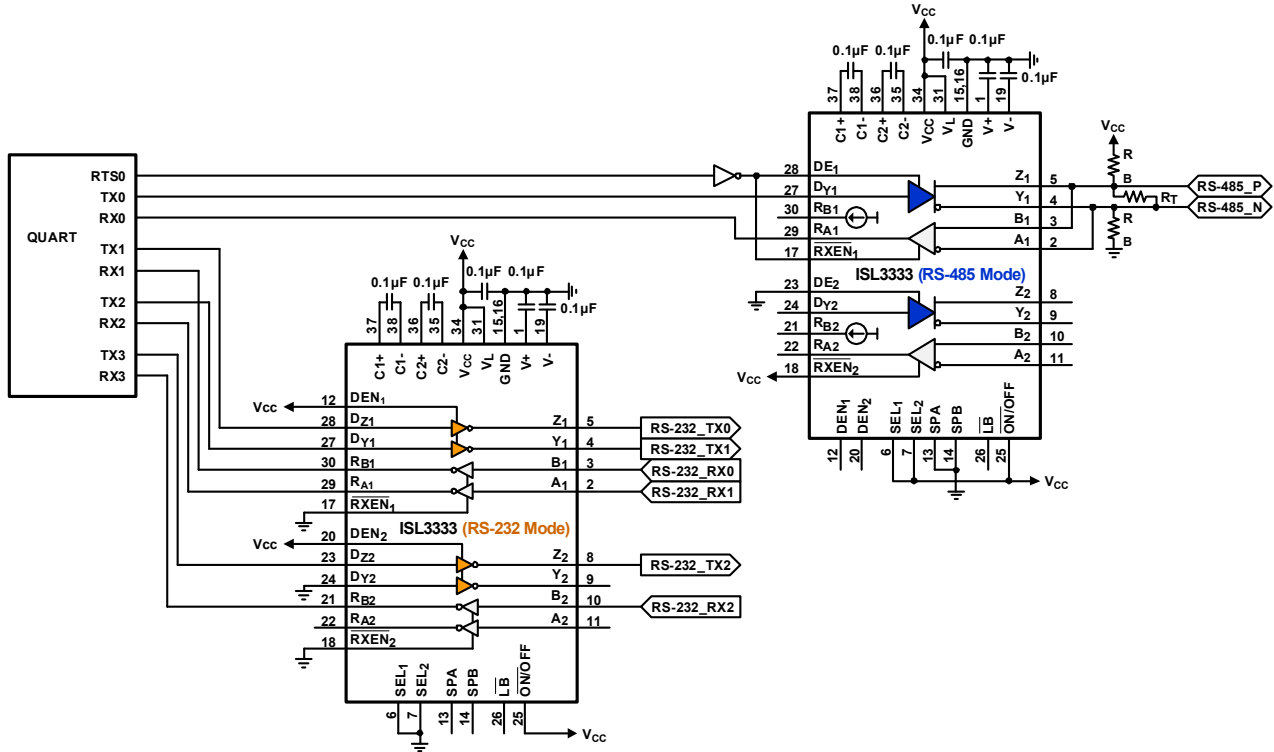

Figure 2. Two ISL3333 Devices Supporting One RS-485 and Three RS-232 Channels

2. Fixed Dual Protocol Transceivers

The lost need for versatility became the design motivation for newer, simpler dual protocol transceivers: the ISL33334 and ISL33337. These devices have fixed ports and fewer feature selections, but come at almost half the price. Figure 3 shows how the 1 x RS-485/3 x RS-232 configuration is accomplished with the ISL33337 and a single channel standard RS-232 transceiver.
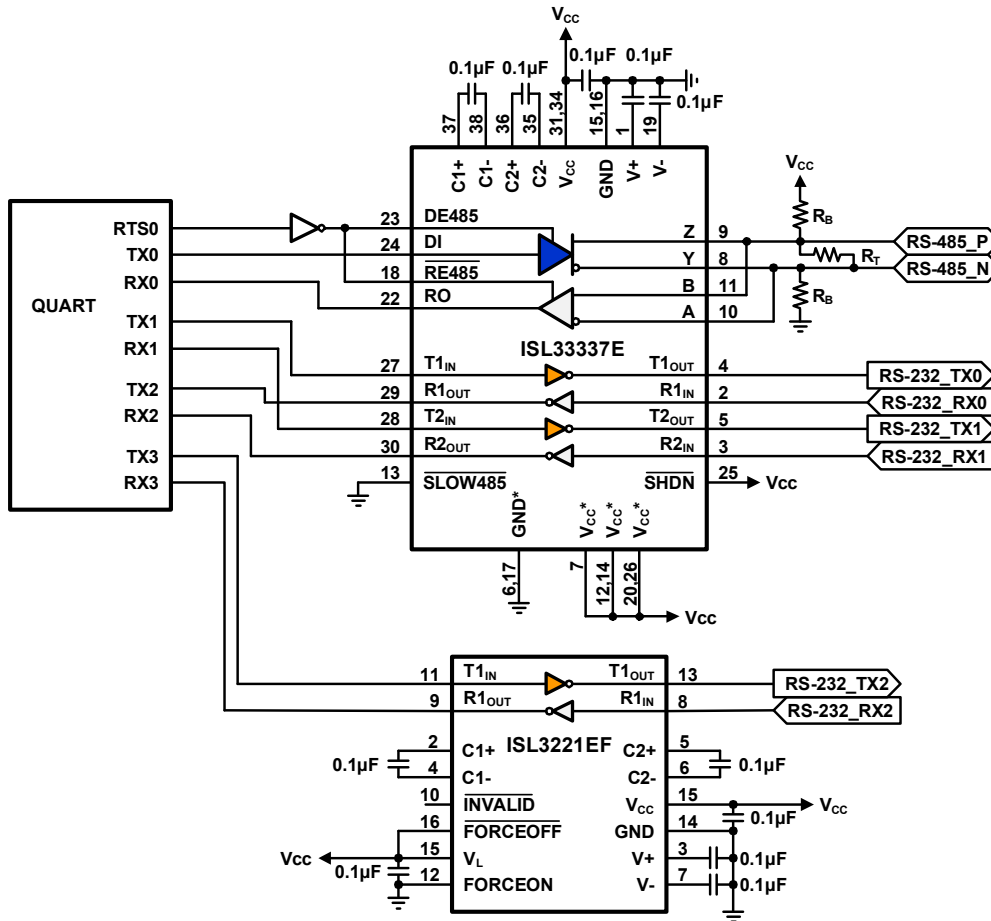
**Figure 3. Single Fixed-Port ISL33337 Device Plus Single RS-232 Transceiver Allowing the Same
Configuration but at Half the Cost**

As this circuit allows for no further expansion, it bears the question: If hardwiring diminishes configurability, why not use dedicated transceivers that come at a much lower cost?

3. Standard Transceivers

Single RS-485 transceivers and triple RS-232 transceivers are readily available, at various speed grades and small size packages. Figure 4 shows an example of a much simpler but most efficient dual protocol interface using the ISL3175 and the ISL83387 transceivers.
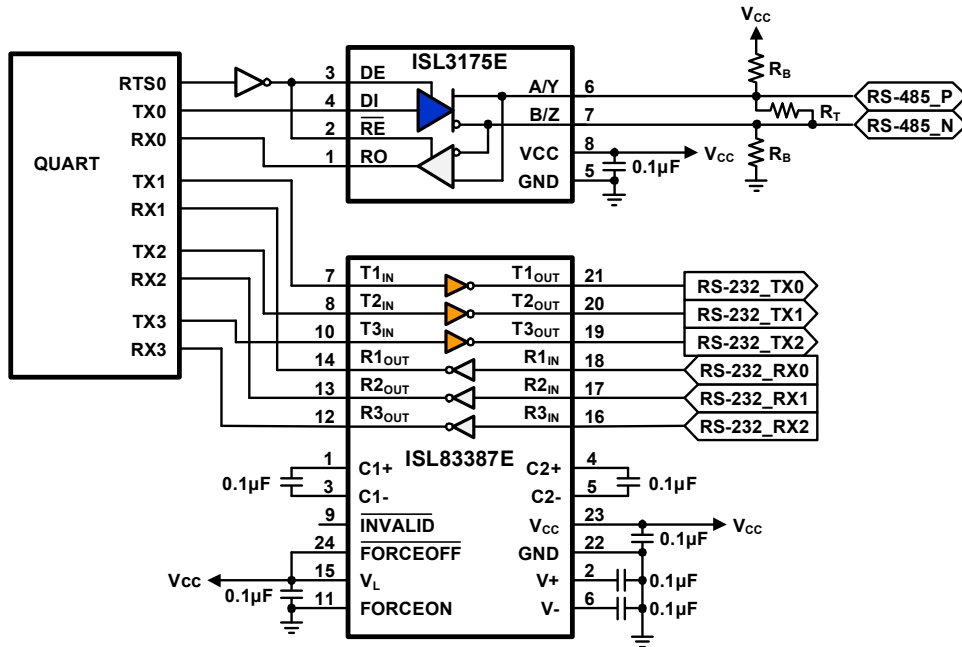
Figure 4. Two Standard Transceivers Accomplishing the Same Task at a Fraction of the Cost

Table 1 compares the three previous solutions by speed, footprint, and price. It turns out that, with the exception of versatility, the use of dedicated transceivers provides the most efficient solution, which is equal in speed performance, but lower in footprint and cost.

Table 1. Solution Comparison

	Solution	Protocol Type	RS-232 Speed (kbps)	RS-485 Speed (kbps)	Footprint	Price (1ku)	Total Footprint	Total Cost (1ku)
1)	2 x ISL3333IRZ	RS-232/RS-485	250	460	6mm×6mm	$4.27	72mm^2	$8.54
2)	ISL33337 + ISL3221	RS-232/RS-485	250	115	6mm×6mm	$1.62	58mm^2	$2.18
		RS-232	250	250	5mm×4.4mm	$0.56		
3)	ISL3175EIUZ + ISL83387EIV	RS-485	–	500	3mm×3mm	$0.65	43.3mm^2	$1.62
		RS-232	250	–	4.4mm×7.8mm	$0.97		

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