RS-485

Unit Load Concept

TB511
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The RS-485 standard requires that a driver to be able to drive up to 32 unit loads. A Unit Load (UL) is the input conductance of a receiver or transceiver (driver disabled) between either bus input terminal (A or B) and the device ground.

A single unit load (1UL) is defined as a 1mA input current at an applied DC voltage of 12V, which is synonymous with a 12kΩ resistance, as shown in Figure 1.

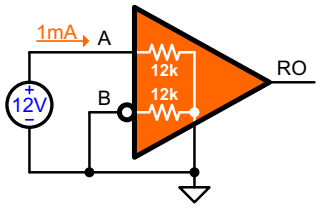

Figure 1. Definition of a Single Unit Load

In the early years of RS-485, all transceivers had 12kΩ common-mode input resistance and hence a 1UL rating. This limited the maximum number of bus transceivers to 32. Modern transceivers however, possess 2-, 4-, and 8-fold higher input resistance and hence UL-ratings of 1/2UL, 1/4UL, and 1/8UL, as shown in Figure 2.

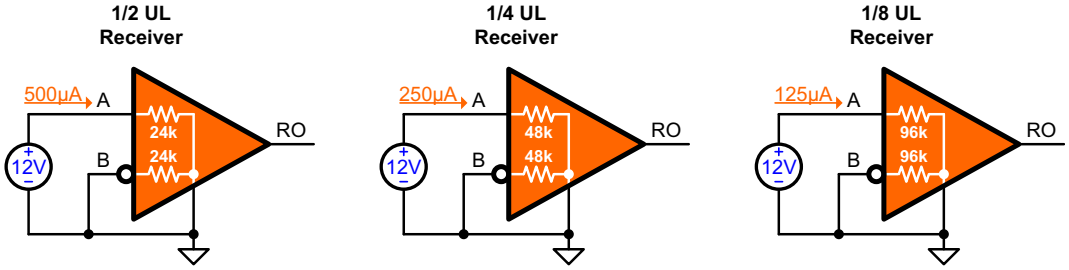

Figure 2. Fractional Unit Load Ratings Increase the Number of Transceivers Allowed on the Bus

The maximum number of transceivers (XCVRs) allowed on the bus can be determined using (EQ. 1). Consequently, lower fractional UL ratings allow for a higher number of bus transceivers until the limit of 32ULs is reached, as shown in Figure 3.

(EQ. 1) $$n_{XCVR} = \frac{32ULs}{UL_{XCVR}}$$

where:

- UL_{XCVR} = Transceiver UL rating
- n_{XCVR} = Number of bus transceivers

Example for a 1/8UL transceiver:

(EQ. 2) $$n_{XCVR} = \frac{32ULs}{UL_{XCVR}} = \frac{32ULs}{\frac{1}{8}UL} = 256$$

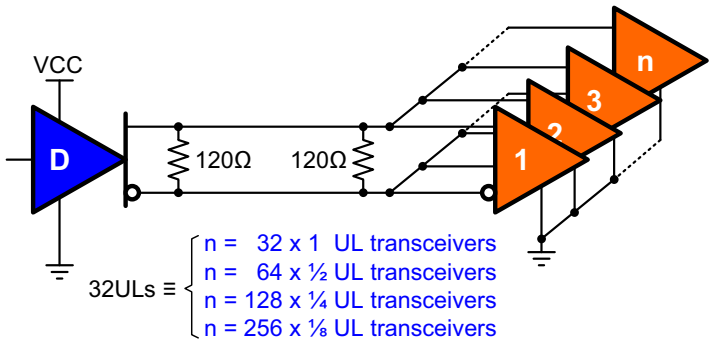

Figure 3. Establishing the Maximum Number of Bus Transceivers

Revision History

Rev.	Date	Description
0.00	Dec 14, 2017	Initial release