

RS-485

Unit Load Concept

TB511  
Rev.0.00  
Dec 14, 2017

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](#).

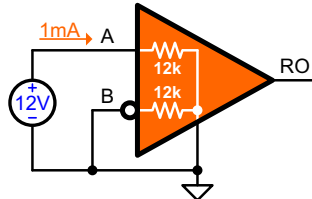


Figure 1. Definition of a Single Unit Load

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](#).

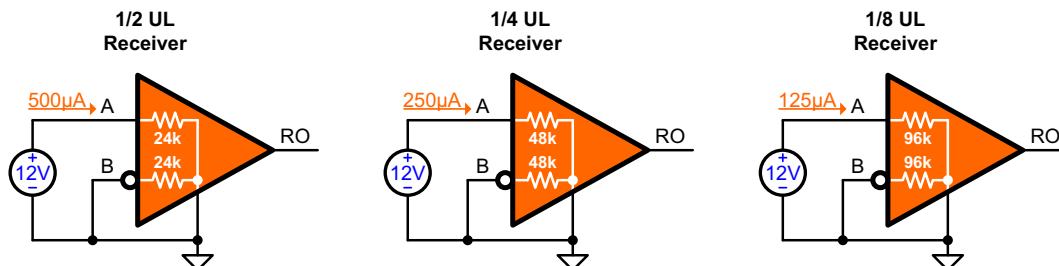


Figure 2. Fractional Unit Load Ratings Increase the Number of Transceivers Allowed on the Bus

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](#).

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

where:

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

Example for a 1/8UL transceiver:

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

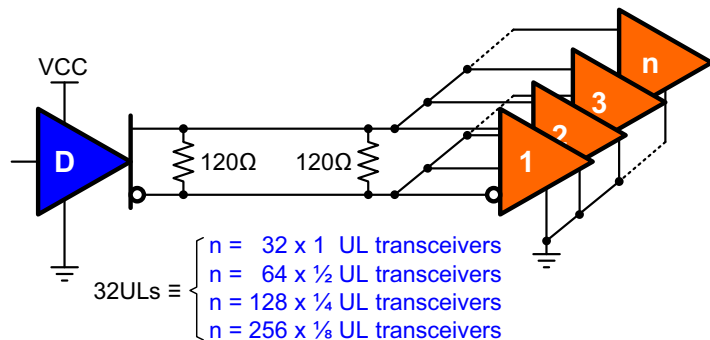


Figure 3. Establishing the Maximum Number of Bus Transceivers

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## Revision History

Rev.	Date	Description
0.00	Dec 14, 2017	Initial release

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