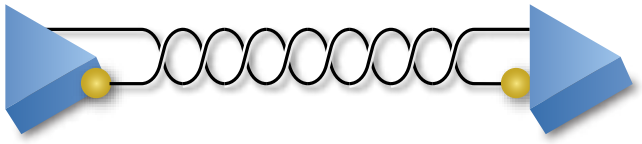
# RS485 Quick Guide



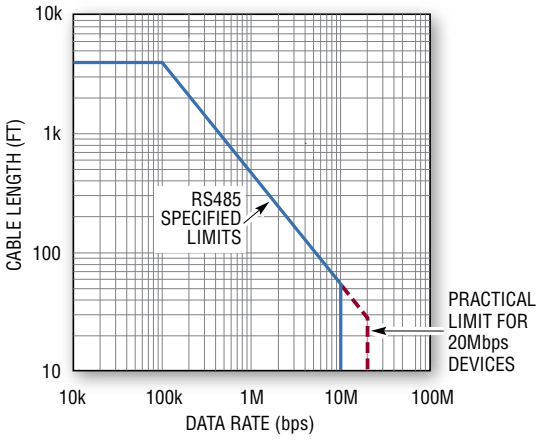
## TIA/EIA-485-A Standard

RS485 conveys data differentially over a terminated twisted pair, permitting up to 10Mbps data rates. The standard specifies electrical characteristics of a driver and receiver, and does not specify any data protocol or connectors. RS485 is popular for inexpensive local networks, multidrop communication links and long haul data transfer over distances of up to 4,000 feet. The use of a balanced line means RS485 has excellent noise rejection and is ideal for industrial and commercial applications. You'll find RS485 in applications as diverse as monitoring oil wells and linking POS terminals, to alarm systems, motion control and HVAC controls. Extended capability transceivers offer data rates up to 100Mbps and up to 256 nodes, as well as 2500$V_{RMS}$ isolation and fault protection up to ±60V.

| Specification | | RS422 | RS485 |
|---|---|---|---|
| Mode of Operation | | Differential | Differential |
| Number of Drivers and Receivers Allowed on One Line | | 1 Driver, 10 Receivers | 32 Drivers, 32 Receivers |
| Maximum Cable Length | | 4000 Feet | 4000 Feet |
| Maximum Data Rate | | 10Mbps | 10Mbps |
| Maximum Voltage Applied to Driver Output | | –0.25V to 6V | –7V to 12V |
| Differential Driver Output Signal | Minimum Loaded | ±2V | ±1.5V |
| | Maximum Unloaded | ±5V | ±5V |
| Termination | | 100Ω | 120Ω |
| Receiver Input Voltage Range | | ±7V | –7V to 12V |
| Receiver Input Sensitivity | | ±200mV | ±200mV |
| Receiver Input Resistance | | 4kΩ (Min) | 12kΩ (Min) |

### What Distance Can Be Achieved?

The achievable distance is a function of the cable. The longer the cable, the greater the attenuation. Because attenuation increases with frequency, cables also exhibit a lowpass filter behavior so that achievable distance diminishes with data rate. The distances recommended by the RS485 standard are shown in the graph to the right. Many cables are capable of higher speed and distance. Consult the cable manufacturer's typical performance curve of 0 to 50% rise time vs cable length.




### What is the Failsafe Receiver Output State with No Input Signal?

That depends on the failsafe type of the receiver. Type 1 devices (see over) output a guaranteed 1 state when the receiver inputs are left open, but the output is undetermined when the inputs are shorted. Type 2 devices output a guaranteed 1 state whether the receiver inputs are left open, shorted or terminated but not driven.

### What is the Proper Way to Terminate the Cable?

The cable should be terminated at each end with a resistance equal to characteristic impedance.

LINEAR TECHNOLOGY

# Linear Technology RS485/RS422 Transceivers

| Part Number | Supply (V) | Max Data Rate (Bits/s) | # Dr | # Rec | Duplex | SHDN | ESD (kV) | Failsafe | Comments | Temp Grade | Package |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2500$V_{RMS}$ Isolation** | | | | | | | | | | | |
| LTM®2881-3/-5 | 3.3/5 | 20M | 1 | 1 | Full | Yes | ±15 | Type 2 | No External Components Required, Isolated 1W DC/DC Converter, Switchable, 120Ω Termination, UL File #E151738 | C, I, H, MP | 15 × 11.25 × 2.8 LGA, 15 × 11.25 × 3.4 BGA |
| LTC1535 | 5 | 250k | 1 | 1 | Full | No | ±8 | Type 2 | UL File #E151738 | C, I | SO(W)-28 |
| **±60V Fault Protection** | | | | | | | | | | | |
| LTC2862-1/-2 | 3 to 5.5 | 20M/250k | 1 | 1 | Half | Yes | ±15 | Type 2 | Pin-Compatible with LT1785A | C, I, H, MP | SO-8, 3 × 3 DFN-8 |
| LTC2863-1/-2 | 3 to 5.5 | 20M/250k | 1 | 1 | Full | No | ±15 | Type 2 | | C, I, H, MP | SO-8, 3 × 3 DFN-8 |
| LTC2864-1/-2 | 3 to 5.5 | 20M/250k | 1 | 1 | Full | Yes | ±15 | Type 2 | Pin-Compatible with LT1791A | C, I, H, MP | SO-14, 3 × 3 DFN-10 |
| LTC2865 | 3 to 5.5 | 20M/250k | 1 | 1 | Full | Yes | ±15 | Type 2 | Logic Supply Pin, SLO Pin | C, I, H | MSOP-12, 4 × 3 DFN-12 |
| LT1785A | 5 | 250k | 1 | 1 | Half | Yes | ±15 | Type 2 | Pin-Compatible with LTC485 | C, I, H | SO-8, DIP-8 |
| LT1791A | 5 | 250k | 1 | 1 | Full | Yes | ±15 | Type 2 | Pin-Compatible with LTC491 | C, I, H | SO-14, DIP-14 |
| **Integrated Switchable 120Ω Termination** | | | | | | | | | | | |
| LTC2854 | 3.3 | 20M | 1 | 1 | Half | Yes | ±25 | Type 2 | Low Power | C, I, H | 3 × 3 DFN-10 |
| LTC2859 | 5 | 20M/250k | 1 | 1 | Half | Yes | ±15 | Type 2 | Slew Rate Control, Low Power | C, I, H | 3 × 3 DFN-10 |
| LTC2855 | 3.3 | 20M | 1 | 1 | Full | Yes | ±15 | Type 2 | Low Power | C, I, H | 4 × 3 DFN-12, SSOP-16 |
| LTC2861 | 5 | 20M/250k | 1 | 1 | Full | Yes | ±15 | Type 2 | Slew Rate Control, Low Power | C, I | 4 × 3 DFN-12, SSOP-16 |
| **3.3V Supply Operation** | | | | | | | | | | | |
| LTC2850 | 3.3 | 20M | 1 | 1 | Half | Yes | ±15 | Type 2 | Low Power | C, I, H | SO-8, MSOP-8, 3 × 3 DFN-8 |
| LTC2851 | 3.3 | 20M | 1 | 1 | Full | No | ±15 | Type 2 | Low Power | C, I, H | SO-8, MSOP-8, 3 × 3 DFN-8 |
| LTC2852 | 3.3 | 20M | 1 | 1 | Full | Yes | ±15 | Type 2 | DE and RE Pins, Low Power | C, I, H | SO-14, MSOP-10, 3 × 3 DFN-10 |
| LTC1480 | 3.3 | 2.5M | 1 | 1 | Half | Yes | ±3.5 | Type 1 | Low Power | C, I | SO-8, DIP- 8 |
| **Low Power** | | | | | | | | | | | |
| LTC2856-1/-2 | 5 | 20M/250k | 1 | 1 | Half | Yes | ±15 | Type 2 | Hot Swap™ Capable | C, I, H | MSOP-8, 3 × 3 DFN-8 |
| LTC2857-1/-2 | 5 | 20M/250k | 1 | 1 | Full | No | ±15 | Type 2 | Hot Swap Capable | C, I, H | MSOP-8, 3 × 3 DFN-8 |
| LTC2858-1/-2 | 5 | 20M/250k | 1 | 1 | Full | Yes | ±15 | Type 2 | Hot Swap Capable | C, I, H | MSOP-10, 3 × 3 DFN-10 |
| LTC1690 | 5 | 5M | 1 | 1 | Full | No | ±15 | Type 2 | | C, I | MSOP-8, SO-8, DIP-8 |
| LTC1481 | 5 | 2.5M | 1 | 1 | Half | Yes | ±10 | Type 1 | | C, I | SO-8, DIP-8 |
| LTC1482 | 5 | 4M | 1 | 1 | Half | Yes | ±15 | Type 2 | Carrier Detect | C, I | MSOP-8, SO-8, DIP-8 |
| LTC1483 | 5 | 150k | 1 | 1 | Half | Yes | ±10 | Type 1 | Low EMI | C, I | SO-8, DIP-8 |
| LTC1484 | 5 | 4M | 1 | 1 | Half | Yes | ±15 | Type 2 | | C, I | MSOP-8, SO-8, DIP-8 |
| LTC1485 | 5 | 10M | 1 | 1 | Half | No | ±10 | Type 1 | | C, I | SO-8, DIP-8 |
| LTC1487 | 5 | 250k | 1 | 1 | Half | Yes | ±10 | Type 1 | Low EMI | C | SO-8, DIP-8 |
| LTC485 | 5 | 2.5M | 1 | 1 | Half | No | ±4 | Type 1 | | C, I, M | SO-8, DIP-8, CERDIP-8 |
| LTC490 | 5 | 2.5M | 1 | 1 | Full | No | ±10 | Type 1 | | C, I | SO-8, DIP-8 |
| LTC491 | 5 | 2.5M | 1 | 1 | Full | No | ±10 | Type 1 | DE and RE Pins | C, I | SO-14, DIP-14 |
| **High Speed** | | | | | | | | | | | |
| LTC1685 | 5 | 52M | 1 | 1 | Half | No | ±4 | Type 2 | | C, I | SO-8 |
| LTC1686 | 5 | 52M | 1 | 1 | Full | No | ±4 | Type 1 | | C, I | SO-8 |
| LTC1687 | 5 | 52M | 1 | 1 | Full | No | ±4 | Type 1 | DE and RE Pins | C, I | SO-14 |
| **Quad Drivers and Receivers** | | | | | | | | | | | |
| LTC1688/89 | 5 | 100M | 4 | 0 | | No | ±4 | | Hot Swap Capable, 1/2 DE Pins | C, I | SO-16 |
| LTC486/87 | 5 | 10M | 4 | 0 | | No | ±4 | Type 1 | Low Power, 1/2 DE Pins | C, I | SO(W)-16, DIP-16 |
| LTC1518/19 | 5 | 52M | 0 | 4 | | No | ±4 | Type 2 | | C, I | SO-16 |
| LTC488/89 | 5 | 10M | 0 | 4 | | No | ±10 | Type 1 | 1/2 DE Pins | C, I | SO(W)-16, DIP-16 |
| LTC1520 | 5 | 50M | 0 | 4 | | No | ±4 | | High Speed, LVDS-Compatible | C | SO-16 |
| **RS232/RS485 Multiprotocol** | | | | | | | | | | | |
| LTC2870 | 3 to 5.5 | 20M/500k | 1 | 1 | Both | Yes | ±26 | Type 2 | Two RS232 Transceivers | C, I | 4 × 5 QFN-28, TSSOP-28 |
| LTC2871 | 3 to 5.5 | 20M/500k | 1 | 1 | Both | Yes | ±16 | Type 2 | Two RS232 Transceivers | C, I | 5 × 7 QFN-38, TSSOP-38 |
| LTC2872 | 3 to 5.5 | 20M/500k | 2 | 2 | Both | Yes | ±16 | Type 2 | Four RS232 Transceivers | C, I | 5 × 7 QFN-38 |

Type 1 = Open; Type 2 = Idle, Open, Short