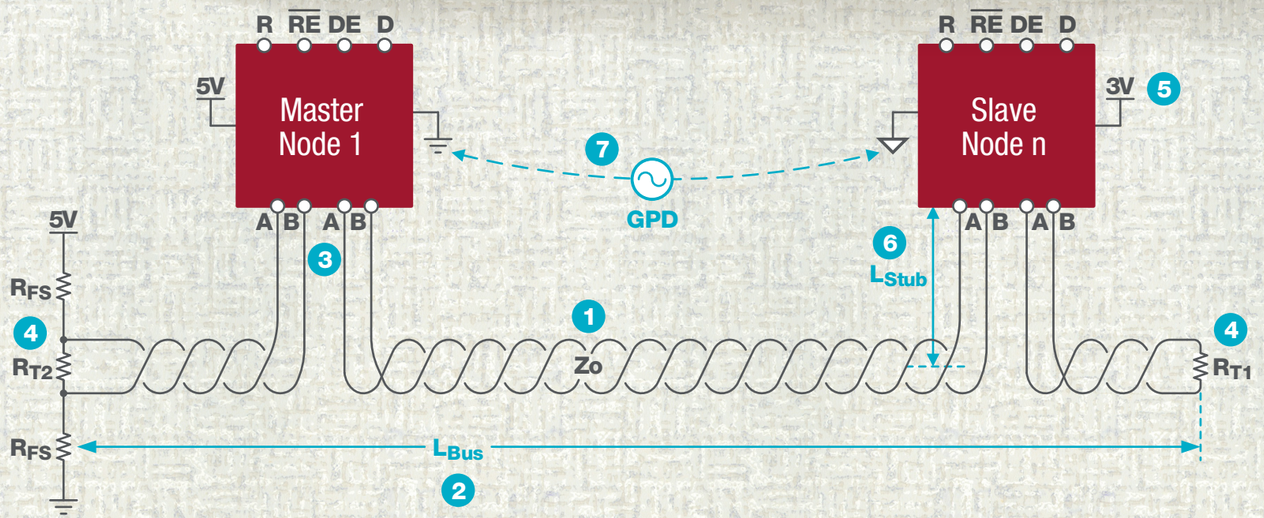
Top 10 RS-485 Design Tips



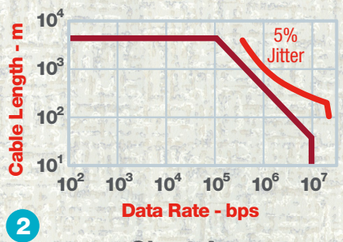
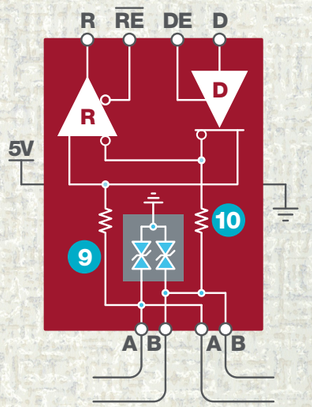
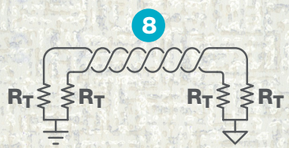


Chart A





1. Determine maximum cable length with Chart A
2. Use twisted-pair cable with Zo = 120Ω or 100Ω
3. Connect bus nodes via daisy-chain
4. Terminate one cable end with RT1 = Z0
   Apply failsafe biasing to the other end

$$R_{FS} = \left(\frac{V_{CC}\text{-min}}{V_{AB}\text{-Idle}} + 1\right) \cdot k$$

   k = 27.8Ω for Zo = 120Ω
   k = 23.4Ω for Zo = 100Ω
   Terminate this end with

$$R_{T2} = \frac{2R_{FS} \cdot Z_0}{2R_{FS} - Z_0}$$

5. You can operate 3V and 5V devices on the same bus
6. Make stub length no longer than $LStub < 3 \cdot 10^{-4} \cdot tr \cdot v$
   LStub = stub length (m)
   tr = driver rise time (ns)
   v = signal velocity (%)
7. For ± 7V GPDs use standard transceivers
   For ± 20V GPDs use SN65HVD17xx
   For higher GPDs use isolated transceivers
8. Terminate unused conductors with $R_{T2}=Z_0$ to their local grounds
9. For ESD, EFT and surge protection use SM712
10. Limit clamping current into the transceiver with 10Ω pulse-proof or MELF resistors

Texas Instruments

A standard of many names
RS-485 is now deemed EIA/TIA-485, but you may also see TIA-485-A, ANSI/TIA/EIA-485 or EIA-485. Keep that straight!

Why is RS-485 so cool?
It enables data transmission speeds of 35 Mbit/s up to 10 m and 100 kbit/s at 1,200 m and can span relatively large distances — up to 4,000 feet!

Rule of thumb
The speed in bit/s multiplied by the length in meters should not exceed 108. Thus a 50-meter cable should not signal faster than 2 Mbit/s.

Purpose-built for industrial
Applications include: programmable logic controllers, motors, welding equipment, building automation and video security.

For more industrial analog design resources, please go to ti.com/analog.