How to Terminate LVDS Connections

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This document discusses termination and biasing schemes for LVDS drivers and receivers with DC and AC coupling configurations. It also shows termination schemes for multidrop and multipoint (M-LVDS) connections.

DC Coupling Configuration

Connecting an LVDS driver, such as DS90LV011A, DS90LV027A, or DS90LV047A, to an LVDS receiver, such as DS90LV012A, DS90LV028A, or DS90LV048A, is fairly simple and only requires a 100-Ω differential termination resistor across the input terminal pair of the receiver as shown in Figure 1. This termination resistor, which should be placed as close to the receiver as possible, is needed to generate the differential voltage across the receiver inputs, and to match the transmission line impedance to reduce reflections. Some LVDS receivers have integrated 100-Ω termination resistors, such as DS90LT012A, SN65LVDT34, or SN65LVDT32B. An external termination should not be used when using such a receiver.

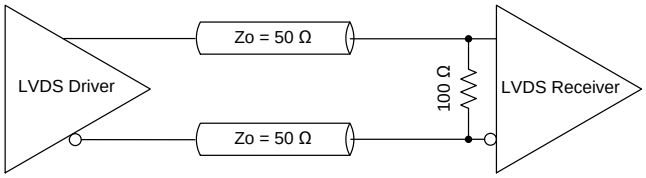

Figure 1. LVDS Connection with DC Coupling

An alternative termination scheme is shown in Figure 2, which has a split termination and a capacitor from the center tap to ground. The capacitor filters common-mode noise and helps with transmission line skew (which could be due to differential lines mismatch or driver output skew). The value of the capacitors depends on the operating frequency, as it needs to look like a short circuit for the AC component of the signal. A capacitor value of 0.1 µF should be adequate for most high data rates (1 Mbps and above).

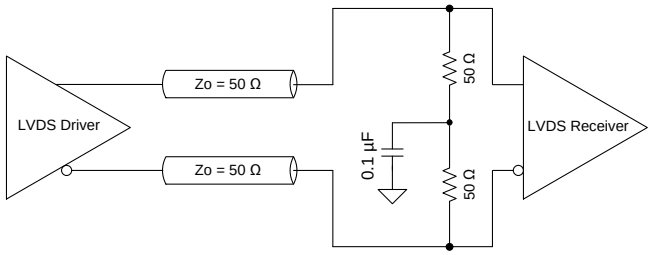

Figure 2. Alternative LVDS Connection with DC Coupling

AC Coupling Configuration

Figure 3 shows the termination in the case of AC-coupled configuration. Note that for AC coupling the data transmitted needs to be DC-balanced (for example, using 8b/10b encoding). In Figure 3, the resistor network at the input of the receiver restores the DC common mode to 1.2 V (assuming Vcc= 3.3 V) which is in the middle of the input common mode range for a standard LVDS receiver. Additionally, the resistor network provides the 100-Ω termination at the input of the receiver. If a termination resistor is integrated into the LVDS receiver, then larger resistor values should be selected in order not to alter the effective termination resistance at the input of the receiver. Suggested values are 10 kΩ for the pull up and 5.7 kΩ for the pull down. The value of AC coupling capacitors depends on the operating frequency, as it needs to block the DC component, but look like a short circuit for the AC component. A capacitor value of 0.1 µF should be adequate for high data rates (1 Mbps and above).

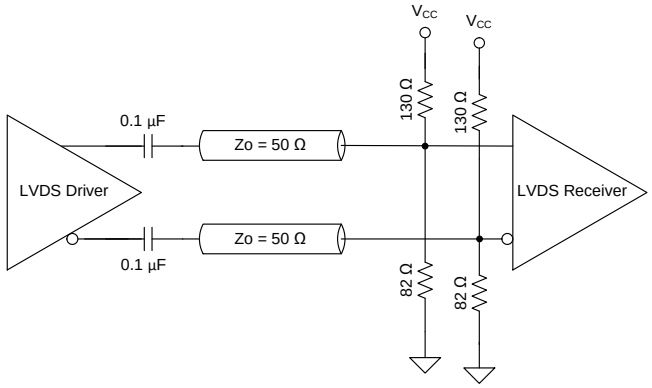

Figure 3. LVDS Connection with AC Coupling

An alternative circuit is shown in Figure 4 which uses a split termination and a capacitor, in addition to a biasing resistor network. The capacitor filters common-mode noise and helps with transmission line skew. Another advantage of this circuit is lower power consumption when compared to the circuit in Figure 3.

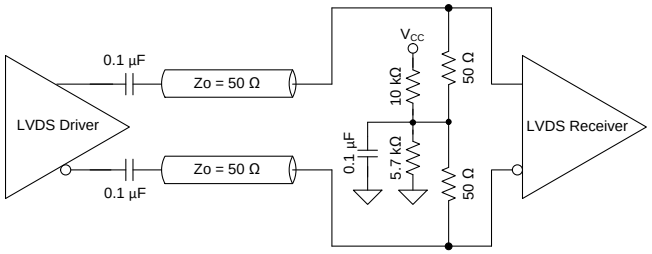

Figure 4. Alternative LVDS Connection with AC Coupling

Another variation on the circuit in Figure 3 is shown in Figure 5. It uses only one pair of resistors to provide the biasing on the negative input terminal. The positive input terminal will also get the common mode voltage through the 100-Ω termination. The advantage of this method is reduced component count. The disadvantage is that there is some differential skew between the positive and negative input terminals.

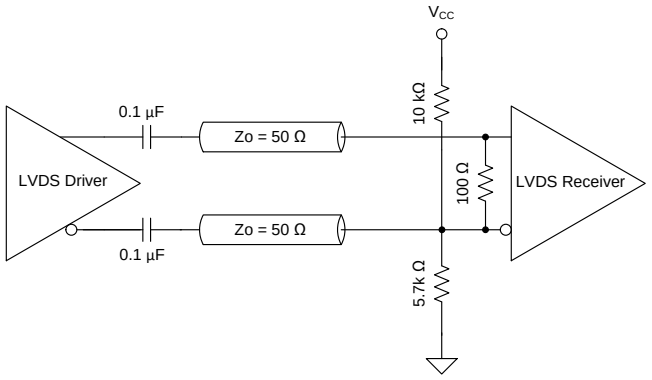

Figure 5. AC-Coupled LVDS Connection with Reduced Component Count

When using an LVDS receiver with a wide common mode range, such as SN65LVDS33, SN65LVDS34, SN65LVDS348, and SN65LVDS352, which have an input common mode range from –4V to 5V, a common mode biasing resistor network is not needed. Only the 100-Ω termination is needed, as shown in Figure 6.

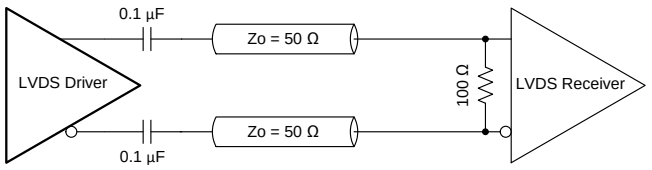

Figure 6. AC-Coupled LVDS Connection When Using Wide Common Mode LVDS Receiver

Multidrop LVDS Termination

When using LVDS transceivers in a multidrop configuration, only one termination is needed which is placed at the input terminals of the farthest receiver as shown in Figure 7.

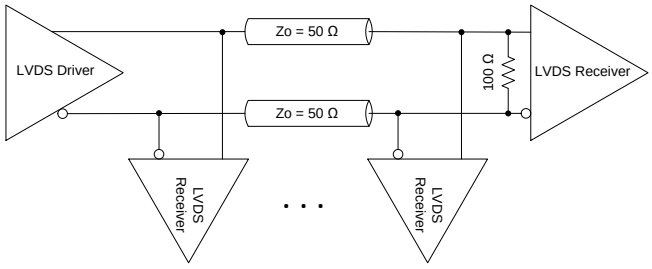

Figure 7. Multidrop LVDS Termination

M-LVDS Termination

When using M-LVDS transceivers, such as SN65MLVD206B, SN65MLVD204B, or SN65MLVD040, in a half duplex multipoint configuration, termination is needed on both ends of the bus as shown in Figure 8. It is not necessary to place the termination close the receivers, rather at the farthest points of both ends of the bus.

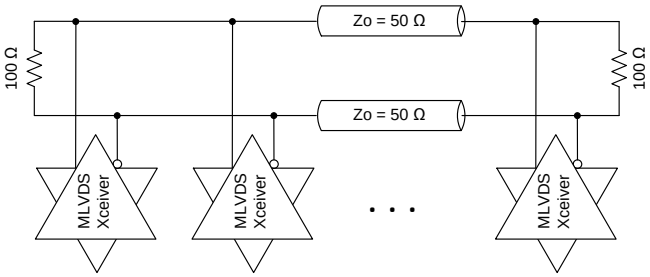

Figure 8. Half Duplex M-LVDS Termination

If using full duplex M-LVDS transceivers, such as SN65MLVD205A or SN65MLVD207, then two differential pairs are utilized, and each of them needs two terminations on both ends of the connection as shown in Figure 9.

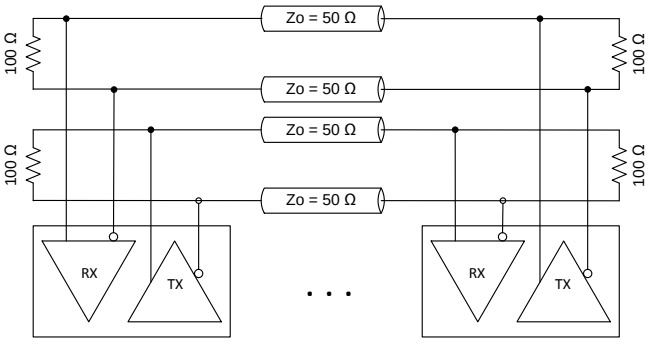

Figure 9. Full Duplex M-LVDS Termination

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