

## Introduction

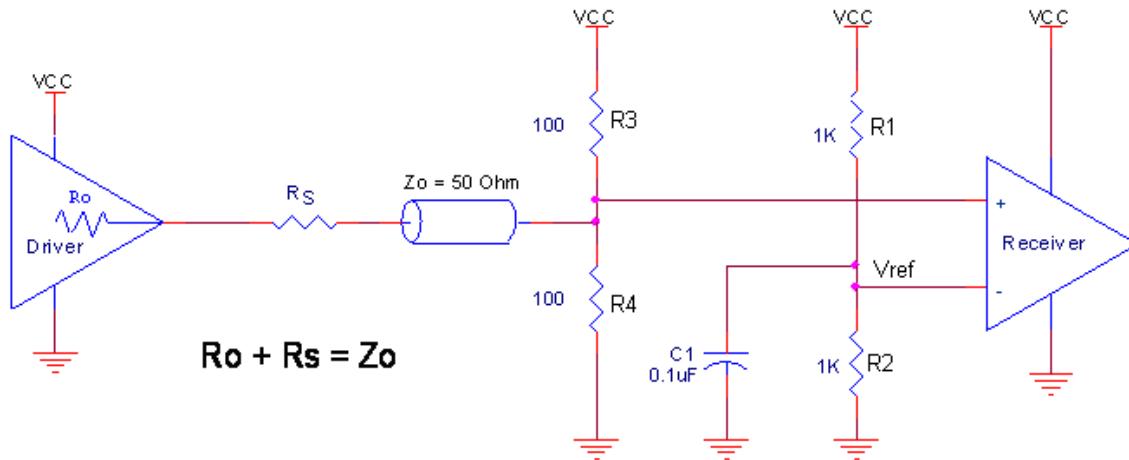
This application note describes how a differential input can be wired to accept single-ended levels.

## Wiring the Differential Input to Accept Single-Ended Levels

Figure 1 shows how a differential input can be wired to accept single-ended levels. The reference voltage  $V_{ref} = V_{cc}/2$  is generated by the bias resistors  $R_1$  and  $R_2$ . The bypass capacitor ( $C_1$ ) is used to help filter noise on the DC bias. This bias circuit should be located as close to the input pin as possible. The ratio of  $R_1$  and  $R_2$  might need to be adjusted to position the  $V_{ref}$  in the center of the input voltage swing. For example, if the input clock swing is 2.5V and  $V_{cc} = 3.3V$ ,  $R_1$  and  $R_2$  value should be adjusted to set  $V_{ref}$  at 1.25V. The values below are for when both the single ended swing and  $V_{cc}$  are at the same voltage. This configuration requires that the sum of the output impedance of the driver ( $R_o$ ) and the series resistance ( $R_s$ ) equals the transmission line impedance.

In addition, matched termination at the input will attenuate the signal in half. This can be done in one of two ways. First,  $R_3$  and  $R_4$  in parallel should equal the transmission line impedance. For most  $50\Omega$  applications,  $R_3$  and  $R_4$  can be  $100\Omega$ . The values of the resistors can be increased to reduce the loading for slower and weaker LVC MOS driver. When using single-ended signaling, the noise rejection benefits of differential signaling are reduced. Even though the differential input can handle full rail LVC MOS signaling, it is recommended that the amplitude be reduced. The datasheet specifies a lower differential amplitude, however this only applies to differential signals. For single-ended applications, the swing can be larger, however  $V_{IL}$  cannot be less than -0.3V and  $V_{IH}$  cannot be more than  $V_{cc}+0.3$ . Though some of the recommended components might not be used, the pads should be placed in the layout. They can be utilized for debugging purposes. The datasheet specifications are characterized and guaranteed by using a differential signal.

**Figure 1. Recommend Schematic for Wiring a Differential Input to Accept Single-Ended Levels**





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