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AND8096/D

Unique One Gates Make Voltage Bilateral Level Translation Simple

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APPLICATION NOTE

The ability to “mix and match” technologies creates a unique opportunity to solve difficult problems. Figure 1 shows a design with the low voltage side at +2.7 V and that must drive a 5 V data line on an external module. In addition, the 5 V data line is connected to the 5 V supply voltage, through a 4.7 kΩ resistor. This is used to detect the presence of a 5 V module.

The simplest way to do this is to use the ON Semiconductor’s “T” version one gate products, in conjunction with standard CMOS products. The “T” version VHC family is designed to operate at 5.0 V and its input threshold is V_{IL} of 0.8 V and V_{IH} of 2.0 V. This matches very nicely with the standard CMOS 2.7 V output. In addition, the “T” level devices can easily drive the 4.7 k resistor, since it can source and sink 8 mA. In order to get bilateral ability, tri–state devices were selected. Going from the 5.0 V side to the 2.7 V, a standard level VHC or LCX one gate is used. Both of these families have overvoltage tolerance at their inputs. The design takes advantage of this fact and by operating the part at 2.7 Volts, while its output is matched to its supply voltage. The designer is free to drive the input up to +7.0 V. The choice of which device to use is dependent upon the speed required. If the application requires more speed the LCX family (NL17Szyy) should be selected, if delay time is not extremely important, then perhaps the VHC device should be used (MC74VHC1Gyy).

The design is very simple, just placing a “125 and “126” back to back allows the two devices to function as a single bilateral device. The EN line of both devices are in parallel. The 125 is low enable, and the 126 is high enable, this permits the two devices to function as a data direction line. The software engineer should take care to establish zeros on both sides before reversing direction, and holding this for about 20 ns, otherwise one of the tri–states can present a very low impedance to the device that is driving it. The design shows using a “T125” on the 2.7 V side, and a “126” on the 5 V side, this means it requires a voltage lower than 0.8 V for the combination to go from the 2.7 V to the 5 V, and a +2.0 V signal to make the transition from the 5.0 side to the 2.7 V. By swapping a “T126” and a “125” the sense of the data direction can be turned around. The data direction line can come from either the 2.7 V side or the 5.0 V side, it makes no difference. The 4.7K resistor in the circuit is easily driven by the VHC device.

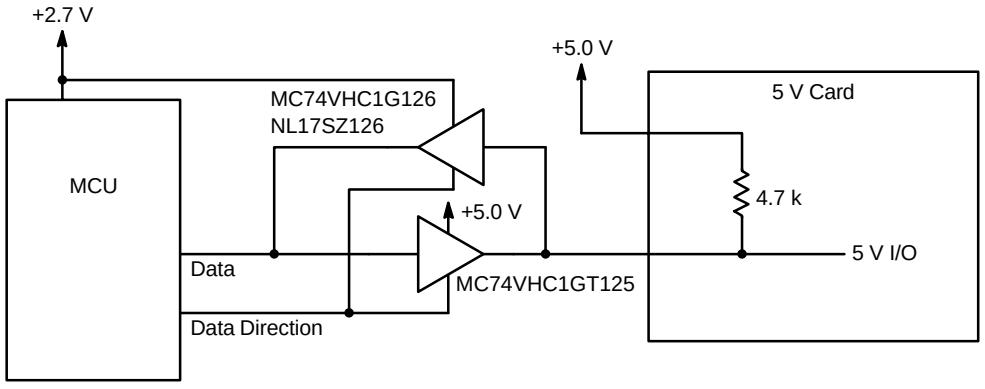

Figure 1.

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