One Wire RS-232 Half Duplex

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Traditional RS-232 communication needs one transmit line (TXD or TX) and one receive line (RXD or RX) and a Ground return line. The setup allows a full-duplex communication; however many applications are using only half-duplex transmissions, as protocols often rely on a transmit/acknowledge scheme.

With a simple circuit as shown in **Figure 1** this is achieved using only two wires (including Ground). This circuit is designed to work with a 'real' RS-232 interface (i.e. using positive voltage for logic 0s and negative voltage for logic 1s), but by reversing the diodes it also works on TTL based serial interfaces often used in microcontroller designs (where 0 V = logic 0; 5 V = logic 1). The circuit needs no additional voltage supply, no external power and no auxiliary voltages from other RS-232 pins (RTS/CTS or DTR/DSR).

Although not obvious at a first glance, the diodes and resistors form a logic AND gate equivalent to the one in **Figure 2** with the output connected to both receiver inputs. The default (idle) output is logic 1 (negative voltage) so the gate's output follows the level of the active transmitter. The idle transmitter also provides the negative auxiliary voltage –U in Figure 2. Because both receivers are connected to one line, this circuit generates a local echo of the transmitted characters into the sender's receiver section. If this is not acceptable, a more complex circuit like the one shown in **Figure 3** is needed (only one side shown). This circuit needs no additional voltage supply either. In this circuit the transmitter pulls its associated receiver to logic 1 (i.e. negative voltage) by a transistor (any standard NPN type) when actively sending a logic 0 (i.e. positive voltage) but keeps the receiver 'open' for the other transmitter when idle (logic 1). Here a negative auxiliary voltage is necessary which is generated by D2 and C1. Due to the start bit of serial transmissions, the transmission line is at logic 1 for at least one bit period per character. The output impedance of most common RS-232 drivers is sufficient to keep the voltage at C1 at the necessary level.

Note: Some RS-232 converters have quite low input impedance; the values shown for the resistors should work in the majority of cases, but adjustments may be necessary. In case of extremely low input impedance the receiving input of the sender may show large voltage variations between 1s and 0s. As long as the voltage is below –3V at any time these variations may be ignored.

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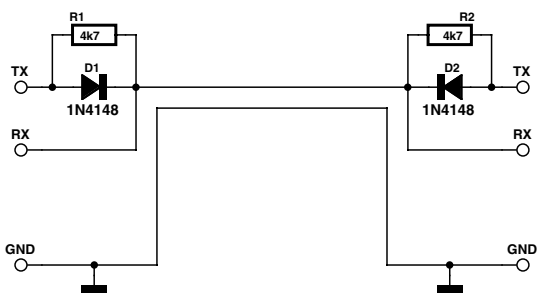

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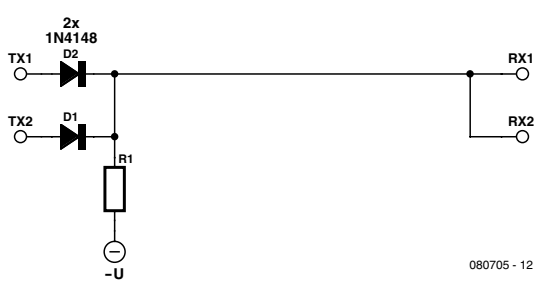

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