

DESIGN NOTES

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RS232 Transceiver with Automatic Power Shutdown Control

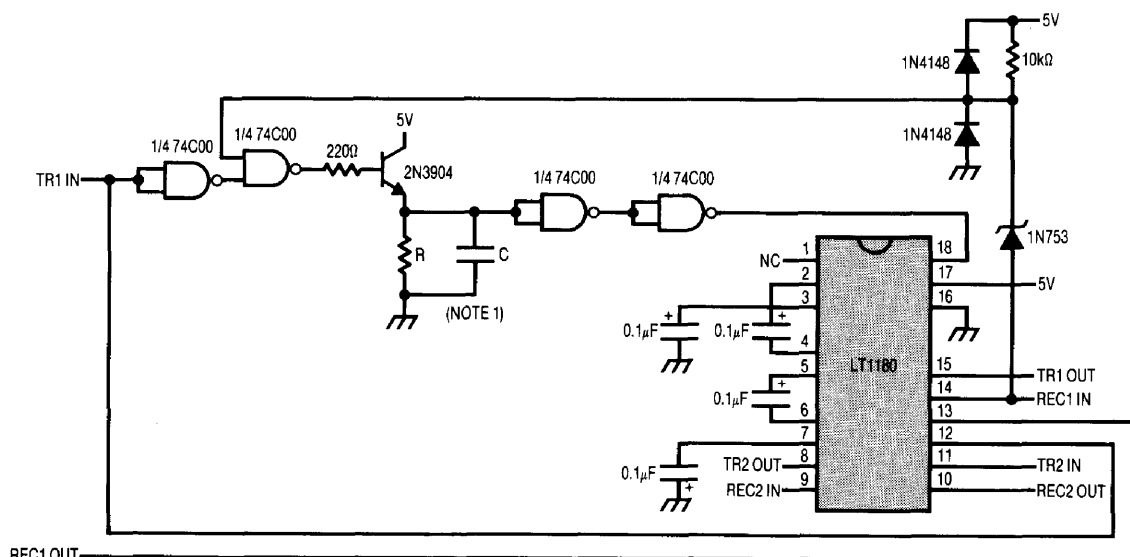
Sean Gold

The LT1180/81 RS232 transceivers with on-chip charge pumps offer some unique features that greatly enhance serial interface performance. Like the LT1080 and LT1130 series transceivers, the LT1180 is fully compliant with all RS232 specifications. The LT1180 is unique since it utilizes a charge pump which oscillates at 150kHz to 200kHz — about twice the frequency of the standard transceivers. In addition to providing excellent current delivery capability, the high speed charge pump can operate with storage capacitors as small as $0.1\mu\text{F}$.

Reducing storage capacitor size to $0.1\mu\text{F}$ shrinks board space, thereby lowering production costs. Small capacitors also shorten the transceiver turn-on time to less than $200\mu\text{s}$, which makes the LT1180 ideal for applications which must address the RS232 transceiver quickly. The interface de-

scribed here takes advantage of fast turn-on to reduce power dissipation.

The circuit shown in Figure 1 automatically shuts down when there is no data flow through the interface. A data stream on either the RS232 or logic inputs activates the transceiver. The data must begin with a logic 1 preamble, and the data stream must contain a sufficient number of 1's to keep the transceiver active. The preamble may be as short as $50\mu\text{s}$. Alternatively, the input to the Automatic SHUTDOWN circuit could be an RS232 handshake signal, such as Data Set Ready (DSR) or Clear to Send (CTS), which remain high during the data transfer. The LT1180's $200\mu\text{s}$ turn-on delay does not limit the data rate in the transceiver. Once the LT1180 is active, it can process data at the maximum 100k baud data rate.



NOTE 1: SELECT RC BASED ON CLOCK SPEED AND REQUIRED DROP OUT TIME.
 $T = RC \approx 2 \cdot T_{\text{DROP OUT}}$. FOR THIS EXAMPLE, $R = 100\text{K}\Omega$ AND $C = 1\mu\text{F}$.
 C SHOULD NOT EXCEED $1\mu\text{F}$ UNLESS THE 2N3904 CURRENT LIMITED WITH A COLLECTOR RESISTOR.

Figure 1. Fast Turn-On Transceiver with Automatic SHUTDOWN Control

A peak detector senses data flow. The extra CMOS gates are buffers which ensure the time constant is relatively independent of input signal level. The drop out time, i.e. the duration of inactivity prior to SHUTDOWN, is approximately $0.5RC$. More specifically, drop out occurs when the voltage on the peak detector decays from $V_{CC} - 0.7V$ to the logic switch point of $V_{CC}/2$. The RS232 input to the control circuit is clamped to protect the logic inputs. The zener diode, D3, forces the turn-on threshold on the RS232 side to $-3.5V$, which prevents the transceiver from turning on when the cable is grounded.

Figures 2 through 4 demonstrate the automatic SHUTDOWN control's response to logic and RS232 signals, as well as zero data flow. The minimum pulse width is $50\mu s$ and the drop out time is set to 50ms. The power supply outputs — the lower two traces in Figures 2 and 3 — become active in less than $200\mu s$. When active, the circuit consumes 16mA of quiescent current. In SHUTDOWN state, the Q-current drops to $50\mu A$.

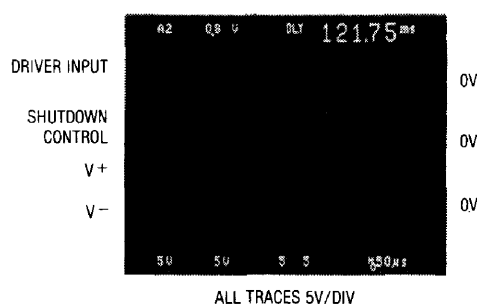


Figure 2. Transceiver Turn-On Via Logic Input

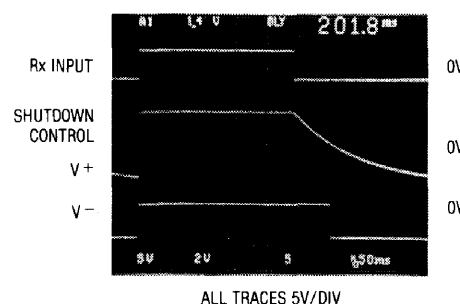


Figure 3. Transceiver Turn-On Via Receiver Input

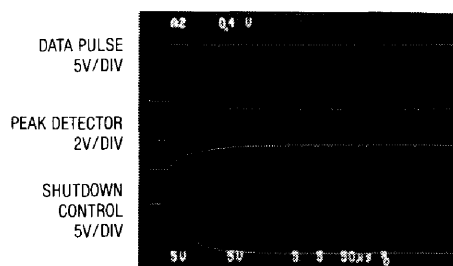


Figure 4. SHUTDOWN After 50ms Without Data Transmission

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