Universal 120/100/75 Ohm Transceiver Termination for the LXT35x/36x

Application Note

January 2001

Order Number: 249163-001

As of January 15, 2001, this document replaces the Level One document known as *AN055*.

Application Note

Contents

Figures

Tables

1.0 General Description

This application note describes an example of a universal transceiver termination for T1/E1 designs which implement Intel LXT350/51 and LXT360/361 transceivers.

For each mode of operation (T1/E1), termination requirements differ. T1 designs require 100 Ω termination. At E1 rates, either 120 Ω or 75 Ω termination can be utilized. Programmable T1/E1 receiver termination helps to take full advantage of the universality of Intel LIUs.

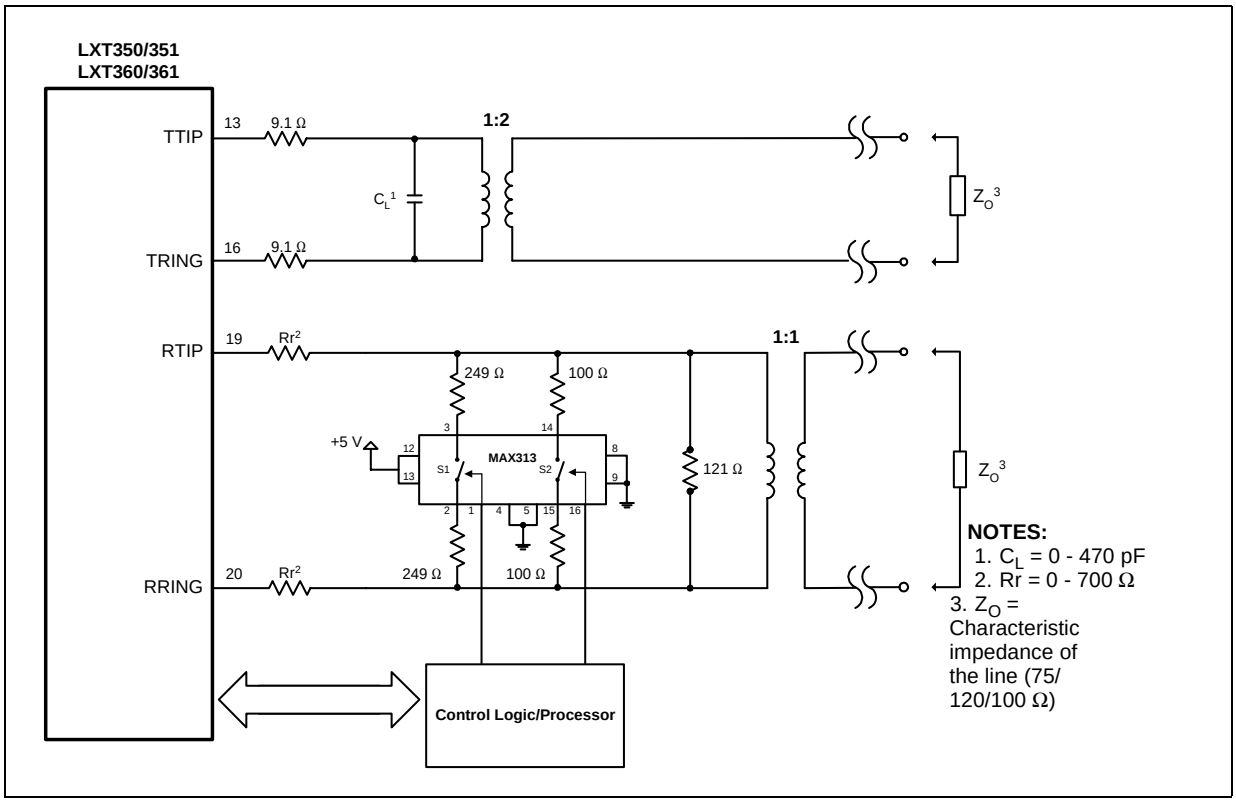
Changes to the receive side of the LIU should be done in a way that they do not impair the performance of the LIU. Receiver range (sensitivity) and noise immunity should not be affected. Additionally, it is important that the added circuitry does not impact the compliance to industry standards for receive return loss. The best way to accomplish such requirements is to employ terminating resistors that are as close as possible to the characteristic impedance of the line (T1: 100 Ω; E1: 120/75 Ω).

1.1 Termination Solutions

Figure 1 presents programmable resistive termination for both T1 and E1 designs, when deploying Intel Universal LIUs. Programmability is accomplished with a Maxim analog switch and control logic. In this case, the Max313, a quad single-pole/single-throw (SPST) analog switch, is used. The Max313 is normally open (NO) and features a low on-resistance (10 Ω maximum, 6.5 Ω typical). It offers low power consumption, low leakage over temperature, and low cost. A quad switch is recommended for designs with multiple T1/E1 ports per card. Single and dual analog switches are also available.

All shown resistors are standard values and 1% tolerance. The receive transformer has a 1:1 ratio, as recommended in the LXT360 data sheet. Table 1 shows how to select/program required termination resistance with switches S1 and S2. Resistors Rr are recommended to be between 0 and 700 Ω.

Figure 1. Universal Programmable T1/E1 Line Interface without Protection Circuitry



1.1.1 Protection Circuitry

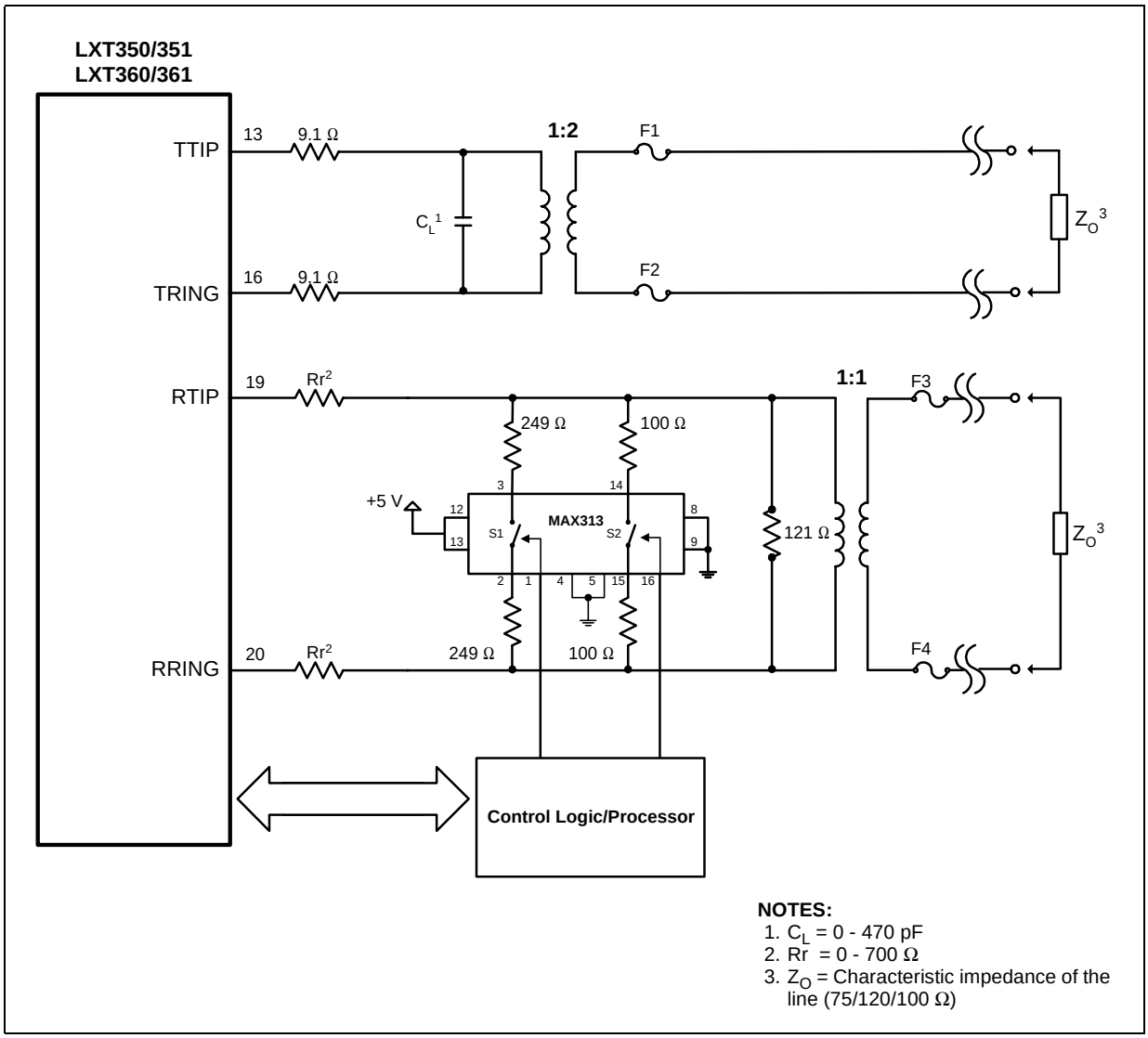
For the purpose of clarity, Figure 1 shows the basic configuration without power cross and lightning protection. However, most long-haul applications require protection circuitry. Figure 2 and Figure 3 show how to design T1/E1 programmable LIU when protection circuitry is required. The design in Figure 2 utilizes fuses F1-F4, while Figure 3 employs PTCs or fused resistors. Fuses and resistors/PTCs are current-limiting components. A more extensive discussion on lightning and power-cross protection circuitry can be found in Application Note 47: *LXT360 Line Protection Circuitry.*

When fuses are used in the protection circuit, all resistors should be the same as in Figure 1. Fuses have very low resistance (near 0 Ω), and have no impact on the transmitted signal amplitude or receiver input impedance.

Table 1. Impedance Options by Switch Setting

S1	S2	Impedance
Off	Off	120 Ω
Off	On	75 Ω
On	Off	100 Ω
On	On	Do Not Use

Figure 2. Universal Programmable T1/E1 Line Interface with Fuses used in Protection Circuitry



If the line card is protected by PTCs or fused resistors, the effect on line resistors must be taken into account. This includes reduction in the amplitude of the transmitted signal and changes to the input impedance on the receive side. To compensate, change the values of the resistors on both the transmit and receive side. Figure 3 shows a design with 6 Ω resistors or equivalent PTCs (PolySwitch). Notice that TTIP and TRING have changed from 9.1 Ω to 7.5 Ω. Also termination on the receive side is adjusted to compensate for protection resistors (R=6Ω).

1.1.2 Board Design Recommendation

It is prudent to keep signal paths between the transceiver and edge connector as short and symmetrical as possible. For best results, place the switching component very close to the LIU.

Figure 3. Universal Programmable T1/E1 Line Interface with Resistive Components used in Protection Circuitry