# LXT332 Dual Channel T1/E1 Transceiver Solution Migration from Dual-Chip (AT&T T7290) to Single-Chip (LXT332) Implementation

## Application Note

*January 2001*

Order Number: 249154-001
As of January 15, 2001, this document replaces the Level One document known as *AN039*.

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# 1.0 General Description

This application note provides manufacturers of multi-channel T1/E1 transmission equipment with a smooth upgrade from a pair of AT&T T7290 single-channel devices to an advanced implementation using a single LXT332 integrated dual-channel device. This app note discusses Hardware Mode only. No Host Mode is available in the T7290.

There are some differences between the two devices in the back end and line interfaces. However, existing T7290 designs can easily be adapted to take advantage of the fully integrated dual channel LXT332.

## 1.1 Advantages

- Simplifies board design
- Single transformer turns ratio for both T1 and E1 applications
- Saves real estate
- Improves jitter performance
- No external crystal required
- Reduces inventory costs
- Additional features with Host Mode Serial I/O

## 1.2 Line Interface Modifications

No framer interface changes are required to upgrade from the T7290 to the LXT332. However, minor modifications to the control circuitry are required. There are also minor differences in the LOS and Transmit Driver monitor outputs.

### 1.2.1 Jitter Attenuation Select

The LXT332 JA circuitry is controlled by the JASEL and MCLK inputs. This function is implemented through the Mode 1 and Mode 2 pins on the T7290. Refer to Table 1 and Table 4 for details.

### 1.2.2 Tristate Output

The Tristate control inputs on the two devices function similarly, but with inverted polarity. The T7290 TRI input is an active low; the LXT332 TRSTE input is an active high. To provide compatibility with existing designs, an inverter must be added to the existing TRI input.

### 1.2.3 Line Length/Pulse Shape Control

Both the LXT332 and the T7290 use 3-input codes to determine pulse shapes for various line lengths. The two coding schemes are shown in Table 2 and Table 5.

### 1.2.4 Loopback Control

Both the LXT332 and the T7290 provide various diagnostic loopbacks. The control codes for executing the various loopbacks are slightly different as shown in Table 3 and Table 6.

### 1.2.5 Loss of Signal

Both the LXT332 and the T7290 provide Loss of Signal (LOS) outputs. The internal detection circuitry which determines when an LOS condition exists is functionally different.

### 1.2.6 Transmit Driver Monitor

Both the LXT332 and the T7290 provide Driver Monitor detectors. The LXT332 DFM output reports short conditions. The T7290 TSC output differentiates between shorts to power supply, shorts to ground and shorts together.

### 1.2.7 Elastic Store Overflow

The T7290 provides an output to report ES overflow conditions. The LXT332 does not report overflow conditions.

**Table 1. AT&T JA Codes**

| JA Placement | Mode 1 | Mode 2 |
|---|---|---|
| Bypass | 0 | 0 |
| Transmit Path | 0 | 1 |
| Receive Path | 1 | 0 |
| Test Mode[1] | 1 | 1 |

1. Not used in normal operation.

**Table 2. AT&T T7290 Line Length Codes**

| EC 3 | EC 2 | EC 1 | Line Length | Cable Loss |
|---|---|---|---|---|
| 1 | 0 | 0 | 0 - 131 ft ABAM | 0.6 dB |
| 0 | 1 | 0 | 131 - 262 ft ABAM | 1.2 dB |
| 1 | 1 | 0 | 262 - 393 ft ABAM | 1.8 dB |
| 0 | 0 | 1 | 393 - 524 ft ABAM | 2.4 dB |
| 1 | 0 | 1 | 524 - 655 ft ABAM | 3.0 dB |
| 0 | 1 | 1 | 75 Ω ITU | |
| 1 | 1 | 1 | 120 Ω G.703 | |
| 0 | 0 | 0 | FCC Part 68, Option A | |

## Table 3. AT&T Loopback Codes

| Mode | LOOPA | LOOPB | TBS |
|---|---|---|---|
| RLOOP | 1 | 0 | N/A |
| LLOOP | 0 | 1 | 1 or 0 |
| TBS | N/A | N/A | 1 |
| Full Local Loop | 1 | 1 | 1 or 0 |

## Table 4. LXT332 JA Codes

| JA Placement | JASEL |
|---|---|
| Bypass | MCLK[1] |
| Transmit Path | 0 |
| Receive Path | 1 |
| 1. JA is bypassed when JASEL is tied to MCLK. | |

## Table 5. LXT332 Line Length Codes

| LEN 2 | LEN 1 | LEN 0 | Line Length | Cable Loss |
|---|---|---|---|---|
| 0 | 1 | 1 | 0 - 133 ft ABAM | 0.6 dB |
| 1 | 0 | 0 | 133 - 266 ft ABAM | 1.2 dB |
| 1 | 0 | 1 | 266 - 399 ft ABAM | 1.8 dB |
| 1 | 1 | 0 | 399 - 533 ft ABAM | 2.4 dB |
| 1 | 1 | 1 | 533 - 655 ft ABAM | 3.0 dB |
| 0 | 0 | 0 | 75 Ω ITU | |
| 0 | 0 | 1 | 120 Ω G.703 | |
| 0 | 1 | 0 | FCC Part 68, Option A | |

## Table 6. LXT332 Loopback Codes

| Mode | RLOOP | LLOOP | TAOS |
|---|---|---|---|
| RLOOP | 1 | 0 | N/A |
| LLOOP | 0 | 1 | N/A |
| DLOOP | 1 | 1 | 1 |
| TAOS | 0 | N/A | 1 |
| RESET | 1 | 1 | 0 |

## 1.2.8 Line Interface Modifications

The line interface must be modified when upgrading from the PEB 2236 to the LXT332. The T1 line interfaces are shown in Figure 1 and Figure 2. The E1 line interfaces for 120 Ω twisted-pair are shown in Figure 3 and Figure 4. The E1 line interfaces for 75 Ω coax are shown in Figure 5 and Figure 6.

**Figure 1. T7290 100 Ω T1 Line Interface Upgrade**

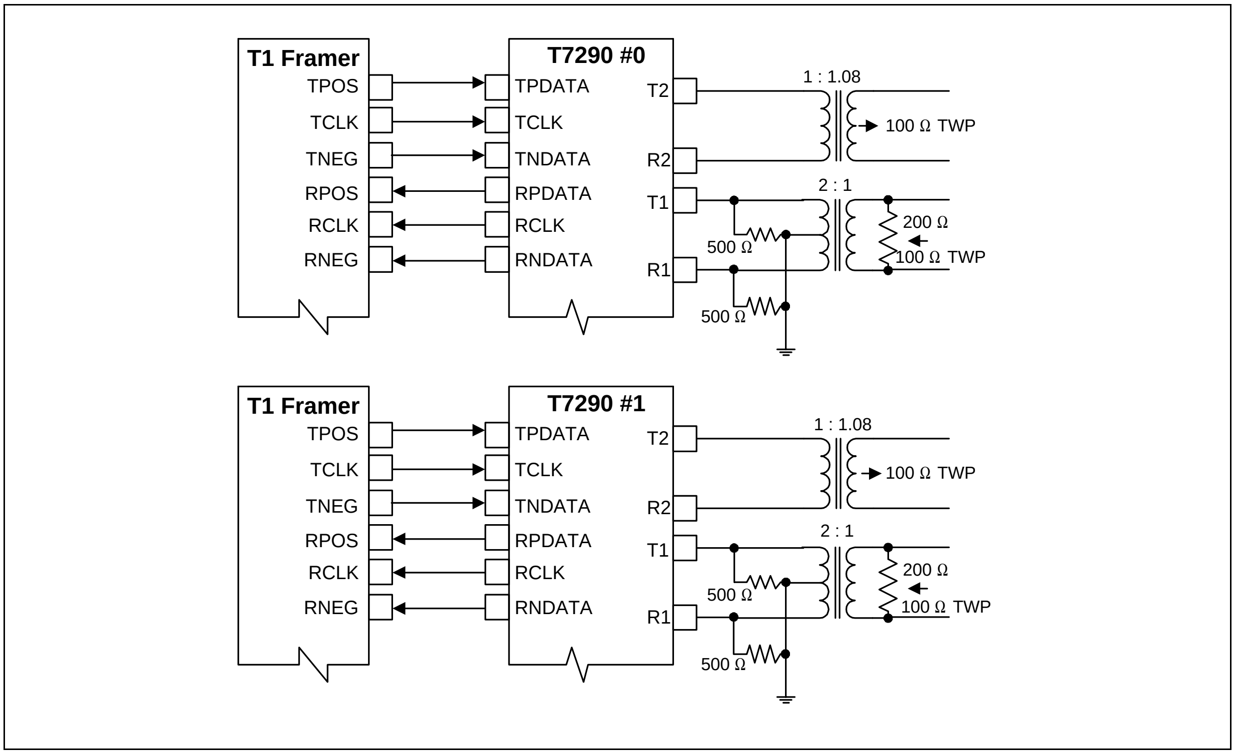


**Figure 2. LXT332 100 Ω T1 Line Interface**

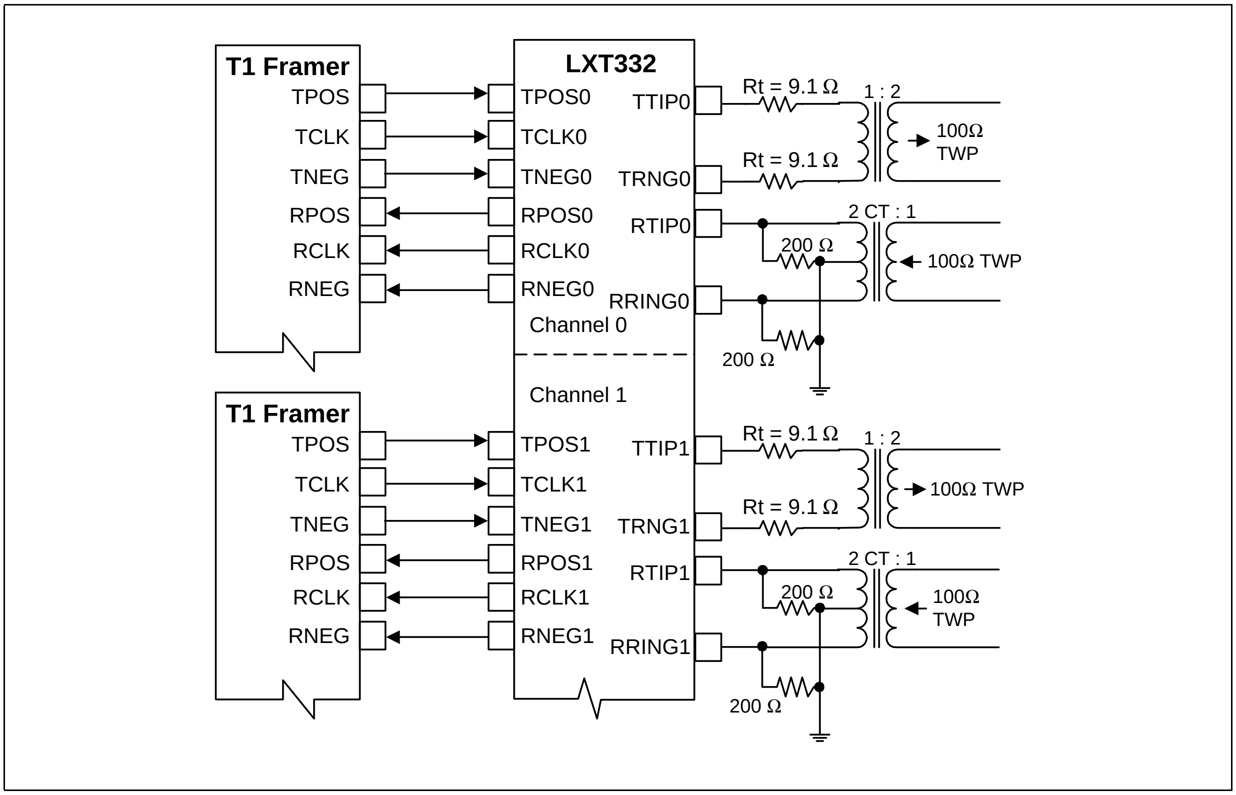


**Figure 3. T7290 120 Ω E1 Line Interface Upgrade**

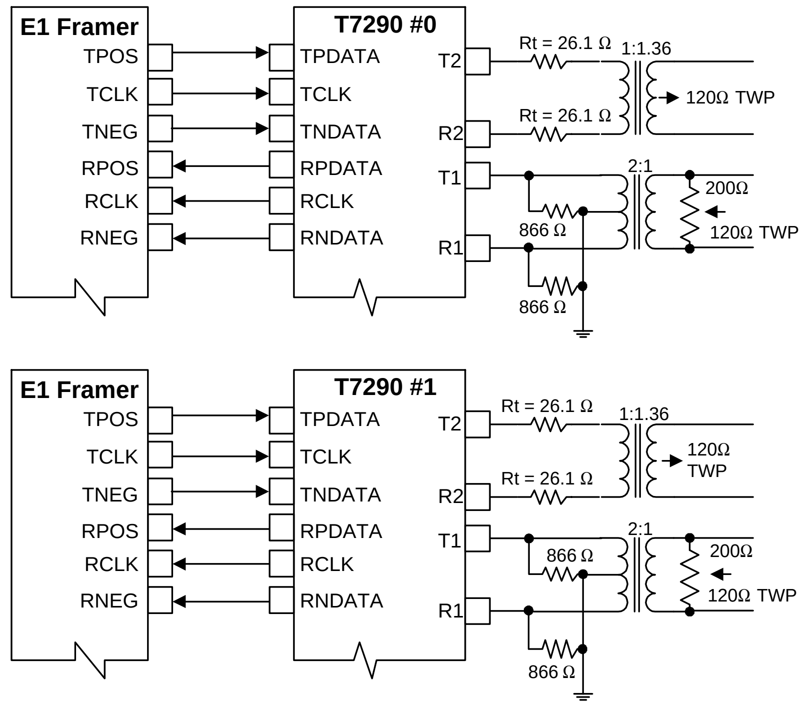


**Figure 4. LXT332 120 Ω E1 Line Interface**

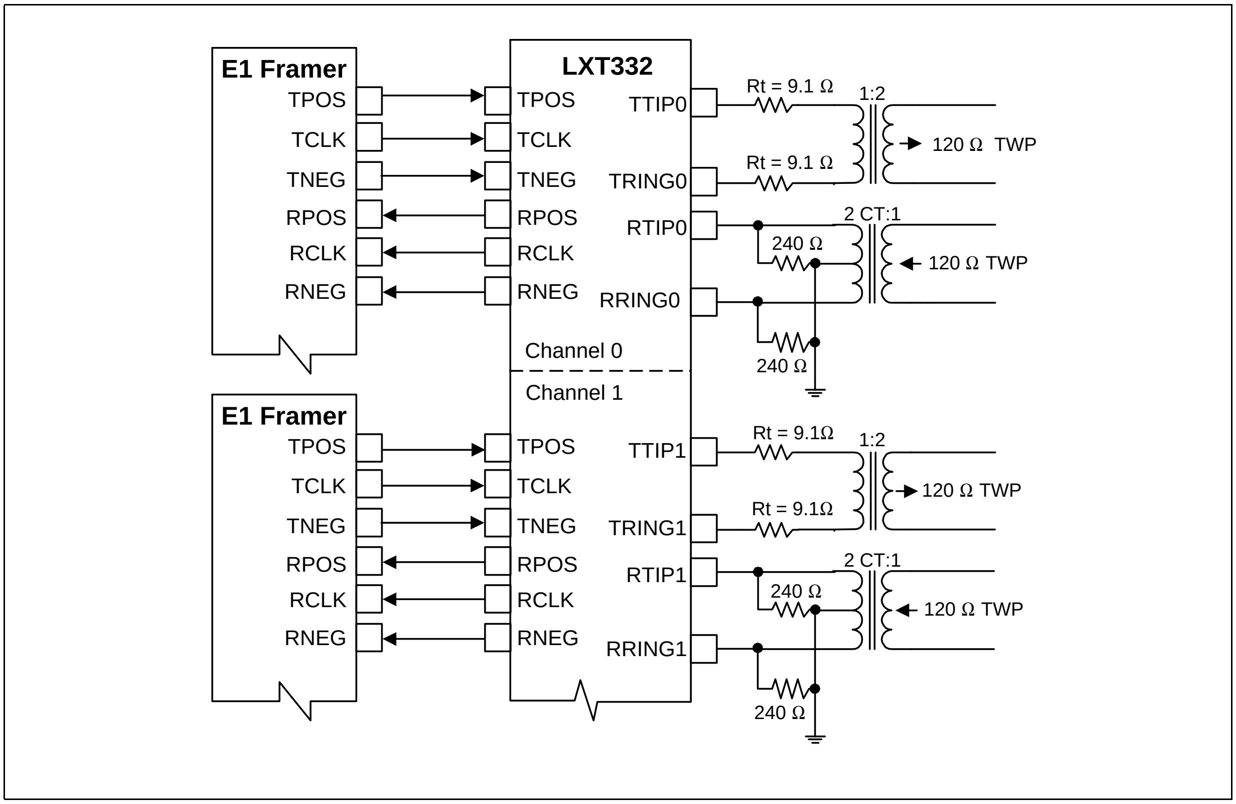


**Figure 5. T7290 75 Ω Coax E1 Line Interface Upgrade**

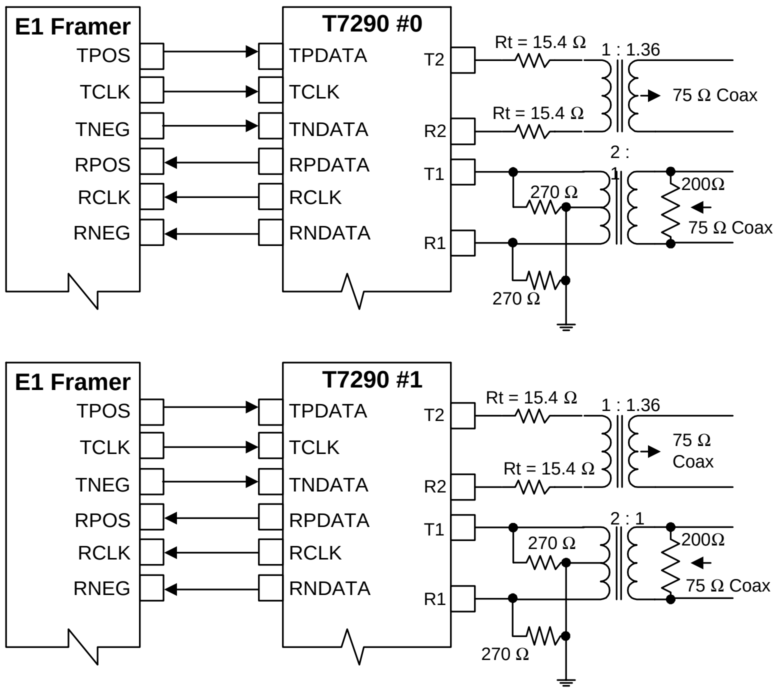
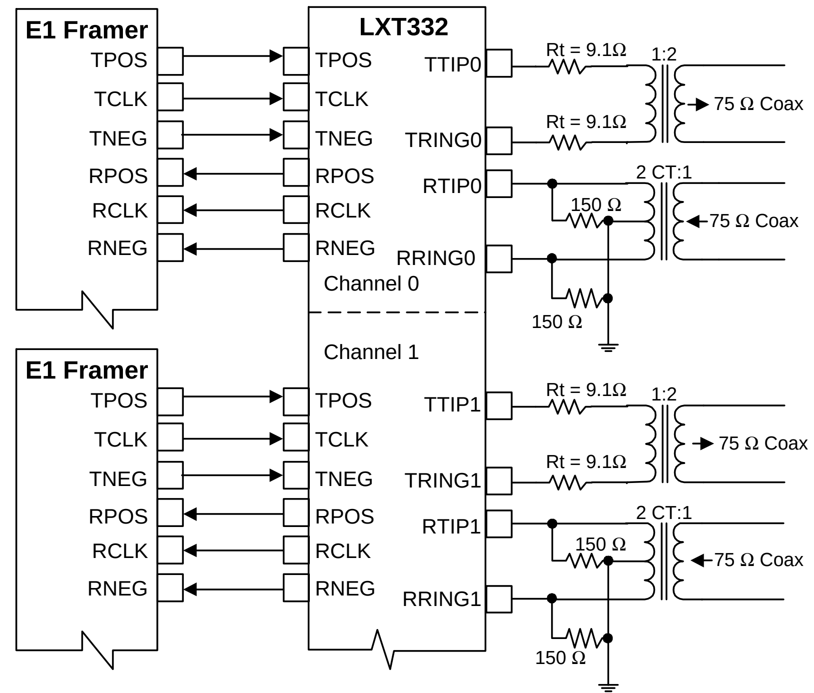
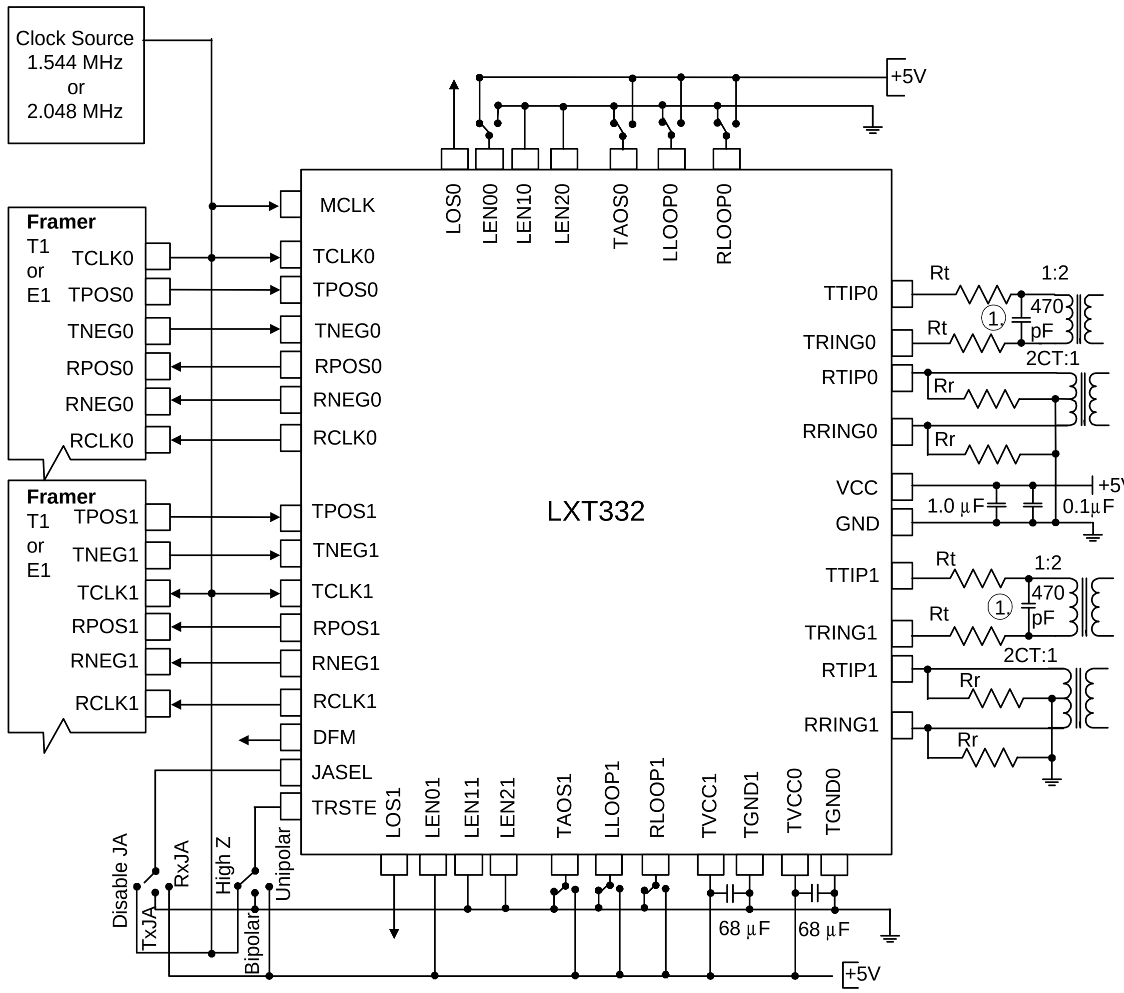


**Figure 6. LXT332 75 Coax Ω E1 Line Interface**




Using the LXT332, it is possible to design a switchable interface board. Figure 7 shows a simplified application which can be used for either T1 or E1 equipment by changing the MCLK and Line Length inputs, and selecting appropriate resistors for Rt and Rr.

## Figure 7. LXT332 Switchable T1/E1 Line Interface (Hardware Mode)




| Media | LEN | Tx Xfmr Ratio | Rt | Rr |
|---|---|---|---|---|
| 100 Ω TWP | 011 - 111 | 1:2 | 9.1 Ω | 200 Ω |
| 120 Ω TWP | 000 | 1:2 | 9.1 Ω | 240 Ω |
| 75 Ω Coax | 000 | 1:2 | 9.1 Ω | 150 Ω |

**NOTE:**

1. Typical value. Adjust for actual board parasitics to obtain optimum return loss.