LXT310 Line Protection Circuitry Application Guidelines

Application Note

January 2001

Order Number: 249147-001

As of January 15, 2001, this document replaces the Level One document known as *AN026a*.

Application Note

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1.0 General Description

This application note provides guidelines for line protection circuitry required in Network Channel Termination Equipment (NCTE), Channel Service Units (CSU), and WAN network interfaces. NCTE is installed at the customer premises end of T1 lines. As these lines run between the customer facilities and the central office, they are subject to over voltage/current stresses from lightning strikes, power crosses, and other noise impairments. Protection circuitry is required to protect the line from injected impairments and the termination equipment (CSU, MUX, PBX, etc.) from overload stresses.

NCTE protection requirements are specified in FCC Part 68 (lightning hazards), UL 1950 (AC hazards), Bellcore TR-TSY-000007 and AT&T Pub 62411. These documents differentiate between longitudinal stress (differential between tip/ring and ground) and metallic stress (differential between tip and ring). Longitudinal stresses are more common and include impulsive noise events such as lightning induced surges. Metallic stresses are less likely and are usually caused by power crosses during maintenance activity.

Since T1 acceptance testing does not meet formal FCC and safety requirements, the final board design should undergo this FCC testing at an approved lab.

1.1 Features

The figure below shows a typical LXT310 line interface.

- Resistors R1, 2, 3, 12, 13 (in the transmit and receive lines) values are selected to match the line impedance. They also provide some current limitation
- Positive Temperature Co-efficient devices (PTCs) (R10, 11, 16, 17) permit “healing” after fault event
- 5.6 Ω resistors and PTCs matched to T1 Line requirements using receive resistor pad and 2:1 transformers
- Line transformers T1 and T2 breakdown ratings should be a minimum of 1.5 kV
- Varistors must have sufficient stand-off voltage to allow normal operation (approximately 4 volts), with low off-state capacitance (< 50 pF)
- Final values for RF chokes, L1, 2, will vary with board design
- Interconnect the line side center taps of the line transformers if sealing currents are present
- No power or ground planes should be located on the circuit board in the area T1 Line connector back to the transformers

Suggested component values are listed in Table 1.

Figure 1. LXT310 Line Protection Circuitry

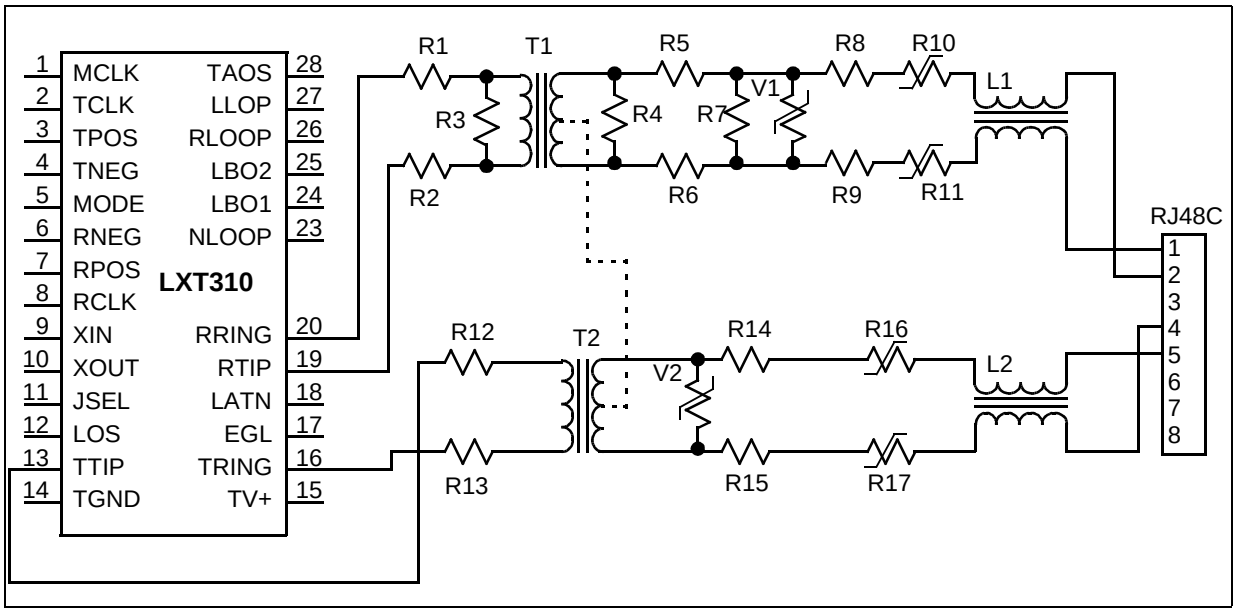

Table 1. Component Values

Ref #	Description
R1,2	100 Ω
R3	402 Ω, 1%
R4	301 Ω, 1%
R5, 6	22 Ω, 2W
R7	232 Ω
R8, 9	5.6 Ω, 1W
R10, 11 R16, 17	600 V, positive temperature co-efficient device – typical: Raychem TR600-160-RA-0.5-.130 4.7 to 8.5 Ω
R12, 13	6.8 Ω, 1/2 W
R14, 15	5.6 Ω, 1 W
V1, 2	Stand-off voltage 4~4.5 V, off-state capacitance < 50 pF – typical: EDAL Industries B529-2
T1, 2	Line transformer, 1:2 turns ratio – typical: Pulse Engineering PE65351
L1, 2	RF Choke, value varies by board design, approximately 33 µH – typical: BH Electronics 500-1164

Table 2. Suppliers

Company	Telephone Number
Raychem, Inc.	(800) 227-7040
Pulse Engineering	(619) 674-8130
EDAL Industries	(203) 467-2591
BH Electronics	(612) 894-9590