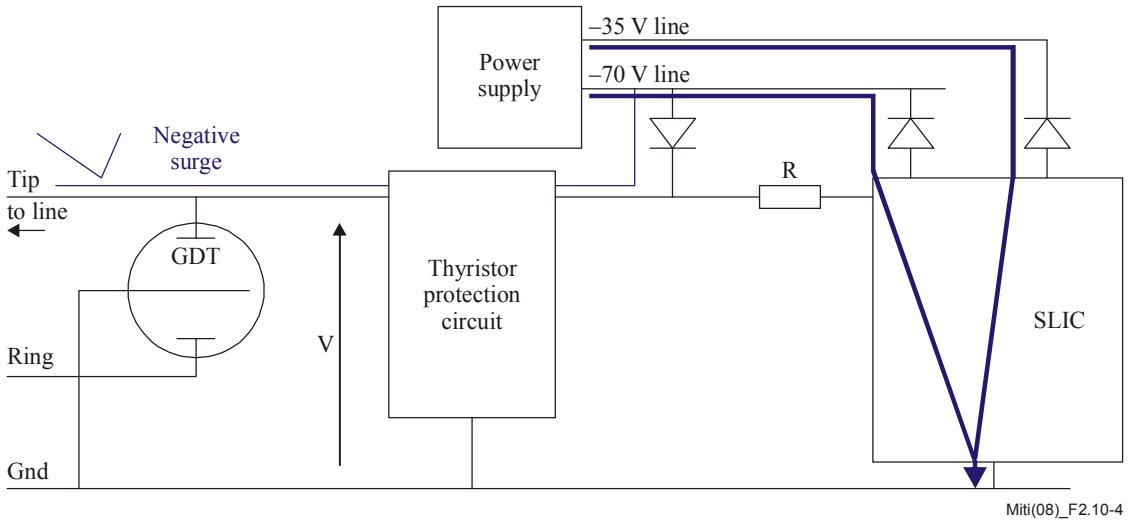
The failure appears to be caused by a negative surge entering under the firing voltage of the thyristor protection circuit (±190 V) and causing the –70 V and the –35 V rails to become more negative by the current entering the power supply via the diode which clamps the incoming line to the –70 V supply rail. When the –70 V rail is surged to approximately –100 V and the –35 V rail is surged to approximately –45 V, the SLIC latches up and the current is conducted from the –70 V and –35 V rails to ground, see Figure 2.10-4, which shows the current path through the thyristor protection circuit and the diode to –70 V, and the current from the –70 V and –35 V rails through the SLIC. It is the power supply current that damages the two diodes which connect from the –35 V and –70 V supply lines to the SLIC circuit (based on the fact that the diode which clamps the incoming line to the –70 V supply rail is not damaged).

The diode which clamps the incoming line to the –70 V supply rail was probably added to prevent the SLIC line inputs exceeding –70 V. However, adding this diode has resulted in rendering the thyristor protection circuit redundant and causing the SLIC to have its –70 V and –35 V ratings exceeded.

The scenario was confirmed by applying surges to a working circuit.

Measurement/Searching techniques/Experiment

Investigation



Magnitude of Voltage V less than required to operate either the thyristor protection circuit or the GDT.
Only part of the Tip side of the circuit is shown for simplicity.

Figure 2.10-4 – Simple circuit showing path of surge on tip side of line