Dual Terminator Resistor Network

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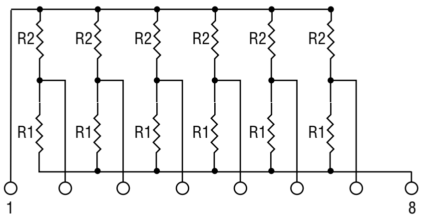
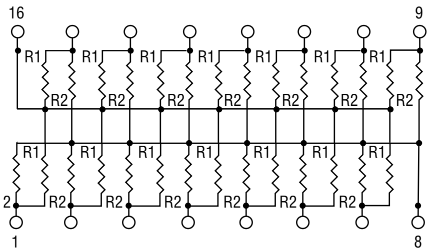
The Dual Terminator (or Thevenin equivalent) Network is commonly used for TTL dual-line termination and pulse squaring or ECL line terminations. In ECL line terminator, R2 functions as an emitter pull-down resistor and is normally tied to the most negative supply voltage to provide proper line currents. R1 is normally tied to ground and functions as the termination resistor and in parallel with R2 provides the characteristic impedance of the transmission line. This results in a zero reflection coefficient of this line to eliminate reflections.

The Dual Terminator circuit is available in both SIP and DIP configurations, as shown below.



SIP



DIP

Testing of Dual Terminators

Since the Dual Terminator circuit has many resistors in parallel, a direct pin-to-pin measurement for the values of R1 and R2 can be made using an ohmmeter with guard capabilities.

The function of the guard pin is to apply and equal voltage across the adjacent (parallel) resistance path. When applied, current flow is eliminated allowing an accurate measurement of the resistor under test.

Using the 8-pin SIP network shown, the testing method would be as follows:

Test R1 Values

To test the first resistor, connect the ohmmeter measurement leads between pin 8 and 2. Connect the guard lead to pin 1. R1 is now guarded and an accurate measurement can be made.

To test the second R1 resistor, connect the measurement leads between pin 8 and pin 3. Connect the guard to pin 1 and make the resistance measurement.

Continue this testing scheme for the remainder of the R1 resistors, always guarding pin 1.

Test R2 Values

To test the first R2 resistor, connect the ohmmeter measurement leads between pin 1 and pin 2. Connect the guard lead to pin 8. The first R2 resistor is now guarded and an accurate measurement can be made.

To test the second R2 resistor, connect the ohmmeter measurement leads between pin 1 and pin 3. Connect the guard lead to pin 8 and make the resistance measurement.

Continue this testing scheme for the remainder of the R2 resistors, always guarding pin 8.

An example of the type of ohmmeter to be utilized that incorporates a guarded measurement capability. It must be noted that guarded measurements using ohmmeters are satisfactory measurements up to a ratio of about 10:1 between R1 and R2. Above a 10:1 ratio, accuracy is degraded and measurements can be incorrect because of inadequate guarding capability of the equipment.

Unguarded Resistance Measurements

In the case where no guarded ohmmeter is available, the individual resistors can be evaluated by comparing the unguarded resistance measurement to the theoretical value of the equivalent series-parallel circuit and determining the percent of error of each resistor.

Example:

Network 4608X-104-221/331 where R1 values are 220W and R2 values are 330Ω.

Rp = Parallel Resistance of Remaining Circuit (See diagram below.)

RE = Equivalent Series - Parallel Resistance Seen by Unguarded Meter

$$RE_{R1} = (P8\text{-}P2) = \frac{R1\,(R2 + Rp)}{R1 + (R2 + Rp)} = \frac{220\,(330 + 110)}{220 + (330 + 110)} = 146.67\Omega \quad 2\%\ \text{Tolerance} \approx \pm 1.96\Omega^*$$

$$RE_{R2} = (P1\text{-}P2) = \frac{R1\,(R2 + Rp)}{R1 + (R2 + RP)} = \frac{3300\,(220 + 110)}{330 + (220 + 110)} = 165\Omega \quad 2\%\ \text{Tolerance} \approx \pm 1.65\Omega^*$$

$$Rp = \frac{550}{5} = 110\Omega$$

Utilization of these formulas will enable you to determine the equivalent unguarded resistance to be expected from any values of R1 and R2 for a Dual Terminator Network.

$$^*2\%\ \text{tolerance} \approx \frac{(RE_{R1})^2}{R1} \times .02 = 1.96\Omega$$