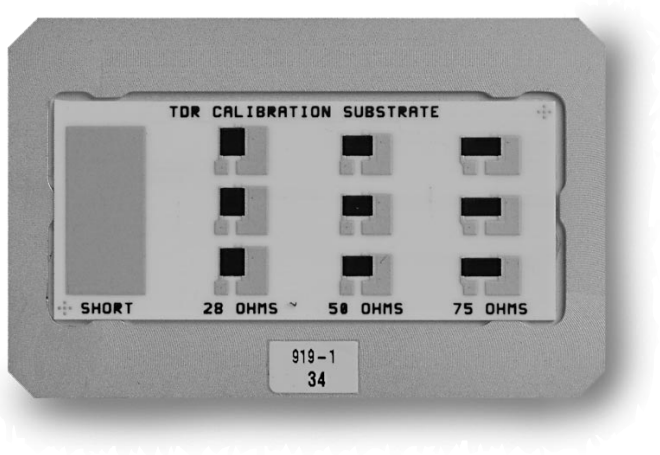
Agilent N1020A-K05
TDR Calibration Substrate
Product Overview

Using the Agilent N1020A-K05 TDR Calibration Substrate For Rambus® Signal Integrity Measurements

Overview

When making highly sensitive measurements on high-speed digital boards, there is little room for error. Not trusting the accuracy of test equipment usually means repeating the test again, which results in lost time in the R&D laboratory. This time cannot be recovered and creates unnecessary time-to-market pressure. When making Time Domain Reflectometry (TDR) measurements on Rambus PCB's, it is recommended that you use the method of calibration AND verification.



Agilent TDR Calibration Substrate

Product Description

The Agilent TDR Calibration Substrate is used when probing Rambus In Line Memory Modules (RIMM's™), Continuity Rambus In Line Memory Modules (CRIMM's), Small Outline Rambus In Line Memory Modules (SO-RIMM's) and mother-boards. The substrate shown above has precision, thick film resistors that are laser trimmed to yield the utmost in accuracy. Durable gold electrodes are fired onto the alumina substrate to insure a long life with various probe tip configurations. The calibration substrate is a non-reactive standard that is recommended for TDR measurements due to the lower frequency content of Time Domain Reflectometers. A 28 Ohm airline is not recommended for TDR, but it can be used effectively with the Vector Network Analyzer.

Calibration and Verification

Using the process of calibration and verification together will enhance the confidence of Rambus board designs. To minimize measurement error, it is best to calibrate a 50-ohm output impedance instrument in a 50-ohm environment. After this calibration is accomplished, the next step is to verify the calibration by measuring a well-known impedance value that is close to the characteristic impedance to the device under test. This two-step process assures that the measurement equipment is highly accurate in the region of interest.

The two step process is done as follows: using a TDR probe with suitable bandwidth, and a TDR oscilloscope with Normalization capability, first probe the short standard on the calibration substrate. This is the electrode area indicated on the left side (see photo). Next, probe the 50-ohm precision resistor, making sure to place the ground pin of the TDR probe on the larger electrode pad. This is done because the excess capacitance of the larger electrode tends to compensate for the excess inductance associated with most probe ground tips. After confirmation from the TDR oscilloscope, the calibration is complete. Next, we must verify.

The verification is done by probing one of the 28-ohm ±0.25% thick film resistors located on the calibration substrate. The ±0.25% translates into ±70 milliohms for the 28-ohm standard. This resolution is important for Rambus applications where the ±2.8-ohm tolerance can easily fail a complete lot of PCB's. Don't forget to probe the larger pad with the ground pin again, same as the 50-ohm procedure. Also, when performing verification, it is important to use the Normalized TDR waveform. The standard TDR waveform will include secondary reflections that will introduce significant inaccuracies at the front end of the device under test (up to 3 ohm for Rambus RIMM's!).

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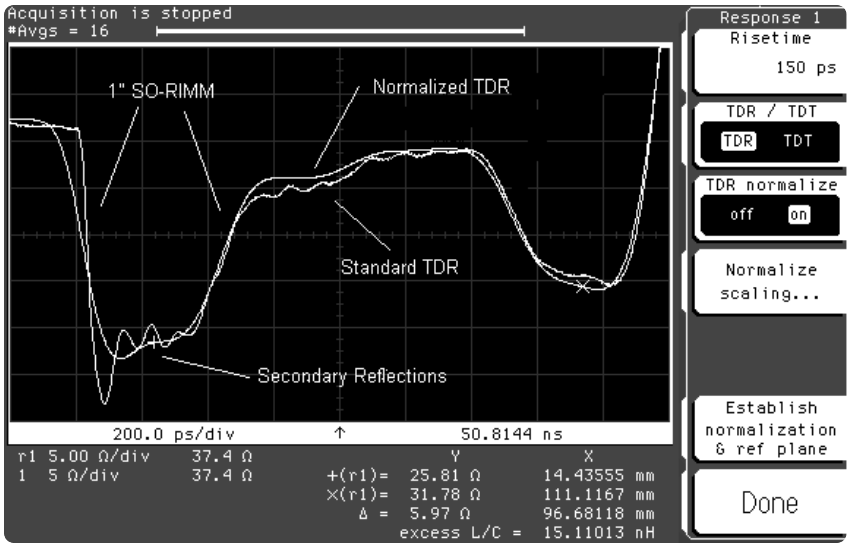

Small Outline Rambus Inline Memory Module (SO-RIMM™) TDR Measurement

Rambus SO-RIMM Measurements

The figure above describes a TDR measurement of a Small Outline Rambus Inline Memory Module (SO-RIMM). This new form factor RIMM module will be used for laptop computer memory architecture and thus is much smaller in size than a typical desktop RIMM. The challenging part of measuring the characteristic impedance of an SO-RIMM module is the very short 28 ohm microstrip segment, typically only 1" long. As can be seen in the TDR waveform above, the secondary reflections that would ordinarily obscure the 1" trace are non-existent on the Normalized TDR waveform. This is because the Calibration Substrate was used with a high frequency TDR probe to set the reference plane at the probe tip. The standard waveform shows how secondary reflections produce measurement error.

Accuracy is Paramount

So, when characteristic impedance measurements are critical, make sure to take the proper steps that allow the best possibility of success. Calibration and verification with precision resistors give the confidence needed with Rambus signal integrity work. Remember that hours lost in the R&D lab usually translate in days lost in time to market. In today's competitive environment, nobody can afford to lose precious time battling with low accuracy test equipment.

Supplemental Characteristics

Size: 35mm x 56mm
Weight: 200 grams
Impedance Accuracy: 0.25% (28 ohms ±70 milliohms)

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