Ironwood Electronics

SM Interposer

0.50 mm pitch

Measurement Results

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Objective

The objective of these measurements is to determine the RF performance of a Ironwood Electronics SM interposer. A signal pin surrounded by grounded pins is selected for the signal transmission. Measurements in both frequency and time domain form the basis for the evaluation. Parameters to be determined are S-parameters, the propagation delay and the attenuation to 100 GHz.

Methodology

Frequency domain measurements were acquired with a combination of network analyzers (Agilent HP8722C to 20 GHz and 8510C to 100 GHz). The instruments are calibrated up to the end of the 0.022" diameter coax probes that are part of the test fixturing. The device under test (DUT) was then mounted to the fixture and the response measured.

Time domain measurements are obtained via Fourier transform from VNA tests. These measurements reveal the type of discontinuities at the interfaces plus contacts.

Test procedures

Measurements were taken up to 20 GHz on the 8722C VNA and up to 100 GHz on an 8510C VNA. These measurements are combined in post-processing and fixture de-embedding.

Setup

Testing was performed with a test setup that consists of a brass plate that contains the coaxial probes. The DUT is aligned and mounted to that plate. The opposite termination is also a metal plate with coaxial probes, albeit in the physical shape of an actual device to be tested or a flat plate with embedded coaxial probes. Measurements are performed for a pin in the center of the array (field), indicated in dark grey:

Signal pins are completely surrounded by ground pins since behavior is similar if they were connected to 50 Ohm driven pins as may be the case in BGA environments.

Figs. 1 and 2 show a typical arrangement base plate and DUT probe:

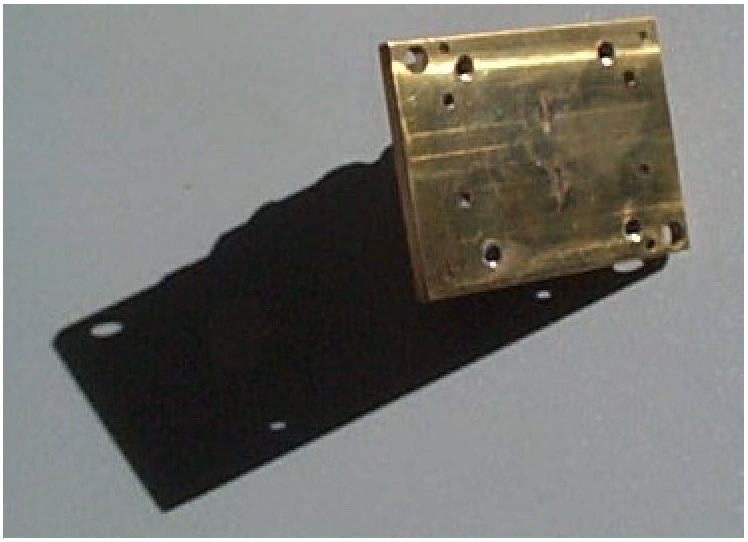

Figure 1 SM interposer base plate example

Figure 2 DUT plate example

The SM interposer and base plate as well as the DUT plate are then mounted in a test fixture similar to that shown in Fig. 3:

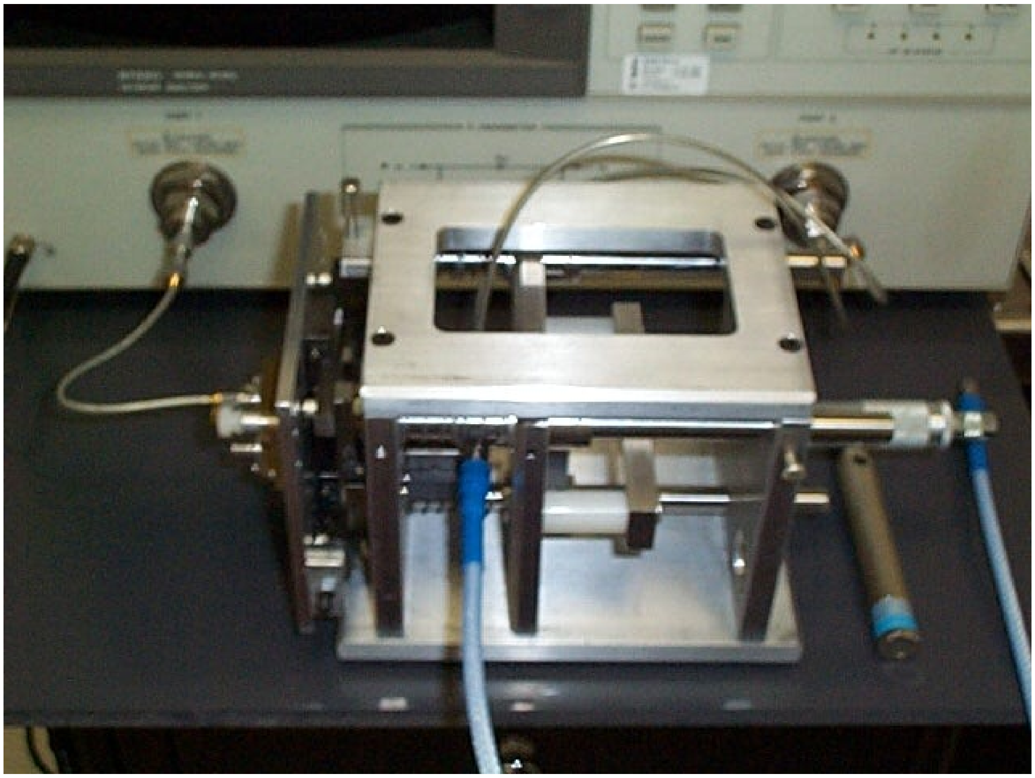

Figure 3 Test fixture example

This fixture provides for independent X,Y and Z control of the components relative to each other. X, Y and angular alignment is established once at the beginning of a test series and then kept constant. Z (depth) alignment is measured via micrometer and is established according to specifications for the particular DUT.

Connections to the VNA are made with high quality coaxial cables.

Measurements

Time domain

Then first measurement to be illuminated is the TDR response. It is obtained for a thru measurement from the PCB side through the socket into a 50 Ohm termination on the IC side of the test coupon:

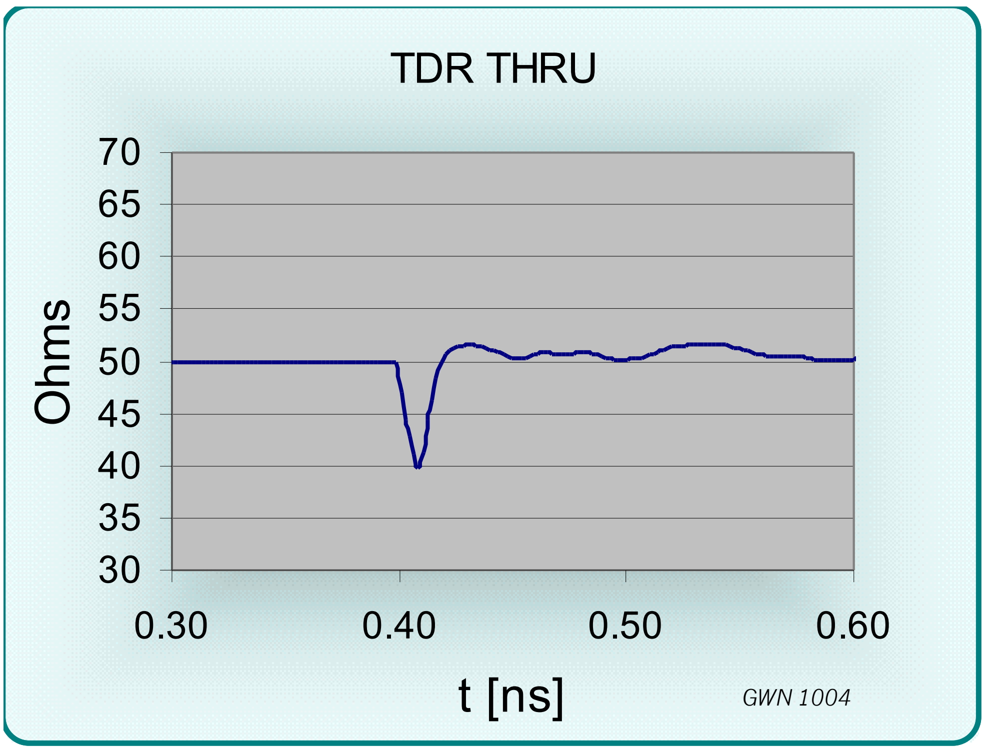

Figure 4 TDR measurement into a 50 Ohm probe

The thru TDR measurement shows a capacitive response. The dip corresponds to an impedance of 39.8 Ohms. It should be kept in mind that the impedance recorded here is not as high or as low as actually found in the specimen because of the risetime of the time step, in this case 10 ps. For connections with comparable or shorter electrical lengths this does not allow the peak to reach its full height.

The TDT performance for a step propagating through the contact arrangement was also recorded:

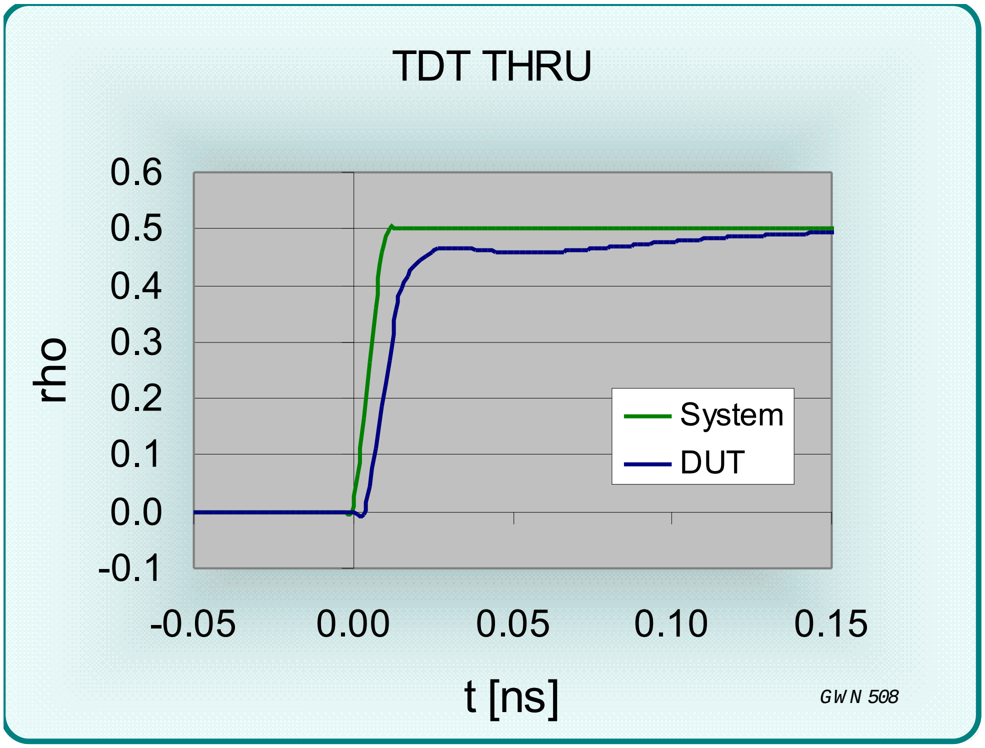

Figure 5 TDT measurement

The TDT measurements for transmission show a noticeable contribution to risetime from the pin array (10-90% RT = 80.2 ps, the system risetime is 7.8 ps). The added delay at the 50% point is 6.0 ps. There is no signal distortion. If the 20%-80% values are extracted, the risetime is only 11.7 ps vs. 5.9 ps system risetime.

Frequency domain

Network analyzer measurements show an insertion loss as below for the frequency range of 200 MHz to 90 GHz.

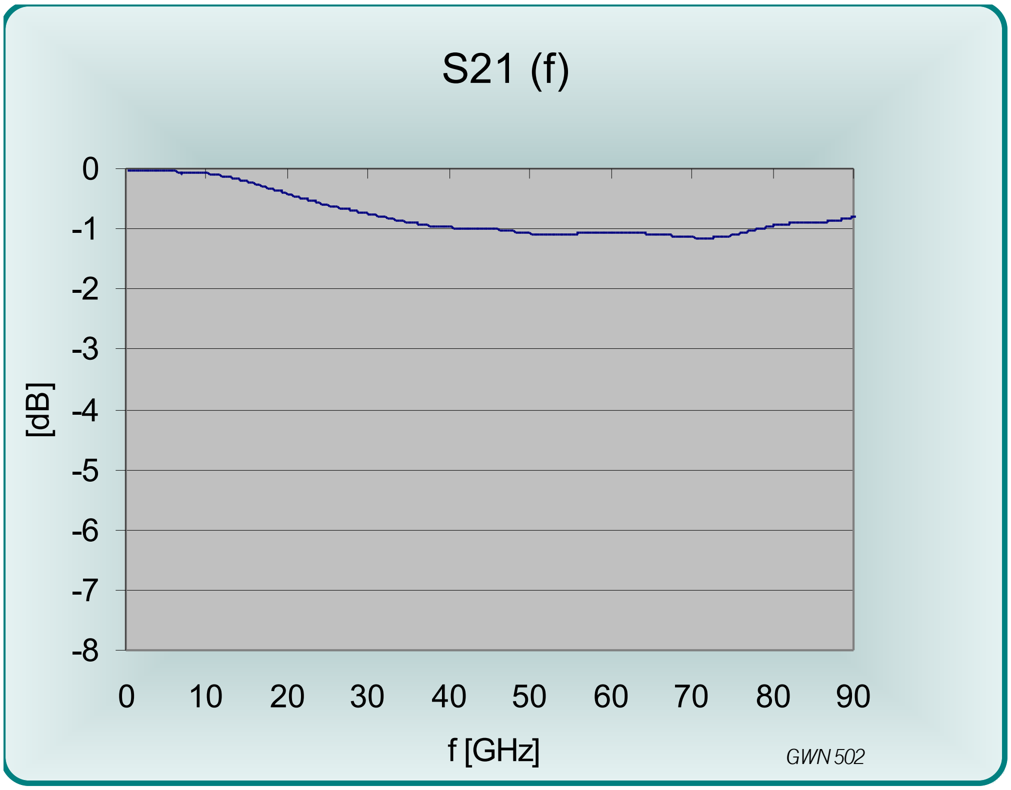

Figure 6 Insertion loss S21 (f)

Insertion loss is less than 1 dB to about 44.8 GHz. The 3 dB point is not reached before 98.0 GHz.

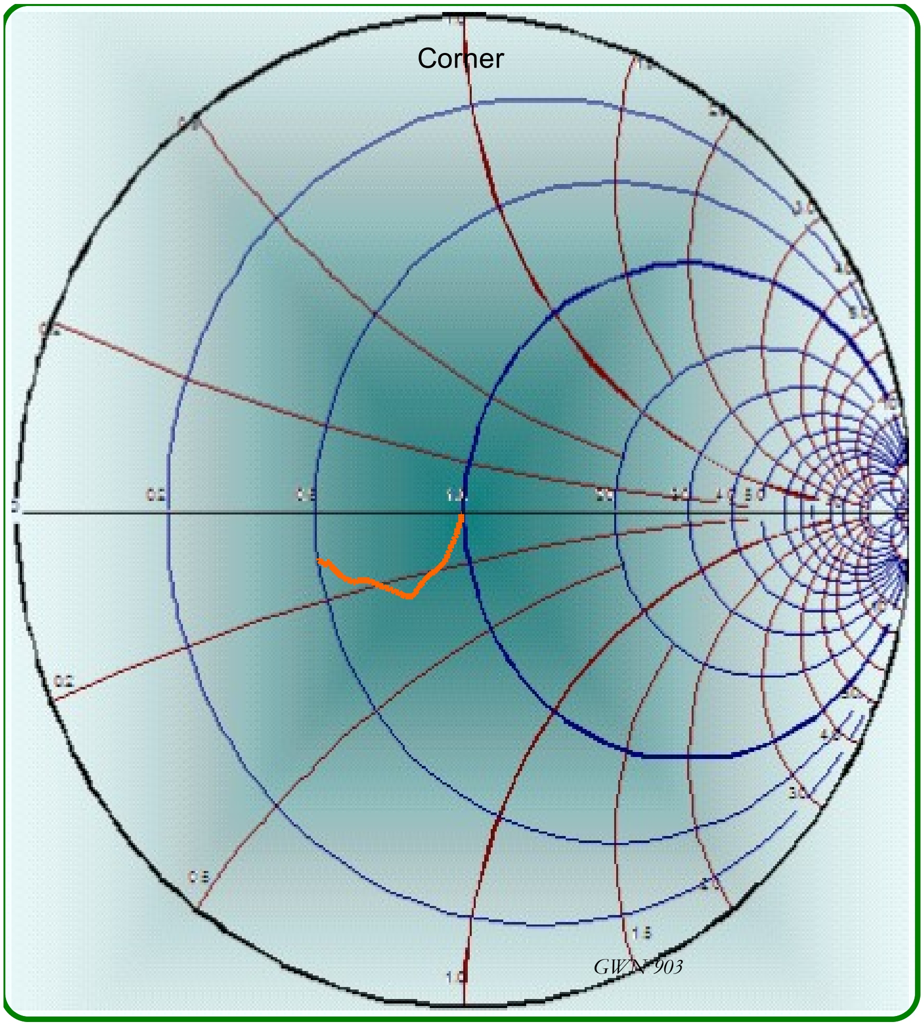

Figure 7 Smith chart for the thru measurement into a 50 Ohm probe

The Smith chart for thru measurements shows a good match at low frequencies. At higher frequencies small reactive components become apparent.

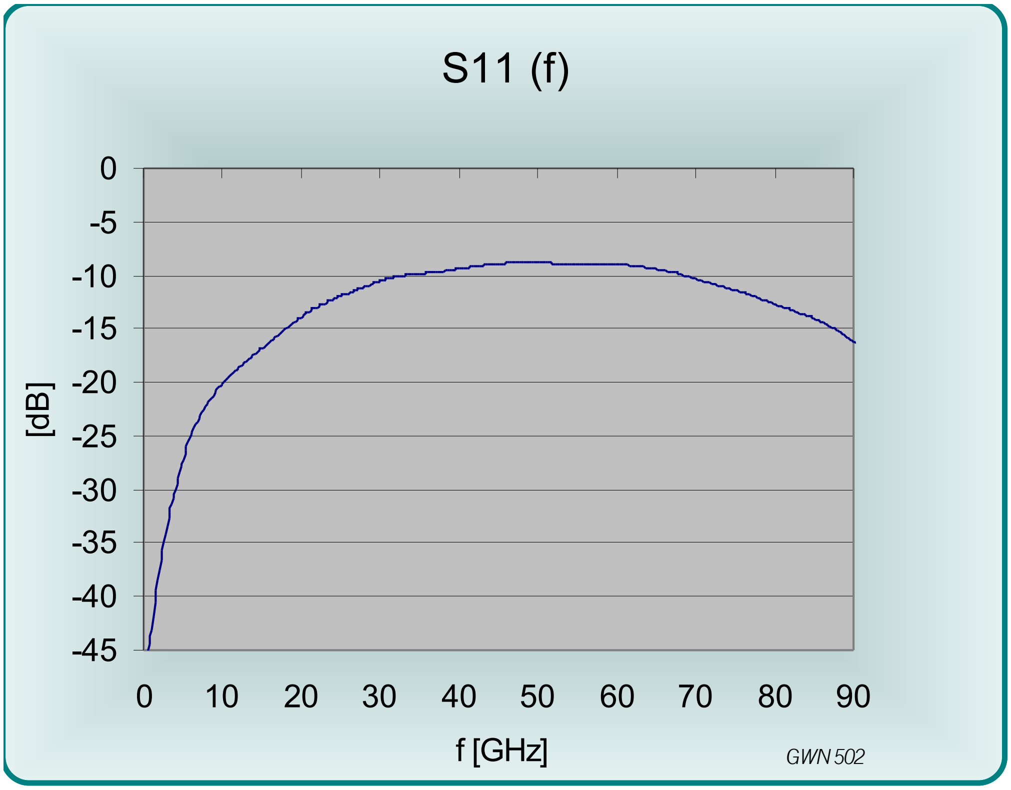

Figure 8 S11 magnitude (f) for the thru measurement into a 50 Ohm probe

Return loss reaches -20 dB at 10.0 GHz for the field site.

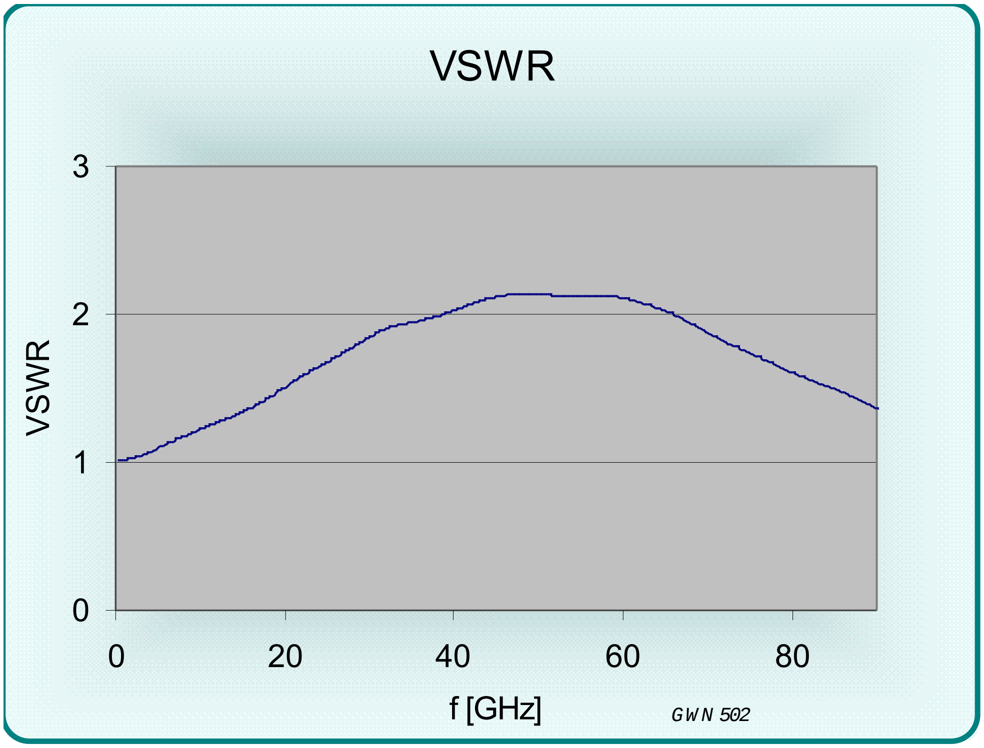

Figure 9 Standing wave ratio VSWR (f) [1 / div.]

The VSWR remains below 2 : 1 to a frequency of 38.6 GHz.