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P-P136A Spring Pin 0.4mm pitch

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Objective

The objective of these measurements is to determine the RF performance of P-P136A spring probes in an array configuration. The arrangement consists of 3 rows of 3 pins each on a 0.4 mm grid. A pin in the center is carrying the signal, all others are grounded. Measurements in both frequency and time domain form the basis for the evaluation. Parameters to be determined are pin capacitance of the signal pin with respect to ground, the signal pin inductance, and the attenuation in the frequency range from 50 MHz to the 3 dB point.

Methodology

Capacitance and inductance were determined through measurements in the frequency domain with a vector network analyzer (HP8522C).

To establish capacitance of the signal pin with respect to the rest of the array, a port 1 calibration is performed. Phase angle information for S11 is selected and displayed. When the array is connected, an approximately linear increase of phase angle with frequency can be observed. It is recorded and will be used for determining the pin capacitance.

The inductance of a pin is found in the same way, except the pin array is compressed by a metal plate instead of an insulator. Thus a short circuit at the far end of the pin array results. Again, the analyzer is calibrated and S11 is recorded. The inductance of the pin can be derived from this measurement.

Setup

Testing was performed with a test fixture that consists of two blocks facing each other and located by two alignment pins. Holes in the blocks receive semi-rigid coaxial cables. Fig. 1 shows this fixture and its components. The P-P136A spring probes are held in a Vespel SP1 block of 0.189" thickness and 0.5" x 1.2" dimensions (Fig. 2). The pin block has alignment holes and is inserted between the two metal plates. Pin compression is limited by the thickness of the pin block.

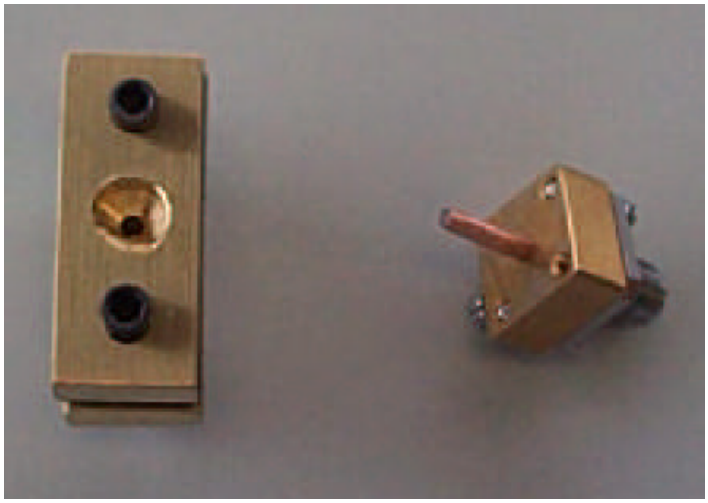

Fig. 1 Test fixture components

Fig. 2 Pin block with spring probe array

Measurements

Frequency domain

Network analyzer reflection measurements for a single sided drive of the signal pin with all other pins open circuited at the opposite end were performed to determine the pin capacitance to ground. The analyzer was calibrated with all pins except the signal pin inserted in the fixture. The phase of S11 was then recorded (Fig. 3). From the shape of the curve the capacitance of the signal pin to ground can be determined to be 0.58 pF.

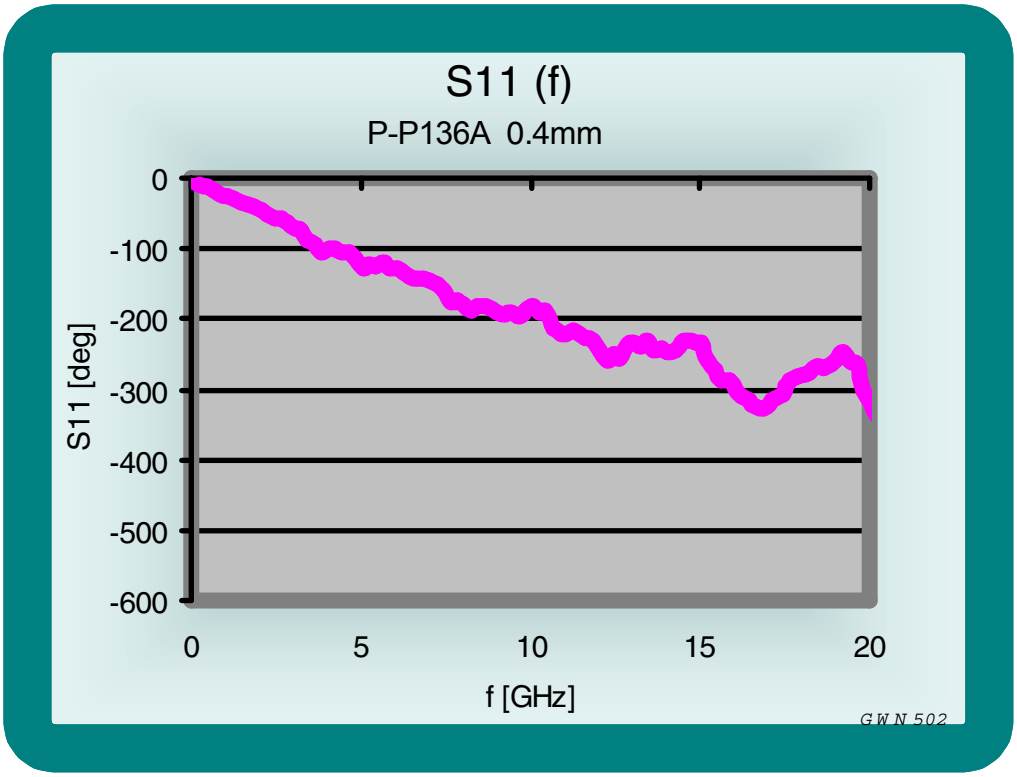

Fig. 3 S11 (f) for the open circuited signal pin

To extract the pin inductance, the same type of measurements was performed with a shorted pin array. Fig. 4 shows the change in reflections from a shorted pin array. Calibration was established with a short placed at the end of the feed coax.

The phase change corresponds to an inductance of 1.1 nH.

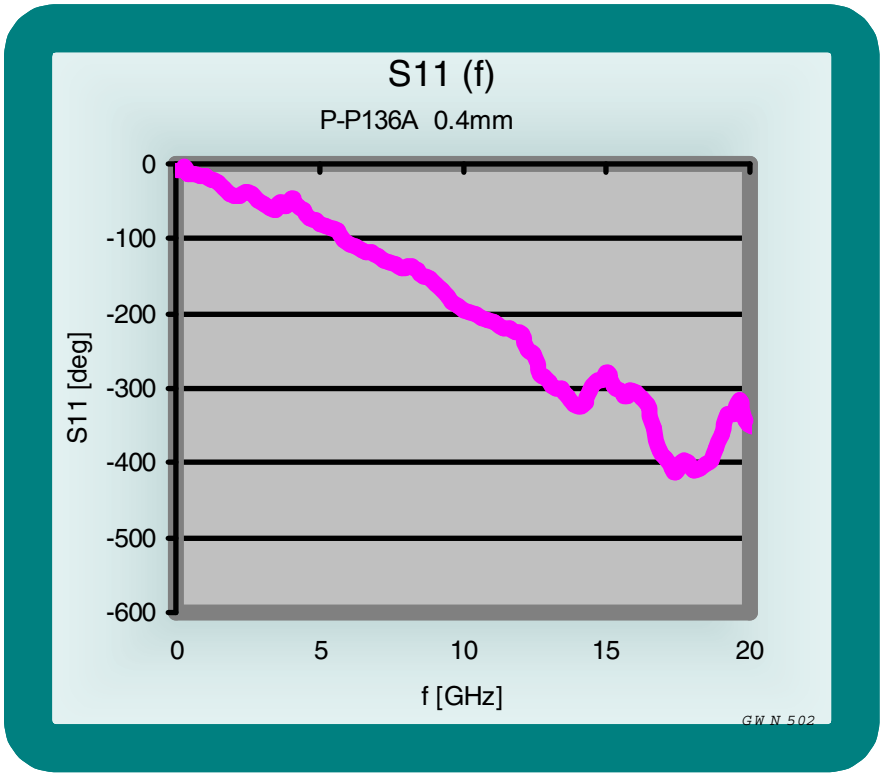

Fig. 4 S11 (f) for the short circuited signal pin

An insertion loss measurement is shown in Fig. 5 for the frequency range of 50 MHz to 20 GHz with a scale of 2 dB per division. Insertion loss is less than 1 dB to 11.5 GHz, while the 3 dB point is reached at 19.3 GHz.

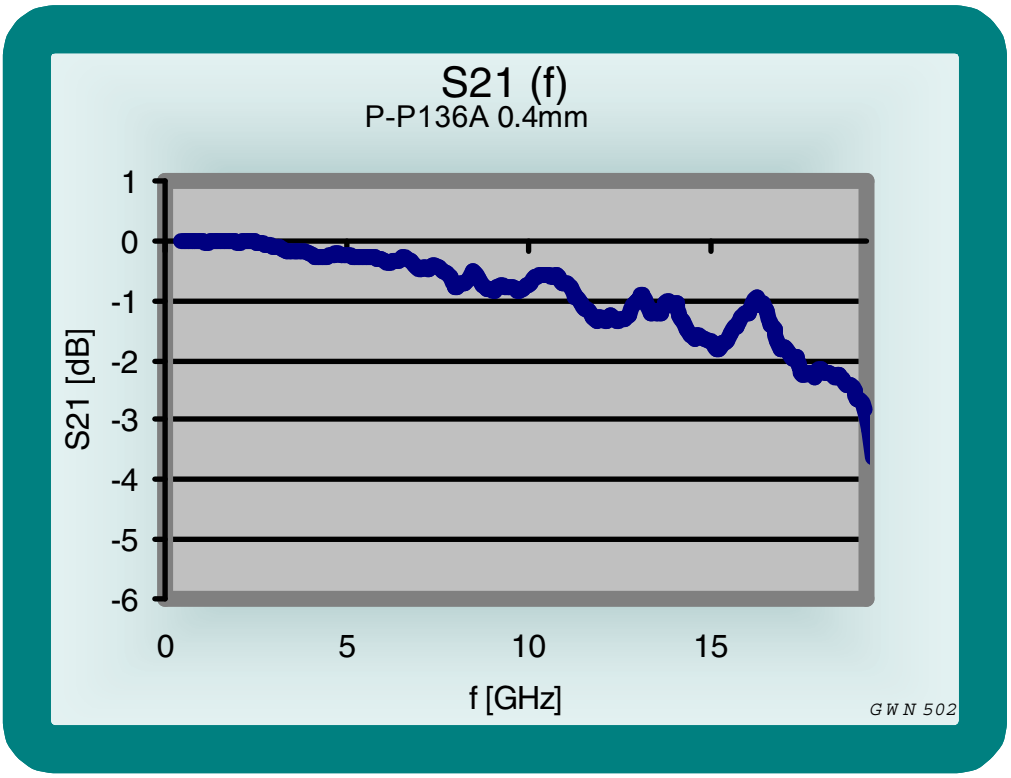

Fig. 5 Insertion loss S21 (f) [2 dB/div.]

Conclusions

The P-P136A type spring probe was investigated in a 0.4 mm pitch array configuration with a signal pin surrounded by ground pins. The dielectric material used was Vespel SP1 with a 0.189” thickness. Interfaces to the network analyzer were established through semi-rigid coaxial cables with K connectors. The spring probes made direct contact with the center conductors or the surrounding ground areas on the mounting blocks.

The insertion loss S21 for a through arrangement was below 1 dB up to a frequency of 11.5 GHz and below 3 dB to 19.3 GHz. Pin inductance is 1.1 nH, pin to ground c apacitance was determined to be 0.58 pF. Current carryi