

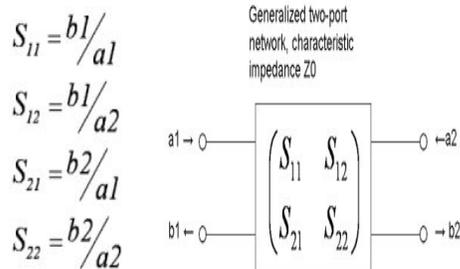
## Information on S parameter Files for various component families

### Purpose:

The purpose of this document is to provide related technical information regarding the acquisition of S-parameter data files obtained for various TFT component families. This document also covers a statistical overview of the repeatability, reproducibility, and uncertainty of entire measurement process.

### Introduction:

Scatter parameters are primarily used to characterize the performance of electronic components at radio and microwave frequencies. S-parameters are especially helpful in modeling components, sub-systems, and systems with software. The parameters  $S_{11}$ ,  $S_{22}$  have the meaning of reflection coefficients, and  $S_{21}$ ,  $S_{12}$ , the meaning of transmission coefficients



Data files obtained are meant to facilitate the development of models using various simulation softwares. S-parameter files can be directly uploaded and are compatible with most industrial simulation softwares.

### Setup Description:

#### Equipment:

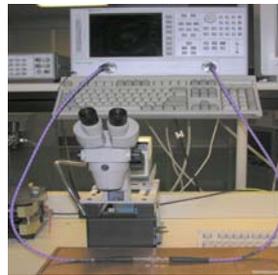
- 1) HP 8722D 40 GHz Vector Network
- 2) Analyzer Agilent 85052B/8719D 3.5mm calibration kit (for SOLT calibration)
- 3) Southwest SMA connector (27 GHz)

- 4) Gore Phaseplex, Part #: EM0CK0CP036\_0, Test Assembly

VNA was set up with following parameters:

- 1) 1601 = Number of Points
- 2) 50 MHz - 40GHz = Start stop frequency
- 3) 10 = Averaging Factor.

Measurements for the devices are done with each component mounted on a 50  $\Omega$  trace Rogers 4350B coupon, as shown in Figure 2a, with the parts unique with the parts unique footprint/mounting pad.



**The footprint is considered part of the component in the S-parameter model.** Specifications of thru coupon are shown in Figure 2b. Picture on left shows measurement setup.

Mounted coupon is held in place using male and female southwest SMA connectors. Figure 3a & Figure 3b show the fixture and test assembly.

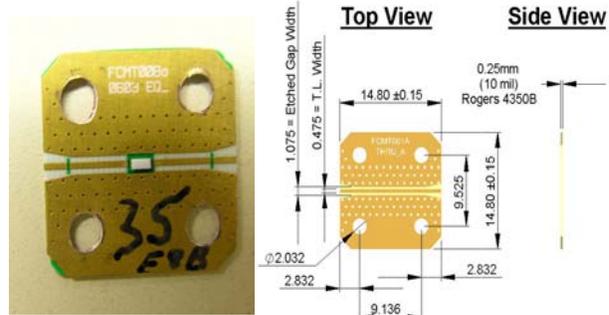


Figure 2a

Figure 2b

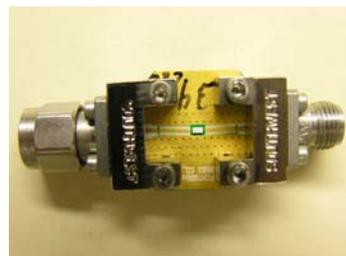


Figure 3a

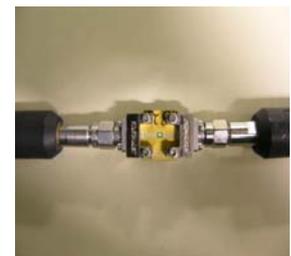


Figure 3b

## Measurement Acquisition Flow

1. Perform full 2 port calibration using 3.5mm kit
2. Assemble Southwest end launch connectors with the mounted DUT.
3. Connect network analyzer cables to fixture.
4. Hit measurement button on network analyzer and wait till 10 averages are complete.
5. Download S parameter file to disk and save.

### De-embed Technique:

De-embedding is performed to move the reference calibration plane from the end of the cable connector to the footprint of the device. This eliminates the influence and effects of the SMA connector, the SMA “launch”, and the Rogers coupon trace on the measurement. This de-embedding is performed by Agilent’s Advance Design Systems (ADS) deembedding model.

**Limitations:** Entire Southwest end launch connector assembly is rated to about 27GHz. VNA used for these measurements is calibrated up to 19 GHz.

Frequency Point	Total Gage R&R
50 MHz	0.0508
5 GHz	0.0341
10 GHz	0.0412
15 GHz	0.0480
20 GHz	0.0456

Experiment: Three Thru coupons are measured three times each on three different days with separate calibration performed each day. 27 S parameter files obtained during 3 run-throughs are analyzed in Minitab using ANOVA method. Five different standard frequency points ( 50 MHz, 5 GHz, 10 GHz, 15 GHz & 20 GHz) are considered for the analysis, results to which are summarized in Table above.

### Repeatability & Reproducibility:

Gage R&R techniques were used to further strengthen the validity of the measurements. Summary of Gage R&R experiments along with results are shown in Table.

### Disclaimer:

S parameter files released by TFT for all the component families are based on an embedded model and could be influenced significantly by external factors such as board traces, board materials, ground planes, or interactions with other components.

### Part #: EF2A51A063E10B (Sample Meas.)

