MA·COM
Technology Solutions

S-Parameter S2P File Format

Rev. V2

Introduction

Listed among many of M/A-COM's products are files that describe the small signal scattering matrix, or s-parameters, of the device. The S2P format is an industry standard and thus is recognized by many simulation programs. This application note describes the basic file format. The general case of the touchstone standard, not described in this application note, extends to more than two ports. Touchstone is a registered trademark of Agilent corporation and is used with permission.

File Format Description

S2P files are ASCII text files. As such, they can be viewed or edited by any standard text editor. The files are not case sensitive.

Option Line

Each file generally has an option line that resembles the following.

GHZ S MA R 50

In the event that no option line is shown, the values shown above are the defaults.

The '#' defines the line as an option line.

'GHZ' defines the units of frequency used in the data. GHZ, MHZ, KHZ, and HZ are acceptable values.

'S' is the type of parameter that has been measured. Typically, this is the type of data the M/A-COM provides. Other possibilities include Y, Z, H, and G which are well documented in many circuit analysis textbooks.

'MA' is what format that the complex data is in.
DB: Decibel Magnitude/Degree Angle
MA: Linear Magnitude/Degree Angle (polar form)
RI: Real Part/Imaginary Part (rectangular form)

The 'DB' form decibel magnitude is computed as 20*Log(linear magnitude).

'R 50' define the system impedance at which the measurements were taken. For CATV systems this impedance will be 75 ohms. Normalized measurements will have a value of 1 ohm.

Comment Lines

Comment lines are denoted by a '!' preceding the text.

! This is a comment line

Comment lines are used optionally for description and test conditions.

Data

The data consists of 9 columns. The first column is always frequency with the units defined in the option line. The next 8 columns define the two port parameters for that given frequency. The order of these parameters are:

<FREQ> **<X11>** <X11> **<X21>** <X21> **<X12>** <X12> **<X22>** <X22>

Where X can be S, Z, Y, H, or G as defined in the option line. The real or magnitude of the parameter is listed first (denoted by the boldface), followed immediately by the imaginary or phase (denoted by the italicized). Phase angles are always measured in degrees. These formats are also defined in the option line.

S1P files describe a single reflection impedance. There are only three columns denoted by

FREQ **X11** *X11*

Noise Parameters

Noise parameters describe the noise circles of a device. They are optionally included at the end of an S2P file. There is not a separate option line for noise parameters. The first frequency of the noise parameters must be less than the highest frequency of the two port parameters so the simulators can distinguish where the two port data stops and the noise data begins.

There are five columns that describe noise parameters. The following describes the noise parameter data format.

<FREQ>   <NF>   <|G|>   <ÐG>   <Rn>

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Noise Parameters (cont'd)

The frequency is governed by the option line. The NF is the minimum noise figure in dB. The |G| and ÐG are the linear magnitude and phase of the optimum reflection coefficient respectively. The form of this impedance is always the same, irrespective of the option line. Rn is the effective noise resistance normalized to the system impedance defined in the option line. It defines the rate at which the noise figure increases as the reflection coefficient is moved away from the optimum (how tightly packed the noise circles are).

Example

The following page holds an example of the S2P format described.

! This is a comment line which is often used to add relevant information to the file.
! Times, dates, part numbers, or test conditions are good candidates for comments.
! There can be as many comments as desired.
GHZ DB S R 50

!Freq	S11(dB)	S11(ang)	S21(dB)	S21(ang)	S12(dB)	S12(ang)	S22(dB)	S22(ang)
0.5	-6.83	-130.4	14.28	116.6	-25.96	-32.11	-6.493	88.3
0.75	-8.315	-176.6	14.39	58.17	-25.59	-76.93	-8.972	44.29
1	-9.136	137.6	14.1	5.361	-25.75	-117	-11.1	4.467
1.25	-9.681	91	13.64	-44.49	-25.6	-153.1	-13.3	-33.35
1.5	-9.933	45.01	13.1	-92.5	-25.39	173.4	-15.76	-68.61
1.75	-10.09	-0.7431	12.5	-139.4	-25.47	140.1	-18.64	-99.81
2	-10.17	-43.74	11.91	175	-25.16	107.4	-22.49	-122.1
2.25	-10.28	-83.98	11.29	130.3	-24.97	76.51	-26.44	-115.9
2.5	-10.8	-122.4	10.73	86.24	-24.05	44.2	-23.76	-101.3
2.75	-11.65	-160.1	10.2	42.44	-23.39	11.11	-19.56	-115.7
3	-13.25	161.5	9.737	-0.6358	-22.68	-22.68	-17.05	-141
0.5	1.118	0.1656	-96.62	0.1263				
0.75	1.131	0.2488	-86.38	0.1463				
1	1.145	0.3353	-78.08	0.1793				
1.25	1.162	0.4226	-70.25	0.2303				
1.5	1.181	0.5076	-62.54	0.3058				
1.75	1.203	0.5869	-54.92	0.4133				
2	1.228	0.6579	-47.48	0.5616				