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Simulation Instruments

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About Simulation Instruments

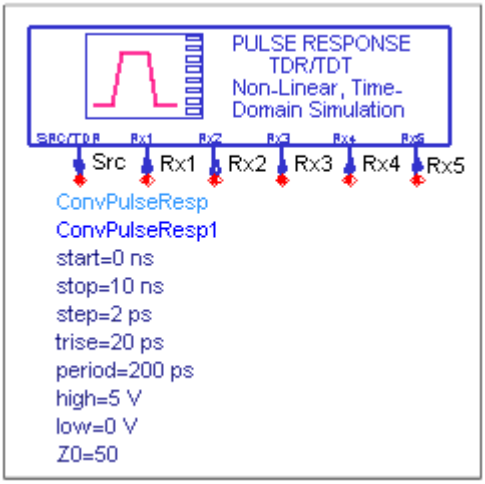
This topic describes the parameters for the simulation instrument components available in the *Simulation - Instrument* component library. These components are used in several of the simulation templates, which are accessed from the Schematic window by selecting **Insert** > **Template**.

Simulation Instrument Components

- *ConvPulseResp (Convolution Pulse Response)* (cktsiminst)
- *ConvStepResp (Convolution Step Response)* (cktsiminst)
- *DC_BJT (Curve Tracer for BJT)* (cktsiminst)
- *DC_FET (Curve Tracer for FET)* (cktsiminst)
- *ImpulseWriter (Impulse Response File Writer)* (cktsiminst)
- *LinearPulseResp (Pulse Response from Frequency Response)* (cktsiminst)
- *LinearStepResp (Linear Response from Frequency Response)* (cktsiminst)
- *SP_BJT (S-Parameters vs. Bias for BJT)* (cktsiminst)
- *SP_Diff (Differential-Mode S-Parameters)* (cktsiminst)
- *SP_FET (S-Parameters vs. Bias for FET)* (cktsiminst)
- *SP_NWA_4Port (4-Port Network Analyzer)* (cktsiminst)
- *SP_NWA_4PortBias (4-Port Network Analyzer with Bias Sources)* (cktsiminst)
- *SP_NWA_4PortBiasLog (4-Port Network Analyzer with Bias, Log Sweep)* (cktsiminst)
- *SP_NWA_4PortLog (4-Port Network Analyzer, Log Sweep)* (cktsiminst)
- *SP_NWA_Log (Network Analyzer for S-Parameters, Log Sweep)* (cktsiminst)
- *SP_NWA (Network Analyzer for S-Parameters)* (cktsiminst)

ConvPulseResp (Convolution Pulse Response)

Symbol



Parameters

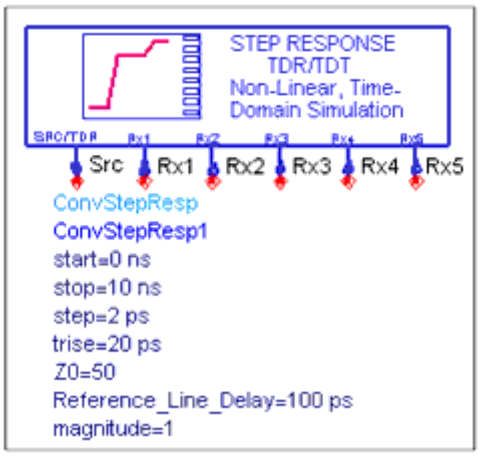
Parameter Name	Description	Units
start	start time for output data	ns
stop	stop time for output data	ns
step	step time for output data	ns
trise	pulse rise time	ps (10 to 90%)
period	pulse period	ps
high	high value of pulse	fV, pv, nv, uv, mv, or V (default)
low	low value of pulse	fV, pv, nv, uv, mv, or V (default)
Z0	impedance of transmit and receive ports	

Notes

1. A template using this item can be accessed by selecting **Insert** > **Template** > **ConvPulseRespT** from the Schematic window.
2. ConvPulseResp emulates an instrument for measuring the reflection and transmission of a network. The test signal is a pulse waveform, whose characteristics you specify. There is one source port, and five receive ports. The source port is also used to measure the reflected signal. The simulation is carried out in the time domain, and if distributed elements are present in the network being simulated, the convolution simulator will be used. The example, *RF_Board/TDRcrosstalk_wrk* shows this component applied.
3. This is a simulation component. No other simulation or control components are needed.

ConvStepResp (Convolution Step Response)

Symbol



Parameters

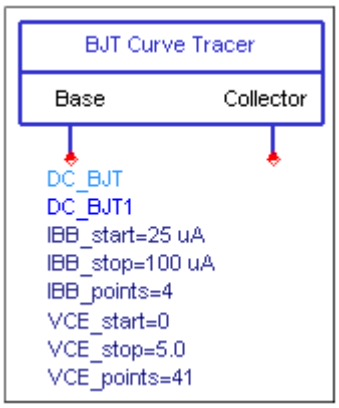
Parameter Name	Description	Units
start	start time for output data	ns
stop	stop time for output data	ns
step	step time for output data	ps
trise	step rise time	ps (10 to 90%)
period	pulse period	ps
Z0	impedance of transmit and receive ports	
Reference_Line_delay	Reference line time delay. This is the time delay of an ideal transmission line internal to the instrument. It just delays the test signal coming out of the *Src* port	
magnitude	step amplitude at transmit port	

Notes

1. A template using this item can be accessed by selecting **Insert** > **Template** > **ConvStepT** from the Schematic window.
2. ConvStepResp emulates an instrument for measuring the reflection and transmission of a network. The test signal is a step waveform, whose characteristics you specify. There is one source port, and five receive ports. The source port is also used to measure the reflected signal. The simulation is carried out in the time domain, and if distributed elements are present in the network being simulated, the convolution simulator will be used. The example, *RF_Board/TDRcrosstalk_wrk* shows this component applied.
3. This is a simulation component. No other simulation or control components are needed.

DC_BJT (Curve Tracer for BJT)

Symbol



Parameters

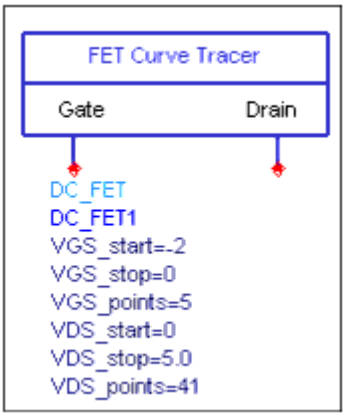
Parameter Name	Description	Units
IBB_start	initial base current	uA
IBB_stop	last base current	uA
IBB_points	number of base current values	
VCE_start	initial collector emitter voltage	
VCE_stop	last collector emitter voltage	
VCE_points	number of collector-emitter values	

Notes

1. A template using this item can be accessed by selecting **Insert** > **Template** > **DC_BJT_T** from the Schematic window.
2. DC_BJT is a DC curve-tracer with a swept voltage source for the collector bias and a swept current source for the base bias.
3. This is a simulation component. No other simulation or control components are needed.

DC_FET (Curve Tracer for FET)

Symbol



Parameters

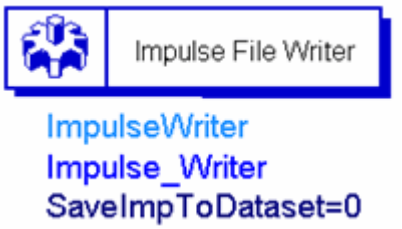
Parameter Name	Description
VGS_start	initial gate voltage
VGS_stop	last gate voltage
VGS_points	number of gate current values
VDS_start	initial drain-source voltage
VDS_stop	last drain-source voltage
VDS_points	number of drain-source values

Notes

1. A template using this item can be accessed by selecting **Insert** > **Template** > **DC_FET_T** from the Schematic window.
2. DC_FET is a DC curve-tracer with two swept voltage sources, one for the gate bias and the other for the drain bias.
3. This is a simulation component. No other simulation or control components are needed.

ImpulseWriter (Impulse Response File Writer)

Symbol



Parameters

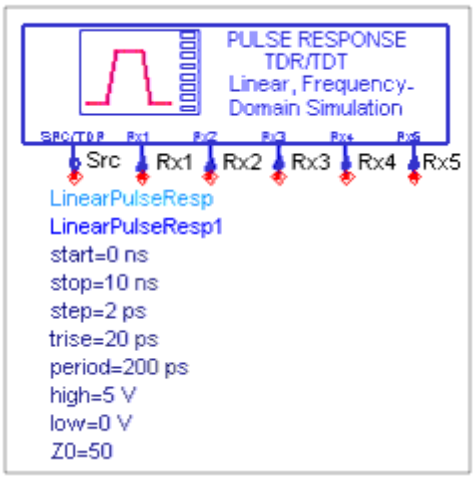
Parameter Name	Description
SaveImpToDataset	save computed impulse responses to dataset (allowed values: 0, 1, no, yes)

Notes

1. ImpulseWriter converts S-parameters imported by SnP block into time domain impulse responses which accurately represent the original spectral. The causality problem associated with band-limited spectrum is circumvented using proprietary technology and the computed impulses are guaranteed to be causal. They are also passive within the original spectrum frequency range. To turn off passivity enforcement, set *EnforcePassivity*=no in the SnP component parameter.
2. The result of impulse responses is exported into an ASCII file created in the workspace data directory. The file name follows the SnP instance name with a suffix of *.imp*. The data format is described in detail in *ADS Impulse File Format* (cktsim).

LinearPulseResp (Pulse Response from Frequency Response)

Symbol



Parameters

Parameters Name	Description	Units
start	start time for output data	ns
stop	stop time for output data	ns
step	step time for output data	ns
trise	pulse rise time	ps (10 to 90%)
period	pulse period	ps
high	high value of pulse	fV, pv, nv, uv, mv, or V (default)
low	low value of pulse	fV, pv, nv, uv, mv, or V (default)
Z0	impedance of transmit and receive ports	

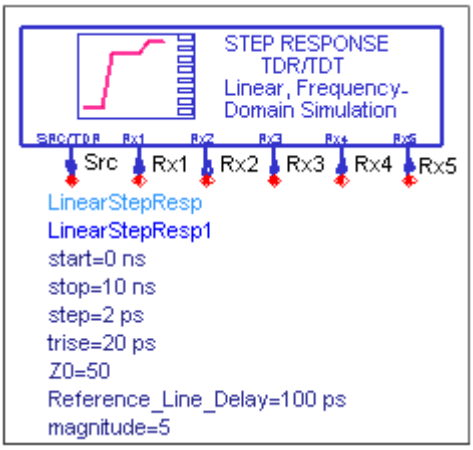
Notes

1. A template using this item can be accessed by selecting **Insert** > **Template** > **LinearPulseRespT** from the Schematic window.
2. LinearPulseResp emulates an instrument for measuring the reflection and transmission of a network. The test signal is a pulse waveform, whose characteristics you specify. There is one source port, and five receive ports. The source port is also used to measure the reflected signal. The simulation is carried out in the frequency domain, and the frequency-domain data is post-processed via the ts() function to get time-domain responses. If any nonlinear elements are included in the network being simulated, they will be modeled as linear elements, linearized around their bias points. The example, *RF_Board/TDRcrosstalk_wrk* shows this component applied.

3. This is a simulation component. No other simulation or control components are needed.

LinearStepResp (Linear Response from Frequency Response)

Symbol



Parameters

Parameter Name	Description	Units
start	start time for output data	ns
stop	stop time for output data	ns
step	step time	ps
trise	step rise time	ps (10 to 90%)
Z0	impedance of transmit and receive ports	
Reference_Line_delay	Reference line time delay	
magnitude	step amplitude at transmit port	

Notes

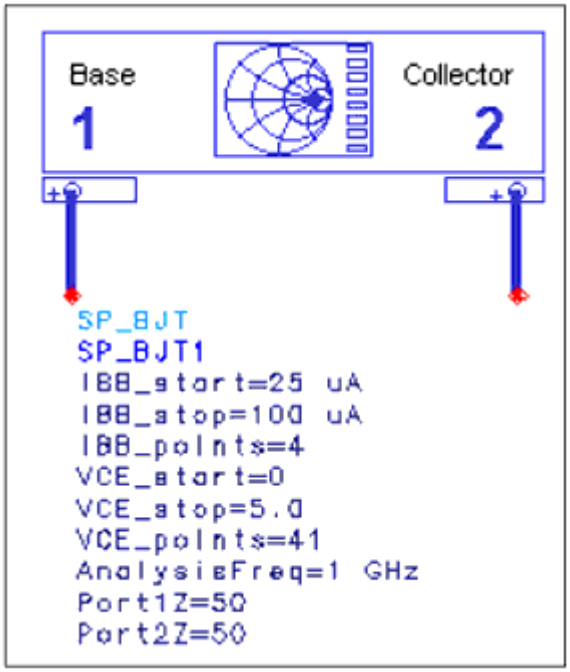
1. A template using this item can be accessed by selecting **Insert** > **Template** > **LinearStepRespT** from the Schematic window.
2. LinearStepResp emulates an instrument for measuring the reflection and transmission of a network. The test signal is a step waveform, whose characteristics you specify. There is one source port, and five receive ports. The source port is also used to measure the reflected signal. The simulation is carried out in the frequency domain, and the frequency-domain data is post-processed via the *ts()* function to get

time-domain responses. If any nonlinear elements are included in the network being simulated, they will be modeled as linear elements, linearized around their bias points. The example, *RF_Board/TDRcrosstalk_wrk* shows this component applied.

3. This is a simulation component. No other simulation or control components are needed.

SP_BJT (S-Parameters vs. Bias for BJT)

Symbol



Parameters

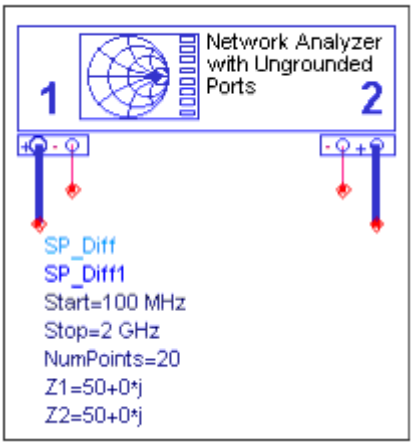
Parameters Name	Description	Units
IBB_start	initial base current	uA
IBB_stop	last base current	uA
IBB_points	number of base current values	
VCE_start	initial collector emitter voltage	
VCE_stop	last collector emitter voltage	
VCE_points	number of collector-emitter values	
AnalysisFreq	Single S-parameter analysis frequency	GHz
Port1Z	port 1 port impedance (complex)	
Port2Z	port 2 port impedance (complex)	

Notes

1. A template using this item can be accessed by selecting **Insert** > **Template** > **SP_BJT_T** from the Schematic window.
2. SP_BJT sets up an S-parameter analysis at one frequency with swept current and swept voltage for the base and collector biases, respectively. This component helps select an operating point for desired gain. Connect it to a bipolar junction transistor, as indicated in the schematic symbol.
3. This is a simulation component. No other simulation or control components are needed.

SP_Diff (Differential-Mode S-Parameters)

Symbol



Parameters

Parameter Name	Description	Unit
Start	start frequency	Hz, KHz, GHz, or MHz (default)
Stop	stop frequency	Hz, KHz, GHz, or MHz (default)
NumPoints	number of points in a linear sweep	
Z1	port 1 port impedance (complex)	
Z2	port 2 port impedance (complex)	

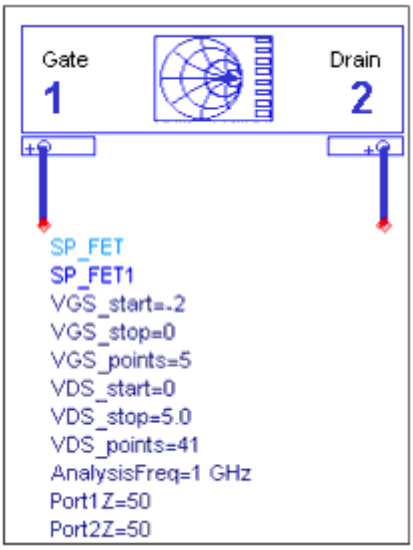
Notes

1. A template using this item can be accessed by selecting **Insert** > **Template** > **SP_DiffT** from the Schematic window.

2. SP_Diff sets up a swept-frequency S-parameter analysis. Ports 1 and 2 of the Network Analyzer are ungrounded, so the S-parameters of differential networks can be simulated without using baluns.
3. This is a simulation component. No other simulation or control components are needed.

SP_FET (S-Parameters vs. Bias for FET)

Symbol



Parameters

Parameter Name	Description
VGS_start	initial gate-source voltage
VGS_stop	last gate-source voltage
VGS_points	number of gate-source current values
VDS_start	initial drain-source voltage
VDS_stop	last drain-source voltage
VDS_points	number of drain-source voltage values
AnalysisFreq	single S-parameter analysis frequency
Port1Z	port 1 port impedance (complex)
Port2Z	port 2 port impedance (complex)

Notes

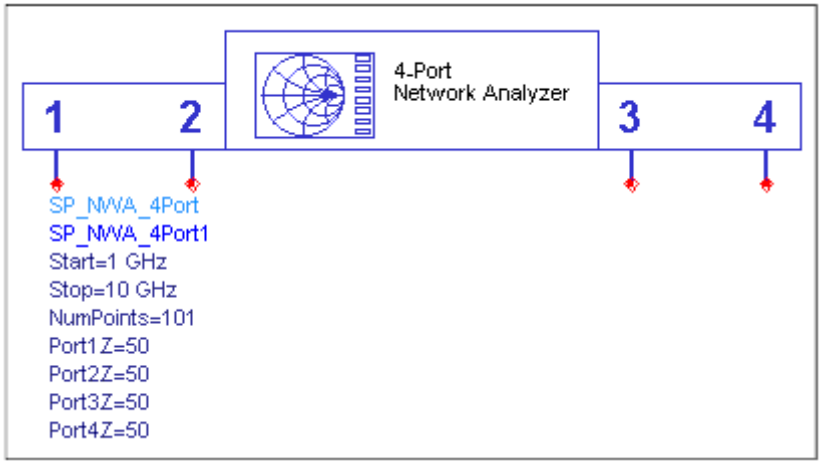
1. A template using this item can be accessed by selecting **Insert** > **Template** >

SP_FET_T from the Schematic window.

2. SP_FET sets up an S-parameter analysis at one frequency with two swept voltage, one each for the for the gate and drain bias. This component helps select an operating point for desired gain. Connect it to a field effect transistor, as indicated in the schematic symbol.
3. This is a simulation component. No other simulation or control components are needed.

SP_NWA_4Port (4-Port Network Analyzer)

Symbol



Parameters

Parameter Name	Description	Units
Start	start frequency	Ghz
Stop	stop frequency	GHz
NumPoints	number of frequency points	
Port1Z	port 1 port impedance (complex)	
Port2Z	port 2 port impedance (complex)	
Port3Z	port 3 port impedance (complex)	
Port4Z	port 4 port impedance (complex)	

Notes

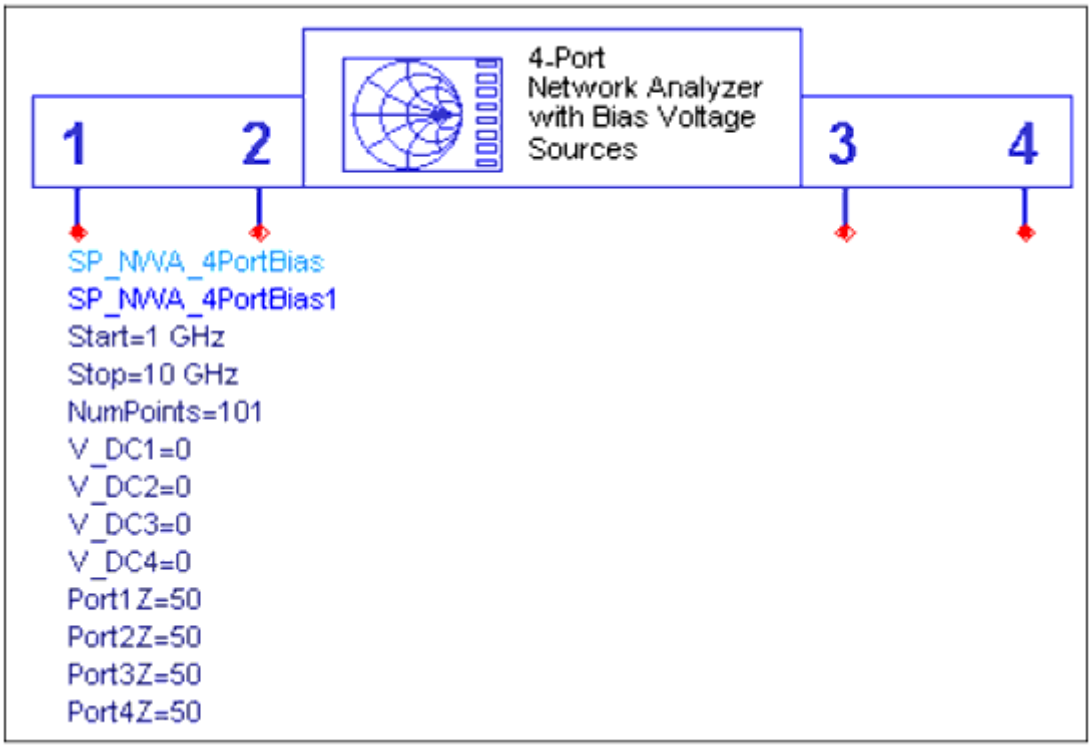
1. A template using this item can be accessed by selecting **Insert** > **Template** > **SP_NWA_4PortT** from the Schematic window.
2. SP_NWA_4Port simulates a four-port S-parameter network analyzer. The extra ports

are useful for testing multi-port devices and for optimizing the 2-port devices side by side. Each port has a separate ideal bias tee to allow a device to be biased directly from this component.

3. This is a simulation component. No other simulation or control components are needed.

SP_NWA_4PortBias (4-Port Network Analyzer with Bias Sources)

Symbol



Parameters

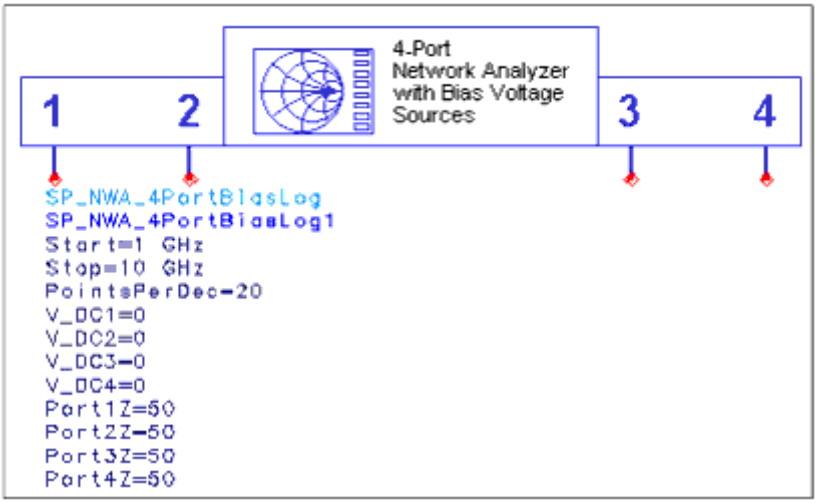
Parameter Name	Description	Units
Start	start frequency	GHz
Stop	stop frequency	GHz
NumPoints	number of frequency points	
V_DC1	port 1 bias voltage	
V_DC2	port 2 bias voltage	
V_DC3	port 3 bias voltage	
V_DC4	port 4 bias voltage	
Port1Z	port 1 port impedance (complex)	
Port2Z	port 2 port impedance (complex)	
Port3Z	port 3 port impedance (complex)	
Port4Z	port 4 port impedance (complex)	

Notes

1. A template using this item can be accessed by selecting **Insert** > **Template** > **SP_NWA_4Port_BiasT** from the Schematic window.
2. SP_NWA_4Port_Bias simulates a four-port S-parameter network analyzer. The extra ports are useful for testing multi-port devices and for optimizing the 2-port devices side by side. Each port has a separate ideal bias tee to allow a device to be biased directly from this component.
3. This component is identical to the SP_NWA_4Port, except that it has ideal bias tees at each port.
4. This is a simulation component. No other simulation or control components are needed.

SP_NWA_4PortBiasLog (4-Port Network Analyzer with Bias, Log Sweep)

Symbol



Parameters

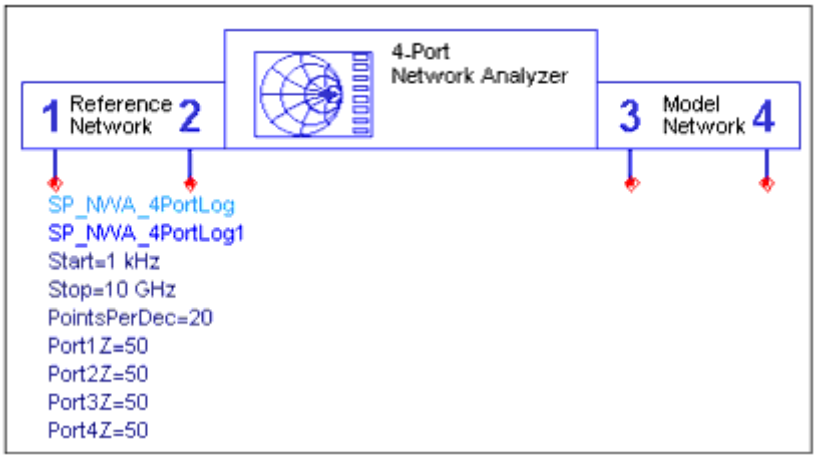
Parameter Name	Description	Units
Start	start frequency	GHz
Stop	stop frequency	GHz
PointsperDec	number of frequency points per decade	
V_DC1	port 1 bias voltage	
V_DC2	port 2 bias voltage	
V_DC3	port 3 bias voltage	
V_DC4	port 4 bias voltage	
Port1Z	port 1 port impedance (complex)	
Port2Z	port 2 port impedance (complex)	
Port3Z	port 3 port impedance (complex)	
Port4Z	port 4 port impedance (complex)	

Notes

1. A template using this item can be accessed by selecting **Insert** > **Template** > **SP_NWA_4Port_BiasLogT** from the Schematic window.
2. SP_NWA_4Port_BiasLog is identical to the SP_NWA_4Port_Bias, except that it has ideal bias tees at each port.
3. This is a simulation component. No other simulation or control components are needed.

SP_NWA_4PortLog (4-Port Network Analyzer, Log Sweep)

Symbol



Parameters

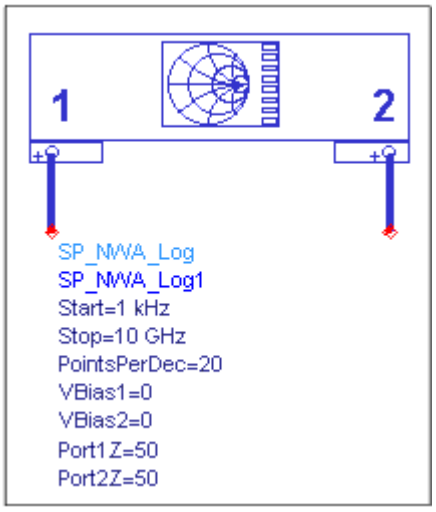
Parameter Name	Description	Units
Start	start frequency	kHz
Stop	stop frequency	GHz
PointsPerDec	frequency points per decade	
Port1Z	port 1 port impedance (complex)	
Port2Z	port 2 port impedance (complex)	
Port3Z	port 3 port impedance (complex)	
Port4Z	port 4 port impedance (complex)	

Notes

1. A template using this item can be accessed by selecting **Insert** > **Template** > **SP_NWA_4PortLogT** from the Schematic window.
2. SP_NWA_4Port_Log is identical to SP_NWA_4Port, except the frequency is swept logarithmically. It simulates a four-port S-parameter network analyzer. The extra ports are useful for testing multi-port devices and for optimizing the 2-port devices side by side. Each port has a separate ideal bias tee to allow a device to be biased directly from this component.
3. This is a simulation component. No other simulation or control components are needed.

SP_NWA_Log (Network Analyzer for S-Parameters, Log Sweep)

Symbol



Parameters

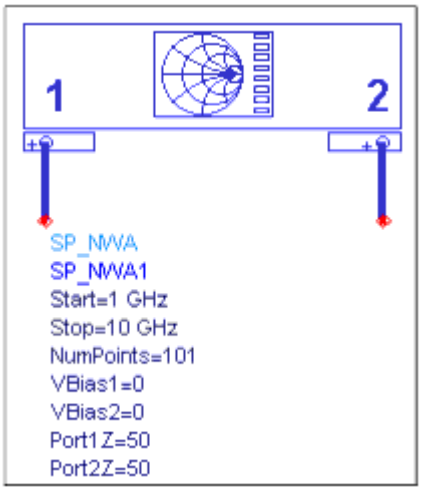
Parameter Name	Description	Units
Start	start frequency	kHz
Stop	stop frequency	GHz
PointsPerDec	frequency points per decade	
Vbias1	port 1 bias voltage	
Vbias2	port 2 bias voltage	
Port1Z	port 1 port impedance (complex)	
Port2Z	port 2 port impedance (complex)	

Notes

1. A template using this item can be accessed by selecting **Insert** > **Template** > **SP_NWA_LogT** from the Schematic window.
2. SP_NWA_LOG is identical to SP_NWA except that frequency is swept logarithmically. It emulates a two-port S-parameter network analyzer. Each port has a separate ideal bias tee to allow a device to be biased directly from the component.
3. This is a simulation component. No other simulation or control components are needed.

SP_NWA (Network Analyzer for S-Parameters)

Symbol



Parameters

Parameter Name	Description	Units
Start	start frequency	GHz
Stop	stop frequency	GHz
NumPoints	number of frequency points	
Vbias1	port 1 bias voltage	
Vbias2	port 1 bias voltage	
Port1Z	port 1 port impedance (complex)	
Port2Z	port 2 port impedance (complex)	

Notes

1. A template using this item can be accessed by selecting **Insert** > **Template** > **SP_NWA_T** from the Schematic window.
2. SP_NWA emulates a two-port S-parameter network analyzer. each port has a separate ideal bias tee to allow a device to be biased directly from this component.
3. This is a simulation component. No other simulation or control components are needed.