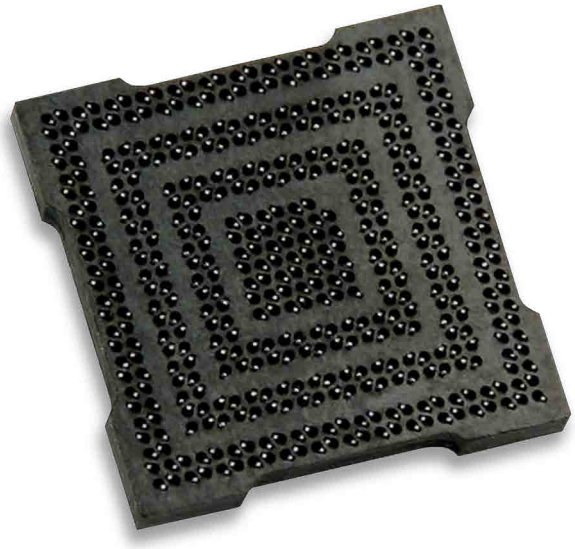
Ironwood ELECTRONICS

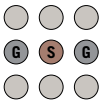
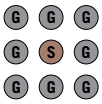
Grypper G40

104468-0014 Contact
0.4 Pitch, 0.25 Ball Diameter
0.5 Pitch, 0.25 Ball Diameter



TEST OBJECTIVE

The objective of this report is to determine the RF transmission characteristics of the Ironwood Electronics Grypper G40 socket for the GSG (ground-signal-ground) configurations. Two product variations at pitches of 0.4 mm and 0.5 mm were studied. Three-dimensional electro-magnetic (EM) field models were simulated for sockets with three contacts embedded in the dielectric material at a pitch of 0.4 mm. Real measurements were performed on the 0.4 mm product, and correlated to the simulated 3D model. Schematic level circuit models were then derived from these simulations and measurements. Data derived from the 3D simulations, physical measurements and schematic models determine the electrical specifications for the Grypper G40 socket.

P2A Configuration	P8A Configuration	Pitches (mm), 0.25 mm Ball	Contact Part Number
 Pattern 2A	 Pattern 8A	0.4 0.5	104468-0014 104468-0014

ELECTRICAL SPECIFICATIONS

P2A Configuration	0.4 mm Pitch*	0.5 mm Pitch	Value Determination
Time Delay	11.1 pS	11.5 pS	Inverse Fast Fourier transform on the transmission, S21, S-parameter.
Short Circuit Inductance	0.77 nH	0.87 nH	Values are determined by a short-circuit one-port model at 1 GHz.
Open Circuit Capacitance	0.183 pF	0.123 pF	Values are determined by a open-circuit one-port model at 1 GHz.
S21 Insertion Loss S11 Return Loss	-1 dB @ 21.5 GHz -10 dB @ 18 GHz -20 dB @ 4.5 GHz	-1 dB @ 21.8 GHz -10 dB @ 10 GHz -20 dB @ 2.8 GHz	Values are based on the 3D model results, except where verified by measurements.
Impedance	64.9 Ω	74.5 Ω	Value calculated from Short Circuit Inductance and Open Circuit Capacitance.
Crosstalk, S41, GSSG Thru	-20 dB @ 5.0 GHz	-20 dB @ 3.7 GHz	Values are based on the 3D model results.

* Specification based on lab measurements.

P8A Configuration	0.4 mm Pitch	0.5 mm Pitch	Value Determination
Time Delay	10.0 pS	10.0 pS	Inverse Fast Fourier transform on the transmission, S21, S-parameter.
Short Circuit Inductance	0.54 nH	0.62 nH	Values are determined by a short-circuit one-port model at 1 GHz.
Open Circuit Capacitance	0.239 pF	0.202 pF	Values are determined by a open-circuit one-port model at 1 GHz.
S21 Insertion Loss S11 Return Loss	-1 dB @ 27 GHz -10 dB @ 24 GHz -20 dB @ 14 GHz	-1 dB @ 29 GHz -10 dB @ 25.7 GHz -20 dB @ 12 GHz	Values are based on the 3D model results, except where verified by measurements.
Impedance	47.5 Ω	55.3 Ω	Value calculated from Short Circuit Inductance and Open Circuit Capacitance.

RESULTS FOR PATTERN 2A

3D Model Simulations for Pattern 2A

Three dimensional EM field simulations were performed using Ansoft's High Frequency Structure Simulator (HFSS™) software. Measurement ports are located at the contact points on the bottom and bottom of the socket. The model contact and pitch configuration was varied to predict the performance of the socket, obtaining results at both 0.4 mm and 0.5 mm. Figure 2 and Figure 3 show results for the GSG 2-port configuration at both 0.4 mm and 0.5 mm pitch. Next, the bottom port was deleted and replaced with a perfect short. The low frequency inductance of the configuration was estimated using this one–port measurement. Similarly, an open circuit measurement was used to estimate the capacitance of the structure. The impedance value was calculated from these estimated results.

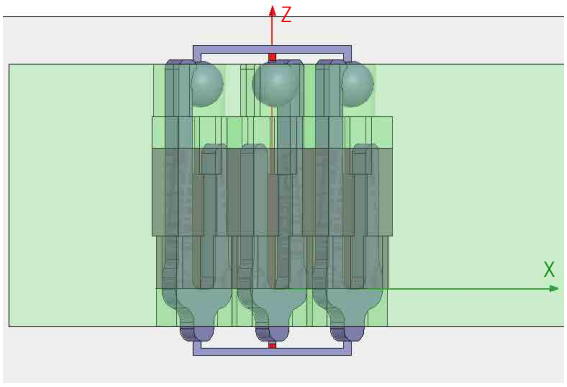


Figure 1. 0.4 mm GSG model configuration

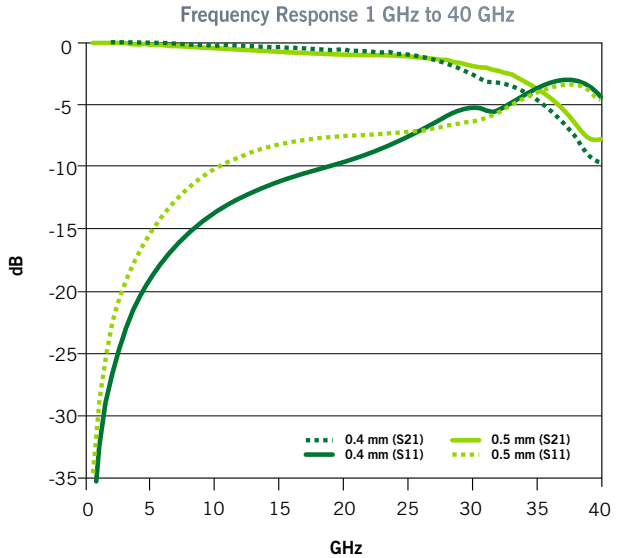


Figure 2. GSG P2A Insertion Loss and Return Loss

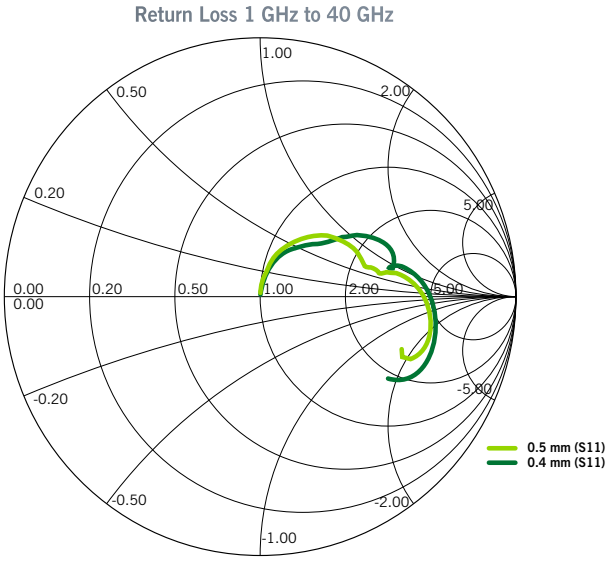


Figure 3. GSG P2A Return Loss plotted on Smith chart

Measurements for Pattern 2A

Cascade Microtech's FPC-800 GSG probes were used to obtain the 0.4 mm socket measurements. To provide a first-order approximation of the socket's performance, the socket was mounted on a small brass plate containing an opening allowing access to the contact area. The plate and socket assembly was then mounted on a positioner and simultaneously probed from both the top and bottom sides. The measured insertion loss is approximately -0.8 dB at 20 GHz, slightly lower than the HFSS™ model's expected value.

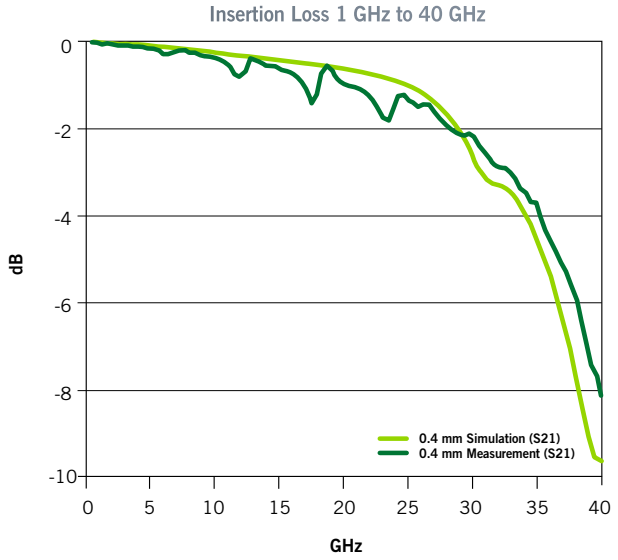


Figure 4. GSG P2A Insertion Loss comparison, 0.4 mm pitch

Figure 5. GSG P2A Return Loss comparison, 0.4 mm pitch

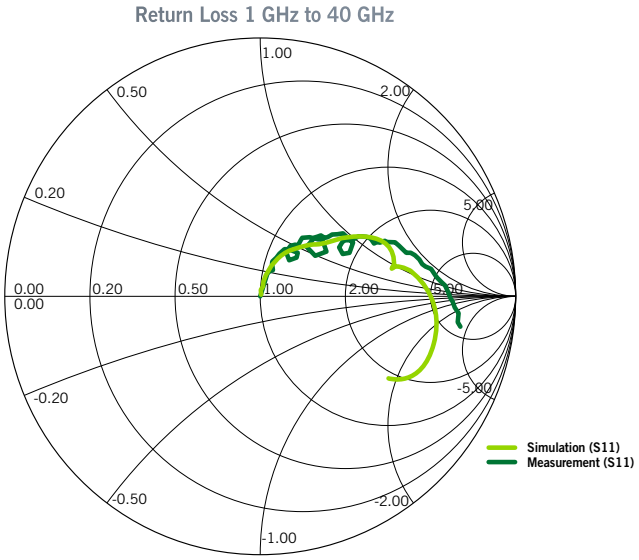


Figure 6. GSG P2A Return Loss comparison plotted on Smith chart, 0.4 mm pitch

Schematic Model

Agilent's Advanced Design System (ADS) was used to construct a GSG schematic model matching the 0.4 mm pitch socket measurement results. The topology selected matches that of the three contacts used in the measurement. Ports 1 and 2 represent the device side and PCB side of the socket, respectively. The 0.4 mm pitch GSG schematic model consists of 9 passive components. The signal contact is represented by three series inductors, forming a total pin inductance of 0.535 nH. Shunt capacitors bridge between the signal contact and the return path contacts. The two return paths are lumped together as two pins in parallel. Shunt capacitance is 0.129 pF. Mutual inductance of 6 pH is added to represent the mutual coupling between the signal and the return paths.

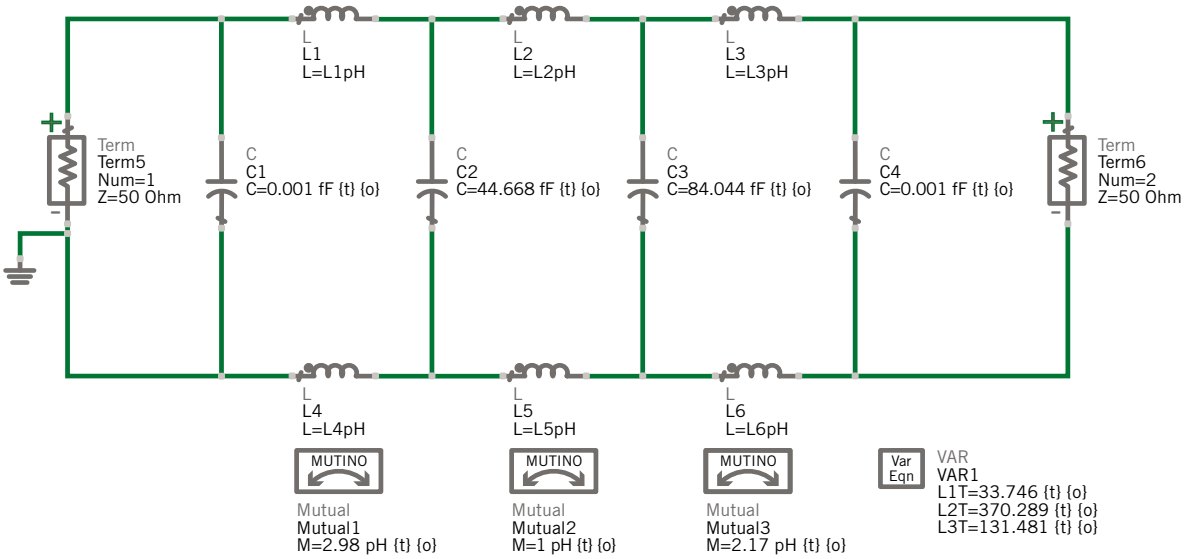


Figure 7. GSG P2A Schematic Model, 0.4mm pitch

An additional pair of ports (ports 3 and 4 not shown) were added in the simulation to compare the schematic model to the GSG measurement file.

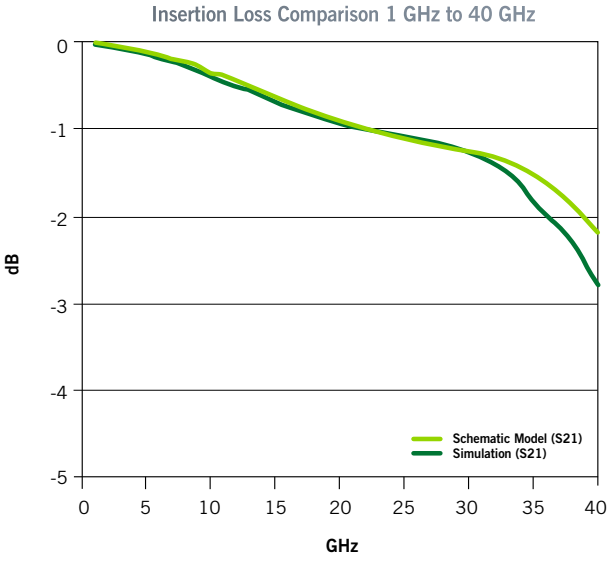


Figure 8. GSG P2A Insertion Loss, 0.4 mm pitch

Figure 9. GSG P2A Return Loss, 0.4 mm pitch

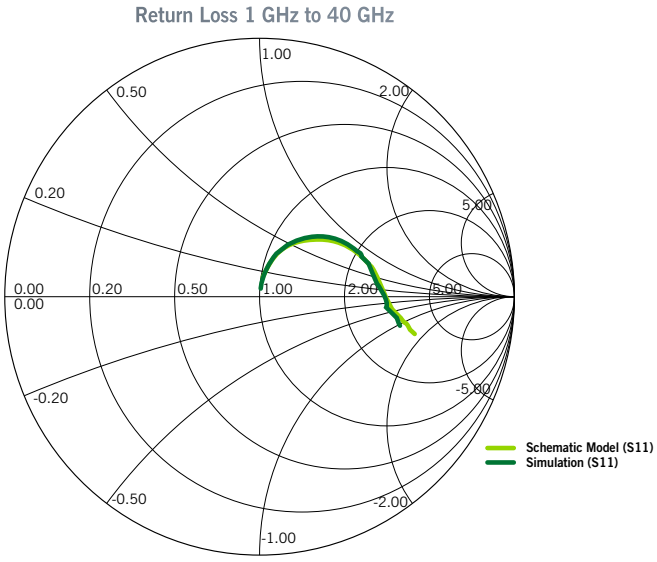


Figure 10. GSG P2A Return Loss plotted on Smith chart, 0.4 mm pitch

RESULTS FOR PATTERN 8A

3D Model Simulations for Pattern 8A

Three dimensional EM field simulations were performed using Ansoft's High Frequency Structure Simulator (HFSS™) software. Measurement ports are located at the contact points on the top, Port 1, and bottom, Port 2, of the socket. This model was updated to reflect the UV cured silicone based adhesive shown in light gray.

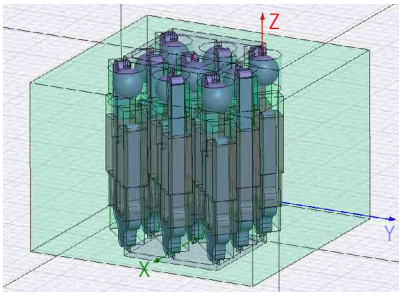


Figure 11. 0.4 mm GSG P8A model configuration

Figure 9 and Figure 10 show results for the GSG P8A 2-port configuration at both 0.4 mm and 0.5 mm pitch.

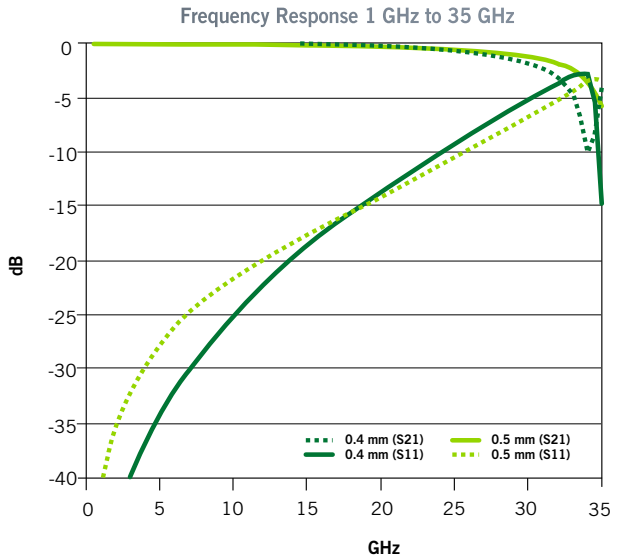


Figure 12. GSG P8A Insertion Loss and Return Loss

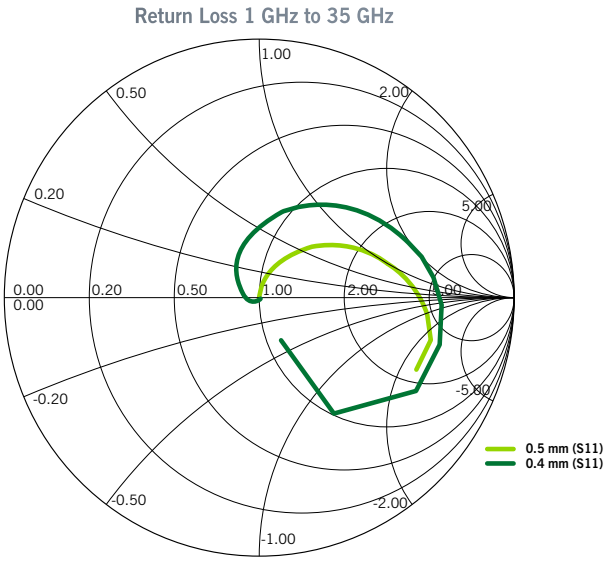


Figure 13. GSG P8A Return Loss plotted on Smith chart

Measurements for Pattern 8A

P8A measurements are not available at this time.

Schematic Model for Pattern 8A Configuration

Agilent's Advanced Design System (ADS) was used to construct a GSG schematic model matching the 0.4 mm pitch socket simulation results. The topology selected matches that of the one signal contact surrounded by eight ground contacts used in the simulation. The GSG schematic model consists of ten passive components. The signal contact is represented along the top by series inductors totaling 380.5 pH series inductor. The eight return paths are joined together in parallel and represented along the bottom series inductors, totaling 48 pH. Shunt capacitors bridge the signal contact and the ground return path. Total capacitance is 114 fF. Finally, an added mutual inductance 23 pH represents the mutual coupling between the two ground contacts and signal.

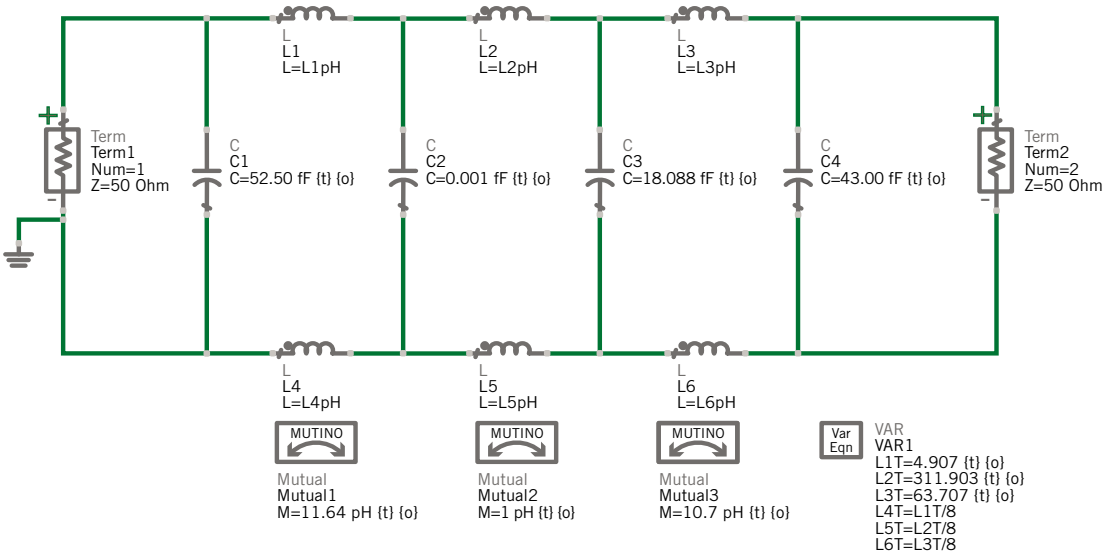


Figure 14. GSG P8A Schematic Model, 0.4 mm pitch

An additional pair of ports (ports 3 and 4, not shown) were added in the simulation to compare the schematic model to the GSG simulation file.

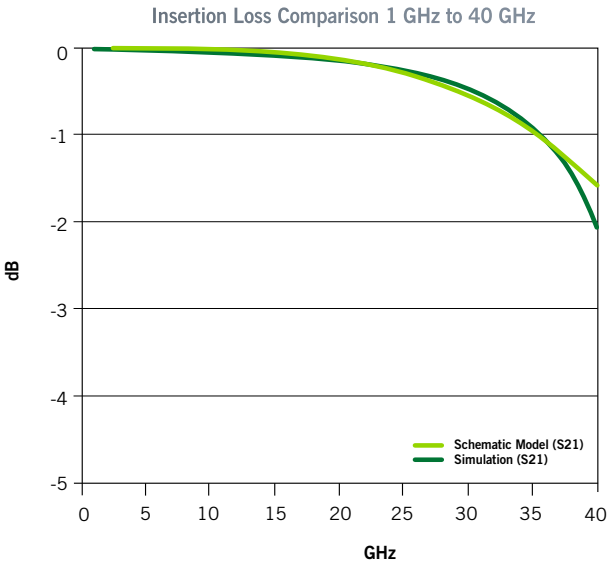


Figure 15. GSG P8A Insertion Loss, 0.4 mm pitch

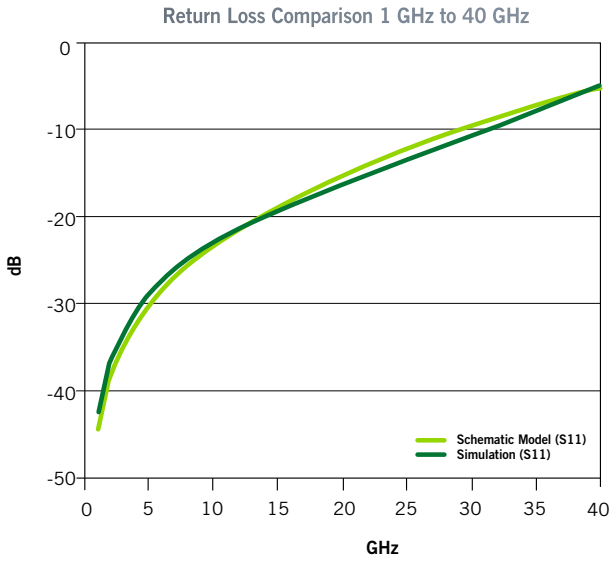


Figure 16. GSG P8A Return Loss, 0.4 mm pitch

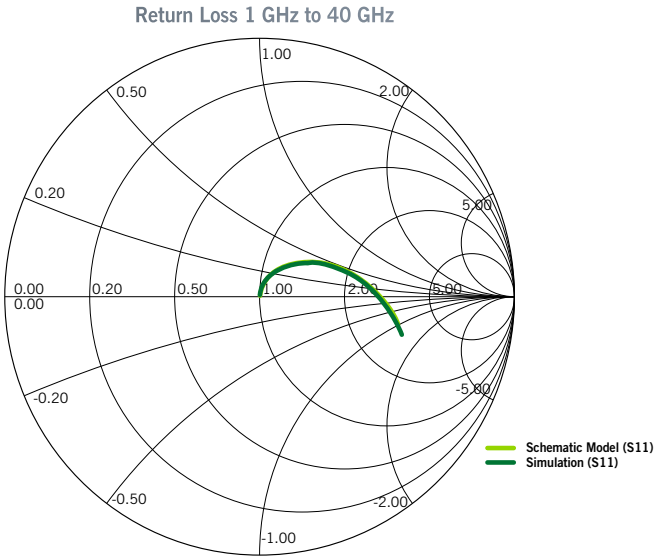
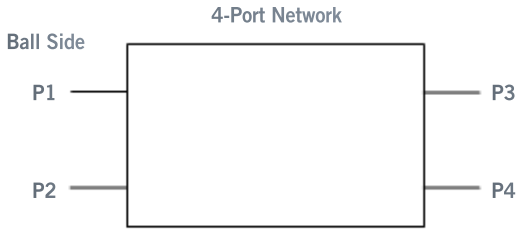


Figure 17. GSG P8A Return Loss Simulation plotted on Smith chart, 0.4 mm pitch

GSSG CROSSTALK ANALYSIS

A 4-Port S-parameter analysis was done to determine the Near End (S21) and Far End (S41) crosstalk.



Far End and Near End Crosstalk for GSSG at 0.4 mm Pitch

The model was analyzed in HFSS™.

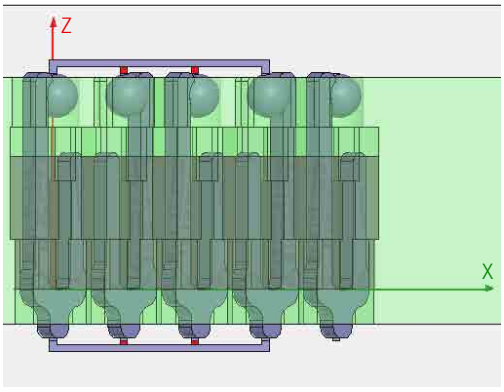


Figure 18. 0.4 mm GSSG model configuration

Far End and Near End Crosstalk for GSSG at a 0.5 mm Pitch
The model was analyzed in HFSS™.

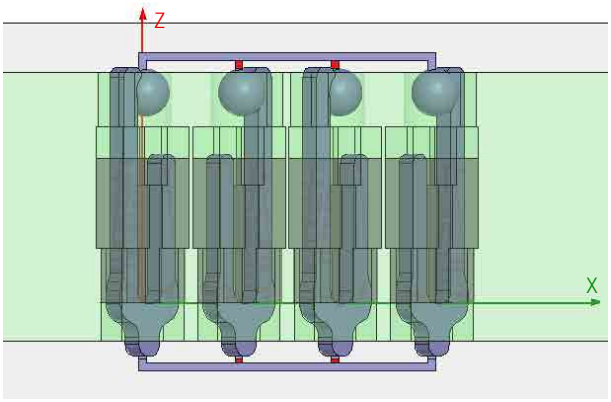


Figure 19. 0.5 mm GSSG model configuration

The Figure 17 plot shows the results for the Grypper G40 with the 0.4 mm pitch. The -20 dB Far End crosstalk limit (10% voltage crosstalk) is reached at 5.0 GHz. The Figure 18 plot shows the results for the Grypper G40 with the 0.5 mm pitch. The -20 dB Far End crosstalk limit (10% voltage crosstalk) is reached at 3.7 GHz.

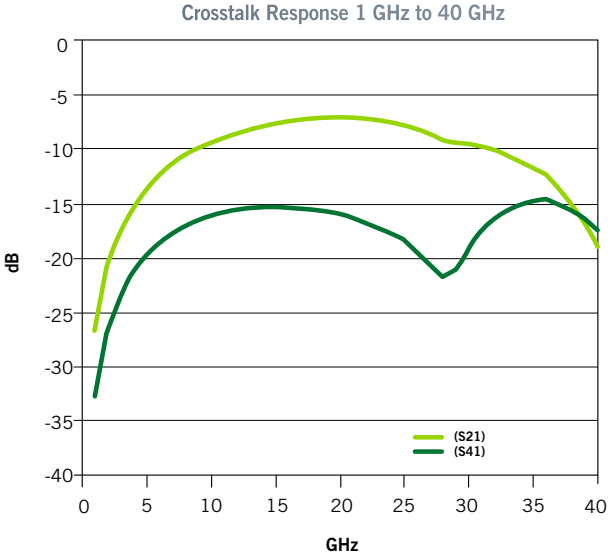


Figure 20. GSSG Crosstalk Response, 0.4 mm pitch

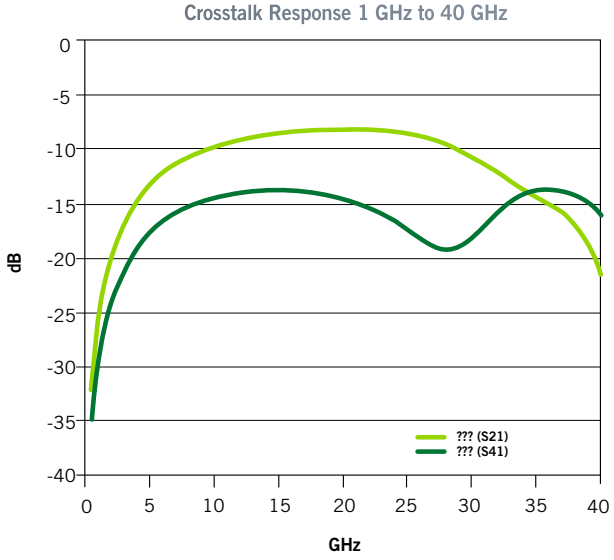


Figure 21. GSSG Crosstalk Response, 0.5 mm pitch

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