



# QFN35

104408-0002 Contact

0.4 Pitch

0.5 Pitch



## TEST OBJECTIVE

The objective of this report is to determine the RF transmission characteristics of the Ironwood Electronics QFN35 socket for the GSG (ground-signal-ground) configurations. The product variation at the pitches of 0.4 mm and 0.5 mm were studied. Three-dimensional electromagnetic (EM) field models were simulated for sockets with three contacts embedded in the dielectric material at a pitch of 0.4 and 0.5 mm. Real measurements were performed on the 0.5 mm pitch 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 QFN35 socket.

P2A Configuration	Pitches (mm)	Contact Part Number
<p>Pattern 2A</p>	0.4	104408-0002
	0.5	104408-0002

## ELECTRICAL SPECIFICATIONS

P2A Configuration	0.4 mm Pitch	0.5 mm Pitch*	Value Determination
Time Delay	14.3 pS	15.2 pS	Inverse Fast Fourier transform on the transmission, S21, S-parameter.
Short Circuit Inductance	1.03 nH	1.23 nH	Values are determined by a short-circuit one-port model at 1 GHz.
Open Circuit Capacitance	0.234 pF	0.213 pF	Values are determined by an open-circuit one-port model at 1 GHz.
S21 Insertion Loss	-1 dB @ 17.4 GHz	-1 dB @ 11.0 GHz	Values are based on the 3D model results, except where verified by measurements.
S11 Return Loss	-10 dB @ 12.0 GHz	-10 dB @ 9.3 GHz	
	-20 dB @ 3.5 GHz	-20 dB @ 3.0 GHz	
Impedance	66.3 $\Omega$	76 $\Omega$	Value calculated from Short Circuit Inductance and Open Circuit Capacitance.
Crosstalk, S41, GSSG Thru	-20 dB @ 7.6 GHz	-20 dB @ 4.8 GHz	Values are based on the 3D model results.

\* Specification based on lab measurements.

## RESULTS

### 3D Model Simulations

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 the bottom, Port 2, of the socket.

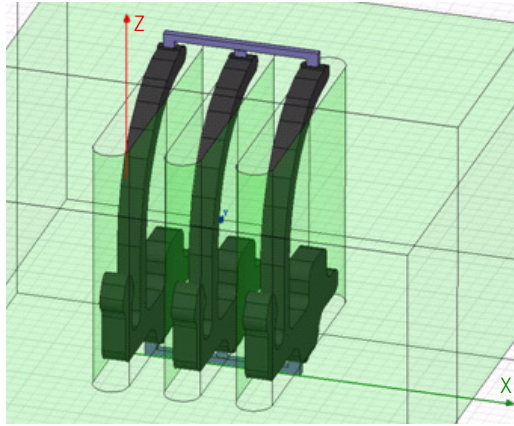


Figure 1. 0.5 mm GSG model configuration

The model contact and pitch configuration was varied to predict the performance of the socket. The contactor was suspended in slots of circles. Figure 2 and Figure 3 show results for the GSG configuration.

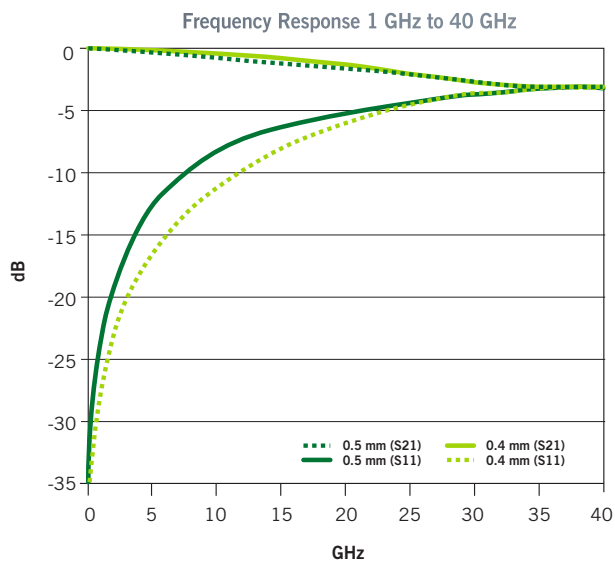


Figure 2. GSG P2A Insertion Loss and Return loss

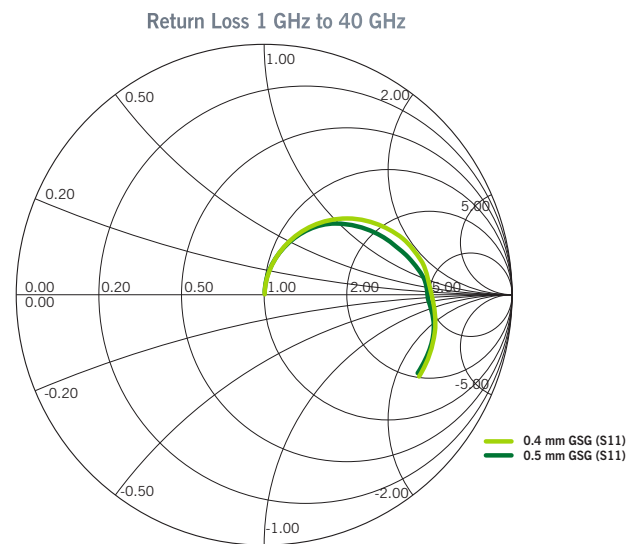


Figure 3. GSG P2A Return Loss plotted on Smith chart

## RESULTS CONT...

### Measurements

Measurements were taken on January 8, 2009, at the Cascade Microtech AmberGlen facility. Cascade Microtech FPC-500 GS and FPC-500 GSG probes were used to gather the 0.5mm 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. A Cascade Model R1000 board test probing station was used for probing.

### The PNA setup was as follows:

1. Start Frequency: 100 MHz
2. Stop Frequency: 40 GHz
3. Number of Points: 201
4. IF Bandwidth: 300 Hz

The PNA was calibrated at the probe tips using a Cascade 106-682A ISS. The ISS provides wide pitch GSG calibration standards, as well as a transmission thru path. The calibration algorithm used was SOLR.

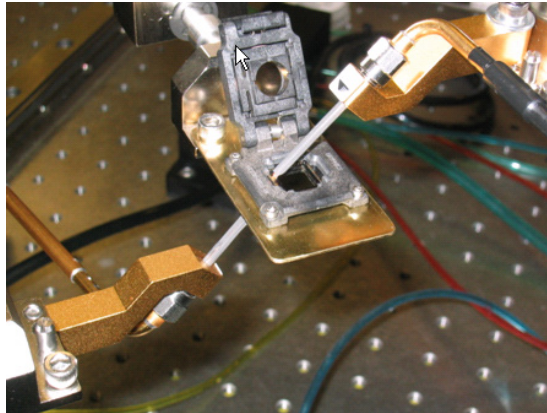


Figure 4. Probing the QFN35 0.5mm with FPC-GSG-500 probes

The insertion loss and return loss correlate relatively well, given the potential differences between the simulation and measurement environments.

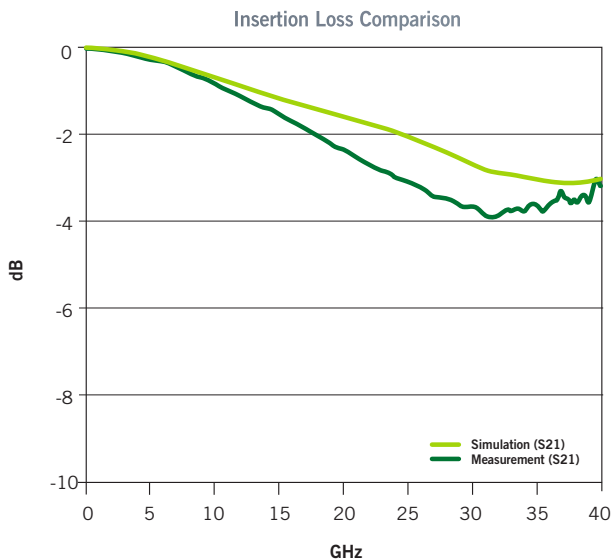


Figure 5. GSG P2A Insertion Loss comparison, 0.5 mm pitch

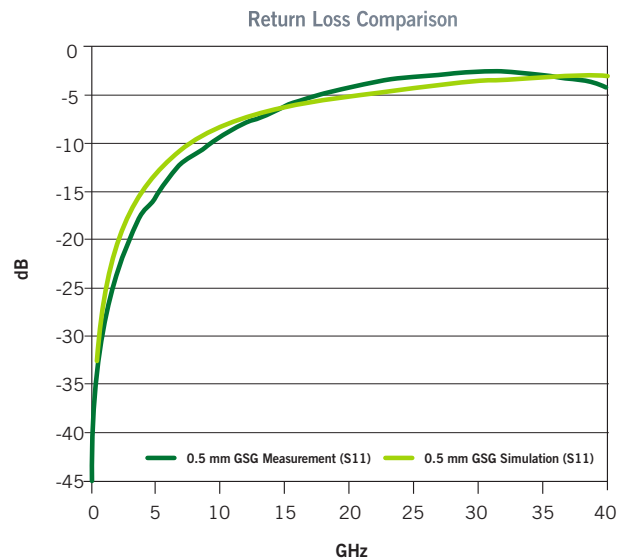


Figure 6. GSG P2A Return Loss comparison, 0.5 mm pitch

## RESULTS CONT...

Plotting the return loss on the Smith chart revealed a high impedance transmission path. The measured response was slightly lower in impedance than the simulation predicted.

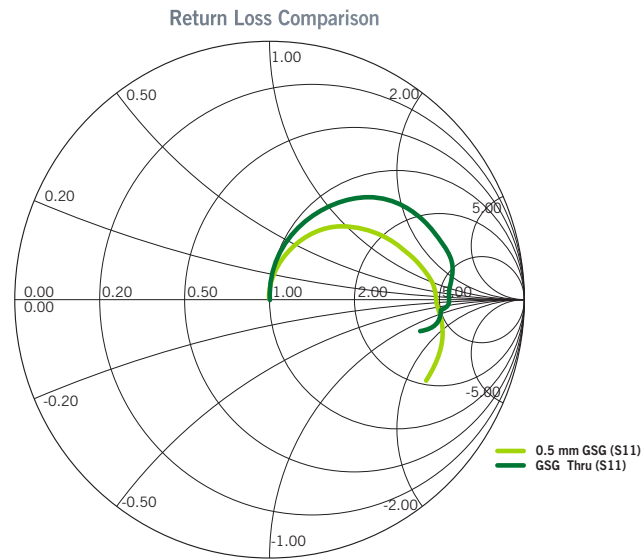
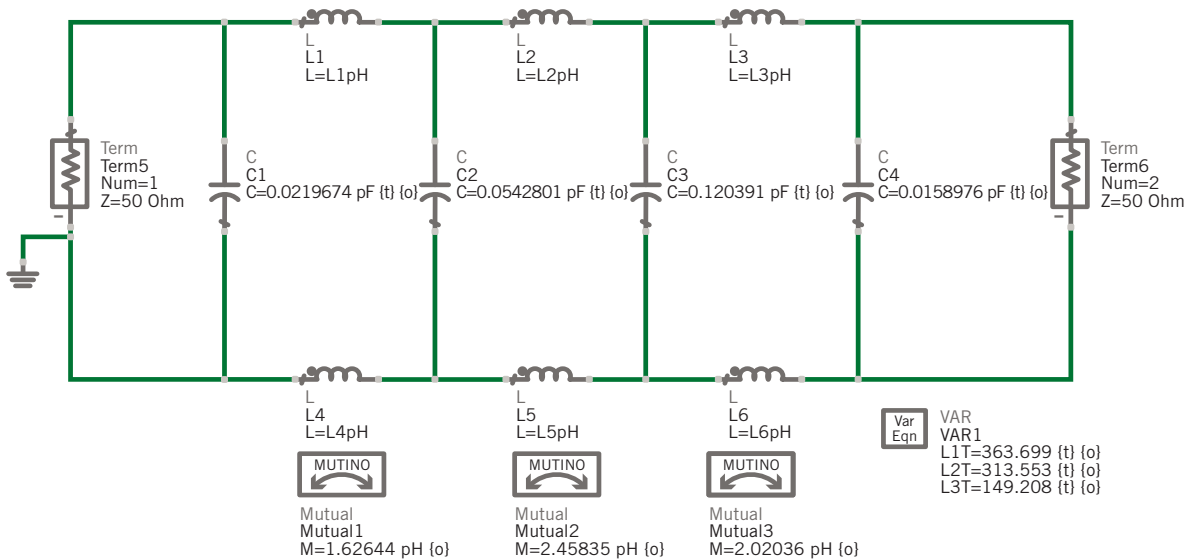


Figure 7. GSG P2A Return Loss comparison plotted on Smith chart, 0.5 mm pitch

### Schematic Model

Agilent's Advanced Design System (ADS) was used to construct a GSG schematic model matching the 0.5 mm pitch socket measurement results. The topology selected matches that of the three contacts used in the measurement.



The GSG schematic model consists of 10 passive components. The signal path is represented along the top by three series inductors, forming a total pin inductance of 0.826 nH. The two grounds forming the return path are represented along the bottom. Each respective return path is 1/2 that of the lumped portion of the signal path, depicting the two ground contacts in parallel. The total ground path inductance is 0.413 nH. The shunt capacitors become the capacitance between the signal and all return paths, 0.213 pF. Finally, three mutual inductance values are added to represent the mutual effects between contacts. The total mutual inductance is 0.006 nH. An additional pair of ports (3 and 4, not shown) are added in the ADS simulation to compare the schematic model to the GSG HFSS™ simulation results.

RESULTS CONT...

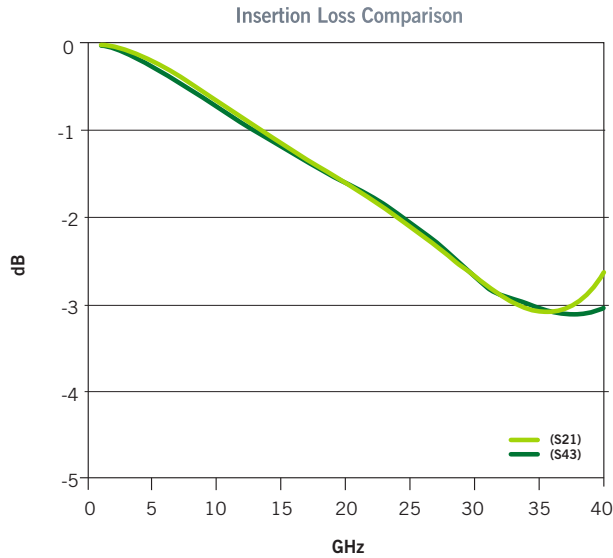


Figure 8. GSG P2A Insertion Loss comparison, 0.5 mm pitch

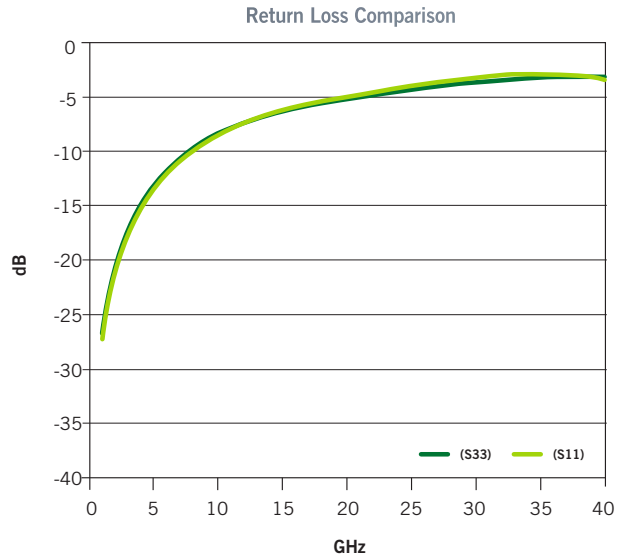


Figure 9. GSG P2A Return Loss comparison, 0.5 mm pitch

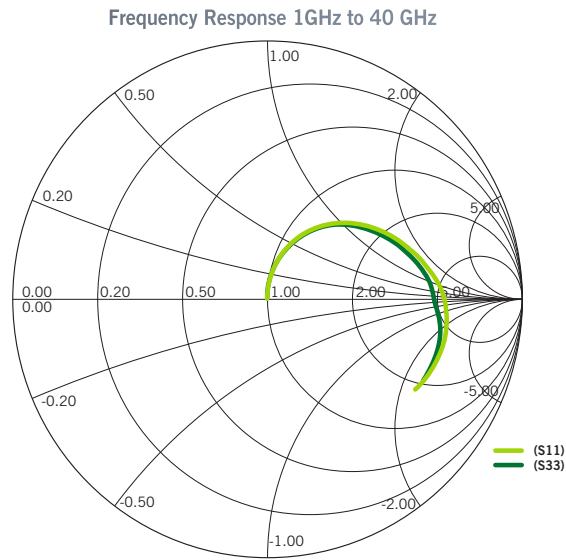


Figure 10. GSG P2A Return Loss plotted on Smith chart, 0.5 mm pitch

