



**Testing the Limits**  
FOR PRODUCT SUCCESS

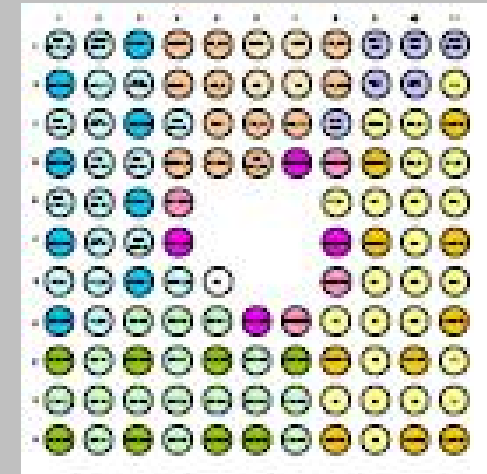
# WLCSP Test Solutions Using Small-pitch Spring Pins

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**Antares Advanced Test Technologies**



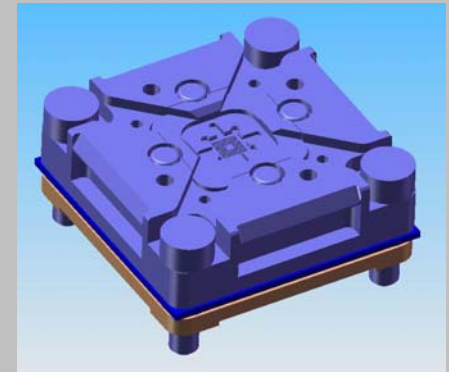
## WLCSP BGA Device

- Pitch: 0.25mm
- Ball diameter: 0.12mm
- Ball height: 0.1mm
- Ball count: ~100
- Package size: ~3.5x3.5x0.3mm
- Frequency: 2GHz



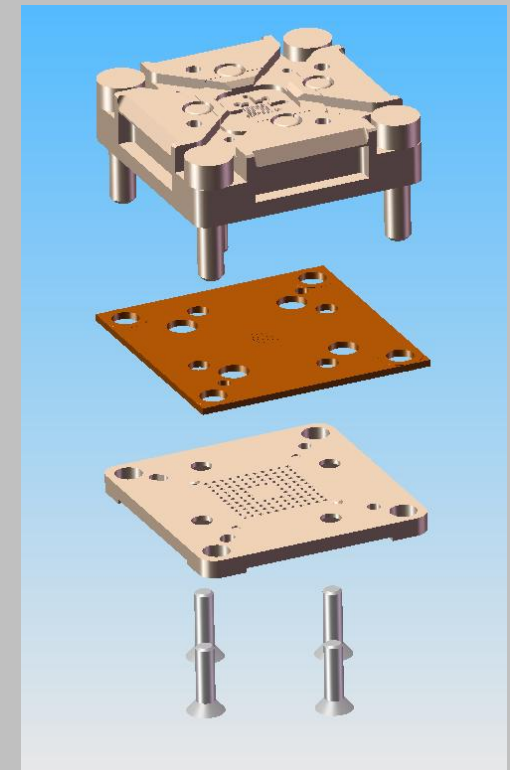
## Test Socket Requirements

- Fanout
  - Minimum loadboard thickness: ~150mil
  - For 0.25mm pitch, via dia~4mil (0.1mm)
  - Aspect ratio ~38:1; Practically can only achieve 10:1~15:1
  - high aspect ratio via has higher manufacturing cost and lower reliability
- Signal Integrity:
  - Smaller dia. pins must have longer length
  - Low pitch/diameter ratio result in lower impedance than 50ohm



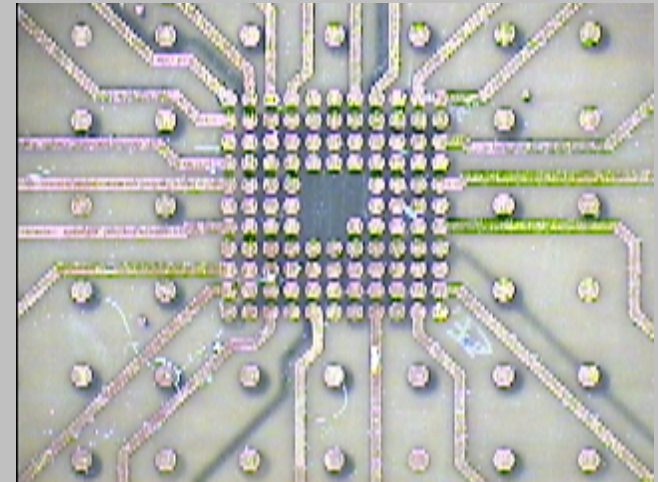
## Socket Structure

- Bottom section
  - larger pins at 1mm pitch
- Interposer
  - Transition from 1mm to 0.25mm pitch
  - 10 layer PCB
- Top section
  - Socket for 0.25mm pitch pins



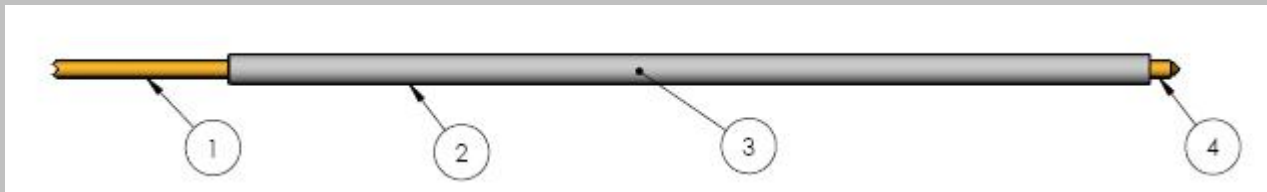
## Fanout Interposer

- 10-layer FR4 board
  - 5 signal layers
  - 1 power layer
  - 4 ground layers
- Total thickness 45 mil
- Via diameter 4 mil
- Top layer pad dia. 8 mil



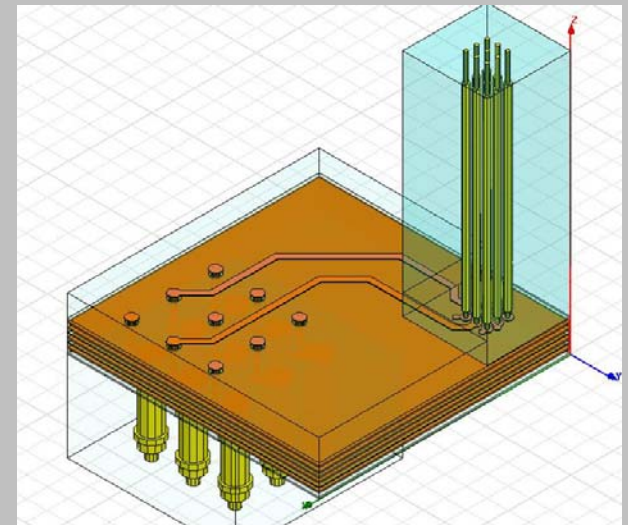
## Contactors

- 0.25mm pitch contactor
  - 0.18mm diameter
  - 5.5mm length
  - Contact resistance
- 1mm pitch contactor
  - 0.5mm diameter
  - 2.15mm length
  - 40mohm contact resistance



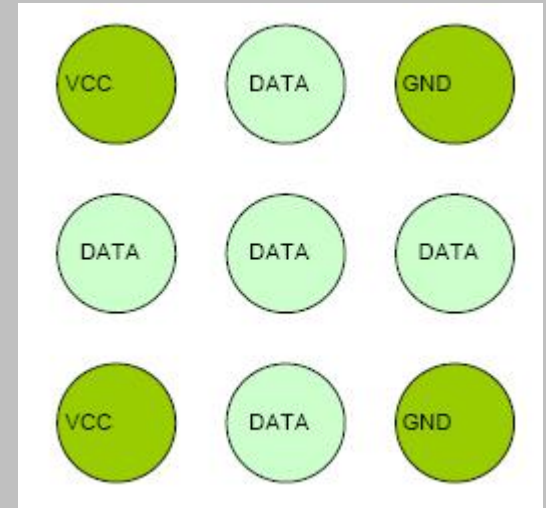
## HFSS Model

- Two types of pins in 3x3 arrays
- Interposer made of 10-layer metal
- Layout traces and pads imported from dxf
- Ground, signal, power pin configuration based on customer pin map

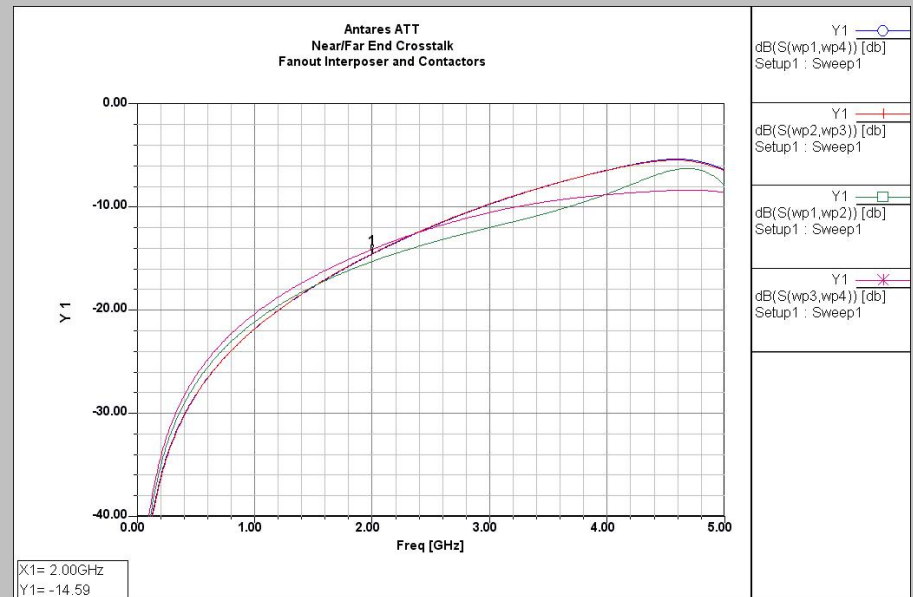
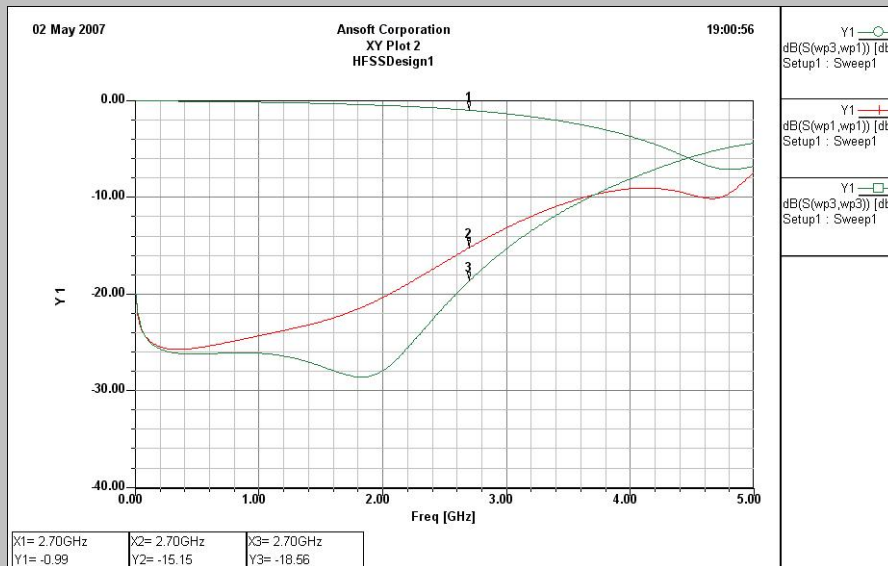


## Signal Integrity Analysis

- Pin map configuration
  - 5 signal, 2 ground, 2 vcc
- Input/output Ports
  - Selected 2 signals on left and bottom side for analysis
- Results expected from SI analysis
  - Insertion loss
  - Return loss
  - Crosstalk



## SI Results – IL, RL, Crosstalk



- Insertion Loss(IL) = 1dB at 2.7GHz
- Return Loss(RL) = 15dB at 2.7GHz
- Crosstalk = -14.6dB at 2GHz



## Conclusion

- Fanout interposer provides test solutions for 0.25~0.3mm small pitch WLCSP devices
- Effective frequency range > 2GHz
- Crosstalk becomes significant for single-ended configuration at 2GHz and above
  - Differential signal will have much lower crosstalk
- Lower cost solution comparing to alternative technologies
- Shorter lead time



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