SM/SMP Product Presentation

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SMP and SM Contact Components

Gold P-Layer
(SMP only)

Top Side
Tips Pierce
DUT

Bottom Side
Tails Compress
SM Columns

SM Interposer

Array of Columns
Elastomer Matrix
Compliant Buttons

Cross Section
Silver Particles
Patented Core
## SMP and SM Contacts

<table>
<thead>
<tr>
<th></th>
<th>SMP-1.0</th>
<th>SMP-0.6</th>
<th>SM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Performance Contacts</strong></td>
<td>2 Piece System</td>
<td>2 Piece System</td>
<td>1 Piece System</td>
</tr>
<tr>
<td>for Hand Test and Automation</td>
<td>Gold P-Layer +</td>
<td>Gold P-Layer +</td>
<td>SM Interposer w/ Core</td>
</tr>
<tr>
<td>(Patented / Proprietary Contact Structures)</td>
<td>SM w/ Core</td>
<td>SM w/ Core</td>
<td>(No Gold P-Layer)</td>
</tr>
<tr>
<td><strong>Packages (BGA, LGA, QFN, CSP, PoP)</strong></td>
<td>All Package Types and Sizes, Full and Partial Array Capabilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Minimum Package Pitch (Mixed Pitch Ok)</strong></td>
<td>0.5 mm</td>
<td>0.35 mm</td>
<td>0.3 mm</td>
</tr>
<tr>
<td><strong>Compressed Contact Length</strong></td>
<td>1.0 mm</td>
<td>0.6 mm</td>
<td>0.4 mm</td>
</tr>
<tr>
<td><strong>Bandwidth (S21 @ -1db Loss)</strong></td>
<td>40 Ghz</td>
<td>&gt; 40 Ghz</td>
<td>&gt; 40 Ghz</td>
</tr>
<tr>
<td><strong>Inductance (Self / Mutual)</strong></td>
<td>0.22 / 0.05 nH</td>
<td>0.13 / 0.03 nH</td>
<td>0.10 / 0.03 nH</td>
</tr>
<tr>
<td><strong>Capacitance (Self / Mutual)</strong></td>
<td>0.25 / 0.04 pF</td>
<td>0.18 / 0.03 pF</td>
<td>0.14 / 0.02 pF</td>
</tr>
<tr>
<td><strong>Contact Resistance</strong></td>
<td>&lt; 25 mOhms</td>
<td>&lt; 25 mOhms</td>
<td>&lt; 25 mOhms</td>
</tr>
<tr>
<td><strong>Current (Continuous / Pulse per Lead)</strong></td>
<td>3.4A / 5.8A @ 20°C</td>
<td>4.2A / 6.0A @ 20°C</td>
<td>8.5A / 8.7A @ 20°C</td>
</tr>
<tr>
<td><strong>Closest Component Proximity</strong></td>
<td>Within 0.5 mm</td>
<td>Within 0.5 mm</td>
<td>Within 0.5 mm</td>
</tr>
<tr>
<td><strong>Compliance (Travel / Operating Stroke)</strong></td>
<td>0.38 / 0.23 mm</td>
<td>0.28 / 0.18 mm</td>
<td>0.23 / 0.13 mm</td>
</tr>
<tr>
<td><strong>Contact Force (Initial per Lead)</strong></td>
<td>25-45 Grams</td>
<td>25-45 Grams</td>
<td>20-40 Grams</td>
</tr>
<tr>
<td><strong>Operating Temperature</strong></td>
<td>-55°C to +155°C</td>
<td>-55°C to +155°C</td>
<td>-55°C to +155°C</td>
</tr>
<tr>
<td><strong>Gold P-Layer Expected Life (Actuations)</strong></td>
<td>&gt; 2,000,000</td>
<td>&gt; 2,000,000</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>SM Interposer Expected Life (Actuations)</strong></td>
<td>&gt; 500,000</td>
<td>&gt; 500,000</td>
<td>&gt; 1,000-100,000</td>
</tr>
<tr>
<td><strong>Value Summary</strong>: High Performance, Reliable, Durable, Compliant and Easily Replaceable = Low Cost of Ownership</td>
<td>Most Robust</td>
<td>Best Electricals w/ Long Life in Prod</td>
<td>Low Cost Custom</td>
</tr>
<tr>
<td><strong>Target Applications</strong></td>
<td>Lrg BGA/Hi Freq/Hi Pwr (IC Test, Industrial, Military, Medical)</td>
<td>RF/ Mmwave/ Hi Speed</td>
<td>Hi Freq-Speed-Pwr</td>
</tr>
</tbody>
</table>

*Contact life may vary and can be influenced by many factors including the package, board, amount of compression, debris, test application, environment, handling and maintenance, etc.

IP, 2/7/2018
SMP-1.0 Contacts

2 Piece System – Gold P-Layer and SM Interposer with Core Technology

Electrical (0.5 mm pitch, measured data with full reports, SPICE models, SnP files and dielectrics available)
- Insertion loss / bandwidth (corner) -1.0 db @ 40 GHz, -1.5 db @ > 90 GHz
- Inductance (field) 0.22 nH
- Mutual inductance (field) 0.05 nH
- Capacitance to ground (field) 0.25 pF
- Mutual capacitance (field) 0.04 pF
- Contact resistance (initial) < 25 mΩ
- Thermal resistance (per contact) 130.5 K/W
- Continuous current rating (per contact) 3.4 amps @ 20°C heat rise
- Pulse rating 1% duty cycle (per contact) 5.8 amps @ 20°C heat rise

Mechanical (qualified and validated, measured data available)
- Contact length (compressed) 1.0 mm
- Minimum pitch 0.5 mm – mixed pitch available
- Packages BGA, LGA, QFN, DFN, CSP, POP – full and partial arrays available
- Structure Gold P-Layer and SM Interposer with core technology (patented)
- Gold P-Layer materials Gold and nickel plating over copper (no vias)
- SM Interposer materials Silver particles in silicone elastomer with polyimide core (patented)
- Compliance range 0.38 mm maximum travel with 0.23 mm operating stroke
- Contact force (per contact) 25-45 grams – depends on amount of compression
- Operating temperature -55°C to +155°C
- Estimated life* Gold P-Layer > 2,000,000 actuations, SM Interposer > 500,000 actuations

* Contact life may vary and can be influenced by many factors including the package, board, amount of compression, debris, test application, environment, handling and maintenance, etc.
# SMP-0.6 Contacts

## 2 Piece System – Gold P-Layer and SM Interposer with Core Technology

### Electrical (0.5 mm pitch, measured data with full reports, SPICE models, SnP files and dielectrics available)

- Insertion loss / bandwidth (corner)  
  -1.0 db @ > 40 GHz, -1.5 db @ > 90 GHz
- Inductance (field)  
  0.13 nH
- Mutual inductance (field)  
  0.03 nH
- Capacitance to ground (field)  
  0.18 pF
- Mutual capacitance (field)  
  0.03 pF
- Contact resistance (initial)  
  < 25 mΩ
- Thermal resistance (per contact)  
  109.8 K/W
- Continuous current rating (per contact)  
  4.2 amps @ 20°C heat rise
- Pulse rating 1% duty cycle (per contact)  
  6.0 amps @ 20°C heat rise

### Mechanical (qualified and validated, measured data available)

- Contact length (compressed)  
  0.6 mm
- Minimum pitch  
  0.35 mm – mixed pitch available
- Packages  
  BGA, LGA, QFN, DFN, CSP, POP – full and partial arrays available
- Structure  
  Gold P-Layer and SM Interposer with core technology (patented)
- Gold P-Layer materials  
  Gold and nickel plating over copper (no vias)
- SM Interposer materials  
  Silver particles in silicone elastomer with polyimide core (patented)
- Compliance range  
  0.28 mm maximum travel with 0.18 mm operating stroke
- Contact force (per contact)  
  25-45 grams – depends on amount of compression
- Operating temperature  
  -55°C to +155°C
- Estimated life*  
  Gold P-Layer > 2,000,000 actuations, SM Interposer > 500,000 actuations

* Contact life may vary and can be influenced by many factors including the package, board, amount of compression, debris, test application, environment, handling and maintenance, etc.
SM Interposer

1 Piece System – SM Interposer with Core Technology

**Electrical** (0.5 mm pitch, measured data with full reports, SPICE models, SnP files and dielectrics available)

- Insertion loss / bandwidth (corner) -1.0 db @ > 40 GHz, -1.2 db @ > 90 GHz
- Inductance (field) 0.10 nH
- Mutual inductance (field) 0.03 nH
- Capacitance to ground (field) 0.14 pF
- Mutual capacitance (field) 0.02 pF
- Contact resistance (initial) < 25 mΩ
- Thermal resistance (per contact) 59.8 K/W
- Continuous current rating (per contact) 8.5 amps @ 20°C heat rise
- Pulse rating 1% duty cycle (per contact) 8.7 amps @ 20°C heat rise

**Mechanical** (qualified and validated, measured data available)

- Contact length (compressed) 0.4-0.6 mm – depends on package
- Minimum pitch 0.3 mm – mixed pitch available
- Packages BGA, LGA, QFN, DFN, CSP, POP – full and partial arrays available
- Structure SM Interposer with core technology (patented)
- SM Interposer materials Silver particles in silicone elastomer with polyimide core (patented)
- Compliance range 0.23 mm maximum travel with 0.13 mm operating stroke
- Contact force (per contact) 20-40 grams – depends on amount of compression
- Operating temperature -55°C to +155°C
- Estimated life* > 1,000-100,000 actuations

* Contact life may vary and can be influenced by many factors including the package, board, amount of compression, debris, test application, environment, handling and maintenance, etc.

IP, 2/7/2018
SMP and SM Contacts – 40 GHz

Insertion Loss
-1dB @ >40GHz

Return Loss
-15dB @ 35GHz

Note: Detailed Reports & S-Parameter Files Available Upon Request
SMP and SM Contacts – 90 GHz

0.5mm Pitch

Insertion Loss
-1.5dB @ >90GHz

Note: Detailed Reports & S-Parameter Files Available Upon Request
SMP and SM Contacts – C & L

0.5mm Pitch

Capacitance (Field)

Inductance (Field)

Inductance
0.10nH to 0.22nH

Note: Detailed Reports & SPICE Models Available Upon Request
SMP and SM Contacts – DC

0.5mm Pitch

Current Carrying Capacity (Continuous)

3.4A to 8.5A per contact
@ 20°C Heat Rise

Current Carrying Capacity (Pulse 1% Duty Cycle)

5.8A to 8.7A per contact
@ 20°C Heat Rise

Note: Detailed Reports Available Upon Request
SMP and SM Contacts

Force – Deflection – Resistance

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IP, 2/7/2018
SMP Cycling Data

0.5mm Pitch QFN
Internal Cycler Data
@ Room Temp (Ambient)

SMP-1.0 Two Piece System
- Excellent Electrical Performance
- ATE HVM Solution

Gold P-Layer and SM Interposer with Core
Enable Long Life and Smooth Electrical Response

IP, 2/7/2018
SMP Cycling Data

0.5mm Pitch QFN
Delta RFS Handler
Tri-Temp Cycling
(Ambient, +150°C, -50°C)

SMP-1.0 Two Piece System
- Excellent Electrical Results
- ATE HVM Solution

AMIENT DELTA RFS - 0.5mm QFN - SMP-1.0

+150C DELTA RFS - 0.5mm QFN - SMP-1.0

-50C DELTA RFS - 0.5mm QFN - SMP-1.0

IP, 2/7/2018
SMP-0.6 Two Piece System
Low Profile Structure:
- Best Electrical Performance
- ATE HVM Solution
SMP Cycling Data

0.5mm 518 BGA
A-Frame Vertical Plunge Cycler
@ Room Temp (Ambient)

SMP-0.6 Two Piece System
Low Profile Structure:
- Best Electrical Performance
- ATE HVM Solution

0.0000
0.0100
0.0200
0.0300
0.0400
0.0500
0.0600
0.0700
0.0800
0.0900
0.1000
0.1100

0 50000 100000 150000 200000 250000 300000 350000 400000 450000 500000

Cycles

Avg
Std Dev
95% Level

0.0000
0.0100
0.0200
0.0300
0.0400
0.0500
0.0600
0.0700
0.0800
0.0900
0.1000
0.1100

CRES Ohms

0.5mm 518 BGA – SMP-0.6 – 500K Cycles

IP, 2/7/2018
SM Cycling Data

0.5mm Pitch QFN
Internal Cycler Data
@ Room Temp (Ambient)

SM One Piece System
SM Interposer Only
Low Cost Solution

Resistance (Ohms)

0.002 0.004 0.006 0.008 0.01 0.012 0.014 0.016

Cycles

0.5mm 44 QFN - SM
LGA Gold Plated
SMP Contacts – BGA Witness Marks

SMP Two Piece Systems
Contact Tips Pierce Only
(No Digging or Scrubbing)

Uniform Sharp Contact Tips Minimize
Ball Damage with No Solder Transfer
and Less Cleaning

Images taken after 5 actuations with the same BGA package
SM Interposer – BGA Witness Marks

SM One Piece System
SM Conductive Particles Pierce Only
(No Digging or Scrubbing)
SM Interposer Conforms & Small Size
Particles Maximize Surface Area Contact
and Prevent Ball Damage