Ironwood Established in 1986

Located in Eagan Minnesota

75 Employees

100,000 Sockets built

1M+ adapters built
MARKETS SERVED
- Semiconductor Manufactures
  - Memory
  - RF
  - Digital / Analog
  - Microprocessors / Microcontrollers
- OEM
- Military Aerospace
- Telecommunications
- Consumer Products
- **Basic sockets** -
  - **SBT**
    - Common Commercially available proven Spring pins
    - IW footprints and we can footprint match
      - NEW common footprints (Aspen) targeted for high volume
      - 0.35 p / 50K+ insertions / up to ~ 20 Ghz
      - Large Z compliance ~ 0.40 mm
<table>
<thead>
<tr>
<th>IW Part Number</th>
<th>P-P204A</th>
<th>P-P201A</th>
<th>P-P185A</th>
<th>P-P184A</th>
<th>P-P196A</th>
<th>P-P150A</th>
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</thead>
<tbody>
<tr>
<td>Minimum Pitch (mm)</td>
<td>0.35</td>
<td>0.35</td>
<td>0.40</td>
<td>0.40</td>
<td>0.50</td>
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<tr>
<td>Pin Type</td>
<td>BGA</td>
<td>LGA</td>
<td>BGA</td>
<td>LGA</td>
<td>BGA</td>
<td>LGA</td>
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<tr>
<td>Free Length (mm)</td>
<td>3.46</td>
<td>2.89</td>
<td>3.81</td>
<td>2.90</td>
<td>3.86</td>
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<tr>
<td>DUT Tip</td>
<td>Crown</td>
<td>Radius</td>
<td>V</td>
<td>Radius</td>
<td>V</td>
<td>Radius</td>
</tr>
<tr>
<td>DUT Tip Dimension</td>
<td>0.17</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.23</td>
<td>0.23</td>
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<tr>
<td>PCB Tip</td>
<td>Radius</td>
<td>Radius</td>
<td>Radius</td>
<td>Radius</td>
<td>Radius</td>
<td>Radius</td>
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<tr>
<td>PCB Tip Dimension</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.23</td>
<td>0.23</td>
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<tr>
<td>DUT Travel</td>
<td>0.3</td>
<td>0.3</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
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<tr>
<td>PCB Travel (Preload)</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
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<tr>
<td>Force (grams)</td>
<td>5.8</td>
<td>5.8</td>
<td>14.5</td>
<td>14.5</td>
<td>30</td>
<td>30</td>
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<tr>
<td>Cres (m Ohms)</td>
<td>&lt;65</td>
<td>&lt;65</td>
<td>&lt;60</td>
<td>&lt;60</td>
<td>&lt;35</td>
<td>&lt;35</td>
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<tr>
<td>CCC @ ambient (Amps)</td>
<td>0.5</td>
<td>0.5</td>
<td>1.8</td>
<td>1.8</td>
<td>2.9</td>
<td>2.9</td>
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<tr>
<td>Bandwidth (GHz @ -1dB)</td>
<td>23.5-26.1</td>
<td>23.5-26.1</td>
<td>20.5-31.7</td>
<td>20.5-31.7</td>
<td>5.2-15.7</td>
<td>5.2-15.7</td>
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<tr>
<td>Self-Inductance (nH)</td>
<td>0.92</td>
<td>0.92</td>
<td>0.75</td>
<td>0.75</td>
<td>0.88</td>
<td>0.88</td>
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<tr>
<td>Temperature (deg C)</td>
<td>-55 / 180C</td>
<td>-55 / 180C</td>
<td>-55 / 180C</td>
<td>-55 / 180C</td>
<td>-55 / 180C</td>
<td>-55 / 180C</td>
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<tr>
<td>Insertion Cycles</td>
<td>75k</td>
<td>75k</td>
<td>75k</td>
<td>75k</td>
<td>125k</td>
<td>125k</td>
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</table>
Wire in Elastomer

- **SG**
  - Gold Plated Brass wires embedded in silicone
  - Different wire matrixes used for specific applications. Thickness from 0.75 mm to 0.15 mm
  - BGA/LGA/QFN - Pad and solder ball devices
    - Down to 0.30 mm Pitch
    - Embedded wires are at an 63° angle
    - Compression mount type socket, but PCB footprint has an offset in one direction to compensate for the angled wires
    - -35° to +125°C
    - 40+ GHz Electrical performance @ 0.4 pitch
- Proprietary Elastomeric interconnect
  - GT /GTP
    - Down to 0.25 pitch
    - -55° to 160° C
    - Contact Resistance < 30 mOhms
    - > 75 Ghz bandwidth
    - 0.15 mm compliance
    - > 1000 Insertion Life
    - Compression type socket
      - GTP layer adds Crown tip interface for longer life and for Pads (LGA/QFN etc devices)
- Lid options
  - Swivel
  - Snap
  - ½ Turn
  - Open Top
  - Removable Double Latch
  - Lever Cam
- Thermal management
  - (Heat sinks, Fans, Water cool)
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Emebedded Wire Elastomer (SG)</th>
<th>Stamped Spring Pins (SBT)</th>
<th>Silver Button Elastomer (GT/GTP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth, GHz</td>
<td>27 to 56.8</td>
<td>4.15 to 31.7</td>
<td>94</td>
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<tr>
<td>Endurance, Cycles*</td>
<td>2K</td>
<td>500K</td>
<td>1K/200K</td>
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<tr>
<td>Resistance, mΩ</td>
<td>20</td>
<td>15</td>
<td>20</td>
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<tr>
<td>Self Inductance, nH</td>
<td>0.11 to 0.28</td>
<td>0.88 to 0.98</td>
<td>0.04</td>
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<tr>
<td>Max Current, Amp</td>
<td>2</td>
<td>8</td>
<td>7.8</td>
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<tr>
<td>Temp Range, °C</td>
<td>-35 to +125</td>
<td>-55 to +180</td>
<td>-55 to +160</td>
</tr>
<tr>
<td>Pitch, mm</td>
<td>0.3 to 1.27</td>
<td>0.3 to 1.27</td>
<td>0.2 to 1.27</td>
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<tr>
<td>Package Types</td>
<td>BGA, QFN, QFP, SOIC</td>
<td>BGA, LGA, QFN, QFP, SOIC</td>
<td>BGA, LGA, QFN</td>
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<td>Lab test</td>
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<tr>
<td>Production test</td>
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<tr>
<td>Field upgrade</td>
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<td>√</td>
<td>√</td>
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<tr>
<td>Temperature test</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Kelvin test</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Burn-in test</td>
<td></td>
<td>√</td>
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</tr>
</tbody>
</table>
Grypper (Zero Footprint)

- SMT Socket
- Same Size as the Device
- Socket solder balled with SAC 305 or Eutectic (Tin/Lead) allowing reflow process to the PCB the same as reflowing a device
- 0.35 to 1.0 pitch
- UP to ~ 1200 I/O
- -55° to +155° C
- Up to 100 Insertions
- Grypper (Zero Footprint)
  - Same size as the Device allows the socket to directly mount into the location as the device
Grypper (Zero Footprint)
- Different Contacts depending on Pitch- I/O count
- Excellent Electrical performance
- Other Supporting Items
  - Alignment Frame - to ensure proper alignment of the device prior to insertion
  - Press- that allows even pressure to the back side of the device - Important on very thin –Chip Scale etc devices
  - Extraction tool – for removing the device

<table>
<thead>
<tr>
<th></th>
<th>Grypper</th>
<th>G80</th>
<th>G40/G35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of pins</td>
<td>&lt;200 I/O</td>
<td>&gt;200 I/O</td>
<td>Based on pitch</td>
</tr>
<tr>
<td>Device Pitch</td>
<td>&gt;0.65mm</td>
<td>&gt;0.65mm</td>
<td>&gt;0.35 to 0.50mm</td>
</tr>
<tr>
<td>Insertion force</td>
<td>95 grams</td>
<td>40 grams</td>
<td>20 grams</td>
</tr>
<tr>
<td>Number of cycles</td>
<td>100</td>
<td>50</td>
<td>50</td>
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<tr>
<td>Electrical</td>
<td>-1db@40Ghz</td>
<td><a href="mailto:-1db@30.8Ghz">-1db@30.8Ghz</a></td>
<td>-1db@24Ghz</td>
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</tbody>
</table>
- Grypper (Zero Footprint)
  - Also Used as a riser for Snoop Boards
- Adapters / Package Converters
  - Simple Redistribution of I/O
    - PGA to BGA
    - QFN to BGA
    - Simple Pitch Change for SOIC
- **Giga Snap**
  - Allow Customer to Plug in Device (PGA type Pin) in the same footprint
  - Female Interposer soldered to target PCB
  - Device solder to Interposer with PGA type pins
- Probing
  - DDR Test Board allowing monitoring of the signals
  - PLCC Device clips with probing option
Adapters / Package Converters

- More complex requiring voltage changes, Impedance control, Differential pairs – RF application / High Speed digital/ other componentry to do the conversion
- No Hard Tooling Charges
- Rapid Development/ Short Lead Times
- Prototype & Production Capabilities

**3 Technology Options:**
- GT Elastomer for Ultra High Speed Short Connections
- Spring Pins: Rugged & Customizable Options
- Permanent Mount Capabilities
- Benchtop – Small Size
  - 410 x 282 x 150 mm (11 x 6 x 16 in.)
  - 8.7 kg (19 lbs.)
- Unique Umbilical / Test Head
  - Pneumatic press force control 0-80kg
  - (0-176 lbs.)
  - Frost Free
  - Quick Disconnect to allow easy transfer to other sites
- Excellent Thermal Control
  - Control and Accuracy is within +/- 0.2° C
- Head interface to Ironwood sockets and other manufactures
- IW capabilities
  - In-house manufacturing of majority of components
  - PCB Assembly
    - Pick and Place and Reflow
  - Electrical and Thermal Simulation