Mechanical Design of Micro Jack Screw Precision Board Stacking Standoff

For VITA and PC/104 Standard Applications

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1 Abstract

Some FPGA mezzanine cards may present a challenge to unmate from their host. In order to ensure the connector set is not damaged, Samtec has developed the Micro Jack Screw Standoff (JSOM) to not only act as a standard PCB standoff but to also aid in unmuting the connector set.

With the density of boards increasing and the challenge of unmuting without causing damage, this paper will explore:

- Mechanical design and application of the JSOM
- Assembly and disassembly processes for the JSOM
- Qualification testing results for the press-fit JSOM
- Specific standards for JSOM application
2 Mechanical Design of the Micro Jack Screw Standoff (JSOM) for High Unmating Forces in High-Normal-Force Applications

Some FPGA mezzanine cards may present a challenge to unmate from their host. In order to ensure the connector set is not damaged, Samtec has developed the Micro Jack Screw Standoff (JSOM) to not only act as a standard PCB standoff but to also aid in unmating the connector set.

The JSOM is designated for use with PCI/104-Express™, PICMG, and VITA systems. JSOM is available with threaded posts or press-fit terminations at stack heights ranging from 5 mm to 15.24 mm, see Image 1. The JSOM standoff family includes M2.5, M3, and #4-40 hardware available with or without thread locker.

2.1 Mechanical Design Factors in the JSOM

Since many of the applications that involve PC/104-Express™, PICMG, and VITA systems are on highly populated boards with sensitive components; it is important to have an accurate way of unmating the connectors, see Image 2. In general, the following features are needed:

1. The need for a standard standoff is required for normal operation and stability of mezzanine cards.
2. The cards need to be removed from the boards in a manner where components, contacts, solder joints, and the boards are not damaged.
3. No additional components should be needed to further complicate board design.
4. Disassembly should remain easily accessible to not interfere with other components.
2.2 Assembly and Disassembly of JSOM

2.2a Assembly Process

The JSOM has two configurations for connecting with the PCB. Assembly of the JSOM -01 lead style involves pressing the base into the lower board, screwing the jack screw into the base, mating the top board to the bottom board while aligning the board holes over the JSOM jack screw, and finally tightening the nut onto the jack screw to lock the top board down.

The JSOM -02 assembly process involves placing the screw through the bottom board facing up towards the top board, screwing the stand-off base onto it, screwing in the jack screw, mating the top board to the bottom board while aligning the board holes over the JSOM jack screw, and finally tightening the nut onto the jack screw to lock the top board down.

Figure 1 shows the -01 Lead Style that utilizes a Nut (A), Jack Screw (B), and Press-In Stand-Off Base (C). Figure 2 shows the -02 Lead Style that utilizes a Nut (A), Jack Screw (B), Stand-Off Base (C), and Screw (D).
2.2b JSOM Disassembly

Both lead styles of the JSOM will unmate the connector in a similar manner. Because this unmating assistance mitigates damage to the components, boards, and solder joints these steps should always be followed.

To unmate, first, remove the nut, see Figure 3. Then, use the hex key in an alternating pattern, as displayed in Figure 4, to gradually lift the top boards and unmate the connectors.
Figure 3. Remove the nuts from the top board.

Figure 4. Use a hex key in an alternating pattern to lift the top board and unmate the connectors.

Referring to Figure 4, users may start at any location when unmating the connectors. However, the user must ensure to use an alternating pattern, and to not take one side too far before moving the other side.
2.3 Retention and Torque Force in JSOM

To determine the Pull Out Force, Retention, the JSOM was tested using three separate PCB options, the differences being the diameter of the holes for the JSOM assemblies. The board hole diameters used were as follows: 0.175” (4.45 mm), 0.170” (4.32 mm), and 0.177” (4.58 mm). All boards were of 0.062” thickness. Testing was performed on the -01 lead style of the JSOM.

In order to test the Pull Out Force, the connector set was secured near the center of the board. The boards were then attached to the normal force analyser and were pulled apart until the part was removed from the board. Figure 3 shows the results of the retention test. Figure 4 is a graphical representation of the results.

<table>
<thead>
<tr>
<th>Sample #</th>
<th>JSOM</th>
<th>Retention Force</th>
<th>Unit: Lbf</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PCB Hole</td>
<td>Force</td>
<td>PCB Hole</td>
</tr>
<tr>
<td>1</td>
<td>0.17191</td>
<td>139.63</td>
<td>0.17410</td>
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<tr>
<td>2</td>
<td>0.17197</td>
<td>120.1</td>
<td>0.17406</td>
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<td>3</td>
<td>0.17190</td>
<td>141.88</td>
<td>0.17402</td>
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<tr>
<td>4</td>
<td>0.17188</td>
<td>124.75</td>
<td>0.17380</td>
</tr>
<tr>
<td>Min</td>
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<td>120.10</td>
<td>0.17380</td>
</tr>
<tr>
<td>Max</td>
<td>0.17197</td>
<td>141.88</td>
<td>0.17410</td>
</tr>
<tr>
<td>Average</td>
<td>0.17192</td>
<td>131.59</td>
<td>0.17400</td>
</tr>
</tbody>
</table>

Figure 3. Results from the Pull Out Force (Retention) test for the -01 lead style JSOM

Figure 4. Graphical Representation of the Pull Out force for the -01 lead style JSOM
Figures 3 and 4 show results that are consistent with the size of the holes. With smaller holes in the PCB it makes sense to see a higher retention force to remove the JSOM.

To determine the Torque, the JSOM was tested using three separate PCB options with the differences being the diameter of the holes for the JSOM assemblies. The board hole diameters used were as follows; 0.175" (4.45 mm), 0.170" (4.32 mm), and 0.177" (4.58 mm). All boards were of 0.062" thickness. Testing was performed on the -01 lead style of the JSOM.

In order to test the Torque, the connector set was secured near the center of the board. The board was then attached to the torque gauge analyser and was torqued until the part was removed from the board. Figure 5 shows the results of the retention test. Figure 6 is a graphical representation of the results.

<table>
<thead>
<tr>
<th>Sample #</th>
<th>JSOM Torque Testing</th>
<th>Unit: Lbf-inch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PCB Hole</td>
<td>Torque</td>
</tr>
<tr>
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<td>0.17183</td>
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<tr>
<td>2</td>
<td>0.17154</td>
<td>44.60</td>
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<td>3</td>
<td>0.17194</td>
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<tr>
<td>4</td>
<td>0.17199</td>
<td>44.00</td>
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<tr>
<td>Min</td>
<td>0.17154</td>
<td>42.30</td>
</tr>
<tr>
<td>Max</td>
<td>0.17199</td>
<td>44.60</td>
</tr>
<tr>
<td>Average</td>
<td>0.17183</td>
<td>43.79</td>
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</table>

Figure 5. Results from the Torque Testing for the -01 lead style JSOM
2.4 Application Recommendations

The JSOM is designated for use with PCI/104-Express™, PICMG, and VITA systems. JSOM is available with threaded posts or press-fit terminations at stack heights ranging from 5 mm to 15.24 mm, with the latter meeting PC/104-Express™ embedded specifications, see Image 1. The JSOM standoff family includes M2.5, M3, and #4-40 hardware available in 10 mm and 12 mm stack heights for VITA 42. For VITA 57.1 and 57.4 the standoff family includes M2.5, M3, and #4-40 hardware available in 8.5 mm and 10 mm stack heights.

2.4a VITA Applications

The JSOM finds an application within VITA with several options including varying thread offerings, stack heights, and with and without thread locker.

VITA 42 Options

- M2.5 Thread
  - 10 mm Stack Height w/ thread locker – ASP-198471-02
  - 12 mm Stack Height w/ thread locker – ASP-198471-03
  - 10 mm Stack Height w/o thread locker – ASP-198471-05
  - 12 mm Stack Height w/o thread locker – ASP-198471-06

Figures 5 and 6 show results that are consistent with the size of the holes. With smaller holes in the PCB it makes sense to see a higher torque required to remove the JSOM.
2.4b PICMG Applications

The JSOM finds an application within PICMG with several options including varying thread offerings, stack heights, and with and without thread locker.

- **M2.5 Thread**
  - 10 mm Stack Height w/ thread locker – ASP-198471-02
  - 10 mm Stack Height w/o thread locker – ASP-198471-05

- **M3 Thread**
  - 8.5 mm Stack Height w/ thread locker – ASP-199169-01
  - 10 mm Stack Height w/ thread locker – ASP-199169-02
  - 8.5 mm Stack Height w/o thread locker – ASP-199169-04
  - 10 mm Stack Height w/o thread locker – ASP-199169-05

- **#4-40 Thread**
  - 8.5 mm Stack Height w/ thread locker – ASP-199167-01
  - 10 mm Stack Height w/ thread locker – ASP-199167-02
  - 8.5 mm Stack Height w/o thread locker – ASP-199167-04
  - 10 mm Stack Height w/o thread locker – ASP-199167-05

2.4c PC/104-Express™ Applications

The JSOM is utilized for PC/104-Express™ through part number:

- 15.24 mm Stack Height - JSOM-1524-02
3 Conclusions

With Samtec’s JSOM design, unmounting heavily populated mezzanine cards becomes much easier to manage. The JSOM expands on the standard standoff while aiding the user to unmount a mezzanine card without damaging the components while not requiring any additional space. Samtec offers the JSOM in multiple stack heights to meet the requirements for VITA 42, VITA 57.1, VITA 57.4, PICMG, and PC/104-Express™.