Mechanical Design of Micro Jack Screw Precision Board Stacking Standoff

Application Note

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Mechanical Design of Micro Jack Screw Precision Board Stacking Standoff

For VITA and PC/104 Standard Applications

Samtec Inc.
520 Park East Boulevard
New Albany, IN 47151-1147
1-800-SAMTEC-9
info@samtec.com

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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 unmating the connector set.

With the density of boards increasing and the challenge of unmating 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.

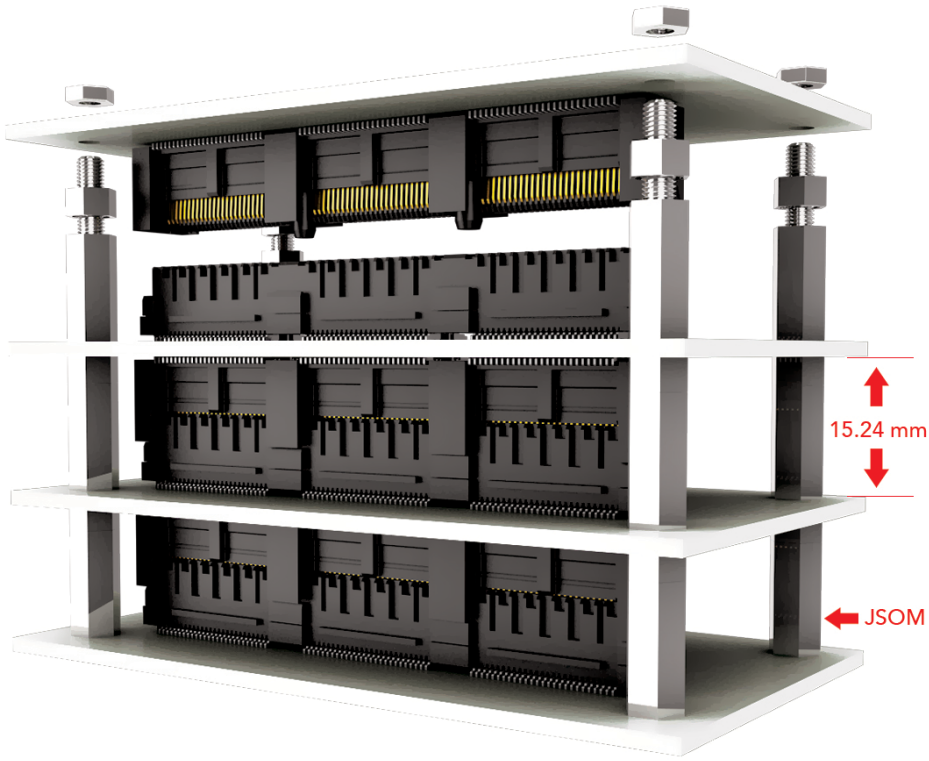

Image 1. 15.24 mm Stack Height JSOM

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.

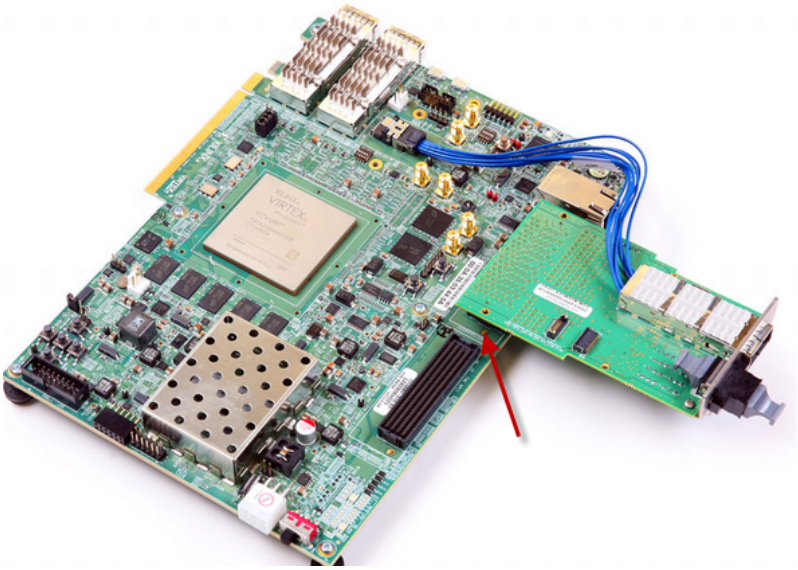

Image 2. VITA 57.4 application of the Xilinx UltraScale+ FPGA VCU118 using JSOM

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).

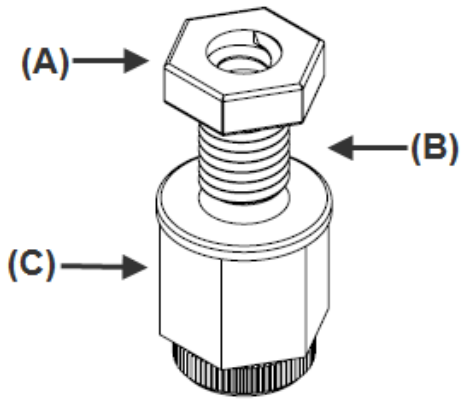

Figure 1 – JSOM Assembly: -01 Lead Style showing Nut (A), Jack Screw (B), and Press-In Stand-Off Base (C).

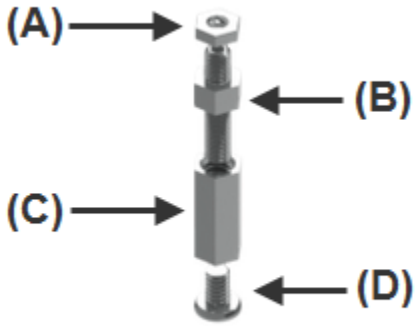

Figure 2 – JSOM Assembly: -02 Lead Style showing Nut (A), Jack Screw (B), Stand-Off Base (C), and Screw (D).

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.

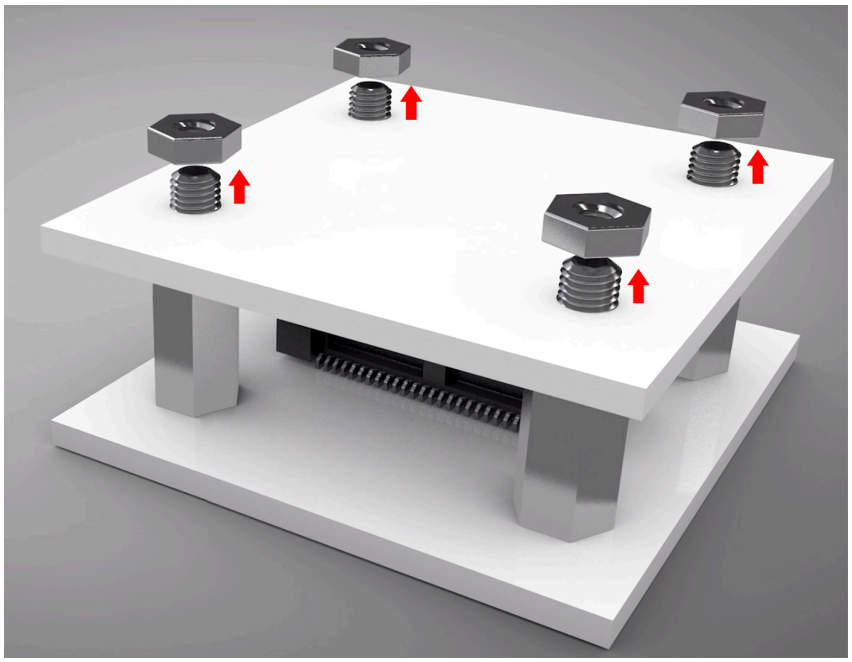

Figure 3. Remove the nuts from the top board.

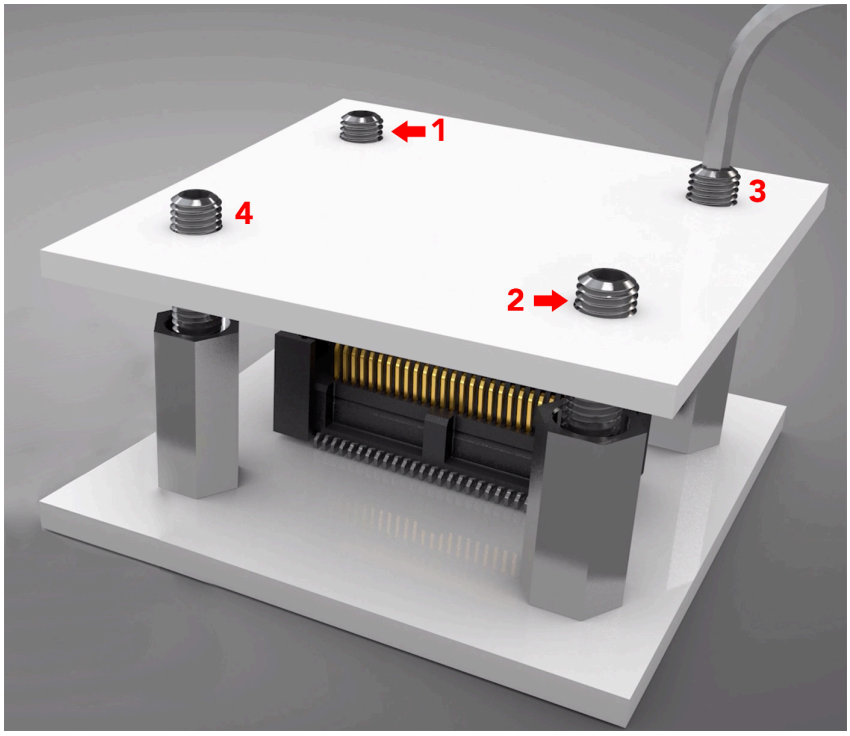

Figure 4. Use a hex key in an alternating pattern to lift the top board and unmate the connectors.

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.

Sample #	JSOM					
	Retention Force				Unit: Lbf	
	PCB Hole	Force	PCB Hole	Force	PCB Hole	Force
1	**0.17191**	**139.63**	0.17410	115.25	0.17767	61.63
2	**0.17197**	**120.1**	0.17406	125.03	0.17766	63.65
3	**0.17190**	**141.88**	0.17402	105.72	0.17768	56.06
4	**0.17188**	**124.75**	0.17380	98.18	0.17772	53.82
Min	0.17188	120.10	0.17380	98.18	0.17766	53.82
Max	0.17197	141.88	0.17410	125.03	0.17772	63.65
Average	0.17192	131.59	0.17400	111.05	0.17768	58.79

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

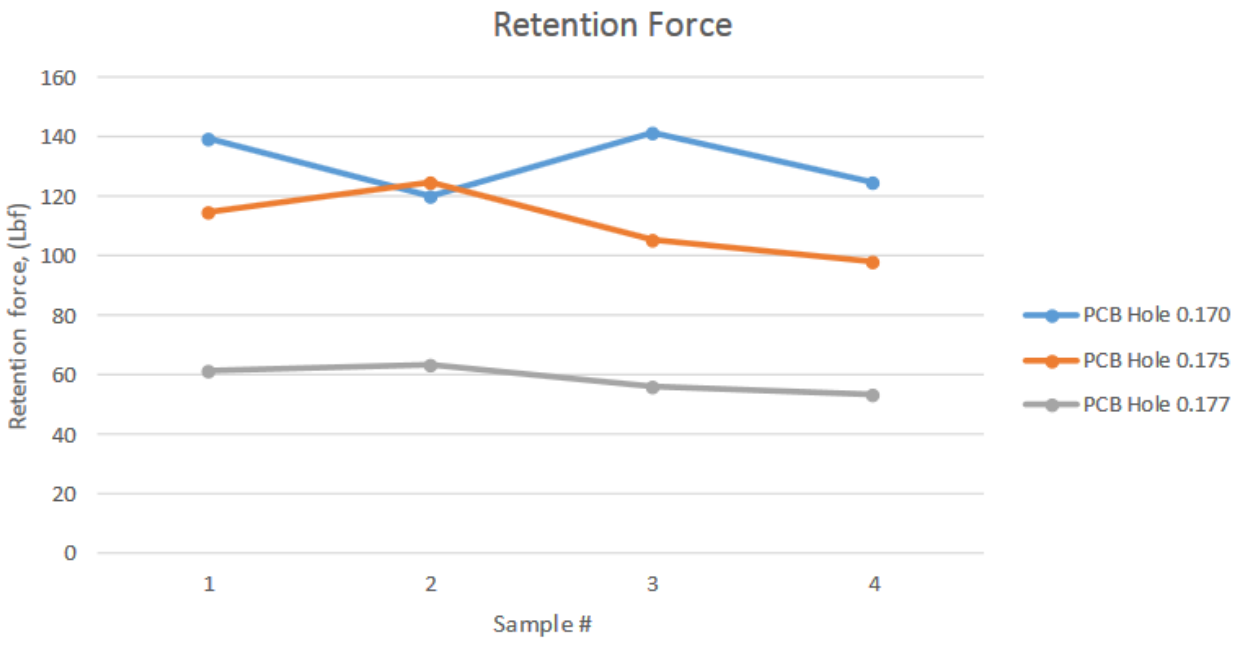

Figure 4. Graphical Representation of the Pull Out force for the -01 lead style JSOM

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.

Sample #	JSOM					
	Torque Testing				Unit: Lbf-inch	
	PCB Hole	Torque	PCB Hole	Torque	PCB Hole	Torque
1	0.17183	44.25	0.17413	38.40	0.17765	25.85
2	0.17154	44.60	0.17412	38.45	0.17764	26.40
3	0.17194	42.30	0.17393	37.90	0.17776	25.10
4	0.17199	44.00	0.17406	38.50	0.17772	26.30
Min	0.17154	42.30	0.17393	37.90	0.17764	25.10
Max	0.17199	44.60	0.17413	38.50	0.17776	26.40
Average	0.17183	43.79	0.17406	38.31	0.17769	25.91

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

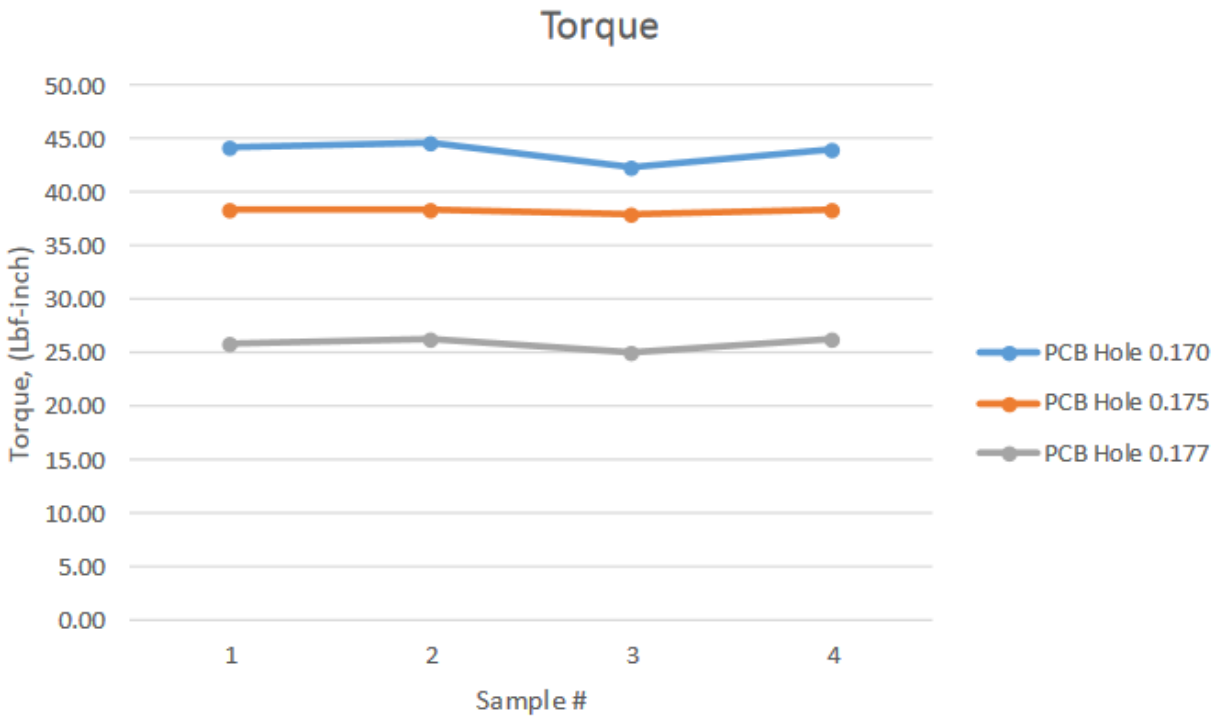

Figure 6. Graphical Representation of the Torque Test Results for the -01 lead style JSOM

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.

2.4 *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

- M3 Thread
  - 10 mm Stack Height w/ thread locker – ASP-199169-02
  - 12 mm Stack Height w/ thread locker – ASP-199169-03
  - 10 mm Stack Height w/o thread locker – ASP-199169-05
  - 12 mm Stack Height w/o thread locker – ASP-199169-06
- #4-40 Thread
  - 10 mm Stack Height w/ thread locker – ASP-199167-02
  - 12 mm Stack Height w/ thread locker – ASP-199167-03
  - 10 mm Stack Height w/o thread locker – ASP-199167-05
  - 12 mm Stack Height w/o thread locker – ASP-199167-06

VITA 57.1 & 57.4 Options

- M2.5 Thread
  - 8.5 mm Stack Height w/ thread locker – ASP-198471-01
  - 10 mm Stack Height w/ thread locker – ASP-198471-02
  - 8.5 mm Stack Height w/o thread locker – ASP-198471-04
  - 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

2.4b 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
  - 10 mm Stack Height w/ thread locker – ASP-199169-02
  - 10 mm Stack Height w/o thread locker – ASP-199169-05
- #4-40 Thread
  - 10 mm Stack Height w/ thread locker – ASP-199167-02
  - 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, unmating heavily populated mezzanine cards becomes much easier to manage. The JSOM expands on the standard standoff while aiding the user to unmate 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™.

SAMTEC USA
P.O. Box 1147 • New Albany, IN 47151-1147 USA
+1-800-SAMTEC-9 (+1-800-726-8329) USA & Canada
Tel: +1-812-944-6733 • Fax: +1-812-948-5047
Email: info@samtec.com

SAMTEC NORTHERN CALIFORNIA
2323 Owen St., Ste 120 • Santa Clara, CA 95054
+1-800-726-8329 (USA & Canada)
Tel: +1-812-944-6733 • Fax: +1-408-217-5171
Email: samtecsiliconvalley@samtec.com

SAMTEC SOUTHERN CALIFORNIA
5410 Trabuco Road • Suite 120 • Irvine, CA 92620
Tel: +1-800-726-8329
Email: samtecsoutherncalifornia@samtec.com

SAMTEC SOUTH AMERICA
Rua Alagoas Nr 1460 • Sala 805 • Bairro Savassi
Belo Horizonte - Minas Gerais 30130-160 • Brazil
Tel: +55 31 9 9146 4447
Email: brazilsales@samtec.com

SAMTEC UNITED KINGDOM
11 Mollins Court • Westfield, Cumbernauld • Scotland G68 9HP
Tel: +44 01236 739292 • Fax: +44 01236 727113
Email: scotland@samtec.com

SAMTEC GERMANY
Streiflacher Str. 7 • 82110 Germering • Germany
+0800 SAMTEC9 (+0800 / 72 68 329) Germany only
Tel: +49 (0) 89 / 89460-0 • Fax: +49 (0) 89 / 89460-299
Email: germany@samtec.com

SAMTEC FRANCE
Val d' Europe Park • 11, rue du Courtalin - Bâtiment B
77700 Magny le Hongre • France
Tel: +33 1 60 95 06 60 • Fax: +33 1 60 95 06 61
Email: france@samtec.com

SAMTEC ITALY
Via Colleoni 25 • Centro Direzionale Colleoni
Palazzo Pegaso Ingresso 3
20864 Agrate Brianza-Monza Brianza (MB) • Italy
Tel: +39 039 6890337 • Fax: +39 039 6890315
Email: italy@samtec.com

SAMTEC NORDIC/BALTIC
Solkraftsvägen 25 • 13570 Stockholm • Sweden
Tel: +46 8 4477280 • Fax: +46 8 7420413
Email: scandinavia@samtec.com

SAMTEC BENELUX
11 Mollins Court • Westfield, Cumbernauld
Scotland G68 9HP
Tel: +44 01236 739292 • Fax: +44 01236 727113
Email: benelux@samtec.com

SAMTEC ISRAEL
21 Bar-Kochva St. • Concord Tower
B'nei Brak, Israel 51260
Tel: +972 3 7526600 • Fax: +972 3 7526690
Email: israel@samtec.com

SAMTEC INDIA
#11, 2nd Floor, Chetana, Dattatreya Road
Basavanagudi • Bangalore • 560 004 India
Tel: +91 80 2660 5303 • +91 73 3866 0600
Email: india@samtec.com

SAMTEC ANZ
2A San Antonio Court • Mentone 3194 • Victoria, Australia
Tel: +613 9580 0683 • Fax: +613 9580 0684
Email: australia@samtec.com

SAMTEC SINGAPORE
1 Kallang Sector #05-01/02 • Kolam Ayer Industrial Park
Singapore 349276
Tel: +65 6745 5955 • Fax: +65 6841 1502
Email: singapore@samtec.com

SAMTEC JAPAN
Nisso No. 16 Bldg. • 3-8-8, Shinyokohama, Kohoku-ku
Yokohama-shi, Kanagawa 222-0033 Japan
Tel: +81 45 475 1385 • Fax: +81 45 475 1340
Email: japan@samtec.com

SAMTEC CHINA
Room 608, Zone A, Hanghui Plaza • No 600 Yunjin Road
Shanghai, China 200232
Tel: +86 21 6057 2288 • Fax: +86 21 5423 4575
Email: china@samtec.com

SAMTEC TAIWAN
Room D, Floor B1, No. 205, Sec. 3 • Beixin Rd.
Xindian District • New Taipei City 23143 • Taiwan
Tel: +886 2 7727 4060 • Fax: +886 2 7727 4179
Email: taiwan@samtec.com

SAMTEC HONG KONG
Room 18, 13/F, Shatin Galleria • 18-24 Shan Mei Street
Fo Tan, Shatin, Hong Kong
Tel: +852 26904858 • Fax: +852 26904842
Email: hongkong@samtec.com

SAMTEC KOREA
#801, 8F, 10, Seongnam-daero 43beon-gil
Bundang-gu, Seongnam-si, Gyeonggi-Do • 13636 South Korea
Tel: +82 31 717 5685 • Fax: +82 70 7500 0246
Email: korea@samtec.com

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