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SFF-8612

Specification for

MiniLink 4/8X Shielded Connector

Rev 1.0 August 8, 2023

Secretariat: SFF TA TWG

Abstract: This specification defines the physical interface and general performance requirements for MiniLink fixed receptacles, which are designed for use in high speed serial, interconnect applications at multi-gigabit speeds. The receptacle has a metal shell which allows it to be used for both internal and external applications. MiniLink cable assemblies provide the other half of the mating interface and are defined in SFF-8611.

This specification is made available for public review at http://www.snia.org/sff/specifications. Comments may be submitted at http://www.snia.org/feedback. Comments received will be considered for inclusion in future revisions of this specification.

The description of a connector in this specification does not assure that the specific component is actually available from connector suppliers. If such a connector is supplied, it must comply with this specification to achieve interoperability between suppliers.

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Intellectual Property

The user's attention is called to the possibility that implementation of this Specification may require the use of an invention covered by patent rights. By distribution of this specification, no position is taken with respect to the validity of a claim or claims or of any patent rights in connection therewith. This specification is considered SNIA Architecture and is covered by the SNIA IP Policy and as a result goes through a request for disclosure when it is published. Additional information can be found at the following locations:

- Results of IP Disclosures: http://www.snia.org/sffdisclosures
- SNIA IP Policy: http://www.snia.org/ippolicy

Change History

Rev 0.1
- First draft

Rev 0.2
- References to plugs removed as those details are in SFF-8611.

Rev 0.3
- Added to the Abstract
- Added additional specs to Section 2
- Revised title of Figure 4-3

Rev 0.9.1 (March 20, 2018)
- Updated to SNIA template
- Reorganized content
- Updated definitions
- Updated drawings and dimension tables to match with other documentation in the industry
- Updated performance & latching requirements
- Reformatted contact sequencing tables
- Added appendix for informative footprint features (shell hold-downs and keep-out zones)

Rev 0.9.2 (August 3, 2018)
- Updated SAS document reference in Section 2. 1 and Sources in Section 2.2
- Updated figures and dimensions to match the latest OCuLink documentation

Foreword

The development work on this specification was done by the SNIA SFF TWG, an industry group. Since its formation as the SFF Committee in August 1990, the membership has included a mix of companies which are leaders across the industry.

When 2 1/2" diameter disk drives were introduced, there was no commonality on external dimensions e.g. physical size, mounting locations, connector type, connector location, between vendors. The SFF Committee provided a forum for system integrators and vendors to define the form factor of disk drives.

During their definition, other activities were suggested because participants in SFF faced more challenges than the form factors. In November 1992, the charter was expanded to address any issues of general interest and concern to the storage industry. The SFF Committee became a forum for resolving industry issues that are either not addressed by the standards process or need an immediate solution.

In July 2016, the SFF Committee transitioned to SNIA (Storage Networking Industry Association), as a TA (Technology Affiliate) TWG (Technical Work Group).

Industry consensus is not a requirement to publish a specification because it is recognized that in an emerging product area, there is room for more than one approach. By making the documentation on competing proposals available, an integrator can examine the alternatives available and select the product that is felt to be most suitable.

SFF meets during the T10 (see www.t10.org) and T11 (see www.t11.org) weeks, and SSWGs (Specific Subject Working Groups) are held at the convenience of the participants.

Many of the specifications developed by SFF have either been incorporated into standards or adopted as standards by ANSI, EIA, JEDEC and SAE.

For those who wish to participate in the activities of the SFF TWG, the signup for membership can be found at:
http://www.snia.org/sff/join

The complete list of SFF Specifications which have been completed or are currently being worked on by the SFF Committee is contained in the document SFF-8000 which can be found at:
http://www.snia.org/sff/specifications

Suggestions for improvement of this specification will be welcome, they should be submitted to:
http://www.snia.org/feedback

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1. Scope

This specification defines the MiniLink shielded, fixed receptacle, contact sequencing, the mating interface, latching criteria, and performance requirements. Example footprints describing how receptacles may be attached to PCBs are also included for reference.

1.1 Application Specific Criteria

This connector is capable of meeting the interface requirements for the high density internal I/O requirements of T10 SAS-4 and OCuLink 1.0.

1.2 Copyright

1.3 Disclaimer

Suggestions for revisions should be directed to http://www.snia.org/feedback/.

2. References

The SFF Committee activities support the requirements of the storage industry, and it is involved with several standards.

2.1 Industry Documents

- EIA 364 Series Electrical Connector/ Socket Test Procedures
- ISO/IEC 14776-155 Serial Attached SCSI – 4 (SAS-4)
- ISO/IEC 14766-154 Serial Attached SCSI – 3 (SAS-3)
- PCIe OCuLink Rev 1.0
- SFF-8410 High Speed Serial Testing for Copper Links
- SFF-8435 Maximizing Card Edge Tolerances Technique
- SFF-8611 Mini Link 4/8X I/O Cable Assemblies
- SFF-9400 Universal 4X/84 Pinout

2.2 Sources

Copies of Electronic Industries Alliance (EIA) standards may be purchased from the Electronic Components Industry Association (ECIA) (https://www.ecianow.org).

Copies of SAS standards may be purchased from the International Committee for Information Technology Standards (INCITS) (http://www.incits.org).

Copies of PCIe standards may be purchased from PCI-SIG (http://pcisig.com).

There are several projects active within the SFF TWG. The complete list of specifications which have been completed or are still being worked on is contained in the document SFF-8000 which can be found at http://www.snia.org/sff/specifications.

2.3 Conventions

The dimensioning conventions are described in ANSI-Y14.5M, Geometric Dimensioning and Tolerancing. All dimensions are in millimeters, which are the controlling dimensional units (if inches are supplied, they are for guidance only).

The ISO convention of numbering is used i.e., the thousands and higher multiples are separated by a space and a period is used as the decimal point. This is equivalent to the English/American convention of a comma and a period.

American	French	ISO
0.6	0,6	0.6
1,000	1 000	1 000
1,323,462.9	1 323 462,9	1 323 462.9

2.4 Definitions

Connector: Two halves of an interface that when joined together, establish electrical contact and mechanical retention between two components. In this specification, the term “connector” does not apply to any specific gender; it can be used to describe the plug, the receptacle, or both. Other common terms include: connector interface, mating interface, and separable interface.

Contact mating sequence: Order of electrical contact established/ terminated during mating/un-mating. Other terms include: contact sequencing, contact positioning, first mate/break last, early mate late break (EMLB), staggered

contacts, and long pin / short pin.

Fixed: The stationary part of a connector interface. In this specification, “fixed” refers to the receptacle side.

Free: The removable part of a connector interface. In this specification, “free” refers to the plug side, module, or cable assembly.

Offset: An alignment shift from the center line of the connector.

Optional: This term describes features which are not required by the SFF Specification. However, if any feature defined by an SFF Specification is implemented, it shall be done in the same way as defined by the Specification. Describing a feature as optional in the text is done to assist the reader.

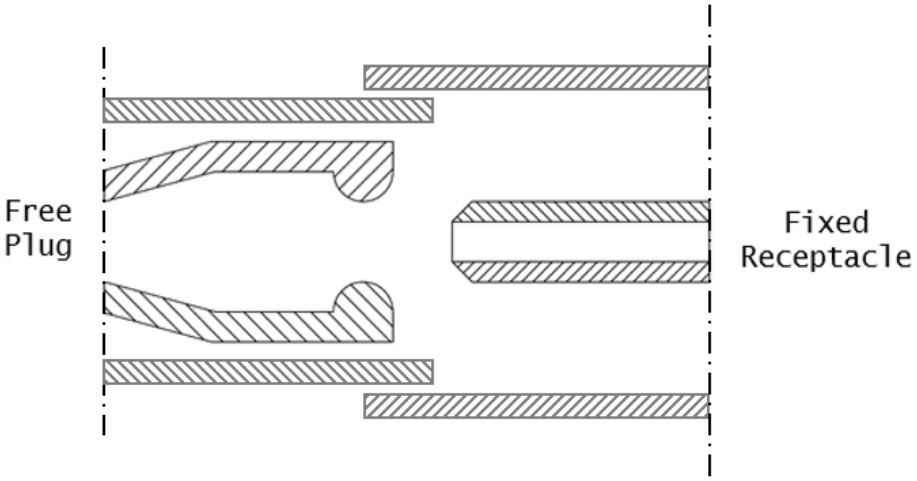


FIGURE 2-1: FIXED RECEPTACLE AND FREE PLUG DEFINITION

PCB: Printed circuit board

Plug: Used to describe the part of the connector that penetrates its mate upon mating, as shown in Figure 2-1. Other common terms include “male,” and “pin connector.”

Receptacle: Used to describe the part of the connector that accepts its mate upon mating, as shown in Figure 2-1. Other common terms include “female,” and “socket connector.”

Right Angle: A receptacle design where the mating direction is parallel to the printed circuit board upon which the receptacle is mounted OR a plug design where the mating direction is perpendicular to the bulk cable.

Straight: A plug design where the mating direction is parallel to the bulk cable.

Surface mount: A termination style in which pins do not penetrate the surface of a PCB. Pins sit on pads on the surface of a PCB and are then soldered to keep the connector or shell in place. Other common terms are “surface mount technology” or “SMT.”

Through hole: A termination style in which rigid pins penetrate the surface of a PCB. Pins typically must be soldered to keep the connector and/or shell in place. Other common terms are “plated through hole” or “PTH.”

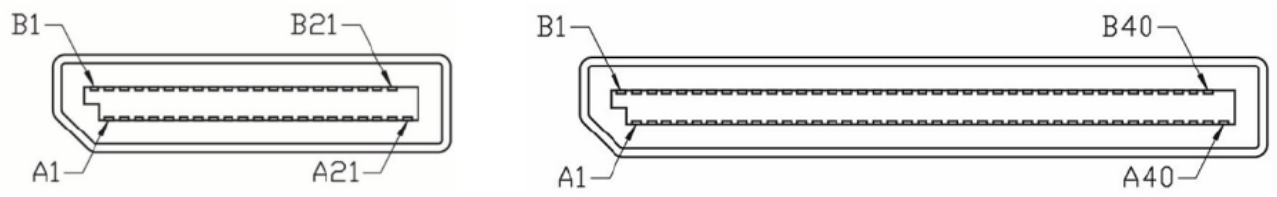
Vertical: A receptacle design where the mating direction is perpendicular to the printed circuit board upon which the receptacle is mounted.

3. General Description

The connector system is based upon fixed receptacles (vertical and right-angle) and free plugs (straight and right-angle). It provides positive retention along with ease of insertion and removal. This specification provides the mechanical description and performance requirements for fixed receptacles. The same mechanical interface applies for both internal and external applications, but separate performance requirements are provided for both use cases. See SFF-8611 for information on free plugs that provide the other half of the interface described here.

4. Contact Length Sequencing

Contact positions are shown in Figure 4-1 for 4X and 8X fixed receptacles. Table 4-1 and Table 4-2 identify the long (1st mate, denoted "L") and short (2nd mate, denoted "S") contacts for 4X and 8X fixed receptacles, respectively.



a) 4X Contact positions b) 8X contact positions

FIGURE 4-1 CONTACT POSITIONS FOR 4X AND 8X FIXED RECEPTACLES

TABLE 4-1 CONTACT LENGTH SEQUENCING FOR 4X FIXED RECEPTACLES

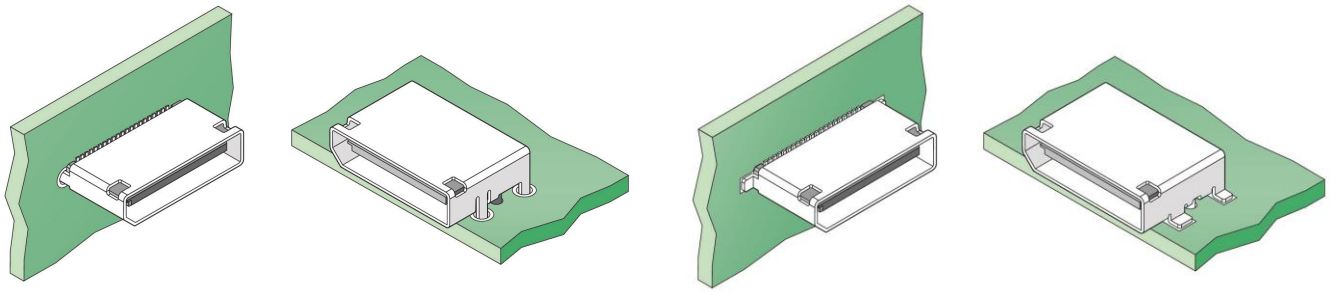
	1	2	3	4	…	17	18	19	20	21
Row A	S	L	S	S	L-S-S sequence repeats in both rows for pins 5-16.	L	S	S	L	S
Row B	S	L	S	S		L	S	S	L	S

TABLE 4-2 CONTACT LENGTH SEQUENCING FOR 8X FIXED RECEPTACLES

	1	2	3	4	5	6	…	34	35	36	37	38	39	40
Row A	L	S	S	L	S	S	L-S-S sequence repeats in both rows for pins 7-33.	L	S	S	L	S	S	L
Row B	L	S	S	L	S	S		L	S	S	L	S	S	L

5. Fixed Receptacles

This specification provides the mechanical definitions for fixed receptacles. Receptacles are available in both vertical and right-angle configurations for 4X of 8X circuit sizes. Signal contacts are terminated to PCBs via SMT, but receptacle shells may be attached via PTH, SMT, or a combination of both.



a) PTH shell b) SMT shell

FIGURE 5-1 EXAMPLE SHELL HOLD-DOWNS

The receptacle shell provides the latching points for the plug, and functions as the guide and strain relief for the free plug. This specification contains normative footprint requirements for vertical and right-angle receptacles including SMT pad locations and dimensions for signal contacts, and locating features for the receptacle relative to the PCB. Example footprints provided in Appendix A provide information on hold-down features for the receptacle shell and component keep-out zones.

For all drawings contained in this specification:

1. Dimensions apply to all 4X and 8X fixed receptacles unless otherwise noted.
2. Latch window dimensions apply to both windows, left and right, on all 4X and 8X fixed receptacles.
3. Refer to Section 4 for contact length sequencing for 4X and 8X receptacles.

5.1 Vertical Fixed Receptacle

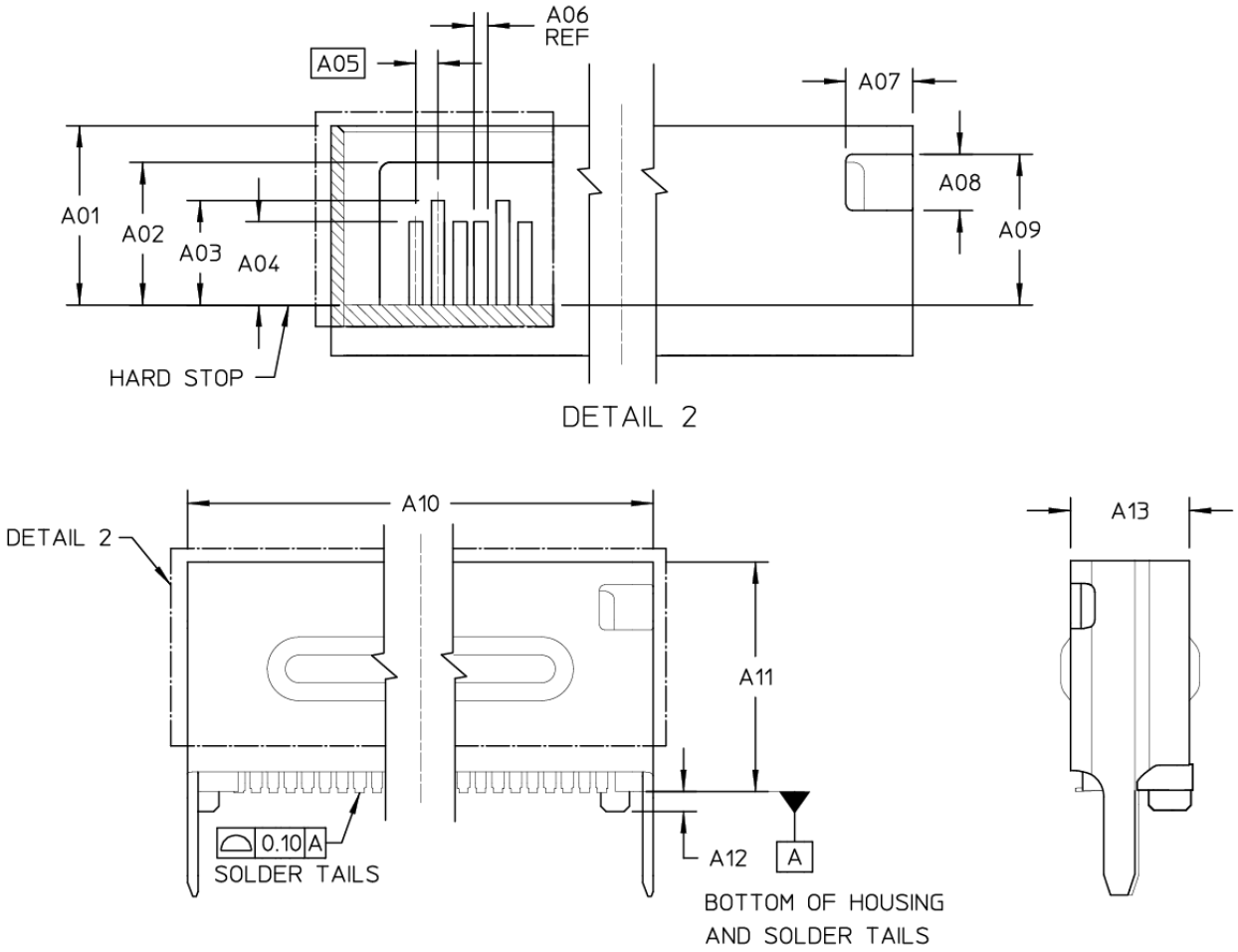


FIGURE 5-2 VERTICAL FIXED RECEPTACLE FORM FACTOR

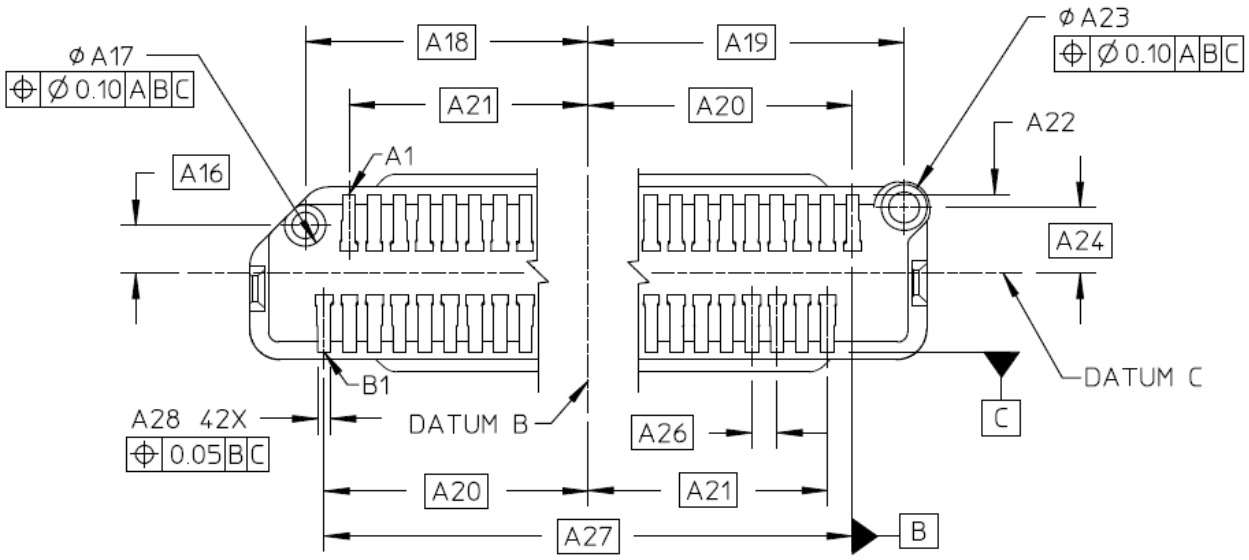


FIGURE 5-3 BOTTOM OF VERTICAL FIXED RECEPTACLE FORM FACTOR

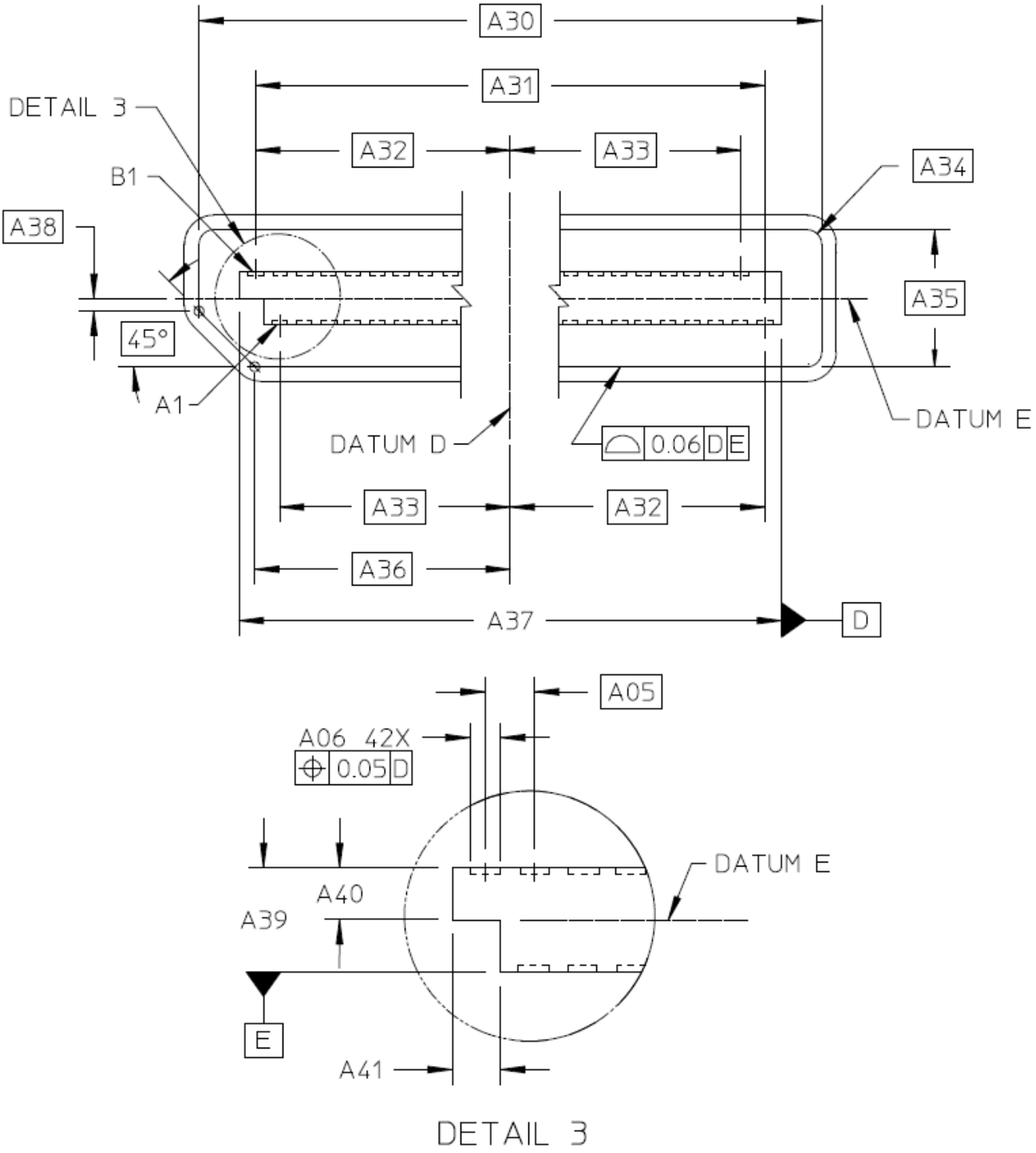
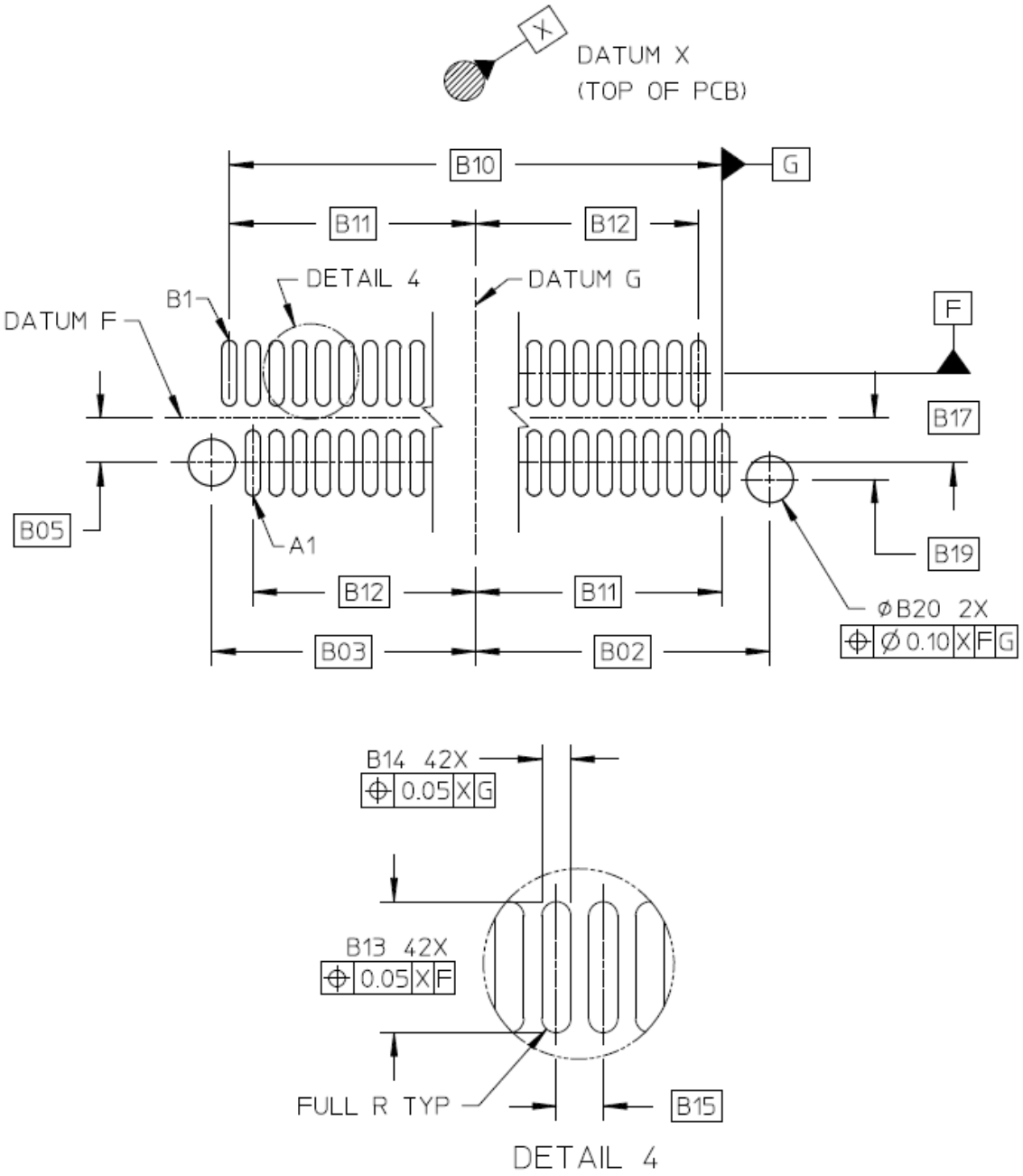


FIGURE 5-4 MATING INTERFACE FOR ALL FIXED RECEPTACLES

TABLE 5-1 VERTICAL FIXED RECEPTACLE FORM FACTOR AND FIXED RECEPTACLE MATING INTERFACE DIMENSIONS

ID	Description	Dimension		Tolerance ±
			8X	
A01	Hard stop to front of shell	4.15		0.08
A02	Hard stop to interface paddle nose	3.30		0.03
A03	Hard stop to 1st mate contacts	2.42		0.12
A04	Hard stop to 2nd mate contacts	2.00		0.12
A05	Fixed connector contact beam pitch - Typical	0.50		Basic
A06	Fixed connector contact width - Typical	0.30		0.03
A07	Latch window width (2X)	1.55		0.08
A08	Latch window length (2X)	1.30		0.08
A09	Hard stop (housing) to latch point (shell) (2x)	3.60		0.11
A10	Connector overall length		22.95	Ref
A11	Connector overall height from bottom of housing surface (Datum A) to top surface of shell	6.66		0.08
A12	Locating peg length (2X)	0.56		0.10
A13	Connector overall width	3.43		Ref
A16	Horizontal CL of solder tail array (Datum C) to CL of left locating peg	0.95		Basic
A17	Left locating peg diameter	0.85		MAX
A18	Vertical CL of solder tail array (Datum B) to CL of left locating peg		10.37	Basic
A19	Vertical CL of solder tail array (Datum B) to CL of right locating peg		11.03	Basic
A20	Vertical CL of solder tail array (Datum B) to CL of outside solder tails (long offset from Datum B) (2X)		10.00	Basic
A21	Vertical CL of solder tail array (Datum B) to CL of inside solder tails (short offset from Datum B) (2X)		9.50	Basic
A22	Edge of Row A solder tail contacts to edge of Row B solder tail contacts (Datum C)	3.14		0.16
A23	Right locating peg diameter	0.85		MAX
A24	Horizontal CL of solder tail array (Datum C) to CL of right locating peg	1.31		Basic
A26	Solder tail contact pitch - Typical	0.50		Basic
A27	Outer solder tails CL to CL (lower left B1 to upper right A21) (Datum B)		20.00	Basic
A28	Solder tail width- Typical	0.26		0.03
A30	Interface (inside shell) cavity width		22.35	Basic
A31	Outer contacts CL to CL (upper left B1 to lower right A21)		20.00	Basic
A32	Vertical CL of interface paddle length (Datum D) to CL outer terminals (2x) (long offset from Datum D)		10.00	Basic
A33	Vertical CL of interface paddle length (Datum D) to CL—inner terminals (2x) (short offset from Datum D)		9.50	Basic
A34	Inner radius of Fixed connector shell (5X)	0.30		Basic
A35	Interface (inside shell) cavity height	2.83		Basic
A36	Vertical CL of interface paddle length (Datum D) to inner sharp corner of shell (TSC)		10.03	Basic

ID	Description	Dimension		Tolerance ±
			8X	
A37	Interface paddle length		20.70	0.03
A38	Horizontal CL of interface paddle (Datum E) to inside shell radius	0.25		Basic
A39	Interface paddle thickness (Datum E) - measured over top of contact beams; plastic/paddle must be below top of contact beams	1.08		0.06
A40	Polarizing notch height	0.54		0.03
A41	Polarizing notch width	0.50		MIN
NOTE: These dimensions apply to Figure 5-2, Figure 5-3 and Figure 5-4 . The following dimensions are not included: A14, A15, A25 and A29.				



NOTE: Refer to Appendix A for examples of shell hold-downs and keep-out zones.

FIGURE 5-5 VERTICAL FIXED RECEPTACLE NORMATIVE FOOTPRINT FEATURES

TABLE 5-2 VERTICAL FIXED RECEPTACLE NORMATIVE FOOTPRINT DIMENSIONS

ID	Description	Dimension		Tolerance ±
		4X	8X	
B02	Vertical CL of solder pad array (Datum G) to CL of right locating hole	6.28	11.03	Basic
B03	Vertical CL of solder pad array (Datum G) to CL of left locating hole	5.62	10.37	Basic
B05	Horizontal CL of solder pad array (Datum F) to CL of left locating hole	0.95		Basic
B10	CL to CL of outer solder pads (Datum G)	10.50	20.00	Basic
B11	Vertical CL of solder pad array (Datum G) to CL outside solder pads	5.25	10.00	Basic
B12	Vertical CL of solder pad array (Datum G) to CL inside solder pads	4.75	9.50	Basic
B13	Solder pad length (42X)	1.40		0.05
B14	Solder pad width (42X)	0.31		0.05
B15	Solder pad pitch	0.50		Basic
B17	Horizontal CL (Row A) to CL (Row B) solder pads	1.91		Basic
B19	Horizontal CL of solder pad array (Datum F) to CL right locating hole	1.31		Basic
B20	Locating hole diameter (2X)	1.00		0.05
NOTE: The following dimensions are not included: B01, B04, B06, B07, B08, B09, B16 and B18.				

5.2 Right-Angle Fixed Receptacle

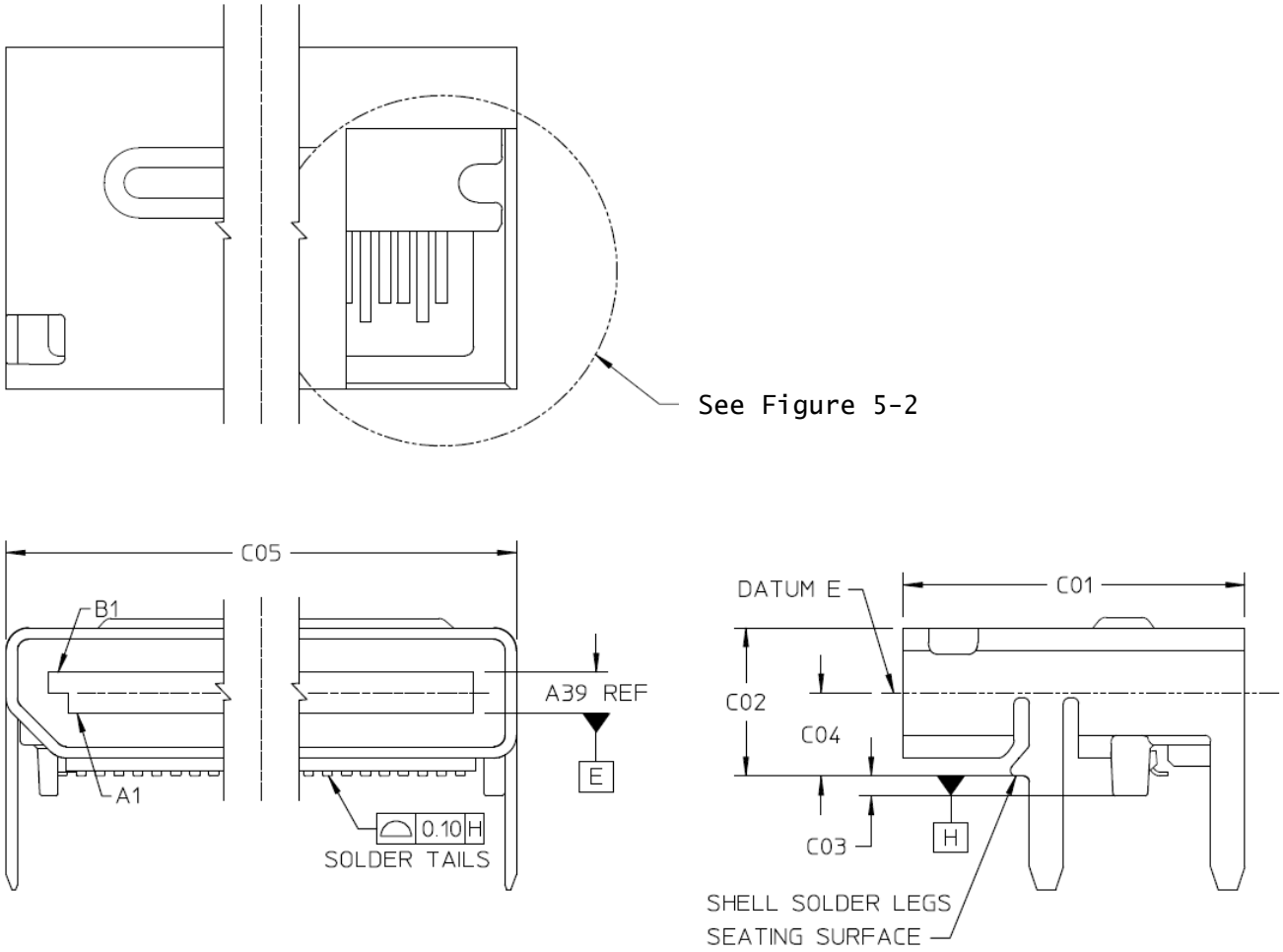


FIGURE 5-6 RIGHT-ANGLE FIXED RECEPTACLE FORM FACTOR

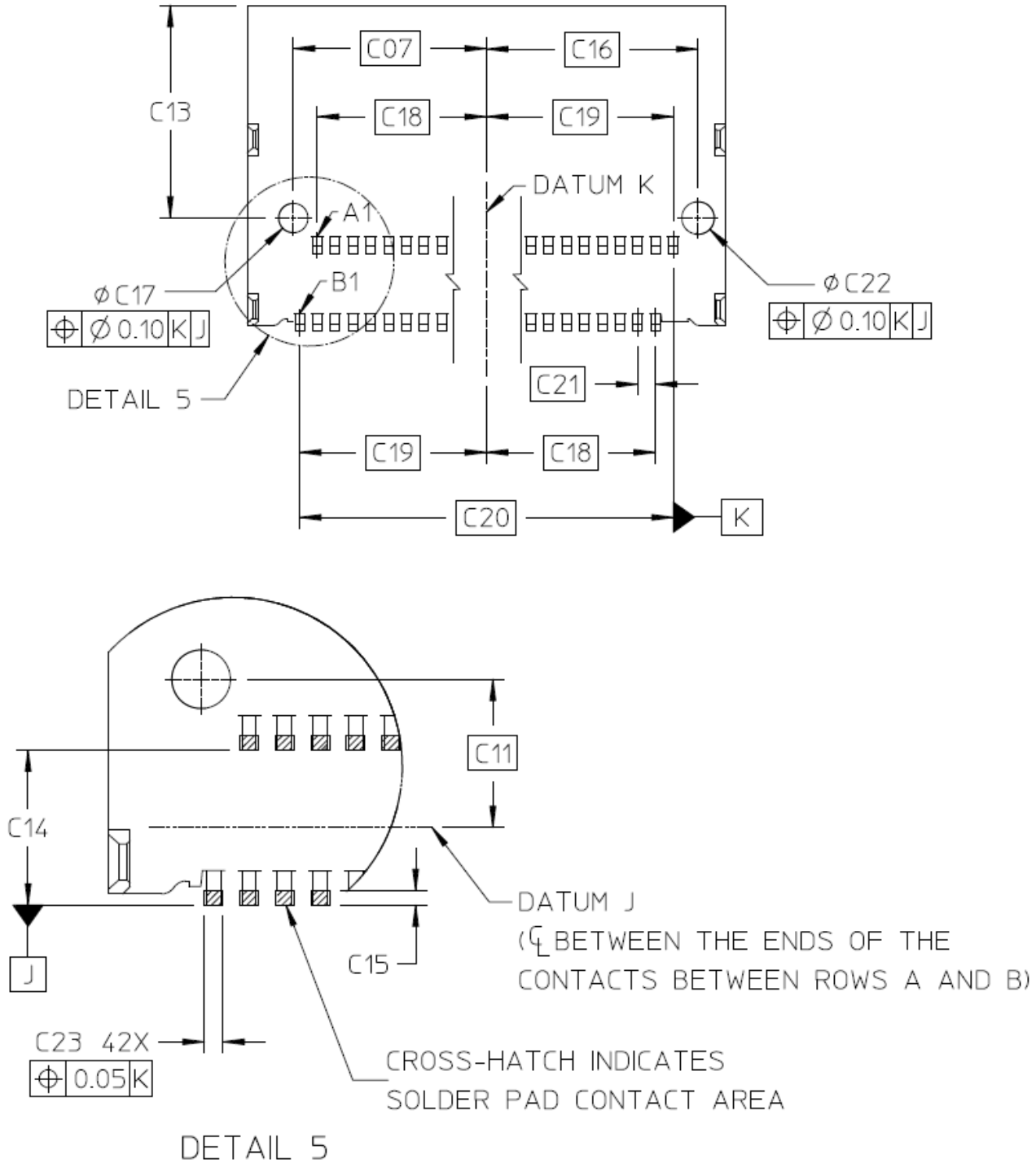
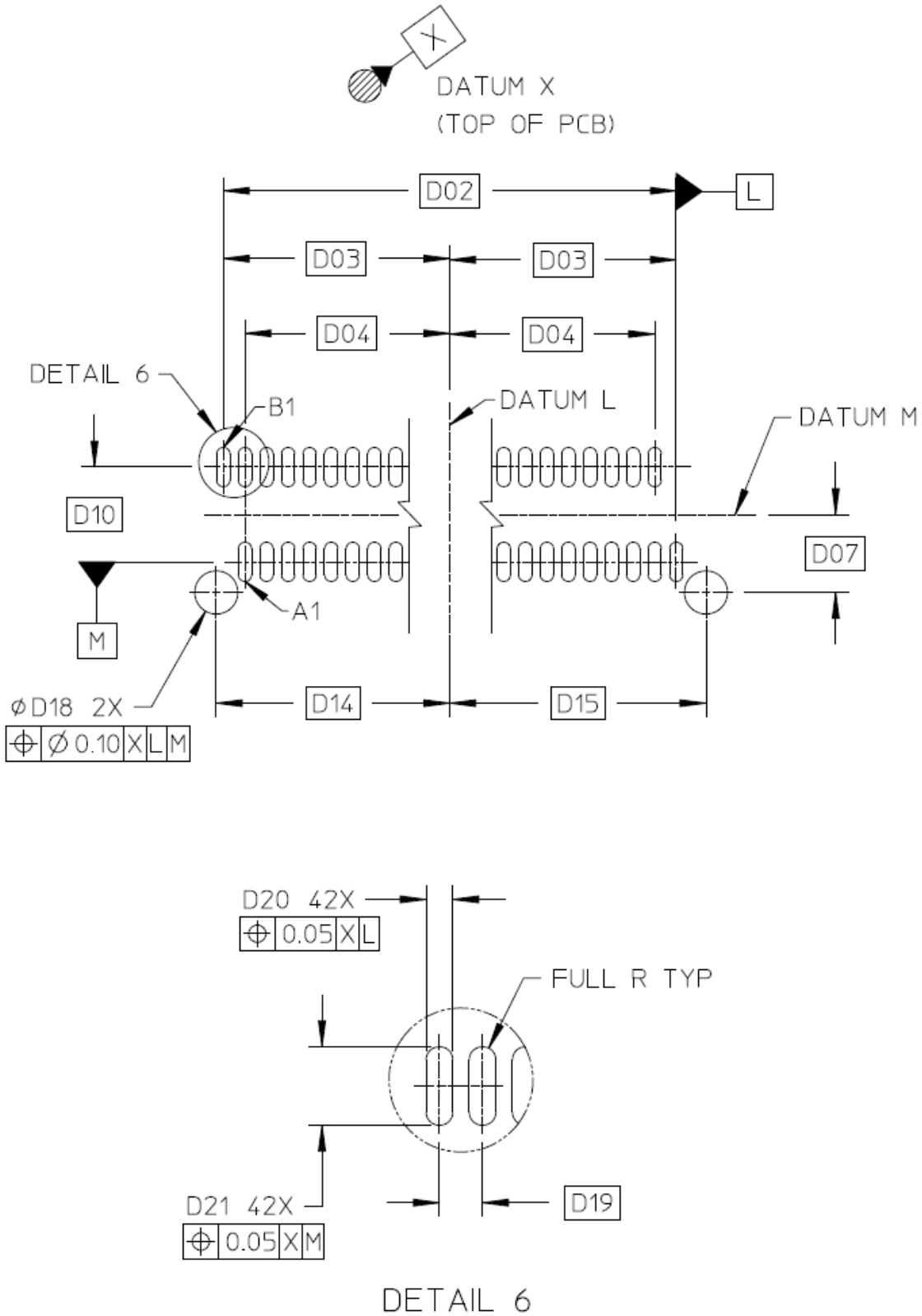


FIGURE 5-7 BOTTOM VIEW OF RIGHT-ANGLE FIXED RECEPTACLE FORM FACTOR

TABLE 5-3 RIGHT-ANGLE RECEPTACLE DIMENSIONS

ID	Description	Dimension		Tolerance ±
			8X	
C01	Connector depth	9.00		0.05
C02	Connector height from bottom of shell seating surface (Datum H)	3.90		Ref
C03	Locating peg length (2X)	0.52		0.10
C04	CL of interface paddle thickness (Datum E) to bottom of shell seating surface (Datum H)	2.20		MIN
C05	Connector length		22.95	0.10
C07	Vertical CL of solder tail array (Datum K) to CL of left locating peg		10.17	Basic
C11	Horizontal CL of locating pegs to CL solder tail array (Datum J)	2.14		Basic
C13	Horizontal CL of locating pegs to front of shell	5.97		0.11
C14	End of solder tail Row “A” contacts to end of solder tail Row “B” contacts (Datum J)	2.18		0.16
C15	Length of solder pad contact area (42X)	0.28		0.03
C16	Vertical CL of solder tail array (Datum K) to CL of right locating peg		10.70	Basic
C17	Left locating peg diameter	0.85		MAX
C18	Vertical CL of solder tail array (Datum K) to CL of inside solder tails		9.50	Basic
C19	Vertical CL of solder tail array (Datum K) to CL of outside solder tails		10.00	Basic
C20	CL to CL of outside solder tails (Datum K)		20.00	Basic
C21	Solder tail pitch	0.50		Basic
C22	Right locating peg diameter	0.85		MAX
C23	Width of solder pad contact area (42X)	0.26		0.03
NOTE: These dimensions apply to Figure 5-6 and Figure 5-7. The following dimensions are not included: C06, C08, C09, C10 and C12.				



DETAIL 6

NOTE: Refer to Appendix A for examples of shell hold-downs and keep-out zones.

FIGURE 5-8 RIGHT-ANGLE FIXED RECEPTACLE NORMATIVE FOOTPRINT FEATURES

TABLE 5-4 RIGHT-ANGLE FIXED RECEPTACLE NORMATIVE FOOTPRINT DIMENSIONS

ID	Description	Dimension		Tolerance ±
			8X	
D02	Vertical CL to CL of outer solder pads (Datum L)		20.00	Basic
D03	Vertical CL of solder pad array (Datum L) to CL outside solder pads		10.00	Basic
D04	Vertical CL of solder pad array (Datum L) to CL inside solder pads		9.50	Basic
D07	Horizontal CL of locating holes to CL of solder pad array (Datum M)	1.81		Basic
D10	Horizontal CL of Row B solder pads to CL of Row A solder pads (Datum M)	2.19		Basic
D14	Vertical CL of solder pad array (Datum L) to CL left locating hole		10.16	Basic
D15	Vertical CL of solder pad array (Datum L) to CL right locating hole		10.69	Basic
D18	Locating hole diameter (2X)	1.00		0.05
D19	Solder pad pitch	0.50		Basic
D20	Solder pad width (42x)	0.31		0.03
D21	Solder pad length (42x)	0.91		0.03
NOTE: The following dimensions are not included: D01, D05, D06, D08, D09, D11, D12, D13, D16 and D17.				

6. Latch Windows

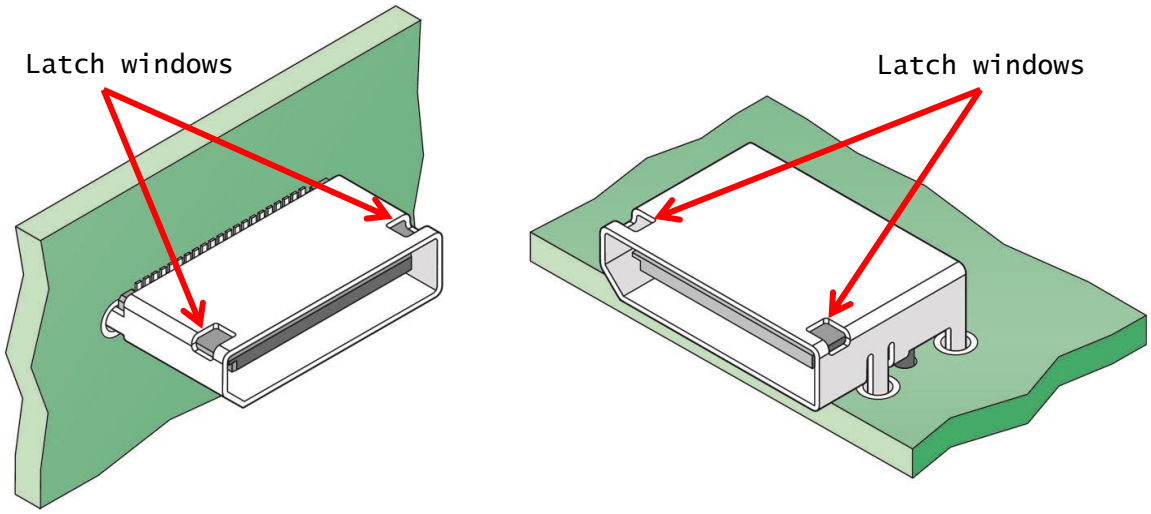


FIGURE 6-1 LATCH WINDOWS IN FIXED RECEPTACLES

The windows on the top of the fixed right-angle receptacle and in the side wall of the fixed vertical receptacle serve as the latching points for free plugs. These windows enable reliable mating between the two halves of the connector interface with acceptable minimum wipe under worst case tolerance conditions. Latch windows accept both the passive and active latches, which are defined in SFF-8611.

7. Performance Requirements

All connectors defined in this specification must meet the performance requirements listed in SFF-8611 when mated. All performance requirements are verified by testing in accordance with EIA-364-1000 unless otherwise noted. Refer to SFF-8611 for all performance requirements and test details.

Appendix A. Examples of Informative Footprint Features for Fixed Receptacles

Receptacle footprints contain both normative and informative features. This section provides examples of the informative footprint attributes such as shell hold-down features and their associated keep-out zones, for vertical and right-angle receptacles.

The information contained in this section is informative and is provided for reference only.

For the mechanical definition of normative features (i.e. dimensions and locations of SMT signal pads, receptacle locating features, etc.), refer to Figure 5-5 and Figure 5-8.

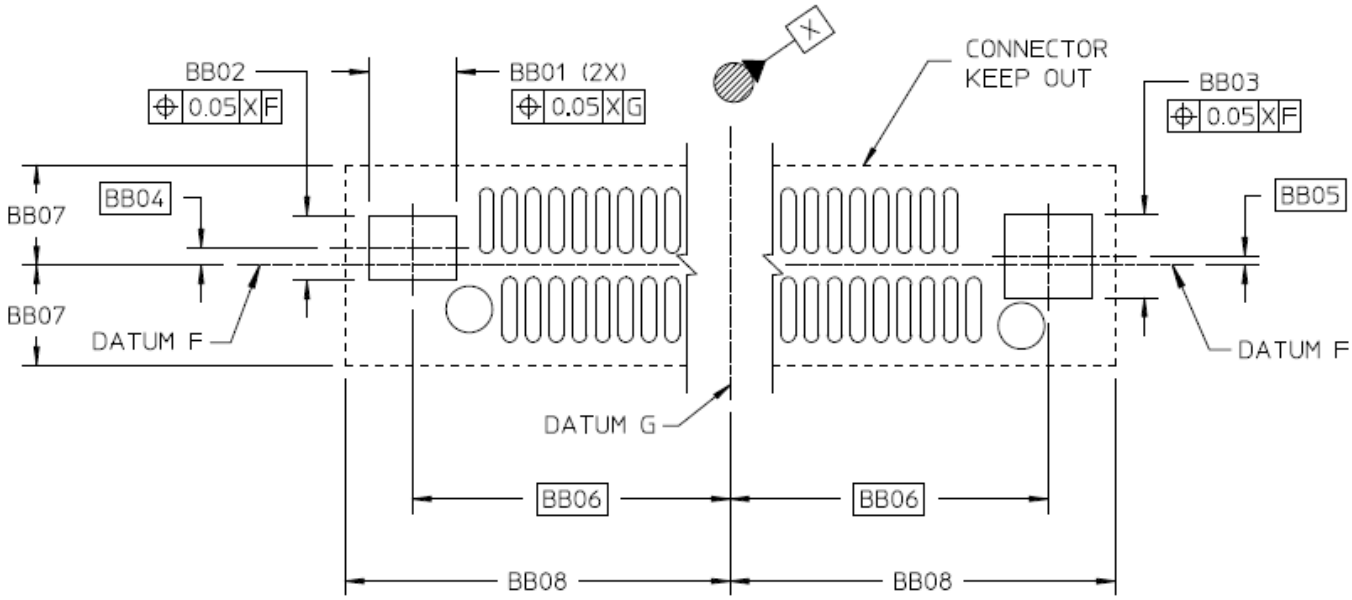


FIGURE A-1 EXAMPLE SMT FOOTPRINT FOR VERTICAL FIXED RECEPTACLES

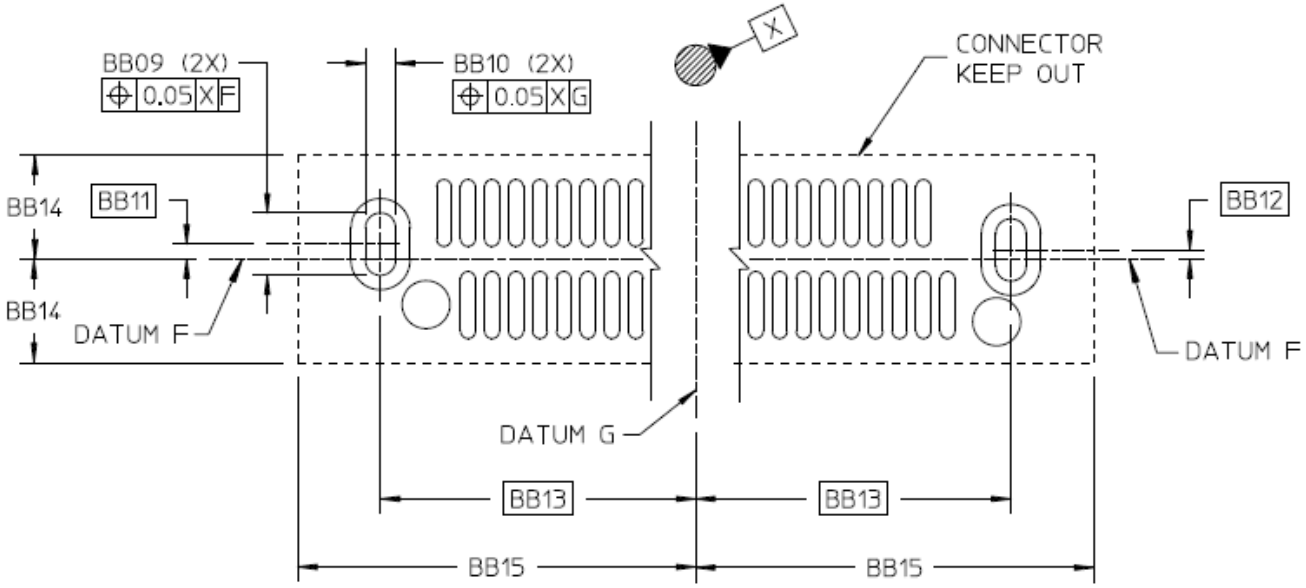


FIGURE A-2 EXAMPLE THROUGH-HOLE FOOTPRINT FOR VERTICAL FIXED RECEPTACLES

TABLE A-1 EXAMPLE VERTICAL FIXED RECEPTACLE HOLD-DOWN DIMENSIONS

ID	Description	Dimension		Tolerance ±
		4X	8X	
SMT Shell Hold-Downs				
BB01	Width of shell solder pad (2X)	1.90		0.10
BB02	Height of left shell solder pad	1.40		0.10
BB03	Height of right shell solder pad	1.80		0.15
BB04	Horizontal CL of solder pad array (Datum F) to CL of left shell solder pad	0.37		Basic
BB05	Horizontal CL of solder pad array (Datum F) to CL of right shell solder pad	0.20		Basic
BB06	Vertical CL of solder pad array (Datum G) to CL of shell solder pad (2X)	6.85	11.60	Basic
BB07	Horizontal CL of solder pad array (Datum F) to edge of keep-out zone height	2.16		0.07
BB08	Vertical CL of solder pad array (Datum G) to edge of keep-out zone width	8.30	13.05	0.07
Through-Hole Shell Hold-Downs				
BB09	Length of shell through-hole (2X)	1.30		0.10
BB10	Width of shell through-hole (2X)	0.64		0.10
BB11	Horizontal CL of solder pad array (Datum F) to center of left shell through-hole	0.31		Basic
BB12	Horizontal CL of solder pad array (Datum F) to center of right shell through-hole	0.19		Basic
BB13	Vertical CL of solder pad array (Datum G) to center of shell through-hole	6.58	11.33	Basic
BB14	Horizontal CL of solder pad array (Datum F) to edge of keep-out zone height	2.16		0.07
BB15	Vertical CL of solder pad array (Datum G) to edge of keep-out zone width	8.30	13.05	0.07

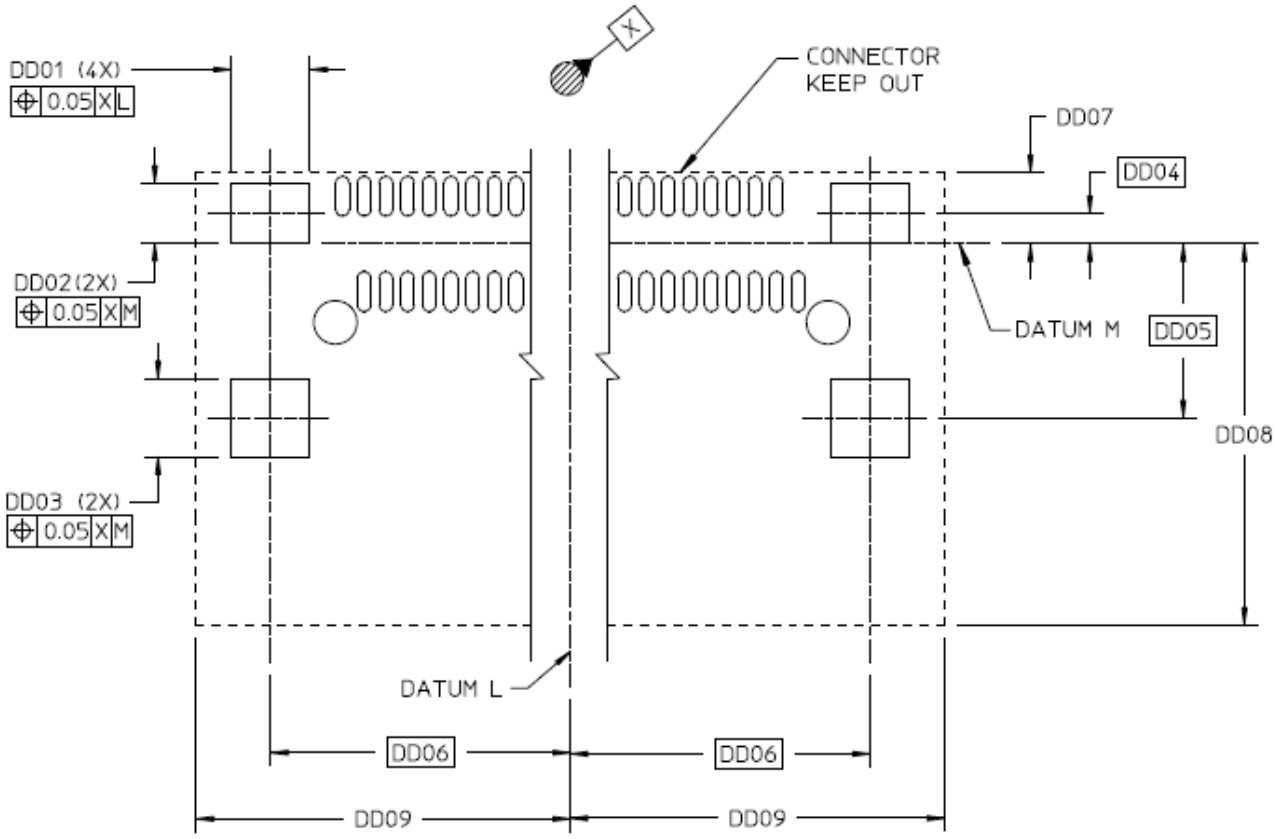


FIGURE A-3 EXAMPLE SMT FOOTPRINT FOR RIGHT-ANGLE FIXED RECEPTACLES

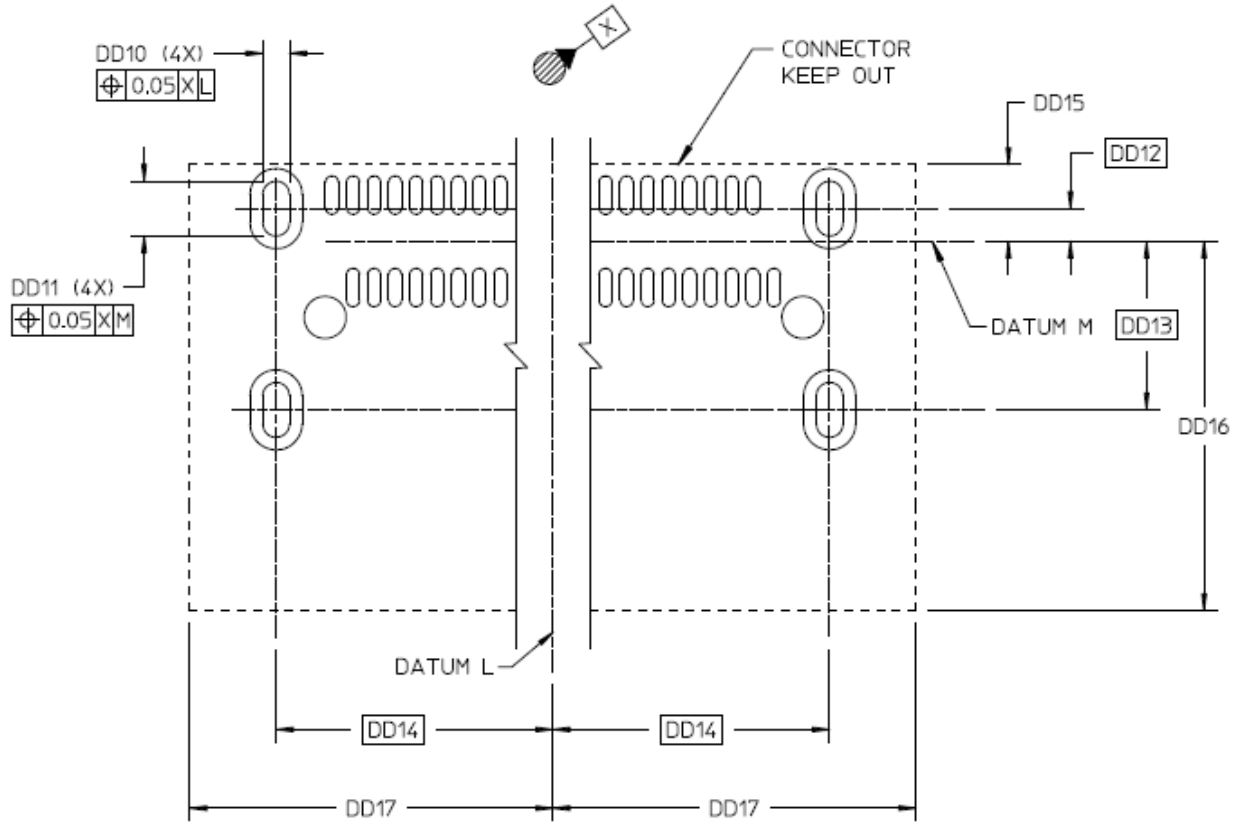


FIGURE A-4 EXAMPLE THROUGH-HOLE FOOTPRINT FOR RIGHT-ANGLE FIXED RECEPTACLES

TABLE A-2 EXAMPLE RIGHT-ANGLE RECEPTACLE HOLD-DOWN DIMENSIONS

ID	Description	Dimension		Tolerance ±
		4X	8X	
SMT Shell Hold-Downs				
DD01	Width of shell solder pad (4X)	1.81		0.10
DD02	Height of small shell solder pad (2X)	1.38		0.10
DD03	Height of large shell solder pad (2X)	1.80		0.10
DD04	Horizontal CL of solder pad array (Datum M) to CL of small shell solder pad	0.71		Basic
DD05	Horizontal CL of solder pad array (Datum M) to CL of large shell solder pad	4.01		Basic
DD06	Vertical CL of solder pad array (Datum L) to CL of shell solder pad	6.91	11.66	0.05
DD07	Horizontal CL of solder pad array (Datum M) to back of keep-out zone height	1.64		0.10
DD08	Horizontal CL of solder pad array (Datum M) to front of keep-out zone height	8.78		0.10
DD09	Vertical CL of solder pad array (Datum L) to edge of keep-out zone width	8.63	13.38	0.07
Through-Hole Shell Hold-Downs				
DD10	Width of shell through-hole (4X)	0.64		0.10
DD11	Length of shell through-hole (4X)	1.30		0.10
DD12	Horizontal CL of solder pad array (Datum M) to center of back shell through-holes	0.71		Basic
DD13	Horizontal CL of solder pad array (Datum M) to center of front shell through-holes	4.01		Basic
DD14	Vertical CL of solder pad array (Datum L) to CL of shell through-hole	6.91	11.66	0.05
DD15	Horizontal CL of solder pad array (Datum M) to back of keep-out zone height	1.64		0.10
DD16	Horizontal CL of solder pad array (Datum M) to front of keep-out zone height	8.78		0.10
DD17	Vertical CL of solder pad array (Datum L) to edge of keep-out zone width	8.63	13.38	0.07