

SFF Committee

**SFF-8088**

Specification for

**Mini Multilane 4X Shielded Connector Shell and Plug**

**Standardized as EIA-976 at Rev 3.2 on April 16, 2011**

This specification was submitted as a project to become a standard, and was Expired at that time.

If there were modifications subsequent to the date of submittal, or any were made during the EIA approvals process, they may not be reflected in this copy.

EIA standards can be purchased from <http://global.ihs.com/>

**CONTINUING ACTIVITY**

Companion and subsequent specifications have been developed.

|          |   |
|----------|---|
| SFF-8086 | Mini Multilane 10 Gb/s 4X Common Elements Connector   |
| SFF-8087 | Mini Multilane 4X Unshielded Connector Shell and Plug |
| SFF-8642 | Mini Multilane 10 Gb/s 12X Shielded Cage/Connector    |
| SFF-8643 | Mini Multilane 12 Gb/s 8/4X Unshielded Connector      |
| SFF-8644 | Mini Multilane 12 Gb/s 8/4X Shielded Cage/Connector   |
| SFF-8645 | Mini Multilane 24 Gb/s 8/4X Shielded Cage/Connector   |
| SFF-8647 | Mini Multilane 14 Gb/s 12X Shielded Cage/Connector    |
| SFF-8648 | Mini Multilane 28 Gb/s 12X Shielded Cage/Connector    |

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SFF Committee

**SFF-8088 Specification for**

**Mini Multilane 4X Shielded Connector Shell and Plug**

Rev 3.3

March 14, 2013

Secretariat: SFF Committee

**Abstract:** This specification defines the physical interface and general performance requirements for the Mini Multilane Shielded connector. One such use is as the Serial Attached SCSI Mini SAS 4X (wide compact external connector).

This specification provides a common reference for systems manufacturers, system integrators, and suppliers. This is an internal working specification of the SFF Committee, an industry ad hoc group.

This specification is made available for public review, and written comments are solicited from readers. Comments received by the members will be considered for inclusion in future revisions of this document.

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.

**Support:** This specification is supported by the identified member companies of the SFF Committee.

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**EXPRESSION OF SUPPORT BY MANUFACTURERS**

The following member companies of the SFF Committee voted in favor of this industry specification.

|                 |                       |
|-----------------|-----------------------|
| 3M              | Hitachi Cable         |
| Adaptec         | Hitachi GST           |
| AMCC            | IBM                   |
| Amphenol        | LSI                   |
| Comax           | Molex                 |
| Dell            | Seagate               |
| EMC             | Sun Microsystems      |
| ENDL            | Toshiba America       |
| FCI             | Tyco                  |
| Foxconn         | Unisys                |
| Hewlett Packard | Vitesse Semiconductor |

The following member companies of the SFF Committee voted to abstain on this industry specification.

|                 |                  |
|-----------------|------------------|
| Arista Networks | Maxtor           |
| Cinch           | Panasonic        |
| Emulex          | Picolight        |
| ETRI            | Pioneer NewMedia |
| Finisar         | Sandisk/RAD      |
| Fujitsu CPA     | Sumitomo         |
| Infineon        | Volex            |
| Intel           |                  |

The user's attention is called to the possibility that implementation to this Specification may require use of an invention covered by patent rights. By distribution of this Specification, no position is taken with respect to the validity of this claim or of any patent rights in connection therewith. Members of the SFF Committee that advise that a patent exists are required to provide a statement of willingness to grant a license under these rights on reasonable and non-discriminatory terms and conditions to applicants desiring to obtain such a license.

**Updated History:**

Rev 3.2 (April 16, 2011)

- Editorial revision to incorporate 2011 titling and review content for consistency prior to being submitted for EIA standardization.

Rev 3.3 (March 14, 2013)

- EIA ballot drew the comment that SFF-8087 and SFF-8088 are shells, and have no speed or electrical characteristics. The title and affected text were changed to reflect this correction.

## Foreword

The development work on this specification was done by the SFF Committee, an industry group. The membership of the committee since its formation in August 1990 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 first use of these disk drives was in specific applications such as laptop portable computers and system integrators worked individually with vendors to develop the packaging. The result was wide diversity, and incompatibility.

The problems faced by integrators, device suppliers, and component suppliers led to the formation of the SFF Committee as an industry ad hoc group to address the marketing and engineering considerations of the emerging new technology.

During the development of the form factor definitions, other activities were suggested because participants in the SFF Committee faced more problems than the physical form factors of disk drives. 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.

Those companies, which have agreed to support a specification, are identified in the first pages of each SFF Specification. Industry consensus is not an essential requirement to publish an SFF 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 Committee meetings are held during T10 weeks (see [www.t10.org](http://www.t10.org)), and Specific Subject Working Groups are held at the convenience of the participants. Material presented at SFF Committee meetings becomes public domain, and there are no restrictions on the open mailing of material presented at committee meetings.

Most of the specifications developed by the SFF Committee have either been incorporated into standards or adopted as standards by EIA (Electronic Industries Association), ANSI (American National Standards Institute) and IEC (International Electrotechnical Commission).

If you are interested in participating or wish to follow the activities of the SFF Committee, the sign up for membership and/or documentation can be found at:

[www.sffcommittee.com/ie/join.html](http://www.sffcommittee.com/ie/join.html)

The complete list of SFF Specifications, which have been completed or are currently being worked on by the SFF Committee, can be found at:

<ftp://ftp.seagate.com/sff/SFF-8000.TXT>

If you wish to know more about the SFF Committee, the principles which guide the activities can be found at:

<ftp://ftp.seagate.com/sff/SFF-8032.TXT>

Suggestions for improvement of this specification will be welcome. They should be sent to the SFF Committee, 14426 Black Walnut Ct, Saratoga, CA 95070.

SFF Committee --

## **Mini Multilane 4X Shielded Connector**

### **1. Scope**

This specification defines the plug, guide/strain relief shell, and latching requirements for the Mini Multilane Shielded connector based upon the mating interface defined in SFF-8086.

### **2. References**

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

#### **2.1 Industry Documents**

The following interface standards and specifications are relevant to this Specification.

- T10/1601D                      SAS 1-1 (Serial Attached SCSI - 1.1)
- SFF-8410                      High Speed Serial Testing for Copper Links
- SFF-8086                      Mini Multilane 10 Gb/s 4X Common Elements Connector

#### **2.2 SFF Specifications**

There are several projects active within the SFF Committee. The complete list of specifications which have been completed or are still being worked on are listed in the specification at <ftp://ftp.seagate.com/sff/SFF-8000.TXT>

#### **2.3 Sources**

Those who join the SFF Committee as an Observer or Member receive electronic copies of the minutes and SFF specifications (<http://www.sffcommittee.com/ie/join.html>).

Copies of ANSI standards may be purchased from the InterNational Committee for Information Technology Standards (<http://tinyurl.com/c4psg>).

Copies of SFF, ASC T10 (SCSI), T11 (Fibre Channel) and T13 (ATA/SATA) standards and standards still in development are available on the HPE version of CD\_Access (<http://tinyurl.com/85fts>).

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### 3. General Description

This specification defines the plug, guide/strain relief, and latching requirements for the Shielded Mini Multilane connector. This specification plus the mating interface and connector footprint defined in SFF-8086 meets the requirements to enable functional multiple sourcing.

The connector provides positive retention along with ease of insertion and removal. The guide/strain relief is incorporated in the shell and works together with the cable plug and latching mechanism to ensure that stress induced by normal cable routing and management is not passed through to the solder joints, which attach the receptacle body to the printed circuit board.

The latch is designed to prevent the plug from bottoming, and a hard stop has been defined to prevent bottoming out should the cable plug be out of spec.

This specification defines the contact range that the retention scheme has to provide to assure acceptable connector performance.

The low profile and small size is well suited to high-speed transmission applications where space is limited.

### 4. Definitions and Conventions

#### 4.1 Definitions

For the purpose of this specification, the definitions in SFF-8086 apply.

#### 4.2 Conventions

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.

| English     | 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 |

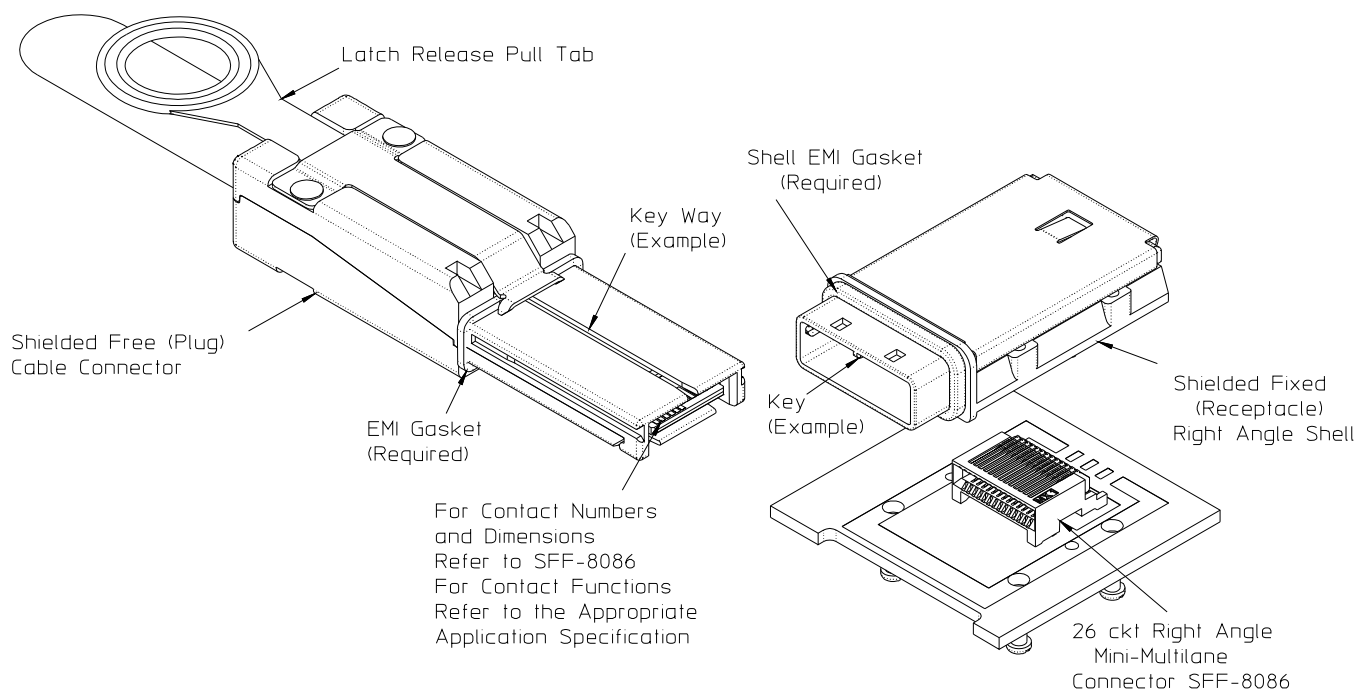
## 5. Connector Description

### 5.1 Performance Requirements

The performance requirements for the contact mating interface for this connector system are defined in SFF-8086 Mini Multilane 10 Gb/s 4X Common Elements Connector. An additional performance requirement for the shielded versions is that the connector system with retention shall withstand 20 lbf minimum axial stress.

### 5.2 General View

The connector system is based upon a common footprint for the receiving body. The footprint positioning holes contain the critical dimensions for locating the receptacle shell. The receptacle shell also functions as the guide and strain relief for the free (plug) connector interface. Figure 5-1 illustrates an example of one such configuration.



**FIGURE 5-1 GENERAL VIEW OF SHROUDED VERSIONS**



The fixed (receptacle) right angle shell comes in alternative versions, as seen in Figure 5-2.

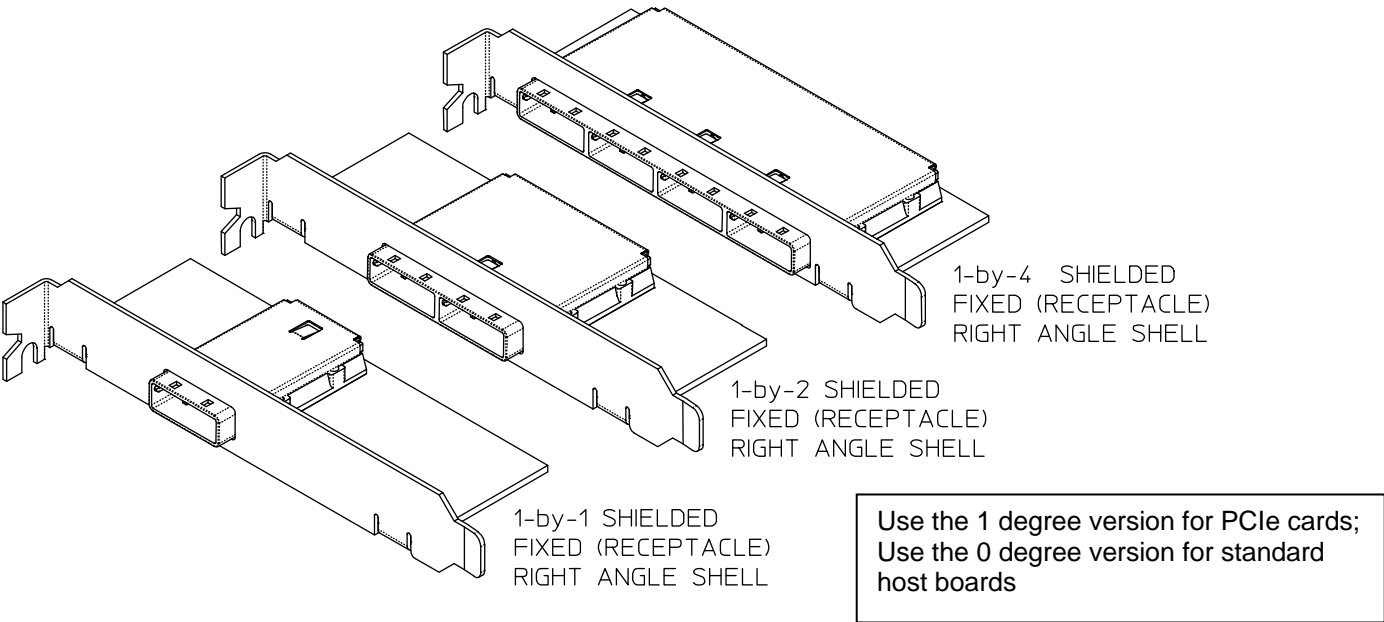


FIGURE 5-2 SHIELDED FIXED (RECEPTACLE) RIGHT ANGLE SHELL CONFIGURATIONS

5.3 Configurations

Table 5-1 lists the versions described in this specification.

TABLE 5-1 SHIELDED FIXED (RECEPTACLE) RIGHT ANGLE SHELL CONFIGURATIONS

| Shielded Version   | Orientation |
|--|-------------|
| 1-by-1 Port 26-circuit Shielded Mini Multilane Connector | Right Angle |
| 1-by-2 Port 26-circuit Shielded Mini Multilane Connector | Right Angle |
| 1-by-4 Port 26-circuit Shielded Mini Multilane Connector | Right Angle |

Note: There are no straight versions specified in this document. In addition, the 26-circuit Shielded Mini Multilane Connector is referred to in SAS as the "Mini SAS 4x" connector.

6. Dimensions

The dimensioning conventions are described in ANSI-Y14.5M, Geometric Dimensioning and Tolerancing. All dimensions are in millimeters.

Dimension related requirements for the connector system addressed in this document are specified in the tables and figures in this clause.

## 6.1 Shielded Free (Plug) Cable Connector

TABLE 6-1 SHIELDED FREE (PLUG) CABLE CONNECTOR DIMENSIONS

| Designator | Description                                | Dimension | Tolerance   |
|------------|--|-----------|-------------|
| E01        | Plug Thickness                             | 12.75     | ±0.13       |
| E02        | Rail Guide Way Length                      | 27.04     | ±0.13       |
| E03        | Snout Bottom to Plug Top                   | 10.55     | ±0.13       |
| E04        | Snout Thickness                            | 5.54      | +0.15/-0.05 |
| E05        | Clearance Groove Length                    | 6.79      | ±0.13       |
| E06        | Snout Tip to Lower Tab Tip                 | 0.75      | ±0.13       |
| E07        | Snout Internal Width                       | 13.72     | ±0.10       |
| E08        | Lower Tab Forward Edge Width               | 8.88      | ±0.13       |
| E09        | Snout Tip to PCB Tip                       | 0.42      | ±0.13       |
| E10        | Snout Length                               | 28.31     | ±0.13       |
| E11        | Plug Width                                 | 18.70     | ±0.10       |
| E12        | Unused                                     |           |             |
| E13        | Unused                                     |           |             |
| E14        | PCB CL to Rail Guide Way Top               | 1.83      | ±0.13       |
| E15        | Rail Guide Way Width                       | 1.25      | ±0.05       |
| E17        | Snout Top Surface Thickness/ Key Way Depth | 0.70      | ±0.05       |
| E18        | Rail Guide Way Top to Snout Top            | 1.07      | ±0.05       |
| E19        | Rail Guide Way Top to Lower Tab Top        | 3.86      | +0.15/-0.05 |
| E20        | Snout Width                                | 17.14     | +0.20/-0.05 |
| E21        | Rail Guide Way Root to Root – Zone A       | 15.64     | ±0.05       |
| E21        | Rail Guide Way Root to Root – Zone B       | 15.94     | ±0.05       |
| E22        | Zone B Length for E21                      | 5.20      | ±0.13       |
| E23        | Zone A Length for E21                      | 18.45     | ±0.13       |
| E24        | Chamfer Depth                              | 0.30      | ±0.05       |
| E25        | Chamfer Length                             | 1.00      | ±0.10       |
| E26        | Chamfer Depth                              | 0.20      | ±0.05       |

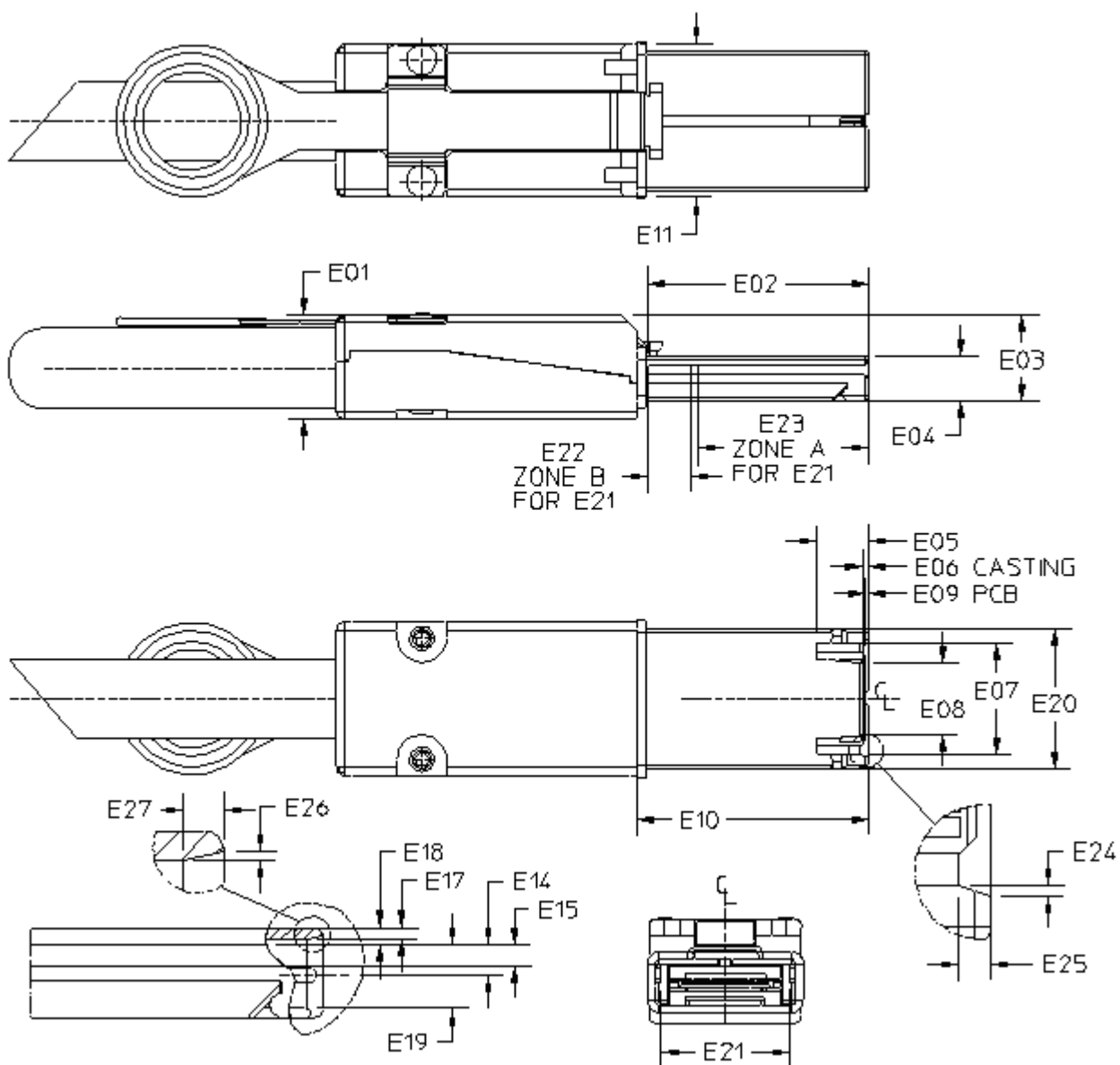
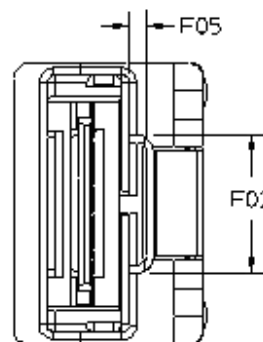
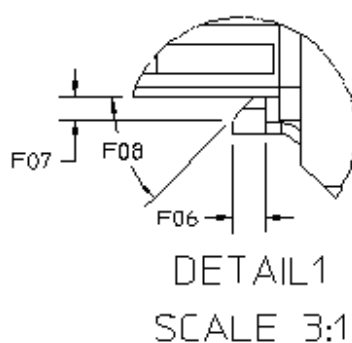
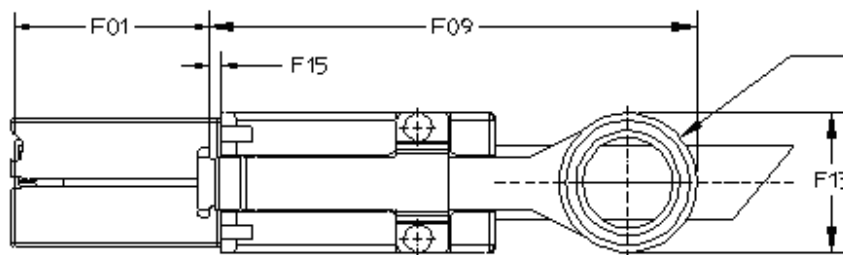
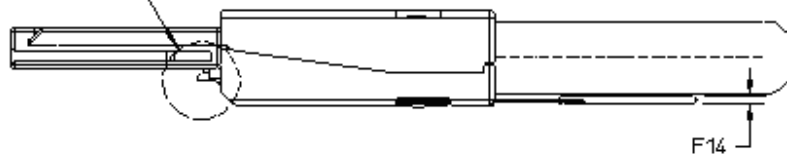


FIGURE 6-1 SHIELDED FREE (PLUG) CABLE CONNECTOR

**TABLE 6-2 SHIELDED FREE (PLUG) CABLE CONNECTOR LATCH AND PULL TAB DIMENSIONS**

| Designator | Description               | Dimension    | Tolerance       |
|------------|---------------------------|--------------|-----------------|
| F01        | Latch to PCB              | 26.28        | $\pm 0.20$      |
| F02        | Width of Barbs            | 9.20         | $\pm 0.10$      |
| F05        | Latch Clearance           | 1.14         | $\pm 0.10$      |
| F06        | Latch Barb Length         | 1.50         | $\pm 0.10$      |
| F07        | Latch Barb Lead-in Height | 1.14         | $\pm 0.10$      |
| F08        | Latch Barb Lead-in Angle  | $33.5^\circ$ | $\pm 1.0^\circ$ |
| F09        | Latch to End of Pull      | 46.50        | Minimum         |
| F10        | Unused                    | ---          | ---             |
| F11        | Unused                    | ---          | ---             |
| F12        | Unused                    | ---          | ---             |
| F13        | Pull Width                | 18.80        | Maximum         |
| F14        | Pull Thickness            | 0.75         | Minimum         |
| F15        | Latch to Plug Body        | 1.60         | $\pm 0.13$      |
|            |                           |              |                 |

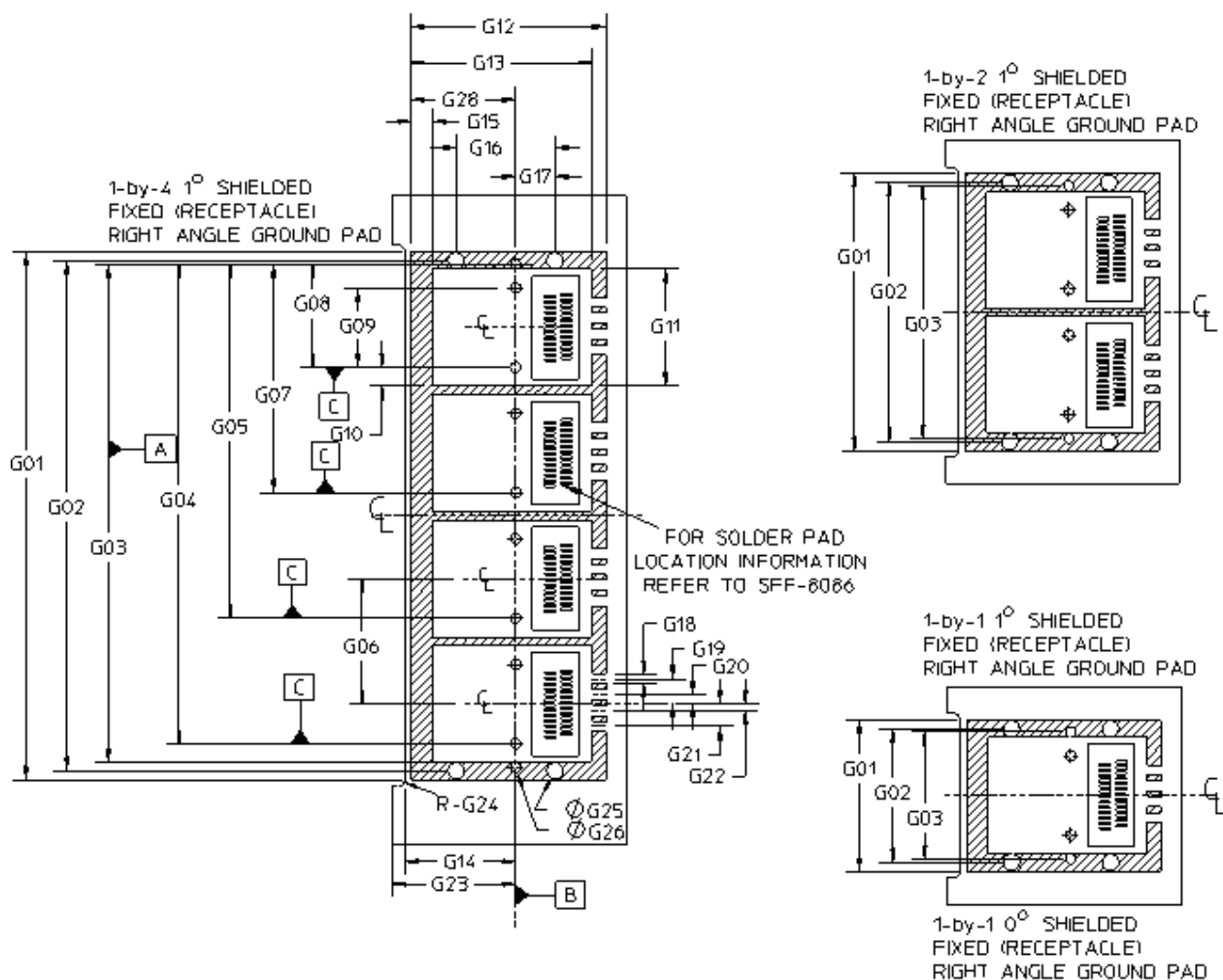
SEE DETAIL1

**FIGURE 6-2 SHIELDED FREE (PLUG) CABLE CONNECTOR LATCH AND PULL TAB**

## 6.2 Shielded Fixed (Receptacle) Right Angle Shell

TABLE 6-3 SHIELDED FIXED (RECEPTACLE) RIGHT ANGLE GROUND PAD DIMENSIONS

| Designator | Description                      | 1-by-4 | 1-by-2 | 1-by-1 | Tolerance |
|------------|----------------------------------|--------|--------|--------|-----------|
| G01        | Ground Pad Width                 | 80.00  | 41.97  | 22.96  | ±0.05     |
| G02        | Screw Hole Spacing               | 77.25  | 39.22  | 20.21  | ±0.05     |
| G03        | Alignment Hole Spacing           | 75.53  | 38.24  | 19.22  | ±0.05     |
| G04        | Ground Pad Datum to Port 4 Datum | 72.65  | N/A    | N/A    | ±0.05     |
| G05        | Ground Pad Datum to Port 3 Datum | 53.64  | N/A    | N/A    | ±0.05     |
| G06        | Port Spacing                     | 19.01  | =      | =      | Reference |
| G07        | Ground Pad Datum to Port 2 Datum | 34.63  | =      | N/A    | ±0.05     |
| G08        | Ground Pad Datum to Port 1 Datum | 15.62  | =      | =      | ±0.05     |
| G09        | Connector Hole Spacing           | 12.00  | =      | =      | ±0.05     |
| G10        | Port Datum to Ground Pad         | 2.87   | =      | =      | ±0.05     |
| G11        | Port Mask Width                  | 17.74  | =      | =      | ±0.05     |
| G12        | Ground Pad to Edge of PCB        | 29.48  | =      | =      | ±0.05     |
| G13        | Port Mask to Edge of PCB         | 27.37  | =      | =      | ±0.05     |
| G14        | Notch to Datum B                 | 16.80  | =      | =      | ±0.05     |
| G15        | Pad Width                        | 3.20   | =      | =      | ±0.13     |
| G16        | Screw Hole Spacing               | 15.00  | =      | =      | ±0.05     |
| G17        | Screw Hole to Datum              | 6.00   | =      | =      | ±0.05     |
| G18        | Trace Alley Width                | 1.50   | =      | =      | ±0.05     |
| G19        | Port CL to Trace Alley 1         | 3.80   | =      | =      | ±0.05     |
| G20        | Port CL to Trace Alley 2         | 1.40   | =      | =      | ±0.05     |
| G21        | Port CL to Trace Alley 4         | 3.40   | =      | =      | ±0.05     |
| G22        | Port CL to Trace Alley 3         | 1.00   | =      | =      | ±0.05     |
| G23        | Card Edge to Datum B             | 18.67  | =      | =      | ±0.13     |
| G24        | Fillet                           | 1.00   | =      | =      | Maximum   |
| G25        | Screw Hole Diameter              | 2.50   | =      | =      | ±0.05     |
| G26        | Locating Hole Diameter           | 1.55   | =      | =      | ±0.05     |
| G27        | Notch to Ground Pad Offset       | 1.00   | =      | =      | Minimum   |
| G28        | Pad Edge to Datum B              | 15.80  | =      | =      | ±0.05     |



#### 1° FOR USE WITH PCI CARD APPLICATIONS

ALL DIMENSIONS TYPICAL. REFER TO 1-by-4 FOR DETAILS

DATUM 'A' CENTERLINE LOCATING  
PEG HOLES FOR SHIELDED  
FIXED (RECEPTACLE)  
RIGHT ANGLE SHELL

DATUM 'B' LOCATING PEG HOLES FOR  
SHIELDED FIXED  
(RECEPTACLE)  
RIGHT ANGLE SHELL

DATUM 'C' REFERENCE DATUM FOR RA  
MINI-MULTILANE CONNECTOR  
SFF-8086 DATUM C

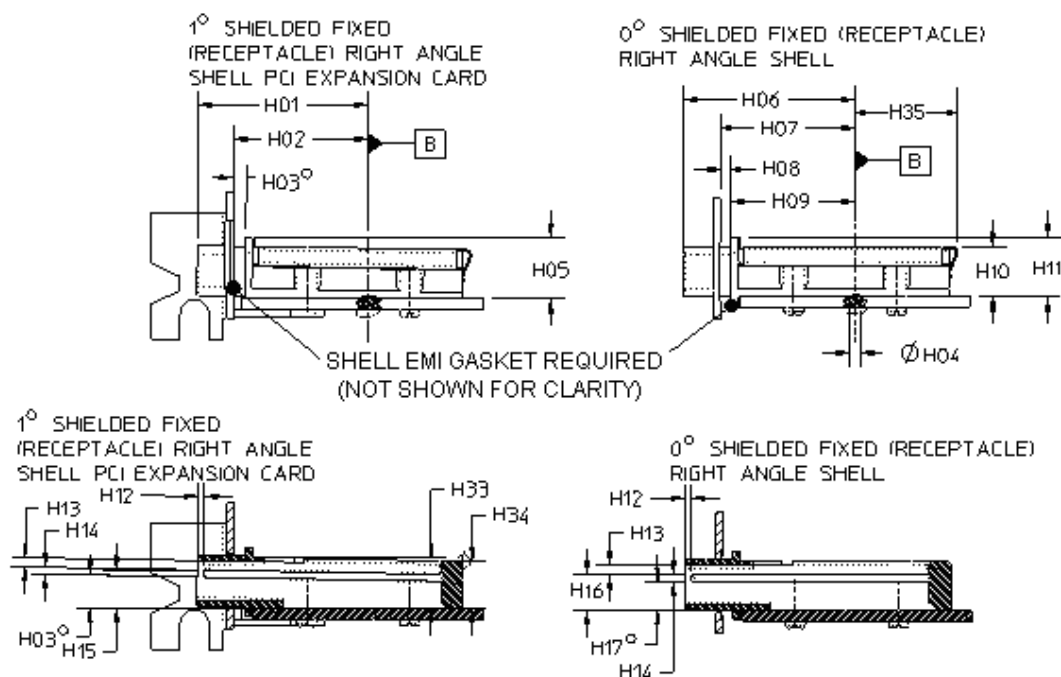
ALL 0° SHIELDED FIXED (RECEPTACLE)  
RIGHT ANGLE GROUND PAD DIMENSIONS  
ARE THE SAME AS 1° SHIELDED  
FIXED (RECEPTACLE) RIGHT ANGLE  
GROUND PAD DIMENSIONS EXCEPT  
NO NOTCH IS REQUIRED IN PCB

THIS APPLIES TO 1-by-1, 1-by-2, AND 1-by-4

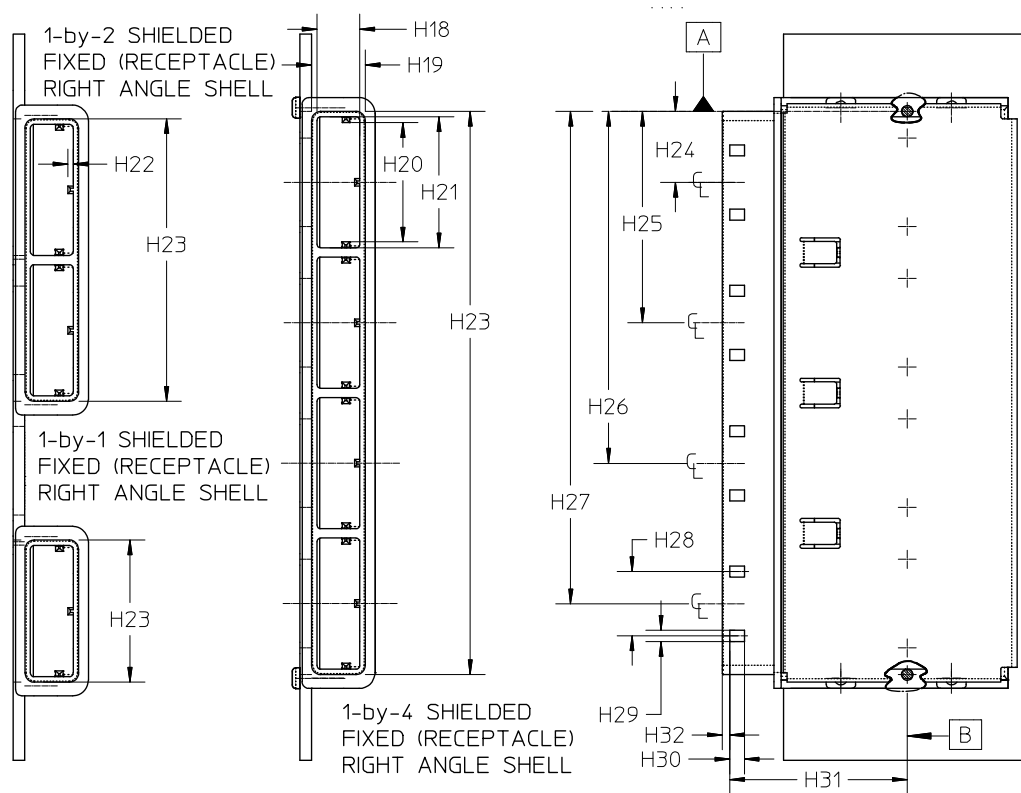
FIGURE 6-3 SHIELDED FIXED (RECEPTACLE) RIGHT ANGLE GROUND PAD

**TABLE 6-4 SHIELDED FIXED (RECEPTACLE) RIGHT ANGLE SHELL DIMENSIONS**

| Designator | Description                      | 1-by-4 | 1-by-2 | 1-by-1 | Tolerance |
|------------|----------------------------------|--------|--------|--------|-----------|
| H01        | EMI Shield to Datum              | 24.96  | =      | =      | Reference |
| H02        | PCI Rail to Datum                | 19.71  | =      | =      | ±0.05     |
| H03        | Guide Rail Angle                 | 1.0°   | =      | =      | Reference |
| H04        | Shield Locator Pin Diameter      | 1.46   | =      | =      | ±0.05     |
| H05        | Flange Height                    | 8.95   | =      | =      | ±0.05     |
| H06        | EMI Shield to Datum              | 25.09  | =      | =      | Reference |
| H07        | Face Plate to Datum              | 19.71  | =      | =      | ±0.05     |
| H08        | EMI Gasket Gap Width             | 1.63   | =      | =      | ±0.50     |
| H09        | Gasket Mate Surface to Datum     | 18.09  | =      | =      | ±0.05     |
| H10        | Rear Height of EMI Shield        | 7.38   | =      | =      | ±0.05     |
| H11        | Flange Height                    | 8.63   | =      | =      | ±0.05     |
| H12        | Guide Rail Set Back              | 1.00   | =      | =      | ±0.05     |
| H13        | Guide Rail to Opening Top        | 1.38   | =      | =      | ±0.05     |
| H14        | Guide Rail Thickness             | 1.00   | =      | =      | ±0.05     |
| H15        | Guide Rail to PCB                | 5.61   | =      | =      | ±0.05     |
| H16        | Guide Rail to PCB                | 5.19   | =      | =      | ±0.05     |
| H17        | Guide Rail Angle                 | 0.0°   | =      | =      | Reference |
| H18        | Port Opening Height              | 5.84   | =      | =      | ±0.05     |
| H19        | EMI Shield Snout Height          | 7.29   | =      | =      | ±0.05     |
| H20        | Guide Rail Internal Spacing      | 16.14  | =      | =      | ±0.05     |
| H21        | Port Opening Width               | 17.74  | =      | =      | ±0.05     |
| H22        | Key Height                       | 0.70   | =      | =      | ±0.05     |
| H23        | EMI Shield Snout Width           | 76.30  | 38.30  | 19.26  | ±0.05     |
| H24        | Datum to Port 1                  | 9.63   | =      | =      | ±0.05     |
| H25        | Datum to Port 2                  | 28.64  | =      | N/A    | ±0.05     |
| H26        | Datum to Port 3                  | 47.65  | N/A    | N/A    | ±0.05     |
| H27        | Datum to Port 4                  | 66.66  | N/A    | N/A    | ±0.05     |
| H28        | Latch Hole Spacing               | 8.70   | =      | =      | ±0.05     |
| H29        | Latch Hole Width                 | 1.50   | =      | =      | ±0.05     |
| H30        | Latch Hole Length                | 2.00   | =      | =      | ±0.05     |
| H31        | Latch Hole Datum                 | 24.09  | =      | =      | ±0.05     |
| H32        | Latch Hole to Snout Face         | 1.00   | =      | =      | ±0.05     |
| H33        | Guide Rail Height at Flange (1°) | 7.42   | =      | =      | ±0.05     |
| H34        | Guide Rail Height at Rear (1°)   | 6.89   | =      | =      | ±0.05     |
| H35        | Datum to back edge (0° and 1°)   | 15.25  | =      | =      | MAX       |



**FIGURE 6-4 SHIELDED FIXED (RECEPTACLE) RIGHT ANGLE SHELL**  
Standard Application – 0 Deg. PCI Card Application – 1 Deg.



ALL DIMENSIONS TYPICAL AND SYMMETRIC ABOUT PORT CENTER LINES

DATUM 'A' LOCATING PIN ON SHIELDED FIXED (RECEPTACLE) RIGHT ANGLE SHELL

DATUM 'B' LOCATING PINS ON SHIELDED FIXED (RECEPTACLE) RIGHT ANGLE SHELL

**FIGURE 6-5 SHIELDED FIXED (RECEPTACLE) RIGHT ANGLE SHELL**



TABLE 6-5 SHIELDED FIXED (RECEPTACLE) RIGHT ANGLE PANEL CUTOUT DIMENSIONS

| Designator | Description                          | 1-by-4 | 1-by-2 | 1-by-1 | Tolerance |
|------------|--------------------------------------|--------|--------|--------|-----------|
| L01        | Conductive Zone Length               | 79.79  | 41.76  | 22.74  | ±0.25     |
| L02        | Opening Length                       | 76.79  | 38.76  | 19.74  | ±0.10     |
| L03        | Conductive Zone Width                | 10.50  | =      | =      | ±0.25     |
| L04        | Opening Width                        | 7.70   | =      | =      | ±0.10     |
| L05        | Opening Corner Radius                | 1.00   | =      | =      | Maximum   |
| L06        | Conductive Zone Corner Radius        | 2.00   | =      | =      | Maximum   |
| L07        | Opening to PCB Offset 1° (above PCB) | 0.33   | =      | =      | +0/-0.20  |
| L08        | Opening to PCB Offset 0° (below PCB) | 0.20   | =      | =      | ±0.10     |

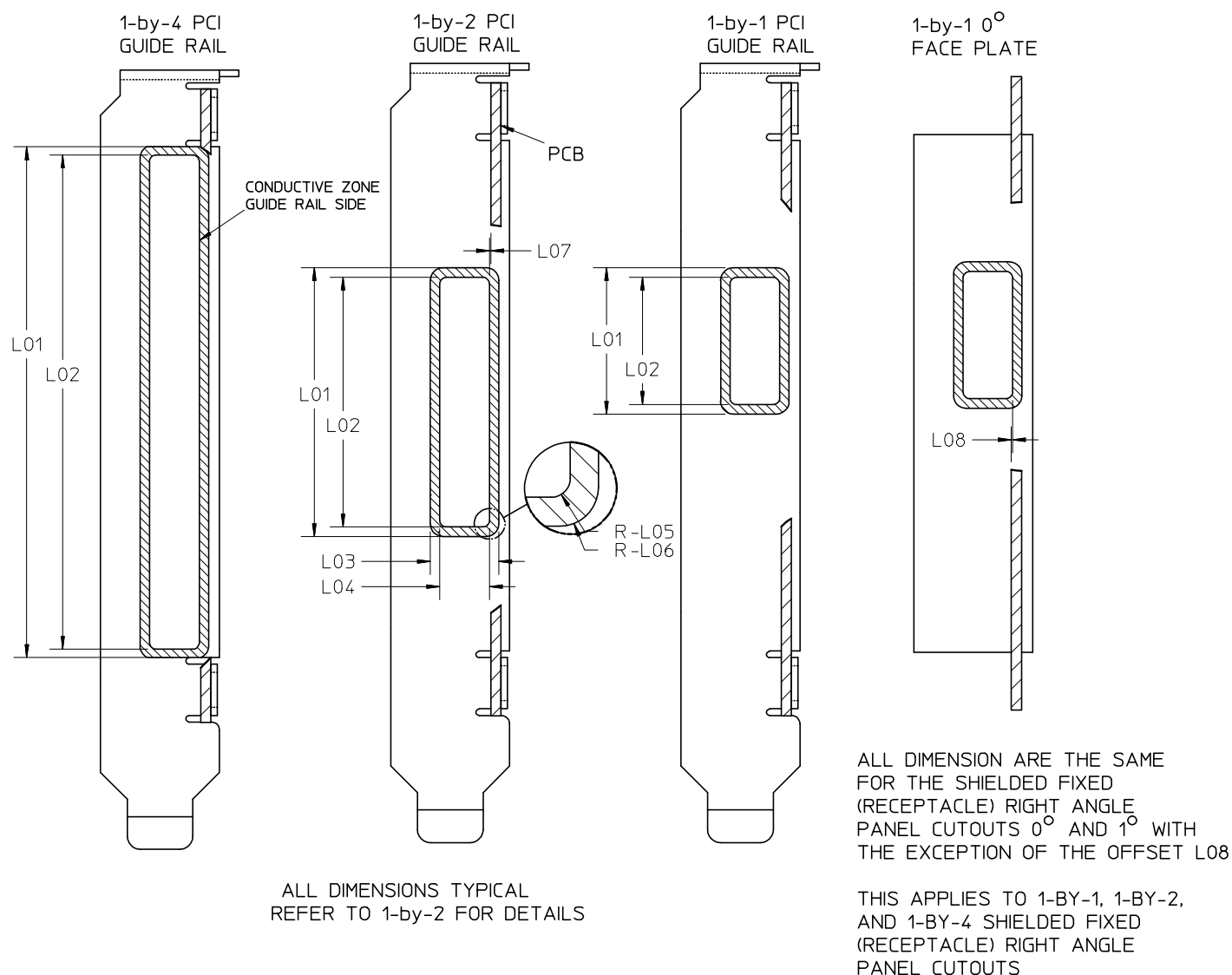


FIGURE 6-6 SHIELDED FIXED (RECEPTACLE) RIGHT ANGLE PANEL CUTOUT

6.3 Shell Blocking Key (Optional)

The keying scheme is defined by the respective standard.

TABLE 6-6 SHELL BLOCKING KEY/KEYWAY DIMENSIONS (OPTIONAL)

| Designator | Description            | Dimension | Tolerance |
|------------|------------------------|-----------|-----------|
| K01        | Plug CL to Key Way 1   | 6.00      | ±0.05     |
| K02        | Plug CL to Key Way 2   | 2.40      | ±0.05     |
| K03        | Plug CL to Key Way 3   | 1.20      | ±0.05     |
| K04        | Plug CL to Key Way 4   | 0.00      | ±0.05     |
| K05        | Plug CL to Key Way 5   | 1.20      | ±0.05     |
| K06        | Plug CL to Key Way 6   | 2.40      | ±0.05     |
| K07        | Plug CL to Key Way 7   | 6.00      | ±0.05     |
| K08        | Key Way Width          | 1.20      | ±0.05     |
| K09        | Key Way Lead-in Width  | 1.70      | ±0.05     |
| K10        | Key Way Lead-in Length | 2.40      | ±0.05     |
| J01        | Port CL to Key 1       | 6.00      | ±0.05     |
| J02        | Port CL to Key 2       | 2.40      | ±0.05     |
| J03        | Port CL to Key 3       | 1.20      | ±0.05     |
| J04        | Port CL to Key 4       | 0.00      | ±0.05     |
| J05        | Port CL to Key 5       | 1.20      | ±0.05     |
| J06        | Port CL to Key 6       | 2.40      | ±0.05     |
| J07        | Port CL to Key 7       | 6.00      | ±0.05     |
| J08        | Key Width              | 1.00      | ±0.05     |

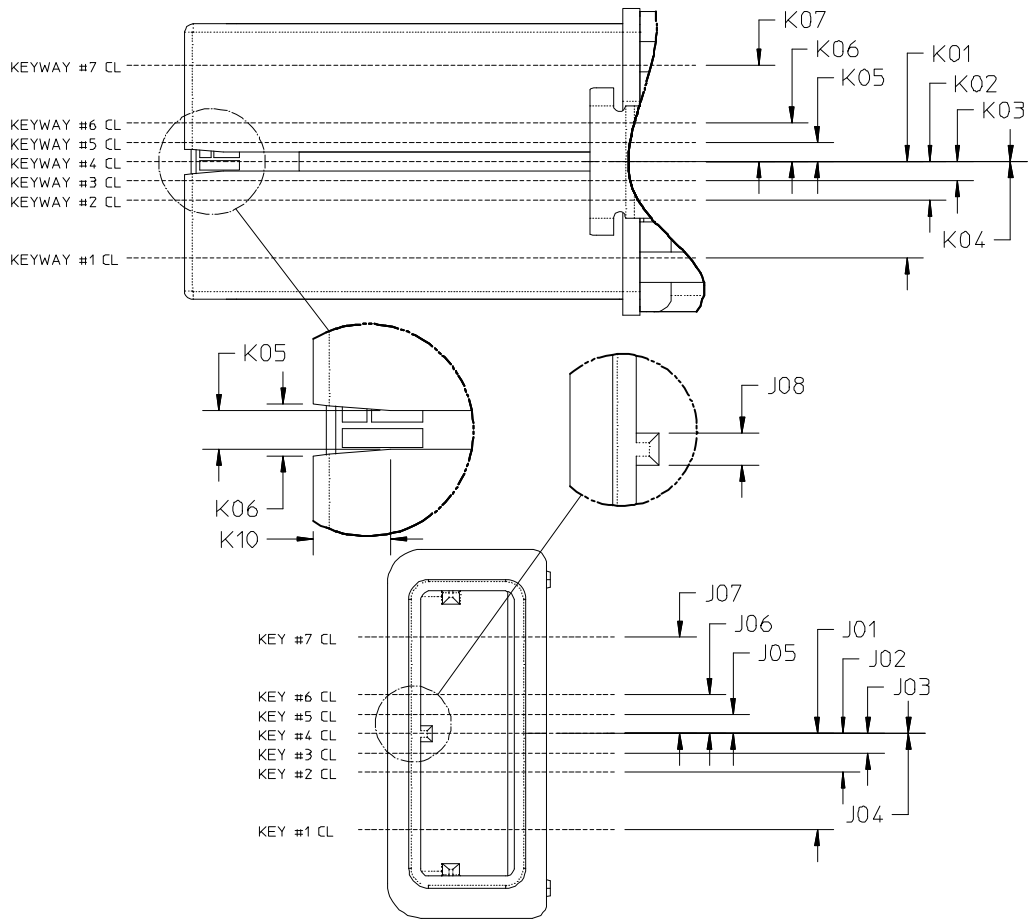


FIGURE 6-7 SHELL BLOCKING KEY DIMENSIONS

#### 6.4 Plug Blocking Key (Optional)

The keying scheme is defined by the respective standard

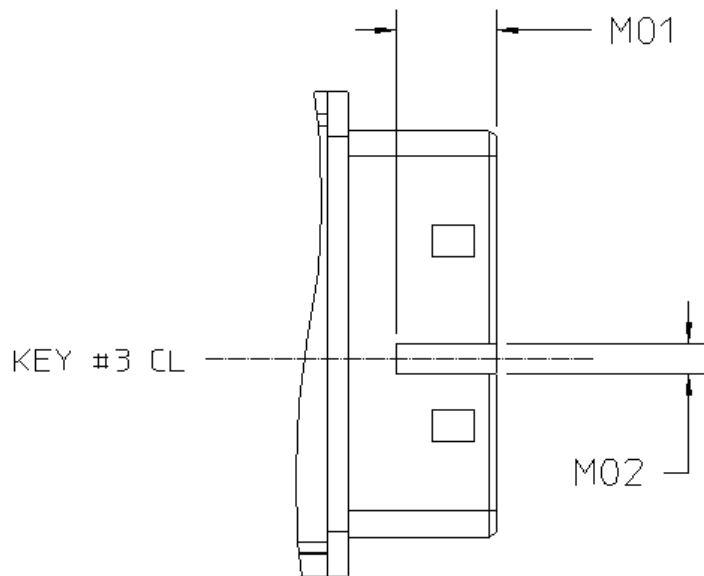


FIGURE 6-8 SHELL KEYWAY DIMENSIONS

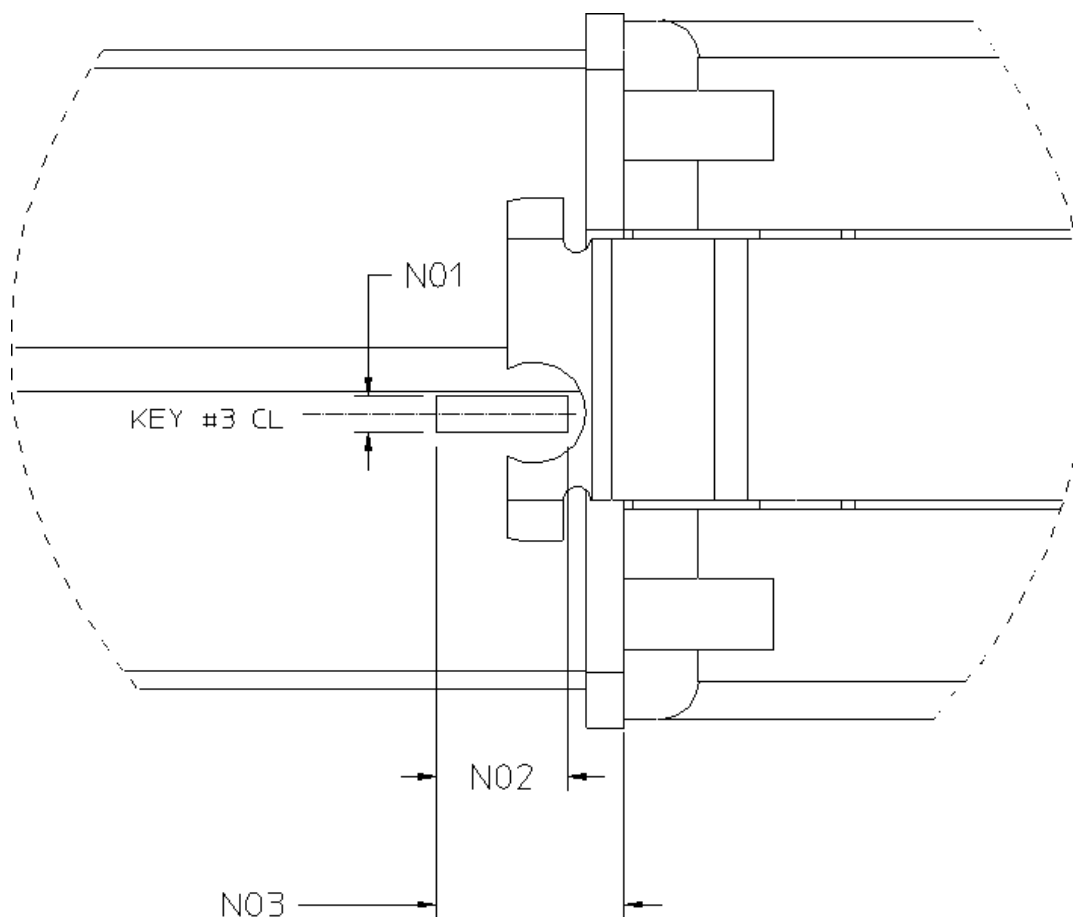


FIGURE 6-9 PLUG BLOCKING KEY DIMENSIONS - TOP VIEW

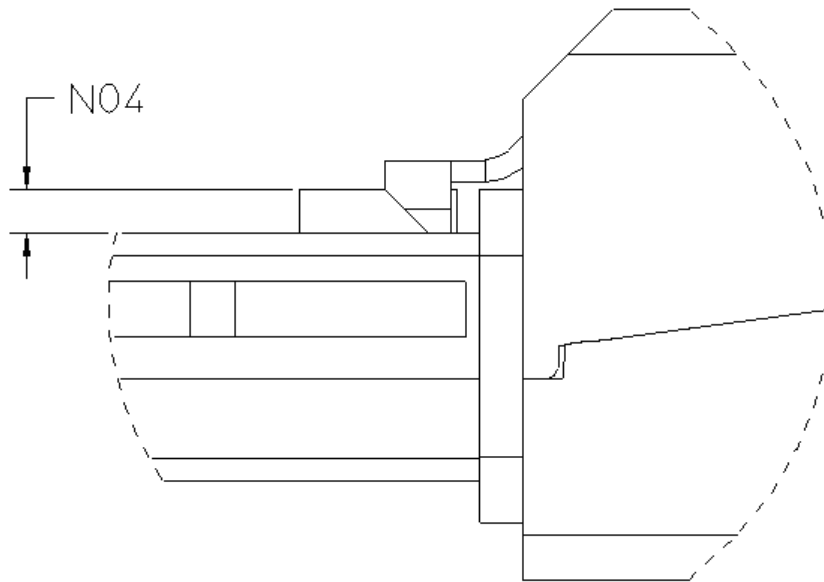


FIGURE 6-10 PLUG BLOCKING KEY DIMENSIONS - SIDE VIEW

TABLE 6-7 PLUG BLOCKING KEY DIMENSIONS

| Designator | Description          | Dimension | Tolerance  |
|------------|----------------------|-----------|------------|
| M01        | Key Way Length       | 4.70      | $\pm 0.05$ |
| M02        | Key Way Width        | 1.36      | $\pm 0.05$ |
| N01        | Key Width            | 0.95      | $\pm 0.05$ |
| N02        | Key Length           | 3.50      | $\pm 0.05$ |
| N03        | Key End to Plug Body | 5.00      | $\pm 0.05$ |
| N04        | Key Height           | 1.00      | $\pm 0.05$ |

### 6.5 Color Coding and Keying Definition

The pull tab color may be used to indicate the intended application for the interface of the cable assembly as defined by the respective application standards. Similarly, specific key arrangements are defined by the respective application standards.

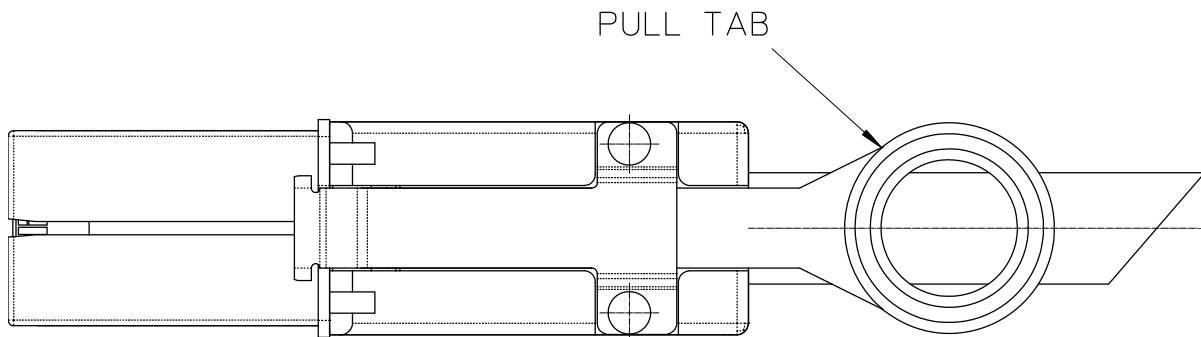


FIGURE 6-11 SHIELDED FREE (PLUG) CABLE CONNECTOR PULL TAB