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SFF Committee

SFF-8611

Specification for

MiniLink 4/8X I/O Cable Assemblies

Rev 0.3 August 20, 2015

Secretariat: SFF Committee

Abstract: This specification defines the physical interface and general performance requirements for the MiniLink cable assemblies, which are designed for use in high speed serial, interconnect applications at multi-gigabit speeds. These cable assemblies are popularly referred to as MiniLink Cable Assemblies and mate with MiniLink Connectors in SFF-8612.

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 specification.

The description of a cable assembly in this specification does not assure that the specific assembly is actually available from cable suppliers. If such a cable assembly 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.

tbd

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

tbd

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, which 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.

Change History

Rev 0.1
- First draft

Rev 0.2
- The speed characteristics and electrical considerations of SFF-8611 were removed to create SFF-8621.

Rev 0.3
- Added to the Abstract
- Added to the list of Industry documents
- Added notes 4 & 5 to 3.1
- Added contact function note to 4.1
- Replaced Figure 4-1, added Fig 4-2, Replaced Fig 5-1.
- Added dimensions for the 8x to Table 5-1
- Revised 6-1 & 6-2 Figure and Table titles
- Added 8x dimensions to tables 6-1, 6-2, 6-4
- Revised dimensions and table notes for Tables 6-1, 6-2, 6-4
- Revised Figure 6-3 to clarify the fold and table description
- Corrected Figure & Table titles for 6-5 and 6-6
- Replaced Figure 6-7 and added the statement below the figure
- Revised the min/max numbers in Table 6-5

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, and 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), 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 signup for membership and/or documentation can be found at:
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.

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FIGURES

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1. Scope

This specification defines the MiniLink cable plug, the basic pinout and the latching requirements for them based upon the mating interface defined herein.

1.1 Application Specific Criteria

This connector is capable of meeting the interface requirements for the internal I/O requirements of T10 SAS-4.

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.

- EIA 364 Electrical Connector/Socket Test Procedures
- INCITS 519 SAS-3
- INCITS 534 SAS-4
- IPC-A-610 Acceptability of Electronic Assemblies
- PCIe OCuLink
- SFF-8410 HSS Copper Testing and Performance Requirements
- SFF-8435 Maximizing Card Edge Tolerances Technique
- SFF-8612 MiniLink 4/8X Shielded Connectors
- SFF-9400 Universal 4/8X Pinouts
- SFF-9401 SAS-4 Internal Cabling Pinout Recommendations

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
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 Inter-National 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).

2.3 Conventions

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

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

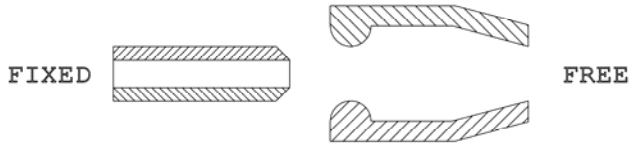
For the purpose of SFF Specifications, the following definitions apply:

Fixed: Used to describe the gender of the mating side of the connector that accepts its mate upon mating. This gender is frequently, but not always, associated with the common terminology "receptacle". Other terms commonly used are "female" and "socket connector". The term "fixed" is adopted from EIA standard terminology as the gender that most commonly exists on the fixed end of a connection, for example, on the board or bulkhead side. In this specification "fixed" is specifically used to describe the mating side gender illustrated in Figure 3-1.

Free: Used to describe the gender of the mating side of the connector that penetrates its mate upon mating. This gender is frequently, but not always, associated with the common terminology "plug". Other terms commonly used are "male" and "pin connector". The term "free" is adopted from EIA standard terminology as the gender that most commonly exists on the free end of a connection, for example, on the cable side. In this specification "free" is specifically used to describe the mating side gender illustrated in Figure 3-1.

Height: Distance from board surface to farthest overall connector feature

Mating Side:The side of the connector that joins and separates from the mating side of a connector of opposite gender. Other terms commonly used in the industry are mating interface, separable interface and mating face.



Note: The free gender is used on the cable side except in the case of wire termination.

FIGURE 2-1 MATING SIDE GENDER DEFINITION

PCB: Printed Circuit Board

Press-fit: Press-fit is a compliant pin, solder free process used to connect connector pins and tabs to a PCB. The mechanical and electrical interfaces between the connector and the PCB are made by a spring-like compliant pin and a plated thru hole (via).

PTH: Plated Through Hole

Right Angle: A connector design for use with printed circuit board assembly technology where the mating direction is parallel to the plane of the printed circuit board.

Straight: A connector design for use with printed circuit board assembly technology where the mating direction is perpendicular to the plane of the printed circuit board.

Surface Mount: A connector design and a printed circuit board design style where the connector termination points do not penetrate the printed circuit board and are subsequently soldered to the printed circuit board.

Termination Side: The side of the connector opposite the mating side that is used for permanently attaching conductors to the connector. Due to contact numbering

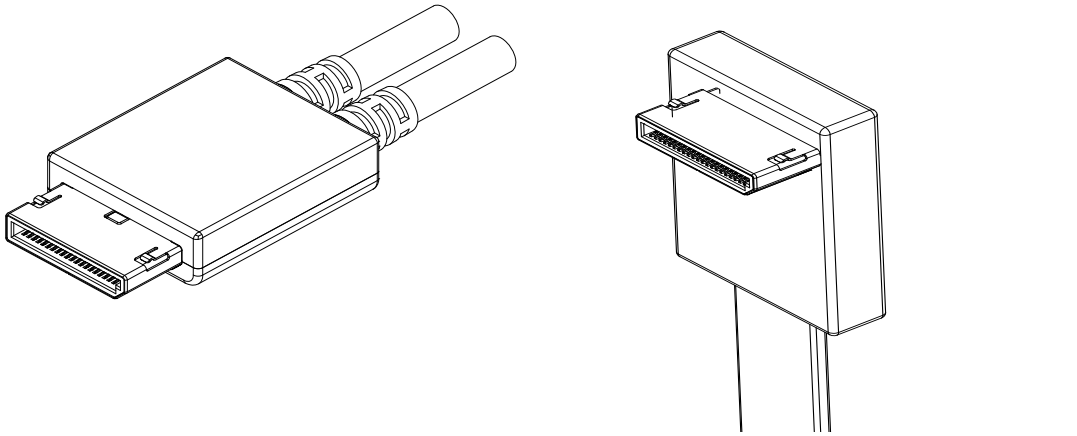
differences between mating side genders the termination side shall always be specified in conjunction with a mating side of a specific gender. Other terms commonly used in the industry are: back end, non-mating side, footprint, pc board side, and post side.

Through Hole: A connector design and a printed circuit board design style where the connector termination points penetrates the printed circuit board and are subsequently soldered to the printed circuit board.

3. Description

The cable assembly system is based upon straight-out and right angle cable exit (free) mating plugs. The integral plug shell functions as the guide for the free (plug) connector interface and also provides the latches for mating with the receptacles in SFF-8612. This connector system provides positive retention along with ease of insertion and removal.
See SFF-8612 for the Fixed (Receptacle) detail/mating interface

This specification provides for 1x1 (4X) and 1x1 (8X) (free side) straight-out and right angle cable exit mating cable plugs.



Straight-out Cable Exit Right Angle Cable Exit

FIGURE 3-1 GENERAL VIEW - FREE CABLE EXIT CONFIGURATIONS

TABLE 3-1 FREE PLUG CABLE EXIT CONFIGURATIONS

Port	Positions	Straight-out	Right Angle
1x1 (4X)	42	X	X
1x1 (8X)	80	X	X

3.1 General Cable Assembly Attributes

1. Dual bundle, single bundle and ribbon cable solutions are acceptable providing they meet all performance and form factor requirements – not all versions are shown.
2. The bulk cable to connector attachment will vary by the type of bulk cable as well as the variety of cable exit solutions and will be left to the cable assembly suppliers to define.
3. Completed cable assemblies shall comply with the cable exit form factor dimensions defined in this specification.
4. Cables may have either Straight-out cable exit or Right angle cable exit versions on either end and 8x to (2) 4x cables may be either style as well.
5. The Free Cable-side Connectors mate with the Host Board-side connectors defined in SFF-8612. They shall be capable of incorporating either passive or active latching solutions for finished cable assemblies to be mechanically retained to the Fixed side connectors.

4. Contact Position Numbering and Length

All Free Cable Assemblies have the same contact numbering as shown.

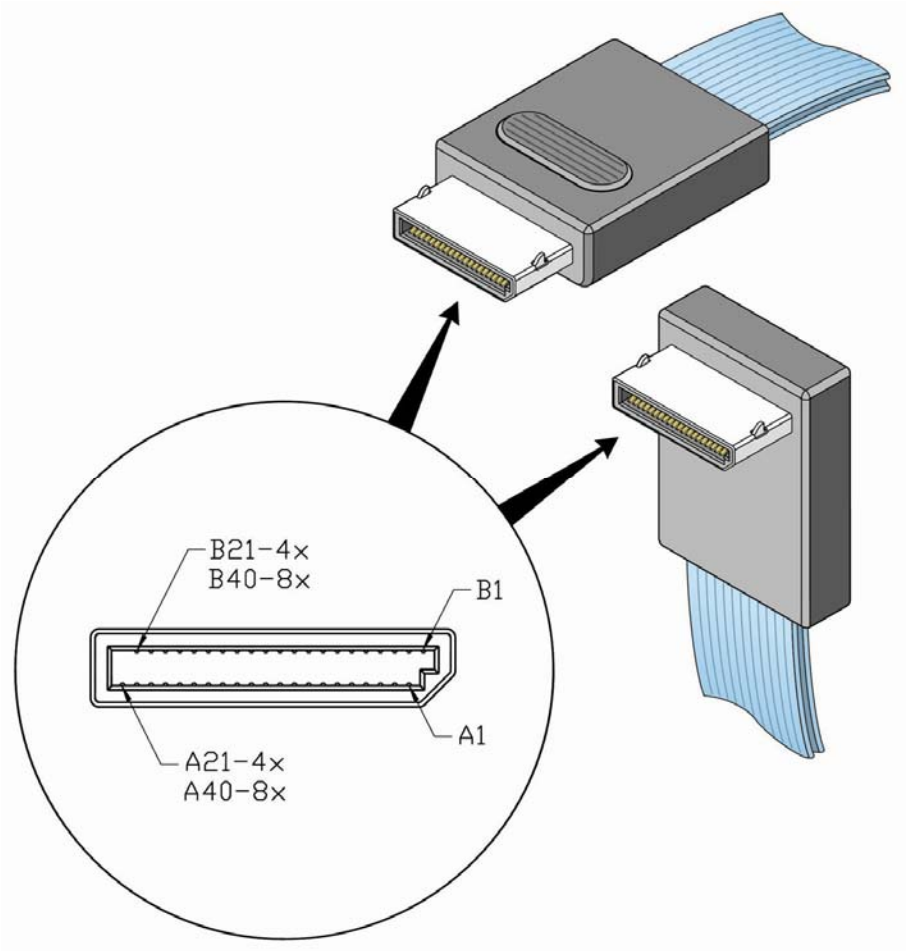


FIGURE 4-1 CONTACT NUMBER LOCATIONS FOR FREE CABLE ASSEMBLIES

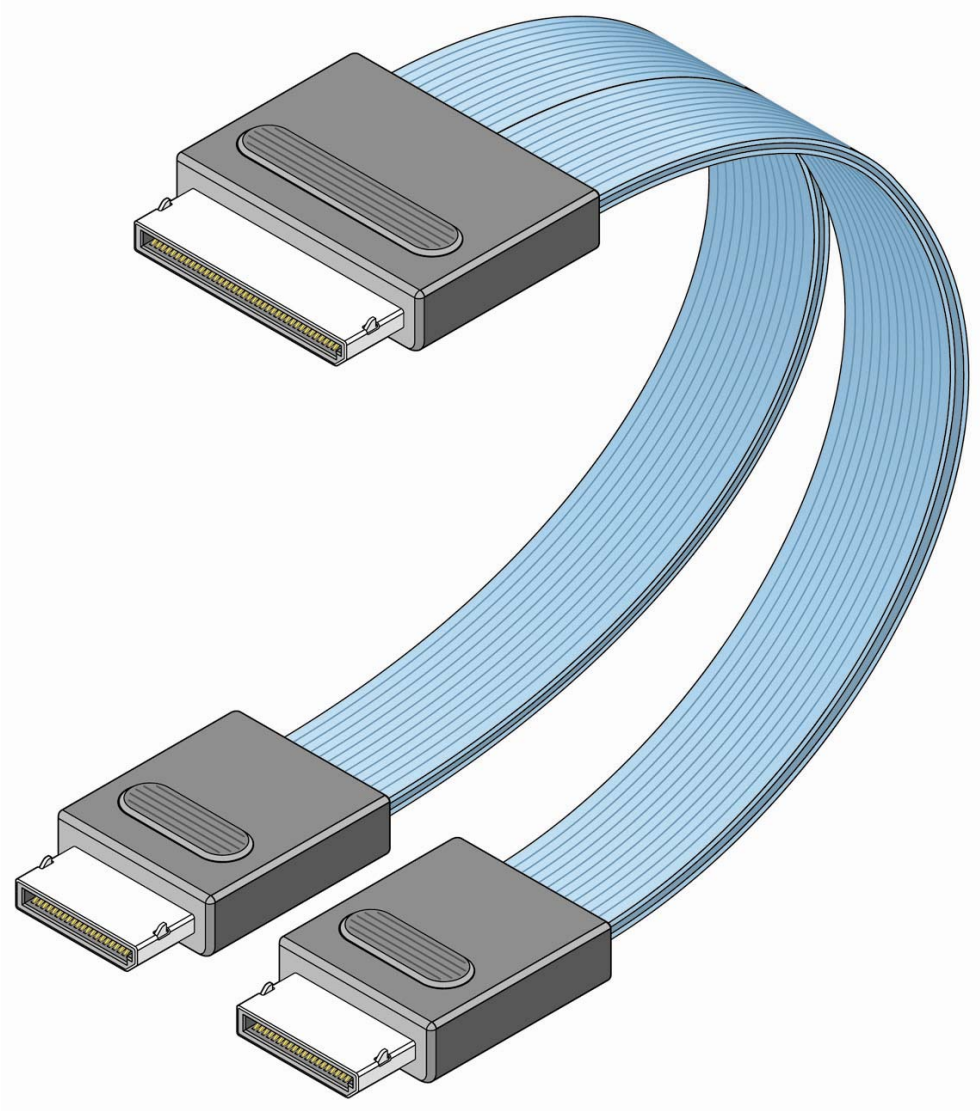


FIGURE 4-2 8X TO (2) 4X FREE CABLE ASSEMBLIES

F

4.1 Locations of the Long and Short Contacts

The contact position numbers are shown in the top row, with the long and short contacts designated as “L” and “S” respectively in the bottom row.

The contact functions are assigned by and are application specific.

TABLE 4-1 LOCATIONS OF THE 4X LONG AND SHORT CONTACTS

Description		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
The contact functions are defined by the application	Row A																					
	Row B																					
Long/Short contact positions		S	L	S	S	L	S	S	L	S	S	L	S	S	L	S	S	L	S	S	L	S

TABLE 4-2 LOCATIONS OF THE 8X LONG AND SHORT CONTACTS

Description		1	2	3	4	5	6	7	8	The LSSL contact length sequence continues through positions 9-29	30	31	32	33	34	35	36	37	38	39	40
The contact functions are defined by the application	Row A																					
	Row B																					
Long/Short contact positions		L	S	S	L	S	S	L	S		S	L	S	S	L	S	S	L	S	S	L

5. Free Connector Mating Interface

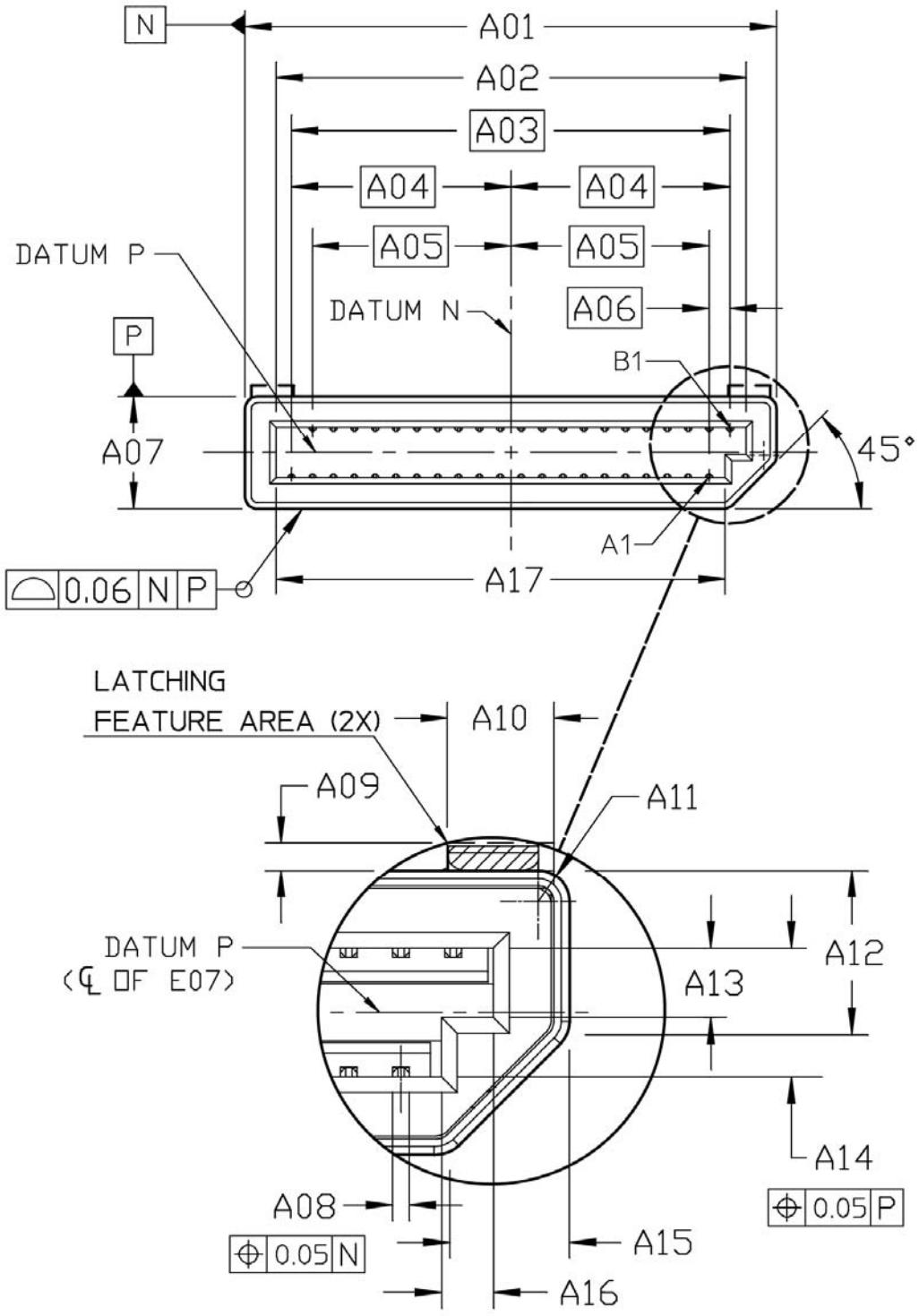


FIGURE 5-1 FREE CONNECTOR MATING INTERFACE

TABLE 5-1 FREE CONNECTOR MATING INTERFACE DIMENSIONS

Designator	Description	Dimension		Tolerance ±
		4X	**8X**	
A01	Connector Shell Width (Datum A)	12.73	**22.27**	0.03
A02	Upper Row Interface Width	11.28	**20.78**	0.03
A03	CL to CL of Outside Contact Beams	10.50	**20.00**	Basic
A04	Vertical CL of Connector Shell to Outside Contacts	5.25	**10.00**	Basic
A05	Vertical CL of Connector Shell to Inside Contacts	4.75	**9.50**	Basic
		Common		
A06	Contact Beam Pitch	0.50		Basic
A07	Connector Shell Height (Datum B)	2.72		0.03
A08	Contact Width	0.16		0.03
A09	Clearance Area Reserved for Latching Mechanism (Height) (2x)	0.43		0.05
A10	Clearance Area Reserved for Latching Mechanism (Width) (2x)	1.05		0.05
A11	Outside Radius (all)	0.30		MAX
A12	Top of Shell to Polarizing Feature TSC (Shell)	1.57		0.04
A13	Polarizing Notch Height	0.67		0.03
A14	Interface Cavity Height (A Side to B Side)	1.23		0.05
A15	Side of Shell to Inside Polarizing Feature TSC	1.15		0.05
A16	Polarizing Notch Width	0.50		0.03
A17	Lower Row Interface Width	10.70	20.30	0.03

6. Free Cable Assemblies

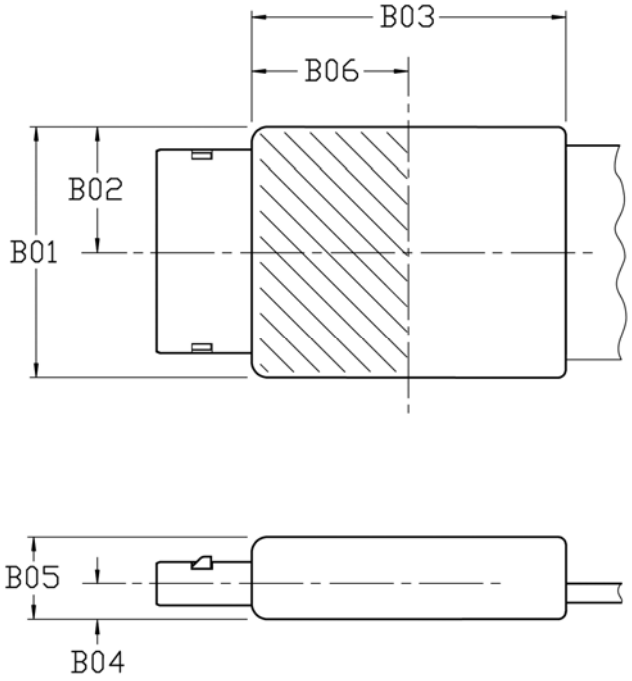


FIGURE 6-1 STRAIGHT-OUT CABLE EXIT INTERNAL CABLE ASSEMBLY

TABLE 6-1 STRAIGHT-OUT CABLE EXIT INTERNAL CABLE ASSEMBLY DIMENSIONS

Designator	Description	Dimension		Tolerance ±
		4X	8X	
B01	Housing Width	17.0	27.50	MAX
		Common		
B02	CL to Housing Edge	As Required for B01		
B03	Housing Length	20.0		MAX
B04	Connector CL to Bottom of Housing	2.20*		MAX
B05	Housing Thickness	7.25		MAX
B06	Boundary for Push to Release DeLatch	10.10		MAX
*Required only to enable the plug to be mated to a Mid-board mounted x4 or x8 Fixed Right Angle Connector See Figure 6-5 and Table 6-5 for passive latch details				

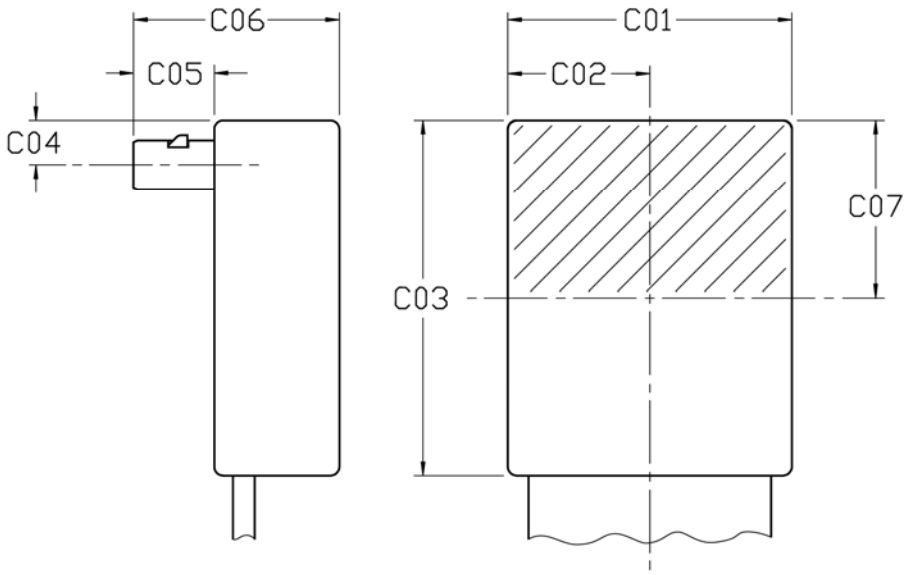


FIGURE 6-2 RIGHT ANGLE CABLE EXIT INTERNAL CABLE ASSEMBLY

TABLE 6-2 RIGHT ANGLE CABLE EXIT INTERNAL CABLE ASSEMBLY DIMENSIONS

Designator	Description	Dimension		Tolerance ±
		4X	8X	
C01	Housing Width	17.0	27.50	MAX
		Common		
C02	CL to Housing Edge	As Required for C01		
C03	Housing Length	21.0		MAX
C04	Connector Interface CL to Edge of Housing	6.5		0.25
C05	Connector Snout Length	5.0		0.05
C06	Overall Height end of snout to top of Housing	9.8*		0.5
C07	Boundary for Release DeLatch	10.10		MAX
*Enables mated height to remain below the MAX component height on a PCIe Add-in card when mated to a x4 or x8 vertical host side connector See Figure 6-6 and Table 6-6 for active latch details				

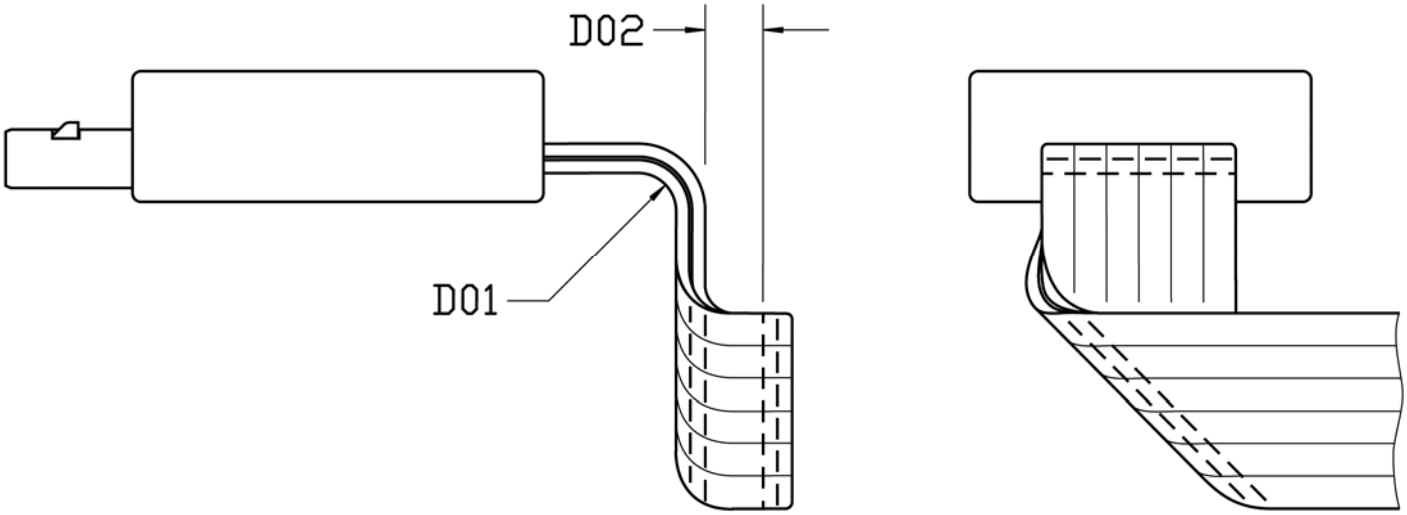


FIGURE 6-3 RIBBON CABLE FOLD

TABLE 6-3 RIBBON CABLE FOLD DIMENSIONS

Designator	Description	Dimension
	Cable Diameter	Supplier Specific
D01	Cable Bend Radius	Bend R MIN Supplier Specific
D02	Note: **Ribbon cable shall not be folded flat against itself when folded.** A minimum space between folded cable shall be maintained to preserve the properties of the cable insulator and thereby the signal integrity.	2x cable thickness Fold R MIN

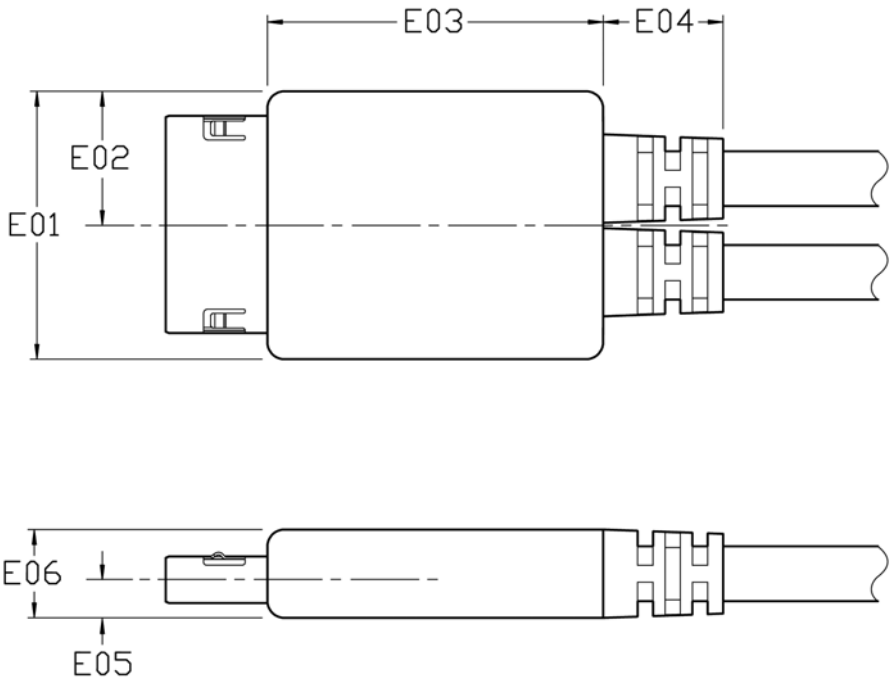


FIGURE 6-4 FREE EXTERNAL CABLE ASSEMBLY

TABLE 6-4 FREE EXTERNAL CABLE ASSEMBLY DIMENSIONS

Designator	Description	Dimension		Tolerance ±
		4x	8x	
E01	Width of Housing	17.00	27.50	MAX
		Common		
E02	CL of Housing to Edge	As Required for E01		
E03	Housing Length	25.00		MAX
E04	Length of Flex Relief (Optional)	7.75		MAX
E05	Connector CL to Bottom of Housing	2.60		MAX
E06	Thickness of Housing	7.25		MAX
* Enables belly to belly implementations on a 1.4 mm MIN thick host board. See Figure 6-5and **Error! Reference source not found.** for passive latch details.				

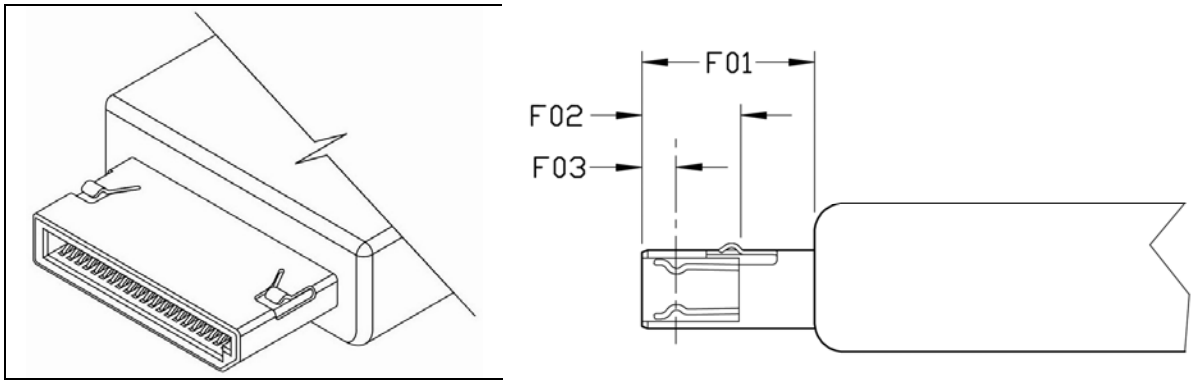


FIGURE 6-5 FREE CABLE PASSIVE LATCH

TABLE 6-5 FREE CABLE PASSIVE LATCH DIMENSIONS

Designator	Description	Dimension	Tolerance ±
F01	Connector Snout Length	5.95	0.05
F02	Front of Connector to Passive Latch Retention Point	3.40	0.05
F03	Front of Connector to Contact Point	1.25	0.05

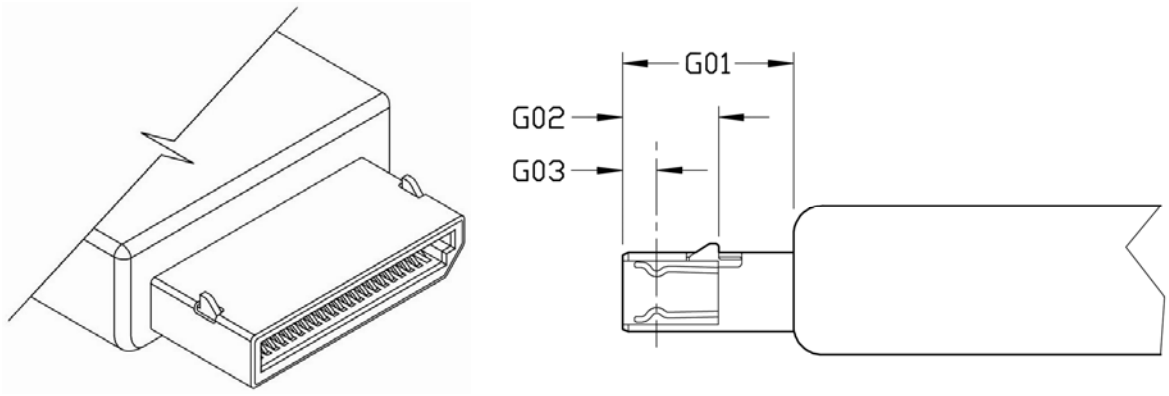


FIGURE 6-6 FREE CABLE ACTIVE LATCH

TABLE 6-6 FREE CABLE ACTIVE LATCH DIMENSIONS

Designator	Description	Dimension	Tolerance ±
G01	Connector Snout Length	5.95	0.05
G02	Front of Connector to Active-Latch Retention Point	3.40	0.08
G03	Front of Connector to Contact Point of Terminal	1.25	0.05

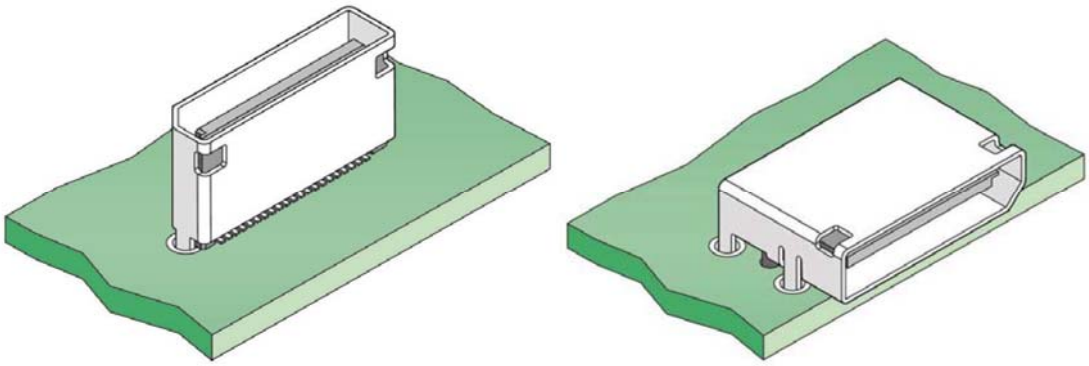


FIGURE 6-7 FIXED CONNECTOR LATCH WINDOWS

The windows in the top of the Fixed right angle connector and the windows in the side wall of the Fixed vertical connector serve as the latching points for the Free Cable latches. The windows accept both passive and active latching solutions that are defined on the Free cable side. For dimensional details, refer to SFF-8612.

TABLE 6-7 CABLE LATCHING REQUIREMENTS

Description	Min	Max		Units	Conditions / Comments
Mating Force					Rate 19-31 mm/s EIA 364-13
- Connector (w/out latch)	2	20 35 35 20	35 35 25 40	N	
- Connector W/ Passive Latch	10	40		N	
- Connector W/Active Latch	8	40		N	
Un-Mating Force					Rate 19-31 mm/s EIA 364-13
- Connector (w/out latch)	1	16		N	
- Connector W/ Passive Latch	8	25		N	
- Connector W/Active Latch W/Pull	8	25		N	
Wrenching Strength W/ Mated Cable- Internal		25		N	Bend cable 90 degrees at minimum bend radius. Pull in 4 axis directions for round cable. Pull in 2 axis directions for flat cable. No damage to plug/cable assembly
Wrenching Strength W/ Mated Cable- External		40		N	Bend cable 90 degrees at minimum bend radius. Pull in 4 axis directions for round cable. Pull in 2 axis directions for flat cable. No damage to plug/cable assembly
Active Latch Retention Strength - Internal	30			N	No damage to plug/cable assembly below Minimum Value
Active Latch Retention Strength - External	60			N	No damage to plug/cable assembly below Minimum Value

7. Performance Requirements

See section 1.1 for the Electrical Performance requirements for this connector solution.

This specification conforms to the test sequences as defined in EIA-364 TS-1000.

TABLE 7-1 TS-1000 REQUIREMENTS

Description	Requirement
Rated Durability Cycles	250
Field Life (3, 5, 7, or 10 years)	10 years ***3 years***
Field Temperature (57, 60, 65, 75, or 85C)	65C degrees
Field Operating Temperature - External	***-25C ~ +55C degrees***
Field Operating Temperature - Internal	***-25C ~ +60C degrees***
Storage Temperature	***-40C to +85C degrees***
Test Group 4 Option	1B
Plating Type (Precious / non-Precious)	Precious
Surface Treatment (Lubricated or non-Lubricated)	Manufacturer to specify

TABLE 7-2 ELECTRICAL REQUIREMENTS

Description	Requirement	Procedure
Current	0.5 A per contact	
Voltage	30 VDC per contact	
Low Level Contact Resistance	Baseline	EIA 364-23 20 mVDC, 10 mA
Insulation Resistance	1000 Megohms minimum between adjacent contacts	100 VDC
Dielectric Withstanding Voltage	No defect or breakdown between adjacent contacts	300 VDC minimum for 1 minute
The minimum Hi-Pot requirement for cable assemblies shall be 240 VDC for 100 ms.		

TABLE 7-3 MECHANICAL REQUIREMENTS

Description	Requirement	Procedure
Mating Force	15ON maximum	EIA 364-13
Un-mating Force	5ON maximum	EIA 364-13
Vibration	- No Damage - No discontinuity longer than 1 microsecond allowed. - 2O milliohms maximum change from initial (baseline) contact resistance ***- 30 mOhm maximum change from initial (baseline) contact resistance***	EIA 364-28
Mechanical Shock	- No Damage ***- No discontinuity longer than one microsecond allowed.*** - 2O milliohms maximum change from initial (baseline) contact resistance ***- 30 mOhm maximum change from initial (baseline) contact resistance***	EIA 364-27
Surface Treatment (Lubricated or non-Lubricated)	***Specified by Manufacturer***	
Rated Durability Cycles - External	***50O***	
Rated Durability Cycles - Internal	***5O***	

TABLE 7-4 ENVIRONMENTAL REQUIREMENTS

Description	Requirement	
Storage Temperature	-2OC to +85C degrees ***-4OC to +85C degrees***	
Humidity	8O percent Relative Humidity	