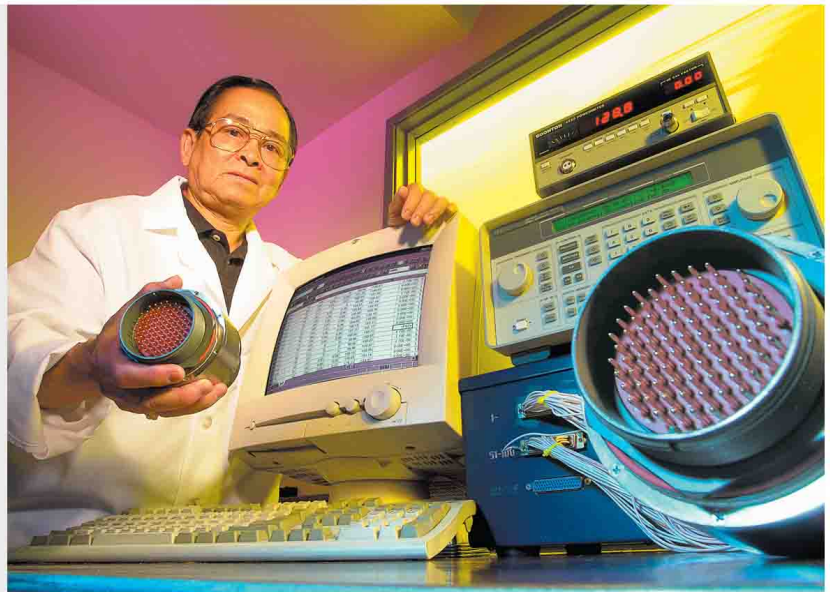
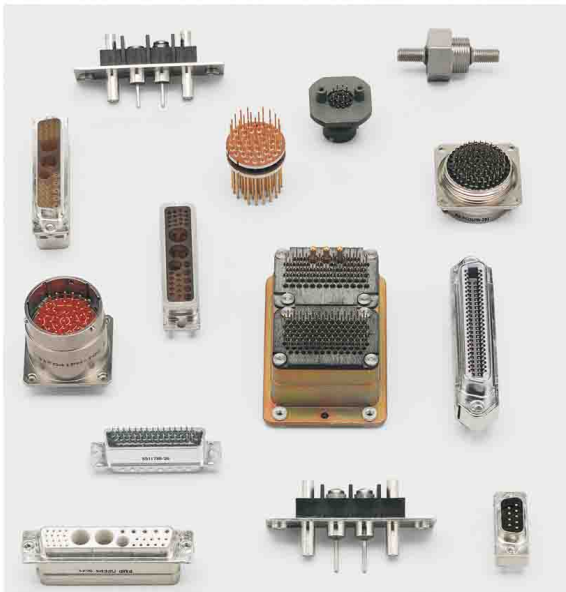


# FILTER CONNECTOR DESIGN GUIDE



Since 1987, EMP Connectors has provided advanced transient suppression and EMI filter connectors for both military and commercial applications. We specialize in custom-built, high-powered designs and EMP is the industry leader in packaging this technology within the smallest overall connector envelope.

This guide contains a small portion of our transient suppression capabilities and product offerings. Please call or e-mail one of our in-house application specialists who will assist in defining your requirements which will allow EMP to create a customized proposal drawing to meet those requirements.



## Advantages of connectors with Transient and EMI Suppression:

1. Transient protection can be combined with EMI filtering if required (See Transient Suppression Design Guide).
2. Mixture of electrical parameters such as power, voltage, polarity, and capacitance are available within the same connector.
3. Protection is located at the Interface of the system.
4. System retrofit to EMP/EMI is compatible with unprotected connectors.
5. Electrical components protected by the shell housing, reducing environmental and mechanical damage.

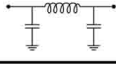
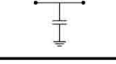
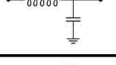
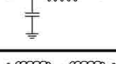

## Electrical Characteristics:

1. In addition to specific filter characteristics shown on the following pages, general characteristics are as follows:

Operating Temp Range		-55° C to 125° C
Current Rating	Size 16	15 amps
	Size 20	7.5 amps
	Size 22	5 amps
Maximum RF Current		3 amps

## Filter Selection:

1. See pages 3, 4 and 5 for specific filter curves. If an application requires filter values not shown consult factory.
2. Other considerations in choosing a filter type are:

Filter Type	Circuit Schematic	Ideal Application
Pi		Unknown or medium source and load impedance
C		High source and high load impedance
LC		Low source and high load impedance
CL		High source and low load impedance
T		Low source and low load impedance

## Cost Considerations:

1. If filtering is required in conjunction with transient suppression, capacitive "C" filtering of 47nF or less is considerably less expensive than other configurations.
1. The greater the number of cavities in the connector, the lower the cost per line.
2. The addition of "Pi" network affects the cost per line noticeably more than capacitive filtering.
3. Receptacles are less expensive than plugs (fewer shell components).
4. Square Flange receptacles provide more stable shell to ground conductivities than jam nut receptacles, and are less expensive.
5. Pin contacts for the connector interface are less expensive than socket contacts.
6. The greater the quantity of connectors the program will use, the lower the cost. Develop a standard connector for use throughout a program if feasible.



# CHECKLIST - FILTER CONNECTORS

PLEASE FAX CHECKLIST ATTN: EMP SALES (714) 665-2099

Reference EMP P/N: \_\_\_\_\_ I.A.W. Mil-Spec: \_\_\_\_\_  
(See Last Page)

Shell Modifications: (Flange location, clinch nuts, helicoils, other)  
\_\_\_\_\_  
\_\_\_\_\_

Special Requirements & Considerations:  
\_\_\_\_\_  
\_\_\_\_\_

Contact Termination:  PC Tail  Solder Cup  Crimp  Other: \_\_\_\_\_

Insulation Resistance: 5GΩ MIN @ \_\_\_\_\_ VDC DWV: \_\_\_\_\_ VDC

### Filter Capacitance

Pin Positions	Filter Value [pF]±20%	Filter Type
1		<input type="checkbox"/> Pi Filter <input type="checkbox"/> C Filter <input type="checkbox"/> L Filter <input type="checkbox"/> T Filter
2		<input type="checkbox"/> Pi Filter <input type="checkbox"/> C Filter <input type="checkbox"/> L Filter <input type="checkbox"/> T Filter
3		<input type="checkbox"/> Pi Filter <input type="checkbox"/> C Filter <input type="checkbox"/> L Filter <input type="checkbox"/> T Filter
4		<input type="checkbox"/> Pi Filter <input type="checkbox"/> C Filter <input type="checkbox"/> L Filter <input type="checkbox"/> T Filter

### Insertion Loss

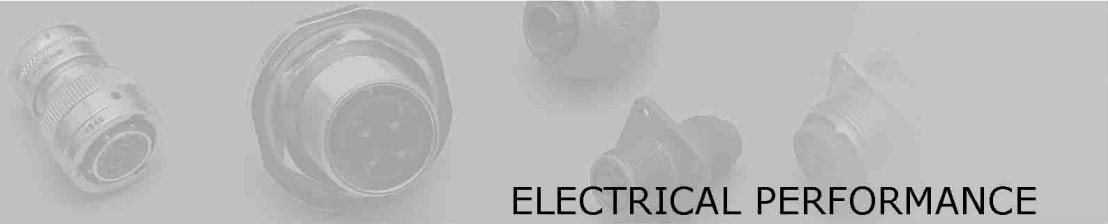
Frequency [MHz]	Attenuation [dB]
1	
2	
3	
4	

Company: \_\_\_\_\_ Phone: \_\_\_\_\_  
Requested By: \_\_\_\_\_ E-Mail: \_\_\_\_\_

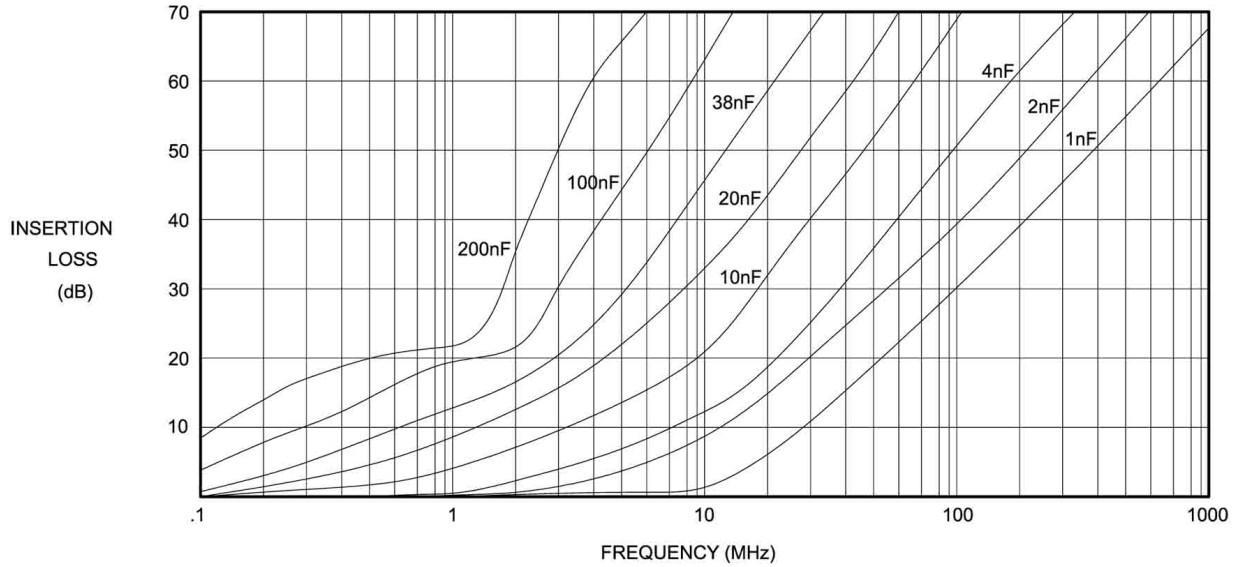
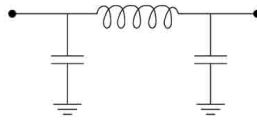
NOTES: 1. For non-filtered lines specify as Insulated Feedthru or Ground.  
2. If filters are needed in conjunction with diode suppression see Filter Connector Checklist in addition to Diode Suppression Checklist.



EMP Connectors, Inc.  
1631 E. St. Andrew Place  
Santa Ana, California 92705  
Tel: (714) 665-2085  
Fax: (714) 665-2099  
sales@empconnectors.com



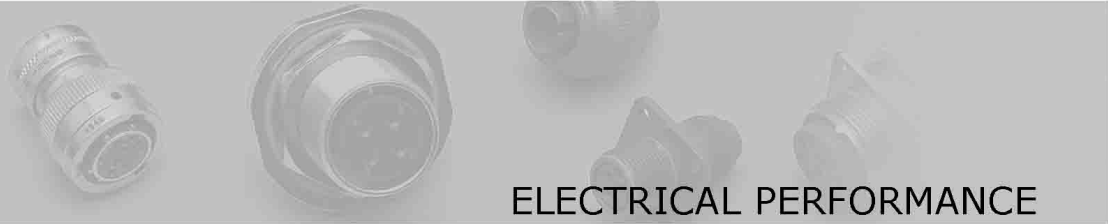
## 'PI' SELECTION CURVES



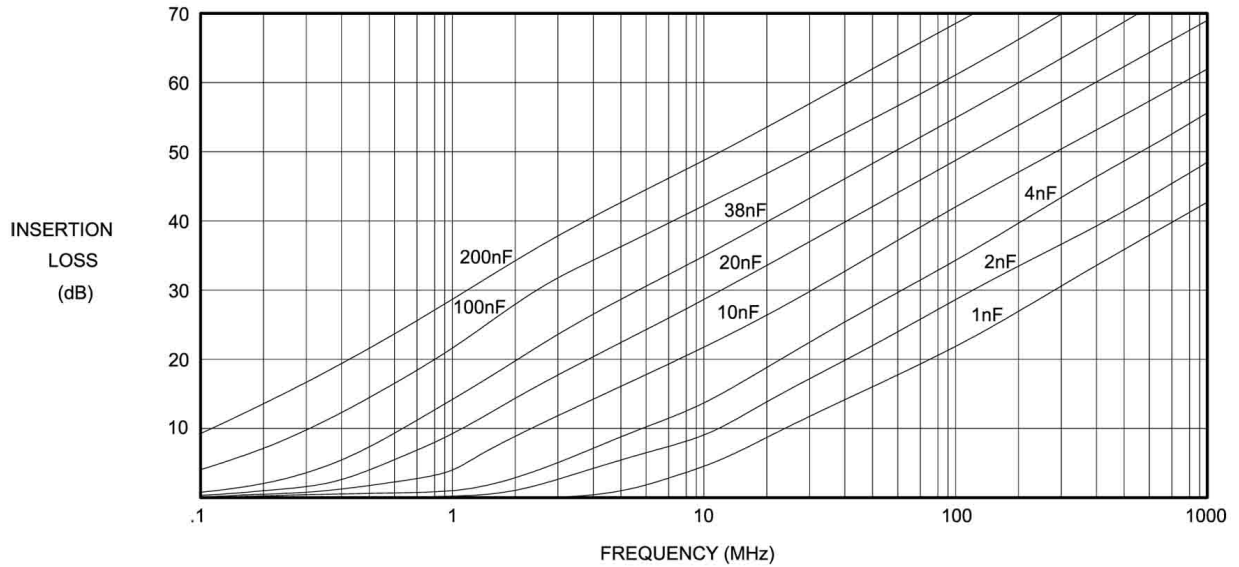
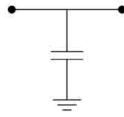
## ELECTRICAL CHARACTERISTICS

Nominal Capacitance		1nF	2nF	4nF	8nF	10nF	20nF	38nF	76nF	100nF	200nF
Capacitance in Nanofarads @ 1KHz, .1VRMS		.8 1.2	1.6 2.4	3.2 4.8	6.4 9.2	8 12	16 24	32 45	64 90	80 120	160 240
Minimum No Load Insertion Loss @ 25°C	Freq										
	100 KHz	-	-	-	-	.1	.3	1	3	4	8
	1 MHz	-	.2	.9	2.9	3.9	8	13.3	18	19.6	22
	2 MHz	.3	1	2.9	6.6	8	12.7	16.8	19.7	21.7	35.6
	10 MHz	1	8	12.8	18.8	21.7	33.5	46.4	59	63	70+
	100 MHz	30	39	51.4	63.7	69.6	70+	70+	70+	70+	70+
	500 MHz	54	66	70+	70+	70+	70+	70+	70+	70+	70+
	1 GHz	68	70+	70+	70+	70+	70+	70+	70+	70+	70+
Voltage Rating		200 VDC / 120 Vrms @ 400 Hz									100 VDC
DWV, sea level with 50 microamps max charge/discharge		500 VDC									300 VDC
Insulation Resistance		5 GΩ minimum @ 100 VDC									



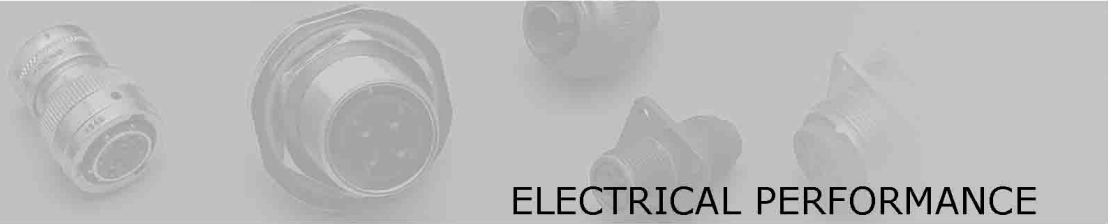


## 'C' SELECTION CURVES

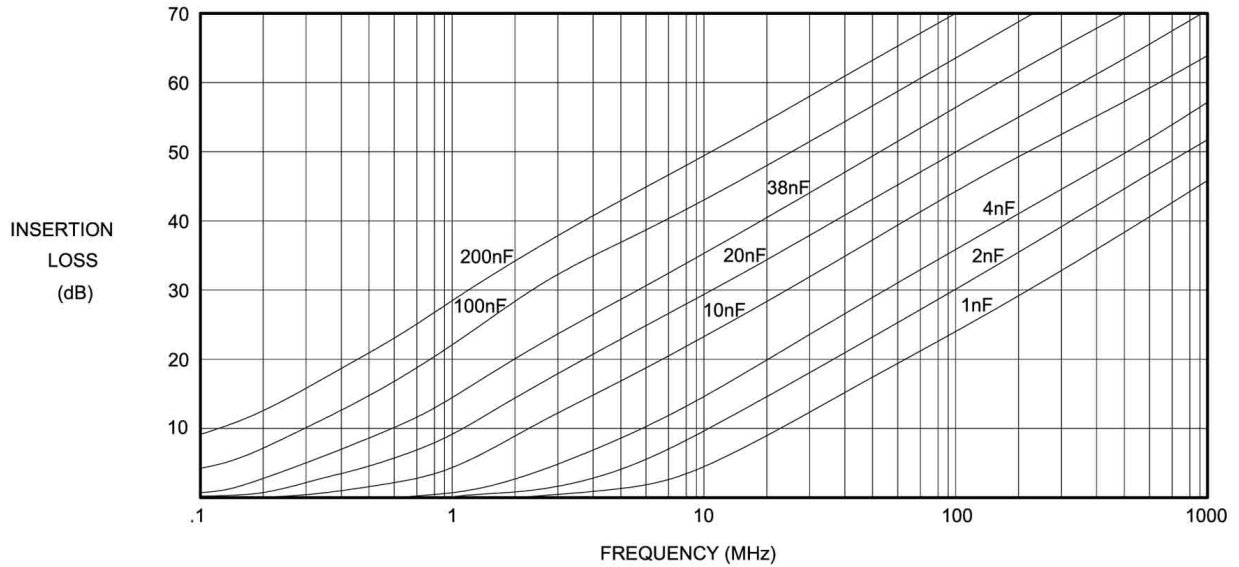
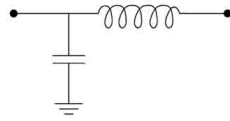


## ELECTRICAL CHARACTERISTICS

Nominal Capacitance		1nF	2nF	4nF	8nF	10nF	20nF	38nF	76nF	100nF	200nF
Capacitance in Nanofarads @ 1KHz, .1VRMS		.8 1.2	1.6 2.4	3.2 4.8	6.4 9.2	8 12	16 24	32 45	64 90	80 120	160 240
Minimum No Load Insertion Loss @ 25°C	Freq										
	100 KHz	-	-	-	-	.1	.3	1	3	4	8.5
	1 MHz	.1	.3	1	3	4	8.5	14	20	22	28
	2 MHz	.3	1	3	7	8.5	14	20	26	28	34
	10 MHz	4	8.5	14	20	22	28	34	40	42	48
	100 MHz	22	28	34	40	42	48	54	60	62	68
	500 MHz	36	42	48	54	56	62	68	70+	70+	70+
	1 GHz	42	48	55	60	62	68	70+	70+	70+	70+
Voltage Rating		200 VDC / 120 Vrms @ 400 Hz									100 VDC
DWV, sea level with 50 microamps max charge/discharge		500 VDC									300 VDC
Insulation Resistance		5 GΩ minimum @ 100 VDC									



## 'L' SELECTION CURVES



## ELECTRICAL CHARACTERISTICS

Nominal Capacitance		1nF	2nF	4nF	8nF	10nF	20nF	38nF	76nF	100nF	200nF
Capacitance in Nanofarads @ 1KHz, .1VRMS		.8 1.2	1.6 2.4	3.2 4.8	6.4 9.2	8 12	16 24	32 45	64 90	80 120	160 240
Minimum No Load Insertion Loss @ 25°C	Freq										
	100 KHz	-	-	-	-	.1	.3	1	3	4	8.5
	1 MHz	-	.2	1	3	4	8.5	14	20	22	28
	2 MHz	-	1	3	7	8.8	14.5	20	26	28	34
	10 MHz	4.8	9.5	15	21	23	29	35	41	43	49
	100 MHz	24	30	36	42	44	50	56	62	64	70+
	500 MHz	37.5	43.5	49.5	55.5	57.5	63.5	70+	70+	70+	70+
	1 GHz	45	52	56	62	63.5	70+	70+	70+	70+	70+
Voltage Rating		200 VDC / 120 Vrms @ 400 Hz								100 VDC	
DWV, sea level with 50 microamps max charge/discharge		500 VDC								300 VDC	
Insulation Resistance		5 GΩ minimum @ 100 VDC									



## Reference Connector Specifications

EMP Connectors comply with the performance requirements set forth by the specifications below.

Test	MIL-DTL-38999 Paragraph Ref.	Description	Requirement
Temperature Cycling	4.5.4	Per Method 1003 of MIL-STD-1344, Condition A, temp range -55°C to 125°C.	No evidence of breaking or electrical deterioration.
Durability	4.5.7	Mated and unmated 500 times to mating connector at a rate of 200 ±100 cycles/hr.	No electrical or mechanical defects affecting performance.
Insulation Resistance (IR)	4.5.9.1	Per Method 3003 of MIL-STD-1344. Measurements shall be between any pair of contacts and between any contact and the connector shell shall be 5,000 MΩ minimum. IR after altitude immersion shall be 1000 MΩ minimum. IR after humidity shall be 100 MΩ Min.	Equal to or greater than the minimum value in the table when tested at the specified voltage per the performance data table.
Dielectric Withstanding Voltage (DWV) (Sea Level)	4.5.10.1	Per Method 3001 of MIL-STD-1344. Measurements shall be between each contact, each adjacent contact, and the shell. Test Voltage shall be maintained at the specified value for for 2 seconds minimum.	There shall be no dielectric breakdown or flashover when tested at specified voltage in per the performance data table.
Dielectric Withstanding Voltage (DWV) (Altitude)	4.5.10.2	Per Method 3001 of MIL-STD-1344. Measurements shall be between each contact, each adjacent contact, and the shell. Test Voltage shall be maintained at the specified value for for 2 seconds minimum. Connector shall be unmated, and only the engaging face shall be subjected to altitude.	Tested to applicable drawing / requirements.
Insert Retention	4.5.11	Per Method 2010 of MIL-STD-1344. A Pressure of 100 psi with a 25 lb. minimum force shall be applied to inserts.	Inserts shall not be displaced or show evidence of damage.
Salt Spray (Corrosion)	4.5.12	Per Method 1001 of MIL-STD-1344, Condition B.	Shall show no exposure of base metal.
Contact Retention	4.5.19	An axial load is applied to the mating end of each contact for 5 seconds minimum. 10 lbs. - size 22, 15 lbs. - size 20, & 25 lbs. - size 16.	Axial displacement of contacts shall not exceed .012 inches.
Vibration	4.5.22.1	Per Method 2005 of MIL-STD-1344, Condition VI Letter J, 8 hrs. longitudinal and perpendicular axis 25°C and 4 hrs. @ -55°C and 125°C.	No evidence of deterioration of Attenuation or IR.
Physical Shock	4.5.23.1	Per Method 2004 of MIL-STD-1344.	No evidence of deterioration of Attenuation or IR.
Humidity	4.5.25	Per Method 1002 of MIL-STD-1344.	Insulation Resistance greater than 100 MΩ when tested at high humidity.
Fluid Immersion	4.5.29	Per Method 1016 of MIL-STD-1344.	Shall meet attenuation after drying.
Electrical Performance	***	All EMP Connectors are 100% electrically tested which includes DWV, Insulation Resistance, and Capacitance Range.	All additional testing can be completed upon customer request.



## CIRCULAR

**A 3 1 F J 3 5 P N - S \* \***

**CONNECTOR TYPE**

- A = MIL-DTL-38999
- B = MIL-C-26482
- C = MIL-DTL-83723
- D = MIL-C-81511
- G = MIL-C-28840
- K = MIL-C-5015

**SERIES**

- 0 = SPECIAL
- 1 = SERIES I
- 2 = SERIES II
- 3 = SERIES III
- 4 = SERIES IV

**STYLE**

- 1 = SQ. FLANGE / WALL MT.
- 2 = BOX MOUNT
- 3 = JAM-NUT
- 4 = FEED THRU
- 5 = ADAPTER
- 6 = PLUG
- 7 = BACK PANEL MOUNT
- 8 = SOLDER MOUNT
- 9 = RECEPTACLE

**PLATING**

- A = TIN
- C = CLEAR CAD
- D = FUSED TIN
- E = NICKEL
- F = ELECTROLESS NICKEL
- G = GOLD
- H = PASSIVATION
- M = COMPOSITE
- S = SILVER
- W = O.D. CADMIUM
- Y = YELLOW CADMIUM

**MODIFICATION CODE**  
(DETERMINED AT FACTORY)

**TERMINATION STYLE**

- A = PC TAIL
- B = SOLDER CUP
- C = CRIMP
- D = N/A (ADAPTER OR OTHER)

**KEYING / CLOCKING**

SEE MIL-STDS

**CONTACT STYLE**

- P = PIN
- S = SOCKET

**ADAPTER**

- A = P/S PIN ON PLUG SIDE
- B = S/P SOCKET ON PLUG SIDE
- C = P/P
- D = S/S

**INSERT ARRANGEMENT**

SEE MIL-STDS

**SHELL SIZE**

- A = 8-9
- B = 10-11
- C = 12-13
- D = 14-15
- E = 16-17
- F = 18-19
- G = 20-21
- H = 22-23
- J = 24-25
- K = 1
- L = 2
- M = 3

**SHELL SIZE (28840 ONLY)**

- A = 11
- B = 13
- C = 15
- D = 17
- E = 19
- F = 23
- G = 25
- H = 29
- J = 33

## D-SUB / MICROMINIATURE

**H D S C 6 2 P \* \***

**HIGH DENSITY**

USE AS REQUIRED

**D-SUB SERIES**

**STYLE**

- A = ADAPTER
- C = CRIMP
- F = FEED THRU
- I = IDC TERMINATION
- L = RIGHT ANGLE BOARD MT.
- S = SOLDER CUP
- T = PC TAIL

**SHELL SIZE**

- E = 1
- A = 2
- B = 3
- C = 4
- D = 5
- M = MICROMINIATURE

**MODIFICATION CODE**  
(DETERMINED AT FACTORY)

**CONTACT STYLE**

- P = PIN
- S = SOCKET

**ADAPTER**

- A = PIN/SOCKET
- B = PIN/PIN
- C = SOCKET/SOCKET

**NUMBER OF CONTACTS**

NOTES: 1. Consult factory for ARINC or any other connector housing with a TVS or Filter requirement.