RF Immunity
The Filtered Connector Specialists

ATD ELEKTRONIK s.r.o.

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We are committed to the full satisfaction of our customers and to meeting their technical requirements.
The highest requirements of quality standards is our company mission, and a continuous improvement program is employed in all the enterprise levels.
Each product is subject to meticulous tightly-controlled test procedures carried out with top-quality tools - from component acceptance inspection, through process control to final examination of the complete product.

COMPANY PRODUCT LINE:

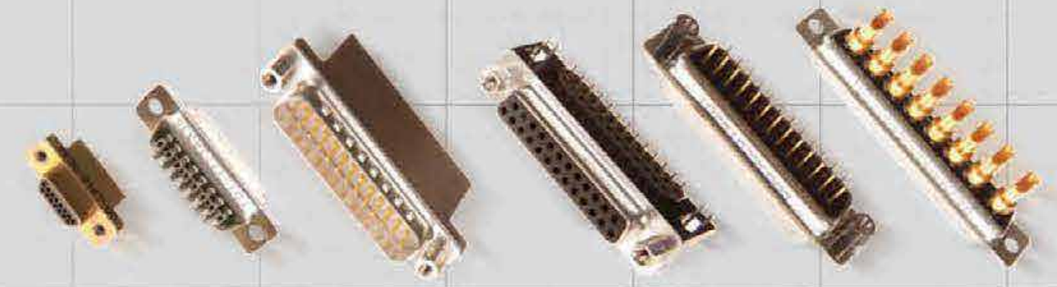
- Filter / Transient Protection D-SUB Connectors
- Filter / Transient Protection Circular Military Connectors
- Feed-Through Filters

Filter / Transient Protection D-SUB Connectors

Military & Commercial

An Innovative Technology of Frequency Filtering

Filter / Transient Protection D-SUB Connectors



ISO 9001:2008 IQC

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Company Profile

YOUR FIRST LINE OF DEFENSE

Established in 2002 as a privately owned company, RF Immunity specializes in design and manufacturing of **EMI/RFI Filtered connectors, Transient Protection, Hermetically Sealed and Customized connectors.** Our products are based on highly advanced filtering technologies and techniques. RF Immunity's miniaturized products are renowned for their quality and performance under extreme environmental conditions.

We've worked hard to achieve and maintain a world-class reputation for the highest level of excellence in quality, on time delivery and customer service that will always exceed the expectations of our customers, to the extent that we collaborate with customers at the earliest stages of design with comprehensive consulting, diagnostic testing and manufacturing services to develop optimum EMI/RFI filtered Connector solutions.

Our unique capabilities allow us to pass on to our customers reduced cycle times and time to market costs. This enables RF Immunity to be a true one stop source from prototype through production of EMC solutions for various applications in major electronics markets such as military, avionic, medical, commercial and more.

RF Immunity Ltd. D-Sub Filtered Connectors

The D-Sub Filtered series feature high performance and optimal filtering solutions.

This series includes multi-filtering connectors, transient protection, ESD and/or EMP filters, etc. All these are integrated into the same shells and dimensions of the standard non-filtering D-Sub connectors.

An innovative EMC platform approach enables RF-Immunity Ltd. to implement Customized Mass Production Technology (CMPT).

CMPT provides the customers with the advantages of flexibility allowing them to use either “off the shelf” products or customized solutions.

These products enable systems to meet and exceed the requirements of the FCC P-15, IEC 1000, EN55022, ENG1000 Standards .

The filtered connectors are designed for integration in military, aerospace, industrial, computer, telecom and medical applications.

Each filtering module is integrated into the connector, keeping the connector outer form and size unchanged and preserving system Form, Fit and Function (F^3). The D-sub series connectors are offered in high quality standard and available for standard density, high density, Combo and in Adapters. Different types of pin arrangements available.

Description of the mechanical mounting accessories is included in this catalog.

The Advantages of the Innovative Filtering Technology Offered by RF Immunity Ltd.

- **Easy retrofit and upgrade**
  Our compact connectors are the same in dimensions as the corresponding unfiltered connectors. System space is not to be concerned about allowing for easy retrofit and upgrade.
- **Design flexibility**
  Our advanced design technologies enable the introduction of a complete selection of both electrical and mechanical solutions, while extensive knowledge allows us to offer design and production of filtered versions of most connector types.
- **Reduced cost and lead times**
  With most standard contact arrangement designs, we can reduce the procurement costs and minimize the tooling expenses, down to zero. Moreover, we offer small quantities and prototypes.
- **Weight and space saving**
  As the filtering elements are placed within the connectors, functional PCB area is kept minimal. Weight is saved compared to the standard configuration of a connector and separate discreet filtering components.
- **Custom designs**
  We cater to various custom designs which call for specific filtering, transient protection, sealing, etc.

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Engineering and Filter Technology

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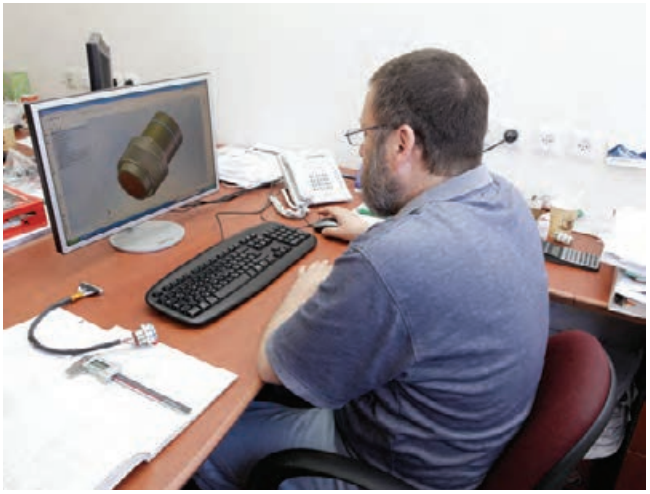
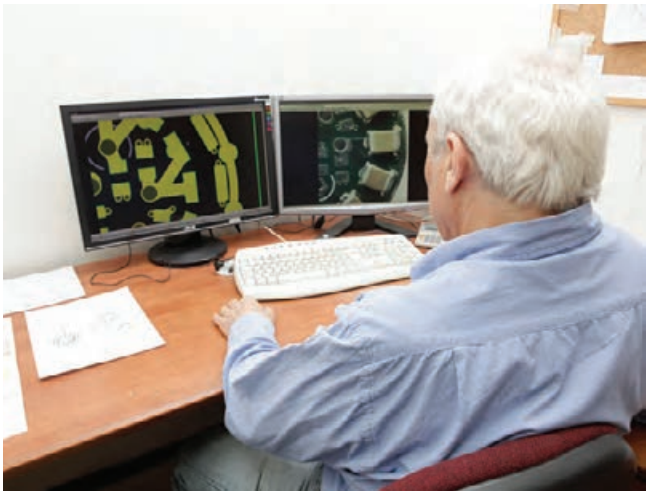
RF Immunity is fully committed to developing and delivering best–of–breed filtered connectors. During its first decade, the company focused on developing unique advantages to create a strong market impact. We spent much time and effort in designing flexible solutions that are ideally suited to customer requirements.
Our technology assures short delivery times, design flexibility and market advantages.

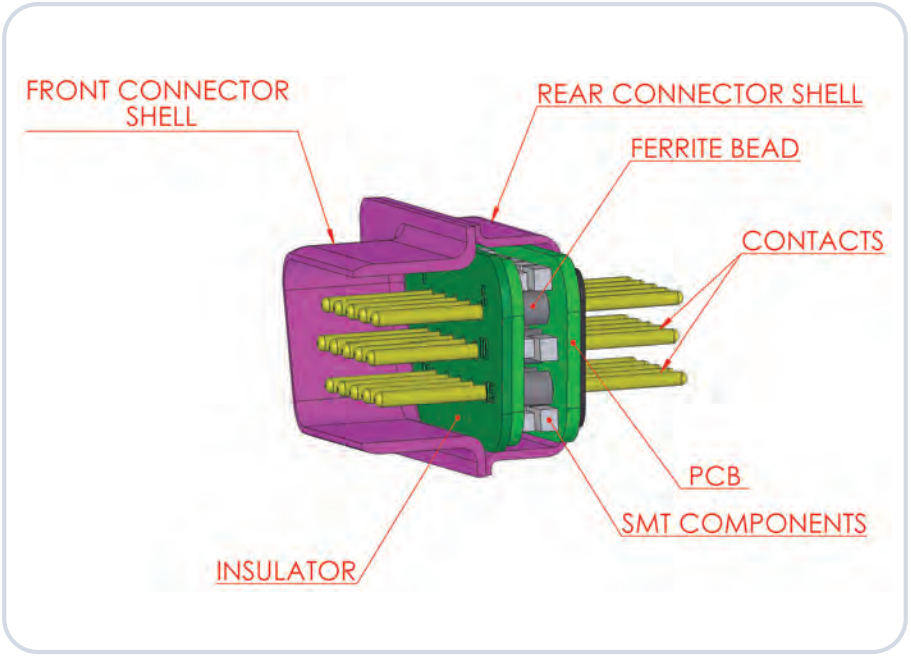
RF Immunity has a strong and highly skilled engineering department to support requests for custom made connectors. Our proven experience relies on long years of practice working hand in hand with global markets of military and industrial applications by developing unique electrical and mechanical products. Our engineering department is equipped with professional state of the art developing software. These tools and knowledge enable us to provide creative and high quality solutions in short developing periods.

RF Immunity's main filtering technology is comprised of discrete component array on PCB / SMT (Surface Mount Technology).

This technology enables great flexibility ensuring unlimited and cost effective filtering designs. Most of our filtering components are off–the–shelf products that allow us to offer fast delivery of prototypes and serial quantities.







Testing

As part of our quality assurance managing procedure, each manufactured item at RF Immunity undergoes a number of in–depth electrical tests within the production process. These tests guarantee full compliance of the end product with the specification requirements, especially when addressing filter characteristics.

RF Immunity manufacturing plant has a laboratory, which is well–equipped to perform established and documented testing procedures. Each product is tested to confirm its compliance to the filter characteristics and the transient protection requirements as per the customer's specifications. Testing documentation is supplied to the end customer upon request.

We perform electrical characteristic inspections as follows:

- Capacitance, Inductance, IR, Conductivity and Resistance
- Common and Differential Mode Attenuation, Crosstalk in single ended and balanced lines (4-port network analyzer)
- TVS and MOV Clamping
- Burn-in

We perform mechanical and environmental inspections as follows:

- Temperature Cycling and Thermal Shock
- Humidity and Salt Spray
- Hermetic sealing test
- Durability
- Vibration and Shock

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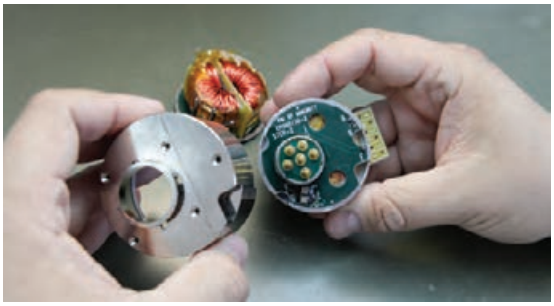
ISO 9001:2008 IQC Institute of Quality & Control Certified Quality Management System

Quality Assurance

"RF Immunity is aware that the products and solutions it produces are crucial to the correct function of the systems and equipment of our customers. Hence, we pay special attention to the quality and process inspection while constantly working towards the implementation of relevant improvements."

Regina Yoffe – Quality Manager.



The RF Immunity Quality Assurance.

We are committed to the full satisfaction of our customers and to meeting all the technical requirements. Meeting the highest level of standard defined quality is our company mission, and an ongoing improvement program has been deployed at all levels of the enterprise.
RF Immunity quality program is ISO 9001 certified and is applied in accordance with the STS(Ship to Stock) method quality program of prime customers.

All our products are subject to meticulous and tightly–controlled test procedures carried out with top–quality tools; from component acceptance inspection, through process control to final examination of the completed products.

RF immunity can supply under customer request RoHS comlaince filter connector. RF Immunity has been Implementing since July the 1st, 2006, the European Directives restrictions regarding environmental responsibilities for electrical and electronics equipment manufacturers.


IQC
Institute of Quality & Control

CERTIFICATE

This is to certify that the Quality Management System of

RF Immunity Ltd.

Was audited by IQC and found to be in compliance with the requirements of the standard:

ISO 9001:2008

This certificate is valid for the following scope of activities:

Development, Production & Marketing of Electronics Units, products for frequency filtering EMI/RFI, Cables and Harnesses

This certificate is valid until:

01.07.2017

Date of first approval:

01.07.2002

This certificate is subject to the continuing satisfactory operation of the Management System and periodic auditing by IQC

28.09.2014
Issue date

Dan Halperin, President

IAF

Institute of Quality & Control Ltd.

ISO 9001:2008 IQC Institute of Quality & Control Certified Quality Management System

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y standards is our company mission, and a continuous improvement program is employed in all the enterprise levels.
controlled test procedures carried out with top-quality tools - from component acceptance inspection, through process control to final exam

D-Sub STD Density

D-Sub High Density

D-Sub Adaptors

D-Sub COMBO (Mixed Layout)

D-Sub Hermetically Sealed

Micro D-Sub Miniature (MDM)

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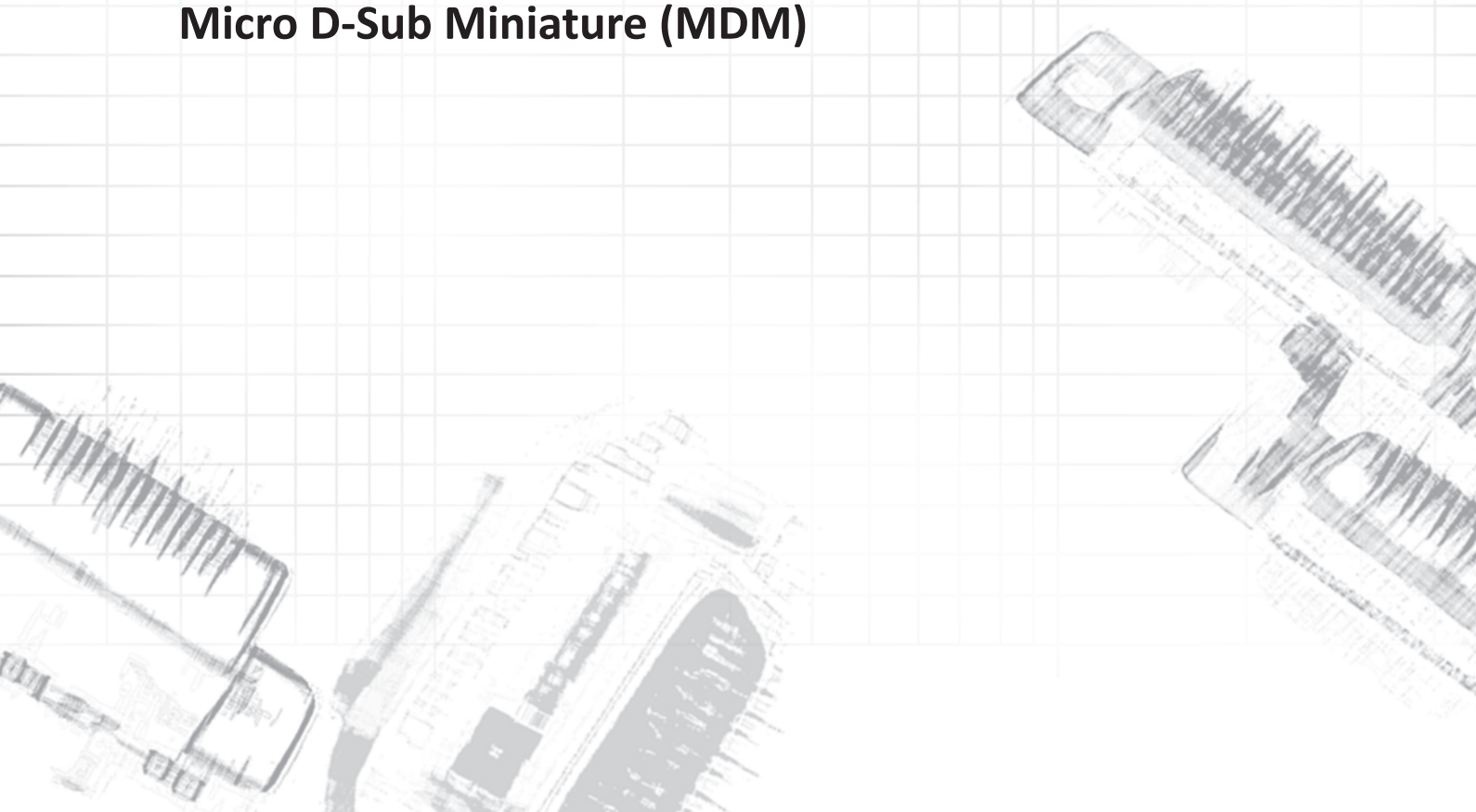

These connectors are qualified for Commercial or Military (per MIL-DTL-24308) grades and characterized by layouts of 9, 15, 25, 37 and 50 contacts of size 20. The maximum current rating of each contact is 7.5A.

Various configurations of embedded filters (C, CL, LC, Pi) and optional integration of protection are available. These are reliable low cost connectors with superior filter performance compared to discrete filters.

The filtered connectors are available either as Plug or Receptacle types with Straight or Right Angle (90º) configurations for PCB and Solder Cup termination styles. These filtered connectors are produced per known D-Sub connector standards and can readily replace the standard non-filtered connectors (Retro-Fit).

General Electrical Characteristics

	Commercial	Commercial RoHS	Meets MIL-DTL-24308	
Order Code (See pg 3)	A	C	B	D
Current Rating	7.5 A			
Insulation Resistance	5 GΩ or 50 ΩF (*)			

(*) – Whichever is less. For higher Insulation Resistance consult Sales

Material & Finish

	Commercial		Meets MIL-DTL-24308	
Order Code (See pg 3)	A	C	B	D
Shell	Steel, Lead Free Tin Plated		Steel, Tin-Lead Plated	Steel, Lead Free Tin Plated
Contacts	Brass/Copper alloy, Flash Gold over Nickel		Brass/Copper alloy, Gold over Nickel	
Insulator	PBT 30% Glass fibers reinforced, UL-94V-0		Thermoplastic/Thermoset per MIL-DTL-24308 or Glass Epoxy, UL94V-0	
Potting	Epoxy Cast			
Accessories	Brass/Steel Nickel plated or Stainless Steel passivated			

Environmental Conditions

	Commercial	Commercial RoHS	Meets MIL-DTL-24308	
Order Code (See pg 3)	A	C	B	D
Operating Temp.	-40 °C +105 °C		-55 °C +105 °C	
Storage Temp.	-40 °C +105 °C		-55 °C +105 °C	
Humidity	Up to 100%		Up to 100%	
Altitude	Not Applicable		40,000 ft	
Shock	40g X 6msec		40g X 6msec	
Vibration	20g RMS, 20-2000 Hz		20g RMS, 20-2000 Hz	
Endurance	200 Cycles		More than 500 Cycles	

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How To Order

SD 09 A 01 C U 10 PF10

D-Sub STD Density

CONTACT ARRANGEMENTS: See page 4

09,15,25,37,50

CLASS: See page 2

A - Commercial
B - Meets MIL-DTL-24308 - Tin-Lead Shell Plating
C - Commercial, RoHS compliance
D - Meets MIL-DTL-24308 - Tin Shell Plating
S - Other Finish option

CONTACT TYPES & CONFIGURATION

See pages 5-15

ACCESSORIES

See pages 37-40

ACCESSORIES STANDARD

A - Without Accessories (choose when the "No Accessories" option was chosen at previous field)
M - Metric
U - Inch

WORKING VOLTAGE: See page 45

01	6.3V	**07**	200V	**14**	800V	**00** - For filters with diversified voltages
02	10V	**08**	250V	**15**	1000V	**99** - For any configuration that incorporates transient protection
03	16V	**09**	300V			
04	25V	**10**	400V			
05	50V	**11**	500V			
06	100V	**12**	600V			

FILTER CODE AND/OR TRANSIENT PROTECTION CODE: See page 45

xxxx - In case where a custom protection is required (diversity of filter types and/or transient protection types) fill XXXX.
Contact sales for customizing.

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Contact Arrangements

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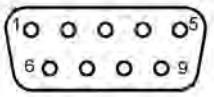
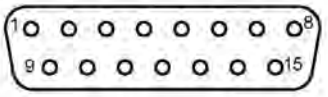
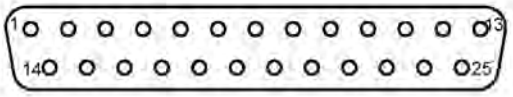
9 Contacts
Order Code 09
Shell Size 1



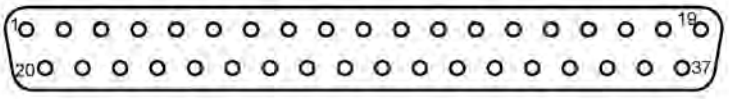
15 Contacts
Order Code 15
Shell Size 2



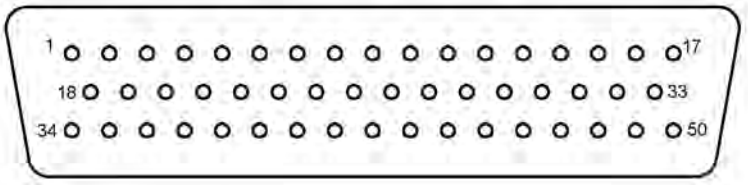
25 Contacts
Order Code 25
Shell Size 3



37 Contacts
Order Code 37
Shell Size 4



50 Contacts
Order Code 50
Shell Size 5



For all arrangements – Contacts size 20AWG

* Front face of Pin insert is shown. Socket insert is opposite.

Contact Types

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Pin Contact

Code	Termination Style	Filter Type	Description	Commercial Code A	MIL Code B	Page
01	Straight PCB	C	Stamp, Flash Gold, selective Tin pl.	+		6
02	Straight PCB	All types	Machined, Flash Gold pl.	+		6
03	Straight PCB	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+	+	6
11	Solder Cup	C	Stamp, Flash Gold, selective Tin pl.	+		8
12	Solder Cup	C	Machined, Flash Gold pl.	+		8
13	Solder Cup	All types	Machined, Flash Gold, Selective Tin pl.	+		8
14	Solder Cup	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold, Selective Tin pl.	+	+	8
15	Solder Cup	C	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+	+	8
23	Wire Wrap	C	Machined, Flash Gold, Selective Tin pl.	+		10
25	R/A PCB 9.4/2.84	All types	Machined, Flash Gold pl.	+		12
26	R/A PCB 9.4/2.84	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+	+	12
39	R/A PCB 7.2/2.84	All types	Machined, Flash Gold pl.	+		14
40	R/A PCB 7.2/2.84	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+	+	14
PO	Special*					

Socket Contact

Code	Termination Style	Filter Type	Description	Commercial Code A	MIL Code B	Page
05	Straight PCB	C	Stamp, Flash Gold, selective Tin pl.	+		7
06	Straight PCB	All types	Machined, Flash Gold pl.	+		7
07	Straight PCB	All types	Machined, Flash Gold, Selective Tin pl.	+		7
09	Straight PCB	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+	+	7
17	Solder Cup	C	Stamp, Flash Gold, selective Tin pl.	+		9
18	Solder Cup	C	Machined, Flash Gold pl.	+		9
19	Solder Cup	All types	Machined, Flash Gold, Selective Tin pl.	+		9
20	Solder Cup	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold, Selective Tin pl.	+	+	9
21	Solder Cup	C	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+	+	9
24	Wire Wrap	C	Machined, Flash Gold, selective Tin pl.	+		11
29	R/A PCB 9.4/2.84	All types	Machined, Flash Gold pl.	+		13
30	R/A PCB 9.4/2.84	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+		13
43	R/A PCB 7.2/2.84	All types	Machined, Flash Gold pl.	+		15
44	R/A PCB 7.2/2.84	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+		15
SO	Special*					

* Contact Sales for customizing.
* Note - Solder Cup termination is applicable for wire 20 & 22 AWG.

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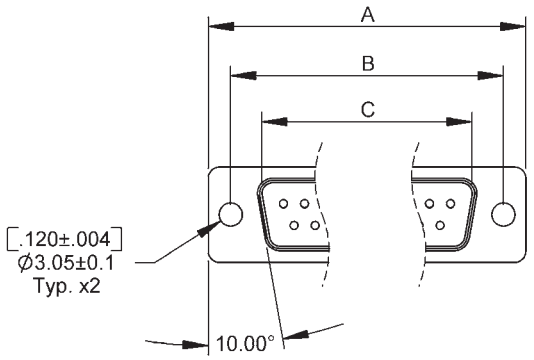
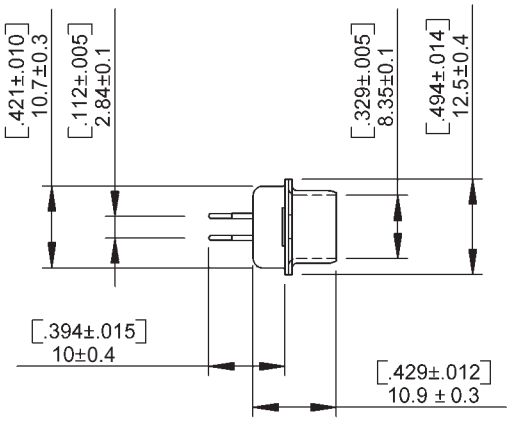
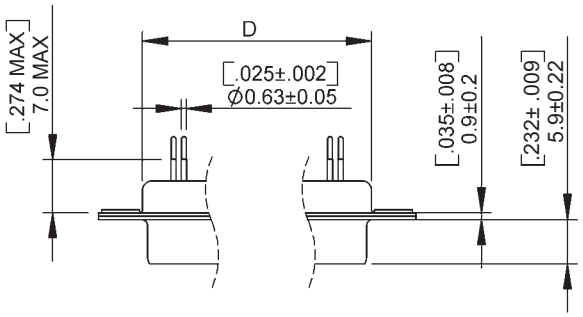
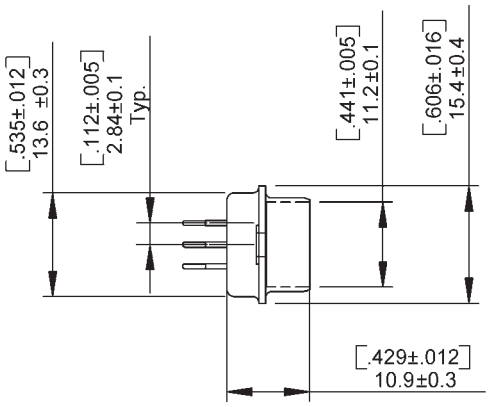
Pin Contact Straight PCB Termination

Contact type and finish: Code Number 01 - 03









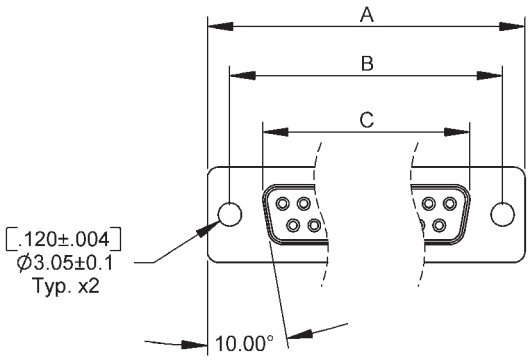
50 contact view

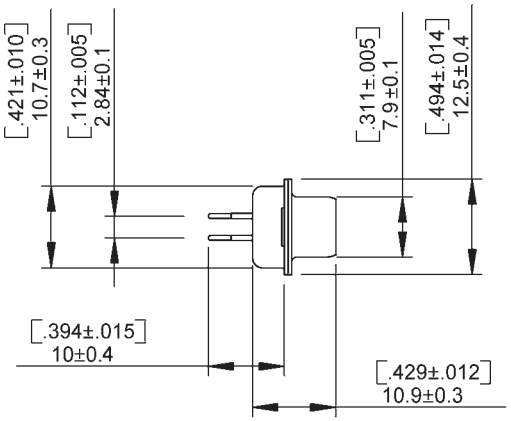
Shell Size	Number of Contacts	A ±0.4 [±.015]	B ±0.1 [±.005]	C ±0.13 [±.005]	D ±0.3 [±.010]
1	9	30.8 [1.213]	25.0 [.984]	16.9 [.666]	19.3 [.759]
2	15	39.1 [1.541]	33.3 [1.312]	25.25 [.994]	27.5 [1.083]
3	25	53.0 [2.088]	47.0 [1.852]	39.0 [1.534]	41.3 [1.625]
4	37	69.3 [2.729]	63.5 [2.500]	55.4 [2.182]	57.7 [2.272]
5	50	66.9 [2.640]	61.1 [2.405]	52.8 [2.079]	55.3 [2.178]

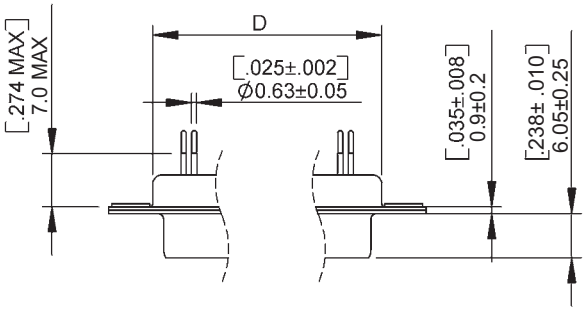
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

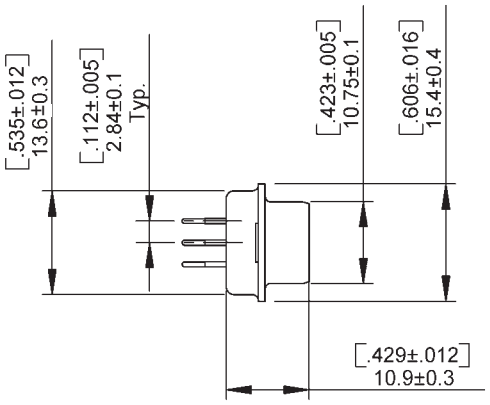
Socket Contact Straight PCB Termination

Contact type and finish: Code Number 05 - 09









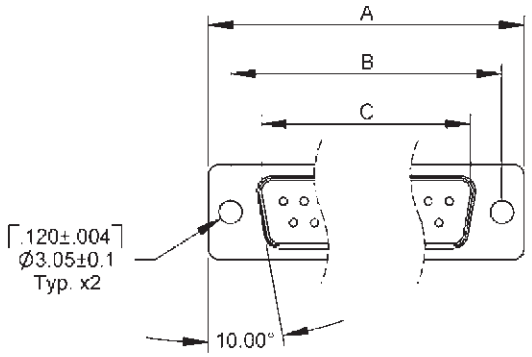
50 contact view

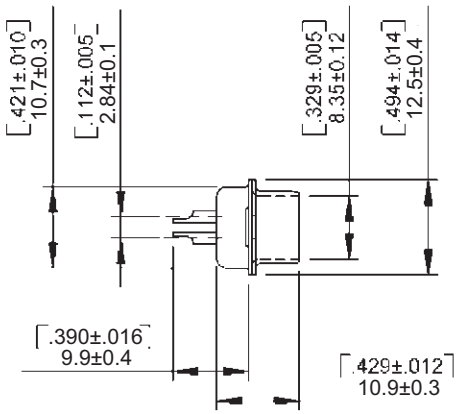
Shell Size	Number of Contacts	A ±0.4 [±.015]	B ±0.1 [±.005]	C ±0.13 [±.005]	D ±0.3 [±.010]
1	9	30.8 [1.213]	25.0 [.984]	16.3 [.643]	19.3 [.759]
2	15	39.1 [1.541]	33.3 [1.312]	24.7 [.971]	27.5 [1.083]
3	25	53.0 [2.088]	47.0 [1.852]	38.4 [1.511]	41.3 [1.625]
4	37	69.3 [2.729]	63.5 [2.500]	54.8 [2.159]	57.7 [2.272]
5	50	66.9 [2.640]	61.1 [2.405]	52.4 [2.064]	55.3 [2.178]

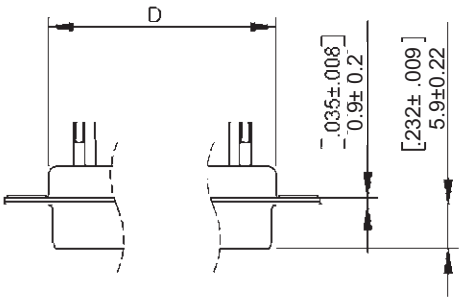
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

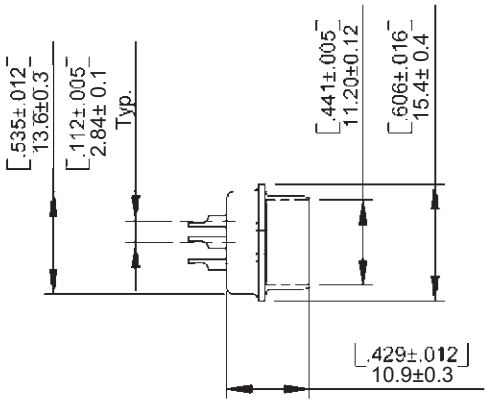
Pin Contact Solder Cup Termination

Contact type and finish: Code Number 11 - 15









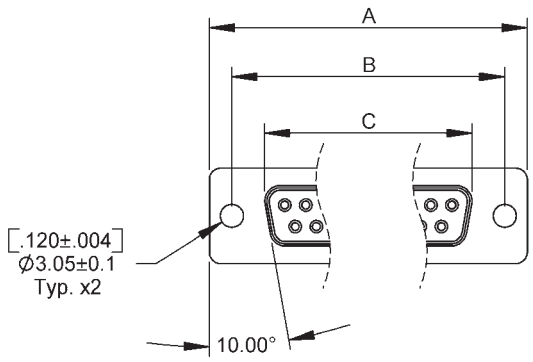
50 contact view

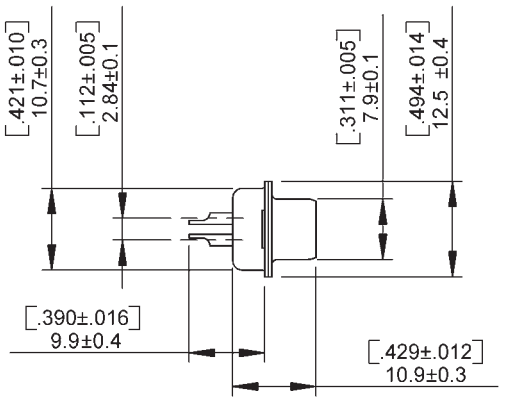
Shell Size	Number of Contacts	A ±0.4 [±.015]	B ±0.1 [±.005]	C ±0.13 [±.005]	D ±0.3 [±.010]
1	9	30.8 [1.213]	25.0 [.984]	16.9 [.666]	19.3 [.759]
2	15	39.1 [1.541]	33.3 [1.312]	25.25 [.994]	27.5 [1.083]
3	25	53.0 [2.088]	47.0 [1.852]	39.0 [1.534]	41.3 [1.625]
4	37	69.3 [2.729]	63.5 [2.500]	55.4 [2.182]	57.7 [2.272]
5	50	66.9 [2.640]	61.1 [2.405]	52.8 [2.079]	55.3 [2.178]

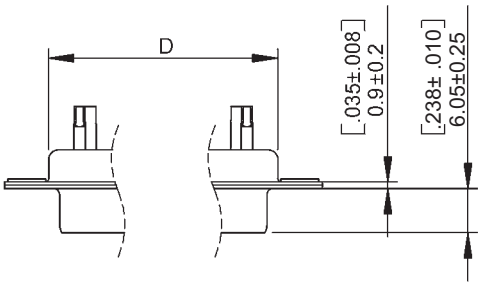
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

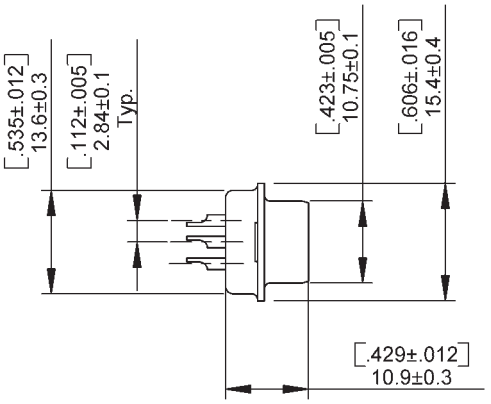
Socket Contact Solder Cup Termination

Contact type and finish: Code Number 17 - 21









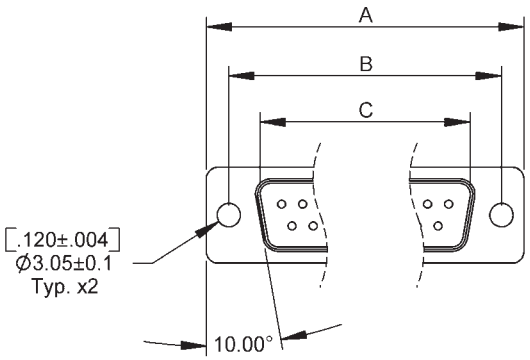
50 contact view

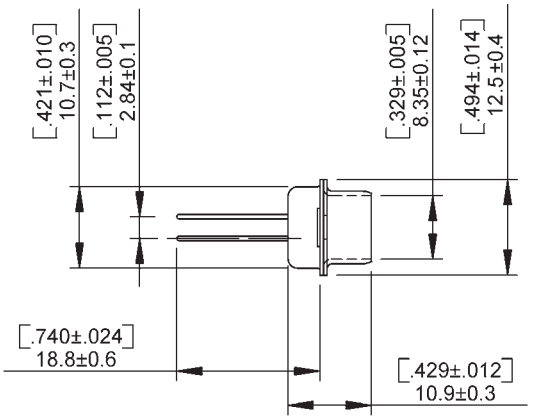
Shell Size	Number of Contacts	A ±0.4 [±.015]	B ±0.1 [±.005]	C ±0.13 [±.005]	D ±0.3 [±.010]
1	9	30.8 [1.213]	25.0 [.984]	16.3 [.643]	19.3 [.759]
2	15	39.1 [1.541]	33.3 [1.312]	24.7 [.971]	27.5 [1.083]
3	25	53.0 [2.088]	47.0 [1.852]	38.4 [1.511]	41.3 [1.625]
4	37	69.3 [2.729]	63.5 [2.500]	54.8 [2.159]	57.7 [2.272]
5	50	66.9 [2.640]	61.1 [2.405]	52.4 [2.064]	55.3 [2.178]

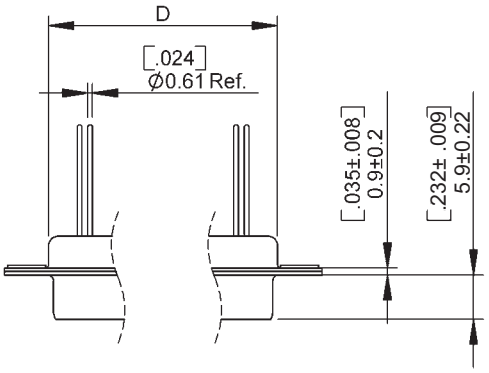
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

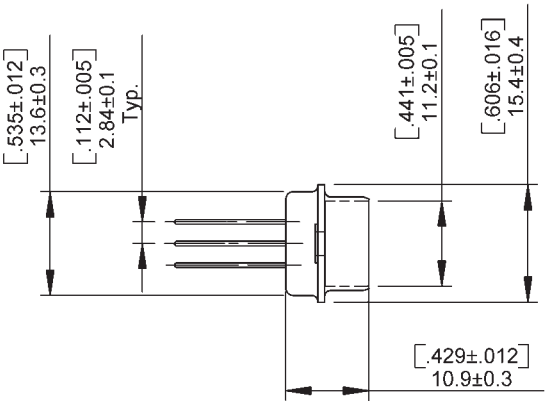
Pin Contact Wire Wrap Termination

Contact type and finish: Code Number 23









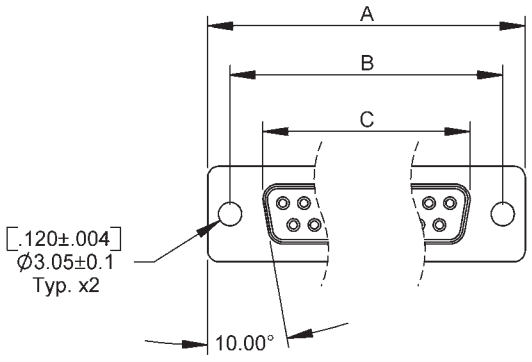
50 contact view

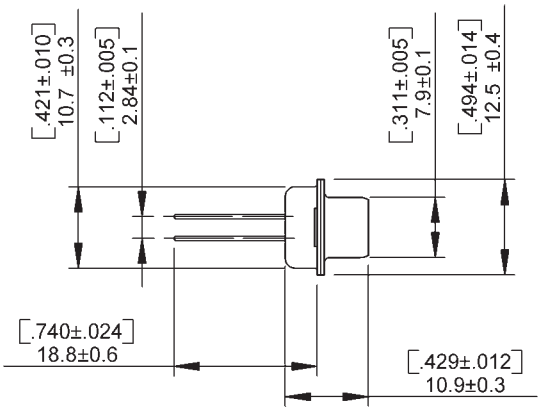
Shell Size	Number of Contacts	A ±0.4 [±.015]	B ±0.1 [±.005]	C ±0.13 [±.005]	D ±0.3 [±.010]
1	9	30.8 [1.213]	25.0 [.984]	16.9 [.666]	19.3 [.759]
2	15	39.1 [1.541]	33.3 [1.312]	25.25 [.994]	27.5 [1.083]
3	25	53.0 [2.088]	47.0 [1.852]	39.0 [1.534]	41.3 [1.625]
4	37	69.3 [2.729]	63.5 [2.500]	55.4 [2.182]	57.7 [2.272]
5	50	66.9 [2.640]	61.1 [2.405]	52.8 [2.079]	55.3 [2.178]

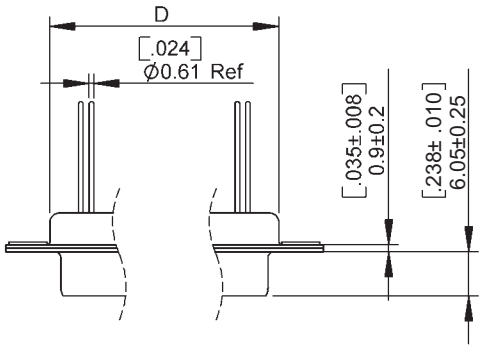
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

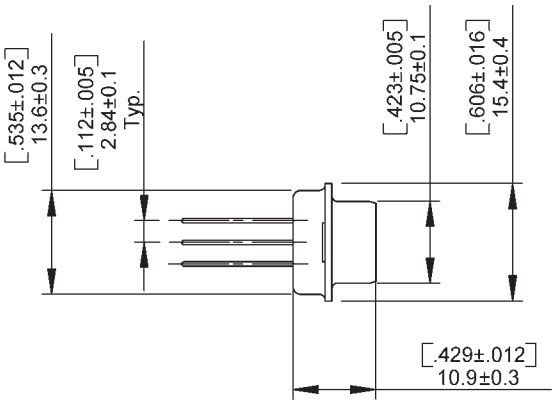
Socket Contact Wire Wrap Termination

Contact type and finish: Code Number 24









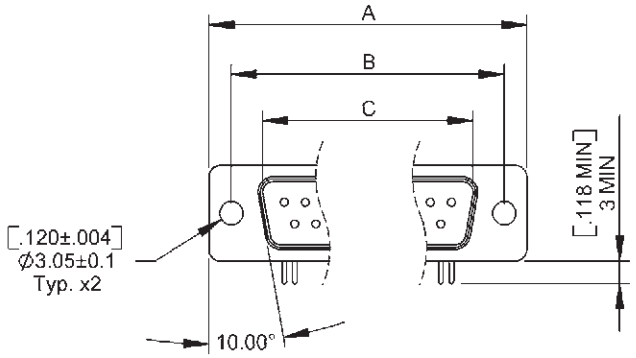
50 contact view

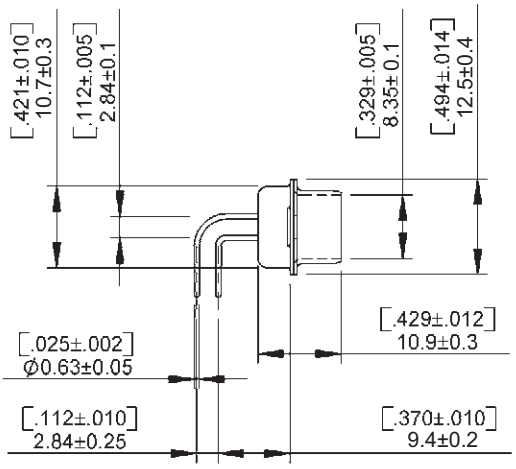
Shell Size	Number of Contacts	A ±0.4 [±.015]	B ±0.1 [±.005]	C ±0.13 [±.005]	D ±0.3 [±.010]
1	9	30.8 [1.213]	25.0 [.984]	16.3 [.643]	19.3 [.759]
2	15	39.1 [1.541]	33.3 [1.312]	24.7 [.971]	27.5 [1.083]
3	25	53.0 [2.088]	47.0 [1.852]	38.4 [1.511]	41.3 [1.625]
4	37	69.3 [2.729]	63.5 [2.500]	54.8 [2.159]	57.7 [2.272]
5	50	66.9 [2.640]	61.1 [2.405]	52.4 [2.064]	55.3 [2.178]

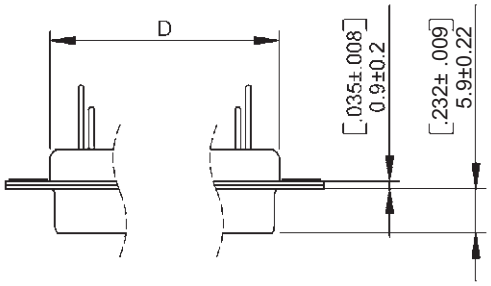
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

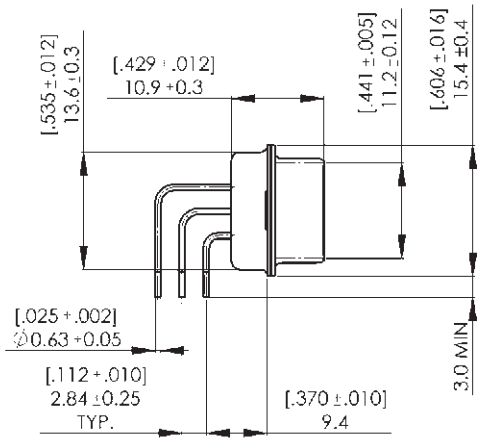
Pin Contact Right Angle PCB Termination

FP: 9.4 [.370]. Pitch 2.84 [.112]
Contact type and finish: Code Number 25-26









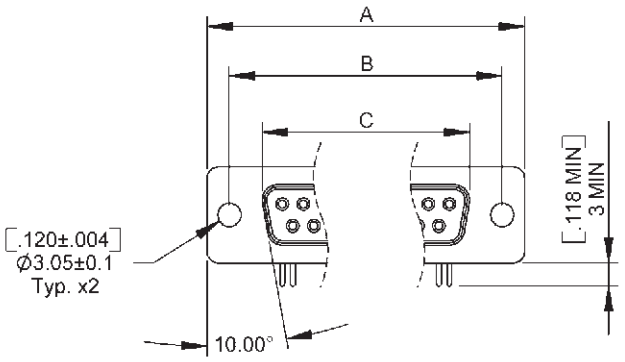
50 contact view

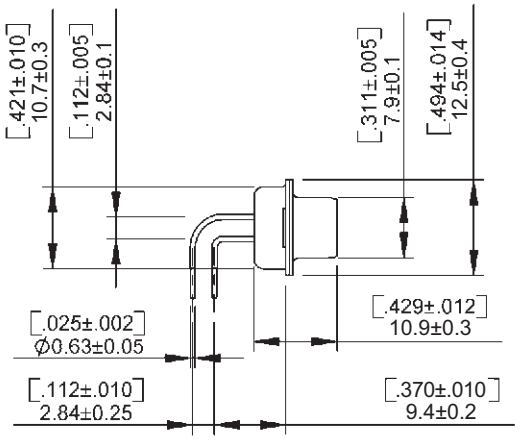
Shell Size	Number of Contacts	A ±0.4 [±.015]	B ±0.1 [±.005]	C ±0.13 [±.005]	D ±0.3 [±.010]
1	9	30.8 [1.213]	25.0 [.984]	16.9 [.666]	19.3 [.759]
2	15	39.1 [1.541]	33.3 [1.312]	25.25 [.994]	27.5 [1.083]
3	25	53.0 [2.088]	47.0 [1.852]	39.0 [1.534]	41.3 [1.625]
4	37	69.3 [2.729]	63.5 [2.500]	55.4 [2.182]	57.7 [2.272]
5	50	66.9 [2.640]	61.1 [2.405]	52.8 [2.079]	55.3 [2.178]

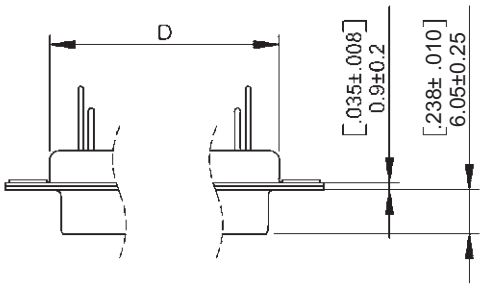
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

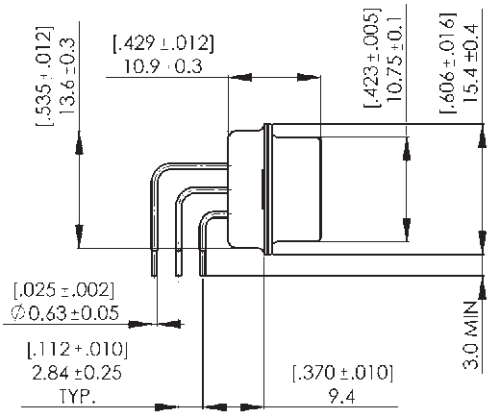
Socket Contact Right Angle PCB Termination

FP: 9.4 [.370]. Pitch 2.84 [.112]
Contact type and finish: Code Number 29-30









50 contact view

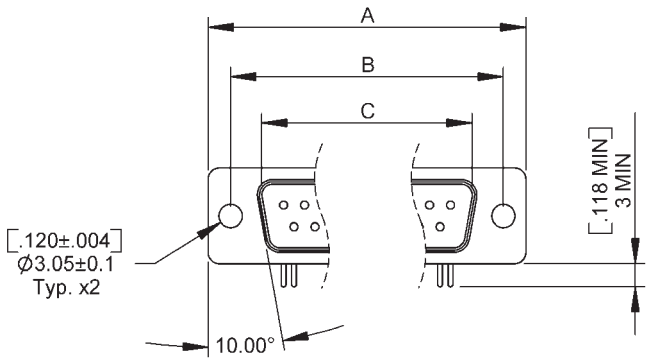
Shell Size	Number of Contacts	A ±0.4 [±.015]	B ±0.1 [±.005]	C ±0.13 [±.005]	D ±0.3 [±.010]
1	9	30.8 [1.213]	25.0 [.984]	16.3 [.643]	19.3 [.759]
2	15	39.1 [1.541]	33.3 [1.312]	24.7 [.971]	27.5 [1.083]
3	25	53.0 [2.088]	47.0 [1.852]	38.4 [1.511]	41.3 [1.625]
4	37	69.3 [2.729]	63.5 [2.500]	54.8 [2.159]	57.7 [2.272]
5	50	66.9 [2.640]	61.1 [2.405]	52.4 [2.064]	55.3 [2.178]

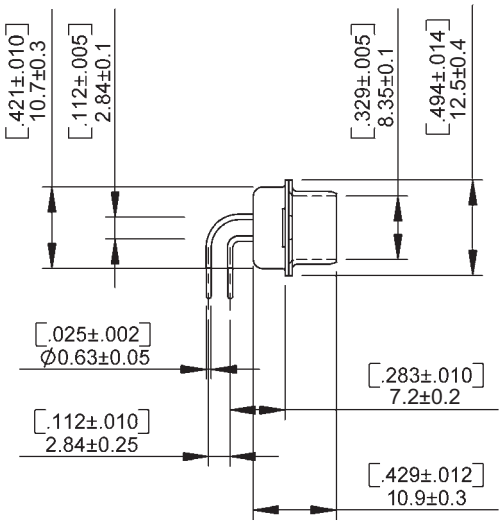
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

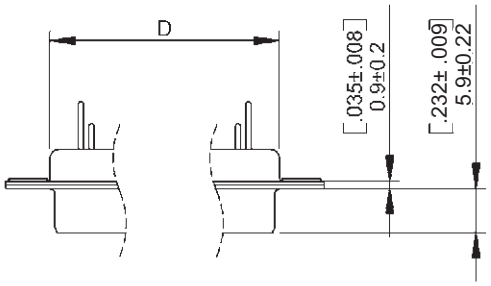
ELEKTRONIK s.r.o.

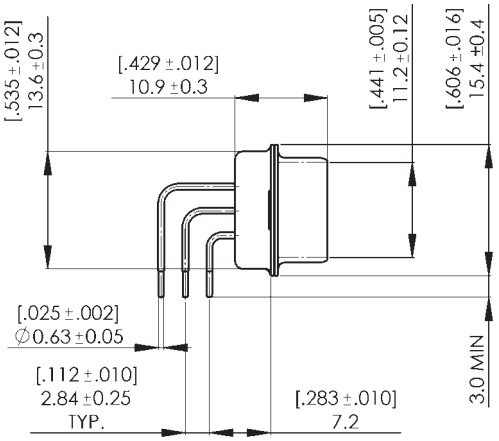
Pin Contact Right Angle PCB Termination

FP: 7.2[.283]. Pitch 2.84 [.112]
Contact type and finish: Code Number 39-40









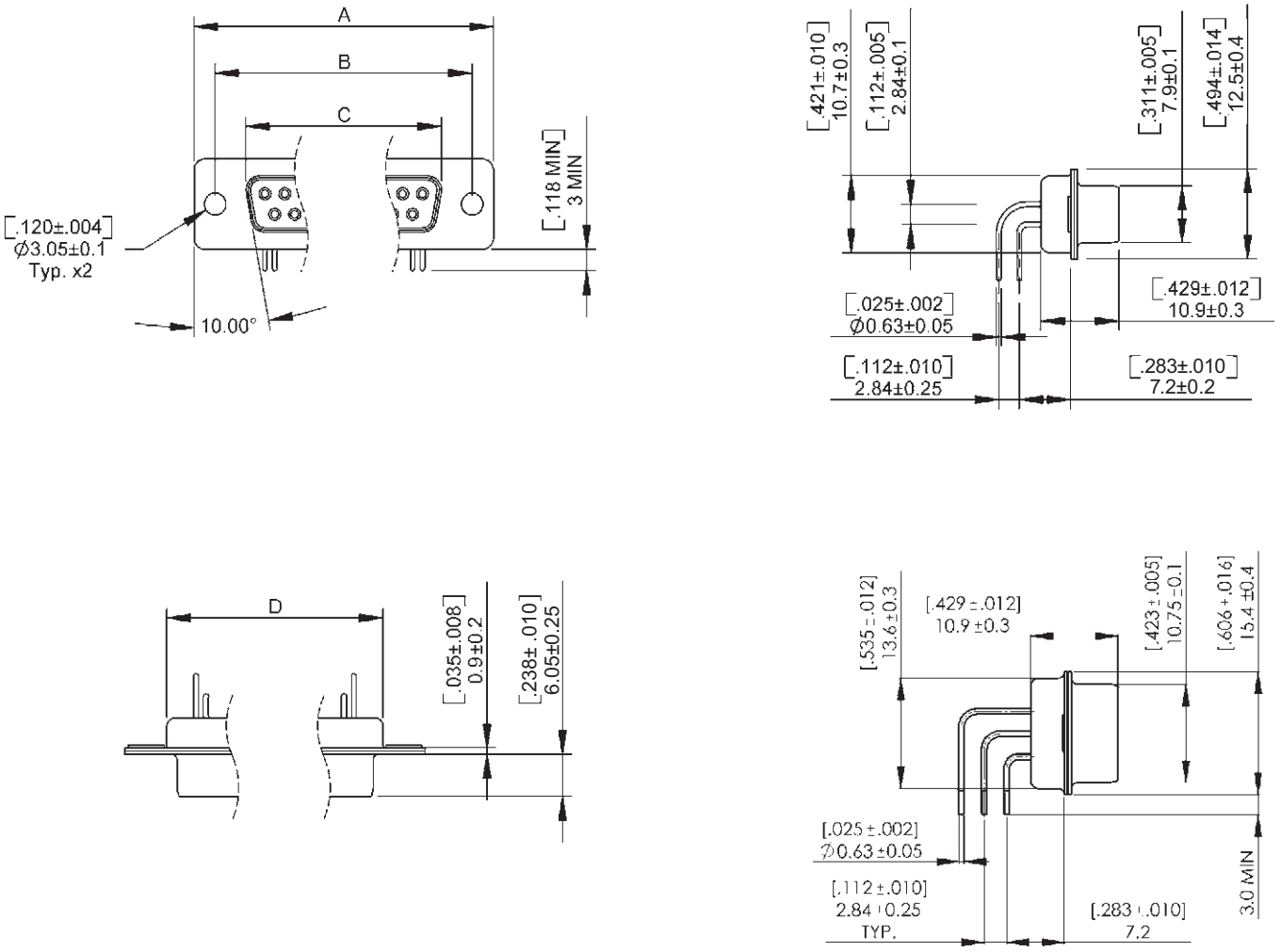
50 contact view

Shell Size	Number of Contacts	A ±0.4 [±.015]	B ±0.1 [±.005]	C ±0.13 [±.005]	D ±0.3 [±.010]
1	9	30.8 [1.213]	25.0 [.984]	16.9 [.666]	19.3 [.759]
2	15	39.1 [1.541]	33.3 [1.312]	25.25 [.994]	27.5 [1.083]
3	25	53.0 [2.088]	47.0 [1.852]	39.0 [1.534]	41.3 [1.625]
4	37	69.3 [2.729]	63.5 [2.500]	55.4 [2.182]	57.7 [2.272]
5	50	66.9 [2.640]	61.1 [2.405]	52.8 [2.079]	55.3 [2.178]

* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

Socket Contact Right Angle PCB Termination

FP: 7.2[.283]. Pitch 2.84 [.112]
Contact type and finish: Code Number 42-44

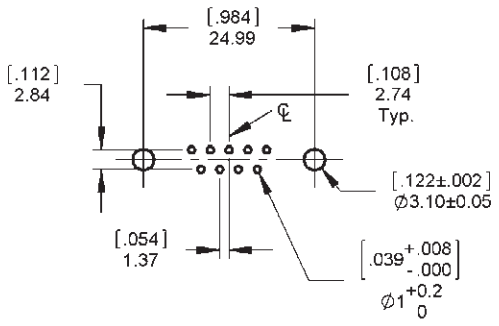


50 contact view

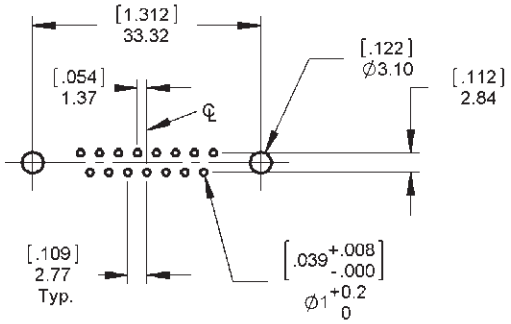
Shell Size	Number of Contacts	A ±0.4 [±.015]	B ±0.1 [±.005]	C ±0.13 [±.005]	D ±0.3 [±.010]
1	9	30.8 [1.213]	25.0 [.984]	16.3 [.643]	19.3 [.759]
2	15	39.1 [1.541]	33.3 [1.312]	24.7 [.971]	27.5 [1.083]
3	25	53.0 [2.088]	47.0 [1.852]	38.4 [1.511]	41.3 [1.625]
4	37	69.3 [2.729]	63.5 [2.500]	54.8 [2.159]	57.7 [2.272]
5	50	66.9 [2.640]	61.1 [2.405]	52.4 [2.064]	55.3 [2.178]

* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

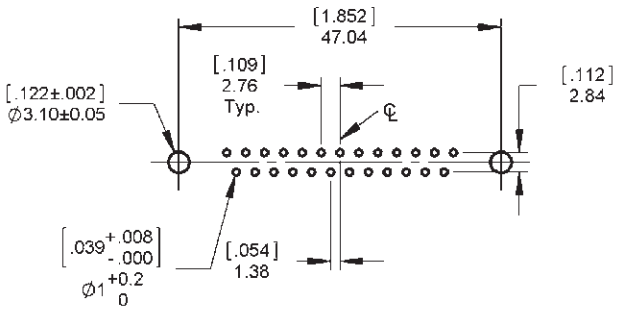
Board Drilling - Straight & R/A PCB Terminations



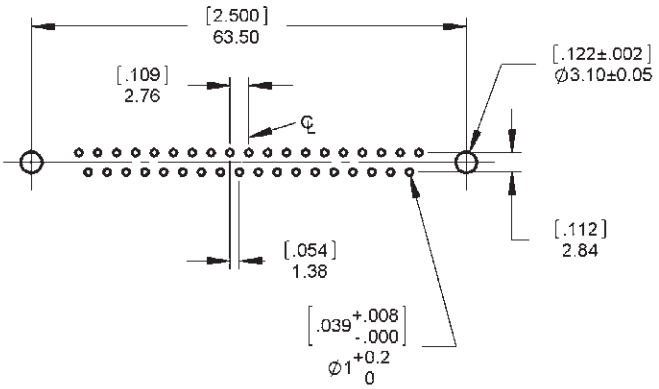
SHELL SIZE : 1
No. OF CONTACTS : 9



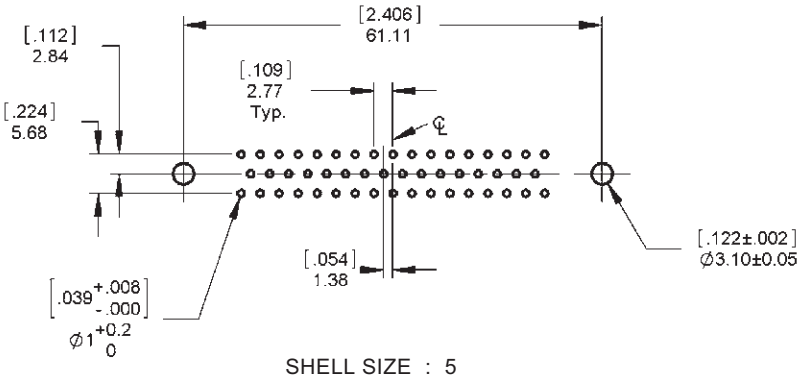
SHELL SIZE : 2
No. OF CONTACTS : 15



SHELL SIZE : 3
No. OF CONTACTS : 25

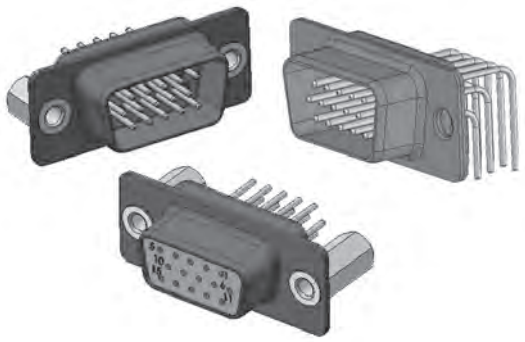


SHELL SIZE : 4
No. OF CONTACTS : 37



SHELL SIZE : 5
No. OF CONTACTS : 50

* View of Male (Plug) connector assembly side. For Female (Receptacle) is opposite.
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.



These connectors are qualified to for Commercial or Military (per MIL-DTL-24308) grades and characterized by layouts of 15, 26, 44, 62 and 78 contacts of size 22 spaced by higher density (compared to STD Density), allowing the incorporation of larger quantity of contacts in a standard D-Sub connector shells. The maximum current rating of contact is 5A and the accepted wire sizes are of 24 to 22 AWG.

Various configurations of embedded filters (C, CL, LC, Pi) and optional integration of protection are available.
The High Density filtered connectors are available either as Plug or Receptacle types with Straight or Right Angle (90°) configurations for PCB and Solder Cup termination styles.

These filtered connectors are produced per known D-Sub connector standards and can readily replace the standard non-filtered connectors (Retro-Fit).

General Electrical Characteristics

	Commercial	Commercial RoHS	Meets MIL-DTL-24308	
Order Code (See pg 18)	A	C	B	D
Current Rating	5 A			
Insulation Resistance	5 GΩ or 50 ΩF (*)			

(*) – Whichever is less. For higher Insulation Resistance consult Sales

Material & Finish

	Commercial	Commercial RoHS	Meets MIL-DTL-24308	
Order Code (See pg 18)	A	C	B	D
Shell	Steel, Lead Free Tin Plated		Steel, Tin-Lead Plated	Steel, Lead Free Tin Plated
Contacts	Brass/Copper alloy, Flash Gold over Nickel		Brass/Copper alloy, Gold over Nickel	
Insulator	PBT 30% Glass fibers reinforced, UL-94V-0		Thermoplastic/Thermoset per MIL-DTL-24308 or Glass Epoxy, UL94V-0	
Potting	Epoxy Cast			
Accessories	Brass/Steel Nickel plated or Stainless Steel passivated			

Environmental Conditions

	Commercial	Commercial RoHS	Meets MIL-DTL-24308	
Order Code (See pg 18)	A	C	B	D
Operating Temp.	-40 °C +105 °C		-55 °C +105 °C	
Storage Temp.	-40 °C +105 °C		-55 °C +105 °C	
Humidity	Up to 100%		Up to 100%	
Altitude	Not Applicable		40,000 ft	
Shock	40g X 6msec		40g X 6msec	
Vibration	20g RMS, 20-2000 Hz		20g RMS, 20-2000 Hz	
Endurance	200 Cycles		More than 500 Cycles	

Content of Section

	Page
General Characteristics (Electrical, Materials, Environmental)	17
How to order	18
Contact Arrangements	19
Contact Types	20
Mechanical Characteristics	21
Board Drilling	24

How To Order

HD 15 A 01 C U 07 PF10

D-Sub High Density

CONTACT ARRANGEMENTS: See page 19

15,26,44,62,78

CLASS: See page 17

A - Commercial
B - Meets MIL-DTL-24308 - Tin-Lead Shell Plating
C - Commercial, RoHS compliance
D - Meets MIL-DTL-24308 - Tin Shell Plating
S - Other Finish option

CONTACT TYPES & CONFIGURATION

See pages 20-23

ACCESSORIES

See pages 37-40

ACCESSORIES STANDARD

A - Without Accessories (choose when the "No Accessories" option was chosen at previous field)
M - Metric
U - Inch

WORKING VOLTAGE: See page 45

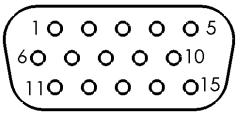
01	6.3V	**07**	200V	**00** - For filters with diversified voltages
02	10V	**08**	250V	**99** - For any configuration that incorporates transient protection
03	16V			
04	25V			
05	50V			
06	100V			

FILTER CODE AND\OR TRANSIENT PROTECTION CODE: See page 45

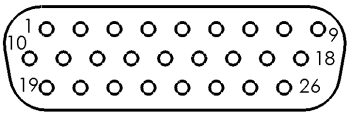
xxxx - In case where a custom protection is required (diversity of filter types and\or transient protection types) fill XXXX.
Contact sales for customizing.

Contact Arrangements

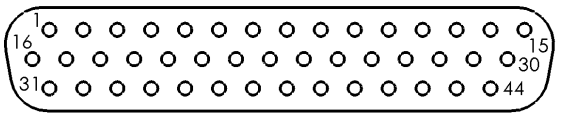
15 Contacts
Order Code 15
Shell Size 1



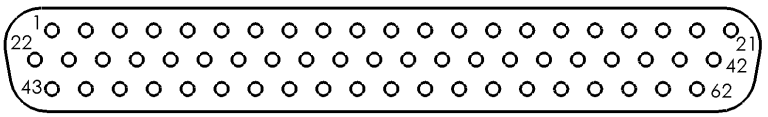
26 Contacts
Order Code 26
Shell Size 2



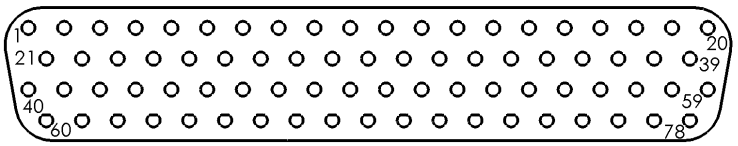
44 Contacts
Order Code 44
Shell Size 3



62 Contacts
Order Code 62
Shell Size 4



78 Contacts
Order Code 78
Shell Size 5



For all arrangements – Contacts size 22AWG

* Front face of Pin insert is shown. Socket insert is opposite.

Contact Types

Pin Contact

Code	Termination Style	Filter Type	Description	Commercial Code A	MIL Code B	Page
41	Straight PCB	All types	Machined, Flash Gold pl.	+		21
42	Straight PCB	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+	+	21
43	Solder Cup	All types	Machined, Flash Gold, Selective Tin pl.	+		21
44	Solder Cup	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+	+	21
45	R/A PCB 8.9/2.54	All types	Machined, Flash Gold pl.	+		23
46	R/A PCB 8.9/2.54	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+	+	23
PO	Special *					

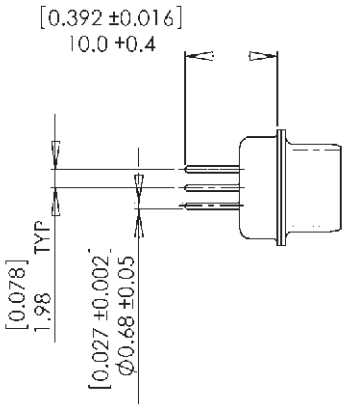
Socket Contact

Code	Termination Style	Filter Type	Description	Commercial Code A	MIL Code B	Page
51	Straight PCB	All types	Machined, Flash Gold pl.	+		22
52	Straight PCB	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+	+	22
53	Solder Cup	All types	Machined, Flash Gold, Selective Tin pl.	+		22
54	Solder Cup	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+	+	22
55	R/A PCB 8.9/2.54	All types	Machined, Flash Gold pl.	+		23
56	R/A PCB 8.9/2.54	All types	Machined, 0.8÷1.3µm (30-50 µInch) Gold pl.	+	+	23
SO	Special *					

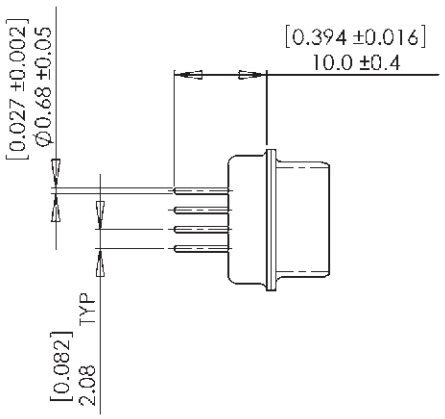
* Contact Sales for customizing.
* Note - Solder Cup termination is for wire 22 AWG.

Pin Contact - Straight PCB Termination

Contact type and finish Code Number: 41-42



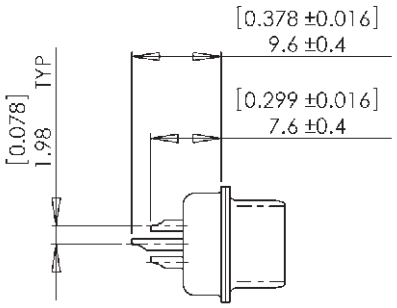
Contact layout	15	26	44	62
Shell size	1	2	3	4



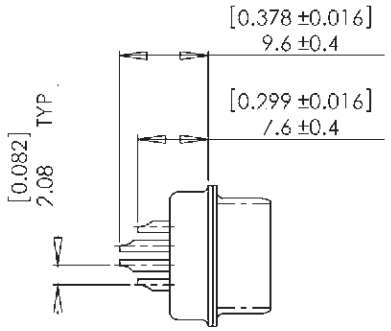
Contact layout	78
Shell size	5

Pin Contact -Solder Cup Termination

Contact type and finish Code Number: 43-44



Contact layout	15	26	44	62
Shell size	1	2	3	4



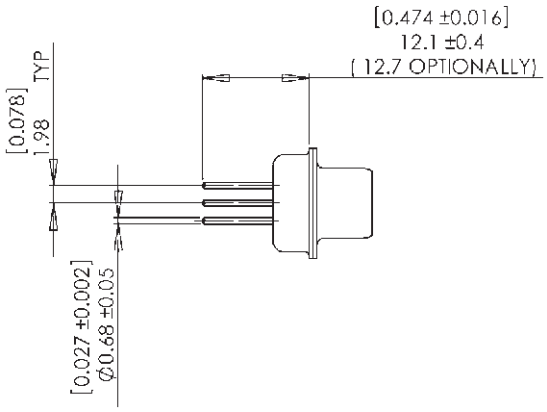
Contact layout	78
Shell size	5

*** Other mechanical dimensions are similar with standard density connectors. See page 6.**

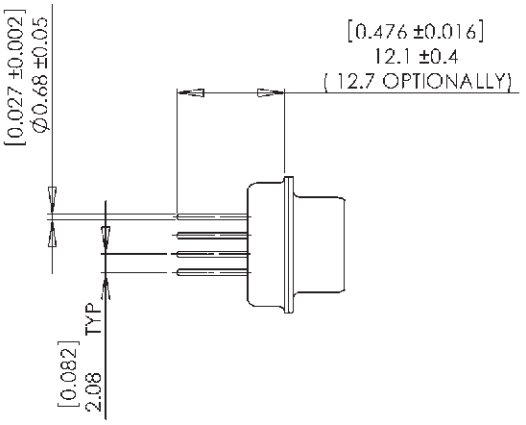
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

Socket Contact -Straight PCB Termination

Contact type and finish Code Number: 51-52



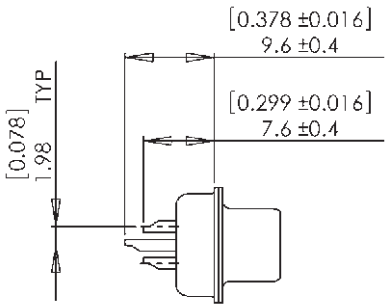
Contact layout	15	26	44	62
Shell size	1	2	3	4



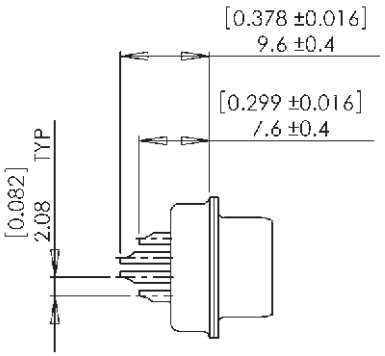
Contact layout	78
Shell size	5

Socket Contact -Solder Cup Termination

Contact type and finish Code Number:53-54



Contact layout	15	26	44	62
Shell size	1	2	3	4



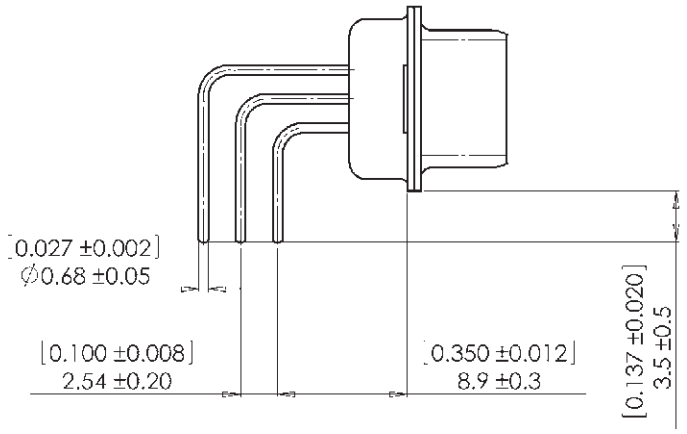
Contact layout	78
Shell size	5

*** Other mechanical dimensions are similar with standard density connectors. See page 7.**

* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

Pin Contact - Right Angle PCB Termination

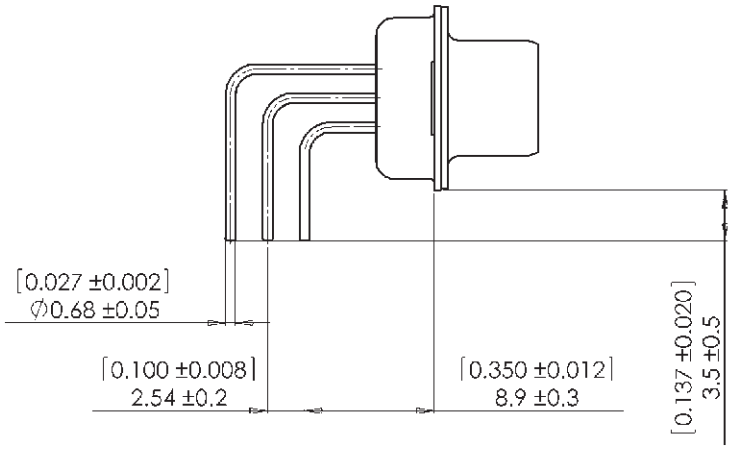
Contact type and finish Code Number: 45-46



Contact layout	15	26	44	62
Shell size	1	2	3	4

Socket Contact - Right Angle PCB Termination

Contact type and finish Code Number: 55-56

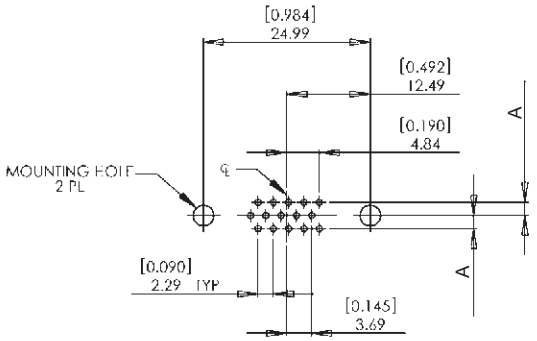


Contact layout	15	26	44	62
Shell size	1	2	3	4

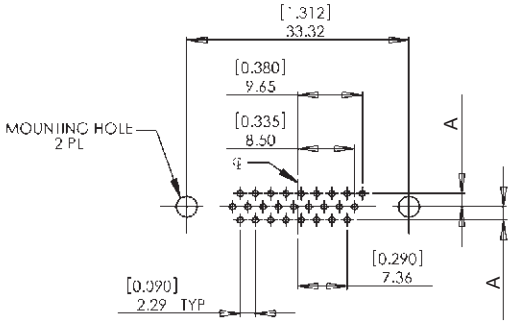
*** Other mechanical dimensions are similar with standard density connectors. See pages 6-7.**

* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

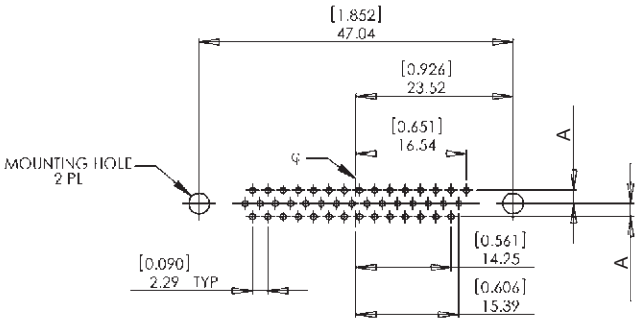
Board Drilling - Straight and Right Angle PCB Termination



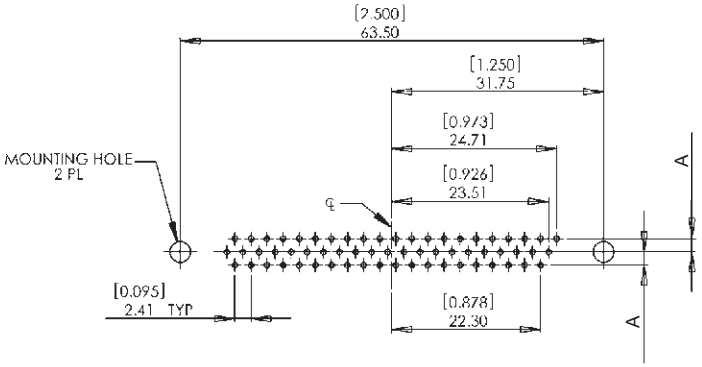
SHELL SIZE : 1
No. OF CONTACTS : 15



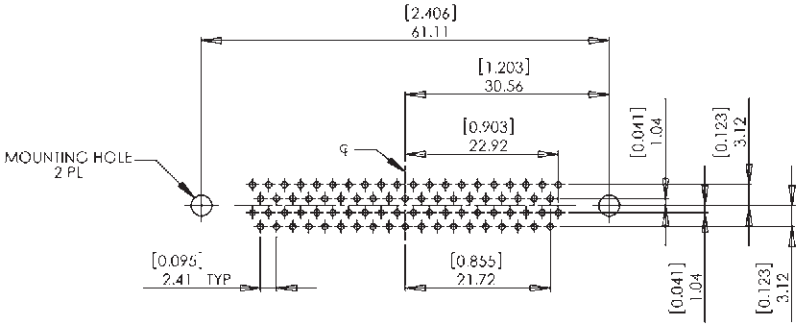
SHELL SIZE : 2
No. OF CONTACTS : 26



SHELL SIZE : 3
No. OF CONTACTS : 44



SHELL SIZE : 4
No. OF CONTACTS : 62



SHELL SIZE : 5
No. OF CONTACTS : 78

	For Straight PCB termination	For R/A PCB termination
A	1.98 [.078]	2.54 [.100]

Recommended Hole Dimensions: For Contatct Hole – Ø 1.0 +0.2 [Ø.039 + .007]
For Mounting Hole – Ø 3.1 +/- 0.1 [.122 +/- .004]

* View of Male (Plug) connector assembly side. For Female (Receptacle) is opposite.
* Dimensions are in Millimeters values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

The filter D-Sub Adaptors are produced for applications wherever adding/replacing by filter connector (Receptacle or Plug) is not possible. This unique solution is also practical for EMC test, integrations and evaluations.

These connectors are qualified for Commercial or Military grades and can be produced with layouts of STD Density (9, 15, 25, 37 and 50 contacts) or High Density (15, 26, 44, 62 and 78 contacts).

The maximum current rating of contact depends on density type of chosen connector.

Various configurations of embedded filters (C, CL, LC, Pi) and optional integration of transient protection are available.

Customization and additional features are available.

General Electrical Characteristics

		Commercial	Commercial RoHS	Meets MIL-DTL-24308	
Order Code (See pg 26)		A	C	B	D
Current Rating	STD	7.5 A			
	HD	5 A			
Insulation Resistance		5 GΩ or 50 ΩF (*)			

(*) – Whichever is less. For higher Insulation Resistance consult Sales

Material & Finish

	Commercial	Commercial RoHS	Meets MIL-DTL-24308	
Order Code (See pg 26)	A	C	B	D
Shell	Steel, Lead Free Tin Plated		Steel, Tin-Lead Plated	Steel, Lead Free Tin Plated
Contacts	Brass/Copper alloy, Flash Gold over Nickel		Brass/Copper alloy, Gold over Nickel	
Insulator	PBT 30% Glass fibers reinforced, UL-94V-0		Thermoplastic/Thermoset per MIL-DTL-24308 or Glass Epoxy, UL94V-0	
Potting	Epoxy Cast			
Accessories	Brass/Steel Nickel plated or Stainless Steel passivated			

Environmental Conditions

	Commercial	Commercial RoHS	Meets MIL-DTL-24308	
Order Code (See pg 26)	A	C	B	D
Operating Temp.	-40 °C ÷105 °C		-55 °C ÷105 °C	
Storage Temp.	-40 °C ÷105 °C		-55 °C ÷105 °C	
Humidity	Up to 100%		Up to 100%	
Altitude	Not Applicable		40,000 ft	
Shock	40g X 6msec		40g X 6msec	
Vibration	20g RMS, 20-2000 Hz		20g RMS, 20-2000 Hz	
Endurance	200 Cycles		More than 500 Cycles	

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How To Order

ADT 09 A 1 C C U 10 PF10

D-Sub Adaptor

CONTACT ARRANGEMENTS: See pages 4,19

09,15,25,37,50 - For Standard Density
15,26,44,62,78 - For High Density

CLASS: See page 25

A - Commercial
B - Meets MIL-DTL-24308 - Tin-Lead Shell Plating
C - Commercial, RoHS compliance
D - Meets MIL-DTL-24308 - Tin Shell Plating
S - Other Finish option

CONTACTS ARRANGEMENT STANDARD

1 - Standard Density
2 - High Density

ACCESSORIES FOR MALE SIDE

See pages 37-40

ACCESSORIES FOR FEMALE SIDE

See pages 37-40

ACCESSORIES STANDARD

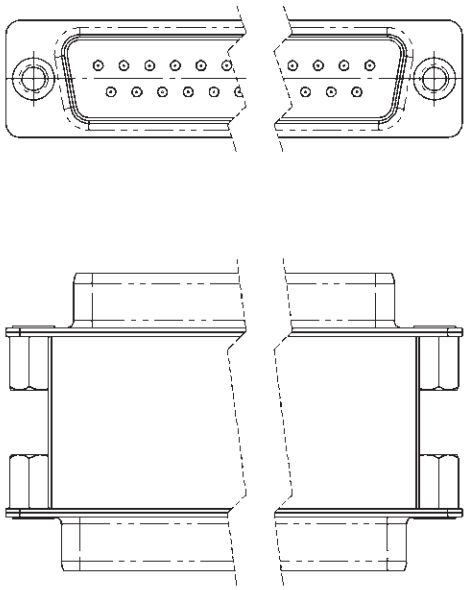
A - Without Accessories (choose when the "No Accessories" option was chosen at previous two fields)
M - Metric
U - Inch

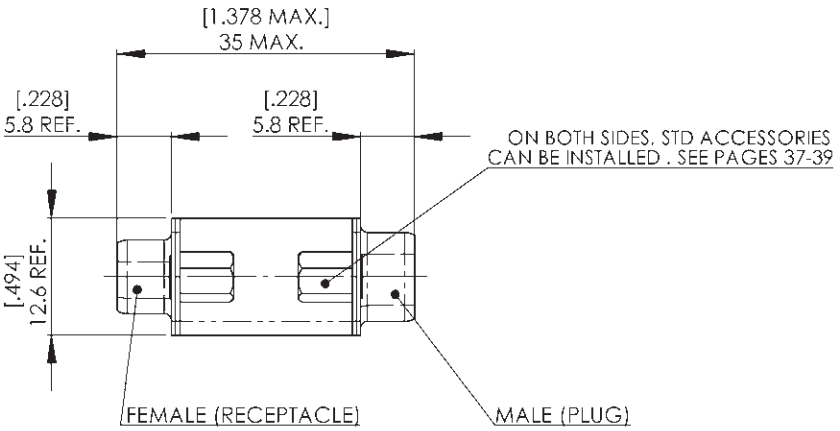
WORKING VOLTAGE: See page 45

01	6.3V	**07**	200V	**14**	800V	**00** - For filters with diversified voltages
02	10V	**08**	250V	**15**	1000V	**99** - For any configuration that incorporates transient protection
03	16V	**09**	300V			
04	25V	**10**	400V			
05	50V	**11**	500V			
06	100V	**12**	600V			

FILTER CODE AND\OR TRANSIENT PROTECTION CODE: See page 45

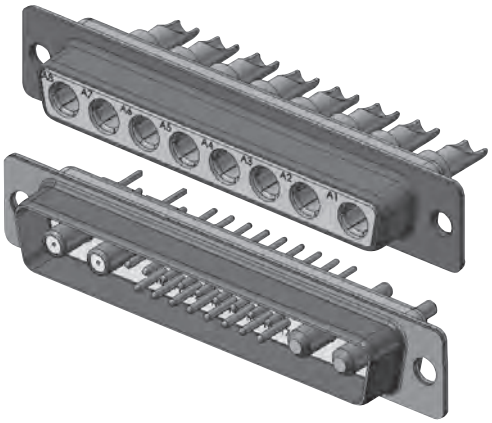
xxxx - In case where a custom protection is required (diversity of filter types and\or transient protection types) fill XXXX.
Contact sales for customizing.





*** The unshown dimensions are similar with Standard D-Sub connectors. See pages 6-7.**

* The shown Standard Density Adaptor is for dimensions reference. Other families are available.
* For contact arrangements see page 4 (STD Density) and page 19 (High Density).
* For dimensions customizing contact sales.
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.



The filtered D-Sub COMBO connectors are produced for applications wherever power lines are used. The connectors are available for Commercial or Military grades.

This series offers a variety of popular contact layouts, including 3W3, 5W5 with power (size 8) contacts only, 21WA4, 36W4 with mixed power and data (size 20) contacts and additional layouts. Filtering and transient protection of all or part of power and data contacts is available.

Combination of size 8 coaxial (not filtered) and power contacts of size 8 is available per special request.
The offered termination types are PCB tail and Solder Cups with variety of termination side sizes of power contacts for different current rating performances (from 10A to 40A).

Various configuration of embedded filters (C, CL, LC, Pi) and optional integration of protection is available.
Customization, hermetically sealing (in special shell shapes) and additional features are available.

General Electrical Characteristics

		Commercial	Commercial RoHS	Meets MIL-DTL-24308	
Order Code (See page 29)		A	C	B	D
Current Rating	8AWG	10A/20A/40A (See table on page 31)			
	20AWG	7.5 A			
	Coax	5 A			
Insulation Resistance		5 GΩ or 50 ΩF (*)			

(*) – Whichever is less. For higher Insulation Resistance consult Sales

Material & Finish

	Commercial	Commercial RoHS	Meets MIL-DTL-24308	
Order Code (See pg 29)	A	C	B	D
Shell	Steel, Lead Free Tin Plated		Steel, Tin-Lead Plated	Steel, Lead Free Tin Plated
Contacts	Brass/Copper alloy, Flash Gold over Nickel		Brass/Copper alloy, Gold over Nickel	
Insulator	PBT 30% Glass fibers reinforced, UL-94V-0		Thermoplastic/Thermoset per MIL-DTL-24308 or Glass Epoxy, UL94V-0	
Potting	Epoxy Cast			
Accessories	Brass/Steel Nickel plated or Stainless Steel passivated			

Environmental Conditions

	Commercial	Commercial RoHS	Meets MIL-DTL-24308	
Order Code (See pg 29)	A	C	B	D
Operating Temp.	-40 °C +105 °C		-55 °C +105 °C	
Storage Temp.	-40 °C +105 °C		-55 °C +105 °C	
Humidity	Up to 100%		Up to 100%	
Altitude	Not Applicable		40,000 ft	
Shock	40g X 6msec		40g X 6msec	
Vibration	20g RMS, 20-2000 Hz		20g RMS, 20-2000 Hz	
Endurance	200 Cycles		More than 500 Cycles	

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ELEKTRONIK s.r.o.

How To Order

DTC 9W4 A 61 C U 01 CF10

D-Sub COMBO

CONTACT ARRANGEMENTS: See page 30

3W3, 5W5,9W4, 8W8, 21WA4, 36W4

CLASS: See page 28

A - Commercial
B - Meets MIL-DTL-24308 - Tin-Lead Shell Plating
C - Commercial, RoHS compliance
D - Meets MIL-DTL-24308 - Tin Shell Plating
S - Other Finish option

CONTACTS TYPE & CONFIGURATION

See page 31

ACCESSORIES

See pages 37-40

ACCESSORIES STANDARD

A - Without Accessories (choose when the "No Accessories" option was chosen at previous field)
M - Metric
U - Inch

WORKING VOLTAGE: See page 45

01	6.3V	**07**	200V	**14**	800V	**00** - For filters with diversified voltages
02	10V	**08**	250V	**15**	1000V	**99** - For any configuration that incorporates transient protection
03	16V	**09**	300V			
04	25V	**10**	400V			
05	50V	**11**	500V			
06	100V	**12**	600V			

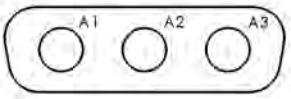
FILTER TYPE: See page 45

xxxx - In case where a custom protection is required (diversity of filter types and\or transient protection types) fill XXXX.
Contact sales for customizing.

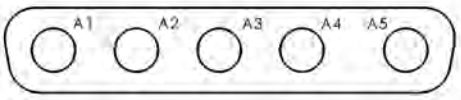
* Coaxial contacts including is available. Coaxial contacts are not filtered.
* For other contact arrangements or/and termination types contact Sales.

Contact Arrangements

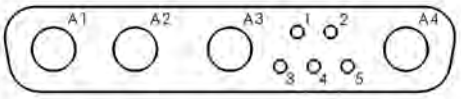
Order Code 3W3
Shell Size 2



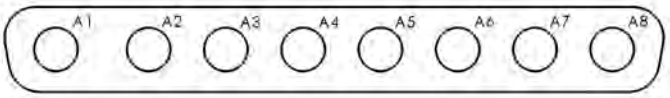
Order Code 5W5
Shell Size 3



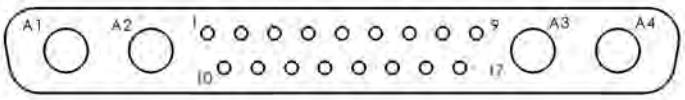
Order Code 9W4
Shell Size 3



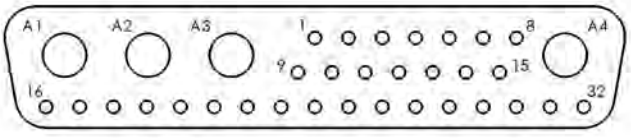
Order Code 8W8
Shell Size 4



Order Code 21WA4
Shell Size 4



Order Code 36W4
Shell Size 5



Contacts size: Signal – 20 AWG
Power – 8 AWG

* Front face of Pin insert is shown. Socket insert is opposite.
** For other arrangements contact sales.

Contact Types

- All contacts are machined and gold plated on mating side

Signal Contacts (size 20):

- Termination Type of Signal contacts is by default determined according to the Termination Type of chosen Power contacts (size 8) as described in the following table.
- Current Rating 7.5 A
- Wire Size - 20÷22 AWG
- Plating is per Material & Finish table (pg. 28), Solder Cups are Tin plated.

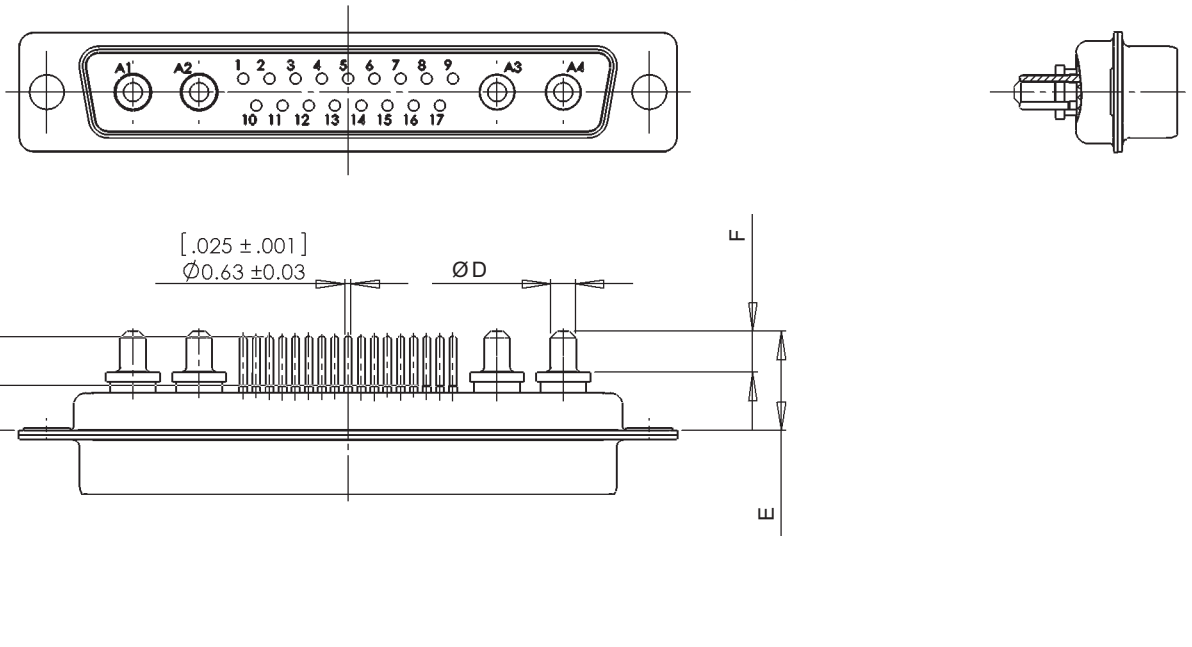
Power Contacts (size 8):

Code for Pin (Plug)	Code for Socket (Recept.)	Termination Type PCB/S.C.	Current Rating [A]	Wire Size [A.W.G.]	Class Military / Commercial	Plating	
						Mating Area (front)	Termination Area (rear)
61	81	Straight PCB	20	-	Comm.	Flash Gold	Tin
62	82	Straight PCB	20	-	MIL.	Gold 0.8 µm	Tin
63	83	Straight PCB	40	-	Comm.	Flash Gold	Tin
64	84	Straight PCB	40	-	MIL.	Gold 0.8 µm	Tin
65	85	Solder Cup	10	16-20	Comm.	Flash Gold	Tin
66	86	Solder Cup	10	16-20	MIL.	Gold 0.8 µm	Flash Gold
67	87	Solder Cup	20	12-16	Comm.	Flash Gold	Tin
68	88	Solder Cup	20	12-16	MIL.	Gold 0.8 µm	Flash Gold
69	89	Solder Cup	40	8-12	Comm.	Flash Gold	Tin
70	90	Solder Cup	40	8-12	MIL.	Gold 0.8 µm	Flash Gold
PO	SO	Special *					

*** For dimensions see page 32.**

* Contact sales for customizing.

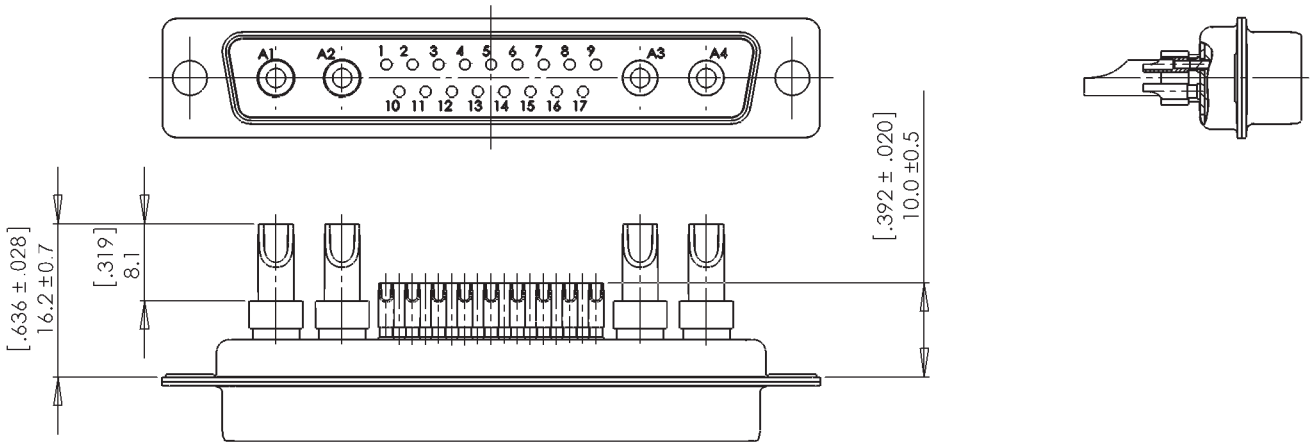
Straight PCB Termination



Power Contacts

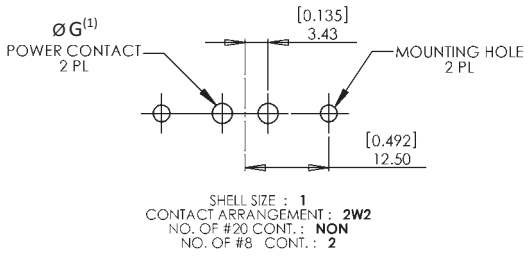
Codes (Per Contacts table on pg. 33)	Current Rating [A]	Ø D ± 0.05 [.002] mm [Inch]	E ± 0.7 [.028] mm [Inch]	F ± 0.1 [.004] mm [Inch]	Board Drilling ØG + 0.2 [.008] mm [Inch]
61, 62, 81, 82	20	2.85 [.112]	10.2 [.402]	3.7 [.146]	3.2 [.126]
63, 64, 83, 84	40	3.75 [.148]	11.2 [.441]	4.7 [.185]	4.1 [.161]

Solder Cup Termination

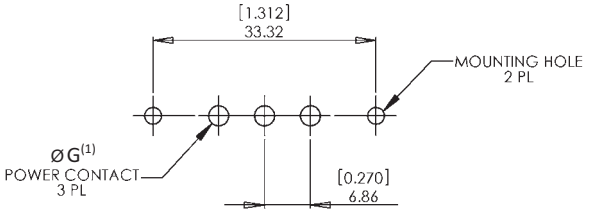


* The dimensions not shown are similar with standard connectors - see pages 6-7.
* The shown dimensions present C-Filter connectors. For Pi-Filter consult sales.
* The shown 21WA4 contacts arrangement is for reference only. Other arrangements are available -see page 30.
* For other terminaton types consult sales.
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.

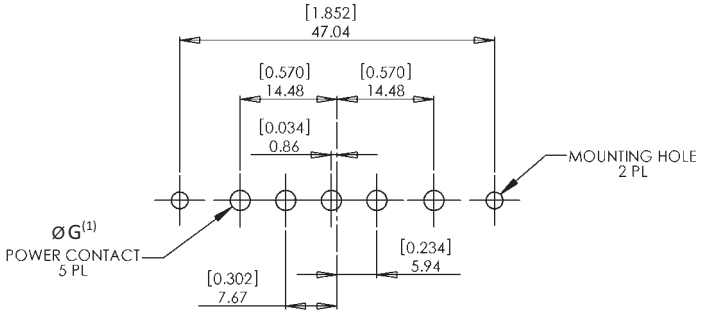
Board drilling - Straight PCB Termination



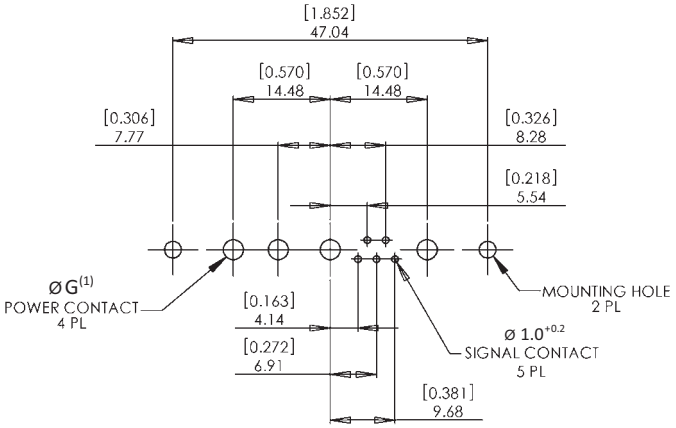
SHELL SIZE : **1**
CONTACT ARRANGEMENT : **2W2**
NO. OF #20 CONT. : **NON**
NO. OF #8 CONT. : **2**



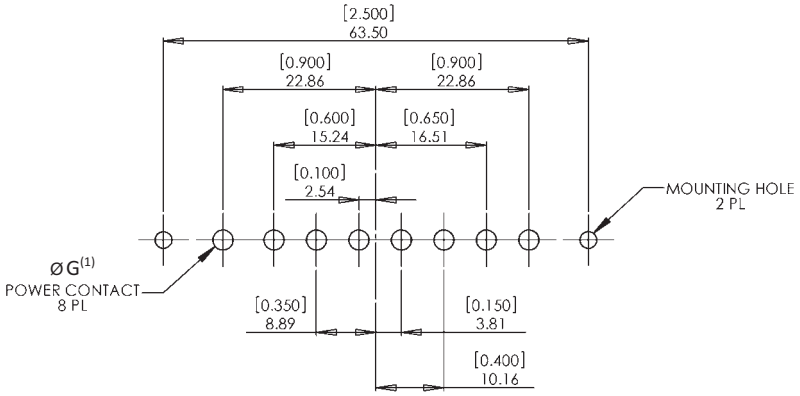
SHELL SIZE : **2**
CONTACT ARRANGEMENT : **3W3**
NO. OF #20 CONT. : **NON**
NO. OF #8 CONT. : **3**



SHELL SIZE : **3**
CONTACT ARRANGEMENT : **5W5**
NO. OF #20 CONT. : **NON**
NO. OF #8 CONT. : **5**

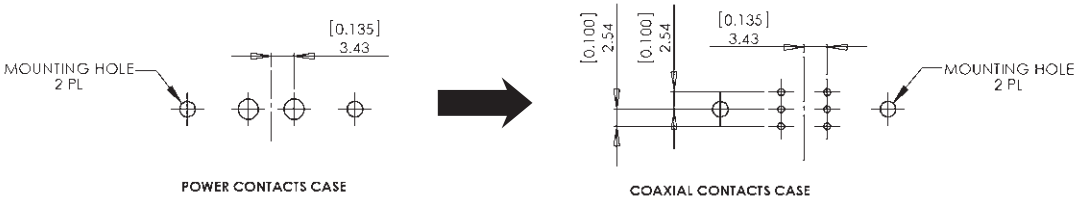


SHELL SIZE : **3**
CONTACT ARRANGEMENT : **9W4**
NO. OF #20 CONT. : **5**
NO. OF #8 CONT. : **4**



SHELL SIZE : **4**
CONTACT ARRANGEMENT : **8W8**
NO. OF #20 CONT. : **NON**
NO. OF #8 CONT. : **8**

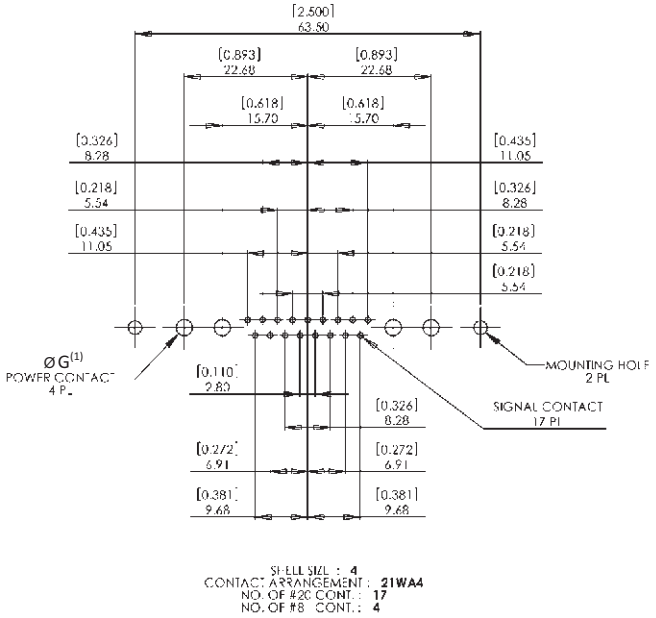
Note:
In case of Coaxial contact combination, place the three holes pattern instead of the Power contact hole, as shown on the following example:

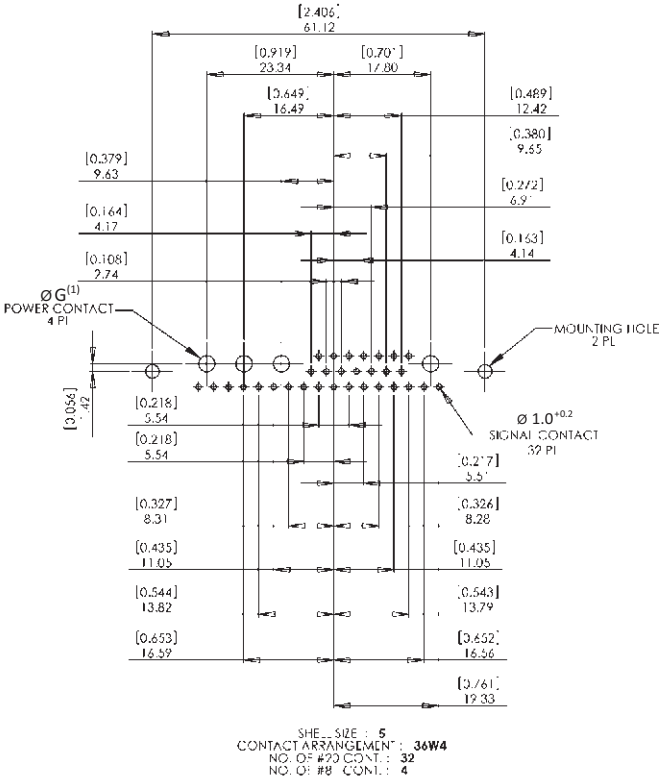


(1) The Ø G dimension see in Power Contacts table on page 32.

* View of Male (Plug) connector assembly side. For Female (Receptacle) is opposite.
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

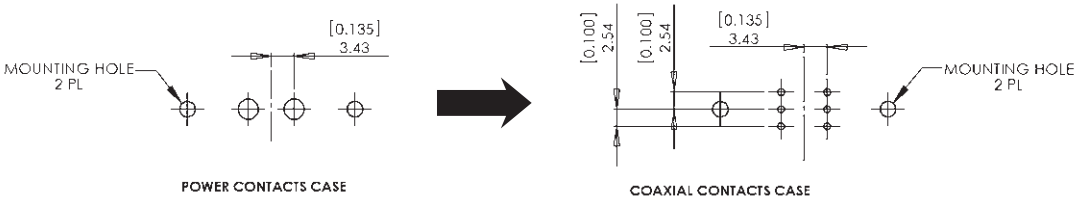
Board drilling - Straight PCB Termination





Note:

In case of Coaxial contact combination, place the three holes pattern instead of the Power contact hole, as shown on the following example:

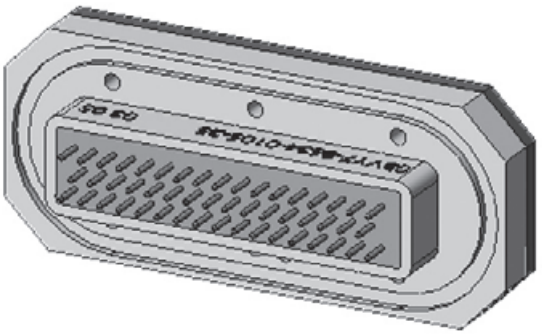


(1) The ØG dimension see in Power Contacts table on page 32.

* View of Male (Plug) connector assembly side. For Female (Receptacle) is opposite.
* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

This family includes filtered/non-filtered D-Sub connectors of Standard Density, High Density and Mixed Layout (COMBO) contact arrangements.
Based on Aluminium machined housing with built in O-Ring, the hermetically sealed connectors are designed for rugged environmental conditions (humidity, dust, fluids, gases) and for use in gas cooled systems (optics etc.). These connectors can be produced with our standard off the shelf forms or with special shell shape as per customer mechanical demands.

The hermetically sealed connectors can meet Military standard or commercial quality requirements. Front and rear mounting configurations are available.
The sealed D-Sub connectors meet sealing conditions of less than 10^{-5} cm^3/sec Helium at $\Delta P = 1atm$.
Stainless steel housing and special O-Ring materials are available upon special request.



General Electrical Characteristics

Current Rating	STD	7.5A
	HD	5A
Insulation Resistance		5 GΩ or 50ΩF (*)

(*) – Whichever is less. For higher Insulation Resistance consult Sales

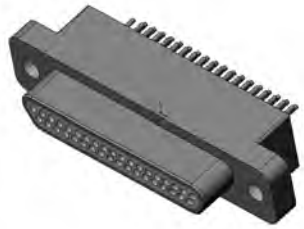
Material & Finish

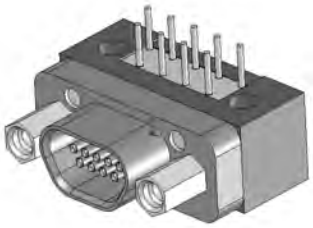
Shell	Alluminium Alloy - Nickel/Cadmium/Chromate Conversion plated, Stainless Steel - Passivated
Contacts	Copper Alloy, Gold or Flash Gold plated over Nickel
Insulator	PBT 30% Glass fibers reinforced UL-94V-0 or Thermoplastic UL-94V-0 or Glass Epoxy
Potting	Silicon and Epoxy Cast
Accessories	Brass/Steel Nickel plated or Stainless Steel passivated

Environmental Conditions

Operating Temp.	-55 °C ÷105 °C
Storage Temp.	-55 °C ÷105 °C
Humidity	Up to 100%
Endurance	200 or 500 Cycles
Vibration	20g RMS, 20-2000Hz
Shock	40g X 6msec
Altitude	40,000 ft
Sealing	Leakage $<10^{-5}$ cm^3/sec Helium at $\Delta P = 1$ atm

* For additional information contact sales.



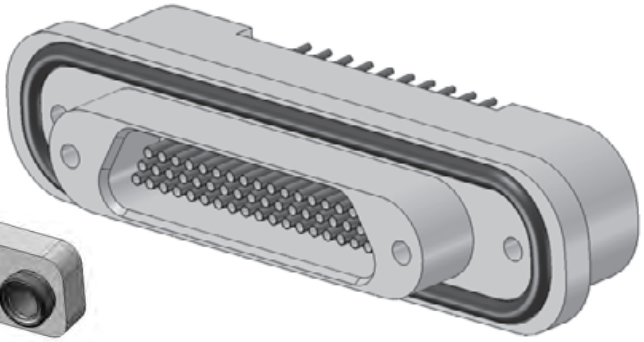


The MDM series features reliable miniature rectangular connectors with 0.050" (1.27 mm) contact spacing pitch.

Based on MIL-DTL-83513, these connectors can accommodate C filter or transient protection in close to standard dimension shells and other filter types in extended dimension shells.

Available wired with wire gauges range from 24AWG to 32AWG and PCB tail terminations. The contact material is Copper Alloy 1.27 µm Gold plated, and the maximum current rating is 3A.

The pin contact features springy design, that provides a superior attachment with a socket, which translates to lower contact resistance and it does so under extreme conditions of vibration, shock and high heat.
Hermetically sealing is available.



General Electrical Characteristics

Current Rating	3A
Insulation Resistance	5 GΩ or 50ΩF (*)

(*) – Whichever is less. For higher Insulation Resistance consult Sales

Material & Finish

Shell	Alluminium Alloy - Nickel/Cadmium/Chromate Conversion plated
Contacts	Copper Alloy, Gold plated over Nickel
Insulator	40% Glass filled Polyphenylene Sulfide
Interfacial Seal	Fluorosilicon Elastomer
Potting	Epoxy Cast
Accessories	Brass/St.Steel - Nickel Plated/Passivated

Environmental Conditions

Operating Temp.	-55 °C +105 °C
Storage Temp.	-55 °C +105 °C
Humidity	Up to 95%
Endurance	More than 1000 Cycles
Vibration (Random)	Up to 20g RMS 10 to 2000Hz
Shock	50g X 6msec Sawtooth Pulse

* For additional information contact sales.

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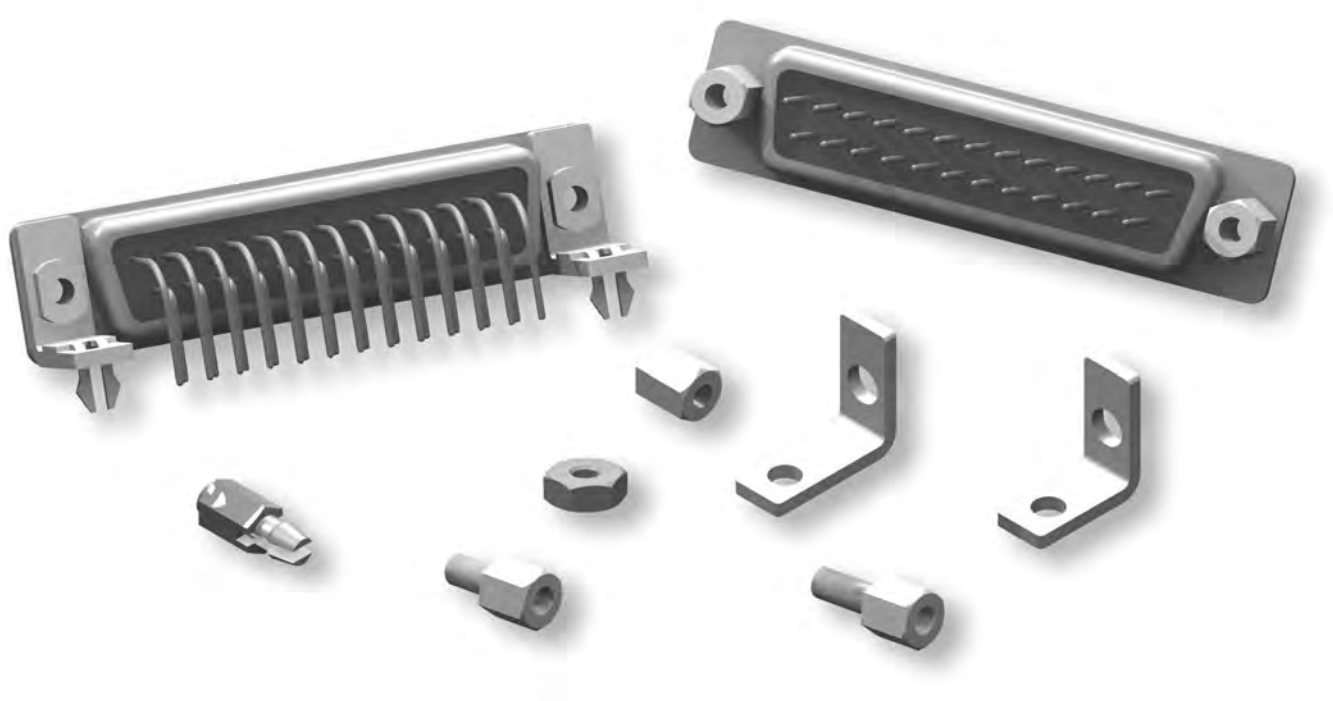
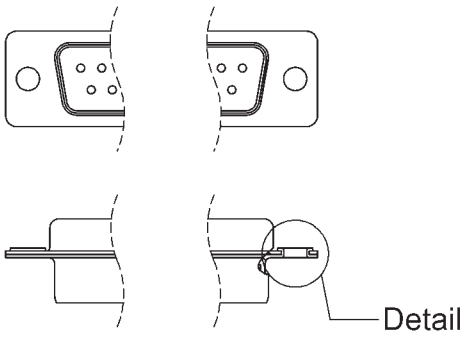
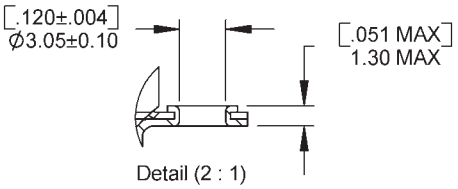
RF Immunity The Filtered Connector Specialists

Order Code	Description	Page
A	Without Accessories	38
C	Rear Thread	38
D	Straight Board Clips	38
G	R/A Bracket with Clinch Nut	39
E	R/A Bracket with Clinch Nut & Board lock	39
H	R/A Bracket with Clinch Nut & Female screw lock, length 5.2 [.205]	40
M	R/A Bracket with Clinch Nut & Female screw lock, length 7 [.276]	40
F	R/A Bracket with Clinch Nut, Board lock & Female screw lock length 5.2 [.205]	40
J	R/A Bracket with Clinch Nut, Board lock & Female screw lock length 7[.276]	40
K	Female Screw Lock, male thread length 5.2 [.205]	40
W	Female Screw Lock, male thread length 7.9 [.311]	40
Z	Special	

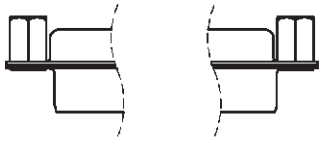


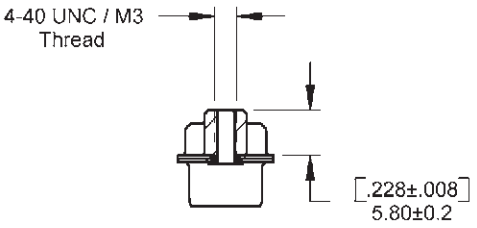
Order Code A Without Accessories



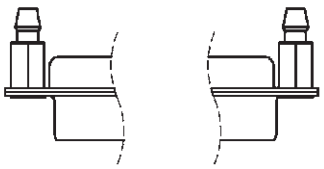


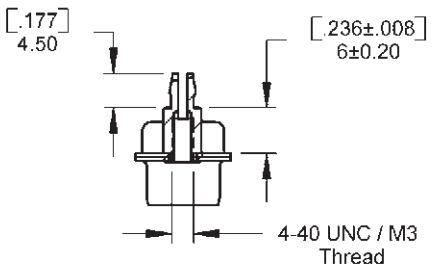
Order Code C Rear Thread





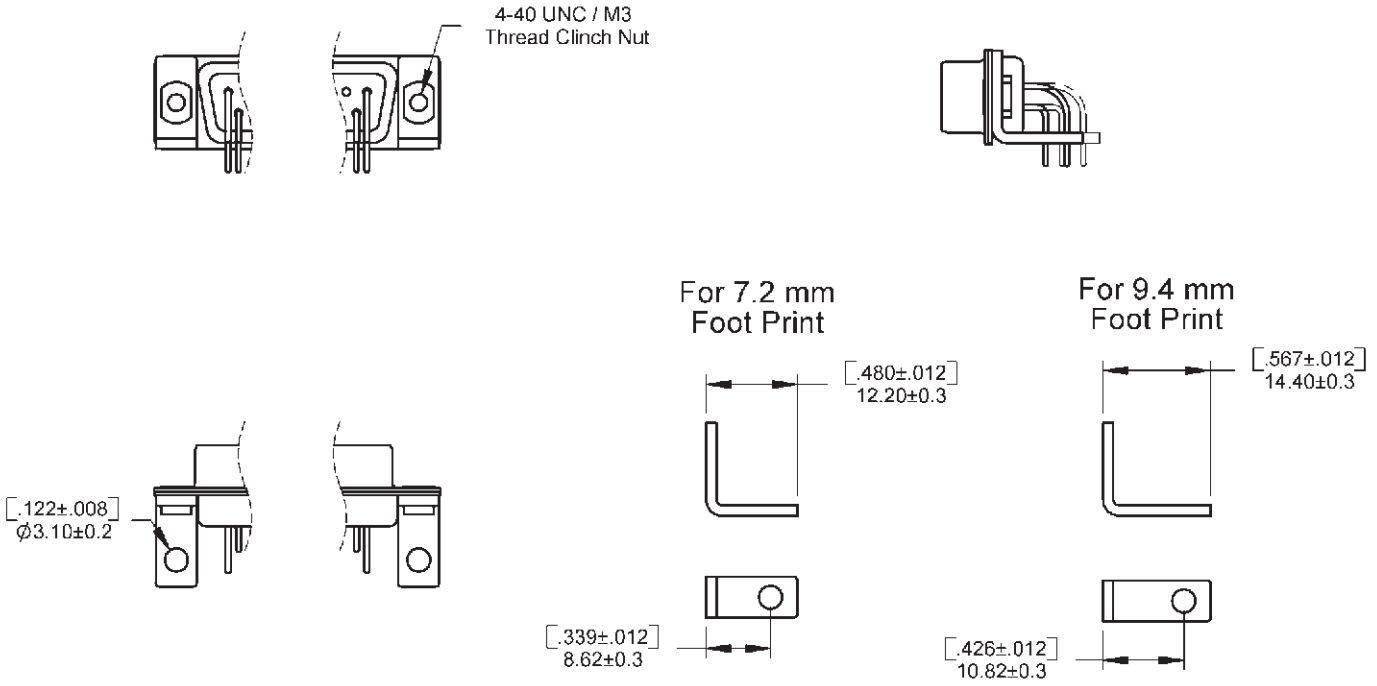
Order Code D Straight Board Clips



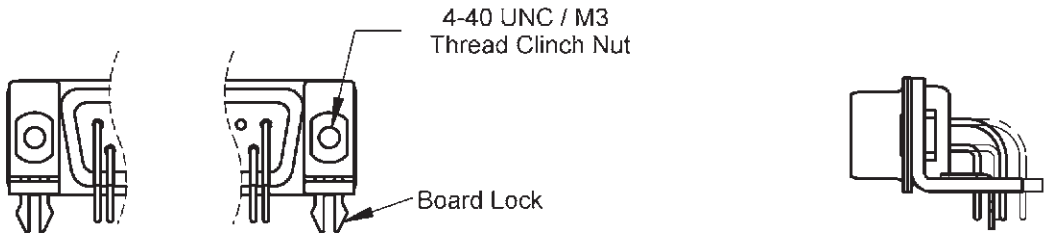


* Dimensions are in Millimeters values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

Order Code G R/A Bracket with Clinch Nut

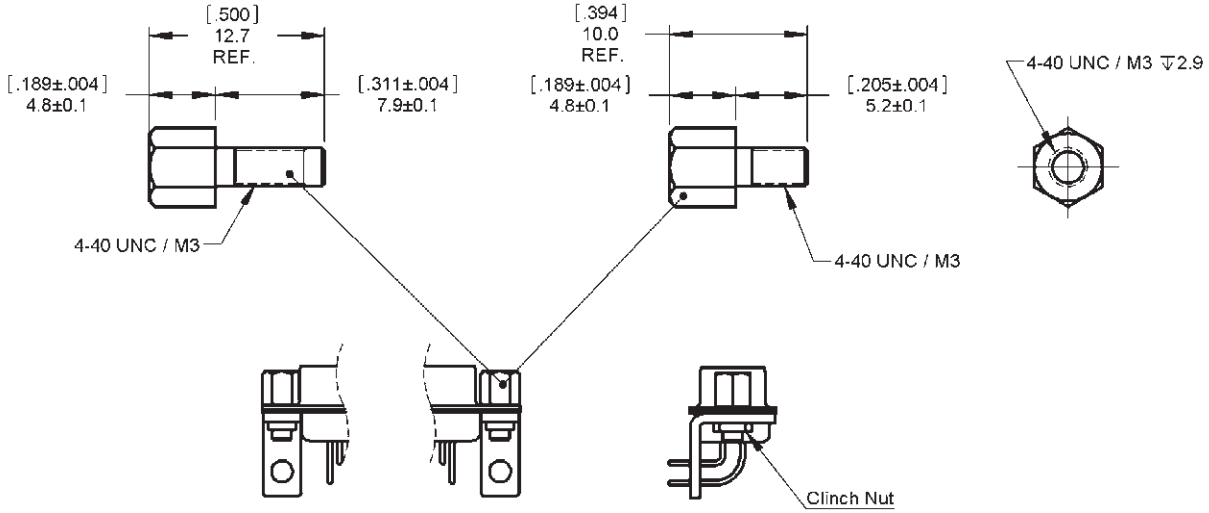


Order Code E R/A Bracket with Board lock & Clinch Nut

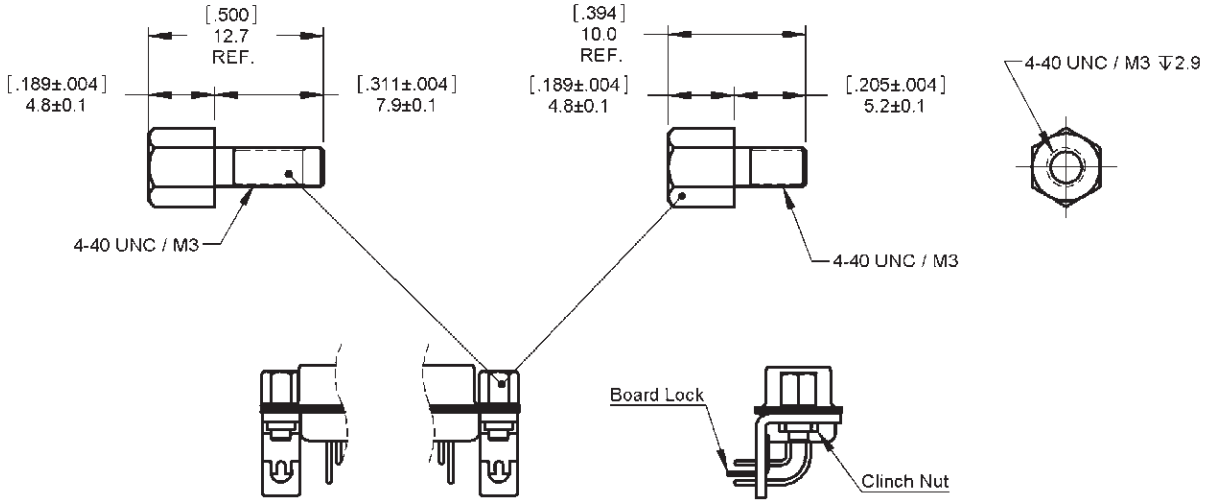


* Dimensions are in Millimeters values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

Order Code H R/A Bracket without Board Lock, with Clinch Nut & Female Screw Lock (male thread length 5.2[.205])
Order Code M R/A Bracket without Board Lock, with Clinch Nut & Female Screw Lock (male thread length 7.9[.311])

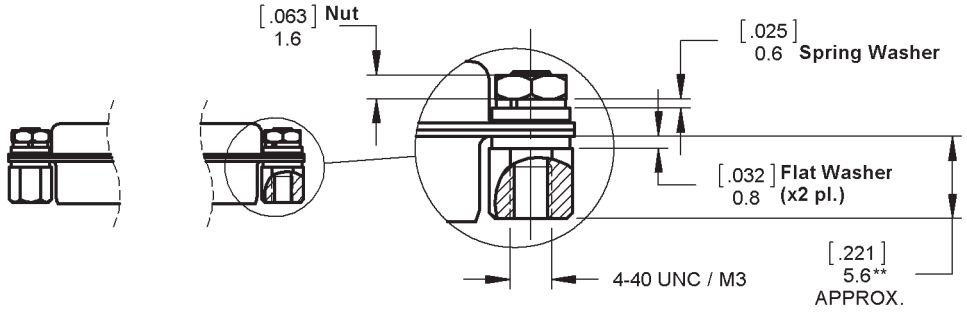


Order Code F R/A Bracket with Board Lock, Clinch Nut & Female Screw Lock (male thread length 5.2[.205])
Order Code J R/A Bracket with Board Lock, Clinch Nut & Female Screw Lock (male thread length 7.9[.311])



Order Code K Female Screw Lock (male thread length 5.2[.205])
Order Code W Female Screw Lock (male thread length 7.9[.311])

** The signed dimension must be 6.35mm[.250"] Min. including the panel thickness (see pg. 41). For panel thickness less than 1.55mm [.061"], one or two flat washers may be required on front.



* Dimensions are in Millimeters values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

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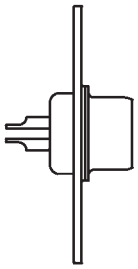
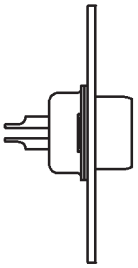
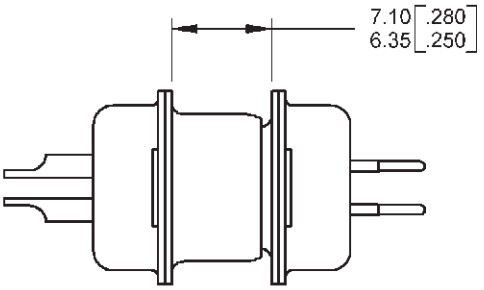
Front Mounting

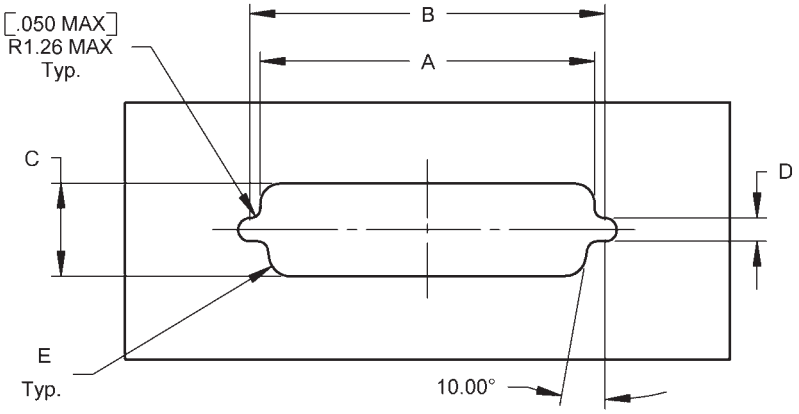


Rear Mounting

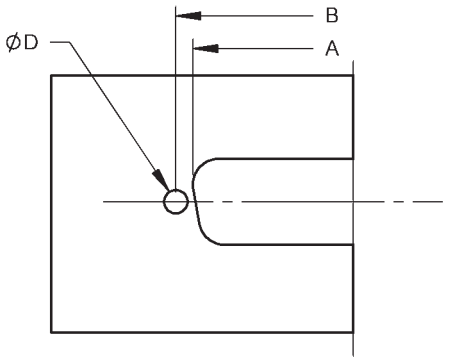


Mating





Standard Cutout



Optional Cutout for rear mounting

No. of Contacts (Shell Size)	Mounting Assembly	A ±0.20 [± .008]	B ±0.20 [± .008]	C ±0.20 [± .008]	D ±0.10 [± .004]	E ±0.20 [± .008]
9 (1)	Front	22.20 [.874]	25.00 [.984]	13.00 [.512]	3.00 [.118]	2.10 [.083]
	Rear	20.50 [.807]	25.00 [.984]	11.40 [.449]	3.00 [.118]	3.40 [.134]
15 (2)	Front	30.50 [1.201]	33.30 [1.311]	13.00 [.512]	3.00 [.118]	2.10 [.083]
	Rear	28.80 [1.134]	33.30 [1.311]	11.40 [.449]	3.00 [.118]	3.40 [.134]
25 (3)	Front	44.30 [1.744]	47.00 [1.850]	13.00 [.512]	3.00 [.118]	2.10 [.083]
	Rear	42.50 [1.673]	47.00 [1.850]	11.40 [.449]	3.00 [.118]	3.40 [.134]
37 (4)	Front	60.70 [2.390]	63.50 [2.500]	13.00 [.512]	3.00 [.118]	2.10 [.083]
	Rear	59.10 [2.327]	63.50 [2.500]	11.40 [.449]	3.00 [.118]	3.40 [.134]
50 (5)	Front	58.30 [2.295]	61.10 [2.406]	15.80 [.622]	3.00 [.118]	2.10 [.083]
	Rear	56.30 [2.217]	61.10 [2.406]	14.10 [.555]	3.00 [.118]	3.40 [.134]

* Dimensions are in Millimeters. Values in brackets are Inches equivalents.
* Dimensions subject to change without prior notice.

This chapter presents the codes and the electrical characteristics of filters and transient protections.

In case of homogenous working voltage, homogenous filter, homogenous transient protection or a combination of these three for all connector contacts, the code can be easily selected and expressed by the last six digits of the P/N.

A customized combination of filters and/or transient protections cannot be coded by this catalog. In such case, replace the last four digits of the P/N with XXXX. For customized P/N, use working voltage codes, filter codes and transient protection codes for each contact groups and fill into table 5 of the Check List, page 89 and contact the sales department.

Filter Type vs. Frequency Range

Use the following table for quick filter type page search:

Frequency Range	Filter Cutoff Frequency	Filter Type Page (1)		
		C	LC & CL(2)	π
UHF	300MHz ≤ f ≤ 3GHz	46	51	55
VHF	30MHz ≤ f ≤ 300MHz	46	51	55
HF	3MHz ≤ f ≤ 30MHz	47	52	56
MF	300kHz ≤ f ≤ 3MHz	48	53	57
LF	30kHz ≤ f ≤ 300kHz	49	54	58
VLF (Audio)	3kHz ≤ f ≤ 30kHz	50	-	59

(1) Refer to the Design Notes (page 84) for explanation regarding the differences between filter topologies and for equivalent circuits.

(2) CL filters are symmetrical to LC filters. Refer to the illustrated description on page 84 for details related to the differences between the two.

Content of Section

	Page
Filter Electrical Characteristics per Contact Arrangement	43
Transient Protection Characteristics per Contact Arrangement	44
Working Voltage Codes	45
Filter and Transient Protection Codes	45
C Filter	46
LC & CL Filter	51
π Filter	55
Introduction to Bidirectional Varistor	60
Transient Protection Codes	61
C Filter Combined with Bidirectional Transient Protection	62
LC Filter Combined with Bidirectional Transient Protection	63
CL Filter Combined with Bidirectional Transient Protection	64

Filter Electrical Characteristics per Contact Arrangement

This section describes the correlation between the maximum capacitance and the working voltage per contact arrangement.

The following tables present the possible maximum capacitance:

Max. Capacitance vs. Working Voltage (6.3VDC ÷ 250VDC):

Family	Contact Arrangement	Filter Type	Working Voltage [VDC]							
			6.3	10	16	25	50	100	200	250
Standard Density	09, 15, 25, 37	C, LC & CL	1µ	1µ	470n	330n	220n	68n	33n	27n
		C² & PI	2µ	2µ	440n	200n	94n	44n	20n	13.6n
	50	C, LC & CL	2µ	2µ	440n	200n	94n	44n	20n	13.6n
		C² & PI	4µ	4µ	880n	400n	188n	88n	40n	27.2n
High Density	15, 26, 44, 62, 78	C, LC & CL	1µ	1µ	220n	100n	47n	22n	10n	6.8n
		C² & PI	2µ	2µ	440n	200n	94n	44n	20n	13.6n
Combo 8 AWG Power Contacts	2W2, 3W3, 5W5, 9W4, 8W8, 21WA4	C, LC & CL	4µ	4µ	1.88µ	1.32µ	880n	272n	132n	108n
		C² & PI	8µ	8µ	1.76µ	800n	376n	176n	80n	54.4n
	36W4	C, LC & CL	1µ	1µ	220n	100n	47n	22n	10n	6.8n
		C² & PI	2µ	2µ	440n	200n	94n	44n	20n	13.6n
Combo 20 AWG Signal Contacts	9W4, 21WA4, 36W4	C, LC & CL	2µ	2µ	440n	200n	94n	44n	20n	13.6n
		C² & PI	4µ	4µ	880n	400n	188n	88n	40n	27.2n

Capacitance [F]

Max. Capacitance vs. Working Voltage (300VDC ÷ 1000VDC):

Family	Contact Arrangement	Filter Type	Working Voltage [VDC]					
			300	400	500	600	800	1000
Standard Density	09, 15, 25, 37	C, LC & CL	15n	12n	12n	8.2n	4.7n	2.7n
Combo 8 AWG Power Contacts	2W2, 3W3, 5W5, 9W4, 8W8, 21WA4	C, LC & CL	60n	48n	48n	32.8n	18.8n	10.8n

Capacitance [F]

These tables can be used in two ways:

(1) Once a contact arrangement is selected, by using these tables the capacitance and the working voltage limits can be extracted.

(2) Once the correct filter type and working voltage are selected, by using these tables the complying contact arrangement can be determined to meet the design requirements.

Note: Filtered D-Sub combined with transient protection will achieve lower capacitance levels.

For more details contact the sales department.

Transient Protection Characteristics per Contact Arrangement

This section describes the correlation between the maximum transient protection energy and the working voltage per contact arrangement.

The following table presents the possible maximum transient energy:

Max. Transient Protection Energy @ 10x1000µs waveform vs. Working Voltage (3.3V_{DC} ÷ 30V_{DC}):

Family	Contact Arrangement	Working Voltage [V_{DC}]						
		3.3	5.6	9	14	18	26	30
Standard Density	09, 15, 25, 37	0.3	0.3	0.2	0.3	0.3	0.3	0.2
	50	0.4	0.4	0.4	0.4	0.4	0.4	0.4
High Density	15, 26, 44, 62, 78	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Combo 8 AWG Power Contacts	2W2, 3W3, 5W5, 9W4, 8W8, 21WA4	1.2	1.2	0.8	1.2	1.2	1.2	0.8
	36W4	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Combo 20 AWG Signal Contacts	9W4, 21WA4	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	36W4	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Energy [J]

These tables can be used in two ways:

(1) Once a contact arrangement is selected, by using this table the transient protection energy and the working voltage limits can be extracted.

(2) Once the correct transient protection energy and working voltage are selected by using this table the complying contact arrangement can be determined to meet the design requirements.

Note: Filtered D-Sub combined with transient protection will achieve lower transient energy levels.

For more details contact the sales department.

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Working Voltage Codes

The working voltage of filter components is expressed by two digits in the P/N (refer to connector family HTO page). Use next tables for selecting the working voltage code.

	Homogenous Working Voltage [V_{DC}]															
DWV	2.5 X WV							1.5 X WV (min. 500V_{DC})				1.2 X WV (min. 750V_{DC})				
WV	6.3	10	16	25	50	100	200	250	300	400	500	600	800	1k	1.5k	2k
Code	1	2	3	4	5	6	7	8	9	10	11	12	14	15	16	17

	Mixed Working Voltage	Transient Protection
Code	00	99

Note: The filter and transient protection energy type limit the working voltage of the filter. Refer to the Filter Electrical Characteristics vs. Contact Arrangement section on pages 43 and Transient Protection Characteristics vs. Contact Arrangement on page 44.

Filter and Transient Protection Codes

The filter code and/or transient protection code are expressed by the last four letters and digits of the P/N. The next sections present the electrical characteristics and codes of:

a. Four filter types (C, LC, CL and Pi). The codes are shown on pages 46-59 along filter types, capacitance and attenuation curves.

b. Three transient protection types and their codes (0.1J, 0.2J and 0.3J). The codes are shown on page 61 along transient protection energy level.

c. Suggested combinations of filter types with transient protection types and their codes. The codes are shown on pages 62-64. Other option also available.

For explanations regarding the selection of the most suitable filter and transient protection refer to the Design Notes (page 76).

Note: The codes are applicable only when the same filter and/or transient protection type is used for all of connector contacts.

For more details contact the sales department.

C Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz ≤ f ≤ 300kHz	300kHz ≤ f ≤ 3MHz	3MHz ≤ f ≤ 30MHz	30MHz ≤ f ≤ 300MHz	300MHz ≤ f ≤ 3GHz

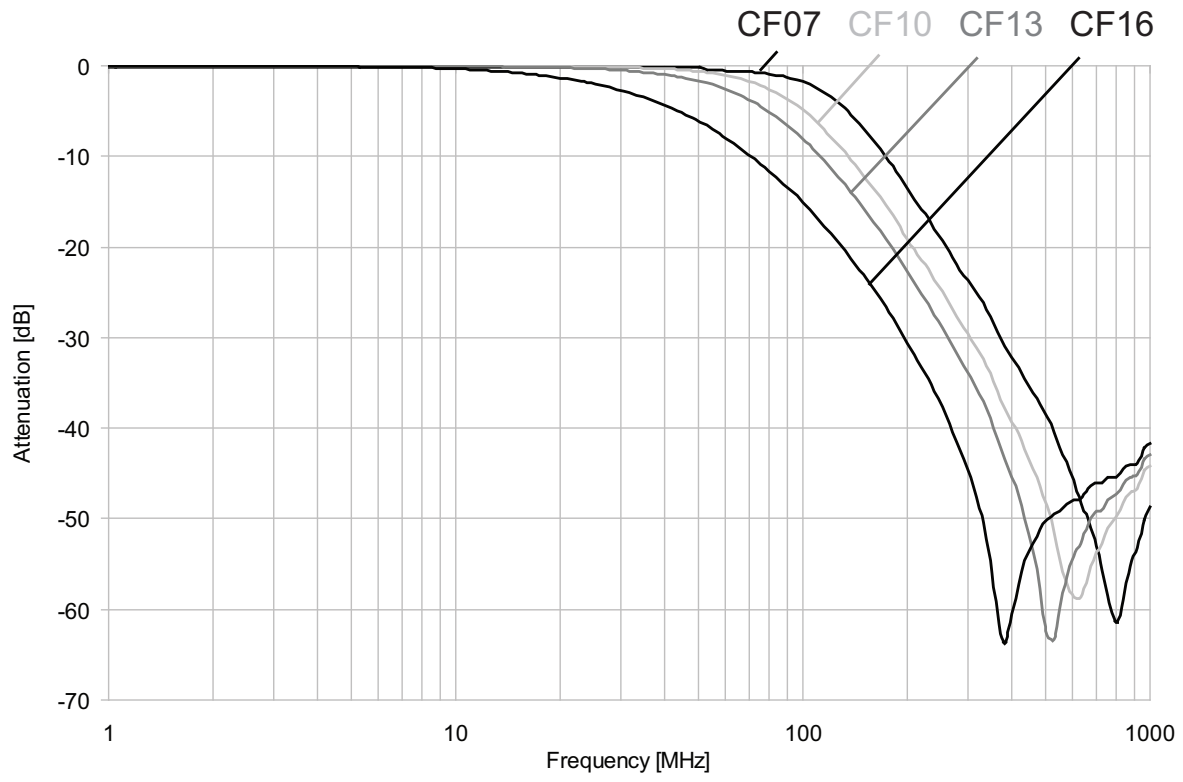
Typical cutoff frequency (-3dB) $f_{co} \geq$ 30MHz .

Minimum Attenuation

Filter Code	Typical Cap. [pF] (2)	f_{co} [MHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
CF07	47	94	0	0	0	0	0	1	21	42	36
CF10	82	64	0	0	0	0	0	3	27	45	33
CF13	120	51	0	0	0	0	1	5	30	55	33
CF16	220	31	0	0	0	1	5	13	41	45	31

(1) Measured in 50Ω system according to MIL-STD -220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
(3) For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

C Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz $\leq f \leq$ 300kHz	300kHz $\leq f \leq$ 3MHz	3MHz $\leq f \leq$ 30MHz	30MHz $\leq f \leq$ 300MHz	300MHz $\leq f \leq$ 3GHz

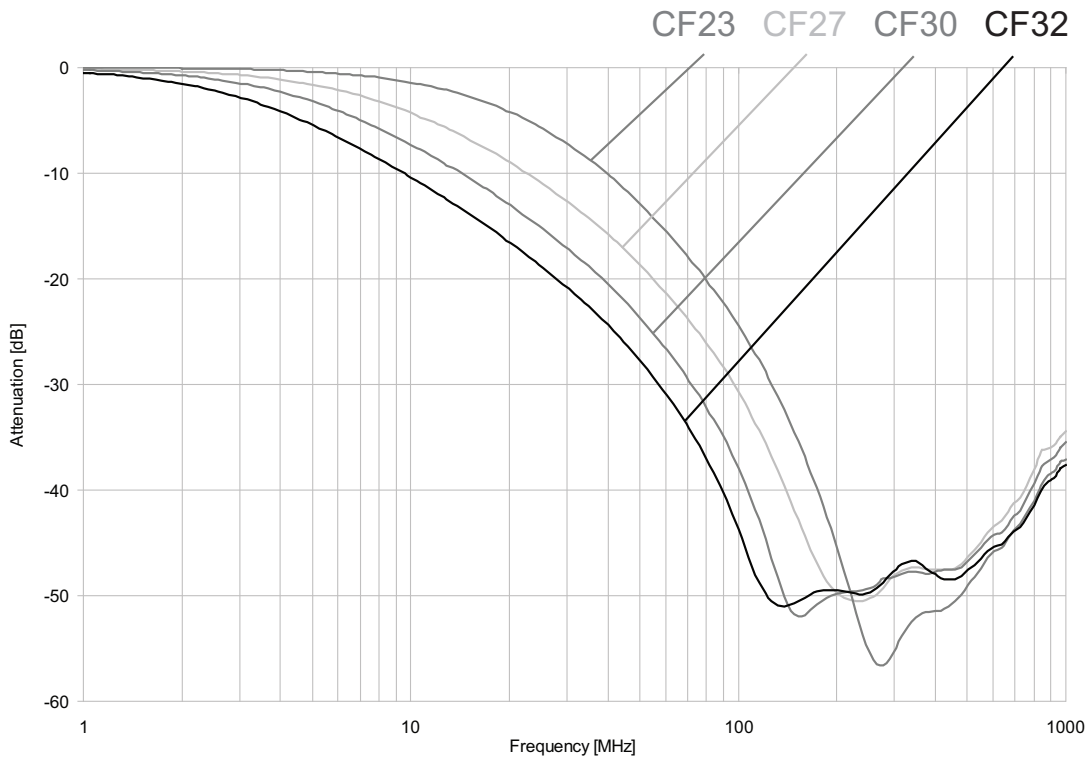
Typical cutoff frequency (-3dB) $f_{co} \geq$ 3MHz .

Minimum Attenuation

Filter Code	Typical Cap. [pF] (2)	f_{co} [MHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
CF20	330	21	0	0	0	3	8	21	53	49	31
CF23	470	16.6	0	0	0	5	10	22	55	49	30
CF26	820	8.4	0	0	1	10	17	31	50	48	31
CF27	1000	8	0	0	1	11	17	29	48	46	28
CF29	1200	5.8	0	0	3	13	19	32	49	47	30
CF30	1500	4.7	0	1	5	16	23	38	48	47	30
CF31	1800	4.1	0	2	6	17	23	39	48	46	31
CF32	2200	3	0	3	7	18	24	41	45	46	29

(1) Measured in 50Ω system according to MIL-STD -220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
(3) For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

C Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz $\leq f \leq$ 300kHz	300kHz $\leq f \leq$ 3MHz	3MHz $\leq f \leq$ 30MHz	30MHz $\leq f \leq$ 300MHz	300MHz $\leq f \leq$ 3GHz

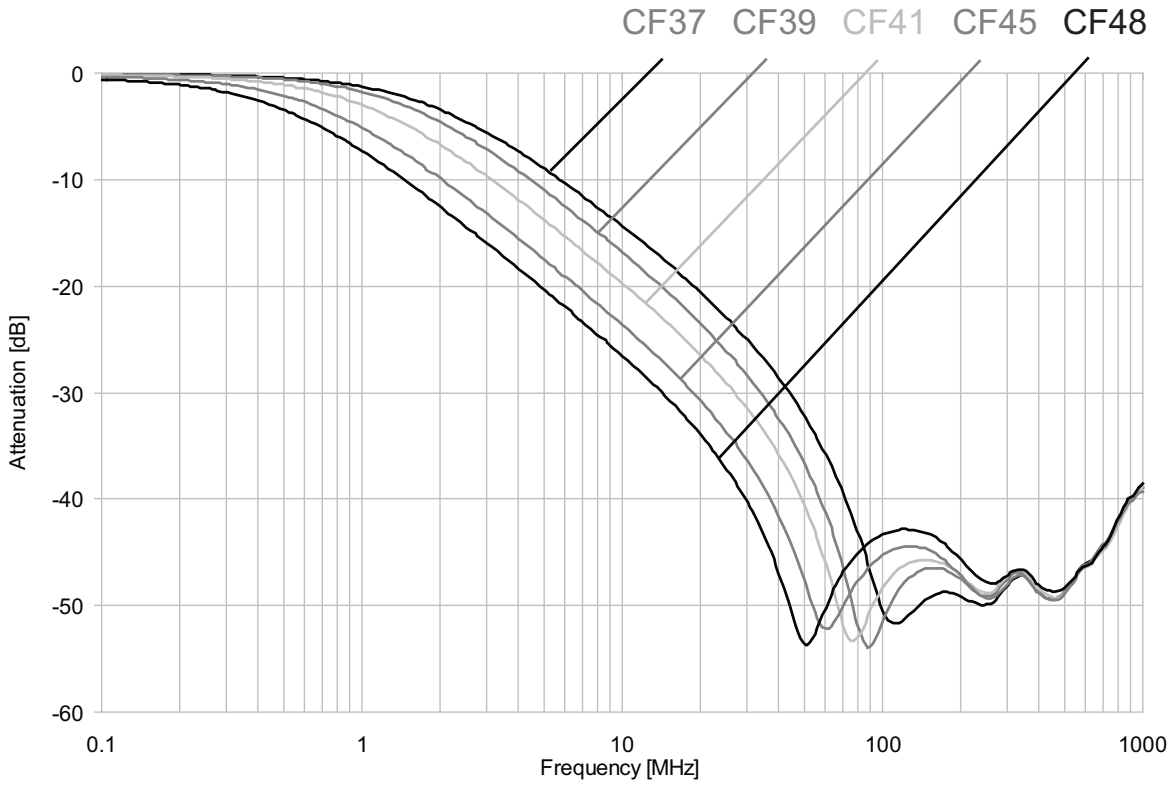
Typical cutoff frequency (-3dB) $f_{co} \geq$ 300kHz .

Minimum Attenuation

Filter Code	Typical Cap. [nF] (2)	f_{co} [MHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
CF37	3.9	1.9	0	6	11	23	31	48	47	45	30
CF39	4.7	1.5	0	7	13	25	34	49	47	46	32
CF40	5.6	1.3	0	8	14	25	32	47	48	48	32
CF41	6.8	1.1	0	10	17	28	38	46	48	48	31
CF42	8.2	0.92	1	12	18	30	41	42	46	46	30
CF45	10	0.65	3	15	20	34	46	44	49	49	33
CF46	12	0.54	4	16	22	34	46	43	48	48	32
CF48	15	0.44	5	18	23	36	50	39	46	46	31

(1) Measured in 50Ω system according to MIL-STD -220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
(3) For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

C Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz $\leq f \leq$ 300kHz	300kHz $\leq f \leq$ 3MHz	3MHz $\leq f \leq$ 30MHz	30MHz $\leq f \leq$ 300MHz	300MHz $\leq f \leq$ 3GHz

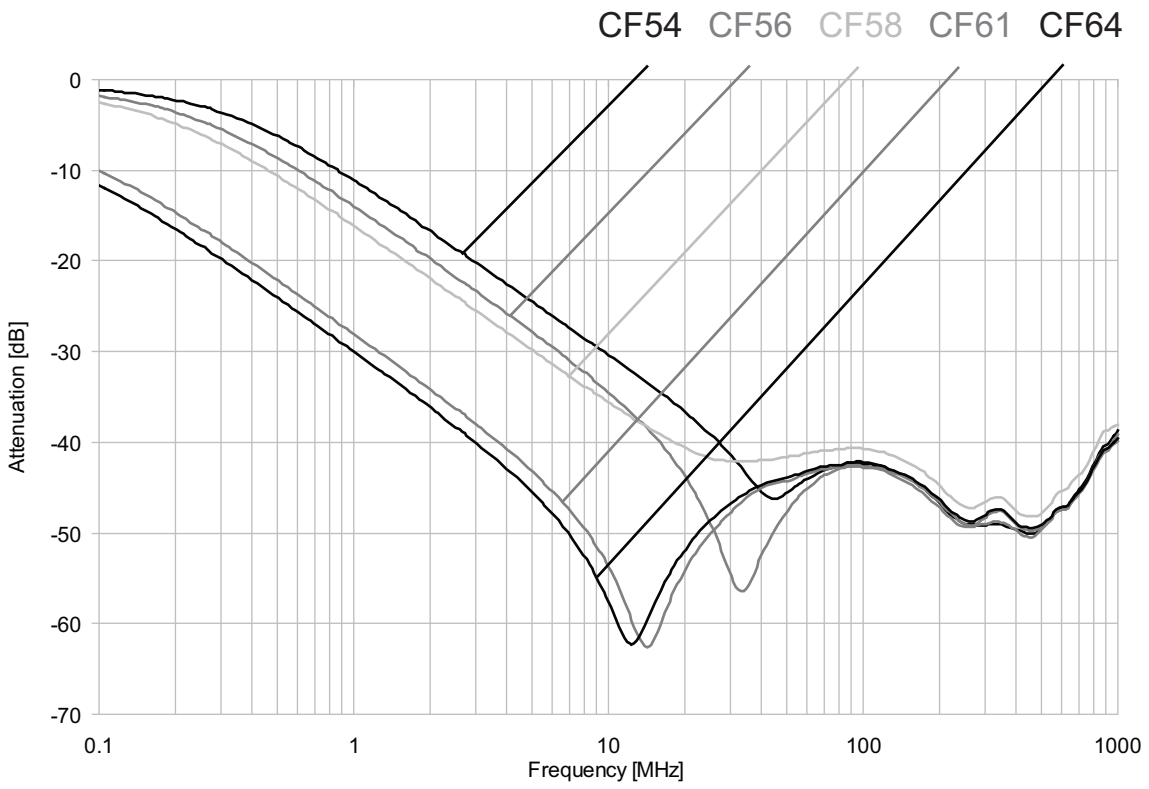
Typical cutoff frequency (-3dB) $f_{co} \geq$ 30kHz .

Minimum Attenuation

Filter Code	Typical Cap. [nF] (2)	f_{co} [kHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
CF54	22	270	8	22	28	45	45	40	48	47	31
CF56	33	188	11	24	30	50	43	40	46	46	31
CF58	47	123	13	27	32	40	40	39	47	45	30
CF61	180	38	25	40	51	44	41	40	48	48	33
CF64	220	30	27	42	54	43	40	40	48	48	32

(1) Measured in 50Ω system according to MIL-STD -220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
(3) For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

C Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz $\leq f \leq$ 300kHz	300kHz $\leq f \leq$ 3MHz	3MHz $\leq f \leq$ 30MHz	30MHz $\leq f \leq$ 300MHz	300MHz $\leq f \leq$ 3GHz

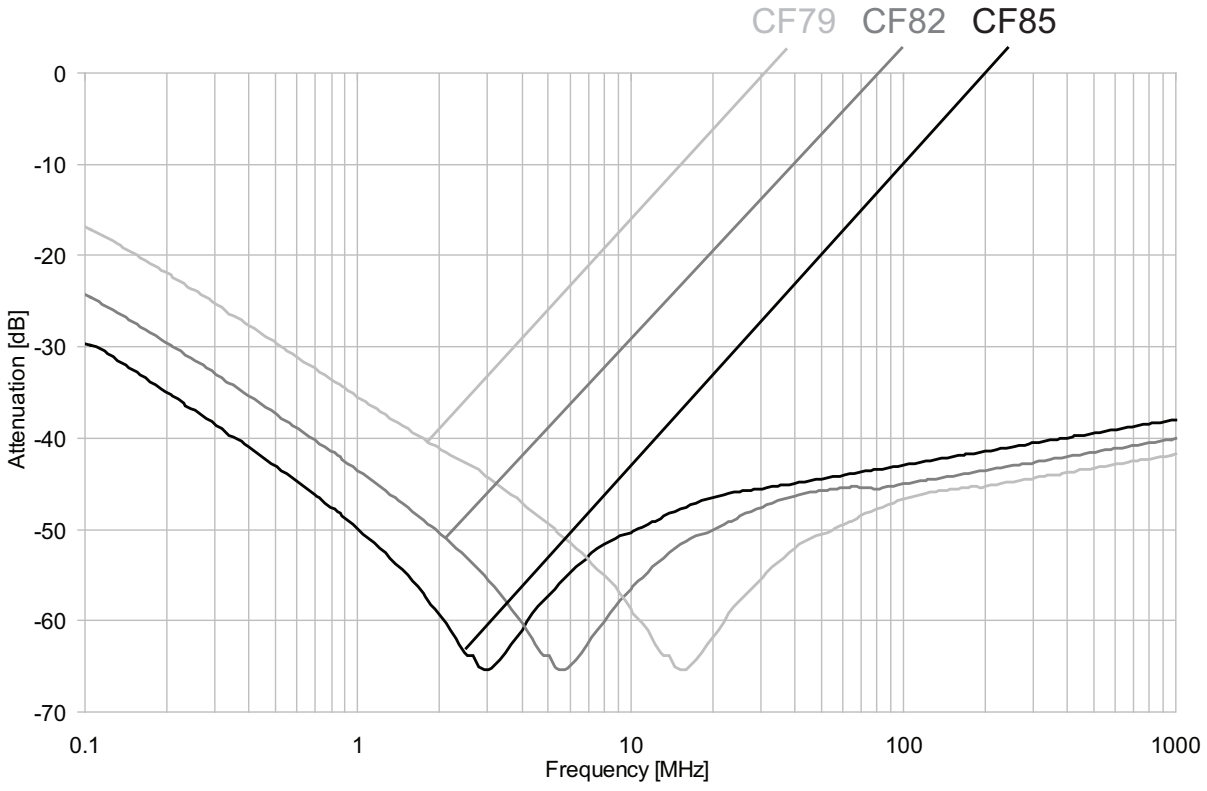
Typical cutoff frequency (-3dB) $f_{co} \geq$ 300kHz .

Minimum Attenuation

Filter Code	Typical Cap. [µF] (2)	f_{co} [kHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
CF79	0.47	12	32	35	42	45	39	38	37	36	34
CF82	1	6.2	40	45	42	43	37	36	35	34	32
CF85	2.2	3	44	42	37	41	35	34	33	32	30

(1) Measured in 50Ω system according to MIL-STD -220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
(3) For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

LC&CL Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz ≤ f ≤ 300kHz	300kHz ≤ f ≤ 3MHz	3MHz ≤ f ≤ 30MHz	30MHz ≤ f ≤ 300MHz	300MHz ≤ f ≤ 3GHz

Typical cutoff frequency (-3dB) $f_{co} \geq$ 30MHz .

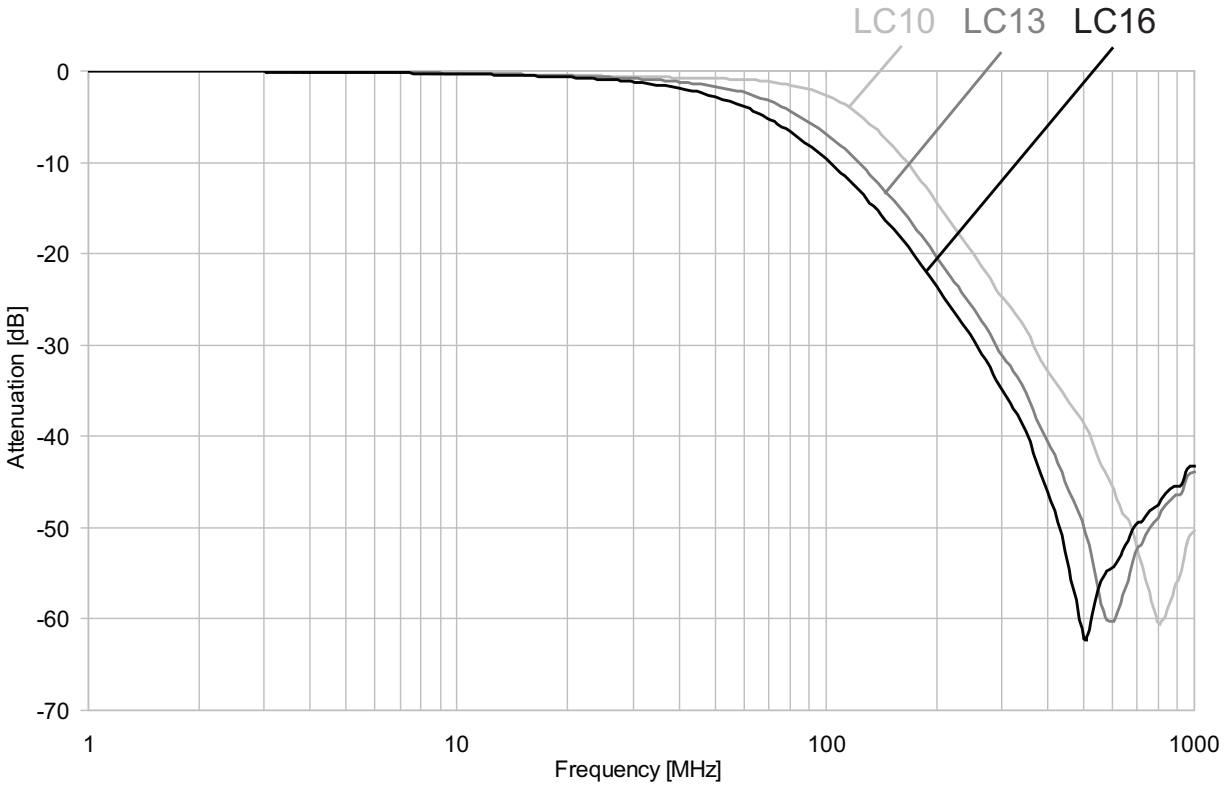
Minimum Attenuation

Filter Code (*)	Typical Cap. [pF] (2)	f_{co} [MHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
LC10	47	106	0	0	0	0	0	0	18	32	38
LC13	82	68	0	0	0	0	0	1	25	43	35
LC16	120	52	0	0	0	0	0	4	29	53	34

(*) For CL filter replace LC with CL

(1) Measured in 50Ω system according to MIL-STD-220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
(3) For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

LC&CL Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz $\leq f \leq$ 300kHz	300kHz $\leq f \leq$ 3MHz	3MHz $\leq f \leq$ 30MHz	30MHz $\leq f \leq$ 300MHz	300MHz $\leq f \leq$ 3GHz

Typical cutoff frequency (-3dB) $f_{co} \geq$ 3MHz .

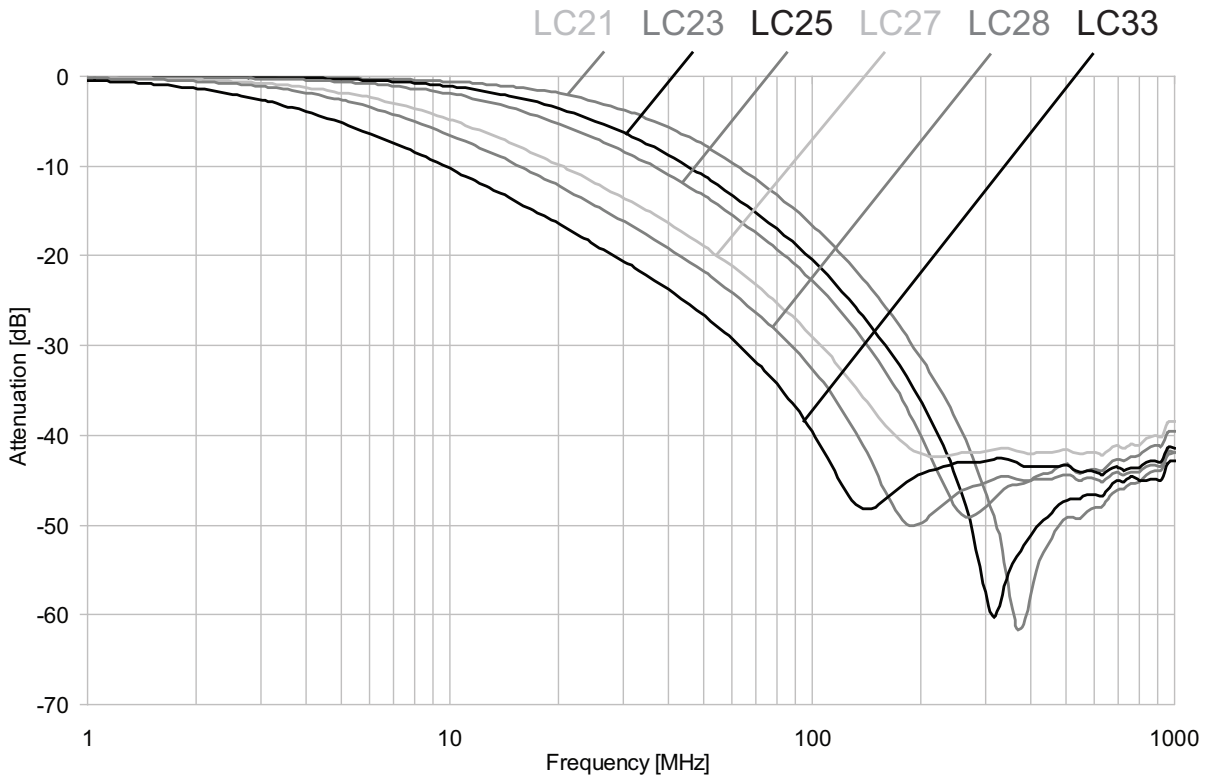
Minimum Attenuation

Filter Code (*)	Typical Cap. [pF] (2)	f_{co} [MHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
LC21	220	26.5	0	0	0	2	5	14	42	52	39
LC23	330	18.2	0	0	0	3	7	15	49	41	34
LC25	470	13.2	0	0	0	6	11	18	43	41	38
LC26	820	7.8	0	0	1	9	15	23	37	36	30
LC27	1000	7	0	0	3	11	17	26	39	38	33
LC28	1200	5.5	0	0	5	14	20	30	41	41	34
LC32	1800	3.6	0	1	6	16	22	32	37	38	33
LC33	2200	3.3	0	3	8	18	24	37	40	42	36

(*) For CL filter replace LC with CL

(1) Measured in 50Ω system according to MIL-STD-220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
(3) For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

LC&CL Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz $\leq f \leq$ 300kHz	300kHz $\leq f \leq$ 3MHz	3MHz $\leq f \leq$ 30MHz	30MHz $\leq f \leq$ 300MHz	300MHz $\leq f \leq$ 3GHz

Typical cutoff frequency (-3dB) $f_{co} \geq$ 300kHz .

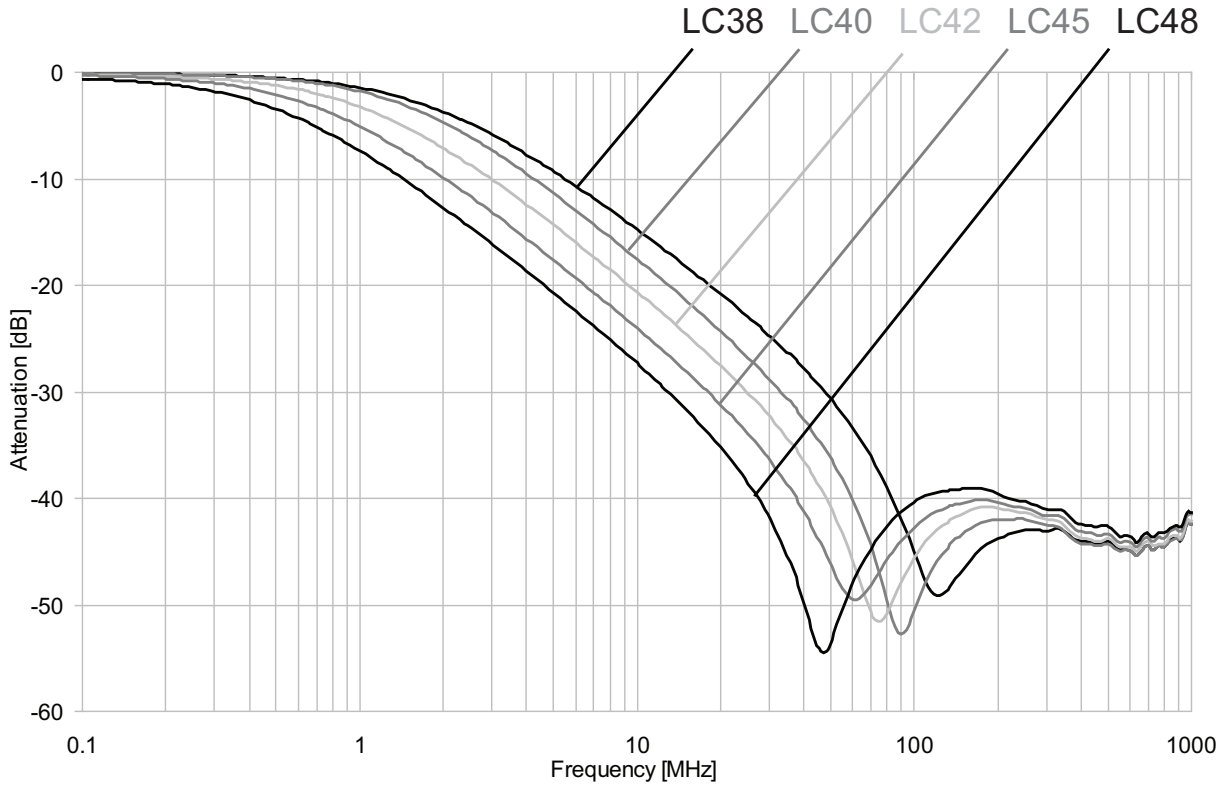
Minimum Attenuation

Filter Code (*)	Typical Cap. [nF] (2)	f_{co} [MHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
LC38	3.9	1.7	0	7	7	22	28	41	39	38	36
LC40	4.7	1.4	0	9	9	25	33	44	37	39	34
LC42	6.8	0.96	1	12	12	29	38	41	38	37	36
LC43	8.2	0.86	2	13	13	30	40	38	36	37	33
LC45	10	0.66	3	15	15	33	42	36	35	37	32
LC48	15	0.45	5	18	18	38	50	35	35	37	33

(*) For CL filter replace LC with CL

(1) Measured in 50Ω system according to MIL-STD-220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
(3) For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

LC&CL Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz $\leq f \leq$ 300kHz	300kHz $\leq f \leq$ 3MHz	3MHz $\leq f \leq$ 30MHz	30MHz $\leq f \leq$ 300MHz	300MHz $\leq f \leq$ 3GHz

Typical cutoff frequency (-3dB) $f_{co} \geq$ 30kHz .

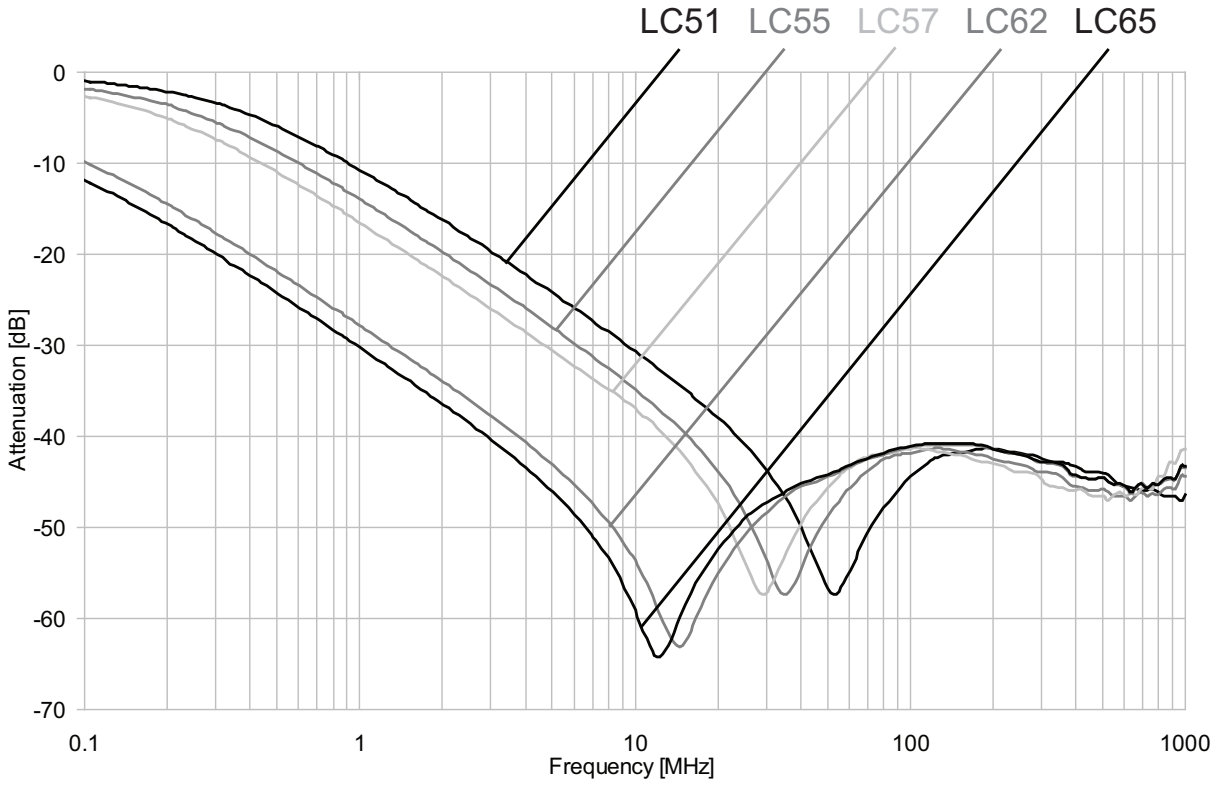
Minimum Attenuation

Filter Code (*)	Typical Cap. [nF] (2)	f_{co} [kHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
LC51	22	270	9	22	29	42	51	39	40	41	37
LC55	33	166	11	25	31	50	44	36	38	40	35
LC57	47	116	15	27	34	51	41	37	39	41	36
LC62	180	35	25	41	50	45	41	35	37	38	35
LC65	220	30	28	43	55	44	40	35	37	38	34

(*) For CL filter replace LC with CL

(1) Measured in 50Ω system according to MIL-STD-220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
(3) For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

π Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz $\leq f \leq$ 300kHz	300kHz $\leq f \leq$ 3MHz	3MHz $\leq f \leq$ 30MHz	30MHz $\leq f \leq$ 300MHz	300MHz $\leq f \leq$ 3GHz

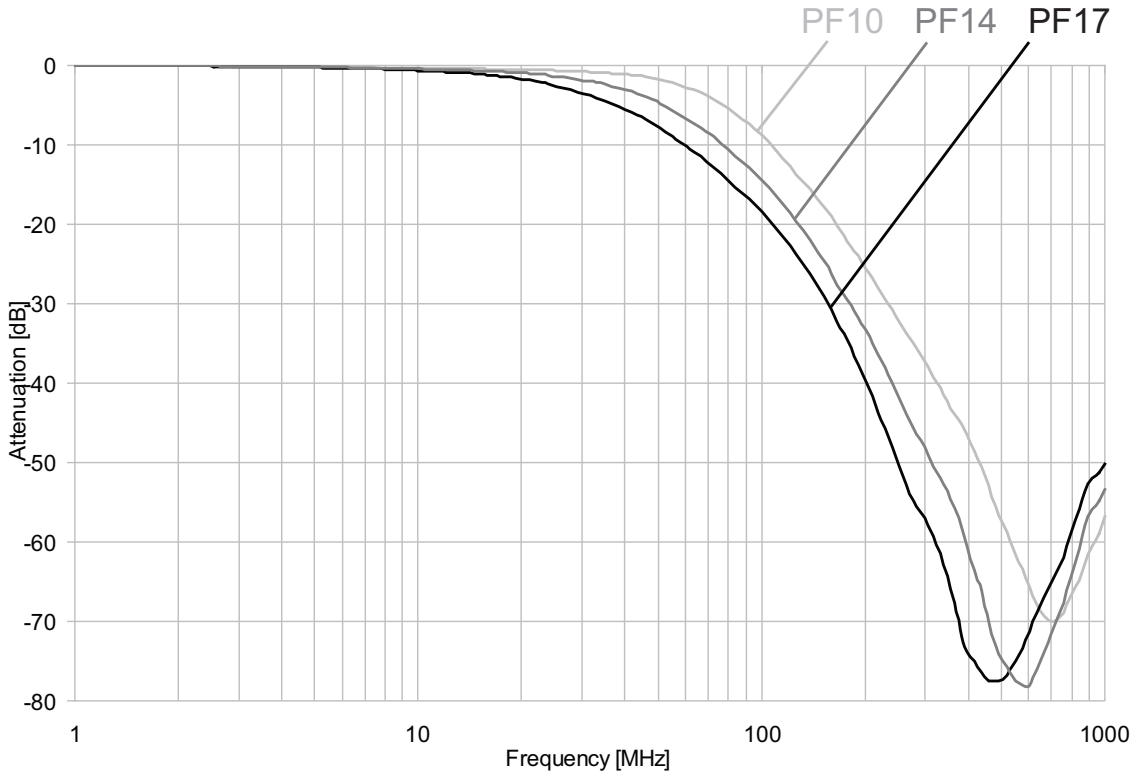
Typical cutoff frequency (-3dB) $f_{co} \geq$ 30MHz .

Minimum Attenuation

Filter Code	Typical Cap. [pF] (2)	f_{co} [MHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
PF06	44	95	0	0	0	0	0	0	23	32	47
PF10	94	63.5	0	0	0	0	0	5	31	48	45
PF14	164	40	0	0	0	0	3	14	45	65	48
PF17	240	28	0	0	0	1	5	16	55	65	45

(1) Measured in 50Ω system according to MIL-STD -220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

π Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz $\leq f \leq$ 300kHz	300kHz $\leq f \leq$ 3MHz	3MHz $\leq f \leq$ 30MHz	30MHz $\leq f \leq$ 300MHz	300MHz $\leq f \leq$ 3GHz

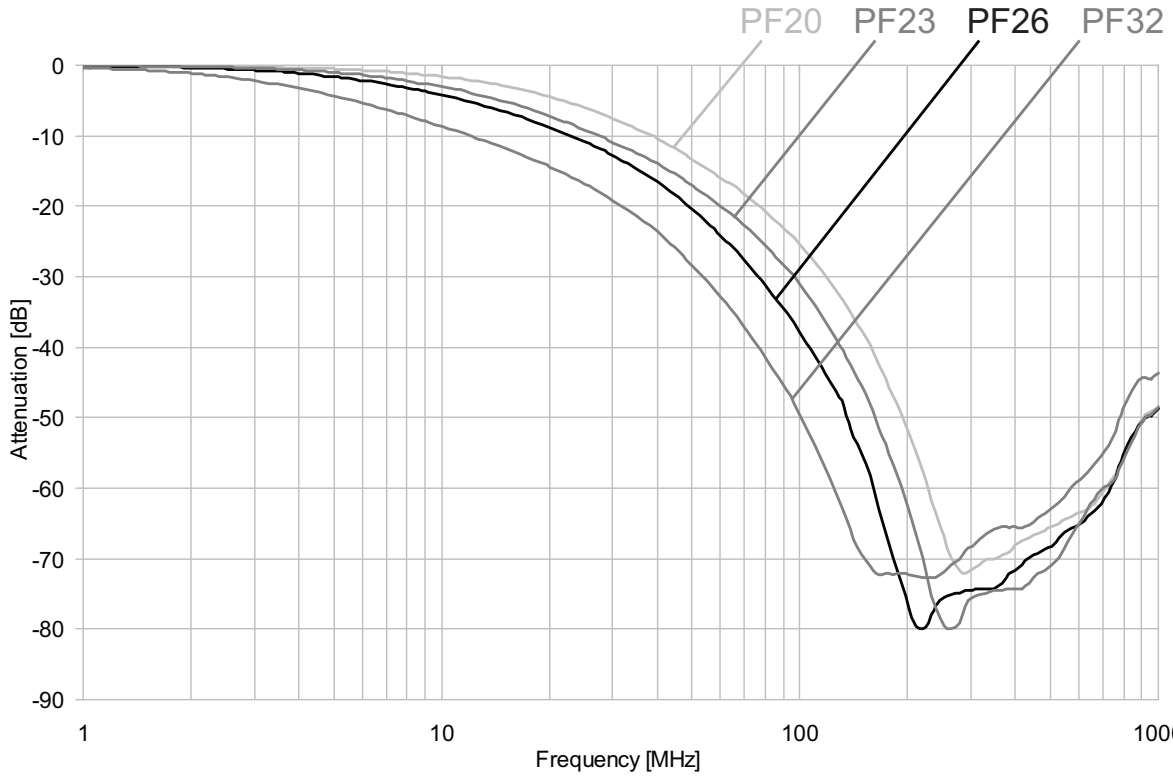
Typical cutoff frequency (-3dB) $f_{co} \geq$ 3MHz .

Minimum Attenuation

Filter Code	Typical Cap. [pF] (2)	f_{co} [MHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
PF20	440	15.5	0	0	0	5	10	19	63	62	47
PF23	660	10	0	0	2	10	17	30	64	61	44
PF26	940	8	0	0	3	12	19	32	56	53	42
PF32	2000	3.8	0	3	8	17	26	45	57	54	40

(1) Measured in 50Ω system according to MIL-STD -220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
(3) For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

π Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz $\leq f \leq$ 300kHz	300kHz $\leq f \leq$ 3MHz	3MHz $\leq f \leq$ 30MHz	30MHz $\leq f \leq$ 300MHz	300MHz $\leq f \leq$ 3GHz

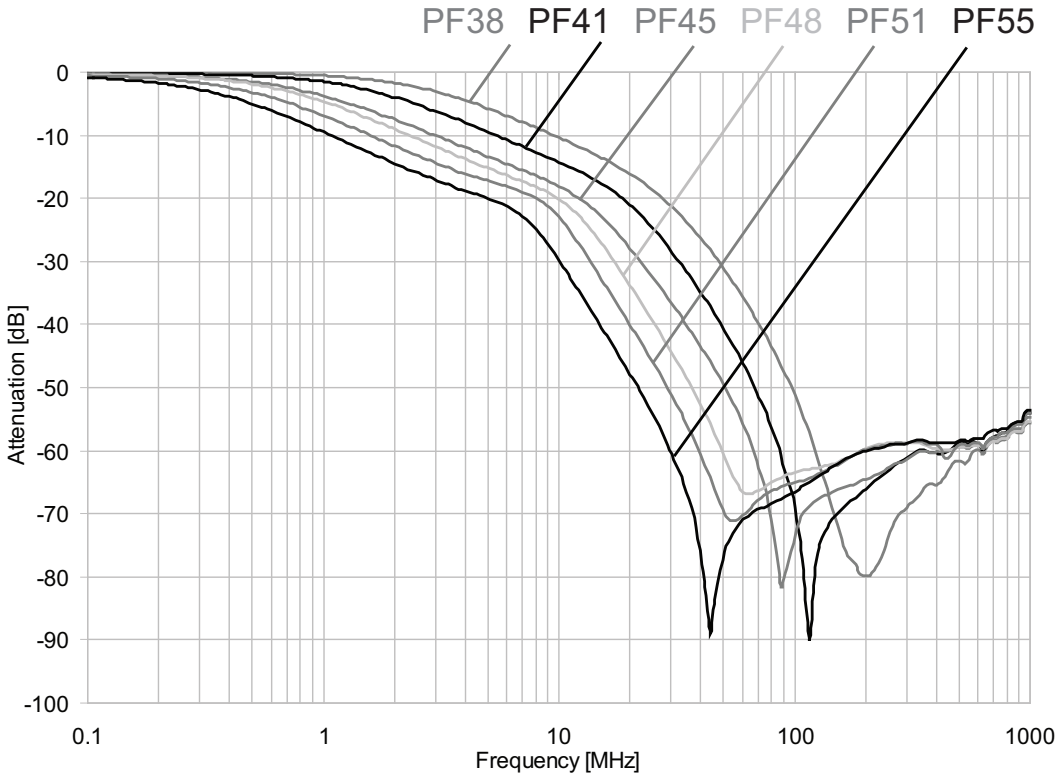
Typical cutoff frequency (-3dB) $f_{co} \geq$ 300kHz .

Minimum Attenuation

Filter Code	Typical Cap. [nF] (2)	f_{co} [MHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
PF38	2.4	3	0	3	7	15	22	45	55	54	42
PF41	4.4	1.6	0	8	12	25	37	61	56	54	44
PF45	7.8	0.84	2	11	15	33	46	51	53	52	42
PF48	9.4	0.7	3	13	18	39	51	58	54	53	43
PF51	13.6	0.48	5	15	20	48	51	60	56	57	43
PF55	20	0.32	7	17	28	55	51	50	54	52	43

(1) Measured in 50Ω system according to MIL-STD -220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
(3) For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

π Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz $\leq f \leq$ 300kHz	300kHz $\leq f \leq$ 3MHz	3MHz $\leq f \leq$ 30MHz	30MHz $\leq f \leq$ 300MHz	300MHz $\leq f \leq$ 3GHz

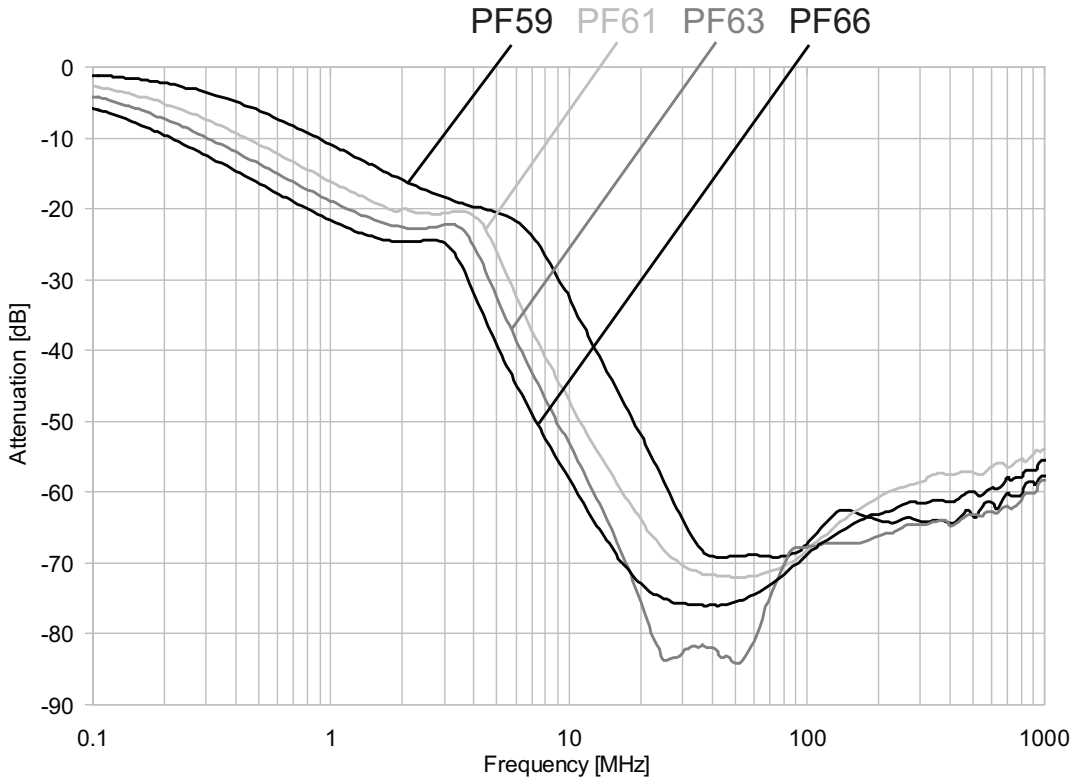
Typical cutoff frequency (-3dB) $f_{co} \geq$ 30kHz .

Minimum Attenuation

Filter Code	Typical Cap. [nF] (2)	f_{co} [kHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
PF59	24	255	8	19	30	54	53	50	55	55	44
PF60	30	210	10	20	34	61	61	57	55	53	45
PF61	44	116	14	25	42	59	57	56	61	52	46
PF63	66	96	17	30	49	62	63	54	59	57	45
PF66	94	71	19	38	55	62	59	58	62	62	46

(1) Measured in 50Ω system according to MIL-STD -220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
(3) For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

π Filter

Audio	LF	MF	HF	VHF	UHF
$f \leq$ 30kHz	30kHz ≤ f ≤ 300kHz	300kHz ≤ f ≤ 3MHz	3MHz ≤ f ≤ 30MHz	30MHz ≤ f ≤ 300MHz	300MHz ≤ f ≤ 3GHz

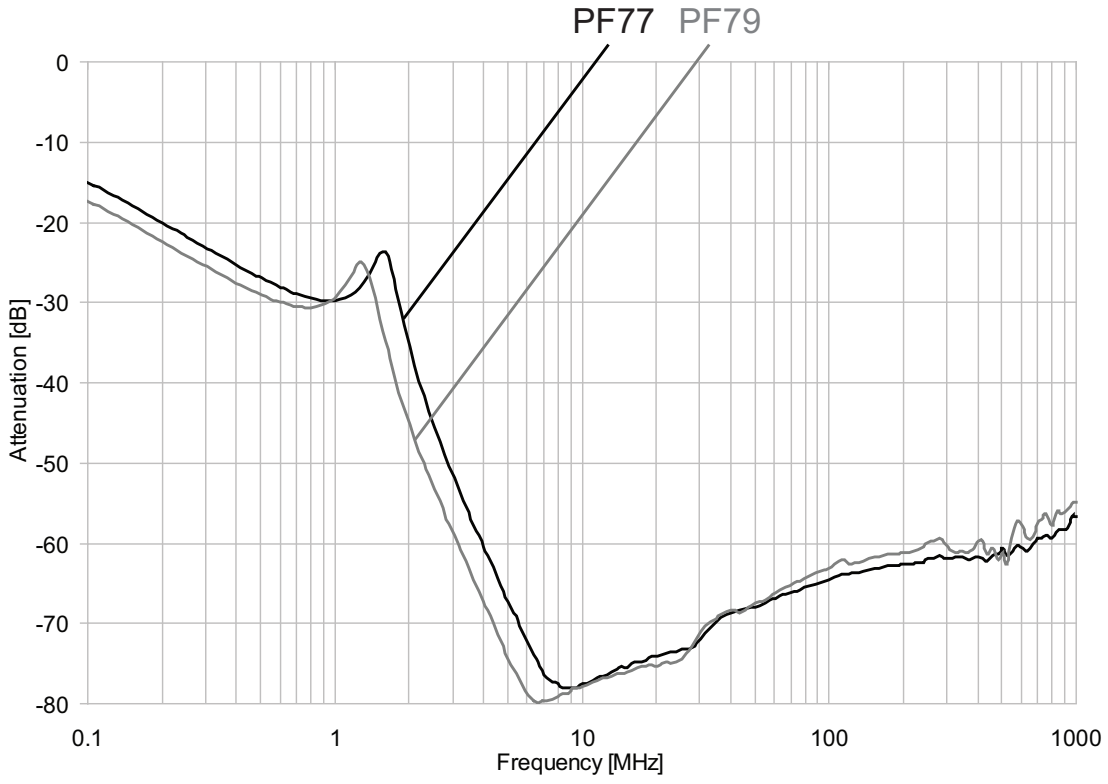
Typical cutoff frequency (-3dB) $f_{co} \leq$ 30kHz .

Minimum Attenuation

Filter Code	Typical Cap. [nF] (2)	f_{co} [kHz] Typical (3)	Min. Attenuation [dB] VS. Frequency [MHz] (1)								
			1	5	10	30	50	100	300	500	1000
PF77	360	18	27	63	63	57	55	55	53	53	41
PF79	440	14.5	27	65	63	57	55	54	53	52	41

(1) Measured in 50Ω system according to MIL-STD -220, no load.
(2) Capacitance tolerance: ±20%. For other capacitance values, contact sales.
(3) For estimation of the filter cut off frequency in non-50Ω system please refer to the design notes.

Typical measured filter attenuation



* Note: All filters characteristics subject to change without prior notice.

Bidirectional Varistors

RF Immunity's technology integrates homogenous or selective transient protection (using Varistors) into connectors without increasing dimensions. This section will help to define a homogenous transient protection Connector or transient protection added to a Filtered Connector.

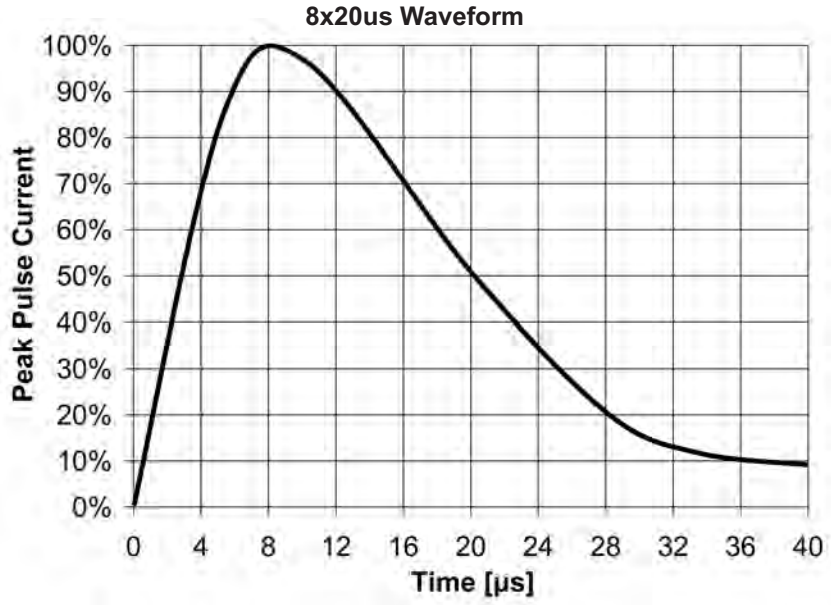
The technology is based on multilayer ZnO (Zink-Oxide) transient suppressor, designed to protect sensitive circuit from transient caused by inductive switching, ESD, EFT, lightning and other phenomenon as IEC 61000-4-2 specifies.

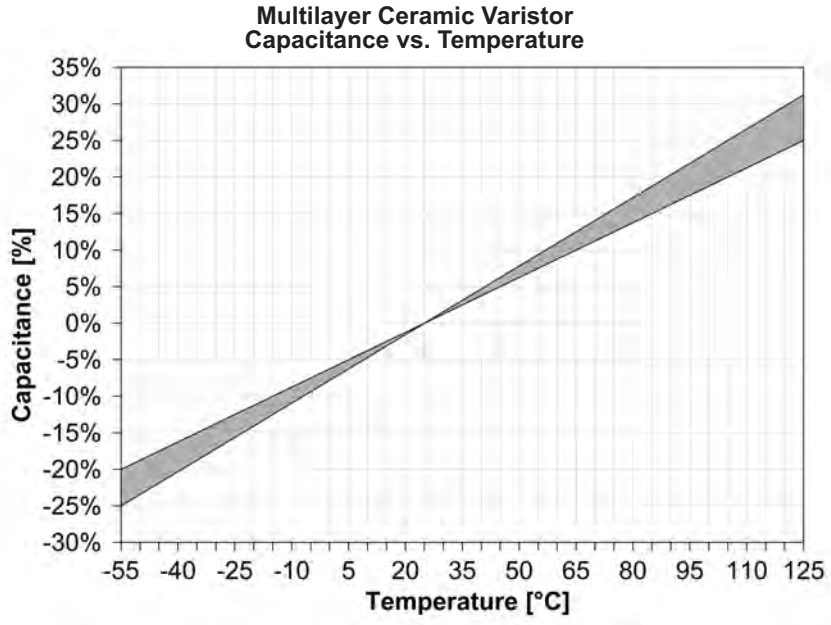
There are two main advantages using Varistors inside the connector shell instead of placing the components on board:

1. The connector is the entry point to the equipment; therefore, this is the weakest point to absorb ESD, lightning and other non-conducted transients. Placing the protection at this point will ensure that no outer transient will enter to the equipment by air-discharge or by conductance through connector contacts and into the sensitive circuits.

2. Comparing to onboard components, the response time of Varistors inside the connector is shorter due to the Varistors grounding point, which is the connector metal shell assembled directly to the equipment enclosure. The onboard components equivalent series inductance plus the unknown elements of the printed circuit traces will cause longer response time and the transient suppressors might be less effective.

Although the Varistors have capacitance, it should not be considered as part of the filter module but as added capacitance due to its tolerances. Therefore, when choosing Transient Protection, special care should be taken for the maximum capacitance level. Low capacitance Varistors are available.





* Note: For higher energy Transient Protection contact sales.

Bidirectional Varistors

Note: For higher energy and/or low capacitance Transient Protection contact sales.

Energy[1] [J]	Transient Protection Code	Working Voltage		Breakdown Voltage @ 1mA$_{DC}$		Clamping Voltage[2] [V]	Peak Current[3] (A)	Typical Capacitance[4] [pF]
		[V_{DC}]	[V_{AC}]	Min. [V]	Max. [V]			
0.1	ZA03	3.3	2.3	3.7	7	13	30	1500
	ZA05	5.5	4.0	6.8	10.2	18	30	800
	ZA09	9.0	6.4	10.8	16	25.5	30	600
	ZA14	14	10	15.9	21.5	32	30	400
	ZA18	18	13	22	28	50	30	200
	ZA26	26	18	31	38	60	30	150
	ZA30	30	21	37	46	74	30	150
0.2	ZB03	3.3	2.3	3.7	7	13	45	3000
	ZB05	5.5	4	6.8	10.2	18	45	1600
	ZB09	9.0	6.4	10.8	16	25.5	45	1200
	ZB14	14	10	15.9	21.5	32	45	800
	ZB18	18	13	22	28	50	45	400
	ZB26	26	18	31	38	60	45	300
	ZB30	30	21	37	46	74	45	300
0.3	ZC03	3.3	2.3	3.7	7	13	120	5000
	ZC05	5.5	4	6.8	10.2	18	120	3000
	ZC14	14	10	15.9	21.5	32	120	900
	ZC18	18	13	22	28	50	100	600
	ZC26	26	18	31	38	60	100	250

(1) Non-Repetitive Surge Energy, 10x1000µs Waveform
(2) @1A$_{DC}$, 8x20µs Waveform
(3) Peak Transient Current Rating, 8x20µs Waveform
(4) Measured @ 0.5V_{RMS}/1kHz.
(5) Maximum Leakage Current 100µA @ W.V.$_{DC}$

* Note: For higher energy Transient Protection contact sales.

Codes for homogenous C Filter combined with Bidirectional Varistors

Working Voltage [VDC]	Transient Protection Code[2]	Energy [J]	Filter Code[1]										
			Cap.										
			CF23	CF26	CF29	CF32	CF39	CF42	CF45	CF48	CF56	CF61	CF64
			470pF	820pF	1.2nF	2.2nF	4.7nF	8.2nF	10nF	15nF	33nF	180nF	220nF
3.3	ZA03	0.1					TA12	TA19	TA26	TA33	TA40	TA47	TA54
							6.2nF	9.7nF	11.5nF	16.5nF	34.5nF	181.5nF	221.5nF
	ZC03	0.3							TD11	TD16	TD21	TD26	TD31
									15nF	20nF	38nF	185nF	225nF
5.6	ZA05	0.1					TA13	TA20	TA27	TA34	TA41	TA48	TA55
							5.5nF	9nF	10.8nF	15.8nF	33.8nF	180.8nF	220.8nF
	ZC05	0.3							TD12	TD17	TD22	TD27	TD32
									13nF	18nF	36nF	183nF	223nF
9	ZA09	0.1					TA14	TA21	TA28	TA35	TA42	TA49	TA56
							5.3nF	8.8nF	10.6nF	15.6nF	33.6nF	180.6nF	220.6nF
14	ZA14	0.1				TA08	TA15	TA22	TA29	TA36	TA43	TA50	TA57
						2.6nF	5.1nF	8.6nF	10.4nF	15.4nF	33.4nF	180.4nF	220.4nF
	ZC14	0.3					TD05	TD08	TD13	TD18	TD23	TD28	TD33
							5.6nF	9.1nF	10.9nF	15.9nF	33.9nF	180.9nF	220.9nF
18	ZA18	0.1			TA05	TA09	TA16	TA23	TA30	TA37	TA44	TA51	TA58
					1.4nF	2.4nF	4.9nF	8.4nF	10.2nF	15.2nF	33.2nF	180.2nF	220.2nF
	ZC18	0.3				TD03	TD06	TD09	TD14	TD19	TD24	TD29	TD34
						2.8nF	5.3nF	8.8nF	10.6nF	15.6nF	33.6nF	180.6nF	220.6nF
26	ZA26	0.1	TA01	TA03	TA06	TA10	TA17	TA24	TA31	TA38	TA45	TA52	TA59
			620pF	970pF	1.35nF	2.35nF	4.85nF	8.35nF	10.15nF	15.15nF	33.15nF	180.15nF	220.15nF
	ZC26	0.3		TD01	TD02	TD04	TD07	TD10	TD15	TD20	TD25	TD30	TD35
				1.07nF	1.45nF	2.45nF	4.95nF	8.45nF	10.25nF	15.25nF	33.25nF	180.25nF	220.25nF
30	ZA30	0.1	TA02	TA04	TA07	TA11	TA18	TA25	TA32	TA39	TA46	TA53	TA60
			620pF	970pF	1.35nF	2.35nF	4.85nF	8.35nF	10.15nF	15.15nF	33.15nF	180.15nF	220.15nF

(1) Refer to the attenuation on pages 46-50.
(2) Refer to the characteristics on page 61.

Example:

Assuming that a CF45 filter and a ZA05 transient protection are selected for all the connector contacts, the combined code can be extracted by finding the intersection of the CF45 **column** with the ZA05 **row**. The combined code is TA27. The typical capacitance of the combined filter is **10.8nF**.

Refer to the design notes (page 84) for estimation of the cutoff frequency (f_{CC}) of the combined filter. If the estimated f_{CC} is too low, select a filter with lower capacitance.

Codes for homogenous LC Filter combined with Bidirectional Varistors

Working Voltage [VDC]	Transient Protection Code[2]	Energy [J]	Filter Code[1]									
			Cap.									
			LC23	LC26	LC32	LC40	LC43	LC45	LC48	LC56	LC62	LC65
			330pF	820pF	1.8nF	4.7nF	8.2nF	10nF	15nF	33nF	180nF	220nF
3.3	ZA03	0.1				TB08	TB15	TB22	TB29	TB36	TB43	TB50
						6.2nF	9.7nF	11.5nF	16.5nF	34.5nF	181.5nF	221.5nF
	ZC03	0.3							TE14	TE19	TE24	TE29
									20nF	38nF	185nF	225nF
5.6	ZA05	0.1				TB09	TB16	TB23	TB30	TB37	TB44	TB51
						5.5nF	9nF	10.8nF	15.8nF	33.8nF	180.8nF	220.8nF
	ZC05	0.3						TE10	TE15	TE20	TE25	TE30
								13nF	18nF	36nF	183nF	223nF
9	ZA09	0.1				TB10	TB17	TB24	TB31	TB38	TB45	TB52
						5.3nF	8.8nF	10.6nF	15.6nF	33.6nF	180.6nF	220.6nF
14	ZA14	0.1			TB04	TB11	TB18	TB25	TB32	TB39	TB46	TB53
					2.2nF	5.1nF	8.6nF	10.4nF	15.4nF	33.4nF	180.4nF	220.4nF
	ZC14	0.3				TE04	TE07	TE11	TE16	TE21	TE26	TE31
						5.6nF	9.1nF	10.9nF	15.9nF	33.9nF	180.9nF	220.9nF
18	ZA18	0.1			TB05	TB12	TB19	TB26	TB33	TB40	TB47	TB54
					2nF	4.9nF	8.4nF	10.2nF	15.2nF	33.2nF	180.2nF	220.2nF
	ZC18	0.3			TE02	TE05	TE08	TE12	TE17	TE22	TE27	TE32
					2.4nF	5.3nF	8.8nF	10.6nF	15.6nF	33.6nF	180.6nF	220.6nF
26	ZA26	0.1		TB02	TB06	TB13	TB20	TB27	TB34	TB41	TB48	TB55
				970pF	1.95nF	4.85nF	8.35nF	10.15nF	15.15nF	33.15nF	180.15nF	220.15nF
	ZC26	0.3		TE01	TE03	TE06	TE09	TE13	TE18	TE23	TE28	TE33
				1.07nF	2.05nF	4.95nF	8.45nF	10.25nF	15.25nF	33.25nF	180.25nF	220.25nF
30	ZA30	0.1	TB01	TB03	TB07	TB14	TB21	TB28	TB35	TB42	TB49	TB56
			480pF	970pF	1.95nF	4.85nF	8.35nF	10.15nF	15.15nF	33.15nF	180.15nF	220.15nF

(1) Refer to the attenuation on pages 51-54.
(2) Refer to the characteristics on page 61.

Example:

Assuming that a LC45 filter and a ZA05 transient protection are selected for all the connector contacts, the combined code can be extracted by finding the intersection of the LC45 **column** with the ZA05 **row**. The combined code is TB23. The typical capacitance of the combined filter is **11.5nF.**

Refer to the design notes (page 84) for estimation of the cutoff frequency (f_{co}) of the combined filter. If the estimated f_{co} is too low, select a filter with lower capacitance.

Codes for homogenous CL Filter combined with Bidirectional Varistors

Working Voltage [VDC]	Transient Protection Code[2]	Energy [J]	Filter Code[1]									
			Cap.									
			CL23	CL26	CL32	CL40	CL43	CL45	CL48	CL56	CL62	CL65
			330pF	820pF	1.8nF	4.7nF	8.2nF	10nF	15nF	33nF	180nF	220nF
3.3	ZA03	0.1				TC08	TC15	TC22	TC29	TC36	TC43	TC50
						6.2nF	9.7nF	11.5nF	16.5nF	34.5nF	181.5nF	221.5nF
	ZC03	0.3							TF14	TF19	TF24	TF29
									20nF	38nF	185nF	225nF
5.6	ZA05	0.1				TC09	TC16	TC23	TC30	TC37	TC44	TC51
						5.5nF	9nF	10.8nF	15.8nF	33.8nF	180.8nF	220.8nF
	ZC05	0.3						TF10	TF15	TF20	TF25	TF30
								13nF	18nF	36nF	183nF	223nF
9	ZA09	0.1				TC10	TC17	TC24	TC31	TC38	TC45	TC52
						5.3nF	8.8nF	10.6nF	15.6nF	33.6nF	180.6nF	220.6nF
14	ZA14	0.1			TC04	TC11	TC18	TC25	TC32	TC39	TC46	TC53
					2.2nF	5.1nF	8.6nF	10.4nF	15.4nF	33.4nF	180.4nF	220.4nF
	ZC14	0.3				TF04	TF07	TF11	TF16	TF21	TF26	TF31
						5.6nF	9.1nF	10.9nF	15.9nF	33.9nF	180.9nF	220.9nF
18	ZA18	0.1			TC05	TC12	TC19	TC26	TC33	TC40	TC47	TC54
					2nF	4.9nF	8.4nF	10.2nF	15.2nF	33.2nF	180.2nF	220.2nF
	ZC18	0.3			TF02	TF05	TF08	TF12	TF17	TF22	TF27	TF32
					2.4nF	5.3nF	8.8nF	10.6nF	15.6nF	33.6nF	180.6nF	220.6nF
26	ZA26	0.1		TC02	TC06	TC13	TC20	TC27	TC34	TC41	TC48	TC55
				970pF	1.95nF	4.85nF	8.35nF	10.15nF	15.15nF	33.15nF	180.15nF	220.15nF
	ZC26	0.3		TF01	TF03	TF06	TF09	TF13	TF18	TF23	TF28	TF33
				1.07nF	2.05nF	4.95nF	8.45nF	10.25nF	15.25nF	33.25nF	180.25nF	220.25nF
30	ZA30	0.1	TC01	TC03	TC07	TC14	TC21	TC28	TC35	TC42	TC49	TC56
			480pF	970pF	1.95nF	4.85nF	8.35nF	10.15nF	15.15nF	33.15nF	180.15nF	220.15nF

(1) Refer to the attenuation on pages 51-54.
(2) Refer to the characteristics on page 61.

Example:

Assuming that a CL45 filter and a ZA05 transient protection are selected for all the connector contacts, the combined code can be extracted by finding the intersection of the CL45 **column** with the ZA05 **row**. The combined code is TC23. The typical capacitance of the combined filter is **11.5nF**.

Refer to the design notes (page 84) for estimation of the cutoff frequency (f_{co}) of the combined filter. If the estimated f_{co} is too low, select a filter with lower capacitance.

y standards is our company mission, and a continuous improvement program is employed in all the enterprise levels.
controlled test procedures carried out with top-quality tools - from component acceptance inspection, through process control to final exam

Other Filter Families

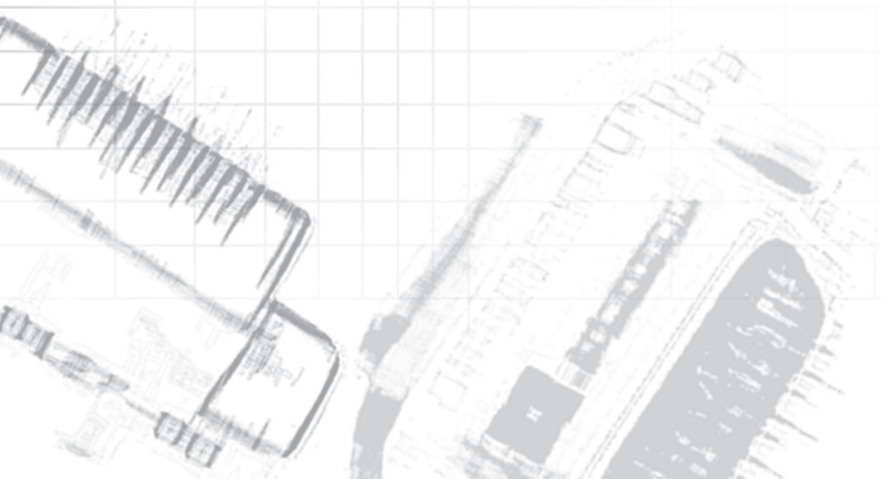
- Arinc 600
- Arinc 404 / DPX
- DPK / MIL-DTL-83733
- Filter Array
- Feed Through Line Filters
- Circular Connectors

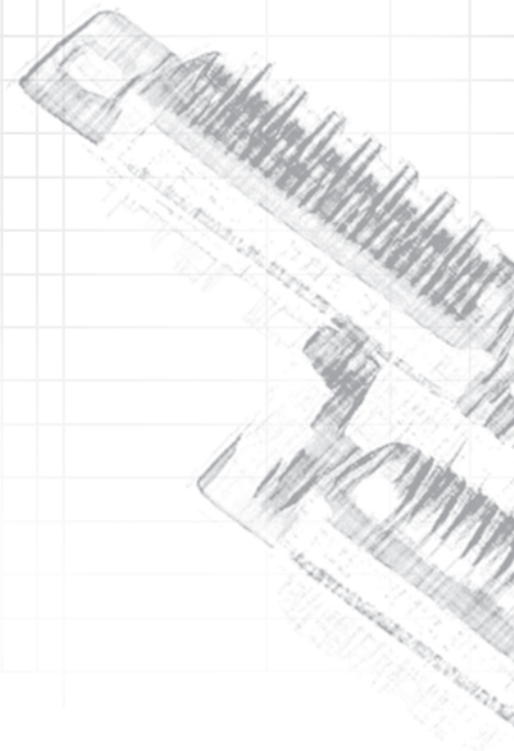
Selected Customized Products

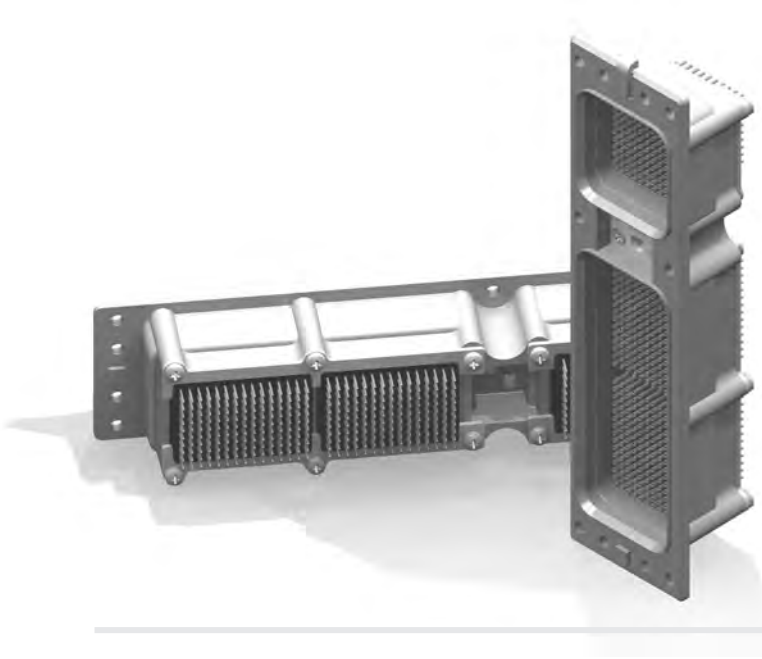
- High attenuation filter from 1kHz up to 1GHz
- Very Low Frequency Filter with low profile extension
- Filter & Lightning protected connector
- Avionic Power Source of 115Vac / 400Hz Filtered connector
- Push-Pull LEMO filtered connector
- Filtered Standoff connector
- Cable assembly
- Hermetically Sealed and Filtered D-Sub connector
- Military RJ45 Connector for Ethernet
- RD1 Filtered connector
- Crimp termination filter connector
- D38999 Series III Filter Adaptor

Design Notes

- Brief introduction to EMC
- EMI Standards
- Selecting Filter topology
- Estimation of Filter Cut Off Frequensy
- About Filter performance measuring methods
- Filter performance in non 50Ω system
- Circular Filter Connectors Check List







ARINC 600, Rack & Panel connector Series, feature low insertion force contacts.

The ARINC 600 connectors are available both in environmental resistant and non-resistant versions.

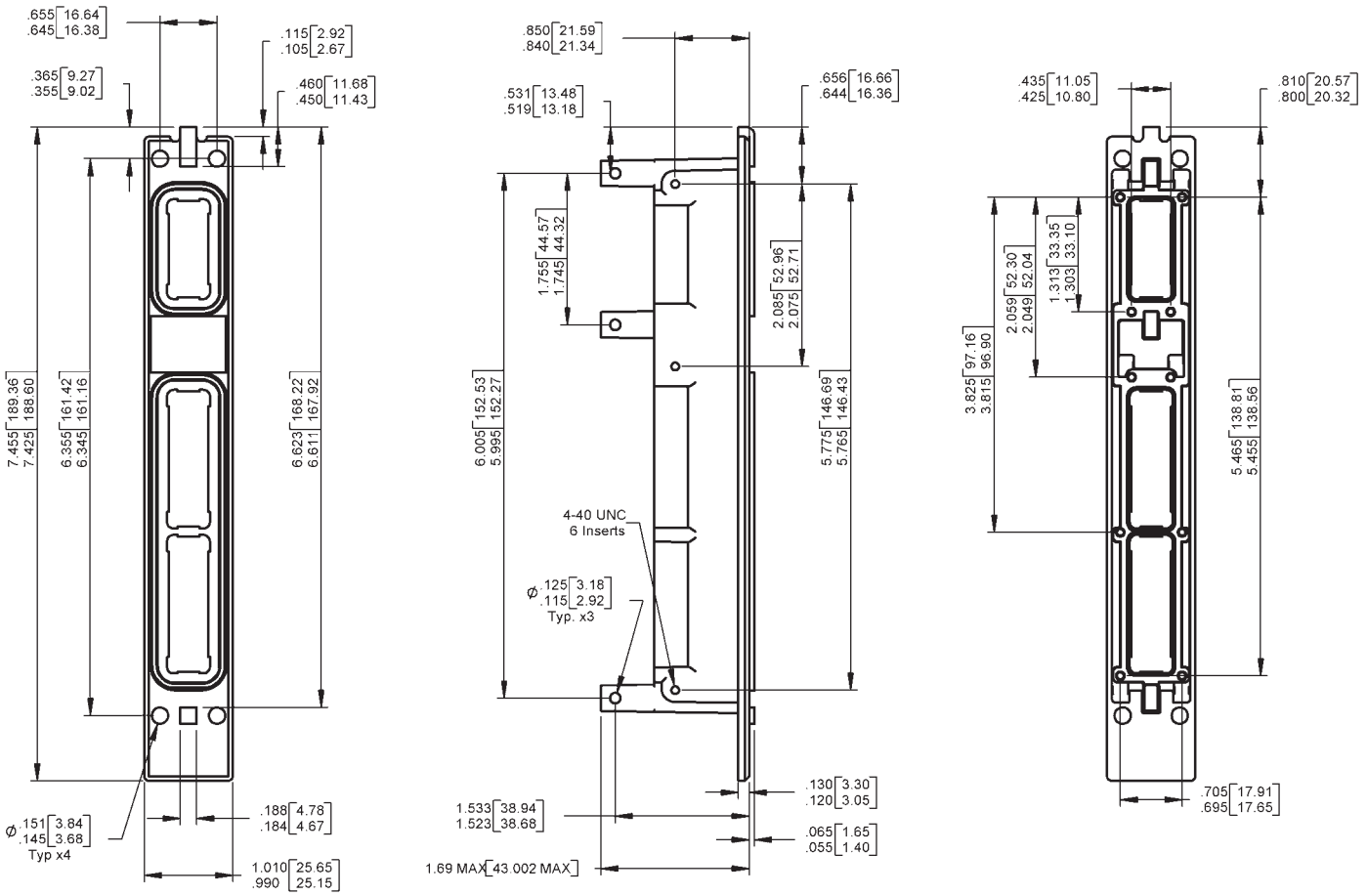
The series uses contact sizes of #1, #8, #12, #16, #20, #22 and Coax sizes of (#1, #5, #8).

The connectors are available in 3 sizes: size 1 (low profile) and size 2 with 3 gangs only while size 3 comprises 6 gangs (the maximum number of contacts of # 22 is 800).

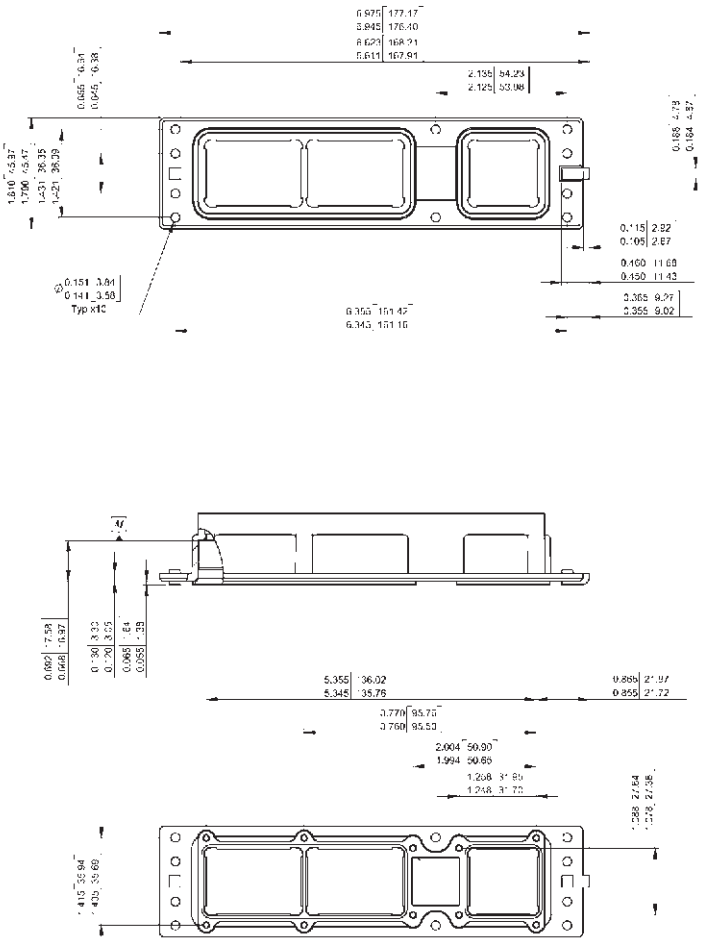
The ARINC 600 connectors are used mainly in Avionic applications.

Filters and protection components are built in as fixed and/or replaceable modules. A diversity of filters and protection types as well as power line filters can be applied to meet RTCA specification.

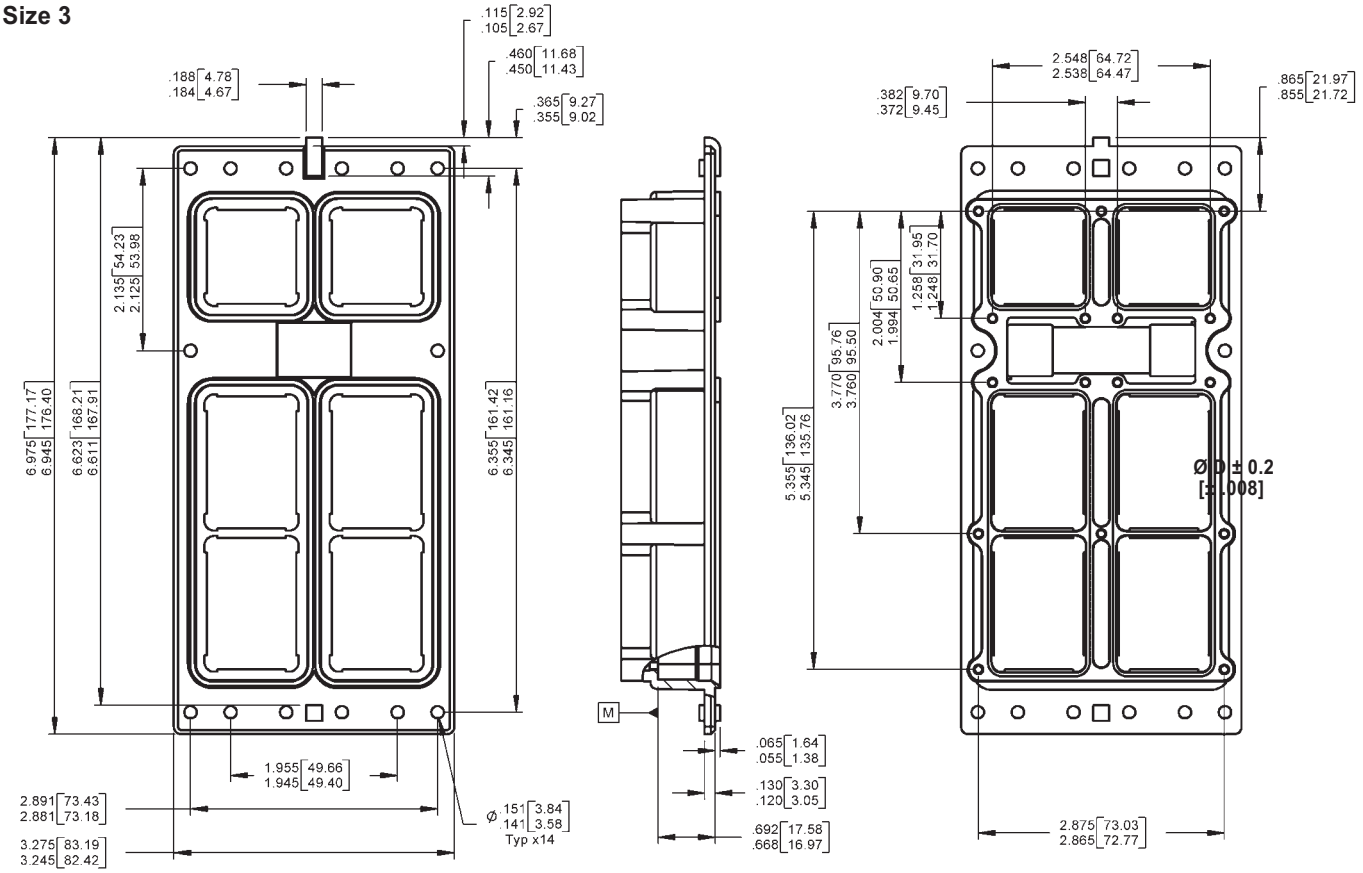
Size 1



Size 2



Size 3


.115 2.92
.105 2.67
.460 11.68
.450 11.43
.365 9.27
.355 9.02
.188 4.78
.184 4.67
2.548 64.72
2.538 64.47
.865 21.97
.855 21.72
.382 9.70
.372 9.45
2.135 54.23
2.125 53.98
1.258 31.95
1.248 31.70
2.004 50.90
1.994 50.65
3.770 95.76
3.760 95.50
6.975 177.17
6.945 176.40
6.623 168.21
6.611 167.91
6.355 161.42
6.345 161.16
5.355 136.02
5.345 135.76
Ø D ± 0.2
[±.008]
M
.065 1.64
.055 1.38
.130 3.30
.120 3.05
.692 17.58
.668 16.97
1.955 49.66
1.945 49.40
2.891 73.43
2.881 73.18
3.275 83.19
3.245 82.42
Ø .151 3.84
.141 3.58
Typ x14
2.875 73.03
2.865 72.77

The ARINC 404 connectors are one piece shell miniature rack and panel connectors. They are available in one, two, three and four gang versions with ARINC 404 standard shells.

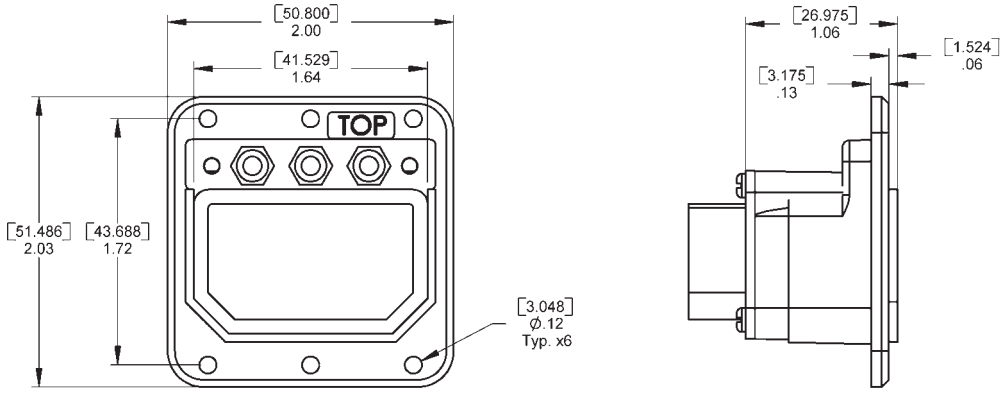
The shells are keystone shaped for polarization. The use of 3 hexagonal polarization posts provides up to 99 unique polarization positions.
The plug and receptacle connectors can include RFI fingers for better conductivity. Receptacle gangs are available.

The series uses contact sizes of #4, #8, #12, #16, #20, #22, and Coax sizes (#5, #9, #11) Per MIL-DTL-81659

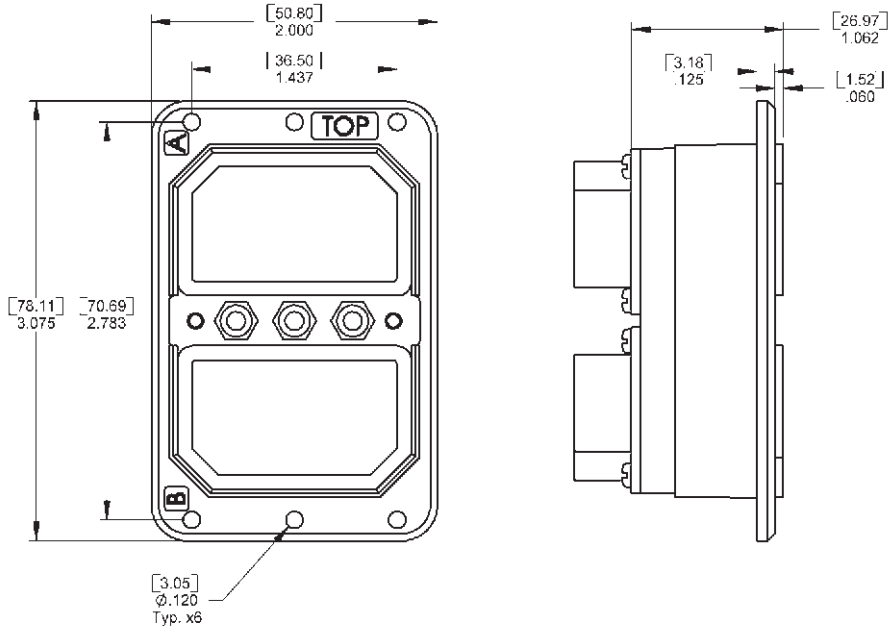
The ARINC 404 connectors are used mainly for Avionic applications.

Filters and protection components are built in as fixed and/or replaceable modules. A diversity of filters and protection types as well as power line filters can be applied to meet RTCA specification.

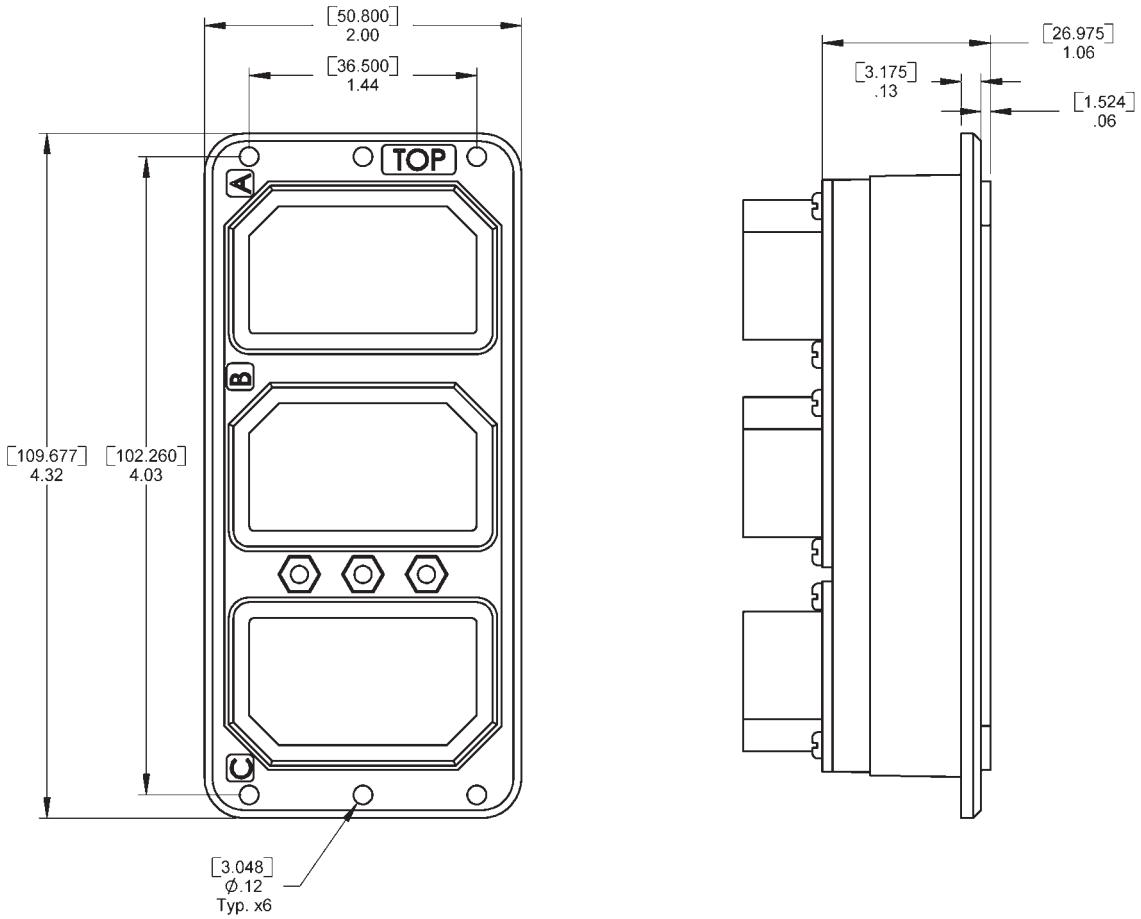
Single Gang Series



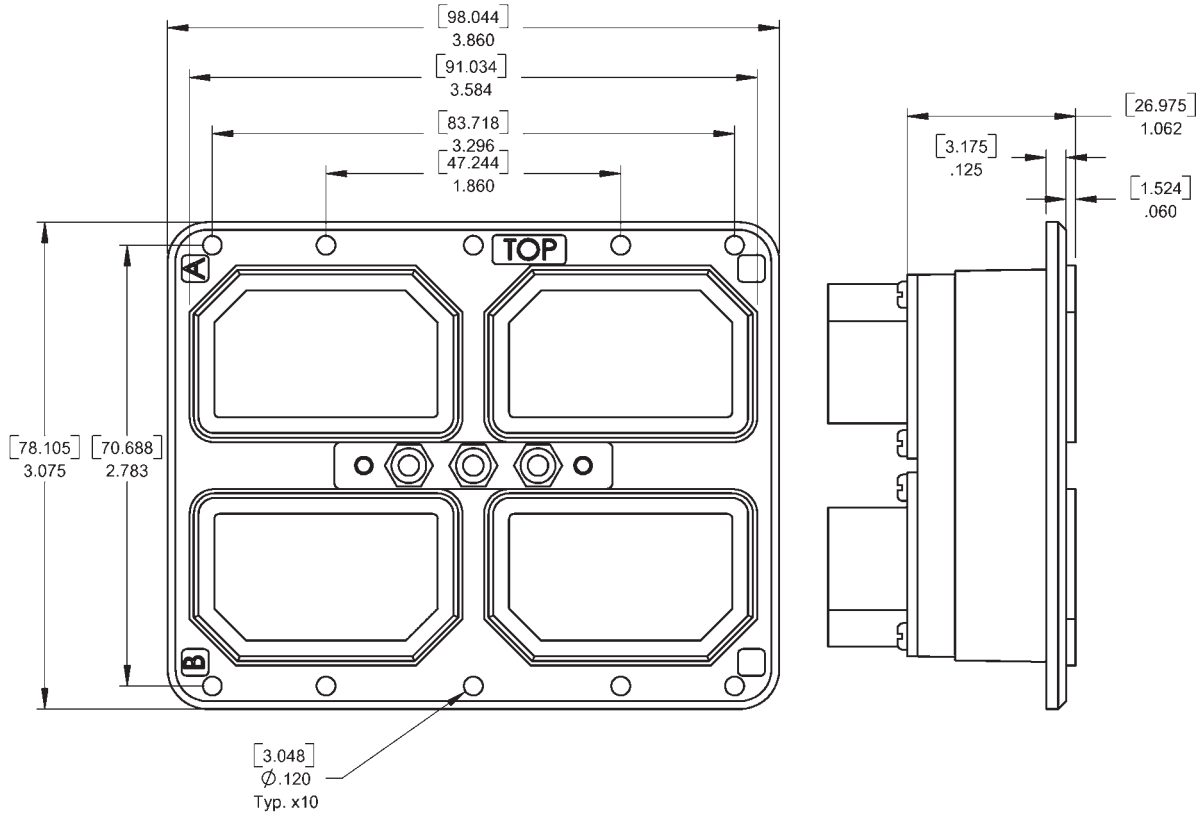
Two Gang Series



Three Gang Series



Four Gang Series

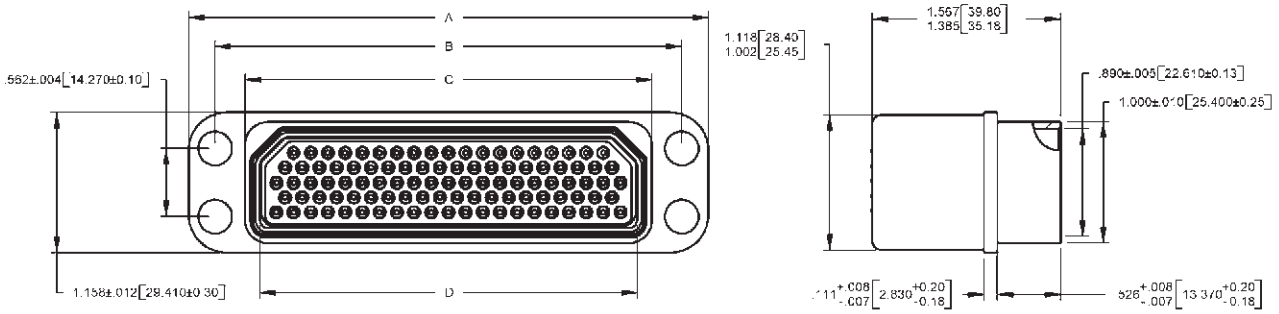


The DPK series rectangular connectors feature high performance environment-resistant.

The DPK connectors have up to 185 contacts with sizes of #22D, #20, #16 & #12 per MIL-DTL-83733.

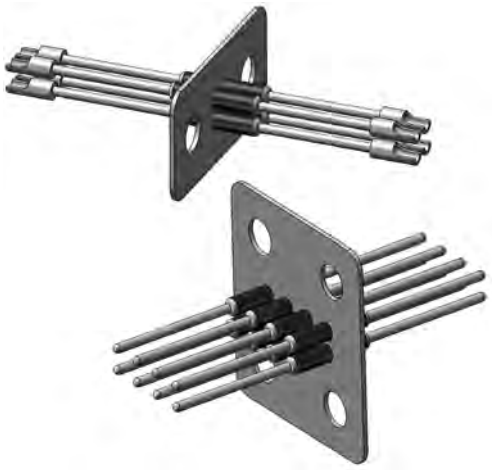
The DPK connectors are used mainly in avionic applications. Filters and transient protection components are built in as constant and/or replaceable modules.

A diversity of filter and transient protection types and of power line filters can be applied to meet the stringent requirements of MIL-STD-461 and RTCA DO160D.



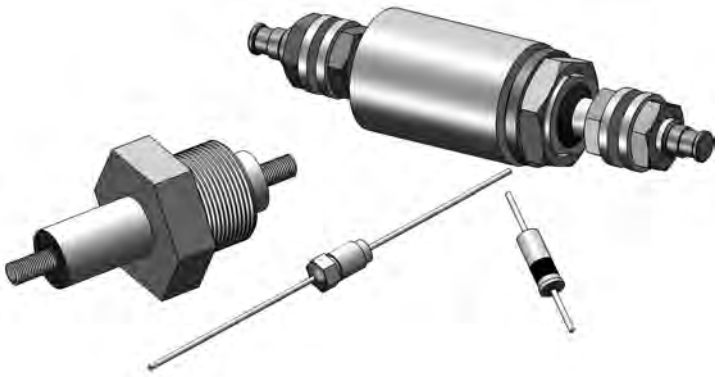
Shell Size	A Max	B Max	C Max	D ± 0.2 [± .008]
DPKA	.979 [24.87]	.596/.590 [15.14/14.99]	.829 [21.06]	.625 [15.88]
DPKB	1.104 [28.05]	.721/.715 [18.03/18.16]	.954 [24.24]	.750 [19.05]

Filter Array



Filter Array, an array of C or Pi Feed-Through filters assembled on metal plate, is a low-cost efficient solution for EMI/RFI problems.
The Filter Array provides EMI protection for signal lines with the applicability to integrate different capacitances.
RF Immunity provides standard as well as fully customized Filter Array, while utilizing various filtering topologies and levels on dimensionally customized metal plate.
The connection can be made either by using suitable headers or direct wiring of Feed-Through contacts to allow easy installation so as to pass on reduced costs in comparison with discrete filters.

Feed Through Line Filters



RF Immunity offers a vast variety of Feed-Through Filter line for commercial and military applications.
Military and Customized Feed-Through Filter Line is produced to meet most stringent customer's specifications - mechanical, electrical and environmental requirements.
This product line can meet few hundreds amperes and few thousand volts requirements as well as various standards such as MIL-STD-28861, MIL-STD-15733, MIL-STD-202 and others. The products can be provided with C, L, PI and T filter topologies and resin or hermetic glass sealing. We can also offer Bolt-In Feed-Through Filter line to be panel installed. The Bolt-In family range supports both signal and power lines - DC and AC - with current of up to hundreds Ampers and DC voltage of up to thousands Volts.

Circular Military Filter & Protected Connectors

The circular military connector families, such as MIL-DTL-38999, MIL-DTL-26482 and MIL-DTL-83723 are available in all standard shell styles, shell materials and finishes.
Hermetically sealed connectors are available. Audio connectors per MIL-DTL-55116, VG95351 and VG96934 are also available.
The connectors are available with all filter topologies for either power, discrete or communication lines for attenuating EMI/RFI and in order to meet EMC standards requirements.
Transient protections of 0.1J to 0.6J are available within standard shell sizes. Higher power and energy levels are also available with extended rear connector housings.
These connectors fully mate with standard connectors and function as drop-in replacements for non-filtered connectors.
Filtered connectors maintain their properties, in most cases, to the mechanical and environmental characteristics that comply with the standard non-filtered connectors.
In addition, R.F.Immunity designs and produces special connectors per customer's requests.
Refer to our Circular Military catalog for more information.

Filter connector for Missile application

Based on D38999 Jam Nut connector with a custom back extension. A power line filter and a signal line filter are enclosed in its housing with a high attenuation filter from 1kHz up to 1GHz

Very Low Frequency Filter with low profile extension for ground mobile application

Based on D38999 Jam Nut connector with a custom low profile back extension. It contains 28V/12A power line filter, double L section filter with Fco=6kHz and a diversity of additional signal filters.

Filtered & Lightning protected connector for HUD application

Designed to meet MIL-STD-461 and RTCA/DO-160E Section 22 standards, the filtered & lightning protected 100 pin, D38999 circular military connector was designated for HUD (Head Up Displays).
The filtering topology includes 3 capacitance levels, according to the customer's pin out requirements.
To accommodate the filtering together with the lightning protection array, a unique square shaped extension was designed to be attached to the rear of the connector.

Avionic Power Source of 115Vac / 400Hz Filtered Connector

Based on D38999/20WE06PN, the connector was designed for filtering and providing attenuation of 20dB from 10 kHz and 60dB from 100 kHz on the Power Leads of Avionic equipment. The filter has Pi filter topology combined with Common Mode Choke and withstands working voltages of 1000Vdc & DWV of 1250Vdc.
The filtered connector complies with the environmental requirements of avionic applications, meaning, vibrations, altitude and pressure.
Due to space limitations, the termination is a side mounted PCB with soldering holes. This provides a flat back of the connector and saves the space.
In addition, the connector has a unique excentric structure of the back side which is shifted compared to mating side due to customer's panel design.

19 contacts Push-Pull LEMO filtered connector for military communication units

The Lemo 19 pin contacts is a push-pull miniature connector where only 3 out of 19 contacts were required to filter. Utilizing our advanced and innovative technology, RF Immunity successfully incorporated HI filter topology to tackle interferences in tactical frequency range of 670kHz - 100MHz to meet MIL-STD-461.
Another unique feature is the mechanical release of only 3 solder cups, out of 19, in the back part of the connector.
The mechanical shape & dimensions were maintained during the filtering process.

55 cont. Filtered Standoff Connector for Avionic applications

This specially designed filtered connector was developed for use in a highly sophisticated avionic laser system which was required to meet both MIL-STD-461 and strict requirements of RTCA-DO160.
The result is a filtered double flange connector with rear thread interface for PCB mounting. Designed with diversified values of capacitances from 0.94nF to 20nF arranged in PI filter topology plus Common Mode Chokes and TVS units for lightning protection.
In addition, the connector is hermetically sealed per MIL standards.

Cable Assembly

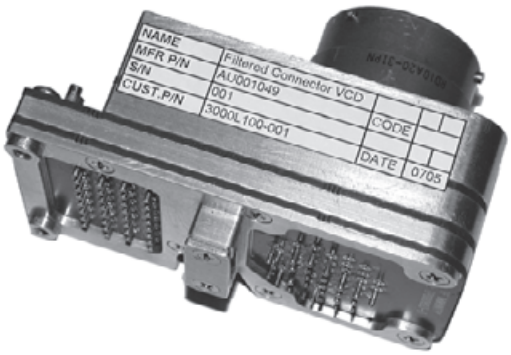
As part of RF Immunity's added value and turnkey solutions in the filter connector field, the company offers cable assembly services.
These servises include: Design and validation, prototyping for customized cable assembly, full control and warranty over the complete wiring and harnesses with in-process testing to ensure the highest levels of reliability for strictly demanding military applications.

Filtered & Hermetically Sealed custom shaped D-Sub Connectors

The showcased connectors are custom made filtered D-Sub 9 pin contacts and 25 socket contacts with different filtering topologies.
In addition to the filtering, the connectors were designed as hermetically sealed units to withstand military sealing standards as low as 10^{-5} cm^3/sec Helium at $\triangle$P=1 atm.
Developed to meet customer's requirements, a front groove was designed to house an O-Ring providing hermetic sealing against the mounted rear panel surface. Rear and front mount design configurations are applicable.
The external mechanical configurations were designed to allow close mounting of the two connectors to meet space constraints on the panel.

MIL RJ45 Connector - Military Filter Connector for Ethernet & Data Lines

The MIL RJ45 Connector introduces the latest technology edge in filtering fast Ethernet protocols (10/100/1000 Base T lines) built to withstand harsh environmental conditions.
Based on circular connector D38999 series III shell size 19 with integrated RJ45 mating side mechanism, the MIL RJ45 filtered connector incorporates magnetic and filter components fully intermatable with standard category 5 cables.
Designed to maintain Ethernet signal integrity and significant Common Mode rejection at tactical frequency range of 2MHz-100MHz, the MIL RJ45 filtered connector complies with strict MIL environmental standards.



RD1 Aircraft power and data BUS Filter Connector

Being tailored for avionic applications, this custom made filter connector is based on a standard 31 pin circular connector able to accommodate any combination of 16 AWG Coax or Twinax contacts.
Retrofitted an existing non-filtered connector to preserve the system performance and mechanical characteristics, the connector's extended housing was designed to meet stringent EMC requirements and withstand avionic extreme environmental conditions.
This connector was designed to incorporate different filter topologies and characteristics for the following signal types: 1) 3 Phase 115VAC/400Hz power supply lines 2) High frequency differential RS422 lines 3) MUX BUS communication lines 4) Discrete lines. All signals were filtered through two filtering levels from PI section to CMC filtering.
In order to incorporate all incoming/outgoing signals, solder cups were designed on the outside surface of the mechanical rear extension.

Filter Connector with crimp termination

Based on MS27497 (D38999 series II), this crimp termination connector was developed in order to meet the request of well-known aircraft manufacturer for maintenance without the need of soldering on aircraft. The connector has extended rear side for accommodating the filter and crimp locking mechanism. The filter was designed to reduce EMI above 3kHz from audio circuits and to withstand lightning strikes per RTCA-DO/160 section 22, level 3. The connector successfully passed all environmental tests according to airborne equipment test procedure.
The crimp termination is available in all other families and series.

D38999 Series III Filter Adaptor

The filter Adaptor is produced for applications wherever adding filter connector is not possible (the equipment is in the field, in action or the connector cannot be unassembled).
This unique solution is also practical for EMC tests, integrations and evaluations.
The connector can integrate selective filtering characteristics for each contact or homogeneous/flat filtering for all contacts. The Adaptor is manufactured from Aluminium and plated with Olive Drab Cadmium.
The shown products are Receptacle to Plug structure, but any configuration of style and filtering can be developed.

Since 2012 the D38999 Filter Adaptor is offered as an off the shelf product.

Brief Introduction to EMC

The concern of designers to product electromagnetic compatibility issues has dramatically increased in the recent years. Many different standards have been developed and released, and all electrical and electronics engineers are aware of different compatibility tests. Unfortunately, there are still a lot of designers that encounter difficulties when dealing with EMC, either with understanding the issue, or in solving the related problems.

So, what is EMC?
ElectroMagnetic Compatibility (EMC) is defined as the ability of a device or system to satisfactorily function (without errors) in the target electromagnetic environmental conditions.
Nowadays, various EMC standards define the permissible electromagnetic interaction between every system and its immediate environment. All electronic systems must be compatible to all other systems in the affected environment, in terms of EMC. This system compatibility must be proven by tests to be certified by the applicable EMC standard.
All these developments had lead to the emergence of a new engineering branch - the EMC engineering.
EMC engineering use analytical methods, design practices, test procedures, and solution hardware and components both to enable the system to function without errors in its target electromagnetic environment, and to prevent it from inflicting errors to any adjacent system. It also enables the system to meet the EMC control specifications limits.

EMC deals with 3 major components:

- The source of interference (noisy system or power supply), also called EMI source.
- The victim of interference (sensitive circuitry), also called EMI victim
- The coupling path.

EMI (Electromagnetic Interference) is defined as the electromagnetic emissions discharged by a device or a system that interfere with the normal operation of other devices or systems.

Electromagnetic compatibility problems are generally solved by identifying at least two of the above mentioned components and eliminating one of them.

Potential sources of electromagnetic compatibility problems include radio transmitters, power lines, electronic circuits, lightnings, lamp dimmers, electric motors, arc welders, solar flares and just about everything that utilizes or creates electromagnetic energy. Potential receptors include radio receivers, electronic circuits, appliances, people, and just about everything that utilizes or can detect electromagnetic energy. The way this electromagnetic energy is transferred from a source to a receptor fall into one of the following four categories.

1. Conductance (electric current)
2. Inductive coupling (magnetic field)
3. Capacitive coupling (electric field)
4. Radiation (electromagnetic field)

The coupling paths are often comprised of a complex combination of these routes, making the path difficult to be identified, even when the source and/or receptor are known. There may be multiple coupling paths, and steps taken to attenuate one may enhance another.

- Conducted noise is coupled between components through interconnecting wires such as power supply and ground lines. Common impedance coupling is caused when currents from two or more circuits flow through the same impedance such as power supply and ground lines.
- Radiated electromagnetic field coupling can be handled in one of the following ways: in the near field, E and H field couplings are handled separately. In the far field, the coupling is handled as a plane wave coupling.
- Electric field coupling is caused by the voltage difference between conductors. The coupling mechanism can be modeled by a capacitor.
- Magnetic field coupling is caused by the current flow in conductors. The coupling mechanism can be modeled by a transformer.

The most common methods used for noise reduction include proper circuit design, shielding, grounding, **filtering**, isolation, separation and orientation, circuit impedance match control, cable design, and other noise cancellation techniques.

RF Immunity gained extensive experience in developing and producing filter and transient protection connectors. We have a variety of off the shelf connectors similar in size to standard connectors, and we have the capacity to develop custom made filtering products that are fully compatible with the customer specifications and enable the customer system to be approved by compatibility tests.

EMI Standards

The requirements for control of EMI characteristics of systems and equipment are defined by specifications and standards.
The specifications and standards define the permmisible interaction between the electromagnetic environment on the one hand, and systems and equipment on the other hand. Different standards are applied in different countries. US, European, British, Australian, Japanese and many other standards are in use in the corresponding countries, but they all fall into 2 major groups of EMI standards:

1. Military.
2. Commercial/Industrial.

Each group is divided into sub-groups, each of which deals with different types of equipment and environment: avionic, ground, navy, communications, etc.
The standard tests relate to 1 or both of the following major categories: conducted and radiated.
These 2 categories deal with emission and susceptibility interferences; it is presented as CE - for conducted emission, RE - for radiated emission, CS - conducted susceptibility and RS - for radiated susceptibility. Each section deals with different level of interference as well as different frequency range.
Herein are the details of a few well-known standards:

- A variety of commercial and industrial standards are in use, and in general, they are applicable to certain types of equipment. Few of these standards are listed in the following table.

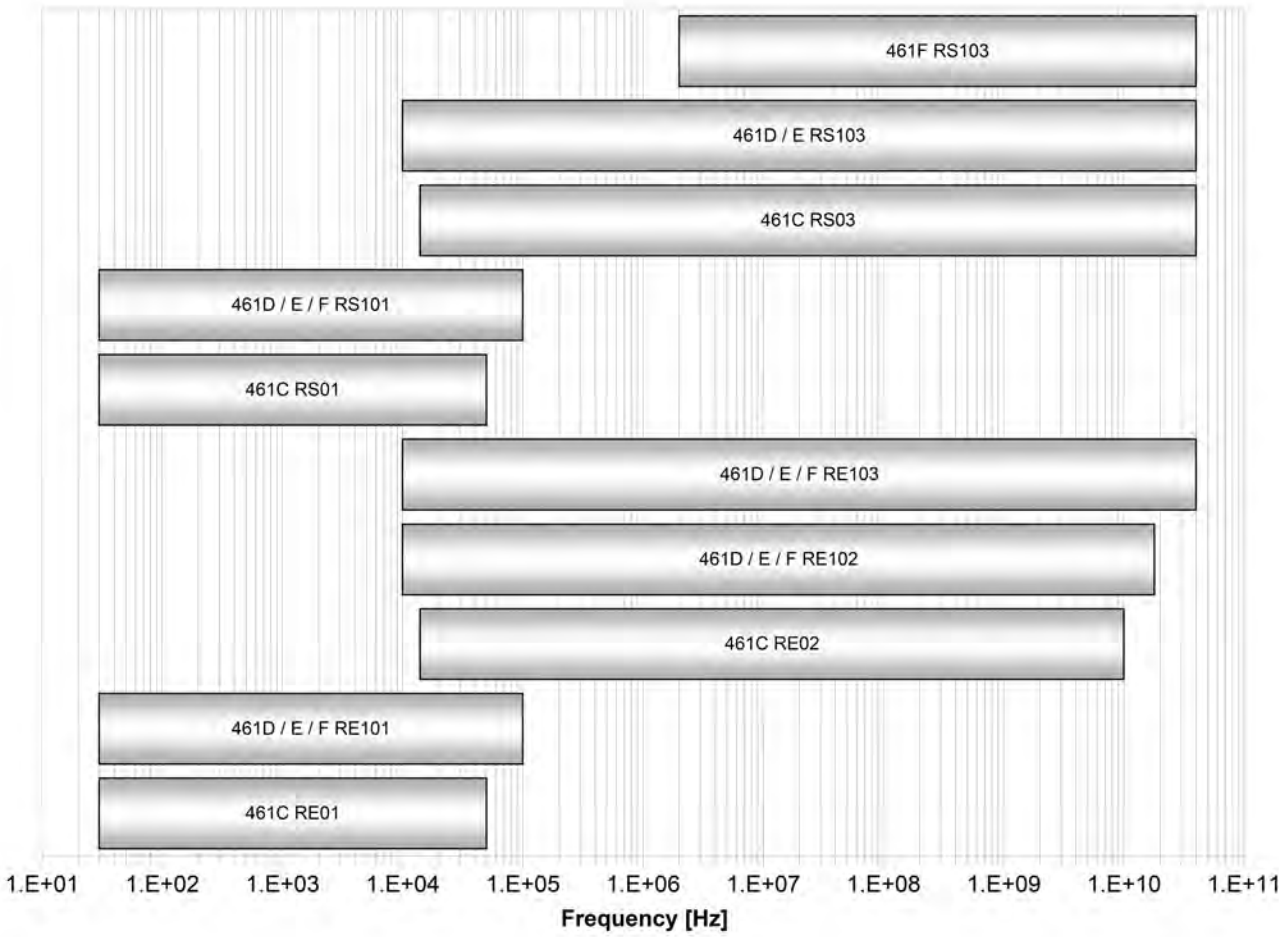
Equipment	Standard	Description	Test
Household Appliances, Electric Tools and similar Aparatus	EN 55014-1	EMC: Emission	CE, RE
	EN 55014-2	EMC: Immunity	CS, RS
Information Technology Equipment	EN 55022	Radio Disturbance Characteristics - Limits and Methods of Measurement	CE, RE
	EN 55024	Immunity Characteristics - Limits and Methods of Measurement	CS, RS
Testing and Measurement Techniques	EN 61000-4-2	Electrostatic Discharge Requirements	ESD
	EN 61000-4-3	Radiated, RF, Electromagnetic Field Immunity	RS
	EN 61000-4-4	Electrical Fast Transient/Burst Immunity Test	Transient
	EN 61000-4-5	Surge Immunity Tests	Lightning
	EN 61000-4-6	Immunity to Conducted Disturbances, Induced by RF Fields	CS

- EUROCAE ED-14D/RTCA-DO-160D
  ENVIROMENTAL CONDITIONS AND TEST PROCEDURES FOR AIRBORNE EQUIPMENT

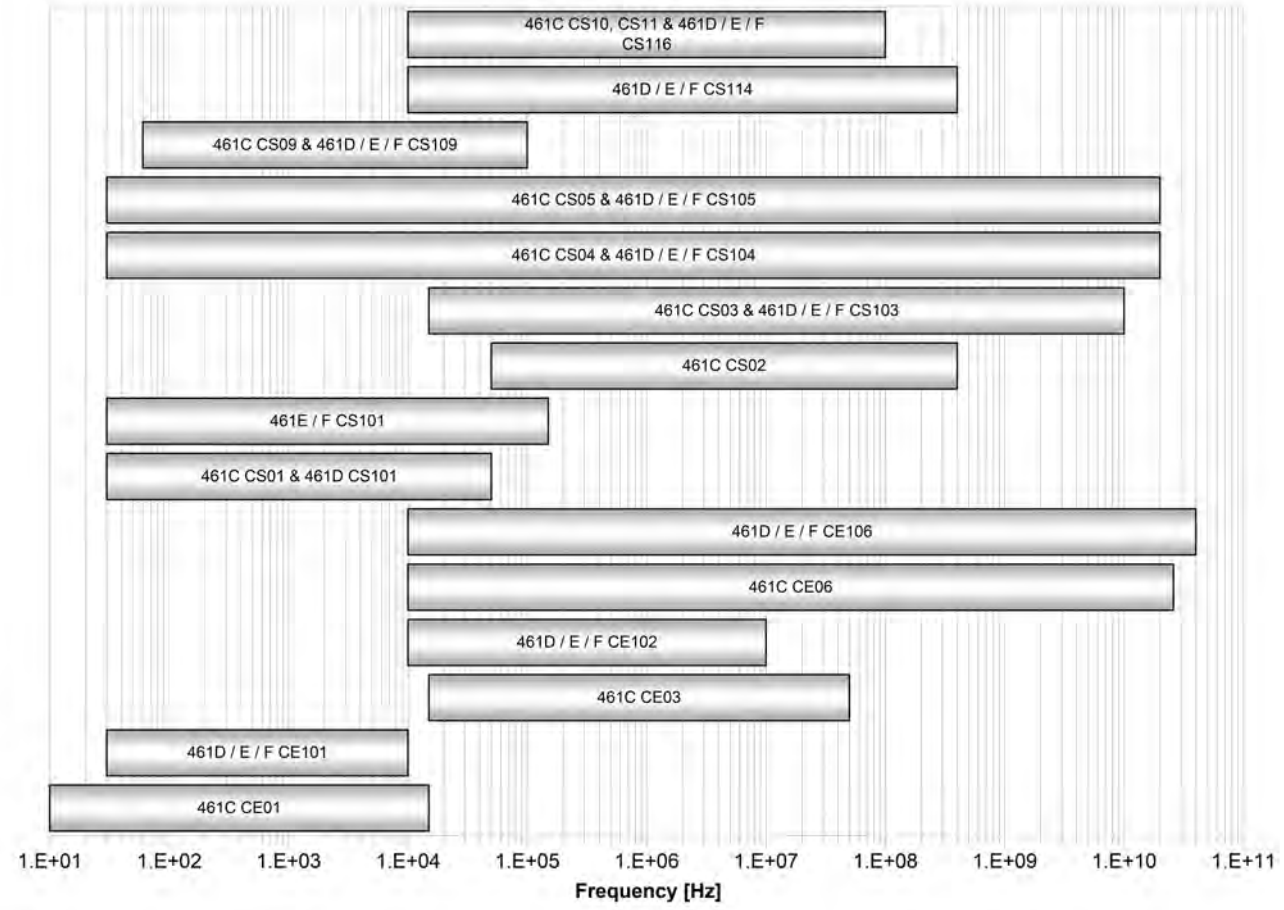
EUROCAE ED-14D/RTCA-DO-160D ENVIROMENTAL CONDITIONS AND TEST PROCEDURES FOR AIRBORNE EQUIPMENT		
Section	**Change**	**Description**
17	-	Voltage Spikes
18	2	Audio Frequency Conducted Susceptibility Power Inputs
19	-	Induced Signal Susceptibility
20	1	Radio Frequency Susceptibility (Radiated and Conducted)
21	-	Emission of Radio Frequency Energy
22	3	Lightning Induced Transient Susceptibility
23	-	Lightning Direct Effects
25	-	Electrostatic Discharge

MIL-STD-461C + MIL-STD-462 Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference			MIL-STD-461D + MIL-STD-462D MIL-STD-461E / F Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment				
MIL - STD - 461C			MIL-STD-461D / E / F		461D	461E	461F
Requirement	Description	Frequency	REQUIREMENT	DESCRIPTION	FREQUENCY	FREQUENCY	FREQUENCY
CE01	Power and Interconnecting Leads	up to 15kHz	CE101	Power Leads	30Hz - 10kHz	30Hz - 10kHz	30Hz - 10kHz
CE03	Power and Interconnecting Leads	15 kHz- 50 MHz	CE102	Power Leads	10kHz - 10MHz	10kHz - 10MHz	10kHz - 10MHz
CE06	Antenna Terminals	10 kHz- 26 GHz	CE106	Antenna Terminal	10kHz - 40GHz	10kHz - 40GHz	10kHz - 40GHz
CE07	Power Leads, Spikes, Time Domain						
CS01	Power Leads	30 Hz- 50 kHz	CS101	Power Leads	30Hz - 50kHz	30Hz - 150kHz	30Hz - 150kHz
CS02	Power and Interconnecting Control Leads	50 kHz- 400 MHz					
CS03	Intermodulation	15 kHz- 10 GHz	CS103	Antenna Port, Intermodulation	15kHz - 10GHz	15kHz - 10GHz	15kHz - 10GHz
CS04	Rejection of Undesired Signals	30 Hz- 20 GHz	CS104	Antenna Port, Rejection of Undesired Signals	30Hz - 20GHz	30Hz - 20GHz	30Hz - 20GHz
CS05	Cross Modulation	30 Hz - 20 GHz	CS105	Antenna Port, Cross-Modulation	30Hz - 20GHz	30Hz - 20GHz	30Hz - 20GHz
CS06	Spikes, Power Leads		CS106	Transients, Power Leads			
CS07	Squelch Circuits						
CS09	Structure (Common Mode) Current	60 Hz- 100 kHz	CS109	Structure Current	60Hz - 100kHz	60Hz - 100kHz	60Hz - 100kHz
			CS114	Bulk Cable Injection	10kHz - 400MHz	10kHz - 200MHz	10kHz - 200MHz
			CS115	Bulk Cable Injection, Impulse Excitation			
CS10	Damped Sinusoidal Transients, Pins and Terminals	10 kHz- 100 MHz	CS116	Damp Sinusoidal Transients, Cables and Power Leads	10kHz - 100MHz	10kHz - 100MHz	10kHz - 100MHz
CS11	Damped Sinusoidal Transients, Cables	10 kHz- 100 MHz					
RE01	Magnetic Field	30 Hz- 50 kHz	RE101	Magnetic Field	30Hz - 100kHz	30Hz - 100kHz	30Hz - 100kHz
RE02	Electric Field	14 kHz- 10 GHz	RE102	Electric Field	10kHz - 18GHz	10kHz - 18GHz	10kHz - 18GHz
RE03	Spurious & Harmonics, Radiated Technique		RE103	Antenna Spurious and Harmonic Outputs	10kHz - 40GHz	10kHz - 40GHz	10kHz - 40GHz
RS01	Magnetic Field	30 Hz- 50 kHz	RS101	Magnetic Field	30Hz - 100kHz	30Hz - 100kHz	30Hz - 100kHz
RS02	Magnetic and Electric Fields						
RS03	Electric Field	14 kHz- 40 GHz	RS103	Electric Field	10kHz - 40GHz	10kHz - 40GHz	2MHz - 40GHz
RS05	Electromagnetic Pulse Field Transient		RS105	Transient Electromagnetic Field			

MIL-STD-461 Radiated Emission and Susceptibility Requirements



MIL-STD-461 Conducted Emission and Susceptibility Requirements



Power Leads Characteristics

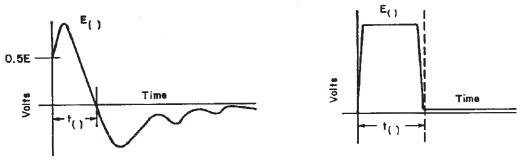
While designing a Filtered and/or Transient Protected Connector, the characteristics of power leads contacts might be critical. By defining the power leads characteristics correctly, the connector and its characteristics will be designed appropriately. Therefore, in any known case of power leads characteristics, the relevant standard or test procedure must be considered, mentioned or described.
Herein are parts of the most common standards that define power leads characteristics.

MIL-STD-461 - Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment

MIL-STD-461C CS06, conducted susceptibility, spikes, power leads

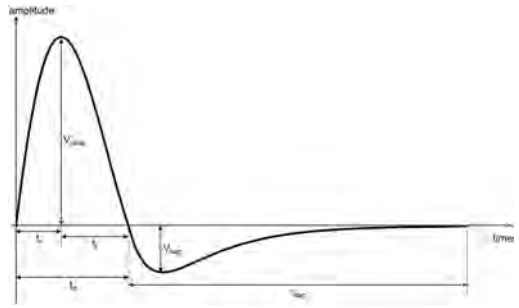
Applicability. This Requirement is applicable to equipment and subsystem AC and DC power leads, including grounds and neutrals which are not grounded internally to the equipment or subsystem.
Limits. The test sample shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when the test spikes having the waveform shown on the following figure are applied to the AC and DC power input leads for a period of not less than 1 minute at each phase position, and for a total test period not exceeding 15 minutes in duration. The values of E() and t() are given below. Each spike shall be superimposed on the powerline voltage waveform.

Part	Spike	E	t
2, 3	1: All services	200V	10µs ± 20%
	2. Air Force and Navy	200V	0.15µs ± 20%
4	1: Army	100V	10µs ± 20%
	2. Navy	400V	5µs ± 20%
5, 6, 7		400V	5µs ± 20%



NOTE: The test sample shall be subjected to the spike(s) with the waveform shown and with the specified voltage(s) and pulsewidth(s).

MIL-STD-461F CS106, conducted susceptibility, transients, power leads
Applicability. This requirement is applicable to submarine and surface ship equipment and subsystem AC and DC input power leads, not including grounds and neutrals.
Limit. The EUT shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when subjected to a test signal with voltage levels as specified in the following figure.



Where:
Vpeak = 400 volt peak
tr = 1.5µsec, ± 0.5µsec
tf = 3.5µsec, ± 0.5µsec
td = 5.0µsec, ± 22%
V_{sag} ≤ 120 volt peak (maximum)
t_{sag} ≤ 20µsec

MIL-STD-461D/E/F CS116, conducted susceptibility, damped sinusoidal transients, cables and power leads, 10kHz to 100MHz.

Applicability. This Requirement is applicable to all interconnecting cables, including power cables, and individual high side power leads. Power returns and neutrals need not be tested individually.
Limits. The EUT shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when subjected to a signal having the waveform shown in figure CS116-1 and having a maximum current as specified in figure CS116-2. The pulses shall be applied for a period of five minutes.

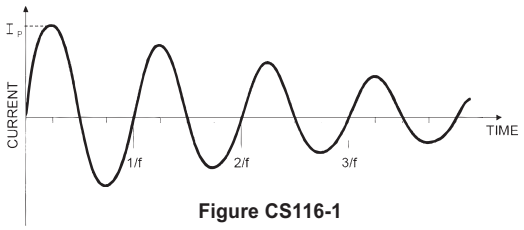


Figure CS116-1

NOTES: 1. Normalized waveform: e-(?ft)/Qsin(2?ft)
Where:
f = Frequency (Hz)
t = Time (sec)
Q = Damping factor, 15 ± 5
2. Damping factor (Q) shall be determined as follows:

$$Q = \frac{\pi(N-1)}{\ln(I_P / I_N)}$$

Where:
Q = Damping factor
N = Cycle number (i.e. N = 2, 3, 4, 5,…)
I_P = Peak current at 1st cycle
I_N = Peak current at cycle closest to 50% decay
I_a = Natural log
3. I_P as specified in figure CS116-2

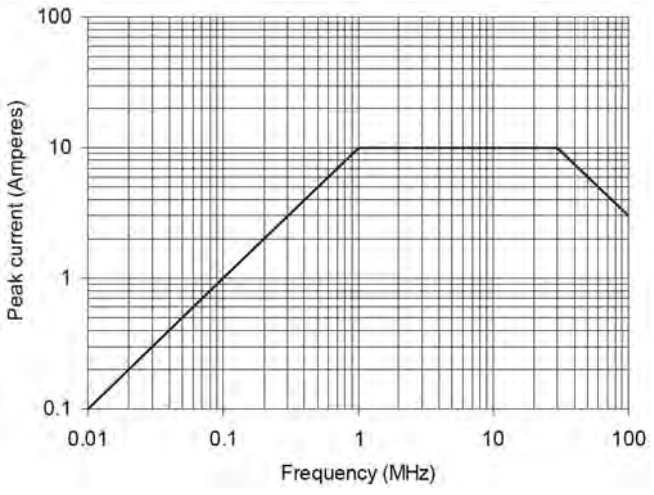
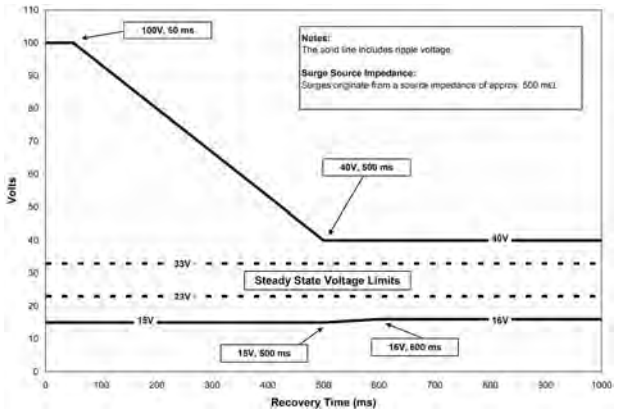
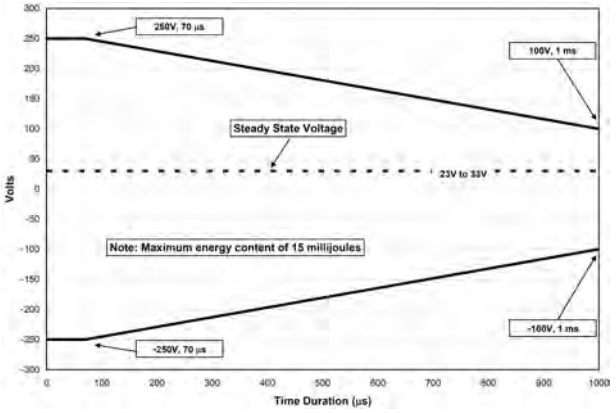


Figure CS116-2

MIL-STD-1275 - Characteristics of 28VDC Electrical Systems in Military Vehicles
This standard covers the limits of steady state and transient voltage characteristics 28VDC electrical power systems for military ground vehicles. The following figures represents MIL-STD-1275D Generator-only Mode:



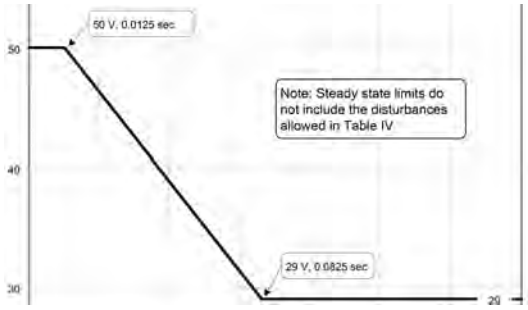
Envelope of Surges



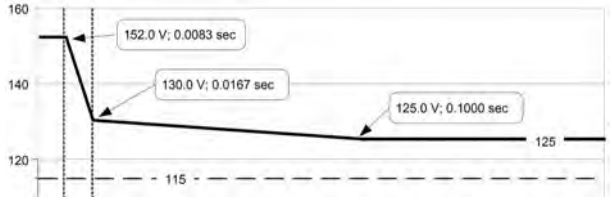
Envelope of Spikes

MIL-STD-704 - Aircraft Electric Power Characteristics
This standard establishes the requirements and characteristics of aircraft electric power provided at the input terminals of electric utilization equipment. Electromagnetic interference and voltage spikes are not covered by this standard.
The following figures represents MIL-STD-704F:

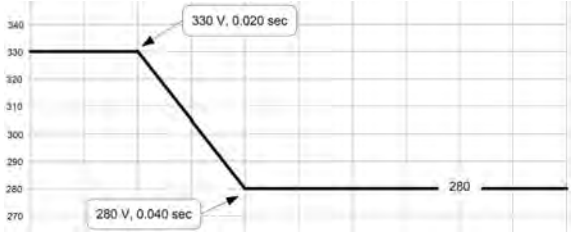
Normal 400Hz AC Voltage Transient



Normal Voltage Transients for 28 volts DC system

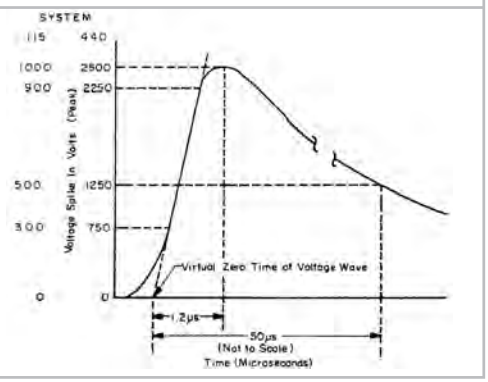


Normal 60Hz Voltage Transient



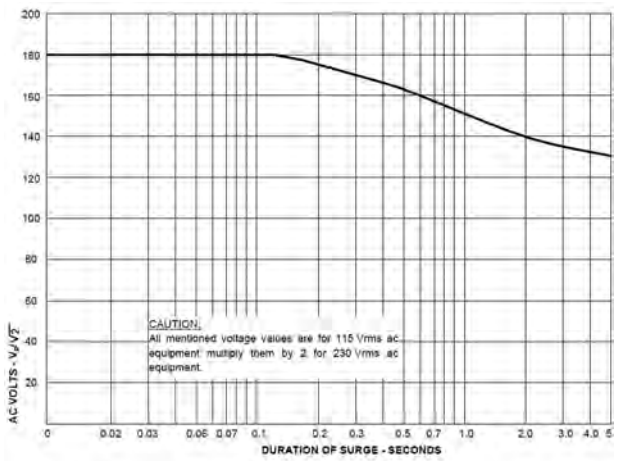
Normal Voltage Transient for 270 volts DC system

MIL-STD-1399 - Interface Standard for Shipboard Systems, Electric Power, Alternating Current
Section 300A establishes electrical interface characteristics for shipboard equipment utilizing AC electric power to ensure compatibility between user equipment and the electric power system.
Classification. Types of shipboard electric power to be supplied from the electric power system are as follows:

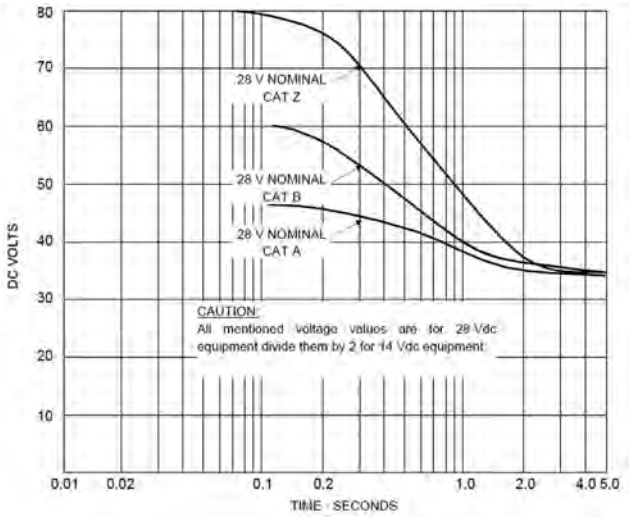
Power Classification		Voltage Transients (>1ms)		Voltage Spike (<1ms)	
		Tolerance	Recovery Time	Peak Value	Wave Shape
Type I	440V or 115V 60Hz ungrounded	±16%	2s	±2,500V (440V sys) ±1,000V (115V sys)	
Type II	440V or 115V 400Hz ungrounded	±16%	2s	±2,500V (440V sys) ±1,000V (115V sys)	
Type III	440V or 115V 400Hz ungrounded	±5%	0.25s	±2,500V (440V sys) ±1,000V (115V sys)	

The RTCA/DO-160 - Environmental Conditions and Test Procedures for Airborne Equipment
The RTAC/DO-160 defines: *"a series of minimum standard environmental test conditions and applicable test procedures for airborne equipment"*. Over the recent years, it has become to the most common standard for defining "Lightning Induced Transient Susceptibility" tests. The following sections and figures represents RTAC/DO-160E:

Section 16 - Input Power
Section 16 defines *"the test conditions and procedures for AC and DC electrical power applied to the terminals of the EUT"*.

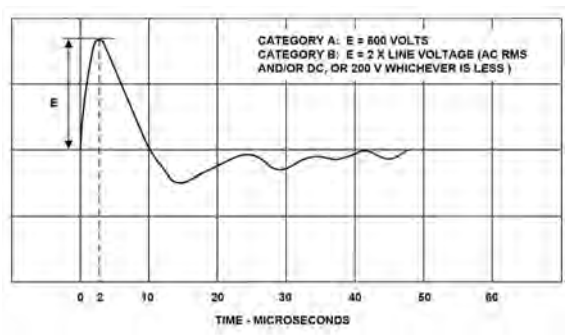


Envelope of AC Abnormal Voltage Surges



Typical Abnormal DC Surge Voltage Characteristics

Section 17 - Voltage Spike
Section 17 determines "whether the equipment can withstand the effects of voltage spikes arriving at the equipment on its power leads, either AC or DC".



Voltage Spike Waveform

Section 22 - Lightning Induced Transient Susceptibility
Section 22 "apply idealized waveforms to verify the capability of equipment to withstand effects of lightning induced electrical transients".

Section 22 defines two groups of test, the pin injection tests and the cable bundle tests. The required tests are described by category designation which consists of five characters:

A, B or **Z**	**1** to **5** or **Z**	**Z** or **X**	**Z** or **X**	**Z** or **X**
Pin Injection Test Waveform Set	Pin Injection Test Level	Cable Bundle Test Waveform Set	Cable Bundle Single and Multiple Stroke Test Level	Cable Bundle Multiple Burst Test Level

Z indicates that the waveform set, the test configuration or the levels applied are different from the designated and the tests are conducted at voltage and/or current levels other than specified in the RTCA/DO-160E. In such case, the specific test conditions and levels shall be described.

The following table shows the **Pin Injection Test Requirements** according to the RTCA/DO-160E:

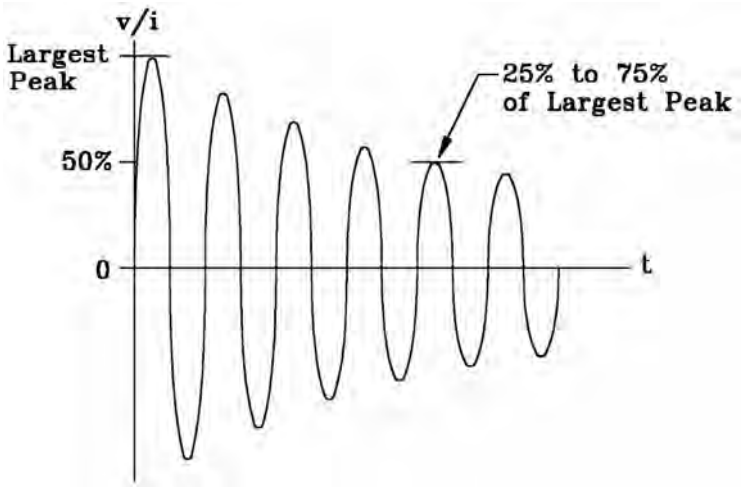
Waveform Set	Test Type	Test Levels	Waveform Nos.	Notes
A	Pin Injection	1 to 5	3, 4	Waveform 3 is applied at 1.0MHz (±20%)
B	Pin Injection	1 to 5	3, 5A	Waveform 3 is applied at 1.0MHz (±20%)

The following table shows the **Test Levels for Pin Injection** according to the RTCA/DO-160E:

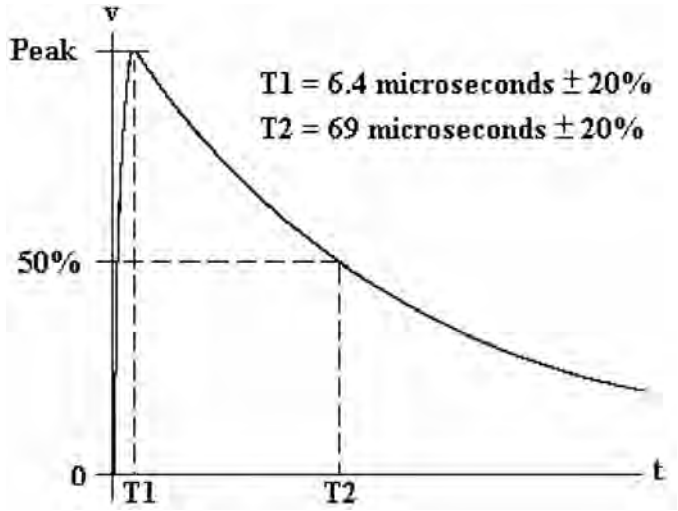
Level	Waveforms					
	3		4		5A	
	Voc	Isc	Voc	Isc	Voc	Isc
1	100	4	50	10	50	50
2	250	10	125	25	125	125
3	600	24	300	60	300	300
4	1500	60	750	150	750	750
5	3200	128	1600	320	1600	1600

Where V_{OC} is the *Peak Open Circuit Voltage (Volts)* and I_{SC} is the *Peak Short Circuit Current (Amps)*.

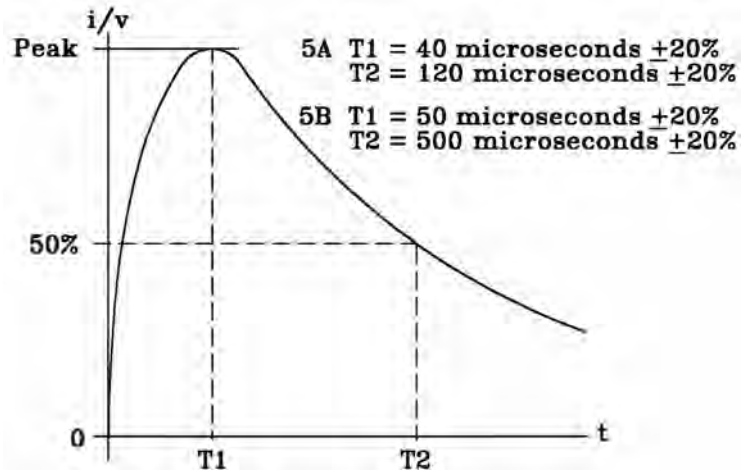
Waveform 3
Waveform 3 is defined as 1MHz decaying sine or cosine/damped oscillatory wave as shown in the next figure:



Waveform 4
Waveform 4 is defined as decaying exponential pulse as described below:



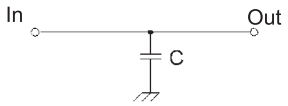
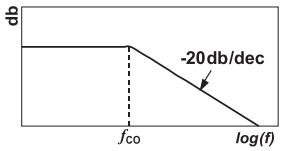
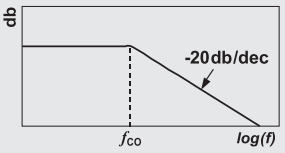
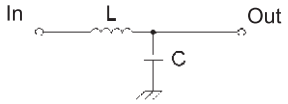
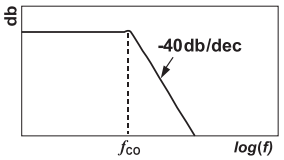
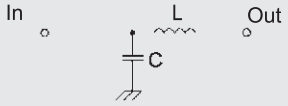
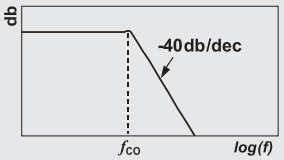
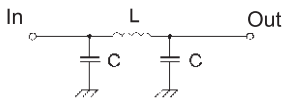
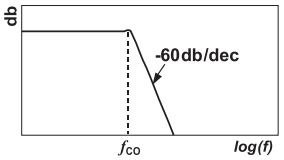
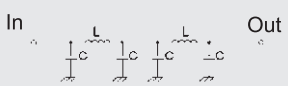
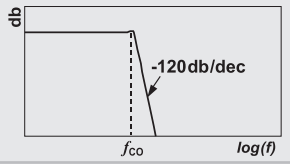
Waveform 5
Waveform 5 is defined as decaying exponential pulse as described below:



Selecting Filter Topology

Low pass passive filters are most commonly used to reduce EMI. There are several basic topologies of these filters - C and C^2, L, LC, CL, π, Double π (or Hi - Filter). Selecting the wrong filter topology may result in system oscillation and malfunction. Selecting the right filter topology is critical to significant EMI reduction and best system performance. The available RF Immunity filter topologies, performances and applications are described in the following table.

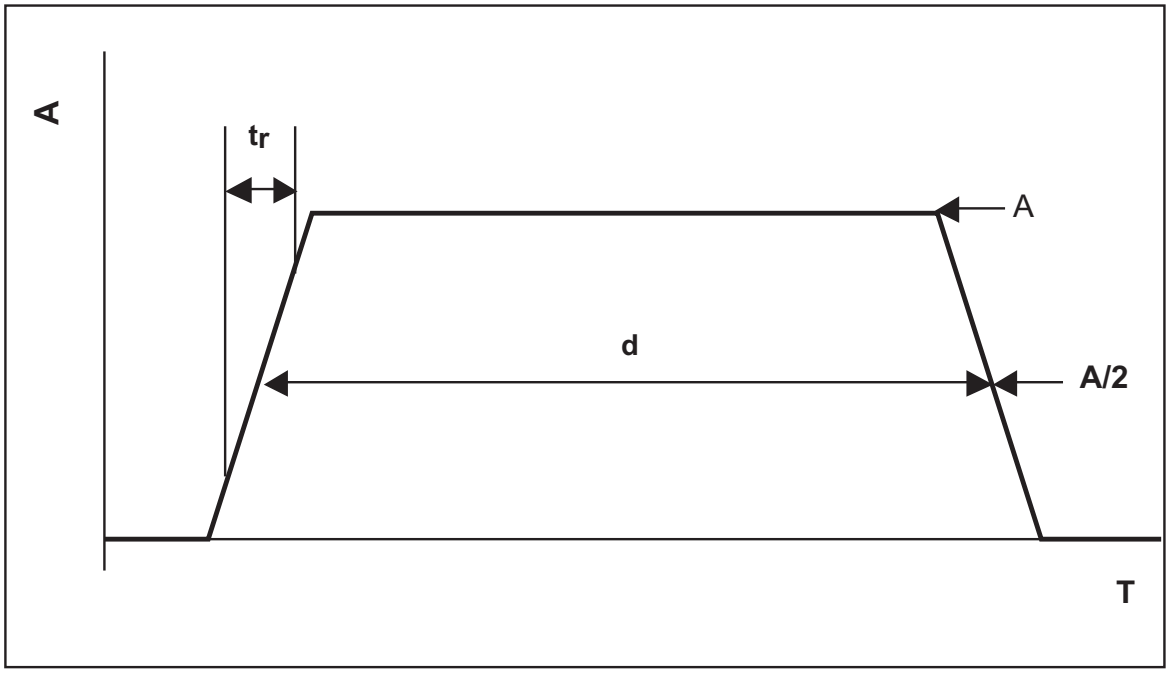
Note that an “In” indicates the mating side and an “Out” indicates the rear side (termination) connector rear end.

Filter Topology Name	Filter Schema	Application	Theoretical f_{co} (Cut off Frequency)	Theoretical Insertion Loss
C And C^2		• The best performance is achieved when used with high impedance load and source • Theoretical slope: -20 db/dec	$f_{co} = \frac{1}{\pi RC}$	
L		• The best performance achieved when used with low impedance load and source • Theoretical slope: -20 db/dec	$f_{co} = \frac{R}{\pi L}$	
LC		• The best performance is achieved when used with high impedance load and low impedance source • Theoretical slope: -40 db/dec	$f_{co} = \frac{1}{\pi\sqrt{LC}}$	
CL		• The best performance is achieved when used with low impedance load and high impedance source • Theoretical slope: -40 db/dec	$f_{co} = \frac{1}{\pi\sqrt{LC}}$	
Pi		• The best performance is achieved when used with high impedance load and source • Theoretical slope: -60 db/dec	$f_{co} = \frac{1}{\pi\sqrt{2LC}}$	
Hi		• The best performance is achieved when used with high impedance load and source • Theoretical slope: -120 db/dec	$f_{co} = \frac{1}{\pi\sqrt{2LC}}$	

Estimation of filter cut off frequency

Once the filter topology is selected, the filter Cut Off Frequency can be determined.
The filter cut off frequency is defined as the -3 db attenuation frequency . Attenuation -3 db means that half of the transmitted power is dissipated across the filter. The -3 db cut off frequency is considered to be the highest operation limit of the low pass filter range. The filter will attenuate dramatically all signals with frequency above the cut off frequency.
If the selected cut off frequency will be too low in comparison to the signal frequency and rise time, the filter will distort the signal shape . If it will be too high, undesired high frequency noise will be a part of the signal shape. Therefore the selection of the proper cut off frequency is crucial to the signal integrity.
To make the proper selection of the filter cut off frequency, the designer must estimate the spectrum of the signal.
The data pulse usually used in electronic systems is trapezoid in shape, with finite rise and fall times.

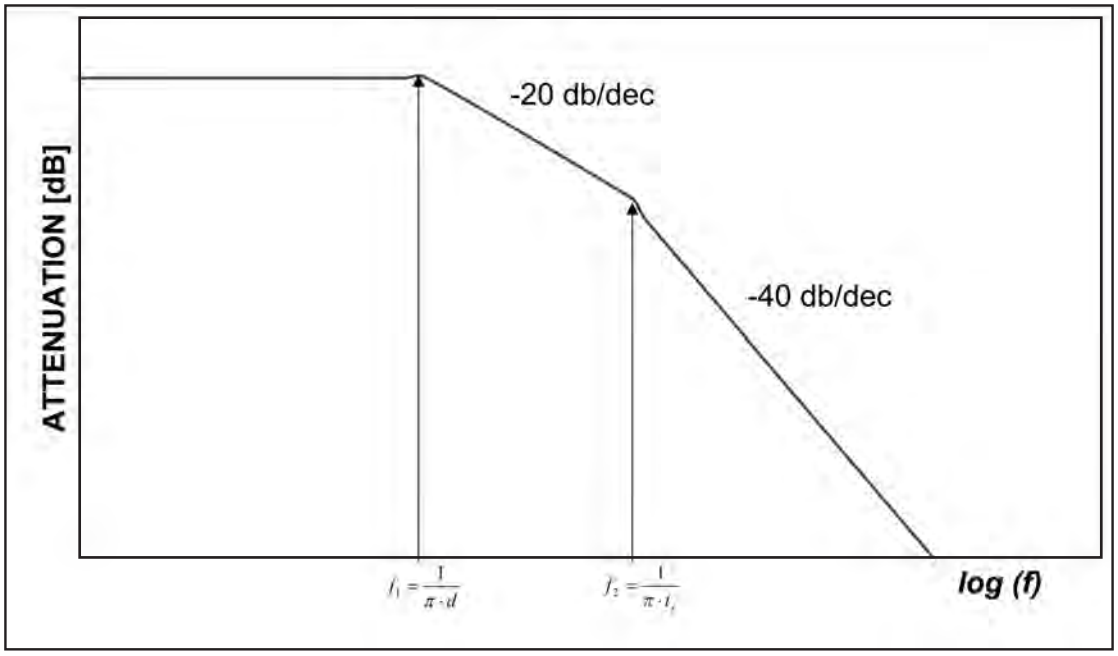
Single trapezoide



- ***A*** - the pulse amplitude
- ***d*** - the pulse duration; is the time interval in which the pulse value is higher than 50% of the amplitude
- t_r - the pulse rise time; is the required time for the signal to go from 10% to 90% of its amplitude.
  Analyzing the pulse using the Fourier method, the following frequency domain graph is obtained.

The graph can help designers in estimating the spectrum of trapezoidal pulses.

Spectrum of trapezoidal data pulse



f_1 - the first corner frequency ; f_2 - the second corner frequency

Please note, that the amplitude (dB) of the spectrum is different for a single data pulse and for a data pulse train, but the corner frequencies remain the same:

$$f_1 = \frac{1}{\pi \cdot d} \quad ; \quad f_2 = \frac{1}{\pi \cdot t_r}$$

The proper filter cut off frequency can be estimated by the following rule of thumb:

$$f_{co} = 10 \cdot f_2$$

where f_{co} is filter cut off frequency.

If an estimation of the cut off frequency is based on f_1 instead of f_2, and/or the coefficient is selected smaller than 10; the resulting filtered signal could be distorted.
However in many cases the designer uses devices with very fast rise and fall times (t_r & t_f) while the signal duration (d) is very long compared to the transition times. The t_r is not a critical factor in these cases. Slowing down the transition times (t_r & t_f) at those designs is possible and actually can be a very good idea. So the estimated cut off frequency of the filter can be detemined as follows:

$$f_{co} = (2 \div 3) \cdot f_2$$

When using both the filter and the transient protection on the similar signal line, the approximation of the common cut off frequency can be calculated using the equation of the C Filter presented on page 60 and assigning the total capacitance of the filter and the transient protection to that equation.

$$f_{co} = \frac{1}{\pi R C_T} \quad ; \quad C_T = C_F + C_{TP}$$

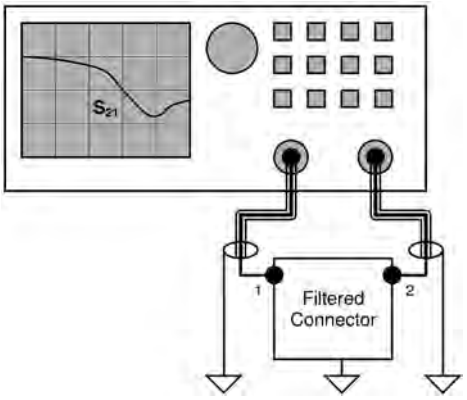
C_T - Total Capacitance
C_F - Typical Capacitance of the Filter
C_{TP} - The Capacitance of Transient Protection

About Filter Performance Measuring Methods

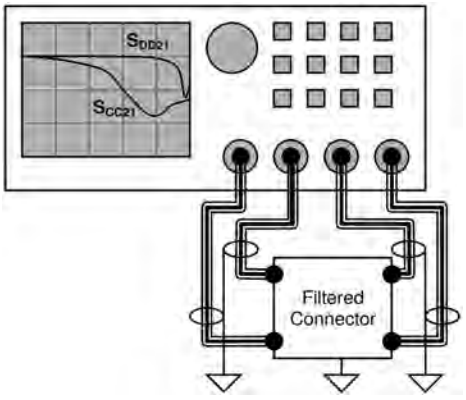
S-parameters measurements are commonly in use to express the insertion loss of single-ended contacts in filtered connector. While measuring insertion loss of balanced filter, Mixed-mode S-parameter should be the method in use.
Since differential signals are becoming more common in military and avionic applications, RF immunity constantly develops and manufactures solutions for these types of signals. By using differential filtering topologies and balanced components, the EMI couple in the common-mode and cancel in differential mode. RF immunity has the abilities to measure the insertion loss of single-ended and balanced filters, according to signals descriptions and customer requirements, by these two following methods:

1. Single-ended lines - S-parameters (Scattering parameters) per MIL-STD-220 under 50Ω source and load impedance, no-load. This method is in use for two-port network models. The measuring range starts at 100kHz and ends at 1.8GHz.

2. Balanced lines (differential pairs) - Mixed-mode S-parameter. By using Mixed-mode S-parameter, both common mode insertion loss and differential mode insertion loss can be measured correctly. This method ensures that no differential degradation is occurring.



1. S-parameters
S_{21} - common mode insertion loss



2. Mixed-mode S-parameter
S_{CC21} - common mode insertion loss
S_{DD21} - differential mode insertion loss

Filter performance in non-50Ω system

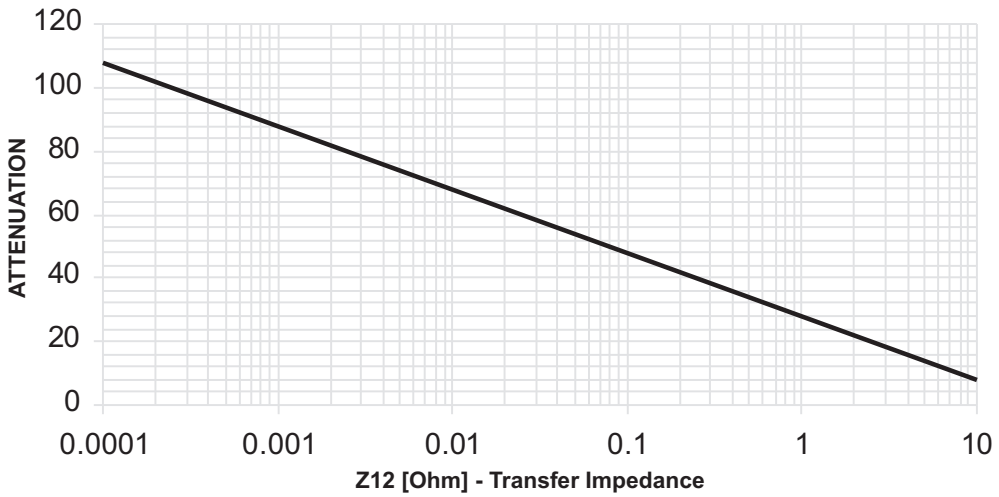
If your system is not 50Ω matched, you can use the following formula for predicting the filter performance when used with other sources and/or load impedances.

$$\text{Attenuation [db]} = 20 \log \left[1 + \frac{Z_S Z_L}{Z_{12}(Z_S + Z_L)} \right]$$

Z_S - Source Impedance
Z_L - Load Impedance
Z_{12} - Transfer Impedance

The transfer impedance Z_{12} can be calculated using the following graph:

Attenuation VS. Transfer Impedance in 50Ω System



* Filter Performance at non-50Ω System.

D-Sub Filtered Connectors

Basically, the easiest way to define Filter Connector is to follow the HTO (How To Order) pages. However, additional information of the specific connector/system application could be helpful for our engineers to either support your request or recommend for "of the shelf" product and/or customized solution.
The next form will help you to describe properly your needs; mechanically, environmentally, electrically, the predicted or already measured interferences and, thus, will give us the tools to learn, check and response to your request correctly. In case that additional information is available, please feel free to share it with us.
This form is also available on our website: *http://www.rfimmunity.com*

1. General Description

R.F. Immunity P/N (based on HTO): _____

Cross Reference Connector P/N
or Filter Connector P/N (if exists): _____

2. Connector Description

Family:		▫ D-Sub Standard Density		▫ D-Sub High Density		
		▫ Combo		▫ Adaptor		
Contact Arrangement:	Standard Density:	▫ 09	▫ 15	▫ 25	▫ 37	▫ 50
	High Density:	▫ 15	▫ 26	▫ 44	▫ 62	▫ 78
	Combo:	▫ 2W2	▫ 3W3	▫ 5W5	▫ 9W4	▫ 8W8
		▫ 21WA4	▫ 36W4	▫ Other:		
Class:		▫ Commercial	▫ Commercial RoHS		▫ MIL-C-24308 Compatible	
Contact Type & Configuration:	Gender:	▫ Pin		▫ Socket		
	Standard Density:	▫ Straight PCB	▫ Solder Cup	▫ Right Angle 9.4	▫ Right Angle 7.2	
	High Density:	▫ Straight PCB	▫ Solder Cup	▫ Special		
	Combo:	▫ Straight PCB		▫ Solder Cup		
Accessories: (per Accessories pages In R.F. Immunity catalog)		▫ A	▫ C	▫ D	▫ G	
		▫ E	▫ H	▫ M	▫ F	
		▫ J	▫ K	▫ W	▫ Z	
Accessories Thread Standard:		▫ Metric		▫ Inch	▫ Without Accessories	
Sealing:		▫ Standard (Up to 10^{-3}cc/s @ Δ P = 1atm)		▫ Hermetic (Up to 10^{-5}cc/s @ Δ P = 1atm)		

3. Additional Information

D-Sub Filtered Connectors

4. Electrical Characteristics for Homogeneous Filtered and/or Protected D-Sub

Working Voltage [V_{DC}]:	¤ 50	¤ 100	¤ 200	¤ 250	¤ 500	¤ 1000	¤ Other:
Filter Type:	¤ C	¤ C²	¤ L	¤ LC	¤ CL	¤ Pi (π)	
Capacitance:							
Energy [Joule]:	¤ 0.1	¤ 0.2	¤ 0.3	¤ Other:			

5. Electrical Characteristics for Special Filter (Please write contacts numbers separated by commas, for example: 1-4, 7-10)

Contacts Number:								1-4, 7-10
Signal Description:								RS-422
Operation Frequency [Hz]:								200kHz
Current Rating [A]:								2A
Working Voltage [V_{DC}/ V_{AC}]:								±15V_{DC}
Filter Type:								C
Capacitance:								470pF
Energy [Joule]:								0.1J

6. Predicted or Measured Interference Level

Interference Level [dB] per Frequency [Hz]:	[dB] @	[kHz]	[dB] @	[kHz]
	[dB] @	[MHz]	[dB] @	[MHz]

7. EMC Standards & Requirements

(Please specify in particular Conducted Susceptibility and Transients Requirements)

8. Additional Information

Terms and Conditions

RF Immunity
RF Immunity Ltd. ("Seller")'s Standard Terms and Conditions of Sale are an integral part of Seller's Quotation and/or final Order Confirmation and/or Acknowledgment of Purchaser's Order. Purchaser shall note these Standard Terms and Conditions on receipt of the Quotation and/or Order Acknowledgement and expressly accepts them by placing the order with Seller.

1. DEFINITIONS
"Seller" shall refer to RF Immunity Ltd. or any entity that owns or is owned or controlled directly or indirectly by RF Immunity Ltd. "Purchaser" shall refer to the entity that receives and accepts Seller's Quotation, and/or Order Acknowledgement. "Product" and "products" include goods/services sold to Purchaser by Seller.

2. OFFER TO SELL
Seller's Quotation is an offer to sell its product on the terms and conditions stated herein, and is not an acceptance of any offer or the confirmation of an existing agreement. The quoted prices in the Quotation are fixed and valid for the time period shown on the front of the Quotation and/or as specifically identified herein. All prices quoted are exclusive of taxes, insurance, freight charges or other incidental expenses, which are the responsibility of Purchaser. No reference herein to Purchaser's purchase order or any other document prepared by, or communication with Purchaser shall constitute Seller's acceptance of any term or condition therein which varies from these Terms and Conditions.

3. ACCEPTANCE AND CONFLICTING TERMS
Seller's Standard Terms and Conditions of Sale may not be contradicted by evidence of any prior agreement or of a contemporaneous oral agreement and may only be explained, supplemented, modified, altered, waived or superseded by a writing signed by both parties. These Standard Terms and Conditions, together with those of Purchaser's terms that are not inconsistent with them and do not: (i) require Seller to take any action beside the supply of its product and finished product test data; (ii) impose restrictions on Seller's activities in addition to those imposed directly by government statutes, or (iii) add to Seller's obligations, shall constitute the agreement between Purchaser and Seller (the "Additional Purchase Terms"). Terms imposing any different or additional obligations are expressly rejected. Seller may send written confirmation of the purchase order (the "Order Acknowledgement") but Seller hereby objects to and rejects any additional terms (other than additional terms that meet the requirements of Additional Purchase Terms) or different terms, including those contained in Purchaser's purchase order, unless Seller expressly identifies and agrees to such terms in writing in the Order Acknowledgement. These Standard Terms and Conditions together with the Additional Purchase Terms constitute the parties' agreement ("Agreement"). These Standard Terms and Conditions shall govern any changes made to the requirements of the Agreement. It is Seller's intent that its Quotation be treated as an offer. However, if Purchaser's purchase order or any other correspondence from Purchaser is deemed to be an offer, Seller's acceptance of Purchaser's offer is expressly conditioned on assent to these Standard Terms and Conditions.

4. PAYMENTS
Payment is due as stated on Seller's Invoice or, if not stated thereon, net 30 days from the date that Products were delivered. Purchaser agrees to pay interest at 18% per annum(1.5% per delayed month) on all invoices not paid in full by the due date. Seller reserves the right to alter Purchaser's credit limit, if any, at any time, or to require payment for any order prior to delivery. Purchaser's failure to make any payments requested by Seller shall give Seller the option to cancel this Agreement or to delay delivery without otherwise affecting Seller's rights hereunder. Payment shall be made in the currency specified by Seller. As partial payment of sums due Seller may accept any check or tender of payment without entering into an accord and satisfaction, without waiver, and without prejudice to Seller's right to full payment of the remainder due or to become due hereunder notwithstanding any terms or conditions endorsed on or stated in any communication related to such check or tender. Seller may apply any payment tendered by Purchaser to any amount owed to Seller by Purchaser whether under this Agreement or otherwise.
All orders under 1000$, excluding blanket order arrangement spreads, will be surcharged with Money Transfer Commission of 25$.

5. INSPECTION AND ACCEPTANCE OF GOODS
Purchaser must check any Order Acknowledgement and immediately inform Seller in writing of any error or anomaly within three 3 days of receipt of Order Confirmation.

6. DELIVERIES
Seller's obligation with respect to each item and delivery date shall be separate and distinct. Delivery dates are to be treated as estimates only. Seller reserves the right to adjust shipment schedules from time to time with notice to Purchaser. Seller's failure to make delivery of any item or to meet any delivery date shall not affect either party's obligation with respect to any remaining items or deliveries specified in this Agreement. Purchaser should confirm the suitability of Seller's standard manufacturing lead times when placing orders. With respect to each delivery obligation contained in this Agreement: (i) Tender of a shipment to any licensed carrier shall constitute delivery to Purchaser; (ii) Seller shall use its commercially reasonable efforts to deliver in accord with the schedule specified in this Agreement. Any delivery not in dispute shall be paid for in accordance with that order's terms to Purchaser, regardless of any dispute as to the other delivered or undelivered goods. Seller is not obligated to package goods for outside storage. Deliveries of up to ten percent (10%) above or below quantities specified in the order shall be accepted by Purchaser and the invoice price will be adjusted accordingly. Unless otherwise specified by Seller, delivery is made at Purchaser's risk and expense, Ex-works at RF Immunity's site, Prat 2 St. Yavne, Israel (Shipping point). The delivery is regarded as complete once the Product leaves Seller's facility. At the written request of the Purchaser, Seller will insure the delivery at Purchaser's expense. Unless specifically instructed by Purchaser, Seller will select an appropriate method of forwarding and routing the Product.

7. INSPECTION OF PRODUCTS, CLAIMS FOR DEFECTS
Purchaser shall inspect the Product it receives within thirty (30) days after delivery or within the period required by applicable law, whichever is shorter. Seller must be notified promptly in writing of any non-conformance. With respect to defects discoverable upon reasonable inspection, all claims are waived if not made within thirty (30) days from date delivered. In the event of any claim by Purchaser regarding the quality of the Product delivered, such Product must be promptly offered to Seller for examination. Seller shall have no obligation to replace or provide credit for Product claimed to be defective unless Seller receives representative samples of the Product and is provided an opportunity to examine the Product at a place convenient to the Seller. Purchaser's right to reject Product shall at all times be limited to that portion of the Product actually defective. No Product may be returned without Seller's prior written authorization and return material authorization number. All Products for return must be freight prepaid by Purchaser. In the event the returned products were examined and determined by the seller as defective, the seller will bear the freight expenses back to purchaser after replacing the defect ones.

8. TITLE RISK OF LOSS
Unless otherwise agreed by the parties in writing, risk of loss or damage to the Product shall pass to Purchaser upon delivery to a common carrier. After Seller's delivery of the Products to the common carrier, all charges of freight, handling and insurance are the responsibility of the Purchaser. Purchaser assumes all risk of loss or damage after delivery of the Products to the carrier; any claims for loss or damage shall be made by Purchaser directly with the carrier. Purchaser shall take title to the Product upon Seller's receipt of payment for the Product delivered.

9. LIMITED WARRANTY
Seller warrants that at the time of delivery the Products sold hereunder shall be free from defects in materials and workmanship and shall conform to Seller's specifications, and, if applicable, acceptance criteria to which Seller has agreed in writing. Purchaser retains sole responsibility for determining whether the Products are fit for the intended use, and for suitability of qualification and acceptance criteria. Seller's Limited Warranty does not cover damage due to natural wear and tear, insufficient maintenance, chemical or electrolytic influences, defective wiring work or installation. Seller's Limited Warranty is void if Purchaser or third parties carry out modifications or repairs on the Product without the prior written agreement of Seller. Claims for defects must be received by Seller in writing within one (1) year from Seller's delivery of Product on which the claim is based or such longer period as required by applicable law. Purchaser's exclusive remedy will be limited to repair, replacement at Seller's facilities, or refund for Products which Seller verifies as defective. Seller shall determine which remedy shall apply in its sole discretion. Seller will retain all replaced parts. Except for the warranty set forth in this Section 9, unless otherwise required by applicable law, SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, AND EXPRESSLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE.

10. LIMITATION OF LIABILITY AND INSURRANCE
NO CLAIM BY PURCHASER OF ANY KIND FOR DAMAGES SHALL BE GREATER IN AMOUNT THAN THE PURCHASE PRICE OF THE PRODUCT IN RESPECT OF WHICH SUCH DAMAGES ARE CLAIMED. SELLER SHALL, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES, INCLUDING, BUT NOT LIMITED TO, LOSS OF BUSINESS OR PROFIT, BASED ON ANY ALLEGED DESIGN OR MANUFACTURING DEFECT, NEGLIGENCE, BREACH OF WARRANTY, STRICT LIABILITY, INDEMNITY, OR ANY OTHER REASON OR LEGAL THEORY ARISING OUT OF THE USE OR HANDLING OF THE PRODUCT OR ITS PERFORMANCE HEREUNDER, TO THE EXTENT THAT SUCH LIABILITY EXTENDS SELLER'S OBLIGATIONS BEYOND THE PRICE PAID TO SELLER FOR THE PRODUCT ON WHICH SUCH CLAIM IS BASED. SELLER SHALL NOT BE LIABLE FOR ANY DIRECT OR CONSEQUENTIAL DAMAGES ARISING FROM DELIVERY DELAY, WHETHER OR NOT ARISING FROM SELLER'S NEGLIGENCE, OR FROM TRANSIT LOSS OR DAMAGE. SELLER IS NOT OBLIGED TO OBTAIN OR MAINTAIN ANY INSURANCE NOT REQUIRED BY APPLICABLE LAW. FOR PURPOSES OF THIS SECTION, SELLER SHALL INCLUDE SELLER'S AFFILIATES INCLUDING ITS PARENT COMPANY TEDER ELECTROMECHANICAL ENGINEERING, A LIMITED LIABILITY COMPANY UNDER THE ISRAELI LAW.

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