

**SECTION 3**



**Board-to-Board: MMBX / SMP-MAX**  
R223 / R222M



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Introduction



50Ω

DC - 12.4 GHz

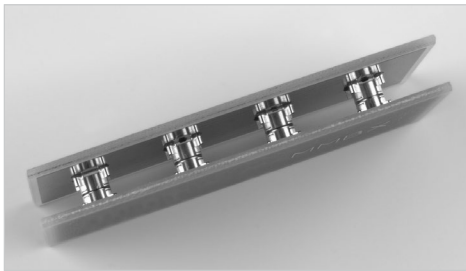
**GENERAL**

- Snap-on mating
- Microminiature coaxial connectors
- Robust
- Surface mount receptacles
- Fully compatible with automated pick and place machines

**APPLICATIONS**

- Board to board applications
- Base station
- High density packaging

MMBX™ connector series is particularly suitable for board to board connection in telecommunication systems. MMBX™ connectors allow a quick connection in a minimum space requirement. Frequency range is DC to 12.4 GHz. SMT connectors are totally compatible with pick and place machines.



• **Space saving**

Its small size is a main advantage for applications requiring board to board distance less than 7mm.

• **Recommended use**

Receptacles and in-series adapters can be either sold separately or with the adapter already inserted in the receptacle. In this case, assembly time will be reduced and you will be sure that the in-series adapter is properly inserted.

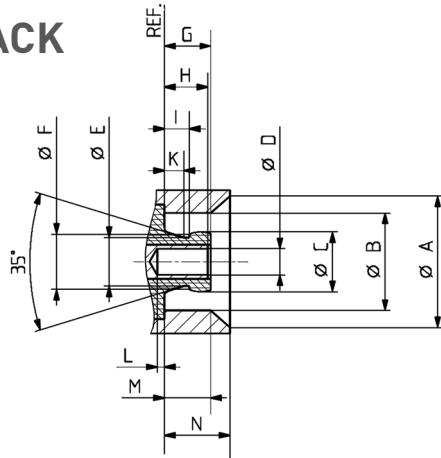


- Retention between receptacle and in-series adapter is ensured by the asymmetrical design of the adapter:
- Snap side: for board to board application, it allows all in-series adapters to remain on the same board during disassembly.
  - Slide side: it allows quick and easy connections with large axial and radial misalignment tolerance.

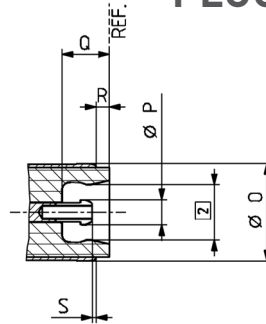
Interface

PCB connectors

JACK



PLUG

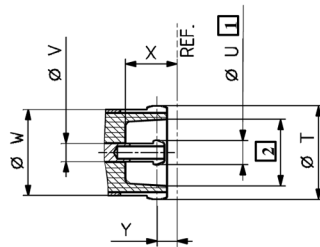


Letter	mm		inch	
	min.	max.	min.	max.
A	5.00 nom.	5.00 nom.	.197 nom.	.197 nom.
B	3.68	3.71	.145	.146
C	2.25	2.30	.088	.090
D	0.98	1.01	.038	.040
E	1.85 nom.	1.85 nom.	.073 nom.	.073 nom.
F	2.10 nom.	2.10 nom.	.083 nom.	.083 nom.
G		1.80		.071
H	1.55	1.75	.061	.069
I	0.90		.035	

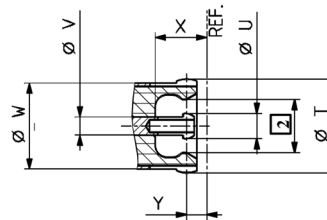
Letter	mm		inch	
	min.	max.	min.	max.
K	0.75 nom.	0.75 nom.	.029 nom.	.029 nom.
L	0		0	
M	1.45		.057	
N	2.50 nom.	2.50 nom.	.098 nom.	.098 nom.
O	3.70 nom.	3.70 nom.	.146 nom.	.146 nom.
P	0.95 nom.	0.95 nom.	.037 nom.	.037 nom.
Q	1.85 nom.	1.85 nom.	.073 nom.	.073 nom.
R	0.50 nom.	0.50 nom.	.020 nom.	.020 nom.
S	0.10 nom.	0.10 nom.	.004 nom.	.004 nom.

In series adapters

Slide-on



Snap-on



Letter	mm	inch
T	3.70 nom.	.146 nom.
U	0.95 nom.	.037 nom.
V	0.70 nom.	.027 nom.

Letter	mm	inch
W	3.65 nom.	.144 nom.
X	2.05 nom.	.080 nom.
Z	0.80 nom.	.031 nom.

- 1 Slotted and flared to meet electrical and mechanical requirements
- 2 Dimension to meet electrical and mechanical requirements

## Characteristics

Test / Characteristics	CECC 22000	Values / Remarks
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### ELECTRICAL CHARACTERISTICS

Impedance		50Ω			
Frequency range		DC - 12.4 GHz			
Typical V.S.W.R. <ul style="list-style-type: none"> <li>• Straight connectors:                             <ul style="list-style-type: none"> <li>- 2/50/S</li> <li>- 2.6/50/S</li> <li>- 2.6/50/D</li> </ul> </li> <li>• Right angle connectors:                             <ul style="list-style-type: none"> <li>- 2/50/S</li> <li>- 2.6/50/S</li> <li>- 2.6/50/D</li> </ul> </li> </ul>	DC - 1 GHz	1 - 2.5 GHz	2.5 - 6 GHz		
		1.05	1.06	1.10	
		1.05	1.06	1.10	
		1.05	1.06	1.10	
		1.05	1.13	1.22	
		1.05	1.06	1.17	
Insulation resistance		> 1 GΩ			
Dielectric withstanding voltage (sea level) <ul style="list-style-type: none"> <li>• 2.50</li> <li>• 2.6/50</li> </ul>	4.4.5	500 Vrms. 50 Hz 750 Vrms. 50 Hz			
Contact resistance <ul style="list-style-type: none"> <li>• Center contact</li> <li>• Outer contact</li> </ul>	4.4.2 4.4.3	≤ 5 mΩ ≤ 1 mΩ			

### MECHANICAL CHARACTERISTICS

Mechanical endurance	4.7.1	100 matings		
Engagement and separation force <ul style="list-style-type: none"> <li>• Engagement</li> <li>• Separation</li> </ul>	4.5.4	30 N max 8-30 N		
Contact captivation	4.5.2	≥ 10 N		
Cable retention force <ul style="list-style-type: none"> <li>• 2/50</li> <li>• 2.6/50</li> </ul>		58 N 110 N		
Vibration	4.6.3 - IEC 68-2-6 Fc	MIL-STD-202, Method 204 D, condition A		

### ENVIRONMENTAL CHARACTERISTICS

Temperature range		-55°C + 155°C		
Thermal shock	4.6.7 - IEC 68-2-14 Na	MIL STD 202, method 107G, condition B1		
Moisture resistance	4.6.6 - IEC 68-2-3 Ca	MIL STD 202, method 106F		
Corrosion	4.6.10 - IEC 68-2-11 Ka	MIL STD 202, method 101, condition B		
Vibration	4.6.3 - IEC 68-2-6 Fc	MIL STD 202, method 204D, condition A		

### MATERIALS

Center & outer contacts		Beryllium copper		
Bodies		Brass		
Ferrules		Copper		
Insulators		PTFE		

### PLATING

Center & outer contacts		Gold/NPGR		
Bodies		NPGR		
Ferrules		NPGR		

All dimensions are given in mm.  
Standard packaging = 100 pieces.

Plugs and PCB receptacles

**STRAIGHT PLUGS (male center contact)**

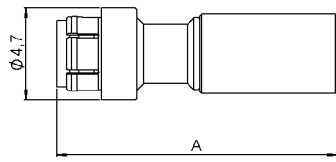
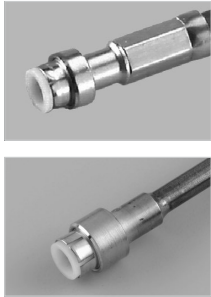


Fig. 1

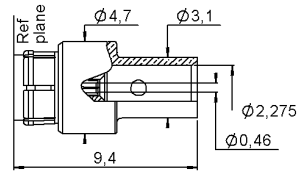


Fig. 2

Cable group	Cable group dia.	Part number	Fig.	A	Captive center contact	Note
RG178 / RG196	2/50/S	R223 081 000	1	14.3	yes	Crimp type for flexible cables
RG174 / RG316	2.6/50/S	R223 082 000		14.5		
RG316	2.6/50/D	R223 083 000				
RG405	.085"	R223 062 000	2			Solder type for semi-rigid cables

**RIGHT ANGLE PLUGS (male center contact)**

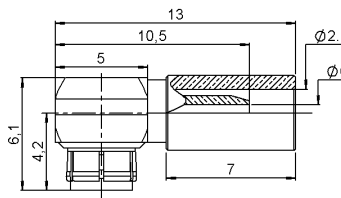
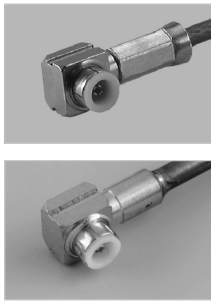


Fig. 1

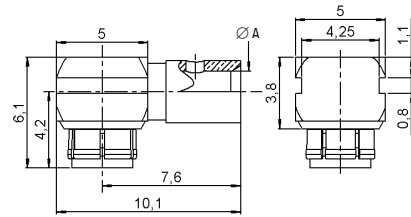


Fig. 2

Cable group	Cable group dia.	Part number	Fig.	A	Captive center contact	Note
RG178 / RG196	2/50/S	R223 181 000	1		yes	Crimp type for flexible cables
RG174 / RG316	2.6/50/S	R223 182 000				
RG316	2.6/50/D	R223 183 000				
RG405	.085"	R223 162 000	2	2.275		Solder type for semi-rigid cables

**STRAIGHT PCB RECEPTACLES WITH PRE-ASSEMBLED ADAPTER (male center contact)**

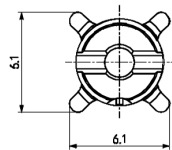


Fig. 1

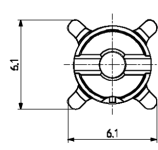


Fig. 2

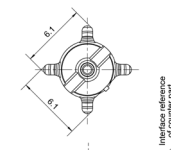
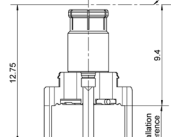
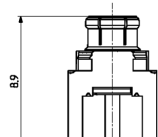
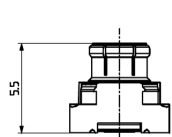


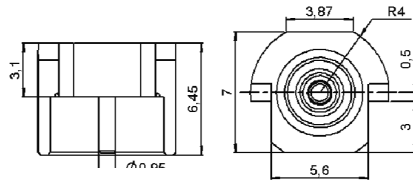
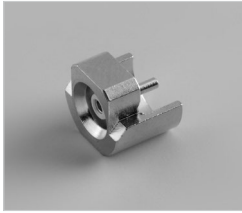
Fig. 3



Part number	Fig.	Captive center contact	PCB	Assembly instructions	Packaging	Note
R223 434 000	1	yes		M01	Bulk 100 pieces	SMT
R223 434 800					Tape & Reel 750 pieces	
R223 435 000	2			P01		
R223 435 010	3					

PCB receptacles

**EDGE CARD PCB RECEPTACLES (female center contact)**



Part number	Captive center contact	Packaging	Note
R223 423 010	yes	Bulk 100 pieces	SMT
R223 423 800		Tape & Reel 650 pieces	

**STRAIGHT PCB RECEPTACLES (female center contact)**

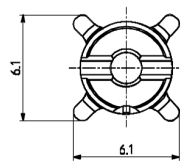
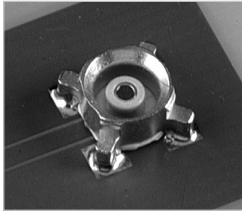


Fig. 1

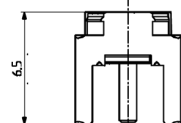
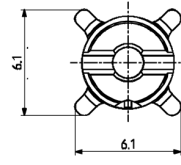


Fig. 2

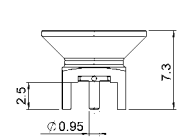
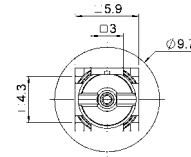


Fig. 3

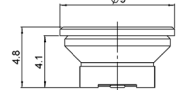
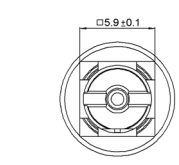
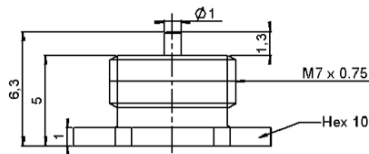
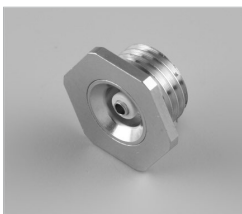


Fig. 4

Part number	Fig.	Captive center contact	PCB	Assembly instructions	Packaging	Note
R223 424 000	1	yes		M01	Bulk 100 pieces	SMT
R223 424 800					Tape & Reel 750 pieces	
R223 424 870	4			M02	Bulk 100 pieces	Catcher's mitt
R223 425 000	2			P01	Bulk 100 pieces	Catcher's mitt
R223 425 800			Tape & Reel 500 pieces			
R223 425 810	3					

**SCREW-ON RECEPTACLE (female center contact)**



Part number	Captive center contact	Panel drilling
R223 555 000	yes	P02

Adapters

**IN SERIES ADAPTERS (male-male center contact)**

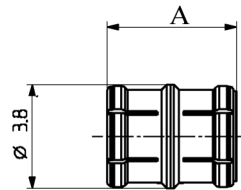
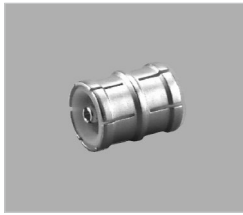


Fig. 1

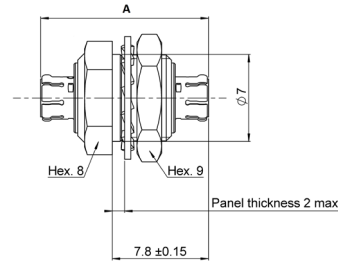


Fig. 2

Part number	Fig.	Length A (mm)	Type	Nominal board to board distance
R223 703 180	1	4.8	Snap-slide	6.7
R223 703 020		9.7	Slide-slide	11.7
R223 703 040		12	Snap-slide	14
R223 703 080		7		9
R223 703 230		20.4		22.4
R223 720 020	2	13.6	Slide-slide Bulkhead	-

Other lengths available, please contact us.

**BETWEEN-SERIES ADAPTERS**

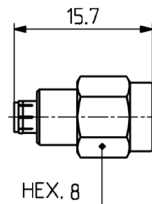


Fig. 1

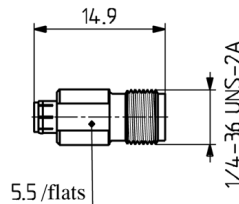


Fig. 2

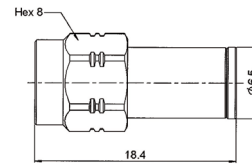


Fig. 3

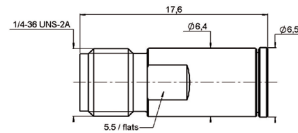


Fig. 4

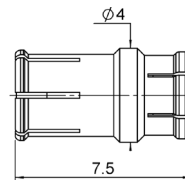


Fig. 5

Part number	Fig.	Series	Packaging
R191 389 100	1	MMBX male/SMA male	Unit
R191 389 200	2	MMBX male/SMA female	
R191 389 300	3	MMBX female/SMA male	
R191 389 400	4	MMBX female/SMA female	
R191 560 000	5	SMP-MAX female/MMBX male snap	Bulk 100 pieces

Other configurations available, with flange, straight and right angle. Please contact us.



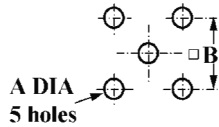
**Demo board**



Part number	Note
R223 990 000	2 SMT receptacles

**Panel drilling**

**P01**



	mm		inch	
	maxi	mini	maxi	mini
A	1.4	1.2	.055	.047
B	5.16	5	.203	.197

**P02**



Threading	
ØA	M7 x 0.75

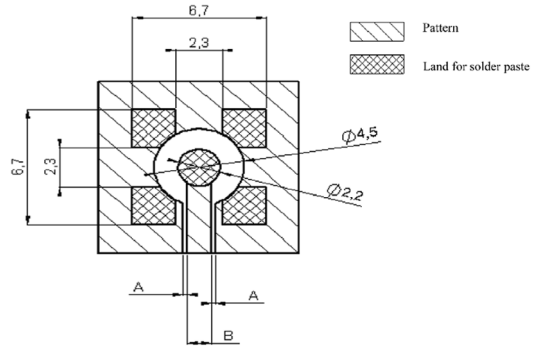
**Assembly instructions**

**M01**

Part number					
R223 424 000	R223 424 800	R223 434 000	R223 434 800	R223 435 000	R223 435 010

**COPLANAR LINE**

- Pattern and signal are on the same side.
- The material of PCB is epoxy resin (FR4) (Er = 4.6).
- The solder resist should be printed except for the land pattern on the PCB.

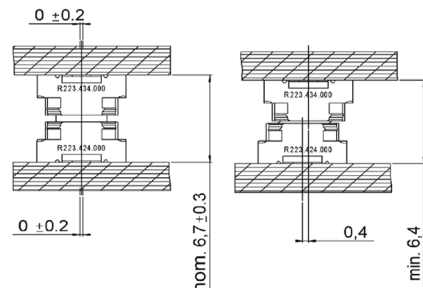
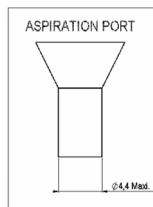
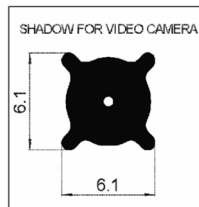


**APPLICATION 75Ω WITH B = 0.55 mm**

PCB thickness (mm)	Coplanar line A (mm)
0.8	0.350
1.0	0.360
1.2	0.365
1.6	0.375

**APPLICATION 50Ω WITH B = 1.2 mm**

PCB thickness (mm)	Coplanar line A (mm)
0.8	0.190
1.0	0.200
1.2	0.205
1.6	0.210



Not valid for R223 424 870, please consult data sheet.

## Introduction



### Board-to-Board solutions

#### The Best Systems

Radiall's engineers work with your engineers, allowing us to develop the best competitively priced misalignment RF coaxial interconnect solutions on the market today.

#### The Best Choices

Radiall offers more board to board choices with four different product groups and ten connector series, that can address the most demanding wireless telecom applications required for the new generation of infrastructure compact equipment. From base stations to repeaters and even handheld and GPS devices, we have a tailored connector solution for you, including the new SMP-MAX, SMP-Spring, IMP-Spring and other large, limited and no misalignment solutions.



#### SMP-MAX

Get the best for less with the new SMP-MAX large misalignment solution. Its patented impedance matching insulator is optimized for a larger operating gap between connectors making it easier for engineers to handle a board-to-board distance tolerance of at least .078" (2.0 mm) without a spring, which is 300% more than the standard SMP. It features a 3° minimum tilt (radial travel) and it has an operating frequency range of DC-6 GHz and a 1.2 max VSWR guaranteed at DC-3 GHz.



SMP-MAX Receptacle



SMP-MAX Adapter

#### Spring-loaded Connectors

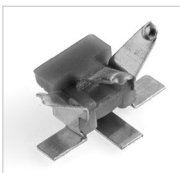
Radiall's one connector IMP-Spring and three connector SMP-Spring, MMBX-Spring, and BMR-Spring large misalignment spring-loaded series are the best for increased maximum distance tolerances. IMP-Spring is a cost effective, unique one connector solution that offers up to .023" (.6 mm) board to board distance tolerance with a tilt (radial travel) up to 4.5°. The new SMP-Spring and MMBX-Spring offer up to .078" (2 mm) board-to-board distance tolerance and a 4.5° tilt (radial travel). All spring-loaded solutions feature consistent VSWR and low RF leakage.



IMP-Spring and SMP-Spring

#### Limited Misalignment

Radiall's one connector IMP and three connector SMP and MMBX limited misalignment series are designed for applications requiring relatively precise distance tolerance of up to .023" (.6 mm) with a tilt (radial travel) of up to 4.5°.

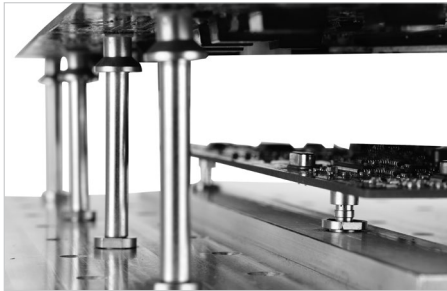
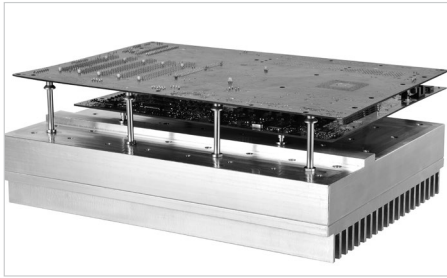


IMP

#### No Misalignment

Radiall's MMT, MMS and MCX series are designed for applications requiring little or no distance tolerance between boards.

Introduction



50Ω	DC - 6 GHz
-----	------------

**GENERAL**

- Microminiature coaxial connectors
- Power up to 300 Watts
- Board to board distance misalignment of at least 0.078" (2.0 mm)
- Tilt (radial misalignment): 3° minimum
- 1.2 max VSWR at DC - 3 GHz

**APPLICATIONS**

- Broadcast
- RF components (filters, amplifiers, ....)
- Wireless communications

**The cost-effective solution for maximum mechanical misalignment**

Of the several RF connectors available for interconnections in wireless remote radio heads, repeaters, base stations, GPS devices, and similar applications, the board-to-board style connector is growing in popularity. The product line has evolved from accommodating limited misalignment to offering the widest tolerances available.

SMP-MAX was introduced by Radiall to provide larger misalignment tolerances than the early version board-to-board connectors like SMP or SMP-spring while offering lower cost.

Featuring an optimized interface, SMP-MAX can work up to 6 GHz board-to-board distance misalignment at least 2.0 mm and radial misalignment 3° minimum.

The SMP-MAX series offers 2 levels of retention provided by the receptacles:

- Slide-on, for the lowest retention
- Snap-on, for a positive locking with a retention

A complete SMP-MAX board-to-board system is made of 3 parts:

SMP-MAX Slide-on receptacle	SMP-MAX In series adapter	SMP-MAX Snap-on receptacle
		

Many other custom configurations are available. Larger distance misalignment and larger tilt versions are also available.

## Characteristics

Test / Characteristics	Values / Remarks		
<b>ELECTRICAL CHARACTERISTICS</b>			
Impedance	50Ω		
Frequency	DC - 6 GHz		
Typical V.S.W.R. (Board to Board connection)	Misalignment	DC - 3 GHz	3-6 GHz
	Radial 0°, Axial 0 mm	< 1.15	< 1.25
	Radial 0°, Axial +/- 1 mm	< 1.20	< 1.35
	Radial 3°, Axial 0 mm	< 1.15	< 1.25
	Radial 3°, Axial +/- 1 mm	< 1.20	< 1.35
Insertion loss (Board to Board connection)	Misalignment	DC - 3 GHz	3-6 GHz
	Radial 0°, Axial 0 mm	0.10	0.15
	Radial 0°, Axial +/- 1 mm	0.12	0.25
	Radial 3°, Axial 0 mm	0.10	0.15
	Radial 3°, Axial +/- 1 mm	0.12	0.25
Insulation resistance	5000 MΩ		
Center contact resistance	< 3 mΩ		
Outer contact resistance	< 1.5 mΩ		
Working voltage	330 VRMS		
Dielectric withstanding voltage	1000 VRMS		
Power handling (typical)	> 300W @ 2.7 GHz, 25°C > 200W @ 2.7 GHz, 85°C		
RF leakage	-70dB to 3 GHz, axial misalignment 0mm		

## MECHANICAL CHARACTERISTICS

Mating cycles	100 cycles	
	Slide-on	Snap-on
Engagement force	< 14 N	< 45 N
Disengagement force	< 9 N	> 9, < 45 N
Center contact retention force	> 7 N	
Minimum distance between PCB	13 mm	
Radial misalignment tolerance	3°min	
Axial misalignment tolerance	2.0 mm Larger axial misalignment version available	

## ENVIRONMENTAL CHARACTERISTICS

Temperature range	-55°C / +165°C
Thermal shock	MIL-STD-202, method 107, condition B
Vibration	MIL-STD-202, method 204, condition B
Shock	MIL-STD-202, method 213, condition A
Corrosion salt spray	MIL-STD-202, method 101, condition B
Moisture resistance	MIL-STD-202, method 106

## MATERIALS

Body	Brass / Beryllium copper
Male center contact	Brass
Female center contact	Beryllium copper
Gasket	Silicon rubber
Insulator	PTFE / PEEK

## PLATING

Body	NPGR / BBR
Male center contact	NPGR
Female center contact	NPGR

Packaging = 100 pieces box / 500 pieces reel.

All dimensions are given in mm.

Jacks, plugs and cabling

**BULKHEAD STRAIGHT SLIDE-ON MALE JACKS FOR CABLES**

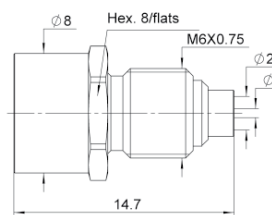


Fig. 1

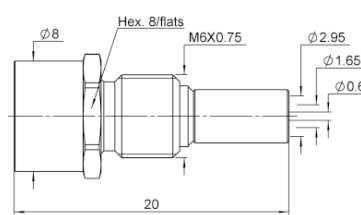
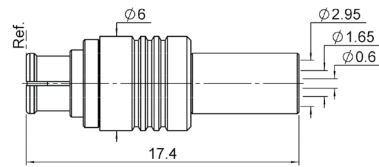


Fig. 2

Cable group	Cable group dia.	Part number	Fig.	Captive center contact	Panel drilling	Packaging
RG405	.085"	R222 M20 700	1	yes	P01	Bulk 100 pieces
RG174 / RG316	2.6/50/S	R222 M20 710	2			

**STRAIGHT FEMALE PLUG FOR FLEXIBLE CABLE**



Cable group	Cable group dia.	Part number	Captive center contact	Packaging
RG174 / RG316	2.6/50/S	R222 M80 400	yes	Bulk 100 pieces

**RIGHT ANGLE FEMALE PLUG FOR FLEXIBLE CABLE**

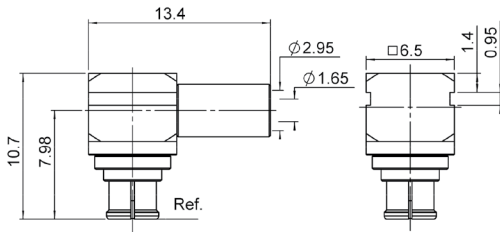


Fig. 1

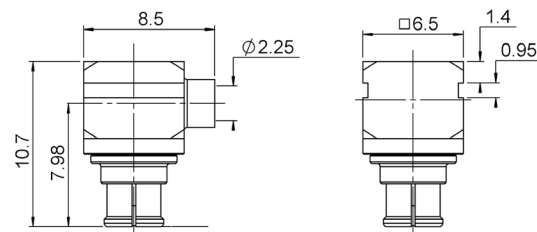
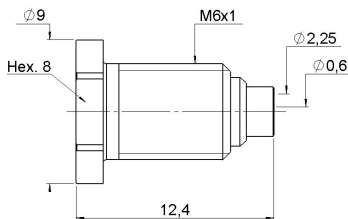


Fig. 2

Cable group	Fig.	Cable group dia.	Part number	Captive center contact	Packaging
RG174 / RG316	1	2.6/50/S	R222 M80 500	yes	Bulk 100 pieces
RG405	2	.085"	R222 M80 517		

**BULKHEAD MALE JACK SNAP TYPE**



Cable group	Cable group dia.	Part number	Captive center contact	Panel drilling	Packaging
RG405	.085"	R222 M20 017	no	P05	100

Receptacles

STRAIGHT SLIDE-ON MALE RECEPTACLES

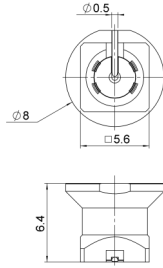


Fig. 1

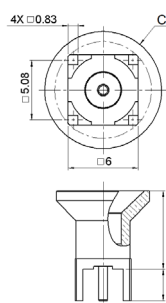


Fig. 2

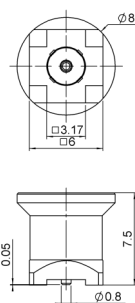


Fig. 3

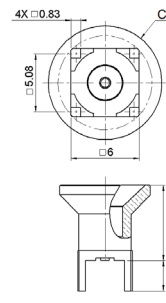


Fig. 4

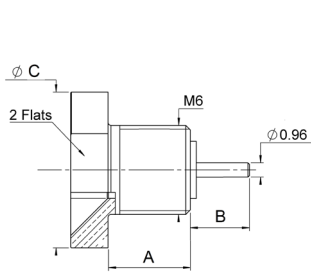


Fig. 5

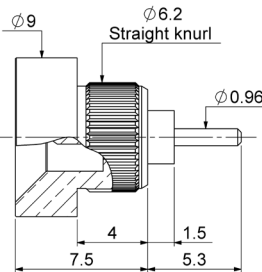


Fig. 6

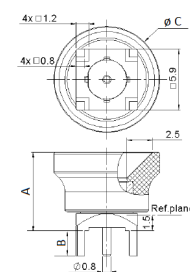


Fig. 7

Part number	Fig.	Dimensions (mm)			Captive center contact	Panel drilling	Packaging	Note
		A	B	C				
R222 M00 700	1				yes		Tape & Reel 500 pieces	SMT
R222 M00 720	2	7.5	1.9	8.3		P02	Bulk 100 pieces	Solder legs
R222 M00 770		8.4	3.4	10				Center contact dia. 0.95
R222 M00 730	4	7.7	1.9	8.3		P03	Tape & Reel 400 pieces	PIH + SMT, with cap
R222 M00 740	3						Tape & Reel 500 pieces	SMT
R222 M10 700	5	5.6	2	9		P01	Bulk 100 pieces	Screw-on
R222 M10 730	6					P04		Press in
R222 M10 750	5	5.6	4	10.5		P01		
R222 M00 790	4	13.3	1.9	12		P03		PIH + SMT
R222 M00 860	2	7.3	3.5	10		P02		Solder legs
R222 M00 880		7.7	2.4					PIH + SMT
R222 M00 890	4	7.2	1.7				500	Composite catcher's mitt / SMT
R222 M03 700	7	7.6	0	10.2		P02	Bulk 100 pieces	Composite catcher's mitt / Solder legs
R222 M03 880		7.7	2.4	10				

Receptacles and adapters

STRAIGHT SNAP-ON MALE RECEPTACLES

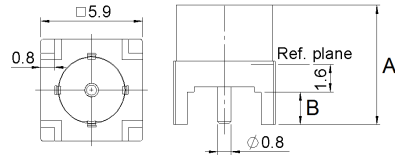


Fig. 1

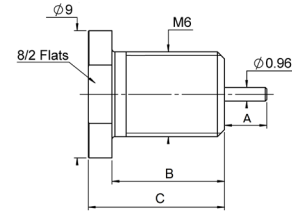


Fig. 2

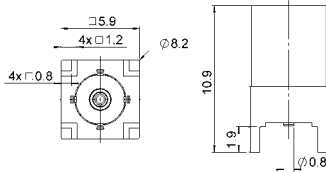


Fig. 3

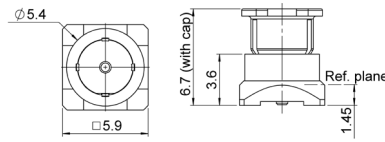


Fig. 4

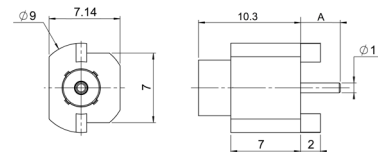


Fig. 5

Part number	Fig.	Dimensions (mm)			Captive center contact	Panel drilling	Packaging	Note
		A	B	C				
R222 M10 000	2	2	7.1	11.15	yes	P01	Bulk 100 pieces	Screw-on, with cap
R222 M10 030		3.5	9.1	11.2				
R222 M10 060		4.1	6.5	8.5				
R222 M00 080	1	7	1.9	P02		Tape & Reel 500 pieces	Solder legs	
R222 M00 090	3							
R222 M00 160	1	8.6	3.5			P02	Bulk 100 pieces	Solder legs
R222 M01 000		6.7	1.7					
R222 M01 040	3			P03		Bulk 400 pieces	PIN + SMT	
R222 M01 090	5	4						
R222 M01 140		3					Tape & Reel 500 pieces	Edge type
R222 M03 000	4				P05	Tape & Reel 500 pieces	Screw-on	

IN-SERIES BOARD-TO-BOARD ADAPTERS

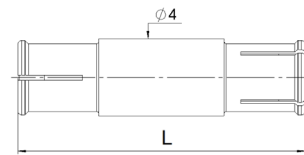


Fig. 1

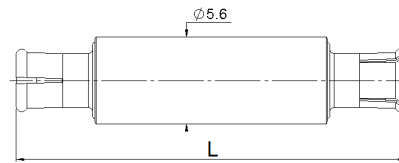


Fig. 2

Part number	Length L (mm)	Fig.	Series	Packaging	
R222 M40 010	9.5	1	SMP-MAX female / SMP-MAX female	Bulk 100 pieces	
R222 M40 050	25.3				
R222 M40 060	12.15				
R222 M40 070	14.9				
R222 M40 080	13.8				
R222 M43 052	25.3				2
R222 M43 072	14.9				
R222 M43 112	16.7				
R222 M43 192	50.5				
R222 M43 202	45.2				
R222 M43 212	46.25				
R222 M43 222	51.15	1			
R222 M43 262	67.5				
R222 M46 012	9.5				
R222 M46 032	7.2				