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GORE® Microwave/RF Assemblies

General Purpose Test Applications

Maximum flexibility, excellent electrical stability

For test applications that require consistent and highly repeatable measurements, GORE® Microwave/RF Assemblies for general purpose test applications provide reliable electrical performance with proven phase and amplitude stability. The smaller diameter and highly flexible, yet durable construction simplify the routing process while ensuring long-lasting electrical performance after installation, particularly in board-to-board and inside-the-box systems. GORE® Microwave/RF Assemblies provide electrical and mechanical integrity for long service life in a lightweight cable assembly.

Greater Flexibility

GORE® Microwave/RF Assemblies are extremely flexible and withstand the rigors of handling and installation. Unlike traditionally designed flexible cables that are more stiff and difficult to handle, Gore's assemblies have a small bend radius that makes routing easy even in tight spaces. Their smaller size and flexibility enable these cables to maintain signal integrity for a longer service life.

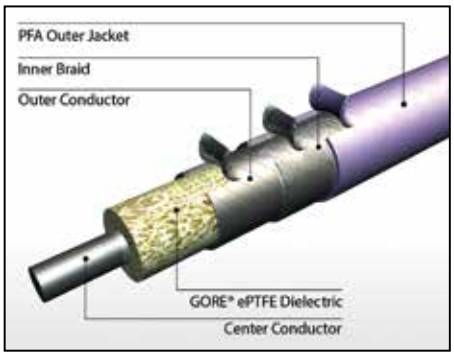
Precise and Repeatable Measurements

GORE® Microwave/RF Assemblies offer excellent electrical performance in applications from DC through 67 GHz. The assemblies' proven phase and amplitude stability ensures accurate and repeatable measurements. Gore tests each assembly after manufacturing to ensure that its insertion loss and VSWR meet performance criteria.

The construction of GORE® Microwave/RF Assemblies enables consistent electrical performance (Figure 1). Gore's expanded polytetrafluoroethylene (ePTFE) insulation has a dielectric constant of 1.4, which translates to low relative loss, high velocity of propagation (85 percent speed of light), low capacitive loading, and high cut-off frequencies. Protected by the inner braid and jacket, the outer conductor delivers a minimum of 100 dB/ft of shielding effectiveness through 18 GHz. A specific assembly's shielding effectiveness is determined by the choice of connector.

Gore provides a variety of standard connectors designed specifically for GORE® Microwave/RF Assemblies. These connectors are engineered to complement the performance of each cable, minimizing loss and reflection for optimized signal transmission.

Figure 1: The Anatomy of GORE® Microwave/RF Assemblies for General Purpose Applications





Benefits of GORE® Microwave/RF Assemblies

- Reliable signal integrity over longer distances with low loss up to 67 GHz
- Reliable, repeatable electrical performance with consistent phase and amplitude stability
- Easy installation with flexible construction and small bend radius
- Decreased weight with smaller diameter for higher density applications
- Design flexibility with a variety of interconnect options

Typical Applications

- Board-to-board systems
- Inside-the-box systems
- Wafer probing
- ATE systems (automated test equipment)
- Load boards
- Environmental test chambers
- Thermal vacuum chambers
- Telecommunication systems
- Optical modules
- Evaluation boards
- Antenna arrays
- Test bench systems
- Module-to-module interconnect
- Backplane interconnects
- Clock distribution

GORE® Microwave/RF Assemblies

Phase Matching

Upon request, phase or time delay matching can be specified for GORE® Microwave/RF Assemblies with frequencies of DC through 67 GHz. According to the performance requirements of the application, cable assemblies can be specified to meet absolute or relative matching values:

- **Absolute match:** One or more assemblies having a specific time delay or phase length target value ± some tolerance value. This type of specification allows replacement or addition of individual cables in a matched set.
- **Relative match:** Two or more assemblies whose time delay or phase length fall within a specified match window. Relative matching ensures consistent matching within a set of cables, but an assembly from one set may not necessarily be matched with cable assemblies in another set.

Gore can provide absolute and relative time delay matching to sub-picosecond tolerances.

High-Density Interconnects

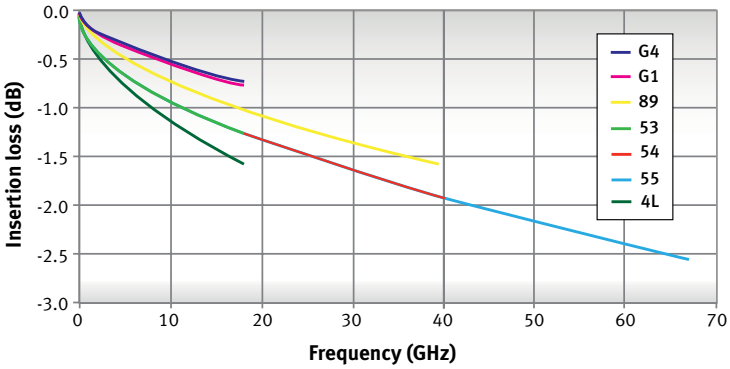
Gore offers several extremely small interconnects that deliver consistent electrical performance with maximum flexibility (Table 1). These assemblies enable you to achieve high density for applications such as printed circuit boards and load boards. The combination of low loss, small diameter and minimum bend radius facilitate easier routing and durable installation, making them an ideal replacement for semi-rigid assemblies (Figure 2). A variety of push-on connectors are available (Table 2). For cable/connector combinations specifically designed for load board applications, contact a Gore representative at electronics.usa@wlgore.com.

Table 1: High-Density Interconnect Specifications[1]

	Gore Cable Type	4L	53	G1	G4	54	89	55
Electrical Properties	Maximum Frequency	18	18	18	18	40	40	67
	Typical VSWR	1.33:1	1.32:1	1.30:1	1.30:1	1.33:1	1.40:1	1.40:1
	Typical Insertion Loss (dB)	1.58	1.26	0.77	0.75	1.93	1.60	2.58
	Impedance (Nominal) (Ohms)	50						
	Attenuation at Maximum Frequency [dB/m (dB/ft)]	5.04 (1.54)	3.69 (1.13)	2.33 (0.71)	2.08 (0.63)	5.45 (1.66)	5.35 (1.63)	7.02 (2.14)
	Dielectric Constant (Nominal)	1.4						
	Velocity of Propagation (Nominal) (%)	85						
	Shielding Effectiveness (dB through 18GHz)	› 100						
	Time Delay (Nominal) [ns/cm (ns/in)]	0.04 (0.103)						
Mech/Env Properties	Center Conductor	Solid	Solid	Stranded	Solid	Solid	Solid	Solid
	Overall Diameter [mm (in)]	1.2 (0.047)	1.8 (0.070)	3.0 (0.120)	3.0 (0.120)	1.8 (0.070)	2.2 (0.085)	1.8 (0.070)
	Nominal Weight [g/m (oz/ft)]	5.6 (1.7)	11.5 (3.5)	29.5 (9.0)	29.5 (9.0)	11.5 (3.5)	13.1 (4.0)	11.5 (3.5)
	Minimum Bend Radius [mm (in)]	6.4 (0.25)	10.2 (0.4)	12.7 (0.5)	12.7 (0.5)	10.2 (0.4)	12.7 (0.5)	10.2 (0.4)
	Temperature Range (°C)	-55 to 125						

[1]The electrical specifications in this table are based on a .03 m (12 in) assembly length and maximum frequency with straight connectors.

Figure 2: Minimum Typical Insertion Loss (dB) for High-Density Interconnects[1]



[1] The electrical specifications in this table are based on a 0.3 m (12 in) assembly length and maximum frequency with straight connectors.

Table 2: Connector Options for High-Density Interconnects

		Gore Cable Type						
		4L	53	G1	G4	54	89	55
Connector Type	**Max. Freq. (GHz)[2]**	**18**	**18**	**18**	**18**	**40**	**40**	**67**
SMA Male	18	S01	S01	R01	R01	S01	S01	
SMA Box Right-Angle Male	18			R71	R71		S71	
SMA Female	18	S02	S02		R02		S02	
SMA Bulkhead Female	18	R42		R42	R42		R42	
SMP Bulkhead Full Male	26.5						ZT4	
SMP Bulkhead Smooth Bore Male	26.5	ZKT	ZKT				ZKT	
SMP Bulkhead Ultra Smooth Bore Male	26.5		ZUJ				ZUJ	
SMP Float Mount Modified Full Male	26.5		ZQF				ZQF	
SMP Female	26.5	ZEM	ZT8	ZEM	ZEM	ZT8	ZT8	
SMP Box Right-Angle Female	26.5	ZF6	ZF6	ZF6	ZF6		ZF6	
SMPM Full Male	67		ZU2			ZU2		
SMPM Smooth Bore Male	67		ZUK				ZUK	
SMPM Female	67	ZST	ZST			ZST	ZST	ZST
SMPM Box Right-Angle Female	67	ZVY	ZVY			ZVY	ZVY	ZVY
SMPM Bulkhead Female	67	ZW7	ZW7				ZW7	
SMPS Box Right-Angle Female	110	ZZA						
TNCA Male	18			C01	C01			
2.92 mm Male	40					0CX	0CQ	
2.92 mm Female	40	0C2	0C2			0C2		
2.4 mm Male	50					0CY		0CY
1.85 mm Male	67					0CZ		0CZ

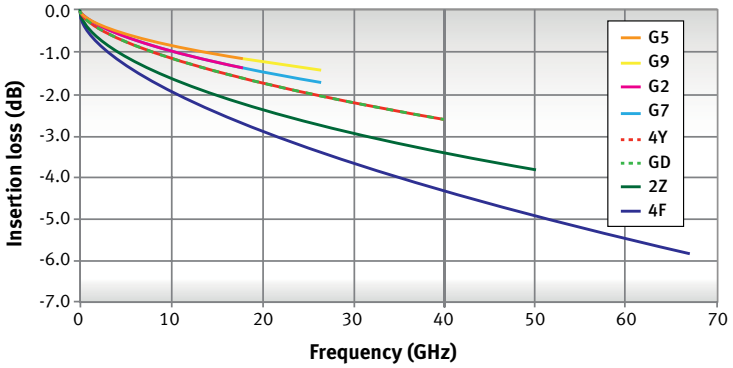
[2] The maximum operating frequency of a test assembly is determined as the lowest frequency of either the connectors or the cable.

GORE® Microwave/RF Assemblies

Wafer Probe and Multi-Purpose Assemblies

These multi-purpose GORE® Microwave/RF Cable Assemblies deliver a combination of excellent electrical and mechanical performance that ensures reliable measurement accuracy after repeated use (Table 3). The flexibility and consistent phase and amplitude stability enable these assemblies to maintain low loss and withstand the motion common in applications such as wafer probing and bench test systems (Figure 3). They also maintain phase and amplitude stability over temperature. These assemblies are available with a variety of connectors (Table 4).

Figure 3: Minimum Typical Insertion Loss (dB) for Wafer Probe and Multi-Purpose Assemblies[3]



[3] The electrical specifications in this table are based on a 0.9 m (36 in) assembly length and maximum frequency with straight connectors.

Table 3: Wafer Probe and Multi-Purpose Assembly specifications[3]

	Gore Cable Type	G5	G2	G9	G7	4Y	GD	2Z	4F
Electrical Properties	Maximum Frequency	18	18	26.5	26.5	40	40	50	67
	Typical VSWR	1.19:1	1.19:1	1.17:1	1.17:1	1.30:1	1.30:1	1.26:1	1.30:1
	Typical Insertion Loss (dB)	1.13	1.36	1.43	1.71	2.65	2.65	3.78	5.84
	Impedance (Nominal) (Ohms)	50							
	Attenuation at Maximum Frequency [dB/m (dB/ft)]	1.06 (0.32)	1.30 (0.40)	1.30 (0.40)	1.62 (0.50)	2.57 (0.78)	2.57 (0.78)	4.13 (1.26)	5.99 (1.83)
	Typical Phase Stability (degree)	+/- 2.0	+/- 2.0	+/- 3.0	+/- 3.0	+/- 5.0	+/- 5.0	+/- 6.0	+/- 8.0
	Typical Amplitude Stability (dB)	‹+/- 0.05							
	Dielectric Constant (Nominal)	1.4							
	Velocity of Propagation (Nominal) (%)	85							
	Shielding Effectiveness (dB through 18GHz)	› 100							
	Time Delay (Nominal) [ns/cm (ns/in)]	0.04 (0.103)							
Mech/Env Properties	Center Conductor	Solid	Stranded	Solid	Stranded	Solid	Solid	Solid	Solid
	Overall Diameter [mm (in)]	4.8 (0.190)	4.8 (0.190)	4.8 (0.190)	4.8 (0.190)	3.8 (0.150)	4.1 (0.160)	3.6 (0.140)	3.0 (0.120)
	Nominal Weight [g/m (oz/ft)]	55.8 (17)	55.8 (17)	55.8 (17)	55.8 (17)	36.1 (11)	36.1 (11)	32.8 (10)	29.5 (9)
	Minimum Bend Radius [mm (in)]	25.4 (1.0)	25.4 (1.0)	25.4 (1.0)	25.4 (1.0)	25.4 (1.0)	25.4 (1.0)	25.4 (1.0)	12.7 (0.5)
	Temperature Range (°C)	-55 to 125							

[3] The electrical specifications in this table are based on a 0.9 m (36 in) assembly length and maximum frequency with straight connectors.

Table 4: Connector Options for Wafer Probe and Multi-Purpose Assemblies

		Gore Cable Type							
		G5	G2	G9	G7	4Y	GD	2Z	4F
Connector Type	**Max. Freq. (GHz)[4]**	**18**	**18**	**26.5**	**26.5**	**40**	**40**	**50**	**67**
SMA Male	18	R01	R01			R01			
SMA Box Right-Angle Male	18	R71	R71			R71			
SMA Swept Right-Angle Male	18	R11	R11						
SMA Female	18	R02	R02						
SMA Bulkhead Female	18	R42	R42						
Precision N Male	18	Q01	Q01						
Precision N Box Right-Angle Male	18	Q71	Q71						
Precision N Swept Right-Angle Male	18	Q11							
Precision N Female	18	Q02	Q02						
TNC Male	12.4	T01	T01						
TNCA Male	18	C01	C01						
TNCA Box Right-Angle Male	18	C71	C71						
TNCA Swept Right-Angle Male	18	C11	C11						
Type N Male	18	N01	N01						
7 mm Hermaphroditic	18	K00	K00						
3.5 mm Male	26.5	D01	D01	D01	D01				
3.5 mm Swept Right-Angle Male	26.5			D11	D11				
3.5 mm Female	26.5	D02	D02	D02	D02				
2.92 mm Male	40					0CQ	0BQ	0BQ	
2.92 mm Box Right-Angle Male	40					ZQA			
2.92 mm Swept Right-Angle Male	40						Z3G		
2.92 mm Female	40					0CP	0BP	0BP	
2.4 mm Male	50					0CJ	0AJ	0AJ	
2.4 mm Swept Right-Angle Male	50							0BW	
2.4 mm Female	50					0CK	0AK	0AK	
1.85 mm Male	67								0BB
1.85 mm Swept Right-Angle Male	67								0BX
1.85 mm Female	67								0BA

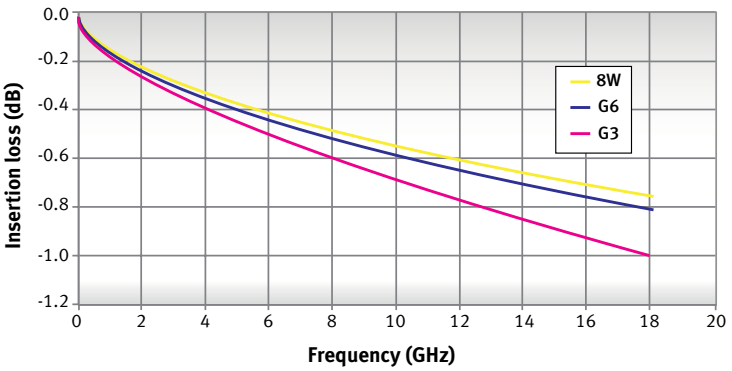
[4] The maximum operating frequency of a test assembly is determined as the lowest frequency of either the connectors or the cable.

GORE® Microwave/RF Assemblies

High Power/Low Loss Assemblies

Traditionally, applications that need high power/low loss assemblies must compromise on flexibility and size. Several highly flexible GORE® Microwave/RF Assemblies deliver low loss and high power-handling capability in a smaller package (Table 5). Delivering reliable performance up to 18 GHz (Figure 4), these assemblies have smaller diameters, making them more flexible and easier to handle. These cables are available with a variety of connectors (Table 6).

Figure 4: Minimum Typical Insertion Loss (dB) for High Power/Low Loss Assemblies[5]



[5] The electrical specifications in this table are based on a 0.9 m (36 in) assembly length and maximum frequency with straight connectors.

Table 5: High Power/Low Loss Assembly Specifications[5]

	Gore Cable Type	G6	G3	8W
Electrical Properties	Maximum Frequency	18	18	18
	Typical VSWR	1.22:1	1.24:1	1.28:1
	Typical Insertion Loss (dB)	0.80	1.00	0.75
	Impedance (Nominal) (Ohms)	50		
	Attenuation at Maximum Frequency [dB/m (dB/ft)]	0.68 (0.21)	0.84 (0.26)	0.63 (0.19)
	Typical Phase Stability (degree)	+/- 8.0	+/- 6.0	+/- 15.0
	Typical Amplitude Stability (dB)	‹+/- 0.05		
	Dielectric Constant (Nominal)	1.4		
	Velocity of Propagation (Nominal) (%)	85		
	Shielding Effectiveness (dB through 18GHz)	› 100		
	Time Delay (Nominal) [ns/cm (ns/in)]	0.04 (0.103)		
Mech/Env Properties	Center Conductor	Solid	Stranded	Solid
	Overall Diameter [mm (in)]	7.4 (0.290)	7.4 (0.290)	8.1 (0.320)
	Nominal Weight [g/m (oz/ft)]	131.2 (40)	131.2 (40)	144.4 (44)
	Minimum Bend Radius [mm (in)]	38.1 (1.5)	38.1 (1.5)	50.8 (2.0)
	Temperature Range (°C)	-55 to 125		

[5] The electrical specifications in this table are based on a 0.9 m (36 in) assembly length and maximum frequency with straight connectors.

Table 6: Connector Options for High Power/Low Loss Assemblies

		Gore Cable Type		
		G6	G3	8W
Connector Type	Max. Freq. (GHz)[6]	18	18	18
SMA Male	18	R01	R01	R01
SMA Male (High Power)	18	ZN1		ZN1
SMA Box Right-Angle Male	18	R71	R71	R71
SMA Box Right-Angle Male (High Power)	18	ZSK		
SMA Female	18	R02	R02	R02
SMA Bulkhead Female	18	R42	R42	R42
Precision N Male	18	Q01	Q01	Q01
TNC Male	12.4	T01	T01	T01
TNCA Male	18	C01	C01	C01
TNCA Box Right-Angle Male	18	C71		C71
TNCA Female	18	C02	C02	C02
Type N Male	18	N01	N01	N01

[6] The maximum operating frequency of a test assembly is determined as the lowest frequency of either the connectors or the cable.

Ordering Information

GORE® Microwave/RF Assemblies are identified by a 12-character part number that designates the cable type, connector types, and assembly length (Table 7):

1 2	3 4 5	6 7 8	9 10 11	12	13
Cable Type	Connector A	Connector B	Assembly Length		-T/V

Positions 1–2: The two-character identifier of the cable

Positions 3–5 and 6–8: Connector codes A and B in alphanumeric order

Positions 9–12: The length of the assembly expressed in inches to the nearest tenth, including zeroes to fill positions if the length is less than three digits

Position 13: Identifier included only for an assembly that has been prepared for thermal vacuum chamber use.

Example part number (positions 1–12): 4LS01S01010

Example part number (positions 1–13): 4LS01S010120-T/V

The **GORE™ Microwave/RF Assembly Builder** is a step-by-step tool that allows you to configure and request a quote for a test assembly with different connector options, assembly lengths, and frequencies. For more information, visit **www.gore.com/rfcablebuilder.**

The **GORE™ Microwave/RF Assembly Calculator** is an online tool that calculates and compares the insertion loss, VSWR, and other parameters for various cable types. For more information, visit **tools.gore.com/gmcacalc.**

Table 7: Part Configuration for Ordering

			Ordering Identifier (Part Number Positions)			
Assembly Type	**Frequency**	**Center Conductor**	**Cable Type (Pos 1-2)**	**Connectors (Pos 3-5 and 6-8)**	**Lengths[7] (Pos 9-12)**	**Thermal Vacuum Identifier (Pos 13)**
High-Density Interconnects (Table 1)	18	Solid	**4L**	See Table 2	**012.0** 12 in (0.30 m)	- T/V
	18	Solid	**53**			- T/V
	18	Stranded	**G1**			- T/V
	18	Solid	**G4**			- T/V
	40	Solid	**54**		**024.0** 24 in (0.61 m)	- T/V
	40	Solid	**89**			- T/V
	67	Solid	**55**			- T/V
Wafer Probe and Multi-Purpose Assemblies (Table 3)	18	Solid	**G5**	See Table 4	**036.0** 36 in (0.91 m)	- T/V
	18	Stranded	**G2**			- T/V
	26.5	Solid	**G9**			- T/V
	26.5	Stranded	**G7**		**048.0** 48 in (1.22 m)	- T/V
	40	Solid	**4Y**			- T/V
	40	Solid	**GD**			- T/V
	50	Solid	**2Z**		**060.0** 60 in (1.52 m	- T/V
	67	Solid	**4F**			- T/V
High Power/Low Loss Assemblies (Table 5)	18	Solid	**G6**	See Table 6		- T/V
	18	Stranded	**G3**			- T/V
	18	Solid	**8W**			- T/V

[7] Additional lengths available upon request

GORE® Microwave/RF Assemblies

RF Jumper Assemblies up to 18 GHz

RF Jumper Assemblies provide a reliable solution for microwave interconnect applications that do not require traceability (Table 8). These 50 Ohm cable assemblies do not have serial numbers, but are 100-percent electrically verified to 18 GHz. They use low-profile SMA pins on both ends for compatibility with most standard systems. The SMA pin connector mates with SMA, 3.5 mm, and 2.92 mm socket connectors. These low-profile connectors allow easy access to system components, making them ideal for systems with multiple assemblies and limited space.

Table 8: Ordering Information

Length (in)	0.145 diameter		0.195 diameter	
	Gore Part Number	Minimum Typical Insertion Loss (dB)	Gore Part Number	Minimum Typical Insertion Loss (dB)
6	145-006.0	0.41	195-006.0	0.33
12	145-012.0	0.66	195-012.0	0.49
18	145-018.0	0.91	195-018.0	0.65
24	145-024.0	1.16	195-024.0	0.81
36	145-036.0	1.67	195-036.0	1.13
48	145-048.0	2.17	195-048.0	1.45
60	145-060.0	2.68	195-060.0	1.78
72	145-072.0	3.18	195-072.0	2.10
96	145-096.0	4.18	195-096.0	2.74
120	145-120.0	5.20	195-120.0	3.39

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