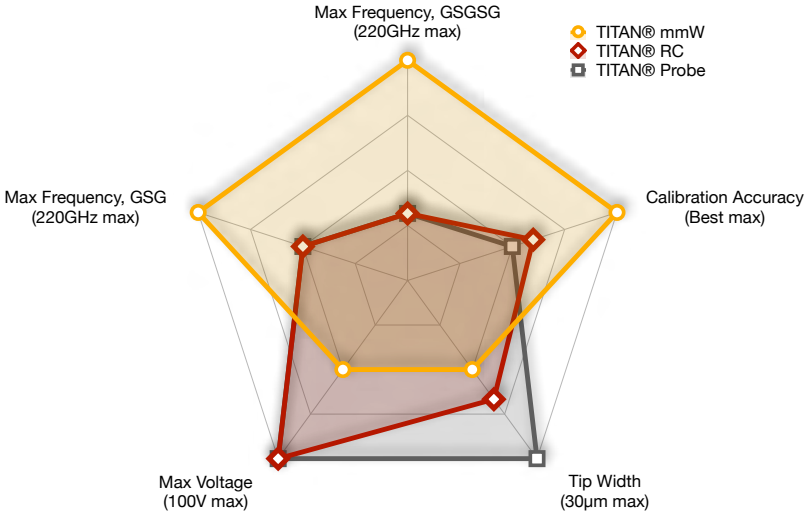
TITAN™ Probe Family for mmWave Applications

Features and Benefits

Elevate your device characterization and mmWave IC test to new heights with the mmWave TITAN™ Probe Line. Designed to guarantee the most consistent calibration and measurement data from DC up to 220 GHz, the mmWave probe family includes 67 GHz, 120 GHz, 145 GHz and 220 GHz probe models in both single-ended and dual probe configurations. Experience unparalleled accuracy of single-ended and differential device and circuit characterization across the broadest device, product and technology spectrum.



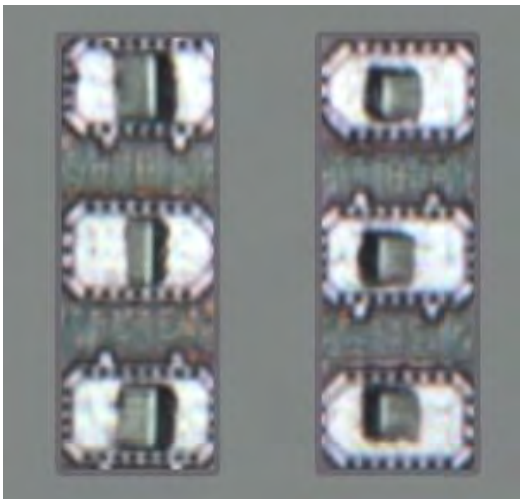
Comparison of the key technology features: TITAN™ mmWave Probes, TITAN™ RC Reduced Contact Probes and standard TITAN™ Probes

Trusted Design for Consistent Results

Drawing from the trusted, optimized and robust tip design of our TITAN™ T220 Probes, the mmWave TITAN™ Probe family ensures minimal parasitic probe-to-pad coupling. The results are consistent measurement data and model parameter correlation across the entire frequency range for each mmWave probe type. Since the entire mmWave probe family utilizes the same probe tip geometry and design, challenging and time-consuming experiments for correlating measurement data between frequency bands and probe models is eliminated.

Smallest Footprint for Next-Generation Devices

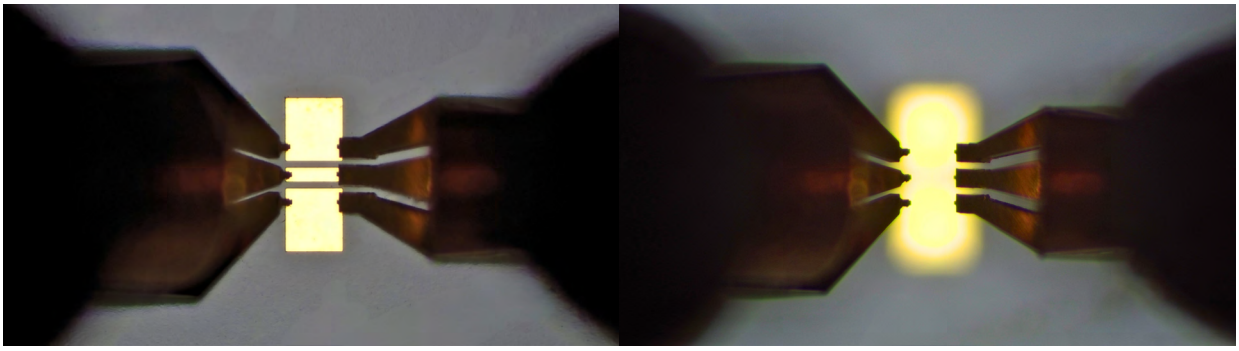
The mmWave TITAN™ Probes feature 15 µm wide tips with unparalleled tip visibility. Each ground and signal contact moves up and down independently, to conform to your pad heights and to ensure consistent probe-to-pad contact. The result is the shortest possible forward skate to enable automated device characterization of the next-generation RF and mmWave Si devices with the pads as small as 25 µm x 20 µm.



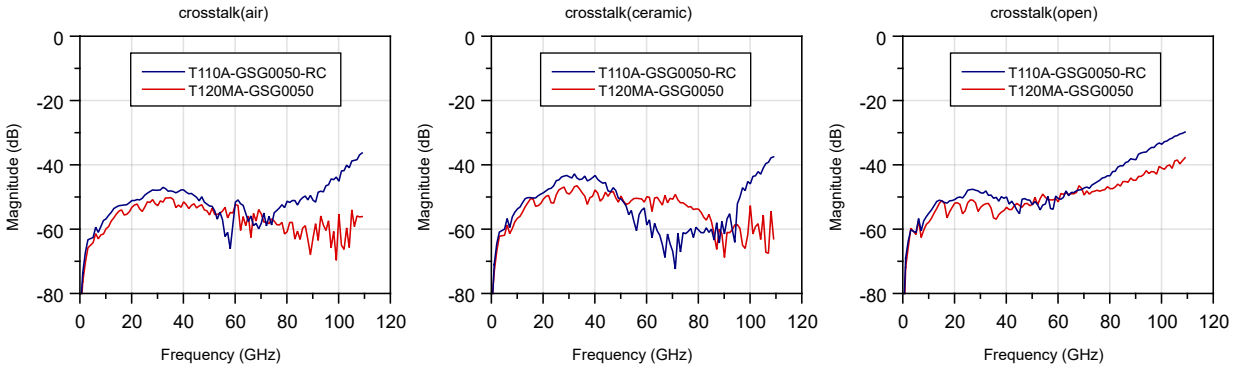
Probe tip scrub marks from a Reduced Contact TITAN™ T110A-GSG050-RC probe (20 µm width, left) and a mmWave T120MA-GSG050 probe (15 µm width, right) on 35x25 µm aluminum pads when operator used recommended value of vertical overtravel for aluminum pads.

Small Tip Aperture: Minimal Calibration Residual Errors

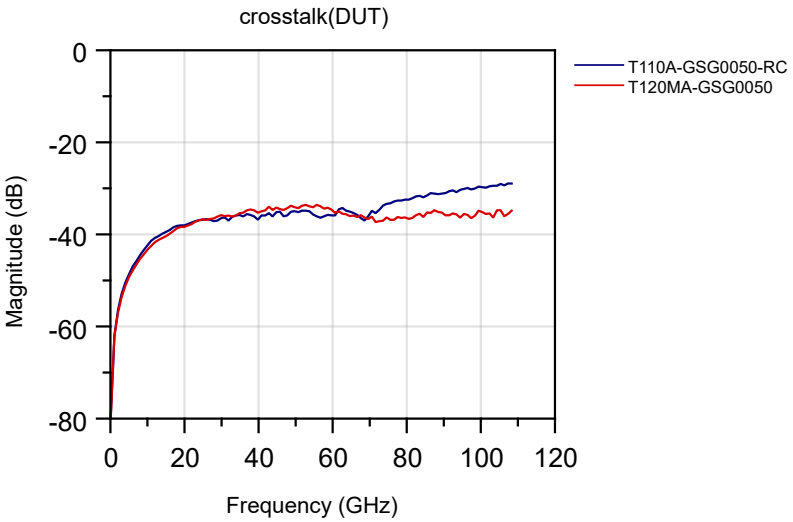
Due to the small aperture of the tips, mmWave TITAN™ Probe family offers unique combination of the tip visibility, tip compliance, lifetime and minimal coupling with the device pads. Probe-to-probe and probe-to-pad crosstalk is drastically minimized at mmWave band, yielding most accurate and repeatable calibration and reproducible device data, operator independent.



Two models of the same 100 µm pitch GSG probe tip configuration: Reduced Contact RC (left) and mmWave (right) TITAN™ Probe models in contact (left picture) and in separation (right picture), respectively.



Measured crosstalk (Open Calibration) for a Reduced Contact T110A-GSG050-RC probe and mmWave TITAN™ T120MA-GSG050 probe with the GSG tips lifted in the air, touching bare ceramic and touching an Open Standard on the TITAN™ TCS-050-100-W Calibration Substrate.



Minimal parasitic coupling: Crosstalk of the DUT open dummy de-embedding element, corrected with the respect to the NIST multiline TRL calibration on TCS-050-100-W substrate for T110A-GSG050-RC and T120MA-GSG050 probes, respectively.

Less Is More: Industry's Lowest Insertion Loss

Our single-ended mmWave models boast the industry's lowest insertion loss of the signal measurement path. When mounted directly on the 0.8 mm male VNA frequency extender ports-like that of the Anritsu VectorStar® 70 kHz - 145 GHz model ME7838D4 VNA - it offers the highest possible measurement dynamic range. The mmWave probe family is also compatible with various VNA systems and frequency bands, such as the 900 Hz - 120 GHz N5291A PNA from Keysight Technologies or R&S® ZVA110 from Rohde & Schwarz.

MPI - We are Ready for The Test™. Are you?

Probe Models

220 GHz probe model: T220MA

Typical Electrical Characteristics

Frequency range	DC to 220 GHz
Ground and signal alignment error	< +/- 3 µm
Insertion loss	< 5.5 dB
Return loss	> 8.5 dB
Contact resistance on Au	< 6 mΩ
Contact resistance on Al	< 45 mΩ
Temperature range*	-40 °C…+175 °C

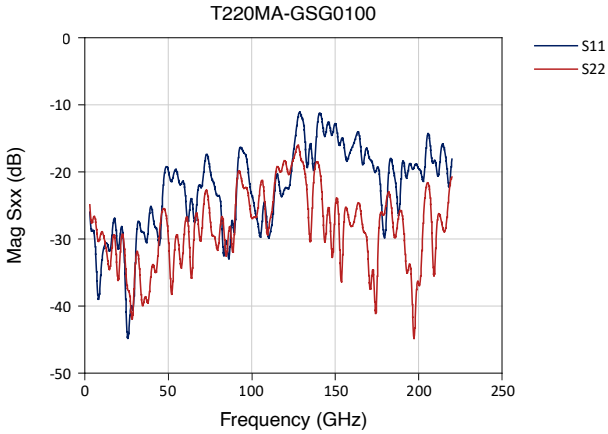
The probe tips of the TITAN™ T220MA and T220MS probes can withstand up to 175°C, however, please consult with Anritsu for the safe operating temperature of the Anritsu 220 GHz frequency extenders to avoid damaging the Anritsu frequency extenders.

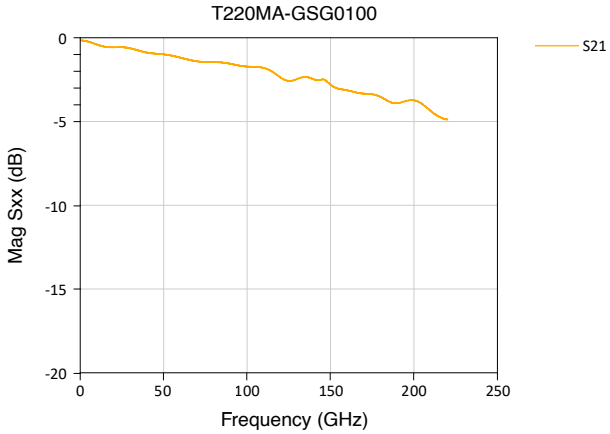
T220MA probe

Mechanical Characteristics

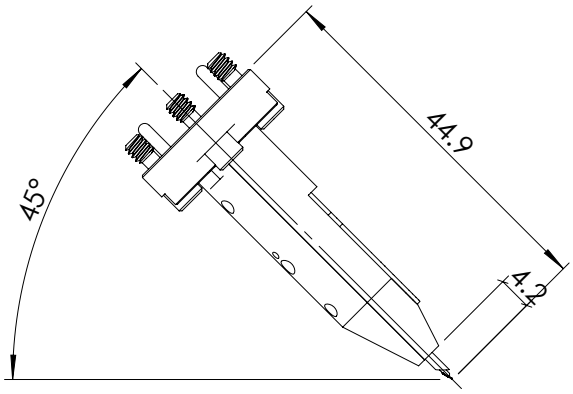
Connector	0.6 mm broadband interface, male
Tip material	Ni Alloy
Tip width	15 µm
Pitch range	50, 75, 100, 125 and 150 µm
Tip configuration	GSG

Typical Electrical Characteristics





Body Dimensions



Unit: mm

165 GHz probe model: T165MLL - Recommended for Load-Pull Applications

Typical Electrical Characteristics

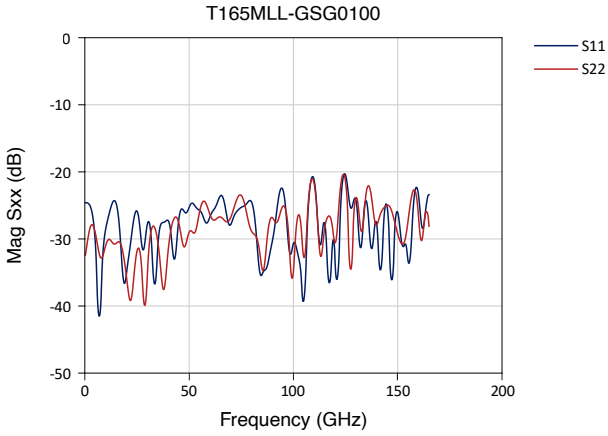
Characteristic Impedance	50 Ω
Frequency range	DC to 165 GHz
Insertion loss	< 2.2 dB
Return loss	> 12 dB
DC Current	< 1 A
DC Voltage	< 50 V
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 45 mΩ
Temperature range	-40 °C…+175 °C

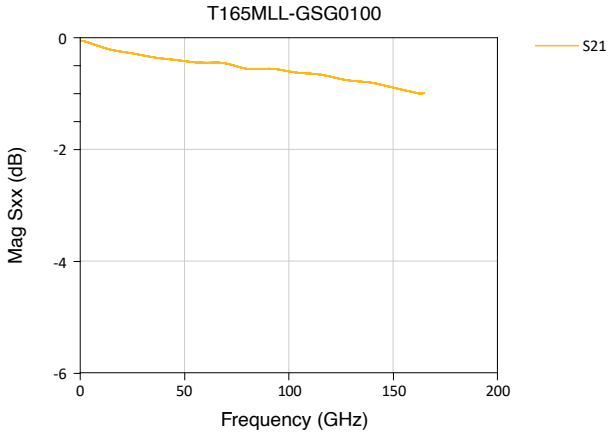
T165MLL probe, A-Style of the connector

Mechanical Characteristics

Connector	0.8 mm, female
Tip material	Ni Alloy
Tip width	15 µm
Pitch range	50, 75, 100, 125, 150, 175 and 200 µm
Tip configuration	GSG
Connectors style	45-degree, straight

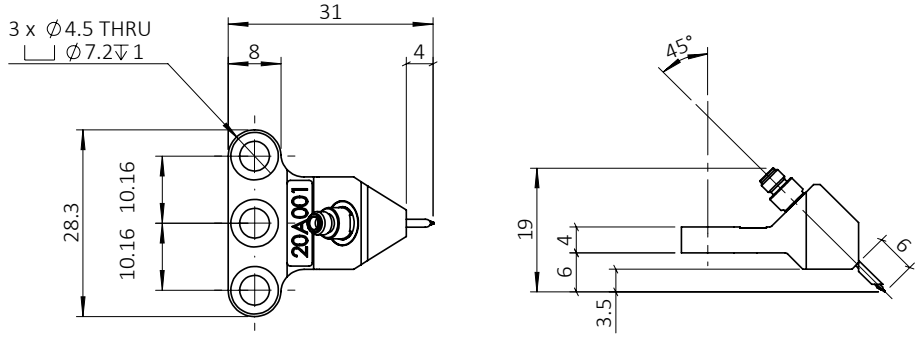
Typical Electrical Characteristics: 165 GHz GSG probe, 100 micron pitch





Body Dimensions

T165MLL probe models



Unit: mm

165 GHz probe model: T165MA

Typical Electrical Characteristics

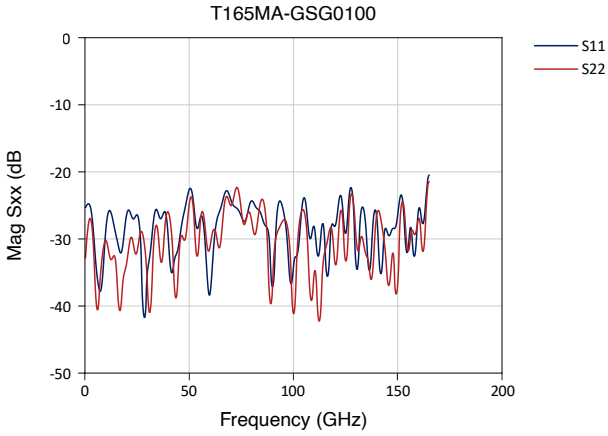
Characteristic Impedance	50 Ω
Frequency range	DC to 165 GHz
Insertion loss	< 2.5 dB
Return loss	> 12 dB
DC Current	< 1 A
DC Voltage	< 50 V
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 45 mΩ
Temperature range	-40 °C…+175 °C

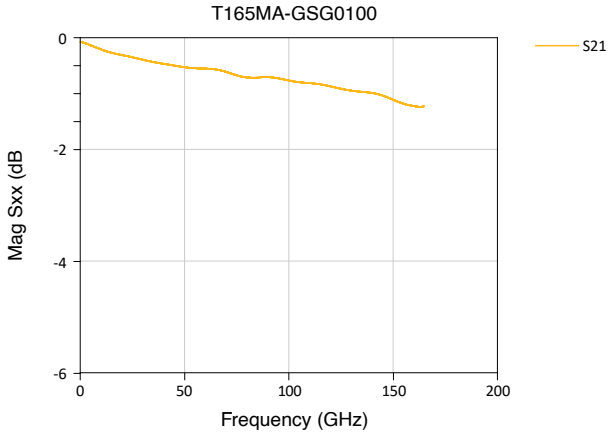
T165MA probe, A-Style of the connector

Mechanical Characteristics

Connector	0.8 mm, female
Tip material	Ni Alloy
Tip width	15 µm
Pitch range	50, 75, 100, 125, 150, 175 and 200 µm
Tip configuration	GSG
Connectors style	45-degree, straight

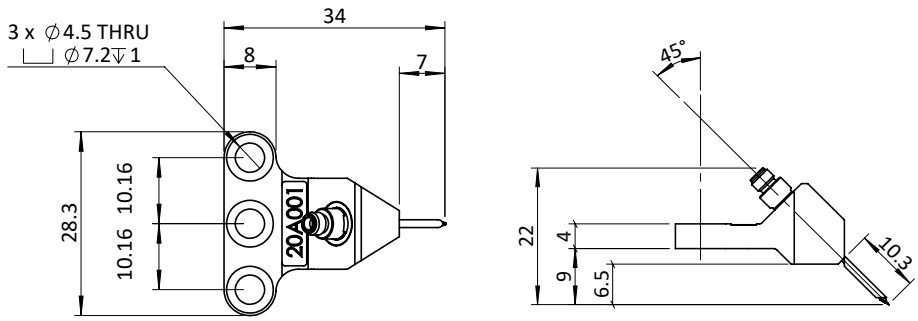
Typical Electrical Characteristics: 165 GHz GSG probe, 100 micron pitch





Body Dimensions

T165MA probe models



Unit: mm

145 GHz probe model: T145MA

Typical Electrical Characteristics

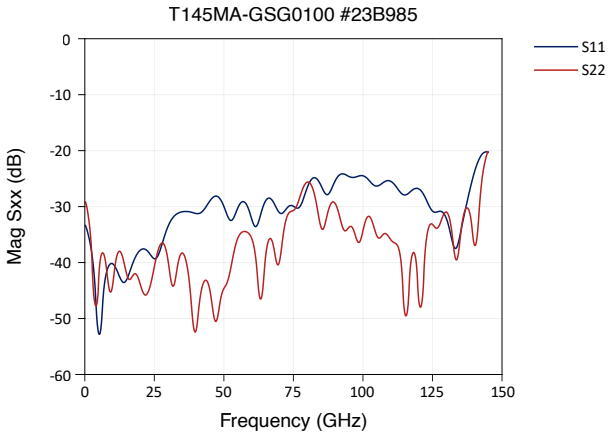
Characteristic Impedance	50 Ω
Frequency range	DC to 145 GHz
Insertion loss	< 2.3 dB
Return loss	> 15 dB
DC Current	< 1 A
DC Voltage	< 50 V
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 45 mΩ
Temperature range	-40 °C…+175 °C

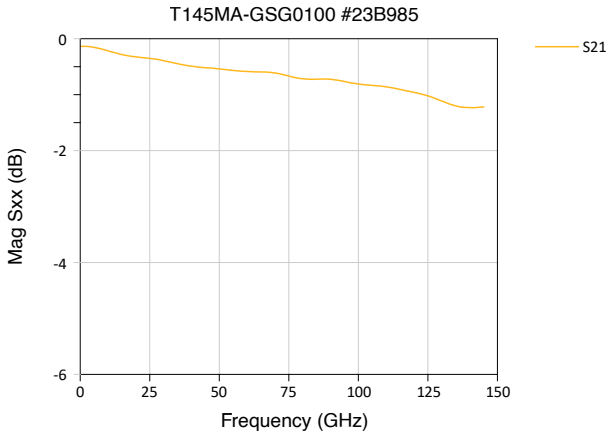
T145MA probe, A-Style of the connector

Mechanical Characteristics

Connector	0.8 mm, female
Tip material	Ni Alloy
Tip width	15 µm
Pitch range	50, 75, 100, 125, 150, 175 and 200 µm
Tip configuration	GSG
Connectors style	45-degree, straight

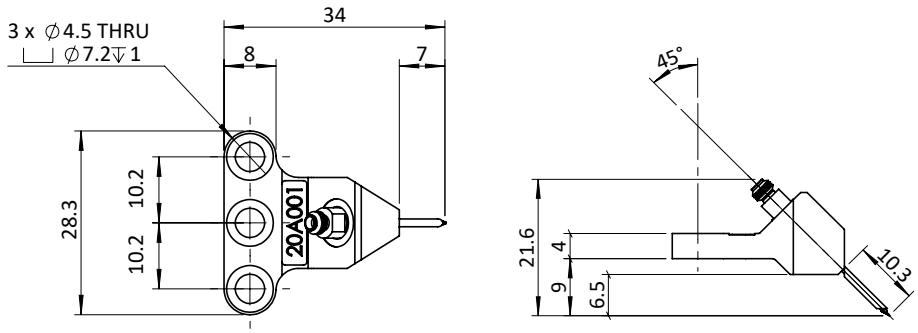
Typical Electrical Characteristics: 145 GHz GSG probe, 100 micron pitch





Body Dimensions

T145MA probe models



Unit: mm

120 GHz probe model: T120MA

Typical Electrical Characteristics

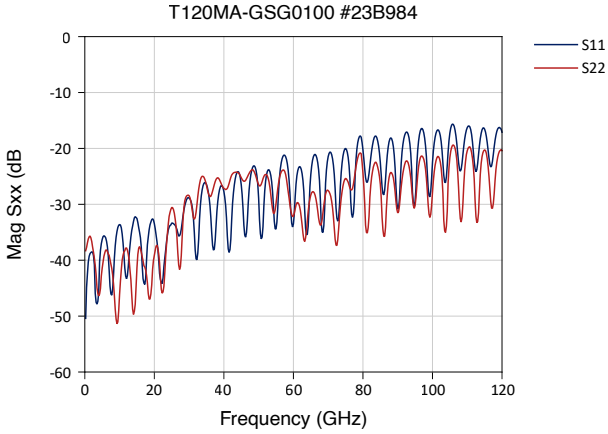
Characteristic Impedance	50 Ω
Frequency range	DC to 120 GHz
Insertion loss	< 2 dB
Return loss	> 10 dB
DC Current	< 1 A
DC Voltage	< 50 V
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 45 mΩ
Temperature range	-40 °C…+175 °C

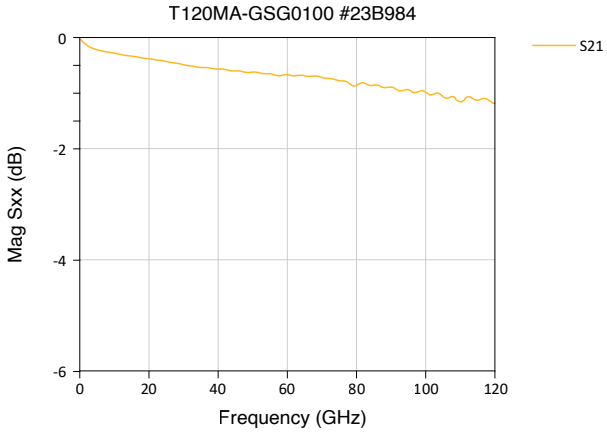
T120MA probe, A-Style of the connector

Mechanical Characteristics

Connector	1.0 mm, female
Tip material	Ni Alloy
Tip width	15 µm
Pitch range	50, 75, 100, 125, 150, 175 and 200 µm
Tip configuration	GSG
Connectors style	45-degree, straight

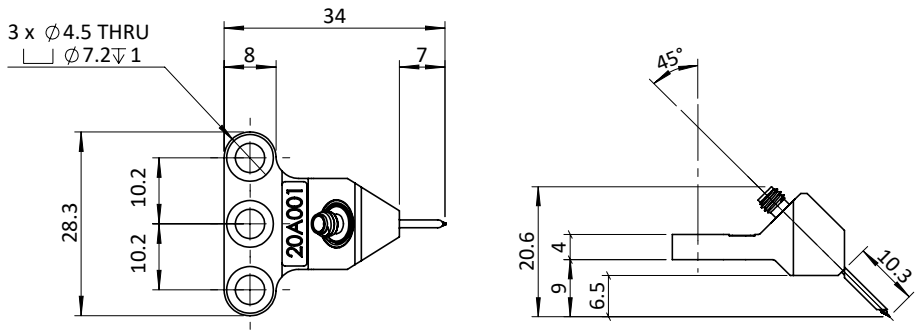
Typical Electrical Characteristics: 120 GHz GSG probe, 100 micron pitch





Body Dimensions

T120MA probe models



Unit: mm

67 GHz probe model: T67MA

Typical Electrical Characteristics

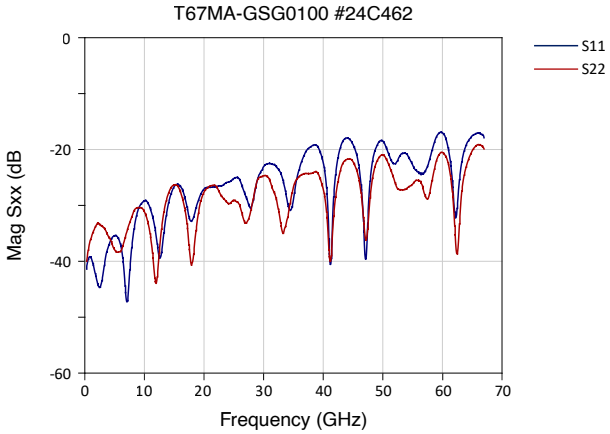
Characteristic Impedance	50 Ω
Frequency range	DC to 67 GHz
Insertion loss	< 1.2 dB
Return loss	> 10 dB
DC Current	< 1 A
DC Voltage	< 50 V
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 45 mΩ
Temperature range	-40 °C…+175 °C

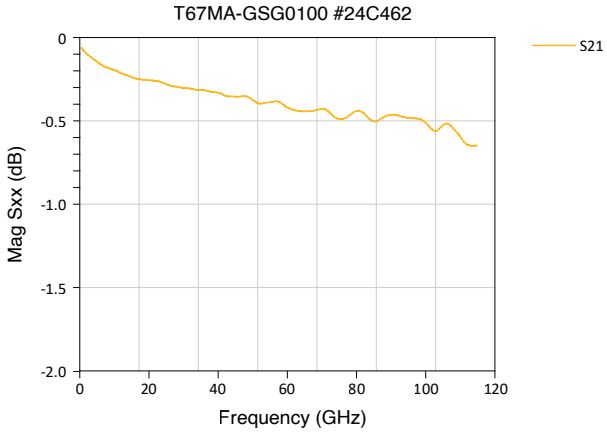
T67MA probe, A-Style of the connector

Mechanical Characteristics

Connector	1.85 mm, female
Tip material	Ni Alloy
Tip width	15 µm
Pitch range	50, 75, 100, 125, 150, 175 and 200 µm
Tip configuration	GSG
Connectors style	45-degree, straight

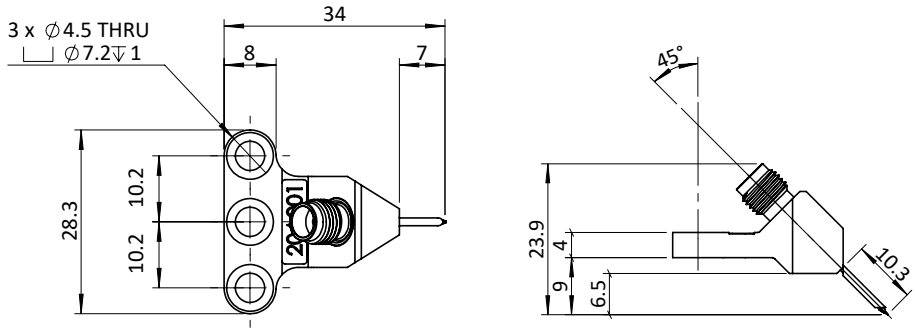
Typical Electrical Characteristics: 67 GHz GSG probe, 100 micron pitch





Body Dimensions

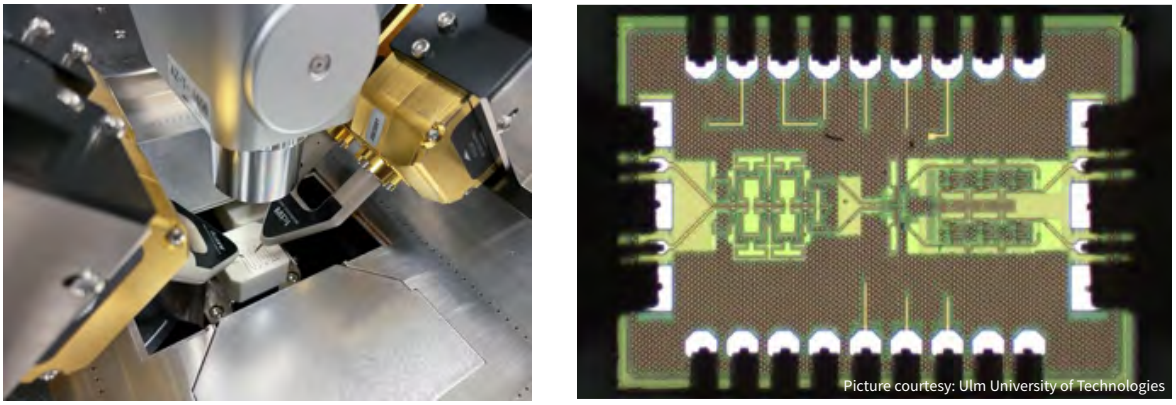
T67MA probe models



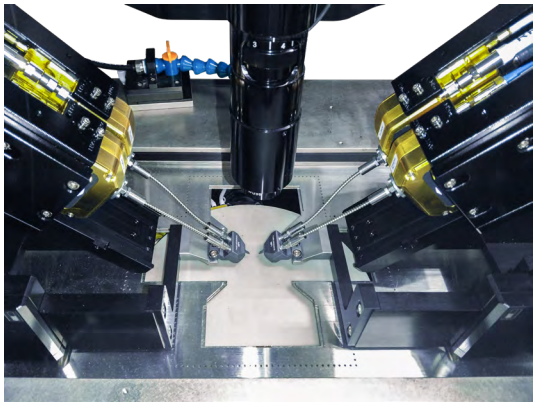
Unit: mm

mmW Dual TITAN™ Probes

The mmWave TITAN™ Probe family excels at broadband applications, handling frequencies up to 220 GHz. This range makes them ideal for applications requiring ultra-high frequency measurements, such as advanced defense systems and ultra-low patency high-speed data transmission. The mmWave Probes family ensures measurement accuracy and data correlation across an unmatched frequency band with 67 GHz, 120 GHz, 145 GHz and 220 GHz, GSGSG dual probe models, reaffirming our commitment to innovation and quality.



Two mmWave Dual TITAN™ T220MS-GSGSG0100 probes (left) and two T220MS-GSGSG0100 dual probes (right) with two 9-contact TITAN™ 100 µm pitch DC Multi Contact Probes used for the characterization of a broadband differential driver.



mmWave Dual TITAN™ T145MS-GSGSG0100 probes configured on the Anritsu VectorStar 145 GHz broadband VNA and MPI TS200-THZ probe system.

220 GHz probe model: T220MS

Typical Electrical Characteristics

Characteristic Impedance	50 Ω
Frequency range	DC to 220 GHz
Insertion loss	< 7 dB
Return loss (at the tips)	> 8 dB
DC Current	< 1 A
DC Voltage	< 50 V
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 45 mΩ
Temperature range*	-40 °C…+175 °C

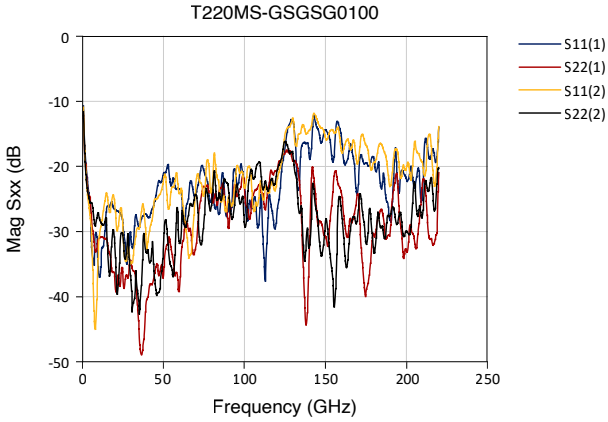
**The probe tips of the TITAN™ T220MA and T220MS probes can withstand up to 175°C, however, please consult with Anritsu for the safe operating temperature of the Anritsu 220 GHz frequency extenders to avoid damaging the Anritsu frequency extenders.*

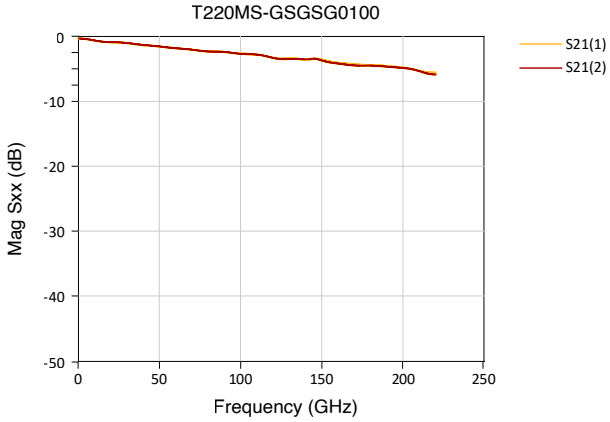
T220MS-GSGSG050 probe

Mechanical Characteristics

Interface	0.6 mm broadband interface, male (two)
Instrumentation integration	Direct mount to Anritsu ME7838G4 70 kHz–220 GHz differential broadband VNA
Tip material	Ni Alloy
Tip width	15 µm
Pitch range	50 to 125 µm with 25 µm step
Tip configuration	GSGSG
Connectors style	Straight, direct mount

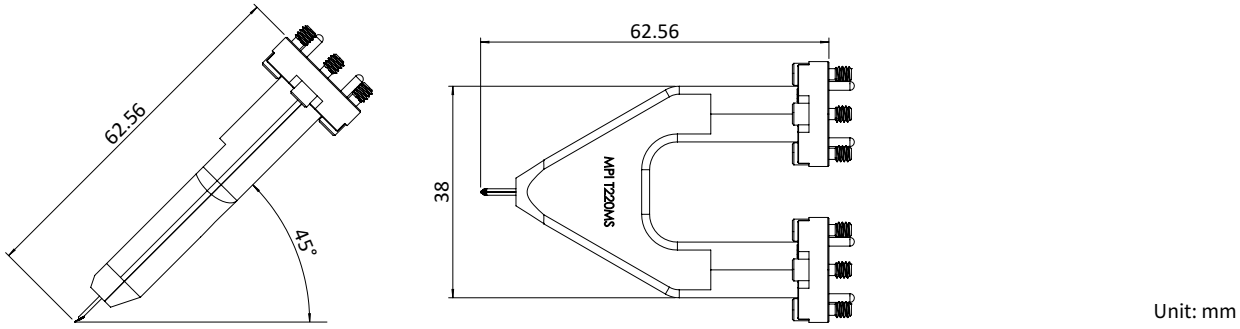
Typical Electric Characteristics: 220 GHz GSGSG probe, 100 micron pitch





Body Dimensions

T220MS probe model



Unit: mm

165 GHz probe model: T165MS

Typical Electrical Characteristics

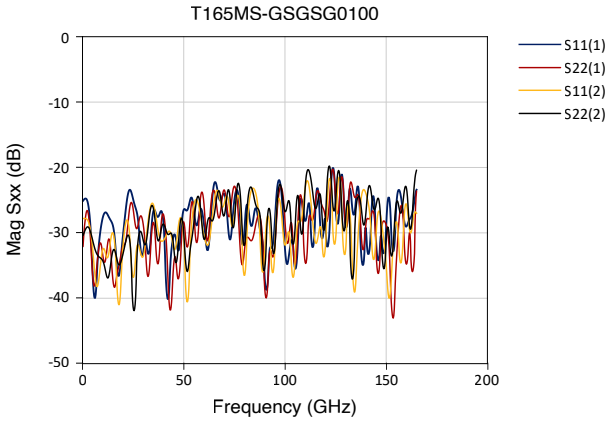
Characteristic Impedance	50 Ω
Frequency range	DC to 165 GHz
Insertion loss	< 3 dB
Return loss	> 12 dB
DC Current	< 1 A
DC Voltage	< 50 V
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 45 mΩ
Temperature range	-40 °C…+175 °C

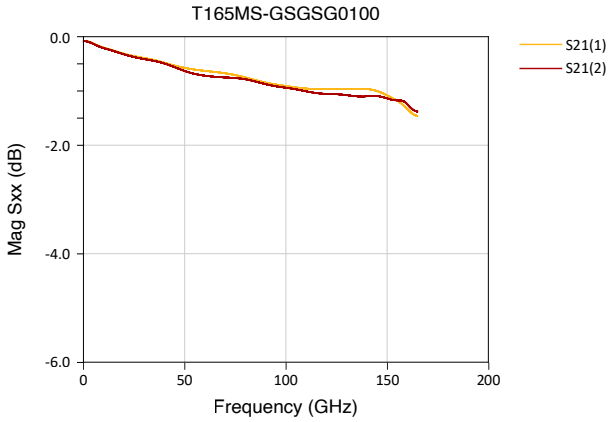
T165MS probe, S-Style of the connector

Mechanical Characteristics

Connector	0.8 mm, female
Tip material	Ni Alloy
Tip width	15 µm
Pitch range	50, 75, 100, 125 and 150 µm
Tip configuration	GSGSG
Connectors style	45-degree, straight

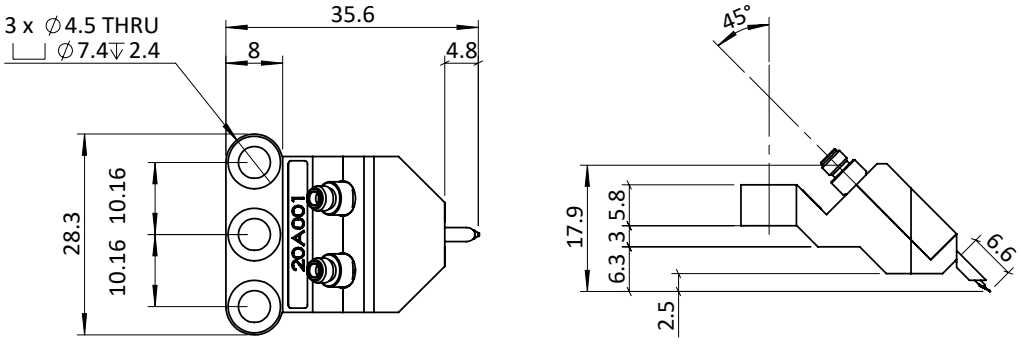
Typical Electric Characteristics: 165 GHz GSGSG probe, 100 micron pitch





Body Dimensions

T165MS probe models



Unit: mm

145 GHz probe model: T145MS

Typical Electrical Characteristics

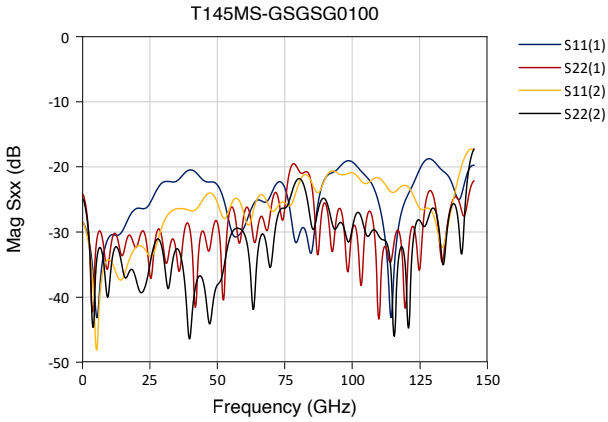
Characteristic Impedance	50 Ω
Frequency range	DC to 145 GHz
Insertion loss	< 2.8 dB
Return loss	> 15 dB
DC Current	< 1 A
DC Voltage	< 50 V
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 45 mΩ
Temperature range	-40 °C…+175 °C

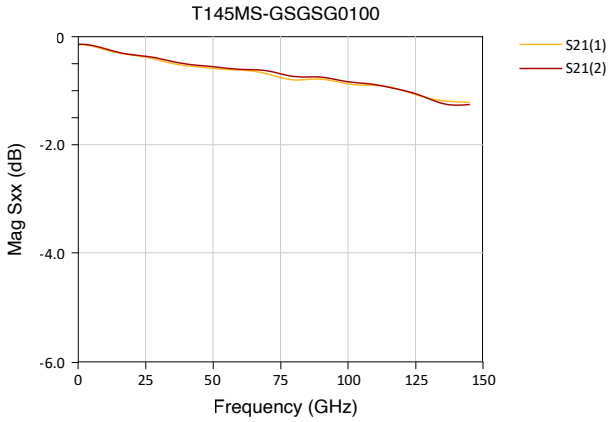
T145MS probe, S-Style of the connector

Mechanical Characteristics

Connector	0.8 mm, female
Tip material	Ni Alloy
Tip width	15 µm
Pitch range	50, 75, 100, 125 and 150 µm
Tip configuration	GSGSG
Connectors style	45-degree, straight

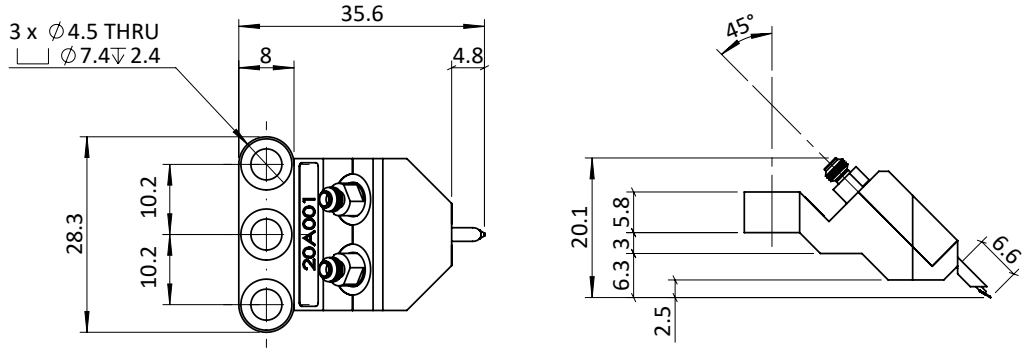
Typical Electric Characteristics: 145 GHz GSGSG probe, 100 micron pitch





Body Dimensions

T145MS probe models



Unit: mm

120 GHz probe model: T120MS

Typical Electrical Characteristics

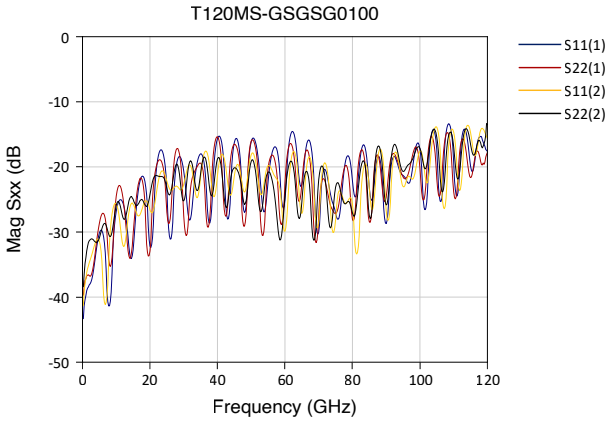
Characteristic Impedance	50 Ω
Frequency range	DC to 120 GHz
Insertion loss	< 2.5 dB
Return loss	> 10 dB
DC Current	< 1 A
DC Voltage	< 50 V
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 45 mΩ
Temperature range	-40 °C…+175 °C

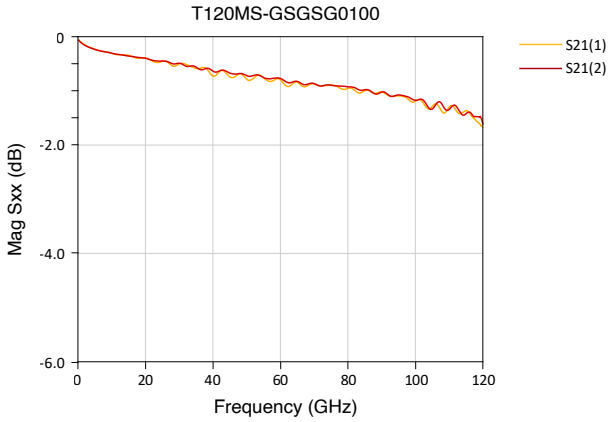
T120MS probe, S-Style of the connector

Mechanical Characteristics

Connector	1.0 mm, female
Tip material	Ni Alloy
Tip width	15 µm
Pitch range	50, 75, 100, 125, 150, 175 and 200 µm
Tip configuration	GSGSG
Connectors style	45-degree, straight

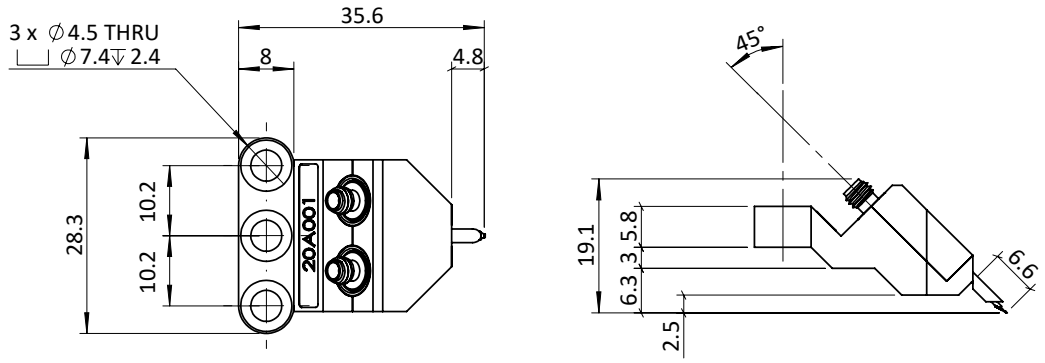
Typical Electric Characteristics: 120 GHz GSGSG probe, 100 micron pitch





Body Dimensions

T120MS probe models



Unit: mm

67 GHz probe model: T67MS

Typical Electrical Characteristics

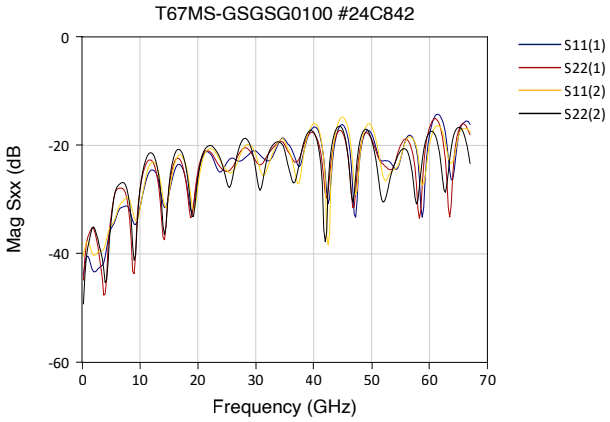
Characteristic Impedance	50 Ω
Frequency range	DC to 67 GHz
Insertion loss	< 1.5 dB
Return loss	> 10 dB
DC Current	< 1 A
DC Voltage	< 50 V
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 45 mΩ
Temperature range	-40 °C…+175 °C

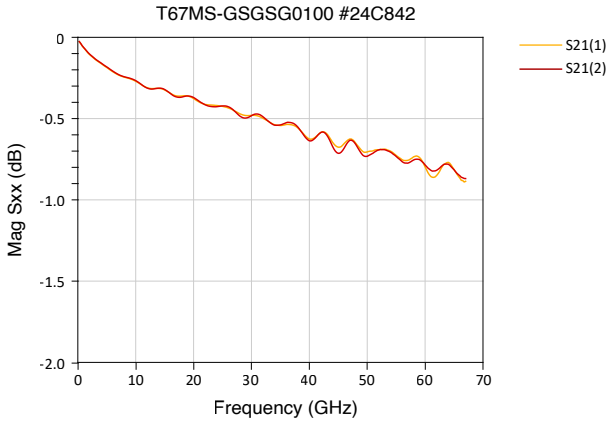
T67MS probe, S-Style of the connector

Mechanical Characteristics

Connector	1.85 mm, female
Tip material	Ni Alloy
Tip width	15 µm
Pitch range	50, 75, 100, 125, 150, 175 and 200 µm
Tip configuration	GSGSG
Connectors style	45-degree, straight

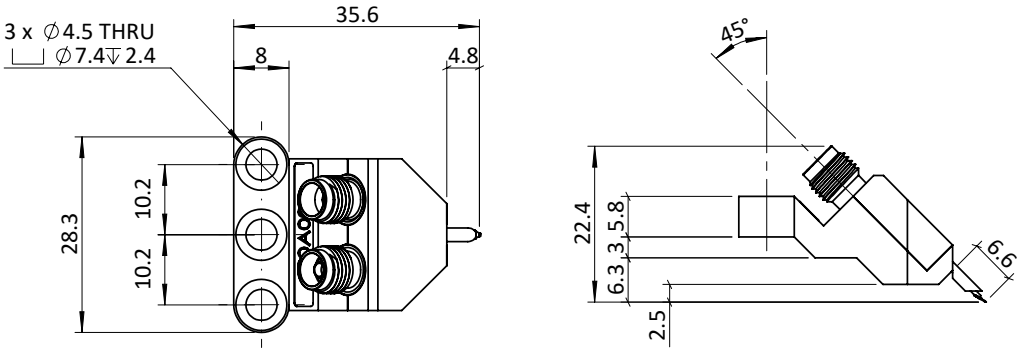
Typical Electric Characteristics: 67 GHz GSGSG probe, 100 micron pitch





Body Dimensions

T67MS probe models

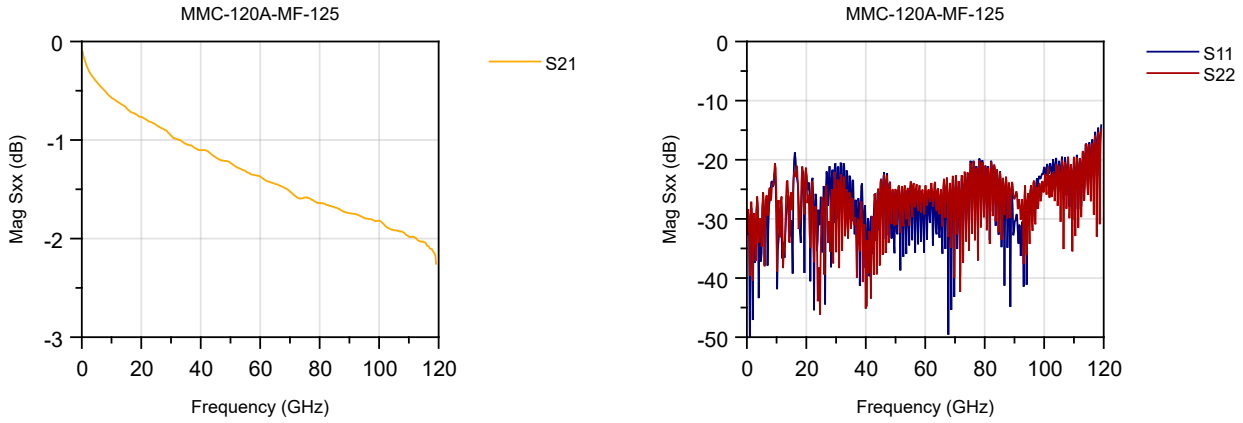


Unit: mm

MPI Accessories

MPI offers precision RF cables tailored for the optimal integration of your TITAN™ RF probes with various test instrumentation setups on MPI probe system platforms and for the best system performance.

	T67MA and T67MS Probes
MMC-67V-MF-800	- Precision flex cable assembly - DC to 67 GHz - V (1.85 mm) male - V (1.85 mm) female connectors - 80 cm long - Recommended for the best measurement dynamic range when VNA is located on the MPI's system instrument shelf behind the scope bridge
MMC-67V-MF-1200	- Precision flex cable assembly - DC to 67 GHz - V (1.85 mm) male - V (1.85 mm) female connectors - 120 cm long
	T120MA and T120MS Probes
MMC-120A-MF-125	- Precision flex cable assembly - DC to 120 GHz - A (1.0 mm) male - A (1.0 mm) female connectors - 12.5 cm long - For use on TS150-THZ System in broadband 120 GHz as well as banded WR15, WR12 and WR10 configurations
MMC-120A-MF-250	- Precision flex cable assembly - DC to 120 GHz - A (1.0 mm) male - A (1.0 mm) female connectors - 25 cm long - Recommended for use on other MPI systems, including the Shiel-DEnvironment™ (SE) models & differential system configurations
	T145MA and T145MS Probes
MMC-145M-MF-150	- Precision flex cable assembly - DC to 145 GHz - M (0.8mm) male - M (0.8mm) female connectors - 15 cm long - Recommended for differential configurations of Anritsu's broad-band 145 GHz VectorStar network analyzer on MPI systems
MMC-145M-120A-MF-150	- Precision flex cable assembly - DC to 120 GHz - M (0.8mm) male - A (1.0mm) female connectors - 15 cm long - Recommended for use with TITAN® T145MA and T145MS mmWave Probes with broadband 110 GHz / 120 GHz VNA systems
MMC-145M-130A-MFKS-150	- Precision flex cable assembly - DC to 130 GHz - M (0.8mm) male - A (1.0mm) female connectors - 15 cm long - Special secure 1.0 mm female connector mount for Keysight N5295AX03 frequency extenders of the PNA-X N5291A system - Recommended for use with TITAN® T145MA and T145MS mmWave probes with Keysight PNA-X N5291A system

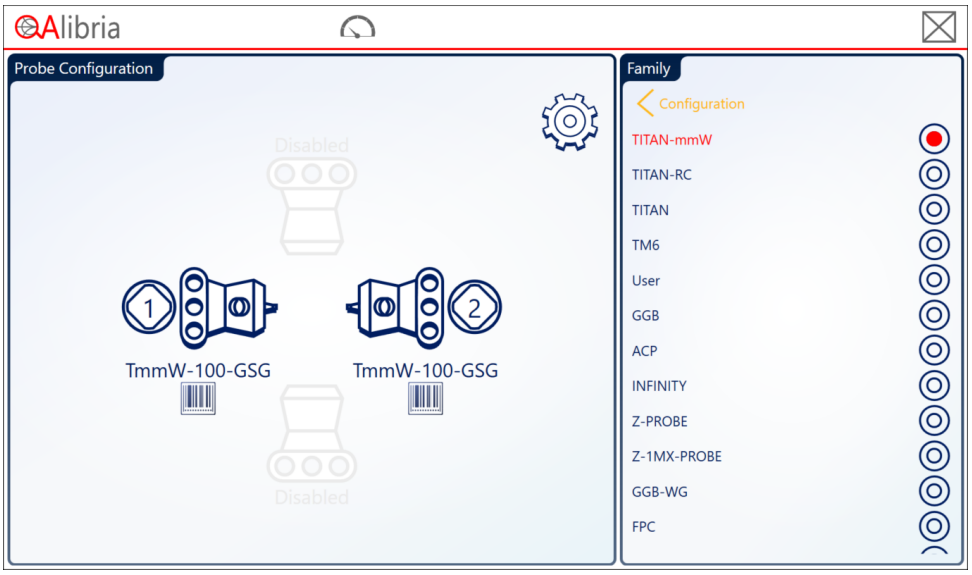


Magnitude of S21 (left) and S11, S22 (right) S-parameters of the MMC-120A-MF-125 cable, respectively.

QAlibria® and Calibration

The MPI RF Calibration suite, QAlibria®, is engineered to streamline the inherently complex and time-intensive RF system calibration process. It offers a highly efficient, repeatable, and accurate approach to achieving optimal calibration results.

QAlibria® features an open architecture that integrates a comprehensive database of calibration substrates and probes, including the necessary definitions for calibration standards and probe correction coefficients. Now, QAlibria® supports the TITAN™ mmWave Probe Family, allowing users to easily select the “TITAN-mmWave” group and corresponding probe pitch from a predefined list. This selection automatically configures all necessary calibration standard definitions and probe-specific electrical parameters, ensuring precise calibration with minimal user intervention.



Example of QAlibria® user interface for the TITAN™ mmWave Probe with 100 µm pitch and GSG tips selected for system calibration.

Correction Coefficients

mmWave GSG

Calibration Substrate	Pitch	C-Open fF	L-Short pH	L-Term pH	Delay (offset) ps	Z0 (offset) Ω
TCS-050-100-W	50	4.8	12	5.2	0.011	500
	75	5	12	6	0.012	500
	90	5.2	12	7.5	0.015	500
	100	5.50	12.0	8.0	0.016	500

Calibration Substrate	Pitch	C-Open fF	L-Short pH	L-Term pH	Delay (offset) ps	Z0 (offset) Ω
AC2-2	125	7.0	5.0	-10.0	-0.020	500

mmWave GSGSG

Calibration Substrate	Pitch	C-Open fF	L-Short pH	L-Term pH	Delay (offset) ps	Z0 (offset) Ω
TCS-GSGSG-0050-0050	50	5.8	26	20	0.040	500
TCS-GSGSG-0075-0075	75	5	26.5	17	0.034	500
TCS-GSGSG-0100-0100	100	6.0	36.0	20.0	0.040	500
TCS-GSGSG-0100-0125	125	7.0	39.0	26.0	0.053	500

Direct contact:
Asia region: ast-asia@mpi-corporation.com
EMEA region: ast-europe@mpi-corporation.com
America region: ast-americas@mpi-corporation.com

MPI global presence: for your local support, please find the right contact here:
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