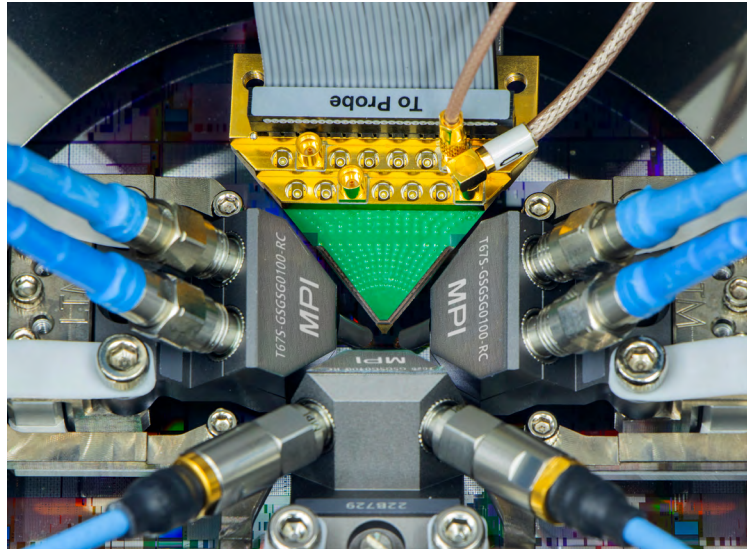


# Dual TITAN™ Probes



## Introduction to Dual TITAN™ Probes

Introducing the Dual TITAN™ Probes from MPI Corporation – a groundbreaking innovation in precision measurement technology. These probes are a testament to our commitment to excellence, merging the renowned features of our single-ended probes with advanced dual probe capabilities. Designed for a range of applications from wireless to mmWave technologies, the Dual TITAN™ Probes set a new standard in measurement accuracy, reliability, and versatility, making them indispensable in modern testing and characterization.

## Requirements for Dual Probes

In today's rapidly evolving technology landscape, the need for dual probes is more pronounced than ever. Dual probes offer enhanced measurement capabilities, crucial for accurately characterizing complex multiport and differential devices. They provide simultaneous measurements of different parameters or locations, increasing efficiency and accuracy. Especially in high-frequency applications, dual probes are vital for ensuring precise data collection and analysis, addressing the challenges of modern electronics testing.

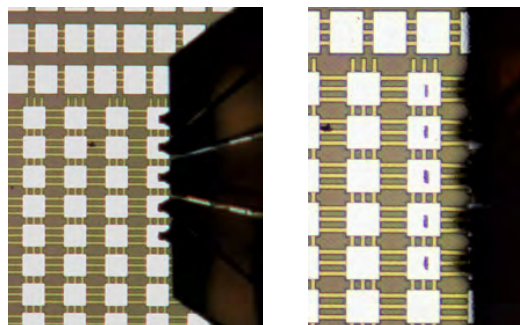
## Enhanced Tip Visibility

In the precision-driven world of RF engineering, the effectiveness of measurement tools is paramount. The Dual TITAN™ Probes are designed with this in mind, offering advanced features that cater specifically to the needs of RF professionals.

**Optimized Tip Visibility for Precise Measurements:** Our Dual TITAN™ Probes feature a unique protrusion tip design, a critical innovation for RF testing and characterization. This design enhances tip visibility, allowing for precise and confident positioning on calibration standards or DUT pads, uneven and rough metallization. It's especially beneficial when working with densely packed test points or small geometries, common in RF applications and Signal Integrity and Printed Board testing, ensuring accurate contact and measurement.

## Unique tip visibility and minimal footprint

Dual TITAN™ Probe T67S-GSGSG0100 contacting Aluminum pads on a Silicon chip. Scrub marks made by tips are approximately 10x30  $\mu\text{m}$  in size after using 20-30  $\mu\text{m}$  of vertical overtravel.



## Advanced Features for RF Applications

### • Unparalleled Calibration Accuracy

Each probe is equipped with 50 Ω MEMS contact tips, perfectly matched to minimize reflection and insertion loss. This precision is vital for accurate S-parameter measurements, ensuring reliable characterization across a wide frequency range, from DC to mmWave frequencies.

### • Robust Design for Extended Use

Recognizing the intense demands of RF testing, the Dual TITAN™ Probes are built for durability. Their uniform wear-out mechanism allows for prolonged use without compromising electrical performance. This extended lifespan, coupled with competitive pricing, provides a cost-effective solution for continuous, high-frequency use.

### • Versatility Across RF Spectrum

Engineered for adaptability, the Dual TITAN™ Probes excel in various RF applications. Whether it's characterizing high-speed digital circuits, performing complex multiport network analyses, or testing advanced wireless and mm-Wave devices, these probes deliver consistent and dependable performance.

## WIRELESS APPLICATIONS, SIGNAL INTEGRITY MEASUREMENTS & BOARD LEVEL TESTING

The Dual TITAN™ Probes, with configurations up to 26 GHz, are ideally suited for commercial wireless applications, signal integrity measurements and board level testing. They offer unmatched precision in characterizing multiport and differential front-ends, integrated circuits, and components. With superior calibration and measurement results, unique contact structure, and exceptional lifespan, these probes ensure high fidelity in signal integrity, making them essential in the development of emerging wireless technologies.

### 26 GHz probe model: T26D

#### Typical Electrical Characteristics

Characteristic Impedance	50 Ω
Frequency range	DC to 26 GHz
Insertion loss (GSGSG configuration)	< 0.5 dB
Return loss (GSGSG configuration)	> 16 dB
Port Crosstalk	< -32 dB
DC Current	< 1 A
DC Voltage	< 100 V
RF power @ 10 GHz	<= 5 W
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 35 mΩ
Temperature range	-40 °C...+175 °C

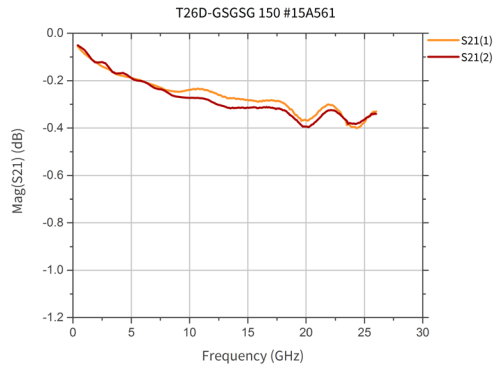
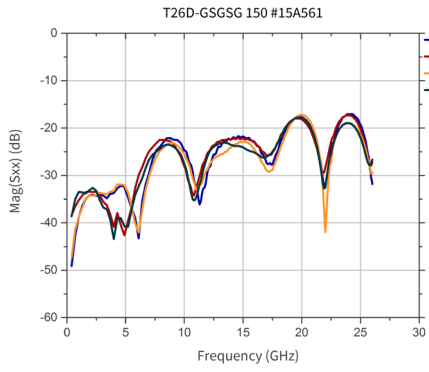


T26D-GSSG0100 Probe

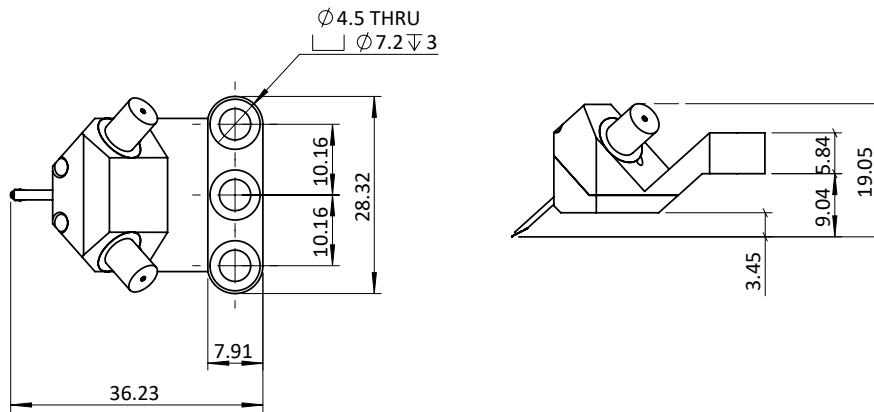
#### Mechanical Characteristics

Connector	SMA, female (boosted, two)
Tip material	Ni Alloy
Tip width	30 μm (standard) 20 μm (RC)
Pitch range, standard tips	<b>GSGSG</b> 50 to 550 μm, with 25 μm step
	<b>GSSG/SGS</b> 50 to 550 μm, with 25 μm step 600 to 1250 μm with 50 μm step
Pitch range, RC tips	50 to 125 μm, with 25 μm step
Tip configurations	GSSG, SGS, GSGSG
Connectors style	45-degree, angled

Typical Electrical Characteristics: Dual 26 GHz GSGSG probe, 150 micron pitch



Body Dimensions

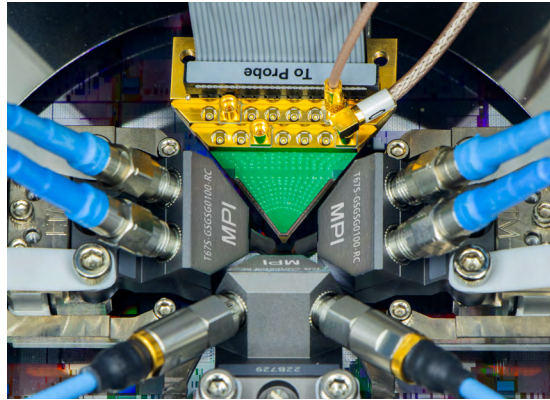
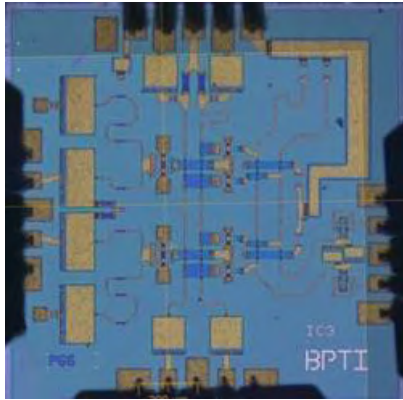


Unit: mm

## mmWAVE APPLICATIONS

Our TITAN™ Probes extend their capabilities to the mmWave spectrum with robust models up to 67 GHz. Designed for characterizing mmWave multiport and differential ICs, switches, and wide-band high-speed data channels, they offer unparalleled precision. The unique tip visibility and minimal footprint, coupled with their long lifespan and affordability, make these probes a preferred choice for applications in advanced telecommunications and satellite communications.

TITAN™ T67S-GSGSG0100, T26D-GSGSG0100 and the multi-contact MCP 100 µm pitch probes used for the characterization of a differential mmW mixer.



### 40 GHz probe model: T40S

#### Typical Electrical Characteristics

Characteristic Impedance	50 Ω
Frequency range	DC to 40 GHz
Insertion loss (GSGSG configuration)	< 0.8 dB
Return loss (GSGSG configuration)	> 11 dB
Port Crosstalk	< -31 dB
DC Current	< 1 A
DC Voltage	< 100 V
RF power @ 10 GHz	<= 5 W
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 35 mΩ
Temperature range	-40 °C...+175 °C

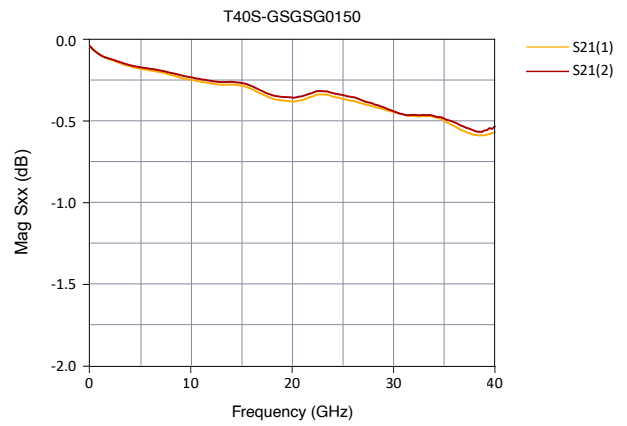
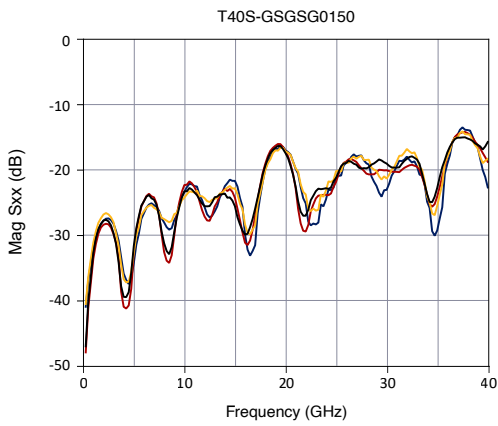


T40S-GSGSG0150 Probe

**Mechanical Characteristics**

Connector	Connector: K (2.92mm), female (two)
Tip material	Ni Alloy
Tip width	30 μm (standard) 20 μm (RC)
Pitch range, standard tips	<b>GSGSG</b> : 50 to 325 μm <b>GSSG/SGS</b> : 50 to 250 μm
Pitch range, RC tips	50 to 125 μm
Pitch step	25 μm
Tip configurations	GSSG, SGS, GSGSG
Connectors style	45-degree, straight

**Typical Electric Characteristics: 40 GHz GSGSG probe, 150 micron pitch**



**50 GHz probe model: T50S**

**Typical Electrical Characteristics**

Characteristic Impedance	50 Ω
Frequency range	DC to 50 GHz
Insertion loss	< 1 dB
Return loss	> 11 dB
Port Crosstalk	< -31 dB
DC Current	< 1 A
DC Voltage	< 100 V
RF power @ 10 GHz	≤ 5 W
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 35 mΩ
Temperature range	-40 °C...+175 °C

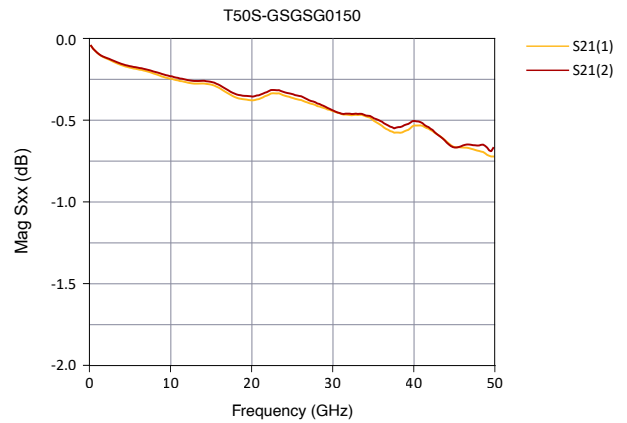
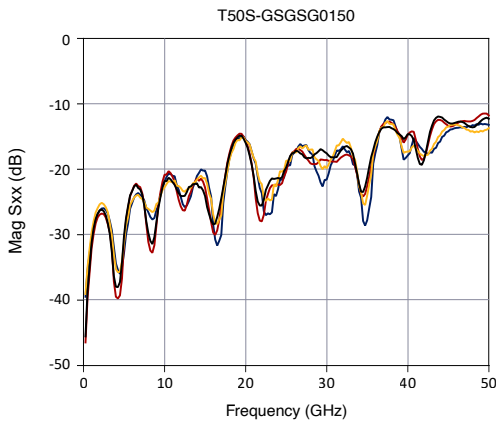


T50S-GSGSG0150 Probe

**Mechanical Characteristics**

Connector	Q (2.4mm), female (two)
Tip material	Ni Alloy
Tip width	30 μm (standard) 20 μm (RC)
Pitch range, standard tips	50 to 325 μm with 25 μm step
Pitch range, RC tips	50 to 125 μm with 25 μm step
Tip configuration	GSGSG
Connectors style	45-degree, straight

**Typical Electric Characteristics: 50 GHz GSGSG probe, 150 micron pitch**



**67 GHz probe model: T67S**

**Typical Electrical Characteristics**

Characteristic Impedance	50 Ω
Frequency range	DC to 67 GHz
Insertion loss	< 1.3 dB
Return loss	> 10 dB
Port Crosstalk, @50 GHz	< -31 dB
DC Current	< 1 A
DC Voltage	< 100 V
RF power @ 10 GHz	<= 5 W
Contact resistance on Au, standard tips	< 6 mΩ
Contact resistance on Al, standard tips	< 35 mΩ
Temperature range	-40 °C...+175 °C

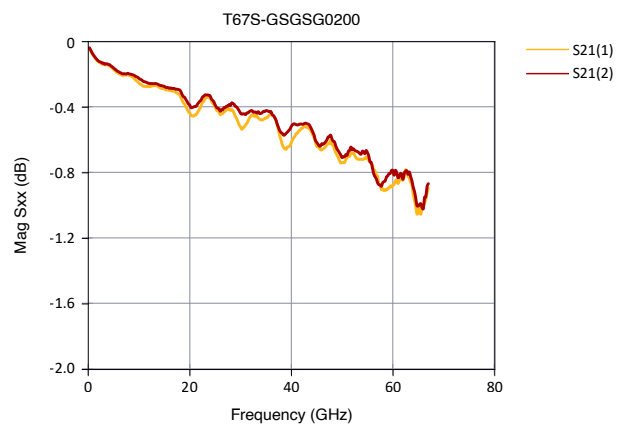
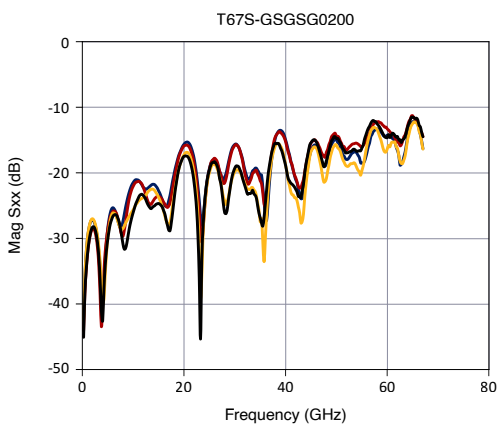


T67S-GSGSG0200 Probe

**Mechanical Characteristics**

Connector	V (1.85 mm), female (two)
Tip material	Ni Alloy
Tip width	30 μm (standard) 20 μm (RC)
Pitch range, standard tips	50 to 250 μm with 25 μm step
Pitch range, RC tips	50 to 125 μm with 25 μm step
Tip configuration	GSGSG
Connectors style	45-degree, straight

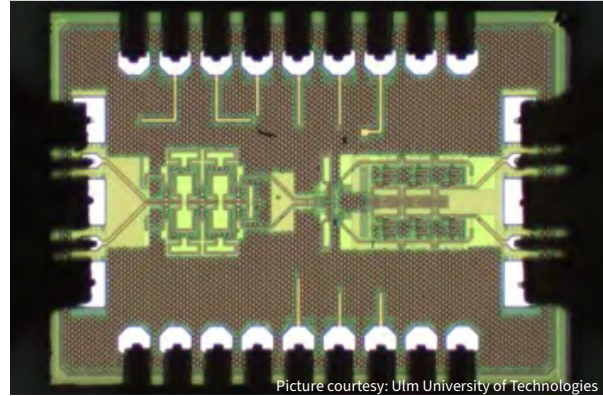
**Typical Electric Characteristics: 67 GHz GSGSG probe, 200 micron pitch**



## mmW BROADBAND APPLICATIONS

The TITAN™ Probe family excels in mmW 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 high-speed data transmission. The probes ensure measurement accuracy across an unmatched frequency band, reaffirming our commitment to innovation and quality.

TITAN™ T220D-GSGSG0100 (left) and T220D-GSGSG0100 with the multi-contact MCP 100 µm pitch probes used for the characterization of a broadband differential driver.



Picture courtesy: Ulm University of Technologies

### 145 GHz probe model: T145S

#### Typical Electrical Characteristics

Characteristic Impedance	50 Ω
Frequency range	DC to 145 GHz
Insertion loss	< 2 dB
Return loss	> 16 dB
DC Current	< 1.5 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...+150 °C



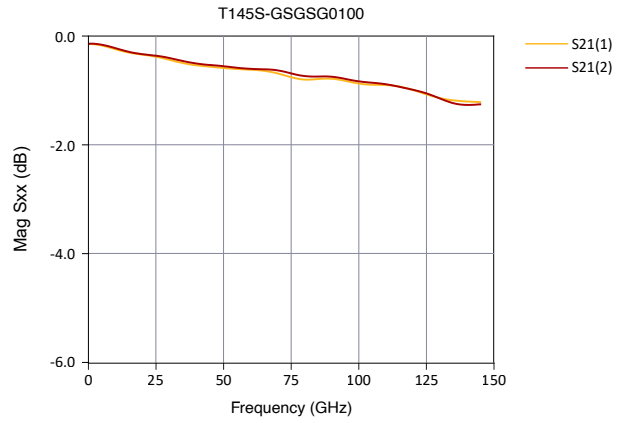
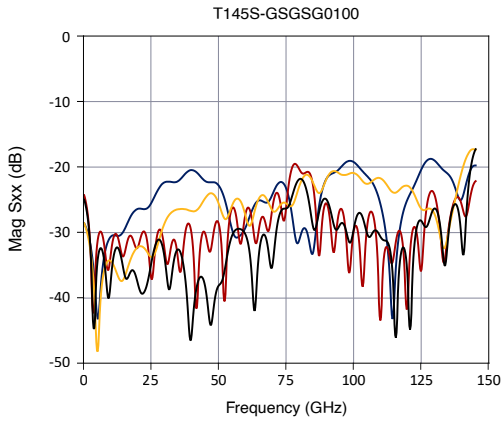
T145S-GSGSG0100 Probe

#### Mechanical Characteristics

Connector	0.8 mm, female (two)
Tip material	Ni Alloy
Tip width	15 µm
Pitch range	50 to 125 µm with 25 µm step
Tip configuration	GSGSG
Connectors style	45-degree, straight

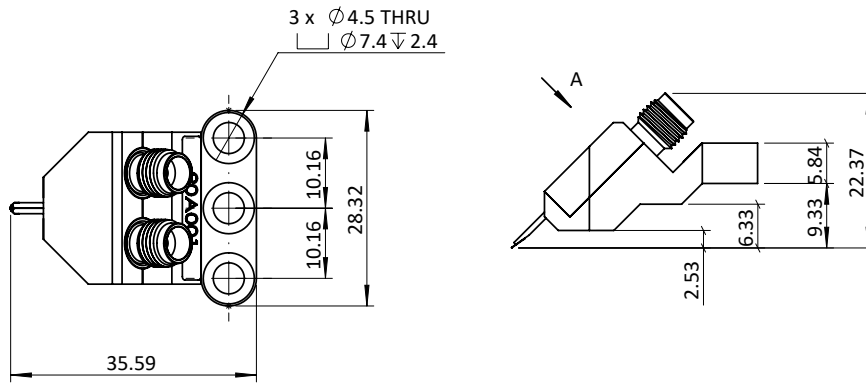


Typical Electric Characteristics: 145 GHz GSGSG probe, 100 micron pitch



Body Dimensions

T40S, T50S, T67S, and T145S probe models



Unit: mm

**220 GHz probe model: T220D**

**Typical Electrical Characteristics**

Characteristic Impedance	50 Ω
Frequency range	DC to 220 GHz
Insertion loss	< 7 dB
Return loss (at the tips)	> 13 dB
DC Current	< 1.5 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...+150 °C

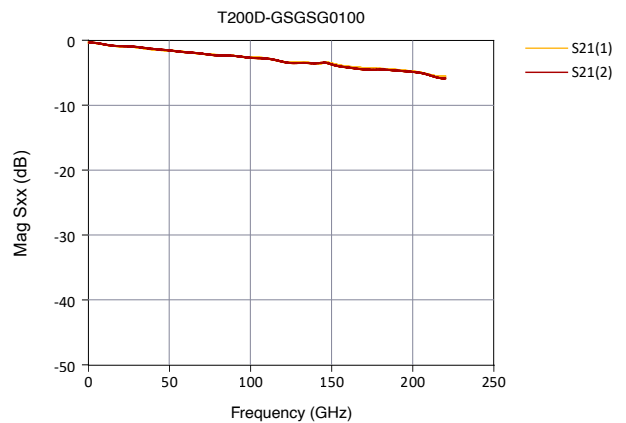
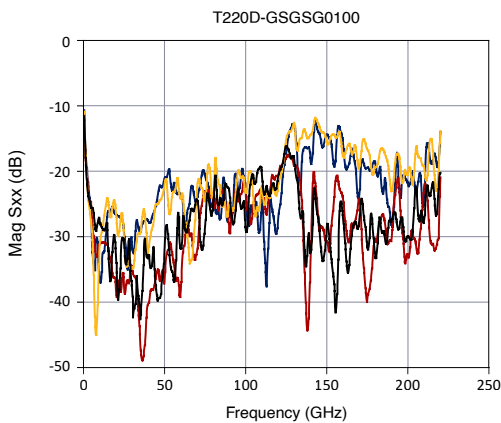


T220D-GSGSG050 Probe

**Mechanical Characteristics**

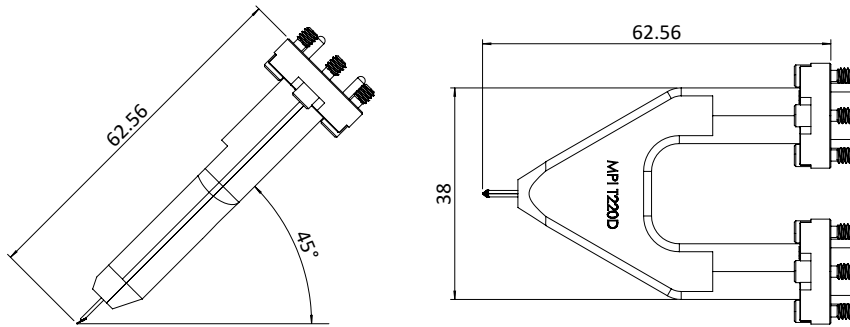
Interface	0.6mm broadband interface, male (two)
Instrumentation integration	Direct mount to Anritsu ME7838G4 70 kHz–220 GHz differential broadband VNA
Tip material	Ni Alloy
Tip width	15 μm
Pitch range	50 to 125 μm with 25 μm step
Tip configuration	GSGSG
Connectors style	Straight, direct mount

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



**Body Dimensions**

T220D probe model



Unit: mm

**CALIBRATION CONFIGURATIONS**

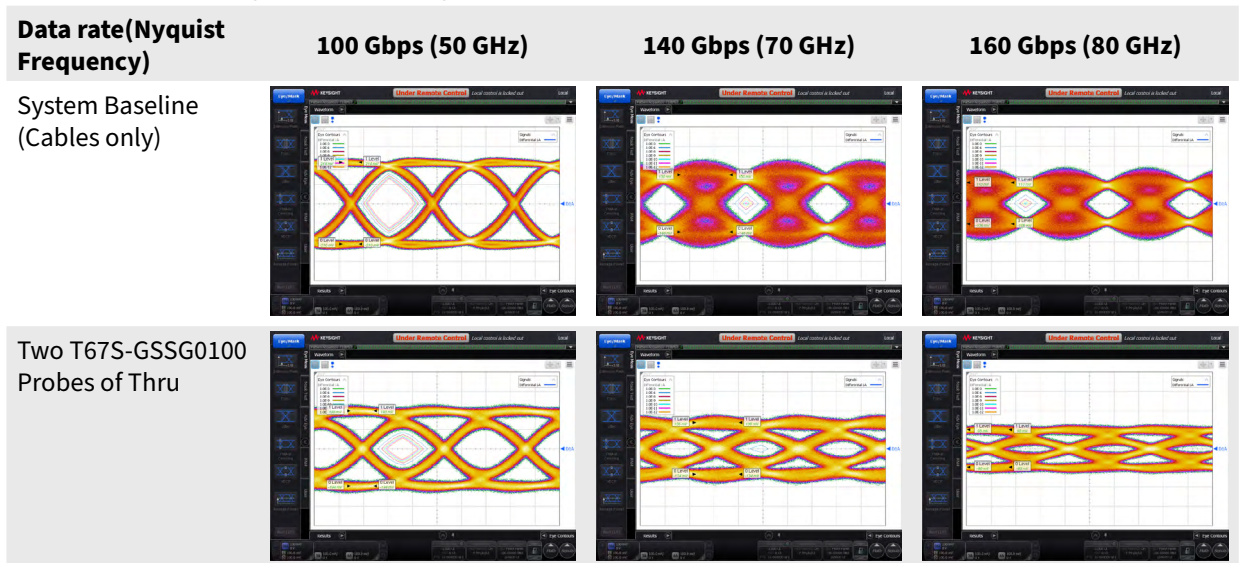
The calibration substrates compliment the probes and are precisely matched to the probe footprint and pitch-making them critical to the highly accurate measurements sought by RF engineers. The Dual TITAN™ Probe family includes a wide selection of new dual TCS calibration substrates supporting GSGSG, GSSG, and SGS probe tip configurations. Following the recommendations of the PlanarCal Consortium, the new approach for designing and optimization of the calibration standards ensures accurate probe calibration up to 220 GHz and beyond.

Systematic measurement error correction methods that are implemented in modern multiport VNAs are based on single-ended measurement processes. S-parameter calibration accuracy degrades with an increase of the probe pitch and the measurement frequency. It is recommended to keep the pitch of the IC pads small, use the GSGSG pad configuration, and design custom calibration standards using the same process as the test device. All these guarantee the best possible accuracy of the S-parameter calibration and characterization of dual/differential ICs.

However, the GSSG probe configuration can be successfully used for the high-speed time-domain characterization (e.g. eye diagram) with instrumentation configurations such as differential signal drives by arbitrary signal generators, differential oscilloscopes, and similar.

Differential eye diagrams of 100 Gbps, 140 Gbps and 160 Gbps signals for two T67S-GSSG0100 probes contacting a differential Thru standard. The system is calibrated to the cable end by IQTools from Keysight Technologies.

**Test: Up to 80 GHz Nyquist Frequency**



**S-PARAMETER MULTIPORT VNA CALIBRATION**

Recommended calibration substrates, GSGSG Probes.

Calibration Substrate Model	Probe pitch, $\mu\text{m}$	Frequency Range, GHz					
		26	40	50	67	145	220
TCS-GSGSG-0050-0050	50	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
TCS-GSGSG-0075-0075	75	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
TCS-GSGSG-0100-0100	100	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
TCS-GSGSG-0100-0125	125	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
TCS-GSGSG-0150-0200	150	Optimal	Optimal	Optimal	Optimal	Not available	Not available
TCS-GSGSG-0150-0200	175	Optimal	Optimal	Optimal	Optimal	Not available	Not available
TCS-GSGSG-0150-0200	200	Optimal	Optimal	Optimal	Optimal	Not available	Not available
TCS-GSGSG-0225-0325	225	Optimal	Optimal	Optimal	Compatible	Not available	Not available
TCS-GSGSG-0225-0325	250	Optimal	Optimal	Optimal	Compatible	Not available	Not available
TCS-GSGSG-0225-0325	275	Optimal	Optimal	Optimal	Compatible	Not available	Not available
TCS-GSGSG-0225-0325	300	Optimal	Optimal	Optimal	Compatible	Not available	Not available
TCS-GSGSG-0225-0325	325	Optimal	Optimal	Optimal	Compatible	Not available	Not available

Optimal - ■ Compatible - ■ Not available - ■

Recommended calibration substrates, GSSG Probes.

Calibration Substrate Model	Probe pitch, $\mu\text{m}$	Frequency Range, GHz			
		26	40	50	67
TCS-GSSG-0050-0050	50	Optimal	Optimal	Compatible	Compatible
TCS-GSSG-0075-0075	75	Optimal	Optimal	Compatible	Compatible
TCS-GSSG-0100-0100	100	Optimal	Optimal	Compatible	Compatible
TCS-GSSG-0100-0125	125	Optimal	Optimal	Compatible	Compatible
TCS-GSSG-0150-0200	150	Optimal	Optimal	Compatible	Compatible
TCS-GSSG-0150-0200	175	Optimal	Optimal	Compatible	Compatible
TCS-GSSG-0150-0200	200	Optimal	Optimal	Compatible	Compatible
TCS-GSSG-0225-0325	225	Optimal	Optimal	Compatible	Compatible
TCS-GSSG-0225-0325	250	Optimal	Optimal	Compatible	Compatible
TCS-GSSG-0225-0325	275	Optimal	Compatible	Compatible	Compatible
TCS-GSSG-0225-0325	300	Optimal	Compatible	Compatible	Compatible
TCS-GSSG-0225-0325	325	Optimal	Compatible	Compatible	Compatible

Optimal - ■ Compatible - ■

## CONCLUSION

The Dual TITAN™ Probes represent a synergy of MPI Corporation's technological prowess and commitment to quality. By integrating the key benefits of our single-ended probes – superior calibration, unique contact structure, exceptional lifetime, and affordability – we offer a product that stands apart in the industry. The Dual TITAN™ Probes are more than just tools; they are a testament to our dedication to pushing the boundaries of precision measurement technology.

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MPI Global Presence

