›Probes Selection Guide

More than 50 different probe models for wafer, package and board level characterization.

FormFactor™

FormFactor offers a wide selection of engineering probes to meet the highly demanding and broad range of on-wafer and signal integrity applications.

Our families of RF, mixed-signal and DC probes are designed to meet the many challenges of the various probing environments and provide a durable, high-performance product that exceeds expectations.

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Probe Family Overview

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Infinity Probes

The Infinity Probe is an ideal match for device characterization and modeling and differential applications, with industry-leading performance. The Infinity Probe provides unmatched performance in both single-signal and dual-signal (differential) applications, providing extremely low contact resistance on aluminum pads with unsurpassed RF measurement accuracy for highly reliable, repeatable measurements. The Infinity Probe is designed for on-wafer/planar surface work only. Proprietary thin-film and coaxial probe technology reduces unwanted couplings to nearby devices and transmission modes. (page 10)

T-Wave Probes

The T-Wave Probes enable wafer-level electrical measurement of millimeterwave devices and materials up to 1.1 THz, setting the industry performance standard for characterization of millimeter and sub-millimeter wavelength devices. The T-Wave Probes deliver low insertion loss and low contact resistance when probing gold pads. (page 15)

Air Coplanar Probes

The Air Coplanar Probe (ACP) is a rugged microwave probe with a compliant tip for accurate, repeatable measurements for both on-wafer as well signal integrity applications. It features excellent probe-tip visibility and the lowest loss available. Configurations for both single and dual signal applications are available. The ACP probe combines outstanding electrical performance with precise probe mechanics and is today's most widely used microwave probe available. (page 18)

|Z| Probes

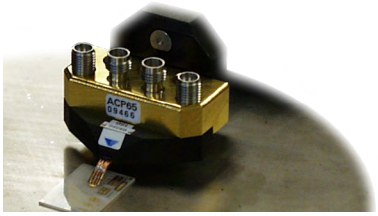
The |Z| Probes assure long probe lifetime and accurate measurements with superior tip compliance. The RF/Microwave signal makes only one transition to the coplanar contact structure within the shielded, air-isolated probe body maintaining signal integrity over a temperature range from 10 K to 300°C. (page 21)

RFIC and Functional Test (multi-contact) Probes

FormFactor offers a variety of durable, high-performance mixed-signal multi-contact probes to streamline RFIC engineering test and production applications up to 110 GHz. The multi-contact probe families include InfinityQuad probe, Multi |Z| Probe, Unity Probe, ACP RF quadrant probe, Eye-Pass probe, DCQ and WPH probes. (page 23)

Board Test and Signal Integrity Probes

FormFactor offers precision, durable fine-pitch probes, ideal for signal integrity probing on IC packages and circuit board work. Many of these probes allow for deep reach capabilities to access contacts over adjacent components. Probes are available to meet the performance requirements of both circuit work or material characterization. (page 29)



Special-purpose RF/microwave Probes

FormFactor offers many custom probes, so if an exact match is not found in this guide, please contact us for a review to determine if we have a probe that will fit your requirements or if we can customize a probe to fit your application.
Some example applications/probes are (page 30):

- Impedance matching probe
- High-performance quadrant probe
- Cryogenic probe

The estimated lifetime indicated in this document can be negatively affected by several variables, such as overtravel used, planarity of the substrate, materials being probed, debris on the surface, skating into passivation, temperature, cleaning frequency and cleaning media.

Quick Probe Selection Guide: RF Probes

			|Z| Probes		Infinity		ACP	
		Key Specifications	Single	Dual	Single	Dual	Single	Dual
		Maximum Frequency	67 GHz	50 GHz	145 GHz	145 GHz***	110 GHz	110 GHz
		Minimum Pad Size	50x50 µm	50x50 µm	25x35 µm	25x35 µm	80x80 µm	80x80 µm
		Typical Raw Insertion Loss @ 40 GHz	0.8 dB	0.8 dB	0.7 dB	0.9 dB	1.0/0.6 dB[3]	1.25 dB
		Compliance	50/300 µm[1]	50 µm	1 µm	1 µm	25 µm	25 µm
		Standard Pitch Range	50-1250 µm	100-500 µm	50-250 µm	100-250 µm	100-1250 µm	100-500 µm
		Maximum DC Current	1.5 A	1.5 A	0.5/2 A[4]	0.5 A	5 A	5 A
		Maximum RF Power @ 2 GHz	15/65 W[2]	15 W	37 dBm	37 dBm	30 W	30 W
		Typical Lifetime on Al Pads	>1,000,000	>1,000,000	>250,000	>250,000	>500,000	>500,000
		Maximum Temperature	300°C	200°C	125°C	125°C	200°C	200°C
		Typical Contact Resistance on Al	50 mΩ	50 mΩ	30 mΩ	30 mΩ	100 mΩ	100 mΩ
Device Modeling and Characterization - Si	2-Port S-Parameter Measurements	DC-67 GHz	◐		●		○	
		67-110 GHz			●		○	
	Differential S-Parameter Measurements	DC-67 GHz		◐		●		○
		67-110 GHz				●		○
	Load-Pull Measurements	DC-67 GHz	●		◐		○	
		67-110 GHz			●		○	
Device Modeling and Characterization - GaAs	2-Port S-Parameter Measurements	DC-67 GHz	◐		◐		●	
		67-110 GHz			◐		●	
	Differential S-Parameter Measurements	DC-67 GHz		◐		◐		●
		67-110 GHz				◐		●
	Load-Pull Measurements	DC-67 GHz	●		◐		◐	
		67-110 GHz			◐		●	
Production Testing - RF Discrete Devices	Al Pads	DC-67 GHz	●	For multi-port	◐	◐		
		67-110 GHz			●	For multi-port		
	Au Pads	DC-67 GHz	●	For multi-port	○	○	◐	◐
		67-110 GHz			○	○	●	For multi-port
PCB Board Test**	Single Signal	DC-67 GHz	●				◐	
		67-110 GHz					●	
	Multi-port/ Differential	DC-67 GHz		●				◐
		67-110 GHz						●

● = Best (Recommended) ◐ = Good ○ = Acceptable NR = Not Recommended

[1] For |Z| Probe PCB
[2] For high-power |Z| Probe
[3] For low-loss ACP probe
[4] For high-current Infinity Probe
* T-Wave probes available from 220 GHz to 1.1 THz.
** Infinity probes available up to 500 GHz.
***Available upon request.

Quick Probe Selection Guide: WaveGuide Probe Guide

	Key Specifications	T-Wave	Infinity	ACP
	Maximum Frequency	1.1 THz	500 GHz	140 GHz
	Minimum Pad Size	25x35 µm	25x35 µm	80x80 µm**
	Compliance	1 µm	1 µm	25 µm
	Standard Pitch Range	25-100 µm	50-150 µm	100-250 µm
	Typical Lifetime on Al Pads	NS	>250,000	>500,000
	Maximum Temperature	125°C	125°C	200°C
	Typical Contact Resistance on Al	300 mΩ	30 mΩ	100 mΩ
Device Modelling and Characterization	Al Pads	◐	●	○
	Au Pads	●	◐	○
Product Testing - RF Discrete Devices	Al Pads	◐	●	◐
	Au Pads	●	◐	◐
PCB Board Test	Single Signal	NR	NR	●
Available Waveguide Bands	WR - 15 (50 GHz - 75 GHz)		X	X
	WR - 12 (60 GHz - 90 GHz)		X	X
	WR - 10 (75 GHz - 110 GHz)		X	X
	WR - 8 (90 GHz - 140 GHz)		X	X
	WR - 6 (110 GHz - 170 GHz)		X	
	WR - 5 (140 GHz - 220 GHz)	X	X	
	WR - 4 (170 GHz - 260 GHz)	X	X	
	WR - 3 (220 GHz - 325 GHz)	X	X	
	WR - 2 (325 GHz - 500 GHz)	X	X	
	WR - 1.5 (500 GHz - 750 GHz)	X		
	WR - 1 (750 GHz - 1.1 THz)	X		

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*** Available upon request.**

**** Smaller pad sizes addressed with Reduced Contact (RC) tips (typically 50x60 µm pads).**

Quick Probe Selection Guide: Mixed-signal / Multi- contact Probes

				Key Specifications	InfinityQuad	Multi |Z|	Unity	ACP-Q	|Z| Probe HF ProbeWedge™
				Maximum Number Contacts	25	35	12	16	12
				Maximum Frequency	110 GHz	20 GHz	20 GHz	110 GHz	67 GHz
				Maximum Number RF Signals	25	16	8	3	2
				Recommended Minimum Pad Size	30x50 µm	60x60 µm	95x95 µm	80x80 µm	80x80 µm
				Power De-coupling	Eye-Pass	On-board	Eye-Pass	On-Tip	On-Tip
				Non-Uniform Pitch	Yes	Yes	No	Yes	Yes
				Maximum Temperature	125°C	200°C	125°C	125°C	125°C
				Online Design Capture	Yes	No	Yes	No	No
IC Test Engineering	Characterization and Verification	Uniform Pitch	<20 GHz		◐	◐	●	○	○
			>20 GHz		●	NR	NR	○	○
		Non-Uniform Pitch	<20 GHz		◐	◐	NR	◐	◐
			>20 GHz		●	NR	NR	●	◐
	Failure Analysis and Design Debug	Uniform Pitch	<20 GHz		◐	◐	●	○	○
			>20 GHz		●	NR	NR	○	○
		Non-Uniform Pitch	<20 GHz		◐	◐	NR	◐	◐
			>20 GHz		●	NR	NR	●	◐
Production Test	Pre-Production	Uniform Pitch	<20 GHz		◐	◐	●	○	○
			>20 GHz		●	NR	NR	○	○
		Non-Uniform Pitch	<20 GHz		◐	●	NR	◐	◐
			>20 GHz		●	NR	NR	●	◐
	Small Scale Production	Uniform Pitch	<20 GHz		◐	◐	●	○	○
			>20 GHz		●	NR	NR	○	○
		Non-Uniform Pitch	<20 GHz		NR	●	NR	◐	◐
			>20 GHz		NR	NR	NR	◐	●
	Large Scale Production	Uniform Pitch	<20 GHz		◐	●	◐	○	○
			>20 GHz		●	NR	NR	○	○
		Non-Uniform Pitch	<20 GHz		NR	●	NR	◐	◐
			>20 GHz		NR	NR	NR	◐	●
Application Specific	Small Pads and Scribe-Street Devices	Uniform Pitch	<20 GHz		●	○	NR	NR	NR
			>20 GHz		●	NR	NR	NR	NR
		Non-Uniform Pitch	<20 GHz		NR	○	NR	NR	NR
			>20 GHz		NR	NR	NR	NR	NR
	mm-Wave Complex IC test (Wireless HDMI, Automobile Radar)	Uniform Pitch	—		●	NR	NR	◐	NR
		Non-Uniform Pitch	—		NR	NR	NR	Recommend uniform pitch pads	NR
	PCB Board Test	Uniform Pitch	<20 GHz		NR	●	○	◐	◐
			>20 GHz		NR	NR	NR	◐	●
		Non-Uniform Pitch	<20 GHz		NR	●	NR	◐	◐
			>20 GHz		NR	NR	NR	◐	●
	Package Device Probing	Uniform Pitch	<20 GHz		●	●	○	◐	◐
			>20 GHz		●	NR	NR	◐	●
		Non-Uniform Pitch	<20 GHz		●	●	NR	◐	◐
			>20 GHz		●	NR	NR	◐	●

Quick Probe Selection Guide: DC Multi-contact Probes

				Key Specifications	Eye-Pass	DCQ	WPH-900	Multi |Z|	ProbeWedge WE	ProbeWedge WD
				Maximum Number Contacts	12	16	12	35	16	40
				Power De-coupling	Eye-Pass	On tip blade	On tip blade	On-board	On tip blade	On-board
				Maximum Current	1 A	500 mA	500 mA	1 A	100 mA	100 mA
				Maximum Voltage	50 V	50 V*	50 V	100 V	50 V	50 V
				RF Bandwidth	500 MHz	500 MHz	500 MHz	500 MHz	500 MHz	50 MHz
				Typical Lifetime on Al Pads	>250,000	>250,000	>250,000	>1,000,000	>250,000	>250,000
				Recommended Minimum Pad Size	95x95 µm	50x50 µm	50x50 µm	60x60 µm	80x80 µm	80x80 µm
				Non-Uniform Pitch	No	Yes	Yes	Yes	Yes	Yes
				Maximum Temperature	125°C	125°C	125°C	200°C	125°C	125°C
				Online Design Capture	Yes	No	No	No	No	No
IC Test Engineering	Simple IC Bias and Control	Uniform Pitch	<16 contacts		◐	●	●	◐	●	◐
			>16 contacts		NR	NR	NR	◐	NR	●
		Non-Uniform Pitch	<16 contacts		NR	●	●	◐	●	◐
			>16 contacts		NR	NR	NR	◐	NR	●
	Characterization and Verification	Uniform Pitch	<16 contacts		●	◐	◐	◐	◐	○
			>16 contacts		NR	NR	NR	●	NR	◐
		Non-Uniform Pitch	<16 contacts		NR	◐	◐	●	◐	○
			>16 contacts		NR	NR	NR	●	NR	◐
	Failure Analysis and Design Debug	Uniform Pitch	<16 contacts		●	◐	◐	◐	◐	○
			>16 contacts		NR	NR	NR	●	NR	◐
		Non-Uniform Pitch	<16 contacts		NR	◐	◐	●	◐	○
			>16 contacts		NR	NR	NR	●	NR	◐
Production Test	Pre-Production	Uniform Pitch	<16 contacts		●	◐	◐	◐	◐	○
			>16 contacts		NR	NR	NR	●	NR	◐
		Non-Uniform Pitch	<16 contacts		NR	◐	◐	●	◐	○
			>16 contacts		NR	NR	NR	●	NR	◐
	Small Scale Production	Uniform Pitch	<16 contacts		◐	◐	◐	●	◐	○
			>16 contacts		NR	NR	NR	●	NR	◐
		Non-Uniform Pitch	<16 contacts		NR	◐	◐	●	◐	○
			>16 contacts		NR	NR	NR	●	NR	◐
	Large Scale Production	Uniform Pitch	<16 contacts		◐	◐	◐	●	◐	○
			>16 contacts		NR	NR	NR	●	NR	◐
		Non-Uniform Pitch	<16 contacts		NR	◐	◐	●	◐	○
			>16 contacts		NR	NR	NR	●	NR	◐

● = Best (Recommended) ◐ = Good ○ = Acceptable NR = Not Recommended

*** Maximum voltage is 50 V without power bypassing, 25 V with standard power bypassing, and component dependent with custom power bypassing option.**

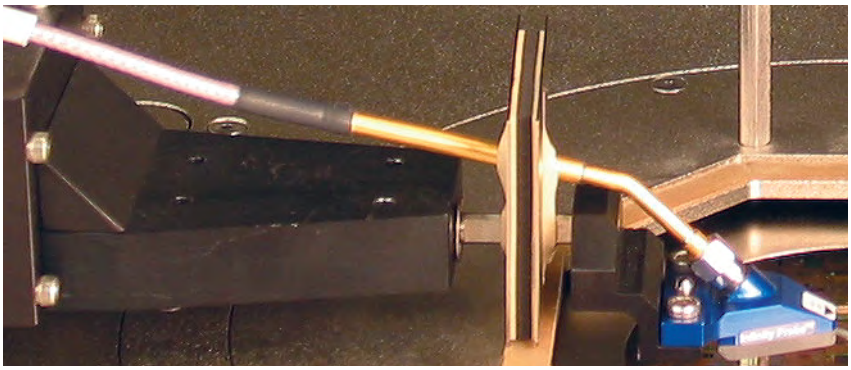
Quick Selection Guide: Frequency Range and Performance

The best case or maximum frequency range achievable for any given probe is determined by its connector and cable types. Beyond this, the probe tip configuration and pitch are other primary attributes that further limit the usable frequency range. Note that single coaxial probes achieve the best RF performance with a GSG tip configuration and a tip pitch from 75 µm to 250 µm. Above 50 GHz, the optimum performance is achieved with a tip pitch from 100 µm to 150 µm. For dual coaxial probes, the optimum tip configuration is GSGSG and the same probe tip pitch ranges. FormFactor recommends that consideration be given to testability when laying out the pad locations to attain optimum performance.

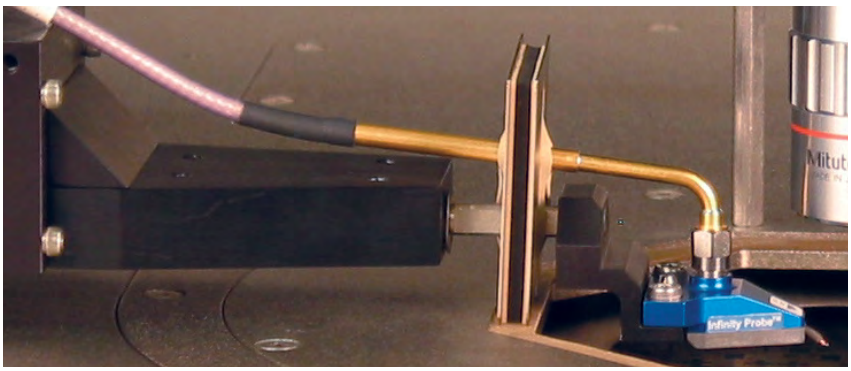
Connector (Max. frequency)	Probe Body Style	Probe
Gore 100 (20 GHz)	Unity probe	Unity Probe
2.92 mm/K(40 GHz) Compatible with SMA (20 GHz), 3.5 mm (26 GHz)	Vertical	I40 / ACP40
	Angled	I40-A / ACP40-A / |Z| Probe
2.4 mm (50 GHz)	Vertical	I50 / ACP50
	Angled and Low-loss version	I50-A / ACP50-A / |Z| Probe
1.85 mm (67 GHz)	Vertical	I67 / ACP65
	Angled and Low-loss version	I67-A / ACP65-A / |Z| Probe
1.0 mm (110 GHz)	Vertical	I110 / ACP110
	Angled	I110-A / ACP110- A
0.8 mm (145 GHz)	Angled	I145

Notes:

1. FormFactor probes use the 2.92 mm / K connector which is compatible with SMA and 3.5 mm, however it is recommended to use a 2.92 mm cable if possible.
2. ACQ probes use the corresponding connector and cable to match your frequency requirements, e.g., ACP50-Q-xxx uses a RF probe with a 2.4 mm connector.
3. All probe RF connectors are female.



Angled probe body style



Vertical probe body style

Infinity Probes

Infinity Probe sets the benchmark for the device characterization and modeling community

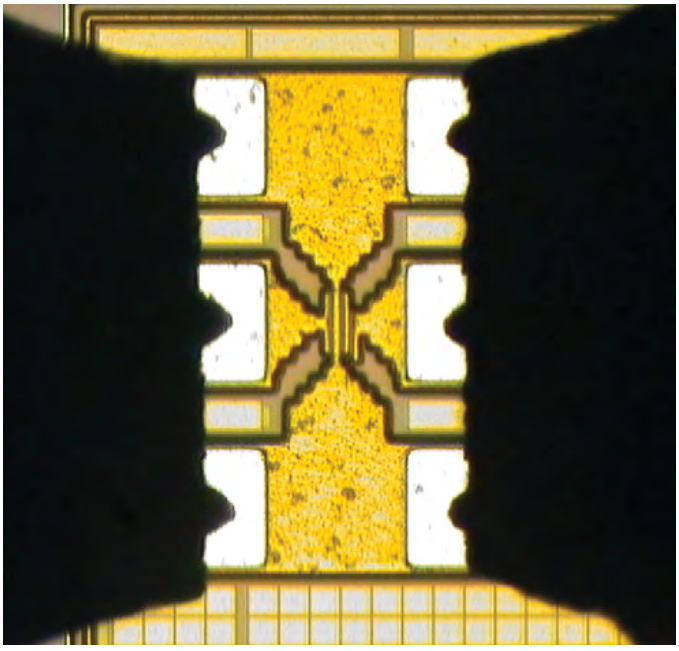
The Infinity probe is truly unique in its architecture that delivers industry leading performance. This revolutionary probe combines extremely low contact resistance on aluminum pads with unsurpassed RF measurement accuracy to provide highly reliable, repeatable measurements. The Infinity Probe reaches this new performance level through the combination of FormFactor's proprietary thin-film technology and coaxial probe technology.

Features

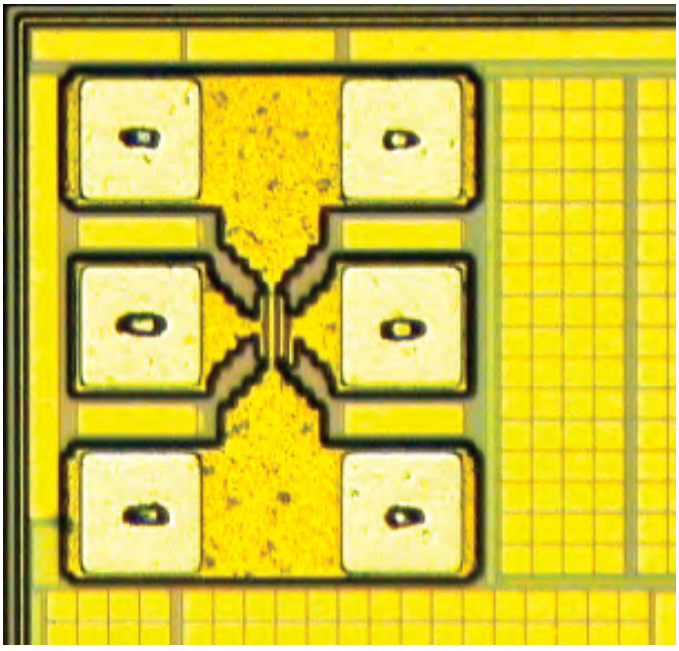
- Lithographic thin-film construction
- Lithographic thin-film construction
- Non-oxidizing nickel alloy tips
- Innovative force delivery mechanism
- 40 to 500 GHz versions
- GSG, SG/GS, GSGSG, GSSG, SGS configurations
- Probe pitch as narrow as 50 µm
- High-current version (2 A) available
- Typical lifetime > 250,000 touchdowns on Al pads

Advantages

- Superior field confinement reduces unwanted couplings to nearby devices and transmission modes
- Low, Stable contact resistance
- Superior measurement accuracy and repeatability
- Small scrub minimizes damage to aluminum pad
- Typical contact resistance: < 0.05 Ω on Al, < 0.02 Ω on Au
- Save valuable wafer space and reduce pad parasitics by being able to shrink pad geometries to 25 x 35 µm (best case)
- Reduction in modeling and design cycle time



Infinity Probe contacting Silicon RF device



Small contact marks enable contact to small pads

Infinity Probes

Contact configuration	GSG, SG, GS	Connector	GSGSG, GSSG, SGS
Frequency range for coaxial probes	I40 – DC to 40 GHz	I40 - 2.92 mm (f)	I40
	I50 – DC to 50 GHz	I50 - 2.4 mm (f)	I50
	I67 – DC to 67 GHz	I67 - 1.85 mm (f)	I67
	I110 – DC to 110 GHz (GSG)	I110 - 1 mm (f)	I110
	I145 - DC to 145 GHz (GSG)	I145 - 0.8mm (f)	NA
Typical insertion loss (GSG, GSGSG versions only)			
DC to 40 GHz	0.7 dB		0.9 dB
40 to 50 GHz	0.8 dB		0.9 dB
50 to 67 GHz	1.1 dB		1.2 dB
67 to 110 GHz	1.4 dB		1.6 dB
110 to 145 GHz	2.5 dB		NA
Typical return loss (GSG, GSGSG versions only)			
DC to 40 GHz	20 dB		15 dB
40 to 50 GHz	17 dB		15 dB
50 to 67 GHz	16 dB		13 dB
67 to 110 GHz	14 dB		11 dB
110 to 145 GHz	14 dB		NA
Crosstalk	-50 dB @ 50 GHz		Typically -40 dB @ 40 GHz; GSGSG 150 Typically -25 dB @ 40 GHz ; GSSG 150
Electrical repeatability	-60 dB		-60 dB
Probe pitch (25 µm increments)	50 to 250 µm pitch (i40, i50 and i67) 50 to 150 µm pitch (i110)		100 to 250 µm pitch -
Recommended overtravel	75 µm		75 µm
Maximum safe overtravel	150 µm		150 µm
Maximum DC current	500 mA (2 A for -HC version)*		500 mA
Thermal range	-65 to 125°C		-65 to 125°C
Rc on aluminum (gold)	Typically < 0.05 Ω (< 0.02 Ω)		Typically < 0.05 Ω (< 0.02 Ω)
Rc variation during one 5-hour single contact cycle**	10 mΩ		10 mΩ
Min. probe pad size	25 x 35 µm (best case)		25 x 35 µm (best case)

* High-current version (2 A) available up to 67 GHz (GSG only).
**Specifications applicable at 25°C operating temperature on clean aluminum.
***See page 32 for recommended Impedance Standard Substrates, and page 34 for a list of cables.

Waveguide Infinity Probes

For each rectangular waveguide designation there are two different probe models.

The “T” models are designed to be compatible with FormFactor's Summit 11000/12000, S300 and Elite300 probing stations.

These models are also TopHat™ compatible when used with TopHat PNs 116-441 and 115-164.

The “S” probe models are compatible with FormFactor's 150mm probing stations.

All models are available without bias network by request.

For Elite300 version waveguide, consult with FormFactor or your local representative for compatibility.

	Body style "T" (tall)	Body style "S" (short)
Waveguide designator (Frequency range)		
WR2 (325 to 500 GHz)	I500-GSG-xx-BT	
WR3 (220 to 325 GHz)	I325-T-GSG-xxx-BT	I325-S-GSG-xxx-BT
WR5 (140 to 220 GHz)	I220-T-GSG-xxx-BT	I220-S-GSG-xxx-BT
WR6 (110 to 170 GHz)	I170-T-GSG-xxx-BT	I170-S-GSG-xxx-BT
WR8 (90 to 140 GHz)	I140-T-GSG-xxx-BT	I140-S-GSG-xxx-BT
WR10 (75 to 110 GHz)	I110-T-GSG-xxx-BT	I110-S-GSG-xxx-BT
WR12 (60 to 90 GHz)	I90-T-GSG-xxx-BT	I90-S-GSG-xxx-BT
WR15 (50 to 75 GHz)	I75-T-GSG-xxx-BT	I75-S-GSG-xxx-BT
Typical insertion loss / return loss		
I500	8/10 dB	
I325	6.5 dB / 13 dB	5 dB / 12 dB
I220	5.2 dB / 13 dB	4 dB / 13 dB
I170	4.7 dB / 13 dB	4 dB / 13 dB
I140	3.1 dB / 13 dB	3 dB / 13 dB
I110	2.6 dB / 13 dB	2 dB / 13 dB
I90	2.6 dB / 13 dB	2 dB / 13 dB
I75	2.1 dB / 13 dB	1.5 dB / 13 dB
Electrical repeatability	-60 dB	-60 dB
Probe pitch (25 µm increments)	50 to 100 µm (WR3, WR5, WR6, and WR8) 50 to 150 µm (WR10, WR12, and WR15)	50 to 100 µm (WR3, WR5, WR6, and WR8) 50 to 150 µm (WR10, WR12, and WR15)
Recommended overtravel	25 to 50 µm	25 to 50 µm
Maximum safe overtravel	100 µm	100 µm
Maximum DC current	500 mA	500 mA
Thermal range	-65 to 125°C	-65 to 125°C
Rc on almunium	Typically < 0.05 Ω	Typically < 0.05 Ω
Rc on gold	Typically < 0.02 Ω	Typically < 0.02 Ω
Rc variation during one 5-hour single contact cycle*	10 mΩ	10 mΩ
Minimum probe pad size	25 x 35 µm (best case)	25 x 35 µm (best case)

***Specifications applicable at 25°C operating temperature on clean aluminum.**

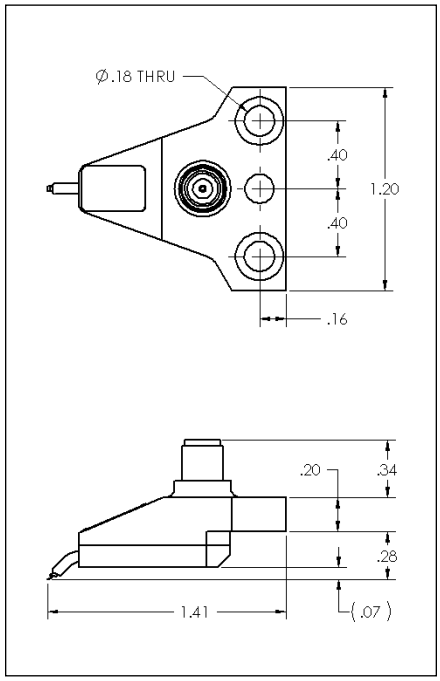
Waveguide Sections for Use with Waveguide Infinity Probes

*For Elite300 version waveguide, consult with FormFactor for compatibility.

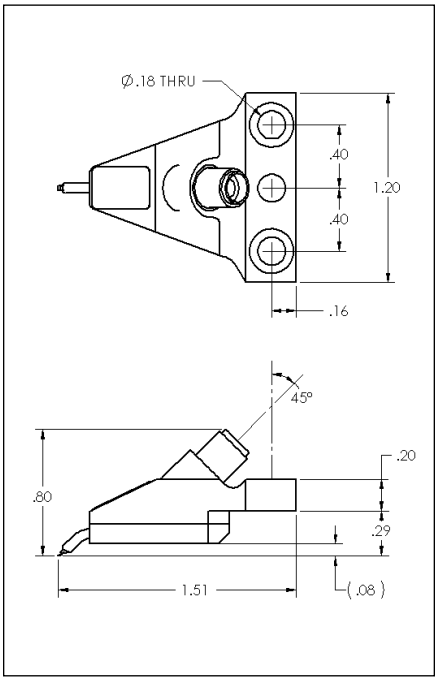
Waveguide "T" model	Waveguide S-bend section
WR3	147-309 (147-310 for Elite 300)
WR5	133-994
WR6	133-995
WR8	133-996
WR10	133-997
WR12	133-998
WR15	133-999

Waveguide "S" model	Waveguide S-bend section
WR2	170-925
WR3	144-399
WR5	133-988
WR6	133-989
WR8	133-990
WR10	133-991
WR12	133-992
WR15	133-993

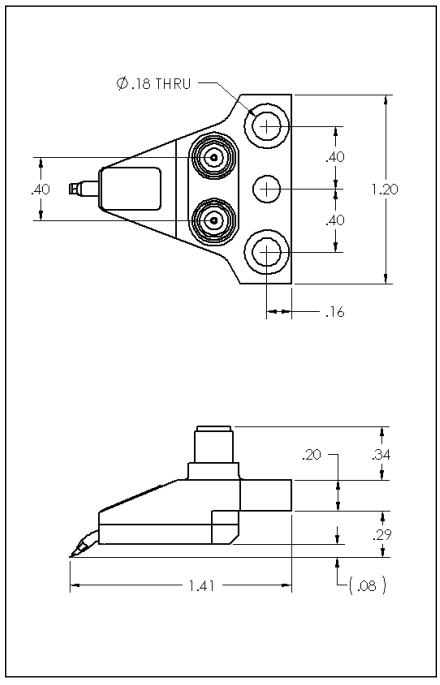
Infinity Probes



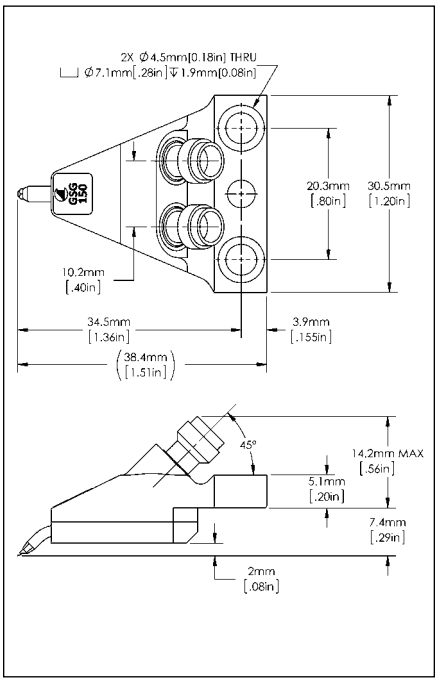
Infinity Probe, vertical body style



Infinity Probe, angled body style

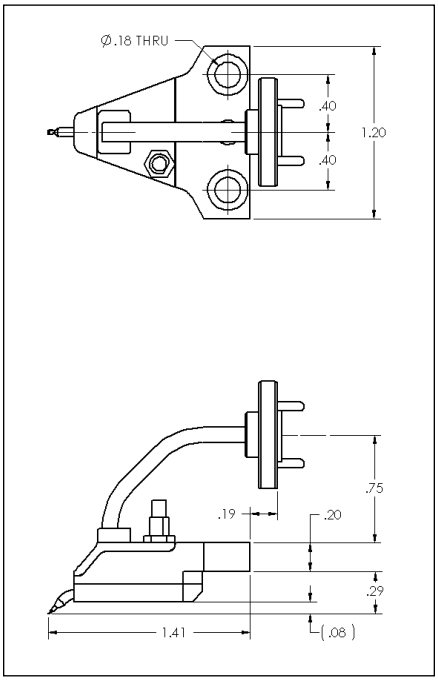


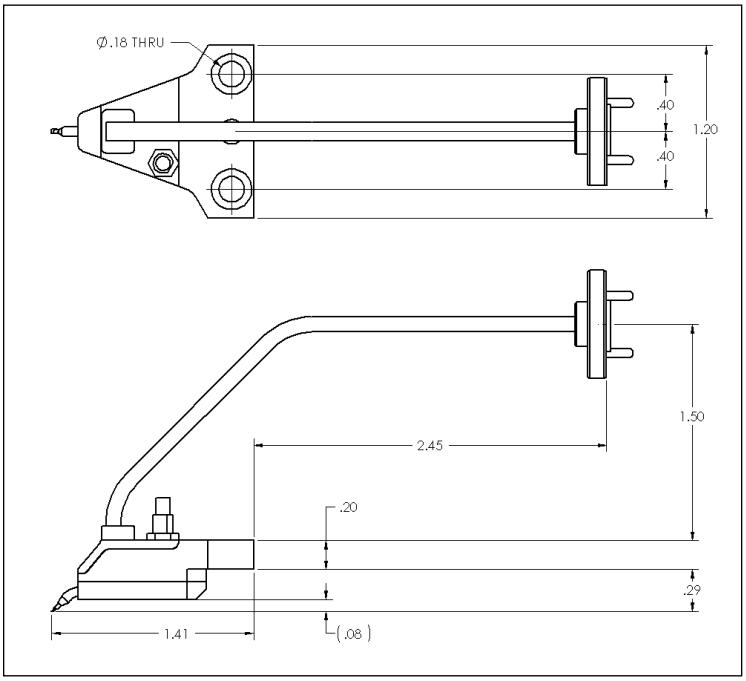
Dual Infinity Probe



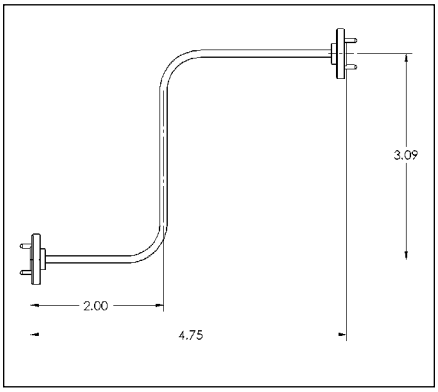
Dual Infinity Probe, vertical body style

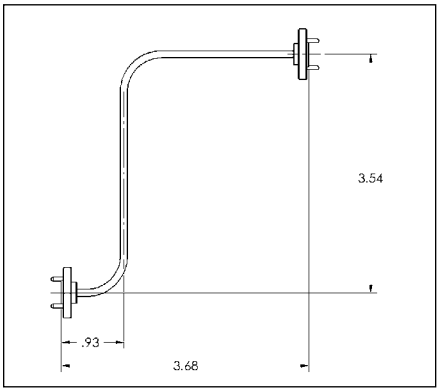
Infinity Probes





Waveguide Infinity Probe - "S" Model on the left, and "T" Model on the right





Waveguide S-bend for Waveguide S & T models: left for 9k probe stations, right for Summit 11K/12K and S300 stations.

Note: Additional versions are available for the Elite300 probe station and for the I325 probe. Consult with factory for more information

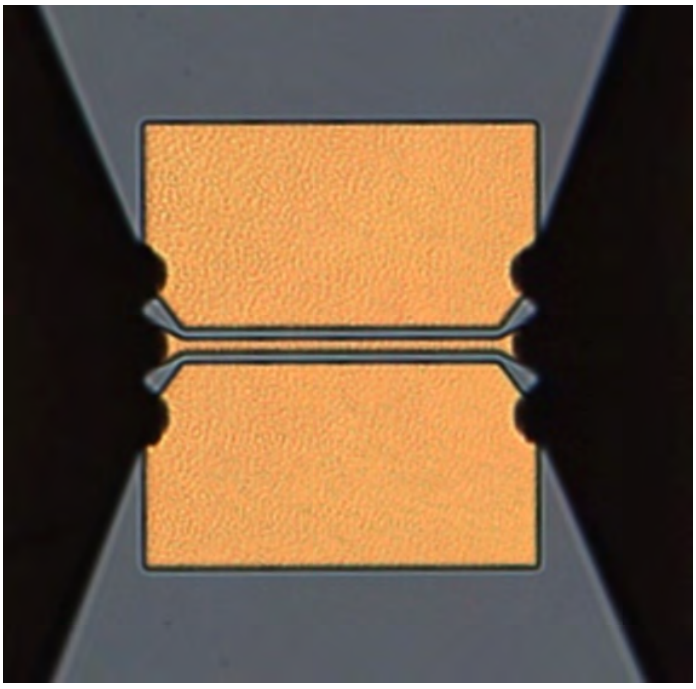
T-Wave Probes

Industry-leading performance for on-wafer measurement of millimeter and sub-millimeter wavelength devices

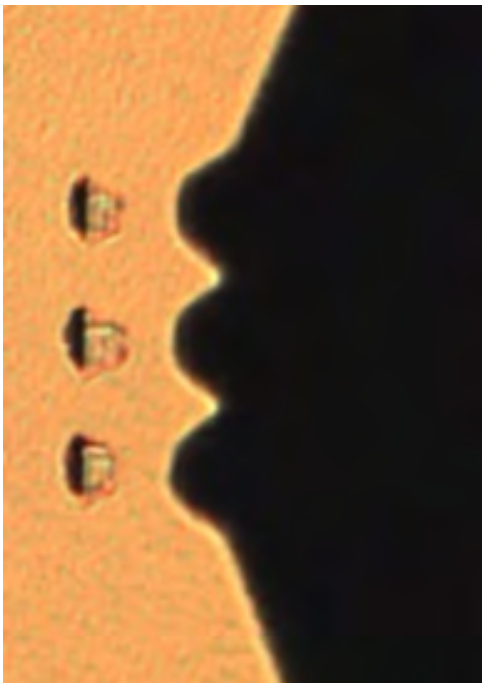
The T-Wave Probes set the industry performance standard for characterization of mmWave devices. This probe delivers low insertion loss and low contact resistance when probing gold pads.

Features
- Low insertion loss
- Low contact resistance
- 140 GHz – 1.1 THz versions
- Probe pitch as narrow as 25 µm
- Lithographically-defined probe tip
- Nickel contacts

Advantages
- Excellent tip visibility
- Ability to characterize 1.1 THz devices
- Typical Insertion loss < 1.5 dB between 140 and 220 GHz
- Integrated DC bias-T with low-profile GPPO connector



T-Wave Probes contacting a CPW thru line



Typical scrub marks of the T-Wave Probes

T-Wave Probes

The 220, 260, and 330 GHz waveguide probes come in two different models. The "T" body style is compatible with FormFactor's Summit 11000/12000, S300 and Elite300 probe stations. The "S" body style is compatible with FormFactor's 150 mm probe stations. All models are available without bias-T by request.

	Body Style "T"	**Body Style "S"**
Waveguide designator (Frequency Range)		
WR1.0 (750 GHz – 1.1THz)	T1100-GSG-25 (Low profile probe)	
WR1.5 (500 GHz – 750 GHz)	T750-GSG-25 (Low profile probe)	
WR2.2 (325 GHz – 500 GHz)	N/A	T500-S-GSG-xx
WR3.4 (220 GHz – 330 GHz)	T330-T-GSG-xxx	T330-S-GSG-xxx
WR4.3 (170 GHz – 260 GHz)	T260-T-GSG-xxx	T260-S-GSG-xxx
WR5.1 (140 GHz – 220 GHz)	T220-T-GSG-xxx	T220-S-GSG-xxx
Typical Insertion Loss / Return Loss		
T1100	7 dB / 15 dB	
T750	5 dB / 15 dB	
T500	N/A	4.5 dB / 15 dB
T330	4.3 dB / 15 dB (typical)	2.9 dB / 15 dB (typical)
T260	3.2 dB / 15 dB (typical)	2.2 dB / 15 dB (typical)
T220	2.3 dB / 15 dB (typical)	1.5 dB / 15 dB (typical)
Probe pitch (25 µm increments)	25 µm (WR1.0 and WR1.5) 25 µm, 50 µm (WR2.2 25-100 µm (WR3.4, WR4.3, WR5.1)	25 µm (WR1.0 and WR1.5) 25 µm, 50 µm (WR2.2) 25-100 µm (WR3.4, WR4.3, WR5.1)
Recommended overtravel	10 µm (Au) 25-35 µm (Al)	10 µm (Au) 25-35 µm (Al)
Maximum safe overtravel	60 µm	60 µm
Maximum DC current	500 mA	00 mA
Rc on Al	Typically < 0.30 Ω	Typically < 0.30 Ω
Rc on Au	Typically < 0.04 Ω	Typically < 0.04 Ω
Rc variation during one 5-hour single contact cycle	N/A	N/A
Minimum probe pad size	25 x 40 µm for passivation windows, 15 x 15 µm Au/no pass (both best cases)	25 x 40 µm for passivation windows, 15 x 15 µm Au/no pass (both best cases)

Contact FormFactor for waveguide sections.

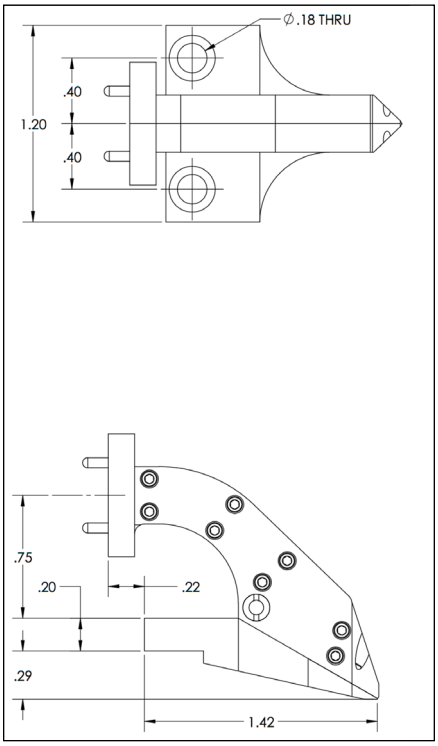
Waveguide Sections for Use with T-Wave Probes

*For Elite300 version waveguide, consult with FormFactor for compatibility.

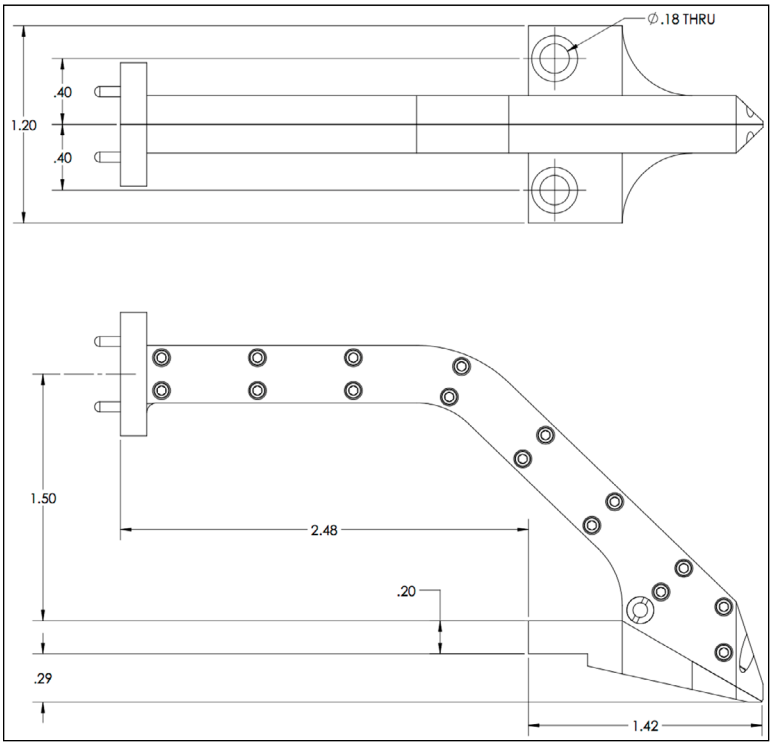
Waveguide "T" model	**Waveguide S-bend section**
WR3.4	147-309
WR4.3	165-696
WR5.1	133-994

Waveguide "S" model	**Waveguide S-bend section**
WR3.4	144-399
WR4.3	165-698
WR5.1	133-988

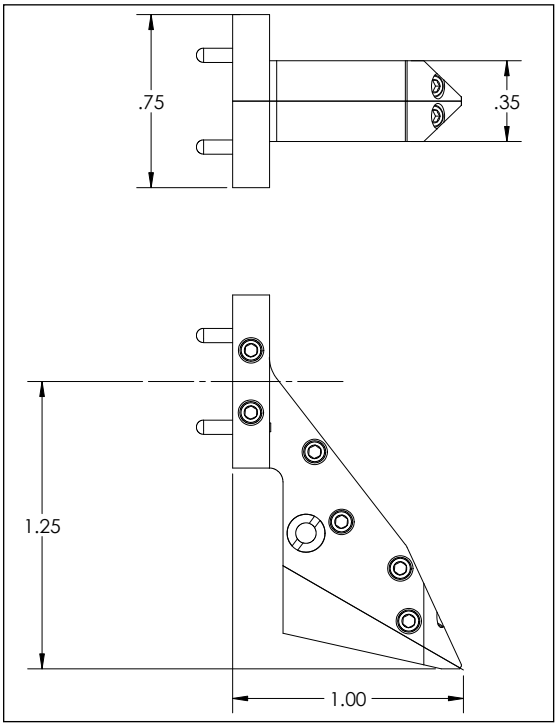
T-Wave Probes



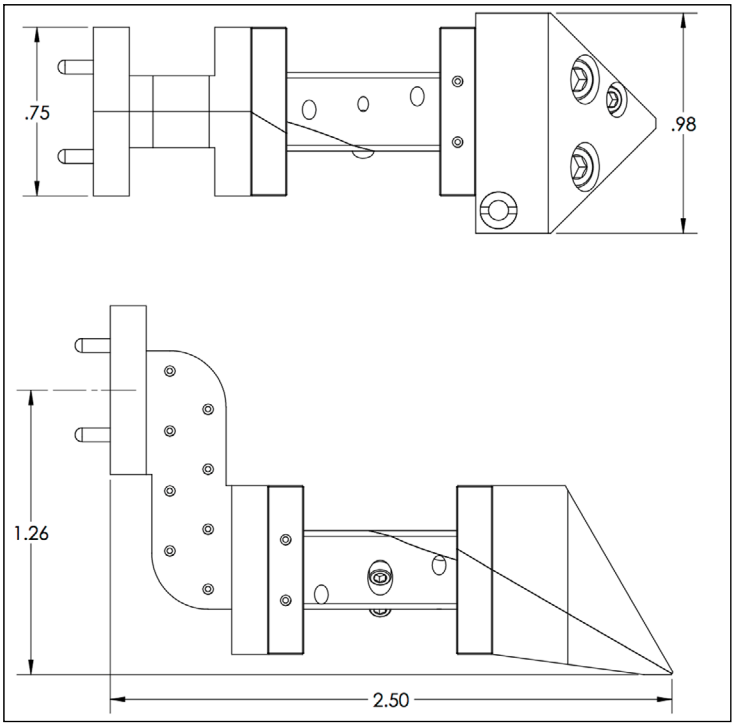
T-Wave Probe – "S" Model



T-Wave Probe – "T" Model



T-Wave Probe – 1.1 THz Model



T-Wave Probe – 750 GHz Model

Air Coplanar Probes

RF and microwave on-wafer probes: long-lasting, rugged, ACP series

The Air Coplanar Probe was developed in response to the need for a rugged microwave probe with a compliant tip for accurate, repeatable measurements on-wafer. Air Coplanar Probes feature excellent probe-tip visibility and the lowest loss available. For measurements where pad area is at a premium, the ACP family is offered with a reduced contact (RC)* area probe tip. The ACP probe family also features dual signal line versions for differential and multiport measurements.

Combining outstanding electrical performance with precise probe mechanics, the ACP probe is the most widely used microwave probe available.

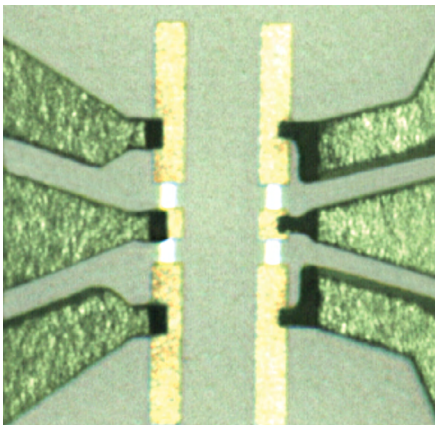
Features

- Unique Air Coplanar tip design
- DC to 110 GHz models available in single and dual line versions
- Low insertion and return loss with ultra-low-loss (-L) versions
- Excellent crosstalk characteristics
- Wide operating temperature -65°C to +200°C
- Wide range of pitches available up to 1250 µm
- Fast delivery available on 100, 125, 150, 200, and 250 µm pitched probes
- Individually supported contacts
- Choice of beryllium copper (BeCu) or tungsten tip material
- Reduced contact (RC) probe tips for small pads
- Precision tip dual configuration available
- BeCu tip provides rugged, repeatable contact on gold pads

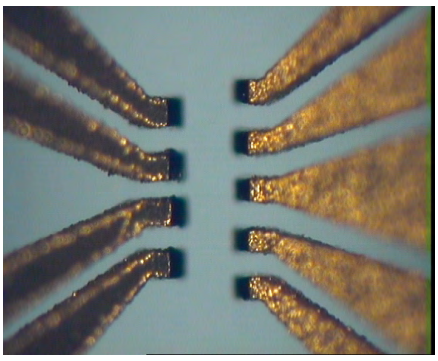
Advantages

- Good visibility at probe tip allows accurate placement on DUT contact-pads
- Outstanding compliance for probing non-planar surfaces
- Stable and repeatable over-temperature measurements
- Typical probe life of 500,000 touchdowns on gold pads
- Reduction in development cycle time

***For pad sizes smaller than 80 µm, use reduced contact area (RC) tips.**



Standard ACP tip (left) versus reduced contact ACP tip (right)



ACP-GSSG (left) vs. ACP-GSGSG (right)

Air Coplanar Probes

	Probe head type	Part number (Note 1,2)	Insertion loss Max. (dB) (Note 12)	Max DC current*	Max RF power**	MicroChamber compatible	Connector	Recommended ISS	
								Standard (100 to 250 µm)	Wide pitch (250 to 1250 µm)
Single Coaxial	DC to 40 GHz (Notes # 1, 2, 11)	ACP40-m-GS-xxx	2.0	5 A	6.5 W	Yes	2.92 mm (f)	103-726	106-683
		ACP40-m-SG-xxx	2.0	5 A	6.5 W	Yes		103-726	106-683
		ACP40-m-GSG-xxx	1.0	5 A	6.5 W	Yes		101-190	106-682
		ACP40-Am-GS-xxx	2.0	5 A	6.5 W	(Note 7)	2.92 mm (f)	103-726	106-683
		ACP40-Am-SG-xxx	2.0	5 A	6.5 W	(Note 7)		103-726	106-683
		ACP40-Am-GSG-xxx	1.0	5 A	6.5 W	(Note 7)		101-190	106-682
		ACP40-Lm-GSG-xxx	0.6 (Note 6)	5 A	6.5 W	(Note 7)		101-190	106-682
	DC to 50 GHz (Notes 1, 2, 11)	ACP50-m-GS-xxx	2.0 @ 40 GHz	5 A	5 W	Yes	2.4 mm (f)	103-726	n/a
		ACP50-m-SG-xxx	2.0 @ 40 GHz	5 A	5 W	Yes		103-726	
		ACP50-m-GSG-xxx	1.4	5 A	5 W	Yes		101-190	
		ACP50-Am-GS-xxx	2.0 @ 40 GHz	5 A	5 W	(Note 7)	2.4 mm (f)	103-726	n/a
		ACP50-Am-SG-xxx	2.0 @ 40 GHz	5 A	5 W	(Note 7)		103-726	
		ACP50-Am-GSG-xxx	1.4	5 A	5 W	(Note 7)		101-190	
		ACP50-Lm-GSG-xxx	1.4	5 A	5 W	(Note 7)		101-190	
	DC to 65 GHz (Notes 1, 2, 11)	ACP65-m-GS-xxx	2.0 @ 40 GHz	5 A	4 W	Yes	1.85 mm (f)	103-726 (Note 8)	n/a
		ACP65-m-SG-xxx	2.0 @ 40 GHz	5 A	4 W	Yes		103-726 (Note 8)	
		ACP65-m-GSG-xxx	2.0	5 A	4 W	Yes		101-190 (Note 8)	
		ACP65-Am-GS-xxx	2.0 @ 40 GHz	5 A	4 W	(Note 7)	1.85 mm (f)	103-726 (Note 8)	n/a
		ACP65-Am-SG-xxx	2.0 @ 40 GHz	5 A	4 W	(Note 7)		103-726 (Note 8)	
		ACP65-Am-GSG-xxx	2.0	5 A	4 W	(Note 7)		101-190 (Note 8)	
		ACP65-Lm-GSG-xxx	2.0	5 A	4 W	(Note 7)		101-190 (Note 8)	
	DC to 110 GHz (Notes 1, 2, 10, 11)	ACP110-Cm-GSG-xxx	1.25	5 A	2 W	Yes	1.0 mm (f)	104-783 (Note 8)	n/a
		ACP110-Am-GSG-xxx	1.25	5 A	2 W	(Note 7)		104-783 (Note 8)	
		ACP110-Lm-GSG-xxx	1.15	5 A	2 W	(Note 7)		104-783 (Note 8)	
Dual coaxial	DC to 110 GHz (Notes 1, 2, 3, 10)	ACPyy-Dm-GSGSG-xxx	1.25 @ 40 GHz (Note 4)	5 A	2 W	Yes	User specified (Note 3)	See ISS list (page 30)	See ISS list (page 30)
		ACPyy-Dm-GSGS-xxx	1.25 @ 18 GHz (Note 4)	5 A	2 W	Yes			
		ACPyy-Dm-GSS-xxx	1.0 @ 10 GHz (Note 4,5)	5 A	2 W	Yes			
		ACPyy-Dm-GSSG-xxx	1.0 @ 10 GHz (Notes 4)	5 A	2 W	Yes			
		ACPyy-Dm-SGS-xxx	1.25 @ 18 GHz (Notes 4)	5 A	2 W	Yes			
		ACPyy-Dm-SGSG-xxx	1.25 @ 18 GHz (Notes 4)	5 A	2 W	Yes			
		ACPyy-Dm-SSG-xxx	1.0 @ 10 GHz (Notes 4,5)	5 A	2 W	Yes			
Waveguide	50 to 75 GHz (Notes 1, 2, 10)	ACP75-Sm-GSG-xxx	1.5	500 mA	4 W	No	WR-15	104-783 (Note 8)	n/a
		ACP75-Tm-GSG-xxx	2.0	500 mA	4 W	Yes	WR-15		
	60 to 90 GHz (Notes 1, 2, 10)	ACP90-Sm-GSG-xxx	2.0	500 mA	3 W	No	WR-12	104-783 (Note 8)	n/a
		ACP90-Tm-GSG-xxx	2.5	500 mA	3 W	Yes	WR-12		
	75 to 110 GHz (Notes 1, 2, 10)	ACP110-Sm-GSG-xxx	2.0	500 mA	2 W	No	WR-10	104-783 (Note 8)	n/a
		ACP110-Tm-GSG-xxx	2.5	500 mA	2 W	Yes	WR-10		
	90 to 140 GHz (Notes 1, 2, 10)	ACP140-Sm-GSG-xxx	2.5	500 mA	2 W	No	WR-8	138-356/357 (Note 8)	n/a
		ACP140-Tm-GSG-xxx	3.0	500 mA	2 W	Yes	WR-8		

*2.5 A for W tip, 5 A for BeCu tip, and 1 A for RC tip. All specs are for probe and DUT at room temperature.
**Rated at highest probe frequency. Additionally each probe is capable of > 30W @ 2.4 GHz, > 10W @ 18 GHz, > 7.5W @ 26.5 GHz.

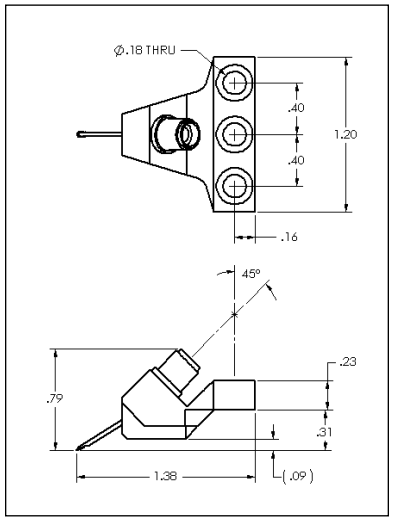
Notes:

1. m refers to the tip material. Delete for BeCu. Change to **W** for tungsten.
2. **xxx** refers to probe contact center to center spacing in microns, e.g. ACP40-GSG-150 is 150 µm. Contacts are on a constant pitch and width is approximately 50 µm.
3. **yy** refers to the connector type. 40 (2.92mm), 50 (2.4 mm), 65 (1.85 mm),110 (1.0 mm).
4. Insertion loss specification is for a 2.92mm connectorized probe.
5. Signal furthest from ground is not specified.
6. Low-loss probe insertion loss for pitches greater than 150 µm and less than or equal to 250 µm is 0.8 dB.
7. Requires new larger top hat assembly.
8. Use of 116-344 ISS absorber recommended.
9. The convention for describing probe head footprints is the sequence of contacts as seen looking down on the probe head tip in its functional position, with the tip pointing away from the viewer, describing contacts from left to right.
10. ACP probes, except 110 models, are available in a wide range of pitches from 50 µm to 1250 µm. Insertion loss and frequency performance applies to pitches from 100 to 250 µm, unless otherwise noted. ACP110 probes available in pitches from 100 to 150 µm; minimum pitch for ACP dual probes is 100 µm.
11. Angled probes require the 114-592 probe mount for cable clearance.
12. Electrical specifications apply to probe pitches of 100 to 250 µm, except for 90, 110 and 140 GHz probes, where the maximum pitch is 150 µm.

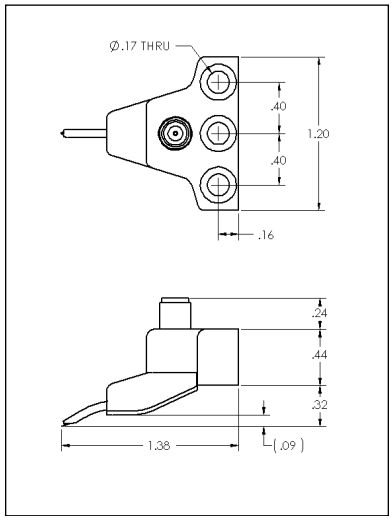
Part Numbers for Reduced Contact Probes

ACP Reduced Contact Probes are available in the same configurations and body styles as the regular ACP series. The standard available pitches are from 100 to 250 µm. Other pitches are available upon request. When ordering, add "**RC**" to the end of the regular ACP part number from the above, e.g. "ACP40-W-GSG-150**RC**"

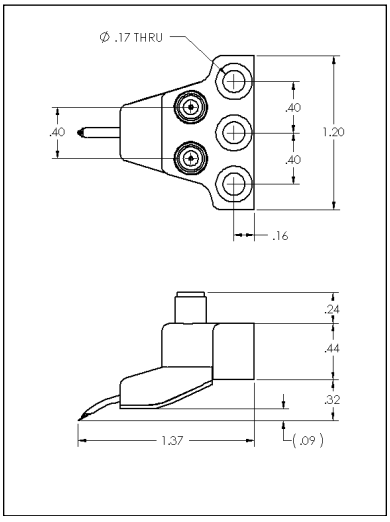
Air Coplanar Probes



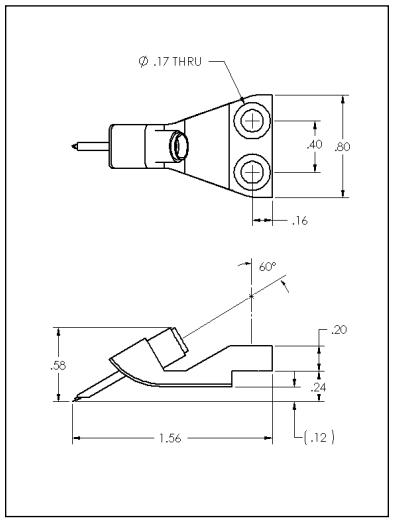
Probe style for: ACP40-Ax, ACP50-Ax, ACP65-Ax, ACP110-Ax.



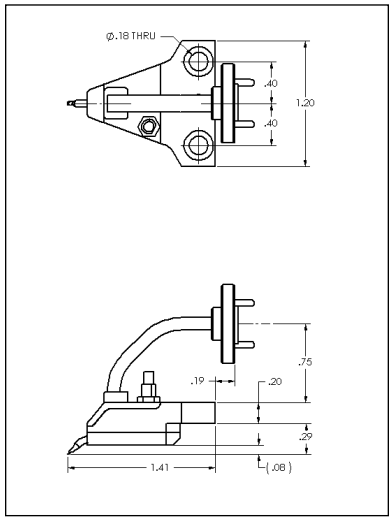
Probe style for: ACP40-x, ACP50-x, ACP65-x, ACP110-Cx.

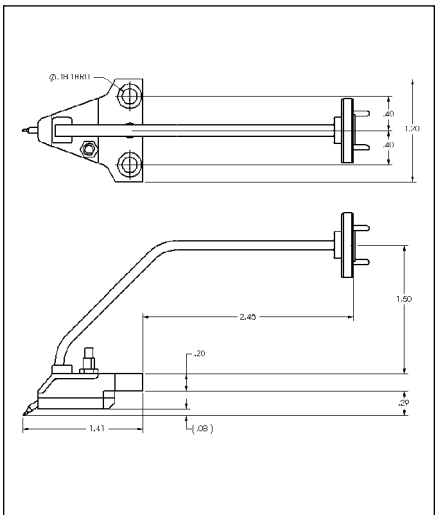


Probe style for: ACP40-Dx, ACP50-Dx, ACP65-Dx, ACP110-Dx.

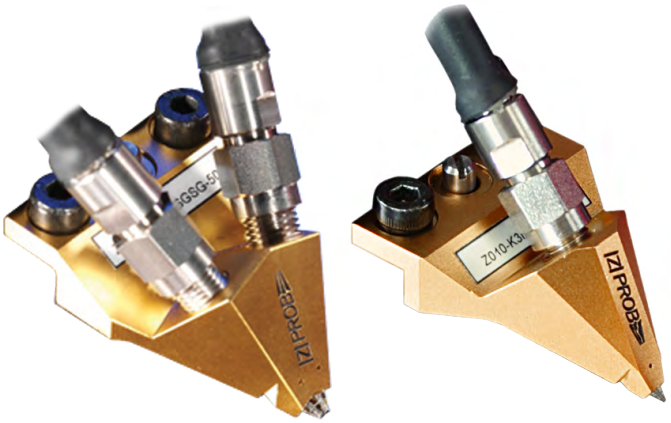


Probe style for: ACP40-Lx, ACP50-Lx, ACP65-Lx, ACP110-Lx.





Waveguide ACP Probe - "S" Model on the left, and "T" Model on the right.



|Z| Probes for RF/Microwave Applications

Excellent performance over a temperature range from 10 K to 300°C with the long life time. Durable |Z| Probes enable easy and repeatable contacts to DUTs. Its robust design of the coplanar contact structure ensures long probe life time. The probe tips can move independently of one another, enabling probing of pad-height deviation of up to 50 µm.

Features

- Long life time (typically > 1,000,000 touchdowns on Al pads)
- Independent, long contact springs to overcome pad height differences up to 50 µm
- Excellent performance in vacuum environments and in a wide temperature range (from 10 K to 300°C)
- High impedance control with perfectly-symmetrical coplanar contact structure, eliminating signal distortion

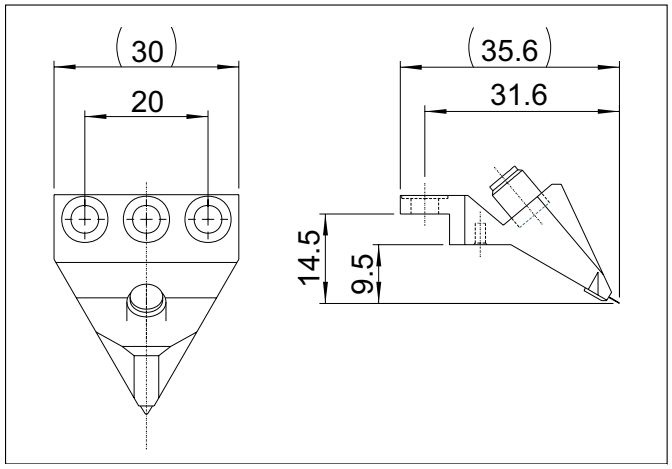
Probe Type	Frequency	Connector	Configuration	Standard Pitch[1,2]	Typical Application / Instrumentation
|Z| Probe (Classic)	DC-10 GHz	2.92 mm	GS, SG	100-1250 µm	Single signal probe, S parameter, TDR, spectrum analysis, oscilloscope
|Z| Probe (Classic)	DC-40 GHz	2.92 mm	GSG	500-1250 µm	
|Z| Probe (1MX)	DC-20 GHz	2.92 mm	GS, SG	50-500 µm	
|Z| Probe (1MX)	DC-40 GHz	2.92 mm	GSG	50-500 µm	
|Z| Probe (1MX)	DC-50 GHz	2.4 mm	GSG	50-500 µm	
|Z| Probe (1MX)	DC-67 GHz	1.85 mm	GSG	50-250 µm	
|Z| Probe Dual (Classic)	DC-10 GHz	2.92 mm	GSSG, SGS	100-250 + 500 µm	Dual signal probe, differential or multiline S parameter, TDR, spectrum analysis, oscilloscope
|Z| Probe Dual (Classic)	DC-40 GHz	2.92 mm	GSGSG	100-250 + 500 µm	
|Z| Probe Dual (1MX)	DC-20 GHz	2.92 mm	GSSG, SGS	100-250 + 500 µm	
|Z| Probe Dual (1MX)	DC-40 GHz	2.92 mm	GSGSG	100-250 + 500 µm	
|Z| Probe Dual (1MX)	DC-50 GHz	2.4 mm	GSGSG	100-250 + 500 µm	
|Z| Probe Power	DC-40 GHz	2.92 mm	GSG	100-500 µm	Single signal probe, high RF power or low loss, S parameter, loadpull, noise parameter
|Z| Probe PCB	DC-4/20 GHz[3]	3.5 mm	GS, SG, GSG	500-2500 µm[4]	Single signal probe, signal integrity, S parameter, TDR, spectrum analysis, oscilloscope

See next page for probe sizes and dimensions

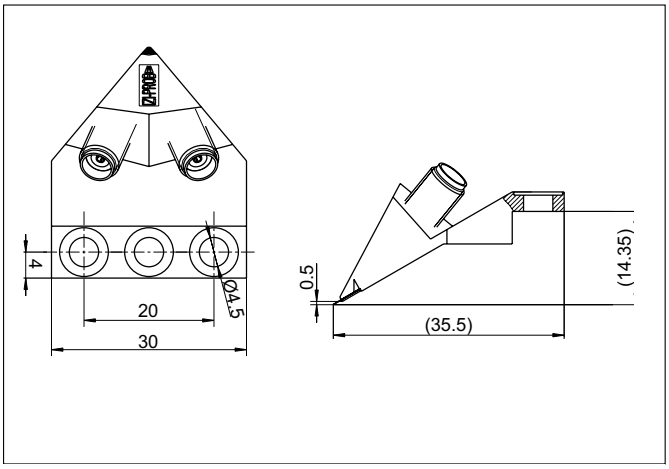
Notes:

1. Pitches outside the listed standard range are available. Contact your local sales representative for more information.
2. Pitches in the range of 50 to 200 µm are generally available in 25 µm increments, and pitches above 200 µm are generally available in 50 µm increments.
3. Able to support frequencies up to 20 GHz for GSG configurations in some cases. Contact your local sales representative for more information.
4. Available pitches for |Z| Probe PCB: 500, 650, 800, 1000, 1250, 1500, 2000, 2500 µm.

IZI Probes



Probe style for |Z| Probes (mm)



Probe style for Dual |Z| Probes (mm)

For more details, visit www.formfactor.com/products/probes.

InfinityQuad Probe

For repeatable and precise engineering tests of DC, logic, RF and mmWave RFIC devices, InfinityQuad probe, the first configurable multi-contact probe, ensures reliable measurement results up to 110 GHz over a wide temperature range. The photo-lithographically defined fine-pitch tip structure enables probing of small pads down to 30 x 50 µm with minimum pad damage and consistent low contact resistance. The durable probe tips ensure more than 250,000 touchdowns on Al pads and Au pads, and provide accurate X, Y and Z alignment.

For more details, visit www.formfactor.com/products/probes/infinityquad and use our online tool to capture your design requirements and receive a quote.

Features

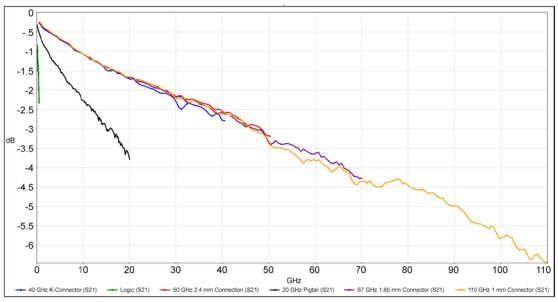
- Customizable configuration up to 25 contacts: RF, Eye-Pass power, ground, logic
- Fine-pitch probe tips enables probing of pitches as small as 75 µm and 30 x 50 µm pads
- Low and repeatable contact resistance on aluminum pads (< 0.05 Ω) ensures accurate results
- Durable probe structure ensures more than 250,000 contacts
- Intuitive design capture tool ensures accurate design and fast product delivery

Specifications

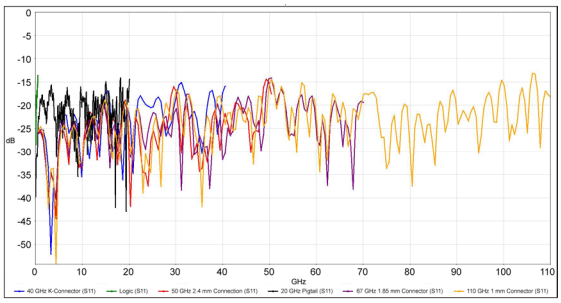
- Number of contacts: From 4 to 25
- Number of 'Premium' channels: Up to 4 Premium channels (40, 50, 67 or 110 GHz)
- Available contact pitch: 75, 80, 100, 125, 150, 200 and 250 µm
- Tip material: Non-oxidizing nickel ally tips
- Minimum pad size: 30 x 50 µm (see Pad layout rules for details)
- Contact area: 12 x 8 µm (nominal)
- Operating temperature: -40°C to +125°C (max. -55°C to +150°C)
- Contact life: > 250,000 touchdowns
- Recommended overtravel: 50 - 75 µm
- Maximum safe overtravel: > 250 µm
- Maximum DC current: 400 mA
- Maximum DC voltage: 50 V power bypass (100 V other)
- Series resistance (not including contact): < 2 Ω

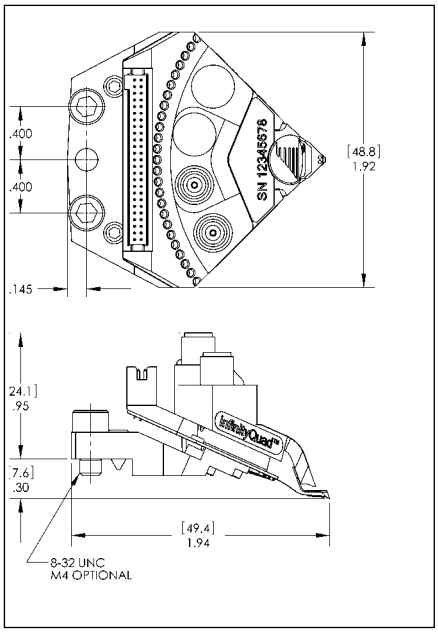
Performance:

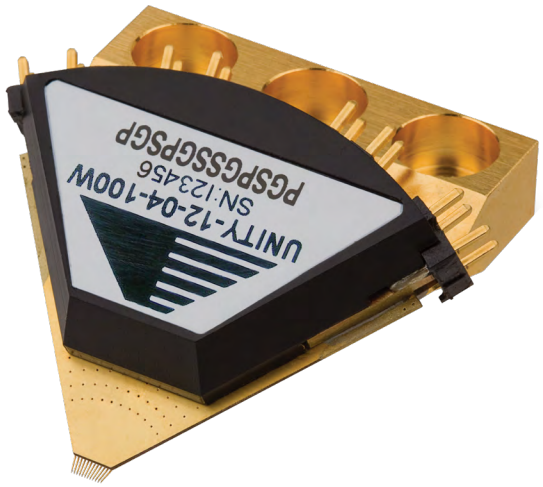
Insertion loss



Return loss







Unity Probe

The multi-contact Unity Probe provides highly flexible configurability, unprecedented durability and ease-of-use for RFIC engineering test. Unlike “bent-to-order” needle-probe solutions, Unity Probes are quickly “built to order” with a precision tip cluster featuring multiple independently compliant fingers to isolate chip components from probing stresses — maximizing probe life and durability. Each contact can be configured to one or several contact types and frequencies, and the Unity Probe delivers on the legendary quality you’ve come to expect from FormFactor’s comprehensive suite of probing solutions.

Features

- Up to 12 contacts; any contact can be DC, Power, Logic to 500 MHz, or RF to 20 GHz
- Online design configuration tool helps you to specify your probe in minutes
- All designs are fully quadrant compatible
- Full solution includes probes, calibration substrates, stations, accessories and calibration software
- Scalable architecture for future needs

Electrical

- Maximum DC current: 1 A
- Maximum DC voltage: 50 V power bypass (>100 V other)
- Series resistance (not including contact): < 0.2 Ω
- Rc on aluminum at 25°C: < 0.1 Ω
- RF connector: Gore 100 series
- DC/Logic connector: Two 0.025 inch square pins on 0.100 inch pitch
- Eye-Pass bypass inductance: 0.4 nH

Mechanical

- Number of contacts: 3 to 12 (Missing contacts count toward max.)
- Available contact pitch: 100 to 250 µm (25 µm steps)
- Tip material: Beryllium copper (BeCu) or tungsten (W)
- Contact area: 50 x 50 µm (nominal)
- Contact life > 250 k touchdowns on aluminum pads, > 500 k touchdowns on gold pads

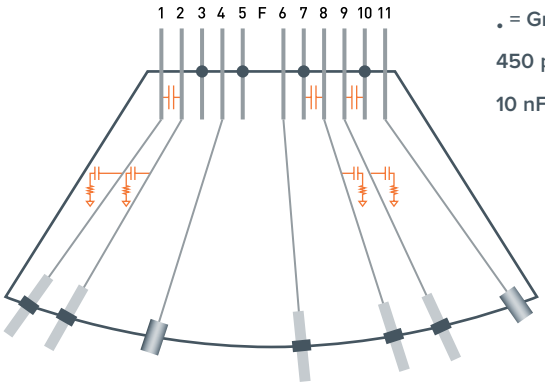
Ordering Information

See Unity Probe product page at www.formfactor.com/product/probes/rf-multicontact/unity-probe/ to learn how to create a configuration code.

Optional cables available

P/N 147-295	SMA Female to square pin 8 in. (20 cm) flex cable
P/N 147-364	2.92 mm Female to Gore 100 8 in. (20 cm) flex cable

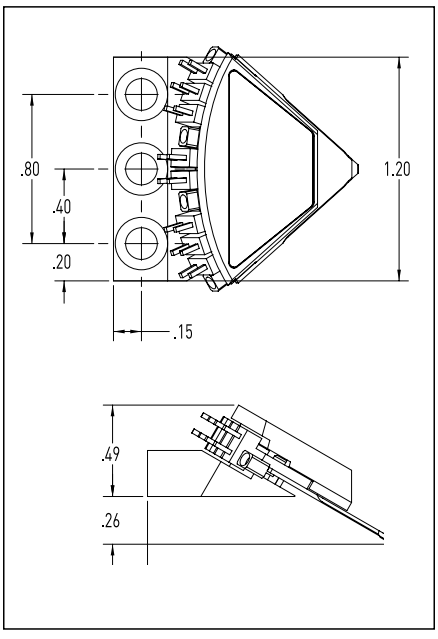
Sample Configuration: P’PGXLG’PP’G

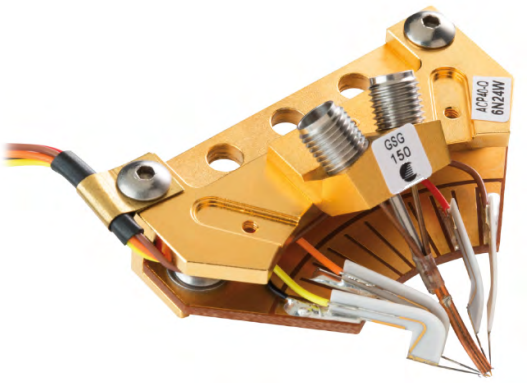


• = Ground connection

450 pF to adjacent finger

10 nF and 2.7 Ω to Ground





ACP Quadrant Probes

Quadrant Probes were developed in response to the need for multiple probe tips in a single module. Configurations consist of all RF or a combination of RF and DC.

The RF probes use Air Coplanar technology to produce a rugged microwave probe with a compliant tip for accurate, repeatable measurements on-wafer. The DC probes use ceramic blade needles for low noise and high performance.

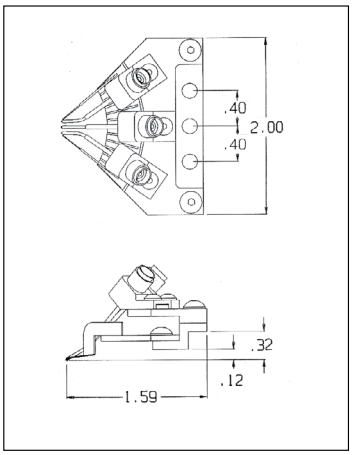
The ACP Quadrant Probes are customizable to fit your specific needs. Please contact us for available options and possible configurations.

Features

- Combination of DC and RF in a single probe module: One dual probe or a maximum of three RF Maximum of 9 DC standard (other quantities upon request).
- Utilizes ACP tip design, GSG, GS or SG
- RF tips available from DC to 110 GHz
- Choice of BeCu or tungsten tips
- DC power needles come standard with 100 pF microwave capacitor
- Power bypass inductance: 8 nH
- Max. DC voltage: 50 V without power bypassing (25 V with standard power bypassing, and component dependent with custom power bypassing)

Advantages

- Ideal for probing the entire circuit for functional test
- Dual ACP configuration supports differential signaling applications
- DC probes can provide power or slow logic to circuit under test



Probe style for: ACPyy-Q-1x, 2x & 30

Probe head type	Part number	Number of RF probes	Number of DC probes
ACP Quadrant Probe	ACPyy-Q-11	1	1
	ACPyy-Q-12	1	2
	ACPyy-Q-13	1	3
	ACPyy-Q-14	1	4
	ACPyy-Q-15	1	5
	ACPyy-Q-16	1	6
	ACPyy-Q-17	1	7
	ACPyy-Q-18	1	8
	ACPyy-Q-19	1	9
	ACPyy-Q-21	2	1
	ACPyy-Q-22	2	2
	ACPyy-Q-23	2	3
	ACPyy-Q-24	2	4
	ACPyy-Q-25	2	5
	ACPyy-Q-26	2	6
	ACPyy-Q-27	2	7
	ACPyy-Q-28	2	8
	ACPyy-Q-30	3	0
	ACPyy-Q-31	3	1
	ACPyy-Q-32	3	2

Notes:

1. yy refers to the connector type: 40 (2.92 mm), 50 (2.4 mm), 65 (1.85 mm), 110 (1.0 mm).
2. Use Quadrant Probe Design Capture Form to specify quantity of RF and/or DC probes, pitch, tip material, configuration and cabling.
3. ACPyy-Q-2x or ACPyy-Q-3x require a minimum pitch of 1200 µm.
4. A design capture form is available online to help with configuring and specifying the probe.

Multi IZI Probe and ProbeWedge

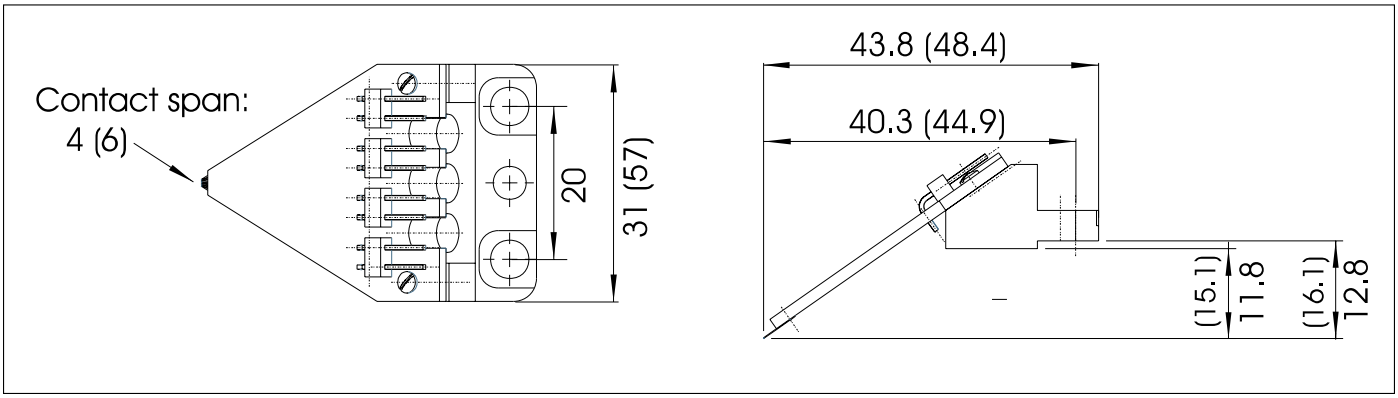
Accurate multi-contact probes with long life time for multiport and digital signal testing. Based on the durable IZI Probe design, Multi IZI Probes and ProbeWedge series allow up to 35 mixed-signal contacts on one probe, with optional on-board components. The Multi IZI Probe can also be integrated into the QuadCard™ for high-throughput RF testing.

Features

- Mix DC and RF/Microwave contacts
- Long lifetime (typically > 1,000,000 touchdowns)
- Excellent performance in temperatures ranging from 10 K to 200°C*
- Probe on any pad material with minimal damage

* Specific criteria and conditions apply. Contact your local Applications Support for more information.

Probe Type	Frequency	Configurable	Non-Uniform Pitch	Number of Contacts
Multi IZI Probe	DC – 25 GHz	Yes	Yes	Up to 35 contacts; can be customized for larger quantities
HF ProbeWedge	DC – 67 GHz	Yes	Yes	Up to 12 contacts
ProbeWedge WE	DC – 20 GHz	Yes	Yes	Up to 40 contacts
ProbeWedge WD	DC – 20 GHz	Yes	Yes	Up to 16 contacts



Multi IZI Probe 3 to 7 pins with medium board size (mm).
Variational figures for Multi IZI Probe 7 to 25 pins with large board size in brackets.

For more details, visit www.formfactor.com/products/probes

Multi-contact DC Probes

Eye-Pass Probe

The Eye-Pass multi-contact DC probe is designed to provide a multitude of simultaneous connections to a wafer or similar devices. The connections may be ground, logic/signal, standard power and Eye-Pass power. For power-supply connections, Eye-Pass high-performance power-bypass technology delivers low impedance and resonance-free power connections over an extremely wide frequency range. Used with ACP-series probes and/or multi-contact RF Unity Probes, Eye-Pass probes provide functional at-speed testing for Known-Good-Die. Customized for the user-selected footprint that best suits your application, Eye-Pass probes feature up to 12 contacts per probe head, precisely aligned in a highly durable precision tip cluster to provide high compliance.

Features

- High-performance power bypassing for low-impedance and oscillation-free testing to more than 20 GHz
- Mix multiple contact types: Ground, Power (Standard or Eye-Pass), Logic/Signal
- Low and repeatable contact resistance on aluminum pads (< 0.25 Ω on Al, < 0.01 Ω on Au)
- Long probe life with more than 250 k touchdowns for moderate volume production test

Electrical

- Maximum DC current: 1 A
- Maximum DC voltage: 50 V power bypass (>100 V other)
- Series resistance: < 1 Ω (not including Rc)
- Connector: 2 x12 square pin header (ground row furthest from tip), Direct mapping of connector pins to contacts (no custom routing)
- Eye-Pass bypass inductance: 0.4 nH

Mechanical

- Number of contacts: 2 to 12 (Missing contacts count toward max.)
- Available contact pitch: 100 to 250 µm uniform spacing
- Tip material Beryllium copper (BeCu) for gold pads (Au) or tungsten (W)
- Contact area: 50 µm x 50 µm (nominal)
- Contact life > 250 k touchdowns on aluminum pads, > 500 k touchdowns on gold pads

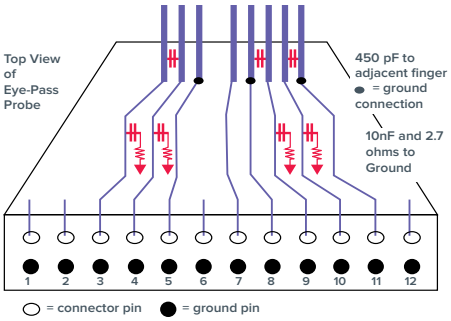
Ordering Information

See Eye-Pass Probe Design Capture page on Eye-Pass probe page at www.formfactor.com/product/probes/rf-multicontact/unity-probe/ to learn how to create a configuration code.

Optional cables available

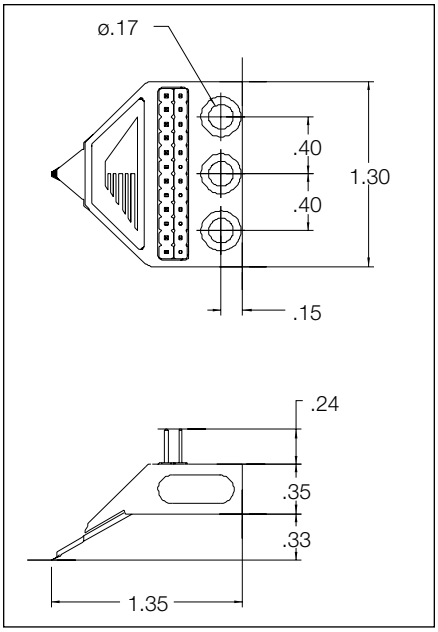
P/N 124-082 BNC Male to 2 pin Molex connector cable, 4ft length (single channel)

Sample Configuration: P'PGXLG'PP'G

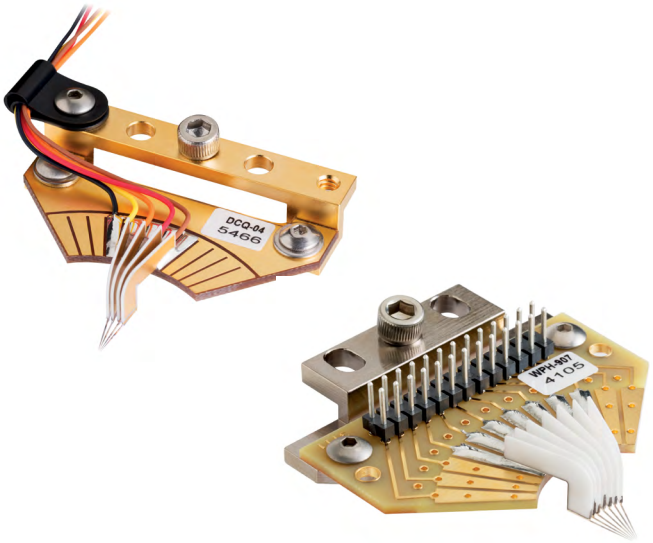


Conn Pin number	Contact	Type
1		No Contact
2		No Contact
3	P	Eye-Pass Power**
4	P	Eye-Pass Power
5	G	Ground
6	X	No Contact
7	L	Logic/Signal
8	G	Ground
9	P	Eye-Pass Power
10	P	Eye-Pass Power
11	G	Ground
12		No Contact

** Adjacent ground recommended for best Eye-Pass Power performance



Multi-contact DC Probes



Multiple configurations for functional circuit testing

The DCQ probes use controlled impedance, ceramic blade needles for low noise and high performance. This needle style allows the placement of high-quality bypass capacitors with very little series inductance due to their close proximity to the probe tip. All of the needles are connected to a common ground plane but individual needles can be easily (ground) isolated for additional low noise performance.

The WPH probes feature up to 12 ceramic-bladed, nickel-plated, tungsten needles with a 2 x 12 square pin cable interface. The circuit board has been laid out such that both series and shunt components can be added to the signal path of each needle.

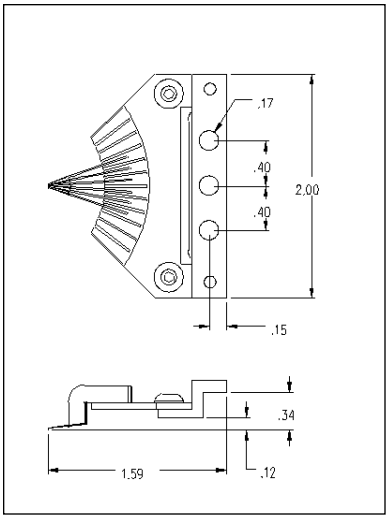
Features

- Customized to customer application
- Up to 16 DC for standard; maximum of 24 DC for custom
- Standard DCQ probes have flat tip needles available in nickel-plated tungsten or BeCu with diameters of 0.75 mil, 1.0 mil and 1.5 mil. WPH probes have full-radius, nickel-plated tungsten needles.
- Supports collinear and non-standard needle configurations
- Power bypass inductance: DCQ 8 nH, WPH 16 nH

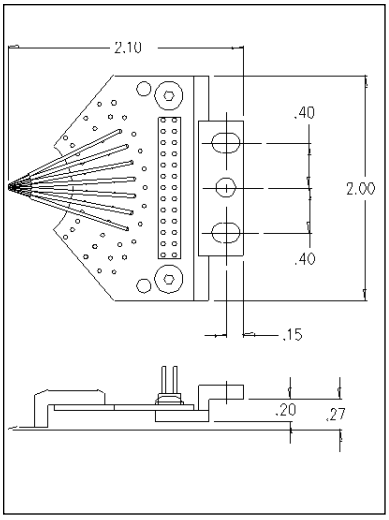
Advantages

- Ideal for probing the entire circuit for functional test
- DC probes can provide power or slow logic to circuit under test

Probe head type	Part number (yy= number of DC probes)	Max. number of DC probes	MicroChamber compatible	Connector
DCQ Quadrant Probe* custom version up to 24 (Note 1)	DCQ-yy	16	Yes (Note 5)	DCQ DC connections are supplied via a wire pig-tail to square pin header, standard. (Note 2)
WPH needle probe heads	WPH-9yy-xxx (Note 3) WPH-9yy-NS (Note 4)	12 12	No No	Circuit board mounted square-pin header, standard.



Probe style for: DCQ-YY



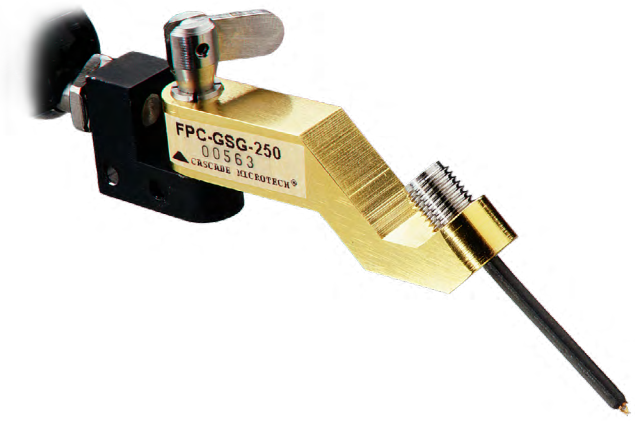
Probe style for: WPH-9YY

Notes:

1. Use Quadrant Probe Design Capture Form to specify number of DC needles and layout of DC lines.
2. Custom coax and triax cabling and/or connectors are available.
3. The -xxx suffix indicates probe contact center-to-center spacing (pitch) in microns, e.g. WPH-908-150 has 8 needles with a spacing of 150 µm (5.91 mils). Needles are in a collinear pattern with constant pitch.
4. Needles may be configured in a non-standard array and/or custom bypass components mounted on PCB.
5. MicroChamber compatibility up to 12 needles.

*** Maximum voltage is 50 V without power bypassing, 25 V with standard power bypassing, and component dependent with custom power bypassing option.**

Board Test and Signal Integrity Probes



Fixed-Pitch Compliant Probe (FPC)

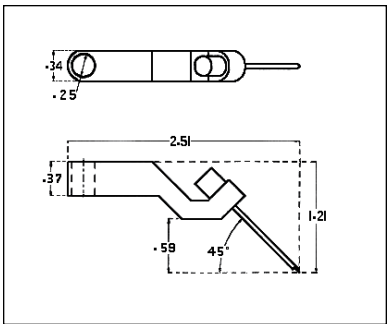
The FPC-Series (Fixed-Pitch Compliant) is a high-frequency 50 Ω coaxial probe that offers a signal line with either one or two low-inductance fixed-pitch ground contacts. The probe tip structure is lithographically defined for unsurpassed impedance control, preserving the highest integrity possible when launching and receiving signals from SMT boards, hybrids and multi-chip modules (MCM).

Features

- DC to 40 GHz bandwidth
- Maximum DC current: 5 A
- 10 ps rise time
- Low insertion and return loss
- 2 mils of tip-to-tip compliance
- High probing angle and clearance
- High-power handling capability

Advantages

- Maintains 50 Ω environment which allows accurate high-frequency measurement of microelectronic modules
- Compliant tips allow probing of non-planar structures
- BeCu tips provide longer probing life and reduce probe damage
- Access contacts close to components, module walls, or other obstructions



Probe style for: FPC

Probe head type	Part number (Notes 1,2,3)	Insertion loss, typical	Return loss min.	Connector & tip type	Recommended cable	Recommended ISS (100 to 250 µm)	Wide pitch (250 to 1250 µm)
DC-40 GHz (Note 4, 5)	FPC-GS-xxx	2.0 dB	10 dB	BeCu. 2.92 mm (f)	124-084-B	103-726	106-683
	FPC-SG-xxx	2.0 dB				103-726	106-683
	FPC-GSG-xxx	1.0 dB				101-190	106-682
DC-40 GHz (Note 4, 5)	FPC-W-GS-xxx	2.0 dB	10 dB	Tungsten 2.92 mm (f)	124-084-B	103-726	106-683
	FPC-W-SG-xxx	2.0 dB				103-726	106-683
	FPC-W-GSG-xxx	1.0 dB				101-190	106-682

Notes:

1. The -**xxx** suffix indicates probe contact center-to-center spacing (pitch) in microns, e.g. FPC40-SG-150 is 150 µm (5.91 mils). Contacts are on a constant pitch and width is approximately 50 µm.
2. The convention for describing probe head footprints is the sequence of contacts as seen looking down on the probe head tip in its functional position, with the tip pointing away from the viewer, describing contacts from left to right.
3. FPC standard pitches are 100, 125, 150, 200, 250, 350, 500, 650, 750, 1000 and 1250 µm. Non-standard pitches are available from 100 µm to 1250 µm and by special order to 3000 µm. Insertion loss applies to standard pitch range. Other pitches may have increased insertion loss. Adapter 106-835 is required for Summit Series positioners.
4. FPC GSG probes: 40 GHz up to 250 µm pitch, 20 GHz up to 1250 µm pitch and 3 GHz up to 3000 µm pitch.FPC GS/SG probes: 40 GHz up to 250 µm pitch, 18 GHz up to 500 µm pitch, 10 GHz up to 1250 µm pitch and 3 GHz up to 3000 µm pitch.
5. FPC probes are not designed for use with MicroChamber probing stations.
6. Use the standard RF mount to FP adapter (P/N 104-913).

Special Purpose Probes

Impedance Matching Probe

The FormFactor Impedance Matching Probes, using proven Air Coplanar Probe technology, are available in both reactive and resistive versions. A choice of either ACP or FPC body styles is available.

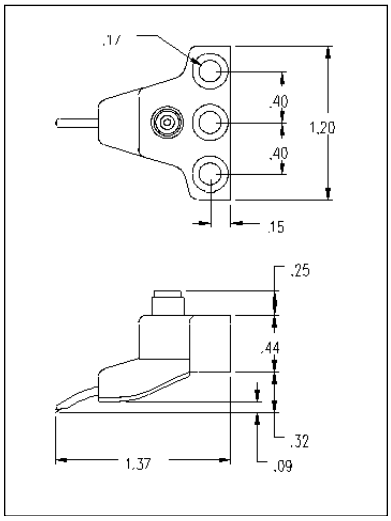
Reactive matching probes provide low-loss transitions such as to the low impedance outputs of power devices. Resistive matching probes are frequently used to singly terminate the patch to a low dynamic resistance laser diode for maximally flat modulation frequency response.

Features

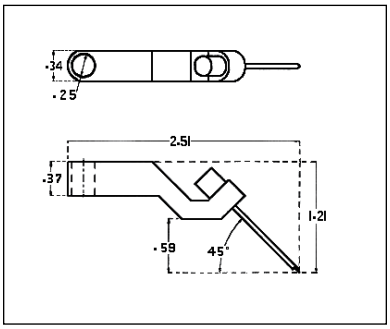
- Choice of reactive or resistive probe
- Choice of center frequency range, value and bandwidth
- Choice of probe tip impedance
- Choice of body styles, ACP or FPC

Advantages

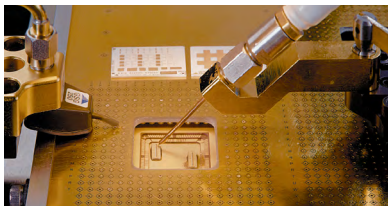
- Improved load-pull measurement tuning range
- Ability to make accurate on-wafer measurement of low-impedance power devices
- Stabilize oscillations in high-gain devices
- Impedance match to low dynamic resistance laser diodes
- Custom configured for your application



Probe style for: ACP20-Z, ACP40-Z and ACP-R



Probe style for: FPC-R



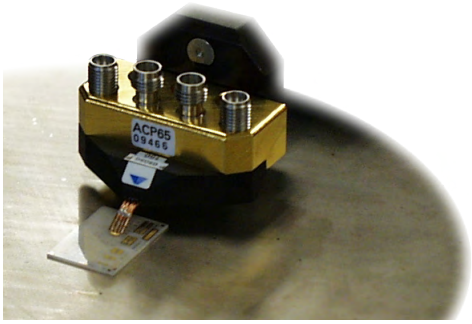
Probe head type	Part number (Note 1, 2, 3)	Center frequency	Bandwidth (GHz)	Connector & tip type	Impedance range (Ω)	MicroChamber compatible
Reactive Probe (Note 4)	ACP20-Z-GSG-xxx	0.85 to 20 GHz	< 10% Std. 10% to 20% optional	BeCu 2.92 mm (f)	24 to 50 Std. 10 to 24 optional	Yes
	ACP40-Z-GSG-xxx	20 to 40 GHz				
Resistive Probe (Note 4)	ACP-R-GS-xxx ACP-R-SG-xxx ACP-R-GSG-xxx		0 to 10	BeCu 2.92 mm (f)	45 ±5% Std. 10 to 300 optional	Yes
Resistive Probe (Note 4)	FPC-R-GS-xxx FPC-R-SG-xxx FPC-R-GSG-xxx		0 to 10	BeCu 2.92 mm (f)	45 ±5% Std. 10 to 300 optional	No

Recommended cable: 132-420 for Summit 11K/12K, and S300 probe stations; 101-162-B for M150, RF-1 and 9K non-MicroChamber stations

Notes:

1. The -**xxx** suffix indicates probe contact center-to-center spacing (pitch) in microns, e.g. ACP40-Z-GSG-150 is 150 µm (5.91 mils). Contacts are on a constant pitch and width is approximately 50 µm.
2. The convention for describing probe head footprints is the sequence of contacts as seen looking down on the probe head tip in its functional position, with the tip pointing away from the viewer, describing contacts from left to right.
3. ACP pitches are available from 50 µm to 1250 µm.
4. Use Impedance Matching Probe Order Form to specify centerfrequency, tip impedance, bandwidth, resistance value and pitch.

Special Purpose Probes



40/80 Gb/s High-Performance Quadrant Probe

Designed to provide wide bandwidth RF connections and simultaneous resonant free power bypass connections for the special needs of high-speed mixed-mode IC for optical networks.

- Low RF loss and excellent impedance control over very wide bandwidth
- High performance resonance-free bypass for low impedance power supplies
- Allows on-wafer evaluation of high performance digital circuits
- Minimal distortion of high-speed digital signals
- Maximized eye diagram test performance at wafer test
- Durable Air Coplanar tip technology for long contact life

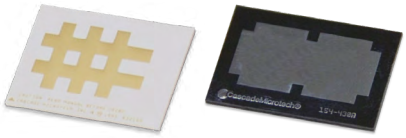
Cryogenic Probe

Designed to provide superior mechanical properties at cryogenic temperatures while maintaining solid RF measurement performance.

- Functional temperature range of -263 to +150°C
- Stainless steel tip material for thermal decoupling
- Coaxial cable with TCE matched inner and outer conductors
- Consistent tip geometry even at cryogenic temperatures

Supporting Accessories

Contact Substrate

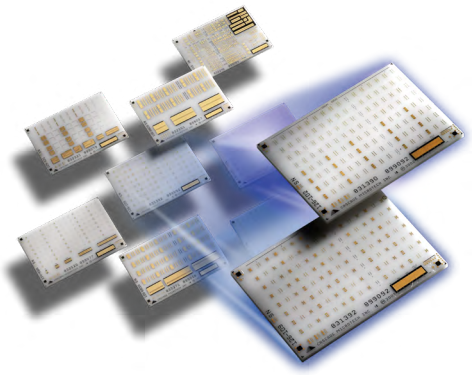


Ordering Information

Part Number	Description
005-018	Gold on ceramic. Used for planarization of probe.
154-430	Aluminum (2 µm) on silicon. Used for planarization of probes and looking at scrub marks.

Impedance Standard Substrate (ISS)

The FormFactor family of Impedance Standard Substrates (ISS) support all of your high-frequency probing applications. Using them ensures greater accuracy and better repeatability in on-wafer calibration of vector network analyzers. Only FormFactor offers the proven accuracy of LRRM calibrations with automatic load inductance compensation.



Ordering Information

Part number	Description	Cal sites	Pitch (µm)
005-016	General purpose	Cal sites vary	
101-190	LRM[1]	27 GSG	100 to 250
103-726	GS[1]	27 GS or SG	100 to 250
104-783	110 GHz and above	27 GSG	75 to 150
104-909	Narrow pitch[1]	13 GSG, 7 GS, 7 SG	50 to 150
106-682	Wide pitch GSG[1]	8 GSG	250 to 1250
106-683	Wide pitch GS/SG[1]	8 GS, 8 SG	250 to 1250
106-686	GP membrane[1]	25 loads	80 to 3000
108-010	Very wide pitch GSG[1]	4 GSG	150 to 3000
108-011	Very wide pitch GS/SG[1]	4 GS, 4 SG	150 to 3000
109-531	Right angle[1]	5 N-E, 5 N-W, 5 E-W	100 to 500
114-456	ACP-RC[1]	27 GSG	100 to 150
126-102	Dual/Differential[1]	17 GSGSG, SGS, SGSG, GSGS	150
129-239	Dual/Differential[1]	17 GSGSG, SGS, SGSG, GSGS	100 to 125
129-240	Dual/Differential[1]	17 GSGSG, SGS, SGSG, GSGS	150 to 225
129-241	Dual/Differential[1]	10 GSGSG, SGS, SGSG, GSGS	250
129-246	Dual/Differential[1]	18 GSSG, SSG, GSS	100 to 150
129-247	Dual/Differential[1]	18 GSSG, SSG, GSS	175 to 250
129-248[2]	General purpose thru[1]	Qty four each, straight, cross, loop back thrus	GSGSG (300 to 650) GSSG (300 to 950)
129-249[2]	General purpose thru[1]	Qty four each, straight, cross, loop back thrus	GSGSG (700 to 1250)[3] GSSG (1000 to 1250)[3]
138-356	110 GHz and above	15 GSG for 50 µm 15 GSG for 75 µm	GSG 50 to 75
138-357	110 GHz and above	9 GSG for 100 µm 9 GSG for 125 µm 12 GSG for 150 µm	GSG 100 to 150
143-033	LRM (110 GHz and above)	27 GSG	100 to 250

1. Recommended upper frequency: 67 GHz
2. Requires P/N 106-683 or P/N 129-249 for wide pitch differential/multiport applications
3. Qty 2 each for pitches 1000-1250 µm

Calibration Substrates for T-Wave Probes

Part number	Description	Pitch (µm)
172-885	Multi-line TRL Substrate, WR1.0, WR1.5, WR2.2, WR3.4, WR4.3, WR5.1	25
172-886	Multi-line TRL Substrate, WR2.2, WR3.4, WR4.3, WR5.1	50
172-887	Multi-line TRL Substrate, WR3.4, WR4.3, WR5.1	75 and 100

Supporting Accessories

Calibration Standard (CSR)

The CSR family of calibration substrates is compatible with the |Z| Probes. All CSR calibration substrates include the Open standard on the substrate itself, providing a more accurate calibration when compared to simply lifting the probes for Open. Also, the resistance of the Load standard remains stable within 0.3% of the ideal value (50 Ω), over a temperature range from 10 to 430 K.

Ordering Information

Part number	Description	Pitch (µm)
41702	|Z| Probe, CSR-4, GSG	250 to 500
41704	|Z| Probe, CSR-5, GS/SG	250 to 500
56407	|Z| Probe, CSR-6, GS/SG	50 to 250
62025	|Z| Probe, CSR-8, GSG	100 to 250
73319	|Z| Probe, CSR-9, GSG	50 to 150
62563	|Z| Probe, CSR-15, GSG	500 to 1250
69061	|Z| Probe, CSR-16, GS/SG	500 to 1250
71391	|Z| Probe, CSR-17, GSG	1000 to 2500
67074	|Z| Probe, CSR-18, GS/SG	1000 to 2500
51077	|Z| Probe, CSR-30, GSGSG	100
51078	|Z| Probe, CSR-31, GSGSG	150
51079	|Z| Probe, CSR-32, GSGSG	200
51080	|Z| Probe, CSR-33, GSGSG	250
51081	|Z| Probe, CSR-34, GSGSG	500
51082	|Z| Probe, CSR-35, GSGSG	125
51874	|Z| Probe, CSR-41, GSSG	125 to 150
51875	|Z| Probe, CSR-43, GSSG	200 to 250
51876	|Z| Probe, CSR-44, GSSG	400 to 600
52379	|Z| Probe, CSR-40, GSSG	100
53527	|Z| Probe, CSR-50, SGS	100
53528	|Z| Probe, CSR-51, SGS	125 to 150
53529	|Z| Probe, CSR-53, SGS	200 to 250
53530	|Z| Probe, CSR-54, SGS	400 to 500
71392	|Z| Probe, CSR-101, GSG/GS/SG	100 to 300
136643	|Z| Probe, Calibration substrate in a silicon wafer	

Supporting Accessories

Cables

FormFactor offers a wide variety of low-loss, thermally-stable cables, which ensure higher-quality measurements and repeatable calibration results. Each cable has a male connector at one end that connects to the probe and a female connector at the other end to connect to the test instrumentation. For vertical style probes, the male connector includes an integrated 90° elbow.

Freq (GHz)	Probe station	Body Style	Length	Part Number (J)	Part Number (G)
DC to 40	CM300xi, Elite300, SUMMIT200, Summit 11/12K	A	48 inch	180-802***	132-423***
		V	48 inch	180-803***	132-420***
	EPS with SMZ168, no MicroChamber	A	48 inch	180-800	124-084-B
	EPS with SlimVue, no MicroChamber	V	48 inch	180-801	101-162-B
DC to 50	CM300xi, Elite300, SUMMIT200, Summit 11/12K	A	48 inch	180-806***	132-424***
		V	48 inch	180-807***	132-421***
	EPS with SMZ168, no MicroChamber	A	48 inch	180-804	124-085-B
	EPS with SlimVue, no MicroChamber	V	48 inch	180-805	103-202-B
DC to 67	CM300xi, Elite300, SUMMIT200, Summit 11/12K	A	36 inch	180-810***	132-425***
		V	36 inch	180-811***	132-422***
	EPS with SMZ168, no MicroChamber	A	36 inch	180-808	124-606-B
	EPS with SlimVue, no MicroChamber	V	36 inch	180-809	124-605-B
DC to 110	CM300xi, Elite300, SUMMIT200, Summit 11/12K**	A	24 cm	180-813***	147-316***
	EPS150/200 with SlimVue, Summit 11/12K*	A	18 cm	180-812	132-458***
	CM300xi*, Elite300*, SUMMIT200*, EPS with SlimVue*	A	10 cm	-	178-383***
	CM300xi**, Elite300**, SUMMIT200**, EPS150/200 with SlimVue**	A	13 cm	-	178-387***

For applications above 50 GHz, a rear-mounted instrument rack is recommended.

*For single port
**For multiport
***Cables for shielded environments with TopHat

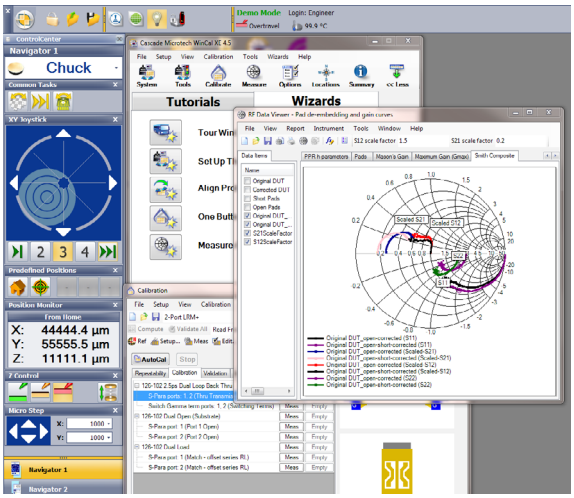
A = 45° angled coaxial connector body style
V = vertical coaxial connector body style
J = Junkosha cables
G = GORE cables

Consult factory for waveguide sections.

Supporting Software

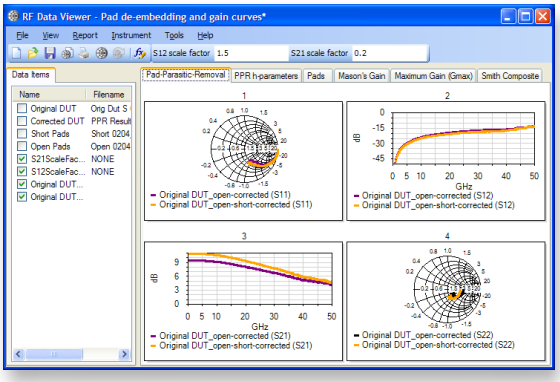
Accurate on-wafer S-parameter measurements up to 500 GHz and beyond

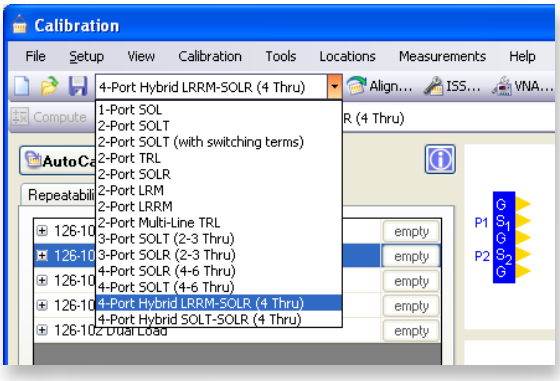
The WinCalXE software accurately calibrates the measurement system and automates measurements, data collection and data transformation, providing repeatable and precise S-parameter data. The WinCal XE 4.7 version is fully compatible with T-Wave Probes, Infinity Probes, ACP probes and |Z| Probes, and supports ISS, CSR and Multi-Line TRL substrates. It is also compatible with Velox™, ProberBench™ and Nucleus™ probe station software, and most commercially available Vector Network Analyzers.



Easy, fast, and accurate RF measurement
WinCal XE's guided and smart system setup and customizable Wizards ensure a correct system setup, reliable VNA calibration, and repeatable data.

Advanced capability for both present and the future
WinCal XE easily converts S-parameters to a device appropriate format, and also enables immediate and live data reduction and viewing. WinCal XE also provides the broadest range of VNA calibration choices up to 4 ports.





Key Features:

- Automatic VNA calibration using calibration method of your choice
- Extensive guidance for correct system setup and calibration
- Convert S-parameters to a device appropriate format
- Customizable display templates and Wizards that adapt to your need
- Powerful measurement sequencing capabilities
- LRRM-SOLR hybrid 4-port calibrations for precision 4-port calibrations
- Error Set Manager provides error set augmentation and error set comparison tools
- Multi-line TRL cal to compare your preferred calibration methods to a NIST-style calibration
- THz probing support
- Enhanced PNA interface for power calibration
- Additional remoting methods

Ordering information:

Part Number	Description
168-690	WinCal XE full version
168-691	WinCal XE full version, 30-day demo
168-692	WinCal XE upgrade version
168-693	WinCal XE university version

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