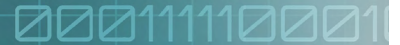


# High Power Probes

## High-voltage/Current Probes and Accessories



### Overview

Cascade high-power probes from FormFactor provide a complete on-wafer solution for over-temperature, low-contact resistance measurements of power semiconductors. Together with Tesla series on-wafer power device characterization system, FormFactor's high-power probes achieve reliable and repeatable on-wafer measurements up to 300 A and 10,000 V.

**Safety Notice:** The probes discussed within this data sheet are designed to be used on FormFactor Tesla on-wafer power device characterization systems that incorporate a light curtain, safety interlocks and other features required for the safe use of these types of probes. These probes are only meant to be used on Tesla systems or probing systems that have the same or substantially equivalent safety features. If there is any uncertainty with regard to the safety requirements for your application of these types of products or the safety features of your probing system(s), please consult with your company's safety officials.

### High-Power Probe Selection Guide

	UHP	HCP		HVP*		
		HCP-1B	HCP-BNC	HVP-3T	HVP-3C	HVP-13
<b>Max. pulsed current</b>	Up to 300 A	100 A	40 A	2 A	5 A	2 A
<b>Voltage</b>	Up to 10,000 V	500 V	500 V	3,000 V (Triax)	3,000 V (Coax)	1,500 V (Triax) 3,000 V (Coax)
<b>Typical probe body residual resistance</b>	≤ 5 mΩ	10 mΩ	10 mΩ	200 mΩ	30 mΩ	30 mΩ
<b>Typical probe life</b>	100,000 touchdowns	100,000 touchdowns	100,000 touchdowns	NA	NA	NA
<b>Probe configuration</b>	single, parallel	single, parallel	single	single	single	single
<b>Typical pad material**</b>	AlSiCu, AlSi, Al	AlSiCu, AlSi, Al, Au***	AlSiCu, AlSi, Al, Au***	AlSiCu, AlSi, Al, Au***	AlSiCu, AlSi, Al, Au***	AlSiCu, AlSi, Al, Au***
<b>Connector type</b>	Insulated HV Banana plug	Dual Banana plug	BNC	Coaxial (Keysight HV Triax)	Coaxial (SHV)	Coaxial BNC (Amphenol 11/16-24 Triax)
<b>Replaceable tip</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Configurable tip</b>	Yes	No****	No****	No	No	No

\* 5,000 V HVP and 10,000 V HVP probes available upon request.

\*\* For HVP probes, different needle types available depending on the pad materials. Please contact FormFactor for more information.

\*\*\* Can be used on Au with BeCu Tips.

\*\*\*\* Configurable tip available as a special request.

## UHP Probe

FormFactor's Ultra-High-Power Probe (UHP), a high-voltage parametric probe, handles both high voltage (up to 10,000 V) and high current (up to 600 A) at a wide temperature range (-55°C to 300°C).

The UHP achieves full I-V characterization with one setup and one touchdown. Together with Tesla on-wafer power device characterization system, the UHP fully utilizes the high-voltage/current capability of Keysight B1505A and N1265A Ultra High Current Expanders.

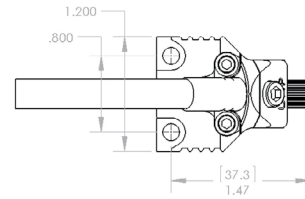
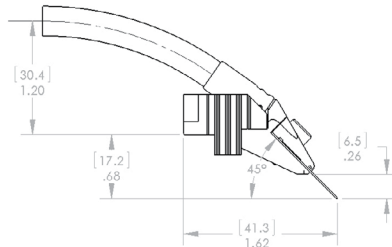
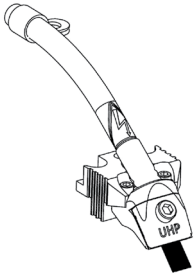
- Coaxial measurements up to 10,000 V and 300 A pulsed (20A DC), without the need for multiple probes and multiple measurement setup changes
- Innovative multi-finger tip design to achieve even distribution of current and minimize pad damage
- Probe current can be doubled up to 600 A when using double probe configuration
- Highly reliable, stable and repeatable measurements with Keysight B1505A and N1265A Ultra High Current Expander



### UHP Probe Holder

Maximum voltage	10,000 V DC at 200°C, 8,000 V at 300°C
Maximum current	300 A pulse (600 A in a parallel configuration) / 20 A DC
Operating temperature range	-55°C to 300°C
Connector type	High-voltage Banana (4 mm)
Length of cable	1 m
Positioner compatibility	SUMMIT™ RF positioners
Probe residual resistance	≤ 5 mΩ
Probe insulation resistance	> 10 TΩ at 25°C (chuck temperature) > 3 TΩ at 200°C (chuck temperature) > 1 TΩ at 300°C (chuck temperature)

## Physical Dimensions



### UHP Probe Tips

Typical contact resistance on AISiCu	$< 2 \text{ m}\Omega$ (AISiCu metal layer) for 12 fingers $< 3 \text{ m}\Omega$ (AISiCu metal layer) for 8 fingers tip $< 6 \text{ m}\Omega$ (AISiCu metal layer) for 4 fingers tip $< 30 \text{ m}\Omega$ (AISiCu metal layer) for 1 fingers tip	
Tip material	Tungsten	
Recommended range of overtravel	125-250 $\mu\text{m}$	
Scrub	~150 $\mu\text{m}$ (at 300 $\mu\text{m}$ overtravel)	
Finger width	Approximately 250 $\mu\text{m}$	
Finger pitch	650 $\mu\text{m}$	
Probe tip layouts	12 fingers (300 A)	7400 $\mu\text{m}$ width
	8 fingers (200 A)	4800 $\mu\text{m}$ width
	4 fingers (100 A)	2200 $\mu\text{m}$ width
	1 finger (25 A)	250 $\mu\text{m}$ width

## ➤ HCP Probe

FormFactor's High-Current Probe (HCP) reduces probe and/or device destruction at high currents. It supports 10 A DC and up to 100 A of pulsed current. By design, the probe tip minimizes contact resistance at the wafer-to-probe interface to prevent device heating at the tip.

The innovative multi-finger probe tip design distributes current evenly over multiple contact points and is joined by a single heat sink that pulls heat from the probe tip.

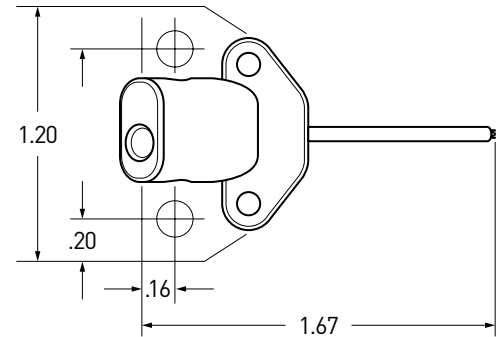
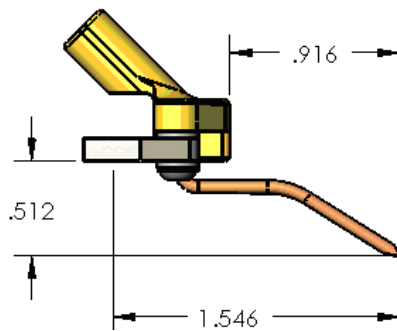
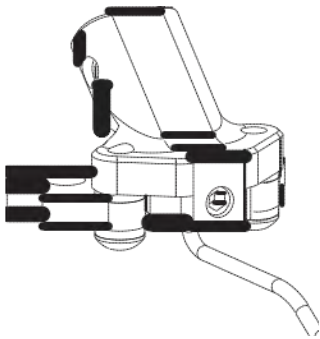
- Minimal contact resistance at the pad-tip junction to reduce heating during measurements, with fewer probe marks
- Measure devices on wafer at high-current conditions over a wide temperature range (-55°C to 300°C)
- Small scrub minimizes damage on Al pad
- Small footprint - tip for small pad probing down to 1 mm x 1 mm pad



### HCP Probe Holder

Maximum voltage	500 V DC Maximum current (DC) 10 A
Maximum current (pulse)	100 A, 1msec max PW, 1% max duty cycle (BNC: 40 A, 1msec max PW, 1% max duty cycle)
Total resistance with tip	10 mΩ (typical)
Operating temperature range	-55°C to 300°C
Isolation resistance	> 100 GΩ at 500 V
Connector type	Dual banana jack or BNC
Length of cable	1 m (BNC: 0.76 m)
Positioner compatibility	Summit RF positioner

## ➤ Physical Dimensions

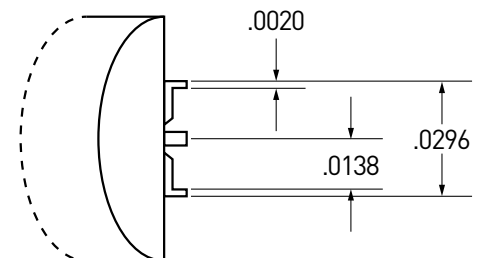
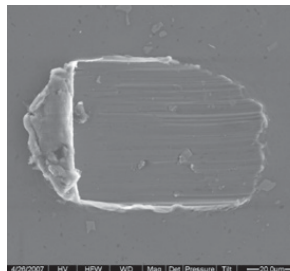


### HCP Probe Tips

Typical contact resistance on Al	20 mΩ
Tip material	Tungsten
Recommended range of overtravel	75-125 μm
Contact force	20 grams per tip (60 grams total) at 100 μm overtravel
Scrub	75 μm

### Typical Scrub Mark on Al Pads

The Tesla system HCP probe has been specifically designed for the purpose of minimizing contact resistance, while reducing the amount of probe damage and/or destruction of the device under test. Pictured here is a typical scrub mark on Al pads.



## > HVP Probe

To ensure precision measurements of today's high-voltage devices, FormFactor's High-Voltage Probes (HVP) provide increased isolation resistance and dielectric strength by incorporating advanced internal isolation materials, as well as custom cabling and connectors.

When used with Tesla on-wafer characterization system, the HVP assures low-noise electrical performance and full triaxial capability at high voltage without any breakdowns.

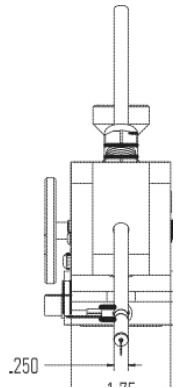
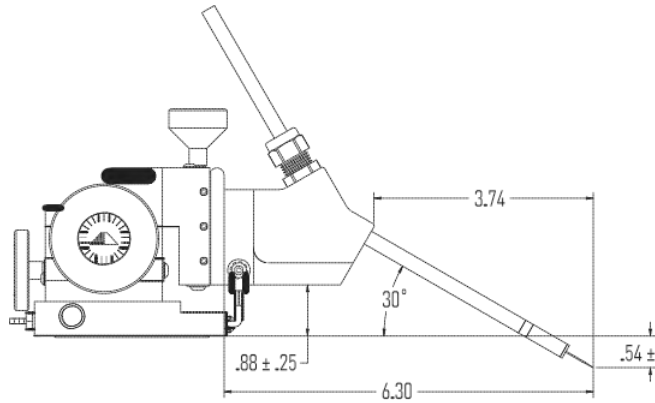
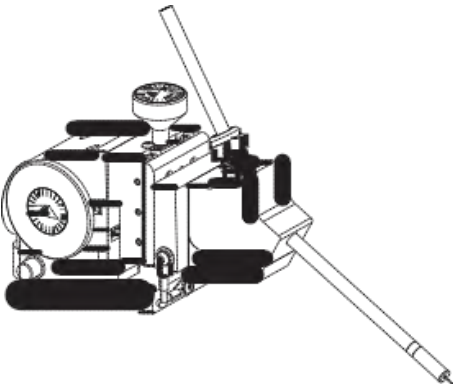
- Accurate coaxial and triaxial measurements up to 10,000 V for a much better understanding of device leakage in the off state
- Highly reliable, stable and repeatable measurements over a wide temperature range (-55°C to 300°C)
- Field-replaceable tips available in a variety of diameters to accommodate device dimensions



### HVP Probe Holder

Maximum voltage guarded (triaxial)	3,000 V DC
Maximum voltage unguarded (coaxial)	10,000 V DC
Maximum current	5 A pulse / 1 A DC
Operating temperature range	-55°C to 300°C
Isolation resistance (force to guard)	> 1 TΩ at 3,000 V
Typical residual capacitance (with PTT needle)	< 0.5 pF
Cable characteristics	Approximately 50 Ω (48 Ω)
Connector type	Amphenol triax threaded 11/16-24, SHV, UHV, or Agilent high-voltage triaxial connector (connector may limit maximum voltage performance)
Replaceable tip type	Straight PTT style needles
Recommended range of overtravel	50 μm to 100 μm
Scrub	20 μm to 40 μm
Positioner compatibility	DPP series positioners

## > Physical Dimensions



### Typical High-Voltage Triaxial Probe Noise (HVP-3T)\*

	10 V				3,000 V			
	- 55°C	25°C	200°C	300°C	- 55°C	25°C	200°C	300°C
Temperature	- 55°C	25°C	200°C	300°C	- 55°C	25°C	200°C	300°C
Noise	30 fA	30 fA	30 fA	30 fA	100 fA	100 fA	100 fA	100 fA

### Typical High-Voltage Coaxial Probe Leakage (HVP-3C)

	10 V				3,000 V			
	- 55°C	25°C	200°C	300°C	- 55°C	25°C	200°C	300°C
Temperature	- 55°C	25°C	200°C	300°C	- 55°C	25°C	200°C	300°C
Noise	30 fA	30 fA	30 fA	30 fA	100 fA	100 fA	100 fA	100 fA

