PS00xxA Optically Isolated Differential Probes and Accessories

Streamline safe, isolated insights

Introduction

Galvanically isolated voltage probes separate the device under test (DUT) from the oscilloscope and earth ground, enabling safer and more accurate measurements. This isolation effectively rejects common-mode signals, minimizes noise interference, and eliminates ground loops in high-voltage environments. A high common-mode rejection ratio (CMRR) is essential for capturing small signals accurately, even in the presence of large common-mode voltages at floating nodes. The CMRR of an isolated probe can be over 100 million times greater than that of a standard differential voltage probe referenced to earth ground.

Beyond high CMRR and enhanced safety, isolated probes offer additional advantages over standard differential probes. Their isolation makes them less susceptible to electromagnetic interference (EMI), reducing signal distortion. Additionally, Keysight's isolated probes support higher offset voltages and wider differential voltage ranges at higher bandwidths, ensuring precise measurements of fast-switching signals and transients in noisy, high-common-mode environments.

Note: This probe is not designed as a handheld probe due to safety and performance concerns.

Applications

Isolated probes offer significant benefits across multiple industries and applications. Most commonly used in power electronic full-bridge and half-bridge architectures, they enhance efficiency and performance testing of fast-switching devices such as wide bandgap GaN and SiC semiconductors. With support for high-voltage differential measurements up to ±2,500 V and the ability to reject common-mode signals up to ±60,000 V, isolated probes play a critical role in applications like automotive electric vehicle (EV) testing and photovoltaic solar power conversion. Other key applications include:

Semiconductor

- Developing power semiconductors, including MOSFETs, IGBTs, and wide bandgap SiC/GaN transistors.
- Testing power converters, inverters, motor drives, and associated evaluation boards.
- Evaluating power management ICs for DC-DC converters, voltage regulators, and battery management systems (BMS).

Automotive

- Testing electric vehicle (EV) powertrains, BMS, and other high-voltage automotive components, including inverters, on-board chargers, and DC-DC converters.

Aerospace and Defense

- Analyzing high-voltage systems in aircraft and spacecraft, such as power distribution for avionics.

Power Electronics

- Debugging power electronic systems like variable frequency drives (VFDs) and motor controllers used in automation, robotics, and HVAC systems.
- Verifying products against safety and regulatory standards, such as IEC 61010, UL, or other EMC requirements for isolated measurements.

Energy

- Validating photovoltaic inverters, wind turbine power systems, and grid-tied energy storage systems.
- Developing and evaluating HVDC converters used in power distribution networks.
- Designing and testing uninterruptible power supplies (UPS) and generators.

Probes, Tips, and Accessories

The main body of the isolated probe consists of a probe pod and sensor head. The pod contains the AutoProbe 1 interface that connects to the oscilloscope input. A probe tip is required to connect the sensor head to the DUT for measurements. Tips are sold separately and vary in voltage performance and connector type.

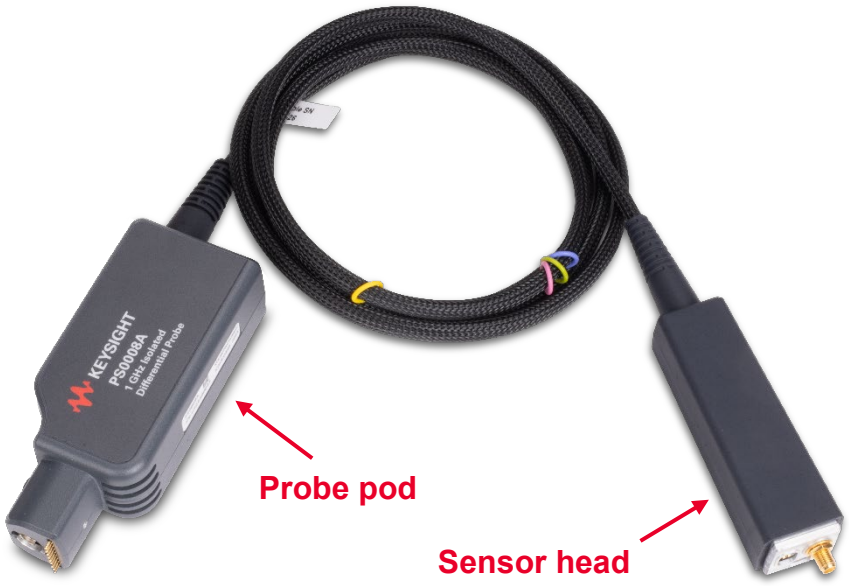


Figure 1. PS0008A 1 GHz isolated probe consisting of a probe pod and sensor head.

Figure 2. MMCX probe tip

Figure 3. 0.100” pitch square pin probe tip

Figure 4. 0.200” pitch square pin probe tip

Each probe comes standard with a bipod. Use of the bipod is recommended for maximum CMRR performance and for measurement setups with voltages larger than 30 Vrms.

Figure 5. Each probe comes with a bipod (PS0013A-64701) for hands-free use.

Model information

	Model	Description
Probes	**PS0004A**	Optically Isolated Differential Probe, 350 MHz, 2-meter
	PS0006A	Optically Isolated Differential Probe, 700 MHz, 2-meter
	PS0008A	Optically Isolated Differential Probe, 1 GHz, 2-meter
Probe Tips	**PS0017A**	Probe Tip, ± 10 V, MMCX
	PS0018A	Probe Tip, ± 30 V, MMCX
	PS0019A	Probe Tip, ± 250 V, MMCX
	PS0022A	Probe Tip, ± 10 V, 100 mil pitch, 0.025” square pin socket
	PS0023A	Probe Tip, ± 100 V, 100 mil pitch, 0.025” square pin socket
	PS0025A	Probe Tip, ± 500 V, 100 mil pitch, 0.025” square pin socket
	PS0027A	Probe Tip, ± 1000 V, 200 mil pitch, 0.025” square pin socket
	PS0028A	Probe Tip, ± 2500 V, 200 mil pitch, 0.025” square pin socket
Accessories	**PS0013-64701**	Bipod (included with each probe)
	8710-2466	SMA Wrench (included with each probe)
	PS0010A	Basic Connectivity Kit
	PS0014A	Isolated Probe Adapter for 3D Probe Positioner (N2787A)
	PS0015A	Probe Deskew and Performance Verification Kit with MMCX

The Basic Connectivity Kit (PS0010A) includes the following accessories:

- DP0021-60002 Solder-in Y-lead tip qty. 1
- DP0021-60001 Socketed Y-lead tip qty. 1
- PP0013-60001 MMCX to square pin adapter qty. 1
- 1400-3652 Micro SMD clip qty. 2
- Microcircuit hook test clips qty. 2
- Channel identification rings qty. 12

Figure 6. Basic connectivity kit (PS0010A)

For sturdier positioning and placement, an adapter for Keysight's 3D probe positioner (N2787A) is available. The adapter requires assembly once delivered.

Figure 7. Adapter for 3D probe positioner disassembled (left) and assembled (right)

The deskew and performance verification kit (PS0015A) for the isolated probes is designed for use with the MMCX connector-style tips. The PS0015A PV fixture is meant only for deskew and performance verification of the probe. It is not designed for any other testing purpose. This fixture is safely rated to the maximum of 30 Vrms / 42 Vpk / 60 V_{DC}. Do not use it on voltages higher than this rating. The PV fixture kit includes one of each of the following:

- Deskew fixture with MMCX connector
- SMA (male) to SMA (male) adapter
- SMA (male) to BNC (female) adapter
- BNC (male) to SMA (male) adapter
- 50 Ω SMA terminator

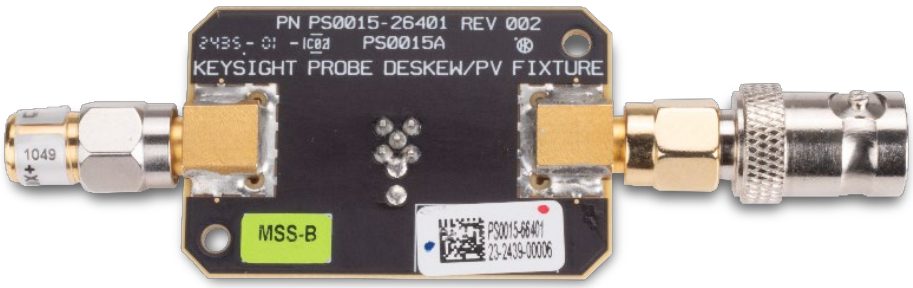


Figure 8. Deskew and performance verification fixture (PS0015A) with SMA and BNC adapters

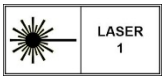
Electrical Specifications and Characteristics

Probe pods and sensor heads

The electrical ratings below are for probe pods and sensor heads without a probe tip. Each isolated probe requires the use of a probe tip, and therefore, the lower electrical rating of the two is applicable when used in combination.

	PS0004A	PS0006A	PS0008A
Bandwidth (-3 dB)[1]	350 MHz	700 MHz	1 GHz
Probe interface	AutoProbe 1	AutoProbe 1	AutoProbe 1
Cable length	2 m	2 m	2 m
Cable type	Optical fiber bundle		
Overvoltage and measurement category per IEC -61010-031[2]	Non-CAT (mains isolated)		
Safety certification	UL-certified		
Output drive	50 Ω		

Laser certification



These probes are Class 1 laser systems under “Normal Use” conditions and comply with IEC 60825-1:2014 standards for laser systems.

View the User Guide for additional certifications.

[1] Denotes a warranted specification using the PS0008A 1 GHz isolated probe with the PS0017A 10 V MMCX probe tip. All other measurements are typical.

[2] IEC Measurement Category MAINS ISOLATED is for measurements performed on circuits not directly connected to mains.

Probe tips

The electrical ratings given below are for probe tips only. Each isolated probe requires the use of a probe tip, and therefore, the lower electrical rating of the two is applicable when used in combination. Specifications represent warranted (as noted) and typical performance after the recommended 30-minute warm-up period.

	PS0017A	PS0018A	PS0019A	PS0022A	PS0023A	PS0025A	PS0027A	PS0028A
Max bandwidth[3]	1 GHz							
Rise time (10-90%)	427 ps	430 ps	365 ps	401 ps	349 ps	336 ps	299 ps	323 ps
Max measurable differential signal ⚠ **($V_{AC,peak}$ + V_{DC} - V_{offset})**[4a,b]	±10 V	±30 V	±250 V	±10 V	±100 V	±500 V	±1,000 V	±2,500 V
Max measurable AC differential signal ($V_{AC,peak}$)[3a,b]	±10 V	±30 V	±250 V	±10 V	±100 V	±500 V	±1,000 V	±2,500 V
Max non-destructive differential voltage ($V_{AC,peak}$ + V_{DC})[3a,b]	±250 V	±250 V	±250 V	±500 V	±500 V	±500 V	±2,500 V	±2,500 V
Max offset (V)[3b]	±250 V	±250 V	±250 V	±250 V	±500 V	±500 V	±2,500 V	±2,500 V
Offset error	±0.5% after calibration, ±2% within 2°C of calibration temperature of pod or sensor							
Differential DC gain accuracy	±1% after calibration, ±1.5% within 2°C of calibration temperature of pod or sensor							
Max common-mode voltage range	±60,000 V							
Common mode rejection ratio (CMRR)								
DC[5]	> 180 dB	> 180 dB	> 180 dB	> 180 dB	> 180 dB	> 180 dB	> 180 dB	> 180 dB
100 kHz	118 dB	102 dB	95 dB	102 dB	102 dB	87 dB	83 dB	74 dB
1 MHz	103 dB	103 dB	92 dB	101 dB	97 dB	84 dB	79 dB	72 dB
10 MHz	93 dB	93 dB	89 dB	87 dB	84 dB	84 dB	79 dB	75 dB
100 MHz	65 dB	63 dB	54 dB	51 dB	48 dB	52 dB	63 dB	49 dB
500 MHz	55 dB	57 dB	43 dB	27 dB	24 dB	23 dB	15 dB	13 dB
1 GHz	54 dB	43 dB	25 dB	22 dB	16 dB	14 dB	9 dB	5 dB
Input impedance[1]	10 MΩ // 3 pF			10 MΩ // 3.5 pF		40 MΩ // 3.5 pF		
Connector type[6]	MMCX			0.100” pitch, 0.025” square pin		0.200” pitch, 0.025” square pin		
System Noise (rms)								
PS0004A (350 MHz)	20 mV	60 mV	504 mV	20 mV	201 mV	1.00 V	2.07 V	5.20 V
PS0006A (700 MHz)	25 mV	76 mV	637 mV	25 mV	254 mV	1.27 V	2.62 V	6.58 V
PS0008A (1 GHz)	32 mV	96 mV	802 mV	32 mV	320 mV	1.60 V	3.30 V	8.29 V

[3] Denotes a warranted specification using the PS0008A 1 GHz isolated probe with the PS0017A 10 V MMCX probe tip as per the performance verification procedure outlined in the User Guide. All other measurements are typical.

[4] (a) Derated with frequency. See voltage derating curves. (b) View the diagram in Figure 9 to compare input voltage ranges.

[5] If an optically isolated probe is held with a non-conducting probe holder that has virtually no DC leakage to the surrounding environment (i.e. very high resistance) then the DC CMRR becomes unmeasurable in practice and is considered nearly infinite.

[6] View the User Guide for connector dimensions.

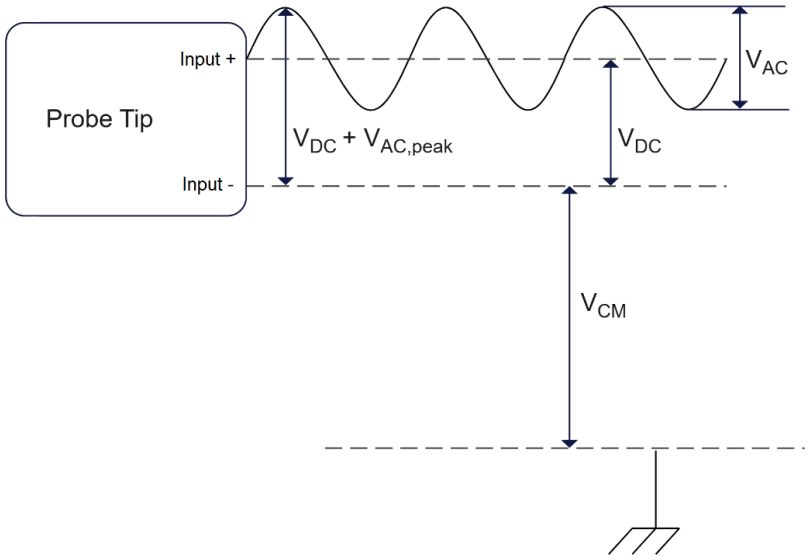


Figure 9. Depiction of the isolated probe input voltage ranges.

Mechanical and Environmental Characteristics

Characteristic	Probe pod	Sensor head	Probe tip
Dimensions	124 x 36 x 53 mm	99 x 30 x 25 mm	232 x 35 x 29 mm (MMCX) 238 x 35 x 29 mm (100 mil) 257 x 35 x 29 mm (200 mil)
Combined probe + tip length	MMCX: 2,432 mm ±30 mm 100 mil: 2,438 mm ±30 mm 200 mil: 2,457 mm ±30 mm		
Approximate weight	375 g (probe pod + sensor head)		40 g
Oscilloscope interface	AutoProbe 1		
Temperature Operating Non-operating	 5°C to +40°C -40°C to +70°C	 0°C to +55°C -40°C to +70°C	 -40°C to +85°C -40°C to +85°C
Altitude Operating[7] Non-operating	 3,100 m (10,171 ft) 4,600 m (15,092 ft)	 3,100 m (10,171 ft) 4,600 m (15,092 ft)	 3,100 m (10,171 ft) 4,600 m (15,092 ft)
Humidity Operating Non-operating	 Up to 80% RH at 40 °C, non-condensing +40 °C, 95% RH (≤ 39.0 °C Dew Point) derated linearly to 25% RH at 70 °C	 Up to 85% RH at 55 °C, non-condensing +40 °C, 95% RH (≤ 39.0 °C Dew Point) derated linearly to 25% RH at 70 °C	 Up to 85% RH at 85 °C, non-condensing +40 °C, 95% RH (≤ 39.0 °C Dew Point) derated linearly to 25% RH at 70 °C
Pollution degree[8]	2 (rated for indoor use only)		

[7] Qualified for 140 hours of continuous use.

[8] Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.

Performance Plots (Typical)

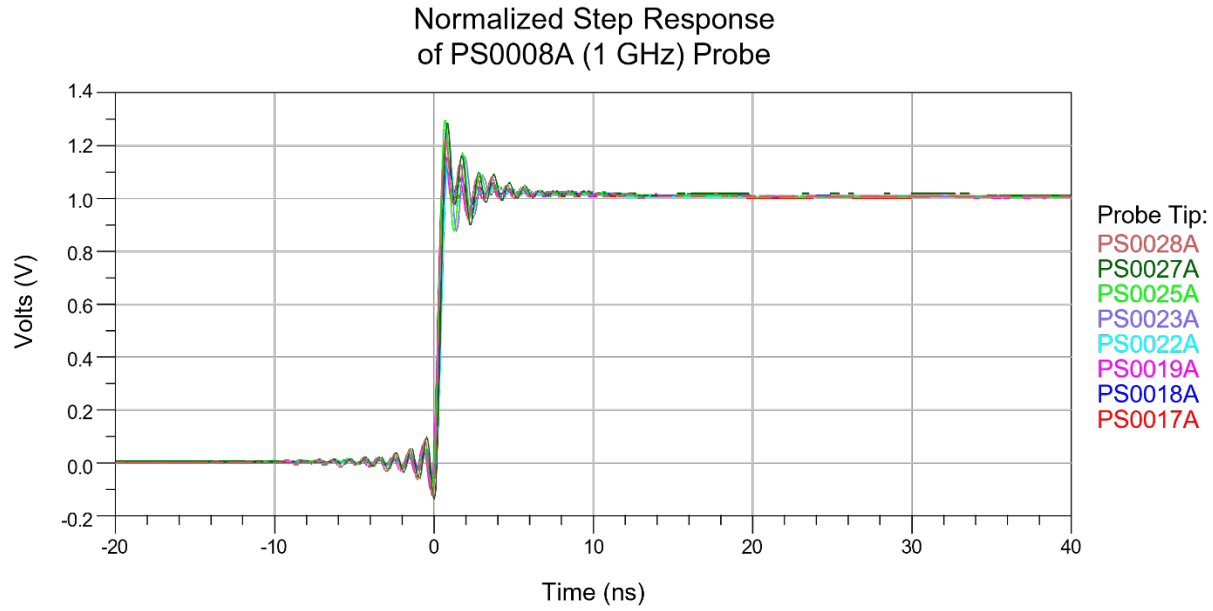


Figure 10. Normalized step response of each probe tip using the PS0008A 1 GHz isolated probe with each probe tip. View the probe tip electrical specifications for 10-90% rise times.

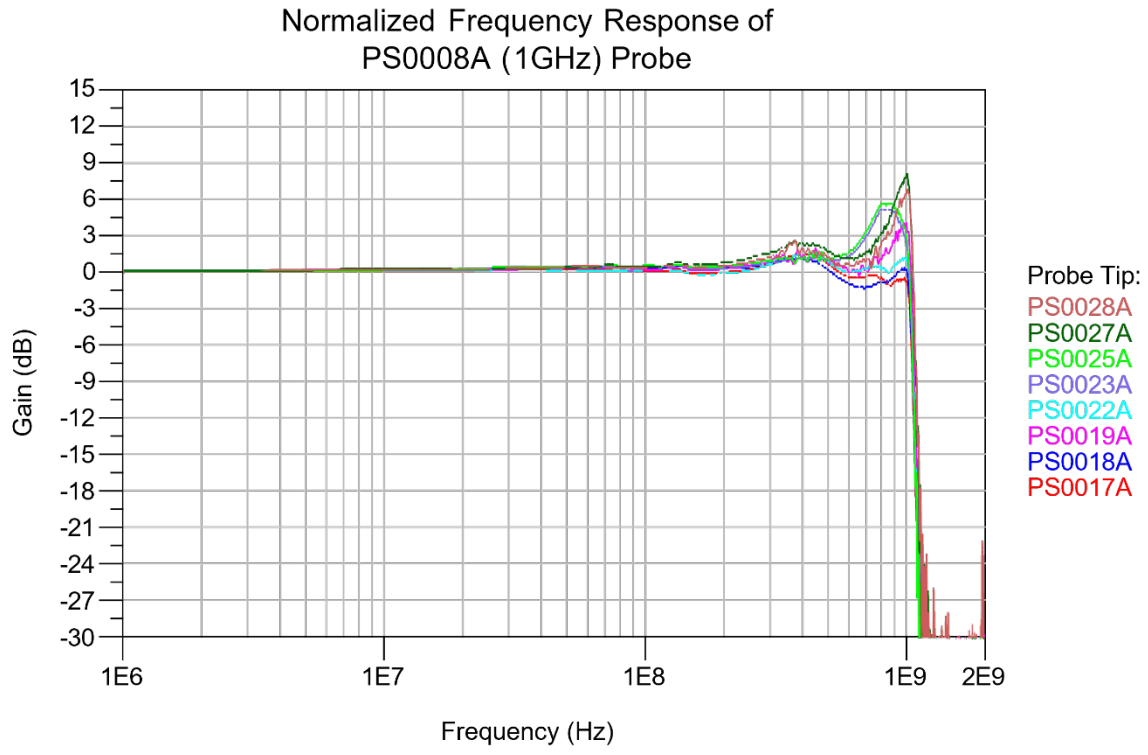


Figure 11. Normalized Vout/Vin maximally frequency response of PS0008A 1 GHz isolated probe with ach probe tip.

Oscilloscope Compatibility

The PS00xxA isolated probes contain Keysight's AutoProbe 1 interface and are compatible with the Infiniium EXR and MXR-Series Oscilloscopes with software version 11.70 or higher.

Ordering Information

Product description	Model number	Services
Optically Isolated Differential Probe, 350 MHz, 2-meter*	PS0004A	1-year warranty and calibration with the option to extend to 3 and 5 years.
Optically Isolated Differential Probe, 700 MHz, 2-meter*	PS0006A	
Optically Isolated Differential Probe, 1 GHz, 2-meter*	PS0008A	
Probe Tip, ± 10 V, MMCX	PS0017A	1-year warranty
Probe Tip, ± 30 V, MMCX	PS0018A	
Probe Tip, ± 250 V, MMCX	PS0019A	
Probe Tip, ± 10 V, 100 mil square pin socket	PS0022A	
Probe Tip, ± 100 V, 100 mil square pin socket	PS0023A	
Probe Tip, ± 500 V, 100 mil square pin socket	PS0025A	
Probe Tip, ± 1000 V, 200 mil square pin socket	PS0027A	
Probe Tip, ± 2500 V, 200 mil square pin socket	PS0028A	
Basic Connectivity Kit	PS0010A	90-day warranty
Isolated Probe Adapter for 3D Probe Positioner (N2787A)	PS0014A	
Probe Deskew and Performance Verification Kit with MMCX	PS0015A	

* Bipod and SMA wrench included