Tektronix®

Active Power Rail Probes
TPR1000 • TPR4000 Datasheet

The TPR1000 and TPR4000 probes provide a low noise, large offset range solution for measurement of ripple on DC power rails ranging from –60 to +60 VDC. Tektronix's power rail probes offer industry leading low noise and high offset range required to measure AC ripple between 200 μV_{p-p} and 800 mV_{p-p} at up to 4 GHz.

Key performance specifications

- Compatible with the 6 series MSO, 5 series MSO, MSO/DPO3000, MDO/DPO4000, MSO/DPO5000, DPO7000, and DPO70000 [1] oscilloscopes

- Bandwidth: [2] [3]
  - DC coupling mode:
    - TPR1000: DC to 1 GHz
    - TPR4000: DC to 4 GHz
  - DC reject mode:
    - TPR1000: 10 kHz to 1 GHz
    - TPR4000: 10 kHz to 4 GHz

- Linear dynamic range: Up to 60 V DC, 1V_{p-p} to bandwidth [4]

- Attenuation: 1.25x [2]

- Measurement accuracy:
  - DC linearity: <0.1%
  - Step response long-term aberrations: ±1%

- Noise:
  - <300 μV_{p-p} noise on 6 Series MSO (20 MHz BW Limit)
  - <1 mV_{p-p} noise on 6 Series MSO (Full Bandwidth)

- Input impedance:
  - 50 kΩ DC to 10 kHz
  - 50 Ω AC > 100 kHz

- Temperature range at tip: [5]
  - –40 to +85 °C (standard accessories)
  - –40 to +155 °C (high temperature cable option)

- Offset:
  - ±60 V offset range
  - Offset setting error: ±2 mV max, ±0.4 µV typical

Applications

- Probing chipsets for power rail voltage supply and control in automotive, industrial and consumer markets

- Probing digital power management, memory and Ethernet connectivity

- Probing noise sources on high-frequency power rails

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[1] DPO70000 oscilloscopes require the optional TCA-VPI50 adapter.

[2] Frequency response optimized for <1 Ω source impedance.

[3] Through SMA-to-SMA cable or Solder Micro-Coax tip.

[4] Max AC RMS of 1 V.

[5] Comp box and oscilloscope temperature range limited to 0 to +55 °C.

Why use a power-rail probe?

The added functionality, higher density, and faster switching speeds of modern electronic products drive the need for lower supply voltages. Designers need to zoom-in on power rails to look for high-frequency intruder signals, measure ripple and analyze coupling effects with tighter tolerances. Oscilloscopes often don't have enough offset to shift the noise and ripple on DC rails to the center of the screen to make the needed measurements.

The TPR1000 and TPR4000 probes provide a low-noise measurement solution (oscilloscope and probe), which is critical to not confuse the noise of the oscilloscope and probe with the noise and ripple of the DC supply being measured. The higher input impedance in the probes minimize the oscilloscope loading effect on DC rails (50 kΩ at DC). The probes provide higher bandwidth to see more signal content (harmonics, faster ripples, etc.) on DC rails that could affect data signals, clocks, etc.

The TPR1000 and TPR4000 provide a best-in-class integrity solution for power integrity and validation engineers in the high speed (µP), low power (mobile) and switched-mode power supply markets. The probes are designed to offer the lowest noise with high bandwidth at 60 V offset, flexible connectivity options to cover customers challenges, and software packages to cover the digital power management market.

Connectivity using probe accessories

The available probe accessories provide solutions for reliable and repeatable power rail measurements.
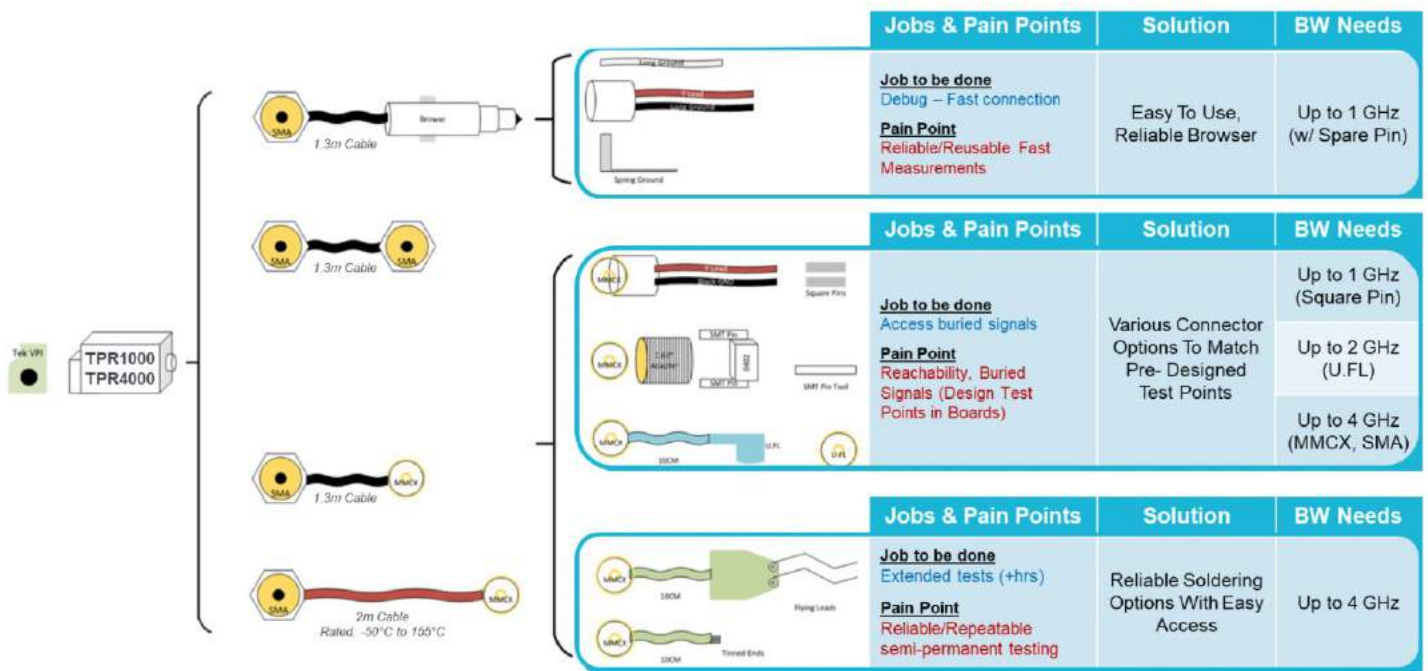
Probe accessories to enable connectivity

Specifications

All specifications are guaranteed unless noted otherwise. All specifications apply to all models unless noted otherwise.

Bandwidth	TPR1000: 1 GHz
	TPR4000: 4 GHz
Offset voltage range	±60 V
Dynamic range	±1 V
Input resistance	50 kΩ DC
	50 Ω AC
Input coupling	DC, LF reject
Accuracy	1 mV
System noise	<300 µV$_{P-P}$ (with 20 MHz bandwidth limit) [6]
	<1.3 mV$_{P-P}$ (at full bandwidth of oscilloscope) [6]
Attenuation	1.25x [7]
Connectivity and accessories	New browser, solder-in and snap-on

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[6] Using 6 Series MSO oscilloscopes. With grounded input and maximum sensitivity set to 1.3 mV/Div.

[7] Frequency response optimized for <1 Ω source impedance.

Ordering information

Models

TPR1000	1 GHz, Single-Ended TekVPI® Power-Rail Probe; includes one TPR4KIT accessory kit
TPR4000	4 GHz, Single-Ended TekVPI® Power-Rail Probe; includes one TPR4KIT accessory kit

Accessory kits

Accessory kits provide flexible and modular connectivity options. Each of the kits are orderable separately.

Description		TPR4KIT (std. accessory)	TPR4KITHT (high temp.)	TPRBRWSR1G (1 GHz browser)	TPR4SIAFLEX (flex tips)	TPR4SIACOAX (micro-coax tips)
1.3 m cable, SMA male-to-MMCX male, 50 Ω		✓				
1.3 m cable, SMA male-to-SMA male, 50 Ω		✓				
Y-lead adapter, MMCX female-to-0.8 mm sockets		✓				
Adapter cable, MMCX female-to-U.FL female, 50 Ω		✓				
Adapter, MMCX female-to-square pin (0.062 centers)		✓				
DUT interface solder pins, set of 20		✓				
Soldering aide tool, 0.062 solder pins over SMT		✓				

Description		TPR4KIT (std. accessory)	TPR4KITHT (high temp.)	TPRBRWSR1G (1 GHz browser)	TPR4SIAFLEX (flex tips)	TPR4SIACOAX (micro-coax tips)
Probe tip tripod support (with living hinge)		✓				
Marker bands, set of 5 (for probe identification)		✓				
Wire card, solderable enameled self-fluxing copper wire (for use with the solder-in tips)		✓				
Solder-in cable adapter, MMCX female-to-solder micro-coax tip, 50 Ω, set of 3		✓	✓			✓
Solder-in cable adapter, MMCX female-to-solder flex-paddle tip, 50 Ω, set of 3		✓	✓		✓	
2 m high-temperature cable, SMA male-to-MMCX male, 50 Ω			✓			
1 GHz browser				✓		
Ground leads (blade, 0.5 mm spring, 15 cm alligator)				✓		
Y-lead adapter, browser tip-to-0.8 mm sockets				✓		

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Micro-SMD clip				✓		
Replacement 0.5 mm browser tips (2 solid tips, 2 spring tips)				✓		

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Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.

Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit www.tek.com.

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