

# 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  $\mu\text{V}_{\text{p-p}}$  and 800  $\text{mV}_{\text{p-p}}$  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 <sup>1</sup> oscilloscopes
- Bandwidth: <sup>2</sup>
  - 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
- Dynamic range: Up to 60 V DC, 1 $\text{V}_{\text{p-p}}$  AC <sup>3</sup>
- Attenuation: 1.25x<sup>2</sup>

<sup>1</sup> DPO70000 oscilloscopes require the optional TCA-VPI50 adapter.

<sup>2</sup> Frequency response optimized for <1  $\Omega$  source impedance.

<sup>3</sup> Max AC RMS of 1 V.

<sup>4</sup> Comp box and oscilloscope temperature range limited to 0 to +55 °C.

- Measurement accuracy:
  - DC linearity: <0.1%
  - DC offset drift:  $\pm 100 \mu\text{V}$
  - Step response long-term aberrations:  $\pm 1\%$
- Noise:
  - <300  $\mu\text{V}_{\text{p-p}}$  noise on 6 Series MSO (20 MHz BW Limit)
  - <1  $\text{mV}_{\text{p-p}}$  noise on 6 Series MSO (Full Bandwidth)
- Input impedance:
  - 50 k $\Omega$  DC to 10 kHz
  - 50  $\Omega$  AC > 100 kHz
- Temperature range at tip: <sup>4</sup>
  - –40 to +85 °C (standard accessories)
  - –40 to +155 °C (high temperature cable option)
- Offset:
  - $\pm 60 \text{ V}$  offset range
  - Offset setting error:  $\pm 2 \text{ mV}$  max,  $\pm 0.4 \mu\text{V}$  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

### 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.

Jobs & Pain Points	Solution	BW Needs
<b>Job to be done</b> Debug – Fast connection <b>Pain Point</b> Reliable/Reusable Fast Measurements	Easy To Use, Reliable Browser	Up to 1 GHz (w/ Spare Pin)
Jobs & Pain Points	Solution	BW Needs
<b>Job to be done</b> Access buried signals <b>Pain Point</b> Reachability, Buried Signals (Design Test Points in Boards)	Various Connector Options To Match Pre- Designed Test Points	Up to 1 GHz (Square Pin) Up to 2 GHz (U.FL) Up to 4 GHz (MMCX, SMA)
Jobs & Pain Points	Solution	BW Needs
<b>Job to be done</b> Extended tests (+hrs) <b>Pain Point</b> Reliable/Repeatable semi-permanent testing	Reliable Soldering Options With Easy Access	Up to 4 GHz

Probe accessories to enable connectivity

## Specifications

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

<b>Bandwidth</b>	TPR1000: 1 GHz TPR4000: 4 GHz
<b>Offset voltage range</b>	±60 V
<b>Dynamic range</b>	±1 V
<b>Input resistance</b>	50 kΩ DC 50 Ω AC
<b>Input coupling</b>	DC, LF reject
<b>Accuracy</b>	1 mV
<b>System noise</b>	<300 μV <sub>P-P</sub> (with 20 MHz bandwidth limit) <sup>5</sup> <1.3 mV <sub>P-P</sub> (at full bandwidth of oscilloscope) <sup>5</sup>
<b>Attenuation</b>	1.25x <sup>6</sup>
<b>Connectivity and accessories</b>	New browser, solder-in and snap-on

<sup>5</sup> Using 6 Series MSO oscilloscopes. With grounded input and maximum sensitivity set to 1.3 mV/Div.

<sup>6</sup> Frequency response optimized for <1 Ω source impedance.










## Ordering information

### Models

<b>TPR1000</b>	1 GHz, Single-Ended TekVPI® Power-Rail Probe; includes one TPR4KIT accessory kit
<b>TPR4000</b>	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 SMA to MMCX standard cable		✓				
1.3 m SMA to SMA standard cable		✓				
2 m SMA to MMCX high temperature cable			✓			
Browser, ground lead (alligator, blade, and spring), pogo pins, and probe ID color bands				✓		
Square pin Y-leads		✓		✓		
Clamp		✓		✓		
U.FL connector		✓				
MMCX to square pin adapter		✓				
Solder micro-coax tip (qty. 3)		✓	✓			✓
Solder flex tip (qty. 3)		✓	✓		✓	



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

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