

## Active Power Rail Probes

### TPR1000 and 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, 4 Series MSO, 3 Series MDO, MDO3000, MDO4000C, MSO/DPO5000B, DPO7000C, and DPO70000C/DX/SX oscilloscopes. Due to software incompatibilities between the TPR1000 and TPR4000 probes and the MDO3000 and MDO4000C oscilloscopes, the accuracy of probe measurements is reduced when these oscilloscopes are used in vertical scale settings less than 2 mV/division. For all other vertical scale settings, the specified accuracy of the probe is maintained. DPO70000 oscilloscopes require the optional TCA-VPI50 adapter.
- Bandwidth:
  - 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
  - Frequency response optimized for  $<1 \Omega$  source impedance.
  - Through SMA-to-SMA cable or Solder Micro-Coax tip.
- Linear dynamic range: Up to 60 V DC, 1  $\text{V}_{\text{p-p}}$  to bandwidth. Max AC RMS of 1 V.

- Attenuation: 1.25x. Frequency response optimized for  $<1 \Omega$  source impedance.
- Measurement accuracy:
  - DC linearity:  $<0.1\%$
  - 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:
  - -40 to +125  $^{\circ}\text{C}$  (standard accessories)
  - -40 to +155  $^{\circ}\text{C}$  (high temperature cable option)
  - Comp box and oscilloscope temperature range limited to 0 to +55  $^{\circ}\text{C}$ .
- Offset:
  - $\pm 60$  V offset range
  - Offset setting error:  $\pm 2$  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 k $\Omega$  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 ( $\mu P$ ), 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)
<b>Jobs &amp; Pain Points</b>	<b>Solution</b>	<b>BW Needs</b>
<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)
<b>Jobs &amp; Pain Points</b>	<b>Solution</b>	<b>BW Needs</b>
<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 k $\Omega$ DC 50 $\Omega$ AC
<b>Input coupling</b>	DC, LF reject
<b>Accuracy</b>	1 mV
<b>System noise</b>	<300 $\mu$ V <sub>P,P</sub> (with 20 MHz bandwidth limit) <1.3 mV <sub>P,P</sub> (at full bandwidth of oscilloscope) Using 6 Series MSO oscilloscopes. With grounded input and maximum sensitivity set to 1.3 mV/Div.
<b>Attenuation</b>	1.25x Frequency response optimized for <1 $\Omega$ source impedance.
<b>Connectivity and accessories</b>	New browser, solder-in and snap-on

---

## Ordering information

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	TPR4KITHT	TPRBRWSR1G	TPR4SIAFLEX	TPR4SIACOAX
		(std. accessory)	(high temp.)	(1 GHz browser)	(flex tips)	(micro-coax tips)
1.3 m cable, SMA male-to-MMCX male, 50 Ω (Orderable outside of TPR4KIT) PN: 174749700		✓				
1.3 m cable, SMA male-to-SMA male, 50 Ω		✓				
Y-lead adapter, MMCX female-to-0.8 mm sockets (Orderable outside of TPR4KIT) PN: 174749600		✓				
Adapter cable, MMCX female-to-U.FL female, 50 Ω (Orderable outside of TPR4KIT) PN: 174749500		✓				
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		✓				

Table continued...

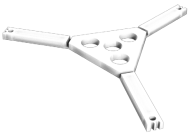



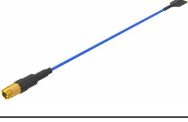






Description		TPR4KIT	TPR4KITHT	TPRBRWSR1G	TPR4SIAFLEX	TPR4SIACOAX
		(std. accessory)	(high temp.)	(1 GHz browser)	(flex tips)	(micro-coax tips)
Probe tip tripod support (with living hinge)		✓				
Marker bands, set of 5 (for probe identification)		✓				
Wire card, solderable enameled self-fluxing copper 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				✓		
Micro-SMD clip				✓		

Table continued...

Description		TPR4KIT	TPR4KITHT	TPRBRWSR1G	TPR4SIAFLEX	TPR4SIACOAX
		(std. accessory)	(high temp.)	(1 GHz browser)	(flex tips)	(micro-coax tips)
Replacement 0.5 mm browser tips (2 solid tips, 2 spring tips)				✓		



Tektronix is ISO 14001:2015 and ISO 9001:2015 certified by DEKRA.



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

ASEAN / Australasia (65) 6356 3900  
 Belgium 00800 2255 4835\*  
 Central East Europe and the Baltics +41 52 675 3777  
 Finland +41 52 675 3777  
 Hong Kong 400 820 5835  
 Japan 81 (120) 441 046  
 Middle East, Asia, and North Africa +41 52 675 3777  
 People's Republic of China 400 820 5835  
 Republic of Korea +82 2 565 1455  
 Spain 00800 2255 4835\*  
 Taiwan 886 (2) 2656 6688

Austria 00800 2255 4835\*  
 Brazil +55 (11) 3759 7627  
 Central Europe & Greece +41 52 675 3777  
 France 00800 2255 4835\*  
 India 000 800 650 1835  
 Luxembourg +41 52 675 3777  
 The Netherlands 00800 2255 4835\*  
 Poland +41 52 675 3777  
 Russia & CIS +7 (495) 6647564  
 Sweden 00800 2255 4835\*  
 United Kingdom & Ireland 00800 2255 4835\*

Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777  
 Canada 1 800 833 9200  
 Denmark +45 80 88 1401  
 Germany 00800 2255 4835\*  
 Italy 00800 2255 4835\*  
 Mexico, Central/South America & Caribbean 52 (55) 56 04 50 90  
 Norway 800 16098  
 Portugal 80 08 12370  
 South Africa +41 52 675 3777  
 Switzerland 00800 2255 4835\*  
 USA 1 800 833 9200

\* European toll-free number. If not accessible, call: +41 52 675 3777

**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](http://www.tek.com).

Copyright © Tektronix, Inc. All rights reserved. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX and TEK are registered trademarks of Tektronix, Inc. All other trade names referenced are the service marks, trademarks, or registered trademarks of their respective companies.