DATA SHEET

PV1 Universal Active Probe

Probing Solution with 5 GHz Bandwidth

C SERIES

Published in Canada on July 20, 2023
MK-D024E-E-23201

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Introduction

OVERVIEW

The PV1 Universal Active Probe is a signal measurement solution for high-speed links carrying low voltage, high-speed signals with a bandwidth of 5 GHz. By providing a completely non-proprietary instrument interface, it facilitates the attachment of a wide range of instruments to any given device under test (DUT) while minimizing circuit loading and maintaining signal integrity. This means that it can be attached to any oscilloscope brand, and it can also be attached to spectrum analyzers, protocol analyzers, and digital capture systems.

The PV1 consists of a lightweight probe amplifier and a solder-in tip. Both components are optimized for accessing hard to reach signals in live systems and for measuring entire buses such as those found in MIPI, DisplayPort, DDR, and similar systems.

KEY FEATURES

- **High bandwidth**: guaranteed 5 GHz bandwidth with a high linearity and accuracy
- **Non-proprietary interface**: output cable of the probe amplifier has a male SMA connector for attachment to any 50 Ohm instrument
- **Optimized voltage range**: linear performance is guaranteed for low-voltage applications such as MIPI
- **Miniature and lightweight**: probe amplifier is housed in a compact enclosure, enabling attachment in confined spaces

KEY BENEFITS

- **Maintain signal integrity**: measure live signal links in their mission modes without custom test fixtures
- **Deploy widely**: connect the PV1 to Introspect Technology instruments or to oscilloscopes, logic analyzers, spectrum analyzers, and digital capture tools
- **Access highly integrated buses**: use the solder-in probe tips for optimized signal sniffing in hard-to-reach locations

ORDERING INFORMATION

TABLE 1: ITEM NUMBERS FOR THE PV1 UNIVERSAL ACTIVE PROBE AND RELATED PRODUCTS

PART NUMBER	NAME	KEY DIFFERENTIATORS
7123	PV1 Universal Active Probe	Universal probe system for 5 GHz applications
7124	PV1PSU Power Supply	Power supply for PV1
7126	PV1 Solder-In Twin Tip	Differential solder-in tip, two signal leads and one ground wire
7127	PV1 Solder-In Single-Ended Tip	Single-ended solder-in tip, one signal lead and one ground wire

Concepts and Terminology

The PV1 probing system consists of the following key components:

- PV1 probe amplifier
- PV1 solder-in tips, either single-ended or differential
- PV1PSU power supply for the probe amplifier
- SMA interface to measurement instrument

Figure 1(a) shows an illustration of the main components of the probing system. Since the PV1 is an active probe, it needs power, and this is provided through the PV1PSU power supply from Introspect Technology (not shown in the figure). Having the PV1PSU as a stand-alone power supply enables the PV1 to be "universal" in that it can attach to any measurement instrument.

Figure 1(b) shows a single-ended solder-in tip of the PV1 probing system. It consists of short attachment wires on the DUT side and an SMPM coaxial connector on the PV1 amplifier side. The solder-in wires are optimized for impedance matching and bandwidth. Every care should be taken to ensure that the short attachment wires are properly soldered to the DUT board with short leads on both the signal and ground pins.

Figure 1(c) below illustrates the attachment of a single-ended solder-in tip to the PV1 probe amplifier. The combination of the light weight of the probe amplifier and the retention mechanism in the connector ensures that this solution is practical for many measurement situations.

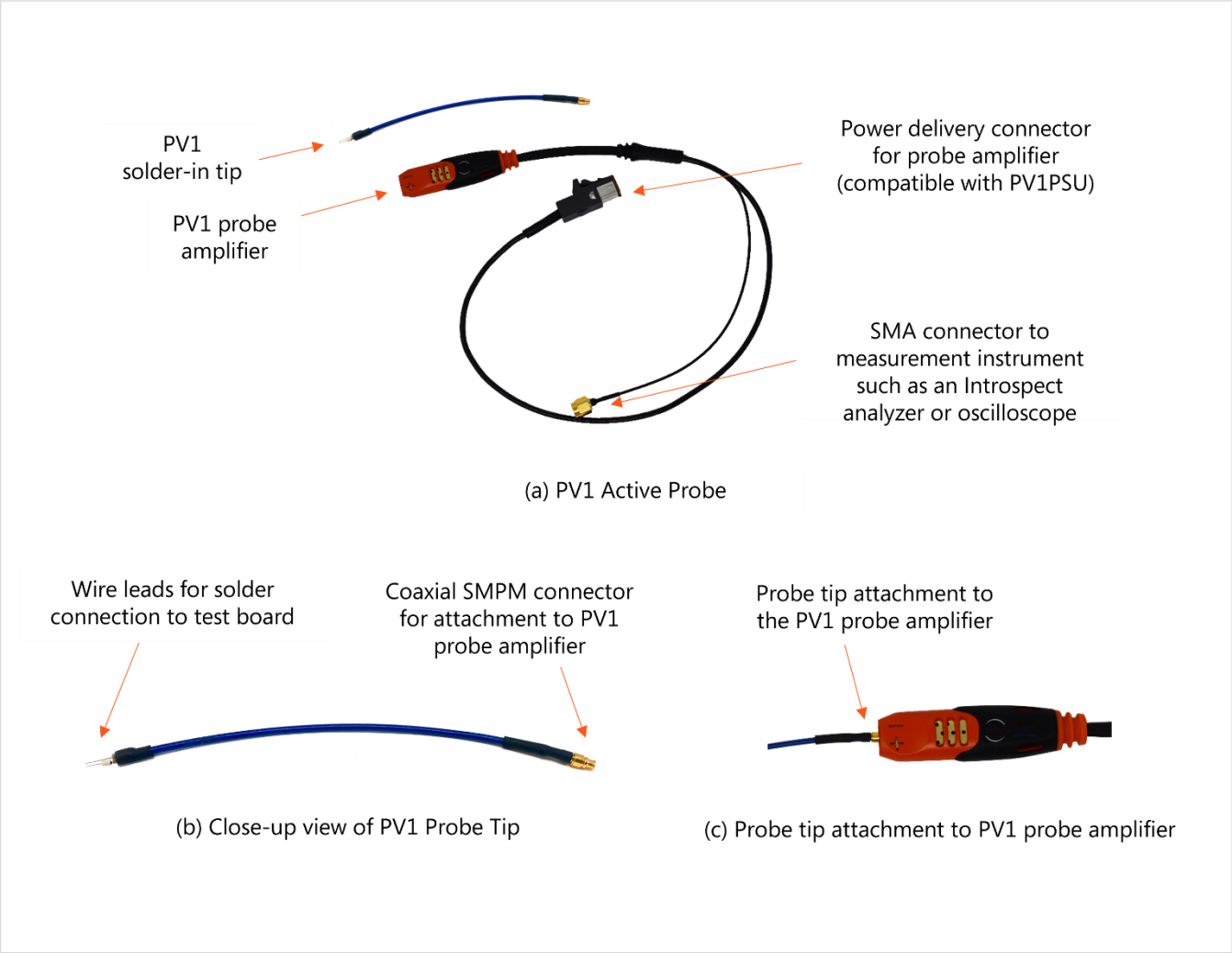

Figure 1: PV1 probing system consisting of the probe amplifier and a solder-in tip

PV1 probe amplifiers may be used with either single-ended or differential types of solder-in tips.

A single-ended probe tip shown in Figure 2(a) and the solder connection wires are highlighted on the left side of the figure. The wire with the axial resistor in Figure 2(a) is the signal connection, and the wire without the axial resistor is the ground connection. Both wires must be soldered to the board under test. The gold coaxial connector shown on the right side of the figure attaches to a single PV1 probe amplifier.

A twin probe tip shown in Figure 2(b) and the solder connection wires are highlighted on the left side of the figure. The two center wires (on the top and bottom of the tip) are for the differential connections, and the off-centre wire is the ground connection (one connection per twin tip). All three wires must be soldered to the board under test. The gold coaxial connector shown on the right side of the figure attaches to two separate PV1 probe amplifiers.

The twin tip may be preferable for differential signal measurement applications, as it provides superior noise performance and a more compact overall interface for small soldering footprints.

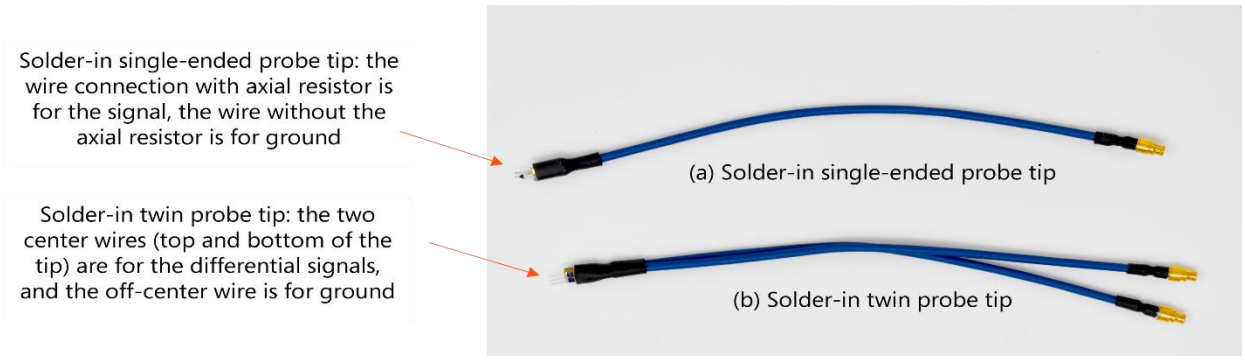

Figure 2: PV1 solder-in probe tip options: (a) single-ended tip and (b) twin tip

Performance Characteristics

Figure 3 shows the step response of the PV1 probing system. This response is obtained by driving the PV1 with an ideal 8-picosecond step input, thus ensuring that the true performance of the PV1 is exposed. As can be seen, a sharp and linear step response is achieved. The corresponding frequency-domain view of the PV1 performance is shown in Figure 4.

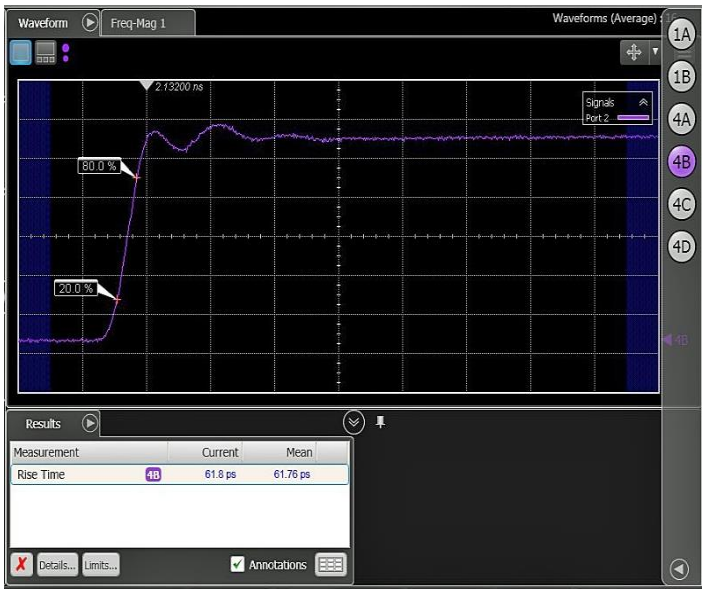

Figure 3: PV1 step response, measured with an 8-picosecond stimulus source

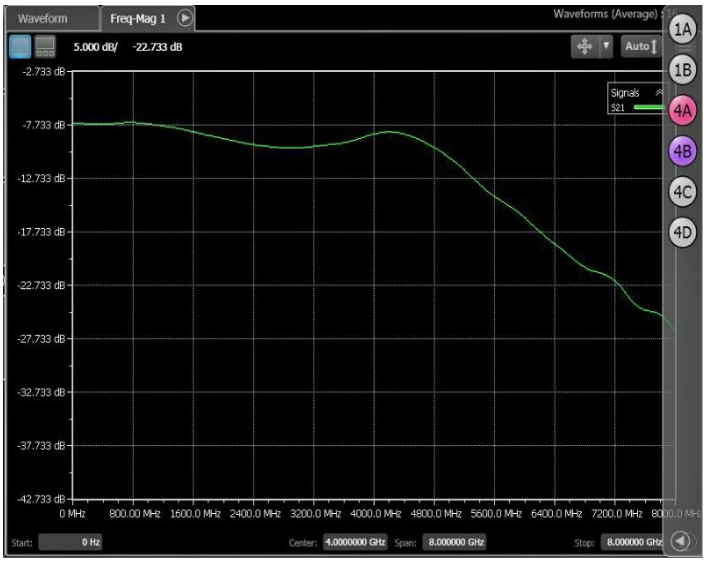

Figure 4: PV1 frequency-domain gain response

Figure 5 shows a 5 Gbps PRBS7 eye diagram measurement performed using the PV1, illustrating high signal fidelity without degradation due to noise or impedance mismatches. Table 1 provides additional technical specifications.

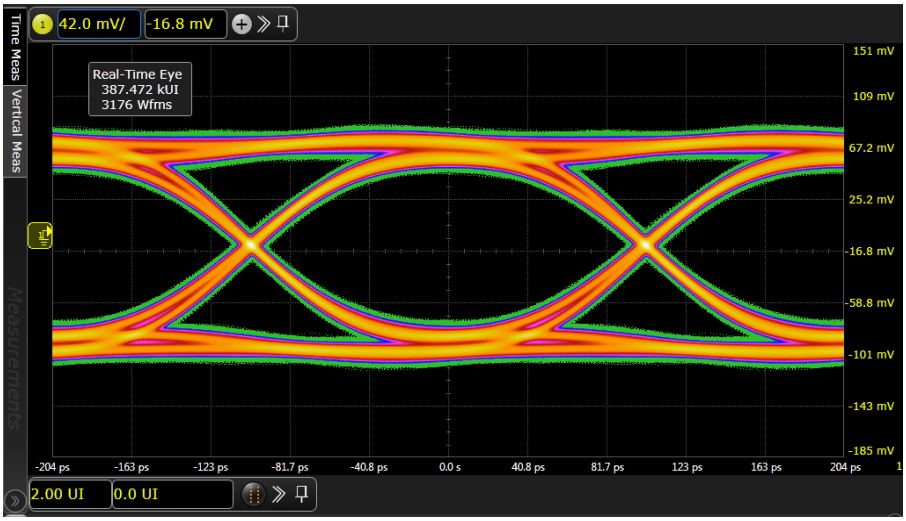

Figure 5: Eye diagram of a PRBS7 pattern running at 5 Gbps as measured by PV1

TABLE 2: KEY PERFORMANCE SPECIFICATIONS

PARAMETER	VALUE	DESCRIPTION
Rise Time	62 ps	20%-80% value
Gain	1.0 V/V	Voltage gain, DC Single-ended or twin tip connection
Linearity	50 dB	Spurious free dynamic range measured at 5 MHz and across entire voltage range
Linear Range	-0.4 V to 0.6 V	Single-ended voltage measurement
Maximum Voltage Range	-1.5 V to 1.8 V	Single-ended voltage measurement
Input Impedance	600 Ω	Single-ended impedance measurement to ground
Power Dissipation	0.8 W	Probe operates at room temperature without cooling

Revision Number	History	Date
1.0	Document Release	January 27, 2019
1.1	Updated specifications and document formatting	December 1, 2019
1.2	Updated specifications	January 12, 2020
1.3	Updated the description of probe tips and updated the specifications in Table 2.	July 20, 2023

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