Isolated Measurement Systems
TIVM1, TIVM1L, TIVH08, TIVH08L, TIVH05, TIVH05L, TIVH02, TIVH02L
Datasheet

The Tektronix TIVM and TIVH Series IsoVu™ Measurement Systems offer galvanically isolated measurement solutions for accurately resolving high bandwidth, differential signals up to ±2500 V in the presence of large common mode voltages with the best in class common mode rejection performance across its bandwidth.

Features and benefits
- Bandwidths from DC to 1 GHz
- 100 Million to 1 (160 dB) Common Mode Rejection from DC up to 1 MHz
- 10,000 to 1 (80 dB) Common Mode Rejection at 1 GHz
- 60 kV peak Common Mode Voltage
- Up to ±2500 V Differential (DC + pk AC)
- Up to ±2500 V offset range
- Output clamping
- Safety certified
- DC and AC input coupling

Applications
- Half/Full Bridge designs using GaN, SiC, IGBTs
- Floating measurements
- Power Converter design
- Power Device evaluation
- Switching Power Supply design
- Inverter design
- Motor Drive design
- Electronic Ballast design
- EMI
- ESD
- Current shunt measurements
- Remote probing capability

Product Description
The TIVM and TIVH Series (IsoVu) products can be used on most Tektronix oscilloscopes with the TekVPI interface and on MSO/DPO70K series oscilloscopes with the TCA-VPI50 adapter. IsoVu utilizes an electro-optic sensor that converts the electrical signal from the sensor tip cables to an optical signal, which electrically isolates the device-under-test from the oscilloscope. IsoVu incorporates four separate lasers, an optical sensor, five optical fibers, and sophisticated feedback and control techniques. The sensor head, which connects to the test point, has complete electrical isolation and is powered over one of the optical fibers (No batteries required). IsoVu is an ideal solution for users making the following measurements:

- Differential measurements in the following conditions:
  - Complete galvanic isolation is required
  - High common mode voltage
  - High frequency common mode interference
  - High frequency measurements
- Measurements in high EMI environments
- EMI compliance testing
- ESD testing
## Specifications

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

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>TIVM1/TIVM1L</th>
<th>TIVH08/TIVH08L</th>
<th>TIVH05/TIVH05L</th>
<th>TIVH02/TIVH02L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth/Rise time (Typical)</td>
<td>1 GHz / ≤ 350 ps</td>
<td>800 MHz / ≤ 435 ps</td>
<td>500 MHz / ≤ 700 ps</td>
<td>200 MHz / ≤ 1.8 ns</td>
</tr>
<tr>
<td>Fiber cable length</td>
<td>TIVM1: 3 m (9.8 ft) TIVM1L: 10 m (32.8 ft)</td>
<td>TIVH08: 3 m (9.8 ft) TIVH08L: 10 m (32.8 ft)</td>
<td>TIVH05: 3 m (9.8 ft) TIVH05L: 10 m (32.8 ft)</td>
<td>TIVH02: 3 m (9.8 ft) TIVH02L: 10 m (32.8 ft)</td>
</tr>
</tbody>
</table>

### TIVM Series attenuation, Differential input voltage range, Offset range, Differential impedance (Typical)

*Use only the sensor tip cables listed below with the TIVM Series.*

<table>
<thead>
<tr>
<th>Sensor tip cable</th>
<th>Attenuation</th>
<th>Differential input voltage</th>
<th>Offset range</th>
<th>Input impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1X range</td>
<td>2X range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMA input</td>
<td>1X</td>
<td>±0.5 V</td>
<td>±1 V</td>
<td>±2 V</td>
</tr>
<tr>
<td>MMCX tip cables</td>
<td>1X</td>
<td>±0.5 V</td>
<td>±1 V</td>
<td>±2 V</td>
</tr>
<tr>
<td>IVTIP1X</td>
<td>5X</td>
<td>±2.5 V</td>
<td>±5 V</td>
<td>±10 V</td>
</tr>
<tr>
<td>IVTIP10X</td>
<td>10X</td>
<td>±5 V</td>
<td>±10 V</td>
<td>±20 V</td>
</tr>
<tr>
<td>IVTIP25X</td>
<td>25X</td>
<td>±12.5 V</td>
<td>±25 V</td>
<td>±50 V</td>
</tr>
<tr>
<td>IVTIP50X</td>
<td>50X</td>
<td>±25 V</td>
<td>±50 V</td>
<td>±100 V</td>
</tr>
</tbody>
</table>

### TIVH Series attenuation, Differential input voltage range, Offset range, Differential impedance (Typical)

*Use only the sensor tip cables listed below with the TIVH Series.*

<table>
<thead>
<tr>
<th>Sensor tip cable</th>
<th>Attenuation</th>
<th>Differential input voltage</th>
<th>Offset range</th>
<th>Input impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1X range</td>
<td>2X range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMA input</td>
<td>1X</td>
<td>±0.5 V</td>
<td>±1 V</td>
<td>±25 V</td>
</tr>
<tr>
<td>MMCX tip cables</td>
<td>1X</td>
<td>±0.5 V</td>
<td>±1 V</td>
<td>±25 V</td>
</tr>
<tr>
<td>IVTIP1X</td>
<td>10X</td>
<td>±5 V</td>
<td>±10 V</td>
<td>±250 V</td>
</tr>
<tr>
<td>MMCX250X</td>
<td>50X</td>
<td>±25 V</td>
<td>±50 V</td>
<td>±250 V</td>
</tr>
<tr>
<td>MMCX250X</td>
<td>250X</td>
<td>±125 V</td>
<td>±250 V</td>
<td>±250 V</td>
</tr>
<tr>
<td>0.100 in Pitch (2.54 mm) Square Pin sensor tip cables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SQPIN100X</td>
<td>100X</td>
<td>±50 V</td>
<td>±100 V</td>
<td>±600 V</td>
</tr>
<tr>
<td>SQPIN500X</td>
<td>500X</td>
<td>±250 V</td>
<td>±500 V</td>
<td>±600 V</td>
</tr>
<tr>
<td>0.200 in Pitch (5.08 mm) Square Pin sensor tip cables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WSQPIN1000X</td>
<td>1000X</td>
<td>±500 V</td>
<td>±1000 V</td>
<td>±2500 V</td>
</tr>
<tr>
<td>WSQPIN2500X</td>
<td>2500X</td>
<td>±1250 V</td>
<td>±2500 V</td>
<td>±2500 V</td>
</tr>
</tbody>
</table>

1. The 800 MHz bandwidth is achieved with the 50X and greater attenuation tips (MMCX50X, MMCX250X, SQPIN100X, SQPIN500X, WSQPIN1000X, or WSQPIN2500X).
2. With 6-inch tip cable sensor head 20 pF plus cable 15 pF.

www.tek.com
### TIVM Series Common mode rejection ratio, sensor tip cables, and adapters (Typical)

<table>
<thead>
<tr>
<th>Sensor tip cable/adapter</th>
<th>DC</th>
<th>1 MHz</th>
<th>100 MHz</th>
<th>200 MHz</th>
<th>500 MHz</th>
<th>1 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MMCX Sensor tip cables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IVTIP1X</td>
<td>160 dB</td>
<td>124 dB</td>
<td>120 dB</td>
<td>110 dB</td>
<td>100 dB</td>
<td>90 dB</td>
</tr>
<tr>
<td>IVTIP5X</td>
<td>160 dB</td>
<td>124 dB</td>
<td>120 dB</td>
<td>110 dB</td>
<td>100 dB</td>
<td>90 dB</td>
</tr>
<tr>
<td>IVTIP10X</td>
<td>160 dB</td>
<td>124 dB</td>
<td>120 dB</td>
<td>110 dB</td>
<td>100 dB</td>
<td>90 dB</td>
</tr>
<tr>
<td>IVTIP25X</td>
<td>160 dB</td>
<td>120 dB</td>
<td>110 dB</td>
<td>100 dB</td>
<td>100 dB</td>
<td>90 dB</td>
</tr>
<tr>
<td>IVTIP50X</td>
<td>160 dB</td>
<td>116 dB</td>
<td>100 dB</td>
<td>90 dB</td>
<td>90 dB</td>
<td>80 dB</td>
</tr>
</tbody>
</table>

**Adapters**

<table>
<thead>
<tr>
<th>Sensor tip cable/adapter</th>
<th>DC</th>
<th>1 MHz</th>
<th>100 MHz</th>
<th>200 MHz</th>
<th>500 MHz</th>
<th>1 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMCX-to 0.1 in (2.54 mm)</td>
<td>160 dB</td>
<td>100 dB</td>
<td>70 dB</td>
<td>60 dB</td>
<td>40 dB</td>
<td>30 dB</td>
</tr>
<tr>
<td>MMCX-to 0.062 in (1.57 mm)</td>
<td>160 dB</td>
<td>100 dB</td>
<td>70 dB</td>
<td>60 dB</td>
<td>40 dB</td>
<td>30 dB</td>
</tr>
</tbody>
</table>

### TIVH Series Common mode rejection ratio, sensor tip cables, and adapters (Typical)

<table>
<thead>
<tr>
<th>Sensor tip cable/adapter</th>
<th>DC</th>
<th>1 MHz</th>
<th>100 MHz</th>
<th>200 MHz</th>
<th>500 MHz</th>
<th>800 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MMCX Sensor tip cables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IVTIP1X</td>
<td>160 dB</td>
<td>120 dB</td>
<td>120 dB</td>
<td>110 dB</td>
<td>110 dB</td>
<td>110 dB</td>
</tr>
<tr>
<td>MMCX10X</td>
<td>160 dB</td>
<td>120 dB</td>
<td>110 dB</td>
<td>102 dB</td>
<td>91 dB</td>
<td>85 dB</td>
</tr>
<tr>
<td>MMCX50X</td>
<td>160 dB</td>
<td>116 dB</td>
<td>100 dB</td>
<td>93 dB</td>
<td>85 dB</td>
<td>80 dB</td>
</tr>
<tr>
<td>MMCX250X</td>
<td>160 dB</td>
<td>104 dB</td>
<td>85 dB</td>
<td>80 dB</td>
<td>73 dB</td>
<td>70 dB</td>
</tr>
</tbody>
</table>

**0.100 in Pitch (2.54 mm) Square Pin sensor tip cables**

<table>
<thead>
<tr>
<th>Sensor head only</th>
<th>Vpk (DC + peak AC)</th>
<th>V_{RMS}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor head only</td>
<td>4.3 Vpk</td>
<td>3 V_{RMS}</td>
</tr>
<tr>
<td>IVTIP1X</td>
<td>4.3 Vpk</td>
<td>3 V_{RMS}</td>
</tr>
<tr>
<td>IVTIP5X</td>
<td>21.5 Vpk</td>
<td>12 V_{RMS}</td>
</tr>
<tr>
<td>IVTIP10X</td>
<td>43 Vpk</td>
<td>16 V_{RMS}</td>
</tr>
<tr>
<td>IVTIP25X</td>
<td>107.5 Vpk</td>
<td>25 V_{RMS}</td>
</tr>
<tr>
<td>IVTIP50X</td>
<td>200 Vpk</td>
<td>35 V_{RMS}</td>
</tr>
</tbody>
</table>
### TIVH Series Maximum non-destructive voltage (Typical)

<table>
<thead>
<tr>
<th>Sensor tip cable</th>
<th>Vpk (DC + peak AC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor head only</td>
<td>25 Vpk</td>
</tr>
<tr>
<td>IVTIP1X</td>
<td>25 Vpk</td>
</tr>
<tr>
<td>MMCX10X</td>
<td>250 Vpk</td>
</tr>
<tr>
<td>MMCX50X</td>
<td>250 Vpk</td>
</tr>
<tr>
<td>MMCX250X</td>
<td>250 Vpk</td>
</tr>
<tr>
<td>SQPIN100X</td>
<td>600 Vpk</td>
</tr>
<tr>
<td>SQPIN500X</td>
<td>600 Vpk</td>
</tr>
<tr>
<td>WSQPIN1000X</td>
<td>2500 Vpk</td>
</tr>
<tr>
<td>WSQPIN2500X</td>
<td>2500 Vpk</td>
</tr>
</tbody>
</table>

#### Common mode voltage
60 kV peak

#### Common mode input impedance (Typical)

<table>
<thead>
<tr>
<th>Input resistance</th>
<th>Galvanically isolated through the fiber optic connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input capacitance</td>
<td>&lt; 2 pF</td>
</tr>
</tbody>
</table>

#### DC Gain accuracy

| Differential DC gain accuracy in 1X range | ±3% ± DC offset error voltage ± input offset accuracy error |
| Differential DC gain accuracy in 2X range | 60% of ± Full Scale: ±3% ± DC offset error voltage ± input offset accuracy error |
|                                           | >60% to 80% of ± Full Scale: 0% to –4% ± DC offset error voltage ± input offset accuracy error |
|                                           | >80% to 100% of ± Full Scale: 0% to –7% ± DC offset error voltage ± input offset accuracy error |

#### System noise (input referred) (Typical)

<table>
<thead>
<tr>
<th>Sensor tip cable/adapter</th>
<th>1X Range</th>
<th>2X Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIVH08/TIVH08L Sensor head input SMA</td>
<td>&lt; 1.2 mV&lt;sub&gt;rms&lt;/sub&gt;</td>
<td>&lt; 1.4 mV&lt;sub&gt;rms&lt;/sub&gt;</td>
</tr>
<tr>
<td>TIVH05/TIVH05L Sensor head input SMA</td>
<td>&lt; 0.72 mV&lt;sub&gt;rms&lt;/sub&gt;</td>
<td>&lt; 0.85 mV&lt;sub&gt;rms&lt;/sub&gt;</td>
</tr>
<tr>
<td>TIVH02/TIVH02L Sensor head input SMA</td>
<td>&lt; 0.61 mV&lt;sub&gt;rms&lt;/sub&gt;</td>
<td>&lt; 0.75 mV&lt;sub&gt;rms&lt;/sub&gt;</td>
</tr>
<tr>
<td>TIVM1/TIVM1L Sensor head input SMA</td>
<td>&lt; 0.8 mV&lt;sub&gt;rms&lt;/sub&gt;</td>
<td>&lt; 1.6 mV&lt;sub&gt;rms&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

Input referred noise with tip cable:

- (Sensor head input SMA noise) * (Tip cable attenuation)

Examples:

- TIVH08 1X Range with MMCX10X tip cable:
  Noise = (1.2 mV<sub>rms</sub>) * (10) = 12 mV<sub>rms</sub>

- TIVH08 2X Range with MMCX10X tip cable:
  Noise = (1.4 mV<sub>rms</sub>) * (10) = 14 mV<sub>rms</sub>

#### Propagation delay

- 3 meter fiber cable: 35 ns ± 5 ns
- 10 meter fiber cable: 68 ns ± 7 ns

#### Laser certification

CLASS I LASER PRODUCT

This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

---

3 Derated with frequency; refer to the Maximum differential input voltage vs. frequency derating graph in the Specifications section of the TIVH Series IsoVu Measurement System User Manual.

4 The capacitance between the sensor head and a reference plane. The sensor head is placed six inches (15.25 cm) above the reference plane.
### Ordering information

**TIVM models**

- **TIVM1**
  Tektronix IsoVu 1 GHz Medium Voltage with 3 m cable
- **TIVM1L**
  Tektronix IsoVu 1 GHz Medium Voltage with 10 m cable

**TIVH models**

- **TIVH08**
  Tektronix IsoVu 800 MHz High Voltage with 3 m cable
- **TIVH08L**
  Tektronix IsoVu 800 MHz High Voltage with 10 m cable
- **TIVH05**
  Tektronix IsoVu 500 MHz High Voltage with 3 m cable
- **TIVH05L**
  Tektronix IsoVu 500 MHz High Voltage with 10 m cable
- **TIVH02**
  Tektronix IsoVu 200 MHz High Voltage with 3 m cable
- **TIVH02L**
  Tektronix IsoVu 200 MHz High Voltage with 10 m cable

### TIVM series

**Standard accessories**

- **016-2108-xx**
  IsoVu product carrying case, soft case
- **016-2110-xx**
  IsoVu accessories carrying case, soft case
- **003-1946-xx**
  Solder aid for 0.062-inch (1.57 mm) pitch square pins (0.016 - 0.018-inch (0.4 - 0.46 mm) square pin installation tool)
- **IVTIP5X**
  5X Sensor tip cable
- **IVTIP25X**
  25X Sensor tip cable
- **003-1947-xx**
  5/16-inch SMA wrench/driver tool
- **131-9717-xx**
  Probe tip adapter (blue), MMCX to 0.1-inch (2.54 mm) square pin (0.025-inch (0.635 mm) square pins)
- **131-9677-xx**
  Probe tip adapter (white), MMCX to 0.062-inch (1.57 mm) square pin (0.016 - 0.018-inch (0.4 - 0.46 mm) square pins)
- **020-3169-xx**
  DUT Interface pin kit with (qty. 20) 0.018-inch (0.46 mm) round solder-in pins
- **352-1171-xx**
  Flexible tripod with quick release
- **344-0693-xx**
  Flexible tripod feet, 3 each
- **352-1170-xx**
  Probe tip tripod support with living hinge, 2 each
- **071-3495-xx**
  User manual (English)

---

Translated manuals can be downloaded as pdf files on your local Tektronix Web site.

**Recommended accessories**

- **IVTIP1X**
  1X Sensor tip cable
- **IVTIP10X**
  10X Sensor tip cable
- **IVTIP50X**
  50X Sensor tip cable
### TIVH series

#### Standard accessories

- **016-2108-xx** IsoVu product carrying case, soft case
- **016-2110-xx** IsoVu accessories carrying case, soft case
- **MMCX50X** 50X Sensor tip cable
- **SQPIN500X** 500X Sensor tip cable
- **003-1947-xx** 5/16-inch SMA wrench/driver tool
- **131-9717-xx** Probe tip adapter (blue), MMCX to 0.1-inch (2.54 mm) square pin (0.025-inch (0.635 mm) square pins)
- **352-1171-xx** Flexible tripod with quick release
- **344-0693-xx** Flexible tripod feet, 3 each
- **352-1170-xx** Probe tip tripod support with living hinge, 2 each
- **071-3556-xx** User manual (English)
- **—** Certificate of traceable calibration

Translated manuals can be downloaded as pdf files on your local Tektronix Web site.

#### Recommended accessories

- **003-1946-xx** Solder aid for 0.062-inch (1.57 mm) pitch square pins (0.016 - 0.018-inch (0.4 - 0.46 mm) square pin installation tool)
- **131-9677-xx** Probe tip adapter (white), MMCX to 0.062-inch (1.57 mm) square pin (0.016 - 0.018-inch (0.4 - 0.46 mm) square pins)
- **020-3169-xx** DUT Interface pin kit with (qty. 20) 0.018-inch (0.46 mm) round solder-in pins
- **IVTIP1X** 1X Sensor tip cable
- **MMCX10X** 10X Sensor tip cable
- **MMCX250X** 250X Sensor tip cable
- **SQPIN100X** 100X Sensor tip cable
- **WSQPIN1000X** 1000X Sensor tip cable
- **WSQPIN2500X** 2500X Sensor tip cable
Supported oscilloscopes

The measurement systems can be used with the following Tektronix oscilloscopes. For oscilloscopes not included in this list, contact your local Tektronix representative.

- 5 Series MSO (WSQPIN2500X tip cables require V1.6 or later oscilloscope firmware)
- MDO3000 series (WSQPIN tip cables require V1.26 or later oscilloscope firmware)
- MDO4000C series (WSQPIN tip cables require V1.06 or later oscilloscope firmware)
- MSO/DPO/MDO4000B series (WSQPIN tip cables are not compatible)
- MSO/DPO5000B series
- DPO7000C series

In addition to the above oscilloscopes, the TIVH and TIVM measurement systems can also be used with the following oscilloscopes with a TCA-VPI50 adapter.

- MSO/DPO70000C series
- MSO/DPO70000DX series
- DPO70000SX series

Options

Service options

- Opt. C3: Calibration Service 3 Years
- Opt. C5: Calibration Service 5 Years
- Opt. D1: Calibration Data Report
- Opt. G3: Complete Care 3 Years (includes loaner, scheduled calibration, and more)
- Opt. R3: Repair Service 3 Years (including warranty)
- Opt. R5: Repair Service 5 Years (including warranty)

Probes and accessories are not covered by the oscilloscope warranty and Service Offerings. Refer to the datasheet of each probe and accessory model for its unique warranty and calibration terms.
Datasheet

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 01 (3) 974 3086
Middle East, Asia, and North Africa +41 52 675 3777
People's Republic of China 400 820 5835
Republic of Korea +82 2 8917 5084, 82 2 8917 5080
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 001 800 650 1835
Luxembourg +41 52 675 3777
The Netherlands 00800 2255 4835*
Poland +41 52 675 3777
Russia & CIS +7 (495) 667564
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 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.

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.

07 Feb 2018 51W-61217-2

www.tek.com