Tektronix

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.

Overview

Overview

Characteristic	TIVM1/TIVM1L	TIVH08/TIVH08L	TIVH05/TIVH05L	TIVH02/TIVH02L
Bandwidth/Rise time (Typical)	1 GHz / ≤ 350 ps	800 MHz / ≤ 435 ps [1]	500 MHz / ≤ 700 ps	200 MHz / ≤ 1.8 ns
Fiber cable length	TIVM1: 3 m (9.8 ft) TIVM1L: 10 m (32.8 ft)	TIVH08: 3 m (9.8 ft) TIVH08L: 10 m (32.8 ft)	TIVH05: 3 m (9.8 ft) TIVH05L: 10 m (32.8 ft)	TIVH02: 3 m (9.8 ft) TIVH02L: 10 m (32.8 ft)

Attenuation and ranges TIVM Series

TIVM Series attenuation, Differential input voltage range, Offset range, Single-ended impedance (Typical)

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

Sensor tip cable	Attenuation	Differential input voltage		Offset range	Single-ended input impedance
		1X range	2X range		
SMA input	1X	±0.5 V	±1 V	±2 V	50 Ω || N.A.
MMCX sensor tip cables					
IVTIP1X	1X	±0.5 V	±1 V	±2 V	50 Ω || N.A.
IVTIP5X	5X	±2.5 V	±5 V	±10 V	250 Ω || <1 pF
IVTIP10X	10X	±5 V	±10 V	±20 V	500 Ω || <1 pF
IVTIP25X	25X	±12.5 V	±25 V	±50 V	1.25 kΩ || <1 pF
IVTIP50X	50X	±25 V	±50 V	±100 V	2.5 kΩ || <1 pF

Attenuation and ranges TIVH Series

TIVH Series attenuation, Differential input voltage range, Offset range, Single-ended impedance (Typical)

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

Sensor tip cable	Attenuation	Differential input voltage		Offset range	Single-ended input impedance
		1X range	2X range		
SMA input	1X	±0.5 V	±1 V	±25 V	1 MΩ || 20 pF
MMCX sensor tip cables					
IVTIP1X	1X	±0.5 V	±1 V	±25 V	1 MΩ || 35 pF [2]
MMCX10X	10X	±5 V	±10 V	±250 V	10 MΩ || 6 pF
MMCX50X	50X	±25 V	±50 V	±250 V	10 MΩ || 3 pF
MMCX250X	250X	±125 V	±250 V	±250 V	10 MΩ || 2 pF
0.100 in Pitch (2.54 mm) Square Pin sensor tip cables					
SQPIN100X	100X	±50 V	±100 V	±600 V	10 MΩ || 3.5 pF

Table continued…

[1] The 800 MHz bandwidth is achieved with the 50X and greater attenuation tips (MMCX50X, MMCX250X, SQPIN100X, SQPIN500X, WSQPIN1000X, or WSQPIN2500X).

Sensor tip cable	Attenuation	Differential input voltage		Offset range	Single-ended input impedance
		1X range	2X range		
SQPIN500X	500X	±250 V	±500 V	±600 V	10 MΩ || 3.5 pF
0.200 in Pitch (5.08 mm) Square Pin sensor tip cables					
WSQPIN1000X	1000X	±500 V	±1000 V	±2500 V	40 MΩ || 3.5 pF
WSQPIN2500X	2500X	±1250 V	±2500 V	±2500 V	40 MΩ || 3.5 pF

Common mode rejection ratio TIVM Series

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

Sensor tip cable/ adapter	DC	1 MHz	100 MHz	200 MHz	500 MHz	1 GHz
MMCX Sensor tip cables						
IVTIP1X	160 dB	124 dB	120 dB	110 dB	100 dB	90 dB
IVTIP5X	160 dB	124 dB	120 dB	110 dB	100 dB	90 dB
IVTIP10X	160 dB	124 dB	120 dB	110 dB	100 dB	90 dB
IVTIP25X	160 dB	120 dB	110 dB	100 dB	100 dB	90 dB
IVTIP50X	160 dB	116 dB	100 dB	90 dB	90 dB	80 dB
Adapters						
MMCX-to 0.1 in (2.54 mm)	160 dB	100 dB	70 dB	60 dB	40 dB	30 dB
MMCX-to 0.062 in (1.57 mm)	160 dB	100 dB	70 dB	60 dB	40 dB	30 dB

Common mode rejection ratio TIVH series

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

Sensor tip cable/ adapter	DC	1 MHz	100 MHz	200 MHz	500 MHz	800 MHz
MMCX Sensor tip cables						
IVTIP1X	160 dB	120 dB	120 dB	110 dB	110 dB	110 dB
MMCX10X	160 dB	120 dB	110 dB	102 dB	91 dB	85 dB
MMCX50X	160 dB	116 dB	100 dB	93 dB	85 dB	80 dB
MMCX250X	160 dB	104 dB	85 dB	80 dB	73 dB	70 dB
0.100 in Pitch (2.54 mm) Square Pin sensor tip cables						
SQPIN100X	160 dB	110 dB	60 dB	50 dB	37 dB	30 dB
SQPIN500X	160 dB	100 dB	70 dB	57 dB	39 dB	30 dB
0.200 in Pitch (5.08 mm) Square Pin sensor tip cables						

Table continued…

[2] With 6-inch tip cable sensor head 20 pF plus cable 15 pF.

Sensor tip cable/ adapter	DC	1 MHz	100 MHz	200 MHz	500 MHz	800 MHz
WSQPIN1000X	160 dB	100 dB	60 dB	47 dB	29 dB	20 dB
WSQPIN2500X	160 dB	100 dB	60 dB	48 dB	33 dB	25 dB
Adapters						
MMCX-to 0.1 in (2.54 mm)	160 dB	85 dB	70 dB	60 dB	40 dB	30 dB
MMCX-to 0.062 in (1.57 mm)	160 dB	85 dB	70 dB	60 dB	40 dB	30 dB

Maximum non-destructive voltage TIVM Series

TIVM Series Maximum non-destructive voltage (Typical)

Sensor tip cable	Vpk (DC + peak AC)	V_{RMS}
Sensor head only	4.3 Vpk	3 V_{RMS}
IVTIP1X	4.3 Vpk	3 V_{RMS}
IVTIP5X	21.5 Vpk	12 V_{RMS}
IVTIP10X	43 Vpk	16 V_{RMS}
IVTIP25X	107.5 Vpk	25 V_{RMS}
IVTIP50X	200 Vpk	35 V_{RMS}

Maximum non-destructive voltage TIVH Series

TIVH Series Maximum non-destructive voltage (Typical)

Sensor tip cable	Vpk (DC + peak AC) [3]
Sensor head only	25 Vpk
IVTIP1X	25 Vpk
MMCX10X	250 Vpk
MMCX50X	250 Vpk
MMCX250X	250 Vpk
SQPIN100X	600 Vpk
SQPIN500X	600 Vpk
WSQPIN1000X	2500 Vpk
WSQPIN2500X	2500 Vpk

[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.

Common mode voltage

Common mode voltage	60 kV peak

Common mode input impedance

Common mode input impedance (Typical)

Input resistance	Galvanically isolated through the fiber optic connection
Input capacitance [4]	< 2 pF

DC Gain accuracy

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

System noise (input referred) (Typical)

Sensor tip cable/adapter	1X Range	2X Range
TIVH08/TIVH08L Sensor head input SMA	< 1.2 mV_{rms}	< 1.4 mV_{rms}
TIVH05/TIVH05L Sensor head input SMA	< 0.72 mV_{rms}	< 0.85 mV_{rms}
TIVH02/TIVH02L Sensor head input SMA	< 0.61 mV_{rms}	< 0.75 mV_{rms}
TIVM1/TIVM1L Sensor head input SMA	< 0.8 mV_{rms}	< 1.6 mV_{rms}
Input referred noise with tip cable	(Sensor head input SMA noise) * (Tip cable attenuation)	(Sensor head input SMA noise) * (Tip cable attenuation)
Examples:	TIVH08 1X Range with MMCX10X tip cable: Noise = (1.2 mV_{rms}) * (10) = 12 mV_{rms}	TIVH08 2X Range with MMCX10X tip cable: Noise = (1.4 mV_{rms}) * (10) = 14 mV_{rms}

Propagation delay

Propagation delay

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

Laser certification

Laser certification	CLASS I LASER PRODUCT

[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.

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

Ordering information

Models

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)
---	Certificate of traceable calibration

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

016-2135-xx	IsoVu product carrying case, soft case
016-2134-xx	IsoVu accessories carrying case, soft case
MMCX50X	50X Sensor tip cable
SQPIN500X	500X Sensor tip cable
003-1951-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)
196-3546-xx	MMCX to IC grabber lead
196-3547-xx	Square pin header to IC grabber lead
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. D3	Calibration Data Report 3 Years (with Opt. C3)
Opt. D5	Calibration Data Report 5 Years (with Opt. C5)
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.

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