



TECHNICAL OVERVIEW

FET Solid State Switches

U9422A/B/C: 300 kHz to 26.5/50/54 GHz, SPDT

U9424A/B/C: 300 kHz to 26.5/50/54 GHz, SP4T

U9428A/B/C: 300 kHz to 26.5/50/54 GHz, SP8T

Key Features

- Broad operating frequency range from 300 kHz to 26.5/50/54 GHz
- Minimizes crosstalk with exceptionally high isolation across broad frequency
- Prevent damage to sensitive components with low video leakage
- Maintain fast throughput switch switching speed in microseconds
- USB connection that comes with multiport configuration connectivity port for PXIe and USB VNA or solder connector options provide switches configuration flexibility

Description

The U942xA/B/C FET solid state switches offer superior performance in terms of isolation and video leakage across a broad operating frequency range of up to 26.5/50/54 GHz. These SPDT/SP4T/SP8T switches are used to increase system flexibility and simplicity and are easily controlled with USB connection; that comes with the flexibility of multiport configuration connectivity port PXIe and USB VNA or through a soldering connector option

These switches offer unmatched isolation performance between ports, as high as 100 dB at 9 GHz or 70 dB up to 54 GHz. In addition, the U942xA/B/C provide low video leakage less than 50 mVpp for SP8T which ensures safe testing of sensitive components. High video leakage can degrade measurement accuracy and possibly damage sensitive components or equipment. Low video leakage makes these switches particularly suited for measuring sensitive devices and components such as mixers and amplifiers. To learn more about video leakage and how it can affect measurements and devices, see Keysight's "Video Leakage Effects on Devices in Component Test Application Note."



The switches fast switching speed in microseconds making it ideal for RF and microwave switching applications in instrumentation, communication, radar, switch matrices and various other test systems where speed and lifetime of a switch are critical parameters.

Specifications

Specifications describe the instrument's warranted performance. Supplemental and typical characteristics are intended to provide information useful in applying the instrument by giving typical, but not warranted performance parameters. U942xA/B/C specifications are tested at nominal voltage at 25°C.

Specifications	U9422A/B/C, SPDT	U9424A/B/C, SP4T	U9428A/B/C
Frequency range	300 kHz to 26.5/50/54 GHz	300 kHz to 26.5/50/54 GHz	300 kHz to 26.5/50/54 GHz
Insertion loss (dB)	300 kHz to 9 GHz: 3.1 9 to 18 GHz: 3.8 18 to 26.5 GHz: 4.6 26.5 to 37 GHz: 5.6 37 to 45 GHz: 5.9 45 to 52 GHz: 7.3 52 to 54 GHz: 8.1	00 kHz to 9 GHz: 4.0 9 to 14 GHz: 4.8 14 to 18 GHz: 5.3 18 to 26.5 GHz: 6.2 26.5 to 33 GHz: 7.0 33 to 38 GHz: 7.7 38 to 45 GHz: 9.3 45 to 50 GHz: 10.2 50 to 54 GHz: 10.8	300 kHz to 18 GHz: 6.0 18 to 28 GHz: 7.6 28 to 35 GHz: 8.3 35 to 42 GHz: 9.5 42 to 47 GHz: 11.5 47 to 54 GHz: 13.2
Isolation (dB)	300 kHz to 500 MHz: 90 500 MHz to 9 GHz: 100 9 to 18 GHz: 90 18 to 22 GHz: 88 22 to 30 GHz: 79.5 30 to 38 GHz: 80 38 to 50 GHz: 77 50 to 54 GHz: 70	300 kHz to 500 MHz: 89 500 MHz to 11 GHz: 96 11 to 26.5 GHz: 90 26.5 to 42 GHz: 78 42 to 46 GHz: 75 46 to 49 GHz: 70 50 to 54 GHz: 64	300 kHz to 500 MHz: 89 500 MHz to 5 GHz: 92 5 to 18 GHz: 65 18 to 32 GHz: 57 32 to 40 GHz: 52 40 to 54 GHz: 50
OFF port return loss, dB (VSWR)	300 kHz to 14 GHz: 13.3 (1.6) 14 to 20 GHz: 11.7 (1.7) 20 to 26.5 GHz: 12.9 (1.59) 26.5 to 40 GHz: 12.7 (1.6) 40 to 45 GHz: 7.8 (2.4) 45 to 51 GHz: 6.3 (2.9) 51 to 54 GHz: 9.5 (2.0)	300 kHz to 8 GHz: 16.3 (1.4) 8 to 13 GHz: 12.5 (1.6) 13 to 35 GHz: 10.6 (1.8) 35 to 39 GHz: 12.8 (1.6) 39 to 43 GHz: 8.7 (2.2) 43 to 50 GHz: 5.1 (3.5) 50 to 54 GHz: 6.8 (2.7)	300 kHz to 8 GHz: 17.5 (1.3) 8 to 15 GHz: 13.5 (1.5) 15 to 43 GHz: 10.0 (1.9) 43 to 54 GHz: 4.5 (3.9)
ON port return loss, dB (VSWR)	300 kHz to 14 GHz: 14 (1.5) 14 to 20 GHz: 11 (1.79) 20 to 28 GHz: 9.5 (2.0) 28 to 45 GHz: 8.4 (2.2) 45 to 54 GHz: 6.2 (2.9)	300 kHz to 9 GHz: 13 (1.5) 9 to 26.5 GHz: 8.5 (2.2) 26.5 to 37 GHz: 7.5 (2.5) 37 to 43 GHz: 5.8 (3.1) 43 to 51 GHz: 5.6 (3.2) 51 to 54 GHz: 7.6 (2.4)	300 kHz to 6 GHz: 11.0 (1.8) 6 to 27 GHz: 7.5 (2.5) 27 to 40 GHz: 7.5 (2.5) 40 to 54 GHz: 5.0 (3.6)

Switching speed	Solder terminal: 0.12 us Multiport configuration connectivity port: 16 us USB 3.1 300 us	Solder terminal: 3 us Multiport configuration connectivity port: 20 us USB 3.1: 300 us	Solder terminal: 4.5 us Multiport configuration connectivity port: 24 us USB 3.1: 300 us
Video leakage, typical	270 mVpp	270 mVpp	50 mVpp
Power handling (max)	25 dBm	25 dBm	26 dBm
Connector type	26.5 GHz: 3.5 mm, 50 GHz: 2.4 mm, 54 GHz: 1.85 mm		
Connectivity	Solder terminal or USB 3.0 with Multiport configuration connectivity port for PXIe and USB VNA		
Automation SW with VNA	Yes (for option 002)		

Note: Applies to all models and specifications: For the first, second and subsequent frequency band, the last frequency test point is $\leq$ (inclusive) the frequency point.

Example for U9422A/B/C isolation: “300 kHz to 500 MHz” (inclusive) until the last point which is $\leq$ 500 MHz with the specs of 90 dB. If it is $\geq$ 500 MHz (example 500.0001 MHz), the specification refers to the next frequency range of “500 MHz to 9 GHz” with the specs of 100 dB

Switches Control and Biasing

U9422x Solder Wire (Option 001)

Power consumption: ~ 100 mA @ VCC = 5 V

Use either 3.3 V or 5 V logic control

U9422x, 3-pins connector to bare wire, 85 mm (for SPDT option 001 only)

CTRL logic	RF port
0	1
1	2

U9424x Solder Wire (Option 001)

Power consumption: ~ 200 mA @ VCC = 5 V

Use either 3.3 V or 5 V logic control

U9424x, 4-pins connector to bare wire, 85 mm (for SP4T option 001 only)		
CTRL1 logic	CTRL2 logic	RF port
0	0	1
1	0	2
0	1	3
1	1	4

U9424x Solder Wire (Option 001)

Power consumption: ~ 350 mA @ VCC = 5 V

Use either 3.3 V or 5 V logic control

U9428x, 5-pins connector to bare wire, 85 mm (for SP8T option 001 only)			
CTRL1 logic	CTRL2 logic	CTRL2 logic	RF port
0	0	0	1
1	0	0	2
0	1	0	3
1	1	0	4
0	0	1	5
1	0	1	6
0	1	1	7
1	1	1	8

Multipoint connectivity with PXIe & USB VNA (Option 002)

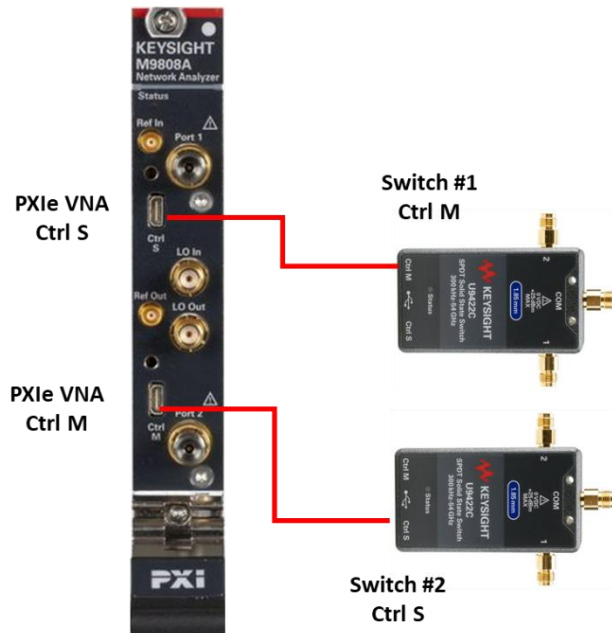


Figure 1: Example of connection using M980xA PXIe VNA to control 2 U9422x switches (Option 002) with multipoint interconnect cable.

USB Connectivity (Option 002)

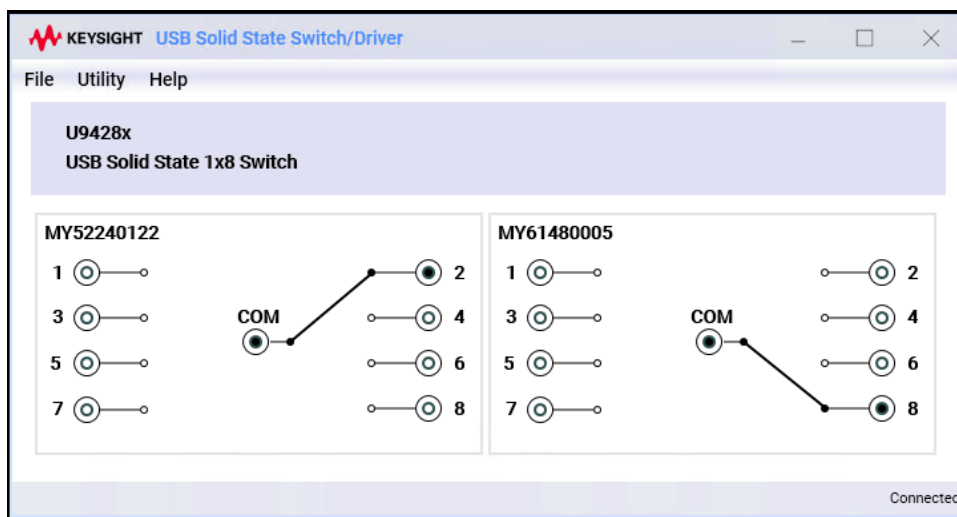


Figure 2: Example of soft front panel (SFP) when connected with U9428x switches. The USB connection allows control of the switches via SFP or through SCPI via Keysight IO control.

Typical Performance

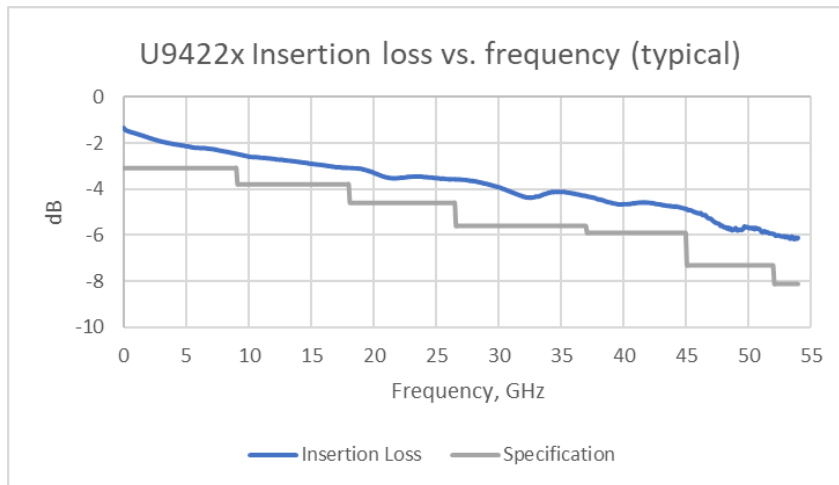


Figure 3. U9422x insertion loss vs frequency (GHz) typical

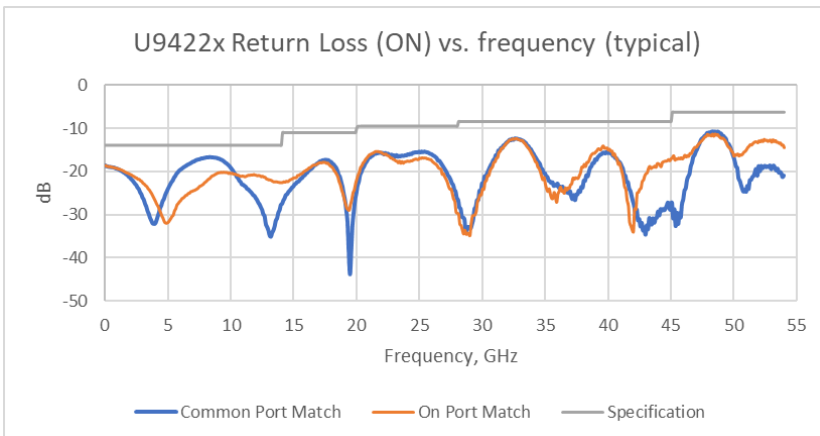


Figure 4. U9422x return loss (ON) vs frequency (GHz) typical

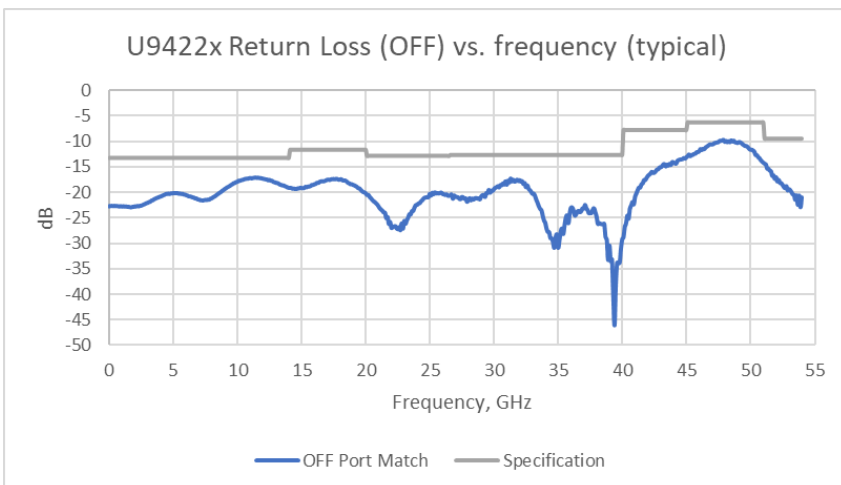


Figure 5. U9422x return loss (OFF) vs frequency (GHz) typical

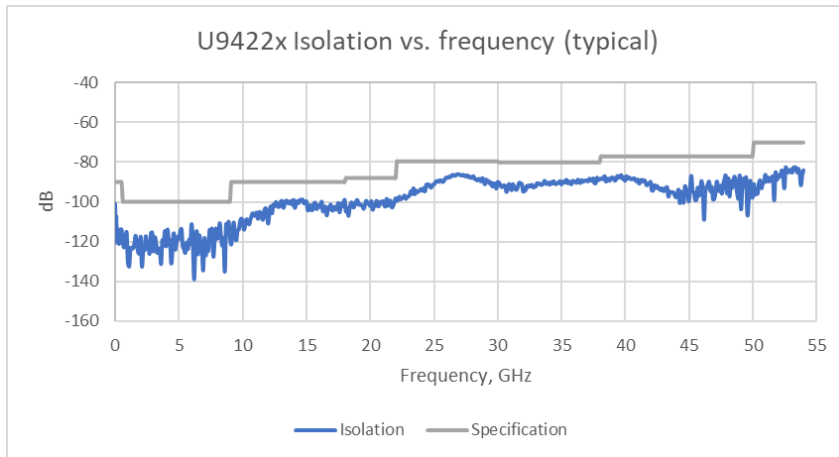


Figure 6. U9422x isolation vs frequency (GHz) typical

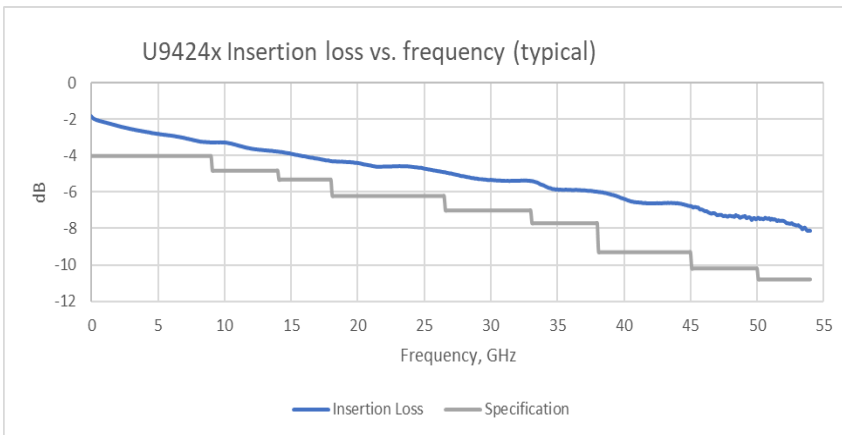


Figure 7. U9424x insertion loss vs frequency (GHz) typical

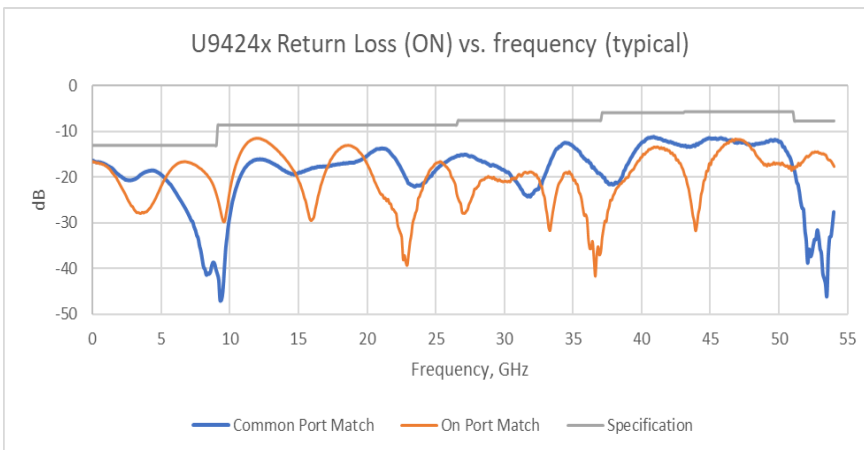


Figure 8. U9424x return loss (ON) vs frequency (GHz) typical

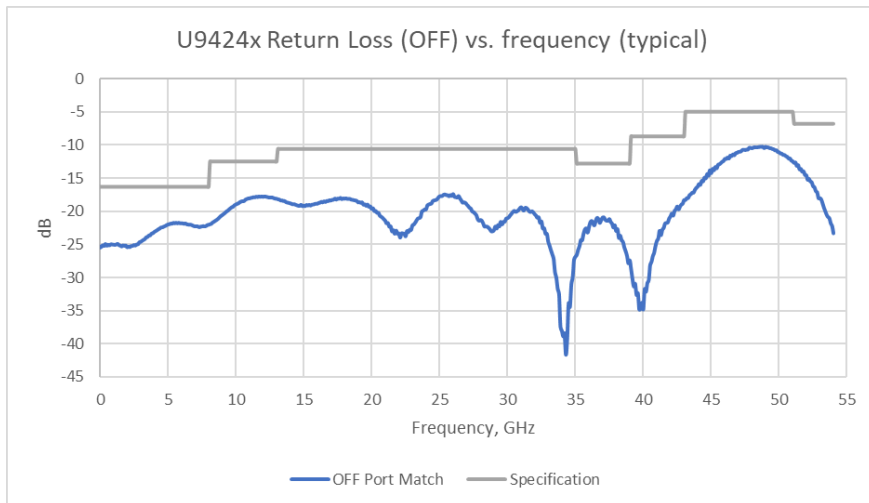


Figure 9. U9424x return loss (OFF) vs frequency (GHz) typical

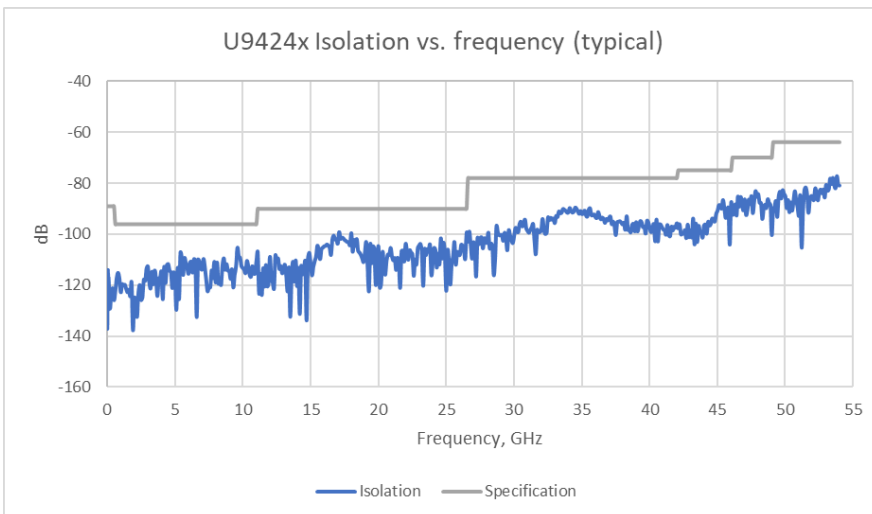


Figure 10. U9424x isolation vs frequency (GHz) typical

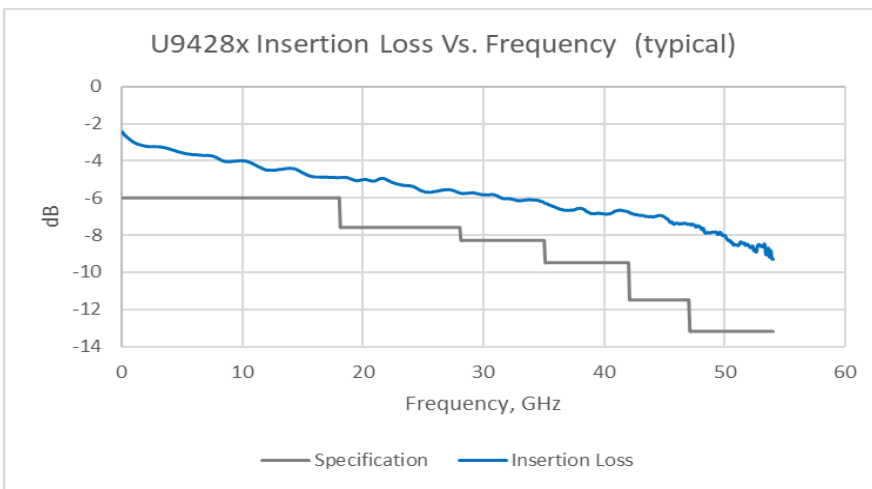


Figure 11. U9428x insertion loss vs frequency (GHz) typical

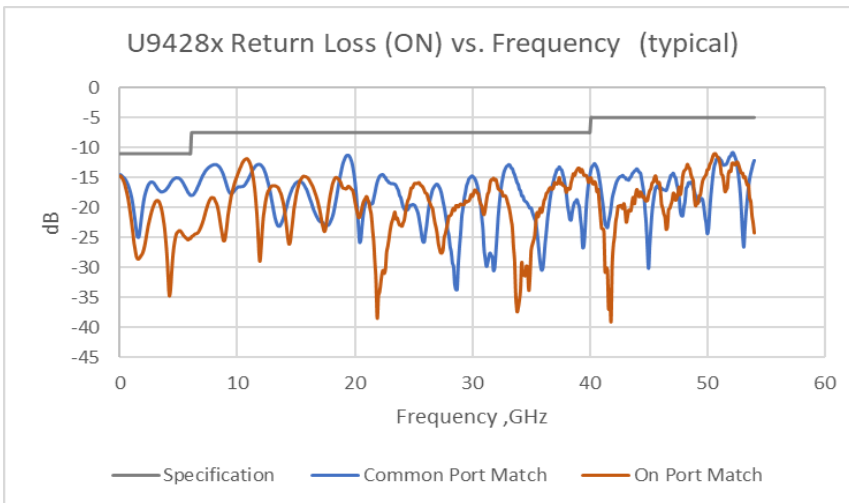


Figure 12. U9428x return loss (ON) vs frequency (GHz) typical

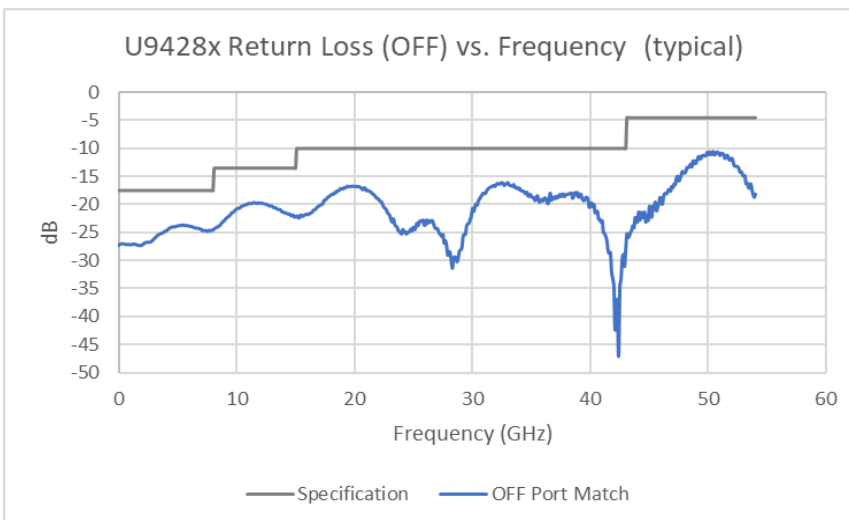


Figure 13. U9428x return loss (OFF) vs frequency (GHz) typical

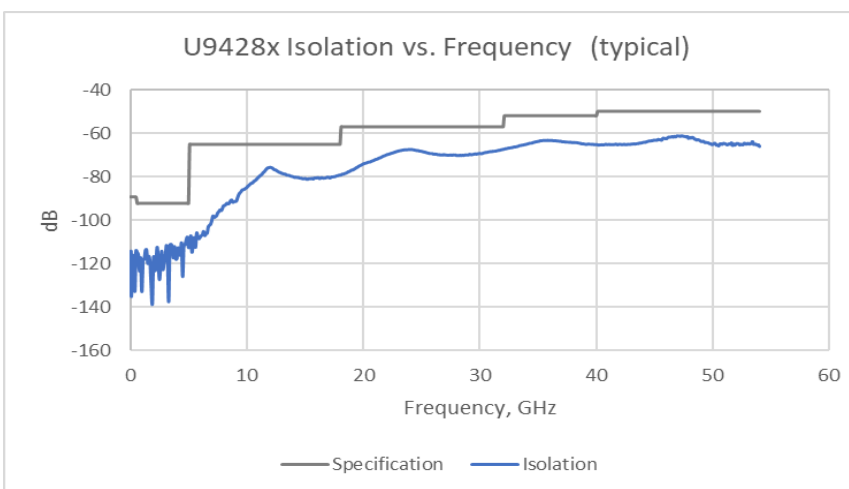


Figure 14. U9428x isolation vs frequency (GHz) typical

Environmental Specifications

The U942xA/B/C FET solid state switches are designed to fully comply with Keysight Technologies' product operating environment specifications. The following summarizes the environmental specifications for these products.

Environment condition	U942xA/B/C
Temperature Operating Storage	0 °C to +55°C – 40 °C to +70°C
Humidity Operating	95% RH at 40°C (non-condensing)
Shock End-user handling Transportation	Delta-V: 1.6 m/s (60 in/s) ±5%, Duration <3ms 50G , Delta-V: 8m/s ±10% at 6 faces
Vibration Operating random Survival random	0.21 Grms 2.41 Grms
Altitude Operating Non-operating	<4,600 meters (15,000 feet) <4,600 meters (15,000 feet)
ESD immunity Direct discharge Air discharge	4 kV per IEC 61000-4-2 8 kV per IEC 61000-4-2

Mechanical Dimensions

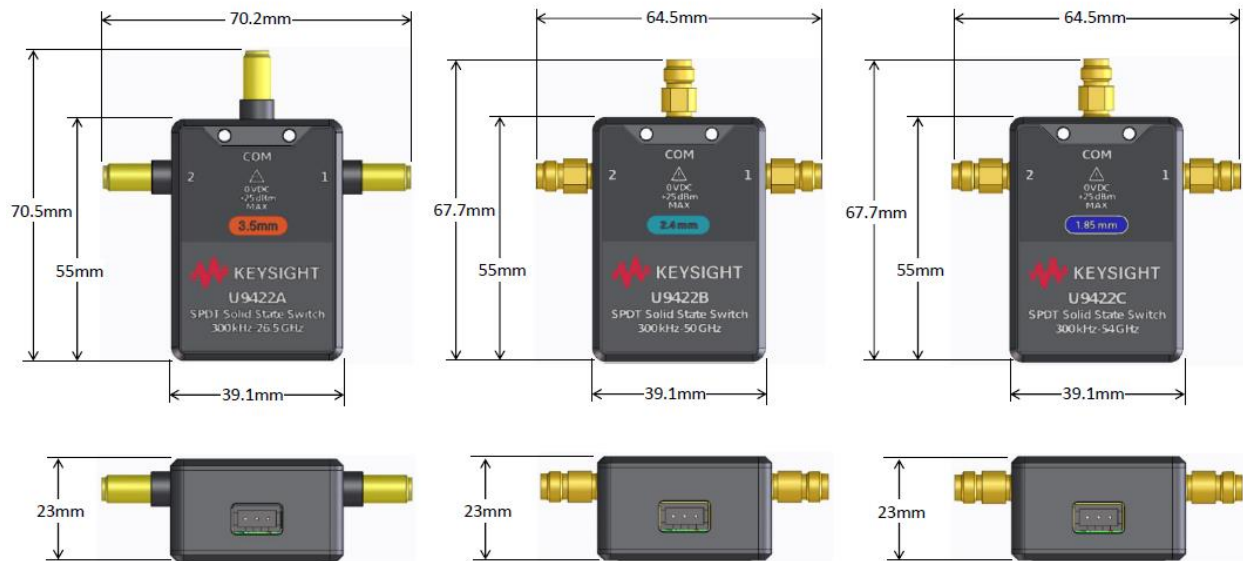


Figure 15. U9422x dimension (option 001), SPDT

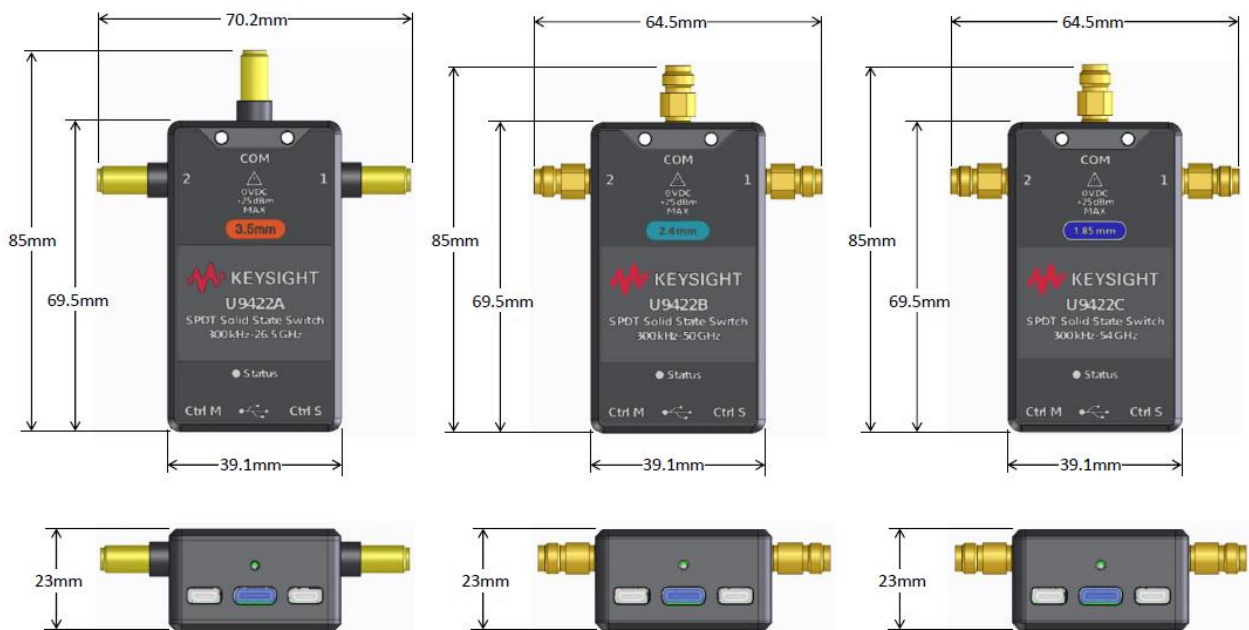


Figure 16. U9422x dimension (option 002), SPDT

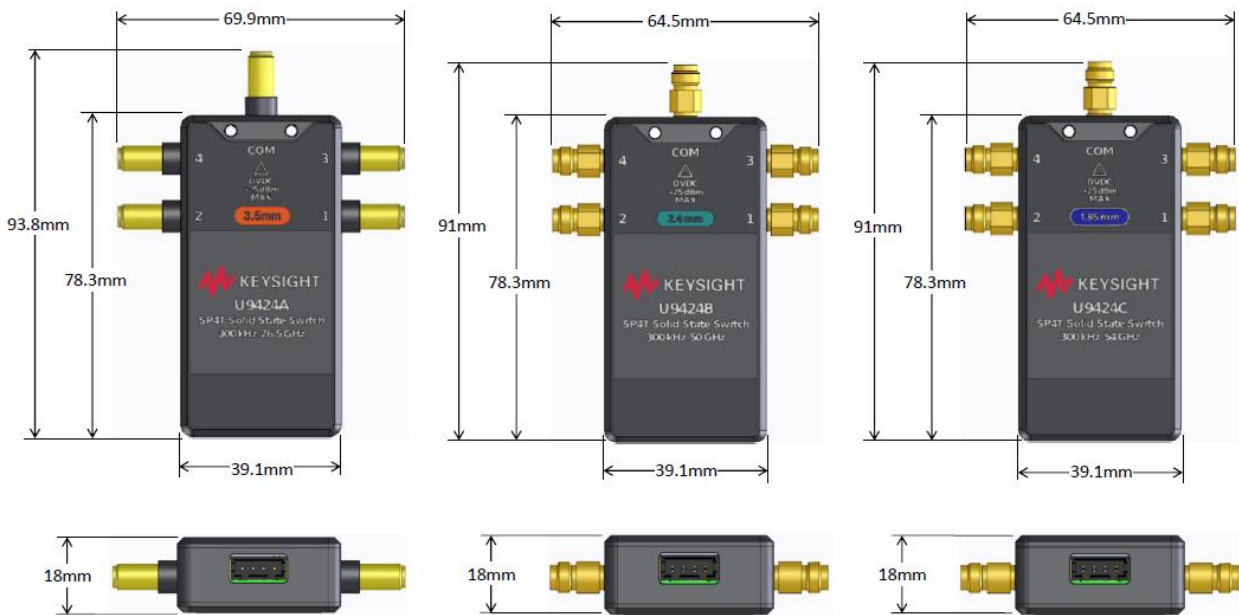


Figure 17. U9424x dimension (option 001), SP4T

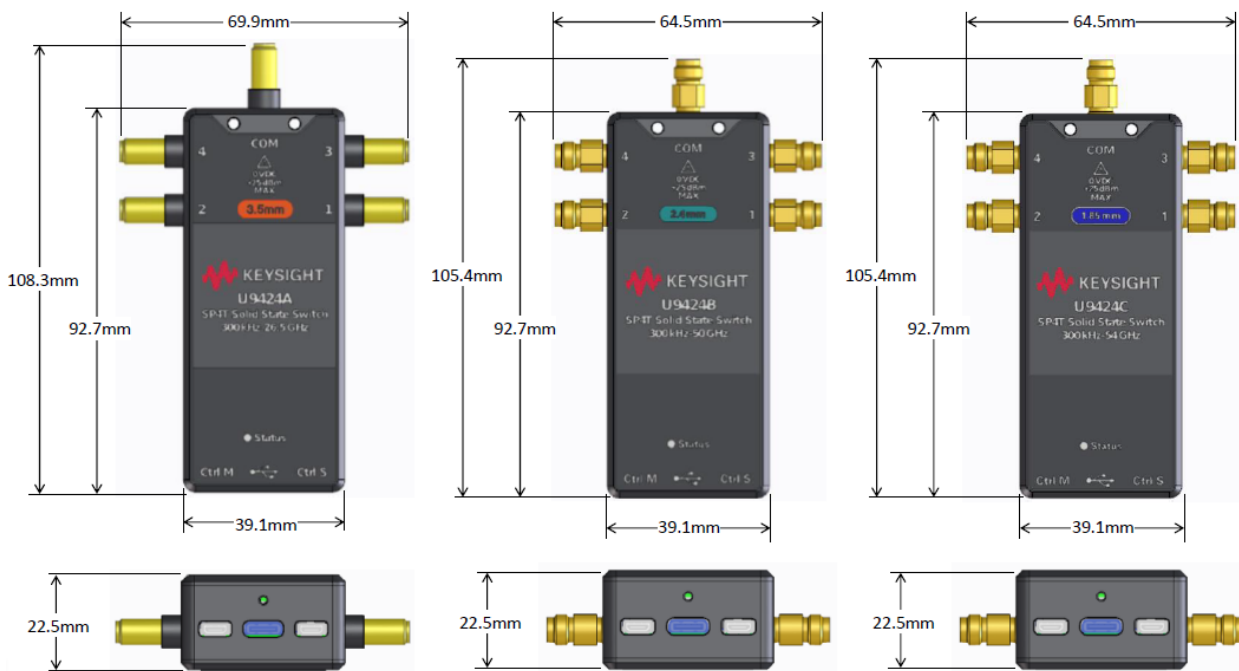


Figure 18. U9424x dimension (option 002), SP4T

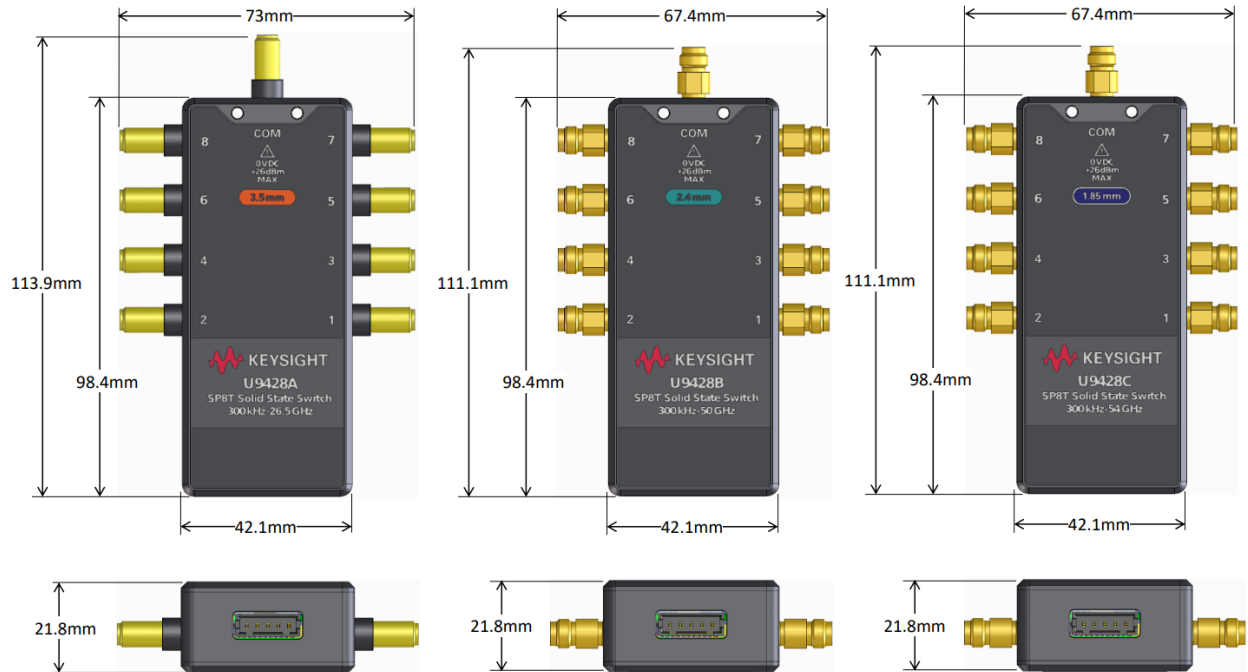


Figure 19. U9428x dimension (option 001), SP8T

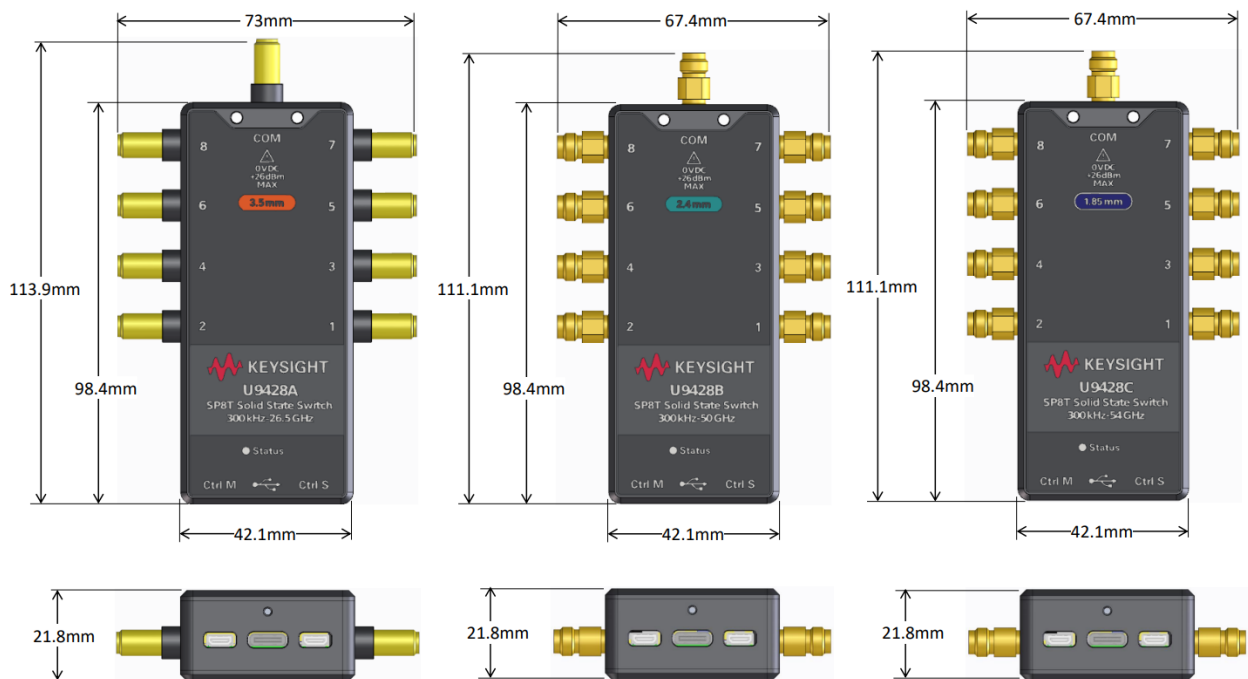


Figure 20. U9428x dimension (option 002), SP8T

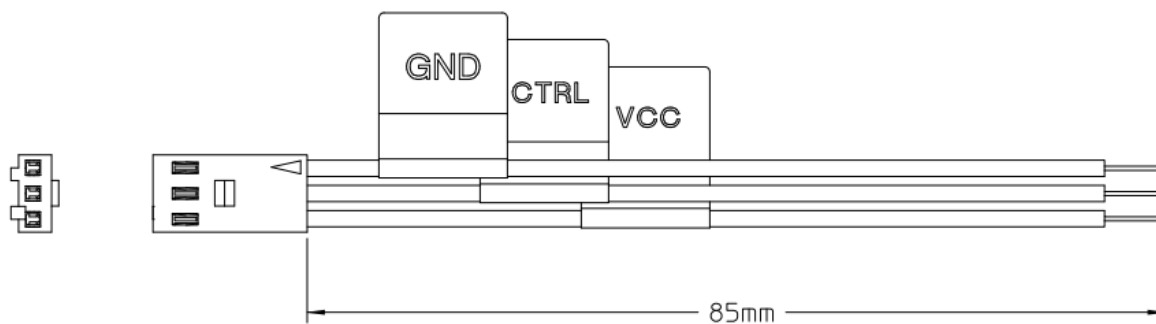


Figure 21. Option 101, 3-pins connector to bare wire, 85 mm (for SPDT option 001 only) dimension

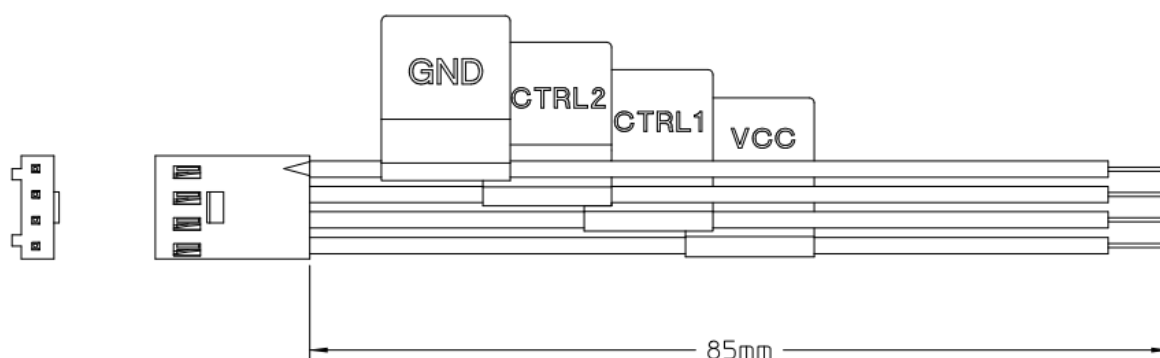


Figure 22. Option 101, 4-pins connector to bare wire, 85 mm (for SP4T option 001 only) dimension

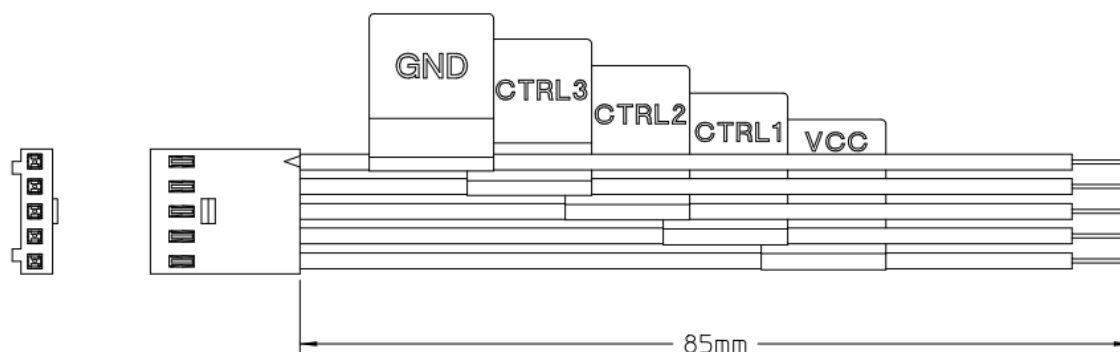


Figure 23. Option 101, 5-pins connector to bare wire, 85 mm (for SP8T option 001 only) dimension

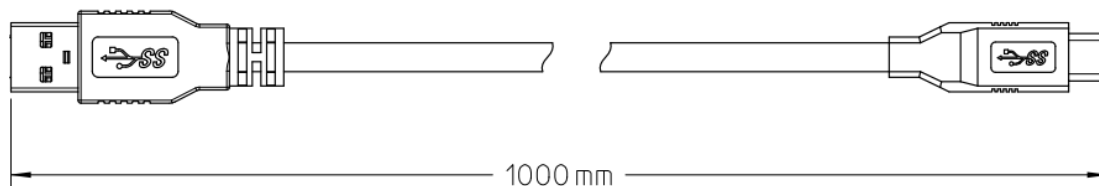


Figure 24. Option 201, USB 3.1 Type-A to Type-C, 1 meter (for option 002 only) dimension

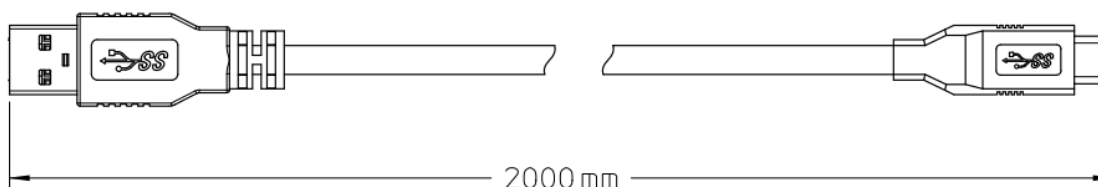


Figure 25. Option 202, USB 3.1 Type-A to Type-C, 2 meters (for option 002 only) dimension

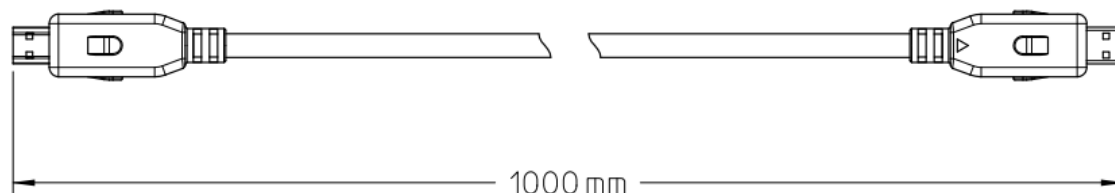


Figure 26. Option 301, interconnect cable for multiport configuration with PXIe & USB VNA (for option 002 only), 1 meter

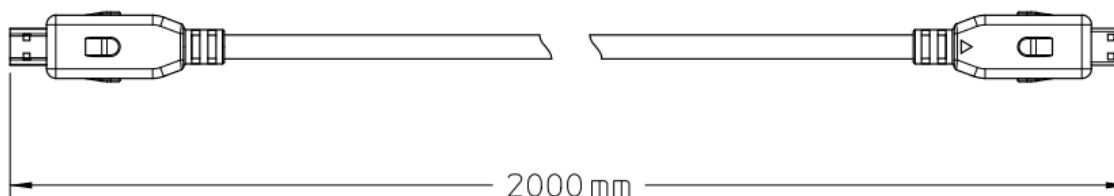


Figure 27. Option 302, interconnect cable for multiport configuration with PXIe & USB VNA (for option 002 only), 2 meters

Ordering information

Model	Description
U9422A	FET Solid State Switch, 300 kHz to 26.5 GHz, SPDT
U9422B	FET Solid State Switch, 300 kHz to 50 GHz, SPDT
U9422C	FET Solid State Switch, 300 kHz to 54 GHz, SPDT
U9424A	FET Solid State Switch, 300 kHz to 26.5 GHz, SP4T
U9424B	FET Solid State Switch, 300 kHz to 50 GHz, SP4T
U9424C	FET Solid State Switch, 300 kHz to 54 GHz, SP4T
U9428A	FET Solid State Switch, 300 kHz to 26.5 GHz, SP8T
U9428B	FET Solid State Switch, 300 kHz to 50 GHz, SP8T
U9428C	FET Solid State Switch, 300 kHz to 54 GHz, SP8T
Connectivity Option	Option 001: Solder terminal, Option 002: USB and multiport configuration port
Cable option	Option 101: 3-pins connector to bare wire, 85 mm (for SPDT option 001 only) 4-pins connector to bare wire, 85 mm (for SP4T option 001 only) 5-pins connector to bare wire, 85 mm (for SP8T option 001 only) Option 201: USB 3.1 Type-A to Type-C, 1 meter (for option 002 only) Option 202: USB 3.1 Type-A to Type-C, 2 meters (for option 002 only) Option 301: interconnect cable for multiport configuration with PXIe & USB VNA (for option 002 only), 1 meter Option 302: interconnect cable for multiport configuration with PXIe & USB VNA (for option 002 only), 2 meters

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