



P9164A/B/C 2X16 & P9165A/B/C 2X8 USB Solid State Switch Matrix

300 kHz to 6.5/9/18 GHz

Compact Form. Zero Compromise

- Choose frequency ranges from 300 kHz up to 18 GHz
- Extend the number of test ports for multi-DUT or multiport devices measurement
- Portable and easily share the compact switch matrix between your location
- Achieve lower cost-per-port test without compromising performance and bench space

Description

Keysight P916x A/B/C 2X8/16 USB solid state switch matrix, 300 kHz to 6.5/9/18 GHz is a full-crossbar switch matrix. It works seamlessly with Keysight's P50xxA streamline series of VNA solution in providing a switch based multiport VNA solution in the form of compact USB controlled involving larger scale of multi-DUT or multiport measurement such as 5G massive MIMO antenna measurement.

The P916xA/B/C is compact and portable. Together with exceptional RF performance, it delivers confidence in your measurement for a reliable and repeatable results while at the same time reducing the overall cost of test.

Block Diagram

Keysight P9164x are 2 slot USB 2x16 solid state switch modules whereas P9165x are 1 slot USB 2x8 solid state switch modules. They are designed to provide switch based multiport VNA solution and can also be used as a generic standalone switching solution, operating from 300 kHz to up to 18GHz. The switch is configured as either 2x8 (2 in, 8 out) or 2x16 (2 in, 16 out) full-crossbar switch and consists of multiple SPDT and SP4T CMOS switches for fast switching. Switching can be done via the Soft Front Panel (provided) or IVI commands, executed from the host computer. A driver circuitry provides the necessary decoding to switch to the selected paths. At any time, 2 RF paths would be in the ON state, connected to user selected output ports, while the rest of the ports will be in an ISOLATION state. Output ports that are not switched will be internally terminated to 50 ohms.

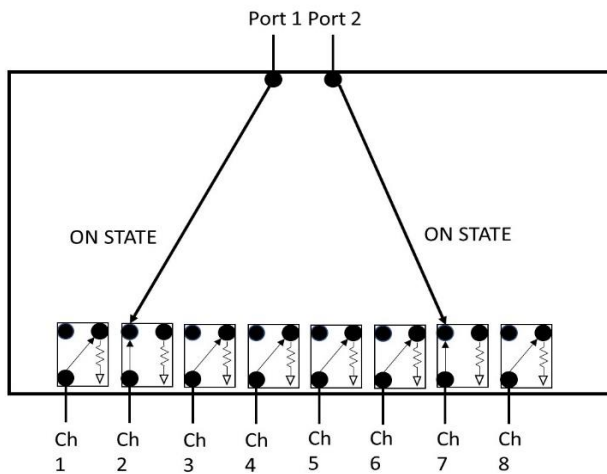


Figure 1. Simplified block diagram of 2X8 switch matrix

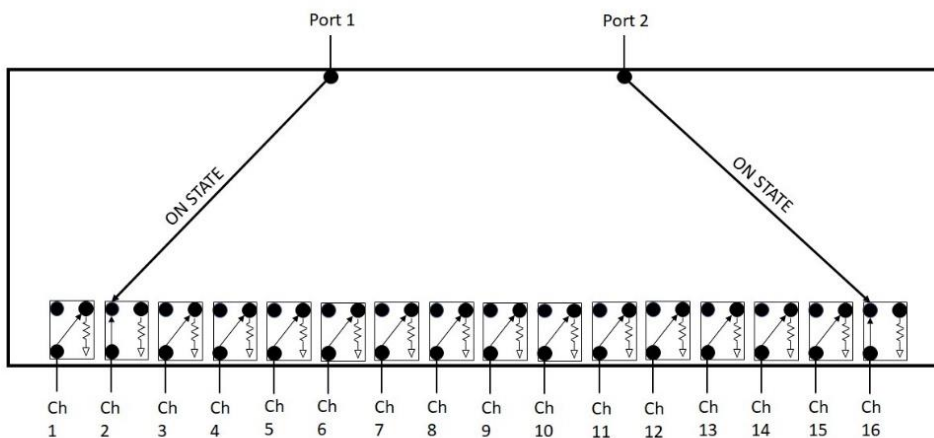


Figure 2. Simplified block diagram of 2X16 switch matrix

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

P9164A/B/C 2X16 USB Solid State Switch Matrix

| Specification | P9164A | P9164B | P9164C |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating Frequency | 300 kHz to 6.5 GHz | 300 kHz to 9 GHz | 300 kHz to 18 GHz |
| Configuration | 2X16 full crossbar | 2X16 full crossbar | 2X16 full crossbar |
| Isolation (dB) | 300 kHz to 2 GHz: 87 2 to 6.5 GHz: 85 | 300 kHz to 2 GHz: 87 2 to 9 GHz: 85 | 300 kHz to 2 GHz: 87 2 to 15 GHz: 85 15 to 18 GHz: 77 |
| Insertion loss (dB) Port 1 to CH9, CH10, CH11, CH12, CH13, CH14, CH15, CH16 and Port 2 to CH1, CH2, CH3, CH4, CH5, CH6, CH7, CH8 | 300 kHz to 2 MHz: 3.7 2 MHz to 100 MHz: 3.5 100 MHz to 2 GHz: 5.1 2 to 4 GHz: 6.8 4 to 6.5 GHz: 8.6 | 300 kHz to 2 MHz: 3.7 2 MHz to 100 MHz: 3.5 100 MHz to 2 GHz: 5.1 2 to 4 GHz: 6.8 4 to 6.5 GHz: 8.6 6.5 to 8 GHz: 9.9 8 to 9 GHz: 10.6 | 300 kHz to 2 MHz: 3.7 2 MHz to 100 MHz: 3.5 100 MHz to 2 GHz: 5.1 2 to 4 GHz: 6.8 4 to 6.5 GHz: 8.6 6.5 to 8 GHz: 9.9 8 to 9 GHz: 10.6 9 to 12.5 GHz: 12.6 12.5 to 15 GHz: 14.3 15 to 17 GHz: 15.3 17 to 18 GHz: 16 |
| Insertion loss (dB) Port 2 to CH9, CH10, CH11, CH12, CH13, CH14, CH15, CH16 and Port 1 to CH1, CH2, CH3, CH4, CH5, CH6, CH7, CH8 | 300 kHz to 2 MHz: 3.7 2 MHz to 100 MHz: 3.5 100 MHz to 2 GHz: 5 2 to 4 GHz: 6.8 4 to 6.5 GHz: 8.4 | 300 kHz to 2 MHz: 3.7 2 MHz to 100 MHz: 3.5 100 MHz to 2 GHz: 5 2 to 4 GHz: 6.8 4 to 6.5 GHz: 8.4 6.5 to 8 GHz: 9.2 8 to 9 GHz: 10 | 300 kHz to 2 MHz: 3.7 2 MHz to 100 MHz: 3.5 100 MHz to 2 GHz: 5 2 to 4 GHz: 6.8 4 to 6.5 GHz: 8.4 6.5 to 8 GHz: 9.2 8 to 9 GHz: 10 9 to 12.5 GHz: 11.3 12.5 to 15 GHz: 12.7 15 to 17 GHz: 14.3 17 to 18 GHz: 14.5 |
| Return loss (Port 1/2 ON) (dB) Port 1 to CH9, CH10, CH11, CH12, CH13, CH14, CH15, CH16 and Port 2 to CH1, CH2, CH3, CH4, CH5, CH6, CH7, CH8 | 300 kHz to 2 MHz: 7.0 2 MHz to 100 MHz: 8.0 100 MHz to 3 GHz: 8.9 3 to 6.5 GHz: 9.7 | 300 kHz to 2 MHz: 7.0 2 MHz to 100 MHz: 8.0 100 MHz to 3 GHz: 8.9 3 to 6.5 GHz: 9.7 6.5 to 9 GHz: 8.4 | 300 kHz to 2 MHz: 7.0 2 MHz to 100 MHz: 8.0 100 MHz to 3 GHz: 8.9 3 to 6.5 GHz: 9.7 6.5 to 9 GHz: 8.4 9 to 10.5 GHz: 8 10.5 to 12 GHz: 7.9 12 to 13.5 GHz: 8.6 13.5 to 17 GHz: 6.4 17 to 18 GHz: 7.4 |

P9164A/B/C 2X16 USB Solid State Switch Matrix (continue)

| Specification | P9164A | P9164B | P9164C |
|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Return loss (Port 1/2 ON) (dB) Port 2 to CH9, CH10, CH11, CH12, CH13, CH14, CH15, CH16 and Port 1 to CH1, CH2, CH3, CH4, CH5, CH6, CH7, CH8 | 300 kHz to 2 MHz: 7.0 2 MHz to 100 MHz: 8.0 100 MHz to 3 GHz: 8.9 3 to 6.5 GHz: 9.7 | 300 kHz to 2 MHz: 7.0 2 MHz to 100 MHz: 8.0 100 MHz to 3 GHz: 8.9 3 to 6.5 GHz: 9.7 6.5 to 9 GHz: 8.4 | 300 kHz to 2 MHz: 7.0 2 MHz to 100 MHz: 8.0 100 MHz to 3 GHz: 8.9 3 to 6.5 GHz: 9.7 6.5 to 9 GHz: 8.4 9 to 10.5 GHz: 8 10.5 to 12 GHz: 7.9 12 to 13.5 GHz: 8.6 13.5 to 17 GHz: 6.4 17 to 18 GHz: 7.4 |
| Return loss (CHx port, ON) (dB) Port 1 to CH9, CH10, CH11, CH12, CH13, CH14, CH15, CH16 and Port 2 to CH1, CH2, CH3, CH4, CH5, CH6, CH7, CH8 | 300 kHz to 2 MHz: 7.0 2 MHz to 100 MHz: 8.0 100 MHz to 5 GHz: 8.9 5 to 5.5 GHz: 8.2 5.5 to 6.5 GHz: 10.1 | 300 kHz to 2 MHz: 7.0 2 MHz to 100 MHz: 8.0 100 MHz to 5 GHz: 8.9 5 to 5.5 GHz: 8.2 5.5 to 6.5 GHz: 10.1 6.5 to 7 GHz: 10.1 7 to 8 GHz: 9.6 8 to 9 GHz: 9.6 | 300 kHz to 2 MHz: 7.0 2 MHz to 100 MHz: 8.0 100 MHz to 5 GHz: 8.9 5 to 5.5 GHz: 8.2 5.5 to 7 GHz: 10.1 7 to 9 GHz: 9.6 9 to 10.5 GHz: 6.1 10.5 to 12 GHz: 5.6 12 to 16 GHz: 6.6 16 to 18 GHz: 6 |
| Return loss (CHx port, ON) (dB) Port 2 to CH9, CH10, CH11, CH12, CH13, CH14, CH15, CH16 and Port 1 to CH1, CH2, CH3, CH4, CH5, CH6, CH7, CH8 | 300 kHz to 2 MHz: 7.0 2 MHz to 100 MHz: 8.0 100 MHz to 5 GHz: 8.9 5 to 5.5 GHz: 8.2 5.5 to 6.5 GHz: 10.1 | 300 kHz to 2 MHz: 7.0 2 MHz to 100 MHz: 8.0 100 MHz to 5 GHz: 8.9 5 to 5.5 GHz: 8.2 5.5 to 6.5 GHz: 10.1 6.5 to 7 GHz: 10.1 7 to 8 GHz: 9.6 8 to 9 GHz: 9.6 | 300 kHz to 2 MHz: 7.0 2 MHz to 100 MHz: 8.0 100 MHz to 5 GHz: 8.9 5 to 5.5 GHz: 8.2 5.5 to 7 GHz: 10.1 7 to 9 GHz: 9.6 9 to 10.5 GHz: 6.1 10.5 to 12 GHz: 5.6 12 to 16 GHz: 6.6 16 to 18 GHz: 6 |
| Return loss (CHx port, OFF) (dB) | 300 kHz to 2 MHz: 12.0 2 MHz to 100 MHz: 12.0 100 MHz to 4 GHz: 13.4 4 to 6.5 GHz: 12.4 | 300 kHz to 2 MHz: 12.0 2 MHz to 100 MHz: 12.0 100 MHz to 4 GHz: 13.4 4 to 6.5 GHz: 12.4 6.5 to 8 GHz: 14 8 to 9 GHz: 11.0 | 300 kHz to 2 MHz: 12.0 2 MHz to 100 MHz: 12.0 100 MHz to 4 GHz: 13.4 4 to 6.5 GHz: 12.4 6.5 to 8 GHz: 14 8 to 9 GHz: 11.0 9 to 10.5 GHz: 9.4 10.5 to 14 GHz: 6 14 to 18 GHz: 5 |
| Typical Temperature Stability - 20 to 30°C (Magnitude dB/°C) | | 300 kHz to 3 GHz: 0.002 3 to 6.5 GHz: 0.003 6.5 to 11 GHz: 0.004 11 to 15 GHz: 0.006 15 to 18 GHz: 0.008 | |
| Typical Temperature Stability - 20 to 30°C (Phase Degree/°C) | | 300 kHz to 3 GHz: 0.02 3 to 6.5 GHz: 0.03 6.5 to 11 GHz: 0.05 11 to 15 GHz: 0.07 15 to 18 GHz: 0.10 | |

P9165A/B/C 2X8 USB Solid State Switch Matrix

| Specification | P9165A | P9165B | P9165C |
|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating Frequency | 300 kHz to 6.5 GHz | 300 kHz to 9 GHz | 300 kHz to 18 GHz |
| Configuration | 2X8 full crossbar | 2X8 full crossbar | 2X8 full crossbar |
| Isolation (dB) | 300 kHz to 1 GHz: 90 1 to 6.5 GHz: 88 | 300 kHz to 1 GHz: 90 1 to 9 GHz: 88 | 300 kHz to 2 GHz: 90 2 to 10 GHz: 88 10 to 15 GHz: 85 15 to 18 GHz: 80 |
| Insertion loss (dB) Port 1 to CH5, CH6, CH7, CH8 and Port 2 to CH1, CH2, CH3, CH4 | 300 kHz to 2 MHz: 3.7 2 MHz to 1 GHz: 4.3 1 to 3 GHz: 5.7 3 to 6.5 GHz: 7.2 | 300 kHz to 2 MHz: 3.7 2 MHz to 1 GHz: 4.3 1 to 3 GHz: 5.7 3 to 6.5 GHz: 7.2 6.5 to 9 GHz: 9.2 | 300 kHz to 2 MHz: 3.7 2 MHz to 1 GHz: 4.3 1 to 3 GHz: 5.7 3 to 6.5 GHz: 7.2 6.5 to 10 GHz: 9.4 10 to 13 GHz: 11.5 13 to 15 GHz: 13.5 15 to 16.5 GHz: 16.5 16.5 to 18 GHz: 16.2 |
| Insertion loss (dB) Port 1 to CH1, CH2, CH3, CH4 and Port 2 to CH5, CH6, CH7, CH8 | 300 kHz to 2 MHz: 3.7 2 MHz to 1 GHz: 4.3 1 to 3 GHz: 5.7 3 to 6.5 GHz: 7.2 | 300 kHz to 2 MHz: 3.7 2 MHz to 1 GHz: 4.3 1 to 3 GHz: 5.7 3 to 6.5 GHz: 7.2 6.5 to 9 GHz: 9.2 | 300 kHz to 2 MHz: 3.7 2 MHz to 1 GHz: 4.3 1 to 3 GHz: 5.7 3 to 6.5 GHz: 7.2 6.5 to 10 GHz: 9.4 10 to 13 GHz: 11.2 13 to 15 GHz: 12.5 15 to 16.5 GHz: 13.5 16.5 to 18 GHz: 14.2 |
| Return loss (Port 1/2 ON) (dB) Port 1 to CH5, CH6, CH7, CH8 and Port 2 to CH1, CH2, CH3, CH4 | 300 kHz to 2 MHz: 7.0 2 MHz to 6.5 GHz: 11.7 | 300 kHz to 2 MHz: 7.0 2 MHz to 6.5 GHz: 11.7 6.5 to 9 GHz: 10.2 | 300 kHz to 2 MHz: 7.0 2 MHz to 8 GHz: 11.7 8 to 10 GHz: 10.2 10 to 13 GHz: 7.7 13 to 15 GHz: 6.7 15 to 16.5 GHz: 4.5 16.5 to 18 GHz: 5.2 |
| Return loss (Port 1/2 ON) (dB) Port 1 to CH1, CH2, CH3, CH4 and Port 2 to CH5, CH6, CH7, CH8 | 300 kHz to 2 MHz: 7.0 2 MHz to 6.5 GHz: 12 | 300 kHz to 2 MHz: 7.0 2 MHz to 6.5 GHz: 12 6.5 to 9 GHz: 10 | 300 kHz to 2 MHz: 7.0 2 MHz to 8 GHz: 12 8 to 10 GHz: 10 10 to 13 GHz: 8.7 13 to 15 GHz: 7.7 15 to 16.5 GHz: 6 16.5 to 18 GHz: 6.5 |

P9165A/B/C 2X8 USB Solid State Switch Matrix (continue)

| Specification | P9165A | P9165B | P9165C |
|--------------------------------------------------------------------------------------------------|--------------------------------------------------|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Return loss (CHx port, ON) (dB) Port 1 to CH5, CH6, CH7, CH8 and Port 2 to CH1, CH2, CH3, CH4 | 300 kHz to 2 MHz: 7.0 2 MHz to 6.5 GHz: 11.7 | 300 kHz to 2 MHz: 7.0 2 MHz to 6.5 GHz: 11.7 6.5 to 9 GHz: 9.7 | 300 kHz to 2 MHz: 7.0 2 MHz to 6.5 GHz: 11.7 6.5 to 10 GHz: 9.7 10 to 11.5 GHz: 9 11.5 to 13.5 GHz: 8.7 13.5 to 15 GHz: 6.7 15 to 16.5 GHz: 4.2 16.5 to 18 GHz: 5.2 |
| Return loss (CHx port, ON) (dB) Port 1 to CH1, CH2, CH3, CH4 and Port 2 to CH5, CH6, CH7, CH8 | 300 kHz to 2 MHz: 7.0 2 MHz to 6.5 GHz: 11.7 | 300 kHz to 2 MHz: 7.0 2 MHz to 6.5 GHz: 11.7 6.5 to 9 GHz: 10 | 300 kHz to 2 MHz: 7.0 2 MHz to 6.5 GHz: 11.7 6.5 to 10 GHz: 8.7 10 to 11.5 GHz: 8.7 11.5 to 13.5 GHz: 9.7 13.5 to 15 GHz: 6.2 15 to 18 GHz: 5.7 |
| Return loss (CHx port, OFF) (dB) | 300 kHz to 2 MHz: 10.0 2 MHz to 6.5 GHz: 12.7 | 300 kHz to 2 MHz: 10.0 2 MHz to 6.5 GHz: 12.7 6.5 to 9 GHz: 9.7 | 300 kHz to 2 MHz: 10.0 2 MHz to 8.5 GHz: 12.5 8.5 to 11 GHz: 8.7 11 to 14 GHz: 10.7 14 to 17 GHz: 5.5 17 to 18 GHz: 6.5 |
| Typical Temperature Stability - 20 to 30°C (Magnitude dB/°C) | | 300 kHz to 8 GHz: 0.002 8 to 11 GHz: 0.003 11 to 18 GHz: 0.007 | |
| Typical Temperature Stability - 20 to 30°C (Phase Degree/°C) | | 300 kHz to 8 GHz: 0.02 8 to 11 GHz: 0.03 11 to 18 GHz: 0.03 | |

Note: Applies to all models and specifications:

For the first, second and subsequent frequency band, the last frequency test point is ≤ (inclusive) the frequency point.

Example for return loss: “300 kHz to 2 MHz” (inclusive) until the last point which is ≤ 2 MHz with the specs of 7.0 dB. If it is ≥ 2 MHz (example 2.0001 MHz), the specification refers to the next frequency range of “2 MHz to 100 MHz” with the specs of 8.0 dB

P916xA/B/C 2X8/16 USB Solid State Switch Matrix Supplemental

Specification and Characteristics

Supplemental characteristics are intended to provide useful information. They are typical but non-warranted performance parameters

| Specification | P916xA/B/C |
|-----------------------------------------------------|------------|
| Maximum input power | 25 dBm |
| Typical switching speed (10% trigger to 90% output) | 50 us |

| | |
|--------------------|---------|
| Typical input P1dB | 25 dBm |
| Typical input TOI | 54 dBm |
| RF connector | SMA (f) |

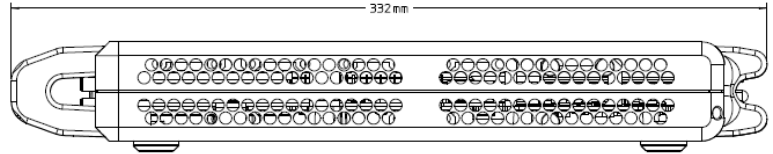
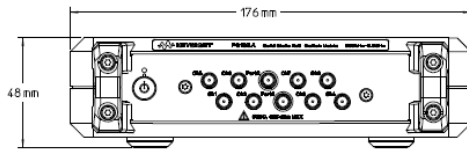
Environmental Specifications

Keysight P916xA/B/C USB solid state switch matrix are designed for indoor use and in an area with low condensation. They are fully complying with Keysight Technologies' product operating environmental specifications. The following summarizes the environmental specifications for these products.

| Environmental specifications | Description |
|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Temperature | |
| Operating | 0 °C to +40 °C |
| Storage | -40 °C to +70 °C |
| Humidity | |
| Operating | 95% RH at 40 °C (non-condensing) |
| Shock | |
| End-user handling | Delta V: 3 m/s (60 in/s) ±5%, Duration <3ms |
| Transportation | 50G, Delta V: 8m/s ±10% |
| Vibration | |
| Operating | Random: 0.3 Grms |
| Survival | Random: 2.41 Grms |
| ESD immunity | |
| Contact discharge | 8 kV per IEC 61000-4-2 |
| Air discharge | 20 kV per IEC 61000-4-2 |
| Altitude | |
| Operating | < 3,000 meters (< 9,842 feet) |
| Radiated Emissions | CISPR11/EN 55011 |
| Conducted Emissions | |
| Radiated Immunity | IEC/EN 61000-4-3 IEC 61000-6-1 (S. Korea requirement for KC) |
| Conducted immunity | IEC/EN 61000-4-6 |
| Surge on AC power line immunity | IEC/EN 61000-4-5 |
| Electrical fast transient (EFT) immunity | IEC/EN 61000-4-4 |
| Voltage dips and interrupts on A.C. power line immunity | IEC/EN 61000-4-11 |
| Electrostatic discharge (ESD) immunity | IEC/EN 61000-4-2 |
| Power frequency magnetic Field immunity test | IEC/EN 61000-4-8 |
| Mains Supply Input Test/ Sound Pressure Test/ Single Fault Conditions/ Temperature Test | IEC/EN 61010-1 3 rd Ed |

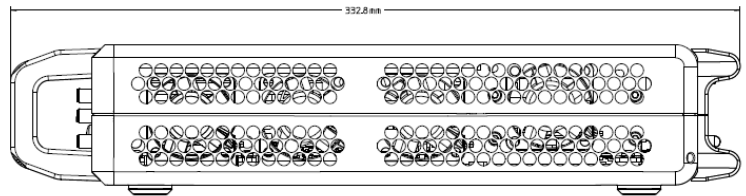
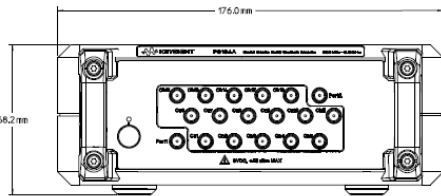
Mechanical Information

Dimensions are in mm (inches) nominal, unless otherwise specified



P9165A/B/C product dimensions (SMA (f) connectors)

| | |
|-----------------------|-----------------------------------------------------------------------|
| Net weight | 1.92 kg |
| Dimension (H x W x D) | 48 mm x 176 mm x 332 mm (1.89 inches x 6.93 inches x 13.07 inches) |



P9164A/B/C product dimensions (SMA (f) connectors)

| | |
|-----------------------|--------------------------------------------------------------------------|
| Net weight | 2.65 kg |
| Dimension (H x W x D) | 68.2 mm x 176 mm x 332.8mm (2.69 inches x 6.93 inches x 13.10 inches) |

Ordering Information

| Description | Description |
|-------------|--------------------------------------------------------|
| P9164A | 2X16 USB Solid State Switch Matrix, 300 kHz to 6.5 GHz |
| P9164B | 2X16 USB Solid State Switch Matrix, 300 kHz to 9 GHz |
| P9164C | 2X16 USB Solid State Switch Matrix, 300 kHz to 18 GHz |
| P9165A | 2X8 USB Solid State Switch Matrix, 300 kHz to 6.5 GHz |
| P9165B | 2X8 USB Solid State Switch Matrix, 300 kHz to 9 GHz |
| P9165C | 2X8 USB Solid State Switch Matrix, 300 kHz to 18 GHz |

Web link

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