TECHNICAL OVERVIEW

M9164A/B/C 2X16 and M9165A/B/C 2X8 PXIe Solid State Switch Matrix

300 kHz to 6.5/9/18 GHz

Drive down the size of test

- Choose frequency ranges from 300 kHz up to 18 GHz
- Extend the number of test ports for multi-DUT or multiport devices measurement
- Highly flexible and easily configurable to meet demanding multiport measurement challenges
- Achieve lower cost-per-port test without compromising performance and bench space

Description

Keysight M916xA/B/C 2X8/16 PXIe solid state switch matrix, 300 kHz to 6.5/9/18 GHz is a full-crossbar switch matrix. It works seamlessly with Keysight's M980xA PXIe series of VNA solution in providing a switch based multiport VNA solution involving larger scale of multi-DUT or multiport measurement such as 5G massive MIMO antenna measurement.

The M916xA/B/C is highly flexible and easily configurable. Together with exceptional RF performance, it delivers confidence in your measurement for reliable and repeatable results while at the same time reducing the overall cost of test.

KEYSIGHT TECHNOLOGIES

Block Diagram

Keysight M9164x are 2 slot PXIe 2x16 solid state switch modules whereas M9165x are slot PXIe 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 300kHz to up to 18GHz. The switch is configured as either a 2x8 (2 in, 8 out) or 2x16 (2 in, 16 out) full-crossbar switch. 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 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 and ISOLATION state. Output ports that are not switched will be internally terminated to 50 ohms.

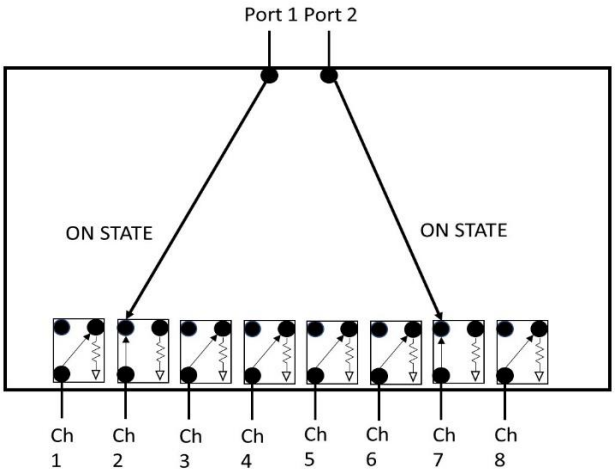


Figure 1. Simplified block diagram of 2X8 switch matrix

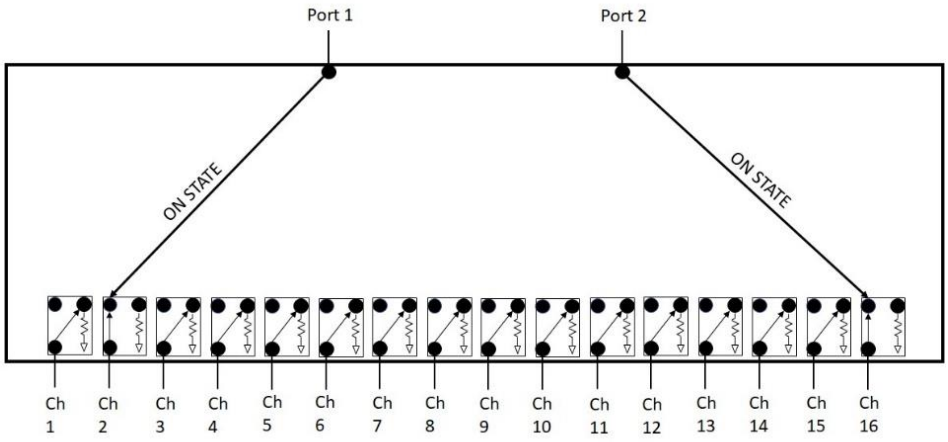


Figure 2. Simplified block diagram of 2X16 switch matrix

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

M9164A/B/C 2X16 PXIe Solid State Switch Matrix

Specification	M9164A	M9164B	M9164C
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

M9164A/B/C 2X16 PXIe Solid State Switch Matrix (continue)

Specification	M9164A	M9164B	M9164C
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		

M9165A/B/C 2X8 PXIe Solid State Switch Matrix

Specification	M9165A	M9165B	M9165C
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

M9165A/B/C 2X8 PXIe Solid State Switch Matrix (continue)

Specification	M9165A	M9165B	M9165C
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

M916xA/B/C 2X8/16 PXIe 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	M916xA/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)

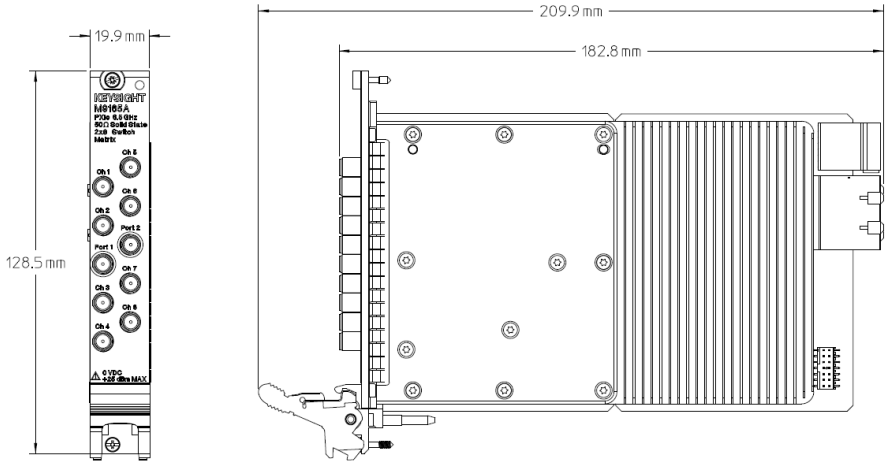
Environmental Specifications

Keysight M916xA/B/C PXIe 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.

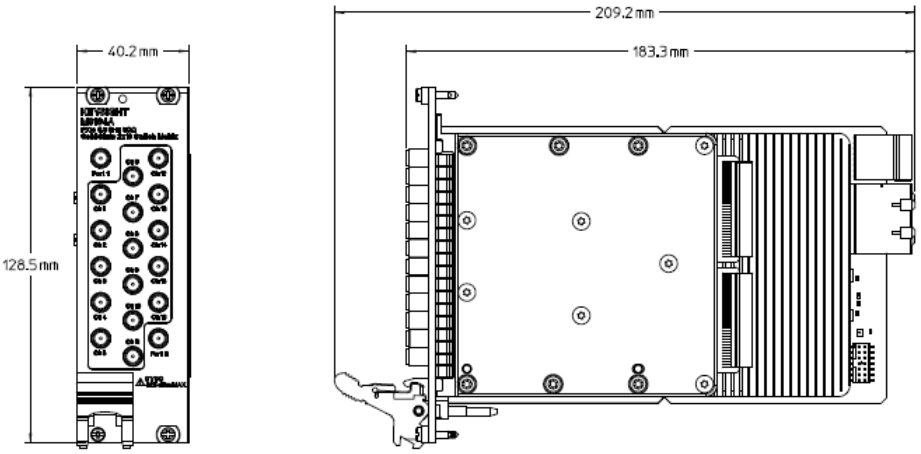
Environmental specifications	Description
Temperature	
Operating	0 °C to +55 °C
Storage	-40 °C to +70 °C
Humidity	
Operating	95% RH at 40 °C (non-condensing)
Shock	
End-user handling	Delta V: 3 m/s (60 in/s) ±5%, Duration <3ms
Transportation	50G, Delta V: 8m/s ±10%
Vibration	
Operating	Random: 0.21 Grms
Survival	Random: 2.41 Grms
ESD immunity	
Contact discharge	6 kV per IEC 61000-4-2
Air discharge	15 kV per IEC 61000-4-2
Altitude	
Operating	< 3,100 meters (< 10,000 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
Temperature test	IEC/EN 61010-1 3rd Ed

Mechanical Information

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



M9165A/B/C product dimensions (SMA (f) connectors)	
Net weight	0.56 kg
Dimension (H x W x D)	128.5 mm x 19.9 mm x 209.9 mm (5.06 inches x 0.78 inches x 8.26 inches)



M9164A/B/C product dimensions (SMA (f) connectors)	
Net weight	0.87 kg
Dimension (H x W x D)	128.5 mm x 40.2 mm x 209.2 mm (5.06 inches x 1.58 inches x 8.24 inches)

Ordering Information

Description	
M9164A	2X16 PXIe Solid State Switch Matrix, 300 kHz to 6.5 GHz
M9164B	2X16 PXIe Solid State Switch Matrix, 300 kHz to 9 GHz
M9164C	2X16 PXIe Solid State Switch Matrix, 300 kHz to 18 GHz
M9165A	2X8 PXIe Solid State Switch Matrix, 300 kHz to 6.5 GHz
M9165B	2X8 PXIe Solid State Switch Matrix, 300 kHz to 9 GHz
M9165C	2X8 PXIe Solid State Switch Matrix, 300 kHz to 18 GHz

Web link

www.keysight.com/find/PXIswitch

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