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# Keysight Technologies

# M9155/6/7C PXI Hybrid Switch Modules

## DC to 26.5 GHz

## Data Sheet




KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

# Overview

## Product description

Keysight Technologies, Inc. has been a leading designer and manufacturer of RF and microwave switches in the global marketplace for more than 60 years. RF and microwave switches are used extensively in microwave test systems for signal routing between instruments and devices under test (DUT).

Keysight designs and manufacturers a comprehensive range of RF and microwave switches to meet your switching requirements. Other than connectorized switches, Keysight also offers switch modules that operate across a broad frequency range and come in a variety of configurations. With Keysight's proven track record in switches (high performance, quality and reliability), these modules will provide a similar set of standards of high accuracy and repeatability for automated test and measurement, signal monitoring and routing applications.

The M9155/6/7C Keysight PXI hybrid switch module series operates from a frequency range of DC to 26.5 GHz. It is being used in applications such as Automatic Test Equipment (ATE), RF communications measurement and RF parametric measurements where a rugged switching module is needed in switching systems.

The PXI hybrid switch module comes in a selection of 3 models; the integration of Keysight dual SPDT switches, dual transfer switches, and a single SP6T configurations. These PXI modules provide an exceptional 0.03 dB insertion loss repeatability, high isolation and low SWR with a long operating life up to 10 million cycles.

## Applications

- Automatic test equipment
- RF communications measurement
- RF parametric measurements

## Features

- A readily scaled integrated switching solution to satisfy your unique platform needs
- 0.03 dB insertion loss repeatability throughout the operating life
- Unmatched isolation of 60 dB at 26.5 GHz
- Soft Front Panel is available for each switch module

## Customer values

- Peace of mind in switch technology from Keysight who has a proven track record of providing versatile, quality RF and microwave switches
- Reduce downtime for recalibration, improve testing efficiency and hence maximize throughput
- Maximize measurement accuracy and system flexibility
- The embedded graphical user interface ease the trouble shooting of your PXI systems

Features

- A readily scaled integrated switching solution to satisfy your unique platform needs
- 0.03 dB insertion loss repeatability throughout the operating life
- Typical operating life up to 10 million cycles
- Unmatched isolation of 60 dB at 26.5 GHz
- Soft front panel is available for each switch module

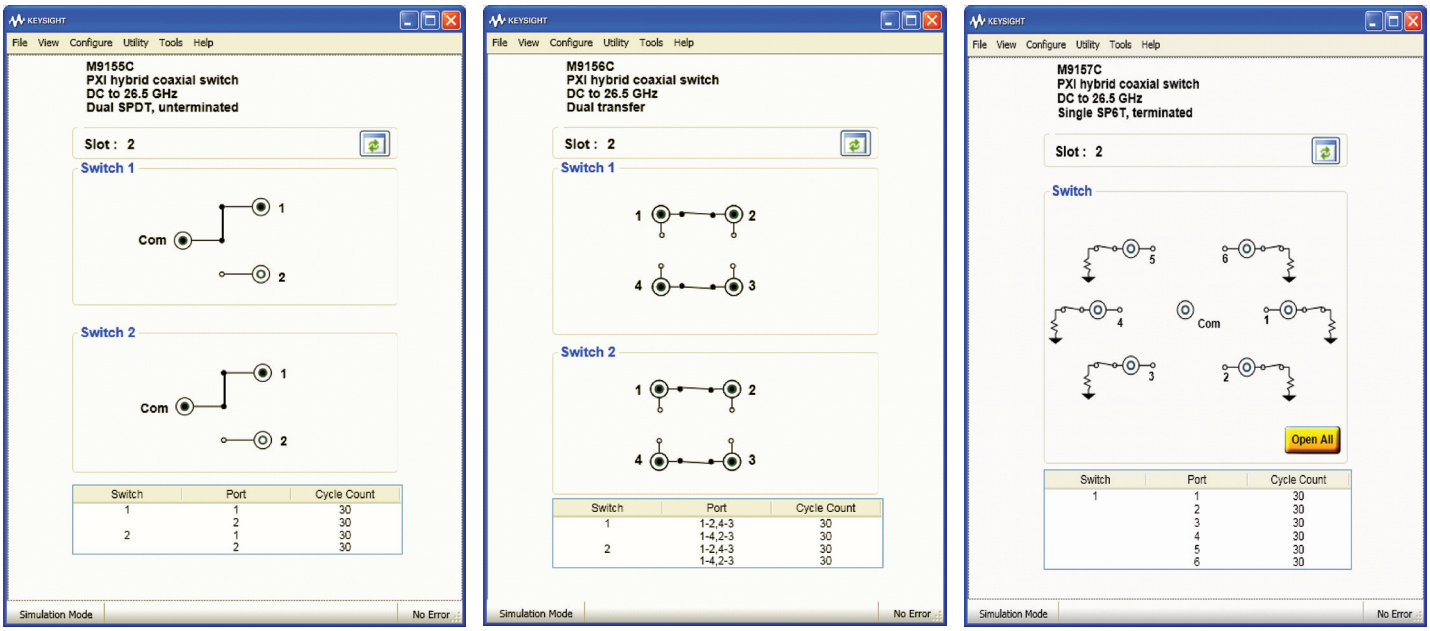
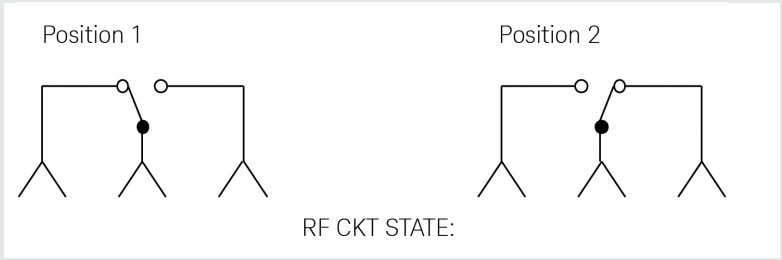
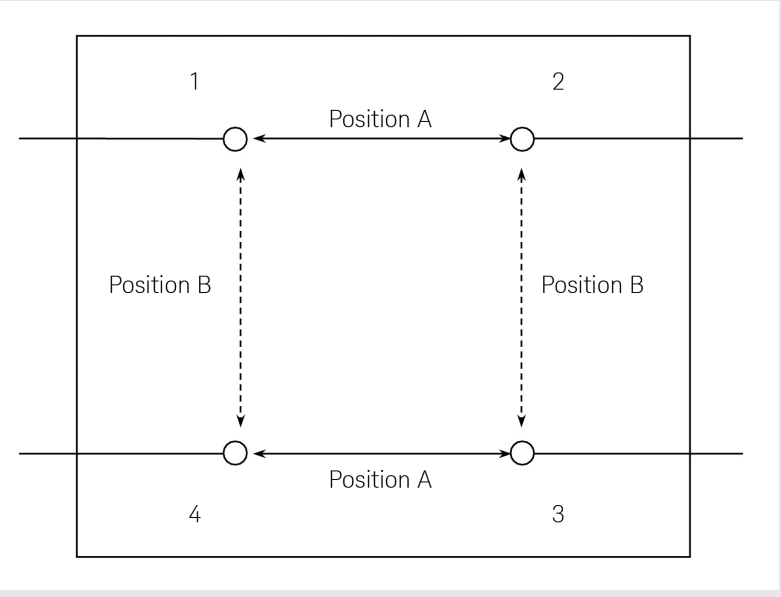


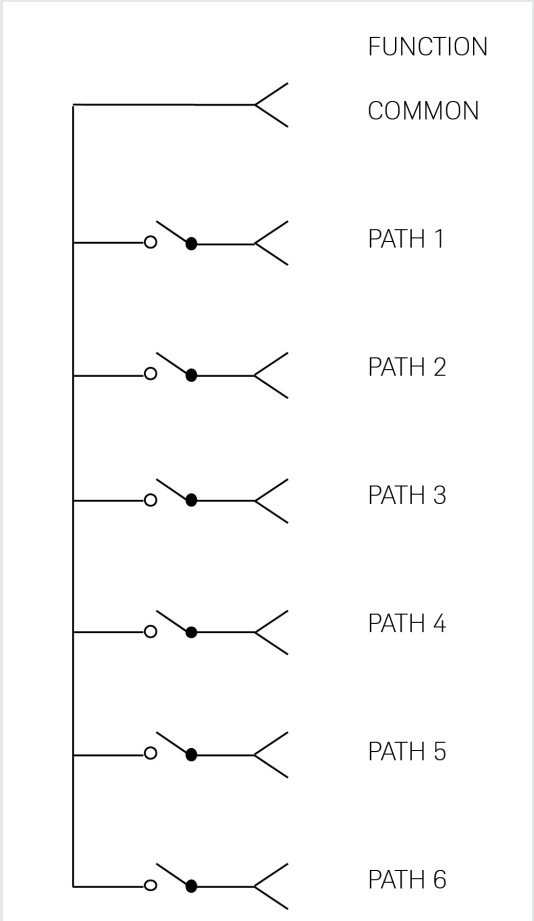

Figure 1. Soft front panel for M9155C, M9156C and M9157C




M9155C is an integration of 2 units of Keysight 8765C with Option 024 (24 V, 3 inch ribbon)




M9156C is an integration of 2 units of Keysight L7222C with Option 161 (24 V, 10-pin DIP)




M9157C is an integration of 1 unit of Keysight L7106C with Option 161 (24 V, 16-pin DIP)

Connections are made via front panel mounted high quality RF coaxial connectors, 3.5 mm (f) or SMA (f) for 50 Ω.

The M9155/6/7C switch modules give you the most reliable and repeatable RF & microwave switching available in the market. Their applications are mainly in automated test equipment for example, RF communication, engineering verification and RF parametric measurement where low insertion loss and ultra high isolation are critical.

These modules provide individual cycle count trackings for each of the switch paths. Cycle count is incremented per each complete Open-Close sequence. The individual cycle count is user-retrievable, either via scripting or the Soft Front Panel. Engineers can use this feature for scheduled maintenance to reduce unexpected system downtime.

# Easy Setup ... Test ... and Maintenance

## Hardware platform

### Compliance

The M9155/6/7C is PXI compliant, using either a PXI-H, PXI-1 or cPCI slot. Designed to benefit from fast data interfaces, the products can be integrated with other test and automation modules in PXI, CompactPCI, and Hybrid chassis. The PXI format offers high performance in a small, rugged package. It is an ideal deployment platform for many automated test systems. A wide array of complementary PXI products is currently available. Products include multimeters, waveform generators, local oscillators, digitizers, and switch multiplexers.

## Software platform

### Drivers

Keysight's switches come complete with software drivers for Windows XP, Windows Vista, Windows 7, and LabVIEW. Also included are application code examples for LabVIEW, LabWindows/CVI, Visual Studio, C, C++, MATLAB.

### Soft front panel

The M9155/6/7C's graphical user interface guides developers through the module setup process. Users can quickly configure the module parameters. The interfaces are implemented using the IVI standard supporting both IVI-COM and IVI-C.

### Easy software integration

Keysight's M9155/6/7C comes complete with software drivers for Windows XP, Windows Vista, Windows 7, and LabVIEW. Also included are application code examples for LabVIEW, LabWindows/CVI, Visual Studio, C, C++, C#, Visual Basic, and MATLAB, which provide M9155/6/7C set up and basic switching functionality. The application code examples are easily modified to quickly integrate the module into your measurement system.

## Calibration intervals

The M9155/6/7C is factory calibrated and shipped with an ISO-9001, NIST-traceable calibration certificate.

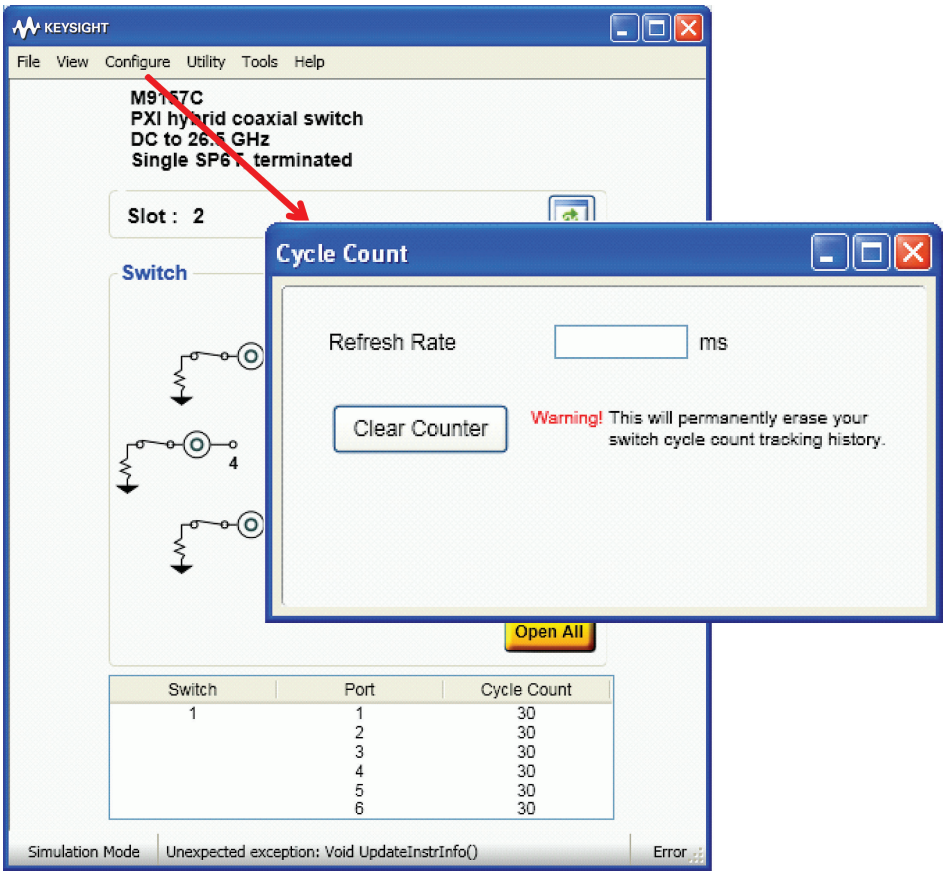



Figure 2. Onboard switch cycle count tracking eases maintenance and reduces unexpected system downtime.

# Technical Specifications

| **RF input specifications** | | | |
|---|---|---|---|
| Input characteristics | | M9155C, M9156C, M9157C | |
| Frequency range | | DC to 26.5 GHz | |
| Characteristics impedance | | 50 Ω | |
| Maximum RF carry power (50 Ω) | | 150 W at 100 MHz at 75 %C | |
| Maximum voltage (cold-switching only) | | 86.6 Vrms | |
| Maximum carry current (per channel) | | 1.73 Arms | |
| Initial on path resistance | | 100 MΩ | |
| Off path resistance > 1 | | 0 MΩ | |
| **RF specifications** | | | |
| Model | M9155C | M9156C | M9157C |
| Switch type | Dual SPDT EM switch | Dual transfer EM switch | Single SP6T EM switch |
| | Keysight 8765C, two each | Keysight L7222C, two each | Keysight L7106C, one |
| Dimension | 1 slot | 2 slots | 3 slots |
| Frequency range | DC to 26.5 GHz | DC to 26.5 GHz | DC to 26.5 GHz |
| Insertion loss<br>f is frequency in GHz | 0.25 + 0.027f<br>DC: 0.25 dB<br>8 GHz: 0.47 dB<br>12.4 GHz: 0.58 dB<br>18 GHz: 0.74 dB<br>26.5 GHz: 0.96 | 0.2 + 0.025f<br>DC: 0.20 dB<br>8 GHz: 0.40 dB<br>12.4 GHz: 0.51 dB<br>18 GHz: 0.65 dB<br>26.5 GHz: 0.86 dB | 0.3 + 0.015f<br>DC: 0.30 dB<br>8 GHz: 0.42 dB<br>12.4 GHz: 0.49 dB<br>18 GHz: 0.57 dB<br>26.5 GHz: 0.70 dB |
| Isolation | 110 - 2.25f<br>DC: 110 dB<br>8 GHz: 92 dB<br>12.4 GHz: 82 dB<br>18 GHz: 70 dB<br>26.5 GHz: 50 dB | 110 - 2f<br>DC: 110 dB<br>8 GHz: 94 dB<br>12.4 GHz: 85 dB<br>18 GHz: 74 dB<br>26.5 GHz: 57 dB | DC - 12 GHz: 90 dB<br>12 - 15 GHz: 70 dB<br>15 - 20 GHz: 65 dB<br>20 - 26.5 GHz: 60 dB |
| VSWR | DC - 4 GHz: 1.25<br>4 - 18 GHz: 1.45<br>18 - 26.5 GHz: 1.70 | DC - 2 GHz: 1.10<br>2 - 4 GHz: 1.15<br>4 - 12.4 GHz: 1.25<br>12.4 - 20 GHz: 1.40<br>20 - 26.5 GHz: 1.65 | DC - 4 GHz: 1.20<br>4 - 12.4 GHz: 1.35<br>12.4 - 20 GHz: 1.45<br>20 - 26.5 GHz: 1.70 |
| Operating life | 5 million cycles | 2 million cycles | 2 million cycles |
| Typical operating life | 10 million cycles | 5 million cycles | 5 million cycles |
| Insertion loss repeatability | 0.03 dB | 0.03 dB | 0.03 dB |
| Impedance | 50 Ω | 50 Ω | 50 Ω |
| RF connectors | 3.5 mm (f) | SMA (f) | SMA (f) |

| **Power requirements** | | | | |
|---|---|---|---|---|
| Power consumption from the backplane supply is as follows: | | | | |
| Voltage | +3.3 V | +5 V | –12 V | +12 V |
| Current | 0.5 A (typ. 0.2 A) | 20 mA (typ. 10 mA) | 0 | 0.4 A (typ. 0.2 A) |

| **General operating data** | |
|---|---|
| Maximum power rating | M9155C which contains two each of 8765C |
| Hot switching | 2 W average for switching with power applied |
| Cold switching | 150 W CW at 3 GHz, 25 °C, 120 W CW at 4.2 GHz, 25 °C |

# Technical Specifications (continued)

| | |
|---|---|
| **General operating data (continued)** | |
| M9156C which contains two each of L7222C | |
| Hot switching | 1 W CW, 50 W peak, 10 us max pulse width, not to exceed 1 W average |
| Cold switching | 150 W CW at 3 GHz, 25 °C, 120 W CW at 4.2 GHz, 25 °C |
| M9157C which contains one L7106C | |
| Into internal termination | |
| Hot switching | 1 W CW, 50 W peak, 10 µs max pulse width, not to exceed 1 W average |
| Into thru path | |
| Hot switching | 2 W CW, 100 W peak, 10 µs max pulse width, not to exceed 2 W average |
| **Environmental and physical specifications** | |
| Temperature | |
| Operating | 0 to 55% C |
| Non-operating | –40 to 70% C |
| Relative humidity | |
| Operating | 95% RF at 40% C, 24 hours cycling, repeated 5 times |
| Non-operating | 50% RH at –10% C to 25% C, 24 hour cycle |
| Vibration | |
| Operating random | 5 - 500 Hz, 0.3 g RMS |
| Vibration | |
| Survival random vibration | 5 - 500 Hz, 3.41 g RMS |
| Shock | |
| End use handling shock | Half-sine wave form, 120 in/s, duration < 3 ms |
| Transportation shock | Trapezoidal, 50 g |
| Altitude test | |
| Operating/non-operation | 15,000 ft (4600 m) |
| ESD Immunity | |
| Air discharge | 15 kV per IEC61000-4-2 |
| Direct discharge[1] | 8 kV per IEC61000-4-2 |
| Safety | This product has input power below the requirements as specified in the Low Voltage Directive (2006/95/EC) |
| EMC | EMC Standard: IEC 61326-1:2005/EN 61326-1:2006<br>Emissions: CISPR 11:2003/EN55011:2007<br>Immunity: IEC 61000-4-3:2002 / EN 61000-4-3:2002<br>Electrostatic Discharge: IEC 61000-4-2:2001/EN 61000-4-2:1995+A1:1998+A2:2001<br>EMC/EMI: CE, C-Tick |
| CE compliance | EMC Compatibility Directive (EMC): 2004/108/EC |
| Warm-up time | Refer to PXI chassis warm up time |
| Dimensions | 3U PXI/CompactPCI standard<br>Front panel complies with IEEE 1101.10 certification and compliance |
| M9155C | 174.8 x 128.7 x 20 mm |
| M9156C | 174.8 x 128.7 x 40.3 mm |
| M9157C | 174.8 x 128.7 x 60.7 mm |
| Weight | |
| M9155C | 0.395 kg |
| M9156C | 0.255 kg |
| M9157C | 0.340 kg |
| Connectors | PXI bus via 32 bit P1/J1 backplane connector. Signals via front panel mounted coaxial 3.5 mm (f) or SMA(f) connectors. |
| Contact Material | Beryllium copper, gold plated |
| Connector compatibility | PXI-h, PXI-1, cPCI |

1. To outer conductor

# Configuration

## Hardware

### Recommended configuration

| Model | Description |
|---|---|
| M9018A | PXIe chassis, 18-slots, 3U, 8 Gb/s |
| M9155C | PXI hybrid coaxial switch, DC to 26.5 GHz, dual SPDT, unterminated |
| M9156C | PXI hybrid coaxial switch, DC to 26.5 GHz, dual transfer |
| M9157C | PXI hybrid coaxial switch, DC to 26.5 GHz, single SP6T, terminated |
| M9021A | PXIe system interface |

## Accessories

| |
|---|
| SMA male-male cable (semi-rigid) |

## Module and chassis compatibility

| PXI chassis compatibility |
|---|
| Compatible with all chassis conforming to the 3U PXI and 3U cPCI specifications |
| Compatible with Keysight M9018A PXIe chassis, 18-slots, 3U, 8 Gb/s |

## Related products

| Model | Description |
|---|---|
| M9155CH40 | PXI hybrid coaxial switch, DC to 40 GHz, dual SPDT, unterminated |
| M9156CH40 | PXI hybrid coaxial switch, DC to 40 GHz, dual transfer |
| M9157CH40 | PXI hybrid coaxial switch, DC to 40 GHz, single SP6T, terminated |
| M9392A | PXI vector signal analyzer |
| M9302A | PXI local oscillator |
| M9351A | PXI downconverter (50 MHz–2.9 GHz) |
| M9360A | PXI attenuator/preselector |
| M9361A | PXI downconverter (2.75 GHz–26.5 GHz) |

# Ordering

| Model | Description |
|---|---|
| M9155C | PXI hybrid coaxial switch, DC to 26.5 GHz, dual SPDT, unterminated |
| M9156C | PXI hybrid coaxial switch, DC to 26.5 GHz, dual transfer |
| M9157C | PXI hybrid coaxial switch, DC to 26.5 GHz, single SP6T, terminated |

# Mechanical Dimensions

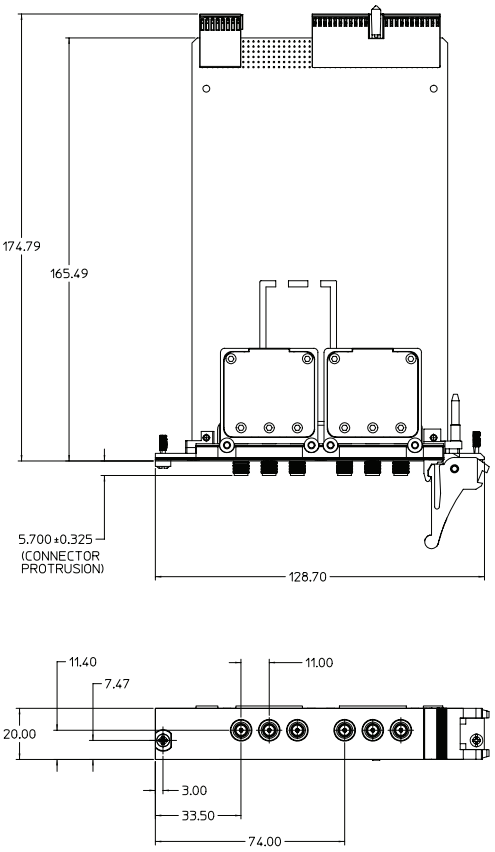



Figure 3. M9155C

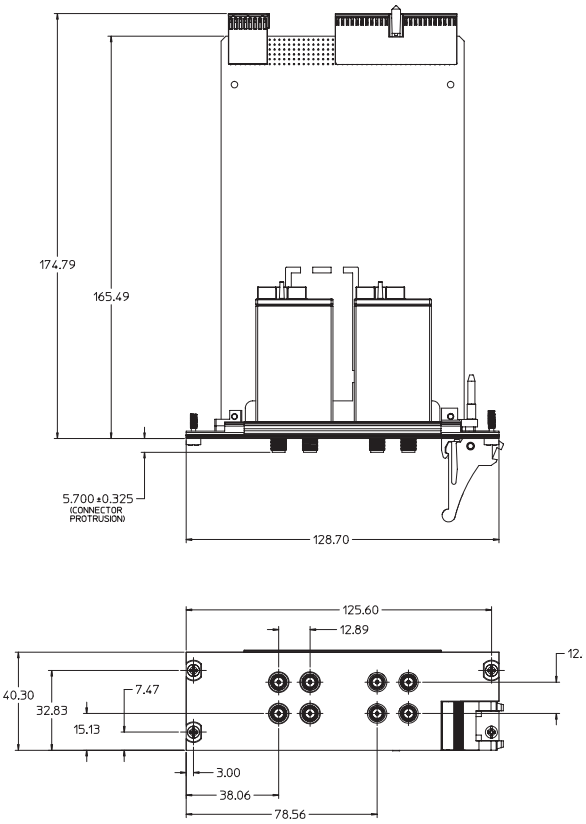



Figure 4. M9156C

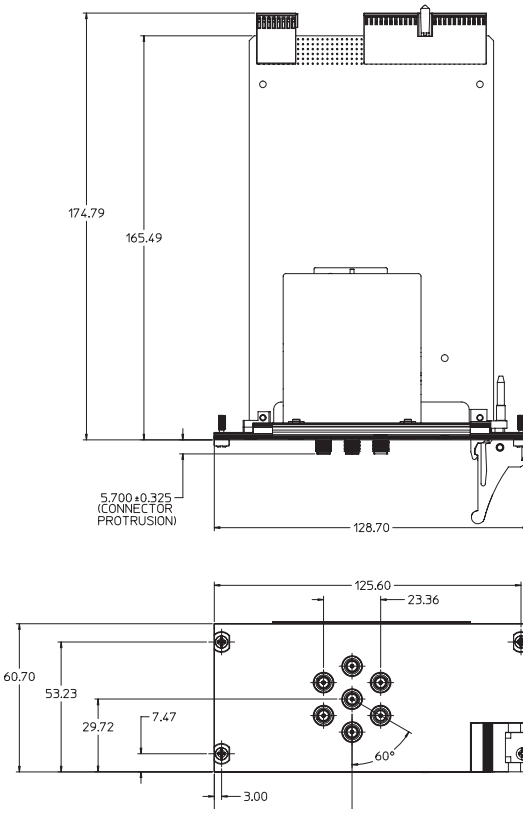



Figure 5. M9157C

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