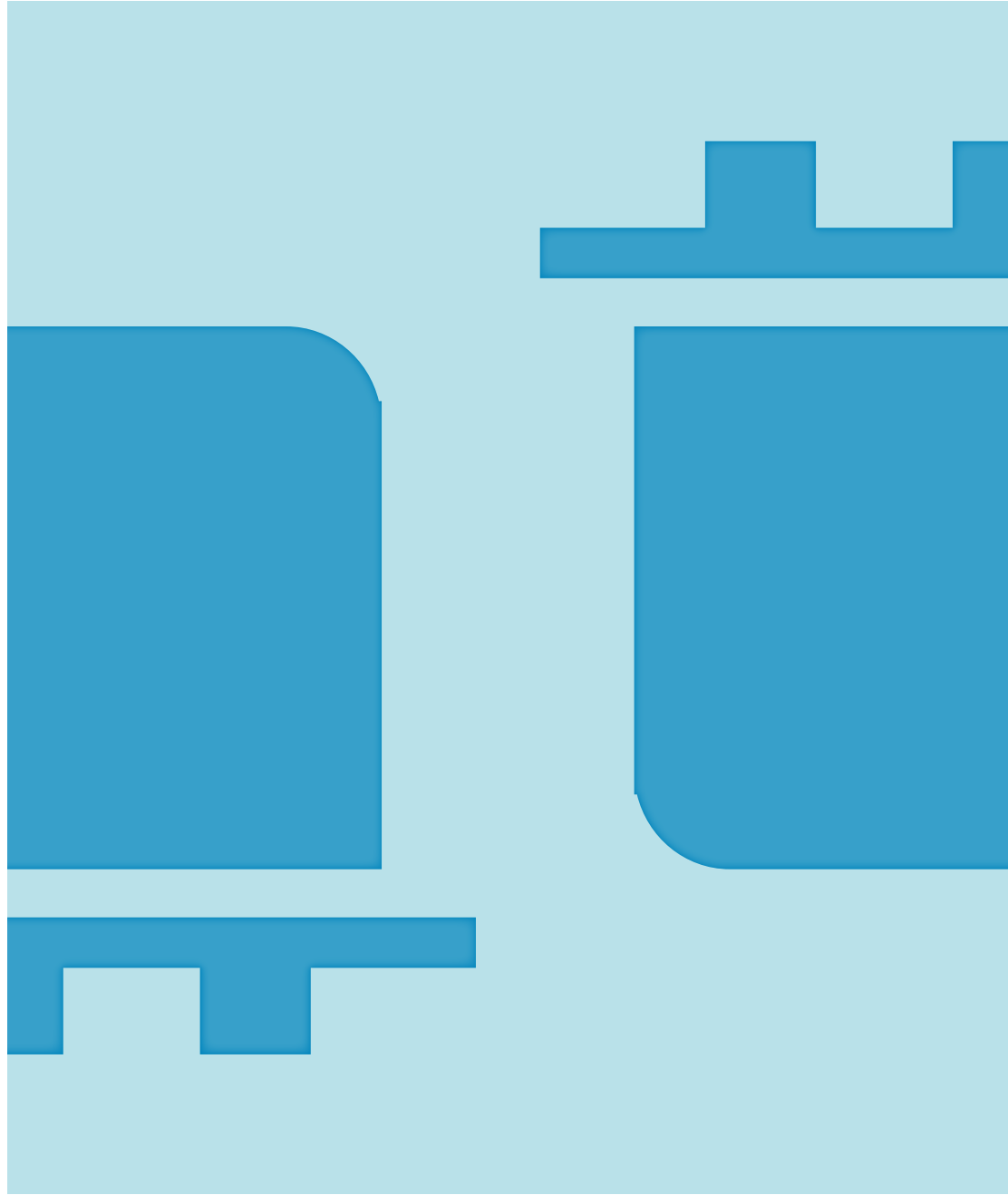




RF & MICROWAVE  
SWITCHES



# Coaxial Switching Products

*Full Line Catalog*



Connectivity has a profound and dramatic impact on the lives of people throughout the world. Because of advancements in technology, **our** lives are more convenient, more secure, more enjoyable and richer than ever. The speed of data enables communication in the **most** remote areas so people can reach all corners of the globe, allows for **important** defense and security, and facilitates space exploration. But technology doesn't just happen. It starts in the mind with ideas, making **connections** never considered in ways that nobody dreamed possible. Seeing the future in ways previously unimagined **is** the act of innovation and it begins with people – the inventors, the dreamers, the pioneers and the engineers – enriching the lives of billions. At Radiall, we have one single, solitary mission; Empower the people that enrich our lives. Enable their innovation by providing reliability and durability. Give them useful information and provide them with valuable guidance when determining the best course for success. We don't invent the future, we enable it. We inspire innovation, we embrace challenges, we challenge the conventional and we collaborate **with** you to succeed. At Radiall, we're proud to say – Our most important connection is with **you**.



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# Company Profile

## *Our Most Important Connection is with You™*

Radiall is a global leader in the design, development and manufacturing of leading edge interconnect solutions. Dedicated to understanding its customers' needs since 1952, Radiall has earned the reputation of being "the best of the best" in engineering ingenuity by providing a constant flow of creative system solutions serving the defense, telecommunications, aerospace, instrumentation, automotive, industrial, medical and broadcast markets.

## *Best Value-added Services*

**Collaboration:** We work closely with your engineers to understand your business, your technical needs, and your budgetary issues.

**Wide Product Range:** We manage our product lines thru the entire lifecycle in order to offer you a wide selection of standard products at an affordable cost.

**Custom Products:** We can tailor products to specific equipment and application needs.

**Global Presence:** We're everywhere you need us, with worldwide sales, engineering support, R&D in North America, Europe, and Asia, and manufacturing facilities strategically located in the United States, Mexico, France, India, and China.

**Responsive Support and Service:** From the design stage, planning to post-installation support, we're with you at every step, whether you need sales support or engineering expertise.

**On-time Delivery:** We support your logistical needs so you get the products when and where you need them.

**Warranty:** We proudly stand behind our products.

## *Certifications and Environmental*

Radiall is ISO 9001: 2008 certified and dedicated to continuous improvement programs that have resulted in also being AS9100, TS16949 and ISO 14001 certified. In addition, Radiall is committed to investing in its people, future technologies and the environment, such as being RoHS (Restriction of Hazardous Substances) and REACH (Registration, Evaluation, Authorization and Restriction of Chemical substances) compliant.



## *The Best End-to-End Interconnect Solutions*

We offer an extensive range of solutions that supports the most demanding signal transmission applications. 4G wireless infrastructure, active array radars, IED's detection, electrical wiring in aircrafts, soldier tactical radios, in-vehicle communications networks, and magnetic resonance imaging systems are just a few of the complex applications that we support.

- RF coaxial connectors
- Fiber optic connectors and transceivers
- Coaxial and fiber optic cable assemblies and harnesses
- High frequency microwave components
- Coaxial switches, including the smallest and most reliable SPDT relay
- Multipin rectangular connectors
- Rack and panel connectors
- Antennas for tactical networks, aerospace and instrumentation



Technical information and sales contacts are available at:  
[www.radiall.com](http://www.radiall.com)

# Radiall at a Glance

## Worldwide Presence

Radiall has a global manufacturing presence. Our International sales network and qualified distributors cover every region around the world. The result is quick and insightful answers to all your requests.

- International Sales Network
- Low cost facilities
- Local manufacturing, logistics and technical support



## North America



## Asia



## Europe



## Market Focus

### Aerospace



### Defense



### Industrial



### Space



### Telecom



### Instrumentation



### Medical



## Radiall Technologies

- Milling
- Plating & plastic metallization
- Molding
- Characterization
- Polishing
- Laser, ultrasonic, vapor, soldering
- Stamping
- Thin & thick film processes
- Etching on Si
- Thick film on AlN
- Test & measurement
- Simulation
- Cable & PTFE wrapping
- Automatic assembly
- Micro-machining



# A Global Range to Meet Your Needs



## RF Coaxial Connectors

Radiall proudly offers the widest range of RF Coaxial Connectors in the Industry with over 12,000 part numbers and 72 product series including AEP® Mil QPL connectors. These precision-made components are a significant part of our heritage and essential to who we are.



## Microwave Components

Radiall has a wide range of coaxial devices, including terminations, attenuators, and couplers using standard interfaces from low to high power. Our state of the art techniques enable us to produce microwave components for use in commercial, military, and space applications.



## Multipin Connectors

Radiall has an unmatched range of rack and panel connectors and the most innovative modular and tool-less connectors used in harnesses and equipment connections. Our modern designs combine light weight, high performance levels and user friendly features to simplify even the most complex connections.



## Space Qualified

Industry leaders across the globe recognize the Radiall brand for quality, reliability, and performance. Our Space Qualified passive product offering includes a wide range of coaxial connectors, cable assemblies, microwave components, and switches with a frequency range up to Ka band.



## Harnesses

The combination of design and manufacturing of RF and microwave cables as well as multipin connectors (EPX, ARINC 404 and 600) allows Radiall to be a specialist of harnesses for onboard or land equipment or communications systems. All types of contacts can be used and mixed such as signal, power, RF, quadrx, fiber optic...



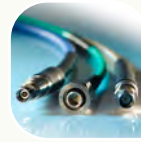
## RF & Microwave Switches

All Radiall switches provide exceptional reliability and performance. A unique modular and patented design of the actuator and transmission link enables Radiall to guarantee operation up to 10 million cycles with excellent repeatability, while reducing delivery times.



## Antennas

Radiall provides highly reliable antenna solutions for industrial and military applications. Our solutions include Line-Of-Sight tactical communications, vehicular mount, GPS, telemetry, and mesh networks. For optimum performance requirements, Radiall offers custom antenna solutions and support.



## RF Cable Assemblies

Radiall has an extensive range of cable assemblies with outstanding electrical performance, low loss, and high frequency. Our range includes flexible, semi rigid and handformable cable assemblies. Our TestPro™ range meets the stringent requirements needed for test and lab applications.



## D-Lightsys®

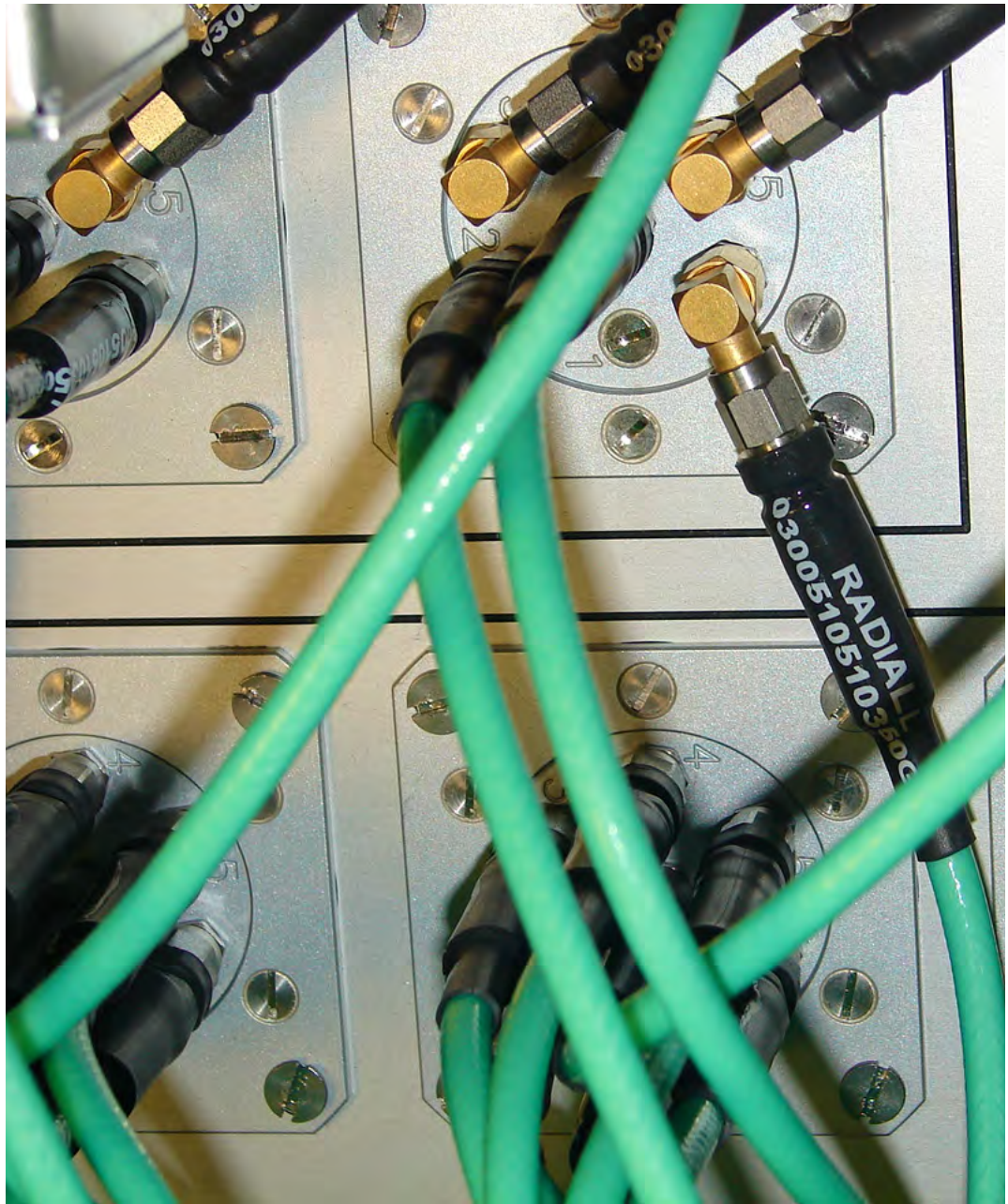
Active Optical Solutions Optimized by D-Lightsys® for harsh environments. From optical transceivers to the world's smallest parallel optics, D-Lightsys® technologies support the most challenging applications, including harsh environments and avionics applications.



## Fiber Optics

Radiall designs and supports high performance end-to-end Optical Interconnect solutions. Our offer includes standard interfaces, termini, connectors, harnesses and custom design optical links and subsystems. The flexibility and high quality of our product range supports harsh environments and demanding applications.

**SECTION 1**



**Technical Information**





**Contents**

**TECHNICAL INFORMATION**

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## Coaxial Switches Activity Information

### EXPERIENCE

With over 60 years of experience and continuous efforts in R&D, Radiall has become Europe's number one source for coaxial connectors. Radiall's position as a market leader has enabled the company to excel in the passive microwave component field for more than 50 years. Radiall's expertise in design, development and manufacturing of passive microwave components is widely acknowledged in today's industry.

### A WIDE RANGE OF SOLUTIONS

Specialized in passive microwave components, Radiall's design team and engineering staff manufactures a wide range of standard coaxial devices including: terminations, attenuators, couplers, coaxial detectors, coaxial and waveguide switches covering a frequency range from DC to 50 GHz.



### RESEARCH AND DEVELOPMENT

Due to the increased complexity of microwave systems more high performance components are required.

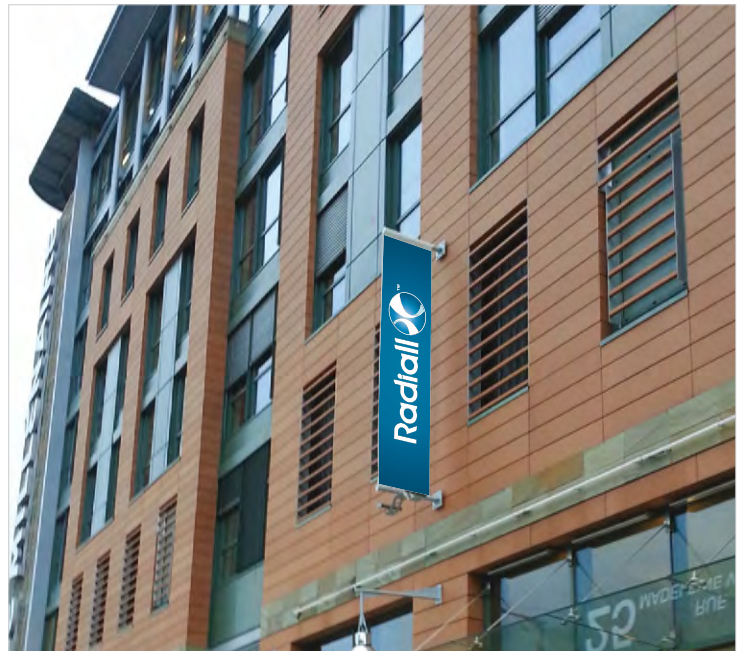
To meet these requirements, Radiall's R&D department is constantly working on development of new products and improvement on existing products.

Equipped with microwave and mechanical CAD and the latest generation of microwave test equipment up to 60 GHz, Radiall uses state-of-the-art technology to optimize products and quickly respond to specific customer requests.



### CAPACITIES AND FACILITIES

Radiall's global presence and worldwide facilities offer expertise in the following: marketing, research and development, industrialization, manufacturing and quality control. This strong heritage enables Radiall to produce a range of high performance and low cost devices for industrial applications, and high reliability components for severe requirements in military and space markets.



Head office - Aubervilliers France

## Coaxial Switches Activity Information

### PRODUCTION

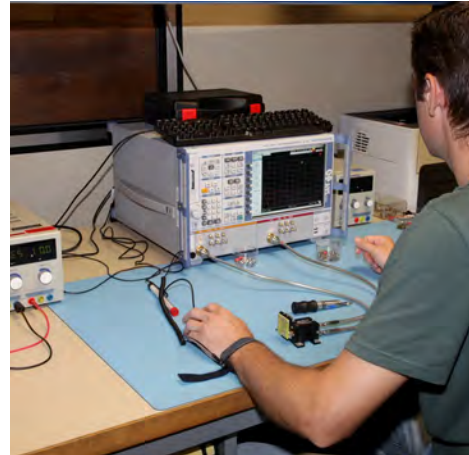
Electrical performance of microwave products is determined by machining quality of individual piece parts and associated plating.

Equipped with computer-controlled machinery, and an in-house plating department, Radiall is able to manufacture high quality piece parts that are compatible with existing components.

Due to the thick and thin film etching equipment, Radiall's production department guarantees the quality of the resistive cells used in most terminated switching products. A prototype workshop allows Radiall to quickly respond to special customer request.

All the phases of manufacturing and test are strictly inspected by our quality department, so as to warrant the constancy of our products and to achieve general and specific requirements.

Radiall's quality department inspects products through all phases of manufacturing and testing, to ensure consistency to all products for customer satisfaction.



### QUALITY AND RELIABILITY AND PATENTS

Radiall's main focus for passive microwave components are quality and reliability. ISO 9001 V2008 label is the best evidence of quality assurance interfaces at every stage of a product from designing to manufacturing.

All new products are subject to a rigid qualification program before massive production begins. Additionally, product quality is reviewed and tested periodically.

### NATO CODE

Radiall is a qualified microwave components manufacturer under military label (manufacturer code F0503 and F6507), and offers quality assurance developed in accordance with N.A.T.O. standards.



TECHNICAL INFORMATION

## Coaxial Switches Activity Information

### A TESTING LABORATORY

As an illustration of Radiall's commitment to quality and reliability, Radiall has an in-house test laboratory qualified by CECC which permits Radiall to complete the majority of tests required by customers.

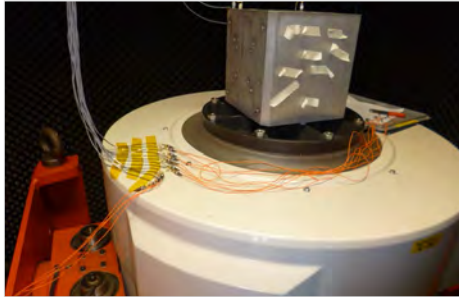
### PARTIAL LIST OF TEST MEANS

#### Electrical



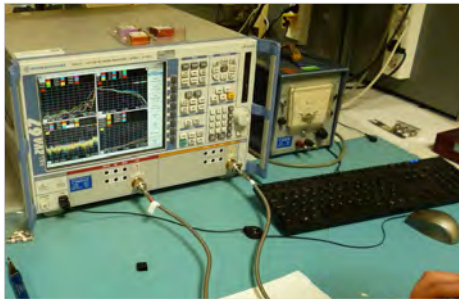
Breakdown voltage	12 KVolts
Insulation resistance	40.103 MOhms
Contact resistance	1μ0hms

#### Environmental



Vibrations: Sine random	0 - 120 g; 5 to 4000 Hz
Shocks	30 to 1000g
Shakes	25 to 40g 6 ms
Thermal vacuum	10-5 TORR; -45 to +100°C
Thermal shock	-70°C +200°C / transfert 20s
Storage temperature	-70°C to +200°C
Humidity	20 to 98 % HR
Salt Spray	-35°C to +55°C
Hermeticity	Helium 10-5 to 10-8 atm cm3 /s

#### Microwave



V.S.W.R. insertion loss Isolation	Vector Network Analyzer From 0.04 up to 60 GHz TDR 150ps
RF Leakage/EMC	Reverberation chamber method 0.5 to 20 GHz / Noise 100 dB
Power Handling	400 W CW at 936 MHz 400 W CW at 17.8 GHz 20 W CW 8 up to 18 GHz 100 W CW at 420 MHz

## Coaxial Switches Activity Information

### CAPABILITIES

Radiall offers a wide variety of coaxial switches to answer customer needs. This catalog is intended to be used as a guide in selecting the right type of switch for a given application. It is important to note that Radiall is not limited to catalog products and has the flexibility to design a specific product on a tight schedule at a reasonable cost. Radiall is always available to discuss specific customer requests.



### RELIABILITY

Radiall's coaxial switches offer exceptional reliability and performance. A unique patented design of the actuator and transmission link enables Radiall to guarantee operation up to 10 million cycle for Terminated SPnT, others series as well, with excellent repeatability.



### LIST OF APPLICABLE DOCUMENTS

AIR 7304	NFC 93563	MIL C 39012
DIN 47295	NFC 93564	MIL E 5400
NFC 93561	NFC 96317	MIL STD 202
NFC 93562	MIL DTL 3928	154 IEC

List of related covering the general mechanical and environmental tests applicable to the devices described in this catalog.

Our Most Important Connection is with You.™

## Coaxial Switches Activity Information

### GENERAL SPECIFICATIONS DESIGNED TO MEET MIL DTL 3928 AND MIL STD 202

#### Environmental Characteristics

Vibrations Method 204	10 - 2000 Hz 10g	Operating
Shocks Method 213	50g, 1/2 sine	Non-operating

*These requirements are guaranteed according to MIL standard, see applicable product section to get more accurate and detailed information.*

#### Mechanical Characteristics, Material and Finished

RF body	Aluminium, Gold plated Aluminium, Nickel plated Aluminium with Cr3 passivation
Contacts	Beryllium Copper, Gold plated
Insulator	PTFE, ULTEM 1000
Connectors	Stainless steel, passivated brass, Nickel plated
Construction	Splash proof
Cover	Aluminium, blue anodized

*All materials and finishes are in accordance with applicable MIL and NF specifications. All connectors are in accordance with applicable MIL, DIN, NF and CEI specifications. All dimensions in this catalog are given in millimeters. The non specified dimensions are given within +/- 0.5 mm.*

#### Manufacturing and Quality Assurance

Radiall's RF switches product line is made of approximately 20 series of switches, with each series divided into a large number of configurations. Part numbers consist of 9 digits, each digit designating a portion of the parts actual identity (such as series, frequency, actuator voltage, etc...).

For each digit, 2 to 10 options are available. A complete part number represents a unique configuration.

Overall, there are more than 80,000 different configurations available with very few subassemblies due to the modularity of the RAMSES switching line (less than 300 different subassemblies).

A Push-Pull manufacturing process has been implemented to reduce both lead time and inventory. Based upon marketing forecast and monthly updates, various subassemblies are manufactured.

When an order is received, an automated MRP system selects the appropriate subassemblies from stock to manufacture the requested products within a short time frame (a few days to a few weeks) depending on the complexity of the product.



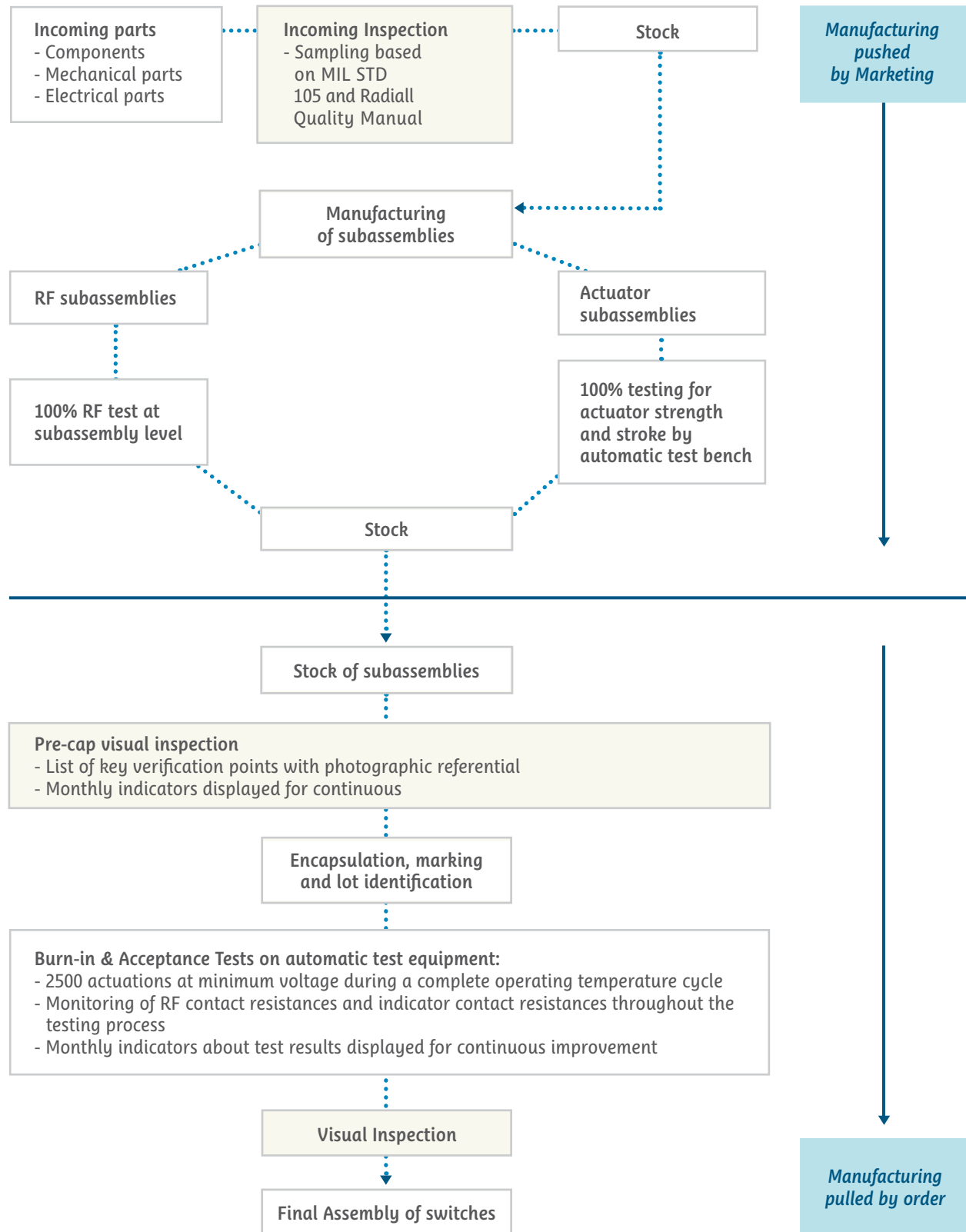
Radiall has adopted the process management philosophy of "Lean Manufacturing".

This process enables the best possible price and lead times on coaxial products by eliminating unnecessary stages of the administrative processes.

The lean manufacturing concept, was first applied to the RAMSES SPDT and SP6T non terminated coaxial products and is now being expended over all coaxial switches.

## Manufacturing and Quality Assurance Flow

Quality

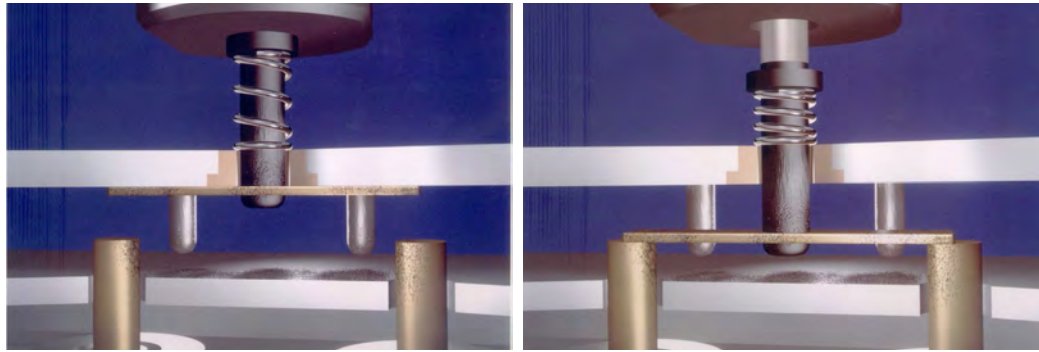


TECHNICAL INFORMATION

## RAMSES Concept

An innovative system has been designed for constructing electromechanical coaxial RF switches with increased long-term reliability. Radiall's Modular System for Electromechanical Switches (RAMSES) is a patented concept that enables microwave coaxial switches to be produced with a typical operating life of 10 million cycles while suffering no decrease in contact resistance reliability over time. In addition, the unique internal construction makes the switches cost-competitive with traditional switches.

Figure 1: conventional switch contacts after one million cycles



a) RF line open

b) RF line closed

### Friction Effects

The unique design of RAMSES is based on the reduction of friction, which minimizes particle deposits that can interfere with the transmission of lower frequency signals (up to 3 GHz).

This particle elimination effect is particularly important for telecommunication applications that are currently in the 900 MHz and 2 GHz range. In addition, the design involves fewer components compared to other microwave switches, making it quick and easy to assemble.

These savings directly relate to lower cost for improved performance. Many of the existing coaxial electromechanical switches also are able to function mechanically for 10 million operations.

However, the reliability and quality of the electrical contact can decrease over the life cycle.

In general, these traditional switches operate by moving a rectangular switching blade section inside a rectangular cavity. The blades are linked with pushers constructed of dielectric material that travel inside an access hole between the RF cavity and switch actuator. The pushers are directed by dielectric material guides. These dielectric parts rub on the blades and inside the access hole and generate isolating particles in the RF cavity that pollute the electrical contacts and ultimately cause running defects.

**Figure 1** shows the build-up of minute dielectric particles on a set of conventional switch contacts after one million cycles. These defects are not particularly noticeable at very high frequencies since the contact is established by a capacitive effect. However the insertion loss of the contacts increases considerably at lower frequencies (3 GHz below).



## RAMSES Concept

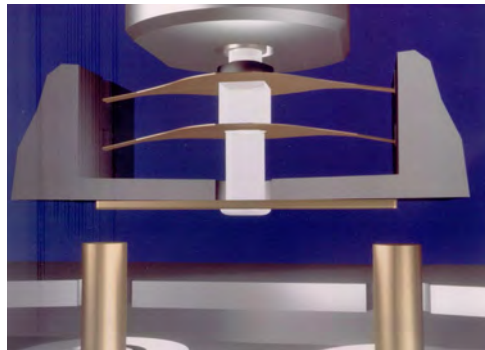
### A New Actuator Configuration

To eliminate this problem of increased insertion loss in the contacts, RAMSES devices incorporate a patented system. This system, compresses two parallel blades suspended from a bearer, which enables the guiding and positioning of the commutation blades to be accomplished entirely outside the RF cavity. These blades impose a rectilinear motion on the switching pusher, suppressing both friction and the production of particles inside the RF cavity. The unique system is extremely small and can be used in all of RAMSES series switches.

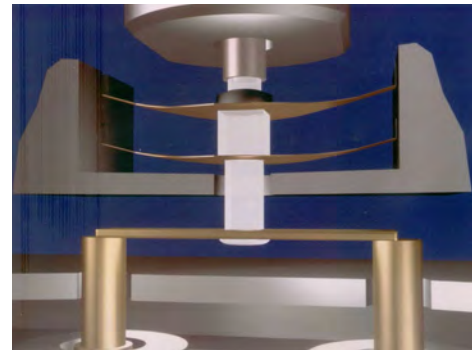
Figure 2: cutaway view



Figure 3: a RAMSES set of contacts



a) RF line open



b) RF line closed

**Figure 2** shows a cutaway view of a RAMSES coaxial switch displaying the actuator mechanism. A second improvement involves a new rectilinear actuator design using high energy magnets and a switching performance in relation to its size.

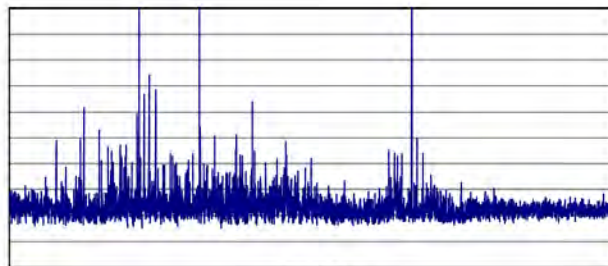
The system is used in the production of both failsafe and latching actuators, depending on how it is applied in the switch. These actuators are either 500g locking forces or 300 to 800g current forces for a power consumption of 100mA at 28V.

The new actuator has the added advantage of very low magnetic leakage, allowing actuators to be used in close proximity to one another without performance degradation. The use of a dry, solid lubricant and the control of friction areas provide an actuator life expectancy of over 50 million operations without defect when temperature range exceeds -55° to +85°C.

### Switch Performances

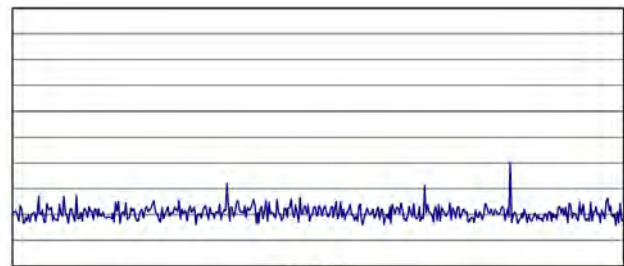
RAMSES series switches have successfully survived tests of 10 million switching temperature cycles from -55° to +85°C while demonstrating good contact resistance stability. Visual inspection of these switches after testing has indicated that the RF lines were free of much of the contamination found during similar tests on traditional switches. A comparison of the actual measured contact resistance obtained from monitoring both conventional and RAMSES switches using several parts that have already been actuated one million cycles is shown in figure 4. Although the conventional switch may not be considered failure, its contact resistance has become unstable, thus degrading its reliability.

Figure 4: A comparison of (a) conventional and



CYCLES

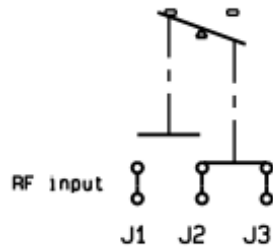
(b) RAMSES switch design contact resistance during one million cycles



CYCLES

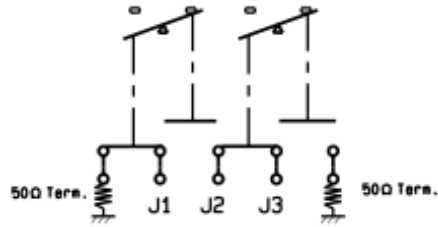
**RF Arrangement**

**Coaxial SPDT Switch**  
(Single Pole Double Throw)



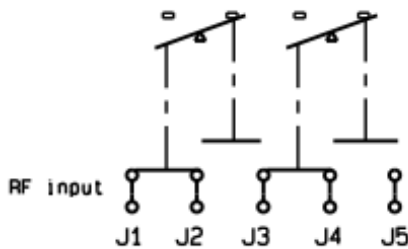
Single pole Double Throw Switch  
A switch with one input port and two selectable output ports

**Coaxial SPDT Terminated Switch**  
(Single Pole Double Throw terminated)



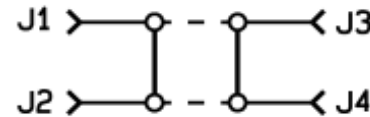
Single Pole Double Throw, Terminated switch  
Same as SPDT, but the unused output port is automatically terminated by a 50 Ohm resistive load.

**Coaxial DP3T Switch**  
(Double Pole Three Throw)



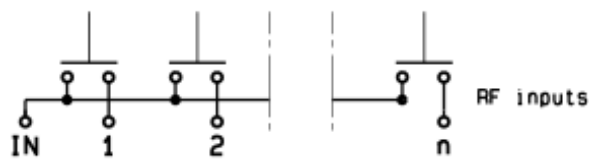
Double Pole Three Throw switch  
A switch with two input ports and three output ports. Each input (J2 - J4) can be switched between two adjacent outputs with one output being common to both inputs

**Coaxial DPDT Switch**  
(Double Pole Double Throw)



Double Pole Double Throw Switch  
A four port switch with two independent paths that operate simultaneously in one of two selected positions. In a DPDT / Transfer switch, the two transmission paths are provided as shown above

**Coaxial Multiposition Switch**  
(Single Pole n Throw)



Single Pole n Throw Switch (n<13)  
A switch with one input port and more than two output ports. The multiposition switch allows direct access to any individual output port by energizing the respective actuator. Radiall SPnT switches provide up to 12 Output ports

**Coaxial Multiposition Terminated Switch**  
(Single Pole n Throw Terminated)



Single Pole n Throw Terminated Switch (n<13)  
Same as SPnT, but each unused output port is automatically terminated in an internal 50 Ohm resistive load.

## Glossary

**Actuator Voltage:** All RAMSES series relays are either 12 or 28 Vdc nominal voltage over the entire temperature range. The switches can be operated with a voltage between -15 % and +10 % of the nominal value. Other voltage as 5, 15 or 24 Volts can be supplied at the customer's request.

**Automatic "Reset":** All Latching version multiposition switches (or SPnT) cause the following scenario:

When a RF path is closed, it remains in the closed position after the voltage is cut-off (latching function). To switch to another path, the first path must be opened via a "RESET" driver, followed by the closing of the second RF path. Without the "RESET" driver, both paths would remain in the ON position at the same time.

To simplify the use of latching products, an "automatic RESET" is recommended. The auto reset feature is accomplished by an electronic circuit which brings about the automatic opening of a previously closed path during changes of position of the switches.

*Note: This option produces a higher current consumption during a few milliseconds (see voltage & current values listed on the product's individual Technical Data Sheet).*

### BCD (Binary Code Decimal) Driver Interface

BCD logic coding				RF & Microwave ways position
E4	E3	E2	E1	
0	0	0	0	Latching models: all ways in "OFF" position
0	0	0	0	Normally Open models: memory of last position
0	0	0	1	Way IN - 1 in "ON" position
0	0	1	0	Way IN - 2 in "ON" position
0	0	1	1	Way IN - 3 in "ON" position
0	1	0	0	Way IN - 4 in "ON" position
0	1	0	1	Way IN - 5 in "ON" position
0	1	1	0	Way IN - 6 in "ON" position
0	1	1	1	Way IN - 7 in "ON" position
1	0	0	0	Way IN - 8 in "ON" position
1	0	0	1	Way IN - 9 in "ON" position
1	0	1	0	Way IN - 10 in "ON" position
1	0	1	1	Way IN - 11 in "ON" position
1	1	0	0	Way IN - 12 in "ON" position
1	1	1	1	Latching models: memory of last position
1	1	1	1	Normally Open models: all ways are in "OFF" position

*Note: E1, E2, E3, E4 are BCD driver pins of the product. E4 applies only with 8 positions or more. E3 applies only 4 positions or more.*

**Break Before Make:** Radiall coaxial relays are considered "break before make". In a break before make product the contact of the first path leaves its state before the final contact has been established.

**Failsafe:** A switch with an actuator that contains a return mechanism, either mechanical or magnetic, that provides RF connection to one selected position when no voltage is applied to the power terminals. This type of switch requires continuous voltage to maintain RF connection to any other position.

**Frequency Range:** The frequency range for each device indicates the maximum frequency Radiall will guarantee for the products performance.

**Indicator Contacts:** Electrical contacts of an "open circuit, short-circuit" type, mechanically linked to the actuator and synchronized with switched RF paths, ensure the recopy of positions of RF transmission paths. When a microwave path is switched, the corresponding indicator contact is closed. It is generally used with pilot lamps to indicate position of RF contacts (characteristics are given for a resistive load).

## Glossary

**Intermodulation (PIM):** or intermod for short, is a form of signal distortion that occurs whenever signals of two or more frequencies are produced in a passive device which contains some linear response. This interference includes low contact pressure, dirty interconnects, magnetic materials or other anodic effect.

The typical value for Radiall switches is around 120 dBc (with 2 carriers at +43 dBm), however products can be designed for higher performance upon request.

**Isolation:** The RF leakage from a connected path to any connector outside that path. Isolation is measured in decibels below the input power.

**Latching:** A switch with an actuator that contains a mechanism, either mechanical or magnetic, that will maintain a chosen RF contact path whether voltage is maintained or not after switching is accomplished. A pulse length of a duration equal to the maximum switching time is enough to change the switch position.

**Life:** Number of toggles a product is able to carry out. Relays and switches of RAMSES, PLATINUM and TITANIUM ranges have a life cycle of 2 to 10 million cycles.

**Normally Open:** is a mode of operation in which all output ports of the switch are disconnected from the input port until a voltage is applied to a selected position.

Switches family	Type of		Pin number	Comments
	Series	Connector		
RAMSES SPDT	SPDT => R570	D-Sub (male)	9 pins	Available only on products described on page 2-20
	SPDT => R572	N/A		Only solder pins
PLATINUM SPDT	SPDT => R595	D-Sub (male)	9 pins	Non terminated models
RAMSES DPDT	DPDT => R577	D-Sub (male)	9 pins	--
TITANIUM DPDT	DPDT => R513	HE10 ribbon receptacle (male)	10 pins	Delivered with ribbon cable 750 mm (30 inches) + HE10 connector (female)
PLATINUM DPDT	DPDT => R593			
RAMSES DP3T (1)	DP3T => R585	N/A		Only solder pins
PLATINUM DP3T (1)	DP3T => R595	D-Sub (male)	9 pins	--
RAMSES & Subminiature SPnT	SPnT => R573/ R574 3 to 10 positions 11 and 12 positions	D-Sub (male)	25 pins	--
			44 pins	High density
	SPnT => R591 4 and 6 positions	Micro-D receptacle (female)	9 pins	--
TITANIUM SPnT	SPnT => R514 4 and 6 positions	HE10 ribbon receptacle (male)	16 pins	Delivered with ribbon cable 750 mm (30 inches) + HE10 connector (female)
PLATINUM SPnT	SPnT => R594 4 and 6 positions			

Note (1): Terminated RAMSES & PLATINUM SPDT are included in R585 & R595

**PLATINUM and TITANIUM series:** The RAMSES concept (without friction) and over 40 years of expertise in manufacturing coaxial switches, Radiall's introduces a new range of high performance coaxial switches to the market place: PLATINUM Series.

Following an increasing need in the instrumentation market, Radiall's PLATINUM coaxial switches are optimized for use in automatic test benches or measurement equipment. With a guarantee insertion loss repeatability of 0.03 dB over the life of the product (10 million), PLATINUM Series switches are perfectly suited for applications requiring excellent RF performance. The full range of coaxial switches, such as SPDT-DP3T (R595 series), transfer relay DPDT (R593 series) and multithrow switches SPnT (R594 series), offer the same level of RF performance and are suitable for use in stringent environments.

TITANIUM series offer the same RF performance as PLATINUM series. TITANIUM products are more economically priced due to the reduced number of life cycles guaranteed (2.5M vs 10M for PLATINUM). This product line is ideal for the Instrumentation market, where RF performance is more critical than the number of actuations guaranteed.

## Glossary

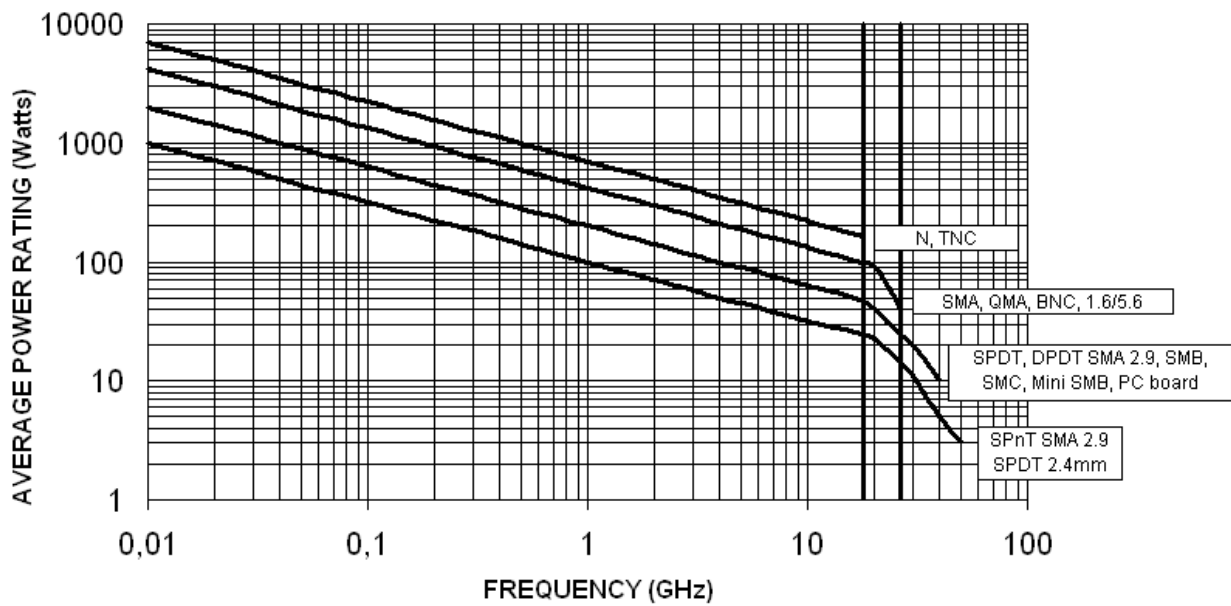
**Polarity:** A common negative polarity is chosen by Radiall for its standard products. An inverted polarity (common plus) is available on RAMSES range, contact Radiall for availability.

*Note: For PLATINUM and TITANIUM series, Common plus polarity potential is chosen for its standard products.*

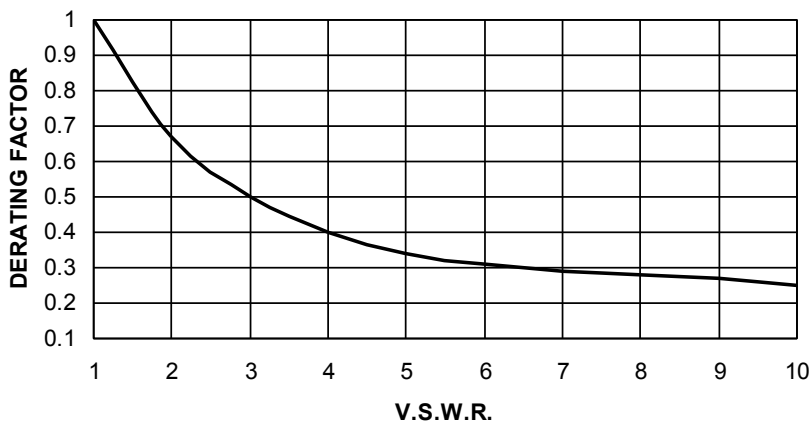
**RF Power Chart:** The RF power rating is the capability of handling RF power (CW power) through closed contacts. The RF power should be removed during switching. Power ratings assume unity V.S.W.R. (matched load) at room temperature (25°C), sea level pressure (14.7 p.s.i.) and cold switching. See below the CW power capability Vs. Frequency Chart. Changes in these specifications require power derating (see derating factor versus V.S.W.R.).

This graph is based on the following conditions:

- Ambient temperature: +25°C
- Sea Level
- V.S.W.R.: 1:1 and cold switching



**Derating Factor:** The average power input must be reduced for load V.S.W.R. above 1:1.



## Glossary

**Peak Power Handling:** The maximum peak power, when applied at room temperature under a pulse of one microsecond every millisecond, will not permanently change the specifications of the switch. Power applied over this limit will alter the RF performance of the switch.

**Repeatability:** The maximum standard deviation in insertion loss specifications on each path over the life of the product. Insertion loss repeatability is specified for all PLATINUM series (0.03dB over 10 million) and all TITANIUM series (0.03dB over 2.5 million).

**RF Connectors:** RF connectors are 50 or 75 Ohms female, unless otherwise specified. The applicable mating dimensions, materials and finish are in accordance with applicable sections of international standard (MIL C 39012, DIN 47295).

NB RADIAL 75 Ohm coaxial switches are only available with DIN 1.6/5.6 (screw, snap and slide connector) and mini SMB RF connectors.

**Self Cut Off:** The ability of a switch to disconnect the actuator voltage as soon as the switching of the position is carried out. The system applies to latching relays and is achieved with solid state circuitry. Self Cut-Off time for our RAMSES coaxial switches is from 40ms to 120ms.

**Solder Pin:** RAMSES relays are equipped with solder pins for the control and indicator contacts. The maximum temperature during soldering should not exceed 250°C for 30 seconds or 300°C for 10 seconds for leadfree soldering process.

**Suppression Diodes:** Diodes connected in parallel with the coil of a switch to suppress transient voltage generated by the self inductance of the coil during the driver signal cut-off. This option is systematically enclosed in all TTL, SELF CUT-OFF and all electronic interfaces.

**Switching Time:** The total amount of time between applying voltage to the actuator terminals and the completion of switching (including all contact bounce - if any). Total switching time consists of three parts, namely inductive delay in the actuator coil, transfer time of the RF contacts, and bounce time of the RF contacts.

**TTL Driver Interface:** The interface of an electronic circuit which enables driving either relays or switches by TTL logic signals. Products equipped with this option have a pin for the voltage of the actuator (12 V or 28 V) as well as a TTL driver pin shared per position. The polarity is not relevant to applications for switches with this option. The logic used is positive, therefore high level nominal +5V (2.2 to 5.5 V) of TTL signal means logic «1» which enables the corresponding microwave way. Low level i.e logic contacts 0, voltage is 0-0.8 V.

**V.S.W.R.:** The Voltage Standing Wave Ratio is a measure of the return loss or level of the reflected signal of a device connected on a transmission line. V.S.W.R. is linked to the coefficient of reflection (r) by the equation:

$$VSWR = \frac{1+r}{1-r} \quad r = \frac{Z-Z_0}{Z+Z_0}$$

V.S.W.R. varies from 1 to ∞, a value equal to 1 represents a perfect matching

with:

“r” is the coefficient of reflection

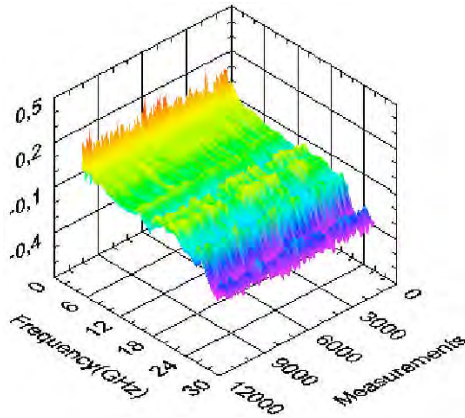
“Z<sub>0</sub>” is the characteristic impedance of the line

“Z” is the impedance of the line

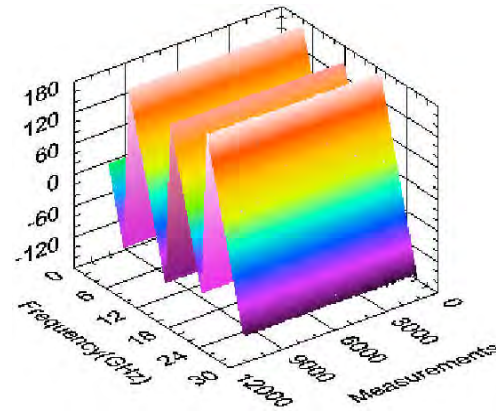
## RF Repeatability and Life Test Parameters

Radiall has built an Automatic Test Bench composed by a Vector Network Analyzer (VNA), Digital Multi-Meters (DMM), PC and a switch driver. This approach is to qualify over the complete life of the switch (2.5 million to 10 million cycles depending on switch models). This ATE extracts and stores the RF parameters or contacts resistances of the switch according to our own internal procedure. For each frequency point a calculation of VSWR, insertion loss and standard deviation are computed. All measurements are performed at room temperature (RF switch is toggled at 3Hz).

The curves in 3D illustrate the RF characteristics over 10 million switching cycles on SP6T-26.5GHz Ramses switch.



Insertion loss over 10 million cycles



Phase over 10 million cycle

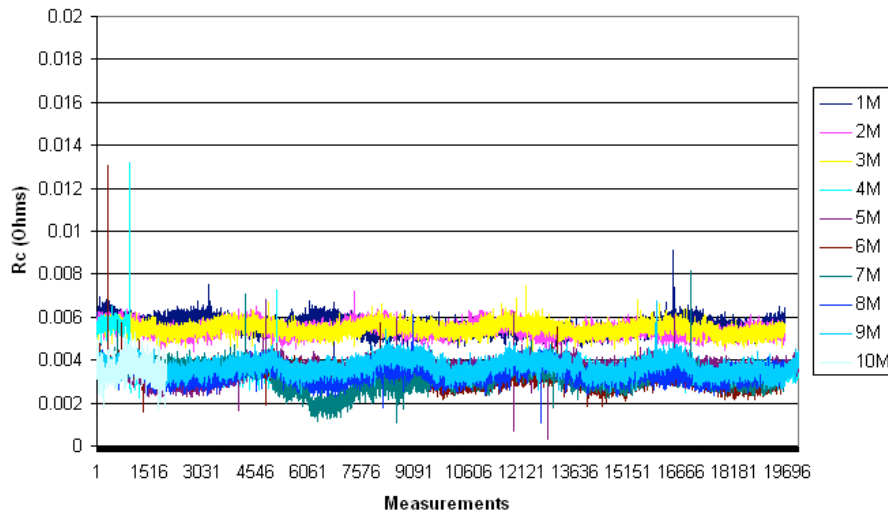
The contribution due to only  $R_c$  can be calculated as follows:

$$RL = 20 \text{ Log}_{10} |\Gamma| = 20 \text{ Log}_{10} \frac{R_c}{2R_o + R_c}$$

$$VSWR = 1 + \frac{R_c}{R_o}$$

$$IL = 10 \text{ Log}_{10} \frac{R_o}{R_o + R_c}$$

The following curve shows RF contact resistance up to 10 million. Switch was toggled at 3Hz with  $R_c$  recorded each 50 cycles.



**Conversions**

**CONVERSION MEASUREMENT UNIT**

- Convert Inch to millimeters: 1 Inch=25.4mm / 1 meter=39.3 Inches
- Convert centimeters to feet: 1 foot=30.48 cm / 1 meter=3.28 feet
- Convert kilogram to pounds: 1 kg=2.20 Lb / 1 pound=0.45 kg

**REFLECTION COEFFICIENT RETURN LOSS CONVERSION**

Reflection coefficient ( $\rho$ )

Standard Wave Ratio  $(1 + \rho) / (1 - \rho)$

Return Loss (dB)  $(-20 \log_{10}\rho)$

Reflection coefficient	V.S.W.R.	Return loss (dB)	Reflection coefficient	V.S.W.R.	Return loss (dB)
0	1.00	∞	0.195	1.48	14.2
0.01	1.02	40.0	0.2	1.5	14.0
0.015	1.03	36.5	0.205	1.52	13.8
0.02	1.04	34.0	0.21	1.53	13.6
0.025	1.05	32.0	0.215	1.55	13.4
0.03	1.06	30.5	0.22	1.56	13.2
0.035	1.07	29.1	0.225	1.58	13.0
0.04	1.08	28.0	0.23	1.6	12.8
0.045	1.09	26.9	0.235	1.61	12.6
0.046	1.10	26.7	0.24	1.63	12.4
0.05	1.11	26.0	0.245	1.65	12.2
0.055	1.12	25.2	0.25	1.67	12.0
0.06	1.13	24.4	0.255	1.68	11.9
0.065	1.14	23.7	0.26	1.7	11.7
0.07	1.15	23.1	0.265	1.72	11.5
0.075	1.16	22.5	0.27	1.74	11.4
0.08	1.17	21.9	0.275	1.76	11.2
0.085	1.19	21.4	0.28	1.78	11.1
0.09	1.20	20.9	0.285	1.80	10.9
0.095	1.21	20.4	0.29	1.82	10.8
0.1	1.22	20.0	0.295	1.84	10.6
0.105	1.23	19.6	0.3	1.86	10.5
0.11	1.25	19.2	0.305	1.88	10.3
0.115	1.26	18.8	0.31	1.90	10.2
0.12	1.27	18.4	0.32	1.94	9.9
0.125	1.29	18.1	0.33	1.99	9.6
0.13	1.30	17.7	0.34	2.03	9.4
0.135	1.31	17.4	0.35	2.08	9.1
0.14	1.33	17.1	0.36	2.13	8.9
0.145	1.34	16.8	0.37	2.17	8.6
0.15	1.35	16.5	0.38	2.23	8.4
0.155	1.37	16.2	0.39	2.28	8.2
0.16	1.38	15.9	0.4	2.33	8.0
0.165	1.4	15.7	0.41	2.39	7.7
0.17	1.41	15.4	0.42	2.45	7.5
0.175	1.42	15.1	0.43	2.51	7.3
0.18	1.44	14.9	0.44	2.57	7.1
0.185	1.45	14.7	0.45	2.64	6.9
0.19	1.47	14.4	0.5	3.00	6.0



## Conversions

### POWER CONVERSION

$\text{dBm} = 10 \times \text{Log}_{10} P \text{ (milliwatts)}$

$P \text{ (milliwatts)} = 10^{(\text{dBm}/10)}$

Power (dBm)	Power (W)	Power (dBm)	Power (W)
-49	0.01 $\mu\text{W}$	1	1.26 mW
-48	0.02 $\mu\text{W}$	2	1.58 mW
-47	0.02 $\mu\text{W}$	3	2.00 mW
-46	0.03 $\mu\text{W}$	4	2.51 mW
-45	0.03 $\mu\text{W}$	5	3.16 mW
-44	0.04 $\mu\text{W}$	6	3.98 mW
-43	0.05 $\mu\text{W}$	7	5.01 mW
-42	0.06 $\mu\text{W}$	8	6.31 mW
-41	0.08 $\mu\text{W}$	9	7.94 mW
-40	0.10 $\mu\text{W}$	10	10 mW
-39	0.13 $\mu\text{W}$	11	12.59 mW
-38	0.16 $\mu\text{W}$	12	15.85 mW
-37	0.20 $\mu\text{W}$	13	19.95 mW
-36	0.25 $\mu\text{W}$	14	25.12 mW
-35	0.32 $\mu\text{W}$	15	31.62 mW
-34	0.40 $\mu\text{W}$	16	39.81 mW
-33	0.50 $\mu\text{W}$	17	50.12 mW
-32	0.63 $\mu\text{W}$	18	63.10 mW
-31	0.79 $\mu\text{W}$	19	79.43 mW
-30	1 $\mu\text{W}$	20	100 mW
-29	1.26 $\mu\text{W}$	21	125.89 mW
-28	1.58 $\mu\text{W}$	22	158.49 mW
-27	2 $\mu\text{W}$	23	199.53 mW
-26	2.51 $\mu\text{W}$	24	251.19 mW
-25	3.16 $\mu\text{W}$	25	316.23 mW
-24	3.98 $\mu\text{W}$	26	398.11 mW
-23	5.01 $\mu\text{W}$	27	501.19 mW
-22	6.31 $\mu\text{W}$	28	630.96 mW
-21	7.94 $\mu\text{W}$	29	794.33 mW
-20	10 $\mu\text{W}$	30	1 W
-19	12.59 $\mu\text{W}$	31	1.26 W
-18	15.85 $\mu\text{W}$	32	1.58 W
-17	19.95 $\mu\text{W}$	33	2 W
-16	25.12 $\mu\text{W}$	34	2.51 W
-15	31.62 $\mu\text{W}$	35	3.16 W
-14	39.81 $\mu\text{W}$	36	3.98 W
-13	50.12 $\mu\text{W}$	37	5.01 W
-12	63.10 $\mu\text{W}$	38	6.31 W
-11	79.43 $\mu\text{W}$	39	7.94 W
-10	100.00 $\mu\text{W}$	40	10 W
-9	125.89 $\mu\text{W}$	41	12.59 W
-8	158.49 $\mu\text{W}$	42	15.85 W
-7	199.53 $\mu\text{W}$	43	19.95 W
-6	251.19 $\mu\text{W}$	44	25.12 W
-5	316.23 $\mu\text{W}$	45	31.62 W
-4	398.11 $\mu\text{W}$	46	39.81 W
-3	501.19 $\mu\text{W}$	47	50.12 W
-2	630.96 $\mu\text{W}$	48	63.10 W
-1	794.33 $\mu\text{W}$	49	79.43 W
0	1 mW	50	100 W

## Conversions

### TEMPERATURE EQUIVALENCE

$$\text{Temp (°C)} = ((\text{°F} - 32) \times 5) / 9$$

$$\text{Temp (°F)} = ((9 \times \text{°C}) / 5) + 32$$

°C	°F	°C	°F	°C	°F
-80	-112.0	22	71.6	73	163.4
-70	-94.0	23	73.4	74	165.2
-60	-76.0	24	75.2	75	167.0
-50	-58.0	25	77.0	76	168.8
-45	-49.1	26	78.8	77	170.6
-40	-40.0	27	80.6	78	172.4
-35	-31.0	28	82.4	79	174.2
-30	-22.0	29	84.2	80	176.0
-25	-13.0	30	86.0	81	177.8
-20	-4.0	31	87.8	82	179.6
-19	-2.2	32	89.6	83	181.4
-18	-0.4	33	91.4	84	183.2
-17	1.4	34	93.2	85	185.0
-16	3.2	35	95.0	86	186.6
-15	5.0	36	96.8	87	188.8
-14	6.8	37	98.6	88	190.4
-13	8.6	38	100.4	89	192.2
-12	10.4	39	102.2	90	194.0
-11	12.2	40	104.0	91	195.8
-10	14.0	41	105.8	92	197.6
-9	15.8	42	107.6	93	199.4
-8	17.6	43	109.4	94	201.2
-7	19.4	44	111.2	95	203.0
-6	21.2	45	113.0	96	204.8
-5	23.0	46	114.8	97	206.6
-4	24.8	47	116.6	98	208.4
-3	26.6	48	118.4	99	210.2
-2	28.4	49	120.2	100	212.0
-1	30.2	50	122.0	105	221.0
0	32.0	51	123.8	110	230.0
1	33.8	52	125.6	115	239.0
2	35.6	53	127.4	120	248.0
3	37.4	54	129.2	130	266.0
4	39.2	55	131.0	140	284.0
5	41.0	56	132.8	150	302.0
6	42.8	57	134.6	160	320.0
7	44.6	58	136.4	170	338.0
8	46.4	59	138.2	180	356.0
9	48.2	60	140.0	190	374.0
10	50.0	61	141.8	200	392.0
11	51.8	62	143.6	250	482.0
12	53.6	63	145.4	300	572.0
13	55.4	64	147.2	350	662.0
14	57.2	65	149.0	400	752.0
15	59.0	66	150.8	500	932.0
16	60.8	67	152.6	600	1112.0
17	62.6	68	154.4	700	1292.0
18	64.4	69	156.2	800	1472.0
19	66.2	70	158.0	900	1652.0
20	68.0	71	159.8	1000	1832.0
21	69.8	72	161.6		

### DERATING TEMPERATURE INFORMATION

The temperature at which the switches are used has an effect on the coil resistance. This is due to the temperature and variation of the resistivity of copper and the pick up voltage.

Formula of the variation of coil resistance versus the temperature is:

$$R' = R (1 + K (t' - t))$$

K = Temperature coefficient (0.0038 for copper)

R = Coil resistance (ohms) at temperature t (°C)

R' = Coil resistance (ohms) at temperature t' (°C)

#### Example of calculation:

Device: SPDT Failsafe R570413000

How to calculate current at 70°C with this relay?

In reference to specifications outlined in the technical data sheet:

Coil resistance 275 Ohms at 25°C ( R = 275, t = 25, t' = 70 )

Nominal current = 102 mA at 25°C

Nominal voltage = 28 volts

New coil resistance at 70°C will be:

$$R' = 275 ( 1 + 0.0038 (70 - 25))$$

$$R' = 275 \times 2.71$$

$$R' = 323 \text{ Ohms}$$

According to the Ohm law ( U = R I ), at 70°C:

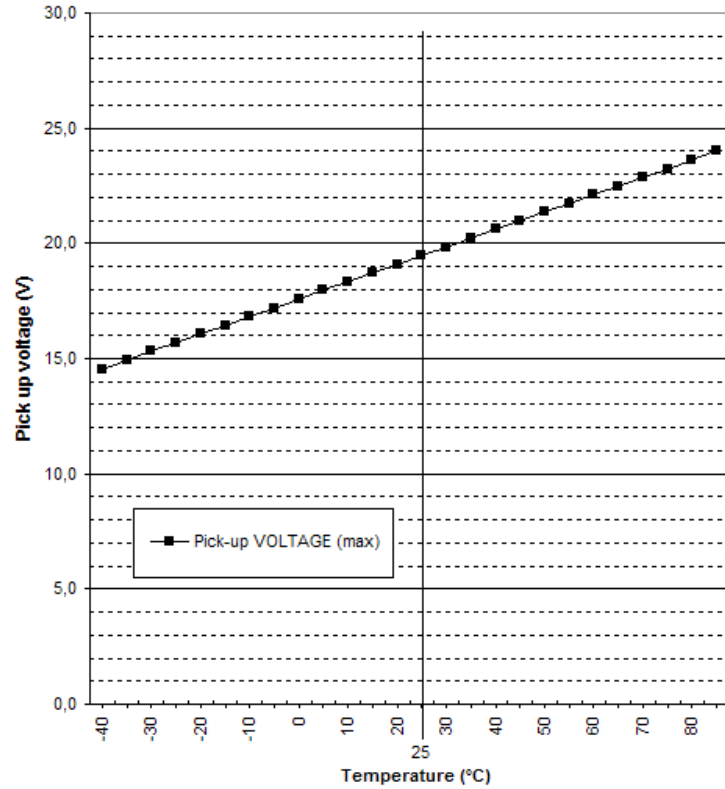
$$U = R \times I$$

$$I = 87 \text{ mA}$$

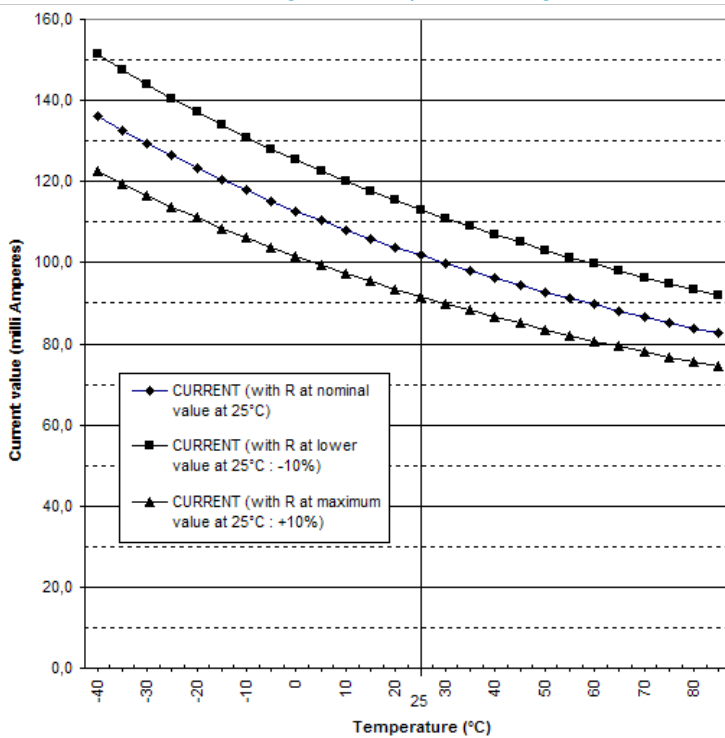
## Conversions

The following graphs are examples of calculation for the same product R570413000 (SPDT SMA)

Maximum pick up voltage versus temperature



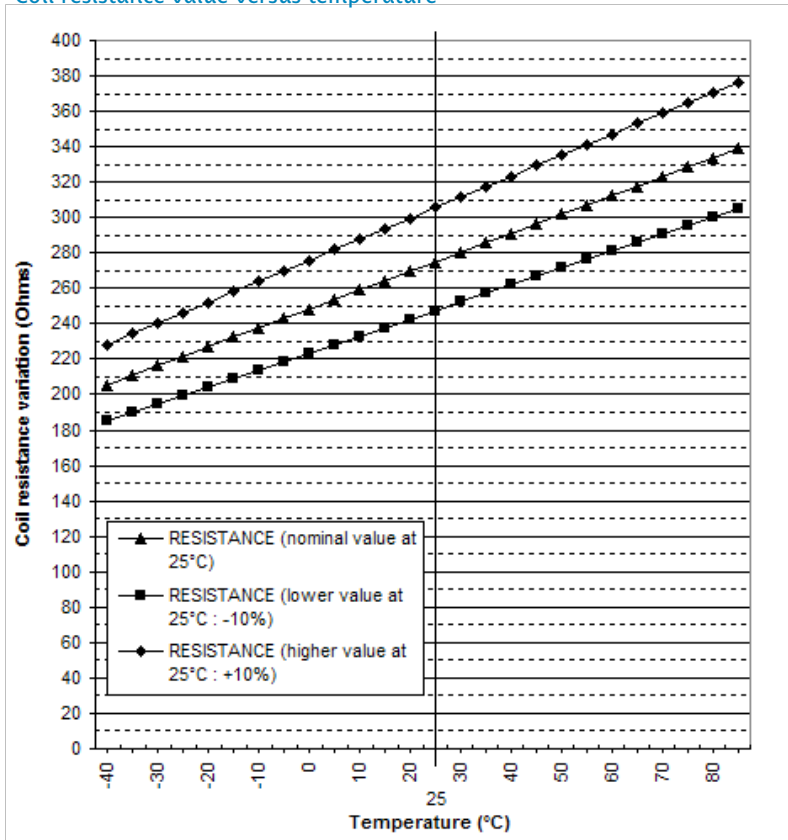
Current value versus voltage over temperature range



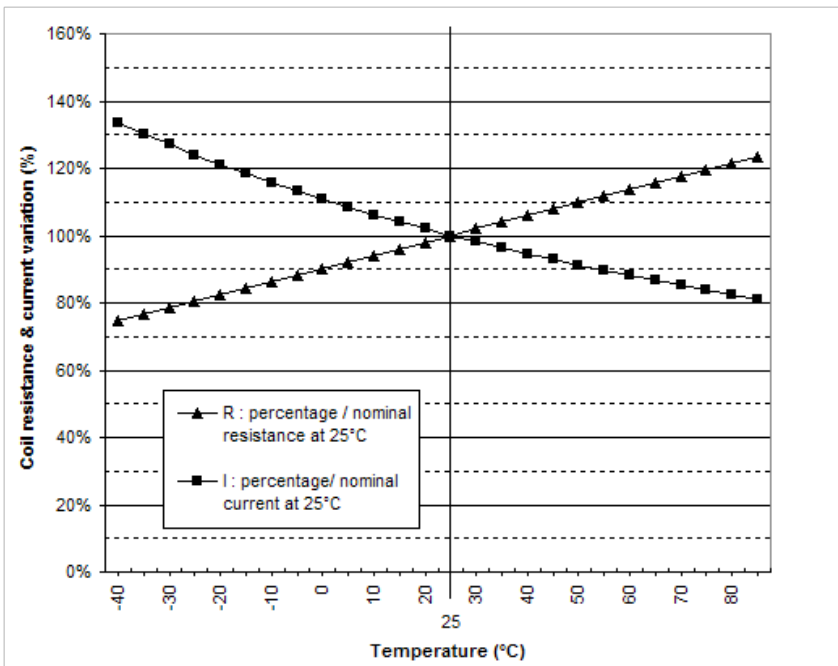
For customer support and more technical information contact a Radiall sales representative.

## Conversions

### Coil resistance value versus temperature



### Maximum pick up voltage variation versus temperature

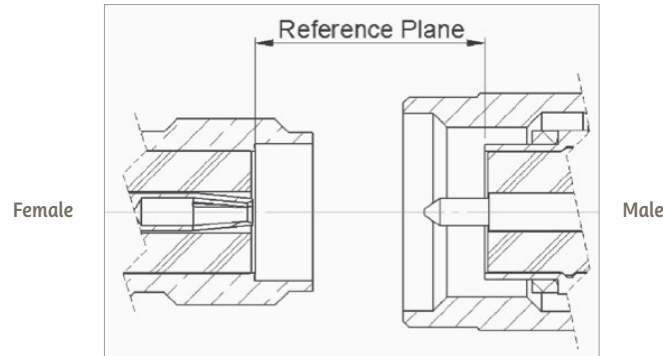


**User Handbook**

**USER HANDBOOK FOR CONNECTOR ASSEMBLY ON COAXIAL SWITCHES**

When connecting RF coaxial connectors to Radiall switches precaution should be taken to avoid irreversible damage on the RF switches.

Use only connectors with the correct interface dimensions



To ensure appropriate torque on the connector, and avoid damage on the contacts it is recommended to use a specific tool with calibrated torque. Apply the recommended torque as shown below:

SMA Connectors	from 80 to 120 N.cm
TNC Connectors	265 N.cm

Connection of semi rigid cable using the center contact of the cables as pin for connecting the female connector

If the center contact is not in alignment with the female socket, the switch RF connector could be damaged.

Female contacts slots

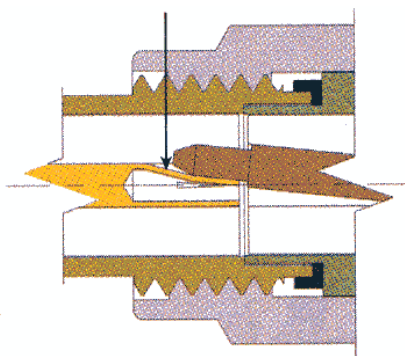


Fig A: Misaligned pin between insulator and female contacts slots

RF connectors with removable nut allow visual confirmation that the center contact is correctly positioned.

Cable	Connector
.085	R125 052 500
.141	R125 055 500

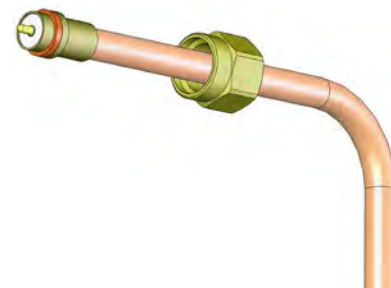




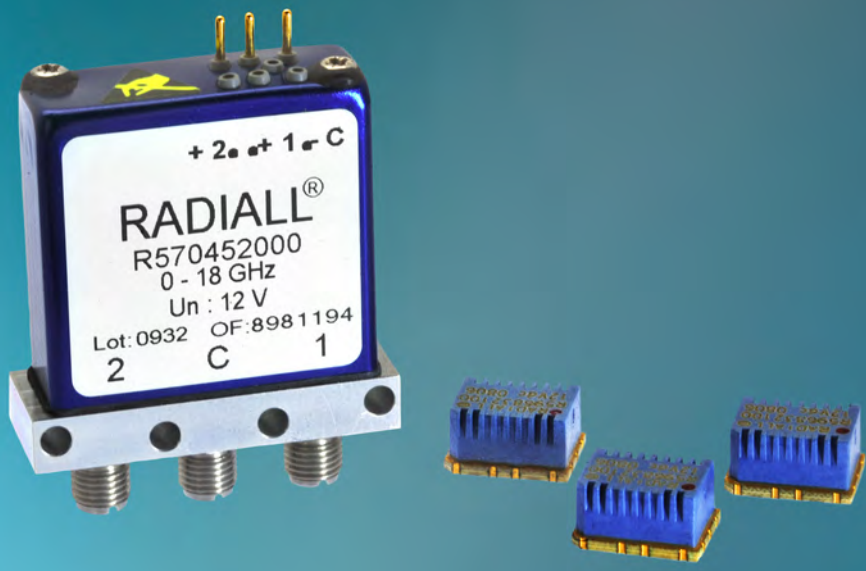


Fig B: Semi rigid cable with removable nut SMA contact

## Applications

Applications	SLIM Line series	RAMSES series	TITANIUM	PLATINUM	Tvac products	Space components
Instrumentation 	Automated test					Not applicable
	Measurement equipments					
	Monitoring devices					
	Test network					
Wireless communication 	Telecommunication				Not applicable	
	Tower mount amplifiers					
	BTS					
	Radio links					
	ECM equipments					
	Repeaters					
	Base stations					
	Point to point link					
Military 	Military radios				Not applicable	
	Electronic warfare					
	Radar					
Space 	Pay-loaded: not applicable					Pay-loaded: Various satellites Communication Observation
	Ground segment					
	Test equipments					
	Earth stations					

SECTION 2



SPDT



## Contents

**Slim Line Series**  
 SMT Power Micro-SPDT with 10 GHz capabilities: R596 Series ..... 2-2 to 2-11

**Ramses Series**  
 SPDT up to 50 GHz: R570 Series (miniature models) ..... 2-12 to 2-15  
 SPDT up to 50 GHz: R572 Series (miniature: low consumption & reduced size models) ..... 2-16 to 2-19  
 SPDT up to 18 GHz: R570 Series (standard models) ..... 2-20 to 2-23

**Electrical Schematics**  
 R570 & R572 Series ..... 2-24 to 2-27

**Platinum Series**  
 High Performance SPDT up to 40 GHz: R595 Series ..... 2-28 to 2-33

Optional Features ..... 2-34

## SPDT PART NUMBER SELECTION GUIDE\*

Slim Line	RAMSES	PLATINUM	Series	Digital Position
SPDT	SPDT	SPDT	Configuration	R 1-3: 4: RF connectors
R596	R570	R570	DC - 3 GHz	
3	-	-	DC - 8 GHz	
8	-	-	SMA 3 GHz	
-	3	3	SMA 6 GHz	
-	-	3	SMA 18 GHz	
-	4	4	SMA 20 GHz	
-	-	4	SMA 26.5 GHz	
-	F	F	SMA 2.9.40 GHz	
-	8	8	2.4mm 50 GHz	
-	J	J	SMB/SMC 3 GHz	
-	B/C	B/C	QMA 6 GHz	
-	E	E	DIN 1.6/5.6, 2.5 GHz	
-	9	9	Mini SMB 3 GHz	
-	H	H	Pc board mount 3 GHz	
-	-	A	N 3 GHz	
-	0	-	N 12.4 GHz	
-	1	-	BNC 3 GHz	
-	2	-	TNC 3 GHz	
-	5	-	TNC 12.4 GHz	
-	6	-	TNC 18 GHz	
-	D	-	TNC 18 GHz	
1/9	1/2	1/2	Failsafe	5: Type
3	3/4/5/6	3/4/5/6	Latching	
2	2	2	12V	6: Voltage
-	-	-	15V	
-	-	-	24V	
3	-	3	28V	
-	3	3	Without	7: TTL opt./model
-	0	0	With	
-	1	1	SPDT non terminated	
-	-	-	Without option	8: Options
1	-	-	Positive common	
-	0	0	Suppression diodes	
-	1	1	Suppression diodes and positive common	
-	3	3	Compatible with TTL driver	
-	4	4	Standard packaging	9: Terminals
-	-	-	Tape and reel of 200 relays	
0	-	-	Tape and reel of 500 relays	
0	-	-	Tape without reel	
0	-	-	Soldered on a connectorized test fixture	
0	0	0	Solder pins	
-	5	5	D-Sub connector	
-	-	-	Certificate of conformity	10: Documentation
-	-	-	Calibration certificate	
-	-	-	Calibration certificate + RF curves	

Example of P/N: R570F12010 is a SPDT SMA 26.5 GHz, failsafe, 12 Vdc, without TTL, with positive common, solder pins.

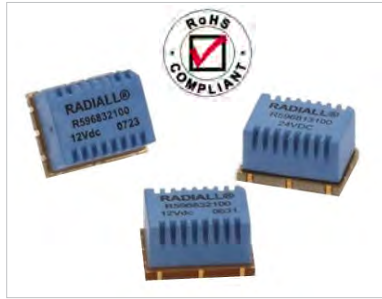
\*For part number creation and available options, see detailed part number selection for each series.



## SMT Power Micro SPDT with 10 GHz Capabilities

### SURFACE MOUNT TECHNOLOGY

Patent pending

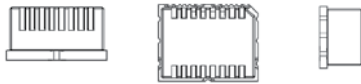


An innovative and original "micro-mechanical" design of the R596 SMT micro-relay offers, excellent RF performance, reliability, and repeatability. The miniature size, and low installation cost make these coaxial switches an ideal solution.

Very low return loss and insertion loss allow this relay to be used in power applications, as well as in typical SMT relay applications such as RF attenuators, RF matrices, spectrum analysers, and telecommunications.

Failsafe models are offered in two RF configurations (direct and inverted). The association of these two products on the same PC board enables the product to perform the bypass function. (For bypass mounting, further information is available on page 2-8).

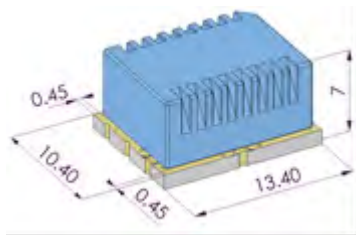
Actual Size



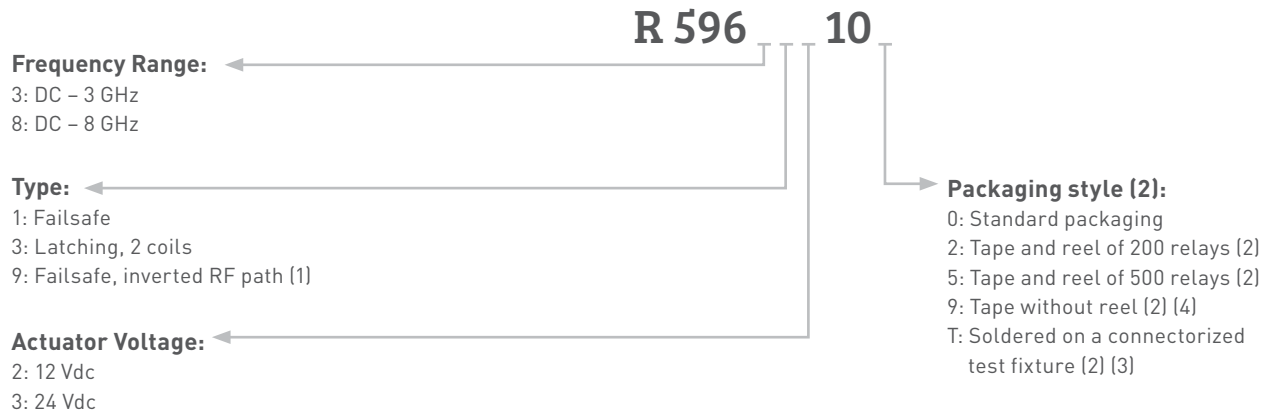
Example of P/N:

R596813100 is a SPDT SMT 8 GHz, 24 Vdc, failsafe, standard packaging.

Typical Outline Drawing  
(All dimensions in mm)



### PART NUMBER SELECTION



(1): To be associated with a failsafe model, so as to achieve the "BYPASS" function (see application details on page 2-8)

(2): Non standard packaging symbols (2, 5, 9 or T) are not marked on the relay

(3): See details about test fixture dimensions on page 2-4

(4): Tape delivered without reel, available for all specific quantities up to 200 pieces

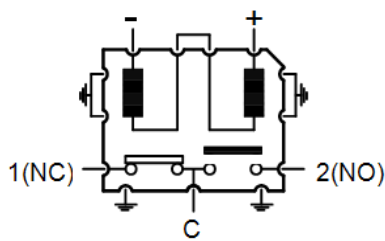
**SMT Power Micro SPDT with 10 GHz Capabilities**

**SLIM LINE GENERAL SPECIFICATIONS**

Operating mode		Failsafe (types 1 and 9)		Latching (type 3)	
Nominal operating voltage (across temperature range)	Vdc	12 (10.2 to 13)	24 (20.5 to 30)	12 (10.2 to 13)	24 (20.5 to 30)
Coil resistance at 23 °C (+/-10%)	Ω	330	1130	205	865
Operating current at 23 °C	mA	36	25	58	32
RF and command ports		1/2 hole gold plated, Infrared reflow, forced air oven or hand soldering (Compatible with lead free soldering processes)			
Switching time at nominal voltage	Making contacts Breaking contacts	Max 4ms (typical 1.8ms), including contact bounce time Max 1ms (typical 0.5ms)			
Life	- Cold switching (max 120 cycles/min) - Hot switching (max 20 cycles/min)	2 million cycles 500.000 cycles (1W, impedance 50Ω, V.S.W.R. < 1.25)			
Insulation		Dielectric test voltage		300 Vrms	
		Insulation resistance at 500Vdc		> 100 MOhms	
Environmental protection		Lead free construction - Waterproof (acc. To IEC 60529 / IP67)			
Mass		< 2g			
Operating temperature range (with no icing nor condensation)	°C	-25 to +85 (5)		-40 to +85	
Storage temperature range	°C	- 55 to +85			
Sine vibration (MIL STD 202, Method 204D)		- Condition D: 10-2000 Hz, 20g		operating	
		- Condition G: 10-2000 Hz, 30g		non operating	
Random vibration (MIL STD 202, Method 214A, Profile I)		- Condition F: 50-2000 Hz, 20.71g		operating	
		- Condition H: 50-2000 Hz, 29.28g		non operating	
Shocks (According to MIL STD 202, Method 213B, Cond. C)		100g / 6 ms, 1/2 sine		operating	

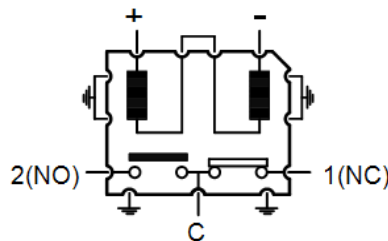
(5): Failsafe models may be used down to -40°C, but if coil remains permanently supplied at nominal voltage, the holding current value must be reduced from 45% to 55% to avoid internal condensation. (for more details, see Radiall application note AN-R596-51 on page 2-10).

**PIN IDENTIFICATION (TOP VIEW)**



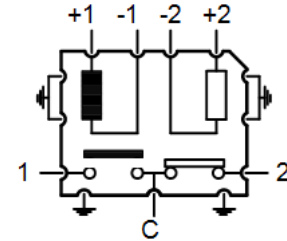
**Failsafe model (Type 1)**

Voltage	RF continuity
De-energized	C <--> 1(NC)
Energized	C <--> 2(NO)



**Inverted failsafe model for Bypass application (Type 9)**

Voltage	RF continuity
De-energized	C <--> 1(NC)
Energized	C <--> 2(NO)



**Latching model (Type 3)**

Voltage	RF continuity
-1 +1	C <--> 1
-2 +2	C <--> 2

**SMT Power Micro SPDT with 10 GHz Capabilities**

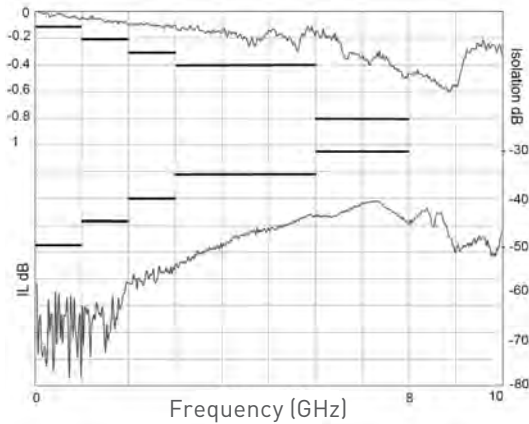
**SLIM LINE PERFORMANCE (S PARAMETERS AVAILABLE ON REQUEST)**

Frequency range GHz		V.S.W.R. (max)	Insertion loss (max) dB	Isolation (min) dB		Average power W (see page 2-5)		Third order Inter modulation	Impedance $\Omega$
				switch alone	switch + board layout (6)	cold switching	hot switching		
DC - 3	DC - 1	1.10	0.10	50	50	400	50	-120 dBc typical (2 carriers 20W)	50
	1 - 2	1.20	0.20	45	40	280	50		
DC - 8	2 - 3	1.35	0.30	40	30	175	40		
	3 - 6	1.35	0.40	35	30	50	25		
	6 - 8	1.40	0.80	30	30	35	5		

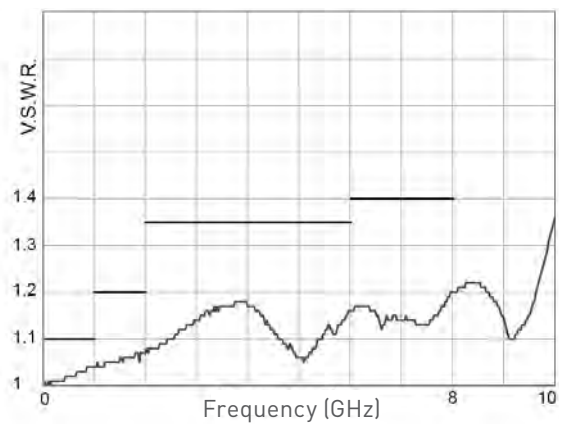
(6): taking account of the reduction of isolation due to coupling between PCB microstrip lines (see isolation dotted curve above and measurement method below)

**TYPICAL RF PERFORMANCES**

Insertion Loss and Isolation

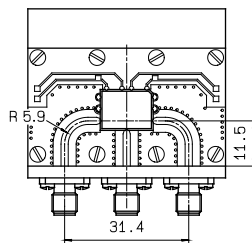
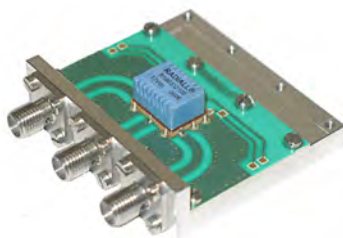


V.S.W.R

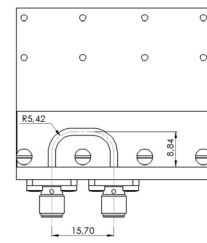


**MEASUREMENT METHOD**

Relay soldered on test fixture (7)



Calibration board



Inputs/Outputs of the calibration board and test fixture are equipped with SMA type receptacle connectors (Radiall part number R125 510 000). The length of the RF tracks is the same on the calibration board and the test fixture circuits. The insertion loss of the relay itself is calculated by subtracting the insertion loss of the "calibration board" to the insertion loss of the "relay welded on the test fixture".

(7): Relay soldered on Test Fixture is available. To order, please use the suffix "T" (part number R596 - - - - T), as explained in page 2-2.

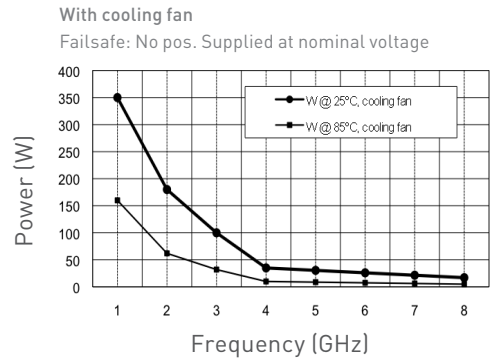
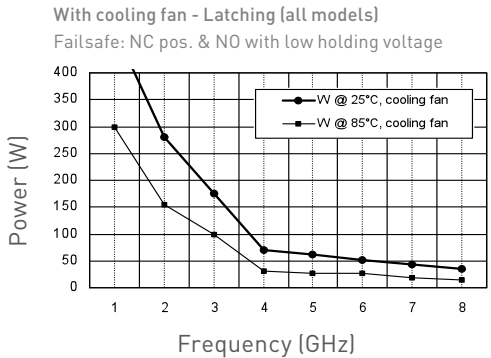
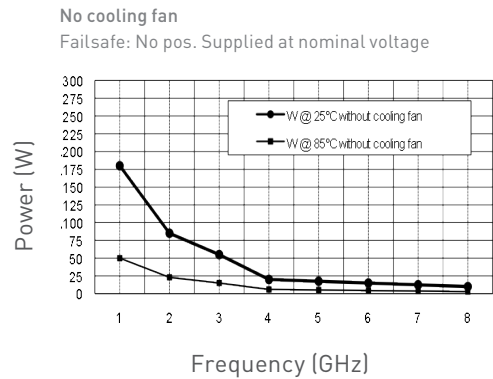
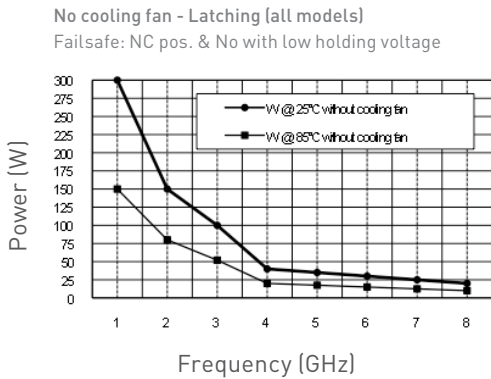
**SMT Power Micro SPDT with 10 GHz Capabilities**

**RF POWER RATING FOR COLD SWITCHING USE**

(Impedance 50 Ohms, V.S.W.R. < 1.25)

Power level depends on environmental conditions:

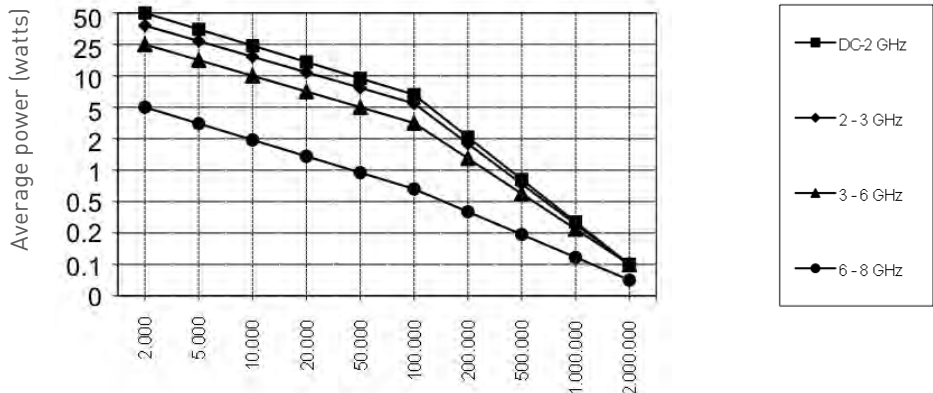
- R596 series have been designed to be used without a cooling fan even for high power applications. However, the power capability may be still improved by using the appropriate cooling fan.
- For failsafe models used with coil permanently supplied (N/O position), the same power level as latching models may be applied: see on application note N° AN-R596-51 on page 2-10, how to implement a “low holding current” function on your PC board, to avoid internal overheating and increase the RF power level.



**LIFE DERATING CURVE FOR HOT SWITCHING USE**

(Impedance 50 Ohms, V.S.W.R. < 1.25) General Specifications

Impedance 50Ω  
V.S.W.R. < 1.25  
max switching frequency:  
30 cycles per mn



## SMT Power Micro SPDT with 10 GHz Capabilities

### RELAY PACKAGING

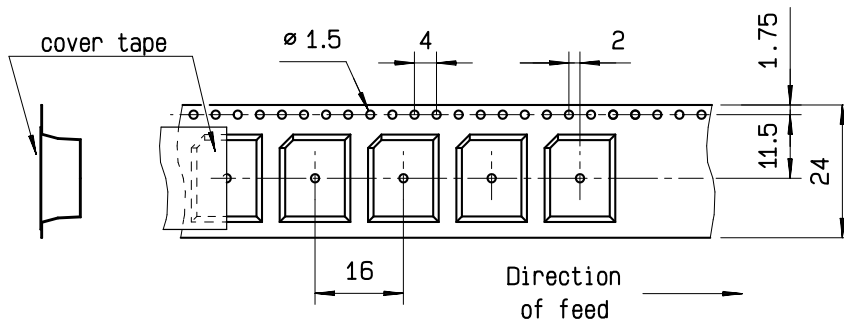
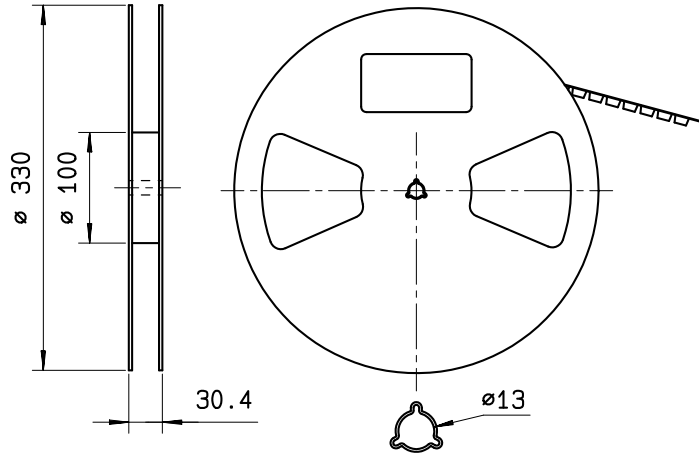
According to IEC 286-3 standard

#### Materials:

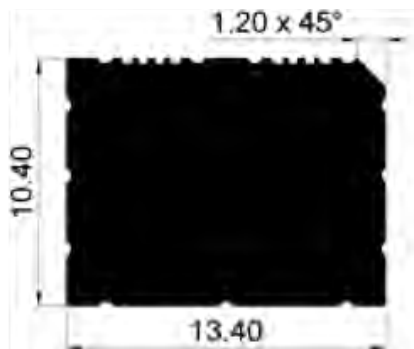
Reel: polyester

Carrier tape: antistatic PETG (polyester)

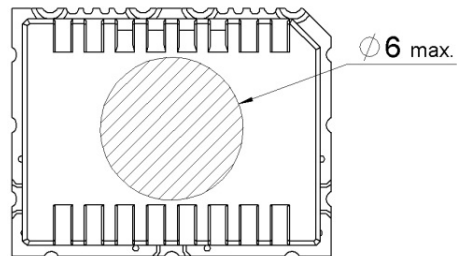
Cover tape: polyester



Video shadow of the relay



Aspiration Area

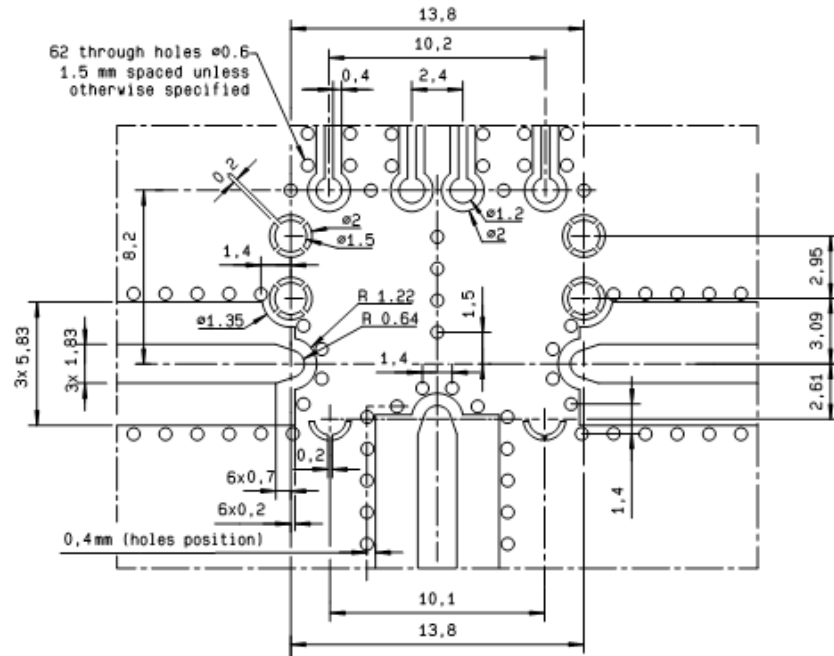


## SMT Power Micro SPDT with 10 GHz Capabilities

### PC BOARD MOUNTING

Board layout

DXF or Gerber format file available upon request (8)



Substrate types

Recommended substrates are **ROGERS RO4003** or **ARLON 25N**

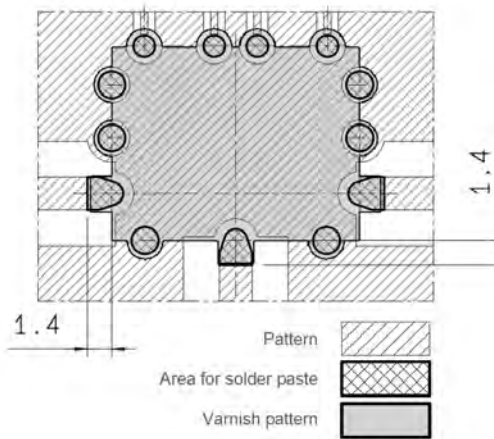
- **Mounting face:** Thickness 0.813 mm Cu double side 17.5µm. Width of track 1.83 mm
- Others substrates: **RO4350**, thickness 0.813 mm Cu double side 17.5µm. Width of track 1.80 mm
- 25FR**, thickness 0.813 mm Cu double side 17.5µm. Width of track 1.76 mm

- **Opposite face:** Plating all over the face

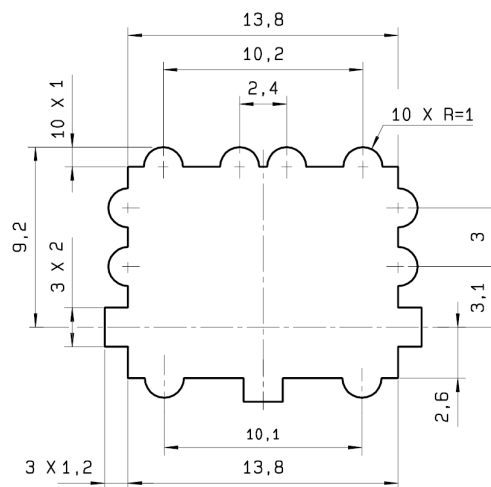
**Total thickness of the tracks (copper over thickness + plating): 40µm**

Other substrates may be used (for instance standard FR4), if provided with adequate modification of the tracks width.

Soldering Pattern



Varnish Pattern

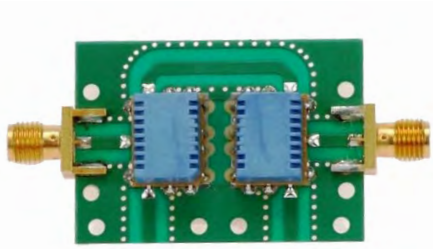


Please contact your local sales representative for additional information

## SMT Power Micro SPDT with 10 GHz Capabilities

### BYPASS APPLICATION

Failsafe Micro-relay typical implantation

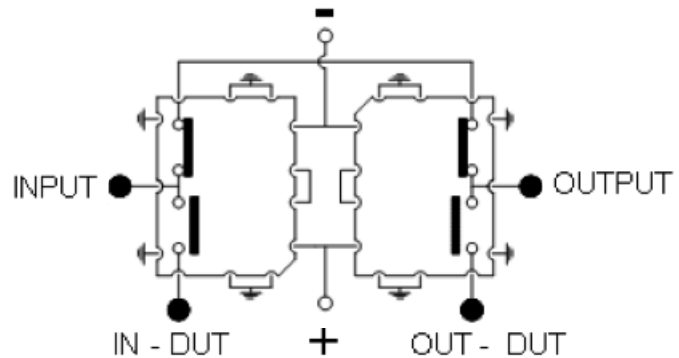
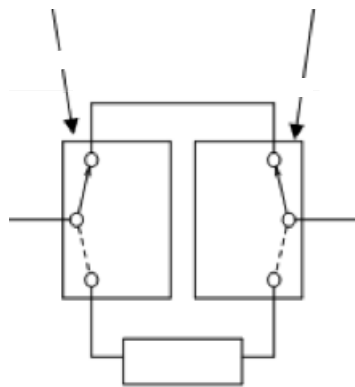


SPDT relays (Single Pole Double Throw) can be used to achieve a bypass switch function. For SMT applications, R596 series, relays are available in two failsafe versions, standard and inverted, to provide symmetric RF ports implantation possibility. The “side by side” implementation of these two versions on a PCB effectively produces the bypass function. The package size is reduced and interconnecting tracks are shortened. Required in order to protect the receiver for transmit/receive applications. Depending on the distance between the two relays, this configuration can achieve high isolation levels, up to 80 dB @ 1GHz, 70 dB @ 2 GHz, and 60 dB @ 6GHz.

### BYPASS TYPICAL IMPLANTATION & PIN IDENTIFICATION

(Top View)

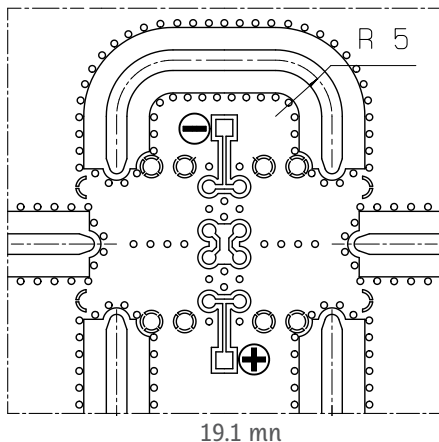
R596.X1X.XXX / R596.X9X.XXX



Voltage	RF continuity
De-energized	INPUT <-> OUTPUT (direct line)
Energized	INPUT <-> IN-DUT / OUT-DUT <-> OUTPUT

### BYPASS PC BOARD MOUNTING

Example of Board layout for bypass application



(See detailed board layout on page 2-7)

## SMT Power Micro SPDT with 10 GHz Capabilities

### RECOMMENDED SOLDERING PROCEDURE

#### A-Soldering procedure using automatic pick and place equipment

##### 1-Solder paste

R596 series are Lead free. Lead free Sn-Ag3.5-Cu0.7 solder cream may be used as well as standard Sn63-Pb35-Ag2. Radiall recommends using a no clean - low residue solder cream (5% solid residue of flux quantity) that will permit the elimination of the cleaning operation step after soldering.

Note: Due to the gold plating of the switch PCB interface, it is important to use a paste made with silver. This will help in avoiding formation of intermetallics as part of the solder joint.

##### 2-Solder paste deposition

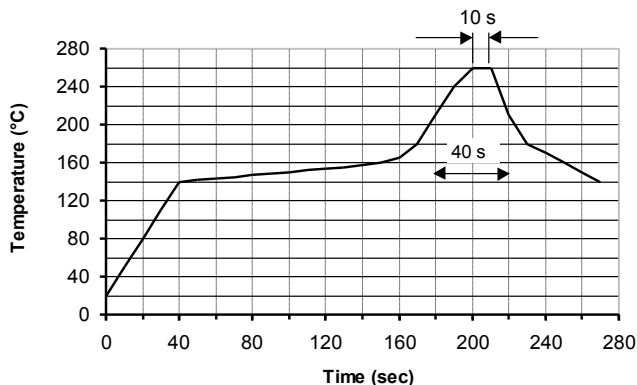
Solder cream may be applied on the board with screen printing or dispenser technologies. For either method, the solder paste must be coated to appropriate thickness and shapes to achieve good solder wetting. Please verify that the edges of the zone are clean and without contamination and that the PCB zoned areas have not oxidized. The design of the mounting pads and the stenciling area are given on page 2-7, for a thickness of the silk-screen printing of 0.15 mm (0.006").

##### 3-Placement of the component

For small lightweight components such as chip components, a self-alignment effect can be expected if small placement errors exist. However, this effect is not as expected for relays components and they require an accurate positioning on their soldering pads, typically +/- 0.1mm (+/-0.004"). Place the relay onto the PCB with automatic pick and place equipment. Various types of suction can be used. Radiall does not recommend using adhesive agents on the component or on the PCB.

##### 4-Soldering: infra-red process

Please refer to the recommended temperature profile for infra-red reflow or forced air convection:



Higher temperature (>260°C) and longer process duration would permanently damage the switches.

##### 5-Cleaning procedure

On miniature relays, high frequency cleaning may cause the contacts to stick. If cleaning is needed, please avoid ultrasonic cleaning and use alcohol based cleaning solutions.



In-line cleaning process, spraying, immersion, especially under temperature, may cause a risk of degradation of internal contacts.

##### 6-Quality check

Verify by visual inspection that the component is centered on the mounting pads. For solder joints, verify by visual inspection that the formation of meniscus on the pads are proper, and have a capillarity amount at least a third of the height.

#### B- Soldering procedure by manual operation

##### 1-Solder paste and flux deposition

Refer to procedure A - 1

Deposit a thin layer of flux on mounting zone, and allow the flux to evaporate a few seconds before applying the solder paste, in order to avoid dilution of the paste.

##### 2-Solder paste deposition

Radiall recommends depositing a small amount of solder paste on the mounting zone area by syringe. Be careful, not to apply solder paste outside of the zone area.

##### 3-Placement of the component:

During manipulation, avoid contaminating the lead surfaces by contact with fingers. Place the component on the mounting zone by pressing on the top of the relay lid.

##### 4-Hand soldering

Iron wattage 30 to 60 W. Tip temperature 280 to 300°C for maximum 5 seconds to keep good RF characteristics above 3GHz. It is important to solder RF ports first, and apply pressure on the relay lid during all the soldering stage, to reduce the air gap between the PC board and the relay.

##### 5-Cleaning procedure

Refer to procedure A - 5

##### 6-Quality check

Verify by visual inspection that component is centred on the mounting pads. For solder joints, verify by visual inspection that the formation of meniscus on the pads are proper, and have a capillarity amount at least a third of the height.



### SMT Power Micro SPDT with 10 GHz Capabilities

#### APPLICATION NOTE AN-R596-051

Subject: How to use failsafe R596 micro-relays over all the guaranteed temperature range, in or condensation environmental conditions.



RF and electrical characteristics are guaranteed on all failsafe R596 switches over their operating temperature range (-25°C to +85°C), and under “no icing nor condensation” conditions.

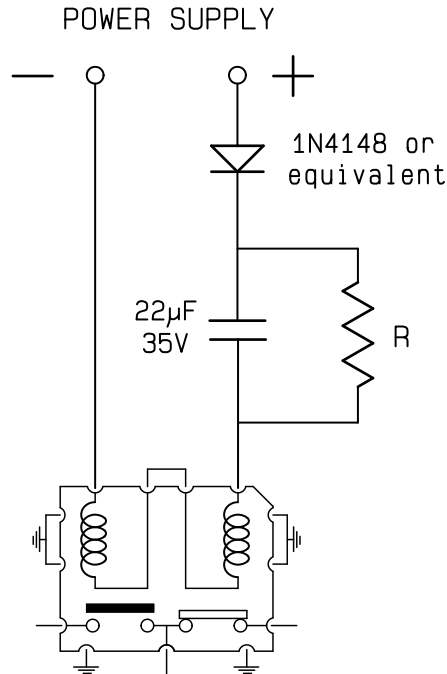
In extreme applications, with failsafe models used at low temperature, continuously in the N/O position (coil permanently supplied), N/C contact failures may occur, due to the high gradient of temperature between the coil (heated by the permanent power 500mW) and the RF paths. N/O contact resistance remains satisfactory, but condensation deposits ice on the open contact N/C, and when power is cut, the N/C position is not correctly established.

Failsafe models can be continuously driven when energized from -40°C, if the coil is not permanently supplied at nominal voltage, and heating and internal condensation is avoided. Once the relay has switched, the operating voltage must be reduced by 50% +/-5%. This low holding voltage is possible on R596 series, as it is enough to maintain the switch in “energized” position (for instance 5.4V to 6.6V for a 12V model). Furthermore it allows the user to save energy, by combining the advantages of latching and failsafe models.

This “holding current” function can be achieved by the implementation of a simple electronic drive on the command PC Board (1 resistor, 1 diode and 1 capacitor), for 12V and 24V models. A typical circuit design is shown on the schematic below. A few milliseconds after switching, the current is divided by two, and the absorbed power is divided by four (i.e. 6V and 110mW for a 12V model).

To reduce the voltage by 50%, the value of resistance R must be equal to the total resistance of the switch coil:

- 12V models: 330 Ohms 1/4W
- 24V models: 1200 Ohms 1/4W



R596 FAILSAFE RELAY

## Applications

### EXAMPLE OF SMT APPLICATIONS

The SMT Series offers a large range of products which can be used in many applications such as:

- Tower mount amplifiers
- Instrumentation
- Military radios
- ECM equipment
- BTS
- Radio-Links
- Repeaters

These products offer the same RF Board and soldering process as all RF components but with a reduced weight and size. They are designed to meet all market specifications.



SLIM LINE SERIES

## SPDT up to 50 GHz

Pc Board - SMA - SMA 2.9 - 2.4mm - QMA - SMC - SMB - mini SMB - DIN 1.6/5.6



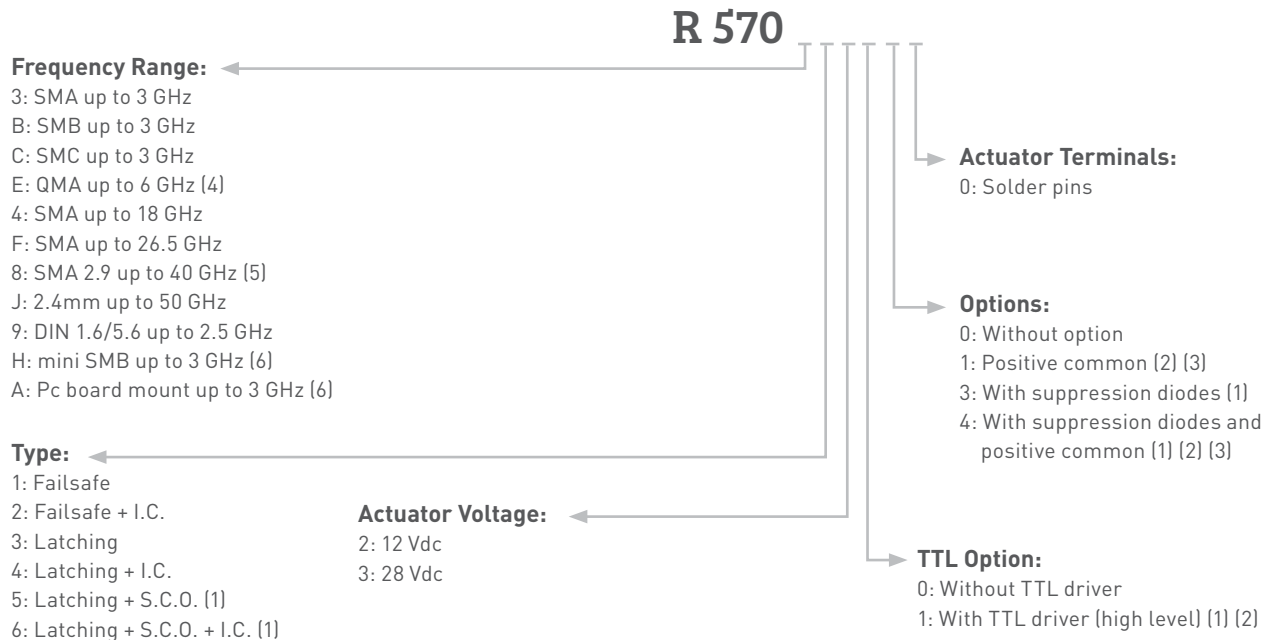
Radiall's RAMSES SPDT switches offer excellent reliability, high performance and operating frequencies from DC to 50 GHz. Radiall's RAMSES concept (which provides for a life span of 10 million cycles) offers a variety of options to meet customer needs.

These switches are dedicated to all market applications including: military, instrumentation and telecommunications.

Example of P/N:

R570413100 is a SPDT SMA 18 GHz, failsafe, 28 Vdc, with TTL driver, without option, solder pins.

### PART NUMBER SELECTION



I.C.: Indicator contact - S.C.O.: Self Cut-Off

(1): Suppression diodes are already included in Self Cut-OFF & TTL option

(2): Polarity is not relevant to application for switches with TTL driver

(3): Positive common shall be specified only with type 3, 4, 5 & 6 because failsafe switches can be used with both polarities

(6): Available only upon request



(4): The QLF trademark (Quick Lock Formula®) standard applies to QMA and QN series and guarantees the full intermateability between suppliers using this trademark. Using QLF certified connectors also guarantees the specified level of RF performances

(5): Connector SMA 2.9 is equivalent to "K connector®", registered trademark of Anritsu

**SPDT up to 50 GHz**

Pc Board - SMA - SMA 2.9 - 2.4mm - QMA - SMC - SMB - mini SMB - DIN 1.6/5.6

**GENERAL SPECIFICATIONS**

Operating mode		Failsafe		Latching	
Nominal operating voltage (across temperature range)	Vdc	12 (10.2 to 13)	28 (24 to 30)	12 (10.2 to 13)	28 (24 to 30)
Coil resistance at 23 °C (+/-10%)	Ω	47.5	275	58	350
Operating current at 23 °C	mA	250	102	210	80
Average power	See Power Rating Chart page <b>1-13</b>				
TTL Input	High level	2.2 to 5.5 Volts		800µA max 5.5 Volts	
	Low level	0 to 0.8 Volts		20µA max 0.8 Volts	
Indicator rating	1 W / 30 V / 100mA				
Switching time	ms	10			
Life	SMA - SMA 2.9 - QMA		10 million cycles		
	DIN 1.6/5.6 - Pc Board		5 million cycles		
	Mini SMB - SMB - SMC		2.5 million cycles		
	2.4mm		2 million cycles		
Connectors	SMA - SMA 2.9 - QMA - DIN 1.6/5.6 - SMB - SMC Mini SMB - Pc Board - 2.4mm				
Operating temperature range	DIN 1.6/5.6 - SMB - SMC - mini SMB - 2.4mm		-25°C to +70°C		
	SMA - SMA 2.9 - QMA - Pc Board		-40°C to +85°C		
Storage temperature range	DIN 1.6/5.6 - SMB - SMC - mini SMB - 2.4mm		-40°C to +85°C		
	SMA - SMA 2.9 - QMA - Pc Board		-55°C to +85°C		
Vibration (MIL STD 202, Method 204D, cond.D)	10-2000 Hz, 20g		Operating		
Shock (MIL STD 202, Method 213B, cond.C)	100g / 6ms, ½ sine		Operating		

**RF PERFORMANCES**

Connectors	Frequency range GHz		V.S.W.R. (max)	Insertion loss (max) dB	Isolation(min) dB	Impedance Ω
DIN 1.6/5.6	DC - 2.5	DC - 1	1.20	0.20	80	75
		1 - 2.5	1.30	0.30	70	
Mini SMB	DC - 3	DC - 1	1.20	0.20	80	
		1 - 3	1.30	0.30	70	
SMB - SMC	DC - 3	DC - 3	1.20	0.20	80	
QMA	DC - 6	DC - 3	1.20	0.20	80	
		3 - 6	1.30	0.30	70	
SMA	DC - 3	DC - 3	1.10	0.15	80	
		3 - 8	1.20	0.20	75	
	DC - 18	8 - 12.4	1.20	0.25	65	
		12.4 - 18	1.40	0.35	60	
SMA 2.9	DC - 26.5	18 - 26.5	1.50	0.50	55	
		DC - 40	DC - 6	1.30	0.30	70
			6 - 12.4	1.40	0.40	60
			12.4 - 18	1.50	0.50	60
18 - 26.5	1.70		0.70	55		
PC Board	DC - 3	26.5 - 40	1.90	0.80	50	
		DC - 3	DC - 3	1.20	0.20	80
2.4 mm	DC - 50	DC - 6	1.30	0.30	70	
		6 - 12.4	1.40	0.40	60	
		12.4 - 18	1.50	0.50	60	
		18 - 26.5	1.70	0.70	55	
		26.5 - 40	1.90	0.80	50	
		40 - 50	1.90	1.10	50	

See page 2-14, 2-18 and 2-19 for typical RF performances

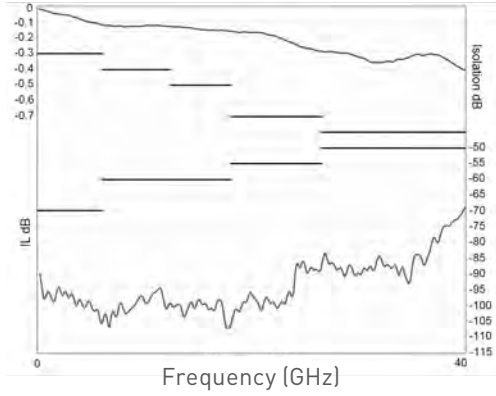
**SPDT up to 50 GHz**

Pc Board - SMA - SMA 2.9 - 2.4mm - QMA - SMC - SMB - mini SMB - DIN 1.6/5.6

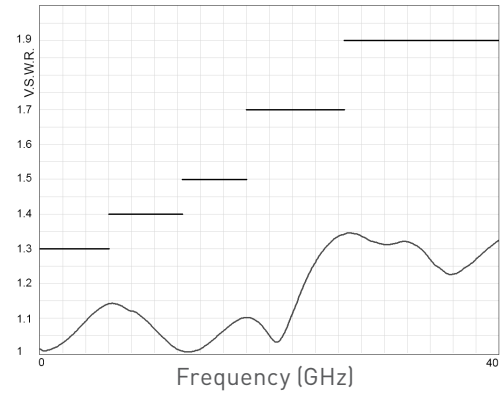
**R570 AND R572 TYPICAL RF PERFORMANCE**

Example: SPDT SMA 2.9 up to 40 GHz

**Insertion Loss and Isolation**

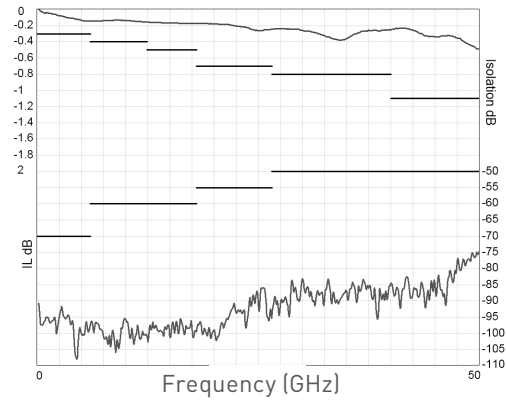


**V.S.W.R.**

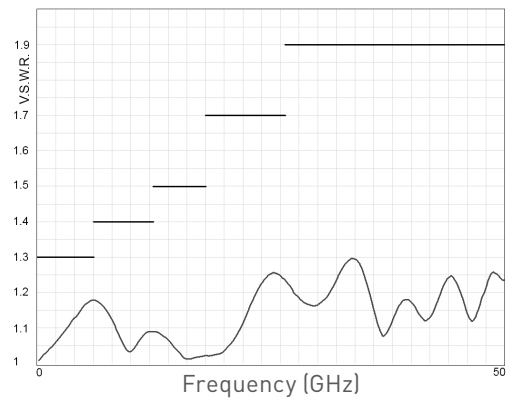


Example: SPDT 2.4mm up to 50 GHz

**Insertion Loss and Isolation**

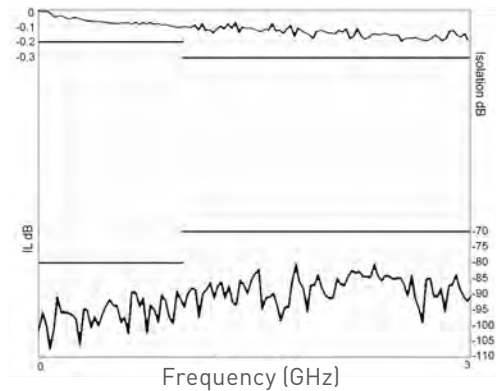


**V.S.W.R.**

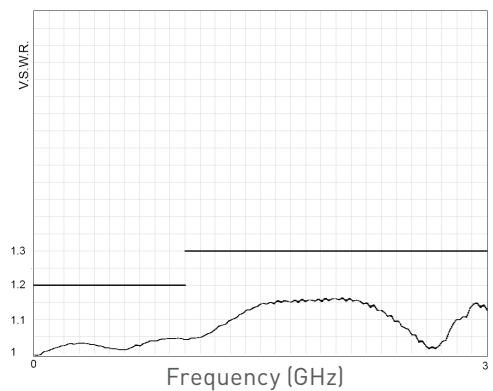


Example: SPDT mini SMB up to 3 GHz

**Insertion Loss and Isolation**



**V.S.W.R.**



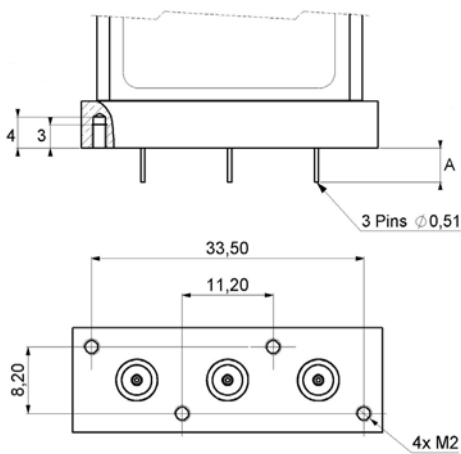
Note: see page 2-18 for other connectors

## SPDT up to 50 GHz

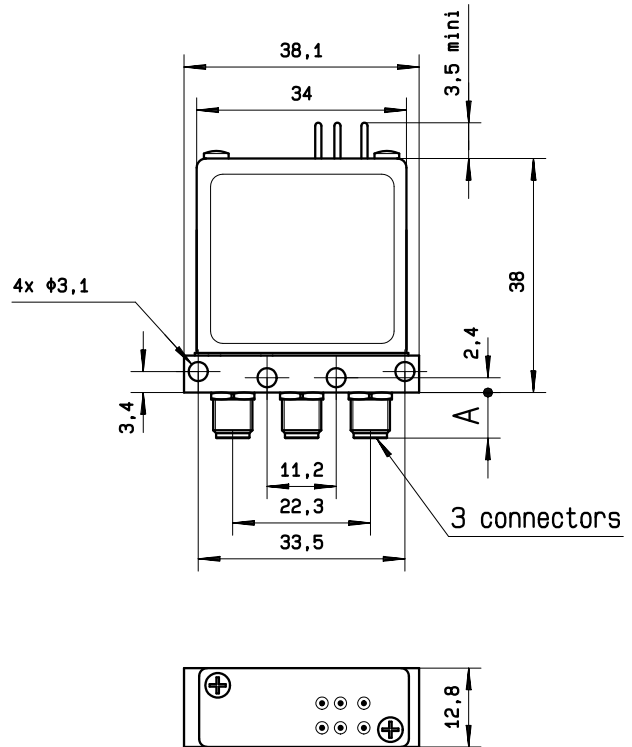
Pc Board - SMA - SMA 2.9 - 2.4mm - QMA - SMC - SMB - mini SMB - DIN 1.6/5.6

### TYPICAL OUTLINE DRAWING

Connectors	A max (mm)
SMA	7.4
SMA 2.9 & 2.4mm	6.3
SMB - SMC	9.3
QMA	10.8
Mini SMB	7.5
DIN 1.6/5.6	11.5
Pc Board	4.5

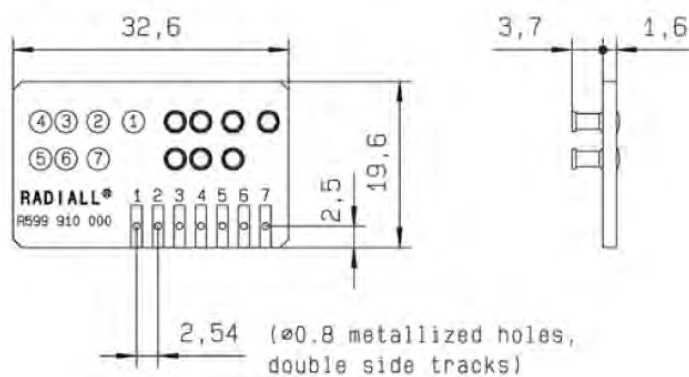


See page 2-27 for pin identification.



### ACCESSORIES

A printed circuit board interface connector (ordered separately) has been designed for easy mounting on terminals. For SPDT model R570 series => Radiall part number: **R599 910 000**



## SPDT up to 50 GHz: Low Consumption & Reduced Size

SMA - SMA 2.9 - 2.4mm - QMA - SMC - SMB - mini SMB - DIN 1.6/5.6



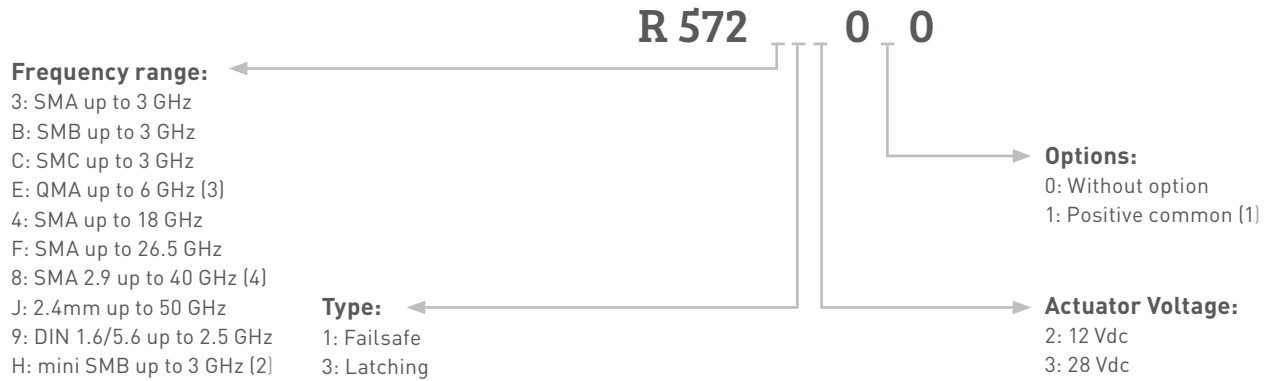
Radiall's RAMSES R572 series are ideal for RF & microwave systems where low current consumption, reduced size, high performance and high reliability are required. Other options are also available as shown on this page.

These switches are perfect for all market applications including: industrial, instrumentation, defense and telecommunications.

Example of P/N:

R572432010 is a SPDT SMA 18 GHz, latching, 12 Vdc, positive common, solder pins.

### PART NUMBER SELECTION



(1): Positive common shall be specified only with type 3 because failsafe switches can be used with both polarities  
 (2): Available only upon request



(3): The QLF trademark (Quick Lock Formula®) standard applies to QMA and QN series and guarantees the full intermateability between suppliers using this trademark. Using QLF certified connectors also guarantees the specified level of RF performances

(4): Connector SMA2.9 is equivalent to "K connector®", registered trademark of Anritsu

**SPDT up to 50 GHz: Low Consumption & Reduced Size**

SMA - SMA 2.9 - 2.4mm - QMA - SMC - SMB - mini SMB - DIN 1.6/5.6

**GENERAL SPECIFICATIONS**

Operating mode		Failsafe		Latching	
Nominal operating voltage (across temperature range)	Vdc	12	28	12	28
		(10.2 to 13)	(24 to 30)	(10.2 to 13)	(24 to 30)
Coil resistance at 23°C (+/-10%)	Ω	75	450	58	350
Operating current at 23°C	mA	160	62	210	80
Average power		See Power Rating Chart page <b>1-13</b>			
Switching time	ms	10			
Life		2.5 million cycles			
Connectors		SMA - SMA 2.9 - QMA - DIN 1.6/5.6 - SMB - SMC Mini SMB - 2.4mm			
Operating temperature range	DIN 1.6/5.6 - SMB - SMC - mini SMB - 2.4mm	-25°C to +70°C			
	SMA - SMA 2.9 - QMA	-40°C to +85°C			
Storage temperature range	DIN 1.6/5.6 - SMB - SMC - mini SMB - 2.4mm	-40°C to +85°C			
	SMA - SMA 2.9 - QMA	-55°C to +85°C			
Vibration (MIL STD 202, Method 204D, cond.C)		10-2000 Hz, 20g		Operating	
Shock (MIL STD 202, Method 213B, cond.G)		50g, 11ms, ½ sine		Operating	

**RF PERFORMANCES**

Connectors	Frequency range GHz		V.S.W.R. (max)	Insertion loss (max) dB	Isolation (min) dB	Impedance Ω
DIN 1.6/5.6	DC - 2.5	DC - 1	1.20	0.20	80	75
		1 - 2.5	1.30	0.30	70	
Mini SMB	DC - 3	DC - 1	1.20	0.20	80	
		1 - 3	1.30	0.30	70	
SMB - SMC	DC - 3	DC - 3	1.20	0.20	80	
QMA	DC - 6	DC - 3	1.20	0.20	80	
		3 - 6	1.30	0.30	70	
SMA	DC - 3 DC - 18 DC - 26.5	DC - 3	1.10	0.15	80	
		3 - 8	1.20	0.20	75	
		8 - 12.4	1.20	0.25	65	
		12.4 - 18	1.40	0.35	60	
SMA 2.9	DC - 40	18 - 26.5	1.50	0.50	55	
		DC - 6	1.30	0.30	70	
		6 - 12.4	1.40	0.40	60	
		12.4 - 18	1.50	0.50	60	
2.4 mm	DC - 50	18 - 26.5	1.70	0.70	55	
		26.5 - 40	1.90	0.80	50	
		26.5 - 40	1.90	0.80	50	
		40 - 50	1.90	1.10	50	
		40 - 50	1.90	1.10	50	

RAMSES SERIES



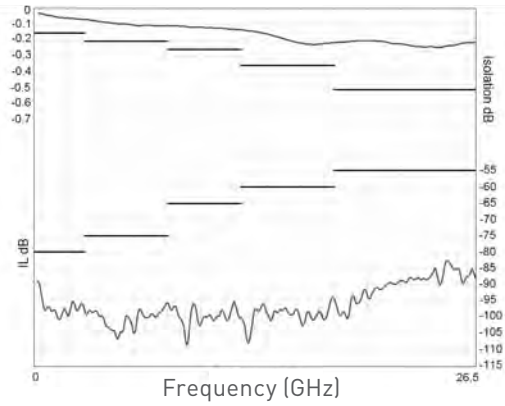
### SPDT up to 50 GHz: Low Consumption & Reduced Size

SMA - SMA 2.9 - 2.4mm - QMA - SMC - SMB - mini SMB - DIN 1.6/5.6

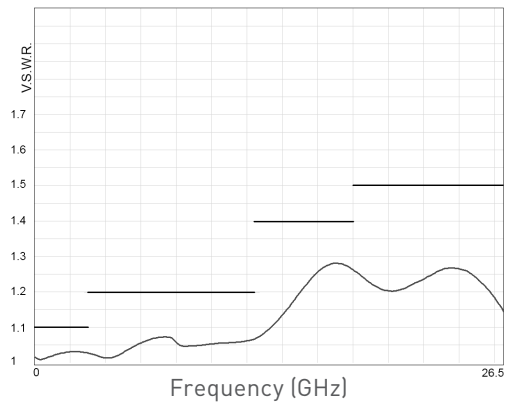
### R570 AND R572 TYPICAL RF PERFORMANCES

Example: SPDT SMA up to 26.5 GHz

#### Insertion Loss and Isolation

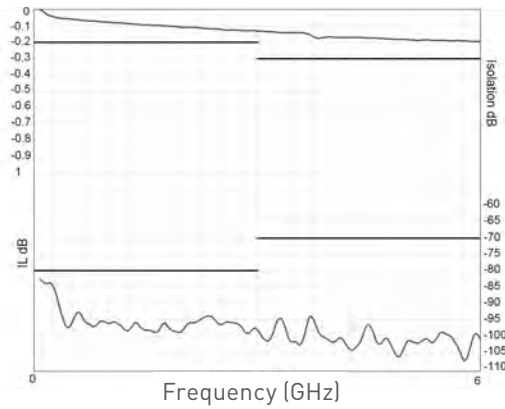


#### V.S.W.R.

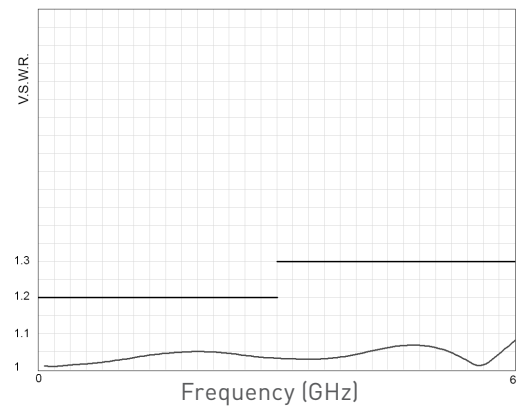


Example: SPDT QMA up to 6 GHz

#### Insertion Loss and Isolation



#### V.S.W.R.



Note: see page 2-14 for other connectors

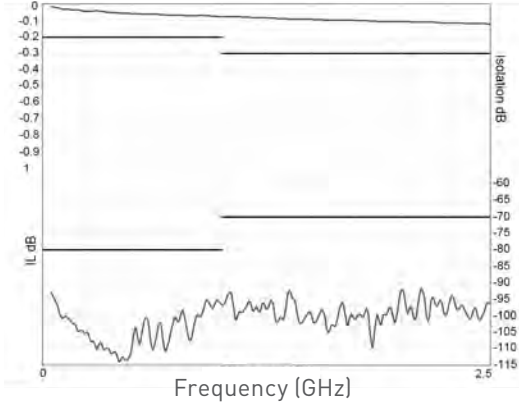
**SPDT up to 50 GHz: Low Consumption & Reduced Size**

SMA - SMA 2.9 - 2.4mm - QMA - SMC - SMB - mini SMB - DIN 1.6/5.6

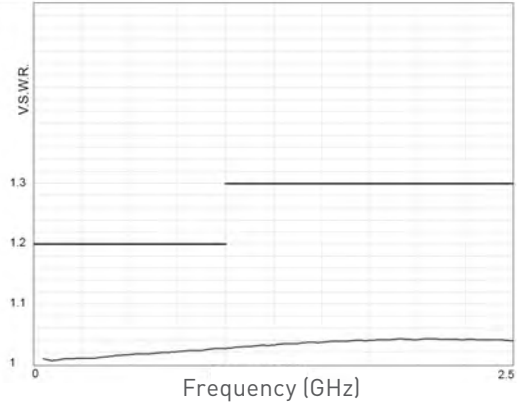
**R570 AND R572 TYPICAL RF PERFORMANCES**

Example: SPDT DIN 1.6/5.6 up to 2.5 GHz

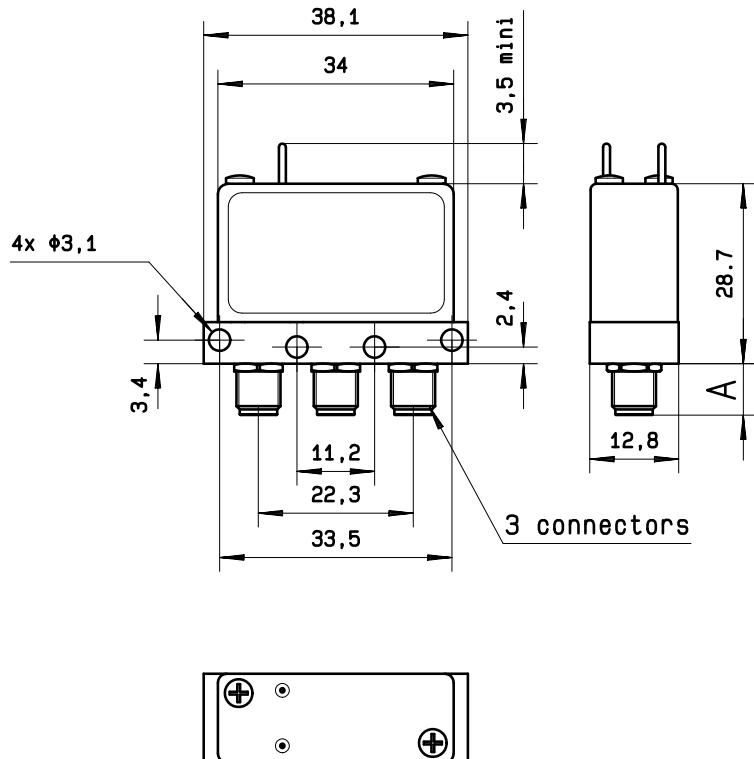
Insertion Loss and Isolation



V.S.W.R.



Connectors	A max (mm)
SMA	7.4
SMA 2.9 & 2.4mm	6.3
SMB - SMC	9.3
QMA	10.8
Mini SMB	7.5
DIN 1.6/5.6	11.5



Note: see page 2-27 for pin identification

**SPDT up to 18 GHz**

N - TNC - BNC



Radiall's RAMSES SPDT N, BNC & TNC switches are designed for high performance in RF & Microwave systems up to 18 GHz.

Radiall's RAMSES concept (modular concept) offers a full range of configurations. They are commonly used for applications where high power handling capability is required.

These switches are dedicated to all market applications including: defense, instrumentation and telecommunications.

Example of P/N:

R570113035 is a SPDT N 12.4 GHz, failsafe, 28 Vdc, with suppression diodes, without option, D-Sub connector.

**PART NUMBER SELECTION**

**R 570**

**Frequency Range:**

- 0: N up to 3 GHz
- 1: N up to 12.4 GHz
- 2: BNC up to 3 GHz
- 5: TNC up to 3 GHz
- 6: TNC up to 12.4 GHz
- D: TNC up to 18 GHz

**Type:**

- 1: Failsafe
- 2: Failsafe + I.C.
- 3: Latching
- 4: Latching + I.C.
- 5: Latching + S.C.O. (1)
- 6: Latching + S.C.O. + I.C. (1)

**Actuator Voltage:**

- 2: 12 Vdc
- 3: 28 Vdc

**Actuator Terminals:**

- 0: Solder pins
- 5: D-Sub connector

**Options:**

- 0: Without option
- 1: Positive common (2) (3)
- 3: With suppression diodes (1)
- 4: With suppression diodes and positive common (2) (3)

**TTL Option:**

- 0: Without TTL driver
- 1: With TTL driver (high level) (1) (2)

I.C.: Indicator contact - S.C.O.: Self Cut-Off

(1): Suppression diodes are already included in Self Cut-OFF & TTL option

(2): Polarity is not relevant to application for switches with TTL driver

(3): Positive common shall be specified only with type 3, 4, 5 & 6 because failsafe switches can be used with both polarities

**SPDT up to 18 GHz**

N - TNC - BNC

**GENERAL SPECIFICATION**

Operating mode		Failsafe		Latching	
Nominal operating voltage (across temperature range)	Vdc	12	28	12	28
		(10.2 to 13)	(24 to 30)	(10.2 to 13)	(24 to 30)
Coil resistance at 23°C (+/-10%)	Ω	38	200	38	225
Operating current at 23°C	mA	320	140	320	125
Average power		See Power Rating Chart page <b>1-13</b>			
TTL input	High level	2.2 to 5.5 Volts		800µA max 5.5 Volts	
	Low level	0 to 0.8 Volts		20µA max 0.8 Volts	
Switching time	ms	10			
Life		2.5 million cycles			
Connectors		N - TNC - BNC			
Actuator terminals		Solders pins or 9 pin D-Sub connector			
Operating temperature range		-40°C to +85°C			
Storage temperature range		-55°C to +85°C			
Vibration (MIL STD 202, Method 204D, cond.D)		10-2000 Hz, 20g		Operating	
Shock (MIL STD 202, Method 213B, cond.C)		100g, 6 ms, ½ sine		Non operating	

**RF PERFORMANCES**

Connectors	Frequency Range GHz	V.S.W.R. (max)	Insertion Loss (max) dB	Isolation (min) dB	Impedance Ω	
N / TNC	DC - 3 DC - 12.4	DC - 1	1.15	0.15	85	50
		1-2	1.20	0.20	80	
		2-3	1.25	0.25	75	
		3-8	1.35	0.35	70	
		8-12.4	1.50	0.50	60	
TNC 18GHz	DC - 18	DC - 6	1.30	0.30	70	
		6-12.4	1.50	0.50	60	
		12.4-18	1.60	0.70	60	
BNC	DC - 3	DC - 1	1.15	0.15	85	
		1-2	1.20	0.20	80	
		2-3	1.25	0.25	75	

Note: see page 2-22 for typical RF performances

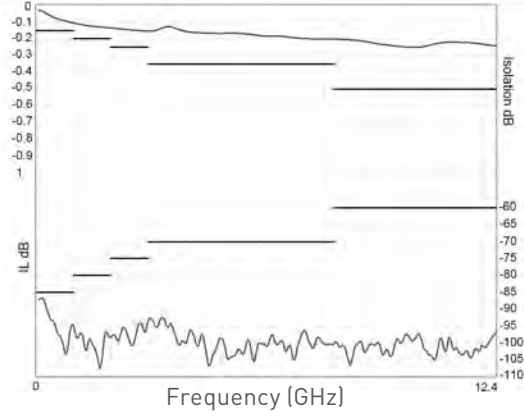
## SPDT up to 18 GHz

N - TNC - BNC

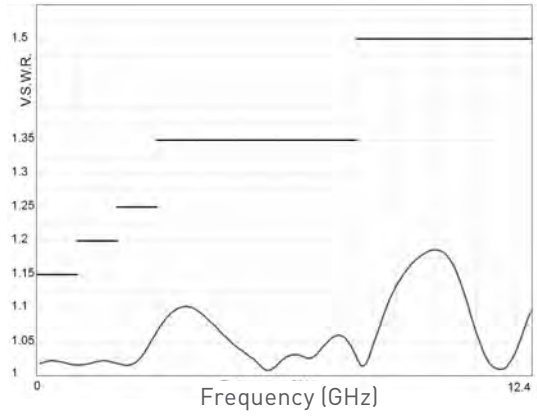
### R570 TYPICAL RF PERFORMANCES

Example: SPDT N and TNC up to 12.4 GHz

Insertion Loss and Isolation

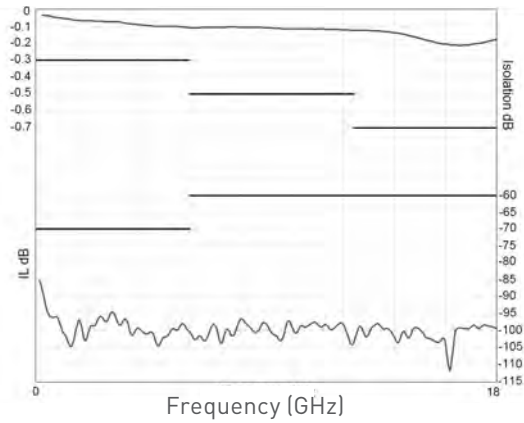


V.S.W.R.

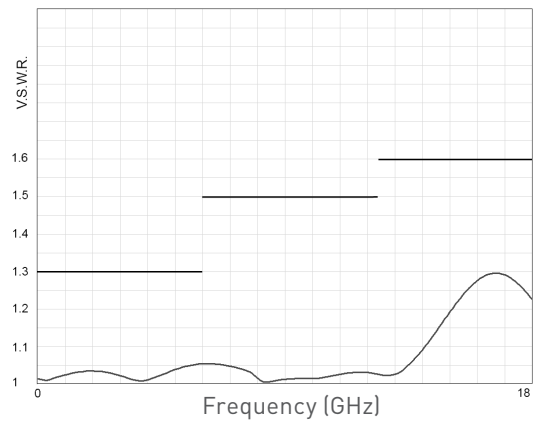


Example: SPDT TNC up to 18 GHz

Insertion Loss and Isolation



V.S.W.R.

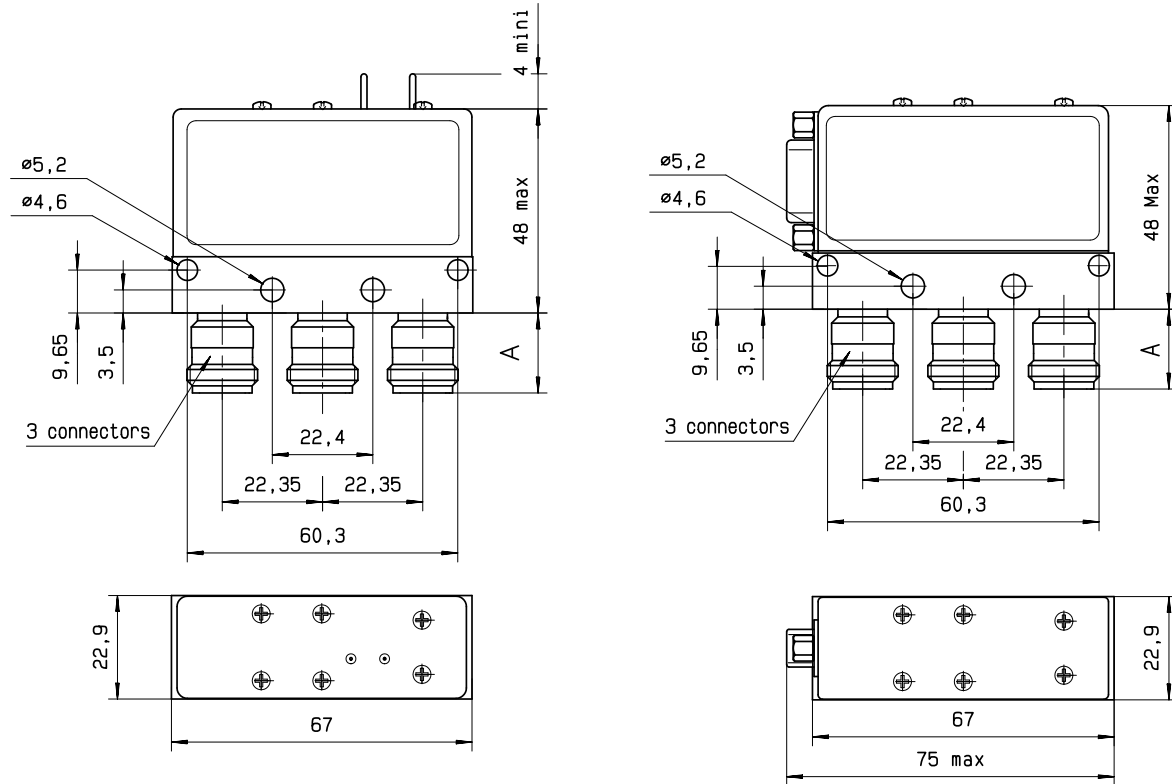


## SPDT up to 18 GHz

N - TNC - BNC

### TYPICAL OUTLINE DRAWING

Example: SPDT N and TNC up to 12.4 GHz



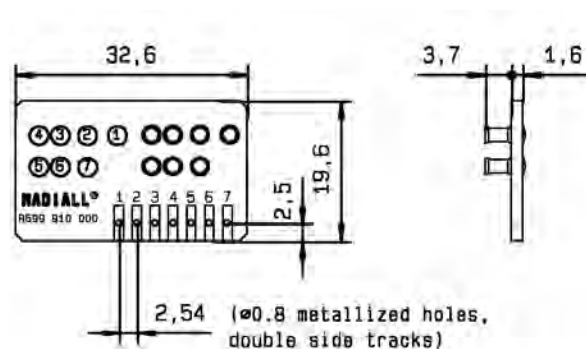
See page 2-27 for pin allocation

See page 2-27 for D-Sub pin allocation

Connectors	N	TNC	BNC
A max (mm)	18.8	11	11

### ACCESSORIES

A printed circuit board interface connector (ordered separately) has been designed for easy mounting on terminals. For SPDT model R570 series => Radiall part number: **R599 910 000**



## Coaxial SPDT - Electrical Schematics

R570/R572 Series

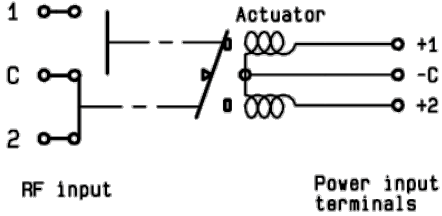
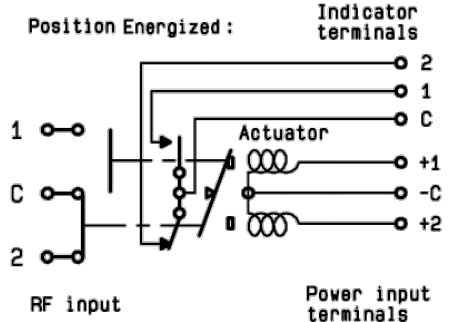
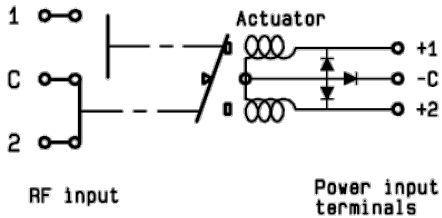
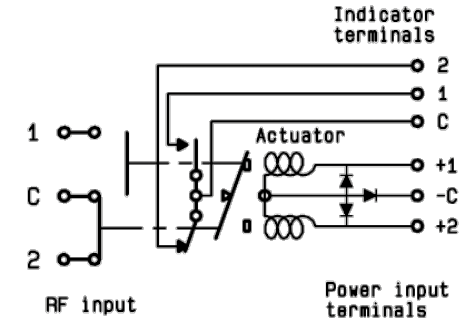
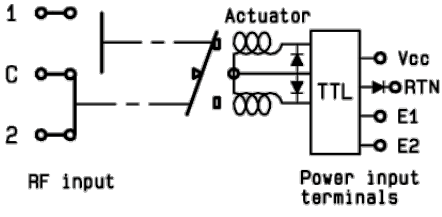
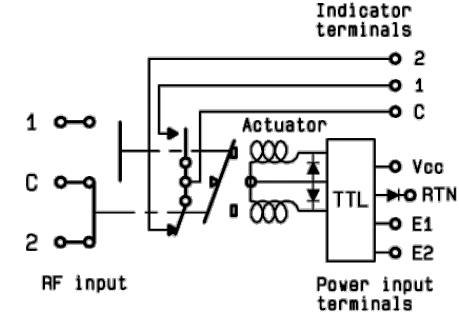
### FAILSAFE

<p><b>WITHOUT OPTION</b> <b>R570 -1- 000 / R572 -1- 000</b></p> <p>Position Energized :</p> <p>RF input</p> <p>Power input terminals</p>	<p><b>WITH INDICATOR CONTACT</b> <b>R570 -2- 000</b></p> <p>Position Energized :</p> <p>Indicator terminals</p> <p>RF input</p> <p>Power input terminals</p>
<p><b>WITH SUPPRESSION DIODES</b> <b>R570 -1- 030</b></p> <p>Position Energized :</p> <p>RF input</p> <p>Power input terminals</p>	<p><b>WITH SUPPRESSION DIODES AND INDICATOR CONTACT</b> <b>R570 -2- 030</b></p> <p>Position Energized :</p> <p>Indicator terminals</p> <p>RF input</p> <p>Power input terminals</p>
<p><b>WITH TTL DRIVER</b> (supression diodes are included) <b>R570 -1- 100</b></p> <p>Position Energized :</p> <p>RF input</p> <p>Power input terminals</p>	<p><b>WITH TTL DRIVER AND INDICATOR CONTACT</b> (supression diodes are included) <b>R570 -2- 100</b></p> <p>Position Energized :</p> <p>Indicator terminals</p> <p>RF input</p> <p>Power input terminals</p>

Coaxial SPDT - Electrical Schematics

R570/R572 Series

LATCHING

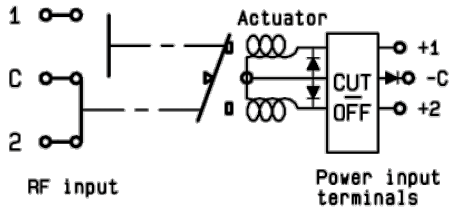
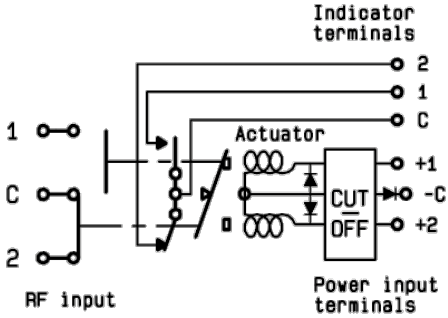
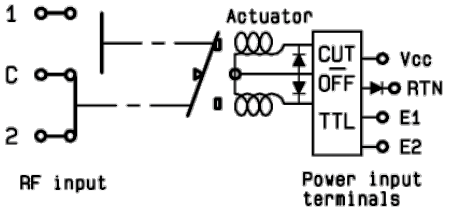
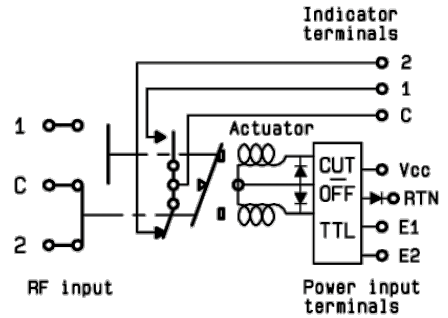
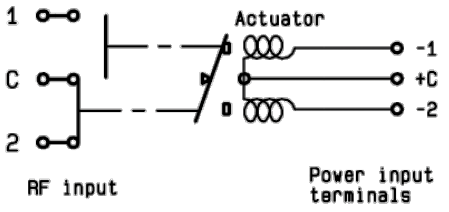
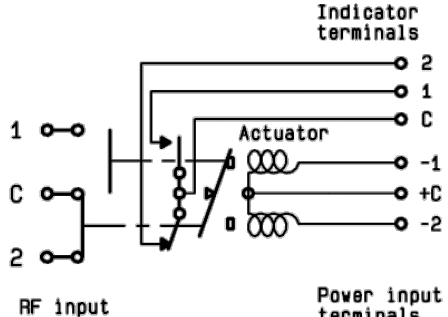
<p><b>WITHOUT OPTION</b> <b>R570-3- 000 AND R572 -3- 000</b></p> 	<p><b>WITH INDICATOR CONTACT</b> <b>R570 -4- 000</b></p> <p>Position Energized :</p> 
<p><b>WITH SUPPRESSION DIODES</b> <b>R570 -3- 030</b></p> 	<p><b>WITH SUPPRESSION DIODES AND INDICATOR CONTACT</b> <b>R570 -4- 030</b></p> 
<p><b>WITH TTL DRIVER</b> (supression diodes are included) <b>R570 -3- 100</b></p> 	<p><b>WITH TTL DRIVER AND INDICATOR CONTACT</b> (supression diodes are included) <b>R570 -4- 100</b></p> 



## Coaxial SPDT - Electrical Schematics

R570/R572 Series

### LATCHING

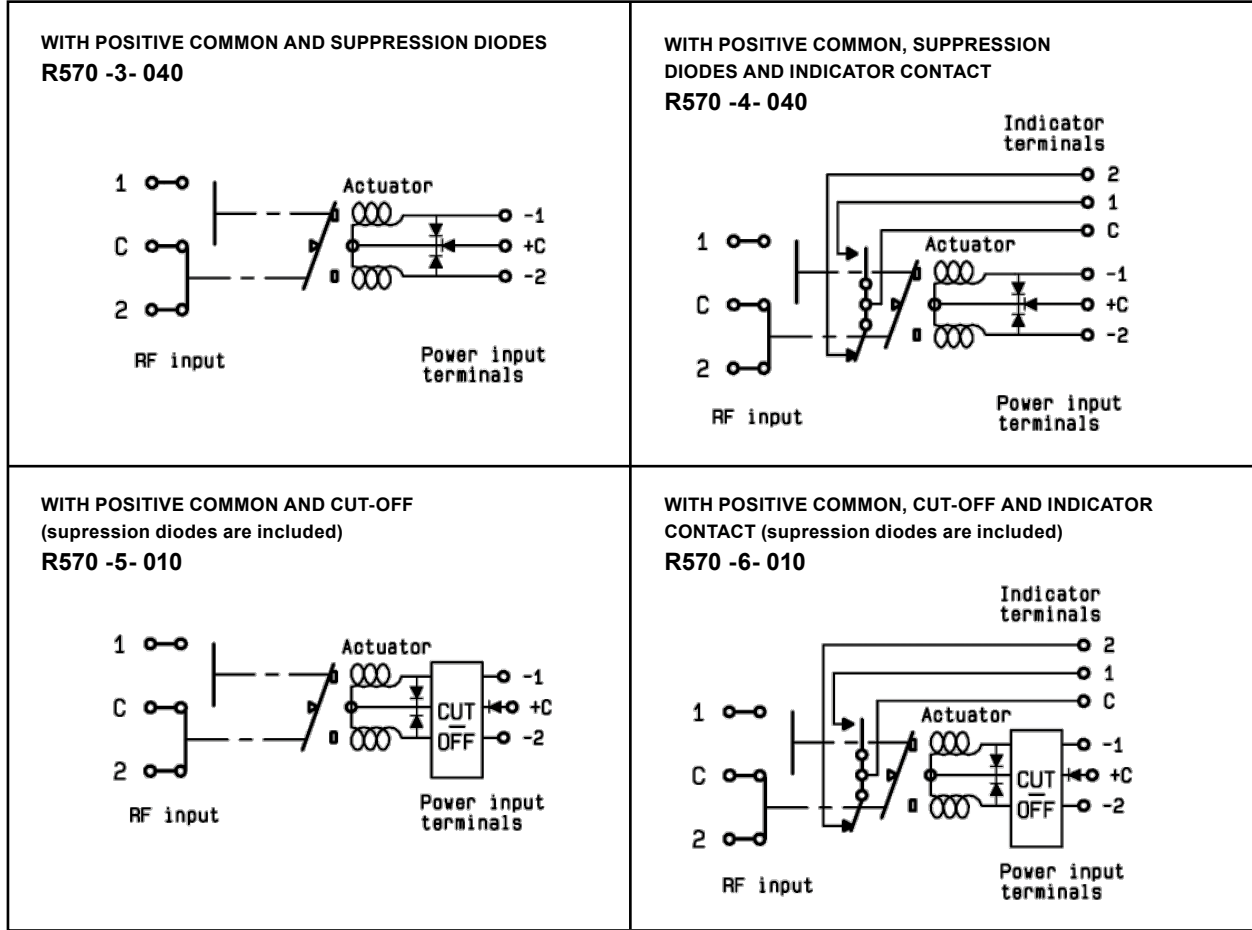
<p><b>WITH CUT-OFF</b> (supression diodes are included) <b>R570 -5- 000</b></p> 	<p><b>WITH CUT-OFF AND INDICATOR CONTACT</b> (supression diodes are included) <b>R570 -6- 000</b></p> 
<p><b>WITH CUT-OFF AND TTL DRIVER</b> (supression diodes are included) <b>R570 -5- 100</b></p> 	<p><b>WITH CUT-OFF, TTL AND INDICATOR CONTACT</b> (supression diodes are included) <b>R570 -6- 100</b></p> 
<p><b>WITH POSTIVE COMMON, NO OPTION</b> <b>R570 -3- 010 / R572 -3- 010</b></p> 	<p><b>WITH POSTIVE COMMON AND INDICATOR CONTACT</b> <b>R570 -4- 010</b></p> 

## Coaxial SPDT - Electrical Schematics

R570/R572 Series

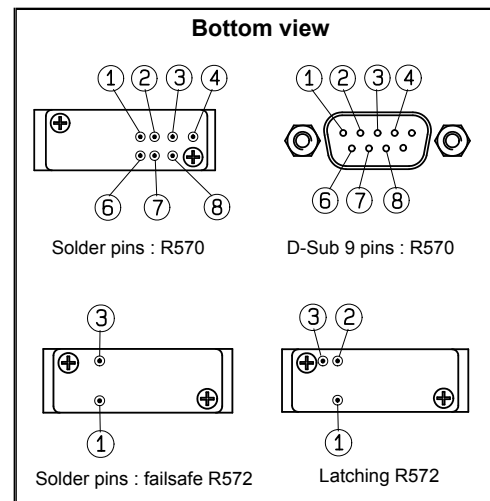
RAMSESE SERIES

### LATCHING



### PIN IDENTIFICATION

Type	PIN						
	1	2	3	4	6	7	8
Failsafe	+		-				
Failsafe + I.C.	+		-		2NO	1NC	C
Failsafe + TTL	E		RTN	VCC			
Failsafe + I.C. + TTL	E		RTN	VCC	2NO	1NC	C
Latching	-2	-1	+C				
Latching + Cut-off	or +2	or +1	or -C				
Latching + I.C.	-2	-1	+C		2	1	C
Latching + I.C. + Cut-off	or +2	or +1	or -C				
Latching + TTL	E2	E1	RTN	VCC			
Latching + TTL + Cut-off							
Latching + TTL + I.C.	E2	E1	RTN	VCC	2	1	C
Latching + TTL + I.C. + Cut-off							



## High performance SPDT up to 40 GHz

SMA - SMA 2.9



Radiall's PLATINUM series switches are optimised to perform at a high level over an extended life cycle, with outstanding RF performance, and a guaranteed insertion loss repeatability of 0.03 dB over a life span of 10 million switching cycles. PLATINUM series switches are perfect for automated test and measurement equipment, as well as signal monitoring devices.

Example of P/N:

R595443125 is a SPDT SMA 20 GHz, latching, 24Vdc, with TTL driver, Indicators, D-Sub connector.

### PART NUMBER SELECTION

**R 595**

**Frequency Range:**

- 3: SMA up to 6 GHz
- 4: SMA up to 20 GHz
- F: SMA up to 26.5 GHz
- 8: SMA 2.9 up to 40 GHz

**Type:**

- 3: Latching (1)
- 4: Latching + I.C. (1)
- 5: Latching + S.C.O. (1)
- 6: Latching + S.C.O. + I.C.(1)

**Actuator Voltage:**

- 3: 24 Vdc
- 7: 15 Vdc

I.C.: Indicator contact - S.C.O.: Self Cut-Off  
 (1): Suppression diodes are already included

**Documentation:**

- : Certificate of conformity
- C: Calibration certificate
- R: Calibration certificate + RF curves

**Actuator Terminals**

- 0: Solder pins
- 5: D-Sub connector

**Options:**

- 1: Without option (positive common)
- 2: Compatible TTL driver (high level)

**Switch model :**

- 1: Non terminated SPDT switch

## High performance SPDT up to 40 GHz

### SMA - SMA 2.9

#### GENERAL SPECIFICATIONS

Operating mode		Latching	
Nominal operating voltage (across temperature range)	Vdc	24 (24 to 30)	15 (12 to 20)
Coil resistance at 23°C (+/- 10%)	Ω	350	120
Operating current at 23°C	mA	68	125
TTL input	High level	3 to 7 Volts: 800µA max 7 Volts	
	Low level	0 to 0.8 Volts: 20µA max 0.8 Volts	
Switching time	ms	15	
Life (Min)	SMA	10 million cycles	
	SMA 2.9	5 million cycles	
Actuator terminals		D-Sub 9 pin female Solder pins	
Weight	g	60	

#### ENVIRONMENTAL SPECIFICATIONS

Operating temperature range	-25°C to + 75°C
Storage temperature range	-55°C to +85°C
Temperature cycling (MIL STD 202F, Method 107D, Cond.A)	-55°C to +85°C (10 cycles)
Sine vibration operating (MIL STD 202, Method 204D, Cond.D)	10 - 2000 Hz, 20g
Random vibration operating	16.91g (rms) 50-2000 Hz 3min/axis
Shock operating (MIL STD 202, Method 213B, Cond.G)	50g / 11ms, sawtooth
Humidity operating	15 to 95% relative humidity
Humidity storage (MIL STD 202, Method 106E, Cond.E)	65°C, 95% RH, 10 days
Altitude operating	15.000 feet (4.600 meters)
Altitude storage (MIL STD 202, Method 105C, Cond.B)	50.000 feet (15.240 meters)

## High performance SPDT up to 40 GHz

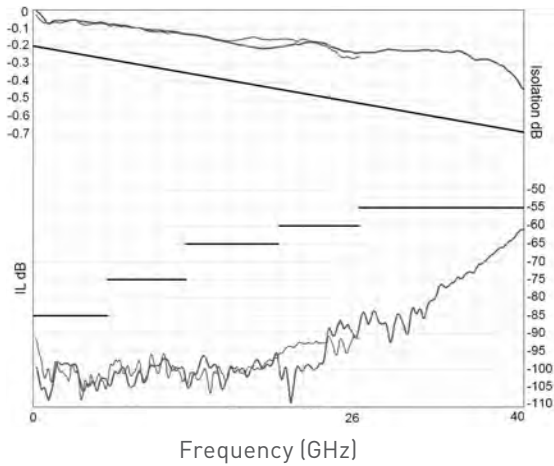
SMA - SMA 2.9

### RF PERFORMANCES

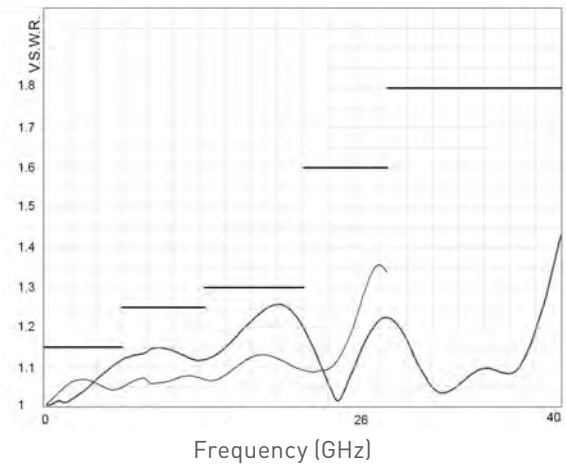
Part Number		R5953--1--	R5954--1--	R595F--1--	R595F--1--	
Frequency range	GHz	DC to 6	DC to 20	DC to 26.5	DC to 40	
Impedance	Ω	50				
Insertion Loss (Max)	dB	0.20 + (0.45 / 26.5) x frequency (GHz)				
Isolation (Min)	dB	85	DC to 6 GHz 6 to 12.4 GHz 12.4 to 20 GHz	85 75 65	DC to 6 GHz 6 to 12.4 GHz 12.4 to 20 GHz 20 to 26.5 GHz 26.5 to 40 GHz	85 75 65 60 55
V.S.W.R (Max)		1.15	DC to 6 GHz 6 to 12.4 GHz 12.4 to 18 GHz 18 to 20 GHz	1.15 1.25 1.30 1.60	DC to 6 GHz 6 to 12.4 GHz 12.4 to 20 GHz 18 to 26.5 GHz	1.15 1.25 1.30 1.60 1.80
Repeatability (up to 10 million cycles measured at 25°C)	dB	0.03 dB maximum			0.05 dB maximum	

### TYPICAL RF PERFORMANCES

Insertion Loss and Isolation



V.S.W.R.



SMA — SMA 2.9 —

## High performance SPDT up to 40 GHz

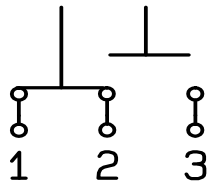
SMA - SMA 2.9

### SWITCH MODEL: NON TERMINATED SPDT SWITCH

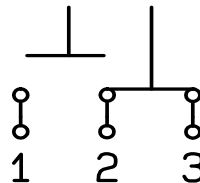
The non terminated SPDT switch is a single pole double throw switch. This switch is considered "break before make".

#### RF SCHEMATIC DIAGRAM

Position E1

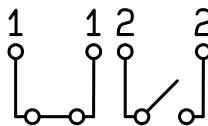


Position E2

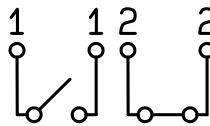


#### POSITION INDICATOR

State 11



State 22



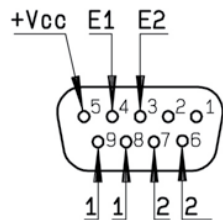
#### Standard drive option "1"

##### (Positive common):

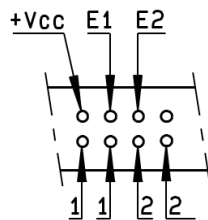
- Connect pin +Vcc to supply (+20 Vdc to +32 Vdc)
- Select desired RF path by applying ground to the corresponding "close" pin (Ex: ground pin E1 to switch to position E1. RF path 1-2 closed and RF path 2-3 open)
- To open desired path and close the new RF path, connect ground to the corresponding "close" pin (Ex: ground pin E2 to open RF path 1-2 and close RF path 2-3)

#### TTL drive option "2"

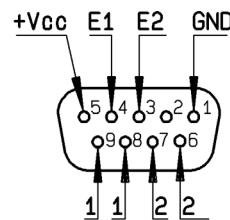
- Connect pin GND to ground
- Connect pin +Vcc to supply (+20 Vdc to +32 Vdc)
- Select (close) desired RF path by applying TTL "High" to the corresponding "drive" pin (Ex: apply TTL "High" to pin E1 to switch to position E1. RF path 1-2 closed and RF path 2-3 open)
- To open desired path and close the new RF path, apply TTL "High" to the "drive" pin which corresponds to the desired RF path (Ex: apply TTL "High" to pin E2)



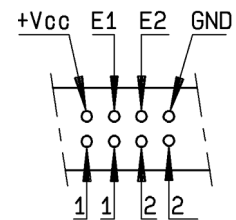
D-Sub connector



Solder pins



D-Sub connector



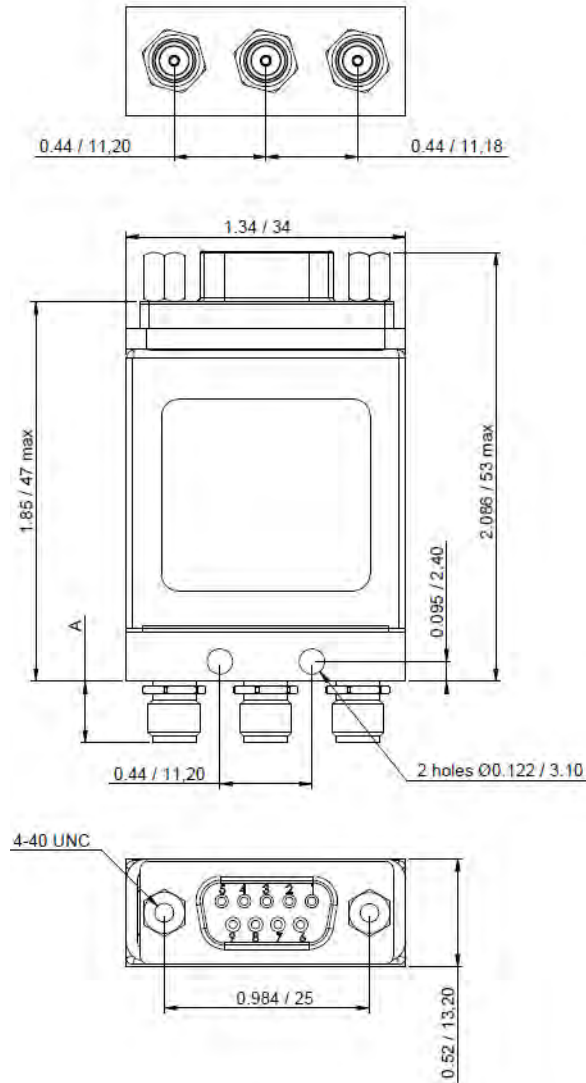
Solder pins

High performance SPDT up to 40 GHz

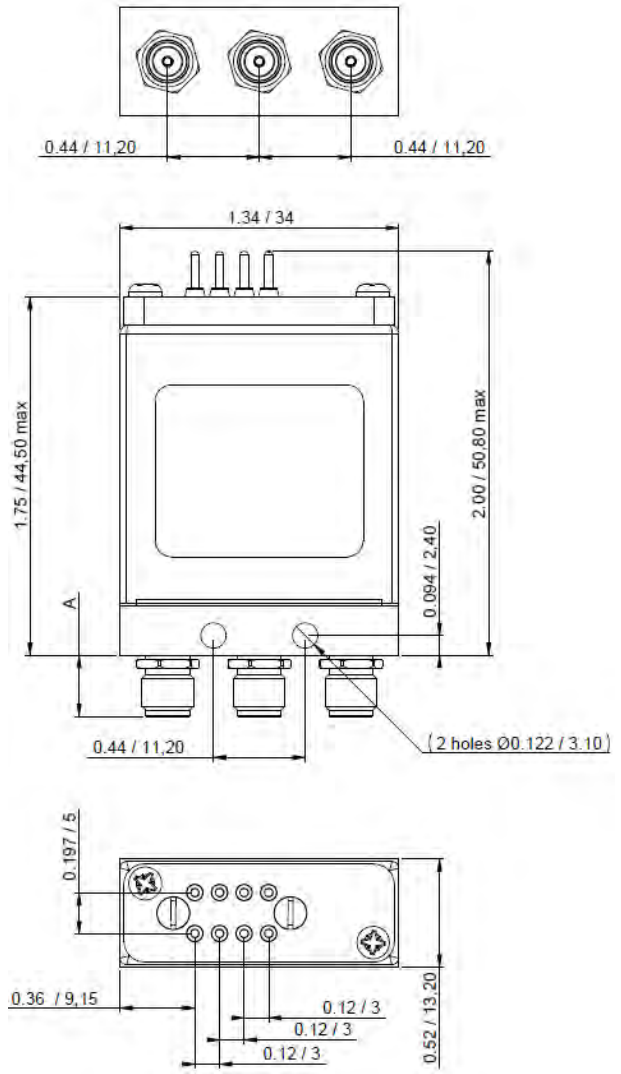
SMA - SMA 2.9

TYPICAL OUTLINE DRAWING

With D-Sub connector



With solder pins



All dimensions are in inches/millimeters

Connectors	A max (mm)
SMA	7.4
SMA 2.9	6.3

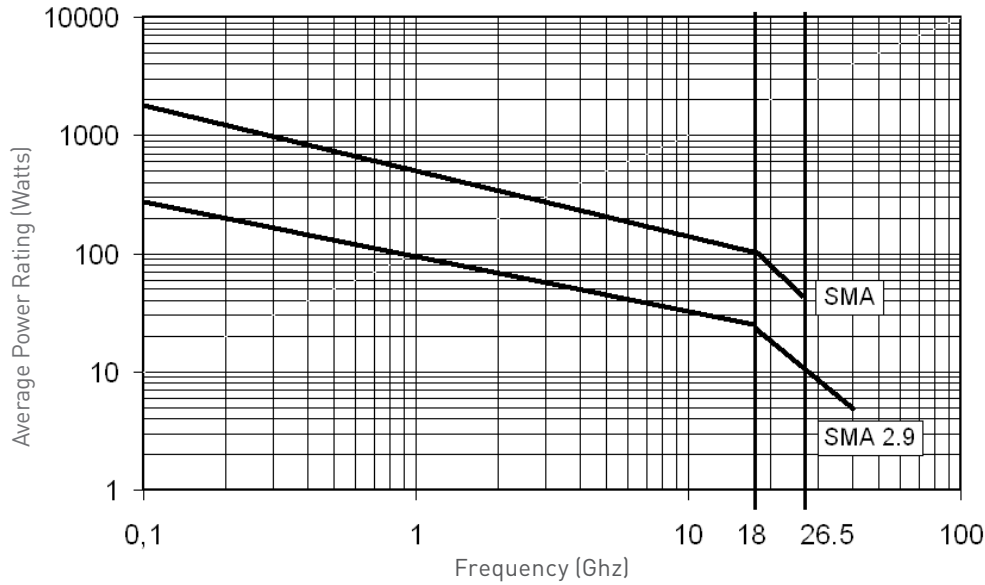
## High performance SPDT up to 40 GHz

SMA - SMA 2.9

### RF POWER RATING CHART

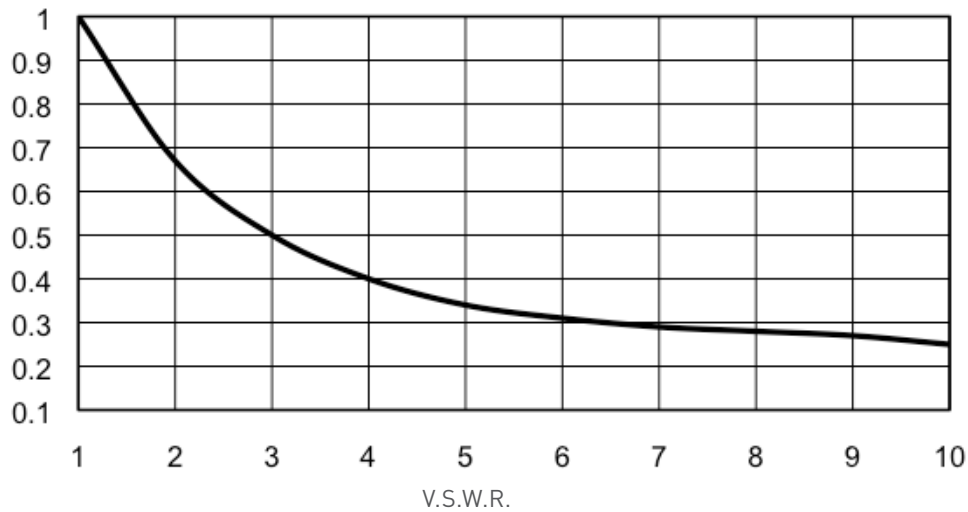
This graph is based on the following conditions:

- Ambient temperature: + 25°C
- Sea level
- V.S.W.R.: 1 and cold switching



### DERATING FACTOR VERSUS VSWR

The average power input must be reduced for load V.S.W.R. above 1:1





### Optional Features for SPDT

#### GENERAL



All miniature SPDT switches fitted with SMA, QMA, SMC, SMB or SMA2.9 connectors can be delivered with 34 mm narrow width RF body. Contact Radiall sales directly for availability.

Examples of dedicated application options:



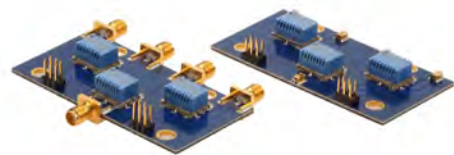
SMA SPDT with a SINGLE input TTL driver. This option is available in a latching configuration upon special request. Key advantages include less wires and easier connection.



SPDT with HN coaxial connectors and MILC38999 circular connector for L band airborne applications.



SPDT models available for high power military applications (up to 100 watts CW from DC to 18 GHz).



A SP4T design up to 8 GHz with SMT relays mounted on a PCB fitted with UMP (Ultra Miniature Pressure) contact. Various switching configurations can be designed according to your specific requests.



A SMA SPDT with a specific RF body (with mounting leg) for easy mounting on front panel of switching matrix.



## DP3T and SPDT Terminated



**Contents**

**RAMSES series**  
 DP3T and Terminated SPDT up to 40 GHz: R585 Series ..... 3-2 to 3-5

**Electrical Schematics**  
 R585 Series ..... 3-6 to 3-11

**PLATINUM Series**  
 High performance DP3T & Terminated SPDT up to 40 GHz: R595 Series ..... 3-12 to 3-21

**Optional Features** ..... 3-22

**DP3T PART NUMBER SELECTION GUIDE\***

Digital Position		R 1-3:	4: RF connectors						5: Type			6: Voltage				7: Switch Model				8: Options				9:Terminals		10:Documentation		
Series	Configuration		SMA 3 GHz	SMA 6 GHz	SMA 18 GHz	SMA 20 GHz	SMA 26.5 GHz	SMA 2.9 40 GHz	Failsafe	Latching	Normally open	12V	15V	24V	28V	DP3T	SPDT Terminated	Terminated 4 ports Bypass	Without option	Positive common	Suppression diodes	Positive common and suppression diodes	TTL driver	Solder pins	D-Sub connector	Certificate of conformity	Calibration certificate	Calibration certificate + RF curves
RAMSES	DP3T	R585	3	-	4	-	F	8	1/2	3/4/5/6	7/8	2	-	-	3	0/1	2/3/4/5	6/7	0	1	3	4	NB	0	-	-	-	-
PLATINUM	DP3T	R595	-	3	-	4	F	8	-	3/4/5/6	-	-	7	3	-	4	2	3	1	-	-	-	2	0	5	-	C	R

Note: TTL driver is already included for the 1, 3, 5 and 7 switch models of the RAMSES R585 series.  
 Example of P/N: R585832000 is a DP3T SMA2.9 40 GHz, latching, 12 Vdc, without option, solder pins.

\*For part number creation and available options, see detailed part number selection for each series.

## DP3T and Terminated SPDT up to 40 GHz

### SMA - SMA 2.9



Radiall's RAMSES DP3T and Terminated SPDT switches offer excellent reliability, high performance and operating frequencies from DC to 40 GHz. A full range of options are available within the RAMSES range in order to offer customers a complete solution.

These relays are dedicated to market applications including: defense, instrumentation and telecommunication.

Example of P/N:

R585423300 is a SPDT terminated SMA 18GHz, failsafe, 28Vdc, indicator contacts, internal terminations without TTL drivers and solder pins.

### PART NUMBER SELECTION

**R 585**

**RF Connectors:**

- 3: SMA up to 3 GHz
- 4: SMA up to 18 GHz
- F: SMA up to 26.5 GHz
- 8: SMA 2.9 up to 40 GHz (4) (5)

**Type:**

- 1: Failsafe
- 2: Failsafe + I.C.
- 3: Latching
- 4: Latching + I.C.
- 5: Latching + S.C.O. (1)
- 6: Latching + S.C.O + I.C. (1)
- 7: Normally open
- 8: Normally open + I.C.

**Actuator Voltage:**

- 2: 12 Vdc
- 3: 28 Vdc

**Actuator Terminals:**

- 0: Solder pins

**Options:**

- 0: Without option
- 1: Positive common (2) (3)
- 3: With suppression diodes (1)
- 4: With suppression diodes and positive common (1) (2) (3)

**Switch Model:**

- 0: DP3T without TTL Driver (DP3T)
- 1: DP3T with TTL Driver (DP3T) (high level) (1) (2)
- 2: SPDT terminated without TTL Driver / (internal termination)
- 3: SPDT terminated with TTL Driver (high level) (1) (2) / (internal termination)
- 4: SPDT terminated without TTL Driver / (external termination)
- 5: SPDT terminated with TTL Driver / (high level) (1) (2) / (external termination)
- 6: Terminated 4 ports bypass no option (external terminations)
- 7: Terminated 4 ports bypass with TTL Driver (external termination)

I.C.: Indicator contact/S.C.O.: Self Cut-Off

(1): Suppression diodes are already included in Self Cut-OFF & TTL option

(2): Polarity is not relevant to application for switches with TTL driver

(3): Positive common shall be specified only with type 3, 4, 5, 6, 7 & 8 because failsafe switches can be used with both polarities

(4): Not available with switch model "2" & "3"

(5): Connector SMA 2.9 is equivalent to "K connector®", registered trademark of Anritsu

## DP3T and Terminated SPDT up to 40 GHz

### SMA - SMA 2.9

#### GENERAL SPECIFICATIONS

Operating mode		Failsafe		Latching		Normally open	
Nominal operating voltage (across operating temperature)	Vdc	12	28	12	28	12	28
		(10.2 to 13)	(24 to 30)	(10.2 to 13)	(24 to 32)	(10.2 to 13)	(24 to 32)
Coil resistance (+/-10%)	Ω	24	138	29	175	47.5	275
Nominal operating current at 23°C	mA	500	205	420	160	250	102
Average power		See Power Rating Chart page <b>1-13</b>					
		Internal terminations: 1 Watt CW into 50 Ohms					
TTL input	2.2 to 5.5 Volts		800µA max 5.5 Volts				
	0 to 0.8 Volts		20µA max 5.5 Volts				
Switching time (Max)	10						
Life (Min)	2 million cycles for products with internal terminations 10 million cycles for all other products						
Connectors	SMA - SMA 2.9						
Actuator terminals	Solder pins						
Operating temperature range	-40°C to +85°C						
Storage temperature range	-55°C to +85°C						
Vibration (MIL STD 202, Method 204D, cond.D)	10-2000 Hz, 20g				Operating		
Shock (MIL STD 202, Method 213B, cond.C)	100g / 11 ms, ½ sine				Operating		

#### RF PERFORMANCES

Connectors	Frequency range GHz		V.S.W.R. (max)	Insertion loss (max) dB	Isolation (min) dB	Impedance Ω
SMA	DC - 3	DC - 3	1.20	0.20	80	50
		3 - 8	1.30	0.30	70	
	DC - 18	8 - 12.4	1.40	0.40	60	
		12.4 - 18	1.50	0.50	60	
		18 - 26.5	1.70	0.70	55	
SMA 2.9	DC - 40	DC - 6	1.30	0.30	70	
		6 - 12.4	1.40	0.40	60	
		12.4 - 18	1.50	0.50	60	
		18 - 26.5	1.70	0.70	55	
		26.5 - 40	1.90	0.80	50	

See page 3-4 for typical RF performances

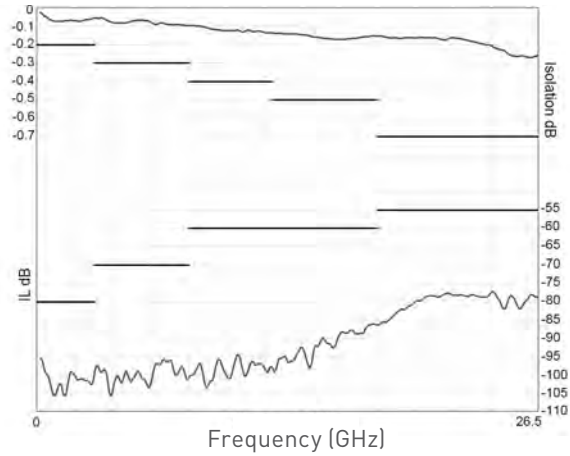
## DP3T and Terminated SPDT up to 40 GHz

SMA - SMA 2.9

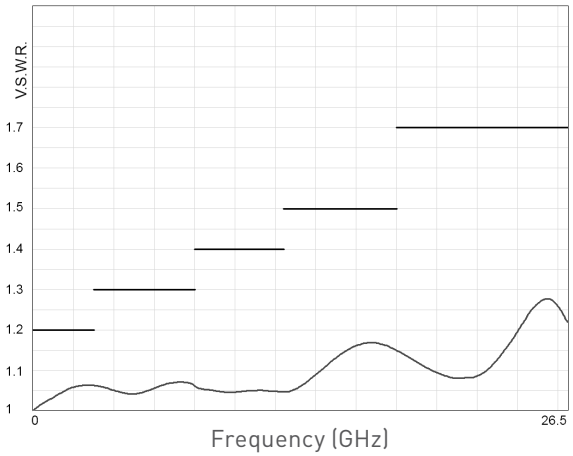
### R585 TYPICAL RF PERFORMANCES

Example: DP3T SMA up to 26.5 GHz

#### Insertion Loss and Isolation

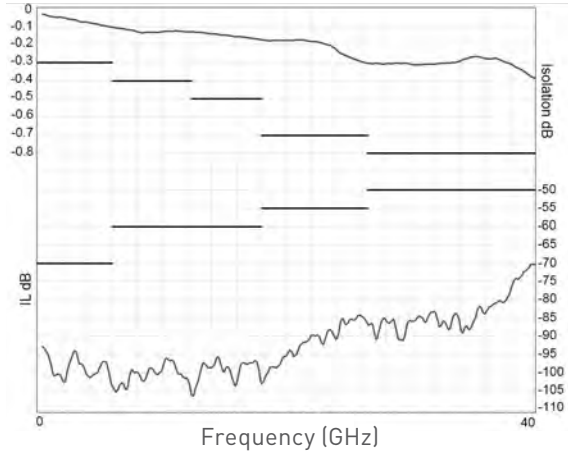


#### V.S.W.R.

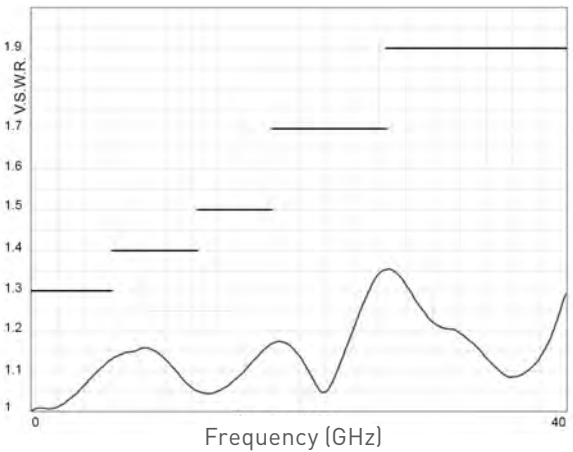


Example: DP3T SMA2.9 up to 40 GHz

#### Insertion Loss and Isolation

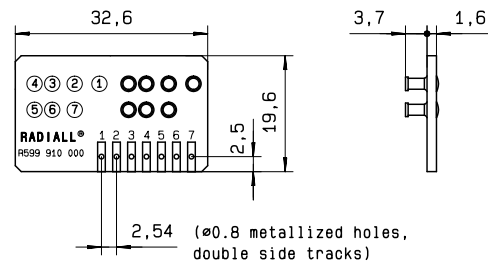


#### V.S.W.R.



### ACCESSORIES

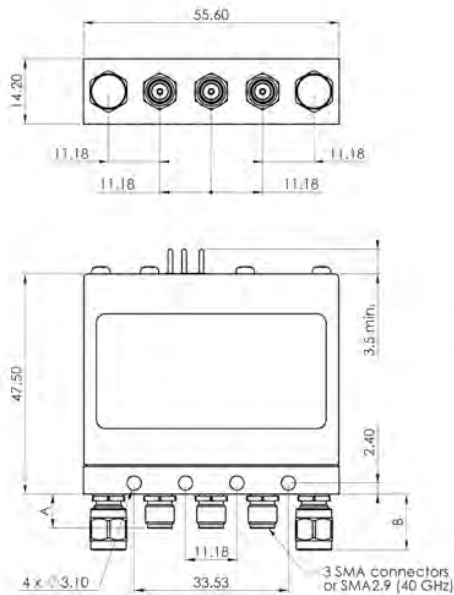
A printed circuit board interface connector (ordered separately) has been designed for easy mounting on terminals. For DP3T model R585 series => Radiall part number: **R599910000**



**DP3T and Terminated SPDT up to 40 GHz**

SMA - SMA 2.9

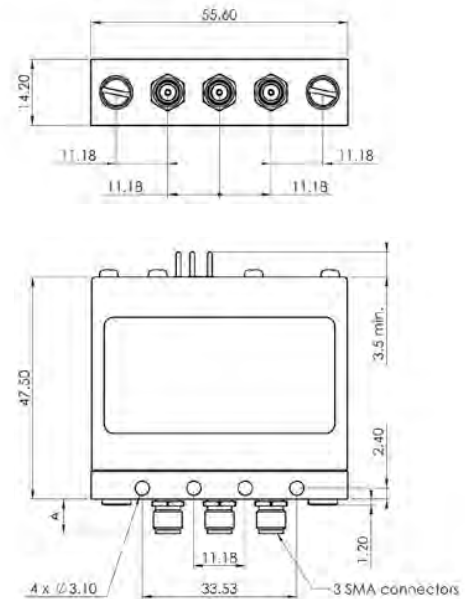
**TYPICAL OUTLINE DRAWING**



**SPDT with external terminations**

R585 --- 4--

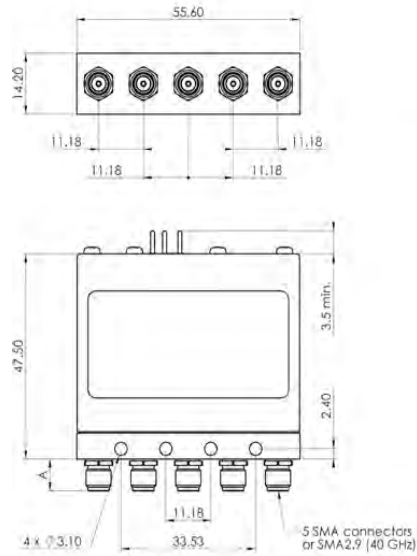
R585 --- 5--



**SPDT with internal terminations**

R585 --- 2--

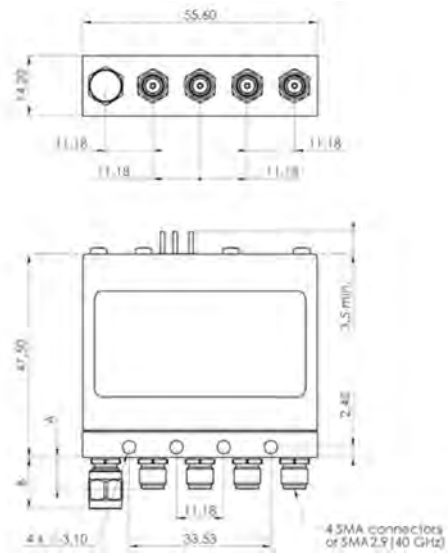
R585 --- 3--



**DP3T**

R585 --- 0--

R585 --- 1--



**Terminated 4 ports BYPASS relay**

R585 --- 6--

R585 --- 7--

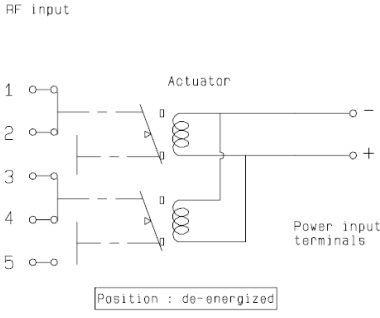
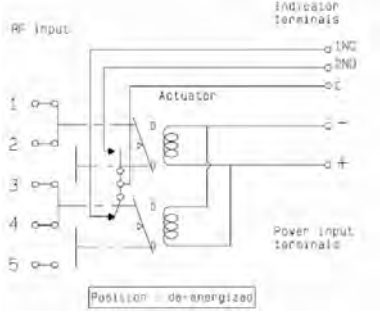
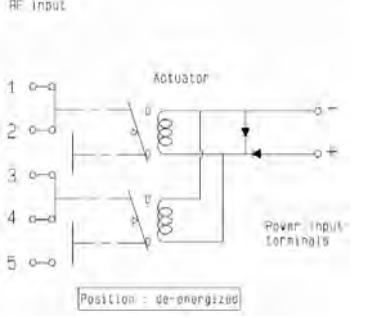
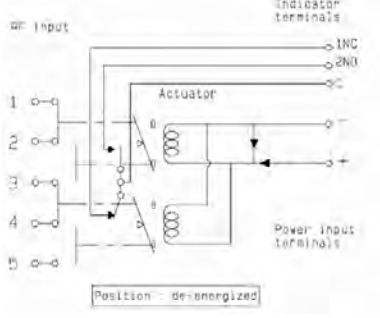
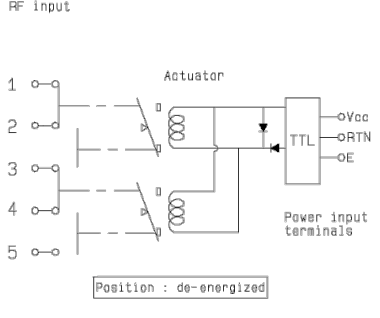
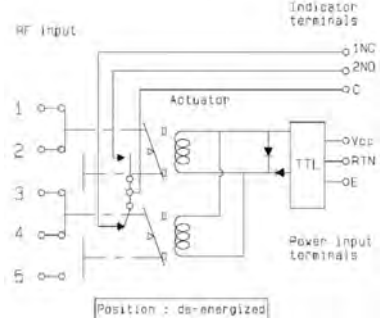
See page 3-11 for pin identification

Connectors	A max (mm)	B max (mm) if applicable
SMA up to 18 GHz	7.4	13.5
SMA up to 26.5 GHz	7.4	21
SMA 2.9 up to 40 GHz	6.3	21

## Coaxial DP3T & Terminated SPDT - Electrical Schematics

### R585 Series

#### FAILSAFE

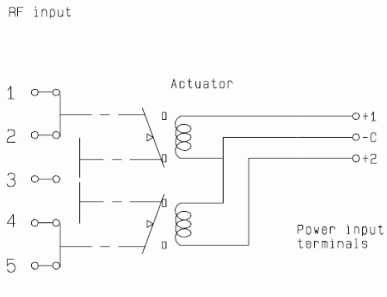
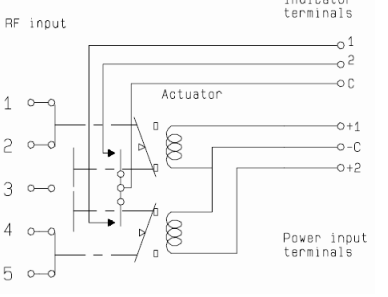
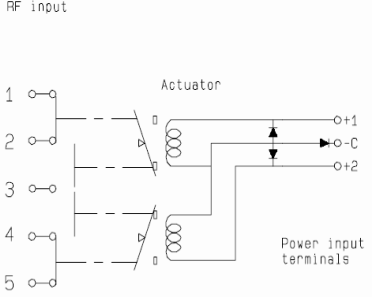
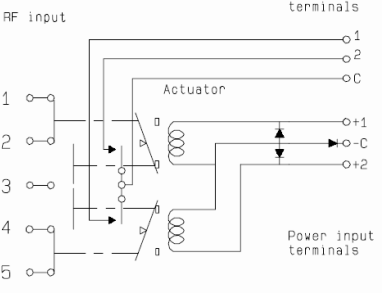
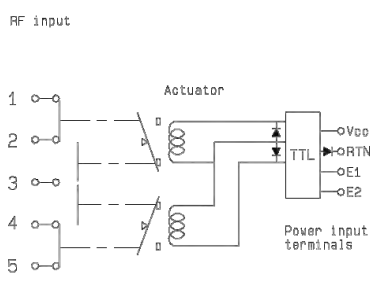
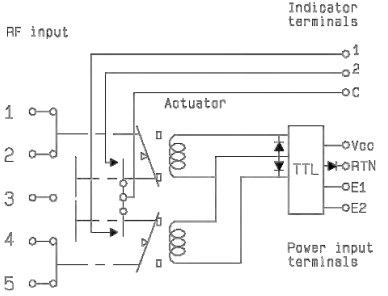
<p><b>WITHOUT OPTION</b>  <b>R585 -1- 000 / R585 -1- 000 / R585 -1- 400</b></p> 	<p><b>WITH INDICATOR CONTACT</b>  <b>R585 -2- 000 / R585 -2- 200 / R585 -2- 400</b></p> 
<p><b>WITH SUPPRESSION DIODES</b>  <b>R585 -1- 030 / R585 -1- 230 / R585 -1- 430</b></p> 	<p><b>WITH SUPPRESSION DIODES AND INDICATOR CONTACT</b>  <b>R585 -2- 030 / R585 -2- 230 / R585 -2- 430</b></p> 
<p><b>WITH TTL DRIVER</b>  <b>(supression diodes are included)</b>  <b>R585 -1- 000 / R585 -1- 300 / R585 -1- 500</b></p> 	<p><b>WITH TTL DRIVER AND INDICATOR CONTACT</b>  <b>(supression diodes are included)</b>  <b>R585 -2- 000 / R585 -2- 300 / R585 -2- 500</b></p> 



## Coaxial DP3T & Terminated SPDT - Electrical Schematics

R585 Series

### NORMALLY OPEN

<p><b>WITHOUT OPTION</b> R585 -7- 000 / R585 -7- 200 / R585 -7- 400</p> 	<p><b>WITH INDICATOR CONTACT</b> R585 -8- 000 / R585 -8- 200 / R585 -8- 400</p> 
<p><b>WITH SUPPRESSION DIODES</b> R585 -7- 030 / R585 -7- 230 / R585 -7- 430</p> 	<p><b>WITH SUPPRESSION DIODES AND INDICATOR CONTACT</b> R585 -8- 030 / R585 -8- 230 / R585 -8- 430</p> 
<p><b>WITH TTL DRIVER</b> (supression diodes are included) R585 -7- 000 / R585 -7- 300 / R585 -7- 500</p> 	<p><b>WITH TTL DRIVER AND INDICATOR CONTACT</b> (supression diodes are included) R585 -8- 100 / R585 -8- 300 / R585 -8- 500</p> 

**Coaxial DP3T & Terminated SPDT - Electrical Schematics**

R585 Series

**NORMALLY OPEN**

<p><b>WITH POSITIVE COMMON, NO OPTION</b> R585 -7- 010 / R585 -7- 210 / R585 -7- 410</p>	<p><b>WITH POSITIVE COMMON AND INDICATOR CONTACT</b> R585 -8- 010 / R585 -8- 210 / R585 -8 - 410</p>
<p><b>WITH POSITIVE COMMON AND SUPPRESSION DIODES</b> R585 -7- 040 / R585 -7- 240 / R585 -7- 440</p>	<p><b>WITH POSITIVE COMMON, INDICATOR CONTACT AND SUPPRESSION DIODES</b> R585 -8- 040 / R585 -8- 240 / R585 -8- 44 0</p>
<p><b>WITHOUT OPTION</b> R585 -3- 000 / R585 -3- 200 / R585 -3- 400</p>	<p><b>WITH INDICATOR CONTACT</b> R585 -4- 000 / R585 -4- 200 / R585 -4- 400</p>

Coaxial DP3T & Terminated SPDT - Electrical Schematics

R585 Series

LATCHING

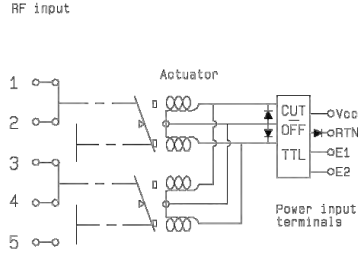
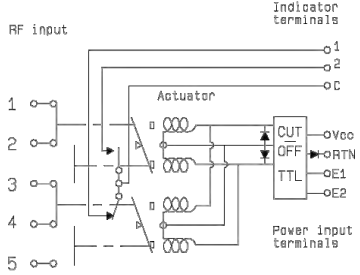
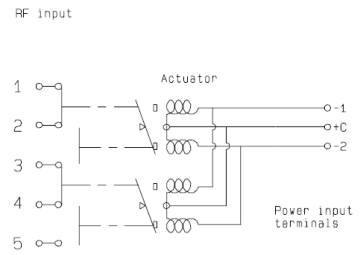
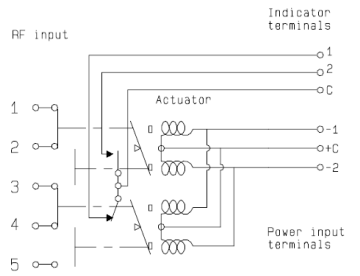
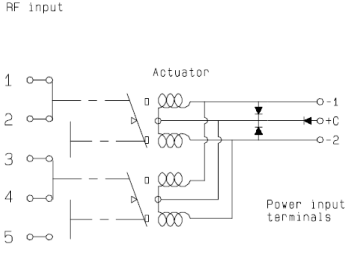
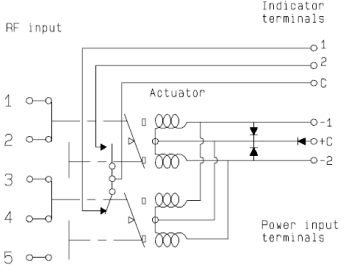
<p><b>WITH SUPPRESSION DIODES</b>  <b>R585 -3- 030 / R585 -3- 230 / R585 -3- 430</b></p>	<p><b>WITH SUPPRESSION DIODES AND INDICATOR CONTACT</b>  <b>R585 -4- 030 / R585 -4- 230 / R585 -4- 430</b></p>
<p><b>WITH TTL DRIVER</b>          (suppression diodes are included)  <b>R585 -3- 100 / R585 -3- 300 / R585 -3- 500</b></p>	<p><b>WITH TTL DRIVER AND INDICATOR CONTACT</b>          (suppression diodes are included)  <b>R585 -4- 100 / R585 -4- 300 / R585 -4- 500</b></p>
<p><b>WITH CUT-OFF</b>          (suppression diodes are included)  <b>R585 -5- 000 / R585 -5- 200 / R585 -5- 400</b></p>	<p><b>WITH CUT-OFF AND INDICATOR CONTACT</b>          (suppression diodes are included)  <b>R585 -6- 000 / R585 -6- 200 / R585 -6- 400</b></p>

RAMSES SERIES

## Coaxial DP3T & Terminated SPDT - Electrical Schematics

### R585 Series

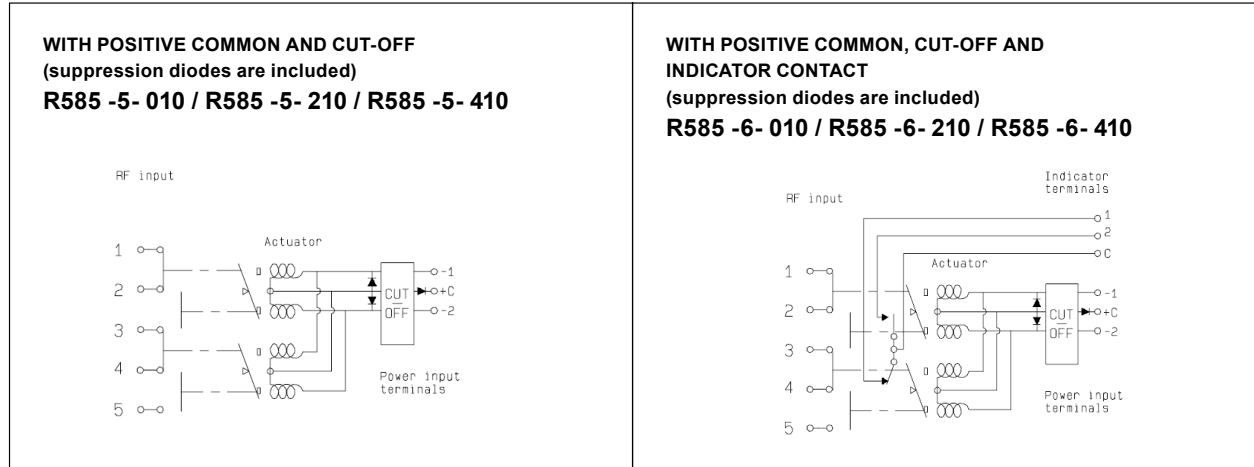
#### LATCHING

<p><b>WITH CUT-OFF AND TTL DRIVER (suppression diodes are included) R585 -5- 100 / R585 -5- 300 / R585 -5- 500</b></p> 	<p><b>WITH CUT-OFF, TTL DRIVER AND INDICATOR CONTACT (suppression diodes are included) R585 -6- 100 / R585 -6- 300 / R585 -6- 500</b></p> 
<p><b>WITH POSITIVE COMMON, NO OPTION R585 -3- 010 / R585 -3- 210 / R585 -3- 410</b></p> 	<p><b>WITH POSITIVE COMMON AND INDICATOR CONTACT R585 -4- 010 / R585 -4- 210 / R585 -4- 410</b></p> 
<p><b>WITH POSITIVE COMMON AND SUPPRESSION DIODES R585 -3- 040 / R585 -3- 240 / R585 -3- 440</b></p> 	<p><b>WITH POSITIVE COMMON, SUPPRESSION DIODES AND INDICATOR CONTACT R585 -4- 040 / R585 -4- 240 / R585 -4- 440</b></p> 

## Coaxial DP3T & Terminated SPDT - Electrical Schematics

R585 Series

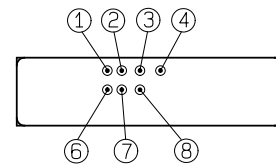
### LATCHING



### PIN IDENTIFICATION

Type	PIN							
	1	2	3	4	6	7	8	
Failsafe	+		-					
Failsafe + I.C.	+		-		2NO	1NC	C	
Failsafe + TTL	E		RTN	VCC				
Failsafe + I.C. + TTL	E		RTN	VCC	2NO	1NC	C	
Latching	-2 or +2	-1 or +1	+C or -C					
Latching + I.C.	-2 or +2	-1 or +1	+C or -C		2	1	C	
Latching + TTL	E2	E1	RTN	VCC				
Latching + TTL + I.C.	E2	E1	RTN	VCC	2	1	C	
Latching + TTL + I.C. + Cut-off	E2	E1	RTN	VCC	2	1	C	
Normally open	-2 or +2	-1 or +1	+C or -C					
Normally open + I.C.	-2 or +2	-1 or +1	+C or -C		2	1	C	
Normally open + TTL	E2	E1	RTN	VCC				
Normally open + TTL + I.C.	E2	E1	RTN	VCC	2	1	C	

### BOTTOM VIEW



RAMSES SERIES

## High performance DP3T & Terminated SPDT up to 40 GHz

SMA - SMA 2.9



Radiall's PLATINUM series switches are optimized to perform at a high level over an extended life cycle. With outstanding RF performance, and a guaranteed insertion loss repeatability of 0.03 dB over a life span of 10 million switching cycles. PLATINUM series switches are perfect for automated test and measurement equipment, as well as signal monitoring devices.

Example of P/N:

R595F63215 is a Terminated SPDT SMA 26.5 GHz, latching with Self Cut-Off, 24Vdc, Indicators, D-Sub connector.

### PART NUMBER SELECTION

**R 595**

**RF Connectors:**

- 3: SMA up to 6 GHz
- 4: SMA up to 20 GHz
- F: SMA up to 26.5 GHz
- 8: SMA 2.9 up to 40 GHz (1)

**Type:**

- 3: Latching
- 4: Latching + I.C.
- 5: Latching + S.C.O.
- 6: Latching + S.C.O. + I.C.

**Actuator Voltage:**

- 3: 24 Vdc
- 7: 15 Vdc

**Switch Model:**

- 2: Terminated SPDT switch
- 3: Terminated 4 ports bypass switch
- 4: Non terminated 5 ports DP3T switch

**Documentation:**

- : Certificate of conformity
- C: Calibration certificate
- R: Calibration certificate + RF curves

**Actuator Terminals:**

- 0: Solder pins
- 5: D-Sub connector

**Options:**

- 1: Without option (positive common)
- 2: Compatible TTL driver (high level)

I.C.: Indicator contact/S.C.O.: Self Cut-Off

(1): Connector SMA2.9 is equivalent to "K connector®", registered trademark of Anritsu

## High performance DP3T & Terminated SPDT up to 40 GHz

### SMA - SMA 2.9

### GENERAL SPECIFICATIONS

Operating mode		Latching	
Nominal operating voltage (across operating temperature)	Vdc	24 (20 to 32)	15 (12 to 20)
Coil resistance (+/-10%)	Ω	175	60
Nominal operating current at 23°C	mA	140	250
Average power		RF path	Cold switching: see Power Chart on page 3-21 Hot switching: 1 Watt CW
		Internal terminations	1 Watt average into 50 Ω
		External terminations	0.5 Watt average into 50 Ω
TTL input	High Level	3 to 7 V; 800 μA max at 7 V	
	Low Level	0 to 0.8 V; 20 μA max at 0.8V	
Switching time (Max)	ms	15	
Life (Min)	SMA	10 million cycles	
	SMA2.9	5 million cycles	
Connectors		SMA - SMA2.9	
Actuator terminals		D-Sub 9 pin female Solder pins	
Weight	g	<100	

### ENVIRONMENTAL SPECIFICATIONS

Operating temperature range	-25°C to +75°C
Storage temperature range	-55°C to +85°C
Temperature cycling (MIL STD 202F, Method 107D, Cond.A)	-55°C to +85°C (10 cycles)
Sine vibration operating (MIL STD 202, Method 204D, Cond.D)	10-2000 Hz, 20g
Random vibration operating	16.91G (rms) 50-2000 Hz 3min/axis
Shock operating (MIL STD 202, Method 213B, Cond.G)	50g / 11ms, sawtooth
Humidity operating	15 to 95% relative humidity
Humidity storage (MIL STD 202, Method 106E, Cond.E)	65°C, 95% RH, 10 days
Altitude operating	15,000 feet (4,600 meters)
Altitude storage (MIL STD 202, Method 105C, Cond.B)	50,000 feet (15,240 meters)

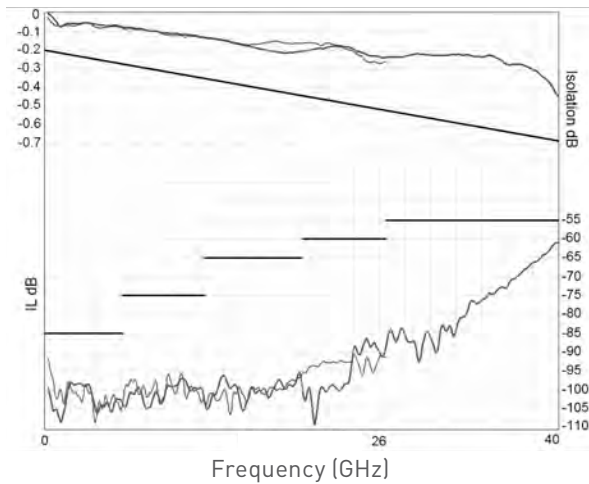
## High performance DP3T & Terminated SPDT up to 40 GHz

SMA - SMA 2.9

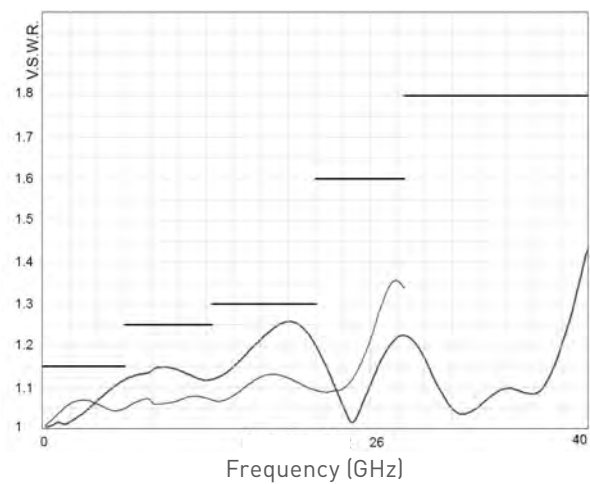
### RF PERFORMANCES

Part Number		R5953-----	R5954-----		R595F-----		R5958-----		
Frequency Range	GHz	DC to 6		DC to 20		DC to 26.5		DC to 40	
Impedance	Ω	50							
Insertion Loss (max)	dB	0.20 + (0.45 / 26.5) x frequency (GHz)							
Isolation (Min)		85	DC to 6 GHz	85	DC to 6 GHz	85	DC to 6 GHz	85	
			6 to 12.4 GHz	75	6 to 12.4 GHz	75	6 to 12.4 GHz	75	
			12.4 to 20 GHz	65	12.4 to 20 GHz	65	12.4 to 20 GHz	65	
			20 to 26.5 GHz	60w	20 to 26.5 GHz	60w	20 to 26.5 GHz	60	
	26.5 to 40 GHz					26.5 to 40 GHz	55		
V.S.W.R. (Max)		1.15	DC to 6 GHz	1.15	DC to 6 GHz	1.15	DC to 6 GHz	1.15	
			6 to 12.4 GHz	1.25	6 to 12.4 GHz	1.25	6 to 12.4 GHz	1.25	
			12.4 to 18 GHz	1.30	12.4 to 18 GHz	1.30	12.4 to 18 GHz	1.30	
			18 to 20 GHz	1.60	18 to 26.5 GHz	1.60	18 to 26.5 GHz	1.60	
			26.5 to 40 GHz					26.5 to 40 GHz	1.80
Repeatability (Up to 10 million cycles measured at 25°C)		0.03 dB maximum					0.05 dB maximum		

Insertion Loss and Isolation



V.S.W.R.



SMA — SMA 2.9 —



## High performance DP3T & Terminated SPDT up to 40 GHz

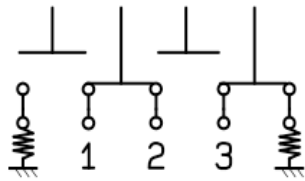
SMA - SMA 2.9

### SWITCH MODEL: TERMINATED SPDT SWITCH

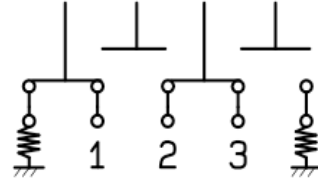
The terminated SPDT switch is a single pole double throw switch where unused ports are terminated into 50 ohms. This switch is considered a “break before make”.

### RF SCHEMATIC DIAGRAM

Position E1

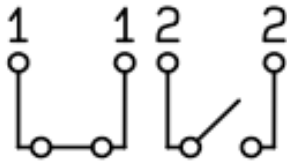


Position E2

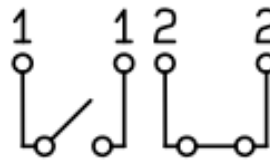


### POSITION INDICATORS

State 11



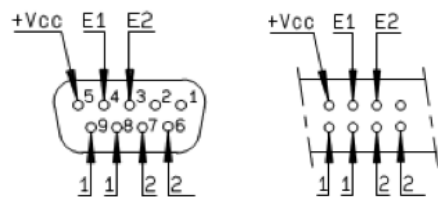
State 22



#### Standard drive option “1”

(Positive common):

- Connect pin +Vcc to supply (+20 Vdc to +32 Vdc)
- Select desired RF path by applying ground to the corresponding "close" pin (Ex: ground pin E1 to switch to position E1. RF path 1-2 closed and RF path 2-3 open)
- To open desired path and close the new RF path, connect ground to the corresponding "close" pin (Ex: ground pin E2 to open RF path 1-2 and close RF path 2-3)

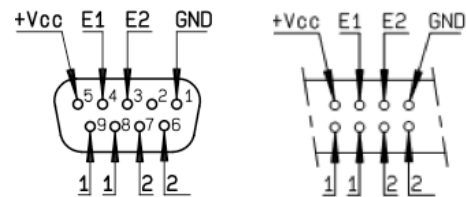


D-sub Connector

Solder Pins

#### TTL drive option “2”

- Connect pin GND to ground
- Connect pin +Vcc to supply (+20 Vdc to +32 Vdc)
- Select (close) desired RF path by applying TTL "High" to the corresponding "drive" pin. (Ex: apply TTL "High" to pin E1 to switch to position E1. RF path 1-2 closed and RF path 2-3 open)
- To open desired path and close the new RF path, apply TTL "High" to the "drive" pin which corresponds to the desired RF path. (Ex: apply TTL "High" to pin E2 to open RF path 1-2 and close RF path 2-3)



D-sub Connector

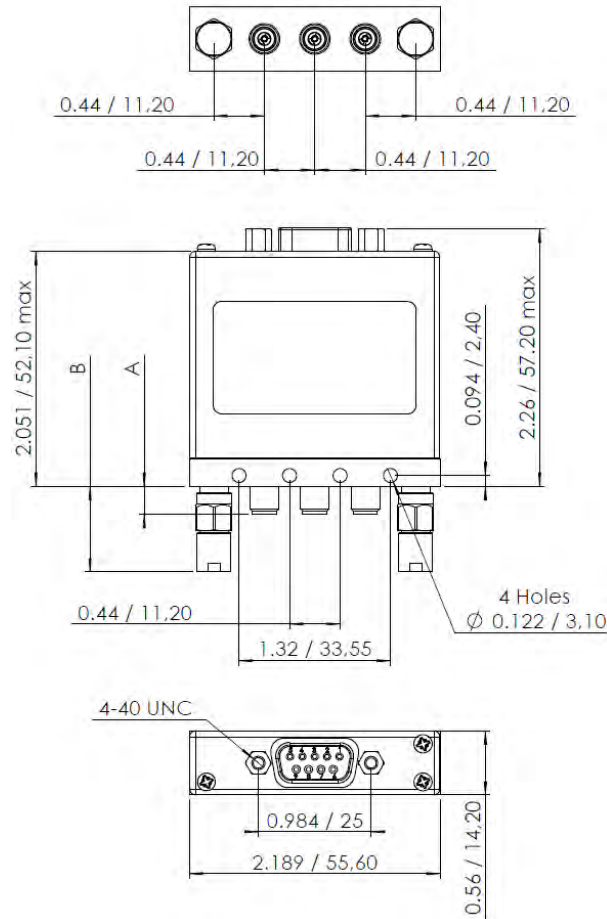
Solder Pins

High performance DP3T & Terminated SPDT up to 40 GHz

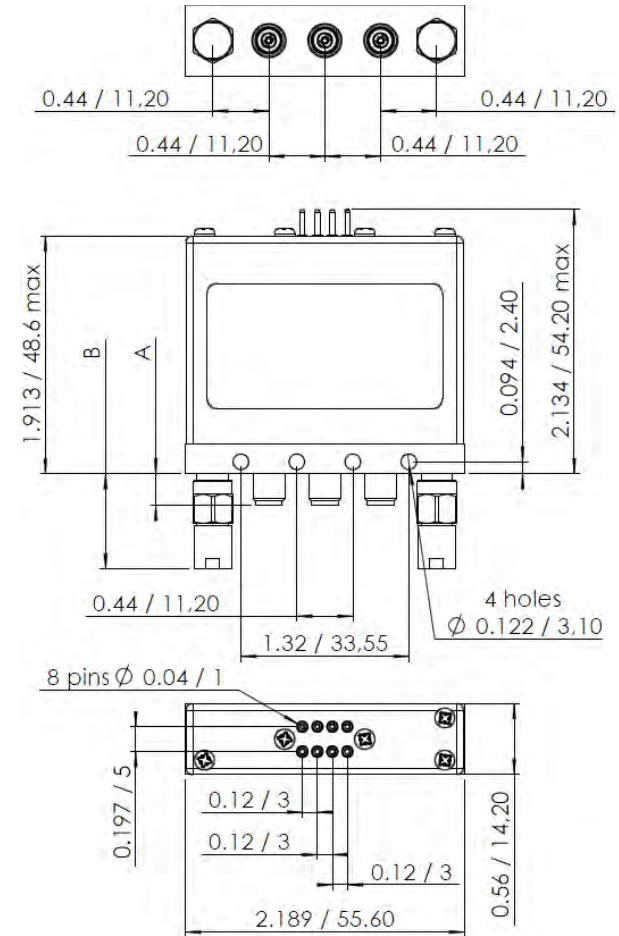
SMA - SMA 2.9

SWITCH MODEL: TERMINATED SPDT SWITCH

With D-Sub connector



With solder pins



All dimensions are in inches/millimeters

Connectors	A max (inches / mm)	B max (inches / mm)	Terminations
SMA up to 26.5 GHz	0.291 / 7.40	0.067 / 1.70	Internal
SMA 2.9 up to 40 GHz	0.248 / 6.30	0.748 / 19.0	External

## High performance DP3T & Terminated SPDT up to 40 GHz

SMA - SMA 2.9

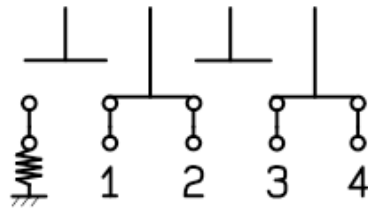
### SWITCH MODEL: TERMINATED 4 PORT SWITCH

The terminated 4 port bypass switch can terminate into the 50 ohms device under test.

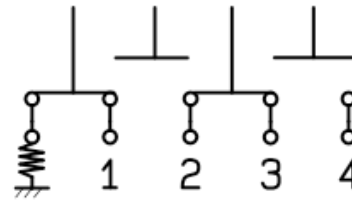
This switch is considered a “break before make”.

### RF SCHEMATIC DIAGRAM

Position E1

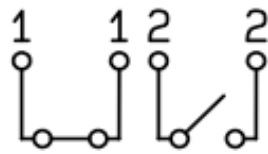


Position E2

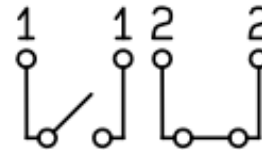


### POSITION INDICATORS

State 11



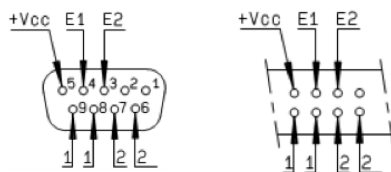
State 22



#### Standard drive option “1”

##### (Positive common):

- Connect pin +Vcc to supply (+20 Vdc to +32 Vdc)
- Select desired RF path by applying ground to the corresponding "close" pin (Ex: ground pin E1 to switch to position E1. RF path 1-2 and RF path 3-4 closed and RF path 2-3 open)
- To open desired path and close the new RF path, connect ground to the corresponding "close" pin (Ex: ground pin E2 to open RF path 1-2 and 3-4 and close RF path 2-3)

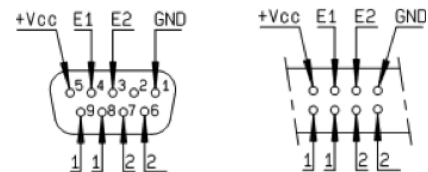


D-Sub connector

Solder pins

#### TTL drive option “2”:

- Connect pin GND to ground
- Connect pin +Vcc to supply (+20 Vdc to +32 Vdc)
- Select (close) desired RF path by applying TTL "High" to the corresponding "drive" pin (Ex: apply TTL "High" to pin E1 to switch to position E1. RF path 1-2 and 3-4 closed and RF path 2-3 open)
- To open desired path and close the new RF path, apply TTL "High" to the "drive" pin which corresponds to the desired RF path (Ex: apply TTL "High" to pin E2 to open RF path 1-2 and 3-4 and close RF path 2-3)



D-Sub connector

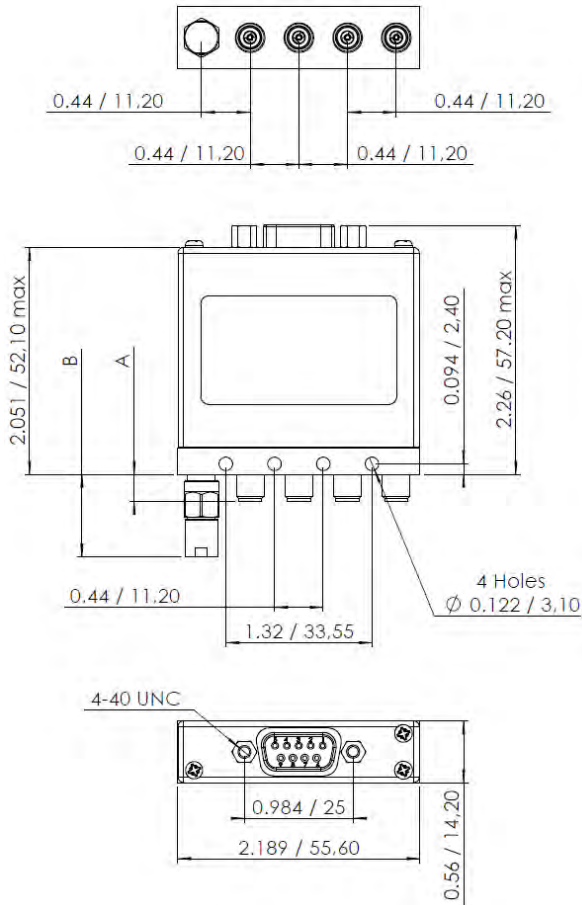
Solder pins

High performance DP3T & Terminated SPDT up to 40 GHz

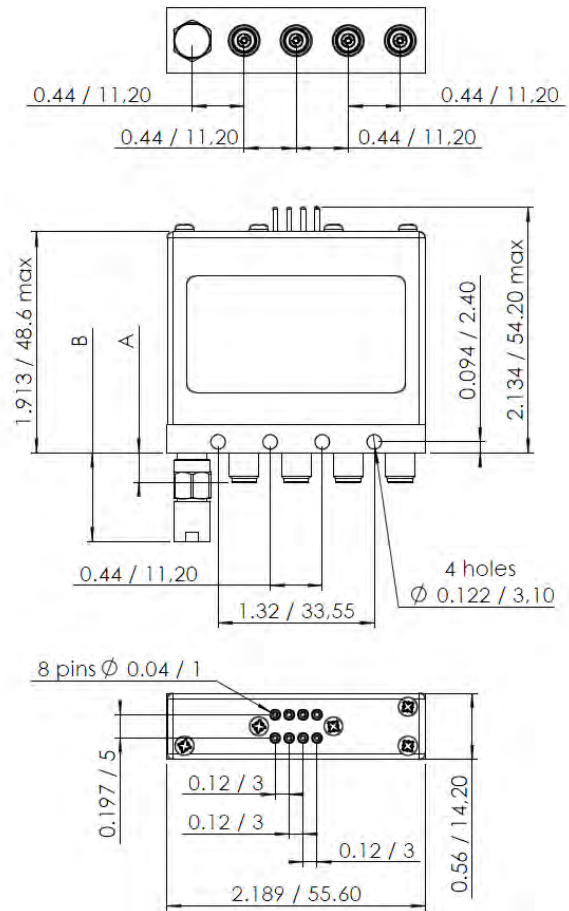
SMA - SMA 2.9

SWITCH MODEL: TERMINATED 4 PORT BYPASS SWITCH

With D-Sub connector



With solder pins



All dimensions are in inches/millimeters

Connectors	A max (inches / mm)	B max (inches / mm)	Terminations
SMA up to 26.5 GHz	0.291 / 7.40	0.067 / 1.70	Internal
SMA 2.9 up to 40 GHz	0.248 / 6.30	0.748 / 19.0	External

## High performance DP3T & Terminated SPDT up to 40 GHz

SMA - SMA 2.9

### SWITCH MODEL: 5 PORT DP3T SWITCH

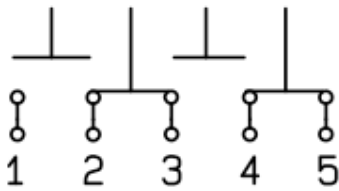
The non terminated 5 port DP3T switch can be used as SPDT with high power terminations, as a bypass switch.

In this application, the fifth port can be terminated externally with a high power termination.

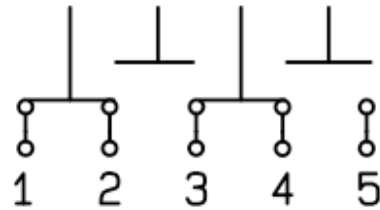
These switches are considered a "break before make".

### RF SCHEMATIC DIAGRAM

Position E1

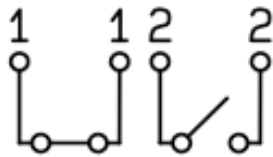


Position E2

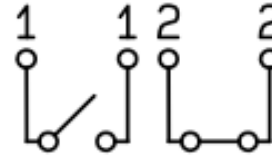


### POSITION INDICATORS

State 11



State 22



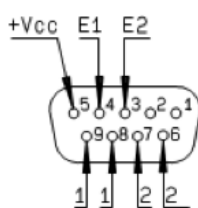
#### Standard drive option "1"

##### (Positive common):

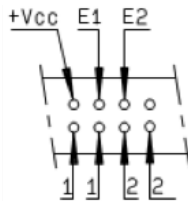
- Connect pin +Vcc to supply (+20 Vdc to +32 Vdc)
- Select desired RF path by applying ground to the corresponding "close" pin (Ex: ground pin E1 to switch to position E1. RF path 2-3 and RF path 4-5 closed and RF path 1-2 and RF path 3-4 open)
- To open desired path and close the new RF path, connect ground to the corresponding "close" pin (Ex: ground pin E2 to open RF path 2-3 and 4-5 and close RF path 1-2 and 3-4)

#### TTL drive option "2":

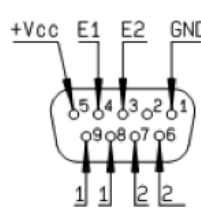
- Connect pin GND to ground
- Connect pin +Vcc to supply (+20 Vdc to +32 Vdc)
- Select (close) desired RF path by applying TTL "High" to the corresponding "drive" pin (Ex: apply TTL "High" to pin E1 to switch to position E1. RF path 2-3 and RF path 4-5 closed and RF path 1-2 and 3-4 open)
- To open desired path and close the new RF path, apply TTL "High" to the "drive" pin which corresponds to the desired RF path. (Ex: apply TTL "High" to pin E2 to open RF path 2-3 and 4-5 and close RF path 1-2 and 3-4)



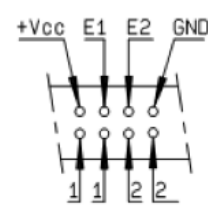
D-Sub connector



Solder pins



D-Sub connector



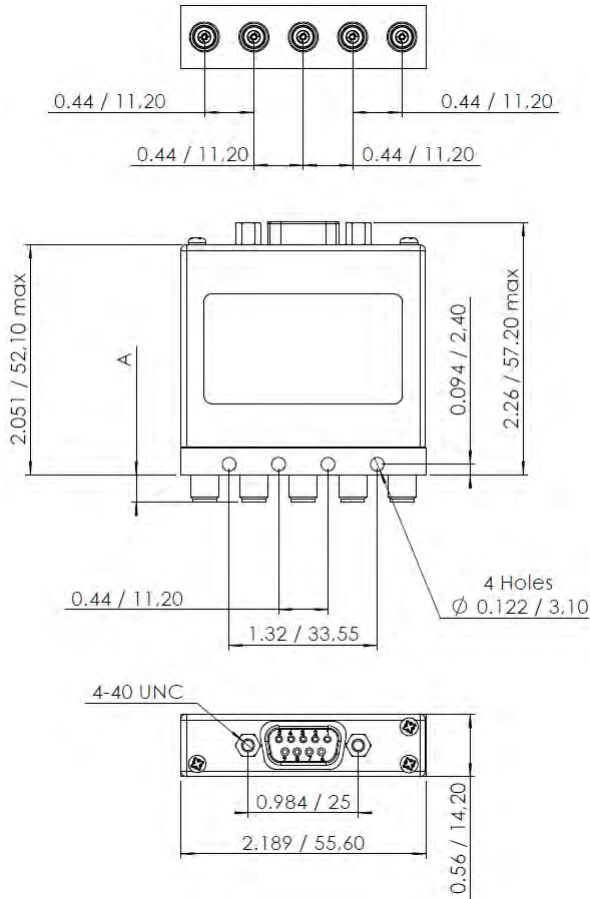
Solder pins

High performance DP3T & Terminated SPDT up to 40 GHz

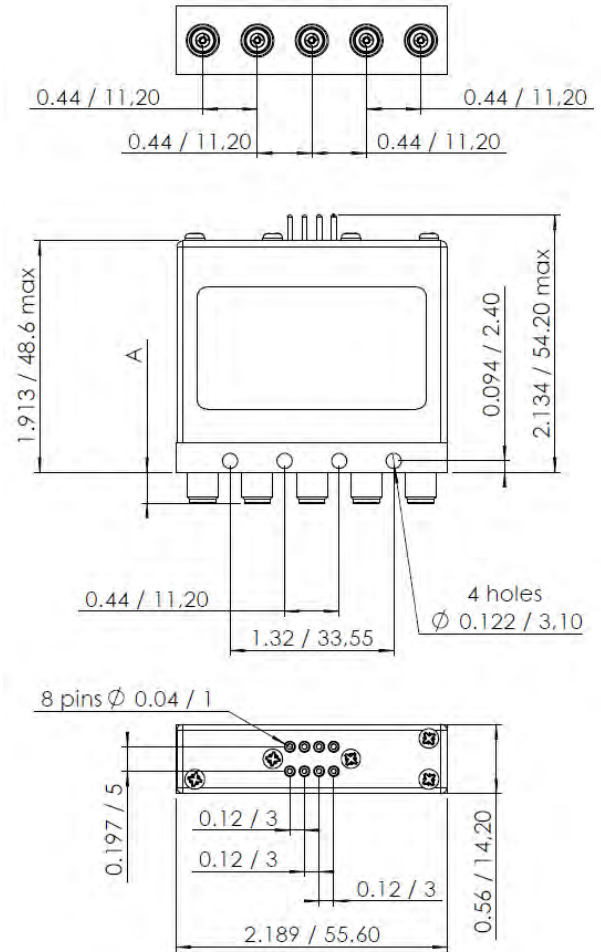
SMA - SMA 2.9

SWITCH MODEL: 5 PORT DP3T SWITCH

With D-Sub connector



With solder pins



All dimensions are in inches/millimeters

Connectors	A max (inches / mm)
SMA up to 26.5 GHz	0.291 / 7.40
SMA 2.9 up to 40 GHz	0.248 / 6.30

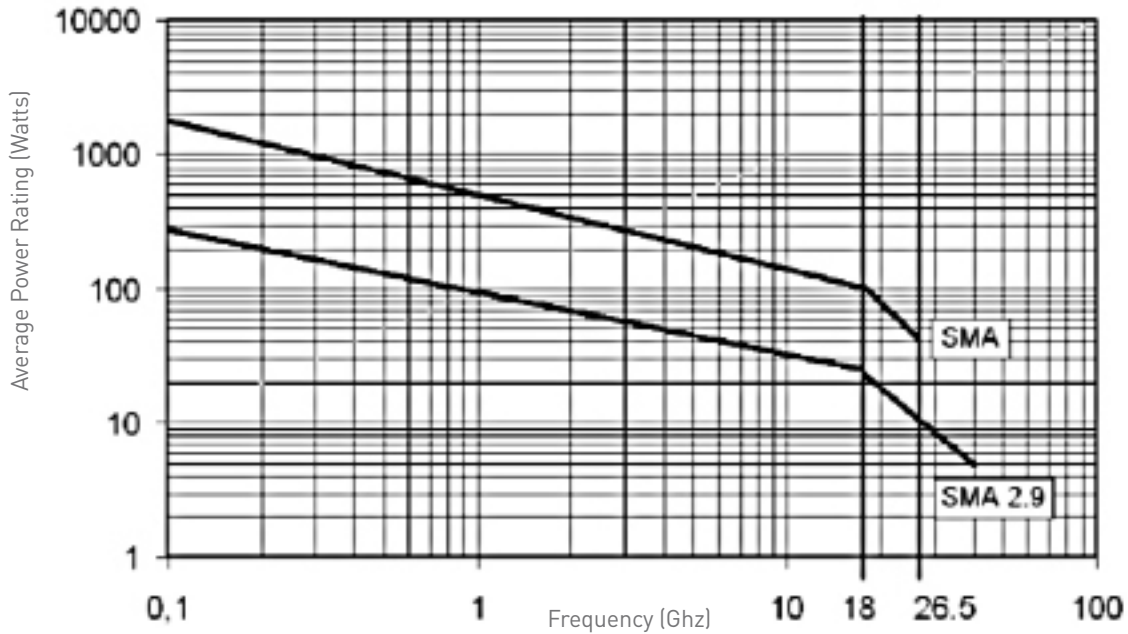
## High performance DP3T & Terminated SPDT up to 40 GHz

SMA - SMA 2.9

### POWER RATING CHART

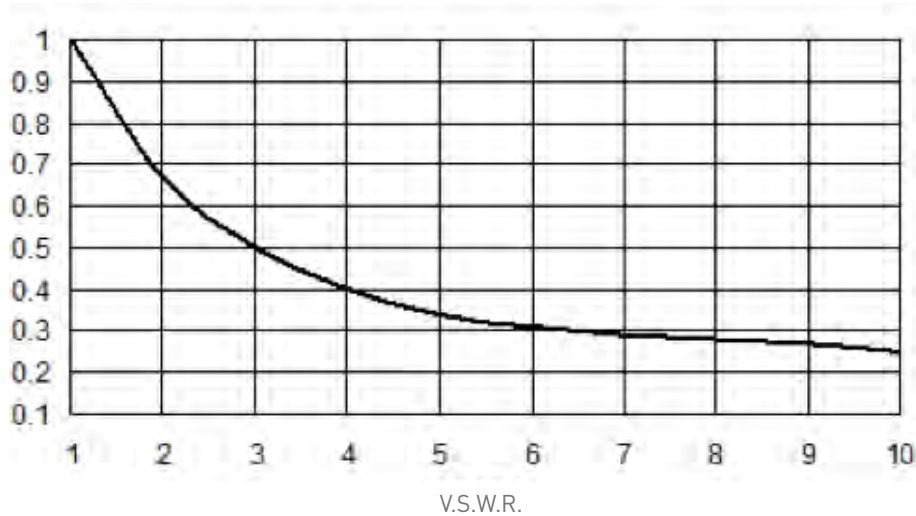
This graph is based on the following conditions:

- Ambient temperature: + 25°C
- Sea level
- V.S.W.R.: 1 and cold switching



### DERATING FACTOR VERSUS V.S.W.R.

The average power input must be reduced for load V.S.W.R. above 1.1

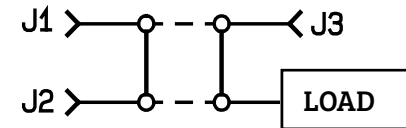


### Optional features for DP3T switches

#### GENERAL

RADIALL DP3T / SPDT terminated are designed only with SMA connectors.

For all other connectors (N, BNC etc.), the same function as SPDT terminated can be easily performed with a standard DPDT and an external load.



POS 1 : J1 to J2 / J3 to load

#### Examples of dedicated applications



This SPDT terminated switch is composed of a DP3T with SMA connectors, and cable load for medium power terminations. The Key advantage of this solution is the ability to mount the switch with external terminations at the desired power level.



This is an example of an SPDT terminated switch that was designed with 2 separate coils for a specific test network application.



SECTION 4



DPDT



## Contents

### RAMSES Series

DPDT up to 40 GHz: R577 miniature..... 4-2 to 4-5

DPDT up to 12.4 GHz RAMSES Concept: standard R577..... 4-6 to 4-9

### Electrical Schematics

R577 miniature and standard R577..... 4-10 to 4-13

### TITANIUM Series

High Performances DPDT Series DC - 40 GHz: R513 Series ..... 4-14 to 4-19

### PLATINUM Series

High performances DPDT up to 40 GHz: R593 Series..... 4-20 to 4-25

Optional Features ..... 4-26

## DPDT PART NUMBER SELECTION GUIDE\*

Digital Position	R 1-3	4: RF connectors										5: Type		6: Voltage			7: TTL opt.		8: Options			9: Terminals			10: Documentation									
Series	Configuration	SMA 3 GHz	SMA 6 GHz	SMA 18 GHz	SMA 20 GHz	SMA 26.5 GHz	SMA 2.9 40 GHz	QMA 6 GHz	DIN 1.6/5.6, 2.5 GHz	N 3 GHz	N 12.4 GHz	BNC 3 GHz	TNC 3 GHz	TNC 12.4 GHz	Failsafe	Latching	12V	24V	28V	Without	With option	Without option	Positive common	Suppression diodes	Suppression diodes and positive common	Solder pins with bracket	Solder pins without bracket	D-Sub connector with bracket	D-Sub connector without bracket	HE 10 with bracket	HE 10 without bracket	Certificate of conformity	Calibration certificate	Calibration certificate + RF Curves
RAMSES	DPDT	R577	3	-	4	-	F	8	E	9	-	-	-	-	1/2	3/4/5/6	2	-	3	0	1	0	1	3	4	0	2	5	7	-	-	-	-	-
		R577	-	-	-	-	-	-	-	0	1	2	5	6	1/2	3/4/5/6	2	-	3	0	1	0	1	3	4	0	2	5	7	-	-	-	-	-
TITANIUM	DPDT	R513	-	3	-	4	F	8	-	-	-	-	-	-	7	-	3	-	-	1	-	-	-	4	-	-	-	8	9	-	-	C	R	
PLATINUM	DPDT	R593	-	3	-	4	F	8	-	-	-	-	-	-	7	-	3	-	-	1	-	-	-	4	-	-	-	8	9	-	-	C	R	

Example of P/N: R577412020 is a DPDT SMA 18 GHz failsafe, 12 Vdc, without TTL driver, solder pins with bracket.

\*For part number creation and available options, see detailed part number selection for each series.

## DPDT up to 40 GHz

SMA – SMA 2.9 – QMA – DIN 1.6/5.6



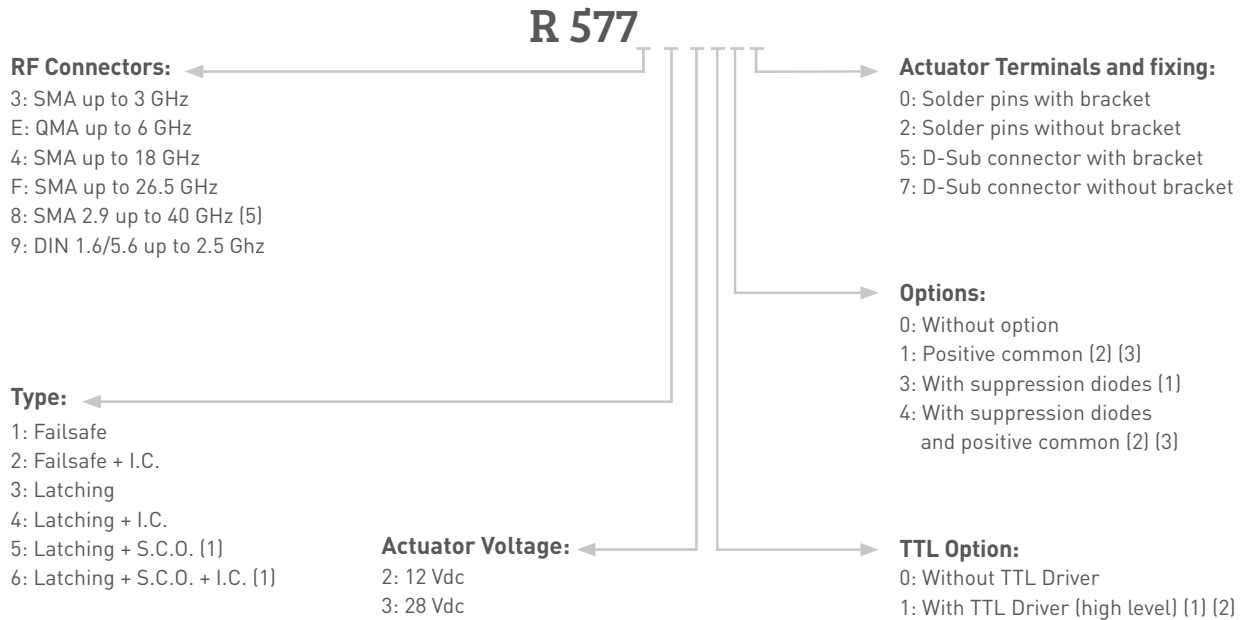
Radiall's DPDT switches offer excellent reliability, high performance and operating frequencies from DC to 40 GHz. Radiall's RAMSES concept guarantees a life span of 2.5 million cycles and provides a full array of options to respond to the needs of our customers.

These relays are well suited for applications across all markets including: Defense, Instrumentation, and Telecom.

Example of P/N:

R577F63105 is a DPDT SMA 26.5 GHz latching with Indicators, Self Cut-Off, 28 Vdc, TTL driver, D-Sub connector.

### PART NUMBER SELECTION



I.C.: Indicator contact - S.C.O.: Self Cut-Off

1: Suppression diodes are already included in self cut-off & TTL option

2: Polarity is not relevant to application for switches with TTL driver

3: Positive common shall be specified only with type 3,4,5 and 6 because failsafe switches can be used with both polarities



(4): The QLF trademark (Quick Lock Formula®) standard applies to QMA and QN series and guaranties the full intermateability between suppliers using this trademark. Using QLF certified connectors also guarantees the specified level of RF performance.

(5): Connector SMA2.9 is equivalent to "K connector®", registered trademark of Anritsu

**DPDT up to 40 GHz**

SMA – SMA 2.9 – QMA – DIN 1.6/5.6

**GENERAL SPECIFICATIONS**

Operating mode		Failsafe		Latching	
Nominal operating voltage (across operating temperature)	Vdc	12 (10.2 / 13)	28 (24 / 30)	12 (10.2 / 13)	28 (24 / 30)
Coil resistance (+/-10%)	Ω	35	200	38	225
Nominal operating current at 23°C	mA	340	140	320	125
Average power		See Power Rating Chart page <b>1-13</b>			
TTL input	High Level	2.2 to 5.5 Volts		800µA max 5.5 Volts	
	Low Level	0 to 0.8 Volts		20µA max 0.8 Volts	
Switching time (Max)	ms	15			
Life		2.5 million cycles			
Connectors		SMA - SMA 2.9 - QMA - DIN 1.6/5.6			
Actuator terminals		Solder pins or male 9 pin D-Sub connector			
Operating temperature range	DIN 1.6/5.6	-25°C to +70°C			
	SMA - SMA 2.9 - QMA	-40°C to +85°C			
Storage temperature range	DIN 1.6/5.6	-40°C to +85°C			
	SMA - SMA 2.9 - QMA	-55°C to +85°C			
Vibration (MIL STD 202, Method 204D, Cond. C)		10-2000 Hz, 10g		operating	
Shock (MIL STD 202, Method 213B, Cond. G)		50g / 11 ms, ½ sine		operating	

**RF PERFORMANCES**

Connectors	Frequency range GHz		V.S.W.R. (max)	Insertion loss (max) dB	Isolation (min) dB	Impedance Ω
DIN 1.6/5/6	DC - 2.5	DC - 1	1.20	0.20	80	75
		1 - 25	1.30	0.30	70	
QMA	DC - 6	DC - 3	1.20	0.20	80	50
		3 - 6	1.20	0.30	70	
SMA	DC - 3 DC - 18 DC - 26.5	DC - 3	1.20	0.20	80	50
		3 - 8	1.30	0.30	70	
		8 - 12.4	1.40	0.40	65	
		12.4 - 18	1.50	0.50	60	
SMA 2.9	DC - 40	18 - 26.5	1.70	0.70	50	50
		DC - 6	1.30	0.30	70	
		6 - 12.4	1.40	0.40	60	
		12.4 - 18	1.50	0.50	60	
		18 - 26.5	1.70	0.70	55	
		26.5 - 40	1.90	0.80	50	

See page 4-4 for typical RF performance

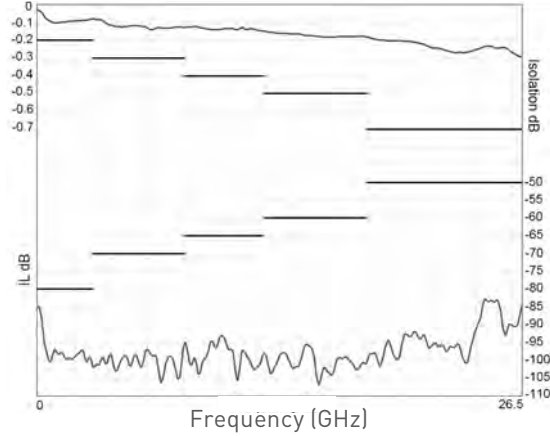
## DPDT up to 40 GHz

SMA – SMA 2.9 – QMA – DIN 1.6/5.6

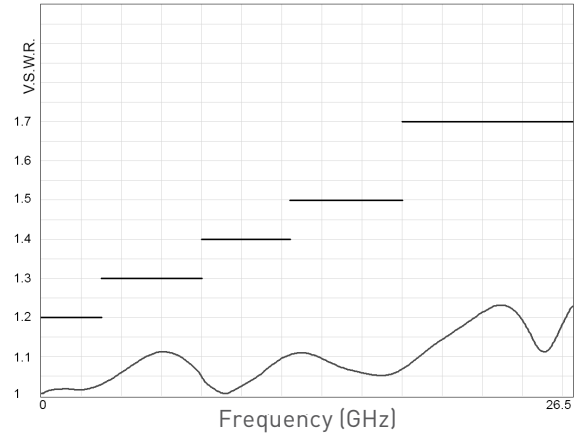
### R577 TYPICAL RF PERFORMANCES

Example: DPDT SMA up to 26.5 GHz

Insertion Loss and Isolation

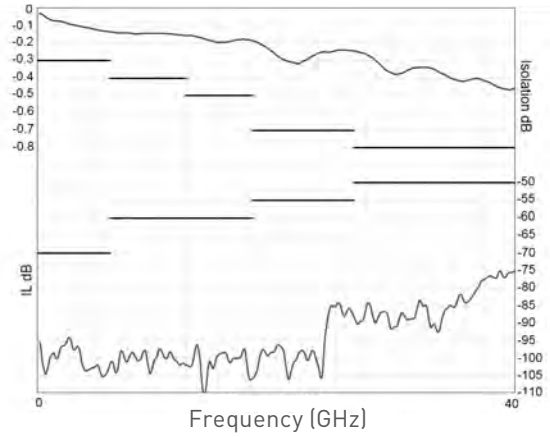


V.S.W.R.

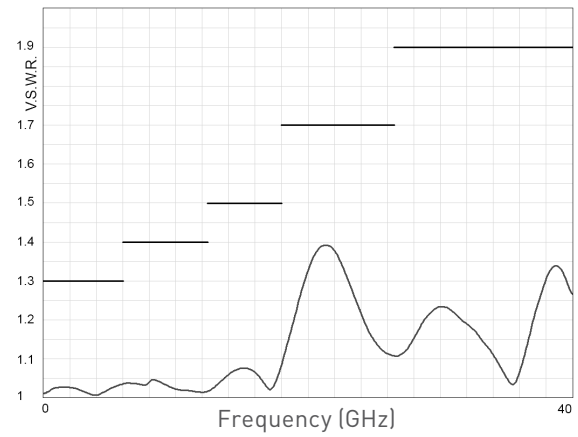


Example: DPDT SMA2.9 up to 40 GHz

Insertion Loss and Isolation



V.S.W.R.

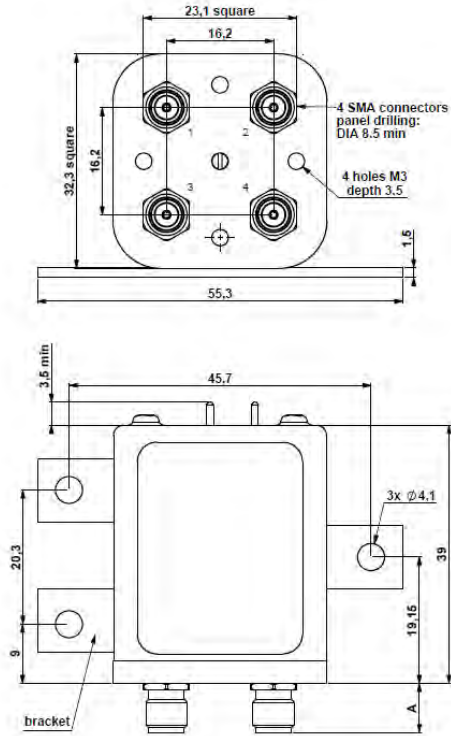


**DPDT up to 40 GHz**

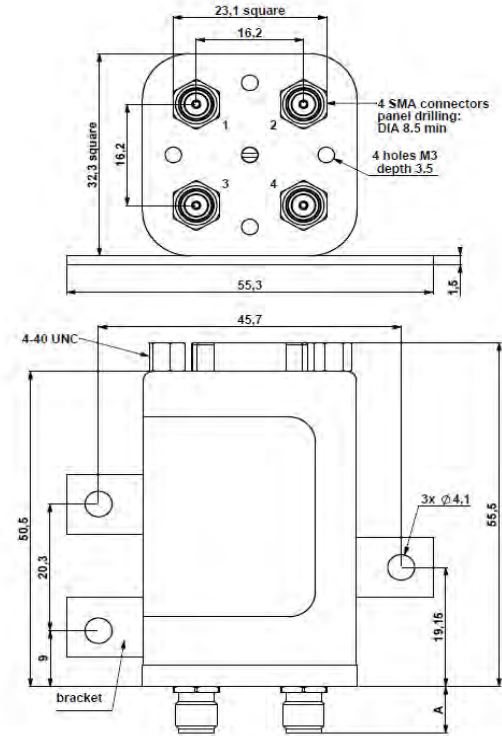
SMA – SMA 2.9 – QMA – DIN 1.6/5.6

**TYPICAL OUTLINE DRAWING**

With solder pins and bracket



With D-Sub connector and bracket



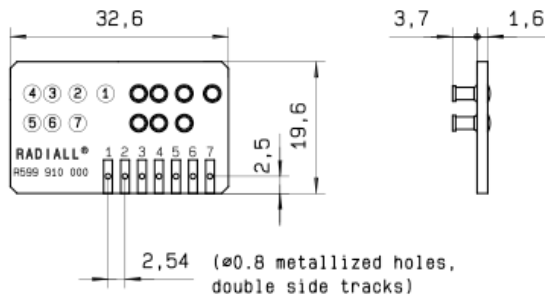
See page 4-13 for pin allocation

Connectors	SMA	SMA 2.9	QMA	DIN 1.6/5.6
A max (mm)	7.4	6.3	10.8	11.5

**ACCESSORIES**

A printed circuit board interface connector (ordered separately) has been designed for easy mounting on terminals.

For DPDT model R577 series => Radiall part number: **R599 910 000**



## DPDT up to 12.4 GHz - Ramses Concept

N - BNC - TNC



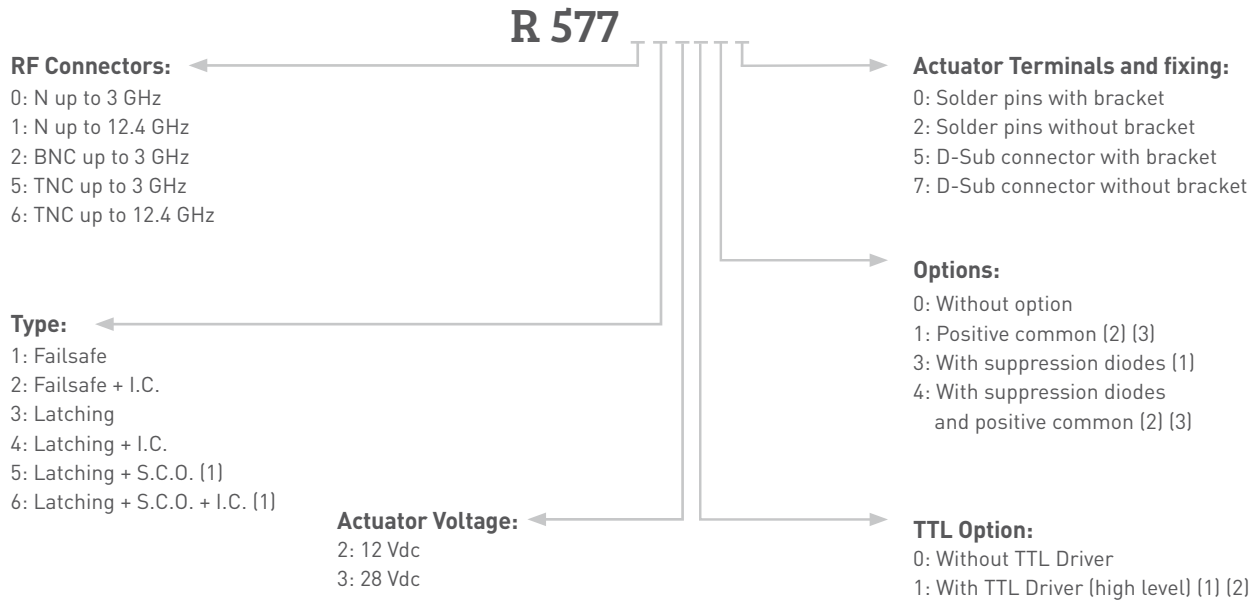
Radiall's DPDT switches offer excellent reliability, high performance and operating frequencies from DC to 12.4 GHz. Radiall's RAMSES concept guarantees a life span of 2.5 million cycles and provides a full array of options to respond to the needs of our customers.

These relays are well suited for applications across all markets including: Defense, Instrumentation, and Telecom.

Example of P/N:

R577122030 is a DPDT N 12.4 GHz, failsafe with Indicators, 12 Vdc, suppression diodes, solder pins with bracket.

### PART NUMBER SELECTION



I.C.: Indicator contact - S.C.O.: Self Cut-Off

1: Suppression diodes are already included in self cut-off & TTL option

2: Polarity is not relevant to application for switches with TTL driver

3: Positive common shall be specified only with type 3,4,5 & 6 because failsafe switches can be used with both polarities

## DPDT up to 12.4 GHz - Ramses Concept

N - BNC - TNC

### GENERAL SPECIFICATIONS

Operating mode		Failsafe		Latching	
Nominal operating voltage (across operating temperature)	Vdc	12 (10.2 / 13)	28 (24 / 30)	12 (10.2 / 13)	28 (24 / 30)
Coil resistance (+/-10%)	Ω	35	200	38	225
Nominal operating current at 23°C	mA	340	140	320	125
Average power	See Power Rating Chart page 1-13				
TTL input	High Level	2.2 to 5.5 Volts			
	Low Level	0 to 0.8 Volts			
Switching time (Max)	ms	15			
Life	2.5 million cycles				
Connectors	N - BNC - TNC				
Actuator terminals	Solder pins or male 9 pin D-Sub connector				
Operating temperature range	-40°C to +85°C				
Storage temperature range	-55°C to +85°C				
Vibration (MIL STD 202, Method 204D, cond. C)	10-2000 Hz, 10g		operating		
Shock (MIL STD 202, Method 213B, cond. G)	50g / 11 ms, ½ sine		operating		

### RF PERFORMANCES

Connectors	Frequency Range GHz		V.S.W.R. (max)	Insertion Loss (max) dB	Isolation (min) dB	Impedance Ω
BNC	DC - 3	DC - 1	1.15	0.15	85	50
		1 - 2	1.20	0.20	80	
		2 - 3	1.25	0.25	75	
N - TNC	DC - 3 DC - 12.4	DC - 1	1.15	0.15	85	
		1 - 2	1.20	0.20	80	
		2 - 3	1.25	0.25	75	
		3 - 8	1.35	0.35	70	
		8 - 12.4	1.50	0.50	60	

See page 4-8 for typical RF performances



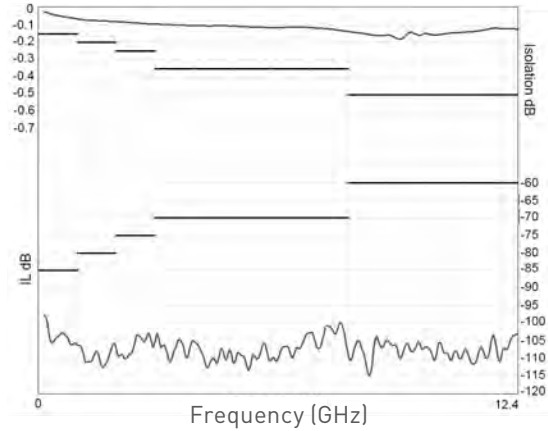
## DPDT up to 12.4 GHz - Ramses Concept

N - BNC - TNC

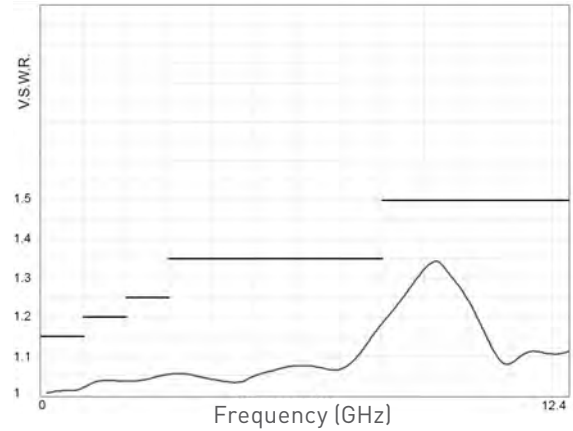
### R577 TYPICAL RF PERFORMANCES

Example: DPDT N/TNC up to 12.4 GHz

Insertion Loss and Isolation

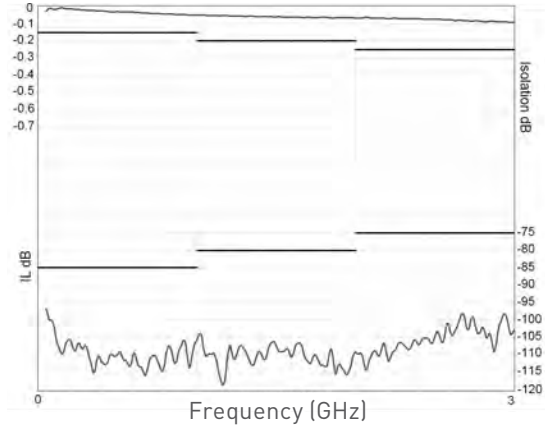


V.S.W.R.

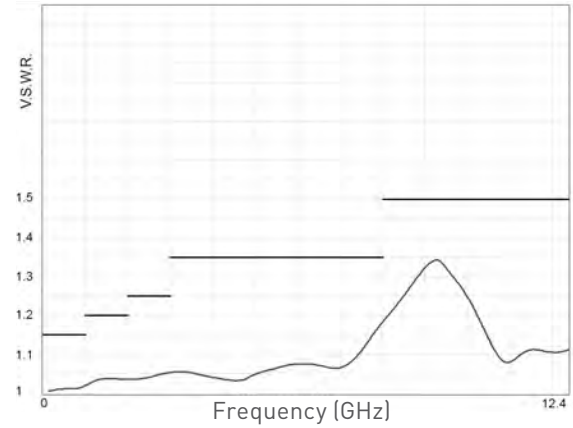


Example: DPDT BNC UP TO 3 GHz

Insertion Loss and Isolation



V.S.W.R.

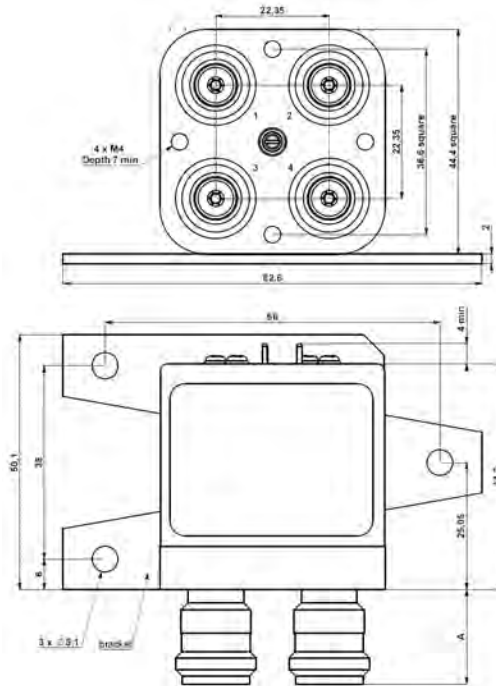


## DPDT up to 12.4 GHz - Ramses Concept

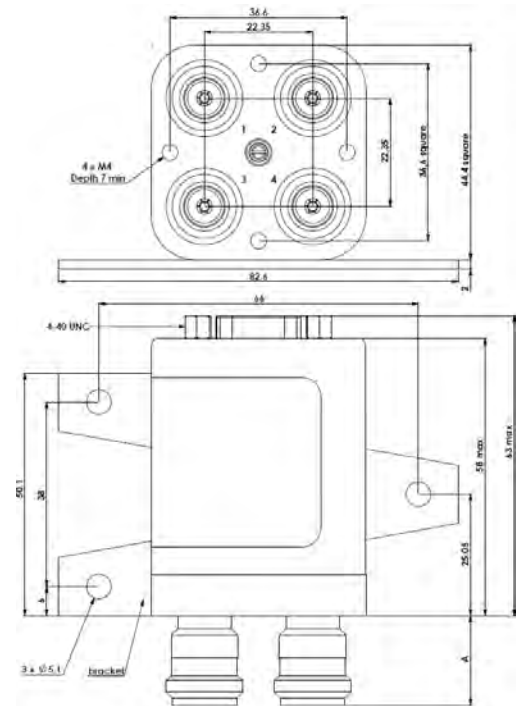
N - BNC - TNC

### TYPICAL OUTLINE DRAWING

With solder pins and bracket



With D-Sub connector and bracket



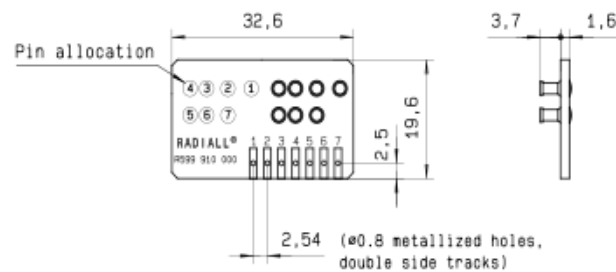
See page 4-13 for pin allocation

Connectors	N	BNC	TNC
A max (mm)	18.8	11	11

### ACCESSORIES

A printed circuit board interface connector (ordered separately) has been designed for easy mounting on terminals.

For DPDT model R577 series => Radiall part number: **R599 910 000**



**Coaxial DPDT - Electrical Schematics**

R577 Series

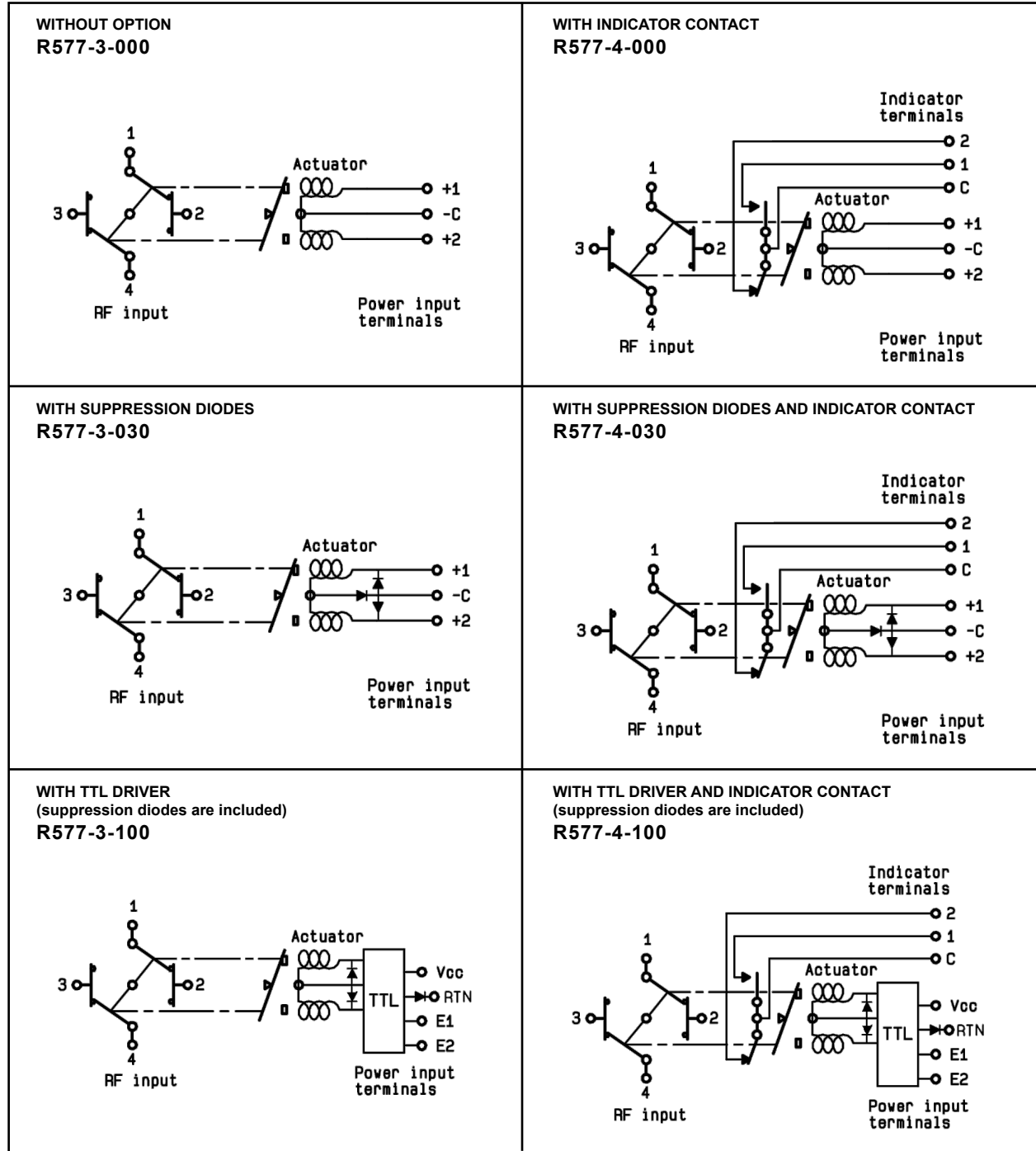
**FAILSAFE**

<p><b>WITHOUT OPTION R577-1-000</b></p> <p>Position: De energized</p> <p>RF input</p> <p>Actuator</p> <p>Power input terminals</p>	<p><b>WITH INDICATOR CONTACT R577-2-000</b></p> <p>Position: De energized</p> <p>RF input</p> <p>Actuator</p> <p>Power input terminals</p> <p>Indicator terminals</p>
<p><b>WITH SUPPRESSION DIODES R577-1-030</b></p> <p>Position: De energized</p> <p>RF input</p> <p>Actuator</p> <p>Power input terminals</p>	<p><b>WITH SUPPRESSION DIODES AND INDICATOR CONTACT R577-2-030</b></p> <p>Position: De energized</p> <p>RF input</p> <p>Actuator</p> <p>Power input terminals</p> <p>Indicator terminals</p>
<p><b>WITH TTL DRIVER (suppression diodes are included) R577-1-100</b></p> <p>Position: De energized</p> <p>RF input</p> <p>Actuator</p> <p>Power input terminals</p> <p>TTL</p>	<p><b>WITH TTL DRIVER AND INDICATOR CONTACT (suppression diodes are included) R577-2-100</b></p> <p>Position: De energized</p> <p>RF input</p> <p>Actuator</p> <p>Power input terminals</p> <p>Indicator terminals</p> <p>TTL</p>

Coaxial DPDT - Electrical Schematics

R577 Series

LATCHING



RAMSES SERIES

**Coaxial DPDT - Electrical Schematics**

R577 Series

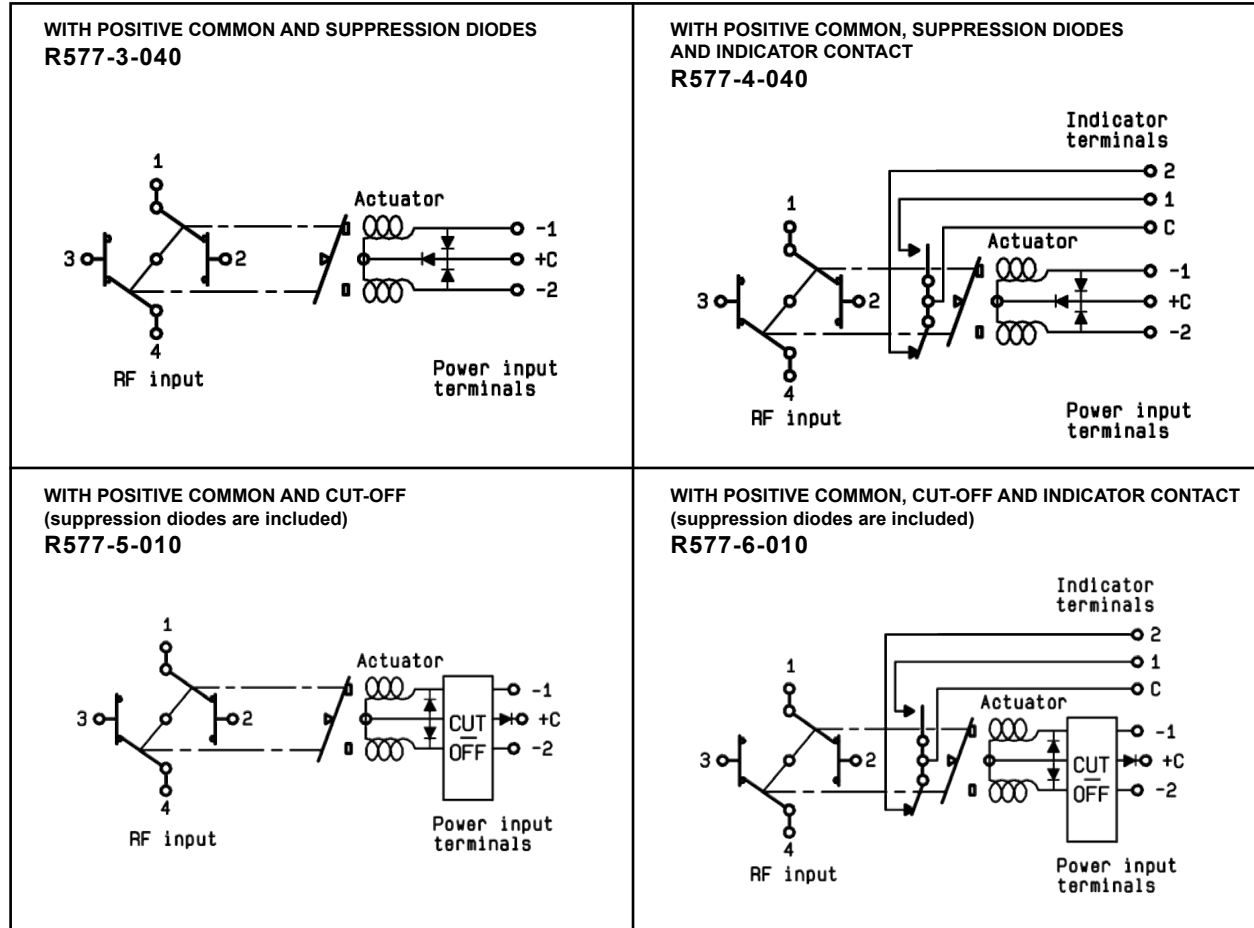
**LATCHING**

<p><b>WITH CUT-OFF</b> (suppression diodes are included) <b>R577-5-000</b></p> <p>RF input</p> <p>Actuator</p> <p>Power input terminals</p> <p>+1 -C +2</p>	<p><b>WITH CUT-OFF AND INDICATOR CONTACT</b> (suppression diodes are included) <b>R577-6-000</b></p> <p>Indicator terminals</p> <p>RF input</p> <p>Actuator</p> <p>Power input terminals</p> <p>+1 -C +2</p>
<p><b>WITH CUT-OFF AND TTL DRIVER</b> <b>R577-5-100</b></p> <p>RF input</p> <p>Actuator</p> <p>Power input terminals</p> <p>Vcc RTN E1 E2</p>	<p><b>WITH CUT-OFF AND INDICATOR CONTACT</b> (suppression diodes are included) <b>R577-6-100</b></p> <p>Indicator terminals</p> <p>RF input</p> <p>Actuator</p> <p>Power input terminals</p> <p>Vcc RTN E1 E2</p>
<p><b>WITH POSITIVE COMMON, NO OPTION</b> <b>R577-3-010</b></p> <p>RF input</p> <p>Actuator</p> <p>Power input terminals</p> <p>-1 +C -2</p>	<p><b>WITH POSITIVE COMMON AND INDICATOR CONTACT</b> <b>R577-4-010</b></p> <p>Indicator terminals</p> <p>RF input</p> <p>Actuator</p> <p>Power input terminals</p> <p>-1 +C -2</p>

## Coaxial DPDT - Electrical Schematics

R577 Series

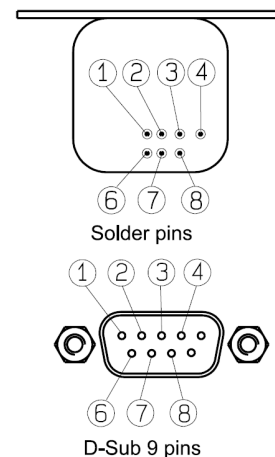
### LATCHING



### PIN IDENTIFICATION

Type	PIN							
	1	2	3	4	5	6	7	8
Failsafe	+		-					
Failsafe + I.C.	+		-			1	2	C
Failsafe + TTL	E		RTN	VCC				
Failsafe + I.C. + TTL	E		RTN	VCC		1	2	C
Latching	-1 or	-2 or	+C or					
Latching + Cut-off	+1	+2	-C					
Latching + I.C.	-1	-2 or	+C or			1	2	C
Latching + I.C. + Cut-off	or +1	+2	-C					
Latching + Cut-off								
Latching + Cut-off + I.C.	E2	E1	RTN	VCC				
Latching + TTL + I.C.	E2	E1	RTN	VCC		1	2	C

### BOTTOM VIEW



## High Performance DPDT

Titanium Series / DPDT up to 40 GHz



Radiall's TITANIUM series switches are optimised to perform at a high level over an extended life cycle. With outstanding RF performance, and a guaranteed insertion loss repeatability of 0.03 dB over a life span of 2.5 million switching cycles. Radiall's TITANIUM switches are perfect for automated test and measurement equipment, as well as signal monitoring devices.

Example of P/N:

R513473148 is a DPDT SMA 20 GHz, latching, Self Cut-Off, diodes, positive common, TTL driver, Indicators, HE10 receptacle with bracket.

### PART NUMBER SELECTION

**R 513**

**RF Connectors:**

- 3: SMA up to 6 GHz
- 4: SMA up to 20 GHz
- F: SMA up to 26.5 GHz
- 8: SMA2.9 up to 40 GHz (2)

**Type:**

- 7: Latching + Self cut-off + Indicators

**Actuator Voltage:**

- 3: 24 Vdc

**TTL Option:**

- 1: With TTL driver (high level)

**Documentation:**

- : Certificate Of conformity
- C: Calibration certificate
- R: Calibration certificate + RF curves

**Actuator Terminals and Fixing:**

- 8: HE 10 receptacle with bracket (1)
- 9: HE 10 receptacle without bracket (1)

**Option:**

- 4: With suppression diodes and positive common

(1): Delivered with 750 mm (30 inches) ribbon cable + HE10 connector  
 (2) Connector SMA2.9 is equivalent to "K connector®" registered trademark of Anritsu.

## High Performance DPDT

Titanium Series / DPDT up to 40 GHz

### GENERAL SPECIFICATIONS

Operating mode		Latching	
Nominal operating voltage (across operating temperature)	Vdc	24 (20/32)	
Coil resistance (+/-10%)	Ω	120	
Nominal operating current at 23°C	mA	200	
Maximum stand-by current	mA	50	
Average power		RF path Cold switching: see RF Power Rating Chart on page 4-19 Hot switching: 1 Watt CW	
TTL input	High Level	3 to 7 V	1.4 mA max at 7 V
	Low Level	0 to 0.8 Volts	-
Indicator specifications		Maximum withstanding voltage	60V
		Maximum current capacity	150 mA
		Maximum « ON » resistance	2.5 Ω
		Minimum « OFF » resistance	100 mΩ
Switching time (Max)	ms	15	
Life (Min)		2.5 million cycles	
Connectors		SMA - SMA 2.9	
Actuator terminals		HE10 ribbon receptacle	
Weight (Max)	g	110	

### ENVIRONMENTAL SPECIFICATIONS

Operating temperature range	-25°C to +75°C
Storage temperature range	-55°C to +85°C
Temperature cycling (MIL-STD-202, Method 107D, Cond.A)	-55°C to +85°C (10 cycles)
Vibration (MIL STD 202, Method 204D, Cond.D)	10-2000 Hz, 10g operating
Shock (MIL STD 202, Method 213B, Cond.C)	50g / 6 ms, 1/2 sine operating
Moisture resistance (MIL STD 202, Method 106E, Cond.E)	65°C, 95% RH, 10 days
Altitude storage (MIL STD 202, Method 105C, Cond.B)	50,000 feet (15,240 meters)
RFI (MIL STD 1344, Method 3008 or IEC 61726)	40dB at 20GHz



## High Performance DPDT

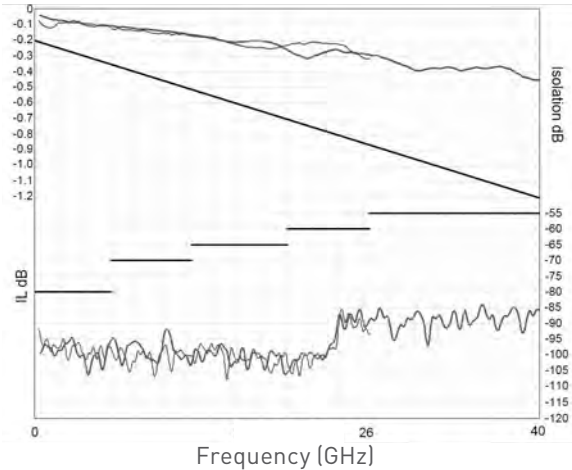
Titanium Series / DPDT up to 40 GHz

### RF PERFORMANCES

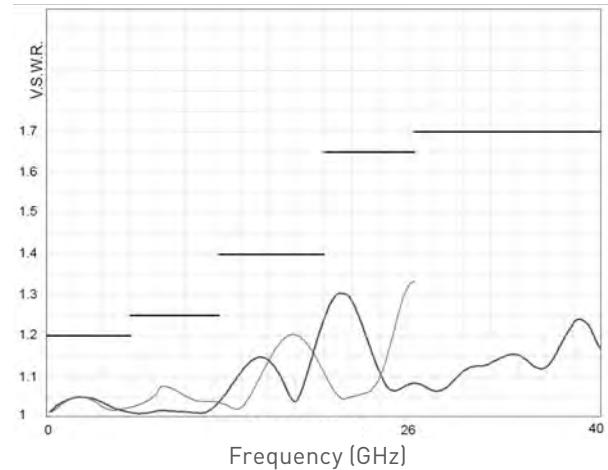
Part Number		R51337314-	R51347314-	R513F7314-	R51387314-
Frequency range	GHz	DC to 6	DC to 20	DC to 26.5	DC to 40
Impedance	Ω	50			
Insertion Loss (Max)	dB	0.2 + 0.025 x frequency (GHz)			
Isolation (Min)	dB	80	DC to 6 GHz 80 6 to 12.4 GHz 70 12.4 to 20 GHz 65	DC to 6 GHz 80 6 to 12.4 GHz 70 12.4 to 20 GHz 65 20 to 26.5 GHz 60	DC to 6 GHz 80 6 to 12.4 GHz 70 12.4 to 20 GHz 65 20 to 26.5 GHz 60 26.5 to 40 GHz 55
V.S.W.R. (Max)		1.20	DC to 6 GHz 1.20 6 to 12.4 GHz 1.25 12.4 to 18 GHz 1.40 18 to 20 GHz 1.65	DC to 6 GHz 1.20 6 to 12.4 GHz 1.25 12.4 to 18 GHz 1.40 18 to 26.5 GHz 1.65	DC to 6 GHz 1.20 6 to 12.4 GHz 1.25 12.4 to 18 GHz 1.40 18 to 26.5 GHz 1.65 26.5 to 40 GHz 1.70
Repeatability (measured at 25°C)		0.03 dB			0.05 dB

### TYPICAL RF PERFORMANCES

Insertion Loss and Isolation



V.S.W.R.



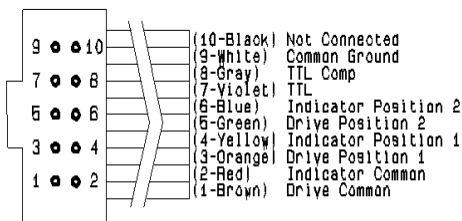
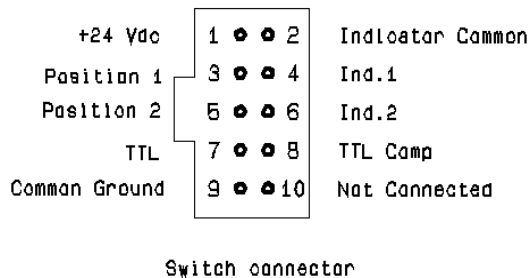
SMA — SMA 2.9 —

## High Performance DPDT

Titanium Series / DPDT up to 40 GHz

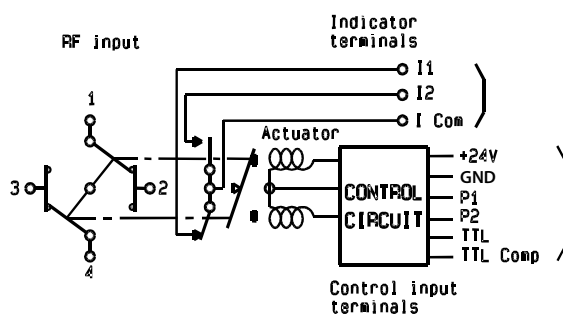
### DRIVING THE SWITCH

Transfer switches are configured with two positions. Each RF path can be closed by applying ground or TTL "High" to the corresponding "driver" pin.



Mating cable connector

### RF SCHEMATIC DIAGRAM



	RF continuity	Indicator
Position 1	1-2 / 3-4	ICom - I1
Position 2	1-3 / 2-4	ICom - I2

#### Standard drive

- Connect pin 9 to ground (See note)
  - Connect pin 1 to supply (+20 VDC to +32 VDC)
  - Select (close) desired RF paths by applying ground to the corresponding "drive" pin (Ex: apply ground to pin 3 to close RF path 1-2 and 3-4)
  - To select the second path, ensure that the unwanted RF path "drive" pin is disconnected from ground. Apply ground to the "drive" pin which corresponds to the desired RF paths
- (Ex: apply ground to pin 5 to close RF path 1-3 and 2-4)

#### TTL drive (Dual line)

- Connect pin 9 to ground
- Connect pin 1 to supply (+20 VDC to +32 VDC)
- Select (close) desired RF path by applying TTL "High" to the corresponding "drive" pin (Ex: apply TTL "High" to pin 7 and TTL "Low" to pin 8 to close RF paths position 1)
- To select the second path, ensure that the unwanted RF path "drive" pins are in TTL "Low" position. Apply TTL "High" to the "drive" pin which correspond to the desired RF path and TTL "low" to the undesired. (Ex: apply TTL "High" to pin 8 and TTL "Low" to pin 7 to close RF paths position 2)

#### TTL drive (Single line)

- Connect pin 9 to ground
- Connect pin 1 to supply (+20 VDC to +32 VDC)
- Connect pin 8 to TTL "High"
- Select (close) position 1 by applying TTL "High" to pin 7 (Ex: apply TTL "High" to pin 7 to close RF paths 1-2 and 3-4)
- Select position 2 by applying TTL "Low" to pin 7 (Ex: apply TTL "Low" to pin 7 to close RF paths 1-3 and 2-4)

#### Note

Pin 9 does not need to be grounded for the switch to operate in standard drive. If pin 9 is not grounded, the position indicators will only function while the appropriate drive is applied. Therefore, if a pulse drive is used and continuous indicator operation is required, pin 9 must be grounded.

## High Performance DPDT

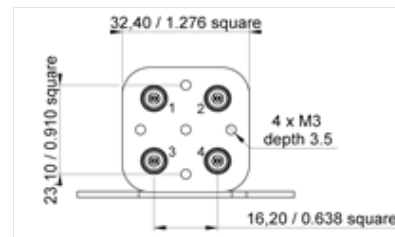
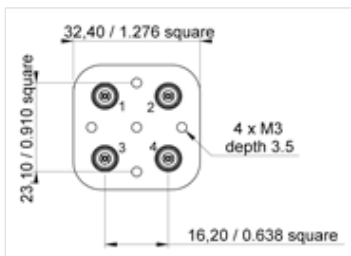
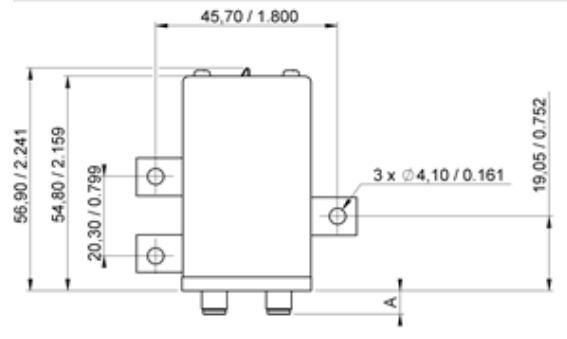
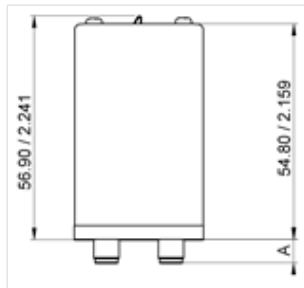
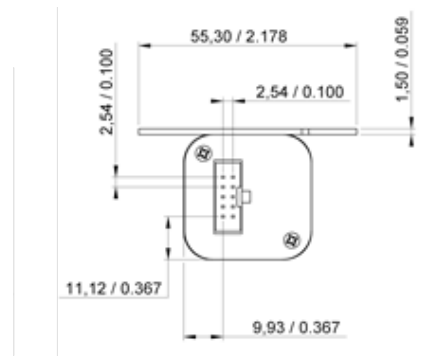
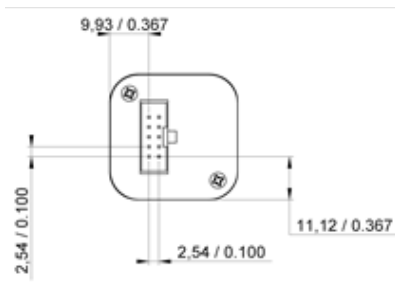
Titanium Series / DPDT up to 40 GHz

### RF PERFORMANCES

	Pin number	Function
	2	Indicator Common
	4	Indicator Position '1'
	6	Indicator Position '2'

The electronic position indicators use photo-MOS transistors which are driven by the mechanical position of the RF paths moving elements. The circuitry consists of a common which can be connected to an output corresponding to selected RF path. The photo-MOS transistors are configured for AC and/or DC operation. The electronic position indicators require the supply (20 to 32 VDC) to be connected to pin 1 and ground connected to pin 9.

### TYPICAL OUTLINE DRAWING



All dimensions are in millimeters / inches

Connectors	SMA	SMA 2.9
A max (mm)	7.4	6.3

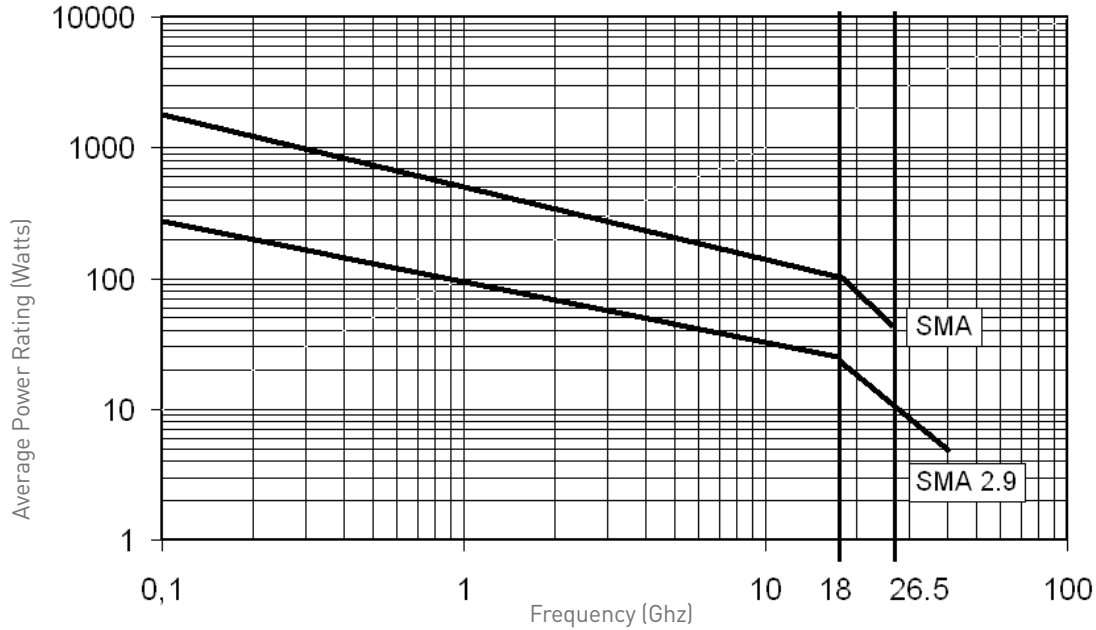
## High Performance DPDT

Titanium Series / DPDT up to 40 GHz

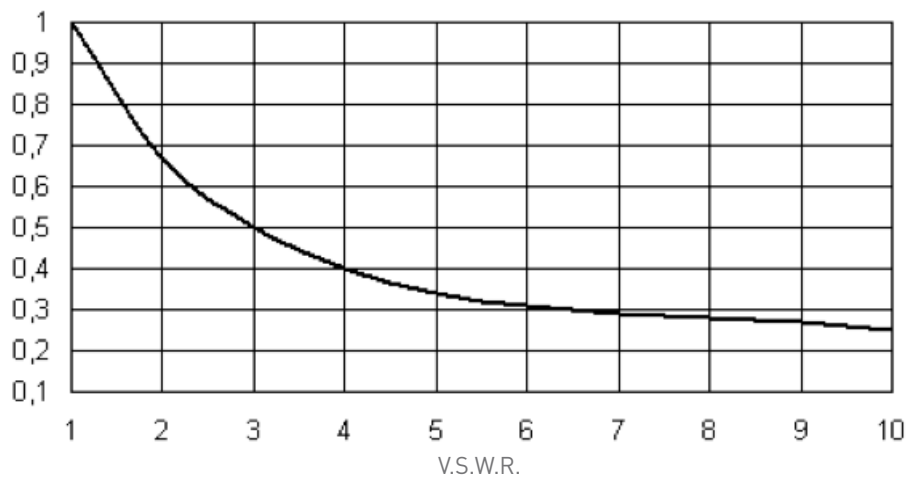
### POWER RATING CHART

This graph is based on the following conditions:

- Ambient temperature: + 25°C
- Sea level
- V.S.W.R.: 1 and cold switching



### DERATING FACTOR VERSUS V.S.W.R.



## High Performance DPDT

Platinum Series / DPDT up to 40 GHz



Radiall's PLATINUM series switches are optimised to perform at a high level over an extended life cycle. With outstanding RF performance, and a guaranteed insertion loss repeatability of 0.03 dB over a life span of 10 million switching cycles. PLATINUM series switches are perfect for automated test and measurement equipment, as well as signal monitoring devices.

Example of P/N:

R593F73148 is a DPDT SMA 26.5 GHz, latching, Self Cut-Off, diodes, positive common, TTL driver, Indicators, HE10 receptacle with bracket.

### PART NUMBER SELECTION

**R 593**

**RF Connectors:**

- 3: SMA up to 6 GHz
- 4: SMA up to 20 GHz
- F: SMA up to 26.5 GHz
- 8: SMA 2.9 up to 40 GHz (2)

**Type:**

- 7: Latching + Self cut-off + Indicators

**Actuator Voltage:**

- 3: 24 Vdc

**TTL Option:**

- 1: With TTL driver (high level)

**Documentation:**

- : Certificate Of conformity
- C: Calibration certificate
- R: Calibration certificate + RF curves

**Actuator Terminals and Fixing**

- 8: HE 10 receptacle with bracket (1)
- 9: HE 10 receptacle without bracket (1)

**Option:**

- 4: With suppression diodes and positive common

(1): Delivered with 750 mm (30 inches) ribbon cable + HE10 connector

(2): Connector SMA 2.9 is equivalent to "K connector®", registered trademark of Anritsu

## High Performance DPDT

Platinum Series / DPDT up to 40 GHz

PLATINUM SERIES

### GENERAL SPECIFICATIONS

Operating mode		Latching	
Nominal operating voltage (across operating temperature)	Vdc	24 (20/32)	
Coil resistance (+/-10%)	Ω	120	
Nominal operating current at 23°C	mA	200	
Maximum stand-by current	mA	50	
Average power		RF path Cold switching: see RF Power Rating Chart on page 4-25 Hot switching: 1 Watt CW	
TTL input	High Level	3 to 7 V	1.4 mA max at 7 V
	Low Level	0 to 0.8 Volts	-
		Maximum withstanding voltage	60V
		Maximum current capacity	150 mA
		Maximum « ON » resistance	2.5 Ω
		Minimum « OFF » resistance	100 MΩ
Switching time (Max)	ms	15	
life (Min)	SMA	10 million cycles	
	SMA 2.9	5 million cycles	
Connectors		SMA - SMA 2.9	
Actuator terminals		HE10 ribbon receptacle	
Weight (Max)	g	110	

### ENVIRONMENTAL SPECIFICATIONS

Operating temperature range	-25°C to +75°C
Storage temperature range	-55°C to +85°C
Temperature cycling (MIL-STD-202, Method 107D, Cond.A)	-55°C to +85°C (10 cycles)
Vibration (MIL STD 202, Method 204D, Cond.D)	10-2000 Hz, 10g operating
Shock (MIL STD 202, Method 213B, Cond.C)	50g / 6 ms, 1/2 sine operating
Moisture resistance (MIL STD 202, Method 106E, Cond.E)	65°C, 95% RH, 10 days
Altitude storage (MIL STD 202, Method 105C, Cond.B)	50,000 feet (15,240 meters)
RFI (MIL STD 1344, Method 3008 or IEC 61726)	40 dB at 20 GHz

## High Performance DPDT

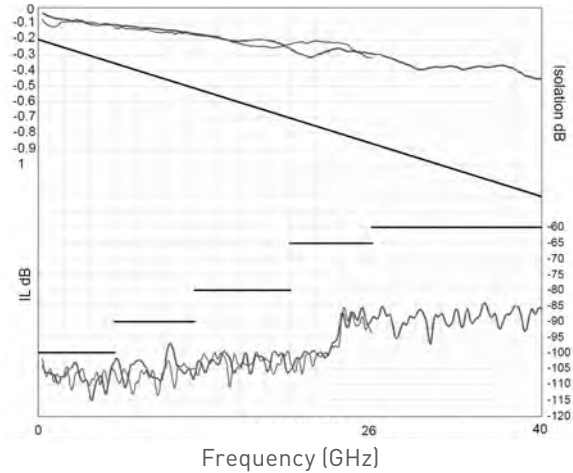
Platinum Series / DPDT up to 40 GHz

### RF PERFORMANCES

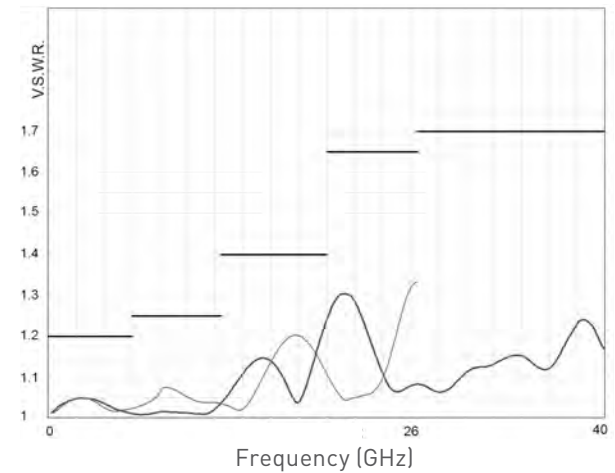
Part Number		R59337314-	R59347314-	R593F7314-	R59387314-
Frequency range	GHz	DC to 6	DC to 20	DC to 26.5	DC to 40
Impedance	Ω	50			
Insertion Loss (Max)	db	0.2 + 0.025 x frequency (GHz)			
Isolation (Min)	dB	100	DC to 6 GHz 100 6 to 12.4 GHz 90 12.4 to 20 GHz 80	DC to 6 GHz 100 6 to 12.4 GHz 90 12.4 to 20 GHz 80 20 to 26.5 GHz 65	DC to 6 GHz 100 6 to 12.4 GHz 90 12.4 to 20 GHz 80 20 to 26.5 GHz 65 26.5 to 40 GHz 60
V.S.W.R. (Max)		1.20	DC to 6 GHz 1.20 6 to 12.4 GHz 1.25 12.4 to 18 GHz 1.40 18 to 20 GHz 1.65	DC to 6 GHz 1.20 6 to 12.4 GHz 1.25 12.4 to 18 GHz 1.40 18 to 20 GHz 1.65	DC to 6 GHz 1.20 6 to 12.4 GHz 1.25 12.4 to 18 GHz 1.40 18 to 26.5 GHz 1.65 26.5 to 40 GHz 1.70
Repeatability (measured at 25°C)		0.03 dB			0.05 dB

### TYPICAL RF PERFORMANCES

Insertion Loss and Isolation



V.S.W.R.



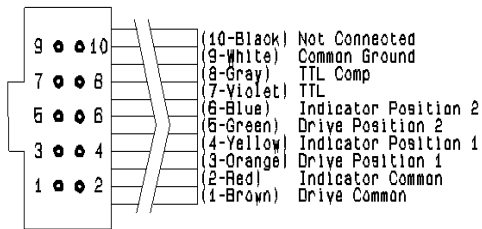
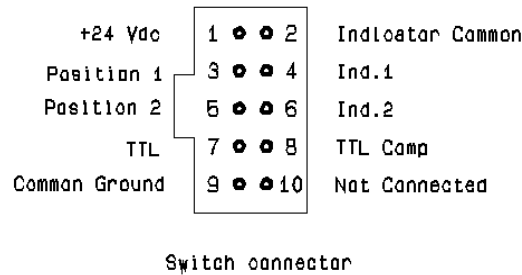
SMA — SMA 2.9 —

## High Performance DPDT

Platinum Series / DPDT up to 40 GHz

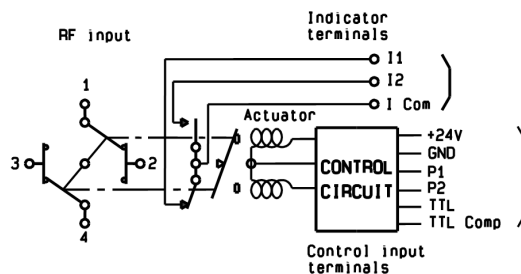
### DRIVING THE SWITCH

Transfer switches are configured with two positions. Each RF path can be closed by applying Ground or TTL "High" to the corresponding "driver" pin.



Mating cable connector

### RF SCHEMATIC DIAGRAM



	RF continuity	Indicator
Position 1	1-2 / 3-4	ICom - I1
Position 2	1-3 / 2-4	ICom - I2

#### Standard drive

- Connect pin 9 to ground (See note)
- Connect pin 1 to supply (+20 VDC to +32 VDC)
- Select (close) desired RF paths by applying ground to the corresponding "drive" pin (Ex: apply ground to pin 3 to close RF path 1-2 and 3-4)
- To select the second path, ensure that the unwanted RF path "drive" pin is disconnected from ground. Apply ground to the "drive" pin which corresponds to the desired RF paths (Ex: apply ground to pin 5 to close RF path 1-3 and 2-4)

#### TTL drive (Dual line)

- Connect pin 9 to ground
- Connect pin 1 to supply (+20 VDC to +32 VDC).
- Select (close) desired RF path by applying TTL "High" to the corresponding "drive" pin (Ex: apply TTL "High" to pin 7 and TTL "Low" to pin 8 to close RF paths position 1)
- To select the second path, ensure that the unwanted RF path "drive" pins are in TTL "Low" position. Apply TTL "High" to the "drive" pin which corresponds to the desired RF path and TTL "low" to the undesired (Ex: apply TTL "High" to pin 8 and TTL "Low" to pin 7 to close RF paths position 2)

#### TTL drive (Single line)

- Connect pin 9 to ground
- Connect pin 1 to supply (+20 VDC to +32 VDC)
- Connect pin 8 to TTL "High"
- Select (close) position 1 by applying TTL "High" to pin 7 (Ex: apply TTL "High" to pin 7 to close RF paths 1-2 and 3-4)
- Select position 2 by applying TTL "Low" to pin 7 (Ex: apply TTL "Low" to pin 7 to close RF paths 1-3 and 2-4)

#### Note

Pin 9 does not need to be grounded for the switch to operate in standard drive. If pin 9 is not grounded, the position indicators will only function while the appropriate drive is applied. Therefore, if a pulse drive is used and continuous indicator operation is required, pin 9 must be grounded.



## High Performance DPDT

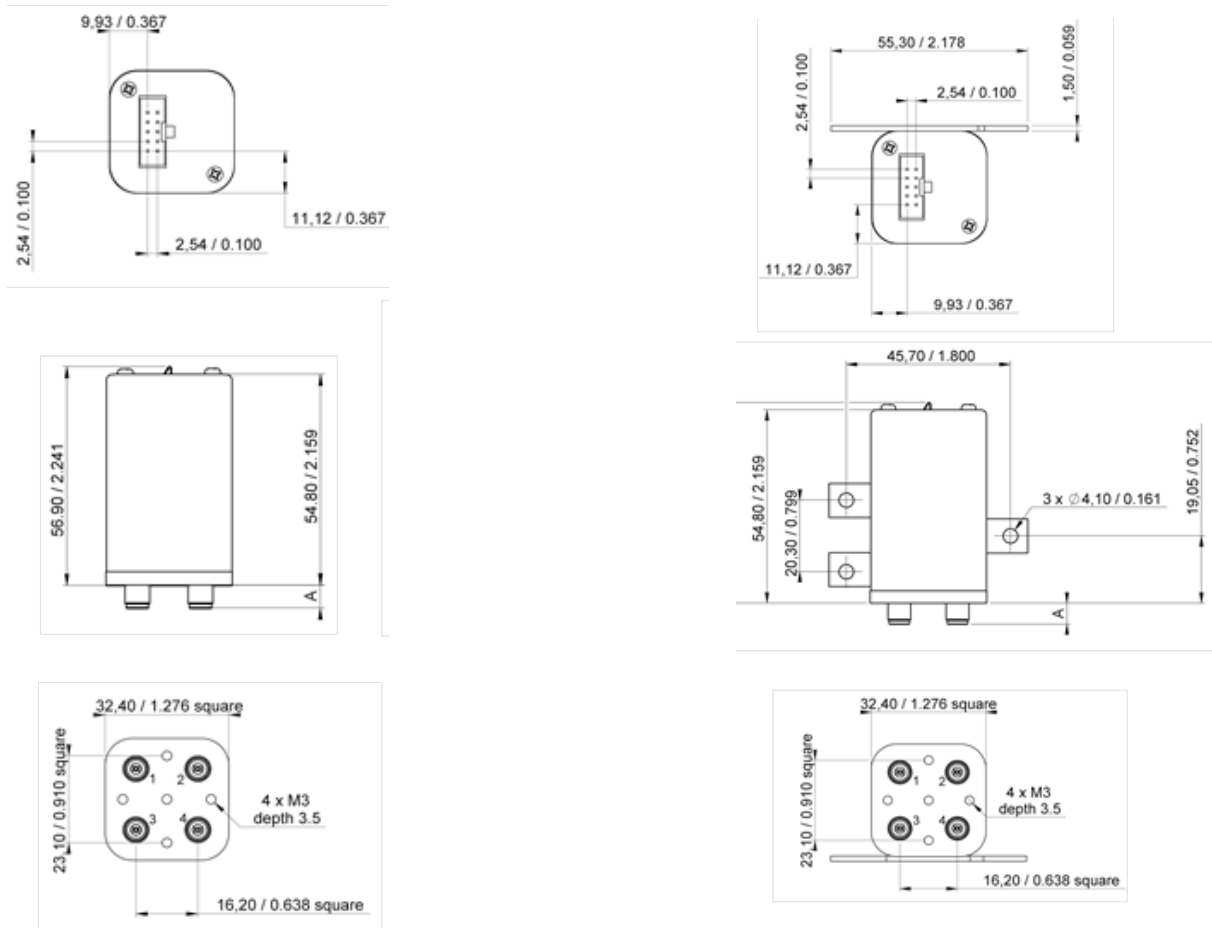
Platinum Series / DPDT up to 40 GHz

### RF PERFORMANCES

	Pin number	Function
	2	Indicator Common
	4	Indicator Position *1*
	6	Indicator Position *2*

The electronic position indicators use photo-MOS transistors which are driven by the mechanical position of the RF paths moving elements. The circuitry consists of a common which can be connected to an output corresponding to selected RF path. The photo-MOS transistors are configured for AC and/or DC operation. The electronic position indicators require the supply (20 to 32 VDC) to be connected to pin 1 and ground connected to pin 9.

### TYPICAL OUTLINE DRAWING



All dimensions are in millimeters / inches

Connectors	SMA	SMA2.9
A max (mm)	7.4	6.3

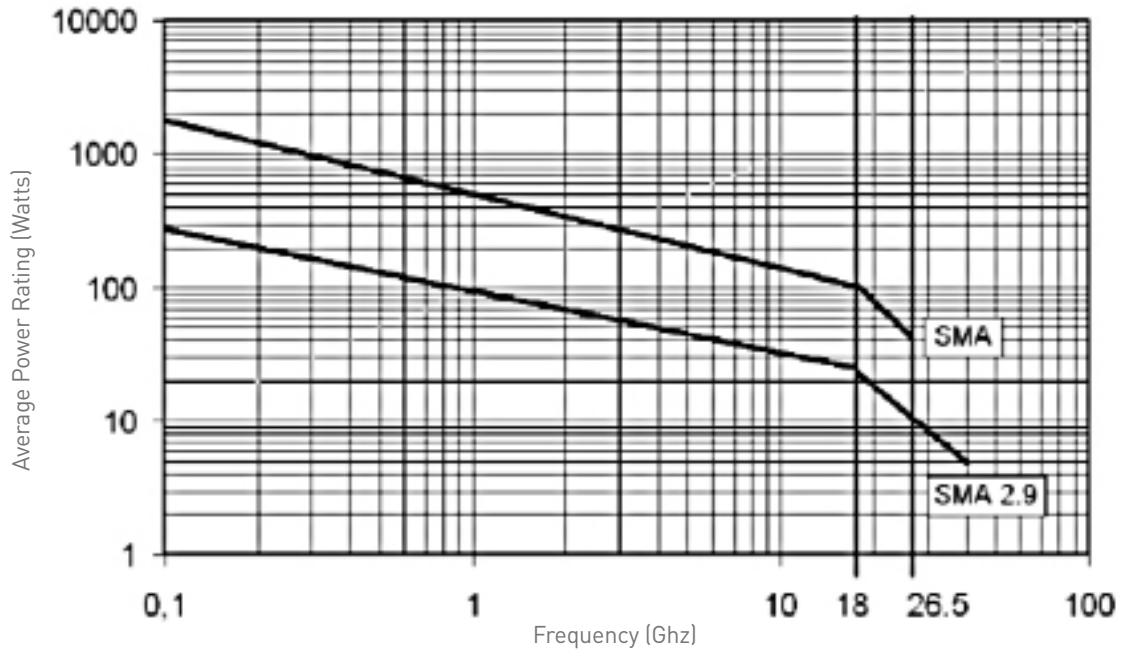
## High Performance DPDT

Platinum Series / DPDT up to 40 GHz

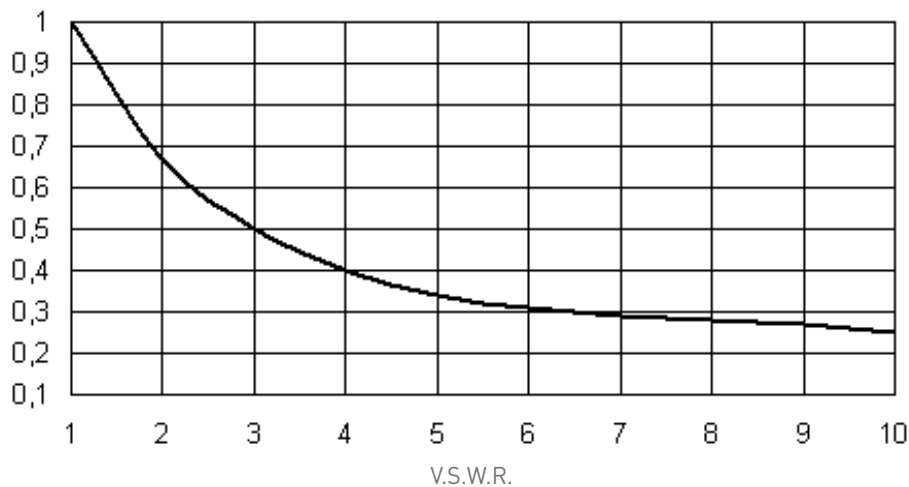
### POWER RATING CHART

This graph is based on the following conditions:

- Ambient temperature: + 25°C
- Sea level
- V.S.W.R.: 1 and cold switching



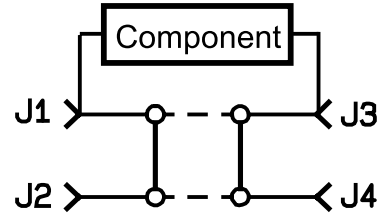
### DERATING FACTOR VERSUS V.S.W.R.



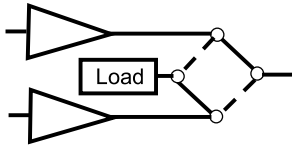
## Optional Features for DPDT Switches

### GENERAL

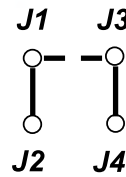
A microwave circuit or component can be inserted into a transmission line by using a DPDT switch as a by-pass product. In event that the short-circuit of the microwave circuit or component is undesirable, the J1/J3 path can be left out (see application option below).



#### Examples of dedicated application options:



This DPDT with a cable load is used for redundancy purposes for 2 amplifiers, one working, the other one in stand-by.



This true By-pass Switch is based on a DPDT with only 3 RF ways instead of 4.

Component inserted in J2/J4  
 POS 1: J1 to J3: Direct line  
 POS 2: J1 to J3: Component line



This DPDT has been fitted with a specific bracket to fulfill a specific customer request.



Subminiature DPDT developed for test bench applications requiring low RF leakage.

SECTION 5



SPnT



**Contents**

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 SPnT up to 40 GHz: R591 Series ..... 5-2 to 5-4

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 R591 Series ..... 5-5 to 5-7

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**ACCESSORIES SPnT**  
 RAMSES Concept: All Series ..... 5-27 to 5-31

**Electrical Schematics**  
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**TITANIUM Series**  
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**PLATINUM Series**  
 High performance SPnT Terminated up to 40 GHz: R594 Series ..... 5-46 to 5-53

**Optional Features** ..... 5-54 & 5-37

**SPNT PART NUMBER SELECTION GUIDE\***

Digital Position		R1-3/model	4: RF connectors													5: Type	6: Voltage			7: Pos.	8: Options				9: Terminals			10: Documentation									
Series	Configuration		Not terminated	Terminated	SMA 3 GHz	SMA 6 GHz	SMA 18 GHz	SMA 20 GHz	SMA 26.5 GHz	SMA 29.26.5 GHz	SMA 2.9 40 GHz	QMA 6 GHz	DIN 1/6/5/6 2.5 GHz	N 3 GHz	N 12.4 GHz	BNC 3 GHz	TNC 3 GHz	TNC 12.4 GHz	Normally open	Latching	12V	24V	28V	Number of positions	Without option	Positive common	TTL driver	Suppression diodes	Positive common and suppression diodes	BCD TTL driver compatible	Solder pins	D-Sub connector	Micro-D connector	HE 10 receptacle	Certificate of conformity	Calibration certificate	Calibration certificate + RF curves
SUBMIN.	SPnT	R591	-	-	-	3	-	-	7	8	E	-	-	-	-	-	-	-	0	2/6	2	-	3	4/6	0	1	2	3	4	0	-	5	-	-	-	-	
RAMSES	SPnT	R57	3	4	3	-	4	-	F	-	8	E	9	0	1	2	5	6	0/1	2/3/4/5/8/9	2	-	3	0-9	0	1	2	3	4	8	0	5	-	-	-	-	-
TITANIUM	SPnT	R51	2	4	-	3	-	4	F	-	8	-	-	-	-	-	-	-	-	7	-	3	-	4/6	-	1	2	-	-	-	-	-	-	7	-	C	R
PLATINUM	SPnT	R594	-	-	-	3	-	4	F	-	8	-	-	-	-	-	-	-	-	4/7	-	3	-	4/6	-	1	2	-	-	-	-	-	-	7	-	C	R

Example of P/N: R591703400 is a SP4T SMA up to 26.5 GHz, normally open, 28 Vdc, without option, solder pins.

\*For part number creation and available options, see detailed part number selection for each series.

## SUBMINIATURE SPnT up to 40 GHz

SMA – SMA 2.9 – QMA



Radiall's R591 coaxial subminiature switches have a typical operating life exceeding 25 million cycles. Providing excellent RF performance, repeatability, and a guaranteed life of 10 million cycles make these switches ideal for Automated Test Equipment (ATE) and other measurement applications. These subminiature switches are also an excellent choice for Mil/Aero applications due to their small size, light weight, and outstanding shock and vibration handling capabilities.

Example of P/N:

R591302420 is a SP4T SMA up to 6 GHz, Normally open, 12 Vdc with TTL driver and solder pins.

### PART NUMBER SELECTION

## R 591

#### RF Connectors:

- 3: SMA up to 6 GHz
- 7: SMA up to 26.5 GHz
- 8: SMA 2.9 up to 40 GHz (6)
- E: QMA up to 6 GHz (5)

#### Type:

- 0: Normally open
- 2: Latching, global reset
- 6: Latching, separated reset (1)

#### Actuator Voltage:

- 2: 12 Vdc
- 3: 28 Vdc

#### Actuator Terminals:

- 0: Solder pins
- 5: Micro-D connector

#### Options:

- 0: Without option
- 1: Positive common (1)
- 2: With TTL driver (2) (3) (4)
- 3: With suppression diodes
- 4: With suppression diodes and positive common

#### Number of positions:

- 4: 4 positions
- 6: 6 positions

(1): Available with "solder pins" models only

(2): Polarity is not relevant to application for switches with TTL driver

(3): Suppression diodes are already included with TTL option

(4): Available with "normally open" models only



(5): The QLF trademark (Quick Lock Formula®) standard applies to QMA and QN series and guarantees the full intermateability between suppliers using this trademark.

Using QLF certified connectors also guarantees the specified level of RF performances.

(6): Connector SMA2.9 is equivalent to "K connector®", registered trademark of Anritsu

## SUBMINIATURE SPnT up to 40 GHz

SMA – SMA 2.9 – QMA

### GENERAL SPECIFICATIONS

Operating mode		Normally open		Latching	
Nominal operating voltage (across operating temperature)	Vdc	12 (10.2 / 13)	28 (21 / 30)	12 (10.2 / 13)	28 (21 / 30)
Coil resistance (+/-10%)	Ω	48	250	60	285
Operating current at 23°C	mA	250	110	200	98
Average power		See RF Power Rating Chart page <b>1-13</b>			
TTL input	High Level	2.2 to 5.5 Volts		800µA max 5.5 Volts	
	Low Level	0 to 0.8 Volts		20µA max 0.8 Volts	
Switching time (Max)	ms	10			
Life		10 million cycles (SMA, QMA) / 2 million cycles (SMA2.9)			
Connectors		SMA - QMA - SMA 2.9			
Actuator terminals		Solder Pins: double row connector for wrapping, soldering (250°C max / 30 sec), or connecting to 2.54 mm pitch female connector. 9 pin micro-D receptacle M83513/07-A according to MIL-C-85513.			
Operating temperature range		-40°C to +85°C			
Storage temperature range		-55°C to +85°C			
Sine vibration (According to MIL STD 202, Method 204D, Cond. D)		10-2000 Hz, 20g	operating		
Random vibration (According to MIL STD 202, Method 214A, Profile I, Cond. F)		50-2000 Hz, 20.71g	operating		
Shock (According to MIL STD 202, Method 213B, Cond. C)		100g / 6 ms, 1/2 sine	operating		

### RF PERFORMANCES

Connectors	Frequency range GHz		V.S.W.R. (max)	Insertion loss (max) dB	Isolation (min) dB	Impedance Ω
QMA / SMA	DC - 6	DC - 3	1.20	0.20	80	50
		3 - 6	1.30	0.30	70	
SMA	DC - 26-5	DC - 3	1.20	0.20	80	
		3 - 8	1.30	0.30	70	
		8 - 12.4	1.40	0.40	60	
		12.4 - 18	1.50	0.50	60	
		18 - 26.5	1.60	0.60	55	
SMA 2.9	DC - 40	DC - 3	1.20	0.20	80	
		3 - 8	1.30	0.30	70	
		8 - 12.4	1.40	0.40	60	
		12.4 - 18	1.50	0.50	60	
		18 - 26.5	1.70	0.70	55	
		26.5 - 40	2.20	1.10	45	

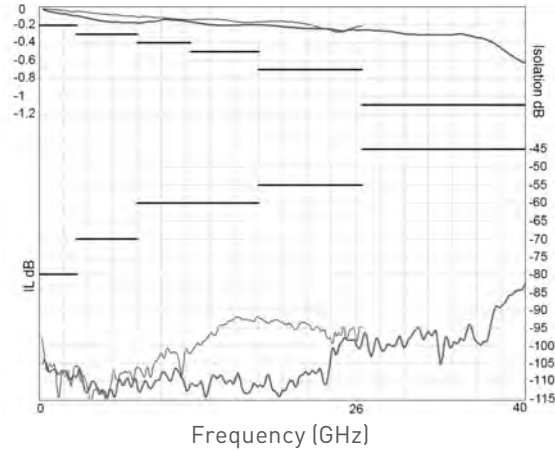
See page 5-4 for typical RF performances

## SUBMINIATURE SPnT up to 40 GHz

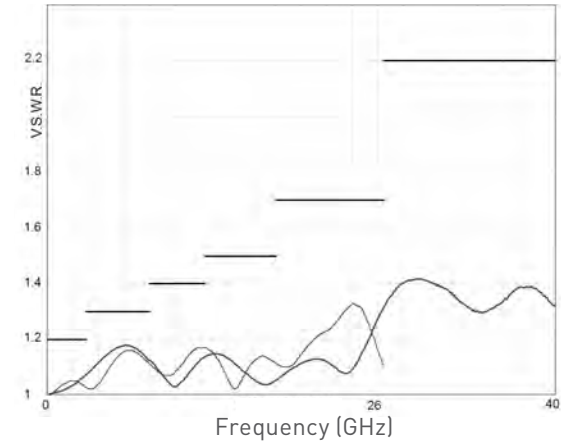
SMA – SMA 2.9 – QMA

### TYPICAL RF PERFORMANCES

#### Insertion Loss and Isolation

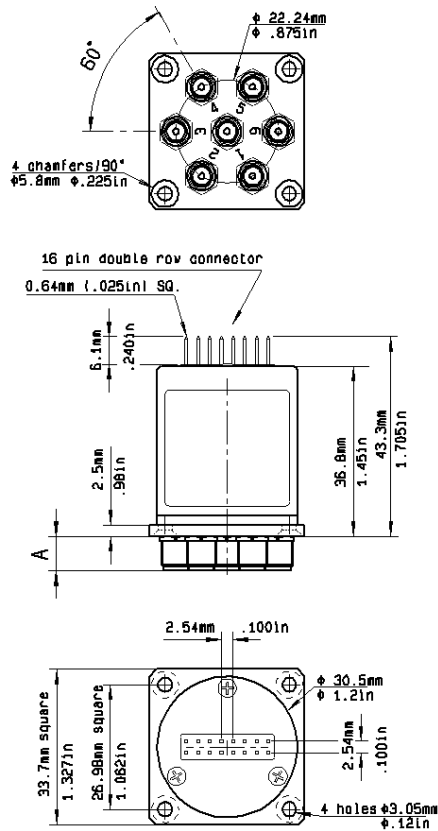


#### V.S.W.R.

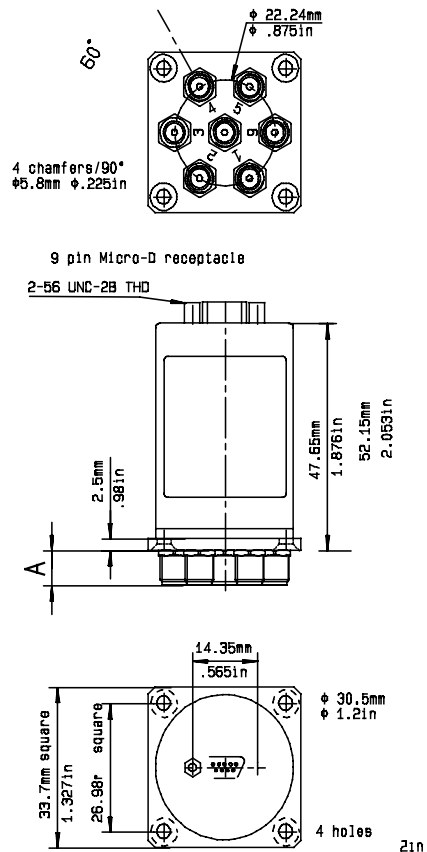


### TYPICAL OUTLINE DRAWING (1)

#### Solder pin Model



#### Micro-D Model



(1) : For SP4T, ways 3 and 6 not connected  
All dimensions are in mm/inches

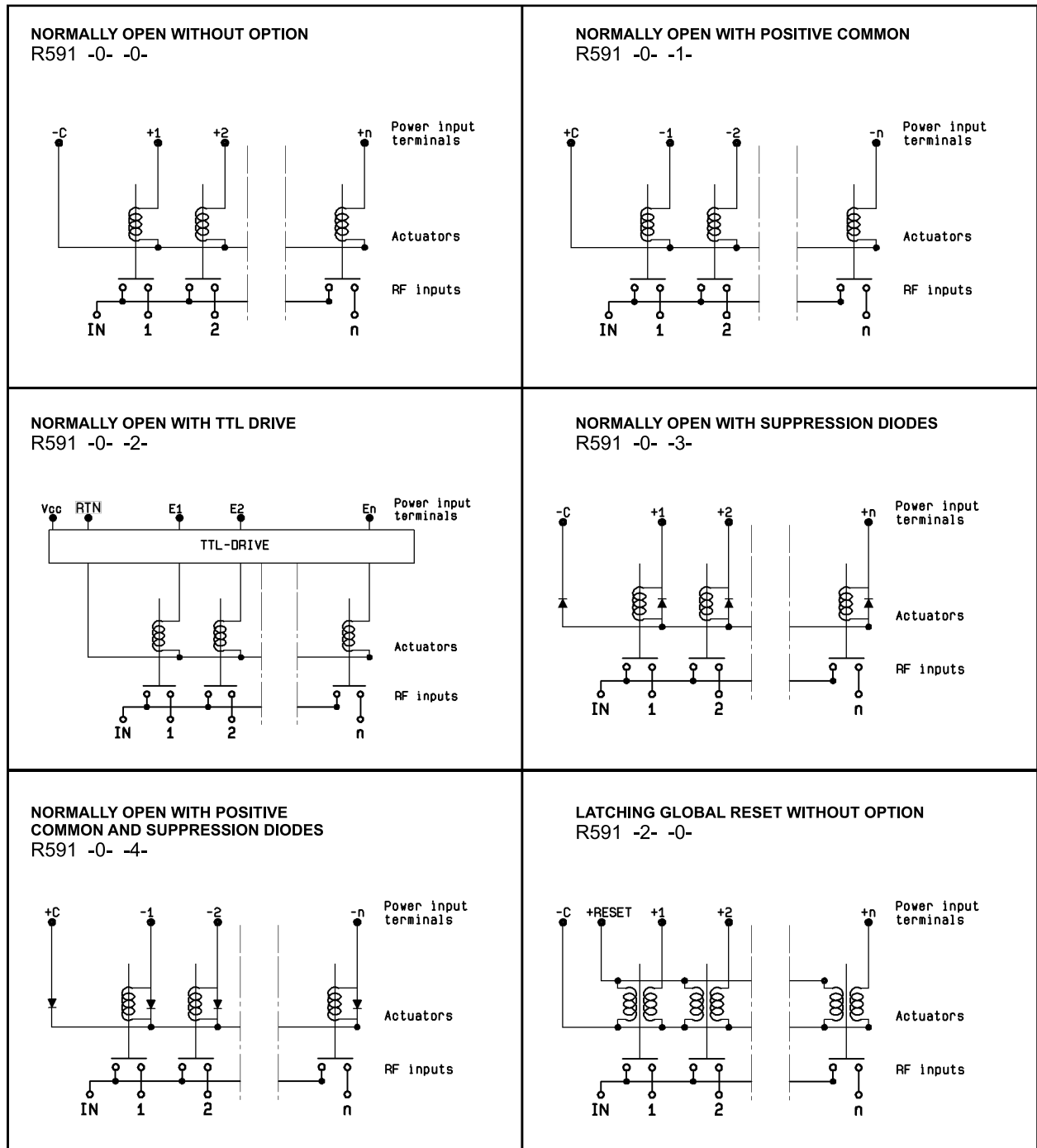
Connectors	SMA	SMA 2.9	QMA
A max (mm/in.)	7.4/0.291	6.3/0.248	10.8/0.425



**SUBMINIATURE SPnT up to 40 GHz**

SMA – SMA 2.9 – QMA

**R591 SERIES ELECTRICAL SCHEMATICS**

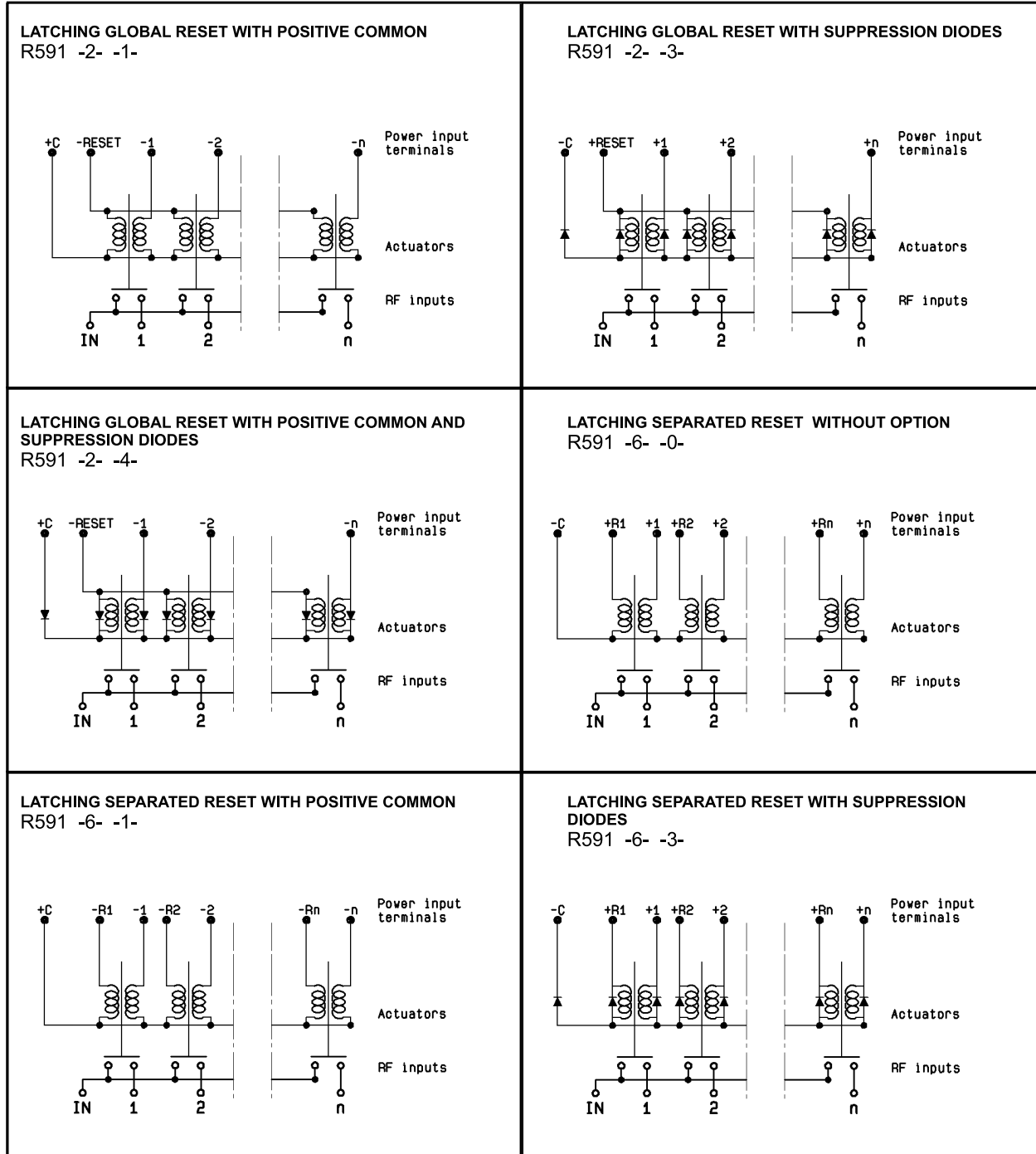


SUBMINIATURE SERIES

**SUBMINIATURE SPnT up to 40 GHz**

SMA – SMA 2.9 – QMA

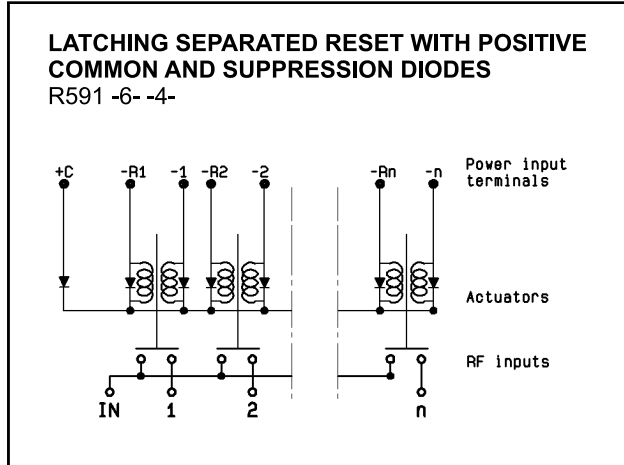
**R591 SERIES ELECTRICAL SCHEMATICS**



## SUBMINIATURE SPnT up to 40 GHz

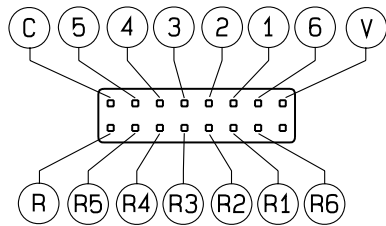
SMA – SMA 2.9 – QMA

### R591 SERIES ELECTRICAL SCHEMATICS

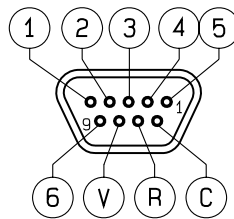


### PIN IDENTIFICATION

Solder pins (top view)\*



9 pin Micro-D (top view)



\*Compatible with 2.54 mm pitch double row

16 contact female connector

NC: not connected

For SP4T, ways 3 and 6 not connected

Pin R = reset of all paths



Type		C	V	1	2	3	4	5	6	R	R1	R2	R3	R4	R5	R6
Normally open	Negative common	-C	NC	+1	+2	+3	+4	+5	+6	NC	NC	NC	NC	NC	NC	NC
	Positive common	+C	NC	-1	-2	-3	-4	-5	-6	NC	NC	NC	NC	NC	NC	NC
Latching global reset	Negative common	-C	NC	+1	+2	+3	+4	+5	+6	+reset	NC	NC	NC	NC	NC	NC
	Positive common	+C	NC	-1	-2	-3	-4	-5	-6	-reset	NC	NC	NC	NC	NC	NC
Latching individual reset*	Negative common	-C	NC	+1	+2	+3	+4	+5	+6	NC	+res.1	+res.2	+res.3	+res.4	+res.5	+res.6
	Positive common	+C	NC	-1	-2	-3	-4	-5	-6	NC	-res.1	-res.2	-res.3	-res.4	-res.5	-res.6
Normally open with TTL drive		RTN	VCC	E1	E2	E3	E4	E5	E6	NC	NC	NC	NC	NC	NC	NC

\*Available with "solder pins" models only.

## SPnT Terminated & non Terminated up to 40 GHz

SMA – SMA 2.9 – QMA – DIN 1.6 / 5.6



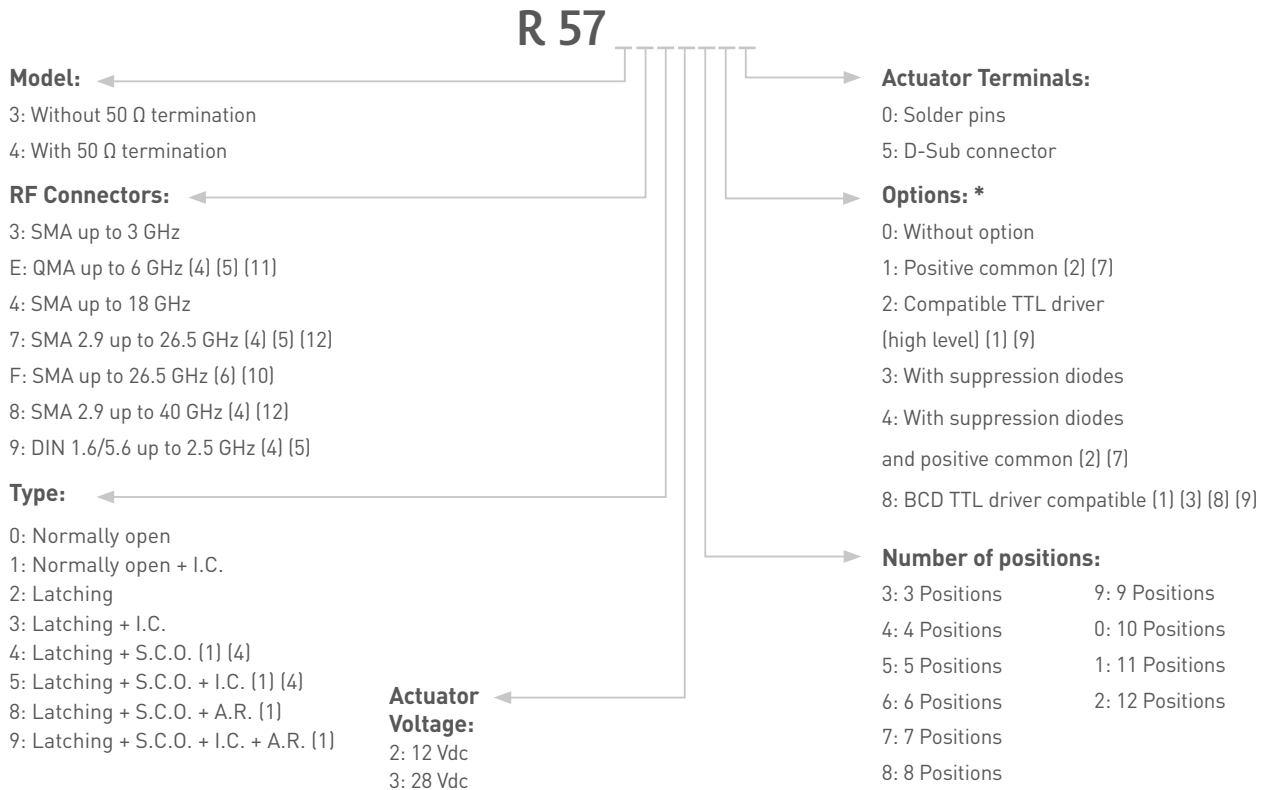
Radiall's R573 & R574 multithrow coaxial switches are offered in many configurations (over 40,000 possible combinations) including Terminated and non Terminated options. Radiall offers reliable products, with shorter delivery times and competitive pricing. Excellent typical RF performance make RAMSES switches (40 GHz) ideal for Automated Test Equipment (ATE) and other measurement applications.

These switches are suitable for defense, industrial, instrumentation and telecommunication applications.

Example of P/N:

R574453605 is a terminated SP6T SMA up to 18 GHz, Latching, Self Cut-Off, 28 Vdc, Indicators and male 25 pin D-Sub connector.

### PART NUMBER SELECTION



I.C.: Indicator contact / S.C.O. : Self Cut-Off / A.R. : Auto Reset

(1): These models are already equipped with suppression diodes

(2): Standard products are equipped with negative common

(3): Latching BCD driver enables also a global reset through driver code 0000 [see BCD logic coding page 1-11]

(4): Available only up to 6 positions

(5): Model "3" only

(6): Model "4" only up to 6 positions

(7): Option not available for type 4, 5, 8 and 9

(8): Option available only with type 0, 1, 8 and 9

(9): Polarity is not relevant to application for switches with TTL driver

(10): 10 positions are available only up to 22 GHz, 12 positions only up to 18 GHz



(11) : The QLF trademark (quick lock formula®) standard applies to QMA and QN series and guarantees the full intermateability between suppliers using this trademark. Using QLF certified connectors also guarantees the specified level of RF performance

(12) connector SMA 2.9 is equivalent to "K connector®", registered trademark of Anritsu

\*For precisions see availability of options chart page 5-9

## SPnT Terminated & non Terminated up to 40 GHz

SMA – SMA 2.9 – QMA - DIN 1.6 / 5.6

### GENERAL SPECIFICATIONS

#### Type 2, 3, 4 and 5:

Latching models have a RESET pin which commands the reset of all positions. This command should be used before switching from one position to another. If not, two positions will be set at the same time.

Note: During the RESET operation the global current is: the nominal operating current multiplied by the number of positions.

#### Type 8, 9:

Latching models with AUTOMATIC RESET are available; these products have an internal SET/RESET circuit which automatically resets all the non-selected positions and sets the desired position. This option simplifies the use of latching switches by suppressing the RESET command in switching sequence.

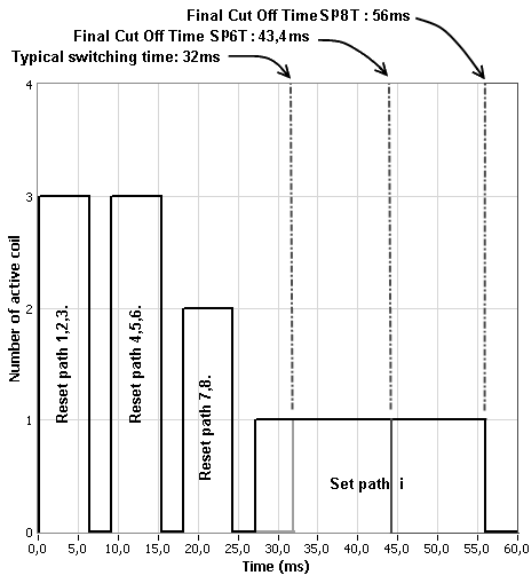
An electronic circuit supplies successively groups of 2, 3 or 4 actuators, in order to limit the maximum current.

The current with this option is the total current of 2, 3 or 4 reset coils in the same time (see table below).

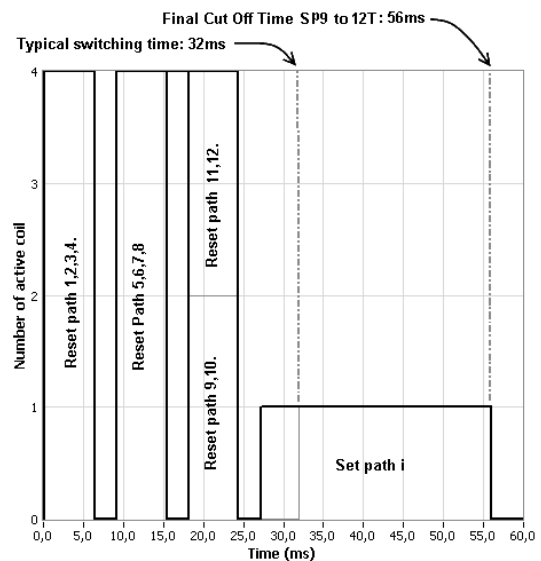
Example: During the AUTOMATIC RESET operation, at 28 Vdc, 4 position switch has a temporary consumption of only 250 mA, during 40 ms maximum.

### SWITCHING SEQUENCE

#### For SP6 to 8T



#### For SP9 to 12T



n = number of positions

Operating Total Current At 23 ° C (mA) SPnT Latching				
Number of positions	12 Volts		28 Volts	
	Manual Reset	Automatic Reset	Manual Reset	Automatic Reset
3 to 4	320 x n	640	125 x n	250
5 to 8	320 x n	960	125 x n	375
9 to 12	320 x n	1280	125 x n	500

Availability of options according to both type and number of positions

Type	Numbers of positions	Available options
0 or 1	3 to 12	0 - 1 - 2 - 3 - 4 - 8
2 or 3	3 to 6	0 - 1 - 2 - 3 - 4
	7 to 12	0 - 1 - 3 - 4
4 or 5	3 to 6	0 - 2
	7 to 12	Not available
8 or 9	3 to 12	0 - 2 - 8

**SPnT Terminated & non Terminated up to 40 GHz**

**SMA – SMA 2.9 – QMA - DIN 1.6 / 5.6  
GENERAL SPECIFICATIONS**

Operating mode		Normally open		Latching	
Nominal operating voltage	Vdc	12 (10.2 / 13)	28 (24 / 30)	12 (10.2 / 13)	28 (24 / 30)
Coil resistance (+/-10%)	Ω	47.5	275	See table on previous page	
Nominal operating current at 23°C	mA	250	102		
Average power		See Power Rating Chart page 1-13			
TTL input	High Level	2.2 to 5.5 V (TTL Option) / 800µA max 5.5 volts 3.5 to 5.5 V (BCD Option)			
	Low Level	0 to 0.8 V (TTL Option) / 20µA max 0.8 volts 0 to 1.5 V (BCD Option)			
Indicator rating		1 Watt / 30 Volts / 100 mA			
Switching time (Max)	ms	15 ms For automatic reset models: SP3T to SP6T => 40 ms SP7T to SP12T => 50 ms			
Life (Min)	Non terminated SP3 to 6T (R573 serie)	SMA - QMA 5 million cycles		SMA 2.9 - 1.6/5.6 2 million cycles	
	Terminated SP3 to 6T (R574 serie)	2 million cycles			
	SP7 to 12T (all models)				
Connectors		SMA - SMA2.9 - QMA - DIN 1.6/5.6			
Actuator terminals		Solder pins or male 25 pin D-sub connector			
Operating temperature range	DIN 1.6/5.6	-25°C to +70°C			
	SMA - SMA 2.9 - QMA	-40°C to +85°C			
Storage temperature range	DIN 1.6/5.6	-40°C to +85°C			
	SMA - SMA 2.9 - QMA	-55°C to +85°C			
Vibration (MIL STD 202, method 204D, cond.D)		10-2000 Hz , 20g operating for SP3 to 8T, survival for SP7 to 12T			
Shock (MIL STD 202, method 213B, cond.C)		100g / 6 ms, 1/2 sine operating for SP3 to 8T, survival for SP7 to 12T			

**RF PERFORMANCES**

SMA Connector						
Number of positions	Frequency Range GHz	V.S.W.R. (max)	Insertion Loss (max) dB	Isolation (min) dB	Impedance Ω	
3 to 6	DC - 3 DC - 18 DC - 26.5	DC - 3	1.20	0.20	80	50
		3-8	1.30	0.30	70	
		8 - 12.4	1.40	0.40	60	
		12.4 - 18	1.50	0.50	60	
		18 - 26.5	1.70	0.70	50	
7 to 8	DC - 3 DC - 26.5	DC - 3	1.20	0.20	80	
		3 - 8	1.30	0.30	70	
		8 - 12.4	1.40	0.40	60	
		12.4 - 16	1.50	0.55	60	
		16 - 18	1.60	0.60	60	
		18 - 22	1.70	0.70	60	
9 to 10	DC - 3 DC - 22	22 - 26.5	2.00	1.10	55	
		DC - 3	1.20	0.20	80	
		3 - 8	1.30	0.30	70	
		8 - 12.4	1.40	0.40	60	
		12.4 - 15.5	1.50	0.50	60	
11 to 12	DC - 3 DC - 18	15.5 - 18	1.70	0.70	55	
		18 - 22	1.80	0.80	55	
		DC - 3	1.20	0.20	80	
		3 - 8	1.40	0.40	70	
		8 - 12.4	1.60	0.60	60	
		12.4 - 15	1.70	0.70	60	
		15 - 18	1.80	0.80	50	

**SPnT Terminated & non Terminated up to 40 GHz**

SMA – SMA 2.9 – QMA – DIN 1.6 / 5.6

**RF PERFORMANCES**

SMA2.9 Connector						
Number of positions	Frequency Range GHz		V.S.W.R. (max)	Insertion Loss (max) dB	Isolation (min) dB	Impedance Ω
3 to 6	DC - 26.5 DC - 40	DC - 6	1.30	0.20	70	50
		6 - 12.4	1.40	0.40	60	
		12.4 - 18	1.50	0.50	60	
		18 - 26.5	1.70	0.70	55	
		26.5 - 40	2.20	1.10	50	

1.6/5.6 Connector						
Number of positions	Frequency Range GHz		V.S.W.R. (max)	Insertion Loss (max) dB	Isolation (min) dB	Impedance Ω
3 to 6	DC - 2.5	DC - 1	1.30	0.20	80	75
		1 - 2.5	1.40	0.30	70	

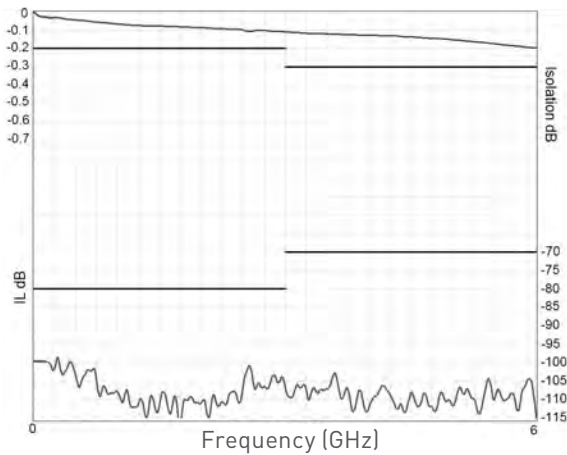
QMA Connector						
Number of positions	Frequency Range GHz		V.S.W.R. (max)	Insertion Loss (max) dB	Isolation (min) dB	Impedance Ω
3 to 6	DC - 6	DC - 3	1.20	0.20	80	50
		3 - 6	1.30	0.30	70	

See page 5-12, 5-13, 5-14 and 5-15 for typical RF performances

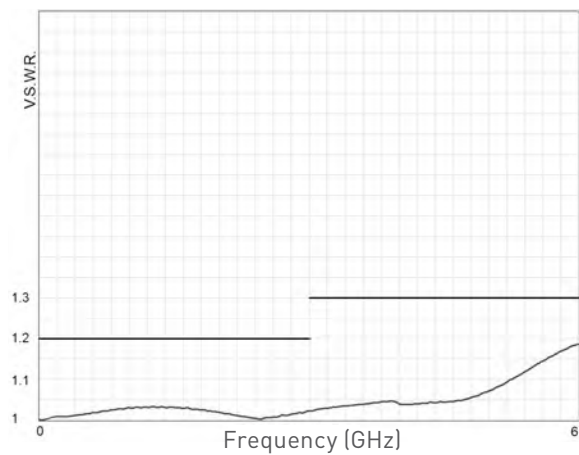
**R573 AND R574 TYPICAL RF PERFORMANCES**

Example: SP6T QMA up to 6 GHz

**Insertion Loss and Isolation**



**V.S.W.R.**

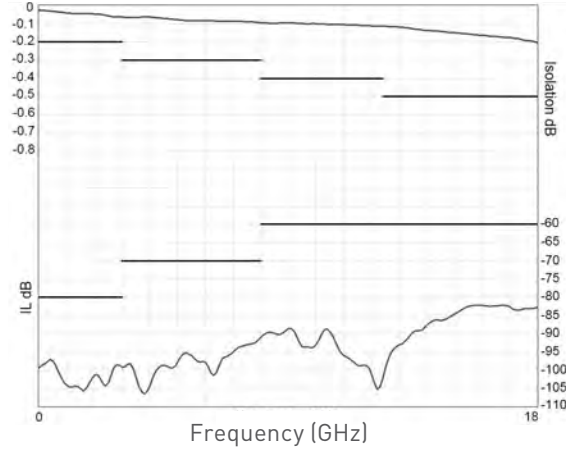


## SPnT Terminated & non Terminated up to 40 GHz

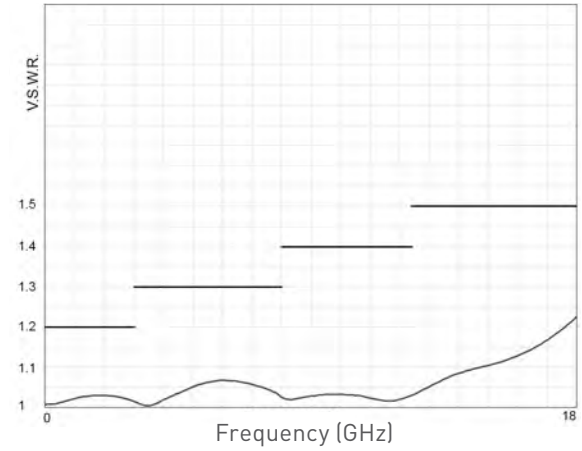
SMA - SMA 2.9 - QMA - DIN 1.6 / 5.6

Example: Non terminated SP6T SMA up to 18 GHz

### Insertion Loss and Isolation

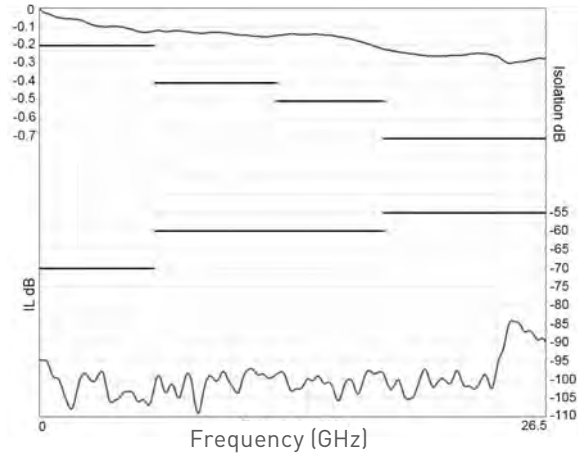


### V.S.W.R.

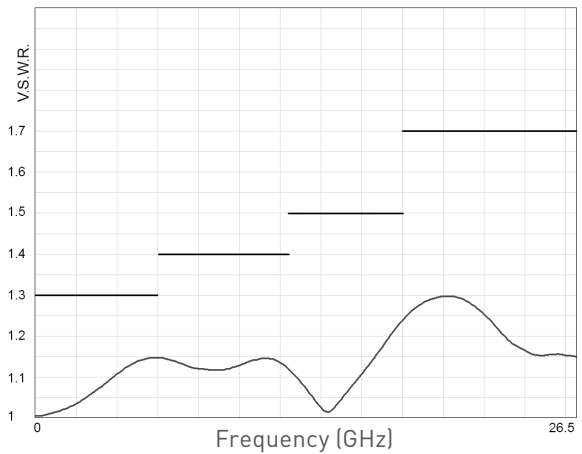


Example: Non terminated SP6T SMA 2.9 up to 26.5 GHz

### Insertion Loss and Isolation

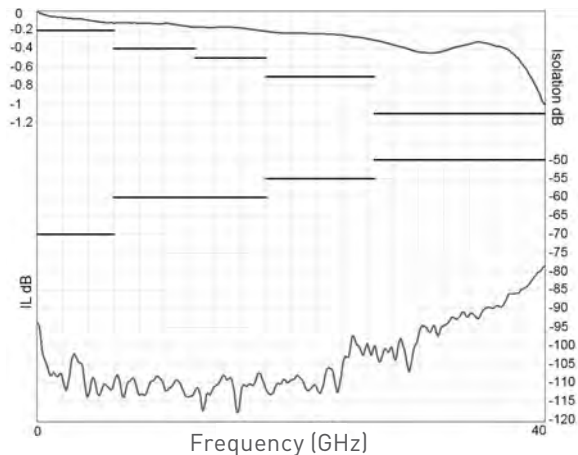


### V.S.W.R.

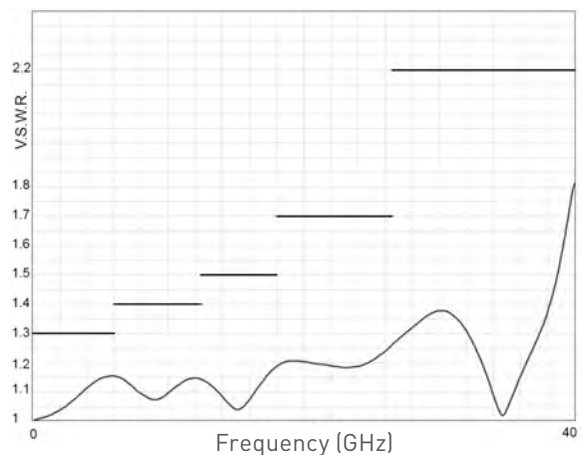


Example: Non terminated SP6T SMA 2.9 up to 40 GHz

### Insertion Loss and Isolation



### V.S.W.R.



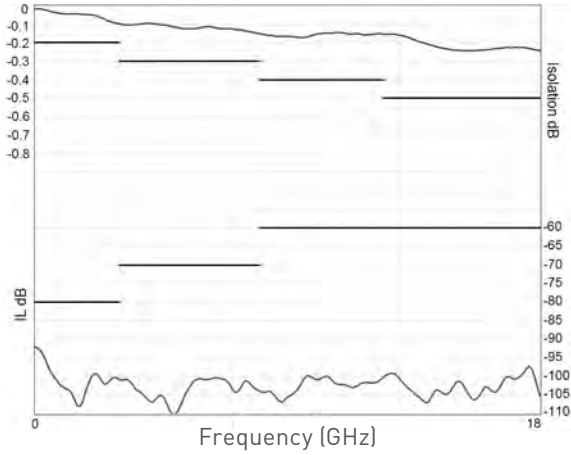


## SPnT Terminated & non Terminated up to 40 GHz

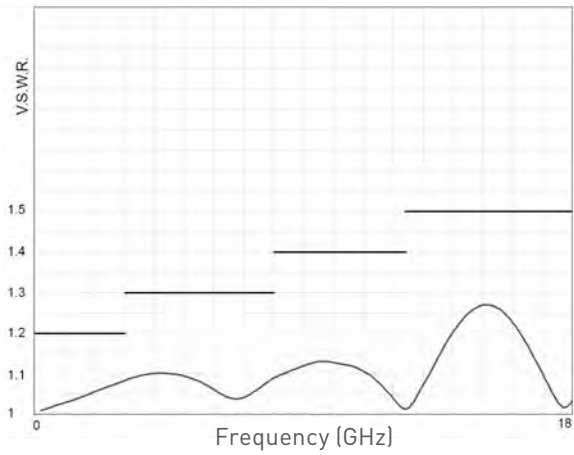
SMA – SMA 2.9 – QMA – DIN 1.6 / 5.6

Example: Terminated SP6T SMA up to 18 GHz

Insertion Loss and Isolation

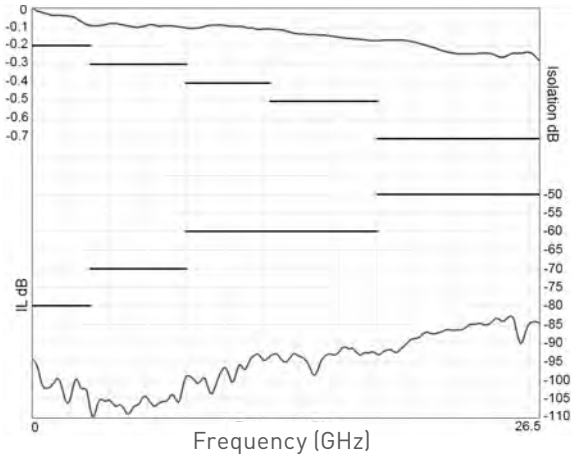


V.S.W.R.

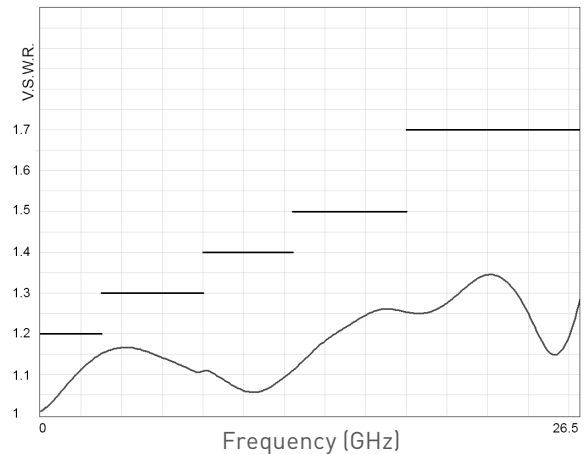


Example: Terminated SP6T SMA up to 26.5 GHz

Insertion Loss and Isolation

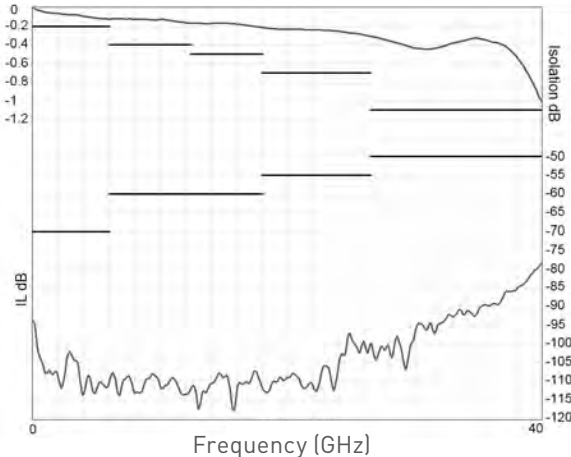


V.S.W.R.

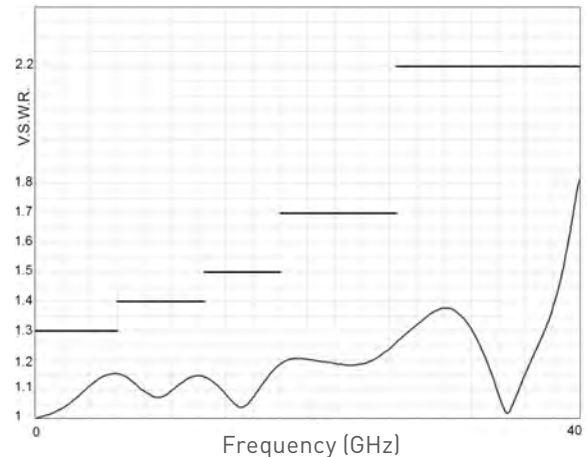


Example: Terminated SP6T SMA 2.9 up to 40 GHz

Insertion Loss and Isolation



V.S.W.R.

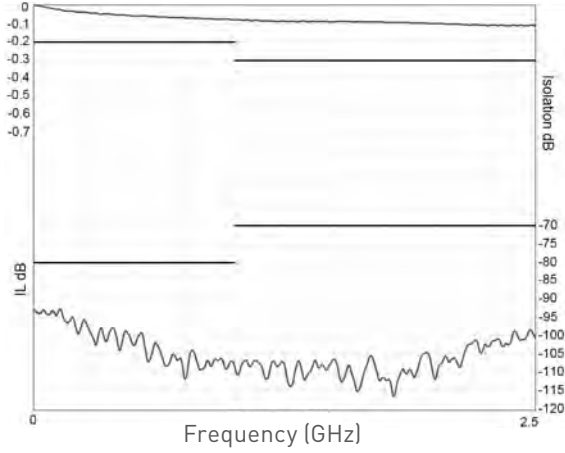


### SPnT Terminated & non Terminated up to 40 GHz

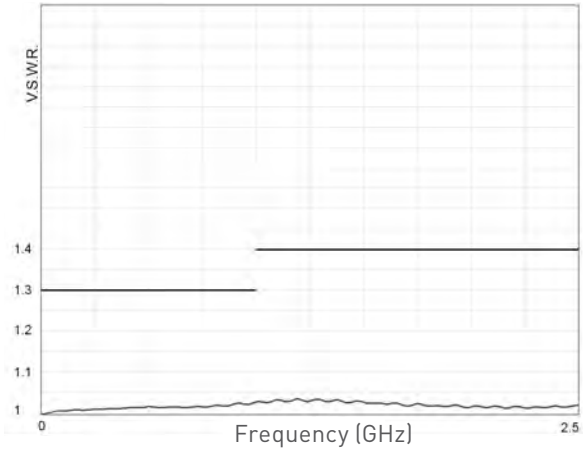
SMA - SMA 2.9 - QMA - DIN 1.6 / 5.6

Example: Non terminated SP6T 1.6/5.6 up to 2.5 GHz

#### Insertion Loss and Isolation

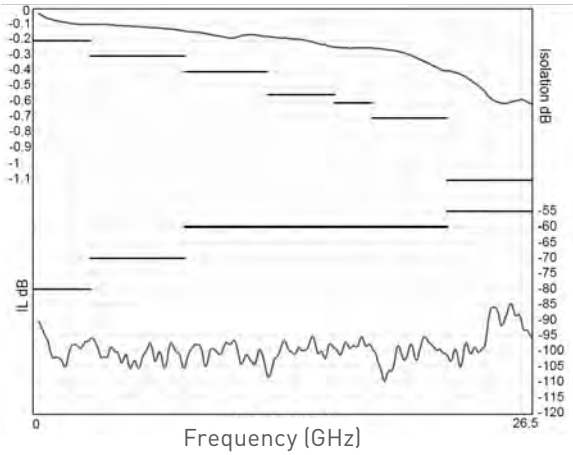


#### V.S.W.R.

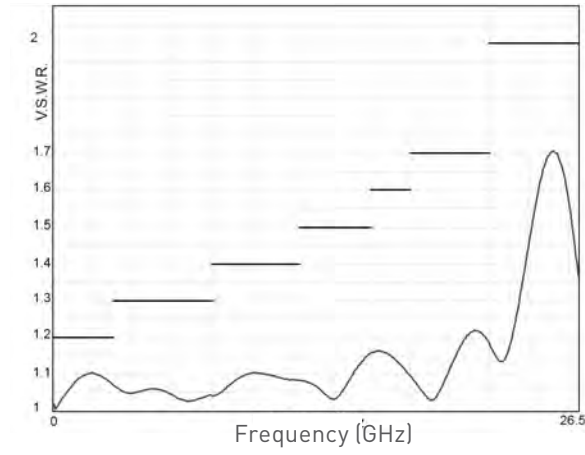


Example: SP8T SMA up to 26.5 GHz

#### Insertion Loss and Isolation

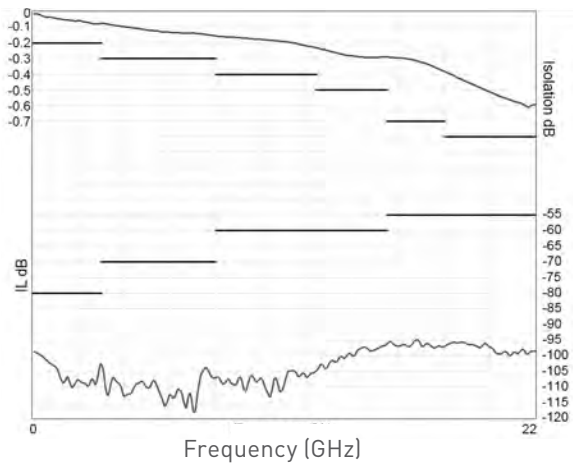


#### V.S.W.R.

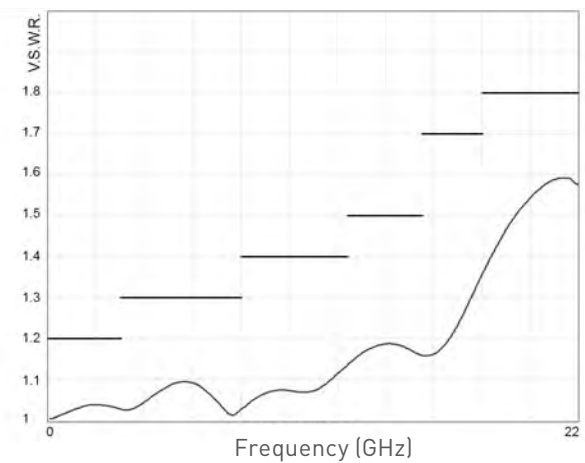


Example: SP10T SMA up to 26.5 GHz

#### Insertion Loss and Isolation



#### V.S.W.R.

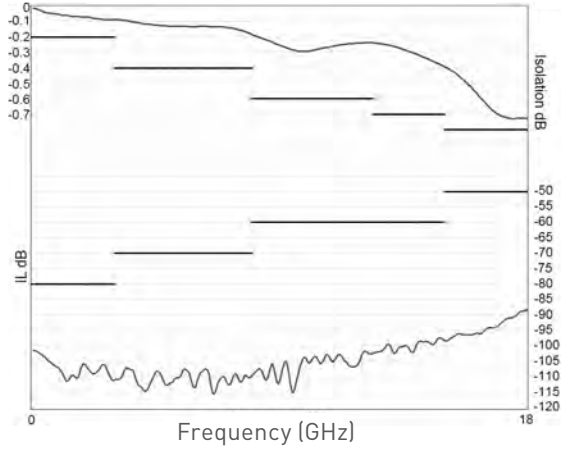


## SPnT Terminated & non Terminated up to 40 GHz

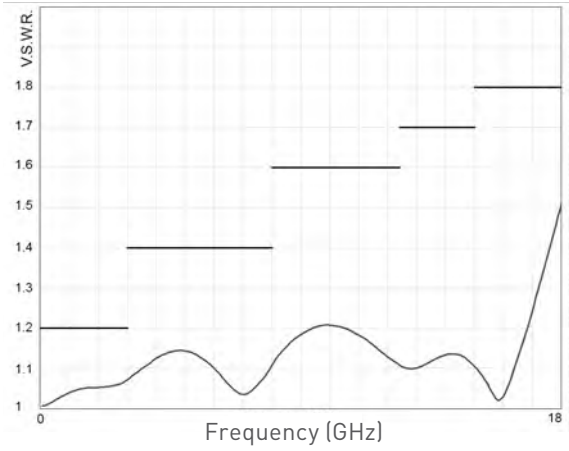
SMA – SMA 2.9 – QMA – DIN 1.6 / 5.6

Example: SP12T SMA up to 18 GHz

### Insertion Loss and Isolation



### V.S.W.R.

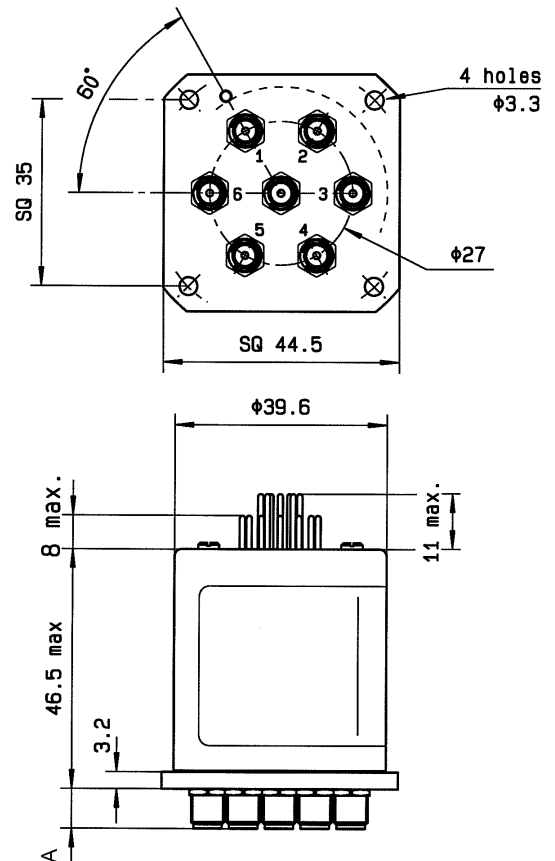


## TYPICAL OUTLINE DRAWINGS

NON TERMINATED 3 to 6 positions

Connectors	A max (mm)
SMA up to 26.5 GHz	7.4
SMA2.9 up to 40 GHz	6.3
QMA up to 6 GHz	10.8
DIN 1.6/5.6 up to 2.5 GHz	11.5

Solder pins	Type 0 or 1 with option 0 - 1 - 3 or 4
	Type 2 or 3 with option 0 or 1



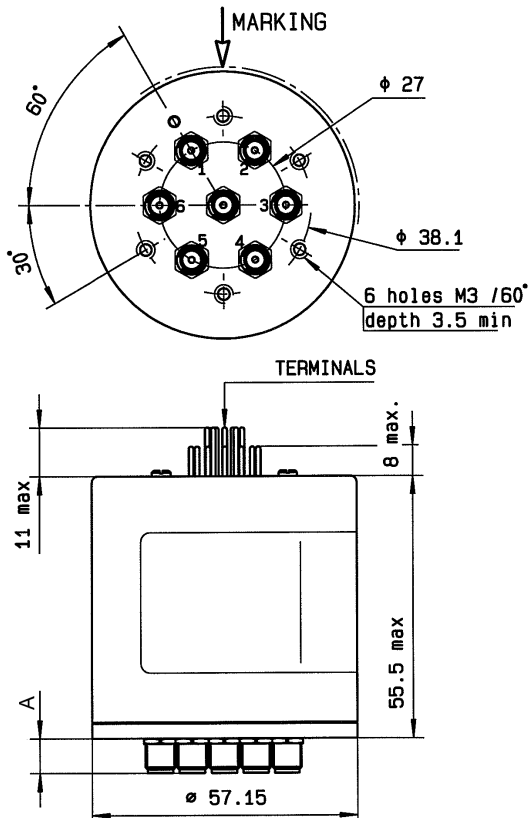
**SPnT Terminated & non Terminated up to 40 GHz**

SMA – SMA 2.9 – QMA – DIN 1.6 / 5.6

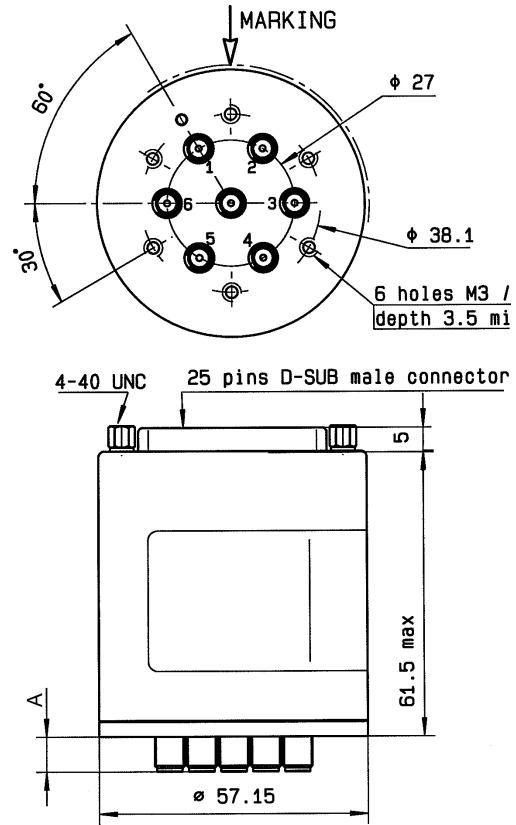
**TYPICAL OUTLINE DRAWINGS**

NON TERMINATED 3 to 6 positions (continued)

Solder pin model



D-sub model



Solder pins	Type 0 or 1 with option 2 or 8
	Type 2 or 3 with option 2 - 3 - 4 or 8
	Type 4 - 5 - 8 or 9 with option 0 - 2 or 8

D-Sub connector	All models
-----------------	------------

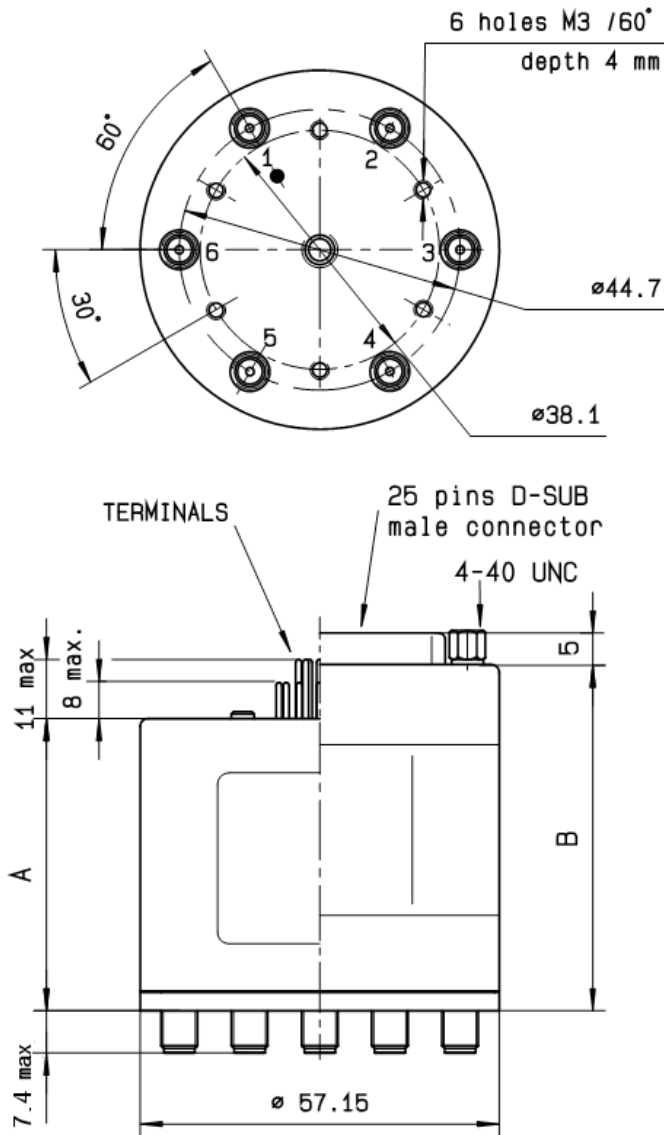
Connectors	A max (mm)
SMA up to 26.5 GHz	7.4
SMA 2.9 up to 40 GHz	6.3
QMA up to 6 GHz	10.8
DIN 1.6/5.6 up to 2.5 GHz	11.5

**SPnT Terminated & non Terminated up to 40 GHz**

SMA – SMA 2.9 – QMA – DIN 1.6 / 5.6

**TYPICAL OUTLINE DRAWINGS**

TERMINATED 3 to 6 positions



	A	B
	Solder Pins	D-Sub Connector
Type 0 - 1 - 2 or 3 with option 0 - 1 - 3 or 4	46.5	61.5
Type 0 - 1 - 2 or 3 with option 2 or 8	55.5	61.5
Type 4 - 5 - 8 or 9 with option 0 - 1 - 2 or 8	55.5	61.5

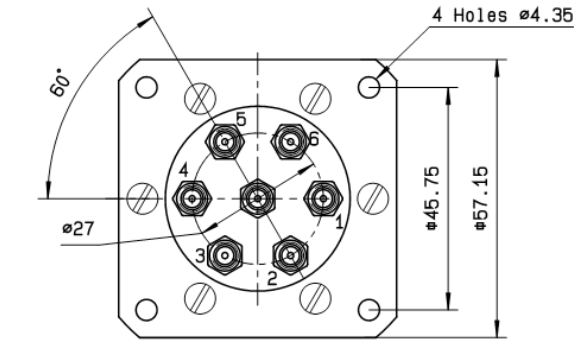
## SPnT Terminated & non Terminated up to 40 GHz

SMA – SMA 2.9 – QMA - DIN 1.6 / 5.6

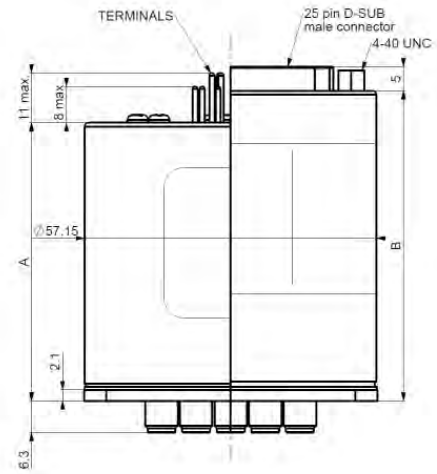
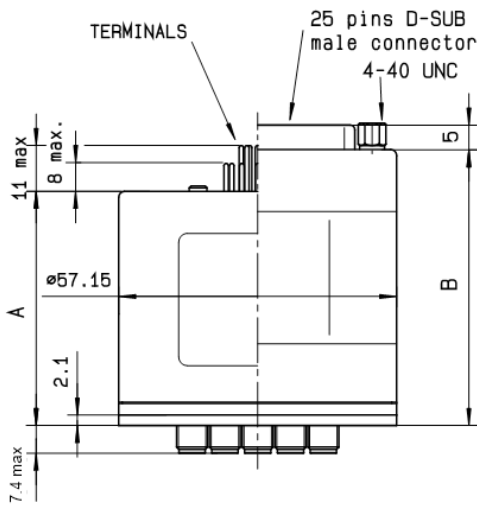
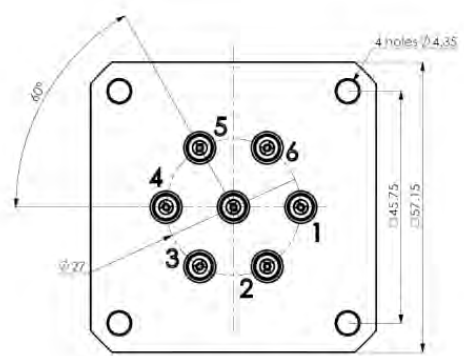
### TYPICAL OUTLINE DRAWINGS

TERMINATED 3 to 6 positions 26.5 GHz & 40 GHz

26.5 GHz model



40 GHz model



	A	B
	Solder Pins	D-Sub Connector
Type 0 - 1 - 2 or 3 with option 0 - 1 - 3 or 4	48.5	63.5
Type 0 - 1 - 2 or 3 with option 2 or 8	57.5	63.5
Type 4 - 5 - 8 or 9 with option 0 - 1 - 2 or 8	57.5	63.5

## SPnT Terminated & non Terminated up to 40 GHz

SMA – SMA 2.9 – QMA – DIN 1.6 / 5.6

### TYPICAL OUTLINE DRAWINGS

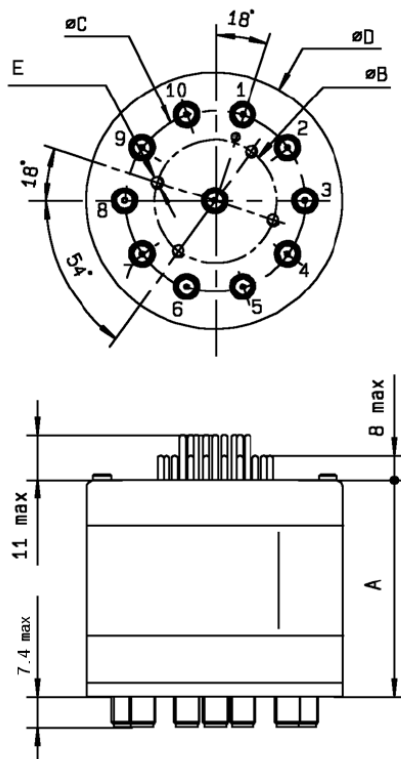
TERMINATED or NON TERMINATED 7 to 12 positions

Type	A (max) mm	
	Solder Pins	D-Sub connector
Type 0 - 1 - 2 or 3 with option 0 - 1 - 3 or 4	50	66
Type 0 - 1 - 2 or 3 with option 2 or 8 and Type 4 - 5 - 8 or 9 with option 0 - 1 - 2 or 8	61	66

Number of positions	B diameter	C diameter	D diameter	E
7 - 8	49.8	44.7	56.9	4 holes M3 depth 4mm
9 - 10	30.5	44.7	63.5	
11 - 12	40.6	55.9	68.3	

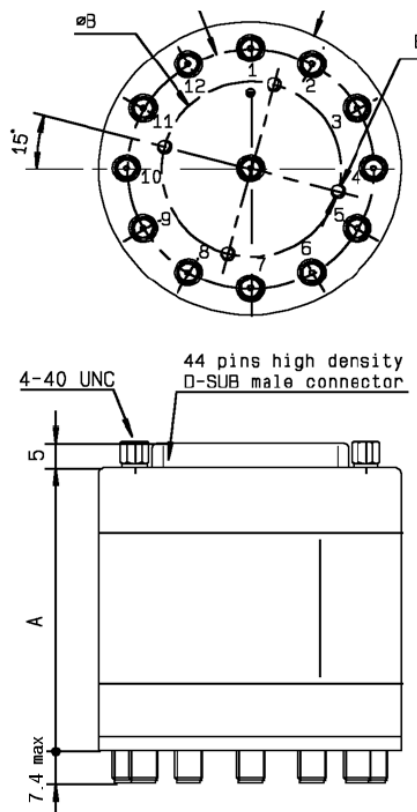
10 position model

Terminated up to 18 GHz with solder pins



12 position model

Terminated up to 12.4 GHz with D-Sub



## SPnT up to 12.4 GHz - RAMSES Concept

N - BNC - TNC



Radiall's R573 & R574 multithrow coaxial switches are offered in many configurations (over 40,000 possible combinations) including Terminated and non Terminated options. Radiall offers reliable products, with shorter delivery times and competitive pricing. Excellent typical RF performance make RAMSES switches (12.4 GHz) ideal for Automated Test Equipment (ATE) and other measurement applications.

These switches are suitable for defense, industrial, and telecommunication applications.

Example of P/N:

R573103600 is a SP6T N up to 12.4 GHz, Normally Open, 28 Vdc, and solder pins.

### PART NUMBER SELECTION

**R 57**

**Model:**

- 3: Without 50 Ω termination
- 4: With 50 Ω termination

**RF Connectors:**

- 0: N up to 3 GHz
- 1: N up to 12.4 GHz (9)
- 2: BNC up to 3 GHz (4) (5)
- 5: TNC up to 3 GHz (4) (5)
- 6: TNC up to 12.4 GHz (4) (5)

**Type:**

- 0: Normally open
- 1: Normally open + I.C.
- 2: Latching
- 3: Latching + I.C.
- 4: Latching + S.C.O. (1) (4)
- 5: Latching + S.C.O. + I.C. (1) (4)
- 8: Latching + S.C.O. + A.R. (1)
- 9: Latching + S.C.O. + I.C. + A.R. (1)

**Actuator Voltage:**

- 2: 12 Vdc
- 3: 28 Vdc

**Actuator Terminals:**

- 0: Solder pins
- 5: D-Sub connector

**Options:\***

- 0: Without option
- 1: Positive common (2) (6)
- 2: Compatible TTL driver (1) (8)
- 3: With suppression diodes
- 4: With suppression diodes and positive common (2) (6)
- 8: BCD TTL driver compatible (1) (3) (7) (8)

**Number of positions:**

- 3: 3 Positions
- 4: 4 Positions
- 5: 5 Positions
- 6: 6 Positions
- 7: 7 Positions
- 8: 8 Positions
- 9: 9 Positions
- 0: 10 Positions
- 1: 11 Positions
- 2: 12 Positions

I.C.: Indicator contact / S.C.O.: Self Cut-Off / A.R.: Auto Reset

(1): These models are already equipped with suppression diodes

(2): Standard products are equipped with negative common

(3): Latching BCD driver enables also a global reset through driver code 0000

(see BCD logic coding page 1-13)

(4): Available only up 6 positions

(5): Model "3" only

(6): Option not available for type 4, 5, 8 and 9

(7): Option available only with type 0, 1, 8 and 9

(8): Polarity is not relevant to application for switches with TTL driver

(9) 7 to 12 positions are available only up to 8 GHz

\*For precisions see availability of options chart page 5-21



## SPnT up to 12.4 GHz - RAMSES Concept

N - BNC - TNC

### GENERAL SPECIFICATIONS

#### Type 2, 3, 4 and 5:

Latching models have a RESET pin which commands the reset of all positions. This command should be used before switching from one position to another. If not, two positions will be set at the same time.

Note: During the RESET operation the global current the nominal operating current multiplied by the number of positions.

#### Type 8, 9:

Latching models with AUTOMATIC RESET are available; these products have an internal SET/RESET circuit which automatically resets all the non-selected positions and sets the desired position. This option simplifies the use of latching switches by suppressing the RESET command in switching sequence.

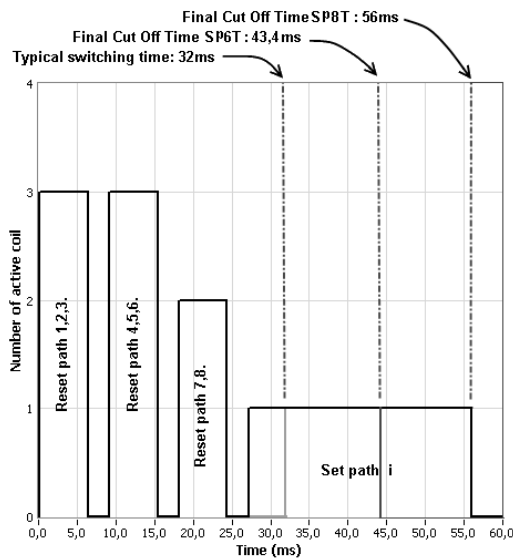
An electronic circuit supplies successively groups of 2, 3 or 4 actuators, in order to limit the maximum current.

The current with this option is the total current of 2, 3 or 4 reset coils in the same time (see table below).

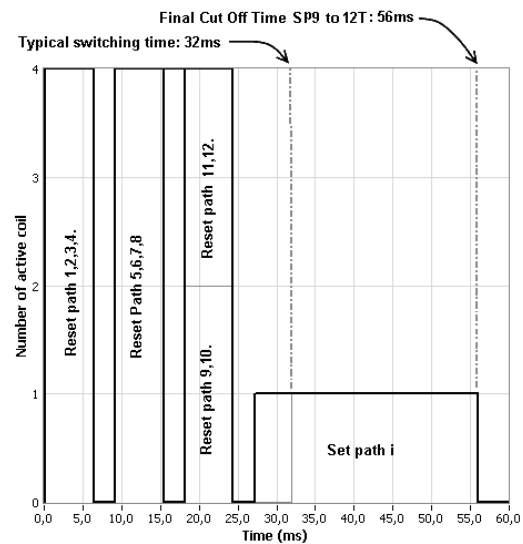
Example: During the AUTOMATIC RESET operation, at 28 Vdc, 4 position switch has a temporary consumption of only 250 mA, during 40 ms maximum.

### SWITCHING SEQUENCE

For SP6 to 8T



For SP9 to 12T



n = number of positions

Operating Total Current At 23 °C (mA) SPnT Latching				
Number of positions	12 Volts		28 Volts	
	Manual reset	Automatic reset	Manual reset	Automatic reset
3 to 4	320 x n	640	125 x n	250
5 to 8	320 x n	960	125 x n	375
9 to 12	320 x n	1280	125 x n	500

Availability of options according to both type and number of positions

Type	Numbers of positions	Available options
0 or 1	3 to 12	0 - 1 - 2 - 3 - 4 - 8
2 or 3	3 to 6	0 - 1 - 2 - 3 - 4
	7 to 12	0 - 1 - 3 - 4
4 or 5	3 to 6	0 - 2
	7 to 12	Not available
8 or 9	3 to 12	0 - 2 - 8

## SPnT up to 12.4 GHz - RAMSES Concept

N - BNC - TNC

### GENERAL SPECIFICATIONS

Operating mode		Normally open		Latching	
Nominal operating voltage (across operating temperature)	Vdc	12 (10.2 / 13)	28 (24 / 30)	12 (10.2 / 13)	28 (24 / 30)
Coil resistance (+/-10%)	Ω	47.5	275	See table on previous page	
Nominal operating current at 23°C	mA	250	102		
Average power		See Power Rating Chart page <b>1-13</b>			
TTL input	High Level	2.2 to 5.5 V (TTL Option) / 3.5 to 5.5 V (BCD Option)		800µA max 5.5 volts	
	Low Level	0 to 0.8 V (TTL Option) / 0 to 1.5 V (BCD Option)		20µA max 0.8 volts	
Indicator rating		1 Watt / 30 Volts / 100 mA			
Switching time (Max)		ms		15 ms For automatic reset models: SP3T to SP6T => 40 ms SP7T to SP12T => 50 ms	
Life (Min)	Non terminated SP3 to 6T (R573 serie)		2 million cycles		
	Terminated SP3 to 6T (R574 serie)				
	SP7 to 12T (all models)				
Connectors		N - TNC - BNC			
Actuator terminals		Solder pins or male 25 pin D-Sub connector			
Operating temperature range		-40°C to +85°C			
Storage temperature range		-55°C to +85°C			
Vibration (MIL STD 202, method 204D, cond.C)		10-2000 Hz , 10g		operating	
Shock (MIL STD 202, method 213B, cond.C)		50g / 1 ms, 1/2 sine		operating	

### RF PERFORMANCES

N - TNC - BNC Connector						
Number of positions	Frequency range GHz	V.S.W.R. (max)	Insertion loss (max) dB	Isolation (min) dB	Impedance Ω	
3 to 6	DC - 12.4	DC - 3	1.20	0.20	80	50
		3 - 8	1.35	0.35	70	
		8 - 12.4	1.50	0.50	60	
7 to 10	DC - 8	DC - 3	1.30	0.30	80	
		3 - 8	1.50	0.50	70	
11 to 12	DC - 8	DC - 3	1.35	0.50	70	
		3 - 8	1.70	1.00	60	

See page 5-25 for typical RF performances

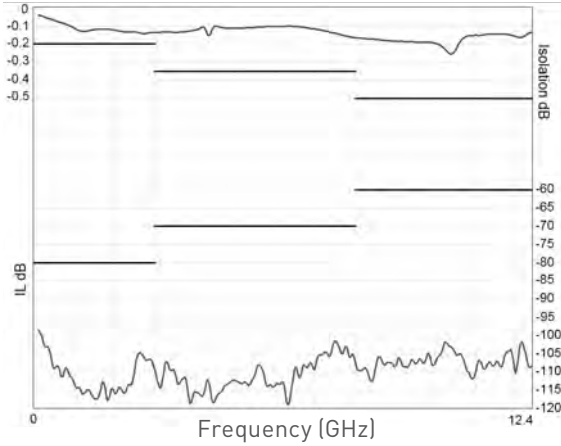
### SPnT up to 12.4 GHz - RAMSES Concept

N - BNC - TNC

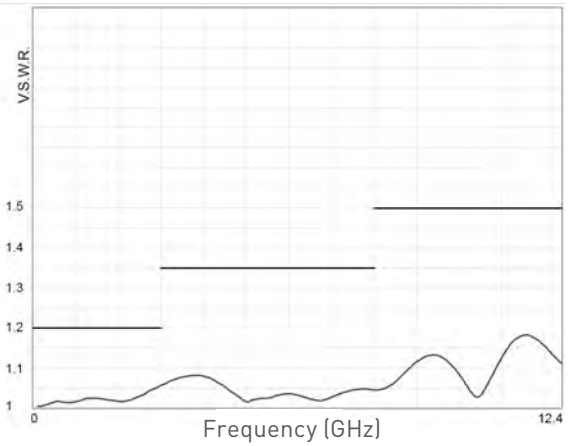
### R573 AND R574 TYPICAL RF PERFORMANCES

Example: SP6T N up to 12.4 GHz

#### Insertion Loss and Isolation

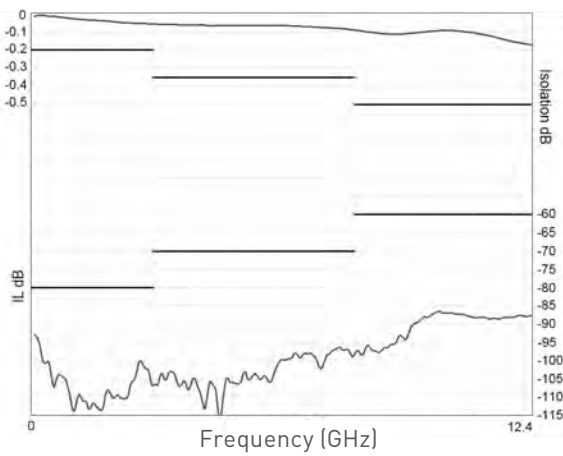


#### V.S.W.R.

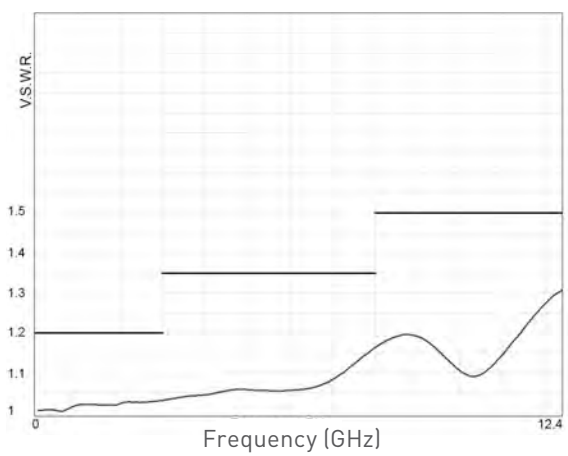


Example: SP6T TNC up to 12.4 GHz

#### Insertion Loss and Isolation

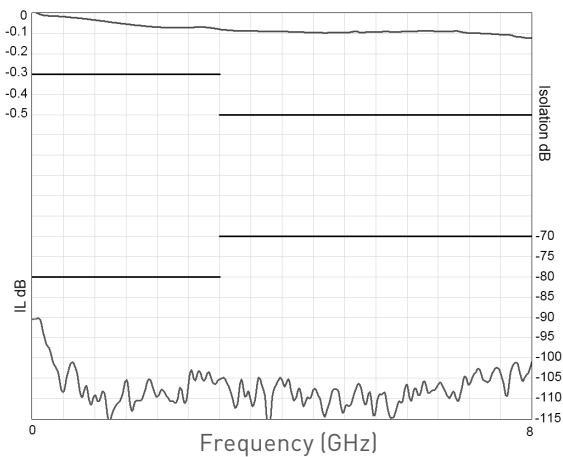


#### V.S.W.R.

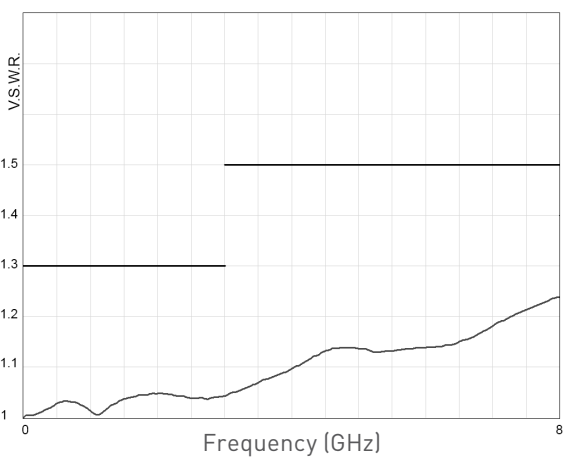


Example: SP8T up to 8 GHz

#### Insertion Loss and Isolation



#### V.S.W.R.



## SPnT up to 12.4 GHz - RAMSES Concept

N - BNC - TNC

### TYPICAL OUTLINE DRAWINGS

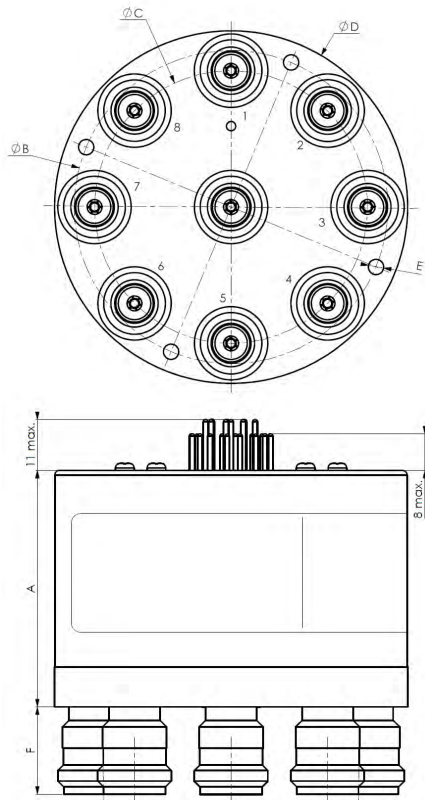
TERMINATED or NOT 3 to 12 positions

Type	A max (mm)	
	Solder Pins	D-Sub Connector
Type 0 - 1 - 2 or 3 with option 0 - 1 - 3 or 4	56	66
Type 0 - 1 - 2 or 3 with option 2 or 8 and Type 4 - 5 - 8 or 9 with option 0 - 1 - 2 or 8	71	71

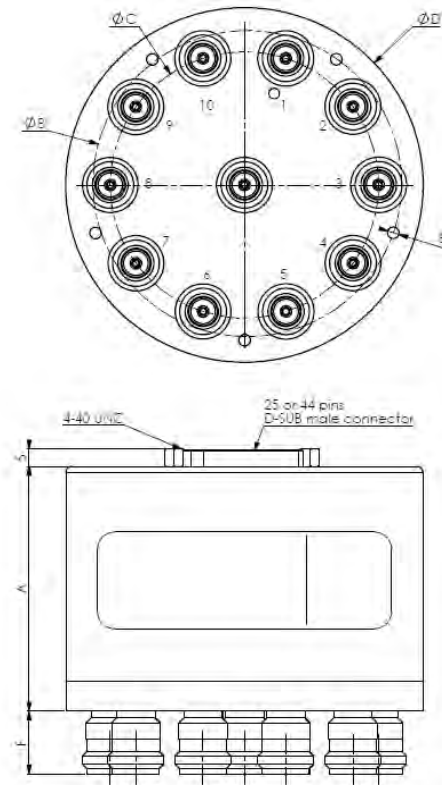
Connectors	F max (mm)
N	18.8
BNC	11
TNC	11

Number of positions	B diameter	C diameter	D diameter	E
3 - 6	54	44.7	63.5	6 holes M4/60°
7 - 8	67.7	58.9	76.2	4 holes M4/90°
9 - 10	88.9	76.2	101.6	5 holes M4/72°
11 - 12	67.7	101.6	127	6 holes M4/60°

Model SP8T positions up to 8 GHz  
with solder pins



Model SP10T positions up to 8 GHz  
D-Sub male connector



### RF CONNECTORS ALLOCATION

See on page 5-25 and 5-26

**SPnT Terminated & non Terminated up to 40 GHz**

SMA – SMA 2.9 – QMA – DIN 1.6 / 5.6

**RF CONNECTORS ALLOCATION FOR SPNT SERIES**

Connectors A: 1.6/5.6, QMA, SMA, SMA 2.9

Other Connectors: N, BNC, TNC

SPnT 3 ways			
NON TERMINATED Version		TERMINATED Version	
Up to 40 GHz models Without option Connectors A	Up to 40 GHz models With option Connectors A and other connectors	Up to 22 GHz models Connectors A and other connectors	26.5 GHz and 40 GHz models with SMA - SMA 2.9
SPnT 4 ways			
NON TERMINATED Version		TERMINATED Version	
Up to 40 GHz models Without option Connectors A	Up to 40 GHz models With option Connectors A and other connectors	Up to 22 GHz models Connectors A and other connectors	26.5 GHz and 40 GHz models with SMA - SMA 2.9
SPnT 5 ways			
NON TERMINATED Version		TERMINATED Version	
Up to 40 GHz models Without option Connectors A	Up to 40 GHz models With option Connectors A and other connectors	Up to 22 GHz models Connectors A and other connectors	26.5 GHz and 40 GHz models with SMA - SMA 2.9

**SPnT Terminated & non Terminated up to 40 GHz**

SMA – SMA 2.9 – QMA - DIN 1.6 / 5.6

**RF CONNECTORS ALLOCATION (CONTINUED)**

Connectors A: 1.6/5.6, QMA, SMA, SMA 2.9

Other Connectors: N, BNC, TNC

SPnT 6 ways			
NON TERMINATED Version		TERMINATED Version	
Up to 40 GHz models Without Option Connectors A	Up to 40 GHz models With Option Connectors A and other connectors	Up to 22 GHz models Connectors A and other connectors	26.5 GHz and 40 GHz models with SMA - SMA 2.9

SPnT 7 and 8 ways	SPnT 9 and 10 ways	SPnT 11 and 12 ways
All connectors	All connectors	All connectors

**ACCESSORIES**

A printed circuit board interface connector has been designed for easy mounting on terminals (must be ordered separately). Refer to page 5-27 for details.

## Accessories - RAMSES Concept

### All Connectors

#### PRINTED CIRCUIT BOARD INTERFACE CONNECTOR

A printed circuit board interface connector (ordered separately) has been designed for easy mounting on terminals.

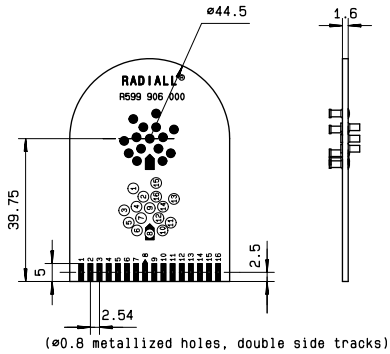
For SPnT model R573 and R574 series: Radiall part number: **R599 906 000 for 3 to 6 positions**

**R599 908 000 for 7 to 8 positions**

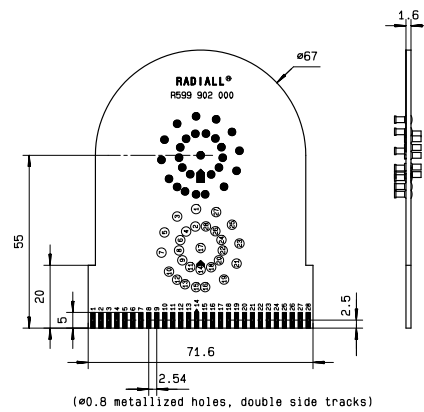
**R599 900 000 for 9 to 10 positions**

**R599 902 000 for 11 to 12 positions**

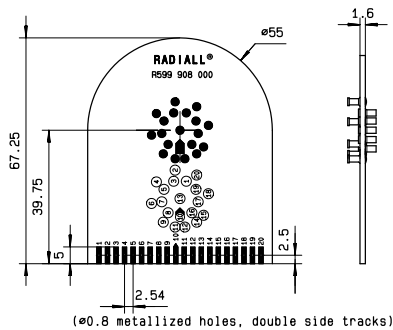
**R599906000**



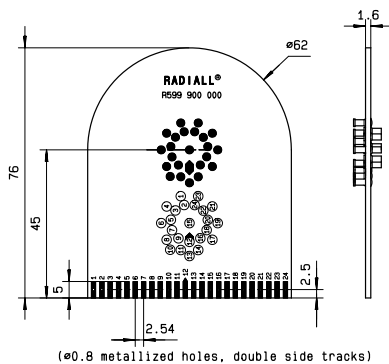
**R599902000**



**R599908000**



**R599900000**

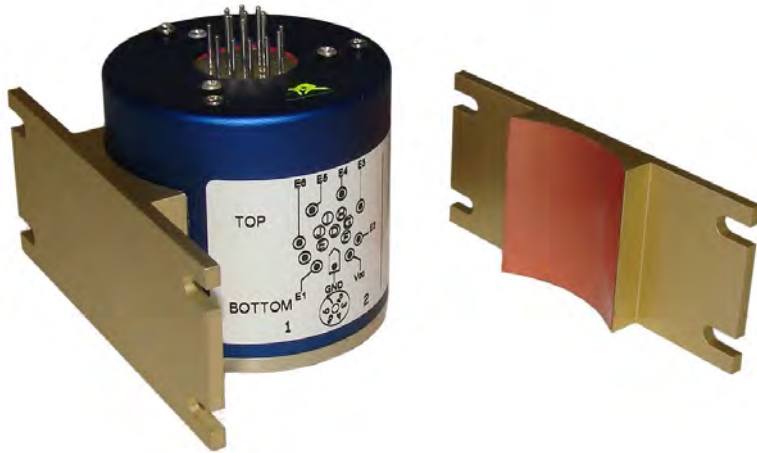


## Accessories - RAMSES Concept

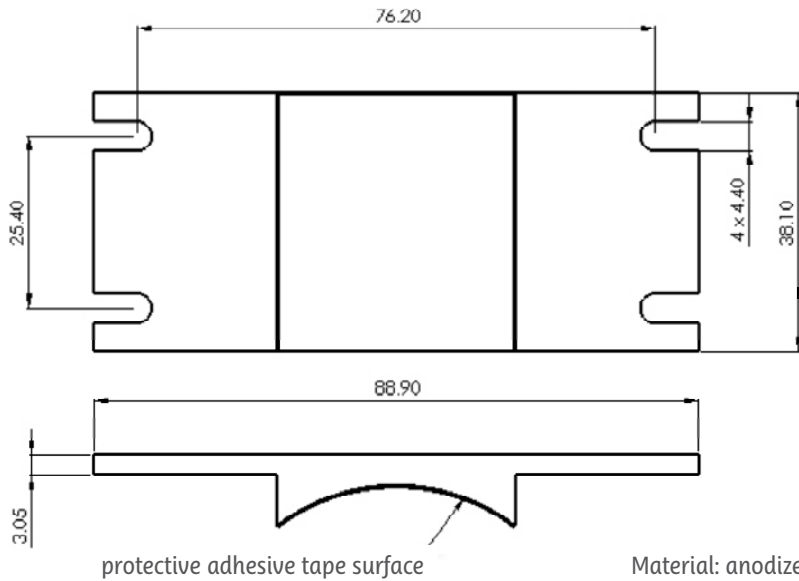
### All Connectors

#### MOUNTING BRACKET

A metal bracket has been designed for an easy mechanical mounting of our SPnT switches for customer installation. These brackets must be ordered separately and assembled according to our recommended process on the following page.



#### MOUNTING BRACKET





## Accessories - RAMSES Concept

### All Connectors

#### FOR MODELS WITH CONNECTORS SMA, QMA, SMA 2.9, DIN 1.6/5.6

Number of positions	Type	Options	Model	Part number
3 to 6 positions	All	2 & 8	R573 series	R599920000
	4, 5, 8, & 9	All		
	All	All	R574 series	
7 & 8 positions	All	All	R573 series	R599920000
			R574 series	
9 & 10 positions	All	All	R573 series	R599921000
			R574 series	
11 & 12 positions	All	All	R573 series	R599921000
			R574 series	

#### FOR MODELS WITH CONNECTORS N, TNC, BNC

Number of positions	Type	Options	Model	Part number
3 to 6 positions	All	All	R573 series	R599921000
			R574 series	
7 to 12 positions	All	All	R573 series	Not Available
			R574 series	

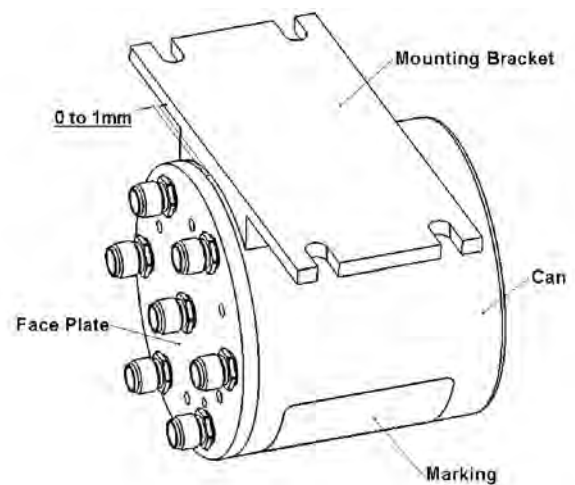
#### Adhesive Bonding Process

- 1) Clean the can with alcohol (Isopropanol or Ethanol).
- 2) Remove the protective adhesive tape surface.
- 3) Glue the mounting bracket ONLY on the blue can and NOT on the RF body.

DO NOT glue mounting bracket on the marking (See drawing).

- 4) Firmly press the mounting bracket against the can, and maintain pressure for several seconds (10 seconds min) to properly bond the unit (See notes 1 & 2).

- 5) The switch can now be installed on your equipment with 4 screws (not included).



## Accessories - RAMSES Concept

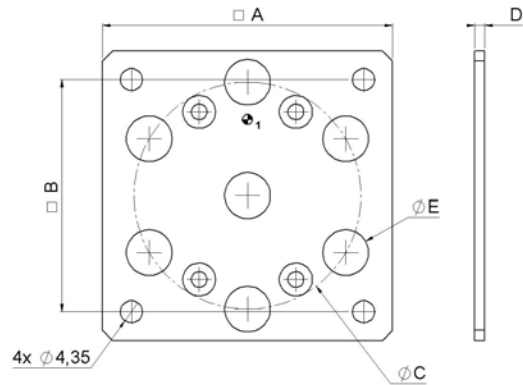
### All Connectors

#### MOUNTING SQUARE FLANGE

A square flange has been designed for easy mechanical mounting of our SPnT switches for customer installation. These flanges must be ordered separately (similar to the mounting bracket) and assembled according to our recommended process



Typical Outline Drawing



Material: Aluminium with Cr3 passivation

Radiall part number	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)
R599 308 000	57.15	45.75	27	2	9
R599 309 000	57.15	45.75	44.70	2	9
R599 310 000	63.45	53.45	27	2	9
R599 311 000	63.45	53.45	44.70	2	9
R599 312 000	63.45	53.45	44.70	2	9
R599 313 000	69.80	59.80	44.70	2	9
R599 314 000	74.60	64.60	55.88	2	9
R599 315 000	71.10	60.30	44.70	3	16.20

#### FOR MODELS WITH CONNECTORS SMA, QMA, SMA2.9, 1.6/5.6

Number of positions	Type	Options	Model	Part number
3 to 6 positions	All	All	R573 series	R599310000
				R599308000
			R574 series	R599311000
				R599309000
7 to 8 positions	All	All	R573 series	R599312000
R574 series				
9 to 10 positions	All	All	R573 series	R599313000
R574 series				
11 to 12 positions	All	All	R573 series	R599314000
R574 series				

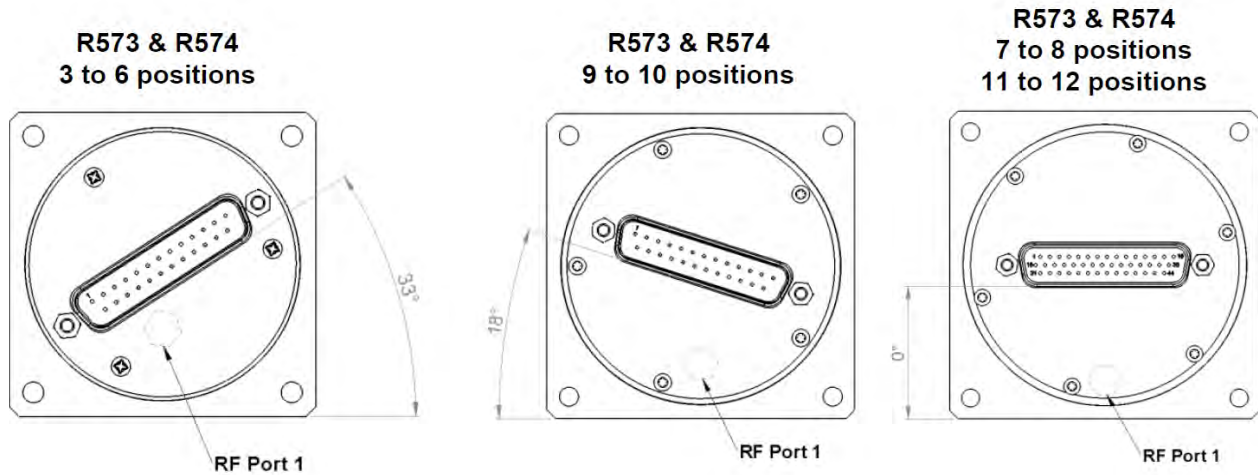
#### FOR MODELS WITH CONNECTORS N, TNC, BNC

Number of positions	Type	Options	Model	Part number
3 to 6 positions	All	All	R573 series	R599315000
			R574 series	

## Accessories - RAMSES Concept

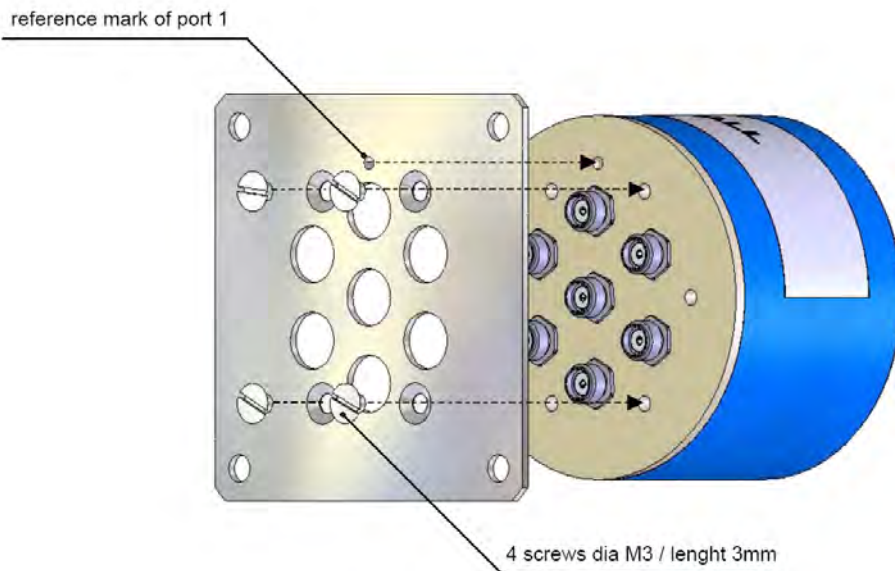
### All Connectors

#### D-SUB CONNECTOR LOCATION



#### ASSEMBLY INSTRUCTIONS

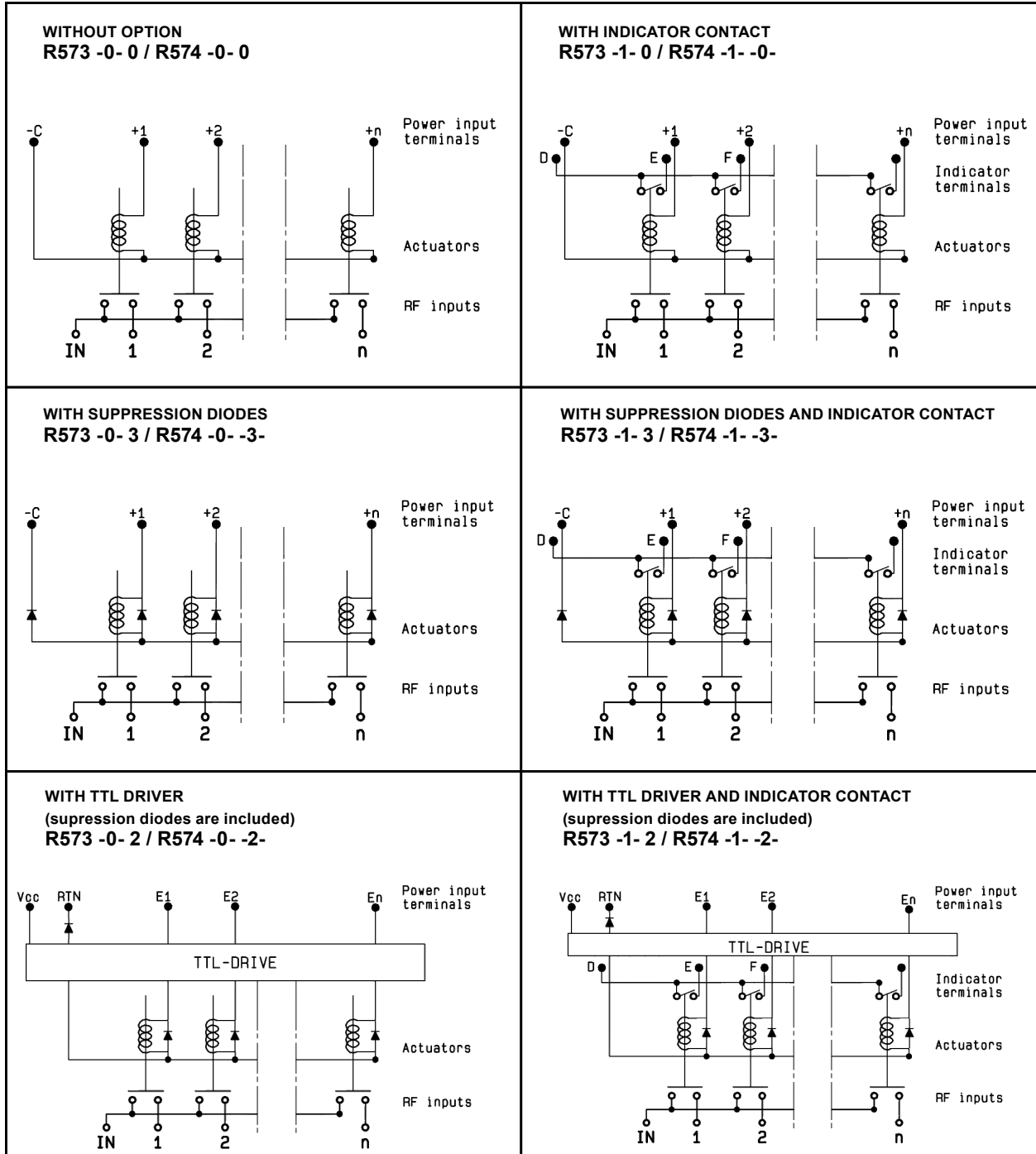
- 1) Assemble the square flange on the RF body of the switch as the following drawing below.  
ATTENTION: Don't forget to correctly position the reference in line with the mark for port 1.
- 2) Tighten the 4 screws (delivered with the square flange).



**COAXIAL SPnT - Electrical Schematics**

R573 - R574 Series

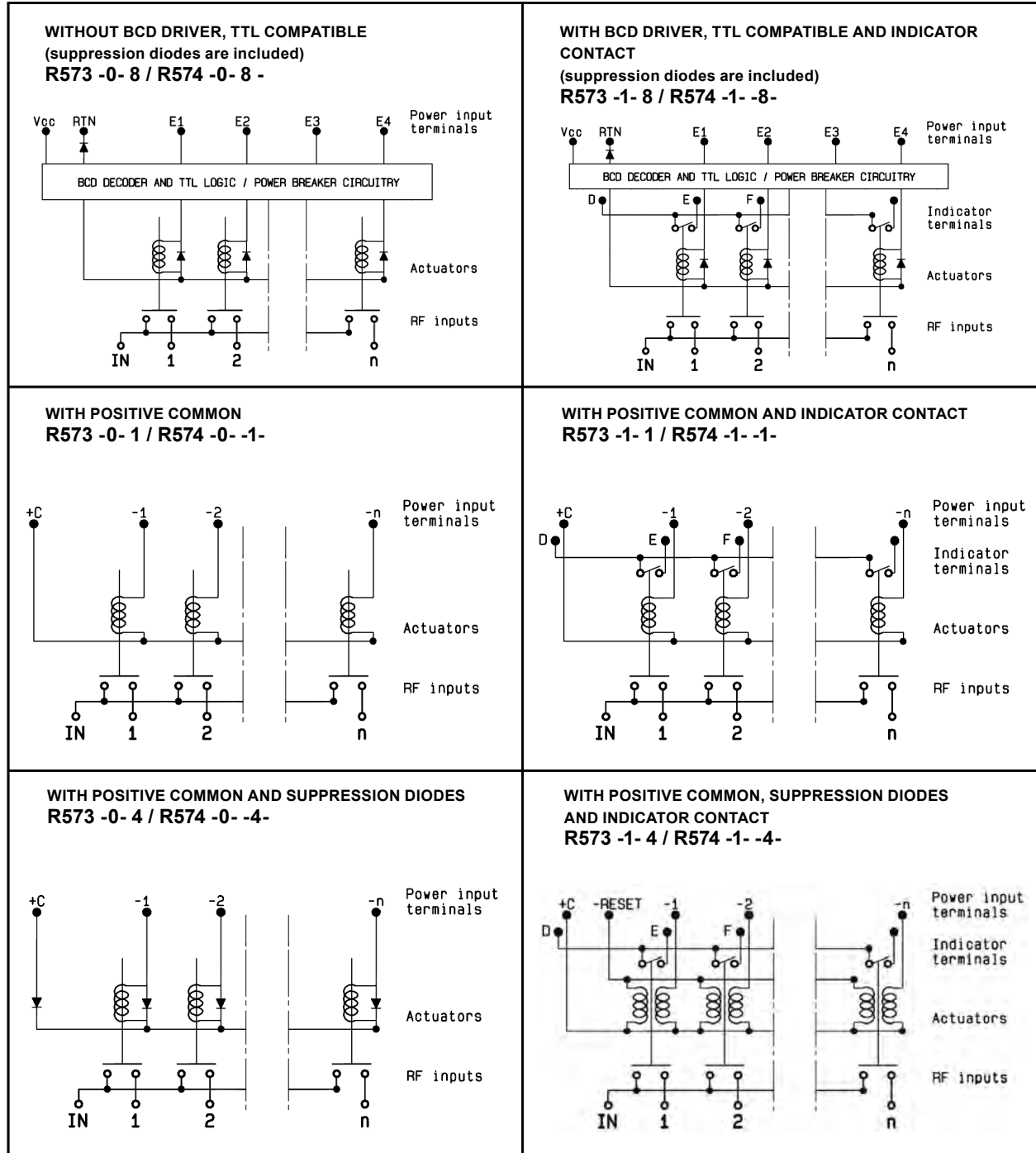
**NORMALLY OPEN**



**COAXIAL SPnT - Electrical Schematics**

R573 - R574 Series

**NORMALLY OPEN**

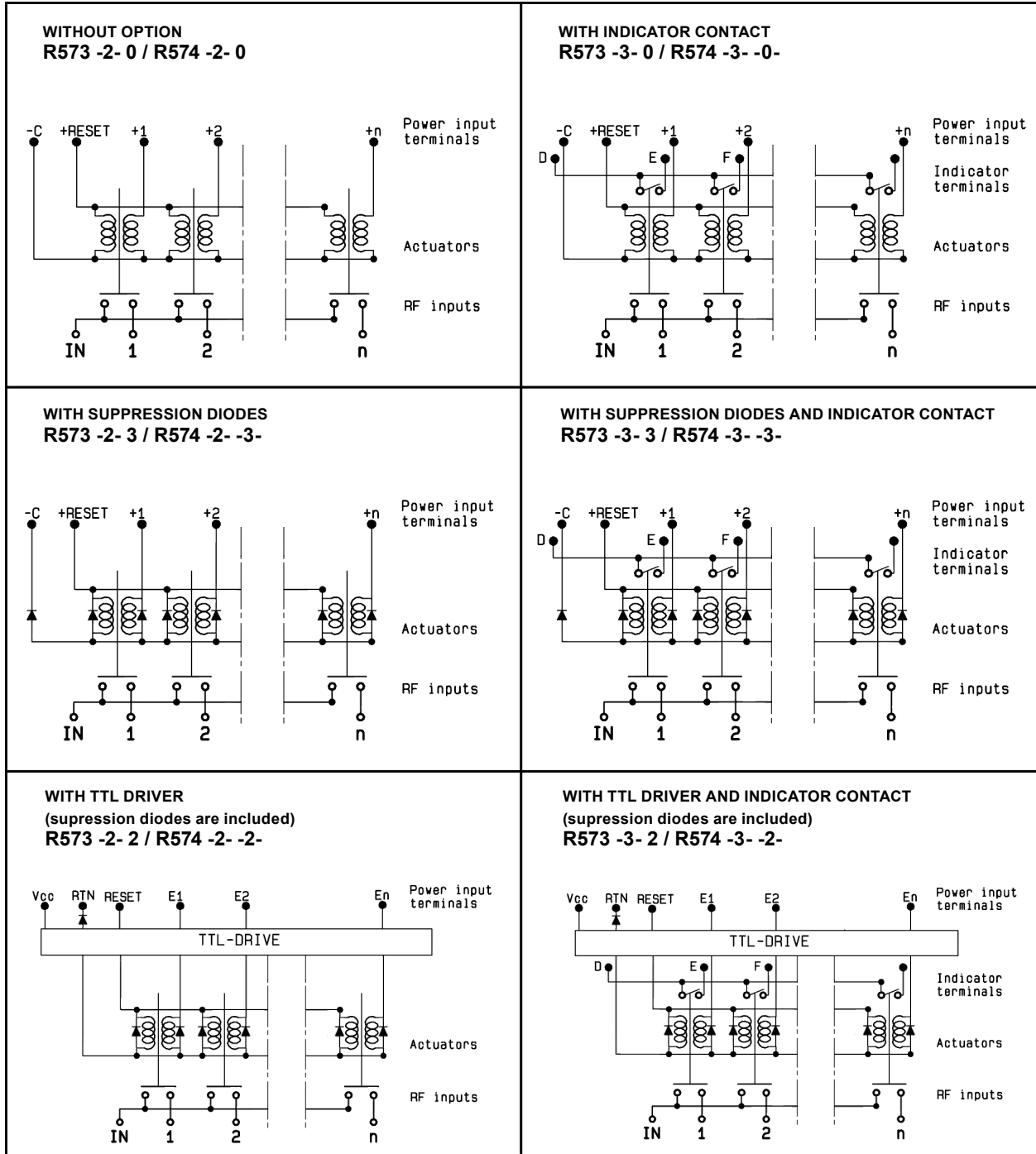


RAMSES SERIES

**COAXIAL SPnT - Electrical Schematics**

R573 - R574 Series

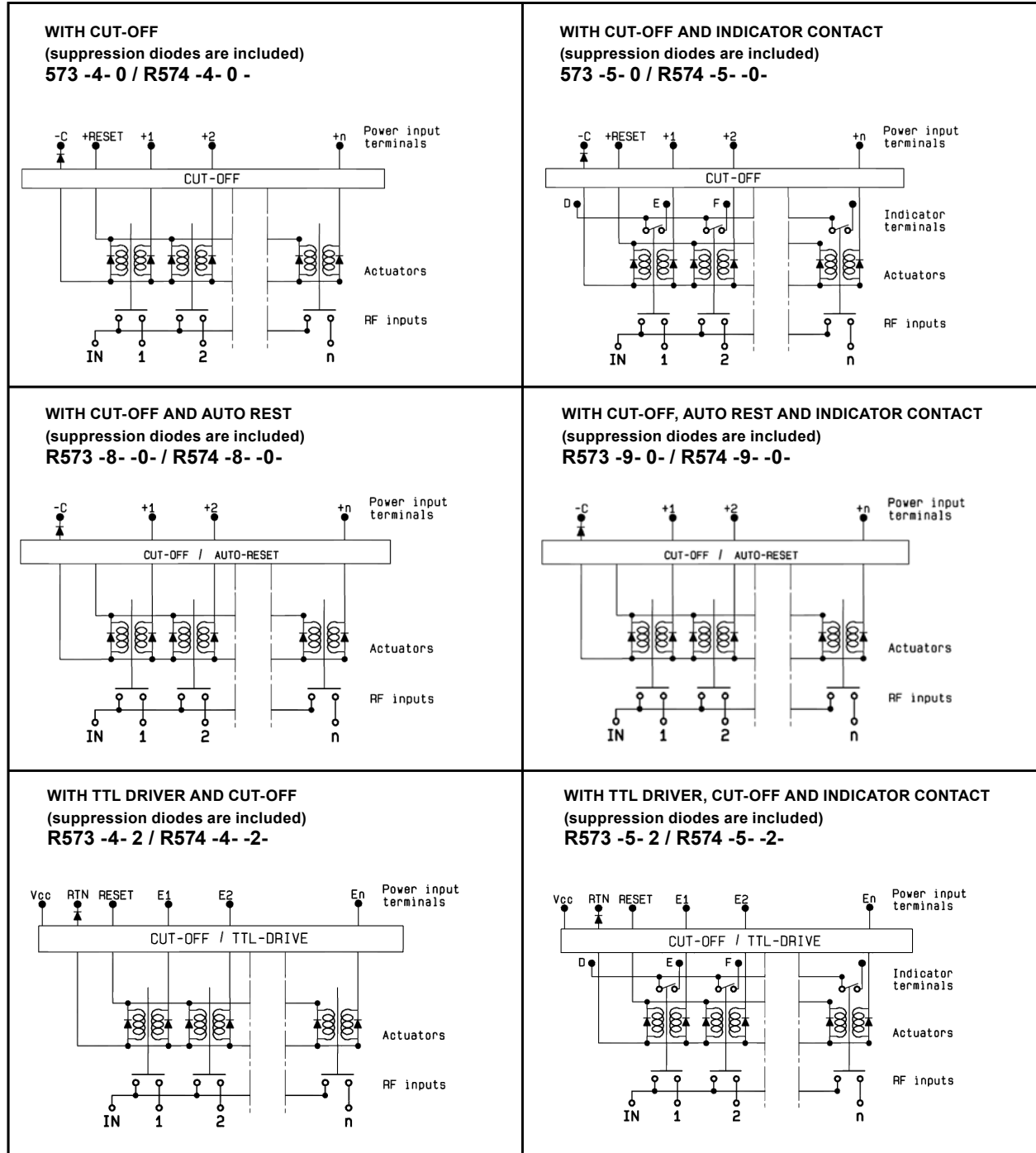
**LATCHING**



**COAXIAL SPnT - Electrical Schematics**

R573 - R574 Series

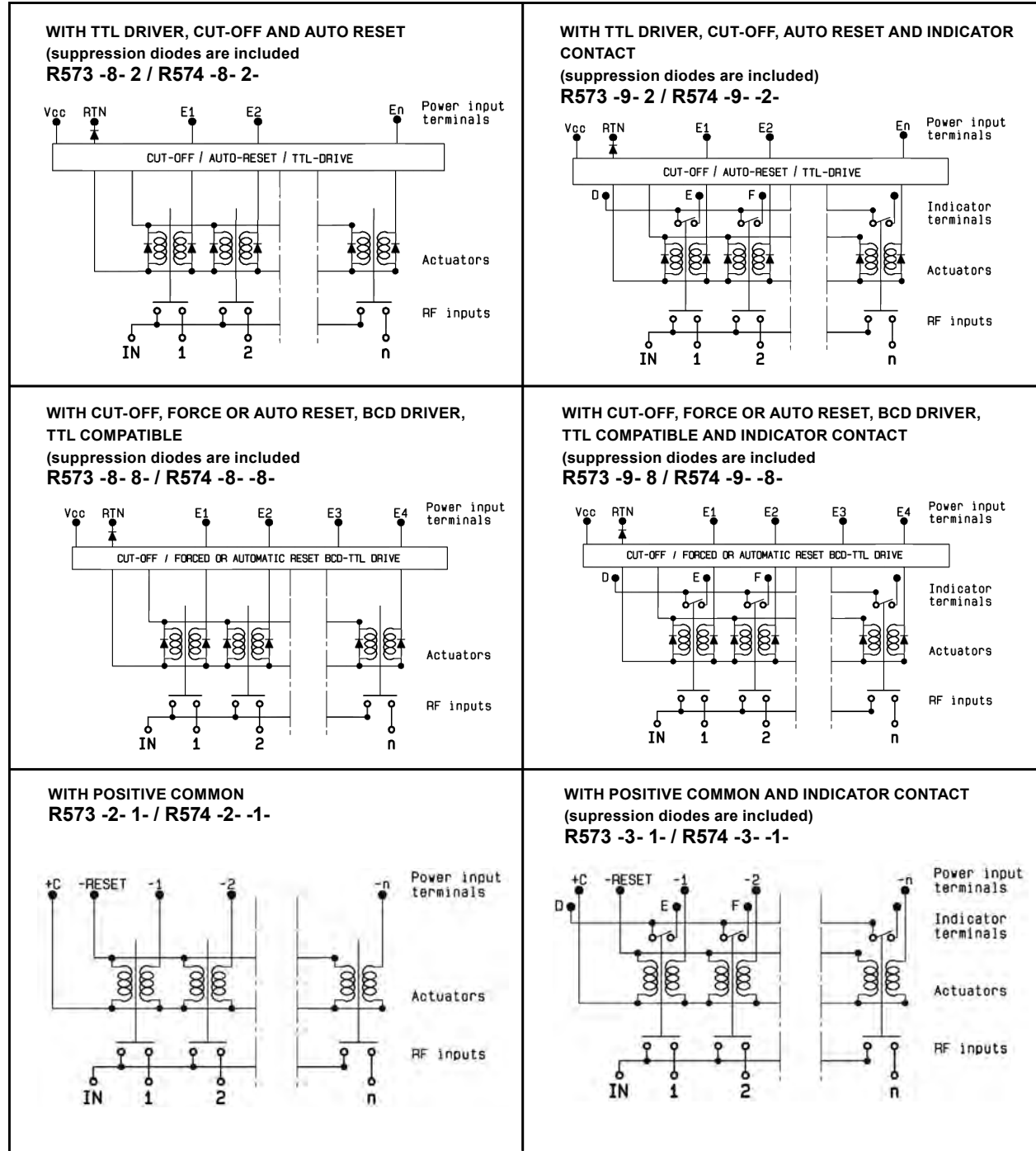
**LATCHING**



**COAXIAL SPnT - Electrical Schematics**

R573 - R574 Series

**LATCHING**

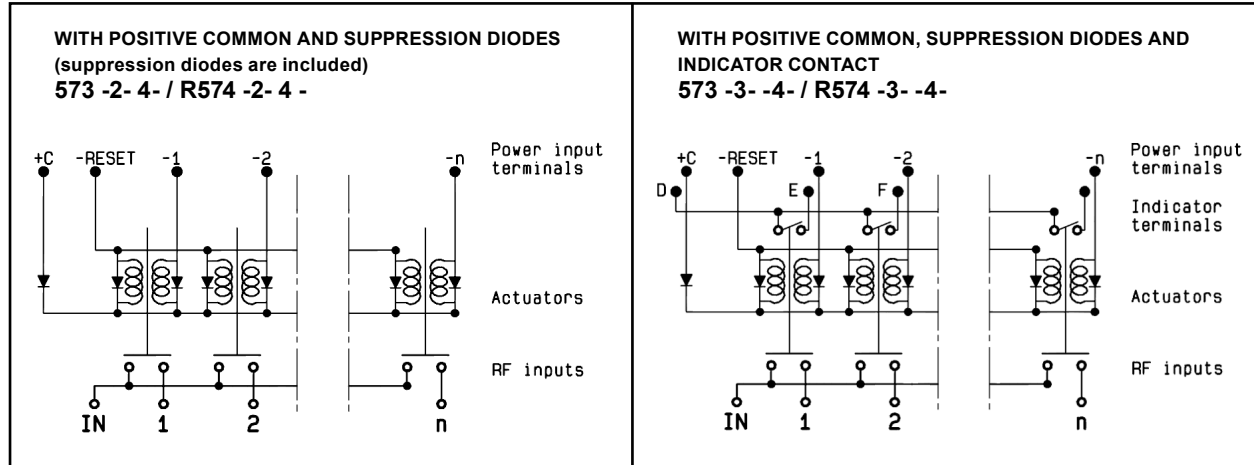




## COAXIAL SPnT - Electrical Schematics

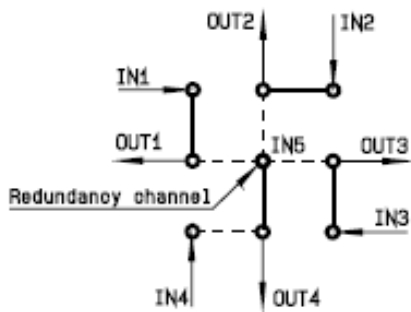
R573 - R574 Series

### LATCHING



Optional Features for SPnT (see additional examples on page 5-54)

Examples of dedicated application options



4P3T with redundancy channel on Out 4  
In 1 to Out 1, In 2 to Out 2, In 3 to Out 3



7P6T



SP6T terminated with External terminations

A Custom Matrix Switch ( 4P3T ) with 4 Input ports and 4 Output ports configured for 3 transmission systems and one redundancy

channel (N+1: N type). This product can be used also as a SP4T Terminated with low external VSWR or medium power terminations.

## High Performance Multiport Switches

TITANIUM Series / SPnT up to 40 GHz



Radiall's TITANIUM switches are optimized to perform at a high level over an extended life cycle. With outstanding RF performance, and a guaranteed insertion loss repeatability of 0.03 dB over a life span of 2.5 million switching cycles, Radiall's TITANIUM switches are a perfect solution for automated test and measurement equipment, as well as signal monitoring devices.

Example of P/N:  
R514F73617 is a SP6T SMA up to 26.5 GHz, Latching, Indicators, Self cut-off, Auto-Reset, 24 Vdc and HE10 receptacle.

### PART NUMBER SELECTION

**R 51**

**Models:**

- 2: Without 50 Ω terminations
- 4: With 50 Ω terminations

**RF Connectors:**

- 3: SMA up to 6 GHz
- 4: SMA up to 20 GHz
- F: SMA up to 26.5 GHz
- 8: SMA 2.9 up to 40 GHz (1)

**Type:**

- 7: Latching + Self cut-off + Auto Reset + Indicators

**Actuator Voltage:**

- 3: 24 Vdc

**Documentation:**

- : Certificate Of Conformity
- C: Calibration certificate
- R: Calibration certificate + RF curves

**Actuator Terminal:**

- 7 : HE 10 receptacle, delivered with 750 mm (30 inches) ribbon cable + HE10 connector

**Options:**

- 1: Positive common (without TTL)
- 2: TTL/5V logic with 24 Vdc supply

**Number of positions:**

- 4: 4 Positions
- 6: 6 Positions

(1) connector SMA 2.9 is equivalent to "K connector®", registered trademark of Anritsu.

## High Performance Multiport Switches

TITANIUM Series / SPnT up to 40 GHz

TITANIUM SERIES

### GENERAL SPECIFICATIONS

Operating mode		Latching	
Nominal operating voltage (across operating temperature)	Vdc	24 (20/32)	
Coil resistance (+/-10%)	Ω	120	
Operating current at 23°C	mA	200	
Maximum stand-by current	mA	50	
Average power Terminated Model	All models	RF path Cold switching: See Power page 5-44	
		Hot switching: 1 Watt Cw	
		Internal terminations 1 Watt average into 50 Ω	
TTL input	High Level	3 to 7 V	1.4 mA max at Vcc = Max
	Low Level	0 to 0.8 Volts	-
Indicator specifications		Maximum withstanding voltage	60V
		Maximum current capacity	150 mA
		Maximum "ON" resistance	2.5 Ω
		Minimum "OFF" resistance	100MΩ
Switching time (Max)	ms	15	
Life (Min) for	SMA	2.5 million cycles	
	SMA 2.9	1 million cycles	
Connectors		SMA - SMA 2.9	
Actuator terminals		HE10 ribbon receptacle	
Weight (Max)	g	230	

### ENVIRONMENTAL SPECIFICATIONS

Operating temperature range	-25°C to +75°C
Storage temperature range	-55°C to +85°C
Temperature cycling (MIL-STD-202, Method 107D, Cond.A)	-55°C to +85°C (10 cycles)
Vibration (MIL STD 202, Method 204D, Cond.D)	10-2000 Hz, 10g operating
Shock (MIL STD 202, Method 213B, Cond.C)	50g / 6 ms, 1/2 sine operating
Moisture resistance (MIL STD 202, Method 106E, Cond.E)	65°C, 95% RH, 10 days
Altitude storage (MIL STD 202, Method 105C, Cond.B)	50,000 feet (15,240 meters)
RFI (MIL STD 1344, Method 3008 or IEC 61726)	55dB at 20GHz
Magnetic field	< 5.10 <sup>-5</sup> gauss at 1 meter

## High Performance Multiport Switches

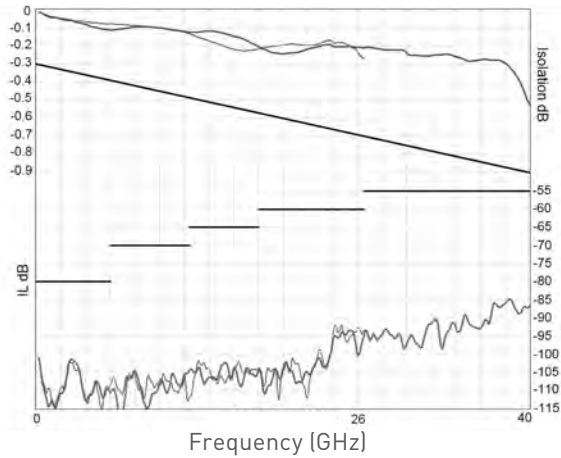
TITANIUM Series / SPnT up to 40 GHz

### RF PERFORMANCES

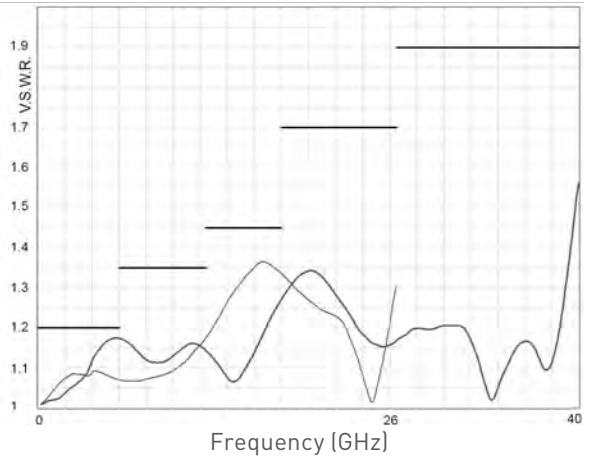
Part number		R51-3-34-7 R51-3-36-7	R51-4-34-7 R51-4-36-7	R51-F-34-7 R51-F-36-7	R51-8-34-7 R51-8-36-7
Frequency Range	GHz	DC to 6	DC to 20	DC to 26.5	DC to 40
Impedance	Ω	50			
Insertion Loss (Max)	dB	0.3 + 0.015 x frequency (GHz)			
Isolation (Min)	dB	80	DC to 6 GHz 80 6 to 12.4 GHz 70 12.4 to 20 GHz 65	DC to 6 GHz 80 6 to 12.4 GHz 70 12.4 to 20 GHz 65 20 to 26.5 GHz 60	DC to 6 GHz 80 6 to 12.4 GHz 70 12.4 to 18 GHz 65 18 to 26.5 GHz 60 26.5 to 40 GHz 55
V.S.W.R. (Max)		1.20	DC to 6 GHz 1.20 6 to 12.4 GHz 1.35 12.4 to 20 GHz 1.45	DC to 6 GHz 1.20 6 to 12.4 GHz 1.35 12.4 to 20 GHz 1.45 20 to 26.5 GHz 1.70	DC to 6 GHz 1.20 6 to 12.4 GHz 1.35 12.4 to 18 GHz 1.45 18 to 26.5 GHz 1.70 26.5 to 40 GHz 1.90
Third order inter Modulation		- 120 dBC typical (2 carriers 20w)			
Repeatability (measured at 25°C)		0.03 dB			0.05 dB

### TYPICAL RF PERFORMANCES

Insertion Loss and Isolation



V.S.W.R.



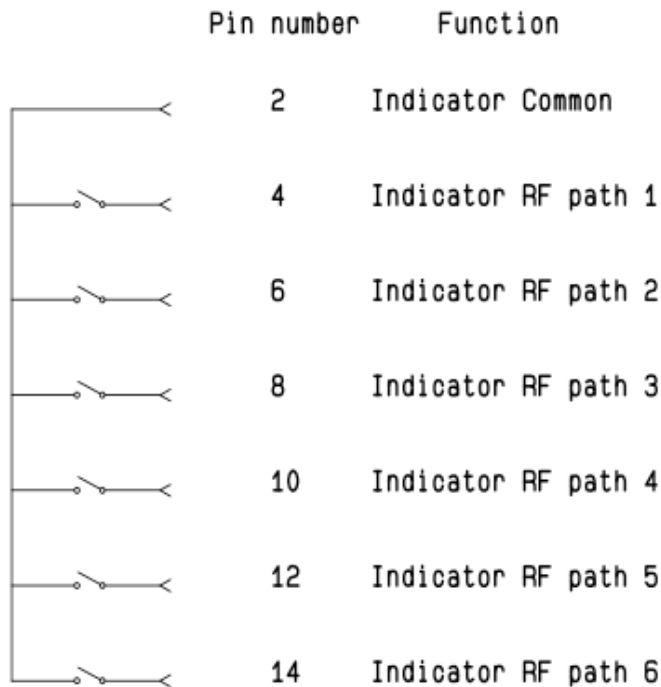
SMA — SMA 2.9 —

## High Performance Multiport Switches

TITANIUM Series / SPnT up to 40 GHz

### ELECTRONIC POSITION INDICATORS

The electronic position indicators use photo-MOS transistors which are driven by the mechanical position of the RF paths moving elements. The circuitry consists of a common which can be connected to an output corresponding to a selected RF path. If one or several RF paths are closed, the corresponding indicators are connected to the common. The photo-MOS transistors are configured for AC and/or DC operation. The electronic position indicators require the supply (20 to 32 VDC) to be connected to pin 1 and ground connected to pin 15.



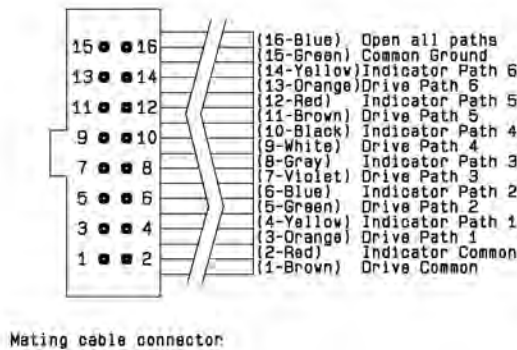
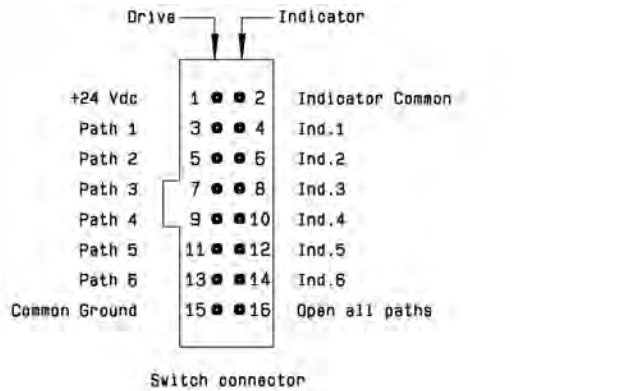
Ways 1 and 4 are not connected for SP4T switches.

## High Performance Multiport Switches

TITANIUM Series / SPnT up to 40 GHz

### TYPE 7: WITH TTL (OPTION "2") / WITHOUT TTL (OPTION "1") AND INDICATORS

Each RF path can be closed by applying ground or TTL "High" for option 2 to the corresponding "drive" pin. In general, except for Make-Before-Break drive, all other RF paths are simultaneously opened by internal logic.



#### Standard drive option "1":

- Connect pin 15 to ground
- Connect pin 1 to supply (+20 VDC to +32 VDC)
- Select (close) desired RF path by applying ground to the corresponding "drive" pin (Ex: apply ground to pin 3 to close RF path 1)
- To select another path, ensure that all unwanted RF path "drive" pins are disconnected from ground (to prevent multiple RF path engagement), then apply ground to the "drive" pin which corresponds to the desired RF path
- To open all RF paths, ensure that all RF path "drive" pins are disconnected from ground. Complete the operation by applying ground to pin 16

#### TTL drive option "2":

- Connect pin 15 to ground
- Connect pin 1 to supply (+20 VDC to +32 VDC)
- Select (close) desired RF path by applying TTL "High" to the corresponding "drive" pin (Ex: apply TTL "High" to pin 3 to close RF path 1)
- To select another path, ensure that all unwanted RF path "drive" pins are in TTL "low" position (to prevent multiple RF path engagement), then apply TTL "high" to the "drive" pin which corresponds to the desired RF path
- To open all RF paths, ensure that all RF path "drive" pins are in TTL "Low" position. Complete the operation by applying TTL "High" to pin 16

#### Break-Before-Make:

Open the undesired RF path for at least 15 minutes (minimum), then close the new RF port

#### Make-Before-Break:

Ensure that the previously selected RF path "drive" is connected to ground (or TTL "High" for option "2"), then close the new RF path

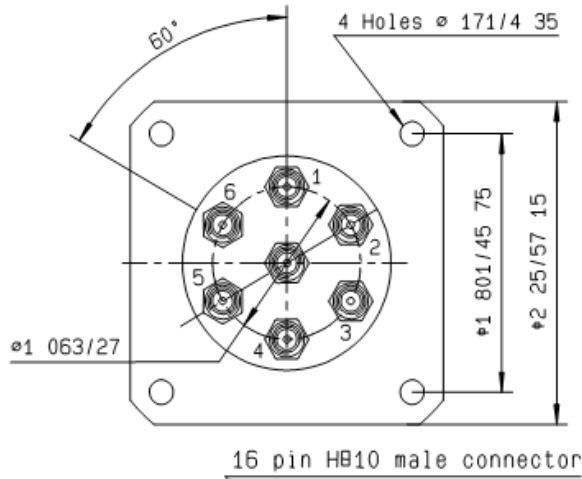
Ways 1 and 4 are not connected for SP4T switches.

## High Performance Multiport Switches

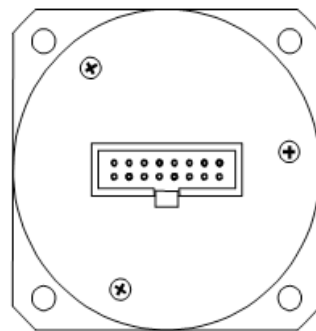
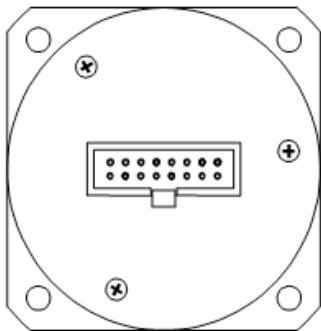
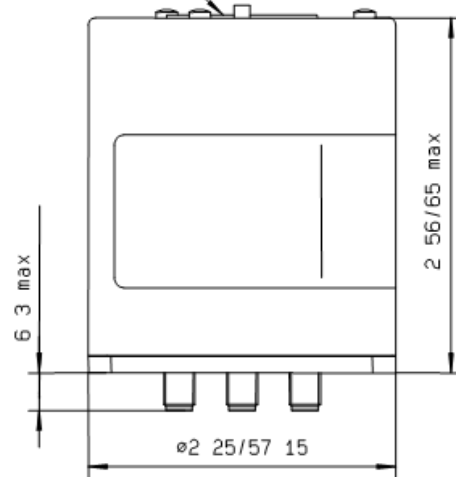
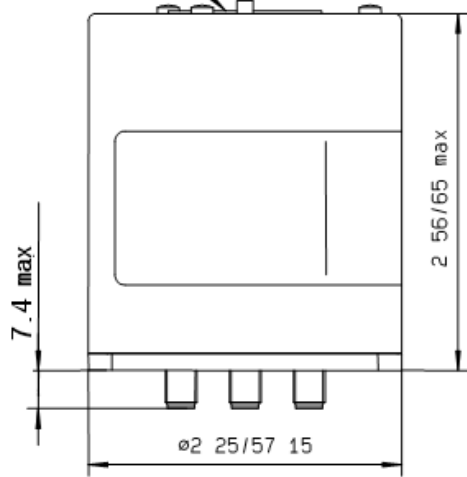
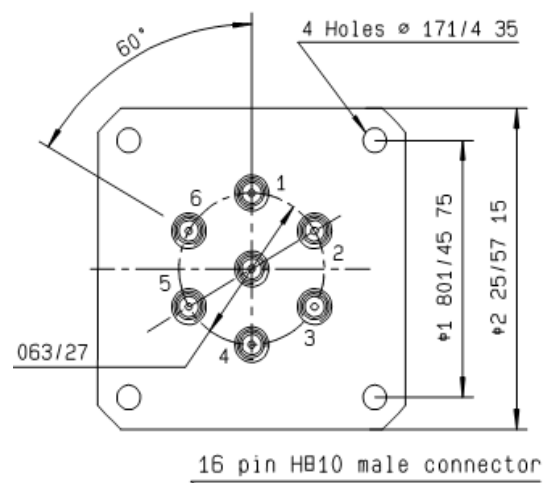
TITANIUM Series / SPnT up to 40 GHz

### TYPICAL OUTLINE DRAWING

SMA connectors



SMA2.9 connectors



Ways 1 and 4 are not connected for SP4T switches.

TITANIUM SERIES

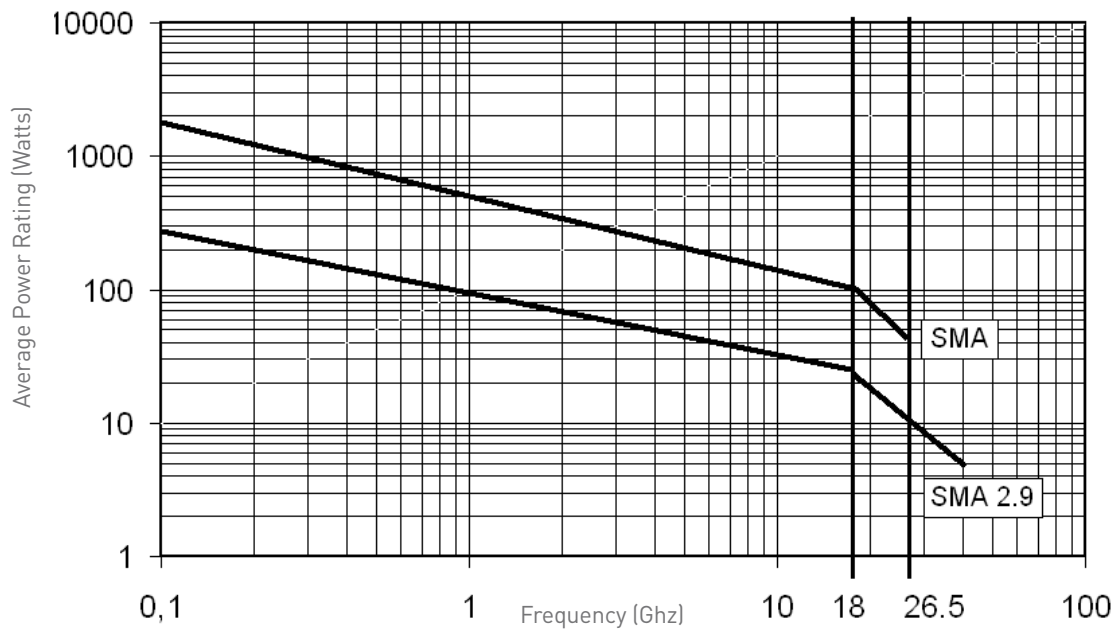
## High Performance Multiport Switches

TITANIUM Series / SPnT up to 40 GHz

### POWER RATING CHART

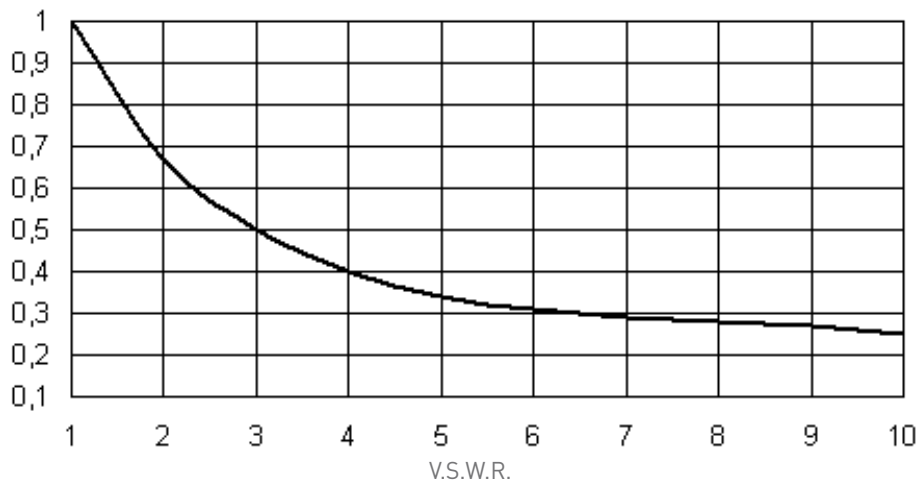
This graph is based on the following conditions:

- Ambient temperature: + 25°C
- Sea level
- V.S.W.R.: 1 and cold switching



### DERATING FACTOR VERSUS VSWR

The average power input must be reduced for load V.S.W.R. above 1:1.

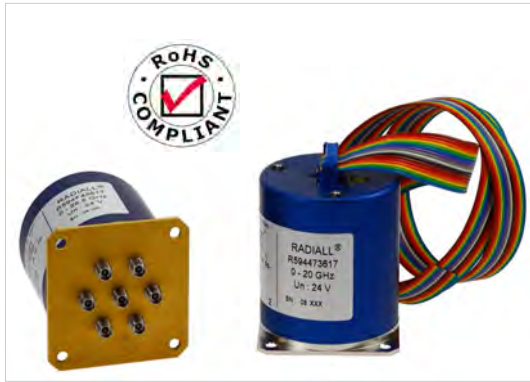


Ways 1 and 4 are not connected for SP4T switches.



## High Performance Multiport Switches

PLATINUM Series / SPnT terminated up to 40 GHz



Radiall's PLATINUM series switches are optimized to perform at a high level over an extended life cycle. With outstanding RF performance, and a guaranteed insertion loss repeatability of 0.03 dB over a life span of 10 million switching cycles, Radiall's PLATINUM series switches are a perfect solution for automated test and measurement equipment, as well as signal monitoring devices.

Example of P/N:

R594873427 is a SPnT SMA2.9 up to 40 GHz, Latching with Indicators, Self cut-off, Auto-Reset, TTL driver and HE10 connector.

### PART NUMBER SELECTION

**R 594**

**RF Connectors:**

- 3: SMA up to 6 GHz
- 4: SMA up to 20 GHz
- F: SMA up to 26.5 GHz
- 8: SMA 2.9 up to 40 GHz (1)

**Type:**

- 4: Latching + Self cut-off without indicator
- 7: Latching + Self cut-off + Auto Reset + Indicators

**Actuator Voltage:**

- 3: 24 Vdc

**Documentation:**

- : Certificate Of Conformity
- C: Calibration certificate
- R: Calibration certificate + RF curves

**Actuator Terminal:**

- 7: HE 10 receptacle, delivered with 750 mm (30 inches) ribbon cable + HE10 connector

**Options:**

- 1: Positive common (without TTL) Type "4" or "7"
- 2: TTL/5V logic with 24 Vdc supply Type "7" only

**Number of positions:**

- 4: 4 Positions
- 6: 6 Positions

(1) connector SMA 2.9 is equivalent to "K connector®", registered trademark of Anritsu.

Ways 1 and 4 are not connected for SP4T switches.

## High Performance Multiport Switches

PLATINUM Series / SPnT terminated up to 40 GHz

PLATINUM SERIES

### GENERAL SPECIFICATIONS

Operating mode		Latching	
Nominal operating voltage (across operating temperature)	Vdc	24 (20/32)	
Coil resistance (+/-10%)	Ω	120	
Operating current at 23°C	mA	200	
Maximum stand-by current	mA	50	
Average power		RF path Cold switching: See Power page <b>5-53</b>	
		Hot switching: 1 Watt Cw	
		Internal terminations 1 Watt average into 50 Ω	
TTL input	High Level	3 to 7 V	1.4 mA max at Vcc = Max
	Low Level	0 to 0.8 Volts	-
Indicator specifications		Maximum withstanding voltage	60V
		Maximum current capacity	150 mA
		Maximum "ON" resistance	2.5 Ω
		Minimum "OFF" resistance	100MΩ
Switching time (Max)	ms	15	
Life (Min) for	SMA	10 million cycles	
	SMA 2.9	2.5 million cycles	
Connectors		SMA - SMA 2.9	
Actuator terminals		HE10 ribbon receptacle	
Weight (Max)	g	230	

### ENVIRONMENTAL SPECIFICATIONS

Operating temperature range	-25°C to +75°C
Storage temperature range	-55°C to +85°C
Temperature cycling (MIL-STD-202, Method 107D, Cond.A)	-55°C to +85°C (10 cycles)
Vibration (MIL STD 202, Method 204D, Cond.D)	10-2000 Hz, 10g operating
Shock (MIL STD 202, Method 213B, Cond.C)	50g / 6 ms, 1/2 sine operating
Moisture resistance (MIL STD 202, Method 106E, Cond.E)	65°C, 95% RH, 10 days
Altitude storage (MIL STD 202, Method 105C, Cond.B)	50,000 feet (15,240 meters)
RFI (MIL STD 1344, Method 3008 or IEC 61726)	55dB at 20GHz
Magnetic field	< 5.10-5 gauss at 1 meter

## High Performance Multiport Switches

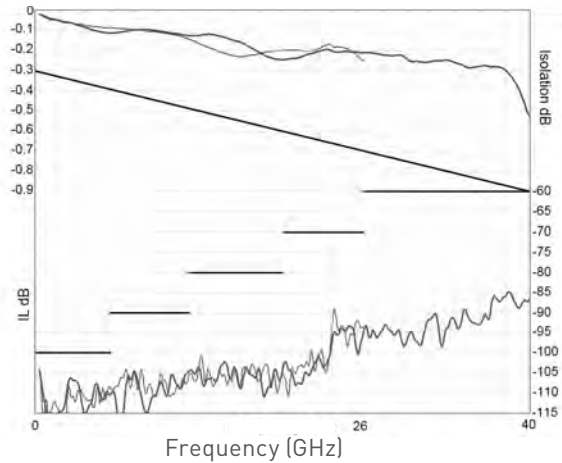
PLATINUM Series / SPnT terminated up to 40 GHz

### RF PERFORMANCES

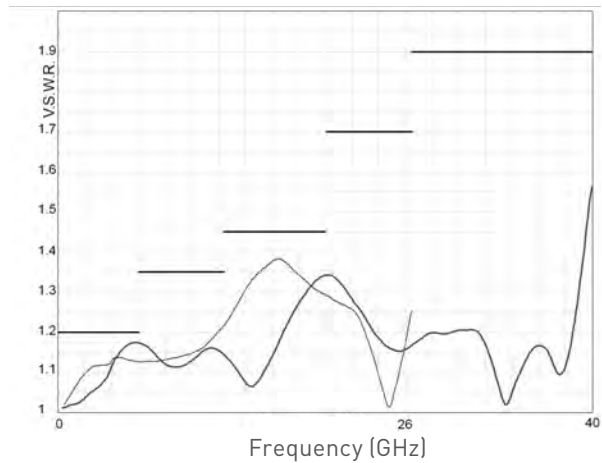
Part number		R5943-34-7	R5944-34-7 R5944-36-7	R594F-34-7 R594F-36-7	R5948-34-7 R5948-36-7			
Frequency Range	GHz	DC to 6	DC to 20	DC to 26.5	DC to 40			
Impedance	Ω	50						
Insertion Loss (Max)	dB	0.3 + 0.015 x frequency [GHz]						
Isolation (Min)	dB	100	DC to 6 GHz	100	DC to 6 GHz	100	DC to 6 GHz	100
			6 to 12.4 GHz	90	6 to 12.4 GHz	90	6 to 12.4 GHz	90
			12.4 to 20 GHz	80	12.4 to 20 GHz	80	12.4 to 18 GHz	80
					20 to 26.5 GHz	70	18 to 26.5 GHz	70
						26.5 to 40 GHz	60	
V.S.W.R. (Max)	dB	1.20	DC to 6 GHz	1.20	DC to 6 GHz	1.20	DC to 6 GHz	1.20
			6 to 12.4 GHz	1.35	6 to 12.4 GHz	1.35	6 to 12.4 GHz	1.35
			12.4 to 20 GHz	1.45	12.4 to 20 GHz	1.45	12.4 to 18 GHz	1.45
					20 to 26.5 GHz	1.70	18 to 26.5 GHz	1.70
							26.5 to 40 GHz	1.90
Repeatability (measured at 25°C)		0.03 dB			0.05 dB			

### TYPICAL RF PERFORMANCES

Insertion Loss and Isolation



V.S.W.R.



SMA — SMA 2.9 —

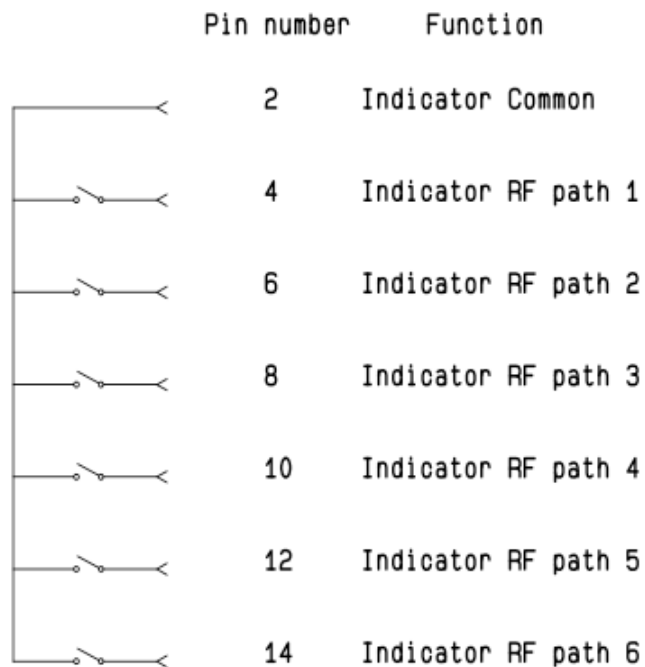
## High Performance Multiport Switches

PLATINUM Series / SPnT terminated up to 40 GHz

### ELECTRONIC POSITION INDICATORS

#### THIS OPTION IS NOT AVAILABLE WITH TYPE 4

The electronic position indicators use photo-MOS transistors which are driven by the mechanical position of the RF paths moving elements. The circuitry consists of a common which can be connected to an output corresponding to selected RF path. If one or several RF paths are closed, the corresponding indicators are connected to the common. The photo-MOS transistors are configured for AC and/or DC operation. The electronic position indicators require the supply (20 to 32 VDC) to be connected to pin 1 and ground connected to pin 15.



Ways 1 and 4 are not connected for SP4T switches.

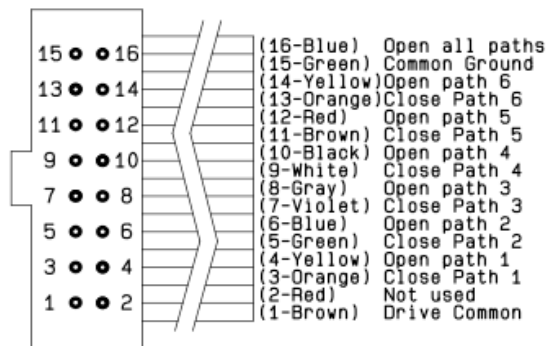
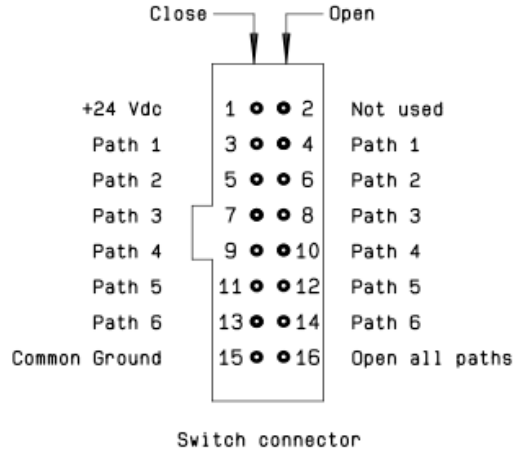
## High Performance Multiport Switches

PLATINUM Series / SPnT terminated up to 40 GHz

### DRIVING THE SWITCH

Each RF path is driven independently, and can be closed or open by applying ground to the corresponding "open" or "close" pin.

#### TYPE 4: WITHOUT TTL AND WITHOUT INDICATOR



#### Standard drive:

- Connect pin 15 to ground
- Connect pin 1 to supply (+20 VDC to +32VDC)
- Select desired RF path by applying ground to the corresponding "close" pin (Ex: ground pin 3 to close RF path 1)
- To open desired RF path connect ground to the corresponding "open" pin (Ex: ground pin 4 to open RF path 1)
- To open all RF paths, first ensure that all RF path "close" pins are disconnected from ground, then to complete the operation, connect pin 16 to ground

#### Make-Before-Break:

Make-Before-Break switching can be accomplished by closing the new RF path before opening the previously selected RF path. To complete the operation, close the new the new RF port for at least 15 minutes (minimum), then open the previously selected RF port.

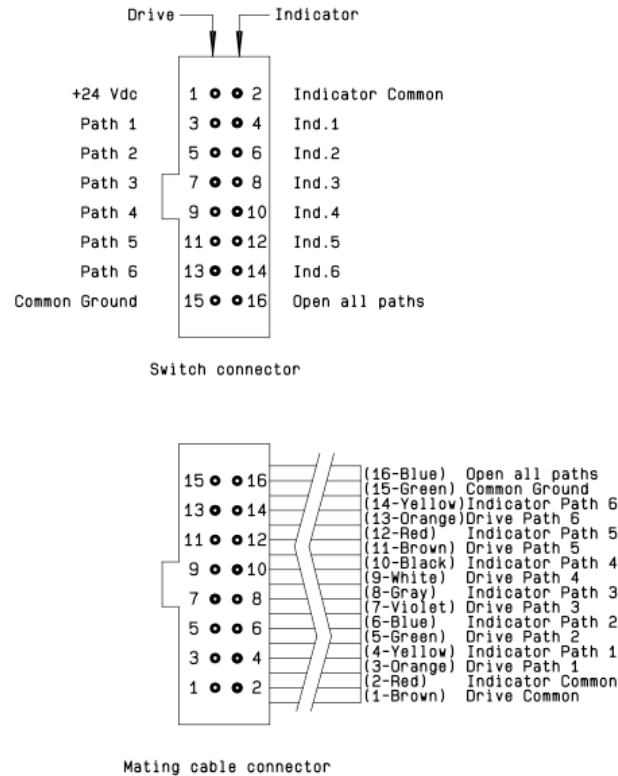
Ways 1 and 4 are not connected for SP4T switches.

## High Performance Multiport Switches

PLATINUM Series / SPnT terminated up to 40 GHz

### TYPE 7: WITH TTL (OPTION "2") / WITHOUT TTL (OPTION "1") AND INDICATORS

Each RF path can be closed by applying Ground or TTL "High" for option 2 to the corresponding "drive" pin. In general, except for Make-Before-Break drive, all other RF paths are simultaneously opened by internal logic.



#### Standard drive option "1":

- Connect pin 15 to ground
- Connect pin 1 to supply (+20 VDC to +32 VDC)
- Select (close) desired RF path by applying ground to the corresponding "drive" pin (Ex: apply ground to pin 3 to close RF path 1)
- To select another path, ensure that all unwanted RF path "drive" pins are disconnected from ground (to prevent multiple RF path engagement), then apply ground to the "drive" pin which corresponds to the desired RF path
- To open all RF paths, ensure that all RF path "drive" pins are disconnected from ground, then complete the operation by applying ground to pin 16

#### TTL drive option "2":

- Connect pin 15 to ground
- Connect pin 1 to supply (+20 VDC to +32 VDC)
- Select (close) desired RF path by applying TTL "High" to the corresponding "drive" pin (Ex: apply TTL "High" to pin 3 to close RF path 1)
- To select another path, ensure that all unwanted RF path "drive" pins are in TTL "Low" position (to prevent multiple RF path engagement), then apply TTL "High" to the "drive" pin which corresponds to the desired RF path
- To open all RF paths, ensure that all RF path "drive" pins are in TTL "Low" position, then to complete the operation by applying TTL "High" to pin 16

#### Break-Before-Make:

Open the undesired RF path after 15 minutes (minimum), then close the new RF port.

#### Make-Before-Break:

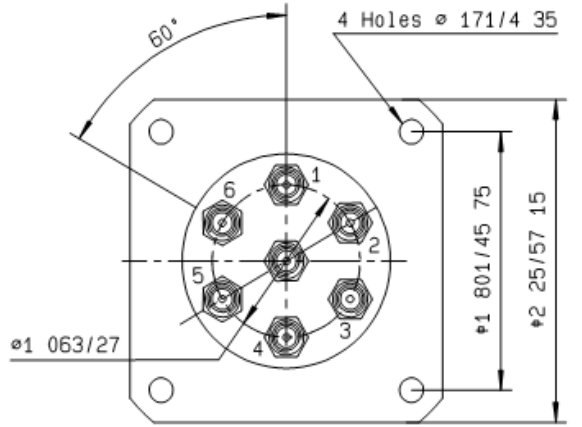
Ensure that the previously selected RF path "drive" is connected to ground (or TTL "High" for option "2"), then close the new RF path.

Ways 1 and 4 are not connected for SP4T switches.

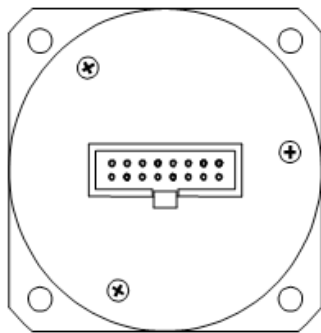
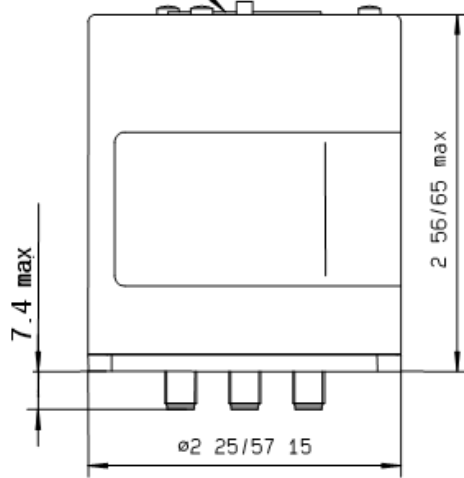
## High Performance Multiport Switches

### TYPICAL OUTLINE DRAWING

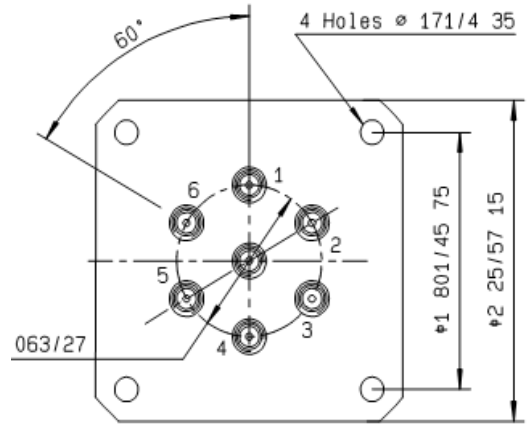
#### SMA connectors



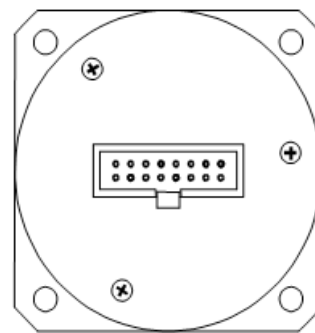
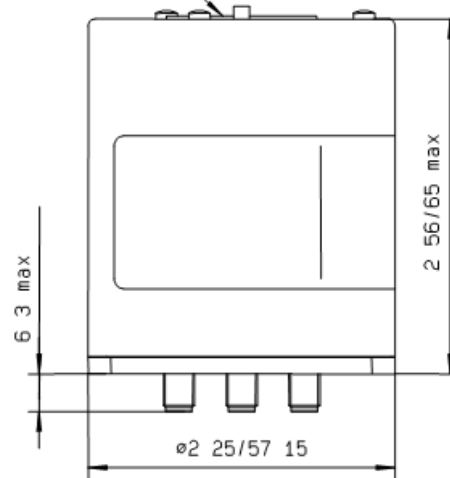
16 pin HB10 male connector



#### SMA 2.9 connectors



16 pin HB10 male connector



Ways 1 and 4 are not connected for SP4T switches.

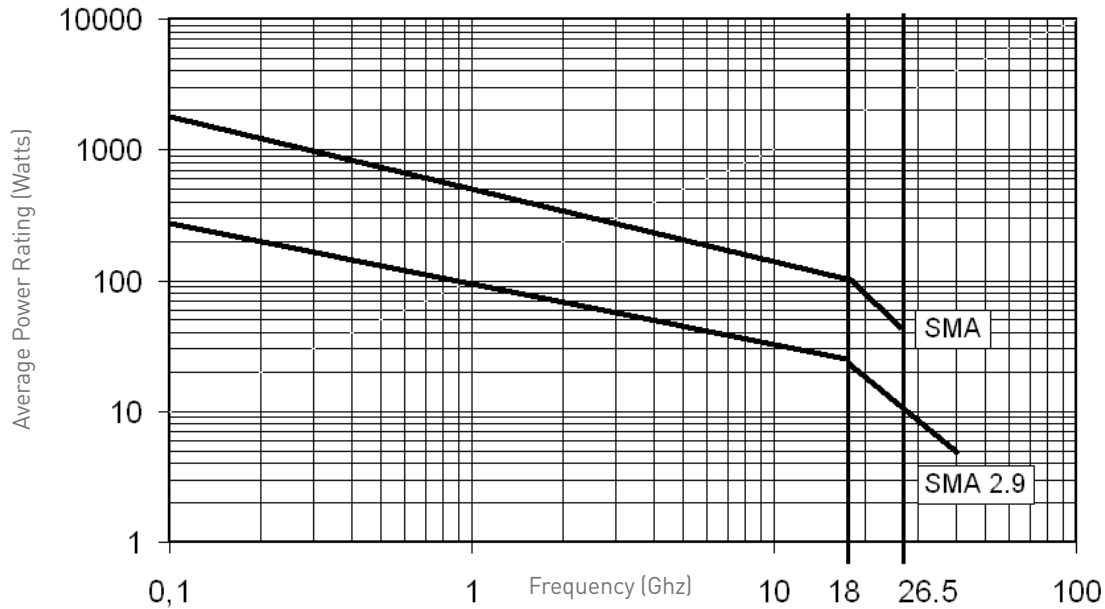
## High Performance Multiport Switches

PLATINUM Series / SPnT terminated up to 40 GHz

### POWER RATING CHART

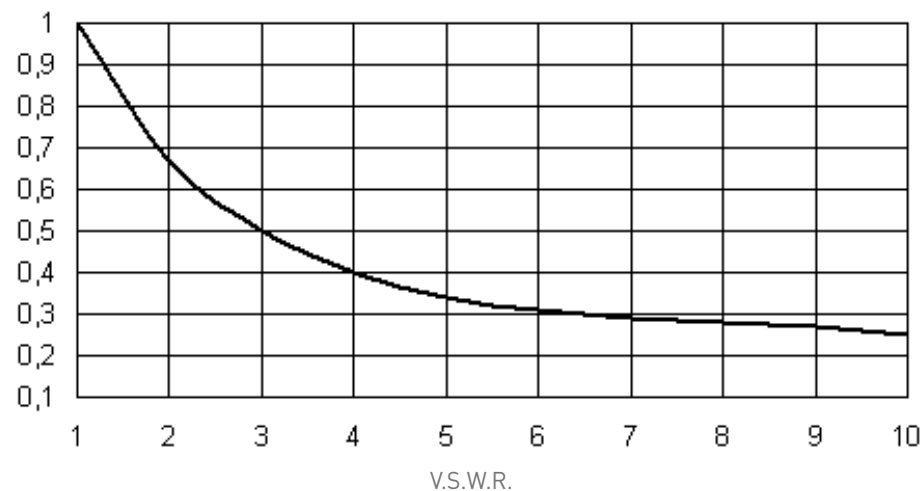
This graph is based on the following conditions:

- Ambient temperature: + 25°C
- Sea level
- V.S.W.R.: 1 and cold switching



### DERATING FACTOR VERSUS VSWR

The average power input must be reduced for load V.S.W.R. above 1:1.





### Optional Features For SPnT

#### EXAMPLES OF DEDICATED APPLICATION OPTIONS



SPnT with flat ribbon cable for easy installation with limited space.



Thermal vacuum SPnT designed based on our expertise in Space. For more detailed information, see page 7-6 to 7-8.



SPnT with special mounting bracket for easy mounting in Automatic Test Equipment.



Subminiature SP6T with a micro D connector instead of solder pins.



SP3T used for a military application with sequential access and severe environmental characteristics.



Subminiature SP6T developed for test bench applications requiring low RF leakage.

SECTION 6



Low Pim



## Contents

### RAMSES Series

SPDT up to 18 GHz: R570xxxxxLP Series .....6-2 to 6-6  
 DPDT up to 18 GHz: R577xxxxxLP Series .....6-7 to 6-11  
 SPnT up to 18 GHz: R573xxxxxLP Series.....6-12 to 6-16

### LOW PIM PART NUMBER SELECTION GUIDE\*

Digital Position		R 1-3:	4: RF connectors		5: Type			6: Voltage		7: TTL Option/Position			8: Options			9: Terminals		LP10-11:	
Series	Configuration		N 12.4 GHz	SMA 18GHz	Failsafe	Latching	Normally open*	12V	28V	Without TTL driver	With TTL driver	Number of positions	Without option	Positive common	Suppression diodes	Positive common and suppression diodes	Solder pins	D-Sub connector	Low Pim
RAMSES	SPDT	R570	1	4	1/2	3/4/5/6	-	2	3	0	1	-	0	1	3	4	0	5	LP
	DPDT	R577	1	4	1/2	3/4/5/6	-	2	3	0	1	-	0	1	3	4	0	5	LP
	SPnT	R573	1	4	-	2/3	0/1	2	3	-	-	4/6	0	1	3	4	0	5	LP

Example of P/N: R573423600LP is a SP6T SMA 18 GHz, latching, 28 Vdc, without option, solder pins.

\*For part number creation and available options, see detailed part number selection for each series.

**SPDT Low PIM up to 18 GHz**

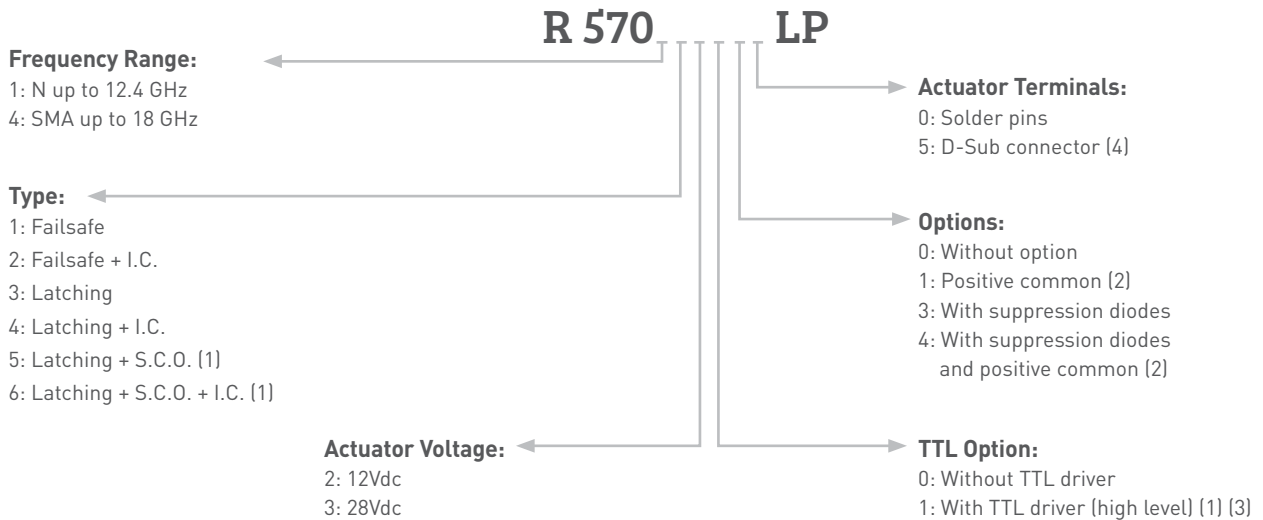


To meet growing market demands created by the deployment of 4G/LTE networks, Radiall has introduced a new range of Low PIM switches. RAMSES SPDT Low PIM switches are perfectly suited for RF test systems and test benches requiring excellent passive intermodulation performance up to 18 GHz, with a guarantee PIM performance of -160 dBc @ +43 dBm over a life span of 2 million switching cycles.

These products are specific to instrumentation and telecommunication applications.

Example of P/N:  
R570413030LP is a SPDT Low PIM SMA 18 GHz, failsafe, 28 Vdc, with suppression diodes, solder pins.

**PART NUMBER SELECTION**



I.C.: Indicator contact - S.C.O.: Self Cut-Off

(1): Suppression diodes are already included in Self Cut-OFF & TTL option

(2): Positive common shall be specified only with type 2, 3, 5 & 6 because failsafe models can be used with both polarities

(3): Polarity is not relevant to application for switches with TTL driver

(4): Available only for N models

**SPDT Low PIM up to 18 GHz**

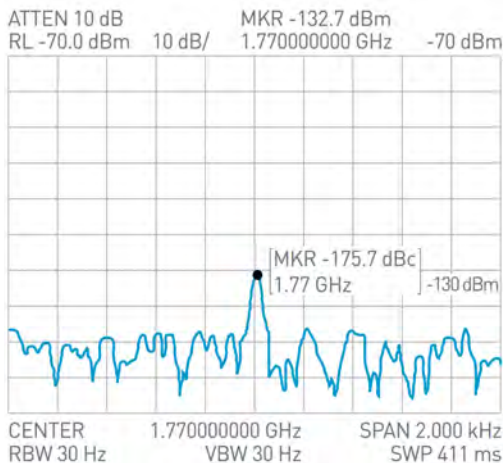
**GENERAL SPECIFICATIONS**

Operating mode		Failsafe		Latching	
Nominal operating voltage (across operating temperature)	Vdc	12 (10.2 to 13)	28 (24 to 30)	12 (10.2 to 13)	28 (24 to 30)
Coil resistance at 23°C (+/-10%)	Ω	47.5	275	58	350
Operating current at 23°C	mA	250	102	210	80
Average power		See Power Rating Chart on page 1-13			
TTL input	High Level	2.2 to 5.5 Volts		800µA max 5.5 Volts	
	Low Level	0 to 0.8 Volts		20µA max 5.5 Volts	
Indicator rating		1 W / 30 V / 100 mA			
Switching time	ms	10			
Life (Min)		2 million cycles			
Connectors		SMA - N			
Operating temperature range		-25°C to +70°C			
Storage temperature range		-55°C to +85°C			
Vibration (MIL STD 202, method 204D, cond.D)		10-2000 Hz, 20g		operating	
Shock (MIL STD 202, method 213B, cond.C)		100g / 6 ms, ½ sine		operating	

**RF PERFORMANCES**

Connectors	Frequency range GHz	V.S.W.R. (max)	Insertion loss (max) dB	Isolation (min) dB	Impedance Ω	Third order intermodulation
N	DC - 12.4	DC - 1	1.15	0.15	85	-160 dBc @ +43 dBm (2 carriers 20W)
		1 - 2	1.20	0.20	80	
		2 - 3	1.25	0.25	75	
		3 - 8	1.35	0.35	70	
		8 - 12.4	1.50	0.50	60	
SMA	DC - 18	DC - 3	1.10	0.15	80	
		3 - 8	1.20	0.20	75	
		8 - 12.4	1.20	0.25	65	
		12.4 - 18	1.40	0.35	60	

**OUTSTANDING PIM PERFORMANCE**



**Passive Intermodulation**

Tone 1	1810 MHz, approximately 43 dBm
Tone 2	1850 MHz, approximately 43 dBm
3rd order PIM	160 dBc at 1770 MHz

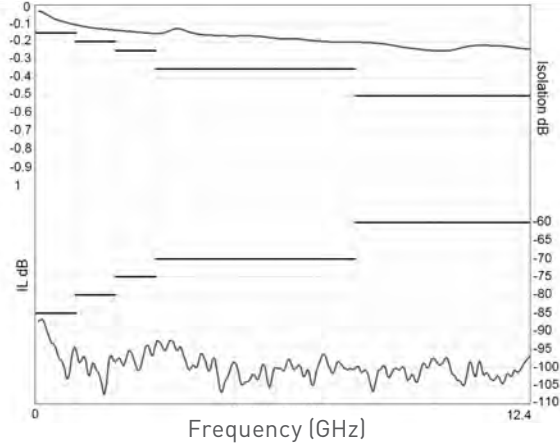
Depending on application, carrier powers and frequencies, PIM measurements can vary. PIM testing is not measured during product acceptance test.

### SPDT Low PIM up to 18 GHz

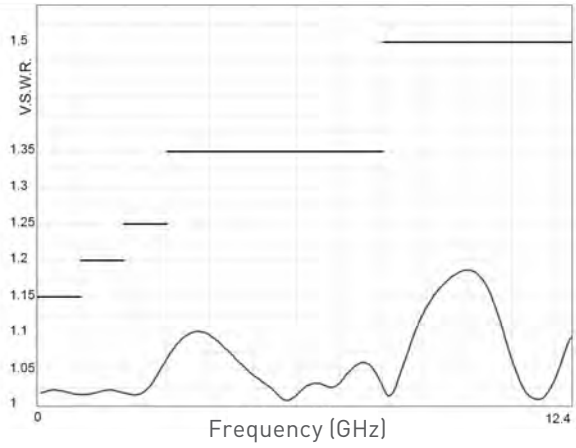
#### TYPICAL RF PERFORMANCES

Example: SPDT N up to 12.4 GHz

Insertion Loss and Isolation

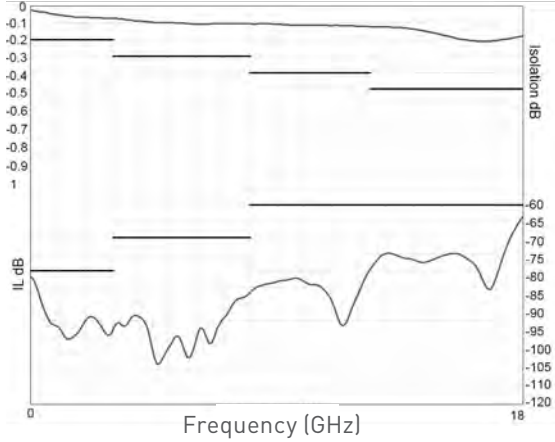


V.S.W.R.

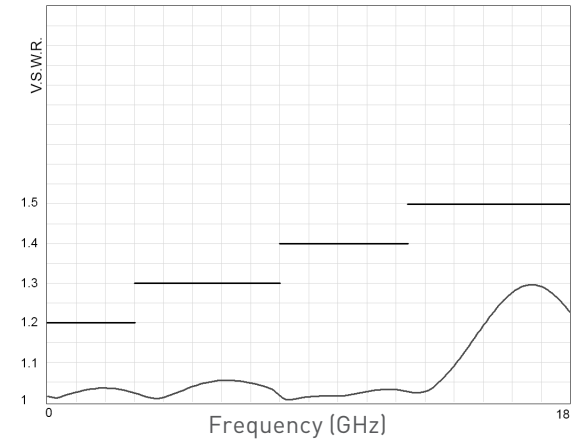


Example: SPDT SMA up to 18 GHz

Insertion Loss and Isolation



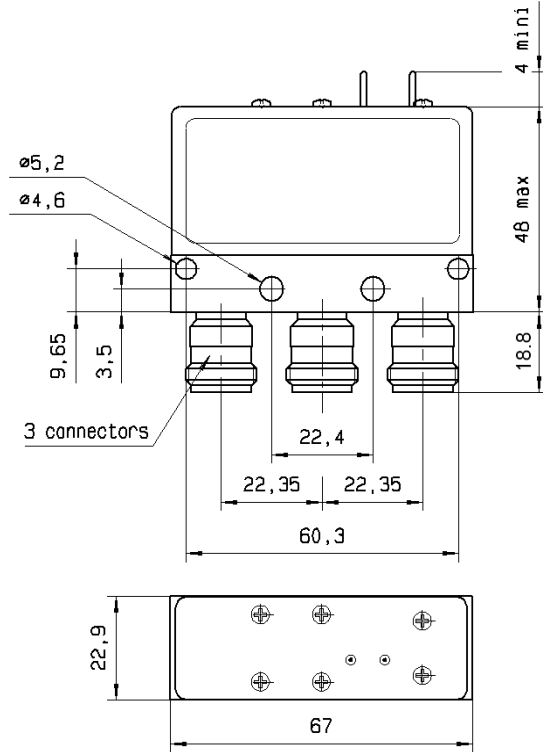
V.S.W.R.



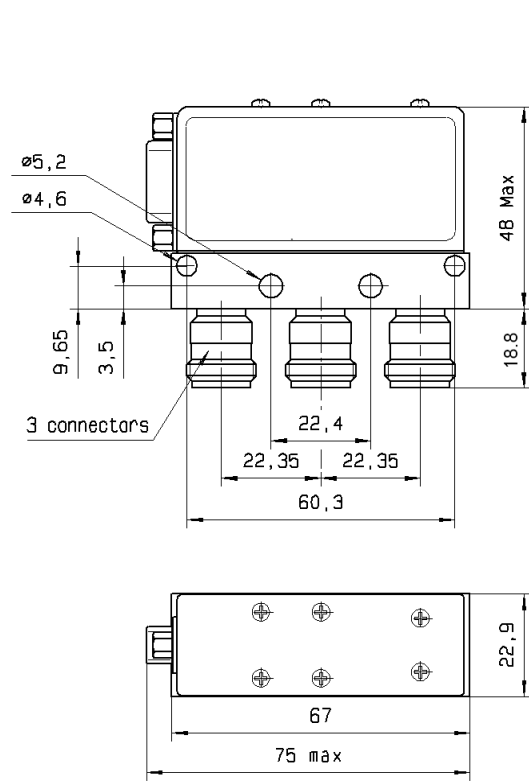
SPDT Low PIM up to 18 GHz

TYPICAL OUTLINE DRAWING

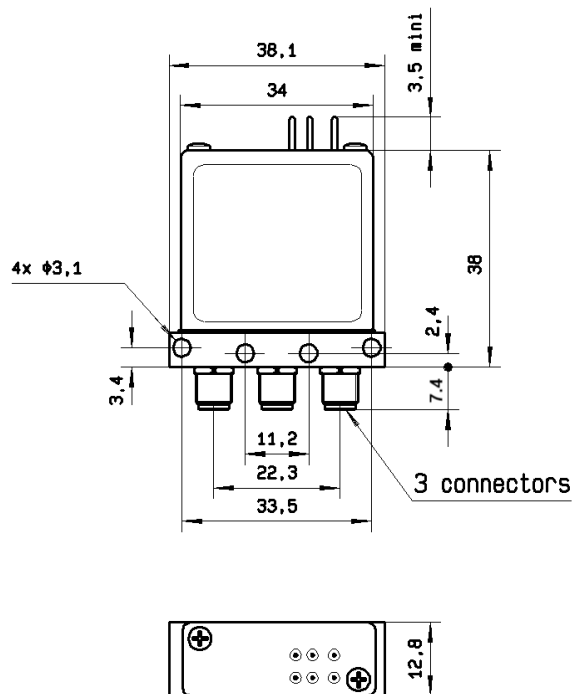
Example: SPDT N up to 12.4 GHz with pins



Example: SPDT N up to 12.4 GHz with D-sub



Example: SPDT SMA up to 18 GHz



LOW PIM

**DPDT Low PIM up to 18 GHz**



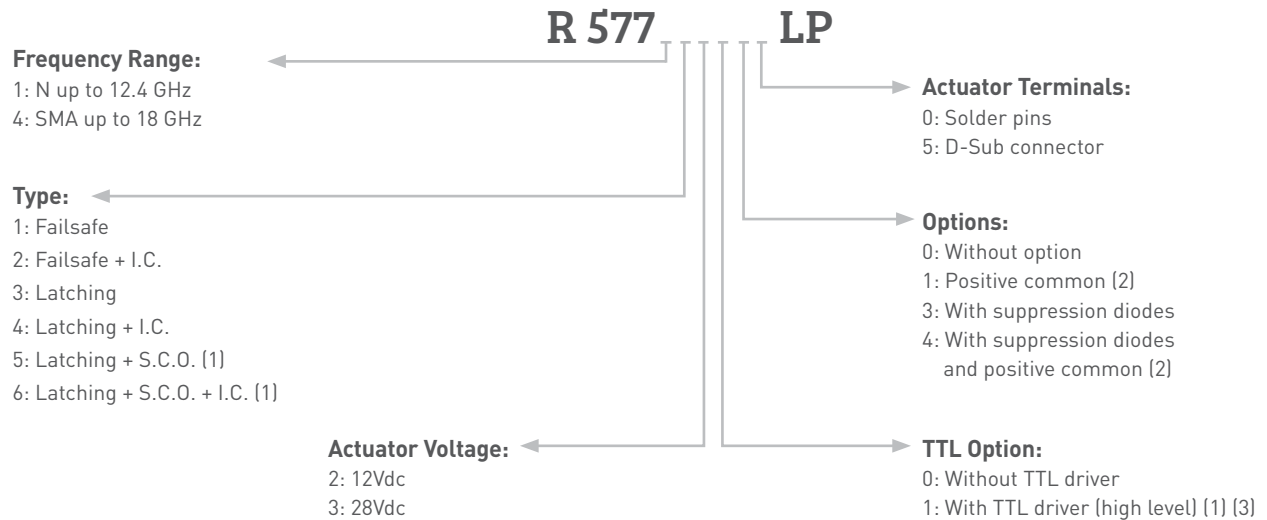
To meet growing market demands created by the deployment of 4G/LTE networks, Radiall has introduced a new range of Low PIM switches. RAMSES DPDT Low PIM switches are perfectly suited for RF test systems and test benches requiring excellent passive intermodulation performance up to 18 GHz, with a guarantee PIM performance of -160 dBc @ +43 dBm over a life span of 2 million switching cycles.

These products are specific to instrumentation and telecommunication applications.

Example of P/N:

R577163105LP is a DPDT Low PIM N 12.4 GHz latching with Indicators, Self Cut-Off, 28 Vdc, TTL driver, D-Sub connector.

**PART NUMBER SELECTION**



I.C.: Indicator contact - S.C.O.: Self Cut-Off

(1): Suppression diodes are already included in Self Cut-OFF & TTL option

(2): Positive common shall be specified only with type 2, 3, 5 & 6 because failsafe models can be used with both polarities

(3): Polarity is not relevant to application for switches with TTL driver



**DPDT Low PIM up to 18 GHz**

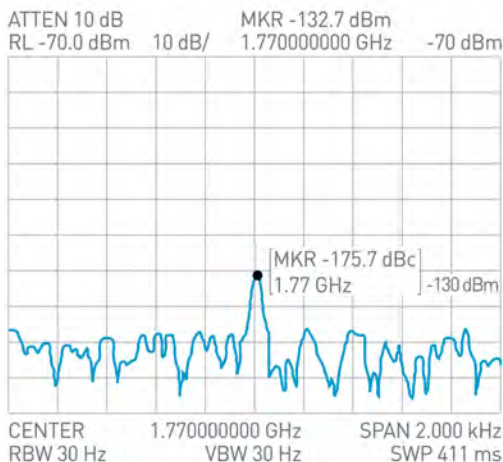
**GENERAL SPECIFICATIONS**

Operating mode		Normally open		Latching	
Nominal operating voltage (across operating temperature)	Vdc	12 (10.2 to 13)	28 (24 to 30)	12 (10.2 to 13)	28 (24 to 30)
Coil resistance at 23°C (+/-10%)	Ω	35	200	38	225
Nominal operating current at 23°C	mA	340	140	320	125
Average power		See Power Rating Chart on page 1-13			
TTL input	High Level	2.2 to 5.5 Volts		800µA max 5.5 Volts	
	Low Level	0 to 0.8 Volts		20µA max 0.8 Volts	
Switching time (Max)	ms	15			
Life (Min)		2 million cycles			
Connectors		SMA - N			
Actuator terminals		Solder pins or male 9 pin D-Sub connector			
Operating temperature range		-25°C to +70°C			
Storage temperature range		-55°C to +85°C			
Vibration (MIL STD 202, method 204D, cond.C)		10-2000 Hz, 10g		operating	
Shock (MIL STD 202, method 213B, cond.G)		50g / 11 ms, ½ sine		operating	

**RF PERFORMANCES**

Connectors	Frequency range GHz	V.S.W.R. (max)	Insertion loss (max) dB	Isolation (min) dB	Impedance Ω	Third order intermodulation
N	DC - 3 DC - 12.4	DC - 1	1.15	0.15	85	-160 dBc @ +43 dBm (2 carriers 20W)
		1 - 2	1.20	0.20	80	
		2 - 3	1.25	0.25	75	
		3 - 8	1.35	0.35	70	
		8 - 12.4	1.50	0.50	60	
SMA	DC - 3 DC - 18	DC - 3	1.20	0.20	80	
		3 - 8	1.30	0.30	70	
		8 - 12.4	1.40	0.40	65	
		12.4 - 18	1.50	0.50	60	

**OUTSTANDING PIM PERFORMANCE**



**Passive Intermodulation**

Tone 1	1810 MHz, approximately 43 dBm
Tone 2	1850 MHz, approximately 43 dBm
3rd order PIM	160 dBc at 1770 MHz

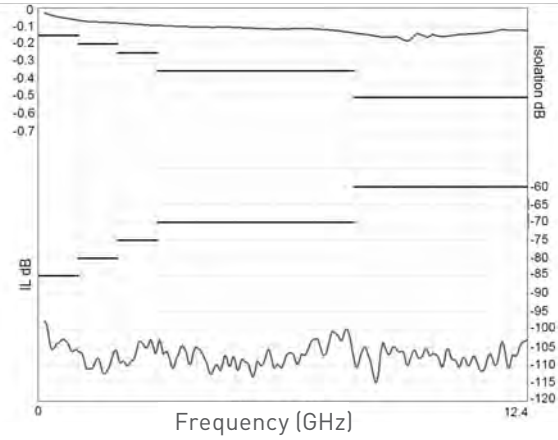
Depending on application, carrier powers and frequencies, PIM measurements can vary. PIM testing is not measured during product acceptance test.

## DPDT Low PIM up to 18 GHz

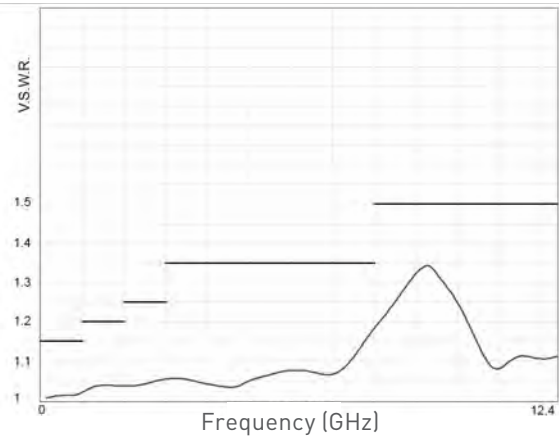
### TYPICAL RF PERFORMANCES

Example: DPDT N up to 12.4 GHz

Insertion Loss and Isolation

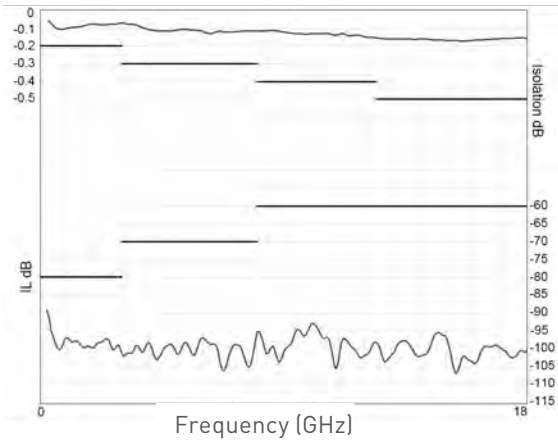


V.S.W.R.

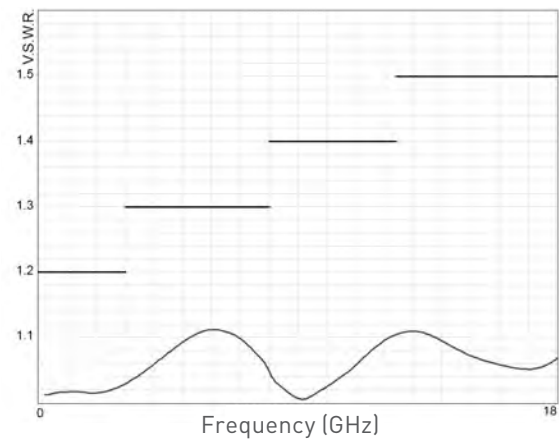


Example: DPDT N up to 18 GHz

Insertion Loss and Isolation



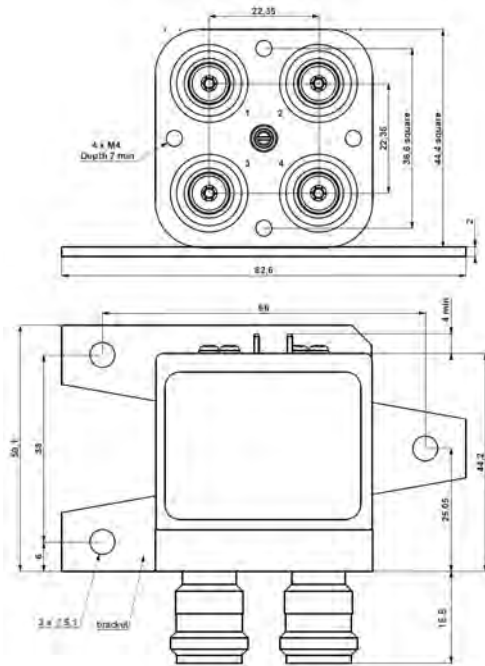
V.S.W.R.



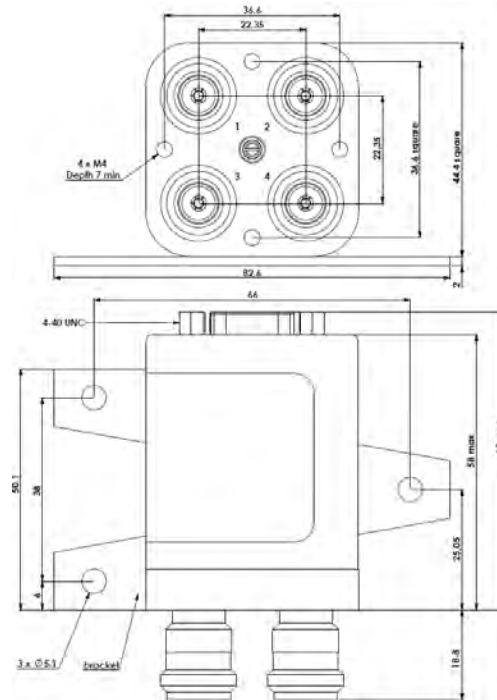
DPDT Low PIM up to 18 GHz

TYPICAL OUTLINE DRAWING

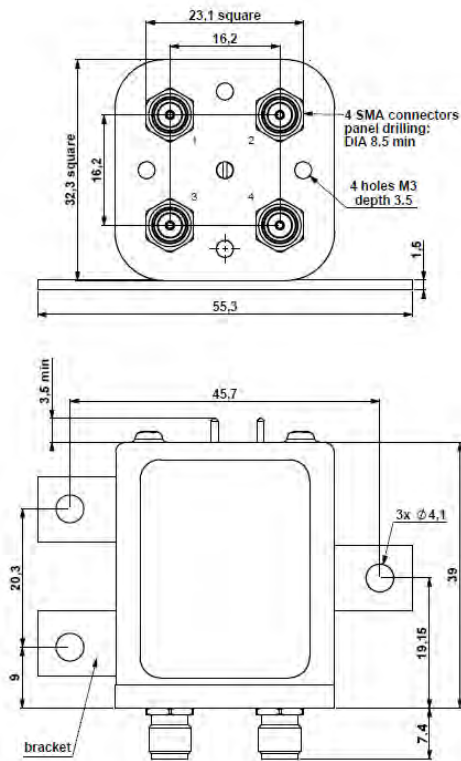
Example: DPDT N up to 12.4 GHz with pins



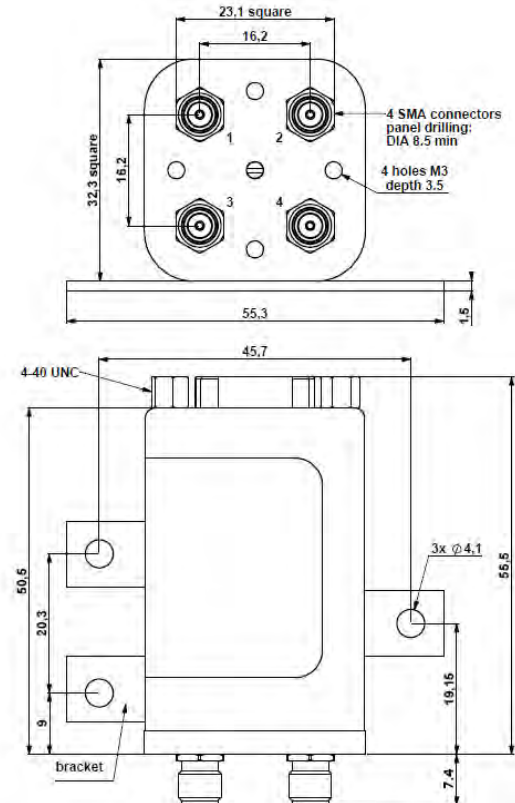
Example: DPDT N up to 12.4 GHz with D-sub



Example: DPDT SMA up to 18 GHz with pins



Example: DPDT SMA up to 18 GHz with pins



**SPnT Low PIM up to 18 GHz**

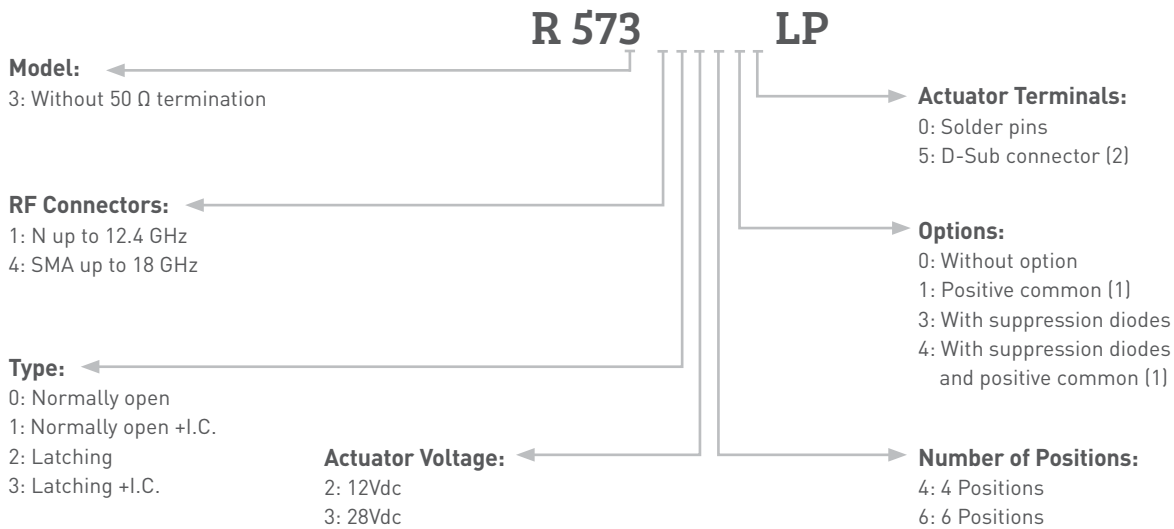


To meet growing market demands created by the deployment of 4G/LTE networks, Radiall has introduced a new range of Low PIM switches. RAMSES SPnT Low PIM switches are perfectly suited for RF test systems and test benches requiring excellent passive intermodulation performance up to 18 GHz, with a guarantee PIM performance of -160 dBc @ +43 dBm over a life span of 2 million switching cycles.

These products are specific to instrumentation and telecommunication applications.

Example of P/N:  
R573403600LP is a SP6T Low PIM SMA up to 18 GHz, Normally Open, 28 Vdc, without option and solder pins.

**PART NUMBER SELECTION**



I.C.: Indicator contact  
(1) Standard products are equipped with negative common  
(2) Only for N models

SPnT Low PIM up to 18 GHz

GENERAL SPECIFICATIONS

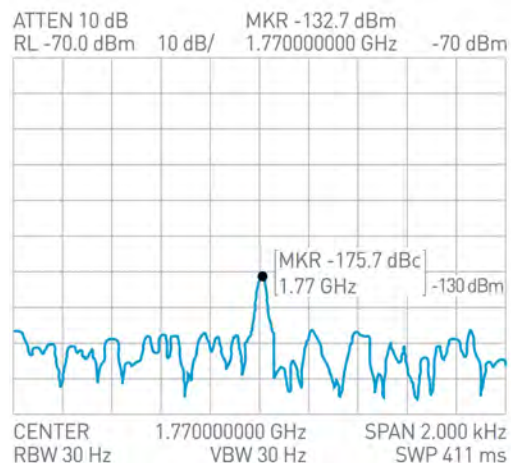
Operating mode		Normally open		Latching	
Nominal operating voltage (across operating temperature)	Vdc	12 (10.2 to 13)	28 (24 to 30)	12 (10.2 to 13)	28 (24 to 30)
Coil resistance at 23°C (+/-10%)	Ω	47.5	275	38	225
Nominal operating current at 23°C	mA	250	102	320 Reset SP4T: 1280 mA* Reset SP6T: 1920 mA*	125 Reset SP4T: 500 mA* Reset SP6T: 750 mA*
Average power		See Power Rating Chart on page 1-13			
TTL input	High Level	2.2 to 5.5 V (TTL Option) / 3.5 to 5.5 V (BCD Option)			
	Low Level	0 to 0.8 V (TTL Option) / 0 to 1.5 V (BCD Option)			
Indicator rating		1 Watt / 30 V / 100 mA			
Switching time (Max)	ms	15			
Life (Min)		2 million cycles			
Connectors		SMA - N			
Actuator terminals		Solder pins or male 25 pin D-Sub connector			
Operating temperature range		-25°C to +70°C			
Storage temperature range		-55°C to +85°C			
Vibration (MIL STD 202, method 204D, cond.D)		10-2000 Hz, 20g operating for SP3 to 6T			
Shock (MIL STD 202, method 213B, cond.C)		100g / 6 ms, ½ sine operating for SP3 to 6T			

\*Reset: supply voltage time 1 sec. max./duty cycle 10%

RF PERFORMANCES

Connectors	Number of positions	Frequency range GHz	V.S.W.R. (max)	Insertion loss (max) dB	Isolation (min) dB	Impedance Ω	Third order intermodulation
SMA	4 and 6	DC - 18	DC - 3	1.20	0.20	80	-160 dBc @ +43 dBm (2 carriers 20W)
			3 - 8	1.30	0.30	70	
			8 - 12.4	1.40	0.40	60	
			12.4 - 18	1.50	0.50	60	
N	DC - 12.4	DC - 3	1.20	0.20	80		
		3 - 8	1.35	0.35	70		
		8 - 12.4	1.50	0.50	60		

OUTSTANDING PIM PERFORMANCE



Passive Intermodulation

Tone 1	1810 MHz, approximately 43 dBm
Tone 2	1850 MHz, approximately 43 dBm
3rd order PIM	160 dBc at 1770 MHz

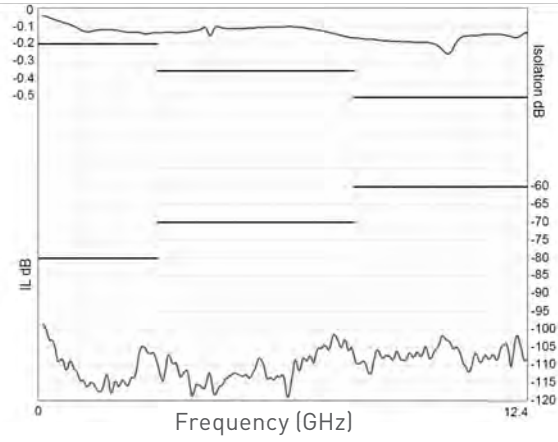
Depending on application, carrier powers and frequencies, PIM measurements can vary. PIM testing is not measured during product acceptance test.

### SPnt Low PIM up to 18 GHz

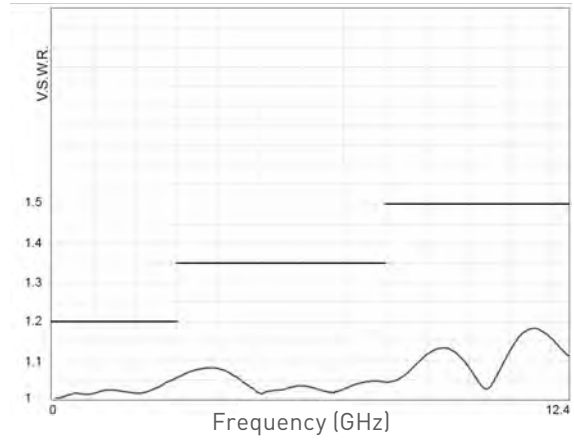
#### TYPICAL RF PERFORMANCES

Example: SP6T N up to 12.4 GHz

##### Insertion Loss and Isolation

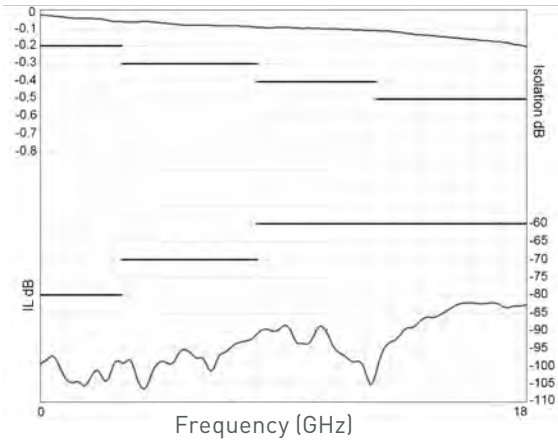


##### V.S.W.R.

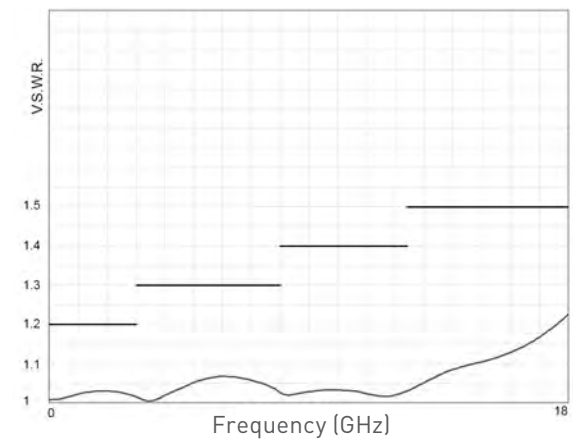


Example: SP6T SMA up to 18 GHz

##### Insertion Loss and Isolation



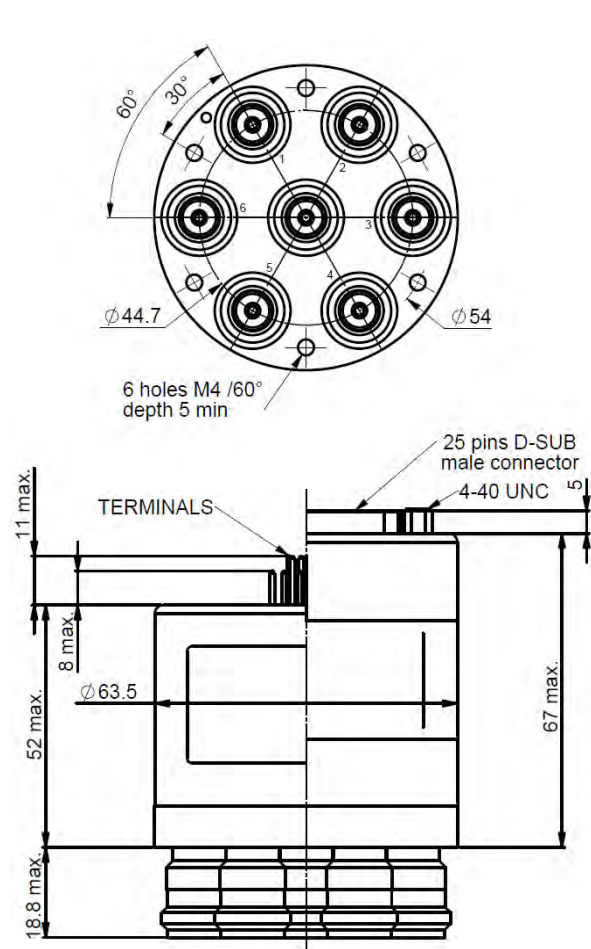
##### V.S.W.R.



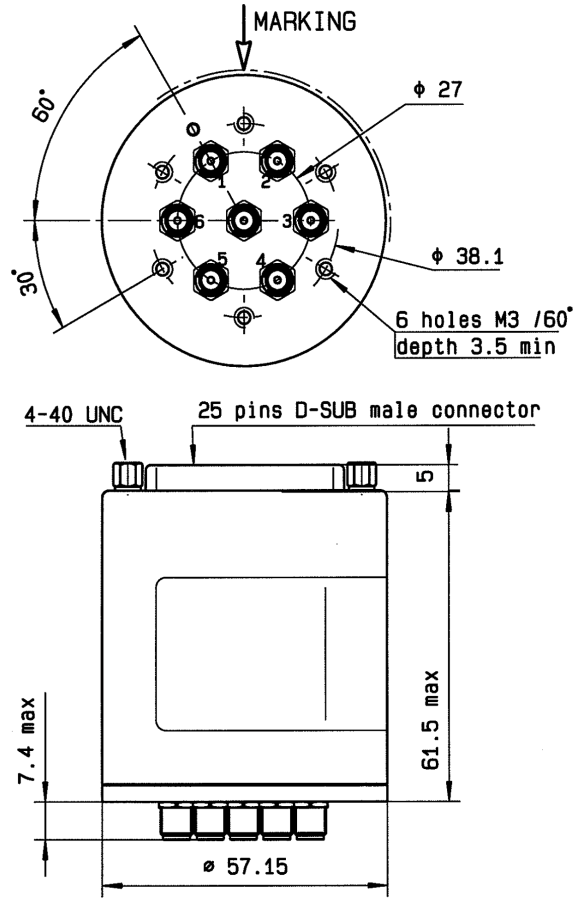
SPnT Low PIM up to 18 GHz

TYPICAL OUTLINE DRAWING

Example: SPnT N up to 12.4 GHz

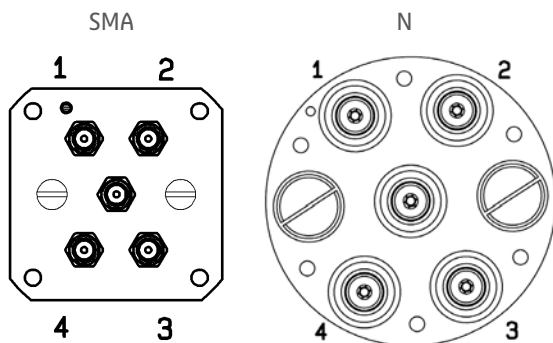


Example: SPnT SMA up to 18 GHz

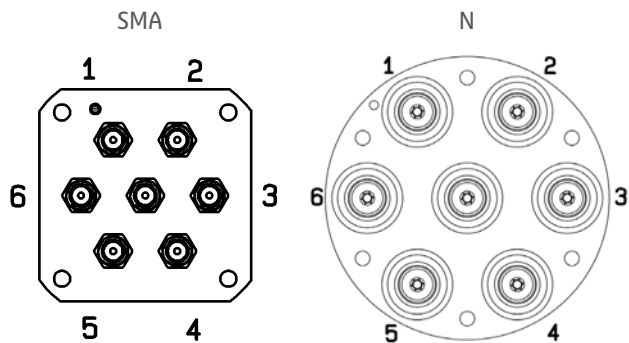


RF CONNECTORS ALLOCATION

SP4T



SP6T



Coaxial Low PIM switches - Electrical schematics

Type		Failsafe	Latching		
Options		Without option	Without option	Cut-off	C+ and suppression diodes
		Indicator contact	Indicator contact	Cut-off and I.C.	C+, suppression diodes and I.C.
		Suppression diodes	Suppression diodes	Cut-off and TTL Driver	C+ and cut-off
		Suppression diodes and I.C.	Suppression diodes and I.C.	Cut-off, TTL and I.C.	C+, cut-off and I.C.
		TTL Driver	TTL Driver	C+	
		TTL Driver and I.C.	TTL Driver and I.C.	C+ and I.C.	
Page Number	SPDT	see page 2-24	see page 2-25	see page 2-26	see page 2-27
	DPDT	see page 4-10	see page 4-11	see page 4-12	see page 4-13

Type		Normally open		Latching		
Options		Without option	C+	Without option	C+	C+ and suppression diodes
		Indicator contact	C+ and I.C.	Indicator contact	C+ and I.C.	C+, suppression diodes and I.C.
		Suppression diodes	C+ and suppression diodes	Suppression diodes		
		Suppression diodes and I.C.	C+, suppression diodes and I.C.	Suppression diodes and I.C.		
Page Number	SPnT	see page 5-32	see page 5-33	see page 5-34	see page 5-35	see page 5-36



**SECTION 7**



**Space**



**Contents**

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High power models ..... 7-12 to 7-17

Thermal Vacuum for Ground Segments ..... 7-18 to 7-20

SECTION 7 TABLE OF CONTENTS

**General Information/Specifications**

**GENERAL INFORMATION/SPECIFICATIONS**

Radiall Hi-Rel switches are manufactured based on over 40 years of experience and thousands of products that have been designed, qualified, and delivered for both commercial and military applications. With a space heritage of over 25 years and products in flight on over 250 satellites around the world, Radiall guarantees the highest level of manufacturing, quality and reliability.

Radiall Hi-Rel coaxial switches have been fully evaluated and approved by the European Space Agency for Space use according to the generic specification ESCC3603. Radiall offers products tested at several levels based on the same hardware including:

- EM: Engineering Model
- QM: Qualification Model
- PFM: Proto Flight Model

Radiall also provides a full range of low cost Hi-Rel switches for space applications. These products, meet the requirements for communication satellite applications according to RAD-GEN-SWIT-001 and follow detailed specifications according to the Radiall part number list (see page 6-3).

**ENVIRONMENTAL CHARACTERISTICS**

		Qualification level
Operation temperature range		- 30°C / + 85°C
Non operation temperature range		- 40°C / + 85°C
Vibration	Sinus	5 – 100 Hz / 20g
	Random	20 – 2000 Hz / 28.57 grms
Schocks		½ sinus / 1200g / 0.25 ms
Pressure		Free space vacuum



## Radial Specifications

### RADIALL BEST RUNNERS PART LIST (FM P/N):

Detail specification	Product	Power cap.	Connectors	Radiall P/N FM	Designation
RAD - DET - SPDT - 001	SPDT	Low power	SMA	R571 492 601	Fixing plate with pins
				R571 472 601	Lay Down with pins
				R571 471 601	Lay Down with D-sub
			SMA 2.9	R571 892 601	Fixing plate with pins
				R571 872 601	Lay Down with pins
				R571 871 601	Lay Down with D-sub
RAD - DET - SPDT - 002	SPDT	High power	TNC	R565 271 601	Lay Down with D-sub, High Cavity
				R565 371 601	Lay Down with D-sub, Standard Cavity
RAD - DET - DPDT - 006	DPDT	Low power	SMA	R578 483 601	Stand Up with D-sub
				R578 472 601	Lay Down with D-sub
				R578 482 601	Stand Up with pins
			SMA 2.9	R578 872 601	Lay Down with pins
				R578 883 601	Stand Up with D-sub
				R578 882 601	Stand Up with pins
RAD - DET - TSSD - 002	T-Switch Sequentiel	Low power	SMA	R587 432 601	Lay Down with pins
				R587 443 601	Stand up with D-sub
				R587 442 601	Stand up with pins
			SMA 2.9	R587 832 621	Lay Down with pins
				R587 842 621	Stand up with pins
				R587 843 621	Stand up with D-sub
RAD - DET - TRSD - 002	T-Switch	High power	TNC	R588 371 601	Lay Down with D-sub
				R588 381 611	Stand up with D-sub
RAD - DET - TRSD - 003	T-Switch Random	Low power	SMA	R587 492 601	Fixing plate with pins
				R587 472 601	Lay Down with pins
				R587 482 601	Stand up with pins
			SMA 2.9	R587 872 601	Lay Down with pins
				R587 882 601	Stand up with pins
				R587 883 601	Stand up with D-sub
RAD - DET - DP3T - 001	DP3T	Low power	SMA	R586 471 601	Lay Down with D-sub
			SMA 2.9	R586 871 601	Lay Down with D-sub
RAD - DET - DP3T - 002	DP3T	High power	TNC	R564 271 601	Lay Down with D-sub, High Cavity
				R564 371 601	Lay Down with D-sub, Standard Cavity
				R564 372 601	Lay Down with pins, Standard Cavity

## Low Power Coaxial SPDT Switch



LOW-POWER LATCHING COAXIAL SPDT SWITCH according to Radiall specification

### RAD-DET-SPDT-001

- DC to 22 GHz with SMA connectors
- Up to 31 GHz with SMA 2.9 connectors
- Telemetry circuit
- Suppression diodes
- D-Sub or solder pins
- Lay Down or Fixing plate
- 44 grams and up

## GENERAL SPECIFICATIONS

	Unit	Min	Typical	Max
Actuation Voltage	V	+22	+26	+29
Pick-Up Voltage	V			+20.5
Actuation Current				
@+29V, +25°C	mA		129	139
@+29V, -30°C			164	176
@+29V, +85°C			105	113
Switching Time	ms			20
Pulse Duration	ms	20		1000
Coil Resistance (at +25°C)	Ω	210	225	
RF Contact Resistance	mΩ			100
	mΩ		1000	
	mΩ	10		
	mA		100	
Coil Isolation at 500 VDC	MΩ	10		
Dielectric Withstanding at 50 or 60Hz	Vrms	500		
Mass				
Variant 001: SPDT, Fixing Plate, Pins	grams			44
Variant 002: SPDT, Lay Down, Pins				62
Variant 003: SPDT, Lay Down, D-Sub				72

## RF PERFORMANCES

### DC to 22 GHz SMA

Frequency	GHz	DC - 4.2	4.2 - 10.7	10.7 - 12.75	12.75 - 14.5	14.5 - 22
Insertion Loss (max)	dB	0.12	0.20	0.25	0.30	0.35
VSWR (max)		1.20:1	1.20:1	1.20:1	1.25:1	1.33:1
Return Loss (min)	(dB)	(21)	(21)	(21)	(19)	(17)
Isolation (min)	dB	70			65	60
E-Field Shielding Effectiveness (min)	dB	75	70	70	70	70

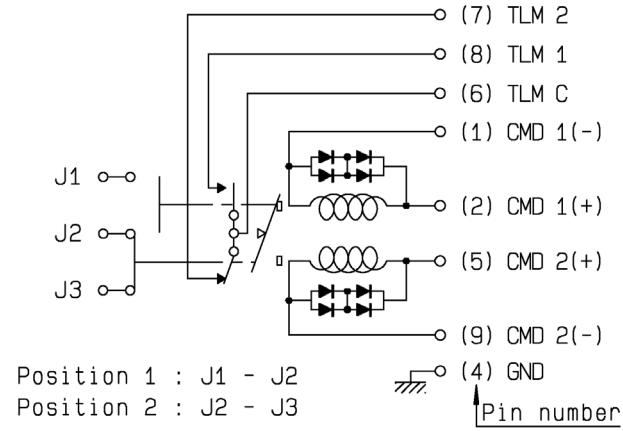
### Ka – band SMA 2.9

Frequency	GHz	17.5-21.5	21.5 - 27.5	27.5 - 31
Insertion Loss (max)	dB	0.45	0.45	0.50
VSWR (max)		1.33:1	1.35:1	1.40:1
Return Loss (min)	(dB)	(17.0)	(16.5)	(15.6)
Isolation (min)	dB	65	60	60
E-Field Shielding Effectiveness (min)	dB	70	60	60
Power Handling (max)	W	10	5	

## Low Power Coaxial SPDT Switch

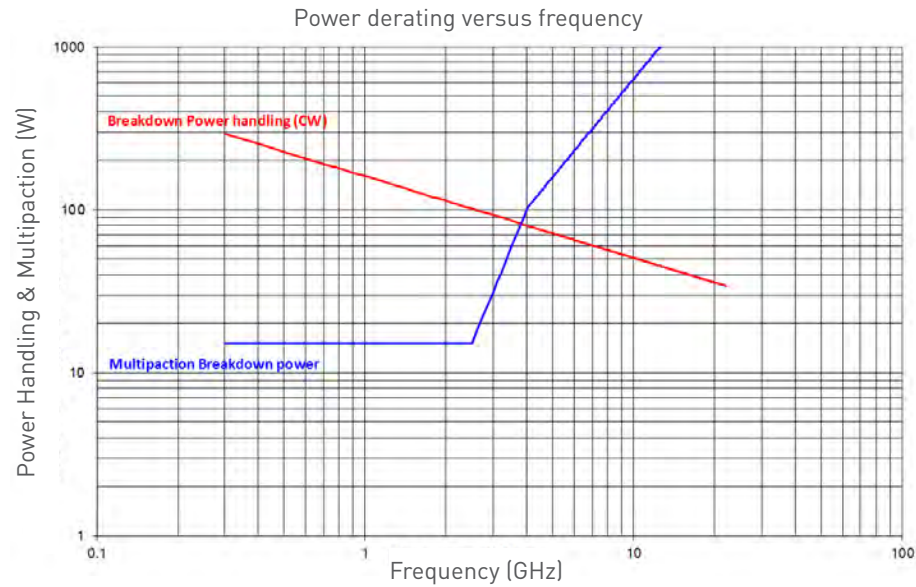
### SCHEMATICS & DRAWINGS

SDPT, lay down, pins:



### POWER DERATING GRAPH

Variant 001 to 003: DC to 22 GHz SMA



Frequency (GHz)	Breakdown Power Handling (W)	Breakdown Multipaction Power (W)
0.3	292.1	15.2
2.3	105.5	15.2
2.4	103.3	15.2
2.5	101.2	15.2
2.6	99.2	17.8
2.7	97.4	20.7
2.8	95.6	23.9
2.9	94.0	27.5
3.0	92.4	31.5
4.0	80.0	101.6
5.0	71.6	158.8
6.0	65.3	228.6
7.0	60.5	311.2
8.0	56.6	406.4
9.0	53.3	514.4
10.0	50.6	635.0
12.0	46.2	914.5
14.0	42.8	1244.7
16.0	40.0	1625.7
18.0	37.7	2057.5
20.0	35.8	2540.2
22.0	34.1	3073.6

## Low Power Coaxial DPDT Switch



LOW-POWER LATCHING COAXIAL DPDT SWITCH according to Radiall specification

### RAD-DET-DPDT-006

- DC to 22 GHz with SMA connectors
- Up to 31 GHz with SMA 2.9 connectors
- Telemetry circuit
- Suppression diodes
- D-Sub or solder pins
- Lay Down or Stand up
- 57 grams and up

## GENERAL SPECIFICATIONS

	Unit	Min	Typical	Max
Actuation Voltage	V	+22	+26	+29
Pick-Up Voltage	V			+20.5
Actuation Current				
@+29V, +25°C	mA		129	139
@+29V, -30°C			164	176
@+29V, +85°C			105	113
Switching Time	ms			25
Pulse Duration	ms	20		1000
Coil Resistance (at +25°C)	Ω	210	225	
RF Contact Resistance	mΩ			100
TLM Indicator Circuit				
Contact Closed	mΩ			1000
Contact Open	MΩ	10		
Contact Current	mA			100
Coil Isolation at 500 VDC	MΩ	10		
Dielectric Withstanding at 50 or 60Hz	Vrms	500		
Mass				
Variant 001-005: C-Switch Stand up D-Sub	grams			80
Variant 002-004: C-Switch Lay Down Pins				57
Variant 003-006: C-Switch Stand up Pins				60

## RF PERFORMANCES

### DC to 22 GHz SMA

Frequency	GHz	DC - 4.2	4.2 - 8.4	8.4 - 14.5	14.5 - 18	18- 20	20- 22
Insertion Loss (max)	dB	0.15	0.25	0.30	0.40	0.50	0.50
VSWR (max)	(dB)	1.20:1	1.25:1	1.25:1	1.33:1	1.33:1	1.40:1
Return Loss (min)		(21)	(19)	(19)	(17)	(17)	(15:6)
Isolation (min)	dB	70			65		
E-Field Shielding Effectiveness (min)	dB	75	70	68	65	60	60

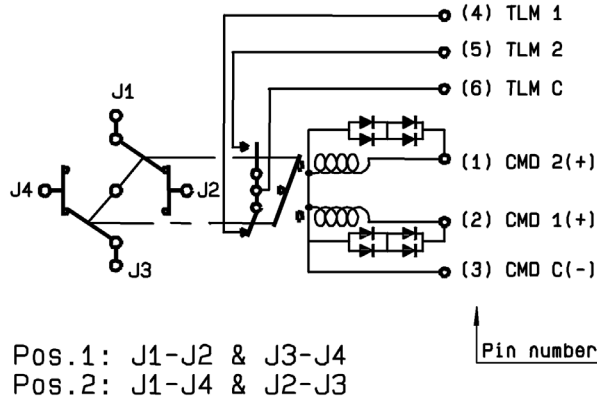
### KA – BAND SMA2.9

Frequency	GHz	17.5-21.5	27.5 - 31
Insertion Loss (max)	dB	0.50	0.65
VSWR (max)	(dB)	1.33:1	1.40:1
Return Loss (min)		(17.7)	(15.6)
Isolation (min)	dB	65	60
E-Field Shielding Effectiveness (min)	dB	60	60
Power Handling (max)	W	10	5

## Low Power Coaxial DPDT Switch

### SCHEMATICS & DRAWINGS

C-Switch, SMA ,Lay Down pins:



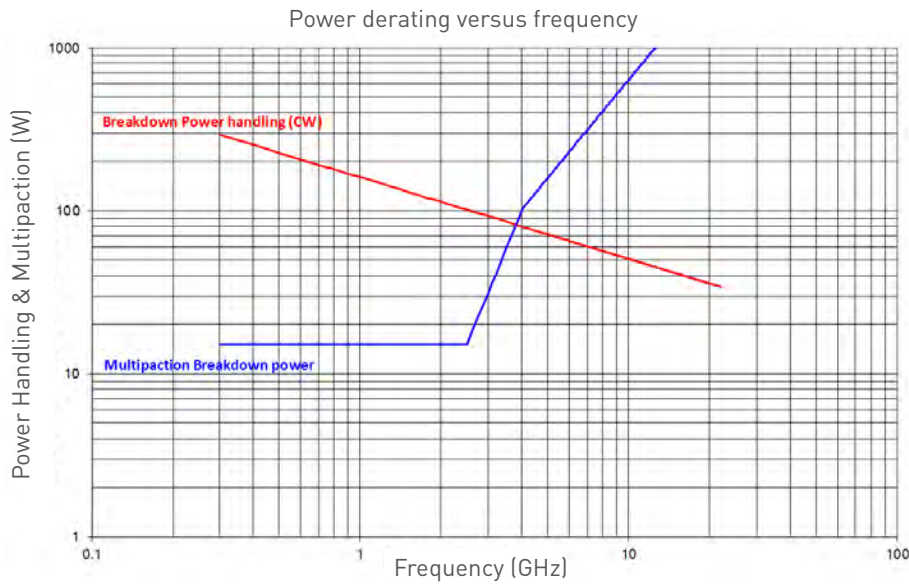
C-Switch, SMA, Stand Up, pins



C-Switch, SMA, Stand Up, D-Sub

### POWER DERATING GRAPH

Variant 001 to 003: DC to 22 GHz SMA



Frequency (GHz)	Breakdown Power Handling (W)	Breakdown Multipaction Power (W)
0.3	292.1	15.2
2.3	105.5	15.2
2.4	103.3	15.2
2.5	101.2	15.2
2.6	99.2	17.8
2.7	97.4	20.7
2.8	95.6	23.9
2.9	94.0	27.5
3.0	92.4	31.5
4.0	80.0	101.6
5.0	71.6	158.8
6.0	65.3	228.6
7.0	60.5	311.2
8.0	56.6	406.4
9.0	53.3	514.4
10.0	50.6	635.0
12.0	46.2	914.5
14.0	42.8	1244.7
16.0	40.0	1625.7
18.0	37.7	2057.5
20.0	35.8	2540.2
22.0	34.1	3073.6



## Low Power Coaxial T Switch



**LOW-POWER LATCHING COAXIAL T SWITCH** according to Radiall specification  
**RAD-DET-TSSD-002 and RAD-DET-TSRD-003**

- Random or Sequential drive
- DC to 22 GHz with SMA connectors
- Up to 31 GHz with SMA 2.9 connectors
- Telemetry circuit
- Suppression diodes
- D-Sub or solder pins
- Stand up or Lay Down or fixing plate
- 58 grams and up

### GENERAL SPECIFICATIONS

	Unit	RAD-DET-TSSD-002 Sequential Drive			RAD-DET-TSRD-003 Random Drive		
		Min	Typical	Max	Min	Typical	Max
Actuation Voltage	V	+22	+26	+29	+22	+26	+29
Pick-Up Voltage	V			+20.5			+20.5
Actuation Current	mA						
@+29V, +25°C			345	364		285	305
@+29V, -30°C				439	462		365
@+29V, +85°C			280	295		234	250
Switching Time	ms			25			20
Pulse Duration	ms	20		1000	20		1000
Coil Resistance (at +25°C)	Ω	79.8	84		88	95	
RF Contact Resistance	mΩ			100			100
TLM Indicator Circuit							
Contact closed	mΩ			1000			1000
Contact Open	mΩ	10			10		
Contact Current	mA			100			100
Coil Isolation at 500 VDC	MΩ	10			10		
Dielectric Withstanding at 50 or 60Hz	Vrms	500			500		
Mass							
T-Switch, Lay Down Pins	grams			73			64
T-Switch, Stand Up D-Sub				100			-
T-Switch, Stand Up Pins				75			75
T-Switch, Fixing Plate				-			58
Torque Screws for							
Fixing unit	N.m			2.0			2.0
For DC connector				0.44			N/A
For SMA connector		0.8	1.1	1.15	0.8	1.1	1.15

### RF PERFORMANCES

#### DC to 22 GHz SMA

Frequency	GHz	DC-4.2	4.2-5.5	5.5-6.6	6.6-7.7	7.7-8.8	8.8-10.5	10.5-14.5	14.5-17.8	17.8-20	20-22
Insertion Loss (max)	dB	0.15	0.17	0.18	0.21	0.24	0.30	0.35	0.45	0.50	0.50
VSWR (max)	(dB)	1.20:1	1.22:1	1.25:1	1.25:1	1.25:1	1.25:1	1.25:1	1.33:1	1.33:1	1.40:1
Return Loss (min)		(21)	(20)	(19)	(19)	(19)	(19)	(19)	(17)	(17)	(15.6)
Isolation (min)	dB	70						65			
E-Field Shielding Effectiveness (min)	dB	75				70			65		

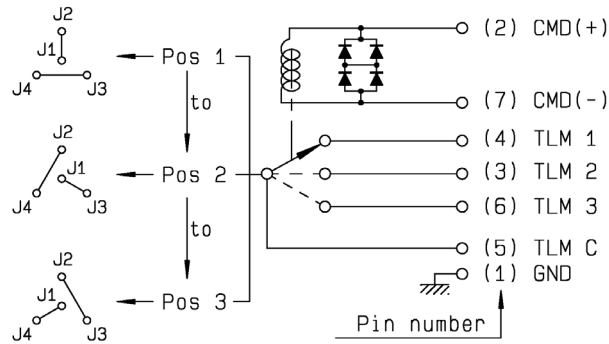
#### KA – BAND SMA2.9

Frequency	GHz	17.5-21.5	27.5 - 31
Insertion Loss (max)	dB	0.50	0.65
VSWR (max)	(dB)	1.33:1	1.40:1
Return Loss (min)		(17)	(15.6)
Isolation (min)	dB	65	60
E-Field Shielding Effectiveness (min)	dB	60	60
Power Handling (max)	W	10	5

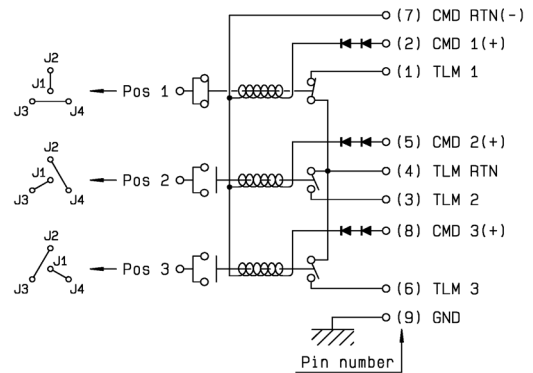
## Low Power Coaxial T Switch

### SCHEMATICS & DRAWINGS

Sequential Drive:



Random Drive:



T-Switch, Lay Down with pins:



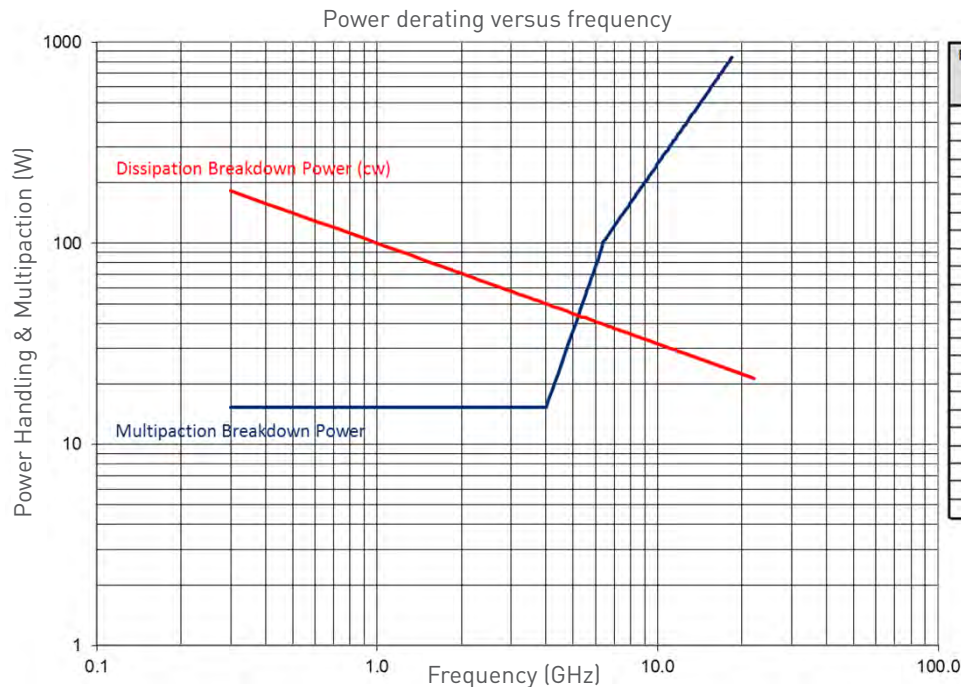
T-Switch, Stand Up with D-Sub:



T-Switch, Fixing plate with pins:

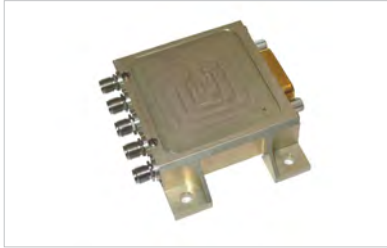
### POWER DERATING GRAPH

Variant 001 to 003: DC to 22 GHz SMA



Frequency (GHz)	Breakdown Dissipation Power (W)	Breakdown Multipaction Power (W)
0.3	187.1	15.2
0.4	162.0	15.2
0.5	144.9	15.2
0.6	132.3	15.2
0.7	122.5	15.2
0.8	114.6	15.2
0.9	108.0	15.2
1.0	102.5	15.2
2.0	72.5	15.2
3.0	59.2	15.2
4.0	51.2	15.2
5.0	45.8	37.1
6.0	41.8	77.0
7.0	38.7	121.6
8.0	36.2	158.8
9.0	34.2	200.9
10.0	32.4	248.1
12.0	29.6	357.2
14.0	27.4	486.2
16.0	25.6	635.0
18.0	24.2	803.7
20.0	22.9	992.3
22.0	21.8	1200.6

## Low Power Coaxial DP3T Switch



LOW-POWER LATCHING COAXIAL DP3T SWITCH according to Radiall specification

### RAD-DET-DP3T-001

- DC to 22 GHz with SMA connectors
- DC to 31 GHz with SMA 2.9 connectors
- Telemetry circuit
- Suppression diodes
- D-Sub
- Lay Down
- 106 grams

## GENERAL SPECIFICATIONS

	Unit	Min	Typical	Max
Actuation Voltage	V	+22	+26	+29
Pick-Up Voltage	V			+20.5
Actuation Current				
@+29V, +25°C	mA		129	139
@+29V, -30°C			164	176
@+29V, +85°C			105	113
Switching Time	ms			20
Pulse Duration	ms	20		1000
Coil Resistance (at +25°C)	Ω	210	225	
RF Contact Resistance	mΩ			100
TLM Indicator Circuit				
Contact closed	mΩ			1000
Contact Open	MΩ	10		
Contact Current	mA			100
Coil Isolation at 500 VDC	MΩ	10		
Dielectric Withstanding at 50 or 60Hz	V <sub>rms</sub>	500		
Mass	grams			106
Torque Screws for				
Fixing unit				2.0
For DC connector	N.m	0.27		0.44
For SMA connector		0.8	1.1	1.15

## RF PERFORMANCES

### DC to 22 GHz SMA

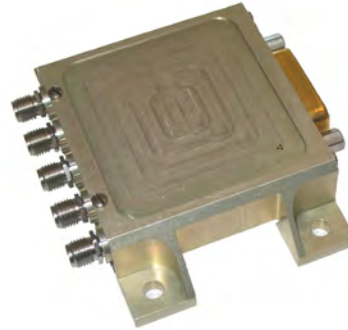
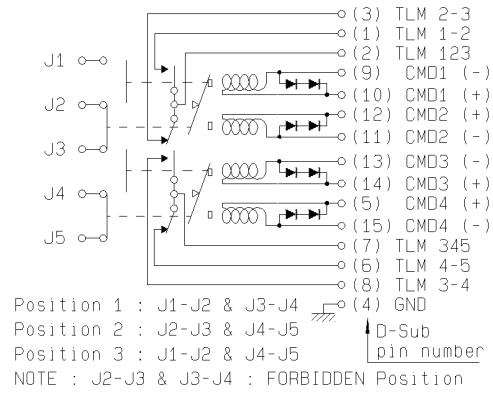
Frequency	GHz	DC - 4.2	4.2 - 10.7	10.7 - 12.75	12.75 - 14.5	14.5 - 22
Insertion Loss (max)	dB	0.15	0.15	0.25	0.30	0.40
VSWR (max)	(dB)	1.15:1	1.20:1	1.25:1	1.25:1	1.40:1
Return Loss (min)		(23.1)	(20.8)	(19.1)	(19.1)	(15.6)
Isolation (min)	dB		70		60	
E-Field Shielding Effectiveness (min)	dB <sub>i</sub>		75		70	

### KA – BAND SMA2.9

Frequency	GHz	17.5-21.5	21.5 - 27.5	27.5 - 31
Insertion Loss (max)	dB	0.50	0.45	0.65
VSWR (max)	(dB)	1.33:1	1.35:1	1.40:1
Return Loss (min)		(17)	(16.5)	(15.6)
Isolation (min)	dB	65	60	
E-Field Shielding Effectiveness (min)	dB <sub>i</sub>	60	60	
Power Handling (max)	W	10	5	

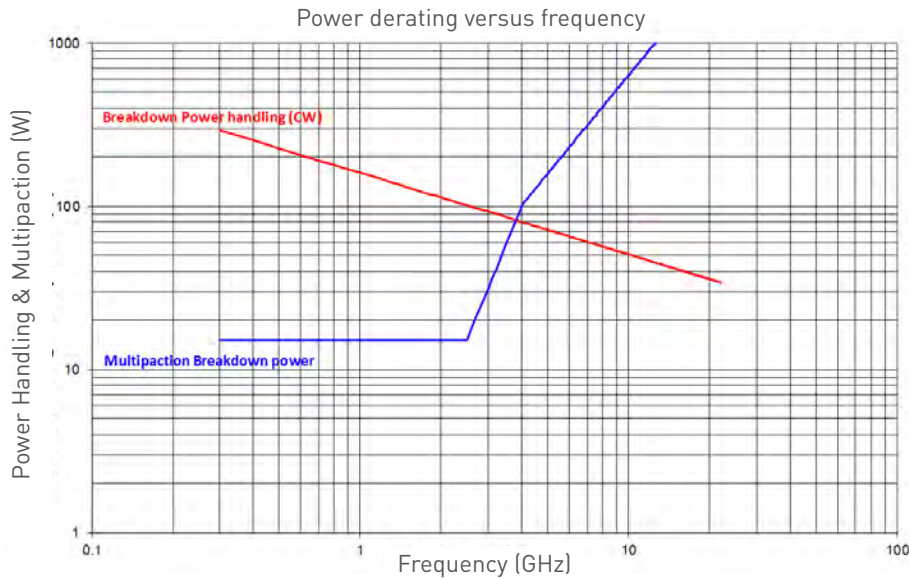
## Low Power Coaxial DP3T Switch

### SCHEMATICS & DRAWINGS



### POWER DERATING GRAPH

Variant 001 to 003: DC to 22 GHz SMA



Frequency (GHz)	Breakdown Power Handling (W)	Breakdown Multipaction Power (W)
0.3	292.1	15.2
2.3	105.5	15.2
2.4	103.3	15.2
2.5	101.2	15.2
2.6	99.2	17.8
2.7	97.4	20.7
2.8	95.6	23.9
2.9	94.0	27.5
3.0	92.4	31.5
4.0	80.0	101.6
5.0	71.6	158.8
6.0	65.3	228.6
7.0	60.5	311.2
8.0	56.6	406.4
9.0	53.3	514.4
10.0	50.6	635.0
12.0	46.2	914.5
14.0	42.8	1244.7
16.0	40.0	1625.7
18.0	37.7	2057.5
20.0	35.8	2540.2
22.0	34.1	3073.6

LOW POWER MODELS

## High Power Coaxial SPDT Switch



**HIGH-POWER LATCHING COAXIAL SPDT SWITCH according to Radiall specification RAD-DET-SPDT-002**

- TNC connectors
- Up to 2.2 GHz, with 160 Watts CW
- Up to 4.8 GHz, with 150 Watts CW
- Telemetry circuit
- Suppression diodes
- D-Sub
- Lay Down
- 275 grams

### GENERAL SPECIFICATIONS

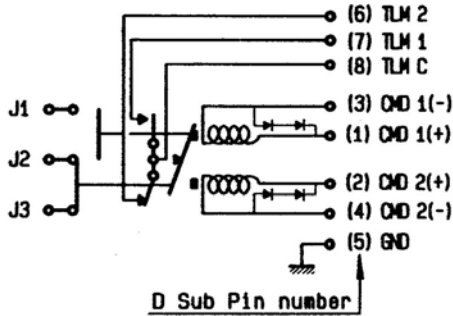
	Unit	Min	Typical	Max
Actuation Voltage	V	+20	+26	+30
Pick-Up Voltage	V			+19
Actuation Current	mA			
@+29V, +25°C		178	188	198
@+29V, -30°C		227	239	251
@+29V, +85°C		145	153	161
Switching Time	ms		25	35
Pulse Duration	ms	50		1000
Coil Resistance (at +25°C)	Ω	152	160	168
RF Contact Resistance	mΩ			100
TLM Indicator Circuit				
Contact closed	mΩ			1000
Contact Open	MΩ	2		
Contact Current	mA			100
Coil Isolation at 500 VDC	MΩ	1		
Dielectric Withstanding at 50 or 60Hz	Vrms	500		
Mass variant 001 & 002	grams			275
Torque Screws for				
Fixing unit	N.m			2.0
For DC connector				0.2
For SMA connector				2.65

### RF PERFORMANCES

Frequency	GHz	DC - 2.2 GHz Variant 001			DC - 4.8 GHz Variant 002			
		0.04 - 1.0	1.0 - 1.6	1.6 - 2.2	0.04 - 1.0	1.0 - 1.6	1.6 - 2.2	2.2 - 4.8
Insertion Loss (max)	dB		0.12			0.12		0.22
VSWR (max)	(dB)		1.20:1			1.20:1		1.38:1
Return Loss (min)			[20.8]			[20.8]		[15.9]
Isolation (min)	dB		70			70		
E-Field Shielding Effectiveness (min)	dB		70			70		60
Power Handling (max)	W	33 @ 1 GHz	85 @ 1.6 GHz	160 @ 2.2 GHz	5 @ 1 GHz	29 @ 1.6 GHz	55 @ 2.2 GHz	102 @ 3 GHz

## High Power Coaxial SPDT Switch

### SCHEMATICS & DRAWINGS



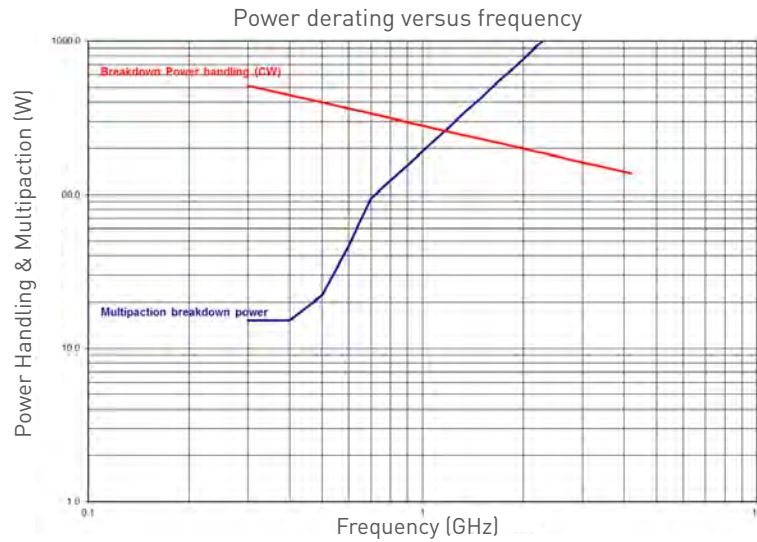
Position 1 : J1 - J2  
 Position 2 : J2 - J3

SPDT Switch, Lay Down, D-Sub, variant 001 & 002:



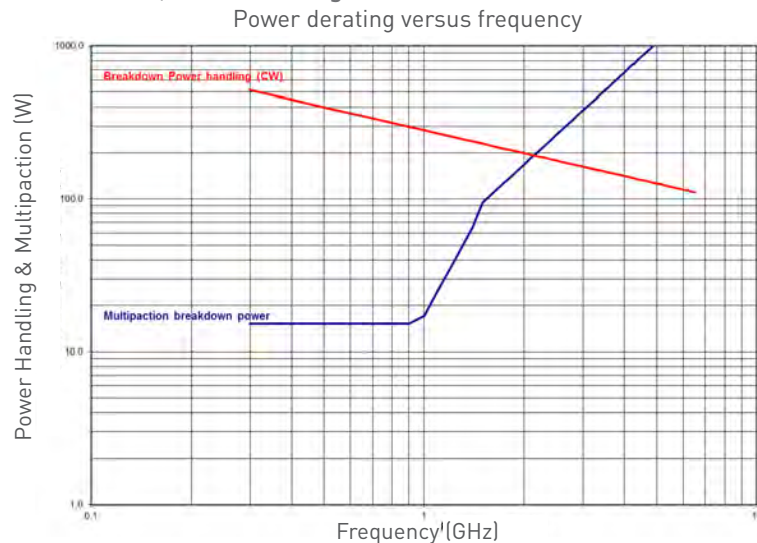
### POWER DERATING GRAPH

Variant 001, High Cavity



Frequency (GHz)	Breakdown Power handling (W)	Breakdown Multipaction Power (W)
0.3	514.7	15.2
0.4	445.8	15.2
0.5	398.7	22.3
0.6	364.0	46.2
0.7	337.0	84.1
0.8	315.2	122.9
0.9	297.2	165.6
1.0	281.9	192.1
1.1	268.8	232.4
1.2	257.4	276.6
1.3	247.3	324.6
1.4	238.3	376.5
1.5	230.2	432.2
1.6	222.9	491.8
1.7	216.2	555.2
1.8	210.1	622.4
1.9	204.5	693.5
2.0	199.4	768.4
2.2	190.1	929.8
2.4	182.0	1106.5
2.6	174.8	1298.6
2.8	168.5	1506.1
3.0	162.8	1728.9
3.5	150.7	2352.2
4.0	141.0	3073.6
4.2	137.6	3388.6

Variant 002, Standard Cavity



Frequency (GHz)	Breakdown Power handling (W)	Breakdown Multipaction Power (W)
0.3	514.7	15.2
0.5	398.7	15.2
1.0	281.9	17.1
1.1	268.8	25.1
1.2	257.4	35.5
1.3	247.3	48.9
1.4	238.3	65.8
1.5	230.2	94.7
1.6	222.9	107.8
1.7	216.2	121.7
1.8	210.1	136.4
1.9	204.5	152.0
2.0	199.4	168.4
2.2	190.1	203.8
2.4	182.0	242.5
2.6	174.8	284.6
2.8	168.5	330.1
3.0	162.8	379.0
3.2	157.6	431.2
3.4	152.9	486.8
3.6	148.6	545.7
3.8	144.6	608.0
4.0	141.0	673.7
4.2	137.6	742.8
4.4	134.4	815.2
4.6	131.4	891.0
4.8	128.7	970.1
5.0	126.1	1052.7
5.5	120.2	1223.7
6.0	115.1	1515.9
6.5	110.6	1779.0

## High Power Coaxial DP3T Switch



### HIGH-POWER LATCHING COAXIAL DP3T SWITCH according to Radiall specification RAD-DET-DP3T-002

- TNC connectors
- Up to 2.2 GHz, with 160 Watts CW
- Up to 4.8 GHz, with 150 Watts CW
- Telemetry circuit
- Suppression diodes
- D-Sub or pins
- Lay Down
- 390 grams and up

### GENERAL SPECIFICATIONS

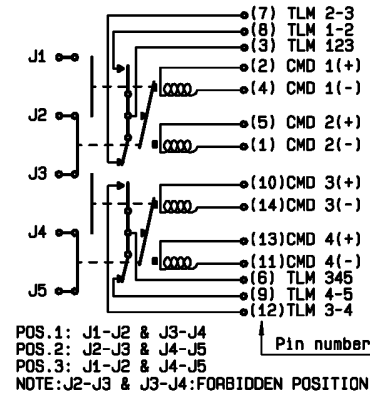
	Unit	Min	Typical	Max
Actuation Voltage	V	+20	+26	+30
Pick-Up Voltage	V			+19
Actuation Current	mA			
@+29V, +25°C		178	188	198
@+29V, -30°C		227	239	251
@+29V, +85°C		145	153	161
Switching Time	ms		25	35
Pulse Duration	ms	50		1000
Coil Resistance (at +25°C)	Ω	152	160	168
RF Contact Resistance	mΩ			100
TLM Indicator Circuit				
Contact closed	mΩ			1000
Contact Open	MΩ	2		
Contact Current	mA			100
Coil Isolation at 500 VDC	MΩ	1		
Dielectric Withstanding at 50 or 60Hz	Vrms	500		
Mass	grams			460
Variant 001: Lay Down D-Sub				445
Variant 002: Lay Down D-Sub Variant 003: Lay Down pins				390
Torque Screws for	N.m			
Fixing unit				2.0
For DC connector For SMA connector				0.2 2.65

### RF PERFORMANCES

Frequency	GHz	DC - 2.2 GHz Variant 001			DC - 4.8 GHz Variant 002 and 003			
		0.04 - 1.0	1.0 - 1.6	1.6 - 2.2	0.04 - 1.0	1.0 - 1.6	1.6 - 2.2	2.2 - 4.8
Insertion Loss (max)	dB	0.12			0.12			0.22
VSWR (max)	(dB)	1.20:1			1.20:1			1.38:1
Return Loss (min)		{20.8}			{20.8}			{15.9}
Isolation (min)	dB	70			70			
E-Field Shielding Effectiveness (min)	dB	70			70			60
Power Handling (max)	W	33 @ 1 GHz	85 @ 1.6 GHz	160 @ 2.2 GHz	5 @ 1 GHz	29 @ 1.6 GHz	55 @ 2.2 GHz	102 @ 3 GHz

## High Power Coaxial DP3T Switch

### SCHEMATICS & DRAWINGS

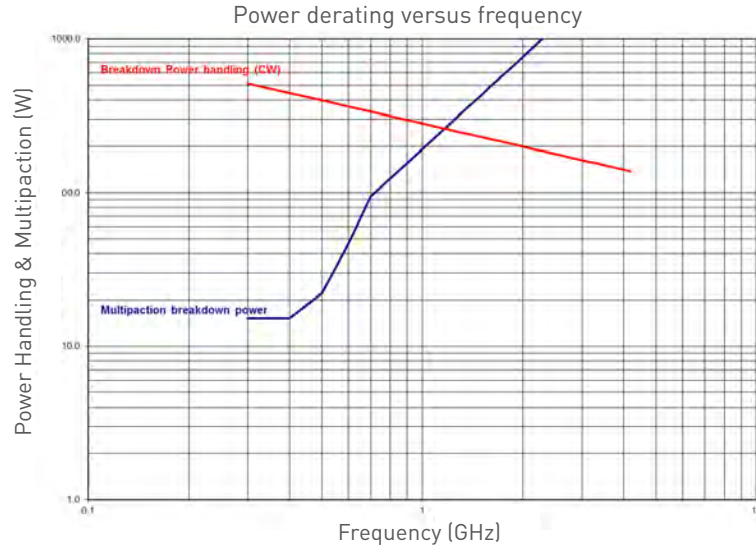


DP3T Switch, Lay Down, Pins:



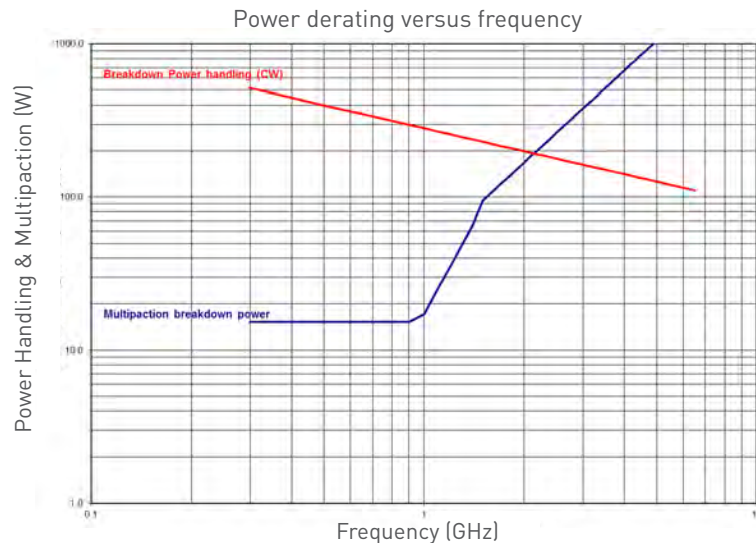
### POWER DERATING GRAPH

Variant 1, High Cavity



Frequency (GHz)	Breakdown Power handling (W)	Breakdown Multipaction Power (W)
0.3	514.7	15.2
0.4	445.8	15.2
0.5	398.7	22.3
0.6	364.0	46.2
0.7	337.0	84.1
0.8	315.2	122.9
0.9	297.2	165.6
1.0	281.9	192.1
1.1	268.8	232.4
1.2	257.4	276.6
1.3	247.3	324.6
1.4	238.3	376.5
1.5	230.2	432.2
1.6	222.9	491.8
1.7	216.2	555.2
1.8	210.1	622.4
1.9	204.5	693.5
2.0	199.4	768.4
2.2	190.1	929.8
2.4	182.0	1106.5
2.6	174.8	1298.6
2.8	168.5	1506.1
3.0	162.8	1728.9
3.5	150.7	2352.2
4.0	141.0	3073.6
4.2	137.6	3388.6

Variant 002, Standard Cavity



Frequency (GHz)	Breakdown Power handling (W)	Breakdown Multipaction Power (W)
0.3	514.7	15.2
0.9	297.2	15.2
1.0	281.9	17.1
1.1	268.8	25.1
1.2	257.4	35.5
1.3	247.3	48.9
1.4	238.3	65.8
1.5	230.2	94.7
1.6	222.9	107.8
1.7	216.2	121.7
1.8	210.1	136.4
1.9	204.5	152.0
2.0	199.4	168.4
2.2	190.1	203.8
2.4	182.0	242.5
2.6	174.8	284.6
2.8	168.5	330.1
3.0	162.8	379.0
3.2	157.6	431.2
3.4	152.9	486.8
3.6	148.6	545.7
3.8	144.6	608.0
4.0	141.0	673.7
4.2	137.6	742.8
4.4	134.4	815.2
4.6	131.4	891.0
4.8	128.7	970.1
5.0	126.1	1052.7
5.5	120.2	1223.7
6.0	115.1	1515.9
6.5	110.6	1779.0



## High Power Coaxial T Switch



**HIGH-POWER LATCHING COAXIAL T SWITCH according to Radiall specification RAD-DET-TSRD-002**

- TNC connectors
- DC to 8 GHz
- Up to 120 Watts CW @ 4 GHz
- Random Drive
- Telemetry circuit
- Suppression diodes
- D-Sub or solder pins
- Lay Down or Stand up
- 355 grams and up

### GENERAL SPECIFICATIONS

	Unit	Min	Typical	Max
Actuation Voltage	V	+22	+26	+29
Pick-Up Voltage	V			+20.5
Actuation Current				
@+29V, +25°C	mA	450	470	490
@+29V, -25°C		555	585	610
@+29V, -30°C		570	595	620
@+29V, +80°C		360	385	405
@+29V, -85°C		365	380	397
Switching Time	ms			35
Pulse Duration	ms	35		1000
Coil Resistance (at +25°C)	Ω	59.3	61.8	64.4
RF Contact Resistance	mΩ			100
TLM Indicator Circuit				
Contact closed	mΩ			1000
Contact Open	MΩ	1		
Contact Current	mA			100
Coil Isolation at 500 VDC	MΩ	1		
Dielectric Withstanding at 50 or 60Hz	Vrms	500		
Mass				
T-Switch, Lay Down, D-Sub	grams			360
T-Switch, Stand Up, D-Sub				355
Torque Screws for				
Fixing unit	N.m			2.0
For DC connector				0.44
For SMA connector				2.65

### RF PERFORMANCES

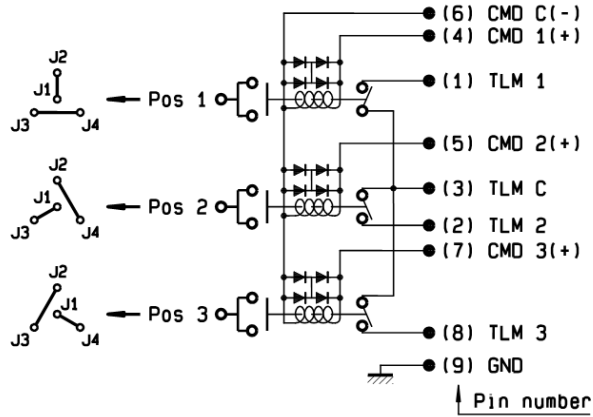
#### DC - 8 GHz Variants 001 & 002

Frequency	GHz	DC - 2	2 - 4.8	4.8 - 6	6 - 8
Insertion Loss (max)	dB	0.17	0.20	0.30	0.40
VSWR (max)	(dB)	1.10:1	1.25:1	1.35:1	1.50:1
Return Loss (min)		[26.4]	[19.1]	[16.5]	[14]
Isolation (min)	dB	70			
E-Field Shielding Effectiveness (min)	dB	75			70

## High Power Coaxial T Switch

### SCHEMATICS & DRAWINGS

T-Switch, TNC, D-Sub, variant 001 & 002:



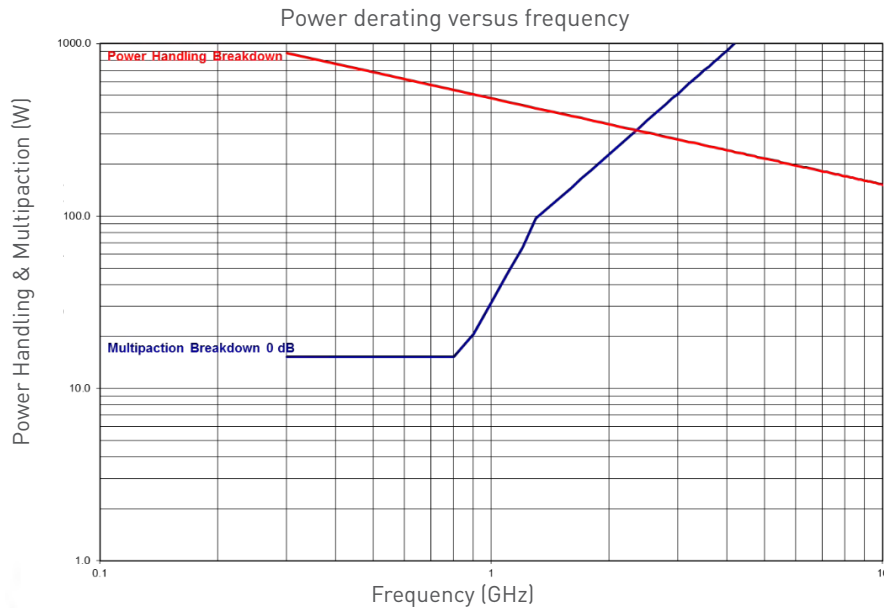
T-Switch, Lay Down, D-Sub, variant 001:



T-Switch, Stand Up, D-Sub, variant 002:



### POWER DERATING GRAPH



Frequency (GHz)	Breakdown Power Handling (W)	Breakdown Multipaction Power (W)
0.3	880.0	15.2
0.4	762.1	15.2
0.5	681.6	15.2
0.6	622.3	15.2
0.7	576.1	15.2
0.8	538.9	15.2
0.9	508.1	20.7
1	482.0	31.5
1.1	459.6	46.2
1.2	440.0	65.4
1.3	422.7	96.6
1.4	407.4	112.0
1.5	393.5	128.6
1.6	381.1	146.3
1.7	369.7	165.2
1.8	359.3	185.2
1.9	349.7	206.3
2	340.8	228.6
2.1	332.6	252.0
2.2	325.0	276.6
2.3	317.8	302.3
2.4	311.1	329.2
2.5	304.8	357.2
2.6	298.9	386.4
2.7	293.3	416.6

## Thermal Vacuum Switches for Ground Segments



With more than 25 years of experience in the space industry, Radiall has developed a product offering that emphasizes reliability and performance. The latest addition to the range includes SPDT, DPDT and SPnT RF switches designed to operate in thermal vacuum environments. These products can be mounted on ground based test benches, used in test equipment, and space vacuum conditions.

Tvac Series switches are designed in accordance with our standard RAMSES product offering and offer identical configurations with excellent performance.

### PART NUMBER SELECTION

6 standard models are available for test benches dedicated to space equipment in Thermal Vacuum environment:

- 22 GHz SPDT coaxial switch: R571 F63 121
- 22 GHz DPDT coaxial switch: R578 F63 121
- 22 GHz non terminated SP6T coaxial switch: R583 F33 121
- 40 GHz SPDT coaxial switch: R571 863 121
- 40 GHz DPDT coaxial switch: R578 863 121
- 40 GHz non terminated SP6T coaxial switch: R583 833 121

Operating mode	Latching	
Nominal operating voltage (across operating temperature)	Vdc	28 (24/30)
Coil resistance (+/-10%)	Ω	DPDT and SP6T: 225 / SPDT: 350
Nominal operating current at 23°	mA	DPDT and SP6T: 125 / SPDT: 80
Average power (Thermal vacuum condition)	See Power rating chart on page 7-20	
Switching time (max)	SPDT and DPDT: 10ms / SP6T: 15ms	
SMA - SMA 2.9	SPDT	10 million cycles
SMA - SMA 2.9	DPDT	2.5 million cycles
SMA - SMA 2.9	SP6T	5 million cycles / 2 million cycles
Connectors (1)	SMA / SMA2.9	

(1) connector SMA 2.9 is equivalent to "K connector®", registered trademark of Anritsu.

## Thermal Vacuum Switches

### ADDITIONAL SPECIFICATION

Polarity		Positive Common
Actuator terminals	SPDT	Solder Pins
	DPDT	Male 9 pins D-Sub connector
	SP6T	Male 25 pins D-Sub connector
Operating temperature range		-40°C to 85°C
Storage temperature range		-55°C to 85°C
Construction		Thermal Vacuum compatible

### SMA CONNECTOR

Switch model	Frequency range GHz	V.S.W.R. (max)	Insertion loss (max) dB	Isolation (min) dB	Impedance $\Omega$	Average power(1) W	Repeatability
SPDT	DC - 22	DC - 3	1.20	0.20	80	50	240
		3 - 8	1.30	0.30	70		150
		8 - 12.4	1.40	0.40	60		120
		12.4 - 18	1.50	0.50	60		100
		18 - 22	1.70	0.70	55		40
DPDT SP6T (non terminated)	DC - 22	DC - 3	1.20	0.20	80	50	240
		3 - 8	1.30	0.30	70		150
		8 - 12.4	1.40	0.40	60		120
		12.4 - 18	1.50	0.50	60		100
		18 - 22	1.70	0.70	50		40

### SMA2.9 CONNECTOR

Switch model	Frequency range GHz	V.S.W.R. (max)	Insertion loss (max) dB	Isolation (min) dB	Impedance $\Omega$	Average power (1) W	Repeatability
SPDT DPDT	DC - 40	DC - 6	1.30	0.30	70	50	80
		6 - 12.4	1.40	0.40	60		60
		12.4 - 18	1.50	0.50	60		50
		18 - 26.5	1.70	0.70	55		20
		26.5 - 40	1.90	0.90	50		10
SP6T (non terminated)	DC - 40	DC - 6	1.30	0.30	70	50	40
		6 - 12.4	1.40	0.40	60		30
		12.4 - 18	1.50	0.50	60		25
		18 - 26.5	1.70	0.70	55		15
		26.5 - 40	1.90	0.90	50		5

(1): Average power at 25°C per RF path / Sea level.

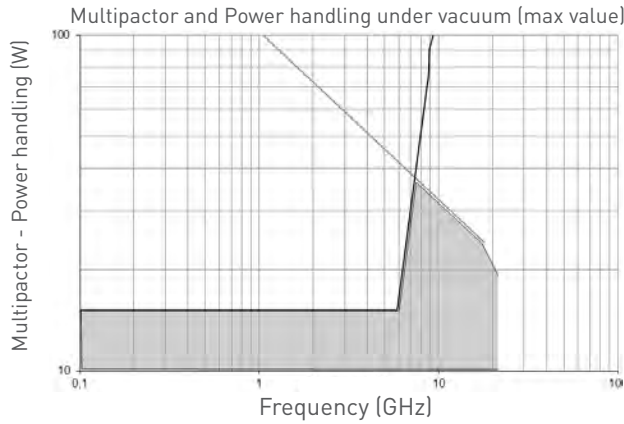
### WHY A THERMAL VACUUM TEST BENCH ?

- It limits the need of hermetic adaptors and cable assemblies
- It improves RF performance
- It decreases the complexity of the Test bench

**Thermal Vacuum Switches**

**POWER DERATING GRAPH**

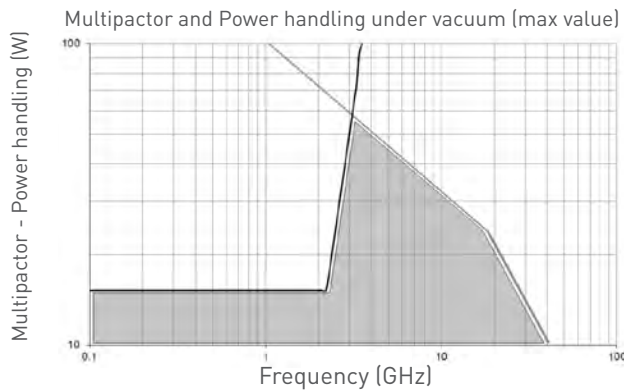
**SMA22 GHz**



SPDT, DPDT and SP6T products

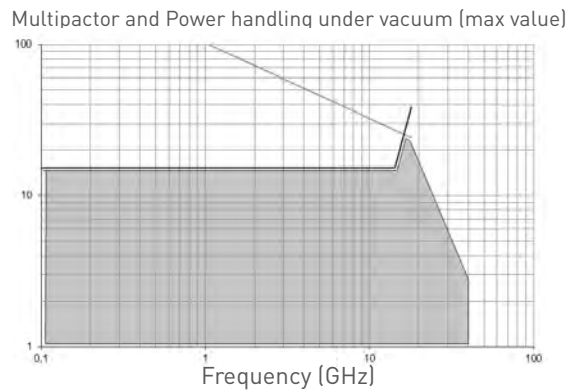
- Power Handling
- Multipactor
- Aver. Power Capability

**SMA2.9 40 GHz**



SPDT and DPDT products

- Power Handling
- Multipactor
- Aver. Power Capability

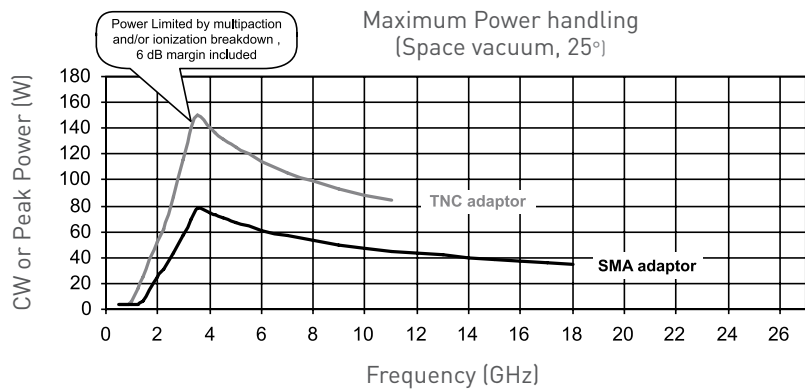


SP6T products

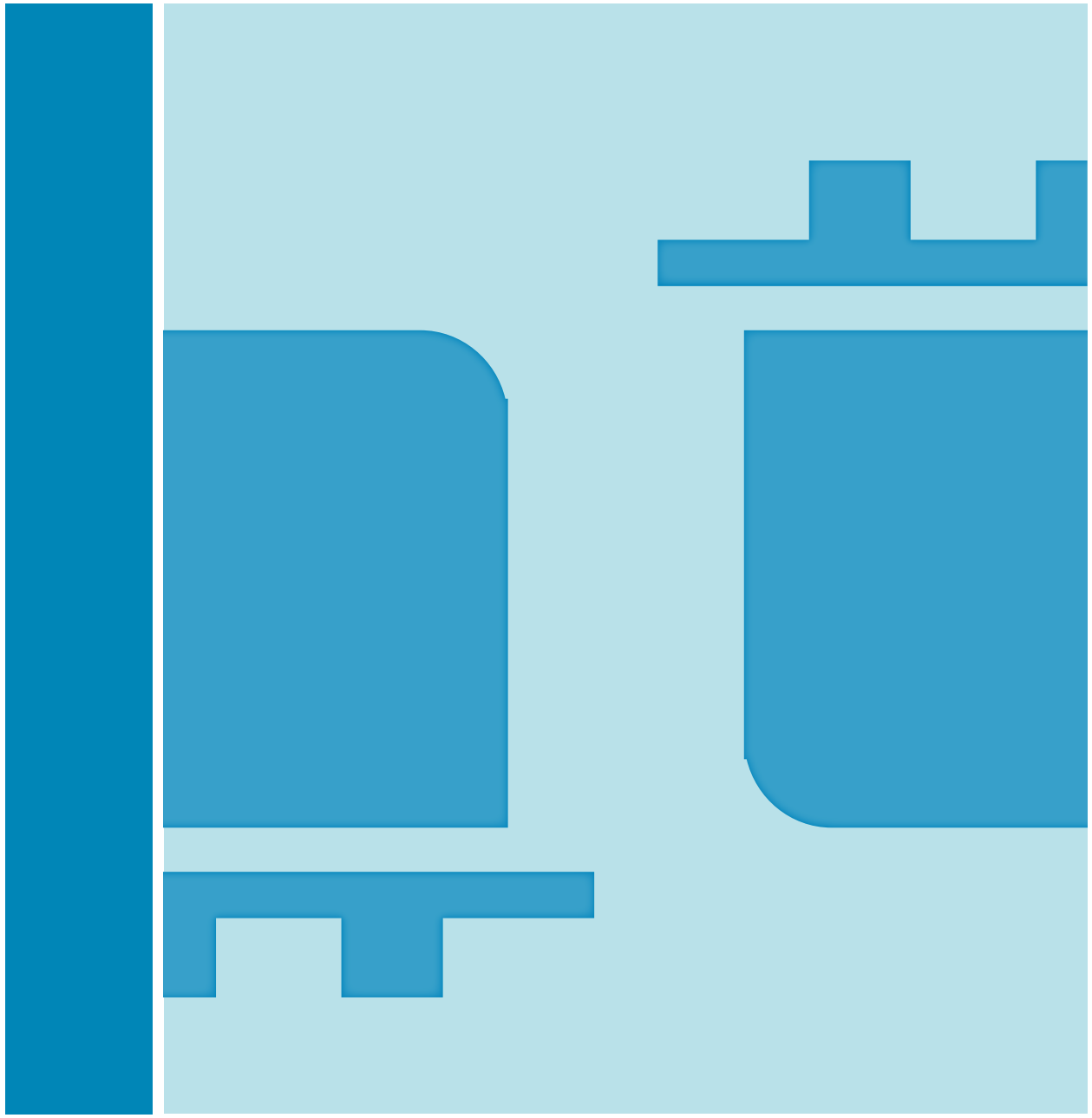
- Power Handling
- Multipactor
- Aver. Power Capability

**HERMETIC FEMALE / FEMALE ADAPTATORS**

- SMA DC - 18 GHz
- TNC DC - 11 GHz
- ESA qualified
- High reliability



**SECTION 8**



**Other**



## Contents

### Other Components

RF & Microwave coaxial products .....	8-2 to 8-3
TestPro cable assemblies .....	8-4
Space qualified products .....	8-5 to 8-6
Switch applications .....	8-7 to 8-8

## RF & Microwave Products

### GENERAL INFORMATION

Specialized in passive RF & Microwave components, Radiall's engineering staff develops and manufactures a wide range of other coaxial standard devices including terminations, attenuators, coaxial couplers, detectors, rotary joints, filters, and phase shifters. This range covers a wide frequency spectrum from DC to 50 GHz for telecom, aerospace, instrumentation and military application.

Radiall introduced TestPro cables assemblies into the market for test and measurement applications, in order to meet customers needs.

For Space applications, Radiall also offers a full range of space components built according to ESA specifications including attenuators, terminations, couplers, connectors, coaxial cable assemblies (flexible or semi-rigid cables) for L, S, C, X, Ku and Ka band applications.



### TERMINATIONS

Radiall's range of terminations is intended to terminate a coaxial transmission through characteristic impedance and dissipating the RF incident power. The main features of our full range of terminations include:

- Power range from 0.5W to 1000W
- Frequency from DC up to 50 GHz
- 50Ω Impedance
- High repeatability
- Compatibility with Broad type connections: BMA, BNC, QMA, QN, N, SMA, SMA2.9, SMB, SMP, SSMA, TNC, 1.0/2.3, 7/16, 2.4mm
- Connector interface according to applicable MIL, DIN, NF and CEI
- Dedicated range for test & measurement with the lowest VSWR



### ATTENUATORS

Attenuators are linear passive transition line components designed to be inserted between two coaxial lines to reduce the input power in a matched system by a predetermined ratio. This ratio is expressed in logarithmic terms. 3dB as a power ratio is 2, 6dB is 4, 20dB is 100, and 30dB is 1000. The main features of our full range of coaxial attenuators include:

- Power range from 1W to 100W
- Frequency from DC up to 40 GHz
- High repeatability
- 50Ω Impedance
- Compatibility with Broad type connections : BNC, QN, N, SMA, SMA 2.9, SMB, TNC, 7/16
- Connector interface according to applicable MIL, DIN, NF and CEI
- Dedicated range for test & measurement with the lowest VSWR





## RF & Microwave Products

### COAXIAL COUPLERS

Radiall's coaxial couplers offer a reliable design to meet the needs of microwave applications. The main features of our full range of coaxial couplers include:

- Directional & 3dB Hybrid 90° couplers
- Power range from 50 to 500 Watts
- Frequency from 0.15 GHz to 8 GHz
- 6, 10, 20 & 30 dB coupling factors
- SMA, Type N offered, TNC 7/16
- Dedicated range providing flat frequency response
- Possibility to design custom coaxial couplers as per customer requirements



### SPECIAL MICROWAVE COMPONENTS

Radiall offers a complete range of special Microwave components suitable for applications utilizing the following devices:

- Feedthrough terminations
- Detectors
- Rotary joints
- DC Blocks
- Monitor tees
- Signal samplers
- Phase shifters
- Filters



#### Feed through terminations

These components are used to properly terminate a transmission line while testing with a high impedance measuring system such as an oscilloscope input.

#### Detectors

A detector is a 2 port device capable of supplying a low frequency signal on its output port (video), of a level proportional to the RF power applied to its input port.

#### Rotary joints

These components provide the transition between 2 coaxial transmission lines that rotate while maintaining necessary RF characteristics.

#### DC blocks

DC blocks are composed of a capacitor inserted to the central conductor of the coaxial line. They block any DC or low frequency current present in the line.

#### Signal samplers

These devices are used to sample part of an RF signal from a coaxial line. They are not directive, and the sample incident reflects energy.

#### Phase shifters

These components create a mechanical adjustable phase shift by variation in the physical length of the transmission line.

**TestPro Cable Assemblies**



TestPro cables are dedicated to bench test cable assemblies. Our TestPro range differs from the SHF range, because the cables and connectors are designed for high performance and testing and measurement.

While others propose cosmetic solutions to appear more robust without any real performance advantages, Radiall's design offers a full range of test bench cables that performs better than any other product on the market.

Test cable assemblies are intended for daily use in component and assembly shops, test labs and automatic test equipment applications. They differ from standard cable assemblies in that they are specifically designed for applications that require repeated connect/disconnect procedures, strenuous flexing situations and applications where cable and connector durability is important.

Key characteristics of the Testpro range include:

- Rugged interface: 5,000 mating/unmating lifecycle
- Flex life: over 20,000 cycles
- High flexibility
- Outstanding phase and loss stability for long calibration intervals

	TestPro 4.2	TestPro 3	TestPo 2 (launch 2014)
Frequency	DC - 18 GHz	DC - 26.5 GHz / DC- 40 GHz	DC - 50 GHz / DC - 67 GHz
Impedance	50 Ω ± 2 Ω	50 Ω ± 1 Ω	50 Ω ± 1 Ω
IL [dB/m]	2.10 @ 18 GHz	2.41 @ 26.5 GHz - 3.11 @ 40 GHz	5.00 @ 50 GHz - 5.92 @ 67 GHz
Test IL [dB/ft]	0.64 @ 18 GHz	0.73 @ 26.5 GHz - 0.94 @ 40 GHz	1.52 @ 50 GHz - 1.80 @ 67 GHz
Phase with flexure stability	2° @ 18 GHz	2° @ 26.5 GHz - 5° @ 40 GHz	6° @ 50 GHz - 8° @ 67 GHz
Amplitude stability (dB)	0.05 @ 18 GHz	0.05 @ 40 GHz	0.05 @ 50 GHz
Shielding Effectiveness	-110 dB min @ 1 GHz	-100 dB min @ 1 GHz	-100 dB min @ 1 GHz
Crush resistance	135 lb/linear in.	260 lb/linear in.	260 lb/linear in.
Minimum bend radius	25 mm (1 in.)	25 mm (1 in.)	25 mm (1 in.)
Temperature (°C)	-55 / + 125 °C	-55 / + 125 °C	-55 / + 125 °C
Connectors	SMA, N, TNC, PC7	SMA 3.5, SMA 2.9, NMD 2.9, TVAC 2.9, SMA 2.4mm, N	2.4mm / 1.85 mm
Flexure life cycle	10,000	20,000	20,000
Mating cycles durability	5,000	5,000	5,000
Armor	Available	Integrated	Integrated
RoHS/REACH	Yes	Yes	Yes

\*Please refer to Testpro catalog D1A295TE

## Space Qualified Products

### COAXIAL CONNECTORS

Full range of coaxial connectors operating up to Ka band.

- SMA and SMA 2.9 interfaces ESCC QPL:

Qualified according to ESCC 3402 specifications by European Space Agency (ESA)



- TNC and SMP interfaces classified EPPL: ESA Preferred Part List

Radiall has expended the SMP range to include, SMP-LOCK connectors featuring a robust locking mechanism. Qualified for space applications, this new interface is the best solution when size, weight, security, and high RF performance are required. This new interface is compatible with most of Radiall products below.

### LOW LOSSES CABLE ASSEMBLIES

Space qualified low loss flexible coaxial cable assemblies up to 40 GHz

- Available connectors: SMA, SMA 2.9, TNC or SMP

### SEMI-RIGID CABLE ASSEMBLIES

Space qualified semi-rigid coaxial cable assemblies up to 40 GHz

- Available connectors: SMA, SMA 2.9, TNC or SMP

### COUPLERS AND POWER DIVIDERS

Space qualified passive couplers DC-22 GHz and power dividers DC-31 GHz

- Admissible power up to 200 WCW

- Available connectors: SMA, SMA 2.9 and TNC



## Space Qualified Products

### COAXIAL SWITCHES

A full range of light weight Space qualified switches operating up to the Ka band.

- SPDT, DPDT, DP3T and T switch configurations available
- Available connectors: SMA, SMA 2.9 and TNC

### TERMINATIONS

Range of low power coaxial loads up to 40 GHz and ESA qualified (European Space Agency).

- Available connectors: SMA, SMA 2.9, SMP and TNC interface

### ATTENUATORS

Range of low power coaxial attenuators DC - 40 GHz qualified by European Space Agency (ESA).

- Available connectors: SMA, SMA 2.9 interface
- Attenuation 0 to 30 dB

### PHASE SHIFTERS

These components create a mechanical adjustable phase shift by variation in the physical length of the transmission line up to 22 GHz.

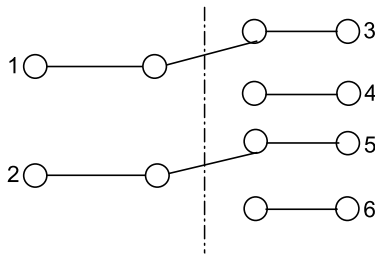


## Switches Application

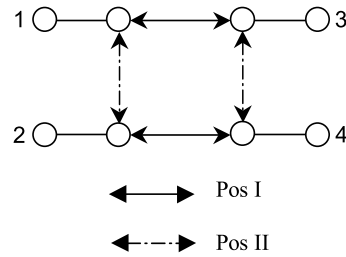
### COAXIAL TRANSFER SWITCHES (DPDT)

A DPDT is Double Pole Double Throw switch that provides two independent pairs of RF paths that are actuated simultaneously. The transfer switch is a modified DPDT device, where as a true DPDT switch is a six port device that contains completely independent transmission paths.

In a transfer switch, two transmission paths are not completely independent as shown below:



DPDT

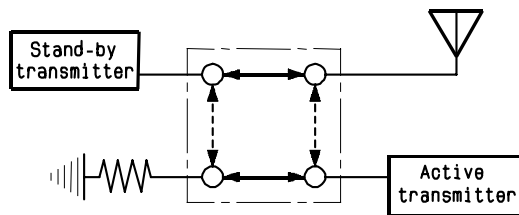


TRANSFER

Examples of transfer switch applications:

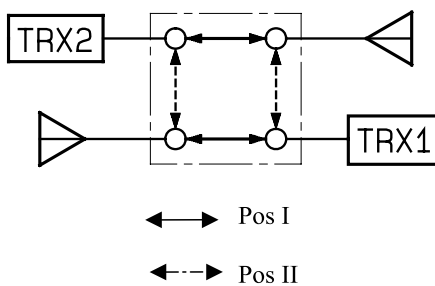
R577 Ramses, R593 Platinum or R513 Titanium series can be selected for this application

Redundancy of two transmitters:



Active transmitters are connected directly to the antenna. A second transmitter is terminated to a medium power termination, and put in stand by position, ready to switch to the antenna in case of a failure of the active transmitter. This is done to create redundancy for antenna maintenance.

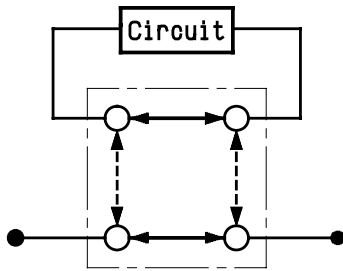
Two transmitters to two antennas:



For better signal diversity, 2 antennas are alternately connected to either of the two transmitters.

## Switches Application

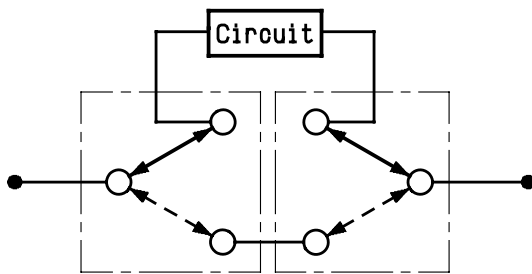
Coaxial Transfer as a bypass switch for circuit insertion applications:



A full RF or microwave passive circuit or circuit element as a filter can be inserted into a coaxial transmission line by using a transfer switch. This element is shortened by a transfer blade in through position.

Other RF arrangements for a bypass function:

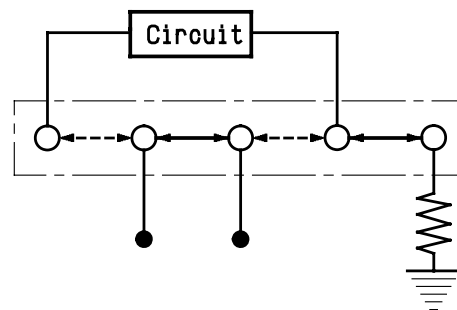
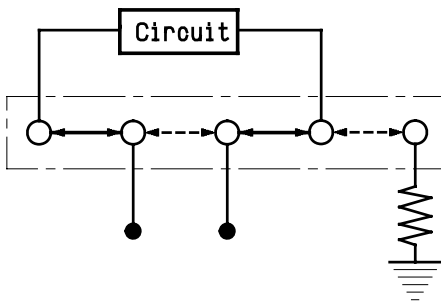
- Two SPDT switches configured to operate as a bypass switch
- R570 RAMSES, R596 (Surface Mount Technology) or R595 PLATINUM series can be used to achieve a bypass function



A more basic option, SPDT (Single Pole Double Throw) can be used to perform a bypass switch function. The advantage of using 2 SPDT relays instead of a transfer switch is a possible reduction in total package size. Generally, the use of 2 SPDT creates a higher isolation than a transfer switch.

A DP3T switch configured to operate as a transfer switch:

A R585 Ramses or R595 Platinum series can be selected to insert a passive or active component or circuit in a RF or microwave line.



An active component as an amplifier can be inserted in a microwave line; this amplifier is connected to a 50 Ohm termination (as a booster in stand-by status) when not inserted in the main coaxial line.



Our most  
important  
connection  
is with you.™

It's not just a slogan. It's a statement of our earnest desire to put you at the forefront of all our business practices. As part of Radiall's mission to be available and accessible, we make it a priority to have local offices around the globe ready and able to assist you – wherever you are, whenever you need us.

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MALAYSIA	NORWAY	PHILIPPINES	POLAND	PORTUGAL	RUSSIA	SINGAPORE	SPAIN	SWITZERLAND	TAIWAN	THAILAND	VIETNAM	SOUTH AFRICA	