

An innovative and original « micro-mechanical » design allows the R596 SMT micro-relay to bring together the excellent reliability, RF and repeatability characteristics of coaxial switches with the miniature size and low cost implementation of surface mount components. 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.

## PART NUMBER SELECTION

Updated  
Revision

R 596 . . . . 0 .

### Frequency range :

3 : DC – 3 GHz  
8 : DC – 8 GHz

### Type :

1 : Failsafe  
3 : Latching, 2 coils

### Actuator Voltage :

2 : 12 Vdc (1)  
3 : 24 Vdc

### Packaging style (2) :

0 : Standard packaging  
2 : Tape and reel of 200 relays (2)  
5 : Tape and reel of 500 relays (2)  
9 : Tape without reel (2) (4)  
T : Soldered on a connectorized test fixture (2) (3)

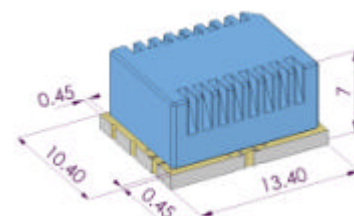
### Product range :

0 : Grade C  
1 : Grade M

- (1) : For 12V failsafe model only : this relay can be used either with 6 Vdc or 12 Vdc actuator voltage, depending on the PC board connections (see schematics page 2)
- (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 3
- (4) : Tape delivered without reel, available for all specific quantities up to 200 pieces



## TYPICAL OUTLINE DRAWING



## ACTUAL SIZE

(All dimensions in mm)

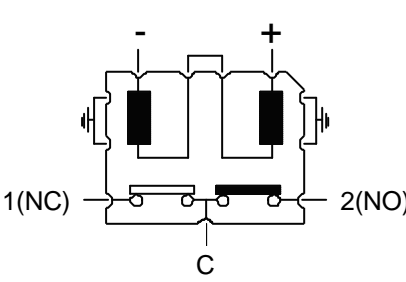
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**GENERAL SPECIFICATIONS**

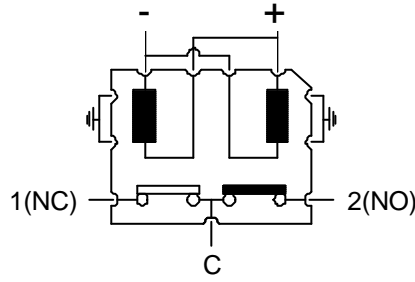
Operating mode		Failsafe			Latching	
Nominal operating voltage (across temperature range) Vdc		6 (note 1) (5.1 to 6.5)	12 (note 1) (10.2 to 13)	24 (20.5 to 30)	12 (10.2 to 13)	24 (20.5 to 30)
Coil resistance at 23°C (+/-10%) Ohms		82	330	1130	205	865
Operating current at 23°C mA		73	36	25	58	32
RF and command ports		½ 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)		Grade M : 2 million cycles ; Grade C : 500.000 cycles 500.000 cycles (1W, impedance 50Ω, V.S.W.R. <1.25)				
Construction		“LEAD FREE” construction – Waterproof (acc. To IEC 60529 / IP67)				
Mass		< 2g				
Operating temperature range  (with no icing nor condensation)		Failsafe  Grade M : -25 to +85 Grade C : -20 to +70			Latching  Grade M : -40 to +85 Grade C : -20 to +70	
Storage temperature range °C		-55 to +85				
Sine vibration (MIL STD 202, Method 204D)		- Condition D : 10-2000 Hz, 20g - Condition G : 10-2000 Hz, 30g			operating non operating	
Random vibration (MIL STD 202, Method 214A, Profile I)		- Condition F : 50-2000 Hz, 20.71 grms - Condition H : 50-2000 Hz, 29.28 grms			operating non operating	
Shocks (According to MIL STD 202, Method 213B, Cond. C)		100g / 6 ms, ½ sine			operating	

(1) The same failsafe relay reference can be used either with 6 Vdc or 12 Vdc actuator voltage, depending on the PC board connections (see schematics below).

**PIN IDENTIFICATION**
**Schematics (Top view)**



Failsafe model connection  
(12 Vdc or 24 Vdc)



Connection of a failsafe 12 Vdc model  
to be used with a 6 Vdc Power supply

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

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

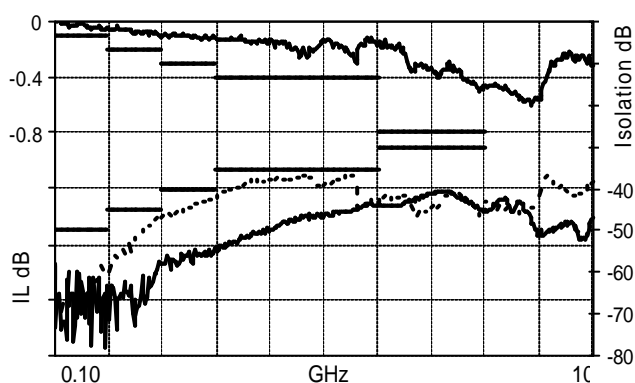
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## RF PERFORMANCES

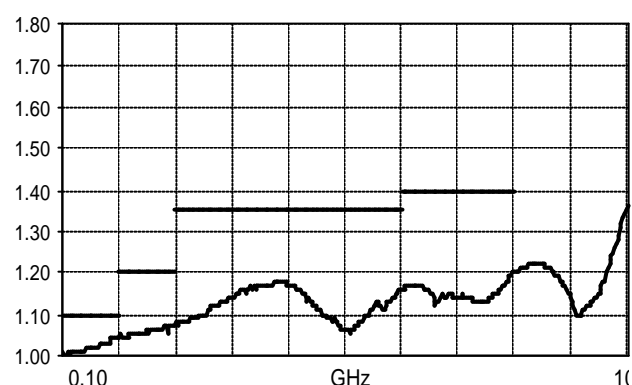
Frequency Range GHz		V.S.W.R (max)	Insertion Loss (max) dB	Isolation (min) dB		Average power W		Third order Inter modulation	Impedance Ohms
				switch alone	switch + board layout (1)	cold switching	hot switching		
DC - 3 DC - 8	DC - 1	1.10	0.10	50	50	120	50	-120 dBc typical (2 carriers 20W)	50
	1 - 2	1.20	0.20	45	40	70	50		
	2 - 3	1.35	0.30	40	30	40	40		
	3 - 6	1.35	0.40	35	30	25	25		
	6 - 8	1.40	0.80	30	30	5	5		

## TYPICAL RF PERFORMANCES

Insertion loss and Isolation



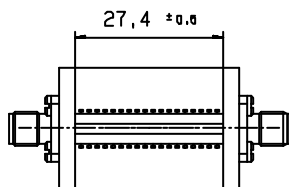
V.S.W.R.



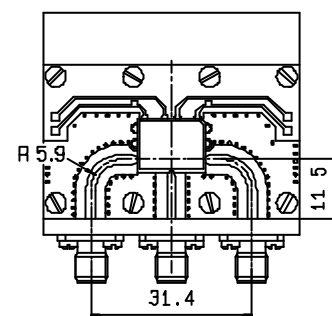
(1) : taking account of the reduction of isolation due to coupling between PCB microstrip lines (see isolation dotted curve above and measurement method below)

## Measurement method

Calibration board



Relay soldered on Test Fixture (4)



Inputs/Outputs of the calibration board and test fixture are equipped with SMA type receptacle connectors, RADIAL part number R125 510 000. 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 final board layout in accordance with the recommended implementation shown above (see dimension details on following pages).

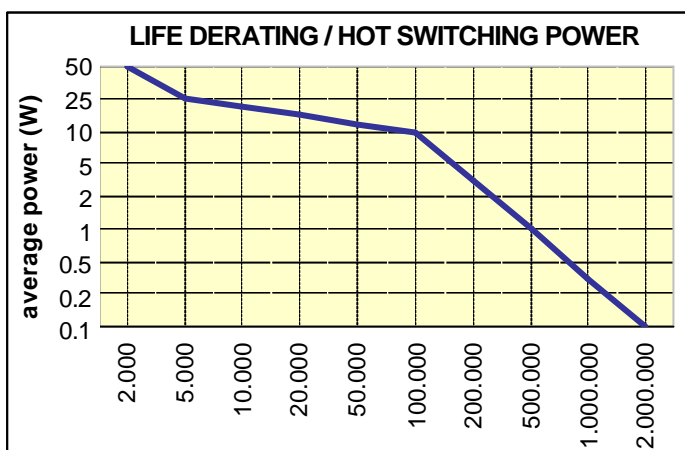
(4) : Relay soldered on Test Fixture available. To order, please use the suffix « T » (part number R596 - - - - T), as explained in page 1.

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## POWER APPLICATION PARAMETERS

### Life derating curve for hot switching use :

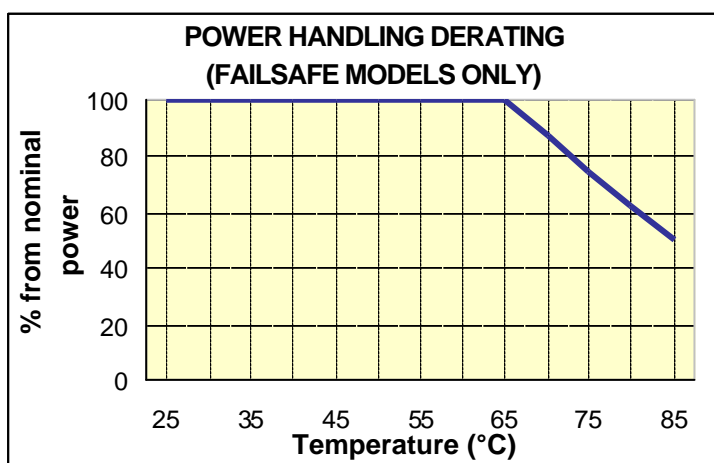
(impedance 50Ω, V.S.W.R. <1.25, max switching frequency 30 cycles per mn)



### Life derating curve for cold switching use, without cooling fan :

Latching models : no derating from -40°C to +85°C

Failsafe models : see power derating curve below



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## RELAY PACKAGING

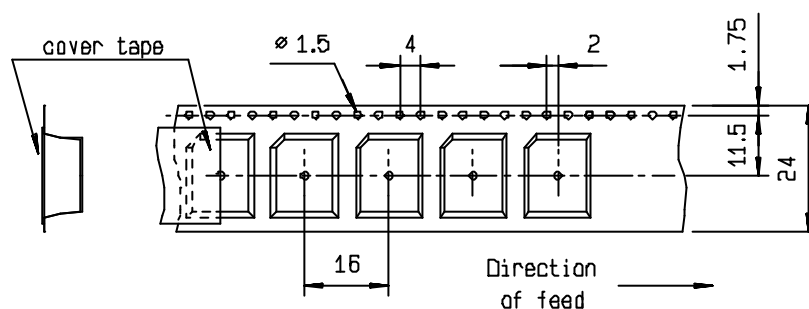
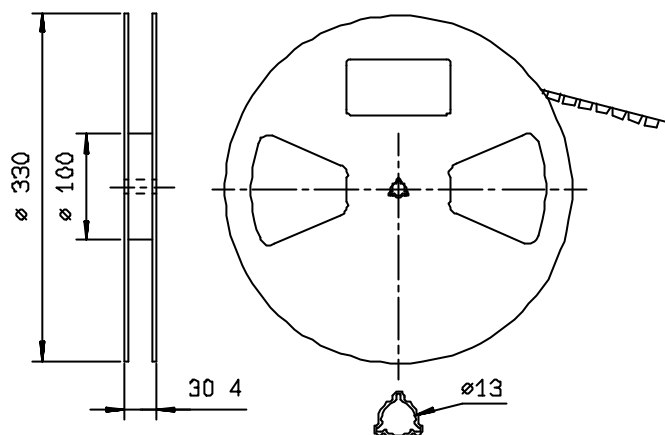
ACCORDING TO IEC 286-3 STANDARD

### MATERIALS

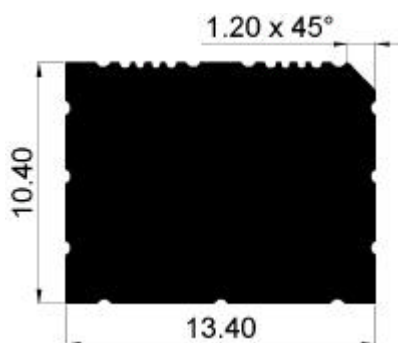
Reel : polyester

Carrier tape : antistatic PETG (polyester)

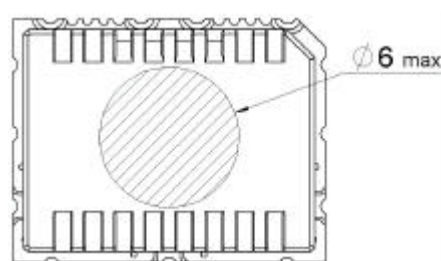
Cover tape : polyester



Video shadow of the relay



Aspiration area

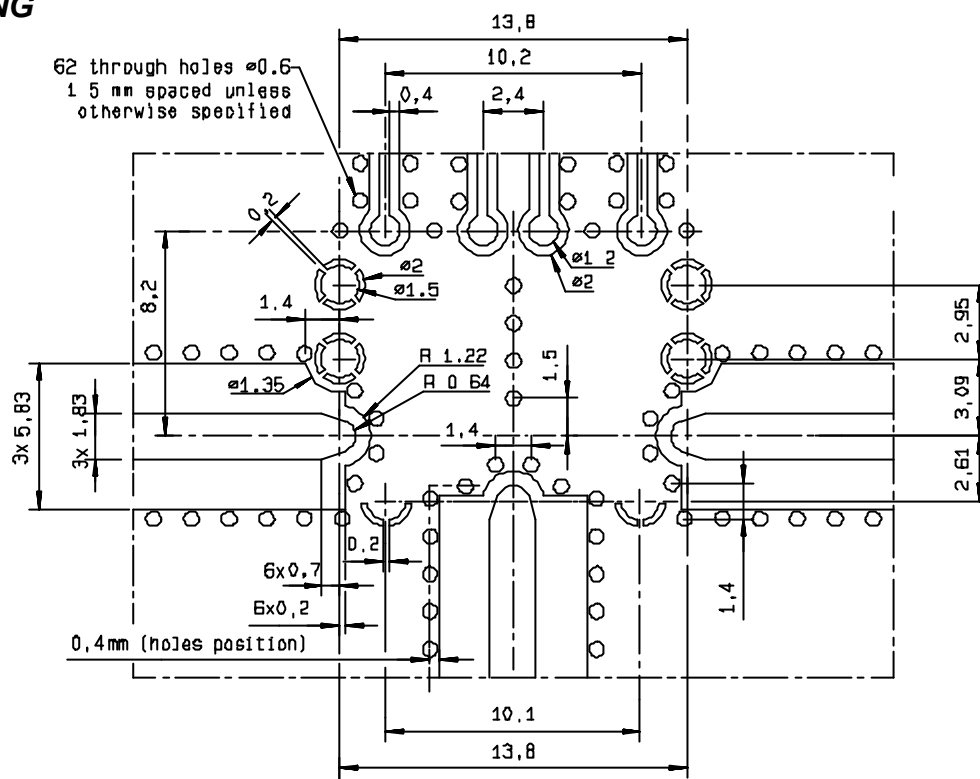


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## PC BOARD MOUNTING

### Board layout

DXF or GERBER format file  
available upon request (1)



### Substrate Types

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

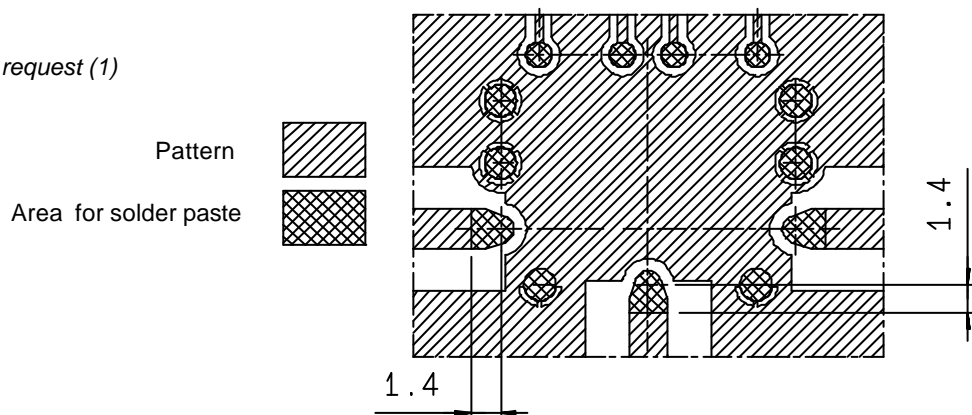
- **Mounting face** : Thickness 0.813 mm Cu double side 17.5 $\mu$ m. Width of track 1.83 mm  
Others substrates : **RO4350** , thickness 0.813 mm Cu double side 17.5 $\mu$ m. Width of track 1.80 mm  
**25FR** , thickness 0.813 mm Cu double side 17.5 $\mu$ m. Width of track 1.76 mm
- **Opposite face** : Plating all over the face.

**Total thickness of the tracks (copper over thickness + plating) : 40 $\mu$ m.**

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

### Relay soldering pattern

DXF format file available upon request (1)



(1) : Please contact us by E-Mail : [switchingproducts@radiall.com](mailto:switchingproducts@radiall.com)

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## RECOMMENDED SMT SOLDERING PROCEDURES

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

#### 1-Solder paste :

R596 series are « Lead Free », and Lead Free Sn-Ag3.5-Cu0.7 solder cream may be used as well as standard Sn63–Pb35–Ag2. RADIAL 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 optically verify that the edges of the zone are clean and without contaminates, and that the PCB zoned areas have not oxydated. The design of the mounting pads and the stenciling area are given on page 5, for a thickness of the silk-screen printing of 0.15 mm (0.006 " ).

#### 3-Placement of the component :

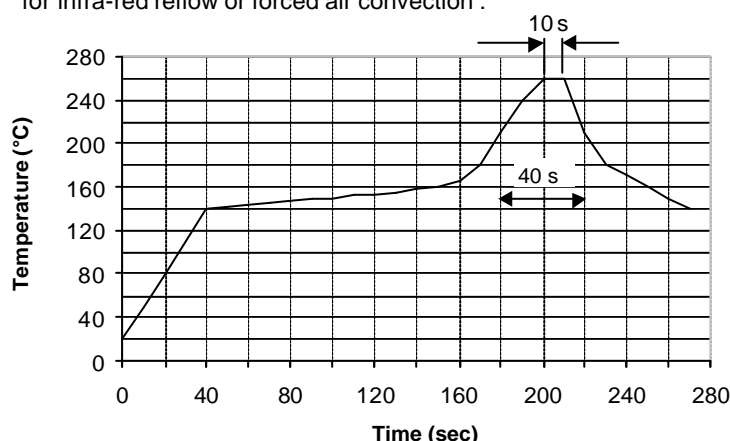
For small lightweight components such as chip components, a self-alignment effect can be expected if small placement errors exist. However, this effect is not as expected for relays components and they require a accurate positioning on their soldering pads, typically +/- 0.1mm (+/-0.004").

Place the relay onto the PCB with automatic pick and place equipment. Various types of suction can be used.

RADIAL does not recommend using adhesive agents on the component or on the PCB.

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

Please follow the RADIAL recommended temperature profile for infra-red reflow or forced air convection :



**CAUTION : higher temperature (>260°C) and longer process duration would damage permanently 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.

#### 6-Quality check :

Verify by visual inspection that the component is centered on the mounting pads.

Solder joints : verify by visual inspection that the formation of meniscus on the pads are proper, and have a capillarity amount upper the third of the height.

### B – Soldering procedure by manual operation

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

Refer to procedure A – 1

Deposite a thin layer of flux on mounting zone.

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 :

RADIAL 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 max. 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, so as to reduce the air gap between the PC board and the relay.

#### 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.

#### 6-Quality check:

Verify by visual inspection that component is centred on the mounting pads.

Solder joints : verify by visual inspection that the formation of meniscus on the RF pads are proper, and have a capillarity amount higher than one third of the height.

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