

MPS2R11-608

Datasheet

**100 MHz–6 GHz 40 W RoHS-Compliant
Monolithic SPDT PIN Switch**





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1 Revision History

1.1 Revision 1.0

Revision 1.0 was the first publication of this document.

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2 Product Overview

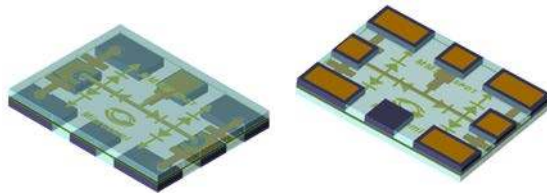
The MPS2R11-608 is a medium-power monolithic microwave surface mount (MMSM) series-shunt pin diode SP2T reflective switch. The technology is a packaged/device integration accomplished at the wafer level. Thermal transfer is optimized by the elimination of the traditional package interface. The MPS2R11-608 is completely compatible with pick-and-place and solder-reflow manufacturing techniques.

This series of diodes meets RoHS requirements according to EU Directive 2002/95/EC.

The standard terminal finish is gold unless otherwise specified. Please contact your Microsemi representative if you have special requirements.

The MPS2R11-608 is an ESD HBM Class 1B with a moisture sensitivity rating of MSL 2.

Figure 1 MPS2R11-608



2.1 Applications

The MPS2R11-608 is optimized for UHF through C Band power and T/R switching applications.

The MPS2R11-608 can handle up to 1 W of input power with as little as 5 V of control bias.

2.1.1 Key Features

The following are the key features of the MPS2R11-608:

- Series-shunt pin diode SP2T
- 40 W CW power handling (on state)
- Low insertion loss
- High isolation
- Surface mount
- 0907 device size
- Stable, low-leakage passivation with rugged glass body
- RoHS compliant¹
- High-power switching
- Surface-mountable
- Compact size (65 mils × 85 mils)

1. These devices are supplied with gold-plated terminations. Consult factory for details.

3 Electrical Specifications

3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings at 25 °C unless otherwise specified.

Table 1 Absolute Maximum Ratings

Rating	Symbol	Value	Unit
Storage temperature	T _{ST}	–65 to 150	°C
Operating temperature	T _{OP}	–65 to 125	°C
CW RF operating power	P _{CW}	40	W
Maximum dissipated power	P _{DISS}	4	W
Forward DC current	I _F	200	mA
Reverse DC voltage	V _R	150	V
ESD HBM		Class 1B	
Moisture sensitivity level		MSL 2	

3.2 Typical Electrical Performance (32 V Control)

The following table shows the typical electrical performance for 32 V control.

Table 2 Typical Electrical Performance (32 V Control)

Parameter	Frequency (MHz)	Bias Condition	Min	Typ	Max
Maximum CW RF input power ²	ALL				40 W
Insertion loss	100	–32 V, –100 mA		0.13 dB	0.18 dB
	1000	–32 V, –100 mA		0.19 dB	0.23 dB
	3000	–32 V, –100 mA		0.28 dB	0.32 dB
	6000	–32 V, –100 mA		0.31 dB	0.38 dB
	8000	–32 V, –100 mA		0.75 dB	0.90 dB
Return loss	100	–32 V, –100 mA	34 dB	36 dB	
	1000	–32 V, –100 mA	17 dB	18 dB	
	3000	–32 V, –100 mA	19 dB	20 dB	
	6000	–32 V, –100 mA	14 dB	16 dB	
	8000	–32 V, –100 mA	10 dB	11 dB	
Isolation	100	–32 V, –100 mA	68 dB	77 dB	
	1000	–32 V, –100 mA	66 dB	72 dB	
	3000	–32 V, –100 mA	50 dB	53 dB	
	6000	–32 V, –100 mA	40 dB	43 dB	
	8000		38 dB	40 dB	
Switching speed				500 ns	

2. Maximum input power is defined as less than 1 dB compression.

3.3 Typical Electrical Performance (5 V Control)

The following table shows the typical electrical performance for 5 V control.

Table 3 Typical Electrical Performance (5 V Control)

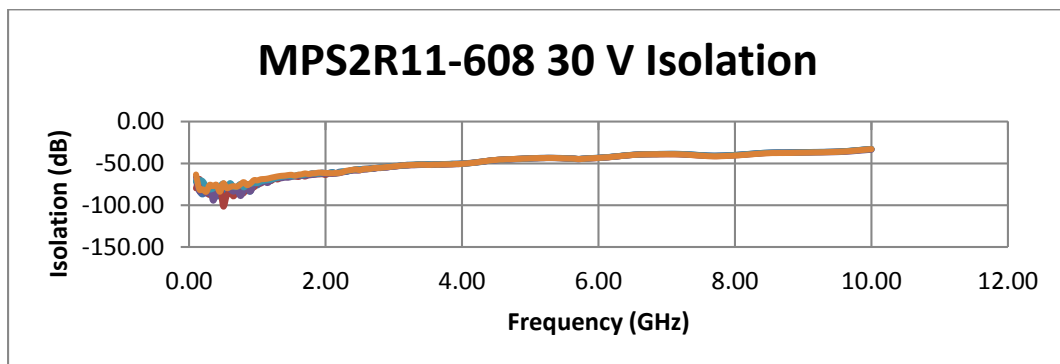
Parameter	Frequency (MHz)	Bias Condition	Min	Typ	Max
Maximum CW RF Input Power ³	ALL				1.0 W
Insertion Loss	100	-5 V, -100 mA		0.13 dB	0.15 dB
	1000	-5 V, -100 mA		0.23 dB	0.25 dB
	3000	-5 V, -100 mA		0.35 dB	0.4 dB
	6000	-5 V, -100 mA		0.42 dB	0.5 dB
	8000	-5 V, -100 mA		0.9 dB	1.1 dB
Return Loss	100	-5 V, -100 mA	34 dB	36 dB	
	1000	-5 V, -100 mA	17 dB	18 dB	
	3000	-5 V, -100 mA	18 dB	19 dB	
	6000	-5 V, -100 mA	14 dB	15 dB	
	8000	-5 V, -100 mA	10 dB	11 dB	
Isolation	100	-5 V, -200 mA	68 dB	77 dB	
	1000	-5 V, -200 mA	66 dB	72 dB	
	3000	-5 V, -200 mA	50 dB	53 dB	
	6000	-5 V, -200 mA	40 dB	43 dB	
	8000	-5 V, -100 mA	38 dB	40 dB	
Switching Speed				500 ns	

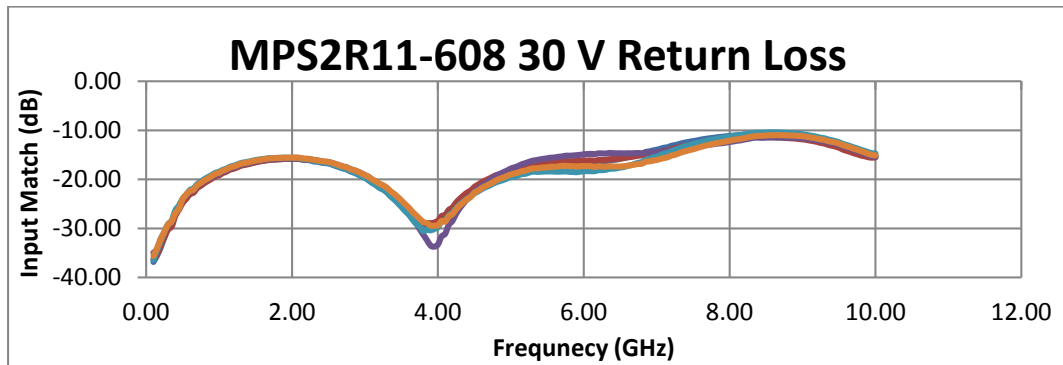
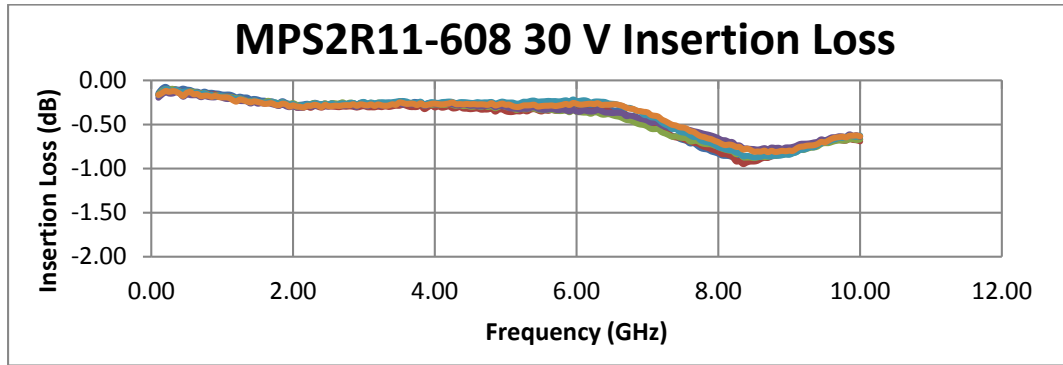
3. Maximum input power is defined as less than 1 dB compression.

3.4 Small Signal Swept Measurements

The following illustrations show the small signal swept measurements where the bias voltage is limited by test equipment (characteristics at nominal bias equivalent or better).

Figure 2 Small Signal Swept Measurements

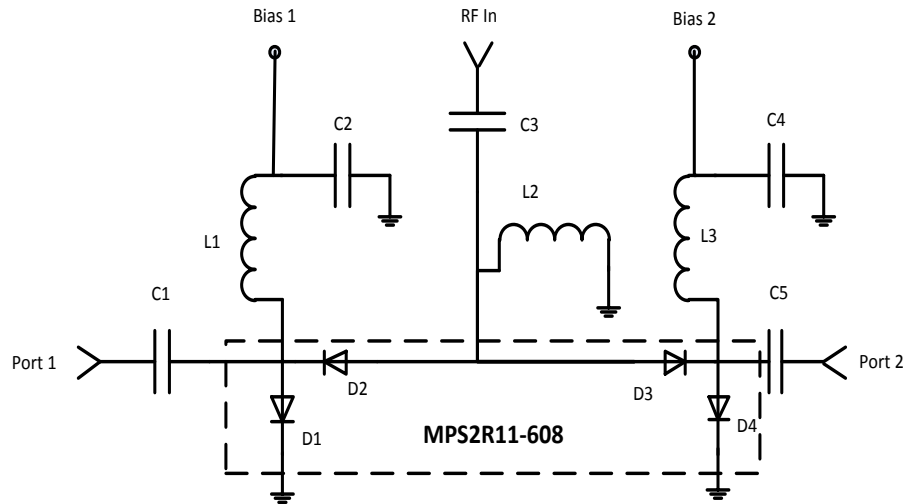




4 Schematic

The following illustration shows how the switching controls signals were applied.

Figure 3 Switching Controls Signals Application



The following table shows the typical bias element values for switching controls.

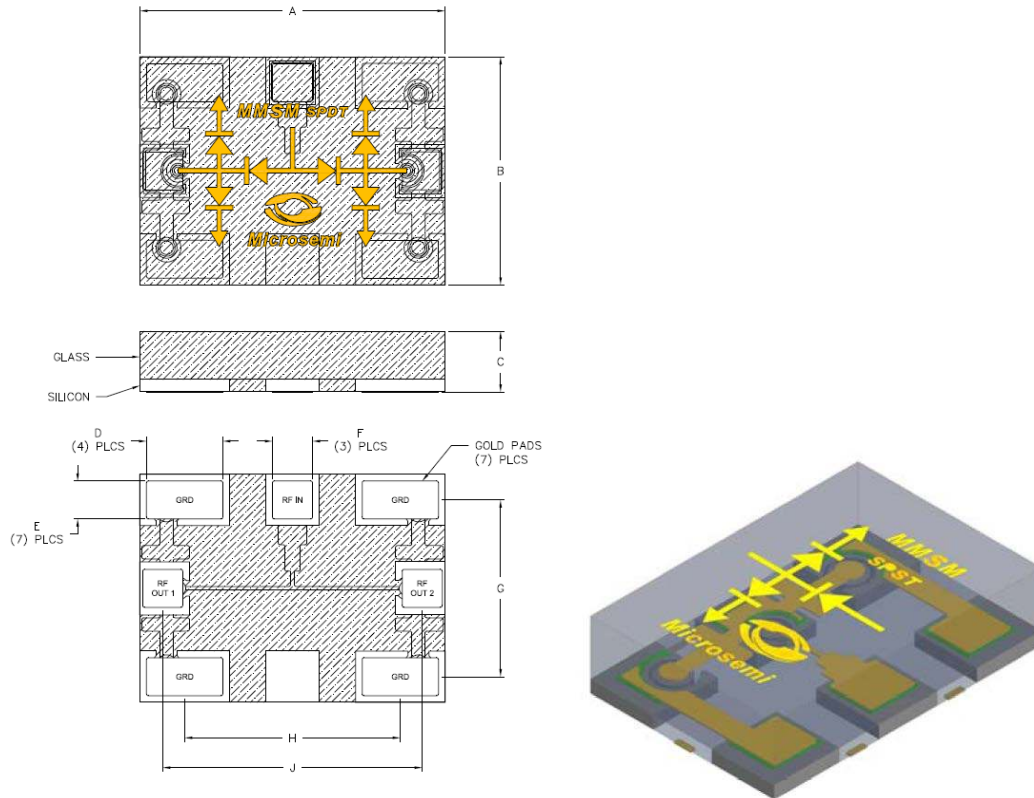
Table 4 Typical Bias Element Values for Switching Controls

Band	C1, C3,C5	C2, C4	L1, L2, L3
VHF (100 MHz–300 MHz)	150 pF	200 pF	400 nH
UHF (300 MHz–3000 MHz)	40 pF	50 pF	90 nH
C Band (4.0 GHz–8.0 GHz)	20 pF	50 pF	20 nH
ISM (902 MHz–928 MHz)	15 pF	50 pF	40 nH

5 Package Outline

The following illustration shows the package outline of the MPS2R11-608 device.

Figure 4 MPS2R11-608 Package Outline



The MPS2R11-608 device has the following package outline dimensions.

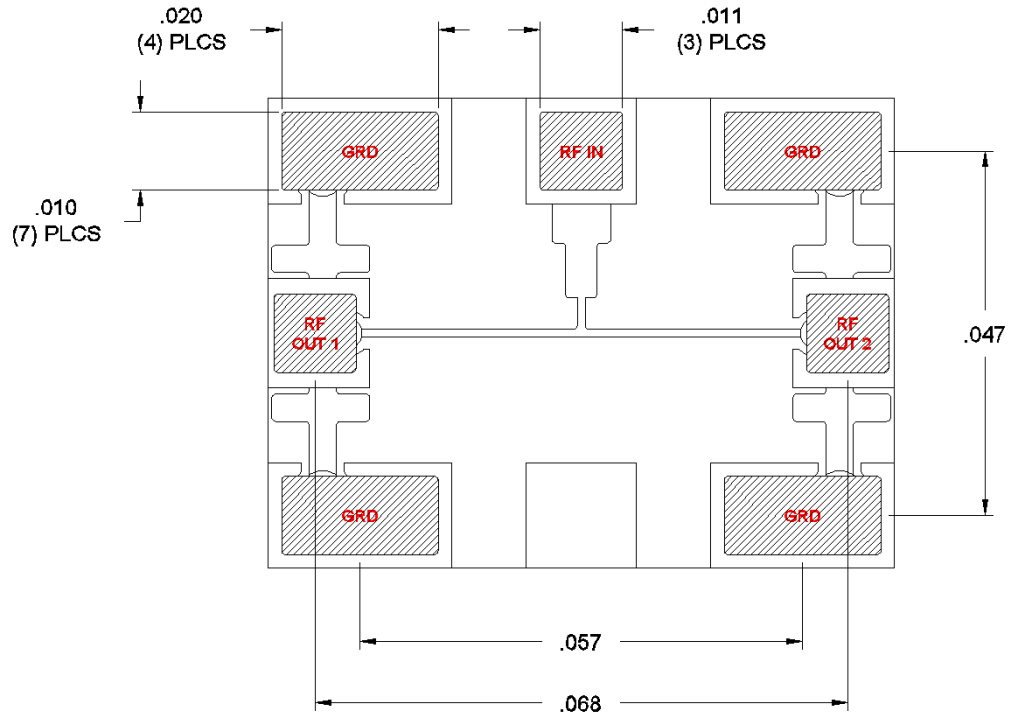
Table 5 MPS2R11-608 Package Dimensions

DIM	Inches			Millimeters		
	Min	Typ	Max	Min	Typ	Max
A	0.076	0.080	0.084	1.930	2.032	2.134
B	0.056	0.060	0.064	1.422	1.524	1.626
C		0.016			0.406	
D		0.020			0.508	
E		0.010			0.254	
F		0.011			0.279	
G		0.047			1.194	
H		0.057			1.448	
J		0.068			1.727	

5.1 Backside Solder Pad Dimensions

The following illustration shows the backside solder pad dimensions of the MPS2R11-608 device (units are in inches).

Figure 5 Backside Solder Pad Dimensions



6 Installation and Handling

MMSM products are compatible with both solder and silver epoxy paste assembly processes. This includes RoHS solder. Reflow temperatures for RoHS solders such as “SAC” Sn/Ag/Cu are higher than traditional Pb/Sn solders, so extra care must be taken when employing RoHS-compatible solders. Silver epoxy paste is recommended for applications where power dissipation is minimal, such as Tuning Varactor/Schottky and low-power PIN diode applications. For applications with incident power levels greater than 30 dBm, solder attachment is strongly recommended. Additionally, as with all microelectronic component assembly, care should be taken to ensure that all circuit boards are clean and free from contamination prior to any such operation.

This section outlines the considerations for manual and automated assembly techniques utilizing either solder or silver epoxy paste.

6.1 Manual Handling and Installation

Solder Assembly

MMSM products are designed to be compatible with modern automatic pick-and-place equipment, and are available in tape and reel format as well as in gel and waffle packs. Because of the nominal size of the units, some care must be taken to avoid causing damage during installation. Although storage temperature ratings (non-operating) are compatible and equivalent to ratings for standard plastic encapsulated lead-frame commercial packages (–55 °C to 125 °C), temperatures during solder installation can exceed this maximum value. It is critical, therefore, as with any other microelectronic part, to minimize thermal gradients across the device. For example, during manual installation, typical electronic pencil soldering tips can exceed 375 °C. When devices are first soldered down to the circuit board on one end only, followed in turn by soldering the opposite end, the original end provides a path to thermal ground. Unlike a thermal shock test, in which both package ends are simultaneously exposed to the same temperatures, a severe thermal gradient may be created during solder iron manual installation. Specifically, if the original soldered end rests at room temperature, soldering of the second end (tip temperature = 375 °C) may create a temperature gradient across the device of 350 °C. Use of a soldering iron tip, therefore, is strongly discouraged. If a tip must be used, the following recommendations will help minimize the risk of damage:

- Limit the tip temperature to the lowest possible temperature appropriate to exceed the liquidus point for the solder being used.
- Use the smallest tip mass available to reduce the tip thermal mass relative to the device length.
- Preheat the circuit board to 100 °C–120 °C to further reduce the temperature gradient.

Following these recommendations will help ensure that thermal differentials are minimized to lower levels.

Silver Paste Assembly

Installation of MMSM products using silver epoxy paste is fairly straightforward. Operators familiar with silver epoxy component assembly can easily adapt their technique to handle MMSM installation. Epotek H20E or equivalent can be used for installation. It is critical that the paste is within the manufacturer’s guidelines for shelf life and pot life.

See [solder pad outline](#) for information on where to dispense and place epoxy. The dots should be approximately 10 mils in diameter. Using tweezers or a vacuum pencil, the MMSM is placed on the

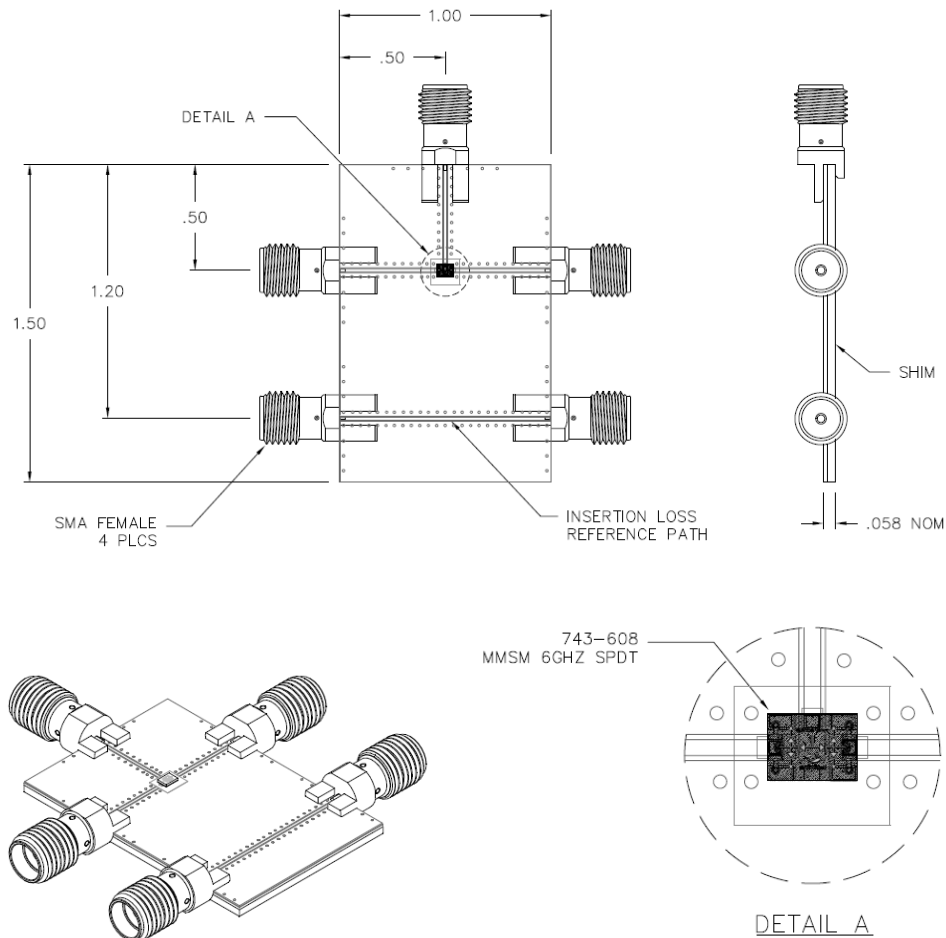
epoxy dots and lightly pressed into place. Excessive epoxy can cause bridging between the solder pads, which can potentially short out the device. Too little epoxy can result in poor electrical or mechanical connection. After installation of the MMSM parts, it is necessary to cure the assembly using the manufacturer's recommended time and temperature settings. Improper curing can result in poor mechanical bonds as well as reduced electrical performance.

For additional installation guidance, consult MicroNote716 at www.microsemi.com.

7 Evaluation Board Assembly

The following illustration shows the evaluation board assembly for the MPS2R11-608 device. All measurements shown are in inches. The evaluation board has a full-metal backside and the solder mask is topside only.

Figure 6 Evaluation Board Assembly



The following table shows additional evaluation board assembly information for the MPS2R11-608 device.

Table 6 Evaluation Board Assembly Information

Ordering part number	MSTF0011
Material	0.016 Rogers 4003, 0.5 oz. copper cladding on both sides (starting thickness)
Finish	Electroless nickel immersion gold (ENIG), both sides

8 Tape and Reel Format

The following illustration shows the tape and reel format for the MPS2R11-608 device.

Figure 7 Tape and Reel Format Diagrams

