MPS2R10-606 Datasheet

50 MHz to 1 GHz RoHS Compliant SPDT Monolithic PIN Switch

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Revision History

1.1 Revision 1.0

Revision 1.0 was the first publication of this document.

1.2 Revision 1.1

In revision 1.1, this document was rebranded to the Microsemi format. There were no changes to the technical content.

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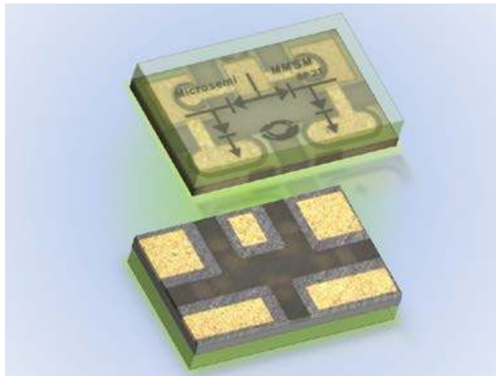
2 Product Overview

The MPS2R10-606 is a RoHS compliant high 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 elimination of the traditional package interface. The MPS2R10-606 is completely compatible with pick and place and solder reflow manufacturing techniques.

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

The standard terminal finish is gold unless otherwise specified. Consult the factory if you have special requirements.

- ESD HBM Class 1B
- Moisture Sensitivity MSL 2



2.1 Applications

The MPS2R10-606 device is optimized for UHF high power and T/R switching applications.

Up to 1 Watt CW power handling with as little as 5 V control.

2.1.1 Key Features

The following are the key features of the MPS2R10-606.

- Series-shunt pin diode SP2T
- 100 W CW power handling
- Low insertion loss
- High isolation
- Surface mount
- 0805 device size
- Stable low leakage passivation with rugged glass body
- RoHS compliant 1

The MPS2R10-606 devices are supplied with gold-plated terminations. For more information, contact your Microsemi representative.

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	ºC
Operating Temperature	T_{OP}	-65 to +125	ºC
CW RF Operating Power	P_{CW}	100	W
Forward DC Current	I_F	200	mA
Reverse DC Voltage	V_R	150	V
ESD HBM		Class 1B	
Moisture Sensitivity		MSL 2	

3.2 Typical Electrical Performance

The following table shows the typical electrical performance for 100 V control.

Table 2 Typical Electrical Performance (100 V Control)

Parameter	Frequency (MHz)	Minimum	Typical	Maximum
Maximum CW RF Input Power[1]	ALL			100 W
Insertion Loss	100		0.1 dB	0.12 dB
	500		0.2 dB	0.25 dB
	1000		0.5 dB	0.6 dB
Return Loss	100	25 dB	28 dB	
	500	13 dB	15 dB	
	1000	7 dB	9 dB	
Isolation	100	55 dB	60dB	
	500	53 dB	55 dB	
	1000	45 dB	47 dB	

1. For information about device bias, see DC Bias Conditions and Logic.

3.3 Typical Electrical Performance

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

Table 3 Typical Electrical Performance (5 V Control)

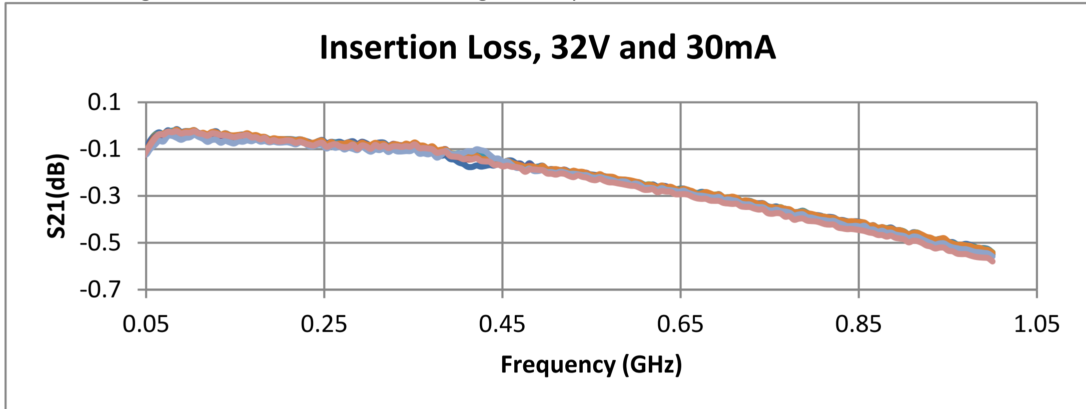
Parameter	Frequency (MHz)	Minimum	Typical	Maximum
Maximum CW RF Input Power[1]	ALL			1 W

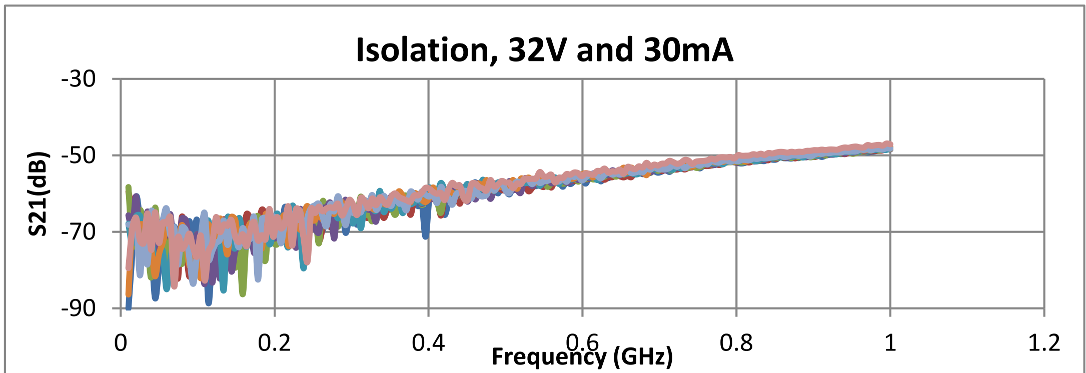
Parameter	Frequency (MHz)	Minimum	Typical	Maximum
Insertion Loss	100		0.05 dB	0.10 dB
	500		0.25 dB	0.30 dB
	1000		0.7 dB	0.85 dB
Return Loss	100	25 dB	28 dB	
	500	13 dB	15 dB	
	1000	7 dB	9 dB	
Isolation	100	55 dB	60 dB	
	500	50 dB	55 dB	
	1000	43 dB	46 dB	

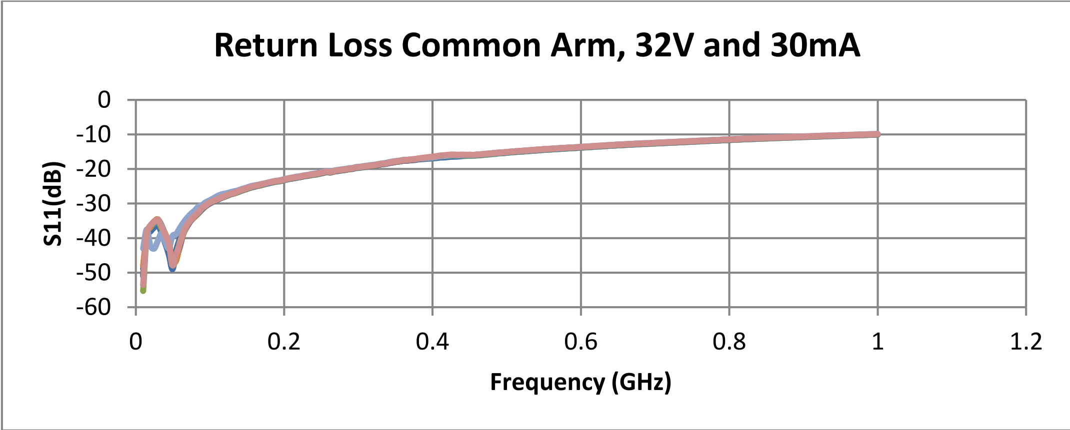
2. Maximum input power defined as <1 dB compression

3.4 Small Signal Swept Measurements

The following illustrations show the small signal swept measurements.







- Bias voltage limited by test equipment.
- Characteristics at nominal bias equivalent or better.

4 Schematic

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

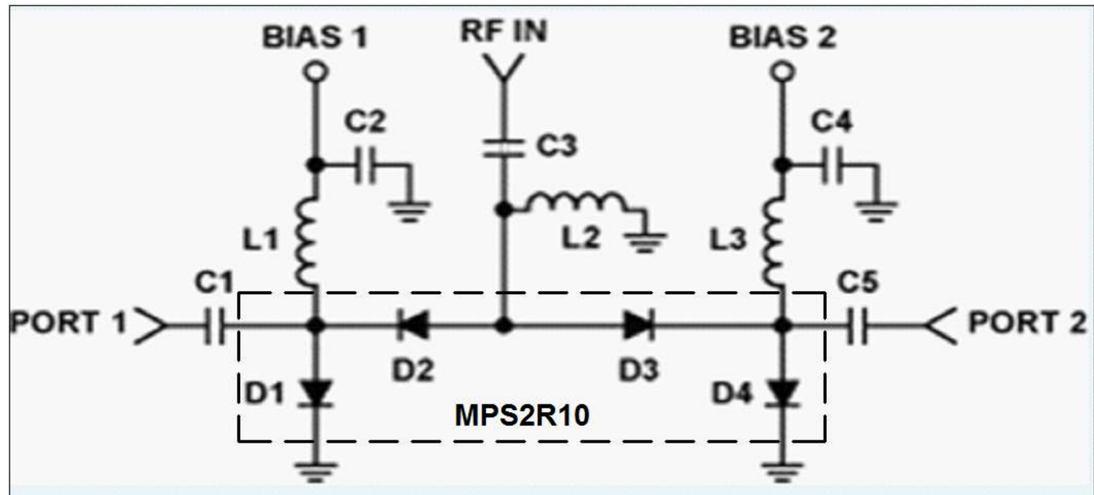


Table 4 Switching Control Signals

Band	C1, C3, C5	C2, C4	L1, L2, L3
VHF (100-300 MHz)	150 pF	200 pF	400 nH
UHF (300-1000 MHz)	40 pF	50 pF	90 nH
ISM (902-928 MHz)	15 pF	50 pF	40 nH

4.1 DC Bias Conditions and Logic

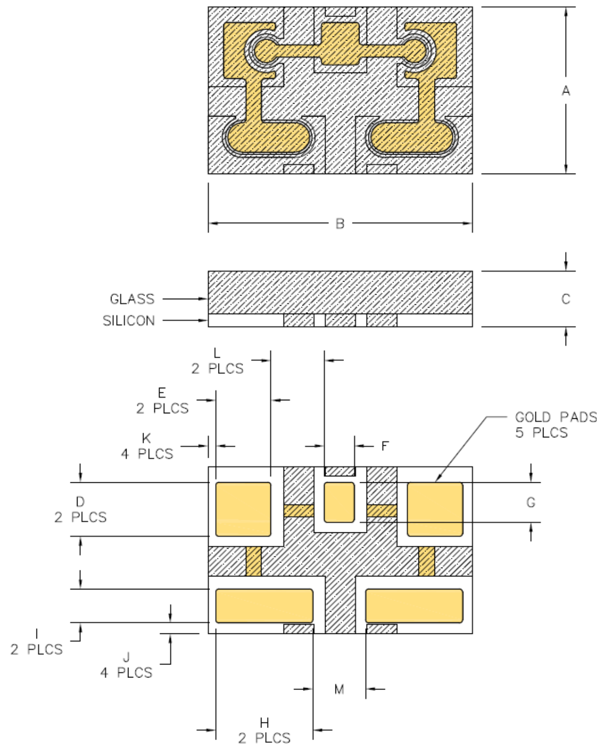
The following table shows the DC bias conditions and logic.

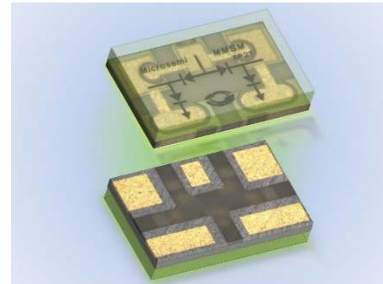
Table 5 DC Bias Conditions and Logic

Bias 1	Bias 2	RF IN Port 1	RF In Port 2
-100 V, 50.0 mA	<1.0 V, 30 mA	Low Loss	Isolation
<1.0 V, 30 mA	-100 V, 50.0 mA	Isolation	Low Loss

5 Package Outline

The MPS2R10-606 device has the following package outline specifications.

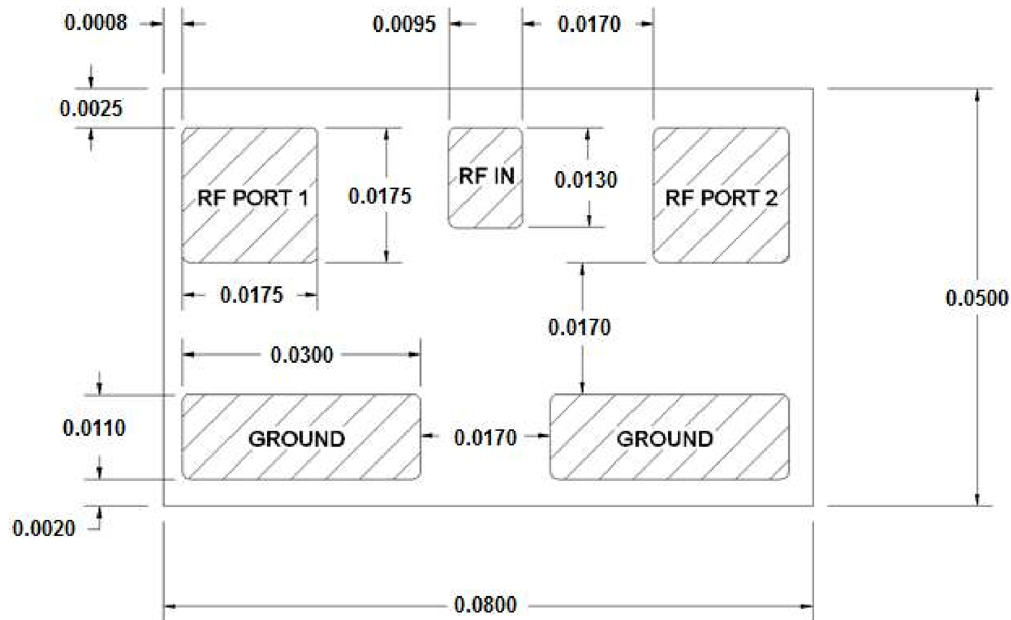




DIM	INCHES			MM		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.048	0.050	0.052	1.219	1.270	1.321
B	0.078	0.080	0.082	1.981	2.032	2.083
C	0.011	0.016	0.021	0.279	0.406	0.533
D	–	0.0175	–	–	0.4445	–
E	–	0.0175	–	–	0.4445	–
F	–	0.0095	–	–	0.2413	–
G	–	0.013	–	–	0.330	–
H	–	0.030	–	–	0.762	–
I	–	0.011	–	–	0.279	–
J	–	0.002	–	–	0.051	–
K	–	0.001	–	–	0.025	–
L	–	0.017	–	–	0.432	–
M	–	0.017	–	–	0.432	–

5.1 Backside Solder Pad Dimensions

The MPS2R10-606 device has the following backside solder pad dimensions.



5.2 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 > 30 dBm, solder attachment is strongly recommended. Additionally, as with all microelectronic component assembly, care should be taken to insure all circuit boards are clean and free from contamination prior to any such operation.

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

5.2.1 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 (i.e. 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 of 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

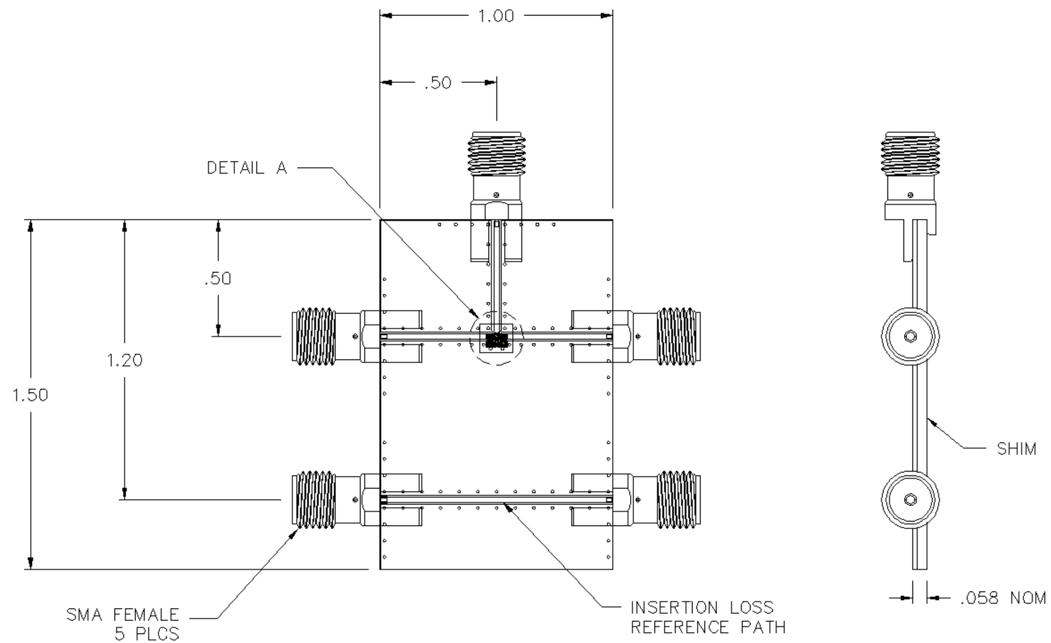
Installation of MMSM product using silver epoxy paste is fairly straight forward. Operators familiar with silver epoxy component assembly can easily adapt his/her technique readily to handle MMSM installation. Epotek H20E or equivalent can be used for installation. It is critical that the paste is within the manufactures guide lines for shelf life and pot life.

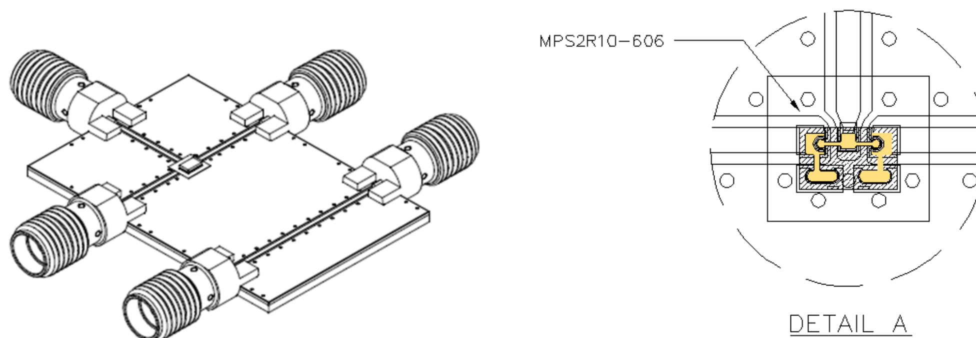
Epoxy is dispensed and placed (See solder pad outline). The dots should be approximately 10 mils in diameter. Using tweezers or a vacuum pencil, the MMSM is placed on the epoxy dots and lightly pressed into place. Excessive epoxy can cause bridging between the solder pads and short out the device. Not enough epoxy can result in poor electrical or mechanical connection. After installation of the MMSM parts, the assembly is cured using the manufactures recommended time and temperature settings. Improper curing can result in poor mechanical bonds as well as reduced electrical performance.

See MicroNote 716 at www.microsemi.com for additional installation guidance.

6 Evaluation Board Assembly

The following illustrations show the evaluation board assembly for the MPS2R10-606 device.



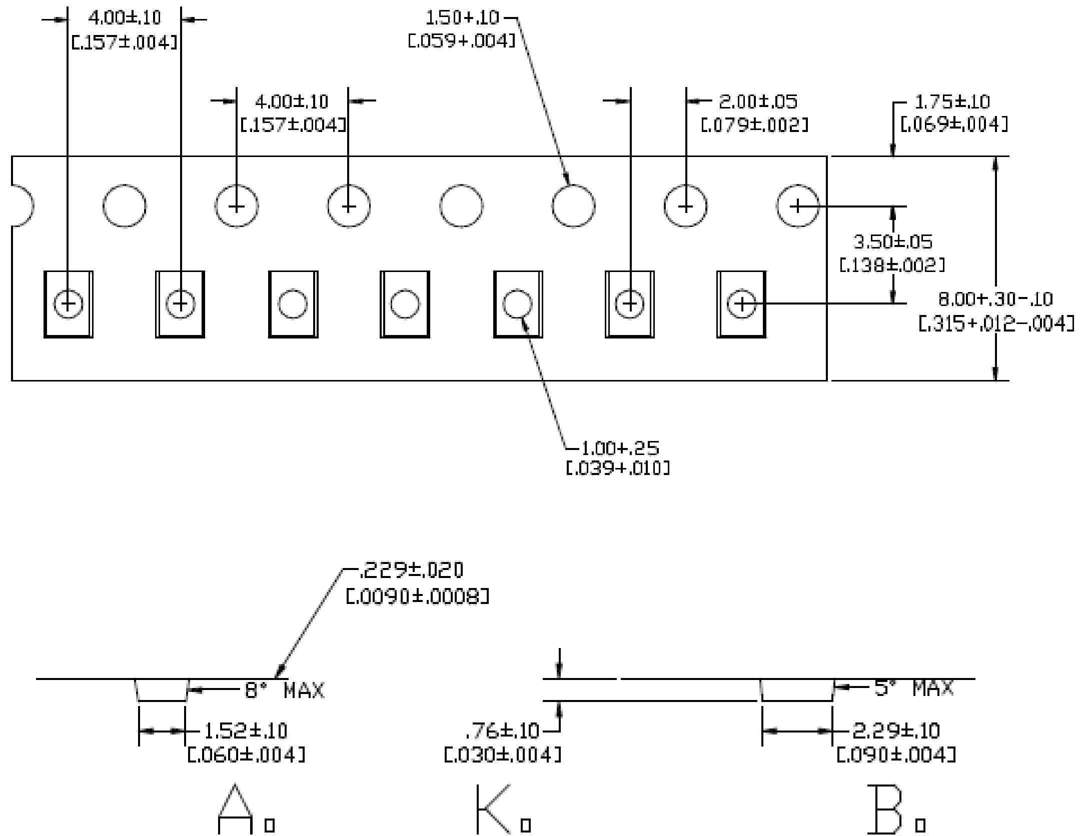


NOTES:

- Order Microsemi part number MSTF0002
- Material: .016 Rogers 4003, ½ Oz Copper, cladding both sides starting thickness.
- Full metal backside.
- Finish: Enig (Gold Immersion), both sides.
- Solder mask topside only.
- Units are in inches.

7 Tape and Reel Format

The following illustrations show the tape and reel format for the MPS2R10-606 device.



For the most current data, see the Microsemi website at www.microsemi.com.

Specifications are subject to change, consult the RFMW Business Unit at (978) 442-5600 for the latest information. For applications information, see www.microsemi.com/design-support/application-notes#rf-and-pin-diode.