

# Surface Mount PIN Diodes

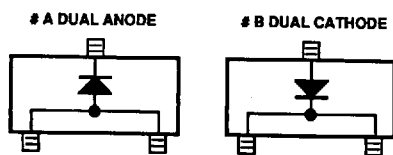
## Technical Data

### HSMP-38XX and HSMP-48XX Series

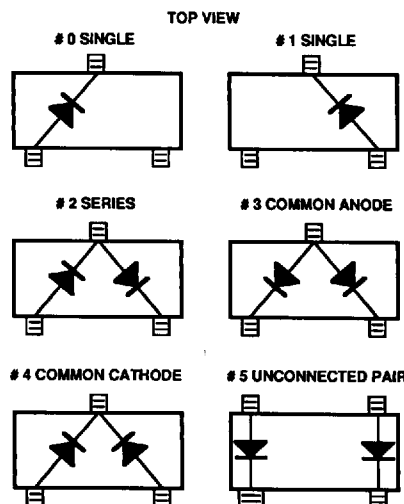
#### Features

- **Diodes Optimized for:**  
 Low Current Switching  
 Low Distortion Attenuating  
 Ultra-Low Distortion Switching  
 Microwave Frequency Operation
- **Surface Mount SOT-23 Package**  
 Single and Dual Versions  
 Tape and Reel Options Available
- **Low Failure in Time (FIT) Rate\***

\*For more information see the Surface Mount PIN Reliability Data Sheet.



#### Package Lead Code Identification



#### Description/ Applications

The HSMP-3800 and HSMP-3810 series are specifically designed for low distortion attenuator applications. The HSMP-3820 and HSMP-3890 series are optimized for switching applications where low resistance at low current, and low capacitance are required. The HSMP-3880 switching diode is an ultra low distortion device optimized for higher power applications from 50 MHz to 1.5 GHz. The HSMP-48XX series are special products featuring ultra low parasitic inductance in the SOT-23 package, specifically designed for use at frequencies which are much higher than the upper limit for conventional SOT-23 PIN diodes. The HSMP-4810 diode is a low distortion attenuating PIN designed for operation to 3 GHz. The HSMP-4820 diode is ideal for limiting and low inductance switching applications up to 1.5 GHz. The HSMP-4890 is optimized for low current switching applications up to 3 GHz.

#### Absolute Maximum Ratings\*\* $T_A = 25^\circ\text{C}$

Symbol	Parameter	Value
$I_f$	Forward Current (1 $\mu\text{s}$ Pulse)	1 Amp
$P_t$	Total Device Dissipation	250 mW <sup>(1)</sup>
$P_{iv}$	Peak Inverse Voltage	Same as $V_{BR}$
$T_j$	Junction Temperature	150°C
$T_{stg}$	Storage Temperature	-65 to 150°C

\*\*Operation in excess of any one of these conditions may result in permanent damage to this device.

#### Note:

1. CW Power Dissipation at  $T_{LEAD} = 25^\circ\text{C}$ . Derate to zero at maximum rated temperature.

## PIN Attenuator Diodes

### Electrical Specifications $T_A = 25^\circ\text{C}$ (Each Diode)

Part Number HSMP-	Package Marking Code <sup>[1]</sup>	Lead Code	Configuration	Nearest Equivalent Axial Lead Part No. 5082-	Minimum Break-down Voltage $V_{BR}$ (V)	Maximum Series Resistance $R_S$ ( $\Omega$ )	Maximum Total Capacitance $C_T$ (pF)	Minimum High Resistance $R_H$ ( $\Omega$ )	Maximum Low Resistance $R_L$ ( $\Omega$ )
3800	D0	0	Single	3080	100	2.5	0.35	1000	8
3801	D1	1	Single						
3802	D2	2	Series						
3804	D4	4	Common Cathode						
3810	E0	0	Single	3081	100	4.0	0.35	1500	10
3811	E1	1	Single						
3812	E2	2	Series						
3813	E3	3	Common Anode						
3814	E4	4	Common Cathode						
Test Conditions					$V_R = V_{BR}$ Measure $I_R \leq 10 \mu\text{A}$	$I_F = 100 \text{ mA}$ $f = 100 \text{ MHz}$	$V_R = 50 \text{ V}$ $f = 1 \text{ MHz}$	$I_F = 0.01 \text{ mA}$ $f = 100 \text{ MHz}$	$I_F = 20 \text{ mA}$ $f = 100 \text{ MHz}$

## PIN Switching Diodes

Part Number HSMP-	Package Marking Code <sup>[1]</sup>	Lead Code	Configuration	Nearest Equivalent Axial Lead Part No. 5082-	Minimum Breakdown Voltage $V_{BR}$ (V)	Maximum Series Resistance $R_S$ ( $\Omega$ )	Maximum Total Capacitance $C_T$ (pF)	Maximum Shunt Mode Harmonic Distortion Hmd (dBc)
3820	F0	0	Single	3188	35	0.6*	1.0*	-
3821	F1	1	Single					
3822	F2	2	Series					
3823	F3	3	Common Anode					
3824	F4	4	Common Cathode					
3880	S0	0	Single	-	100	6.5	0.40	-55
3881	S1	1	Single					
3890	G0	0	Single	-	35	2.5	0.30**	-
3891	G1	1	Single					
3892	G2	2	Series					
3893	G3	3	Common Anode					
3894	G4	4	Common Cathode					
3895	G5	5	Unconnected Pair					
Test Conditions					$V_R = V_{BR}$ Measure $I_R \leq 10 \mu\text{A}$	$I_F = 5 \text{ mA}$ $f = 100 \text{ MHz}$ $I_F = 10 \text{ mA}^*$	$V_R = 50 \text{ V}$ $f = 1 \text{ MHz}$ $V_R = 20 \text{ V}^*$ $V_R = 5 \text{ V}^{**}$	$2 f_o, Z_o = 50 \text{ W}$ $f_o = 400 \text{ MHz}$ $P_{in} = +30 \text{ dBm}$ 0 V bias

#### Note:

1. Package marking code is white. Package marking code is suffix "L" for low profile.

## PIN General Purpose Diodes

Part Number HSMP-	Package Marking Code <sup>(1)</sup>	Lead Code	Configuration	Nearest Equivalent Axial Lead Part No. 5082-	Minimum Breakdown Voltage $V_{BR}$ (V)	Maximum Series Resistance $R_S$ ( $\Omega$ )	Maximum Total Capacitance $C_T$ (pF)
3830	K0	0	Single	3077	200	1.5	0.3
3831	K1	1	Single				
3832	K2	2	Series				
3833	K3	3	Common Anode				
3834	K4	4	Common Cathode				
Test Conditions					$V_R = V_{BR}$ Measure $I_R \leq 10 \mu A$	$I_F = 100 \text{ mA}$ $f = 100 \text{ MHz}$	$V_R = 50 \text{ V}$ $f = 1 \text{ MHz}$

### Note:

1. Package marking code is white. Package marking code is suffix "L" for low profile.

## High Frequency (Low Inductance, 500 MHz - 3 GHz) PIN Diodes

Part Number HSMP-	Package Marking Code	Lead Code	Configuration	Minimum Break-down Voltage $V_{BR}$ (V)	Maximum Series Resistance $R_S$ ( $\Omega$ )	Typical Total Capacitance $C_T$ (pF)	Maximum Total Capacitance $C_T$ (pF)	Typical Total Inductance $L_T$ (nH)	Application
4810	EB	B	Dual Cathode	100	4.0	0.35	0.4	1.0	Attenuator
4820	FA	A	Dual Anode	35	0.8*	0.75*	1.0*	1.0*	Limiter
4890	GA	A	Dual Anode	35	2.5*	0.33	0.375	1.0	Switch
				$V_R = V_{BR}$ Measure $I_R \leq 10 \mu A$	$I_F = 100 \text{ mA}$ $I_F = 10 \text{ mA}^*$	$V_R = 50 \text{ V}$ $f = 1 \text{ MHz}$ $V_R = 20 \text{ V}^*$	$V_R = 50 \text{ V}$ $f = 1 \text{ MHz}$ $V_R = 0 \text{ V}^*$	$f = 500 \text{ MHz} - 3 \text{ GHz}$ $f = 500 \text{ MHz} - 1.5 \text{ GHz}^*$	

### Note:

1. Package marking code is white. Package marking code is suffix "L" for low profile.

## Typical Parameters at $T_A = 25^\circ\text{C}$

Part Number HSMP-	Series Resistance $R_S$ ( $\Omega$ )	Carrier Lifetime $T$ (ns)	Reverse Recovery Time $T_{rr}$ (ns)
380X	55	1800	500
381X/4810	75	1500	300
382X/4820	1.5	70*	7
383X	20	500	80
388X	3.8	2500	550
389X/4890	3.8	200*	-
Test Conditions	$I_F = 1 \text{ mA}$ $f = 100 \text{ MHz}$ $I_F = 10 \text{ mA}^*$	$I_F = 50 \text{ mA}$ $I_R = 250 \text{ mA}$ $I_F = 10 \text{ mA}^*$ $I_R = 6 \text{ mA}^*$	$V_R = 10 \text{ V}$ $I_F = 20 \text{ mA}$ 90% Recovery

Typical Parameters at  $T_A = 25^\circ\text{C}$  (unless otherwise noted), Single Diode

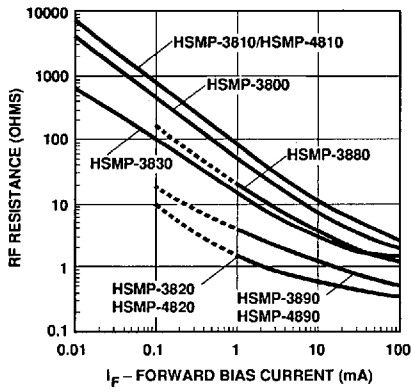


Figure 1. RF Resistance at  $25^\circ\text{C}$  vs. Forward Bias Current.

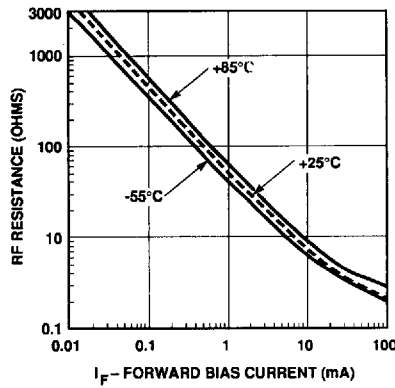


Figure 2. RF Resistance vs. Forward Bias Current for HSMP-3800.

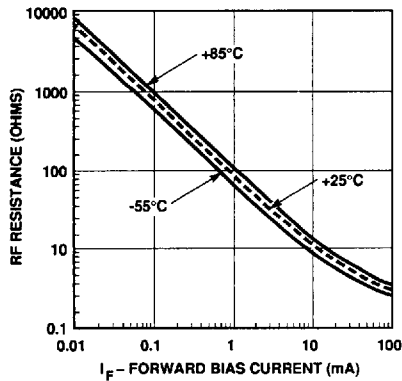


Figure 3. RF Resistance vs. Forward Bias Current for HSMP-3810 and HSMP-4810.

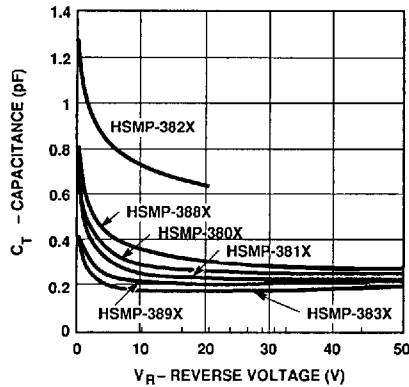


Figure 4. Capacitance vs. Reverse Voltage.

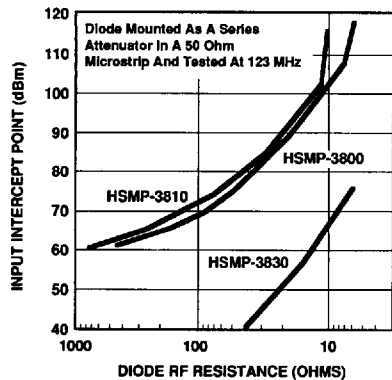


Figure 5. 2nd Harmonic Input Intercept Point vs. Diode RF Resistance for Attenuator Diodes.

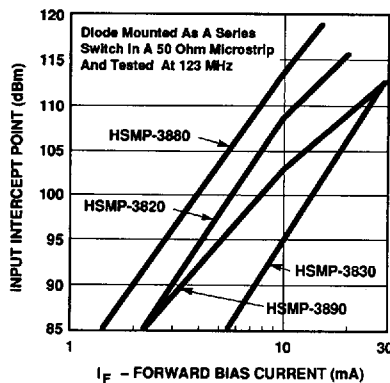


Figure 6. 2nd Harmonic Input Intercept Point vs. Forward Bias Current for Switch Diodes.

Typical Parameters (continued)

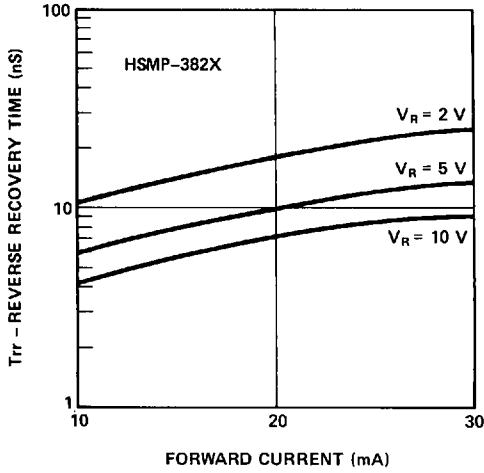


Figure 7. Reverse Recovery Time vs. Forward Current for Various Reverse Voltages. HSMP-3820 Series.

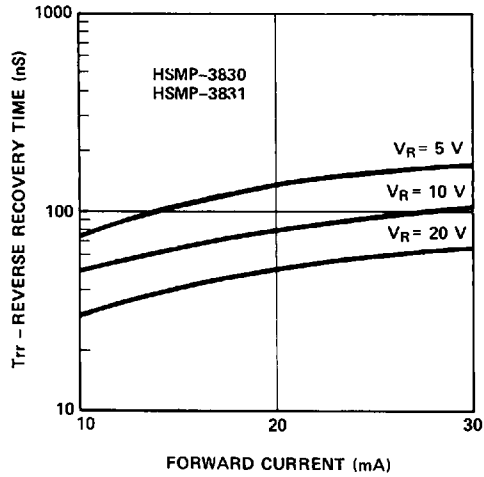


Figure 8. Reverse Recovery Time vs. Forward Current for Various Reverse Voltages. HSMP-3830 Series

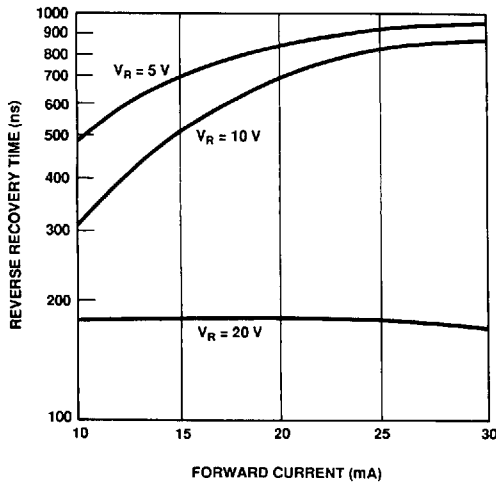


Figure 9. Typical Reverse Recovery Time vs. Reverse Voltage. HSMP-3880 Series.

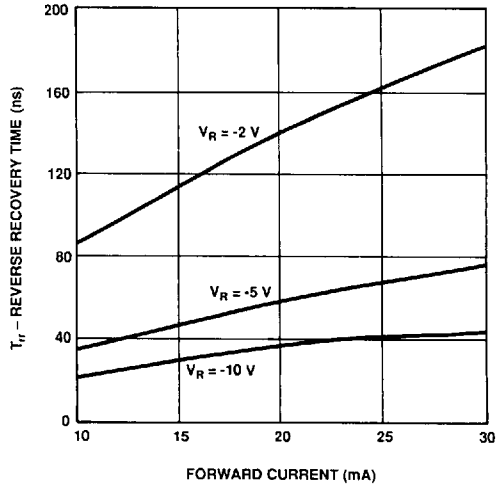


Figure 10. Typical Reverse Recovery Time vs. Reverse Voltage. HSMP-3890 Series.

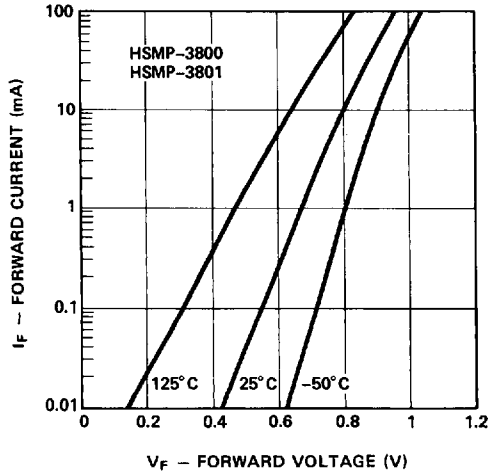


Figure 11. Forward Current vs. Forward Voltage. HSMP-3880 Series.

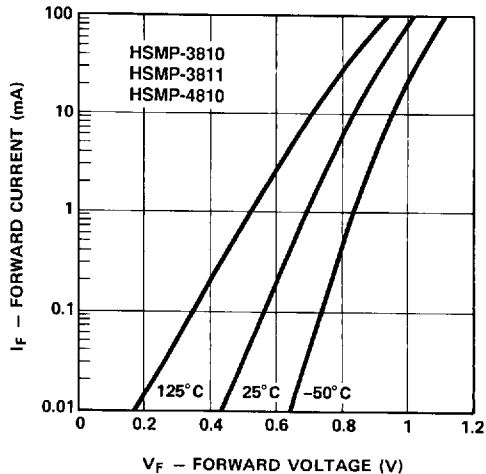


Figure 12. Forward Current vs. Forward Voltage. HSMP-3810 and HSMP-4810 Series.

## Typical Parameters (continued)

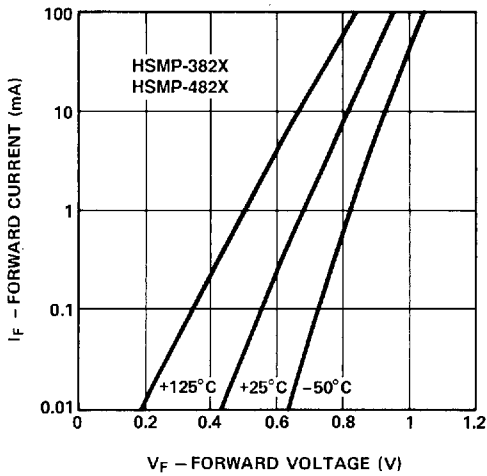


Figure 13. Forward Current vs. Forward Voltage. HSMP-3820 and HSMP-4820 Series.

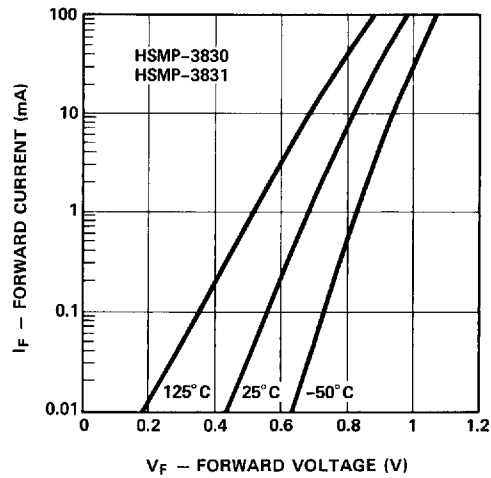


Figure 14. Forward Current vs. Forward Voltage. HSMP-3830 Series.

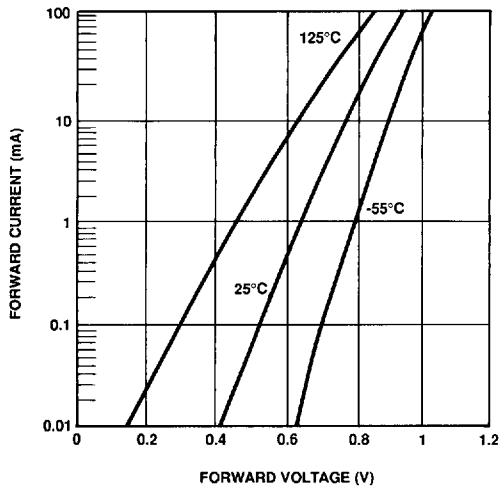


Figure 15. Typical Forward Current vs. Forward Voltage. HSMP-3880 Series.

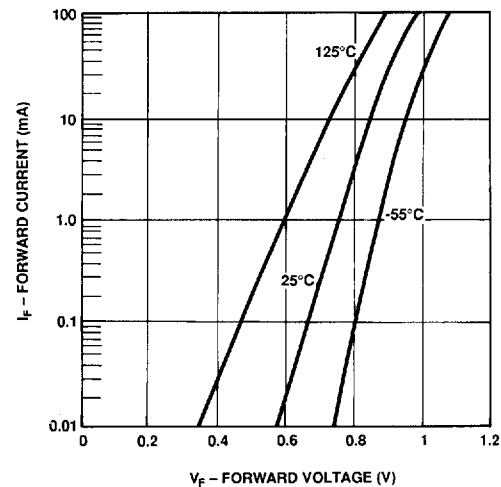
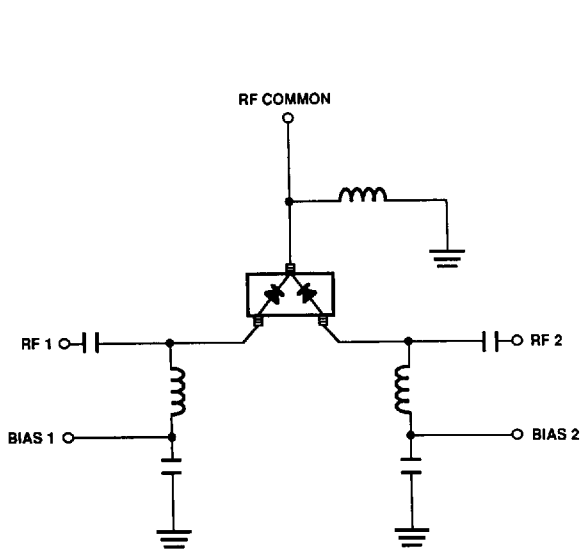
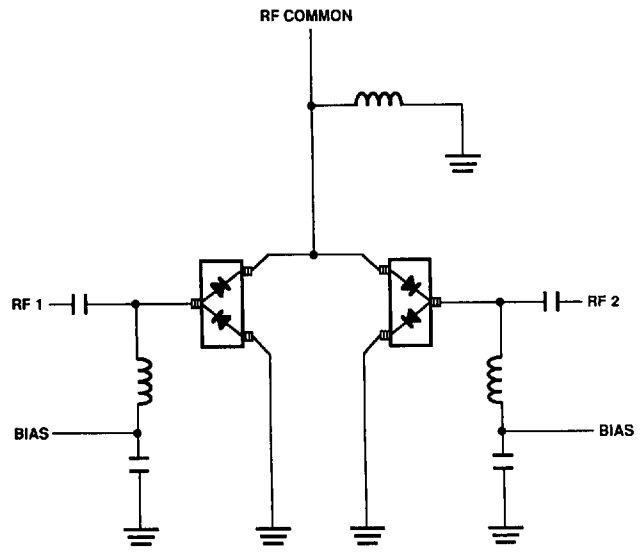


Figure 16. Typical Forward Current vs. Forward Voltage. HSMP-3890 and HSMP-4890 Series.

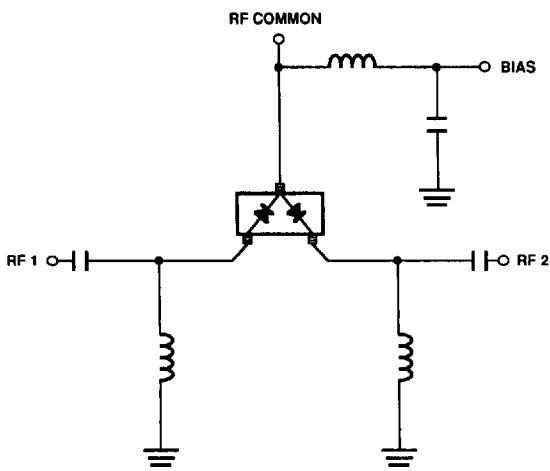
## Typical Applications for Multiple Diode Products



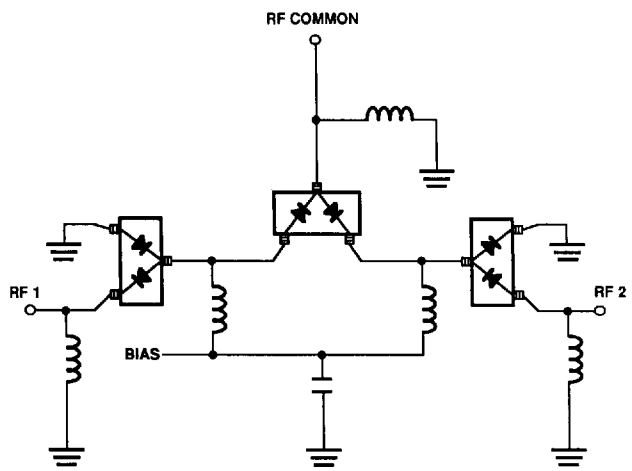
Simple SPDT Switch, Using Only Positive Bias Current.



High Isolation SPDT Switch.

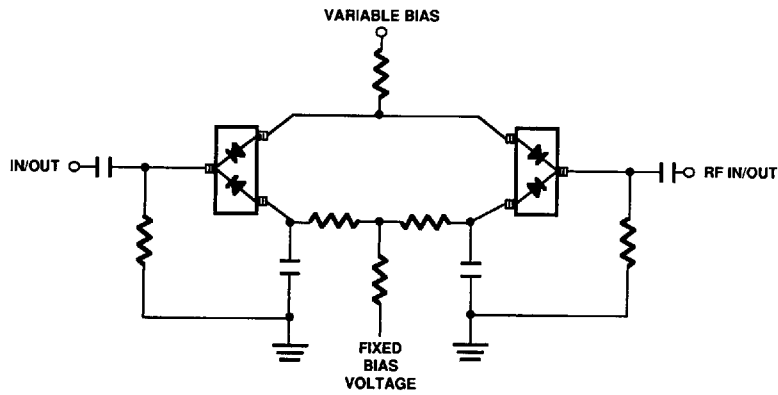


SPDT Switch Using Both Positive and Negative Bias Current.

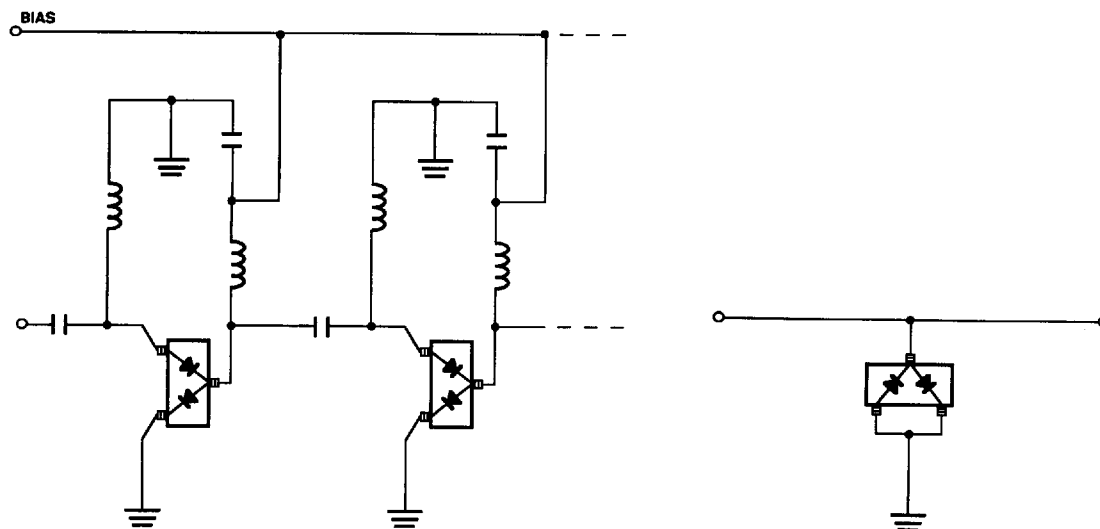


Very High Isolation SPDT Switch.

## Typical Applications for Multiple Diode Products (cont.)



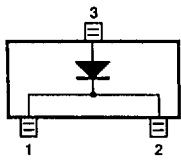
### Four Diode $\Pi$ Attenuator.



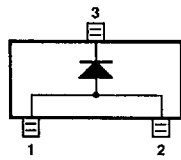
High Isolation SPST Switch (Repeat Cells as Required).

Power Limiter Using HSMP-3822 Diode Pair.

## Typical Applications for HSMP-48XX Low Inductance Series

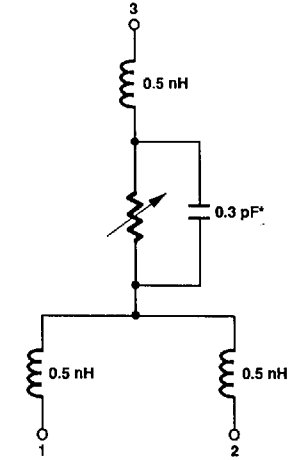


HSMP-4810



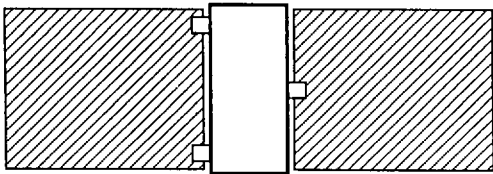
HSMP-4820 & HSMP-4890

Internal Connections

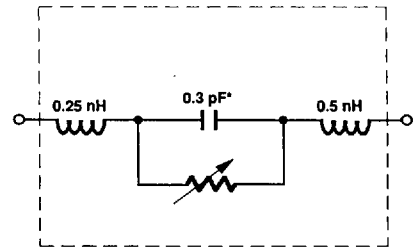


\* 0.8 pF TYPICAL FOR HSMP-3820

Equivalent Circuit



Circuit Layout

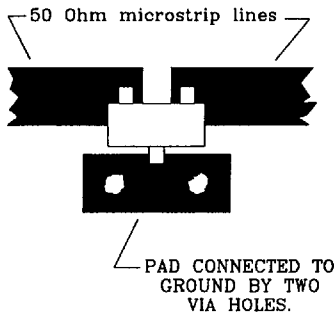


\* 0.8 pF TYPICAL FOR HSMP-3820

Equivalent Circuit

### Microstrip Series Connection for HSMP-48XX Series

In order to take full advantage of the low inductance of the HSMP-48XX series when using them in a series application, both lead 1 and lead 2 should be connected together, as shown above.

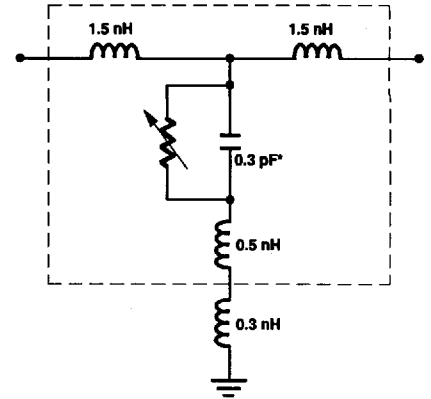


Circuit Layout

**Microstrip Shunt Connection for HSMP-48XX Series**

In the diagram above, the center conductor of the microstrip line is interrupted and leads 1 and 2 of the HSMP-

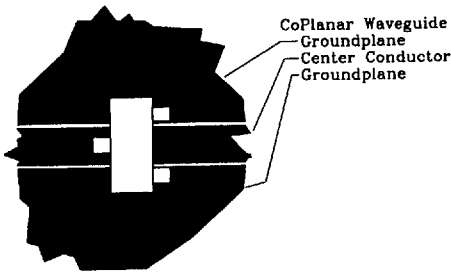
38XX series diode are placed across the resulting gap. This forces the 0.5 nH lead inductance of leads 1 and 2 to appear as part of a low pass filter, reducing the shunt parasitic inductance and



\* 0.8 pF TYPICAL FOR HSMP-4820

Equivalent Circuit

increasing the maximum available attenuation. The 0.3 nH of shunt inductance external to the diode is created by the via holes, and is a good estimate for 0.032" thick material.

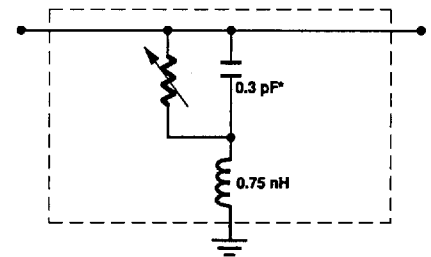


Circuit Layout

**Co-Planar Waveguide Shunt Connection for HSMP-48XX Series**

Co-Planar waveguide, with ground on the top side of the printed circuit board, is shown

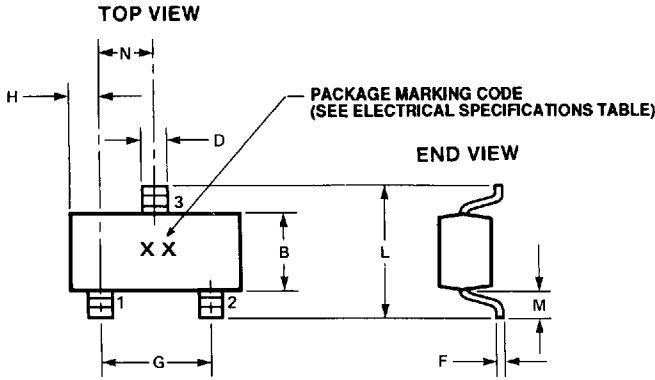
in the diagram above. Since it eliminates the need for via holes to ground, it offers lower shunt parasitic inductance and higher maximum attenuation when compared to a microstrip circuit.



\* 0.8 pF TYPICAL FOR HSMP-4820

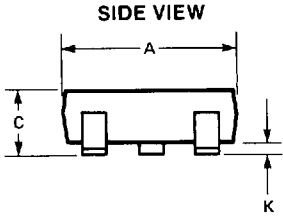
Equivalent Circuit

### Package Dimensions



**STANDARD PROFILE**

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.80	3.06	0.110	0.120
B	1.20	1.40	0.047	0.055
C*	0.85	1.20	0.035	0.047
D	0.37	0.54	0.015	0.021
F	0.086	0.152	0.003	0.006
G	1.78	2.04	0.070	0.080
H	0.45	0.60	0.018	0.024
K*	0.10	0.25	0.004	0.010
L	2.10	2.65	0.083	0.104
M	0.45	0.69	0.018	0.027
N	0.89	1.02	0.035	0.040



**LOW PROFILE OPTION:**  
 WITH C MIN/MAX OF 0.85/1.02 MILLIMETERS, 0.033/0.041 INCHES;  
 WITH K MIN/MAX OF 0.013/0.10 MILLIMETERS, 0.0005/0.004 INCHES

Outline 23 (SOT-23)

### Package Characteristics

- Lead Material ..... Alloy 42
- Lead Finish ..... Tin-Lead
- Maximum Soldering Temperature ..... 260°C for 5 seconds
- Min. Lead Strength ..... 2 pounds pull
- Typical Package Inductance ..... 2 nH
- Typical Package Capacitance ..... 0.15 pF (opposite leads)

**Ordering Information**

**Standard Profile**

Option T30 = Bulk  
Option T31 = Tape and Reel,  
See Figure 17  
Option T32 = Tape and Reel,  
See Figure 18

**Low Profile**

Option L30 = Bulk  
Option L31 = Tape and Reel,  
See Figure 17  
Option L32 = Tape and Reel,  
See Figure 18

Conforms to Electronic Industries RS-481, "Taping of Surface Mounted Components for Automated Placement."  
Standard Quantity is 3,000 Devices/Reel.

Specify Part Number followed by Option Number

Example:

H SMP-X8XX Option X XX

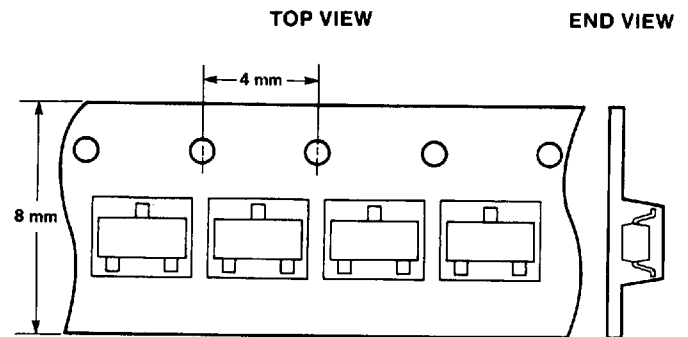
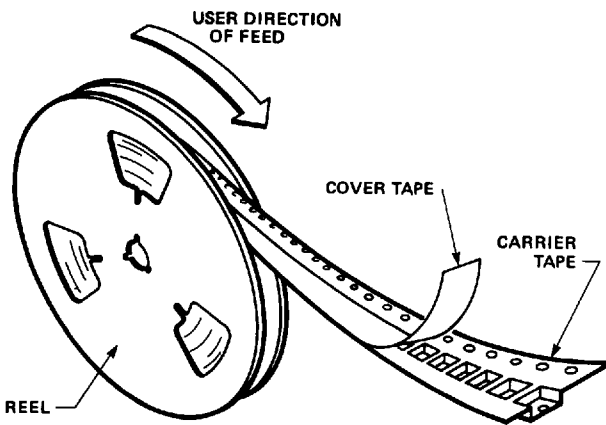
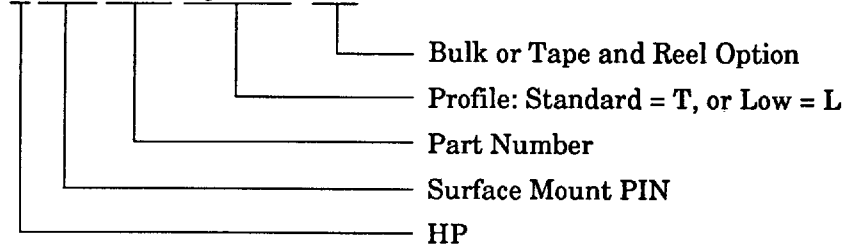


Figure 17. Options T31, L31.

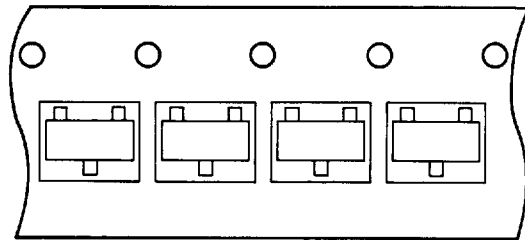


Figure 18. Options T32, L32.

For more information call:

United States: 1-800-752-0900\*

Canada: (416) 678-9430\*

Europe: (44) 276-685753\*

Asia Pacific/Australia: (65) 290-6360\*

Japan: (81 3) 3331-6111\*

\*Or call your local HP sales office listed in your telephone directory. Ask for a Components representative.

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Obsoletes 5091-6211E (1/93)  
Printed in U.S.A. 5091-9184E (9/93)