

Surface Mount PIN Diodes

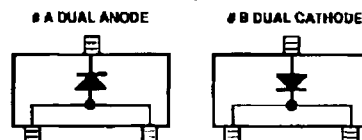
Technical Data

HSMP-38XX and HSMP-48XX Series

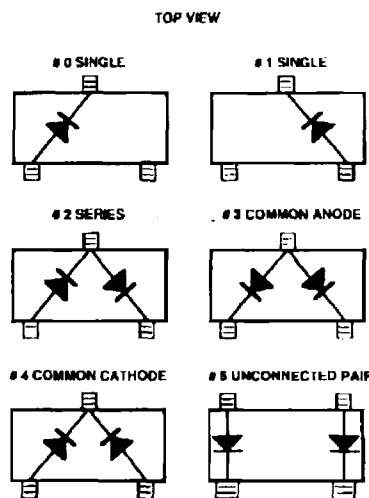
Features

- 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 μs Pulse)	1 Amp
P_t	Total Device Dissipation	250 mW ⁽¹⁾
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.

Notes

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 ⁽¹⁾	Lead Code	Configuration	Nearest Equivalent Axial Lead Part No. 5082-	Minimum Break-down Voltage V_{BR} (V)	Maximum Series Resistance R_s (Ω)	Maximum Total Capacitance C_T (pF)	Minimum High Resistance R_H (Ω)	Maximum Low Resistance R_L (Ω)
3800 3801 3802 3804	D0 D1 D2 D4	0 1 2 4	Single Single Series Common Cathode	3080	100	2.5	0.35	1000	8
3810 3811 3812 3813 3814	E0 E1 E2 E3 E4	0 1 2 3 4	Single Single Series Common Anode Common Cathode	3081	100	4.0	0.35	1500	10
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 ⁽¹⁾	Lead Code	Configuration	Nearest Equivalent Axial Lead Part No. 5082-	Minimum Breakdown Voltage V_{BR} (V)	Maximum Series Resistance R_s (Ω)	Maximum Total Capacitance C_T (pF)	Maximum Shunt Mode Harmonic Distortion Hmd (dBc)
3820 3821 3822 3823 3824	F0 F1 F2 F3 F4	0 1 2 3 4	Single Single Series Common Anode Common Cathode	3188	35	0.6*	1.0*	-
3880 3881	S0 S1	0 1	Single Single	-	100	6.5	0.40	-55
3890 3891 3892 3893 3894 3895	G0 G1 G2 G3 G4 G5	0 1 2 3 4 5	Single Single Series Common Anode Common Cathode Unconnected Pair	-	35	2.5	0.30**	-
Test Conditions					$V_R = V_{BR}$ Measure $I_R \leq 10 \mu\text{A}$	$I_F = 5 \text{ mA}$ $f = 100 \text{ MHz}$ $I_F = 10 \text{ mA}^*$	$V_R = 50 \text{ V}$ $f = 1 \text{ MHz}$ $V_R = 20 \text{ V}^*$ $V_R = 5 \text{ V}^{**}$	$2 f_m Z_0 = 50 \text{ W}$ $f_m = 400 \text{ MHz}$ $P_{in} = +30 \text{ dBm}$ 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 HAMP-	Package Marking Code ⁽¹⁾	Lead Code	Configuration	Nearest Equivalent Axial Lead Part No. 5082-	Minimum Breakdown Voltage V_{BR} (V)	Maximum Series Resistance R_s (Ω)	Maximum Total Capacitance C_T (pF)
3830	K0	0	Single	3077	200	15	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 $I_R \leq 10 \mu A$	$I_F = 100 \text{ mA}$ $f = 100 \text{ MHz}$	$V_R = 50 \text{ V}$ $f = 1 \text{ MHz}$

Notes

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 (Ω)	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 $I_R \leq 10 \mu A$	$I_F = 100 \text{ mA}$ $I_F = 10 \text{ mA}^*$	$V_R = 50 \text{ V}$ $f = 1 \text{ MHz}$ $V_R = 20 \text{ V}^*$	$V_R = 50 \text{ V}$ $f = 1 \text{ MHz}$ $V_R = 0 \text{ V}^*$	$f = 500 \text{ MHz} - 3 \text{ GHz}$ $f = 500 \text{ MHz} - 1.5 \text{ GHz}$	

Notes

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 (Ω)	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

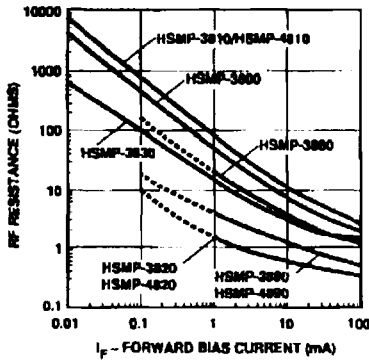


Figure 1. RF Resistance at 25°C vs. Forward Bias Current.

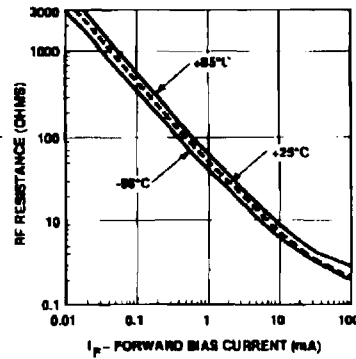


Figure 2. RF Resistance vs. Forward Bias Current for HSMP-3800.

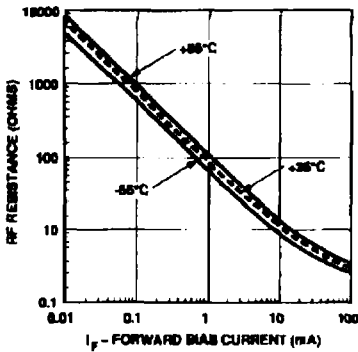


Figure 3. RF Resistance vs. Forward Bias Current for HSMP-3810 and HSMP-4810.

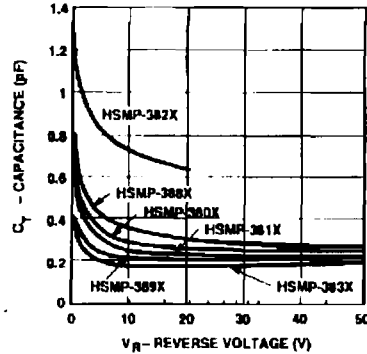


Figure 4. Capacitance vs. Reverse Voltage.

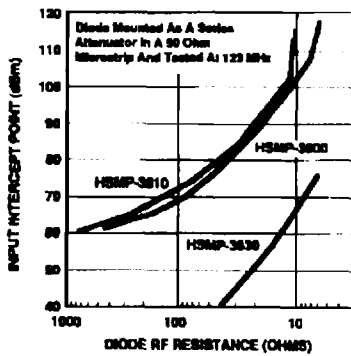


Figure 5. 2nd Harmonic Input Intercept Point vs. Diode RF Resistance for Attenuator Diodes.

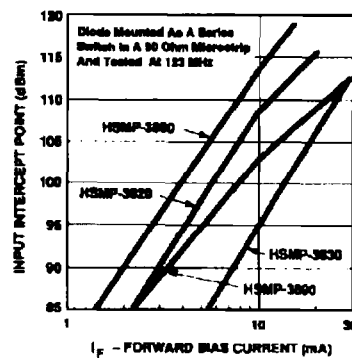


Figure 6. 2nd Harmonic Input Intercept Point vs. Forward Bias Current for Switch Diodes.

Typical Parameters (continued)

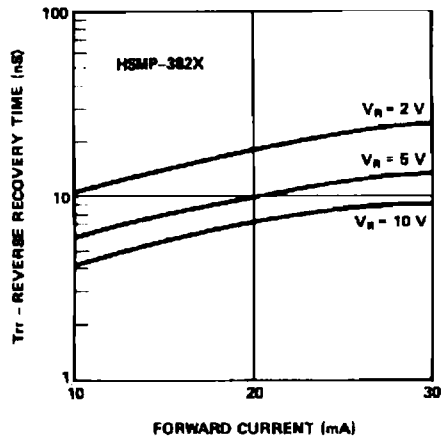


Figure 7. Reverse Recovery Time vs. Forward Current for Various Reverse Voltages. HSMP-382X Series.

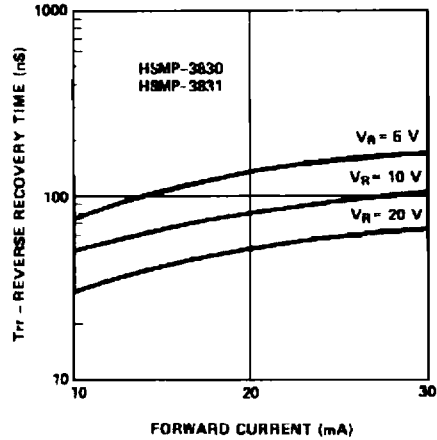


Figure 8. Reverse Recovery Time vs. Forward Current for Various Reverse Voltages. HSMP-3830 and HSMP-3831 Series.

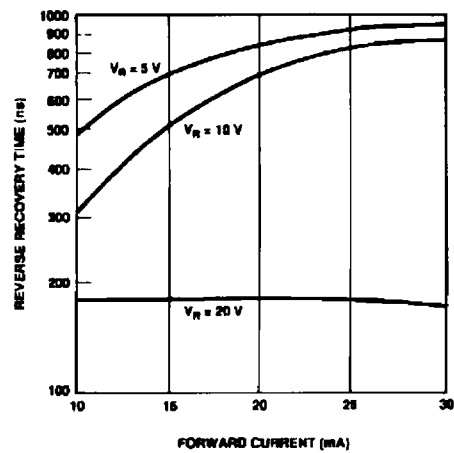


Figure 9. Typical Reverse Recovery Time vs. Reverse Voltage. HSMP-3880 Series.

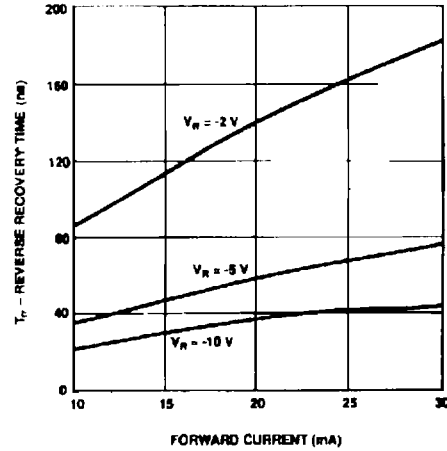


Figure 10. Typical Reverse Recovery Time vs. Reverse Voltage. HSMP-3890 Series.

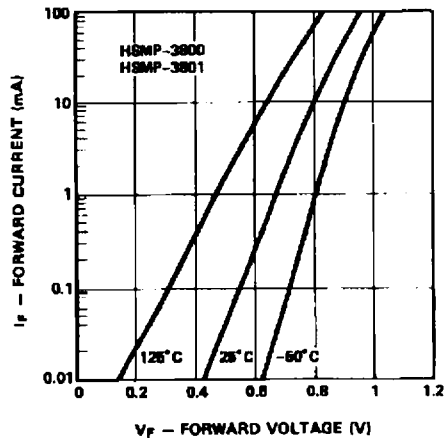


Figure 11. Forward Current vs. Forward Voltage. HSMP-3880 Series.

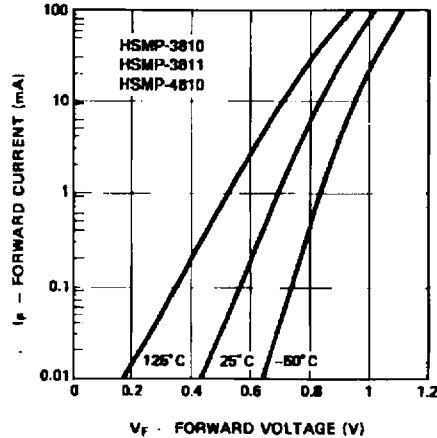


Figure 12. Forward Current vs. Forward Voltage. HSMP-3810 and HSMP-4810 Series.

Typical Parameters (continued)

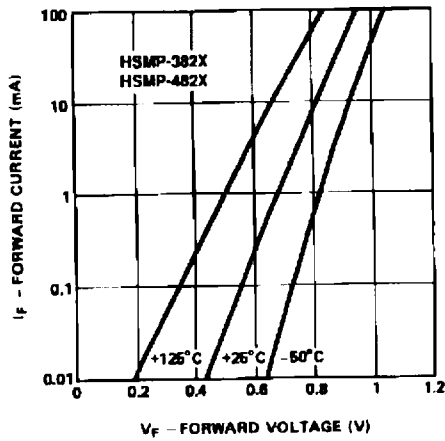


Figure 13. Forward Current vs. Forward Voltage. HSMP-3820 and HSMP-4820 Series.

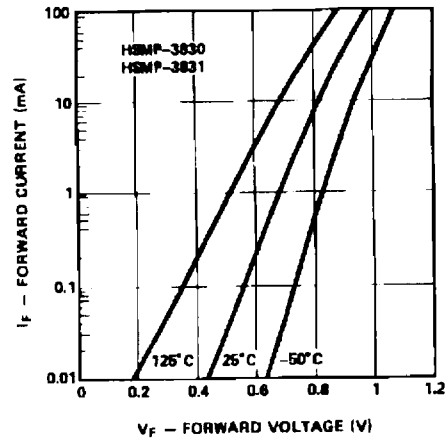


Figure 14. Forward Current vs. Forward Voltage. HSMP-3830 Series.

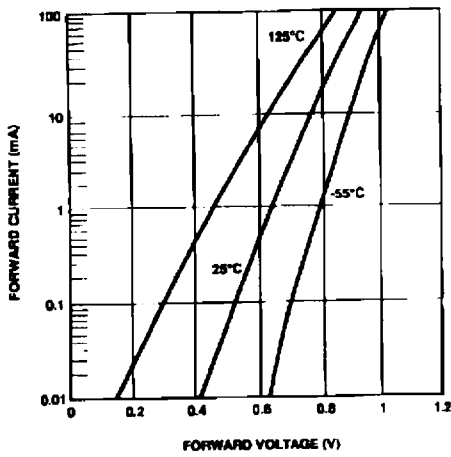


Figure 15. Typical Forward Current vs. Forward Voltage. HSMP-3890 Series.

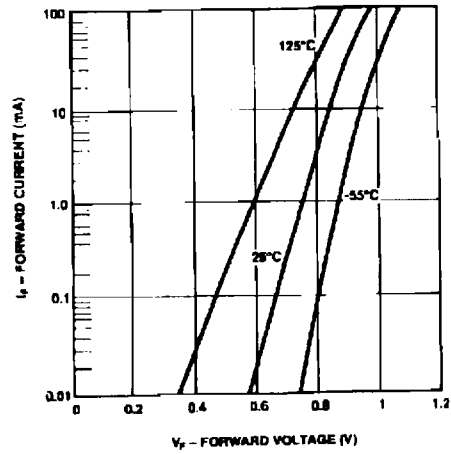
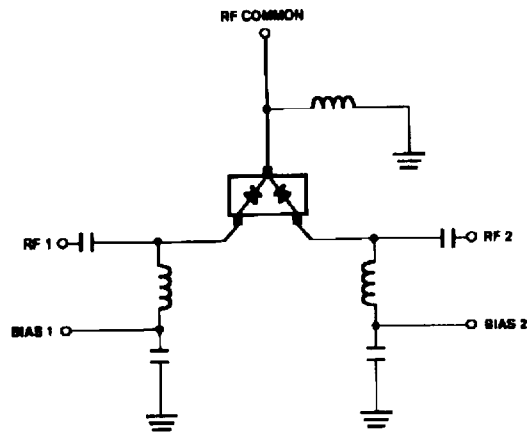
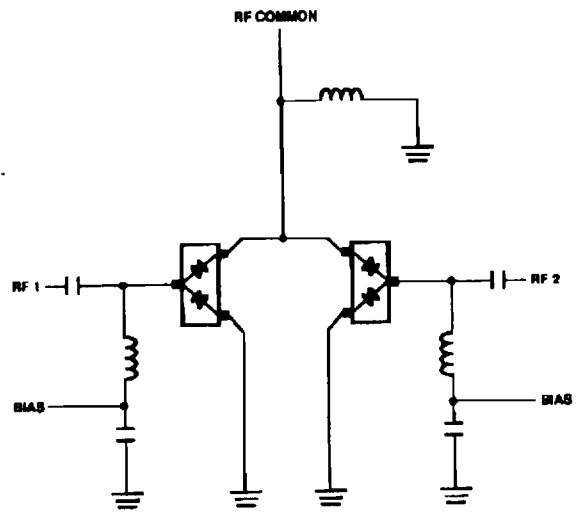


Figure 16. Typical Forward Current vs. Forward Voltage. HSMP-3890 and HSMP-4890 Series.

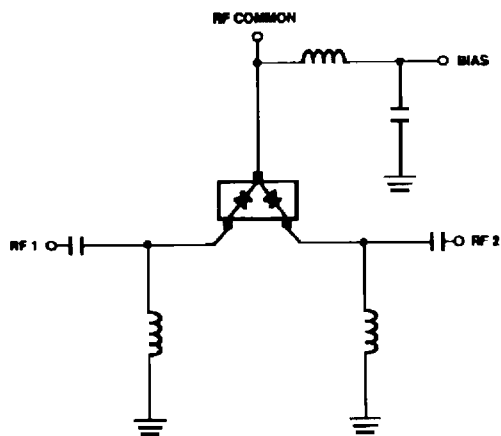
Typical Applications for Multiple Diode Products



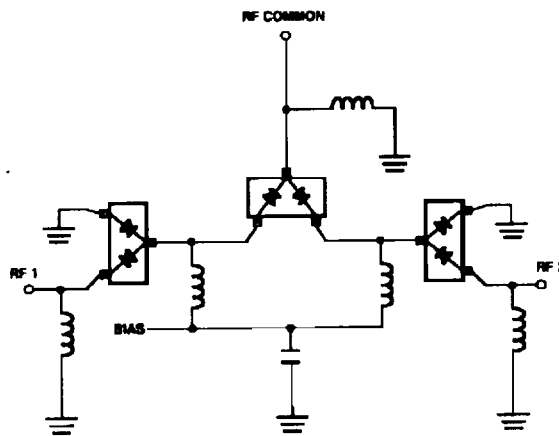
Simple SPDT Switch, Using Only Positive Bias Current.



High Isolation SPDT Switch.

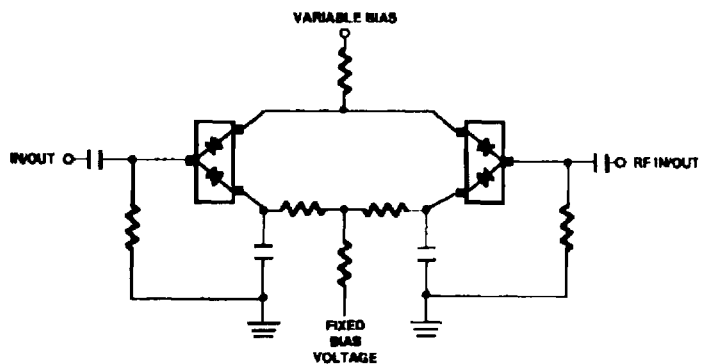


SPDT Switch Using Both Positive and Negative Bias Current.

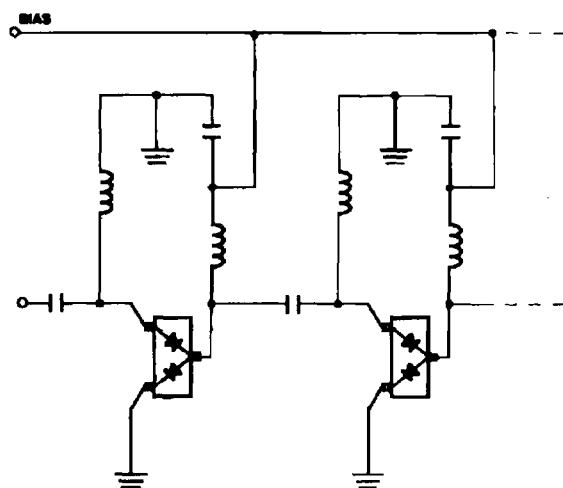


Very High Isolation SPDT Switch.

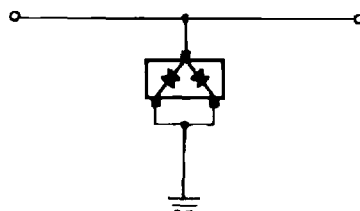
Typical Applications for Multiple Diode Products (cont.)



Four Diode II Attenuator.

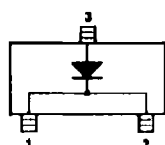


High Isolation SPST Switch (Repeat Cells as Required).

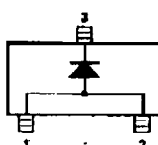


Power Limiter Using HEMP-3622 Diode Pair.

Typical Applications for HSMP-48XX Low Inductance Series

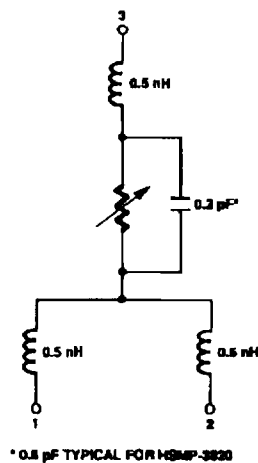


HSMP-4810



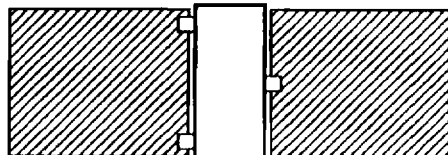
HSMP-4820 & HSMP-4830

Internal Connections

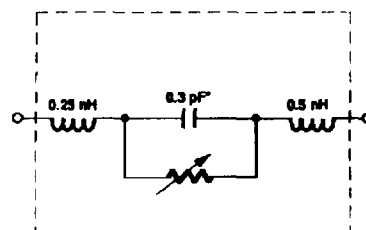


* 0.3 pF TYPICAL FOR HSMP-3820

Equivalent Circuit



Circuit Layout

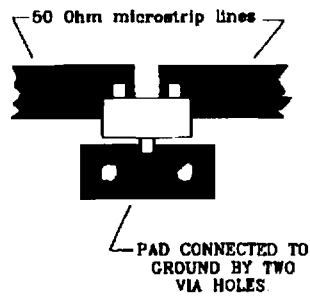


* 0.3 pF TYPICAL FOR HSMP-3820

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.

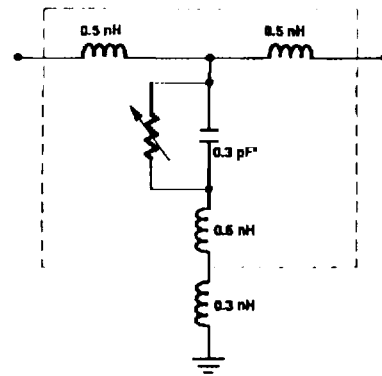


Circuit Layout

Microstrip Shunt Connection for HSMP-48XX Series

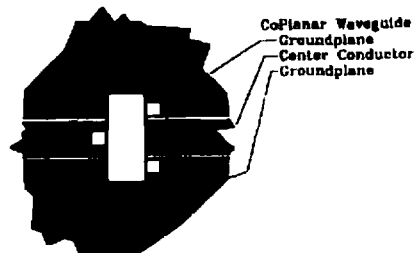
In the diagram above, the center conductor of the microstrip line is interrupted and leads 1 and 2 of the HSMP-

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



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.

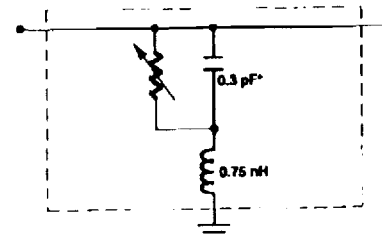


Circuit Layout

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

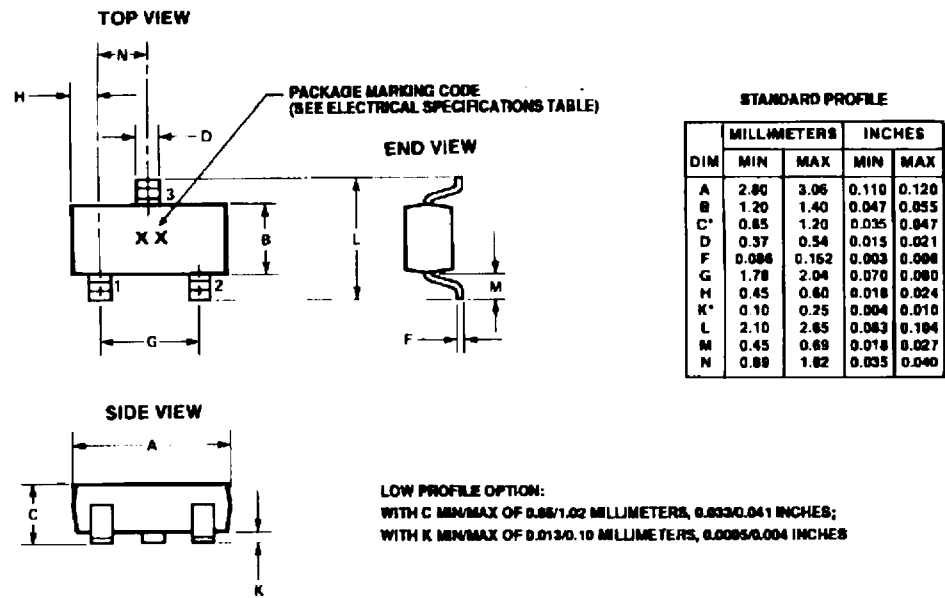
Co-Planar waveguide, with ground on the top side of the printed circuit board, is shown

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.



Equivalent Circuit

Package Dimensions



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

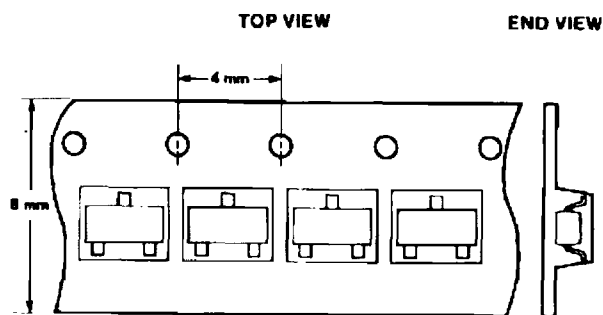
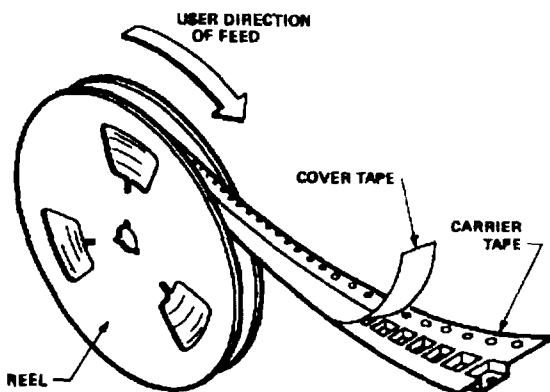
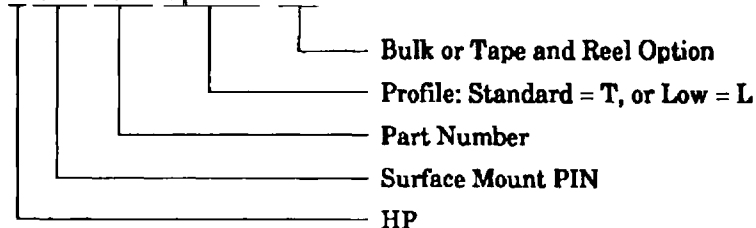


Figure 17. Options T31, L31.

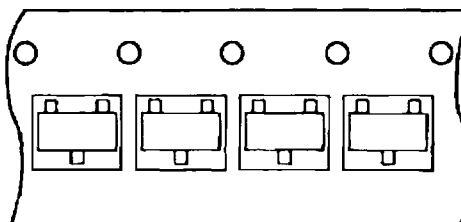


Figure 18. Options T32, L32.

For more information:

United States: call your local HP sales
office listed in your telephone directory.
Ask for a Components representative.

Canada: (416) 206-4725

Europe: (49) 7031/14-0

Asia Pacific/Australia: (65) 290-6360

Japan: (81 3) 3331-6111

Data Subject to Change

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