HEWLETT® PACKARD

Surface Mount PIN Diodes

Technical Data

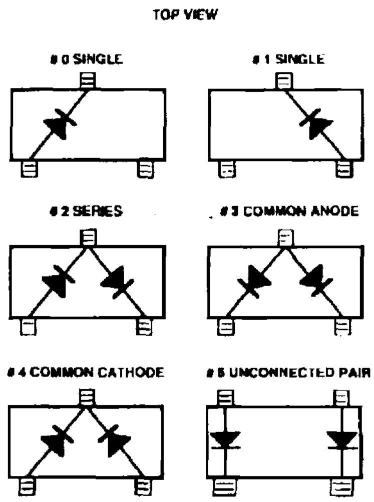
HSMP-38XX and HSMP-48XX Series

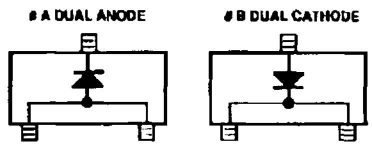
Features

- **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





Absolute Maximum Ratings** $T_A = 25°C$

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.

Note:
1. CW Power Dissipation at $T_{LEAD} = 25°C$. Derate to zero at maximum rated temperature.

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.

HEWPS057

PIN Attenuator Diodes

Electrical Specifications $T_A = 25°C$ (Each Diode)

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)	Minimum High Resistance R_H (Ω)	Maximum Low Resistance R_L (Ω)
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 $I_R \le 10\ \mu A$	$I_F = 100$ mA f = 100 MHz	$V_R = 50$ V f = 1 MHz	$I_F = 0.01$ mA f = 100 MHz	$I_F = 20$ mA f = 100 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	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 $I_R \le 10\ \mu A$	$I_F = 5$ mA f = 100 MHz $I_F = 10$ mA*	$V_R = 50$ V f = 1 MHz $V_R = 20$ V* $V_R = 5$ V**	$2 f_o$, $Z_o = 50$ W $f_o = 400$ MHz $P_{in} = +30$ 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[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	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 $I_R \le 10$ µA	$I_F = 100$ mA f = 100 MHz	$V_R = 50$ V f = 1 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 Breakdown 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 $I_R \le 10$ µA	$I_F = 100$ mA $I_F = 10$ mA*	$V_R = 50$ V f = 1 MHz $V_R = 20$ V*	$V_R = 50$ V f = 1 MHz $V_R = 0$ V*	f = 500 MHz - 3 GHz f = 500 MHz - 1.5 GHz	

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

Typical Parameters at $T_A = 25°C$

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	$I_F = 1$ mA f = 100 MHz $I_F = 10$ mA*	$I_F = 50$ mA $I_R = 250$ mA $I_F = 10$ mA* $I_R = 6$ mA*	$V_R = 10$ V $I_F = 20$ mA 90% Recovery

Typical Parameters at T_A = 25°C (unless otherwise noted), Single Diode

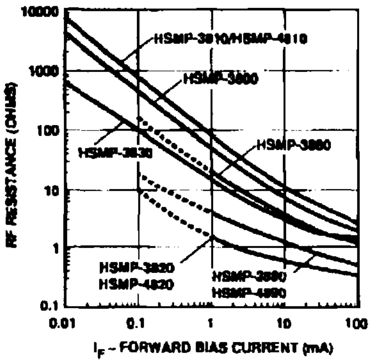


Figure 1. RF Resistance at 25°C vs. Forward Bias Current.

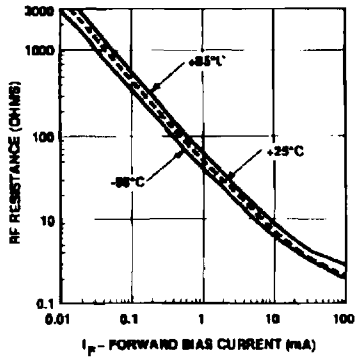


Figure 2. RF Resistance vs. Forward Bias Current for HSMP-3800.

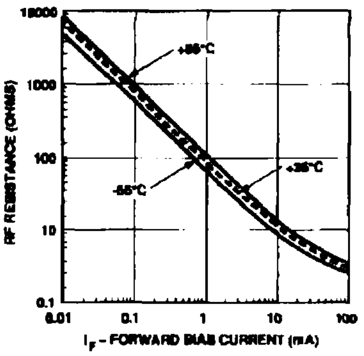


Figure 3. RF Resistance vs. Forward Bias Current for HSMP-3810 and HSMP-4810.

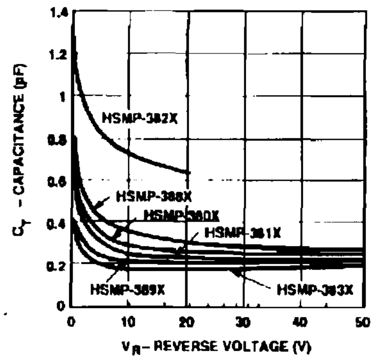


Figure 4. Capacitance vs. Reverse Voltage.

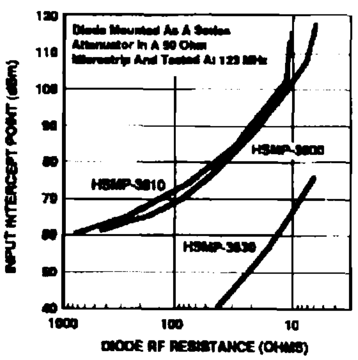


Figure 5. 2nd Harmonic Input Intercept Point vs. Diode RF Resistance for Attenuator Diodes.

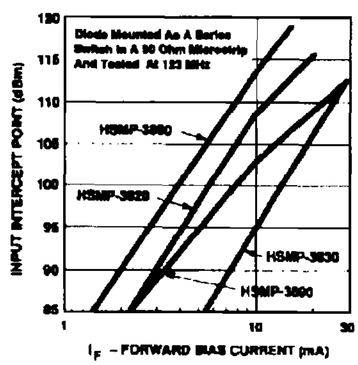


Figure 6. 2nd Harmonic Input Intercept Point vs. Forward Bias Current for Switch Diodes.

Typical Parameters (continued)

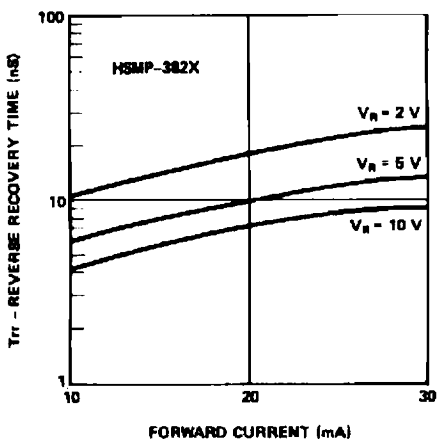


Figure 7. Reverse Recovery Time vs. Forward Current for Various Reverse Voltages. HSMP-3820 Series.

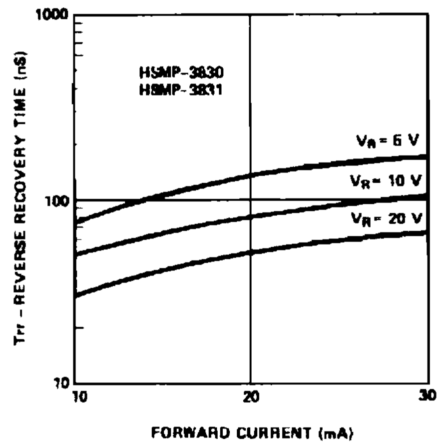


Figure 8. Reverse Recovery Time vs. Forward Current for Various Reverse Voltages. HSMP-3830 Series

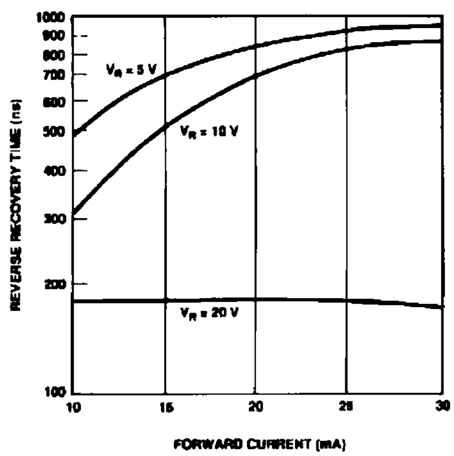


Figure 9. Typical Reverse Recovery Time vs. Reverse Voltage. HSMP-3880 Series.

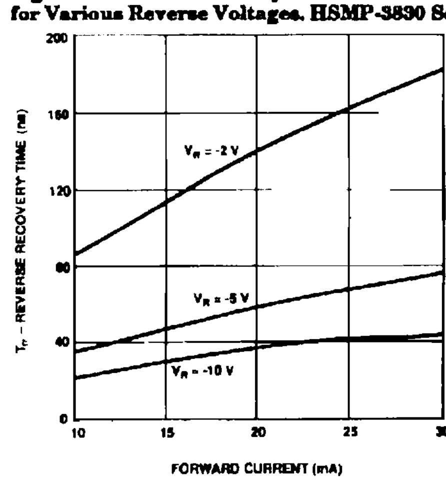


Figure 10. Typical Reverse Recovery Time vs. Reverse Voltage. HSMP-3890 Series.

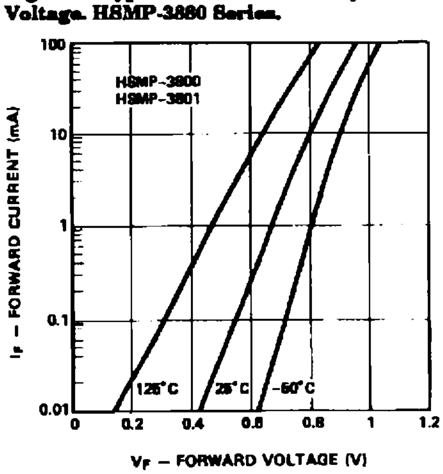


Figure 11. Forward Current vs. Forward Voltage. HSMP-3880 Series.

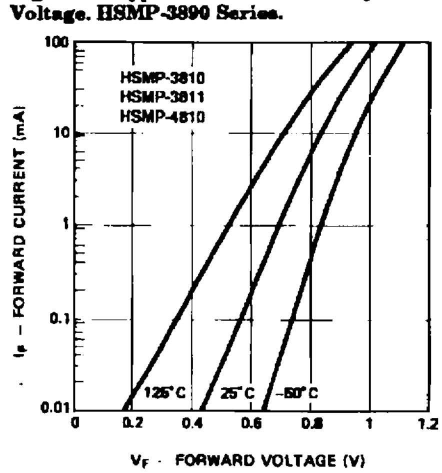


Figure 12. Forward Current vs. Forward Voltage. HSMP-3810 and HSMP-4810 Series.

Typical Parameters (continued)

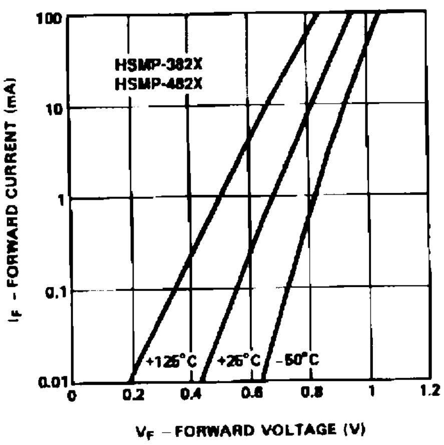


Figure 13. Forward Current vs. Forward Voltage. HSMP-3820 and HSMP-4820 Series.

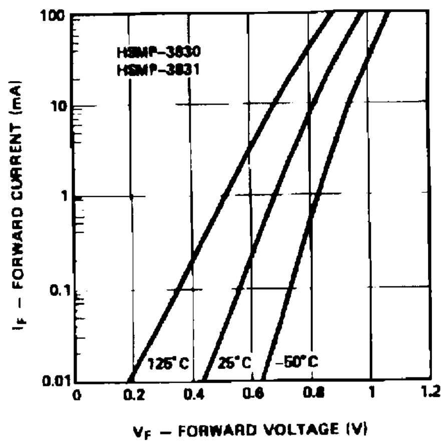


Figure 14. Forward Current vs. Forward Voltage. HSMP-3830 Series.

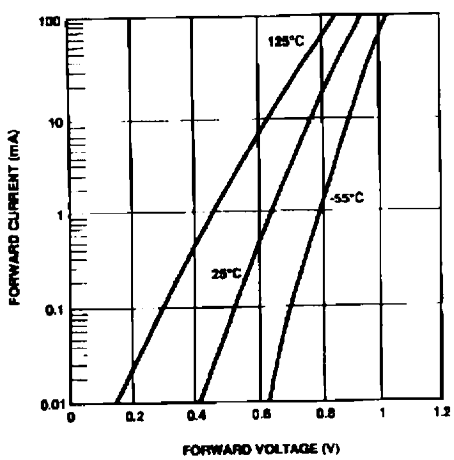


Figure 15. Typical Forward Current vs. Forward Voltage. HSMP-3880 Series.

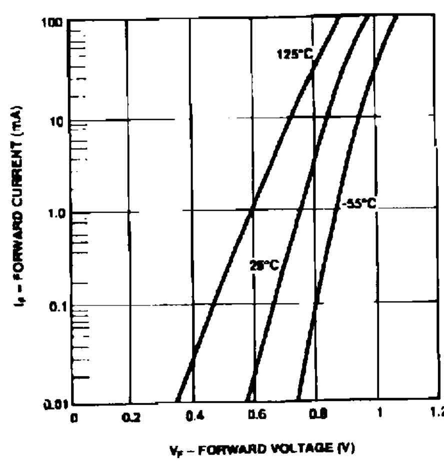
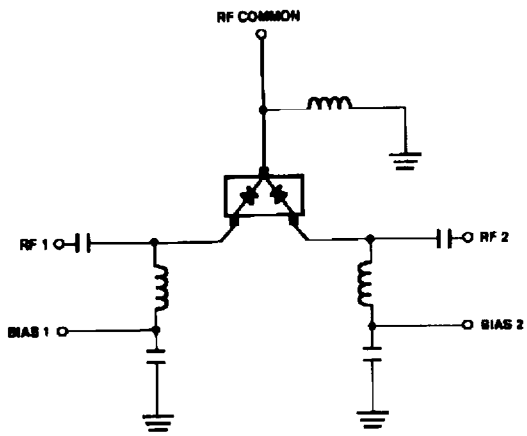
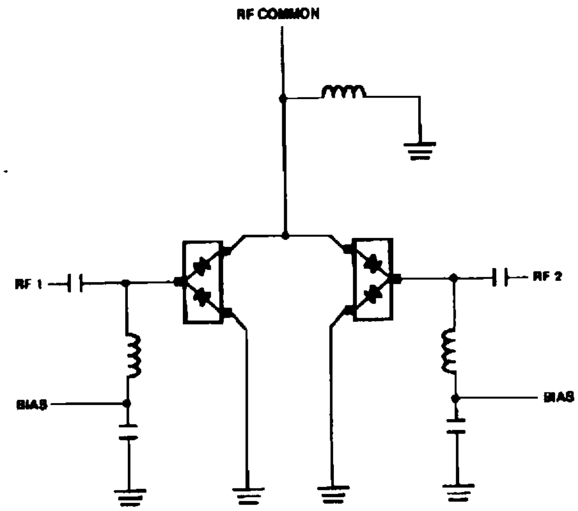


Figure 16. Typical Forward Current vs. Forward Voltage. HSMP-3890 and HSMP-4890 Series.

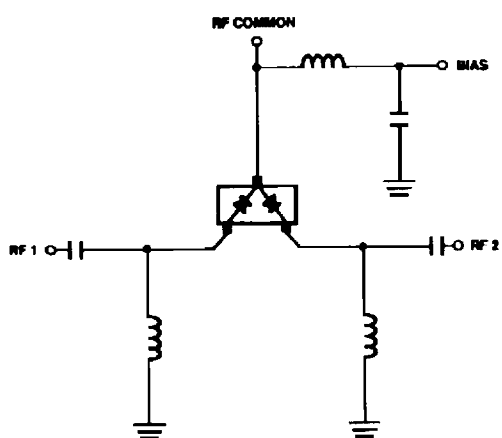
Typical Applications for Multiple Diode Products



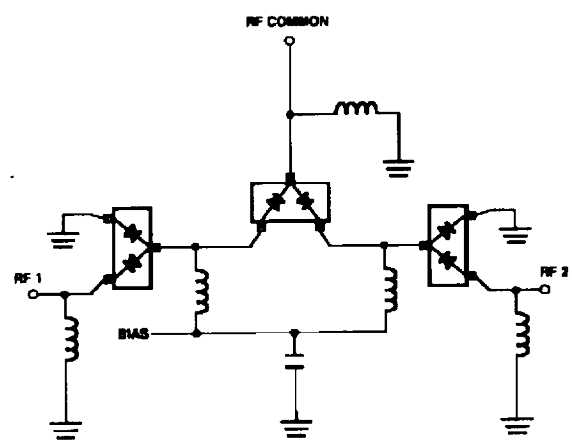
Simple SPDT Switch, Using Only Positive Bias Current.



High Isolation SPDT Switch.

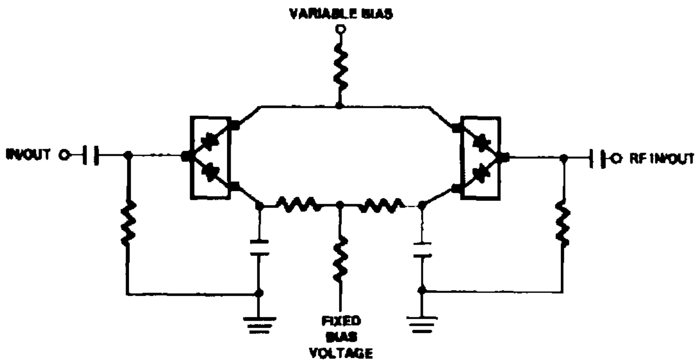


SPDT Switch Using Both Positive and Negative Bias Current.

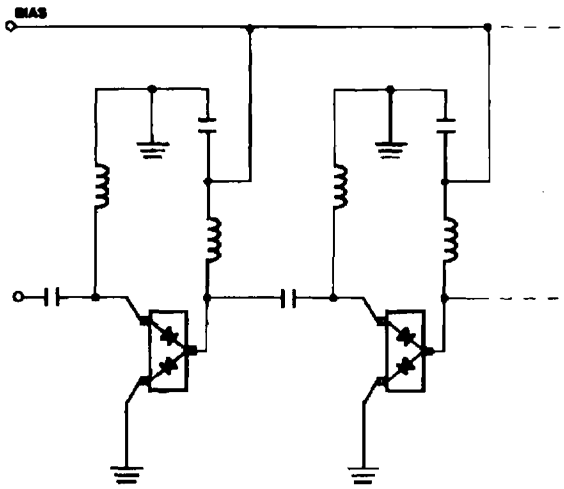


Very High Isolation SPDT Switch.

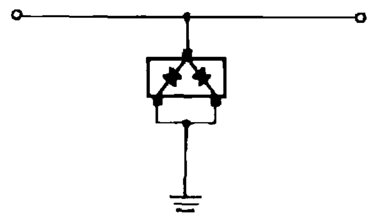
Typical Applications for Multiple Diode Products (cont.)



Four Diode Π Attenuator.

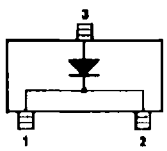


High Isolation SPST Switch (Repeat Cells as Required).

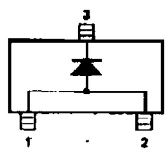


Power Limiter Using HSMP-3822 Diode Pair.

Typical Applications for HSMP-48XX Low Inductance Series

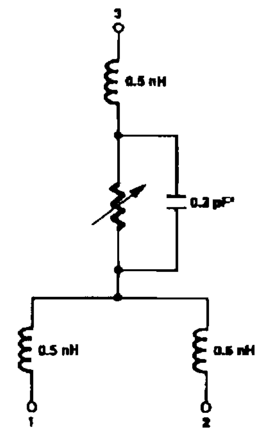


HSMP-4810



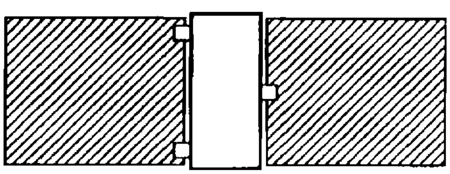
HSMP-4820 & HSMP-4890

Internal Connections

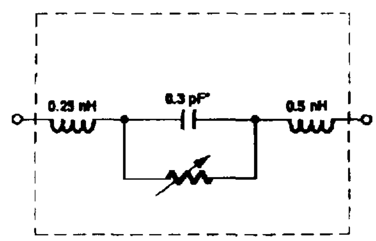


* 0.8 pF TYPICAL FOR HSMP-3820

Equivalent Circuit



Circuit Layout

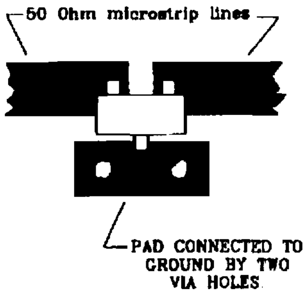


* 0.8 pF TYPICAL FOR HSMP-3820

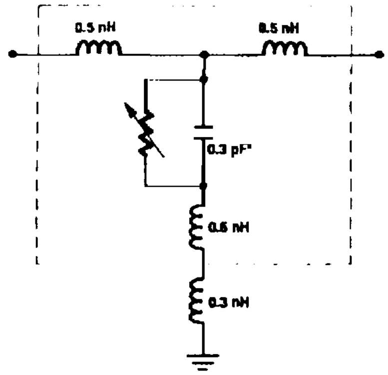
Equivalent Circuit

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

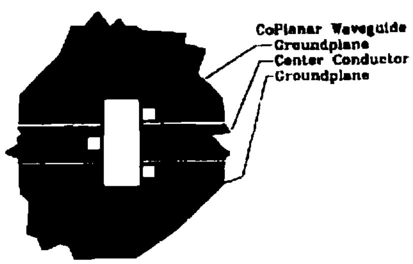


* 0.8 pF TYPICAL FOR HSMP-4820

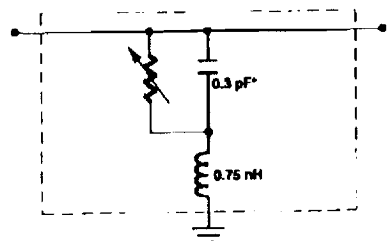
Equivalent Circuit

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 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



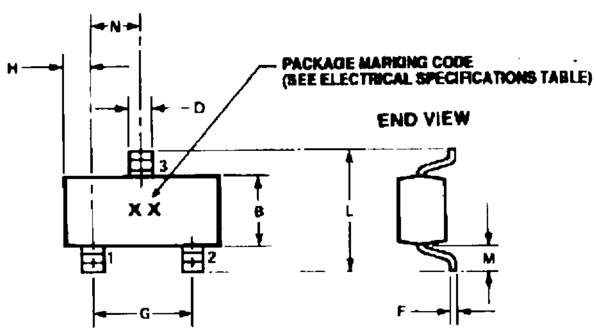
* 0.8 pF TYPICAL FOR HSMP-4820

Equivalent Circuit

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

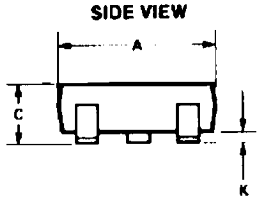
Co-Planar waveguide, with ground on the top side of the printed circuit board, is shown in the diagram above. Since it eliminates the need for via holes to ground, it offers lower shunt parasitic inductance and higher maximum attenuation when compared to a microstrip circuit.

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	0.162	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 0.86/1.02 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

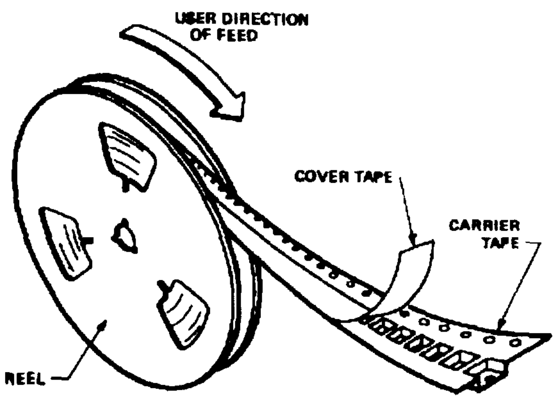
Conforms to Electronic Industries RS-481, "Taping of Surface Mounted Components for Automated Placement." Standard Quantity is 3,000 Devices/Reel.

Specify Part Number followed by Option Number

Example:

H SMP-X8XX Option X XX

- XX — Bulk or Tape and Reel Option
- X — Profile: Standard = T, or Low = L
- X8XX — Part Number
- SMP — Surface Mount PIN
- H — HP



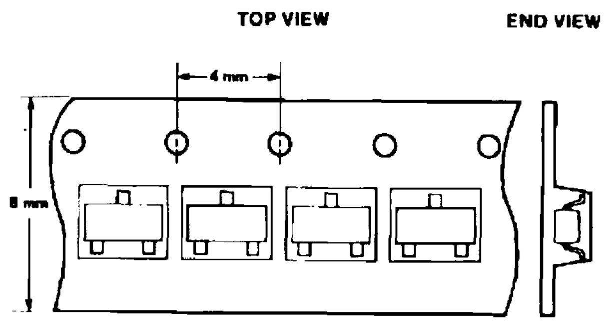


Figure 17. Options T31, L31.

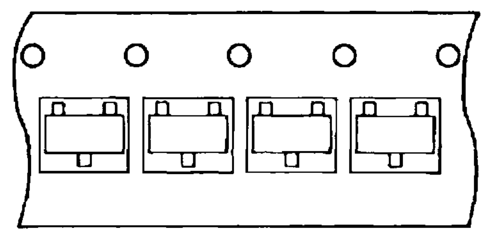


Figure 18. Options T32, L32.

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

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