HEWLETT® PACKARD

Surface Mount PIN Diodes in SOT-323 (SC-70)

Technical Data

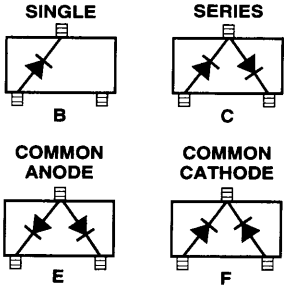
HSMP-381A Series
HSMP-386A Series
HSMP-389A Series

Features

- **Diodes Optimized for:**
  Low Current Switching
  Low Distortion Attenuating
  Ultra-Low Distortion Switching
  Microwave Frequency Operation
- **Surface Mount SOT-323 (SC-70)Package**
  Single and Pair 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 (Top View)



Description/Applications

The HSMP-381A series is specifically designed for low distortion attenuator applications. The HSMP-386A series is a general purpose PIN diode designed for low current attenuators and low cost switches. The HSMP-389A series is optimized for switching applications where low resistance at low current, and low capacitance are required.

Absolute Maximum Ratings[1], T_C = + 25°C

Symbol	Parameter	Unit	Absolute Maximum
I_f	Forward Current (1 µs Pulse)	Amp	1
P_{iv}	Peak Inverse Voltage	V	Same as V_{BR}
T_J	Junction Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to 150
θ_{jc}	Thermal Resistance[2]	°C/W	300

Notes:

1. Operation in excess of any one of these conditions may result in permanent damage to the device.
2. T_C = 25°C, where T_C is defined to be the temperature at the package pins where contact is made to the circuit board.

Electrical Specifications, T_C = +25°C, each diode

PIN Attenuator Diodes

Part Number HSMP-	Package Marking Code[1]	Lead Code	Configuration	Minimum Breakdown Voltage V_{BR} (V)	Maximum Total Resistance R_T (Ω)	Maximum Total Capacitance C_T (pF)	Minimum High Resistance R_H (Ω)	Maximum Low Resistance R_L (Ω)
381B	E0	B	Single	100	3.0	0.35	1500	10
381C	E2	C	Series					
381E	E3	E	Common Anode					
381F	E4	F	Common Cathode					
Test Conditions				$V_R = V_{BR}$ Measure $I_R \leq 10$ μA	I_F = 100 mA f = 100 MHz	V_R = 50 V f = 1 MHz	I_R = 0.01 mA f = 100 MHz	I_F = 20 mA f = 100 MHz

PIN General Purpose Diodes

Part Number HSMP-	Package Marking Code[1]	Lead Code	Configuration	Minimum Breakdown Voltage V_{BR} (V)	Typical Total Resistance R_T (Ω)		Typical Total Capacitance C_T (pF)
386B	L0	B	Single	50	3.0	1.5*	0.20
386C	L2	C	Series				
386E	L3	E	Common Anode				
386F	L4	F	Common Cathode				
Test Conditions				$V_R = V_{BR}$ Measure $I_R \leq 10$ μA	I_F = 10 mA f = 100 MHz I_F = 100 mA*		V_R = 50 V f = 1 MHz

PIN Switching Diodes

Part Number HSMP-	Package Marking Code[1]	Lead Code	Configuration	Minimum Breakdown Voltage V_{BR} (V)	Maximum Total Resistance R_T (Ω)	Maximum Total Capacitance C_T (pF)
389B	G0	B	Single	100	2.5	0.30
389C	G2	C	Series			
389E	G3	E	Common Anode			
389F	G4	F	Common Cathode			
Test Conditions				$V_R = V_{BR}$ Measure $I_R \leq 10$ μA	I_F = 5 mA f = 100 MHz	V_R = 5 V f = 1 MHz

Typical Parameters at T_C = +25°C

Part Number HSMP-	Total Resistance R_T (Ω)	Carrier Lifetime τ (ns)	Reverse Recovery Time T_{rr} (ns)	Total Capacitance (pF)
381A Series	75	1500	300	0.27
386A Series	22	500	80	0.20
389A Series	3.8	200*	—	—
Test Conditions	I_F = 1 mA f = 100 MHz	I_F = 50 mA T_R = 250 mA I_F = 10 mA* I_R = 6 mA*	V_R = 10 V I_F = 20 mA 90% Recovery	50 V

Note:

1. Package marking code is laser marked.

Typical Performance, T_C = 25°C

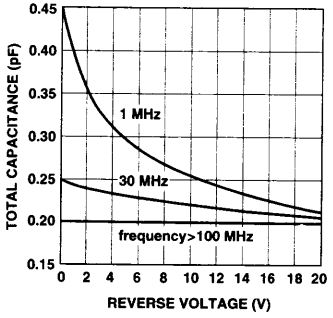


Figure 1. RF Capacitance vs. Reverse Bias, HSMP-381A Series.

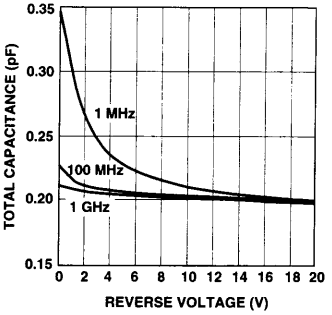


Figure 2. RF Capacitance vs. Reverse Bias, HSMP-386A Series.

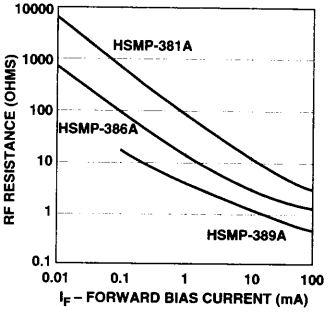


Figure 3. Total RF Resistance at 25° C vs. Forward Bias Current.

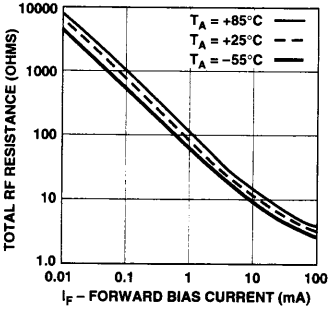


Figure 4. RF Resistance vs. Forward Bias Current for HSMP-381A Series.

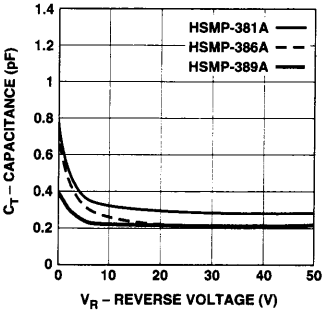


Figure 5. Capacitance vs. Reverse Voltage at 1 MHz.

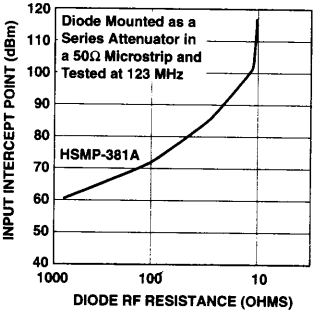


Figure 6. 2nd Harmonic Input Intercept Point vs. Diode RF Resistance for Attenuator Diodes.

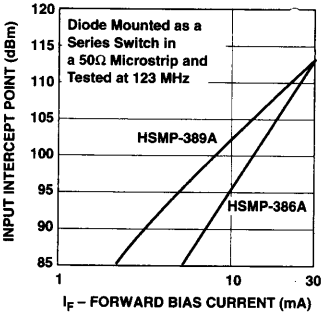


Figure 7. 2nd Harmonic Input Intercept Point vs. Forward Bias Current for Switch Diodes.

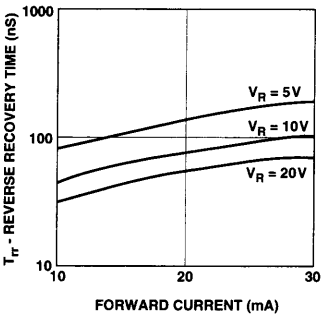


Figure 8. Reverse Recovery Time vs. Forward Current for Various Reverse Voltages. HSMP-386A Series.

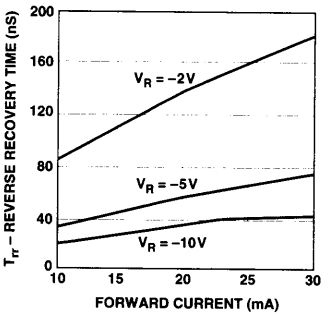


Figure 9. Typical Reverse Recovery Time vs. Reverse Voltage. HSMP-389A Series.

Typical Performance, T_C = 25°C

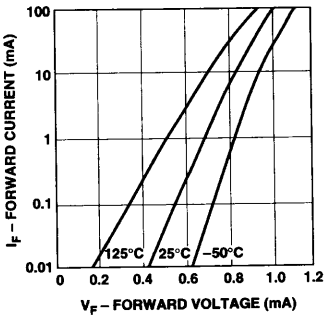


Figure 10. Forward Current vs. Forward Voltage. HSMP-381A Series.

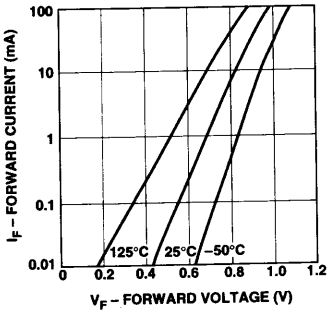


Figure 11. Forward Current vs. Forward Voltage. HSMP-386A Series.

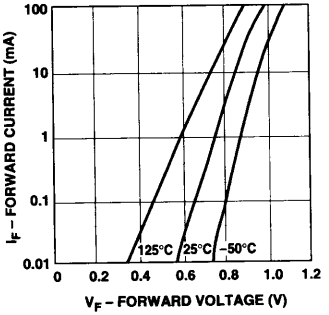


Figure 12. Forward Current vs. Forward Voltage. HSMP-389A Series.

Typical Applications for Multiple Diode Products

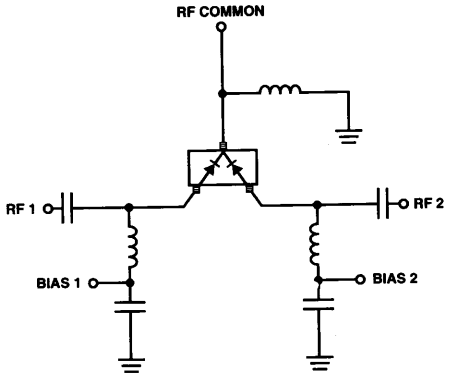


Figure 13. Simple SPDT Switch, Using Only Positive Bias Current.

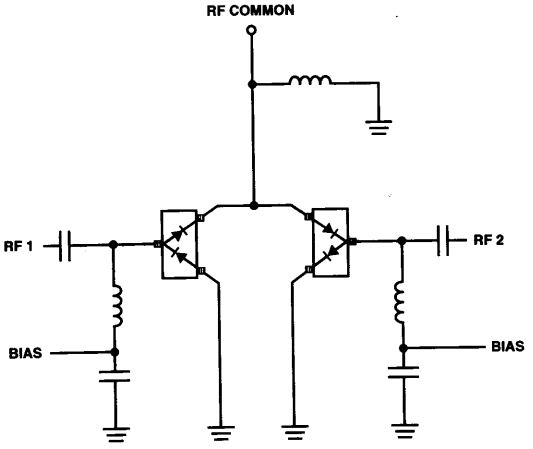


Figure 14. High Isolation SPDT Switch.

Typical Applications for Multiple Diode Products (continued)

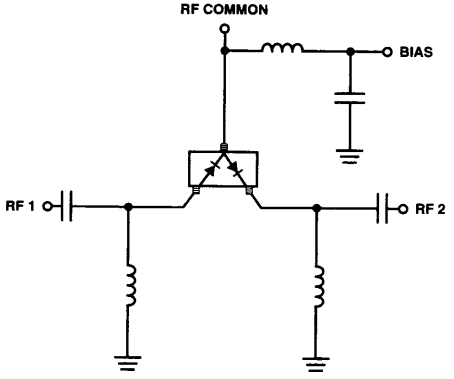


Figure 15. SPDT Switch Using Both Positive and Negative Bias Current.

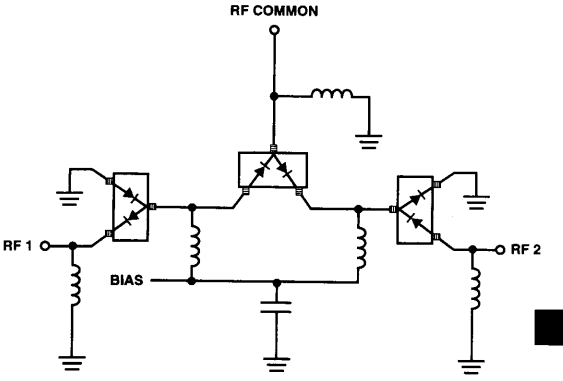


Figure 16. Very High Isolation SPDT Switch.

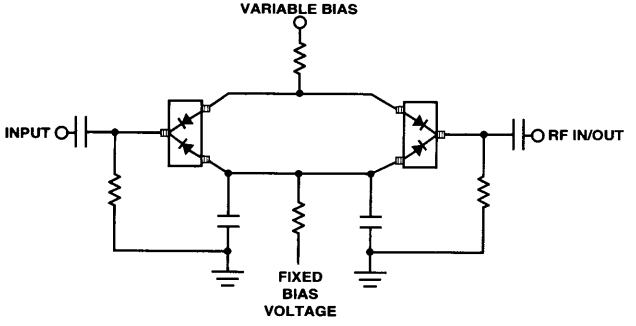


Figure 17. Four Diode π Attenuator.

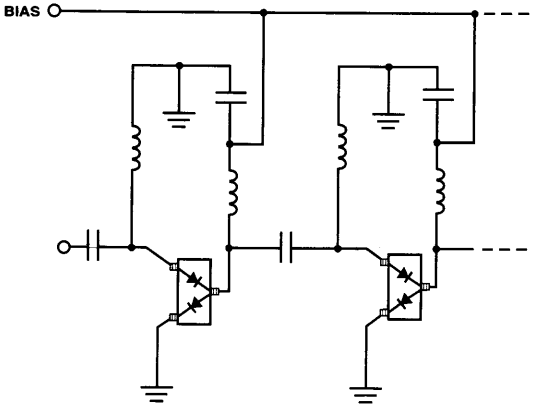


Figure 18. High Isolation SPST Switch (Repeat Cells as Required).

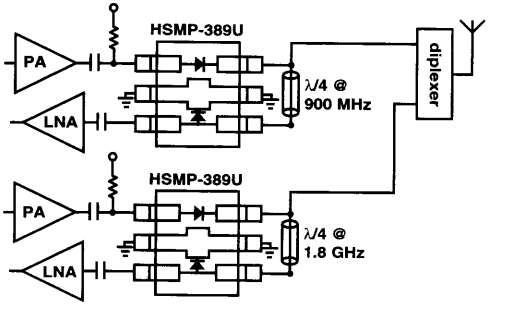


Figure 19. Dualmode 900/1800 MHz Tx/Rx Switch.

Assembly Information

SOT-323 PCB Footprint

A recommended PCB pad layout for the miniature SOT-323 (SC-70) package is shown in Figure 20 (dimensions are in inches). This layout provides ample allowance for package placement by automated assembly equipment without adding parasitics that could impair performance.

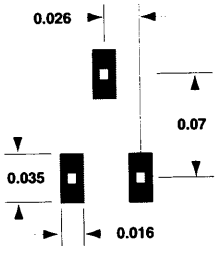


Figure 20. PCB Pad Layout (dimensions in inches).

SMT Assembly

Reliable assembly of surface mount components is a complex process that involves many material, process, and equipment factors, including: method of heating (e.g., IR or vapor phase reflow, wave soldering, etc.) circuit board material, conductor thickness and pattern, type of solder alloy, and the thermal conductivity and thermal mass of components. Components with a low mass, such as the SOT-323 package, will reach solder reflow temperatures faster than those with a greater mass.

HP's SOT-323 diodes have been qualified to the time-temperature profile shown in Figure 21. This profile is representative of an IR reflow type of surface mount assembly process.

After ramping up from room temperature, the circuit board with components attached to it (held in place with solder paste) passes through one or more preheat zones. The preheat zones increase the temperature of the board and components to prevent thermal shock and begin evaporating solvents from the solder paste. The reflow zone briefly elevates the temperature sufficiently to produce a reflow of the solder.

The rates of change of temperature for the ramp-up and cool-down zones are chosen to be low enough to not cause deformation of the board or damage to components due to thermal shock. The maximum temperature in the reflow zone (T_{MAX}) should not exceed 235 °C.

These parameters are typical for a surface mount assembly process for HP SOT-323 diodes. As a general guideline, the circuit board and components should be exposed only to the minimum temperatures and times necessary to achieve a uniform reflow of solder.

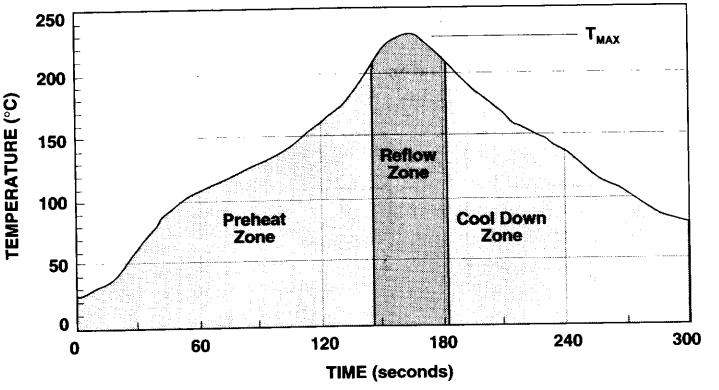
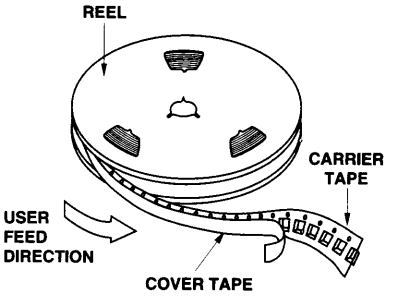
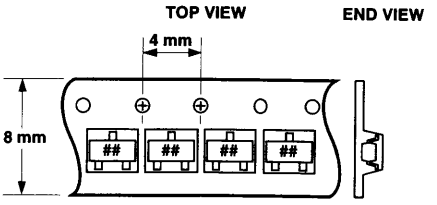


Figure 21. Surface Mount Assembly Profile.

Device Orientation

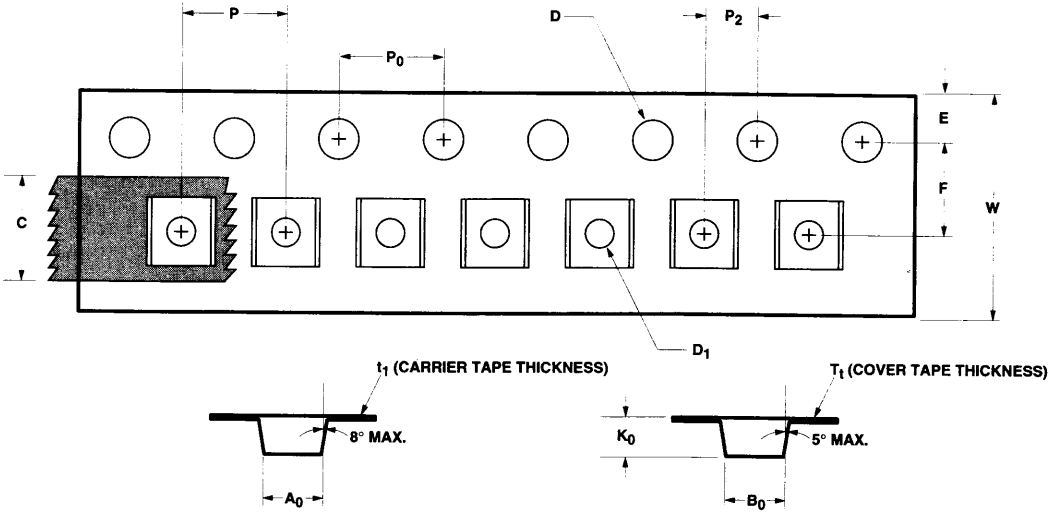




Note: "##" represents Package Marking Code.

Tape Dimensions

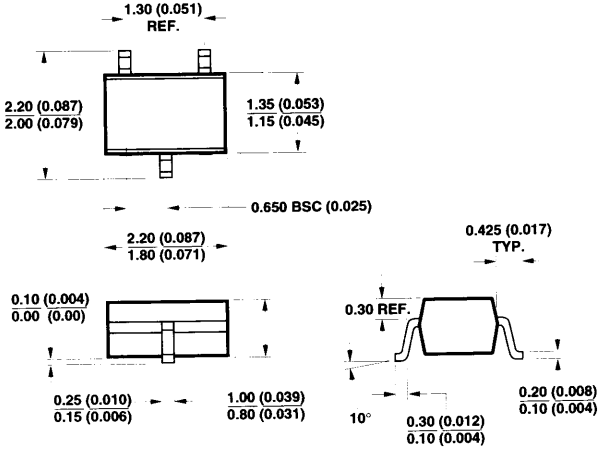
For Outline SOT-323 (SC-70 3 Lead)



DESCRIPTION		SYMBOL	SIZE (mm)	SIZE (INCHES)
CAVITY	LENGTH	A_0	2.24 ± 0.10	0.088 ± 0.004
	WIDTH	B_0	2.34 ± 0.10	0.092 ± 0.004
	DEPTH	K_0	1.22 ± 0.10	0.048 ± 0.004
	PITCH	P	4.00 ± 0.10	0.157 ± 0.004
	BOTTOM HOLE DIAMETER	D_1	1.00 + 0.25	0.039 + 0.010
PERFORATION	DIAMETER	D	1.55 ± 0.05	0.061 ± 0.002
	PITCH	P_0	4.00 ± 0.10	0.157 ± 0.004
	POSITION	E	1.75 ± 0.10	0.069 ± 0.004
CARRIER TAPE	WIDTH	W	8.00 ± 0.30	0.315 ± 0.012
	THICKNESS	t_1	0.255 ± 0.013	0.010 ± 0.0005
COVER TAPE	WIDTH	C	5.4 ± 0.10	0.205 ± 0.004
	TAPE THICKNESS	T_t	0.062 ± 0.001	0.0025 ± 0.00004
DISTANCE	CAVITY TO PERFORATION (WIDTH DIRECTION)	F	3.50 ± 0.05	0.138 ± 0.002
	CAVITY TO PERFORATION (LENGTH DIRECTION)	P_2	2.00 ± 0.05	0.079 ± 0.002

Package Dimensions

Outline SOT-323 (SC-70)



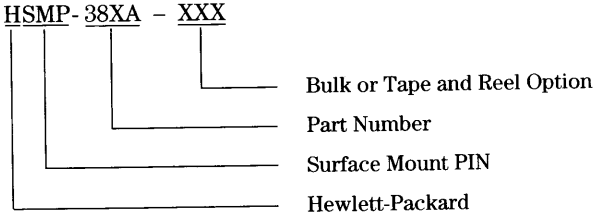
DIMENSIONS ARE IN MILLIMETERS (INCHES)

Package Characteristics

Lead Material	Copper
Lead Finish	Tin-Lead 85/15%
Maximum Soldering Temperature	260°C for 5 seconds
Minimum Lead Strength	2 pounds pull
Typical Package Inductance	2 nH
Typical Package Capacitance	0.08 pF (opposite leads)

Ordering Information

Specify part number followed by option. For example:



Option – BLK = Bulk, 100 pcs. per antistatic bag
Option – TR1 = Tape and Reel, 3000 devices per 7" reel

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