HEWLETT PACKARD

Beam Lead Schottky Diode Pairs for Mixers and Detectors

Technical Data

HSCH-5500 Series

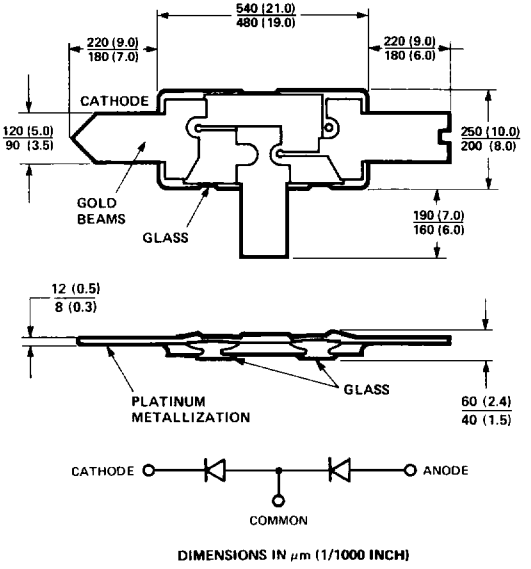
Features

- **Monolithic Pair**
  Closely Matched Electrical Parameters
- **Low Capacitance**
  0.1 pF Maximum at 0 Volts
- **Low Noise Figure**
  Guaranteed 7.5 dB at 26 GHz
- **Rugged Construction**
  4 Grams Minimum Lead Pull
- **Platinum Tri-Metal System**
  High Temperature Stability
- **Polyimide Scratch Protection**
- **Silicon Nitride Passivation**
  Stable, Reliable Performance

Description

These dual beam lead diodes are constructed using a metal-semiconductor Schottky barrier junction. Advanced epitaxial techniques and precise process control insure uniformity and repeatability of this planar passivated microwave semiconductor. A nitride passivation layer provides immunity from contaminants which could otherwise lead to I_R drift.

The HP beam lead process allows for large beam anchor pads for rugged construction (typical 6 gram pull strength) without degrading capacitance.



Outline 04B

Maximum Ratings (for Each Diode)

Pulse Power Incident at T_A = 25°C ..... 1 W
Pulse Width = 1 μs, Du = 0.001
CW Power Dissipation at T_A = 25°C ..... 150 mW
Measured in an infinite heat sink derated linearly to zero at maximum rated temperature
T_{OPR} – Operating Temperature Range ..... -65°C to +175 °C
T_{STG} – Storage Temperature Range ..... -65°C to +200°C
Minimum Lead Strength ..... 4 grams pull on any lead
Diode Mounting Temperature ..... 350°C for 10 sec. max.

These diodes are ESD sensitive. Handle with care to avoid static discharge through the diode.

Applications

The beam lead diode is ideally suited for use in stripline or microstrip or coplanar waveguide circuits. Its small physical size and uniform dimensions give it low parasitics and repeatable RF characteristics through K-band.

These dual beam leads are intended for use in balanced mixers and in even harmonic anti-parallel pair mixers. By using several of these devices in the proper configuration it is easy to assemble bridge quads, star quads, and ring quads for Class I, II, or III type double balanced mixers.

Bonding and Handling Procedures

See page 3-45.

Table IA. Electrical Specifications for RF Tested Diodes at T_A = 25°C

Part Number HSCH-	Barrier	Max. Noise Figure NF (dB)	I_F Impedance Z_{IF} (Ω) Min.	I_F Impedance Z_{IF} (Ω) Max.	Max. SWR	Min. Breakdown Voltage V_{BR} (V)	Max. Dynamic Resistance R_D (Ω)	Max. ΔR_D (Ω)	Max. Total Capacitance C_T (pF)	Max. ΔC_T (pF)	Max. Forward Voltage V_F (mV)	Max. ΔV_F (mV)	Max. I_R (nA)
5520	Medium	7.5 at 26 GHz	200	400	1.5:1	4	20	3	0.10	0.02	500	10	100
5510		7.0 at 16 GHz					20		0.10				
5518		7.2 at 16 GHz					16	2	0.15	0.03			
5514		6.2 at 9.375 GHz					12		0.25				
5540	Low	7.5 at 26 GHz	150	350			20	3	0.10	0.02	375		400
5530		7.0 at 16 GHz					20		0.10				
5538		7.2 at 16 GHz					16	2	0.15	0.03			
5534		6.2 at 9.375 GHz					12		0.25				
Test Conditions		DC Load Resistance - 0 Ω LO Power = 1 mW I_F = 30 MHz, 1.5 dB NF				I_R = 10 μA	I_F = 5 mA		V_R = 0 V f = 1 MHz		I_F = 1 mA		V_R = 1 V
						Measured across adjacent leads.							

Table IB. Electrical Specifications for DC Tested Diodes at T_A = 25°C

Part Number HSCH-[1]	Barrier	Minimum Breakdown Voltage V_{BR} (V)	Maximum Dynamic Resistance R_D (Ω)	Max. ΔR_D (Ω)	Maximum Total Capacitance C_T (pF)	Max. ΔC_T (pF)	Maximum Forward Voltage V_F (mV)	Max. ΔV_F (mV)	Max. I_R (nA)
5511	Medium	4	20	3	0.10	0.02	500	10	100
5512			16	2	0.15	0.03			
5516			12		0.25				
5531	Low		20	3	0.10	0.02	375		400
5532			16	2	0.15	0.03			
5536			12		0.25				
Test Conditions		I_R = 10 μA	I_F = 5 mA		V_R = 0 V f = 1 MHz		I_F = 1 mA		V_R = 1 V

Note:

1. Standard Hi-Rel program available on HSCH-5511 and HSCH-5531. (See Tables II, III, and IV.) Others are available upon request.

Typical Detector Characteristics at T_A = 25°C

Medium Barrier and Low Barrier (DC Bias)

Parameter	Symbol	Typical Value	Units	Test Conditions
Tangential Sensitivity	TSS	-55	dBm	20 μA Bias, Zero Bias, P_{in} = -40 dBm, R_L = 100 kΩ Video Bandwidth = 2 MHz f = 10 GHz
Voltage Sensitivity	γ	9.0	mV/μW	
Video Resistance	R_V	1350	Ω	

Low Barrier (Zero Bias)

Parameter	Symbol	Typical Value	Units	Test Conditions
Tangential Sensitivity	TSS	-46	dBm	Zero Bias, Zero Bias, P_{in} = -30 dBm, R_L = 10 MΩ Video Bandwidth = 2 MHz f = 10 GHz
Voltage Sensitivity	γ	17	mV/μW	
Video Resistance	R_V	1.4	MΩ	

Typical Parameters

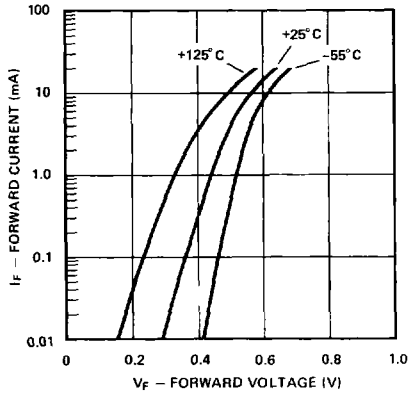


Figure 1. Typical Forward Characteristics for Medium Barrier Beam Lead Diodes. HSCH-5520 and HSCH-551X Series.

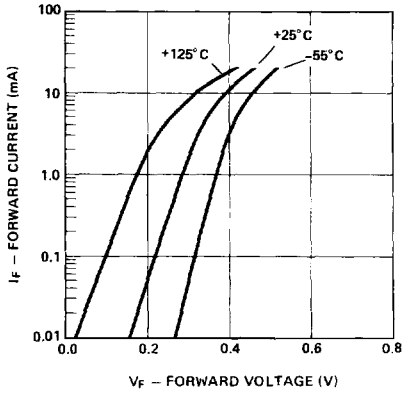


Figure 2. Typical Forward Characteristics for Low Barrier Beam Lead Diodes. HSCH-5540 and HSCH-553X Series.

Typical Parameters (cont.)

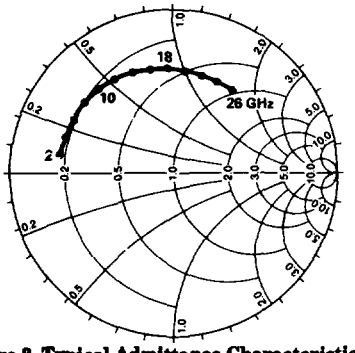


Figure 3. Typical Admittance Characteristics with 1 mA Self Bias. HSCH-5510, -5520, -5530, and -5340.

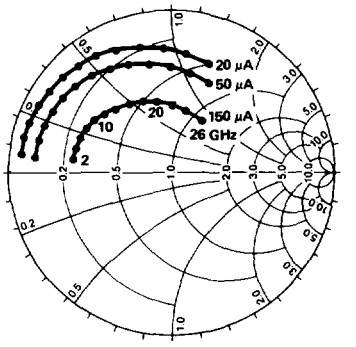


Figure 4. Typical Admittance Characteristics with External Bias. HSCH-5510, -5520, -5530, and -5540.

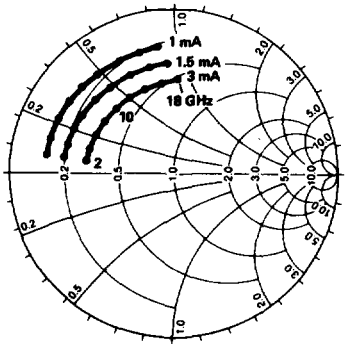


Figure 5. Typical Admittance Characteristics with Self Bias. HSCH-5518, -5538.

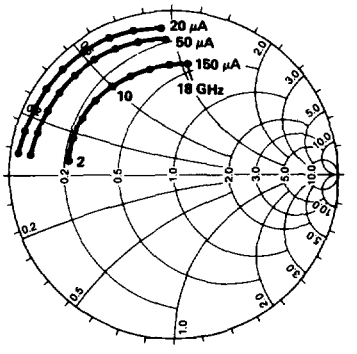


Figure 6. Typical Admittance Characteristics with External Bias. HSCH-5518, -5538.

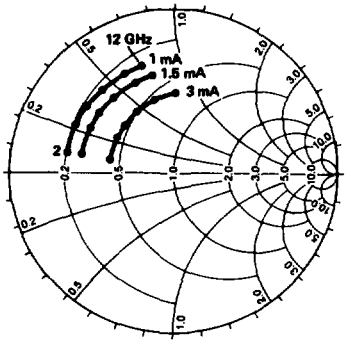


Figure 7. Typical Admittance Characteristics with Self Bias. HSCH-5514, -5534.

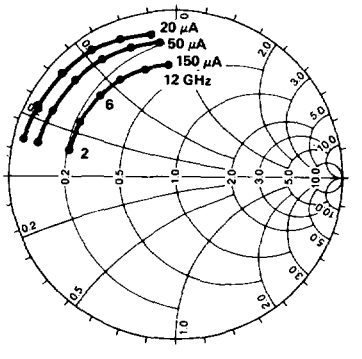


Figure 8. Typical Admittance Characteristics with External Bias. HSCH-5514, -5534.

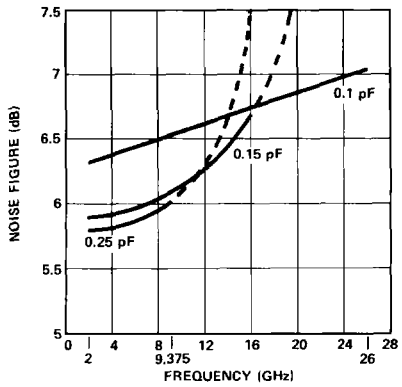
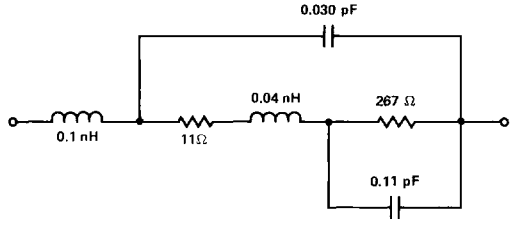


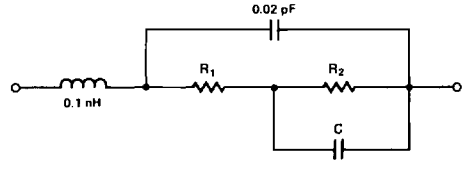
Figure 9. Typical Noise Figure vs. Frequency.

Models for Each Beam Lead Schottky Diode

HSCH-5510, -5520, -5530, -5540
1 mA Self Bias

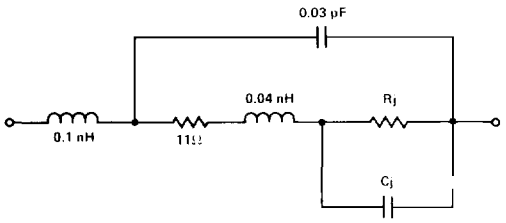


HSCH-5514, -5518, -5534, -5538
Self Bias



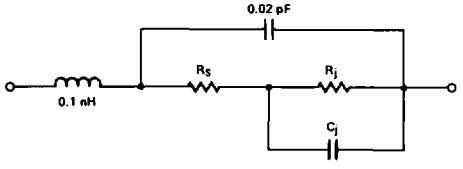
Part Numbers	1.0 mA Self Bias			1.5 mA Self Bias			3.0 mA Self Bias		
	R_1 (Ω)	R_2 (Ω)	C (pF)	R_1 (Ω)	R_2 (Ω)	C (pF)	R_1 (Ω)	R_2 (Ω)	C (pF)
HSCH-5518, -5538	5.0	393	0.11	5.2	232	0.11	5.0	150	0.12
HSCH-5514, -5534	5.1	244	0.16	5.0	178	0.16	5.0	109	0.19

HSCH-5510, -5520, -5530, -5540
External Bias



Part Numbers	20 μA DC Bias		50 μA DC Bias		150 μA DC Bias	
	R_j (Ω)	C_j (pF)	R_j (Ω)	C_j (pF)	R_j (Ω)	C_j (pF)
HSCH-5510, -5520, -5530, -5540	1400	0.09	560	0.09	187	0.10

HSCH-5518, -5538, -5514, -5534
External Bias



Part Numbers	20 μA DC Bias			50 μA DC Bias			150 μA DC Bias		
	R_S (Ω)	R_j (Ω)	C_j (pF)	R_S (Ω)	R_j (Ω)	C_j (pF)	R_S (Ω)	R_j (Ω)	C_j (pF)
HSCH-5518, -5538	2.8	1240	0.11	4.7	618	0.12	2.7	211	0.13
HSCH-5514, -5534	5.1	2050	0.18	3.9	665	0.19	4.7	242	0.20