HEWLETT hp PACKARD

COMPONENTS

BEAM LEAD SCHOTTKY DIODES FOR MIXERS AND DETECTORS (1-18 GHz)

5082-2229 5082-2716
5082-2264 5082-2767
5082-2299 5082-2768
5082-2509 5082-2769
5082-2510 5082-2778
5082-2709 5082-2779

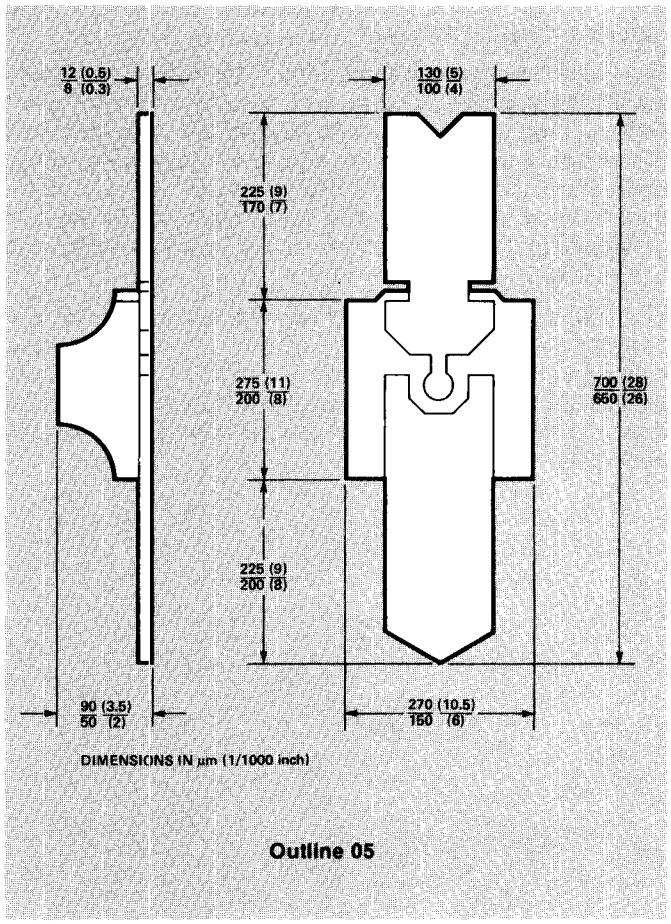
Features

PLANAR SURFACE
Easier Bonding, Stronger Leads

PASSIVATED
Stable, Reliable Performance

LOW NOISE FIGURE
6 dB Typical at 9 GHz

HIGH UNIFORMITY
Tightly Controlled Process Insures Uniform RF Characteristics



Outline 05

Description

These 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.

During manufacturing, gold leads are deposited onto a glass passivation layer before the wafer is separated into dice. This provides exceptional lead strength.

Applications

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

The basic medium barrier devices in this family are DC tested 5082-2709, -2716, and -2767. Batch matched versions are available as the 5082-2509 and -2510. Equivalent low barrier devices are 5082-2229, -2299 and -2264.

For applications requiring guaranteed RF performance, the 5082-2768 is selected for 6.5 dB maximum noise figure at 9.375 GHz, with RF matched pairs available as the 5082-2778. The 5082-2769 is rated at 7.5 dB maximum noise figure at 16 GHz with RF matched pairs available as the 5082-2779.

Application Note 963 is a treatise on impedance matching for mixer and detector circuits using the -2709 as an example.

Maximum Ratings

Pulse Power Incident at $T_A = 25°C$ 1W
CW Power Dissipation at $T_A = 25°C$ 300mW
T_{OPR} — Operating Temperature Range -60°C to +150°C
T_{STG} — Storage Temperature Range ... -60°C to +150°C
Maximum Pull On Any Lead ..... 2 grams
Diode Mounting Temperature ... 220°C for 10 sec. max.

Operation of these devices within the above temperature ratings will assure a device Mean Time Between Failure (MTBF) of approximately 1 x 10^7 hours.

DC Electrical Specifications at $T_A = 25°C$

MEDIUM BARRIER

Parameter	Symbol	5082-2709/† -2768/-2778	5082-2716/ -2769/-2779	5082-2767	Units	Test Conditions
Minimum Breakdown Voltage	V_{BR}	3	3	3	V	$I_R = 10\mu A$
Maximum Forward Voltage	V_F		1.0		V	$I_F = 20$ mA
Maximum Total Capacitance	C_T	0.25	0.15	0.10	pF	$V_R = 0V$, f = 1MHz
Typical Forward Voltage	V_F		450		mV	$I_F = 1$mA
DC Batch Matched Units*	—	5082-2509 †	5082-2510	—	—	$\Delta V_F \leq 15$mV at 5mA

† $I_F = 30$mA

LOW BARRIER

Parameter	Symbol	5082-2229	5082-2299	5082-2264	Units	Test Conditions
Minimum Breakdown Voltage	V_{BR}	3	3	3	V	$I_R = 10\mu A$
Maximum Forward Voltage	V_F	1V at 30mA	1V at 20mA	1V at 20mA	V	I_F — as shown
Maximum Total Capacitance	C_T	0.25	0.15	.10	pF	$V_R = 0V$, f = 1MHz
Typical Forward Voltage	V_F		250		mV	$I_F = 1$mA

RF Electrical Specifications at $T_A = 25°C$

MEDIUM BARRIER

Parameter	Symbol	5082-2768	5082-2769	Units	Test Conditions
Maximum Noise Figure	NF_{SSB}	6.5 at 9.375 GHz	7.5 at 16 GHz	dB	1mW L.O. Power IF = 30 MHz, 1.5 dB NF
Maximum SWR	SWR	1.5:1	1.5:1	—	
IF Impedance	Z_{IF}	250-500	250-500	Ω	
RF Batch Matched Units*	—	5082-2778	5082-2779	—	$\Delta NF \leq 0.3$ dB, $\Delta Z_{IF} \leq 25\Omega$

*Minimum batch size 20 units.

Typical Detector Characteristics at $T_A = 25°C$

MEDIUM BARRIER

Parameter	Symbol	Typical Value	Units	Test Conditions
Tangential Sensitivity	TSS	-54	dBm	20μA Bias Video Bandwidth = 2 MHz f = 10 GHz
Detection Sensitivity	γ	6.6	mV/μW	
Video Resistance	R_V	1400	Ω	

LOW BARRIER

Parameter	Symbol	Typical Value	Units	Test Conditions
Tangential Sensitivity	TSS	-42	dBm	Zero Bias Video Bandwidth = 2 MHz f = 10 GHz
Detection Sensitivity	γ	8	mV/μW	
Video Resistance	R_V	400	kΩ	

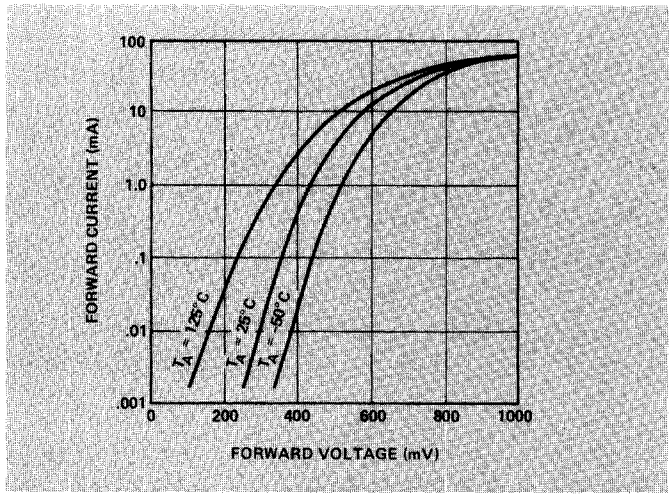


Figure 1. Typical Forward Characteristics, 5082-2709, -2509, -2768 and -2778.

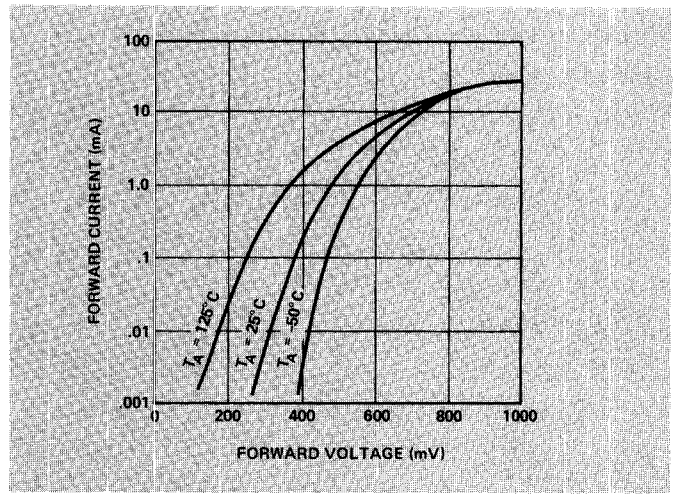


Figure 2. Typical Forward Characteristics, 5082-2716, -2510, -2767, -2769 and -2779.

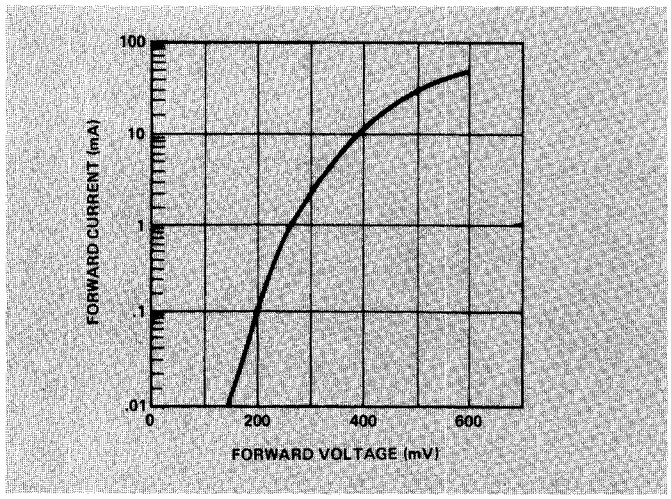


Figure 3. Typical Forward Characteristics, 5082-2229, at 25° C.

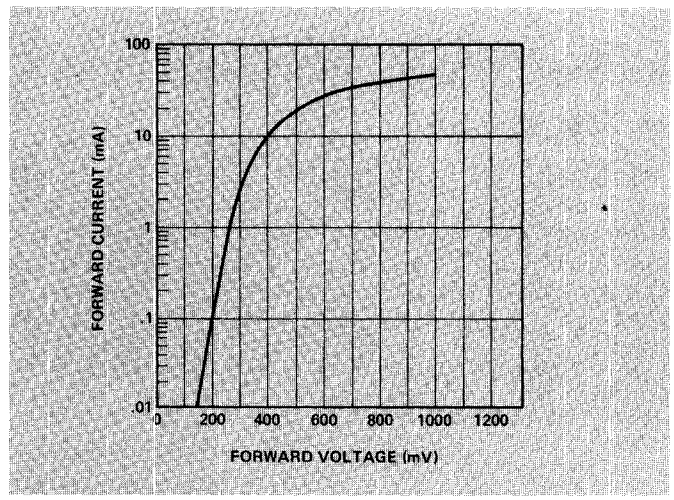


Figure 4. Typical Forward Characteristics, 5082-2299, -2264 at 25° C.

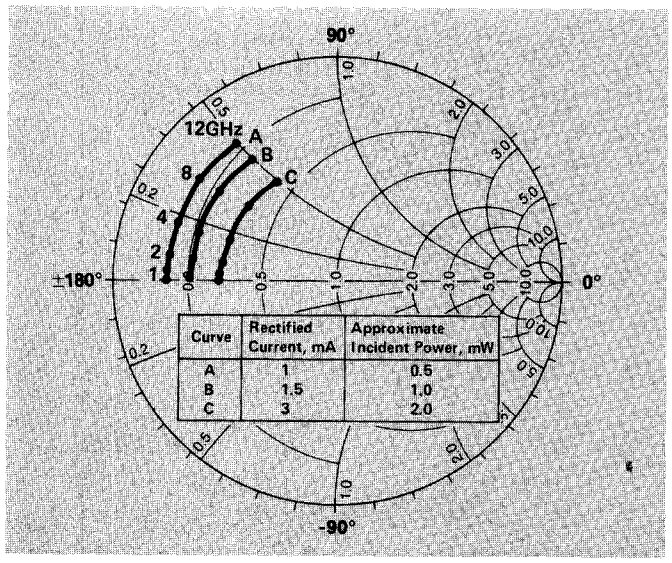


Figure 5. Typical Admittance Characteristics, 5082-2709, -2509, -2768 and -2778 with Self Bias.

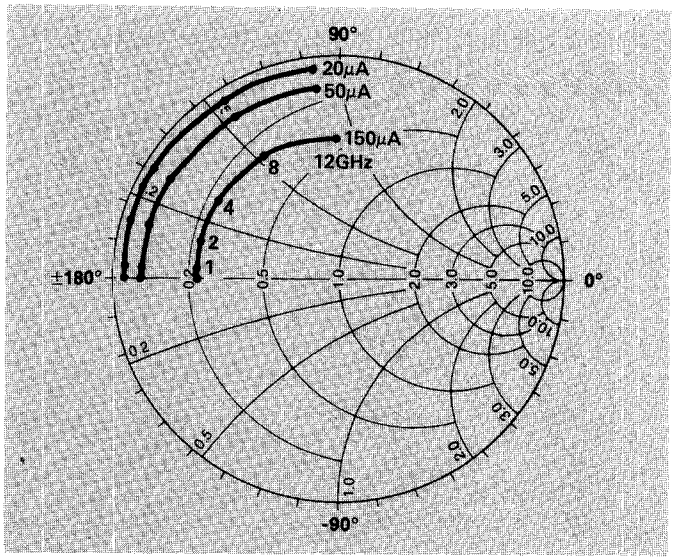


Figure 6. Typical Admittance Characteristics, 5082-2709, -2509, -2768 and -2778 with External Bias.

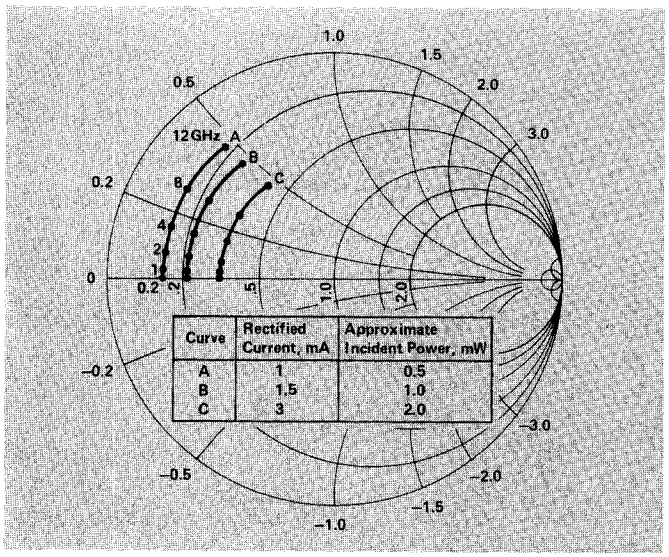


Figure 7. Typical Admittance Characteristics, 5082-2716, -2510, -2767, -2769 and -2779 with Self Bias.

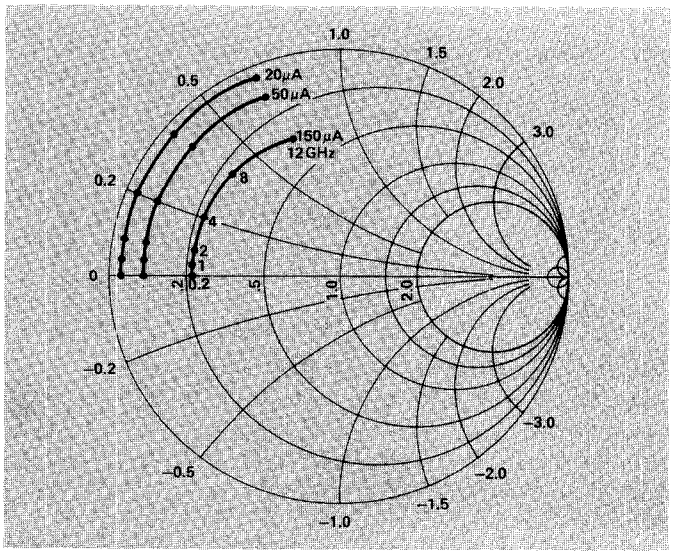


Figure 8. Typical Admittance Characteristics, 5082-2716, -2510, -2767, -2769 and -2779 with External Bias.

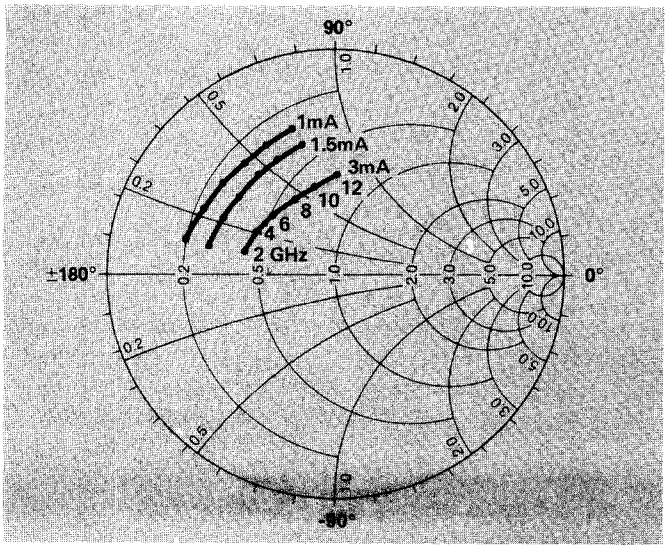


Figure 9. Typical Admittance Characteristics, 5082-2229 with Self Bias.

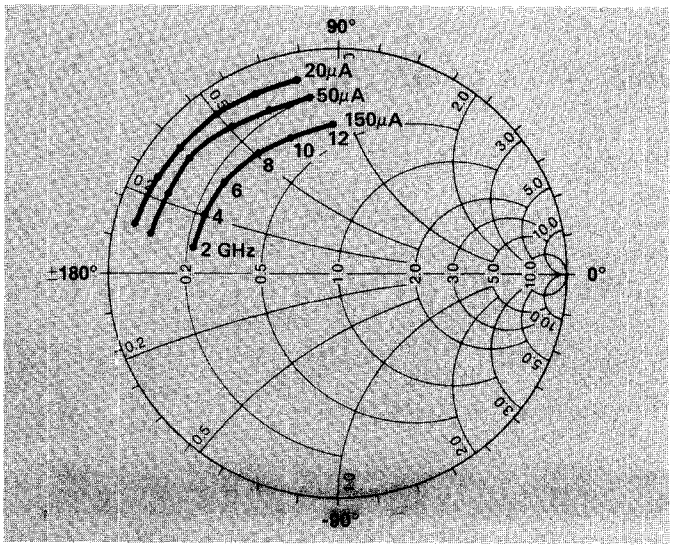


Figure 10. Typical Admittance Characteristics, 5082-2229 with External Bias.

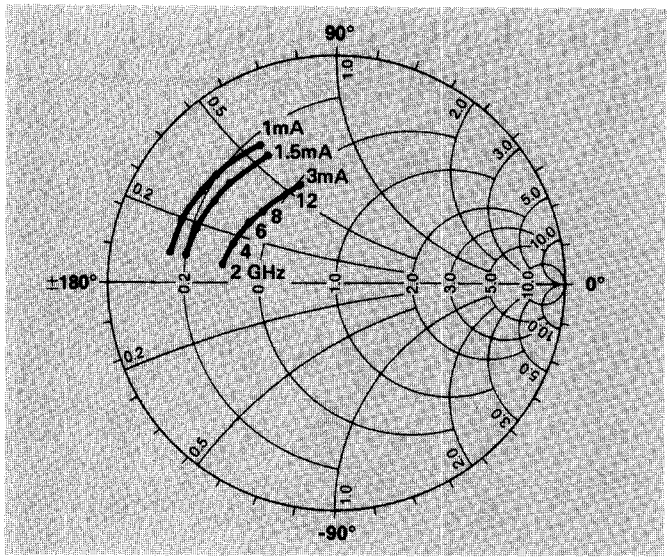


Figure 11. Typical Admittance Characteristics, 5082-2299, -2264, with Self Bias.

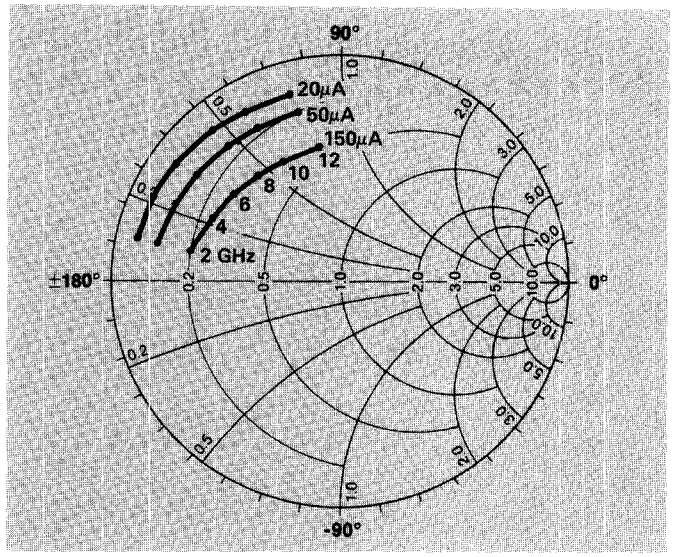


Figure 12. Typical Admittance Characteristics, 5082-2299, -2264, with External Bias.

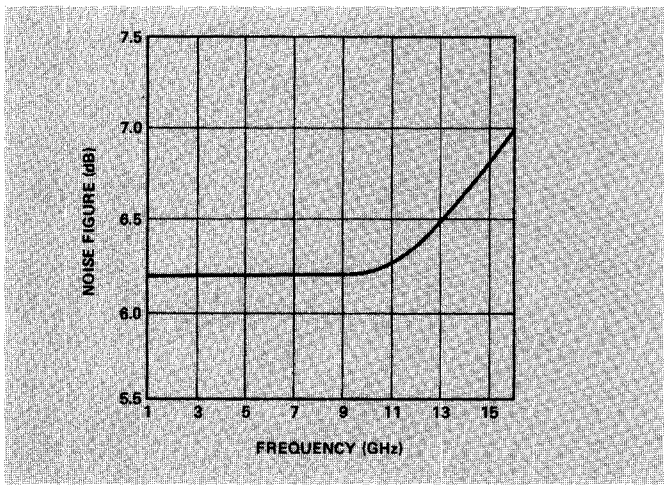


Figure 13. Typical Noise Figure vs. Frequency.

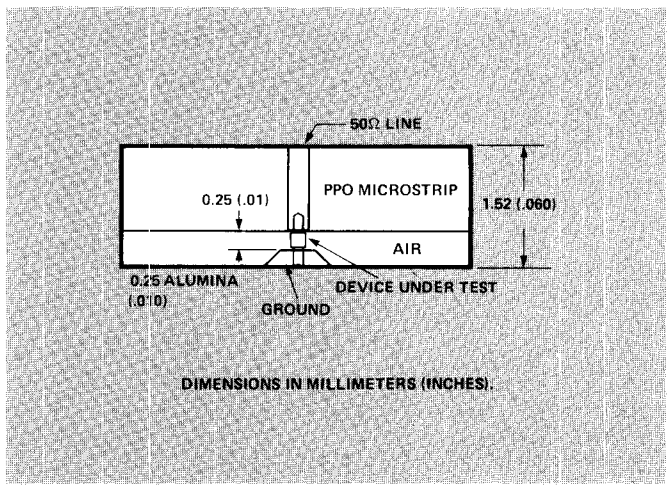
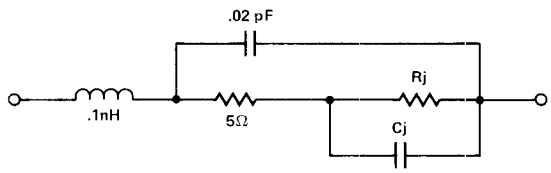


Figure 14. Admittance Test Circuit.

Notes: 1. 1 μs pulse, Du = .001.
2. Power absorbed by the diode. DC load resistance <1Ω.

MODELS FOR BEAM LEAD SCHOTTKY DIODES



Medium Barrier Diodes

Diode	1.5mA Self Bias Rj(Ω)	Cj(pF)	20μADC Bias Rj(Ω)	Cj(pF)
5082-2768	230	.12	2770	.19
5082-2769	230	.09	2440	.14

SEE PAGE 182 FOR HANDLING AND BONDING RECOMMENDATIONS.

Low Barrier Diodes

Diode	1.5mA Self Bias Rj(Ω)	Cj(pF)	20μADC Bias Rj(Ω)	Cj(pF)
5082-2229	175	.16	1010	.17
5082-2299	220	.13	900	.15