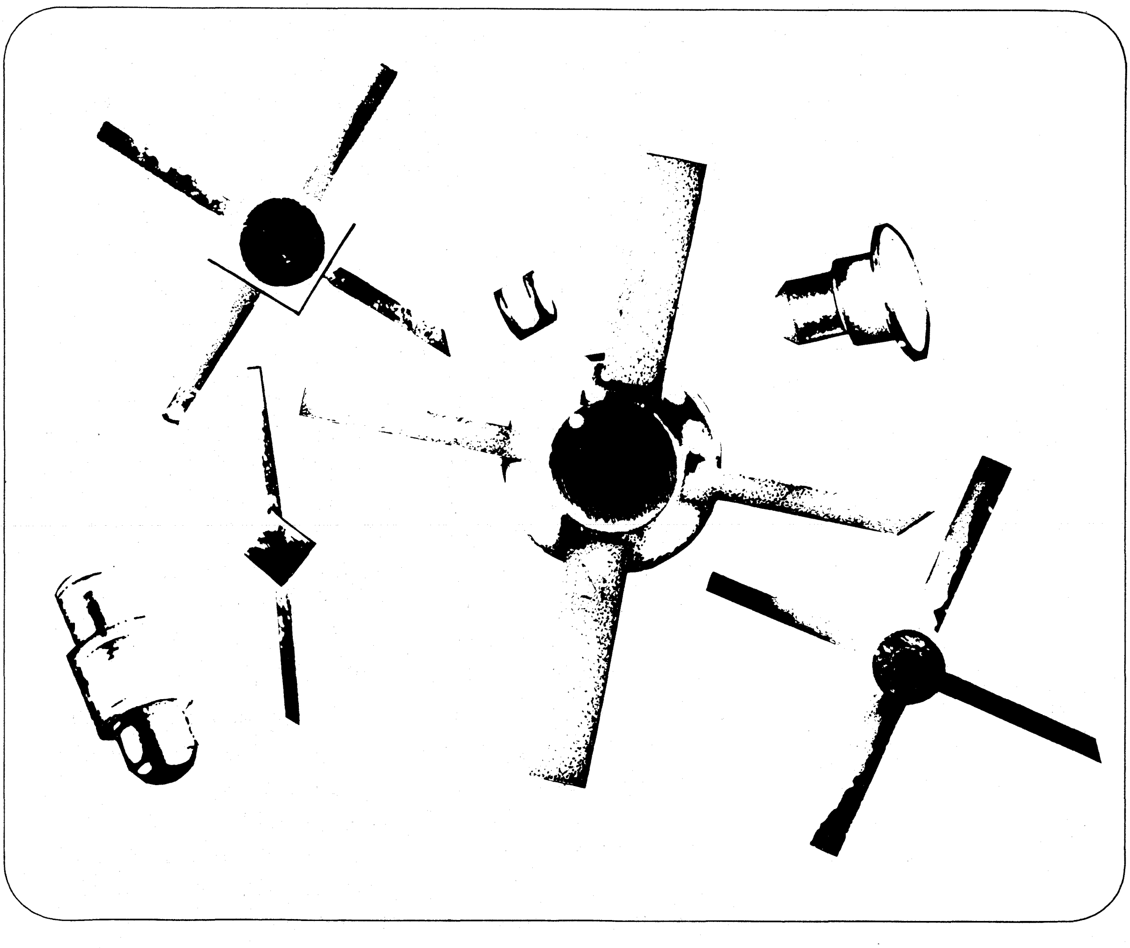
1977 Diode and Transistor Designer's Catalog



A Brief Sketch

Hewlett-Packard is one of the world's leading designers and manufacturers of electronic, medical, analytical, and computing instruments and systems, diodes, transistors, and optoelectronic products. Since its founding in Palo Alto, California, in 1939, HP has done its best to offer only products that represent significant technological advancements.

To maintain its leadership in instrument and component technology, Hewlett-Packard invests heavily in new product development. Research and development expenditures traditionally average about 10 percent of sales revenue, and 1,500 engineers and scientists are assigned the responsibilities of carrying out the company's various R and D projects.

HP produces more than 3,500 products at 26 domestic divisions in California, Colorado, Oregon, Idaho, Massachusetts, New Jersey and Pennsylvania and at overseas plants located in the German Federal Republic, Scotland, France, Japan, Singapore, and Brazil.

However, for the customer, Hewlett-Packard is no farther away than the nearest telephone. There are 172 HP sales and service offices located in 65 countries around the world.

These field offices are staffed by trained engineers, each of whom has the primary responsibility of providing technical assistance and data to customers. A vast communications network has been established to link each field office with the factories and with corporate offices. No matter what the product or the request, a customer can be accommodated by a single contact with the company.

Hewlett-Packard is guided by a set of written objectives. One of these is "to provide products and services of the greatest possible value to our customers". Through application of advanced technology, efficient manufacturing, and imaginative marketing, it is the customer that the more than 30,000 Hewlett-Packard people strive to serve. Every effort is made to anticipate the customer's needs, to provide the customer with products that will enable more efficient operation, to offer the kind of service and reliability that will merit the customer's highest confidence, and to provide all of this at a reasonable price.

To better serve its many customers' broad spectrum of technological needs, Hewlett-Packard publishes several catalogs. Among these are:

- Electronic Instruments and Systems for Measurement/Computation (General Catalog)
- DC Power Supply Catalog
- Medical Instrumentation Catalog
- Analytical Instruments for Chemistry Catalog
- Coax. and W/G Measurement Accessories Catalog
- Optoelectronics Designer's Catalog

All catalogs are available at no charge from your local HP sales office.

RF and Microwave Semiconductors

A decade of intensive solid state research, the development of advanced manufacturing techniques and continued expansion has enabled Hewlett-Packard to become a high volume supplier of quality, competitively priced RF and Microwave diodes and transistors.

In addition to our broad product line, Hewlett-Packard also offers the following services: immediate delivery from any of our authorized stocking distributors, applications support, special QA testing, and a one year guarantee on all of our RF and Microwave products.

This package of products and services has enabled Hewlett-Packard to become a recognized leader in the RF and Microwave industry.

About this Catalog

This Diode and Transistor Designer's Catalog contains detailed, up-to-date specifications on our complete product line. It is divided into the following major sections: Schottky Barrier Diodes, PIN Diodes for Signal Control, Microwave Source Diodes, Devices for Hybrid Integrated Circuits, Military Approved Devices, Microwave Transistors, and Integrated Products. It also includes an index of Microwave Semiconductor Application Notes which are available from any of the Hewlett-Packard Sales and Service Offices listed on page 8-6 or from any of the Distributors listed on page 8-4.

How to Use this Catalog

For your convenience, we have incorporated three methods for locating components:

- a Table of Contents that allows you to locate components by their general description,
- a Numeric Index that lists all components by part number, and
- a Selection Guide for each product group giving a brief overview of the product line.

How to Order

All Hewlett-Packard components may be ordered through any of the Sales and Service Offices listed on page 8-6. In addition, for immediate delivery of Hewlett-Packard components, contact any of the world-wide stocking distributors listed on page 8-4.

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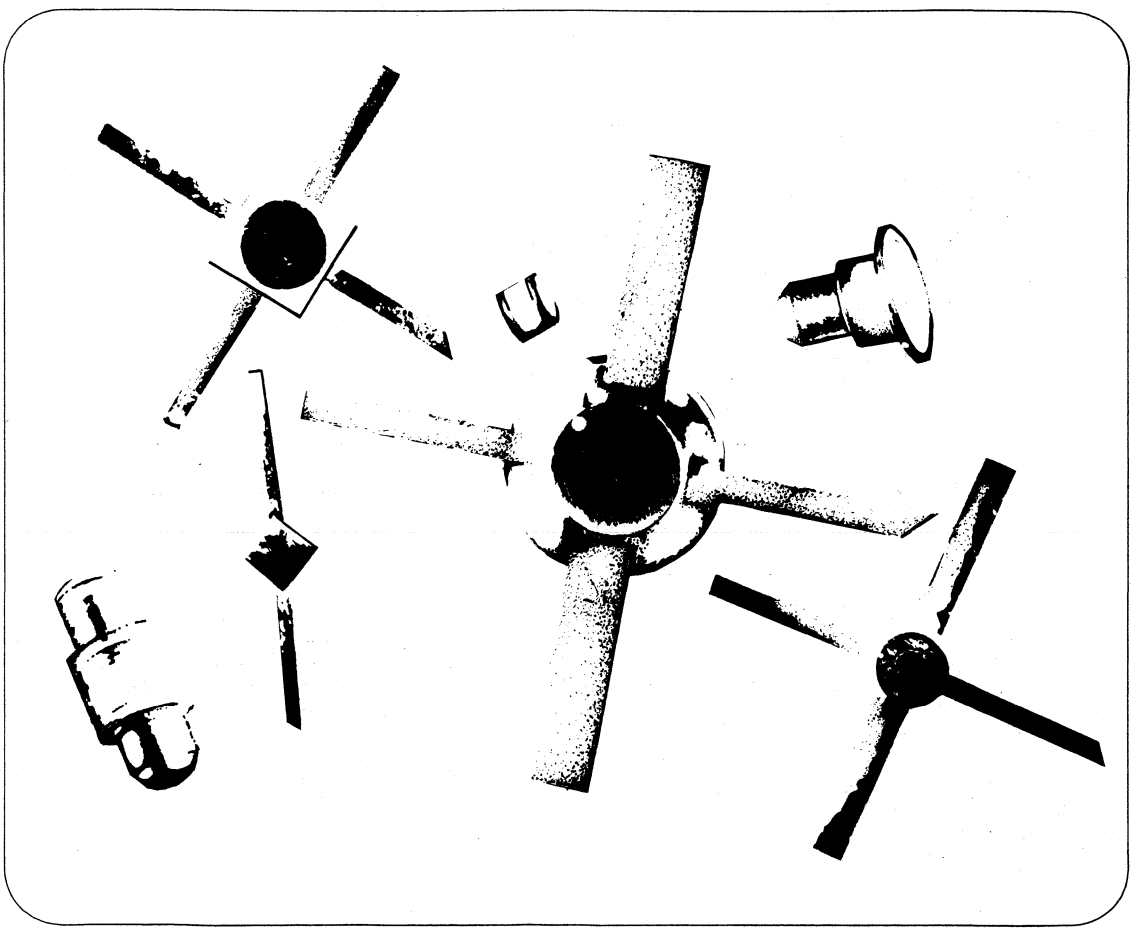
Numeric Index

Schottky Barrier Diodes



Schottky Barrier Diodes — Selection Guide

Schottky Barrier Diodes for General Purpose Applications (Page 1-4)

Part Number 5082-	Package Outline	Minimum Breakdown Voltage V_{BR} (V)	Maximum Forward Voltage V_F (mV)	V_F=1V Max at Forward Current I_F (mA)	Maximum Reverse Leakage Current I_R (nA)	at V_R (V)	Maximum Capacitance C_T (pF)
2800 (1N5711)	15	70	410	15	200	50	2.0
2837	05	70	410	15	200	50	2.0
2305	15	30	400	75	300	15	1.0
2301 (1N5765)	15	30	400	50	300	15	1.0
2302 (1N5766)	15	30	400	35	300	15	1.0
2303 (1N5767)	15	20	400	35	500	15	1.2
2810 (1N5712)	15	20	410	35	100	15	1.2
2811	15	15	410	20	100	8	1.2
2900	15	10	400	20	100	5	1.2
2835	15	5*	340	10*	100	1	1.0
HSCH-1001 (1N6263)	D0-35	60	410	15	200	50	2.2
Test Conditions		I_R = 10 μA *I_R = 100 μA	I_F = 1 mA	*V_F = .45V			V_R = 0 V f = 1.0 MHz

Note: Effective Minority Carrier Lifetime (τ) for all these diodes is 100 ps max. Measured with Krakauer method at 20 mA.

Schottky Barrier Diodes for Stripline and Microstrip Mixers and Detectors (Page 1-9)

Package Outline	Barrier	Part Number 5082-	Frequency Range (GHz)	Measure Of Performance*	Matched Pairs 5082-	Applications
05 Beam Lead	Medium	2709	1-12	0.25 pF	2509	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 through Ku Band.
		2716	1-18	0.15 pF	2510	
		2767	1-18	0.10 pF	**	
		2768	1-12	6.5 dB	2778	
		2769	1-18	7.5 dB (16 GHz)	2779	
	Low	2229	1-12	0.25 pF	**	
		2299	1-18	0.15 pF		
		2264	1-18	0.10 pF		
H-2 Hermetic	Medium	2200	1-12	6.0 dB	2201	The H-2 Package provides a hermetic carrier for the beam lead diodes for easier handling.
		2202	1-12	6.5 dB	2203	
	Low	2765	1-12	6.0 dB	2766	
		2785	1-12	6.5 dB	2786	
C-2 Broadband	Medium	2207	1-18	6.0 dB	2208	The C-2 package provides a broadband carrier for the beam lead diodes for easier handling.
		2209	1-18	6.5 dB	2210	
	Low	2774	1-18	6.0 dB	2775	
		2794	1-18	6.5 dB	2795	

*The measure of performance is C_T for DC specified diodes and NF at 9.375GHz for RF specified diodes.

**Matched pairs are available upon request.

Schottky Barrier Diode Quads for Double Balanced Mixers (Page 1-13)

Package Outline \ Frequency	Barrier	To 2 GHz	2-4 GHz	4-8 GHz	8-12 GHz	12-18 GHz
05	Medium	5082-9696	5082-9696	5082-9394	5082-9396	5082-9398
Beam Lead	Low	5082-9697	5082-9697	5082-9395	5082-9397	5082-9399
E-1	Medium	5082-2830	5082-2276	5082-2277		
Low Cost	Low	5082-2831				
H-4	Medium	5082-2261	5082-2261	5082-2263		
Hermetic	Low	5082-2231	5082-2231	5082-2233		
C-4	Medium	5082-2291	5082-2291	5082-2292	5082-2293	5082-2294
Broadband	Low	5082-2271	5082-2271	5082-2272	5082-2279	5082-2280

Schottky Barrier Diodes For Mixers and Detectors (Page 1-17)

Package Outline	Barrier	Noise Figure NF (dB)	Frequency			
			To 2 GHz	2-6 GHz	6-12 GHz	12-18 GHz
15	Medium	6.0	5082-2817 5082-2400	5082-2565		
		7.0	5082-2350	5082-2520		
49	Medium	6.0			5082-2713	
		6.5			5082-2711	5082-2723 5082-2721*
	Low	6.0			5082-2285	
		6.5			5082-2287	
44	Medium	6.0			5082-2701	
		6.5			5082-2702	5082-2273
	Low	6.0			5082-2295	
		6.5			5082-2297	

*The Noise Figure for the 5082-2721 is 7.0 dB.

Schottky Barrier Diodes for Detectors

Part Number	Package Outline	Maximum Tangential Sensitivity TSS (dBm)	Voltage Sensitivity Minimum γ (mV/μW)	Video Resistance RV (KΩ) Min.	Video Resistance RV (KΩ) Max.	Page Number
HSCH-3171	15	-46	30.0	80	300	1-15 Zero Bias Schottky Detector Diodes
HSCH-3206	49	-42	10.0	100	300	
HSCH-3207	44	-42	8.0	80	300	
HSCH-3486	15	-52	8.0	2	8	
5082-2824		-56	6.0	1.2	1.5	1-21 Schottky Barrier Diodes for Detectors
5082-2787*		-52	3.5	1.2	1.6	
5082-2755		-55	5.0	1.2	1.6	
5082-2751	49	-55	5.0	1.2	1.6	
5082-2750	44	-55	5.0	1.2	1.6	
Test Conditions		Video Bandwidth=2 MHz f_{RF}=2 GHz for 5082-2824, 10 GHz for all others I_{BIAS}=20 μA; Video Amp Eq. Noise, R_A=500Ω	Same as for TSS at RF Signal Power Level of -40 dBm			

*RF Parameters for the 5082-2787 are sample tested only.

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COMPONENTS

SCHOTTKY BARRIER DIODES FOR GENERAL PURPOSE APPLICATIONS

5082-2301/02
5082-2303/05
5082-2800
5082-2810/11
5082-2835
5082-2837
5082-2900
HSCH-1001 (1N6263)

Features

LOW TURN-ON VOLTAGE: .34V at 1mA
PICO-SECOND SWITCHING SPEED
HIGH BREAKDOWN VOLTAGE: Up to 70V
UNIFORM FORWARD TRACKING

Description/Applications

The 5082-2800, 2810, 2811 are passivated Schottky barrier diodes which use a patented "guard ring" design to achieve a high breakdown voltage. They are packaged in a low cost glass package. They are well suited for high level detecting, mixing, switching, gating, log or A-D converting, video detecting, frequency discriminating, sampling and wave shaping.

The 5082-2835 is a passivated Schottky diode in a low cost glass package. It is optimized for low turn-on voltage. The 5082-2835 is particularly well suited for UHF mixing.

The 5082-2837 is a passivated Beam Lead version of the 5082-2800.

The 5082-2300 and 2900 Series devices are unpassivated Schottky diodes in a glass package. These diodes have extremely low 1/f noise and are ideal for low noise mixing, and high sensitivity detecting. They are particularly well suited for use in Doppler or narrow band video receivers.

Application Note 942 describes several applications in which these diodes are used for signal conversion, speed up of a transistor, clipping and clamping.

The HSCH-1001 is a Hybrid Schottky diode sealed in a rugged DO-35 glass package suitable for automatic insertion. The low turn-on voltage, fast switching speed, and low cost of these diodes make them ideal for general purpose switching.

Maximum Ratings at $T_A = 25°C$

Junction Operating and Storage Temperature Range

5082-2305, 2301, 2302, 2303, 2900 ...	-60°C to +125°C
5082-2800, 2810, 2811, HSCH-1001 ...	-65°C to +200°C
5082-2835, 2837	-60°C to +150°C

DC Power Dissipation (Measured in an infinite heat sink)
Derate linearly to zero at maximum rated temperature

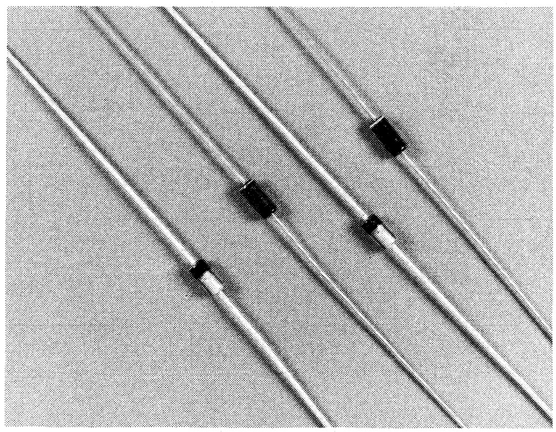
5082-2305, 2301, 2302, 2303, 2900	125 mW
5082-2800, 2810, 2811	250 mW
5082-2835, 2837	150 mW
HSCH-1001	400 mW

Soldering Temperature

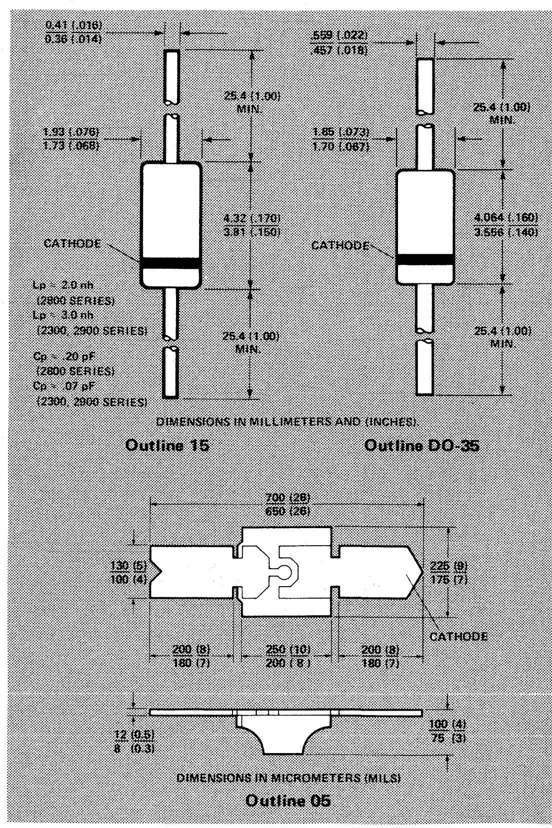
Outline 15	230°C for 5 sec.
Outline DO-35	260°C for 10 sec.
Outline 05	220°C for 10 sec.

Peak Inverse Voltage .... V_{BR}

Prolonged exposure to peak voltages exceeding PIV may cause gradual degradation of diode performance.



Package Dimensions



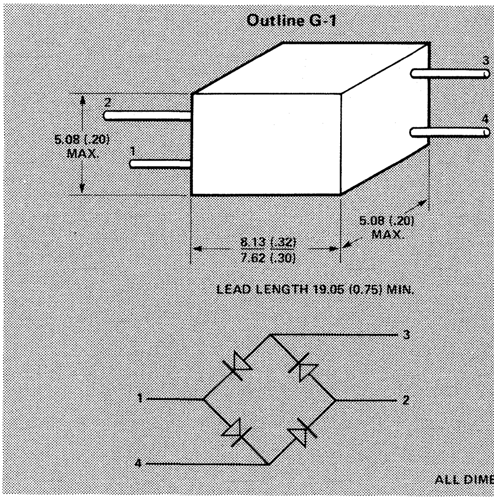
Electrical Specifications at $T_A = 25°C$

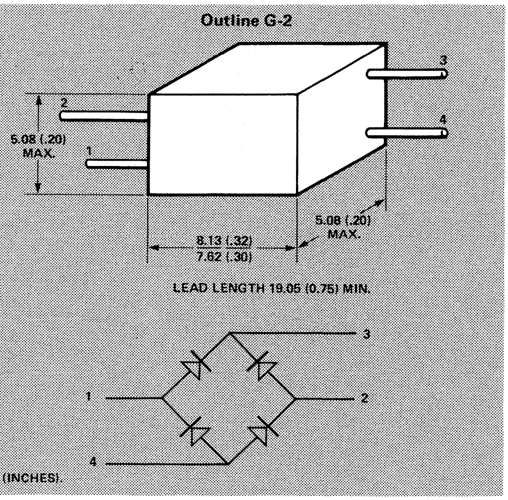
Part Number 5082-	Package Outline	Minimum Breakdown Voltage V_{BR} (V)	Maximum Forward Voltage V_F (mV)	V_F=1V Max at Forward Current I_F (mA)	Maximum Reverse Leakage Current I_R (nA)	at V_R (V)	Maximum Capacitance C_T (pF)
2800	15	70	410	15	200	50	2.0
2837	05	70	410	15	200	50	2.0
2305	15	30	400	75	300	15	1.0
2301	15	30	400	50	300	15	1.0
2302	15	30	400	35	300	15	1.0
2303	15	20	400	35	500	15	1.2
2810	15	20	410	35	100	15	1.2
2811	15	15	410	20	100	8	1.2
2900	15	10	400	20	100	5	1.2
2835	15	5*	340	10*	100	1	1.0
HSCH-1001 (1N6263)	D0-35	60	410	15	200	50	2.2
Test Conditions		$I_R = 10\ \mu A$ *$I_R = 100\ \mu A$	$I_F = 1$ mA	*$V_F = .45V$			$V_R = 0$ V f = 1.0 MHz

Note: Effective Minority Carrier Lifetime (τ) for all these diodes is 100 ps max. Measured with Krakauer method at 20 mA.

Matched Pairs and Quads

Basic Part Number 5082-	Matched Pair Unconnected	Matched Quad Unconnected	Matched Ring Quad Encapsulated G-1 Outline	Matched Bridge Quad Encapsulated G-2 Outline	Batch Matched	Test Conditions
2301	5082-2306 $\Delta V_F = 20$ mV $\Delta Co = 0.2$ pF					ΔV_F at I_F = 0.75–20 mA ΔCo at f = 1.0 MHz
2303	5082-2308 $\Delta V_F = 20$ mV $\Delta Co = 0.2$ pF	5082-2370 $\Delta V_F = 20$ mV $\Delta Co = 0.2$ pF	5082-2396 $\Delta V_F = 20$ mV $\Delta Co = 0.2$ pF	5082-2356 $\Delta V_F = 20$ mV $\Delta Co = 0.2$ pF		ΔV_F at I_F = 0.75–20 mA ΔCo at f = 1.0 MHz
2900	5082-2912 $\Delta V_F = 30$ mV	5082-2970 $\Delta V_F = 30$ mV	5082-2996 $\Delta V_F = 30$ mV	5082-2997 $\Delta V_F = 30$ mV		ΔV_F at I_F = 1.0 – 10 mA
2800	5082-2804 $\Delta V_F = 20$ mV	5082-2805 $\Delta V_F = 20$ mV			5082-2836 $\Delta V_F = 10$ mV $\Delta C_o = 0.1$ pF	ΔV_F at I_F = 0.5 -5 mA ΔC_o at f = 1.0 MHz
2811		5082-2815 $\Delta V_F = 20$ mV	5082-2813 $\Delta V_F = 20$ mV	5082-2814 $\Delta V_F = 20$ mV	5082-2826 $\Delta V_F = 10$ mV $\Delta C_o = 0.1$ pF	ΔV_F at I_F = 10 mA ΔC_o at f = 1.0 MHz
2835					5082-2080 $\Delta V_F = 10$ mV $\Delta C_o = 0.1$ pF	ΔV_F at I_F = 10 mA ΔC_o at f = 1.0 MHz





LEAD	COLOR
1	BROWN
2	RED
3	ORANGE
4	YELLOW

ALL DIMENSIONS IN MILLIMETERS (INCHES).

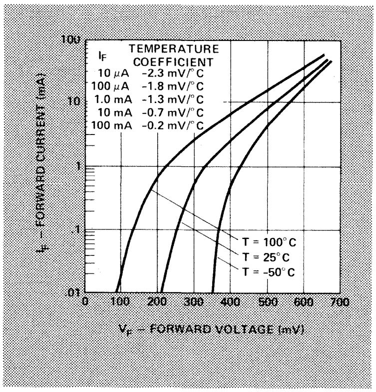


Figure 1. I-V Curve Showing Typical Temperature Variation for 5082-2300 Series Schottky Diodes.

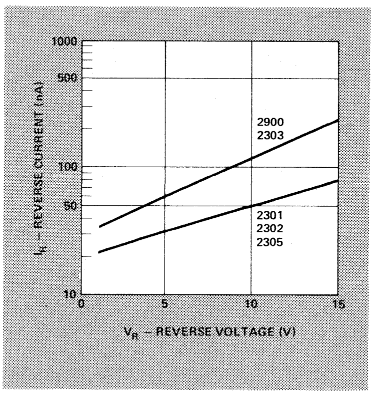


Figure 2. 5082-2300 and 5082-2900 Series Typical Reverse Current vs. Reverse Voltage at T_A = 25°C.

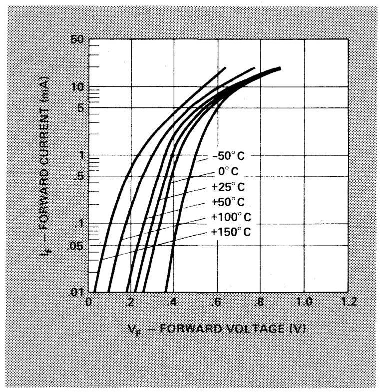


Figure 3. I-V Curve Showing Typical Temperature Variation for 5082-2800 Schottky Diodes.

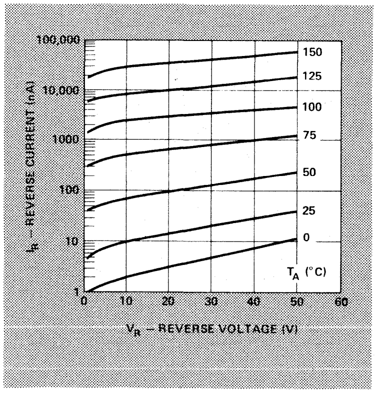


Figure 4. (5082-2800) Typical Variation of Reverse Current (I_R) vs. Reverse Voltage (V_R) at Various Temperatures.

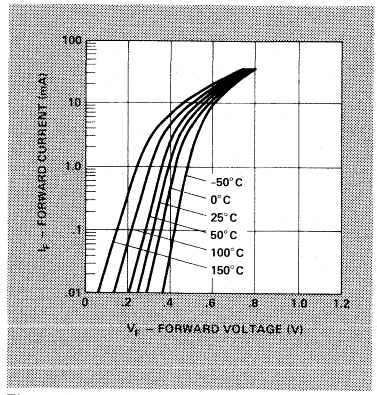


Figure 5. I-V Curve Showing Typical Temperature Variation for the 5082-2810 Schottky Diode.

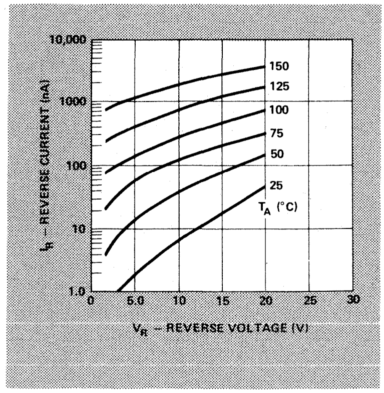


Figure 6. (5082-2810) Typical Variation of Reverse Current (I_R) vs. Reverse Voltage (V_R) at Various Temperatures.

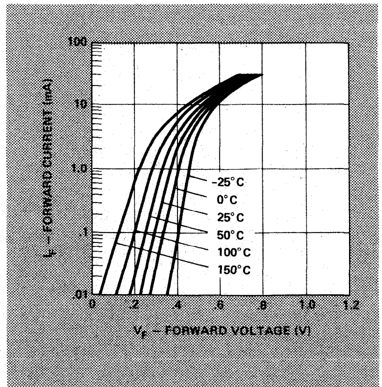


Figure 7. I-V Curve Showing Typical Temperature Variation for 5082-2811 Schottky Diode.

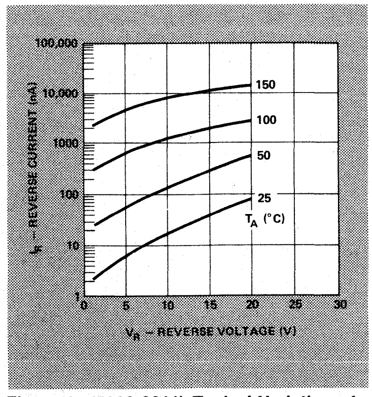


Figure 8. (5082-2811) Typical Variation of Reverse Current (I_R) vs. Reverse Voltage (V_R) at Various Temperatures.

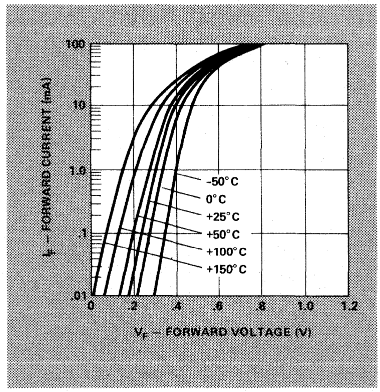


Figure 9. I-V Curve Showing Typical Temperature Variations for 5082-2835 Schottky Diode.

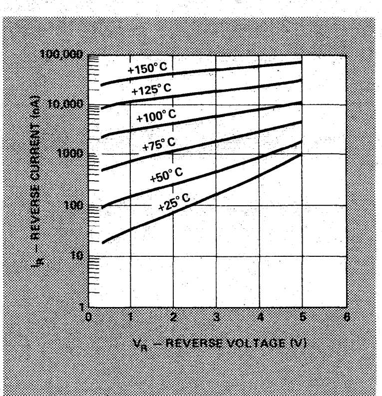


Figure 10. (5082-2835) Typical Variation of Reverse Current (I_R) vs. Reverse Voltage (V_R) at Various Temperatures.

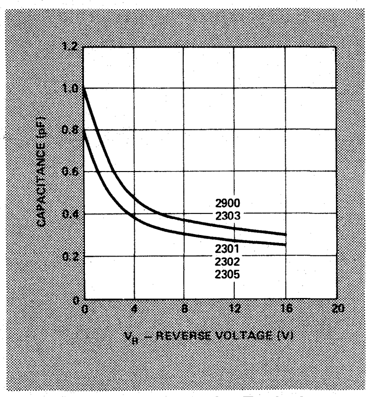


Figure 11. 5082-2300 Series Typical Capacitance vs. Reverse Voltage at T_A = 25°C.

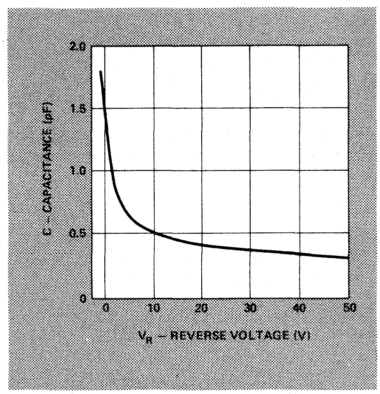


Figure 12. (5082-2800) Typical Capacitance (C) vs. Reverse Voltage (V_R) at T_A = 25°C.

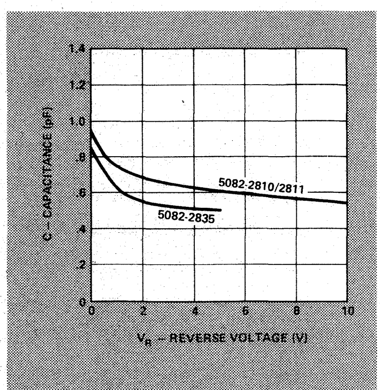


Figure 13. Typical Capacitance (C) vs. Reverse Voltage (V_R).

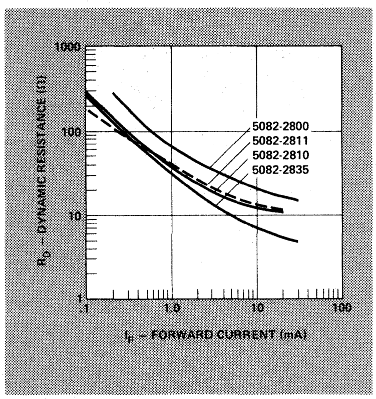


Figure 14. Typical Dynamic Resistance (R_D) vs. Forward Current (I_F).

Mechanical Specifications

Lead Material .... Dumet
Lead Finish: .... Tin
Maximum Soldering Temperature ...... 235°C for 5 sec
Lead Strength .... 10 lb lead pull min
Typical Package Inductance .... 1.8 nH
Typical Package Capacitance .... 0.25 pF

Lead Material	Dumet
Lead Finish:	Tin
Maximum Soldering Temperature	235°C for 5 sec
Lead Strength	10 lb lead pull min
Typical Package Inductance	1.8 nH
Typical Package Capacitance	0.25 pF

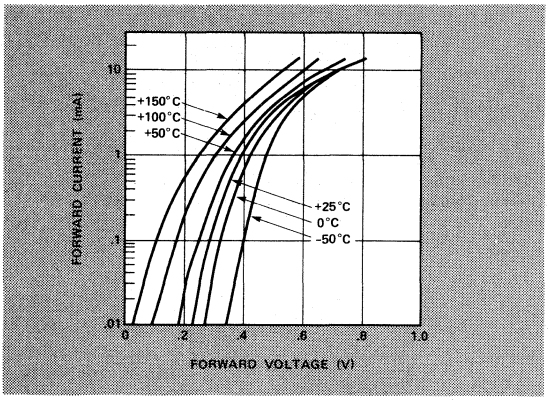


Figure 1. Typical Variation of Forward Current (I_F) vs. Forward Voltage (V_F) at Various Temperatures. HSCH-1001

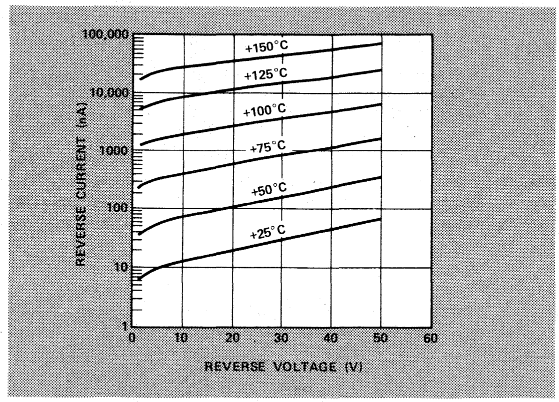


Figure 2. Typical Variation of Reverse Current (I_R) vs. Reverse Voltage (V_R) at Various Temperatures. HSCH-1001

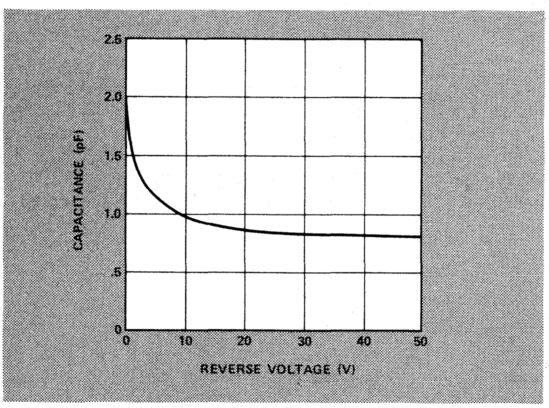


Figure 3. Typical Capacitance (C) vs. Reverse Voltage (V_R) at T_A = 25°C. HSCH-1001

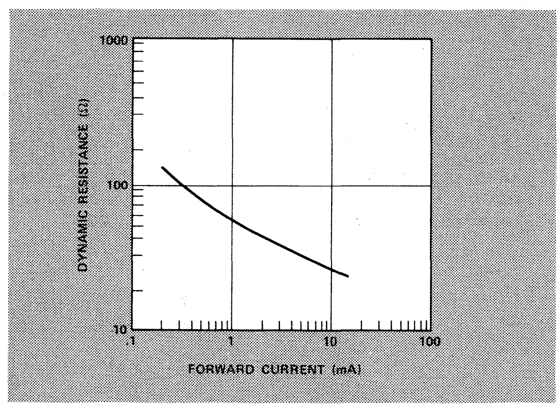


Figure 4. Typical Dynamic Resistance (R_D) vs. Forward Current (I_F) at = 25°C. HSCH-1001

HEWLETT hp PACKARD
COMPONENTS

SCHOTTKY BARRIER DIODES FOR STRIPLINE AND MICROSTRIP MIXERS AND DETECTORS

5082-2200 SERIES
5082-2229 SERIES
5082-2709 SERIES
5082-2765/66
5082-2774/75
5082-2785/86
5082-2794/95

Features

SMALL SIZE

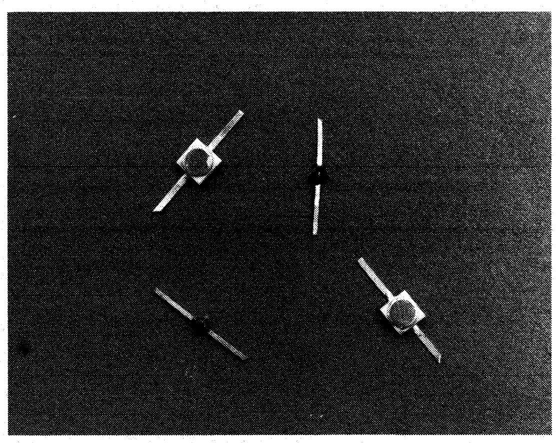
LOW NOISE FIGURE
6 dB Typical at 9 GHz

RUGGED DESIGN

HIGH UNIFORMITY

HIGH BURNOUT RATING
1 W RF Pulse Power Incident

BOTH MEDIUM AND LOW BARRIER AVAILABLE



Description/Applications

This family consists of medium barrier and low barrier beam lead diodes and these same diodes mounted in easily handled carrier packages. Low barrier diodes provide optimum noise figure at low local oscillator drive levels. Medium barrier diodes provide a wider dynamic range for lower distortion mixer designs. The family provides a range of both dc and rf specified diodes. Application Note 940 gives recommended handling and bonding techniques. Application Note 963 presents impedance matching techniques for mixer and detector circuits.

Selection Guide

Package Outline	Barrier	Part Number 5082-	Frequency Range (GHz)	Measure Of Performance*	Matched Pairs 5082-	Applications
05 Beam Lead	Medium	2709	1-12	0.25 pF	2509	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 through Ku Band.
		2716	1-18	0.15 pF	2510	
		2767	1-18	0.10 pF	**	
		2768	1-12	6.5 dB	2778	
		2769	1-18	7.5 dB (16 GHz)	2779	
	Low	2229	1-12	0.25 pF	*	
		2299	1-18	0.15 pF	**	
		2264	1-18	0.10 pF		
H-2 Hermetic	Medium	2200	1-12	6.0 dB	2201	The H-2 Package provides a hermetic carrier for the beam lead diodes for easier handling.
		2202	1-12	6.5 dB	2203	
	Low	2765	1-12	6.0 dB	2766	
		2785	1-12	6.5 dB	2786	
C-2 Broadband	Medium	2207	1-18	6.0 dB	2208	The C-2 package provides a broadband carrier for the beam lead diodes for easier handling.
		2209	1-18	6.5 dB	2210	
	Low	2774	1-18	6.0 dB	2775	
		2794	1-18	6.5 dB	2795	

*The measure of performance is C_T for DC specified diodes and NF at 9.375GHz for RF specified diodes.
**Matched pairs are available upon request.

RF Electrical Specifications at $T_A = 25°C$

Part Number 5082-	Package	Recommended Frequency	Barrier	L.O. Test Frequency (GHz)	Maximum Noise Figure NF (dB)	IF Impedance Min. ZIF	IF Impedance Max. (Ω)	Maximum SWR	Matched Pair 5082-
2768	Beam Lead	1-12 GHz	Medium	9.375	6.5	250	500	1.5:1	2778
2769		12-18 GHz	Medium	16	7.5	250	500	1.5:1	2779
2229		1-12 GHz	Low	9.375	6.5	100	300	1.5:1	*
2299		12-18 GHz	Low	16	7.5	100	300	1.5:1	*
2200	H-2	1-12 GHz	Medium	9.375	6.0	200	400	1.5:1	2201
2202		1-12 GHz	Medium	9.375	6.5	200	400	2.0:1	2203
2765		1-12 GHz	Low	9.375	6.0	100	300	1.5:1	2766
2785		1-12 GHz	Low	9.375	6.5	100	300	2.0:1	2786
2207	C-2	1-18 GHz	Medium	9.375	6.0	250	500	1.5:1	2208
2209		1-18 GHz	Medium	9.375	6.5	250	500	2.0:1	2210
2774		1-18 GHz	Low	9.375	6.0	200	400	1.5:1	2775
2794		1-18 GHz	Low	9.375	6.5	200	400	2.0:1	2795
Test Conditions					DC Load Resistance = 0 Ω L.O. power = 1 mW IF = 30 MHz, 1.5 dB NF				$\Delta NF \leq 0.3$ dB $\Delta Z_{IF} \leq 25\ \Omega$

*Matched pairs are available upon request.

DC Electrical Specifications at $T_A = 25°C$

BEAM LEAD DIODES

Part Number 5082-	Recommended Frequency	Barrier	Maximum Capacitance C_T (pF)	Maximum Forward Voltage = 1 V at Forward Current I_F (mA)	Maximum Reverse Current I_R (μA)	Batch Matched
2709	1-12 GHz	Medium	0.25	30	10	2509
2716	1-18 GHz	Medium	0.15	20	10	2510
2767	1-18 GHz	Medium	0.10	20	10	*
2229	1-12 GHz	Low	0.25	20	10	*
2299	1-18 GHz	Low	0.15	15	10	*
2264	1-18 GHz	Low	0.10	15	10	*
Test Conditions			$V_R = 0$ V f = 1 MHz		$V_R = 3$ V	$\Delta V_F \leq 15$ mV at 1 mA

*Matched pairs are available upon request.

Typical Detector Parameters

Parameter	Symbol	Typical Value	Units	Test Conditions
Tangential Sensitivity	TSS	-54	dBm	20 μA Bias
Voltage Sensitivity	γ	6.6	mV/μW	Video Bandwidth = 2 MHz R_L = 100KΩ
Video Resistance	R_V	1400	Ω	f = 10 GHz

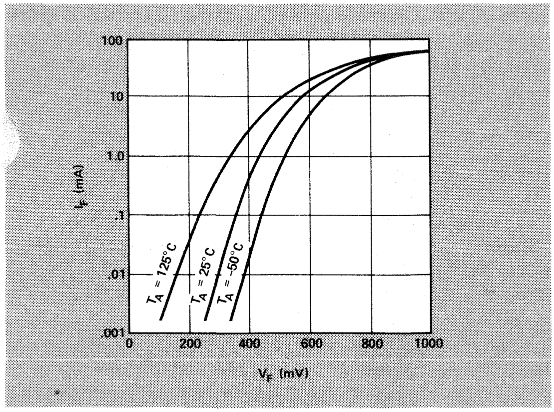


Figure 1. Typical Forward Characteristics, 5082-2709, -2509, -2768 and -2778.

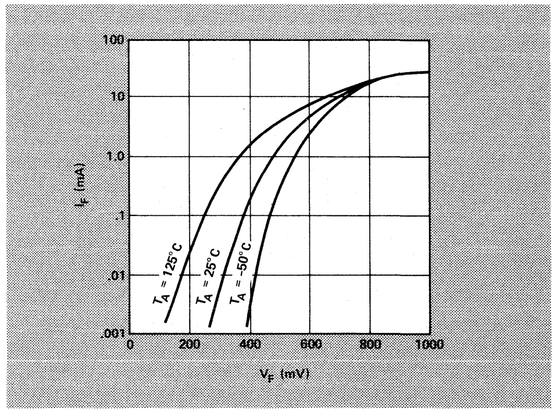
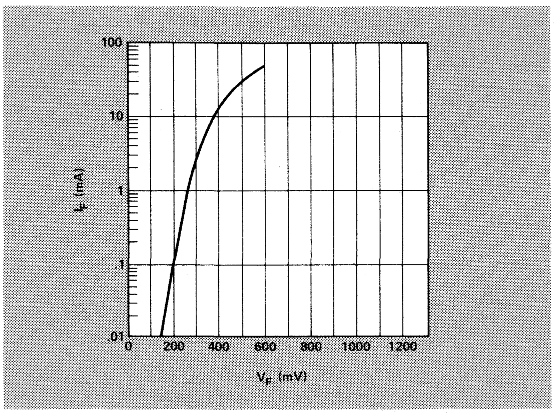


Figure 2. Typical Forward Characteristics, 5082-2716, -2510, -2767, -2769 and -2779.



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

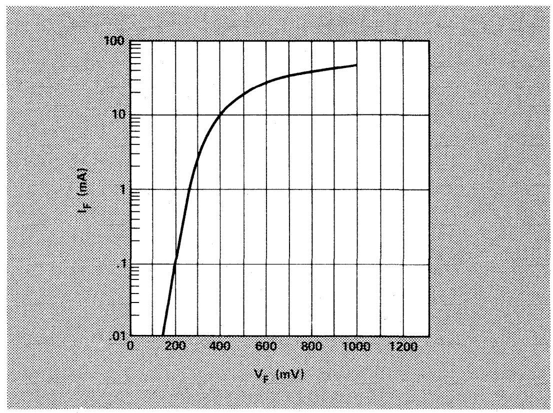


Figure 4. Typical Forward Characteristics, 5082-2299, at 25° C.

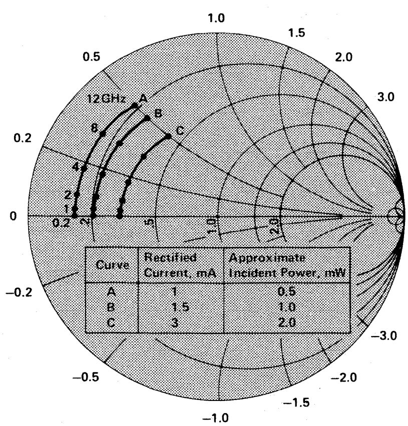


Figure 5. Typical Admittance Characteristics, 5082-2709, -2509, -2768 and -2778 with self bias.

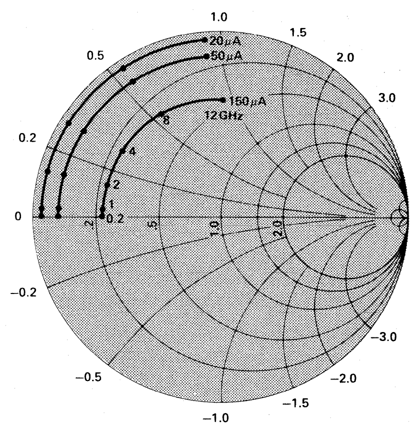
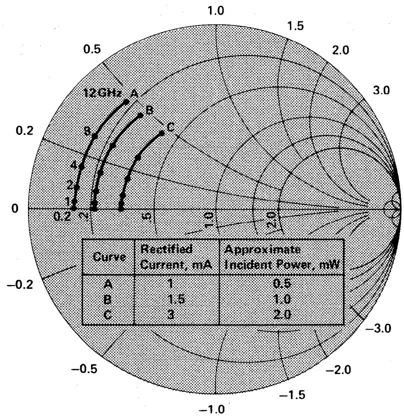


Figure 6. Typical Admittance Characteristics, 5082-2709, -2509, -2768 and -2778 with external bias.



Curve	Rectified Current, mA	Approximate Incident Power, mW
A	1	0.5
B	1.5	1.0
C	3	2.0

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

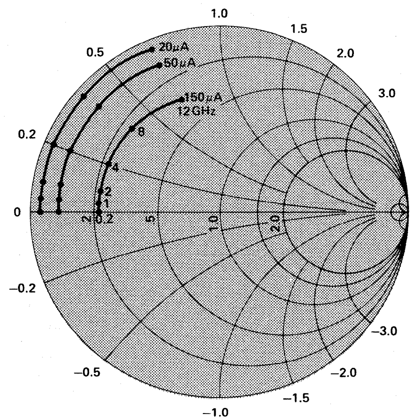


Figure 8. Typical Admittance Characteristics, 5082-2716, -2510, -2767, -2769 and -2779 with external bias.

Maximum Ratings at T_A=25°C

Pulse Power Incident at T_A = 25°C .... 1 W
(1 μs pulse, Du = .001 for 1 minute)

CW Power Dissipation T_A = 25°C
(Mounted in infinite Heat Sink)
Beam Lead Diodes .... 300 mW
C-2 and H-2 Packaged Diodes .... 125 mW
(Derate linearly to Zero at Maximum Operating Temperature)

Junction Operating and Storage Temperature Range
C-2 Packaged Diodes .... -65°C to +125°C
Beam Lead and H-2 Packaged Diodes .... -65°C to +150°C

Lead Strength, Beam Lead .... 2 grams

Diode Mounting Temperature
Beam Lead Diodes .... 220°C for 10 sec. max.
C-2 and H-2 Packaged Diodes .... 235°C for 10 sec. max.

Peak Inverse Voltage .... 3 V

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

Prolonged exposure to peak voltages exceeding PIV may cause gradual degradation of diode performance.

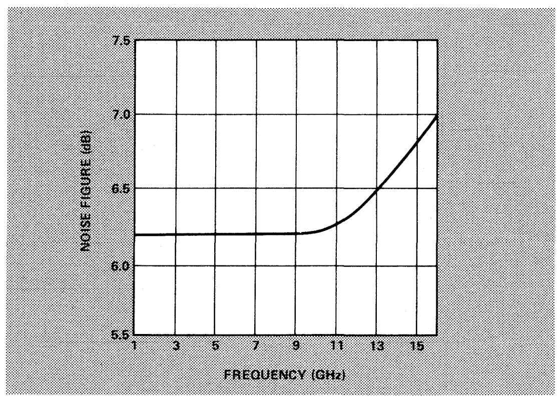


Figure 9. Typical Noise Figure vs. Frequency.

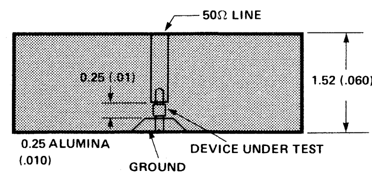
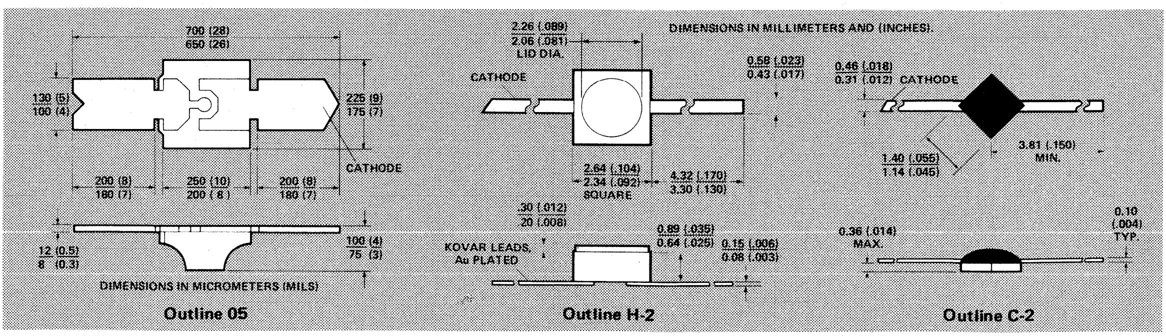


Figure 10. Admittance Test Circuit.

Package Dimensions



HEWLETT PACKARD COMPONENTS

SCHOTTKY BARRIER DIODE QUADS FOR DOUBLE BALANCED MIXERS

5082-2231/33
5082-2261/63
5082-2271/72
5082-2279/80
5082-2291/92
5082-2293/94
5082-2830/31

Features

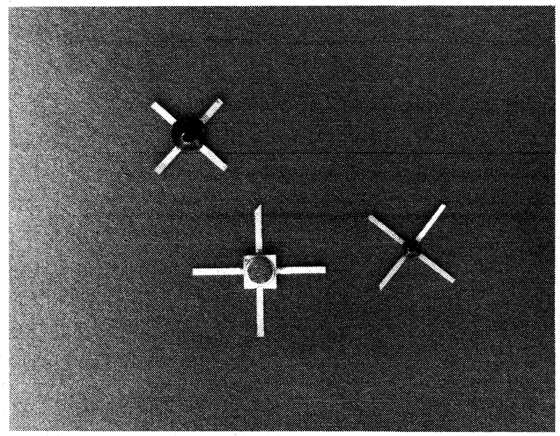
SMALL SIZE
Eases Broad Band Designs

TIGHT MATCH
Improves Mixer Balance

IMPROVED BALANCE OVER TEMPERATURE

RUGGED DESIGN

BOTH MEDIUM AND LOW BARRIER DIODES AVAILABLE



Description / Applications

These matched diode quads use a monolithic array of Schottky diodes interconnected in ring configuration. The relative proximity of the diode junction on the wafer assures uniform electrical characteristics and temperature tracking.

These diodes are designed for use in double balanced mixers, phase detectors, AM modulators, and pulse modulators requiring wideband operation and small size. The low barrier diodes allow for optimum mixer noise figure at lower than conventional local oscillator levels. The wider dynamic range of the medium barrier diodes allows for better distortion performance.

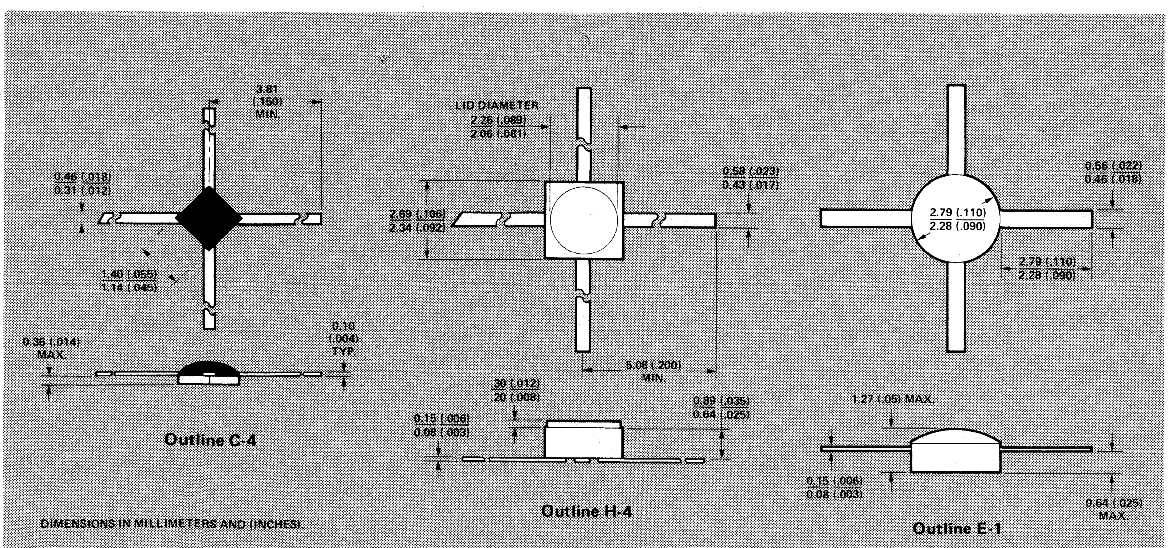
Maximum Ratings at $T_A = 25°C$

Junction Operating and Storage Temperature Range:
H-4 Packaged Diodes .... -65°C to +150°C
E-1 and C-4 Packaged Diodes .... -65°C to +125°C

DC Power Dissipation .... 75 mW per Junction
Derate linearly to zero at maximum rated temperature. (Measured in infinite heat sink.)

Soldering Temperature .... 220°C for 10 sec.

Package Dimensions



Selection Guide

Package Outline \ Frequency	Barrier	To 2 GHz	2-4 GHz	4-8 GHz	8-12 GHz	12-18 GHz
05	Medium	5082-9696	5082-9696	5082-9394	5082-9396	5082-9398
Beam Lead	Low	5082-9697	5082-9697	5082-9395	5082-9397	5082-9399
E-1	Medium	5082-2830	5082-2276	5082-2277		
Low Cost	Low	5082-2831				
H-4	Medium	5082-2261	5082-2261	5082-2263		
Hermetic	Low	5082-2231	5082-2231	5082-2233		
C-4	Medium	5082-2291	5082-2291	5082-2292	5082-2293	5082-2294
Broadband	Low	5082-2271	5082-2271	5082-2272	5082-2279	5082-2280

Electrical Characteristics at T_A=25°C / Typical Parameters

Part Number 5082-	Package	Maximum Capacitance C_T (pF)	Maximum Capacitance Difference ΔC_T (pF)	Forward Voltage V_F (V)[2]	Series Resistance R_S (Ω)
9697	05 Beam Lead	0.55	0.10	0.30	5
9395		0.40	0.10	0.30	5
9397		0.20	0.05	0.30	7
9399		0.15	0.05	0.30	7
9696		0.55	0.10	0.40	7
9394		0.35	0.10	0.40	7
9396		0.20	0.05	0.45	7
9398		0.15	0.05	0.45	7
2231	H-4	0.60	0.10	0.30	5
2233		0.35	0.05	0.30	7
2261		0.60	0.10	0.40	7
2263		0.35	0.05	0.45	7
2830	E-1	0.40	0.20	0.40	7
2831		0.40	0.20	0.25	7
2276		0.60	0.10	0.40	10
2277		0.40	0.10	0.45	15
2271	C-4	0.60	0.10	0.30	5
2272		0.45	0.10	0.30	5
2279		0.25	0.05	0.30	7
2280		0.20	0.05	0.30	7
2291		0.60	0.10	0.40	7
2292		0.40	0.10	0.40	7
2293		0.25	0.05	0.45	7
2294		0.20	0.05	0.45	7
Test Conditions		V_R=0 f=1 MHz[1]	V_R=0 f=1 MHz[1]	I_F=1mA Measured between Adjacent Leads.	

Notes: 1. Measured between diagonal leads. 2. Maximum ΔV_F = 20 mV at I_F = 5mA measured between diagonal leads.

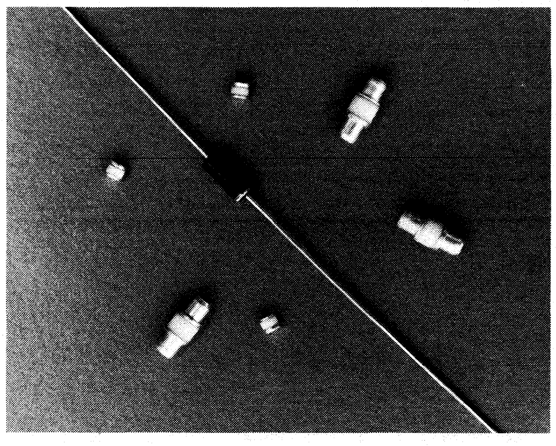
HEWLETT PACKARD
COMPONENTS

ZERO BIAS SCHOTTKY DETECTOR DIODE

HSCH-3171
HSCH-3206
HSCH-3207
HSCH-3486

Features

HIGH VOLTAGE SENSITIVITY
NO BIAS REQUIRED
CHOICE OF HIGH OR LOW VIDEO IMPEDANCE



Description/Applications

The high zero bias voltage sensitivity of these Schottky Barrier diodes makes them ideally suitable for narrow bandwidth video detectors, ECM receivers, and measurement equipment.

Maximum Ratings at T_A=25°C

Operating and Storage Temperature .... -60° C to +125° C
Incident RF Peak Power HSCH-3486,3207,3206 ... 1W
HSCH-3171 .... 0.5W
CW Power Dissipation @T = 25° C 150mW
(Power absorbed by Diode)
(Derate linearly to 0 W at 125° C)
Soldering Temperature .... 230° C for 5 sec.

Electrical Specifications at T_A=25°C

Part Number HSCH-	Package Outline	Maximum Tangential Sensitivity T_{SS} (dBm)	Minimum Voltage Sensitivity (mV/μW)	Video Resistance R_V (KΩ)	
				Min.	Max.
3486	15	-52	8	2	8
3171	15	-46	30	80	300
3207	44	-42	8	80	300
3206	49	-42	10	100	300
Test Conditions		Video Bandwidth = 2 MHz f_{test} = 10 GHz	Power in = -40 dBm f_{test} = 10 GHz		

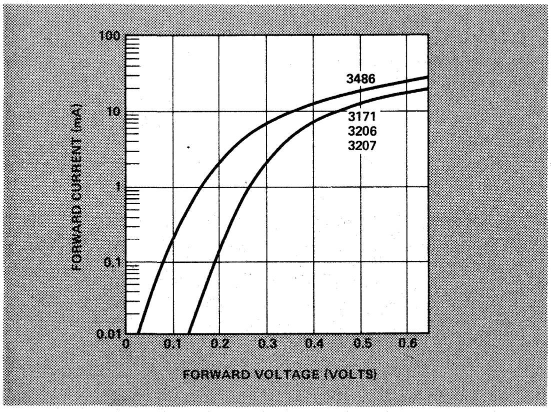


Figure 1. Typical I-V Characteristic.

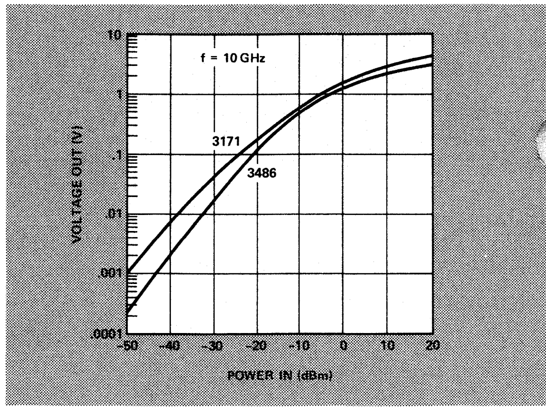
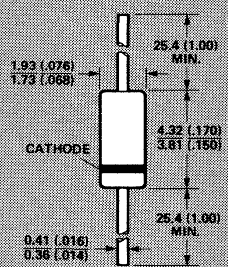


Figure 2. Dynamic Transfer Characteristic.

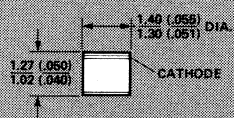
Package Dimensions



Outline 15

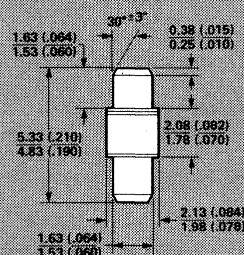
HSCH-3171

HSCH-3486



Outline 44

HSCH-3207



Outline 49

HSCH-3206

HEWLETT PACKARD
COMPONENTS

SCHOTTKY BARRIER DIODES FOR MIXERS AND DETECTORS

5082-2285/87
5082-2295/97
5082-2817
5082-2350 SERIES
5082-2701/02
5082-2711/13
5082-2721/23

Features

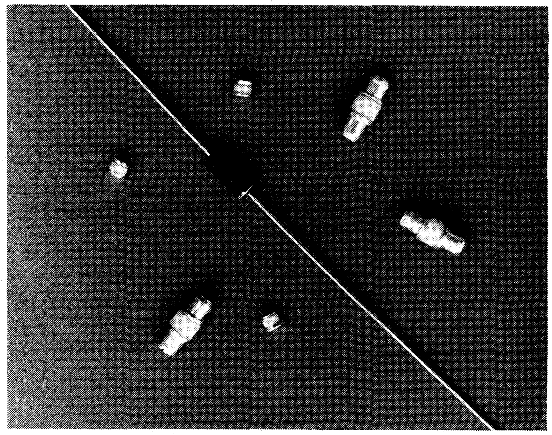
LOW AND STABLE NOISE FIGURE

HIGH BURNOUT RATING
1 W RF Pulse Power Incident

RUGGED DESIGN

HIGH UNIFORMITY

BOTH MEDIUM AND LOW BARRIER DIODES AVAILABLE



Description / Applications

These Schottky diodes are optimized for use in broad band and narrow band microstrip, coaxial, or waveguide mixer assemblies operating to 18 GHz. The low barrier diodes give optimum noise figure performance at low local oscillator drive levels. Medium barrier diodes provide a wider dynamic range for lower distortion mixer designs. The 5082-2350, -2400, -2510 and -2565 have extremely low 1/f noise, making them ideal for use as Doppler mixers.

Maximum Ratings at T_A=25°C

Junction Operating and Storage Temperature Range
5082-2400, 2401, 2565, 2566, 2350, 2351, 2520, 2521 .... -60°C to +125°C
All other diodes .... -60°C to +150°C

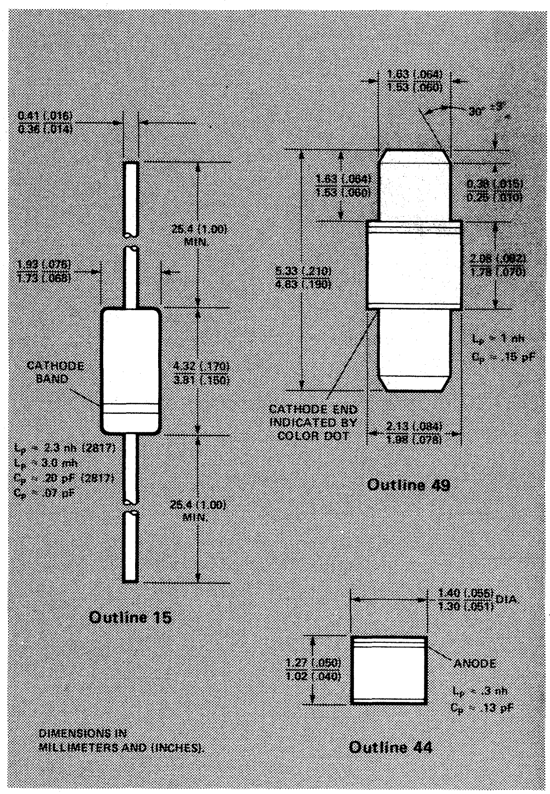
CW Power Dissipation .... 200 mW
Derate linearly to 0 W at max. rated temperature (Measured in an infinite heat sink).

Pulse Power Dissipation
Power absorbed by the diode. 1 μs pulse, Du = .001 (For 1 minute)
5082-2400, 2350 .... 15 W
5082-2565, 2520 .... 4 W
All other diodes .... 1 W

Soldering Temperature .... 230°C for 5 sec.

Note: These diodes are pulse sensitive. Handle with care to avoid static discharge through the diode. Prolonged exposure to peak voltages exceeding PIV may cause gradual degradation of diode performance.

Package Dimensions



Selection Guide

Package Outline	Barrier	Noise Figure NF (dB)	Frequency: To 2 GHz	Frequency: 2-6 GHz	Frequency: 6-12 GHz	Frequency: 12-18 GHz
15	Medium	6.0	5082-2817 5082-2400	5082-2565		
		7.0	5082-2350	5082-2520		
49	Medium	6.0			5082-2713	
		6.5			5082-2711	5082-2723 5082-2721*
	Low	6.0			5082-2285	
		6.5			5082-2287	
44	Medium	6.0			5082-2701	
		6.5			5082-2702	5082-2273
	Low	6.0			5082-2295	
		6.5			5082-2297	

*The Noise Figure for the 5082-2721 is 7.0 dB.

Electrical Characteristics at $T_A = 25°C$

Part Number 5082-	Package Outline	Barrier	LO Test Frequency (GHz)	Maximum Noise Figure NF(dB)	IF Impedance Z_{IF} (Ω) Min.	IF Impedance Z_{IF} (Ω) Max.	Maximum SWR	Matched Pair 5082-
2817	15	Medium	2.0	6.0	250	400	1.8:1	2818
2400		Medium	2.0	6.0	150	250	1.5:1	2401
2350		Medium	2.0	7.0	150	250	1.5:1	2351
2565		Medium	3.0	6.0	100	250	1.5:1	2566
2520		Medium	3.0	7.0	100	250	1.5:1	2521
2713	49	Medium	9.375	6.0	200	400	1.5:1	2714
2711		Medium	9.375	6.5	200	400	2.0:1	2712
2285		Low	9.375	6.0	100	250	1.5:1	2286
2287		Low	9.375	6.5	100	250	2.0:1	2288
2701	44	Medium	9.375	6.0	200	400	1.5:1	2706
2702		Medium	9.375	6.5	200	400	1.5:1	2707
2295		Low	9.375	6.0	100	250	1.5:1	2296
2297		Low	9.375	6.5	100	250	2.0:1	2298
2723	49	Medium	16	6.5	200	400	1.5:1	2724
2721		Medium	16	7.0	200	400	2.0:1	2722
2273	44	Medium	16	6.5	200	400	2.0:1	2298
Test Conditions			L.O. Power = 1 mW IF = 30 MHz, 1.5 dB NF Zero DC Load Resistance (100Ω for 5082-2817)		Same as for NF except IF = 10 KHz		Same as for NF	$\Delta NF \leq 0.3dB$ $\Delta Z_{IF} \leq 25\Omega$

Typical Parameters

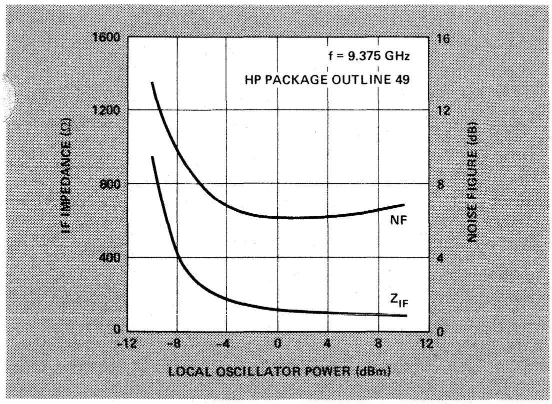


Figure 1. Typical Noise Figure and IF Impedance vs. Local Oscillator Power, 5082-2285 through -2288 (Package 49). Diode unmatched in 50Ω line.

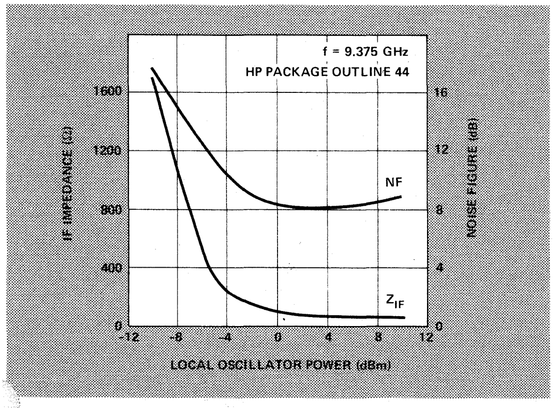


Figure 2. Typical Noise Figure and IF Impedance vs. Local Oscillator Power, 5082-2295 through -2298 (Package 44). Diode unmatched in 50Ω line.

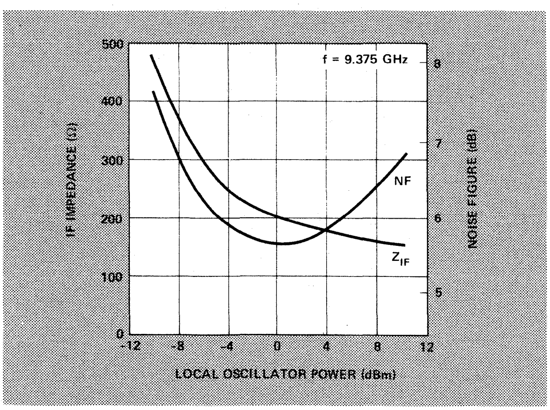


Figure 3. Typical Noise Figure and IF Impedance vs. Local Oscillator Power. Diode matched at each local oscillator power level (5082-2285, 2295).

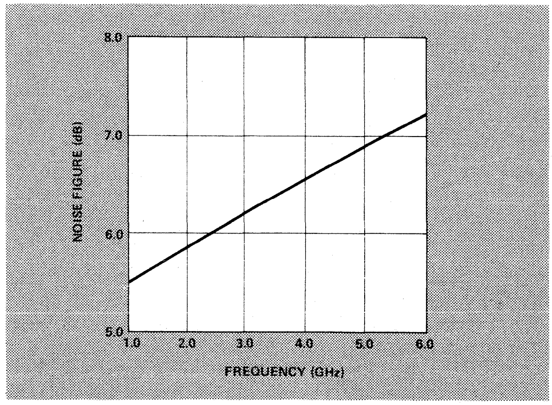


Figure 4. Typical HP 5082-2400 Noise Figure vs. Frequency with P_{LO} = 1.0 mW, f_{IF} = 30 MHz, and NF_{IF} = 1.5 dB. Mount tuned at each frequency.

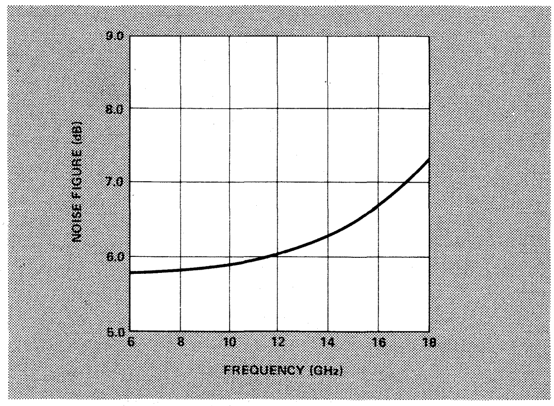


Figure 5. Typical Single Sideband Noise Figure vs. Frequency. IF = 30 MHz, NF_{IF} = 1.5 dB, P_{LO} = 1 mW. Diode matched at each frequency (5082-2200, 2700 series).

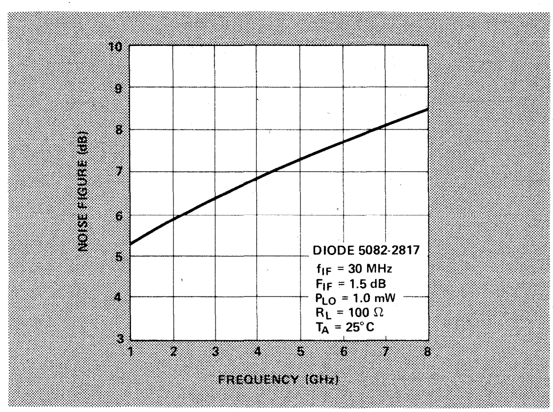


Figure 6. Single Sideband Noise Figure (including an IF-amplifier noise figure of 1.5 dB) vs. Frequency. The mount is tuned for minimum noise figure at each frequency.

Typical Parameters (Continued)

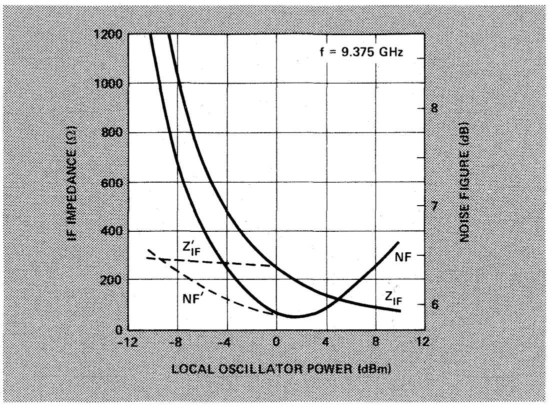


Figure 7. Typical Noise Figure and IF Impedance for 5082-2711 vs. Local Oscillator Power. Note the improved performance at low levels of LO power when dc bias is superimposed (dashed curves).

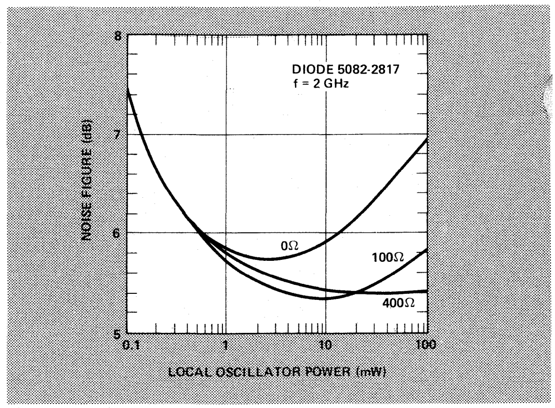


Figure 8. Single Sideband Noise Figure (including an IF-amplifier noise figure of 1.5 dB) vs. Incident LO Power for Various dc-load Resistances R_L. (The mount is tuned for minimum noise figure at each LO power level).

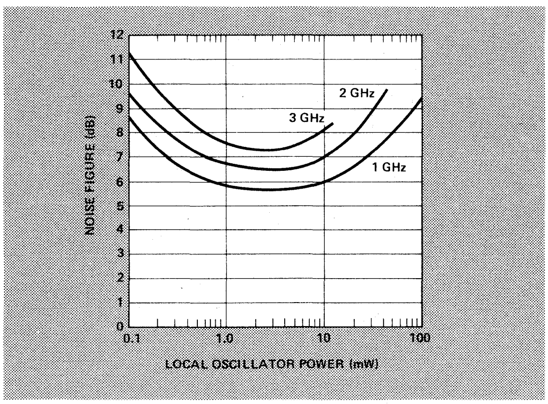


Figure 9. Typical 5082-2350 Noise Figure vs. Local Oscillator Power at 1.0, 2.0 and 3.0 GHz with f_{IF} = 30 MHz and NF_{IF} - 1.5 dB.

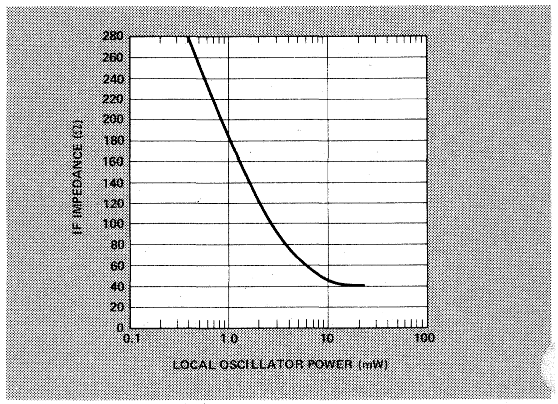


Figure 10. Typical 5082-2300 and 2400 Series IF Impedance vs. Local Oscillator Power with f_{LO} = 2.0 GHz and f_{IF} = 30 MHz.

HEWLETT hp PACKARD
COMPONENTS

SCHOTTKY BARRIER DIODES FOR DETECTORS

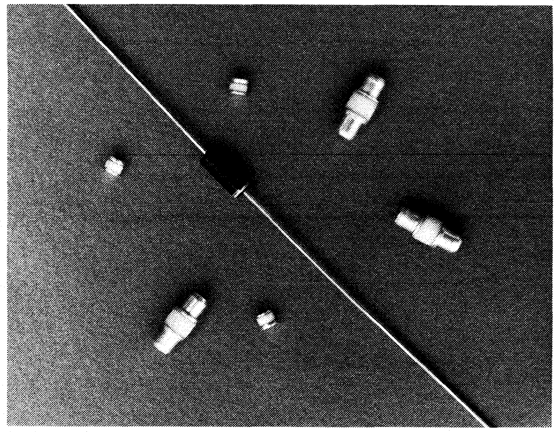
5082-2750/51
5082-2755
5082-2787
5082-2824

Features

IMPROVED DETECTION SENSITIVITY
TSS OF -55 dBm at 10 GHz

LOW 1/f NOISE
Typical Noise-Temperature Ratio = 4 dB at 1 kHz

HIGH PEAK POWER DISSIPATION
4.5 W RF Peak Pulse Power



Description / Applications

The low 1/f noise and high voltage sensitivity make these Schottky barrier diodes ideally suitable for narrow bandwidth video detectors, and Doppler mixers as required in Doppler radar equipment, ECM-receivers, and measurement equipment.

Maximum Ratings at $T_A = 25°C$

Junction Operating and Storage Temperature Range
- 5082-2824 .... -65°C to +200°C
- All Others .... -60°C to +150°C

DC Power Dissipation — Power Absorbed by Diode
- Derate Linearly to zero at Maximum Temperature
  - 5082-2824 (Applied for 1 minute) .... 1 W
  - 5082-2824 (Continuous) .... 250 mW
  - All Others (Continuous) .... 100 mW

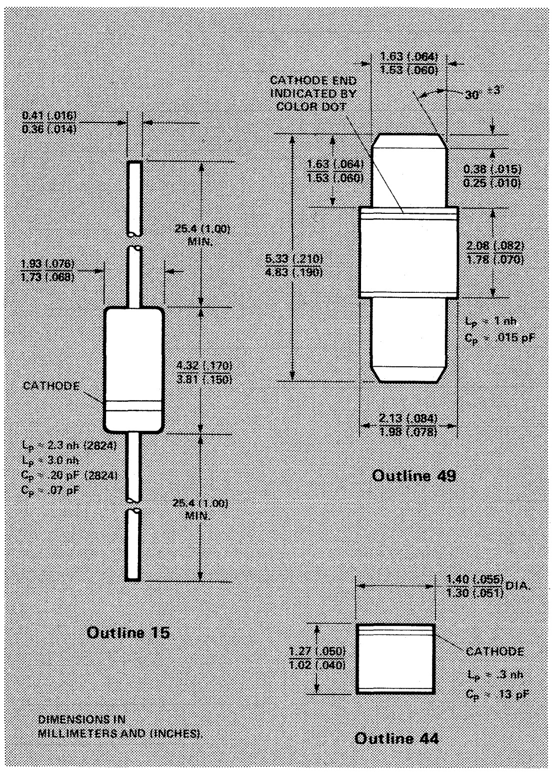
Soldering Temperature .... 230°C for 5 sec.

RF Peak Pulse Power
- Pulse Width = 1 μs, Du = .001, R_L = 38K Ω (Applied for 1 minute)
  - 5082-2824 (Power Absorbed by Diode) ..... 4.5 W
  - All Others (Power Incident) .... 2.0 W

Maximum Peak Inverse Voltage (PIV) .... V_{BR}

Prolonged exposure to peak voltages exceeding PIV may cause gradual degradation of diode performance.

Package Dimensions



Electrical Specifications at $T_A = 25°C$ / Typical Parameters

Part Number 5082-	Package Outline	Maximum Tangential Sensitivity TSS (dBm)	Voltage Sensitivity Minimum γ (mV/µW)	Video Resistance Rv (kΩ) Min.	Video Resistance Rv (kΩ) Max.	Noise Temperature Ratio at f (dB)	Breakdown Voltage V_{BR} (V)
2824	15	-56	6.0	1.2	1.5	2 at 20 kHz 8 at 1 kHz	15
2787*	15	-52	3.5	1.2	1.6	5.0 at 20 kHz 15.0 at 1 kHz	4
2755	15	-55	5.0	1.2	1.6	5.0 at 20 kHz 15.0 at 1 kHz	5
2751	49	-55	5.0	1.2	1.6	5.0 at 20 kHz 15.0 at 1 kHz	5
2750	44	-55	5.0	1.2	1.6	5.0 at 20 kHz 15.0 at 1 kHz	5
Test Conditions		Video Bandwidth = 2 MHz f_{RF} = 2GHz for 5082-2824, 10 GHz for all others I_{BIAS} = 20 µA; Video Amp Eq. Noise, R_A = 500Ω.	Same as for TSS at RF Signal Power Level of -40 dBm			R_V = 50 Ω	I_R = 10 µA

*RF Parameters for the 5082-2787 are sample tested only.

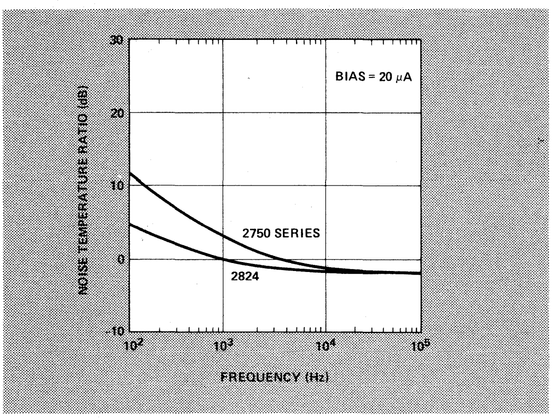


Figure 1. Typical Flicker (1/f) Noise vs. Frequency.

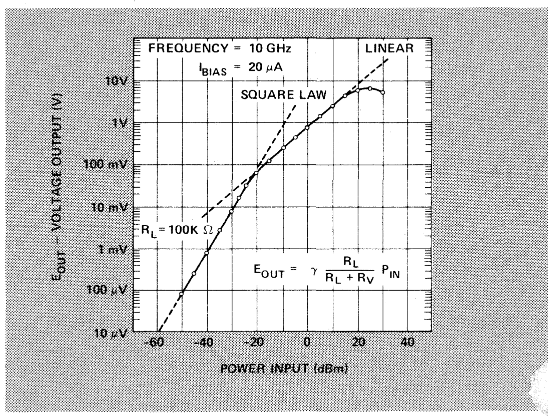


Figure 2. Typical Dynamic Transfer Characteristic. (5082-2750 Series).

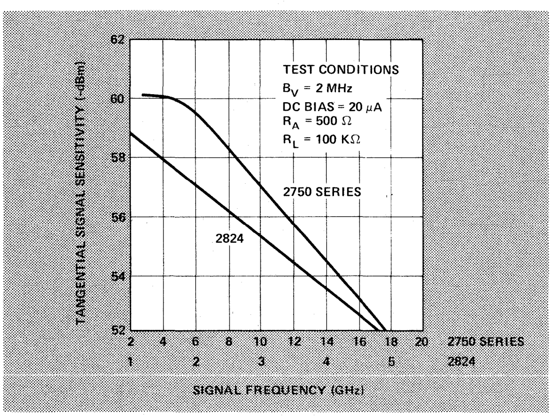


Figure 3. Typical TSS vs. Frequency.

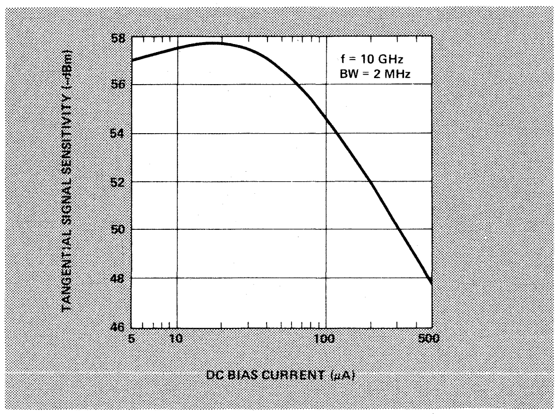


Figure 4. Typical TSS vs. Bias (5082-2750 Series).

HEWLETT PACKARD
COMPONENTS

PRINTED CIRCUIT BALANCED MIXER

5082-9200

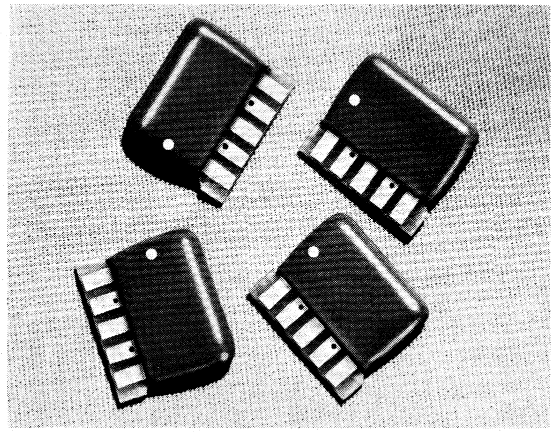
Features

LOW DISTORTION:
2nd Order Intercept +32 dBm
3rd Order Intercept +8 dBm

LOW CONVERSION LOSS:
6.5 dB

RUGGED:
Only 2 Discrete Parts

LOW COST:
Prices for High Volume Applications



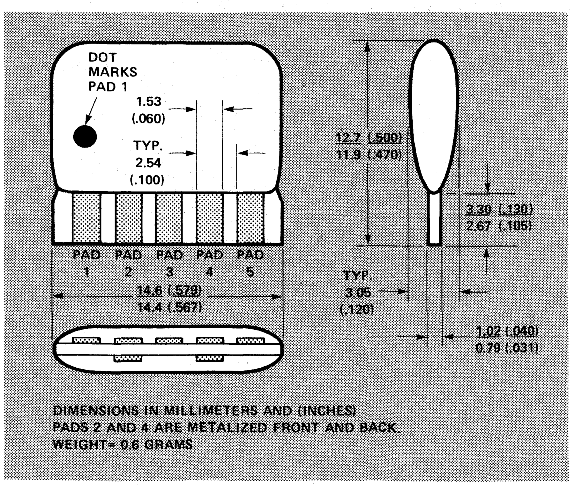
Description/Applications

The 5082-9200 is a single balanced mixer which exhibits excellent performance and reliability. Its design combines the advantages of three proven technologies: Schottky beam lead diodes, printed circuit boards, and epoxy encapsulation. The unique Hewlett-Packard monolithic diode pair and printed circuit transformer are optimized for low distortion, high isolation, and low conversion loss. The epoxy encapsulation provides a very rugged, low cost package for the mixer. The 5082-9200 package is designed to facilitate PC board insertion and solder connection.

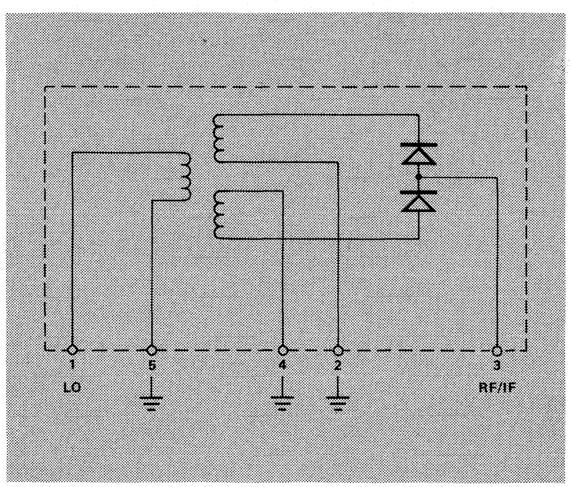
The 5082-9200 is designed for high volume mixer applications requiring a high degree of product uniformity and reliability. This low distortion, low-loss mixer performs well in many applications including TV, CATV, FM stereo, avionics, mobile radio, and instrumentation.

Other 5082-9200 functions include phase detection, sampling and doubling.

Package Dimensions



Schematic



Maximum Ratings at $T_A = 25°C$

Operating Temperature Range . . . . –30°C to 100°C
Storage Temperature Range . . . . –55°C to 100°C
Operating Power (either port) . . . . 100mW max @ 25°C
Pad Soldering Temperature . . . . 230°C for 10 sec. max.

Electrical Specifications at $T_A = 25°C$

Parameter	Min.	Typical	Max.	Units	Test Conditions [1]
Conversion Loss		6.5	7.5	dB	RF = 200–600MHz
		7.5	8.0	dB	RF = 600–900MHz
Isolation (LO To RF/IF)	45	See Figure 5		dB	LO = 200MHz
	25				LO = 900MHz
RF/IF Frequency Range		DC to 1200		MHz	
LO Frequency Range		100 to 1200		MHz	
Signal Compression		+6		dBm	RF input level for 1dB output compression
Two Tone Intermodulation Output Intercepts					LO = 660MHz
• Second Order		+32		dBm	RF_1 = 600MHz
• Third Order		+8			RF_2 = 602MHz

Typical Parameters (Conditions per note [1])

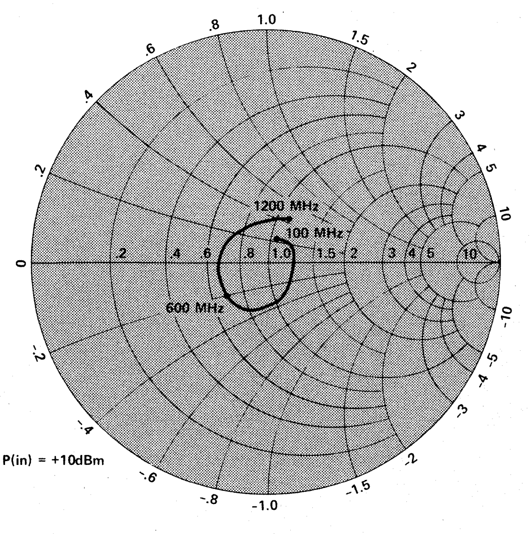
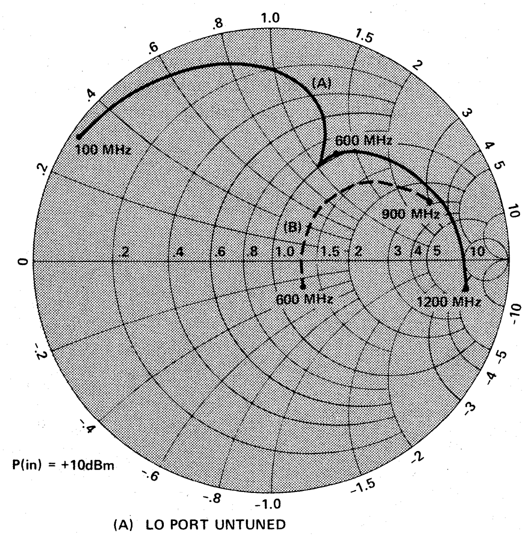


Figure 1. RF/IF Impedance Plot



(A) LO PORT UNTUNED
(B) LO PORT TUNED WITH SERIES C = 2.7pf

Figure 2. LO Impedance Plot

NOTE [1] Basic Test Conditions:
LO Level = +10dBm
RF Level = –5dBm
IF frequency = 60MHz

50 ohm resistive system
Filter losses not included
Mixer mounted as shown on Figure A and B.

Typical Parameters (Continued)

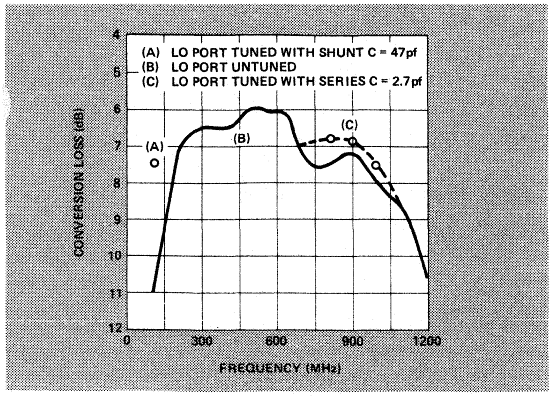


Figure 3. Conversion Loss vs. Frequency

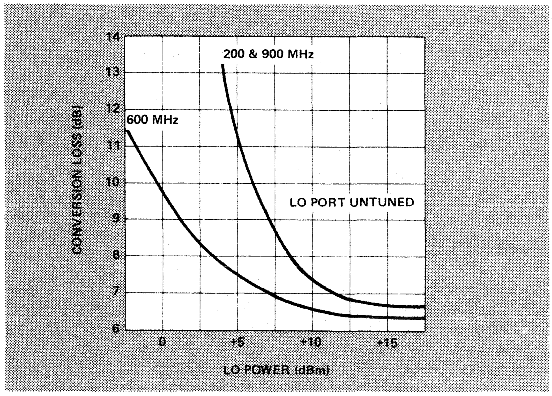


Figure 4. Conversion Loss vs. LO Power

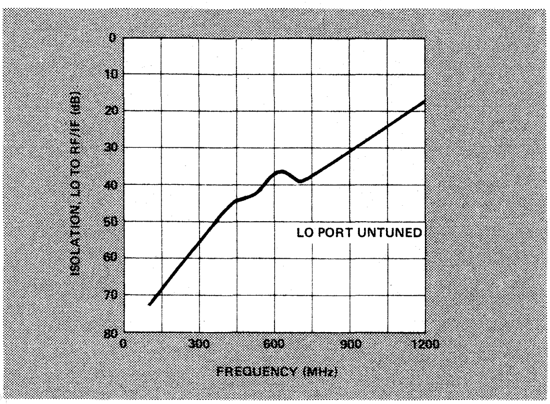


Figure 5. Isolation vs. Frequency

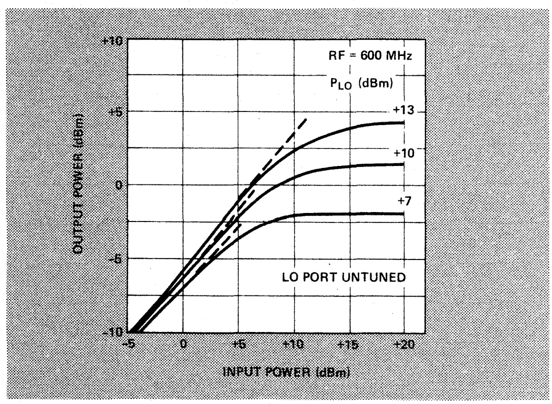


Figure 6. Signal Compression vs. LO Power

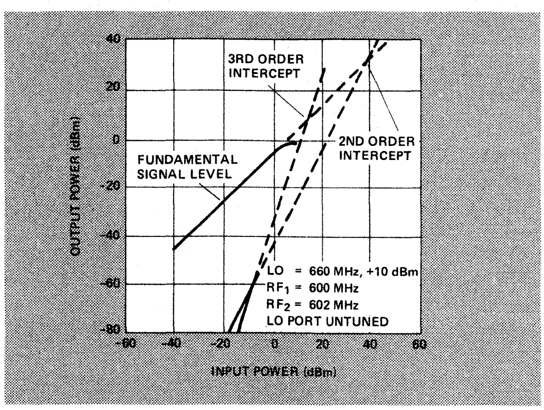


Figure 7. Two Tone Intermodulation

Circuit Board Mounting

Figure A is a test circuit board layout for the mixer in 50Ω microstrip form. Single sided layouts are satisfactory.

For optimum mixer performance, pads 2 & 4 should be soldered to RF ground from both sides of the 5082-9200 (Figure B), using either conventional hand soldering or high volume wave-soldering techniques.

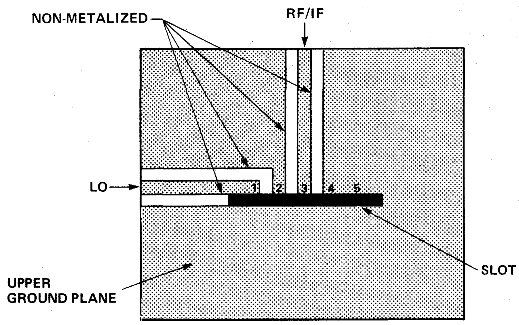


Figure A. Transmission Line Side

CIRCUIT BOARD

Glass Epoxy
(dielectric constant ≅ 5)

Thickness: 0.79mm (.031")

Line Width: 1.3mm (.050")

Line Spacing: 1.3mm (.050")

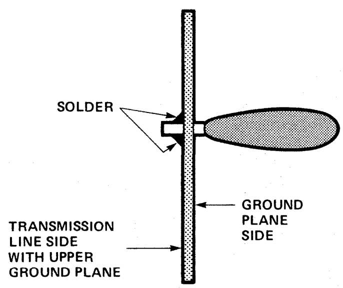


Figure B. Side View

Mixer Use

The 5082-9200 is a single balanced mixer with a common RF/IF port. A diplexer is required to separate the two signals. Many existing RF and IF filters will adequately perform the diplexing. Additionally, the diplexer can be designed to serve other functions.

1) RF input filtering for out-of-band protection.
2) IF selectivity improvement.
3) Image termination.
4) Spurious products termination.

Figure C is a schematic of a diplexer designed for RF operation of greater than 300MHz with an IF of 60MHz, using the Figure A circuit board.

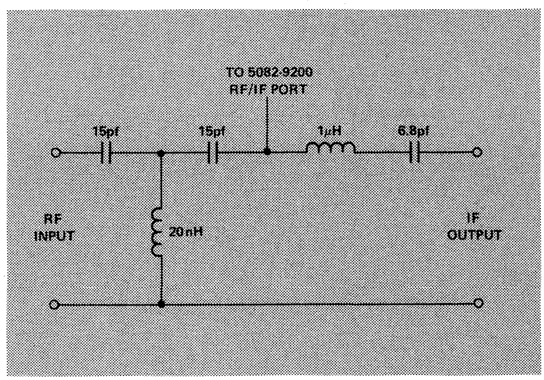
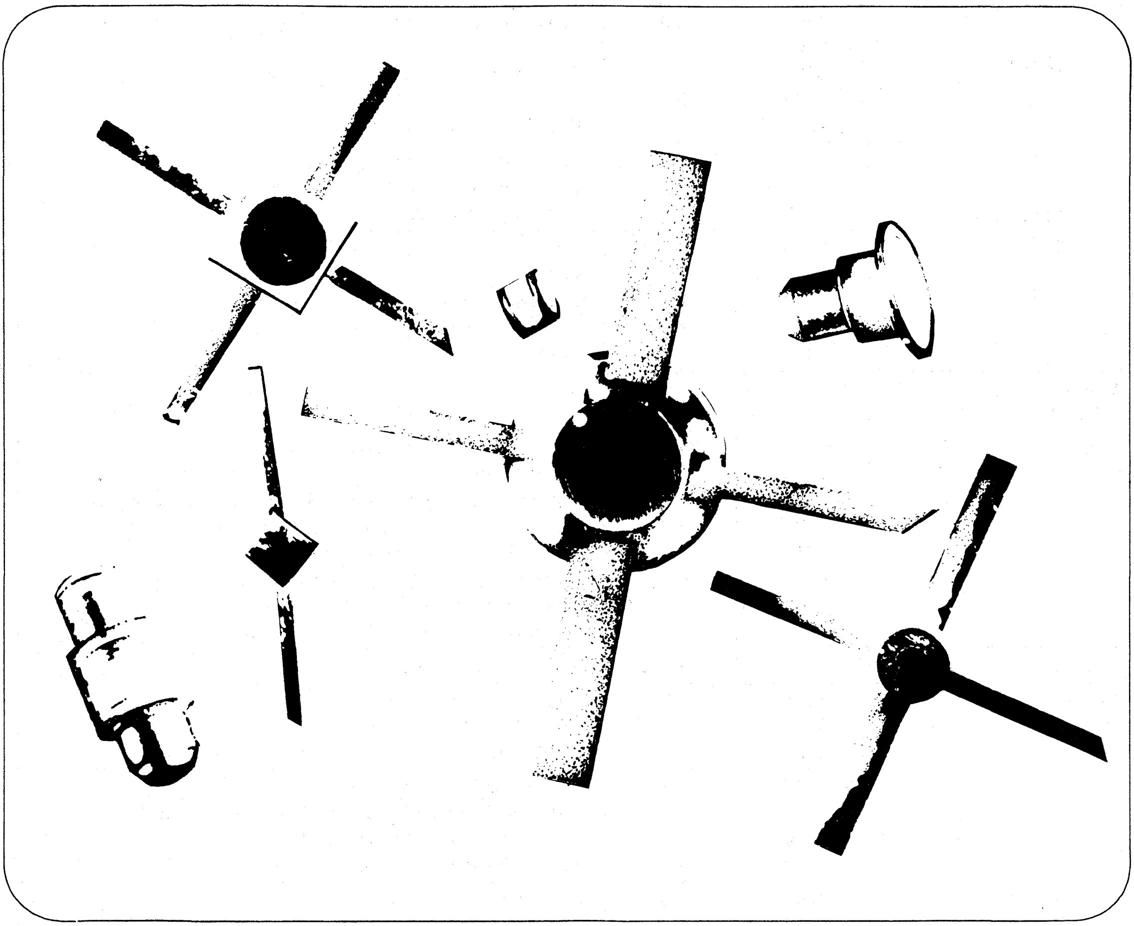


Figure C.

Additional details are contained in Hewlett Packard Application Note # AN965 "Printed Circuit Balanced Mixer, Design and Applications."

Signal Control Diodes



Signal Control Diodes — Selection Guide

PACKAGE	PART NO. 5082-	PAGE NO.	DESCRIPTION
Glass 15	3080	2-3	VHF/UHF Attenuating and AGC
	3081	2-3	
	1N5767		
	3077	2-3	General Purpose VHF/UHF/Microwave
	3001	2-3	
	3002	2-3	
	3039	2-3	
	3003	2-3	Specified for Controlled Attenuation
	3004	2-3	
	3042	2-3	10ns Switching
	3043	2-3	
	3168	2-3	VHF/UHF Band Switching
	3188	2-3	
Ceramic 31	3201	2-9	Medium Power — Anode Heat Sink
	3202	2-9	
	3303	2-9	Medium Power — Cathode Heat Sink
	3304	2-9	
	3306	2-9	10ns Switching — Cathode Heat Sink
Ceramic 38	3101	2-9	Medium Power — Anode Heat Sink
	3102	2-9	
	3301	2-9	Medium Power — Cathode Heat Sink
	3302	2-9	
	3305	2-9	10ns Switching — Cathode Heat Sink
Stripline (Hermetic) 60 61	3141	2-15	10ns Switching — Cathode Heat Sink
	3170	2-15	Medium Power — Cathode Heat Sink
	3140	2-15	Medium Power — Canode Heat Sink
	3041	2-15	10ns Switching — Cathode Heat Sink
	3304	2-9	Medium Power — Cathode Heat Sink
	3040	2-15	Medium Power — Anode Heat Sink
	3046	2-15	High Pulse Power — Anode Heat Sink
	3071	2-15	Limiter
Devices for Hybrid Integrated Circuits			
Chip	0001	4-3	10ns Switching — Cathode Back Contact
	0025	4-3	VHF/UHF Attenuating and AGC — Anode Back Contact
	0039	4-3	VHF/UHF Attenuating and AGC — Anode Back Contact
	0034	4-3	VHF/UHF Band Switching — Cathode Back Contact
	0012	4-3	General Purpose — Anode Back Contact
	0030	4-3	General Purpose — Cathode Back Contact
	0047	4-3	General Purpose — Anode Back Contact
	0049	4-3	General Purpose — Anode Back Contact
Beam Lead	3900	2-7	Beam Lead PIN Diodes
LID	3045	4-3	10ns Switching
	3085	4-3	VHF/UHF Attenuating and AGC
	3005	4-3	General Purpose
Ministrip	3010	4-3	10ns Switching — Cathode Heat Sink
	3086	4-3	VHF/UHF Attenuating and AGC — Anode Heat Sink
	3000	4-3	General Purpose — Anode Heat Sink
	3309	4-3	General Purpose — Cathode Heat Sink
Microstrip Post	3258	4-3	10ns Switching — Cathode Heat Sink
	3259	4-3	General Purpose — Anode Heat Sink

HEWLETT PACKARD
COMPONENTS

PIN DIODES FOR RF SWITCHING AND ATTENUATING

5082-3001/02
5082-3003/04
5082-3039
5082-3042/43
5082-3077
5082-3080/81
5082-3168/88

Features

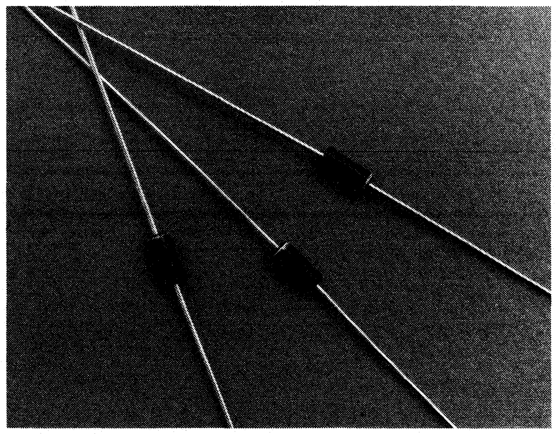
LOW HARMONIC DISTORTION

LARGE DYNAMIC RANGE

LOW SERIES RESISTANCE

LOW CAPACITANCE

LOW TEMPERATURE COEFFICIENT
Typically Less Than 20% Resistance Change from 25°C to 100°C

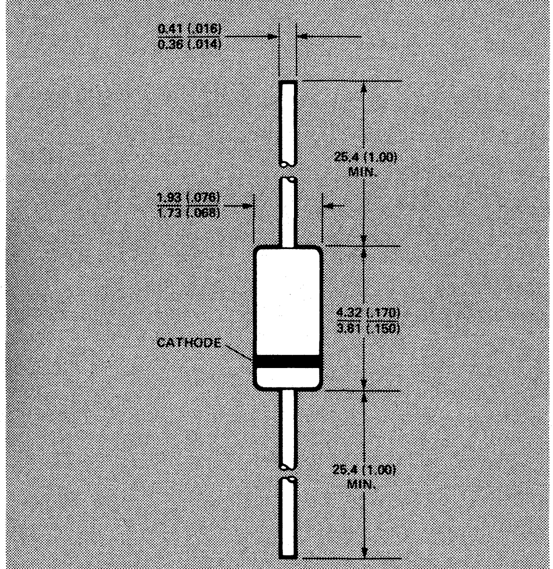


Description / Applications

The general purpose switching diodes are intended for low power switching applications such as RF duplexers, antenna switching matrices, digital phase shifters, and time multiplex filters. The 5082-3168/3188 are optimized for VHF/UHF bandswitching.

The RF resistance of a PIN diode is a function of the current flowing in the diode. The current controlled resistors are specified for use in control applications such as variable RF attenuators, automatic gain control circuits, RF modulators, electrically tuned filters, analog phase shifters, and RF limiters.

Package Dimensions



Outline 15

DIMENSIONS IN MILLIMETERS AND (INCHES).

Maximum Ratings at $T_A = 25°C$

Junction Operating and Storage Temperature Range .... -65°C to +150°C
Power Dissipation .... 250 mW
(Derate linearly to zero at 150°C)
Peak Inverse Voltage (PIV) .... V_{BR}
Soldering Temperature .... 235°C, 5 sec.

General Purpose Diodes
Electrical Specifications at $T_A = 25°C$

Part Number 5082-	Maximum Total Capacitance C_T	Minimum Breakdown Voltage V_{BR}	Maximum Residual Series Resistance R_S	Minimum Effective Carrier Lifetime τ	Maximum Reverse Recovery Time t_{rr}
GENERAL PURPOSE SWITCHING AND ATTENUATING					
3002	0.2	300	1.0	100	100 (typ)
3001	0.25	200	1.0	100	100 (typ)
3039	0.25	150	1.25	100	100 (typ)
3077	0.3	200	1.5	100	100 (typ)
FAST SWITCHING					
3042	0.4*	70	1.0*	15 (typ)	5
3043	0.4*	50	1.5*	15 (typ)	10
BAND SWITCHING					
3188	1.0*	35	0.6**	40 (typ)	12 (typ)
3168	2.0*	35	0.5**	40 (typ)	12 (typ)
Test Conditions	$V_R = 50V$ *$V_R = 20V$ f = 1 MHz	$V_R = V_{BR}$ Measure $I_R \leqslant 10\mu A$	$I_F = 100mA$ *$I_F = 20mA$ **$I_F = 10mA$ f = 100 MHz	$I_F = 50mA$ $I_R = 250mA$	$I_F = 20mA$ $V_R = 10V$ 90% Recovery

Note: Typical CW power switching capability for a short switch in a 50Ω system is 2.5W.

RF Current Controlled Resistor Diodes
Electrical Specifications at $T_A = 25°C$

Part Number 5082-	Minimum Effective Carrier Lifetime τ	Minimum Breakdown Voltage V_{BR}	Maximum Residual Series Resistance R_S	Maximum Total Capacitance C_T	High Resistance Limit, R_H		Low Resistance Limit, R_L		Resistance vs. Bias Slope, χ	
					Min.	Max.	Min.	Max.	Min.	Max.
3003	100	100	1.5	0.3	920	1380	16	24	-0.9	-0.86
3004	100	100	1.5	0.3	690	1040	12	18	-0.9	-0.86
3080(IN5767)*	1300(typ)	100	2.5	0.4	1000	—		8**		
3081	2000(typ)	100	3.5	0.4	1500			8**		
Units	ns	V	Ω	pF	Ω		Ω		—	
Test Conditions	I_F=50mA I_R=250mA	$V_R = V_{BR}$, Measure $I_R \leqslant 10\mu A$	I_F=100mA f=100mHz	V_R=50V f=1mHz	I_B=0.01mA f=100mHz		I_B=1.0mA **I_B=20mA f=100mHz		I_B=0.01mA and 1.0mA f=100mHz	

*The IN5767 has the additional specifications:
τ = 1.0 μsec minimum
I_R = 1 μA maximum at V_R = 50V
V_F = 1V maximum at I_F = 100mA.

Typical Parameters

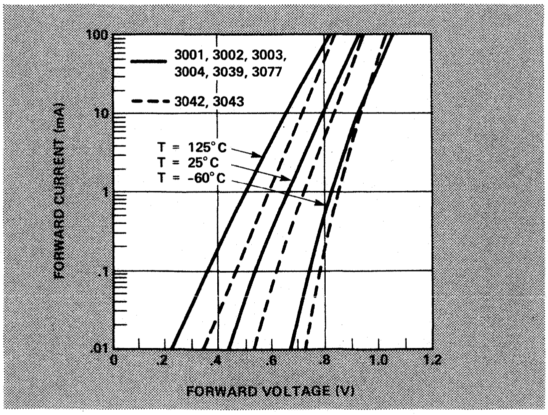


Figure 1. Typical Forward Current vs. Forward Voltage.

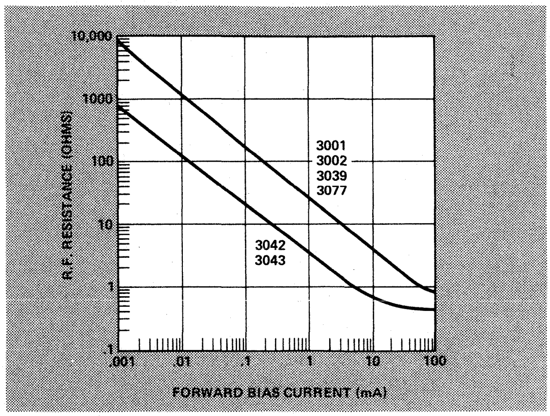


Figure 2. Typical RF Resistance vs. Forward Bias Current.

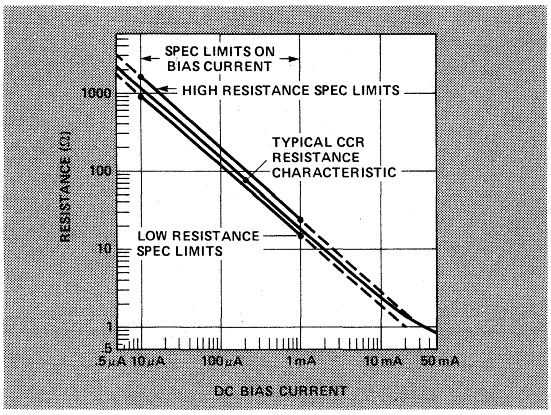


Figure 3. RF Resistance vs. Bias Current for 5082-3003.

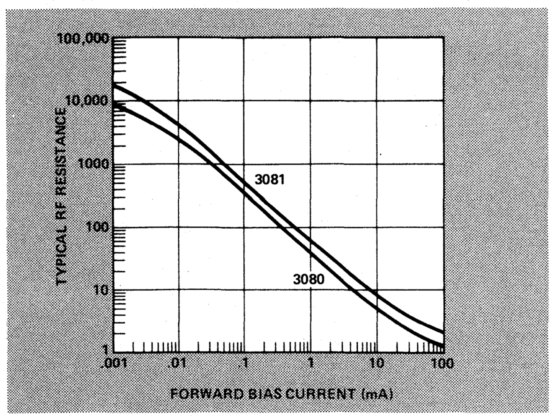


Figure 4. Typical RF Resistance vs. Forward Bias Current.

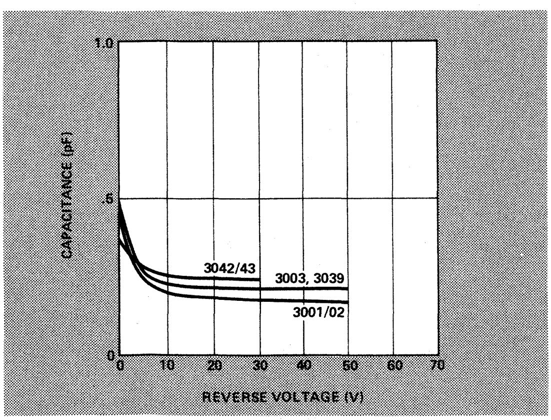


Figure 5. Typical Capacitance vs. Reverse Voltage 5082-3001,3002,3003,3039,3042,3043.

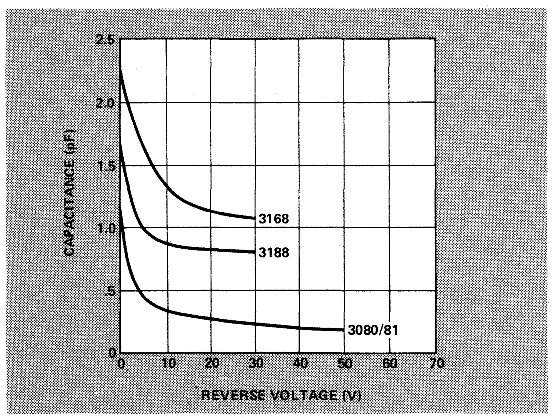


Figure 6. Typical Capacitance vs. Reverse Voltage 5082-3080, 3081,3168,3188.

Typical Parameters (Continued)

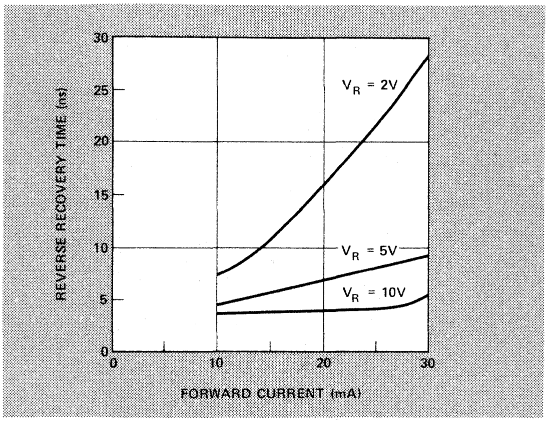


Figure 7. Typical Reverse Recovery Time vs. Forward Current for Various Reverse Driving Voltages, 5082-3042,3043.

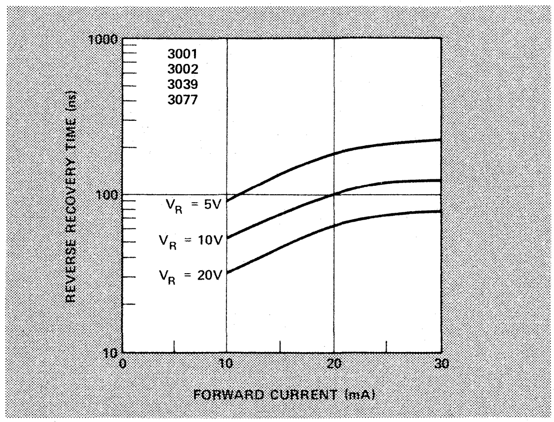


Figure 8. Typical Reverse Recovery Time vs. Forward Current for Various Reverse Driving Voltages.

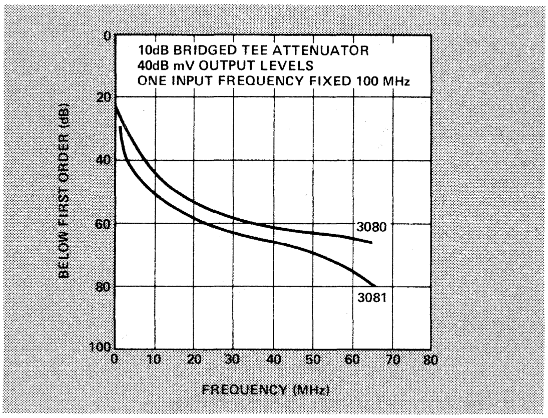


Figure 9. Typical Second Order Intermodulation Distortion.

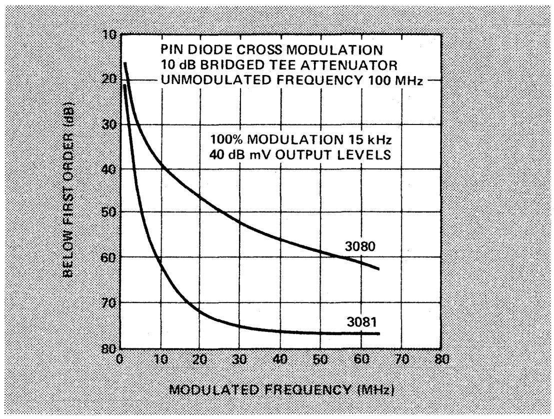


Figure 10. Typical Cross Modulation Distortion.

HEWLETT PACKARD
COMPONENTS

BEAM LEAD PIN DIODES

5082-3900

SIGNAL CONTROL DIODES

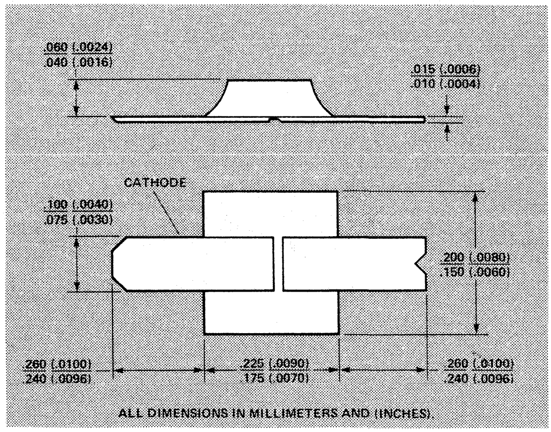
Features

HIGH BREAKDOWN VOLTAGE
200 V

LOW CAPACITANCE
0.02 pF

RUGGED CONSTRUCTION
2 Grams Minimum Lead Pull

NITRIDE PASSIVATED



ALL DIMENSIONS IN MILLIMETERS AND (INCHES).

Description / Applications

The HP 5082-3900 Beam Lead PIN diodes are constructed to offer exceptional lead strength while achieving excellent electrical performance at microwave frequencies.

The HP 5082-3900 Beam Lead PIN diode is designed for use in stripline or microstrip circuits using welding or thermocompression bonding techniques. PIN applications include switching, attenuating, phase shifting, limiting and modulating at microwave frequencies.

Maximum Ratings at $T_A = 25°C$

Junction Operating Temperature .... -65°C to +150°C
Storage Temperature .... -65°C to +150°C
Diode Mounting
Temperature .... 220°C for 10 sec. max.
Power Dissipation .... 250 mW
(Derate linearly to zero at 150°C)
Minimum Lead Strength .... 2 grams pull on either lead

Electrical Specifications at $T_A = 25°C$

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Breakdown Voltage[1]	V_{BR}	150	200	–	V	$V_R = V_{BR}$, measure $I_R \leq 10\mu A$
Series Resistance[1]	R_S	–	6	8	ohm	$I_f = 50$ mA, f = 100 MHz
Capacitance	C_o	–	.02	.025	pF	V = 0 V, f = 3 GHz
Minority Carrier Lifetime	τ	–	150	–	ns	$I_f = 50$ mA, $I_r = 250$ mA

Note 1. Higher V_{BR} or Lower R_S units available for special requirements.

Typical Parameters

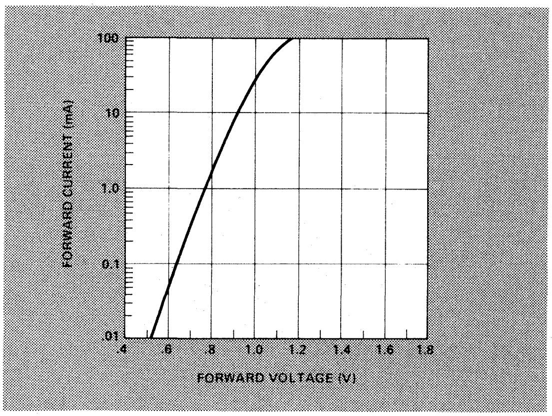


Figure 1. Typical Forward Conduction Characteristics.

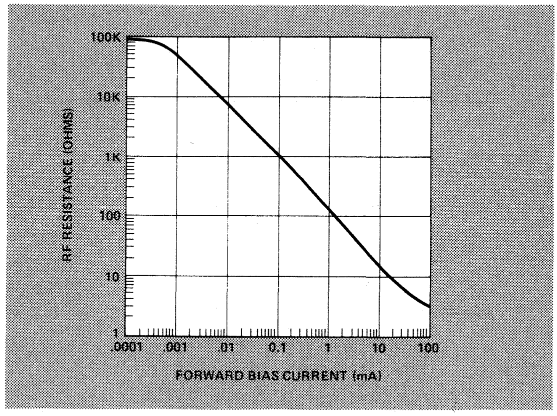


Figure 2. Typical RF Resistance vs. DC Bias Current.

HEWLETT hp PACKARD

COMPONENTS

PIN DIODES FOR FAST SWITCHING RF POWER SWITCHING AND ATTENUATION

5082-3101/02
5082-3201/02
5082-3301/02
5082-3303/04
5082-3305/06

RF POWER SWITCHING/ATTENUATING

Features

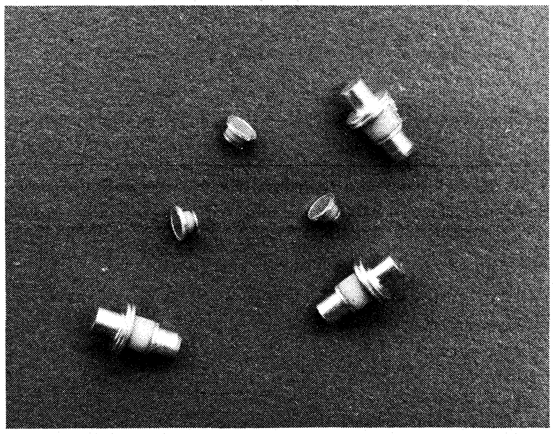
HIGH ISOLATION
Greater Than 25 dB

LOW INSERTION LOSS

HIGH CONTROL SIGNAL DYNAMIC RANGE
10,000: 1 RF Resistance Change

LOW HARMONIC DISTORTION LIFETIME
Greater Than 100 ns

BOTH ANODE AND CATHODE HEAT SINK MODELS AVAILABLE



Description/Applications

HP PIN diodes are silicon devices manufactured using modern processing techniques to provide optimum characteristics for RF switching, signal conditioning and control. These devices are of planar passivated design. Both anode and cathode heat sink models are available.

PIN diodes provide a variable RF resistance with DC bias current. The main advantages of a PIN diode over PN switching diodes are the low forward resistance and the low device capacitance.

These HP PIN Diodes are intended for use in RF switching, multiplexing, modulating, phase shifting, and attenuating applications from approximately 10 MHz to frequencies well into the microwave region. Due to their low parasitic capacitance and inductance, both HP Package Outline 31 and 38 are well suited for broadband circuits up to 1 GHz and for resonated circuits up to 8 GHz. Broad band designs above 1 GHz are usually more economical using stripline PIN diodes (HP Package Outlines 60 and 61) or devices for microstrip circuits (HP Package Outlines 72 and 74).

These devices are especially useful where the lowest residual series resistance and junction capacitance are required for high on-to-off switching ratios. At constant bias the RF resistance is relatively insensitive to temperature, increasing only 20% for a temperature change from +25°C to +100°C.

FAST SWITCHING/ATTENUATING

Features

NANOSECOND SWITCHING TIME
Typically Less Than 5 ns

LOW RESIDUAL SERIES RESISTANCE
Less Than 1Ω

LOW DRIVE CURRENT REQUIRED
Less Than 20 mA for 1Ω R_S

CATHODE HEAT SINK

Description/Applications

The HP 5082-3305 and 5082-3306 are passivated silicon PIN diodes of mesa construction. Precisely controlled processing provides an exceptional combination of fast RF switching and low residual series resistance.

These HP PIN diodes provide unique benefits in the high isolation to insertion loss ratio afforded by the low residual resistance at low bias currents and the ultra-fast recovery realized through lower stored charge. Where low drive power is desired these diodes provide excellent performance at very low bias currents.

The HP 5082-3305 and 5082-3306 ceramic package PIN diodes are intended for controlling and processing microwave signals up to Ku band. Typical applications include single and multi-throw switches, pulse modulators, amplitude modulators, phase shifters, duplexers, diplexers and TR switches.

Maximum Ratings at T_A=25°C

Junction Operating and Storage Temperature Range
. . . . -65°C to +150°C
DC Power Dissipation (Derate linearly to zero at 150°C)
HP 5082-3305 . . . . 0.7 W
HP 5082-3306 . . . . 1.25W
HP 5082-3101, 3102, 3301, 3302 . . . . 1.0 W
HP 5082-3201, 3202, 3303, 3304 . . . . 3.0 W
Soldering Temperature . . . . 230°C for 5 Sec.

Mechanical Specifications

The HP Package Outline 31 has a metal ceramic hermetic seal. The heat sink stud is gold-plated copper. The opposite stud is gold-plated kovar. Typical package inductance is 1.0 nH and typical package capacitance is 0.2 pF.

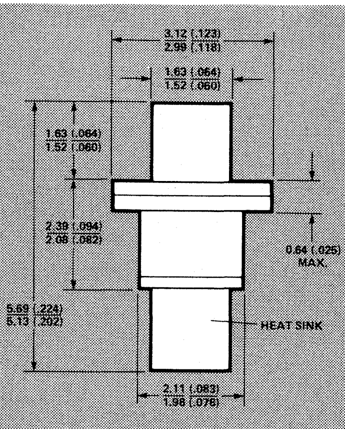
The HP Package Outline 38 also has a metal ceramic hermetic seal. The heat sink contact is gold plated copper. The opposite contact is gold-plated kover. Typical package inductance is 0.4 nH and typical package capacitance is 0.2 pF.

Environmental Capabilities

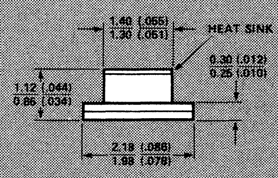
Both packages are designed to have the environmental capabilities as outlined in MIL-STD-750 with the following conditions:

		Conditions
Temperature, Storage	1031	See Maximum Ratings
Temperature, Operating	—	See Maximum Ratings
Solderability	2026	230°C as applicable
Temperature, Cycling	1051	5 cycles, -65 to +125°C
Thermal Shock	1056	5 cycles, 0 to +100°C
Moisture Resistance	1021	10 days, 90-98% RH
Shock	2016	5 blows, X_1, Y_1, Y_2 at 1500 G
Vibration Fatigue	2046	32 hrs. X, Y, Z, at 1500 G
Vibration Variable Frequency	2056	Four 4-min cycles, X, Y, Z, at 20 G Min., 100 to 2000 Hz
Constant Acceleration	2006	X_1, Y_1, Y_2 at 20,000 G
Salt Atmosphere	1041	35°C fog for 24 hours

Package Dimensions



Outline 31



Outline 38

DIMENSIONS IN MILLIMETERS AND (INCHES).

RF POWER SWITCHING/ATTENUATING

Electrical Specifications at $T_A = 25°C$

Part Number 5082-	Package Outline	Heat Sink	Minimum Breakdown Voltage V_{BR}	Maximum Total Capacitance C_T	Maximum Residual Series Resistance R_S	Minimum Carrier Lifetime τ	Typical Reverse Recovery Time t_{rr}	Typical CW Power Handling Capability P_A
3101	38	Anode	200	0.32	1.2	100	150	40
3102	38	Anode	300	0.30	0.8	100	150	60
3201	31	Anode	200	0.35	1.2	100	150	120
3202	31	Anode	300	0.32	0.8	100	150	180
3301	38	Cathode	200	0.40	1.2	100	150	40
3302	38	Cathode	300	0.32	0.8	100	150	60
3303	31	Cathode	200	0.40	1.2	100	150	120
3304	31	Cathode	300	0.32	0.8	100	150	180
Units			V	pF	Ω	ns	ns	W
Test Conditions			$V_R = V_{BR}$, meas. $I_R \leq 10\mu A$	$V_R = 50V, f = 1MHz$	$I_F = 100mA$ $f = 100MHz$	$I_F = 50mA$ $I_R = 250mA$	$I_F = 20mA$, $V_R = 10V$ 90% Recovery	Series* Switch in 50Ω System

*Divide by four for a shunt switch.

FAST SWITCHING/ATTENUATING

Electrical Specifications at $T_A = 25°C$

Part Number 5082-	Package Outline	Heat Sink	Minimum Breakdown Voltage V_{BR}	Maximum Total Capacitance C_{VR}	Maximum Series Resistance R_S	Maximum Reverse Recovery Time t_{rr}
3305	38	Cathode	70	0.4	1.0	10.0
3306	31	Cathode	70	0.45	1.0	10.0
Units			V	pF	Ω	ns
Test Conditions			$V_R = V_{BR}$, meas. $I_R \leq 10\mu A$	f = 1 MHz $V_R = 20V$	f = 100 MHz $I_F = 20mA$	$I_F = 20mA$ $V_R = 10V$ 90% Recovery

FAST SWITCHING/ATTENUATING
Typical Parameters (5082-3305 and -3306)

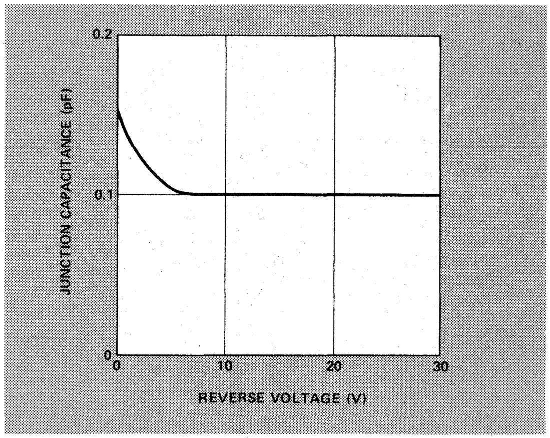


Figure 1. Typical Junction Capacitance vs. Reverse Voltage.

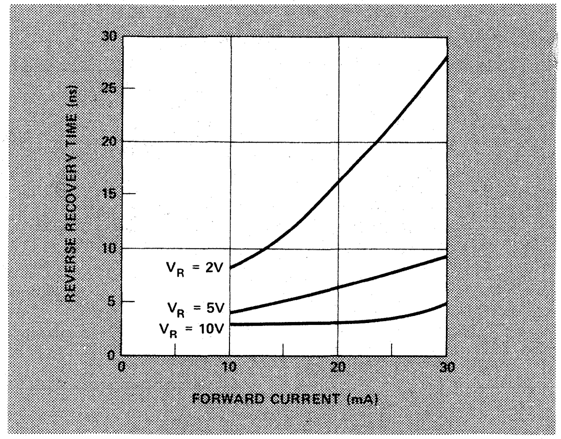


Figure 2. Typical Reverse Recovery Time vs. Forward Current for Various Reverse Driving Voltages. For further discussion of switching characteristics, see 5082-3041 data sheet.

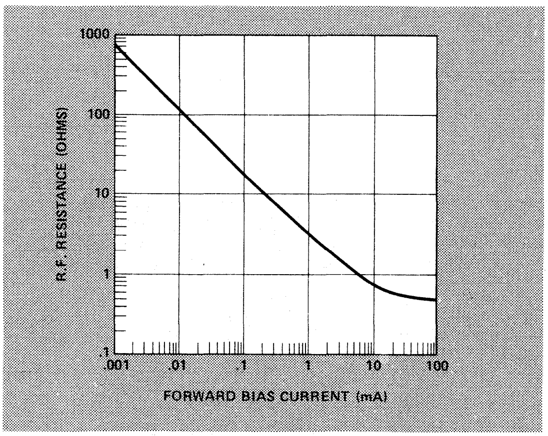


Figure 3. Typical RF Resistance vs. Forward Bias Current.

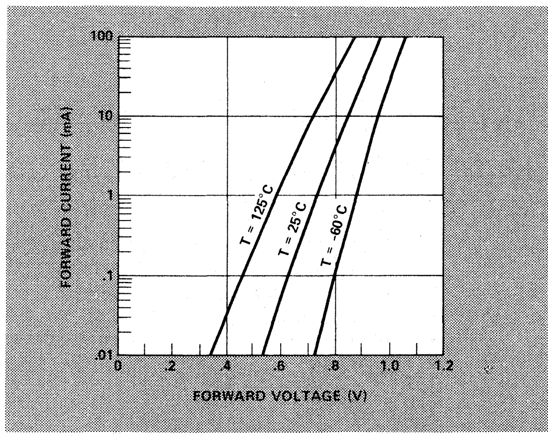


Figure 4. Typical Forward Current vs. Forward Voltage.

RF POWER SWITCHING/ATTENUATING
Typical Parameters (5082-3101, -3102, -3201, -3202, -3301, -3302, -3303, -3304)

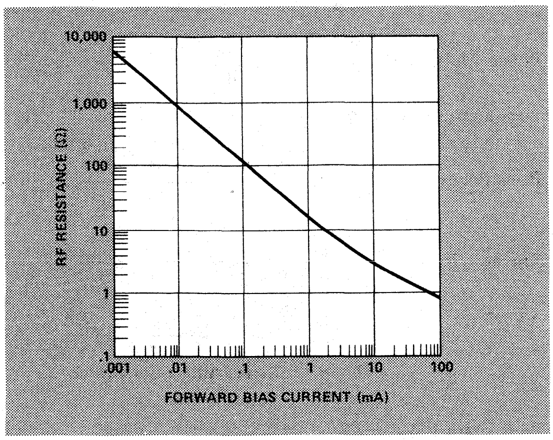


Figure 5. Typical RF Resistance vs. Forward Bias Current.

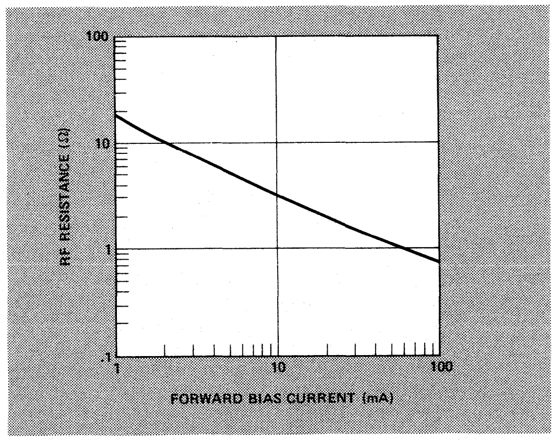


Figure 6. Typical RF Resistance vs. Forward Bias Current.

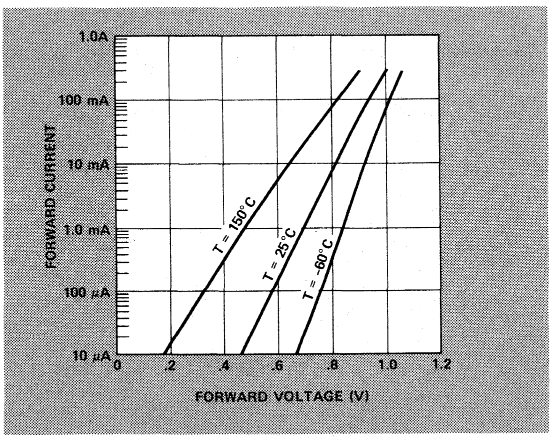


Figure 7. Typical Forward Characteristics.

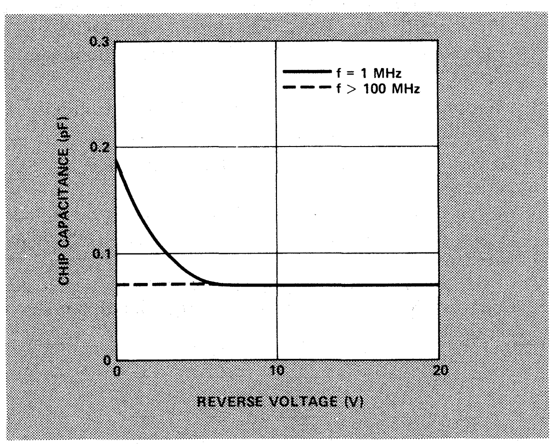


Figure 8. Typical Chip Capacitance vs. Reverse Voltage.

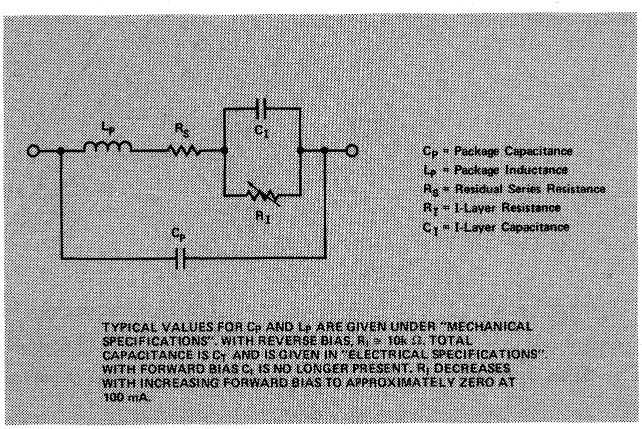


Figure 9. Device Equivalent Circuit.

Power Handling Capability

Calculation of Power Handling Capability of PIN Diode Attenuators and Switches: This summary of equations for power handling calculations is intended to provide the tools for a first order analysis of the RF power handling capability of TR switches, phase shifters, or attenuators. It is assumed that parasitic circuit elements are negligible or tuned out.

Summary of Symbols:

P_A — Power in transmission line (maximum available power to load).

P_R — Power dissipated in PIN diode, may be as high as P_{DISS} max specified for the device under consideration.

R — Resistance of PIN diode in "on" or "off" condition, whichever creates higher P_R.

V_{BR} — Breakdown voltage of PIN diode.

A — Attenuation ratio of series or parallel diode inserted into transmission line.

CALCULATION SEQUENCE:

1. Read P_{DISS} max from the absolute maximum ratings.
2. Determine the CW Power Multiplier from Equation (1) for a shunt circuit, or Equation (4) for a series circuit. Alternatively, Figure 12 can be used if diode resistance is known, or Figure 13 can be used if circuit attenuation is known.
3. Multiply P_{DISS} max by the CW Power Multiplier to determine CW power handling capability.
4. Determine the Pulse Power Multiplier, if applicable, from Figure 14.
5. Multiply the CW power handling capability by the Pulse Power Multiplier to determine pulse power handling capability.
6. Check for power handling limit due to V_{BR} by using Equation (3) for shunt circuits and Equation (6) for series circuits.

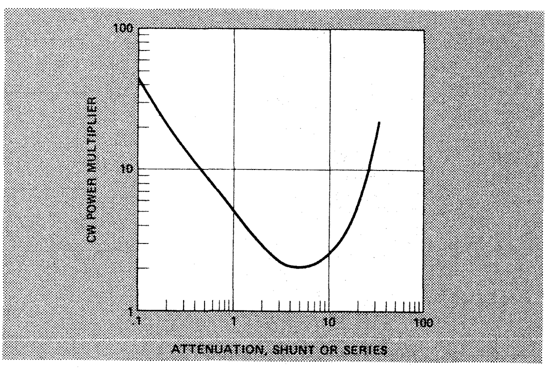


Figure 13. CW Power Multiplier vs. Series or Shunt Attenuation.

Shunt Circuit

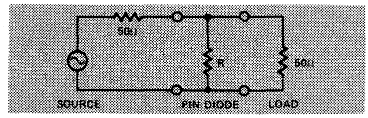


Figure 10. Shunt Attenuator/Switch Circuit.

$$\text{Power Multiplier: } \frac{P_A}{P_R} = \frac{(25 + R)^2}{50R} \qquad (1)$$

$$\text{Attenuation: } A = 20 \log_{10} \left(1 + \frac{25}{R}\right), \text{dB} \qquad (2)$$

$$\text{Breakdown Voltage Limit: } P_A\,(\text{max}) = \frac{(V_{BR} - V_R)^2}{100}, \text{W} \qquad (3)$$

Series Circuit

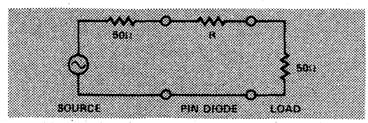


Figure 11. Series Attenuator/Switch Circuit.

$$\text{Power Multiplier: } \frac{P_A}{P_R} = \frac{(100 + R)^2}{200R} \qquad (4)$$

$$\text{Attenuation: } A = 20 \log_{10} \left(1 + \frac{R}{100}\right), \text{dB} \qquad (5)$$

$$\text{Breakdown Voltage Limit: } P_A\,(\text{max}) = \frac{(V_{BR} - V_R)^2}{400}, \text{W} \qquad (6)$$

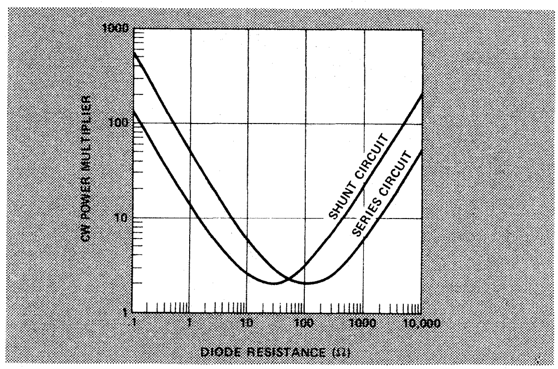


Figure 12. CW Power Multiplier vs. Diode Resistance.

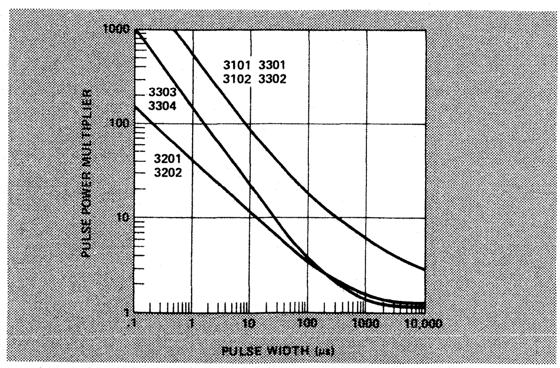
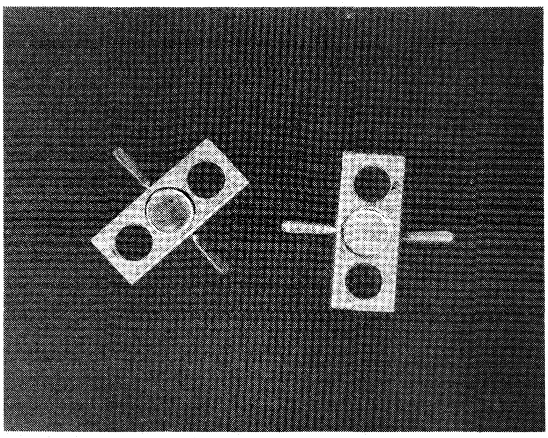


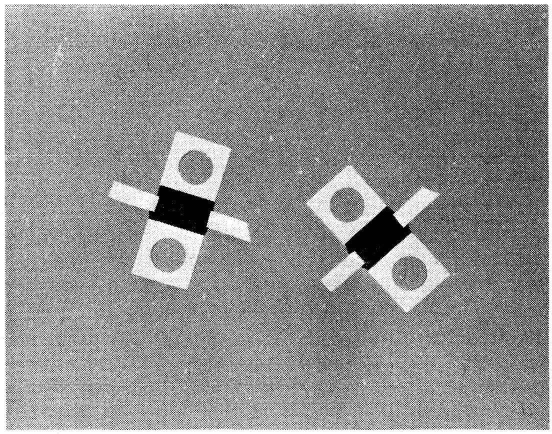
Figure 14. Pulse Power Multiplier vs. Pulse Width.

HEWLETT PACKARD
COMPONENTS

PIN DIODES FOR STRIPLINE AND MICROSTRIP SWITCHES ATTENUATORS AND LIMITERS

5082-3040/41
5082-3046
5082-3071
5082-3140/41
5082-3170
5082-3340





Features

HERMETIC
(5082-3140, 3141, 3170)

BROADBAND OPERATION
HF through X-band

LOW INSERTION LOSS
Less than 0.5 dB to 10 GHz (5082-3140, 3170)

HIGH ISOLATION
Greater than 20 dB to 10 GHz (5082-3140, 3170)

FAST SWITCHING/MODULATING
5 ns typical (5082-3141)

LESS DRIVE CURRENT REQUIRED
Less than 20 mA for 20 dB isolation (5082-3141)

Features

LOW COST TO USE
Designed for easy mounting

BROADBAND OPERATION
HF through Ku-band

LOW INSERTION LOSS
Less than 0.5 dB to 10 GHz (5082-3040, 3340)

LOW DRIVE CURRENT REQUIRED
Less than 20 mA for 20 dB isolation (5082-3041)

FAST SWITCHING MODULATION
5 ns typical (5082-3041)

HIGH POWER LIMITING
50 W peak pulse power (5082-3071)

Description

When forward biased these PIN diodes will appear as current variable resistors in shunt with a 50 ohm transmission line. The resistance varies between less than 1 ohm at high forward bias to greater than 10,000 ohms at zero or reverse bias.

The HP 5082-3040, -3046, -3340, -3140 and -3170 are passivated planar devices. The HP 5082-3041, -3071 and -3141 are passivated mesa devices. All of the devices are in a shunt configuration in stripline packages. These diodes are optimized for good continuity of characteristic impedance which allows a continuous transition when used in 50 ohm microstrip or stripline circuits.

Of these devices, the HP 5082-3040, -3041, -3046, -3071 and -3340 are in HP Package Outline 61.

The HP 5082-3140, -3141 and -3170 are in HP Package Outline 60. This package is hermetic and can be used for Hi-Rel applications. The HP 5082-3140, -3141 and -3170 are direct mechanical replacements for Outline 61 (with top cap in place) diodes HP 5082-3040, -3041, and -3340 respectively. The only electrical difference is the location of the chip in each package. Except in those few applications where the difference in phase relationship is important, the Outline 60 devices can be used as replacements.

The HP 5082-3071 passive limiter chip is functionally integrated into a 50 ohm transmission line to provide a broadband, linear, low insertion loss transfer characteristic for small signal levels. At higher signal levels self-rectification reduces the diode resistance to provide limiting as shown in Figure 6. Limiter performance is practically independent of temperature over the rated temperature range.

Applications

SWITCHES/ATTENUATORS

These diodes are designed for applications in microwave and HF-UHF systems using stripline, or microstrip transmission line techniques.

Typical circuit functions performed consist of switching, duplexing, multiplexing, leveling, modulating, limiting, or gain control functions as required in TR switches, pulse modulators, phase shifters, and amplitude modulators operating in the frequency range from HF through Ku-Band.

These diodes provide nearly ideal transmission characteristics from HF through Ku-Band.

The 5082-3340 and 4082-3170 are reverse polarity devices with characteristics similar to the 5082-3040 and 5082-3140 respectively.

The 5082-3041 and 5082-3141 are recommended for applications requiring fast switching or high frequency modulation of microwave signals, or where the lowest bias current for maximum attenuation is required.

The 5082-3046 has been developed for high peak pulse power handling as required in TR switches for distance measurement and TACAN equipment. The long effective minority carrier lifetime provides for low intermodulation products down to 10 MHz.

More information is available in HP Application Note 922 (Applications of PIN Diodes) and 929 (Fast Switching PIN Diodes). Special Note #5 discusses harmonic generation in PIN diodes.

LIMITER

The 5082-3071 limiter module is designed for applications in telecommunication equipment, ECM receivers, distance measuring equipment, radar receivers, telemetry equipment, and transponders operating anywhere in the frequency range from 500 MHz through 10 GHz. An external dc return is required for self bias operation. This dc return is often present in the existing circuit, i.e. inductively coupled antennas, or it can be provided by a $\lambda/4$ resonant shunt transmission line. Selection of a high characteristic impedance for the shunt transmission line affords broadband operation. Another easy to realize dc return consists of a small diameter wire connected at a right angle to the electric field in a microstrip or stripline circuit. A 10 mA forward current will actuate the PIN diode as a shunt switch providing approximately 20 dB of isolation.

HP Package Outline 61 Cover Channel

The cover channel supplied with each diode should be used in balanced stripline circuits in order to provide good electrical continuity from the upper to the lower ground plane through the package base metal. Higher order modes will be excited if this cover is left off or if poor electrical contact is made to the ground plane.

The package transmission channel is filled with epoxy resin which combines a low expansion coefficient with high chemical stability.

Maximum Ratings at T_A=25°C

Part No. 5082-	-3140 -3170	-3141	-3040 -3340	-3041	-3046	-3071
Junction Operating and Storage Temperature Range	-65°C to 150°C	-65°C to 150°C	-65°C to 125°C	-65°C to 125°C		
Power Dissipation[1]	2.5 W	1.0 W	2.5 W	1.0 W	4.0 W	1.0 W
Peak Incident Pulse Power[2]	225 W	50 W	225 W	50 W	2000 W	50 W
Peak Inverse Voltage	150 V	70 V	150 V	70 V	450 V	50 V
Soldering Temperature	230°C for 5 sec.					

Notes:
1. Device properly mounted in sufficent heat sink, derate linearly to zero at maximum operating temperature.
2. t_p = 1 μs, f = 10 GHz, Du - .001, Z_0 = 50Ω. (Exception: -3071 is tested at 9.4 GHz.)

Electrical Specifications at T_A=25°C - Attenuator Diodes

Part Number 5082-	Package Outline	Heat Sink	Minimum Isolation (dB)	Maximum Insertion Loss (dB)	Maximum SWR	Maximum Reverse Recovery Time t_{rr} (ns)	Typical Carrier Lifetime τ (ns)	Typical CW Power Switching Capability P_A (W)
3140	60	Anode	20	0.5	1.5	–	500	30
3141	60	Cathode	20	1.0	1.5	10	15	13
3170	60	Cathode	20	0.5	1.5	–	500	30
3040	61	Anode	20	0.5	1.5	–	500	30
3041	61	Cathode	20	1.0	1.5	10	15	13
3046	61	Anode	20	1.0	1.5	–	1000	50
3340	61	Cathode	20	0.5	1.5	–	500	30
Test Conditions (Note 3)	–	–	I_F=100mA (Except 3041,3141; I_F=20mA)	I_F = 0 P_{in} = 1mW	I_F = 0 P_{in} = 1mW	I_F = 20mA V_R = 10V Recovery to 90%	I_F = 50mA I_R = 250mA	–

Note 3: Test Frequencies: 8 GHz 5082-3041, -3046 and -3141. 10 GHz 5082-3040, -3140, 3170 and -3340.

Electrical Specifications at T_A=25°C - Limiter Diode

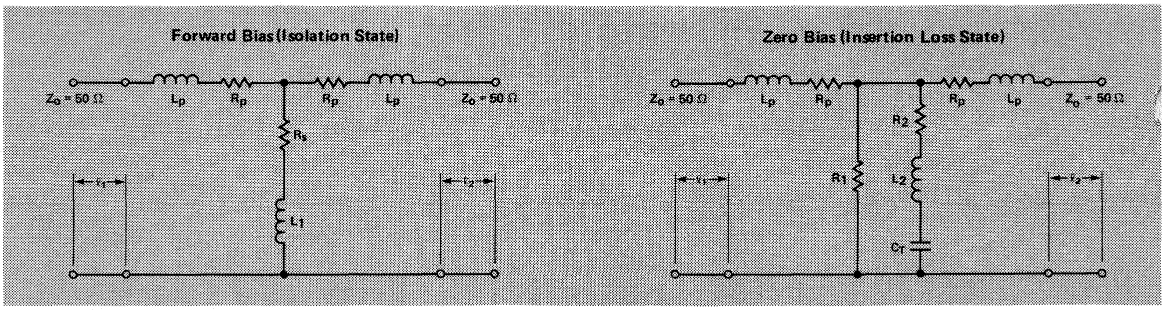
Part Number 5082-	Package Outline	Heat Sink	Maximum Insertion Loss (dB)	Maximum SWR	Maximum RF Leakage Power (W)	Typical Recovery Time (ns)
3071	61	Cathode	1.2	2.0	1.0	100
Test Conditions	–	–	P_{in} = 0 dBm f = 9.4GHz	P_{in} = 0 dBm f = 9.4GHz	P_{in} = 50 W	P_{in} = 50 W

Environmental Capabilities

Applications requiring high reliability testing should use HP Package Style 60 diodes which are capable of passing the following environmental tests:

Characteristic	MIL-STD-750 Reference	Conditions
Moisture Resistance	1021	
Temperature, Storage	1031	-65°C to +150°C
Temperature, Operating	–	-65°C to +150°C
Solderability	2026	230°C as applicable
Temperature, Cycling	1051	5 cycles, -65°C to +150°C
Thermal Shock	1056	5 cycles, 0°C to +100°C
Shock	2016	5 blows, X_1, X_2, Y_1, Y_2, Z_1, Z_2 at 1500 G
Vibration Fatigue	2046	32 hours, X, Y, Z at 20 G
Vibration Variable Frequency	2056	Four 4-min. cycles, X, Y, Z, at 20 G Min., 100 to 2000 Hz
Constant Acceleration	2006	20,000 G X_1, X_2, Y_1, Y_2, Z_1, Z_2
Terminal Strength	2036	Tension and Bending Stress
Barometric Pressure	1001	150,000 feet
Salt Atmosphere	1041	
Hermetic Seal	1071	Helium and Gross Leak

Equivalent Circuits



Typical Equivalent Circuit Parameters - Forward Bias

Part Number 5082-	Lp (pH)	Rp (Ω)	Rs (Ω)	L_1 (pH)	ℓ_1 (mm)	ℓ_2 (mm)
3040, 3340	200	0.25	1.0	20	2.4	5.0
3041	220	0.25	1.0	20	2.4	5.0
3046	220	0.25	0.6	17	2.4	5.0
3140, 3170	150	0.0	0.95	30	3.8	3.8
3141	150	0.0	0.8	20	3.8	3.8

Typical Equivalent Circuit Parameters - Zero Bias

Part Number 5082-	Lp (pH)	Rp (Ω)	R_1 (KΩ)	L_2 (pH)	R_2 (KΩ)	C_T (pF)	ℓ_1 (mm)	ℓ_2 (mm)
3040, 3340	200	0.25	∞	0	5.0	0.10	2.4	5.0
3041	220	0.25	∞	0	1.5	0.15	2.4	5.0
3046	220	0.25	∞	0	1.5	0.15	2.4	5.0
3140, 3170	30	0.0	1.2	16	0.0	0.20	5.3	5.3
3141	200	0.0	∞	0	0.4	0.14	4.4	4.4

Typical Parameters

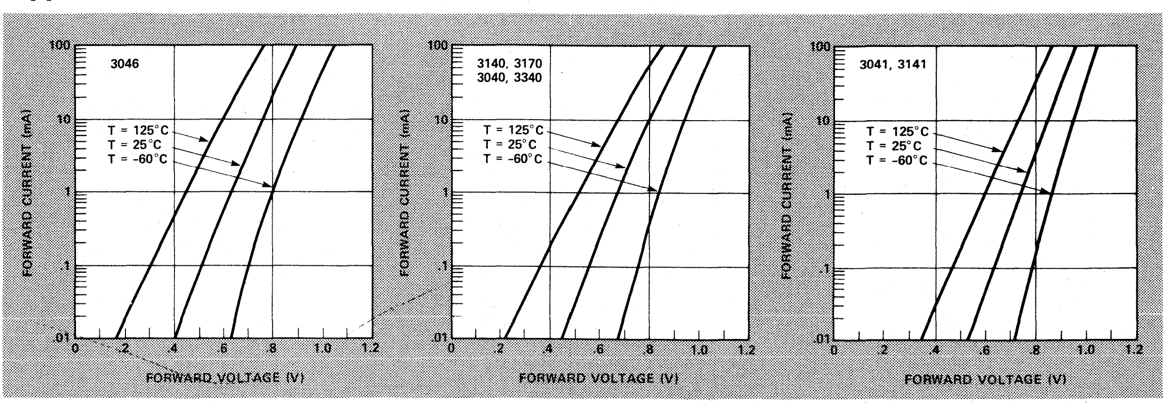


Figure 1. Typical Forward Characteristics.

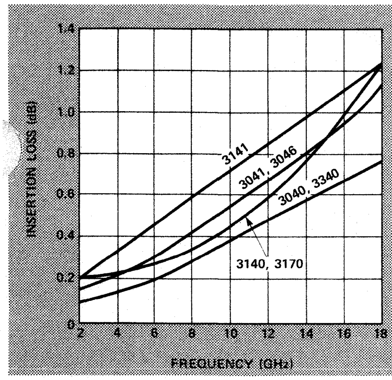


Figure 2. Typical Insertion Loss vs. Frequency.

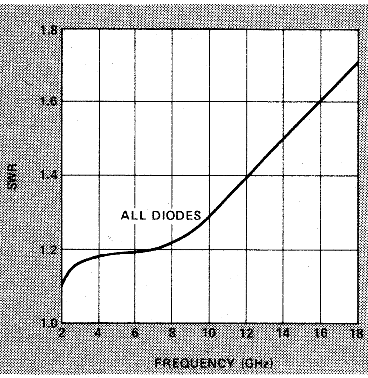


Figure 3. Typical SWR vs. Frequency.

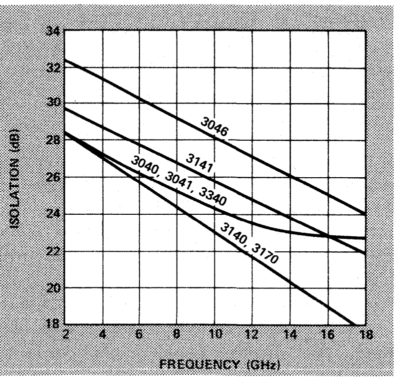


Figure 4. Typical Isolation vs. Frequency.

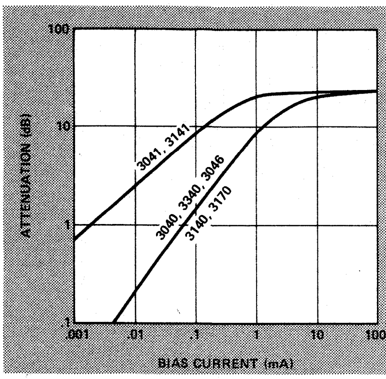


Figure 5. Typical Attenuation Above Zero Bias Insertion Loss vs. Bias Current at f = 8 GHz.

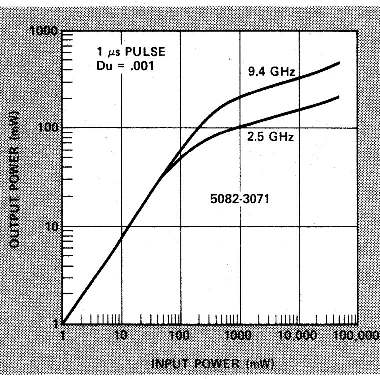
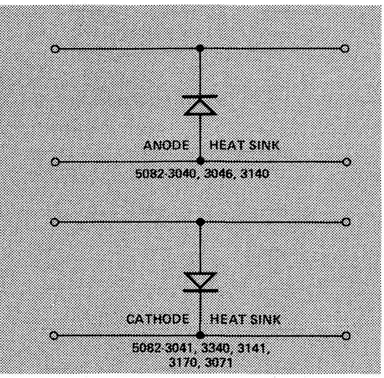


Figure 6. Typical Pulse Limiting Characteristics.



HEAT SINK POLARITY

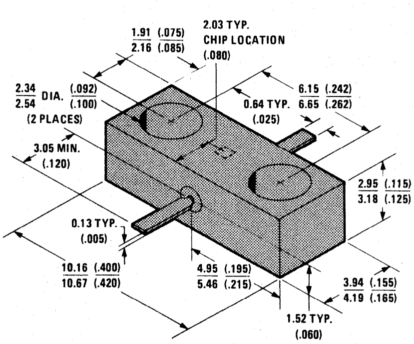


Figure 7. HP Package 60 Outline.

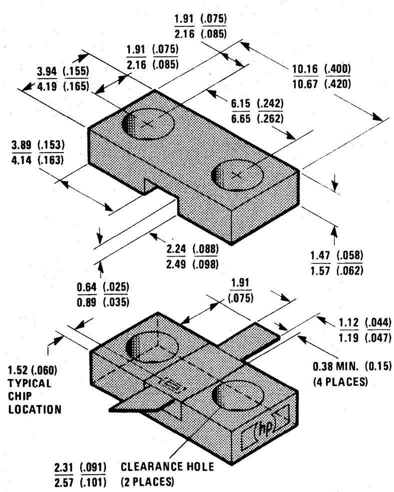


Figure 8. HP Package 61 Outline.

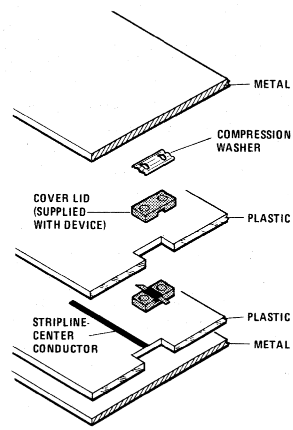


Figure 9. Suggested Stripline Assembly.

SIGNAL CONTROL DIODES

Typical Switching Parameters

RF SWITCHING SPEED

HP 5082-3141 and HP 5082-3041

The RF switching speed of the HP 5082-3141 and HP 5082-3041 may be considered in terms of the change in RF isolation at 2 GHz. This switching speed is dependent upon the forward bias current, reverse bias drive pulse, and characteristics of the pulse source. The RF switching speed for the shunt-mounted stripline diode in a 50Ω system is considered for two cases: one driving the diode from the forward bias state to the reverse bias state (isolation to insertion loss), second, driving the diode from the reverse bias state to the forward bias state (insertion loss to isolation).

The total time it takes to switch the shunt diode from the isolation state (forward bias) to the insertion loss state (reverse bias) is shown in Figure 10. These curves are for three forward bias conditions with the diode driven in each case with three different reverse voltage pulses (V_{PR}). The total switching time for each case includes the delay time (pulse initiation to 20 dB isolation) and transition time (20 dB isolation to 0.9 dB isolation). Slightly faster switching times may be realized by spiking the leading edge of the pulse or using a lower impedance pulse driver.

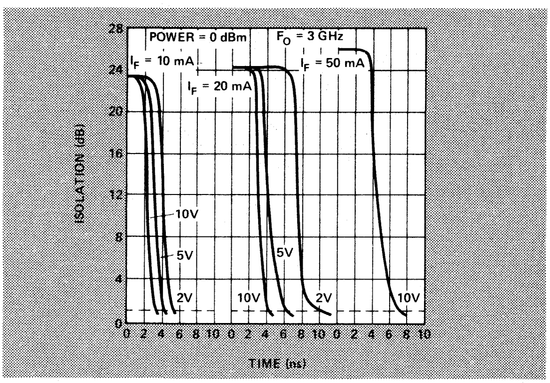


Figure 10. Isolation vs. Time (Turn-on) for HP 5082-3141 and HP 5082-3041. Frequency, 2 GHz.

The time it takes to switch the diode from zero or reverse bias to a given isolation is less than the time from isolation to the insertion loss case. For all cases of forward bias generated by the pulse generator (positive pulse), the RF switching time from the insertion loss state to the isolation state was less than 2 nanoseconds. A more detailed treatise on switching speed is published in AN929; Fast Switching PIN Diodes.

REVERSE RECOVERY TIME

Shown below is reverse recovery time, (t_{rr}) vs. forward current, (I_F) for various reverse pulse voltages V_{PR}. The circuit used to measure t_{rr} is shown in Figure 11.

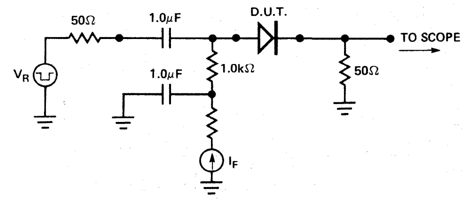


Figure 11. Basic t_{rr} Test Setup.

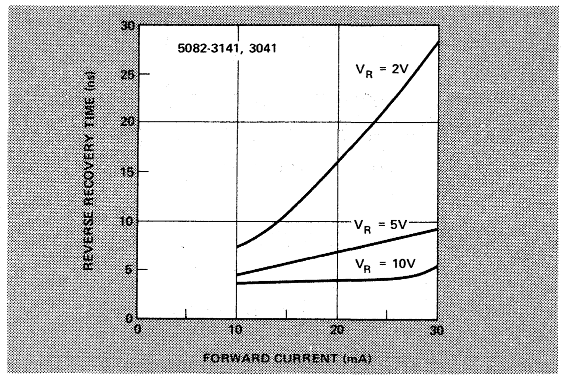


Figure 12. Typical Reverse Recovery Time vs. Forward Current for Various Reverse Driving Voltages, 5082-3141, -3041.

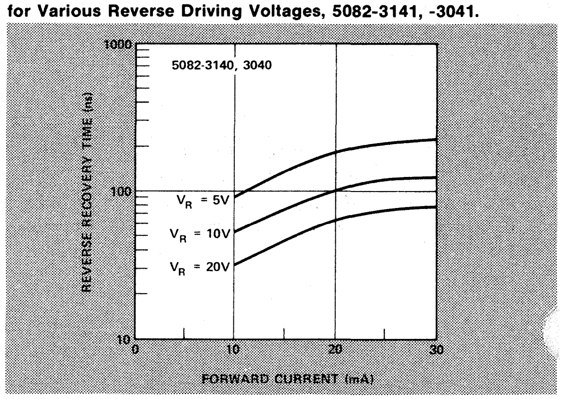


Figure 13. Typical Reverse Recovery Time vs. Forward Current for Various Reverse Driving Voltages, 5082-3140, -3040.

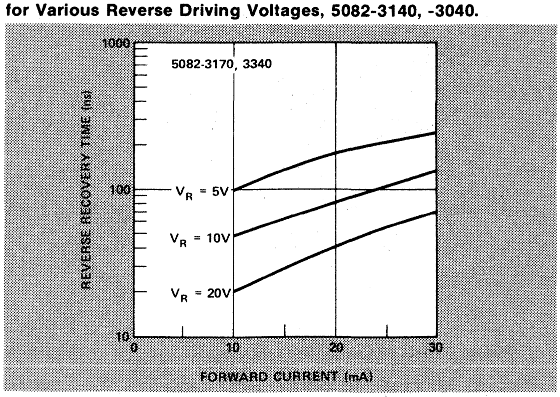
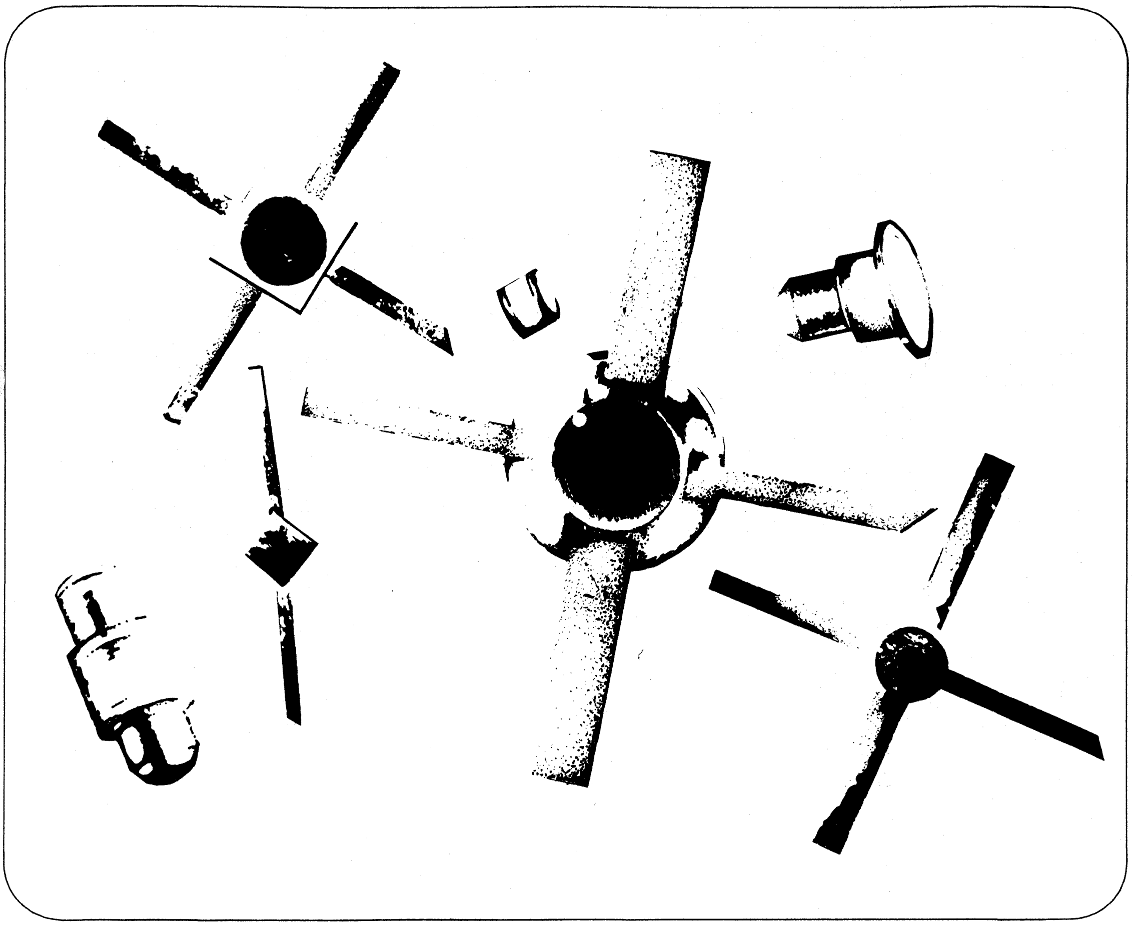


Figure 14. Typical Reverse Recovery Time vs. Forward Current for Various Reverse Driving Voltages, 5082-3170, -3340.

Microwave Source Diodes



Microwave Source Diodes — Selection Guide

Double Drift Pulsed IMPATT Diodes (Page 3-3)

Peak Power Out/ Center Frequency	Part Number 5082-
12 W 10 GHz	-0710
9 W 16.5 GHz	-0716

Double Drift CW IMPATT Diodes (Page 3-7)

Power Out/ Center Frequency	Part Number 5082-
1.75 W 7 GHz	-0607
3.00 W 8 GHz	-0608
1.5 W 10 GHz	-0610
2.5 W 11 GHz	-0611

IMPATT Diodes (Page 3-13)

Power Out/ Frequency Range	Part Number 5082-
100 mW: 5-9 GHz 8-12 GHz 10-14 GHz	 0431/0434 0432/0435 0433/0436
500 mW: 8-10 GHz 10-12 GHz	 0400 0401
1.5–1.0 W: 4-6.4 GHz 5.9-8.4 GHz 8-10 GHz 10-12 GHz 10-13.5 GHz	 0423 0424 0425 0426 0427

Step Recovery Diodes (Page 3-15)

Typical Output Frequency Range, GHz	High Efficiency Multiplier Versions 5082-	RF Tested Versions 5082-	DC Tested Versions 5082-
.4-1.5	0803 0815 0825 0833 0840		0180 0112 0114 0151
1-3	0800 0801 0802	0300 0303	0241
3-5	0805 0806 0807	0310	0132
5-8	0810 0811 0812	0310	0132
7-10	0820 0821 0822		0243
8-12	0830 0831	0320	0253
10-20	0835 0836 0885	0335	

Chips and other devices for MIC shown on page 4-3.

HEWLETT PACKARD
COMPONENTS

SILICON DOUBLE DRIFT IMPATT DIODES FOR PULSED POWER SOURCES

5082-0710 X-BAND

5082-0716 Ku-BAND

Features

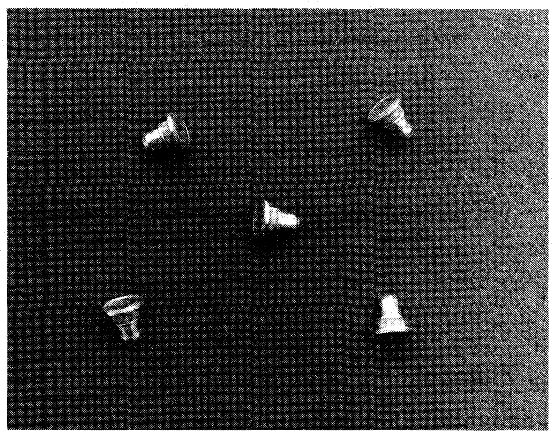
HIGH PEAK POWER
Typically Greater Than 14W Peak at 10 GHz, and 11W Peak at 16 GHz

HIGH AVERAGE POWER
25% Duty Cycle at Peak Power Rating

HIGH EFFICIENCY
Typically 11%

$\frac{\text{SIN } x}{x}$ SPECTRUM

HIGH RELIABILITY
Designed to Meet the Requirements of MIL-S-19500



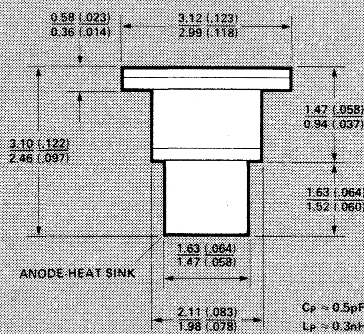
Description /Applications

Silicon double drift IMPATT (IMPact Ionization Avalanche Transit Time) diodes are junction devices operated with reverse bias sufficient to cause avalanche breakdown. Holes and electrons generated in the avalanche region travel across their respective drift regions and are collected at the contacts. The phase delay between voltage and current resulting from the avalanche process in combination with the drift time produces negative resistance at microwave frequencies.

Double drift IMPATTs offer advantages of higher power and efficiency, lower junction capacitance per unit area, and lower fm noise as compared to single drift silicon IMPATTs.

Stable operation at high peak power levels make these devices ideally suited for X and Ku-band pulsed radar applications such as missile guidance systems, lightweight man-pack radar, and active phased array radar. For more information, see AN961, Silicon Double-Drift IMPATT Diodes for Pulse Applications.

Package Dimensions



OUTLINE 46

ALL DIMENSIONS IN MILLIMETERS AND (INCHES).

Maximum Ratings at $T_A = 25°C$

Average Junction Operating Temperature	−65°C to +225°C
Average Junction Temperature Rise, ΔT_j	200°C
Storage Temperature	−65°C to +150°C
Power Dissipation	$\frac{200°C}{\Theta_T}$
Soldering Temperature	220°C for 5 sec.

MICROWAVE SOURCE DIODES

Electrical Specifications at T_A=25°C

Parameter	Symbol	5082-0710	5082-0716	Units	Notes
Center Frequency	f_o	10	16.5	GHz	1
Minimum Peak Output Power at Center Frequency	P_P	12	9	W	1,2
Minimum Average Output Power at Center Frequency	P_{AVG}	3	2.25	W	1,2

Typical Parameters at T_A=25°C

Parameter	Symbol	5082-0710	5082-0716	Units	Notes
Efficiency	η	11	11	%	1,2
Pulsed Operating Voltage	V_{OP}	145	100	V	
Pulsed Operating Current	I_{OP}	900	900	mA	
Breakdown Voltage	V_{BR}	115	78	V	I_R = .5mA
Junction Capacitance at Breakdown	$C_{J(VBR)}$	1.25	0.8	pF	f = 1 MHz
Thermal Resistance	Θ_T	6.5	8.5	°C/W	3

NOTES:
1. Average output power is measured as an oscillator at approximately f_O. Average junction temperature is less than 225°C with an ambient temperature of 25°C. Peak power is calculated using the relationship:

$$P_P = \frac{P_{AVG}}{\text{duty cycle}}$$

2. Measured at a pulse width of 800 ns and a duty cycle of 25%.
3. Θ_T is measured with the diode mounted in a copper heatsink using the dc avalanche resistance method (see HP Application Note 935, page 6).

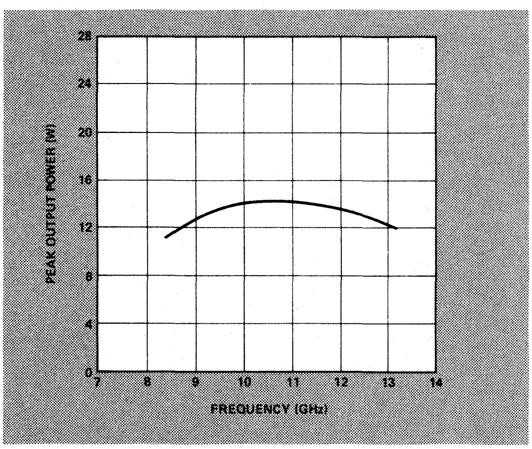


Figure 1. Typical Peak Power Output vs. Frequency, 5082-0710. 800 ns pulse width, 25% duty cycle, $\Delta Tj_{(avg)}$ = 175°C. Output power maximized at each frequency.

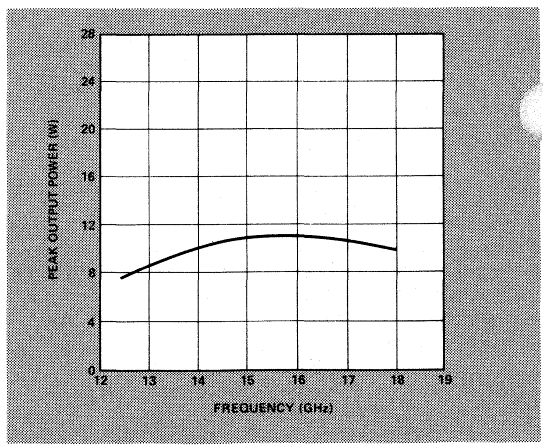


Figure 2. Typical Peak Power Output vs. Frequency, 5082-0716. 800 ns pulse width, 25% duty cycle, $\Delta Tj_{(avg)}$ = 175°C. Output power maximized at each frequency.

Typical Parameters, 5082-0710

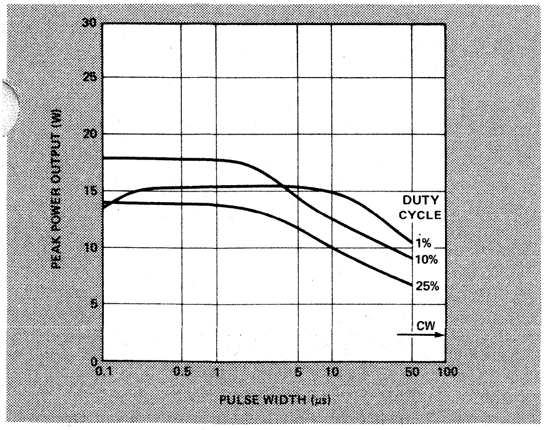


Figure 3. Typical Peak Power Output vs. Pulse Width at 10.5 GHz with duty cycle as a parameter, 5082-0710. ΔTj less than 200°C.

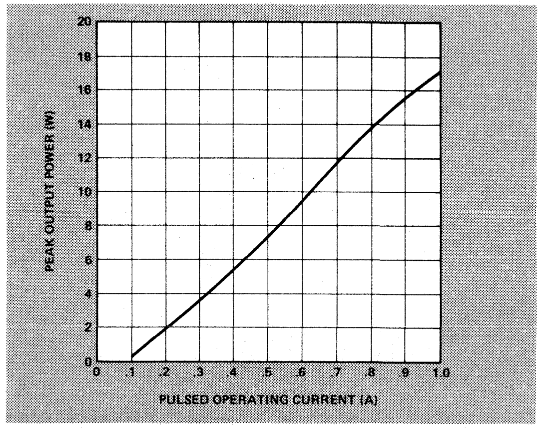


Figure 4. Typical Peak Power Output vs. Pulsed Operating Current, 5082-0710. 800 ns pulse width, 25% duty cycle, 10.5 GHz. Output power maximized at each current level.

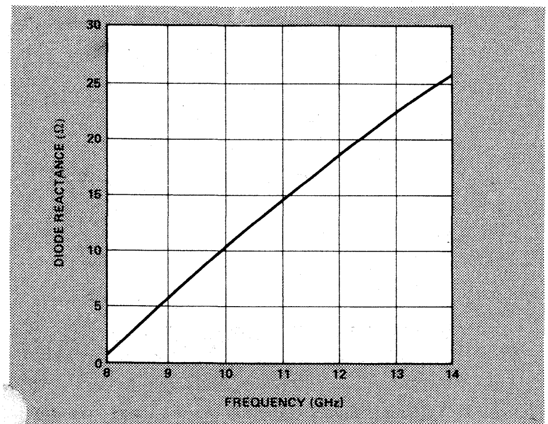


Figure 5. Typical Diode Reactance vs. Frequency, 5082-0710.

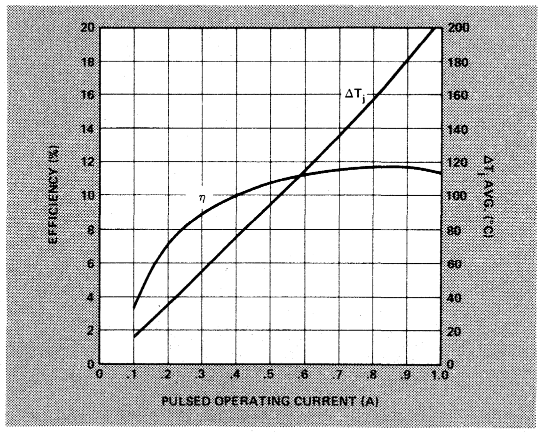


Figure 6. Typical Efficiency and ΔTj (avg) vs. Pulsed Operating Current, 5082-0710. 800 ns pulse width, 25% duty cycle, 10.5 GHz. Output power maximized for each current level.

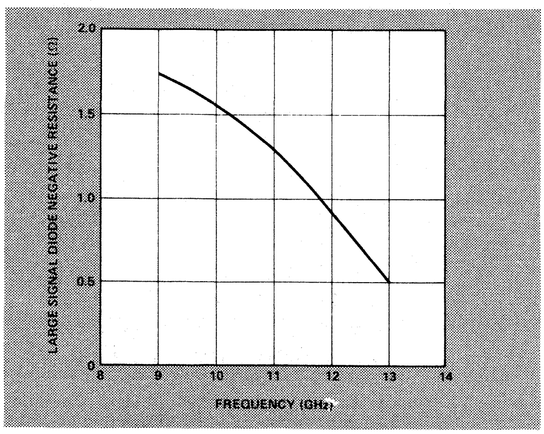


Figure 7. Typical Large Signal Diode Negative Resistance vs. Frequency, 5082-0710.

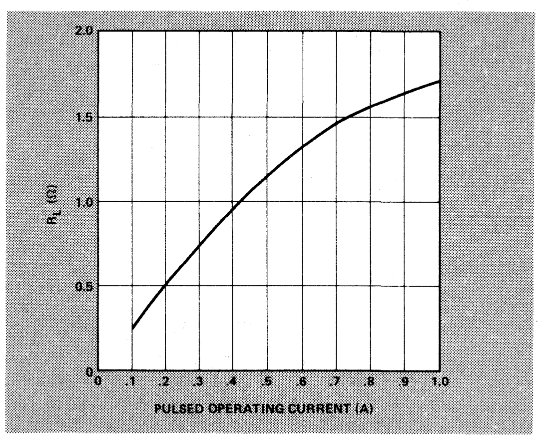


Figure 8. Typical Load Resistance vs. Pulsed Operating Current, 5082-0710. 800 ns pulse width, 25% duty cycle, 10.5 GHz. Output power maximized for each current level.

Typical Parameters, 5082-0716

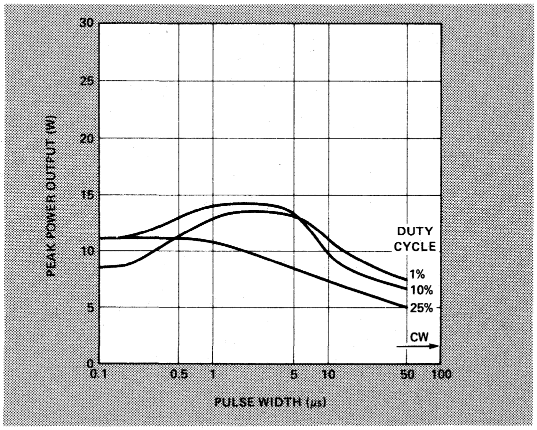


Figure 9. Typical Peak Power Output vs. Pulse Width at 16.5 GHz with duty cycle as a parameter, 5082-0716. Tj less than 200°C.

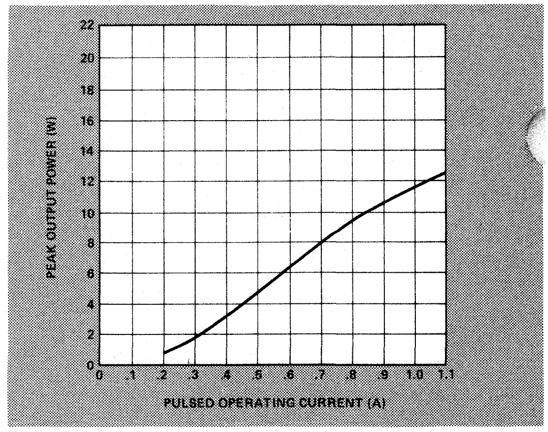


Figure 10. Typical Peak Power Output vs. Pulsed Operating Current, 5082-0716. 800 ns pulse width, 25% duty cycle, 16.5 GHz. Output power maximized at each current level.

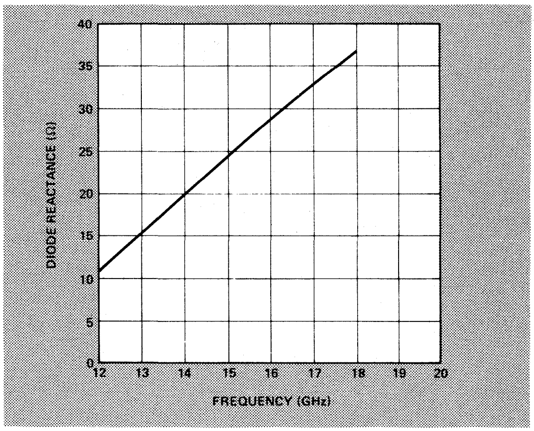


Figure 11. Typical Diode Reactance vs. Frequency, 5082-0716.

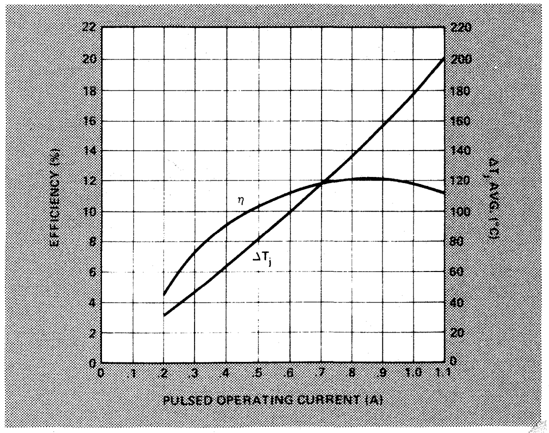


Figure 12. Typical Efficiency and ΔTj (avg) vs. Pulsed Operating Current, 5082-0716. 800 ns pulse width, 25% duty cycle, 16.5 GHz. Output power maximized for each current level.

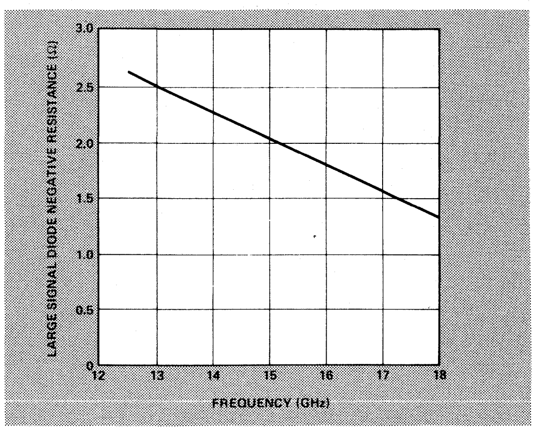


Figure 13. Typical Large Signal Diode Negative Resistance vs. Frequency, 5082-0716.

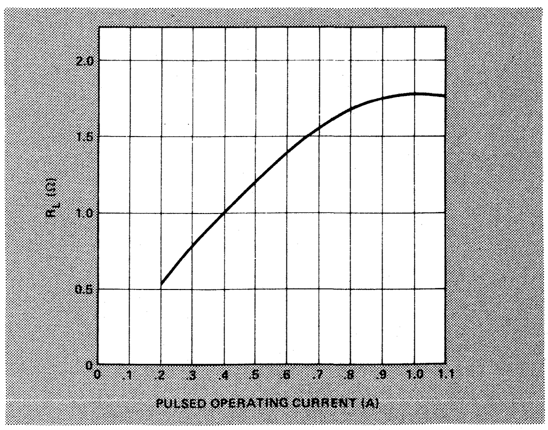


Figure 14. Typical Load Resistance vs. Pulsed Operating Current, 5082-0716. 800 ns pulse width, 25% duty cycle, 16.5 GHz. Output power maximized for each current level.

HEWLETT hp PACKARD

COMPONENTS

SILICON DOUBLE DRIFT IMPATT DIODES FOR CW POWER SOURCES

5.9-8.4 GHz
5082-0607
5082-0608

10-14 GHz
5082-0610
5082-0611

Features

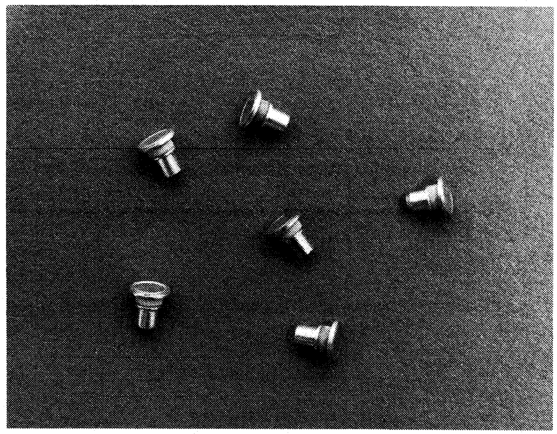
HIGH POWER OUTPUT
Typically: 3W from 5.9 to 8.4 GHz
2.5W from 10 to 14 GHz

HIGH EFFICIENCY

LOW NOISE

HIGH AMBIENT OPERATION
Specified Output Power Available at 50° C Ambients

HIGH RELIABILITY
Designed to Exceed the Requirements of MIL-S-19500



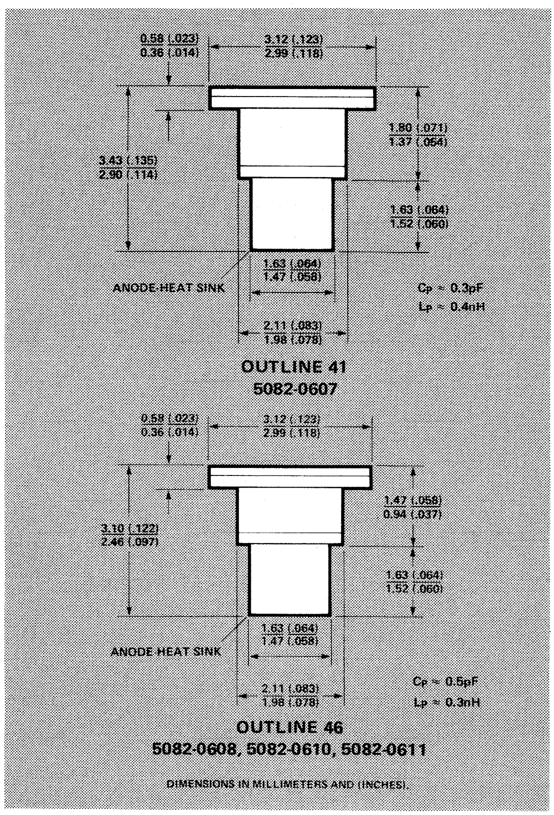
Description/Applications

Double drift silicon IMPATT (IMPact Ionization Avalanche Transit Time) diodes are junction devices operated with reverse bias sufficient to cause avalanche breakdown. Holes and electrons generated in the avalanche region travel across their respective drift regions and are collected at the contacts. The phase delay between voltage and current resulting from the avalanche process in combination with the drift time produces negative resistance at microwave frequencies.

Double drift IMPATT diodes offer advantages of higher power and efficiency, lower junction capacitance per unit area, and lower fm noise, as compared to single drift silicon IMPATT diodes.

Because of their high output power, efficiency and reliability, these devices are ideally suited for use as the active element in oscillators and amplifiers in point-to-point telecommunications links and CW Doppler radar. For more information see HP AN 962 Silicon Double Drift IMPATT Diodes for high power CW microwave applications and HP AN 968 IMPATT Amplifier.

Package Dimensions



Maximum Ratings at $T_A = 25°C$

Junction Operating Temperature	-65°C to +250°C
Junction Temperature Rise, ΔT_j	200°C
Storage Temperature	-65°C to +150°C
Power Dissipation	$\frac{200°C}{\Theta_T}$
Soldering Temperature	220°C for 5 sec.

Electrical Specifications at $T_A = 25°C$

Parameter	Symbol	5082-0607	5082-0608	5082-0610	5082-0611	Units	Notes
Minimum CW Output Power	P_O	1.75	3.0	1.5	2.5	W	1,2
Test Frequency	f_O	7.2		11.2		GHz	1

Typical Parameters

Parameter	Symbol	5082-0607	5082-0608	5082-0610	5082-0611	Units	Notes
Efficiency	η	11	10.5	10	10	%	$\eta = \frac{P_O}{P_{IN}} \times 100$
Operating Voltage	V_{OP}	180	180	120	120	V	
Operating Current	I_{OP}	95	165	130	210	mA	
Breakdown Voltage	V_{BR}	150	150	99	99	V	$I_R = .5$ mA
Junction Capacitance at Breakdown	$C_{J(VBR)}$	0.35	0.7	0.35	0.7	pF	f = 1 MHz
Thermal Resistance	Θ_T	11	6.5	14	8	°C/W	3
Package Outline	–	41	46	46	46	–	–

Notes: 1. Output power measured as an oscillator. Junction temperature is less than 225°C with an ambient temperature of 25°C. Typical diodes satisfy the minimum specification throughout the operating frequency range. Special models tested at other frequencies are available upon special request.

2. The mount for an IMPATT diode must provide an adequate heat flow path away from the diode stud. The junction temperature rise will be: $\Delta T_j = \Theta_T (P_{IN} - P_O)$.

3. Θ_T is measured with the diode mounted in a copper heatsink using the dc avalanche resistance method (see HP AN 935, page 6). Θ_{jc}, use $\Theta_{jc} = \Theta_T - 1.5°C/W$ (1.5°C/W has been found to be a nominal value for a good heat flow path in the diode mount).

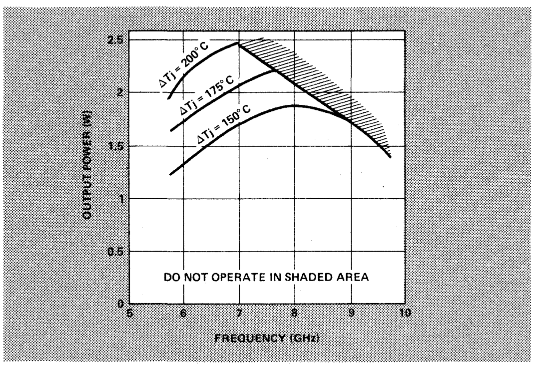


Figure 1. Typical Output Power vs. Frequency, 5082-0607. Output power maximized at each frequency.

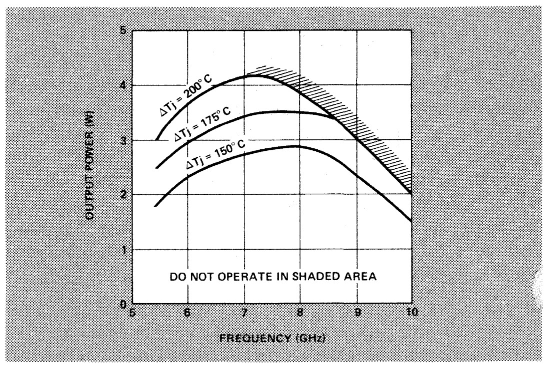


Figure 2. Typical Output Power vs. Frequency, 5082-0608. Output power maximized at each frequency.

CAUTION: *Performance in shaded region may be characterized by power saturation and noisy output spectrum. Operation under these conditions can result in diode failure (See HP AN 959-1).*

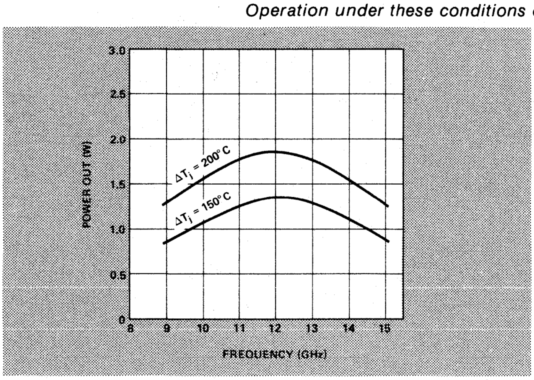


Figure 3. Typical Output Power vs. Frequency, 5082-0610. Output power maximized at each frequency.

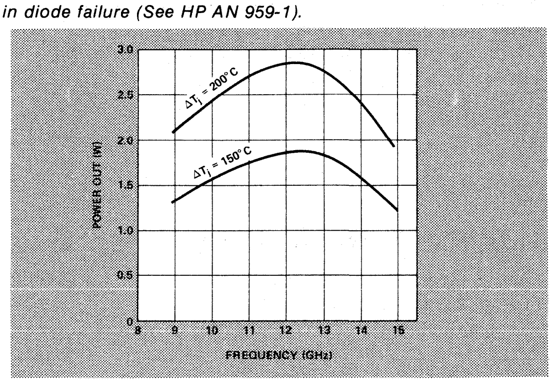


Figure 4. Typical Output Power vs. Frequency, 5082-0611. Output power maximized at each frequency.

Typical Parameters, 5082-0607

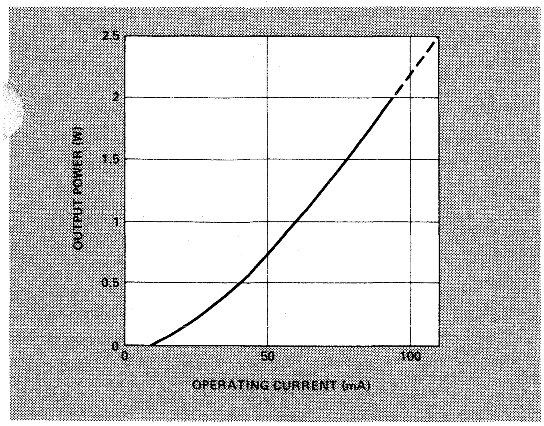


Figure 5. Typical Output Power vs. Operating Current at 7.2 GHz, 5082-0607. Output power maximized at each current level.

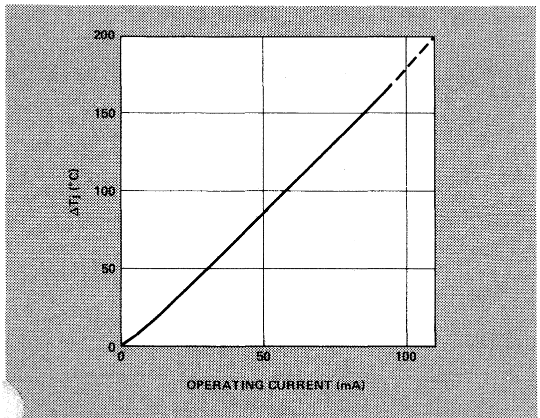


Figure 6. Typical Junction Operating Temperature Rise (ΔTj) vs Operating Current at 7.2 GHz, 5082-0607. Output power maximized at each current level.

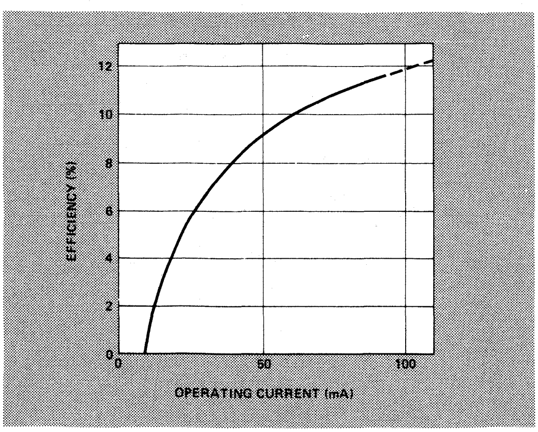


Figure 7. Typical Efficiency vs. Operating Current at 7.2 GHz, 5082-0607. Output power maximized at each current level.

Typical Parameters, 5082-0608

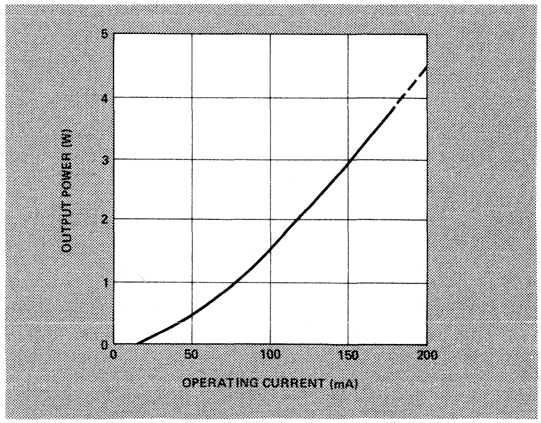


Figure 8. Typical Output Power vs. Operating Current at 7.2 GHz, 5082-0608. Output power maximized at each current level.

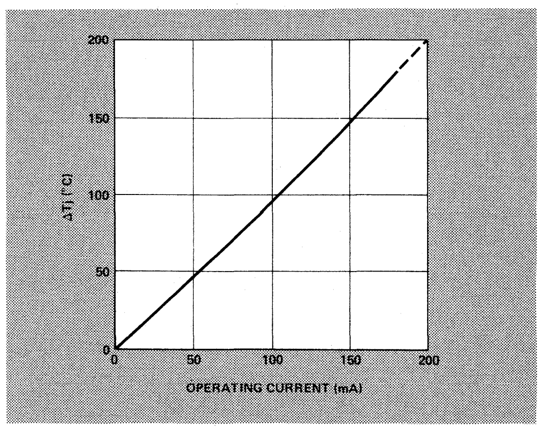


Figure 9. Typical Junction Operating Temperature Rise (ΔTj) vs. Operating Current at 7.2 GHz, 5082-0608. Output power maximized at each current level.

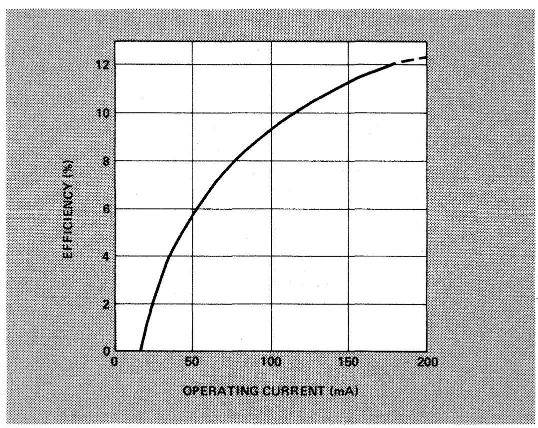


Figure 10. Typical Efficiency vs. Operating Current at 7.2 GHz, 5082-0608. Output power maximized at each current level.

Typical Parameters, 5082-0610

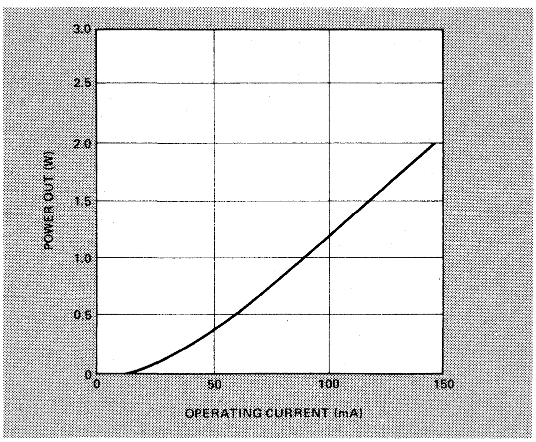


Figure 11. Typical Output Power vs. Operating Current at 11.5 GHz, 5082-0610. Output power maximized at each current level.

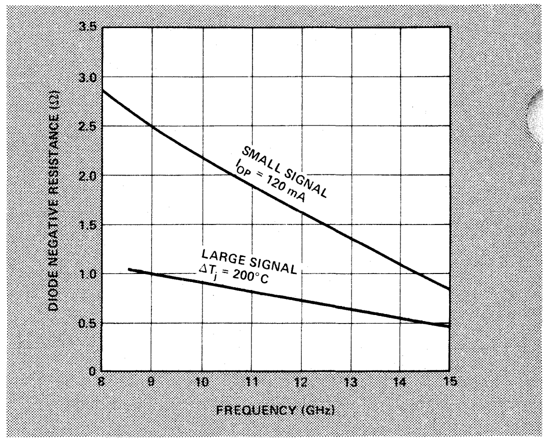


Figure 12. Typical Diode Negative Resistance vs. Frequency, 5082-0610. Large signal values derived with output power maximized at each frequency.

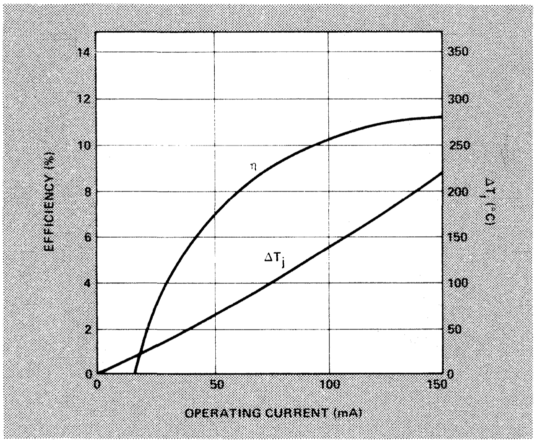


Figure 13. Typical Efficiency and Junction Operating Temperature Rise (ΔTj) vs. Operating Current at 11.5 GHz, 5082-0610. Output power maximized at each current level.

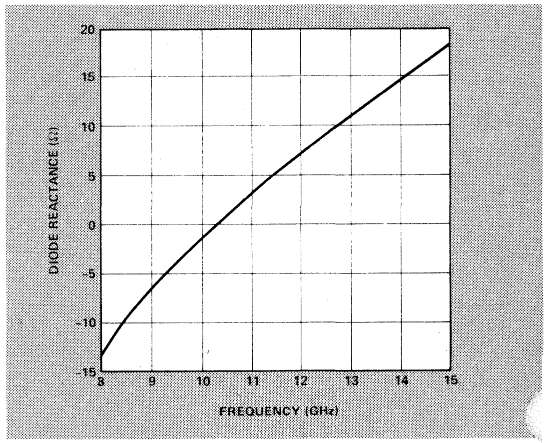


Figure 14. Typical Small Signal Diode Reactance vs. Frequency, 5082-0610. I_{OP} = 120 mA.

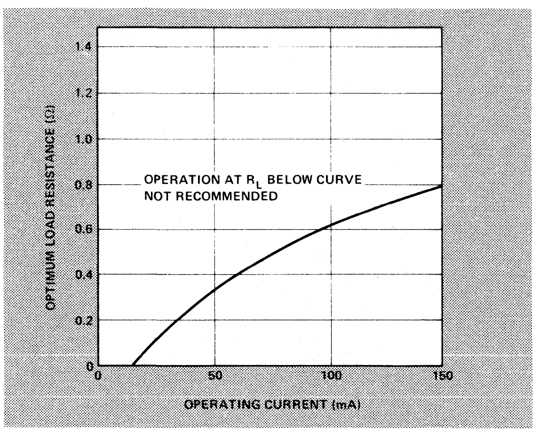


Figure 15. Typical Load Resistance vs. Operating Current at 11.5 GHz, 5082-0610. Output power maximized at each current level.

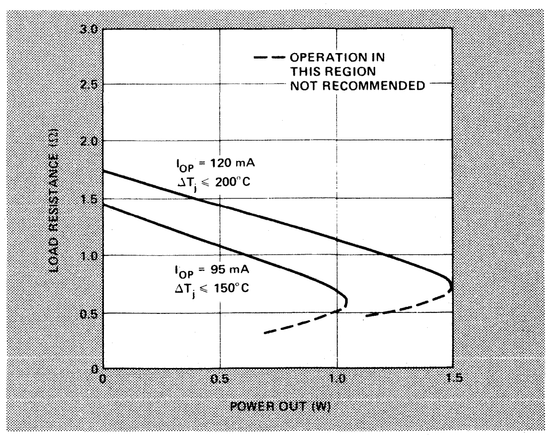


Figure 16. Typical Load Resistance vs. Output Power at 11.5 GHz with ΔTj as a parameter, 5082-0610.

Typical Parameters, 5082-0611

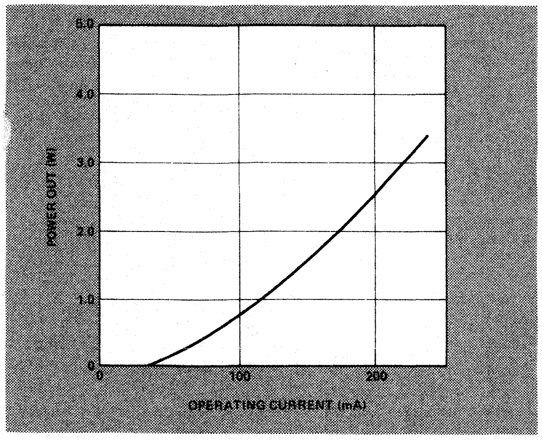


Figure 17. Typical Output Power vs. Operating Current at 11.5 GHz, 5082-0611. Output power maximized at each current level.

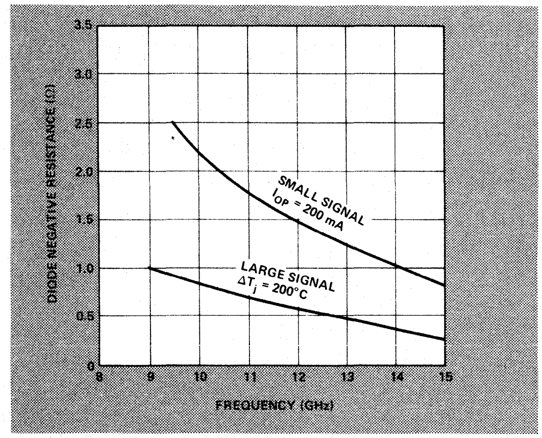


Figure 18. Typical Diode Negative Resistance vs. Frequency, 5082-0611. Large signal values derived with output power maximized at each frequency.

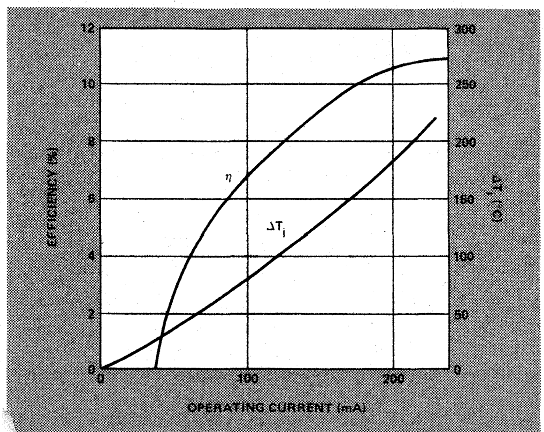


Figure 19. Typical Efficiency and Junction Operating Temperature Rise (ΔTj) vs. Operating Current at 11.5 GHz, 5082-0611. Output power maximized at each current level.

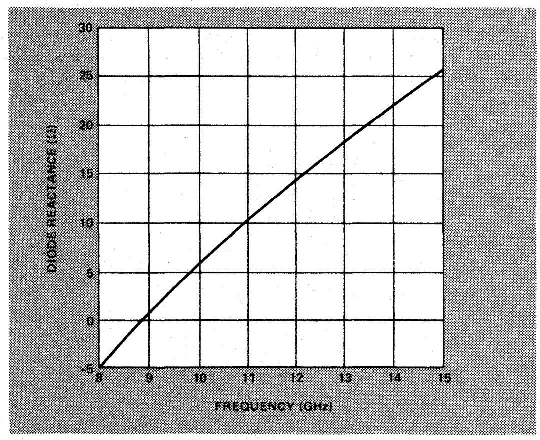


Figure 20. Typical Small Signal Diode Reactance vs. Frequency, 5082-0611. I_{OP} = 200 mA.

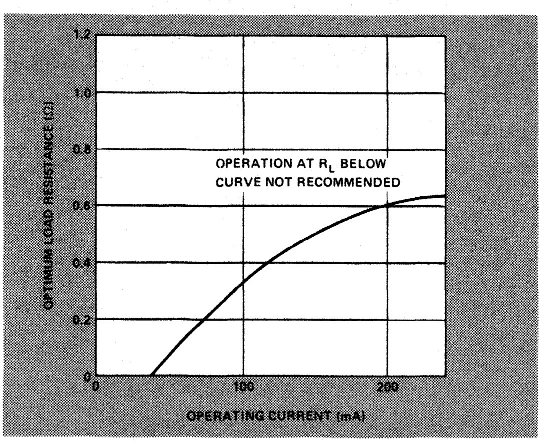


Figure 21. Typical Load Resistance vs. Operating Current at 11.5 GHz, 5082-0611. Output power maximized at each current level.

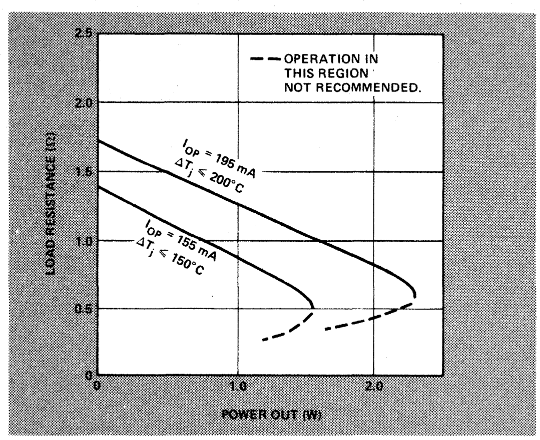


Figure 22. Typical Load Resistance vs. Output Power at 11.5 GHz with ΔTj as a parameter, 5082-0611.

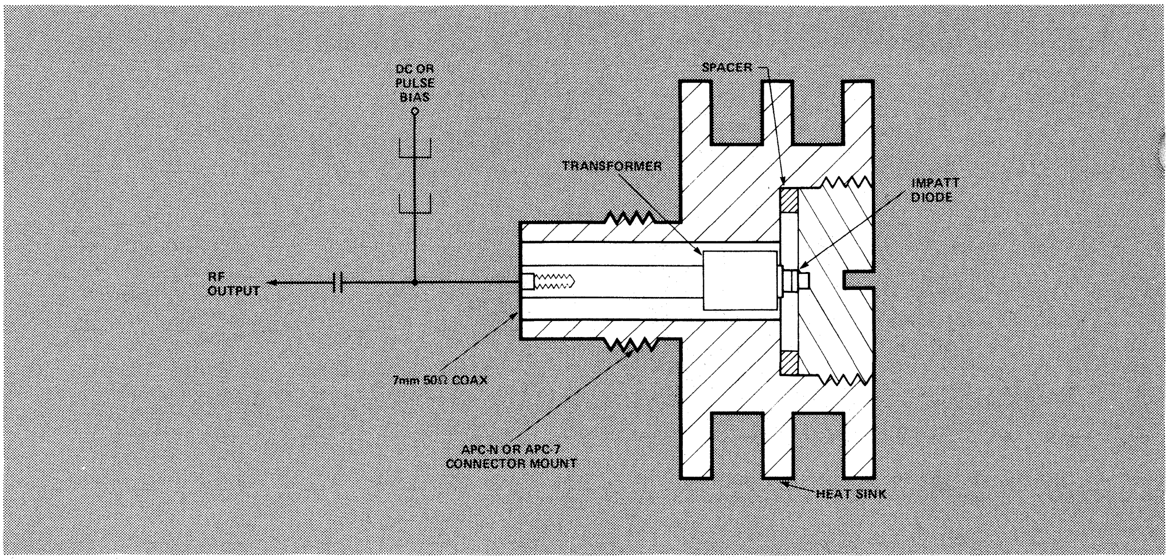


Figure 23. Simplified Drawing of Coaxial Cavity. Detailed mechanical drawings are available on request. A tuning screw should be used with this cavity. The use of fixed tuned cavities is not recommended for IMPATT Diodes. Minor variations of diode impedance among production units require some tuning capability.

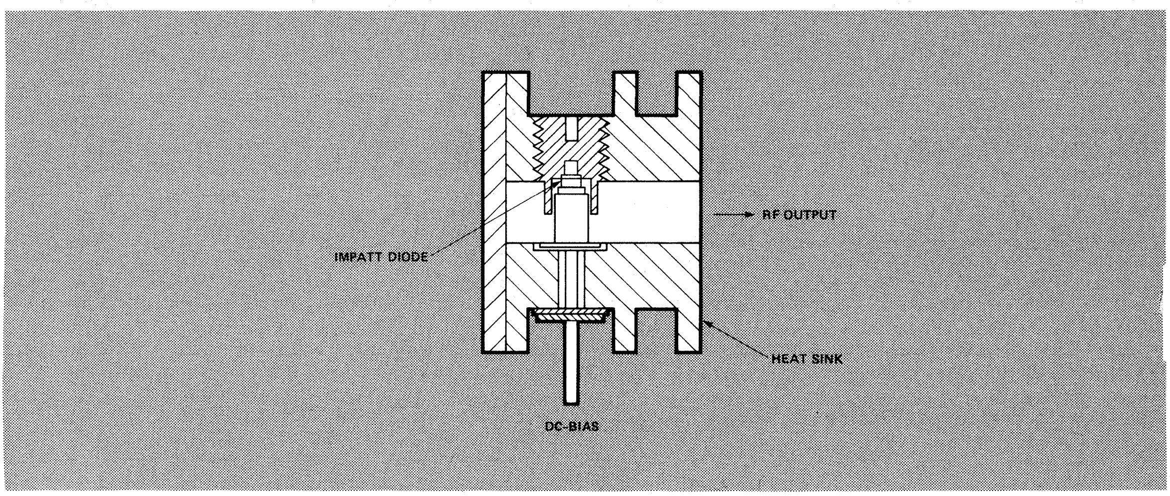


Figure 24. Waveguide Cavity.

HEWLETT hp PACKARD
COMPONENTS

SILICON IMPATT DIODES 4-14 GHz

5082-0400 SERIES

Features

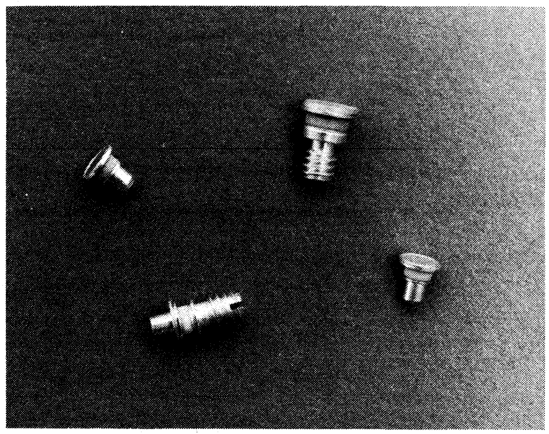
5082-0423 THROUGH -0427 OPTIMIZED FOR HIGH OUTPUT POWER

5082-0431 THROUGH -0436 OPTIMIZED FOR CONSUMER AND INDUSTRIAL EQUIPMENT REQUIRING 10-150 mW

LOW NOISE

HIGH RELIABILITY

LOW THERMAL RESISTANCE



MICROWAVE SOURCE DIODES

Description

IMPATT (IMPact Ionization Avalanche Transit Time) diodes are junction devices operated with reverse bias sufficient to cause avalanche breakdown. In this diode, the combination of avalanche generation and drift of carriers across the diode's active region produces negative resistance at microwave frequencies. Thus, in the appropriate circuit, the device can be the active element of a microwave oscillator or microwave amplifier.

These IMPATTs use the integral heatsink technology developed at Hewlett-Packard. During manufacture, junction layers are grown epitaxially on the semiconductor wafer, the heatsink is plated on, then the wafer is etched away to form individual diode mesas. The heatsink, which also serves as a substrate, is then cut into separate chips. This fabrication technique achieves intimate thermal contact between junction and heatsink.

Reliability

HP IMPATT diodes are designed to meet the requirements of MIL-S-19500 and are suitable for high reliability applications where maximum performance under the most adverse operating conditions is desired.

Applications

Devices of the 5082-0430 series are optimized for consumer and industrial applications requiring a low cost oscillator diode for the frequency range 5-14 GHz. The devices operate in a properly adjusted cavity as a 100 mW oscillator. Typical applications consist of intrusion alarm radars, traffic control radars, fuses, automatic braking systems and low cost telecommunications repeaters.

Because of their high power output, efficiency and reliability, the 5082-0423 through -0427 are ideally suited for use as the active element in oscillators and amplifiers from C to Ku-Band in point-to-point telecommunications links, telemetry systems, and Doppler landing and navigation systems.

Properly designed IMPATT oscillator circuits can have noise performance comparable to that of reflex klystron or Gunn oscillators in virtually any application. Of particular interest for Doppler radar systems is the fact that IMPATT diodes exhibit no measurable l/f noise near the carrier. More detailed information is available in HP Application Note 935.

Maximum Ratings at $T_A = 25°C$

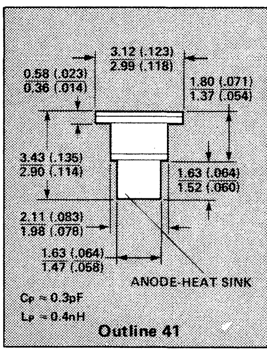
Storage Temperature Range . . . . -60°C to +150°C
Junction Operating Temperature Range . . -65°C to +200°C
Power Dissipation . . . . $\frac{200 - T_A}{\Theta_T}$
Soldering Temperature . . . . 220°C for 5 sec.

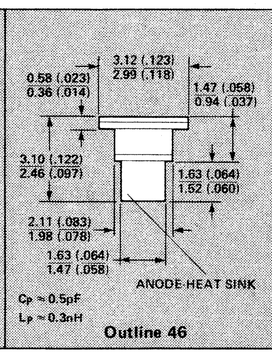
Electrical Specifications and Typical Parameters at $T_A = 25°C$

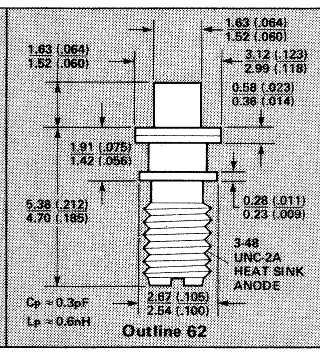
Part Number 5082-	Minimum CW Output Power[1] W	Recommended Frequency Range[1] GHz	Typical Efficiency[2] %	Typical Operating Voltage V	Typical Operating Current mA	Typical Junction Capacitance pF[3]	Typical Thermal Resistance °C/W[4]	Package Style
Low Power Series								
0431	0.1	5-9	3.5	110	25	0.29	35	41
0432	0.1	8-12	3.5	90	30	0.20	35	41
0435	0.1	8-12	3.5	90	30	0.20	35	62
0433	0.1	10-14	3.5	75	35	0.30	35	41
0436	0.1	10-14	3.5	75	35	0.30	35	62
Medium Power Series								
0400	0.5	8-10	6.5	95	115	0.52	16	41
0401	0.5	10-12	6	80	130	0.57	17	41
High Power Series								
0423	1.5	4-6.4	5.5	150	200	1.4	5.5	64
0424	1.5	5.9-8.4	6.5	125	220	1.1	6.5	64
0425	1.25	8-11	6	100	210	0.9	8.5	64
0426	1.0	10-12	7	80	200	0.8	10.5	41
0427	1.0	10-13.5	7	80	200	0.8	10.5	46

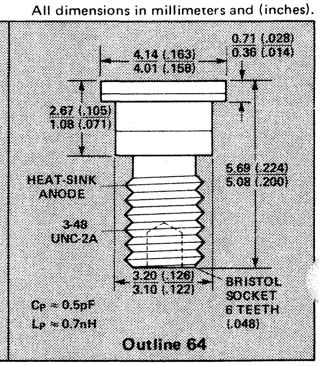
NOTES:
1. Measured in a fixed tuned oscillator at approximately midband. Typical diodes satisfy the minimum specification throughout the operating frequency range. Special models tested at other frequencies are available upon request.
2. $\eta = (P_O/P_{IN}) \times 100$.
3. Measured at 1.0 MHz.
4. The mount for an IMPATT diode must provide an adequate heat flow path away from the diode stud. The junction temperature rise will be: $\Delta T_j = \Theta_T (P_{IN} - P_O)$ Θ_T is measured with the diode mounted in an OFHC copper heatsink using the dc avalanche resistance method (cf HP Application Note 935, Page 6). To determine Θ_{jc}, use $\Theta_{jc} = \Theta_T - 1.5°$ C/W (1.5° C/W has been found to be a nominal value for a good heat flow path in the diode mount).

All dimensions in millimeters and (inches).









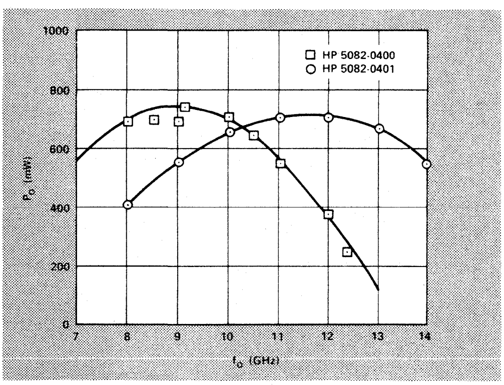


Figure 1. Typical Output Power as a Function of Frequency for HP 5082-0400 and HP 5082-0401.

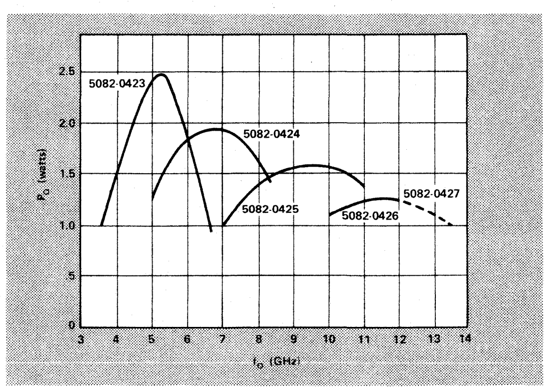


Figure 2. Typical Output Power vs. Frequency at $\Delta T_j = 175°C$. Optimized cavities will give better performance off center frequency.

STEP RECOVERY DIODES

5082-0100 SERIES
5082-0200 SERIES
5082-0300 SERIES
5082-0800 SERIES

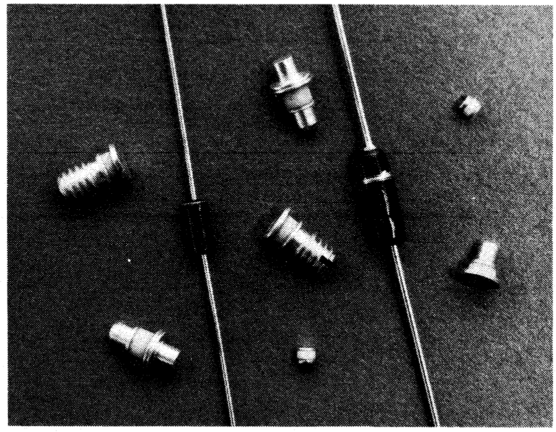
Features

OPTIMIZED FOR BOTH LOW AND HIGH ORDER MULTIPLIER DESIGNS FROM UHF THROUGH Ku BAND

PASSIVATED CHIP FOR MAXIMUM STABILITY AND RELIABILITY

AVAILABLE IN A VARIETY OF PACKAGES

SPECIAL ELECTRICAL SELECTIONS AVAILABLE UPON REQUEST



Description/Applications

These diodes are manufactured using modern epitaxial growth techniques. The diodes are passivated with a thermal oxide for maximum stability. The result is a family of devices offering highly repeatable, efficient and reliable performance. These diodes are designed to meet the general requirements of MIL-S-19500.

The 5082-0800 Series diode is designed to maximize cut-off frequency while maintaining a fast transition time. This characteristic leads to excellent performance in either low or high order multipliers and in comb generators. All ceramic package diodes in the 5082-0800 Series are supplied with measured data.

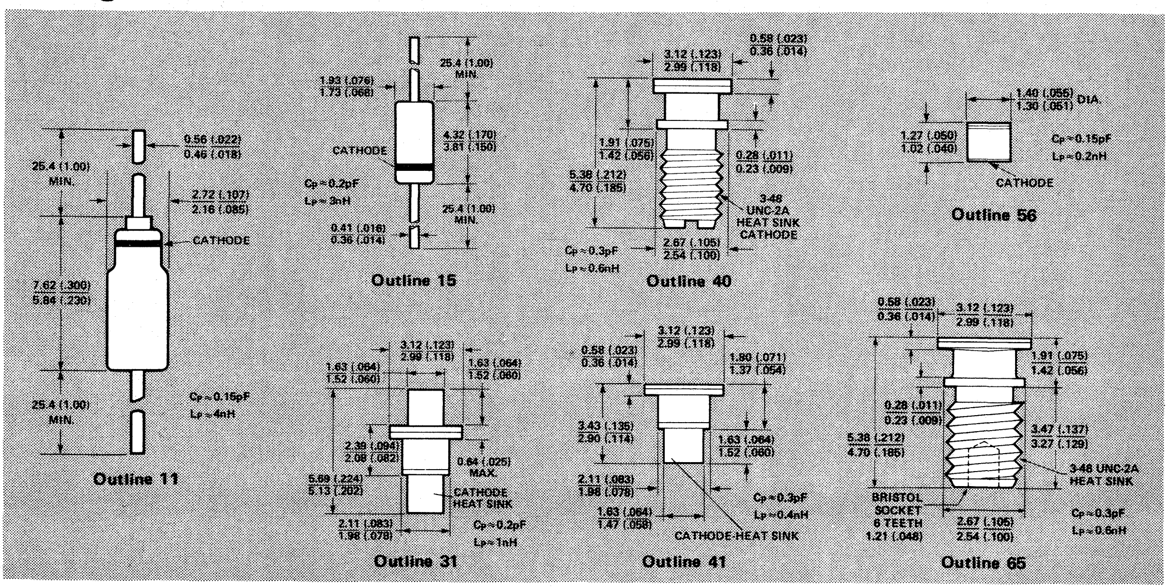
Maximum Ratings at $T_A = 25°C$

Junction Operating and Storage Temperature .... 65°C to 200°C

DC Power Dissipation .... $\frac{200°C - T_{case}}{\theta_{jc}}$

Soldering Temperature .... 230°C for 5 sec.

Package Dimensions



Mechanical Specifications

Hewlett-Packard's step recovery diodes are available in a variety of packages. Special package configuration is available upon request. Contact your local HP Field Office for additional information.

The metal-ceramic packages are hermetically sealed. The anode studs and flanges are gold-plated Kovar. The cathode studs are gold-plated copper. The maximum soldering temperature is 230°C for 5 seconds.

The HP outline 15 package has a glass hermetic seal with dumet leads. The leads should be restricted so that any bend starts at least 1.6 mm (.063 in.) from the glass body. The maximum soldering temperature is 230°C for 5 seconds.

Diodes for High Efficiency Multipliers (All Specifications at T_A = 25°C)

Ceramic Packaged Diodes

ELECTRICAL SPECIFICATIONS / TYPICAL PARAMETERS

Part Number 5082-	Junction Capacitance at -6V, $C_{j(-6)}$ *[1] [pF] Min.	Junction Capacitance at -6V, $C_{j(-6)}$ *[1] [pF] Max.	Minimum Breakdown Voltage, V_{BR} * @ I_R=10μA [V]	Minimum Cutoff Frequency, f_c[2] [GHz]	Package Outline	Typical Output Frequency Range [GHz]	Typical Output Power, P_o[3] [W]	Typical Lifetime, τ* [ns]	Typical Transition Time* t_t [ps]	Typical Transition Time* Charge Level [pC]	Typical Thermal Resistance, Θ_{jc} [°C/W]
0800 0801 0802	3.5	5.0	75	100	40 31 41	1-3	10	250	350	1500	15
0805 0806 0807	2.5	3.5	60	140	31 40 41	3-5	6	100	250	1500	20
0810 0811 0812	1.5	2.5	60	140	31 40 41	5-8	4	100	200	1000	25
0820 0821 0822	0.7	1.5	45	160	31 41 40	7-10	2.5	50	100	300	30
0830 0831	0.35	1.2	25	200	31 41	8-12	1.0	20	75	300	45
0835 0836 0885	0.1	0.5	15	350	31 41 56	10-20	0.3	10	50	100	60

*Data supplied with each diode includes measured V_{BR} and $C_{T(-6)}$ and lot typical τ and t_t.

Glass Packaged Diodes (Outline 15)[4]

ELECTRICAL SPECIFICATIONS / TYPICAL PARAMETERS

Part Number 5082-	Maximum Junction Capacitance at -6V, $C_{j(-6)}$[1] [pF]	Minimum Breakdown Voltage, V_{BR} @I_R=10μA [V]	Minimum Cutoff Frequency, f_c [2] [GHz]	Typical Lifetime, τ [ns]	Typical Transition Time t_t [ps]	Typical Transition Time Charge Level [pC]
0803	6.0	70	100	250	350	1500
0815	4.0	50	140	60	250	1500
0825	1.8	45	160	50	95*	300
0833	1.4	25	175	30	75*	300
0840	0.6	15	300	10	50*	100

*The transition times shown for the package 15 devices are limited by the package inductance to a minimum of 100 ps. The lower transition times shown for the -0825, -0833 and -0840 are based on the performance of the chip.

RF Tested Diodes (All Specifications at T_A = 25° C)

ELECTRICAL SPECIFICATIONS / TYPICAL PARAMETERS

Part Number 5082-	Output Frequency, f_o [GHz]	N Order	Minimum Output Power, P_o[5] [W]	Junction Capacitance at −10V, C_j[1] [pF] Min.	Max.	Breakdown Voltage at I_R=10μA V_{BR} [V] Min.	Max.	Maximum Thermal Resistance, θ_{jc} [°C/W]	Package Outline	Maximum Transition Time t_t [ps]	Charge Level [pc]	Typical Lifetime, τ [ns]
0300	2	X 10	2.0	3.2	4.7	75	100	14	40	450	2400	200
0303	2	X 10	2.0	3.2	4.7	75	100	14	65[6]	450	2400	200
0310	6	X 10	0.4	1.6	2.7	40	60	30	41	160	1000	75
0320	10	X 5	0.23	0.35	1.0	25	40	60	41	75	300	40
0335	16	X 8	0.03	0.25	0.5	20	30	75	31	60	100	15

DC Tested Diodes (All Specifications at T_A = 25° C)

ELECTRICAL SPECIFICATIONS / TYPICAL PARAMETERS

Part Number 5082-	Maximum Junction Capacitance at −10V, $C_{j(-10)}$[1] [pF]	Minimum Breakdown Voltage at I_R=10μA V_{BR} [V]	Maximum Transition Time t_t [ps]	Charge Level [pC]	Typical Lifetime τ [ns]	Package Outline	Typical Thermal Resistance Θ_{jc} [°C/W]
0113[7]	4.85	35	250	1500	100	11	300
0241	4.6	65	275	1500	100	31	60
0180	4.45	50	225	1500	100	11	300
0114[7]	3.85	35	225	1500	100	11	300
0112	1.55	35	175	1000	50	11	300
0132	1.5	35	175	1000	50	31	100
0243	1.2	35	110	600	30	31	100
0151	0.65	15	90	200	20	15	600
0253[7]	0.6	25	80	200	20	31	75
0153	0.4	25	90	200	20	15	600

Suggested output frequency, $f_{o(max)} \leq 1/t_t$

NOTES:
1. Capacitance selection is available upon request. Contact your local sales office.
2. $f_c = \dfrac{1}{2\pi R_s C_{j(-6)}}$
3. As a doubler at midband.
4. For package outline 15 typical thermal resistance is 600° C/W with adequate heat sink.
5. Guaranteed multiplier tested results.
   Input power is: 5082-0300 15W, 5082-0320 2W, 5082-0310 4W, 5082-0335 0.65W
6. Package 65 is a modified version of the package 40. It features a 6-tooth, 1.21mm (.048 in) Bristol socket rather than a screw driver slot. A Bristol socket wrench is shipped with each order for 5082-0303.
7. The 5082-0113, -0114 and -0253 are also available by EIA registration numbers 1N5163, 1N5164 and 1N4547 respectively.

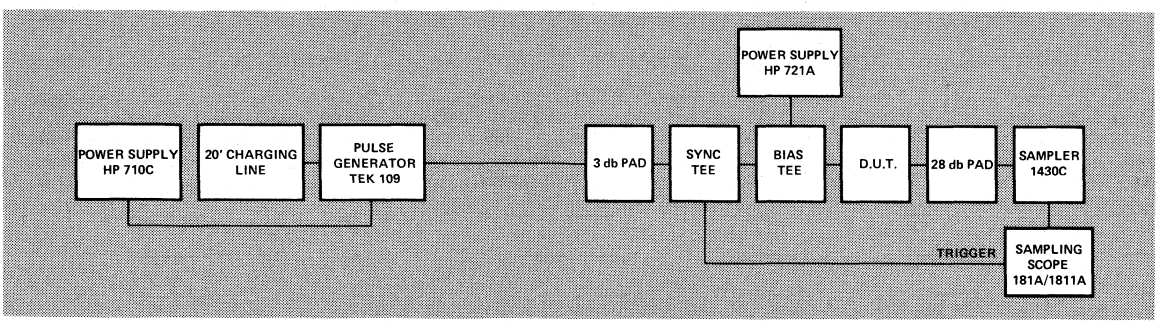


Figure 1. Test circuit for transition time. The pulse generator circuit is adjusted for a 0.5 A pulse when testing 5082-0151, 0253, 0335, 0835, 0836, 0885 and 0840. A pulse of 1.0 A is used for all other diodes. The bias current is adjusted for the specified stored charge level. The transition time is read between the 20% and the 80% points on the oscilloscope.

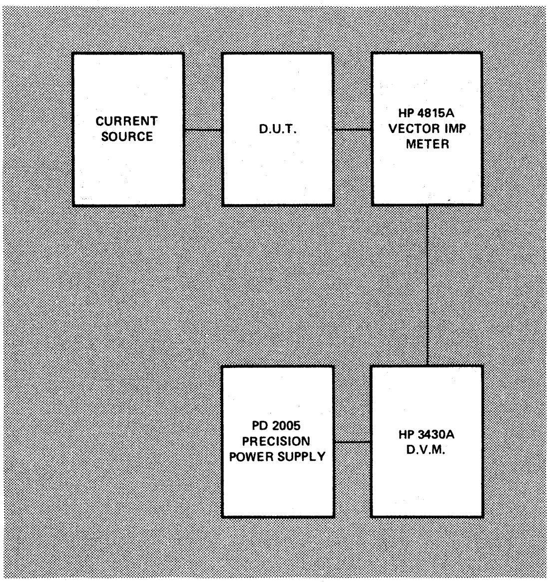


Figure 2. Test set-up for measurement of series resistance. The D.U.T. is forward biased (I_F) and the real part of the diode impedance is measured at 100 MHz. The D.V.M. is set up to read the real part on the Vector Voltmeter. The precision power supply is used to offset the test circuit resistance. R_S is measured at I_F = 100mA except 0800, 0801, 0802, 0803 where I_F = 500mA.

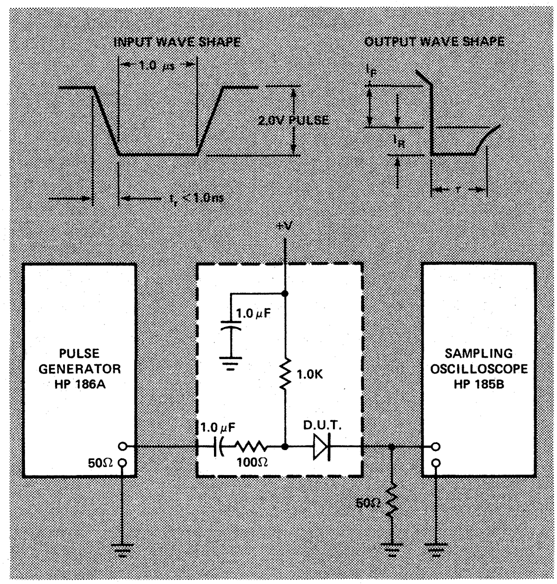


Figure 3. The Circuit for Measurement of the Effective Minority Carrier Lifetime. The value of the reverse current (I_R) is approximately 6 mA and the forward current (I_F) is 1.71 I_R. The lifetime (τ) is measured across the 50% points of the observed wave shape. The input pulse is provided by a pulse generator having a rise time of less than one nanosecond. The output pulse is amplified and observed on a sampling oscilloscope.

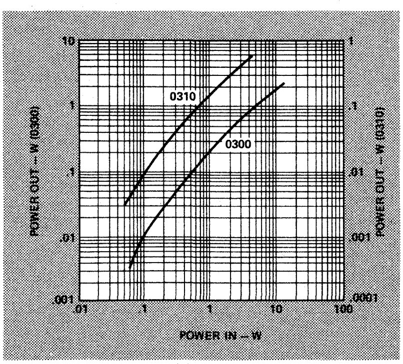


Figure 4. Typical Output Powers vs. Input Power at T_A = 25°C. The 5082-0300 is measured in a x 10 multiplier with P_{IN} at 0.2 GHz and P_O at 2.0 GHz. The 5082-0310 is measured in a x 10 multiplier with P_{IN} at 0.6 GHz and P_O at 6.0 GHz.

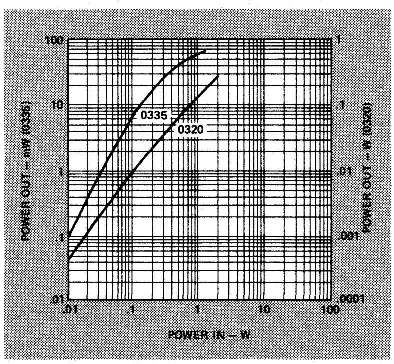


Figure 5. Typical Output Power vs. Input Power at T_A = 25°C. The 5082-0335 is measured in a x 8 multiplier with P_{IN} at 2 GHz and P_O at 16 GHz. The 5082-0320 is measured in a x 5 multiplier with P_{IN} at 2.0 GHz and P_O at 10 GHz.

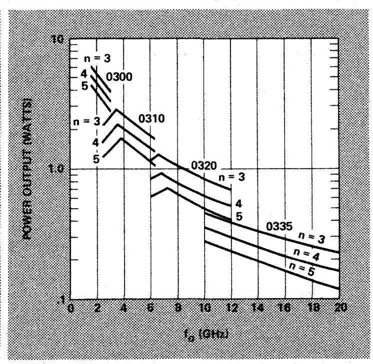
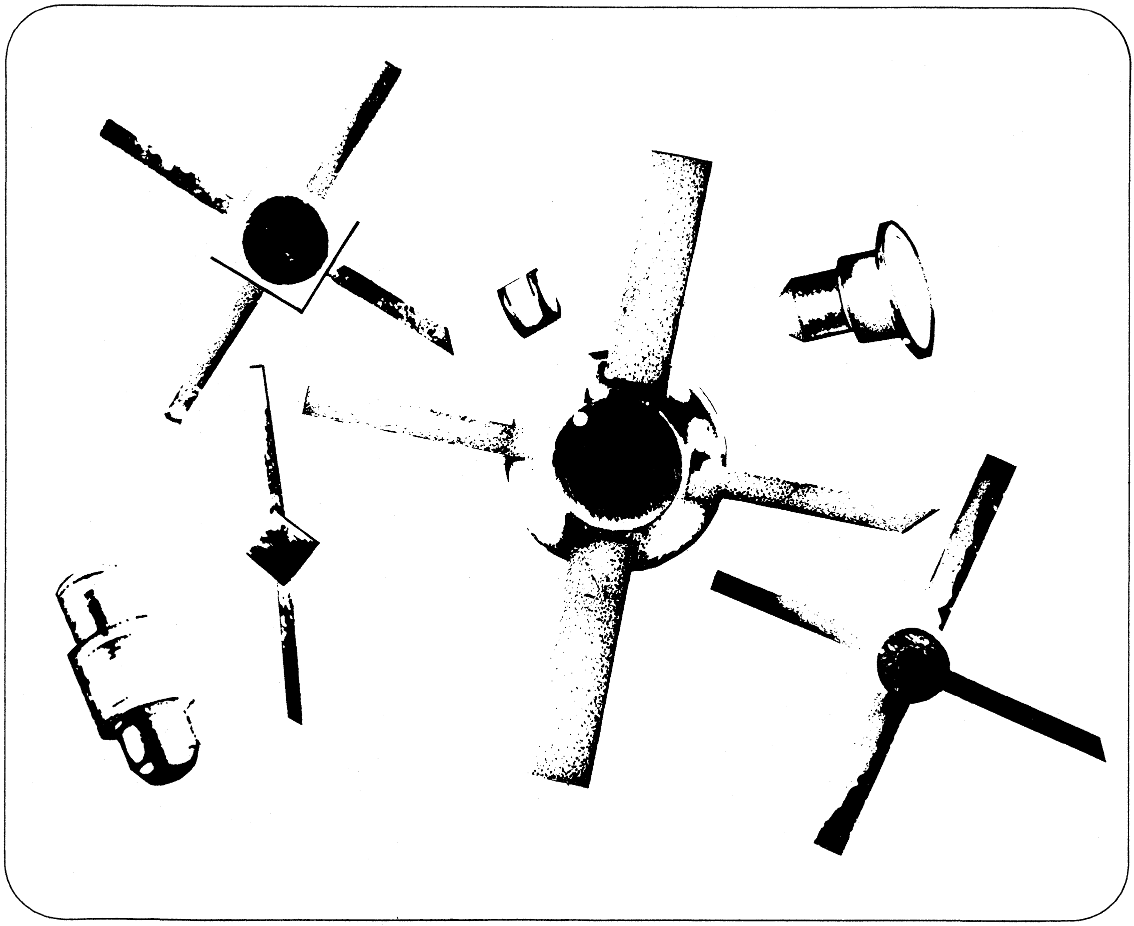


Figure 6. Predicted power output curves for 03XX step recovery diodes in X3, X4, and X5 multiplier applications. These results were obtained using computer organization programs.

Devices For
Hybrid Integrated Circuits

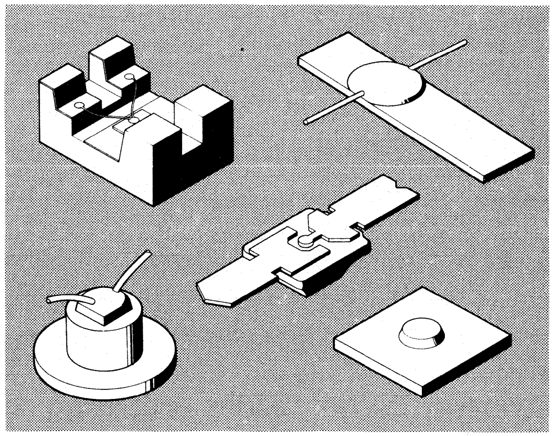


HEWLETT PACKARD
COMPONENTS

DEVICES FOR HYBRID INTEGRATED CIRCUITS

Devices

MIS CHIP CAPACITORS
SCHOTTKY BARRIER DIODES
PIN DIODES
STEP RECOVERY DIODES



Description

Hewlett-Packard offers a complete line of RF, microwave and switching semiconductor diodes and MIS capacitors in forms especially designed for hybrid integrated circuits.

Diodes included are Schottky barrier diodes for RF and microwave switches, mixers and detectors; PIN diodes for RF and microwave switches and AGC attenuators, and step recovery diodes for comb generators and frequency multipliers.

In addition to chips, package forms include the LID (Leadless Inverted Device), Ministrip, Microstrip Post, and Beam Lead.

Although all devices offered are passivated, it is recommended that the end item be hermetically sealed for maximum stability and reliability.

Most dc and RF parameters can be specially tested and guaranteed. Contact your local HP sales office for assistance if special specification is required.

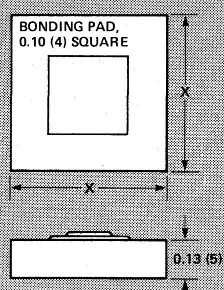
Although not all are listed in this brochure, most Hewlett-Packard diodes are available in chip form. Any available chip can be supplied in any of the carriers listed. Contact your local HP sales office for price, availability, and specifications of any special device not included in this brochure.

MIS Chip Capacitors

ELECTRICAL SPECIFICATIONS AT T_A = 25°C

Part Number HCAP-	Capacitance ±15%[1] (pF)	Minimum Breakdown Voltage, V_{BR} (V)	Chip Outline
6050	0.5	250	A
6100	1.0	250	A
6200	2.0	250	A
4500	5.0	150	A
4101	10.0	150	A
4151	15.0	150	B
4201	20.0	100	B
4251	25.0	100	B
4301	30.0	100	B
4401	40.0	100	B
4451	45.0	100	B

CHIP OUTLINE DRAWING



OUTLINE:	A	B	C
DIMENSION X:	0.50 (20)	0.64 (25)	0.76 (30)

NOMINAL DIMENSIONS IN mm AND ($\frac{INCH}{1000}$)

Operating and Storage Temperature Range: -55°C to +200°C
Temperature Coefficient of Capacitance: 200 ppm/°C Max.
Top Contact: Note 2.
Back Contact: Note 2.

Notes:
1. Other capacitance values as well as tighter tolerances are available. Capacitance values from 46-100 pF supplied as Outline C.
2. The chip back contact is nickel/gold and is suitable for AuGe or AuSn solder, or epoxy die attach. The bonding pad is Au and can be wire bonded by Thermo-compression or ultrasonic techniques.

Schottky Barrier Diodes

Schottky Barrier Diodes For General Purpose Applications

ELECTRICAL SPECIFICATIONS AT T_A = 25°C

Part Number, 5082-					Minimum Breakdown Voltage, V_{BR} (V)	Minimum Forward Current I_F (mA)	Maximum Junction Capacitance, C_{jo} (pF)	Nearest Equivalent Packaged Part No. 5082-
Chip For Epoxy Or Solder Die Attach	Chip For Eutectic Or Solder Die Attach	Beam Lead	LID (Outline 50)	Ministrip (Outline 71)				
0024	0094	2837	2802	2801	70	15	1.7	2800
0087	0057				20	35	1.0	2810
0097	0058		2844	2845	15	20	1.1	2811
0031					5	10*	0.8	2835
300°C 1 Min.	400°C 1 Min.	220°C 10 Sec.	250°C 5 Sec.	250°C 5 Sec.	—	—	—	Soldering Conditions
Notes: 1,2	2	6	1,7,8 C_P = .18pF	1,4 C_P = .13pF	I_R = 10 μA	V_F = 1V *V_F = 0.45V	V_R = 0V f = 1 MHz	Notes

Note: Total capacitance $C_{TO} = C_{jo} + C_P$.

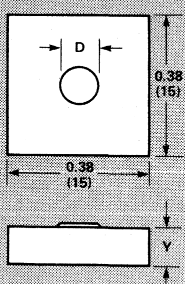
Schottky Barrier Diodes For Mixing and Detecting

ELECTRICAL SPECIFICATIONS AT T_A = 25°C **TYPICAL PARAMETERS**

Part Number, 5082-				Maximum Junction Capacitance, C_{jo} (pF)	Typical Noise Figure, NF (dB) [C]	Typical Tangential Sensitivity, TSS, (dBm)	Nearest Equivalent Packaged Part No. 5082-
Chip	Beam Lead [B]	LID (Outline 50)	Ministrip (Outline 71)				
0023	2709	2705	2710	0.18	6.0	-54	2713
0029	2716 2767	—	—	0.14	7.0*	-54	2721
0013 [A]	2229 [A] 2229 [A]	—	—	0.18	6.0	-54	2285 [A]
0009	—	2754	2753	0.14	7.0	-55	2750
250°C, 1 Min. or 300°C, 15 Sec.	220°C 10 Sec.	250°C 5 Sec.	250°C 5 Sec.	—	—	—	Soldering Conditions
Notes: 1,2	6	1,7,8 C_P = .18 pF	1,4 C_P = .13 pF	V_R = 0V f = 1 MHz	f = 9.375 GHz *f = 16 GHz	f = 10 GHz BW = 2MHz	Notes

Notes: [A] Low V_F Schottky Barrier Diodes. [B] For complete Beam Lead specifications refer to individual product specification sheet: "Schottky Barrier Diodes for Stripline and Microstrip Mixers and Detectors". [C] NF includes 1.5 dB for the IF Amplifier.

CHIP OUTLINE DRAWING



ALL DIMENSIONS IN mm AND (MILS)

DIMENSION	HP PART NUMBER 5082 - 0024 0094	0057, 0058, 0087, 0097	0031	0013, 0023,* 0029	0009*
D	0.09 (3.6)	0.07 (2.8)	0.05 (2.0)	0.02 (0.80)	0.02 (0.80)
Y	0.13 (5.2)	0.13 (5.2)	0.13 (5.2)	0.13 (5.2)	0.10 (4)
TOP CONTACT	Au, ANODE	Au, ANODE	Ag with Au flash, ANODE	Au, ANODE	Au, CATHODE
BOTTOM CONTACT	Au, CATHODE	Au, CATHODE	Au, CATHODE	Au, CATHODE	Au, ANODE
OPER & STG. TEMP. RANGE	-65°C to +200°C		-65°C to +150°C		

* 9 - contact versions are available as 5082-0041 (5082-0023) and 5082-9891 (5082-0009).

PIN Diodes

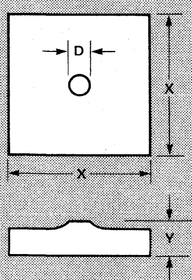
ELECTRICAL SPECIFICATIONS AT T_A = 25°C — TYPICAL PARAMETERS

Part Number, 5082-				Minimum Breakdown Voltage, V_{BR}(V)	Typical Junction Capacitance, C_{jVR}(pF)	Typical Series Resistance, R_S(Ω)	Typical Lifetime, τ (ns)	Typical Reverse Recovery Time, t_{rr} (ns)	Nearest Equivalent Packaged Part No. 5082-
Chip	LID (Outline 50)	Ministrip (Outline 72)	Post (Outline 74)						
0012	3005	3000	3259	150	0.07	0.8	400	100	3001
0030	—	3309	—	150	0.07	0.8	400	100	3301
0047	—	—	—	150	0.09	0.6	400	100	3001
9882	—	—	—	150	0.09	0.6	400	100	3301
0025	3085	3086	—	100	0.10	1.5	1300	1000	3080
0039	—	—	—	100	0.10	2.0	2000	1000	3081
0001*	3045	3010	3258	70	0.12*	0.8*	15	5	3041
0049	—	—	—	400	0.12	0.6	800	200	3046
0034	—	—	—	35	0.80*	0.4**	40	12	3168
425°C, 1 Min. *300°C, 1 Min.	250°C 5 Sec.	325°C 5 Sec.	250°C 5 Sec.						Soldering Conditions
Notes: 3 *2	7,8 C_P = .18pF	4 C_P = .13pF	9 C_P = .13pF	I_R = 10 μA	V_R=50V *V_R=20V f=1 MHz	I_F=100mA *I_F=20 mA **I_F=10mA f=100MHz	I_F=50mA I_R=250mA	I_F=20mA V_R=10V	Notes

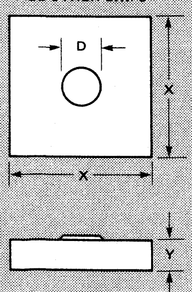
Note: Total capacitance $C_{TVR} = C_{jVR} + C_P$.

CHIP OUTLINE DRAWINGS

5082-0001



ALL OTHER CHIPS



DIMENSION	HP PART NUMBER 5082 - 0012 0047	0030 9882	0034	0025	0039	0049	0001
D	0.10 (4)	0.10 (4)	0.10 (4)	0.23 (9)	0.23 (9)	0.23 (9)	0.05 (2)
X	0.38 (15)	0.38 (15)	0.38 (15)	0.51 (20)	0.51 (20)	0.51 (20)	0.38 (15)
Y	0.09 (3.6)	0.09 (3.6)	0.13 (5.2)	0.15 (6)	0.23 (9.2)	0.08 (3.2)	0.10 (4)
TOP CONTACT	Au, CATHODE	Au, ANODE	Ag, ANODE	Ag, CATHODE	Ag, CATHODE	Ag, CATHODE	Ag, ANODE
BOTTOM CONTACT	Au, ANODE	Au, CATHODE	Au, CATHODE	Au, ANODE	Au, ANODE	Au, ANODE	Au, CATHODE

ALL DIMENSIONS IN mm AND (MILS)

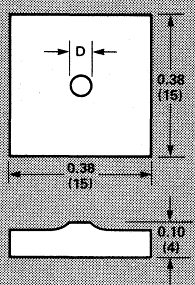
OPERATING AND STORAGE TEMPERATURE RANGE: -60°C TO +150°C.

Step Recovery Diodes

ELECTRICAL SPECIFICATIONS AT $T_A = 25°C$ — **TYPICAL PARAMETERS**

Part Number, 5082-								
Chip	LID (Outline 50)	Ministrip (Outline 72)	Minimum Breakdown Voltage, V_{BR}(V)	Typical Chip Capacitance, C_{jVR}(pF)	Typical Lifetime, τ (ns)	Typical Transition Time, t_t(ps)	Nearest Equivalent Packaged Part No. 5082-	
0020	0316	0305	25	0.4-1.0	30	75	0830	
0008	0318	0340	15	0.15-0.5	10	50*	0835	
300°C 1 Min.	250°C 5 Sec.	250°C 5 Sec.	—	—	—		Soldering Conditions	
3	7,8 C_P = .18pF	4 C_P = .13pF	I_R=10 uA	V_R=10 V f=1 MHz		Charge Level 300 pC *100 pC	Notes	

CHIP OUTLINE DRAWINGS



DIMENSION	5082 - 0020	5082 - 0080
D	0.10 (4)	0.06 (2.4)

ALL DIMENSIONS IN mm AND (MILS)

Top Contact: Ag, Anode
Bottom Contact: Au, Cathode
Operating and Storage Temperature
Range: −60°C to +150°C

Notes

1. Handle with grounded tweezers and grounded bonding equipment. These diodes are pulse sensitive and may be damaged by electrostatic charges. Eutectic bonding or die attaching may damage the chip. A preform must be used.
2. Use standard thermocompression bonding techniques. Ultrasonic bonding is not recommended.
3. Either ultrasonic or thermocompression bonding techniques can be employed.
4. Ministrip Handling and Mounting Techniques
   The Ministrips may be mounted by using conductive epoxy such as Hysol K20 or Dupont 5504. Conventional soldering techniques may also be used.

   Direct heating or resistive heating of the substrate using a parallel gap welder are acceptable methods. High temperature solder preforms such as gold-tin (280°C Eutectic) may be used for the Step Recovery and PIN diodes. Low temperature solder preforms such as tin-lead should be used with the Schottky barrier diodes. The composition of the solder preform should be compatible with the techniques and materials used in the substrate and conductive land patterns.

   The leads may be attached by using ultrasonic or thermocompression bonding methods. A parallel gap welder may also be used (Figure 1). Conventional soldering techniques are not recommended for the gold leads.
5. Reverse Polarity - Anode is the bottom contact and the Cathode is the top contact.
6. Handling Beam Lead Diodes
   Hewlett-Packard beam lead diodes require careful handling. The handling techniques described here are necessary so that the diodes will not be mechanically or electrically damaged. The diodes are very small and magnification may be used to see them inside the shipping container.

   These beam lead diodes are shipped in a flat, plastic container. The inside bottom surface of the container is coated with a thin layer of silicone to which the diodes adhere. They are covered with anti-static silk. A vacuum pickup with a #27 tip is recommended for picking up single beam lead devices. This should be done under 20 X magnification for accurate positioning of the tip on the die.

   If a vacuum pickup is not used, it is recommended that a wooden toothpick or a plain Q-tip stick be used as a handling probe. The diode will adhere to the end of the wooden probe without danger of mechanically or electrically damaging the diode. It can then be placed where needed.

   Tweezers can also be used but they must be electrically grounded to the surface upon which the device is being placed. The tweezers should be used as a probe to lift the diode, not to grasp the diode. If used to grasp the diode, the gold tabs can be deformed.

   A beam lead diode can be destroyed electrically by a static discharge through the diode. Hence they must be handled so static discharges cannot occur.

   Parallel gap welding or thermocompression bonding are recommended.
7. Polarity Designation on LIDs. See Outline 50 (LID Package) below.

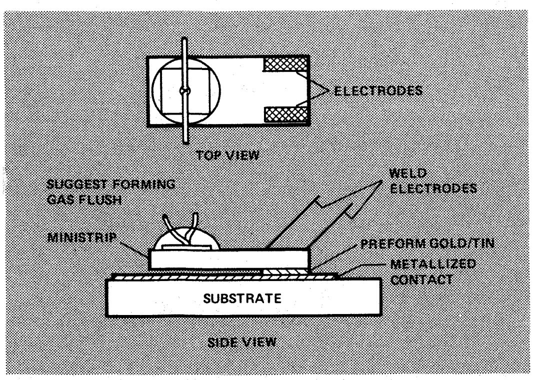
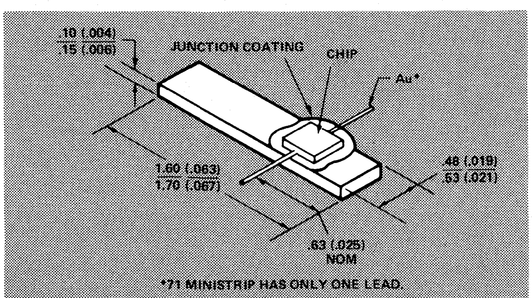
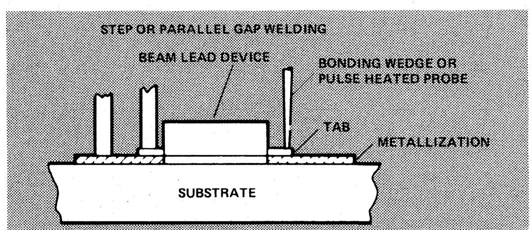


Figure 1. Resistance Heating the Ministrip

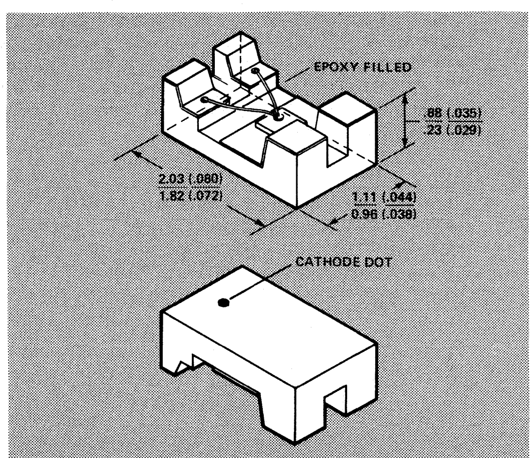


Outline 71,72

ALL DIMENSIONS IN MILLIMETERS AND (INCHES).



Beam Lead Attachment

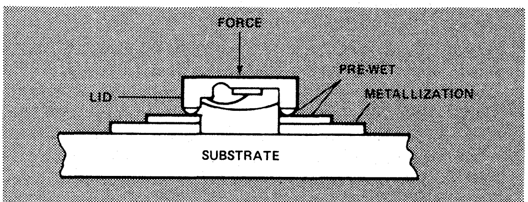


Outline 50 (LID Package)

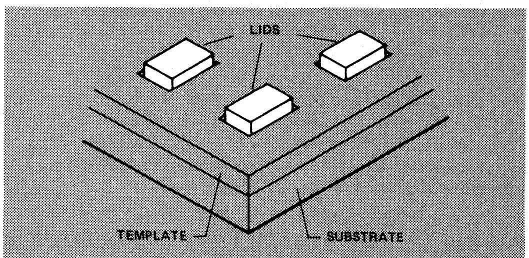
8. Leadless Inverted Device (LID)

Mounting Recommendations

The LID may be mounted by individually soldering each device or batch flow soldered as illustrated below:



LID Mounting



Batch Reflow Soldering of LIDs

Prior to soldering it is advisable to tin each device. Scrub the pads of the LID with a Pink Pearl eraser to remove any dirt or other foreign matter. Then rinse the LID in TCE (Trichloroethylene).

Dip the LID in Alpha 711 Flux using titanium tweezers. With those tweezers, place the unit in a solder bath of 62% Sn, 36% Pb, and 2% Ag, for 30 seconds and remove. Note, the solder bath must be maintained at a temperature of 220°C plus or minus 5°C through the process.

Dip the LID in the solder bath again for 3 seconds. When removing the LID, hold it 1/8 inch above the solder pot for 5 seconds to obtain thermal equilibrium.

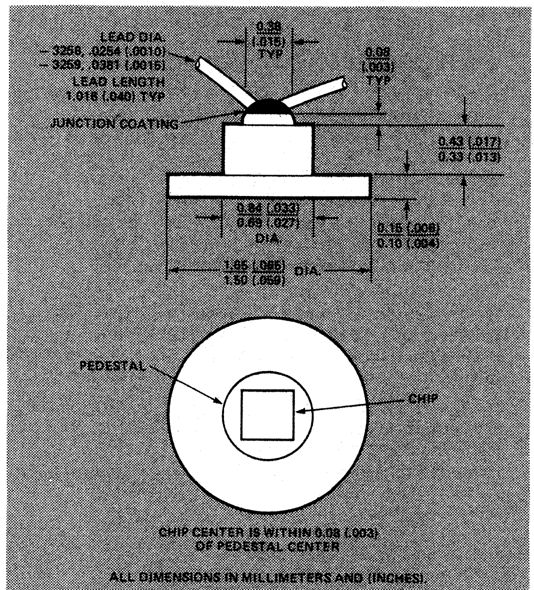
Wait 10 seconds before rinsing in TCE. Brush off the TCE with an artist's brush.

Now inspect each LID under a microscope to see if the tin covers over 90% of the contact pad area and if this area appears to have a shiny, bright, continuous homogeneous solder casting. If the LID appearance fails to meet the inspection criteria, repeat the tinning process, starting with the flux dip.

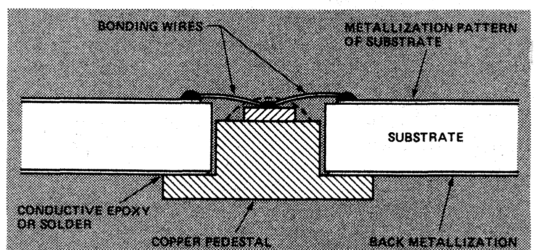
9. The HP package outline 74 consists of a gold plated copper pedestal. The top contact wire exhibits an inductance (L_P) of approximately .5 nH for a typical connecting wire length of approximately 20 mils.

The polarity of the 5082-3258 is cathode on heat sink. The polarity of the 5082-3259 is anode on heat sink.

After attachment of a gold wire, the chip is covered with a thin layer of silicone junction coating for protection against mechanical damage. The connecting wires are bent upwards for transportation and easy circuit insertion.



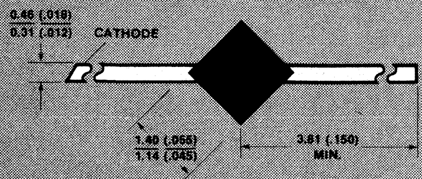
Outline 74 (Post)



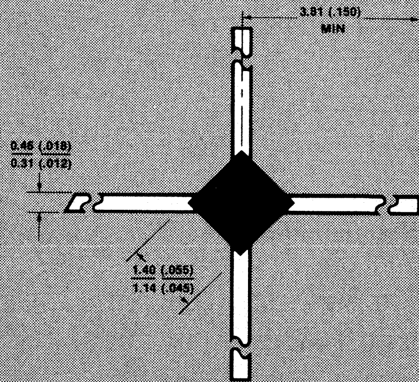
Suggested Microstrip Assembly Technique

Microwave Diode Package Outlines

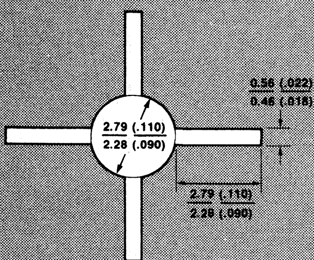
All Dimensions in Millimeters (Inches). For Complete Package Specifications Refer to Individual Product Specification Sheets.



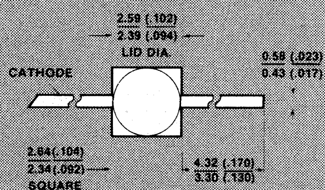
OUTLINE C2



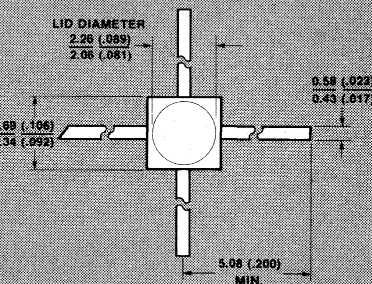
OUTLINE C4



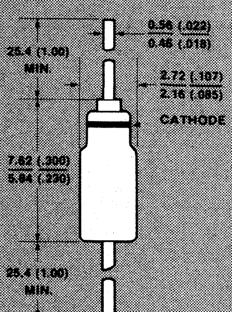
OUTLINE E1



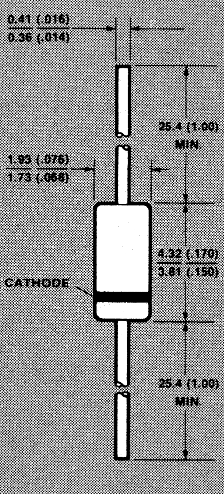
OUTLINE H2



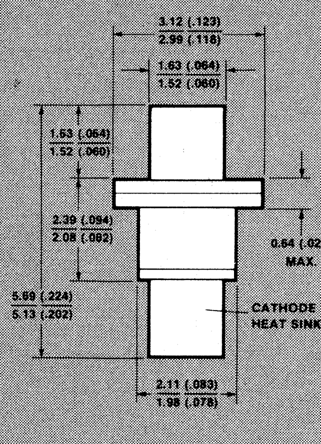
OUTLINE H4



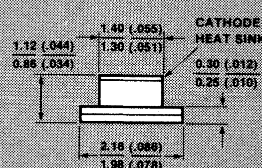
OUTLINE 11



OUTLINE 15



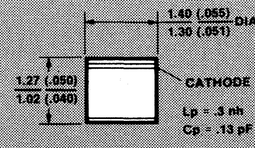
OUTLINE 31



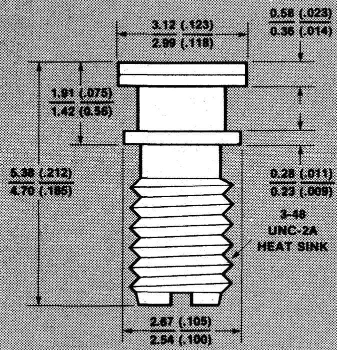
OUTLINE 38

DEVICES FOR HYBRID I.C.s

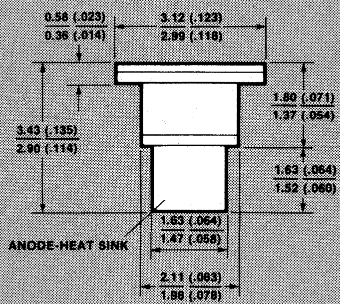
All Dimensions in Millimeters (Inches). For Complete Package Specifications Refer to Individual Product Specification Sheets.



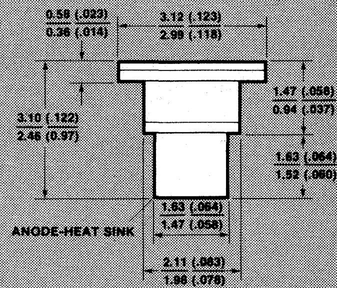
OUTLINES 44,56



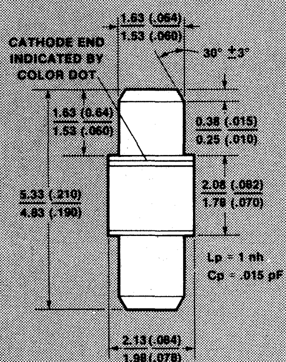
OUTLINE 40



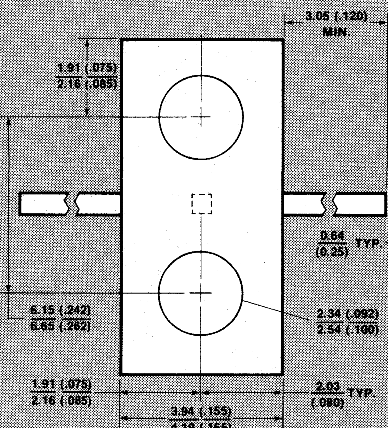
OUTLINE 41



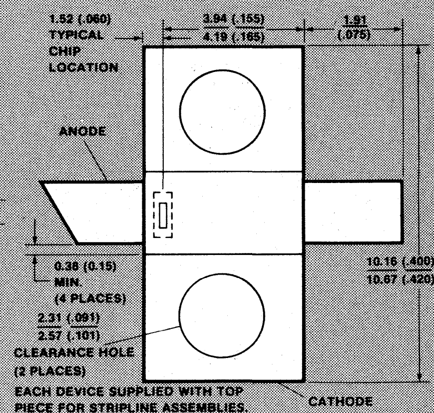
OUTLINE 46



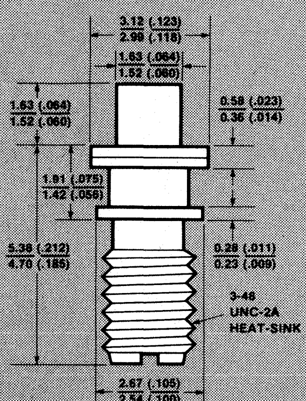
OUTLINE 49



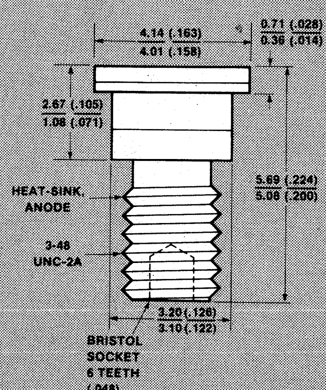
OUTLINE 60



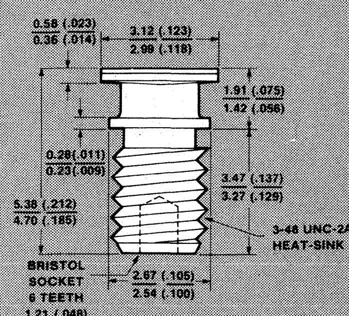
OUTLINE 61



OUTLINE 62

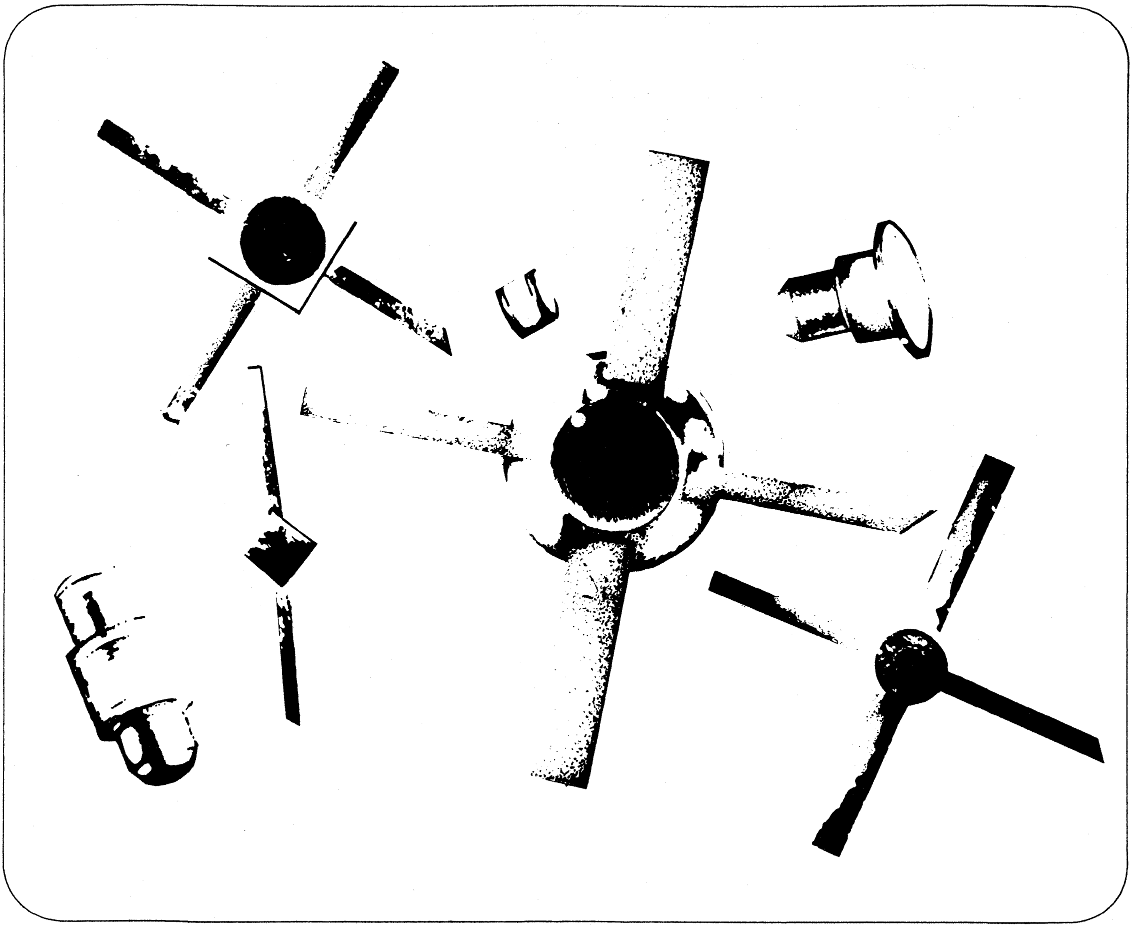


OUTLINE 64



OUTLINE 65

Military Approved Devices



Military Approved
PIN and Schottky Diodes — Selection Guide

Commercial Part No. 5082-	Military Approved JAN/JANTX/JANTXV*	Page Number
2800	1N5711	5-5
2810	1N5712	5-7
3039	1N5719	5-9

*JANTXV approval does not apply to the 1N5719.

High Reliability Test Program[1]– Selection Guide

Commercial Part No. 5082-[1]	Commercial Part Page No.	High Reliability Test Program Page No.
GLASS PACKAGED STEP RECOVERY DIODES		
0112	3-15	5-11
0114	3-15	5-11
0151	3-15	5-11
0180	3-15	5-11
[2]	3-15	5-11
CERAMIC PACKAGED STEP RECOVERY DIODES		
0132	3-15	5-11
0241	3-15	5-11
0243	3-15	5-11
0253	3-15	5-11
0300	3-15	5-11
0310	3-15	5-11
0320	3-15	5-11
0335	3-15	5-11
[2]	3-15	5-11
CERAMIC PACKAGED MICROWAVE MIXER DIODES		
2701	1-17	5-11
2702	1-17	5-11
2706	1-17	5-11
2707	1-17	5-11
2711	1-17	5-11
2712	1-17	5-11
2713	1-17	5-11
2714	1-17	5-11
2721	1-17	5-11
2722	1-17	5-11
2723	1-17	5-11
2724	1-17	5-11
PIN RF RESISTOR DIODES		
3003	2-3	5-11
3004	2-3	5-11
3080	2-3	5-11
3081	2-3	5-11

Commercial Part No. 5082-[1]	Commercial Part Page No.	High Reliability Test Program Page No.
CERAMIC PACKAGED PIN DIODES		
3101	2-9	5-11
3102	2-9	5-11
3201	2-9	5-11
3202	2-9	5-11
3304	2-9	5-11
3305	2-9	5-11
3306	2-9	5-11
HERMETIC STRIPLINE PIN DIODES		
3140	2-15	5-11
3141	2-15	5-11
3170	2-15	5-11
DIODE CHIPS		
0001	4-3	5-11
0008	4-3	5-11
0009	4-3	5-11
0012	4-3	5-11
0020	4-3	5-11
0023	4-3	5-11
0024	4-3	5-11
0025	4-3	5-11
0029	4-3	5-11
0030	4-3	5-11
0031	4-3	5-11
0087	4-3	5-11
0097	4-3	5-11
MICROWAVE TRANSISTORS		
35824A	6-10	5-11
35826E	6-10	5-11
35829E	6-10	5-11
35866E	6-11	5-11

Note 1. All Hewlett-Packard Diodes that have been Hi-Rel tested and are offered as part of one of our High Reliability Test Programs have been assigned a two or three digit prefix, TX- or TXB-, which replaces the commercial part number prefix 5082-.

Note 2. All 0800 series high efficiency SRD diodes are available.

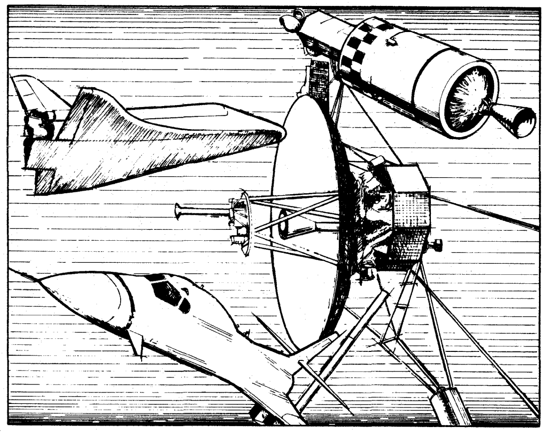
HEWLETT PACKARD COMPONENTS

SCHOTTKY SWITCHING DIODE MILITARY APPROVED MIL-S-19500/444

1N5711
JAN 1N5711
JANTX 1N5711
JANTXV 1N5711

Features

HIGH BREAKDOWN VOLTAGE
PICO-SECOND SWITCHING SPEED
LOW TURN-ON



Description/Applications

The JAN Series 1N5711 is an epitaxial, planar passivated Schottky Barrier Diode designed to have pico-second switching speed. HP commercial part number 5082-2800 is equivalent to the 1N5711. These devices are well suited for high level detecting, mixing, switching, gating and converting, video detecting, frequency discriminating sampling and wave shaping applications that require the hi-reliability of a JAN/JANTX device.

Maximum Ratings at $T_A = 25°C$

Operating and Storage Temperature
Range .... -65°C to 200°C
Reverse Voltage (Working) .... 50 V (peak)
Power Dissipation .... 250 mW
Derate a 1.43 mW/°C for T_A = 25°C to 200°C; assumes an infinite heat sink.

MILITARY APPROVED DEVICES

lectrical Specifications at $T_A = 25°C$ (Unless Otherwise Specified)

(Per Table I, Group A Testing of MIL-S-19500/444)

Specification	Symbol	Min.	Max.	Units	Test Conditions
Breakdown Voltage	V_{BR}	70	–	V_{dc}	I_R = 10μA
Forward Voltage	V_{F1}	–	.410	V_{dc}	I_{F1} = 1mA
Forward Voltage	V_{F2}	–	1.0	V_{dc}	I_{F2} = 15mA dc
Reverse Leakage Current	I_R	–	200	nA	V_R = 50V
Reverse Leakage Current	I_R	–	200	μA	V_R = 50V, T_A = +150°C
Capacitance	$C_{T(o)}$	–	2.0	pF	V_R = 0V and f = 1MHz
Effective Minority Carrier Lifetime	τ	–	100	pS	I_F = 5mA Krakauer Method [Note 1]

Note 1: Per DESC drawing C-68001

JAN 1N5711: Samples of each lot are subjected to Group A inspection for parameters listed in Table I, and to Group B and Group C tests listed below. All tests are to the conditions and limits specified by MIL-S-19500/444.

JANTX 1N5711: Devices undergo 100% screening tests as listed below to the conditions and limits specified by MIL-S-19500/444. A sample of the JANTX lot is then subjected to Group A, Group B, and Group C tests as for the JAN 1N5711 above

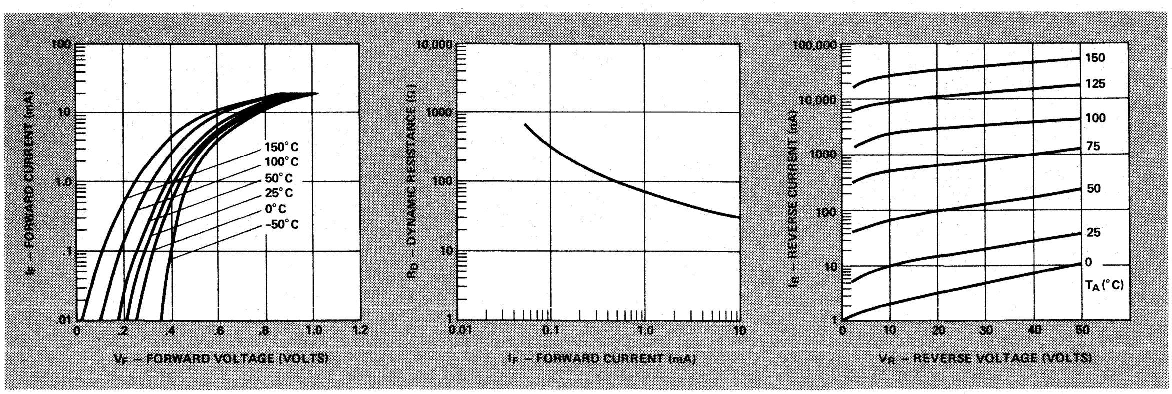
JANTXV 1N5711: Devices are subject to 100% visual inspection in accordance with amendment 4 of MIL-S-19500/444 pr to being subjected to TX screening.

Group B Sample Acceptance Tests	Method MIL-STD-750
Physical Dimensions	2066
Solderability	2026
Temperature Cycling	1051C
Thermal Shock (Strain)	1056A
Terminal Strength: Tension	2036A
Fine Leak Test	1071H
Gross Leak Test	1071E
Moisture Resistance	1021
Mechanical Shock	2016
Vibration, Variable Frequency	2056
Constant Acceleration	2006
Terminal Strength: Lead Fatigue	2036E
Temperature Storage (200°C, 1K hrs.)	1031
Operating Life P_T=250 mW, V_r=50 V [pk] (f = 60, T_A = 25°C, t = 1K hrs.)	1026

Group C Sample Acceptance Tests	Method MIL-STD-750
Low Temp. Operation (−65°C)	
Forward Voltage	4011
Breakdown Voltage	4021
Salt Atmosphere	1041
Resistance to Solvents	*
Temperature Cycling	1051C
TX Screening (100%)	
High Temp. Storage (200°C, 48 hrs.)	1032
Thermal Shock (Strain)	1056A
Constant Acceleration	2006
Fine Leak	1071H
Gross Leak	1071E
Burn-In P_T = 250 mW dc, V = 50V[pk] (T_A = 25°C, f = 60Hz, t = 96hrs)	
Evaluation of Drift (I_R, V_F)	

*MIL-STD-202, Method 215

Typical Parameters



HEWLETT hp PACKARD
COMPONENTS

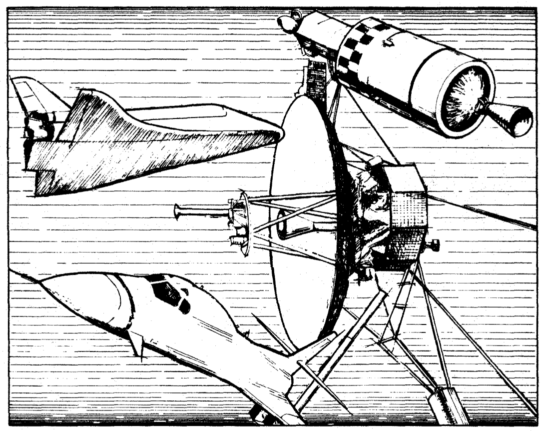
SCHOTTKY SWITCHING DIODE MILITARY APPROVED MIL-S-19500/445

1N5712
JAN 1N5712
JANTX 1N5712
JANTXV 1N5712

Features

PICO-SECOND SWITCHING SPEED

LOW TURN-ON VOLTAGE



Description/Applications

The 1N5712 is an epitaxial, planar passivated Schottky Barrier Diode designed to have pico-second switching speed. Commercial part number 5082-2810 is equivalent to the 1N5712. These devices are well suited for high level detecting, mixing, switching, gating, A-D converting, video detecting, frequency discriminating sampling and wave shaping applications that require the high reliability of a JAN/JANTX device.

Maximum Ratings at T_A=25°C

Operating and Storage Temperature
Range .... -65°C to 200°C
Reverse Voltage (Working) .... 16V (peak)
Power Dissipation .... 250 mW
Derate at 2.0 mW/°C for T_A = 25°C to 200°C; assumes an infinite heat sink.

ectrical Specifications at T_A=25°C

Per Table I, Group A Testing of MIL-S-19500/445)

Specification	Symbol	Min.	Max.	Units	Test Conditions
Breakdown Voltage	V_{BR}	20		V_{dc}	I_R = 10μAdc
Forward Voltage	V_{F1}		.55	V_{dc}	I_{F1} = 1 mAdc
Forward Voltage	V_{F2}		1.0	V_{dc}	I_{F2} = 35 mAdc
Reverse Leakage Current	I_R		150	nAdc	V_R = 16 Vdc
Capacitance	$C_{T(o)}$		1.2	pF	V_R = 0V and f = 1 MHz
Effective Minority Carrier Lifetime	τ		100	pS	I_F = 5 mA Krakauer Method [Note 1]

Note 1: Per DESC drawing C-68001

JAN 1N5712: Samples of each lot are subjected to Group A inspection for parameters listed in Table I, and to Group B and Group C tests listed below. All tests are to the conditions and limits specified by MIL-S-19500/445. A summary of the data gathered in groups A, B, and C lot acceptance testing is supplied with each shipment.

JANTX 1N5712: Devices undergo 100% screening tests as listed below to the conditions and limits specified by MIL-S-19500/445. A sample of the JANTX lot is then subjected to Group A, Group B, and Group C tests as for the JAN 1N5712 above. summary of the data gathered in groups A, B, and C lot acceptance testing is supplied with each shipment.

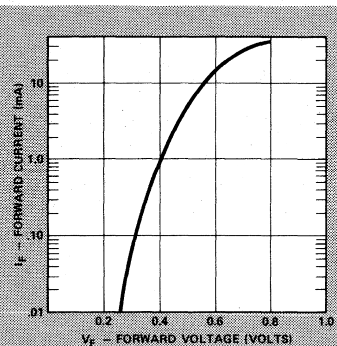
JANTXV 1N5712: Devices are subject to 100% visual inspection in accordance with amendment 4 of MIL-S-19500/445 prior to being subjected to TX screening.

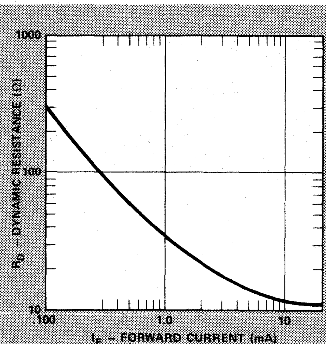
Group B Sample Acceptance Tests	Method MIL-STD-750
Physical Dimensions	2066
Solderability	2026
Temperature Cycling	1051C
Thermal Shock (Strain)	1056A
Terminal Strength: Tension	2036A
Fine Leak Test	1071H
Gross Leak Test	1071E
Moisture Resistance	1021
Mechanical Shock	2016
Vibration, Variable Frequency	2056
Constant Acceleration	2006
Terminal Strength: Lead Fatigue	2036E
Temperature Storage (200°C, 1K hrs.)	1031
Operating Life (P_T=250mW, V_r=16V [pk] (f=60, T_A=25°C, t=1K hrs.)	1026

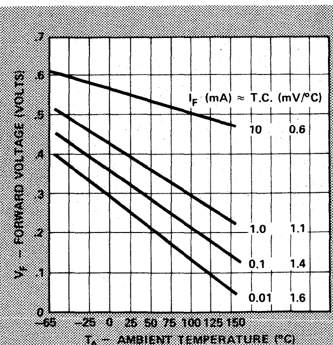
Group C Sample Acceptance Tests	Method MIL-STD-750
Low Temp. Operation (−65°C)	
Forward Voltage	4011
Reverse Breakdown Voltage	4021
Salt Atmosphere	1041
Resistance to Solvents	*
Temperature Cycling	1051C
TX Screening (100%)	
High Temp. Storage (200°C, 48 hrs.)	1032
Thermal Shock (Strain)	1056A
Constant Acceleration	2006
Fine Leak	1071H
Gross Leak	1071E
Burn-In (P_T=250mW dc, V=16V [pk] (T_A=25°C, f=60 Hz, t=96 hrs.)	
Evaluation of Drift (I_R, V_F)	

*MIL-STD-202, Method 215

Typical Parameters







HEWLETT PACKARD
COMPONENTS

PIN SWITCHING DIODE MILITARY APPROVED MIL-S-10500/443

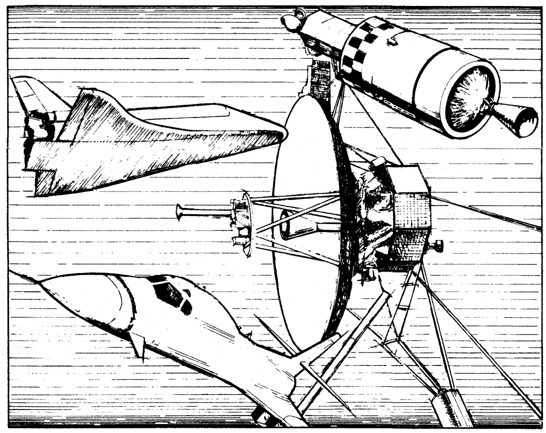
1N5719 JAN 1N5719 JANTX 1N5719

Features

LARGE DYNAMIC RANGE

LOW HARMONIC DISTORTION

HIGH SERIES ISOLATION



Description/Applications

The 1N5719 is a planar passivated silicon PIN diode designed for use in RF switching circuits. HP commercial part number 5082-3039 is equivalent to the 1N5719. These devices are well suited for variable attenuator, AGC, modulator, limiter and phase shifter applications that require the high reliability of a JAN/JANTX device.

Maximum Ratings at T_A=25°C

Operating and Storage Temperature
Range .... -65°C to +150°C
Reverse Voltage (Working) .... 100 V dc
Reverse Voltage (non-rep) .... 150 V pk
Power Dissipation [At 25°C] .... 250 mW
Derate at 2.0 mW/°C above T_A = 25°C; assumes an infinite heat sink.

MILITARY APPROVED DEVICES

Electrical Specifications at T_A=25°C

(Per Table I, Group A Testing of MIL-S-19500/443)

Specification	Symbol	Min.	Max.	Units	Test Conditions
Breakdown Voltage	V_{BR}	150		Vdc	I_R = 10μA dc
Forward Voltage	V_F		1.0	Vdc	I_F = 100mA dc
Reverse Current	I_R		250	nAdc	V_R = 100V dc
Reverse Current	I_R		15	μAdc	V_R = 100Vdc, T_A = 150°C
Capacitance	C_{VR}		.30	pF	V_R = 100Vdc, f = 1MHz
Series Resistance	R_S		1.25	Ω	I_F = 100mAdc, f = 100MHz
Effective Carrier Lifetime	τ	100		ns	I_F = 50mA, I_R = 250mA

JAN 1N5719: Samples of each lot are subjected to Group A inspection for parameters listed in Table I, and to Group B and Group C tests listed below. All tests are to the conditions and limits specified by MIL-S-19500/443. A summary of the data gathered in Groups A, B, and C lot acceptance testing is supplied with each shipment.

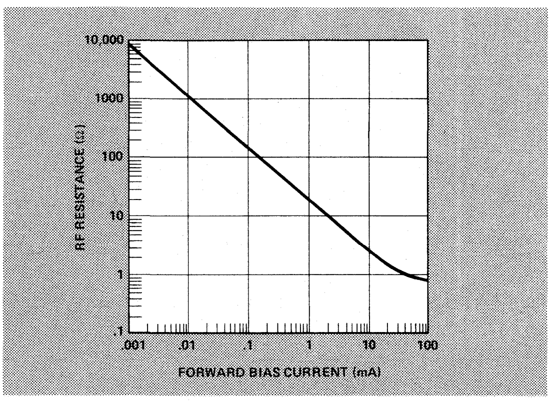
JANTX 1N5719: Devices undergo 100% screening tests as listed below to the conditions and limits specified by MIL-S-19500/443. A sample of the JANTX lot is then subjected to Group A, Group B, and Group C tests as for the JAN 1N5719 above. A summary of the data gathered in Groups A, B, and C lot acceptance testing is supplied with each shipment.

Group B Sample Acceptance Tests	Method MIL-STD-750
Physical Dimensions	2066
Solderability	2026
Temperature Cycling	1051F
Thermal Shock (Strain)	1056A
Terminal Strength: Tension	2036A
Hermetic Seal	1071E
Moisture Resistance	1021
Mechanical Shock	2016
Vibration, Variable Frequency	2056
Constant Acceleration	2006
Terminal Strength: Lead Fatigue	2036E
Salt Atmosphere	1041
Temperature Storage (T_A = 150°C, t = 1k hrs.)	1031
Operating Life (I_o = 70mAdc, V_R = 120V [pk], f = 60Hz, T_A = 25°C, t = 1k hrs.)	1026

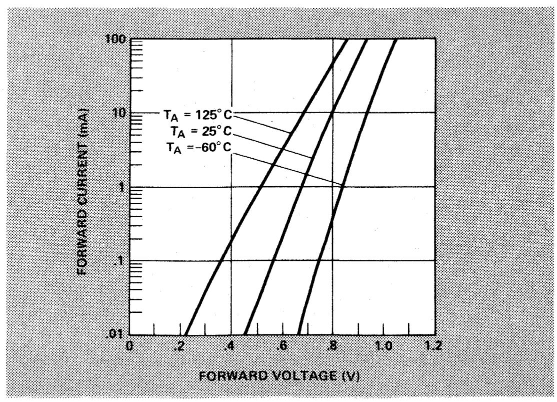
Group C Sample Acceptance Tests	Method MIL-STD-750
Barometric Pressure	1001
Reverse Current	4016
Salt Atmosphere	1041
Resistance to Solvents	*
Temperature Cycling	1051F
Low Temperature Operation (−65°C)	
Forward Voltage	4011
Breakdown Voltage	4021
TX Screening (100%)	
High Temp Storage (150°C, 48 hrs.)	1032
Temperature Cycling	1051F
Constant Acceleration	2006
Fine Leak	1071 G or H
Gross Leak	1071E
Burn-in (I_o = 70mAdc, V_R = 120V [pk], T_A = 25°C, f = 60Hz, t = 96 hrs.)	
Evaluation of Drift (I_R, V_F)	

*MIL-STD-202, Method 215

Typical Parameters



Typical RF Resistance vs. Forward Bias Current.



Typical Forward Current vs. Forward Voltage.

HEWLETT hp PACKARD
COMPONENTS

STANDARD HIGH RELIABILITY TEST PROGRAMS

Description

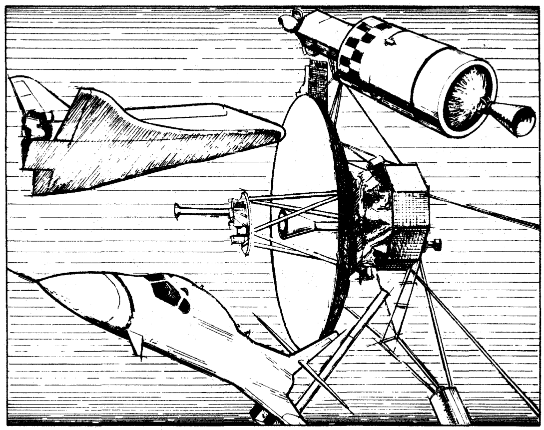
In addition to military qualified (JAN/JANTX) Schottky barrier and PIN diodes, Hewlett-Packard offers a line of standard high reliability test programs for many of our commercial devices. These programs are patterned after MIL-S-19500 and are designed to:

1. Eliminate the costly requirement of generating High-Reliability specifications, and
2. Offer off-the-shelf delivery for many High-Reliability devices.
3. Aid in writing High Reliability specifications, if required.

Standard High-Reliability Test Programs are available for all of the HP commercial devices listed in Table I.

Three basic levels of High-Reliability testing are offered:

1. The TX prefix indicates a part that is preconditioned and screened to a program similar to that shown in Table III.
2. The TXB prefix identifies a part that is preconditioned and screened to TX level with a Group B lot sample test as shown in Table V.
3. The TXV and TXVB prefix indicates that an internal visual is included as part of the preconditioning and screening.



From these three basic levels, several combinations are available. Please refer to Table II as a guide for ordering.

Detailed Data Sheets are available for all devices in the program. Please contact your local HP sales office for additional information.

TABLE I. HIGH RELIABILITY TEST PROGRAMS

Commercial Part No.	High Reliability Part No.
STEP RECOVERY DIODES	
5082-0112	TX-0112
5082-0114	TX-0114
5082-0132	TX-0132
5082-0151	TX-0151
5082-0180	TX-0180
5082-0241	TX-0241
5082-0243	TX-0243
5082-0253	TX-0253
5082-0300	TX-0300
5082-0310	TX-0310
5082-0320	TX-0320
5082-0335	TX-0335
*	
SCHOTTKY BARRIER DIODES	
5082-2234	TX-2234
5082-2235	TX-2235
5082-2701	TX-2701
5082-2702	TX-2702
5082-2703	TX-2703
5082-2706	TX-2706
5082-2707	TX-2707
5082-2708	TX-2708
5082-2711	TX-2711
5082-2712	TX-2712
5082-2713	TX-2713
5082-2714	TX-2714
5082-2721	TX-2721
5082-2722	TX-2722
5082-2723	TX-2723
5082-2724	TX-2724
PIN DIODES	
5082-3003	TX-3003
5082-3004	TX-3004
5082-3080	TX-3080
5082-3081	TX-3081
5082-3101	TX-3101
5082-3102	TX-3102
5082-3140	TX-3140
5082-3141	TX-3141
5082-3170	TX-3170
5082-3201	TX-3201
5082-3202	TX-3202
5082-3304	TX-3304
5082-3305	TX-3305
5082-3306	TX-3306
DIODE CHIPS	
5082-0001	TX-0001
5082-0008	TX-0008
5082-0009	TX-0009
5082-0012	TX-0012
5082-0020	TX-0020
5082-0023	TX-0023
5082-0024	TX-0024
5082-0025	TX-0025
5082-0029	TX-0029
5082-0030	TX-0030
5082-0031	TX-0031
5082-0087	TX-0087
5082-0097	TX-0097
MICROWAVE TRANSISTORS	
35824A	TX35824A
35826E	TX35826E
35829E	TX35829E
35866E	TX35866E

*All 0800 Series high efficiency SRD diodes are available.

TABLE II. HIGH RELIABILITY TEST LEVELS

Ordering Information

Examples:

Diode	Transistor	Inspection Level
5082-3080	35829E	Commercial
TX-3080	TX35829E	100% Screen
TXB-3080	TXB35829E	100% Screen/Group B
TXV-3080	TXV35829E	100% Screen/Visual
TXVB-3080	TXVB35829E	100% Screen/Visual/ Group B

TABLE III. TYPICAL[1] 100% PRECONDITIONING AND SCREENING PROGRAM

Inspection	MIL-STD-750 Method	Condition
1. Internal Visual and/or X-ray[2]	2072 or 2076	–
2. High Temperature Life	1032	48 hrs. min. at max. storage temp.
3. Thermal Shock	1051	10 cycles, see Note 3.
4. Constant Acceleration	2006	20,000 G, Y_1
5. Fine Leak	1071	H or G
6. Gross Leak	1071	A or C
7. Electrical	–	See Note 3.
8. Burn-in	1038	See Note 3.
9. Electrical	–	Same as Step 7.
10. Stability Verification	–	See Note 3.

TABLE IV. TYPICAL[1] GROUP PROGRAM (T_A=25°C).

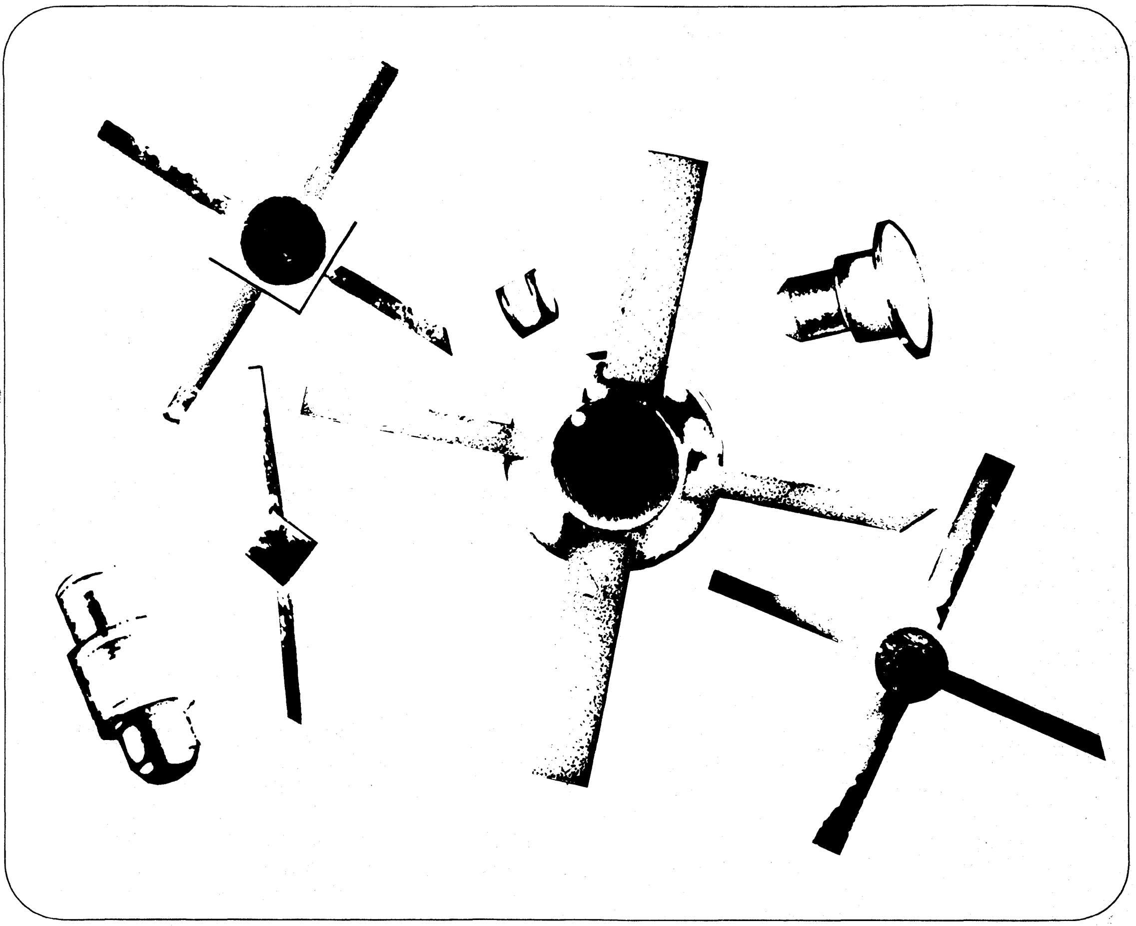
Inspection	MIL-STD-750 Method	Condition	LTPD
Subgroup 1 Visual Mechanical	2071	–	5
Subgroup 2 Electrical	–	See Note 3	5

TABLE V. TYPICAL[1] GROUP B PROGRAM

Inspection	MIL-STD-750 Method	Conditions	LTPD[3]
Subgroup 1			
Physical dimensions	2066	–	10-20
Subgroup 2			
Solderability	2026		10-20
Thermal Shock	1051	10 Cycles, See Note	
Thermal Shock	1056	A	
Hermetic Seal	1071	Condition A or C	
Moisture Resistance	1021		
Electrical	–	Same as Step 7, Table III	
Subgroup 3			
Shock	2016	1500G, 1/2 ms, 5X@ X_1, Y_1, Y_2	10-20
Vibration, Variable Frequency	2056	–	
Constant Acceleration	2006	20,000 G @ X_1, Y_1, Y_2	
Electrical	–	Same as Step 7, Table III	
Subgroup 4			
Terminal Strength	2036	E	10-20
Subgroup 5			
High Temperature Life	1031	Max. storage temperature	λ=5
Electricals	–	Same as Step 7, Table III	
Subgroup 6			
Operating Life	1026	See Note 3	λ=5
Electricals	–	Same as Step 7, Table III	

Notes:
1. The program shown is representative of packaged diode devices. A typical program for diode chips, beam leads or transistors would differ. Please refer to the detailed Hi-Rel data sheets for these products.
2. X-ray is optional and available for a lot charge.
3. Please refer to the detailed Hi-Rel data sheets for the actual test conditions. Contact your nearest HP Sales Office.

Microwave Transistors



Microwave Transistors — Selection Guide

Hewlett-Packard has a major commitment to the needs of microwave component users. Typical of this commitment is our new line of silicon bipolar and Gallium Arsenide Field Effect Transistors.

Recent advances in silicon processing, including ion implantation and local oxidation, have yielded a new line of silicon bipolar transistors offering improved noise figures and very consistent DC and RF parameters.

The HXTR Series transistors are recommended for all new designs in the frequency range to 6 GHz. The 35800 Series of transistors will remain in production.

The HFET-1000 is the first in a series of GaAs FET products from HP. Total materials control from growing the bulk crystal to final device fabrication assures the user a continuous supply of high performance devices.

Noise Figure Specified Transistors

Part Number	Specification Frequency	Max. N.F.	Package	Page Number
HXTR-6101	4 GHz	3.0 dB	HPAC 70GT	6-13
HXTR-6102	4 GHz	2.7 dB	HPAC 70GT	6-15
HXTR-6103	2 GHz	2.2 dB	HPAC 100	6-17
HXTR-6104	1.5 GHz	1.6 dB	HPAC 100	6-19
HXTR-6105	4 GHz	4.2 dB	HPAC 100	6-21
35861E Option 100	4 GHz	4.5 dB	HPAC 200	6-11
35866E Option 100	4 GHz	4.5 dB	HPAC 100	6-11
35868L	4 GHz	4.5 dB	HPAC 70GT	6-11
HFET-1000	10 GHz	3.6 dB*	Chip	6-5

*Typical Noise Figure.

General Purpose Transistors

Part Number	Specification Frequency	Min. Gain	Package	Page Number
HXTR-2101	4 GHz	9.0 dB	HPAC 100	6-23
35821E	2 GHz	6.0 dB*	HPAC 200	6-10
35824A	1 GHz	10.0 dB†	TO-72	6-10
35826E	2 GHz	6.0 dB*	HPAC 100	6-10
35827E	2 GHz	6.0 dB*	Coax	6-10
35828E	2 GHz	11.0 dB	HPAC 70GT	6-10
35829E	2 GHz	10.0 dB	HPAC 200A	6-10
35861E	2 GHz	8.0 dB*	HPAC 200	6-11
35866E	2 GHz	8.0 dB*	HPAC 100	6-11
35868E	4 GHz	8.0 dB	HPAC 70GT	6-11

*Minimum $|S_{21E}|^2$
†typ S_{21}

Linear Power Transistors

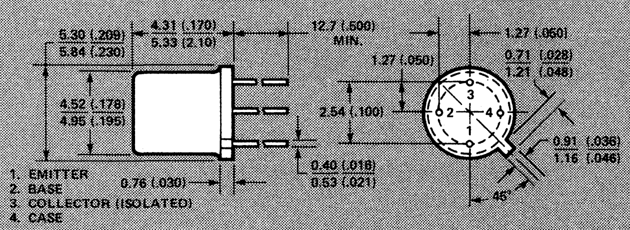
Part Number	Specification Frequency	Min. $P_{1\ dB}$	Package	Page Number
35812E	2 GHz	25 dBm	HPAC 200SA	6-9
35831E Option 005	2 GHz	—	HPAC 200	6-9
35853E	2 GHz	26 dBm*	HPAC 200 GB	6-9
35854E	2 GHz	26 dBm*	HPAC 200GS	6-9
35859E	2 GHz	25 dBm	HPAC 200A	6-9

$P_{1\ dB}$ = Output power at 1 dB gain compression
*Typical $P_{1\ dB}$

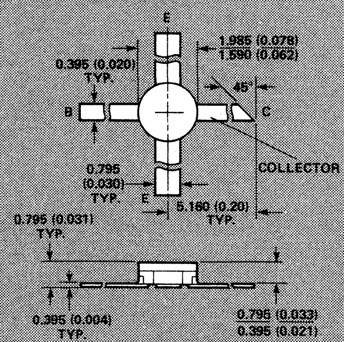
Transistor Package Selection Guide

Package Style	Low Noise		General Purpose		Linear Power	
	TRANSISTOR CATEGORY					
	Part Number	Page Number	Part Number	Page Number	Part Number	Page Number
Chip	HFET-1000	6-5				
TO-72			35824A	6-10		
HPAC 70GT	HXTR-6101 HXTR-6102 35868L	6-13 6-15 6-11	35828E 35868E	6-10 6-11		
HPAC 100	HXTR-6103 HXTR-6104 HXTR-6105 35866E Option 100	6-17 6-19 6-21 6-11	HXTR-2101 35826E 35866E	6-23 6-10 6-11		
HPAC 200	35861E Option 100	6-11	35821E 35861E	6-10 6-10	35831E Option 005	6-9
HPAC 200A			35829E	6-10	35859E	6-9
HPAC 200GB					35853E	6-9
HPAC 200GS					35854E	6-9
HPAC 200SA					35812E	6-9

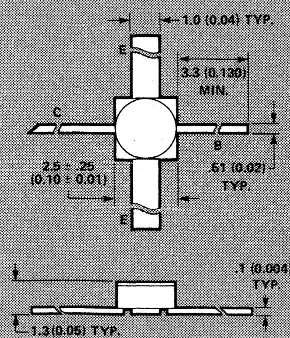
All Dimensions in Millimeters (Inches). For Complete Package Specifications Refer to Individual Product Specification Sheets.



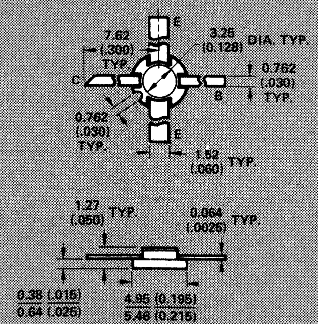
TO-72



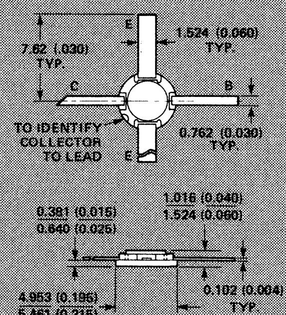
HPAC 70GT



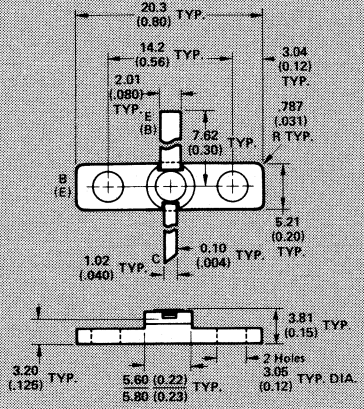
HPAC 100



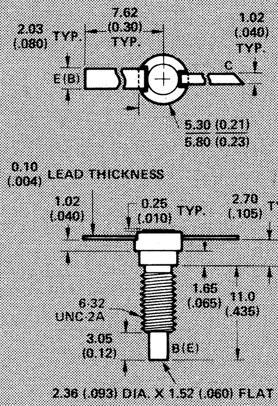
HPAC 200



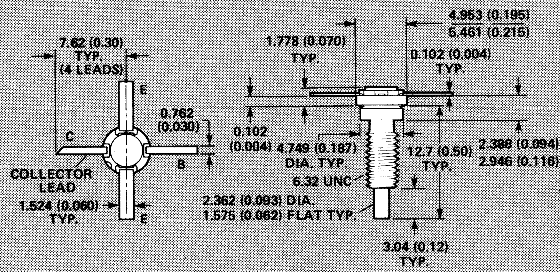
HPAC 200A



HPAC 200GB



HPAC 200GS



HPAC 200SA

HEWLETT PACKARD

COMPONENTS

MICROWAVE GaAs FET CHIP

HFET-1000

Features

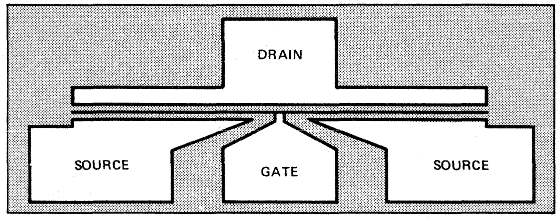
LOW NOISE FIGURE
3.6 dB Typical N.F. at 10 GHz

HIGH GAIN
11.0 dB Typical Gain at 10 GHz

HIGH DYNAMIC RANGE
14.5 dBm Linear Power Output at 10 GHz

RUGGED CHIP

INTEGRAL CHANNEL SCRATCH PROTECTION



Chip Dimensions in mm (in.)
0.66 (.026) x 0.29 (.011) x 0.13 (.005)
Length and width ± .02 (.0008)
(See page 4 for bonding pad dimensions.)

Description

The HFET-1000 is a Gallium Arsenide Schottky Barrier Field Effect Transistor Chip designed for low noise figure, high gain and substantial power at 10 GHz. The chip is provided with a dielectric scratch protection layer over the active area. The gate width is 500 micrometers resulting in a typical linear output power greater than 25 mW.

Electrical Specifications at $T_A = 25°C$

Symbol	Parameters and Test Conditions	Units	Min.	Typ.	Max.
I_{DSS}	Saturated Drain Current V_{DS} = 4.0 V, V_{GS} = 0 V	mA	40		120
V_{GSP}	Pinch Off Voltage V_{DS} = 4.0 V, I_{DS} = 100 μA	V	−1.5		−5.0
g_m	Transconductance V_{DS} = 4.0 V, ΔV_{GS} = 0 V to −0.5 V	mmho	30	45	
$G_{a(max)}$	Maximum Available Gain V_{DS} = 4.0 V, V_{GS} = 0 V FREQ = 8 GHz 10 GHz 12 GHz	dB dB dB		13.0 11.0 9.5	
F_{min}	Noise Figure V_{DS} = 3.5V I_{DS} = 15% I_{DSS} (Typ. 12 mA) FREQ = 8 GHz 10 GHz 12 GHz	dB dB dB		2.9 3.6 4.1	
G_a	Associated Gain At N.F. Bias FREQ = 8 GHz 10 GHz 12 GHz	dB dB dB		8.9 6.9 4.3	
P_{1dB}	Power At 1 dB Compression FREQ = 10 GHz V_{DS} = 4.0 V, I_{DS} = 50% I_{DSS}	dBm		14.5	

Maximum Ratings at $T_A = 25°C$

Symbol	Parameter	Limits
V_{DS}	Drain To Source Voltage $-5V \leqslant V_{GS} \leqslant 0 V$	5V
V_{GS}*	Gate To Source Voltage $5.0 V \geqslant V_{DS} \geqslant 0.0 V$	-5V
T_{CH}**	Max. Channel Temperature	125°C
	Storage Temperature	-65°C to +125°C

*Max. Forward Gate Current should not exceed 1 mA.
**Θ_{CB} — Thermal resistance, channel to back of chip = 100°C/W.

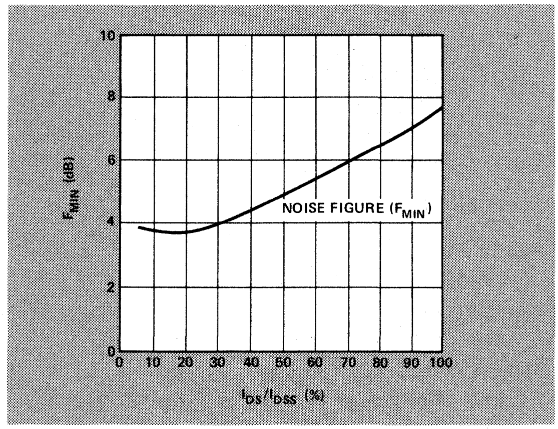


Figure 1. Typical noise figure vs. I_{DS} as a percentage of I_{DSS}. Frequency = 10 GHz, V_{DS} = 3.5V.

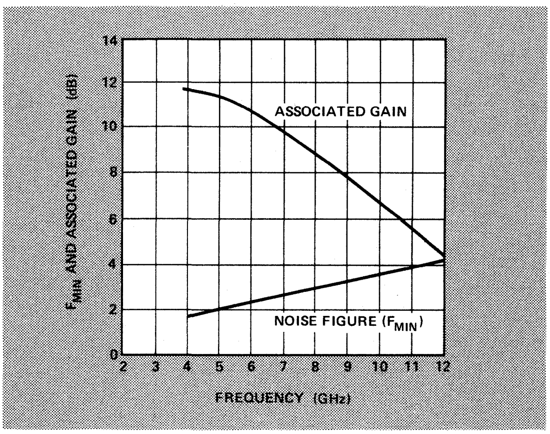


Figure 2. Typical F_{min} and associated gain vs. frequency. V_{DS} = 3.5V, I_{DS} = 15% I_{DSS}.

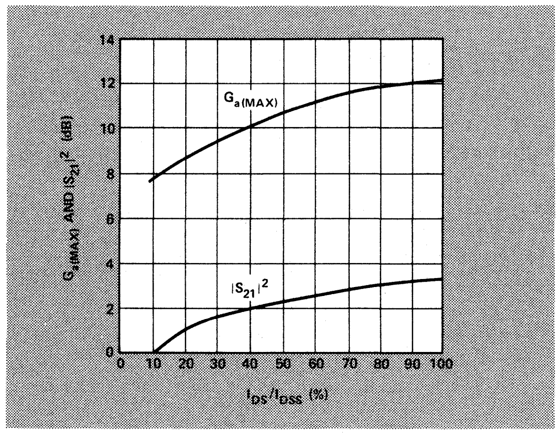


Figure 3. Typical $G_{a\,(max)}$ and $|S_{21}|^2$ vs. I_{DS} as a percentage of I_{DSS}. Frequency = 10 GHz, V_{DS} = 4.0V.

Typical S-Parameters V_{DS} = 3.5V, I_{DS} = 15% I_{DSS} (Noise Figure Bias)

Frequency, GHz	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.0	0.954	-32	2.171	152	0.037	72	0.719	-11
3.0	0.912	-49	2.100	139	0.054	63	0.742	-18
4.0	0.862	-66	1.957	124	0.067	55	0.735	-23
5.0	0.821	-81	1.820	111	0.075	48	0.710	-28
6.0	0.791	-94	1.609	99	0.078	42	0.700	-34
7.0	0.762	-104	1.525	91	0.081	38	0.693	-40
8.0	0.745	-113	1.350	80	0.085	33	0.691	-47
9.0	0.738	-120	1.210	71	0.084	30	0.701	-54
10.0	0.737	-125	1.081	65	0.082	30	0.712	-58
11.0	0.720	-128	1.011	60	0.082	31	0.719	-60
12.0	0.714	-131	0.907	55	0.081	31	0.738	-62

Typical S-Parameters V_{DS} = 4.0V, V_{GS} = 0V ($G_{a(max)}$ Bias)

Frequency, GHz	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
2.0	0.941	-41	3.358	148	0.019	71	0.790	-9
3.0	0.900	-62	3.178	133	0.028	62	0.760	-17
4.0	0.851	-80	2.801	120	0.031	57	0.759	-19
5.0	0.823	-96	2.500	107	0.032	53	0.744	-24
6.0	0.804	-106	2.208	97	0.034	50	0.742	-29
7.0	0.781	-117	2.050	90	0.035	50	0.743	-33
8.0	0.765	-125	1.790	80	0.031	49	0.744	-40
9.0	0.760	-132	1.600	72	0.036	52	0.756	-44
10.0	0.758	-135	1.417	66	0.036	55	0.764	-50
11.0	0.740	-139	1.351	62	0.037	60	0.779	-52
12.0	0.733	-141	1.191	57	0.038	64	0.787	-54

Mason's Gain, U

Mason's Gain is an invariant obtained by unilateralizing a two port device with a reciprocal, linear and lossless feedback network. It is useful as a comparison of FET gain performance in frequency ranges where the gain is conditionally stable.

$$U = \frac{1/2\,\left|(S_{21}/S_{12}) - 1\right|^2}{k\,\left|S_{21}/S_{12}\right| - \mathrm{Re}\,(S_{21}/S_{12})}$$

$$k = \frac{1 + \left|S_{11}S_{22} - S_{12}S_{21}\right|^2 - \left|S_{11}\right|^2 - \left|S_{22}\right|^2}{2\left|S_{12}\right|\,\left|S_{21}\right|}$$

$$G_{a\,(max)} = \left|S_{21}/S_{12}\right|\,(k \pm \sqrt{k^2 - 1})$$

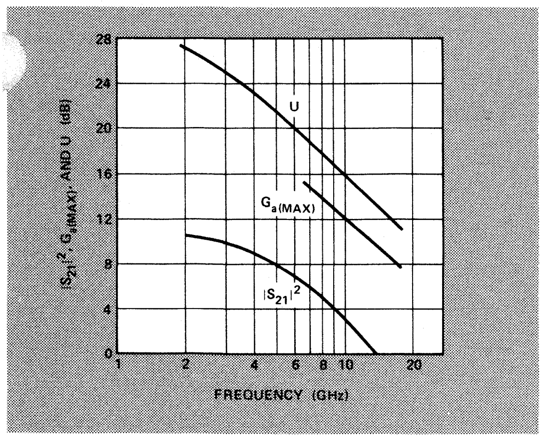


Figure 4. U_1, $|S_{21}|^2$ and $G_{a\,(max)}$ vs. frequency. V_{DS} = 4.0V, V_{GS} = 0.0V.

Handling And Use Precautions

1. Device voltage breakdown and permanent damage can be caused by the following:

   a. Inductive Pickup —
   From large transformers, switching power supplies, induction ovens, etc. Use shielded signal and power cables.

   b. Transients —
   From voltmeters, multimeters, signal generators, curve tracers, etc. Avoid turning instrument power on and off, or switching between instrument ranges when bias is applied to the device.

   From thermal compression and pulse bonders. Ensure that bonders are adequately grounded.

   c. Static Discharge —
   From humans and instruments. Use grounded tweezers to handle chips. Discharge static charge before connecting instruments to the chip.

2. Light Sensitivity — GaAs FET characteristics are light sensitive and this should be borne in mind when making d.c. and r.f. measurements. Ensure that the measurement environment is the same as the use environment.

3. Moisture — The presence of excessive moisture on a FET chip surface under normal operating voltages may cause irreversible damage.

4. Application of Bias — When applying bias to the FET, first apply the gate voltage, then the drain voltage. When removing bias remove the gate voltage last.

Die Attach And Wire Bonding

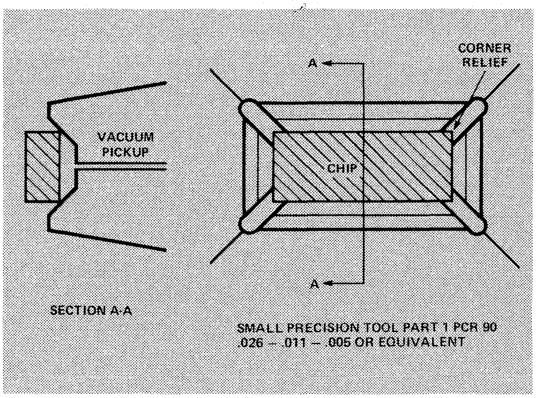


Figure 5. Recommended Die Attach Collect.

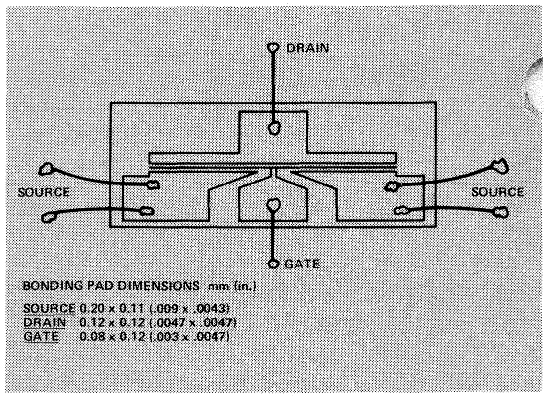


Figure 6. Bonding Diagram and Pad Dimensions.

Die Attaching

The FET chip can be die attached manually using a pair of tweezers, or automatically using a collet. In either case provide a flow of forming gas over the stage area. Start with a stage temperature of 300° C and raise as required. The chip should not be exposed to greater than 320° C for more than 30 seconds. Use 80/20 gold/tin preform of 625 x 250 x 25 micrometers (.025 x .010 x .001 in.). When using tweezers make sure that the chip is level to facilitate subsequent capillary wire bonding. The requirement is less critical for wedge bonding.

Gallium arsenide material is more brittle than silicon and should be handled with care. When using a collet, it is important to have a flat die attach surface. By using a minimum of downward force, the chance of breaking the chip is reduced.

Wire Bonding

Thermal-compression bonding of eighteen micron (.0007") diameter, pure gold, stress relieved wire can be used.

Start with a stage temperature of 225° C and a tip temperature of 150° C. The typical bonding force should be approximately 30 grams and should not exceed 40 grams.

The wire bond on the gate pad should remain well inside the pad boundaries. Additionally, mechanical contact with the transparent channel area must be avoided to prevent gate damage.

LINEAR POWER MICROWAVE TRANSISTORS

35812E
35831E OPTN 005
35853E
35854E
35859E

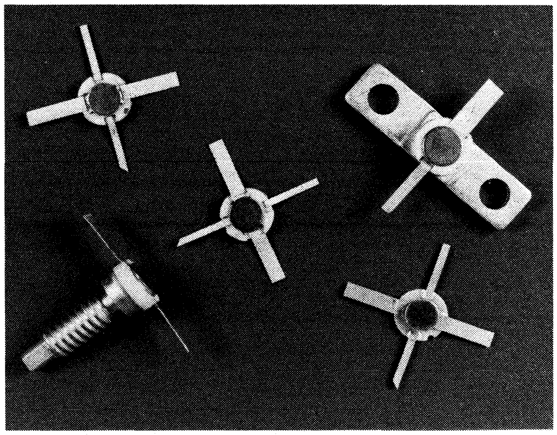
Features

GUARANTEED LINEAR POWER
26 dBm Typical at 2 GHz

GUARANTEED TUNED GAIN VERSIONS

EMITTER BALLASTED CHIP VERSIONS

RUGGED HERMETIC PACKAGE



DC Electrical Specifications at $T_A = 25°C$

Symbol	Parameter	Test Conditions	35831E Optn 005 Min.	Max.	All Others Min.	Max.	Units
I_{CBO1}	Collector-Base Leakage Current	V_{CB}=30 V (35 V[1])	–	100	–	300	μA
I_{CEO}	Collector-Emitter Leakage Current	V_{CE}=25 V (30 V[1])	–	0.5	–	2.5	mA
I_{CBO2}	Collector-Cut-off Current	V_{CB}=15 V	–	100	–	100	μA
h_{FE}	Forward Current Transfer Ratio	V_{CE}=15 V, I_C=100 mA (15 mA[1])	15	125	15	150	–

Note 1. 35831E Option 005 only

Packages

Part Number	Package Outline	Thermal Resistance, Θ_{JC}
35812E	HPAC-200SA	90°C/W
35831E	HPAC-200	50°C/W
35853E	HPAC-200GB	50°C/W
35854E	HPAC-200GS	50°C/W
35859E	HPAC-200A	90°C/W

RF Electrical Specifications at $T_A = 25°C$

Symbol	Parameter	Test Conditions	35812E Min.	Typ.	35831E Optn 005 Min.	Typ.	35853E Typ.	35854E Typ.	35859E Min.	Typ.	Units
$\|S_{21E}\|^2$	Transducer Power Gain	Note 1	–	–	3.0	4.0	3.3	3.3	–	–	dB
G_T	Tuned Gain	Note 1	6.0	7.0	–	–	–	–	6.0	7.0	dB
P_{1dB}	Output Power at 1 dB Compression	Note 1	25.0	26.5	–	–	26.0	26.0	25.0	26.5	dBm
P_{SAT}	Saturated Output Power at 3 dB Gain	Note 1	–	28.0	–	–	29.0	29.0	–	28.0	dBm

Note 1: V_{CE}=15 V, I_C=100 mA (except 35831E Optn 005, where I_C=60 mA), f=2 GHz.
Reflection coefficients: 35812E, 35859E; $\Gamma_S = 0.83 \angle -147°$, $\Gamma_L = 0.69 \angle 114°$ 35853E, 35854E; $\Gamma_S = 0.85 \angle -132°$, $\Gamma_L = 0.53 \angle 129°$

Maximum Ratings at $T_{CASE} = 25°C$

T_J - Junction Temperature	175°C	V_{CBO} - Collector to Base Voltage	30 V (35 V[2])
T_{STG} - Storage Temperature	-65°C to +200°C	V_{CEO} - Collector to Emitter Voltage	25 V (30 V[2])
P_T - Total Power Dissipation:[1]		V_{EBO} - Emitter to Base Voltage	1.5 V
35812E, 35831E, 35859E	1.6 W	I_C - DC Collector Current	125 mA (80 mA[2])
35853E, 35854E	2.5 W	Lead Soldering Temperature	250°C, 10 sec

Notes: 1. See package table for junction-to-case thermal resistance. 2. For 35831E Option 005 only.

HEWLETT PACKARD

COMPONENTS

GENERAL PURPOSE MICROWAVE TRANSISTORS

35821E
35824A
35826E
35827B/E
35828E
35829E

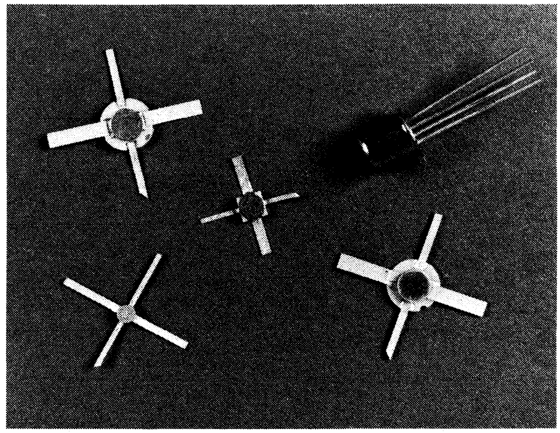
Features

HIGH FREQUENCY
Usable to 6 GHz

RUGGED HERMETIC PACKAGES

LOW NOISE FIGURE
2 dB Typical at 2 GHz

GUARANTEED TUNED GAIN VERSIONS



Packages

Part Number	Package Outline	Thermal Resistance, Θ_{JC}
35821E	HPAC-200	70°C/W
35824A	TO72	375°C/W
35826E	HPAC-100	150°C/W
35827B/E	COAX	[1]
35828E	HPAC-70GT	225°C/W
35829E	HPAC-200A	160°C/W

Note 1. 70°C/W to collector post, 130°C/W to base or emitter ring.

DC Electrical Specifications at T_A=25°C

Symbol	Parameter	Test Conditions	Min.	Max.	Units
I_{CBO1}	Collector-Base Leakage Current	V_{CB}=27 V	–	100	μA
I_{CEO}	Collector-Emitter Leakage Current	V_{CE}=20 V	–	500	μA
I_{CBO2}	Collector-Cut-off Current	V_{CB}=15 V	–	10	μA
h_{FE}	Forward Current Transfer Ratio	V_{CE}=15 V, I_C=15 mA	15	150	–

RF Electrical Specifications at T_A= 25°C

Symbol	Parameter	Test Conditions	35821E		35824A	35826E		35827E		35828E		35829E		Units
			Min.	Typ.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	
$\|S_{21E}\|^2$	Transducer Power Gain	Note 1	6.0	7.0	–	6.0	7.0	6.0	7.0	–	–	–	–	dB
$G_{A(MAX)}$	Maximum Available Gain	Note 1	–	12.0	6.0	–	12.0	–	12.0	–	–	–	–	dB
G_T	Tuned Gain	Notes 1,3	–	–	–	–	–	–	–	11.0	13.0	10.0	12.5	dB
F_{MIN}	Minimum Noise Figure	Note 2	–	3.8	–	–	3.8	–	–	–	–	–	–	dB
P_{1dB}	Output Power at 1 dB Compression	Note 1	–	–	–	–	15.0	–	–	–	17.5	–	17.0	dBm

Note 1: V_{CE} = 15 V, I_C = 15 mA, f = 2 GHz
Note 2: V_{CE} = 10 V, I_C = 5 mA, f = 2 GHz
Note 3: 35828E measured with Γ_S = 0.87 $\angle -167°$, Γ_L = 0.75 $\angle 92°$
35829E measured with Γ_S = 0.72 $\angle -155°$, Γ_L = 0.76 $\angle 91°$

Maximum Ratings at T_{CASE} = 25°C

T_J - Junction Temperature	175°C	P_T - Total Power Dissipation: [1]	
T_{STG} - Storage Temperature	-65°C to +200°C	35821E, 35826E, 35827B/E	700 mW
V_{CBO} - Collector to Base Voltage	27 V	35824A	400 mW
V_{CEO} - Collector to Emitter Voltage	20 V	35828E	600 mW
V_{EBO} - Emitter to Base Voltage	1.5 V	35829E	630 mW
I_C - DC Collector Current	35 mA	Lead Soldering Temperature	250°C, 10 sec

Note 1. See package table for junction-to-case thermal resistance.

LOW NOISE MICROWAVE TRANSISTORS

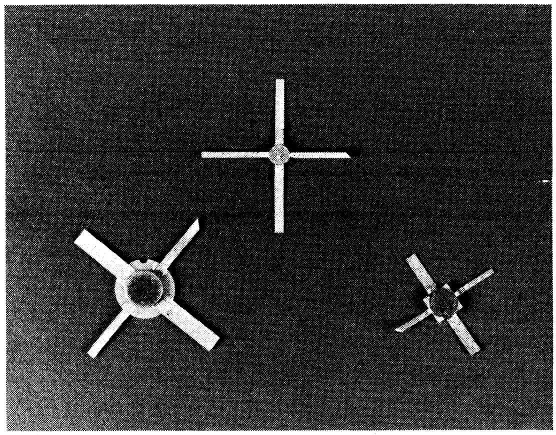
35861E
35861E OPTN 100
35866E
35866E OPTN 100
35868E/L

Features

LOW NOISE FIGURE
4.2 dB Typical at 4 GHz

HIGH GAIN
7.5 dB Typical at 4 GHz
Guaranteed Tuned Gain Versions

RUGGED HERMETIC PACKAGES



DC Electrical Specifications at $T_A = 25°C$

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
BV_{CBO}	Collector-Base Breakdown Voltage	$I_C = 100\ \mu A$	20	30	–	V
I_{CEO}	Collector-Emitter Leakage Current	$V_{CE} = 15$ V	–	–	500	μA
I_{CBO2}	Collector-Cut-off Current	$V_{CB} = 10$ V	–	–	1.0	μA
h_{FE}	Forward Current Transfer Ratio	$V_{CE} = 10$ V, $I_C = 10$ mA	20	–	200	–

Packages

Part Number	Package Outline	Thermal Resistance, Θ_{JC}
35861E	HPAC-200	80°C/W
35866E	HPAC-100	200°C/W
35868E/L	HPAC-70GT	250°C/W

RF Electrical Specifications at $T_A = 25°C$

Symbol	Parameter	Test Conditions	35861E, 35866E Std. Typ.	Optn 100 Typ.	Optn 100 Max.	35868E Min.	35868E Typ.	35868L Min.	35868L Typ.	35868L Max.	Units
F_{MIN}	Min Noise Figure @ f = 2 GHz	Note 1	3.3	2.5	3.0	–	–	–	–	–	dB
	Min Noise Figure @ f = 4 GHz	Note 1	4.8	4.2	4.5	–	–	–	4.2	4.5	dB
G_A	Associated Gain	Note 1	–	–	–	–	–	7.0	7.5	–	dB
G_T	Tuned Gain	Note 2	–	–	–	8.0	10.0	8.0	10.0	–	dB

Note 1: $V_{CE} = 10$ V, $I_C = 5$ mA, f = 4 GHz (except as noted)
35868L measured with $\Gamma_O = 0.5\ \angle{-170°}$, $\Gamma_L = 0.69\ \angle{102°}$

Note 2: $V_{CE} = 10$ V, $I_C = 10$ mA, f = 4 GHz, $\Gamma_S = 0.85\ \angle{-149°}$, $\Gamma_L = 0.88\ \angle{88°}$

Maximum Ratings at $T_{CASE} = 25°C$

T_J - Junction Temperature	175°C	V_{CBO} - Collector to Base Voltage	20 V
T_{STG} - Storage Temperature	-65°C to +200°C	V_{CEO} - Collector to Emitter Voltage	15 V
P_T - Total Power Dissipation: [1]		V_{EBO} - Emitter to Base Voltage	1.5 V
35861E, 35866E	300 mW	I_C - DC Collector Current	20 mA
35868E/L	250 mW	Lead Soldering Temperature	250°C, 10 sec

Note 1. See package table for junction-to-case thermal resistance.

HEWLETT PACKARD

COMPONENTS

LOW NOISE MICROWAVE TRANSISTOR

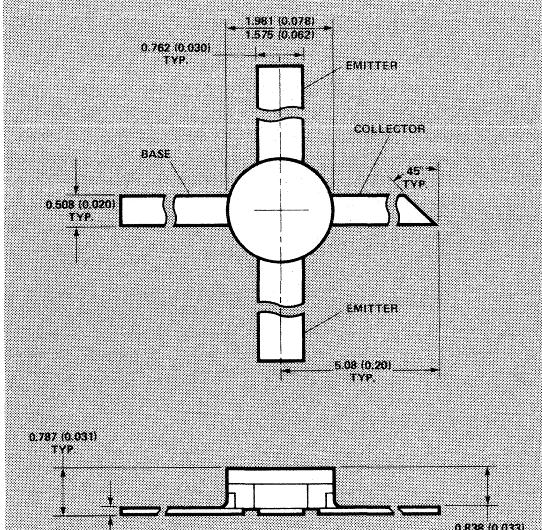
HXTR-6101

Features

LOW NOISE FIGURE
2.8dB at 4GHz, Typical

HIGH GAIN
9.0dB Typical Gain at N.F. Bias Conditions

RUGGED HERMETIC PACKAGE
Co-fired Metal/Ceramic Construction



OUTLINE HPAC-70GT

DIMENSIONS IN MILLIMETERS AND (INCHES).

Description

The HXTR-6101 is an NPN bipolar transistor designed for minimum noise figure at 4 GHz. The device utilizes ion implantation techniques in its manufacture and the chip is also provided with scratch protection over its active area. The HXTR-6101 is supplied in the HPAC-70GT, a rugged metal/ceramic hermetic package, and is capable of meeting the environmental requirements of MIL-S-19500 and the test requirements of MIL-STD 750/883.

Electrical Specifications at $T_A = 25°C$

Symbol	Parameters And Test Conditions	Test MIL-STD-750B	Units	Min.	Typ.	Max.
BV_{CES}	Collector Emitter Breakdown Voltage at $I_C = 100\mu A$	3001.1	V	30		
I_{CEO}	Collector emitter leakage current at $V_{CE} = 10V$	3041.1	nA			500
I_{CBO}	Collector cut off current at $V_{CB} = 10V$	3036.1	nA			100
h_{FE}	Forward current transfer ratio at $V_{CE} = 10V$, $I_C = 4mA$	3076.1	–	50	150	250
F_{MIN}	Minimum Noise Figure at 4GHz	3246.1	dB		2.8	3.0
	at 1.5GHz		dB		1.6	
G_a	Associated Gain at 4GHz		dB	8.0	9.0	
	at 1.5GHz		dB		15	
	Bias for above: $V_{CE} = 10V$, $I_C = 4mA$					
M_{MIN}*	Minimum Noise Measure $V_{CE} = 10V$, $I_C = 4mA$, f = 4GHz				3.1	3.4

$$*M_{MIN} = 10 \text{ Log} \left(1 + \frac{F_{MIN} - 1}{1 - 1/G_a}\right)$$

Noise measure (M_{MIN}) is the system noise figure of an infinite cascaded chain of identical amplifier stages. F_{MIN} and G_a specified as power ratios.

MICROWAVE TRANSISTORS

Maximum Ratings at $T_A = 25°C$

Symbol	Parameter	Limits
V_{CBO}	Collector to Base Voltage*	25V
V_{CEO}	Collector to Emitter Voltage	16V
V_{EBO}	Emitter to Base Voltage*	1.0V
I_C	D.C. Collector Current	10mA
P_T	Total Device Dissipation**	150mW
T_J	Junction Temperature	200°C
T_{STG}	Storage Temperature	−65°C to +200°C
— —	Lead Temperature (Soldering, 10 seconds each lead)	+250°C

*Case Temperature = 25°C
**Derate at 4mW/°C For $T_C > 163°C$

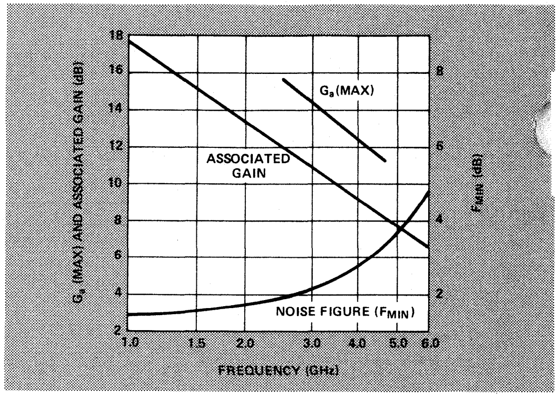


Figure 1. Typical $G_{a(MAX)}$, F_{MIN} and Associated Gain vs. Frequency at V_{CE} = 10V, I_C = 4mA.

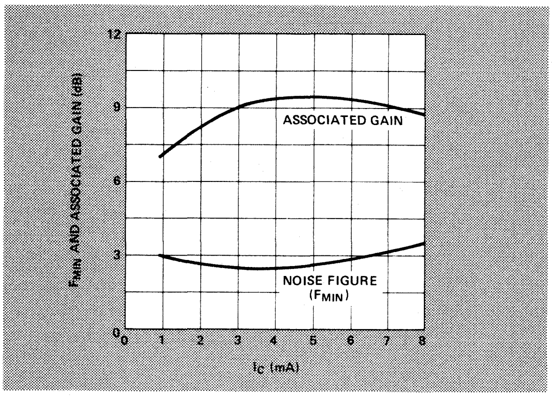


Figure 2. Typical F_{MIN} and Associated Gain vs. I_C at 4GHz for V_{CE} = 10V (Tuned for F_{MIN}).

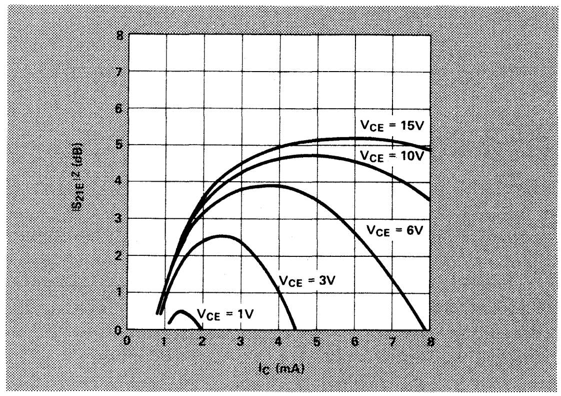


Figure 3. Typical $|S_{21E}|^2$ vs. Bias at 4GHz.

Typical S-Parameters V_{CE} = 10V, I_C = 4mA

Freq. (GHz)	S_{11} Mag.	S_{11} Ang.	S_{21} Mag.	S_{21} Ang.	S_{12} Mag.	S_{12} Ang.	S_{22} Mag.	S_{22} Ang.
0.100	0.917	-11	7.149	168	0.007	79	0.991	-4
0.500	0.782	-54	6.277	135	0.026	54	0.901	-18
1.000	0.635	-98	5.037	113	0.037	33	0.787	-30
1.500	0.598	-127	3.881	87	0.039	28	0.763	-35
2.000	0.589	-149	3.148	71	0.042	26	0.754	-43
2.500	0.570	-163	2.646	59	0.042	25	0.760	-50
3.000	0.575	-173	2.209	48	0.043	25	0.773	-58
3.500	0.560	180	1.948	37	0.046	25	0.795	-64
4.000	0.548	173	1.665	29	0.049	24	0.816	-71
4.500	0.530	167	1.450	20	0.053	24	0.850	-76
5.000	0.518	160	1.346	11	0.058	23	0.860	-84
5.500	0.500	152	1.210	1	0.060	22	0.880	-92
6.000	0.489	146	1.076	-7	0.063	20	0.877	-99
7.000	0.491	132	0.897	-23	0.069	15	0.872	-108
8.000	0.512	120	0.770	-35	0.083	10	0.870	-116

HEWLETT hp PACKARD

COMPONENTS

LOW NOISE MICROWAVE TRANSISTOR

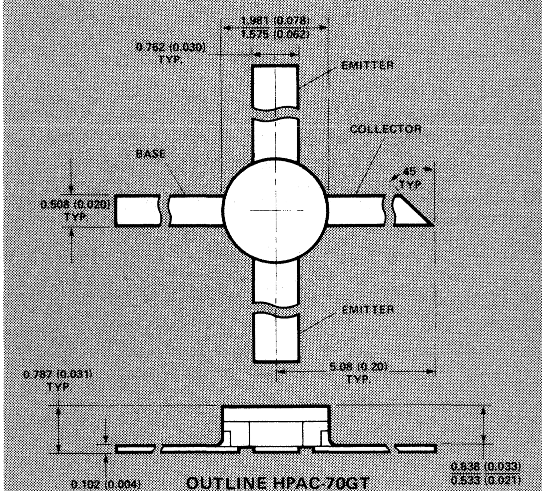
HXTR-6102

Features

GUARANTEED LOW NOISE FIGURE
2.7 dB at 4 GHz, Max., 2.5 dB Typical

HIGH GAIN
9.0 dB Typical Gain at N.F. Bias Conditions

RUGGED HERMETIC PACKAGE
Co-fired Metal/Ceramic Construction



OUTLINE HPAC-70GT

DIMENSIONS IN MILLIMETERS AND (INCHES).

Description

The HXTR-6102 is an NPN bipolar transistor designed for minimum noise figure at 4 GHz. The device utilizes ion implantation techniques in its manufacture and the chip is also provided with scratch protection over its active area.

The HXTR-6102 is supplied in the HPAC-70GT, a rugged metal/ceramic hermetic package, and is capable of meeting the environmental requirements of MIL-S-19500 and the test requirements of MIL-STD-750/883.

Electrical Specifications $T_A = 25°C$

Symbol	Parameters And Test Conditions	Test MIL-STD-750B	Units	Min.	Typ.	Max.
BV_{CES}	Collector Emitter Breakdown Voltage at $I_C = 100\mu A$	3001.1	V	30		
I_{CEO}	Collector emitter leakage current at $V_{CE} = 10V$	3041.1	nA			500
I_{CBO}	Collector cut off current at $V_{CB} = 10V$	3036.1	nA			100
h_{FE}	Forward current transfer ratio at $V_{CE} = 10V$, $I_C = 4mA$	3076.1	–	50	150	250
F_{MIN}	Minimum Noise Figure at 4GHz	3246.1	dB		2.5	2.7
G_a	Associated Gain at 4GHz		dB	8.0	9.0	
	Bias for above: $V_{CE} = 10V$, $I_C = 4mA$					
M_{MIN}*	Minimum Noise Measure $V_{CE} = 10V$, $I_C = 4mA$, $f = 4GHz$				2.8	3.1

$$^{*}M_{MIN} = 10 \text{ Log} \left(1 + \frac{F_{MIN} - 1}{1 - 1/G_a}\right)$$

Noise measure (M_{MIN}) is the system noise figure of an infinite cascaded chain of identical amplifier stages. F_{MIN} and G_a specified as power ratios.

MICROWAVE TRANSISTORS

Maximum Ratings at $T_A = 25°C$

Symbol	Parameter	Limits
V_{CBO}	Collector to Base Voltage*	25V
V_{CEO}	Collector to Emitter Voltage	16V
V_{EBO}	Emitter to Base Voltage*	1.0V
I_C	D.C. Collector Current	10mA
P_T	Total Device Dissipation**	150mW
T_J	Junction Temperature	200° C
T_{STG}	Storage Temperature	−65° C to +200° C
— —	Lead Temperature (Soldering, 10 seconds each lead)	+250° C

*Case Temperature = 25° C
**Derate at 4mW/° C For $T_C > 163°C$

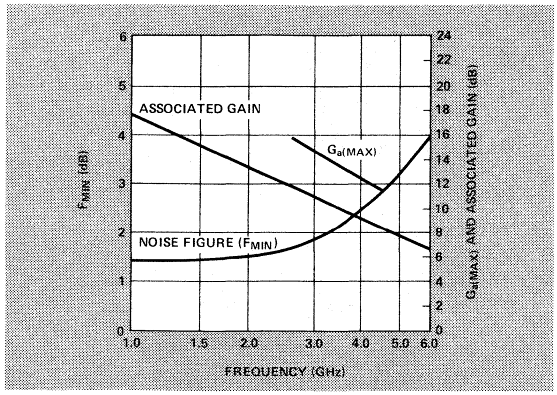


Figure 1. Typical $G_{a(MAX)}$, F_{MIN} and Associated Gain vs. Frequency at V_{CE} = 10V, I_C = 4mA.

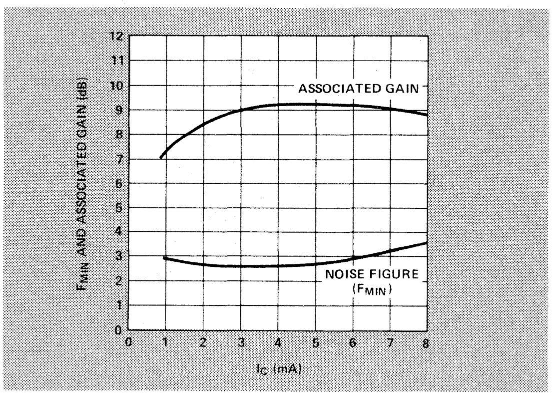


Figure 2. Typical F_{MIN} and Associated Gain vs. I_C at 4GHz for V_{CE} = 10V (Tuned for F_{MIN}).

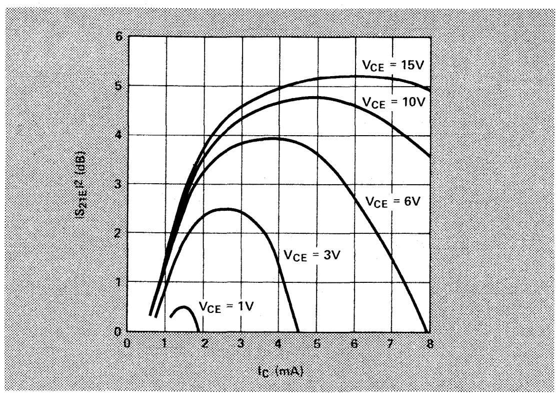


Figure 3. Typical $|S_{21E}|^2$ vs. Bias at 4GHz.

Typical S-Parameters V_{CE} = 10V, I_C = 4mA

	S_{11}		S_{21}		S_{12}		S_{22}	
Freq. (GHz)	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.100	0.917	-11	7.149	168	0.007	79	0.991	-4
0.500	0.782	-54	6.277	135	0.026	54	0.901	-18
1.000	0.635	-98	5.037	113	0.037	33	0.787	-30
1.500	0.598	-127	3.881	87	0.039	28	0.763	-35
2.000	0.589	-149	3.148	71	0.042	26	0.754	-43
2.500	0.570	-163	2.646	59	0.042	25	0.760	-50
3.000	0.575	-173	2.209	48	0.043	25	0.773	-58
3.500	0.560	180	1.948	37	0.046	25	0.795	-64
4.000	0.548	173	1.665	29	0.049	24	0.816	-71
4.500	0.530	167	1.450	20	0.053	24	0.850	-76
5.000	0.518	160	1.346	11	0.058	23	0.860	-84
5.500	0.500	152	1.210	1	0.060	22	0.880	-92
6.000	0.489	146	1.076	-7	0.063	20	0.877	-99
7.000	0.491	132	0.897	-23	0.069	15	0.872	-108
8.000	0.512	120	0.770	-35	0.083	10	0.870	-116

HEWLETT hp PACKARD
COMPONENTS

LOW NOISE MICROWAVE TRANSISTOR

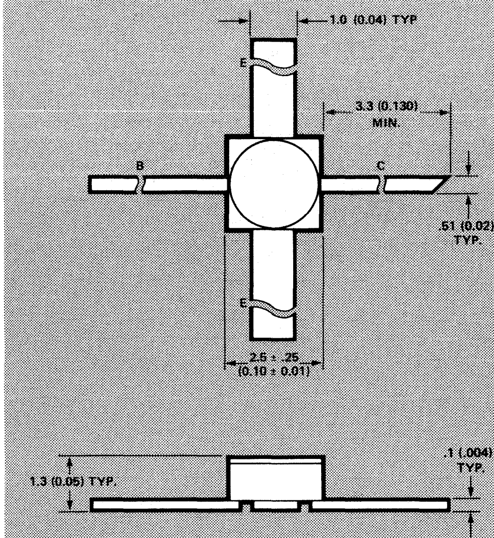
HXTR-6103

Features

GUARANTEED LOW NOISE FIGURE
2.2 dB Max. at 2 GHz, 1.8 dB Typical

HIGH GAIN
12.0 dB Typical Gain at N.F. Bias Conditions

RUGGED HERMETIC PACKAGE
Co-fired Metal/Ceramic Construction



DIMENSIONS IN MILLIMETERS (INCHES).

HPAC-100 Package Outline

Description

The HXTR-6103 is an NPN bipolar transistor designed for minimum noise figure at 2 GHz. The device utilizes ion implantation techniques and Ti-Pt-Au metalization in its manufacture. The chip is provided with scratch protection over its active area.

The HXTR-6103 is supplied in the HPAC-100, a rugged metal/ceramic hermetic package, and is capable of meeting the environmental requirements of MIL-S-19500 and the test requirements of MIL-STD-750/883.

Electrical Specifications at T_A=25°C

Symbol	Parameters And Test Conditions	Test MIL-STD-750B	Units	Min.	Typ.	Max.
BV_{CES}	Collector Emitter Breakdown Voltage at I_C = 100μA	3011.1	V	30		
I_{CEO}	Collector Emitter Leakage Current at V_{CE} = 10V	3041.1	nA			500
I_{CBO}	Collector Cut Off Current at V_{CB} = 10V	3036.1	nA			100
h_{FE}	Forward Current Transfer Ratio at V_{CE}=10V, I_C=3mA	3076.1	–	50	150	250
F_{MIN}	Minimum Noise Figure at 2 GHz	3246.1	dB		1.8	2.2
G_a	Associated Gain at 2 GHz	3246.1	dB	11.0	12.0	
	Bias for above: V_{CE} = 10V, I_C = 3 mA					
M_{MIN}*	Minimum Noise Measure V_{CE} = 10V, I_C = 3 mA, f = 2 GHz				1.90	2.35

$$*M_{MIN} = 10 \text{ Log} \left(1 + \frac{F_{MIN} - 1}{1 - 1/G_a}\right)$$

Noise measure (M_{MIN}) is the system noise figure of an infinite cascaded chain of identical amplifier stages. F_{MIN} and G_a specified as power ratios.

Maximum Ratings at $T_A = 25°C$

Symbol	Parameter	Limits
V_{CBO}	Collector to Base Voltage*	25V
V_{CEO}	Collector to Emitter Voltage	16V
V_{EBO}	Emitter to Base Voltage*	1.0V
I_C	D.C. Collector Current	10mA
P_T	Total Device Dissipation**	150mW
T_J	Junction Temperature	200° C
T_{STG}	Storage Temperature	−65° C to +200° C
—	Lead Temperature (Soldering, 10 seconds each lead)	+250° C

*Case Temperature = 25° C
**Derate at 3.3 mW/° C For $T_C > 155°C$

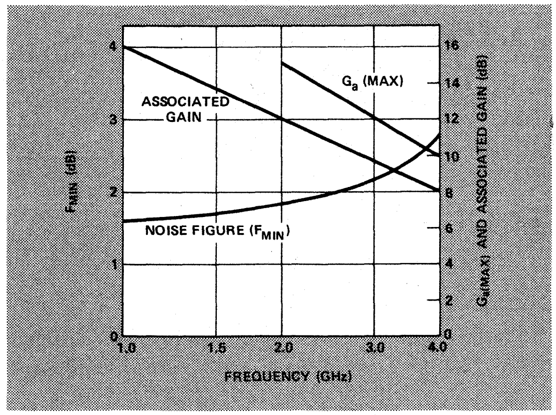


Figure 1. Typical $Ga_{(MAX)}$, F_{MIN} and Associated Gain vs. Frequency at V_{CE} = 10V, I_C = 3 mA.

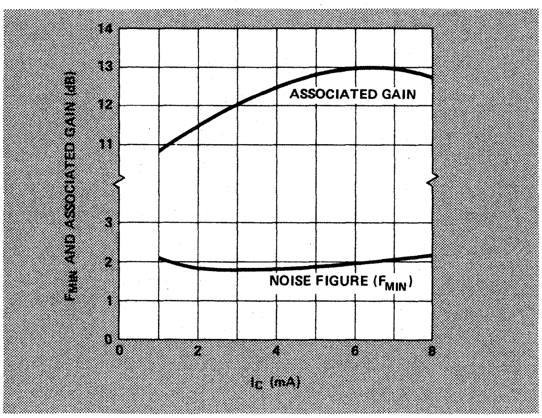


Figure 2. Typical F_{MIN} and Associated Gain vs. I_C at 2 GHz for V_{CE} = 10V (Tuned for F_{MIN}).

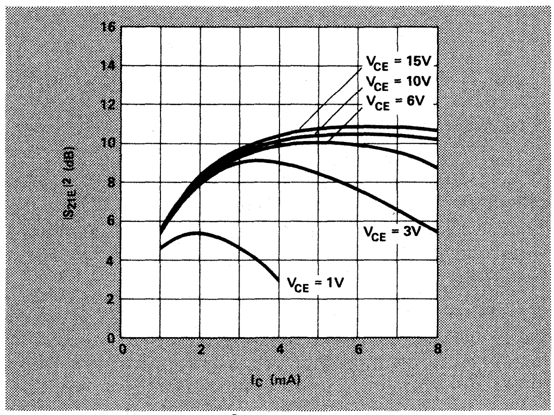


Figure 3. Typical $|S21E|^2$ vs. Bias at 2 GHz.

Typical S Parameters V_{CE} = 10V, I_C = 3 mA

	S_{11}		S_{21}			S_{12}			S_{22}	
Freq. (GHz)	Mag.	Ang.	Mag.	dB	Ang.	Mag.	dB	Ang.	Mag.	Ang.
0.100	0.886	-14.0	9.012	19.10	169.0	0.007	-43.10	80.0	0.997	-5.0
0.200	0.852	-28.0	8.830	18.92	158.0	0.014	-37.08	72.0	0.974	-9.0
0.300	0.809	-42.0	8.483	18.57	148.0	0.022	-33.15	67.0	0.952	-13.0
0.400	0.773	-54.0	8.049	18.11	139.0	0.026	-31.70	62.0	0.923	-16.0
0.500	0.753	-66.0	7.534	17.54	131.0	0.031	-30.17	55.0	0.897	-19.0
0.600	0.720	-76.0	7.025	16.93	124.0	0.034	-29.37	51.0	0.871	-22.0
0.700	0.704	-85.0	6.497	16.25	118.0	0.037	-28.64	48.0	0.850	-23.0
0.800	0.683	-93.0	6.016	15.59	113.0	0.038	-28.40	44.0	0.827	-26.0
0.900	0.663	-100.0	5.584	14.94	109.0	0.041	-27.74	42.0	0.814	-27.0
1.000	0.638	-105.0	5.223	14.36	104.0	0.042	-27.54	39.0	0.793	-29.0
1.500	0.537	-134.0	3.738	11.45	83.0	0.045	-26.94	31.0	0.747	-38.0
2.000	0.515	-154.0	2.974	9.47	68.0	0.047	-26.56	30.0	0.718	-45.0
2.500	0.508	-170.0	2.391	7.57	55.0	0.049	-26.20	29.0	0.707	-57.0
3.000	0.494	179.0	2.052	6.24	42.0	0.051	-25.85	34.0	0.727	-63.0
3.500	0.502	168.0	1.773	4.97	31.0	0.054	-25.35	35.0	0.739	-74.0
4.000	0.487	156.0	1.521	3.64	20.0	0.061	-24.29	39.0	0.760	-81.0
5.000	0.484	136.0	1.195	1.55	-1.0	0.075	-22.50	40.0	0.775	-95.0
6.000	0.511	121.0	1.015	0.13	-17.0	0.096	-20.35	41.0	0.824	-107.0

HEWLETT PACKARD

COMPONENTS

LOW NOISE MICROWAVE TRANSISTOR

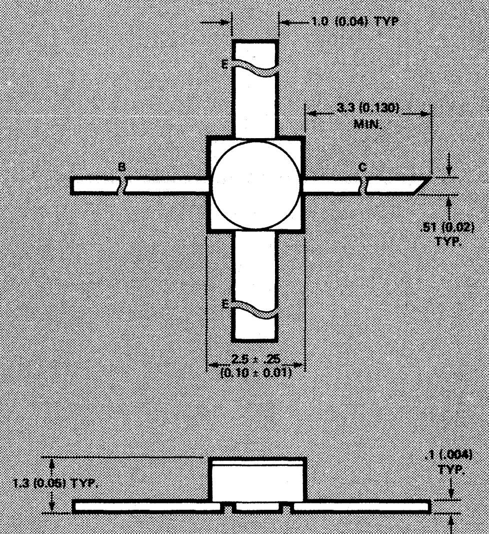
HXTR-6104

Features

GUARANTEED LOW NOISE FIGURE
1.6 dB Max. at 1.5 GHz

HIGH GAIN
14.0 dB Typical Gain at N.F. Bias Conditions

RUGGED HERMETIC PACKAGE
Co-fired Metal/Ceramic Construction



DIMENSIONS IN MILLIMETERS (INCHES).

HPAC-100 Package Outline

Description

The HXTR-6104 is an NPN bipolar transistor designed for minimum noise figure at 1.5 GHz. The device utilizes ion implantation techniques and Ti-Pt-Au metalization in its manufacture. The chip is provided with scratch protection over its active area.

The HXTR-6104 is supplied in the HPAC-100, a rugged metal/ceramic hermetic package, and is capable of meeting the environmental requirements of MIL-S-19500 and the test requirements of MIL-STD-750/883.

Electrical Specifications at $T_A = 25°C$

Symbol	Parameters And Test Conditions	Test MIL-STD-750B	Units	Min.	Typ.	Max.
BV_{CES}	Collector Emitter Breakdown Voltage at $I_C = 100\mu A$	3011.1	V	30		
I_{CEO}	Collector Emitter Leakage Current at $V_{CE} = 10V$	3041.1	nA			500
I_{CBO}	Collector Cut Off Current at $V_{CB} = 10V$	3036.1	nA			100
h_{FE}	Forward Current Transfer Ratio at $V_{CE}=10V, I_C=3mA$	3076.1	–	50	150	250
F_{MIN}	Minimum Noise Figure at 1.5 GHz	3246.1	dB		1.4	1.6
G_a	Associated Gain at 1.5GHz		dB	13.0	14.0	
	Bias for above: $V_{CE} = 10V$, $I_C = 3$ mA					
M_{MIN}*	Minimum Noise Measure $V_{CE} = 10V$, $I_C = 3$ mA, f= 1.5 GHz				1.45	1.67

$$^*M_{MIN} = 10 \text{ Log} \left(1 + \frac{F_{MIN} - 1}{1 - 1/G_a}\right)$$

Noise measure (M_{MIN}) is the system noise figure of an infinite cascaded chain of identical amplifier stages. F_{MIN} and G_a specified as power ratios.

MICROWAVE TRANSISTORS

Maximum Ratings at $T_A = 25°C$

Symbol	Parameter	Limits
V_{CBO}	Collector to Base Voltage*	25V
V_{CEO}	Collector to Emitter Voltage	16V
V_{EBO}	Emitter to Base Voltage*	1.0V
I_C	D.C. Collector Current	10mA
P_T	Total Device Dissipation**	150mW
T_J	Junction Temperature	200° C
T_{STG}	Storage Temperature	−65° C to +200° C
— —	Lead Temperature (Soldering, 10 seconds each lead)	+250° C

*Case Temperature = 25° C
**Derate at 3.3 mW/°C For $T_C > 155°C$

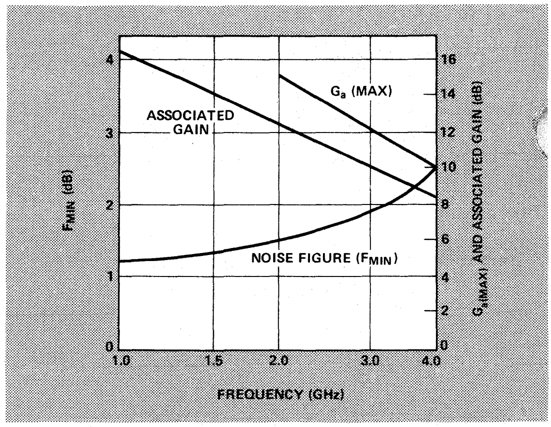


Figure 1. Typical $G_{a(MAX)}$, F_{MIN} and Associated Gain vs. Frequency at V_{CE} = 10V, I_C = 3 mA.

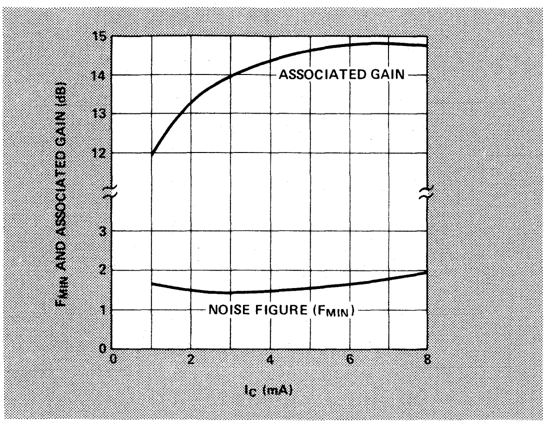


Figure 2. Typical F_{MIN} and Associated Gain vs. I_C at 1.5 GHz for V_{CE} = 10V (Tuned for F_{MIN}).

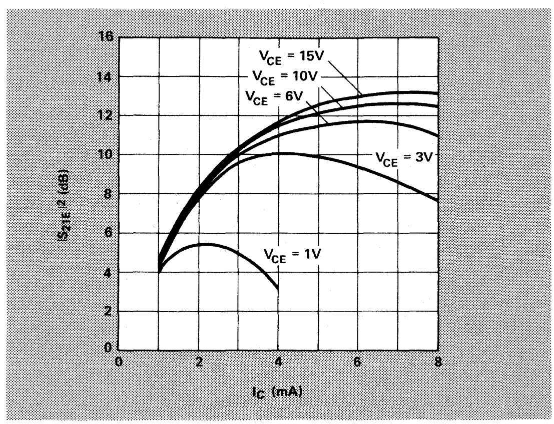


Figure 3. Typical $|S_{21E}|^2$ vs. Bias at 1.5 GHz.

Typical S Parameters V_{CE} = 10V, I_C = 3 mA

	S_{11}		S_{21}			S_{12}			S_{22}	
Freq. (GHz)	Mag.	Ang.	Mag.	dB	Ang.	Mag.	dB	Ang.	Mag.	Ang.
0.100	0.886	-14.0	9.012	19.10	169.0	0.007	-43.10	80.0	0.997	-5.0
0.200	0.852	-28.0	8.830	18.92	158.0	0.014	-37.08	72.0	0.974	-9.0
0.300	0.809	-42.0	8.483	18.57	148.0	0.022	-33.15	67.0	0.952	-13.0
0.400	0.773	-54.0	8.049	18.11	139.0	0.026	-31.70	62.0	0.923	-16.0
0.500	0.753	-66.0	7.534	17.54	131.0	0.031	-30.17	55.0	0.897	-19.0
0.600	0.720	-76.0	7.025	16.93	124.0	0.034	-29.37	51.0	0.871	-22.0
0.700	0.704	-85.0	6.497	16.25	118.0	0.037	-28.64	48.0	0.850	-23.0
0.800	0.683	-93.0	6.016	15.59	113.0	0.038	-28.40	44.0	0.827	-26.0
0.900	0.663	-100.0	5.584	14.94	109.0	0.041	-27.74	42.0	0.814	-27.0
1.000	0.638	-105.0	5.223	14.36	104.0	0.042	-27.54	39.0	0.793	-29.0
1.500	0.537	-134.0	3.738	11.45	83.0	0.045	-26.94	31.0	0.747	-38.0
2.000	0.515	-154.0	2.974	9.47	68.0	0.047	-26.56	30.0	0.718	-45.0
2.500	0.508	-170.0	2.391	7.57	55.0	0.049	-26.20	29.0	0.707	-57.0
3.000	0.494	179.0	2.052	6.24	42.0	0.051	-25.85	34.0	0.727	-63.0
3.500	0.502	168.0	1.773	4.97	31.0	0.054	-25.35	35.0	0.739	-74.0
4.000	0.487	156.0	1.521	3.64	20.0	0.061	-24.29	39.0	0.760	-81.0
5.000	0.484	136.0	1.195	1.55	-1.0	0.075	-22.50	40.0	0.775	-95.0
6.000	0.511	121.0	1.015	0.13	-17.0	0.096	-20.35	41.0	0.824	-107.0

HEWLETT hp PACKARD
COMPONENTS

LOW NOISE MICROWAVE TRANSISTOR

HXTR-6105

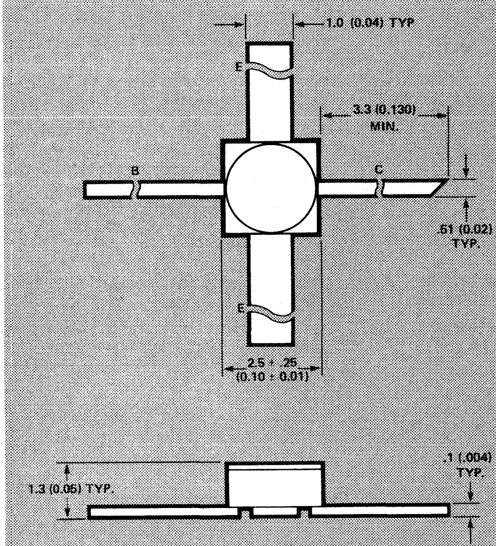
Features

LOW NOISE FIGURE
4.2 dB Maximum at 4 GHz Guaranteed

HIGH GAIN
9 dB Typ. at NF Bias Conditions

WIDE OUTPUT DYNAMIC RANGE

RUGGED HERMETIC PACKAGE
Co-fired Metal/Ceramic Construction



DIMENSIONS IN MILLIMETERS (INCHES).

HPAC-100 Package Outline

Description

The HXTR-6105 is an NPN bipolar transistor designed for low noise at 4 GHz with high output dynamic range. This transistor also features high output power and high gain at the NF bias and tuning conditions.

The device utilizes ion implantation techniques and Ti-Pt-Au metalization in its manufacture, and the chip is provided with a dielectric scratch protection over its active area.

The HXTR-6105 is supplied in the HPAC-100, a rugged metal/ceramic hermetic package, and is capable of meeting the environmental requirements of MIL-S-19500 and the test requirements of MIL-STD-750/883.

Electrical Specifications at $T_A = 25°C$

Symbol	Parameters and Test Conditions	MIL-STD-750B Test Method	Units	Min.	Typ.	Max.
BV_{CES}	Collector-Emitter Breakdown Voltage $I_C = 100\mu A$	3011.1	V	30		
I_{CEO}	Collector-Emitter Leakage Current at $V_{CE} = 15V$	3041.1	nA			500
I_{CBO}	Collector Cut Off Current at $V_{CB} = 15V$	3036.1	nA			100
h_{FE}	Forward Current Transfer Ratio at $V_{CE} = 15V$, $I_C = 15mA$	3076.1*	—	50	120	220
F_{MIN}	Minimum Noise Figure					
	At 4 GHz		dB		3.8	4.2
	At 1.5 GHz	3246.1	dB		2.2	
G_a	Associated Gain					
	At 4 GHz		dB	8.0	9.0	
	At 1.5 GHz		dB		15.0	
P_{1dB}	Associated Power Output at 1dB Compression At 4 GHz $V_{CE} = 15V$, $I_C = 15mA$		dBm		14	
M_{MIN}	Minimum Noise Measure $V_{CE} = 15V$, $I_C = 15mA$, F = 4 GHz		dB		4.2	4.7

*300 µsec wide pulse measurement ≤2% duty cycle.

Maximum Ratings at $T_A = 25°C$

Symbol	Parameter	Limits
V_{CBO}	Collector to Base Voltage*	25V
V_{CEO}	Collector to Emitter Voltage	16V
V_{EBO}	Emitter to Base Voltage*	1.0V
I_C	D.C. Collector Current	30mA
P_T	Total Device Dissipation**	400mW
T_J	Junction Temperature	200° C
T_{STG}	Storage Temperature	−65° C to +200° C
— —	Lead Temperature (Soldering, 10 seconds each lead)	+250° C

*Case Temperature = 25° C
**Derate at 4.4 mW/° C TC ⩾110° C

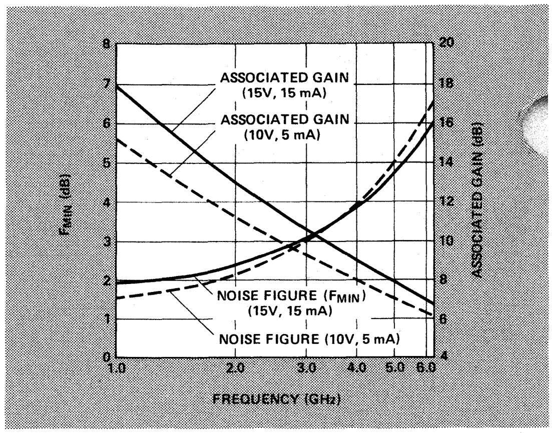


Figure 1. Typical F_{MIN} and Associated Gain vs. Frequency.

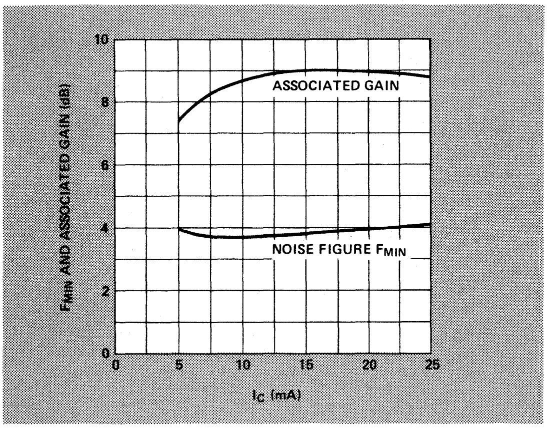


Figure 2. Typical F_{MIN} and Associated Gain vs. I_C at 4 GHz for V_{CE} = 15V (Tuned for F_{MIN}).

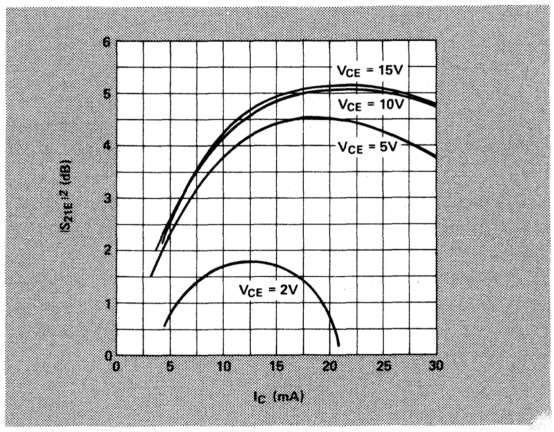


Figure 3. Typical $|S_{21E}|^2$ vs. Bias at 4 GHz.

Typical S Parameters V_{CE} = 15V, I_C = 15mA

	S11		S21			S12			S22	
Freq. (GHz)	Mag.	Ang.	Mag.	dB	Ang.	Mag.	dB	Ang.	Mag.	Ang.
0.100	0.661	-52.0	28.291	29.03	152.0	0.011	-39.17	69.0	0.899	-16.0
0.500	0.589	-139.0	12.519	21.95	101.0	0.026	-37.70	41.0	0.553	-33.0
1.000	0.589	-169.0	6.712	16.54	80.0	0.033	-29.63	45.0	0.472	-37.0
1.500	0.586	177.0	4.538	13.14	65.0	0.042	-27.54	49.0	0.468	-41.0
2.000	0.614	165.0	3.483	10.84	53.0	0.053	-25.51	50.0	0.471	-50.0
2.500	0.603	159.0	2.752	8.79	43.0	0.063	-24.01	51.0	0.495	-61.0
3.000	0.616	148.0	2.283	7.17	32.0	0.073	-22.73	52.0	0.502	-68.0
3.500	0.615	141.0	1.926	5.69	21.0	0.085	-21.41	49.0	0.542	-80.0
4.000	0.615	132.0	1.696	4.59	10.0	0.100	-20.00	47.0	0.570	-85.0
4.500	0.601	126.0	1.495	3.49	0.0	0.112	-19.02	45.0	0.603	-94.0
5.000	0.598	118.0	1.348	2.59	-9.0	0.138	-17.20	42.0	0.652	-102.0
5.500	0.605	112.0	1.229	1.79	-20.0	0.144	-16.83	35.0	0.658	-112.0
6.000	0.624	104.0	1.113	0.93	-29.0	0.156	-16.14	31.0	0.670	-122.0
7.000	0.619	84.0	0.932	-0.61	-47.0	0.203	-13.85	18.0	0.677	-143.0
8.000	0.632	56.0	0.743	-2.58	-64.0	0.220	-13.15	6.0	0.650	-153.0

HEWLETT PACKARD

COMPONENTS

GENERAL PURPOSE MICROWAVE TRANSISTOR

HXTR-2101

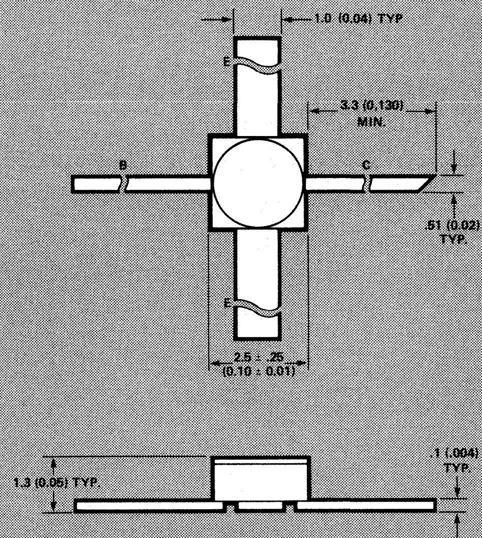
Features

HIGH GAIN

10.5 dB Typical at 4 GHz

WIDE OUTPUT DYNAMIC RANGE

RUGGED HERMETIC PACKAGE



DIMENSIONS IN MILLIMETERS (INCHES).

HPAC-100 Package Outline

Description

The HXTR-2101 is an NPN bipolar transistor designed for high gain and output power at 4 GHz. The device utilizes ion implantation techniques and Ti-Pt-Au metalization in its manufacture. The chip is provided with a dielectric scratch protection over its active area.

The HXTR-2101 is supplied in the HPAC-100, a rugged metal/ceramic hermetic package, and is capable of meeting the environmental requirements of MIL-S-19500 and the test requirements of MIL-STD-750/883.

Electrical Specifications at $T_A = 25°C$

Symbol	Parameters and Test Conditions	MIL-STD-750B Test Method	Units	Min.	Typ.	Max.
BV_{CES}	Collector-Emitter Breakdown Voltage $I_C = 100\mu A$	3011.1	V	30		
I_{CEO}	Collector-Emitter Leakage Current at $V_{CE} = 15V$	3041.1	nA			500
I_{CBO}	Collector Cutoff Current at $V_{CB} = 15V$	3036.1	nA			100
h_{FE}	Forward Current Transfer Ratio $V_{CE} = 15V$, $I_C = 15mA$	3076.1*	–	50	120	220
G_T	Tuned Gain		dB	9.0	10.5	
P_{1dB}	Power Output at 1 dB Compression		dBm		18.5	
	Bias Conditions for Above: $V_{CE} = 15V$, $I_C = 25mA$, Frequency = 4 GHz					

*300 μsec wide pulse measurement ≤2% duty cycle.

Maximum Ratings at $T_A = 25°C$

Symbol	Parameter	Limits
V_{CBO}	Collector to Base Voltage*	25V
V_{CEO}	Collector to Emitter Voltage	16V
V_{EBO}	Emitter to Base Voltage*	1.0V
I_C	D.C. Collector Current	35 mA
P_T	Total Device Dissipation**	450 mW
T_J	Junction Temperature	200°C
T_{STG}	Storage Temperature	-65°C to +200°C
— —	Lead Temperature (Soldering, 10 seconds each lead)	+250°C

*Case Temperature = 25°C
**Derate at 4.4mW/°C T_C >97°C.

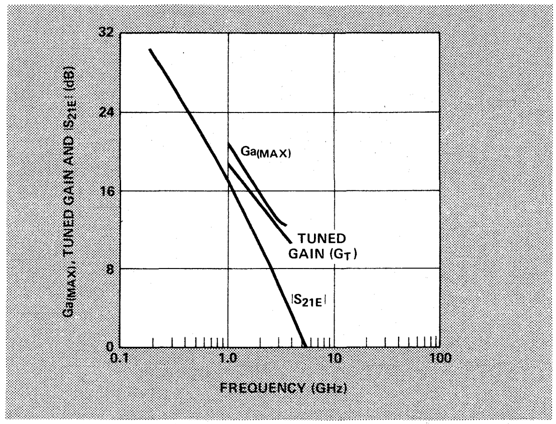


Figure 1. Typical $Ga_{(MAX)}$, S_{21E} and Tuned Gain vs. Frequency at V_{CE} = 15V, I_C = 25 mA.

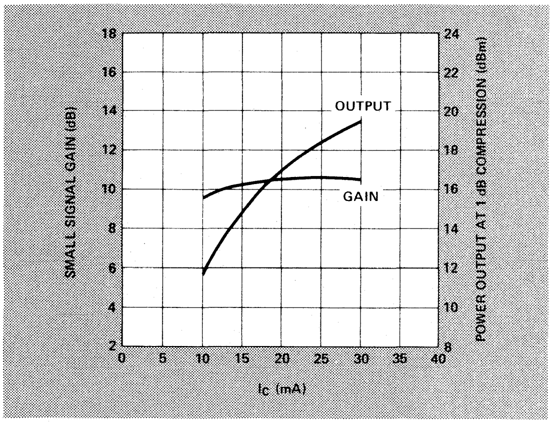


Figure 2. Typical Power Output at 1 dB Compression and Small Signal Gain vs. I_C at 4 GHz for V_{CE} = 15V.

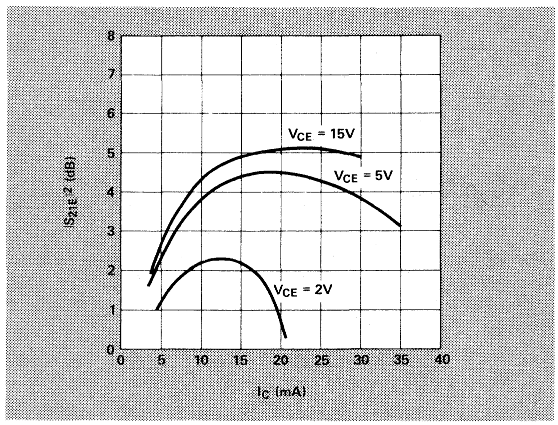
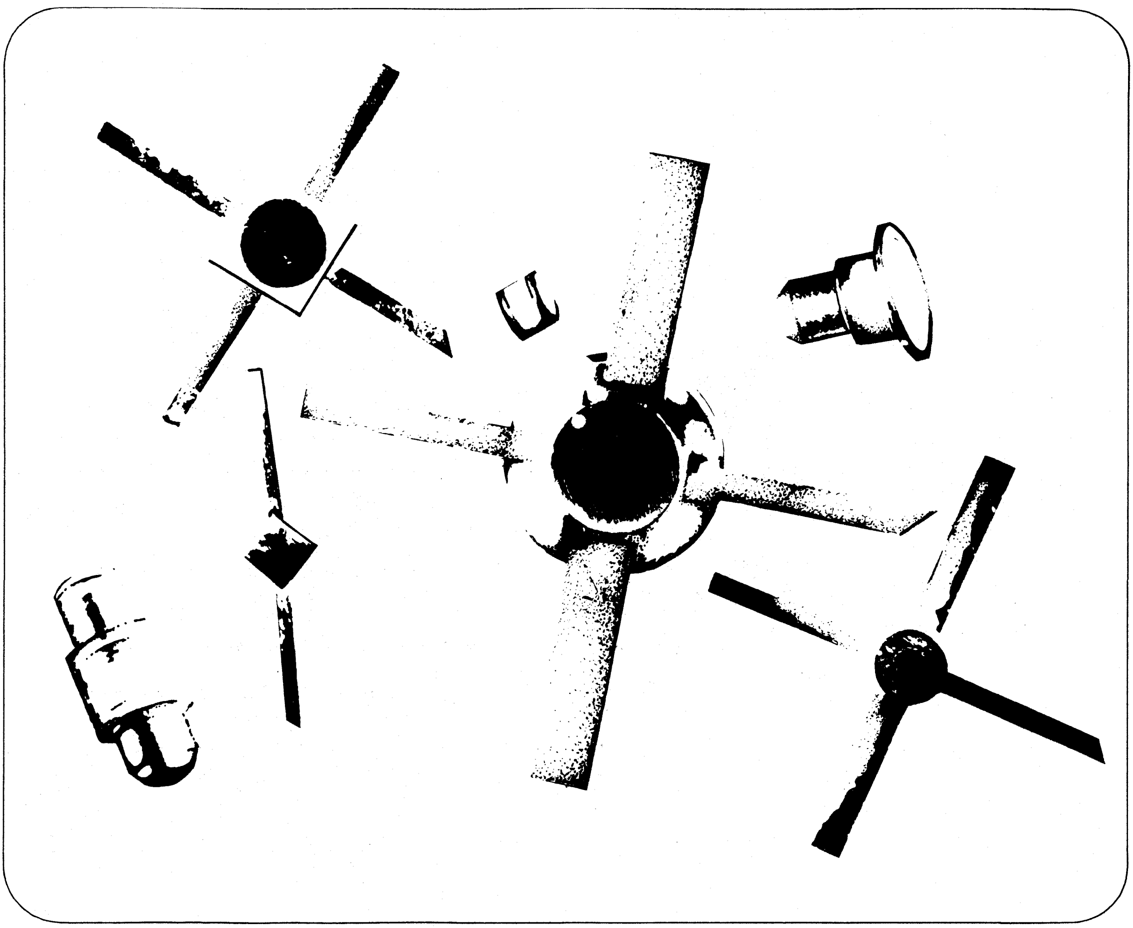


Figure 3. Typical $|S21E|^2$ vs. Bias at 4 GHz.

Typical S Parameters V_{CE} = 15V, I_C = 25mA

Freq. (GHz)	S_{11} Mag.	S_{11} Ang.	S_{21} Mag.	S_{21} dB	S_{21} Ang.	S_{12} Mag.	S_{12} db	S_{12} Ang.	S_{22} Mag.	S_{22} Ang.
0.100	0.591	-66.0	34.601	30.78	146.0	0.010	-40.00	69.0	0.858	-18.0
0.500	0.584	-150.0	12.740	22.10	96.0	0.022	-33.15	44.0	0.514	-27.0
1.000	0.594	-175.0	6.858	16.72	78.0	0.030	-30.46	51.0	0.437	-32.0
1.500	0.591	173.0	4.613	13.28	64.0	0.040	-27.96	55.0	0.446	-39.0
2.000	0.601	162.0	3.533	10.96	53.0	0.052	-25.68	55.0	0.442	-49.0
2.500	0.607	156.0	2.790	8.91	43.0	0.062	-24.15	55.0	0.470	-60.0
3.000	0.621	146.0	2.320	7.31	33.0	0.074	-22.62	56.0	0.477	-67.0
3.500	0.625	139.0	1.960	5.85	22.0	0.087	-21.21	53.0	0.520	-79.0
4.000	0.617	131.0	1.730	4.76	11.0	0.103	-19.74	50.0	0.552	-84.0
4.500	0.610	123.0	1.496	3.50	1.0	0.115	-18.79	48.0	0.592	-93.0
5.000	0.601	116.0	1.348	2.59	-9.0	0.141	-17.02	44.0	0.648	-102.0
5.500	0.617	109.0	1.229	1.79	-19.0	0.161	-15.86	36.0	0.655	-113.0
6.000	0.620	103.0	1.110	0.91	-28.0	0.166	-15.60	32.0	0.662	-123.0
6.500	0.617	93.0	1.005	0.04	-37.0	0.207	-13.68	28.0	0.665	-131.0
7.000	0.613	83.0	0.939	-0.55	-46.0	0.210	-13.56	14.0	0.648	-140.0
7.500	0.601	70.0	0.841	-1.50	-53.0	0.215	-13.35	5.0	0.638	-145.0
8.000	0.623	55.0	0.749	-2.51	-63.0	0.220	-13.15	3.0	0.625	-150.0

Integrated Products

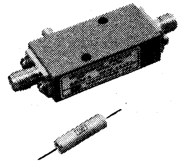


HEWLETT PACKARD
COMPONENTS

INTEGRATED PRODUCTS

SWITCHES MIXERS MODULATORS LIMITERS GENERATORS

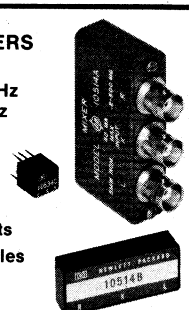
PIN DIODE SWITCHES



- Broadband, .1-18 GHz
- 33140 Series Optimized for Fast Switching, 5ns
- Add-on Driver Available for 33190A Series
- 33130 Series Optimized for Low Insertion Loss
- Medium and High Isolation Units Available in Each Series
- Hermetic PIN Diode Modules

	Part Number	Min. Isolation and (Max. Insertion Loss), dB				
		1-2GHz	2-4GHz	4-8GHz	8-12GHz	12-18GHz
General Purpose	33102A	35(1.0)	40(1.3)	45(2.0)	45(2.0)	45(2.5)
	33132A	33(1.0)	37(1.0)	43(1.2)	43(1.4)	43(1.8)
	33104A	65(1.0)	80(1.5)	80(2.1)	80(2.2)	—
	33134A	65(1.0)	80(1.4)	80(1.6)	80(1.8)	80(2.3)
Fast Switching	33142A	30(1.0)	40(1.0)	45(1.5)	45(1.5)	45(2.5)
	33144A	60(1.1)	80(1.4)	80(1.7)	80(2.0)	80(3.0)

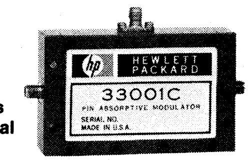
DOUBLE BALANCED MIXERS



- Broadband
  - 10534 Series: .05 - 150 MHz
  - 10514 Series: .2 - 500 MHz
- Low Conversion Loss
- Low 1/f Noise, Typically Less than 100 mV per Root Hz
- High Isolation Between Ports
- Wide Range of Package Styles
  - "A" Versions: BNC Jacks (Options Available)
  - "B" Versions: Pins for PC Mounting
  - "C" Versions: Miniature, Pins for PC Mounting
- Hermetically Sealed Schottky Diodes

Part Number	Frequency Range, MHz		Typical Conversion Loss, dB
	LO and RF	IF	
10534A 10534B 10534C	.2 — 35 .05 — 150	dc — 35 dc — 150	5.5 7.5
10514A 10514B	.5 — 50 .2 — 500	dc — 50 dc — 500	5.5 8.0
10514C	15 — 250 10 — 500	dc — 250 dc — 500	6.0 8.0

PIN ABSORPTIVE MODULATORS



- 50Ω Match at all Attenuation Levels
- Greater than Octave Band Coverage
- 50ns Switching (10ns Available on Special Request)
- Hermetic PIN Diode Modules

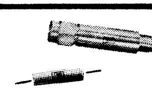
Part Number	Min. Attenuation and (Max. Insertion Loss), dB					
	1-2GHz	2-4GHz	4-8GHz	8-12GHz	12-15GHz	15-18GHz
33000C	35(1.8)	40(2.5)	—	—	—	—
33000D	65(2.0)	80(3.0)	—	—	—	—
33008C	—	—	45(2.3)	—	—	—
33008E*	—	—	45(1.8)	—	—	—
33008D	—	—	80(2.5)	—	—	—
33001C	—	—	—	45(3.0)	45(3.2)	45(4.3)
33001E*	—	—	—	45(2.5)	45(3.0)	45(3.5)
33001D	—	—	—	80(3.0)	80(3.5)	80(4.5)
33001F*	—	—	—	80(2.5)	80(3.0)	80(4.0)

*Low Insertion Loss Models

PIN DIODE LIMITERS

- Broadband, .4-12 GHz
- Low Limiting Threshold, 5mW Typical, 8-12 GHz
- Low Insertion Loss, 1.5dB Typical, 8-12 GHz
- Low Leakage, 20mW Typical, 8-12 GHz
- Hermetic PIN Diode Module
  - 33701A — Module
  - 33711A — Module with SMA Connectors

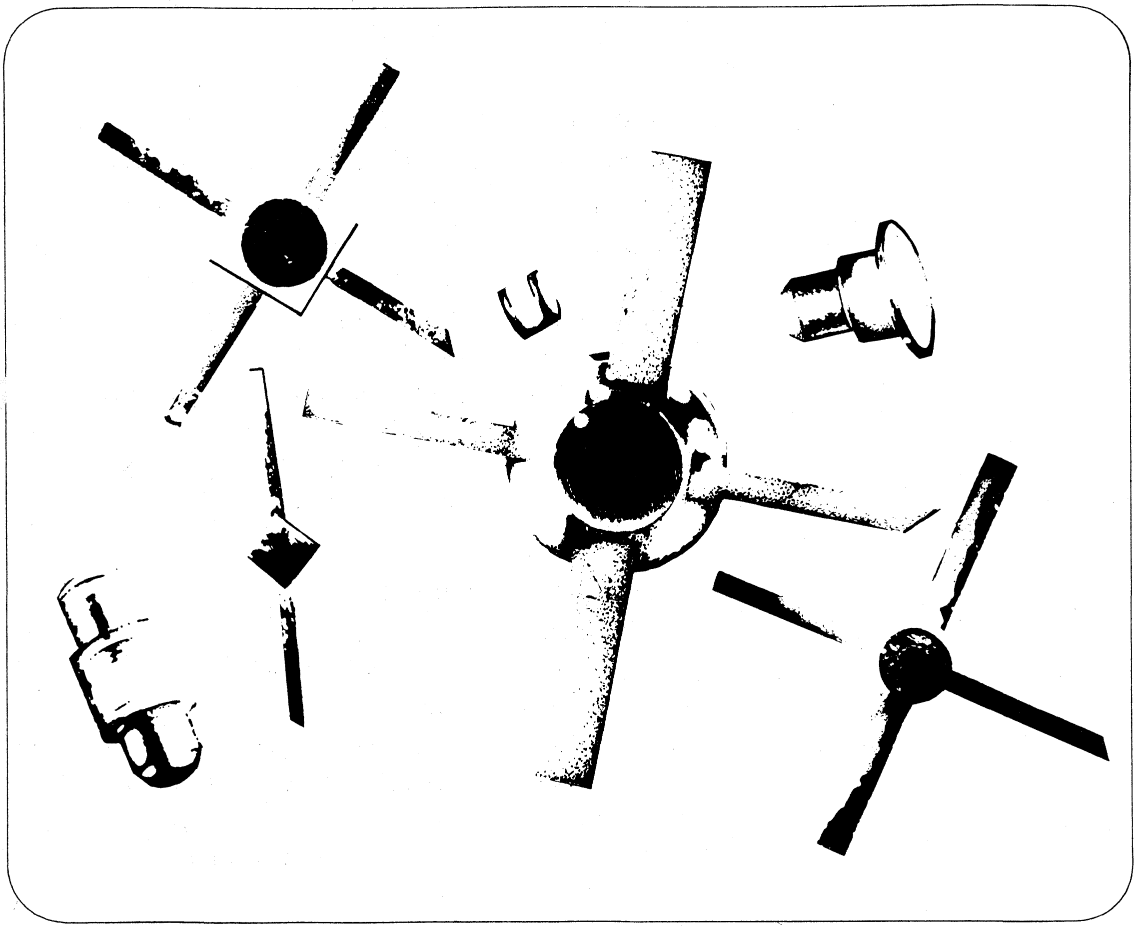
COMB GENERATORS



- 100, 250, 500 and 1000 MHz Drive Frequencies (Drive Frequencies in 50-1500 MHz Range Available on Special Request)
- Input Matched to 50 Ω
- Self-biased, no External Bias Required
- Narrow Output Pulses: 130ps Pulse Width with 10V Amplitude
- Broadband Output Comb
- Hermetic Step Recovery Diode Modules

Part Number		Drive Freq., MHz	Typ. Output Power per Comb, dBm			
Comb Generator	Design Module		1-4 GHz	4-8 GHz	8-12 GHz	12-18 GHz
33002A	33002B	100	-5	-15	-25	-35
33003A	33003B	250	0	-5	-15	-30
33004A	33004B	500	+10	+5	-5	-15
33005C	33005D	1000	+10	+5	0	-5

Appendix



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