HEWLETT PACKARD

Stripline PIN Diode Switches/ Attenuators

5082-3040
5082-3041
5082-3340

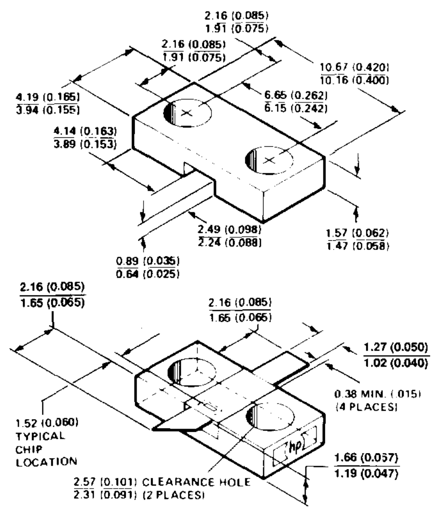
Features

- **Low Cost to Use**
  Designed for Easy Mounting
- **Broadband Operation**
  HF Through X-Band
- **Low Insertion Loss**
  Less than 0.5 dB to 10 GHz (5082-3040, -3340)
- **High Isolation**
  Greater than 20 dB to 10 GHz
- **Fast Switching/Modulation**
  5 ns Typical (5082-3041)
- **Low Drive Current Required**
  Less than 20 mA for 20 dB Isolation (5082-3041)

Description/ Applications

These diodes are designed for applications in microwave and HF-UHF systems using strip-line 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.



DIMENSIONS IN MILLIMETERS AND (INCHES)

Outline 61

Maximum Ratings

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

Notes:
1. Device properly mounted in sufficient heat sink at 25°C, derate linearly to zero at maximum operating temperature.
2. $t_p = 1\ \mu s$, $f = 10$ GHz, $Du = 0.001$, $Z_O = 50\ \Omega$, $T_A = 25°C$.

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

The 5082-3340 is a reverse polarity device with characteristics similar to the 5082-3040. The 5082-3041 is recommended for applications requiring fast switching or high frequency modulation of microwave signals, or where the lowest bias current for the maximum attenuation is required.

More information is available in HP AN 922 (Applications of PIN Diodes) and 929 (Fast Switching PIN Diodes).

Mechanical Specifications

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. Outline 61 has a gold plated copper body with gold plated Kovar leads.

Electrical Specifications at T_A = 25°C

Part Number 5082-	Package Outline	Heat Sink	Min. Isolation (dB)	Max. Insertion Loss (dB)	Max. SWR	Max. Reverse Recovery Time t_{rr} (ns)	Typical Carrier Lifetime τ (ns)	Typical CW Power Switching Capability P_A (W)
3040	61	Anode	20	0.5	1.5	–	400	30
3041	61	Cathode	20	1.0	1.5	10	35*	13
3340	61	Cathode	20	0.5	1.5	–	400	30
Test[1] Conditions	–	–	I_F = 100 mA (Except 3041; I_F = 20 mA)	I_F = 0 P_{in} = 1 mW	I_F = 0 P_{in} = 1 mW	I_F = 20 mA V_R = 10 V Recovery to 90%	I_F = 50 mA I_R = 250 mA *I_F = 10 mA *I_R = 6 mA	–

Note:
1. Test Frequencies: 8 GHz 5082-3041; 10 GHz 5082-3040, and -3340.

Typical Parameters

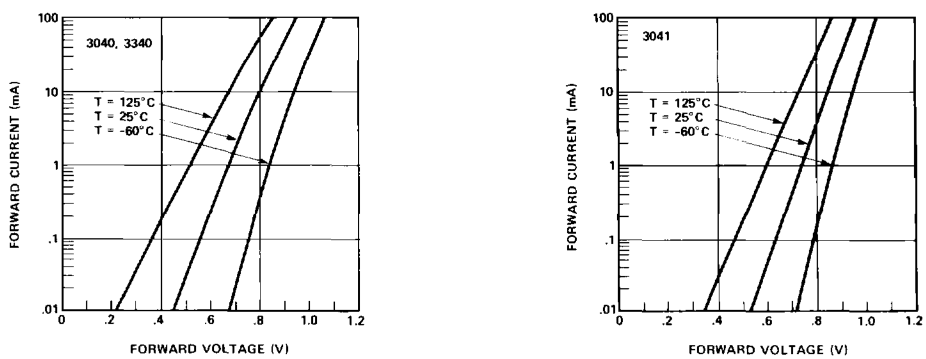


Figure 1. Typical Forward Characteristics.

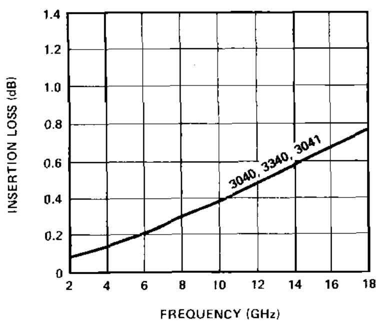


Figure 2. Typical Insertion Loss vs. Frequency.

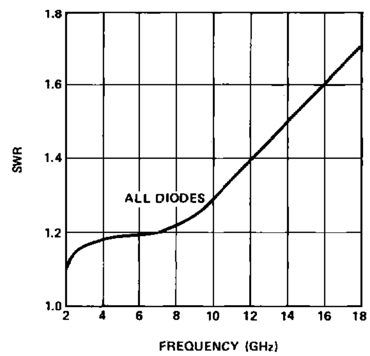


Figure 3. Typical SWR vs. Frequency.

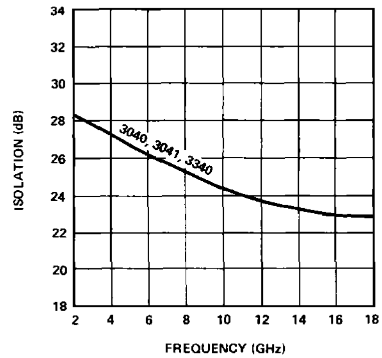


Figure 4. Typical Isolation vs. Frequency.

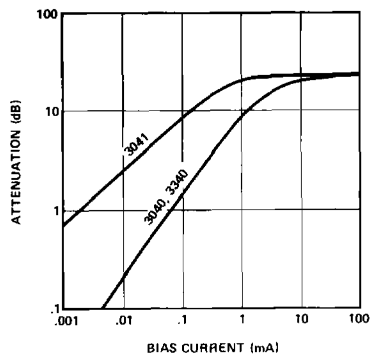
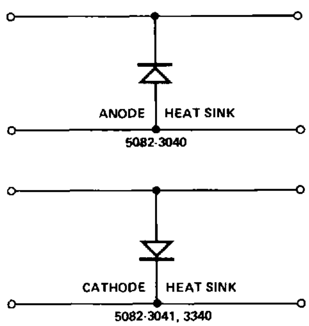
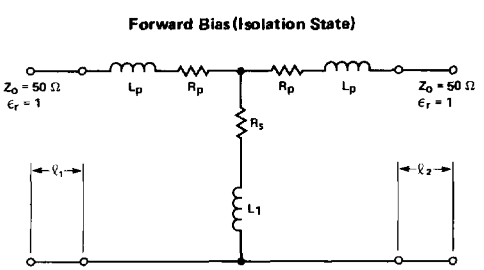


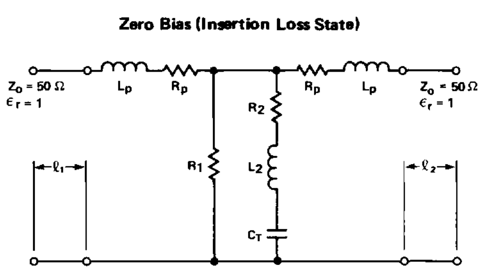
Figure 5. Typical Attenuation above Zero Bias Insertion Loss vs. Bias Current at f = 8 GHz.



HEAT SINK POLARITY

Equivalent Circuits





Typical Equivalent Circuit Parameters–Forward Bias

Part Number 5082-	Lp (pH)	Rp (Ω)	Rs (Ω)	L_1 (pH)	1 (mm)	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

Typical Equivalent Circuit Parameters–Zero Bias

Part Number 5082-	Lp (pH)	Rp (Ω)	R_1 (KΩ)	L_2 (pH)	R_2 K(Ω)	C_T (pF)	1 (mm)	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

Typical Switching Parameters

RF Switching Speed HP 5082-3041

The RF switching speed of the 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 50 Ω 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 6. 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.

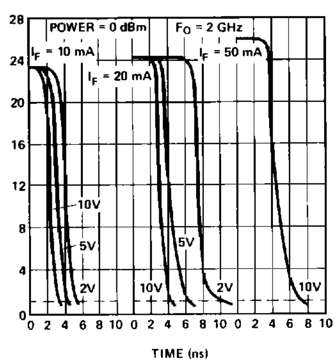


Figure 6. Isolation vs. Time (Turn-on) for HP 5082-3041. Frequency, 2 GHz.

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_R. The circuit used to measure t_{rr} is shown in Figure 7.

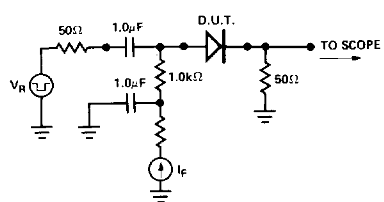


Figure 7. Basic t_{rr} Test Setup.

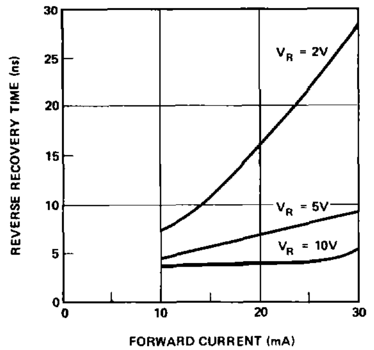


Figure 8. Typical Reverse Recovery Time vs. Forward Current for Various Reverse Driving Voltages, 5082-3041.

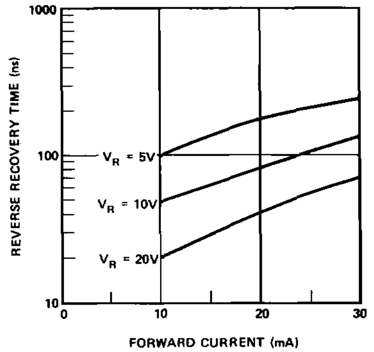


Figure 9. Typical Reverse Recovery Time vs. Forward Current for Various Reverse Driving Voltages, 5082-3340.

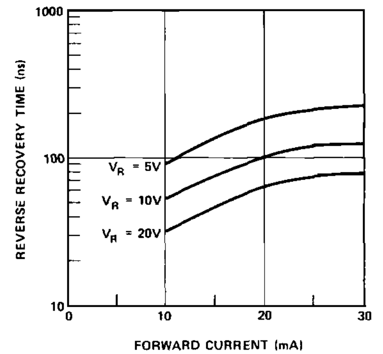


Figure 10. Typical Reverse Recovery Time vs. Forward Current for Various Reverse Driving Voltages, 5082-3040.

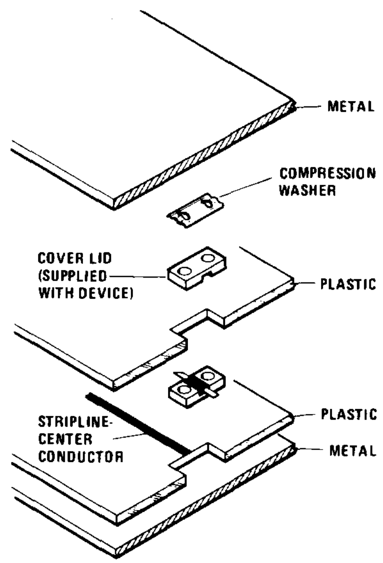


Figure 11. Suggested Stripline Assembly.