HEWLETT PACKARD

Low Loss Microwave SPST Switches and Attenuators DC-18 GHz

Technical Data

33132A
33134A

Features

- **Low Insertion Loss**
- **High Isolation**
- **Low SWR**

Description

HP SPST switches utilize PIN diodes in shunt across a 50 ohm transmission line. At microwave frequencies the PIN diode presents a very high impedance at zero bias. With the diode in shunt, the switch is "on" at zero bias (well matched and passing all the incident RF power). Approximately 15 mA of DC current per diode reduces the diode impedance to much less than 50 ohms. Thus the switch is "off" when the diode is heavily forward biased (high mismatch reflecting most of the power back to the source). When switching from the "on" to "off" state, the switch can be set at any attenuation level between those two extremes. The PIN diode allows a smooth and repeatable variation of attenuation with change in bias level.

The HP 33130 series are complete switches with RF connectors, bias circuits, and built in DC returns.

Switch Schematics

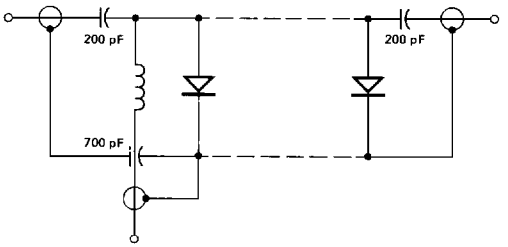


Figure 1. Switch Assembly Schematic. 33130 Series.

Model	Diode Polarity	Number of Diodes
33132A	As Shown	2
33134A	As Shown	4

For further technical details, see HP Application Note 922, "Applications of PIN Diodes."

Electrical Specifications

Maximum Ratings

Parameter	33130 Series
Operating Temperature	-55°C to +95°C
Storage Temperature	-55°C to +125°C
CW RF Power at T_{CASE} = 25°C	2 W (Derate to 0.85 Watt at 95°C)
Pulse RF Power at T_{CASE} = 25°C (1 µs, 0.001 duty cycle)	75 W (Derate to 33 Watt at 95°C)
Control Current/Voltage	See following table

Maximum Control Current/Voltage

Model	Current (mA)	Voltage (V)
33132A	+200	-100 to +1.0
33134A	+400	-100 to +1.0

RF Power Handling

The breakdown voltage of the diode, the maximum diode power dissipation, the bias state, and the frequency of the RF signal all determine the maximum RF power a switch can handle.

Pulse Width Correction Factor

Apply to Incidental Power Ratings of Figure 2.

Pulse Width	Correction Factor
0.5 µs	1 .55
2.0 µs	0.62

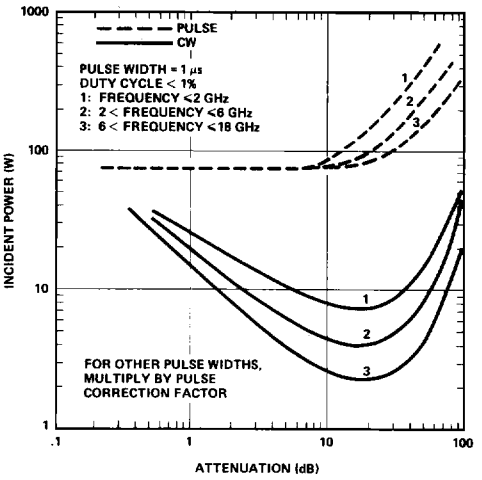


Figure 2. Incident Pulse and CW Power Ratings vs. Attenuation. See Table for Pulse Correction Factor (T_C = 25°C).

Driver Considerations

Driver requirements are dictated by the specific application. When the switch is used as a modulator or attenuator, a current amplifier is required. Suitable integrated circuits can be obtained for either laboratory or OEM applications. The HP 33190B is also suitable as a driver. Typical 10%-90% switching speed is 50 to 100 ns in either off-on or on-off switching.

Noise Figure

Equal to attenuation.

Distortion

Internally generated harmonics are typically 40 dB below the fundamental at input power levels up to 2 watts.

RF to DC Isolation

Isolation of the RF from the control circuit is typically 30 dB.

Electrical Specifications at T_{CASE} = 25°C

33130 Series Switches

Model	Parameter	Conditions	Frequency Range (GHz)					
			0.1-1.0	1.0-2.0	2.0-4.0	4.0-8.0	8.0-12.0	12.0-18.0
33132A	Min. Isolation (dB)[1]	I_C = 30 mA	28	33	37	43	43	43
	Max. Insertion Loss (dB)	V_C = -10 V	1.0	1.0	1.0	1.2	1.4	2.0
	Max. SWR		1.7	1.7	1.7	1.9	1.9	2.2
33134A	Min. Isolation (dB)	I_C = 200 mA	40	60	80	80	80	80
	Max. Insertion Loss (dB)	V_C = -10 V	1.0	1.0	1.4	1.6	1.8	2.5
	Max. SWR		1.7	1.7	2.0	2.0	2.0	2.2

Note:
1. 3-6 dB improvement in isolation in the frequency range 0.1-12 GHz can be realized by increasing bias current to 100 mA.

Typical Characteristics

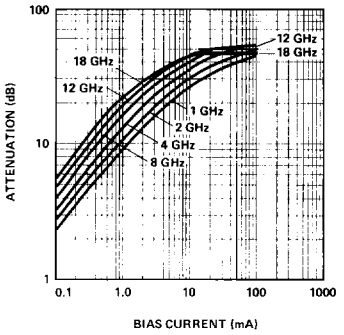


Figure 3. Attenuation of the 33132A as a Function of Bias Current with Frequency as a Parameter.

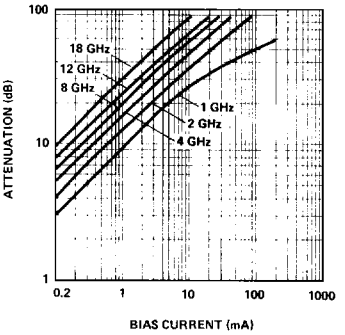


Figure 4. Attenuation of the 33134A as a Function of Bias Current with Frequency as a Parameter.

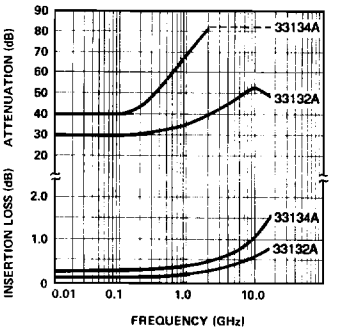


Figure 5. Typical Attenuation and Insertion Loss vs. Frequency.

Ordering Information

33130 Series General Purpose Switches

The HP 33130 series switch is a broadband general purpose switch. The standard unit is supplied with SMA jack (female) RF connectors and SMC jack bias connector. An SMA jack bias connector is available as Option 001.

Mechanical Specifications

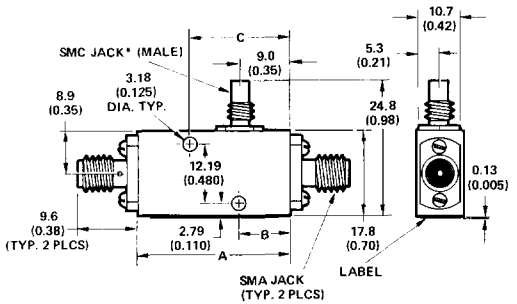
Size: See Outline Drawing.

Finish: 33130 Series - Body: painted.

Maximum Weight	33130 Series	
	33132A	33134A
Ounces	0.8	1.0
Grams	23	29

Outline Drawing

33130 Series



Model	A	B	C
33132A	31.8 (1.25)	9.7 ± 0.25 (0.383 ± 0.010)	21.9 ± 0.25 (0.863 ± 0.010)
33134A	37.3 (1.47)	12.5 ± 0.25 (0.493 ± 0.010)	24.7 ± 0.25 (0.973 ± 0.010)

*SMA Jack available as Option 001.

Environmental Capabilities

33130 Series:

Non-Operating Temperature Cycling: MIL-STD-883, Method 1010, Test Condition B (-55°C to +125°C).

Operating Temperature: MIL-E-5400 Table I, Class 2 (-55°C to +95°C continuous).

Shock: MIL-STD-883 Method 2002, Test Condition B.

Moisture Resistance: MIL-STD-883, Method 1004.

Salt Atmosphere: (corrosion) MIL-STD-883, Method 1009, Test Condition A.