# Series 195 Octave-Band PIN Diode Attenuator/Modulator

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Applicaton Notes for Microwave Attenuators

## SERIES 195

Series 195 current-controlled attenuator/modulators provide small size with greater than octave-bandwidth performance at low cost. All models except the 1950A* provide a minimum of 60 dB of attenuation with fall times of 20 nsec max, and rise times ranging from 25 nsec for the 1951 and 1952 to 125 nsec max for the 1956 and 1958. The 1950A* provides a minimum of 80 dB of attenuation with a fall time of 50 nsec max and a rise time of 250 nsec max. These characteristics make this series suitable for a wide range of applications including level setting, complex amplitude modulation, pulse modulation and high-speed switching. The eight models in the Series 195 encompass a frequency range from 0.5 to 18 GHz. All models except the 1950A* are capable of extended bandwidth operation, typically 3:1, with only moderate degradation in performance at the band edges.

As shown in figures 1 and 2 below, the RF circuit employed in all models except the Model 1950A* uses two shunt arrays of PIN diodes and two quadrature hybrid couplers. The quadrature hybrids are of a unique GMC microstrip design which are integrated with the diode arrays to yield a minimal package size. The RF circuit employed in the Model 1950A* uses one shunt array of PIN diodes with input and output impedance matching circuits.

- **Absorptive**
- **Current controlled**
- **0.5 to 18 GHz frequency range**
- **High performance MIC quadrature hybrid design**
- **High speed**

*Model 1950A is a special-order product. Consult factory before ordering.

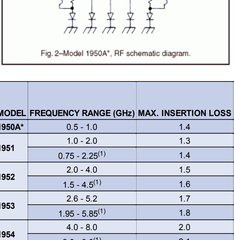


Fig. 1–Models 1951-1958, RF schematic diagram.

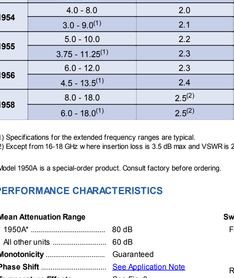


Fig. 2–Model 1950A*, RF schematic diagram.

| MODEL | FREQUENCY RANGE (GHz) | MAX. INSERTION LOSS | MAX. VSWR | FLATNESS (± dB) AT MEAN ATTENUATION LEVELS UP TO 10 dB | 20 dB | 40 dB | 60 dB | 80 dB |
|---|---|---|---|---|---|---|---|---|
| **1950A*** | 0.5 - 1.0 | 1.4 | 2.0 | 0.3 | 0.8 | 1.7 | 2.2 | 3.2 |
| **1951** | 1.0 - 2.0 | 1.3 | 1.5 | 0.3 | 0.8 | 1.5 | 1.6 | |
| | 0.75 - 2.25[1] | 1.4 | 2.0 | 0.5 | 1.4 | 3.0 | 3.5 | |
| **1952** | 2.0 - 4.0 | 1.5 | 1.5 | 0.3 | 0.8 | 1.5 | 1.6 | |
| | 1.5 - 4.5[1] | 1.6 | 2.0 | 0.5 | 1.4 | 3.0 | 3.5 | |
| **1953** | 2.6 - 5.2 | 1.7 | 1.6 | 0.3 | 0.8 | 1.5 | 1.6 | |
| | 1.95 - 5.85[1] | 1.8 | 2.1 | 0.5 | 1.4 | 3.0 | 3.5 | |
| **1954** | 4.0 - 8.0 | 2.0 | 1.7 | 0.3 | 0.8 | 1.5 | 1.6 | |
| | 3.0 - 9.0[1] | 2.1 | 2.2 | 0.5 | 1.4 | 3.0 | 3.5 | |
| **1955** | 5.0 - 10.0 | 2.2 | 1.7 | 0.5 | 0.9 | 1.5 | 1.6 | |
| | 3.75 - 11.25[1] | 2.3 | 2.2 | 0.7 | 1.4 | 3.0 | 3.5 | |
| **1956** | 6.0 - 12.0 | 2.3 | 1.8 | 0.7 | 1.0 | 1.5 | 1.6 | |
| | 4.5 - 13.5[1] | 2.4 | 2.2 | 0.9 | 1.5 | 3.0 | 3.5 | |
| **1958** | 8.0 - 18.0 | 2.5[2] | 1.8[2] | 0.7 | 1.0 | 1.5 | 1.6 | |
| | 6.0 - 18.0[1] | 2.5[2] | 1.8[2] | 0.9 | 1.5 | 3.0 | 3.5 | |

(1) Specifications for the extended frequency ranges are typical.
(2) Except from 16-18 GHz w here insertion loss is 3.5 dB max and VSWR is 2.0 max

*Model 1950A is a special-order product. Consult factory before ordering.

## PERFORMANCE CHARACTERISTICS

**Mean Attenuation Range**
1950A* ..... 80 dB
All other units ..... 60 dB
**Monotonicity** ..... Guaranteed
**Phase Shift** ..... See Application Note
**Temperature Effects** ..... See Fig. 3
**Power Handling Capability**
Without Performance Degradation
1950A*,1951 ..... 10 mW cw or peak
All other units ..... 100 mW cw or peak
Survival Power (from -65°C to +25°C; see Fig. 4 for higher temperatures)
All units ..... 1 W average 25W peak (1 µsec max pulse width)

**Switching Speed**
Fall Time
1950A* ..... 50 nsec max[3]
All other units ..... 20 nsec max[3]
Rise Time
1950A* ..... 250 nsec max[3]
All other units ..... 125 nsec max[3]
**Bias Current for Maximum Attenuation**
1950A* ..... 5 to 35 mA
All other units ..... 15 to 70 mA

(3) For attenuation steps of 10 dB or more.

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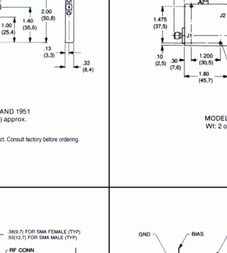


*Fig. 4-Series 195 power derating factor*

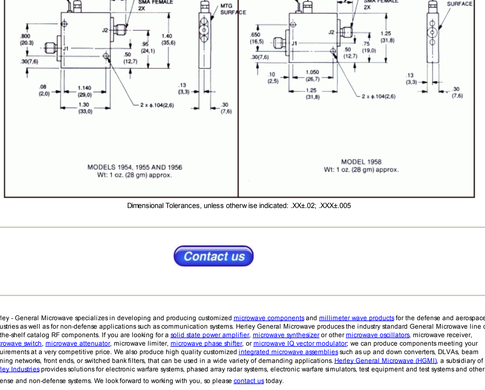


Fig 3—Series 195, typical effects of temperature on attenuation

## ENVIRONMENTAL RATINGS

**Operating Temperature Range** ..... -54°C to + 125°C
**Non-Operating Temperature Range** ..... -65°C to + 125°C
**Humidity** ..... MIL-STD-202F, Method 103B, Cond. B (96 hrs. at 95%)
**Shock** ..... MIL-STD-202F, Method 213B, Cond. B (75G, 6 msec)
**Vibration** ..... MIL-STD-202F, Method 204D, Cond. B (.06" double amplitude or 15G, whichever is less)
**Altitude** ..... MIL-STD-202F, Method 105C, Cond. B (50,000 ft.)
**Temp. Cycling** ..... MIL-STD-202F, Method 107D, Cond. A, 5 cycles

## AVAILABLE OPTIONS

| Option No. | Description |
|---|---|
| **3** | SMA female bias connector |
| **7** | Two SMA male rf connectors |
| **10** | One SMA male (J1) and one SMA female (J2) rf connector |
| **64** | SMC male bias connector |
| **64A** | SMB male bias connector |

## DIMENSIONS AND WEIGHTS




Dimensional Tolerances, unless otherw ise indicated: .XX±.02; .XXX±.005

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