



COAXIAL WIDEBAND

# Digital Step Attenuator ZX76-31R5A-PNS+

50Ω 31.5 dB, 0.5 dB Step DC to 4 GHz

## THE BIG DEAL

- 6-bit digital step attenuator
- High speed parallel control interface
- Low insertion loss
- Fast attenuation transitions
- No control software or PC required



Generic photo used for illustration purposes only

|            |                 |
|------------|-----------------|
| Model No.  | ZX76-31R5A-PNS+ |
| Case Style | HK1149          |
| Connectors | SMA             |

## APPLICATIONS

- Test Setup
- Lab
- Instrumentation

**RoHS Compliant**

See our website for RoHS Compliance methodologies and qualifications

## PRODUCT OVERVIEW

ZX76-31R5A-PNS+ is a 6-bit digital step attenuator with parallel control and dual (positive and negative) supply voltage inputs. Attenuation can be set from 0 to 31.5 dB in 0.5 dB steps, with 0.1 dB typical accuracy. The attenuator is housed in a compact unibody package, with SMA RF connections and a snap-fit control input.

The high speed parallel control interface supports manual control and integration with a wide range of microcontroller and custom I/O (input / output) control systems. Data is entered into the internal 6-bit register using 5V logic levels and then latched to set the attenuation.

For applications requiring Ethernet / USB control and software support, please review Mini-Circuits' R\_DAT series of programmable attenuators at <https://www.minicircuits.com/WebStore/RF-Programmable-Step-Attenuators.html>

## KEY FEATURES

| Feature                              | Advantages                                                                                                                                                                                       |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Wideband operation, from DC to 4 GHz | Supports a range of applications in communications, satellite and defense.                                                                                                                       |
| Excellent RF performance             | Low insertion loss and 18 dB typical return loss minimize the impact on overall system performance.                                                                                              |
| Dual voltage supply inputs           | Separate positive & negative supply rails reduce the noise & spurious effects associated with internal negative voltage generators and allow faster attenuation switching (up to 1 MHz).         |
| Parallel control                     | High speed parallel control, no PC, software control or clock needed. Allows manual control of attenuation setting.<br>Designed for integration with generic control systems at 5V logic levels. |

**RF ELECTRICAL SPECIFICATIONS, DC - 4 GHz,  $T_{AMB}=25^{\circ}C$ ,  $V_{DD}=+3V$ ,  $V_{SS}=-3.3V$** 

| Parameter                                                                   | Frequency (MHz) | Min. | Typ.   | Max.         | Units |
|-----------------------------------------------------------------------------|-----------------|------|--------|--------------|-------|
| Insertion Loss @ 0dB Attenuation Setting                                    | DC - 1000       | —    | 1.4    | 2.0          | dB    |
|                                                                             | 1000 - 2400     | —    | 1.9    | 2.7          |       |
|                                                                             | 2400 - 4000     | —    | 2.5    | 3.3          |       |
| Accuracy @ 0.5 dB Attenuation Setting                                       | DC - 1000       | —    | ± 0.03 | ± 0.10       | dB    |
|                                                                             | 1000 - 2400     | —    | ± 0.05 | ± 0.15       |       |
|                                                                             | 2400 - 4000     | —    | ± 0.07 | ± 0.20       |       |
| Accuracy @ 1 dB Attenuation Setting                                         | DC - 1000       | —    | ± 0.02 | ± 0.10       | dB    |
|                                                                             | 1000 - 2400     | —    | ± 0.05 | ± 0.15       |       |
|                                                                             | 2400 - 4000     | —    | ± 0.10 | ± 0.25       |       |
| Accuracy @ 2 dB Attenuation Setting                                         | DC - 1000       | —    | ± 0.05 | ± 0.15       | dB    |
|                                                                             | 1000 - 2400     | —    | ± 0.15 | ± 0.25       |       |
|                                                                             | 2400 - 4000     | —    | ± 0.15 | ± 0.35       |       |
| Accuracy @ 4 dB Attenuation Setting                                         | DC - 1000       | —    | ± 0.07 | ± 0.20       | dB    |
|                                                                             | 1000 - 2400     | —    | ± 0.15 | ± 0.25       |       |
|                                                                             | 2400 - 4000     | —    | ± 0.23 | ± 0.50       |       |
| Accuracy @ 8 dB Attenuation Setting                                         | DC - 1000       | —    | ± 0.03 | ± 0.25       | dB    |
|                                                                             | 1000 - 2400     | —    | ± 0.15 | ± 0.50       |       |
|                                                                             | 2400 - 4000     | —    | ± 0.60 | ± 0.80       |       |
| Accuracy @ 16 dB Attenuation Setting                                        | DC - 1000       | —    | ± 0.10 | ± 0.30       | dB    |
|                                                                             | 1000 - 2400     | —    | ± 0.15 | ± 0.70       |       |
|                                                                             | 2400 - 4000     | —    | ± 1.10 | ± 1.45       |       |
| Input IP3 (at Min. and Max. Attenuation) <sup>1</sup>                       | DC - 4000       | —    | +52    | —            | dBm   |
| Input Power @ 0.2dB Compression (at Min. and Max. Attenuation) <sup>1</sup> | DC - 4000       | —    | +24    | —            |       |
| Input Operating Power                                                       | 0.010 - 50      | —    | —      | See figure 1 | dBm   |
|                                                                             | 50 - 4000       | —    | —      | +24          |       |
| Return Loss                                                                 | DC - 1000       | 12.5 | 21     | —            | dB    |
|                                                                             | 1000 - 2400     | 11.5 | 18     | —            |       |
|                                                                             | 2400 - 4000     | 10.0 | 14     | —            |       |

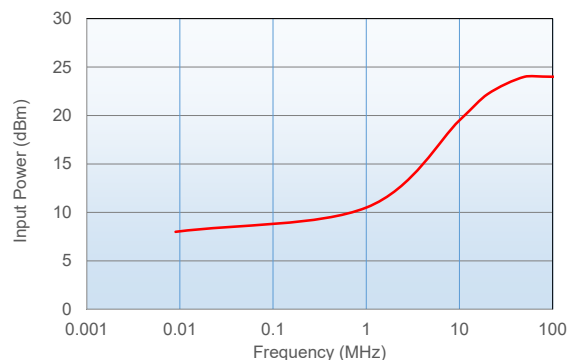
<sup>1</sup> Input IP3 and 1dB compression degrade below 1 MHz. Input power not to exceed max operating specification for continuous operation.

**DC ELECTRICAL SPECIFICATIONS**

| Parameter                         | Min.           | Typ. | Max.           | Units |
|-----------------------------------|----------------|------|----------------|-------|
| Positive Supply Voltage, $V_{DD}$ | +2.7           | +3   | +3.6           | V     |
| Positive Supply Current, $I_{DD}$ | —              | —    | 3              | mA    |
| Negative Supply Voltage, $V_{SS}$ | -3.6           | -3.3 | -3.2           | V     |
| Negative Supply Current, $I_{SS}$ | —              | 16   | 40             | μA    |
| Control Input Low                 | -0.3           | —    | +0.3x $V_{DD}$ | V     |
| Control Input High                | +0.7x $V_{DD}$ | —    | +5             | V     |
| Control Current                   | —              | —    | 400            | μA    |

**SWITCHING SPECIFICATIONS**

| Parameter                                                  | Min. | Typ. | Max. | Units |
|------------------------------------------------------------|------|------|------|-------|
| Switching Speed, 50% Control to 0.5dB of Attenuation Value | —    | 1    | —    | μsec  |
| Switching Control Frequency                                | —    | 1    | —    | MHz   |

**FIGURE 1: Max Input Operating Power vs Frequency**



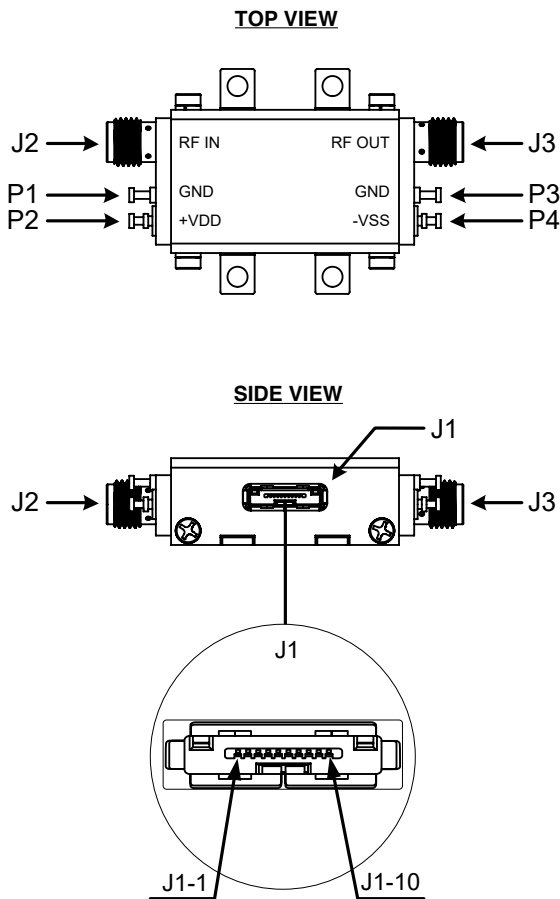
# Digital Step Attenuator ZX76-31R5A-PNS+

## ABSOLUTE MAXIMUM RATINGS

| Parameter                    | Ratings                |
|------------------------------|------------------------|
| Operating Temperature        | -40°C to 85°C          |
| Storage Temperature          | -40°C to 85°C          |
| V <sub>DD</sub>              | -0.3V Min., +5.5V Max. |
| V <sub>SS</sub>              | -3.6V Min., +0.3V Max. |
| Voltage on any control input | -0.3V Min., +6V Max.   |
| ESD, HBM                     | 500V                   |
| ESD, MM                      | 100V                   |
| Input Power                  | +30dBm                 |

Permanent damage may occur if any of these limits are exceeded. Operating in the range between operating power limits and absolute maximum ratings for extended periods of time may result in reduced life and reliability.

## PIN CONFIGURATION



## PIN DESCRIPTION

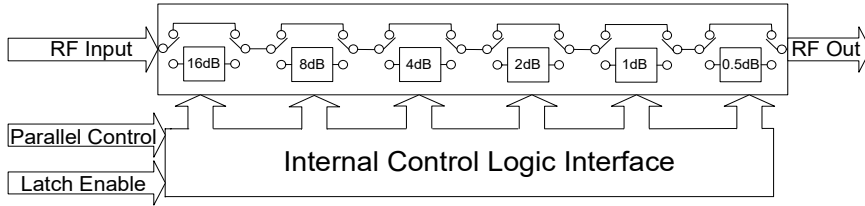
| Function        | Pin Number | Description                         |
|-----------------|------------|-------------------------------------|
| LE              | J1-1       | Latch Enable Input                  |
| C1              | J1-2       | Control for attenuation bit, 1.0 dB |
| C0.5            | J1-3       | Control for attenuation bit, 0.5 dB |
| N/C             | J1-4       | Not Connected                       |
| C16             | J1-5       | Control for attenuation bit, 16 dB  |
| GND             | J1-6       | Ground Connection                   |
| GND             | J1-7       | Ground Connection                   |
| C4              | J1-8       | Control for attenuation bit, 4 dB   |
| C8              | J1-9       | Control for attenuation bit, 8 dB   |
| C2              | J1-10      | Control for attenuation bit, 2 dB   |
| RF in           | J2         | RF in port <sup>2</sup>             |
| RF out          | J3         | RF out port <sup>2</sup>            |
| GND             | P1         | Ground Connection                   |
| V <sub>DD</sub> | P2         | Positive Supply Voltage             |
| GND             | P3         | Ground Connection                   |
| V <sub>SS</sub> | P4         | Negative Supply Voltage             |

<sup>2</sup> Both RF ports must be held at 0VDC or DC blocked with an external series capacitor.



# Digital Step Attenuator ZX76-31R5A-PNS+

## SIMPLIFIED SCHEMATIC



The ZX76-31R5A-PNS+ parallel interface consists of 6 control bits that select the desired attenuation state, as shown in Table 1: Truth Table.

TABLE 1. TRUTH TABLE

| Attenuation State | C16 | C8 | C4 | C2 | C1 | C0.5 |
|-------------------|-----|----|----|----|----|------|
| Reference         | 0   | 0  | 0  | 0  | 0  | 0    |
| 0.5 (dB)          | 0   | 0  | 0  | 0  | 0  | 1    |
| 1 (dB)            | 0   | 0  | 0  | 0  | 1  | 0    |
| 2 (dB)            | 0   | 0  | 0  | 1  | 0  | 0    |
| 4 (dB)            | 0   | 0  | 1  | 0  | 0  | 0    |
| 8 (dB)            | 0   | 1  | 0  | 0  | 0  | 0    |
| 16 (dB)           | 1   | 0  | 0  | 0  | 0  | 0    |
| 31.5 (dB)         | 1   | 1  | 1  | 1  | 1  | 1    |

Note: Not all 64 possible combinations of C0.5 - C16 are shown in table

The parallel interface timing requirements are defined by Figure 1 (Parallel Interface Timing Diagram) and Table 2 (Parallel Interface AC Characteristics), and the switching speed.

For latched parallel programming the Latch Enable (LE) should be held LOW while changing attenuation state control values, then pulse LE HIGH to LOW (per Figure 1) to latch new attenuation state into the device.

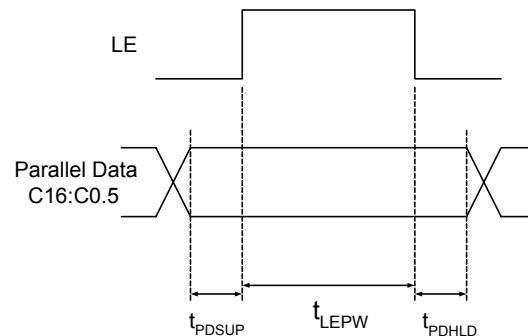
For direct parallel programming, the Latch Enable (LE) line should be pulled HIGH. Changing the attenuation state control values will immediately change the device's state to a new attenuation value. Direct mode is ideal for manual control of the device (using hardware, switches, or jumpers).

Control cables for programming can be ordered separately. For details see page 5.

TABLE 2. PARALLEL INTERFACE AC CHARACTERISTICS

| Symbol      | Parameter                                       | Min. | Units |
|-------------|-------------------------------------------------|------|-------|
| $t_{LEPW}$  | LE minimum pulse width                          | 10   | ns    |
| $t_{PDSUP}$ | Data set-up time before clock rising edge of LE | 10   | ns    |
| $t_{PDHLD}$ | Data hold time after clock falling edge of LE   | 10   | ns    |

FIGURE 1: PARALLEL INTERFACE TIMING DIAGRAM



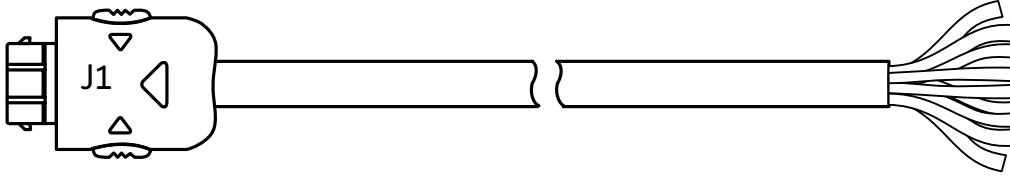
## POWER-UP STATE

When the attenuator powers up and LE is logic low, the nominal attenuation is set on 0 dB. When LE is logic high, the nominal attenuation selected upon control logics ( see Table 1 ).



# Digital Step Attenuator **ZX76-31R5A-PNS+**

## ZX76-WP+ CONTROL CABLE



## RECOMMENDED ACCESSORIES

An optional ZX76-WP+ is a shielded cable on one end and a connector on the other end designed to mate to the ZX76-31R5A-PNS+. These bare wires enable the customer to assemble their own cable as required to interface with the ZX76-31R5A-PNS+ (cable length is 4.9ft/ 1.5meters).

## ZX76-WP+ WIRING INFORMATION

| J1 Pin Number | Function | Description                          | Wire Color |
|---------------|----------|--------------------------------------|------------|
| J1-1          | LE       | Latch Enable Input                   | White      |
| J1-2          | C1       | Control for attenuation bit, 1.0 dB  | Yellow     |
| J1-3          | C0.5     | Control for attenuation bit, 0.5 dB  | Green      |
| J1-5          | C16      | Control for attenuation bit, 16.0 dB | Blue       |
| J1-7          | GND      | Ground Connection                    | Black      |
| J1-8          | C4       | Control for attenuation bit, 4.0 dB  | Orange     |
| J1-9          | C8       | Control for attenuation bit, 8.0 dB  | Brown      |
| J1-10         | C2       | Control for attenuation bit, 2.0 dB  | Red        |

Note: Other pins not connected. Cable shield connected to case ground.



### TYPICAL PERFORMANCE DATA (AT 25°C)

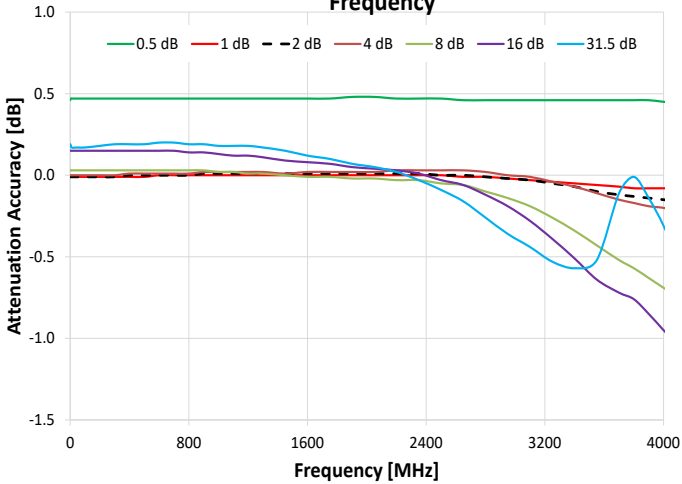
| Freq.<br>[MHz] | I.Loss<br>[dB] | Attenuation relative to Insertion Loss<br>[dB] |       |       |       |       |       |       |
|----------------|----------------|------------------------------------------------|-------|-------|-------|-------|-------|-------|
|                |                | @ Attenuation setting [dB]                     |       |       |       |       |       |       |
|                |                | 0.5                                            | 1     | 2     | 4     | 8     | 16    | 31.5  |
| 0.1            | -1.21          | 0.46                                           | -0.01 | -0.01 | 0.00  | 0.03  | 0.15  | 0.18  |
| 1              | -1.23          | 0.47                                           | -0.01 | -0.01 | 0.00  | 0.03  | 0.15  | 0.19  |
| 10             | -1.24          | 0.47                                           | -0.01 | -0.01 | 0.00  | 0.03  | 0.15  | 0.17  |
| 100            | -1.27          | 0.47                                           | -0.01 | -0.01 | 0.00  | 0.03  | 0.15  | 0.17  |
| 200            | -1.31          | 0.47                                           | -0.01 | -0.01 | 0.00  | 0.03  | 0.15  | 0.18  |
| 400            | -1.38          | 0.47                                           | -0.01 | 0.00  | 0.01  | 0.03  | 0.15  | 0.19  |
| 500            | -1.42          | 0.47                                           | -0.01 | 0.00  | 0.01  | 0.03  | 0.15  | 0.19  |
| 700            | -1.49          | 0.47                                           | 0.00  | 0.00  | 0.01  | 0.03  | 0.15  | 0.20  |
| 800            | -1.54          | 0.47                                           | 0.00  | 0.00  | 0.01  | 0.03  | 0.14  | 0.19  |
| 1000           | -1.61          | 0.47                                           | 0.00  | 0.01  | 0.02  | 0.02  | 0.13  | 0.18  |
| 1100           | -1.65          | 0.47                                           | 0.00  | 0.01  | 0.02  | 0.02  | 0.12  | 0.18  |
| 1300           | -1.73          | 0.47                                           | 0.00  | 0.01  | 0.02  | 0.01  | 0.11  | 0.17  |
| 1450           | -1.79          | 0.47                                           | 0.00  | 0.01  | 0.01  | 0.00  | 0.09  | 0.15  |
| 1750           | -1.92          | 0.47                                           | 0.00  | 0.01  | 0.02  | -0.01 | 0.07  | 0.10  |
| 1900           | -1.98          | 0.48                                           | 0.00  | 0.01  | 0.02  | -0.02 | 0.05  | 0.07  |
| 2200           | -2.11          | 0.47                                           | 0.00  | 0.01  | 0.03  | -0.03 | 0.03  | 0.02  |
| 2350           | -2.18          | 0.47                                           | 0.00  | 0.01  | 0.03  | -0.03 | 0.01  | -0.03 |
| 2650           | -2.29          | 0.46                                           | -0.01 | 0.00  | 0.03  | -0.06 | -0.06 | -0.16 |
| 2800           | -2.32          | 0.46                                           | -0.01 | -0.01 | 0.02  | -0.10 | -0.12 | -0.26 |
| 3100           | -2.39          | 0.46                                           | -0.03 | -0.03 | -0.01 | -0.19 | -0.28 | -0.44 |
| 3250           | -2.41          | 0.46                                           | -0.04 | -0.05 | -0.04 | -0.26 | -0.39 | -0.53 |
| 3550           | -2.44          | 0.46                                           | -0.06 | -0.10 | -0.11 | -0.43 | -0.64 | -0.52 |
| 3700           | -2.45          | 0.46                                           | -0.07 | -0.12 | -0.15 | -0.52 | -0.72 | -0.11 |
| 3900           | -2.48          | 0.46                                           | -0.08 | -0.14 | -0.19 | -0.63 | -0.85 | -0.14 |
| 4000           | -2.52          | 0.45                                           | -0.08 | -0.15 | -0.20 | -0.69 | -0.95 | -0.31 |

| Freq.<br>[MHz] | Return Loss In<br>[dB]     |        |        |        |        |        |        |        | Return Loss Out<br>[dB]    |        |        |        |        |        |        |        |
|----------------|----------------------------|--------|--------|--------|--------|--------|--------|--------|----------------------------|--------|--------|--------|--------|--------|--------|--------|
|                | @ Attenuation setting [dB] |        |        |        |        |        |        |        | @ Attenuation setting [dB] |        |        |        |        |        |        |        |
|                | 0                          | 0.5    | 1      | 2      | 4      | 8      | 16     | 31.5   | 0                          | 0.5    | 1      | 2      | 4      | 8      | 16     | 31.5   |
| 0.1            | -18.79                     | -20.34 | -21.87 | -19.97 | -21.00 | -24.11 | -43.54 | -39.26 | -18.63                     | -19.24 | -19.43 | -24.48 | -28.24 | -32.18 | -28.59 | -36.22 |
| 1              | -18.66                     | -20.23 | -21.75 | -19.81 | -20.79 | -23.77 | -41.88 | -39.24 | -18.51                     | -19.13 | -19.30 | -24.34 | -27.99 | -31.68 | -28.14 | -36.21 |
| 10             | -18.54                     | -20.10 | -21.62 | -19.72 | -20.73 | -23.73 | -41.56 | -39.38 | -18.39                     | -19.02 | -19.21 | -24.20 | -27.86 | -31.61 | -28.16 | -36.19 |
| 100            | -18.57                     | -20.12 | -21.63 | -19.74 | -20.74 | -23.72 | -40.92 | -39.47 | -18.52                     | -19.15 | -19.33 | -24.35 | -28.02 | -31.76 | -28.24 | -36.06 |
| 200            | -18.59                     | -20.15 | -21.66 | -19.77 | -20.78 | -23.77 | -40.26 | -38.91 | -18.49                     | -19.12 | -19.30 | -24.30 | -27.94 | -31.64 | -28.17 | -36.14 |
| 400            | -18.58                     | -20.12 | -21.61 | -19.73 | -20.70 | -23.60 | -37.38 | -38.75 | -18.42                     | -19.03 | -19.22 | -24.10 | -27.58 | -30.96 | -27.69 | -37.19 |
| 500            | -18.59                     | -20.12 | -21.60 | -19.72 | -20.68 | -23.53 | -36.24 | -38.34 | -18.53                     | -19.14 | -19.32 | -24.22 | -27.69 | -30.98 | -27.66 | -37.29 |
| 700            | -18.54                     | -20.05 | -21.51 | -19.64 | -20.58 | -23.35 | -34.55 | -37.77 | -18.51                     | -19.11 | -19.28 | -24.10 | -27.46 | -30.44 | -27.27 | -37.66 |
| 800            | -18.53                     | -20.03 | -21.49 | -19.63 | -20.56 | -23.28 | -33.81 | -37.22 | -18.50                     | -19.10 | -19.27 | -24.06 | -27.37 | -30.24 | -27.11 | -37.93 |
| 1000           | -18.60                     | -20.08 | -21.51 | -19.63 | -20.49 | -23.06 | -31.95 | -35.67 | -18.49                     | -19.07 | -19.23 | -23.92 | -27.04 | -29.56 | -26.56 | -38.81 |
| 1100           | -18.45                     | -19.92 | -21.32 | -19.48 | -20.32 | -22.83 | -31.20 | -35.37 | -18.47                     | -19.06 | -19.21 | -23.87 | -26.96 | -29.35 | -26.39 | -38.97 |
| 1300           | -18.21                     | -19.58 | -20.87 | -19.05 | -19.74 | -21.82 | -27.94 | -32.70 | -18.43                     | -18.96 | -19.05 | -23.40 | -25.97 | -27.52 | -24.83 | -41.98 |
| 1450           | -18.16                     | -19.44 | -20.63 | -18.72 | -19.19 | -20.87 | -25.73 | -30.69 | -18.39                     | -18.82 | -18.82 | -22.80 | -24.76 | -25.59 | -23.12 | -38.06 |
| 1750           | -18.02                     | -19.10 | -20.04 | -17.94 | -18.07 | -19.27 | -23.06 | -27.09 | -18.59                     | -18.74 | -18.53 | -21.92 | -22.78 | -23.15 | -21.20 | -27.90 |
| 1900           | -18.03                     | -18.96 | -19.75 | -17.70 | -17.77 | -19.05 | -23.03 | -26.34 | -18.33                     | -18.34 | -18.09 | -21.00 | -21.52 | -22.19 | -20.81 | -24.79 |
| 2200           | -16.33                     | -16.85 | -17.27 | -16.23 | -16.59 | -18.37 | -22.81 | -23.02 | -17.11                     | -16.99 | -16.87 | -18.66 | -19.11 | -21.03 | -21.57 | -20.69 |
| 2350           | -15.74                     | -16.13 | -16.45 | -15.95 | -16.61 | -18.97 | -24.23 | -22.36 | -16.08                     | -16.01 | -16.02 | -17.33 | -17.92 | -20.53 | -22.69 | -19.17 |
| 2650           | -14.58                     | -14.86 | -15.07 | -15.20 | -16.20 | -19.23 | -24.51 | -20.38 | -14.64                     | -14.69 | -14.85 | -15.74 | -16.50 | -19.69 | -23.85 | -17.56 |
| 2800           | -14.41                     | -14.63 | -14.78 | -15.16 | -16.30 | -19.58 | -24.24 | -19.59 | -14.20                     | -14.29 | -14.49 | -15.28 | -16.08 | -19.41 | -24.03 | -17.03 |
| 3100           | -14.14                     | -14.30 | -14.36 | -15.11 | -16.45 | -19.79 | -22.16 | -18.09 | -13.82                     | -13.96 | -14.21 | -14.75 | -15.51 | -18.80 | -22.90 | -15.96 |
| 3250           | -14.11                     | -14.22 | -14.22 | -15.13 | -16.46 | -19.38 | -20.38 | -17.07 | -13.91                     | -14.08 | -14.34 | -14.75 | -15.46 | -18.62 | -21.91 | -15.59 |
| 3550           | -14.01                     | -13.95 | -13.79 | -14.86 | -15.83 | -17.18 | -16.65 | -14.76 | -14.85                     | -15.02 | -15.28 | -15.26 | -15.68 | -18.10 | -19.33 | -14.83 |
| 3700           | -13.95                     | -13.81 | -13.59 | -14.62 | -15.33 | -15.99 | -15.19 | -13.77 | -15.81                     | -15.95 | -16.20 | -15.76 | -15.94 | -17.75 | -18.06 | -14.53 |
| 3900           | -13.72                     | -13.53 | -13.24 | -14.13 | -14.52 | -14.60 | -13.64 | -12.57 | -17.04                     | -17.14 | -17.36 | -16.18 | -15.99 | -16.83 | -16.21 | -14.05 |
| 4000           | -13.77                     | -13.60 | -13.30 | -14.15 | -14.51 | -14.49 | -13.43 | -12.37 | -17.39                     | -17.45 | -17.64 | -16.09 | -15.76 | -16.18 | -15.31 | -13.73 |

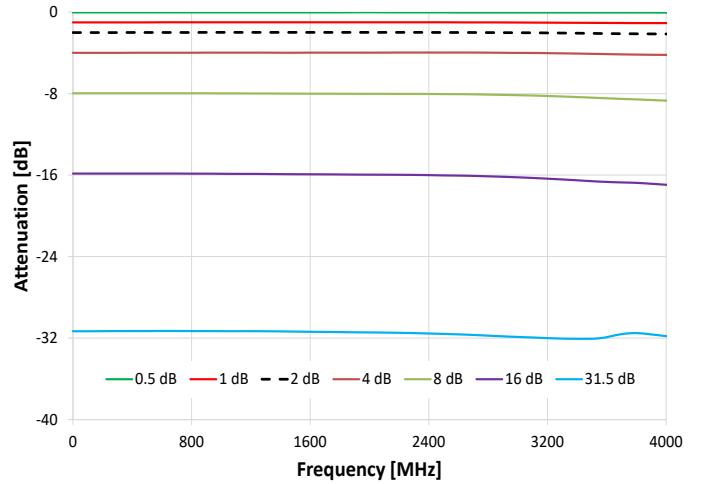


### TYPICAL PERFORMANCE CURVES (AT 25°C)

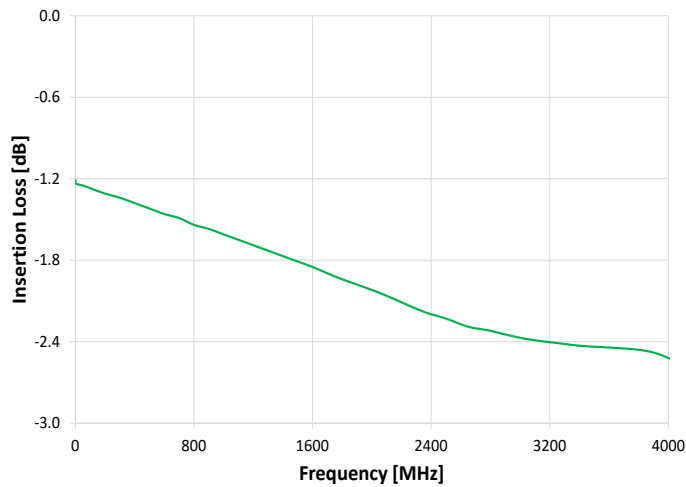
Attenuation Accuracy relative to Insertion Loss vs. Frequency



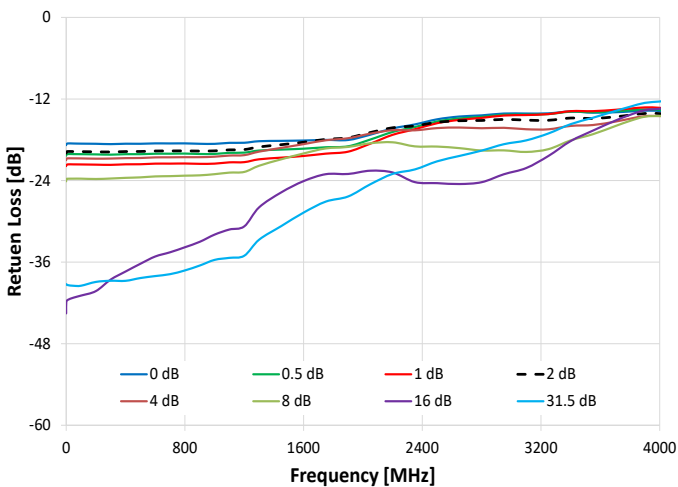
Attenuation relative to Insertion Loss vs. Frequency



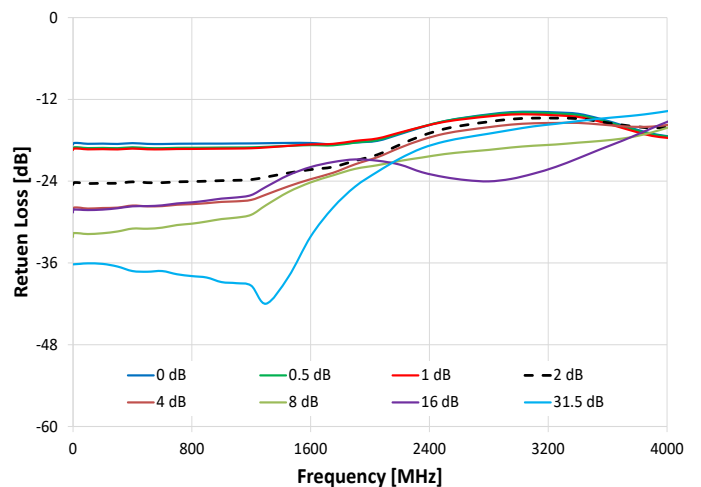
Insertion Loss vs. Frequency



R. Loss In vs. Frequency over Attenuation settings



R. Loss Out vs. Frequency over Attenuation settings






# Digital Step Attenuator **ZX76-31R5A-PNS+**

## ORDERING INFORMATION

| Model           | Description                                                                 |
|-----------------|-----------------------------------------------------------------------------|
| ZX76-31R5A-PNS+ | Digital attenuator - Parallel interface, Dual Voltage (Positive & Negative) |

| Recommended Accessories                                                           | Part No. | Description                  |
|-----------------------------------------------------------------------------------|----------|------------------------------|
|  | ZX76-WP+ | 4.9 ft. (1.5M) Control Cable |

## ADDITIONAL DETAILED TECHNICAL INFORMATION

|                      |                                              |
|----------------------|----------------------------------------------|
| Performance Data     | Data Table                                   |
|                      | Swept Graphs                                 |
|                      | S-Parameter (S2P Files) Data Set (.zip.file) |
| Case Style           | HK1149                                       |
| Environmental Rating | ENV28T14                                     |

Additional information is available on our dash board. To access this information [click here](#)

- NOTES**
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# Digital Step Attenuator

# ZX76-31R5A-PN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=-40°C

| FREQUENCY<br>(MHz) | STEP ATTENUATION* AT TTL CONTROL STATE<br>(dB) |        |        |        |        |        |        |         |
|--------------------|------------------------------------------------|--------|--------|--------|--------|--------|--------|---------|
|                    | 000000                                         | 000001 | 000010 | 000100 | 001000 | 010000 | 100000 | 111111  |
|                    | THRU LOSS                                      | 0.5 dB | 1.0 dB | 2.0 dB | 4.0 dB | 8.0 dB | 16 dB  | 31.5 dB |
| 0.1                | 1.03                                           | 0.55   | 1.05   | 2.07   | 4.10   | 8.12   | 16.06  | 31.62   |
| 0.3                | 1.03                                           | 0.55   | 1.06   | 2.07   | 4.10   | 8.11   | 16.06  | 31.62   |
| 0.5                | 1.05                                           | 0.54   | 1.05   | 2.06   | 4.09   | 8.10   | 16.03  | 31.60   |
| 1                  | 1.07                                           | 0.54   | 1.05   | 2.06   | 4.08   | 8.08   | 16.02  | 31.59   |
| 5                  | 1.06                                           | 0.54   | 1.05   | 2.06   | 4.08   | 8.08   | 16.01  | 31.58   |
| 10                 | 1.06                                           | 0.54   | 1.05   | 2.06   | 4.08   | 8.08   | 16.01  | 31.58   |
| 50                 | 1.06                                           | 0.54   | 1.04   | 2.06   | 4.08   | 8.07   | 16.00  | 31.57   |
| 100                | 1.07                                           | 0.54   | 1.04   | 2.06   | 4.08   | 8.07   | 16.00  | 31.57   |
| 200                | 1.11                                           | 0.54   | 1.05   | 2.06   | 4.08   | 8.08   | 16.01  | 31.58   |
| 300                | 1.10                                           | 0.54   | 1.04   | 2.05   | 4.07   | 8.07   | 15.99  | 31.55   |
| 400                | 1.12                                           | 0.54   | 1.04   | 2.06   | 4.08   | 8.07   | 16.00  | 31.56   |
| 500                | 1.13                                           | 0.54   | 1.05   | 2.06   | 4.08   | 8.08   | 16.01  | 31.56   |
| 600                | 1.12                                           | 0.54   | 1.04   | 2.06   | 4.08   | 8.07   | 16.00  | 31.55   |
| 700                | 1.14                                           | 0.54   | 1.05   | 2.06   | 4.08   | 8.09   | 16.02  | 31.57   |
| 800                | 1.13                                           | 0.54   | 1.05   | 2.06   | 4.08   | 8.08   | 16.01  | 31.56   |
| 900                | 1.14                                           | 0.54   | 1.05   | 2.06   | 4.08   | 8.08   | 16.02  | 31.56   |
| 1000               | 1.16                                           | 0.54   | 1.05   | 2.06   | 4.08   | 8.09   | 16.02  | 31.57   |
| 1100               | 1.15                                           | 0.54   | 1.04   | 2.06   | 4.08   | 8.08   | 16.01  | 31.54   |
| 1200               | 1.19                                           | 0.54   | 1.05   | 2.06   | 4.08   | 8.09   | 16.03  | 31.56   |
| 1300               | 1.24                                           | 0.54   | 1.04   | 2.05   | 4.07   | 8.09   | 16.02  | 31.54   |
| 1400               | 1.31                                           | 0.53   | 1.04   | 2.04   | 4.06   | 8.08   | 16.01  | 31.51   |
| 1500               | 1.36                                           | 0.53   | 1.03   | 2.04   | 4.06   | 8.08   | 16.02  | 31.49   |
| 1600               | 1.43                                           | 0.53   | 1.03   | 2.04   | 4.05   | 8.09   | 16.02  | 31.45   |
| 1700               | 1.49                                           | 0.53   | 1.03   | 2.03   | 4.05   | 8.09   | 16.03  | 31.41   |
| 1800               | 1.56                                           | 0.53   | 1.02   | 2.03   | 4.04   | 8.10   | 16.04  | 31.36   |
| 1900               | 1.64                                           | 0.53   | 1.02   | 2.02   | 4.04   | 8.11   | 16.05  | 31.34   |
| 2000               | 1.70                                           | 0.53   | 1.02   | 2.02   | 4.04   | 8.13   | 16.08  | 31.36   |
| 2100               | 1.76                                           | 0.53   | 1.02   | 2.02   | 4.04   | 8.15   | 16.12  | 31.37   |
| 2200               | 1.82                                           | 0.53   | 1.02   | 2.03   | 4.05   | 8.17   | 16.16  | 31.38   |
| 2300               | 1.90                                           | 0.53   | 1.02   | 2.03   | 4.05   | 8.20   | 16.19  | 31.36   |
| 2400               | 1.97                                           | 0.53   | 1.02   | 2.03   | 4.06   | 8.23   | 16.23  | 31.35   |
| 2500               | 2.00                                           | 0.53   | 1.03   | 2.04   | 4.06   | 8.25   | 16.25  | 31.33   |
| 2600               | 2.03                                           | 0.53   | 1.03   | 2.04   | 4.07   | 8.27   | 16.27  | 31.31   |
| 2700               | 2.06                                           | 0.54   | 1.03   | 2.04   | 4.08   | 8.29   | 16.29  | 31.29   |
| 2800               | 2.09                                           | 0.54   | 1.04   | 2.05   | 4.08   | 8.31   | 16.32  | 31.28   |
| 2900               | 2.13                                           | 0.54   | 1.04   | 2.06   | 4.10   | 8.34   | 16.37  | 31.28   |
| 3000               | 2.16                                           | 0.54   | 1.04   | 2.06   | 4.11   | 8.38   | 16.41  | 31.25   |
| 3200               | 2.25                                           | 0.55   | 1.05   | 2.08   | 4.13   | 8.43   | 16.40  | 30.55   |
| 3400               | 2.31                                           | 0.56   | 1.06   | 2.09   | 4.15   | 8.48   | 16.43  | 30.57   |
| 3600               | 2.42                                           | 0.56   | 1.07   | 2.12   | 4.19   | 8.59   | 16.62  | 31.13   |
| 3800               | 2.62                                           | 0.56   | 1.07   | 2.14   | 4.25   | 8.74   | 16.93  | 32.26   |
| 4000               | 2.84                                           | 0.57   | 1.09   | 2.19   | 4.32   | 8.92   | 17.32  | 32.93   |
| 4200               | 2.76                                           | 0.59   | 1.12   | 2.24   | 4.39   | 9.08   | 17.46  | 31.31   |
| 4400               | 2.61                                           | 0.60   | 1.14   | 2.27   | 4.44   | 9.22   | 17.60  | 30.83   |
| 4600               | 2.61                                           | 0.60   | 1.14   | 2.27   | 4.46   | 9.34   | 17.79  | 31.16   |
| 4800               | 2.71                                           | 0.60   | 1.14   | 2.25   | 4.45   | 9.41   | 17.90  | 31.58   |
| 5000               | 2.93                                           | 0.59   | 1.12   | 2.24   | 4.44   | 9.48   | 18.01  | 31.89   |

\* Step Attenuation above Thru Loss (TTL Logic 00000).

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# Digital Step Attenuator

# ZX76-31R5A-PN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=-40°C

| FREQUENCY<br>(MHz) | INPUT RETURN LOSS AT TTL CONTROL STATE<br>(dB) |                  |                  |                  |                  |                  |                 |                   |
|--------------------|------------------------------------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------------|
|                    | 000000<br>0 dB                                 | 000001<br>0.5 dB | 000010<br>1.0 dB | 000100<br>2.0 dB | 001000<br>4.0 dB | 010000<br>8.0 dB | 100000<br>16 dB | 111111<br>31.5 dB |
| 0.1                | 19.72                                          | 22.01            | 24.49            | 22.83            | 25.72            | 36.93            | 26.19           | 23.61             |
| 0.3                | 19.72                                          | 22.00            | 24.47            | 22.83            | 25.72            | 36.79            | 26.26           | 23.62             |
| 0.5                | 19.71                                          | 21.99            | 24.46            | 22.74            | 25.53            | 35.85            | 26.45           | 23.63             |
| 1                  | 19.57                                          | 21.86            | 24.30            | 22.57            | 25.30            | 35.29            | 26.53           | 23.63             |
| 5                  | 19.45                                          | 21.72            | 24.13            | 22.44            | 25.17            | 35.00            | 26.60           | 23.69             |
| 10                 | 19.44                                          | 21.70            | 24.11            | 22.42            | 25.14            | 34.90            | 26.63           | 23.71             |
| 50                 | 19.47                                          | 21.71            | 24.09            | 22.39            | 25.07            | 34.57            | 26.74           | 23.80             |
| 100                | 19.49                                          | 21.71            | 24.08            | 22.32            | 24.95            | 34.04            | 26.95           | 23.95             |
| 200                | 19.51                                          | 21.68            | 23.98            | 22.14            | 24.63            | 32.91            | 27.45           | 24.35             |
| 300                | 19.37                                          | 21.49            | 23.72            | 21.90            | 24.30            | 32.08            | 28.07           | 24.78             |
| 400                | 19.12                                          | 21.20            | 23.36            | 21.71            | 24.11            | 31.84            | 28.30           | 24.93             |
| 500                | 18.97                                          | 21.02            | 23.16            | 21.66            | 24.07            | 31.83            | 28.36           | 24.95             |
| 600                | 18.85                                          | 20.91            | 23.04            | 21.70            | 24.17            | 32.25            | 28.09           | 24.75             |
| 700                | 18.95                                          | 21.08            | 23.30            | 21.98            | 24.57            | 33.40            | 27.41           | 24.29             |
| 800                | 19.11                                          | 21.30            | 23.60            | 22.21            | 24.88            | 34.22            | 27.03           | 24.04             |
| 900                | 19.41                                          | 21.67            | 24.07            | 22.57            | 25.33            | 35.37            | 26.54           | 23.73             |
| 1000               | 19.70                                          | 22.02            | 24.51            | 22.87            | 25.67            | 35.61            | 26.13           | 23.51             |
| 1100               | 19.66                                          | 21.97            | 24.43            | 22.77            | 25.51            | 34.55            | 26.12           | 23.59             |
| 1200               | 19.59                                          | 21.88            | 24.31            | 22.72            | 25.41            | 33.76            | 25.94           | 23.53             |
| 1300               | 19.23                                          | 21.34            | 23.51            | 21.63            | 23.86            | 29.50            | 26.63           | 24.63             |
| 1400               | 19.04                                          | 20.98            | 22.94            | 21.32            | 23.16            | 27.87            | 27.66           | 26.12             |
| 1500               | 18.83                                          | 20.72            | 22.58            | 20.90            | 22.65            | 27.36            | 28.76           | 27.41             |
| 1600               | 18.83                                          | 20.67            | 22.48            | 21.05            | 22.71            | 27.50            | 29.41           | 28.11             |
| 1700               | 19.13                                          | 21.00            | 22.83            | 21.17            | 22.75            | 27.26            | 28.63           | 28.25             |
| 1800               | 18.95                                          | 20.71            | 22.41            | 20.59            | 21.94            | 26.00            | 29.48           | 30.60             |
| 1900               | 19.09                                          | 20.77            | 22.35            | 20.17            | 21.36            | 25.41            | 31.68           | 33.44             |
| 2000               | 18.87                                          | 20.36            | 21.75            | 19.60            | 20.75            | 24.90            | 35.73           | 34.16             |
| 2100               | 18.68                                          | 19.99            | 21.18            | 19.55            | 20.68            | 25.06            | 40.58           | 31.55             |
| 2200               | 18.54                                          | 19.69            | 20.68            | 19.11            | 20.24            | 24.68            | 52.46           | 29.48             |
| 2300               | 18.21                                          | 19.10            | 19.83            | 18.46            | 19.59            | 23.98            | 39.88           | 26.61             |
| 2400               | 17.28                                          | 17.94            | 18.47            | 17.70            | 18.91            | 23.20            | 30.99           | 23.53             |
| 2500               | 16.79                                          | 17.37            | 17.84            | 17.45            | 18.73            | 23.01            | 28.61           | 22.38             |
| 2600               | 16.46                                          | 16.98            | 17.39            | 17.27            | 18.59            | 22.80            | 26.80           | 21.42             |
| 2700               | 16.18                                          | 16.63            | 16.98            | 17.03            | 18.38            | 22.39            | 25.02           | 20.41             |
| 2800               | 15.86                                          | 16.27            | 16.58            | 16.75            | 18.12            | 21.86            | 23.43           | 19.47             |
| 2900               | 15.59                                          | 15.97            | 16.22            | 16.56            | 17.93            | 21.35            | 22.07           | 18.63             |
| 3000               | 15.38                                          | 15.71            | 15.92            | 16.35            | 17.70            | 20.78            | 20.99           | 17.94             |
| 3200               | 14.95                                          | 15.16            | 15.28            | 15.84            | 17.07            | 19.29            | 18.82           | 16.47             |
| 3400               | 14.48                                          | 14.56            | 14.53            | 15.40            | 16.32            | 17.41            | 16.39           | 14.72             |
| 3600               | 14.48                                          | 14.38            | 14.19            | 14.77            | 15.25            | 15.41            | 14.25           | 13.09             |
| 3800               | 14.98                                          | 14.63            | 14.26            | 14.64            | 14.60            | 13.93            | 12.60           | 11.83             |
| 4000               | 15.01                                          | 14.63            | 14.20            | 14.50            | 14.28            | 13.36            | 11.93           | 11.26             |
| 4200               | 15.87                                          | 15.52            | 14.96            | 15.04            | 14.72            | 13.49            | 11.75           | 11.02             |
| 4400               | 18.22                                          | 17.60            | 16.59            | 16.65            | 15.78            | 13.68            | 11.50           | 10.78             |
| 4600               | 22.13                                          | 20.17            | 18.22            | 18.59            | 16.52            | 13.37            | 10.96           | 10.38             |
| 4800               | 26.23                                          | 21.32            | 18.72            | 19.33            | 16.30            | 12.64            | 10.26           | 9.89              |
| 5000               | 23.65                                          | 20.01            | 18.03            | 18.93            | 15.89            | 12.16            | 9.85            | 9.68              |

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# Digital Step Attenuator

# ZX76-31R5A-PN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=-40°C

| FREQUENCY<br>(MHz) | OUTPUT RETURN LOSS AT TTL CONTROL STATE<br>(dB) |                  |                  |                  |                  |                  |                 |                   |
|--------------------|-------------------------------------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------------|
|                    | 000000<br>0 dB                                  | 000001<br>0.5 dB | 000010<br>1.0 dB | 000100<br>2.0 dB | 001000<br>4.0 dB | 010000<br>8.0 dB | 100000<br>16 dB | 111111<br>31.5 dB |
| 0.1                | 19.55                                           | 20.70            | 21.33            | 30.07            | 57.68            | 32.48            | 34.36           | 23.26             |
| 0.3                | 19.56                                           | 20.70            | 21.34            | 30.04            | 56.79            | 32.56            | 34.44           | 23.26             |
| 0.5                | 19.45                                           | 20.58            | 21.22            | 29.77            | 51.90            | 33.09            | 35.32           | 23.28             |
| 1                  | 19.39                                           | 20.54            | 21.15            | 29.70            | 50.99            | 33.25            | 35.69           | 23.28             |
| 5                  | 19.23                                           | 20.37            | 20.98            | 29.38            | 48.27            | 33.46            | 35.81           | 23.32             |
| 10                 | 19.21                                           | 20.34            | 20.95            | 29.33            | 47.86            | 33.51            | 35.87           | 23.34             |
| 50                 | 19.17                                           | 20.29            | 20.89            | 29.26            | 46.51            | 33.66            | 36.07           | 23.41             |
| 100                | 19.17                                           | 20.27            | 20.85            | 29.28            | 45.33            | 33.93            | 36.49           | 23.55             |
| 200                | 19.00                                           | 20.06            | 20.61            | 28.90            | 43.00            | 35.02            | 38.10           | 23.93             |
| 300                | 19.13                                           | 20.16            | 20.69            | 29.10            | 43.62            | 35.50            | 39.05           | 24.10             |
| 400                | 19.25                                           | 20.29            | 20.83            | 29.24            | 44.08            | 35.12            | 38.53           | 23.99             |
| 500                | 19.55                                           | 20.62            | 21.17            | 29.69            | 45.00            | 34.45            | 37.64           | 23.82             |
| 600                | 19.74                                           | 20.85            | 21.44            | 29.90            | 46.18            | 33.83            | 36.50           | 23.61             |
| 700                | 19.84                                           | 20.99            | 21.60            | 29.93            | 49.44            | 33.52            | 35.65           | 23.50             |
| 800                | 19.69                                           | 20.85            | 21.47            | 29.46            | 47.29            | 33.86            | 35.60           | 23.61             |
| 900                | 19.52                                           | 20.66            | 21.28            | 29.10            | 45.01            | 34.06            | 35.39           | 23.69             |
| 1000               | 19.31                                           | 20.43            | 21.04            | 28.60            | 41.89            | 34.49            | 35.42           | 23.90             |
| 1100               | 19.13                                           | 20.24            | 20.84            | 28.19            | 40.42            | 35.12            | 35.87           | 24.09             |
| 1200               | 19.19                                           | 20.30            | 20.90            | 28.31            | 40.75            | 34.89            | 35.58           | 24.05             |
| 1300               | 19.08                                           | 20.13            | 20.67            | 28.12            | 36.64            | 33.59            | 32.89           | 24.52             |
| 1400               | 19.10                                           | 20.04            | 20.48            | 27.10            | 34.38            | 38.26            | 34.30           | 26.73             |
| 1500               | 19.70                                           | 20.59            | 20.96            | 28.37            | 36.69            | 40.82            | 35.15           | 26.61             |
| 1600               | 19.91                                           | 20.74            | 21.03            | 27.58            | 34.19            | 41.96            | 33.63           | 27.81             |
| 1700               | 19.94                                           | 20.71            | 20.95            | 27.15            | 32.78            | 42.66            | 33.34           | 28.53             |
| 1800               | 20.08                                           | 20.71            | 20.86            | 26.85            | 31.03            | 40.33            | 33.26           | 29.37             |
| 1900               | 19.82                                           | 20.32            | 20.40            | 26.00            | 28.97            | 36.34            | 32.89           | 29.40             |
| 2000               | 19.95                                           | 20.33            | 20.35            | 25.72            | 27.96            | 35.27            | 34.93           | 27.73             |
| 2100               | 19.67                                           | 19.92            | 19.93            | 24.31            | 26.00            | 31.91            | 34.03           | 26.81             |
| 2200               | 19.14                                           | 19.30            | 19.33            | 22.94            | 24.25            | 29.40            | 34.34           | 25.06             |
| 2300               | 18.07                                           | 18.17            | 18.22            | 21.17            | 22.21            | 26.52            | 32.45           | 22.96             |
| 2400               | 17.12                                           | 17.19            | 17.29            | 19.64            | 20.52            | 24.28            | 29.91           | 20.90             |
| 2500               | 16.65                                           | 16.72            | 16.86            | 19.05            | 19.91            | 23.51            | 28.72           | 20.18             |
| 2600               | 16.24                                           | 16.33            | 16.50            | 18.46            | 19.31            | 22.76            | 27.43           | 19.53             |
| 2700               | 15.89                                           | 15.98            | 16.16            | 17.78            | 18.59            | 21.79            | 25.80           | 18.75             |
| 2800               | 15.54                                           | 15.64            | 15.83            | 17.15            | 17.93            | 20.87            | 24.21           | 17.97             |
| 2900               | 15.31                                           | 15.43            | 15.63            | 16.79            | 17.50            | 20.23            | 22.98           | 17.35             |
| 3000               | 15.01                                           | 15.15            | 15.37            | 16.44            | 17.09            | 19.60            | 21.88           | 16.78             |
| 3200               | 14.54                                           | 14.71            | 14.95            | 15.82            | 16.31            | 18.24            | 19.55           | 15.55             |
| 3400               | 14.49                                           | 14.66            | 14.88            | 15.65            | 15.94            | 17.35            | 17.93           | 14.74             |
| 3600               | 15.48                                           | 15.62            | 15.79            | 15.86            | 15.75            | 16.37            | 16.23           | 13.86             |
| 3800               | 17.74                                           | 17.78            | 17.86            | 16.84            | 16.06            | 15.67            | 14.90           | 13.30             |
| 4000               | 19.53                                           | 19.27            | 19.18            | 16.92            | 15.67            | 14.67            | 13.65           | 12.75             |
| 4200               | 19.97                                           | 19.47            | 19.17            | 16.09            | 14.75            | 13.49            | 12.37           | 11.94             |
| 4400               | 21.81                                           | 20.97            | 20.37            | 16.27            | 14.62            | 12.95            | 11.66           | 11.44             |
| 4600               | 25.72                                           | 23.70            | 22.45            | 16.71            | 14.67            | 12.53            | 11.10           | 11.09             |
| 4800               | 29.10                                           | 25.77            | 24.07            | 16.88            | 14.69            | 12.20            | 10.67           | 10.90             |
| 5000               | 23.64                                           | 22.55            | 21.82            | 16.12            | 14.14            | 11.54            | 10.02           | 10.50             |

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# Digital Step Attenuator

# ZX76-31R5A-PN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=+25°C

| FREQUENCY<br>(MHz) | STEP ATTENUATION* AT TTL CONTROL STATE |                  |                  |                  |                  |                  |                 |                   |
|--------------------|----------------------------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------------|
|                    | (dB)                                   |                  |                  |                  |                  |                  |                 |                   |
|                    | 000000<br>THRU LOSS                    | 000001<br>0.5 dB | 000010<br>1.0 dB | 000100<br>2.0 dB | 001000<br>4.0 dB | 010000<br>8.0 dB | 100000<br>16 dB | 111111<br>31.5 dB |
| 0.1                | 1.21                                   | 0.52             | 1.01             | 2.01             | 4.00             | 7.97             | 15.85           | 31.32             |
| 0.3                | 1.22                                   | 0.52             | 1.01             | 2.01             | 4.00             | 7.97             | 15.85           | 31.31             |
| 0.5                | 1.22                                   | 0.51             | 1.01             | 2.01             | 4.00             | 7.97             | 15.85           | 31.32             |
| 1                  | 1.23                                   | 0.51             | 1.01             | 2.01             | 4.00             | 7.97             | 15.85           | 31.31             |
| 5                  | 1.23                                   | 0.52             | 1.01             | 2.01             | 4.00             | 7.97             | 15.85           | 31.32             |
| 10                 | 1.24                                   | 0.52             | 1.01             | 2.01             | 4.00             | 7.97             | 15.85           | 31.33             |
| 50                 | 1.25                                   | 0.52             | 1.01             | 2.01             | 4.00             | 7.97             | 15.85           | 31.33             |
| 100                | 1.27                                   | 0.52             | 1.01             | 2.01             | 4.00             | 7.97             | 15.85           | 31.33             |
| 200                | 1.31                                   | 0.52             | 1.01             | 2.01             | 4.00             | 7.97             | 15.85           | 31.32             |
| 300                | 1.34                                   | 0.51             | 1.01             | 2.01             | 4.00             | 7.97             | 15.85           | 31.31             |
| 400                | 1.38                                   | 0.51             | 1.01             | 2.00             | 3.99             | 7.97             | 15.85           | 31.31             |
| 500                | 1.42                                   | 0.51             | 1.01             | 2.00             | 3.99             | 7.97             | 15.85           | 31.31             |
| 600                | 1.46                                   | 0.51             | 1.00             | 2.00             | 3.99             | 7.97             | 15.85           | 31.30             |
| 700                | 1.49                                   | 0.51             | 1.00             | 2.00             | 3.99             | 7.97             | 15.85           | 31.30             |
| 800                | 1.54                                   | 0.51             | 1.00             | 2.00             | 3.99             | 7.97             | 15.86           | 31.31             |
| 900                | 1.57                                   | 0.51             | 1.00             | 1.99             | 3.98             | 7.97             | 15.86           | 31.31             |
| 1000               | 1.61                                   | 0.51             | 1.00             | 1.99             | 3.98             | 7.98             | 15.87           | 31.32             |
| 1100               | 1.65                                   | 0.51             | 1.00             | 1.99             | 3.98             | 7.98             | 15.88           | 31.32             |
| 1200               | 1.69                                   | 0.51             | 1.00             | 1.99             | 3.98             | 7.99             | 15.88           | 31.32             |
| 1300               | 1.73                                   | 0.51             | 1.00             | 1.99             | 3.98             | 7.99             | 15.89           | 31.33             |
| 1400               | 1.77                                   | 0.51             | 1.00             | 1.99             | 3.98             | 8.00             | 15.90           | 31.34             |
| 1500               | 1.81                                   | 0.51             | 1.00             | 1.99             | 3.98             | 8.00             | 15.91           | 31.36             |
| 1600               | 1.85                                   | 0.51             | 1.00             | 1.99             | 3.98             | 8.01             | 15.92           | 31.38             |
| 1700               | 1.89                                   | 0.51             | 1.00             | 1.99             | 3.98             | 8.01             | 15.93           | 31.40             |
| 1800               | 1.93                                   | 0.51             | 1.00             | 1.99             | 3.98             | 8.02             | 15.94           | 31.42             |
| 1900               | 1.98                                   | 0.51             | 1.00             | 1.99             | 3.98             | 8.02             | 15.95           | 31.43             |
| 2000               | 2.02                                   | 0.51             | 1.00             | 1.99             | 3.98             | 8.02             | 15.95           | 31.45             |
| 2100               | 2.07                                   | 0.51             | 1.00             | 1.99             | 3.98             | 8.02             | 15.96           | 31.46             |
| 2200               | 2.11                                   | 0.51             | 1.00             | 1.99             | 3.97             | 8.03             | 15.97           | 31.48             |
| 2300               | 2.15                                   | 0.51             | 1.00             | 1.99             | 3.97             | 8.03             | 15.98           | 31.51             |
| 2400               | 2.19                                   | 0.51             | 1.00             | 2.00             | 3.97             | 8.04             | 16.00           | 31.55             |
| 2500               | 2.23                                   | 0.51             | 1.00             | 2.00             | 3.97             | 8.05             | 16.03           | 31.59             |
| 2600               | 2.26                                   | 0.52             | 1.01             | 2.00             | 3.98             | 8.06             | 16.05           | 31.64             |
| 2700               | 2.29                                   | 0.52             | 1.01             | 2.00             | 3.98             | 8.08             | 16.08           | 31.70             |
| 2800               | 2.32                                   | 0.52             | 1.01             | 2.01             | 3.98             | 8.10             | 16.12           | 31.76             |
| 2900               | 2.35                                   | 0.52             | 1.02             | 2.01             | 3.99             | 8.12             | 16.17           | 31.83             |
| 3000               | 2.37                                   | 0.53             | 1.02             | 2.02             | 4.00             | 8.15             | 16.22           | 31.89             |
| 3200               | 2.41                                   | 0.53             | 1.03             | 2.04             | 4.03             | 8.23             | 16.35           | 31.99             |
| 3400               | 2.43                                   | 0.54             | 1.05             | 2.07             | 4.07             | 8.34             | 16.51           | 32.07             |
| 3600               | 2.44                                   | 0.55             | 1.07             | 2.10             | 4.13             | 8.46             | 16.68           | 31.93             |
| 3800               | 2.46                                   | 0.56             | 1.08             | 2.13             | 4.17             | 8.57             | 16.76           | 31.51             |
| 4000               | 2.52                                   | 0.56             | 1.08             | 2.15             | 4.20             | 8.69             | 16.95           | 31.81             |
| 4200               | 2.67                                   | 0.56             | 1.08             | 2.16             | 4.23             | 8.81             | 17.17           | 32.37             |
| 4400               | 2.93                                   | 0.56             | 1.07             | 2.16             | 4.25             | 8.93             | 17.46           | 33.47             |
| 4600               | 3.14                                   | 0.56             | 1.08             | 2.18             | 4.28             | 9.07             | 17.78           | 33.66             |
| 4800               | 3.12                                   | 0.57             | 1.09             | 2.18             | 4.29             | 9.17             | 17.95           | 32.29             |
| 5000               | 3.11                                   | 0.56             | 1.07             | 2.14             | 4.24             | 9.22             | 18.09           | 31.86             |

\* Step Attenuation above Thru Loss (TTL Logic 00000).

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# Digital Step Attenuator

# ZX76-31R5A-PN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=+25°C

| FREQUENCY<br>(MHz) | INPUT RETURN LOSS AT TTL CONTROL STATE<br>(dB) |                  |                  |                  |                  |                  |                 |                   |
|--------------------|------------------------------------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------------|
|                    | 000000<br>0 dB                                 | 000001<br>0.5 dB | 000010<br>1.0 dB | 000100<br>2.0 dB | 001000<br>4.0 dB | 010000<br>8.0 dB | 100000<br>16 dB | 111111<br>31.5 dB |
| 0.1                | 18.79                                          | 20.34            | 21.87            | 19.97            | 21.00            | 24.11            | 43.54           | 39.26             |
| 0.3                | 18.77                                          | 20.32            | 21.84            | 19.96            | 20.99            | 24.08            | 43.26           | 39.23             |
| 0.5                | 18.76                                          | 20.31            | 21.83            | 19.90            | 20.88            | 23.85            | 42.07           | 39.31             |
| 1                  | 18.66                                          | 20.23            | 21.75            | 19.81            | 20.79            | 23.77            | 41.88           | 39.24             |
| 5                  | 18.56                                          | 20.12            | 21.64            | 19.74            | 20.75            | 23.75            | 41.62           | 39.31             |
| 10                 | 18.54                                          | 20.10            | 21.62            | 19.72            | 20.73            | 23.73            | 41.56           | 39.38             |
| 50                 | 18.55                                          | 20.11            | 21.62            | 19.73            | 20.73            | 23.72            | 41.22           | 39.48             |
| 100                | 18.57                                          | 20.12            | 21.63            | 19.74            | 20.74            | 23.72            | 40.92           | 39.47             |
| 200                | 18.59                                          | 20.15            | 21.66            | 19.77            | 20.78            | 23.77            | 40.26           | 38.91             |
| 300                | 18.64                                          | 20.19            | 21.69            | 19.79            | 20.76            | 23.70            | 38.56           | 38.74             |
| 400                | 18.58                                          | 20.12            | 21.61            | 19.73            | 20.70            | 23.60            | 37.38           | 38.75             |
| 500                | 18.59                                          | 20.12            | 21.60            | 19.72            | 20.68            | 23.53            | 36.24           | 38.34             |
| 600                | 18.53                                          | 20.05            | 21.51            | 19.65            | 20.59            | 23.39            | 35.17           | 38.05             |
| 700                | 18.54                                          | 20.05            | 21.51            | 19.64            | 20.58            | 23.35            | 34.55           | 37.77             |
| 800                | 18.53                                          | 20.03            | 21.49            | 19.63            | 20.56            | 23.28            | 33.81           | 37.22             |
| 900                | 18.59                                          | 20.09            | 21.54            | 19.66            | 20.56            | 23.23            | 33.01           | 36.50             |
| 1000               | 18.60                                          | 20.08            | 21.51            | 19.63            | 20.49            | 23.06            | 31.95           | 35.67             |
| 1100               | 18.45                                          | 19.92            | 21.32            | 19.48            | 20.32            | 22.83            | 31.20           | 35.37             |
| 1200               | 18.44                                          | 19.89            | 21.29            | 19.44            | 20.26            | 22.73            | 30.74           | 35.06             |
| 1300               | 18.21                                          | 19.58            | 20.87            | 19.05            | 19.74            | 21.82            | 27.94           | 32.70             |
| 1400               | 18.09                                          | 19.40            | 20.60            | 18.75            | 19.30            | 21.07            | 26.22           | 31.08             |
| 1500               | 18.15                                          | 19.41            | 20.56            | 18.61            | 19.03            | 20.58            | 25.07           | 29.87             |
| 1600               | 18.11                                          | 19.31            | 20.38            | 18.36            | 18.64            | 20.01            | 24.08           | 28.71             |
| 1700               | 18.16                                          | 19.28            | 20.28            | 18.17            | 18.34            | 19.58            | 23.42           | 27.78             |
| 1800               | 17.98                                          | 19.01            | 19.90            | 17.82            | 17.94            | 19.18            | 23.07           | 26.90             |
| 1900               | 18.03                                          | 18.96            | 19.75            | 17.70            | 17.77            | 19.05            | 23.03           | 26.34             |
| 2000               | 17.60                                          | 18.38            | 19.05            | 17.24            | 17.36            | 18.73            | 22.78           | 25.25             |
| 2100               | 16.90                                          | 17.54            | 18.08            | 16.65            | 16.86            | 18.38            | 22.51           | 23.93             |
| 2200               | 16.33                                          | 16.85            | 17.27            | 16.23            | 16.59            | 18.37            | 22.81           | 23.02             |
| 2300               | 15.93                                          | 16.36            | 16.71            | 16.03            | 16.57            | 18.71            | 23.65           | 22.58             |
| 2400               | 15.47                                          | 15.84            | 16.12            | 15.79            | 16.55            | 19.11            | 24.59           | 22.02             |
| 2500               | 14.99                                          | 15.31            | 15.56            | 15.43            | 16.28            | 19.00            | 24.38           | 21.17             |
| 2600               | 14.73                                          | 15.02            | 15.24            | 15.28            | 16.22            | 19.14            | 24.49           | 20.66             |
| 2700               | 14.46                                          | 14.72            | 14.91            | 15.11            | 16.15            | 19.22            | 24.32           | 20.06             |
| 2800               | 14.41                                          | 14.63            | 14.78            | 15.16            | 16.30            | 19.58            | 24.24           | 19.59             |
| 2900               | 14.20                                          | 14.40            | 14.52            | 15.04            | 16.25            | 19.57            | 23.44           | 18.92             |
| 3000               | 14.15                                          | 14.32            | 14.40            | 15.05            | 16.33            | 19.67            | 22.72           | 18.41             |
| 3200               | 14.14                                          | 14.26            | 14.27            | 15.15            | 16.50            | 19.59            | 20.95           | 17.40             |
| 3400               | 13.84                                          | 13.87            | 13.79            | 14.80            | 15.96            | 18.09            | 18.19           | 15.70             |
| 3600               | 13.76                                          | 13.70            | 13.54            | 14.57            | 15.47            | 16.70            | 16.21           | 14.43             |
| 3800               | 13.84                                          | 13.66            | 13.41            | 14.37            | 14.90            | 15.22            | 14.34           | 13.14             |
| 4000               | 13.77                                          | 13.60            | 13.30            | 14.15            | 14.51            | 14.49            | 13.43           | 12.37             |
| 4200               | 14.90                                          | 14.63            | 14.12            | 15.01            | 15.08            | 14.38            | 12.78           | 11.82             |
| 4400               | 17.09                                          | 16.42            | 15.50            | 16.56            | 16.02            | 14.28            | 12.22           | 11.40             |
| 4600               | 21.93                                          | 19.84            | 17.97            | 19.40            | 17.50            | 14.24            | 11.79           | 11.25             |
| 4800               | 24.89                                          | 20.88            | 18.59            | 19.88            | 17.09            | 13.37            | 11.02           | 10.74             |
| 5000               | 22.12                                          | 19.52            | 17.97            | 18.84            | 16.24            | 12.62            | 10.42           | 10.39             |

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# Digital Step Attenuator

# ZX76-31R5A-PN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=+25°C

| FREQUENCY<br>(MHz) | OUTPUT RETURN LOSS AT TTL CONTROL STATE |                  |                  |                  |                  |                  |                 |                   |
|--------------------|-----------------------------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------------|
|                    | (dB)                                    |                  |                  |                  |                  |                  |                 |                   |
|                    | 000000<br>0 dB                          | 000001<br>0.5 dB | 000010<br>1.0 dB | 000100<br>2.0 dB | 001000<br>4.0 dB | 010000<br>8.0 dB | 100000<br>16 dB | 111111<br>31.5 dB |
| 0.1                | 18.63                                   | 19.24            | 19.43            | 24.48            | 28.24            | 32.18            | 28.59           | 36.22             |
| 0.3                | 18.62                                   | 19.23            | 19.42            | 24.47            | 28.22            | 32.16            | 28.58           | 36.17             |
| 0.5                | 18.52                                   | 19.13            | 19.32            | 24.32            | 27.99            | 31.69            | 28.19           | 36.20             |
| 1                  | 18.51                                   | 19.13            | 19.30            | 24.34            | 27.99            | 31.68            | 28.14           | 36.21             |
| 5                  | 18.41                                   | 19.03            | 19.22            | 24.21            | 27.88            | 31.63            | 28.17           | 36.18             |
| 10                 | 18.39                                   | 19.02            | 19.21            | 24.20            | 27.86            | 31.61            | 28.16           | 36.19             |
| 50                 | 18.42                                   | 19.06            | 19.24            | 24.24            | 27.90            | 31.66            | 28.19           | 36.13             |
| 100                | 18.52                                   | 19.15            | 19.33            | 24.35            | 28.02            | 31.76            | 28.24           | 36.06             |
| 200                | 18.49                                   | 19.12            | 19.30            | 24.30            | 27.94            | 31.64            | 28.17           | 36.14             |
| 300                | 18.54                                   | 19.16            | 19.34            | 24.31            | 27.88            | 31.38            | 27.97           | 36.53             |
| 400                | 18.42                                   | 19.03            | 19.22            | 24.10            | 27.58            | 30.96            | 27.69           | 37.19             |
| 500                | 18.53                                   | 19.14            | 19.32            | 24.22            | 27.69            | 30.98            | 27.66           | 37.29             |
| 600                | 18.55                                   | 19.16            | 19.33            | 24.22            | 27.66            | 30.82            | 27.55           | 37.19             |
| 700                | 18.51                                   | 19.11            | 19.28            | 24.10            | 27.46            | 30.44            | 27.27           | 37.66             |
| 800                | 18.50                                   | 19.10            | 19.27            | 24.06            | 27.37            | 30.24            | 27.11           | 37.93             |
| 900                | 18.49                                   | 19.09            | 19.25            | 24.00            | 27.23            | 29.92            | 26.86           | 38.14             |
| 1000               | 18.49                                   | 19.07            | 19.23            | 23.92            | 27.04            | 29.56            | 26.56           | 38.81             |
| 1100               | 18.47                                   | 19.06            | 19.21            | 23.87            | 26.96            | 29.35            | 26.39           | 38.97             |
| 1200               | 18.46                                   | 19.04            | 19.17            | 23.77            | 26.75            | 28.93            | 26.04           | 39.34             |
| 1300               | 18.43                                   | 18.96            | 19.05            | 23.40            | 25.97            | 27.52            | 24.83           | 41.98             |
| 1400               | 18.39                                   | 18.85            | 18.89            | 22.97            | 25.11            | 26.12            | 23.59           | 40.09             |
| 1500               | 18.34                                   | 18.74            | 18.72            | 22.59            | 24.36            | 25.04            | 22.65           | 35.86             |
| 1600               | 18.40                                   | 18.71            | 18.61            | 22.30            | 23.71            | 24.18            | 21.93           | 32.13             |
| 1700               | 18.46                                   | 18.67            | 18.51            | 22.00            | 23.04            | 23.42            | 21.38           | 29.15             |
| 1800               | 18.58                                   | 18.67            | 18.45            | 21.69            | 22.41            | 22.87            | 21.08           | 26.76             |
| 1900               | 18.33                                   | 18.34            | 18.09            | 21.00            | 21.52            | 22.19            | 20.81           | 24.79             |
| 2000               | 18.20                                   | 18.12            | 17.86            | 20.45            | 20.84            | 21.81            | 20.87           | 23.30             |
| 2100               | 17.83                                   | 17.70            | 17.49            | 19.67            | 20.05            | 21.47            | 21.17           | 21.95             |
| 2200               | 17.11                                   | 16.99            | 16.87            | 18.66            | 19.11            | 21.03            | 21.57           | 20.69             |
| 2300               | 16.41                                   | 16.32            | 16.28            | 17.75            | 18.29            | 20.67            | 22.22           | 19.64             |
| 2400               | 15.72                                   | 15.67            | 15.72            | 16.89            | 17.52            | 20.32            | 23.12           | 18.67             |
| 2500               | 15.20                                   | 15.20            | 15.30            | 16.34            | 17.04            | 20.03            | 23.40           | 18.19             |
| 2600               | 14.80                                   | 14.83            | 14.97            | 15.91            | 16.67            | 19.79            | 23.69           | 17.77             |
| 2700               | 14.49                                   | 14.54            | 14.72            | 15.57            | 16.35            | 19.60            | 23.93           | 17.40             |
| 2800               | 14.20                                   | 14.29            | 14.49            | 15.28            | 16.08            | 19.41            | 24.03           | 17.03             |
| 2900               | 14.01                                   | 14.12            | 14.34            | 15.05            | 15.85            | 19.21            | 23.89           | 16.66             |
| 3000               | 13.84                                   | 13.97            | 14.21            | 14.84            | 15.64            | 18.99            | 23.47           | 16.30             |
| 3200               | 13.83                                   | 13.99            | 14.25            | 14.70            | 15.43            | 18.63            | 22.22           | 15.67             |
| 3400               | 14.11                                   | 14.30            | 14.57            | 14.82            | 15.45            | 18.35            | 20.66           | 15.19             |
| 3600               | 15.04                                   | 15.21            | 15.47            | 15.34            | 15.71            | 17.97            | 18.91           | 14.72             |
| 3800               | 16.46                                   | 16.58            | 16.82            | 16.02            | 16.03            | 17.36            | 17.14           | 14.32             |
| 4000               | 17.39                                   | 17.45            | 17.64            | 16.09            | 15.76            | 16.18            | 15.31           | 13.73             |
| 4200               | 18.27                                   | 18.22            | 18.28            | 16.04            | 15.41            | 15.13            | 13.89           | 13.06             |
| 4400               | 20.26                                   | 20.04            | 19.89            | 16.55            | 15.52            | 14.51            | 12.95           | 12.59             |
| 4600               | 25.03                                   | 23.82            | 22.99            | 17.41            | 15.83            | 13.96            | 12.16           | 12.26             |
| 4800               | 27.89                                   | 25.53            | 24.21            | 17.70            | 15.80            | 13.28            | 11.37           | 11.94             |
| 5000               | 22.61                                   | 21.91            | 21.47            | 17.10            | 15.42            | 12.68            | 10.79           | 11.71             |

**Notes**

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# Digital Step Attenuator

# ZX76-31R5A-PN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=+85°C

| FREQUENCY<br>(MHz) | STEP ATTENUATION* AT TTL CONTROL STATE |                  |                  |                  |                  |                  |                 |                   |
|--------------------|----------------------------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------------|
|                    | (dB)                                   |                  |                  |                  |                  |                  |                 |                   |
|                    | 000000<br>THRU LOSS                    | 000001<br>0.5 dB | 000010<br>1.0 dB | 000100<br>2.0 dB | 001000<br>4.0 dB | 010000<br>8.0 dB | 100000<br>16 dB | 111111<br>31.5 dB |
| 0.1                | 1.22                                   | 0.52             | 1.02             | 2.01             | 4.00             | 7.92             | 15.89           | 31.25             |
| 0.3                | 1.23                                   | 0.52             | 1.02             | 2.01             | 4.00             | 7.92             | 15.89           | 31.24             |
| 0.5                | 1.25                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.87           | 31.22             |
| 1                  | 1.27                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.89             | 15.86           | 31.21             |
| 5                  | 1.26                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.86           | 31.22             |
| 10                 | 1.26                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.86           | 31.22             |
| 50                 | 1.26                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.86           | 31.22             |
| 100                | 1.26                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.86           | 31.22             |
| 200                | 1.30                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.87           | 31.23             |
| 300                | 1.29                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.86           | 31.22             |
| 400                | 1.31                                   | 0.52             | 1.02             | 2.01             | 4.00             | 7.90             | 15.87           | 31.23             |
| 500                | 1.34                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.87           | 31.23             |
| 600                | 1.34                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.86           | 31.21             |
| 700                | 1.38                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.87           | 31.22             |
| 800                | 1.38                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.86           | 31.20             |
| 900                | 1.41                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.86           | 31.20             |
| 1000               | 1.43                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.87           | 31.21             |
| 1100               | 1.43                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.86           | 31.19             |
| 1200               | 1.47                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.90             | 15.87           | 31.21             |
| 1300               | 1.56                                   | 0.52             | 1.02             | 2.01             | 3.99             | 7.91             | 15.88           | 31.21             |
| 1400               | 1.65                                   | 0.51             | 1.02             | 2.01             | 3.99             | 7.92             | 15.90           | 31.22             |
| 1500               | 1.74                                   | 0.51             | 1.02             | 2.01             | 3.99             | 7.93             | 15.92           | 31.23             |
| 1600               | 1.83                                   | 0.51             | 1.02             | 2.01             | 4.00             | 7.95             | 15.94           | 31.24             |
| 1700               | 1.92                                   | 0.51             | 1.02             | 2.01             | 4.00             | 7.96             | 15.96           | 31.25             |
| 1800               | 2.01                                   | 0.51             | 1.02             | 2.02             | 4.01             | 7.98             | 15.99           | 31.26             |
| 1900               | 2.10                                   | 0.51             | 1.02             | 2.02             | 4.01             | 8.00             | 16.02           | 31.29             |
| 2000               | 2.20                                   | 0.52             | 1.02             | 2.02             | 4.01             | 8.02             | 16.05           | 31.35             |
| 2100               | 2.29                                   | 0.52             | 1.02             | 2.03             | 4.02             | 8.04             | 16.09           | 31.42             |
| 2200               | 2.38                                   | 0.52             | 1.03             | 2.03             | 4.02             | 8.06             | 16.13           | 31.51             |
| 2300               | 2.47                                   | 0.52             | 1.03             | 2.04             | 4.02             | 8.09             | 16.17           | 31.60             |
| 2400               | 2.55                                   | 0.52             | 1.03             | 2.04             | 4.02             | 8.11             | 16.22           | 31.67             |
| 2500               | 2.59                                   | 0.53             | 1.03             | 2.04             | 4.02             | 8.12             | 16.24           | 31.68             |
| 2600               | 2.64                                   | 0.53             | 1.03             | 2.04             | 4.03             | 8.14             | 16.27           | 31.69             |
| 2700               | 2.68                                   | 0.53             | 1.04             | 2.05             | 4.03             | 8.15             | 16.29           | 31.70             |
| 2800               | 2.72                                   | 0.53             | 1.04             | 2.05             | 4.03             | 8.17             | 16.32           | 31.69             |
| 2900               | 2.77                                   | 0.53             | 1.04             | 2.05             | 4.03             | 8.19             | 16.35           | 31.65             |
| 3000               | 2.82                                   | 0.53             | 1.04             | 2.06             | 4.03             | 8.21             | 16.36           | 31.46             |
| 3200               | 2.89                                   | 0.54             | 1.04             | 2.07             | 4.04             | 8.24             | 16.36           | 31.13             |
| 3400               | 3.00                                   | 0.54             | 1.04             | 2.09             | 4.05             | 8.30             | 16.45           | 31.49             |
| 3600               | 3.17                                   | 0.54             | 1.05             | 2.09             | 4.07             | 8.39             | 16.64           | 32.21             |
| 3800               | 3.38                                   | 0.54             | 1.06             | 2.12             | 4.13             | 8.53             | 16.96           | 33.25             |
| 4000               | 3.47                                   | 0.55             | 1.08             | 2.16             | 4.18             | 8.68             | 17.21           | 32.47             |
| 4200               | 3.36                                   | 0.56             | 1.11             | 2.20             | 4.24             | 8.83             | 17.40           | 31.51             |
| 4400               | 3.28                                   | 0.58             | 1.13             | 2.23             | 4.30             | 9.01             | 17.71           | 31.69             |
| 4600               | 3.32                                   | 0.58             | 1.13             | 2.25             | 4.34             | 9.18             | 18.01           | 32.29             |
| 4800               | 3.49                                   | 0.58             | 1.12             | 2.25             | 4.34             | 9.30             | 18.24           | 32.82             |
| 5000               | 3.74                                   | 0.57             | 1.10             | 2.23             | 4.33             | 9.40             | 18.41           | 32.97             |

\* Step Attenuation above Thru Loss (TTL Logic 00000).

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# Digital Step Attenuator

# ZX76-31R5A-PN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=+85°C

| FREQUENCY<br>(MHz) | INPUT RETURN LOSS AT TTL CONTROL STATE<br>(dB) |                  |                  |                  |                  |                  |                 |                   |
|--------------------|------------------------------------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------------|
|                    | 000000<br>0 dB                                 | 000001<br>0.5 dB | 000010<br>1.0 dB | 000100<br>2.0 dB | 001000<br>4.0 dB | 010000<br>8.0 dB | 100000<br>16 dB | 111111<br>31.5 dB |
| 0.1                | 18.17                                          | 19.34            | 20.32            | 18.20            | 18.45            | 19.87            | 25.76           | 29.49             |
| 0.3                | 18.16                                          | 19.34            | 20.31            | 18.19            | 18.44            | 19.85            | 25.71           | 29.47             |
| 0.5                | 18.15                                          | 19.32            | 20.30            | 18.14            | 18.37            | 19.75            | 25.61           | 29.50             |
| 1                  | 18.06                                          | 19.26            | 20.24            | 18.09            | 18.32            | 19.73            | 25.60           | 29.53             |
| 5                  | 17.96                                          | 19.15            | 20.14            | 18.04            | 18.30            | 19.74            | 25.64           | 29.60             |
| 10                 | 17.94                                          | 19.14            | 20.12            | 18.03            | 18.29            | 19.73            | 25.64           | 29.60             |
| 50                 | 17.94                                          | 19.14            | 20.12            | 18.04            | 18.32            | 19.77            | 25.72           | 29.72             |
| 100                | 17.94                                          | 19.14            | 20.13            | 18.06            | 18.35            | 19.84            | 25.86           | 29.97             |
| 200                | 17.92                                          | 19.14            | 20.15            | 18.12            | 18.45            | 19.98            | 26.21           | 30.55             |
| 300                | 17.92                                          | 19.15            | 20.18            | 18.17            | 18.54            | 20.14            | 26.51           | 31.06             |
| 400                | 17.91                                          | 19.15            | 20.21            | 18.23            | 18.62            | 20.26            | 26.69           | 31.39             |
| 500                | 17.96                                          | 19.19            | 20.25            | 18.27            | 18.63            | 20.20            | 26.35           | 30.77             |
| 600                | 17.96                                          | 19.18            | 20.21            | 18.22            | 18.54            | 20.05            | 25.86           | 29.96             |
| 700                | 17.97                                          | 19.16            | 20.18            | 18.18            | 18.46            | 19.90            | 25.36           | 29.13             |
| 800                | 17.87                                          | 19.03            | 20.01            | 18.02            | 18.27            | 19.61            | 24.69           | 28.16             |
| 900                | 17.85                                          | 18.98            | 19.93            | 17.93            | 18.15            | 19.42            | 24.28           | 27.61             |
| 1000               | 17.82                                          | 18.93            | 19.85            | 17.83            | 18.01            | 19.23            | 23.81           | 26.97             |
| 1100               | 17.67                                          | 18.74            | 19.62            | 17.63            | 17.81            | 18.98            | 23.38           | 26.41             |
| 1200               | 17.62                                          | 18.68            | 19.54            | 17.56            | 17.72            | 18.87            | 23.19           | 26.20             |
| 1300               | 17.58                                          | 18.60            | 19.35            | 17.32            | 17.37            | 18.31            | 22.00           | 24.76             |
| 1400               | 17.46                                          | 18.42            | 19.12            | 17.04            | 16.96            | 17.70            | 20.84           | 23.35             |
| 1500               | 17.47                                          | 18.37            | 19.02            | 16.84            | 16.64            | 17.23            | 20.04           | 22.37             |
| 1600               | 17.53                                          | 18.37            | 18.95            | 16.71            | 16.41            | 16.89            | 19.48           | 21.64             |
| 1700               | 17.65                                          | 18.43            | 18.93            | 16.65            | 16.27            | 16.68            | 19.13           | 21.12             |
| 1800               | 17.63                                          | 18.33            | 18.77            | 16.53            | 16.15            | 16.58            | 18.98           | 20.81             |
| 1900               | 17.47                                          | 18.07            | 18.43            | 16.34            | 15.96            | 16.45            | 18.82           | 20.40             |
| 2000               | 17.09                                          | 17.59            | 17.86            | 16.07            | 15.79            | 16.40            | 18.82           | 20.12             |
| 2100               | 16.65                                          | 17.05            | 17.26            | 15.81            | 15.66            | 16.44            | 18.99           | 19.95             |
| 2200               | 16.08                                          | 16.41            | 16.58            | 15.50            | 15.52            | 16.55            | 19.25           | 19.77             |
| 2300               | 15.42                                          | 15.68            | 15.81            | 15.12            | 15.33            | 16.66            | 19.56           | 19.48             |
| 2400               | 14.86                                          | 15.07            | 15.15            | 14.84            | 15.26            | 16.92            | 20.14           | 19.26             |
| 2500               | 14.65                                          | 14.84            | 14.90            | 14.77            | 15.31            | 17.19            | 20.62           | 19.24             |
| 2600               | 14.49                                          | 14.67            | 14.71            | 14.74            | 15.40            | 17.52            | 21.20           | 19.26             |
| 2700               | 14.37                                          | 14.53            | 14.55            | 14.74            | 15.52            | 17.91            | 21.85           | 19.27             |
| 2800               | 14.17                                          | 14.33            | 14.33            | 14.66            | 15.56            | 18.18            | 22.28           | 19.12             |
| 2900               | 13.95                                          | 14.09            | 14.07            | 14.56            | 15.57            | 18.42            | 22.55           | 18.84             |
| 3000               | 13.78                                          | 13.89            | 13.87            | 14.50            | 15.60            | 18.66            | 22.69           | 18.54             |
| 3200               | 13.65                                          | 13.69            | 13.62            | 14.56            | 15.81            | 19.05            | 22.09           | 17.73             |
| 3400               | 13.64                                          | 13.60            | 13.46            | 14.61            | 15.85            | 18.64            | 20.07           | 16.60             |
| 3600               | 13.68                                          | 13.56            | 13.32            | 14.53            | 15.62            | 17.54            | 17.84           | 15.40             |
| 3800               | 13.42                                          | 13.23            | 12.92            | 14.08            | 14.93            | 16.05            | 15.79           | 14.08             |
| 4000               | 13.27                                          | 13.08            | 12.72            | 13.81            | 14.45            | 15.07            | 14.39           | 12.99             |
| 4200               | 14.36                                          | 14.07            | 13.53            | 14.67            | 15.02            | 14.87            | 13.55           | 12.34             |
| 4400               | 16.94                                          | 16.24            | 15.27            | 16.71            | 16.38            | 14.84            | 12.85           | 11.97             |
| 4600               | 20.89                                          | 18.96            | 17.28            | 19.05            | 17.44            | 14.43            | 12.13           | 11.64             |
| 4800               | 23.44                                          | 20.20            | 18.32            | 19.65            | 17.21            | 13.62            | 11.37           | 11.29             |
| 5000               | 20.80                                          | 18.90            | 17.80            | 18.42            | 16.32            | 12.92            | 10.83           | 11.08             |

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# Digital Step Attenuator

# ZX76-31R5A-PN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, TEMPERATURE=+85°C

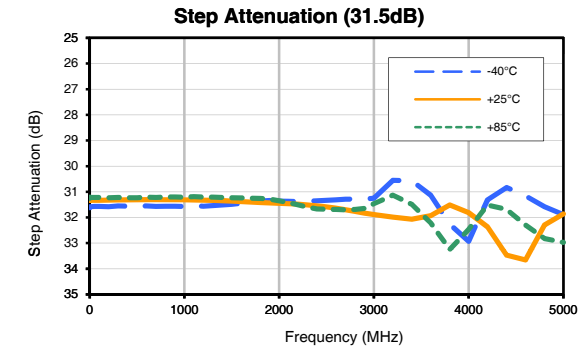
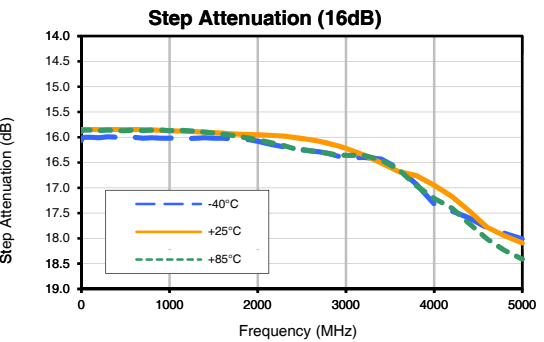
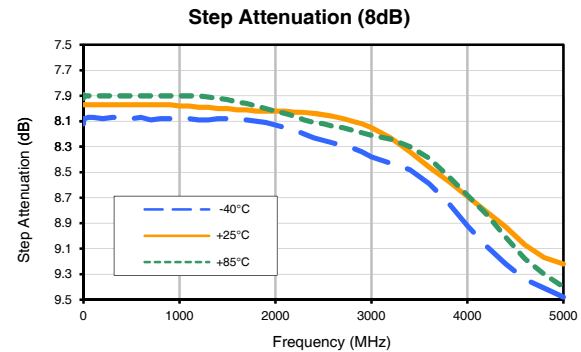
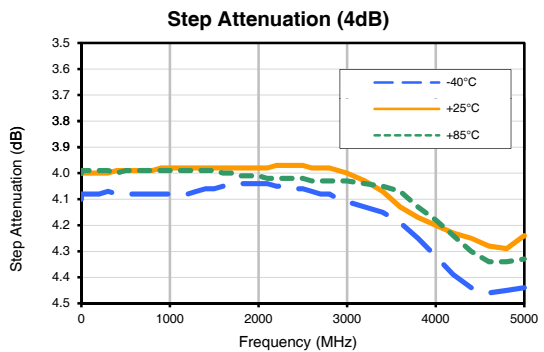
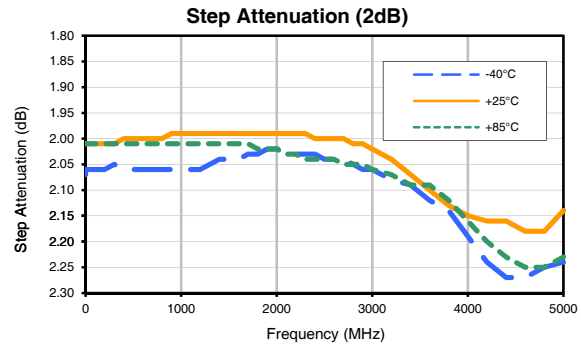
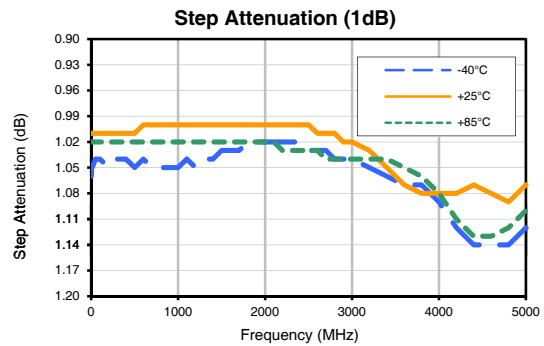
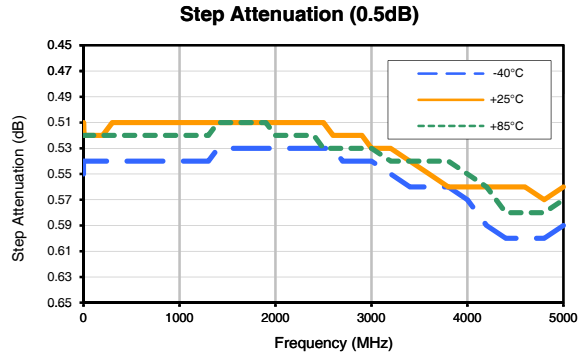
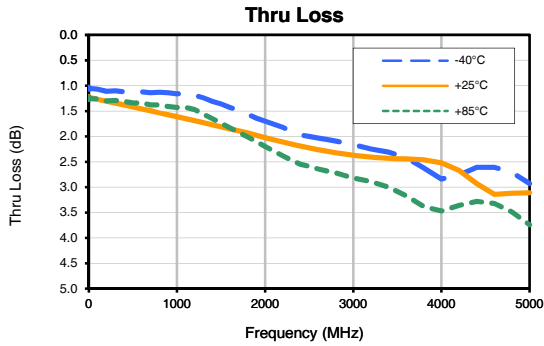
| FREQUENCY<br>(MHz) | OUTPUT RETURN LOSS AT TTL CONTROL STATE<br>(dB) |                  |                  |                  |                  |                  |                 |                   |
|--------------------|-------------------------------------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------------|
|                    | 000000<br>0 dB                                  | 000001<br>0.5 dB | 000010<br>1.0 dB | 000100<br>2.0 dB | 001000<br>4.0 dB | 010000<br>8.0 dB | 100000<br>16 dB | 111111<br>31.5 dB |
| 0.1                | 18.03                                           | 18.36            | 18.23            | 21.73            | 23.27            | 23.97            | 21.63           | 31.20             |
| 0.3                | 18.03                                           | 18.35            | 18.22            | 21.72            | 23.25            | 23.94            | 21.62           | 31.19             |
| 0.5                | 17.93                                           | 18.26            | 18.14            | 21.63            | 23.14            | 23.81            | 21.48           | 31.19             |
| 1                  | 17.92                                           | 18.27            | 18.14            | 21.65            | 23.16            | 23.82            | 21.48           | 31.22             |
| 5                  | 17.84                                           | 18.20            | 18.08            | 21.58            | 23.13            | 23.86            | 21.55           | 31.35             |
| 10                 | 17.83                                           | 18.18            | 18.07            | 21.57            | 23.12            | 23.86            | 21.55           | 31.36             |
| 50                 | 17.88                                           | 18.25            | 18.14            | 21.66            | 23.24            | 24.00            | 21.67           | 31.66             |
| 100                | 18.03                                           | 18.40            | 18.28            | 21.87            | 23.47            | 24.25            | 21.86           | 32.21             |
| 200                | 18.13                                           | 18.52            | 18.42            | 22.12            | 23.81            | 24.69            | 22.22           | 33.46             |
| 300                | 18.29                                           | 18.69            | 18.59            | 22.37            | 24.14            | 25.06            | 22.51           | 34.65             |
| 400                | 18.19                                           | 18.59            | 18.51            | 22.25            | 24.05            | 25.01            | 22.50           | 34.62             |
| 500                | 18.10                                           | 18.48            | 18.39            | 22.01            | 23.71            | 24.55            | 22.14           | 33.10             |
| 600                | 17.89                                           | 18.26            | 18.16            | 21.64            | 23.24            | 24.01            | 21.74           | 31.74             |
| 700                | 17.76                                           | 18.12            | 18.01            | 21.36            | 22.88            | 23.57            | 21.37           | 30.67             |
| 800                | 17.69                                           | 18.04            | 17.91            | 21.18            | 22.61            | 23.21            | 21.07           | 29.90             |
| 900                | 17.75                                           | 18.10            | 17.95            | 21.22            | 22.60            | 23.13            | 20.98           | 29.71             |
| 1000               | 17.80                                           | 18.14            | 17.99            | 21.23            | 22.56            | 23.02            | 20.86           | 29.43             |
| 1100               | 17.83                                           | 18.16            | 18.00            | 21.24            | 22.53            | 22.93            | 20.77           | 29.24             |
| 1200               | 17.94                                           | 18.26            | 18.09            | 21.34            | 22.60            | 22.92            | 20.72           | 29.18             |
| 1300               | 17.77                                           | 18.02            | 17.84            | 20.82            | 21.78            | 21.79            | 19.71           | 26.91             |
| 1400               | 17.76                                           | 17.95            | 17.69            | 20.50            | 21.18            | 20.93            | 18.93           | 25.23             |
| 1500               | 17.75                                           | 17.87            | 17.55            | 20.18            | 20.59            | 20.17            | 18.24           | 23.73             |
| 1600               | 17.86                                           | 17.88            | 17.49            | 19.96            | 20.13            | 19.63            | 17.80           | 22.53             |
| 1700               | 17.89                                           | 17.83            | 17.38            | 19.64            | 19.62            | 19.15            | 17.48           | 21.41             |
| 1800               | 17.82                                           | 17.67            | 17.19            | 19.23            | 19.10            | 18.78            | 17.32           | 20.47             |
| 1900               | 17.67                                           | 17.45            | 16.97            | 18.78            | 18.59            | 18.50            | 17.29           | 19.67             |
| 2000               | 17.42                                           | 17.17            | 16.72            | 18.27            | 18.12            | 18.35            | 17.46           | 19.03             |
| 2100               | 17.02                                           | 16.76            | 16.37            | 17.67            | 17.61            | 18.21            | 17.72           | 18.40             |
| 2200               | 16.54                                           | 16.29            | 15.98            | 17.05            | 17.11            | 18.16            | 18.19           | 17.85             |
| 2300               | 15.95                                           | 15.76            | 15.58            | 16.44            | 16.66            | 18.21            | 18.91           | 17.40             |
| 2400               | 15.33                                           | 15.21            | 15.15            | 15.85            | 16.23            | 18.32            | 19.88           | 17.02             |
| 2500               | 15.00                                           | 14.92            | 14.91            | 15.53            | 15.98            | 18.32            | 20.39           | 16.79             |
| 2600               | 14.67                                           | 14.63            | 14.66            | 15.21            | 15.73            | 18.32            | 20.95           | 16.56             |
| 2700               | 14.40                                           | 14.39            | 14.46            | 14.94            | 15.52            | 18.33            | 21.56           | 16.35             |
| 2800               | 14.12                                           | 14.14            | 14.25            | 14.68            | 15.31            | 18.34            | 22.20           | 16.14             |
| 2900               | 13.88                                           | 13.93            | 14.09            | 14.45            | 15.13            | 18.37            | 22.84           | 15.96             |
| 3000               | 13.67                                           | 13.76            | 13.95            | 14.25            | 14.98            | 18.40            | 23.41           | 15.77             |
| 3200               | 13.66                                           | 13.78            | 14.00            | 14.16            | 14.87            | 18.47            | 23.82           | 15.38             |
| 3400               | 13.96                                           | 14.11            | 14.34            | 14.25            | 14.93            | 18.58            | 23.13           | 15.11             |
| 3600               | 14.64                                           | 14.78            | 15.03            | 14.64            | 15.23            | 18.70            | 21.38           | 14.92             |
| 3800               | 15.86                                           | 16.01            | 16.28            | 15.29            | 15.64            | 18.30            | 18.93           | 14.63             |
| 4000               | 16.60                                           | 16.72            | 16.96            | 15.36            | 15.50            | 17.18            | 16.62           | 14.15             |
| 4200               | 17.42                                           | 17.51            | 17.69            | 15.53            | 15.42            | 16.20            | 14.93           | 13.61             |
| 4400               | 19.82                                           | 19.78            | 19.84            | 16.44            | 15.90            | 15.59            | 13.77           | 13.26             |
| 4600               | 25.13                                           | 24.29            | 23.81            | 17.81            | 16.62            | 15.00            | 12.82           | 13.08             |
| 4800               | 27.99                                           | 26.00            | 24.89            | 18.42            | 16.81            | 14.20            | 11.91           | 12.87             |
| 5000               | 22.45                                           | 21.95            | 21.71            | 18.06            | 16.62            | 13.56            | 11.28           | 12.75             |

**Notes**

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Typical Performance Curves

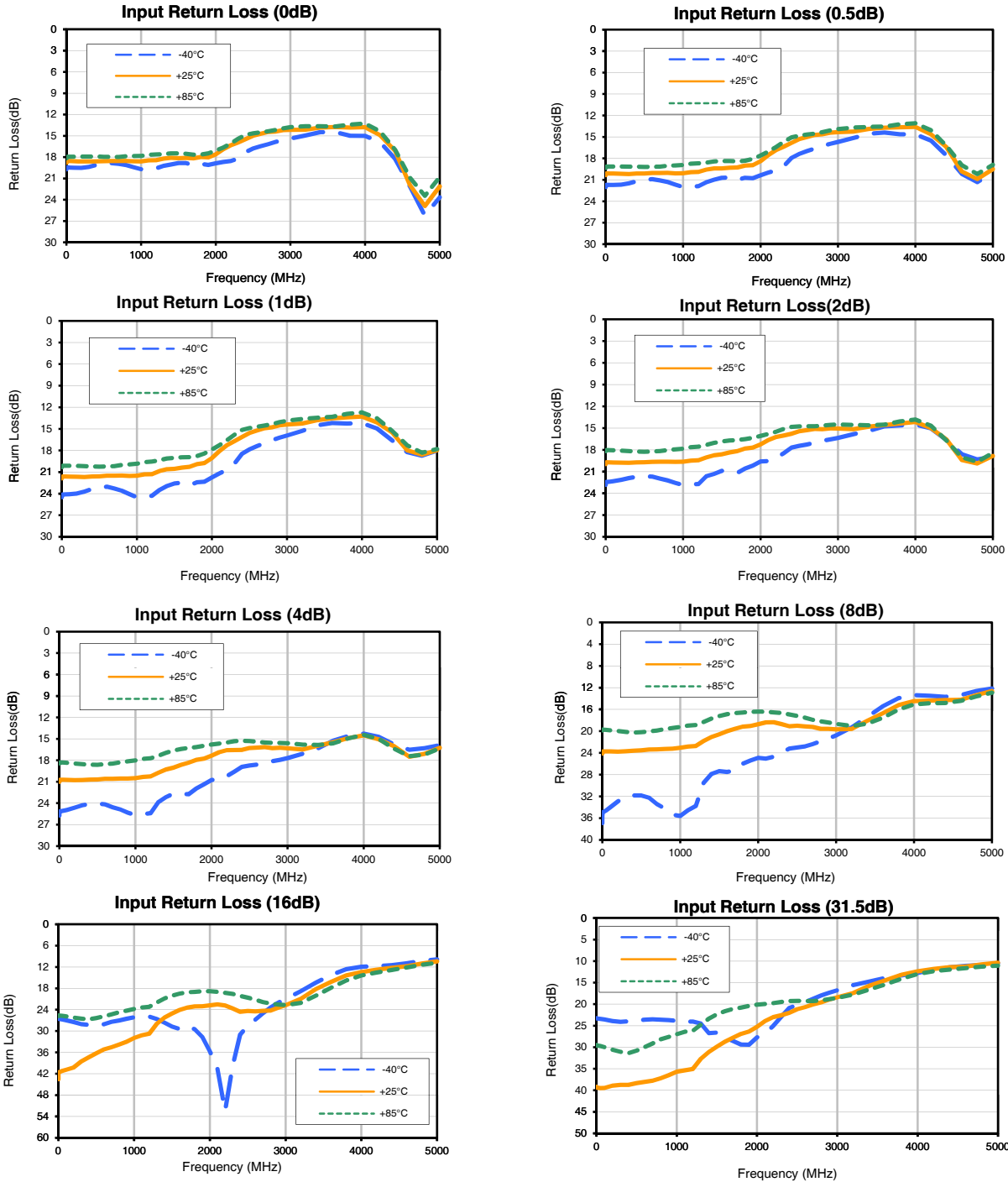


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## Typical Performance Curves

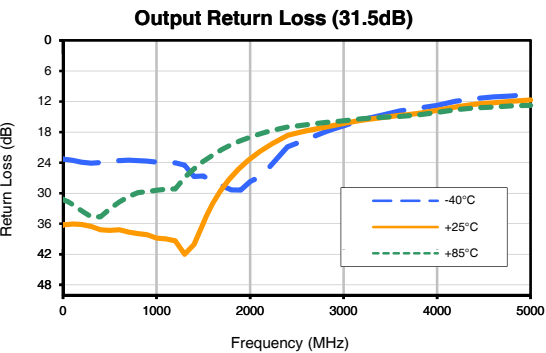
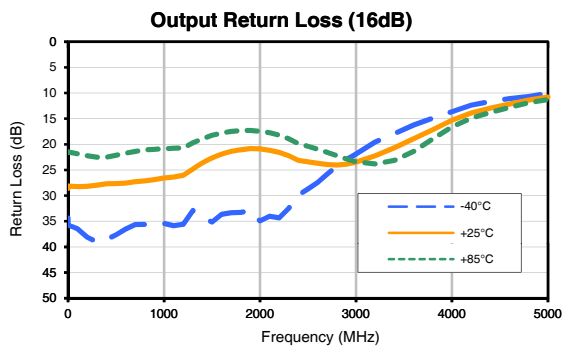
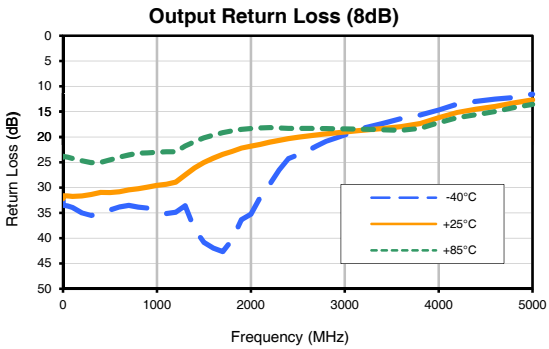
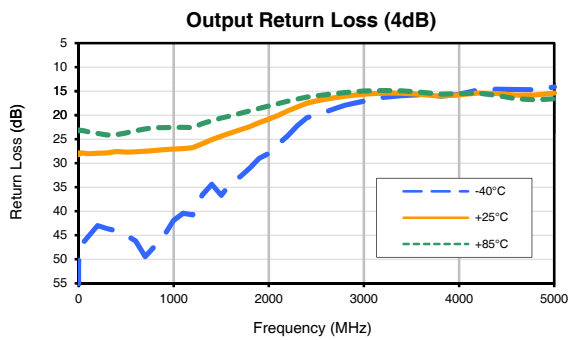
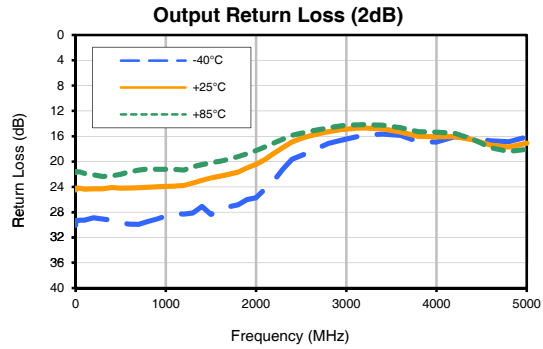
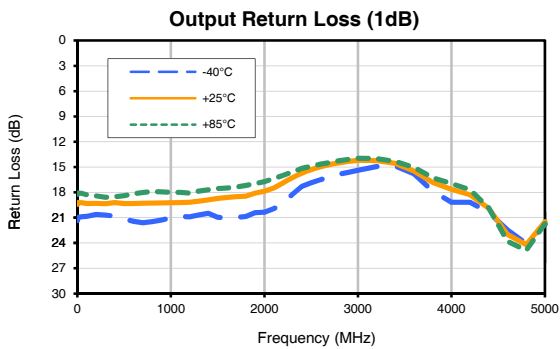
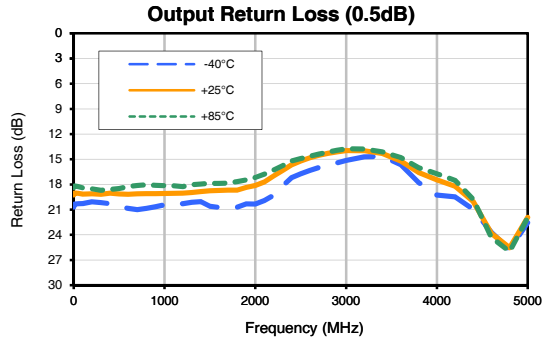
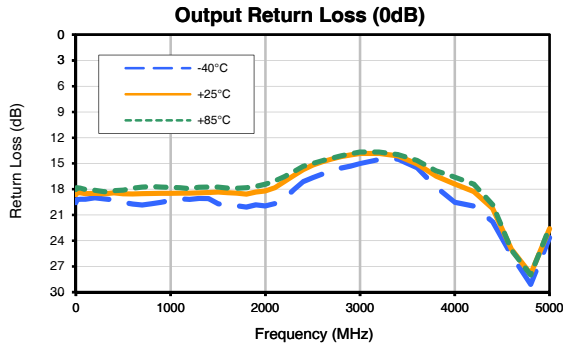


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## Typical Performance Curves



**Notes**

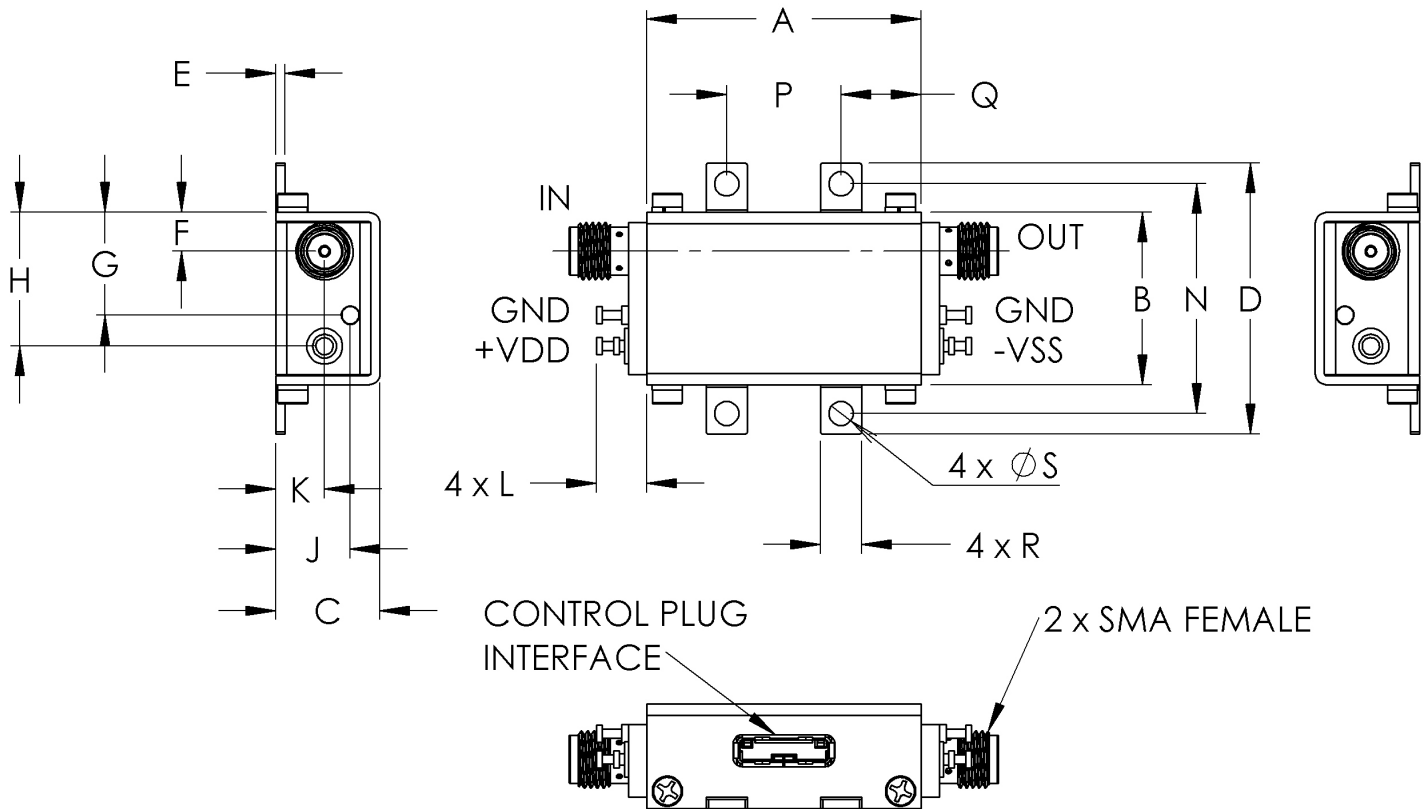
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# Case Style

# HK

## Outline Dimensions

## HK1149



| CASE #. | A               | B              | C              | D               | E             | F             | G              | H              | J             | K             | L             | M | N              |
|---------|-----------------|----------------|----------------|-----------------|---------------|---------------|----------------|----------------|---------------|---------------|---------------|---|----------------|
| HK1149  | 1.20<br>(30.48) | .75<br>(19.15) | .46<br>(11.61) | 1.18<br>(30.07) | .04<br>(1.02) | .17<br>(4.32) | .45<br>(11.40) | .59<br>(14.86) | .33<br>(8.31) | .21<br>(5.44) | .22<br>(5.59) | - | 1.00<br>(25.4) |

| CASE #. | P              | Q             | R             | S              | WT GRAMS |
|---------|----------------|---------------|---------------|----------------|----------|
| HK1149  | .50<br>(12.70) | .35<br>(8.89) | .18<br>(4.57) | .106<br>(2.69) | 35       |

Dimensions are in inches (mm). Tolerances: 2Pl.  $\pm .03$ ; 3Pl.  $\pm .015$   
Tolerance on hole size and interaxes dimensions to be  $\pm .005$ .

### Note:

1. Case material: Brass
2. Case finish: Nickel plate

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All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

| Specification              | Test/Inspection Condition                                                              | Reference/Spec                       |
|----------------------------|----------------------------------------------------------------------------------------|--------------------------------------|
| Operating Temperature      | -40° to 85° C<br>Ambient Environment                                                   | Individual Model Data Sheet          |
| Storage Temperature        | -40° to 85° C<br>Ambient Environment                                                   | Individual Model Data Sheet          |
| Barometric Pressure        | 100,000 Feet                                                                           | MIL-STD-202, Method 105, Condition D |
| Humidity                   | 90% RH, 65°C<br>Units may require bake-out after humidity to restore full performance. | MIL-STD-202, Method 103              |
| Thermal Shock              | -65° to 125°C, 5 cycles                                                                | MIL-STD-202, Method 107, Condition B |
| Vibration (High Frequency) | 20g peak, 10-2000 Hz, 12 times in each of three perpendicular directions (total 36)    | MIL-STD-202, Method 204, Condition D |
| Mechanical Shock           | 100g, 6ms sawtooth, 3 shocks each direction 3 axes (total 18)                          | MIL-STD-202, Method 213, Condition I |