

# Surface Mount Digital Step Attenuator

## DAT-31R5A+ Series

50Ω 0 to 31.5 dB, 0.5 dB Step DC to 4.0 GHz

### The Big Deal

- Wideband, operates up to 4 GHz
- Immune to latchup
- High IP3, 52 dBm



CASE STYLE: DG983-2

### Product Overview

The DAT-31R5A+ series of 50Ω digital step attenuators provides adjustable attenuation from 0 to 31.5 dB in 0.5 dB steps. The control is a 6-bit serial/parallel interface, and the attenuators operate with either single positive or dual (positive and negative) supply voltage. DAT-31R5A+ series models are produced by a unique CMOS process on silicon, offering the performance of GaAs with the advantages of conventional CMOS devices.

### Key Features

| Feature                                                                                                            | Advantages                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Wideband operation, specified from DC to 4.0 GHz                                                                   | Can be used in multiple applications such as communications, satellite and defense, reducing part count.                                                                                                                        |
| Serial or parallel interface                                                                                       | Models available with serial or parallel interface mode to suit customer demand.                                                                                                                                                |
| Good VSWR, 1.2:1 typ.                                                                                              | Eases interfacing with adjacent components and results in low amplitude ripple.                                                                                                                                                 |
| Single positive supply models:<br>(Model suffixes: -SP+ and -PP+)<br>+2.3 to +3.6V+                                | Use of single positive supply simplifies power supply design. An internal negative voltage generator supplies the desired negative voltage. Single positive supply results in excellent spurious performance, -140 dBm typical. |
| Dual supply models:<br>(Model suffixes: -SN+ and -PN+)<br>+2.7 to +3.6V (Positive) and<br>-3.6 to -3.2V (Negative) | Dual supply provides spurious-free operation. It also allows fast switching up to 1 MHz (vs. 25 kHz for single supply).                                                                                                         |
| Useable over a wide range of supply voltages, +2.3/2.7 to 5.2V                                                     | Wide range of positive operating voltages allows the DAT-31R5A+ Series of models to be used in a wide range of applications. See Application Note AN-70-006 for operation above +3.6V                                           |
| Footprint compatible to DAT-31R5-XX+ Series (XX=SN/SP/PN/PP)                                                       | Can fit into existing footprint and provide wideband performance, to 4 GHz instead of 2.4 GHz.                                                                                                                                  |
| Safe attenuation transitions                                                                                       | The DAT-31R5A-XX+ series is designed to prevent any momentary positive 'spikes' in power during attenuation transitions                                                                                                         |



# Digital Step Attenuator

50Ω DC-4000 MHz

31.5 dB, 0.5 dB Step

6 Bit, Serial control interface, Dual Supply Voltage

## Product Features

- Immune to latch up
- Excellent accuracy, 0.1 dB Typ
- Serial control interface
- Fast switching control frequency, up to 1 MHz typ.
- Low Insertion Loss
- High IP3, +52 dBm Typ
- Very low DC power consumption
- Excellent return loss, 20 dB Typ
- Small size 4.0 x 4.0 mm



*Generic photo used for illustration purposes only*

## DAT-31R5A-SN+

CASE STYLE: DG983-2

**+RoHS Compliant**

*The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications*

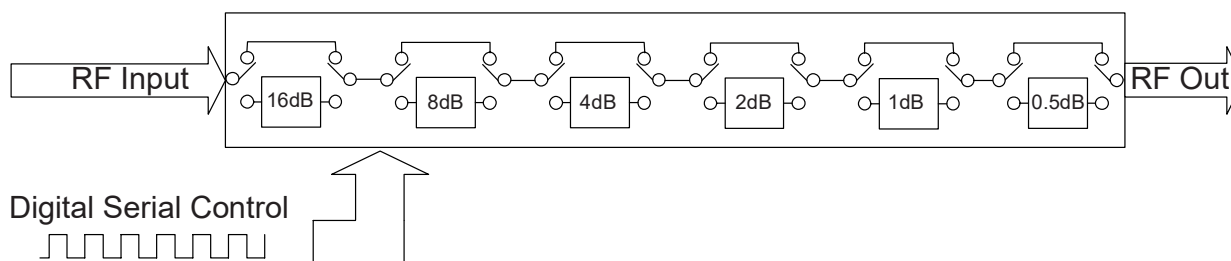
## Typical Applications

- Base Station Infrastructure
- Portable Wireless
- CATV & DBS
- MMDS & Wireless LAN
- Wireless Local Loop
- UNII & Hiper LAN
- Power amplifier distortion canceling loops

## General Description

The DAT-31R5A+ series of 50Ω digital step attenuators provides adjustable attenuation of 0 to 31.5 dB in 0.5 dB steps. The control is a 6-bit serial interface, and the attenuators operate with dual (positive and negative) supply voltage. DAT-31R5A-SN+ is produced using a CMOS process on silicon, offering the performance of GaAs with the advantages of conventional CMOS devices.

## Simplified Schematic



RF Electrical Specifications (Note1), DC-4000 MHz,  $T_{AMB}=25^{\circ}\text{C}$ ,  $V_{DD}=+3\text{V}$ ,  $V_{SS}=-3.2\text{V}$ 

| Parameter                                                               | Freq. Range (GHz) | Min. | Typ. | Max.       | Units |
|-------------------------------------------------------------------------|-------------------|------|------|------------|-------|
| Accuracy @ 0.5 dB Attenuation Setting                                   | DC-1              | —    | 0.03 | 0.1        | dB    |
|                                                                         | 1-2.4             | —    | 0.05 | 0.15       |       |
|                                                                         | 2.4-4             | —    | 0.07 | 0.2        |       |
| Accuracy @ 1 dB Attenuation Setting                                     | DC-1              | —    | 0.02 | 0.1        | dB    |
|                                                                         | 1-2.4             | —    | 0.05 | 0.15       |       |
|                                                                         | 2.4-4             | —    | 0.1  | 0.25       |       |
| Accuracy @ 2 dB Attenuation Setting                                     | DC-1              | —    | 0.05 | 0.15       | dB    |
|                                                                         | 1-2.4             | —    | 0.15 | 0.25       |       |
|                                                                         | 2.4-4             | —    | 0.15 | 0.35       |       |
| Accuracy @ 4 dB Attenuation Setting                                     | DC-1              | —    | 0.07 | 0.2        | dB    |
|                                                                         | 1-2.4             | —    | 0.15 | 0.25       |       |
|                                                                         | 2.4-4             | —    | 0.23 | 0.5        |       |
| Accuracy @ 8 dB Attenuation Setting                                     | DC-1              | —    | 0.03 | 0.2        | dB    |
|                                                                         | 1-2.4             | —    | 0.15 | 0.5        |       |
|                                                                         | 2.4-4             | —    | 0.6  | 0.8        |       |
| Accuracy @ 16 dB Attenuation Setting                                    | DC-1              | —    | 0.1  | 0.3        | dB    |
|                                                                         | 1-2.4             | —    | 0.15 | 0.7        |       |
|                                                                         | 2.4-4             | —    | 1.1  | 1.45       |       |
| Insertion Loss (note 1) @ all attenuator set to 0dB                     | DC-1              | —    | 1.3  | 1.9        | dB    |
|                                                                         | 1-2.4             | —    | 1.6  | 2.4        |       |
|                                                                         | 2.4-4             | —    | 2.1  | 3.0        |       |
| Input IP3 (note 2) (at Min. and Max. Attenuation)                       | DC-4              | —    | +52  | —          | dBm   |
| Input Power @ 0.2dB Compression (note 2) (at Min. and Max. Attenuation) | DC-4              | —    | +24  | —          | dBm   |
| Input Operating Power                                                   | 10 kHz to 50 MHz  | —    | —    | See Fig. 1 | dBm   |
|                                                                         | >50 MHz           | —    | —    | +24        |       |
| VSWR                                                                    | DC-1              | —    | 1.2  | 1.5        | :1    |
|                                                                         | 1-2.4             | —    | 1.2  | 1.6        |       |
|                                                                         | 2.4-4             | —    | 1.4  | 1.9        |       |

## Notes:

1. Tested on Evaluation Board TB-342, See Figure 3.

2. Insertion loss values are de-embedded from test board Loss (test board's Insertion Loss: 0.10dB @ 100MHz, 0.35dB @ 1000MHz, 0.60dB @ 2400MHz, 0.75dB @ 4000MHz).

3. 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         |
|---------------------------|------|------|--------------|---------------|
| $V_{DD}$ , Supply Voltage | 2.7  | 3    | 3.6 (Note 4) | V             |
| $V_{SS}$ , Supply Voltage | -3.6 | -3.3 | -3.2         | V             |
| $I_{DD}$ Supply Current   | —    | —    | 100          | $\mu\text{A}$ |
| $I_{SS}$ Supply Current   | —    | 16   | 40           | $\mu\text{A}$ |
| Control Input Low         | -0.3 | —    | +0.6         | V             |
| Control Input High        | 1.17 | —    | 3.6          | V             |
| Control Current           | —    | —    | 20 (Note 5)  | $\mu\text{A}$ |

4. For operation above +3.6V, see Application Note AN-70-006

5. Except, 30 $\mu\text{A}$  typ for C0.5, C16 at +3.6V

## Absolute Maximum Ratings (Note 6,7)

| Parameter                    | Ratings               |
|------------------------------|-----------------------|
| Operating Temperature        | -40°C to 105°C        |
| Storage Temperature          | -65°C to 150°C        |
| $V_{DD}$                     | -0.3V Min., 5.5V Max. |
| $V_{SS}$                     | -3.6V Min., 0.3V Max. |
| Voltage on any control input | -0.3V Min., 3.6V Max. |
| Input Power                  | +30dBm                |
| Thermal Resistance           | 37°C/W                |

6. Permanent damage may occur if any of these limits are exceeded.

7. Operation between max operating and absolute max input power will result in reduced reliability.

## Switching Specifications

| Parameter                                                  | Min. | Typ. | Max. | Units           |
|------------------------------------------------------------|------|------|------|-----------------|
| Switching Speed, 50% Control to 0.5dB of Attenuation Value | —    | 1.0  | —    | $\mu\text{Sec}$ |
| Switching Control Frequency                                | —    | 1.0  | —    | MHz             |

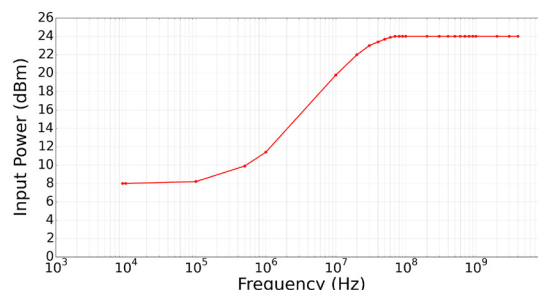


Figure 1. Max Input Operating Power vs Frequency

# Digital Step Attenuator

## DAT-31R5A-SN+

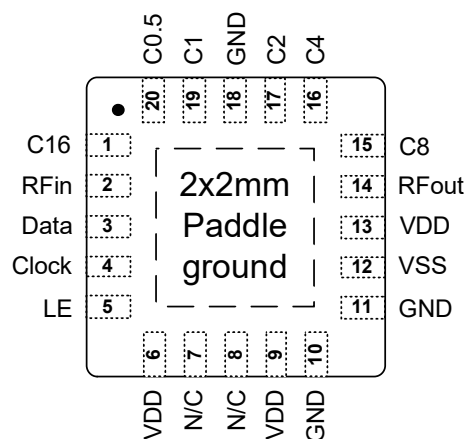
### Pin Description

| Function        | Pin Number | Description                                     |
|-----------------|------------|-------------------------------------------------|
| C16             | 1          | Control for Attenuation bit, 16dB (Notes 3,4,6) |
| RF in           | 2          | RF in port (Note 1)                             |
| Data            | 3          | Serial Interface data input (Note 3)            |
| Clock           | 4          | Serial Interface clock input                    |
| LE              | 5          | Latch Enable Input (Note 2)                     |
| V <sub>DD</sub> | 6          | Positive Supply Voltage                         |
| N/C             | 7          | Not connected                                   |
| N/C             | 8          | Not connected                                   |
| V <sub>DD</sub> | 9          | Positive Supply Voltage                         |
| GND             | 10         | Ground connection                               |
| GND             | 11         | Ground connection                               |
| V <sub>SS</sub> | 12         | Negative Supply Voltage                         |
| V <sub>DD</sub> | 13         | Positive Supply Voltage (Note 7)                |
| RF out          | 14         | RF out port (Note 1)                            |
| C8              | 15         | Control for attenuation bit, 8 dB (Note 4)      |
| C4              | 16         | Control for attenuation bit, 4 dB (Note 4)      |
| C2              | 17         | Control for attenuation bit, 2 dB (Note 4)      |
| GND             | 18         | Ground Connection                               |
| C1              | 19         | Control for attenuation bit, 1 dB (Note 4)      |
| C0.5            | 20         | Control for attenuation bit, 0.5 dB (Note 4,6)  |
| GND             | Paddle     | Paddle ground (Note 5)                          |

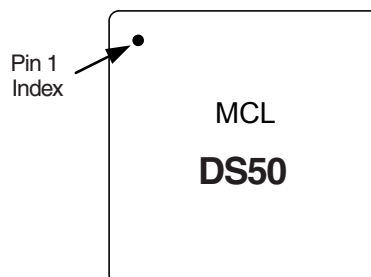
#### Notes:

- Both RF ports must be held at 0VDC or DC blocked with an external series capacitor.
- Latch Enable (LE) has an internal 2MΩ to internal positive supply voltage.
- Place a 10KΩ resistor in series, as close to pin as possible to avoid freq. resonance.
- Refer to Power-up Control Settings.
- The exposed solder pad on the bottom of the package (See Pin configuration) must be grounded for proper device operation.
- This pin has an internal 200 kΩ resistor to ground.
- When VDD<=3.6V this pin may be connected directly to VDD, when 3.6V< VDD <=5.2V need to use a voltage divider to reduce voltage on this pin to a voltage in the range +1.17 to 3.6V. See Application note AN-70-006.

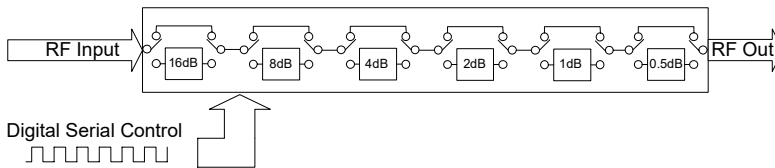
### Pin Configuration (Top View)



### Device Marking



## Simplified Schematic



The DAT-31R5A-SN+ serial 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    |

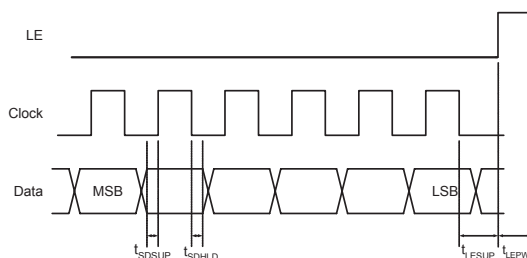
Note: Not all 64 possible combinations of C0.5 - C16 are shown in table

The serial interface is a 6-bit serial in, parallel-out shift register buffered by a transparent latch. It is controlled by three CMOS-compatible signals: Data, Clock, and Latch Enable (LE). The Data and Clock inputs allow data to be serially entered into the shift register, a process that is independent of the state of the LE input.

The LE input controls the latch. When LE is HIGH, the latch is transparent and the contents of the serial shift register control the attenuator. When LE is brought LOW, data in the shift register is latched.

The shift register should be loaded while LE is held LOW to prevent the attenuator value from changing as data is entered. The LE input should then be toggled HIGH and brought LOW again, latching the new data. The timing for this operation is defined by **Figure 2** (Serial Interface Timing Diagram) and **Table 2** (Serial Interface AC Characteristics).

**Figure 2: Serial interface Timing Diagram**



**Table 2. Serial Interface AC Characteristics**

| Symbol      | Parameter                                        | Min. | Max. | Units |
|-------------|--------------------------------------------------|------|------|-------|
| $f_{clk}$   | Serial data clock frequency (Note 1)             |      | 10   | MHz   |
| $t_{clkH}$  | Serial clock HIGH time                           | 30   |      | ns    |
| $t_{clkL}$  | Serial clock LOW time                            | 30   |      | ns    |
| $t_{LESUP}$ | LE set-up time after last clock falling edge     | 10   |      | ns    |
| $t_{LEPW}$  | LE minimum pulse width                           | 30   |      | ns    |
| $t_{SDSUP}$ | Serial data set-up time before clock rising edge | 10   |      | ns    |
| $t_{SDHLD}$ | Serial data hold time after clock falling edge   | 10   |      | ns    |

Note 1.  $f_{clk}$  verified during the functional pattern test. Serial programming sections of the functional pattern are clocked at 10MHz to verify  $f_{clk}$  specification.

The DAT-31R5A-SN+, uses a common 6-bit serial word format, as shown in **Table 3**: 6-Bit attenuator Serial Programming Register Map.

The first bit, the MSB, corresponds to the 16 dB Step and the last bit, the LSB, corresponds to the 0.5 dB step.

| Table 3. 6-Bit attenuator Serial Programming Register Map |    |    |    |    |      |
|-----------------------------------------------------------|----|----|----|----|------|
| B5                                                        | B4 | B3 | B2 | B1 | B0   |
| C16                                                       | C8 | C4 | C2 | C1 | C0.5 |

↑  
MSB  
(first in)

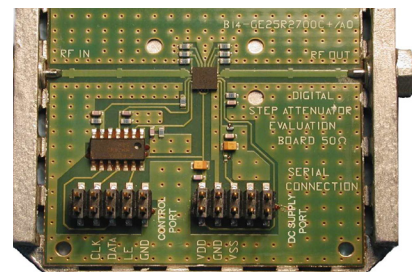
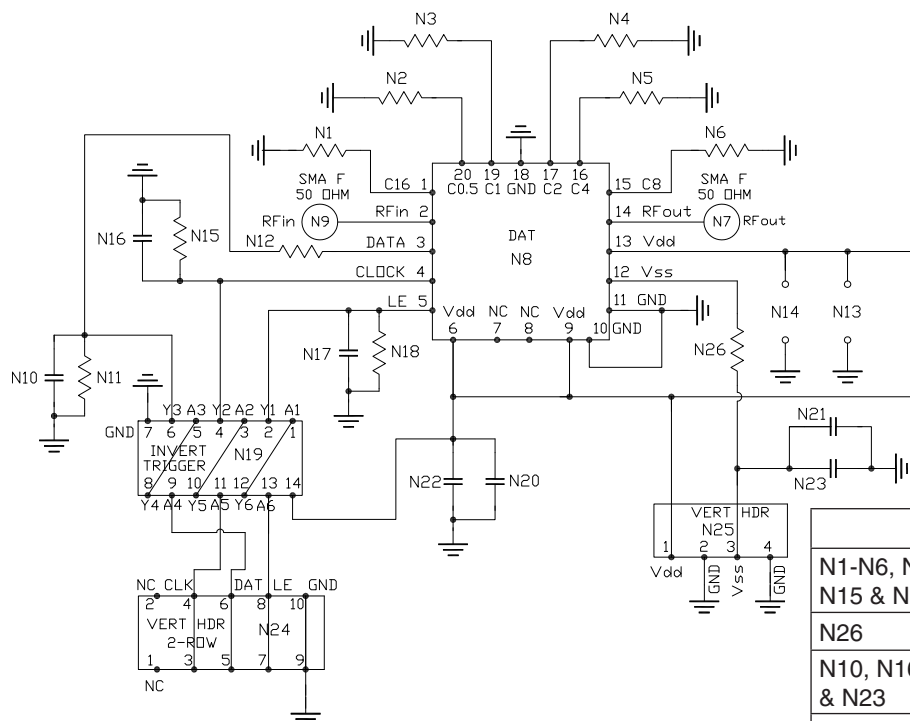
↑  
LSB  
(last in)

#### Power-up Control Settings

The DAT-31R5A-SN+ always assumes a specifiable attenuation setting on power-up, allowing a known attenuation state to be established before an initial serial control word is provided.

When the attenuator powers up, the six control bits are set to whatever data is present on the six data inputs (C0.5 to C16).

This allows any one of the 64 attenuation settings to be specified as the power-up state.



**TB-342**

## Notes

1. Both RF ports must be held at 0VDC or DC blocked with an external series capacitor.
2. Test Board TB-342 is designed for operation for VDD=2.3 to 3.6V. For operation over 3.6V to 5.2V, See Application Note AN-70-006
3. VDD=Vdd

| Bill of Materials          |                                       |
|----------------------------|---------------------------------------|
| N1-N6, N11, N12, N15 & N18 | Resistor 0603 10 KOhm +/- 1%          |
| N26                        | Resistor 0603 0 Ohm                   |
| N10, N16, N17, N20 & N23   | NPO Capacitor 0603 100pF +/- 5%       |
| N21 & N22                  | Tantalum Capacitor 0805 100nF +/- 10% |
| N19                        | Hex Invert Schmitt Trigger MSL1       |

**Fig 3. Evaluation Board Schematic, TB-342, used for characterization (DUT not soldered on TB-342)**

## Test Equipment

### For Insertion Loss, Isolation and Return Loss:

Agilent's E5071C Network Analyzer & E3631A Power Supply.

### For Compression:

Agilent's N9020A Signal Analyzer, E8247C RF Generator, E3631A Power Supply & U2004A Power Sensor.

### For Input IP3:

Agilent's N9020A Signal Analyzer, N5181A Signal Generators, E3631A Power Supply, U2004A Power Sensor.

### For Spurs:

Agilent N5181A Signal Generator, E4440A Spectrum Analyzer.

### For Switching Time:

Agilent's N5181A Signal Generator, 81110A Pulse Generator, 54832B Oscilloscope, E3631A Power Supply.

### For Max Control Frequency:

Agilent's N5181A Signal Generator, N9020A Signal Analyzer, E3631A Power Supply, 81110A Pulse Generator.

## Measurement Conditions

### For Insertion Loss, Isolation and Return Loss:

VDD=+2.7/+3/+5.5V & Pin=0dBm

VSS=-3.2/-3.6V

### For Compression: Pin=0/+24dBm. VDD=+3V, VSS=-3V

### For Input IP3: Pin=+10dBm/100mW.

Tone spacing: 0.1 MHz to 1 MHz RF Freq and 1 MHz to 4200 MHz RF Freq, VDD=+3V, VSS=-3V

### For Spurs: RF IN at 1000MHz and -20dBm. VDD=+3V

### For Switching Time:

RF Freq=501MHz/0dBm, Pulse for LE=1Hz/0/+3.4V, Delay=500ms, Width=500ms. VDD=+3V & VSS=-3V

### For Max Control Frequency:

RF Freq=501MHz, 0dBm. VDD=+3V, VSS=-3V

**Additional Detailed Technical Information**

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

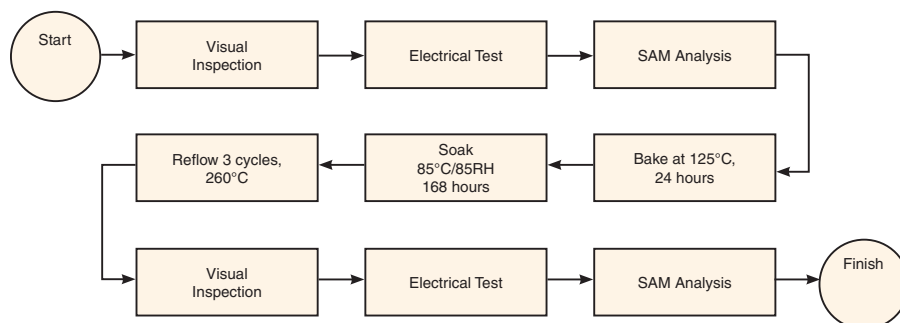
|                                                                 |                                                                              |
|-----------------------------------------------------------------|------------------------------------------------------------------------------|
| <b>Performance Data</b>                                         | Data Table                                                                   |
|                                                                 | Swept Graphs                                                                 |
|                                                                 | S-Parameter (S2P Files) Data Set (.zip file)                                 |
| <b>Case Style</b>                                               | DG983-2 Plastic package, exposed paddle, lead finish: NiPdAu                 |
| <b>Tape &amp; Reel</b><br>Standard quantities available on reel | F87<br>7" reels with 20, 50, 100 or 200 devices<br>13" reels with 3K devices |
| <b>Suggested Layout for PCB Design</b>                          | PL-181                                                                       |
| <b>Evaluation Board</b>                                         | TB-342                                                                       |
| <b>Environmental Ratings</b>                                    | ENV33T1                                                                      |

**ESD Rating**

Human Body Model (HBM): Class 1C (1000 to <2000V) in accordance with MIL-STD-883 method 3015

**MSL Rating**

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

**MSL Test Flow Chart****Additional Notes**

- Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
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# Digital Step Attenuator

# DAT-31R5A-SN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, Vss=-3.2V, TEMPERATURE=-40°C

| FREQUENCY<br>(MHz) | STEP ATTENUATION* AT TTL CONTROL STATE<br>(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                | 1.02                                           | 0.54             | 1.04             | 2.05             | 4.07             | 8.05             | 15.92           | 31.52             |
| 0.3                | 1.01                                           | 0.54             | 1.05             | 2.05             | 4.07             | 8.05             | 15.92           | 31.51             |
| 0.5                | 1.01                                           | 0.54             | 1.05             | 2.05             | 4.07             | 8.05             | 15.92           | 31.52             |
| 1                  | 1.01                                           | 0.54             | 1.05             | 2.05             | 4.07             | 8.05             | 15.92           | 31.50             |
| 5                  | 1.04                                           | 0.54             | 1.05             | 2.05             | 4.07             | 8.05             | 15.92           | 31.50             |
| 10                 | 1.04                                           | 0.54             | 1.05             | 2.05             | 4.07             | 8.05             | 15.92           | 31.52             |
| 50                 | 1.06                                           | 0.54             | 1.04             | 2.05             | 4.07             | 8.05             | 15.92           | 31.51             |
| 100                | 1.06                                           | 0.54             | 1.04             | 2.05             | 4.06             | 8.04             | 15.91           | 31.50             |
| 200                | 1.07                                           | 0.54             | 1.05             | 2.05             | 4.06             | 8.05             | 15.92           | 31.50             |
| 300                | 1.07                                           | 0.54             | 1.05             | 2.05             | 4.07             | 8.06             | 15.93           | 31.51             |
| 400                | 1.07                                           | 0.55             | 1.05             | 2.05             | 4.08             | 8.07             | 15.94           | 31.52             |
| 500                | 1.08                                           | 0.55             | 1.05             | 2.06             | 4.08             | 8.07             | 15.95           | 31.53             |
| 600                | 1.10                                           | 0.54             | 1.05             | 2.05             | 4.07             | 8.07             | 15.95           | 31.51             |
| 700                | 1.12                                           | 0.55             | 1.05             | 2.05             | 4.08             | 8.07             | 15.95           | 31.50             |
| 800                | 1.15                                           | 0.54             | 1.05             | 2.05             | 4.07             | 8.08             | 15.96           | 31.49             |
| 900                | 1.18                                           | 0.55             | 1.05             | 2.06             | 4.08             | 8.08             | 15.97           | 31.53             |
| 1000               | 1.20                                           | 0.55             | 1.05             | 2.06             | 4.08             | 8.10             | 15.99           | 31.57             |
| 1100               | 1.21                                           | 0.55             | 1.05             | 2.06             | 4.09             | 8.11             | 16.02           | 31.59             |
| 1200               | 1.23                                           | 0.55             | 1.05             | 2.07             | 4.09             | 8.13             | 16.04           | 31.64             |
| 1300               | 1.25                                           | 0.55             | 1.06             | 2.07             | 4.10             | 8.14             | 16.07           | 31.68             |
| 1400               | 1.27                                           | 0.55             | 1.06             | 2.07             | 4.11             | 8.16             | 16.11           | 31.77             |
| 1500               | 1.30                                           | 0.55             | 1.06             | 2.08             | 4.11             | 8.18             | 16.13           | 31.75             |
| 1600               | 1.32                                           | 0.55             | 1.06             | 2.08             | 4.12             | 8.20             | 16.17           | 31.86             |
| 1700               | 1.35                                           | 0.56             | 1.07             | 2.08             | 4.13             | 8.22             | 16.21           | 31.89             |
| 1800               | 1.36                                           | 0.56             | 1.07             | 2.09             | 4.14             | 8.24             | 16.25           | 31.94             |
| 1900               | 1.37                                           | 0.56             | 1.08             | 2.10             | 4.16             | 8.28             | 16.31           | 31.95             |
| 2000               | 1.38                                           | 0.57             | 1.08             | 2.11             | 4.17             | 8.32             | 16.36           | 31.89             |
| 2100               | 1.40                                           | 0.57             | 1.09             | 2.12             | 4.19             | 8.35             | 16.41           | 31.88             |
| 2200               | 1.42                                           | 0.57             | 1.09             | 2.13             | 4.20             | 8.39             | 16.47           | 31.88             |
| 2300               | 1.44                                           | 0.57             | 1.09             | 2.14             | 4.22             | 8.43             | 16.51           | 31.80             |
| 2400               | 1.45                                           | 0.57             | 1.10             | 2.14             | 4.23             | 8.46             | 16.55           | 31.72             |
| 2500               | 1.46                                           | 0.58             | 1.10             | 2.15             | 4.24             | 8.50             | 16.61           | 31.67             |
| 2600               | 1.48                                           | 0.58             | 1.10             | 2.16             | 4.26             | 8.53             | 16.63           | 31.34             |
| 2700               | 1.50                                           | 0.58             | 1.10             | 2.16             | 4.26             | 8.56             | 16.67           | 31.31             |
| 2800               | 1.52                                           | 0.58             | 1.10             | 2.16             | 4.26             | 8.58             | 16.68           | 31.18             |
| 2900               | 1.53                                           | 0.57             | 1.09             | 2.15             | 4.25             | 8.58             | 16.68           | 30.99             |
| 3000               | 1.53                                           | 0.57             | 1.08             | 2.14             | 4.24             | 8.58             | 16.68           | 30.98             |
| 3200               | 1.52                                           | 0.56             | 1.07             | 2.12             | 4.20             | 8.57             | 16.67           | 30.83             |
| 3400               | 1.55                                           | 0.55             | 1.05             | 2.10             | 4.17             | 8.57             | 16.74           | 31.35             |
| 3600               | 1.62                                           | 0.55             | 1.05             | 2.09             | 4.16             | 8.61             | 16.92           | 31.81             |
| 3800               | 1.70                                           | 0.55             | 1.05             | 2.09             | 4.17             | 8.68             | 17.17           | 31.84             |
| 4000               | 1.76                                           | 0.55             | 1.05             | 2.10             | 4.18             | 8.74             | 17.27           | 30.68             |
| 4200               | 1.77                                           | 0.56             | 1.07             | 2.11             | 4.20             | 8.82             | 17.37           | 29.73             |
| 4400               | 1.84                                           | 0.57             | 1.08             | 2.13             | 4.23             | 8.91             | 17.46           | 29.18             |
| 4600               | 1.89                                           | 0.58             | 1.10             | 2.15             | 4.27             | 9.03             | 17.64           | 29.09             |
| 4800               | 1.94                                           | 0.59             | 1.12             | 2.17             | 4.32             | 9.20             | 17.91           | 29.35             |
| 5000               | 1.97                                           | 0.60             | 1.13             | 2.20             | 4.37             | 9.37             | 18.10           | 29.18             |

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



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# Digital Step Attenuator

# DAT-31R5A-SN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, Vss=-3.2V, 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                | 18.81                                          | 20.52            | 22.30            | 20.53            | 21.99            | 26.32            | 37.91           | 30.70             |
| 0.3                | 18.90                                          | 20.62            | 22.40            | 20.64            | 22.08            | 26.40            | 37.90           | 30.64             |
| 0.5                | 18.92                                          | 20.62            | 22.41            | 20.65            | 22.08            | 26.38            | 37.85           | 30.67             |
| 1                  | 19.05                                          | 20.78            | 22.58            | 20.76            | 22.17            | 26.52            | 37.61           | 30.58             |
| 5                  | 19.07                                          | 20.81            | 22.61            | 20.79            | 22.21            | 26.59            | 37.53           | 30.55             |
| 10                 | 19.06                                          | 20.80            | 22.60            | 20.79            | 22.21            | 26.55            | 37.65           | 30.60             |
| 50                 | 19.01                                          | 20.72            | 22.46            | 20.67            | 22.02            | 26.15            | 39.48           | 31.38             |
| 100                | 19.01                                          | 20.65            | 22.36            | 20.52            | 21.77            | 25.64            | 43.19           | 32.75             |
| 200                | 18.76                                          | 20.35            | 21.97            | 20.33            | 21.63            | 25.54            | 38.29           | 31.43             |
| 300                | 19.09                                          | 20.78            | 22.47            | 20.87            | 22.37            | 26.92            | 34.09           | 28.87             |
| 400                | 19.21                                          | 20.97            | 22.77            | 21.14            | 22.77            | 27.88            | 33.62           | 28.40             |
| 500                | 18.67                                          | 20.37            | 22.09            | 20.61            | 22.25            | 27.17            | 35.51           | 29.40             |
| 600                | 18.63                                          | 20.25            | 21.89            | 20.41            | 21.97            | 26.57            | 36.95           | 29.85             |
| 700                | 18.79                                          | 20.39            | 21.99            | 20.55            | 22.09            | 26.83            | 35.56           | 29.03             |
| 800                | 18.71                                          | 20.26            | 21.78            | 20.42            | 21.97            | 26.73            | 35.73           | 28.98             |
| 900                | 18.41                                          | 19.88            | 21.29            | 20.13            | 21.70            | 26.45            | 34.51           | 28.18             |
| 1000               | 18.22                                          | 19.65            | 20.99            | 20.00            | 21.68            | 26.73            | 32.37           | 26.91             |
| 1100               | 18.22                                          | 19.64            | 20.97            | 20.08            | 21.87            | 27.24            | 30.94           | 26.01             |
| 1200               | 18.27                                          | 19.67            | 20.97            | 20.11            | 21.94            | 27.56            | 30.30           | 25.54             |
| 1300               | 18.22                                          | 19.57            | 20.77            | 20.05            | 21.90            | 27.50            | 28.68           | 24.44             |
| 1400               | 18.74                                          | 20.09            | 21.24            | 20.61            | 22.58            | 28.47            | 26.54           | 23.06             |
| 1500               | 19.08                                          | 20.43            | 21.57            | 21.03            | 23.18            | 29.62            | 25.72           | 22.56             |
| 1600               | 19.01                                          | 20.32            | 21.39            | 20.98            | 23.18            | 29.68            | 25.29           | 22.23             |
| 1700               | 18.81                                          | 20.05            | 21.03            | 20.80            | 23.05            | 29.27            | 24.63           | 21.73             |
| 1800               | 18.62                                          | 19.77            | 20.64            | 20.64            | 22.90            | 28.35            | 23.45           | 20.83             |
| 1900               | 18.84                                          | 19.98            | 20.77            | 20.98            | 23.32            | 27.57            | 21.96           | 19.76             |
| 2000               | 19.38                                          | 20.59            | 21.35            | 21.69            | 24.15            | 27.25            | 21.01           | 19.12             |
| 2100               | 19.82                                          | 21.10            | 21.85            | 22.26            | 24.79            | 26.69            | 20.34           | 18.64             |
| 2200               | 20.36                                          | 21.72            | 22.44            | 22.96            | 25.50            | 25.95            | 19.67           | 18.17             |
| 2300               | 21.11                                          | 22.65            | 23.34            | 23.99            | 26.49            | 25.17            | 19.03           | 17.73             |
| 2400               | 21.70                                          | 23.37            | 24.02            | 24.77            | 27.00            | 24.37            | 18.51           | 17.34             |
| 2500               | 22.76                                          | 24.63            | 25.08            | 25.99            | 27.31            | 23.15            | 17.77           | 16.77             |
| 2600               | 24.63                                          | 27.05            | 27.01            | 28.30            | 27.70            | 21.92            | 16.98           | 16.18             |
| 2700               | 26.95                                          | 31.55            | 30.69            | 32.74            | 28.44            | 21.16            | 16.48           | 15.88             |
| 2800               | 28.09                                          | 37.71            | 35.59            | 39.83            | 28.63            | 20.67            | 16.17           | 15.74             |
| 2900               | 29.32                                          | 43.36            | 34.91            | 38.88            | 27.28            | 19.96            | 15.78           | 15.47             |
| 3000               | 29.33                                          | 35.56            | 31.64            | 34.09            | 26.15            | 19.46            | 15.50           | 15.29             |
| 3200               | 27.13                                          | 30.36            | 29.44            | 31.46            | 26.07            | 19.53            | 15.59           | 15.56             |
| 3400               | 29.70                                          | 32.55            | 29.76            | 33.43            | 26.86            | 20.05            | 15.96           | 15.90             |
| 3600               | 38.53                                          | 37.81            | 30.04            | 33.99            | 27.73            | 21.01            | 16.60           | 16.33             |
| 3800               | 30.04                                          | 30.19            | 27.74            | 28.34            | 27.29            | 22.54            | 17.63           | 17.00             |
| 4000               | 23.13                                          | 23.25            | 22.68            | 22.65            | 23.30            | 22.64            | 18.39           | 17.12             |
| 4200               | 19.57                                          | 19.76            | 19.52            | 19.50            | 20.33            | 21.24            | 18.33           | 16.56             |
| 4400               | 17.84                                          | 17.86            | 17.54            | 17.73            | 18.31            | 18.88            | 16.81           | 15.06             |
| 4600               | 17.44                                          | 17.41            | 16.98            | 17.26            | 17.64            | 17.69            | 15.67           | 14.04             |
| 4800               | 18.31                                          | 18.11            | 17.40            | 17.83            | 17.80            | 16.93            | 14.66           | 13.25             |
| 5000               | 20.99                                          | 20.06            | 18.64            | 19.32            | 18.31            | 16.00            | 13.48           | 12.43             |

# Digital Step Attenuator

# DAT-31R5A-SN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, Vss=-3.2V, 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                | 18.49                                           | 19.27            | 19.61            | 25.31            | 30.65            | 40.19            | 35.65           | 29.79             |
| 0.3                | 18.57                                           | 19.34            | 19.67            | 25.44            | 30.78            | 40.51            | 35.81           | 29.76             |
| 0.5                | 18.65                                           | 19.39            | 19.73            | 25.50            | 30.87            | 40.55            | 35.74           | 29.78             |
| 1                  | 18.77                                           | 19.51            | 19.83            | 25.68            | 31.08            | 40.99            | 35.90           | 29.68             |
| 5                  | 18.89                                           | 19.64            | 19.96            | 25.86            | 31.30            | 41.38            | 36.09           | 29.66             |
| 10                 | 18.90                                           | 19.65            | 19.98            | 25.87            | 31.30            | 41.32            | 36.05           | 29.74             |
| 50                 | 18.90                                           | 19.65            | 19.95            | 25.76            | 30.87            | 39.87            | 35.10           | 30.29             |
| 100                | 18.81                                           | 19.49            | 19.79            | 25.32            | 29.98            | 36.98            | 33.39           | 31.48             |
| 200                | 18.67                                           | 19.35            | 19.66            | 24.91            | 29.07            | 34.81            | 33.09           | 30.24             |
| 300                | 18.53                                           | 19.25            | 19.60            | 24.83            | 29.01            | 34.75            | 34.52           | 28.49             |
| 400                | 18.90                                           | 19.67            | 20.02            | 25.55            | 29.84            | 35.15            | 36.49           | 27.12             |
| 500                | 19.49                                           | 20.29            | 20.64            | 26.71            | 31.51            | 37.43            | 41.44           | 26.66             |
| 600                | 19.59                                           | 20.32            | 20.64            | 26.59            | 31.10            | 38.44            | 40.95           | 27.32             |
| 700                | 19.23                                           | 19.94            | 20.24            | 25.54            | 29.23            | 35.13            | 38.17           | 27.07             |
| 800                | 19.32                                           | 19.98            | 20.27            | 25.27            | 28.28            | 33.21            | 37.32           | 26.28             |
| 900                | 19.28                                           | 19.91            | 20.20            | 24.70            | 27.14            | 31.28            | 36.15           | 25.23             |
| 1000               | 19.34                                           | 19.96            | 20.27            | 24.42            | 26.48            | 30.06            | 35.67           | 24.15             |
| 1100               | 19.43                                           | 20.08            | 20.42            | 24.53            | 26.48            | 29.88            | 35.97           | 23.61             |
| 1200               | 19.49                                           | 20.12            | 20.47            | 24.39            | 26.15            | 29.43            | 35.34           | 23.19             |
| 1300               | 19.30                                           | 19.94            | 20.33            | 24.03            | 25.75            | 29.04            | 34.53           | 22.83             |
| 1400               | 18.80                                           | 19.45            | 19.87            | 23.48            | 25.32            | 28.86            | 34.11           | 22.63             |
| 1500               | 18.49                                           | 19.12            | 19.55            | 23.03            | 24.80            | 28.38            | 33.33           | 22.31             |
| 1600               | 18.26                                           | 18.87            | 19.28            | 22.44            | 23.99            | 27.29            | 31.63           | 21.72             |
| 1700               | 17.96                                           | 18.54            | 18.95            | 21.76            | 23.08            | 26.07            | 29.79           | 21.00             |
| 1800               | 17.57                                           | 18.14            | 18.56            | 21.02            | 22.16            | 24.76            | 27.71           | 20.14             |
| 1900               | 17.41                                           | 18.00            | 18.44            | 20.72            | 21.68            | 23.81            | 26.00           | 19.37             |
| 2000               | 17.56                                           | 18.18            | 18.64            | 20.88            | 21.63            | 23.34            | 24.89           | 18.88             |
| 2100               | 17.71                                           | 18.34            | 18.80            | 20.99            | 21.54            | 22.89            | 24.01           | 18.46             |
| 2200               | 17.91                                           | 18.56            | 19.01            | 21.08            | 21.36            | 22.33            | 23.07           | 17.98             |
| 2300               | 18.34                                           | 19.01            | 19.47            | 21.40            | 21.31            | 21.79            | 22.12           | 17.52             |
| 2400               | 18.85                                           | 19.54            | 20.00            | 21.70            | 21.22            | 21.25            | 21.26           | 17.10             |
| 2500               | 19.35                                           | 20.10            | 20.56            | 22.08            | 21.21            | 20.80            | 20.50           | 16.75             |
| 2600               | 20.19                                           | 21.06            | 21.58            | 23.00            | 21.52            | 20.48            | 19.80           | 16.47             |
| 2700               | 21.35                                           | 22.48            | 23.10            | 24.60            | 22.12            | 20.30            | 19.28           | 16.33             |
| 2800               | 22.73                                           | 24.25            | 25.10            | 26.61            | 22.78            | 20.18            | 18.85           | 16.30             |
| 2900               | 23.25                                           | 25.22            | 26.41            | 29.25            | 23.69            | 20.24            | 18.58           | 16.41             |
| 3000               | 23.12                                           | 25.30            | 26.77            | 33.00            | 24.81            | 20.47            | 18.53           | 16.70             |
| 3200               | 21.93                                           | 23.89            | 25.17            | 36.15            | 26.87            | 21.02            | 18.57           | 17.47             |
| 3400               | 20.45                                           | 21.98            | 22.91            | 31.01            | 28.48            | 21.54            | 18.68           | 18.48             |
| 3600               | 19.50                                           | 20.77            | 21.46            | 28.06            | 29.09            | 21.99            | 18.84           | 19.62             |
| 3800               | 19.17                                           | 20.31            | 20.87            | 26.63            | 28.73            | 22.15            | 18.88           | 20.64             |
| 4000               | 20.69                                           | 21.88            | 22.40            | 29.90            | 31.20            | 22.87            | 19.24           | 20.93             |
| 4200               | 23.64                                           | 25.12            | 25.76            | 33.93            | 29.31            | 22.08            | 18.57           | 19.67             |
| 4400               | 27.55                                           | 29.76            | 30.97            | 30.41            | 25.63            | 20.72            | 17.58           | 18.02             |
| 4600               | 34.41                                           | 41.00            | 47.97            | 24.94            | 21.94            | 18.33            | 15.75           | 16.13             |
| 4800               | 35.29                                           | 35.41            | 33.77            | 22.02            | 19.57            | 16.33            | 14.09           | 14.58             |
| 5000               | 27.81                                           | 27.39            | 26.76            | 19.94            | 17.82            | 14.68            | 12.65           | 13.36             |

# Digital Step Attenuator

# DAT-31R5A-SN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, Vss=-3.2V, TEMPERATURE=+25°C

| FREQUENCY<br>(MHz) | STEP ATTENUATION* AT TTL CONTROL STATE<br>(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                | 1.13                                           | 0.53             | 1.02             | 2.01             | 4.01             | 7.94             | 15.83           | 31.28             |
| 0.3                | 1.12                                           | 0.53             | 1.02             | 2.01             | 4.01             | 7.94             | 15.83           | 31.30             |
| 0.5                | 1.12                                           | 0.52             | 1.02             | 2.01             | 4.01             | 7.94             | 15.83           | 31.30             |
| 1                  | 1.12                                           | 0.52             | 1.02             | 2.01             | 4.01             | 7.93             | 15.83           | 31.28             |
| 5                  | 1.15                                           | 0.53             | 1.02             | 2.01             | 4.01             | 7.94             | 15.83           | 31.28             |
| 10                 | 1.15                                           | 0.53             | 1.02             | 2.01             | 4.01             | 7.94             | 15.83           | 31.30             |
| 50                 | 1.16                                           | 0.53             | 1.02             | 2.01             | 4.01             | 7.94             | 15.83           | 31.29             |
| 100                | 1.16                                           | 0.53             | 1.02             | 2.01             | 4.01             | 7.94             | 15.83           | 31.29             |
| 200                | 1.16                                           | 0.52             | 1.02             | 2.01             | 4.01             | 7.94             | 15.83           | 31.29             |
| 300                | 1.17                                           | 0.52             | 1.02             | 2.01             | 4.00             | 7.94             | 15.83           | 31.29             |
| 400                | 1.18                                           | 0.52             | 1.02             | 2.01             | 4.00             | 7.94             | 15.84           | 31.29             |
| 500                | 1.19                                           | 0.52             | 1.02             | 2.01             | 4.01             | 7.94             | 15.85           | 31.30             |
| 600                | 1.21                                           | 0.53             | 1.02             | 2.01             | 4.01             | 7.95             | 15.85           | 31.30             |
| 700                | 1.22                                           | 0.52             | 1.02             | 2.01             | 4.01             | 7.95             | 15.86           | 31.30             |
| 800                | 1.24                                           | 0.52             | 1.02             | 2.01             | 4.01             | 7.96             | 15.86           | 31.31             |
| 900                | 1.26                                           | 0.52             | 1.02             | 2.01             | 4.01             | 7.96             | 15.88           | 31.34             |
| 1000               | 1.29                                           | 0.52             | 1.02             | 2.01             | 4.01             | 7.97             | 15.89           | 31.37             |
| 1100               | 1.31                                           | 0.53             | 1.02             | 2.01             | 4.01             | 7.98             | 15.91           | 31.41             |
| 1200               | 1.34                                           | 0.53             | 1.02             | 2.01             | 4.01             | 7.98             | 15.92           | 31.45             |
| 1300               | 1.36                                           | 0.53             | 1.02             | 2.01             | 4.01             | 7.99             | 15.95           | 31.51             |
| 1400               | 1.38                                           | 0.53             | 1.02             | 2.02             | 4.02             | 8.01             | 15.97           | 31.56             |
| 1500               | 1.41                                           | 0.53             | 1.02             | 2.02             | 4.02             | 8.02             | 16.00           | 31.62             |
| 1600               | 1.43                                           | 0.53             | 1.03             | 2.02             | 4.03             | 8.04             | 16.04           | 31.69             |
| 1700               | 1.46                                           | 0.53             | 1.03             | 2.03             | 4.04             | 8.06             | 16.08           | 31.77             |
| 1800               | 1.48                                           | 0.53             | 1.03             | 2.04             | 4.05             | 8.08             | 16.12           | 31.82             |
| 1900               | 1.50                                           | 0.54             | 1.04             | 2.04             | 4.06             | 8.11             | 16.18           | 31.88             |
| 2000               | 1.51                                           | 0.54             | 1.04             | 2.05             | 4.07             | 8.15             | 16.23           | 31.92             |
| 2100               | 1.53                                           | 0.54             | 1.05             | 2.06             | 4.09             | 8.19             | 16.29           | 31.93             |
| 2200               | 1.55                                           | 0.55             | 1.05             | 2.07             | 4.11             | 8.23             | 16.35           | 31.92             |
| 2300               | 1.56                                           | 0.55             | 1.06             | 2.08             | 4.12             | 8.27             | 16.41           | 31.87             |
| 2400               | 1.57                                           | 0.55             | 1.06             | 2.09             | 4.14             | 8.31             | 16.46           | 31.82             |
| 2500               | 1.58                                           | 0.55             | 1.06             | 2.10             | 4.15             | 8.34             | 16.51           | 31.73             |
| 2600               | 1.60                                           | 0.55             | 1.06             | 2.10             | 4.16             | 8.38             | 16.55           | 31.58             |
| 2700               | 1.62                                           | 0.55             | 1.06             | 2.10             | 4.16             | 8.40             | 16.57           | 31.42             |
| 2800               | 1.64                                           | 0.55             | 1.05             | 2.10             | 4.15             | 8.41             | 16.59           | 31.26             |
| 2900               | 1.65                                           | 0.55             | 1.05             | 2.09             | 4.14             | 8.42             | 16.58           | 31.14             |
| 3000               | 1.66                                           | 0.54             | 1.04             | 2.08             | 4.13             | 8.42             | 16.58           | 31.07             |
| 3200               | 1.64                                           | 0.53             | 1.02             | 2.06             | 4.10             | 8.42             | 16.61           | 31.14             |
| 3400               | 1.68                                           | 0.53             | 1.01             | 2.04             | 4.07             | 8.43             | 16.69           | 31.58             |
| 3600               | 1.75                                           | 0.52             | 1.01             | 2.04             | 4.07             | 8.48             | 16.89           | 32.17             |
| 3800               | 1.83                                           | 0.52             | 1.01             | 2.04             | 4.08             | 8.55             | 17.11           | 31.95             |
| 4000               | 1.88                                           | 0.53             | 1.02             | 2.06             | 4.10             | 8.62             | 17.25           | 30.82             |
| 4200               | 1.91                                           | 0.53             | 1.03             | 2.07             | 4.11             | 8.68             | 17.31           | 29.81             |
| 4400               | 1.99                                           | 0.54             | 1.05             | 2.08             | 4.13             | 8.76             | 17.42           | 29.33             |
| 4600               | 2.03                                           | 0.55             | 1.06             | 2.10             | 4.17             | 8.88             | 17.65           | 29.40             |
| 4800               | 2.07                                           | 0.57             | 1.09             | 2.13             | 4.22             | 9.06             | 17.96           | 29.63             |
| 5000               | 2.13                                           | 0.58             | 1.10             | 2.16             | 4.27             | 9.25             | 18.21           | 29.56             |

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



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# Digital Step Attenuator

# DAT-31R5A-SN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, Vss=-3.2V, 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                | 17.93                                          | 19.15            | 20.30            | 18.41            | 18.88            | 20.71            | 28.31           | 33.69             |
| 0.3                | 18.02                                          | 19.23            | 20.39            | 18.48            | 18.94            | 20.75            | 28.39           | 33.78             |
| 0.5                | 18.02                                          | 19.22            | 20.39            | 18.49            | 18.94            | 20.75            | 28.39           | 33.72             |
| 1                  | 18.15                                          | 19.36            | 20.53            | 18.59            | 19.00            | 20.81            | 28.47           | 33.75             |
| 5                  | 18.17                                          | 19.39            | 20.55            | 18.61            | 19.04            | 20.84            | 28.47           | 33.80             |
| 10                 | 18.18                                          | 19.39            | 20.55            | 18.61            | 19.05            | 20.84            | 28.44           | 33.84             |
| 50                 | 18.17                                          | 19.37            | 20.54            | 18.61            | 19.03            | 20.80            | 28.34           | 33.57             |
| 100                | 18.30                                          | 19.52            | 20.68            | 18.72            | 19.13            | 20.91            | 28.47           | 33.73             |
| 200                | 18.25                                          | 19.45            | 20.60            | 18.69            | 19.09            | 20.88            | 28.33           | 33.43             |
| 300                | 18.29                                          | 19.48            | 20.63            | 18.71            | 19.11            | 20.89            | 28.25           | 33.29             |
| 400                | 18.36                                          | 19.55            | 20.69            | 18.75            | 19.14            | 20.89            | 28.17           | 33.12             |
| 500                | 18.30                                          | 19.46            | 20.60            | 18.71            | 19.12            | 20.88            | 28.10           | 33.01             |
| 600                | 18.28                                          | 19.44            | 20.54            | 18.68            | 19.09            | 20.87            | 27.94           | 32.72             |
| 700                | 18.15                                          | 19.27            | 20.33            | 18.54            | 18.95            | 20.71            | 27.54           | 31.88             |
| 800                | 18.09                                          | 19.19            | 20.21            | 18.46            | 18.87            | 20.63            | 27.32           | 31.22             |
| 900                | 18.02                                          | 19.08            | 20.06            | 18.41            | 18.85            | 20.66            | 27.40           | 30.80             |
| 1000               | 18.00                                          | 19.05            | 20.00            | 18.41            | 18.88            | 20.78            | 27.69           | 30.58             |
| 1100               | 17.92                                          | 18.91            | 19.82            | 18.37            | 18.89            | 20.88            | 27.98           | 30.24             |
| 1200               | 17.84                                          | 18.80            | 19.65            | 18.32            | 18.88            | 20.98            | 28.21           | 29.62             |
| 1300               | 17.69                                          | 18.60            | 19.39            | 18.26            | 18.91            | 21.19            | 28.76           | 28.96             |
| 1400               | 17.54                                          | 18.41            | 19.15            | 18.22            | 18.99            | 21.52            | 29.55           | 28.25             |
| 1500               | 17.38                                          | 18.21            | 18.90            | 18.19            | 19.10            | 21.92            | 30.45           | 27.56             |
| 1600               | 17.23                                          | 18.02            | 18.67            | 18.17            | 19.23            | 22.39            | 31.28           | 26.81             |
| 1700               | 17.14                                          | 17.90            | 18.51            | 18.23            | 19.44            | 23.02            | 32.02           | 26.05             |
| 1800               | 17.11                                          | 17.85            | 18.42            | 18.34            | 19.73            | 23.80            | 31.86           | 25.17             |
| 1900               | 17.10                                          | 17.85            | 18.40            | 18.51            | 20.08            | 24.68            | 30.69           | 24.25             |
| 2000               | 17.23                                          | 17.98            | 18.50            | 18.79            | 20.54            | 25.68            | 28.87           | 23.29             |
| 2100               | 17.60                                          | 18.36            | 18.84            | 19.32            | 21.27            | 26.94            | 26.80           | 22.28             |
| 2200               | 18.26                                          | 19.05            | 19.51            | 20.17            | 22.35            | 28.47            | 25.12           | 21.50             |
| 2300               | 19.07                                          | 19.95            | 20.39            | 21.17            | 23.61            | 29.59            | 23.79           | 20.89             |
| 2400               | 19.95                                          | 20.97            | 21.41            | 22.32            | 25.06            | 30.06            | 22.71           | 20.37             |
| 2500               | 21.39                                          | 22.63            | 23.01            | 24.14            | 27.30            | 29.09            | 21.47           | 19.73             |
| 2600               | 23.44                                          | 25.12            | 25.38            | 26.96            | 30.60            | 27.19            | 20.28           | 19.09             |
| 2700               | 25.94                                          | 28.77            | 28.97            | 31.30            | 35.22            | 25.55            | 19.41           | 18.68             |
| 2800               | 27.53                                          | 33.00            | 34.30            | 36.99            | 38.55            | 24.46            | 18.88           | 18.50             |
| 2900               | 28.21                                          | 36.25            | 41.28            | 40.58            | 36.37            | 23.81            | 18.61           | 18.45             |
| 3000               | 28.58                                          | 37.21            | 43.76            | 39.14            | 33.23            | 23.09            | 18.28           | 18.30             |
| 3200               | 27.27                                          | 31.46            | 33.11            | 31.98            | 29.40            | 22.09            | 17.82           | 18.23             |
| 3400               | 27.88                                          | 33.09            | 36.21            | 33.82            | 32.30            | 23.48            | 18.64           | 19.22             |
| 3600               | 31.60                                          | 43.37            | 39.26            | 39.30            | 46.08            | 26.04            | 19.83           | 20.20             |
| 3800               | 26.11                                          | 27.24            | 26.97            | 26.78            | 29.67            | 32.80            | 22.57           | 21.93             |
| 4000               | 20.93                                          | 21.14            | 20.99            | 21.25            | 22.80            | 28.19            | 24.42           | 21.36             |
| 4200               | 18.07                                          | 18.17            | 18.03            | 18.45            | 19.66            | 23.39            | 23.08           | 19.38             |
| 4400               | 16.40                                          | 16.40            | 16.16            | 16.73            | 17.69            | 20.16            | 20.00           | 16.97             |
| 4600               | 15.92                                          | 15.88            | 15.56            | 16.27            | 17.06            | 18.70            | 17.97           | 15.47             |
| 4800               | 16.97                                          | 16.67            | 16.04            | 17.00            | 17.42            | 17.71            | 16.10           | 14.22             |
| 5000               | 19.89                                          | 18.94            | 17.70            | 19.07            | 18.61            | 16.95            | 14.62           | 13.37             |

# Digital Step Attenuator

# DAT-31R5A-SN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, Vss=-3.2V, TEMPERATURE=+25°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                | 17.68                                           | 18.07            | 18.11            | 21.97            | 24.03            | 25.46            | 23.36           | 36.33             |
| 0.3                | 17.74                                           | 18.13            | 18.18            | 22.05            | 24.09            | 25.52            | 23.42           | 36.47             |
| 0.5                | 17.82                                           | 18.20            | 18.23            | 22.11            | 24.13            | 25.53            | 23.41           | 36.37             |
| 1                  | 17.92                                           | 18.31            | 18.33            | 22.22            | 24.25            | 25.66            | 23.49           | 36.47             |
| 5                  | 18.04                                           | 18.41            | 18.43            | 22.35            | 24.36            | 25.71            | 23.52           | 36.50             |
| 10                 | 18.06                                           | 18.43            | 18.44            | 22.36            | 24.34            | 25.67            | 23.50           | 36.45             |
| 50                 | 18.08                                           | 18.45            | 18.46            | 22.35            | 24.30            | 25.61            | 23.46           | 36.03             |
| 100                | 18.09                                           | 18.47            | 18.49            | 22.35            | 24.29            | 25.63            | 23.49           | 35.83             |
| 200                | 18.17                                           | 18.55            | 18.56            | 22.41            | 24.32            | 25.67            | 23.53           | 35.36             |
| 300                | 18.29                                           | 18.66            | 18.66            | 22.52            | 24.40            | 25.76            | 23.60           | 34.85             |
| 400                | 18.52                                           | 18.86            | 18.85            | 22.73            | 24.55            | 25.87            | 23.71           | 34.24             |
| 500                | 18.57                                           | 18.91            | 18.90            | 22.75            | 24.51            | 25.89            | 23.76           | 33.49             |
| 600                | 18.79                                           | 19.10            | 19.06            | 22.94            | 24.64            | 26.00            | 23.84           | 32.73             |
| 700                | 18.95                                           | 19.25            | 19.20            | 23.02            | 24.65            | 26.06            | 23.96           | 31.88             |
| 800                | 19.10                                           | 19.35            | 19.29            | 23.04            | 24.57            | 26.05            | 24.01           | 30.95             |
| 900                | 18.99                                           | 19.25            | 19.20            | 22.79            | 24.26            | 25.94            | 24.07           | 30.05             |
| 1000               | 18.83                                           | 19.08            | 19.04            | 22.45            | 23.90            | 25.77            | 24.12           | 29.06             |
| 1100               | 18.63                                           | 18.88            | 18.86            | 22.07            | 23.48            | 25.60            | 24.24           | 28.09             |
| 1200               | 18.41                                           | 18.65            | 18.66            | 21.63            | 23.01            | 25.43            | 24.47           | 27.04             |
| 1300               | 18.07                                           | 18.31            | 18.36            | 21.09            | 22.45            | 25.20            | 24.78           | 26.04             |
| 1400               | 17.65                                           | 17.91            | 18.01            | 20.48            | 21.85            | 24.95            | 25.23           | 25.04             |
| 1500               | 17.22                                           | 17.51            | 17.65            | 19.92            | 21.29            | 24.67            | 25.75           | 24.08             |
| 1600               | 16.84                                           | 17.15            | 17.33            | 19.41            | 20.77            | 24.40            | 26.47           | 23.17             |
| 1700               | 16.52                                           | 16.84            | 17.06            | 18.97            | 20.30            | 24.12            | 27.27           | 22.28             |
| 1800               | 16.27                                           | 16.61            | 16.86            | 18.63            | 19.93            | 23.88            | 28.17           | 21.53             |
| 1900               | 16.10                                           | 16.46            | 16.73            | 18.38            | 19.62            | 23.63            | 28.91           | 20.79             |
| 2000               | 16.04                                           | 16.43            | 16.73            | 18.26            | 19.45            | 23.45            | 29.43           | 20.16             |
| 2100               | 16.11                                           | 16.51            | 16.84            | 18.29            | 19.40            | 23.32            | 29.32           | 19.59             |
| 2200               | 16.38                                           | 16.80            | 17.14            | 18.52            | 19.53            | 23.30            | 28.69           | 19.14             |
| 2300               | 16.91                                           | 17.35            | 17.70            | 19.01            | 19.86            | 23.37            | 27.75           | 18.80             |
| 2400               | 17.62                                           | 18.08            | 18.43            | 19.67            | 20.31            | 23.47            | 26.59           | 18.54             |
| 2500               | 18.42                                           | 18.94            | 19.31            | 20.55            | 20.96            | 23.69            | 25.53           | 18.42             |
| 2600               | 19.44                                           | 20.05            | 20.46            | 21.81            | 21.89            | 23.96            | 24.51           | 18.38             |
| 2700               | 20.60                                           | 21.35            | 21.82            | 23.55            | 23.12            | 24.29            | 23.65           | 18.47             |
| 2800               | 21.91                                           | 22.87            | 23.43            | 25.93            | 24.67            | 24.58            | 22.88           | 18.67             |
| 2900               | 22.79                                           | 23.99            | 24.66            | 28.81            | 26.42            | 24.80            | 22.23           | 18.99             |
| 3000               | 22.89                                           | 24.27            | 25.02            | 33.25            | 28.84            | 25.10            | 21.72           | 19.49             |
| 3200               | 21.28                                           | 22.54            | 23.17            | 38.37            | 37.15            | 25.38            | 20.98           | 20.96             |
| 3400               | 19.77                                           | 20.73            | 21.15            | 29.42            | 35.68            | 25.08            | 20.49           | 23.21             |
| 3600               | 18.71                                           | 19.49            | 19.77            | 26.16            | 30.46            | 24.63            | 20.26           | 26.07             |
| 3800               | 19.05                                           | 19.74            | 19.90            | 26.28            | 29.97            | 24.92            | 20.46           | 28.31             |
| 4000               | 20.76                                           | 21.37            | 21.42            | 29.62            | 33.93            | 26.69            | 21.15           | 27.66             |
| 4200               | 23.51                                           | 24.08            | 24.10            | 35.53            | 37.33            | 28.86            | 21.66           | 24.38             |
| 4400               | 26.99                                           | 27.45            | 27.66            | 29.80            | 28.49            | 26.46            | 20.64           | 21.06             |
| 4600               | 30.70                                           | 30.93            | 31.59            | 25.07            | 23.81            | 22.04            | 18.22           | 18.31             |
| 4800               | 36.77                                           | 35.19            | 34.77            | 22.73            | 21.19            | 18.74            | 15.78           | 16.27             |
| 5000               | 33.49                                           | 31.40            | 29.97            | 21.06            | 19.29            | 16.29            | 13.78           | 14.69             |



# Digital Step Attenuator

# DAT-31R5A-SN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, Vss=-3.2V, TEMPERATURE=+105°C

| FREQUENCY<br>(MHz) | STEP ATTENUATION* AT TTL CONTROL STATE<br>(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                | 1.30                                           | 0.51             | 0.99             | 1.97             | 3.95             | 7.83             | 15.72           | 31.02             |
| 0.3                | 1.28                                           | 0.51             | 0.99             | 1.97             | 3.95             | 7.83             | 15.72           | 31.00             |
| 0.5                | 1.28                                           | 0.51             | 0.99             | 1.98             | 3.95             | 7.83             | 15.72           | 31.02             |
| 1                  | 1.29                                           | 0.51             | 0.99             | 1.98             | 3.95             | 7.83             | 15.73           | 31.01             |
| 5                  | 1.31                                           | 0.51             | 0.99             | 1.97             | 3.95             | 7.83             | 15.73           | 31.02             |
| 10                 | 1.31                                           | 0.51             | 0.99             | 1.98             | 3.95             | 7.83             | 15.73           | 31.02             |
| 50                 | 1.32                                           | 0.51             | 0.99             | 1.98             | 3.95             | 7.84             | 15.73           | 31.02             |
| 100                | 1.30                                           | 0.51             | 1.00             | 1.97             | 3.95             | 7.84             | 15.73           | 31.02             |
| 200                | 1.31                                           | 0.51             | 1.00             | 1.98             | 3.95             | 7.84             | 15.74           | 31.02             |
| 300                | 1.33                                           | 0.51             | 0.99             | 1.98             | 3.95             | 7.84             | 15.74           | 31.01             |
| 400                | 1.35                                           | 0.51             | 0.99             | 1.97             | 3.95             | 7.84             | 15.74           | 31.02             |
| 500                | 1.37                                           | 0.51             | 0.99             | 1.97             | 3.95             | 7.84             | 15.75           | 31.03             |
| 600                | 1.39                                           | 0.51             | 0.99             | 1.98             | 3.95             | 7.85             | 15.75           | 31.04             |
| 700                | 1.41                                           | 0.51             | 0.99             | 1.98             | 3.95             | 7.85             | 15.76           | 31.05             |
| 800                | 1.44                                           | 0.51             | 0.99             | 1.98             | 3.95             | 7.86             | 15.77           | 31.06             |
| 900                | 1.46                                           | 0.51             | 0.99             | 1.98             | 3.95             | 7.86             | 15.78           | 31.10             |
| 1000               | 1.49                                           | 0.50             | 0.99             | 1.98             | 3.95             | 7.87             | 15.79           | 31.15             |
| 1100               | 1.51                                           | 0.51             | 0.99             | 1.98             | 3.96             | 7.87             | 15.81           | 31.18             |
| 1200               | 1.54                                           | 0.51             | 0.99             | 1.98             | 3.95             | 7.88             | 15.82           | 31.24             |
| 1300               | 1.57                                           | 0.51             | 1.00             | 1.98             | 3.95             | 7.88             | 15.83           | 31.30             |
| 1400               | 1.59                                           | 0.51             | 1.00             | 1.98             | 3.95             | 7.89             | 15.86           | 31.41             |
| 1500               | 1.62                                           | 0.51             | 1.00             | 1.98             | 3.95             | 7.89             | 15.87           | 31.41             |
| 1600               | 1.65                                           | 0.51             | 1.00             | 1.98             | 3.96             | 7.91             | 15.91           | 31.56             |
| 1700               | 1.67                                           | 0.51             | 1.00             | 1.99             | 3.96             | 7.93             | 15.95           | 31.67             |
| 1800               | 1.70                                           | 0.51             | 1.00             | 1.99             | 3.97             | 7.94             | 15.99           | 31.75             |
| 1900               | 1.72                                           | 0.52             | 1.01             | 2.00             | 3.98             | 7.97             | 16.04           | 31.86             |
| 2000               | 1.73                                           | 0.52             | 1.01             | 2.00             | 3.98             | 7.99             | 16.09           | 31.85             |
| 2100               | 1.75                                           | 0.52             | 1.01             | 2.01             | 4.00             | 8.02             | 16.13           | 31.85             |
| 2200               | 1.77                                           | 0.52             | 1.02             | 2.02             | 4.01             | 8.06             | 16.19           | 31.86             |
| 2300               | 1.78                                           | 0.52             | 1.02             | 2.03             | 4.02             | 8.10             | 16.26           | 31.90             |
| 2400               | 1.79                                           | 0.53             | 1.02             | 2.04             | 4.03             | 8.13             | 16.31           | 31.84             |
| 2500               | 1.80                                           | 0.53             | 1.02             | 2.04             | 4.04             | 8.17             | 16.38           | 31.87             |
| 2600               | 1.82                                           | 0.53             | 1.03             | 2.05             | 4.05             | 8.20             | 16.41           | 31.56             |
| 2700               | 1.84                                           | 0.53             | 1.02             | 2.05             | 4.05             | 8.23             | 16.44           | 31.50             |
| 2800               | 1.86                                           | 0.53             | 1.02             | 2.05             | 4.05             | 8.25             | 16.47           | 31.42             |
| 2900               | 1.87                                           | 0.52             | 1.02             | 2.04             | 4.04             | 8.26             | 16.47           | 31.25             |
| 3000               | 1.87                                           | 0.52             | 1.01             | 2.03             | 4.03             | 8.27             | 16.49           | 31.27             |
| 3200               | 1.85                                           | 0.52             | 1.00             | 2.02             | 4.01             | 8.29             | 16.52           | 31.15             |
| 3400               | 1.90                                           | 0.51             | 0.98             | 2.00             | 3.99             | 8.31             | 16.63           | 31.84             |
| 3600               | 1.96                                           | 0.50             | 0.98             | 2.00             | 3.99             | 8.37             | 16.83           | 32.56             |
| 3800               | 2.04                                           | 0.50             | 0.98             | 2.01             | 4.01             | 8.44             | 17.05           | 32.23             |
| 4000               | 2.12                                           | 0.51             | 0.99             | 2.03             | 4.02             | 8.50             | 17.15           | 30.94             |
| 4200               | 2.18                                           | 0.51             | 1.00             | 2.04             | 4.03             | 8.54             | 17.22           | 30.02             |
| 4400               | 2.24                                           | 0.52             | 1.01             | 2.04             | 4.03             | 8.58             | 17.28           | 29.38             |
| 4600               | 2.28                                           | 0.53             | 1.03             | 2.06             | 4.06             | 8.70             | 17.54           | 29.61             |
| 4800               | 2.31                                           | 0.55             | 1.06             | 2.09             | 4.10             | 8.88             | 17.89           | 29.94             |
| 5000               | 2.39                                           | 0.56             | 1.08             | 2.12             | 4.16             | 9.08             | 18.23           | 30.06             |

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



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IF/RF MICROWAVE COMPONENTS

# Digital Step Attenuator

# DAT-31R5A-SN+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, Vss=-3.2V, TEMPERATURE=+105°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                | 16.71                                          | 17.44            | 18.11            | 16.13            | 15.90            | 16.45            | 19.66           | 21.42             |
| 0.3                | 16.78                                          | 17.52            | 18.18            | 16.19            | 15.94            | 16.48            | 19.69           | 21.43             |
| 0.5                | 16.77                                          | 17.52            | 18.18            | 16.18            | 15.94            | 16.48            | 19.67           | 21.40             |
| 1                  | 16.88                                          | 17.62            | 18.27            | 16.26            | 15.99            | 16.51            | 19.69           | 21.42             |
| 5                  | 16.91                                          | 17.65            | 18.30            | 16.29            | 16.02            | 16.53            | 19.71           | 21.44             |
| 10                 | 16.91                                          | 17.64            | 18.30            | 16.30            | 16.02            | 16.54            | 19.71           | 21.45             |
| 50                 | 17.03                                          | 17.78            | 18.45            | 16.44            | 16.17            | 16.71            | 19.95           | 21.72             |
| 100                | 17.31                                          | 18.10            | 18.80            | 16.74            | 16.49            | 17.08            | 20.48           | 22.38             |
| 200                | 17.25                                          | 18.06            | 18.77            | 16.76            | 16.55            | 17.18            | 20.58           | 22.55             |
| 300                | 16.90                                          | 17.64            | 18.28            | 16.33            | 16.08            | 16.59            | 19.60           | 21.34             |
| 400                | 17.03                                          | 17.73            | 18.34            | 16.31            | 15.96            | 16.35            | 19.17           | 20.81             |
| 500                | 17.23                                          | 17.90            | 18.49            | 16.41            | 16.02            | 16.37            | 19.12           | 20.75             |
| 600                | 17.17                                          | 17.82            | 18.37            | 16.32            | 15.91            | 16.24            | 18.89           | 20.47             |
| 700                | 16.99                                          | 17.60            | 18.13            | 16.13            | 15.71            | 16.00            | 18.53           | 20.02             |
| 800                | 17.00                                          | 17.58            | 18.06            | 16.08            | 15.64            | 15.92            | 18.39           | 19.79             |
| 900                | 16.99                                          | 17.54            | 18.00            | 16.10            | 15.68            | 15.97            | 18.42           | 19.77             |
| 1000               | 16.88                                          | 17.40            | 17.84            | 16.06            | 15.67            | 16.01            | 18.50           | 19.77             |
| 1100               | 16.66                                          | 17.17            | 17.59            | 15.98            | 15.66            | 16.08            | 18.60           | 19.79             |
| 1200               | 16.57                                          | 17.04            | 17.43            | 15.99            | 15.74            | 16.24            | 18.84           | 19.92             |
| 1300               | 16.44                                          | 16.91            | 17.29            | 16.03            | 15.89            | 16.51            | 19.25           | 20.23             |
| 1400               | 16.27                                          | 16.73            | 17.10            | 16.05            | 16.02            | 16.80            | 19.70           | 20.55             |
| 1500               | 16.02                                          | 16.48            | 16.84            | 16.02            | 16.14            | 17.12            | 20.24           | 20.87             |
| 1600               | 15.84                                          | 16.29            | 16.64            | 16.03            | 16.29            | 17.48            | 20.83           | 21.22             |
| 1700               | 15.74                                          | 16.19            | 16.55            | 16.11            | 16.51            | 17.95            | 21.61           | 21.70             |
| 1800               | 15.76                                          | 16.22            | 16.57            | 16.29            | 16.84            | 18.56            | 22.66           | 22.34             |
| 1900               | 15.77                                          | 16.24            | 16.59            | 16.48            | 17.20            | 19.26            | 23.89           | 22.92             |
| 2000               | 15.87                                          | 16.34            | 16.68            | 16.75            | 17.63            | 20.09            | 25.39           | 23.43             |
| 2100               | 16.06                                          | 16.55            | 16.87            | 17.09            | 18.15            | 21.07            | 27.30           | 23.89             |
| 2200               | 16.41                                          | 16.91            | 17.22            | 17.58            | 18.81            | 22.27            | 29.70           | 24.30             |
| 2300               | 17.01                                          | 17.54            | 17.82            | 18.32            | 19.75            | 23.98            | 33.24           | 24.72             |
| 2400               | 17.84                                          | 18.42            | 18.67            | 19.32            | 20.99            | 26.38            | 36.11           | 24.92             |
| 2500               | 18.91                                          | 19.55            | 19.76            | 20.57            | 22.50            | 29.63            | 33.32           | 24.68             |
| 2600               | 20.22                                          | 20.95            | 21.11            | 22.07            | 24.38            | 34.81            | 29.92           | 24.43             |
| 2700               | 22.06                                          | 23.01            | 23.09            | 24.22            | 27.15            | 51.44            | 27.00           | 23.97             |
| 2800               | 24.37                                          | 25.84            | 25.88            | 27.13            | 31.35            | 36.58            | 24.64           | 23.42             |
| 2900               | 27.13                                          | 29.76            | 29.64            | 30.87            | 37.68            | 30.53            | 22.89           | 22.69             |
| 3000               | 29.28                                          | 34.40            | 34.41            | 34.05            | 39.79            | 27.77            | 21.81           | 22.23             |
| 3200               | 28.43                                          | 34.26            | 46.68            | 31.08            | 30.93            | 24.80            | 20.51           | 22.04             |
| 3400               | 27.17                                          | 31.44            | 37.63            | 28.77            | 28.61            | 24.24            | 20.37           | 22.82             |
| 3600               | 27.15                                          | 31.09            | 35.41            | 27.92            | 28.57            | 26.48            | 22.10           | 26.12             |
| 3800               | 23.64                                          | 24.88            | 25.35            | 23.80            | 24.90            | 28.84            | 26.08           | 35.24             |
| 4000               | 19.52                                          | 19.85            | 19.84            | 19.79            | 20.86            | 25.93            | 36.38           | 28.91             |
| 4200               | 16.41                                          | 16.52            | 16.43            | 16.85            | 17.87            | 21.80            | 29.66           | 21.97             |
| 4400               | 14.80                                          | 14.82            | 14.64            | 15.35            | 16.32            | 19.53            | 23.26           | 18.37             |
| 4600               | 14.06                                          | 14.01            | 13.73            | 14.65            | 15.54            | 18.04            | 19.58           | 16.02             |
| 4800               | 14.90                                          | 14.68            | 14.18            | 15.42            | 16.19            | 17.78            | 17.53           | 14.83             |
| 5000               | 17.37                                          | 16.62            | 15.65            | 17.37            | 17.50            | 17.02            | 15.34           | 13.71             |



# Digital Step Attenuator

# DAT-31R5A-SN+

## Typical Performance Data

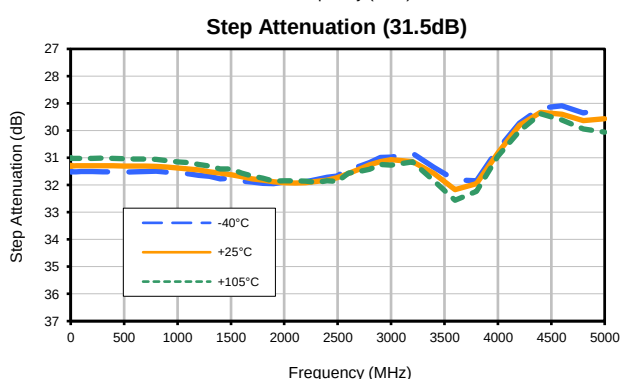
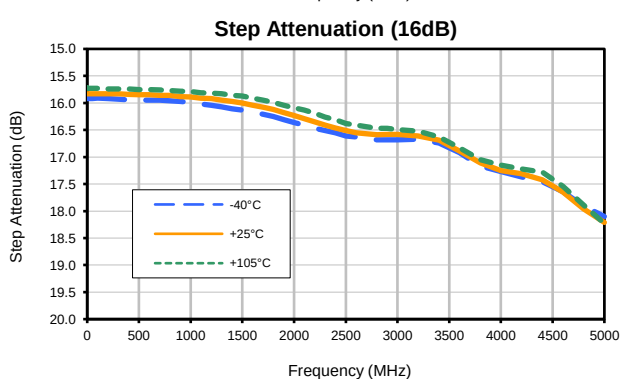
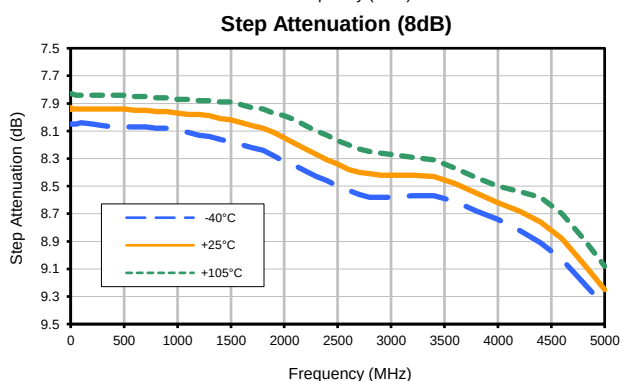
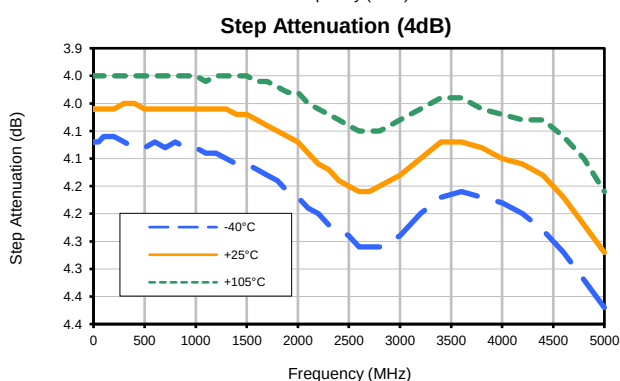
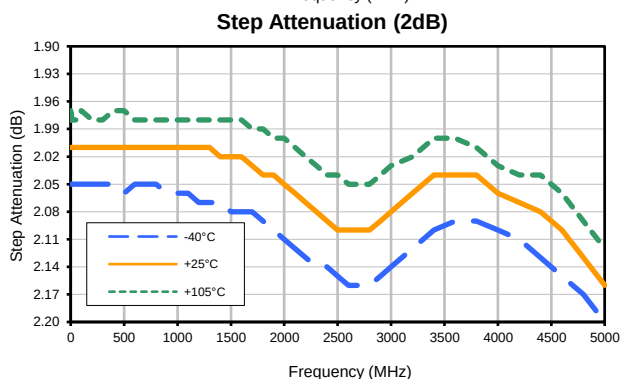
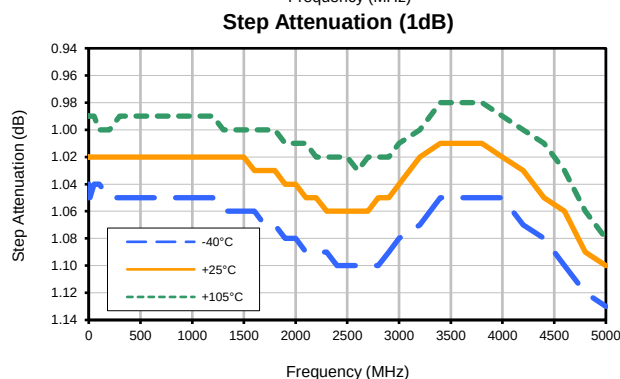
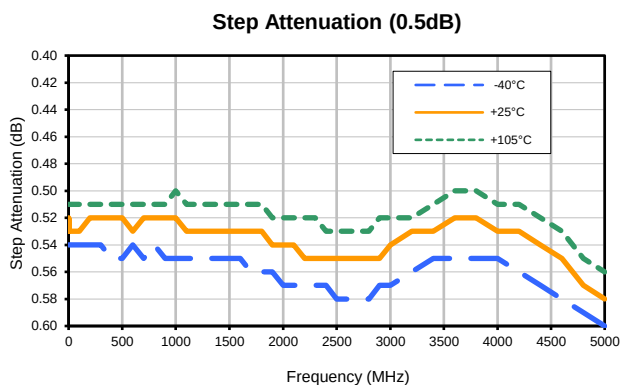
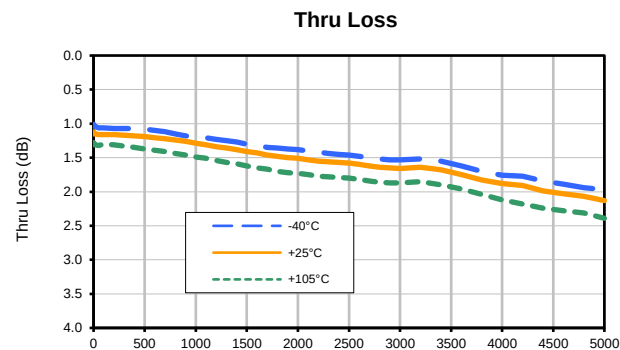
TEST CONDITIONS: INPUT POWER=0 dBm, Vdd=+3V, Vss=-3.2V, TEMPERATURE=+105°C

| 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                | 16.48                                           | 16.54            | 16.33            | 18.79            | 19.28            | 19.06            | 17.40           | 22.10             |
| 0.3                | 16.54                                           | 16.60            | 16.39            | 18.84            | 19.31            | 19.10            | 17.42           | 22.12             |
| 0.5                | 16.57                                           | 16.64            | 16.42            | 18.86            | 19.31            | 19.10            | 17.41           | 22.09             |
| 1                  | 16.67                                           | 16.72            | 16.49            | 18.93            | 19.37            | 19.13            | 17.44           | 22.11             |
| 5                  | 16.77                                           | 16.81            | 16.58            | 19.01            | 19.42            | 19.15            | 17.47           | 22.11             |
| 10                 | 16.79                                           | 16.82            | 16.59            | 19.03            | 19.45            | 19.17            | 17.48           | 22.12             |
| 50                 | 16.86                                           | 16.91            | 16.68            | 19.17            | 19.60            | 19.37            | 17.66           | 22.40             |
| 100                | 16.95                                           | 17.01            | 16.81            | 19.33            | 19.84            | 19.67            | 17.96           | 22.87             |
| 200                | 17.21                                           | 17.30            | 17.10            | 19.72            | 20.25            | 20.07            | 18.29           | 23.47             |
| 300                | 17.35                                           | 17.39            | 17.13            | 19.65            | 20.00            | 19.64            | 17.86           | 22.72             |
| 400                | 17.36                                           | 17.34            | 17.04            | 19.41            | 19.61            | 19.11            | 17.37           | 21.84             |
| 500                | 17.29                                           | 17.23            | 16.93            | 19.23            | 19.37            | 18.85            | 17.15           | 21.38             |
| 600                | 17.55                                           | 17.48            | 17.14            | 19.41            | 19.45            | 18.89            | 17.17           | 21.26             |
| 700                | 17.75                                           | 17.62            | 17.24            | 19.47            | 19.43            | 18.81            | 17.08           | 21.02             |
| 800                | 17.75                                           | 17.60            | 17.22            | 19.34            | 19.21            | 18.61            | 16.95           | 20.63             |
| 900                | 17.57                                           | 17.41            | 17.05            | 19.05            | 18.96            | 18.47            | 16.89           | 20.29             |
| 1000               | 17.39                                           | 17.25            | 16.91            | 18.79            | 18.75            | 18.40            | 16.92           | 20.04             |
| 1100               | 17.15                                           | 17.02            | 16.74            | 18.52            | 18.57            | 18.42            | 17.05           | 19.88             |
| 1200               | 16.84                                           | 16.76            | 16.52            | 18.20            | 18.34            | 18.43            | 17.22           | 19.72             |
| 1300               | 16.43                                           | 16.40            | 16.23            | 17.80            | 18.07            | 18.44            | 17.44           | 19.55             |
| 1400               | 16.08                                           | 16.08            | 15.98            | 17.43            | 17.83            | 18.53            | 17.75           | 19.39             |
| 1500               | 15.74                                           | 15.78            | 15.74            | 17.10            | 17.61            | 18.65            | 18.17           | 19.26             |
| 1600               | 15.47                                           | 15.56            | 15.56            | 16.85            | 17.45            | 18.85            | 18.70           | 19.19             |
| 1700               | 15.25                                           | 15.36            | 15.42            | 16.62            | 17.31            | 19.04            | 19.28           | 19.07             |
| 1800               | 15.06                                           | 15.21            | 15.30            | 16.43            | 17.19            | 19.28            | 20.00           | 18.95             |
| 1900               | 14.96                                           | 15.13            | 15.26            | 16.31            | 17.12            | 19.55            | 20.82           | 18.81             |
| 2000               | 14.95                                           | 15.14            | 15.30            | 16.27            | 17.11            | 19.90            | 21.87           | 18.69             |
| 2100               | 15.07                                           | 15.28            | 15.46            | 16.35            | 17.21            | 20.35            | 23.21           | 18.59             |
| 2200               | 15.33                                           | 15.56            | 15.76            | 16.57            | 17.43            | 20.93            | 24.86           | 18.56             |
| 2300               | 15.76                                           | 16.00            | 16.22            | 16.94            | 17.78            | 21.68            | 27.03           | 18.59             |
| 2400               | 16.38                                           | 16.64            | 16.87            | 17.50            | 18.31            | 22.64            | 30.07           | 18.70             |
| 2500               | 17.17                                           | 17.44            | 17.69            | 18.25            | 19.02            | 23.86            | 34.35           | 18.93             |
| 2600               | 18.18                                           | 18.48            | 18.73            | 19.27            | 19.98            | 25.47            | 38.75           | 19.31             |
| 2700               | 19.25                                           | 19.60            | 19.85            | 20.53            | 21.17            | 27.49            | 35.56           | 19.77             |
| 2800               | 20.46                                           | 20.87            | 21.12            | 22.17            | 22.72            | 30.26            | 31.07           | 20.40             |
| 2900               | 21.37                                           | 21.89            | 22.13            | 24.03            | 24.58            | 33.87            | 28.00           | 21.16             |
| 3000               | 22.01                                           | 22.65            | 22.88            | 26.47            | 27.13            | 37.14            | 25.65           | 22.16             |
| 3200               | 21.09                                           | 21.76            | 21.92            | 29.72            | 33.04            | 30.78            | 22.48           | 25.38             |
| 3400               | 19.14                                           | 19.66            | 19.74            | 26.13            | 28.71            | 25.57            | 20.53           | 31.08             |
| 3600               | 18.03                                           | 18.43            | 18.41            | 23.44            | 24.78            | 22.97            | 19.44           | 37.00             |
| 3800               | 18.20                                           | 18.47            | 18.33            | 22.95            | 23.58            | 22.26            | 19.30           | 31.01             |
| 4000               | 19.75                                           | 19.85            | 19.57            | 24.24            | 24.17            | 23.56            | 20.35           | 27.45             |
| 4200               | 22.14                                           | 21.98            | 21.64            | 25.41            | 25.08            | 27.54            | 22.61           | 24.92             |
| 4400               | 23.80                                           | 23.53            | 23.48            | 23.94            | 24.24            | 42.13            | 24.86           | 22.27             |
| 4600               | 24.09                                           | 24.06            | 24.53            | 21.80            | 22.38            | 29.67            | 22.36           | 19.75             |
| 4800               | 25.43                                           | 25.58            | 26.25            | 20.81            | 21.01            | 22.45            | 18.29           | 17.60             |
| 5000               | 30.58                                           | 29.97            | 29.83            | 20.67            | 20.08            | 18.53            | 15.25           | 15.92             |

# Digital Step Attenuator

## Typical Performance Curves

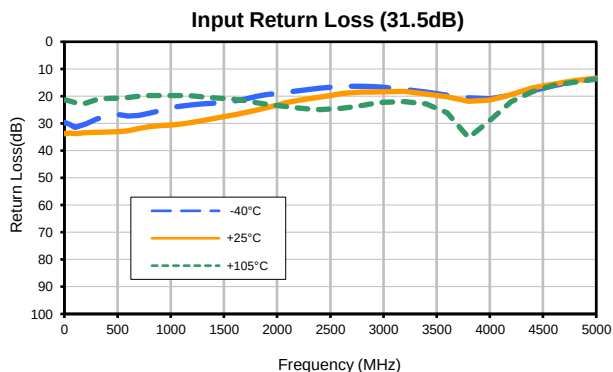
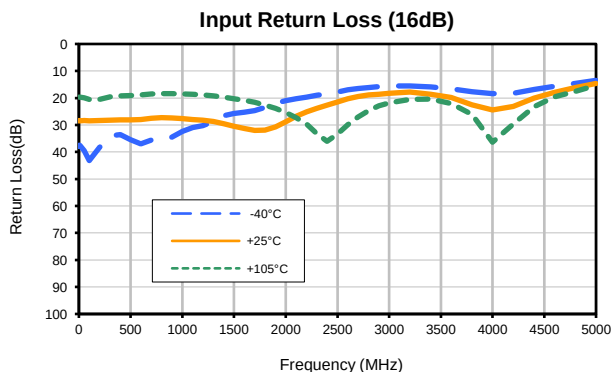
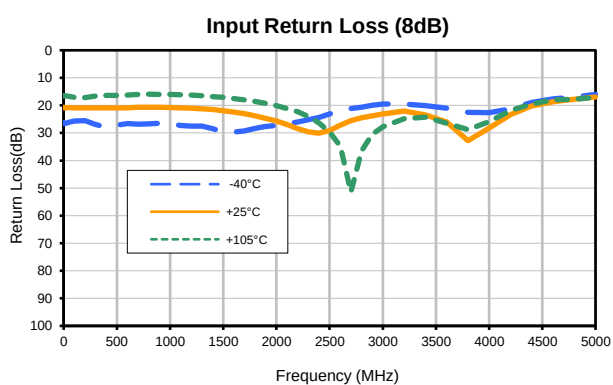
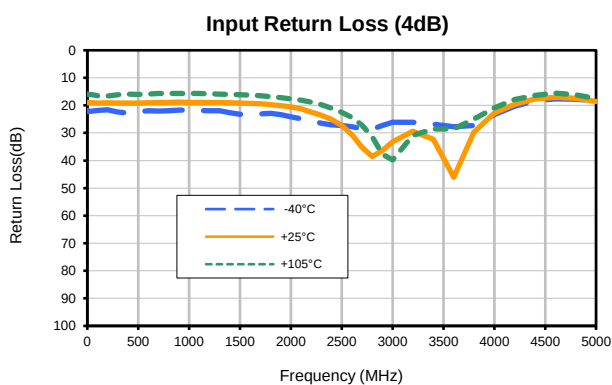
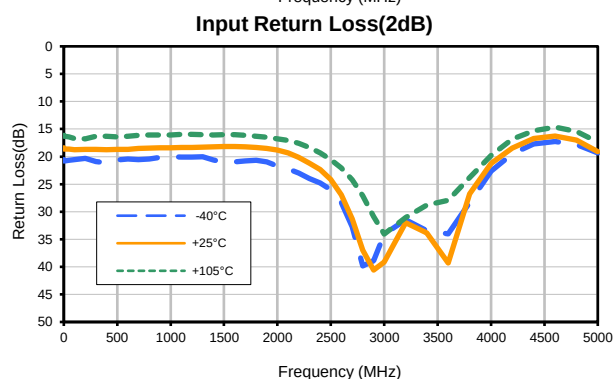
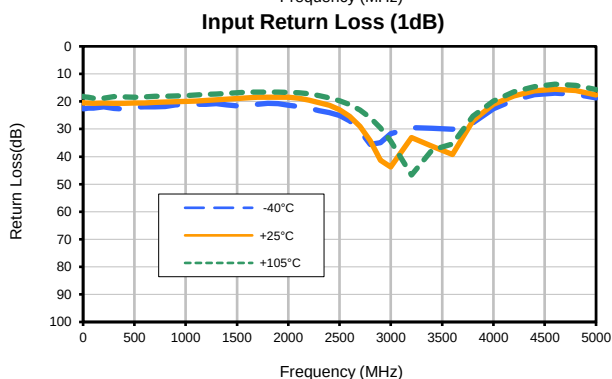
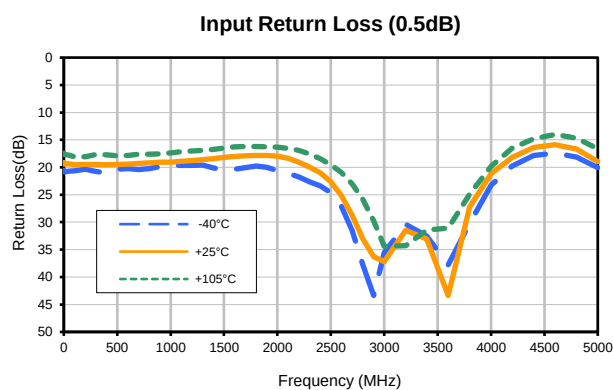
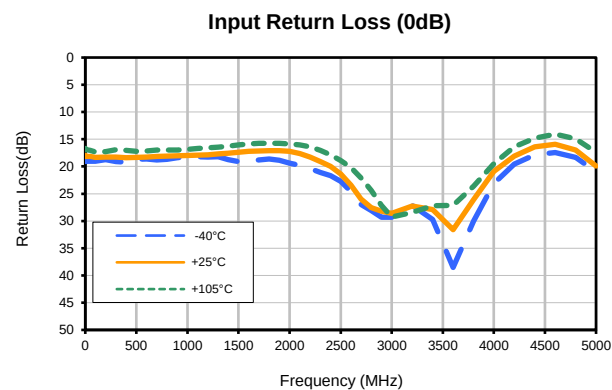
**DAT-31R5A-SN+**



# Digital Step Attenuator

## Typical Performance Curves

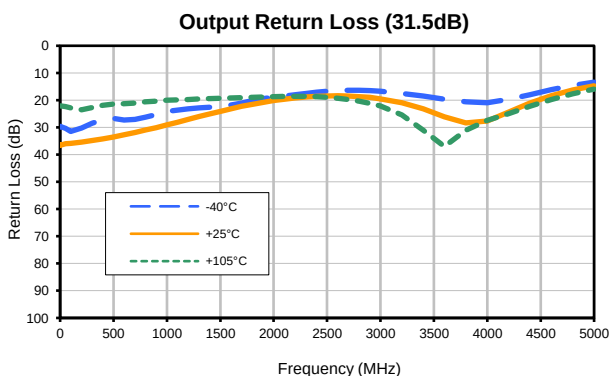
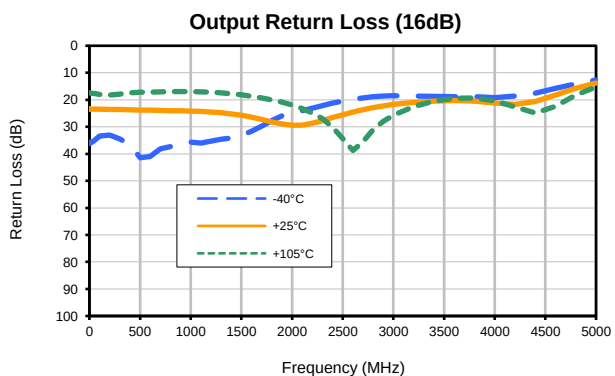
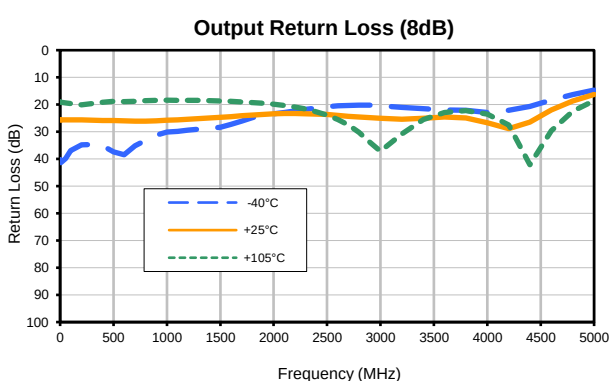
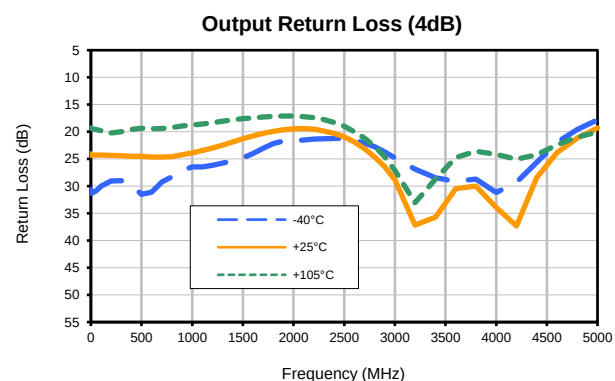
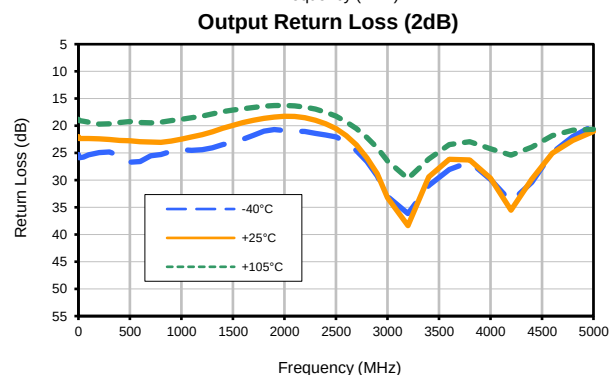
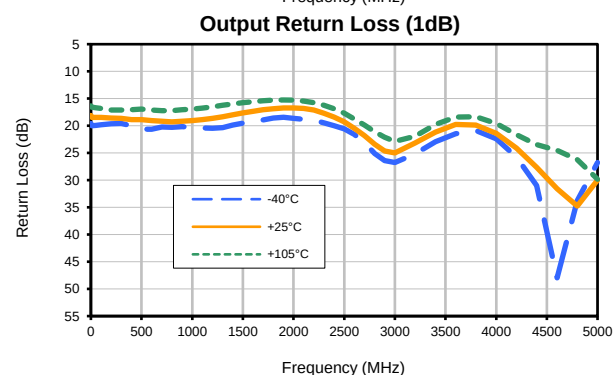
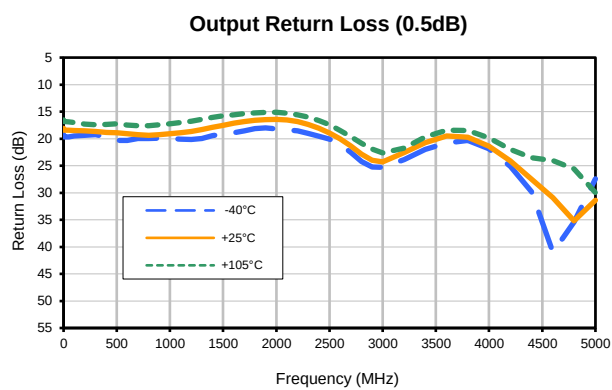
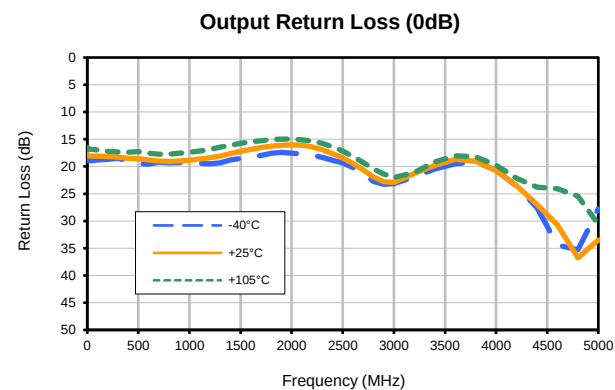
**DAT-31R5A-SN+**



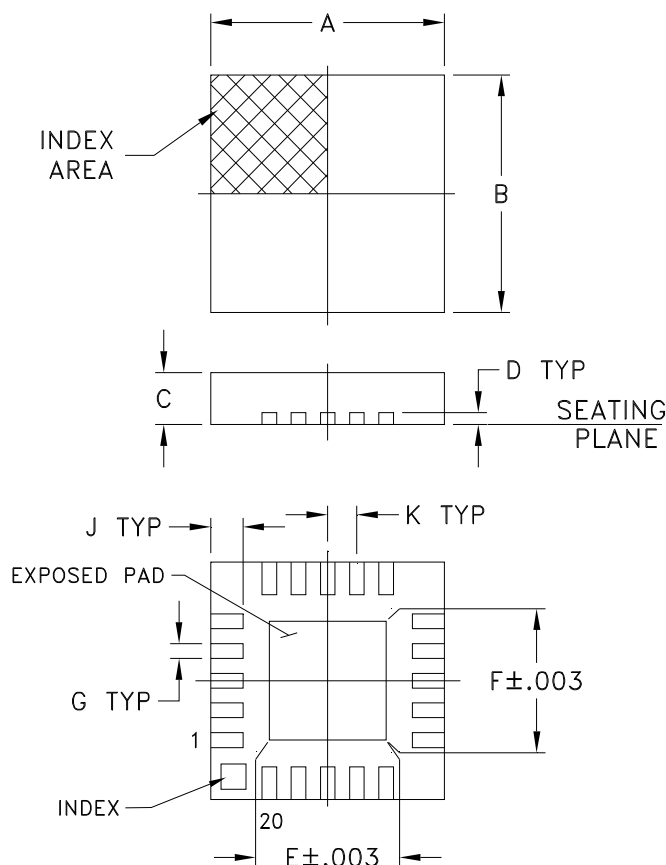
# Digital Step Attenuator

## Typical Performance Curves

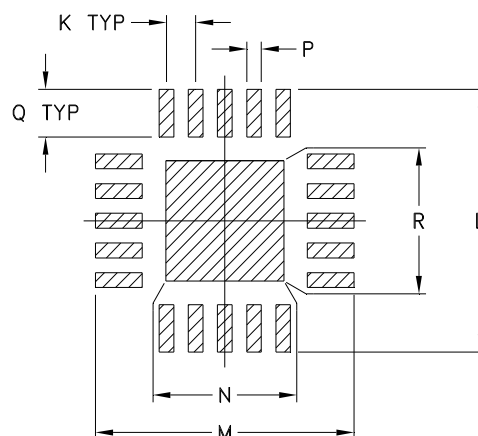
**DAT-31R5A-SN+**



### Outline Dimensions



### PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm .002$

| CASE #  | A              | B              | C              | D              | E              | F              | G              | H        | J              | K              |
|---------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------|----------------|----------------|
| DG983-2 | .157<br>(4.00) | .157<br>(4.00) | .033<br>(0.85) | .008<br>(0.20) | .085<br>(2.15) | .085<br>(2.15) | .009<br>(0.23) | --<br>-- | .022<br>(0.55) | .020<br>(0.50) |

| CASE #  | L              | M              | N              | P              | Q              | R              | WT. GRAM |
|---------|----------------|----------------|----------------|----------------|----------------|----------------|----------|
| DG983-2 | .177<br>(4.50) | .177<br>(4.50) | .081<br>(2.06) | .010<br>(0.25) | .032<br>(0.81) | .081<br>(2.06) | .04      |

Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .01$ ; 3 Pl.  $\pm .005$

#### Notes:

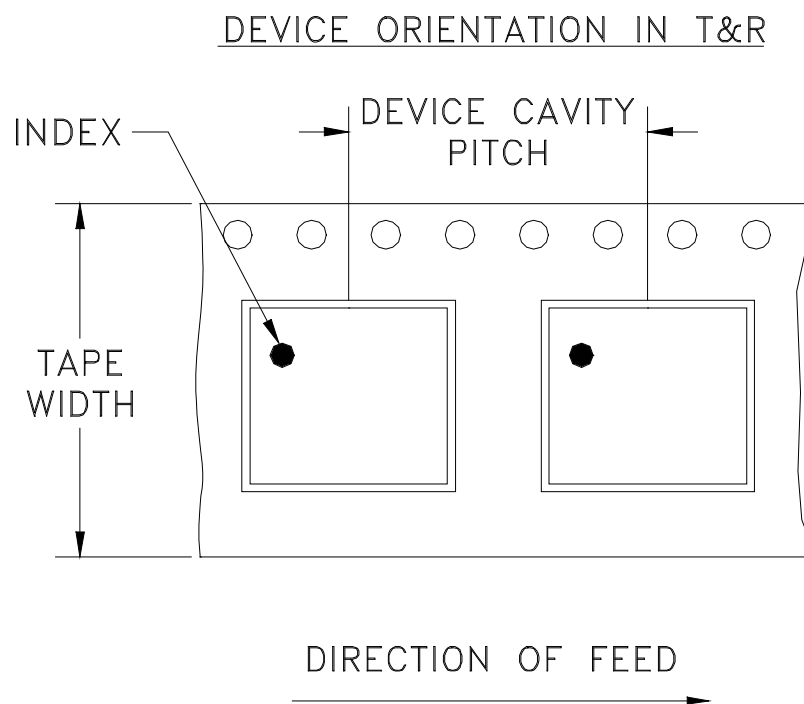
1. Case material: Plastic.
2. Termination finish:

For RoHS Case Styles: 0.2  $\mu$ inches of Gold (Au) over 0.1  $\mu$ inched of Palladium (Pd) over 10  $\mu$ inches of Nickel (Ni). All models, (+) suffix.

For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.



# Tape & Reel Packaging TR-F87



| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel                    |      |
|----------------|-------------------------|-------------------|-------------------------------------|------|
| 12             | 8                       | 7                 | Small quantity standards (see note) | 20   |
|                |                         |                   |                                     | 50   |
|                |                         |                   |                                     | 100  |
|                |                         |                   |                                     | 200  |
|                |                         |                   |                                     | 500  |
|                |                         |                   |                                     | 1000 |
|                |                         | 13                | Standard                            | 3000 |

**Note : Please Consult individual model data sheet to determine device per reel availability**

Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: [www.minicircuits.com/pages/pdfs/tape.pdf](http://www.minicircuits.com/pages/pdfs/tape.pdf)



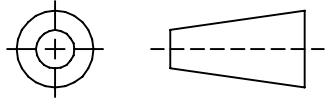
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## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No. | DESCRIPTION                                   | DATE  | DR | AUTH |
|-----|---------|-----------------------------------------------|-------|----|------|
| OR  | M96972  | NEW RELEASE (FROM RAVON)                      | 03/05 | DK | HH   |
| A   | M102713 | MODIFIED HATCH, NOTES & ADDED "...WITH SMOBC" | 01/06 | GT | IL   |
| B   | M103510 | ADD R7 & CHANGE LOCATION DESIGNATORS          | 07/09 | EM | KN   |
| B   | R63339  | ADD R7 & CHANGE LOCATION DESIGNATORS          | 07/09 | EM | KN   |

## SUGGESTED MOUNTING CONFIGURATION

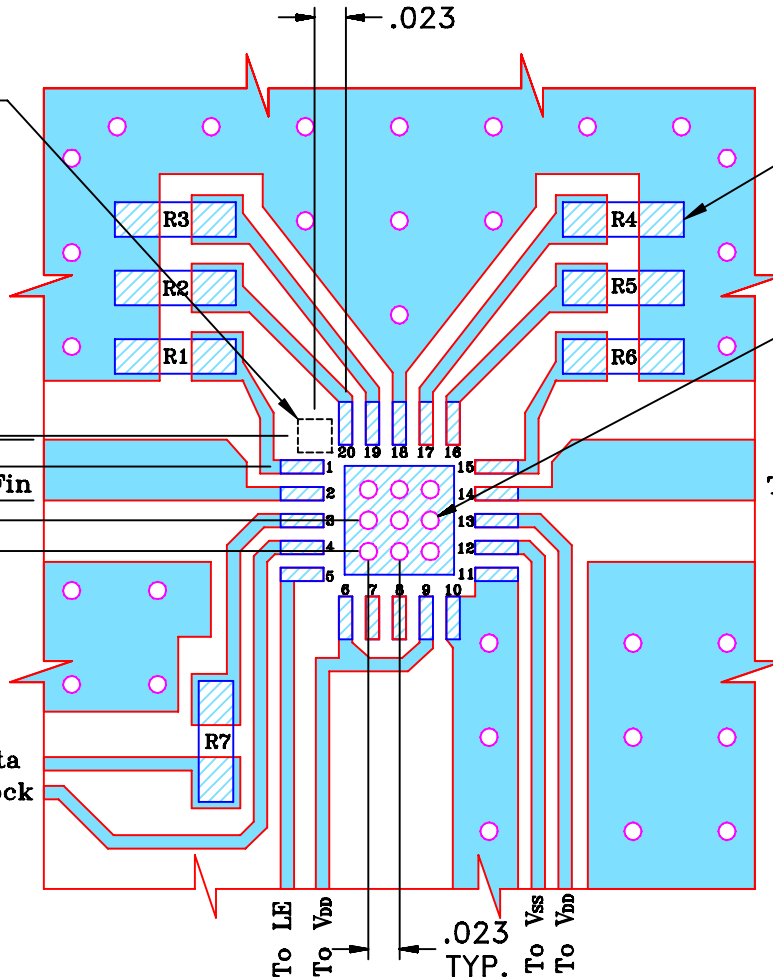
FOR DG983-1 CASE STYLE, qh PIN CONNECTIONS, 50 Ω.

KEEP-OUT ZONE,  
.025 X.025, AVOID  
TRACES IN THIS AREA  
TO PREVENT SHORT TO  
METAL INDEX ON BOTTOM  
SIDE OF COMPONENT

.045±.002  
LINE WIDTH  
2 PL.  
(SEE BELOW)

.023  
TYP.

To Data  
To Clock



NOTE 2

9xØ.013  
PLUGGED PTH  
FOR GROUND

To RFout

## NOTES:

- TRACE WIDTH IS SHOWN FOR FR4 WITH DIELECTRIC THICKNESS. .025"±.002". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
- 0603 SIZE CHIP FOOT PRINTS SHOWN FOR REFERENCE, VALUES OF RESISTORS WILL VARY BASED ON APPLICATION.
- BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

■ DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

■ DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED

INITIALS

DATE

DIMENSIONS ARE IN INCHES

DRAWN

DK (RAVON)

08 MAR 05

TOLERANCES ON:

CHECKED

RZ (RAVON)

08 MAR 05

2 PL DECIMALS ± .005

APPROVED

HH (RAVON)

08 MAR 05

ANGLES ±

FRACTIONS ±

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ASHEETA1.DWG REV:A DATE:01/12/95



Mini-Circuits® 13 Neptune Avenue  
Brooklyn NY 11235

PL, qh, DG983-1  
TB-342 (50 Ω)

SIZE

CODE IDENT

DRAWING NO:

REV:

A

15542

98-PL-181

B

FILE: 98PL181

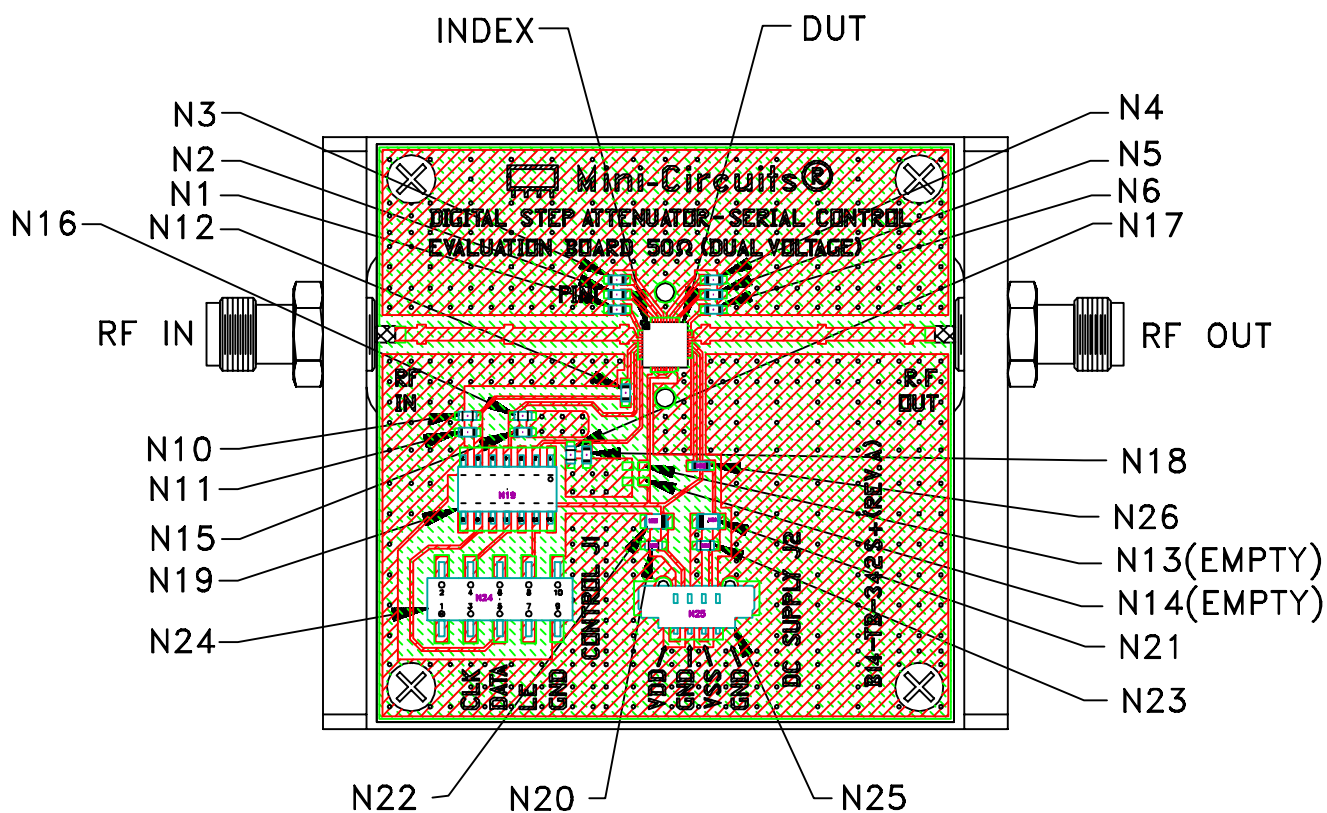
SCALE: 7:1

SHEET:

1 OF 1



# Evaluation Board and Circuit

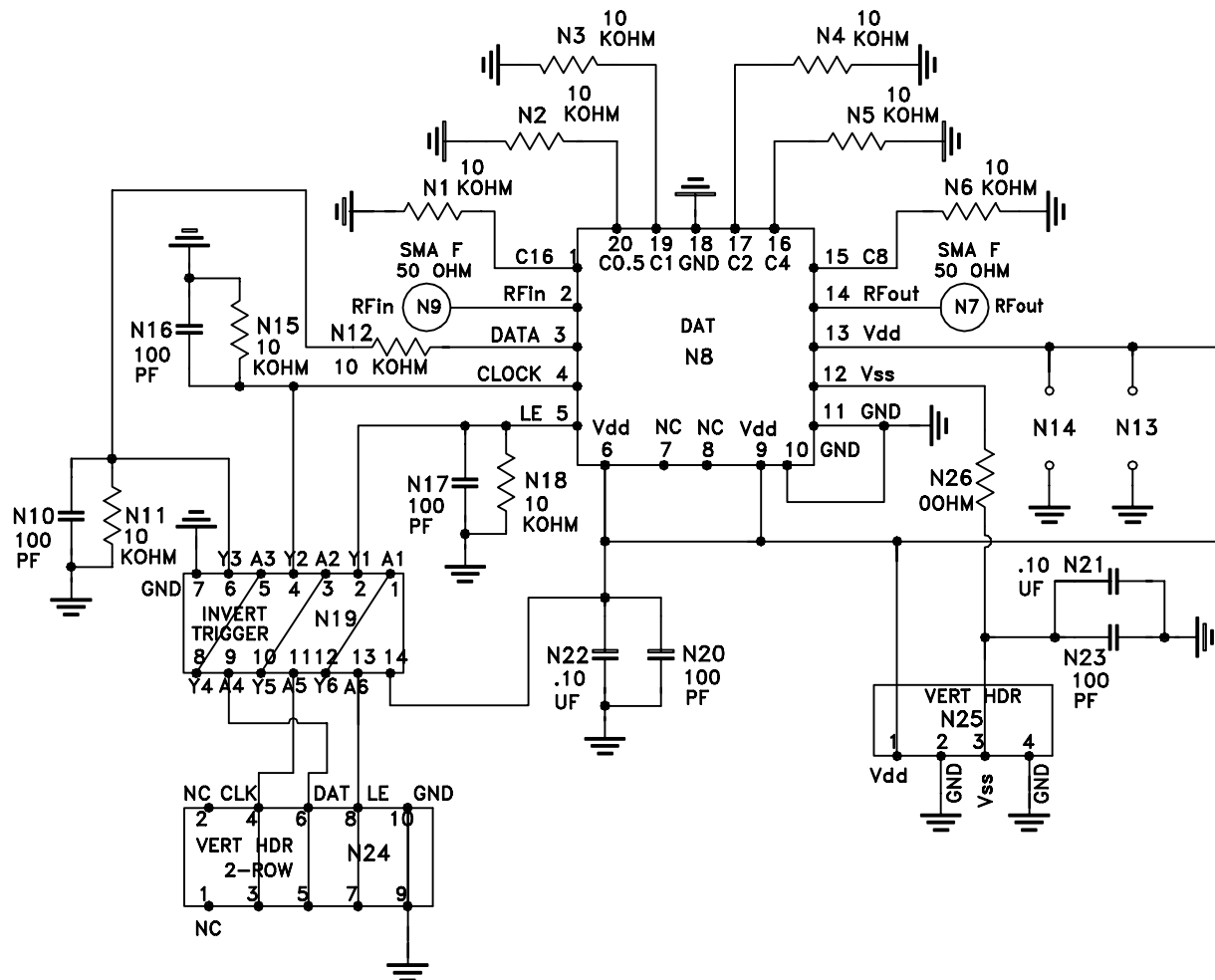


TB-342

## Notes:

1. N-Type Female connectors.
2. PCB Material: FR4 Grade IT 180TC (ITEQ Corporation) or equivalent, Dielectric Constant=4.7, Thickness=.025 inch.

 Mini-Circuits®



Schematic Diagram



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 or -40° to 105° C<br>Ambient Environment  | Refer to Individual Model Data Sheet                  |
| Storage Temperature            | -55° to 100° C or -65° to 150° C<br>Ambient Environment | Refer to Individual Model Data Sheet                  |
| Temperature Humidity Bias      | 85°C, 85% RH, 96 hours                                  | JESD22-A101B                                          |
| Thermal Shock                  | -55° to 100°C, 100 cycles                               | MIL-STD-202, Method 107, Condition A-3, except +100°C |
| Solder Reflow Heat             | Pb-Free Process: 260°C peak                             | J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1         |
| Solderability                  | 10X magnification, 95% coverage                         | JESD22-B102, Method 1: Dip and Look Test              |
| Marking Resistance to Solvents | Laser marked, visual observation                        | Mini-Circuits D4-Q4T0-04                              |