DATA SHEET

AA103-72/-72LF: 10 MHz - 2.5 GHz GaAs One-Bit Digital Attenuator (10 dB LSB)

Applications

- Cellular radio
- Wireless data systems
- WLL gain level control circuits

Features

- Attenuation: 10 dB
- Single, positive control voltage: 3 V
- Low loss
- Small SOT-5 package (MSL1, 260 °C per JEDEC J-STD-020)

NEW Skyworks offers lead (Pb)-free, RoHS (Restriction of Hazardous Substances)-compliant packaging.

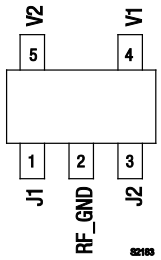


Figure 2. AA103-72/-72LF Pinout – 5-Pin SOT-5 (Top View)

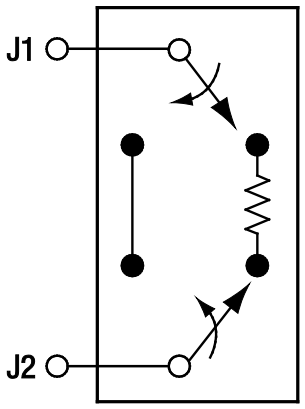


Figure 1. AA103-72/-72LF Block Diagram

Description

The AA103-72/-72LF are one-bit GaAs FET digital attenuators in a low-cost SOT-5 package. These devices provide an LSB of 10 dB.

The AA103-72/-72LF are particularly suited where high attenuation accuracy, low insertion loss, and low intermodulation products are required.

A functional block diagram is shown in Figure 1. The pin configuration and package are shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.

Table 1. AA103-72/-72LF Signal Descriptions

Pin #	Name	Description	Pin #	Name	Description
1	J1	RF port. Must be DC blocked.	4	V1	DC control bias
2	RF_GND	RF ground. Must be AC-coupled to ground.	5	V2	DC control bias
3	J2	RF port. Must be DC blocked.			

Table 2. AA103-72/-72LF Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
RF input power	P_{IN}		1 W > 500 MHz 0/8 V 0.5 W @ 50 MHz 0/8 V	dBm dBm
Supply voltage	V_S		8	V
Control voltage	V_{CTL}	–0.2	+8.0	V
Operating temperature	T_{OP}	–40	+85	°C
Storage temperature	T_{STG}	–65	+150	°C

Note: Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

***CAUTION**: Although this device is designed to be as robust as possible, Electrostatic Discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times.*

Electrical and Mechanical Specifications

The absolute maximum ratings of the AA103-72/-72LF are provided in Table 2. Electrical specifications are provided in Tables 3.

Typical performance characteristics of the AA103-72/-72LF are illustrated in Figures 3 through 5.

The state of the AA103-72/-72LF is determined by the logic provided in Table 4.

Table 3. AA103-72/-72LF Electrical Specifications (Note 1)
(V_{CTL} = 0/3 V Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition (Note 2)	Min	Typical	Max	Units
Insertion loss (Note 2)	IL	10 MHz to 0.5 GHz 0.5 GHz to 1.0 GHz 1.0 GHz to 2.5 GHz		0.3 0.3 0.4	0.5 0.6 0.7	dB dB dB
Attenuation range				10		dB
Attenuation accuracy (Note 3)		10 MHz to 1.0 GHz 1.0 GHz to 2.5 GHz	± (0.25 + 3% of attenuation setting) ± (0.4 + 5% of attenuation setting)			dB dB
Voltage Standing Wave Ratio (I/O)	VSWR	10 MHz to 2.5 GHz		1.2:1	1.4:1	–
Voltage Standing Wave Ratio (attenuation state) (Note 4)	VSWR	0.01 GHz to 2.5 GHz		1.5:1	2.0:1	–
Switching characteristics (Note 4): Rise/fall On/off Video feedthrough		 10/90% or 90/10% RF 50% V_{CTL} to 90/10% RF T_{RISE} = 1 ns, bandwidth = 500 MHz		 150 300 70		 ns ns mV
1 dB Input Compression Point	IP1dB	0.5 to 2.5 GHz: V_S = 3 V, V_S = 5 V		 +20 +26		 dBm dBm
3rd Order Input Intercept Point	IIP3	For two-tone input, P_{IN} = +10 dBm/tone, 0.5 to 2.5 GHz: V_S = 3 V V_S = 5 V		 +41 +45		 dBm dBm
Control voltages	V_{CTL}	V_{CTL} = V_{LOW} V_{CTL} = V_{HIGH}	0 3 @ 25 µA typical to 5 V		0.2 5 @ 50 µA typical	V V

Note 1: Performance is guaranteed only under the conditions listed in this Table.

Note 2: Insertion loss changes by 0.003 dB/ °C.

Note 3: Maximum attenuation includes insertion loss.

Note 4: Switching characteristics vary with value chosen for bypass capacitor.

Table 4. AA103-72/-72LF Truth Table

J1 to J2	V1 (Pin 4)	V2 (Pin 6)
Insertion loss	V_{HIGH}	0
Attenuation	0	V_{HIGH}

Note: V_{HIGH} = +3 V to +5 V (V_S = V_{HIGH} ± 0.2 V).
All other conditions not recommended.

Typical Performance Characteristics

(V_{CTL} = 0/3 V Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)

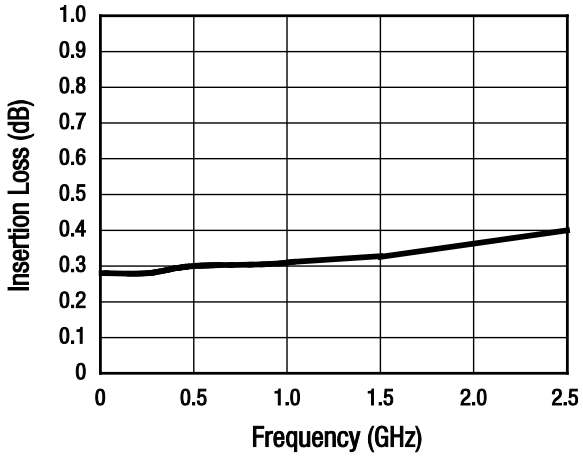


Figure 3. Insertion Loss vs Frequency

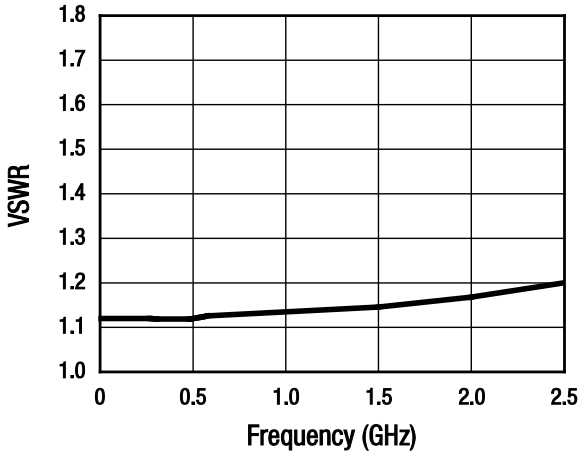


Figure 4. VSWR vs Frequency

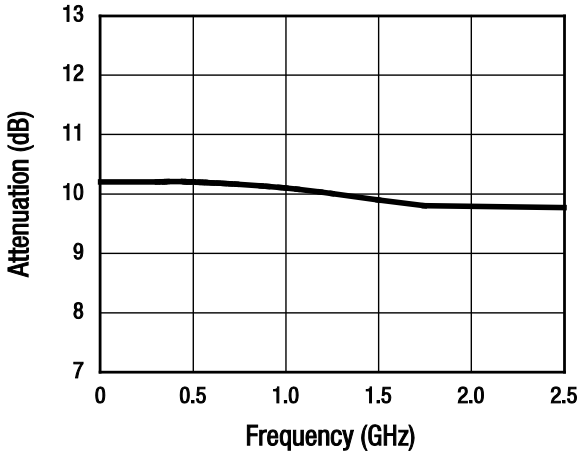


Figure 5. Attenuation vs Frequency

Evaluation Board Description

The AA103-72/-72LF Evaluation Board is used to test the performance of the AA103-72/-72LF digital attenuator. An Evaluation Board schematic diagram is shown in Figure 6.

Package Dimensions

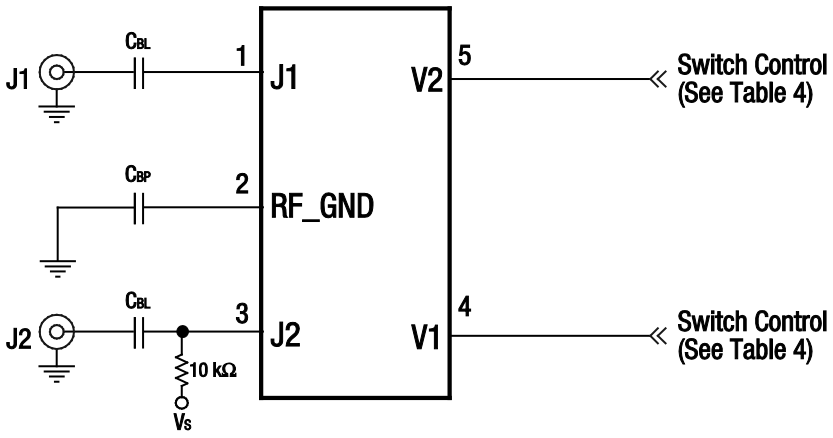
Package dimensions for the 5-pin SOT-5 are shown in Figure 7, and tape and reel dimensions are provided in Figure 8.

Package and Handling Information

Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

THE AA103-72/-72LF is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.



Note: DC blocking capacitors (C_{BL}), bypass capacitor (C_{BP}), and biasing resistor must be supplied externally for positive voltage operation.
C_{BL} = 33 pF, C_{BP} = 33 pF for 900 MHz operation.

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Figure 6. AA103-72/-72LF Evaluation Board Schematic Diagram

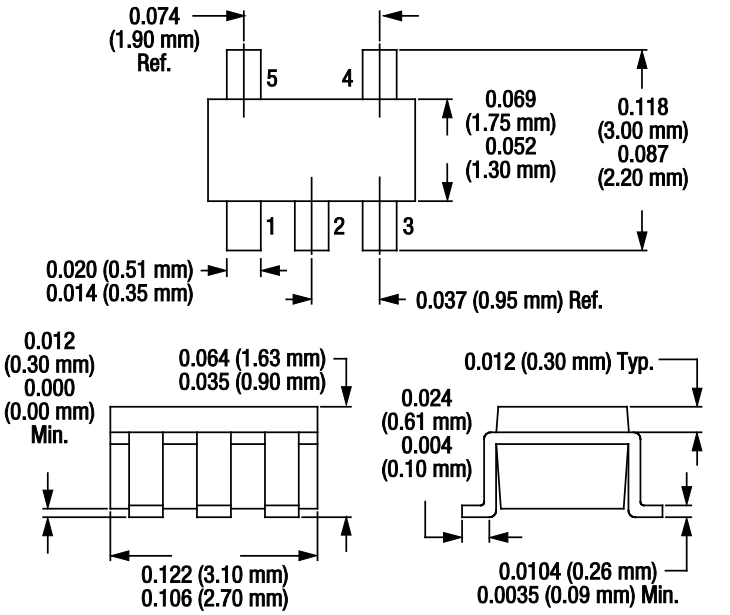

Figure 7. AA103-72/-72LF 5-Pin SOT-5 Package Dimensions

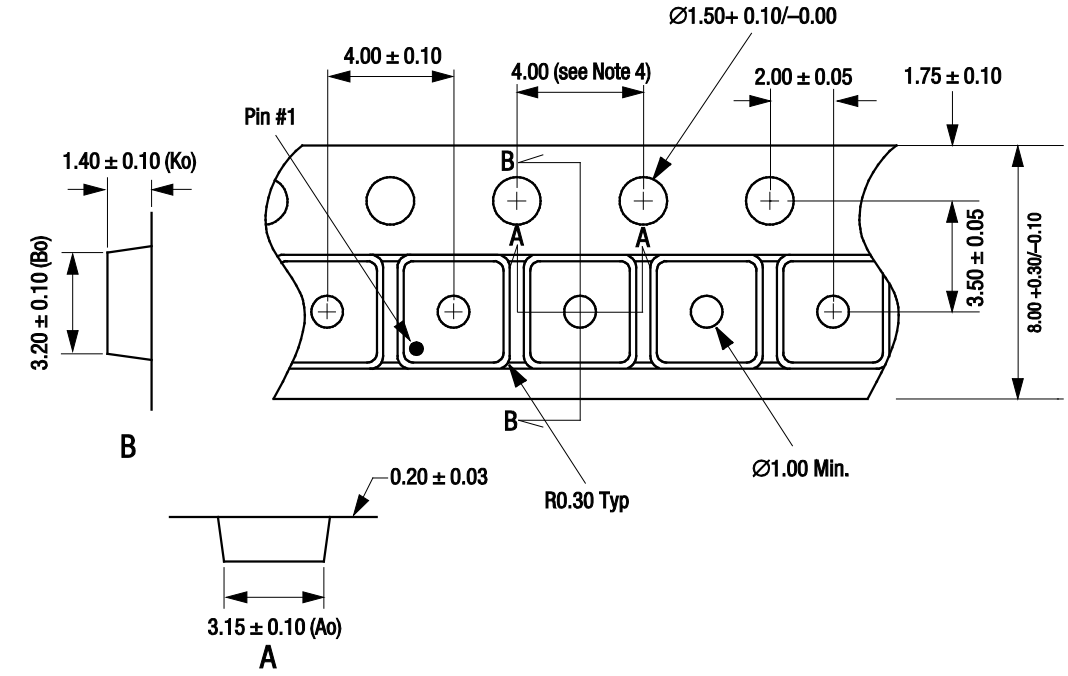

Figure 8. AA103-72/-72LF Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Numbers
AA103-72/-72LF One-Bit Digital Attenuator	AA103-72/-72LF	AA103-72/-72LF-EVB

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