DATA SHEET

AA102-80, AA102-80LF: GaAs IC 5-Bit Digital Attenuator 0.5 dB LSB Positive Control 0.5–2.5 GHz

Features

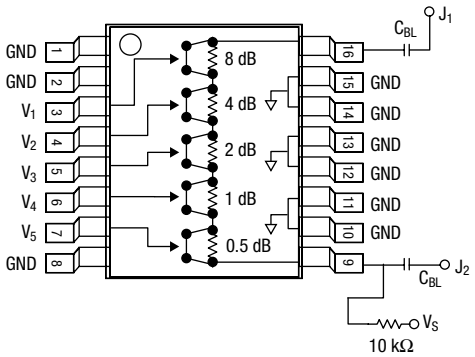
- Attenuation 0.5 dB steps to 15.5 dB with high accuracy
- Single positive control (3 to 5 V) for each bit
- Low DC power consumption
- Small low-cost SSOP-16 plastic package
- Available lead (Pb)-free and RoHS-compliant MSL-1 @ 260 °C per JEDEC J-STD-020

Description

The AA102-80 is a 5-bit, single positive control GaAs IC FET digital attenuator in a low-cost SSOP-16 package. This attenuator has an LSB of 0.5 dB and a total attenuation of 15.5 dB. The attenuator requires external DC blocking capacitors, positive supply voltage (V_S) and five individual bit control voltages (V_1–V_5). It is particularly suited where high attenuation accuracy, low insertion loss and low intermodulation products are required. Typical applications include base station, wireless data, and wireless local loop gain level control circuits.

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

Pin Out



DC blocking capacitors (C_{BL}) and biasing resistor must be supplied externally for positive voltage operation.
C_{BL} = 47 pF for operation >500 MHz.

Electrical Specifications at -40 °C to +85 °C

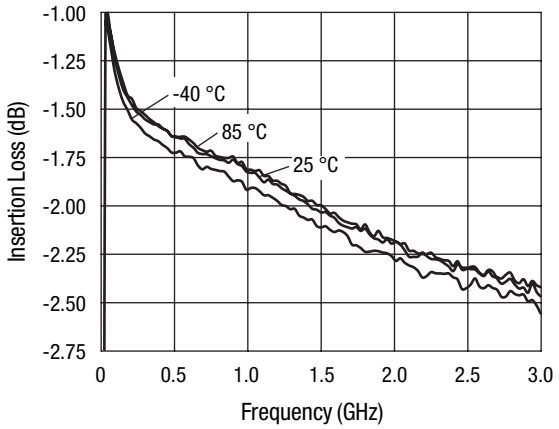
Z_0 = 50 Ω, V_{CTL} = 0/5 V, unless otherwise noted

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Insertion loss		0.5–1.0 GHz 1.0–2.0 GHz 2.0–2.5 GHz		1.9 2.4 3.2	2.3 2.7 3.5	dB dB dB
Attenuation range				15.5		dB
Attenuation accuracy[1]		0.4–0.5 GHz 0.5–1.0 GHz 1.0–2.5 GHz	± (0.3 + 4% of attenuation setting in dB) ± (0.2 + 3% of attenuation setting in dB) ± (0.3 + 5% of attenuation setting in dB)			dB dB dB
VSWR (I/O)[2]		0.4–0.5 GHz 0.5–2.5 GHz		1.9 1.5:1	2.2 2.0:1	
Switching characteristics Rise, fall On, off Video feedthru	 10/90% or 90/10% RF 50% CTL to 90/10% RF T_{RISE} = 1 ns, BW = 500 MHz			 125 250 75		 ns ns mV
Input power for 1 dB compression	V_S = 3 V V_S = 5 V	0.5–2.5 GHz 0.5–2.5 GHz	20 24	24 30		dBm dBm
Intermodulation intercept point (IP3)	For two-tone input power 5 dBm V_S = 3 V V_S = 5 V	 0.5–2.5 GHz 0.5–2.5 GHz	 42 43	 48 49		 dBm dBm
Control voltages	V_{LOW} = 0 to 0.2 V @ 20 µA max. V_{HIGH} = 3 V @ 100 µA max. to 5 V @ 200 µA max. V_S = V_{HIGH} ± 0.2 V					

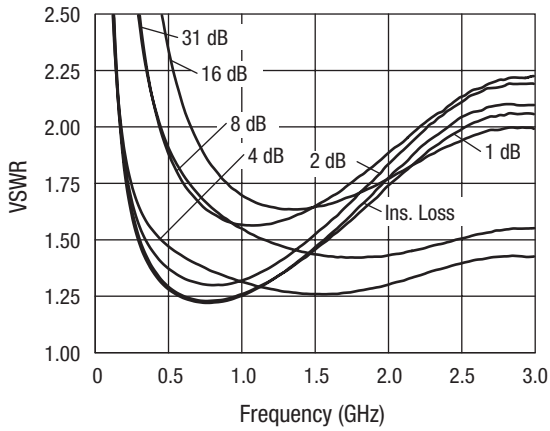
1. Attenuation referenced to insertion loss.
2. Input/output.

Typical Performance Data (0, 5 V)

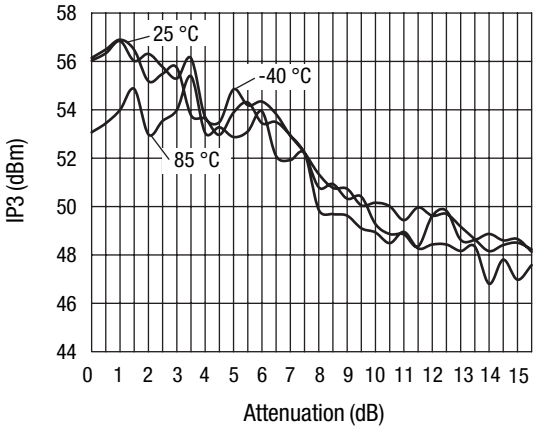
Z_0 = 50 Ω, V_{CTL} = 0/5 V, unless otherwise noted



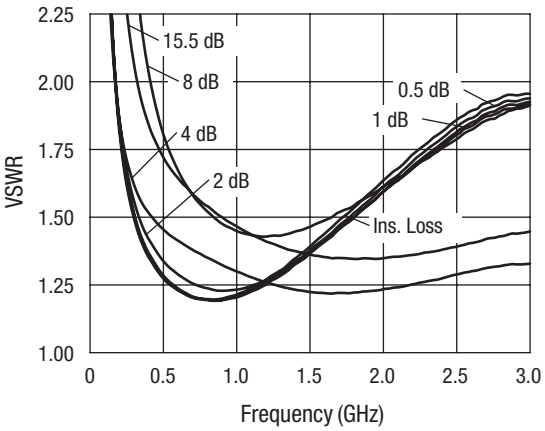
Insertion Loss vs. Frequency



VSWR vs. Frequency (25 °C)



IP3 vs. Attenuation and Temperature (500 MHz)

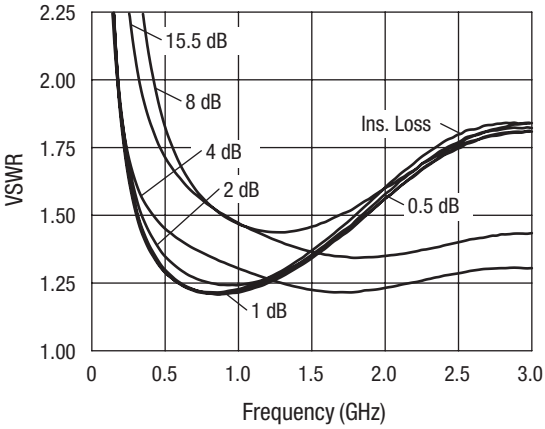


VSWR vs. Frequency (85 °C)

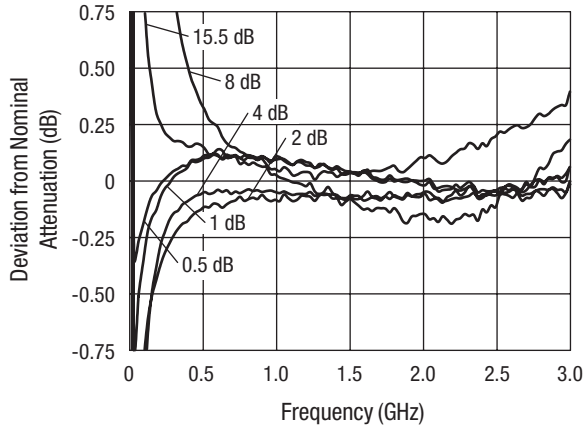
Compression Point vs. Attenuation, Voltage, and Temperature

Attenuation State	Control Voltage (V)	Input Power @ 1 dB Compression		
		25 °C (dBm)	85 °C (dBm)	-40 °C (dBm)
Ins. loss	5	30.7	30.1	30.1
0.5	5	31.6	31.1	31.1
1	5	31	30.5	30.2
2	5	31.4	30.9	30.5
4	5	36.8	36.8	36.8
8	5	27.4	33.8	27.1
15.5	5	32.9	31.2	33.3

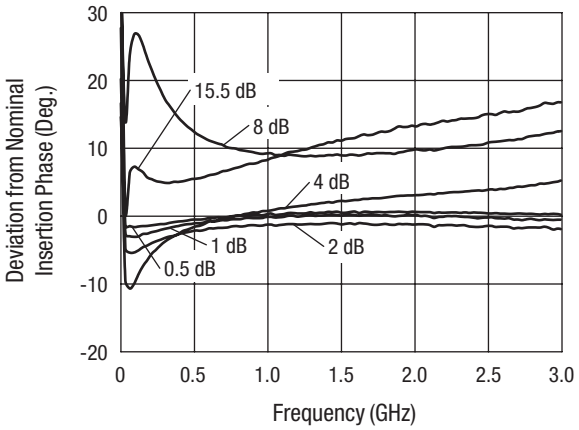
Frequency = 0.5–2.5 GHz.



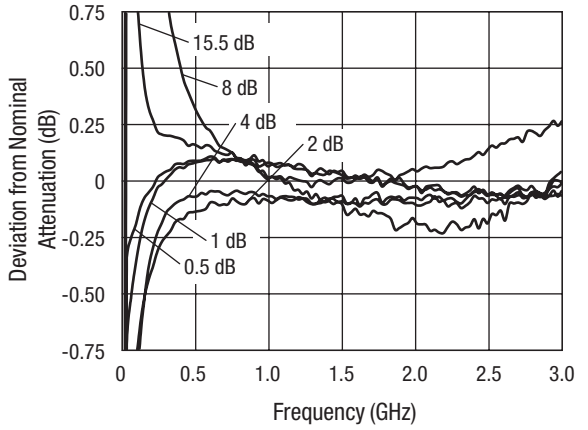
VSWR vs. Frequency (-40 °C)



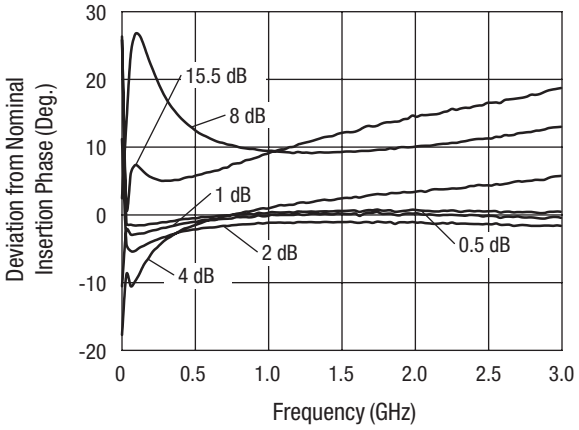
Attenuation Accuracy vs. Frequency (25 ˚C)



Attenuation Phase Accuracy vs. Frequency (25 ˚C)



Attenuation Accuracy vs. Frequency (85 ˚C)



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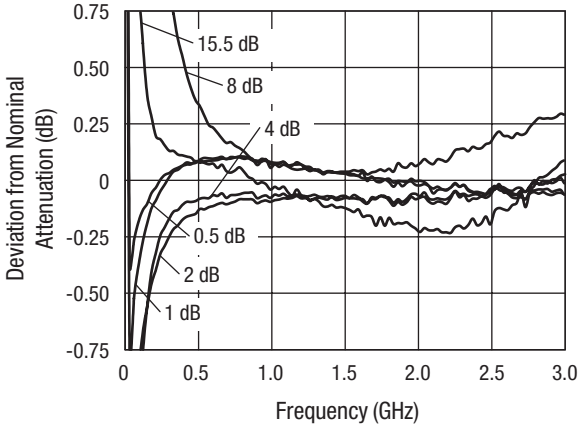
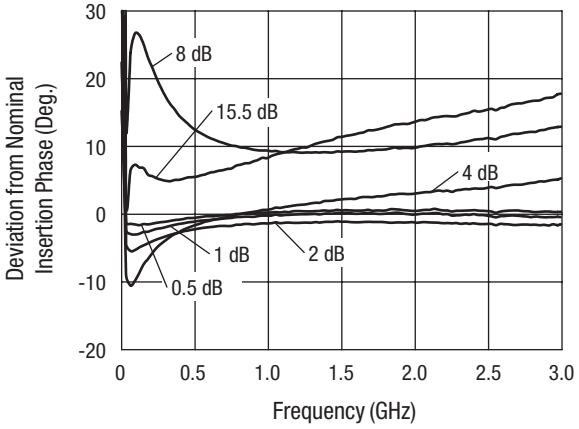


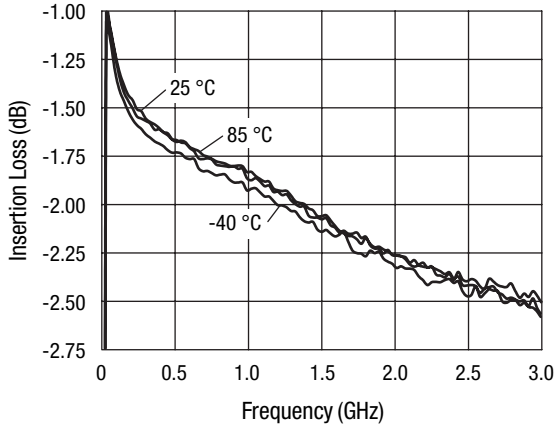
Attenuation Accuracy vs. Frequency (-40 ˚C)



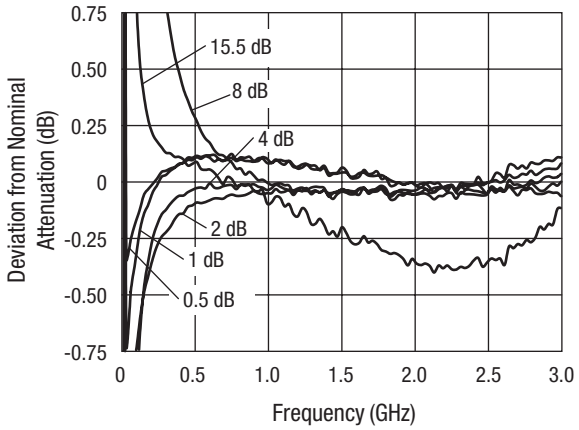
Attenuation Phase Accuracy vs. Frequency (-40 ˚C)

Typical Performance Data (0, 3 V)

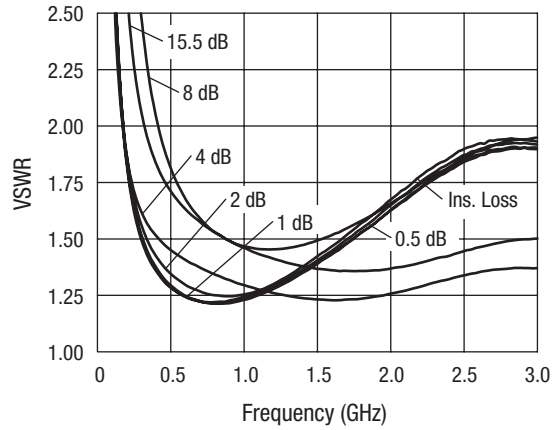
Z_0 = 50 Ω, V_{CTL} = 0/5 V, unless otherwise noted



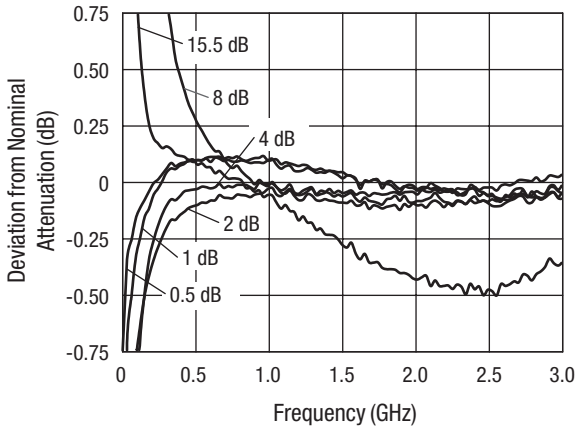
Insertion Loss vs. Frequency



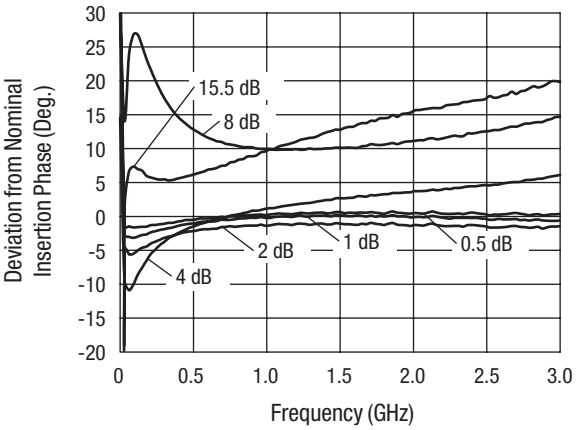
Attenuation Accuracy vs. Frequency (25 ˚C)



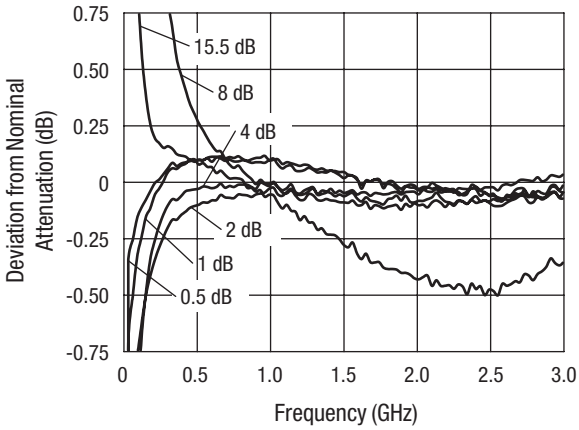
VSWR vs. Frequency (25 ˚C)



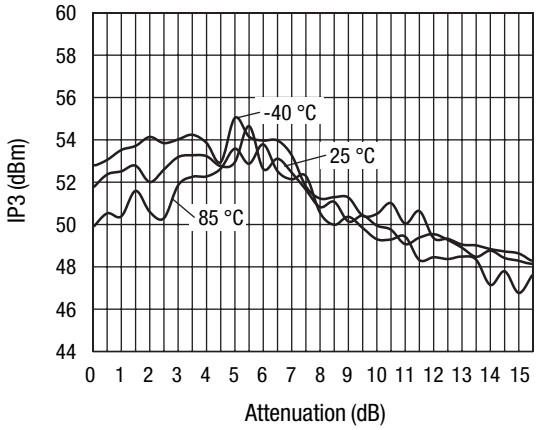
Attenuation Accuracy vs. Frequency (85 ˚C)



Attenuation Phase Accuracy vs. Frequency (25 ˚C)



Attenuation Accuracy vs. Frequency (-40 ˚C)



IP3 vs. Attenuation and Temperature (500 MHz)

Compression Point vs. Attenuation, Voltage, and Temperature

Attenuation State	Control Voltage (V)	Input Power @ 1 dB Compression		
		25 °C (dBm)	85 °C (dBm)	-40 °C (dBm)
Ins. Loss	3	24.1	23.7	24.1
0.5	3	24.4	24	25
1	3	24.4	23.8	24.3
2	3	24.7	24.1	24.5
4	3	36.8	36.8	36.8
8	3	26.7	26.8	29.6
15.5	3	27.1	25.6	28.7

Frequency = 0.5–2.5 GHz.

Truth Table

V_1	V_2	V_3	V_4	V_5	Attenuation
8 dB	4 dB	2 dB	1 dB	0.5 dB	J_1–J_2
V_{HIGH}	V_{HIGH}	V_{HIGH}	V_{HIGH}	V_{HIGH}	Reference I.L.
V_{HIGH}	V_{HIGH}	V_{HIGH}	V_{HIGH}	0	0.5 dB
V_{HIGH}	V_{HIGH}	V_{HIGH}	0	V_{HIGH}	1 dB
V_{HIGH}	V_{HIGH}	0	V_{HIGH}	V_{HIGH}	2 dB
V_{HIGH}	0	V_{HIGH}	V_{HIGH}	V_{HIGH}	4 dB
0	V_{HIGH}	V_{HIGH}	V_{HIGH}	V_{HIGH}	8 dB
0	0	0	0	0	15.5 dB max. atten.

V_{HIGH} = 3 to 5 V ($V_S = V_{HIGH} \pm 0.2$ V).

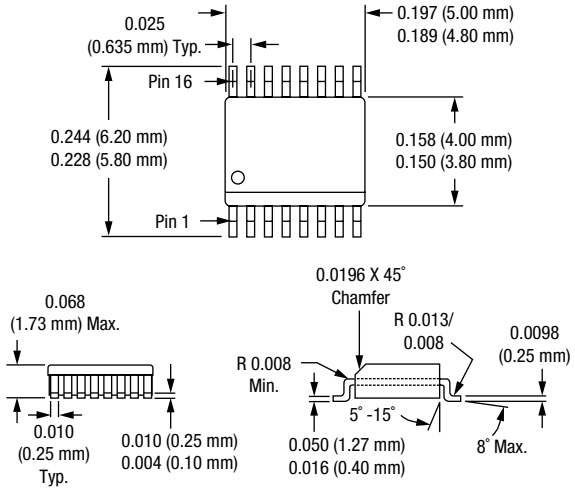
Absolute Maximum Ratings

Characteristic	Value
RF input power	2 W > 500 MHz 0/8 V 0.75 W @ 50 MHz 0/8 V
Supply voltage	8 V
Control voltage	-0.2 V, +8 V
Operating temperature	-40 °C to +85 °C
Storage temperature	-65 °C to +150 °C

Performance is guaranteed only under the conditions listed in the specifications table and is not guaranteed under the full range(s) described by the Absolute Maximum specifications. Exceeding any of the absolute maximum/minimum specifications may result in permanent damage to the device and will void the warranty.

CAUTION: *Although this device is designed to be as robust as possible, ESD (Electrostatic Discharge) 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 must be employed at all times.*

SSOP-16



Recommended Solder Reflow Profiles

Refer to the *"Recommended Solder Reflow Profile"* Application Note.

Tape and Reel Information

Refer to the *"Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation"* Application Note.