DATA SHEET

AA104-73, AA104-73LF: GaAs IC 1-Bit Digital Attenuator, 32 dB 300 kHz–2.5 GHz

Features

- 1-bit attenuation of 32 dB 300 kHz–1 GHz, 27 dB 1–2 GHz, 24 dB 2–2.5 dB
- Combine with AA260-85 or AA101-80 for 63 dB 6-bit solution
- Tune with one capacitor and/or resistor to desired operating frequency and attenuation
- Ideal for both IF and RF applications including cable, GSM, PCS, EDGE, 3G and ISM
- Available lead (Pb)-free and RoHS-compliant MSL-1 @ 260 °C per JEDEC J-STD-020

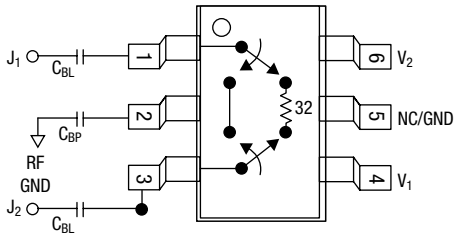
Description

The AA104-73 is a 1-bit, GaAs IC FET digital attenuator in a low-cost SOT-6 package. This attenuator has up to 32 dB total attenuation. The attenuator requires two lines of voltage control. The AA104-73 is particularly suited where high attenuation accuracy, low insertion loss, and low intermodulation products are required. Typical application is as a sixth bit value for the AA260-85 and AA101-80. A total attenuation of 63 dB in 1 dB steps can be obtained by combining the two attenuators.

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

Pin Out

Positive Voltage



C_{BL} = 47 pF for frequencies >500 MHz. See table on previous page for C_{BP} value.
See application notes APN2013 and APN2014 for 6 bit attenuator requirements.

Electrical Specifications at -40 °C to +85 °C (0, 3 V), (0, 5 V)

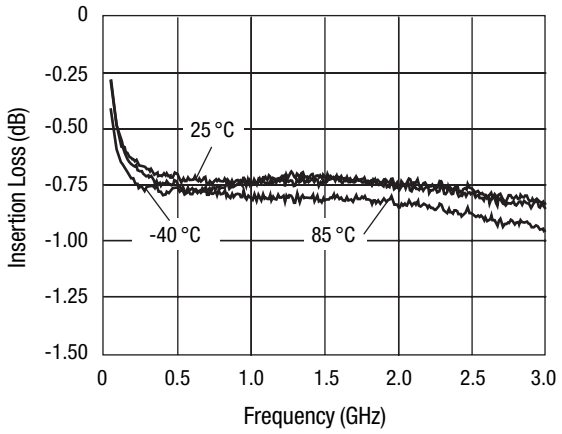
Parameter[1]	Frequency[2]	Min.	Typ.	Max.	Unit
Insertion loss	300 kHz–1.0 GHz		0.8	1.0	dB
	1.0–2.0 GHz		0.9	1.2	dB
	2.0–2.5 GHz		1.0	1.3	dB
Attenuation range	300 kHz–1.0 GHz		32		dB
	1.0–2.0 GHz		27		dB
	2.0–2.5 GHz		24		dB
	2.3–2.5 GHz		23		dB
Attenuation accuracy[3, 4]	300 kHz–0.5 GHz	± (0.4 + 10% of attenuation setting in dB)			dB
	0.85–0.95 GHz	± (0.4 + 5% of attenuation setting in dB)			dB
	1.7–2.0 GHz	± (0.5 + 6% of attenuation setting in dB)			dB
	2.0–2.5 GHz	± (0.6 + 7% of attenuation setting in dB)			dB
	2.3–2.5 GHz	± (0.7 + 7% of attenuation setting in dB)			
VSWR (insertion loss state)[5]	300 kHz–2.5 GHz		1.2:1	1.5:1	
VSWR (attenuation state)[5]	300 kHz–2.5 GHz		1.5:1	2.0:1	

1. All measurements made in a 50 Ω system, unless otherwise specified.
2. Operates to 300 kHz when controlled with negative voltage, C_{BP} not required.
3. Attenuation value set by C_{BP}.
4. Attenuation referenced to insertion loss.
5. Input/output. In band.

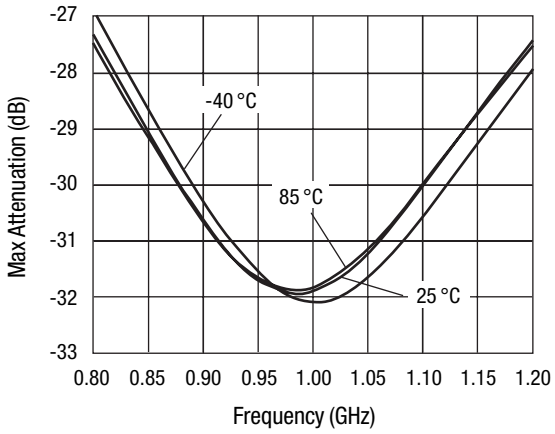
Electrical Specifications at -40 °C to +85 °C (0, 3 V), (0, 5 V)

Parameter	Condition	Frequency	Min.	Typ.	Max.	Unit
Switching characteristics						
Rise, fall	10/90% or 90/10% RF			50		ns
On, off	50% CTL to 90/10% RF			100		ns
Video feedthru	T_{RISE} = 1 ns, BW = 500 MHz			25		mV
Input Power for 1 dB compression	V_S = 3 V	0.5–2.5 GHz	14	21		dBm
	V_S = 5 V	0.5–2.5 GHz	18	23		dBm
Intermodulation intercept point (IP3)	For two-tone input power +10 dBm					
	V_S = 3 V	0.5–2.5 GHz	36	41		dBm
	V_S = 5 V	0.5–2.5 GHz	38	44		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.					

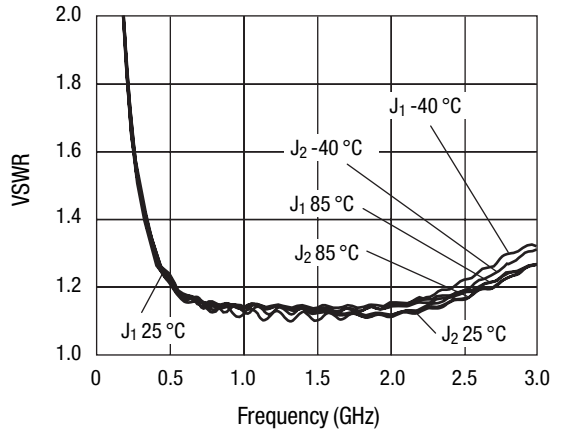
Typical Performance Data at -40 °C to +85 °C (0, 5 V) C_{BP} = 12 pF, C_{BL} = 47 pF



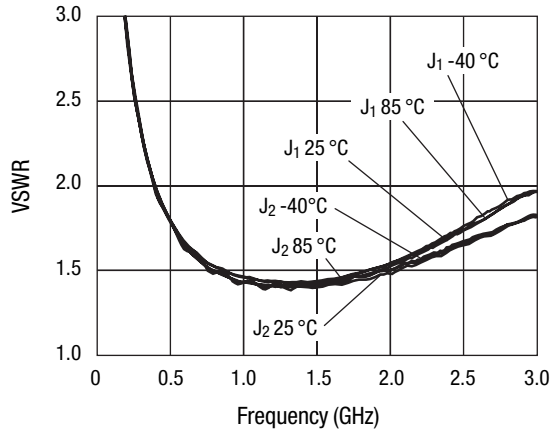
Insertion Loss vs. Frequency



32 dB State vs. Frequency



VSWR vs. Frequency
Insertion Loss State



VSWR vs. Frequency
32 dB State

Compression Point vs. Voltage and Temperature

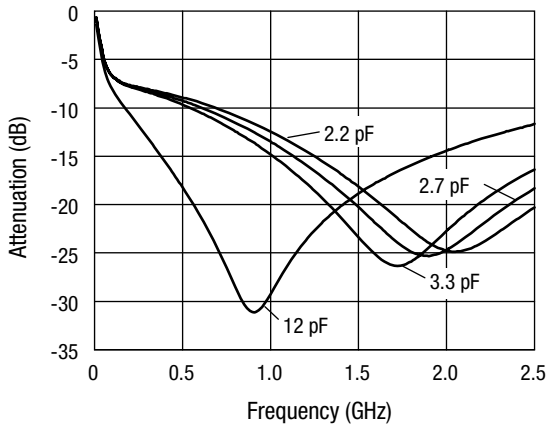
Control voltage (V)	Temperature (°C)	1 dB Compression insertion loss state (dBm)	1 dB Compression 32 dB state (dBm)
3	-40	21	16.5
3	25	21	15
3	85	21	14
5	-40	22	22.5
5	25	22	22.5
5	85	22	22.5

Frequency: 500 MHz.

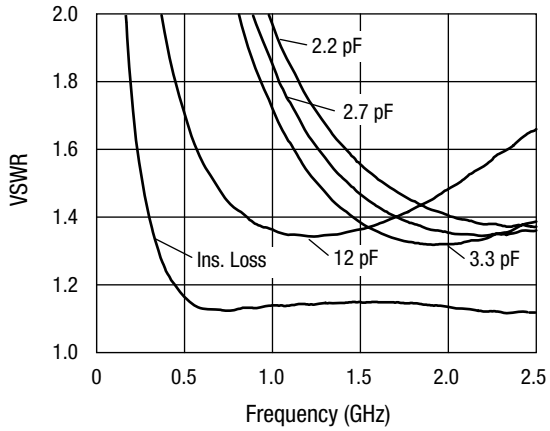
IP3 vs. Voltage and Temperature

Control Voltage (V)	Temperature (°C)	IP3 @ 10 dBm each tone (dBm)
3	-40	41
3	25	42
3	85	40
5	-40	43
5	25	44
5	85	42

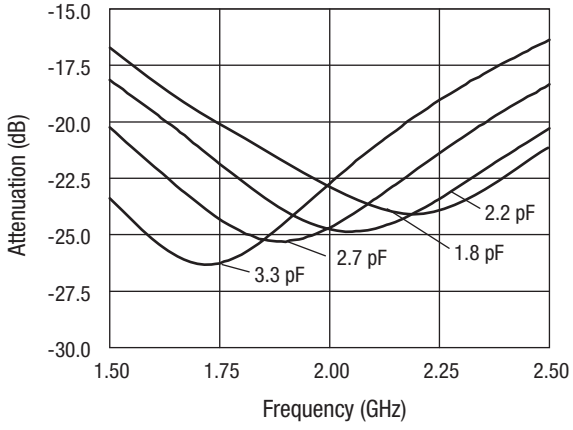
Two-tone input power: 10 dBm each tone.
Tone frequencies: 500 and 501 MHz.



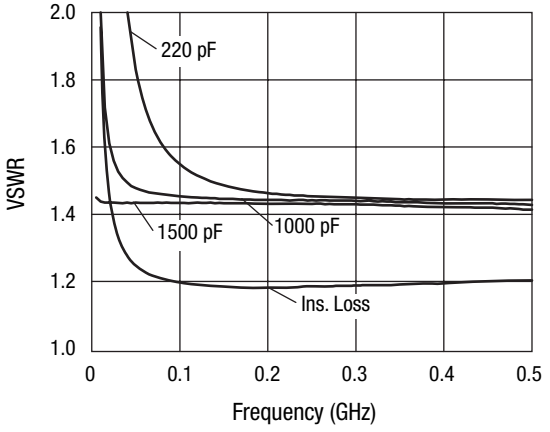
Attenuation vs. Frequency DC–2.5 GHz
C_{BP} = 2.2, 2.7, 3.3 and 12 pF



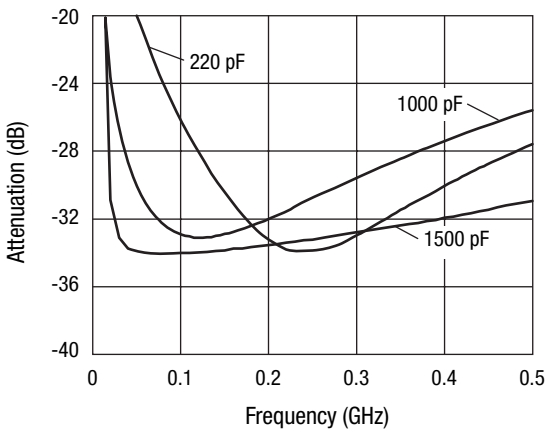
VSWR vs. Frequency DC–2.5 GHz
C_{BP} = 2.2, 2.7, 3.3 and 12 pF



Attenuation vs. Frequency 1.5–2.5 GHz
C_{BP} = 2.2, 2.7, and 3.3 pF



VSWR vs. Frequency DC–0.5 GHz
C_{BP} = 220, 1000, 1500 pF



Attenuation vs. Frequency DC–0.5 GHz
C_{BP} = 220, 1000, 1500 pF

Truth Table

Positive Control

V_1	V_2	Attenuation J_1–J_2
V_{HIGH}	0	Reference I.L.
0	V_{HIGH}	32 dB

All other conditions not recommended.
V_{HIGH} = 3 to 5 V.

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.

C_{BL} (pF)	C_{BP} (pF)	Operating Frequency (GHz)
47	1.8	2.3–2.5
47	2.2	2–2.3
47	2.7	1.8–2
47	3.3	1.6–1.8
47	12	0.9–1.05
47	15	0.8–0.9
330	220	0.2–0.35
1500	1000	0.07–0.2
10000	1500	0.015–0.25

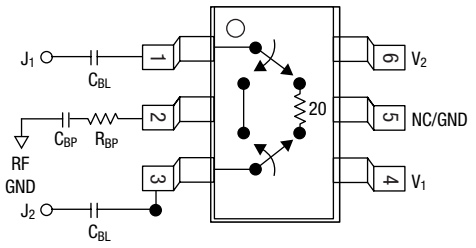
Absolute Maximum Ratings

Characteristic	Value
RF input power	1 W > 500 MHz 0/8 V 0.5 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

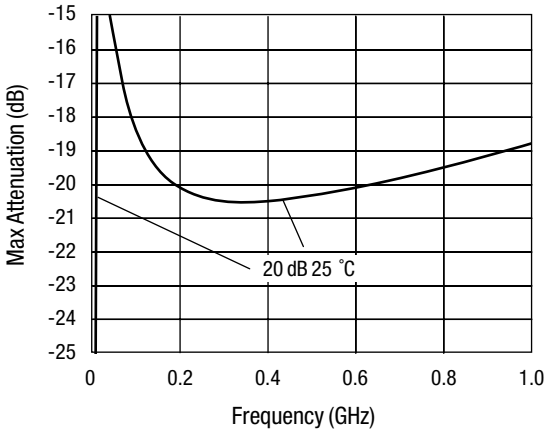
Performance is guaranteed only under the conditions listed in the specifications table and is not guaranteed under the full range(s) described by the Absolute Maximum specifications. Exceeding any of the absolute maximum/minimum specifications may result in permanent damage to the device and will void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

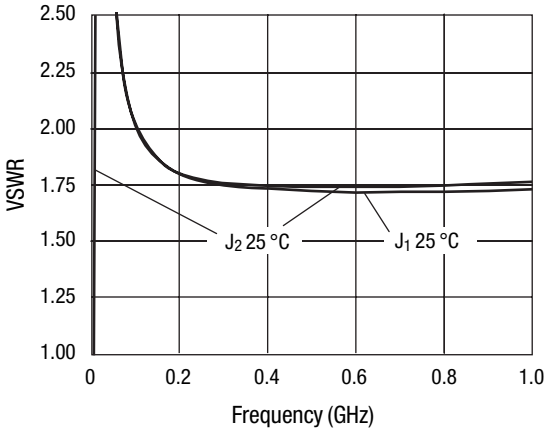
Application: AA104-73 Used as 1-Bit 20 dB Attenuator 25 °C (0, 5 V)



C_{BL} = 220 pF, C_{BP} = 100 pF, R_{BP} = 15 Ω, f_C = 400 MHz with select values of C_{BP} and R_{BP}, center frequency and attenuation value respectively can be varied.



20 dB State vs. Frequency
C_{BP} = 100 pF, C_{BL} = 220 pF, R_{BP} = 15 Ω



VSWR vs. Frequency
20 dB State

SOT-6