

DATA SHEET

AA105-86, AA105-86LF: GaAs IC 4-Bit Digital Attenuator, 1 dB LSB 0.5–3.0 GHz

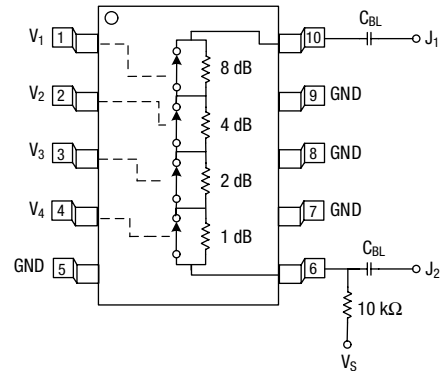
Features

- Attenuation 1 dB steps to 15 dB with high accuracy
- Single positive control (3 to 5 V) for each bit
- Low DC power consumption
- Miniature, low-cost MSOP-10 plastic package
- Available lead (Pb)-free and RoHS-compliant MSL-1 @ 260 °C per JEDEC J-STD-020

Description

The AA105-86 is a 4-bit, single positive control GaAs IC FET digital attenuator. It requires DC blocking capacitors, positive supply voltage (V_S) and four individual positive bit control voltages (V_1 – V_4). The AA105-86 is particularly suited where high attenuation accuracy, low insertion loss and low intermodulation products are required. Typical applications include cellular radio, 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.

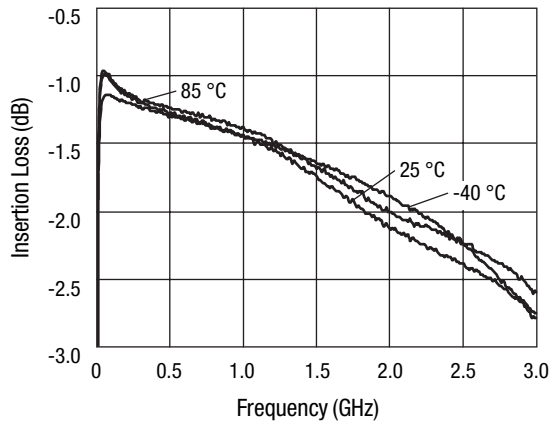
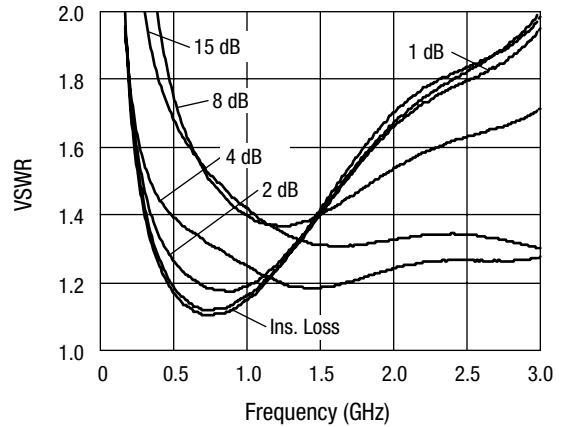
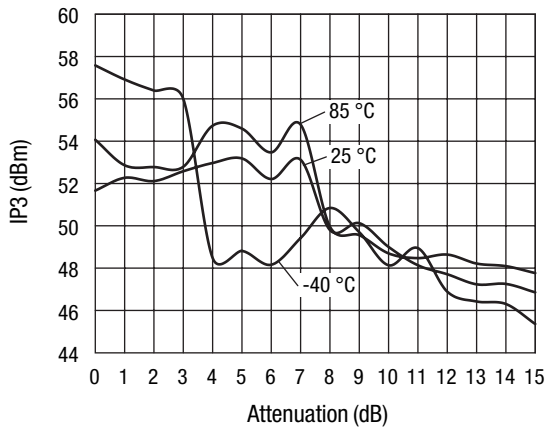
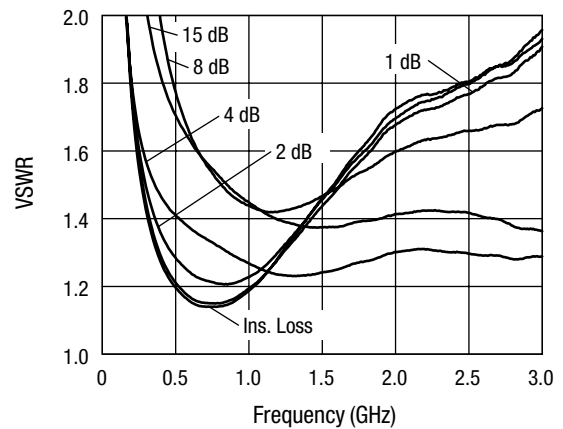
Electrical Specifications at 25 °C (0, 5 V)

Parameter ⁽¹⁾	Condition	Frequency	Min.	Typ.	Max.	Unit
Insertion loss		0.5–1.0 GHz		1.5	1.8	dB
		1.0–2.0 GHz		2.1	2.4	dB
		2.0–2.5 GHz		2.4	2.7	dB
		2.5–3.0 GHz		2.7	3.0	dB
Attenuation range				15		dB
Attenuation accuracy ⁽²⁾		0.5–1.0 GHz	$\pm (0.2 + 2\% \text{ of Attenuation setting in dB})$			dB
		1.0–3.0 GHz	$\pm (0.3 + 3\% \text{ of Attenuation setting in dB})$			dB
VSWR (I/O) ⁽³⁾		0.5–2.5 GHz 2.5–3.0 GHz		1.5:1 1.7:1	2.0:1 2.2:1	
Switching characteristics						
Rise, fall	10/90% or 90/10% RF			180		ns
On, off	50% CTL to 90/10% RF			270		ns
Video feedthru	$T_{RISE} = 1 \text{ ns}$, BW = 500 MHz			50		mV
Input power for 1 dB compression	$V_S = 3 \text{ V}$	0.5–3.0 GHz	20	24		dBm
	$V_S = 5 \text{ V}$	0.5–3.0 GHz	25	29		dBm
Intermodulation intercept point (IP3)	For two-tone input power +5 dBm					
	$V_S = 3 \text{ V}$	0.5–3.0 GHz	43	49		dBm
	$V_S = 5 \text{ V}$	0.5–3.0 GHz	44	50		dBm
Control voltages	$V_{LOW} = 0 \text{ to } 0.2 \text{ V @ } 20 \text{ } \mu\text{A max.}$ $V_{HIGH} = 3 \text{ V @ } 100 \text{ } \mu\text{A max. to } 5 \text{ V @ } 200 \text{ } \mu\text{A max.}$ $V_S = V_{HIGH} \pm 0.2 \text{ V}$					

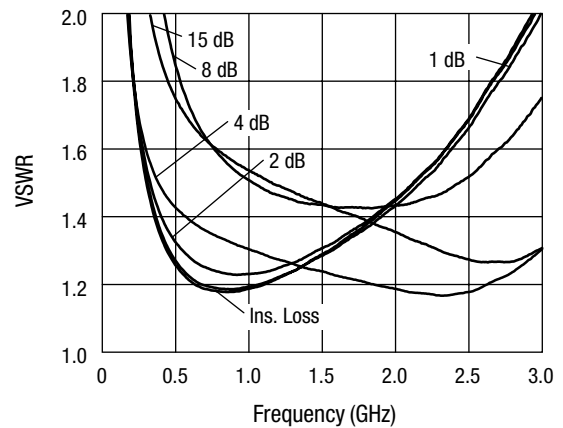
1. All measurements made in a 50 Ω system, unless otherwise specified.

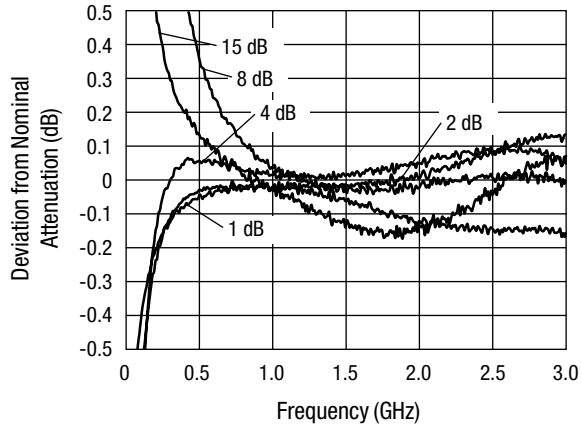
2. Attenuation referenced to insertion loss.

3. Input/output.

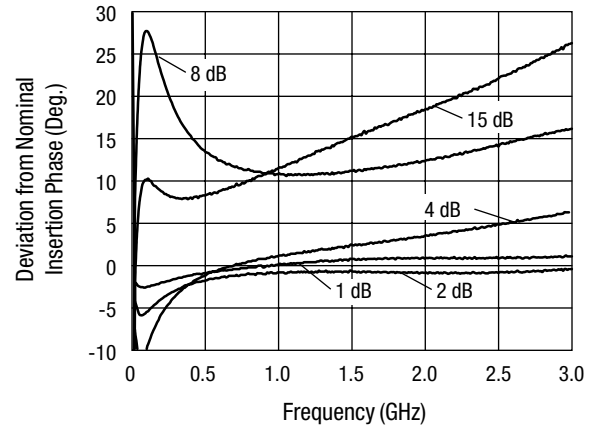
Typical Performance Data (0, 5 V)**Insertion Loss vs. Frequency****VSWR vs. Frequency (25 °C)****IP3 vs. Attenuation and Temperature (500 MHz)****VSWR vs. Frequency (85 °C)****Compression Point vs. Attenuation, Voltage, and Temperature**

Attenuation State	Control Voltage (V)	Input Power @ 1 dB Compression		
		25 °C (dBm)	85 °C (dBm)	-40 °C (dBm)
Ins. loss	5	31.1	30.9	31.2
1 dB	5	31.3	31.4	31.3
2 dB	5	31	30.8	31.1
4 dB	5	32.5	31.4	33.6
8 dB	5	33	32.4	33.5
15 dB	5	29.9	28	31.4

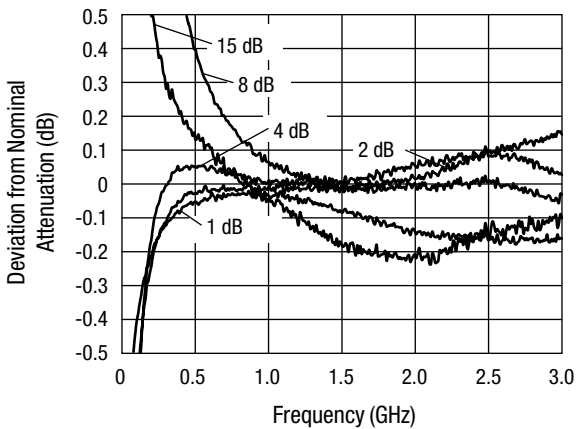
**VSWR vs. Frequency (-40 °C)**



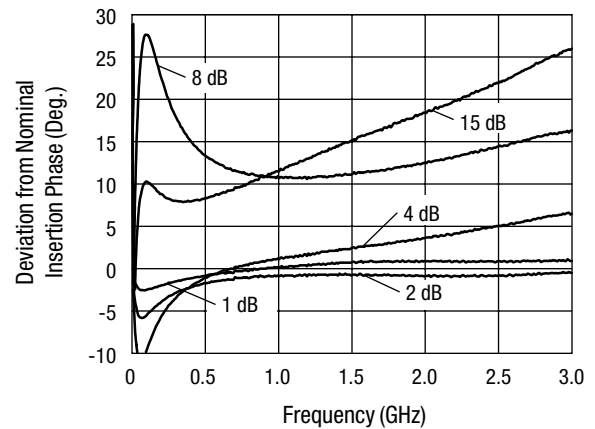
Attenuation Accuracy vs. Frequency (25 °C)



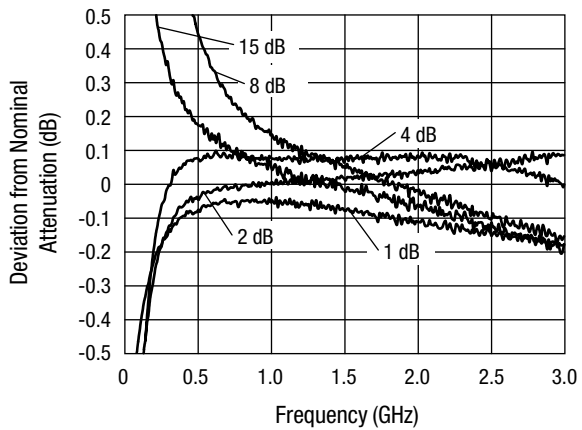
Attenuation Phase Accuracy vs. Frequency (25 °C)



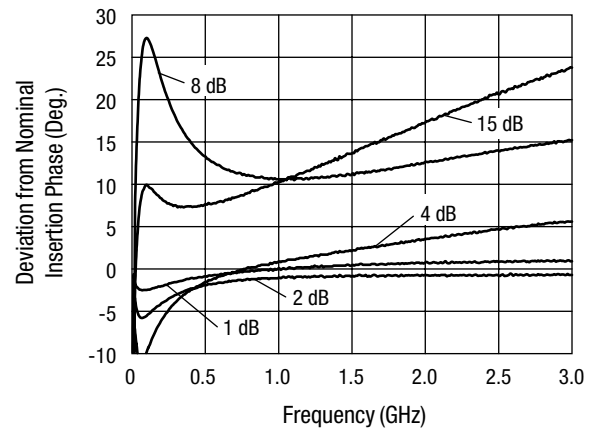
Attenuation Accuracy vs. Frequency (85 °C)



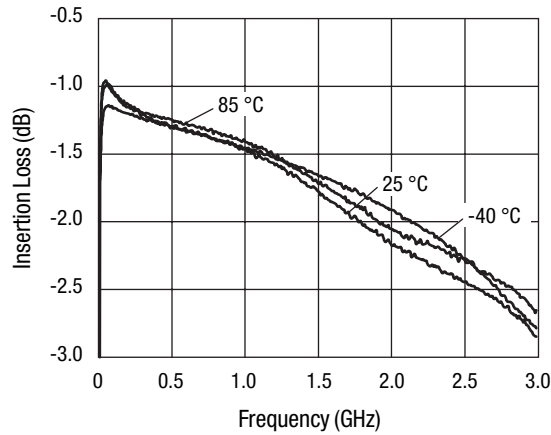
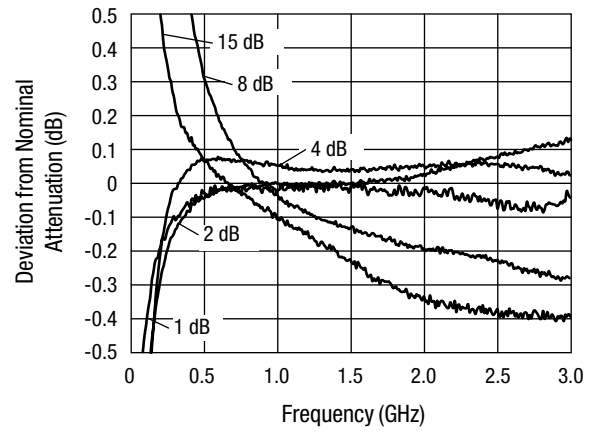
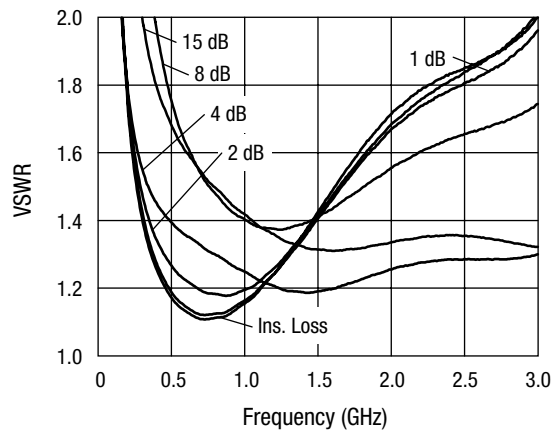
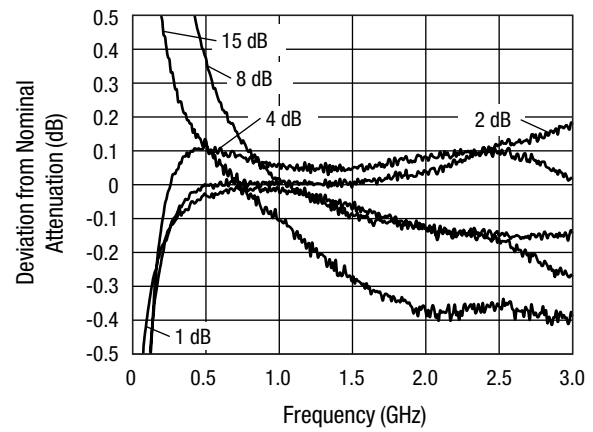
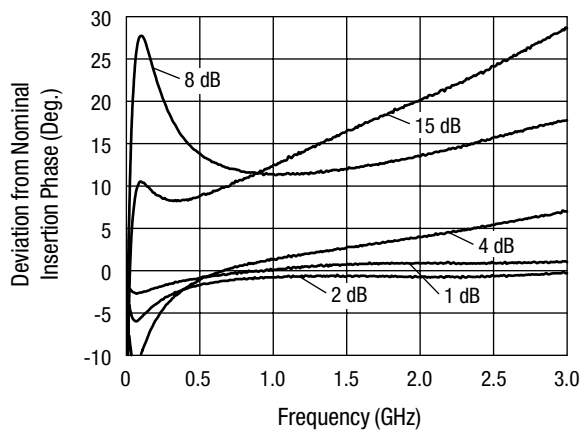
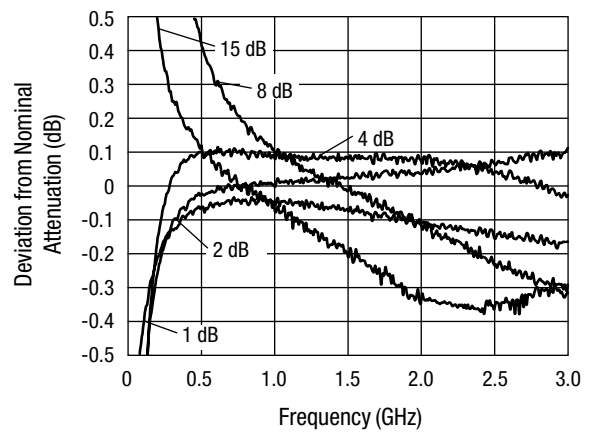
Attenuation Phase Accuracy vs. Frequency (85 °C)

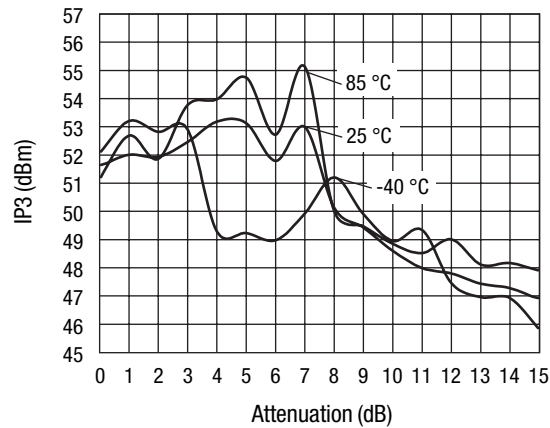


Attenuation Accuracy vs. Frequency (-40 °C)



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

Typical Performance Data (0, 3 V)**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)**



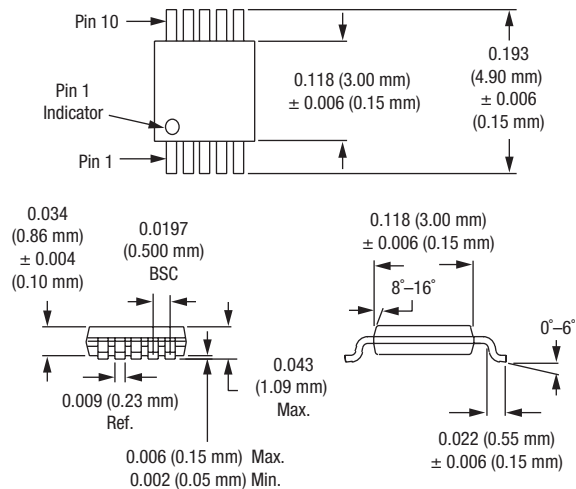
IP3 vs. Attenuation and Temperature (500 MHz)

Truth Table

V ₁	V ₂	V ₃	V ₄	Attenuation J ₁ -J ₂
8 dB	4 dB	2 dB	1 dB	
V _{HIGH}	V _{HIGH}	V _{HIGH}	V _{HIGH}	Reference I.L.
V _{HIGH}	V _{HIGH}	V _{HIGH}	0	1 dB
V _{HIGH}	V _{HIGH}	0	V _{HIGH}	2 dB
V _{HIGH}	0	V _{HIGH}	V _{HIGH}	4 dB
0	V _{HIGH}	V _{HIGH}	V _{HIGH}	8 dB
0	0	0	0	15 dB max. atten.

V_{HIGH} = 3 to 5 V (V_S = V_{HIGH} ± 0.2 V).

MSOP-10



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	24.7	24.2	24.4
1 dB	3	25.2	24.9	25
2 dB	3	24.8	24.2	24.7
4 dB	3	31.1	30.5	31.9
8 dB	3	25.1	25.9	27.3
15 dB	3	24.9	24.4	27

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.

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.

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