SKYWORKS®

DATA SHEET

AA117-85, AA117-85LF: GaAs IC 5-Bit Digital Attenuator with Driver 1 dB LSB Positive Control LF–2 GHz

Features

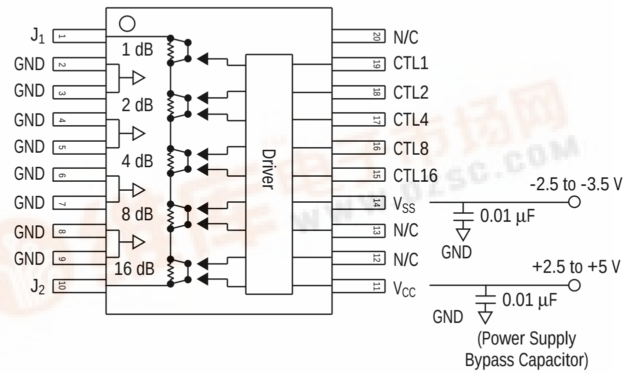
- Attenuation 1 dB steps to 31 dB with high accuracy
- Single positive control (3 V or 5 V) for each bit
- Low DC power consumption
- CMOS Integrated silicon driver, positive and negative supplies required
- Designed for use at IF frequencies
- High-noise linearity @ P_{IN} < -10 dBm
- Available lead (Pb)-free and RoHS-compliant MSL-1 @ 260 °C per JEDEC J-STD-020

Description

The AA117-85 is a 5-bit, single positive control GaAs IC FET digital attenuator with driver. It is particularly suited at IF frequencies where high attenuation accuracy, low insertion loss and low intermodulation products are required. Typical applications include base station, wireless data, broadband and wireless local loop gain control circuits. For single supply design and higher input signal levels, see AA110-85.

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

Pin Out

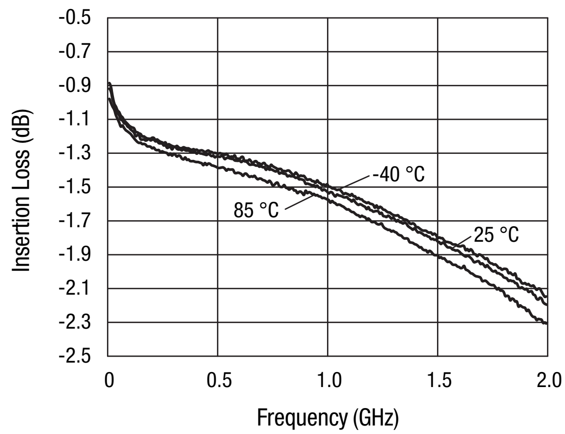


Electrical Specifications at -40 °C to +85 °C (V_{CC} = 5 V, V_{SS} = -3 V)

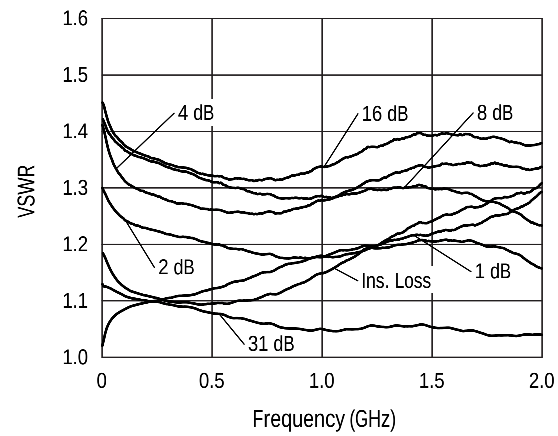
Parameter[1]	Condition	Frequency	Min.	Typ.	Max.	Unit
Insertion loss[2]		LF–0.5 GHz LF–1.0 GHz LF–2.0 GHz		1.4 1.7 2.2	1.7 2.1 2.6	dB dB dB
Attenuation range				31		dB
Attenuation accuracy[3]		LF–0.5 GHz LF–1.0 GHz LF–2.0 GHz	± (0.2 + 2% of attenuation setting in dB) ± (0.25 + 3% of attenuation setting in dB) ± (0.4 + 6% of attenuation setting in dB)			dB dB dB
VSWR (I/O)[4]		LF–2.0 GHz		1.5:1	1.8:1	
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			 15 50 50		 ns ns mV
Input power for 1 dB compression	V_{CC} = 5 V, V_{SS} = -3 V	0.5–2.0 GHz 0.05 GHz	22 16	27 20		dBm dBm
Intermodulation intercept point (IP3)	For Two-tone Input Power 5 dBm V_{CC} = 5 V	0.5–2.0 GHz 0.05 GHz	40 28	46 34		dBm dBm
Thermal resistance				85		°C/W
Supply voltages[5]	V_{CC} V_{SS}		2.5 -2.5	3 -3	5.0 -3.5	V V
Supply currents	V_{CC} = 5 V, V_{SS} = -3 V V_{CC} = 3 V, V_{SS} = -3 V			1.5 1.0		mA mA
Control voltages[6]	V_{CC} = 5 V, V_{SS} = -3 V CTL1, CTL2, CTL4, CTL8, CTL16 = Logic 0 CTL1, CTL2, CTL4, CTL8, CTL16 = Logic 1		 0 2.5	 3	 0.8 5.0	 V V

1. All measurements made in a 50 Ω system, unless otherwise specified.
2. Insertion loss changes by 0.003 dB/°C.
3. Attenuation referenced to insertion loss.
4. Input/output.
5. V_{CC} must be supplied prior to V_{SS}.
6. Control voltage must not exceed V_{CC}.

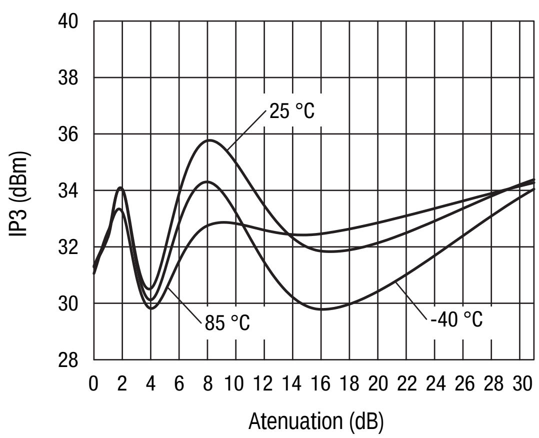
Typical Performance Data (V_{CC} = 5 V)



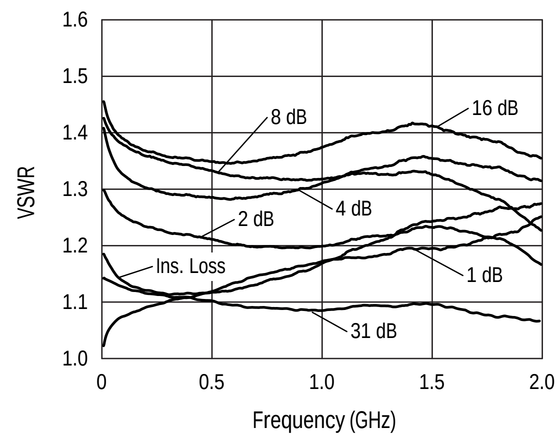
Insertion Loss vs. Frequency



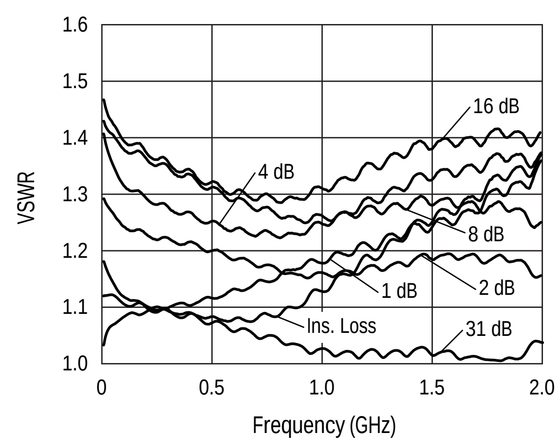
VSWR vs. Frequency (25 °C)



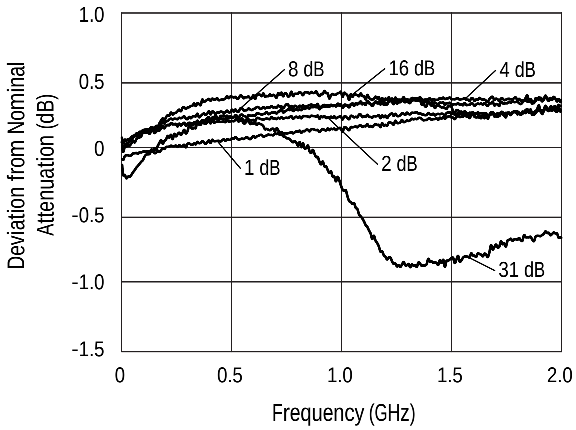
IP3 vs. Attenuation and Temperature, Main Bits (50 MHz) V_{CC} = 5 V



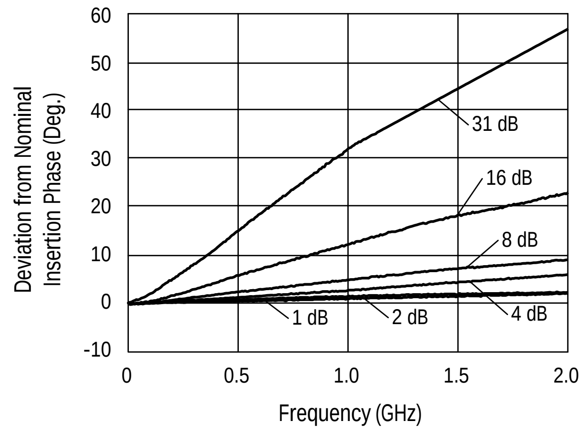
VSWR vs. Frequency (85 °C)



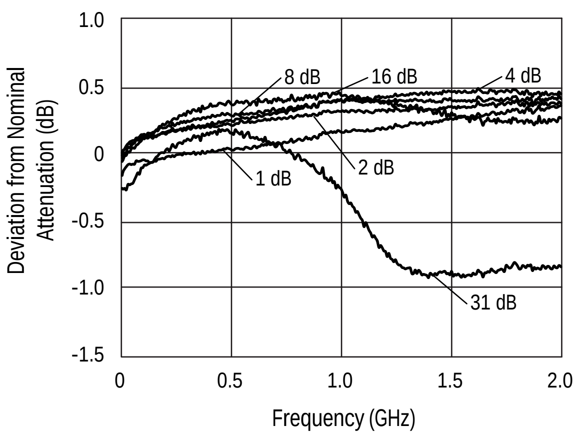
VSWR vs. Frequency (-40 °C)



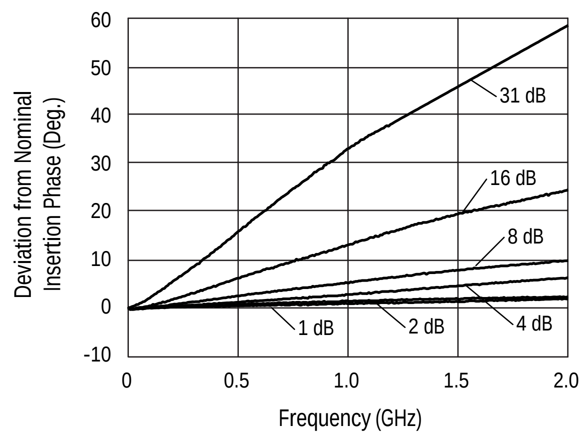
Attenuation Accuracy vs. Frequency (25 ˚C)



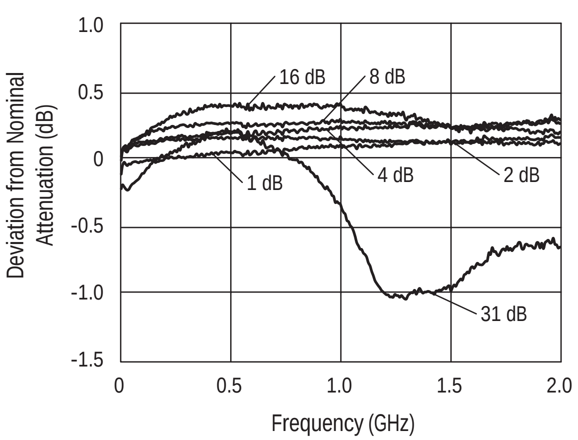
Attenuation Phase Accuracy vs. Frequency (25 ˚C)



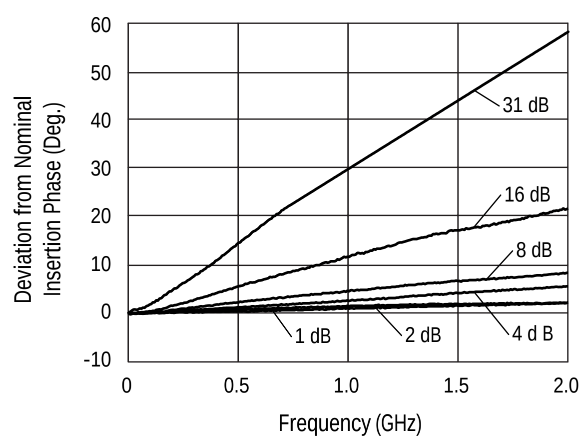
Attenuation Accuracy vs. Frequency (85 ˚C)



Attenuation Phase Accuracy vs. Frequency (85 ˚C)

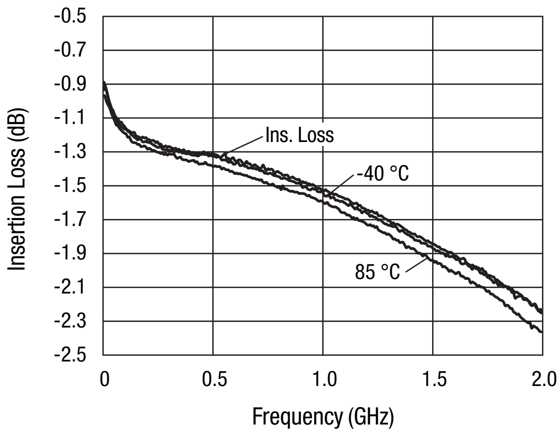


Attenuation Accuracy vs. Frequency (-40 ˚C)

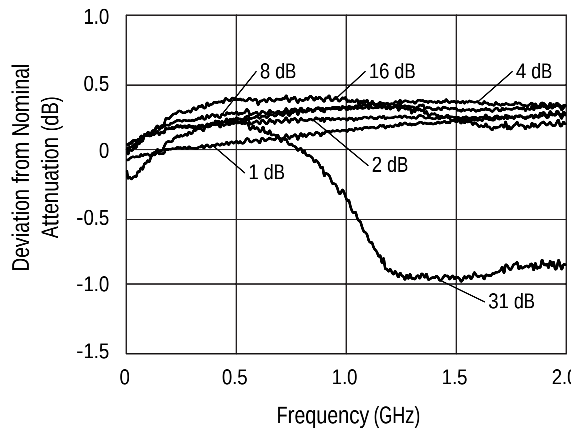


Attenuation Phase Accuracy vs. Frequency (-40 ˚C)

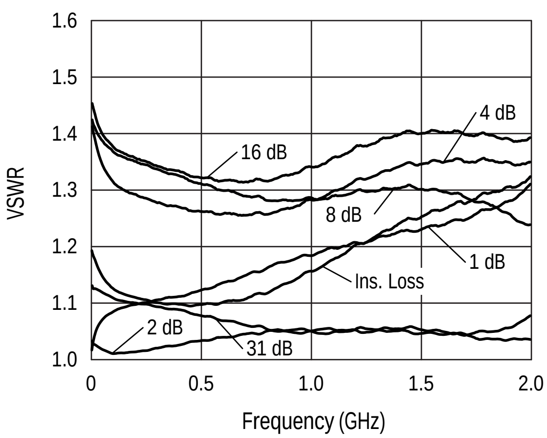
Typical Performance Data (V_{CC} = 3 V)



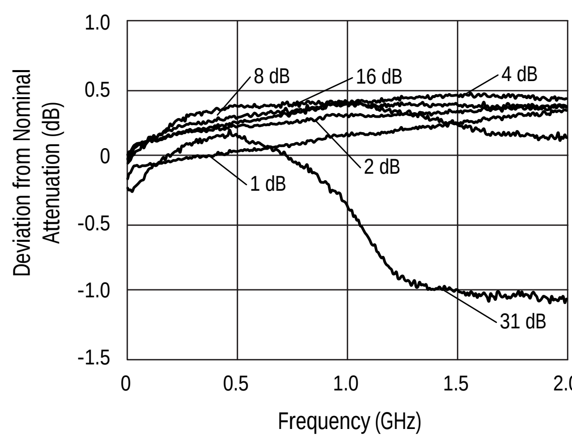
Insertion Loss vs. Frequency



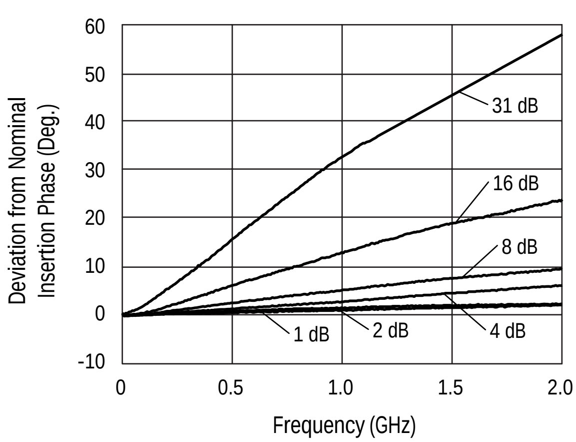
Attenuation Accuracy vs. Frequency (25 ˚C)



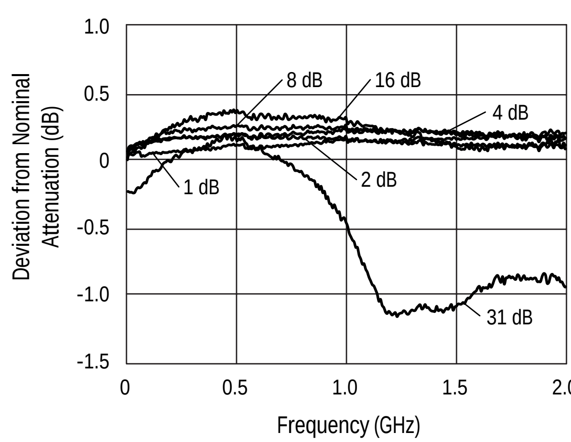
VSWR vs. Frequency (25 ˚C)



Attenuation Accuracy vs. Frequency (85 ˚C)



Attenuation Phase Accuracy vs. Frequency (25 ˚C)



Attenuation Accuracy vs. Frequency (-40 ˚C)

Compression Point vs. Attenuation, Voltage, and Temperature

Attenuation State	V_{SS} Voltage (V)	Input Power @ 1 dB Compression		
		25 °C (dBm)	85 °C (dBm)	-40 °C (dBm)
Ins. loss	-3	16.6	16.6	16.5
1 dB	-3	17.5	17.5	17.5
2 dB	-3	18.9	19	18.8
4 dB	-3	16.3	16.6	16.3
8 dB	-3	20.6	21.1	21.8
16 dB	-3	15.5	15.1	16.2
31 dB	-3	20.2	19.9	20.1

Frequency = 50 MHz.

Truth Table

CTL1	CTL2	CTL4	CTL8	CTL16	Attenuation J_1–J_2
0	0	0	0	0	Ins. Loss
1	0	0	0	0	1 dB
0	1	0	0	0	2 dB
0	0	1	0	0	4 dB
0	0	0	1	0	8 dB
0	0	0	0	1	16 dB
1	1	1	1	1	31 dB

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.

Absolute Maximum Ratings

Characteristic	Value
RF input power	2 W > 500 MHz, 0/6 V 0.5 W > 50 MHz, 0/6 V
Supply voltage	6 V
Control voltage[1]	-0.2 V, +6 V
Operating temperature	-40 °C to +85 °C
Storage temperature	-65 °C to +150 °C
Θ_{JC}	85 °C/W

1. Control voltage must not exceed supply voltage.

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-20