

# GaAs IC 5 Bit Digital Attenuator with Driver

## 1 dB LSB Positive Control DC–2 GHz



AA117-85

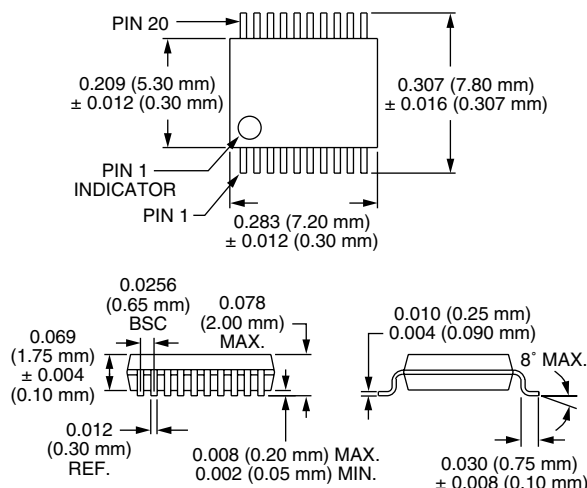
### Features

- 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

### 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

### SSOP-20



required. Typical applications include base station, wireless data, broadband and wireless local loop gain control circuits.

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

| Parameter <sup>1</sup>                 | Condition                                                                                                             | Frequency   | Min.                                            | Typ.        | Max.        | Unit     |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------|-------------|-------------|----------|
| Insertion Loss <sup>2</sup>            |                                                                                                                       | DC–0.5 GHz  |                                                 | 1.4         | 1.7         | dB       |
|                                        |                                                                                                                       | DC–1.0 GHz  |                                                 | 1.7         | 2.1         | dB       |
|                                        |                                                                                                                       | DC–2.0 GHz  |                                                 | 2.2         | 2.6         | dB       |
| Attenuation Range                      |                                                                                                                       |             |                                                 | 31          |             | dB       |
| Attenuation Accuracy <sup>3</sup>      |                                                                                                                       | DC–0.5 GHz  | $\pm (0.2 + 2\%$ of Attenuation Setting in dB)  |             |             | dB       |
|                                        |                                                                                                                       | DC–1.0 GHz  | $\pm (0.25 + 3\%$ of Attenuation Setting in dB) |             |             | dB       |
|                                        |                                                                                                                       | DC–2.0 GHz  | $\pm (0.4 + 6\%$ of Attenuation Setting in dB)  |             |             | dB       |
| VSWR (I/O) <sup>4</sup>                |                                                                                                                       | DC–2.0 GHz  |                                                 | 1.5:1       | 1.8:1       |          |
| Switching Characteristics <sup>5</sup> | Rise, Fall (10/90% or 90/10% RF)                                                                                      |             |                                                 | 15          |             | ns       |
|                                        | On, Off (50% CTL to 90/10% RF)                                                                                        |             |                                                 | 50          |             | ns       |
|                                        | Video Feedthru                                                                                                        |             |                                                 | 50          |             | mV       |
| Input Power for 1 dB Compression       | $V_{CC} = +5$ V, $V_{SS} = -3$ V                                                                                      | 0.5–2.0 GHz | +22                                             | +27         |             | dBm      |
|                                        |                                                                                                                       | 0.05 GHz    | +16                                             | +20         |             | dBm      |
| Intermodulation Intercept Point (IP3)  | For Two-tone Input Power +5 dBm<br>$V_{CC} = +5$ V                                                                    | 0.5–2.0 GHz | +40                                             | +46         |             | dBm      |
|                                        |                                                                                                                       | 0.05 GHz    | +28                                             | +34         |             | dBm      |
| Supply Voltages                        | $V_{CC}$<br>$V_{SS}$                                                                                                  |             | 2.5<br>-2.5                                     | 3.0<br>-3.0 | 5.0<br>-3.5 | V<br>V   |
| Supply Currents                        | $V_{CC} = 5$ V, $V_{SS} = -3$ V<br>$V_{CC} = 3$ V, $V_{SS} = -3$ V                                                    |             |                                                 | 1.5<br>1.0  |             | mA<br>mA |
| Control Voltages                       | $V_{CC} = 5$ V, $V_{SS} = -3$ V<br>CTL1, CTL2, CTL4, CTL8, CTL16 = Logic 0<br>CTL1, CTL2, CTL4, CTL8, CTL16 = Logic 1 |             | 0<br>3.5                                        |             | 0.8<br>5.0  | V<br>V   |

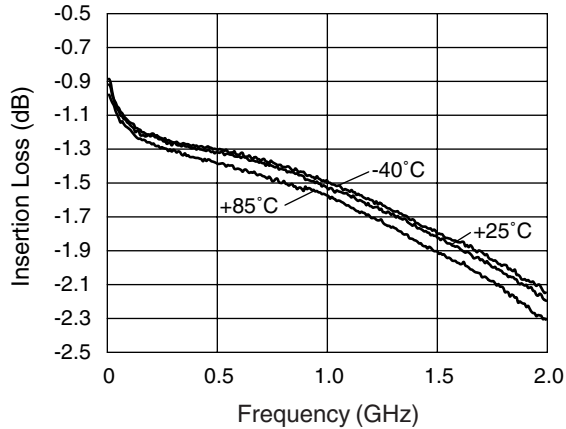
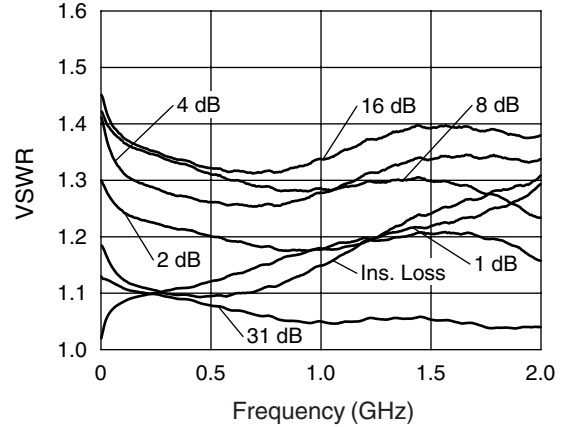
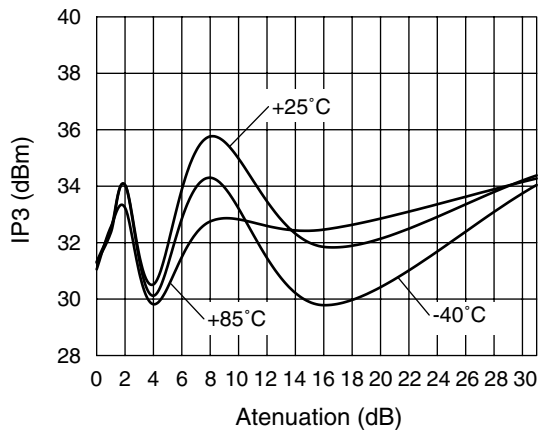
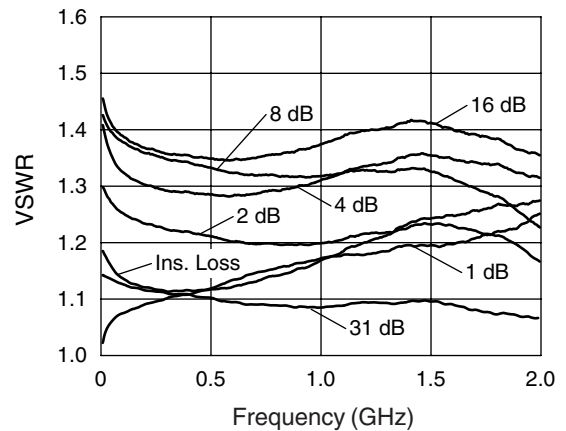
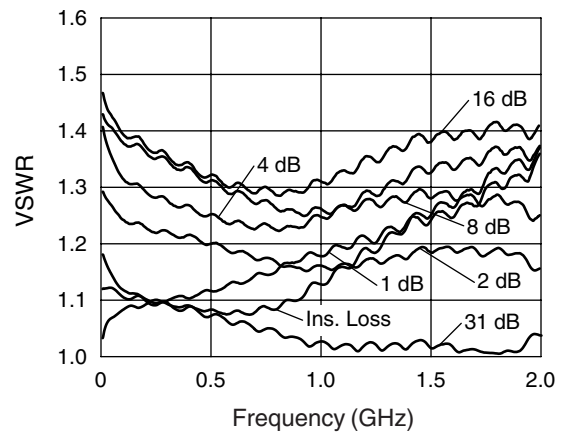
1. All measurements made in a 50  $\Omega$  system, unless otherwise specified.

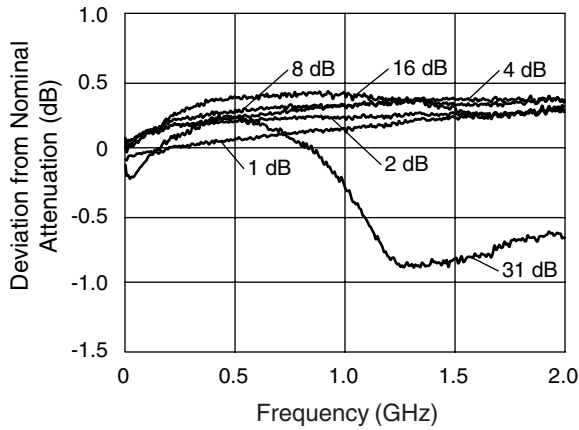
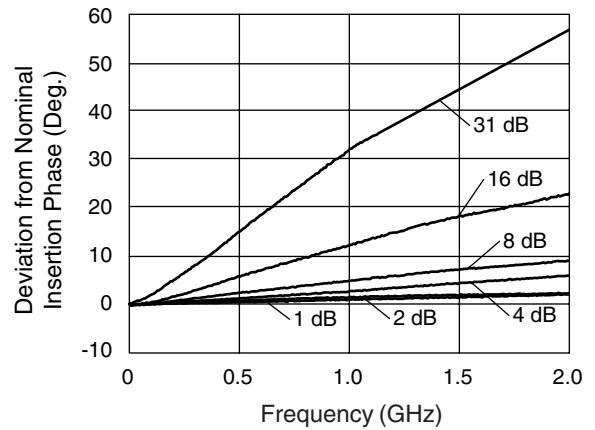
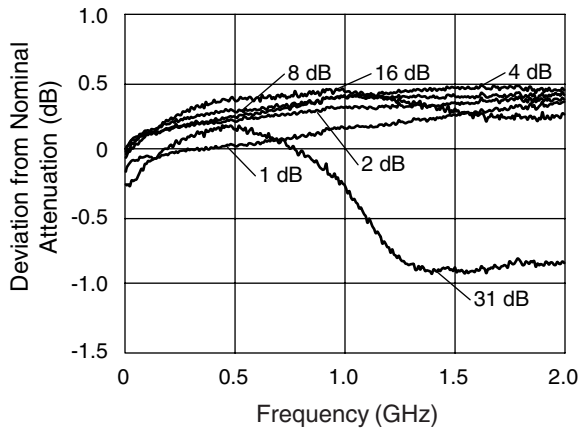
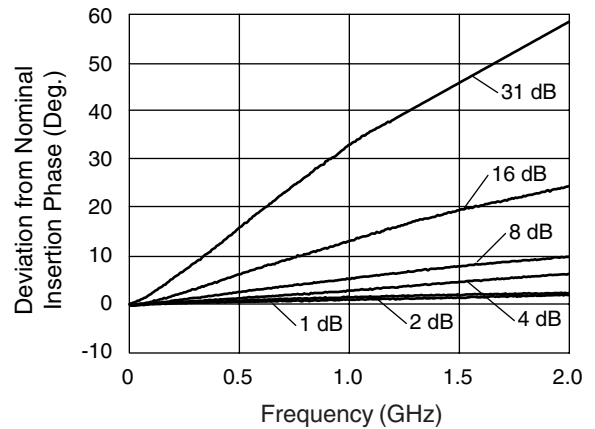
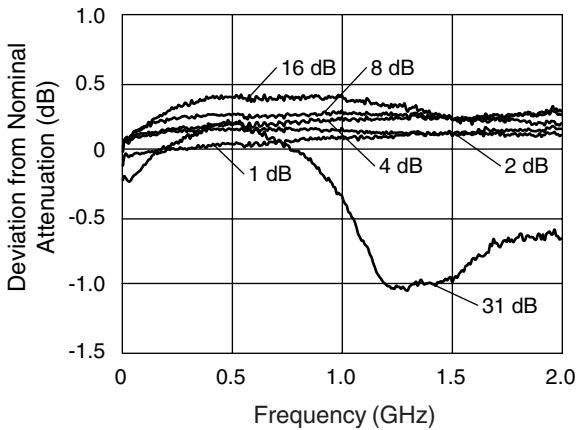
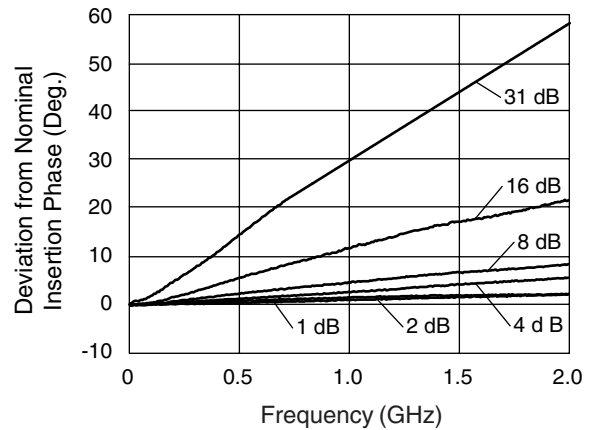
2. Insertion loss changes by 0.003 dB/°C.

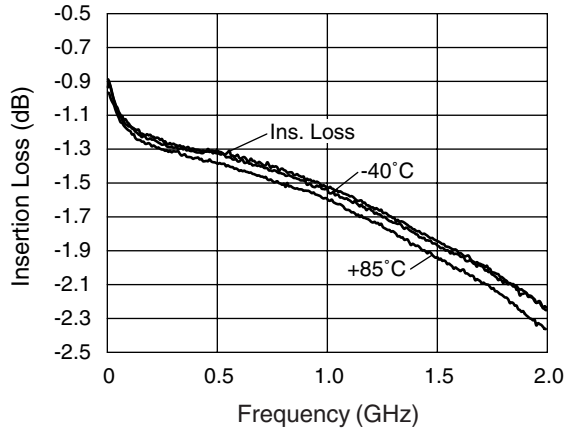
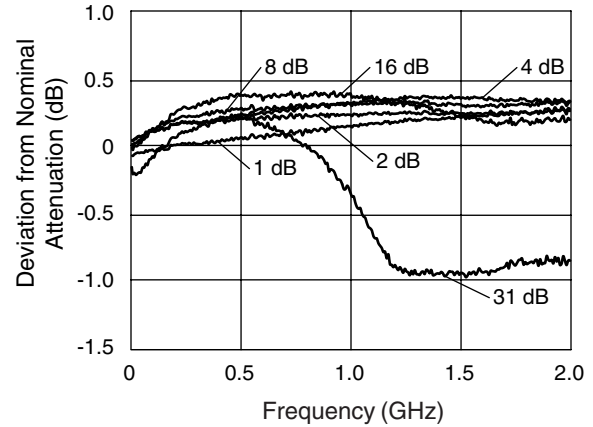
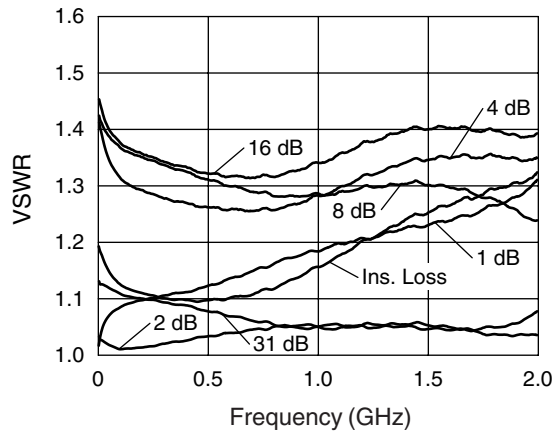
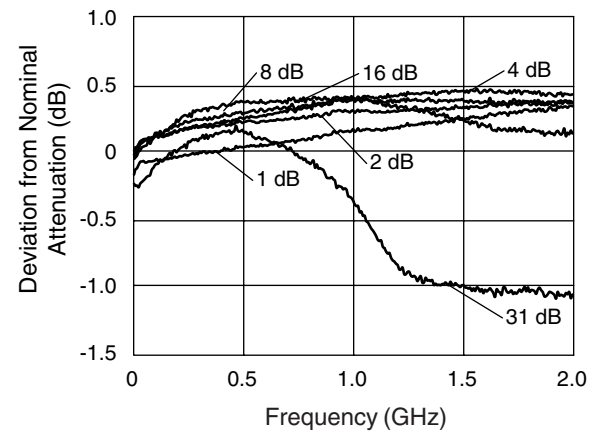
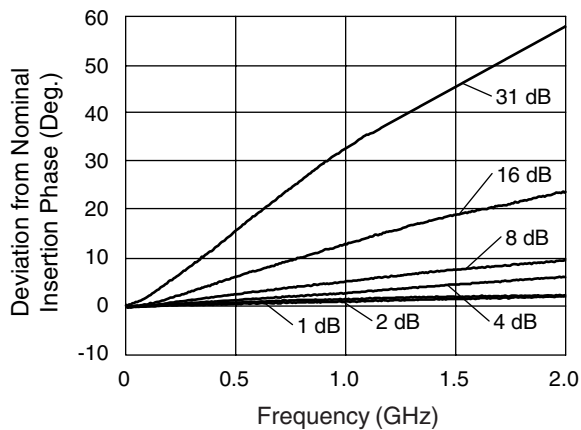
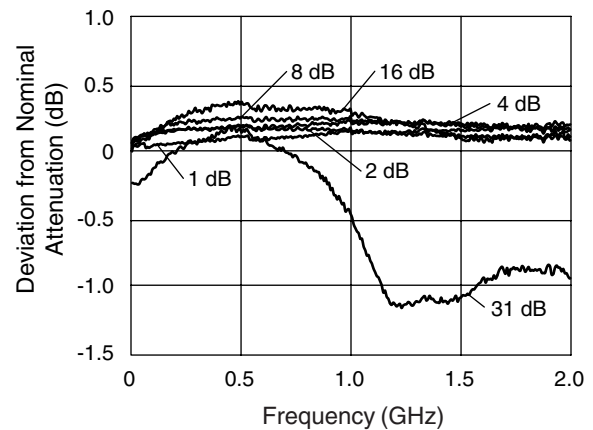
3. Attenuation referenced to insertion loss.

4. Input/output.

5. Video feedthru measured with 1 ns risetime pulse and 500 MHz bandwidth.

**Typical Performance Data ( $V_{CC} = +5\text{ V}$ )****Insertion Loss vs. Frequency****VSWR vs. Frequency ( $+25^{\circ}\text{C}$ )****IP3 vs. Attenuation and Temperature,  
Main Bits (50 MHz)  $V_{CC} = +5\text{ V}$** **VSWR vs. Frequency ( $+85^{\circ}\text{C}$ )****VSWR vs. Frequency ( $-40^{\circ}\text{C}$ )**

**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 ( $V_{CC} = +3\text{ V}$ )****Insertion Loss vs. Frequency****Attenuation Accuracy vs. Frequency ( $25^{\circ}\text{C}$ )****VSWR vs. Frequency ( $25^{\circ}\text{C}$ )****Attenuation Accuracy vs. Frequency ( $85^{\circ}\text{C}$ )****Attenuation Phase Accuracy vs. Frequency ( $25^{\circ}\text{C}$ )****Attenuation Accuracy vs. Frequency ( $-40^{\circ}\text{C}$ )**

Compression Point vs. Attenuation,  
Voltage, and Temperature

| Attenuation<br>State | V <sub>SS</sub><br>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<br>J <sub>1</sub> –J <sub>2</sub> |
|------|------|------|------|-------|-----------------------------------------------|
| 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                                         |

Absolute Maximum Ratings

| Characteristic               | Value                                         |
|------------------------------|-----------------------------------------------|
| RF Input Power               | 2 W > 500 MHz, 0/6 V<br>0.5 W > 50 MHz, 0/6 V |
| Supply Voltage               | 6 V                                           |
| Control Voltage <sup>1</sup> | -0.2 V, +6 V                                  |
| Operating Temperature        | -40°C to +85°C                                |
| Storage Temperature          | -65°C to +150°C                               |
| Θ <sub>JC</sub>              | 85°C/W                                        |

Note: Exceeding these ratings may cause irreversible damage.  
1. Control voltage must not exceed supply voltage.

Pin Out

