



# 346C Series Multi-Octave 10 Bit Digital PIN Diode Attenuators

**Contact us**

Application Notes for [Microwave Attenuators](#)

- **Frequency range: 0.5 GHz-18GHz in four overlapping ranges**
- **Attenuation range: 60 dB**
- **Programming: 10-Bit binary**
- **LSB: 0.06 dB**
- **Monotonicity: guaranteed**

The 346C Series is a family of Non-reflective PIN diode attenuators, each programmable to 60 dB in attenuation steps as low as 0.06 dB, and covering the frequency range from 0.5 GHz to 18 GHz in four overlapping multi-octave bands.

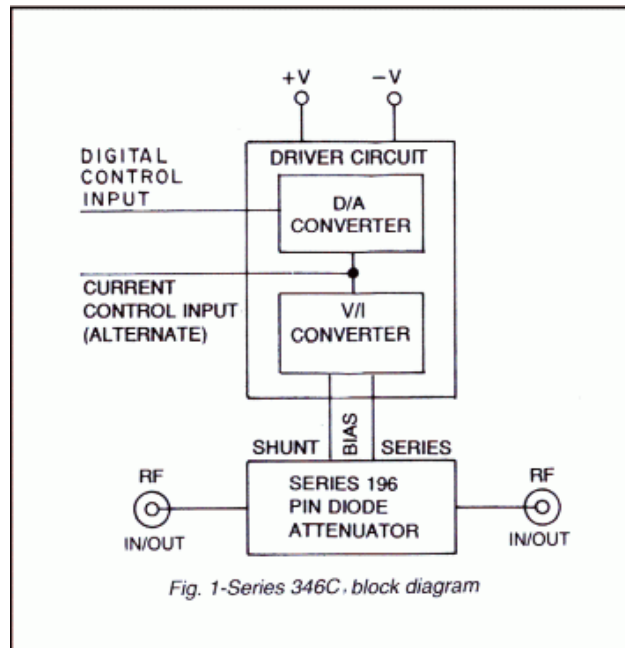
Each model in the Series comprises an integrated assembly of a dual (current-controlled) PIN diode attenuator, and a driver circuit consisting of a D/A converter and a voltage-to-current converter. (See Figure 1 below)

The RF circuit consists of two wide-band, T-pad attenuator sections in tandem. The levels of series and shunt currents required to maintain a bilateral match at all attenuation levels are provided by the driver.

This arrangement assures monotonicity over the operating band at all levels of attenuation and for any programmed attenuation step.



3460C



## PERFORMANCE CHARACTERISTICS

CHARACTERISTIC	MODEL 3460C*	MODEL 3461C	MODEL 3462C*	MODEL 3468C
Frequency Range (GHz)	0.5-4	0.5-8	2-8	2-18
Mean Attenuation Range (dB)	60	60	60	60
Insertion Loss (dB) (max)	2.5	2.5 (0.5-4 GHz) 3.2 (4-8 GHz)	3.2	4.5
VSWR (max)	1.8	1.8	1.8	2.0
Flatness up to				
20 dB	± 0.5 dB	± 0.75 dB	± 0.75 dB	± 1.0 dB
40 dB	± 0.75 dB	± 1.0 dB	± 1.0 dB	± 1.25 dB
60 dB	± 1.0 dB	± 1.5 dB	± 1.5 dB	± 3.0 dB

\*Special-order product. Consult factory before ordering.

**Accuracy of Attenuation**

0 to 20 dB.....	± 1.0 dB
20 to 40 dB.....	± 1.5 dB
40 to 60 dB.....	± 2.0 dB

**Monotonicity**..... Guaranteed

**Minimum Attenuation Step** 0.06 dB<sup>(1)</sup>

**Logic Input**

Logic "0" (Bit OFF) .....	-0.3 to +0.8V
Logic "1" (Bit ON) .....	+2.0 to +5.0V
Input Current .....	10 µA max.

<b>Phase Shift</b> .....	See figure 2
<b>Temperature Coefficient</b> .....	± 0.02 dB/ °C
<b>Power Handling Capability</b>	
Without Performance Degradation	
All Units.....	Up to 50 mW cw or peak (see figure 3)
Survival Power	
All units.....	2 W average or peak, from -65(°)C to +25(°)C (see figure 4 for higher temperatures).
<b>Switching Time</b>	
ON Time.....	1.0 µsec. max.
OFF Time.....	0.5 µsec. max.
<b>Programming</b> .....	Positive true binary. For complementary code, specify Option 2. To interface with other logic families, please contact factory.

<b>Nominal Control Voltage Characteristics</b>	
<b>Range</b> .....	0 to 3 mA
<b>Transfer Function</b> .....	20 dB / mA
<b>Input Impedance</b> .....	3 kohm
<b>Power Supply</b>	
<b>Requirements</b> .....	+12V to +15V, 90 mA -12V to -15V, 60 mA
<b>Power Supply Rejection</b> .....	
	Less than 0.1 dB / volt change in either supply

- The Series 346C attenuators are 10-bit digital attenuators. In order to use this device with a lesser number of bits (lower resolution), the user may simply ground the logic pins for the lowest order unused bits. For example, a Series 346C unit operated as an 8-bit unit would have Pin 15 and Pin 3 connected to ground. All other parameters remain unchanged.

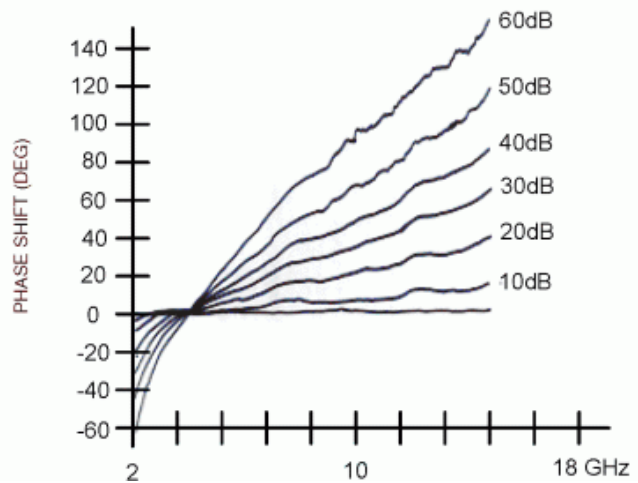
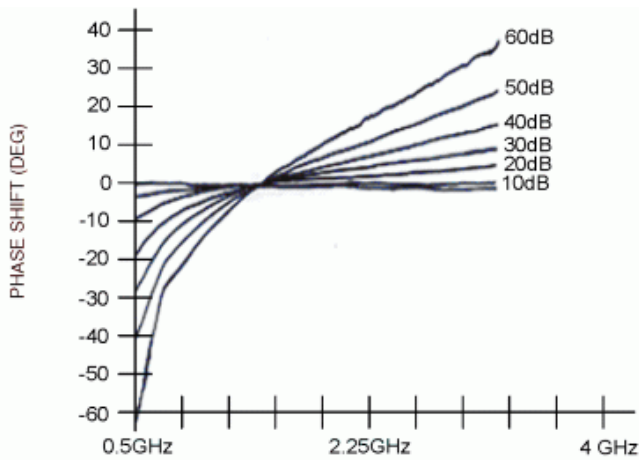


Fig. 2 - Series 346C, typical phase shift as a function of attenuation & frequency

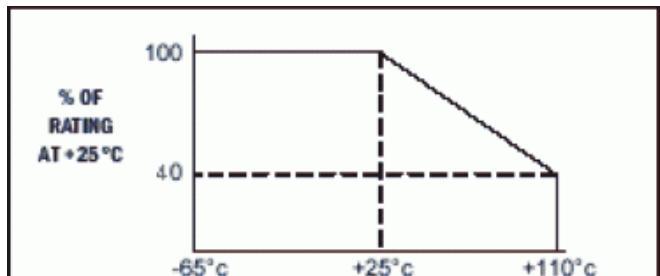
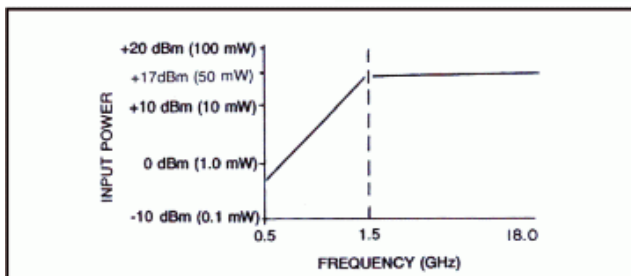
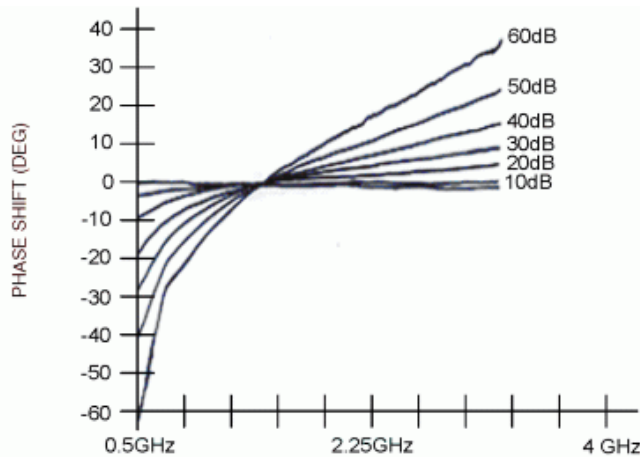


Fig. 3-Series 346C, maximum peak and average operating power without performance degradation

TEMPERATURE

Fig. 4-Model 346C, survival power derating factor

**ENVIRONMENTAL RATINGS**

<b>Operating Temperature</b>	
Range.....	-54°C to +110°C
<b>Non-Operating</b>	
<b>Temperature Range</b> .....	-65°C to +125°C
<b>Humidity</b> .....	MIL-STD-202F, Method 103B, Cond. B (96 hrs. at 95%)
<b>Shock</b> .....	MIL-STD-202F, Method 213B, Cond. B (75G, 6 msec)
<b>Vibration</b> .....	MIL-STD-202F, Method 204D, Cond. B (.06" double amplitude or 15G, whichever is less)
<b>Altitude</b> .....	MIL-STD-202F, Method 105C, Cond. B (50,000 ft.)
<b>Temp. Cycling</b> .....	MIL-STD-202F, Method 107D, Cond. A, 5 cycles

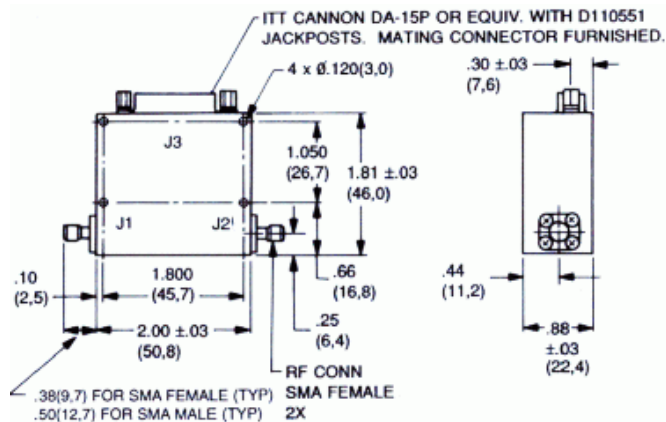
**AVAILABLE OPTIONS**

Option No.	Description
2	Complementary programming (logic "0" is bit on)
7	Two SMA male RF connectors
10	One SMA male (J1) and one SMA female (J2) RF connector
C38	30 dB attenuation range. Consult factory for impact on specifications.
Z06	1 to 18 GHz operation. I.L 4.8dB max.

**ACCESSORY FURNISHED**

Mating power/logic connector

**DIMENSIONS AND WEIGHT**



**SERIES 346C**

**Wt: 3 Oz. (85 gm) approx.**

Dimensional Tolerances, unless otherwise indicated: XX ± .02; XXX ± .005

PIN NO.	J3 PIN FUNCTIONS(1)(4)
1	GND (Note 2)
2	ANALOG INPUT(Note 3)
3	0.13 dB
4	GND
5	0.25 dB
6	0.5 dB
7	1dB
8	2dB
9	4dB
10	8dB
11	16dB
12	32 dB(MSB)
13	+V
14	-V
15	0.06 dB(LSB)

(1) All unused logic inputs must be grounded.

(2) For normal programming control Pin 1 must be grounded or at logic "0". Application of logic "1" to Pin 1 overrides the digital input and sets the unit to insertion loss. For units with complementary programming (Option 2), the application of a logic "1" to Pin 1 sets the unit to high isolation (60 dB or greater).

(3) Pin 2 is available to (a) monitor the D/A converter output, (b) apply a modulation signal from a current source, or (c) apply an independent analog signal for turn-on, turn-off or vernier attenuation levels. If not used as described in (a), (b) or (c). Pin 2 must be open.

(4) The Series 346C attenuators are 10-bit digital attenuators. In order to use this device with a lesser number of bits (lower resolution), the user may simply ground the logic pins for the lowest order unused bits. For example, a Series 346C unit operated as an 8-bit unit would have Pin 15 and Pin 3 connected to ground. All other parameters remain unchanged.



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