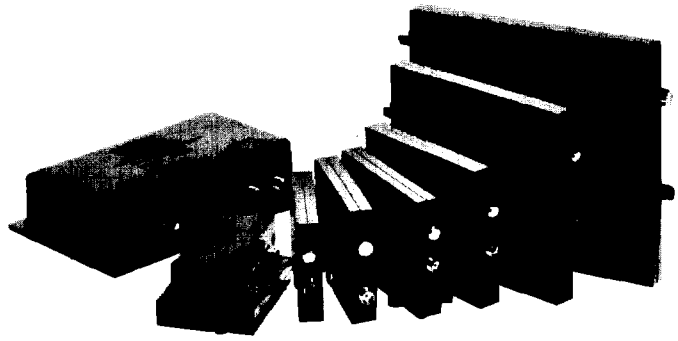
Anaren

Analog Attenuators PIN Diode, Absorptive



Features

Low VSWR at any attenuation
0.5 to 18 GHz coverage
Low phase shift versus attenuation
Temperature compensated voltage driver
5.5 dB/Volt linearizer
Flat attenuation response over frequency and temperature range
Meets MIL-E-5400, Class 3 requirements

Applications

Attenuators for load sensitive devices
Precision attenuation control
Remote controlled test set-ups
Instrumentation
Modulation
Simulation
Switching

Description

Absorptive attenuators are used when good input and output VSWR is required at any attenuation level. Anaren offers two types of analog absorptive attenuators, current controlled and voltage controlled.

Current Controlled A line of basic current controlled, absorptive attenuators provide smooth, repeatable attenuation versus current characteristics. See Figure 1 for typical attenuation versus current characteristics. DC blocks and bias filtering are integrated into the units. The basic attenuator consists of PIN diode modules between two 90° hybrid couplers. (See page 189 for block diagram and description.) This technique provides good match at any attenuation level.

Voltage Controlled A series of voltage controlled models integrates temperature compensated, voltage controlled drivers into a single attenuator/driver package. This attenuator/driver series possesses the same features as the voltage controlled attenuators, but permits direct voltage (rather than current control of attenuation while providing excellent temperature stability from −54° to +95°C. See Figure 2 for typical attenuation versus voltage characteristics.

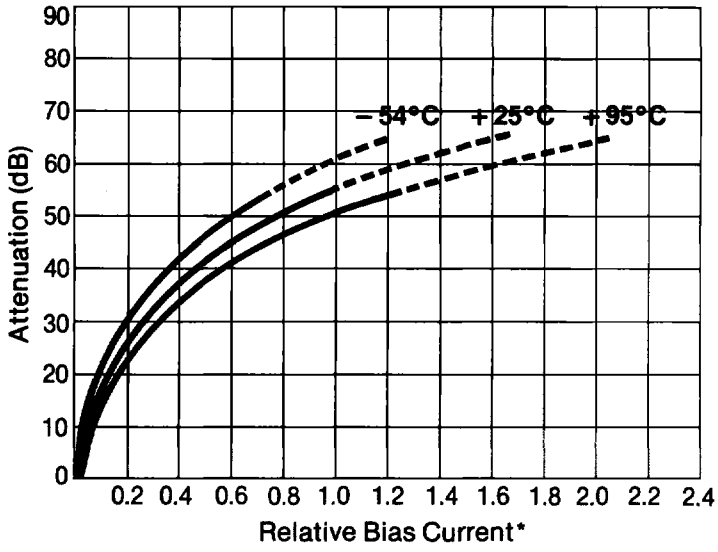
Linearizer the Model 300010 is a separate linearizing unit which, when used with the voltage controlled attenuators, develops an attenuation response of 5.5 dB/V ± 3.0 dB (± 1 dB with custom alignment). The linearizer output simply connects to the attenuator voltage drive port through a coaxial cable. The (attenuator/driver/linearizer) combination is temperature compensated from −54° to +95°C. See Figure 2 for a comparison of attenuation versus voltage characteristics with and without the linearizer.

Electrical Specifications

Model No.		Frequency (GHz)	Attenuation Range Min (dB)	Attenuation Flatness* (dB)	Insertion Loss Max (dB)	VSWR Max
Current Controlled (w/o Driver)	Voltage Controlled (with Driver)					
60364	60464	0.5-1.0	55	±2.0	1.5	1.7
60365	60465	1.0-2.0	55	±2.0	1.7	1.5
60366	60466	2.0-4.0	55	±2.0	2.0	1.6
60367	60467	4.0-8.0	55	±3.0	2.5	1.8
6A0368	6A0468	7.0-11.0	55	±2.0	2.7	2.0
60368	60468	8.0-12.4	55	±2.0	2.9	2.0
60369	60469	12.4-18.0	55	±3.0	4.3	2.5

* Attenuation flatness specified at 45 dB attenuation; add ±0.75 dB at 55 dB attenuation. At lower attenuation or narrower bandwidth or both, flatness is improved.

Specifications subject to change without notice.



*Due to diode tolerances, and lot-to-lot variations, maximum current required for 55dB attenuation varies from +6 to +30 mA at 25°C. Normally, it's +10 to +15 mA.

Figure 1 - Typical Attenuation vs. Relative Bias Current
(Current Controlled Attenuators)

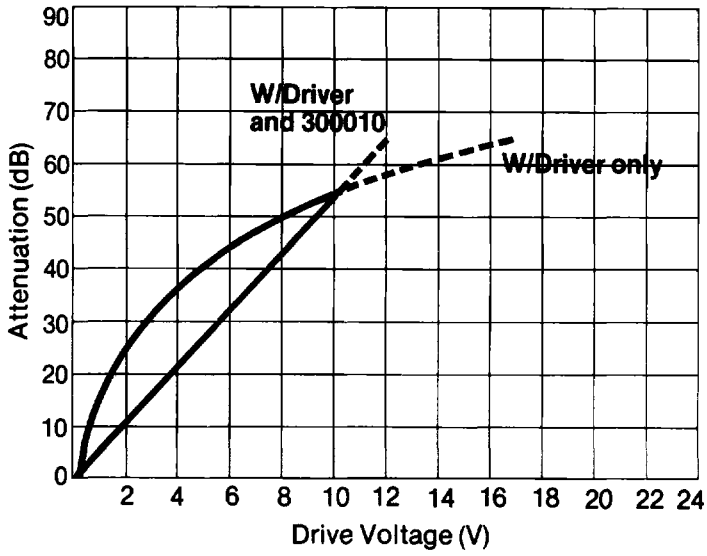


Figure 2—Typical Attenuation vs. Drive Voltage
(Voltage Controlled Attenuators with, and without Model 300010 Linearizer)

Additional Specifications

Current Controlled Models

RF Ports: DC impedance is greater than 10^6 ohms.

Bias Port: Input impedance essentially follows that of a silicone diode (anode connected to bias port).

Bias: +30 mA maximum (typically +10 to +15 mA) for 55 dB attenuation.

Burnout level is greater than 300 mA.

V_{BR} is greater than 100V.

RF Power (Survival): CW, 2W maximum, linearly derated above 25°C to 1W at 95°C. Pulsed (1.0 μs, 0.01 duty cycle), 50W peak maximum, linearly derated above 25°C to 25W peak at 95°C.

Distortion: Harmonics are 50 dB below fundamental at RF power of 0.030W for 60364, 0.060W for 60365, and 0.100W for all other models.

Switching Time: With unspiked 50 ohm drive, 0.3 μs maximum (typically 0.1 μs) from 0 dB to 55 dB attenuation ("On"); 0.5 μs maximum (typically 0.1 μs) from 55 dB to 10 dB attenuation, 4.5 μs maximum from 10 dB to 0 dB attenuation ("Off").

RF Leakage: —40 dB at bias port (typical).

Voltage Controlled and Linearized Models

Same specifications as current controlled models except as modified below:

Drive Port: Input impedance is 10k ohms.

Input voltage is 0 to +10V for 55 dB attenuation.

Switching: **Voltage Controlled Models**
0.7 μs maximum (typically 0.5 μs) from zero to 55 dB attenuation; 22 μs (typically 20 μs) from 55 dB attenuation to zero dB attenuation as measured from 50% of switch command pulse to within .5 dB of insertion loss state.

Linearized Models (with Model 300010 Linearizer)
20 μs maximum (typically 10 μs) from zero to 55 dB attenuation; 25 μs maximum (typically 22 μs) from 55 dB attenuation to zero dB attenuation as measured from 50% of switch command pulse to within .5 dB of insertion loss state. Model 300010 Linearizer propagation delay is .25 μs.

Video Leakage: —60 dB at RF port.

Temperature Stability: ±5% maximum attenuation change (±7% maximum with 300010 Linearizer) from —54°C at +95°C to any attenuation.

Linearity (For Linearized Models Only): With 300010 Linearizer. Attenuation response is 5.5 dB / V ±3.0 dB (±1.0 dB with custom alignment).

DC Power: Voltage controlled models and 300010 Linearizer require ±15V, 50 mA maximum.

Specifications subject to change without notice.

PIN Attenuator/Driver, 60460 Series, and 300010 Linearizer

The following is information on the typical characteristics of Anaren PIN attenuator/drivers which may be of interest to the user. No specifications are implied by this information.

Supply Voltage

The 60460 Series PIN Attenuator supply voltage specifications are ±15V at ±50 ma. Actual current drain typically runs about +35 ma and −5 ma. Supply voltages may be in any combination of ± values between 11V and 17V without appreciable degradation of performance. If a supply voltage exceeds 17V, the semiconductor devices in the driver will be subjected to excessive junction stress which may be detremental to reliability. When a supply voltage drops below 11V, the attenuation dynamic range is clipped because the input control voltage (0 to +10V) can exceed the "supply voltage minus semiconductor junction drop" of the driver output stage.

The 300010 linearizer has the same ±15V, ±50 ma specification as the 60460 series. The actual current drain of the linearizer typically is +35 ma and −20 ma. The linearizer can tolerate supply voltages between ±9V to ±17V. It can operate with a lower voltage than the 60460 because its circuitry uses an internal zenar regulated supply whose value is not affected until the power supply voltage drops below 9V. Little change in linearity will be noticed over the 9V to 17V supply values.

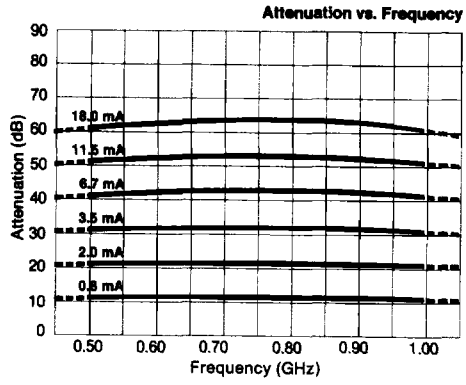
PIN Attenuator Switching Speed

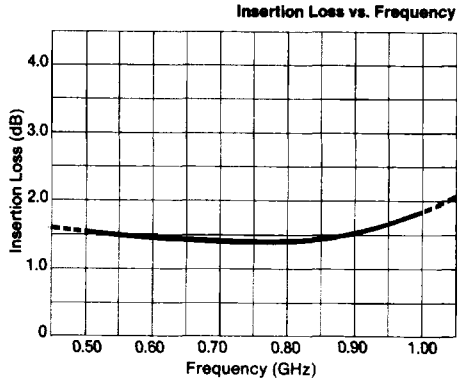
Catalog specifications are 22 μsec max from insertion loss to 55dB attenuation and from 55dB attenuation to within .5dB of insertion loss. Actual speed runs about 12 μsec and 14 μsec respectively. A contributor to the slow speed is the differential amplifier in the driver. This amp has an output slew rate of about 1 volt/μsec where it takes about 7 volts of output swing to drive the attenuator diodes from zero to 55dB attenuation. Another contributor to the slow speed is the attenuator diodes. They have a moderate speed (sub μsec) for intermediate attenuation changes, (i.e., changing from 20dB attenuation to 30dB attenuation.) However, they have a stored charge characteristic which causes hysterises or delay to the attenuation change of several microseconds when the attenuation is changed from some level to zero or near zero attenuation.

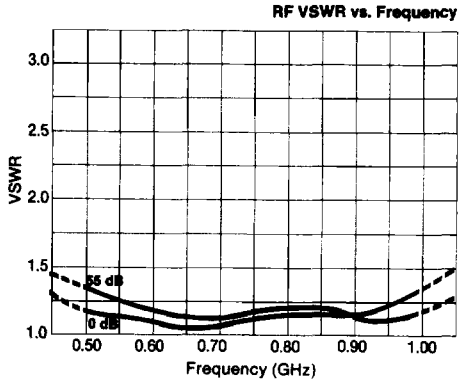
The slow response of the attenuator has advantages in stability, resetability and low intermodulation products.

When the 300010 linearizer is used, it may contribute an additional microsecond or so to the 60460 speed because it has the same type of differential amplifier as the 60460 series driver.

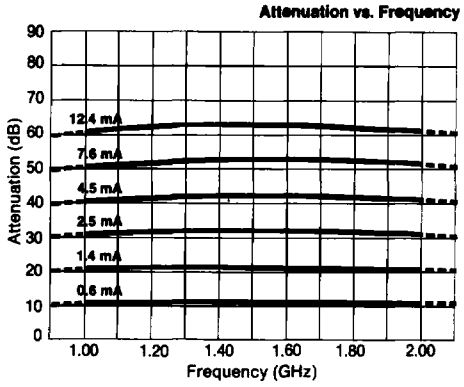
Model 60364

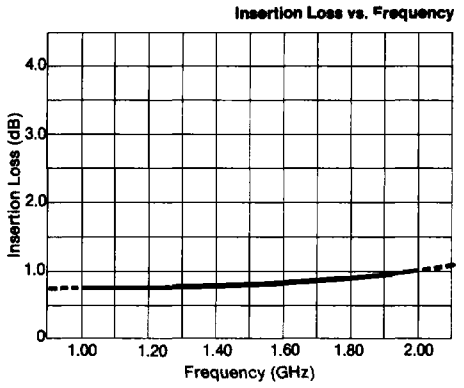


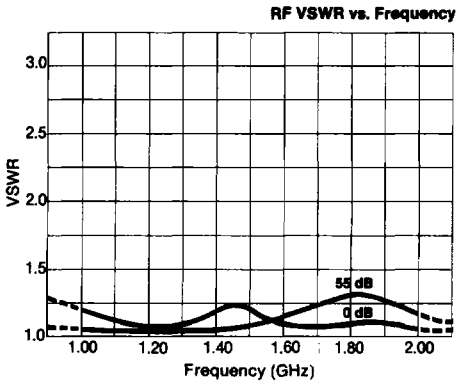




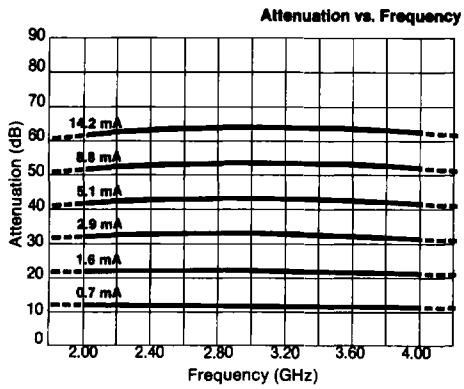
Model 60365

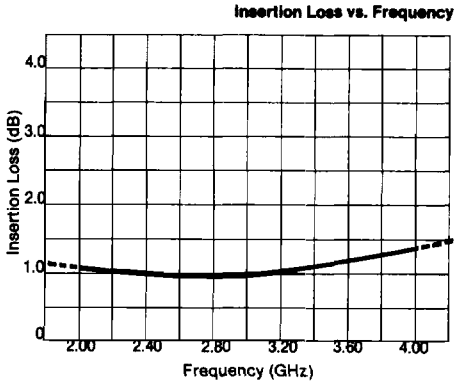


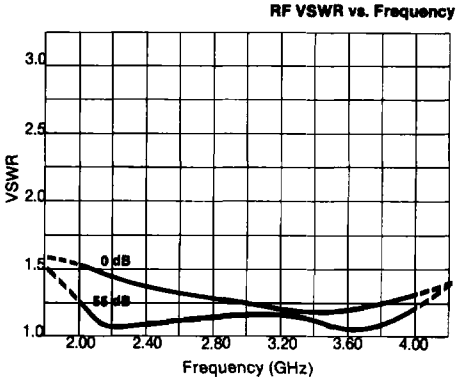




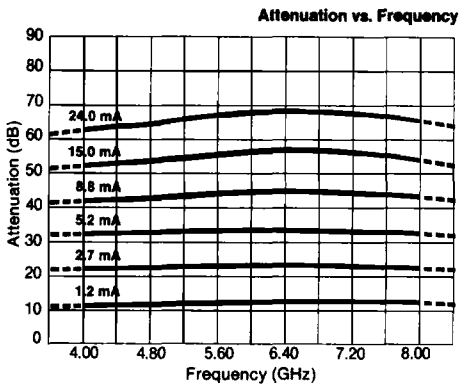
Model 60366

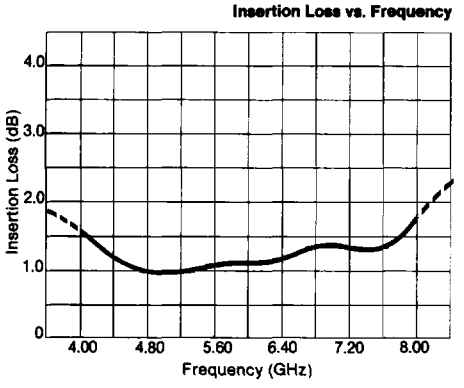


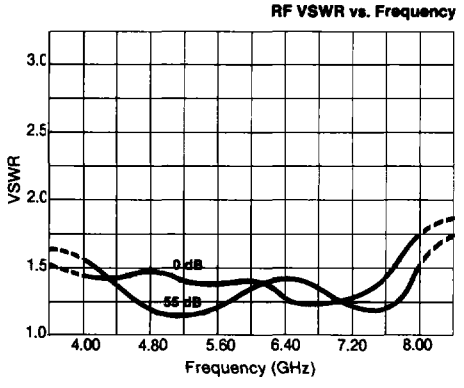




Model 60367

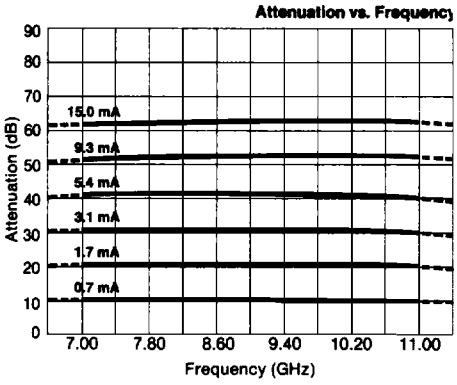


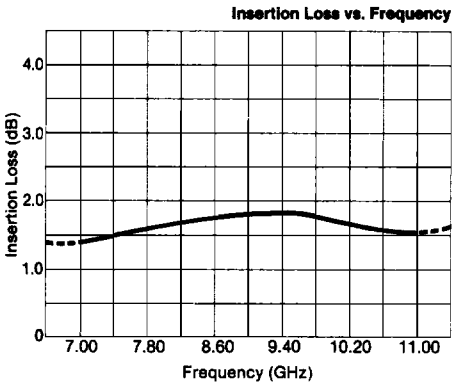


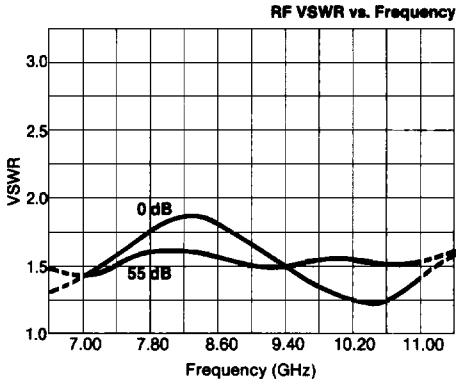


Specifications subject to change without notice.

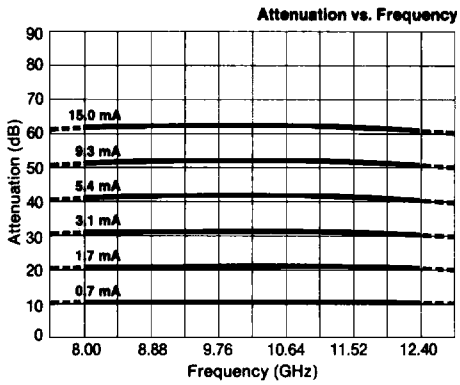
Model 6A0368

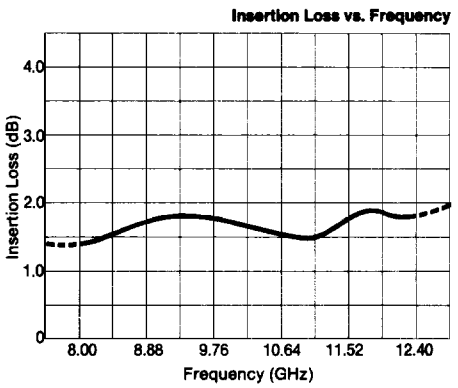


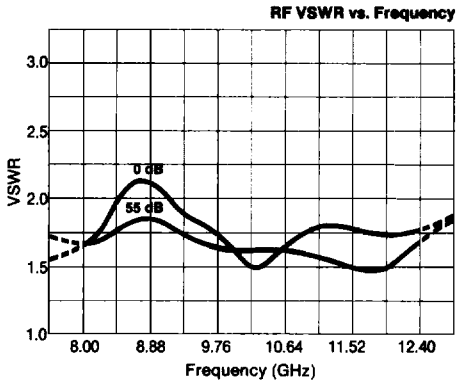




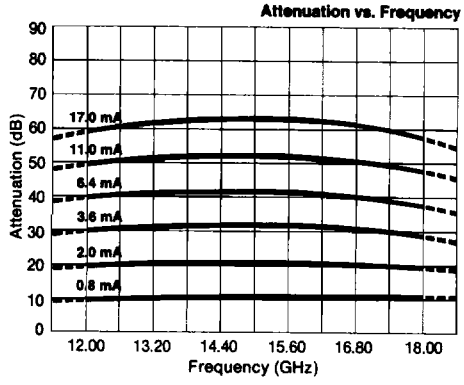
Model 60368

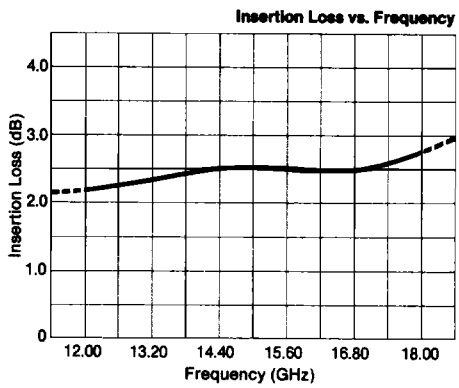


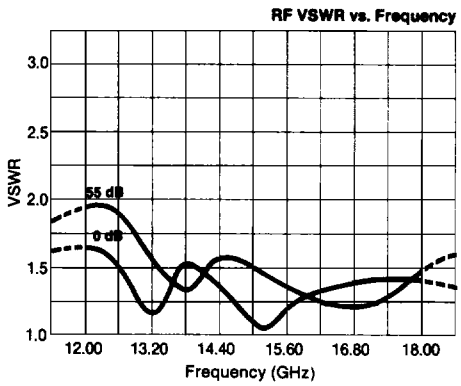




Model 60369







Specifications subject to change without notice.

Mechanical Specifications: PIN Attenuators

Model No.	A		B		C		D		E		F		G		Figure No.	Weight	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm		oz	gm
60364	4.25	108	3.80	97	1.47	37	3.25	83	3.55	90	3.37	86	2.52	64	1	9.0	255
60365	3.40	86	3.00	76	1.37	35	2.12	54	2.80	71	2.40	61	1.70	43	1	6.6	187
60366	2.70	69	2.15	55	0.94	24	1.56	40	1.90	48	1.70	43	1.62	41	1	4.0	114
60367	2.50	64	1.82	46	0.87	22	1.37	35	1.57	40	1.70	43	1.40	36	1	3.2	91
60368	2.25	57	1.75	45	0.50	13	1.25	32	1.50	38	1.38	35	1.12	28	1	2.9	82
6A0368	2.25	57	1.75	45	0.50	13	1.25	32	1.50	38	1.38	35	1.12	28	1	2.9	82
60369	2.00	51	1.55	39	0.62	16	1.12	28	1.30	33	1.20	31	1.00	25	1	2.4	68
60464	4.25	108	3.80	97	1.47	37	3.25	83	3.55	90	3.37	86	1.11	28	2	15.4	437
60465	3.40	86	3.00	76	1.37	35	2.12	54	2.80	71	2.40	61	.98	25	2	10.3	292
60466	2.70	69	2.15	55	0.94	24	1.56	40	1.90	48	1.70	43	.85	22	2	5.9	167
60467	2.50	64	1.82	46	0.87	22	1.37	35	1.57	40	1.70	43	.75	19	2	4.7	133
60468	2.25	57	1.75	45	0.50	13	1.25	32	1.50	38	1.38	35	.65	17	2	4.4	125
6A0468	2.25	57	1.75	45	0.50	13	1.25	32	1.50	38	1.38	35	.65	17	2	4.4	125
60469	2.00	51	1.55	39	0.62	16	1.12	28	1.30	33	1.20	31	.65	17	2	5.9	167

Figure 1

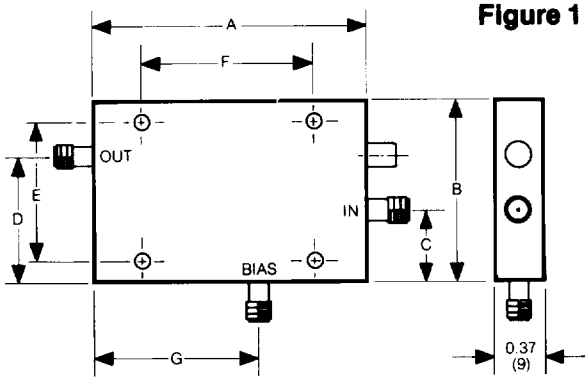
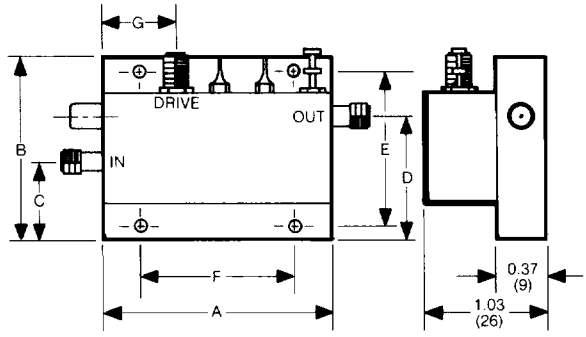


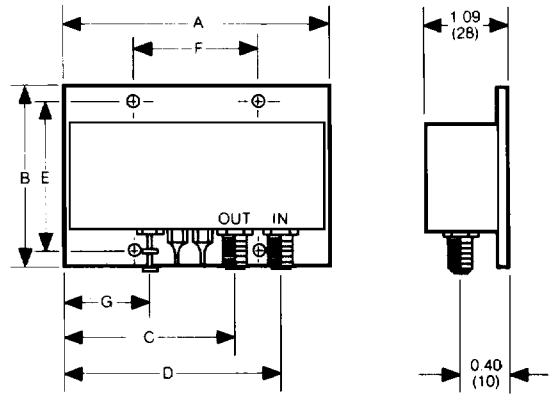
Figure 2



Mechanical Specifications: Linearizer

Linearizer Model No.	A		B		C		D		E		F		G		Figure No.	Weight	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm		oz	gm
300010	4.25	108	2.85	72	2.99	76	3.59	91	2.53	64	2.45	62	1.19	30	3	10.8	306

Figure 3



Contact Anaren for latest outline details.

Dimensions in inches and (mm)
Connectors: SMA, Female, per MIL-C-39012
DC Connectors are EMI Feedthroughs
Mounting Hole Dia: .145 ± .005 (3.7 ± .1), 4-places

Specifications subject to change without notice.