ATTENUATORS, PIN DIODE
0.25–18 G Hz

SERIES GT, 1GT, 2GT, GA

GENERAL INFORMATION

KDI/Triangle Pin Diode attenuators continuously change the amplitude of a microwave signal by applying a varying DC current, voltage, or digital signal, depending upon the Model type selected. The basic current controlled models do not have thermal compensation included, the voltage controlled & digital models have linearization and/or temperature compensation options.

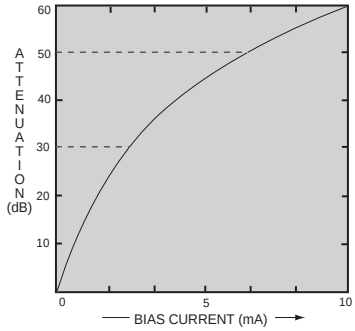
A matched configuration of diodes keeps the VSWR low through all values of attenuation and frequency.

Linearization is provided in some models, which produces an output signal that is linearly proportional to the control voltage.

Temperature compensation is also provided in some models, over either the –55 to +85 degree C range, 10–40 degree C range, or 0-70 degree C range depending upon the Model type selected. Digitally controlled analog attenuators, Model series "GA", require an TTL binary logic input. Standard units in the GA series have an 8 bit input producing 256 discrete values of attenuation. Optional 10–12 bit logic is readily available simply by specifying in the model number with a dash number.

GENERAL SPECIFICATIONS

R.F. Power:	To prevent self-biasing, the attenuators should be operated at less than 100 mW CW, and 60 watts peak. Units will not be damaged by application of 1 watt CW or 100 watts peak.
RF Impedance:	50 OHMS.
Current (GT Models):	+10 mA, maximum attenuation. 0 mA, zero attenuation for all current controlled models.
Power Requirements:	±15 volts at ±50 mA maximum. For all models. 1GT, 2GT, GA (except GT)
Control Voltage (1 GT and 2 GT Models):	0–10 volts produces 0–32 dB for 32 dB models and 0–64 dB for 64 dB models. Other values of control voltage can be provided on request.
Maximum Control Voltage:	10 VDC
Control Input Impedance:	10 K ohms, 20 pf.
Switching Period:	Standard models can be changed from any value of attenuation to any other value in 10 microsec. Units can be provided with switching speed to 300 nanosec. on request. Speed is related to maximum attenuation required. That is, 32 dB models are faster than 64 dB models. Insertion Loss will increase by a factor of 1.6 on higher speed models.
Connectors:	SMA standard, others on request.



Typical curve of attenuation vs. bias current for GT Models.

BASIC MODEL TYPES

Model No.*	Input Control	Accuracy Chart No.	Input Control	Input Fixed
GT-( )	Current	A, B	0–10MA	None
1-GT-( )	VOLTAGE 10° TO 40°C	A, B	0–10VDC	+ & – 15VDC @50 MA MAX
1-GT-( )TT	VOLTAGE-TEMP COMP –55° TO +85°C	C	0–10VDC	+ & – 15VDC @50 MA MAX
1-GT-( )TR	VOLTAGE-TEMP COMP 0° TO 70°C	D	0–10VDC	+ & – 15VDC @50 MA MAX
2-GT-( )	VOLTAGE- LINEARIZED 10° TO 40°C	A, B	0–10VDC	+ & – 15VDC @50 MA MAX
2-GT-( )TT	VOLTAGE-LINEARIZED TEMP COMP –55° TO +85°C	C	0–10VDC	+ & – 15VDC @50 MA MAX
2-GT-( )TR	VOLTAGE-LINEARIZED TEMP COMP 0° TO 70°C	D	0–10VDC	+ & – 15VDC @50 MA MAX
GA-( )	DIGITAL-TTL 10° TO 40°C	A, B	TTL	+ & – 15VDC @50 MA MAX
GA-( )TT	DIGITAL-TTL- TEMP COMP –55° TO +85° C	C	TTL	+ & – 15VDC @50 MA MAX
GA-( ) TR	DIGITAL-TTL-TEMP COMP 0° TO 70° C	D	TTL	+ & – 15VDC @50 MA MAX

KEY: Inches[Millimeters] .XX ±.03 .XXX ±.010 [.X ±0.8 .XX ±0.25]

ISO 9001 REGISTERED FIRM

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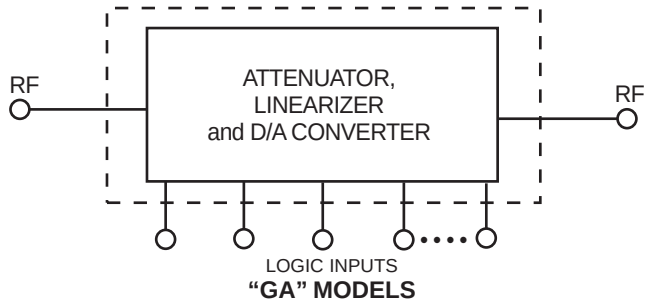


"GA" MODELS

"GA" MODELS-DIGITAL LOGIC: TTL COMPATIBLE.

NO. OF BITS = 8 L.S.B. = .25 dB ATTENUATION: 63.75 dB

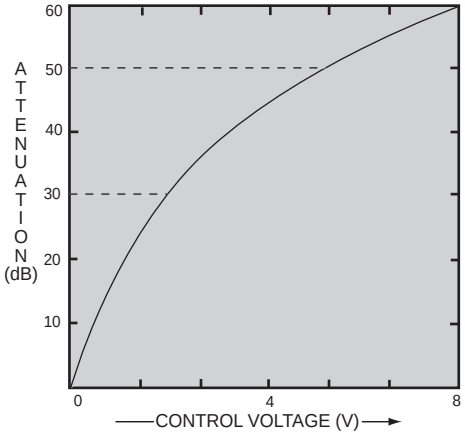
BIT SIZE	.25	.5	1	2	4	8	16	32	
LOGIC	0	0	0	0	0	0	0	0	= REF. (INS. LOSS)
LOGIC	0	0	0	1	0	1	0	0	= 10 dB
LOGIC	0	0	0	0	1	0	1	0	= 20 dB
LOGIC	0	0	0	1	1	1	1	0	= 30 dB
LOGIC	0	0	0	0	0	1	0	1	= 40 dB
LOGIC	0	0	0	1	0	0	1	1	= 50 dB
LOGIC	0	0	0	0	1	1	1	1	= 60 dB
LOGIC	1	1	1	1	1	1	1	1	= 63.75 dB

NOTE: Least Sig. Bit for 32 dB unit is .125 dB. Most Sig. Bit is 16 dB.

MODEL TYPE SPECIFICATIONS

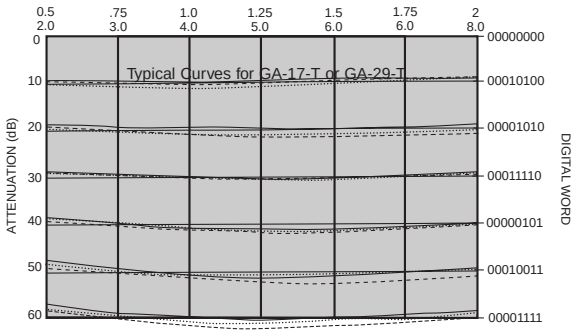
Type**	Frequency GHz	Max VSWR	Max (1) IL dB	Atten Range dB	Outline GT-( ) Models	Outline 1, 2 GT-( ) Models	Outline GA Models
(10)	0.25–0.5	1.5	2.3	32	1	11	21
(11)	0.25–0.5	1.5	2.3	64	1	11	21
(13)	0.5–1.0	1.5	2.5	32	2	12	22
(14)	0.5–1.0	1.5	2.5	64	2	12	22
(16)	0.5–2.0	1.75	2.8	32	3	13	23
(17)	0.5–2.0	1.75	2.8	64	3	13	23
(19)	1.0–2.0	1.5	2.8	32	4	14	24
(20)	1.0–2.0	1.5	2.8	64	4	14	24
(22)	1.0–4.0	1.75	3.1	32	5	15	25
(23)	1.0–4.0	1.75	3.1	64	5	15	25
(25)	2.0–4.0	1.5	3.1	32	4	14	24
(26)	2.0–4.0	1.5	3.1	64	4	14	24
(28)	2.0–8.0	1.8	3.7	32	6	16	26
(29)	2.0–8.0	1.8	3.7	64	6	16	26
(30)	4.0–8.0	1.75	3.4	32	6	16	26
(31)	4.0–8.0	1.75	3.4	64	6	16	26
(32)	4.0–12.0	1.9	4.0	32	7	17	26
(38)	6.0–18.0	2.2	4.2	64	7	17	26
(39)	8.0–12.4	2	3.8	32	7	17	26
(40)	8.0–12.4	2.1	3.3	64	7	17	26
(41)	8.0–18.0	2.2	3.75	32	7	17	26
(43)	12.0–18.0	2	3.75	32	7	17	26
(50)	2.0–18.0	2.2	5.0	32	8	18	26
(51)	2.0–18.0	2.5	5.0	64	8	18	26

**Select type by adding to Model No.
(1) Subtract 0.5 dB from insertion loss for GT and 1 GT Series



VOLTAGE VS ATTENUATOR MODEL 1GT.

TEMPERATURE COMPENSATED DIGITALLY CONTROLLED ANALOG PIN DIODE ATTENUATORS SERIES GA-TT/TR



LEGEND _____ **+85°C**
..... **+25°C**
- - - - - **-54°C**

NOTE: SINGLE OCTIVE MODELS ARE FLATTER

KEY: Inches[Millimeters] .XX ±.03 .XXX ±.010 [.X ±0.8 .XX ±0.25]

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CHART A

ATTENUATION ACCURACY VS FREQUENCY

@ 25°C Temperature
SERIES GA, GT, 1GT 2GT

Octave Models (2:1 Frequency)	Greater than Octave Models
±0.4 dB to 10 dB	±0.5 dB to 10 dB
±0.75 dB to 20 dB	±1.0 dB to 20 dB
±1.0 dB to 30 dB	±1.5 dB to 30 dB
±1.25 dB to 40 dB	±1.75 dB to 40 dB
±1.75 dB to 64 dB	±3.0 dB to 64 dB

[See note (4)]

CHART B

ATTENUATION ACCURACY VS FREQUENCY AND TEMPERATURE

over the +10°C to +40°C temperature range
SERIES GA, GT, 1GT, 2GT

Octave Models (2:1 Frequency)	Greater than Octave Models
± 0.5 dB to 10 dB	± 0.75 dB to 10 dB
± 1.0 dB to 20 dB	± 1.25 dB to 20 dB
± 1.5 dB to 30 dB	± 1.75 dB to 30 dB
± 1.7 dB to 40 dB	± 2.0 dB to 40 dB
± 2.5 dB to 64 dB	± 3.5 dB to 64 dB

[See note (4)]

CHART C

ATTENUATION ACCURACY VS FREQUENCY AND TEMPERATURE

over the –55°C to +85°C temperature range
SERIES GA-(TT), 1, 2GT(TT)

Octave Models (2:1 Frequency)	Greater than Octave Models
±0.75 dB to 10 dB	±1.0 dB to 10 dB
±1.2 dB to 20 dB	±1.5 dB to 20 dB
±1.5 dB to 30 dB	±2.0 dB to 30 dB
±2.0 dB to 40 dB	±2.5 dB to 40 dB
±3.0 dB to 64 dB	±4.0 dB to 64 dB

[See note (4)]
Attentuation accuracy given above assumes 0.1% regulation of power supply voltages

Notes:

1. Harmonic Distortion: Approximately –50 dBc for Pin ≤ 0 dBm at a frequency of 1.0 GHz for most units. This value improves by approximately 10 dB per octave as the frequency increases; however, since this value is dependent on bandwidth of the unit, power input, and switching speed required, the factory should be consulted if harmonic content is an important system requirement.
2. Two/Tone Intermodulation Products: Second and third order products approximately 50 dBC for Pin ≤ 0 dBm (each signal) at all attenuation settings.
3. If a narrow frequency bandwidth is required, KDI/Triangle can supply a unit that is electrically optimized for that bandwidth. Mechanical dimensions will remain the same as the standard unit, and the price will generally be lower. Specify the frequency range when ordering a narrow bandwidth model, and a special part number will be assigned.
4. Add 1.5 dB to all accuracy numbers for types (50) and (51). Two RF connectors are in line.
5. Attenuation vs. temperature only is ± 0.02 dB/°C typical. (At 64 dB)
6. When ordering, add suffix indicating required temperature compensation range to the model number, i.e. the 1-GT-32-T, compensated over the temperature range –55°C to +85°C, would be ordered as 1-GT-32-TT. If compensation from 0°C to +70°C is required, the model number would be 1-GT-32-TR. (See "attenuation accuracy vs frequency and temperature" tables for specifications.)
7. Monotonicity guaranteed for all models.

CHART D

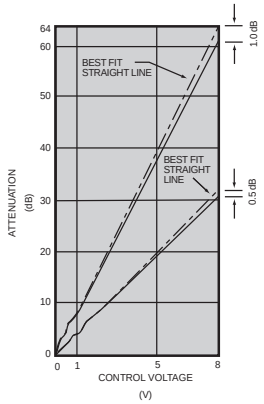
ATTENUATION ACCURACY VS FREQUENCY AND TEMPERATURE

over the 0°C to +70°C temperature range
SERIES GA-(TR) 1,2-GT-(TR)

Octave Models (2:1 Frequency)	Greater than Octave Models
±0.6 dB to 10 dB	±0.8 dB to 10 dB
±1.0 dB to 20 dB	±1.5 dB to 20 dB
±1.3 dB to 30 dB	±1.7 dB to 30 dB
±1.7 dB to 40 dB	±2.2 dB to 40 dB
±2.4 dB to 64 dB	±3.5 dB to 64 dB

[See note (4)]
Attentuation accuracy given above assumes 0.1% regulation of power supply voltages
*Add T or R suffix (see temperature information).

TYPICAL CURVE OF ATTENUATION VS. CONTROL VOLTAGE FOR 2GT MODELS



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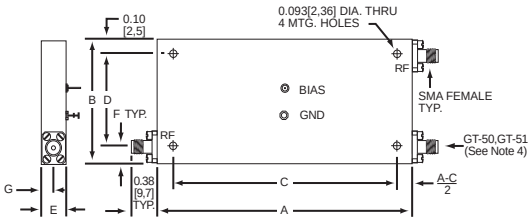
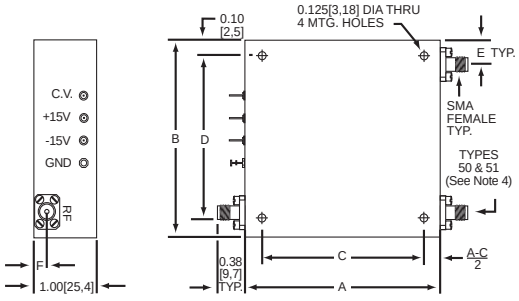
SERIES GT (CURRENT INPUT) MECHANICAL OUTLINES

Out-line	A in[mm]	B in[mm]	C in[mm]	D in[mm]	E in[mm]	F in[mm]	G in[mm]
1	5.00[127,0]	3.00[76,2]	4.600[116,84]	2.800[71,12]	.38[9,65]	0.75[19,1]	0.19[0,48]
2	5.00[127,0]	2.50[63,5]	4.600[116,84]	2.300[58,42]	.38[9,65]	0.30[7,6]	0.19[0,48]
3	3.50[88,9]	3.50[88,9]	3.100[78,74]	3.300[83,82]	.44[11,18]	0.30[7,6]	0.25[6,4]
4	3.50[88,9]	1.75[44,45]	3.100[78,74]	1.550[39,37]	.38[9,65]	0.38[9,65]	0.19[0,48]
5	2.50[63,5]	2.50[63,5]	2.100[53,3]	2.300[58,42]	.44[11,18]	0.30[7,6]	0.25[6,4]
6	1.80[45,7]	1.80[45,7]	1.400[35,56]	1.600[40,64]	.44[11,18]	0.35[8,9]	0.25[6,4]
7	1.50[38,1]	1.50[38,1]	1.100[27,94]	1.300[33,02]	.44[11,18]	0.35[8,9]	0.25[6,4]
8	2.00[50,8]	1.81[45,97]	1.800[45,7]	1.050[26,67]	.44[11,18]	0.25[6,4]	0.24[6,10]



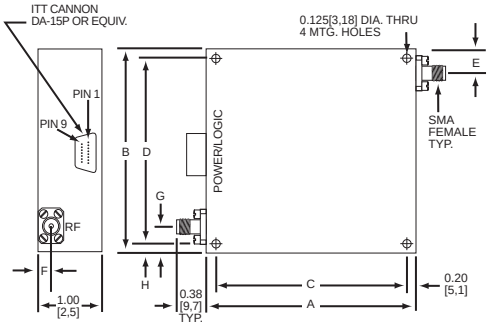
SERIES 1GT, 2GT (VOLTAGE INPUT) MECHANICAL OUTLINES

Out-line	A in[mm]	B in[mm]	C in[mm]	D in[mm]	E in[mm]	F in[mm]
11	5.00[127,0]	3.00[76,2]	4.600[116,84]	2.800[71,12]	0.75[19,1]	0.19[0,48]
12	5.00[127,0]	2.50[63,5]	4.600[116,84]	2.300[58,42]	0.32[8,12]	0.19[0,48]
13	3.50[88,9]	3.50[88,9]	3.100[78,74]	3.300[83,82]	0.63[16,0]	0.25[6,4]
14	3.50[88,9]	1.75[44,45]	3.100[78,74]	1.550[39,37]	0.38[9,65]	0.19[0,48]
15	2.50[63,5]	2.50[63,5]	2.100[53,3]	2.300[58,42]	0.32[8,12]	0.25[6,4]
16	1.80[45,7]	1.80[45,7]	1.400[35,56]	1.600[40,64]	0.35[8,9]	0.25[6,4]
17	1.50[38,1]	1.50[38,1]	1.100[27,94]	1.300[33,02]	0.35[8,9]	0.25[6,4]
18	2.00[50,8]	1.81[45,97]	1.800[45,7]	1.050[26,67]	0.25[6,4]	0.24[6,1]



SERIES GA (DIGITAL INPUT) MECHANICAL OUTLINES

Out-line	A in[mm]	B in[mm]	C in[mm]	D in[mm]	E in[mm]	H in[mm]	G in[mm]	F in[mm]
21	5.00[127,0]	3.00[76,2]	4.600[116,84]	2.750[69,85]	0.75[19,1]	0.19[4,83]	0.75[19,1]	0.13[3,30]
22	5.00[127,0]	2.50[63,5]	4.600[116,84]	2.250[57,15]	0.32[8,12]	0.19[4,83]	0.32[8,12]	0.13[3,30]
23	3.00[76,2]	3.50[88,9]	3.100[78,74]	2.750[69,85]	0.38[9,65]	0.25[6,4]	0.35[8,9]	0.13[3,30]
24	3.50[88,9]	1.75[44,45]	3.100[78,74]	1.550[39,37]	0.40[10,2]	0.19[4,83]	0.35[8,9]	0.10[2,5]
25	2.50[63,5]	2.50[63,5]	2.100[53,3]	2.250[57,15]	0.32[8,12]	0.25[6,4]	0.32[8,12]	0.13[3,30]
26	2.50[63,5]	2.50[63,5]	2.100[53,3]	1.750[44,45]	0.50[12,7]	0.25[6,4]	0.50[12,7]	0.13[3,30]



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