

## GaAs MMIC 5 - BIT DIGITAL ATTENUATOR DC - 10 GHz

FEBRUARY 2001

### Features

BANDWIDTH: DC-10 GHZ

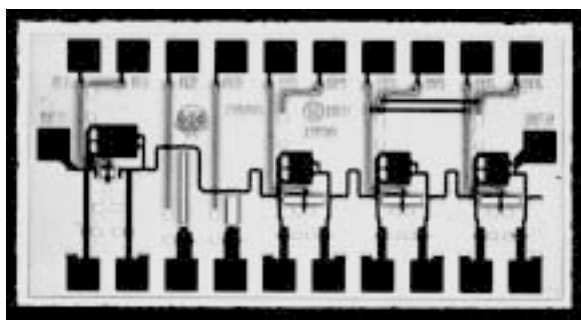
LOW INSERTION LOSS : <6 dB

31 dB ATTENUATION RANGE

FAST SWITCHING: 6 nS

### General Description

The HMC110 chip is a 5-bit digital attenuator with a 31 dB range in 1 dB steps. Each bit is activated by applying 0V to port A and disabled with -5 V to port A. Port B (as applicable) is biased with the complement of port A. Applications include military ECM and communications as well as commercial microwave radios. See SMT packaged versions; HMC110G16 (hermetic) and HMC110C14 (non hermetic).



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ATTENUATORS

DIE

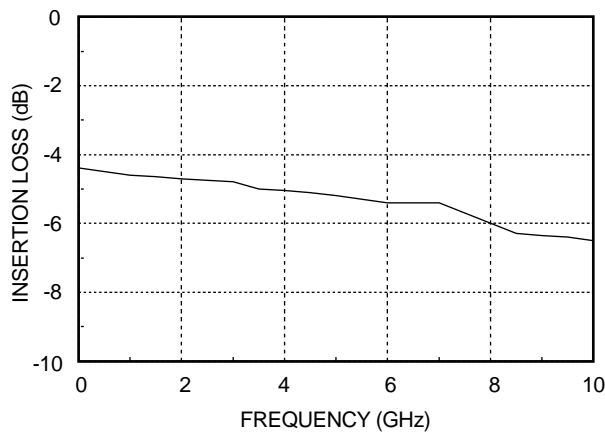
### Guaranteed Performance With 0/-5V Control, -55 to +85 deg C

Parameter	Freq.	Min.	Typ.	Max.	Units
Reference Insertion Loss	DC - 5 GHz		5.2	6.0	dB
	DC - 10 GHz		6.2	7.0	dB
Attenuation Range	DC - 10 GHz	27	31		dB
Return Loss	DC - 2 GHz	12	15		dB
	DC - 10 GHz	8	10		dB
Attenuation Accuracy	DC - 10 GHz	+/- 0.5 dB +/- 5% of setting max.			dB
	DC - 10 GHz	+/- 0.6 dB +/- 5% of setting max.			dB
	DC - 10 GHz	+/- 0.6 dB +/- 8% of setting max.			dB
	DC - 10 GHz	+/- 0.6 dB +/- 10% of setting max.			dB
Switching Characteristics tRISE, tFALL (10/90% RF) tON, tOFF (50% CTL to 10/90% RF)	DC - 10 GHz		3		ns
			6		ns
Input Power for 0.2 dB Comp.	0.5 - 10 GHz	Min Atten:	+22		dBm
		Max Atten:	+5		dBm
Input Third Order Intercept	0.5 - 10 GHz	Min Atten:	+44		dBm
		Max Atten:	+32		dBm

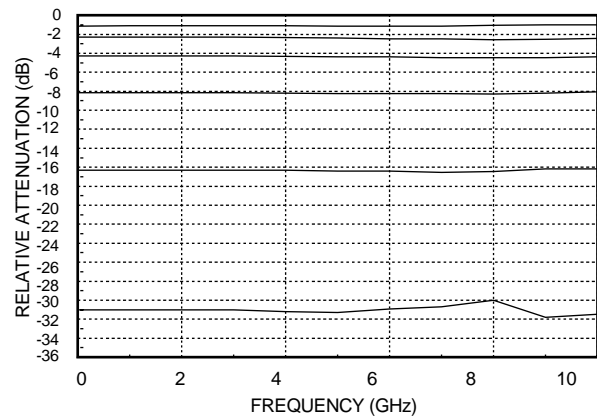
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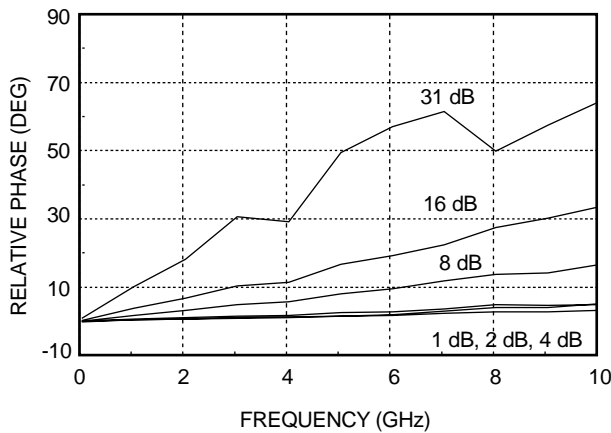
**Insertion Loss**



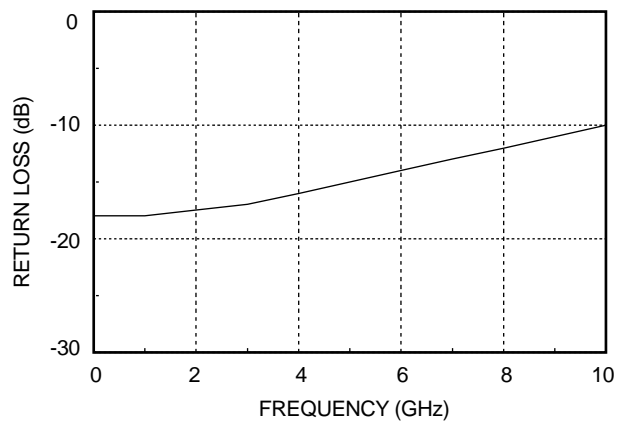
**Relative Attenuation**



**Relative Phase**



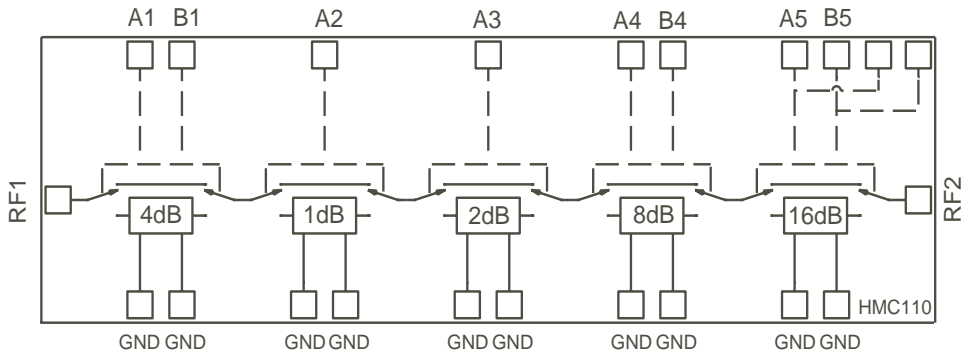
**Return Loss**



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### Schematic



2 ATTENUATORS

DIE



### Absolute Maximum Ratings

Control Voltage Range	+0.5 to -8.5 Vdc
Storage Temperature	-65 to +150 deg C
Operating Temperature	-55 to +125 deg C
RF Input Power (0.5 - 4 GHz)	
Insertion Loss State	+27 dBm
Any Attenuation State	+13 dBm

### Truth Table

Control Input								Att Set
4 dB Bit		1dB	2dB	8dB Bit		16dB Bit		
A1	B1	A2	A3	A4	B4	A5	B5	
Hi	Lo	Hi	Hi	Hi	Lo	Hi	Lo	Ref
Hi	Lo	Lo	Hi	Hi	Lo	Hi	Lo	1dB
Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	2dB
Lo	Hi	Hi	Hi	Hi	Lo	Hi	Lo	4dB
Hi	Lo	Hi	Hi	Lo	Hi	Hi	Lo	8dB
Hi	Lo	Hi	Hi	Hi	Lo	Lo	Hi	16dB

Any combination of above states will provide an attenuation approximately equal to the sum of the bits selected.

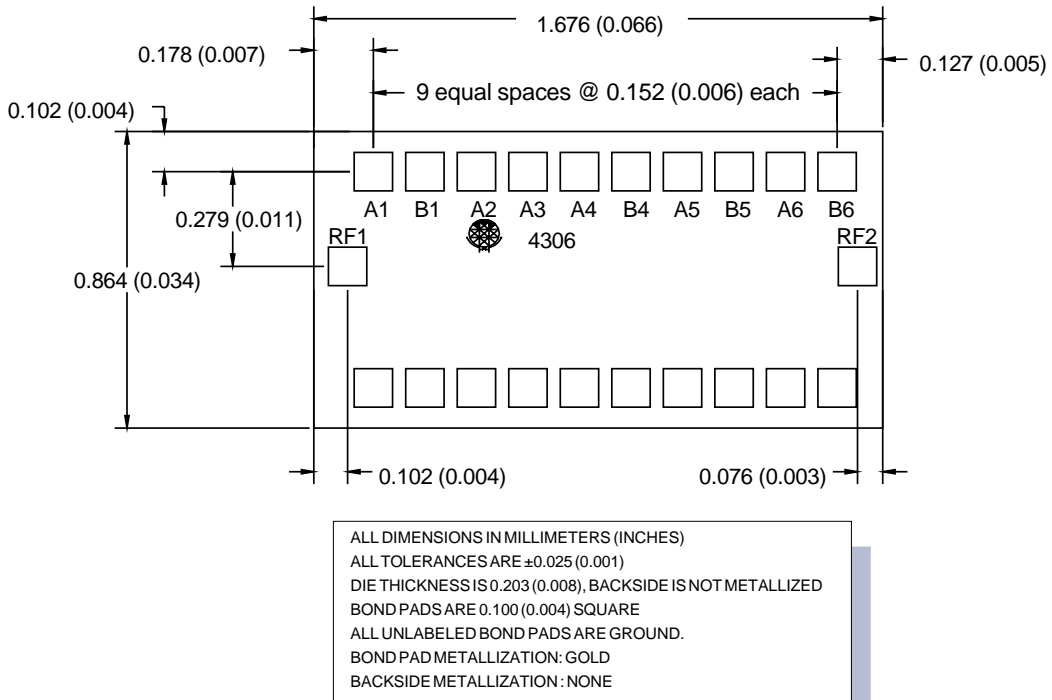
### Control Voltages

State	Bias Condition
Low	0 to -0.2V @20uA Max
High	-3V@50uA Typ to -8V@500uA Max

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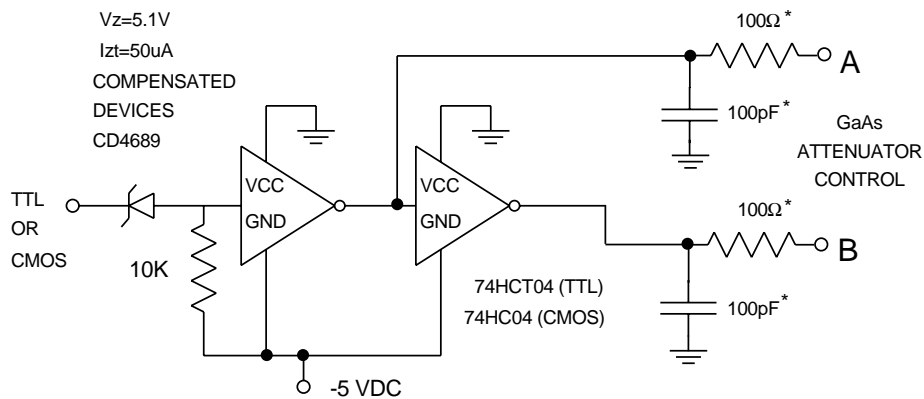
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### Die Outline ( See page 8 - 2 and 8 - 3 DIE HANDLING NOTES)



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ATTENUATORS  
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### Suggested Driver Circuit



Simple driver using inexpensive standard logic ICs provides fast switching using minimum DC current.  
 \* Recommended values to suppress unwanted RF signals at A/B control lines. You may adjust for switching speed considerations.