

## GaAs MMIC SMT 5 - BIT DIGITAL ATTENUATOR DC - 6 GHz

FEBRUARY 2000

### Features

BANDWIDTH: DC - 6 GHz

BIT LEVELS: 1, 2, 4, 8, 16 dB

31 dB ATTENUATION RANGE



### General Description

The HMC110C14 is a 5-bit digital attenuator in a non-hermetic 14 lead surface mount package. Each bit is activated by applying a 0V control, and then disabled by applying -5 V control to the specified control pin. The five primary attenuation states can be activated independently, or collectively for a maximum combined attenuation level of 31 dB. See the non-hermetic DC-2 GHz HMC110G16. The HMC110C14 may be used for 2.4 GHz ISM, VSAT, 5.2 GHz UNII, 5.8 GHz ISM, or microwave radio applications.

2

ATTENUATORS

SMT



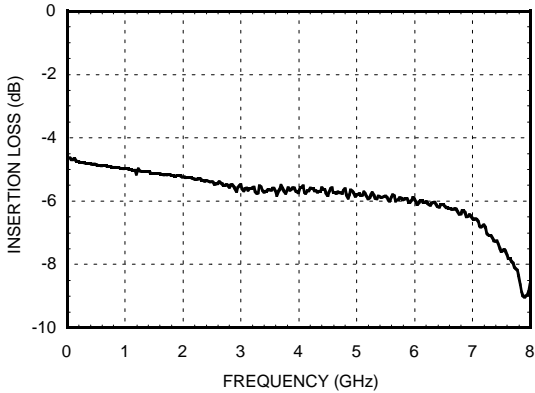
### Guaranteed Performance With 0/-5V Control, -55 to +85 deg C

Parameter	Freq.	Min.	Typ.	Max.	Units
Insertion Loss	DC-6 GHz		5.5	6.5	dB
Attenuation Range	DC-6 GHz	27	31		dB
Return Loss (Input)	DC-6 GHz	8	12		dB
Return Loss (Output)	DC-6 GHz	10	14		dB
Attenuation Accuracy: 1 - 7 dB States 8 - 15 dB States 16 - 23 dB States 24 - 31 dB States	DC-6 GHz DC-6 GHz DC-6 GHz DC-6 GHz	+ / - 0.5 dB +/- 5% of Setting Max. + / - 0.6 dB +/- 5% of Setting Max. + / - 0.6 dB +/- 8% of Setting Max. + / - 0.6 dB +/- 10% of Setting Max.			dB dB dB dB
Switching Characteristics tRISE, tFALL (10/90%) tON, tOFF (50% CTL to 10/90% RF)	DC-6 GHz		3 6		ns ns
Input Power for 0.2 dB Comp Min Atten: Max Atten:	0.5 - 6		+22 + 5		dBm dBm
Input Third Order Intercept Point Min Atten: Max Atten:	0.5 - 6		+44 +32		dBm dBm

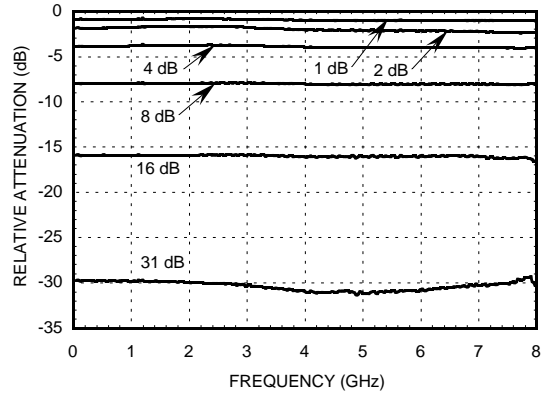
## HMC110C14 SMT 5 - BIT DIGITAL ATTENUATOR DC - 6 GHz

FEBRUARY 2000

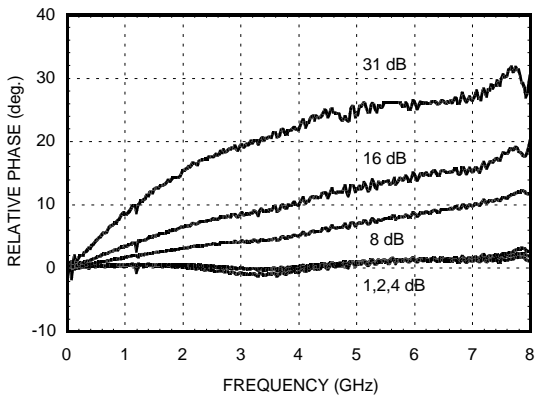
**Insertion Loss**



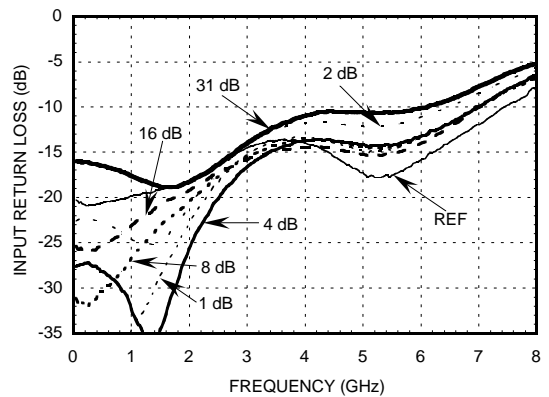
**Relative Attenuation**



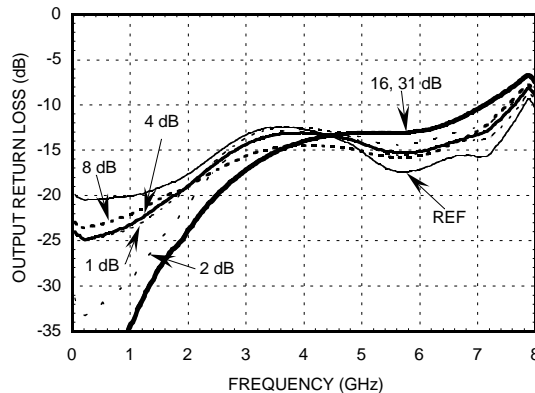
**Relative Phase**



**Input Return Loss**



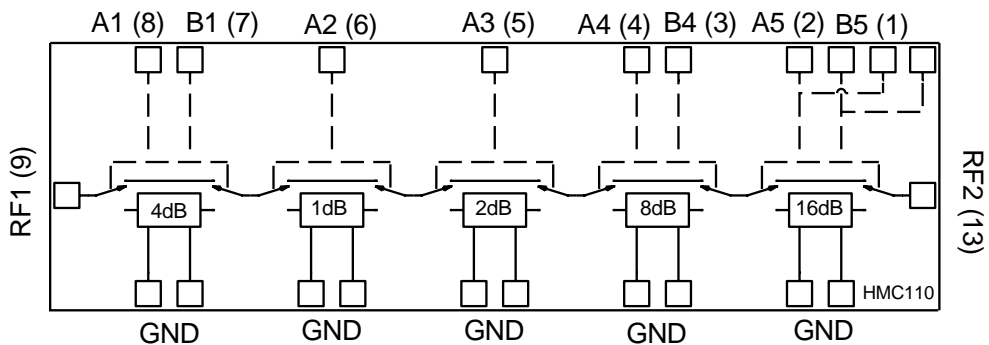
**Output Return Loss**



## HMC110C14 SMT 5 - BIT DIGITAL ATTENUATOR DC - 6 GHz

FEBRUARY 2000

### Schematic



Pin # = ( ); Pins 10 - 12, 14 and package bottom are GND.

2  
ATTENUATORS  
SMT

### 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)	+27 dBm
Insertion Loss State	+13 dBm
Any Attenuation State	

### 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.

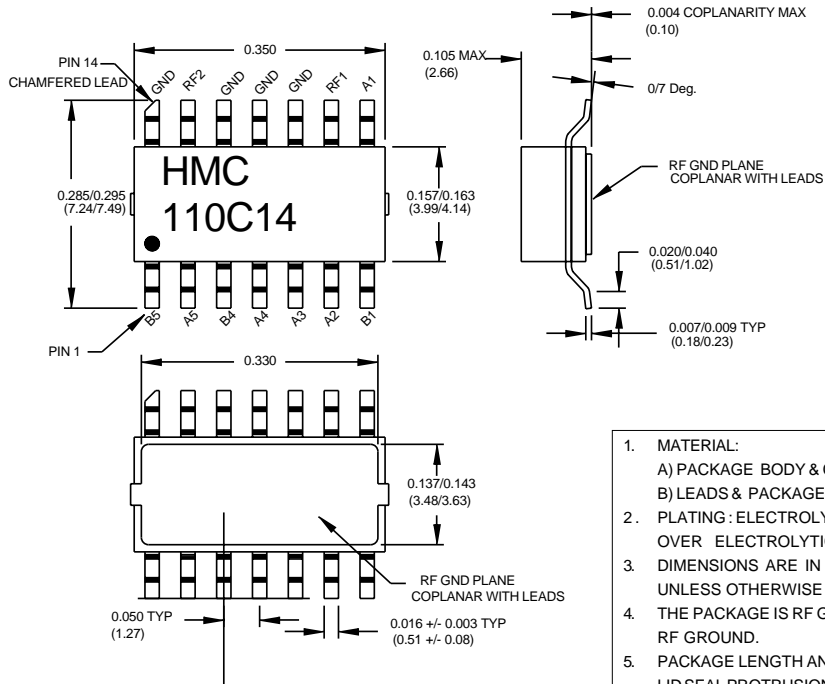
### Control Voltages

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

## HMC110C14 SMT 5 - BIT DIGITAL ATTENUATOR DC - 6 GHz

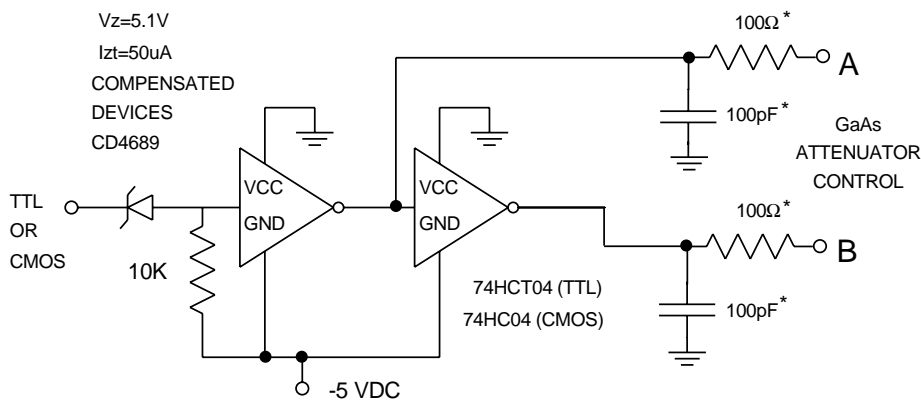
FEBRUARY 2000

### Outline



1. MATERIAL:  
A) PACKAGE BODY & COVER : WHITE ALUMINA (92%)  
B) LEADS & PACKAGE BOTTOM: COPPER
2. PLATING : ELECTROLYTIC GOLD 100 - 200 MICRONICHES OVER ELECTROLYTIC NICKEL 100 TO 200 MICRONICHES.
3. DIMENSIONS ARE IN INCHES (MILLIMETERS). UNLESS OTHERWISE SPECIFIED ALL TOL. ARE  $\pm 0.005 (\pm 0.13)$ .
4. THE PACKAGE IS RF GROUND AND MUST BE SOLDERED TO THE PCB RF GROUND.
5. PACKAGE LENGTH AND WIDTH DIMENSIONS SHOWN DO NOT INCLUDE LID SEAL PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.005 (0.127MM) PER SIDE.

### 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.