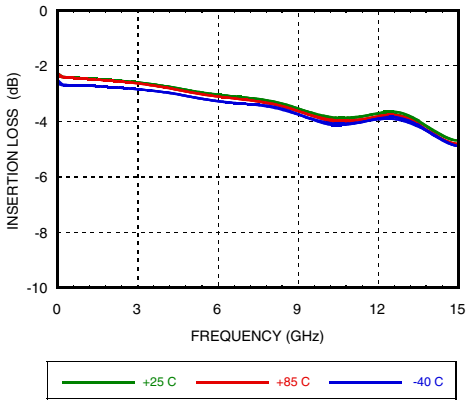
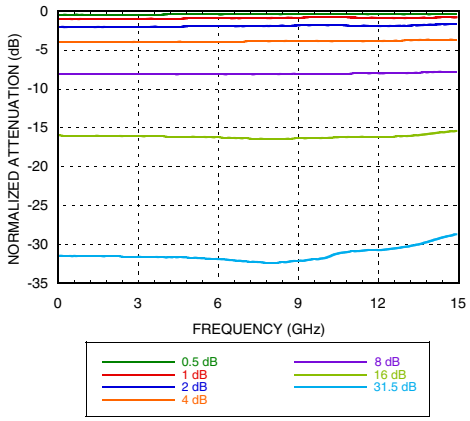
0.5dB LSB GaAs MMIC 6-BIT DIGITAL ATTENUATOR, DC - 13 GHz

Insertion Loss



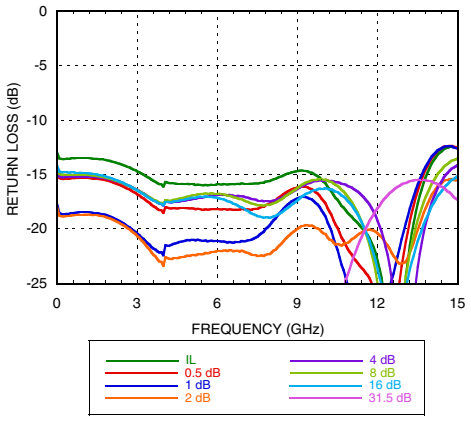
Normalized Attenuation

(Only Major States are Shown)



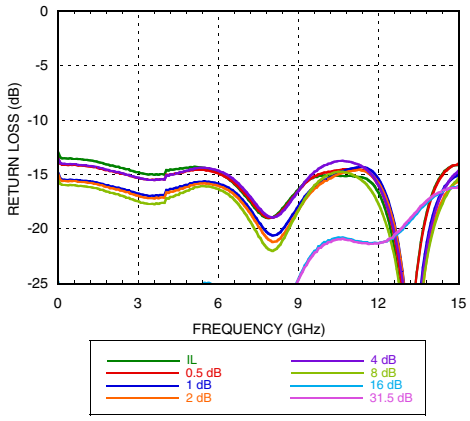
Input Return Loss

(Only Major States are Shown)



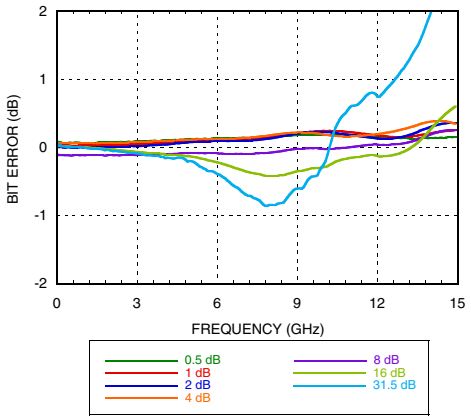
Output Return Loss

(Only Major States are Shown)

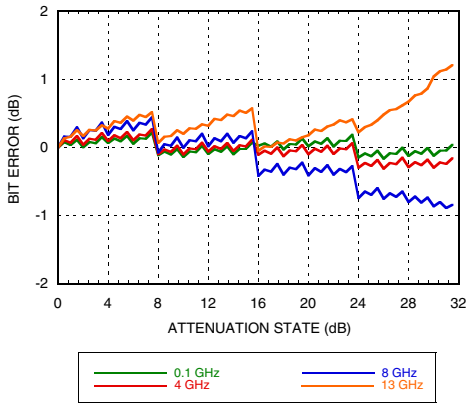


Bit Error vs. Frequency

(Only Major States are Shown)



Bit Error vs. Attenuation State

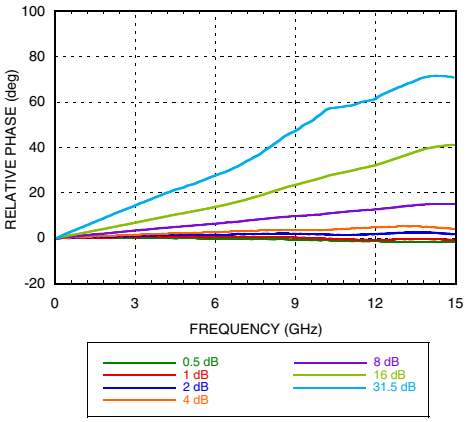


For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106
Phone: 781-329-4700 • Order online at www.analog.com
Application Support: Phone: 1-800-ANALOG-D

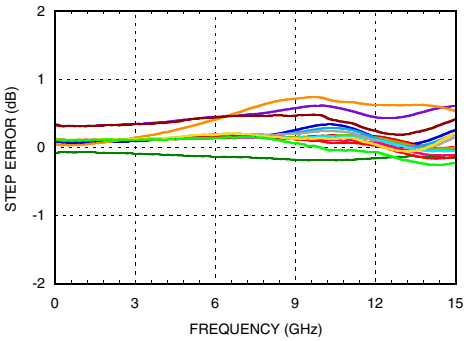
0.5dB LSB GaAs MMIC 6-BIT DIGITAL ATTENUATOR, DC - 13 GHz

Relative Phase vs. Frequency

(Only Major States are Shown)



Worst Case Step Error Between Successive Attenuation States



Truth Table

Control Voltage Input						Attenuation State RF1 - RF2
V1 16 dB	V2 8 dB	V3 4 dB	V4 2 dB	V5 1 dB	V6 0.5 dB	
Low	Low	Low	Low	Low	Low	Reference I.L.
Low	Low	Low	Low	Low	High	0.5 dB
Low	Low	Low	Low	High	Low	1 dB
Low	Low	Low	High	Low	Low	2 dB
Low	Low	High	Low	Low	Low	4 dB
Low	High	Low	Low	Low	Low	8 dB
High	Low	Low	Low	Low	Low	16 dB
High	High	High	High	High	High	31.5 dB

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

Bias Voltage & Current

Vee Range= -5 Vdc ± 10%		
Vee (VDC)	Iee (Typ.) (mA)	Iee (Max.) (mA)
-5	2	5

Control Voltage

State	Bias Condition
Low	0 to -3V @ 35 µA Typ.
High	Vee to Vee +0.8V @ <1 µA Typ.

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106
Phone: 781-329-4700 • Order online at www.analog.com
Application Support: Phone: 1-800-ANALOG-D

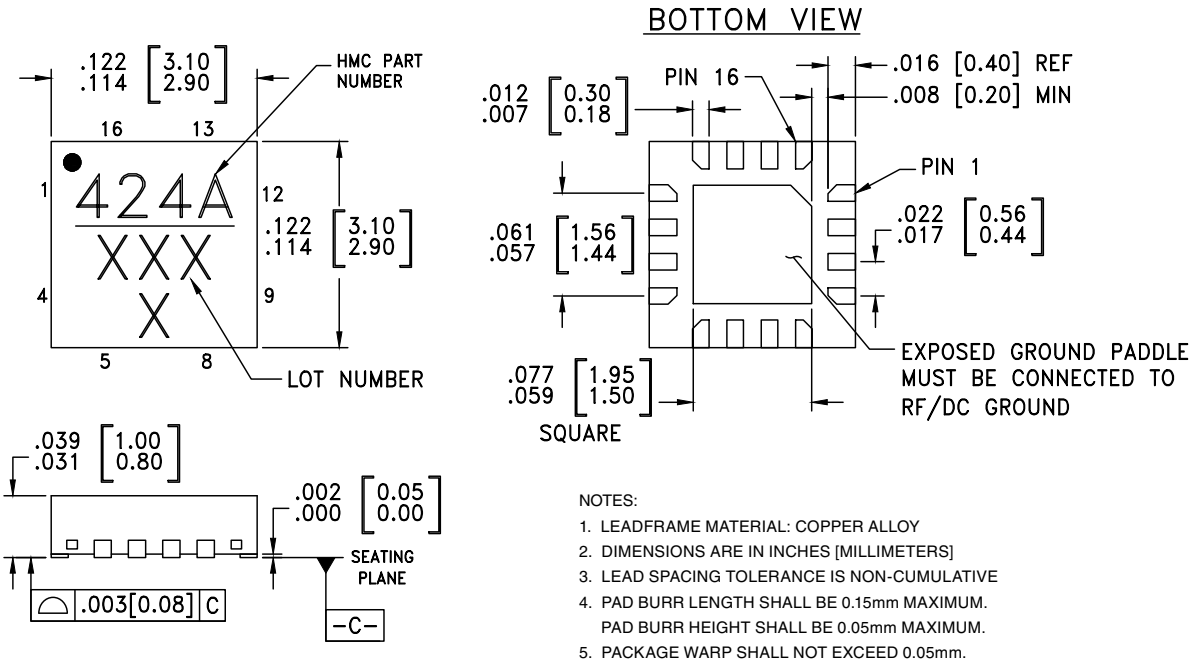
0.5dB LSB GaAs MMIC 6-BIT DIGITAL ATTENUATOR, DC - 13 GHz

Absolute Maximum Ratings

Control Voltage (V1 to V6)	Vee - 0.5 Vdc
Bias Voltage (Vee)	-7 Vdc
Channel Temperature	150 °C
Thermal Resistance	330 °C/W
Storage Temperature	-65 to + 150 °C
Operating Temperature	-55 to +85 °C
RF Input Power (0.5 - 13 GHz)	+25 dBm
ESD Sensitivity (HBM)	Class 1A

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



NOTES:

1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE
4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM. PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [2]
HMC424ALP3E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [1]	424A XXXX

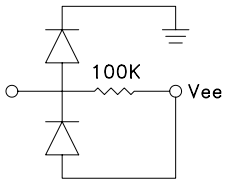
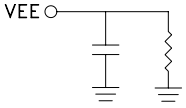
[1] Max peak reflow temperature of 260 °C
[2] 4-Digit lot number XXXX

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106
Phone: 781-329-4700 • Order online at www.analog.com
Application Support: Phone: 1-800-ANALOG-D

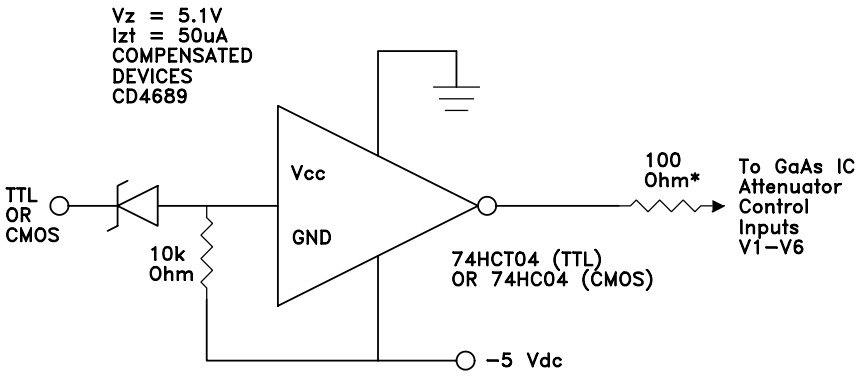
RoHS✓ EARTH FRIENDLY

0.5dB LSB GaAs MMIC 6-BIT DIGITAL ATTENUATOR, DC - 13 GHz

Pin Description

Pad Number	Function	Description	Interface Schematic
1, 3, 10, 12	GND	Package bottom has an exposed metal paddle that must also be connected to RF ground	
2, 11	RFIN, RFOUT	This pin is DC coupled and matched to 50 Ohm. Blocking capacitors are required if RF line potential is not equal to 0V.	
4, 5, 6, 7, 8, 9	V6 - V1	See truth table and control voltage table.	
13, 14, 16	N/C	This pin should be connected to PCB RF ground to maximize performance	
15	VEE	Supply Voltage -5V ± 10%	

Suggested Driver Circuit *(One Circuit Required Per Bit Control Input)*



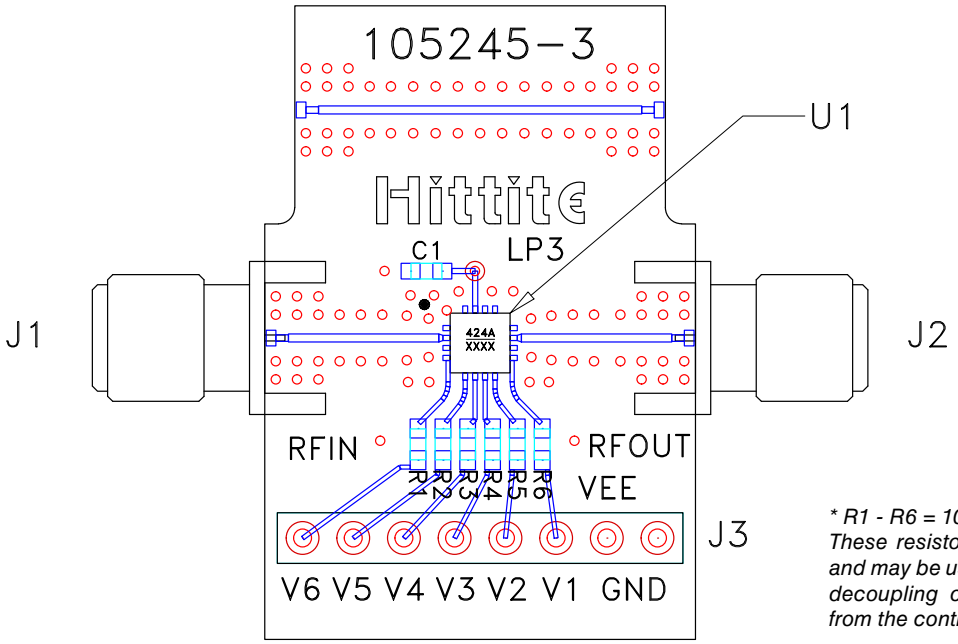
Simple driver using inexpensive standard logic ICs provides fast switching using minimum DC current.
** Recommended value to suppress unwanted RF signals at V1 - V6 control lines.*

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106
Phone: 781-329-4700 • Order online at www.analog.com
Application Support: Phone: 1-800-ANALOG-D

RoHS✓ EARTH FRIENDLY

0.5dB LSB GaAs MMIC 6-BIT DIGITAL ATTENUATOR, DC - 13 GHz

Evaluation PCB



** R1 - R6 = 100 Ohm.*
These resistors are optional and may be used to enhance decoupling of the RF path from the control inputs.

List of Materials for Evaluation PCB EV1HMC424ALP3 [1]

Item	Description
J1 - J2	PCB Mount SMA Connector
J3	8 Pin DC Connector
C1	0.01 µF Capacitor, 0603 Pkg.
R1 - R6	100 Ohm Resistor, 0603 Pkg.
U1	HMC424ALP3E Digital Attenuator
PCB [2]	105245 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 Ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown is available from Hittite upon request.

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106
Phone: 781-329-4700 • Order online at www.analog.com
Application Support: Phone: 1-800-ANALOG-D