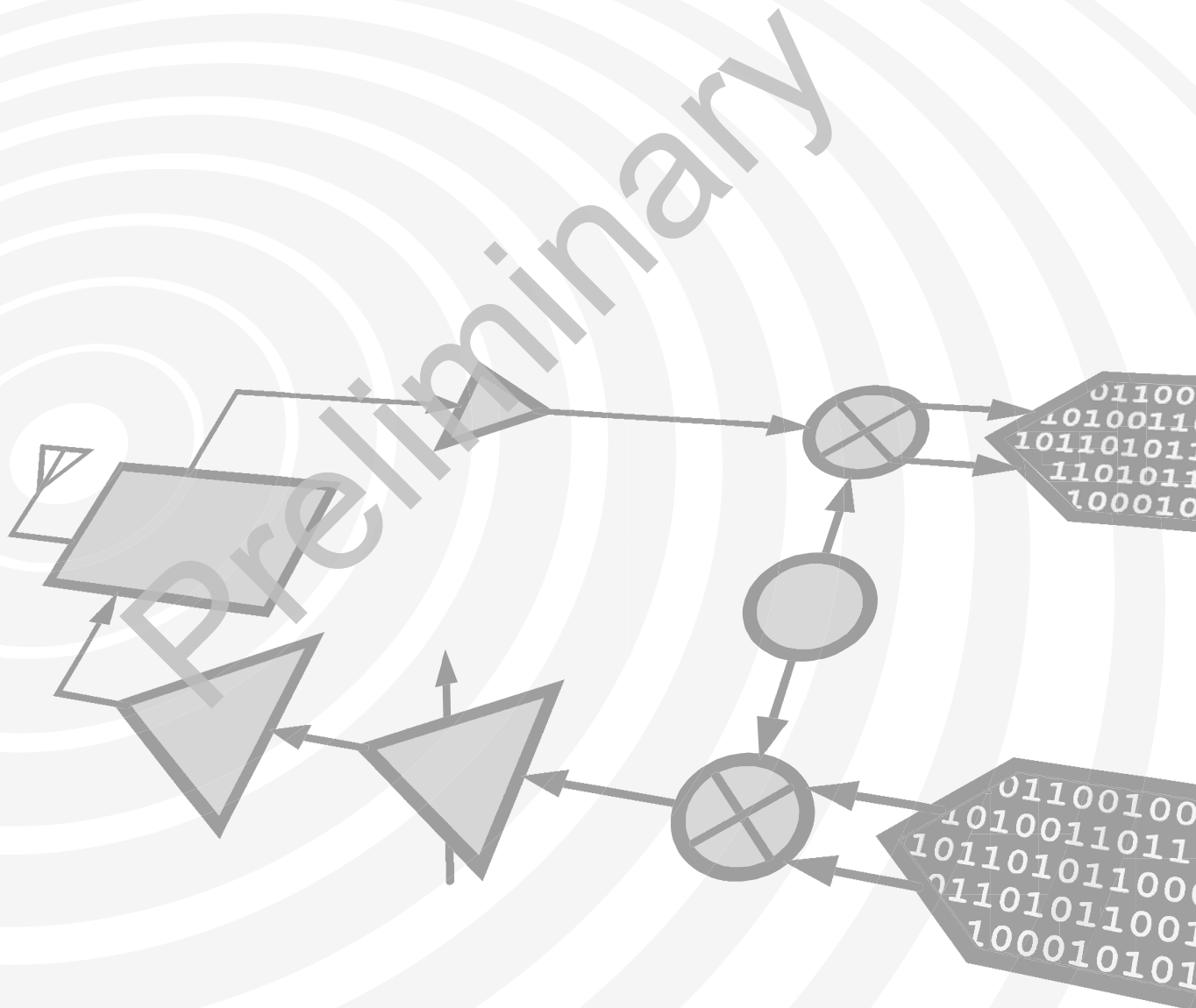


# Analog Devices Welcomes Hittite Microwave Corporation



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Preliminary

## 0.5 dB LSB GaAs MMIC 5-BIT DIGITAL ATTENUATOR, 0.1 - 30 GHz

### Typical Applications

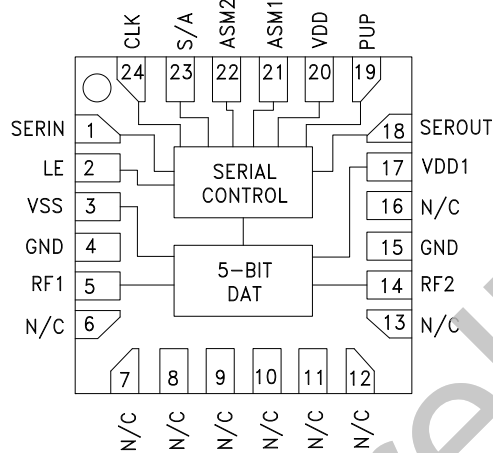
The HMC1019ALP4E is ideal for:

- Fiber Optics & Broadband Telecom
- Microwave Radio & VSAT
- Military Radios, Radar & ECM
- Space Applications
- Sensors
- Test & Measurement Equipment

### Features

- 0.5 dB LSB Steps to 15.5 dB
- TTL/CMOS Compatible, Serial Control
- Unique Asynchronous Mode Control Allows Immediate Attenuation Level Setting
- ±0.5 dB Typical Bit Error
- High Input IP3: +45 dBm
- 24 Lead 4x4mm SMT Package: 16mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC1019ALP4E is a broadband 5-bit GaAs IC digital attenuator in a low cost leadless surface mount package. Covering 0.1 to 30.0 GHz, the insertion loss is less than 4.0 dB typical. The attenuator bit values are 0.5 (LSB), 1, 2, 4, 8 for a total attenuation of 15.5 dB. Attenuation accuracy is excellent at ±0.3 dB typical step error with an IIP3 of +45 dBm. The control interface is CMOS/TTL compatible and accepts a three wire serial input. The HMC1019ALP4E features a user selectable power up state and a serial-output port for cascading other Hittite serial controlled components.

### Electrical Specifications, $T_A = +25^\circ\text{C}$ , With $V_{dd} = V_{dd1} = +5\text{V}$ , $V_{ss} = -5\text{V}$

Parameter	Frequency (GHz)	Min.	Typ.	Max.	Units
Insertion Loss	0.1 - 18.0 GHz		3.0	4.5	dB
	18.0 - 26.5 GHz		4.0	6.0	dB
	26.5 - 30.0 GHz		5.0	6.5	dB
Attenuation Range	0.1 - 30.0 GHz		31		dB
Return Loss (RF1 & RF2, All Atten. States)	0.1 - 30.0 GHz		12		dB
Attenuation Accuracy: (Referenced to Insertion Loss)	0.5 - 7.5 dB States	0.1 - 30.0 GHz	± (0.3 + 6%) of Atten. Setting Max		dB
	8 - 15.5 dB States	0.1 - 30.0 GHz	± (0.3 + 8%) of Atten. Setting Max		dB
Input Power for 0.1 dB Compression	0.1 - 0.5 GHz		22		dBm
	0.5 - 30.0 GHz		27		dBm
Input Third Order Intercept Point (Two-Tone Input Power= 0 dBm Each Tone)	0.1 - 0.5 GHz		42		dBm
	0.5 - 30.0 GHz		45		dBm
Switching Characteristics	0.1 - 30.0 GHz		60		ns
		tRISE, tFALL (10/90% RF) tON/tOFF (50% CTL to 10/90% RF)	90		ns
I <sub>dd1</sub>	0.1 - 30.0 GHz	2.5	4.5	6.5	mA
I <sub>ss</sub>	0.1 - 30.0 GHz	-7.0	-5.0	-3.0	mA

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**0.5 dB LSB GaAs MMIC 5-BIT DIGITAL  
ATTENUATOR, 0.1 - 30 GHz**
**Asynchronous Mode Truth Table**

ASM1	ASM2	Attenuation State RF1-RF2
High	High	Reference I.L.
High	Low	1.5 dB
Low	High	14 dB
Low	Low	15.5 dB

**PUP Truth Table**

PUP	Attenuation State
High	Reference I.L.
Low	15.5 dB

Note: The logic state of ASM1-ASM2 determines the power-up state of the part per truth table for the asynchronous mode when LE is high at power-up.

**Bias Voltages & Currents**

Vdd	+5V @ 0.2 mA
Vdd1	+5V @ 4.5 mA
Vss	-5V @ 5 mA

**Control Voltage**

State	Bias Condition
Low	0 to 0.8V @ 1 $\mu$ A
High	2 to 5V @ 1 $\mu$ A

**Serial Mode Truth Table**

Control Voltage Input					Attenuation State RF1 - RF2
P4 8 dB	P3 4 dB	P2 2 dB	P1 1 dB	P0 0.5 dB	
High	High	High	High	High	Reference I.L.
High	High	High	High	Low	0.5 dB
High	High	High	Low	High	1 dB
High	High	Low	High	High	2 dB
High	Low	High	High	High	4 dB
Low	High	High	High	High	8 dB
Low	Low	Low	Low	Low	15.5 dB

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

Parameter	Typ.
Min. serial period, $t_{SCK}$	100 ns
Control set-up time, $t_{CS}$	20 ns
Control hold-time, $t_{CH}$	20 ns
LE setup-time, $t_{LN}$	10 ns
Min. LE pulse width, $t_{LEW}$	10 ns
Min LE pulse spacing, $t_{LES}$	630 ns
Serial clock hold-time from LE, $t_{CKN}$	10 ns
Hold Time, $t_{PH}$	0 ns
Latch Enable Minimum Width, $t_{LEN}$	10 ns
Setup Time, $t_{PS}$	2 ns

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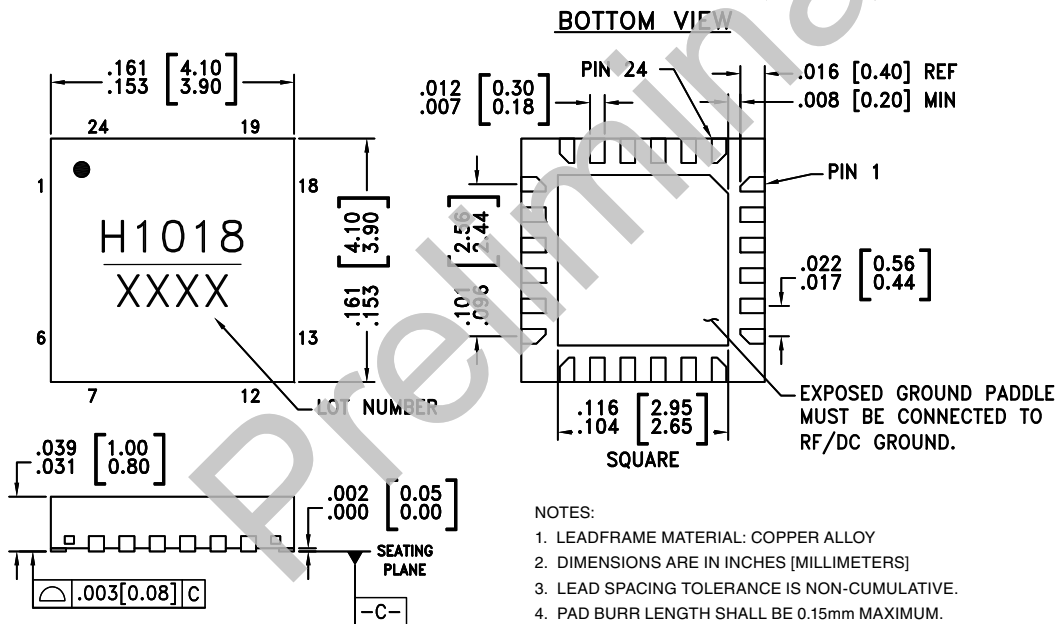
### Absolute Maximum Ratings

RF Input Power (0.1 to 30.0 GHz)	+27 dBm
Control Voltage (CLK, SERIN, LE, PUP, ASM1, ASM2, S/A)	Vdd + 0.5V
Vdd, Vdd1	+7 Vdc
Vss	-7 Vdc
Channel Temperature	150 °C
Continuous P <sub>diss</sub> (T = 85 °C) (derate 6.8 mW/°C above 85 °C)	0.445 W
Thermal Resistance	146 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class 1A



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

### Outline Drawing



NOTES:

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