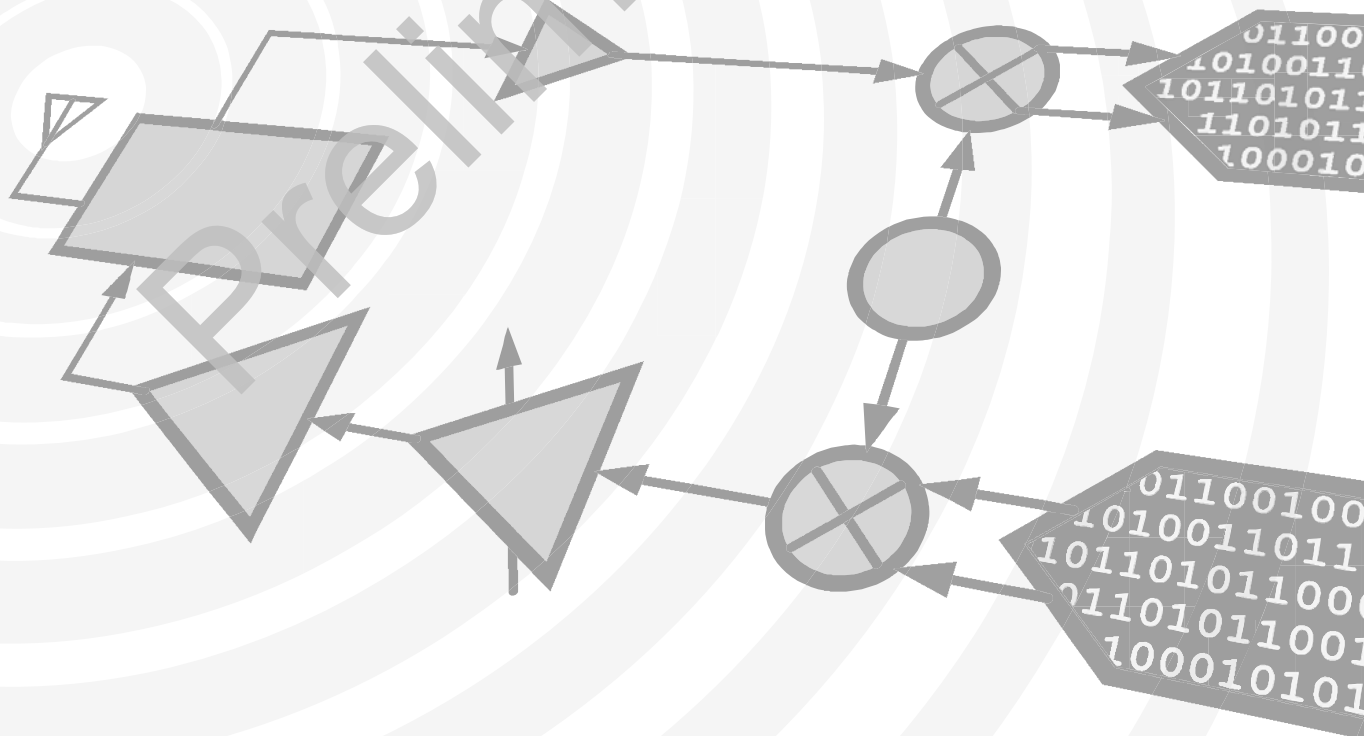


Analog Devices Welcomes Hittite Microwave Corporation



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Preliminary

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

Typical Applications

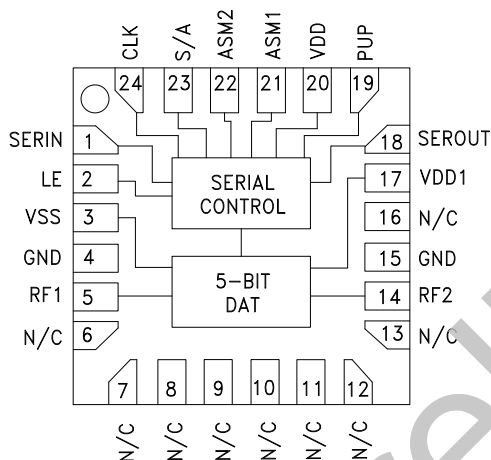
The HMC1018ALP4E is ideal for:

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

Features

- 1.0 dB LSB Steps to 31 dB
- TTL/CMOS Compatible, Serial Control
- Unique Asynchronous Mode Control Allows Immediate Attenuation Level Setting
- ±1.0 dB Typical Bit Error
- High Input IP3: +43 dBm
- 24 Lead 4x4mm SMT Package: 16mm²

Functional Diagram



General Description

The HMC1018ALP4E 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 5.5 dB typical. The attenuator bit values are 1.0 (LSB), 2, 4, 8, 16 for a total attenuation of 31 dB. Attenuation accuracy is excellent at ±0.4 dB typical step error with an IIP3 of +43 dBm. The control interface is CMOS/TTL compatible and accepts a three wire serial input. The HMC1018ALP4E 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		4.5	6.0	dB
	18.0 - 26.5 GHz		5.5	7.0	dB
	26.5 - 30.0 GHz		7.0	8.0	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)	1.0 - 15 dB States	0.1 - 33.0 GHz	± (0.5 + 5%) of Atten. Setting Max		dB
	16 - 31 dB States	0.1 - 20.0 GHz	± (0.5 + 5%) of Atten. Setting Max		dB
	16 - 31 dB States	20.0 - 33.0 GHz	± (0.6 + 8%) of Atten. Setting Max		dB
Input Power for 0.1 dB Compression	0.1 - 0.5 GHz		20		dBm
	0.5 - 30.0 GHz		25		dBm
Input Third Order Intercept Point (Two-Tone Input Power= 0 dBm Each Tone)	0.1 - 0.5 GHz		40		dBm
	0.5 - 30.0 GHz		43		dBm
Switching Characteristics	0.1 - 30.0 GHz	tRISE, tFALL (10/90% RF)	60		ns
		tON/tOFF (50% CTL to 10/90% RF)	90		ns
I _{dd1}	0.1 - 30.0 GHz	2.5	4.5	6.5	mA
I _{ss}	0.1 - 30.0 GHz	-7.0	-5.0	-3.0	mA

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**1.0 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	3 dB
Low	High	28 dB
Low	Low	31 dB

PUP Truth Table

PUP	Attenuation State
High	Reference I.L.
Low	31 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 μ A
High	2 to 5V @ 1 μ A

Serial Mode Truth Table

Control Voltage Input					Attenuation State RF1 - RF2
P4 16 dB	P3 8 dB	P2 4 dB	P1 2 dB	P0 1 dB	
High	High	High	High	High	Reference I.L.
High	High	High	High	Low	1 dB
High	High	High	Low	High	2 dB
High	High	Low	High	High	4 dB
High	Low	High	High	High	8 dB
Low	High	High	High	High	16 dB
Low	Low	Low	Low	Low	31 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



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

RF Input Power (0.1 to 30.0 GHz)	+25 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 Pdis (T = 85 °C) (derate 6.9 mW/°C above 85 °C)	0.451 W
Thermal Resistance	144 °C/W
Storage Temperature	-65 to + 150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class 1A

The drawing shows a leadframe for a 10-pin package. The top view is a square with a central area labeled "H1018" and "XXXX". The bottom view shows the leadframe with 10 pins, labeled "PIN 1" and "PIN 24". The drawing includes dimensions in inches and millimeters, and a note about the exposed ground paddle.

TOP VIEW

Dimensions (inches [millimeters]):

- Overall width: .161 [4.10]
- Overall height: .153 [3.90]
- Pin pitch (width): .039 [1.00]
- Pin pitch (height): .031 [0.80]
- Lead width: .002 [0.05]
- Lead thickness: .000 [0.00]
- Seating plane: .003 [0.08] C

BOTTOM VIEW

Dimensions (inches [millimeters]):

- Pin pitch (width): .012 [0.30]
- Pin pitch (height): .007 [0.18]
- Pin width: .016 [0.40]
- Pin height: .008 [0.20] MIN
- Lead width: .022 [0.56]
- Lead thickness: .017 [0.44]
- Lead spacing: .101 [2.56]
- Lead thickness: .036 [2.44]
- Lead width: .116 [2.95]
- Lead thickness: .104 [2.65]

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.

EXPOSED GROUND PADDLE MUST BE CONNECTED TO RF/DC GROUND.

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.