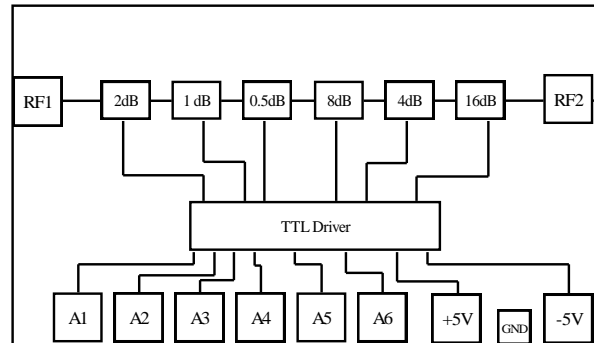


0.5 – 4 GHz 6-Bit Digital Attenuator

Features

- ◆ 0.5-4.0 GHz Frequency range
- ◆ 31.5 dB Attenuation range
- ◆ 0.5dB resolution
- ◆ 3.5dB Insertion loss max.
- ◆ 5 deg Phase error over all states
- ◆ 1.5:1 Input/Output VSWR
- ◆ On-chip TTL integrated control Inputs
- ◆ 0.5µm InGaAs pHEMT Technology
- ◆ Chip size : 4.05mm x 2.2mm x 0.1 mm

Functional diagram



Typical Applications

- ◆ Radar Systems
- ◆ Broadband Communication
- ◆ Military & Space
- ◆ Instrumentation Applications
- ◆ Test and Measurements

Description

The ASL3002 is a high performance GaAs MMIC 6-bit digital attenuator offering an attenuation range of 31.5dB in steps of 0.5dB. The attenuator bit values are 0.5(LSB), 1,2,4,8 and 16dB for a total attenuation of 31.5dB. The attenuator features an integrated TTL driver for facilitating a 6-bit digital control. The Driver operates on +5/-5V supplies with minimal DC power consumption. This die is fabricated using a highly reliable 0.5µm InGaAs pHEMT technology and is fully protected with Silicon Nitride passivation for reliable operation.

Absolute Maximum Ratings ⁽¹⁾

Parameter	Absolute Maximum	Units
RF input Power	25	dBm
Positive supply Voltage	+6	V
Negative supply voltage	-6	V
Control voltage	-0.5 to +5.5	V
Operating Temperature	-55 to +85	°C
Storage Temperature	-65 to +150	°C

1. Operation beyond these limits may cause permanent damage to the component

Electrical Specifications @ $T_A = 25\text{ }^\circ\text{C}$, $Z_o = 50\Omega$

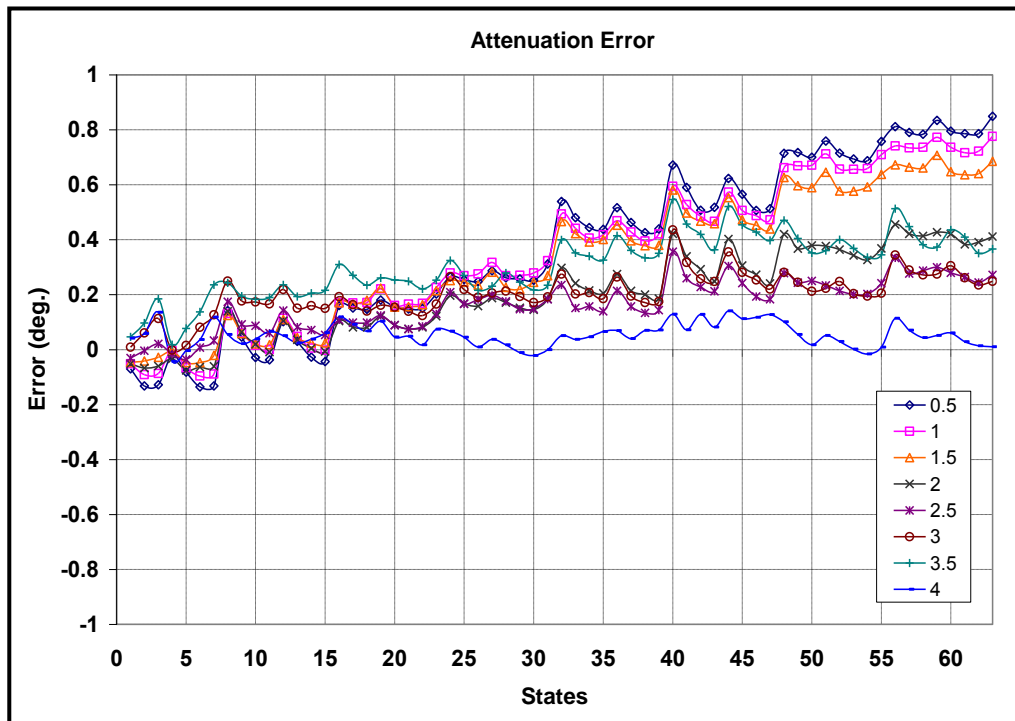
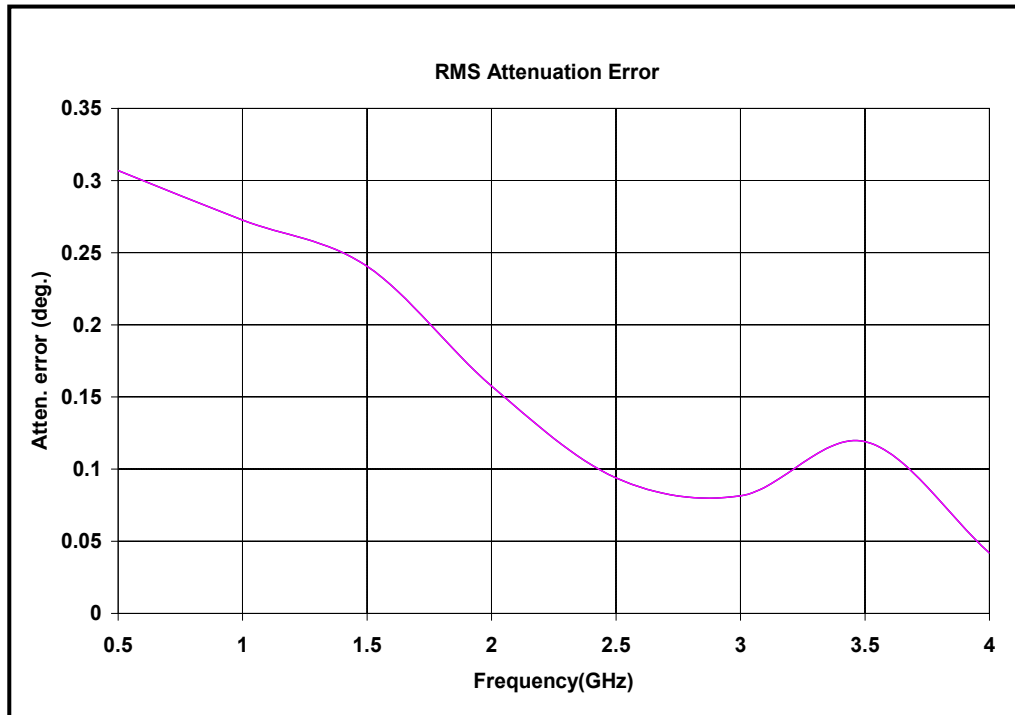
Parameter	Min.	Typ.	Max.	Units
Bandwidth	0.5	-	4.0	GHz
Insertion Loss	-	3	-	dB
Input VSWR,all states	-	1.5:1	-	Ratio
Output VSWR,all states	-	1.5:1	-	Ratio
Attenuation Range	0	-	31.5	dB
Attenuation Accuracy	-	0.6	-	dB
Phase variation, over all states (max.)	-	8	-	deg.
RMS Attenuation error	-	< 0.25	-	dB
Input power @ P-1dB	-	24	-	dBm
Driver Bias Voltages	-	+5, -5	-	V
Control Voltage	-	0/+5	-	V

Note:

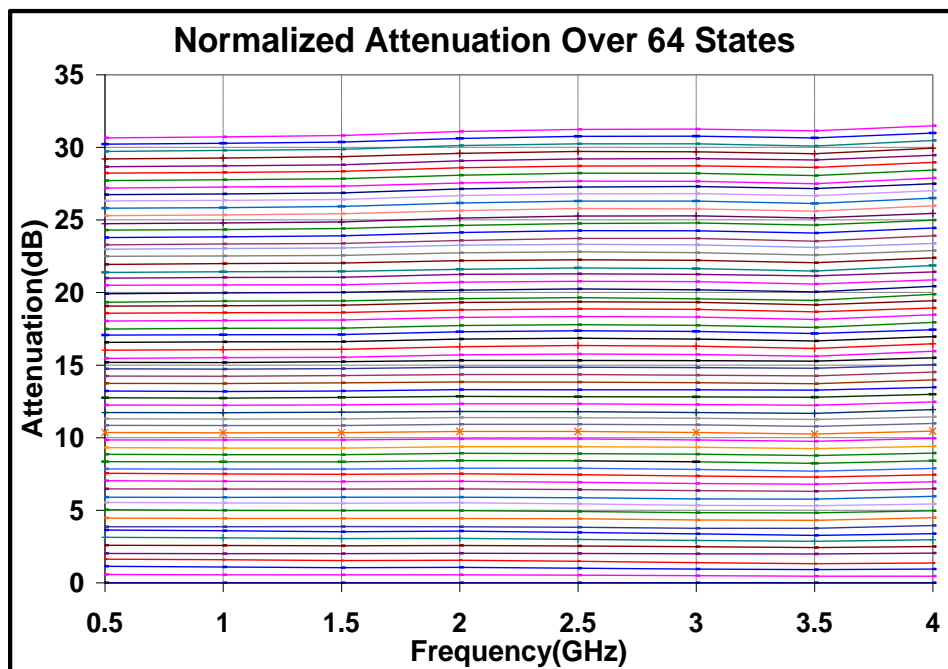
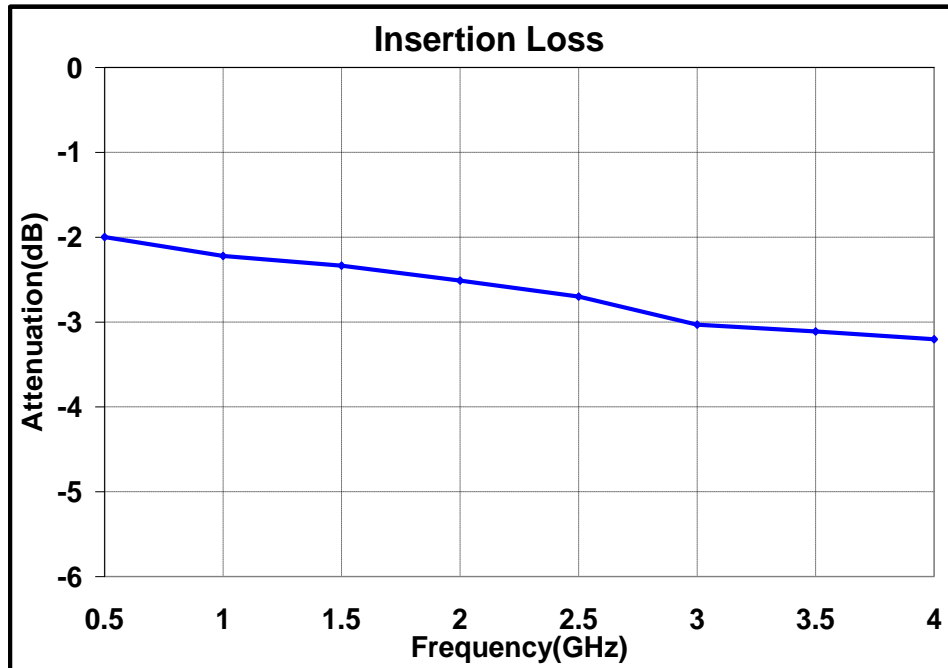
1. The above mentioned electrical specifications are measured in 50ohm line test fixture.

Test fixture data

Driver Bias +5V,-5V; Control 0/+5V; $T_A = 25\text{ }^\circ\text{C}$

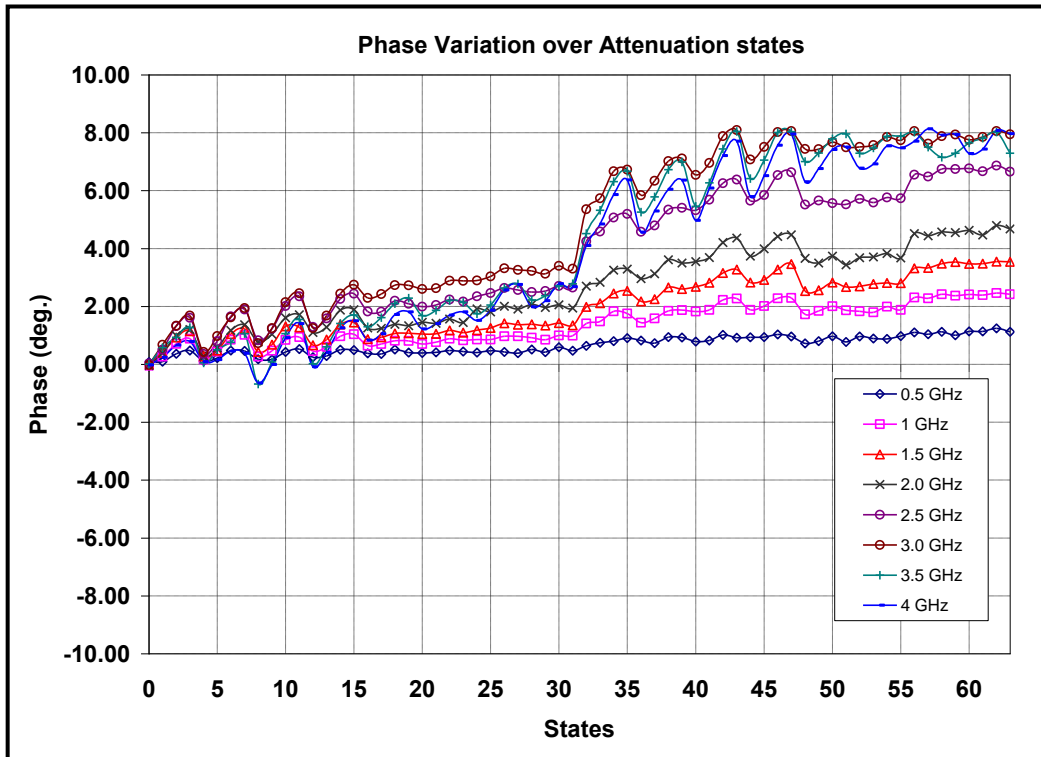


Test fixture data

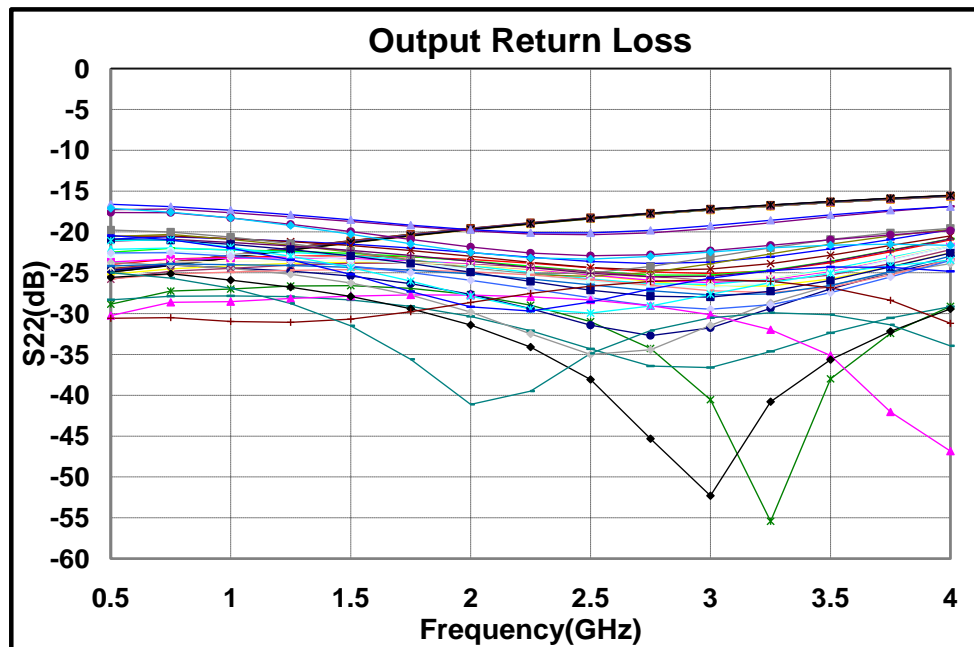
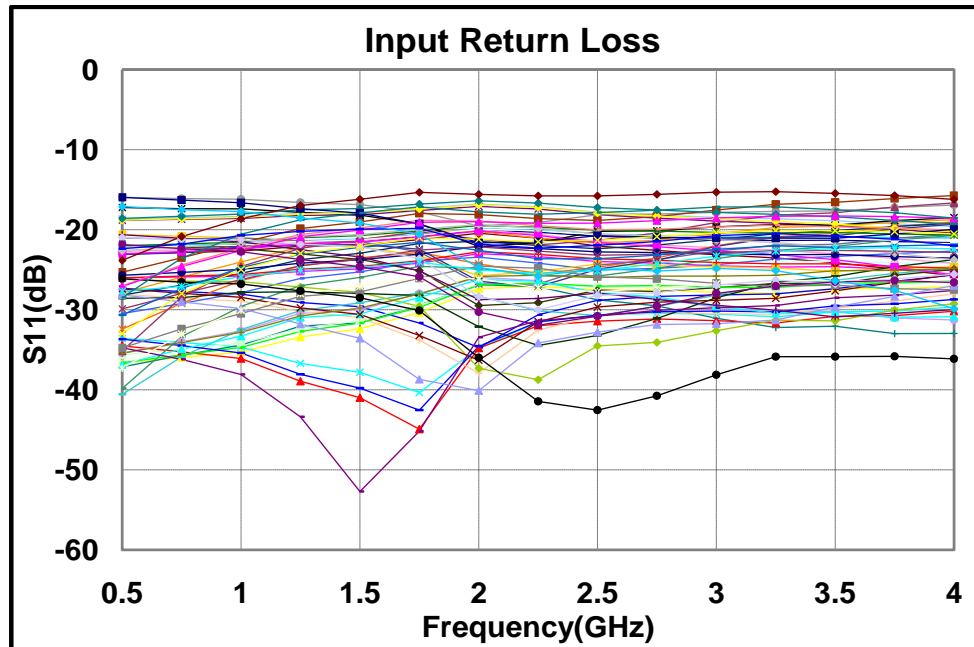
 Driver Bias +5V,-5V; Control 0/+5V; $T_A = 25\text{ }^\circ\text{C}$


Test fixture data

Driver Bias +5V,-5V; Control 0/+5V; $T_A = 25\text{ }^\circ\text{C}$



Test fixture data

 Driver Bias +5V,-5V; Control 0/+5V; $T_A = 25\text{ }^\circ\text{C}$


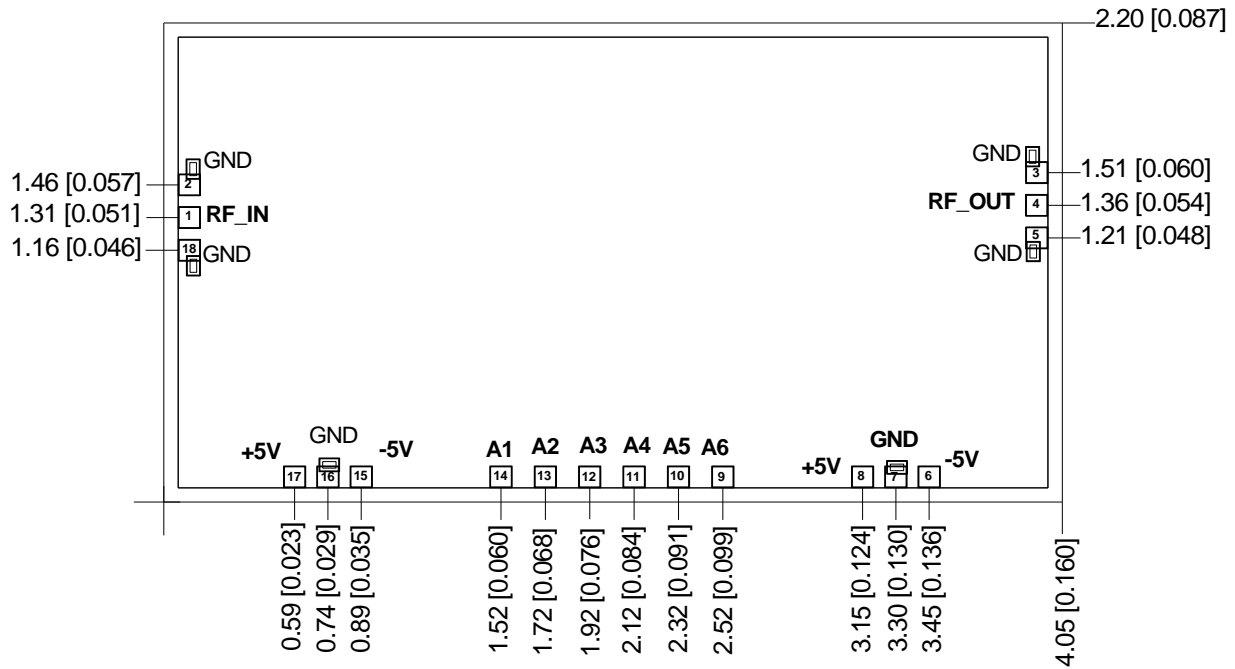
Truth Table

State	Attenuation (dB)	TTL Control (1 = 3 to 5 V, 0 = 0 to 0.2 V)					
		A6 (16)	A5 (8)	A4(4)	A3 (2)	A2(1)	A1 (0.5)
0	0	0	0	0	0	0	0
1	0.5	0	0	0	0	0	1
2	1	0	0	0	0	1	0
3	1.5	0	0	0	0	1	1
4	2	0	0	0	1	0	0
5	2.5	0	0	0	1	0	1
6	3	0	0	0	1	1	0
7	3.5	0	0	0	1	1	1
8	4	0	0	1	0	0	0
9	4.5	0	0	1	0	0	1
10	5	0	0	1	0	1	0
11	5.5	0	0	1	0	1	1
12	6	0	0	1	1	0	0
13	6.5	0	0	1	1	0	1
14	7	0	0	1	1	1	0
15	7.5	0	0	1	1	1	1
16	8	0	1	0	0	0	0
17	8.5	0	1	0	0	0	1
18	9	0	1	0	0	1	0
19	9.5	0	1	0	0	1	1
20	10	0	1	0	1	0	0
21	10.5	0	1	0	1	0	1
22	11	0	1	0	1	1	0
23	11.5	0	1	0	1	1	1
24	12	0	1	1	0	0	0
25	12.5	0	1	1	0	0	1
26	13	0	1	1	0	1	0
27	13.5	0	1	1	0	1	1
28	14	0	1	1	1	0	0
29	14.5	0	1	1	1	0	1
30	15	0	1	1	1	1	0
31	15.5	0	1	1	1	1	1
32	16	1	0	0	0	0	0
33	16.5	1	0	0	0	0	1
34	17	1	0	0	0	1	0
35	17.5	1	0	0	0	1	1

Truth Table

State	Attenuation (dB)	TTL Control (1 = 3 to 5 V, 0 = 0 to 0.2 V)					
		A6 (16)	A5 (8)	A4(4)	A3 (2)	A2(1)	A1 (0.5)
36	18.0	1	0	0	1	0	0
37	18.5	1	0	0	1	0	1
38	19	1	0	0	1	1	0
39	19.5	1	0	0	1	1	1
40	20	1	0	1	0	0	0
41	20.5	1	0	1	0	0	1
42	21	1	0	1	0	1	0
43	21.5	1	0	1	0	1	1
44	22	1	0	1	1	0	0
45	22.5	1	0	1	1	0	1
46	23	1	0	1	1	1	0
47	23.5	1	0	1	1	1	1
48	24	1	1	0	0	0	0
49	24.5	1	1	0	0	0	1
50	25	1	1	0	0	1	0
51	25.5	1	1	0	0	1	1
52	26	1	1	0	1	0	0
53	26.5	1	1	0	1	0	1
54	27	1	1	0	1	1	0
55	27.5	1	1	0	1	1	1
56	28	1	1	1	0	0	0
57	28.5	1	1	1	0	0	1
58	29	1	1	1	0	1	0
59	29.5	1	1	1	0	1	1
60	30	1	1	1	1	0	0
61	30.5	1	1	1	1	0	1
62	31	1	1	1	1	1	0
63	31.5	1	1	1	1	1	1

Mechanical Characteristics



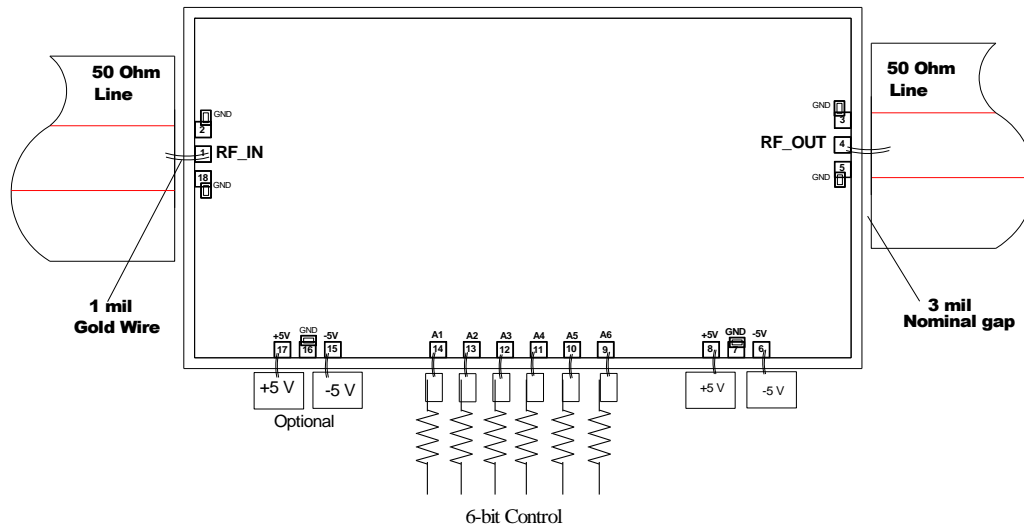
Units: millimetres (inches)

All RF and DC bond pads are 100µm x 100µm

Note:

1. Pad no. 1 : RF_IN
2. Pad no. 4 : RF_OUT
3. Pad no. 6 : -5V
4. Pad no. 8 : +5V
5. Pad nos. 9 – 14 : Control pads ; Pad 9 - MSB (16 dB) ; Pad 14 - LSB (0.5dB)
6. Pad no. 15 : optional -5V
7. Pad no. 17 : optional +5V

Recommended Assembly Diagram



Note:

1. The RF input & output ports are DC coupled.
2. For reliable operation external DC blocking capacitors are required at the RF input & out ports.
3. It is recommended to use 200-500 Ω resistors in the control path as shown.

Die attach: For Epoxy attachment, use of a two-component conductive epoxy is recommended. An epoxy fillet should be visible around the total die periphery. If Eutectic attachment is preferred, use of fluxless AuSn (80/20) 1-2 mil thick preform solder is recommended. Use of AuGe preform should be strictly avoided.

Wire bonding: For DC pad connections use either ball or wedge bonds. For best RF performance, use of 150 - 200 μm length of wedge bonds is advised. Single Ball bonds of 250-300 μm though acceptable, may cause a deviation in RF performance.



GaAs MMIC devices are susceptible to Electrostatic discharge. Proper precautions should be observed during handling, assembly & testing

All information and Specifications are subject to change without prior notice

Aelius Semiconductors Pte. Ltd., Singapore