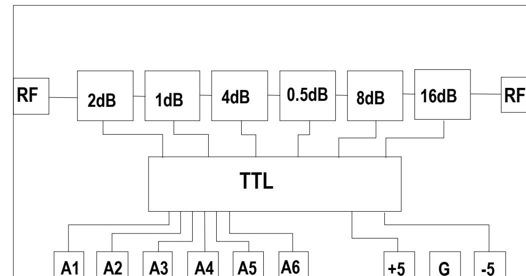
0.5 – 10.5 GHz 6-Bit Digital Attenuator

Features

- **Frequency Range : 0.5 to 10.5 GHz**
- **31.5dB Attenuation Range**
- **4.5dB Insertion loss max.**
- **10^0 max. phase variation**
- **1.5:1 Input\Output VSWR**
- **0.35dB RMS Error**
- **TTL Control Inputs**
- **0.5µm InGaAs pHEMT Technology**
- **Chip Size : 4.0 mm x 2.2 mm x 0.1 mm**

Functional Diagram



Typical Applications

- **Radar**
- **Military & Space**
- **Instrumentation**
- **Test and Measurements**
- **Instrumentation Applications**

Description

The AMT2361011 is a high performance 6-bit digital attenuator MMIC offering an attenuation range of 31.5dB in steps 0.5dB. The attenuator bit values are 0.5dB (LSB), 1,2,4,8 and 16dB (MSB) for a total attenuation of 31.5dB. The attenuator features an excellent attenuation accuracy of ±0.5dB over all 64 states with a very low phase variation of 10 deg.(max.). The attenuator provides an integral TTL driver, facilitating a 6-bit control. The driver operates on +5/-5V voltages with minimal DC power consumption. The MMIC die is fabricated using a robust 0.5µm InGaAs pHEMT technology.

Absolute Maximum Ratings (1)

Parameter	Absolute Maximum	Units
RF Input Power	20	dBm
Positive Supply Voltage	+6	V
Negative Supply Voltage	-6	V
Control Voltage	-0.5 to +5.5	V
Operating Temperature	-55 to +85	ºC
Storage Temperature	-65 to +150	ºC

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

Electrical Specifications [1] @ T_A = 25 °C, Z_o =50 Ω

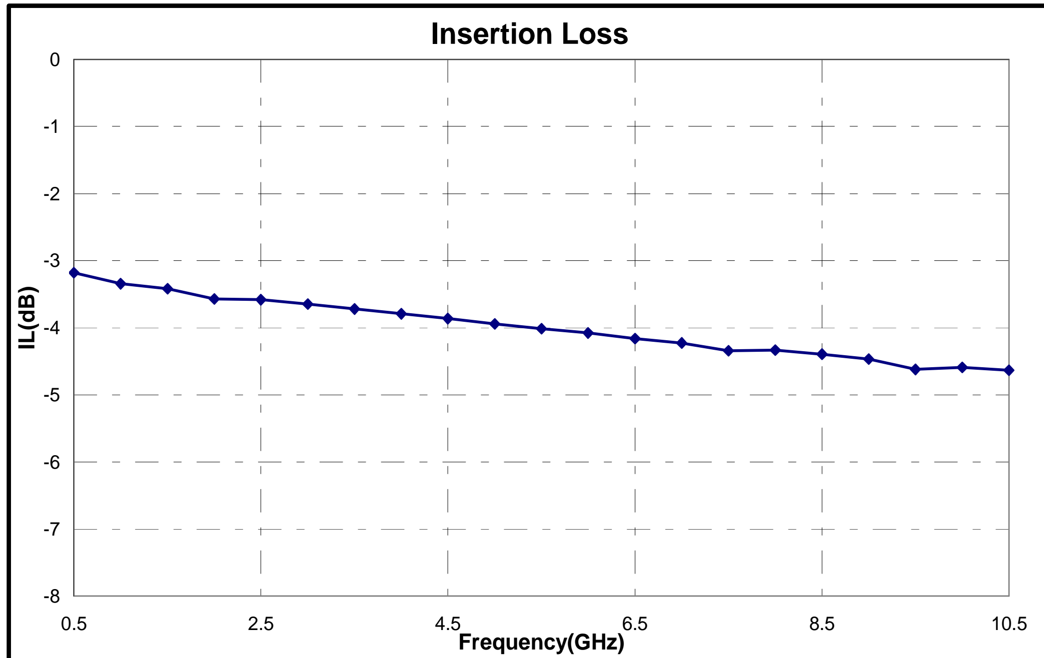
Parameter	Frequency(GHz)	Value	Units
Insertion Loss	0.5 -10.5	4.6	dB
Attenuation Range	0.5 -10.5	0-31.5	dB
Attenuation step	0.5 -10.5	0.5	dB
Attenuation Accuracy (All States)	0.5 - 2.5 2.5 – 6.0 6.0 – 10.5	± 0.2 + 3% of Attn. Setting Max ± 0.1 + 2% of Attn. Setting Max ± 0.1 + 1% of Attn. Setting Max	dB
Phase variation over 64 states	0.5 -10.5	10	deg
RMS Error	0.5 - 2.5 2.5 - 6.5 6.5 - 10.5	< 0.35 < 0.25 < 0.20	dB
Input/Output VSWR	0.5 -10.5	1.5:1	
DC Bias Voltages	-	+5, -5	V
Control Voltage	-	0 / +5	V

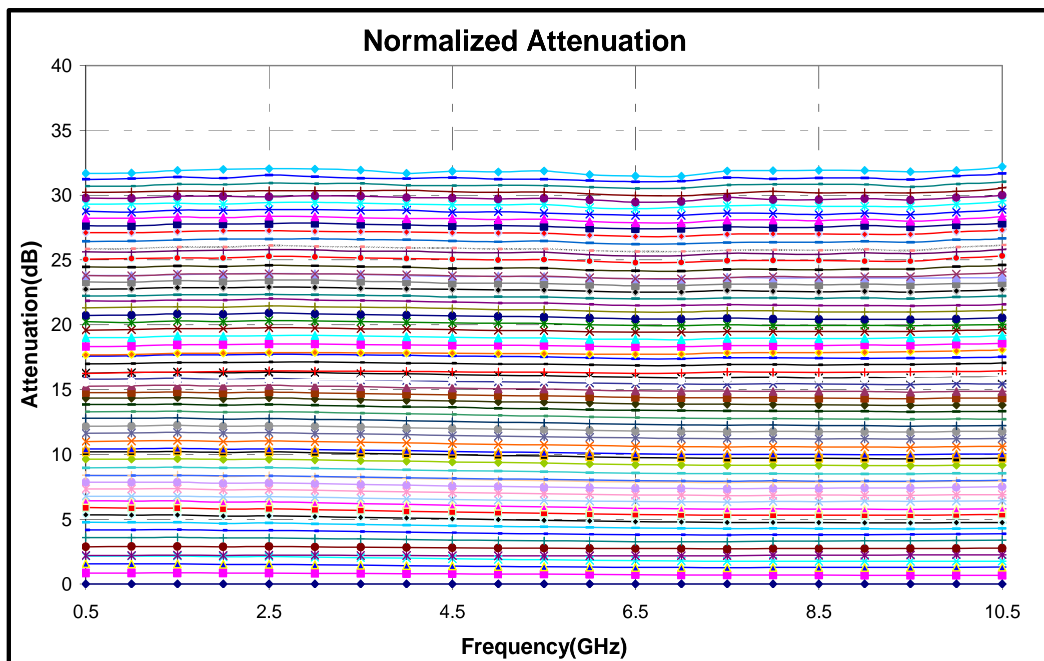
Note:

1. The above mentioned electrical specifications are measured On-Wafer.

On Wafer data

$T_A = 25\,^{o}C$





On Wafer data

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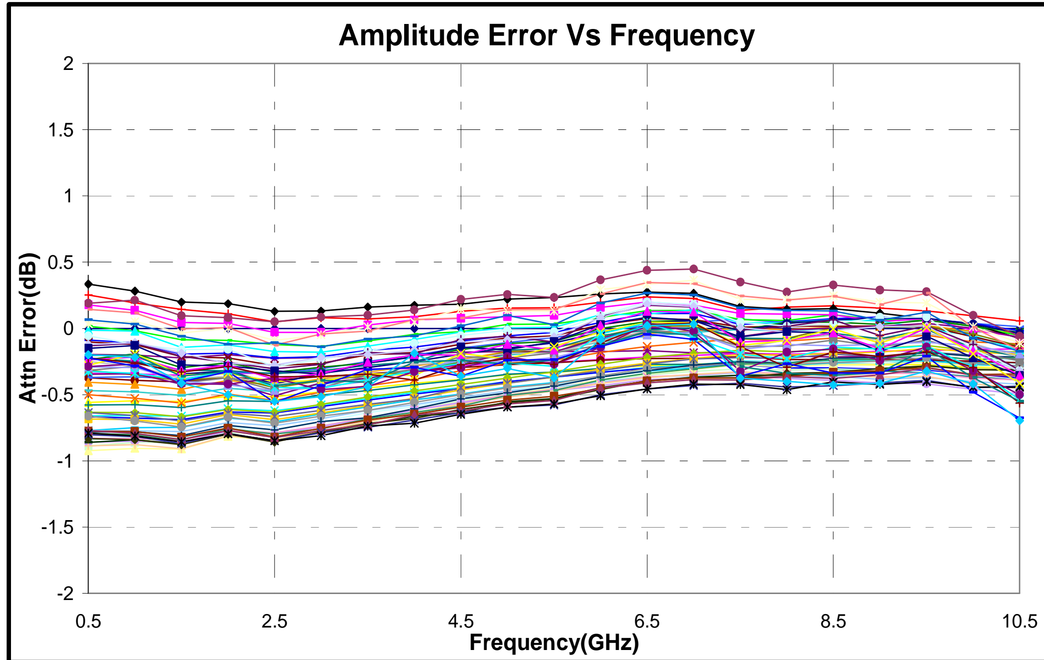

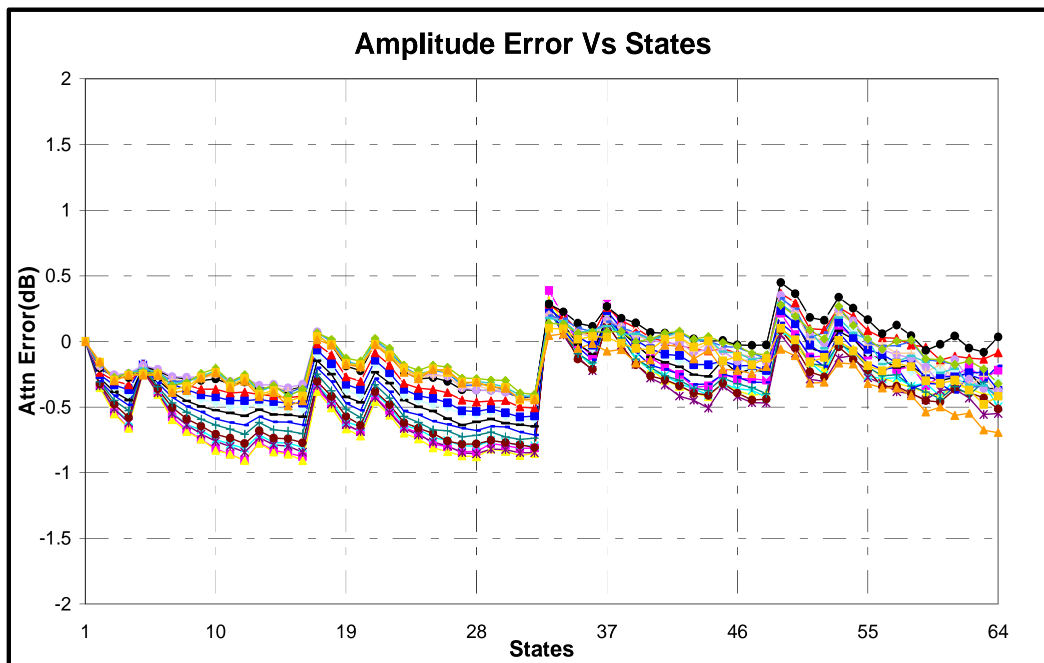

On Wafer data

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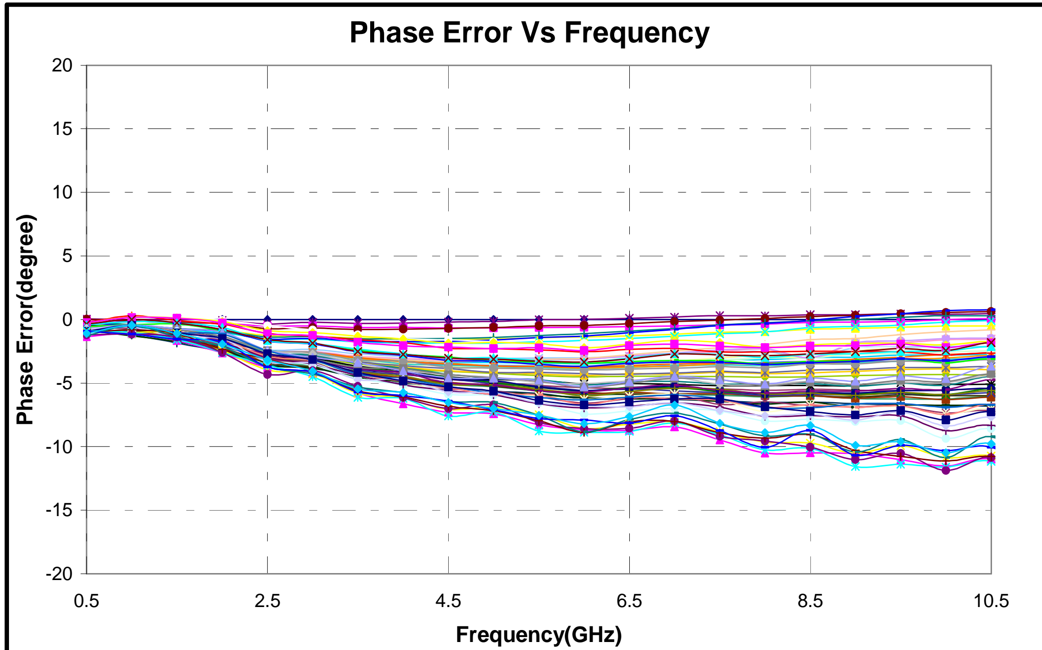

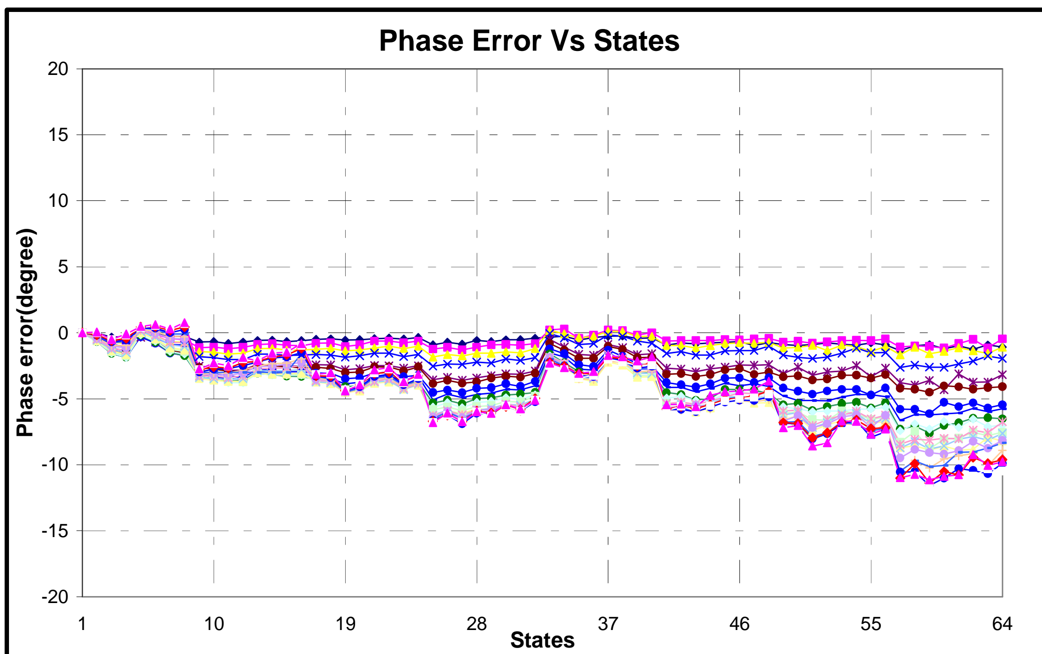

On Wafer data

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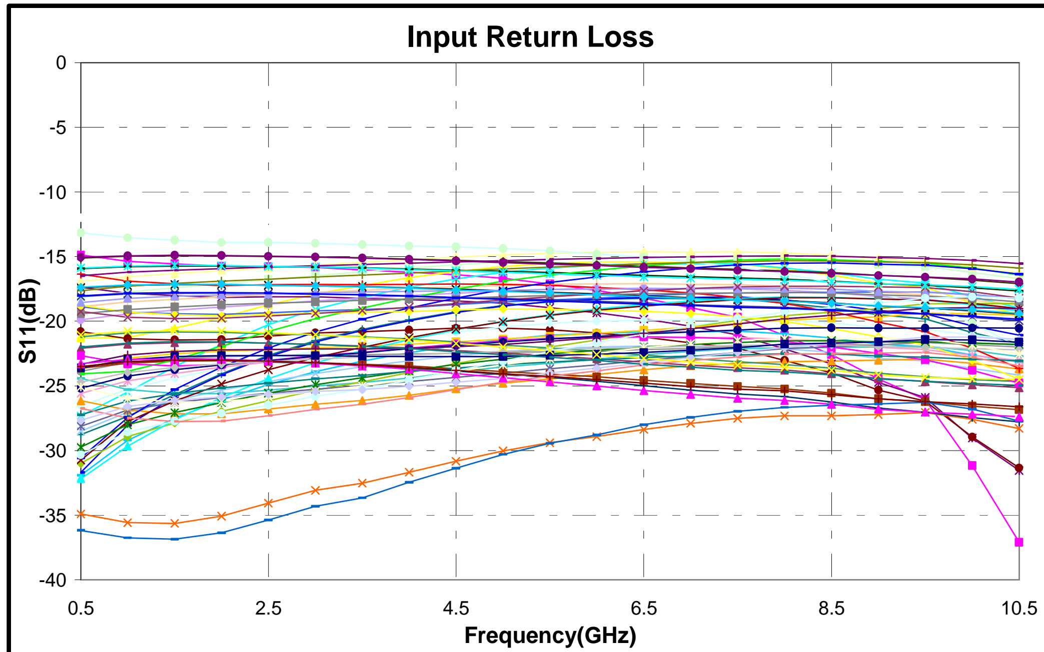
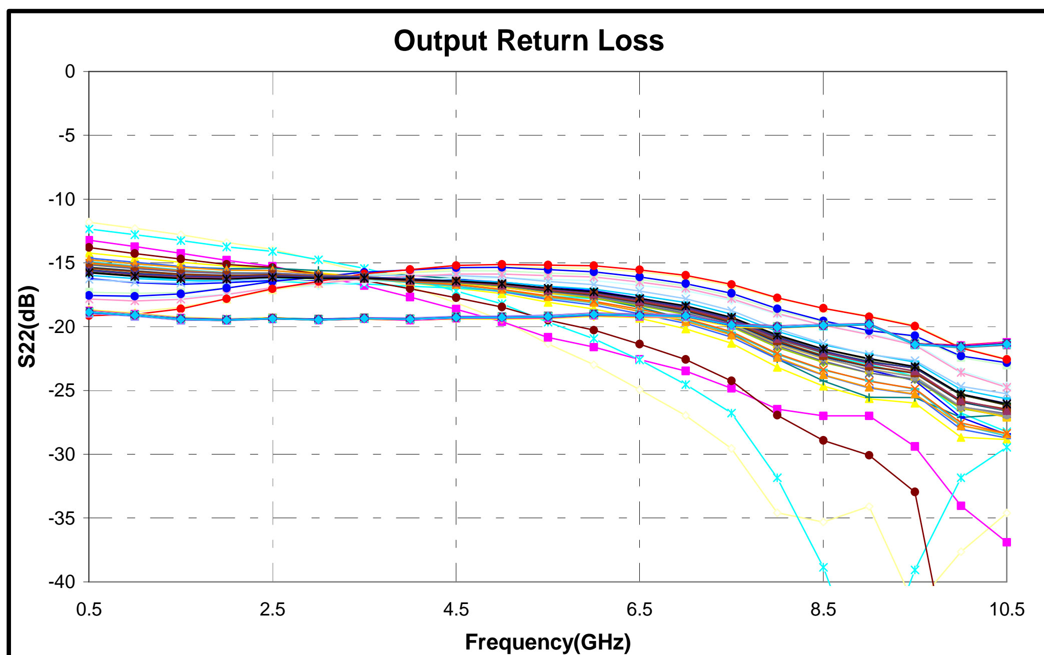
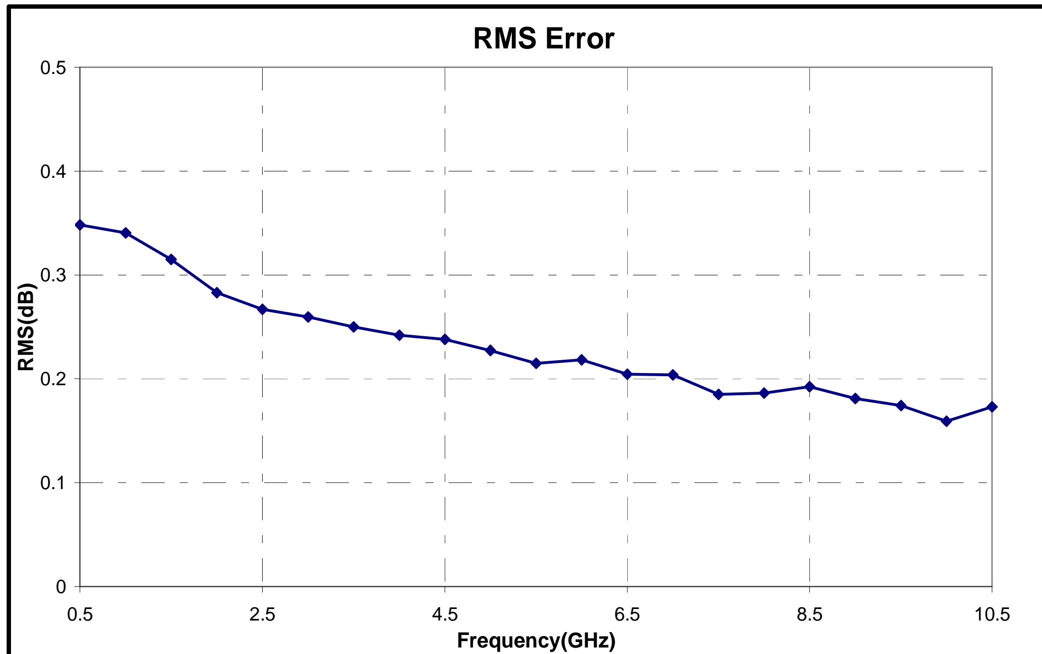




On Wafer data

$T_A = 25\,^{o}C$



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Truth Table

State	Attenuation (dB)	TTL Control (1 = 3.5 to 5 V, 0 = 0 to 0.5 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 = 3.5 to 5 V, 0 = 0 to 0.5 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

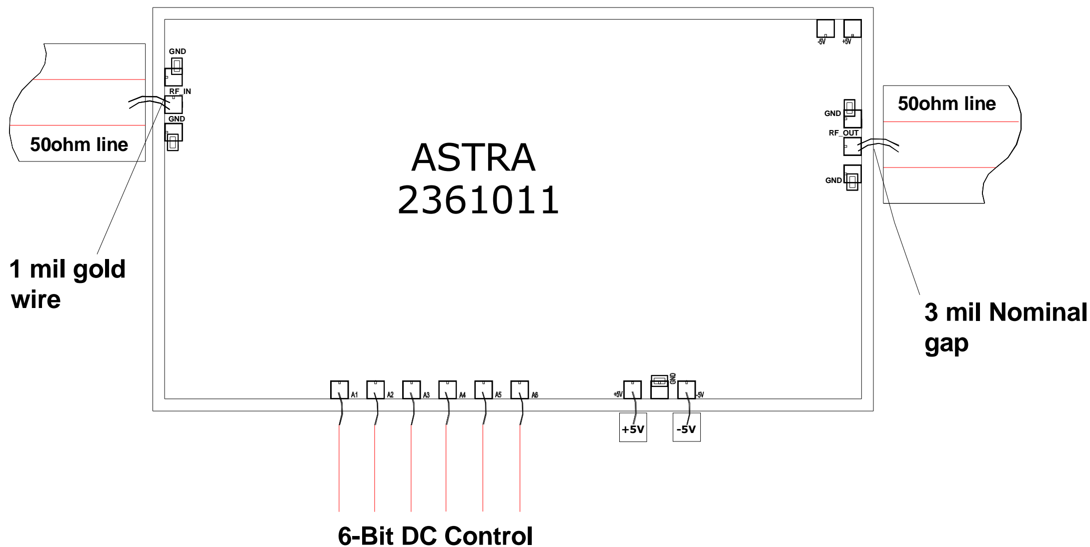
Mechanical Characteristics

Units: millimeters (inches)

Note:

1. All RF and DC bond pads are 100μm x 100μm
2. Pad no.1: RF Port 1
3. Pad no.2: Optional -5V
4. Pad no.3: Optional +5V
5. Pad no.4: RF Port 2
6. Pad no.5: -5V
7. Pad no.6: +5V
8. Pad nos.7-12: Control pads; Pad 7: MSB(16dB) & Pad 12: LSB (0.5dB)

Recommended Assembly Diagram



Note:

1. The RF input & output ports are DC coupled
2. No external components are required for this chip

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 - 200µm length of wedge bonds is advised. Single Ball bonds of 250-300µm 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

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