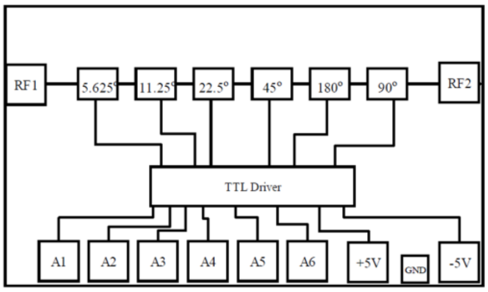
6 – 18GHz 6 BIT DIGITAL PHASE SHIFTER

Features

- **Frequency Range: 6 – 18GHz**
- **Insertion Loss: < -18dB**
- **RMS Phase Error: < 8Deg**
- **RMS Amplitude Error: < 1dB**
- **Peak Phase Error: +3 to -15Deg**
- **Input & Output RL: -10dB Typ.**
- **On-chip TTL drivers**
- **Chip size: 5mm x 3.5mm x 0.1mm**

Functional Diagram



Typical Applications

- Radar
- Military & Space
- Instrumentation

Description

The ASL 2020 is a wideband phase shifter operating in the 6-18GHz frequency range. The phase shifter features RMS phase error of less than 8deg over the operating frequency range. The phase shifter offers a mid-band insertion loss of 14dB and 10dB typical return loss over the operating bandwidth. The on-chip integrated TTL interface provides easy access to control the phase shift with a 6-bit digital control command. The TTL driver operates on +5/-5V supplies with minimal DC power consumption.

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 @ T_A = 25 °C, Z_o = 50Ω

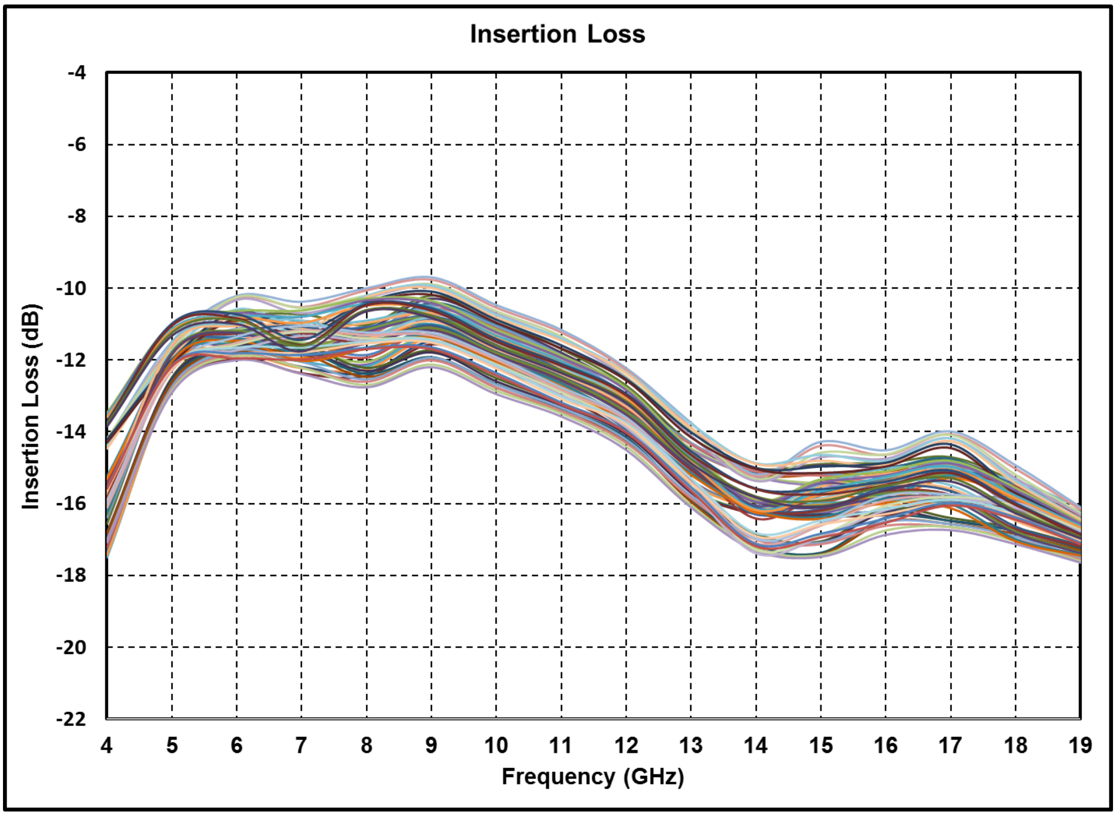
Parameter	Min.	Typ.	Max.	Units
Frequency Range		6.0-18.0		GHz
Phase Shift		0-360 in 64 steps		Deg.
Phase Resolution		5.625		Deg.
Insertion Loss	-18	-14	-9	dB
RMS Amplitude Error	0.4	0.7	1	dB
Peak Phase Error		+3 to -15		Deg.
RMS Phase Error (Calibrated) RMS Phase Error (Un-Calibrated)	1 2	3 5	4 8	Deg.
Input Return Loss	--	-10	-9	dB
Output Return Loss	--	-10	-6	dB
DC Supply		+5/-5		V
Control Voltages ON OFF		TTL compatible +3 to +5 V 0 to +0.5 V		 V V
Current[2]		14		mA

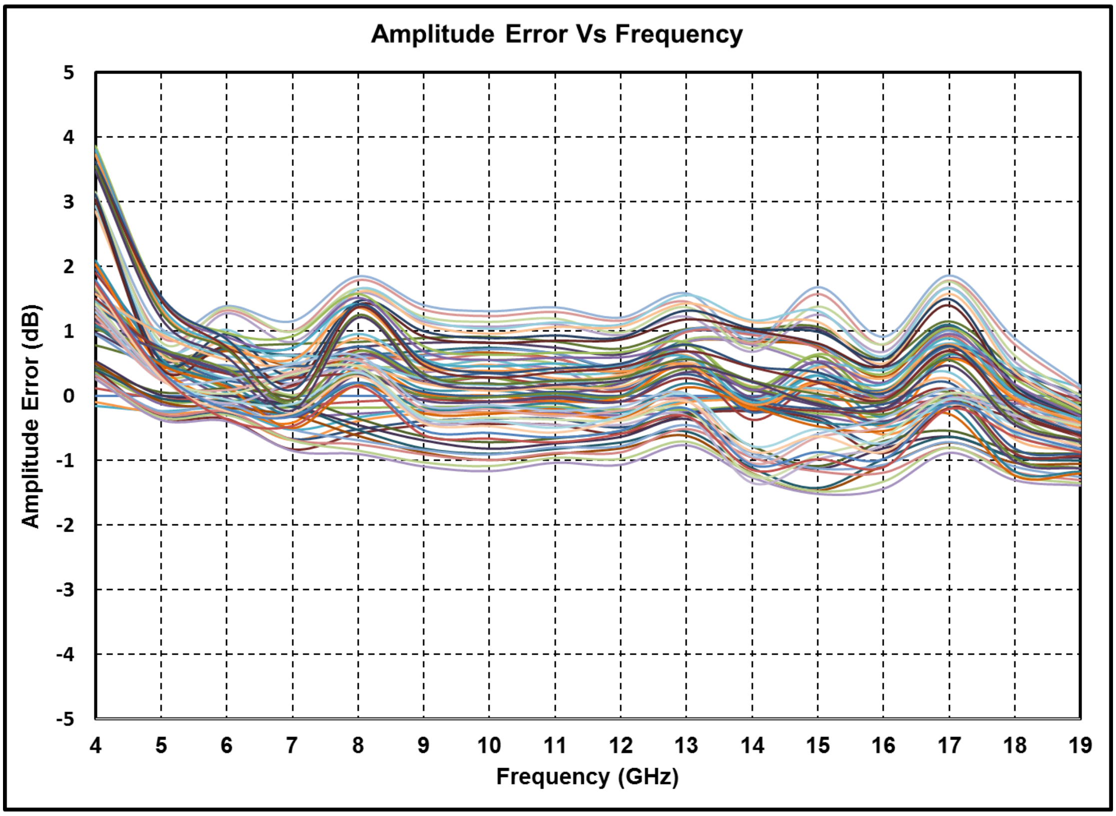
Note:

1. The above mentioned electrical specifications are measured On-Wafer.
2. The current mentioned is overall current drawn on both +5V & -5V supply.

On Wafer data

Driver Bias +5V, -5V; Control Voltage 0/+5V; T_A = 25 °C





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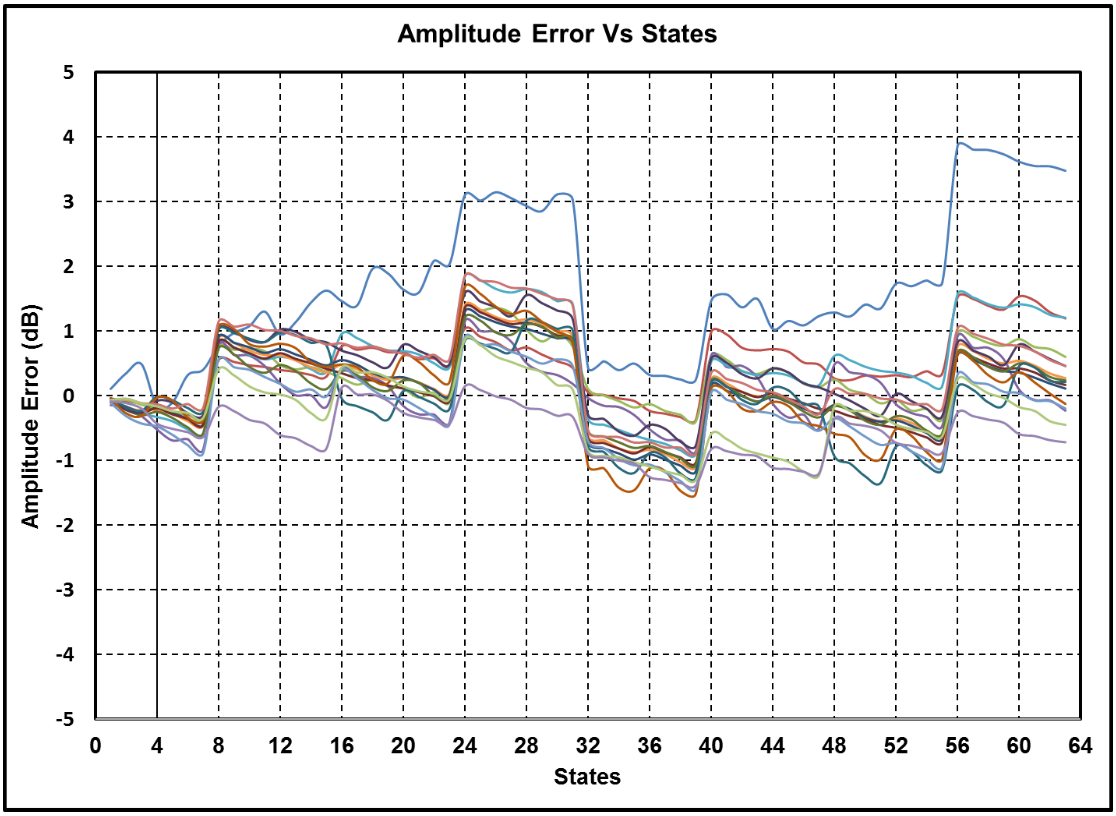

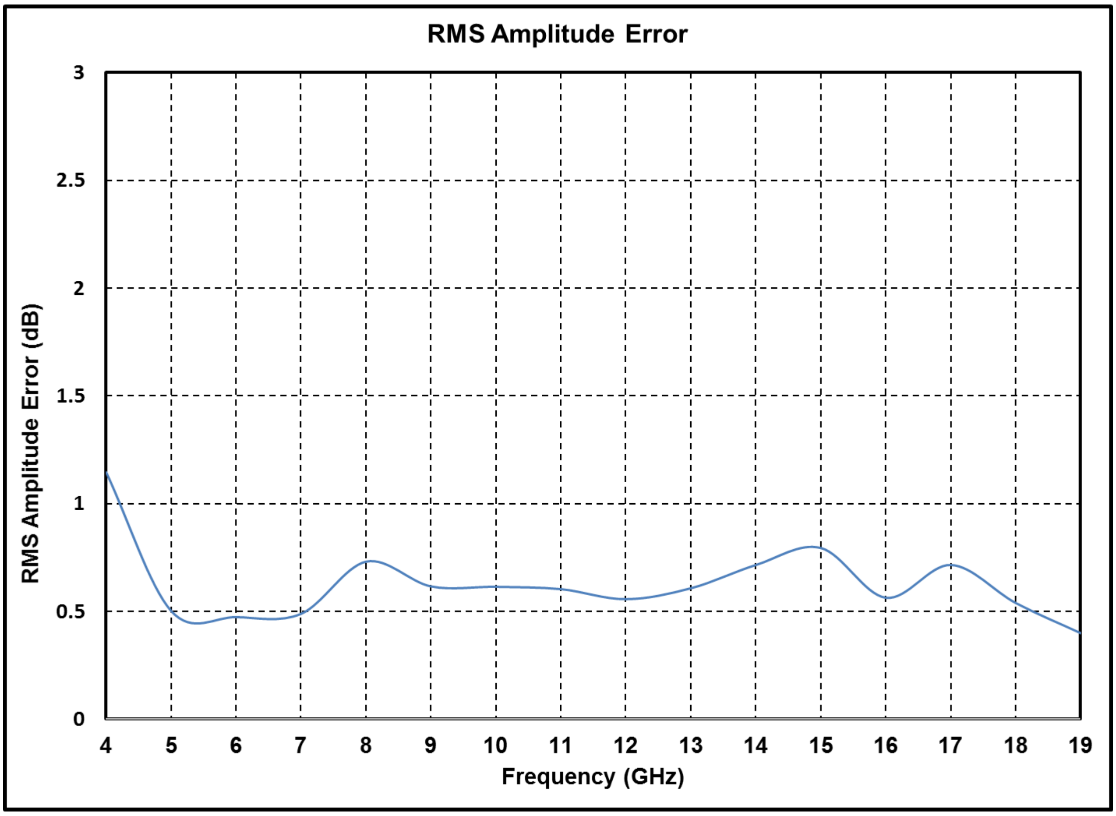

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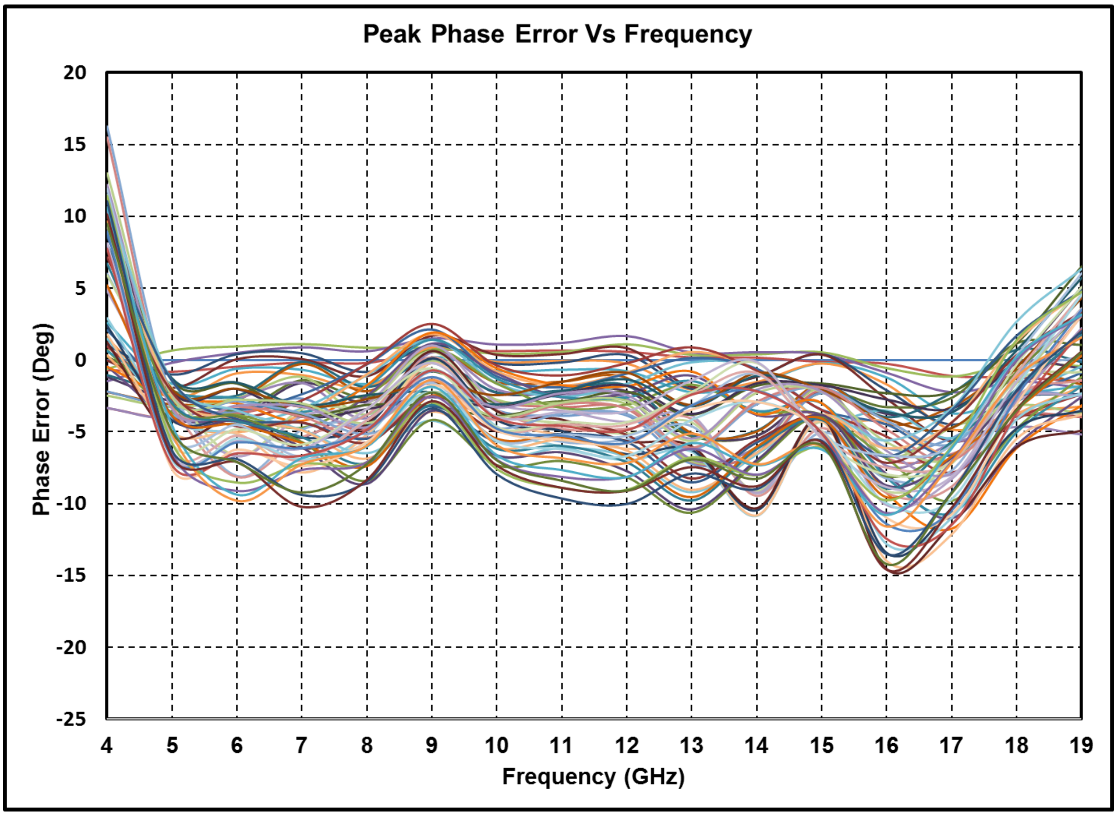

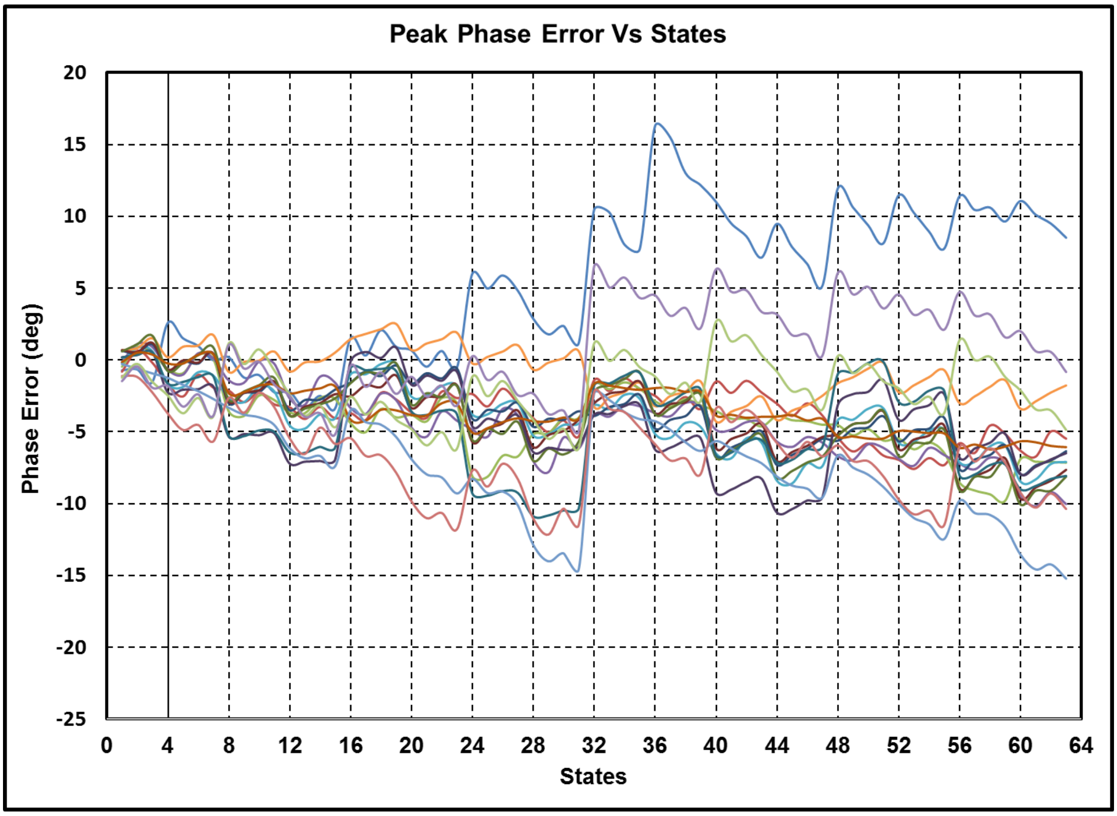

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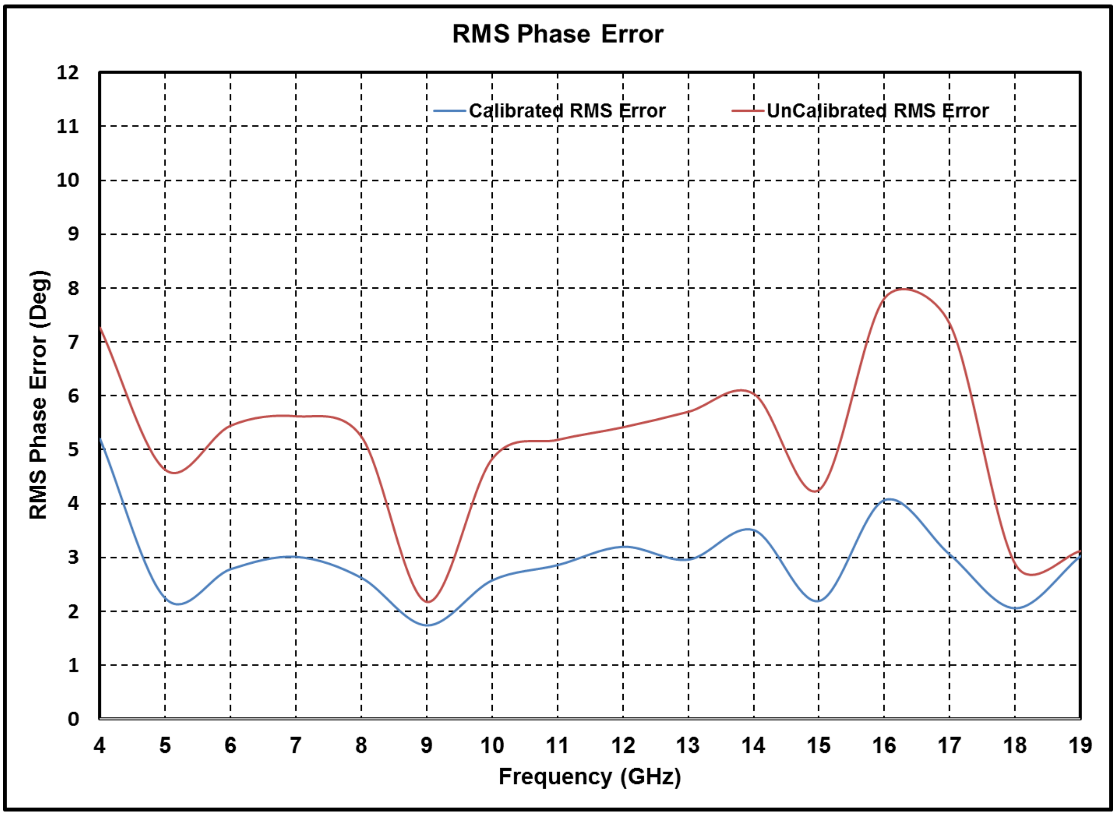

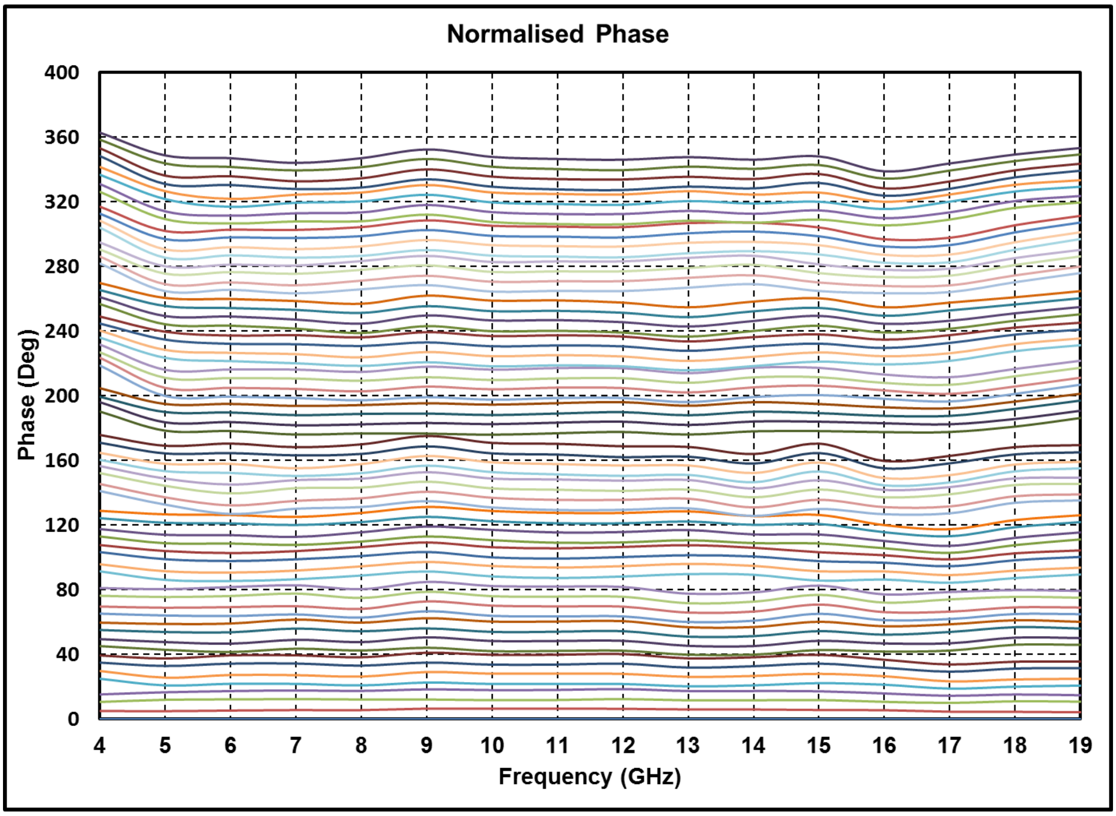

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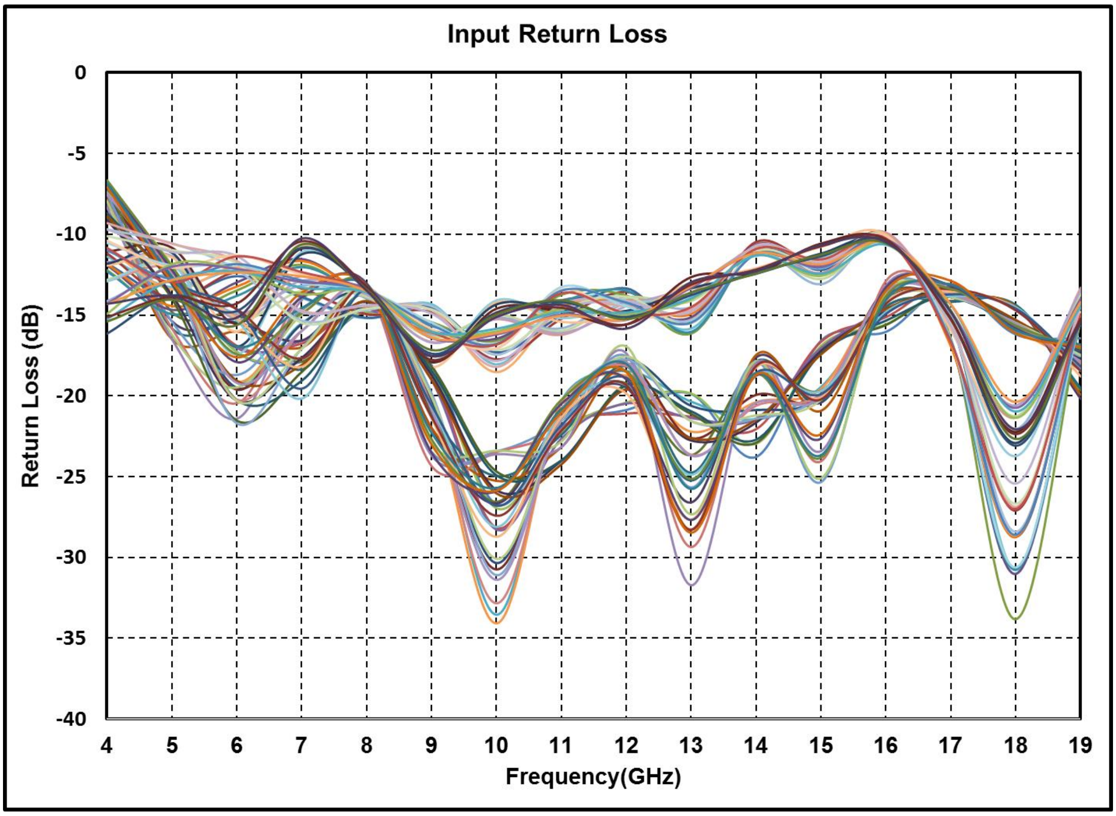
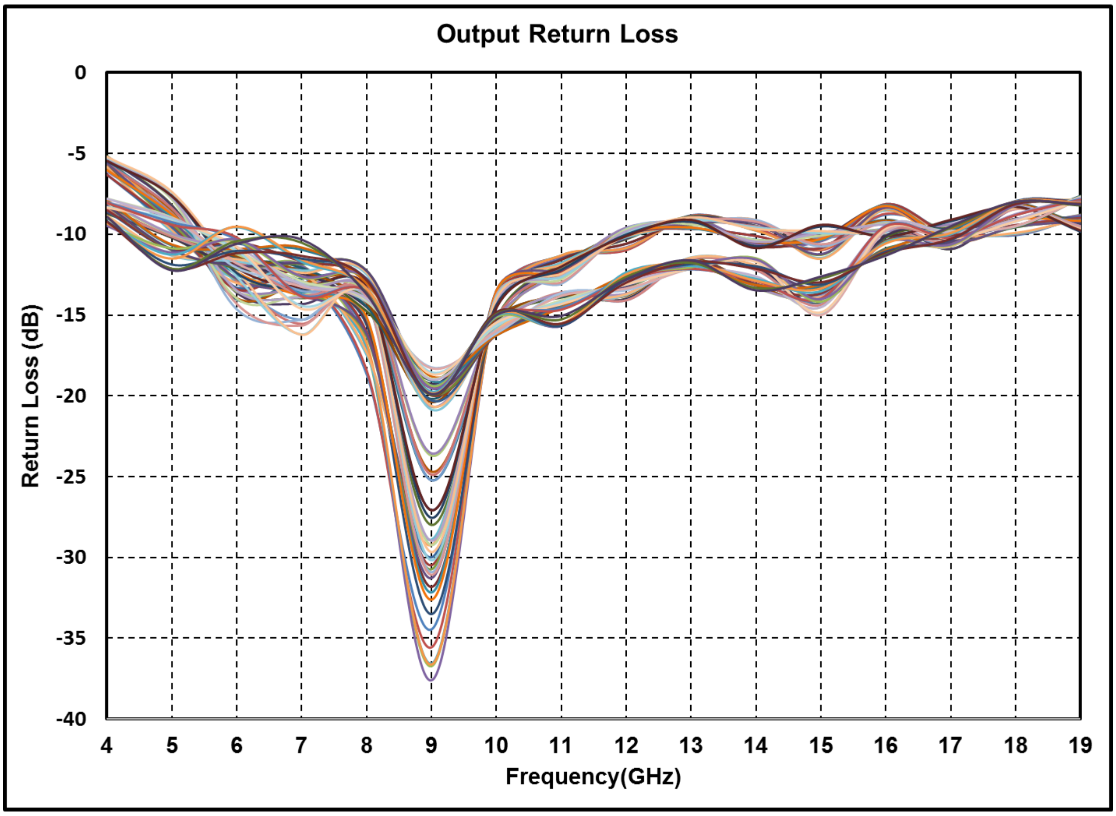
Driver Bias +5V, -5V; Control Voltage 0/+5V; T_A = 25 °C





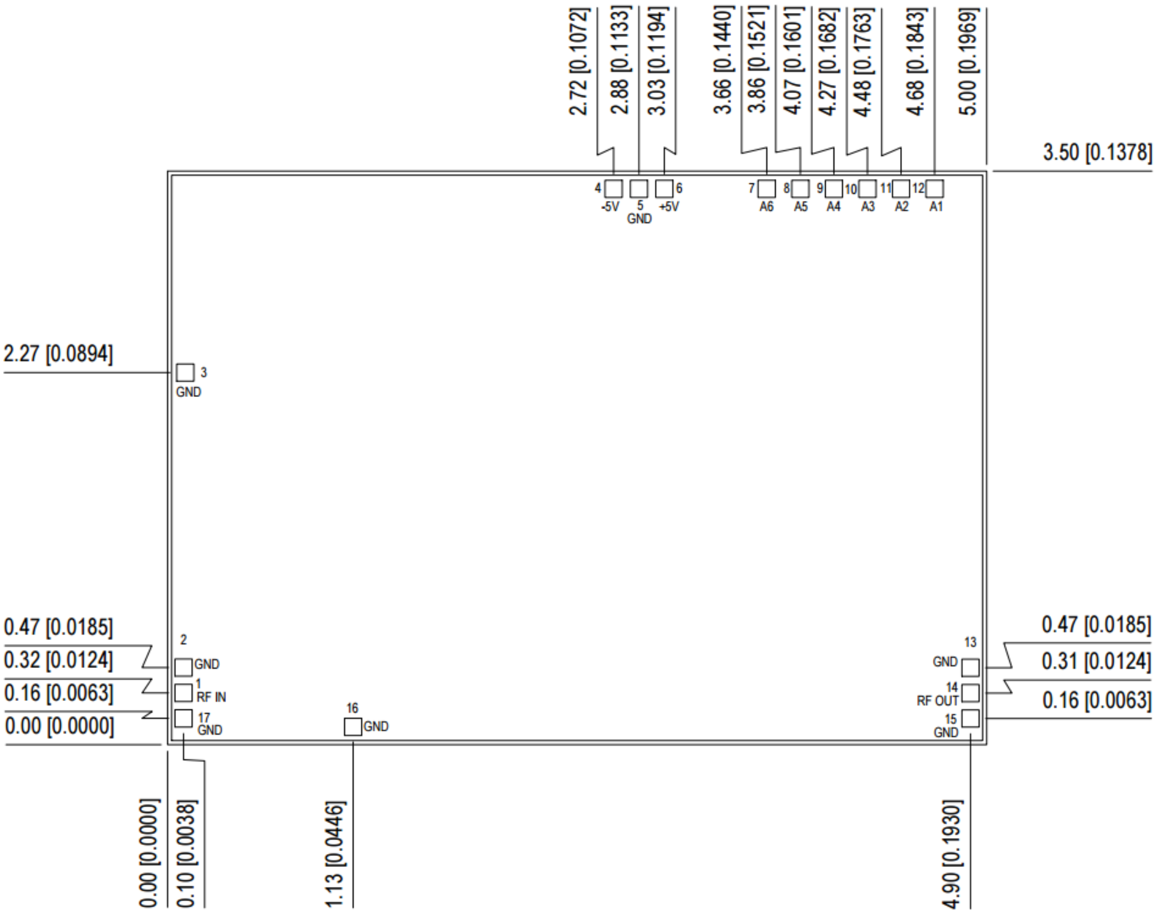
Truth Table

S.No.	Phase Shift	180Deg	90Deg	45Deg	22.5Deg	11.25Deg	5.625Deg
		A6	A5	A4	A3	A2	A1
1	0	0	0	0	0	0	0
2	5.625	0	0	0	0	0	1
3	11.25	0	0	0	0	1	0
4	16.875	0	0	0	0	1	1
5	22.5	0	0	0	1	0	0
6	28.125	0	0	0	1	0	1
7	33.75	0	0	0	1	1	0
8	39.375	0	0	0	1	1	1
9	45	0	0	1	0	0	0
10	50.625	0	0	1	0	0	1
11	56.25	0	0	1	0	1	0
12	61.875	0	0	1	0	1	1
13	67.5	0	0	1	1	0	0
14	73.125	0	0	1	1	0	1
15	78.75	0	0	1	1	1	0
16	84.375	0	0	1	1	1	1
17	90	0	1	0	0	0	0
18	95.625	0	1	0	0	0	1
19	101.25	0	1	0	0	1	0
20	106.875	0	1	0	0	1	1
21	112.5	0	1	0	1	0	0
22	118.125	0	1	0	1	0	1
23	123.75	0	1	0	1	1	0
24	129.375	0	1	0	1	1	1
25	135	0	1	1	0	0	0
26	140.625	0	1	1	0	0	1
27	146.25	0	1	1	0	1	0
28	151.875	0	1	1	0	1	1
29	157.5	0	1	1	1	0	0
30	163.125	0	1	1	1	0	1
31	168.75	0	1	1	1	1	0
32	174.375	0	1	1	1	1	1
33	180	1	0	0	0	0	0
34	185.625	1	0	0	0	0	1
35	191.25	1	0	0	0	1	0
36	196.875	1	0	0	0	1	1

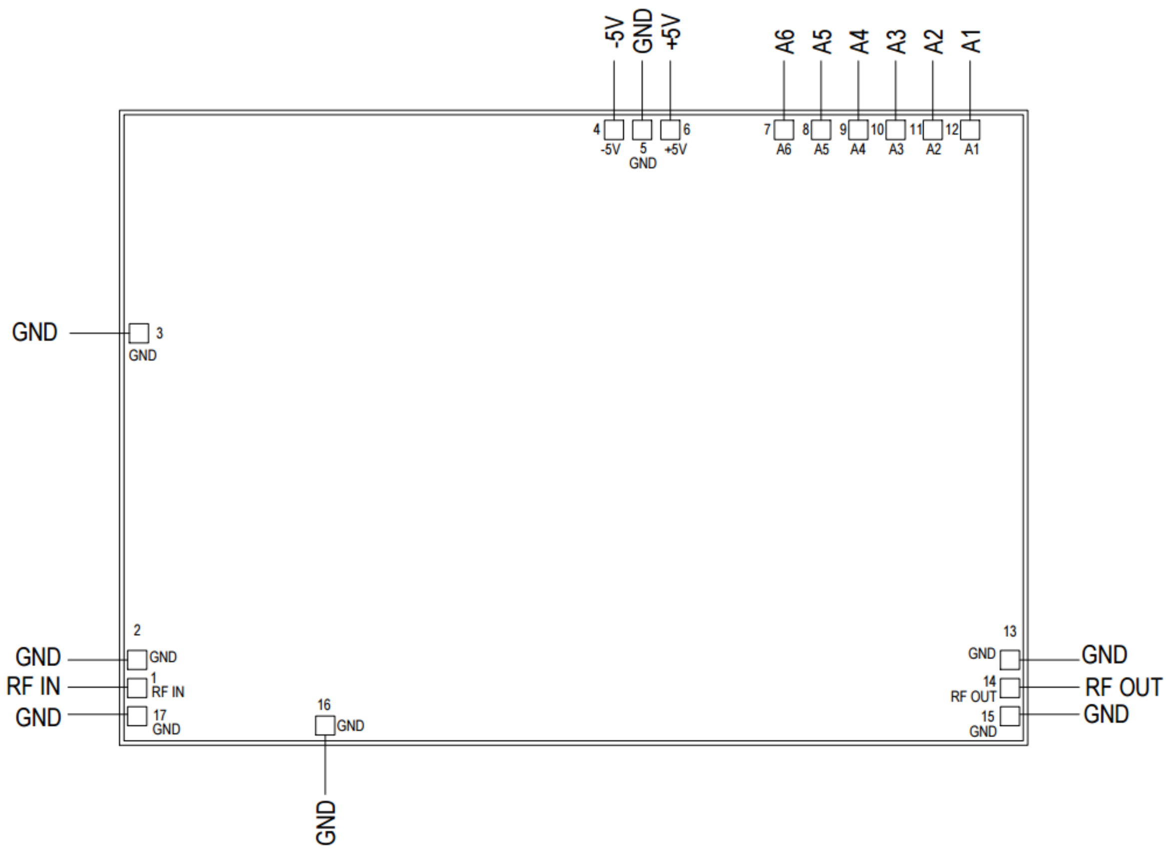
Truth Table

S.No.	Phase Shift	180Deg	90Deg	45Deg	22.5Deg	11.25Deg	5.625Deg
		A6	A5	A4	A3	A2	A1
37	202.5	1	0	0	1	0	0
38	208.125	1	0	0	1	0	1
39	213.75	1	0	0	1	1	0
40	219.375	1	0	0	1	1	1
41	225	1	0	1	0	0	0
42	230.625	1	0	1	0	0	1
43	236.25	1	0	1	0	1	0
44	241.875	1	0	1	0	1	1
45	247.5	1	0	1	1	0	0
46	253.125	1	0	1	1	0	1
47	258.75	1	0	1	1	1	0
48	264.375	1	0	1	1	1	1
49	270	1	1	0	0	0	0
50	275.625	1	1	0	0	0	1
51	281.25	1	1	0	0	1	0
52	286.875	1	1	0	0	1	1
53	292.5	1	1	0	1	0	0
54	298.125	1	1	0	1	0	1
55	303.75	1	1	0	1	1	0
56	309.375	1	1	0	1	1	1
57	315	1	1	1	0	0	0
58	320.625	1	1	1	0	0	1
59	326.25	1	1	1	0	1	0
60	331.875	1	1	1	0	1	1
61	337.5	1	1	1	1	0	0
62	343.125	1	1	1	1	0	1
63	348.75	1	1	1	1	1	0
64	354.375	1	1	1	1	1	1

Mechanical Characteristics



RF & DC Pad Details



Units : millimeters (inches)

1. All RF and DC bond pads are 100µm x 100µm in size
2. Pad no. 1 : RF IN
3. Pad no. 14 : RF OUT
4. Pad no. 4 : -5 V
5. Pad no. 6 : +5 V
6. Pad no. 7,8,9,10,11,12 : A6,A5,A4,A3,A2,A1 (Phase Controls)
7. Pad no. 2,3,5,13,15,17 : GND

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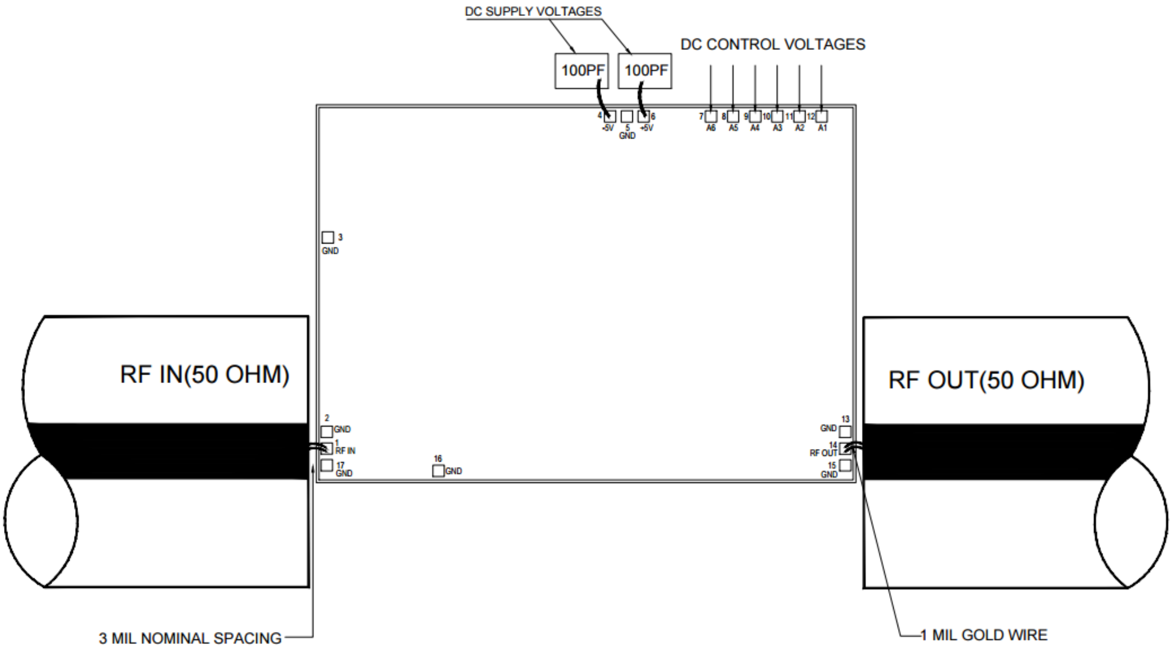
Recommended Assembly Diagram



Note:

1. 1. Two 1 mil (0.0254mm) bond wires of minimum length should be used for RF input and output.
2. The RF input & output ports are DC de – coupled.

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 flux less 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. Please download and refer to datasheet from website before using the product.

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