



MMIC DIE

Voltage Variable Attenuator **PVA-453-34-D+**

Mini-Circuits

50Ω 10 to 45 GHz

THE BIG DEAL

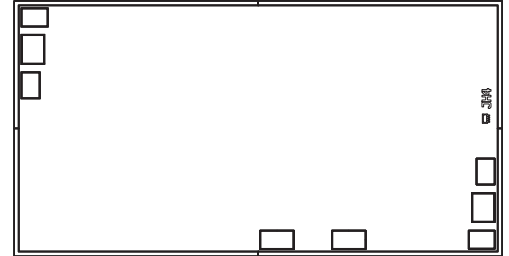
- Ultra-broad band, 10 to 45 GHz
- Wide attenuation range, up to 51 dB typ at 30 GHz
- Excellent return loss for all attenuation states
- Low insertion loss, 2 dB typ
- High IIP3 in all attenuation states

APPLICATIONS

- 5G MIMO and Back Haul Radio Systems
- Satellite Communications
- Test and Measurement Equipment
- Radar, EW, and ECM Defense Systems

PRODUCT OVERVIEW

The PVA-453-34-D+ is an absorptive voltage variable attenuator MMIC die fabricated using GaAs pHEMT technology. This VVA covers the frequency range of 10 to 45 GHz offering high dynamic range, low distortion, and low insertion loss. It features two independently controlled attenuators using analog control voltages from -4V to 0V. This product is ideal for applications where a DC voltage is utilized to control RF signal levels such as temperature compensation and AGC circuits.



+RoHS Compliant

The +Suffix identifies RoHS Compliance.
See our website for methodologies and qualifications

SEE ORDERING INFORMATION ON THE LAST PAGE

KEY FEATURES

Features	Advantages
High IIP3, +26 to +43 dBm typ. over attenuation range	Low distortion enabling improved system performance
Wide attenuation range, <ul style="list-style-type: none"> • 45 dB typ. at 20 GHz • 51 dB typ. at 30 GHz • 38 dB typ. at 40 GHz 	Low insertion loss and high dynamic range simplify the use of analog signal control.



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ELECTRICAL SPECIFICATIONS AT 25°C, 50Ω, UNLESS NOTED OTHERWISE²

Frequency (GHz)	Condition ¹	Min Attenuation (dB) ³ Typ.	Max Attenuation (dB) Typ.	Attenuation Range (dB) Typ.	Return Loss (dB) Typ.	IIP3 (dBm) Worst Case, Typ.
10-20	VCTL1 = -4 V to 0 V, VCTL2 = -4 V	2.1	23.8	21.7	17	30
20-30		2.2	27.6	25.4	14	
30-40		3.0	31.1	28.1	16	
40-45		4.1	34.0	29.9	19	
10-20	VCTL1 = 0 V, VCTL2 = -4 V to 0 V	23.8	41.6	17.7	14	30
20-30		27.6	51.9	24.3	13	
30-40		31.2	48.0	16.8	15	
40-45		34.0	38.0	4.0	18	
10-20	VCTL1 = -4 V to 0 V, VCTL2 = -4 V to 0 V VCTL1 = VCTL2	2.1	41.5	39.5	17	26
20-30		2.2	51.9	49.7	14	
30-40		3.0	48.0	45.0	16	
40-45		4.1	38.0	33.9	19	

1. VCTL1 and VCTL2: -4V (min. attenuation) to 0V (max. attenuation). Maximum current for VCTL1 or VCTL2: 5 mA (max at VCTL= -4V)

2. Tested in industry standard 3.5x2.5 mm, 16-lead MCLP package.

3. Min attenuation state is the insertion loss.

MAXIMUM RATINGS⁴

Parameter	Ratings
Operating Case Temperature	-40°C to 85°C
Control Voltage (Vctl1/Vctl2)	-5 to +1V
Absolute Max. RF Input Level	+23 dBm
Junction Temperature	150°C
Thermal Resistance at max. attenuation	44.8°C/W

4. Permanent damage may occur if any of these limits are exceeded.

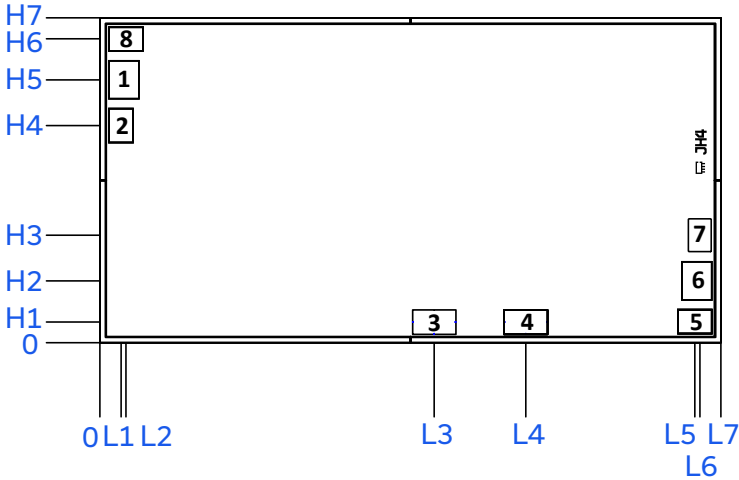


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BONDING PAD POSITION / DESCRIPTION



Function	Pad Number	Description
RF-IN	1	RF Input Pad
GROUND	2,5,7,8	Ground
VCTL1	3	Control Voltage 1
VCTL2	4	Control Voltage 2
RF OUT	6	RF Output Pad

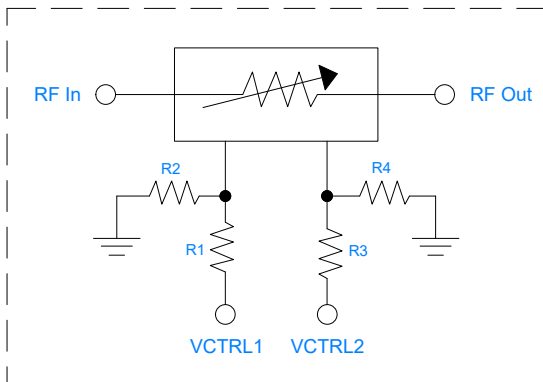
- 1. Bond Pad material - Gold
- 2. Bottom of Die - Gold plated

DIMENSION IN μm , TYP.

L1	L2	L3	L4	L5	L6	L7	H1	H2	H3	H4	H5	H6	H7
77.0	96.0	1231.0	1568.0	2190.0	2209.0	2286.0	76.0	228.0	396.0	800.0	968.0	1118.0	1196.0

Thickness	Die Size	Pad Size 1 & 6	Pad Size 2 & 7	Pad Size 3 & 4	Pad Size 5 & 8
100	2286 x 1196	100 x 130	78 x 115	150 x 80	115 x 78

APPLICATION CIRCUIT AND PAD DESCRIPTION



RECOMMENDED WIRE LENGTH AND LOOP HEIGHT, TYP.

Wire	Wire Length (mils)	Wire Loop Height (mils)
RF-IN	12	7
RF-OUT	12	7
VCTL1 AND VCTL2	Not Critical	

Components	Size	Value	Qty	Part Number
R1, R3	0201	6.2 kΩ	2	RK73414TTC6201F
R2, R4	0201	2.1 kΩ	2	RK73H1HT2010F



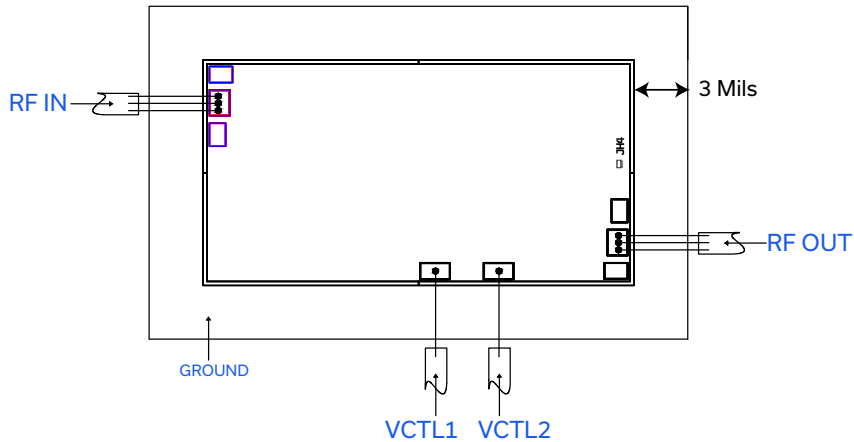
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ASSEMBLY DIAGRAM



ASSEMBLY PROCEDURE

- Storage**
Die should be stored in a dry nitrogen purged desiccators or equivalent.
- ESD**
 MMIC voltage variable attenuator die are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be open in clean room conditions at an appropriately grounded anti-static workstation.
- Die Handling and Attachment**
Devices need careful handling using correctly designed collets, it is recommended to handle the chip along the edges with a custom design collet. The die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are Ablestik 84-1 LMISR4 or equivalents. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition. The surface of the chip has exposed air bridges and should not be touched with vacuum collet, tweezers or fingers.
- Wire Bonding**
Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the die gold bond pads. Thermo-sonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1mil diameter. Bonds must be made from the bond pads on the die to the packaged or substrate. All bond wires should be kept as short as low as reasonable to minimize performance degradation due to undesirable series inductance.



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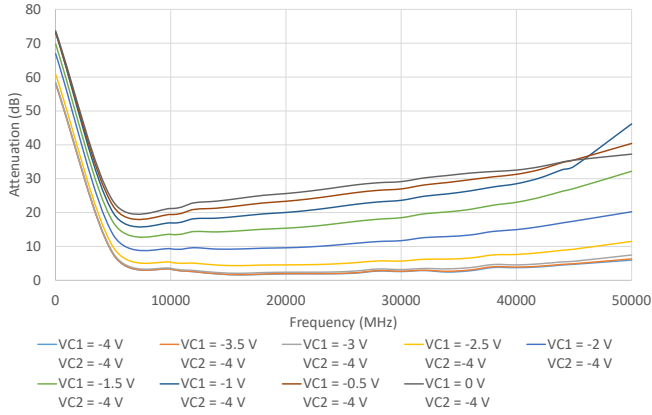
Voltage Variable Attenuator PVA-453-34-D+

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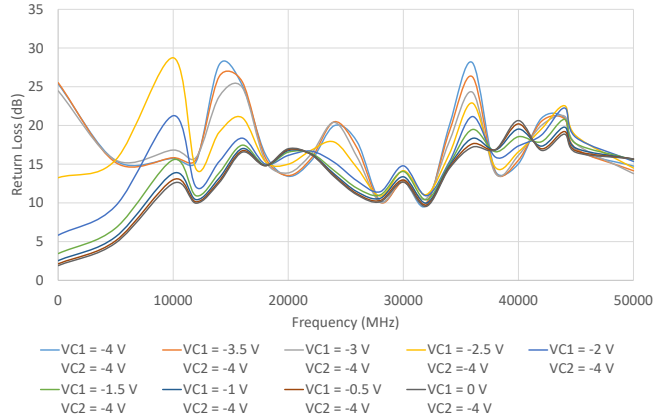
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TYPICAL PERFORMANCE CURVES

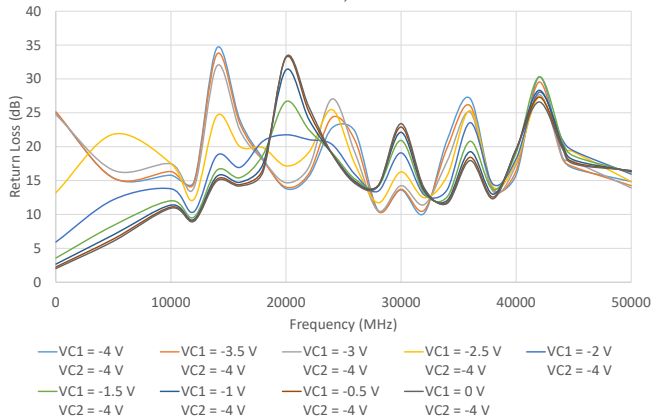
Attenuation vs. Frequency at Various Control Voltages
VCTRL 1 = -4 V to 0 V, VCTRL 2 = -4 V



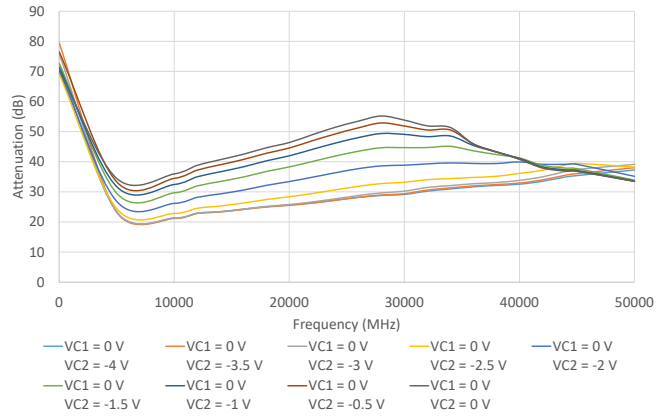
Input Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = -4 V to 0 V, VCTRL 2 = -4 V



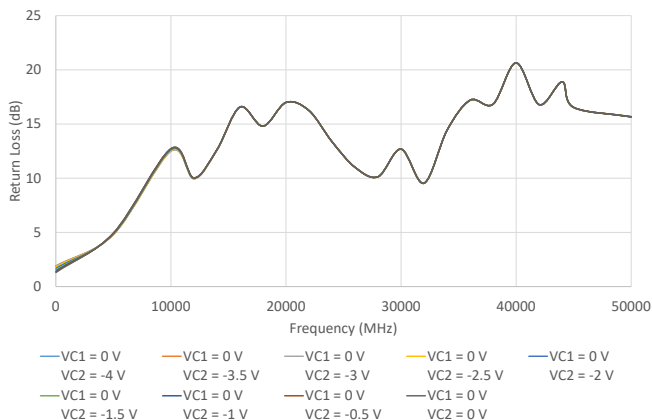
Output Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = -4 V to 0 V, VCTRL 2 = -4 V



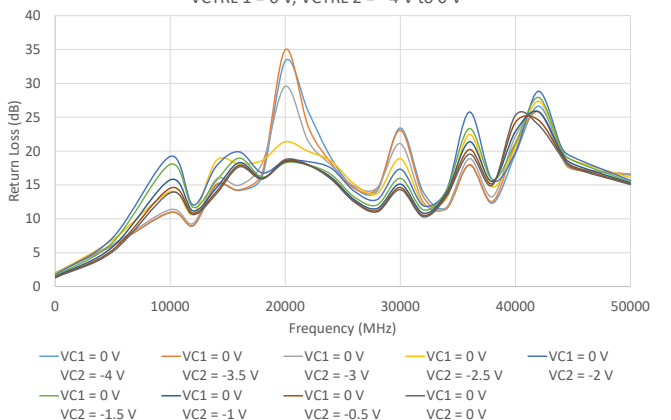
Attenuation vs. Frequency at Various Control Voltages
VCTRL 1 = 0 V, VCTRL 2 = -4 V to 0 V



Input Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = 0 V, VCTRL 2 = -4 V to 0 V



Output Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = 0 V, VCTRL 2 = -4 V to 0 V





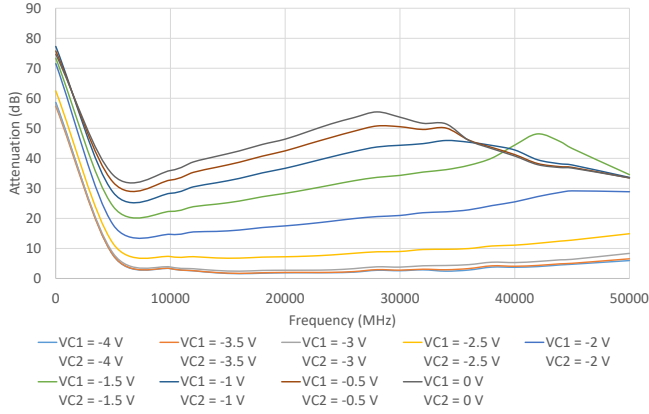
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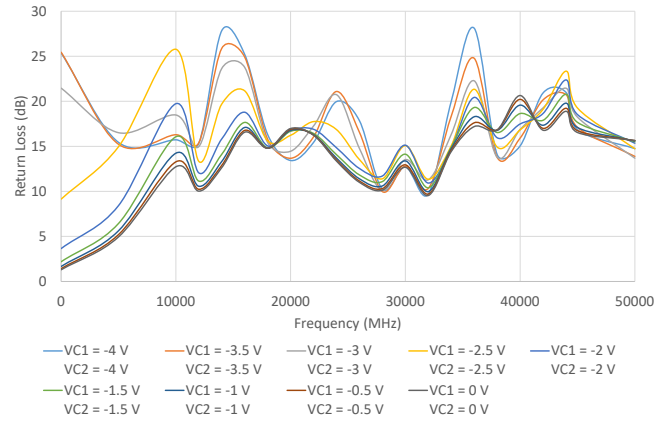
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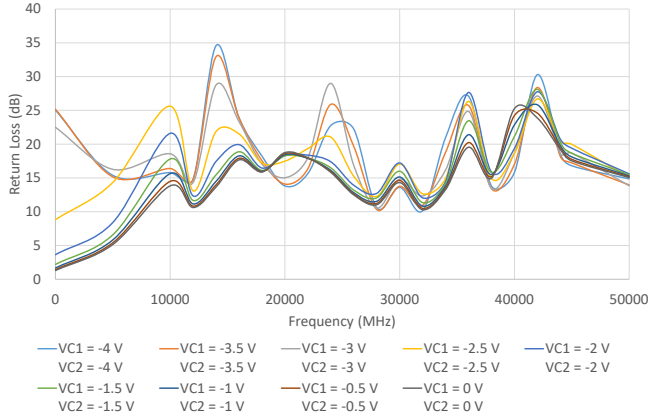
Attenuation vs. Frequency at Various Control Voltages
VCTRL1 = VCTRL2 = -4 V to 0 V



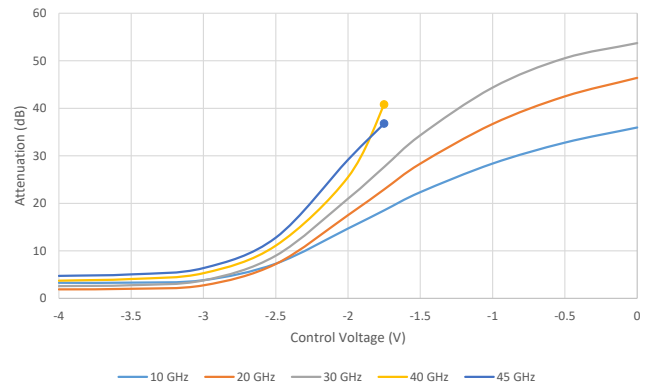
Input Return Loss vs. Frequency at Various Control Voltages
VCTRL1 = VCTRL2 = -4 V to 0 V



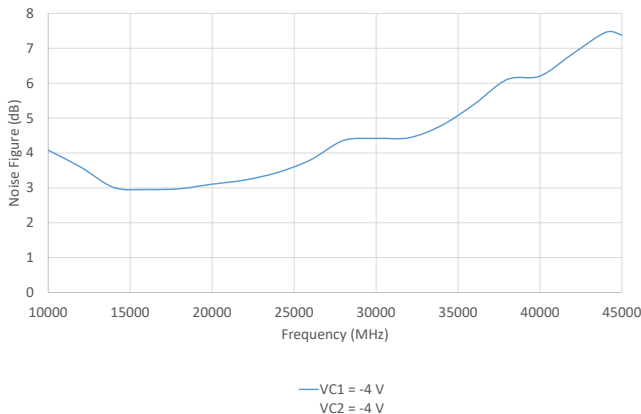
Output Return Loss vs. Frequency at Various Control Voltages
VCTRL1 = VCTRL2 = -4 V to 0 V



Attenuation vs. Control Voltage at Various Frequencies
(VCTRL1 = VCTRL2)



Noise Figure vs. Frequency





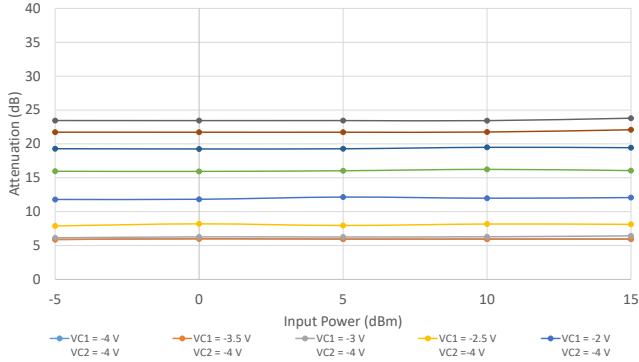
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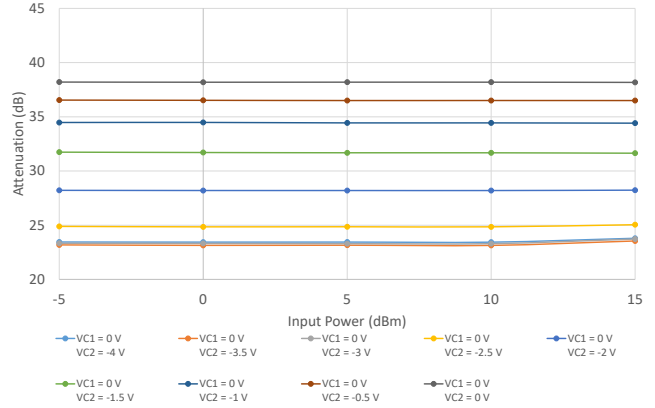
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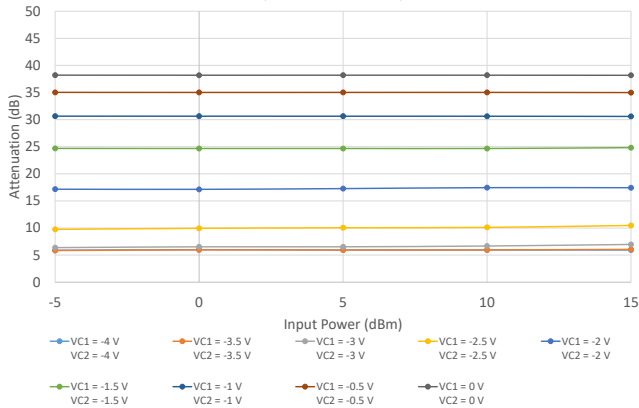
Attenuation vs. Input Power Over Control Voltages at 10 GHz (Fixed VCTRL2)



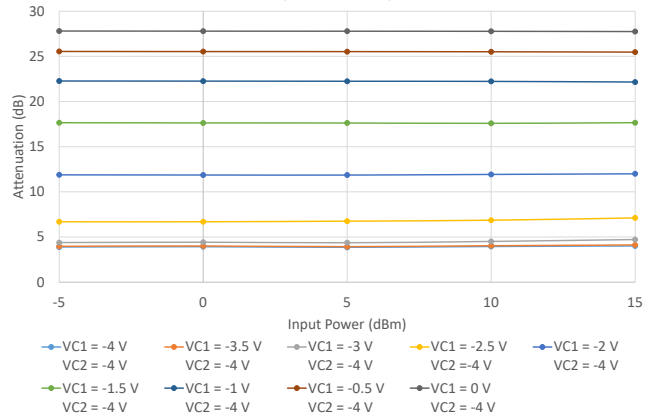
Attenuation vs. Input Power Over Control Voltages at 10 GHz (Fixed VCTRL1)



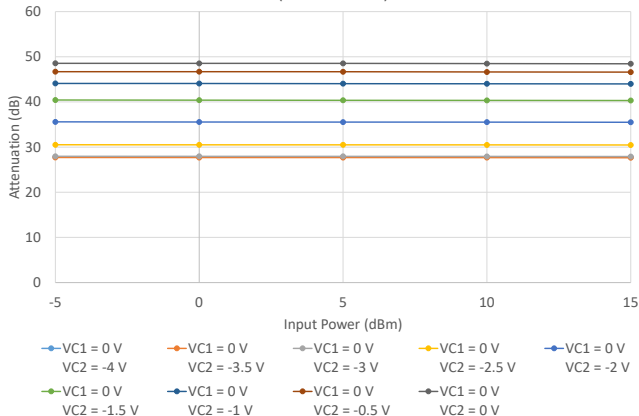
Attenuation vs. Input Power Over Control Voltages at 10 GHz (VCTRL1 = VCTRL2)



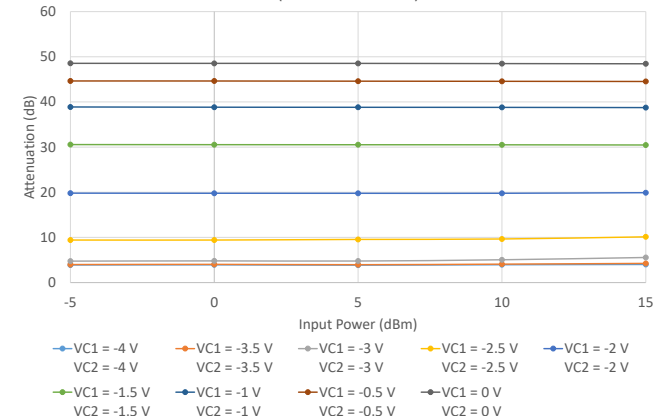
Attenuation vs. Input Power Over Control Voltages at 20 GHz (Fixed VCTRL2)



Attenuation vs. Input Power Over Control Voltages at 20 GHz (Fixed VCTRL1)



Attenuation vs. Input Power Over Control Voltages at 20 GHz (VCTRL1 = VCTRL2)





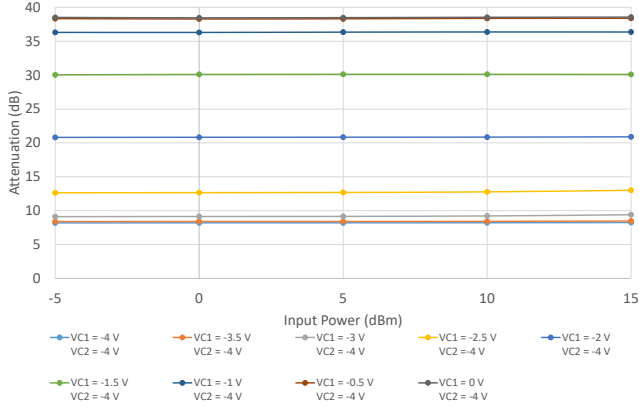
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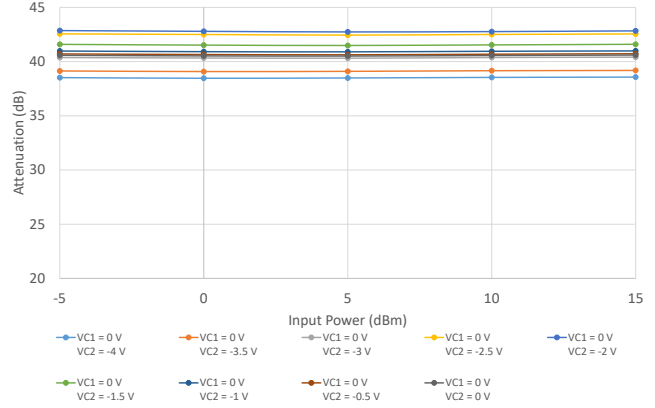
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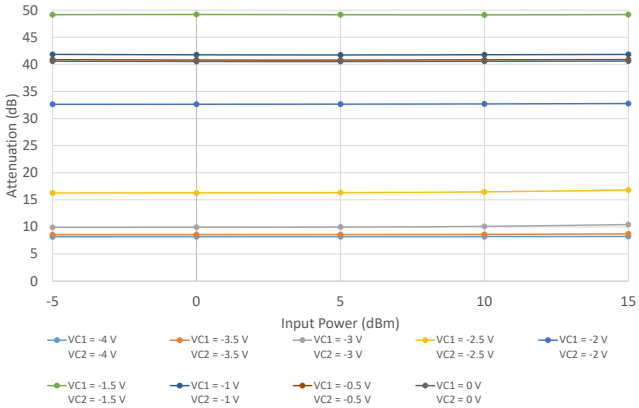
Attenuation vs. Input Power Over Control Voltages at 44 GHz (Fixed VCTRL2)



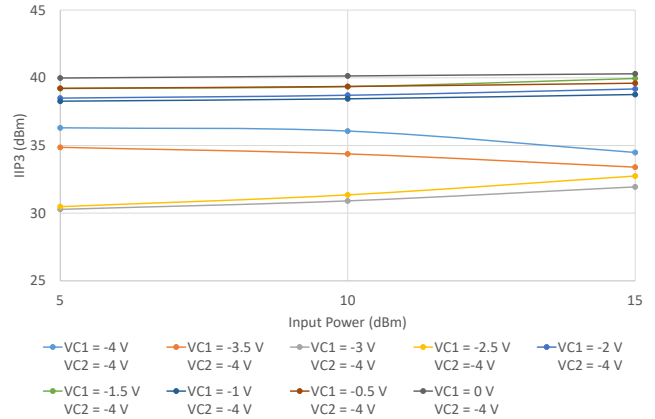
Attenuation vs. Input Power Over Control Voltages at 44 GHz (Fixed VCTRL1)



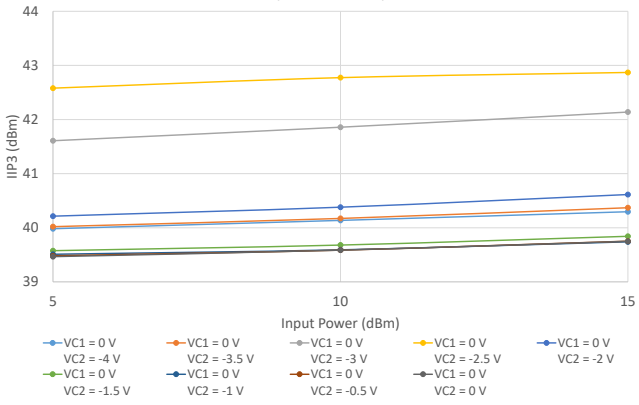
Attenuation vs. Input Power Over Control Voltages at 44 GHz (VCTRL1 = VCTRL2)



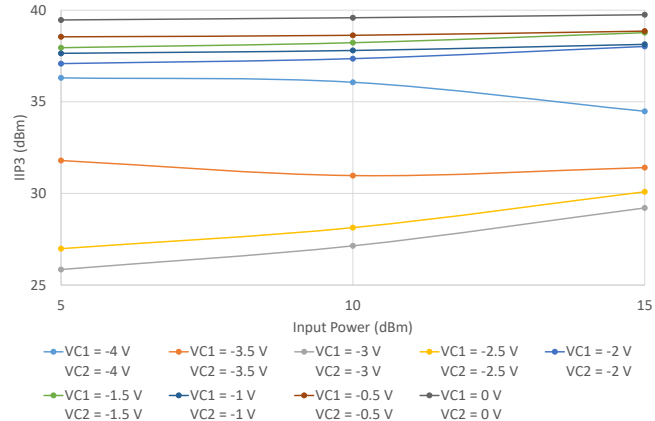
IIP3 vs. Input Power Over Control Voltages at 10 GHz (Fixed VCTRL2)



IIP3 vs. Input Power Over Control Voltages at 10 GHz (Fixed VCTRL1)



IIP3 vs. Input Power Over Control Voltages at 10 GHz (VCTRL1 = VCTRL2)



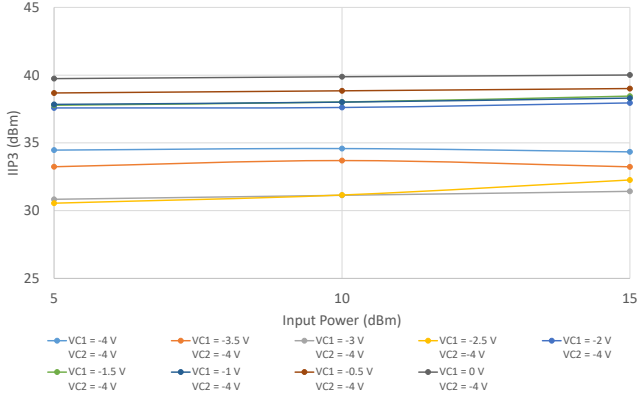


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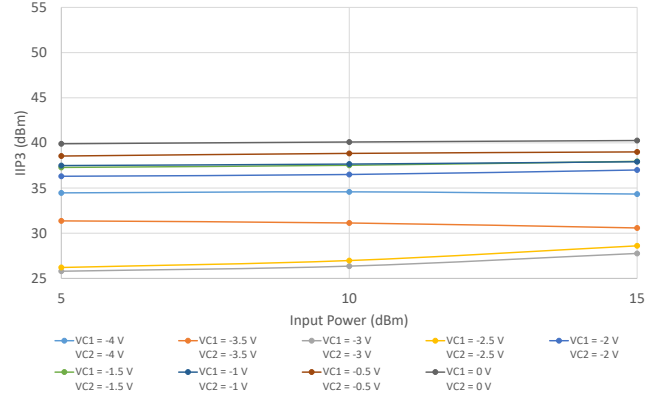
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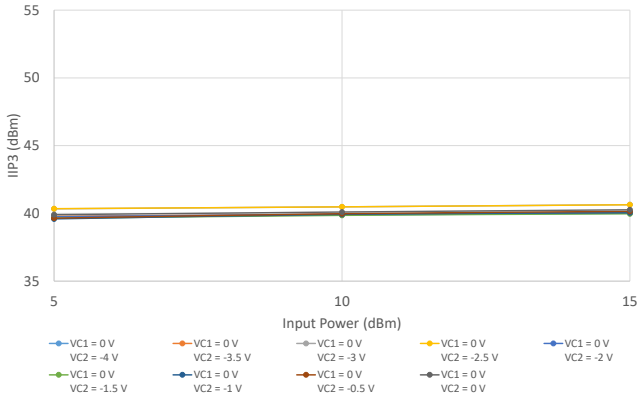
IIP3 vs. Input Power Over Control Voltages at 20 GHz (Fixed VCTRL2)



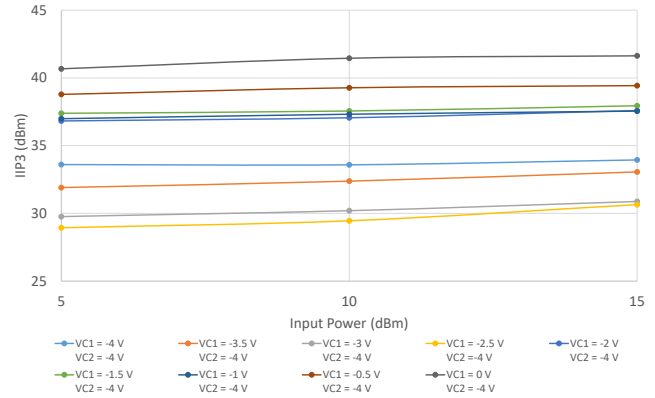
IIP3 vs. Input Power Over Control Voltages at 20 GHz (VCTRL1 = VCTRL2)



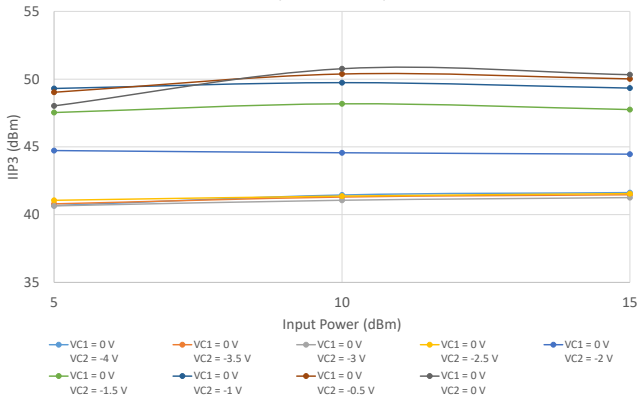
IIP3 vs. Input Power Over Control Voltages at 20 GHz (Fixed VCTRL1)



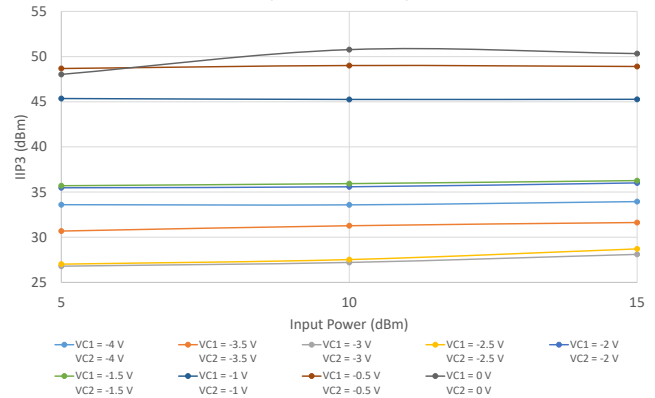
IIP3 vs. Input Power Over Control Voltages at 44 GHz (Fixed VCTRL2)



IIP3 vs. Input Power Over Control Voltages at 44 GHz (Fixed VCTRL1)



IIP3 vs. Input Power Over Control Voltages at 44 GHz (VCTRL1 = VCTRL2)





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ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD.

Performance Data	Data Table	
	Swept Graphs	
	S-Parameter (S2P Files) Data Set with and without port extension(.zip file)	
Case Style	Die	
Die Ordering and packaging information	Quantity, Package Small, Gel - Pak: 5,10,50,100 KGD* Medium†, Partial wafer: KGD*<714 Large†, Full Wafer	Model No. PVA-453-34-DG+ PVA-453-34-DP+ PVA-453-34-DF+
	†Available upon request contact sales representative	
Die Marking	JH4	
Environmental Ratings	ENV80	

*Known Good Die ("KGD") means that the die are taken from PCM good wafer and then visually inspected per Mini-Circuits' criteria. Though this is not definitive, it does provide a higher degree of confidence that the die are capable of meeting typical RF electrical parameters specified by Mini-Circuits.

ESD RATING**

Human Body Model (HBM): Class 1A (250 V to < 500 V) in accordance with ANSI/ESD STM5.1-2001

** Tested in industry standard 2.5x3.5 mm, 16-lead MCLP Package.

NOTES

- Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
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Typical Performance Data

Frequency (MHz)	Attenuation relative to control voltage @ Temperature = -40°C					
	(dB)					
	VCTRL1 = -4 V VCTRL2 = -4 V	VCTRL1 = -2 V VCTRL2 = -4 V	VCTRL1 = 0 V VCTRL2 = -4 V	VCTRL1 = -2 V VCTRL2 = -2 V	VCTRL1 = 0 V VCTRL2 = -2 V	VCTRL1 = 0 V VCTRL2 = 0 V
2000	14.74	22.55	34.70	26.90	36.43	41.95
2500	13.00	20.51	32.59	24.85	34.49	40.57
3000	11.61	18.74	30.70	23.06	32.81	39.49
3500	10.45	17.11	28.93	21.40	31.27	38.55
4000	9.43	15.55	27.18	19.82	29.80	37.66
4500	8.53	14.11	25.55	18.33	28.46	36.82
5000	7.71	12.89	24.23	17.07	27.37	36.11
5500	6.95	11.98	23.42	16.15	26.70	35.73
6000	6.26	11.39	23.12	15.64	26.51	35.82
6500	5.66	11.00	23.11	15.38	26.63	36.22
7000	5.14	10.65	23.14	15.20	26.82	36.79
7500	4.66	10.25	23.04	14.98	26.95	37.34
8000	4.21	9.75	22.76	14.65	26.93	37.67
8500	3.85	9.25	22.42	14.25	26.80	37.85
9000	3.61	8.84	22.15	13.88	26.67	37.91
9500	3.46	8.63	22.12	13.66	26.66	37.99
10000	3.31	8.62	22.39	13.65	26.91	38.30
11000	2.88	8.85	23.47	14.06	28.00	39.74
12000	2.52	8.89	24.27	14.40	29.07	41.44
13000	2.10	8.61	24.60	14.47	29.76	42.64
14000	1.84	8.36	24.80	14.41	30.21	43.36
15000	1.62	8.26	25.14	14.46	30.71	44.19
16000	1.55	8.40	25.80	14.80	31.53	45.22
17000	1.59	8.54	26.40	15.23	32.43	46.42
18000	1.74	8.58	26.74	15.53	33.11	47.39
19000	1.94	8.65	27.00	15.80	33.77	48.08
20000	1.84	8.66	27.29	16.03	34.45	49.56
21000	1.75	8.65	27.58	16.20	35.03	50.70
22000	1.83	8.84	27.99	16.59	35.77	51.75
23000	1.89	9.10	28.50	17.06	36.67	53.45
24000	1.87	9.27	28.92	17.40	37.36	54.76
25000	1.89	9.50	29.35	17.79	37.99	55.82
26000	2.05	9.85	29.88	18.29	38.79	57.32
27000	2.46	10.16	30.26	18.65	39.33	58.62
28000	2.79	10.39	30.51	18.94	39.69	59.99
29000	2.56	10.41	30.57	19.03	39.86	58.08
30000	2.42	10.40	30.52	19.06	39.57	55.80
31000	2.81	10.96	31.18	19.70	39.98	54.66
32000	3.00	11.57	31.95	20.34	40.60	54.01
33000	2.50	11.70	32.25	20.42	40.38	52.89
34000	2.39	11.71	32.47	20.43	40.32	51.71
35000	2.64	11.86	32.84	20.60	40.36	50.11
36000	2.87	12.22	33.49	21.09	40.43	46.60
37000	3.17	12.57	33.43	21.52	39.79	44.52
38000	3.65	12.94	33.12	21.99	39.27	42.94
39000	3.80	13.21	33.19	22.43	39.46	41.74
40000	3.53	13.35	33.10	22.87	39.29	40.14
41000	3.55	13.72	33.19	23.60	38.62	38.50
42000	3.83	14.22	33.22	24.39	37.71	37.13
43000	4.23	14.80	34.33	24.99	38.41	37.11
44000	4.30	14.40	34.48	23.20	38.27	36.40
45000	4.62	14.87	35.01	23.64	38.49	36.46
46000	4.68	15.31	35.37	24.05	38.45	36.40
47000	4.72	15.78	36.12	24.33	38.33	36.10
48000	4.71	16.33	35.60	24.72	36.82	34.87
49000	4.91	16.91	35.51	25.08	36.22	34.49
50000	5.32	17.13	36.03	24.72	35.76	33.81

Typical Performance Data

Frequency (MHz)	Attenuation relative to control voltage @ Temperature = 25°C					
	(dB)					
	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
2000	14.77	23.38	33.80	27.79	35.89	40.82
2500	13.02	21.33	31.71	25.77	33.96	39.31
3000	11.62	19.51	29.79	23.96	32.26	38.11
3500	10.45	17.82	27.96	22.28	30.71	37.02
4000	9.43	16.23	26.19	20.69	29.22	36.04
4500	8.52	14.77	24.57	19.23	27.89	35.12
5000	7.68	13.55	23.27	18.00	26.83	34.36
5500	6.91	12.66	22.45	17.13	26.17	33.93
6000	6.22	12.08	22.12	16.63	25.96	33.96
6500	5.62	11.71	22.07	16.41	26.05	34.29
7000	5.09	11.40	22.08	16.29	26.26	34.82
7500	4.61	11.00	21.93	16.09	26.37	35.29
8000	4.16	10.50	21.62	15.78	26.32	35.54
8500	3.78	9.99	21.24	15.39	26.17	35.60
9000	3.52	9.60	20.97	15.05	26.02	35.64
9500	3.38	9.43	20.96	14.87	26.02	35.69
10000	3.24	9.45	21.25	14.91	26.29	36.04
11000	2.82	9.71	22.21	15.36	27.30	37.36
12000	2.44	9.77	22.92	15.76	28.33	38.94
13000	2.02	9.54	23.19	15.88	29.00	40.07
14000	1.75	9.30	23.33	15.87	29.42	40.79
15000	1.53	9.22	23.63	15.96	29.90	41.51
16000	1.45	9.38	24.22	16.35	30.69	42.62
17000	1.46	9.55	24.79	16.84	31.58	43.72
18000	1.56	9.62	25.11	17.21	32.29	44.65
19000	1.79	9.67	25.32	17.48	32.89	45.47
20000	1.73	9.70	25.59	17.74	33.54	46.65
21000	1.55	9.75	25.89	18.01	34.20	47.75
22000	1.71	9.95	26.28	18.41	34.92	48.86
23000	1.79	10.21	26.76	18.89	35.74	50.22
24000	1.72	10.45	27.23	19.32	36.51	51.50
25000	1.74	10.71	27.65	19.74	37.16	52.47
26000	1.88	11.07	28.16	20.24	37.88	53.62
27000	2.22	11.44	28.64	20.70	38.45	55.00
28000	2.58	11.63	28.82	20.93	38.89	55.05
29000	2.50	11.61	28.84	20.97	38.87	55.06
30000	2.19	11.76	29.00	21.17	38.81	53.90
31000	2.64	12.32	29.66	21.77	39.29	52.54
32000	2.96	12.89	30.39	22.36	39.68	52.03
33000	2.35	13.11	30.80	22.54	39.69	51.53
34000	2.13	13.14	31.01	22.55	39.67	50.79
35000	2.38	13.27	31.33	22.73	39.82	49.41
36000	2.62	13.72	32.01	23.34	39.99	46.12
37000	2.81	14.13	32.10	23.86	39.65	44.42
38000	3.28	14.50	32.00	24.41	39.30	42.60
39000	3.57	14.77	32.17	24.97	39.92	41.80
40000	3.26	15.01	32.48	25.61	39.97	40.31
41000	3.18	15.47	32.87	26.50	39.34	38.67
42000	3.43	16.02	33.05	27.54	38.35	37.27
43000	3.78	16.69	34.39	28.24	39.17	37.22
44000	4.52	16.96	34.93	28.70	39.17	36.93
45000	4.73	17.48	35.49	29.17	39.13	36.77
46000	4.85	18.03	36.19	29.38	38.84	36.48
47000	4.93	18.62	37.12	29.50	38.51	36.10
48000	5.04	19.21	37.53	29.47	37.44	35.32
49000	5.43	19.78	37.27	29.31	36.11	34.23
50000	5.97	20.23	37.25	28.88	35.16	33.49

Typical Performance Data

Frequency (MHz)	Attenuation relative to control voltage @ Temperature = 85°C					
	(dB)					
	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
2000	14.74	23.85	32.88	28.34	35.25	39.63
2500	13.02	21.79	30.77	26.31	33.35	38.07
3000	11.65	19.97	28.83	24.52	31.64	36.77
3500	10.49	18.25	26.97	22.83	30.05	35.57
4000	9.48	16.64	25.20	21.24	28.57	34.47
4500	8.59	15.18	23.60	19.81	27.25	33.49
5000	7.77	13.98	22.33	18.62	26.22	32.72
5500	7.01	13.10	21.51	17.78	25.57	32.27
6000	6.33	12.54	21.15	17.30	25.32	32.23
6500	5.74	12.18	21.06	17.10	25.38	32.49
7000	5.22	11.86	21.00	16.98	25.54	32.93
7500	4.75	11.46	20.81	16.81	25.63	33.30
8000	4.31	10.97	20.47	16.51	25.56	33.47
8500	3.96	10.47	20.08	16.14	25.38	33.51
9000	3.73	10.11	19.82	15.83	25.24	33.49
9500	3.57	9.97	19.83	15.69	25.26	33.56
10000	3.41	10.02	20.11	15.75	25.52	33.89
11000	2.99	10.31	21.00	16.25	26.50	35.17
12000	2.64	10.37	21.61	16.68	27.47	36.59
13000	2.24	10.14	21.81	16.83	28.09	37.62
14000	2.00	9.93	21.93	16.85	28.49	38.23
15000	1.81	9.91	22.25	17.03	29.01	39.00
16000	1.77	10.10	22.81	17.47	29.81	40.06
17000	1.81	10.26	23.29	17.96	30.64	41.20
18000	1.96	10.31	23.55	18.32	31.31	42.06
19000	2.12	10.38	23.78	18.63	31.92	42.86
20000	2.03	10.44	24.07	18.92	32.56	43.91
21000	2.01	10.56	24.38	19.27	33.25	44.94
22000	2.09	10.79	24.79	19.72	33.96	45.98
23000	2.10	11.06	25.29	20.20	34.78	47.36
24000	2.08	11.30	25.72	20.63	35.50	48.54
25000	2.12	11.57	26.15	21.07	36.15	49.34
26000	2.32	11.96	26.69	21.61	36.89	50.47
27000	2.76	12.35	27.16	22.09	37.56	51.26
28000	3.04	12.52	27.37	22.27	37.86	52.11
29000	2.76	12.52	27.45	22.35	37.92	52.19
30000	2.69	12.75	27.73	22.62	38.02	51.48
31000	3.09	13.34	28.44	23.23	38.50	50.72
32000	3.18	13.88	29.16	23.76	38.95	50.32
33000	2.73	14.07	29.53	23.92	38.96	50.37
34000	2.75	14.10	29.76	23.96	38.95	49.56
35000	3.00	14.30	30.10	24.21	39.25	48.68
36000	3.32	14.88	30.90	24.96	39.58	45.88
37000	3.67	15.27	31.09	25.53	39.62	44.57
38000	4.10	15.65	31.17	26.15	39.46	42.63
39000	4.20	15.97	31.55	26.83	40.31	42.08
40000	3.97	16.29	32.18	27.69	40.73	40.62
41000	4.05	16.78	32.75	28.68	40.41	39.09
42000	4.35	17.38	33.28	29.86	39.15	37.35
43000	4.79	18.11	34.60	30.76	39.93	37.44
44000	5.21	17.74	35.60	29.46	39.92	36.90
45000	5.36	18.23	36.35	29.83	39.99	36.81
46000	5.34	18.68	36.98	30.27	39.83	36.67
47000	5.42	19.21	38.21	30.34	39.29	36.24
48000	5.64	19.96	38.76	30.69	37.46	34.97
49000	6.07	20.55	38.83	30.57	36.51	34.34
50000	6.68	20.87	40.63	29.88	35.85	33.77

Typical Performance Data

Frequency (MHz)	Input Return Loss Relative To Control Voltage @ Temperature = -40°C					
	(dB)					
	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
2000	19.51	5.66	1.93	3.82	1.82	1.69
2500	17.03	5.67	2.01	3.97	1.92	1.85
3000	15.72	5.92	2.24	4.36	2.17	2.15
3500	15.16	6.45	2.60	5.00	2.56	2.59
4000	15.05	7.35	3.13	5.99	3.11	3.19
4500	15.27	8.67	3.82	7.29	3.82	3.93
5000	15.42	10.31	4.61	8.80	4.64	4.77
5500	16.02	11.85	5.35	10.03	5.39	5.53
6000	17.68	12.42	5.79	10.38	5.83	5.96
6500	20.90	11.95	5.91	10.13	5.95	6.06
7000	25.86	11.21	5.88	9.84	5.92	6.02
7500	31.38	10.80	5.91	9.87	5.94	6.03
8000	31.49	11.07	6.18	10.50	6.22	6.29
8500	22.17	12.10	6.81	11.86	6.85	6.93
9000	16.97	14.16	8.02	14.38	8.07	8.15
9500	14.76	17.70	9.94	18.66	10.01	10.11
10000	14.80	23.53	12.24	22.32	12.36	12.47
11000	18.65	16.10	11.86	14.38	11.92	11.99
12000	15.07	11.75	9.39	11.67	9.39	9.43
13000	18.78	12.28	9.52	12.53	9.52	9.54
14000	28.24	15.51	12.13	16.11	12.14	12.16
15000	31.50	21.03	16.76	22.36	16.83	16.87
16000	23.05	17.82	15.74	18.24	15.70	15.75
17000	21.07	15.71	14.21	15.73	14.20	14.21
18000	15.56	14.96	14.47	14.99	14.52	14.51
19000	12.17	13.94	15.03	14.44	14.93	14.95
20000	13.59	15.27	16.30	15.70	16.03	16.08
21000	16.00	19.96	19.65	20.67	19.72	19.69
22000	15.37	16.98	17.18	17.33	17.28	17.26
23000	15.60	14.45	13.33	14.03	13.15	13.21
24000	18.62	15.43	13.09	14.96	13.12	13.14
25000	22.21	14.47	12.11	13.92	12.15	12.16
26000	17.99	12.08	10.11	11.55	9.98	10.01
27000	11.58	11.04	9.37	11.11	9.38	9.38
28000	9.45	10.67	9.27	11.05	9.28	9.28
29000	11.33	12.55	10.88	12.78	10.77	10.80
30000	13.32	16.75	13.50	17.43	13.67	13.66
31000	10.04	11.60	9.78	11.77	9.70	9.74
32000	8.63	9.31	7.98	9.21	7.85	7.89
33000	12.46	10.56	9.18	10.20	9.20	9.20
34000	18.57	14.21	13.37	13.88	13.53	13.48
35000	21.31	20.88	20.08	19.83	19.53	19.68
36000	32.10	22.79	16.61	21.87	16.89	16.86
37000	16.29	15.46	13.66	15.06	13.62	13.65
38000	11.36	13.32	14.80	13.34	14.69	14.73
39000	10.79	13.60	18.11	14.03	18.16	18.15
40000	13.80	14.39	17.12	14.48	17.17	17.18
41000	18.80	15.12	14.15	14.64	13.94	14.01
42000	21.35	17.29	14.23	16.82	13.99	14.06
43000	22.86	22.96	17.75	23.54	17.99	17.92
44000	22.34	23.51	19.14	22.97	18.79	18.70
45000	17.74	19.94	17.63	20.08	17.47	17.44
46000	12.48	13.61	12.16	13.55	12.14	12.13
47000	11.62	11.37	10.19	11.15	10.12	10.10
48000	14.75	12.36	11.21	12.24	11.37	11.38
49000	14.38	11.72	11.50	11.01	10.85	10.73
50000	12.32	12.84	13.60	12.61	13.26	13.21

Typical Performance Data

Frequency (MHz)	Input Return Loss Relative To Control Voltage @ Temperature = 25°C					
	(dB)					
	VCTRL1 = -4 V VCTRL2 = -4 V	VCTRL1 = -2 V VCTRL2 = -4 V	VCTRL1 = 0 V VCTRL2 = -4 V	VCTRL1 = -2 V VCTRL2 = -2 V	VCTRL1 = 0 V VCTRL2 = -2 V	VCTRL1 = 0 V VCTRL2 = 0 V
2000	19.21	5.25	2.13	3.65	1.98	1.83
2500	16.90	5.29	2.22	3.82	2.11	2.02
3000	15.62	5.59	2.47	4.23	2.38	2.35
3500	14.94	6.16	2.87	4.91	2.81	2.82
4000	14.81	7.02	3.40	5.85	3.37	3.43
4500	15.12	8.19	4.08	7.04	4.07	4.15
5000	15.38	9.62	4.86	8.41	4.87	4.98
5500	16.11	10.97	5.61	9.59	5.64	5.76
6000	18.03	11.60	6.11	10.09	6.15	6.27
6500	21.56	11.33	6.27	9.97	6.32	6.43
7000	26.61	10.71	6.24	9.71	6.30	6.40
7500	31.62	10.42	6.29	9.79	6.36	6.44
8000	36.62	10.77	6.61	10.45	6.68	6.76
8500	23.95	11.92	7.36	11.89	7.44	7.52
9000	17.45	14.04	8.68	14.37	8.77	8.86
9500	14.53	17.38	10.62	18.06	10.72	10.83
10000	14.12	21.32	12.67	20.33	12.80	12.91
11000	18.06	15.34	11.94	14.28	12.02	12.08
12000	14.53	11.74	9.74	11.83	9.78	9.81
13000	18.26	12.28	9.97	12.58	9.99	10.02
14000	26.52	15.43	12.59	15.96	12.61	12.64
15000	29.09	19.64	16.52	20.64	16.56	16.58
16000	22.79	17.58	15.86	18.10	15.88	15.90
17000	21.43	15.31	14.14	15.34	14.13	14.14
18000	16.99	14.37	14.13	14.41	14.12	14.13
19000	11.94	14.56	15.46	15.10	15.47	15.47
20000	12.40	16.74	17.58	17.35	17.59	17.59
21000	17.26	18.82	19.09	19.26	19.10	19.10
22000	14.93	16.93	16.77	17.12	16.78	16.78
23000	14.79	14.90	13.93	14.77	13.93	13.93
24000	20.00	14.32	12.68	13.98	12.67	12.68
25000	21.24	14.20	12.23	13.81	12.23	12.23
26000	17.35	12.68	10.91	12.42	10.91	10.91
27000	11.95	10.92	9.55	10.98	9.55	9.55
28000	9.39	11.00	9.76	11.29	9.76	9.76
29000	10.19	13.80	12.05	14.13	12.04	12.05
30000	14.21	15.48	13.07	15.84	13.08	13.08
31000	9.94	11.80	10.18	12.03	10.19	10.19
32000	7.62	10.03	8.76	10.04	8.76	8.76
33000	11.30	10.97	9.86	10.65	9.85	9.85
34000	19.66	14.61	14.37	14.19	14.35	14.35
35000	20.98	24.55	22.56	23.92	22.56	22.55
36000	30.97	20.37	16.20	19.67	16.20	16.21
37000	18.10	15.11	14.16	14.87	14.15	14.15
38000	11.75	13.66	15.45	13.78	15.44	15.43
39000	10.32	14.05	17.73	14.33	17.72	17.72
40000	12.05	15.27	16.69	15.31	16.71	16.72
41000	16.57	16.44	15.11	16.29	15.11	15.12
42000	20.05	18.36	15.54	18.21	15.53	15.54
43000	23.99	22.42	18.41	22.37	18.39	18.41
44000	20.99	22.26	18.88	22.38	20.56	18.89
45000	16.84	18.45	16.52	18.53	19.12	16.54
46000	13.94	14.47	13.11	14.43	17.36	13.11
47000	13.77	12.51	11.51	12.38	14.89	11.50
48000	15.59	12.55	11.94	12.39	13.81	11.92
49000	15.61	14.05	13.93	13.94	14.54	13.90
50000	14.75	15.36	15.69	15.35	15.66	15.65



Typical Performance Data

Frequency (MHz)	Input Return Loss Relative To Control Voltage @ Temperature = 85°C					
	(dB)					
	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
2000	19.39	5.06	2.34	3.58	2.15	1.98
2500	16.87	5.12	2.44	3.76	2.28	2.17
3000	15.51	5.44	2.71	4.20	2.58	2.53
3500	14.94	6.06	3.16	4.91	3.06	3.06
4000	14.82	6.98	3.77	5.90	3.70	3.75
4500	15.07	8.19	4.52	7.12	4.48	4.56
5000	15.28	9.60	5.35	8.48	5.33	5.44
5500	15.93	10.89	6.13	9.62	6.13	6.25
6000	17.63	11.44	6.60	10.10	6.62	6.74
6500	20.85	11.14	6.71	9.96	6.76	6.86
7000	25.91	10.53	6.62	9.70	6.69	6.79
7500	32.15	10.27	6.65	9.79	6.73	6.82
8000	29.65	10.70	7.04	10.51	7.11	7.20
8500	21.10	11.97	7.91	12.05	7.99	8.09
9000	16.52	14.26	9.43	14.66	9.51	9.62
9500	14.74	17.77	11.56	18.31	11.64	11.78
10000	15.12	21.05	13.54	19.91	13.62	13.77
11000	18.68	14.94	12.18	14.18	12.30	12.36
12000	15.17	11.69	9.97	11.84	10.07	10.10
13000	19.11	12.25	10.29	12.56	10.31	10.34
14000	27.21	15.56	13.13	16.15	13.15	13.17
15000	34.85	19.75	17.12	20.53	17.07	17.12
16000	22.78	17.33	15.82	17.82	15.97	15.98
17000	20.65	15.16	14.17	15.24	14.22	14.21
18000	15.05	14.32	14.25	14.39	14.13	14.12
19000	12.40	14.75	15.42	15.30	15.52	15.50
20000	14.22	17.08	17.35	17.88	17.95	17.89
21000	16.02	18.91	19.30	19.22	19.10	19.10
22000	15.50	16.87	16.88	16.86	16.58	16.60
23000	16.45	14.97	13.86	14.91	14.17	14.17
24000	19.32	14.36	12.98	14.06	12.94	12.95
25000	21.92	14.26	12.69	13.98	12.59	12.59
26000	17.59	12.60	10.98	12.55	11.23	11.21
27000	11.15	10.80	9.70	10.87	9.67	9.67
28000	9.39	11.15	10.16	11.36	10.07	10.08
29000	12.20	14.71	12.94	15.06	13.13	13.13
30000	13.77	15.80	13.86	15.97	13.58	13.60
31000	10.11	11.67	10.26	11.92	10.37	10.36
32000	9.09	10.04	8.83	10.12	9.06	9.05
33000	13.35	11.08	10.27	10.78	10.20	10.20
34000	17.09	15.23	15.87	14.75	15.31	15.31
35000	21.89	29.56	23.98	29.89	25.30	25.32
36000	28.41	19.20	16.39	18.39	15.83	15.88
37000	15.15	14.94	14.49	14.68	14.38	14.38
38000	11.49	14.10	15.82	14.27	16.00	15.98
39000	11.52	14.57	17.53	14.79	17.52	17.50
40000	14.92	15.55	16.44	15.62	16.30	16.29
41000	19.39	16.63	15.08	16.87	15.44	15.39
42000	21.42	18.67	15.83	18.97	16.43	16.38
43000	22.23	22.29	19.44	21.87	18.80	18.84
44000	21.67	23.32	20.09	23.49	20.28	20.26
45000	16.77	18.24	16.54	18.53	16.86	16.90
46000	14.30	14.23	13.12	14.26	13.16	13.19
47000	13.66	12.43	11.60	12.36	11.63	11.64
48000	14.55	12.20	11.80	12.01	11.64	11.64
49000	14.83	13.51	13.15	13.58	13.57	13.58
50000	14.09	14.78	14.93	14.96	15.24	15.23

Typical Performance Data

Frequency (MHz)	Output Return Loss Relative To Control Voltage @ Temperature = -40°C					
	(dB)					
	VCTRL1 = -4 V VCTRL2 = -4 V	VCTRL1 = -2 V VCTRL2 = -4 V	VCTRL1 = 0 V VCTRL2 = -4 V	VCTRL1 = -2 V VCTRL2 = -2 V	VCTRL1 = 0 V VCTRL2 = -2 V	VCTRL1 = 0 V VCTRL2 = 0 V
2000	20.14	5.89	2.04	3.83	2.10	1.74
2500	17.57	6.04	2.18	3.95	2.34	1.93
3000	16.07	6.49	2.50	4.27	2.77	2.21
3500	15.34	7.37	3.04	4.85	3.44	2.63
4000	15.06	8.79	3.81	5.75	4.38	3.21
4500	15.16	10.71	4.72	6.97	5.59	3.93
5000	15.26	12.83	5.67	8.56	7.05	4.82
5500	15.93	13.32	6.17	10.09	8.29	5.78
6000	17.62	11.91	6.08	10.59	8.68	6.38
6500	20.82	10.53	5.81	10.08	8.45	6.44
7000	25.26	9.95	5.82	9.51	8.27	6.23
7500	30.28	10.23	6.24	9.40	8.50	6.11
8000	37.69	11.58	7.25	9.95	9.35	6.27
8500	22.92	14.35	8.97	11.44	11.14	6.93
9000	17.08	18.11	11.13	14.20	14.26	8.23
9500	14.59	17.64	12.13	19.34	19.35	10.44
10000	14.39	14.12	10.87	24.84	20.33	13.51
11000	17.12	10.17	8.23	14.03	12.76	12.95
12000	14.43	9.88	8.32	11.47	11.15	9.67
13000	18.66	13.52	11.13	13.22	13.28	10.13
14000	36.98	20.07	15.42	18.28	18.87	13.43
15000	31.95	19.12	15.78	23.88	24.21	17.87
16000	22.73	16.40	13.86	19.96	19.83	17.35
17000	24.99	17.14	13.44	17.16	17.22	15.39
18000	17.57	18.95	14.62	15.65	15.97	14.86
19000	12.37	18.06	18.27	15.11	15.51	15.40
20000	12.98	18.85	27.11	16.35	16.52	16.92
21000	15.70	22.30	30.27	19.35	19.33	19.24
22000	16.43	22.37	29.36	19.47	19.53	19.16
23000	16.90	20.66	22.76	17.59	17.62	16.74
24000	20.59	20.48	19.92	17.07	17.18	15.67
25000	27.55	17.81	16.73	15.13	15.30	13.81
26000	19.42	14.12	13.11	12.36	12.60	11.08
27000	11.87	12.13	11.81	11.14	11.41	9.69
28000	9.56	11.83	12.51	11.38	11.59	9.66
29000	11.67	14.24	16.14	13.84	13.89	11.47
30000	14.50	21.01	27.60	18.93	19.07	14.72
31000	10.45	14.13	17.45	12.72	12.92	10.63
32000	8.84	10.52	11.85	9.74	9.68	8.12
33000	12.98	10.55	9.86	10.19	9.91	8.65
34000	17.78	12.71	10.54	13.46	13.02	11.98
35000	17.81	16.65	13.24	19.08	18.59	17.38
36000	29.23	23.91	17.33	26.72	25.06	18.92
37000	22.76	18.70	14.48	18.70	17.91	14.53
38000	13.39	13.90	11.24	14.79	14.52	12.96
39000	11.54	13.05	11.43	14.62	14.74	15.08
40000	15.10	15.84	15.61	17.38	17.87	22.70
41000	24.51	21.08	25.81	21.39	22.07	29.65
42000	28.28	24.69	34.68	23.30	23.77	23.98
43000	24.59	27.14	23.47	25.40	24.87	21.13
44000	19.94	22.48	21.03	21.99	21.78	20.19
45000	15.30	18.83	17.16	18.39	18.16	16.57
46000	15.55	18.89	16.12	18.95	18.32	16.28
47000	15.15	17.06	14.47	17.16	16.55	15.03
48000	16.28	13.53	12.06	12.96	12.84	11.61
49000	16.52	12.75	12.35	12.13	12.27	11.23
50000	14.17	15.40	16.17	15.34	15.53	14.84

Typical Performance Data

Frequency (MHz)	Output Return Loss Relative To Control Voltage @ Temperature = 25°C					
	(dB)					
	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
2000	19.90	5.52	2.29	3.68	2.29	1.91
2500	17.48	5.69	2.45	3.82	2.55	2.10
3000	16.00	6.19	2.81	4.18	3.00	2.42
3500	15.26	7.11	3.40	4.80	3.71	2.89
4000	14.99	8.53	4.23	5.73	4.69	3.53
4500	15.10	10.32	5.18	6.95	5.91	4.30
5000	15.26	12.14	6.13	8.47	7.38	5.24
5500	16.00	12.48	6.60	9.91	8.64	6.22
6000	17.81	11.31	6.48	10.46	9.09	6.85
6500	21.00	10.11	6.19	10.03	8.85	6.90
7000	25.14	9.62	6.17	9.49	8.62	6.66
7500	29.33	9.98	6.63	9.39	8.80	6.52
8000	36.65	11.42	7.73	10.00	9.65	6.74
8500	24.24	14.23	9.60	11.56	11.48	7.50
9000	17.65	17.42	11.72	14.50	14.76	9.02
9500	14.62	16.34	12.23	19.75	19.91	11.51
10000	14.07	13.25	10.73	23.24	20.24	14.65
11000	16.57	10.05	8.44	14.00	13.13	12.96
12000	13.98	10.07	8.72	11.81	11.61	10.15
13000	18.47	13.47	11.44	13.31	13.39	10.64
14000	35.25	19.45	15.61	17.92	18.41	13.86
15000	31.30	18.56	15.83	23.43	23.73	18.42
16000	22.27	16.27	14.00	19.46	19.46	17.32
17000	25.11	17.08	13.81	16.81	16.91	15.38
18000	18.41	19.15	15.39	15.71	15.96	15.07
19000	12.11	19.21	19.66	15.77	16.03	15.97
20000	12.32	19.93	27.56	16.86	16.95	17.32
21000	16.52	21.54	28.69	18.59	18.60	18.68
22000	15.75	22.28	26.41	19.25	19.28	18.88
23000	15.86	21.01	22.65	18.07	18.10	17.36
24000	20.61	19.52	19.19	16.74	16.81	15.70
25000	24.70	17.24	16.29	14.97	15.11	13.85
26000	20.04	14.34	13.46	12.71	12.88	11.57
27000	12.17	12.33	12.09	11.31	11.48	10.04
28000	9.49	12.37	13.07	11.78	11.90	10.23
29000	10.55	15.71	17.60	14.97	14.98	12.67
30000	14.81	20.65	25.81	18.06	18.20	14.81
31000	10.19	14.57	17.32	13.03	13.10	11.11
32000	7.86	11.20	12.14	10.41	10.33	8.91
33000	11.90	10.76	10.10	10.55	10.37	9.26
34000	19.87	12.50	10.72	13.48	13.23	12.54
35000	18.37	17.89	14.72	21.67	21.32	20.85
36000	24.99	25.84	19.36	25.38	24.50	18.91
37000	28.80	17.22	14.15	17.52	17.11	14.63
38000	14.09	14.23	12.01	15.63	15.45	14.40
39000	10.40	14.56	13.20	16.53	16.63	17.46
40000	12.98	17.63	17.84	19.21	19.60	24.89
41000	22.78	22.34	28.50	22.30	22.85	29.37
42000	27.59	25.88	33.05	24.12	24.34	24.50
43000	28.09	25.07	24.06	23.51	23.42	21.74
44000	18.56	21.09	19.78	20.24	18.88	19.21
45000	16.80	19.39	17.47	18.65	16.53	17.53
46000	16.02	17.60	15.71	16.92	13.11	15.92
47000	16.29	15.19	13.70	14.54	11.50	13.73
48000	18.77	14.17	13.24	13.50	11.93	12.84
49000	16.81	14.86	14.69	14.27	13.91	13.73
50000	14.86	15.95	16.48	15.47	15.67	15.05

Typical Performance Data

Frequency (MHz)	Output Return Loss Relative To Control Voltage @ Temperature = 85°C					
	(dB)					
	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
2000	20.04	5.33	2.53	3.59	2.44	2.04
2500	17.39	5.52	2.70	3.75	2.70	2.24
3000	15.88	6.05	3.09	4.12	3.16	2.58
3500	15.16	7.01	3.74	4.78	3.90	3.09
4000	14.88	8.45	4.64	5.74	4.91	3.78
4500	14.98	10.21	5.66	6.98	6.17	4.63
5000	15.14	11.91	6.63	8.50	7.65	5.63
5500	15.88	12.14	7.06	9.91	8.93	6.65
6000	17.62	11.01	6.85	10.43	9.37	7.27
6500	20.97	9.90	6.51	10.00	9.09	7.27
7000	25.96	9.53	6.52	9.51	8.86	7.01
7500	33.17	10.00	7.04	9.47	9.04	6.90
8000	33.84	11.55	8.25	10.15	9.93	7.19
8500	21.79	14.36	10.21	11.79	11.81	8.07
9000	16.80	16.99	12.20	14.83	15.14	9.77
9500	14.75	15.60	12.31	20.01	20.21	12.45
10000	14.85	12.80	10.73	22.45	20.24	15.55
11000	17.33	9.99	8.61	14.03	13.37	13.14
12000	14.65	10.19	8.99	11.94	11.81	10.47
13000	19.19	13.67	11.85	13.45	13.54	11.09
14000	38.54	19.03	15.78	18.18	18.54	14.52
15000	34.92	18.01	15.66	22.40	22.58	18.48
16000	22.91	16.49	14.38	19.07	19.12	17.20
17000	25.91	17.54	14.47	16.88	16.97	15.65
18000	17.03	19.58	16.25	15.93	16.12	15.41
19000	12.60	19.81	20.63	16.13	16.30	16.28
20000	13.56	20.50	26.99	17.28	17.29	17.62
21000	15.59	21.16	26.97	18.28	18.28	18.46
22000	16.36	20.92	23.81	18.33	18.38	18.09
23000	18.09	20.30	20.83	17.83	17.86	17.11
24000	22.78	19.61	18.84	17.19	17.22	16.13
25000	30.08	17.59	16.67	15.44	15.54	14.44
26000	18.39	14.11	13.35	12.60	12.73	11.67
27000	11.17	11.99	11.86	10.99	11.12	9.93
28000	9.45	12.45	13.21	11.78	11.86	10.43
29000	12.43	16.54	18.34	15.64	15.63	13.51
30000	14.96	21.65	27.13	18.43	18.52	15.48
31000	10.36	14.37	16.54	12.80	12.84	11.17
32000	9.29	11.02	11.52	10.31	10.25	9.03
33000	14.30	10.75	10.01	10.71	10.57	9.66
34000	16.68	13.12	11.57	14.36	14.16	13.72
35000	18.84	19.88	16.58	25.15	24.69	23.77
36000	33.28	24.49	19.37	23.80	23.28	18.94
37000	20.61	17.24	14.74	17.68	17.38	15.34
38000	13.23	14.75	12.83	16.35	16.23	15.51
39000	12.63	15.79	14.62	18.11	18.18	19.47
40000	17.89	20.00	20.92	21.83	22.16	29.02
41000	27.09	24.53	31.09	24.66	25.14	33.17
42000	26.03	24.84	33.20	23.73	24.04	26.12
43000	21.74	22.75	22.66	21.41	21.42	20.76
44000	16.54	19.00	18.06	18.73	18.54	17.47
45000	16.39	18.69	16.62	19.01	18.68	17.15
46000	18.82	20.00	17.91	19.90	19.58	17.95
47000	18.31	17.47	16.05	17.17	16.95	15.74
48000	18.50	14.11	13.08	13.97	13.85	13.00
49000	15.32	13.65	13.25	13.54	13.50	12.88
50000	13.54	15.21	15.86	14.93	14.96	14.59

Typical Performance Data

Frequency (MHz)	Noise Figure Vs. temperature (dB)		
	-40°C	+25°C	+85°C
	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -4 V VCTRL 2 = -4 V
10000	3.50	4.14	4.82
11000	3.27	4.05	4.38
12000	2.76	3.57	4.15
13000	2.59	3.56	3.78
14000	2.26	2.90	3.53
15000	2.13	3.00	3.37
16000	2.06	2.82	3.52
17000	2.46	3.11	3.65
18000	2.23	3.13	3.98
19000	2.49	3.55	4.01
20000	2.29	2.97	3.45
21000	2.46	3.32	3.84
22000	2.46	3.46	4.08
23000	2.42	3.45	3.99
24000	2.25	3.19	4.12
25000	2.75	3.39	4.09
26000	2.83	3.89	4.55
27000	2.93	4.17	4.66
28000	3.50	4.48	4.65
29000	3.26	4.23	5.03
30000	3.17	4.41	4.94
31000	3.04	4.35	4.91
32000	3.32	4.65	5.12
33000	3.52	4.34	5.22
34000	3.51	4.73	5.38
35000	3.53	4.89	5.55
36000	3.79	5.47	5.98
37000	4.22	5.52	6.40
38000	4.79	5.73	6.83
39000	5.51	6.75	7.29
40000	4.86	6.37	6.90
41000	5.82	6.07	7.06
42000	5.32	6.86	7.65
43000	6.60	7.57	8.28
43500	6.43	7.26	8.21
44000	6.15	7.74	8.89
45000	6.26	6.60	7.88

Typical Performance Data

Attenuation vs. input power at 10 GHz @ 25°C						
Input Power	(dB)					
(dBm)	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
-5	6.00	11.81	23.52	17.29	28.36	38.41
0	6.12	11.87	23.52	17.28	28.35	38.41
5	6.01	12.24	23.53	17.44	28.35	38.41
10	6.07	12.02	23.52	17.66	28.35	38.41
15	6.05	12.21	23.76	17.49	28.34	38.39

Attenuation vs. input power at 20 GHz @ 25°C						
Input Power	(dB)					
(dBm)	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
-5	3.88	11.89	27.86	19.90	35.76	48.75
0	3.92	11.87	27.84	19.88	35.70	48.75
5	3.84	11.88	27.83	19.88	35.69	48.74
10	3.94	12.06	27.82	19.89	35.68	48.70
15	3.99	12.04	27.80	19.98	35.66	48.66

Attenuation vs. input power at 44 GHz @ 25°C						
Input Power	(dB)					
(dBm)	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
-5	8.67	21.39	38.72	33.08	42.88	40.78
0	8.67	21.40	38.66	33.12	42.78	40.73
5	8.68	21.41	38.68	33.17	42.74	40.71
10	8.69	21.43	38.75	33.22	42.78	40.78
15	8.72	21.46	38.77	33.27	42.82	40.81

Typical Performance Data

Attenuation vs. input power at 20 GHz @ temperature -40°C						
Input Power	(dBm)					
(dBm)	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
-5	3.07	10.21	28.68	17.61	35.86	50.60
0	3.22	10.22	28.67	17.60	35.82	50.57
5	3.14	10.27	28.67	17.61	35.81	50.58
10	3.20	10.25	28.65	17.71	35.80	50.56
15	3.06	10.42	28.61	17.77	35.77	50.50

Attenuation vs. input power at 20 GHz @ temperature 25°C						
Input Power	(dBm)					
(dBm)	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
-5	3.88	11.89	27.86	19.90	35.76	48.75
0	3.92	11.87	27.84	19.88	35.70	48.75
5	3.84	11.88	27.83	19.88	35.69	48.74
10	3.94	12.06	27.82	19.89	35.68	48.70
15	3.99	12.04	27.80	19.98	35.66	48.66

Attenuation vs. input power at 20 GHz @ temperature 85°C						
Input Power	(dBm)					
(dBm)	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
-5	4.01	12.56	26.17	20.88	34.54	45.90
0	4.16	12.55	26.16	20.87	34.50	45.89
5	3.96	12.52	26.16	20.86	34.50	45.88
10	4.16	12.52	26.15	20.84	34.49	45.85
15	4.15	12.68	26.13	20.88	34.47	45.83

Typical Performance Data

IIP3 vs. input power at 10 GHz @ temperature 25°C						
Input Power	(dBm)					
(dBm)	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
5	36.04	38.53	40.14	37.29	40.34	39.63
10	36.12	38.62	40.27	37.54	40.50	39.79
15	34.51	38.96	40.41	38.13	40.71	39.93

IIP3 vs. input power at 20 GHz @ temperature 25°C						
Input Power	(dBm)					
(dBm)	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
5	34.23	38.19	39.89	36.67	39.86	40.12
10	34.43	38.06	40.01	36.79	40.10	40.24
15	34.28	38.24	40.15	37.27	40.19	40.39

IIP3 vs. input power at 44 GHz @ temperature 25°C						
Input Power	(dBm)					
(dBm)	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
5	33.88	37.44	41.49	36.01	44.92	48.67
10	33.84	37.74	42.14	36.25	45.76	51.61
15	34.18	38.21	42.47	36.70	45.65	50.85

Typical Performance Data

IIP3 vs. input power at 20 GHz @ temperature -40°C						
Input Power	(dBm)					
(dBm)	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
5	35.57	33.54	38.42	31.58	38.56	38.66
10	34.97	33.94	38.45	32.01	38.56	38.90
15	34.54	34.96	38.62	33.08	38.72	39.10

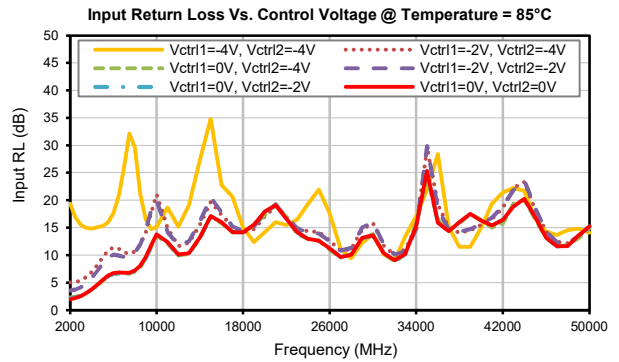
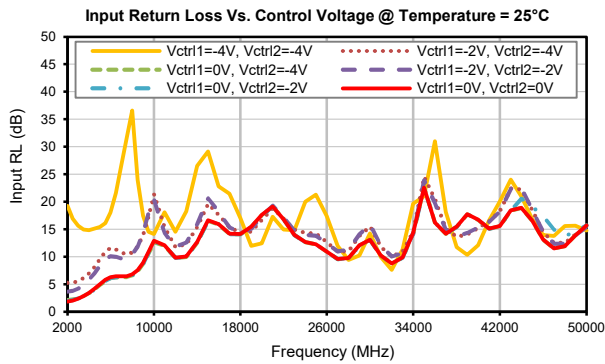
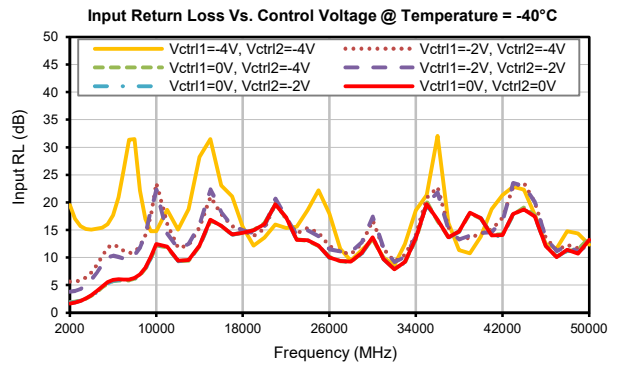
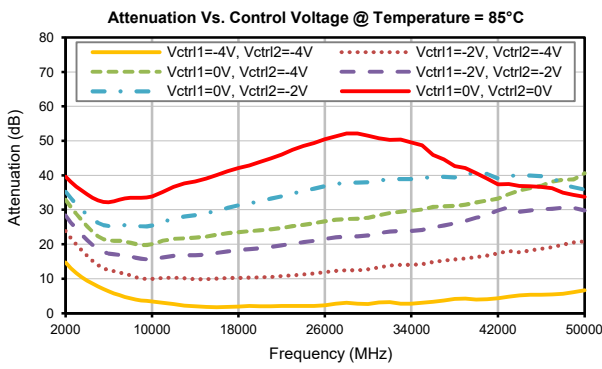
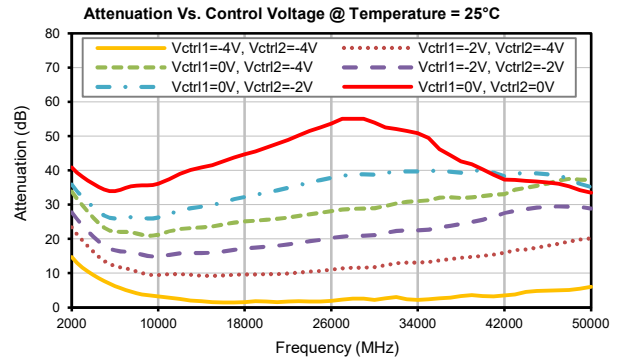
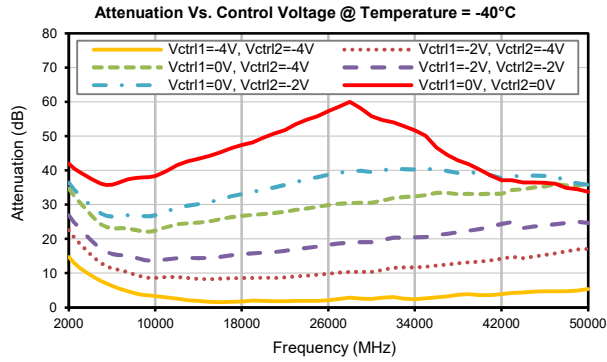
IIP3 vs. input power at 20 GHz @ temperature 25°C						
Input Power	(dBm)					
(dBm)	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
5	34.24	38.29	39.80	36.53	39.78	39.96
10	34.41	38.01	39.97	36.63	39.97	40.12
15	34.22	38.19	40.08	37.10	40.10	40.30

IIP3 vs. input power at 20 GHz @ temperature 85°C						
Input Power	(dBm)					
(dBm)	VCTRL1 = -4 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -4 V	VCTRL1 = 0 V VCTRL 2 = -4 V	VCTRL1 = -2 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = -2 V	VCTRL1 = 0 V VCTRL 2 = 0 V
5	33.61	39.59	41.16	41.02	41.21	40.95
10	34.09	39.67	41.27	41.06	41.16	41.19
15	33.68	40.08	41.28	41.17	41.18	41.29

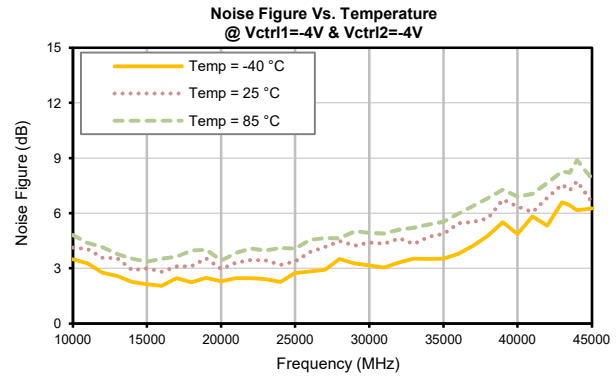
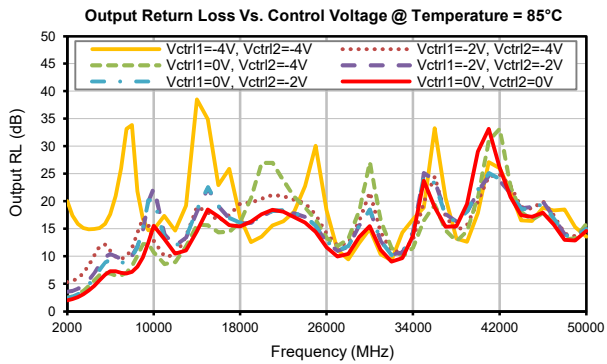
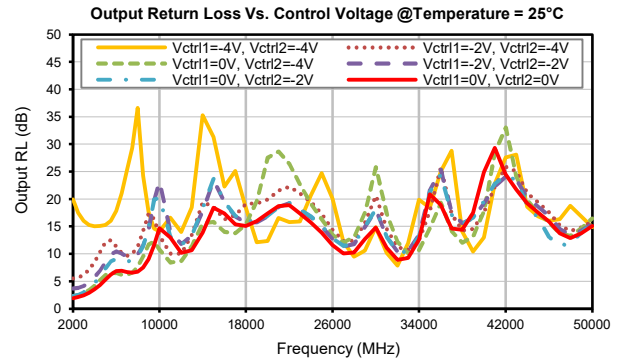
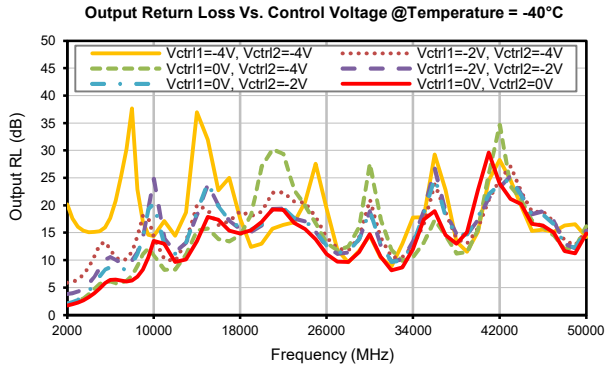
Voltage Variable Attenuator

Typical Performance Curves

PVA-453-34-D+



Typical Performance Curves



All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

Specification	Test/Inspection Condition	Reference/Spec
Operating Temperature	-40° to 85° C or -40° to 105° C or -55° to 105° C or -45° to 105° C Ambient Environment	Refer to Individual Model Data Sheet
Storage Environment (Die)	-65° to 150°C	Individual Model Data Sheet
Storage Environment(Packaging)	-40° to 70°C and 40 to 60% humidity (In Factory Shipped Package)	