

Quad PIN Diode π Attenuator 5 – 3000 MHz

**MA4P274-1225T/MA4P7455-1225T
V1**

Features

- 4 PIN Diodes in SOT-25 Plastic Package
- Externally Selectable Bias and RF Match Network
- 5 – 3,000 MHz Useable Frequency Band
- + 43 dBm IP3@ 1 GHz (50 Ω)
- 1.0 dB Loss @ 1 GHz (50 Ω)
- 30 dB Attenuation @ 1 GHz (50 Ω)
- Lead-Free (RoHS Compliant) equivalent available with 260 °C reflow compatibility

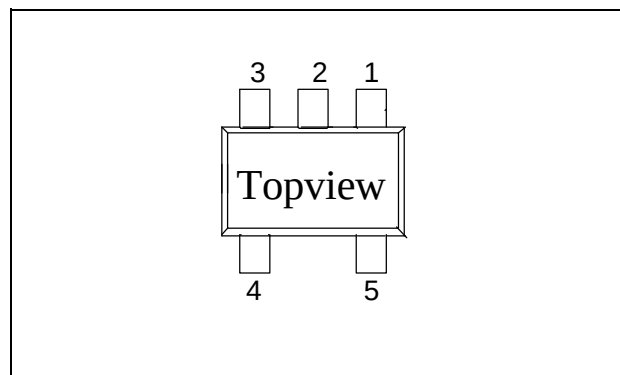
Description and Applications

M/A-COM's MA4P274-1225T/MA4P7455-1225T is a wideband, lower insertion loss, high IP3, Quad PIN Diode π Attenuator in a low-cost, surface mount SOT-25 package. Four PIN Diodes in one package reduce design parasitics and improve circuit density.

These devices are offered with standard Sn/Pb plating, as well as with 100% matte Sn plating on our RoHS compliant equivalent device.

These PIN Diode Attenuators perform well where RF Signal Amplitude Control is required in 50 Ω Handset Circuits and 75 Ω Broadband CATV Systems. Exceptional Insertion Loss, Attenuation Range, and IP3 at <10 mA bias make these devices suitable for better power level control in RF Amplifiers.

Package Outline (Topview)



Pin Configuration

PIN	Function	PIN	Function
1	RF In	4	Shunt 1 Bias
2	Series Bias	5	Shunt 2 Bias
3	RF Out		

Part Number	RoHS Compliant Part Number
MA4P274 -1225	MA4P7455-1225
MA4P274 -1225T	MA4P7455-1225T

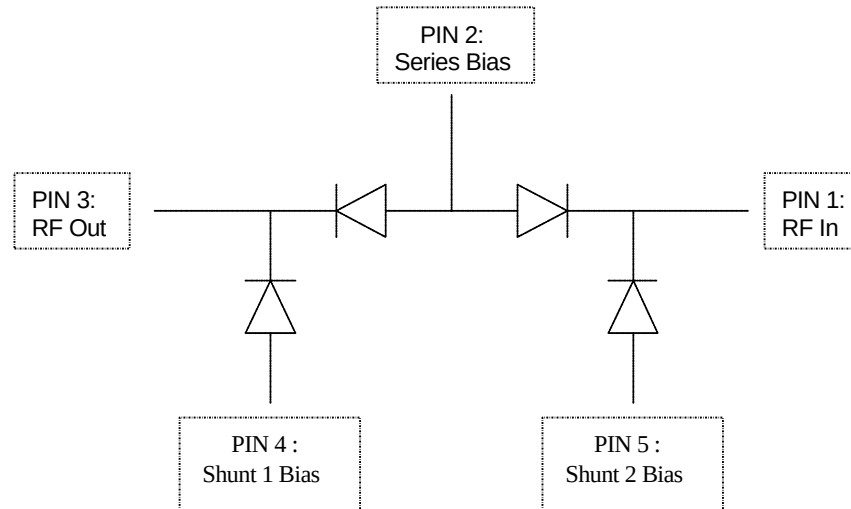
Electrical Specifications @ +25 °C

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Ct @ 0 V	100 MHz	pF		0.45	0.50
Rs @ 1 mA	100 MHz	Ω		13	18
Rs @ 10 mA	100 MHz	Ω		2.3	3.0
V _b	D.C.	V	125	150	
Minority Carrier Lifetime	(50 % - 90 %) Voltage If = + 10mA, Ir = - 6mA Pulse @ 100 kHz Sq Wave	nS		1000	2000
Power Dissipation	D.C. and F = 5 – 3,000 MHz Derate linearly to 0 mW at 125 C Using 1,000 deg-C/W Thermal Resistance	mW			100
RF Incident Power	F = 5 – 3,000 MHz Vshunt 1 & 2 Diode Bias = 0.75 V Vseries Diode Bias = 0 to 20 V	dBm			+ 20

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Functional Schematic



Case Style - SOT-25

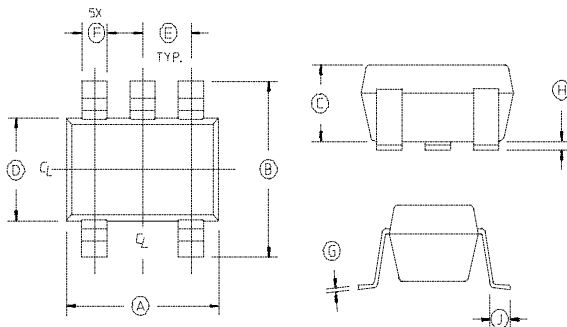
Dim	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	.1103	.1181	2.80	3.10
B	.1023	.1181	2.6	3.00
C	0.0355	.0512	0.9	1.30
D	0.0591	.0669	1.5	1.70
E	.0374 REF.		0.95 REF.	
F	.0138	.0197	.35	.50
G	.0031	0.0079	.08	0.2
H	.0002	.0059	.05	.15
J	.0138	.0216	.35	.55

Absolute Maximum Ratings¹

Parameter	Absolute Maximum
Operating Temperature	-65 °C to +125 °C
Storage Temperature, No Dissipated Power	-65 °C to +150 °C
DC Voltage at Temperature Extremes	-100 V
DC Current at 25 °C	75 mA

1. Exceeding these limits may cause permanent damage.

Please refer to Application Note M538 for surface mounting instructions.



- Dimensions do not include mold peaks, protrusion or gate burrs which shall not exceed 0.0098 in. (.25) mm per side.
- Leads Coplanarity should be 0.003 (0.08) mm Max.

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**Typical 50 W RF Performance @ +25 °C using Wide and RF Circuit Design
 (Values Shown include Through Loss Calibrated Out of RF Test Circuit)**

Parameter	Frequency Range	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	5 – 1,000 MHz	+ 3 mA / Series Diode and 0.75 V Shunt 1 and 2 Bias F = 1 GHz	dB		-2.0	
Insertion Loss	5 – 1,000 MHz	+ 6.5 mA / Series Diode and 0.75 V Shunt 1 and 2 Bias F = 1 GHz	dB		-1.0	
Return Loss	5 – 1,000 MHz	+ 6.5 mA / Series Diode and 0.75 V Shunt 1 and 2 Bias F = 1 GHz	dB		-10	
Attenuation	5 – 1,000 MHz	0 mA / Series Diode and 0.75 V Shunt 1 and 2 Bias F = 1 GHz	dB		-29	
Input IP3	5 – 1,000 MHz	0 mA / Series Diode and 0.75 V Shunt 1 and 2 Bias F1 = 1000 MHz, F2 = 1100 MHz	dBm		43	
Input IP3	5 – 1,000 MHz	+ 6.5 mA / Series Diode and 0.75 V Shunt 1 and 2 Bias F1 = 1000 MHz, F2 = 1100 MHz	dBm		43	
Input IP3	5 – 1,000 MHz	0 mA / Series Diode and 0.75 V Shunt 1 and 2 Bias F1 = 100 MHz, F2 = 110 MHz	dBm		43	
Input IP3	5 – 1,000 MHz	+ 6.5 mA / Series Diode and 0.75 V Shunt 1 and 2 Bias F1 = 100 MHz, F2 = 110 MHz	dBm		33	
Settling Time	5 – 1,000 MHz	Within 1 dB of Final Attenuation Value F = 1 GHz	uS		3	
RF C.W. Incident Power	5 – 1,000 MHz	0 – 20 V Series Diode Bias and 0.75 V Shunt 1 and 2 Bias	dBm		+ 20	

**Typical 75 W RF Performance @ +25 °C using Wide and RF Circuit Design
 (Values Shown include Through Loss Calibrated Out of RF Test Circuit)**

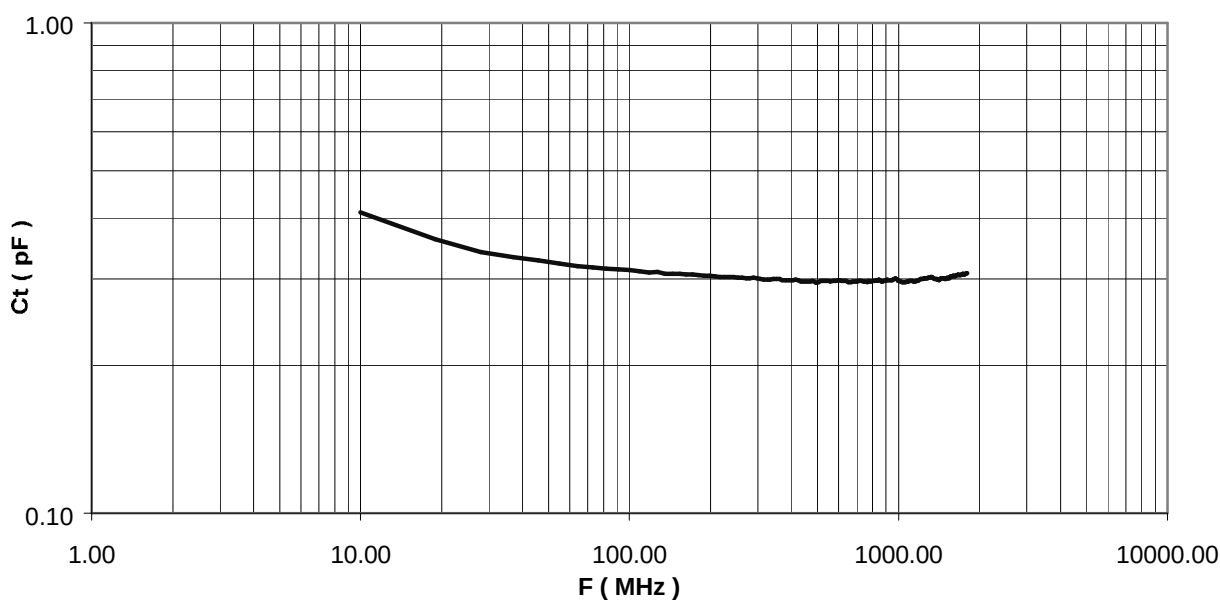
Parameter	Frequency Range	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	5 – 1,000 MHz	+ 2 mA / Series Diode and 1.0 V Shunt 1 and 2 Bias F = 1 GHz	dB		-1.1	
Insertion Loss	5 – 1,000 MHz	+ 4.5 mA / Series Diode and 1.0 V Shunt 1 and 2 Bias F = 1 GHz	dB		-0.6	
Attenuation	5 – 1,000 MHz	0 mA / Series Diode and 1 V Shunt 1 and 2 Bias F = 1 GHz	dB		-27	
Return Loss	5 – 1,000 MHz	+ 4.5 mA / Series Diode and 1.0 V Shunt 1 and 2 Bias F = 1 GHz	dB		-10	

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5 –3000 MHz**

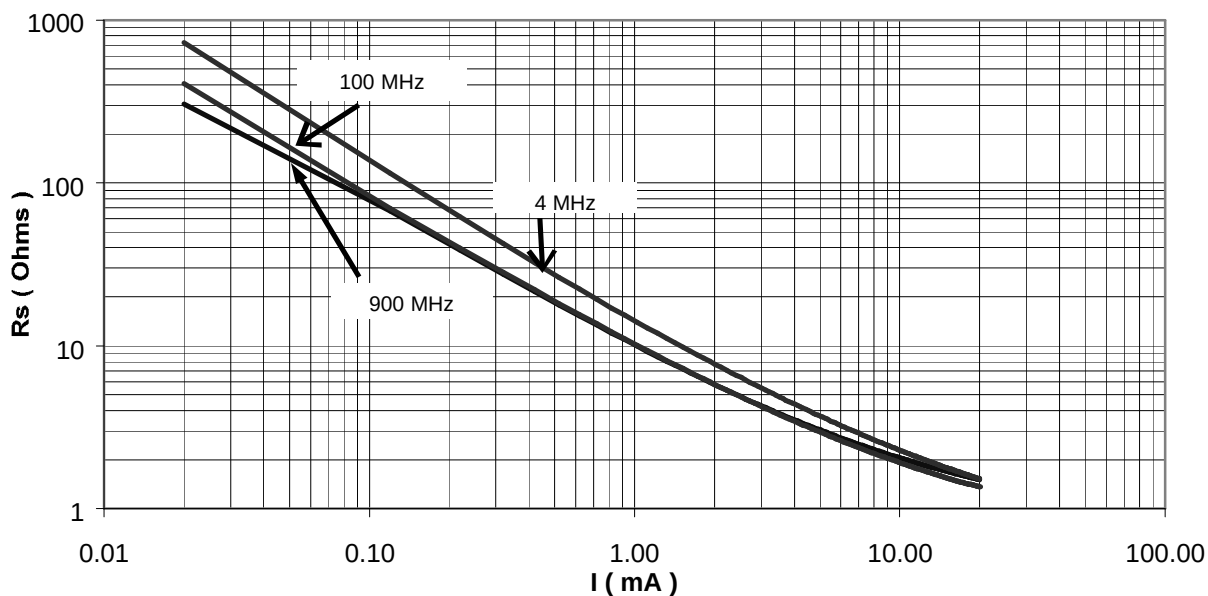
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Typical Performance Curves

Diode C_t vs Frequency @ 0 V



Diode R_s vs I

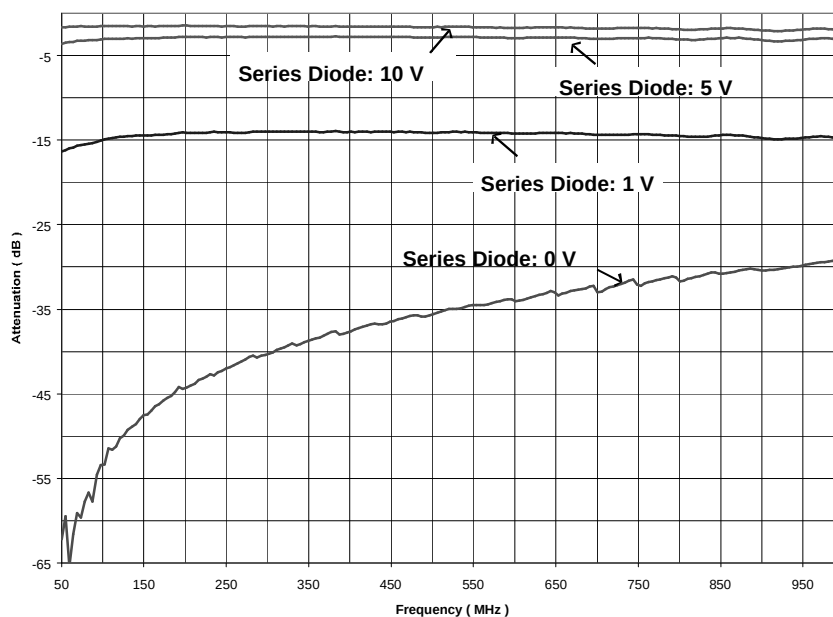


**Quad PIN Diode p Attenuator
5 –3000 MHz**

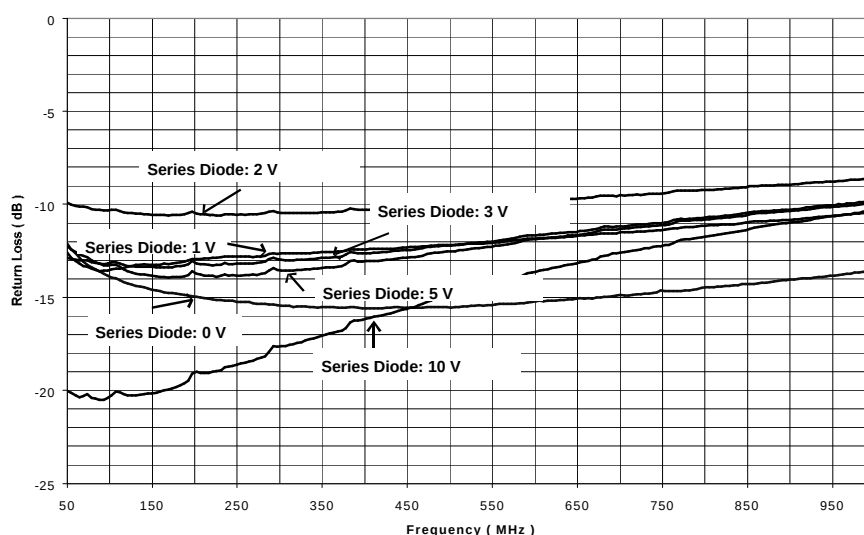
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Typical Performance Curves

Attenuation vs Frequency in 50 Ohms, Shunt Bias = 0.75 V



Return Loss vs Frequency in 50 Ohms, Shunt Bias = 0.75 V

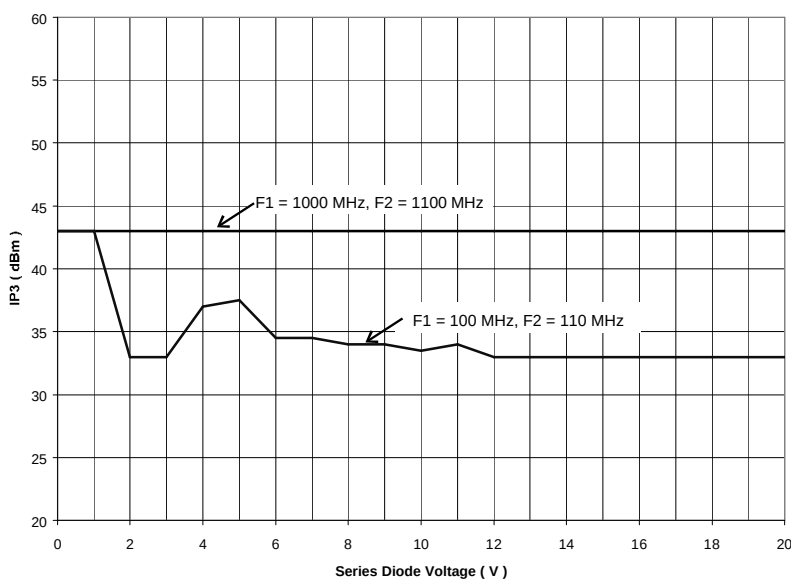


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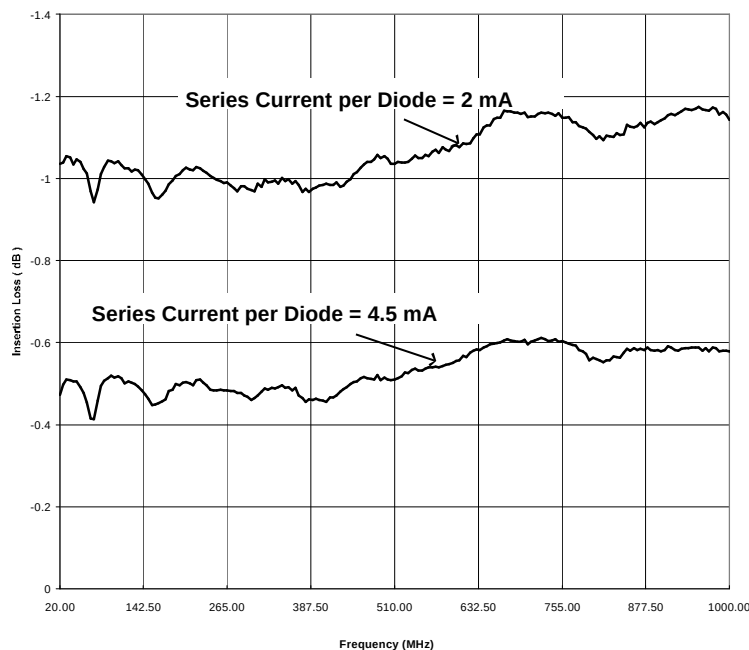
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Typical Performance Curves

IP3 vs Series Voltage, $V_{shunt} = .075\text{ V}$



Insertion Loss vs Frequency in 75 Ohms, Shunt Bias = 1 V

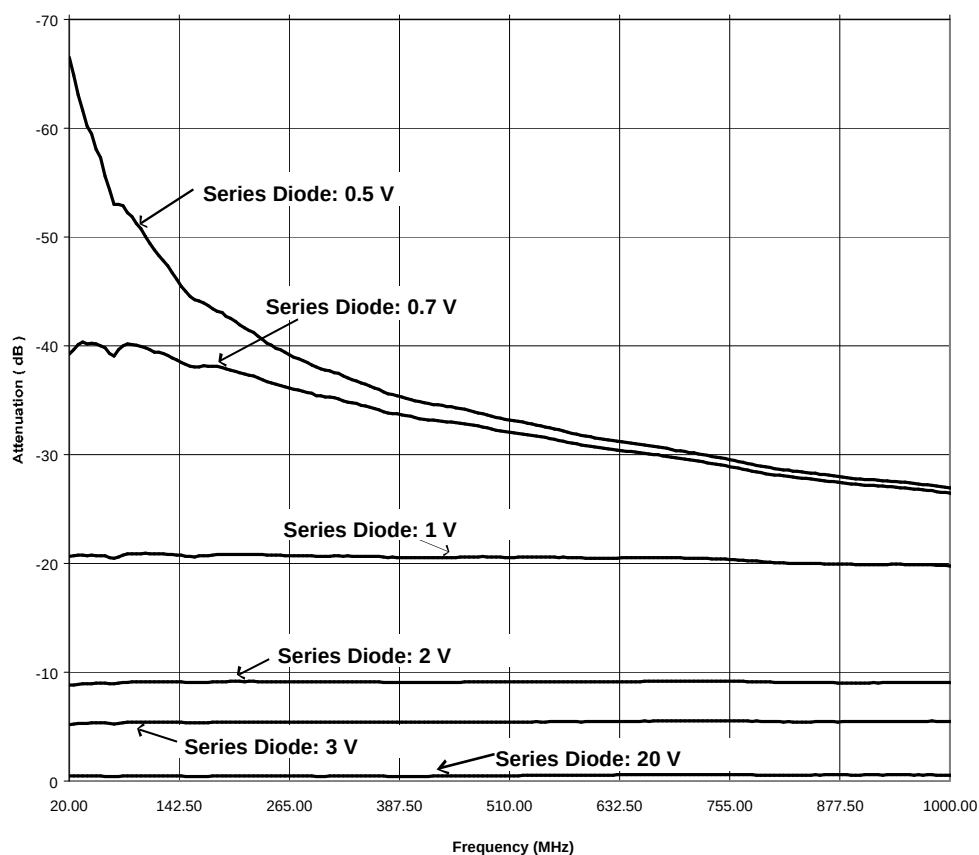


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Typical Performance Curves

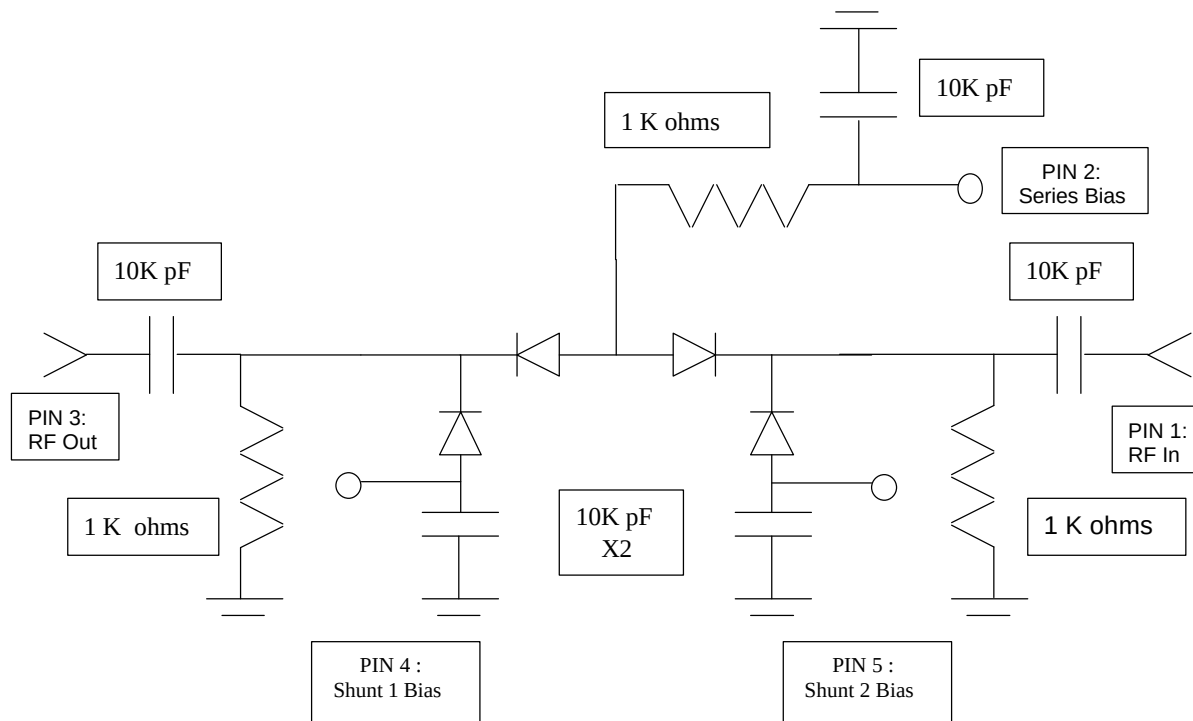
Attenuation vs Frequency in 75 Ohms, Shunt Bias = 1 V



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5 - 1,000 MHz Wideband RF Circuit



Note : Keeping PIN 4 & PIN 5 as Separate Bias Points (Same V) reduces RF leakage (increases attenuation) through an otherwise connected Common Anode Bias Node.

5 - 1,000 MHz Wideband RF Circuit Parts List

Item	Supplier	Supplier P/N
4003 or 4350 Circuit Board 4003 ($\epsilon_r = 3.38$), 4350 ($\epsilon_r = 3.48$)	Rogers Corporation www.rogers-corp.com	RO4003 , RO4350
Capacitor, 10 K pF 3.2 mm L x 1.6 mm W x 1.15 mm H	Murata www.murata.com	GRM42-6COH103K25PB
Resistor, 1K Ω 1.0 mm L x 0.5 mm w x 0.25 mm H	Piconics www.piconics.com	C1001BC42KSA

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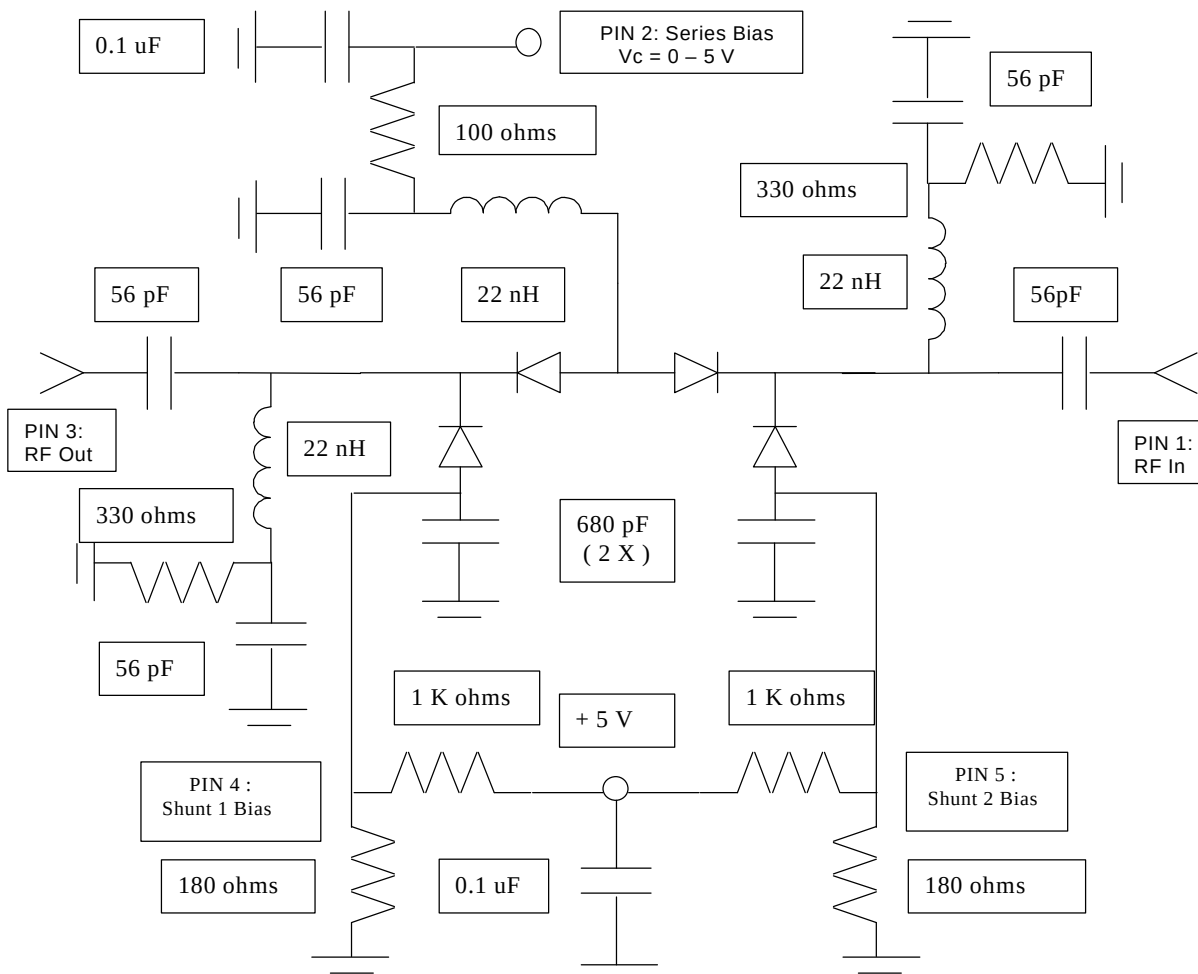
**Series and Shunt Diode Bias Currents as a Function of Vseries and Vshunt Voltage
Using Wideband RF Circuit (Values shown are PER DIODE)**

Vshunt Bias (V)	Vseries Bias (V)	Iseries Diode (mA)	Ishunt Diode (mA)
0.75	0	0.000	0.192
0.75	1	0.106	0.120
0.75	2	0.443	0.048
0.75	3	0.773	0
0.75	4	1.099	0
0.75	5	1.426	0
0.75	6	1.750	0
0.75	7	2.092	0
0.75	8	2.424	0
0.75	9	2.756	0
0.75	10	3.088	0
0.75	11	3.421	0
0.75	12	3.754	0
0.75	13	4.087	0
0.75	14	4.410	0
0.75	15	4.743	0
0.75	16	5.081	0
0.75	17	5.406	0
0.75	18	5.750	0
0.75	19	6.079	0
0.75	20	6.413	0

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1 – 3 GHz 50 W, Higher Frequency, Lower Tuning Voltage RF Circuit



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5 –3000 MHz**

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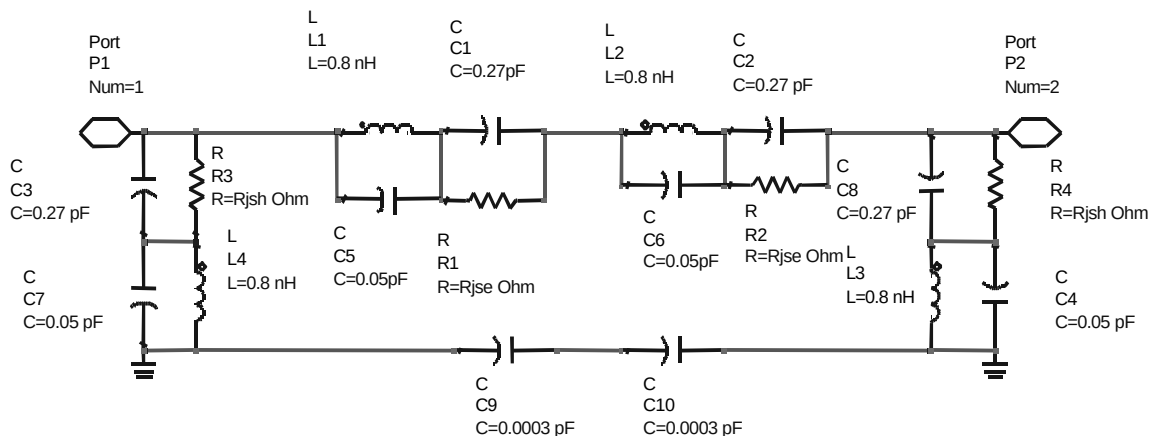
1 - 3 GHz Higher Frequency RF Circuit Parts List

Item	Supplier	Supplier P/N
4003 or 4350 Circuit Board 4003 ($\epsilon_r = 3.38$), 4350 ($\epsilon_r = 3.48$)	Rogers Corporation www.rogers-corp.com	RO4003 , RO4350
Capacitor, .01 uF, Power Supply Filter 1.6 mm L x 0.80 mm W x .080 mm H	Murata www.murata.com	GRM39X7R104K25PB
Capacitor, 680 pF, Diode RF Bypass 2.0 mm L x 1.5 mm W x .085 mm H	Murata	GRM40COG681K50PB
Capacitor, 56 pF, D.C. Block, RF Decoupling 1.0 mm L x 0.5 mm W x 0.5 mm H	Murata	GRM36COG560K50PB
Inductor, 22 nH, RF Choke	Coilcraft www.coilcraft.com	1812SMS-22NJ
Resistor, 100 Ω 1.0 mm L x 0.5 mm w x 0.25 mm H	Piconics www.piconics.com	C1001BC42KSA
Resistor, 180 Ω 1.0 mm L x 0.5 mm w x 0.25 mm H	Piconics	C1800BC42KSA
Resistor, 330 Ω 1.0 mm L x 0.5 mm w x 0.25 mm H	Piconics	C3300BC42KSA
Resistor, 1K Ω 1.0 mm L x 0.5 mm w x 0.25 mm H	Piconics	C1001BC42KSA

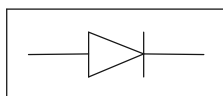
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Lumped Model of SOT-25, PIN Diode p Quad Attenuator



SPICE MODEL



Pin Diode Model
NLPINM2
Is=1E-14 A
Vi=0 V
Un=900 cm²/V-sec
Wi=60 um
Rr=1.25 Ohm
Cmin=0.20 pF
Tau=1.0 usec
Rs=0.1 Ohm
Cjo=0.27 pF
Vj=0.7 V
M=0.5
Fc=0.5
Imax=2.5E+6 A/m²
Kf=0
Af=1
Ffe=1
wBV= 150 V

Ordering Information

Model Number	Package
MA4P274 -1225/ MA4P7455-1225	Tube
MA4P274 -1225T/ MA4P7455-1225T	Tape and Reel