Quad PIN Diode p 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

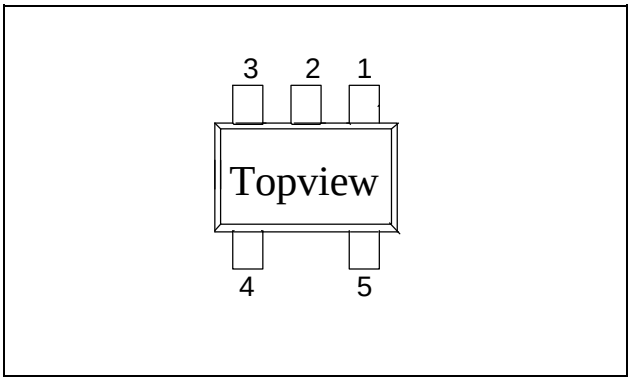
Description and Applications

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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Quad PIN Diode p Attenuator
5 –3000 MHz

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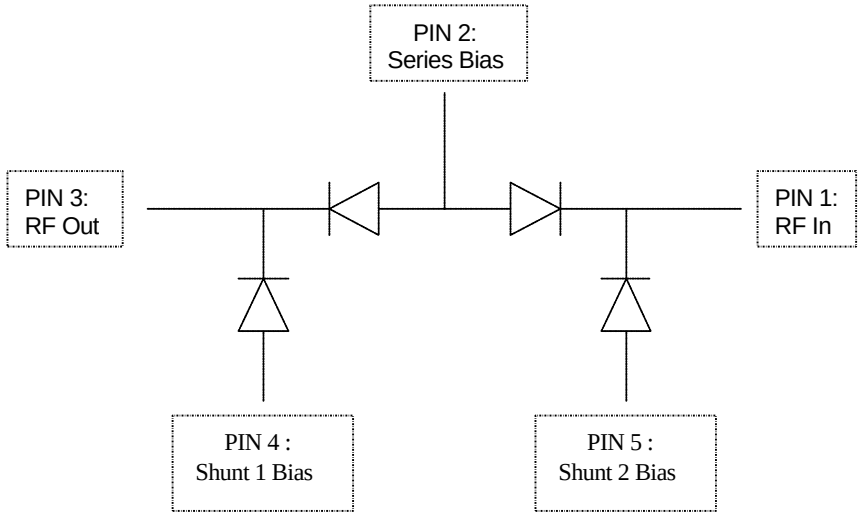
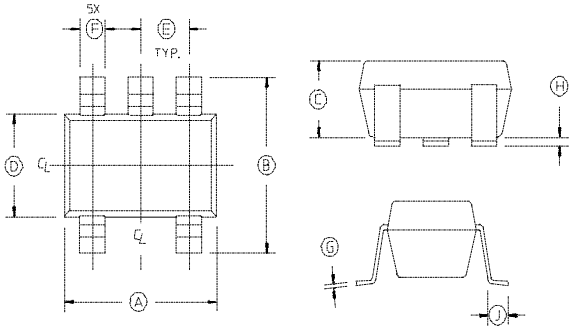
V1

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



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

Absolute Maximum Ratings[1]

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.

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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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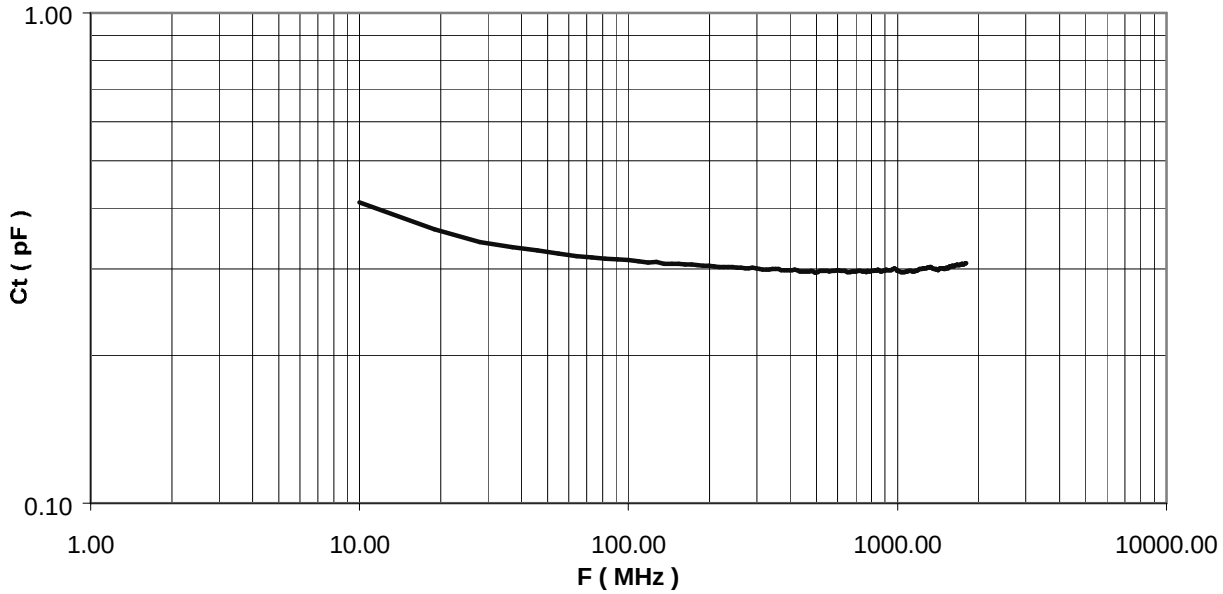
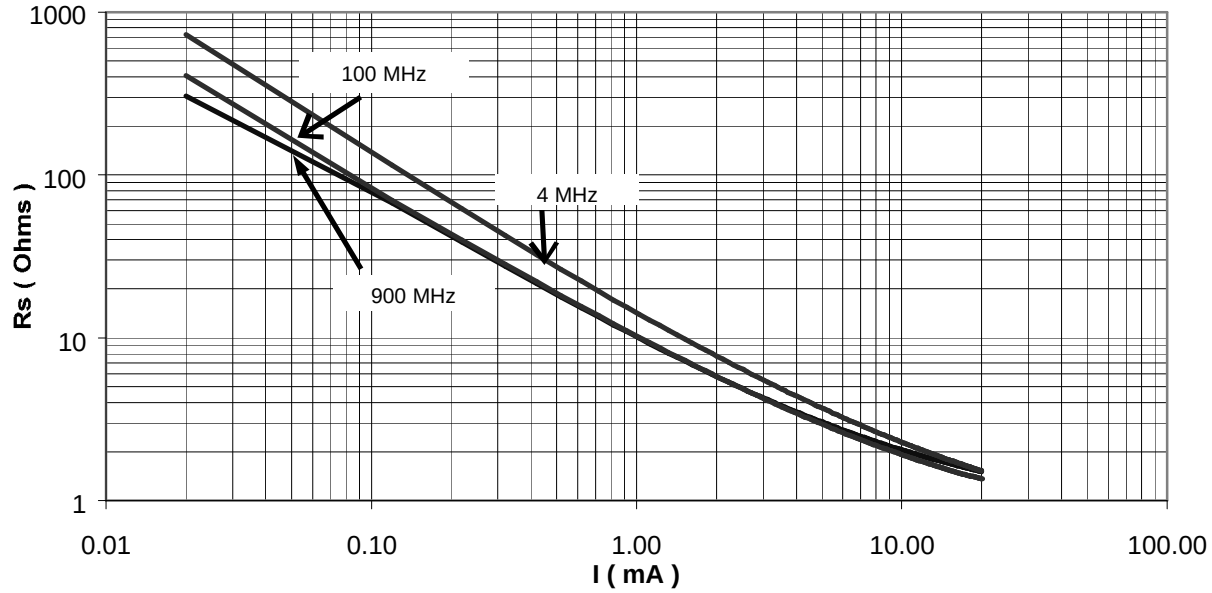
Typical Performance Curves

Diode Ct vs Frequency @ 0 V



Diode Rs vs I



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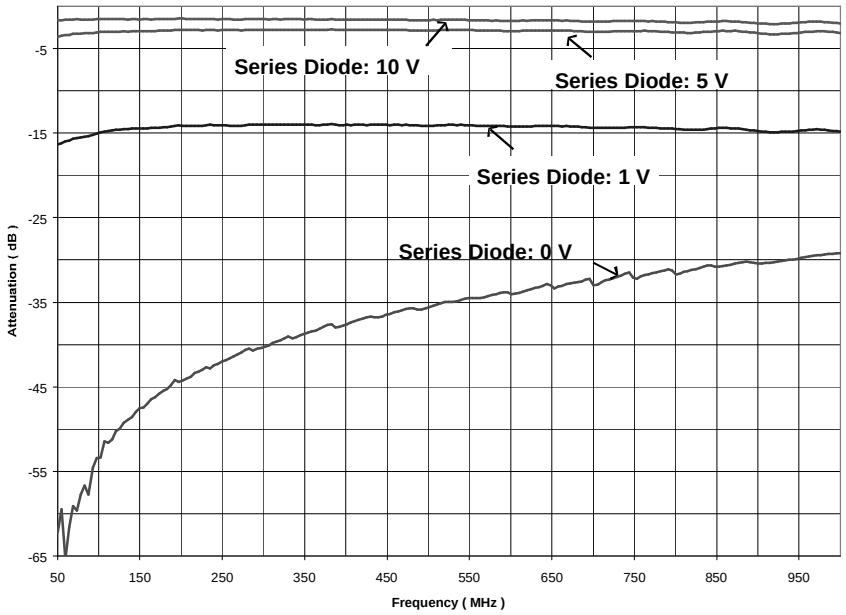
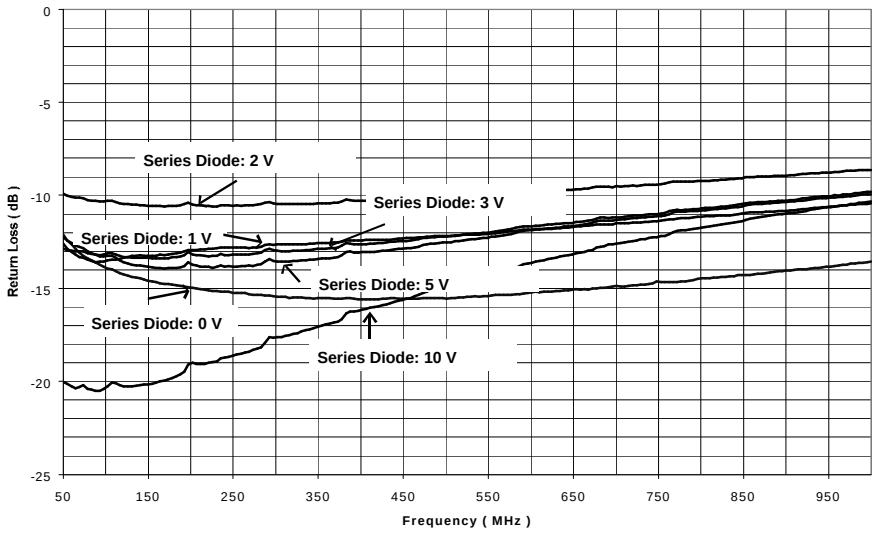
Typical Performance Curves

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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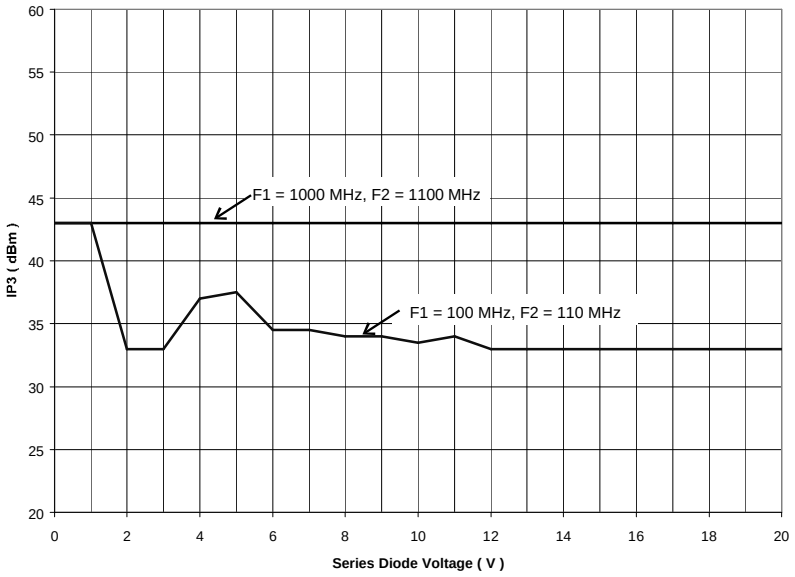
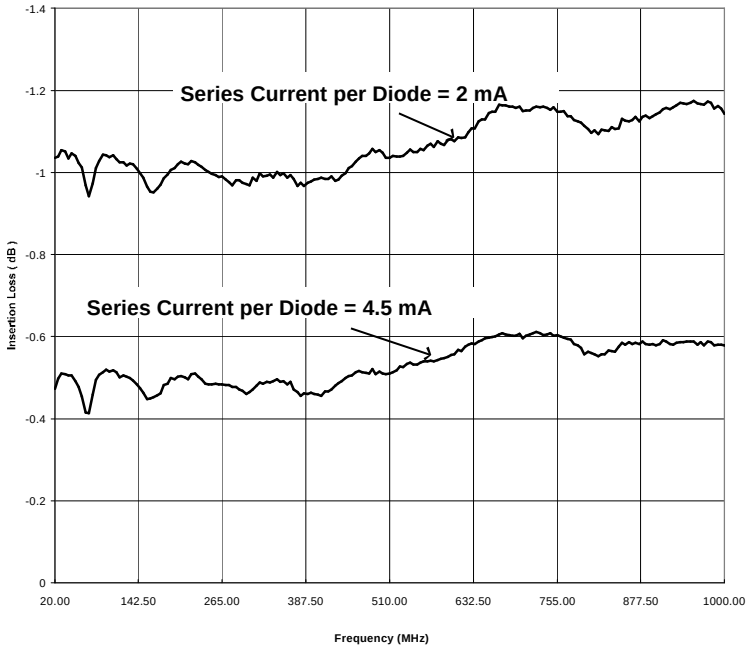
Typical Performance Curves

IP3 vs Series Voltage, Vshunt = .075 V



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



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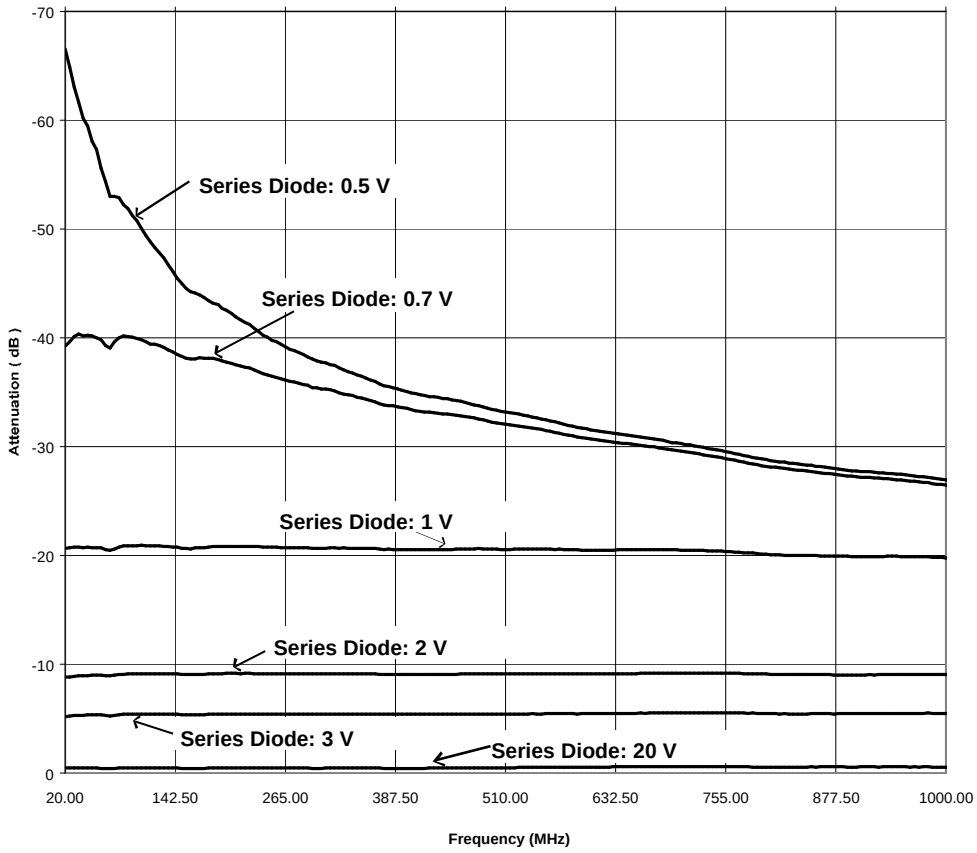
Typical Performance Curves

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



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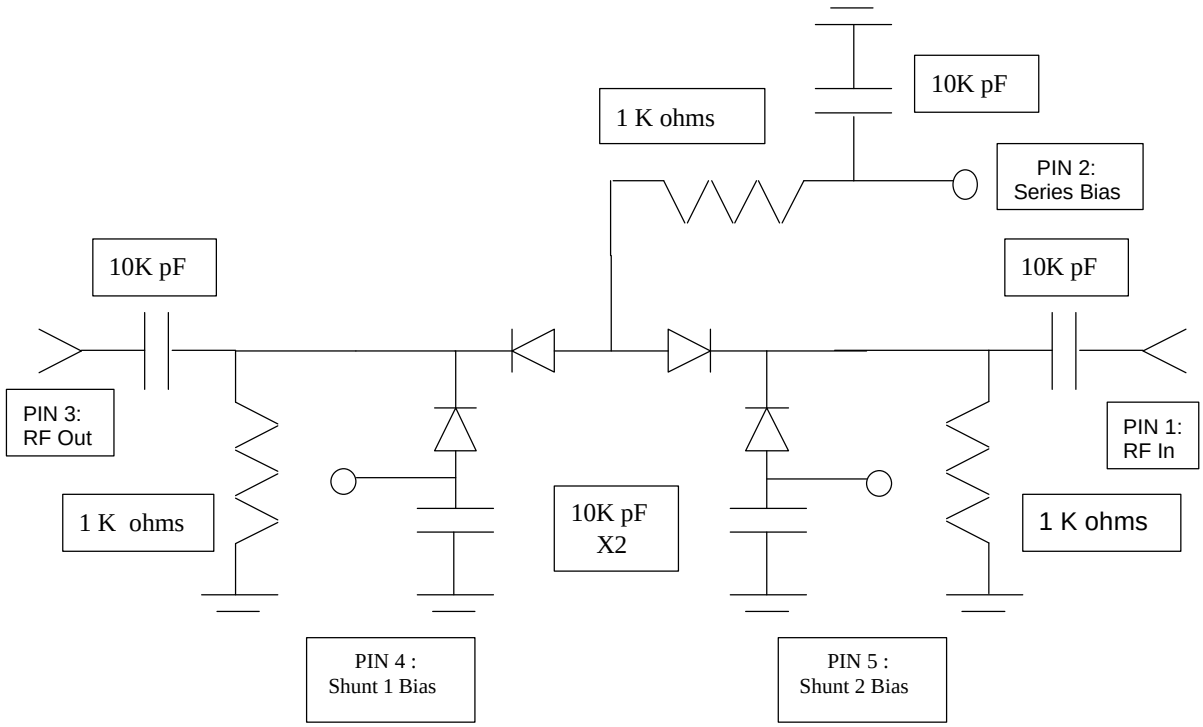
5 - 1,000 MHz Wideband RF Circuit



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 (e_r = 3.38), 4350 (e_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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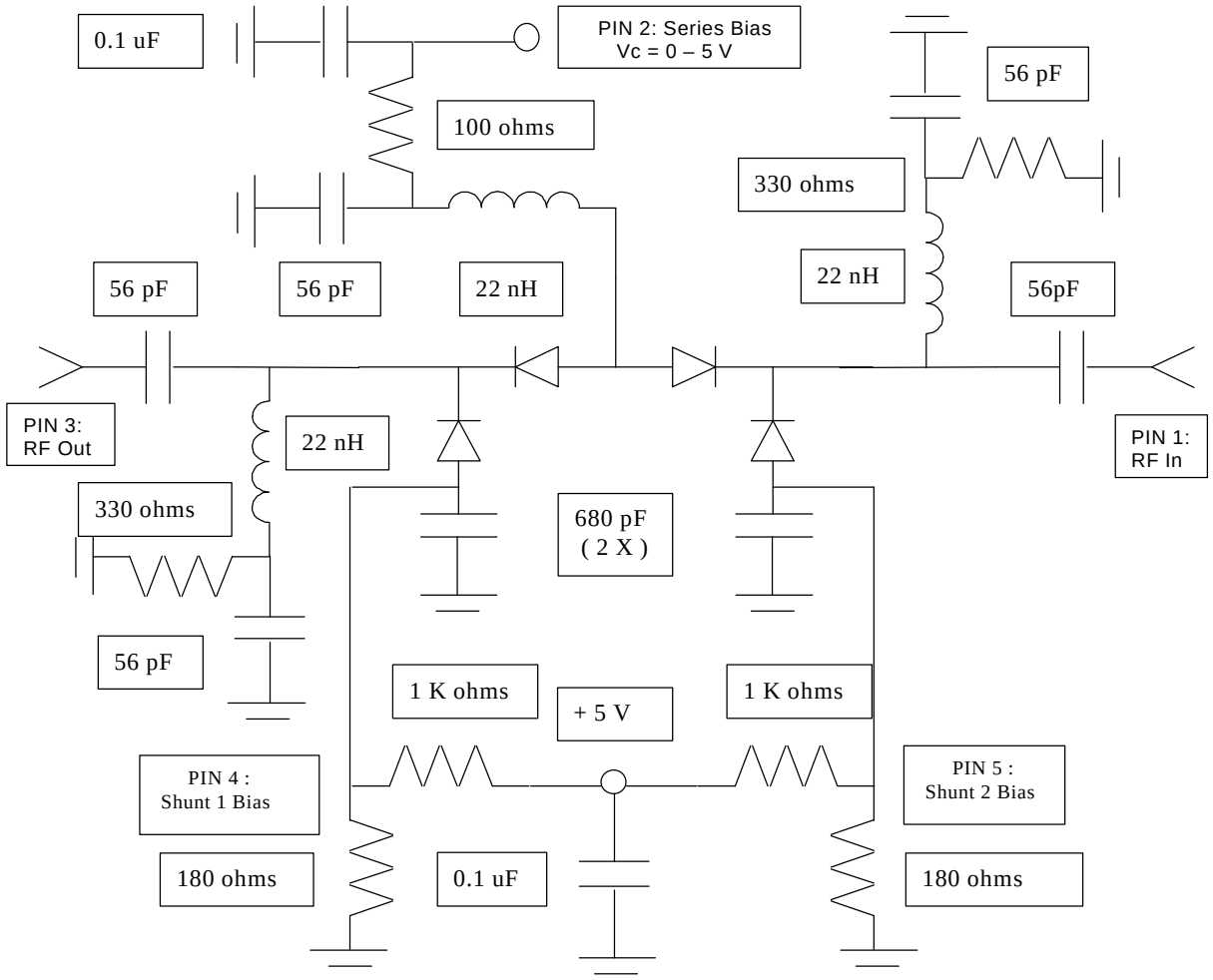
1 – 3 GHz 50 W, Higher Frequency, Lower Tuning Voltage RF Circuit



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

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1 - 3 GHz Higher Frequency RF Circuit Parts List

Item	Supplier	Supplier P/N
4003 or 4350 Circuit Board 4003 (e_r = 3.38), 4350 (e_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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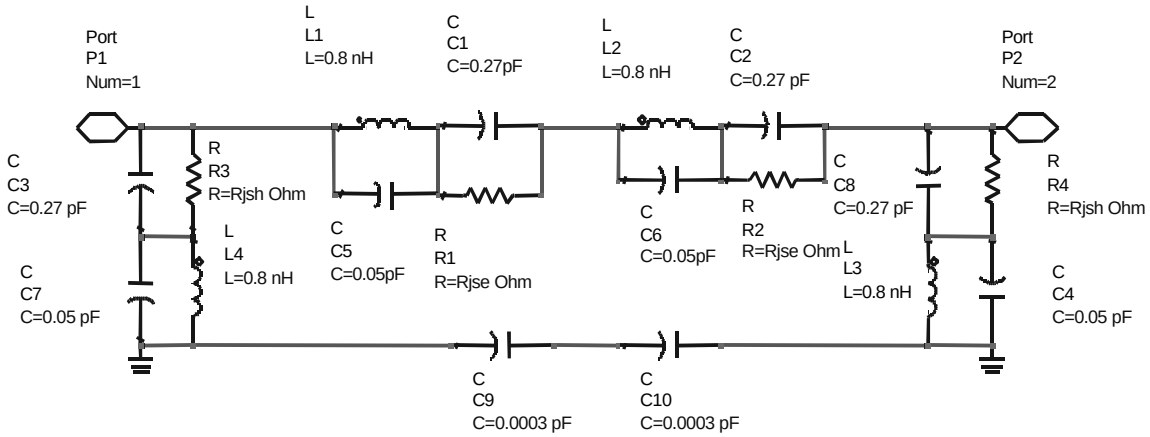
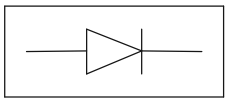
Lumped Model of SOT-25, PIN Diode p Quad Attenuator



SPICE MODEL



Pin Diode Model
NLPINM2
Is=1E-14 A
Vi=0 V
Un=900 cm^2/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/m^2
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

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