

High IP3 Voltage Variable Attenuator

RVA-2000+

50Ω 150 to 2000 MHz

Maximum Ratings

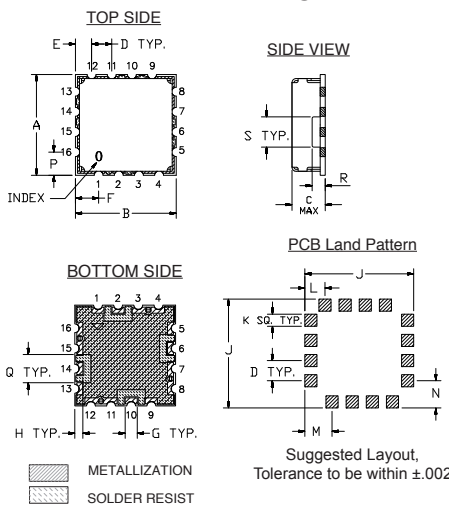
Operating Temperature	-55°C to 85°C
Storage Temperature	-55°C to 85°C
Absolute Max. Supply Voltage(V+)	12V
Absolute Max. Control Voltage(Vctrl)	20V
Absolute Max. RF Input Level	+30 dBm

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

Pin Connections

RF IN	2
RF OUT	10
V CONTROL	6
V+	14
GROUND	1,3,4,5,7,8,9,11,12,13,15,16

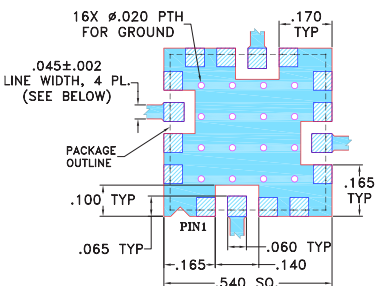
Outline Drawing



Outline Dimensions (inch/mm)

A	B	C	D	E	F	G	H	J
.500	.500	.195	.100	.080	.115	.060	.040	.540
12.70	12.70	4.95	2.54	2.03	2.92	1.52	1.02	13.72
K	L	M	N	P	Q	R	S	wt
.060	.100	.135	.135	.115	.140	.070	.150	grams
1.52	2.54	3.43	3.43	2.92	3.56	1.78	3.81	1.0

Demo Board MCL P/N: TB-163 Suggested PCB Layout (PL-040)



- NOTE:
- TRACE WIDTH IS SHOWN FOR FR4 WITH DIELECTRIC THICKNESS 0.025" ± 0.0025"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
 - BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
 - DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
 - DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Features

- Frequency range, 150-2000 MHz
- High RF Input level, +31dBm Max.
- High IP3, +55 dBm typ.
- Fast Rise/Fall Time, 5μSec/4μSec Typ.
- Good VSWR at IN/OUT ports over attenuation range
- Minimal phase deviation over attenuation range
- No external bias and RF matching network required
- Shielded case
- Aqueous washable



CASE STYLE: DV874

+RoHS Compliant

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

Applications

- Power level control
- Feed forward amplifiers

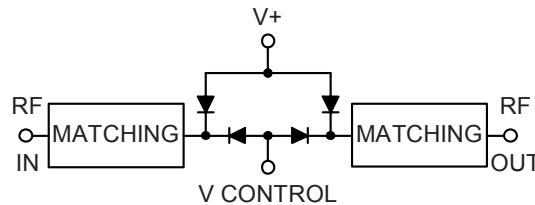
Electrical Specifications (T_{AMB} = 25°C)

FREQ. (MHz)	MIN. INSERTION LOSS, dB (+17V)		MAX. ATTENUATION dB (0V)		INPUT POWER (dBm)	CONTROL Voltage Current (V) (mA)		IP3 (dBm)	RETURN LOSS (dB)	POWER SUPPLY Voltage Current (V) (mA)	
	Min.	Max.	Typ.	Max.		Typ.	Max.			Typ.	Max.
150 - 500	2.8	3.5	46	34	+30	0 - 17	30	53	23	+5	10
500 - 1500	3.0	4.5	35	23	+30	0 - 17	30	56	22	+5	10
1500 - 2000	3.5	5.0	29	20	+30	0 - 17	30	57	21	+5	10

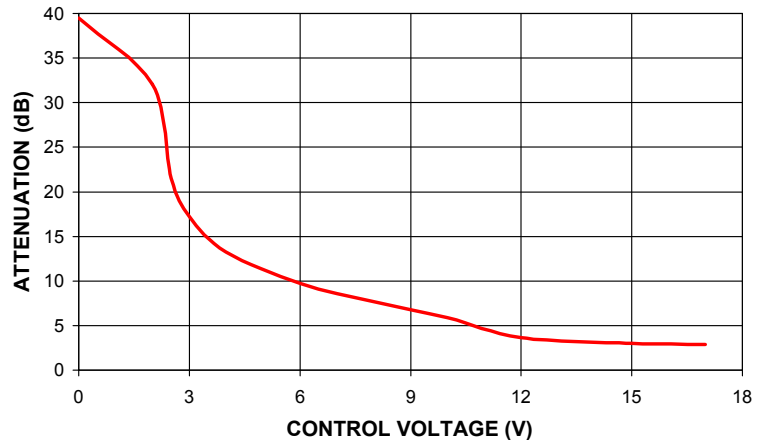
Notes:

- Rise/Fall time: 5μSec/4μSec Typ.
- Switching Time, turn on/off: 6μSec. Typ.

Equivalent Schematic



RVA-2000+ TYPICAL ATTENUATION AT 500 MHz

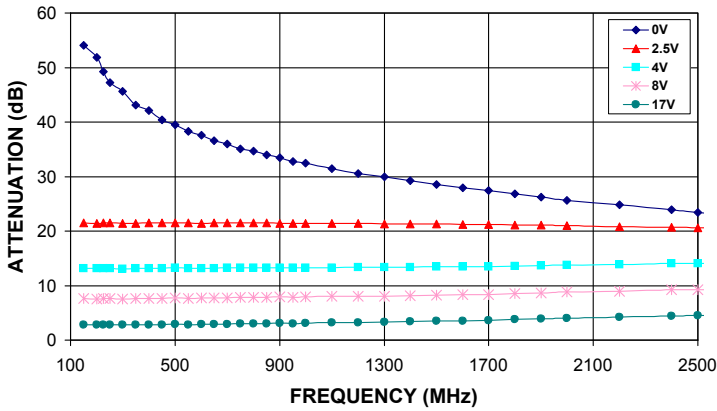


Notes

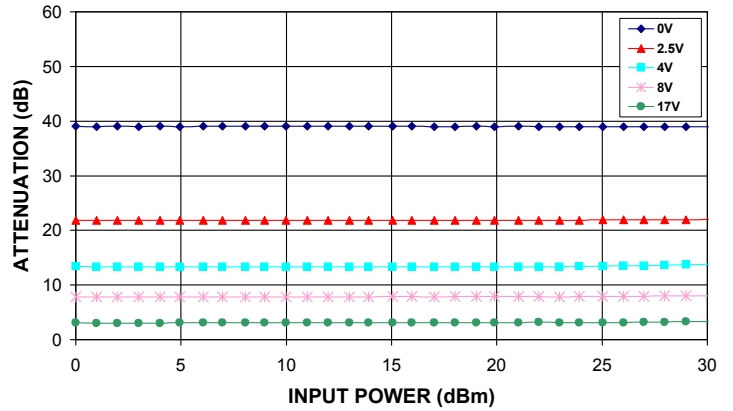
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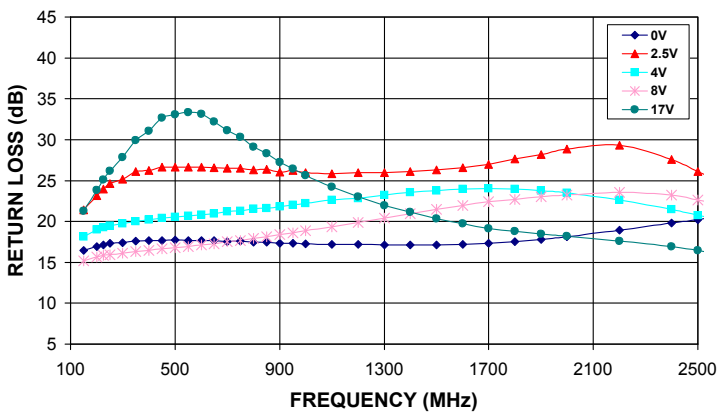
RVA-2000+
ATTENUATION Vs. FREQUENCY
OVER CONTROL VOLTAGES



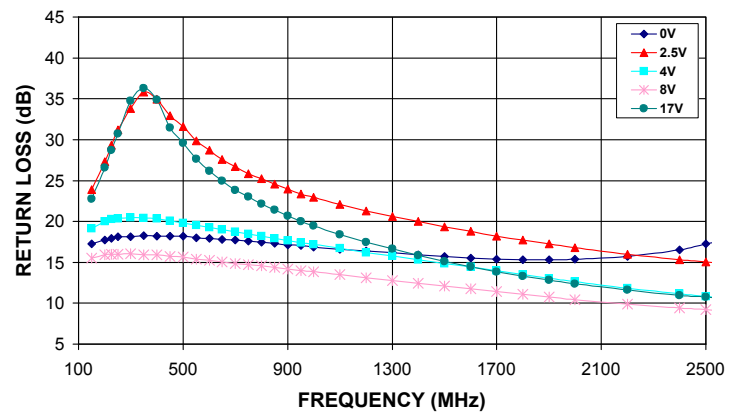
RVA-2000+
ATTENUATION Vs. INPUT POWER
OVER CONTROL VOLTAGES AT 500MHz



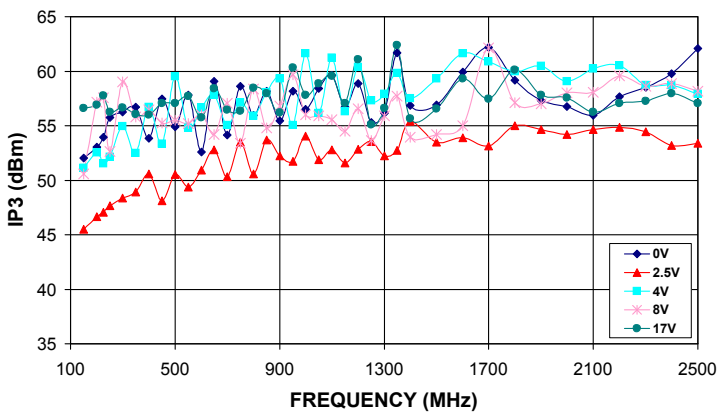
RVA-2000+
INPUT RETURN LOSS Vs. FREQUENCY
OVER CONTROL VOLTAGES



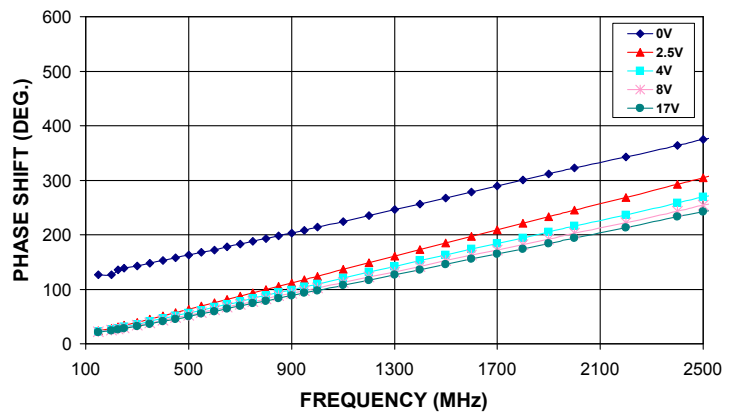
RVA-2000+
OUTPUT RETURN LOSS Vs. FREQUENCY
OVER CONTROL VOLTAGES



RVA-2000+
IP3 Vs. FREQUENCY
OVER CONTROL VOLTAGES



RVA-2000+
PHASE SHIFT Vs. FREQUENCY
OVER CONTROL VOLTAGES



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Voltage Variable Attenuator

RVA-2000+

Typical Performance Data

V CONTROL (V)	ATTENUATION @ 500 MHz (dB) @V+=5V
0.0	39.46
2.0	32.06
2.5	21.49
3.0	17.24
4.0	13.22
6.0	9.73
8.0	7.71
10.0	5.88
12.0	3.68
15.0	3.01
17.0	2.88

FREQ. (MHz)	ATTENUATION vs. V CONTROL @ V+=5V				
	(dB)				
	@V Control=0V	@V Control=2.5V	@V Control=4V	@V Control=8V	@V Control=17V
150	54.05	21.54	13.20	7.63	2.80
200	51.81	21.42	13.14	7.58	2.77
225	49.27	21.48	13.16	7.60	2.78
250	47.19	21.48	13.19	7.63	2.80
300	45.65	21.41	13.11	7.57	2.78
350	43.14	21.43	13.16	7.63	2.81
400	42.09	21.46	13.16	7.63	2.82
450	40.42	21.47	13.20	7.68	2.85
500	39.46	21.49	13.22	7.71	2.88
550	38.29	21.46	13.16	7.66	2.86
600	37.59	21.45	13.20	7.72	2.90
650	36.60	21.47	13.19	7.72	2.92
700	35.94	21.47	13.23	7.78	2.95
750	35.10	21.47	13.24	7.79	2.97
800	34.66	21.47	13.26	7.83	3.01
850	33.94	21.46	13.25	7.83	3.01
900	33.44	21.44	13.26	7.89	3.08
950	32.75	21.39	13.22	7.82	3.03
1000	32.42	21.44	13.30	7.96	3.14
1100	31.50	21.39	13.31	7.99	3.18
1200	30.60	21.41	13.32	8.01	3.23
1300	29.91	21.35	13.33	8.07	3.31
1400	29.26	21.26	13.38	8.19	3.43
1500	28.58	21.27	13.43	8.28	3.51
1600	27.98	21.21	13.44	8.32	3.56
1700	27.41	21.16	13.44	8.36	3.64
1800	26.82	21.14	13.56	8.56	3.81
1900	26.25	21.06	13.65	8.69	3.92
2000	25.66	21.00	13.74	8.80	4.01
2200	24.79	20.84	13.82	8.95	4.21
2400	23.90	20.69	14.04	9.25	4.47
2500	23.46	20.58	14.08	9.29	4.53

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Voltage Variable Attenuator

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Typical Performance Data

FREQ. (MHz)	INPUT RETURN LOSS Vs. V CONTROL @ V+=5V				
	(dB)				
	@V Control=0V	@V Control=2.5V	@V Control=4V	@V Control=8V	@V Control=17V
150	16.45	21.41	18.12	15.20	21.25
200	16.90	23.13	18.97	15.68	23.82
225	17.14	23.95	19.28	15.85	25.08
250	17.33	24.61	19.46	15.94	26.18
300	17.39	25.20	19.77	16.15	27.85
350	17.59	26.08	20.04	16.33	29.94
400	17.65	26.25	20.21	16.48	31.06
450	17.69	26.61	20.42	16.66	32.68
500	17.72	26.66	20.53	16.79	33.10
550	17.66	26.66	20.68	16.94	33.33
600	17.65	26.64	20.81	17.10	33.12
650	17.63	26.57	20.95	17.28	32.18
700	17.55	26.48	21.20	17.52	31.15
750	17.57	26.54	21.30	17.69	30.31
800	17.47	26.31	21.53	17.95	29.09
850	17.49	26.39	21.64	18.11	28.34
900	17.33	26.07	21.85	18.38	27.22
950	17.35	26.26	22.02	18.59	26.42
1000	17.25	25.95	22.22	18.86	25.63
1100	17.17	25.87	22.59	19.36	24.24
1200	17.19	25.94	22.85	19.85	23.00
1300	17.14	25.99	23.21	20.40	21.96
1400	17.11	26.08	23.55	20.94	21.15
1500	17.16	26.28	23.78	21.46	20.37
1600	17.22	26.56	23.99	21.98	19.71
1700	17.32	26.96	24.05	22.40	19.17
1800	17.54	27.62	23.96	22.70	18.78
1900	17.79	28.20	23.79	23.02	18.45
2000	18.14	28.85	23.48	23.23	18.19
2200	18.96	29.34	22.64	23.58	17.58
2400	19.84	27.58	21.45	23.23	16.93
2500	20.19	26.14	20.75	22.64	16.44

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Typical Performance Data

FREQ. (MHz)	OUTPUT RETURN LOSS Vs. V CONTROL @ V+=5V				
	(dB)				
	@V Control=0V	@V Control=2.5V	@V Control=4V	@V Control=8V	@V Control=17V
150	17.23	23.89	19.11	15.54	22.73
200	17.70	27.32	20.02	15.93	26.59
225	17.95	29.29	20.28	16.02	28.73
250	18.11	31.19	20.35	16.01	30.75
300	18.15	33.80	20.48	16.03	34.74
350	18.26	35.84	20.38	15.94	36.29
400	18.22	34.95	20.34	15.91	34.91
450	18.20	32.92	20.08	15.75	31.47
500	18.17	31.60	19.84	15.62	29.59
550	18.01	29.84	19.55	15.41	27.64
600	17.93	28.70	19.27	15.24	26.17
650	17.82	27.58	19.01	15.08	24.99
700	17.72	26.70	18.73	14.88	23.86
750	17.60	25.87	18.46	14.72	23.00
800	17.46	25.21	18.23	14.56	22.17
850	17.35	24.55	17.94	14.36	21.41
900	17.13	23.94	17.68	14.17	20.71
950	17.03	23.36	17.37	13.96	19.99
1000	16.88	22.98	17.20	13.83	19.50
1100	16.61	22.08	16.73	13.49	18.41
1200	16.39	21.29	16.21	13.12	17.48
1300	16.16	20.62	15.78	12.80	16.63
1400	15.93	19.98	15.35	12.47	15.85
1500	15.72	19.35	14.88	12.13	15.13
1600	15.55	18.79	14.42	11.78	14.46
1700	15.39	18.22	13.95	11.44	13.85
1800	15.31	17.70	13.49	11.10	13.30
1900	15.30	17.24	13.07	10.79	12.81
2000	15.37	16.80	12.63	10.46	12.35
2200	15.72	15.98	11.85	9.91	11.61
2400	16.52	15.34	11.15	9.42	10.99
2500	17.25	15.05	10.84	9.21	10.73

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Typical Performance Data

FREQ. (MHz)	INPUT IP3 Vs. V CONTROL @ V+=5V				
	(dBm)				
	@V Control=0V	@V Control=2.5V	@V Control=4V	@V Control=8V	@V Control=17V
150	52.02	45.52	51.14	50.60	56.63
200	53.05	46.65	52.56	57.14	56.91
225	53.92	47.04	51.54	57.56	57.78
250	55.74	47.67	52.16	52.66	56.25
300	56.28	48.35	54.97	59.04	56.65
350	56.69	48.92	52.51	55.79	56.04
400	53.86	50.60	56.69	56.44	56.00
450	57.47	48.10	53.35	55.25	57.08
500	54.92	50.55	59.53	55.52	57.04
550	57.83	49.36	54.79	55.22	57.69
600	52.60	50.95	56.66	56.02	55.77
650	59.09	52.77	57.79	54.19	58.41
700	54.14	50.32	55.04	57.06	56.48
750	58.60	53.47	57.10	53.38	56.35
800	55.97	50.58	55.91	58.35	58.46
850	58.16	53.67	58.08	54.82	57.97
900	55.43	52.25	59.32	56.81	56.19
950	58.18	51.75	55.04	59.66	60.31
1000	56.53	54.03	61.64	56.03	57.82
1050	58.41	51.89	56.18	55.89	58.88
1100	59.63	52.78	61.22	55.57	59.58
1150	56.70	51.60	56.30	54.48	57.06
1200	58.88	52.82	60.37	56.54	61.06
1250	55.32	53.53	57.33	53.65	55.08
1300	56.14	52.24	57.93	55.91	56.59
1350	61.69	52.72	59.80	57.71	62.37
1400	56.87	55.38	57.49	53.95	55.67
1500	56.89	53.49	59.34	54.19	56.56
1600	59.91	53.90	61.62	55.02	59.31
1700	62.20	53.14	60.89	62.12	57.47
1800	59.15	55.01	59.99	57.13	60.13
1900	57.30	54.65	60.48	56.99	57.82
2000	56.76	54.20	59.06	57.99	57.58
2100	55.94	54.66	60.22	58.05	56.25
2200	57.64	54.85	60.54	59.59	57.08
2300	58.54	54.45	58.70	58.62	57.27
2400	59.79	53.20	58.73	58.87	57.95
2500	62.09	53.39	57.92	58.16	57.07

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Typical Performance Data

FREQ. (MHz)	PHASE SHIFT Vs. V CONTROL @ V+=5V				
	(deg)				
	@V Control=0V	@V Control=2.5V	@V Control=4V	@V Control=8V	@V Control=17V
150	126.49	23.62	22.52	22.25	21.10
200	126.86	28.14	26.35	25.56	24.24
225	135.90	31.02	28.62	27.41	26.10
250	138.92	33.96	31.07	29.55	28.05
300	143.16	39.14	35.65	33.75	32.14
350	148.02	45.26	40.82	38.38	36.52
400	152.63	51.00	45.87	43.04	41.01
450	157.85	57.25	51.36	48.08	45.67
500	162.75	63.15	56.47	52.72	50.27
550	167.46	68.98	61.66	57.62	54.88
600	172.10	74.96	66.85	62.37	59.57
650	177.64	81.18	72.39	67.51	64.34
700	182.55	87.30	77.69	72.41	69.14
750	187.73	93.63	83.27	77.64	73.92
800	193.00	99.47	88.35	82.24	78.64
850	198.26	105.87	94.23	87.94	83.61
900	203.19	111.60	98.82	92.02	88.10
950	208.07	117.81	104.75	97.80	93.09
1000	214.39	123.85	109.66	102.15	97.80
1100	224.31	136.23	120.60	112.46	107.53
1200	235.64	148.55	131.24	122.30	116.95
1300	245.94	160.62	141.70	132.10	126.39
1400	255.95	172.69	152.31	142.00	136.02
1500	267.78	185.10	163.18	152.37	145.84
1600	278.55	197.04	173.80	162.50	155.43
1700	289.21	208.82	183.94	172.07	164.66
1800	300.74	221.07	194.34	181.87	174.34
1900	311.31	233.11	205.04	192.28	184.30
2000	322.12	245.33	215.92	202.72	194.10
2200	342.69	268.64	236.43	222.19	212.71
2400	364.18	292.67	258.34	243.58	232.89
2500	374.67	304.63	269.21	253.97	242.65

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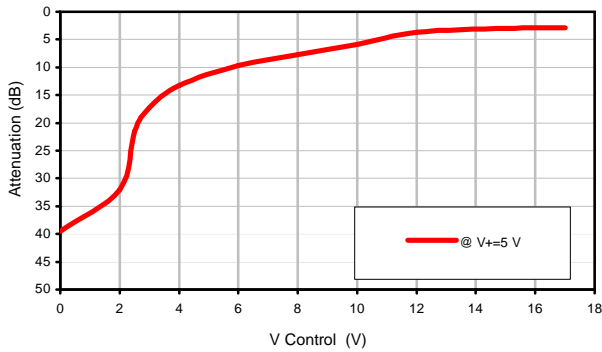


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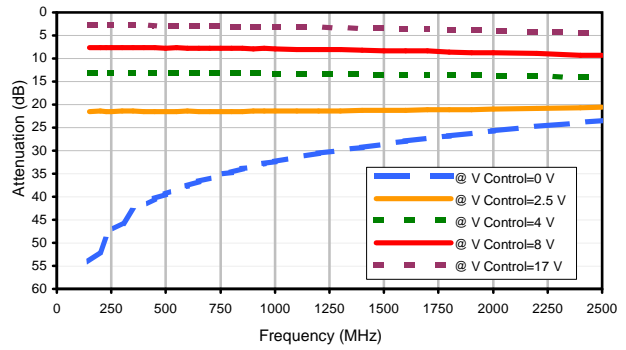
Typical Performance Curves

RVA-2000+

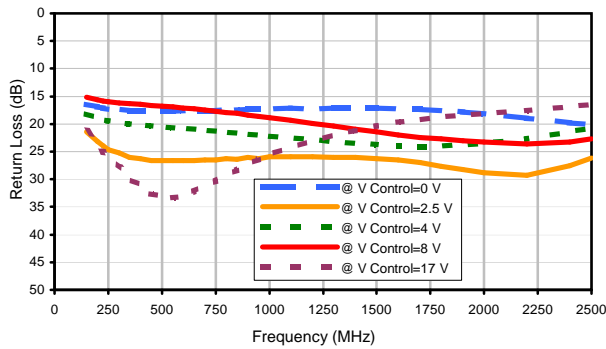
Attenuation @ 500 MHz



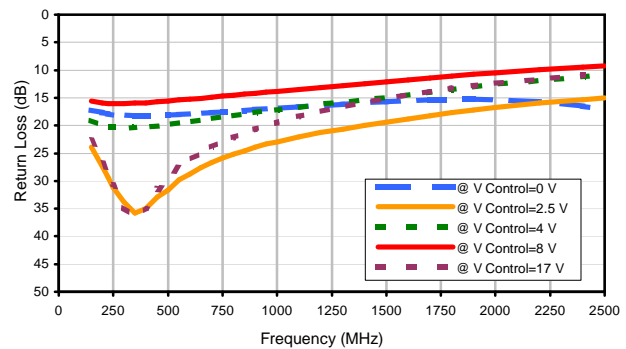
Attenuation @ V+=5 V



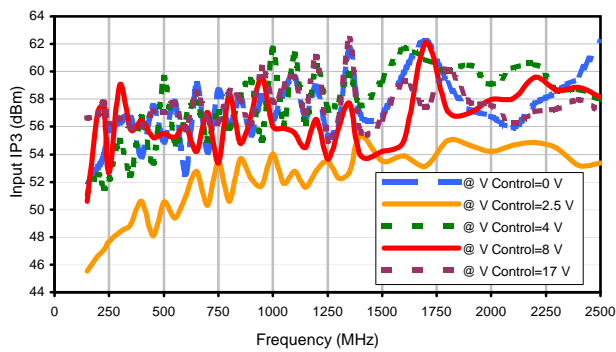
Input Return Loss @ V+=5 V



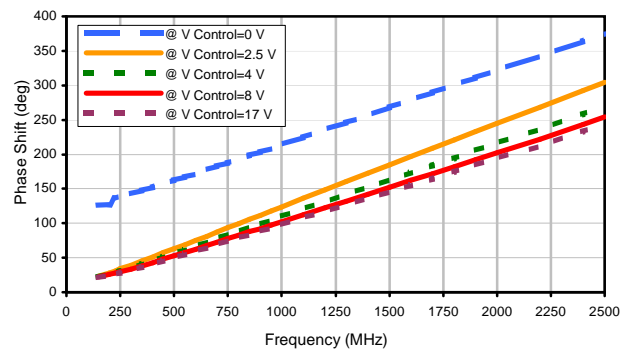
Output Return Loss @ V+=5 V



Input IP3 @ V+=5 V



Phase Shift @ V+=5 V



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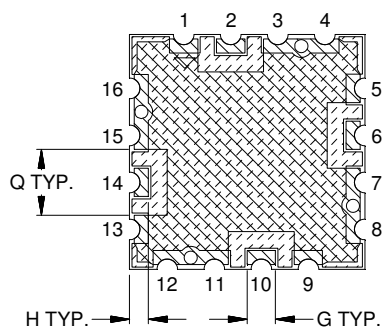
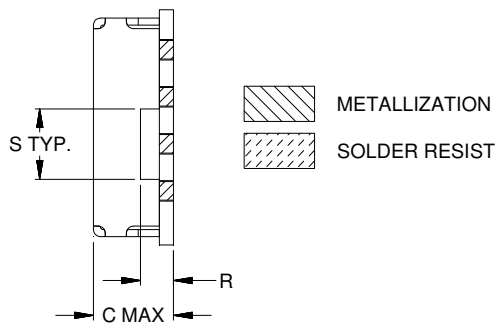
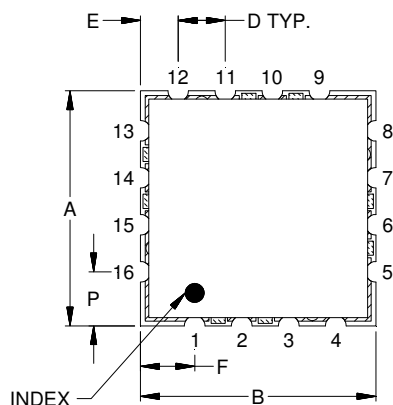


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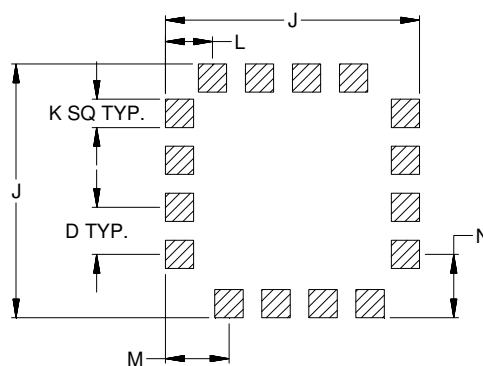


Outline Dimensions

DV874



PCB Land Pattern



Suggested Layout,
Tolerance to be within ± 0.02

CASE#	A	B	C	D	E	F	G	H	J	K	L	M
DV874	.500 (12.70)	.500 (12.70)	.195 (4.95)	.100 (2.54)	.080 (2.03)	.115 (2.92)	.060 (1.52)	.040 (1.02)	.540 (13.72)	.060 (1.52)	.100 (2.54)	.135 (3.43)

CASE#	N	P	Q	R	S	WT.GRAM
DV874	.135 (3.43)	.115 (2.92)	.140 (3.56)	.070 (1.78)	.150 (3.81)	1.0

Dimensions are in inches (mm). Tolerances: 2Pl. $\pm .03$; 3Pl. $\pm .015$

Notes:

- Case material: Nickel-Silver alloy.
- Base: Printed wiring laminate.
- Termination finish:
 - For RoHS Case Styles: 3-5 μ inch (.08-.13 microns) Gold over 120-240 μ inch (3.05-6.10 microns) Nickel plate.
 - For RoHS-5 Case Styles: Tin-Lead plate.



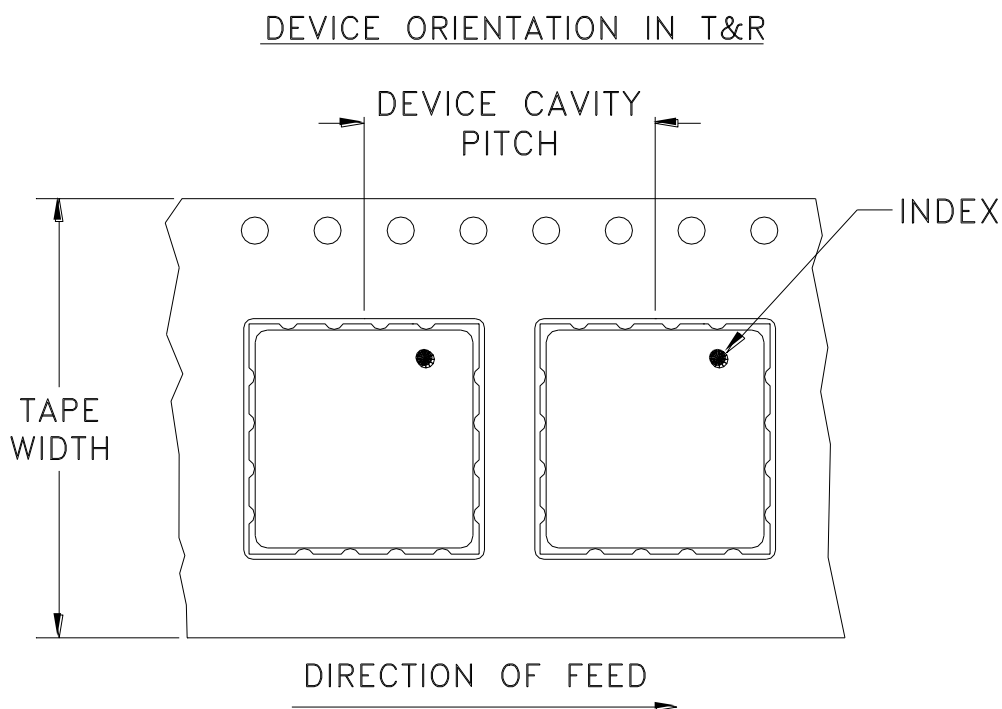
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

RF/IF MICROWAVE COMPONENTS

Tape & Reel Packaging TR-F37



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
24	16	7	Small quantity standards (see note)	10
				20
				50
				100
		13	Standard	200
			500	

Note: Please consult individual model data sheet to determine device per reel availability.

Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: www.minicircuits.com/pages/pdfs/tape.pdf



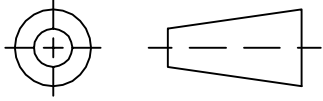
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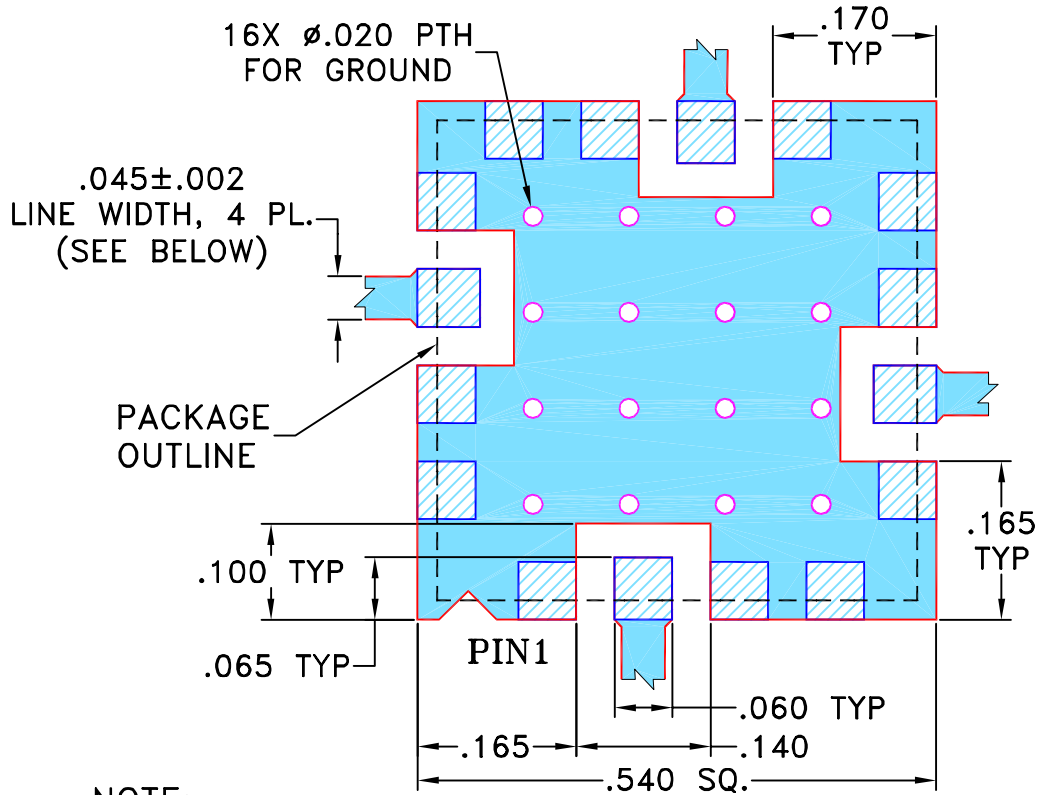
THIRD ANGLE PROJECTION



REVISIONS

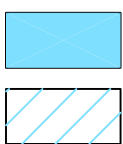
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
A	M94233	CHANGE LINE WIDTH	09/04	RZ	HH
B	M101567	ADD CS: DV874	10/05	DK	HH
B	R82061	ADD CS: DV874	10/05	DK	HH
C	M102713	ADDED "...WITH SMOBC"	01/12/06	GF	IL

SUGGESTED MOUNTING CONFIGURATION FOR DV894 & DV897 CASE STYLES, "np" PIN CONNECTION



NOTE:

1. TRACE WIDTH IS SHOWN FOR FR4 WITH DIELECTRIC THICKNESS 0.025" ± 0.0025"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.



DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED	INITIALS		DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005 ANGLES ± FRACTIONS ±	DRAWN	DK (RAVON)	28 OCT 05
	CHECKED	RZ (RAVON)	28 OCT 05
	APPROVED	HH (RAVON)	28 OCT 05



Mini-Circuits®

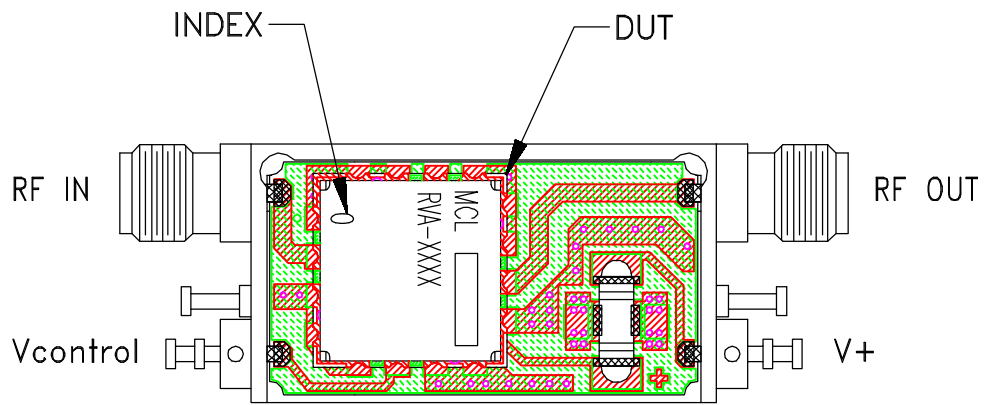
13 Neptune Avenue
Brooklyn NY 11235

PL, np, DV894/897, RVA, TB-163

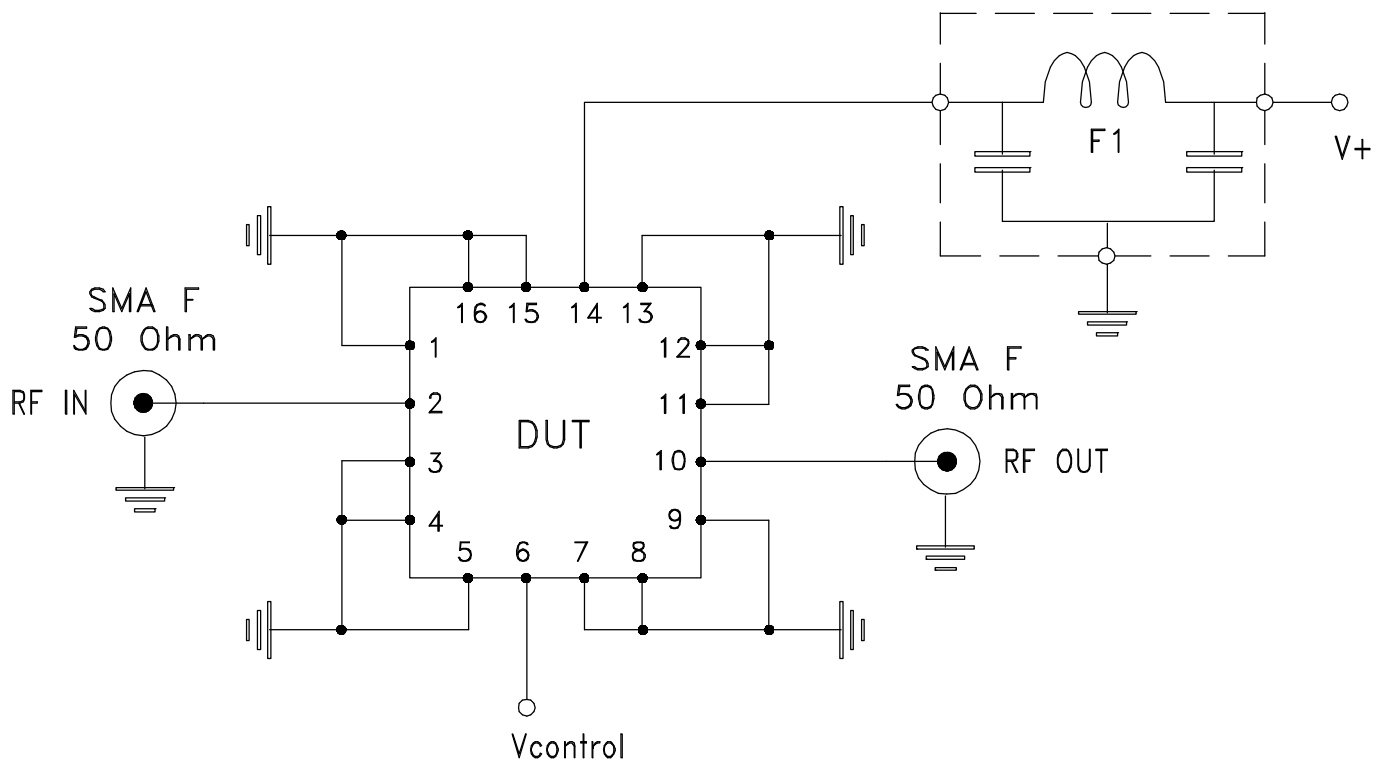
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SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-040	C
FILE:	98PL040	SCALE:	5:1
		SHEET:	1 OF 1

Evaluation Board and Circuit



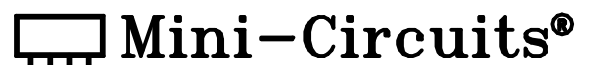
TB-163



Schematic Diagram

Notes:

1. SMA Female connectors.
2. PCB Material: ROGERS R04350B or equivalent, Dielectric Constant=4.5, Thickness=.020 inch.



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	-55° to 85°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 85° C Ambient Environment	Individual Model Data Sheet
Humidity	90 to 95% RH, 240 hours, 50°C	MIL-STD-202, Method 103, Condition A, Except 50°C and end-point electrical test done within 12 hours
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Solder Reflow Heat	Sn-Pb Eutectic Process: 225°C peak Pb-Free Process, 245°C peak	J-STD-020, Table 4-1, 4-2 and 5-2, Figure 5-1
Solderability	10X Magnification	J-STD-002, Para 4.2.5, Test S, 95% Coverage
Vibration (High Frequency)	20g peak, 20-2000 Hz, 4 times in each of three axes (total 12)	MIL-STD-883, Method 2007.3, Condition A
Mechanical Shock	50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes	MIL-STD-202, Method 213, Condition A
Marking Resistance to Solvents	Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C	MIL-STD-202, Method 215