

Voltage Variable Attenuator

RVA-33+

50Ω 20 to 3000 MHz

The Big Deal

- Broad band, 20 to 3000 MHz
- High linearity: IP2 +85 dBm, IP3 +50 dBm
- Well matched in/out ports, return loss 18 dB
- Drop-in, no external matching circuits required



CASE STYLE: DV874

Product Overview

The RVA-33+ is a Voltage Variable 50Ω matched Attenuator built into a shielded (0.500" x 0.500" x 0.195") case. The model utilizes well matched PIN diodes, carefully biased in order to enable over 40 dB of attenuation range control while maintaining very good input & output port matching.

Key Features

Feature	Advantages
High Linearity: IP2 +85 dBm typ. IP3 +50 dBm typ.	Low distortion enabling improved system performance.
Minimal phase deviation over attenuation range	Can provide low signal distortion over attenuation range.
Return Loss	18 dB typ return loss across frequency and control voltage ranges provides an excellent match under all operating conditions allowing for straightforward cascading.
Attenuation 40 dB typ. up to 1500 MHz	Very useable for adjusting signal strength and increasing dynamic range.

Notes

A. 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.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp



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Broad Band Voltage Variable Attenuator

RVA-33+

50Ω 20 to 3000 MHz

Maximum Ratings

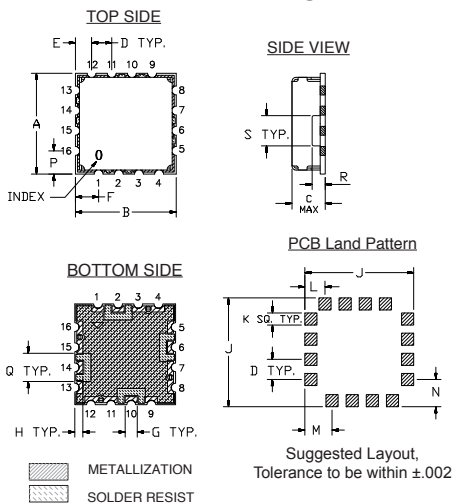
Operating Temperature	-55°C to 85°C
Storage Temperature	-55°C to 85°C
Absolute Max. Supply Voltage(V ₊)	6.0V
Absolute Max. Control Voltage(V _{ctrl})	5.5V
Absolute Max. RF Input Level	+23dBm

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

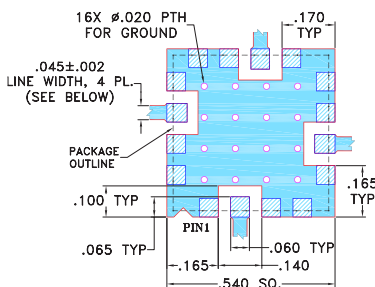
Outline Drawing



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

Features

- Broadband, 20-3000 MHz
- 40 dB attenuation @1500 MHz
- IP3, +50 dBm typ.
- IP2, +85 dBm typ.
- Minimal phase deviation over attenuation range
- No external bias and RF matching network required
- Shielded case
- Aqueous washable

Applications

- WiMAX 2.5GHz
- Power level control
- Feed forward amplifier
- Test equipment



CASE STYLE: DV874

+RoHS Compliant

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

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

FREQ. (MHz)		MIN. INSERTION LOSS, dB (+5V)		MAX. ATTEN. dB (0V)		INPUT POWER (dBm)	CONTROL Voltage Current (V) (mA)		IP3* (dBm)	IP2* (dBm)	RETURN LOSS (dB)	POWER SUPPLY Voltage Current (V) (mA)	
Min.	Max.	Typ.	Max.	Typ.	Min.	Max.		Max.	Typ.	Typ.	Typ.		Max.
20 - 500		2.3	3.5	55	40	+23	0 - 5	45	48	75	21	+5	5
500 - 1500		2.3	3.5	43	35	+23	0 - 5	45	55	90	19	+5	5
1500 - 3000		3.0	4.5	37	30	+23	0 - 5	45	55	92	16	+5	5

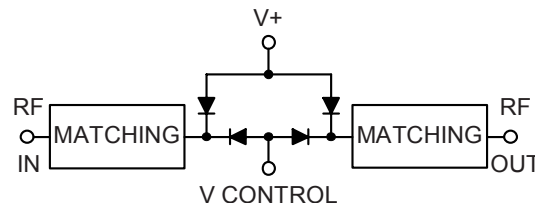
Notes:

Rise/Fall time: 12 / 3 μSec Typ.

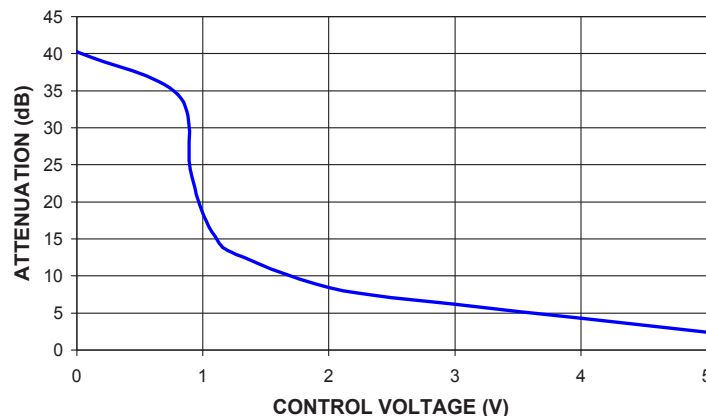
Switching Time, turn on/off time: 15 / 55 μSec. Typ.

* Typical IP2 & IP3 @ V_c = 5V

Equivalent Schematic



RVA-33+ TYPICAL ATTENUATION AT 1500 MHz



Notes

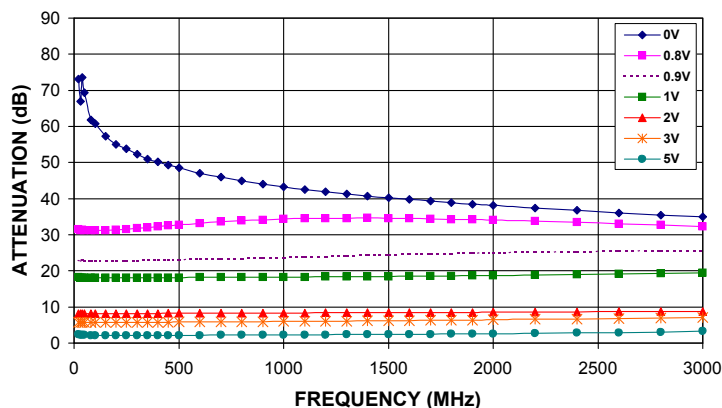
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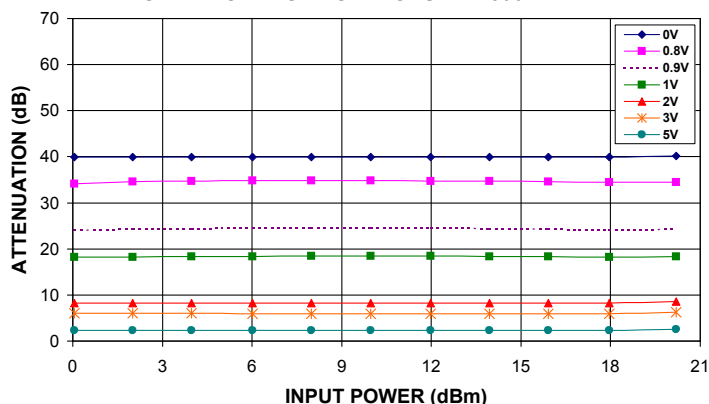
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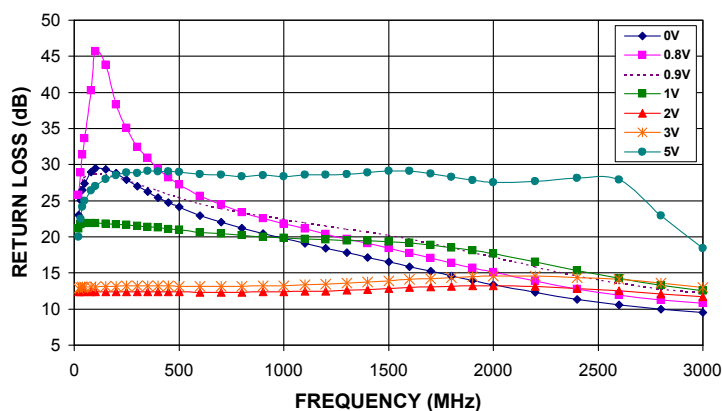
**RVA-33+
ATTENUATION Vs. FREQUENCY
OVER CONTROL VOLTAGES**



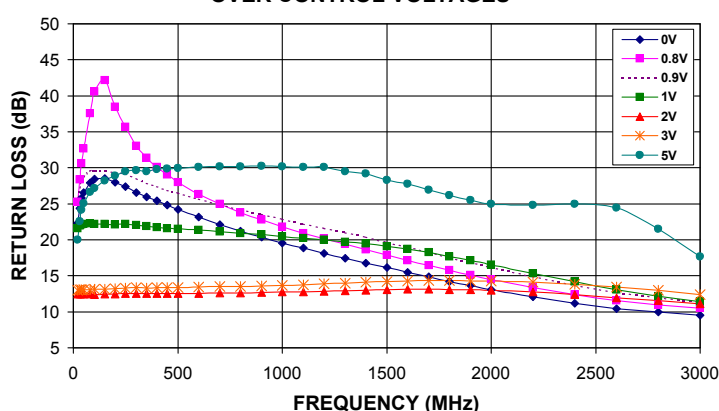
**RVA-33+
ATTENUATION Vs. INPUT POWER
OVER CONTROL VOLTAGES AT 1500 MHz**



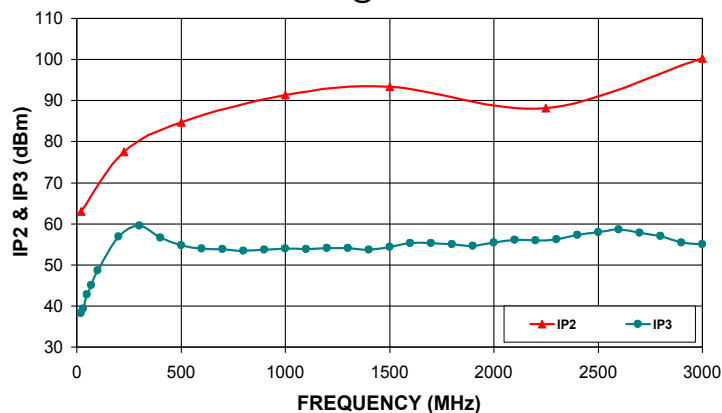
**RVA-33+
INPUT RETURN LOSS Vs. FREQUENCY
OVER CONTROL VOLTAGES**



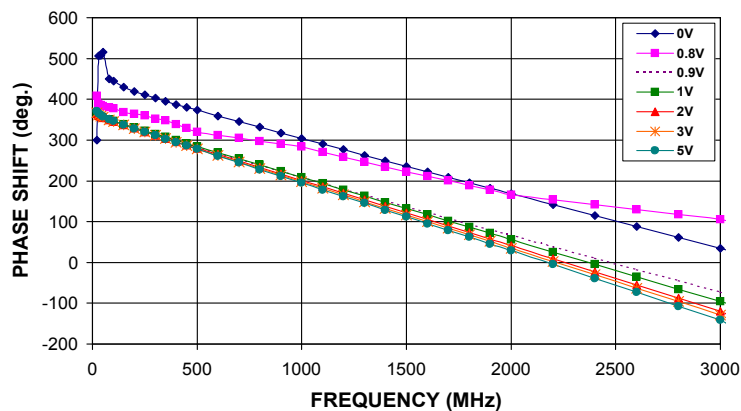
**RVA-33+
OUTPUT RETURN LOSS Vs. FREQUENCY
OVER CONTROL VOLTAGES**



**RVA-33+
IP2 & IP3 Vs. FREQUENCY
@ Vc=5V**



**RVA-33+
PHASE SHIFT Vs. FREQUENCY
OVER CONTROL VOLTAGES**



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Typical Performance Data

V CONTROL (V)	ATTENUATION @ 1500 MHz (dB) @V+=5V
0.0	40.25
0.8	34.54
0.9	24.40
1.0	18.43
1.1	15.28
1.2	13.38
2.0	8.43
3.0	6.17
4.0	4.29
5.0	2.41

FREQ. (MHz)	ATTENUATION Vs. V CONTROL @ V+=5V						
	(dB)						
	@V Control=0V	@V Control=0.8V	@V Control=0.9V	@V Control=1V	@V Control=2V	@V Control=3V	@V Control=5V
20	73.07	31.56	22.88	18.19	8.15	5.78	2.47
30	66.89	31.26	22.81	18.16	8.14	5.73	2.30
40	73.63	31.34	22.84	18.16	8.15	5.73	2.25
50	69.36	31.23	22.81	18.14	8.13	5.71	2.20
80	61.78	31.23	22.78	18.12	8.12	5.70	2.15
100	60.73	31.24	22.79	18.11	8.14	5.71	2.13
150	57.22	31.26	22.76	18.10	8.15	5.70	2.10
200	55.09	31.40	22.76	18.10	8.15	5.71	2.09
250	53.77	31.55	22.79	18.11	8.16	5.73	2.09
300	52.26	31.76	22.82	18.10	8.17	5.75	2.09
350	51.01	31.97	22.86	18.11	8.19	5.75	2.09
400	50.17	32.25	22.90	18.12	8.20	5.77	2.10
450	49.29	32.49	22.96	18.13	8.22	5.79	2.12
500	48.47	32.72	23.00	18.15	8.23	5.81	2.13
600	47.08	33.15	23.15	18.17	8.26	5.85	2.17
700	45.96	33.55	23.27	18.20	8.29	5.88	2.19
800	44.96	33.87	23.39	18.22	8.31	5.91	2.21
900	44.07	34.11	23.52	18.24	8.32	5.94	2.23
1000	43.30	34.34	23.68	18.27	8.34	5.97	2.26
1100	42.56	34.45	23.82	18.28	8.35	6.01	2.28
1200	41.91	34.58	23.96	18.32	8.38	6.05	2.31
1300	41.31	34.59	24.11	18.35	8.39	6.08	2.34
1400	40.76	34.61	24.24	18.39	8.40	6.12	2.36
1500	40.25	34.54	24.40	18.43	8.43	6.17	2.41
1600	39.77	34.48	24.52	18.47	8.45	6.21	2.44
1700	39.32	34.41	24.64	18.54	8.47	6.26	2.48
1800	38.89	34.27	24.78	18.58	8.50	6.31	2.51
1900	38.47	34.15	24.89	18.63	8.51	6.37	2.55
2000	38.13	34.02	25.02	18.70	8.55	6.44	2.61
2200	37.39	33.72	25.22	18.83	8.61	6.56	2.70
2400	36.76	33.43	25.39	19.00	8.66	6.68	2.79
2600	36.02	33.03	25.51	19.15	8.70	6.80	2.91
2800	35.49	32.70	25.61	19.33	8.76	6.93	3.06
3000	34.98	32.28	25.59	19.50	8.81	7.06	3.26

Typical Performance Data

FREQ. (MHz)	INPUT RETURN LOSS Vs. V CONTROL @ V+=5V						
	(dB)						
	@V Control=0V	@V Control=0.8V	@V Control=0.9V	@V Control=1V	@V Control=2V	@V Control=3V	@V Control=5V
20	22.98	25.81	24.89	21.16	12.35	12.86	19.98
30	25.06	28.86	26.69	21.72	12.42	13.02	22.51
40	26.46	31.41	27.77	21.88	12.43	13.08	24.15
50	27.37	33.62	28.25	21.91	12.40	13.06	25.00
80	28.95	40.29	28.80	21.92	12.39	13.07	26.39
100	29.50	45.74	28.71	21.86	12.38	13.09	27.01
150	29.35	43.79	28.60	21.81	12.39	13.13	28.02
200	28.82	38.34	28.22	21.71	12.40	13.15	28.50
250	27.94	35.11	27.95	21.66	12.41	13.18	28.92
300	27.00	32.44	27.34	21.53	12.40	13.19	28.85
350	26.29	30.92	26.87	21.38	12.40	13.18	29.10
400	25.44	29.41	26.40	21.27	12.39	13.19	29.07
450	24.76	28.24	25.87	21.08	12.37	13.18	29.07
500	24.11	27.27	25.44	20.96	12.36	13.17	28.96
600	22.97	25.63	24.57	20.64	12.33	13.15	28.70
700	22.03	24.42	23.91	20.42	12.34	13.15	28.59
800	21.21	23.42	23.33	20.20	12.32	13.16	28.40
900	20.45	22.56	22.85	20.02	12.35	13.22	28.48
1000	19.79	21.83	22.38	19.86	12.37	13.25	28.34
1100	19.12	21.12	21.96	19.73	12.43	13.35	28.60
1200	18.45	20.41	21.50	19.59	12.49	13.43	28.60
1300	17.78	19.73	21.09	19.50	12.58	13.56	28.65
1400	17.12	19.06	20.69	19.44	12.72	13.74	28.89
1500	16.50	18.42	20.26	19.35	12.86	13.93	29.15
1600	15.87	17.77	19.73	19.14	12.96	14.09	29.12
1700	15.22	17.07	19.13	18.86	13.05	14.23	28.71
1800	14.58	16.37	18.48	18.52	13.14	14.37	28.32
1900	13.95	15.69	17.82	18.12	13.21	14.49	27.86
2000	13.40	15.08	17.19	17.66	13.24	14.58	27.52
2200	12.32	13.89	15.85	16.51	13.11	14.56	27.67
2400	11.31	12.76	14.58	15.30	12.85	14.36	28.14
2600	10.56	11.94	13.61	14.27	12.57	14.12	27.94
2800	9.94	11.27	12.75	13.28	12.11	13.58	22.91
3000	9.50	10.80	12.17	12.56	11.72	12.99	18.38

Typical Performance Data

FREQ. (MHz)	OUTPUT RETURN LOSS Vs. V CONTROL @ V+=5V						
	(dB)						
	@V Control=0V	@V Control=0.8V	@V Control=0.9V	@V Control=1V	@V Control=2V	@V Control=3V	@V Control=5V
20	22.35	25.29	25.12	21.60	12.48	12.96	20.02
30	24.40	28.34	27.14	21.97	12.47	13.06	22.53
40	25.77	30.63	28.10	22.10	12.45	13.08	24.13
50	26.58	32.66	28.77	22.21	12.44	13.08	25.05
80	27.95	37.56	29.57	22.23	12.43	13.10	26.63
100	28.43	40.59	29.55	22.17	12.42	13.11	27.15
150	28.52	42.13	29.53	22.15	12.44	13.17	28.18
200	28.02	38.50	29.34	22.14	12.48	13.23	28.88
250	27.38	35.69	29.11	22.16	12.51	13.29	29.47
300	26.59	33.07	28.55	22.06	12.53	13.33	29.63
350	25.96	31.37	27.86	21.86	12.51	13.32	29.53
400	25.40	30.12	27.38	21.74	12.51	13.33	29.78
450	24.84	29.02	26.83	21.58	12.51	13.33	29.84
500	24.20	28.01	26.51	21.54	12.54	13.37	29.95
600	23.14	26.36	25.67	21.33	12.56	13.42	30.13
700	22.13	24.96	24.90	21.11	12.61	13.49	30.19
800	21.21	23.75	24.15	20.89	12.64	13.54	30.20
900	20.40	22.77	23.55	20.73	12.70	13.63	30.26
1000	19.58	21.79	22.84	20.46	12.74	13.69	30.19
1100	18.84	20.91	22.18	20.21	12.79	13.77	30.08
1200	18.15	20.14	21.58	19.99	12.87	13.88	30.11
1300	17.47	19.37	20.95	19.72	12.93	13.98	29.52
1400	16.79	18.62	20.34	19.47	13.01	14.10	29.16
1500	16.14	17.88	19.65	19.07	13.05	14.16	28.30
1600	15.47	17.15	18.97	18.71	13.12	14.27	27.80
1700	14.86	16.45	18.28	18.23	13.13	14.31	26.95
1800	14.22	15.76	17.53	17.68	13.09	14.32	26.17
1900	13.64	15.11	16.83	17.12	13.04	14.29	25.47
2000	13.10	14.50	16.14	16.55	12.98	14.28	24.97
2200	12.08	13.36	14.88	15.35	12.73	14.13	24.86
2400	11.19	12.35	13.68	14.17	12.36	13.83	25.00
2600	10.46	11.54	12.68	13.07	11.94	13.44	24.47
2800	9.95	10.95	11.92	12.18	11.53	13.01	21.54
3000	9.56	10.51	11.31	11.43	11.08	12.41	17.67

Typical Performance Data

FREQ. (MHz)	INPUT IP3 Vs. V CONTROL @ V+=5V (dBm)
	@V Control=5V
20	35.61
30	38.71
40	43.18
50	44.72
80	47.19
100	52.23
150	56.18
200	57.58
250	57.36
300	56.59
350	57.10
400	56.68
450	56.17
500	56.32
600	57.78
700	58.74
800	58.28
900	57.82
1000	58.21
1100	57.06
1200	55.63
1300	56.62
1400	55.06
1500	55.87
1600	57.15
1700	55.91
1800	55.98
1900	56.24
2000	56.53
2200	56.35
2400	55.95
2600	55.24
2800	55.37
3000	55.29

FREQ. (MHz)	INPUT IP2 Vs. V CONTROL @ V+=5V (dBm)
	@V Control=5V
20	55.00
225	75.28
500	80.17
1000	85.34
1500	71.39
2250	89.27
3000	93.50

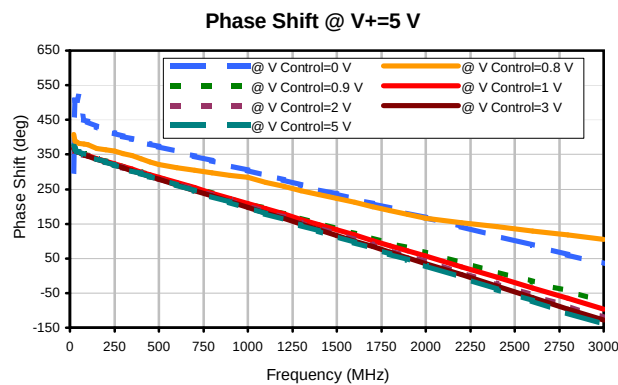
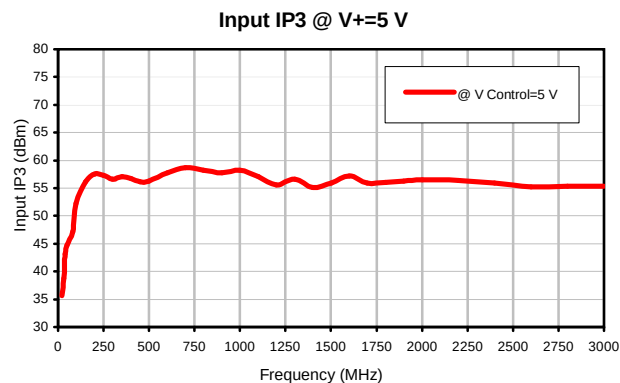
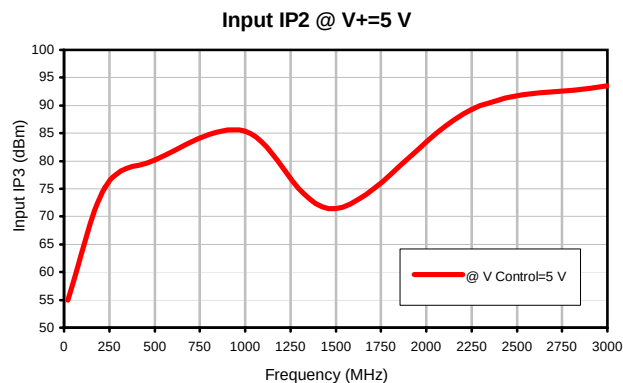
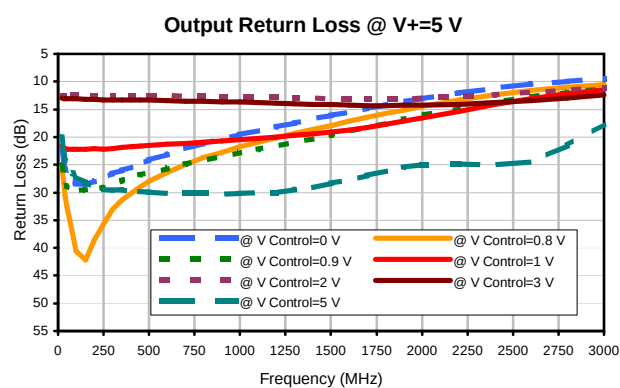
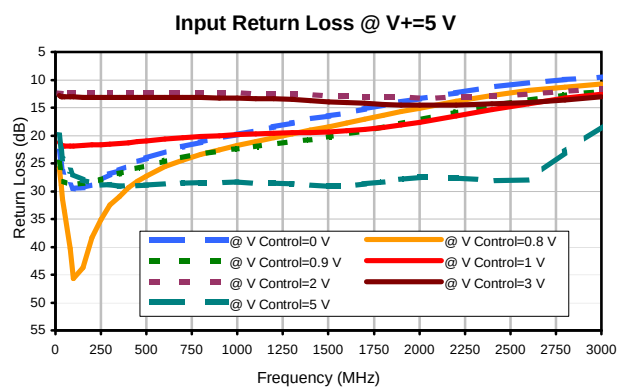
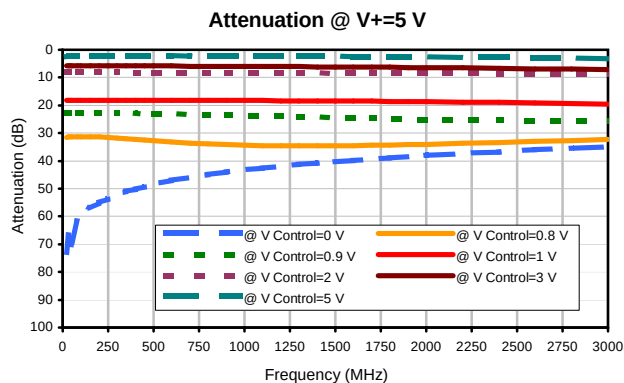
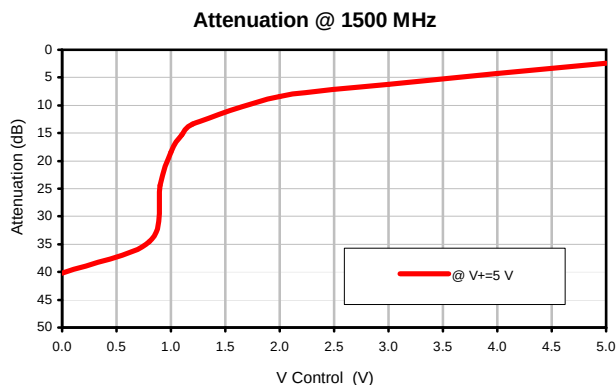
Typical Performance Data

FREQ. (MHz)	PHASE SHIFT Vs. V CONTROL @ V+=5V						
	(deg)						
	@V Control=0V	@V Control=0.8V	@V Control=0.9V	@V Control=1V	@V Control=2V	@V Control=3V	@V Control=5V
20	300.24	407.82	367.86	365.76	364.68	366.42	370.88
30	506.11	388.27	362.76	361.09	360.43	361.56	364.83
40	507.44	385.53	359.34	358.16	357.48	358.23	360.83
50	516.18	382.54	356.74	355.83	354.95	355.54	357.67
80	449.99	379.88	350.65	350.14	349.02	349.23	350.63
100	444.44	378.15	347.03	346.58	345.37	345.44	346.57
150	429.52	368.07	338.60	338.46	336.91	336.71	337.37
200	419.21	363.49	330.41	330.57	328.65	328.26	328.54
250	410.75	359.59	322.34	322.68	320.46	319.84	319.94
300	402.59	352.24	314.43	314.96	312.43	311.55	311.41
350	394.87	347.77	306.62	307.28	304.38	303.27	302.96
400	387.42	338.13	298.84	299.60	296.38	295.06	294.52
450	380.35	329.00	291.12	291.99	288.39	286.89	286.13
500	373.36	320.43	283.46	284.34	280.38	278.71	277.75
600	359.16	312.35	268.29	269.15	264.44	262.47	261.18
700	345.14	304.53	253.23	254.00	248.64	246.20	244.59
800	331.38	297.21	238.33	238.88	232.81	230.11	228.07
900	317.43	290.13	223.47	223.65	216.96	213.91	211.55
1000	303.82	283.34	208.77	208.48	201.11	197.70	194.99
1100	290.35	270.23	194.16	193.38	185.26	181.49	178.44
1200	276.57	257.80	179.62	178.14	169.36	165.26	161.87
1300	262.76	245.79	165.20	162.88	153.45	149.03	145.26
1400	249.28	234.09	150.87	147.67	137.55	132.78	128.68
1500	235.54	222.61	136.55	132.46	121.57	116.53	112.03
1600	222.09	211.27	122.35	117.26	105.63	100.28	95.43
1700	208.37	200.03	108.16	101.93	89.63	83.97	78.74
1800	194.94	188.60	94.10	86.78	73.67	67.70	62.13
1900	181.34	177.24	80.05	71.44	57.64	51.40	45.42
2000	167.99	165.42	66.03	56.17	41.56	35.10	28.67
2200	141.27	153.72	38.19	25.70	9.51	2.56	-4.86
2400	114.48	142.08	10.27	-4.82	-22.66	-30.10	-38.60
2600	87.55	129.86	-17.39	-35.24	-55.00	-62.73	-72.56
2800	60.76	117.85	-45.06	-65.54	-87.41	-95.58	-106.88
3000	33.90	105.48	-72.88	-95.69	-120.03	-128.52	-141.33

Voltage Variable Attenuator

Typical Performance Curves

RVA-33+



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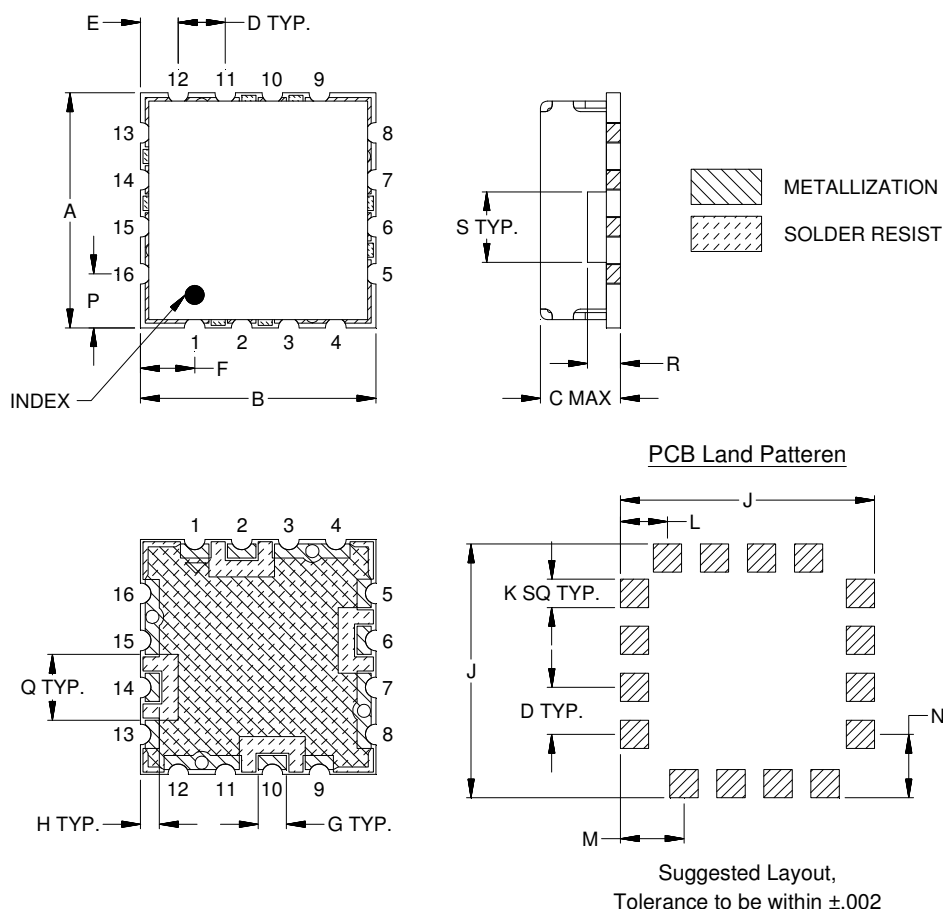
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REV. X2
RVA-33+
110731
Page 1 of 1

Outline Dimensions

DV874



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.

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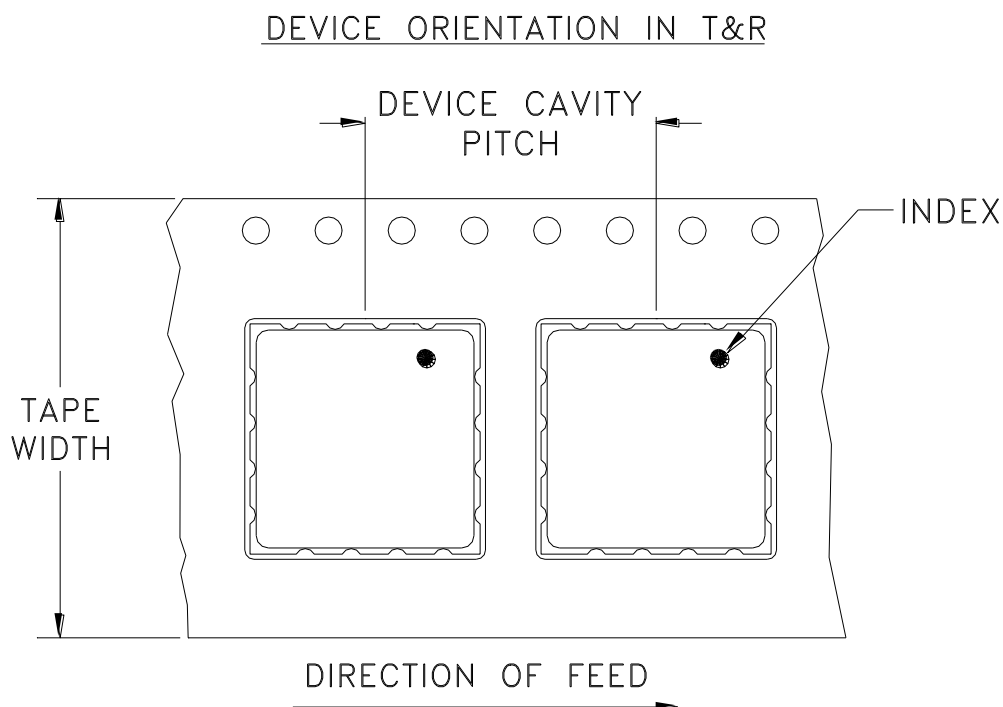
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RF/IF MICROWAVE COMPONENTS

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



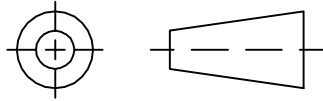
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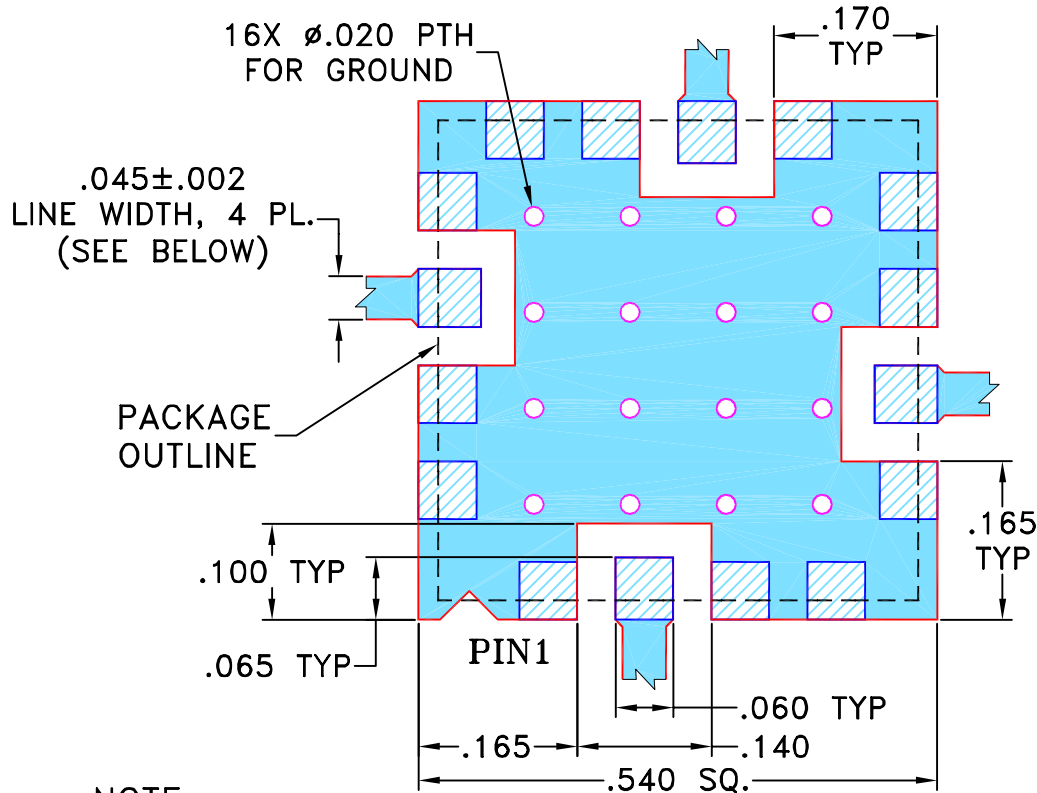
THIRD ANGLE PROJECTION



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" $\pm$ 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 $\pm$ 3 PL DECIMALS $\pm$.005ANGLES $\pm$ FRACTIONS $\pm$

DRAWN

DK (RAVON)

28 OCT 05

CHECKED

RZ (RAVON)

28 OCT 05

APPROVED

HH (RAVON)

28 OCT 05

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

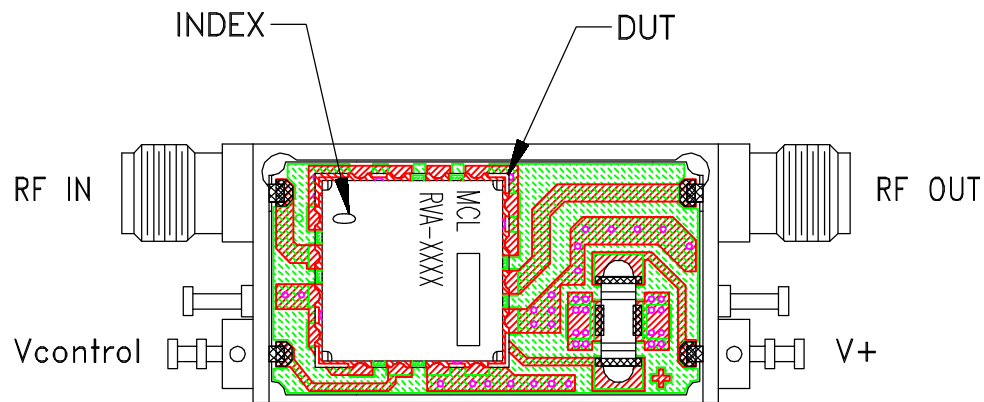
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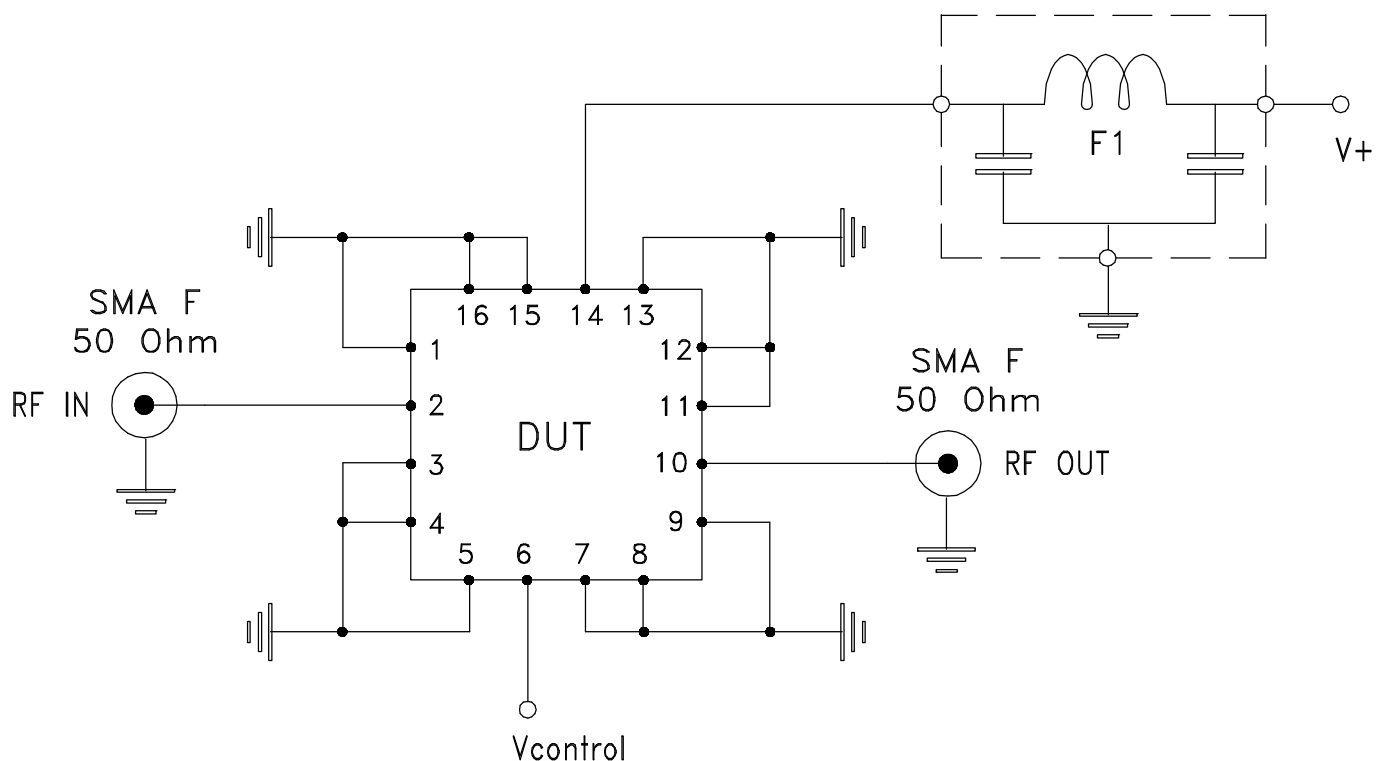
SCALE: 5:1

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.

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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