

Broad Band

# Voltage Variable Attenuator

RVA-3000R+

50Ω 20 to 3000 MHz



CASE STYLE: DV874

## The Big Deal

- Wideband, 20-3000MHz, usable up to 6000 MHz
- High IP3, 53 dBm
- Minimal phase deviation
- No external matching circuits required

**+RoHS Compliant**

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

## Typical Applications

- Power level control
- Feed forward amplifiers

## Product Overview

The RVA-3000R+ of voltage variable attenuator provides adjustable attenuation up to over 50 dB with a control voltage of 0 to 17V. The RVA-3000R+ features high linearity (IP3 53 dBm typ) and good matching.

## Key Features

Feature	Advantages
Wideband operation, specified from 20 to 3000 MHz	Can be used in multiple applications, reducing part count.
Good VSWR, 1.2:1 typ.	Eases interfacing with adjacent components and results in low amplitude ripple.
High linearity	Low distortion enabling improved system performance
Minimal phase deviation over attenuation range	Can provide low signal distortion over attenuation range



## RF Electrical Specifications, 20-3000 MHz, $T_{AMB}=25^{\circ}C$ , $V_{+}=+5V$ , $50\Omega$

Parameter	Freq. Range (MHz)	Min.	Typ.	Max.	Units
Insertion Loss @ $V_{CONTROL}=+17V$	20 - 500	—	2.5	3.5	dB
	500 - 1500	—	2.8	4.0	
	1500 - 3000	—	3.5	5.0	
Max Attenuation @ $V_{CONTROL}=0V$	20 - 500	39	56	—	dB
	500 - 1500	34	44	—	
	1500 - 3000	26	35	—	
Max Input Power @ $V_{CONTROL}=0V$ to $17V$	20 - 3000	+26	—	—	dBm
Return Loss @ $V_{CONTROL}=0V$ to $17V$	20 - 500	—	23	—	dB
	500 - 1500	—	26	—	
	1500 - 3000	—	18	—	
Input IP3 @ $V_{CONTROL}=0V$ to $17V$	20 - 500	—	48	—	dBm
	500 - 1500	—	56	—	
	1500 - 3000	—	57	—	
Supply current @ $V_{CONTROL}=0V$ to $17V$	20 - 3000	—	—	10	mA
Control current @ $V_{CONTROL}=0V$ to $17V$	20 - 3000	—	—	30	mA

## Switching Specifications

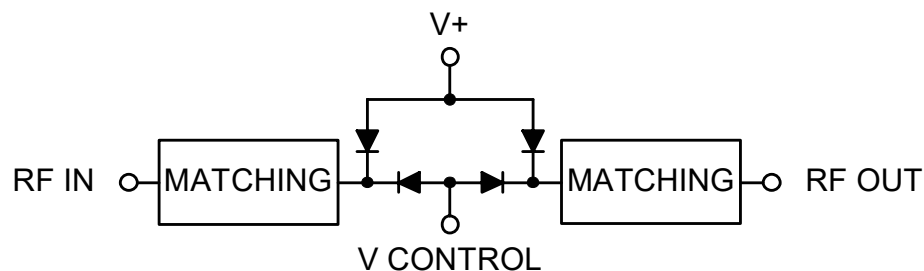
Parameter	Min.	Typ.	Max.	Units
Switching Speed, 50% Control to 0.5dB of Attenuation Value	—	5.5	—	$\mu$ Sec
Rise time, 10% to 90% of Attenuation Value	—	2	—	$\mu$ Sec
Fall time, 90% to 10% of Attenuation Value	—	3.5	—	$\mu$ Sec

## Absolute Maximum Ratings

Parameter	Ratings
Operating Temperature	-55°C to +85°C
Storage Temperature	-55°C to +85°C
$V_{+}$	12V Max.
$V_{CONTROL}$	20V Max.
Input Power	+26 dBm

Permanent damage may occur if any of these limits are exceeded. Operation between max operating and absolute max input power will result in reduced reliability.

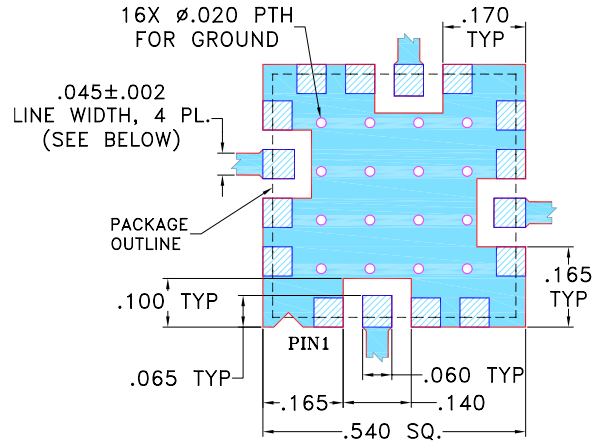
## Equivalent Schematic



## Pin Description

Function	Pin Number	Description
GND	1	Ground connection
RF in	2	RF in port
GND	3	Ground connection
GND	4	Ground connection
GND	5	Ground connection
V <sub>CNTRL</sub>	6	Control Voltage
GND	7	Ground connection
GND	8	Ground connection
GND	9	Ground connection
RF out	10	RF out port )
GND	11	Ground connection
GND	12	Ground connection
GND	13	Ground connection
V+	14	Supply Voltage
GND	15	Ground connection
GND	16	Ground connection

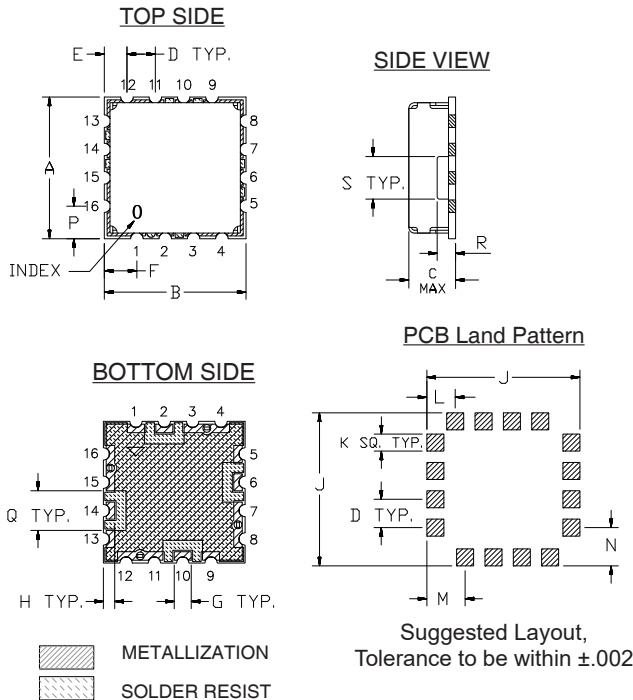
## Demo Board MCL P/N: TB-163 Suggested PCB Layout (PL-040)



### NOTE:

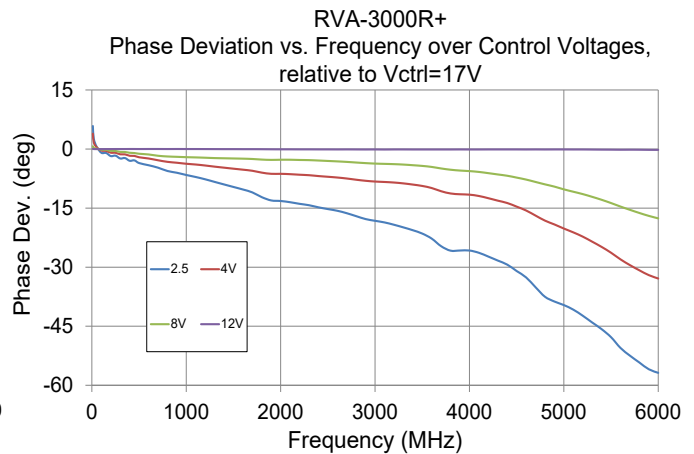
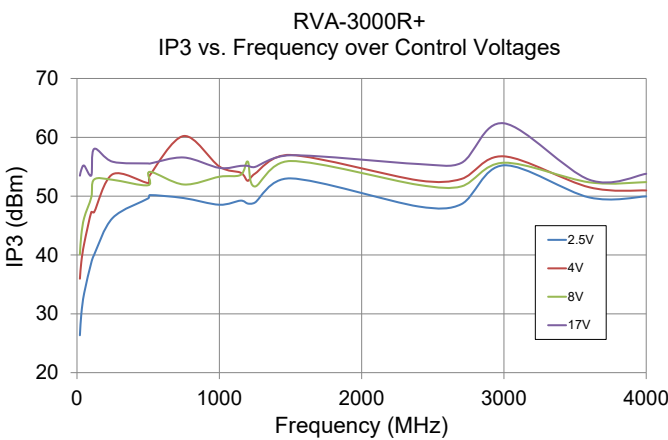
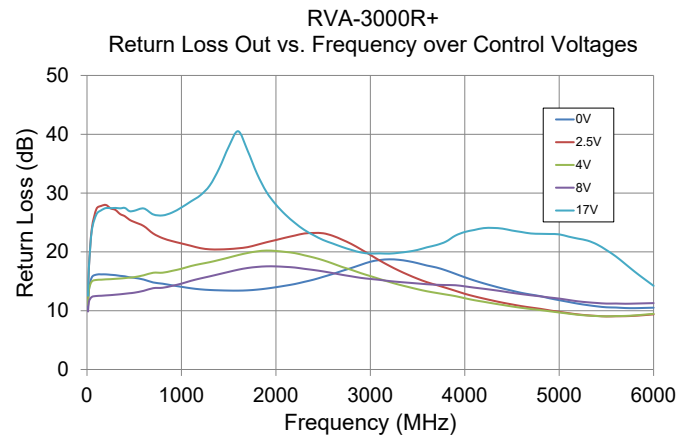
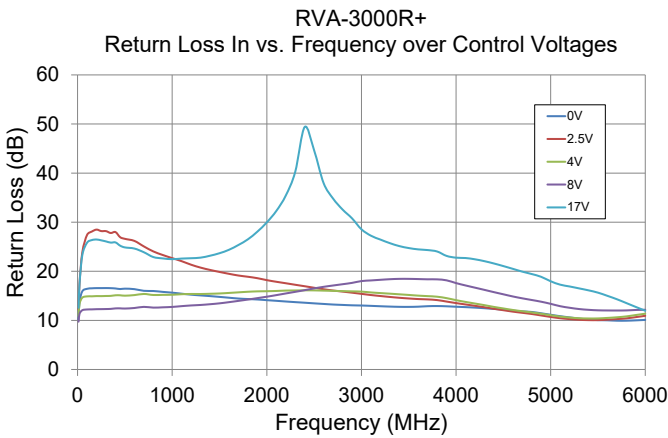
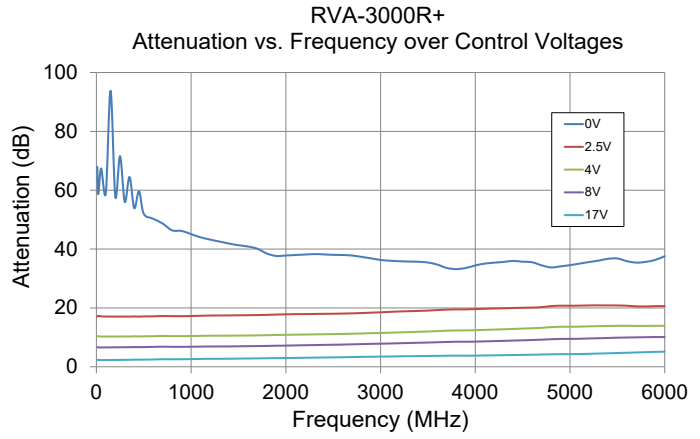
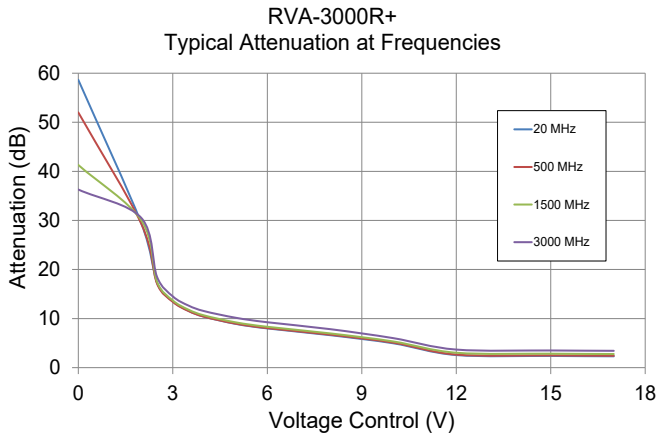
- TRACE WIDTH IS SHOWN FOR FR4 WITH DIELECTRIC THICKNESS 0.025" ± 0.0025"; COPPER: 1/2 OZ. EACH SIDE.  
FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
  - BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
  - DENOTES COPPER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

## Outline Drawing



## Outline Dimensions (inch/mm)

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



## Additional Detailed Technical Information

additional information is available on our dash board. To access this information [click here](#)

<b>Performance Data</b>	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
<b>Case Style</b>	DV874 Metal package, lead finish: NiAu alloy
<b>Tape &amp; Reel</b> Standard quantities available on reel	F37 7" reels with 10, 20, 50, or 100 devices 13" reels with 200 or 500 devices
<b>Suggested Layout for PCB Design</b>	PL-040
<b>Evaluation Board</b>	TB-163
<b>Environmental Ratings</b>	ENV65T3

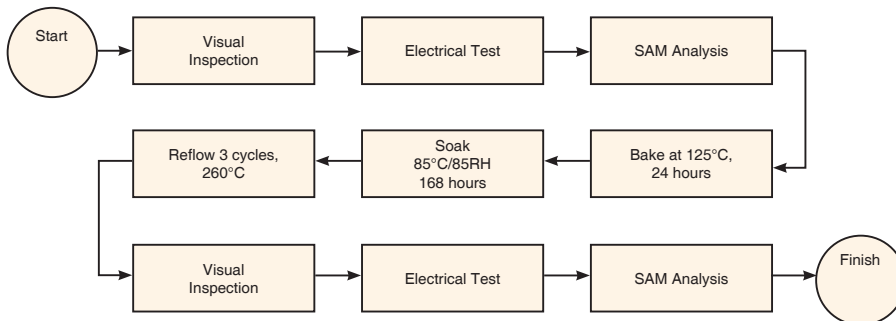
## ESD Rating

Human Body Model (HBM): Class 2 (up to 2000V) in accordance with ANSI / ESDA / JEDEC JS-001.

## MSL Rating

Moisture Sensitivity: MSL1 in accordance with IPC / JEDEC J-STD-020D

## MSL Test Flow Chart



## Additional Notes

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# Voltage Variable Attenuator

# RVA-3000R+

## Typical Performance Data

V CONTROL (V)	ATTENUATION at V+= 5V			
	(dB)			
	@ 20 MHz	@ 50 MHz	@ 500 MHz	@ 1000 MHz
0.0	58.7	52.0	41.3	36.3
2.0	29.4	29.3	30.0	30.5
2.5	17.3	17.1	17.5	18.5
3.0	13.5	13.4	13.7	14.5
3.5	11.6	11.5	11.8	12.7
4.0	10.4	10.4	10.6	11.5
5.0	8.9	9.0	9.2	10.2
6.0	8.0	8.1	8.3	9.3
8.0	6.6	6.7	7.0	7.9
10.0	5.0	5.1	5.3	6.0
12.0	2.6	2.7	3.0	3.7
15.0	2.4	2.5	2.8	3.5
17.0	2.3	2.4	2.8	3.4

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
20	58.65	17.28	10.39	6.63	2.33
50	67.40	17.12	10.30	6.57	2.26
100	59.05	17.06	10.30	6.60	2.28
150	93.78	17.04	10.29	6.61	2.29
200	57.81	17.04	10.31	6.64	2.31
250	71.58	17.03	10.30	6.64	2.32
300	56.00	17.06	10.33	6.67	2.35
400	53.88	17.09	10.37	6.71	2.40
500	52.00	17.10	10.37	6.72	2.42
600	50.30	17.13	10.41	6.77	2.47
700	48.67	17.23	10.49	6.84	2.56
800	46.35	17.19	10.44	6.79	2.54
1000	45.07	17.24	10.47	6.82	2.60
1250	42.66	17.32	10.54	6.90	2.70
1500	41.30	17.48	10.63	6.97	2.77
1750	39.88	17.61	10.74	7.08	2.87
2000	37.81	17.81	10.88	7.21	2.96
2250	37.57	17.77	10.94	7.33	3.08
2500	38.03	18.01	11.12	7.50	3.19
2750	36.94	18.31	11.34	7.68	3.31
3000	36.30	18.50	11.52	7.85	3.44
3250	35.32	18.70	11.74	8.06	3.60
3500	35.42	19.09	12.00	8.25	3.68
3750	35.84	19.17	12.15	8.37	3.74
4000	34.42	19.60	12.45	8.56	3.79
4250	35.17	19.73	12.73	8.82	3.97
4500	35.69	20.06	13.00	9.00	4.04
4750	35.96	20.47	13.31	9.22	4.15
5000	34.53	20.74	13.62	9.48	4.29
5250	34.30	20.64	13.81	9.74	4.53
5500	36.80	20.84	13.93	9.88	4.68
5750	38.60	20.76	13.91	9.96	4.85
6000	37.56	20.63	13.91	10.10	5.14

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REV. OR

RVA-3000R+

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Page 1 of 5



# Voltage Variable Attenuator

# RVA-3000R+

## 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
20	13.71	17.46	13.34	11.33	17.38
50	15.94	23.90	14.63	12.08	23.35
100	16.44	27.41	14.89	12.23	25.83
150	16.54	28.09	14.90	12.25	26.36
200	16.58	28.49	14.95	12.29	26.48
250	16.58	28.19	14.94	12.30	26.31
300	16.59	28.18	14.97	12.32	26.09
400	16.51	27.99	15.11	12.45	25.89
500	16.47	26.61	15.03	12.42	24.87
600	16.37	26.19	15.15	12.53	24.64
700	16.03	25.07	15.38	12.76	23.89
800	15.99	24.05	15.17	12.61	22.91
1000	15.65	22.68	15.22	12.75	22.48
1250	15.11	21.13	15.46	13.14	22.72
1500	14.79	19.87	15.48	13.48	23.69
1750	14.39	18.99	15.77	14.13	26.03
2000	14.12	18.20	15.94	14.83	29.97
2250	13.69	17.45	16.25	15.80	38.56
2500	13.47	16.65	16.11	16.52	44.63
2750	13.25	15.95	15.95	17.24	32.85
3000	13.03	15.41	15.86	18.01	28.56
3250	12.82	14.99	15.64	18.41	26.81
3500	12.75	14.47	15.18	18.46	24.74
3750	12.65	13.97	14.68	18.17	23.76
4000	12.78	13.53	14.12	17.60	22.78
4250	12.53	12.93	13.41	16.67	23.03
4500	12.19	12.08	12.43	15.32	21.07
4750	11.65	11.27	11.57	14.14	19.22
5000	11.14	10.71	11.06	13.38	17.98
5250	10.50	10.30	10.62	12.59	17.19
5500	10.05	10.06	10.40	12.06	15.66
5750	9.94	10.26	10.63	11.92	13.78
6000	10.09	10.94	11.36	12.17	11.98

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# Voltage Variable Attenuator

# RVA-3000R+

## 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
20	13.55	17.44	13.57	11.55	17.44
50	15.67	23.88	14.95	12.34	23.59
100	16.14	27.32	15.23	12.51	26.39
150	16.18	27.81	15.27	12.55	27.07
200	16.18	27.97	15.33	12.61	27.45
250	16.11	27.39	15.36	12.66	27.42
300	16.05	27.13	15.42	12.73	27.47
400	15.85	26.06	15.54	12.89	27.47
500	15.60	25.08	15.70	13.07	26.99
600	15.30	24.39	16.02	13.39	27.38
700	14.81	23.12	16.45	13.84	26.37
800	14.60	22.33	16.46	13.91	26.20
1000	14.07	21.43	17.13	14.61	27.55
1250	13.52	20.48	18.18	15.72	30.30
1500	13.43	20.47	19.03	16.61	37.86
1750	13.51	20.93	19.98	17.41	34.80
2000	14.00	22.01	20.15	17.54	28.04
2250	14.61	22.87	19.85	17.39	24.38
2500	15.76	23.16	18.58	16.69	22.02
2750	17.16	21.62	17.10	15.93	20.67
3000	18.33	19.48	15.88	15.41	19.72
3250	18.73	17.35	14.71	14.94	19.51
3500	18.09	15.43	13.65	14.64	20.33
3750	16.83	14.00	12.84	14.42	21.60
4000	15.69	12.87	12.12	14.15	23.38
4250	14.47	11.96	11.45	13.69	23.90
4500	13.41	11.06	10.72	13.05	23.63
4750	12.52	10.34	10.13	12.50	23.09
5000	11.80	9.80	9.70	12.07	22.98
5250	11.10	9.35	9.29	11.56	22.42
5500	10.59	9.02	9.04	11.22	20.31
5750	10.40	9.02	9.10	11.15	16.98
6000	10.52	9.37	9.47	11.30	14.23

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## Typical Performance Data

FREQ. (MHz)	INPUT IP3 Vs. V CONTROL @ V+=5V (dBm)			
	@V Control=2.5V	@V Control=4V	@V Control=8V	@V Control=17V
20	26.36	35.96	40.13	53.48
30	29.97	38.81	43.43	54.49
50	33.51	41.92	46.32	55.19
100	38.69	47.28	49.81	53.52
120	40.04	47.28	52.84	58.03
250	46.29	53.73	52.79	55.85
500	49.62	52.24	51.87	55.56
512	50.18	53.57	54.14	55.54
750	49.67	60.23	51.99	56.57
1000	48.54	55.04	53.31	54.80
1150	49.24	53.98	53.62	55.15
1200	48.74	52.61	55.88	55.15
1250	48.91	53.82	51.65	54.96
1500	53.02	57.01	55.98	56.95
2400	48.24	52.68	51.92	55.46
2700	48.63	52.92	51.66	55.64
3000	55.24	56.77	55.69	62.38
3600	49.78	51.51	52.36	52.79
4000	49.96	50.97	52.40	53.80

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# Voltage Variable Attenuator

# RVA-3000R+

## Typical Performance Data

FREQ. (MHz)	PHASE SHIFT Vs. V CONTROL @ V+=5V (relative to V Control= 17V)			
	(deg)			
	@V Control=2.5V	@V Control=4V	@V Control=8V	@V Control=12V
20	2.65	1.65	0.28	0.04
50	0.59	0.44	0.13	0.00
100	-0.96	-0.39	-0.16	-0.01
150	-1.00	-0.49	-0.20	0.00
200	-1.80	-0.94	-0.46	0.00
250	-1.69	-0.96	-0.49	0.01
300	-2.41	-1.35	-0.72	0.01
400	-2.99	-1.72	-0.94	0.02
500	-3.56	-2.09	-1.18	0.02
600	-4.12	-2.41	-1.37	0.02
700	-4.73	-2.85	-1.69	0.03
800	-5.57	-3.25	-1.87	0.02
1000	-6.60	-3.75	-2.06	0.01
1250	-8.15	-4.42	-2.29	-0.02
1500	-9.67	-5.03	-2.42	-0.05
1750	-11.35	-5.67	-2.57	-0.09
2000	-13.27	-6.37	-2.78	-0.14
2250	-14.62	-6.90	-2.98	-0.17
2500	-15.35	-7.15	-3.12	-0.19
2750	-16.89	-7.80	-3.48	-0.20
3000	-18.34	-8.37	-3.80	-0.21
3250	-20.72	-9.18	-4.20	-0.23
3500	-21.60	-9.51	-4.41	-0.24
3750	-23.10	-10.33	-4.95	-0.24
4000	-25.90	-11.72	-5.73	-0.24
4250	-28.81	-13.29	-6.51	-0.24
4500	-31.12	-14.77	-7.39	-0.24
4750	-34.23	-16.85	-8.57	-0.24
5000	-39.77	-20.34	-10.39	-0.25
5250	-45.23	-23.84	-12.16	-0.29
5500	-47.95	-26.51	-13.90	-0.34
5750	-51.44	-29.55	-15.88	-0.40
6000	-57.05	-33.10	-17.84	-0.45

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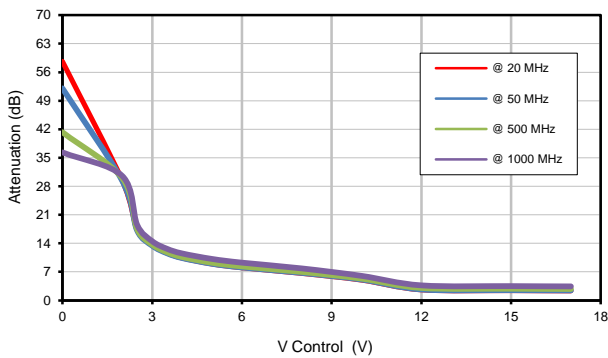


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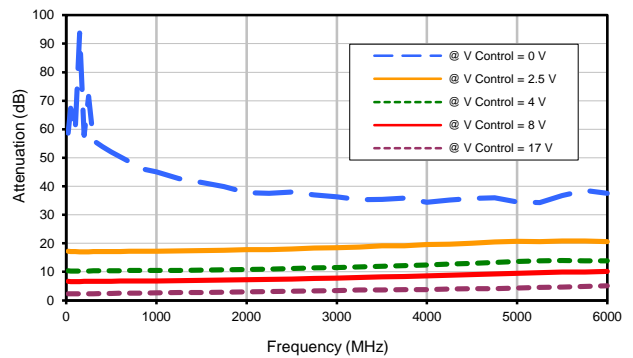
## Typical Performance Curves

RVA-3000R+

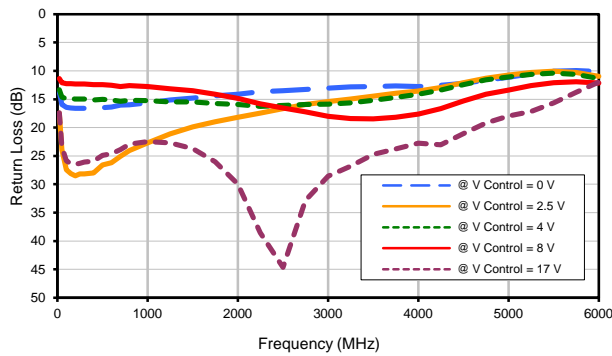
Attenuation at Frequencies



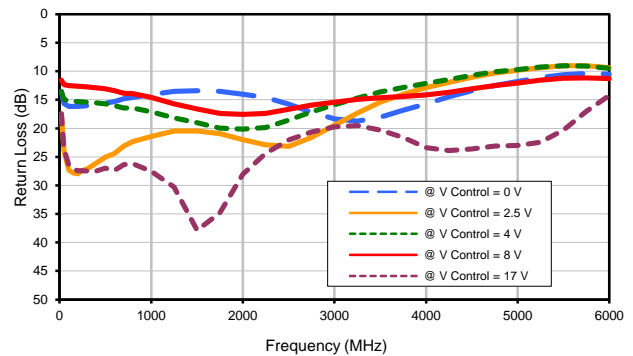
Attenuation @ V+=5 V



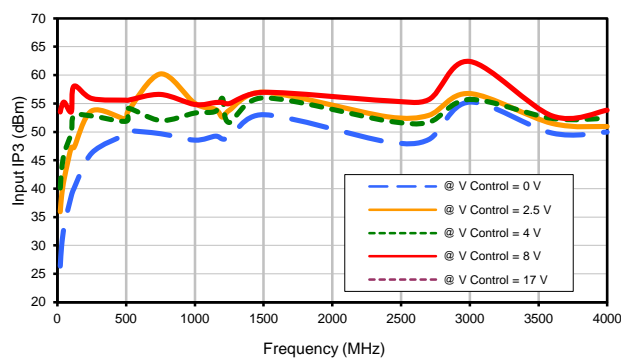
Input Return Loss @ V+=5 V



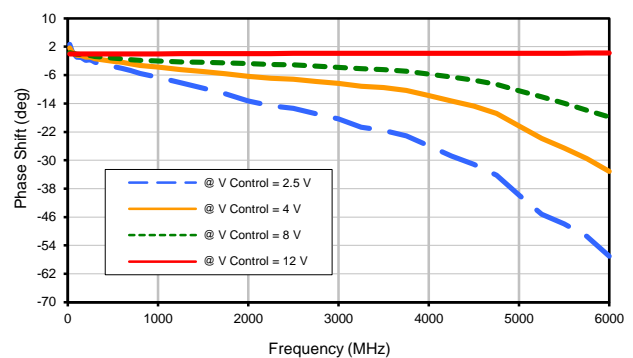
Output Return Loss @ V+=5 V



Input IP3 @ V+=5 V



Phase Shift @ V+=5 V (relative to Vctrl= 17V)



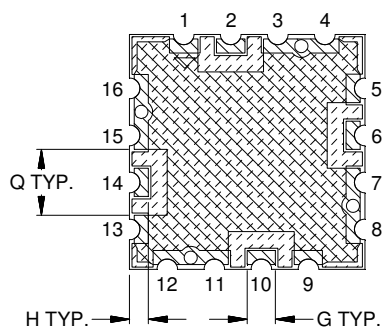
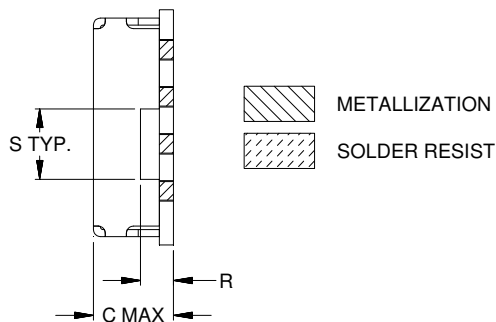
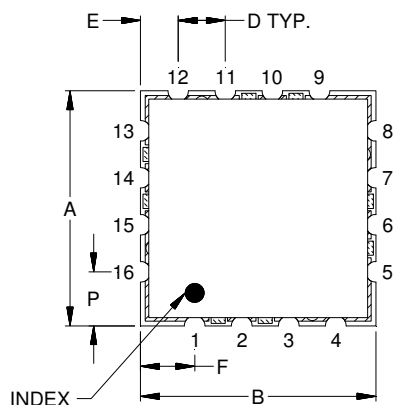
**Notes**

- 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-Circuits' 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](http://www.minicircuits.com/MCLStore/terms.jsp)

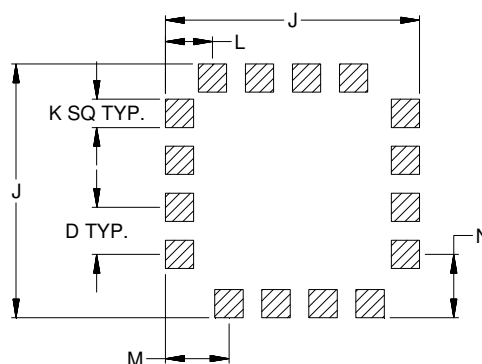


## Outline Dimensions

## DV874



PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm 0.02$

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  $\mu$  inch (.08-.13 microns) Gold over 120-240  $\mu$  inch (3.05-6.10 microns) Nickel plate.
  - For RoHS-5 Case Styles: Tin-Lead plate.



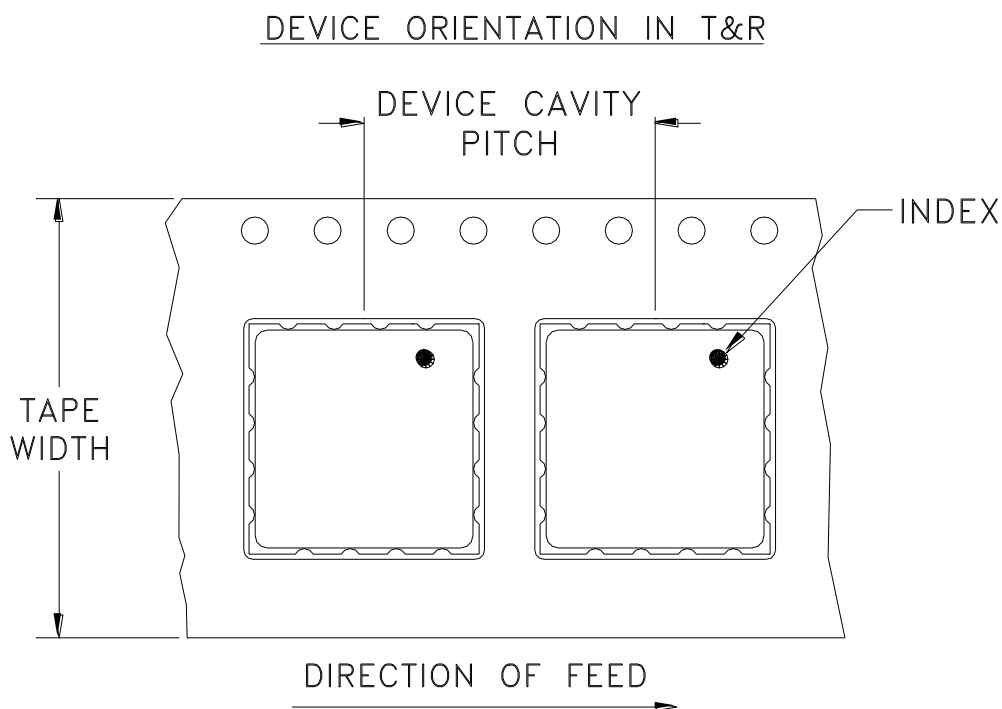
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: [www.minicircuits.com](http://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](http://www.minicircuits.com/pages/pdfs/tape.pdf)



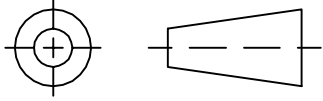
INTERNET <http://www.minicircuits.com>

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

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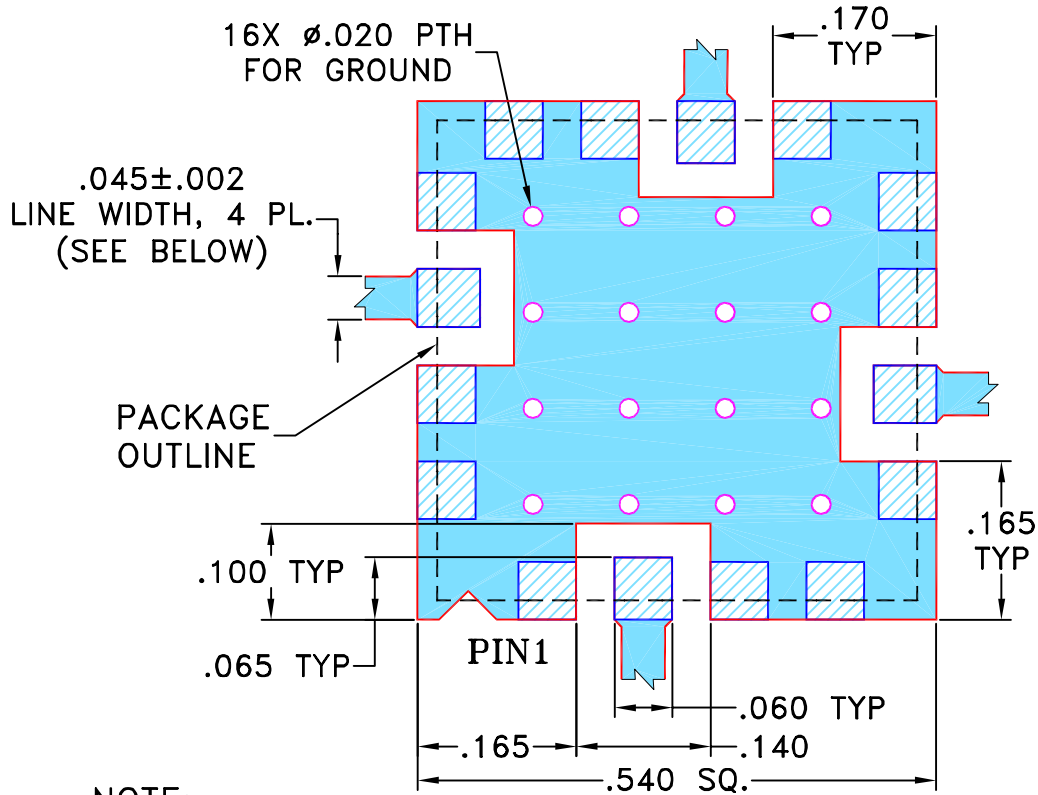
THIRD ANGLE PROJECTION



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 ±

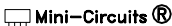
	INITIALS	DATE
DRAWN	DK (RAVON)	28 OCT 05
CHECKED	RZ (RAVON)	28 OCT 05
APPROVED	HH (RAVON)	28 OCT 05



**Mini-Circuits®**

13 Neptune Avenue  
Brooklyn NY 11235

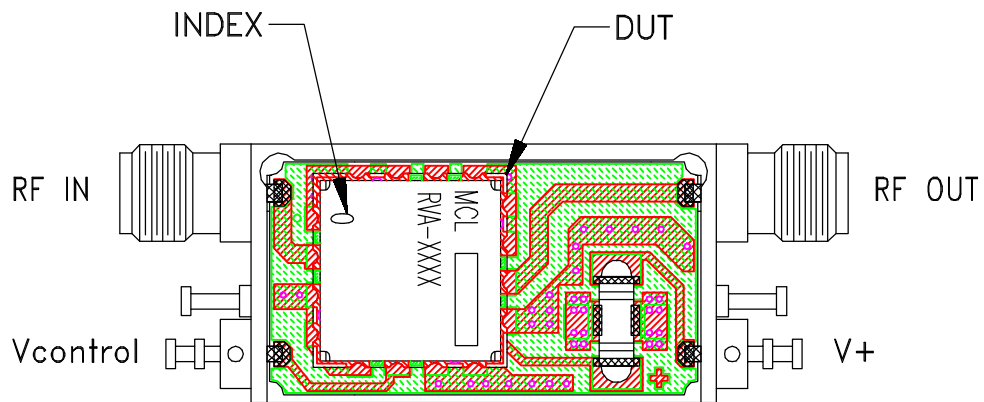
**PL, np, DV894/897, RVA, TB-163**

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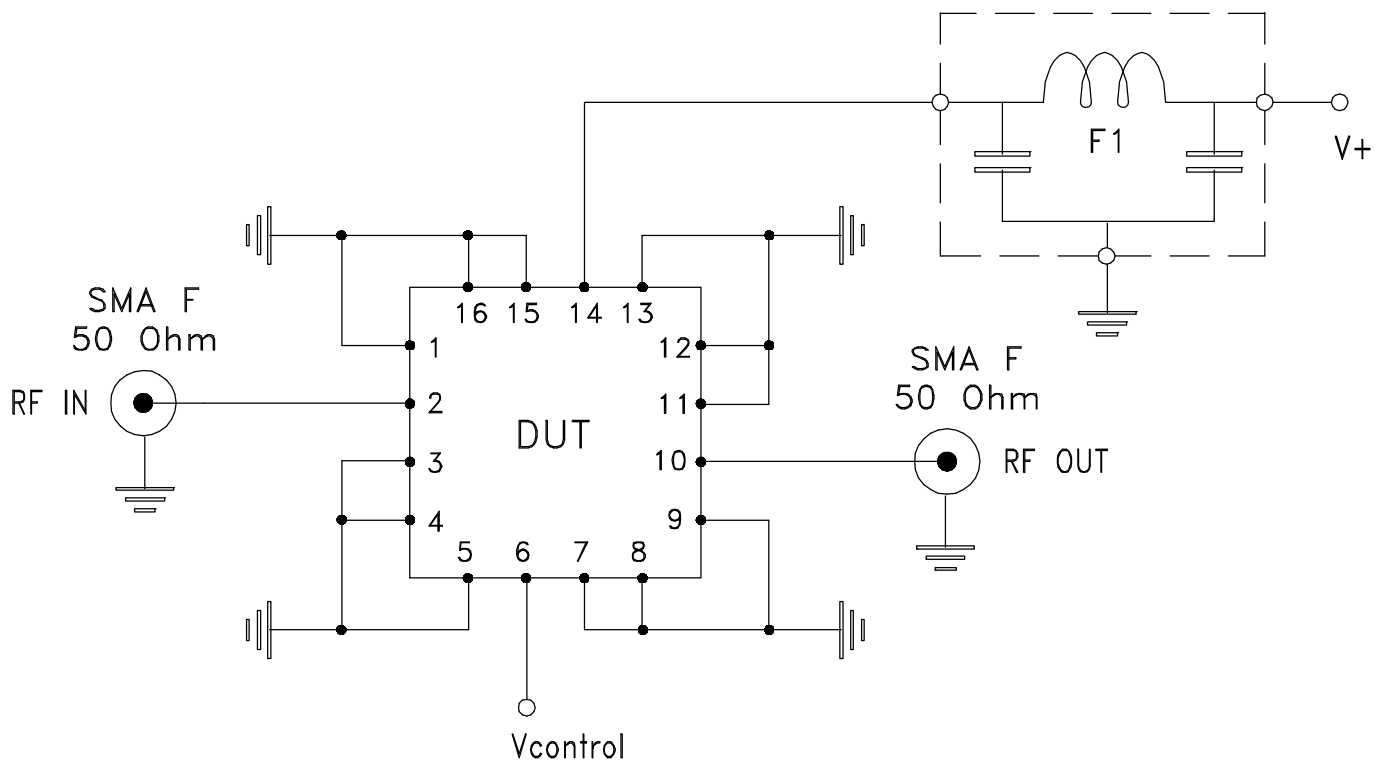
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-040	C
FILE:	98PL040	SCALE:	5:1
SHEET:	1	OF	1

ASHEETA1.DWG REV:A DATE:01/12/95

# Evaluation Board and Circuit



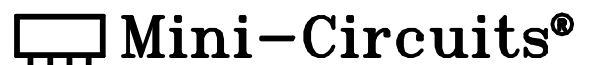
TB-163



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