

Surface Mount Voltage Variable Attenuator

50Ω 600 to 1200 MHz

VACC-09+

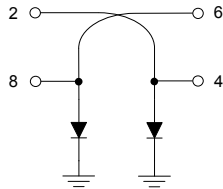
Maximum Ratings

Operating Temperature	-45°C to 85°C
Storage Temperature	-55°C to 100°C
Absolute Max. Control Current	10mA
Absolute Max. RF Input Level	+15 dBm
Permanent damage may occur if any of these limits are exceeded.	

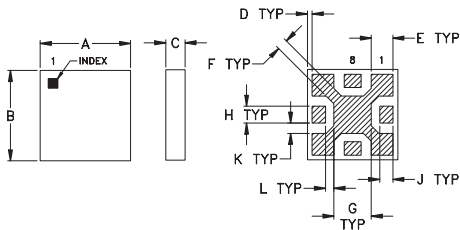
Pin Connections

RF IN	2
V CONTROL 1	8
V CONTROL 2	4
RF OUT	6
GROUND	1,3,5,7

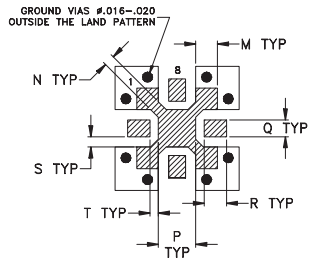
Equivalent schematic of DUT



Outline Drawing



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

Outline Dimensions (inch/mm)

A	B	C	D	E	F	G	H	J	
.150	.150	.065	.008	.036	.018	.062	.028	.022	
3.81	3.81	1.65	0.20	0.91	0.46	1.57	0.71	0.56	
K	L	M	N	P	Q	R	S	T	WT.
.017	.014	.036	.018	.062	.028	.037	.017	.014	GRAM
0.43	0.36	0.91	0.46	1.57	0.71	0.94	0.43	0.36	.06

Notes

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
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Features

- frequency range, 600-1200 MHz
- IP3, 48 dBm typ.
- minimum current at min. attenuation
- low insertion loss
- protected by US patent 7,030,713

Applications

- variable gain amplifier
- feed forward amps
- ALC circuits



CASE STYLE: GF995

+RoHS Compliant

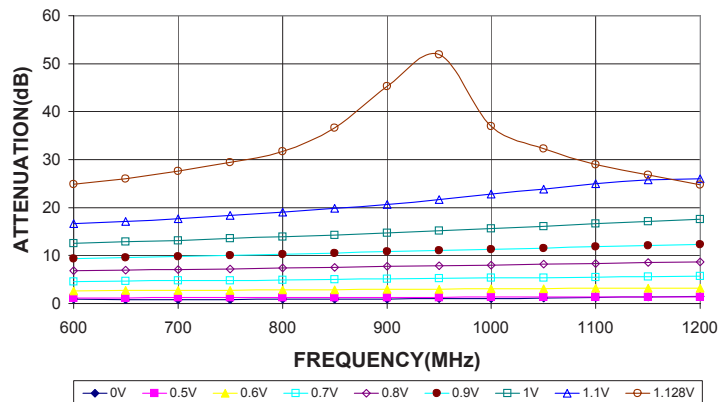
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Electrical Specifications

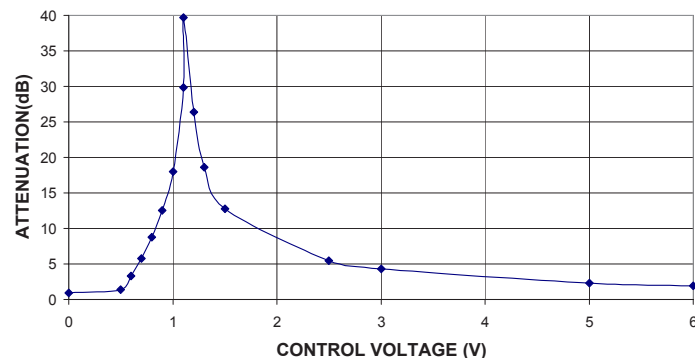
FREQ (MHz)	INSERTION LOSS (dB)		ATTENUATION (dB)		IP3* (dBm)		RETURN LOSS (dB)		CONTROL VOLTAGE** (V)
	Min.	Max.	Typ.	Min.	Typ.	Min.	Input Typ.	Output Typ.	
600-1200			1.0	2.2	25	20	48	40	0-6

* Input IP3 tested with two tones separated by 1 MHz at 7 dBm each and 0V control voltage.
** Using recommended control port biasing.

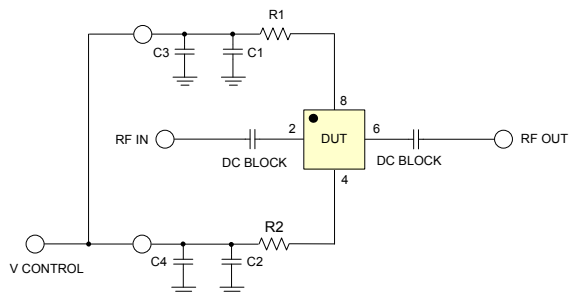
VACC-09+ ATTENUATION Vs. FREQUENCY Vs. CONTROL VOLTAGE



VACC-09+ TYPICAL ATTENUATION AT 900MHz

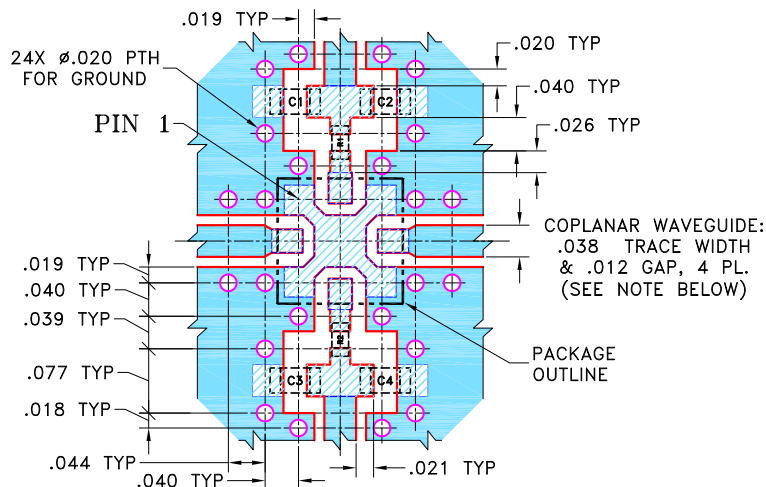


Recommended control port biasing configuration



R1, R2: 2K OHM CHIP RESISTOR (0402, AS CLOSE AS POSSIBLE TO THE DEVICE)
C1, C2: 0.01 UF CHIP CAPACITOR (0603)
C3 C4: 6.8 PF CHIP CAPACITOR (0603)

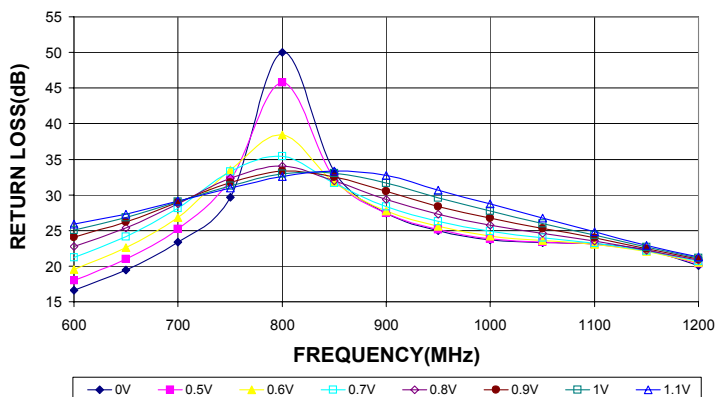
Demo Board MCL P/N: TB-250 Suggested PCB Layout (PL-148)



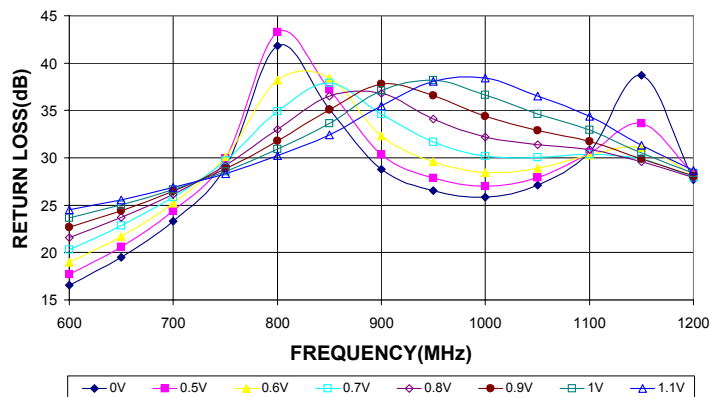
CAPACITORS C1,C3: .01 uF, 0603 SIZE
CAPACITORS C2,C4: 6.8 pF, 0603 SIZE
RESISTORS R1,R2: 2 KOhm, 0402 SIZE

- NOTES:**
1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .020" $\pm$.0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
 2. IF YOUR PCB DESIGN RULES ALLOW, GROUND VIAS SHOULD BE PLACED UNDER THE LAND PATTERN FOR BETTER RF PERFORMANCE.
 3. 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

VACC-09+ INPUT RETURN LOSS Vs. FREQUENCY Vs. CONTROL VOLTAGE



VACC-09+ OUTPUT RETURN LOSS Vs. FREQUENCY Vs. CONTROL VOLTAGE

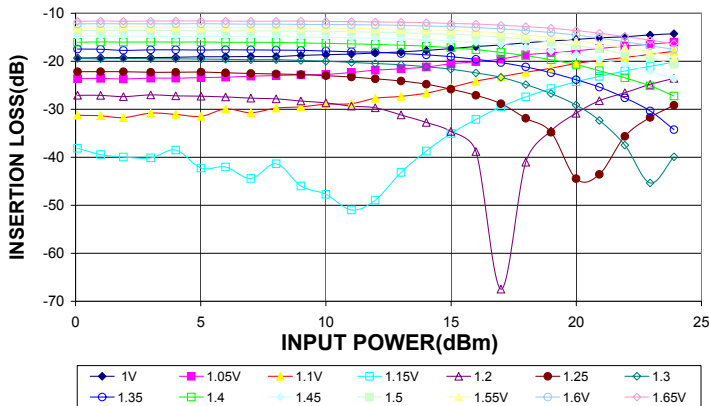


Notes

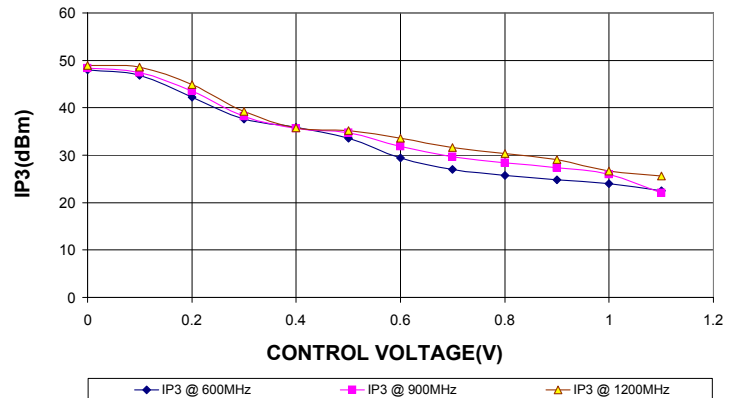
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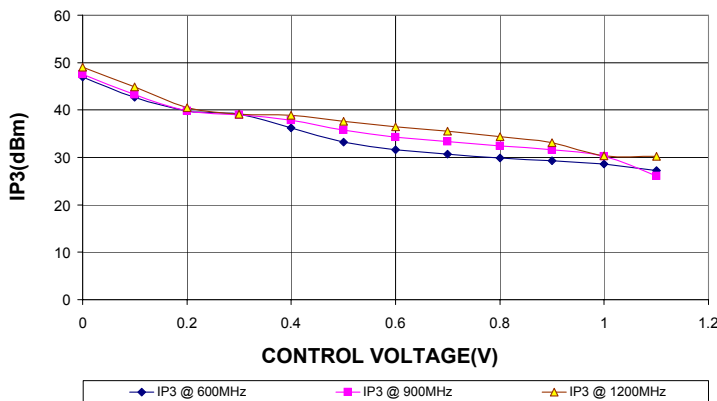
VACC-09+
INSERTION LOSS Vs. INPUT POWER @ 900MHz



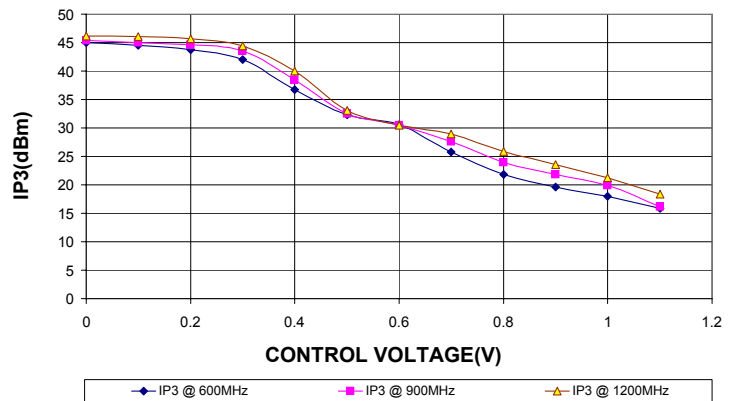
VACC-09+
IP3 Vs. CONTROL VOLTAGE
Vs. FREQUENCY @ 25°C



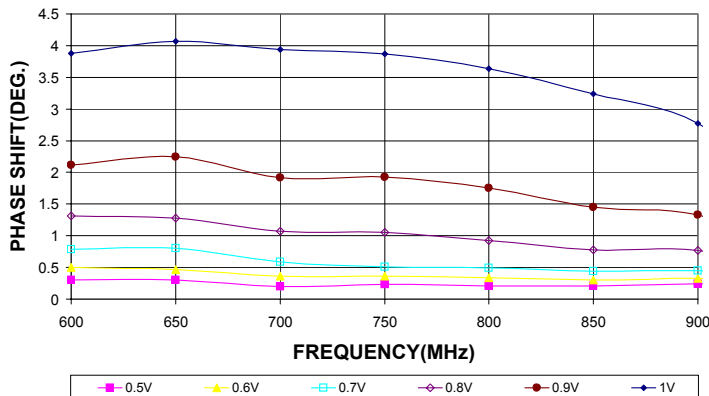
VACC-09+
IP3 Vs. CONTROL VOLTAGE
Vs. FREQUENCY @ 85°C



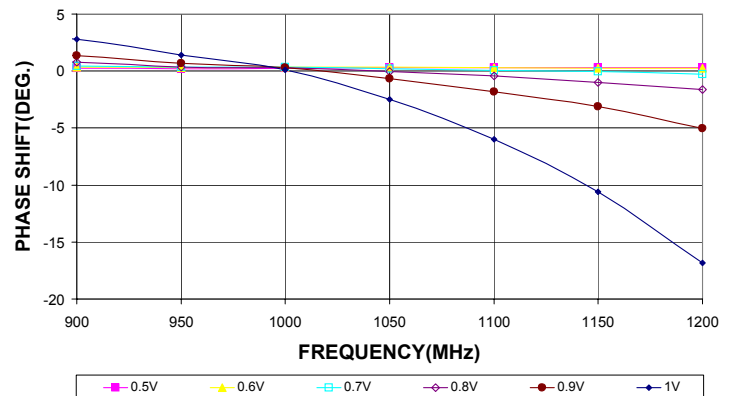
VACC-09+
IP3 Vs. CONTROL VOLTAGE
Vs. FREQUENCY @ -45°C



VACC-09+
PHASE SHIFT Vs. FREQUENCY Vs. CONTROL VOLTAGE
600-900MHz (WITH RELATION TO 0V CONTROL VOLTAGE)



VACC-09+
PHASE SHIFT Vs. FREQUENCY Vs. CONTROL VOLTAGE
900-1200MHz (WITH RELATION TO 0V CONTROL VOLTAGE)



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Typical Performance Data

V CONTROL	ATTENUATION @ 900 MHz
(V)	(dB)
0.00	0.95
0.50	1.41
0.60	3.27
0.70	5.75
0.80	8.76
0.90	12.54
1.00	18.02
1.10	29.82
1.15	39.66
1.20	26.38
1.30	18.62
1.50	12.76
2.50	5.48
3.00	4.30
5.00	2.33
6.00	1.89

FREQ. (MHz)	ATTENUATION Vs. V CONTROL					
	(dB)					
	@V Control 0V	@V Control 0.6V	@V Control 0.8V	@V Control 1.0V	@V Control 1.1V	@V Control 1.128V
600	0.87	2.66	6.83	12.52	16.61	24.88
650	0.84	2.70	6.95	12.84	17.10	25.96
700	0.84	2.74	7.09	13.16	17.69	27.61
750	0.85	2.79	7.24	13.52	18.31	29.42
800	0.87	2.85	7.39	13.89	19.02	31.68
850	0.91	2.90	7.54	14.31	19.83	36.61
900	0.95	2.95	7.72	14.73	20.66	45.24
950	1.01	2.99	7.86	15.19	21.65	51.94
1000	1.05	3.05	8.04	15.68	22.76	36.94
1050	1.14	3.10	8.19	16.13	23.84	32.32
1100	1.22	3.14	8.34	16.60	24.93	29.02
1150	1.32	3.19	8.50	17.09	25.74	26.78
1200	1.46	3.24	8.65	17.53	25.97	24.77

Typical Performance Data

FREQ. (MHz)	INPUT RETURN LOSS Vs. V CONTROL					
	(dB)					
	@V Control 0V	@V Control 0.5V	@V Control 0.6V	@V Control 0.8V	@V Control 1.0V	@V Control 1.1V
600	16.60	17.97	19.55	22.73	25.06	25.91
650	19.46	20.97	22.57	25.33	26.82	27.31
700	23.40	25.20	26.86	28.71	29.07	29.15
750	29.67	32.11	33.52	32.38	31.25	30.95
800	50.02	45.78	38.43	34.03	32.93	32.60
850	33.30	32.35	31.76	32.00	33.04	33.33
900	27.47	27.46	27.74	29.35	31.67	32.75
950	24.98	25.13	25.58	27.29	29.57	30.68
1000	23.67	23.85	24.25	25.78	27.72	28.73
1050	23.30	23.35	23.58	24.62	25.99	26.71
1100	23.17	23.03	23.05	23.54	24.39	24.86
1150	22.26	22.14	22.08	22.25	22.68	22.93
1200	20.09	20.36	20.56	20.86	21.13	21.27

Typical Performance Data

FREQ. (MHz)	OUTPUT RETURN LOSS Vs. V CONTROL					
	(dB)					
	@V Control 0V	@V Control 0.5V	@V Control 0.6V	@V Control 0.8V	@V Control 1.0V	@V Control 1.1V
600	16.57	17.72	18.99	21.58	23.65	24.50
650	19.49	20.61	21.72	23.69	25.03	25.56
700	23.31	24.40	25.22	26.13	26.67	26.88
750	29.01	29.96	30.11	29.19	28.54	28.35
800	41.81	43.28	38.18	32.99	30.91	30.23
850	35.11	37.22	38.41	36.53	33.66	32.41
900	28.80	30.34	32.28	36.80	37.09	35.48
950	26.55	27.89	29.58	34.10	38.20	38.06
1000	25.85	27.00	28.43	32.20	36.64	38.45
1050	27.09	27.93	28.90	31.36	34.60	36.51
1100	30.66	30.50	30.26	30.84	32.92	34.40
1150	38.70	33.66	31.09	29.62	30.51	31.31
1200	27.72	28.31	28.20	27.91	28.37	28.69

REV. X1
VACC-09+
070708
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Voltage Variable Attenuator

VACC-09+

Typical Performance Data

FREQ. (MHz)	INPUT IP3 Vs. V CONTROL					
	(dBm)					
	@V Control 0V	@V Control 0.5V	@V Control 0.6V	@V Control 0.8V	@V Control 1.0V	@V Control 1.1V
600	48.02	33.63	29.47	25.70	24.00	22.46
900	48.33	34.69	31.84	28.38	25.98	22.07
1200	48.92	35.25	33.55	30.39	26.70	25.60

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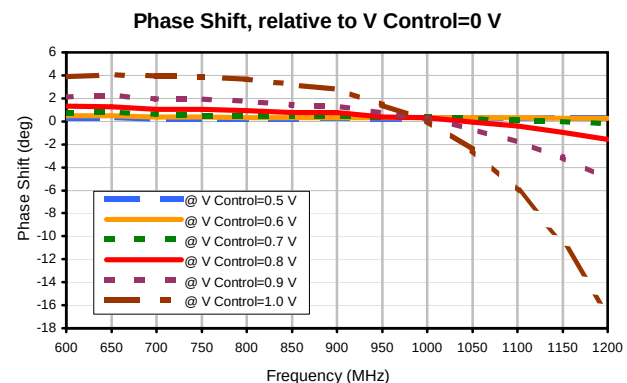
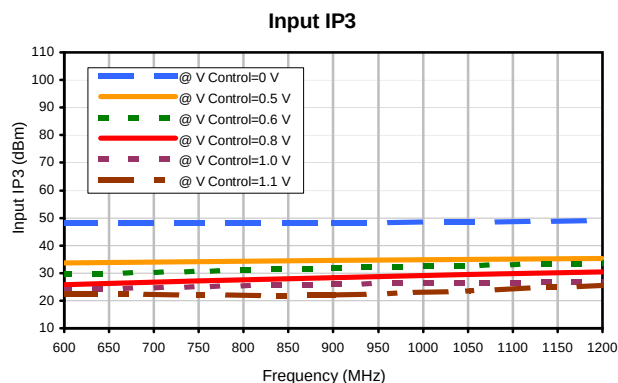
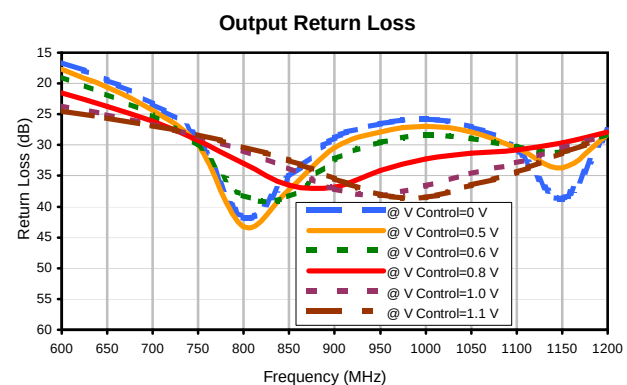
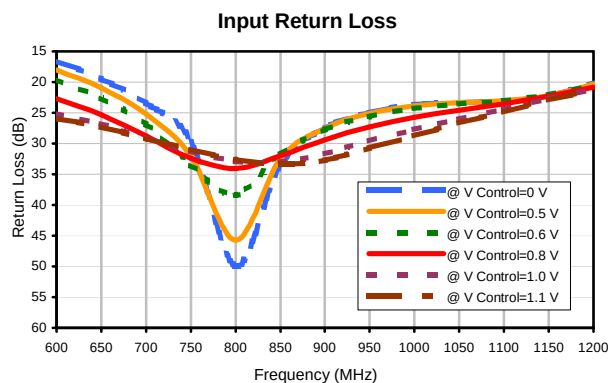
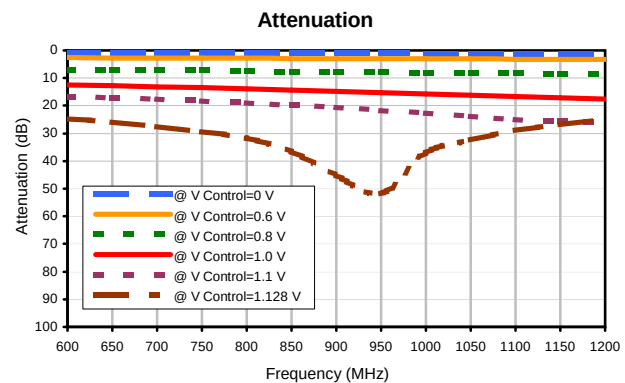
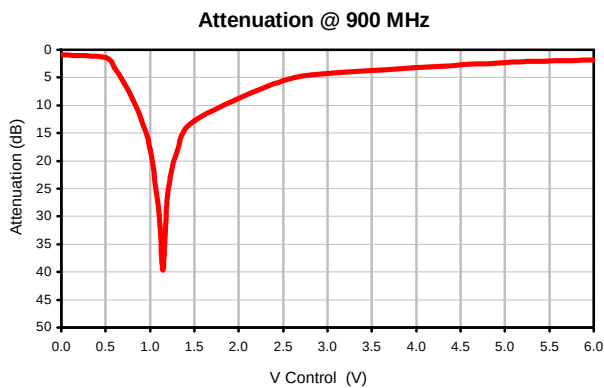
Typical Performance Data

FREQ. (MHz)	PHASE SHIFT Vs. V CONTROL (RELATIVE TO V CONTROL=0 V)					
	(deg)					
	@V Control 0.5V	@V Control 0.6V	@V Control 0.7V	@V Control 0.8V	@V Control 0.9V	@V Control 1V
600	0.30	0.50	0.79	1.31	2.12	3.88
650	0.30	0.47	0.80	1.28	2.25	4.07
700	0.20	0.36	0.59	1.07	1.92	3.94
750	0.23	0.36	0.51	1.05	1.93	3.87
800	0.21	0.34	0.49	0.92	1.75	3.64
850	0.21	0.30	0.44	0.78	1.45	3.24
900	0.24	0.33	0.45	0.77	1.33	2.77
950	0.21	0.30	0.35	0.36	0.69	1.41
1000	0.26	0.34	0.36	0.31	0.28	0.11
1050	0.30	0.34	0.22	-0.05	-0.68	-2.49
1100	0.29	0.32	0.08	-0.41	-1.81	-6.00
1150	0.31	0.27	-0.04	-0.98	-3.12	-10.59
1200	0.32	0.27	-0.26	-1.60	-5.01	-16.85

Voltage Variable Attenuator

Typical Performance Curves

VACC-09+



REV. X1
VACC-09+
070708
Page 1 of 1

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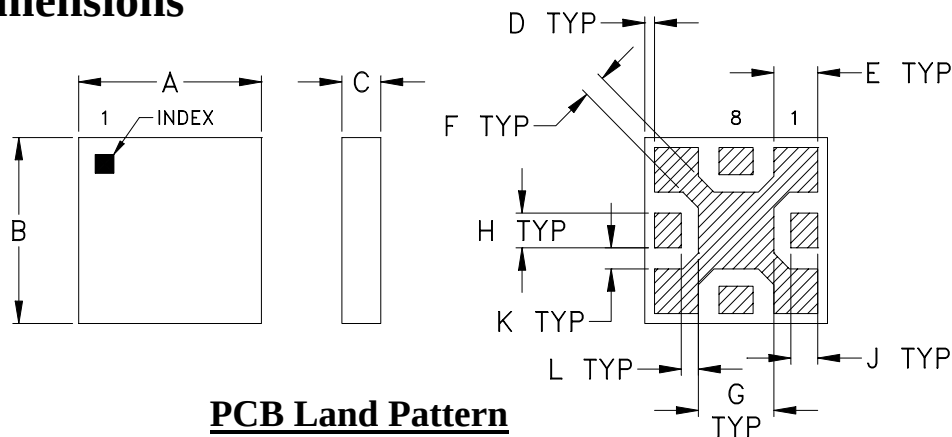
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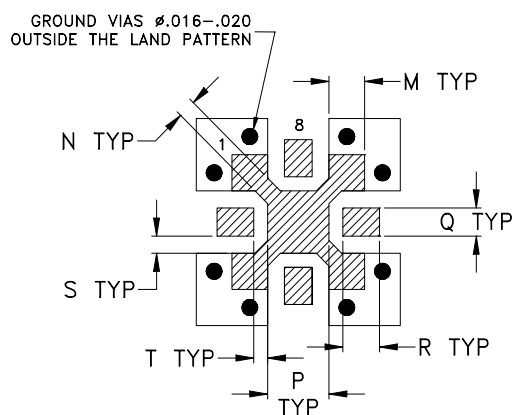
The Design Engineers Search Engine finds the model you need, Instantly • For detailed performance specs & shopping online see



GF981
GF995



PCB Land Pattern



Suggested Layout,
Tolerance to be within $\pm .002$

CASE #	A	B	C	D	E	F	G	H	J	K
GF981	.150	.150	.032 (.81)	.008	.036	.018	.062	.028	.022	.017
GF995	(3.81)	(3.81)	.065 MAX (1.65)	(0.20)	(0.91)	(0.46)	(1.57)	(0.71)	(0.56)	(0.43)

CASE #	L	M	N	P	Q	R	S	T	WT. GRAM
GF981	.014	.036	.018	.062	.028	.037	.017	.014	.05
GF995	(0.36)	(0.91)	(0.46)	(1.57)	(0.71)	(0.94)	(0.43)	(0.36)	.06

Dimensions are in inches (mm). Tolerances: 2Pl. $\pm .01$; 3Pl. $\pm .005$

Notes:

1. Open style, Ceramic Base.
2. Termination finish: Palladium Silver.



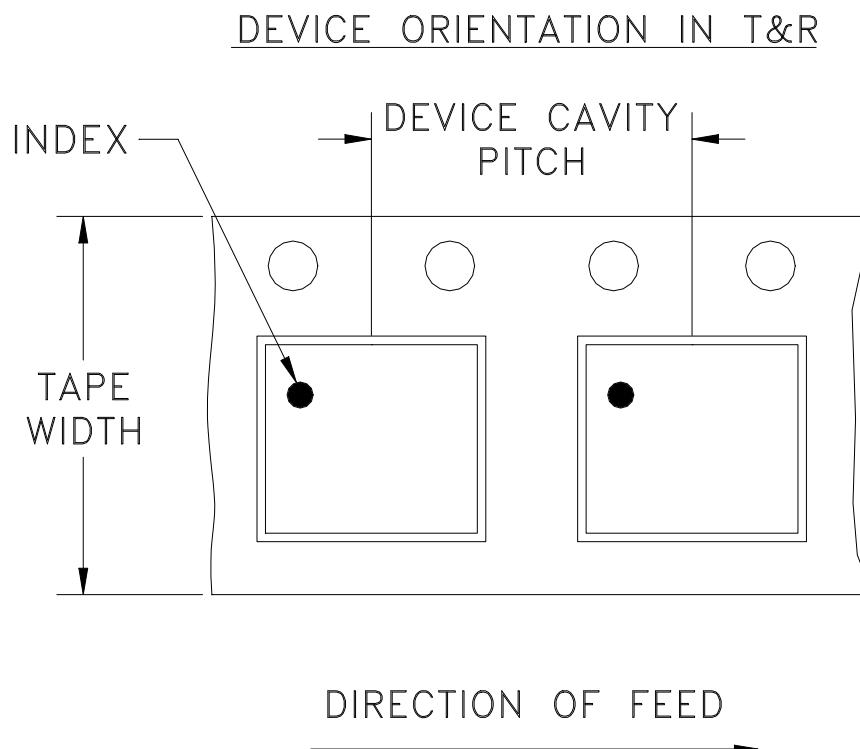
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Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
12	8	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000
		13	Standard	2000
				3000
				4000

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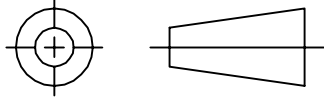
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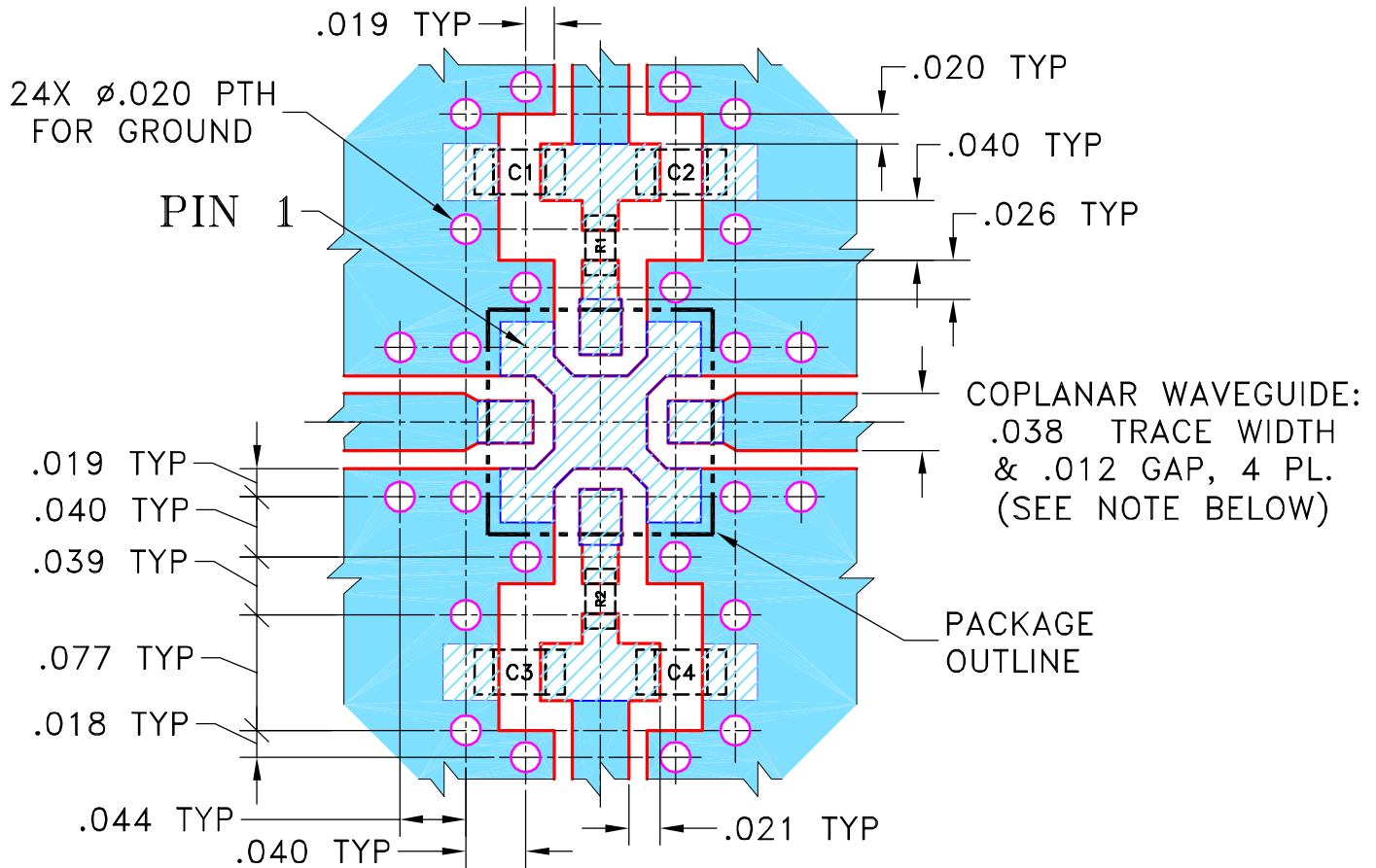
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M89321	NEW RELEASE	11/24/03	GF	ABD
A	M91387	"pj" PIN CONNECTION WAS "nz"	03/15/04	AV	LER(BC)
B	M102713	GF995 WAS GF981, UPDATED NOTES	01/12/06	GF	IL

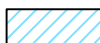
**SUGGESTED MOUNTING CONFIGURATION
FOR GF995 CASE STYLE, "pj" PIN CONNECTION**



CAPACITORS C1,C3: .01 μ F, 0603 SIZE
CAPACITORS C2,C4: 6.8 pF, 0603 SIZE
RESISTORS R1,R2: 2 K Ω m, 0402 SIZE

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 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

DRAWN

GF

11/19/03

TOLERANCES ON:

CHECKED

AV

11/24/03

2 PL DECIMALS $\pm$

APPROVED

ABD

11/24/03

3 PL DECIMALS $\pm$.005ANGLES $\pm$ FRACTIONS $\pm$
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PL, pj, GF995, VACC, TB-250

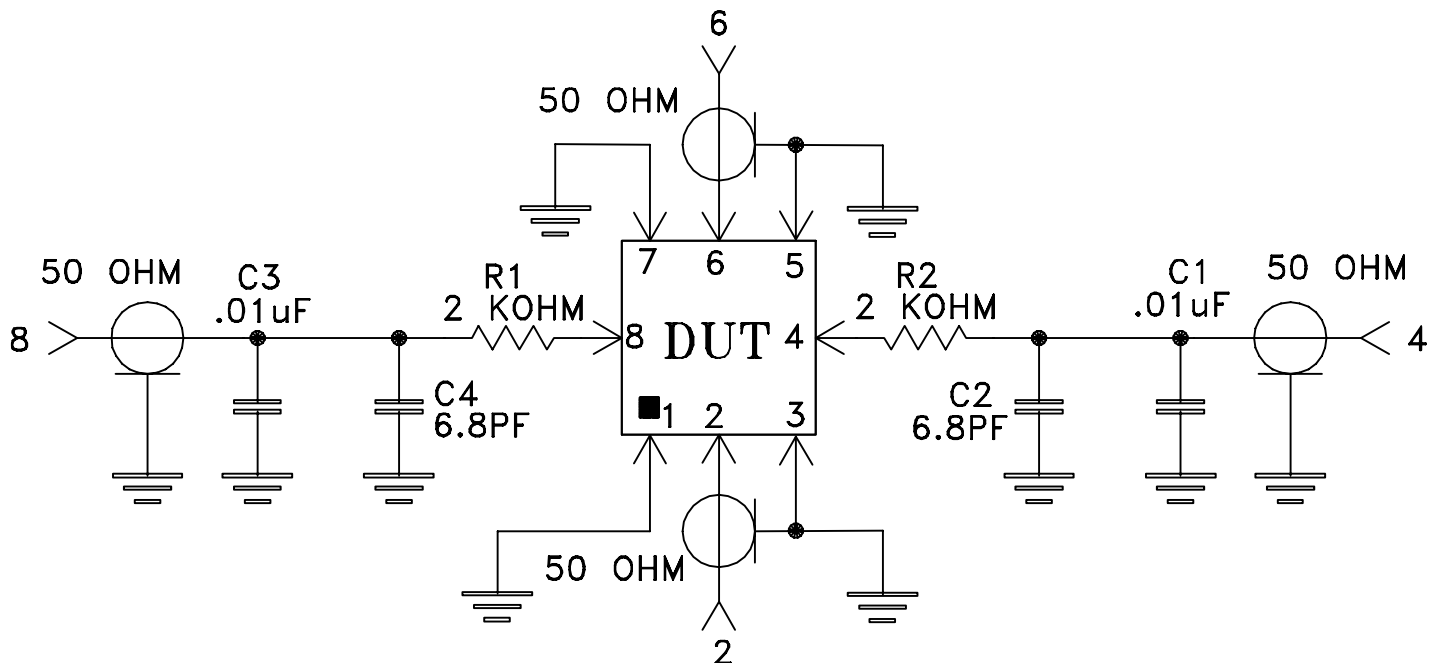
SIZE
ACODE IDENT
15542DRAWING NO:
98-PL-148REV:
B

FILE: 98PL148

SCALE: 8:1

SHEET: 1 OF 1

For Pin Connections refer to Data Sheet of the DUT



REV: D
SH: 2 OF 2



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	-45° to 85°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° 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 Eutetic Process: 225°C peak Pb-Free Process 245° - 250°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, 10-2000 Hz, 12 times in each of three perpendicular directions (total 36)	MIL-STD-202, Method 204, Condition D
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