

Surface Mount

# Monolithic Amplifier

DC-2 GHz

## Product Features

- Wideband, DC to 2 GHz
- Cascadable
- Internally Matched to 50 Ohms
- Aqueous washable
- Protected under US Patent 6,943,629



Generic photo used for illustration purposes only

## VAM-7+

CASE STYLE: MMM168

## Typical Applications

- Cellular
- PCN
- Instrumentation
- UHF/VHF

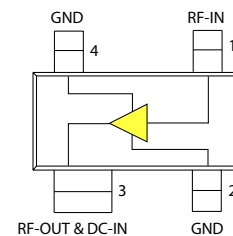
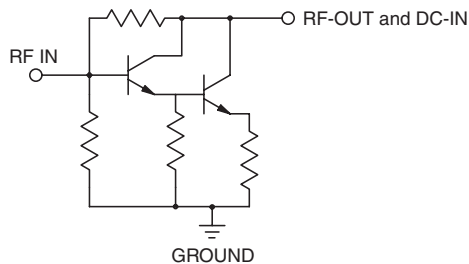
**+RoHS Compliant**

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

## General Description

VAM-7+ (RoHS compliant) is wideband amplifier offering high dynamic range. It has repeatable performance from lot to lot. It is enclosed in an SOT143 style package. It uses Darlington configuration and is fabricated using InGaP HBT technology.

## simplified schematic and pin description



Function	Pin Number	Description
RF IN	1	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
RF-OUT and DC-IN	3	RF output and bias pin. DC voltage is present on this pin; therefore a DC blocking capacitor is necessary for proper operation. An RF choke is needed to feed DC bias without loss of RF signal due to the bias connection, as shown in "Recommended Application Circuit".
GND	2,4	Connections to ground. Use via holes as shown in "Suggested Layout for PCB Design" to reduce ground path inductance for best performance.

### 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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Electrical Specifications at 25°C and 22mA, unless noted

Parameter	Min.	Typ.	Max.	Units
Frequency Range*	DC		2	GHz
Gain	f=0.1 GHz	—	13.0	dB
	f=1 GHz	—	12.0	
	f=2 GHz	7.8	9.8	
Input Return Loss	f=DC to 2 GHz		14	dB
Output Return Loss	f=DC to 2 GHz		14	dB
Output Power @ 1 dB compression	f=1GHz		+5.5	dBm
Output IP3	f=1 GHz		+18	dBm
Noise Figure	f=1 GHz		5.0	dB
Recommended Device Operating Current		22		mA
Device Operating Voltage		3.8		V
Device Voltage Variation vs. Temperature at 22 mA		-2.3		mV/°C
Device Voltage Variation vs. Current at 25°C		15.1		mV/mA
Thermal Resistance, junction-to-case <sup>1</sup>		505		°C/W

\*Guaranteed specification DC-2 GHz. Low frequency cut off determined by external coupling capacitors.

Absolute Maximum Ratings

Parameter	Ratings
Operating Temperature*	-20°C to 85°C
Storage Temperature	-55°C to 100°C
Operating Current	50mA
Power Dissipation	175mW
Input Power	13dBm

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

These ratings are not intended for continuous normal operation.

<sup>1</sup>Case is defined as ground leads.

\*Based on typical case temperature rise 5°C above ambient.

Notes

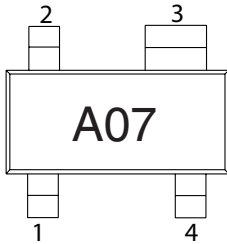
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Product Marking



Markings in addition to model number designation may appear for internal quality control purposes.

Additional Detailed Technical Information

Additional information is available on our web site. To access this information enter the model number on our web site home page.

Performance data, graphs, s-parameter data set (.zip file)

Case Style: MMM168

VAM-7+: Plastic molded SOT143 style package, lead finish: Matte-Tin

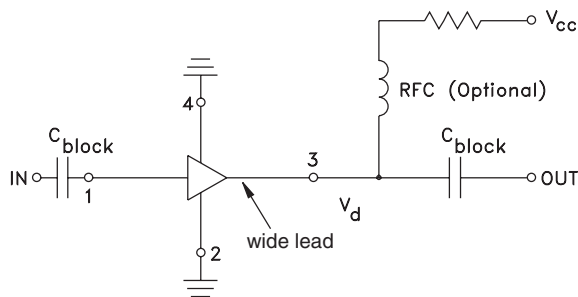
Tape & Reel: F8

Suggested Layout for PCB Design: PL-251

Evaluation Board: TB-415-7+

Environmental Ratings: ENV08

Recommended Application Circuit



R BIAS	
Vcc	"1%" Res. Values (ohms) for Optimum Biasing
7	137
8	182
9	226
10	274
11	316
12	365
13	412
14	453
15	499

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**ESD Rating**

Human Body Model (HBM): Class 1B (500 v to < 1000 v) in accordance with ANSI/ESD STM 5.1 - 2001

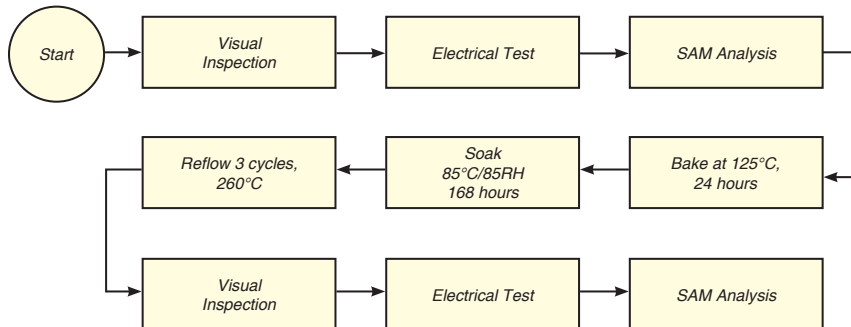
Machine Model (MM): Class M1 (< 100 v) in accordance with ANSI/ESD STM 5.2 - 1999

**MSL Rating**

Moisture Sensitivity: MSL1 in accordance with IPC/JEDECJ-STD-020C

No.	Test Required	Condition	Standard	Quantity
1	Visual Inspection	Low Power Microscope Magnification 40x	MIP-IN-0003 (MCT spec)	45 units
2	Electrical Test	Room Temperature	SCD (MCL spec)	45 units
3	SAM Analysis	Less than 10% growth in term of delamination	J-Std-020C (Jedec Standard)	45 units
4	Moisture Sensitivity Level 1	Bake at 125°C for 24 hours Soak at 85°C/85%RH for 168 hours Reflow 3 cycles at 260°C peak	J-Std-020C (Jedec Standard)	45 units

**MSL Test Flow Chart**



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# MMIC Amplifier

# VAM-7+

## Typical Performance Data

FREQUENCY (MHz)	GAIN (dB) 22 mA	ISOLATION (dB) 22 mA	RETURN LOSS IN (dB) 22 mA	RETURN LOSS OUT (dB) 22 mA
100	13.00	18.60	30.46	14.43
200	12.90	18.50	27.96	14.43
400	12.80	18.40	27.96	14.43
600	12.60	18.10	26.02	14.43
800	12.30	17.70	23.10	13.98
1000	12.00	17.40	21.94	14.43
1500	10.90	16.10	17.72	14.43
2000	9.80	15.20	14.90	14.90
2500	8.60	14.70	12.04	14.90
3000	7.20	14.70	9.90	15.39

REV. X1  
VAM-7+  
061101  
Page 1 of 1



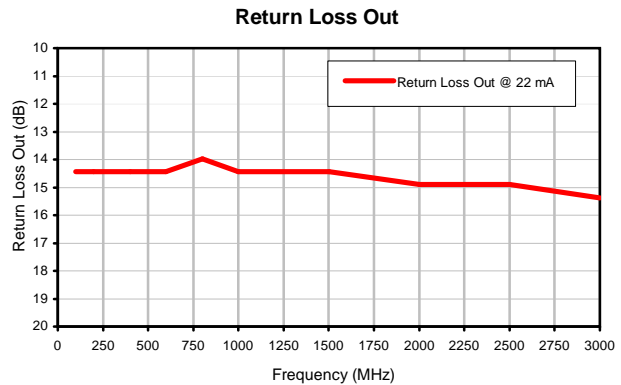
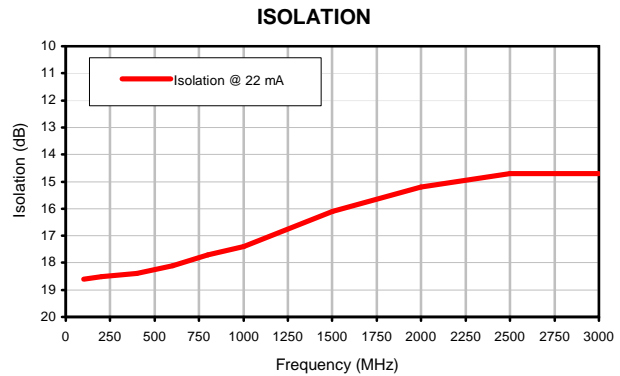
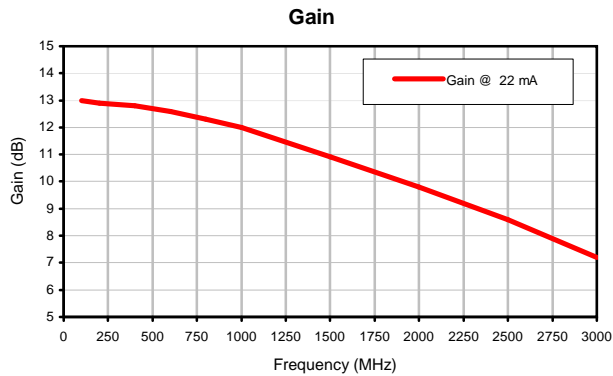
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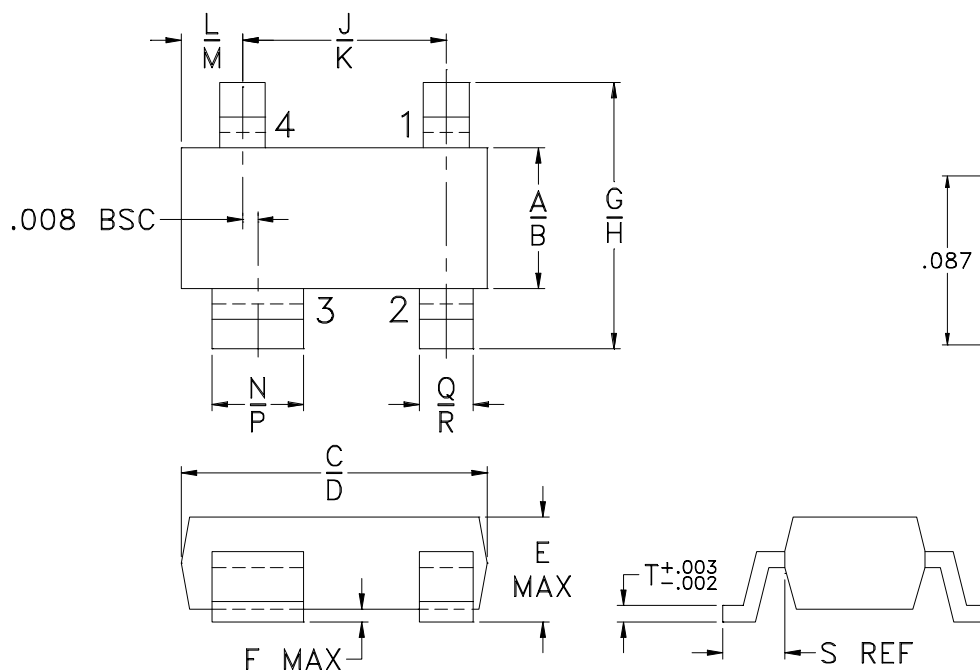
The Design Engineers Search Engine finds the model you need, Instantly • For detailed performance specs & shopping online see



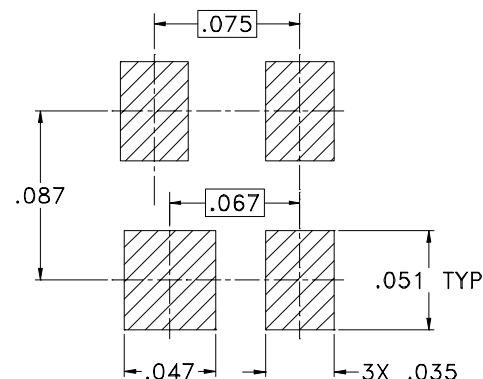
## Typical Performance Curves



### Outline Dimensions



### PCB Land Pattern



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

CASE #.	A	B	C	D	E	F	G	H	J	K	L	M	N	P
MMM168	.045 (1.14)	.055 (1.40)	.105 (2.67)	.120 (3.05)	.047 (1.19)	.005 (0.13)	.083 (2.11)	.104 (2.64)	.070 (1.78)	.080 (2.03)	.018 (0.46)	.024 (0.61)	.030 (0.76)	.036 (0.91)

CASE #.	Q	R	S	T	WT, GRAM
MMM168	.015 (0.38)	.021 (0.53)	.023 (0.58)	.005 (0.13)	.01

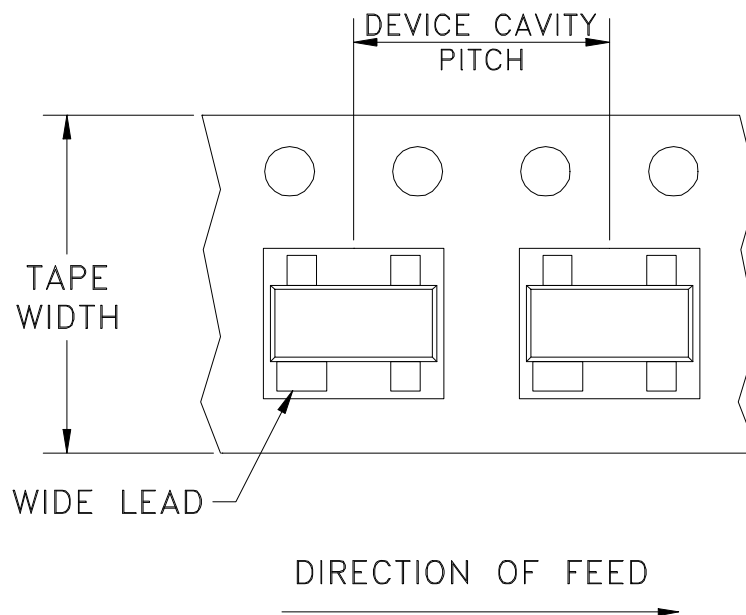
Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .01$ ; 3 Pl.  $\pm .005$

#### Notes:

- Case material: Plastic.
- Termination finish:  
For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier.  
For RoHS-5 Case Styles: Tin-Lead plate.

# Tape & Reel Packaging TR-F8

## DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
8	4	7	3000

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.

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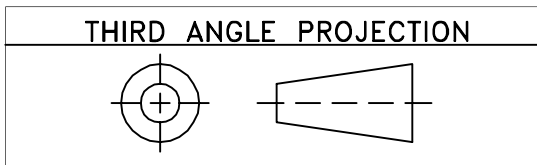
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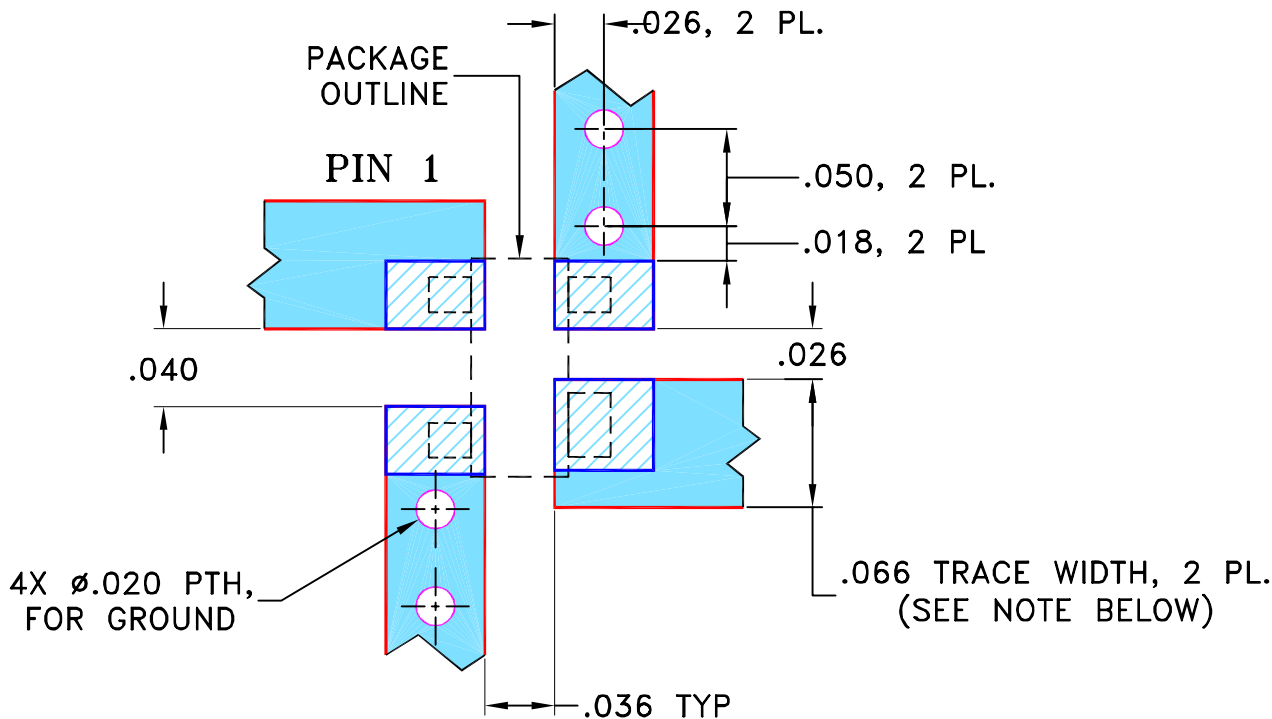
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REVISIONS					
REV OR	ECN No.	DESCRIPTION	DATE	DR	AUTH
	M108433	NEW RELEASE	11/14/06	PW	IG

**SUGGESTED MOUNTING CONFIGURATION  
FOR MMM168 CASE STYLE, "cb" PIN CONNECTION**

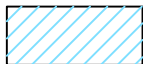


**NOTES:**

- TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS  $.030" \pm .002"$ ; 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

UNLESS OTHERWISE SPECIFIED	INITIALS	DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005 ANGLES ± FRACTIONS ±	DRAWN	PW 11/11/06
	CHECKED	IL 11/14/06
	APPROVED	IG 11/14/06



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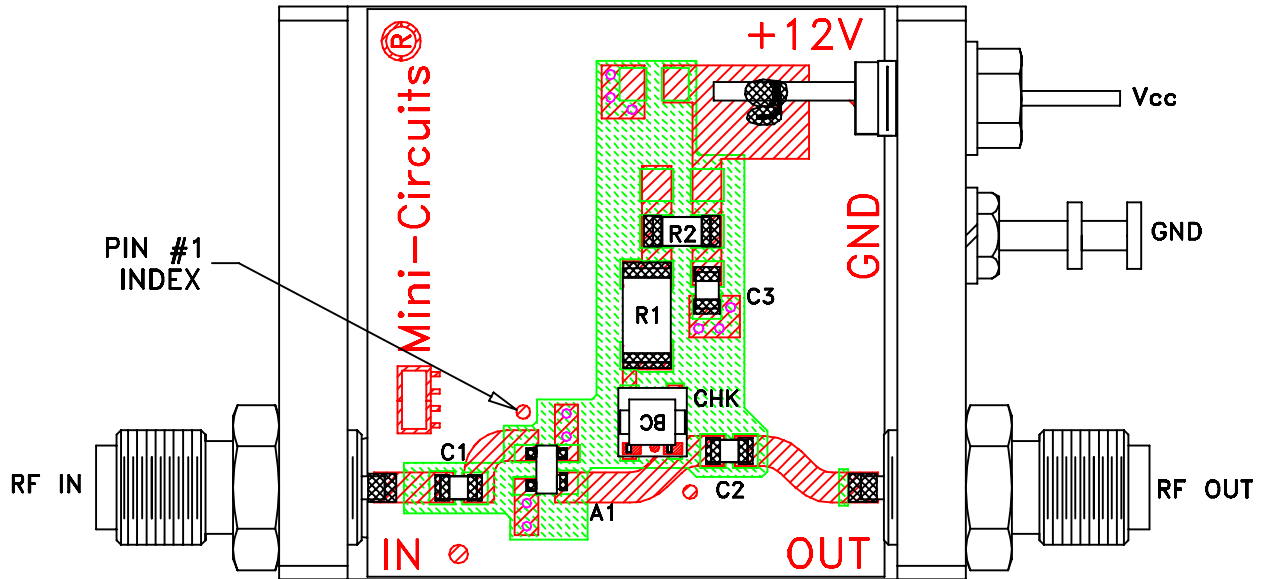
**PL, cb, MMM168, VAM, TB-415-X+**

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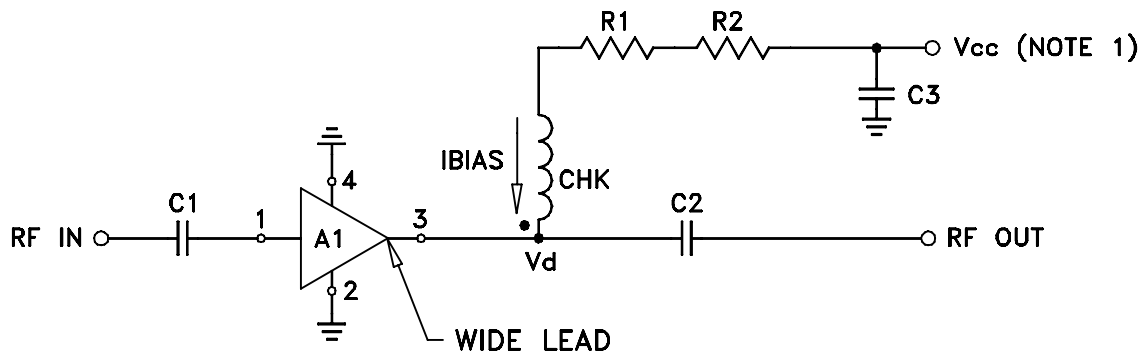
ASHEETA1.DWG REV:A DATE:01/12/95

SIZE A	CODE IDENT 15542	DRAWING NO: 98-PL-251	REV: OR
FILE: 98PL251	SCALE: 10:1	SHEET: 1 OF 1	

# Evaluation Board and Circuit



TB-415-7+




COMPONENT	VALUE
A1	VAM-7(+)
C1 (NOTE 4)	2400 pF
C2 (NOTE 4)	2400 pF
C3 (bypass)	0.1 uF
R1	365 Ohms, 0.75W
R2	8.25 Ohms, 0.25W
CHK	Mini-Circuits TCCH-80+

Schematic Diagram

**NOTE:**

1. Vcc voltage:  $+12 \pm 0.2V$ .
2. SMA Female connectors.
3. PCB material: Rogers R04350 or equivalent, dielectric constant=3.5, dielectric thickness=.030 inch.
4. Capacitors, C1 & C2 should be free of resonance up to the highest frequency specified.

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Specification	Test/Inspection Condition	Reference/Spec
Operating Temperature	-20° to 85°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C Ambient Environment	Individual Model Data Sheet
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Mechanical Shock	1.5Kg, 0.5 ms, 5 shock pulses, Y1 direction only	MIL-STD-883, Method 2002, Condition B, except Y1 direction only
Vibration (Variable Frequency)	50g peak	MIL-STD-883, Method 2007, Condition B
Autoclave	15 psig, 100% RH, 121°C, 96 hours	JESD22-A102, Condition C
HAST	130°C, 85% RH, 96 hours	JESD22-A110
Solderability	10X Magnification	J-STD-002, Para 4.2.5, Test S, 95% Coverage
Solder Reflow Heat	Sn-Pb Eutetic Process: 240°C peak Pb-Free Process: 260°C peak	J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1
Moisture Sensitivity: Level 1	Bake at 125°C for 24 hours Soak at 85°C/85% RH for 168 hours, Reflow 3 cycles at 260°C peak	J-STD-020
Marking Resistance to Solvents	Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether +	MIL-STD-202, Method 215

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
	monoethanolamine at 63°C to 70°C	