



Mini-Circuits

MMIC SURFACE MOUNT

# Monolithic Amplifier

**MAR-1SM+**

50 $\Omega$  DC to 1 GHz

## FEATURES

- Wideband, DC to 1 GHz
- Exact Footprint Substitute for Avago's MSA-0186
- Internally Matched to 50 $\Omega$
- Low Current, 17 mA
- Unconditionally Stable
- Protected by US Patent, 6,943,629



Generic photo used for illustration purposes only

CASE STYLE: WW107

## +RoHS Compliant

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

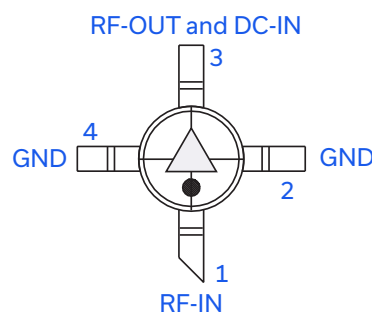
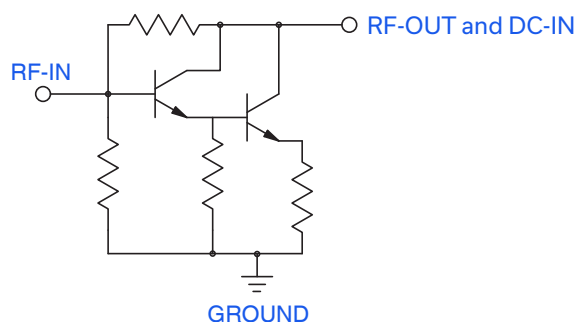
## APPLICATIONS

- Cellular
- Instrumentation
- VHF/UHF Receivers/Transmitters

## PRODUCT OVERVIEW

MAR-1SM+ (RoHS compliant) is a wideband amplifier offering high dynamic range. It has repeatable performance from lot to lot. It is enclosed in a Micro-X package. MAR-1SM+ uses Darlington configuration and is fabricated using InGaP HBT technology. Expected MTTF is 14,000 years at +85°C case temperature.

## 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.

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## ELECTRICAL SPECIFICATIONS AT +25°C AND 17 mA UNLESS NOTED OTHERWISE

Parameter	Conditions (GHz)	Min.	Typ.	Max.	Units
Frequency Range <sup>1</sup>		DC		1	GHz
Gain	0.1 1	15 <sup>2</sup>	17.8 16.5		dB
Input Return Loss	DC - 1		17.5		dB
Output Return Loss	DC - 1		21		dB
Output Power @ 1 dB Compression	0.5		+2.5		dBm
Output IP3	0.5		+14		dBm
Noise Figure	0.5		3.3		dB
Recommended Device Operating Current			17		mA
Device Operating Voltage			+5.0		V
Device Voltage Variation vs. Temperature at 17 mA			-2.9		mV/°C
Device Voltage Variation vs. Current at +25°C			15.0		mV/mA
Thermal Resistance, Junction-to-Case <sup>3</sup>			208		°C/W

1. Guaranteed specification DC-1 GHz. Low frequency cut off determined by external coupling capacitors.

2. Full temperature range.

3. Case is defined as ground leads.

## ABSOLUTE MAXIMUM RATINGS

Parameter	Ratings
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +100°C
Operating Current	40 mA
Power Dissipation	200 mW
Input Power	+13 dBm

Permanent damage may occur if any of these limits are exceeded. These ratings are not intended for continuous normal operation.





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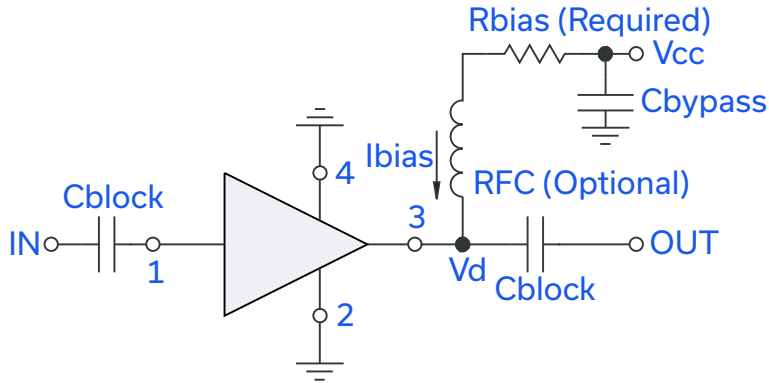
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# Monolithic Amplifier

**MAR-1SM+**

50Ω DC to 1 GHz

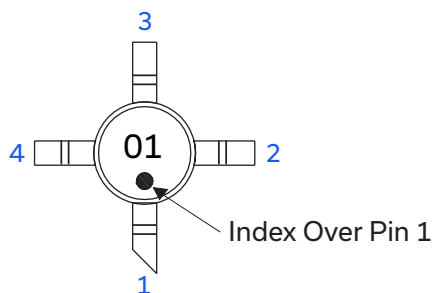
## RECOMMENDED APPLICATION CIRCUIT



Test Board includes case, connectors, and components (in bold) soldered to PCB

R BIAS	
Vcc	"1%" Res. Values (Ohms) for Optimum Biasing
7	118
8	178
9	237
10	294
11	357
12	412
13	464
14	536
15	590

## PRODUCT MARKING



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





MMIC SURFACE MOUNT

# Monolithic Amplifier

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50Ω DC to 1 GHz

ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASHBOARD. [CLICK HERE](#)

Performance Data & Graphs	Data Table
	Swept Graphs
	S-Parameter Data Set (.zip file)
Case Style	WW107 Plastic micro-x package, 0.085 body diameter, Lead Finish: Matte-Tin
Tape & Reel Standard Quantities Available on Reel	F4 7" Reels with 20, 50, 100, 200, 500 or 1K devices
Suggested Layout for PCB Design	PL-253
Evaluation Board	TB-411-1+
Environmental Ratings	ENV08T3

## ESD RATING

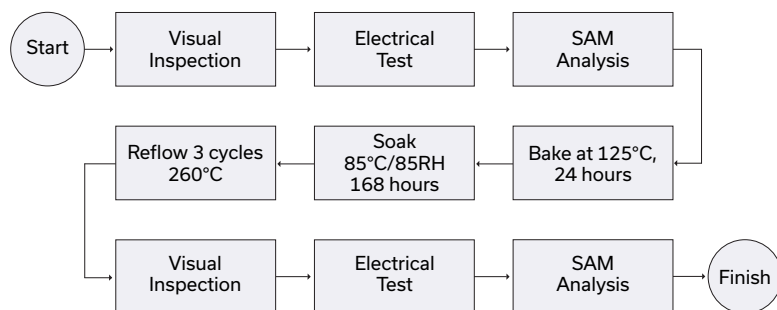
Human Body Model (HBM): Class 1B ( 500 V to < 1,000 V) in accordance with ANSI/ESD STM 5.1 - 2001  
Machine Model (MM): Class M1 ( < 100 V) in accordance with ESD STM 5.2 - 1999

## 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



## 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-Circuits' applicable established test performance criteria and measurement instructions.
- 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/terms/viewterm.html](http://www.minicircuits.com/terms/viewterm.html)



# MMIC Amplifier

# MAR-1SM+

## Typical Performance Data

FREQUENCY (MHz)	GAIN (dB) 17 mA	ISOLATION (dB) 17 mA	RETURN LOSS IN (dB) 17 mA	RETURN LOSS OUT (dB) 17 mA
100	18.50	21.94	23.10	23.10
500	17.50	21.94	24.44	23.10
1000	15.50	20.00	24.44	20.92
1500	13.70	17.72	27.96	20.00
2000	12.30	15.92	24.44	15.92
2500	10.60	14.89	20.00	15.92
3000	9.30	13.98	18.42	16.48
3500	7.90	13.15	13.97	15.92
4000	6.60	12.04	11.06	15.39

REV. X1  
MAR-1SM+  
061031  
Page 1 of 1



Patent Pending

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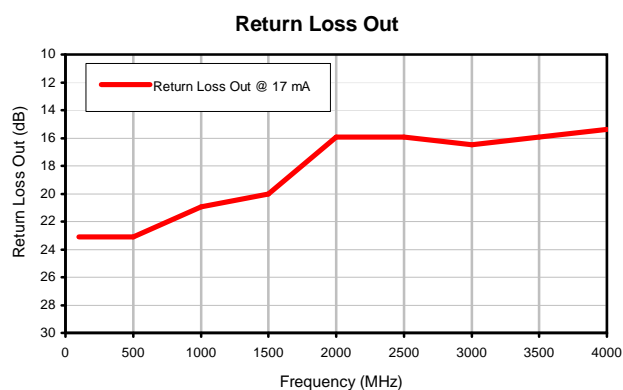
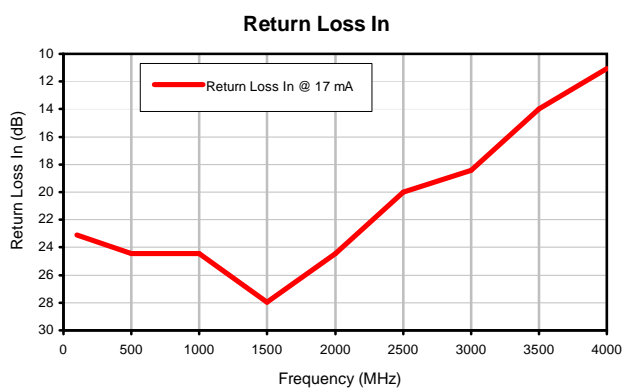
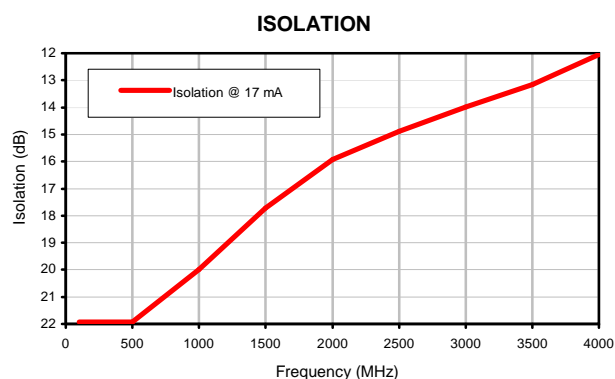
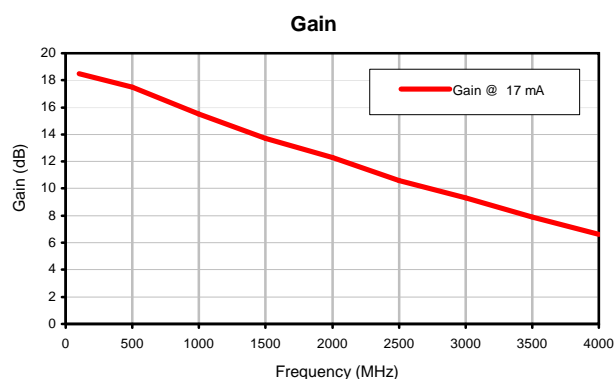
IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS 9100 CERTIFIED RoHS compliant

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

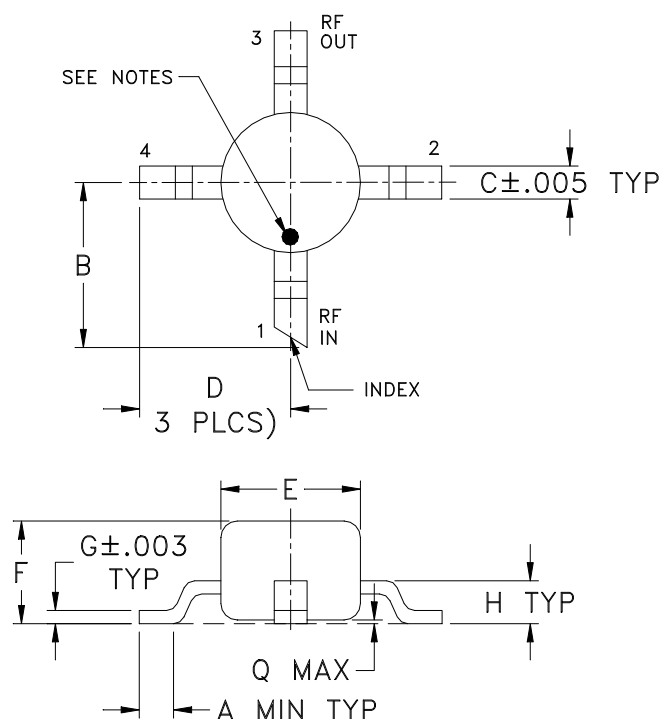
The Design Engineers Search Engine finds the model you need, Instantly • For detailed performance specs & shopping online see



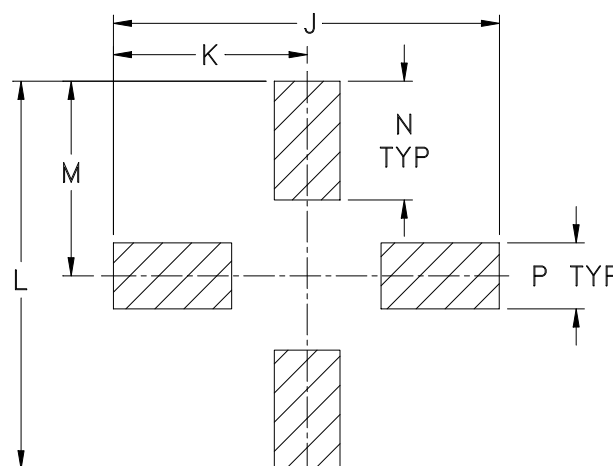
## Typical Performance Curves



## 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	Q	WT. GRAMS
WW107	.012 (0.30)	.10 (2.54)	.020 (0.51)	.092 (2.34)	.085 (2.16)	.060 (1.52)	.007 (0.18)	.026 (0.66)	.235 (5.97)	.118 (3.00)	.235 (5.97)	.118 (3.00)	.072 (1.83)	.040 (1.02)	.020 (0.51)	.015

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

### Notes:

- Case material: Plastic.
- Termination finish:  
For RoHS Case Styles: Matte tin Plate.  
For RoHS-5 Case Styles: Tin-Lead plate.
- RF input termination (1) identified by one or both of the following at factory option:
  - diagonally cut termination, which may be  $45^\circ$  (ref) in either direction;
  - orientation mark on the case. Model dash number is identified by color dot or alphanumeric code on case. See specification data sheet.

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

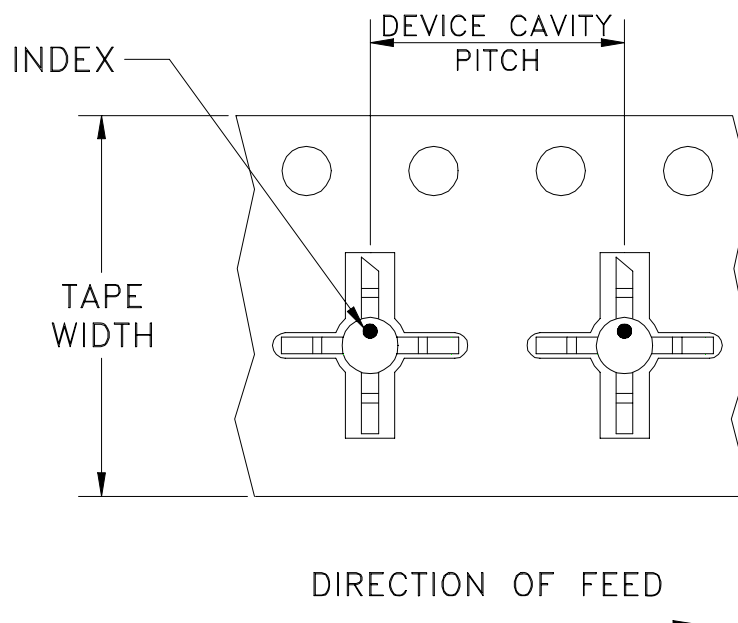
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Mini-Circuits ISO 9001 & ISO 14001 Certified

# Tape & Reel Packaging TR-F4

## DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
12	8	7	Small quantity standards (see note)	20
				50
				100
				200
				500
		7	Standard	1000

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)



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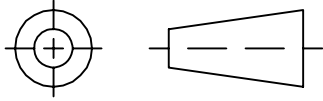
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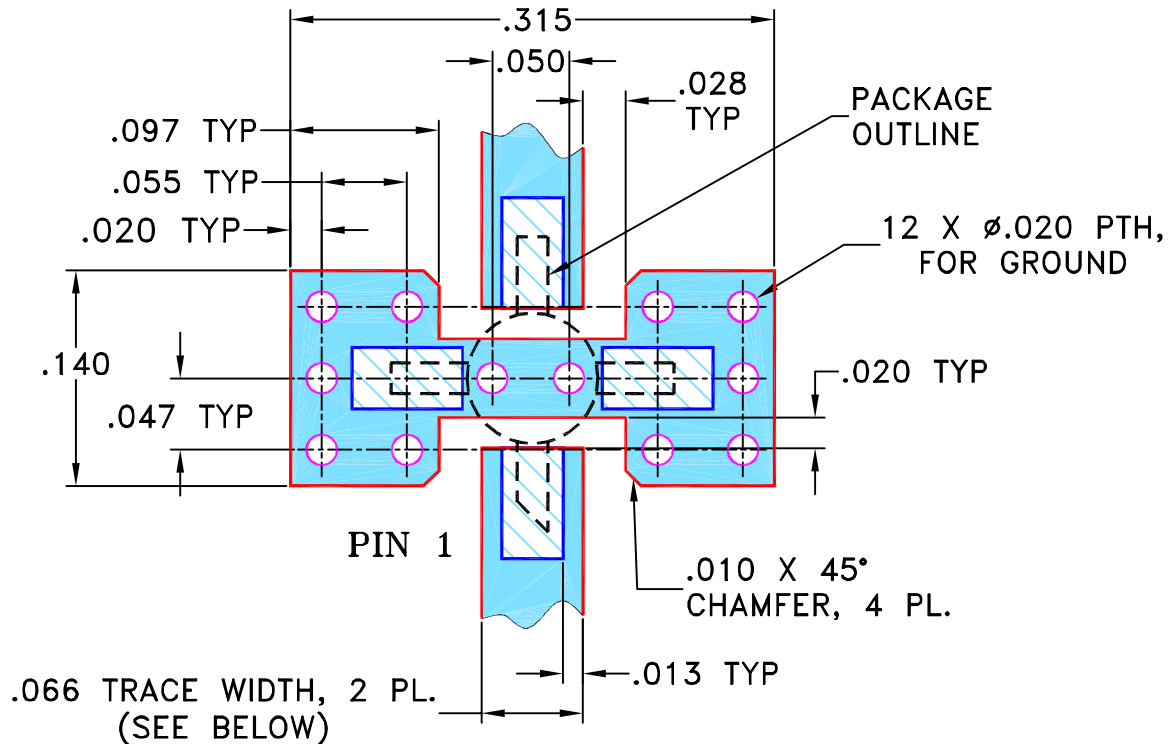
## THIRD ANGLE PROJECTION



## REVISIONS

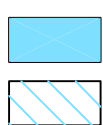
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	M108436	NEW RELEASE	11/14/06	PW	IG

### SUGGESTED MOUNTING CONFIGURATION FOR WW107 CASE STYLE, "cb" PIN CONNECTION



## NOTES:

1. 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.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
3. IF PCB DESIGN RULES ALLOW, PLACE GROUND VIAS UNDER THE LAND PATTERN FOR BETTER RF PERFORMANCE. OTHERWISE PLACE GROUND VIAS AS CLOSE TO LAND PATTERN AS POSSIBLE.



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  $\pm .005$ ANGLES  $\pm$ FRACTIONS  $\pm$ 

DRAWN

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11/11/06

CHECKED

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13 Neptune Avenue  
Brooklyn NY 11235

PL, cb, WW107, MAR, TB-411-XX+

SIZE

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CODE IDENT

15542

DRAWING NO:

98-PL-253

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OR

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98PL253

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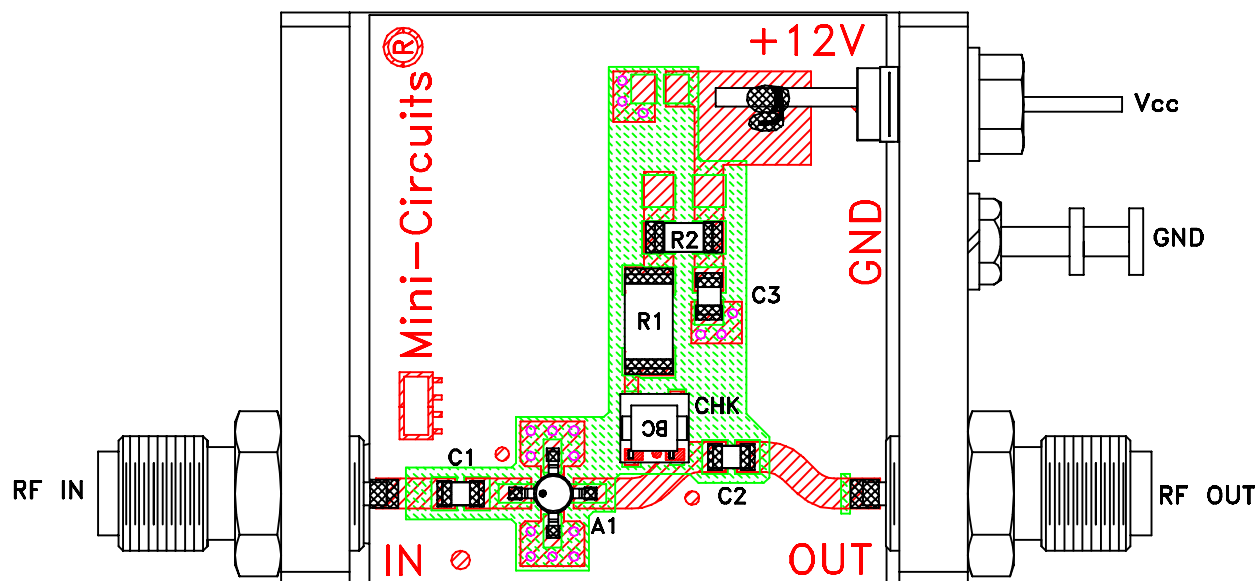
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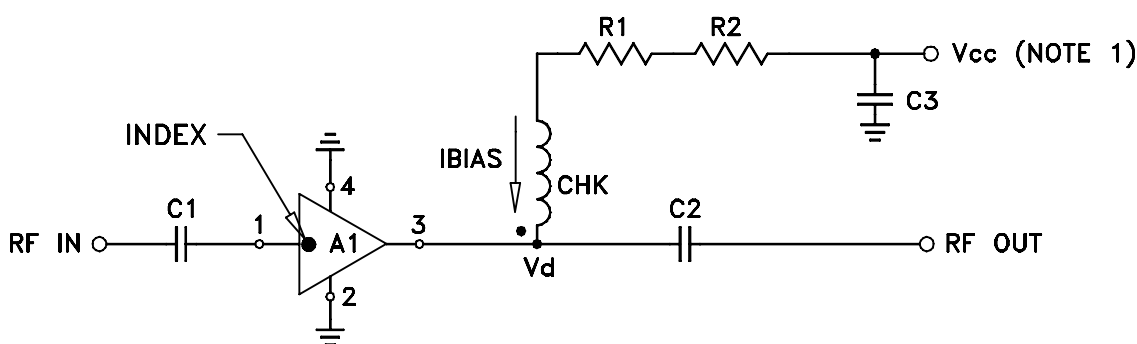
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ASHEETA1.DWG REV:A DATE:01/12/95

# Evaluation Board and Circuit



TB-411-1+




COMPONENT	VALUE
A1	MAR-1SM(+)
C1 (NOTE 4)	2400 pF
C2 (NOTE 4)	2400 pF
C3 (bypass)	0.1 uF
R1	412 Ohms, 0.75W
R2	0 Ohm, 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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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	-40° 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



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Specification	Test/Inspection Condition	Reference/Spec
	monoethanolamine at 63°C to 70°C	