

Surface Mount

# Monolithic Amplifier

DC-7 GHz

## Features

- Miniature SOT-89 Package
- Frequency range, DC to 7 GHz
- Internally Matched to 50 Ohms
- Output power, 11.2 dBm typ.
- Excellent package for heat dissipation, exposed metal bottom
- Aqueous washable
- Protected by US Patent 6,943,629

## Applications

- Cellular
- PCS
- Communication receivers & transmitters



Generic photo used for illustration purposes only

## Gali-29+

CASE STYLE: DF782

**+RoHS Compliant**

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

## General Description

Gali-29+ (RoHS compliant) is a wideband amplifier offering high dynamic range. Lead finish is SnAgNi. It has repeatable performance from lot to lot, and is enclosed in a SOT-89 package. It uses patented Transient Protected Darlington configuration and is fabricated using InGaP HBT technology. Expected MTTF is 2,000 years at 85°C case temperature. Gali-29+ is designed to be rugged for ESD and supply switch-on transients.

## 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.
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**Electrical Specifications at 25°C and 40mA, unless noted**

Parameter		Min.	Typ.	Max.	Units
Frequency Range*		DC		7	GHz
Gain	f=0.1 GHz	—	15.4	—	dB
	f=1 GHz	—	15.1	—	
	f=2 GHz	12.7	14.7	—	
	f=3 GHz	—	13.7	—	
	f=4 GHz	—	13.6	—	
	f=6 GHz	—	12.9	—	
	f=8 GHz	—	14.2	—	
Input Return Loss	f= DC to 3 GHz		14		dB
	f= 3 to 7 GHz		12.5		
Output Return Loss	f= DC to 3 GHz		14		dB
	f= 3 to 7 GHz		8.0		
Output Power @ 1 dB compression	f=7 GHz	10.0	11.2	—	dBm
Output IP3	f=2 GHz		24.7		dBm
Noise Figure	f=2 GHz		6.0		dB
Recommended Device Operating Current			40		mA
Device Operating Voltage		3.2	3.6	4.0	V
Device Voltage Variation vs. Temperature at 40 mA			-1.9		mV/°C
Device Voltage Variation vs. Current at 25°C			8.6		mV/mA
Thermal Resistance, junction-to-case <sup>1</sup>			120		°C/W

\*Guaranteed specification DC-7 GHz. Low frequency cut off determined by external coupling capacitors.

**Absolute Maximum Ratings**

Parameter	Ratings
Operating Temperature*	-45°C to 85°C
Storage Temperature	-65°C to 150°C
Operating Current	55mA
Input Power	15dBm

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 2°C above ambient.

**Notes**

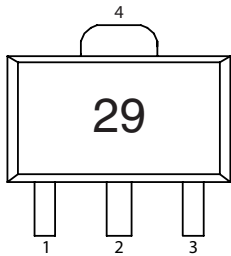
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**Product Marking**



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: DF782**

Plastic package, exposed paddle, lead finish: Matte-Tin

**Tape & Reel: F55**

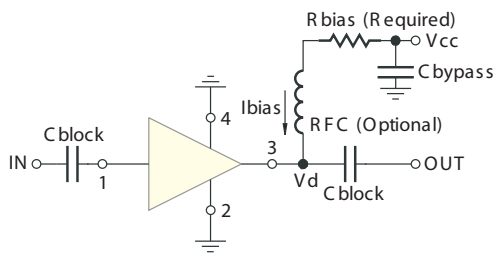
7" reels with 20, 50, 100, 200, 500, 1K devices.

**Suggested Layout for PCB Design: PL-019**

**Evaluation Board: TB-409-29+**

**Environmental Ratings: ENV08T2**

**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	88.7
8	113
9	137
10	162
11	187
12	215
13	237
14	261
15	287
16	316
17	340
18	365
19	392
20	412

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**ESD Rating**

Human Body Model (HBM): Class 1A (250V to < 500V) in accordance with ANSI/ESD STM 5.1 - 2001

Machine Model (MM): Class M1 (< 100V) 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

# GALI-29+

## Typical Performance Data

FREQUENCY (MHz)	GAIN (dB) 40 mA	ISOLATION (dB) 40 mA	RETURN LOSS IN (dB) 40 mA	RETURN LOSS OUT (dB) 40 mA
100	15.52	18.81	14.78	18.39
200	15.55	18.72	14.85	17.69
400	15.51	18.79	15.07	17.23
600	15.39	18.81	14.96	17.02
800	15.30	18.86	14.82	16.73
1000	15.21	18.87	14.89	16.58
1200	15.10	18.83	14.99	16.27
1400	14.99	18.84	15.07	16.13
1600	14.90	18.82	15.33	16.24
1800	14.79	18.85	15.73	16.33
2000	14.67	18.84	16.08	16.47
2200	14.55	18.77	16.33	16.66
2500	14.39	18.91	16.69	16.96
2800	14.20	18.85	16.60	16.96
3000	14.08	19.12	16.38	16.66
3200	13.95	19.07	15.97	16.31
3400	13.82	19.17	15.77	15.85
3600	13.74	19.31	15.49	15.24
3800	13.63	19.37	15.34	14.68
4000	13.54	19.49	15.36	14.18
4200	13.46	19.77	15.45	13.67
4400	13.45	19.86	15.67	13.23
4600	13.45	19.96	15.82	12.68
4800	13.44	20.04	16.05	12.40
5000	13.39	20.15	16.33	12.08
5200	13.39	20.18	16.28	11.60
5400	13.48	20.32	15.81	11.06
5600	13.55	20.09	15.09	10.52
5800	13.61	19.99	14.19	10.04
6000	13.88	20.15	13.27	9.58
6200	14.12	20.01	12.24	8.90
6400	14.29	19.83	11.50	8.30
6600	14.55	19.94	11.16	7.93
6800	14.69	19.75	11.30	7.56
7000	14.86	19.56	11.38	7.00
7500	15.42	18.75	11.80	5.08
8000	15.83	17.93	13.11	3.16
8500	15.18	17.02	13.80	2.40
9000	14.18	15.24	15.55	2.39
9500	11.30	13.99	25.90	5.94
10000	9.70	12.44	16.94	6.80

REV. X1  
GALI-29+  
061031  
Page 1 of 1



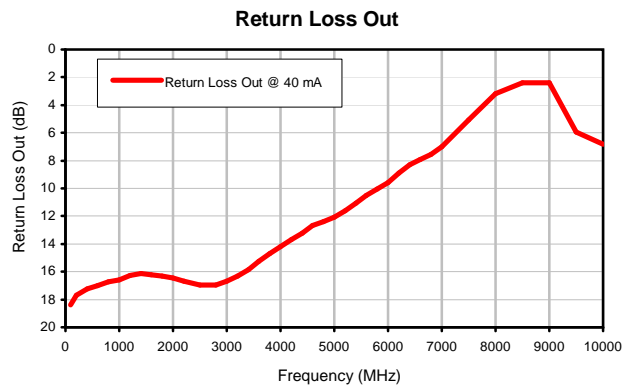
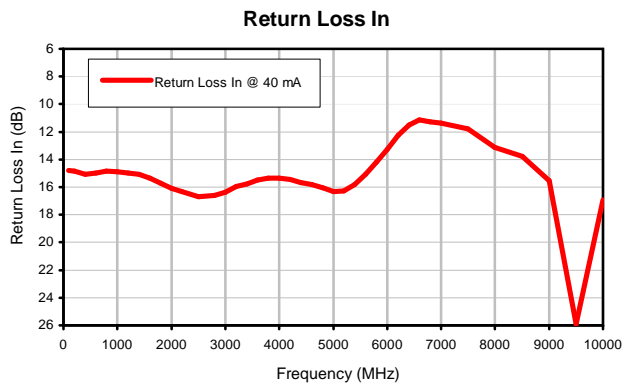
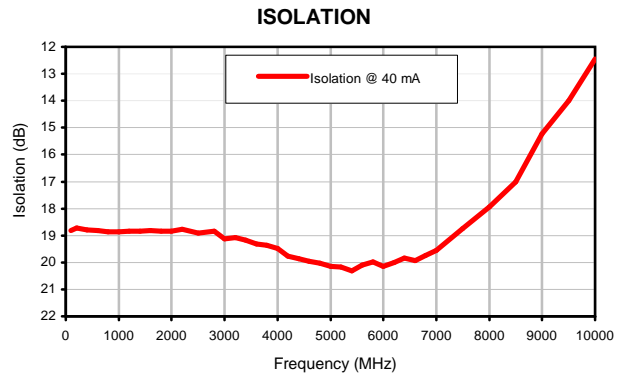
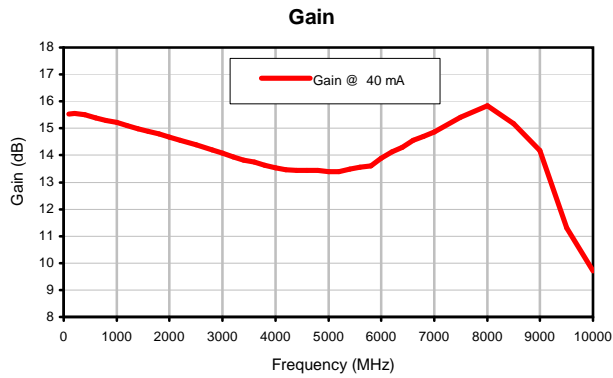
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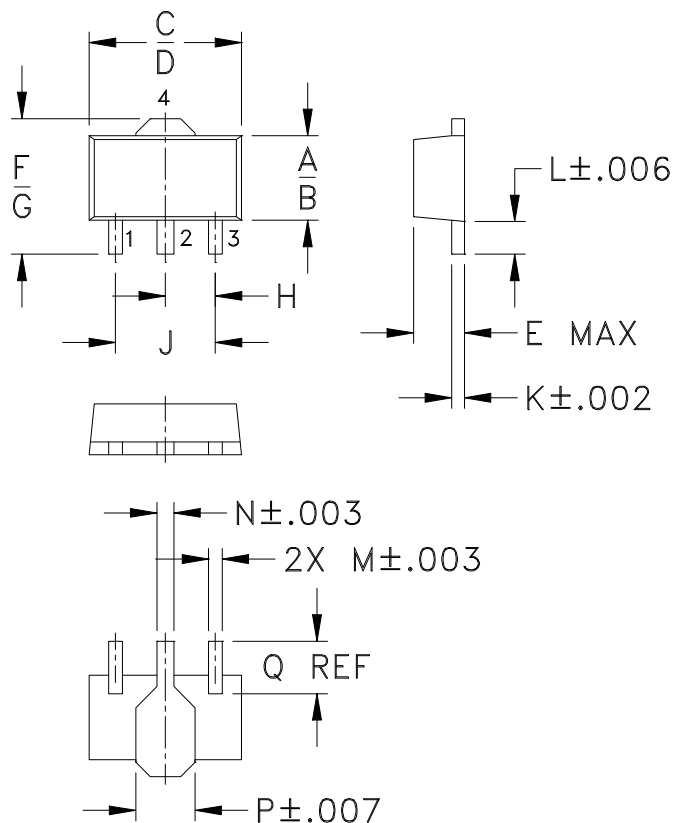
The Design Engineers Search Engine finds the model you need, Instantly • For detailed performance specs & shopping online see



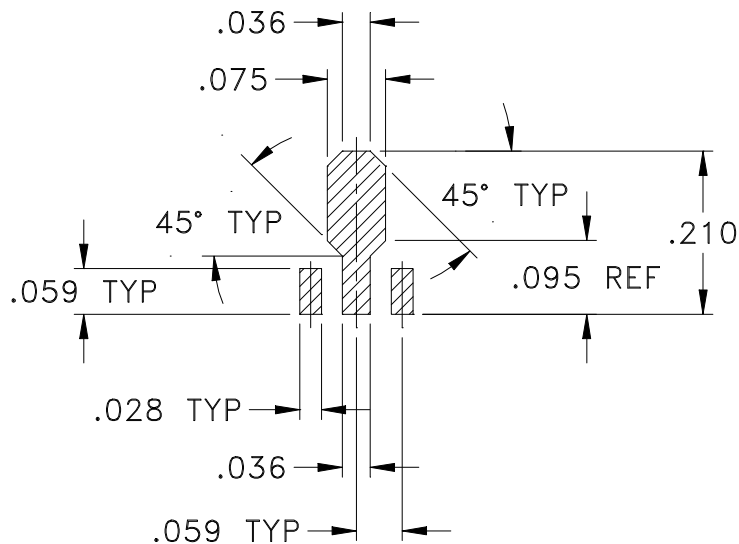
## Typical Performance Curves



### 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
DF782	.102 (2.59)	.090 (2.29)	.181 (4.60)	.173 (4.39)	.063 (1.60)	.167 (4.24)	.155 (3.94)	.059 (1.50)	.118 (3.00)	.015 (0.38)	.041 (1.04)	.016 (0.41)

CASE #	N	P	Q	WT. GRAM
DF782	.019 (0.48)	.065 (1.65)	.062 (1.57)	.2

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

#### Notes:

- Case material: Plastic.
- Termination finish:  
 For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier or Matte-Tin.  
 All models, (+) suffix. See model Data sheet.  
 For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.



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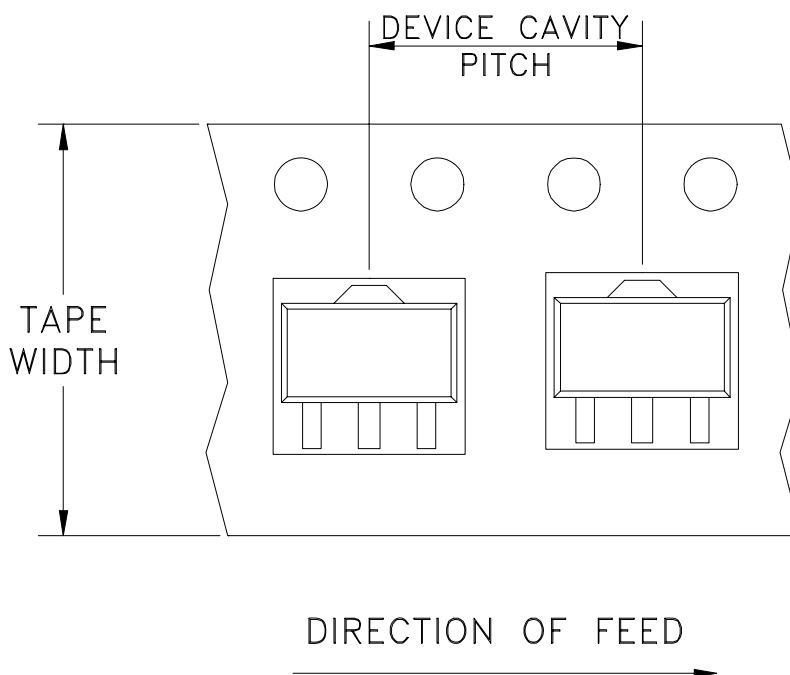
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# Tape & Reel Packaging TR-F55

## DEVICE ORIENTATION IN T&R



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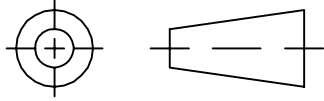
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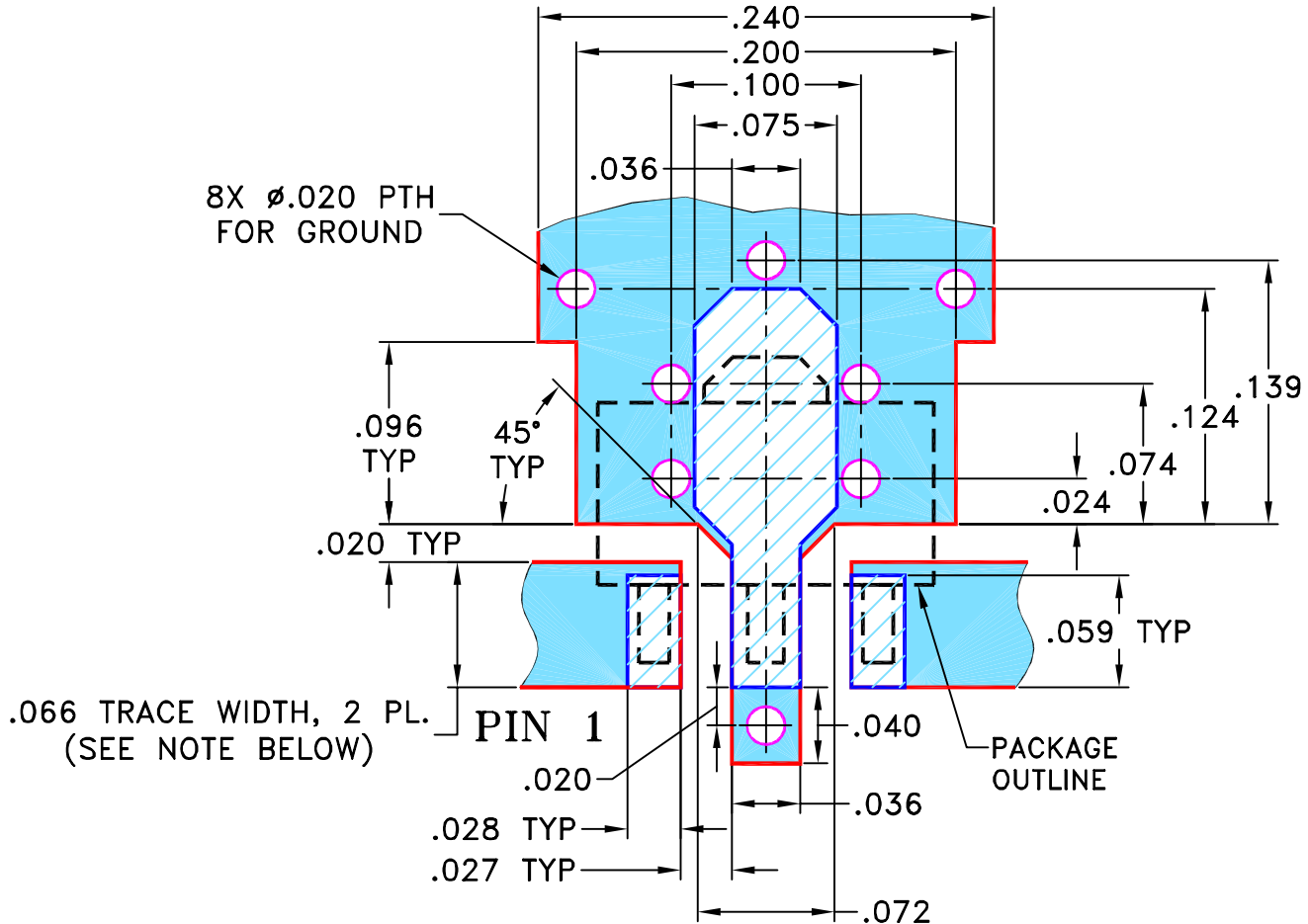
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
A	M76190	CHANGED DISCRIPTION	04/01	GF	CT
B	M82575	UPDATED DRAWING	08/05/02	AV	LC
C	M102713	ADDED NOTE 2 & "...WITH SMOBC"	01/17/06	MMG	IL
D	M108434	UPDATED DRAWING PER TB-409+	11/14/06	PW	IG

SUGGESTED MOUNTING CONFIGURATION  
FOR DF782 CASE STYLE, "mz" PIN CONNECTION



- NOTES:** 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .030" ± .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.



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	AV 01/15/01
	CHECKED	YB 01/23/01
	APPROVED	DB 01/23/01

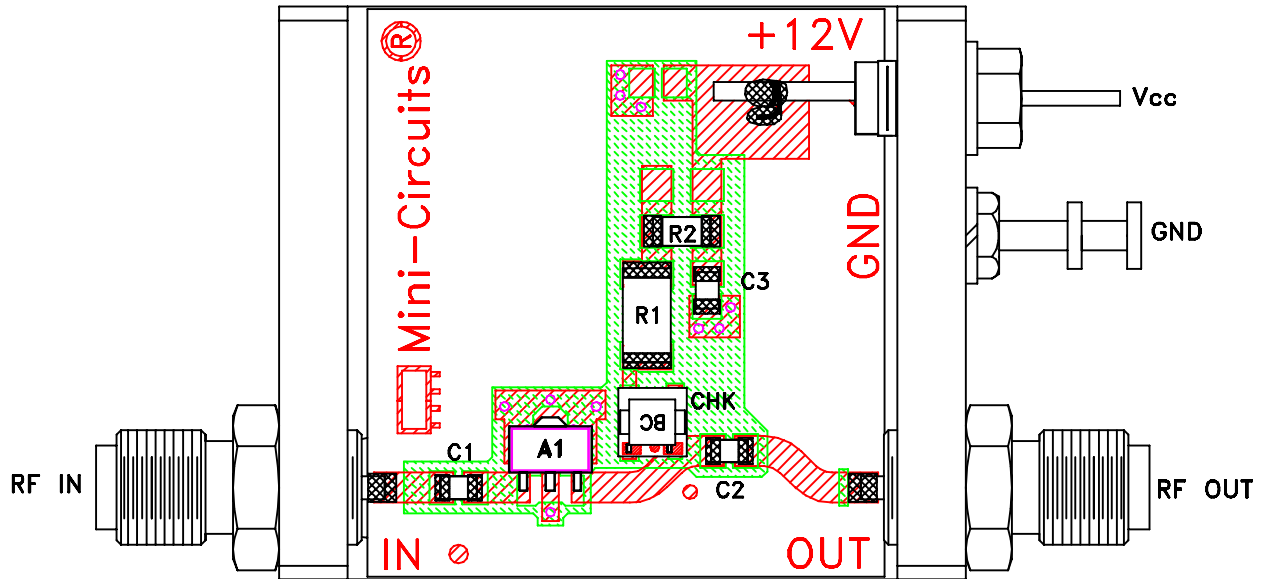
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PL, mz, DF782, GALI, TB-409-XXX+

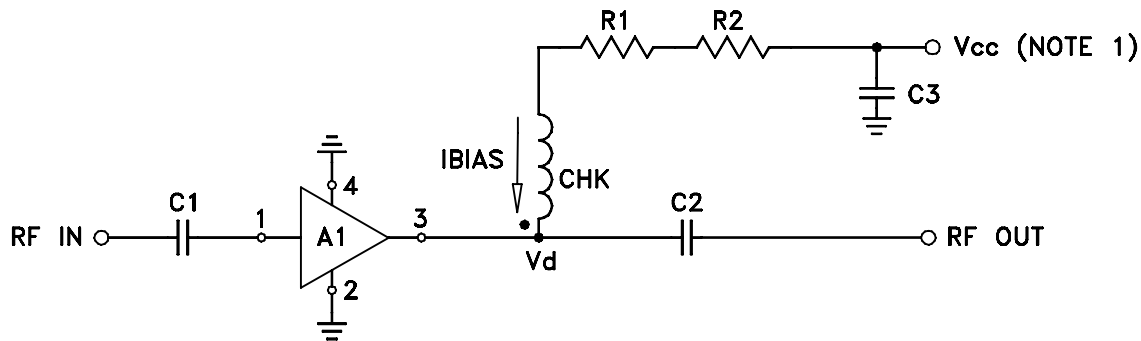
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SIZE A	CODE IDENT 15542	DRAWING NO: 98-PL-019	REV: D
FILE: 98PL019	SCALE: 10:1	SHEET: 1 OF 1	

# Evaluation Board and Circuit



TB-409-29+




COMPONENT	VALUE
A1	Gali-29(+)
C1 (NOTE 4)	2400 pF
C2 (NOTE 4)	2400 pF
C3 (bypass)	0.1 uF
R1	210 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 RO4350 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.

 **Mini-Circuits®**

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 or -40° to 85°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-65° to 150° 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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<b>Specification</b>	<b>Test/Inspection Condition</b>	<b>Reference/Spec</b>
	monoethanolamine at 63°C to 70°C	