

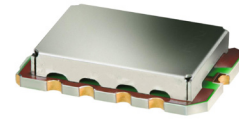
Low Noise Amplifier

TAMP-1521GLN+

50 Ω 1380 to 1520 MHz

The Big Deal

- Ultra Low Noise Figure, 0.6 dB typ.
- High IP3, 27.5 dBm typ.
- High Gain, 35 dB typ.
- Integrated Bias Matching and Stability Circuits



CASE STYLE: JQ1382

Product Overview

The TAMP-1521GLN+ (RoHS compliant) utilizes advanced E-PHEMT technology in a 2-stage low noise amplifier design built into a shielded case (size: .591"x.394"x.118"). The drop-in module offers ultra low noise figure and high gain with good input and output return loss over the entire frequency range and without the need of external matching components.

Key Features

Feature	Advantages
Ultra Low NF	With only 0.6 dB NF, the TAMP-1521GLN+ enables greater sensitivity for receiver applications. It includes all matching and stability circuits making this Drop-in LNA module a turn-key solution for ensuring system sensitivity in demanding applications.
High Output IP3	At +27.5 dBm IP3, in combination with its low noise performance, the TAMP-1521GLN+ can improve a systems' spur-free dynamic range which is often the critical driver in many receiver applications.
Very flat, High Gain	With gain of 35 dB and flatness of ± 0.35 dB, this amplifier can insulate a receiver NF from component losses or NF of the 2nd stage amplifier following the TAMP-1521GLN+.
Power In at 1dB Comp.: -20dBm typ. Input no damage, +17dBm	Provides a good safety margin against damage or saturation from unwanted high power RF signals present at the input to a receiver.
Well Matched input/ output ports	With typical return loss of 21 dB at the input and output ports, the TAMP-1521GLN+ can be used in cascade with many 50 Ohm components and maintain minimal interaction or reflections.
Drop-in Module	Eliminates the need for designers to optimize low noise transistor bias and matching circuitry. The TAMP-1521GLN+ provides the outstanding combined performance and does not require any external elements. The case PCB area is smaller than most LNA transistor designs with external circuitry.
Metal Case	Provides a protective enclosure improving handling robustness in addition to shielding the sensitive high gain devices from close by circuitry.
Unconditionally stable	No adverse effects due to loading of the input and output ports avoiding potential instability which can be a critical requirement when integrating high gain, high frequency devices on an open PCB assembly.

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-Circuit's applicable established test performance criteria and measurement instructions.
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Surface Mount

Low Noise Amplifier

TAMP-1521GLN+

50Ω

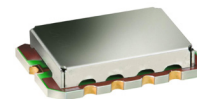
1380 to 1520 MHz

Features

- Ultra low noise figure, 0.6 dB typ.
- High gain, 35 dB typ.
- Output power, up to +13.5 dBm typ.
- Good output IP3, 27.5 dBm typ.
- Good VSWR, 1.2:1 typ.
- Unconditionally stable

Applications

- Military & Avionics
- Base station transceiver, tower mounted amplifier, repeater
- General purpose low noise amplifier



CASE STYLE: JQ1382

+RoHS Compliant

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

Electrical Specifications at 25°C

Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Frequency Range		1380		1520	MHz
Noise Figure	1380 - 1520		0.6	0.9	dB
Gain	1380 - 1520	33	35		dB
Gain Flatness	1380 - 1520		± 0.35	± 0.65	dB
Output Power at 1dB compression	1380 - 1520	11.5	13.5		dBm
Output third order intercept point (OIP3)	1380 - 1520		27.5		dBm
Input VSWR	1380 - 1520		1.20		:1
Output VSWR	1380 - 1520		1.15		:1
DC Supply Voltage			5.0		V
DC Supply Current			50	70	mA

Pin Connections

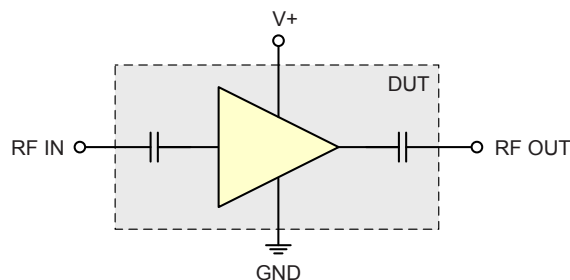
RF IN	10
RF OUT	5
V+	7
GROUND	1,2,3,4,6,8,9,11

Maximum Ratings

Parameter	Ratings
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
Operating Voltage	5.5 V
Input RF Power (no damage)	+17 dBm
Power Consumption	390 mW

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

Simplified Schematic



ESD Rating

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

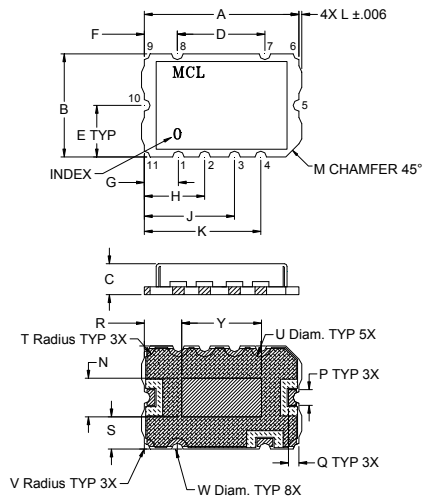
Machine Model (MM): Class M1 (40 V) in accordance with ANSI/ESD STM 5.2 - 1999

Notes

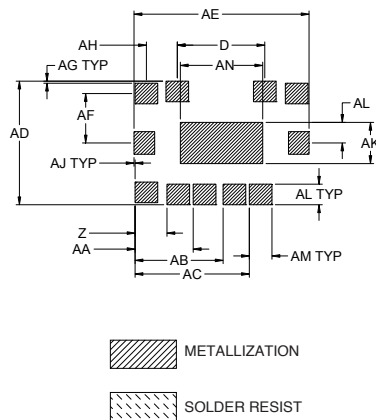
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Outline Drawing



PCB Land Pattern

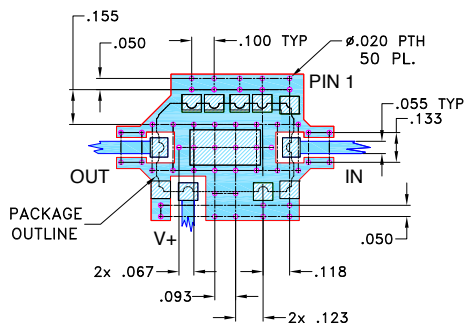


Outline Dimensions (inch mm)

A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U
.591	.394	.118	.335	.197	.126	.130	.230	.344	.445	.011	.050	.148	.060	.040	.143	.123	.042	.084
15.0	10.0	3.0	8.5	5.0	3.2	3.3	5.85	8.75	11.3	.28	1.27	3.75	1.52	1.02	3.63	3.13	1.07	2.13

V	W	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	AN	wt.
.022	.044	.305	.122	.222	.337	.437	.472	.669	.189	.008	.118	.004	.158	.079	.087	.315	grams
.56	1.12	7.75	3.1	5.65	8.55	11.1	12.0	17.0	4.8	.20	3.0	.10	4.0	2.0	2.2	8.0	0.8

Demo Board MCL P/N: TB-468+ Suggested PCB Layout (PL-293)



NOTES:

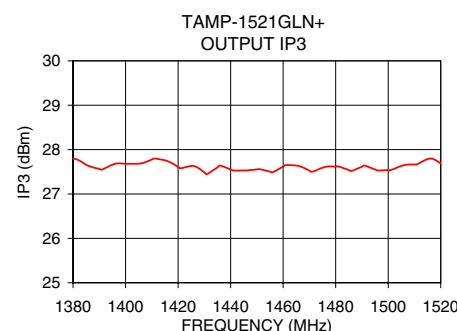
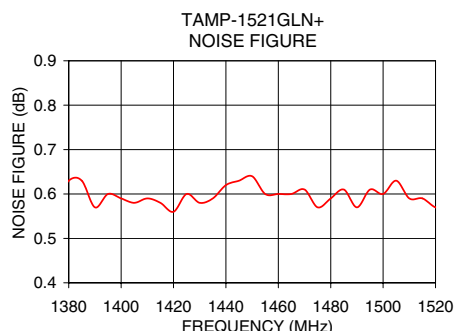
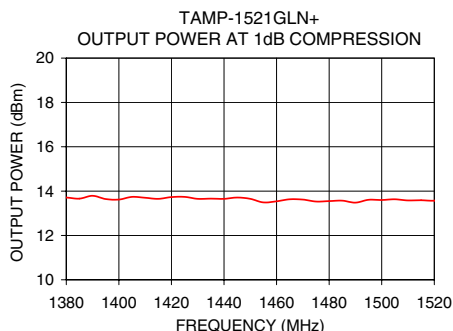
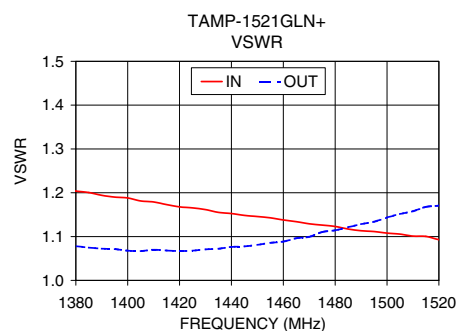
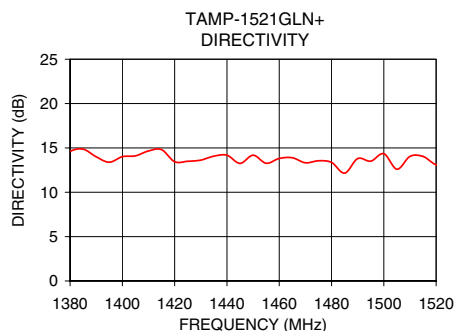
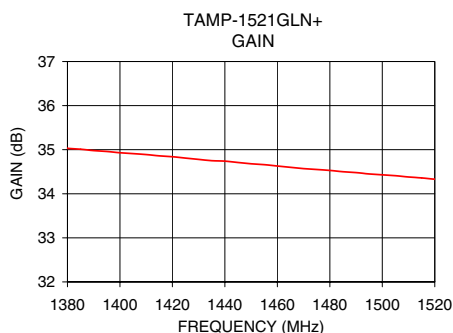
- TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .002; COPPER 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
 - BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

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FREQUENCY (MHz)	GAIN (dB)	DIRECTIVITY (dB)	VSWR IN (:1)	VSWR OUT (:1)	NOISE FIGURE (dB)	P. OUT @ 1dB COMPR. (dBm)	OUTPUT IP3 (dBm)
1380.00	35.03	14.61	1.20	1.08	0.63	13.71	27.79
1390.00	34.98	14.00	1.19	1.07	0.57	13.79	27.57
1400.00	34.93	14.01	1.19	1.07	0.59	13.62	27.68
1410.00	34.89	14.66	1.18	1.07	0.59	13.70	27.78
1420.00	34.84	13.44	1.17	1.07	0.56	13.73	27.61
1430.00	34.78	13.62	1.16	1.07	0.58	13.65	27.49
1435.00	34.75	14.07	1.16	1.07	0.59	13.66	27.60
1440.00	34.74	14.18	1.15	1.08	0.62	13.65	27.55
1445.00	34.71	13.26	1.15	1.08	0.63	13.71	27.53
1450.00	34.68	14.18	1.15	1.08	0.64	13.65	27.55
1455.00	34.66	13.27	1.14	1.09	0.60	13.49	27.50
1460.00	34.63	13.81	1.14	1.09	0.60	13.54	27.62
1470.00	34.57	13.32	1.13	1.10	0.61	13.62	27.53
1480.00	34.53	13.36	1.12	1.11	0.59	13.55	27.62
1485.00	34.50	12.16	1.12	1.12	0.61	13.57	27.54
1490.00	34.48	13.79	1.11	1.13	0.57	13.48	27.62
1495.00	34.45	13.51	1.11	1.13	0.61	13.61	27.55
1500.00	34.43	14.35	1.11	1.14	0.60	13.60	27.54
1510.00	34.38	14.05	1.10	1.16	0.59	13.58	27.67
1520.00	34.33	13.11	1.09	1.17	0.57	13.57	27.69



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Typical Performance Data

**NOTE: Use PDF Bookmarks to view DATA at required conditions
or to view GRAPHS.**

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: I = 48mA, Vd = 5V @Temperature = +25degC

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Delta	(dBm)	(dBm)	(dB)
1380	35.03	49.64	20.68	28.51	2.76	0.19	27.50	13.71	0.63
1385	35.01	49.87	20.81	28.86	2.83	0.18	27.90	13.66	0.63
1390	34.98	48.98	21.06	29.13	2.59	0.20	27.80	13.79	0.57
1395	34.96	48.35	21.23	29.26	2.43	0.22	27.59	13.64	0.60
1400	34.93	48.94	21.31	29.68	2.59	0.20	27.55	13.62	0.59
1405	34.91	49.01	21.61	29.80	2.62	0.20	27.91	13.74	0.58
1410	34.89	49.55	21.71	29.42	2.78	0.19	27.75	13.70	0.59
1415	34.86	49.66	21.98	29.64	2.82	0.18	27.82	13.65	0.58
1420	34.84	48.28	22.23	29.79	2.44	0.21	27.66	13.73	0.56
1425	34.81	48.30	22.34	29.69	2.45	0.21	27.45	13.74	0.60
1430	34.78	48.40	22.53	29.33	2.49	0.21	27.68	13.65	0.58
1435	34.75	48.82	22.85	29.16	2.61	0.20	27.57	13.66	0.59
1440	34.74	48.92	22.99	28.70	2.64	0.20	27.77	13.65	0.62
1445	34.71	47.97	23.22	28.56	2.40	0.22	27.77	13.71	0.63
1450	34.68	48.86	23.36	28.20	2.64	0.19	27.54	13.65	0.64
1455	34.66	47.93	23.52	27.72	2.40	0.22	27.44	13.49	0.60
1460	34.63	48.44	23.81	27.45	2.54	0.20	27.87	13.54	0.60
1465	34.60	48.49	24.04	26.77	2.56	0.20	27.70	13.63	0.60
1470	34.57	47.89	24.34	26.49	2.41	0.22	27.52	13.62	0.61
1475	34.55	48.10	24.53	25.63	2.47	0.21	27.48	13.53	0.57
1480	34.53	47.89	24.74	25.34	2.42	0.21	27.50	13.55	0.59
1485	34.50	46.66	25.14	24.85	2.14	0.25	27.82	13.57	0.61
1490	34.48	48.27	25.42	24.40	2.53	0.20	27.60	13.48	0.57
1495	34.45	47.96	25.55	24.05	2.46	0.21	27.30	13.61	0.61
1500	34.43	48.78	25.82	23.49	2.69	0.19	27.54	13.60	0.60
1505	34.41	47.01	25.99	23.05	2.23	0.23	27.58	13.63	0.63
1510	34.38	48.43	26.35	22.72	2.60	0.20	27.66	13.58	0.59
1515	34.36	48.40	26.41	22.23	2.60	0.20	27.71	13.59	0.59
1520	34.33	47.44	27.04	22.08	2.35	0.22	27.63	13.57	0.57

Amplifier

TAMP-1521GLN+

Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: I = 46mA, Vd = 5V @Temperature = -40degC

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Delta	(dBm)	(dBm)	(dB)
1380	35.74	49.40	20.75	32.23	2.49	0.21	27.57	13.51	0.46
1385	35.72	48.61	20.83	33.57	2.30	0.23	27.48	13.52	0.45
1390	35.68	49.40	21.00	34.42	2.51	0.21	27.01	13.86	0.40
1395	35.65	49.42	21.29	35.84	2.52	0.21	27.49	13.57	0.41
1400	35.62	48.51	21.64	36.59	2.30	0.23	27.52	13.42	0.40
1405	35.60	48.76	22.02	37.69	2.37	0.22	27.39	13.65	0.40
1410	35.58	48.79	21.95	38.13	2.38	0.22	27.38	13.54	0.40
1415	35.55	48.44	22.33	37.97	2.30	0.23	27.49	13.71	0.41
1420	35.53	48.27	22.48	38.51	2.27	0.23	27.48	13.98	0.38
1425	35.50	48.51	22.62	36.90	2.34	0.22	27.64	13.89	0.41
1430	35.48	48.40	22.84	35.87	2.31	0.23	27.42	13.81	0.41
1435	35.44	47.70	23.00	36.12	2.16	0.24	27.53	13.84	0.40
1440	35.43	48.05	23.14	34.43	2.25	0.23	27.21	13.76	0.44
1445	35.39	48.84	23.34	34.46	2.45	0.21	27.33	13.93	0.46
1450	35.36	47.67	23.45	33.95	2.17	0.24	27.41	13.85	0.44
1455	35.34	47.69	23.69	32.49	2.18	0.24	27.45	13.66	0.42
1460	35.32	48.11	23.86	31.66	2.28	0.23	27.43	13.65	0.41
1465	35.28	47.94	24.00	30.68	2.25	0.23	27.50	13.81	0.40
1470	35.25	48.15	24.26	29.86	2.31	0.23	27.48	13.85	0.41
1475	35.23	47.97	24.42	28.87	2.27	0.23	27.12	13.76	0.38
1480	35.22	47.51	24.64	28.21	2.17	0.24	27.69	13.81	0.42
1485	35.19	48.29	24.83	27.67	2.36	0.22	27.39	13.78	0.42
1490	35.16	47.69	25.26	26.82	2.22	0.24	27.50	13.72	0.37
1495	35.14	48.05	25.25	26.27	2.31	0.23	27.42	13.82	0.40
1500	35.12	48.51	25.70	25.74	2.43	0.21	27.49	13.73	0.41
1505	35.09	48.10	25.87	25.18	2.33	0.22	27.31	13.78	0.42
1510	35.07	47.19	25.44	24.75	2.13	0.25	27.44	13.67	0.40
1515	35.04	47.47	25.89	24.43	2.20	0.24	27.65	13.66	0.40
1520	35.01	47.93	25.83	23.97	2.31	0.23	27.45	13.60	0.37

Amplifier

TAMP-1521GLN+

Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: I = 49mA, Vd = 5V @Temperature = +85degC

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Delta	(dBm)	(dBm)	(dB)
1380	34.52	48.09	20.39	25.83	2.46	0.21	27.73	13.49	0.82
1385	34.50	48.63	20.58	25.99	2.62	0.20	27.83	13.46	0.81
1390	34.47	49.20	20.84	26.06	2.79	0.19	27.85	13.52	0.77
1395	34.44	49.51	21.13	25.72	2.89	0.18	27.63	13.55	0.77
1400	34.41	49.79	21.33	25.75	2.99	0.17	27.92	13.52	0.77
1405	34.39	47.85	21.56	25.57	2.44	0.21	27.78	13.45	0.78
1410	34.37	48.08	21.74	25.65	2.50	0.21	27.83	13.51	0.78
1415	34.34	48.49	21.84	25.48	2.62	0.20	27.80	13.51	0.78
1420	34.32	48.44	22.08	25.39	2.62	0.20	27.88	13.52	0.75
1425	34.30	48.63	22.32	25.06	2.67	0.19	27.73	13.50	0.78
1430	34.27	48.43	22.57	25.07	2.63	0.20	28.06	13.51	0.79
1435	34.24	48.50	22.85	24.97	2.66	0.19	27.70	13.48	0.78
1440	34.23	49.16	22.94	24.70	2.85	0.18	27.58	13.54	0.82
1445	34.19	48.56	23.22	24.58	2.69	0.19	27.57	13.47	0.84
1450	34.17	48.11	23.41	24.37	2.57	0.20	27.63	13.40	0.82
1455	34.15	47.02	23.62	24.10	2.29	0.23	28.01	13.39	0.81
1460	34.12	47.76	23.94	23.72	2.49	0.21	27.71	13.34	0.80
1465	34.10	47.80	24.14	23.44	2.50	0.20	27.38	13.41	0.79
1470	34.07	47.96	24.47	23.13	2.55	0.20	27.87	13.44	0.78
1475	34.05	48.05	24.71	22.73	2.58	0.20	27.88	13.36	0.76
1480	34.03	48.87	24.95	22.47	2.82	0.18	27.54	13.33	0.78
1485	34.00	48.95	25.23	22.17	2.86	0.18	27.38	13.32	0.81
1490	33.97	48.94	25.53	21.82	2.86	0.18	27.95	13.35	0.75
1495	33.95	48.79	25.93	21.31	2.82	0.18	27.55	13.35	0.80
1500	33.92	48.30	26.11	21.15	2.68	0.19	27.66	13.41	0.78
1505	33.90	47.68	26.57	20.79	2.52	0.20	27.84	13.47	0.80
1510	33.88	47.63	26.83	20.59	2.51	0.20	27.95	13.38	0.79
1515	33.85	47.69	27.09	20.28	2.53	0.20	27.63	13.38	0.79
1520	33.83	48.99	27.49	19.86	2.92	0.17	27.69	13.41	0.77

REV. X1
TAMP-1521GLN+
100414
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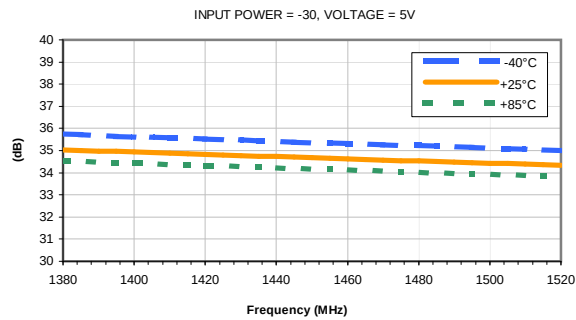


Amplifier

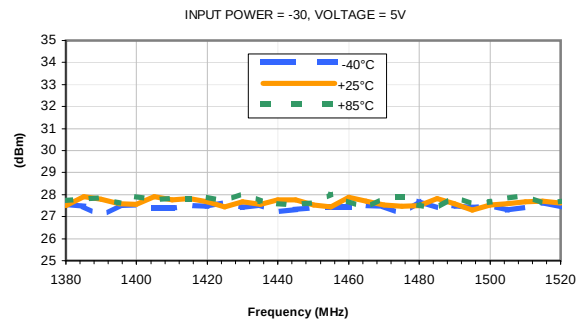
TAMP-1521GLN+

Typical Performance Curves

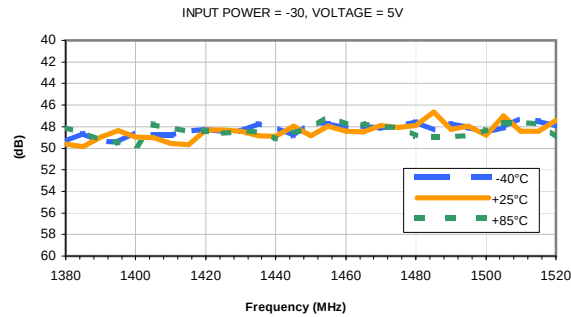
GAIN vs. FREQUENCY & TEMPERATURE



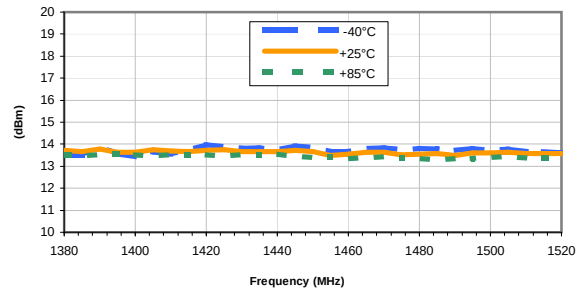
OUTPUT IP3 vs. FREQUENCY & TEMPERATURE



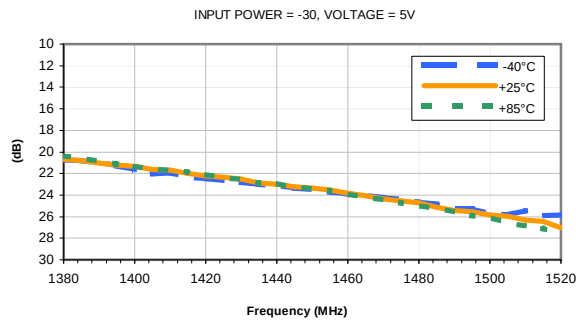
ISOLATION vs. FREQUENCY & TEMPERATURE



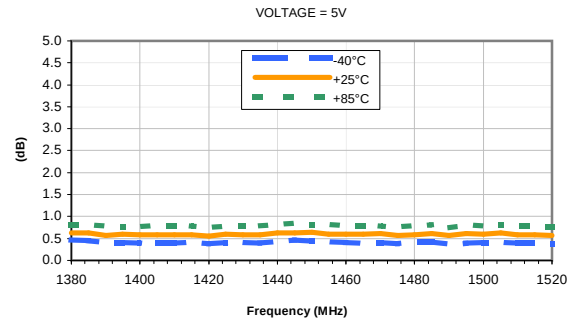
OUTPUT POWER at 1dB COMPRESSION
vs. FREQUENCY & TEMPERATURE



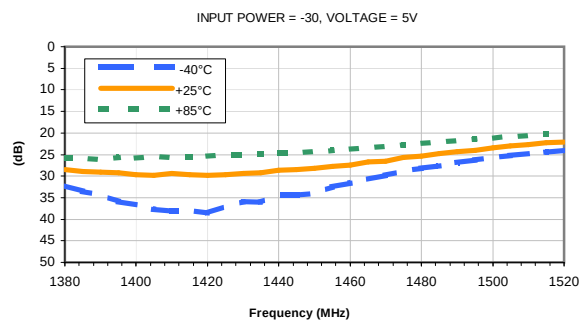
INPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE



NOISE FIGURE vs. FREQUENCY & TEMPERATURE



OUTPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE



REV. X1
TAMP-1521GLN+
100414
Page 1 of 1

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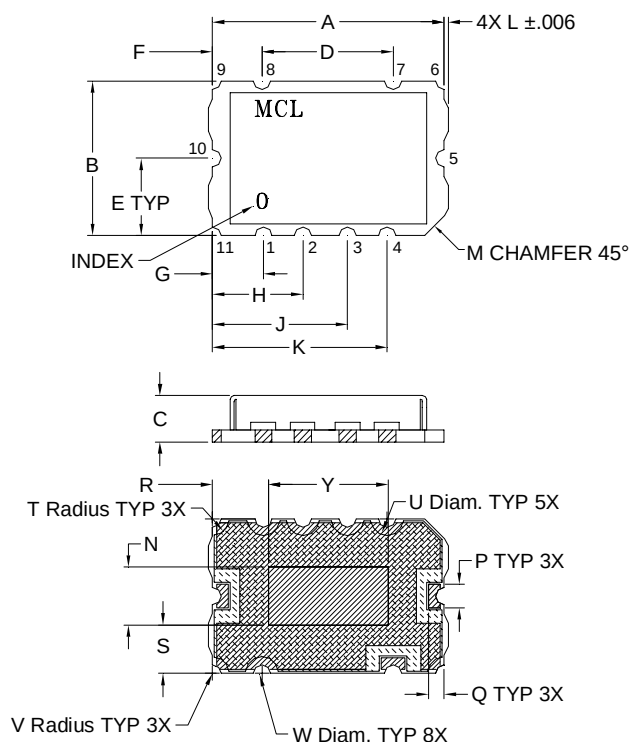
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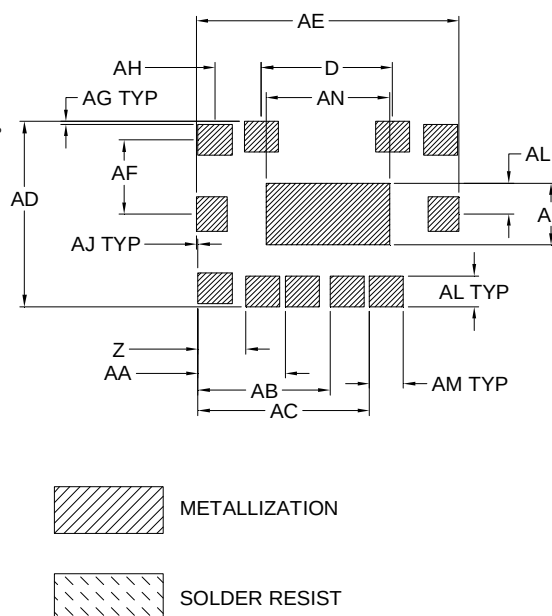


Outline Dimensions



PCB Land Pattern

Suggested Layout



CASE#	A	B	C	D	E	F	G	H	J	K	L	M	N	P
JQ1382	.591 (15.0)	.394 (10.0)	.118 (3.0)	.335 (8.5)	.197 (5.0)	.126 (3.2)	.130 (3.3)	.230 (5.85)	.344 (8.75)	.445 (11.3)	.011 (.28)	.050 (1.27)	.148 (3.75)	.060 (1.52)

CASE#	Q	R	S	T	U	V	W	Y	Z	AA	AB	AC	AD	AE
JQ1382	.040 (1.02)	.143 (3.63)	.123 (3.13)	.042 (1.07)	.084 (2.13)	.022 (.56)	.044 (1.12)	.305 (7.75)	.122 (3.1)	.222 (5.65)	.337 (8.55)	.437 (11.1)	.472 (12.0)	.669 (17.0)

CASE#	AF	AG	AH	AJ	AK	AL	AM	AN	WT. GRAMS
JQ1382	.189 (4.8)	.008 (.20)	.118 (3.0)	.004 (.10)	.158 (4.0)	.079 (2.0)	.087 (2.2)	.315 (8.0)	.8

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

Notes:

1. Case material: Nickel-Silver alloy.
2. Base: Printed wiring laminate.
3. Termination finish:

For RoHS Case Styles: 3-5 μ inch (.08-.13 microns) Gold over 120-240 μ inch (3.05-6.10 microns) Nickel plate

For RoHS-5 Case Styles: Tin-Lead plate.



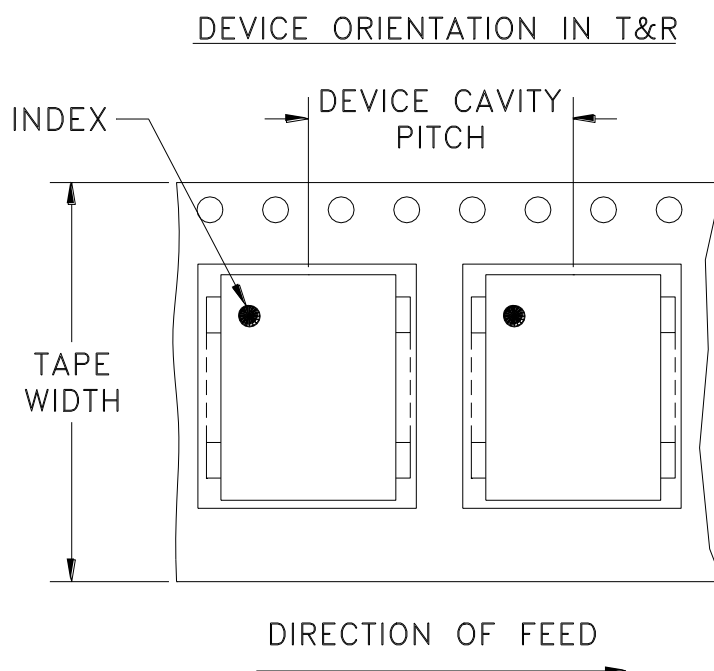
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RF/IF MICROWAVE COMPONENTS

Tape & Reel Packaging TR-F10



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
24	16	7	10,20,50,100,200
		13	500

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

Note: Please consult individual model data sheet to determine device per reel availability.



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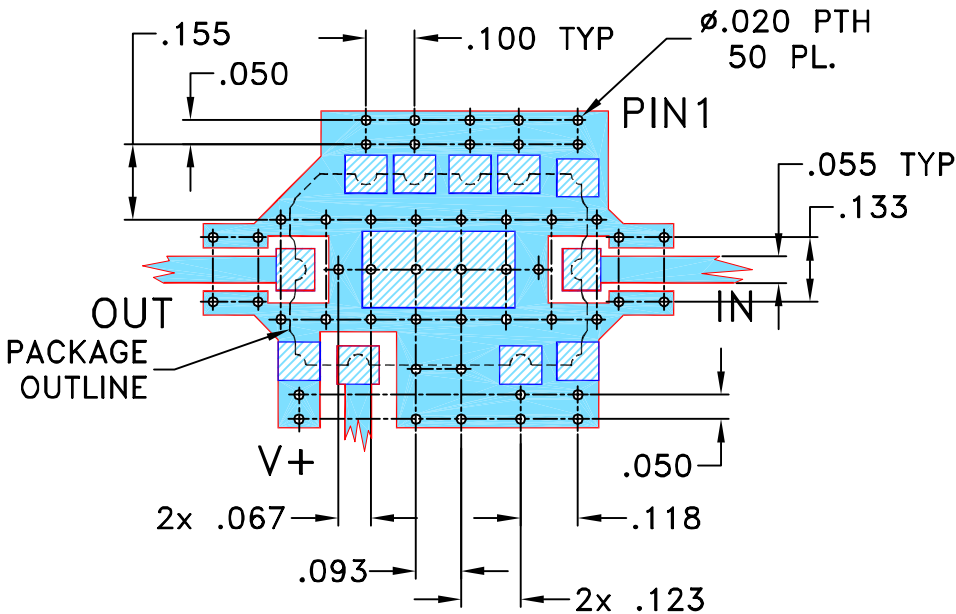
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THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M119697	NEW RELEASE	10/08	HB	HH
A	M120556	UPDATE GROUND PLANE DIM.	12/08	HB	HH
A	R75063	UPDATE GROUND PLANE DIM.	12/08	HB	HH

SUGGESTED MOUNTING CONFIGURATION FOR
JQ1382 CASE STYLE, "11AM01" PIN CODE



NOTES:

- 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.
- 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	HB	05.10.08
	CHECKED	DH	28.10.08
	APPROVED	HH	29.10.08



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Brooklyn NY 11235

PL, 11AM01, JQ1382, TAMP, TB-468

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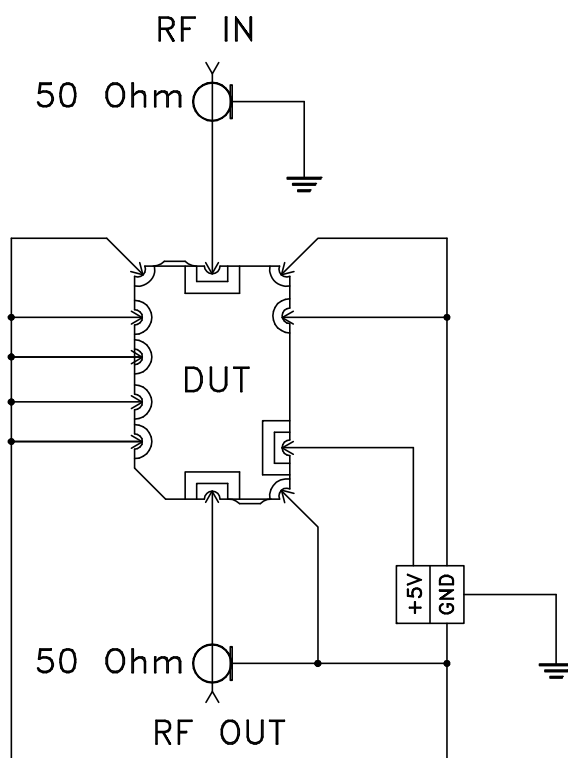
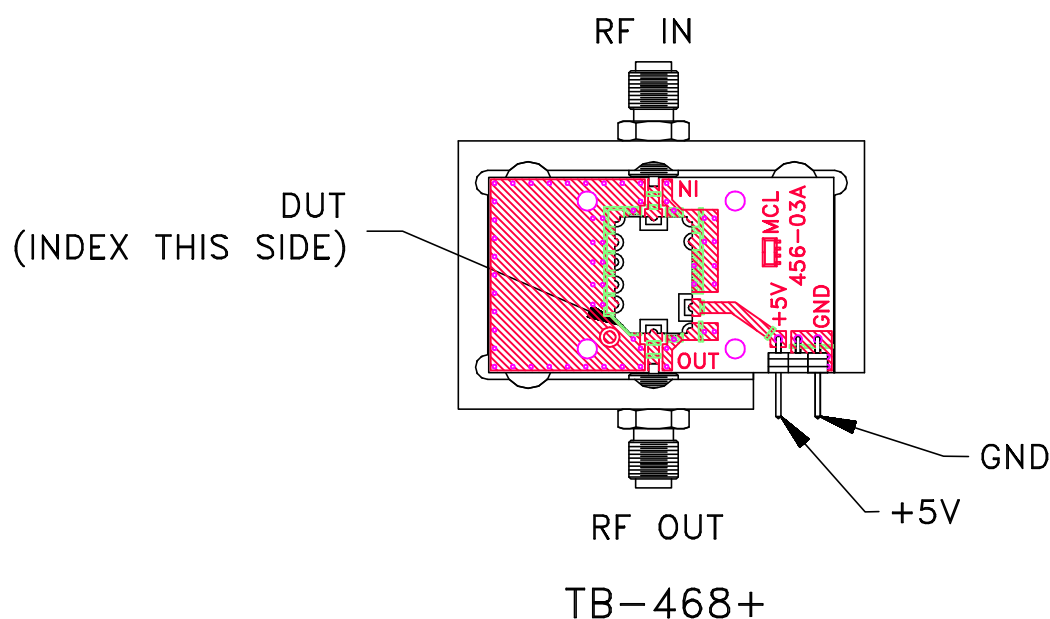
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ASHEETA1.DWG REV:A

DATE:01/12/95

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-293	A
FILE:	98PL293	SCALE:	2.5:1
SHEET:	1	OF	1

Evaluation Board and Circuit



Schematic Diagram

Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent, Dielectric Constant=3.5, Thickness=.030 inch.

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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
HAST	130°C, 85% RH, 96 hours	JESD22-A110
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