Ultra Low Noise, Low Current

E-PHEMT Transistor

TAV1-551+

50Ω 0.045 to 6 GHz

The Big Deal

- Low Noise Figure, 0.5 dB typ at 0.9 GHz
- Gain, 20.9 dB typ. at 0.9 GHz
- High OIP3, +22 dBm typ. at 0.9 GHz

CASE STYLE: TE2769

Product Overview

TAV1-551+ is a low noise, high gain device manufactured using E-PHEMPT* technology enabling it to work with a single positive supply voltage. It has outstanding Noise figure, particularly below 2.5 GHz, and when combining this noise figure with gain in a single device it makes it an ideal amplifier for multiple applications.

Key Features

Feature	Advantages
Wideband, 0.045 to 6 GHz	Use in multiple applications: UHF, VHF, communication infrastructure
High Gain, Low noise figure	High Gain limits the effect of noise figure due to previous stages
Small size, 1.18 x 1.42 x 0.85 mm, MCLP package	Small foot print saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB.

* Enhancement mode Pseudomorphic High Electron Mobility Transistor.

Ultra Low Noise, Low Current

E-PHEMT Transistor 0.045-6 GHz

Product Features

- Low Noise Figure, 0.5 dB typ. at 0.9 GHz
- Gain, 20.9 dB typ. at 0.9 GHz
- High Output IP3, +24 dBm at 2 GHz, 4V
- Output Power at 1dB compression, +20dBm, 4V
- Wide bandwidth
- External biasing and matching required

TAV1-551+

CASE STYLE: TE2769

+RoHS Compliant

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

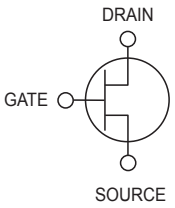
Typical Applications

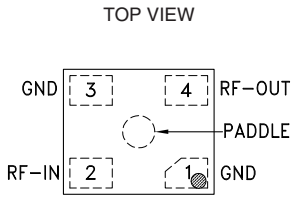
- Cellular
- ISM
- GSM
- WCDMA
- WiMax
- WLAN
- UNII and HIPERLAN

General Description

TAV1-551+ is a low noise, high gain device manufactured using E-PHEMPT* technology enabling it to work with a single positive supply voltage. It has outstanding Noise figure, particularly below 2.5 GHz, and when combining this noise figure with gain in a single device it makes it an ideal amplifier for multiple applications.

simplified schematic and pin description





Function	Pad Number	Description
RF-IN	2	Gate used for RF input
RF-OUT	4	Drain used for RF output
GND	1,3 and Paddle	Source terminal and Paddle, normally connected to ground.

* Enhancement mode Pseudomorphic High Electron Mobility Transistor.

Electrical Specifications at T_{AMB}=25°C, Frequency 0.045 to 6 GHz

Symbol	Parameter	Condition		Min.	Typ.	Max.	Units
DC Specifications							
V_{GS}	Operational Gate Voltage	V_{DS}=3V, I_{DS}=15 mA		0.22	0.34	0.46	V
V_{TH}	Threshold Voltage	V_{DS}=3V, I_{DS}= 4 mA		0.18	0.26	0.38	V
I_{DSS}	Saturated Drain Current	V_{DS}=3V, V_{GS}=0 V		—	1.0	5.0	uA
G_M	Transconductance	V_{DS} =3V, Gm =$\Delta I_{DS}/\Delta V_{GS}$ ΔV_{GS} = V_{GS2}-V_{GS1} V_{GS1}= V_{GS1} at I_{DS}=15 mA V_{GS2}= V_{GS1} +0.05V		215	251	285	mS
I_{GSS}	Gate leakage Current	V_{GD}=V_{GS}=-3V		—	—	95	µA
RF Specifications[1], Z0=50 Ohms (Figure 1)							
NF[1]	Noise Figure	V_{DS}=3V, I_{DS}=15 mA	f=0.9 GHz		0.5		dB
			f=2.0 GHz	—	0.6	0.9	
			f=3.9 GHz		0.8		
			f=5.8 GHz		1.4		
		V_{DS}=4V, I_{DS}=15 mA	f=2.0 GHz		0.6		
Gain	Gain	V_{DS}=3V, I_{DS}=15 mA	f=0.9 GHz		21.6		dB
			f=2.0 GHz	14.4	16.7	18.4	
			f=3.9 GHz		11.9		
			f=5.8 GHz		8.6		
		V_{DS}=4V, I_{DS}=15 mA	f=2.0 GHz		16.7		
OIP3	Output IP3	V_{DS}=3V, I_{DS}=15 mA	f=0.9 GHz		23.9		dBm
			f=2.0 GHz	20	24.5	—	
			f=3.9 GHz		24.4		
			f=5.8 GHz		26.0		
		V_{DS}=4V, I_{DS}=15 mA	f=2.0 GHz		24.5		
P1dB[2]	Power output at 1 dB Compression	V_{DS}=3V, I_{DS}=15 mA	f=0.9 GHz		16.0		dBm
			f=2.0 GHz	**16**	17.4	—	
			f=3.9 GHz		18.4		
			f=5.8 GHz		18.8		
		V_{DS}=4V, I_{DS}=15 mA	f=2.0 GHz		19.8		

Absolute Maximum Ratings[3]

Symbol	Parameter	Max.	Units
V_{DS} [4]	Drain-Source Voltage	5	V
V_{GS} [4]	Gate-Source Voltage	-5 to 0.7	V
V_{GD} [4]	Gate-Drain Voltage	-5 to 0.7	V
I_{DS} [4]	Drain Current	100	mA
I_{CS}	Gate Current	2	mA
P_{DISS}	Total Dissipated Power	360	mW
P_{IN} [5]	RF Input Power	17	dBm
T_{CH}	Channel Temperature	150	°C
T_{OP}	Operating Temperature	-40 to 85	°C
T_{STD}	Storage Temperature	-65 to 150	°C
Θ_{JC}	Thermal Resistance	160	°C/W

Notes:
1. Includes test board loss (tested on Mini-Circuits TB-TAV1-551+ test board.
2. Drain current bias is allowed to increase during compression measurement.
3. Operation of this device above any one of these parameters may cause permanent damage
4. Assumes DC quiescent conditions
5. I_{GS} is limited to 2 mA during test.

Characterization Test Circuit

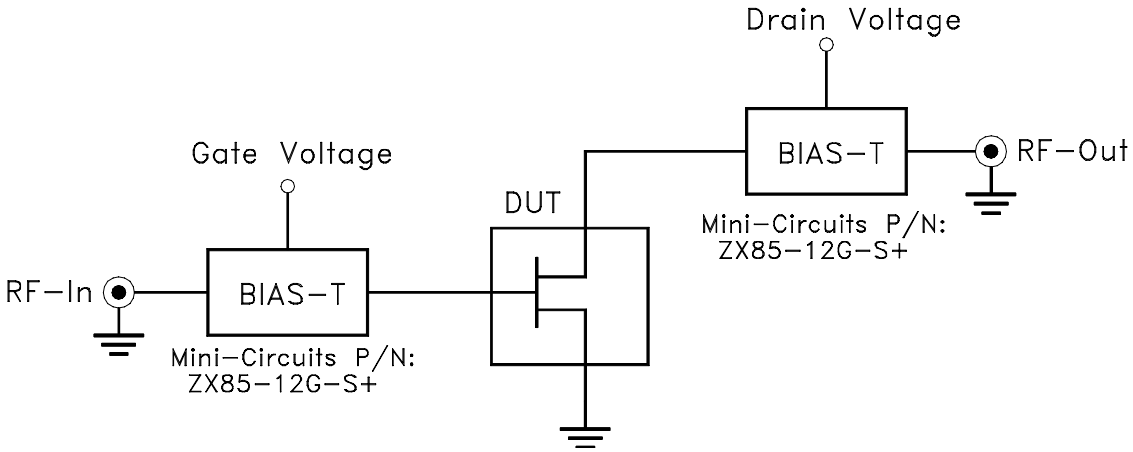


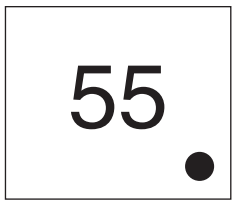
Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Test Board TB-TAV1-551+)

Gain, Output power at 1dB compression (P1 dB), Noise Figure and output IP3 (OIP3) are measured using Keysight/Agilent Network Analyzer PNA-X.

Conditions:

1. Drain voltage (with reference to source, V_{DS})= 3 or 4V as shown.
2. Gate Voltage (with reference to source, V_{GS}) is set to obtain desired Drain-Source current (IDS) as shown in specification table.
3. Gain: Pin= -25dBm
4. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/tone at output.
5. No external matching components used.

Product Marking



Additional Detailed Technical Information *additional information is available on our dash board. To access this information click here*	
Performance Data	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
Case Style	TE2769 *Plastic package, exposed paddle, lead finish: Matte-Tin plated*
Tape & Reel **Standard quantities available on reel**	F90 *7" reels with 20, 50, 100, 200, 500,1K,2K or 3K devices*
Suggested Layout for PCB Design	98-PL-665
Evaluation Board	TB-TAV1-551+
Environmental Ratings	ENV08T2

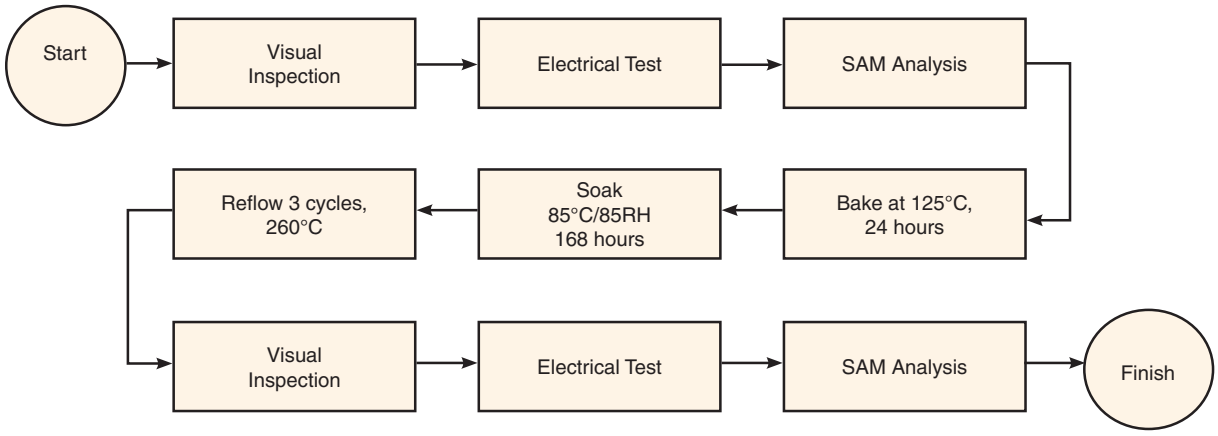
ESD Rating

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

MSL Rating

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

MSL Test Flow Chart



Additional 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.

C. 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/MCLStore/terms.jsp

Typical Performance Data

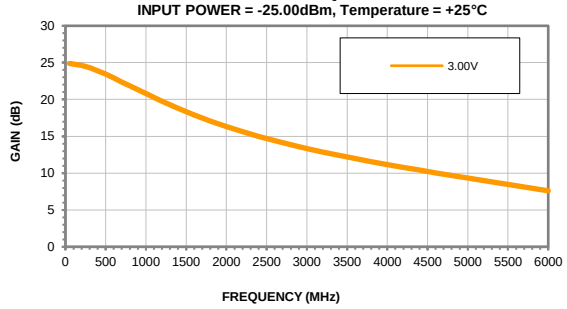
Definitions:
Input Return Loss = -S11 (dB)
Gain(Power Gain) = S21 (dB)
Reverse Isolation = -S12 (dB)
Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 3.00V, Id = 14.96mA @ Temperature = +25°C

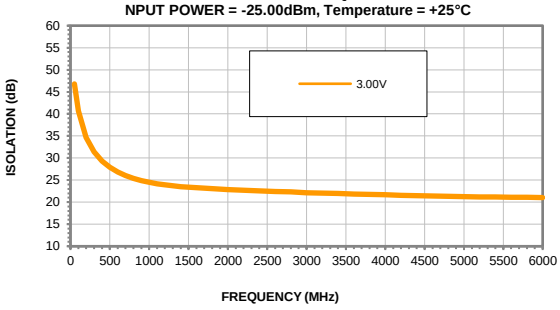
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
50	24.89	46.80	0.01	3.05	0.03	1.00	24.27	16.97	3.40
100	24.82	40.71	0.04	3.12	0.04	1.01	24.30	16.67	3.34
200	24.61	34.63	0.16	3.31	0.06	1.03	23.74	16.64	3.31
300	24.30	31.41	0.32	3.61	0.08	1.06	23.37	16.56	3.28
400	23.90	29.29	0.51	3.99	0.10	1.09	23.04	16.73	3.30
500	23.44	27.90	0.73	4.41	0.12	1.13	22.79	16.26	3.29
600	22.92	26.82	0.95	4.89	0.15	1.16	22.99	16.31	3.51
700	22.39	26.02	1.17	5.38	0.17	1.19	22.84	16.77	3.33
800	21.87	25.38	1.38	5.88	0.20	1.22	23.11	16.87	3.33
900	21.33	24.90	1.56	6.36	0.22	1.25	23.90	16.67	3.33
1000	20.80	24.49	1.75	6.83	0.24	1.27	24.03	16.80	3.33
1100	20.27	24.18	1.90	7.29	0.27	1.29	23.63	17.08	3.38
1200	19.77	23.91	2.04	7.71	0.29	1.30	24.31	16.95	3.41
1400	18.81	23.51	2.28	8.54	0.34	1.33	24.25	17.04	3.41
1600	17.90	23.26	2.48	9.24	0.38	1.35	24.10	17.49	3.37
1800	17.08	23.04	2.63	9.87	0.43	1.36	24.58	17.30	3.38
2000	16.32	22.86	2.77	10.39	0.48	1.37	23.92	17.69	3.40
2200	15.63	22.68	2.88	10.86	0.52	1.37	24.28	17.76	3.49
2400	14.98	22.57	2.97	11.29	0.57	1.38	24.57	17.70	3.47
2600	14.40	22.42	3.05	11.70	0.61	1.38	24.31	18.00	3.49
2800	13.85	22.31	3.12	12.08	0.65	1.38	24.60	18.38	3.49
3000	13.33	22.16	3.17	12.46	0.69	1.39	25.17	18.05	3.49
3200	12.85	22.06	3.23	12.91	0.74	1.39	25.12	18.07	3.52
3400	12.40	21.98	3.27	13.32	0.78	1.39	25.15	18.25	3.51
3600	11.97	21.86	3.29	13.76	0.82	1.39	24.93	18.25	3.55
3800	11.56	21.73	3.30	14.25	0.85	1.40	24.51	18.71	3.60
4000	11.16	21.65	3.31	14.79	0.89	1.40	25.51	18.13	3.64
4200	10.78	21.57	3.30	15.30	0.93	1.41	26.51	17.81	3.64
4400	10.41	21.50	3.29	15.84	0.96	1.41	26.43	18.01	3.72
4600	10.05	21.39	3.27	16.30	0.99	1.41	26.21	17.90	3.75
4800	9.69	21.33	3.24	16.71	1.03	1.42	25.31	18.50	3.76
5000	9.33	21.26	3.21	17.02	1.06	1.42	25.61	18.16	3.79
5200	8.98	21.19	3.16	17.18	1.09	1.43	25.80	18.27	3.84
5400	8.62	21.15	3.10	17.17	1.12	1.43	25.88	18.19	3.88
5600	8.27	21.11	3.05	17.09	1.15	1.44	26.24	18.68	3.92
5800	7.93	21.07	3.02	16.82	1.18	1.44	26.13	18.50	3.94
6000	7.60	21.03	2.99	16.49	1.21	1.44	26.64	18.21	4.04

Typical Performance Curves

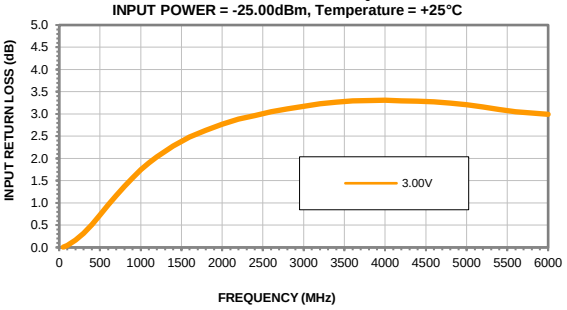
GAIN vs. FREQUENCY
INPUT POWER = -25.00dBm, Temperature = +25°C



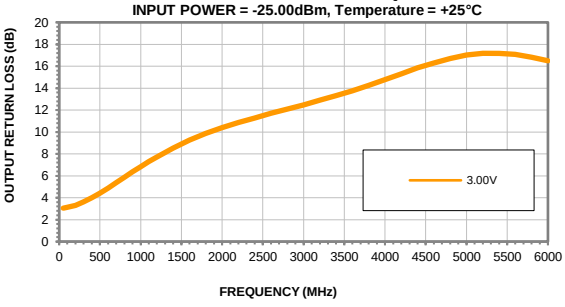
ISOLATION vs. FREQUENCY
NPUT POWER = -25.00dBm, Temperature = +25°C



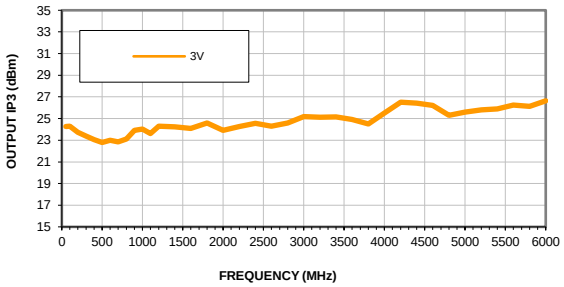
INPUT RETURN LOSS vs. FREQUENCY
INPUT POWER = -25.00dBm, Temperature = +25°C



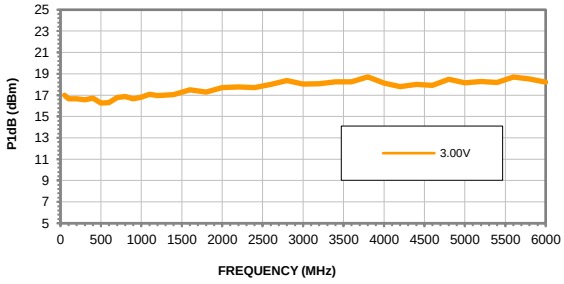
OUTPUT RETURN LOSS vs. FREQUENCY
INPUT POWER = -25.00dBm, Temperature = +25°C



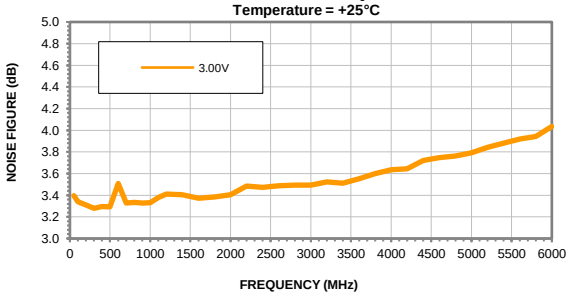
OUTPUT IP3 vs. FREQUENCY
OUTPUT POWER = 5 dBm/tone, Temperature = +25°C



P1dB vs. FREQUENCY & DEVICE VOLTAGE
Temperature = +25°C



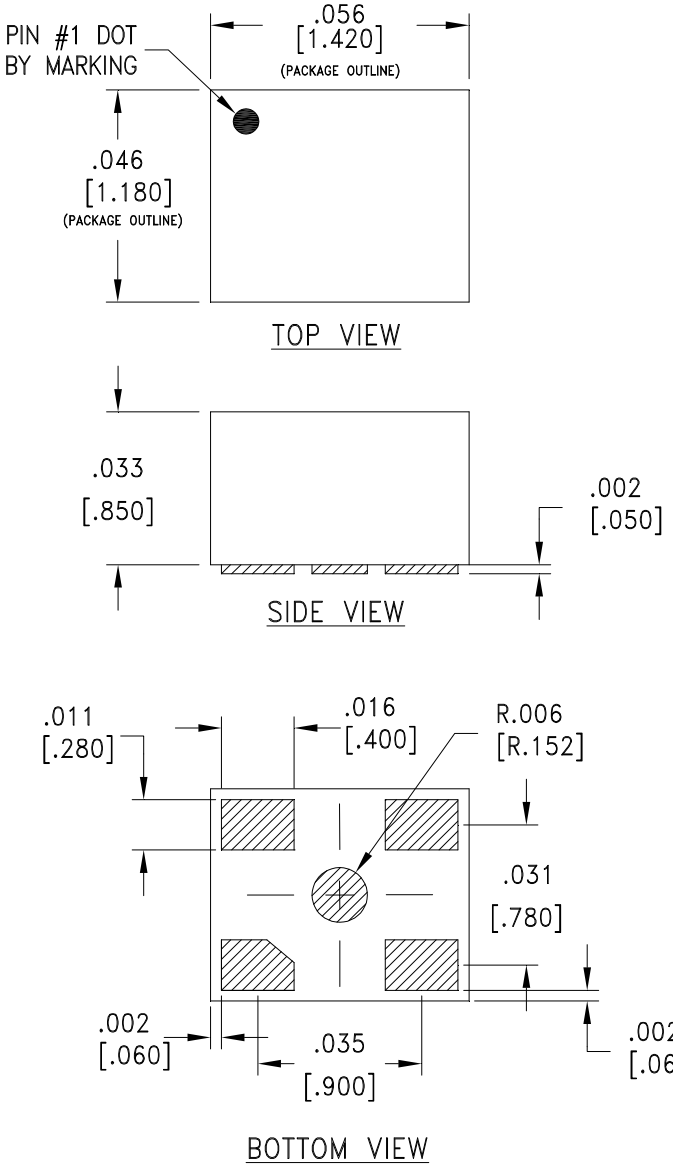
NOISE FIGURE vs. FREQUENCY
Temperature = +25°C



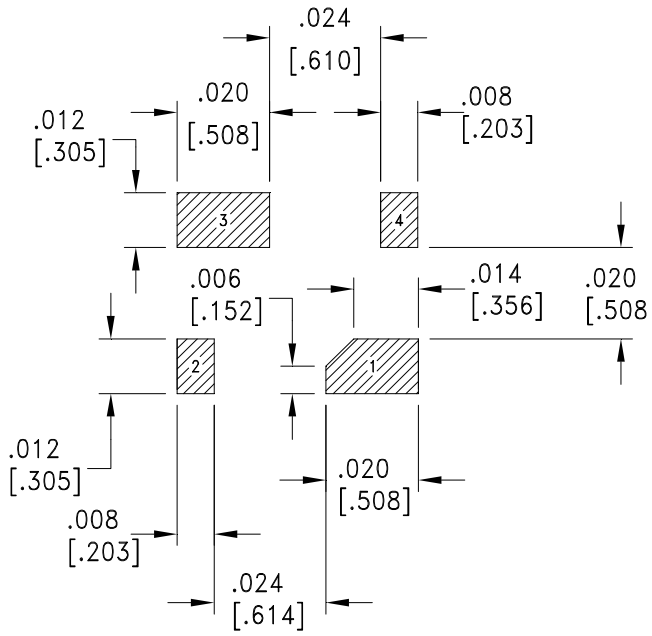
Case Style TE

Outline Dimensions

TE2769



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

Weight: .0047 grams

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

Notes:

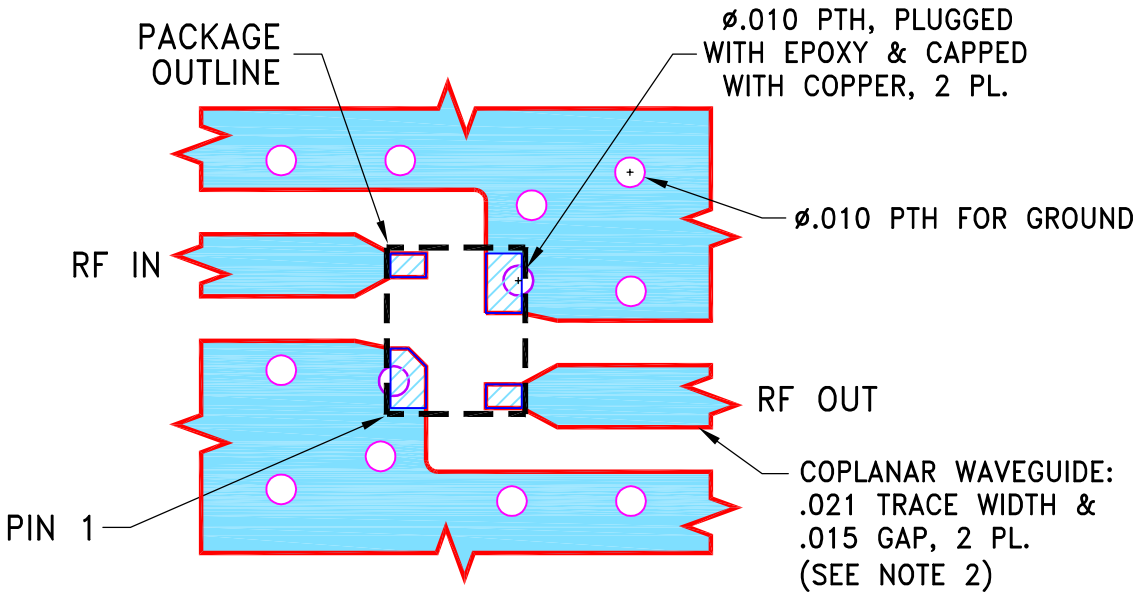
1. Case material: Plastic.
2. Termination finish:

   For RoHS Case Styles: Matte-Tin plate.

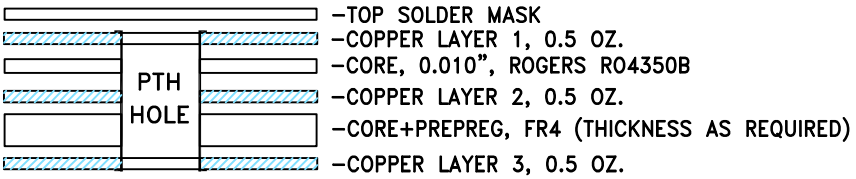
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-001106	NEW RELEASE	12/18/19	ITG	GH

SUGGESTED MOUNTING CONFIGURATION FOR TE2769 CASE STYLE



STACK-UP DIAGRAM



1. TOTAL FINISHED THICKNESS 0.065" ± 10%.
2. PTH HOLES PRESENT FROM COPPER LAYER 1 TO 3.

NOTES:

1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH & GAP ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010±.001". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
3. UNIT FOOT PRINT IS OPTIMIZED FOR PERFORMANCE AND IS DIFFERENT FROM CASE STYLE TE2769 RECOMMENDATIONS.
4. LAYERS 2 & 3 OF THE PCB ARE 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	DRAWN	ITG	12/18/19
TOLERANCES ON:	CHECKED	GF	12/18/19
2 PL DECIMALS ±	APPROVED	GH	12/18/19
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

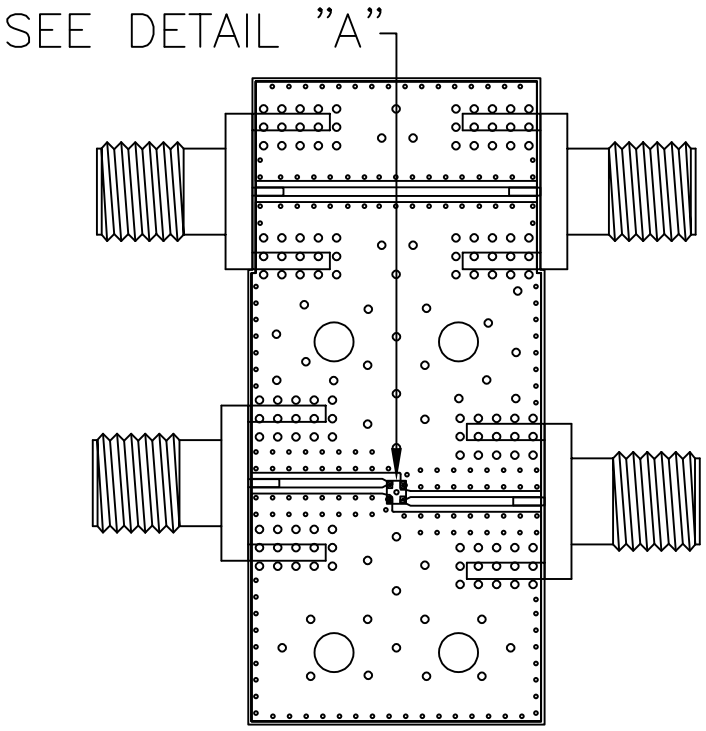
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

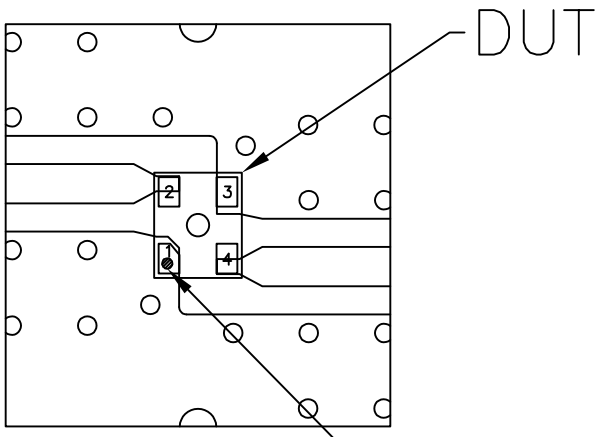
PL, TE2769, TB-TAVI-541+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-665	OR

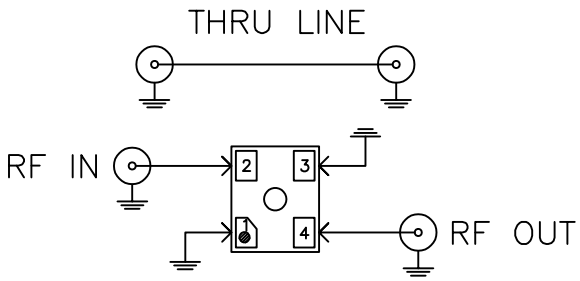
FILE:	SCALE:	SHEET:
98PL665	15:1	1 OF 1

Evaluation Board and Circuit





DETAIL "A"
(SCALE 5:1)



SCHEMATIC DIAGRAM
(SCALE 5:1)

Function	Pad
RF IN	2
RF OUT	4
GND	1,3

Notes:

1. 50 Ohm SMA Female Connectors.
2. PCB Material: Roger RO4350B or equivalent, Dielectric constant=3.5, Thickness=0.01 inch

Mini-Circuits®

Mini-Circuits

Environmental Specifications **ENV08T2**

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

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	