Ultra Low Noise, Medium Current

E-PHEMT Transistor

TAV2-14LN+

50Ω 0.05 to 10 GHz

2mm x 2mm

The Big Deal

- Low Noise Figure, 0.6 dB typ. at 6 GHz, 2V
- High Gain, 16.4 dB typ. at 6 GHz, 4V
- High OIP3, +30.9 dBm typ. at 6 GHz, 4V
- High P1dB, 18.8 dBm typ. at 6 GHz, 4V

Product Overview

Mini-Circuits' TAV2-14LN+ is a MMIC E-PHEMT* transistor with an operating frequency range from 0.05 to 10 GHz. This model combines high gain with extremely low noise figure, resulting in lower overall system noise. Low NF and IP3 performance make it an ideal choice for sensitive receivers in communications systems. Manufactured using highly repeatable E-PHEMT technology, the unit comes housed in a tiny 2x2mm MCLP package. This model requires external biasing and matching.

Key Features

Feature	Advantages
Wideband, 0.05 to 10 GHz Usable to 12 GHz	A single device covers many wireless communications bands including cellular, ISM, GSM, WCDMA, WiMax, WLAN, 5G and more.
High IP3 vs. DC power consumption • +30.9 dBm at 6 GHz, 4V • +33.2 dBm at 12 GHz, 4V	The TAV2-14LN+ matches industry leading IP3 performance relative to device size and power consumption. Enhanced linearity over a broad frequency range makes the device ideal for use in: • Driver amplifiers for complex waveform up converter paths • Drivers in linearized transmit systems
Combines high gain (16.4 dB) with very low Noise Figure (0.7 dB)	The unique combination of high gain and low Noise Figure results in lower overall system noise.
2 x 2mm 6-lead MCLP package	Tiny footprint 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.

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Product Features

- Low Noise Figure, 0.6 dB typ. at 6 GHz, 2V,
- Gain, 16.4 dB typ. at 6 GHz, 4V
- High Output IP3, +30.9 dBm at 6 GHz, 4V
- Output Power at 1dB comp., +18.8 dBm at 6 GHz, 4V
- External biasing and matching required
- Usable to 12 GHz

Generic photo used for illustration purposes only

CASE STYLE: MC1630-1

+RoHS Compliant

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

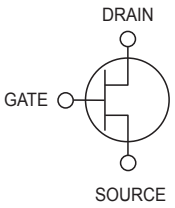
Typical Applications

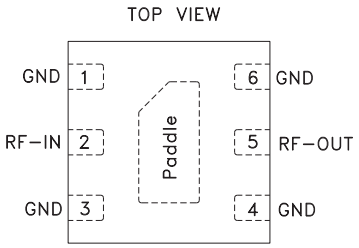
- 5G
- Cellular
- ISM
- GSM
- WCDMA
- WiMax
- WLAN
- UNII and HIPERLAN

General Description

Mini-Circuits' TAV2-14LN+ is a MMIC E-PHEMT* transistor with an operating frequency range from 0.05 to 10 GHz. This model combines high gain with extremely low noise figure, resulting in lower overall system noise. Low NF and IP3 performance make it an ideal choice for sensitive receivers in communications systems. Manufactured using highly repeatable E-PHEMT technology, the unit comes housed in a tiny 2x2mm MCLP package. This model requires external biasing and matching.

simplified schematic and pin description





Function	Pin Number	Description
RF-IN	2	Gate used for RF input
RF-OUT	5	Drain used for RF output
GND	1,3,4,6 & Paddle	Source terminal, normally connected to ground.

Electrical Specifications at T_{AMB}=25°C

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
		DC Specifications				
V_{TH}	Threshold Voltage	V_{DS}=4V, I_{DS}=4 mA		0.37		V
I_{DSS}	Saturated Drain Current	V_{DS}=4V, V_{GS}=0 V	—	2.0	—	µA
G_M	Transconductance	V_{DS} =4V, Gm =$\Delta I_{DS}/\Delta V_{GS}$, $\Delta V_{GS} = V_{GS2}-V_{GS1}$, V_{GS2}=0.7V, V_{GS1}=0.6V ΔI_{DS} =(I_{DS} at V_{GS2})-(I_{DS} at V_{GS1})	—	192	—	mS
I_{GSS}	Gate leakage Current	V_{GD}=V_{GS}=-3V	—	1.0		µA

RF & DC Specifications, Z0=50 Ohms

Parameter	Condition (GHz)	V_{DS} = 4V[1], I_{DS} = 40mA			V_{DS} = 2V[1] I_{DS} = 20mA	VS = 5V[2]	VS = 3V[2]	Units
		Min.	Typ.	Max.	Typ.	Typ.	Typ.	
Gain	0.05	21	23.4	25.7	22	—	—	dB
	6	14.7	16.4	18	15.9	12.7	11.9	
	8	12.5	13.9	15.3	13.3	10.1	9.4	
	10	10.8	11.8	13.2	11.3	9.8	9.1	
	12	—	10.2	—	10	—	—	
Input Return Loss	0.05	—	—	—	—	—	—	dB
	6		7		6	11	10	
	8		7		6	15	12	
	10		7		7	8	7	
	12		8		7	—	—	
Output Return Loss	0.05		5		5	—	—	dB
	6		13		13	7	7	
	8		20		17	8	9	
	10		20		17	7	7	
	12		19		16	—	—	
P1dB[3]	0.05		17.7		13.3	—	—	dBm
	6		18.8		13.1	12.6	8.5	
	8		19.1		13.4	11.2	7.4	
	10		19.4		13.5	13.4	10.2	
	12		19.1		13	—	—	
OIP3 Pout=5dBm/Tone	0.05		27.1		22.8	—	—	dBm
	6		30.9		24.9	25.9	20.8	
	8		31.6		25.9	25.4	18.6	
	10		33.0		28.5	27.0	21.8	
	12		33.2		29.0	—	—	
Noise Figure	0.05		2.5		0.7	—	—	dB
	6		0.7		0.6	0.8	0.7	
	8		0.7		0.6	1.0	0.8	
	10		0.8		0.7	1.0	0.7	
	12		1.0		0.8	—	—	
I_{DS}	DC		40		20	54	23	mA
V_{GS}	DC	0.44	0.65	0.72	0.58	—	—	V

1. Measured in test board TB-TAV2-14LN+. See Fig 1.
2. Measured in eval board TB-TAV2-14LNE+ (designed for 6-10 GHz). See Fig. 2.
3. Drain current bias allowed to increase during compression measurement.

Absolute Maximum Ratings[4]

Symbol	Parameter	Max.	Units
V_{DS}[5]	Drain-Source Voltage	5	V
V_{GS}[5]	Gate-Source Voltage at V_{DS}=4V	-5 &1	V
I_{DS}[5]	Drain Current at V_{DS}=4V	65	mA
I_{GS}	Gate Current	15	µA
P_{DISS}	Total Dissipated Power	325	mW
P_{IN}[6]	RF Input Power	18 (5-minute max.) 15 (continuous)	dBm
T_{CH}	Channel Temperature	150	°C
T_{OP}	Operating Temperature	-40 to 85	°C
T_{STD}	Storage Temperature	-65 to 150	°C
θjc	Thermal Resistance	170	°C/W

4. Operation of this device above any one of these parameters may cause permanent damage.
5. Assumes DC quiescent conditions.
6. I_{GS} is limited to 15µA during test.

Characterization Test Circuit

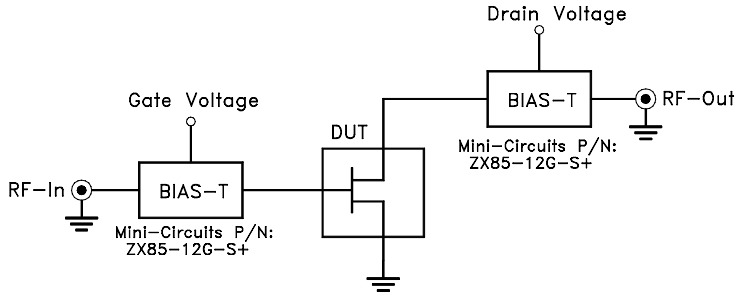
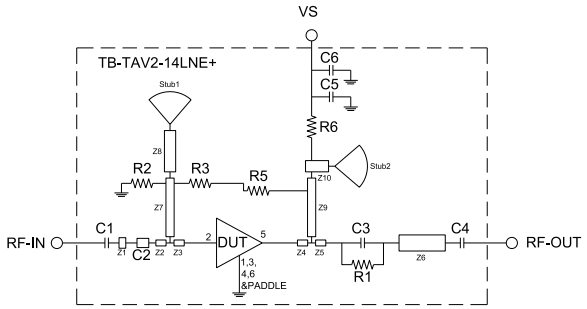


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT is soldered on Mini-Circuits Test Board TB-TAV2-14LN+)
Gain, Output power at 1dB compression (P1dB), Noise Figure and output IP3 (OIP3) are measured using Agilent's Microwave Network Analyzer N5242A PNA-X.

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

Application Test Circuit



Component	Size	Value	Part Number	Manufacturer
C1	0402	1pF	GRM1555C1H1R0CA01D	Murata
C2	Low–Zc microstrip as 0.15pF shunt capacitor to GND (refer to PCB layout for dimensions)			
C3	0402	0.3pF	GJM1555C1HR30BB01D	Murata
C4	0402	1pF	GRM1555C1H1R0CA01D	Murata
C5	0402	3.3pF	GRM1555C1H3R3CA01D	Murata
C6	0805	1uF	GRM21BR71C105KA01L	Murata
R1	0402	330hm	RK73H1ETTP33R0F	Koa
R2	0402	5.6KOhm	RK73H1ETTP5601F	Koa
R3	0402	8.2KOhm	RK73H1ETTP8201F	Koa
R5	0402	4.7KOhm	RK73H1ETTP4701F	Koa
R6	0402	430hm	RK73H1ETTP43R0F	Koa
Stub1, Stub2	Radial stubs of length = 1.75mm, angle = 70 deg, input line width = 0.54mm			
Z1–Z10	Transmission–line matching elements, refer to PCB layout for physical dimensions			

Fig 2. Block Diagram of Test Circuit used for characterization. (DUT is soldered on Mini-Circuits Application test board TB-TAV2-14LNE+)
Gain, Return loss, Output power at1dB compression (P1dB), output IP3 (OIP3) and noise figure measured using Agilent's microwave network analyzer N5242A PNA-X.
Conditions:
1. Supply voltage, V_S=3V&5V
2. Gain and Return loss: Pin= -25dBm
3. Output IP3 (OIP3): Two Tones spaced 1 MHz apart, 5dBm/ tone at output.

Product Marking

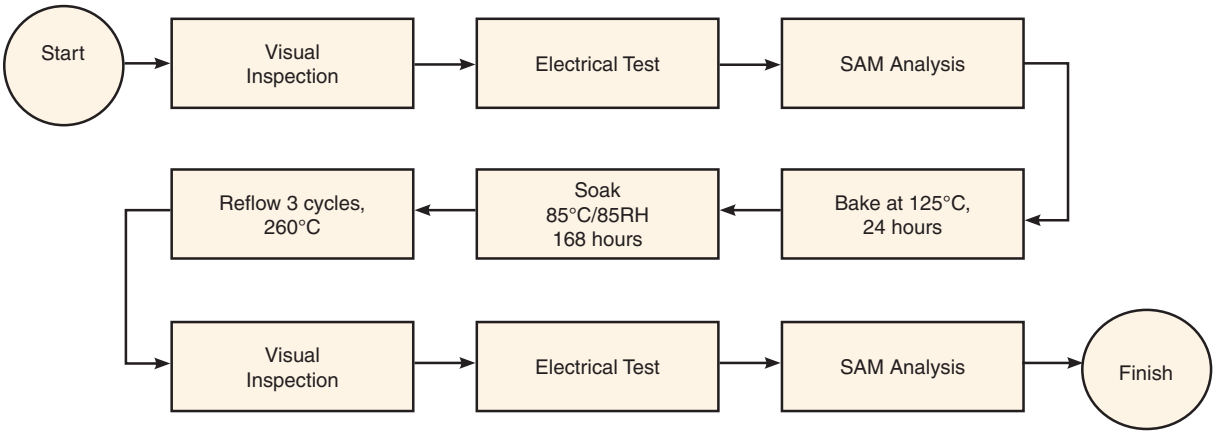
Marking may contain other features or characters for internal lot control

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	MC1630-1 *Plastic package, exposed paddle, lead finish: Matte-Tin*
Tape & Reel **Standard quantities available on reel**	F55 *7" reels with 20, 50, 100, 200, 500 or 1K devices*
Suggested Layout for PCB Design	PL-659
Evaluation Board	TB-TAV2-14LN+ & TB-TAV2-14LNE+
Environmental Ratings	ENV08T1

ESD Rating

Human Body Model (HBM): Class 0 (50V to 250V) in accordance with ANSI/ESD STM 5.1 - 2001

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

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