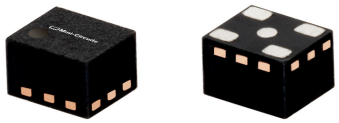
ULTRA LOW NOISE

D-PHEMT Transistor TAV1-331NM+

50Ω 10 to 4000 MHz Non-Magnetic Leadframe

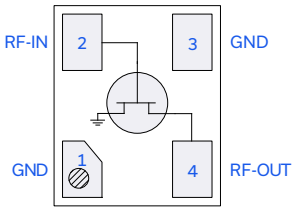
THE BIG DEAL

- No ferrous material in package leadframe
- Low Noise Figure, Typ. 0.5dB
- High Gain, Typ. 24.2dB
- High Output IP3, Typ. +31.7dBm
- Low Current, 60mA
- External biasing and matching required
- May be used as a replacement [a,b] for Broadcom ATF-331M4



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



APPLICATIONS

- MRI
- ISM
- 5G MIMO Radio Systems
- Wi-Fi 6
- Tactical Radio
- OFDM

PRODUCT OVERVIEW

Mini-Circuits' TAV1-331NM+ is a MMIC D-pHEMT* transistor with an operating frequency range from 10 to 4000MHz. This model combines high gain with extremely low noise figure, resulting in lower overall system noise. Low NF and high OIP3 performance make it an ideal choice for sensitive receivers in communications systems. Manufactured using highly repeatable D-pHEMT* technology, the unit comes housed in a tiny 1.4x1.2mm Non-Magnetic package. This model requires external biasing and matching.

KEY FEATURES

Features	Advantages
Non-Magnetic Package	Ideal for use in MRI and other magnetic sensitive applications.
Wideband, 10 to 4000MHz	A single device covers many wireless communications bands including cellular, ISM, GSM, WCDMA, WiMax, WLAN, and more.
High IP3 vs. DC power consumption • +31.7dBm at 300MHz • +36.5dBm at 4000MHz	The TAV1-331NM+ 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

* Depletion mode Pseudomorphic High Electron Mobility Transistor.

A Note: Suitability for model replacement within a particular system must be determined by and is solely the responsibility of the customer based on, among other things, electrical performance criteria, stimulus conditions, and application, compatibility with other components and environmental conditions and stresses.

B. The Broadcom ATF-331M4 part number is used for identification and comparison purposes only.

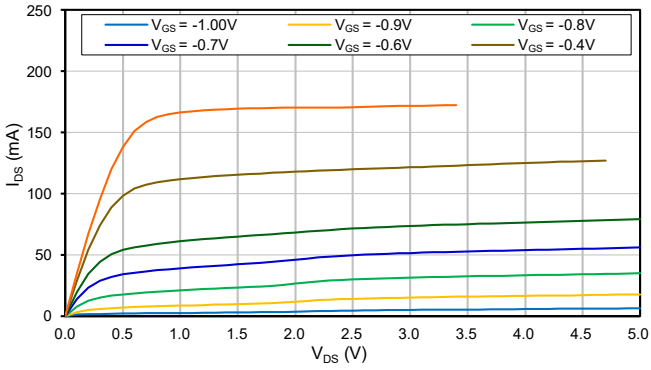
ELECTRICAL SPECIFICATIONS[1] AT +25°C, V_{DS}= +4V, I_{DS} = 60mA, UNLESS NOTED OTHERWISE

Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Frequency Range		10		4000	MHz
Noise Figure	50 300 900 2000 4000		0.8 0.5 0.5 0.7 1.0		dB
Gain	50 300 900 2000 4000	24.2 23.8 21.3 16.7 11.5	24.7 24.2 21.8 17.3 12.3		dB
Output Power at 1dB Compression (P1dB)	50 300 900 2000 4000		+19.7 +19.8 +20.2 +20.9 +21.5		dBm
Output Third-Order Intercept P_{OUT} = 0dBm/Tone	50 300 900 2000 4000		+30.8 +31.7 +33.0 +34.6 +36.5		dBm
Isolation	50 300 900 2000 4000		50 35 27 25 22		dB
Output Return Loss	50 300 900 2000 4000		6.1 6.5 8.7 12.1 16.5		dB
Device Operating Gate Voltage (V_{GS})		-0.96	-0.69	-0.51	V
Pinch-off Voltage (V_P) @ V_{DS} = +1.5V, I_{DS} = 10% of I_{DSS}			-0.81		V
Saturated Drain Current (I_{DSS}) @ V_{DS} = +4V, V_{GS} = 0V			228		mA
Transconductance (G_M) @ V_{DS} = +4V, $G_M = \Delta I_{DS}/\Delta V_{GS}$			282		mS
Gate to Drain Leakage Current (I_{GDO}) @ V_{GD} = -5V				1000	µA
Gate leakage Current (I_{GSS}) @ V_{GD} = V_{GS} = -4V				600	µA

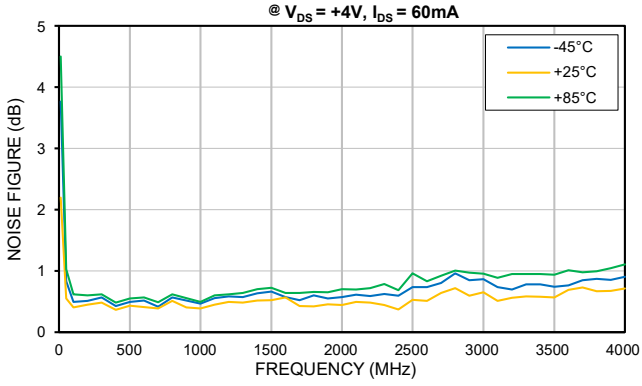
1. Tested on Mini-Circuits Characterization Test/Evaluation Board TB-TAV1-331NMC+. See Figure 2.

TYPICAL PERFORMANCE GRAPHS

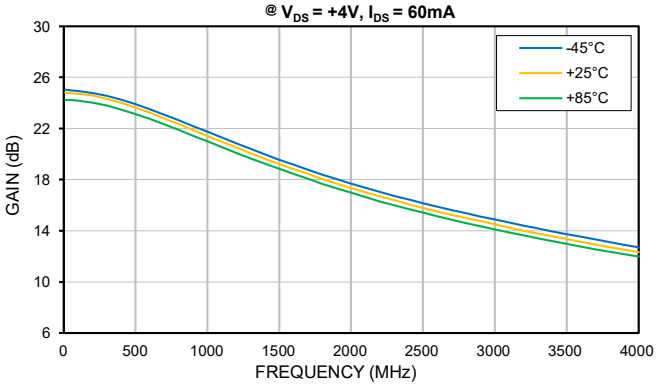
DRAIN CURRENT vs. GATE-SOURCE VOLTAGE(2)



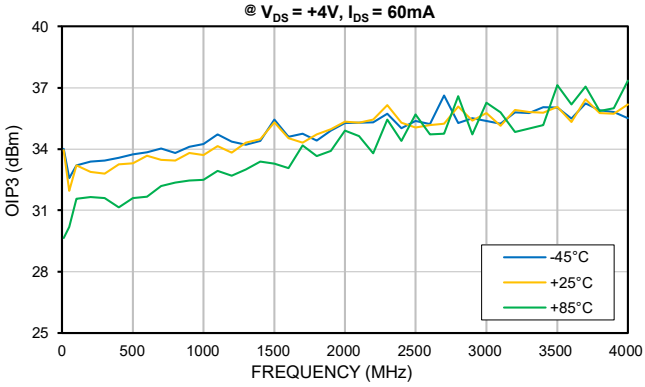
NOISE FIGURE vs. TEMPERATURE(1)
@ V_{DS} = +4V, I_{DS} = 60mA



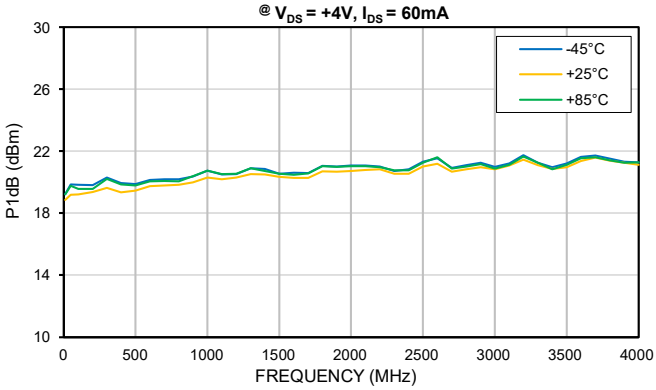
GAIN vs. TEMPERATURE(1)
@ V_{DS} = +4V, I_{DS} = 60mA



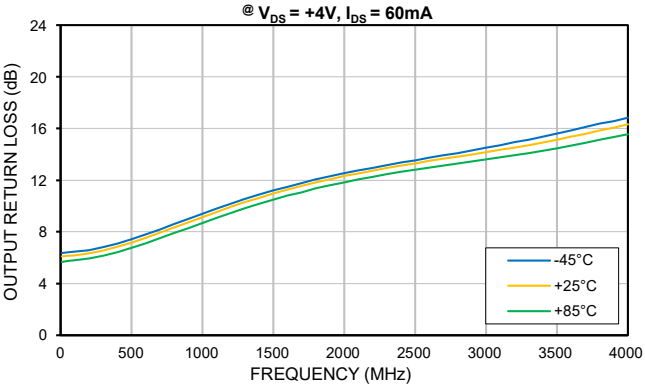
OUTPUT IP3 vs. TEMPERATURE(1)
@ V_{DS} = +4V, I_{DS} = 60mA



P1dB vs. TEMPERATURE(1)
@ V_{DS} = +4V, I_{DS} = 60mA



OUTPUT RETURN LOSS vs. TEMPERATURE(1)
@ V_{DS} = +4V, I_{DS} = 60mA



(1). Includes test board loss
(2). Drain current was allowed to increase during compression measurement

ABSOLUTE MAXIMUM RATINGS[2]

Parameter	Ratings
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Junction Temperature[3]	+150°C
Total Power Dissipation	400mW
Input Power (CW)	+20dBm
Drain-Source Voltage[4]	+5V
Gate-Source Voltage[4]	-5V
Gate-Drain Voltage[4]	-5V
Drain Current[4]	149mA

2. Permanent damage may occur if any of these limits are exceeded. Maximum ratings are not intended for continuous normal operation.
3. Peak temperature on top of Die.
4. Assumes DC quiescent condition, V_{GS} = -0.51V, V_{DS} = +4V

THERMAL RESISTANCE

Parameter	Ratings
Thermal Resistance (Θ_{jc})[5]	106°C/W

5. Θ_{jc}= (Hot Spot Temperature on Die - Temperature at Ground Lead)/Dissipated Power

ESD RATING

	Class	Voltage Range	Reference Standard
HBM	0B	125V to <250V	ANSI/ESDA/JEDEC JS-001-2017

ESD HANDLING PRECAUTION: This device is designed to be Class 0B for HBM. Static charges may easily produce potentials higher than this with improper handling and can discharge into DUT and damage it. As a preventive measure Industry standard ESD handling precautions should be used at all times to protect the device from ESD damage.

MSL RATING

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020E /JEDEC J-STD-033C

FUNCTIONAL DIAGRAM

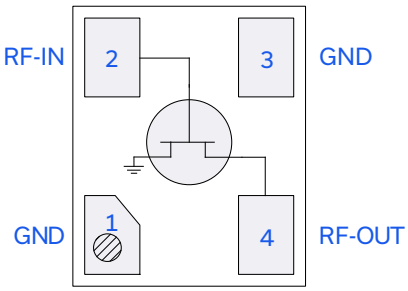


Figure 1. TAV1-331NM+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description (Refer to Figure 2)
RF-IN	2	RF-IN Pad connects to Gate
RF-OUT	4	RF-OUT Pad connects to Drain
GND	1, 3, and Paddle	Connects to ground

CHARACTERIZATION TEST BOARD

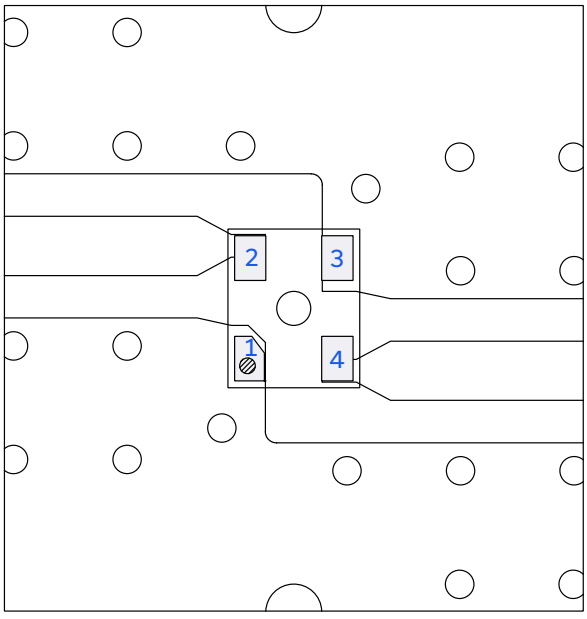


Figure 2. DUT soldered on Mini-Circuits Characterization Test Board: TB-TAV1-331NMC+

Electrical Parameters and Conditions
Gain, Output Power at 1dB Compression (P1dB), Output IP3 (OIP3), and Noise Figure measured using N5247B PNA-X microwave network analyzer.

Conditions:
1. Drain Voltage (with reference to source, V_{DS}) = +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 Specification Table.
3. Gain: P_{IN} = -25dBm.
4. Output IP3 (OIP3): Two tones, spaced 1MHz apart, 0dBm/tone at output.
5. No External Matching Components Used.

Caution: Permanent damage to the device will occur if the Power ON and Power OFF Sequences are not followed.

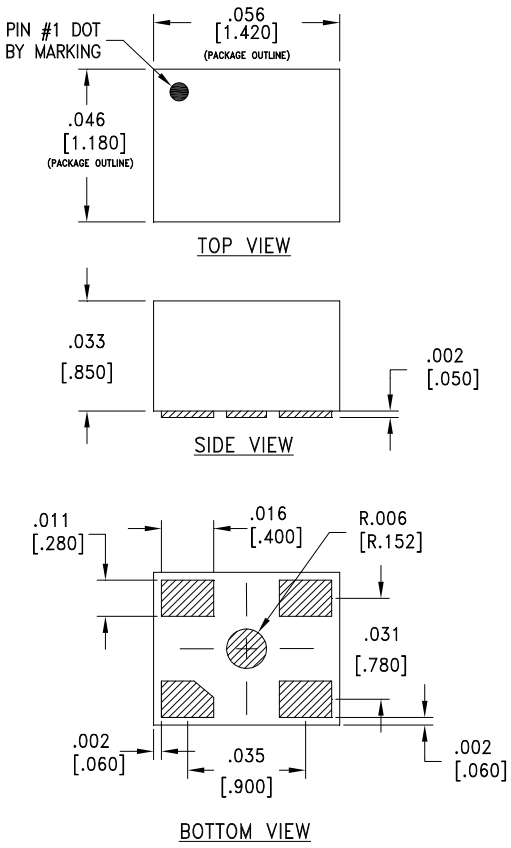
Power ON Sequence:
1) Set V_{GS} = -2V. Apply V_{GS}.
2) Set V_{DS} = +4V. Apply V_{DS}.
3) Increase V_{GS} to obtain desired I_{DS} as shown in specification table.
4) Apply RF Signal.

Power OFF Sequence:
1) Turn off RF Signal.
2) Adjust V_{GS} down to -2V.
3) Turn off V_{DS}.
4) Turn off V_{GS}.

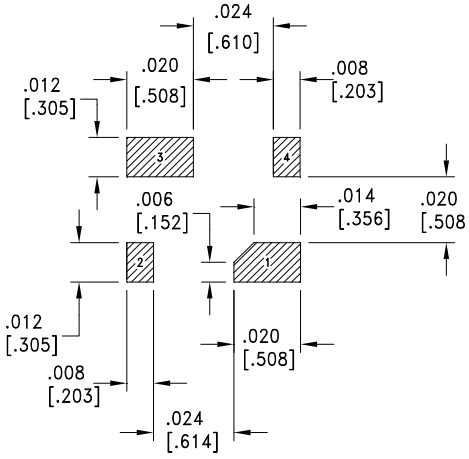
D-PHEMT Transistor TAV1-331NM+

50Ω 10 to 4000 MHz Non-Magnetic Leadframe

CASE STYLE DRAWING



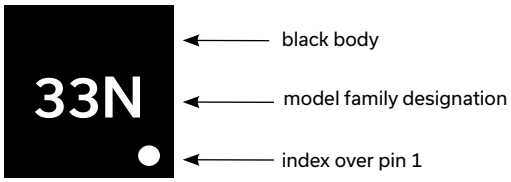
PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

Weight: .0047 grams
Dimensions are in inches (mm). Tolerances: 2 Pl. + .01; 3 Pl. + .005

PRODUCT MARKING



Marking may contain other features or characters for internal lot control

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD CLICK HERE

Performance Data & Graphs	Data Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	TE2769 Plastic package, exposed paddle, Lead Finish: Matte-Tin
RoHS Status	Compliant
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	PL-758
Evaluation Board	TB-TAV1-331NMC+ Gerber File
Environmental Ratings	ENV08T2

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/terms/viewterm.html

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