

Ultra Low Noise, Medium Current D-PHEMT Transistor

10-4000 MHz

Product Features

- Low Noise Figure, 0.5 dB typ. at 300 MHz
- Gain, 24.1 dB typ. at 300 MHz
- High Output IP3, +32.3 dBm typ. at 300 MHz
- Output Power at 1dB comp., +19.6 dBm typ. at 300 MHz
- Low Current, 60mA
- External biasing and matching required



Generic photo used for illustration purposes only

SAV-331+

CASE STYLE: TE2769

Typical Applications

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

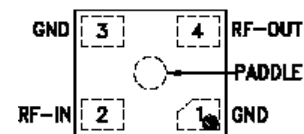
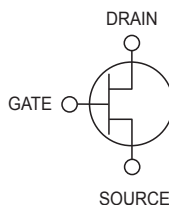
+RoHS Compliant

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

General Description

Mini-Circuits' SAV-331+ is a MMIC D-PHEMT transistor with an operating frequency range from 10 to 4000 MHz. 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 D-PHEMT* technology, the unit comes housed in a tiny 4-lead SOT-343 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	4	Drain used for RF output
GND	1,3 and Paddle	Source terminal and Paddle, normally connected to ground.

* 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 at $T_{AMB}=25^{\circ}\text{C}$, Frequency 10 to 4000 MHz

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
DC Specifications						
V_{GS}	Operational Gate Voltage	$V_{DS}=4\text{V}$, $I_{DS}=60\text{ mA}$	-0.81	-0.69	-0.57	V
V_p	Pinch-off Voltage	$V_{DS}=1.5\text{ V}$, $I_{DS}=10\%$ of I_{DSS}		-0.81		V
I_{DSS}	Saturated Drain Current	$V_{DS}=4\text{V}$, $V_{GS}=0\text{ V}$		228		μA
G_M	Transconductance	$V_{DS}=3\text{V}$, $G_m=\Delta I_{DS}/\Delta V_{GS}$ $\Delta V_{GS}=V_{GS1}-V_{GS2}$ $V_{GS1}=V_{GS}$ at $I_{DS}=60\text{ mA}$ $V_{GS2}=V_{GS1}+0.05\text{V}$	—	—	—	mS
	Gate to Drain Leakage Current	$V_{GD}=5\text{V}$			1000	μA
I_{GSS}	Gate leakage Current	$V_{GD}=V_{GS}=-4\text{V}$			600	μA
Specifications, $Z_0=50\text{ Ohms}$ (Figure 1)*						
NF	Noise Figure	$V_{DS}=4\text{V}$, $I_{DS}=60\text{ mA}$				
			f=50 MHz	0.9		
			f=300 MHz	0.6		
			f=900 MHz	0.5		
			f=2000 MHz	0.6	0.8	
			f=4000 MHz	1.0		
Gain	Gain	$V_{DS}=4\text{V}$, $I_{DS}=60\text{ mA}$				
			f=50 MHz	24.6		
			f=300 MHz	24.1		
			f=900 MHz	21.6		
			f=2000 MHz	13.9	17.0	18.3
			f=4000 MHz	12.0		
OIP3	Output IP3	$V_{DS}=4\text{V}$, $I_{DS}=60\text{ mA}$				
			f=50 MHz	31.7		
			f=300 MHz	31.8		
			f=900 MHz	32.9		
			f=2000 MHz	34.6		
			f=4000 MHz	37.3		
P1dB	Power output at 1 dB Compression	$V_{DS}=4\text{V}$, $I_{DS}=60\text{ mA}$				
			f=50 MHz	19.6		
			f=300 MHz	20.1		
			f=900 MHz	18.0	20.4	
			f=2000 MHz	18.9	21.3	
			f=4000 MHz	21.3		
Θ_{JC}	Thermal Resistance			106		$^{\circ}\text{C/W}$

Absolute Maximum Ratings⁽¹⁾

Symbol	Parameter	Max.	Units
V_{DS}	Drain-Source Voltage ²	5	V
V_{GS}	Gate-Source Voltage ²	-5	V
V_{GD}	Gate-Drain Voltage ²	-5	V
I_{DS}	Drain Current ²	149	mA
P_{DISS}	Total Dissipated Power	400	mW
P_{IN}	RF Input Power	20	dBm
T_{CH}	Channel Temperature	150	$^{\circ}\text{C}$
T_{OP}	Operating Temperature	-40 to 85	$^{\circ}\text{C}$
T_{STD}	Storage Temperature	-65 to 150	$^{\circ}\text{C}$

Notes:

(1) Operation of this device above any one of these parameters may cause permanent damage.

(2) Assumes DC quiescent conditions, $V_{GS} = -0.51\text{ V}$, $V_{DS} = 4\text{ V}$.

Characterization Test Circuit

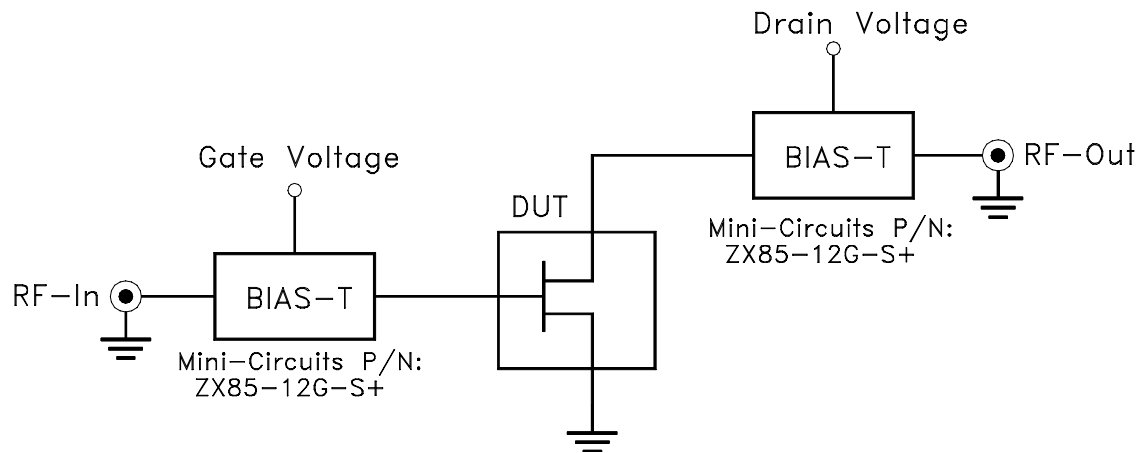


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Test Board TB-SAV-331+) Gain, Output power at 1dB compression (P1 dB) and output IP3 (OIP3) are measured using R&S Network Analyzer ZVA-24. Noise Figure measured using keysight PNA-X.

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 graphs or 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.

Fig 2. Test Board used for characterization, Mini-Circuits P/N TB-SAV-331+ (Material: Rogers 4350, Thickness: 0.02")

Product Marking

Additional Detailed Technical Information	
<i>additional information is available on our dash board. To access this information click here</i>	
Performance Data	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
Case Style	TE2769 <i>Plastic package, exposed paddle, lead finish: Matte-Tin plated</i>
Tape & Reel Standard quantities available on reel	F90 <i>7" reels with 20, 50, 100, 200, 500, 1K, 2K or 3K devices</i>
Suggested Layout for PCB Design	PL-627
Evaluation Board	TB-SAV-331+
Environmental Ratings	ENV08T2

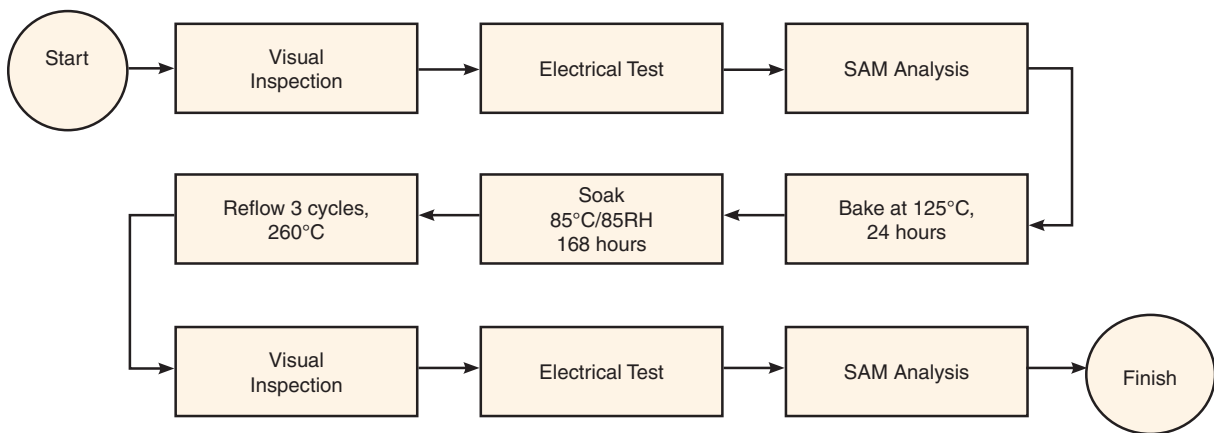
ESD Rating

Human Body Model (HBM): Class 0 (<250V) 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