Ultra Low Noise, Medium Current

D-PHEMT Transistor

SAV-331+

50Ω 10 to 4000 MHz

The Big Deal

- Low noise figure, 0.5 dB
- High gain, 24.1 dB
- High IP3, +32.3 dBm
- High P1dB, 19.6 dBm

CASE STYLE: MMM1362

Product Overview

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.

Key Features

Feature	Advantages
Wideband, 10 to 4000 MHz	A single device covers many wireless communications bands including cellular, ISM, GSM, WCDMA, WiMax, WLAN, and more.
High IP3 vs. DC power consumption • +32.3 dBm at 300 MHz • +38.7 dBm at 4000 MHz	The SAV-331+ 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 upconverter paths • Drivers in linearized transmit systems
Combines high gain (24.1 dB) with very low noise Figure (0.5 dB)	The unique combination of high gain and low noise Figure results in lower overall system noise.

* Depletion mode Pseudomorphic High Electron Mobility Transistor.

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

SAV-331+

CASE STYLE: MMM1362

+RoHS Compliant

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

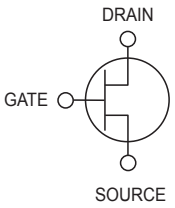
Typical Applications

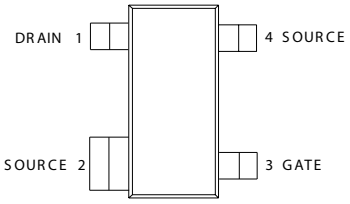
- Cellular
- ISM
- GSM
- WCDMA
- WiMax
- WLAN
- UNII and HIPERLAN

General Description

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





SOT-343 (SC-70) PACKAGE

Function	Pin Number	Description
Source	2 & 4	Source terminal, normally connected to ground
Gate	3	Gate used for RF input
Drain	1	Drain used for RF output

* Depletion mode Pseudomorphic High Electron Mobility Transistor.

Electrical Specifications at T_{AMB}=25°C, Frequency 10 to 4000 MHz

Symbol	Parameter	Condition		Min.	Typ.	Max.	Units
DC Specifications							
V_{GS}	Operational Gate Voltage	V_{DS}=4V, I_{DS}=60 mA		-0.81	-0.69	-0.57	V
V_p	Pinch-off Voltage	V_{DS}=1.5 V, I_{DS}= 10% of Idss			-0.81		V
I_{DSS}	Saturated Drain Current	V_{DS}=4V, V_{GS}=0 V			228		mA
G_M	Transconductance	V_{DS}=4V, Gm=Δ I_{DSS}/ΔV_P			282		mS
I_{GDO}	Gate to Drain Leakage Current	V_{GD}=-5V				1000	uA
I_{GSS}	Gate leakage Current	V_{GD}=V_{GS}=-4V				600	uA
Specifications, Z_0=50 Ohms (Figure 1)*							
NF	Noise Figure	V_{DS}=4V, I_{DS}=60 mA	f=40 MHz		0.9		dB
			f=300 MHz		0.5		
			f=900 MHz		0.4		
			f=2000 MHz		0.5	0.8	
			f=4000 MHz		0.9		
Gain	Gain	V_{DS}=4V, I_{DS}=60 mA	f=10 MHz		24.6		dB
			f=300 MHz		24.1		
			f=900 MHz		21.3		
			f=2000 MHz	13.9	16.6	18.3	
			f=4000 MHz		11.5		
OIP3	Output IP3	V_{DS}=4V, I_{DS}=60 mA	f=10 MHz		30.9		dBm
			f=300 MHz		32.3		
			f=900 MHz		33.5		
			f=2000 MHz		35.5		
			f=4000 MHz		38.7		
P1dB	Power output at 1 dB Compression	V_{DS}=4V, I_{DS}=60 mA	f=10 MHz		19.1		dBm
			f=300 MHz		19.6		
			f=900 MHz	18.0	20.2		
			f=2000 MHz	18.9	21.1		
			f=4000 MHz		21.8		
Θ_{JC}	Thermal Resistance				109		°C/W

* Tested on Mini-Circuits TB-471+ test board.

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	°C
T_{OP}	Operating Temperature	-40 to 85	°C
T_{STD}	Storage Temperature	-65 to 150	°C

Notes:
(1) Operation of this device above any one of these parameters may cause permanent damage.
(2) Assumes DC quiescent conditions, Vgs = -0.51 V, Vds = 4 V.

Characterization Test Circuit

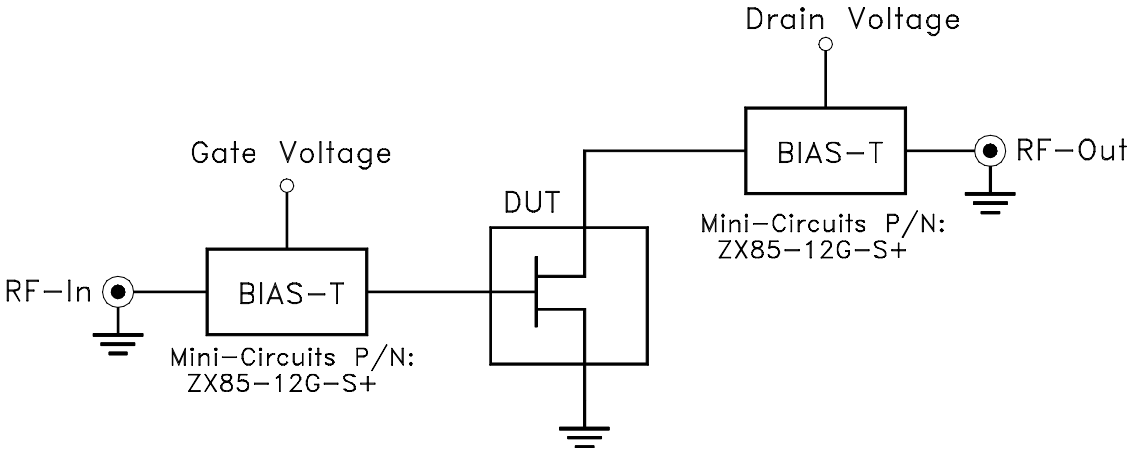


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Test Board TB-471+)

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 (IDS) 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.

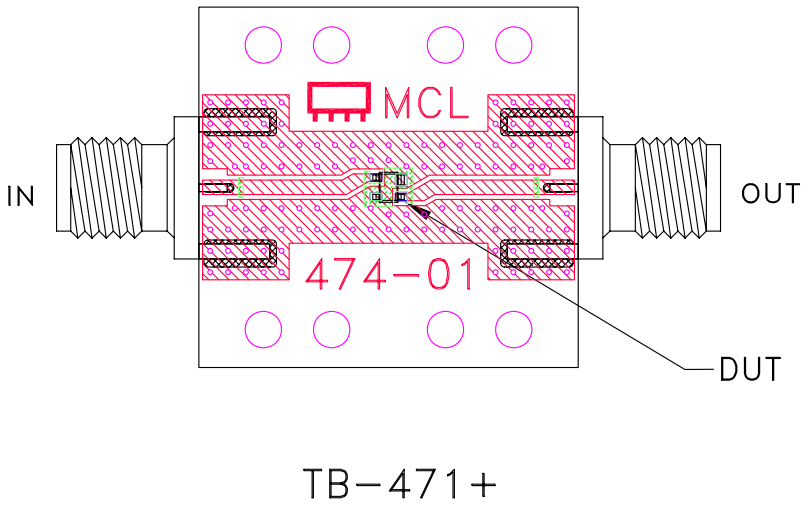
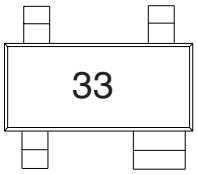


Fig 2. Test Board used for characterization, Mini-Circuits P/N TB-471+ (Material: Rogers 4350, Thickness: 0.02")

Product Marking



Additional Detailed Technical Information

Additional information is available on our web site www.minicircuits.com. To access this information enter the model number on our web site home page.

Performance data, graphs, s-parameter data set (.zip file)

Case Style: MMM1362
Plastic molded SOT-343 (SC-70) style package, lead finish: matte tin

Suggested Layout for PCB Design: PL-300

Tape & Reel: F90
Standard quantities availabe on reel: *7" reels with 20, 50, 100, 200, 500, 1K, 2K, or 3K devices.*

Characterization Test Board: TB-471+

Environmental Ratings: ENV08T2

ESD Rating

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

MSL Rating

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