

JFET VHF/UHF Amplifiers

N-Channel — Depletion

J308
J309
J310

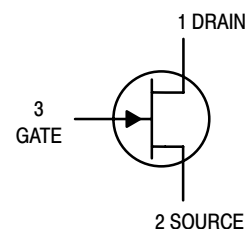
ON Semiconductor Preferred Devices

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain–Source Voltage	V_{DS}	25	Vdc
Gate–Source Voltage	V_{GS}	25	Vdc
Forward Gate Current	I_{GF}	10	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	350 2.8	mW mW/°C
Junction Temperature Range	T_J	–65 to +125	°C
Storage Temperature Range	T_{stg}	–65 to +150	°C



CASE 29–11, STYLE 5
TO–92 (TO–226AA)



ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Gate–Source Breakdown Voltage ($I_G = -1.0\ \mu\text{Adc}$, $V_{DS} = 0$)	$V_{(BR)GSS}$	–25	—	—	Vdc
Gate Reverse Current ($V_{GS} = -15\ \text{Vdc}$, $V_{DS} = 0$, $T_A = 25^\circ\text{C}$) ($V_{GS} = -15\ \text{Vdc}$, $V_{DS} = 0$, $T_A = +125^\circ\text{C}$)	I_{GSS}	— —	— —	–1.0 –1.0	nAdc μAdc
Gate Source Cutoff Voltage ($V_{DS} = 10\ \text{Vdc}$, $I_D = 1.0\ \text{nAdc}$)	$V_{GS(off)}$	–1.0 –1.0 –2.0	— — —	–6.5 –4.0 –6.5	Vdc

ON CHARACTERISTICS

Zero–Gate–Voltage Drain Current ⁽¹⁾ ($V_{DS} = 10\ \text{Vdc}$, $V_{GS} = 0$)	I_{DSS}	12 12 24	— — —	60 30 60	mAdc
Gate–Source Forward Voltage ($V_{DS} = 0$, $I_G = 1.0\ \text{mAdc}$)	$V_{GS(f)}$	—	—	1.0	Vdc

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Characteristic	Symbol	Min	Typ	Max	Unit
SMALL-SIGNAL CHARACTERISTICS					
Common-Source Input Conductance ($V_{DS} = 10 \text{ Vdc}$, $I_D = 10 \text{ mAdc}$, $f = 100 \text{ MHz}$)	$\text{Re}(y_{is})$	—	0.7	—	mmhos
J308		—	0.7	—	
J309		—	0.5	—	
J310		—	0.5	—	
Common-Source Output Conductance ($V_{DS} = 10 \text{ Vdc}$, $I_D = 10 \text{ mAdc}$, $f = 100 \text{ MHz}$)	$\text{Re}(y_{os})$	—	0.25	—	mmhos
Common-Gate Power Gain ($V_{DS} = 10 \text{ Vdc}$, $I_D = 10 \text{ mAdc}$, $f = 100 \text{ MHz}$)	G_{pg}	—	16	—	dB

1. Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 3.0\%$.

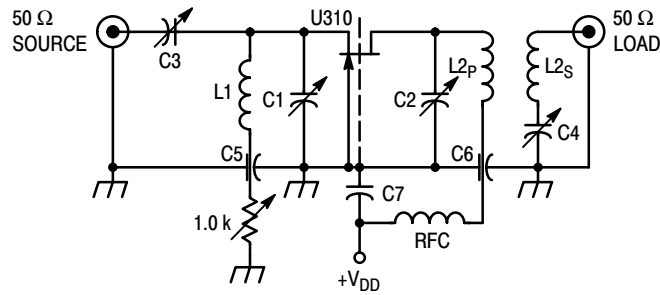
SMALL-SIGNAL CHARACTERISTICS (continued)

Common-Source Forward Transconductance ($V_{DS} = 10 \text{ Vdc}$, $I_D = 10 \text{ mAdc}$, $f = 100 \text{ MHz}$)	$\text{Re}(y_{fs})$	—	12	—	mmhos
Common-Gate Input Conductance ($V_{DS} = 10 \text{ Vdc}$, $I_D = 10 \text{ mAdc}$, $f = 100 \text{ MHz}$)	$\text{Re}(y_{ig})$	—	12	—	mmhos
Common-Source Forward Transconductance ($V_{DS} = 10 \text{ Vdc}$, $I_D = 10 \text{ mAdc}$, $f = 1.0 \text{ kHz}$)	g_{fs}	8000	—	20000	μmhos
J308		10000	—	20000	
J309		8000	—	18000	
J310		8000	—	18000	
Common-Source Output Conductance ($V_{DS} = 10 \text{ Vdc}$, $I_D = 10 \text{ mAdc}$, $f = 1.0 \text{ kHz}$)	g_{os}	—	—	250	μmhos
Common-Gate Forward Transconductance ($V_{DS} = 10 \text{ Vdc}$, $I_D = 10 \text{ mAdc}$, $f = 1.0 \text{ kHz}$)	g_{fg}	—	13000	—	μmhos
J308		—	13000	—	
J309		—	13000	—	
J310		—	12000	—	
Common-Gate Output Conductance ($V_{DS} = 10 \text{ Vdc}$, $I_D = 10 \text{ mAdc}$, $f = 1.0 \text{ kHz}$)	g_{og}	—	150	—	μmhos
J308		—	100	—	
J309		—	150	—	
J310		—	150	—	
Gate-Drain Capacitance ($V_{DS} = 0$, $V_{GS} = -10 \text{ Vdc}$, $f = 1.0 \text{ MHz}$)	C_{gd}	—	1.8	2.5	pF
Gate-Source Capacitance ($V_{DS} = 0$, $V_{GS} = -10 \text{ Vdc}$, $f = 1.0 \text{ MHz}$)	C_{gs}	—	4.3	5.0	pF

FUNCTIONAL CHARACTERISTICS

Noise Figure ($V_{DS} = 10 \text{ Vdc}$, $I_D = 10 \text{ mAdc}$, $f = 450 \text{ MHz}$)	NF	—	1.5	—	dB
Equivalent Short-Circuit Input Noise Voltage ($V_{DS} = 10 \text{ Vdc}$, $I_D = 10 \text{ mAdc}$, $f = 100 \text{ Hz}$)	$\bar{e}_n$	—	10	—	$\text{nV}/\sqrt{\text{Hz}}$

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C1 = C2 = 0.8 – 10 pF, JFD #MVM010W.
 C3 = C4 = 8.35 pF Erie #539-002D.
 C5 = C6 = 5000 pF Erie (2443-000).
 C7 = 1000 pF, Allen Bradley #FA5C.
 RFC = 0.33 μ H Miller #9230-30.
 L1 = One Turn #16 Cu, 1/4" I.D. (Air Core).
 L2P = One Turn #16 Cu, 1/4" I.D. (Air Core).
 L2S = One Turn #16 Cu, 1/4" I.D. (Air Core).

Figure 1. 450 MHz Common-Gate Amplifier Test Circuit

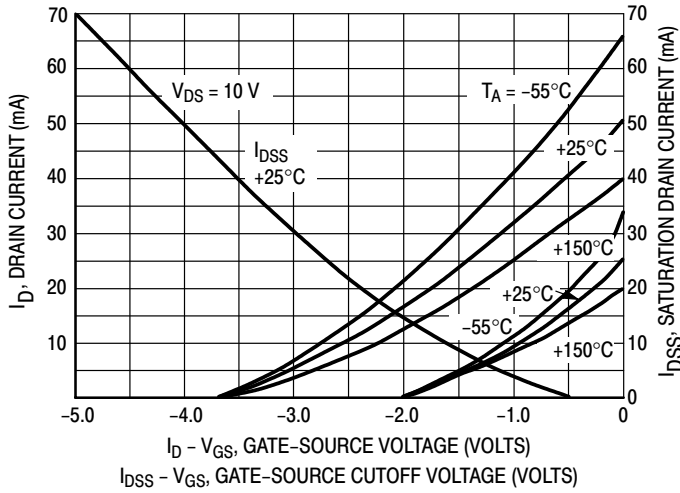


Figure 2. Drain Current and Transfer Characteristics versus Gate-Source Voltage

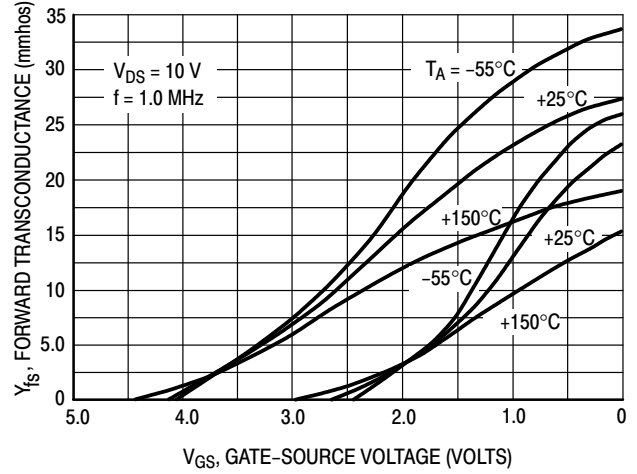


Figure 3. Forward Transconductance versus Gate-Source Voltage

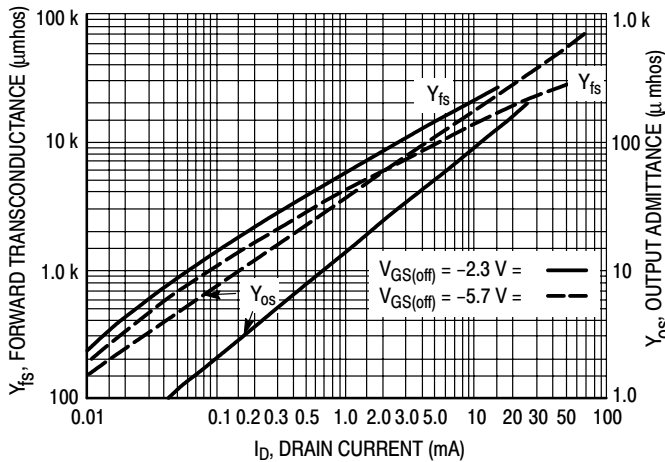


Figure 4. Common-Source Output Admittance and Forward Transconductance versus Drain Current

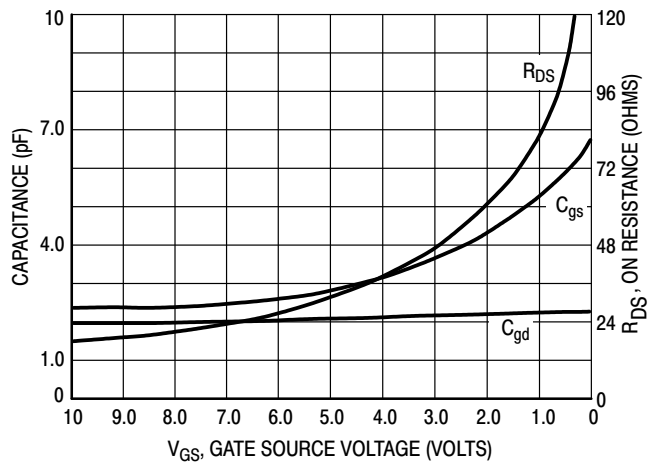


Figure 5. On Resistance and Junction Capacitance versus Gate-Source Voltage

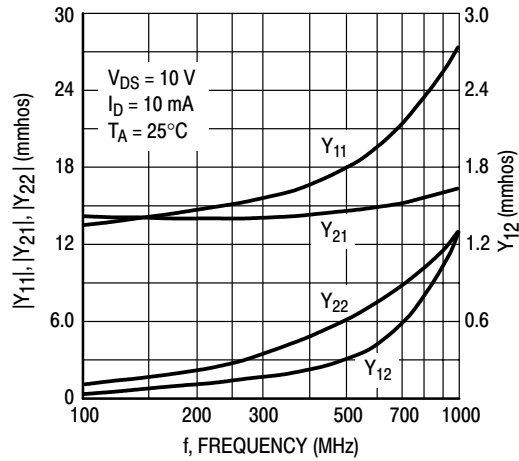


Figure 6. Common-Gate Y Parameter Magnitude versus Frequency

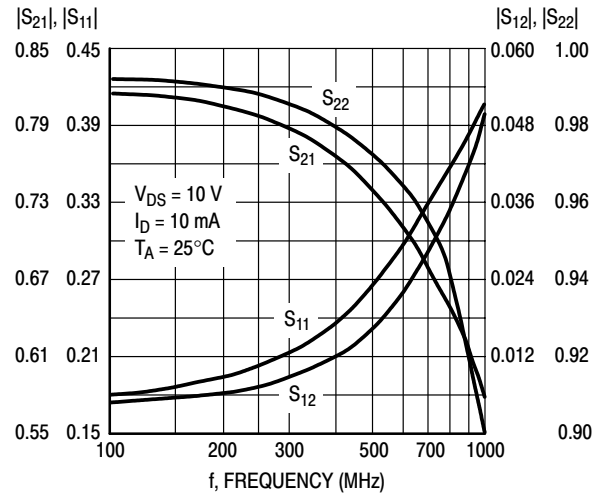


Figure 7. Common-Gate S Parameter Magnitude versus Frequency

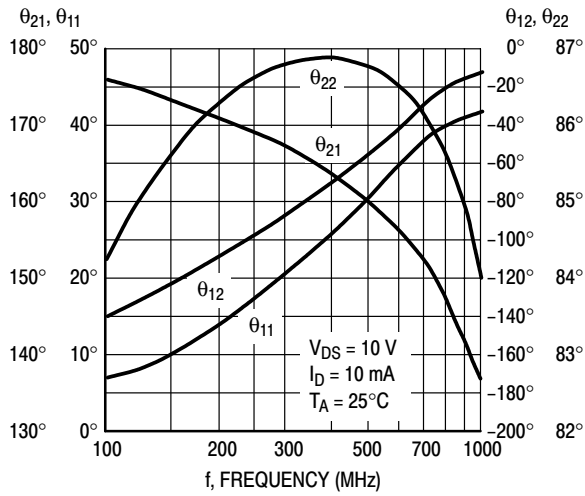


Figure 8. Common-Gate Y Parameter Phase-Angle versus Frequency

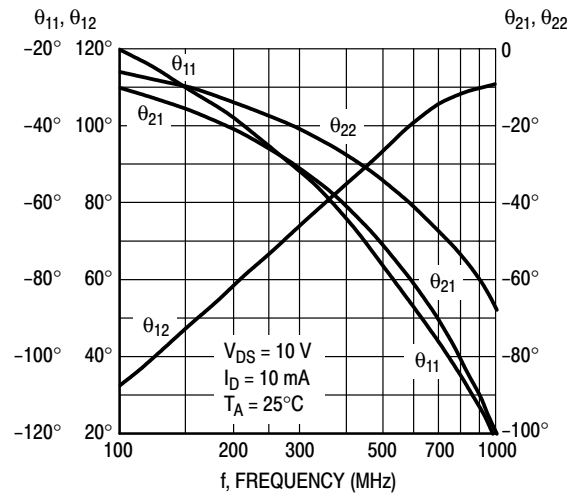


Figure 9. S Parameter Phase-Angle versus Frequency

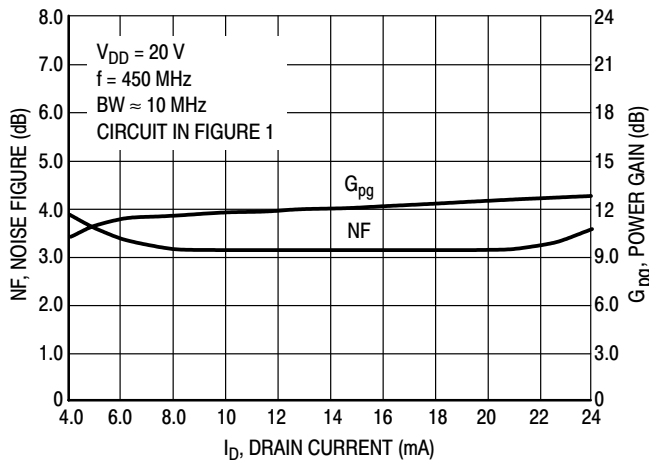


Figure 10. Noise Figure and Power Gain versus Drain Current

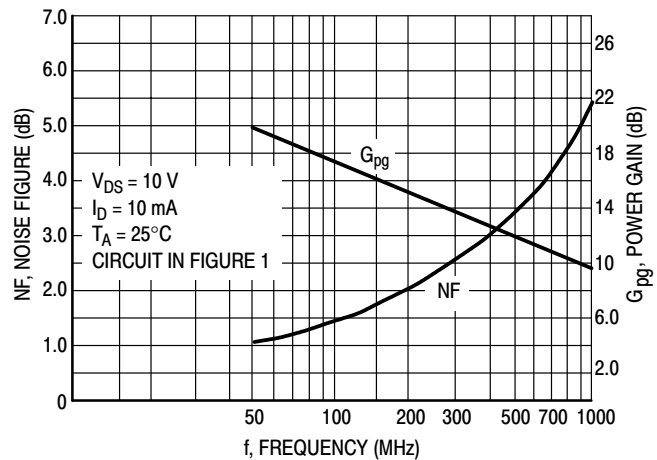
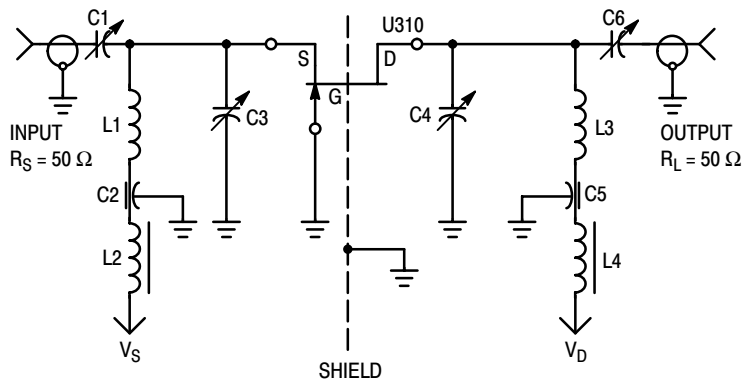


Figure 11. Noise Figure and Power Gain versus Frequency

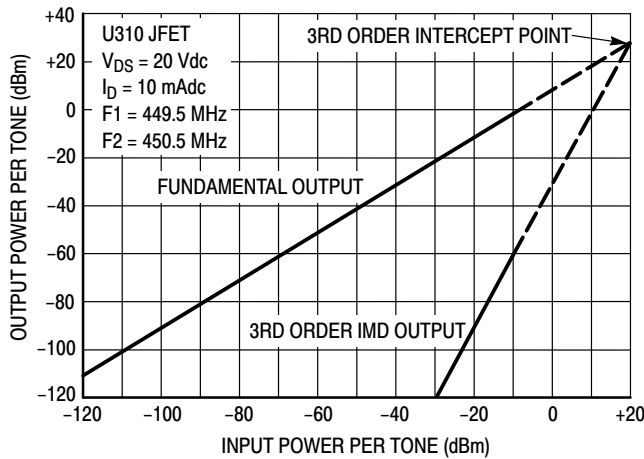
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B_W (3 dB) – 36.5 MHz
 I_D – 10 mAdc
 V_{DS} – 20 Vdc
 Device case grounded
 IM test tones – $f_1 = 449.5$ MHz, $f_2 = 450.5$ MHz
 $C_1 = 1$ –10 pF Johanson Air variable trimmer.
 $C_2, C_5 = 100$ pF feed thru button capacitor.
 $C_3, C_4, C_6 = 0.5$ –6 pF Johanson Air variable trimmer.
 $L_1 = 1/8'' \times 1/32'' \times 1-5/8''$ copper bar.
 $L_2, L_4 =$ Ferroxcube Vx200 choke.
 $L_3 = 1/8'' \times 1/32'' \times 1-7/8''$ copper bar.

Figure 12. 450 MHz IMD Evaluation Amplifier

Amplifier power gain and IMD products are a function of the load impedance. For the amplifier design shown above with C_4 and C_6 adjusted to reflect a load to the drain resulting in a nominal power gain of 9 dB, the 3rd order intercept point (IP) value is 29 dBm. Adjusting C_4, C_6 to provide larger load values will result in higher gain, smaller bandwidth and lower IP values. For example, a nominal gain of 13 dB can be achieved with an intercept point of 19 dBm.



Example of intercept point plot use:

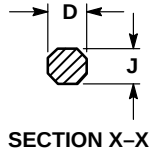
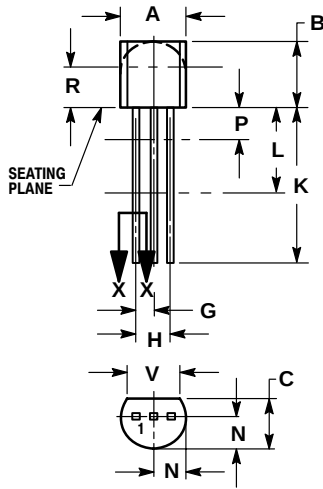
Assume two in-band signals of -20 dBm at the amplifier input. They will result in a 3rd order IMD signal at the output of -90 dBm. Also, each signal level at the output will be -11 dBm, showing an amplifier gain of 9.0 dB and an intermodulation ratio (IMR) capability of 79 dB. The gain and IMR values apply only for signal levels below comparison.

Figure 13. Two Tone 3rd Order Intercept Point

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PACKAGE DIMENSIONS

TO-92 (TO-226AA)
CASE 29-11
ISSUE AL



STYLE 5:
PIN 1. DRAIN
2. SOURCE
3. GATE

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.021	0.407	0.533
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	---	12.70	---
L	0.250	---	6.35	---
N	0.080	0.105	2.04	2.66
P	---	0.100	---	2.54
R	0.115	---	2.93	---
V	0.135	---	3.43	---

Notes

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