

JFET VHF/UHF Amplifiers

N-Channel — Depletion

J308
J309
J310

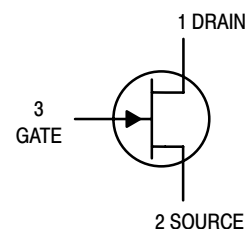
ON Semiconductor Preferred Devices

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 $\leq 3.0\%$.

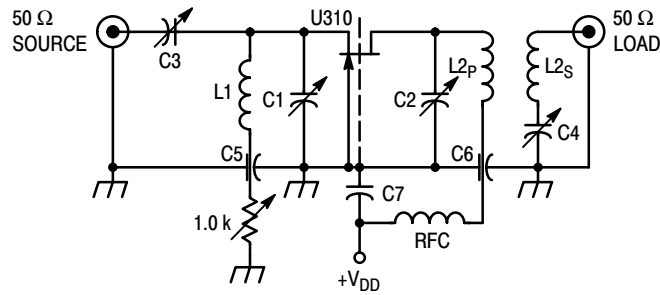
SMALL-SIGNAL CHARACTERISTICS (continued)

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

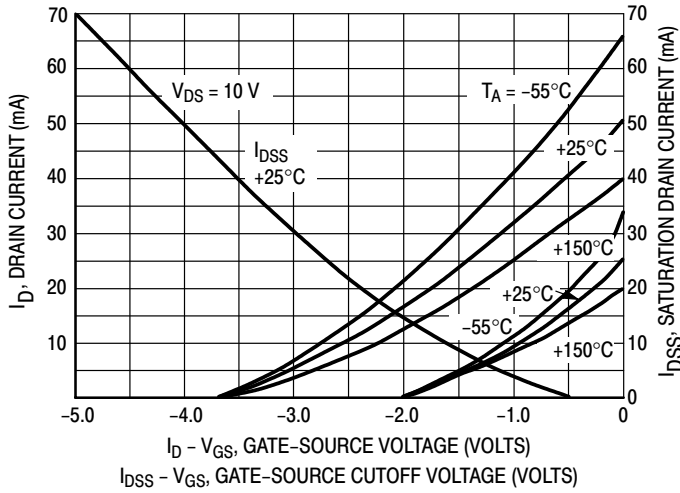


Figure 2. Drain Current and Transfer Characteristics versus Gate-Source Voltage

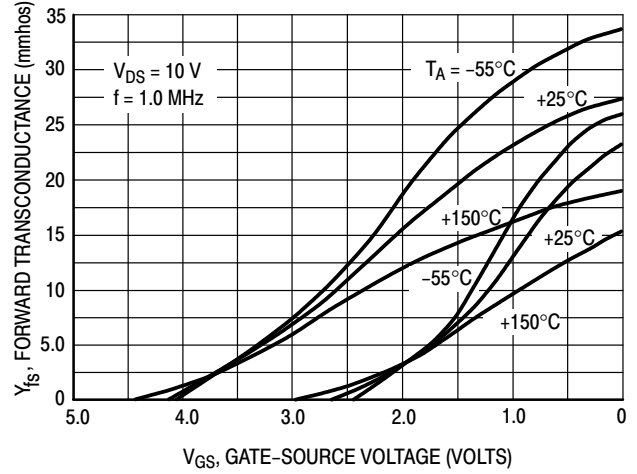


Figure 3. Forward Transconductance versus Gate-Source Voltage

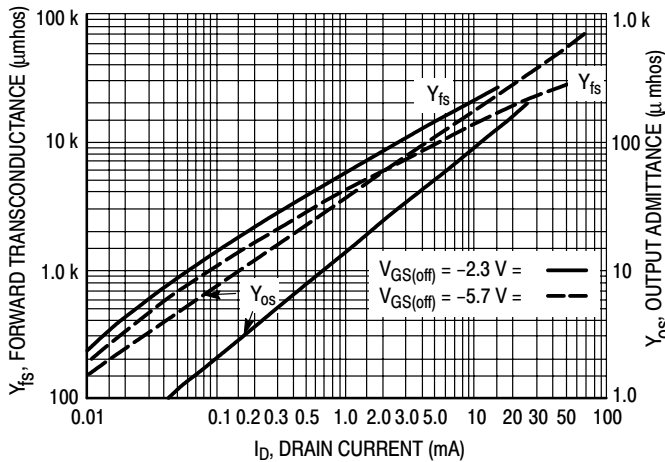


Figure 4. Common-Source Output Admittance and Forward Transconductance versus Drain Current

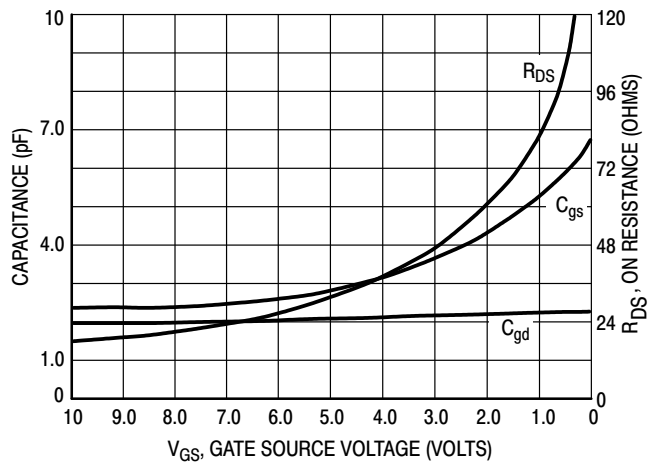


Figure 5. On Resistance and Junction Capacitance versus Gate-Source Voltage

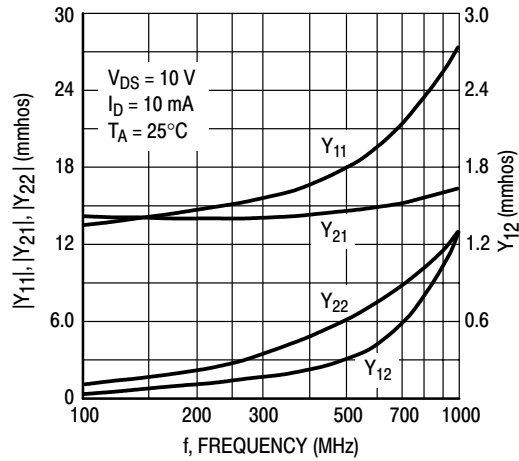


Figure 6. Common-Gate Y Parameter Magnitude versus Frequency

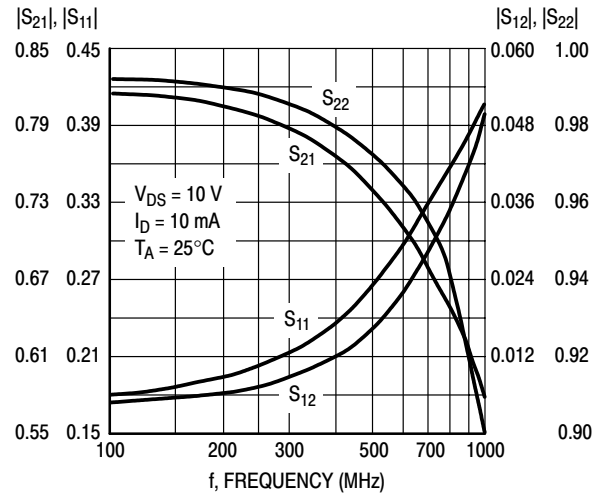


Figure 7. Common-Gate S Parameter Magnitude versus Frequency

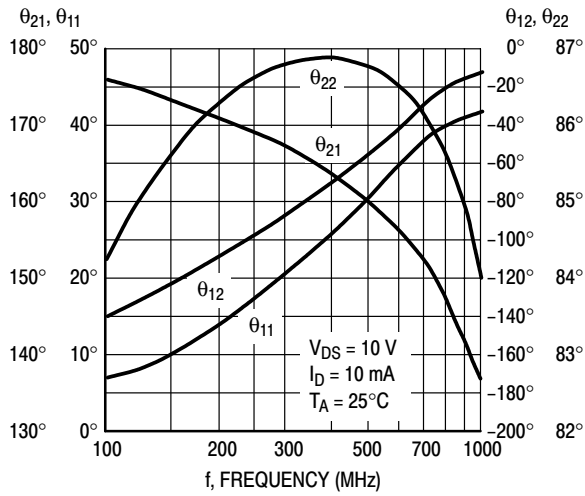


Figure 8. Common-Gate Y Parameter Phase-Angle versus Frequency

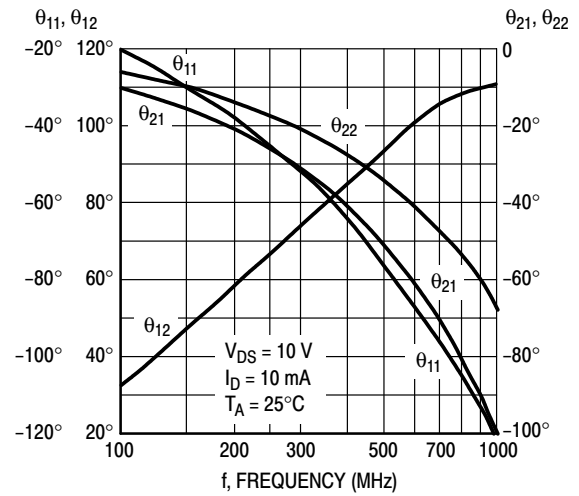


Figure 9. S Parameter Phase-Angle versus Frequency

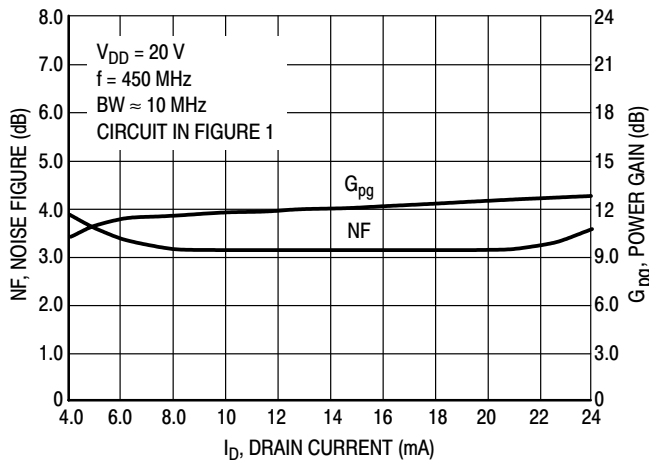


Figure 10. Noise Figure and Power Gain versus Drain Current

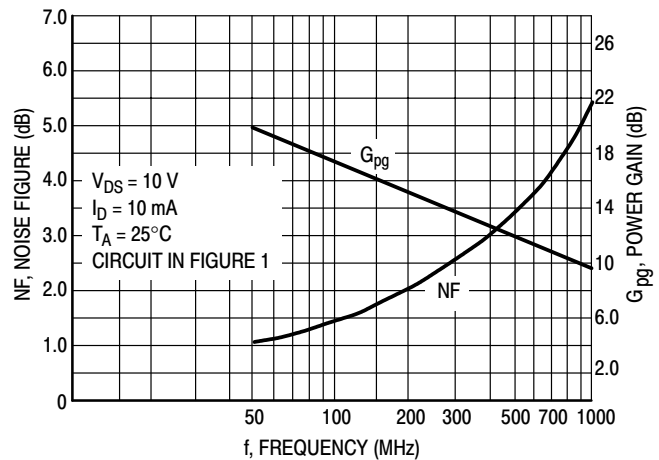
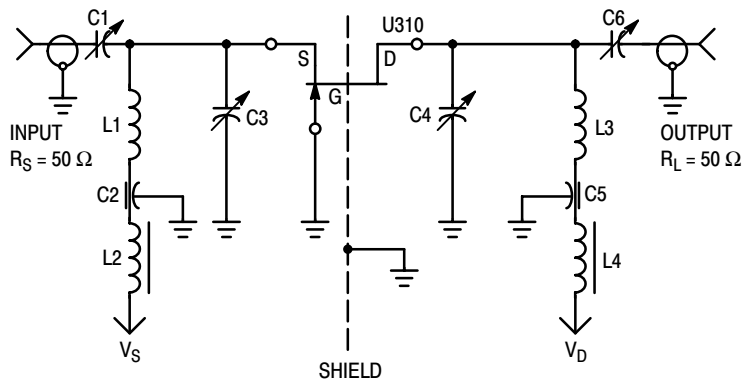


Figure 11. Noise Figure and Power Gain versus Frequency

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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.

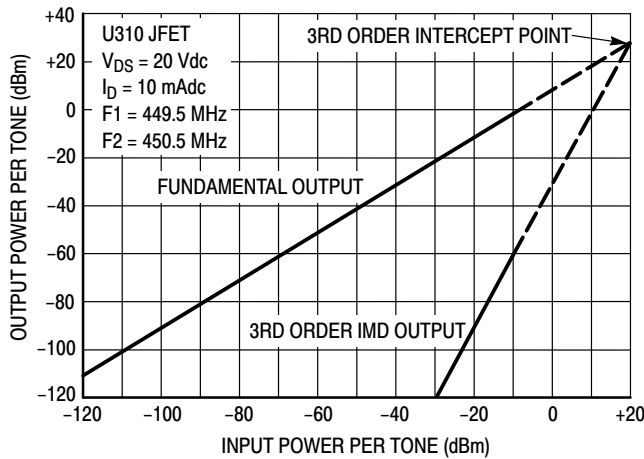


Figure 13. Two Tone 3rd Order Intercept Point

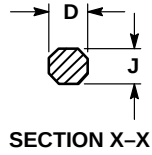
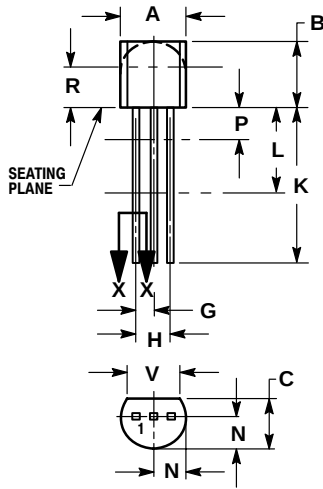
Example of intercept point plot use:

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.

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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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