2N4416,A

CASE 20-03, STYLE 1
TO-72 (TO-206AF)

JFET
VHF/UHF AMPLIFIER

N-CHANNEL — DEPLETION

MAXIMUM RATINGS

Rating		Symbol	Value	Unit
Drain-Source Voltage		V_{DS}	30	Vdc
Drain-Gate Voltage	2N4416 2N4416A	V_{DG}	35 30	Vdc
Gate-Source Voltage		V_{GS}	30	Vdc
Gate Current		I_G	10	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C		P_D	300 1.71	mW mW/°C
Operating and Storage Junction Temperature Range		T_J, T_{stg}	−65 to +175	°C

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ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted.)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Gate-Source Breakdown Voltage (I_G = 1.0 μAdc, V_{DS} = 0)	2N4416 2N4416A	$V_{(BR)GSS}$	30 35	— —	Vdc
Gate Reverse Current (V_{GS} = 20 Vdc, V_{DS} = 0) (V_{GS} = 20 Vdc, V_{DS} = 0, T_A = +150°C)		I_{GSS}	— —	100 200	pAdc
Gate Source Cutoff Voltage (I_D = 1.0 nAdc, V_{DS} = 15 Vdc)		$V_{GS(off)}$	—	6.0	Vdc
Gate Source Voltage (I_D = 0.5 mAdc, V_{DS} = 15 Vdc)		V_{GS}	1.0	5.5	Vdc
Gate-Source Forward Voltage (I_G = 1.0 mAdc, V_{DS} = 0)		$V_{GS(f)}$	—	1.0	Vdc
ON CHARACTERISTICS					
Zero-Gate-Voltage Drain Current(1) (V_{DS} = 15 Vdc, V_{GS} = 0)		I_{DSS}	5.0	15	mAdc
SMALL-SIGNAL CHARACTERISTICS					
Forward Transfer Admittance(1) (V_{DS} = 15 Vdc, V_{GS} = 0, f = 1.0 kHz)		$\|Y_{fs}\|$	4500	7500	μmhos
Real Part of Forward Transfer Admittance (V_{DS} = 15 Vdc, V_{GS} = 0, f = 400 MHz)		$Y_{fs(real)}$	4000	—	μmhos
Real Part of Input Admittance (V_{DS} = 15 Vdc, V_{GS} = 0, f = 100 MHz) (V_{DS} = 15 Vdc, V_{GS} = 0, f = 400 MHz)		$Y_{is(real)}$	— —	100 1000	μmhos
Output Admittance (V_{DS} = 15 Vdc, V_{GS} = 0, f = 1.0 kHz)		$\|Y_{os}\|$	—	50	μmhos
Real Part of Output Admittance (V_{DS} = 15 Vdc, V_{GS} = 0, f = 100 MHz) (V_{DS} = 15 Vdc, V_{GS} = 0, f = 400 MHz)		$Y_{os(real)}$	— —	75 100	μmhos
Imaginary Part of Input Admittance (V_{DS} = 15 Vdc, V_{GS} = 0, f = 100 MHz) (V_{DS} = 15 Vdc, V_{GS} = 0, f = 400 MHz)		$Y_{is(imag)}$	— —	2500 10,000	μmhos
Imaginary Part of Output Admittance (V_{DS} = 15 Vdc, V_{GS} = 0, f = 100 MHz) (V_{DS} = 15 Vdc, V_{GS} = 0, f = 400 MHz)		$Y_{os(imag)}$	— —	1000 4000	μmhos

ELECTRICAL CHARACTERISTICS (continued) (T_A = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit
Input Capacitance (V_{DS} = 15 Vdc, V_{GS} = 0, f = 1.0 MHz)	C_{iss}	—	4.0	pF
Reverse Transfer Capacitance (V_{DS} = 15 Vdc, V_{GS} = 0, f = 1.0 MHz)	C_{rss}	—	0.8	pF
Common Source Output Capacitance (V_{DS} = 15 Vdc, V_{GS} = 0, f = 1.0 MHz)	C_{oss}	—	2.0	pF
FUNCTIONAL CHARACTERISTICS				
Noise Figure (Figures 3 and 4)	NF			dB
(V_{DS} = 15 Vdc, I_D = 5.0 mAdc, $R_g \approx$ 1000 Ohms, f = 100 MHz)		—	2.0	
(V_{DS} = 15 Vdc, I_D = 5.0 mAdc, $R_g \approx$ 1000 Ohms, f = 400 MHz)		—	4.0	
Small-Signal Power Gain Common Source (Figure 1)	G_{ps}			dB
(V_{DS} = 15 Vdc, I_D = 5.0 mAdc, f = 100 MHz)		18	—	
(V_{DS} = 15 Vdc, I_D = 5.0 mAdc, f = 400 MHz)		10	—	

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 1.0%.

POWER GAIN

FIGURE 1 – EFFECTS OF DRAIN CURRENT

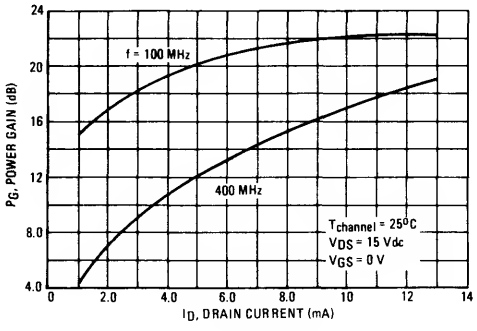
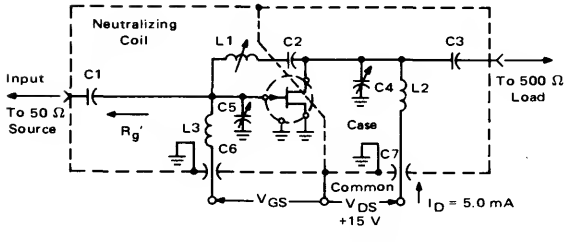


FIGURE 2 – 100 MHz and 400 MHz NEUTRALIZED TEST CIRCUIT



Adjust V_{GS} for I_D = 50 mA
V_{GS} < 0 Volts

NOTE: The noise source is a hot-cold body (AIL type 70 or equivalent) with a test receiver (AIL type 136 or equivalent).

Reference Designation	VALUE	
	100 MHz	400 MHz
C1	7.0 pF	1.8 pF
C2	1000 pF	17 pF
C3	3.0 pF	1.0 pF
C4	1-12 pF	0.8-8.0 pF
C5	1-12 pF	0.8-8.0 pF
C6	0.0015 μF	0.001 μF
C7	0.0015 μF	0.001 μF
L1	3.0 μH*	0.2 μH**
L2	0.15 μH*	0.03 μH**
L3	0.14 μH*	0.022 μH**

*L1 17 turns, (approx. – depends upon circuit layout) AWG #28 enameled copper wire, close wound on 9/32" ceramic coil form. Tuning provided by a powdered iron slug.

L2 4-1/2 turns, AWG #18 enameled copper wire, 5/16" long, 3/8" I.D. (AIR CORE).

L3 3-1/2 turns, AWG #18 enameled copper wire, 1/4" long, 3/8" I.D. (AIR CORE).

**L1 6 turns, (approx. – depends upon circuit layout) AWG #24 enameled copper wire, close wound on 7/32" ceramic coil form. Tuning provided by an aluminum slug.

L2 1 turn, AWG #16 enameled copper wire, 3/8" I.D. (AIR CORE).

L3 1/2 turn, AWG #16 enameled copper wire, 1/4" I.D. (AIR CORE).

NOISE FIGURE

($T_{channel}$ = 25°C)

FIGURE 3 – EFFECTS OF DRAIN-SOURCE VOLTAGE

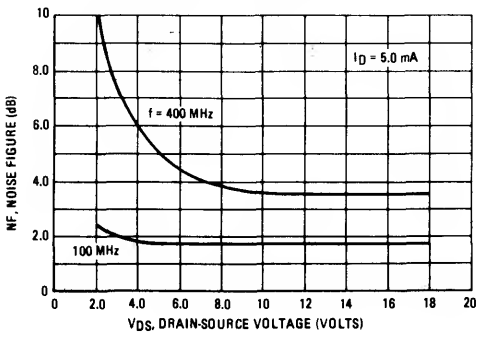
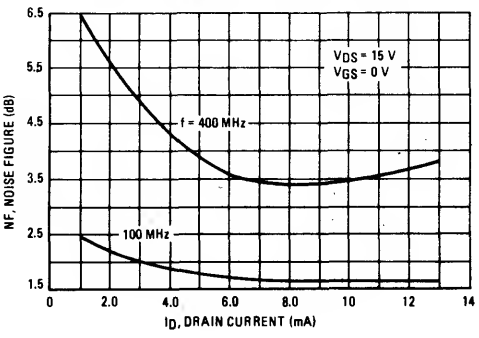
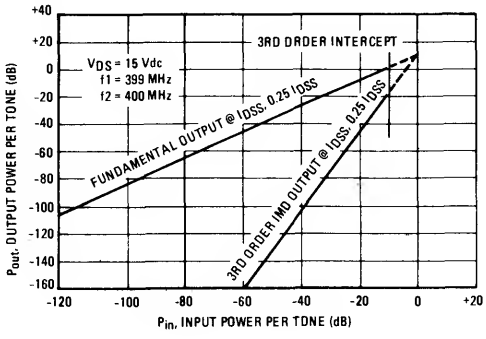


FIGURE 4 – EFFECTS OF DRAIN CURRENT



INTERMODULATION CHARACTERISTICS

FIGURE 5 – THIRD ORDER INTERMODULATION DISTORTION



COMMON SOURCE CHARACTERISTICS

ADMITTANCE PARAMETERS

(V_{DS} = 15 Vdc, $T_{channel}$ = 25°C)

FIGURE 6 – INPUT ADMITTANCE (y_{is})

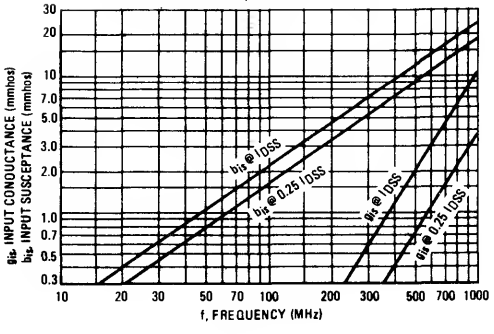


FIGURE 7 – REVERSE TRANSFER ADMITTANCE (y_{rs})

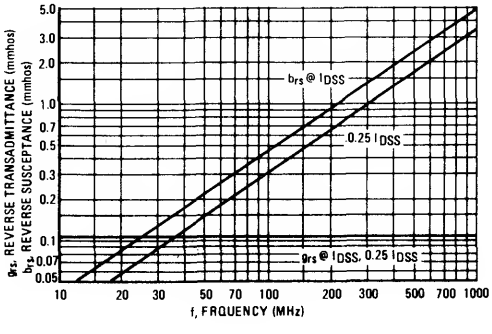


FIGURE 8 – FORWARD TRANSADMITTANCE (Y_{fs})

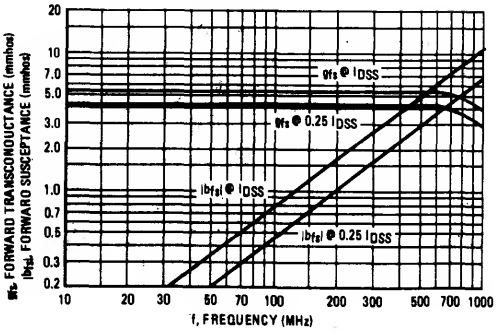
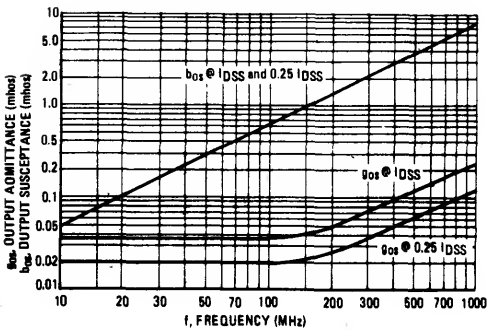


FIGURE 9 – OUTPUT ADMITTANCE (Y_{os})



COMMON SOURCE CHARACTERISTICS

S-PARAMETERS

(V_{DS} = 15 Vdc, $T_{channel}$ = 25°C,
Data Points in MHz)

FIGURE 10 – S_{11s}

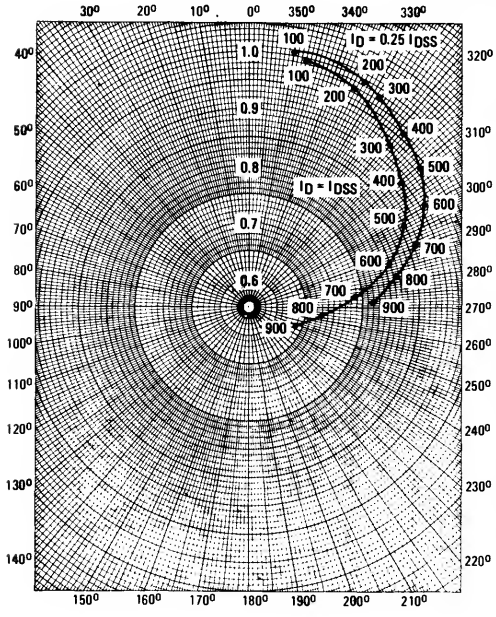


FIGURE 11 – S_{12s}

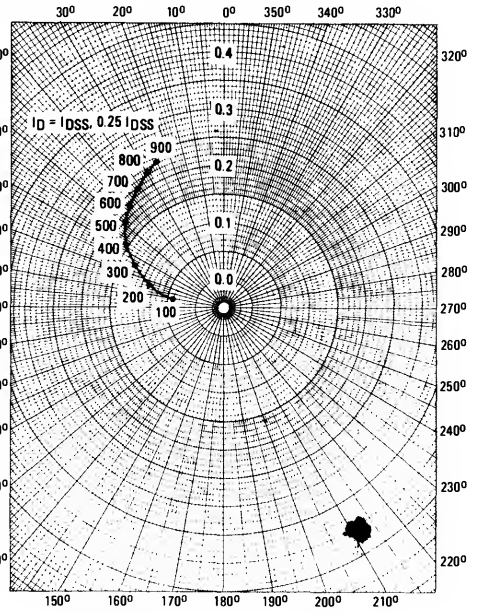


FIGURE 12 – S_{21s}

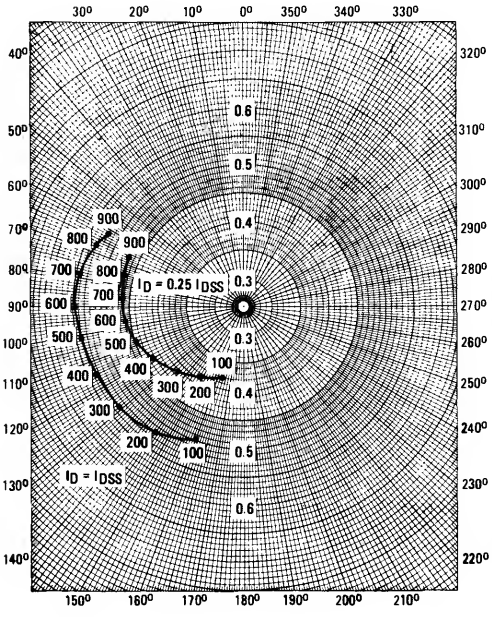
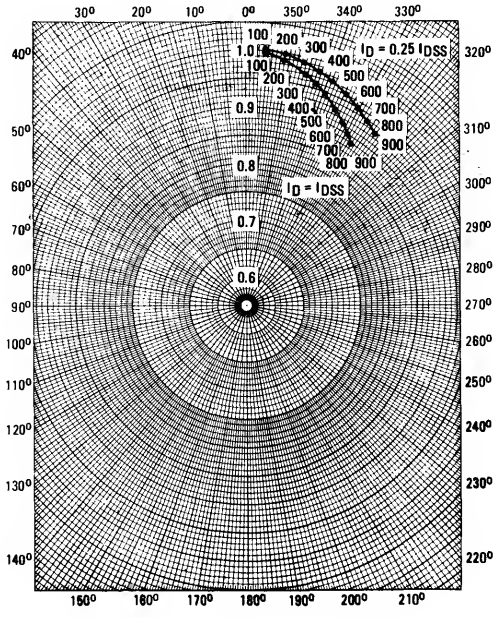


FIGURE 13 – S_{22s}



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COMMON GATE CHARACTERISTICS

ADMITTANCE PARAMETERS

(V_{DG} = 15 Vdc, $T_{channel}$ = 25°C)

FIGURE 14 – INPUT ADMITTANCE (y_{ig})

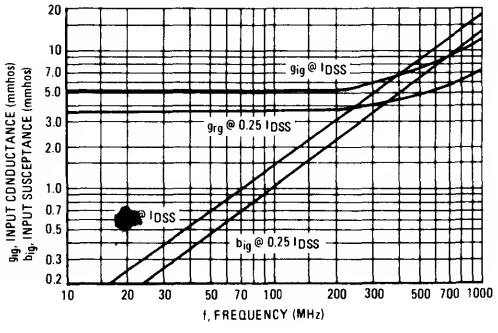


FIGURE 15 – REVERSE TRANSFER ADMITTANCE (y_{rg})

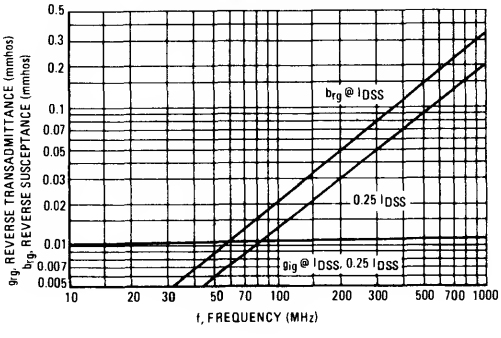


FIGURE 16 – FORWARD TRANSFER ADMITTANCE (y_{fg})

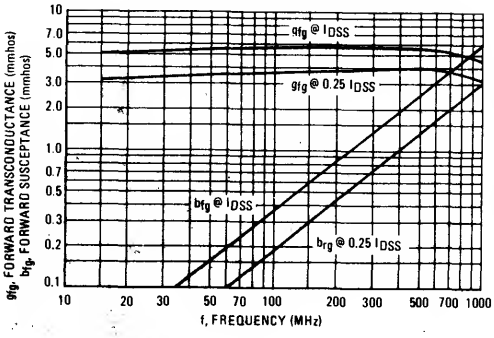
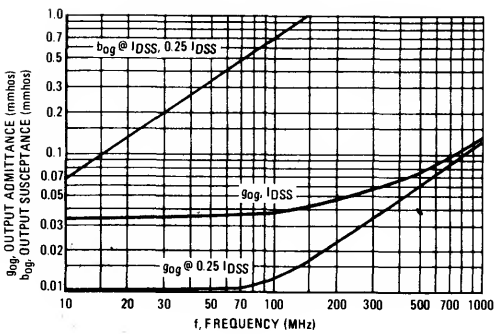


FIGURE 17 – OUTPUT ADMITTANCE (y_{og})



COMMON GATE CHARACTERISTICS

S-PARAMETERS

(V_{DG} = 15 Vdc, $T_{channel}$ = 25°C, Data Points in MHz)

FIGURE 18 – S_{11g}

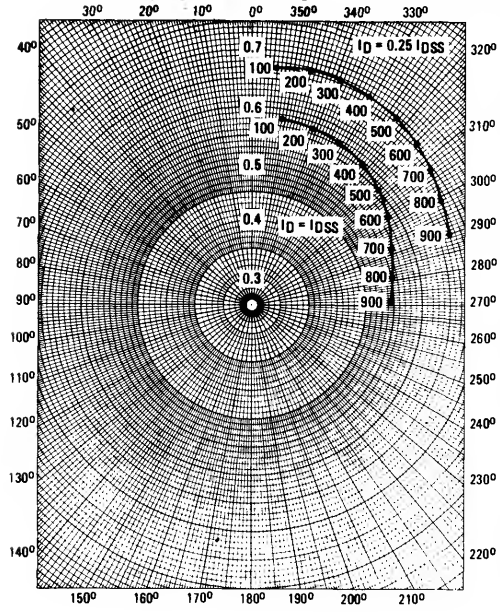


FIGURE 19 – S_{12g}

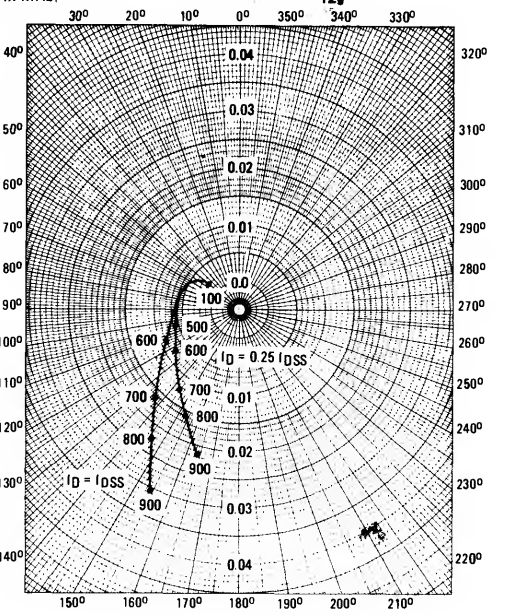


FIGURE 20 – S_{21g}

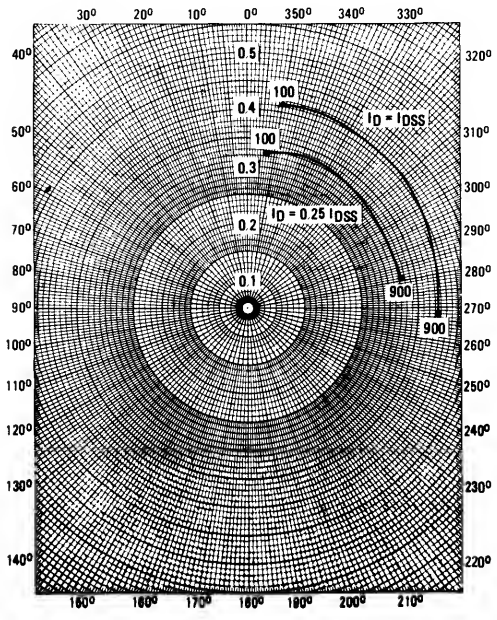
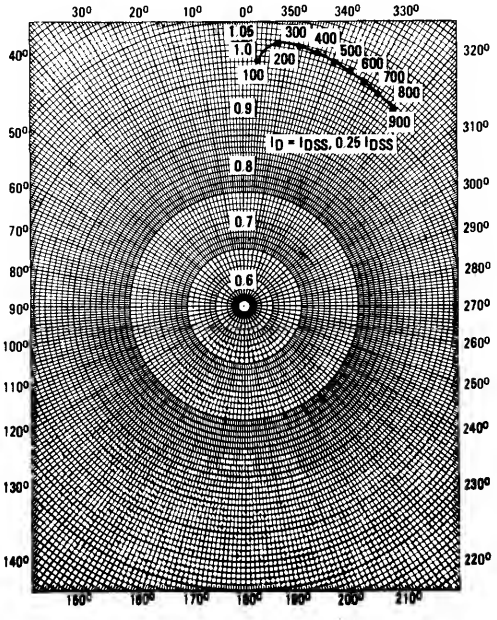


FIGURE 21 – S_{22g}



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