

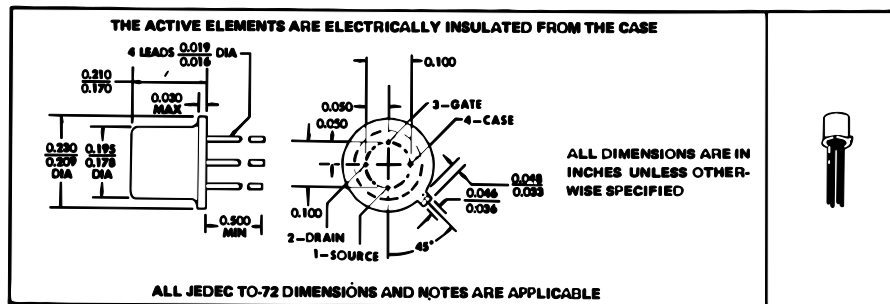
TYPES 2N4416, 2N4416A N-CHANNEL SILICON JUNCTION FIELD-EFFECT TRANSISTORS

BULLETIN NO. DL-5 6810649, JANUARY 1968

FOR VHF AMPLIFIER AND MIXER APPLICATIONS

- High Power Gain... 10 dB Min at 400 MHz
- Low Noise Figure... 4 dB Max at 400 MHz
- High Transconductance... 4000 μ mho Min at 400 MHz
- Low C_{iss} ... 0.8 pF Max
- High $|y_{fs}|/C_{iss}$ Ratio (High-Frequency Figure-of-Merit)
- Cross-Modulation Minimized by Square-Law Transfer Characteristic
- Recommended for Use in VHF-UHF Bandpass Amplifiers
- Excellent for General Purpose Amplifier and Chopper Applications

*mechanical data



absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)

	2N4416	2N4416A
*Drain-Gate Voltage	30 V	35 V
*Drain-Source Voltage	30 V	35 V
*Reverse Gate-Source Voltage	-30 V	-35 V
*Continuous Forward Gate Current	← 10 mA →	
*Continuous Device Dissipation at (or below) 25°C Free-Air Temperature (See Note 1)	← 300 mW →	
Continuous Device Dissipation at (or below) 125°C Case Temperature (See Note 2)	← 450 mW →	
*Storage Temperature Range	-65°C to 200°C	
*Lead Temperature 1/8 Inch from Case for 60 Seconds	← 300°C →	

NOTES: 1. Derate linearly to 200°C free-air temperature at the rate of 1.7 mW/°C.
2. Derate linearly to 200°C case temperature at the rate of 6 mW/°C.

*Indicates JEDEC registered data

TYPES 2N4416, 2N4416A

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electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	2N4416 MIN MAX	2N4416A MIN MAX	UNIT
V _{GS} Gate-Source Breakdown Voltage	I _G = -1 µA, V _{DS} = 0	-30°	-35°	V
V _{GS} Gate-Source Forward Voltage	I _G = 1 mA, V _{DS} = 0	-0.1°	-0.1°	V
I _{SS} Gate Reverse Current	V _{GS} = -20 V, V _{DS} = 0	-0.1°	-0.1°	nA
V _{DS(on)} Drain-Source On-Voltage	V _{GS} = 15 V, I _D = 1 mA	-0.2°	-0.2°	V
V _{DS} Drain-Source Saturation Voltage	V _{GS} = 15 V, I _D = 0.5 mA	-0.1°	-0.1°	V
I _{SS} Zero-Gate-Voltage Drain Current	V _{GS} = 15 V, V _{DS} = 0, See Note 3	5°	5°	mA
y _{fs} Forward Transfer Admittance	V _{GS} = 15 V, V _{DS} = 0, f = 1 kHz	4.5°	4.5°	mmho
y _{os} Output Admittance	V _{GS} = 15 V, V _{DS} = 0, f = 1 kHz	0.05°	0.05°	mmho
C _{iss} Input Capacitance	V _{GS} = 15 V, V _{DS} = 0, f = 1 MHz	4°	4°	pF
C _{rss} Reverse Transfer Capacitance	V _{GS} = 15 V, V _{DS} = 0, f = 1 MHz	0.8°	0.8°	pF
C _{oss} Output Capacitance	V _{GS} = 15 V, V _{DS} = 0, f = 1 MHz	2°	2°	pF
Re(f _h) Input Resistance	V _{GS} = 15 V, V _{DS} = 0, f = 100 MHz	0.1°	0.1°	mmho
Im(f _h) Input Susceptance	V _{GS} = 15 V, V _{DS} = 0, f = 100 MHz	2.5°	2.5°	mmho
Re(f _{os}) Output Resistance	V _{GS} = 15 V, V _{DS} = 0, f = 100 MHz	0.075°	0.075°	mmho
Im(f _{os}) Output Susceptance	V _{GS} = 15 V, V _{DS} = 0, f = 100 MHz	1°	1°	mmho
Re(f _{is}) Input Resistance	V _{GS} = 15 V, V _{DS} = 0, f = 100 MHz	1°	1°	mmho
Im(f _{is}) Input Susceptance	V _{GS} = 15 V, V _{DS} = 0, f = 100 MHz	10°	10°	mmho
Re(f _{os}) Output Resistance	V _{GS} = 15 V, V _{DS} = 0, f = 100 MHz	4°	4°	mmho
Im(f _{os}) Output Susceptance	V _{GS} = 15 V, V _{DS} = 0, f = 100 MHz	0.1°	0.1°	mmho
Re(f _{is}) Input Resistance	V _{GS} = 15 V, V _{DS} = 0, f = 100 MHz	4°	4°	mmho
Im(f _{is}) Input Susceptance	V _{GS} = 15 V, V _{DS} = 0, f = 100 MHz	0.1°	0.1°	mmho

NOTE 3: This parameter must be measured using pulse techniques. I_D = 200 µA, duty cycle ≤ 1%.

†Test instruments guarantee this value in addition to the JEDEC registered value, which is also shown.

*Operating characteristics at 25°C free-air temperature

PARAMETER	TEST CONDITIONS†	MIN	MAX	UNIT
Small-Signal Common-Source Neutralized Insertion Power Gain	V _{GS} = 15 V, I _D = 5 mA, f = 100 MHz, R _G = 1 kΩ, See Figure 1	10		dB
Small-Signal Common-Source Neutralized Insertion Power Gain	V _{GS} = 15 V, I _D = 5 mA, f = 400 MHz, R _G = 1 kΩ, See Figure 1	10		dB
Small-Signal Common-Source Neutralized Insertion Power Gain	V _{GS} = 15 V, I _D = 5 mA, f = 100 MHz, R _G = 1 kΩ, See Figure 1	2		dB
Small-Signal Common-Source Neutralized Insertion Power Gain	V _{GS} = 15 V, I _D = 5 mA, f = 400 MHz, R _G = 1 kΩ, See Figure 1	4		dB

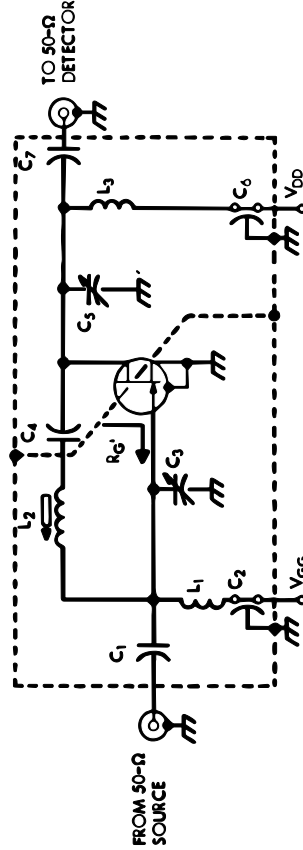
†The fourth lead (lead) is connected to the source for all measurements.

*Indicates JEDEC registered data

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PARAMETER MEASUREMENT INFORMATION



CIRCUIT COMPONENT INFORMATION (See Note 4)			
CAPACITORS		COILS	
100 MHz	400 MHz	100 MHz	400 MHz
C ₁ 7 pF	1.8 pF	L ₁ 0.14 µH, 3.5 T, #18 enameled copper wire, 1/2" I.D., 1/2" long	0.022 µH, 1/2" of #16 copper wire formed to 0.5 T, 1/2" I.D.
C ₂ 0.0015 µF	0.001 µF	L ₂ 3 µH, 17 T, #28 enameled copper wire, close wound, 1/2" I.D., powdered iron slug	0.2 µH, 6 T, #24 enameled copper wire, close wound, 1/2" I.D., aluminum slug
C ₃ 1-12 pF	0.9-8 pF	L ₃ 0.25 µH, 4.5 T, #18 enameled copper wire, 1/2" I.D., 1/2" long	0.03 µH, 1/2" of #16 enameled copper wire formed to 1 T, 1/2" I.D.
C ₄ 1000 pF	27 pF		
C ₅ 1-12 pF	0.9-8 pF		
C ₆ 0.0015 µF	0.001 µF		
C ₇ 3 pF	1 pF		

FIGURE 1—NEUTRALIZED POWER GAIN AND SPOT NOISE FIGURE TEST CIRCUIT

NOTE 4: Transformed equivalent source resistance (R_S) is 1000 Ω at 100 MHz for 100-MHz amplifier, and 1000 Ω at 400 MHz for 400-MHz amplifier.

THERMAL INFORMATION

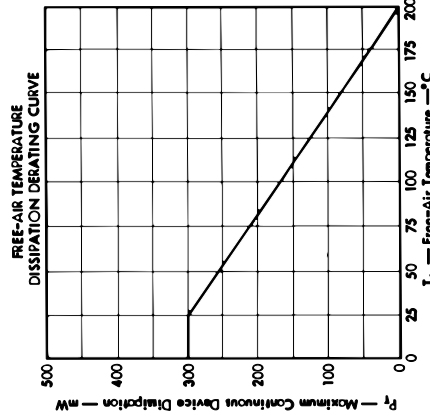


FIGURE 2

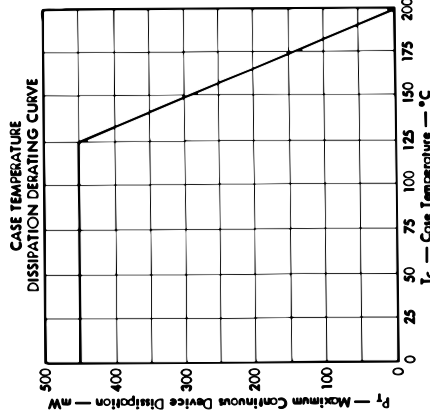


FIGURE 3