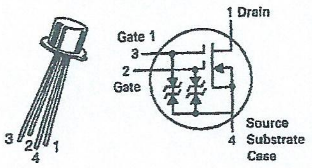
3N201
3N202
3N203

CASE 20-03, STYLE 9
TO-72 (TO-206AF)



DUAL-GATE MOSFET VHF AMPLIFIER

N-CHANNEL — DEPLETION

Refer to MPF201 for additional graphs.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	25	Vdc
Drain-Gate Voltage	V_{DG1} V_{DG2}	30 30	Vdc
Drain Current	I_D	50	mAdc
Gate Current	I_{G1} I_{G2}	±10 ±10	mAdc
Total Device Dissipation @ $T_A = 25°C$ Derate above 25°C	P_D	360 2.4	mW mW/°C
Total Device Dissipation @ $T_C = 25°C$ Derate above 25°C	P_D	1.2 8.0	Watt mW/°C
Lead Temperature	T_L	300	°C
Junction Temperature Range	T_J	−65 to +175	°C
Storage Channel Temperature Range	T_{stg}	−65 to +175	°C

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage ($I_D = 10\ \mu Adc, V_S = 0, V_{G1S} = V_{G2S} = -5.0$ Vdc)		$V_{(BR)DSX}$	25	—	—	Vdc
Gate 1-Source Breakdown Voltage(1) ($I_{G1} = \pm 10$ mAdc, $V_{G2S} = V_{DS} = 0$)		$V_{(BR)G1SO}$	±6.0	±12	±30	Vdc
Gate 2-Source Breakdown Voltage(1) ($I_{G2} = \pm 10$ mAdc, $V_{G1S} = V_{DS} = 0$)		$V_{(BR)G2SO}$	±6.0	±12	±30	Vdc
Gate 1 Leakage Current ($V_{G1S} = \pm 5.0$ Vdc, $V_{G2S} = V_{DS} = 0$) ($V_{G1S} = -5.0$ Vdc, $V_{G2S} = V_{DS} = 0, T_A = 150°C$)		I_{G1SS}	— —	±.040 —	±10 −10	nAdc μAdc
Gate 2 Leakage Current ($V_{G2S} = \pm 5.0$ Vdc, $V_{G1S} = V_{DS} = 0$) ($V_{G2S} = -5.0$ Vdc, $V_{G1S} = V_{DS} = 0, T_A = 150°C$)		I_{G2SS}	— —	±.050 —	±10 −10	nAdc μAdc
Gate 1 to Source Cutoff Voltage ($V_{DS} = 15$ Vdc, $V_{G2S} = 4.0$ Vdc, $I_D = 20\ \mu Adc$)		$V_{G1S(off)}$	−0.5	−1.5	−5.0	Vdc
Gate 2 to Source Cutoff Voltage ($V_{DS} = 15$ Vdc, $V_{G1S} = 0, I_D = 20\ \mu Adc$)		$V_{G2S(off)}$	−0.2	−1.4	−5.0	Vdc
ON CHARACTERISTICS						
Zero-Gate-Voltage Drain Current(2) ($V_{DS} = 15$ Vdc, $V_{G1S} = 0, V_{G2S} = 4.0$ Vdc)	3N201,3N202 3N203	I_{DSS}	6.0 3.0	13 11	30 15	mAdc
SMALL-SIGNAL CHARACTERISTICS						
Forward Transfer Admittance(3) ($V_{DS} = 15$ Vdc, $V_{G2S} = 4.0$ Vdc, $V_{G1S} = 0$, f = 1.0 kHz)	3N201,3N202 3N203	$\lvert Y_{fs} \rvert$	8.0 7.0	12.8 12.5	20 15	mmhos
Input Capacitance ($V_{DS} = 15$ Vdc, $V_{G2S} = 4.0$ Vdc, $I_D = I_{DSS}$, f = 1.0 MHz)		C_{iss}	—	3.3	—	pF
Reverse Transfer Capacitance ($V_{DS} = 15$ Vdc, $V_{G2S} = 4.0$ Vdc, $I_D = 10$ mAdc, f = 1.0 MHz)		C_{rss}	0.005	0.014	0.03	pF
Output Capacitance ($V_{DS} = 15$ Vdc, $V_{G2S} = 4.0$ Vdc, $I_D = I_{DSS}$, f = 1.0 MHz)		C_{oss}	—	1.7	—	pF
FUNCTIONAL CHARACTERISTICS						
Noise Figure ($V_{DD} = 18$ Vdc, $V_{GG} = 7.0$ Vdc, f = 200 MHz) (Figure 1) ($V_{DD} = 18$ Vdc, $V_{GG} = 6.0$ Vdc, f = 45 MHz) (Figure 3)	3N201 3N203	NF	— —	1.8 5.3	4.5 6.0	dB

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

Characteristic		Symbol	Min	Typ	Max	Unit
Common Source Power Gain		G_{ps}				dB
(V_{DD} = 18 Vdc, V_{GG} = 7.0 Vdc, f = 200 MHz) (Figure 1)	3N201		15	20	25	
(V_{DD} = 18 Vdc, V_{GG} = 6.0 Vdc, f = 45 MHz) (Figure 3)	3N203		20	25	30	
(V_{DD} = 18 Vdc, f_{LO} = 245 MHz, f_{RF} = 200 MHz) (Figure 2)	3N202	G_c(5)	15	19	25	
Bandwidth		BW				MHz
(V_{DD} = 18 Vdc, V_{GG} = 7.0 Vdc, f = 200 MHz) (Figure 1)	3N201		5.0	—	9.0	
(V_{DD} = 18 Vdc, f_{LO} = 245 MHz, f_{RF} = 200 MHz) (Figure 2)	3N202		4.5	—	7.5	
(V_{DD} = 18 Vdc, V_{GG} = 6.0 Vdc, f = 45 MHz) (Figure 3)	3N203		3.0	—	6.0	
Gain Control Gate-Supply Voltage(4)		$V_{GG(GC)}$				Vdc
(V_{DD} = 18 Vdc, ΔG_{ps} = −30 dB, f = 200 MHz) (Figure 1)	3N201		0	−1.0	−3.0	
(V_{DD} = 18 Vdc, ΔG_{ps} = −30 dB, f = 45 MHz) (Figure 3)	3N203		0	−0.6	−3.0	

(1) All gate breakdown voltages are measured while the device is conducting rated gate current. This ensures that the gate-voltage limiting network is functioning properly.

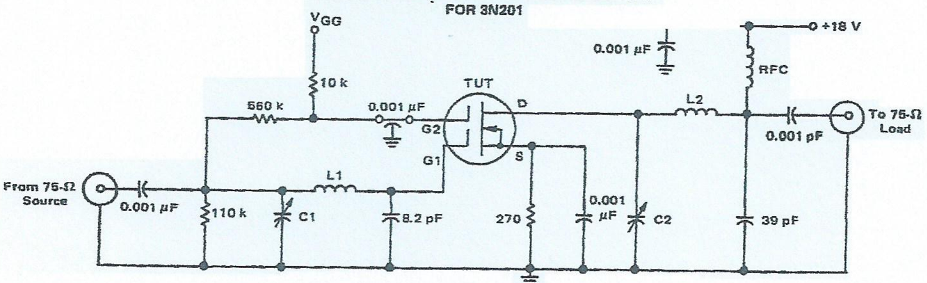
(2) Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

(3) This parameter must be measured with bias voltages applied for less than 5 seconds to avoid overheating.

(4) ΔG_{ps} is defined as the change in G_{ps} from the value at V_{GG} = 7.0 volts (3N201) and V_{GG} = 6.0 volts (3N203).

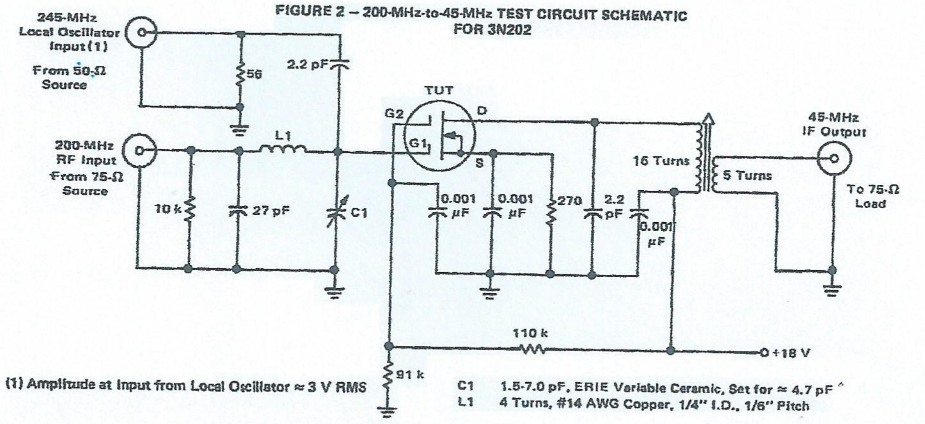
(5) Power Gain Conversion

FIGURE 1 — 200-MHz TEST CIRCUIT SCHEMATIC FOR 3N201



C1	4.0 30 pF, ERIE Variable Ceramic, Set for ≈ 22 pF
C2	4.0 30 pF, ERIE Variable Ceramic, Set for ≈ 10 pF
L1	4 Turns, #14 AWG Cooper, 1/4" I.D., 1/6" Pitch
L2	3 Turns, #14 AWG Cooper, 1/4" I.D., 1/8" Pitch
RFC	DELEVAN No. 153712, 1.0 µH

FIGURE 2 — 200-MHz-to-45-MHz TEST CIRCUIT SCHEMATIC FOR 3N202

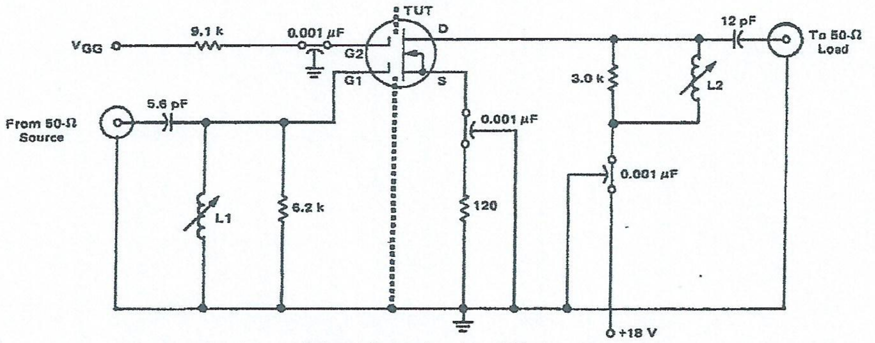


(1) Amplitude at Input from Local Oscillator ≈ 3 V RMS

C1	1.5-7.0 pF, ERIE Variable Ceramic, Set for ≈ 4.7 pF
L1	4 Turns, #14 AWG Copper, 1/4" I.D., 1/6" Pitch

3N201, 3N202, 3N203

FIGURE 3 — 45-MHz TEST CIRCUIT SCHEMATIC
3N203



L1 14 Turns, #30 AWG Copper, Close-Wound 7/32" OD form with ARNOLD ENGINEERING "J" Tuning Core

L2 10 Turns, #30 AWG Copper, Close-Wound 7/32" OD form with ARNOLD ENGINEERING "J" Tuning Core

TYPICAL CHARACTERISTICS

FIGURE 4 — DRAIN CURRENT versus DRAIN to SOURCE VOLTAGE

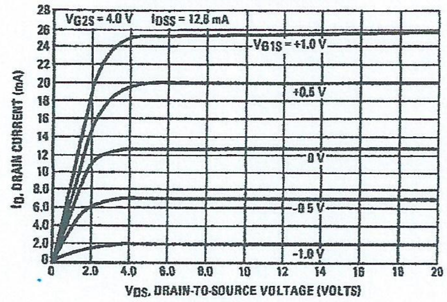


FIGURE 5 — DRAIN CURRENT versus GATE-ONE to SOURCE VOLTAGE

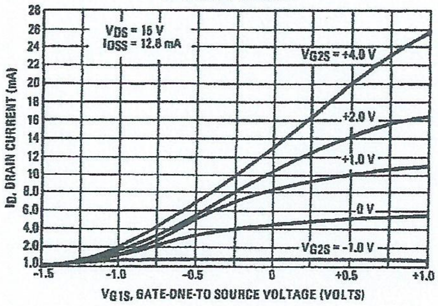


FIGURE 6 — SMALL-SIGNAL COMMON-SOURCE GATE-ONE FORWARD TRANSFER ADMITTANCE versus DRAIN CURRENT

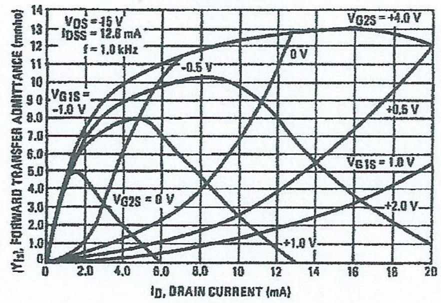
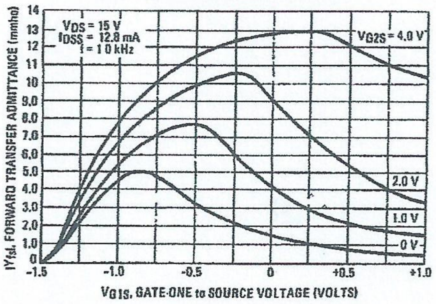


FIGURE 7 — SMALL-SIGNAL COMMON-SOURCE GATE-ONE FORWARD TRANSFER ADMITTANCE versus GATE-ONE to SOURCE VOLTAGE



3N201, 3N202, 3N203

FIGURE 8 — SMALL-SIGNAL COMMON-SOURCE GATE-ONE FORWARD TRANSFER ADMITTANCE versus GATE-TWO to SOURCE VOLTAGE

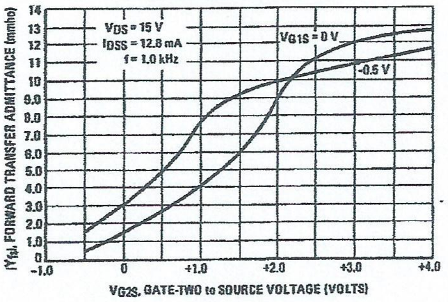
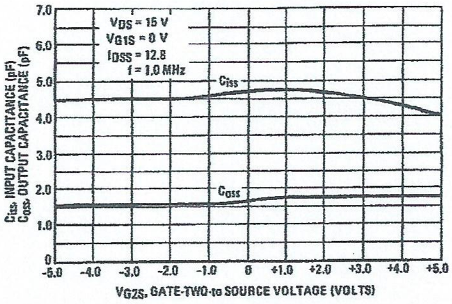


FIGURE 9 — SMALL-SIGNAL COMMON-SOURCE GATE-ONE INPUT AND OUTPUT CAPACITANCE versus GATE-TWO-to-SOURCE VOLTAGE



TYPICAL CHARACTERISTICS

FIGURE 10 — COMMON-SOURCE POWER GAIN AND SPOT NOISE FIGURE versus DRAIN CURRENT

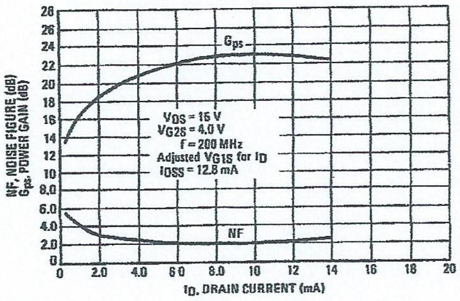


FIGURE 11 — COMMON-SOURCE POWER GAIN AND SPOT NOISE FIGURE versus GAIN CONTROL GATE-SUPPLY VOLTAGE — 3N201

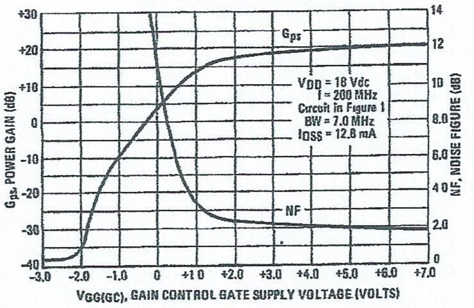


FIGURE 12 — COMMON-SOURCE POWER GAIN versus DRAIN SUPPLY CURRENT — 3N201

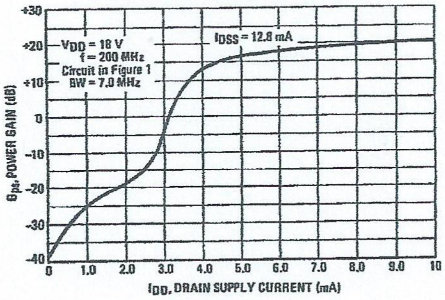
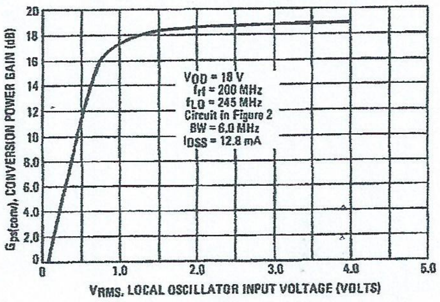


FIGURE 13 — SMALL-SIGNAL COMMON-SOURCE CONVERSION POWER GAIN versus LOCAL OSCILLATOR INPUT VOLTAGE — 3N202



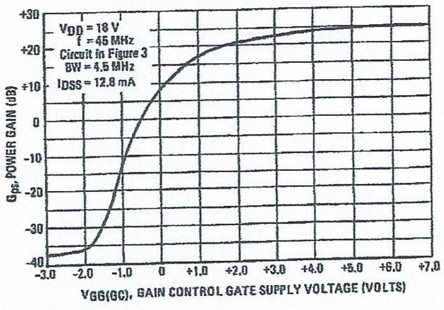


FIGURE 14 — SMALL-SIGNAL COMMON SOURCE INSERTION POWER GAIN versus GAIN CONTROL GATE-SUPPLY VOLTAGE — 3N203

TYPICAL CHARACTERISTICS

FIGURE 15 — SMALL-SIGNAL GATE ONE FORWARD TRANSFER ADMITTANCE versus FREQUENCY

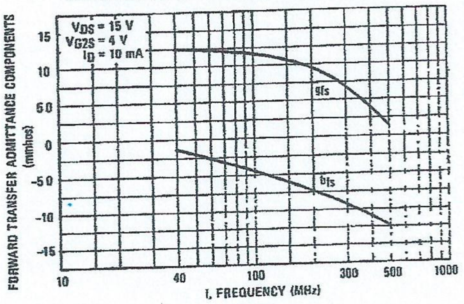


FIGURE 16 — SMALL-SIGNAL GATE ONE INPUT ADMITTANCE versus FREQUENCY

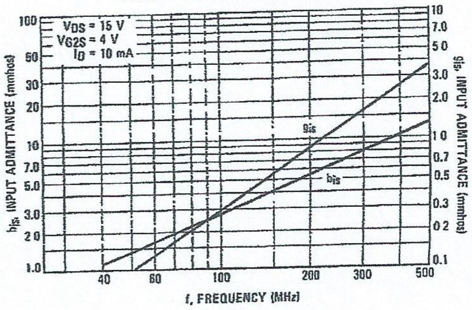


FIGURE 17 — SMALL-SIGNAL GATE ONE OUTPUT ADMITTANCE versus FREQUENCY