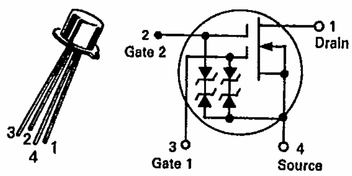
N-CHANNEL DUAL-GATE SILICON-NITRIDE PASSIVATED MOS FIELD-EFFECT TRANSISTORS

. . . depletion mode dual gate transistors designed for VHF amplifier and mixer applications.

- MFE201 — VHF Amplifier
  MFE202 — VHF Mixer
  MFE203 — IF Amplifier
- Low Reverse Transfer Capacitance — C_{rss} = 0.03 pF (Max)
- High Forward Transfer Admittance — $|y_{fs}|$ = 8–20 mmhos — MFE201, MFE202
  = 7–15 mmhos — MFE203
- Diode Protected Gates

MFE201 thru MFE203

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



DUAL-GATE MOSFETs

N-CHANNEL — DEPLETION

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSX}	20	Vdc
Drain-Gate Voltage	V_{DG1} V_{DG2}	30 30	Vdc
Gate Current	I_{G1} I_{G2}	±10 ±10	mAdc
Drain Current — Continuous	I_D	50	mAdc
Total Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	360 2.4	mW mW/°C
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.2 8.0	Watt mW/°C
Storage Channel Temperature Range	T_{stg}	−65 to +200	°C
Junction Temperature Range	T_J	−65 to +175	°C
Lead Temperature, 1/16″ From Seated Surface for 10 Seconds	T_L	300	°C

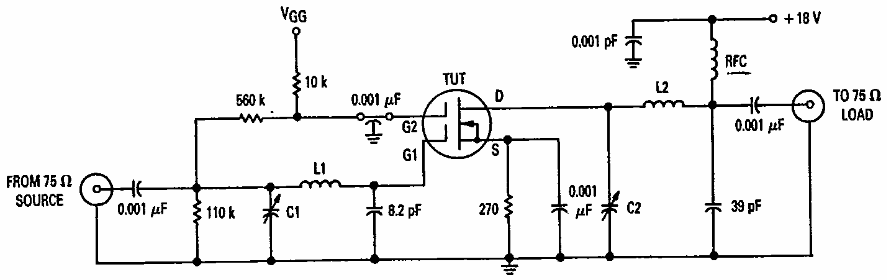
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain-Source Breakdown Voltage (I_D = 10 μAdc, V_S = 0, V_{G1S} = V_{G2S} = −5.0 Vdc)	$V_{(BR)DSX}$	20	—	—	Vdc
Gate 1 — Source Breakdown Voltage(1) (I_{G1} = ±10 mAdc, V_{G2S} = V_{DS} = 0)	$V_{(BR)G1SO}$	±6.0	±12	±30	Vdc
Gate 2 — Source Breakdown Voltage(1) (I_{G2} = ±10 mAdc, V_{G1S} = V_{DS} = 0)	$V_{(BR)G2SO}$	±6.0	±12	±30	Vdc
Gate 1 to Source Cutoff Voltage (V_{DS} = 15 Vdc, V_{G2S} = 4.0 Vdc, I_D = 20 μAdc)	$V_{G1S(off)}$	−0.5	−1.5	−5.0	Vdc
Gate 2 to Source Cutoff Voltage (V_{DS} = 15 Vdc, V_{G1S} = 0, I_D = 20 μAdc)	$V_{G2S(off)}$	−0.2	−1.4	−5.0	Vdc
Gate 1 Leakage Current (V_{G1S} = ±5.0 Vdc, V_{G2S} = V_{DS} = 0) (V_{G2S} = −5.0 Vdc, V_{G2S} = V_{DS} = 0, T_A = 150°C)	I_{G1SS}	— —	±0.04 —	±10 −10	nAdc μAdc
Gate 2 Leakage Current (V_{G2S} = ±5.0 Vdc, V_{G1S} = V_{DS} = 0) (V_{G2S} = −5.0 Vdc, V_{G1S} = V_{DS} = 0, T_A = 150°C)	I_{G2SS}	— —	±0.05 —	±10 −10	nAdc μAdc
ON CHARACTERISTICS					
Zero-Gate Voltage Drain Current(2) (V_{DS} = 15 Vdc, V_{G1S} = 0, V_{G2S} = 4.0 Vdc) MFE201, MFE202 MFE203	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) MFE201, MFE202 MFE203	$\|y_{fs}\|$	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}	—	4.3	—	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
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

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

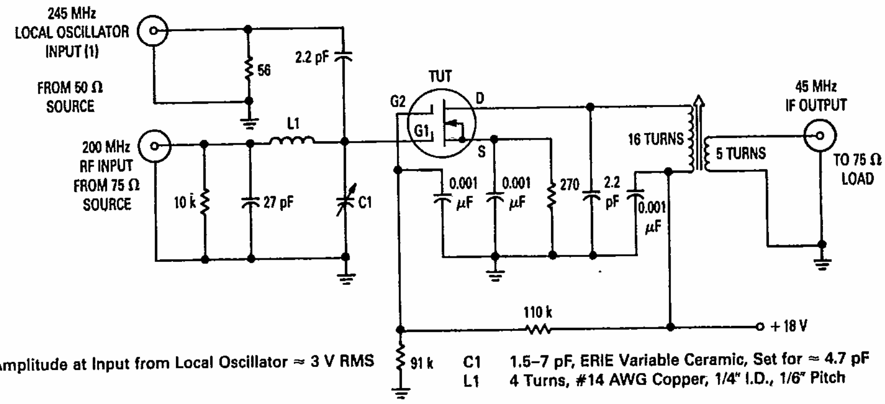
Characteristic	Symbol	Min	Typ	Max	Unit
FUNCTIONAL CHARACTERISTICS					
Noise Figure	NF				dB
(V_{DD} = 18 Vdc, V_{GG} = 7.0 Vdc, f = 200 MHz) (Figure 1) MFE201		—	1.8	4.5	
(V_{DD} = 18 Vdc, V_{GG} = 6.0 Vdc, f = 45 MHz) (Figure 3) MFE203		—	5.3	6.0	
Common Source Power Gain	G_{ps}				dB
(V_{DD} = 18 Vdc, V_{GG} = 7.0 Vdc, f = 200 MHz) (Figure 1) MFE201		15	20	25	
(V_{DD} = 18 Vdc, V_{GG} = 6.0 Vdc, f = 45 MHz) (Figure 3) MFE203		20	25	30	
(V_{DD} = 18 Vdc, f_{LO} = 245 MHz, f_{RF} = 200 MHz) (Figure 2) MFE202	G_c(5)	15	19	25	
Bandwidth	BW				MHz
(V_{DD} = 18 Vdc, V_{GG} = 7.0 Vdc, f = 200 MHz) (Figure 1) MFE201		5.0	—	9.0	
(V_{DD} = 18 Vdc, f_{LO} = 245 MHz, f_{RF} = 200 MHz) (Figure 2) MFE202		4.5	—	7.5	
(V_{DD} = 18 Vdc, V_{GG} = 6.0 Vdc, f = 45 MHz) (Figure 3) MFE203		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) MFE201		0	−1.0	−3.0	
(V_{DD} = 18 Vdc, ΔG_{ps} = −30 dB, f = 45 MHz) (Figure 3) MFE203		0	−0.6	−3.0	

Notes:
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 (MFE201) and V_{GG} = 6.0 volts (MFE203).
5. Power Gain Conversion.



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

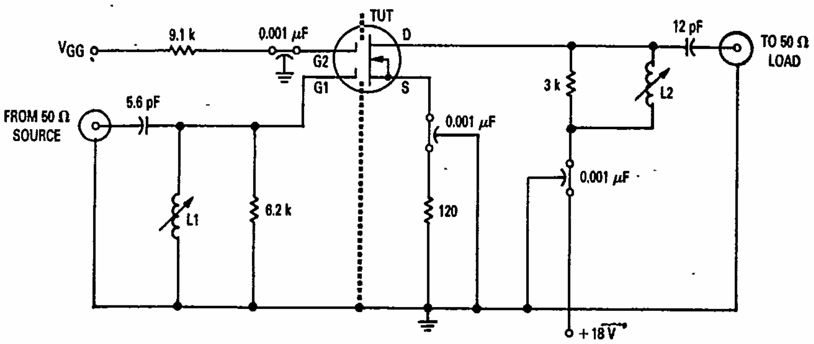
Figure 1. 200 MHz Test Circuit Schematic For MFE201



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

C1	1.5–7 pF, ERIE Variable Ceramic, Set for ≈ 4.7 pF
L1	4 Turns, #14 AWG Copper, 1/4" I.D., 1/6" Pitch

Figure 2. 200 MHz to 45 MHz Test Circuit Schematic For MFE202



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

Figure 3. 45 MHz Test Circuit Schematic MFE203

TYPICAL CHARACTERISTICS

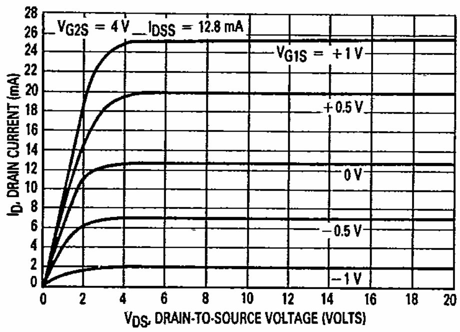


Figure 4. Drain Current versus Drain-to-Source Voltage

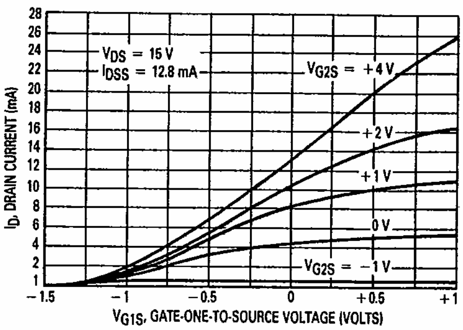


Figure 5. Drain Current versus Gate-One-to-Source Voltage

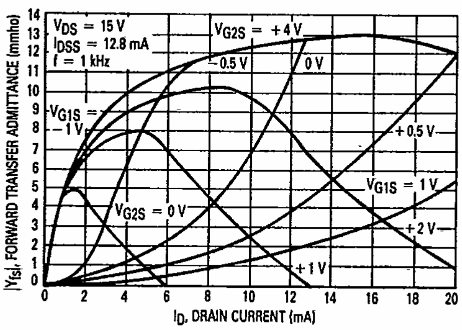


Figure 6. Small-Signal Common-Source Gate-One Forward Transfer Admittance versus Drain Current

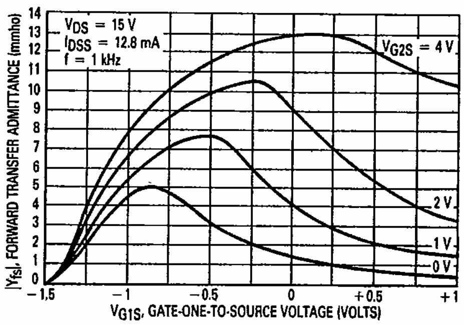


Figure 7. Small-Signal Common-Source Gate-One Forward Transfer Admittance versus Gate-One-to-Source Voltage

TYPICAL CHARACTERISTICS

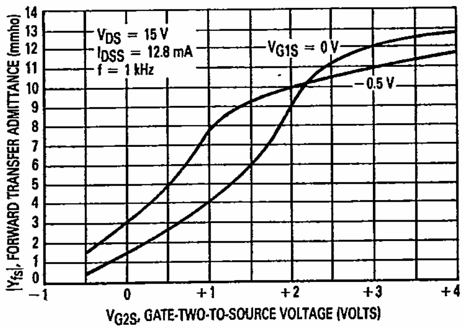


Figure 8. Small-Signal Common-Source Gate-One Forward Transfer Admittance versus Gate-Two-to-Source Voltage

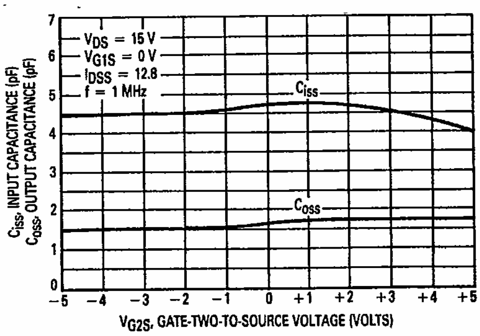


Figure 9. Small-Signal Common-Source Gate-One Input and Output Capacitance versus Gate-Two-to-Source Voltage

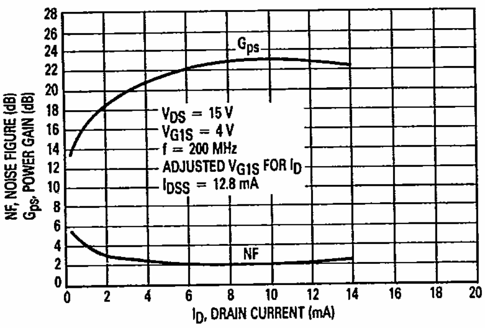


Figure 10. Common-Source Power Gain and Spot Noise Figure versus Drain Current

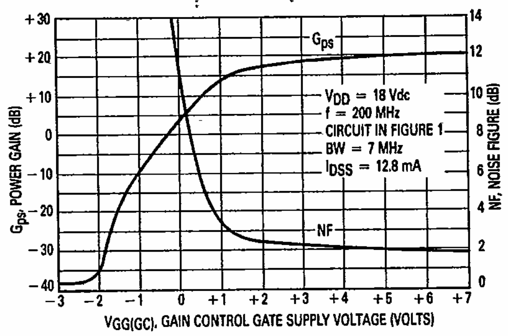


Figure 11. Common-Source Power Gain and Spot Noise Figure versus Gain Control Gate-Supply Voltage — MFE201

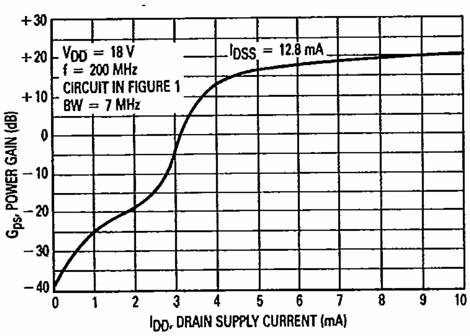


Figure 12. Common-Source Power Gain versus Drain Supply Current — MFE201

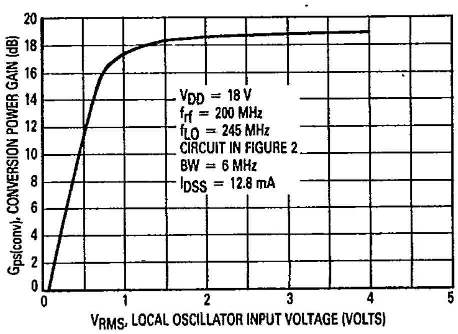


Figure 13. Small-Signal Common-Source Conversion Power Gain versus Local Oscillator Input Voltage — MFE202

4

4

TYPICAL CHARACTERISTICS

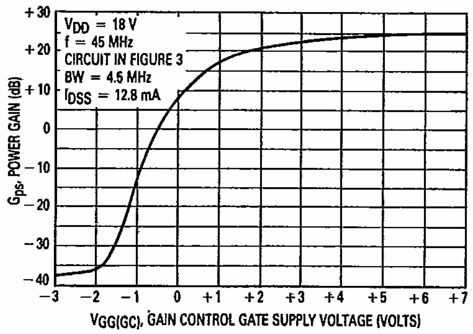


Figure 14. Small-Signal Common Source Insertion Power Gain versus Gain Control Gate-Supply Voltage — MFE203

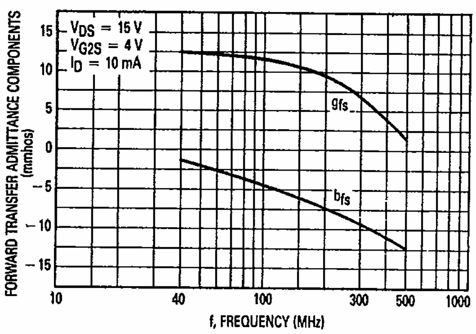


Figure 15. Small-Signal Gate One Forward Transfer Admittance versus Frequency

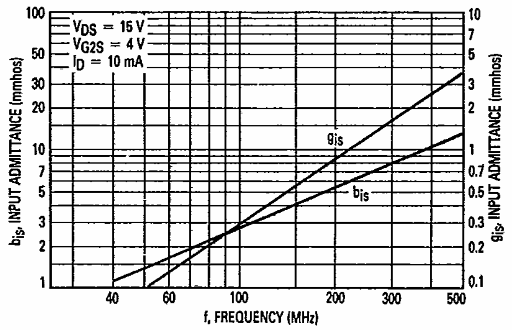


Figure 16. Small-Signal Gate One Input Admittance versus Frequency

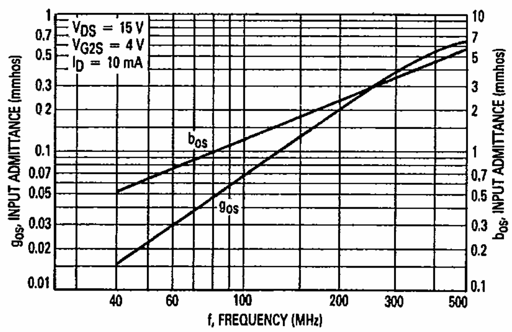


Figure 17. Small-Signal Gate One Output Admittance versus Frequency