

**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 —
 $C_{rss} = 0.03 \text{ pF (Max)}$
- High Forward Transfer Admittance —
 $|y_{fs}| = 8\text{--}20 \text{ mmhos}$ — MFE201, MFE202
 $= 7\text{--}15 \text{ mmhos}$ — MFE203
- Diode Protected Gates

MAXIMUM RATINGS

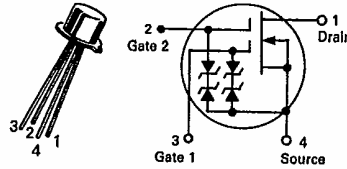
Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSX}	20	Vdc
Drain-Gate Voltage	V_{DG1} V_{DG2}	30 30	Vdc
Gate Current	I_{G1} I_{G2}	± 10 ± 10	mAdc
Drain Current — Continuous	I_D	50	mAdc
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	360 2.4	mW mW/°C
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ 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 ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain-Source Breakdown Voltage ($I_D = 10 \mu\text{Adc}$, $V_S = 0$, $V_{G1S} = V_{G2S} = -5.0 \text{ Vdc}$)	$V_{(BR)DSX}$	20	—	—	Vdc
Gate 1 — Source Breakdown Voltage(1) ($I_{G1} = \pm 10 \text{ mAdc}$, $V_{G2S} = V_{DS} = 0$)	$V_{(BR)G1SO}$	± 6.0	± 12	± 30	Vdc
Gate 2 — Source Breakdown Voltage(1) ($I_{G2} = \pm 10 \text{ mAdc}$, $V_{G1S} = V_{DS} = 0$)	$V_{(BR)G2SO}$	± 6.0	± 12	± 30	Vdc
Gate 1 to Source Cutoff Voltage ($V_{DS} = 15 \text{ Vdc}$, $V_{G2S} = 4.0 \text{ Vdc}$, $I_D = 20 \mu\text{Adc}$)	$V_{G1S(off)}$	-0.5	-1.5	-5.0	Vdc
Gate 2 to Source Cutoff Voltage ($V_{DS} = 15 \text{ Vdc}$, $V_{G1S} = 0$, $I_D = 20 \mu\text{Adc}$)	$V_{G2S(off)}$	-0.2	-1.4	-5.0	Vdc
Gate 1 Leakage Current ($V_{G1S} = \pm 5.0 \text{ Vdc}$, $V_{G2S} = V_{DS} = 0$) ($V_{G2S} = -5.0 \text{ Vdc}$, $V_{G2S} = V_{DS} = 0$, $T_A = 150^\circ\text{C}$)	I_{G1SS}	—	± 0.04	± 10	nAdc μAdc
Gate 2 Leakage Current ($V_{G2S} = \pm 5.0 \text{ Vdc}$, $V_{G1S} = V_{DS} = 0$) ($V_{G2S} = -5.0 \text{ Vdc}$, $V_{G1S} = V_{DS} = 0$, $T_A = 150^\circ\text{C}$)	I_{G2SS}	—	± 0.05	± 10	nAdc μAdc
ON CHARACTERISTICS					
Zero-Gate Voltage Drain Current(2) ($V_{DS} = 15 \text{ Vdc}$, $V_{G1S} = 0$, $V_{G2S} = 4.0 \text{ Vdc}$)	MFE201, MFE202 MFE203 I_{DSS}	6.0 3.0	13 11	30 15	mAdc
SMALL-SIGNAL CHARACTERISTICS					
Forward Transfer Admittance(3) ($V_{DS} = 15 \text{ Vdc}$, $V_{G2S} = 4.0 \text{ Vdc}$, $V_{G1S} = 0$, $f = 1.0 \text{ kHz}$)	MFE201, MFE202 MFE203 $ y_{fs} $	8.0 7.0	12.8 12.5	20 15	mmhos
Input Capacitance ($V_{DS} = 15 \text{ Vdc}$, $V_{G2S} = 4.0 \text{ Vdc}$, $I_D = I_{DSS}$, $f = 1.0 \text{ MHz}$)	C_{iss}	—	4.3	—	pF
Output Capacitance ($V_{DS} = 15 \text{ Vdc}$, $V_{G2S} = 4.0 \text{ Vdc}$, $I_D = I_{DSS}$, $f = 1.0 \text{ MHz}$)	C_{oss}	—	1.7	—	pF
Reverse Transfer Capacitance ($V_{DS} = 15 \text{ Vdc}$, $V_{G2S} = 4.0 \text{ Vdc}$, $I_D = 10 \text{ mAdc}$, $f = 1.0 \text{ MHz}$)	C_{res}	0.005	0.014	0.03	pF

**MFE201,
thru
MFE203**

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



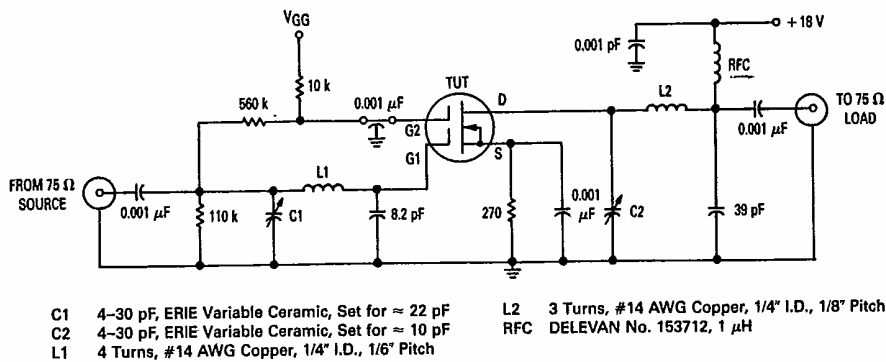
**DUAL-GATE
MOSFETs**

N-CHANNEL — DEPLETION

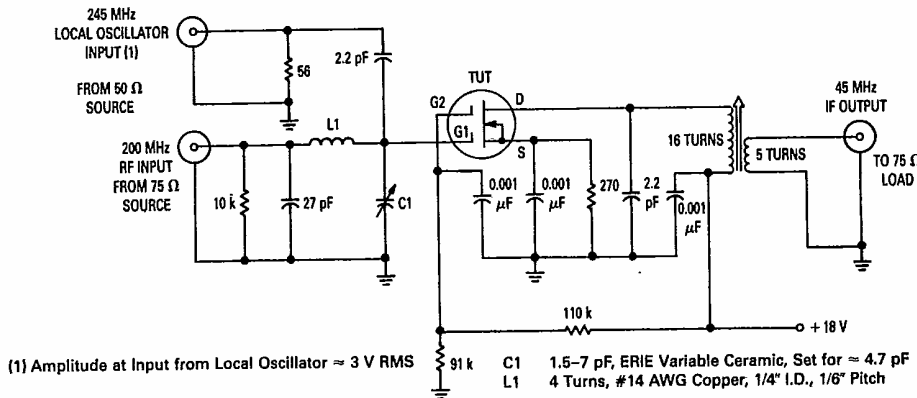
ELECTRICAL CHARACTERISTICS (continued) ($T_A = 25^{\circ}\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
FUNCTIONAL CHARACTERISTICS					
Noise Figure ($V_{DD} = 18\text{ Vdc}$, $V_{GG} = 7.0\text{ Vdc}$, $f = 200\text{ MHz}$) (Figure 1) MFE201 ($V_{DD} = 18\text{ Vdc}$, $V_{GG} = 6.0\text{ Vdc}$, $f = 45\text{ MHz}$) (Figure 3) MFE203	NF	—	1.8 5.3	4.5 6.0	dB
Common Source Power Gain ($V_{DD} = 18\text{ Vdc}$, $V_{GG} = 7.0\text{ Vdc}$, $f = 200\text{ MHz}$) (Figure 1) MFE201 ($V_{DD} = 18\text{ Vdc}$, $V_{GG} = 6.0\text{ Vdc}$, $f = 45\text{ MHz}$) (Figure 3) MFE203 ($V_{DD} = 18\text{ Vdc}$, $f_{LO} = 245\text{ MHz}$, $f_{RF} = 200\text{ MHz}$) (Figure 2) MFE202	G_{ps} $G_{c(5)}$	15 20 15	20 25 19	25 30 25	dB
Bandwidth ($V_{DD} = 18\text{ Vdc}$, $V_{GG} = 7.0\text{ Vdc}$, $f = 200\text{ MHz}$) (Figure 1) MFE201 ($V_{DD} = 18\text{ Vdc}$, $f_{LO} = 245\text{ MHz}$, $f_{RF} = 200\text{ MHz}$) (Figure 2) MFE202 ($V_{DD} = 18\text{ Vdc}$, $V_{GG} = 6.0\text{ Vdc}$, $f = 45\text{ MHz}$) (Figure 3) MFE203	BW	5.0 4.5 3.0	— — —	9.0 7.5 6.0	MHz
Gain Control Gate-Supply Voltage(4) ($V_{DD} = 18\text{ Vdc}$, $\Delta G_{ps} = -30\text{ dB}$, $f = 200\text{ MHz}$) (Figure 1) MFE201 ($V_{DD} = 18\text{ Vdc}$, $\Delta G_{ps} = -30\text{ dB}$, $f = 45\text{ MHz}$) (Figure 3) MFE203	$V_{GG}(GC)$	0 0	-1.0 -0.6	-3.0 -3.0	Vdc

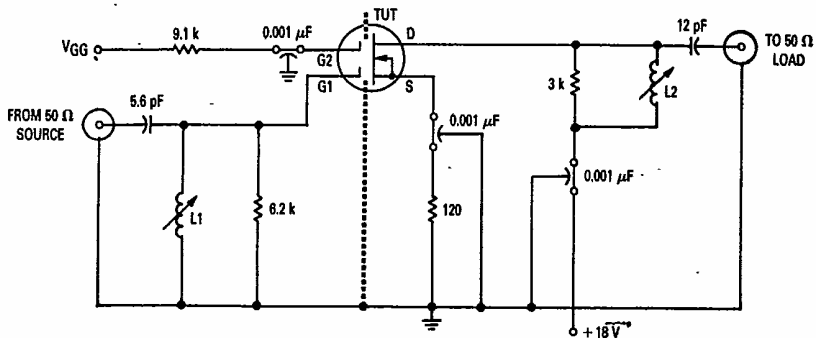
- Notes:**
1. All gate breakdown voltages are measured while the device is conducting rated gate current. This ensures that the gate-voltage limiting network is functioning properly.
 2. Pulse Test: Pulse Width = 300 μs , Duty Cycle $\leq 2.0\%$.
 3. This parameter must be measured with bias voltages 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.



**Figure 1. 200 MHz Test Circuit Schematic
For MFE201**



**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

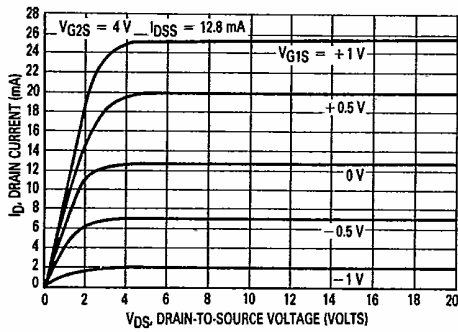


Figure 4. Drain Current versus Drain-to-Source Voltage

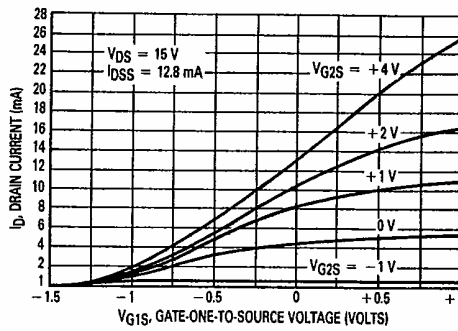


Figure 5. Drain Current versus Gate-One-to-Source Voltage

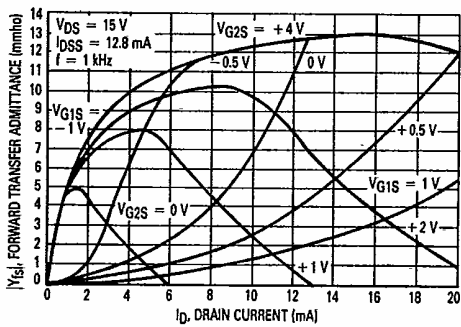


Figure 6. Small-Signal Common-Source Gate-One Forward Transfer Admittance versus Drain Current

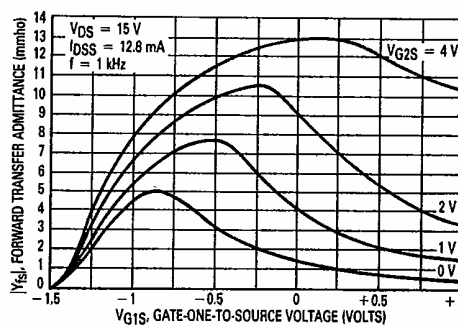


Figure 7. Small-Signal Common-Source Gate-One Forward Transfer Admittance versus Gate-One-to-Source Voltage

TYPICAL CHARACTERISTICS

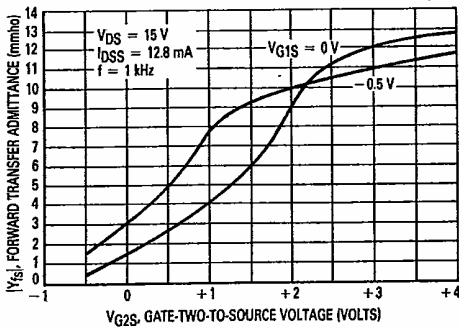


Figure 8. Small-Signal Common-Source Gate-One Forward Transfer Admittance versus Gate-Two-to-Source Voltage

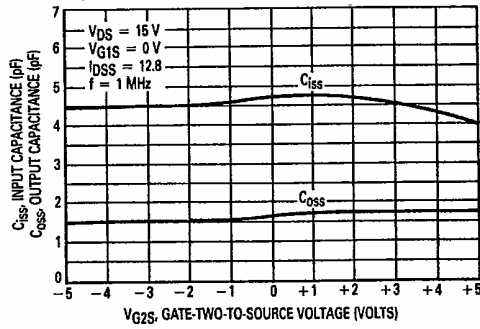


Figure 9. Small-Signal Common-Source Gate-One Input and Output Capacitance versus Gate-Two-to-Source Voltage

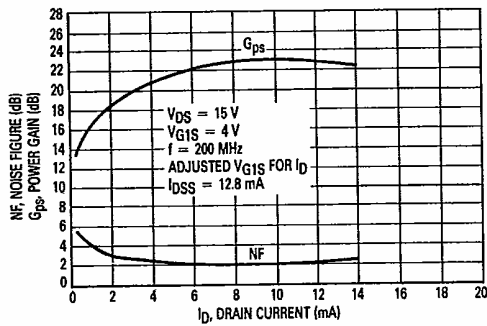


Figure 10. Common-Source Power Gain and Spot Noise Figure versus Drain Current

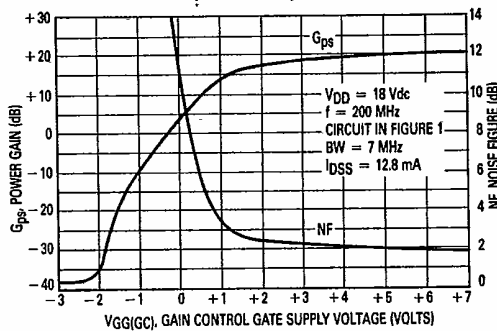


Figure 11. Common-Source Power Gain and Spot Noise Figure versus Gain Control Gate-Supply Voltage — MFE201

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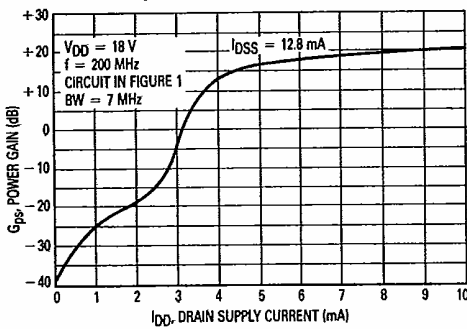


Figure 12. Common-Source Power Gain versus Drain Supply Current — MFE201

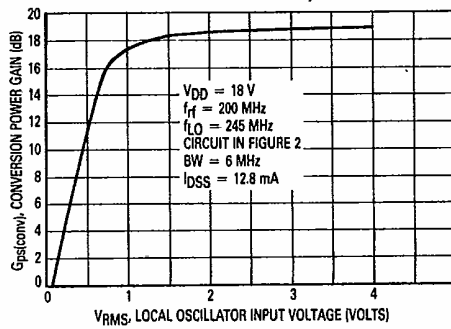


Figure 13. Small-Signal Common-Source Conversion Power Gain versus Local Oscillator Input Voltage — MFE202

TYPICAL CHARACTERISTICS

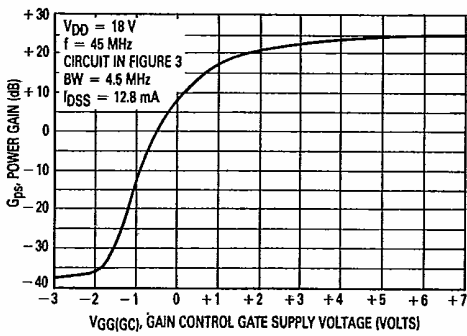


Figure 14. Small-Signal Common Source Insertion Power Gain versus Gain Control Gate-Supply Voltage — MFE203

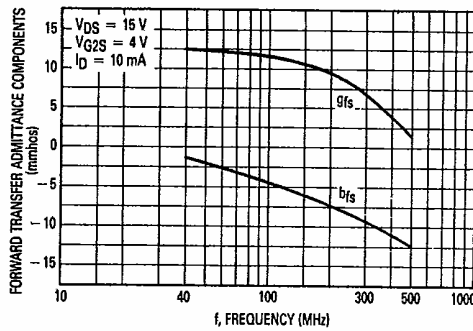


Figure 15. Small-Signal Gate One Forward Transfer Admittance versus Frequency

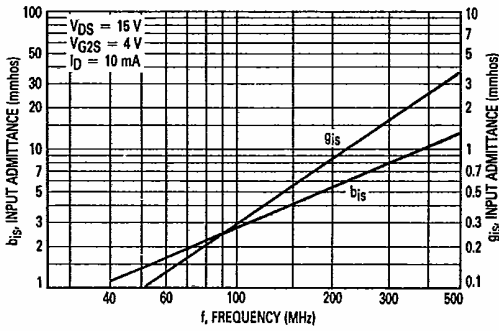


Figure 16. Small-Signal Gate One Input Admittance versus Frequency

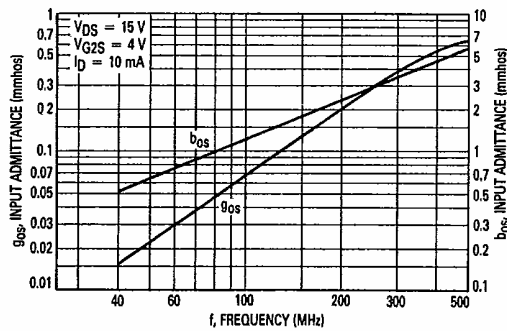


Figure 17. Small-Signal Gate One Output Admittance versus Frequency

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