

# MFE201 Datasheet

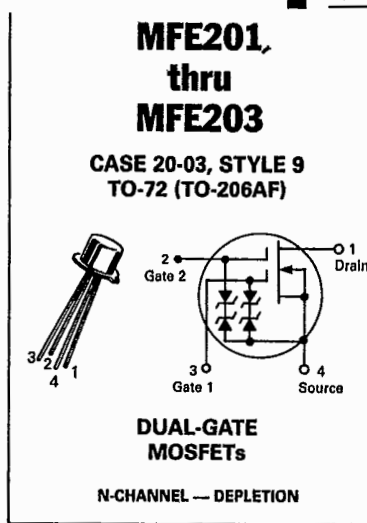
## N-CHANNEL DUAL-GATE SILICON-NITRIDE PASSIVATED MOS FIELD-EFFECT TRANSISTORS

... 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	$V_{DG1}$	30	Vdc
	$V_{DG2}$	30	Vdc
Gate Current	$I_{G1}$	$\pm 10$	mAdc
	$I_{G2}$	$\pm 10$	mAdc
Drain Current — Continuous	$I_D$	50	mAdc
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	360	mW
		2.4	mW/ $^\circ\text{C}$
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.2	Watt
		8.0	mW/ $^\circ\text{C}$
Storage Channel Temperature Range	$T_{stg}$	$-65 \text{ to } +200$	$^\circ\text{C}$
Junction Temperature Range	$T_J$	$-65 \text{ to } +175$	$^\circ\text{C}$
Lead Temperature, 1/16" From Seated Surface for 10 Seconds	$T_L$	300	$^\circ\text{C}$



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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
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) ( $I_{G1} = \pm 10 \text{ mAdc}$ , $V_{G2S} = V_{DS} = 0$ )	$V_{(BR)G1SO}$	$\pm 6.0$	$\pm 12$	$\pm 30$	Vdc
Gate 2 — Source Breakdown Voltage(1) ( $I_{G2} = \pm 10 \text{ mAdc}$ , $V_{G1S} = V_{DS} = 0$ )	$V_{(BR)G2SO}$	$\pm 6.0$	$\pm 12$	$\pm 30$	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 ( $V_{G1S} = \pm 5.0 \text{ Vdc}$ , $V_{G2S} = V_{DS} = 0$ ) ( $V_{G2S} = -5.0 \text{ Vdc}$ , $V_{G2S} = V_{DS} = 0$ , $T_A = 150^\circ\text{C}$ )	$I_{G1SS}$	—	$\pm 0.04$	$\pm 10$	nAdc
		—	—	-10	$\mu\text{Adc}$
Gate 2 Leakage Current ( $V_{G2S} = \pm 5.0 \text{ Vdc}$ , $V_{G1S} = V_{DS} = 0$ ) ( $V_{G2S} = -5.0 \text{ Vdc}$ , $V_{G1S} = V_{DS} = 0$ , $T_A = 150^\circ\text{C}$ )	$I_{G2SS}$	—	$\pm 0.05$	$\pm 10$	nAdc
		—	—	-10	$\mu\text{Adc}$
<b>ON CHARACTERISTICS</b>					
Zero-Gate Voltage Drain Current(2) ( $V_{DS} = 15 \text{ Vdc}$ , $V_{G1S} = 0$ , $V_{G2S} = 4.0 \text{ Vdc}$ )	$I_{DSS}$	6.0 3.0	13 11	30 15	mAdc
<b>SMALL-SIGNAL CHARACTERISTICS</b>					
Forward Transfer Admittance(3) ( $V_{DS} = 15 \text{ Vdc}$ , $V_{G2S} = 4.0 \text{ Vdc}$ , $V_{G1S} = 0$ , $f = 1.0 \text{ kHz}$ )	$ 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 ( $V_{DS} = 15 \text{ Vdc}$ , $V_{G2S} = 4.0 \text{ Vdc}$ , $I_D = 10 \text{ mAdc}$ , $f = 1.0 \text{ MHz}$ )	$C_{rss}$	0.005	0.014	0.03	pF

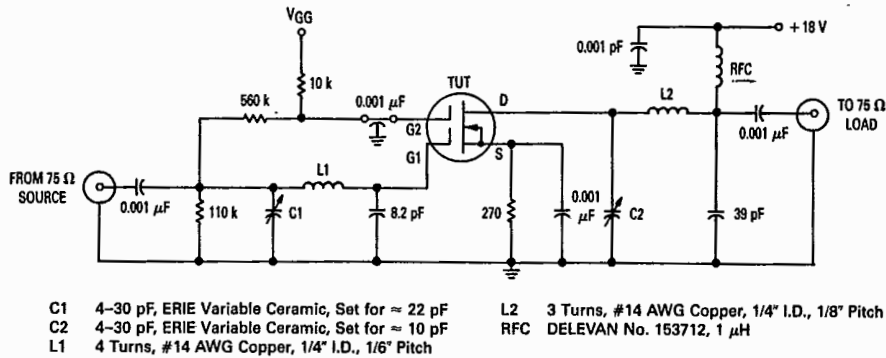
MOTOROLA SMALL-SIGNAL TRANSISTORS, FETs AND DIODES

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

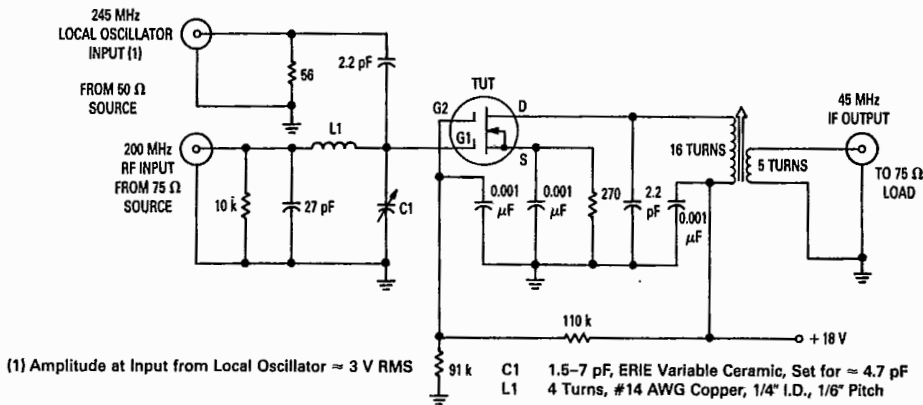
Characteristic	Symbol	Min	Typ	Max	Unit
<b>FUNCTIONAL CHARACTERISTICS</b>					
Noise Figure ( $V_{DD} = 18\text{ Vdc}$ , $V_{GG} = 7.0\text{ Vdc}$ , $f = 200\text{ MHz}$ ) (Figure 1) MFE201 ( $V_{DD} = 18\text{ Vdc}$ , $V_{GG} = 6.0\text{ Vdc}$ , $f = 45\text{ MHz}$ ) (Figure 3) MFE203	NF	—	1.8 5.3	4.5 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	$G_{ps}$	15	20 25	25 30	dB
	$G_c(5)$	15	19	25	
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	-1.0 -0.6	-3.0 -3.0	Vdc

**Notes:**

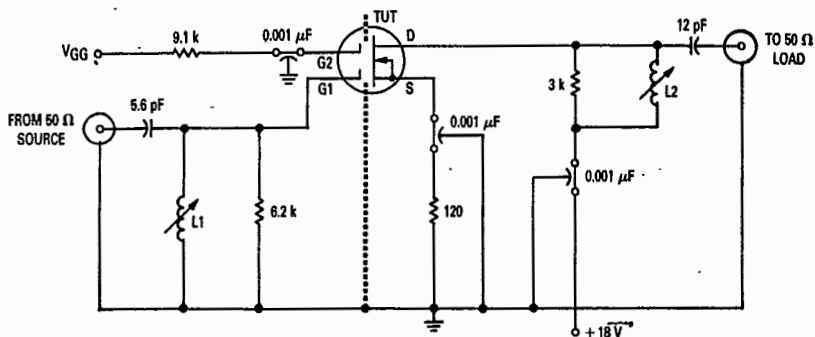
- All gate breakdown voltages are measured while the device is conducting rated gate current. This ensures that the gate-voltage limiting network is functioning properly.
- Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .
- This parameter must be measured with bias voltages applied for less than 5 seconds to avoid overheating.
- $\Delta G_{ps}$  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).
- 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

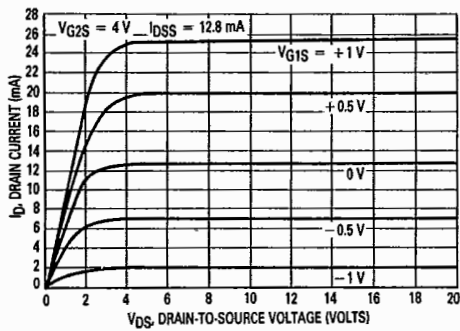


Figure 4. Drain Current versus Drain-to-Source Voltage

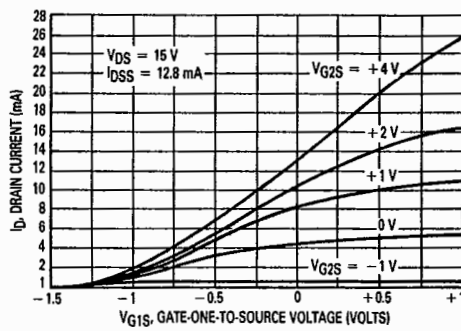


Figure 5. Drain Current versus Gate-One-to-Source Voltage

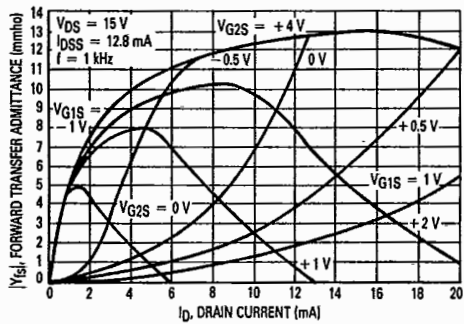


Figure 6. Small-Signal Common-Source Gate-One Forward Transfer Admittance versus Drain Current

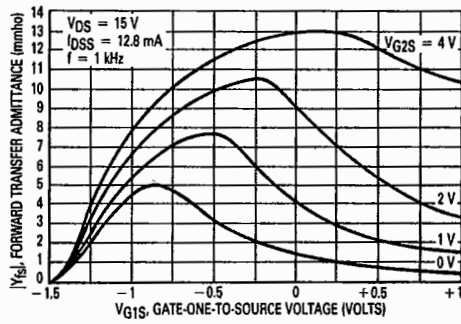


Figure 7. Small-Signal Common-Source Gate-One Forward Transfer Admittance versus Gate-One-to-Source Voltage

TYPICAL CHARACTERISTICS

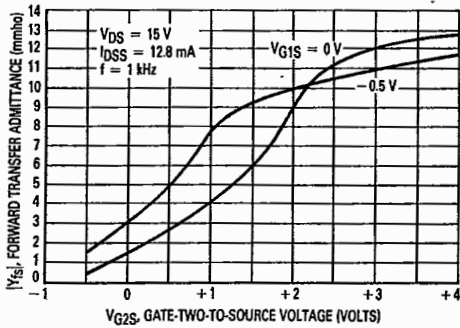


Figure 8. Small-Signal Common-Source Gate-One Forward Transfer Admittance versus Gate-Two-to-Source Voltage

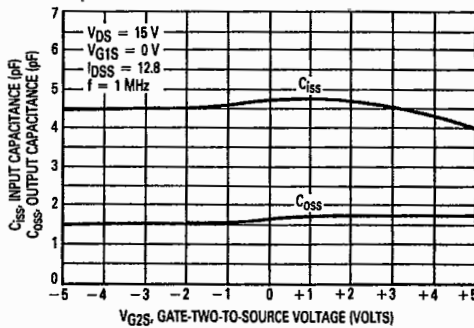


Figure 9. Small-Signal Common-Source Gate-One Input and Output Capacitance versus Gate-Two-to-Source Voltage

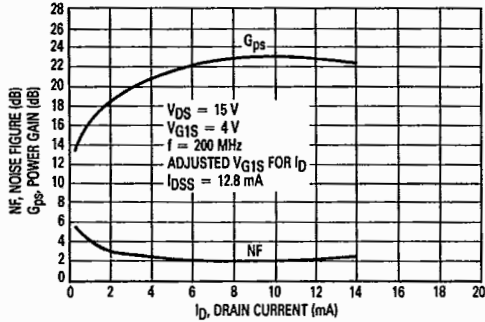


Figure 10. Common-Source Power Gain and Spot Noise Figure versus Drain Current

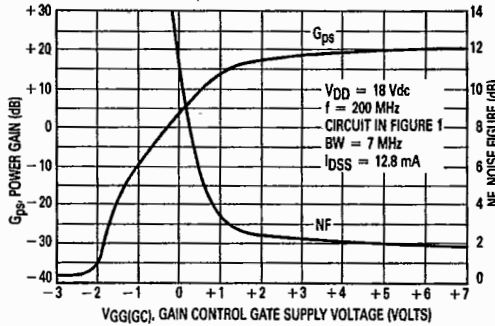


Figure 11. Common-Source Power Gain and Spot Noise Figure versus Gain Control Gate-Supply Voltage — MFE201

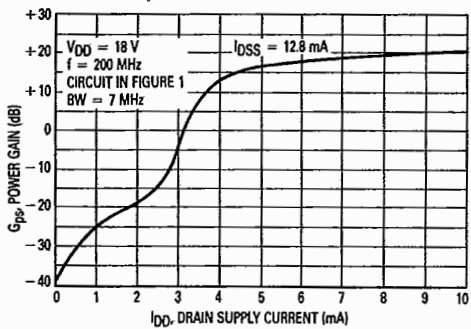


Figure 12. Common-Source Power Gain versus Drain Supply Current — MFE201

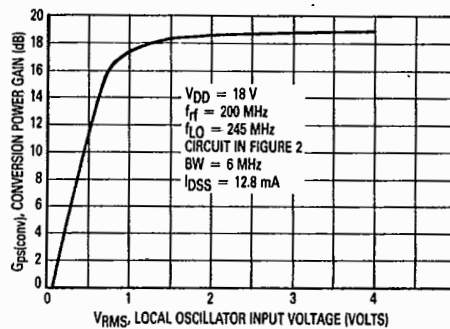


Figure 13. Small-Signal Common-Source Conversion Power Gain versus Local Oscillator Input Voltage — MFE202

TYPICAL CHARACTERISTICS

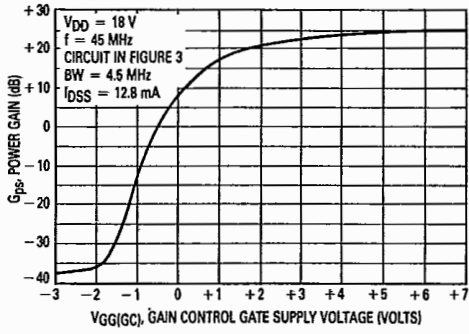


Figure 14. Small-Signal Common Source Insertion Power Gain versus Gain Control Gate-Supply Voltage — MFE203

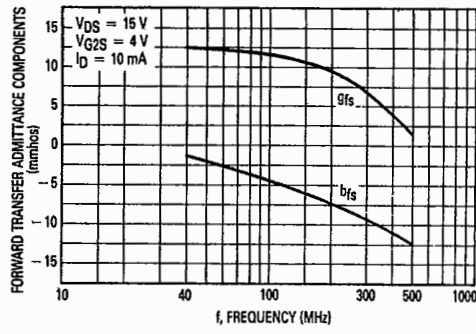


Figure 15. Small-Signal Gate One Forward Transfer Admittance versus Frequency

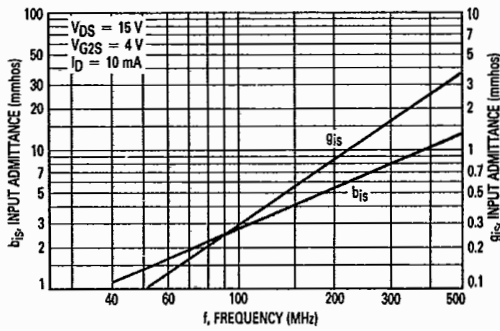


Figure 16. Small-Signal Gate One Input Admittance versus Frequency

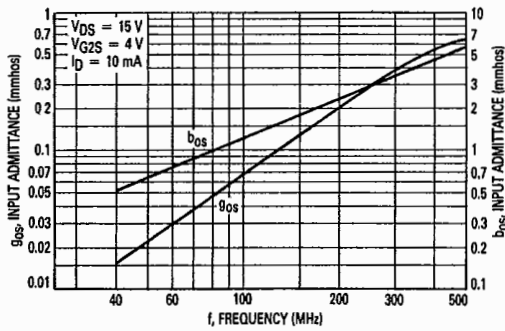


Figure 17. Small-Signal Gate One Output Admittance versus Frequency