

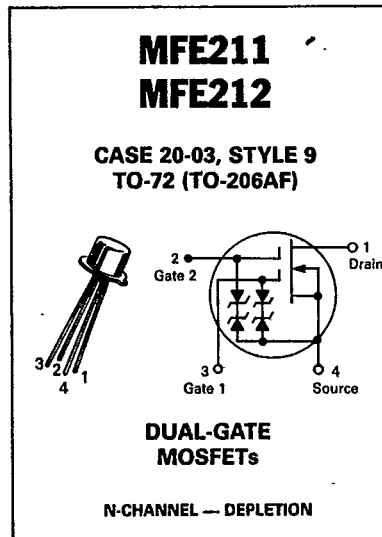
**N-CHANNEL DUAL-GATE
SILICON-NITRIDE PASSIVATED
MOS FIELD-EFFECT TRANSISTORS**

... high Y_{fs} depletion mode dual gate transistors designed for VHF amplifier and mixer applications.

- MFE211 — VHF Amplifier/IF Amplifier
MFE212 — VHF Mixer
- High Forward Transfer Admittance — $|Y_{fs}| = 17\text{--}40$ mmhos
- Low Reverse Transfer Capacitance — $C_{rss} = 0.03$ pF (Max)
- Diode Protected Gates

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSX}	20	Vdc
Drain-Gate Voltage	V_{DG1} V_{DG2}	35 35	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/ $^\circ\text{C}$
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	1.2 8.0	Watt mW/ $^\circ\text{C}$
Storage Channel Temperature Range	T_{stg}	-65 to $+200$	$^\circ\text{C}$
Junction Temperature Range	T_J	-65 to $+175$	$^\circ\text{C}$
Lead Temperature, 1/16" From Seated Surface for 10 Seconds	T_L	300	$^\circ\text{C}$



4

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Drain-Source Breakdown Voltage ($I_D = 10$ μAdc , $V_{G1S} = V_{G2S} = -4.0$ Vdc)	$V_{(BR)DSX}$	20	—	Vdc
Gate 1 — Source Breakdown Voltage(1) ($I_{G1} = \pm 10$ mAdc, $V_{G2S} = V_{DS} = 0$)	$V_{(BR)G1SO}$	± 6.0	—	Vdc
Gate 2 — Source Breakdown Voltage(1) ($I_{G2} = \pm 10$ mAdc, $V_{G1S} = V_{DS} = 0$)	$V_{(BR)G2SO}$	± 6.0	—	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 -0.5	-5.5 -4.0	Vdc
Gate 2 to Source Cutoff Voltage ($V_{DS} = 15$ Vdc, $V_{G1S} = 0$, $I_D = 20$ μAdc)	$V_{G2S(off)}$	-0.2 -0.2	-2.5 -4.0	Vdc
Gate 1 Leakage Current ($V_{G1S} = \pm 5.0$ Vdc, $V_{G2S} = V_{DS} = 0$) ($V_{G1S} = -5.0$ Vdc, $V_{G2S} = V_{DS} = 0$, $T_A = 150^\circ\text{C}$)	I_{G1SS}	—	± 10 -10	mAdc μAdc
Gate 2 Leakage Current ($V_{G2S} = \pm 5.0$ Vdc, $V_{G1S} = V_{DS} = 0$) ($V_{G2S} = -5.0$ Vdc, $V_{G1S} = V_{DS} = 0$, $T_A = 150^\circ\text{C}$)	I_{G2SS}	—	± 10 -10	nAdc μAdc
ON CHARACTERISTICS				
Zero-Gate Voltage Drain Current(2) ($V_{DS} = 15$ Vdc, $V_{G1S} = 0$, $V_{G2S} = 4.0$ Vdc)	I_{DSS}	6.0	40	mAdc
SMALL-SIGNAL CHARACTERISTICS				
Forward Transfer Admittance(3) ($V_{DS} = 15$ Vdc, $V_{G2S} = 4.0$ Vdc, $V_{G1S} = 0$, $f = 1.0$ kHz)	$ Y_{fs} $	17	40	mmhos
Reverse Transfer Capacitance ($V_{DS} = 15$ Vdc, $V_{G2S} = 4.0$ Vdc, $I_D = 10$ mAdc, $f = 1.0$ MHz)	C_{rss}	0.005	0.05	pF

(continued)

MFE211, MFE212

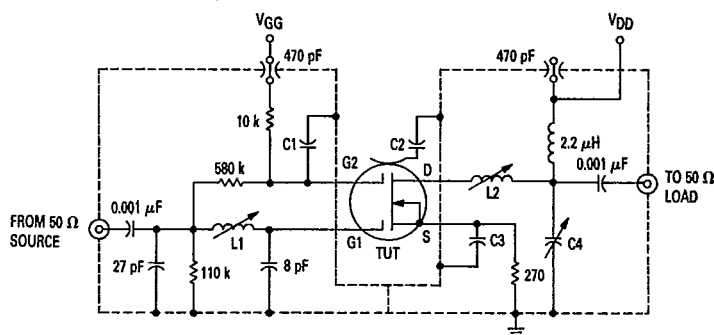
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ELECTRICAL CHARACTERISTICS (continued) ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit
FUNCTIONAL CHARACTERISTICS				
Noise Figure ($V_{DD} = 18\text{ Vdc}$, $V_{GG} = 7.0\text{ Vdc}$, $f = 200\text{ MHz}$) ($V_{DD} = 24\text{ Vdc}$, $V_{GG} = 6.0\text{ Vdc}$, $f = 45\text{ MHz}$)	NF	—	3.5 4.0	dB
Common Source Power Gain ($V_{DD} = 18\text{ Vdc}$, $V_{GG} = 7.0\text{ Vdc}$, $f = 200\text{ MHz}$) ($V_{DD} = 18\text{ Vdc}$, $V_{GG} = 6.0\text{ Vdc}$, $f = 45\text{ MHz}$) ($V_{DD} = 18\text{ Vdc}$, $f_{LO} = 245\text{ MHz}$, $f_{RF} = 200\text{ MHz}$)	G_{ps} $G_c(5)$	24 29 21	35 37 28	dB
Bandwidth ($V_{DD} = 18\text{ Vdc}$, $V_{GG} = 7.0\text{ Vdc}$, $f = 200\text{ MHz}$) ($V_{DD} = 18\text{ Vdc}$, $f_{LO} = 245\text{ MHz}$, $f_{RF} = 200\text{ MHz}$) ($V_{DD} = 18\text{ Vdc}$, $V_{GG} = 6.0\text{ Vdc}$, $f = 45\text{ MHz}$)	BW	5.0 4.0 3.5	12 7.0 6.0	MHz
Gain Control Gate-Supply Voltage(4) ($V_{DD} = 18\text{ Vdc}$, $\Delta G_{ps} = -30\text{ dB}$, $f = 200\text{ MHz}$) ($V_{DD} = 18\text{ Vdc}$, $\Delta G_{ps} = -30\text{ dB}$, $f = 45\text{ MHz}$)	$V_{GG}(GC)$	— —	-2.0 ± 1.0	Vdc

Notes:

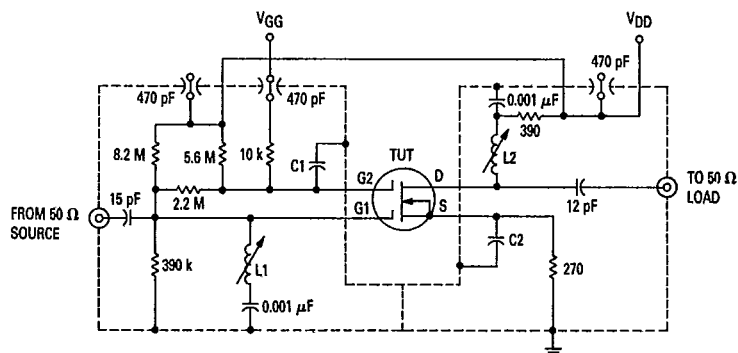
1. All gate breakdown voltages are measured while the device is conducting rated gate current. This ensures that the gate-voltage limiting network is functioning properly.
2. Pulse Test: Pulse Width = $300\text{ }\mu\text{s}$, Duty Cycle $\leq 2.0\%$.
3. This parameter must be measured with bias voltages applied for less than 5 seconds to avoid overheating. The signal is applied to gate 1 with gate 2 at ac ground.
4. ΔG_{ps} is defined as the change in G_{ps} from the value at $V_{GG} = 7.0\text{ volts}$ (MFE211).
5. Power Gain Conversion. Amplitude at input from local oscillator is adjusted for maximum G_c .



C1, C2 & C3: Leadless disc ceramic, $0.001\text{ }\mu\text{F}$
C4: ARCO 462, 5–80 pF, or equivalent

L1: 3 Turns #18, 3/16" diameter aluminum slug
L2: 8 Turns #20, 3/16" diameter aluminum slug

Figure 1. 200 MHz Power Gain, Gain Control Voltage, and Noise Figure Test Circuit for MFE211



C1: Leadless disc ceramic, $0.001\text{ }\mu\text{F}$
C2: Leadless disc ceramic, $0.01\text{ }\mu\text{F}$

L1: 8 Turns #28, 5/32" diameter form, type "J" slug
L2: 9 Turns #28, 5/32" diameter form, type "J" slug

Figure 2. 45 MHz Power Gain and Noise Figure Test Circuit for MFE211

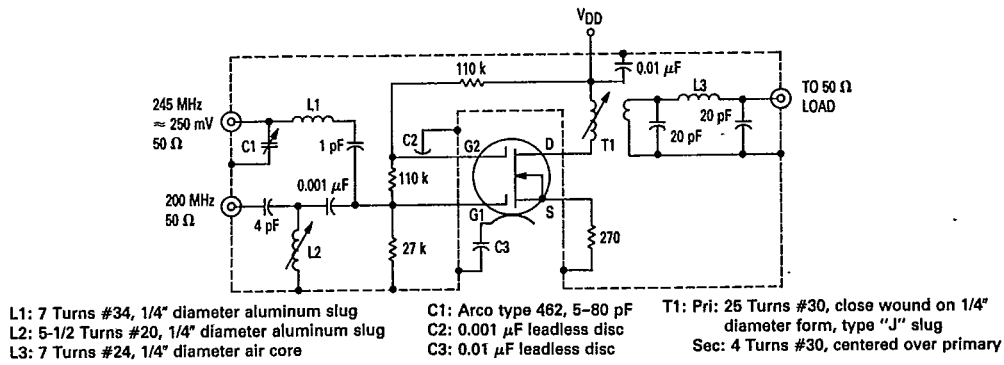


Figure 3. 200 MHz-to-45 MHz Circuit for Conversion Power Gain for MFE212

TYPICAL CHARACTERISTICS

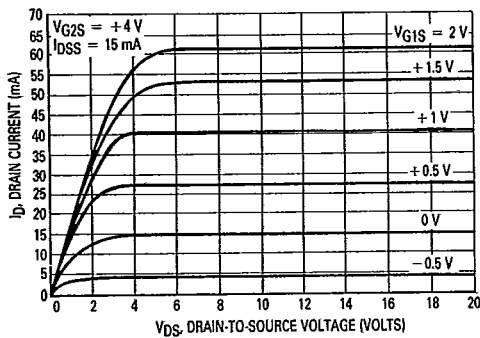


Figure 4. Drain Current versus Drain-to-Source Voltage

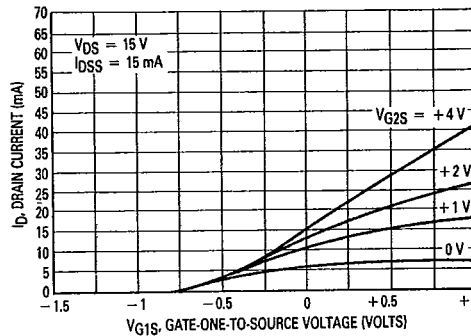


Figure 5. Drain Current versus Gate-One-to-Source Voltage

SMALL-SIGNAL COMMON-SOURCE PARAMETER

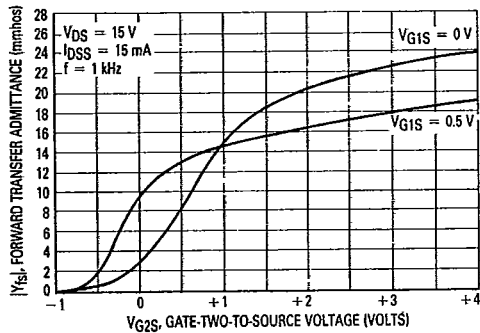


Figure 6. Forward Transfer Admittance versus Gate-Two-to-Source Voltage

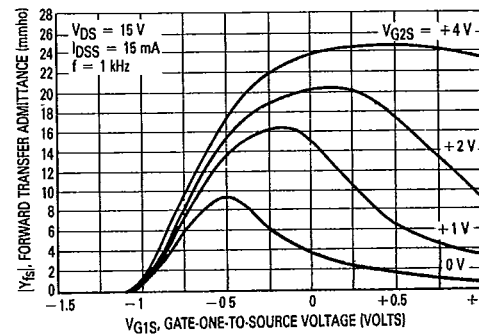


Figure 7. Forward Transfer Admittance versus Gate-One-to-Source Voltage

T-31-25

TYPICAL CHARACTERISTICS (continued)

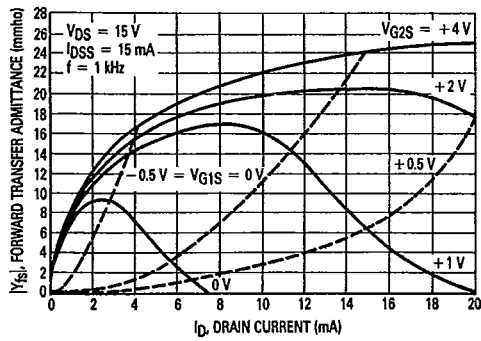


Figure 8. Forward Transfer Admittance versus Drain Current

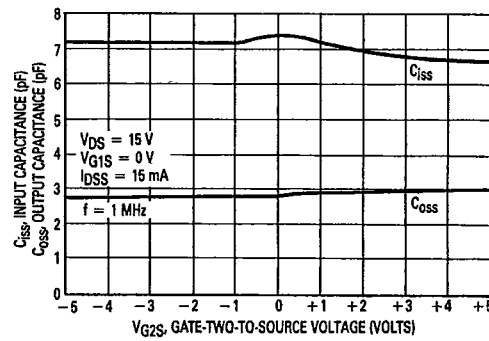


Figure 9. Input and Output Capacitance versus Gate-Two-to-Source Voltage

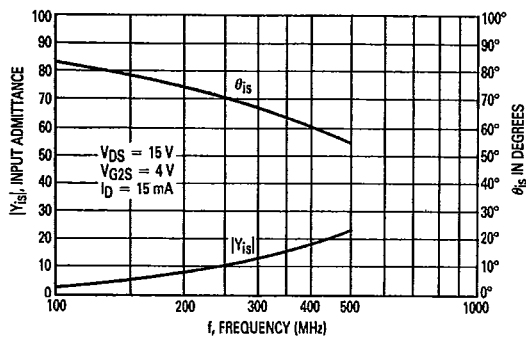


Figure 10. Small-Signal Gate-One Input Admittance versus Frequency

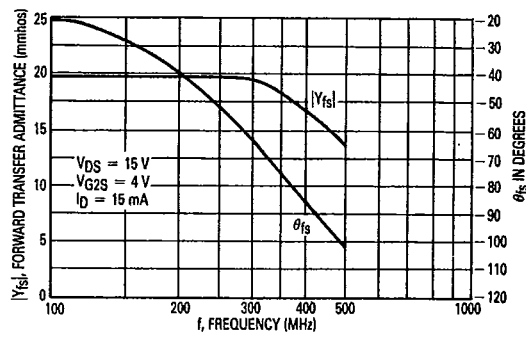


Figure 11. Small-Signal Forward Transfer Admittance versus Frequency

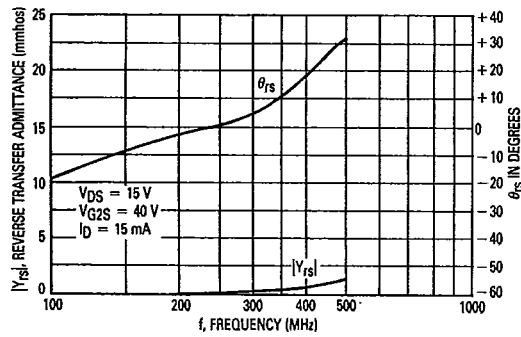


Figure 12. Small-Signal Gate-One Reverse Transfer Admittance versus Frequency

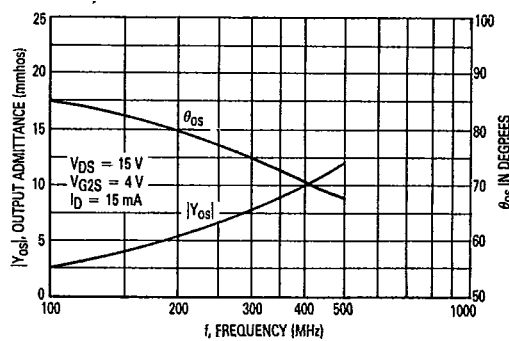


Figure 13. Small-Signal Gate-One Output Admittance versus Frequency

TYPICAL CHARACTERISTICS (continued)

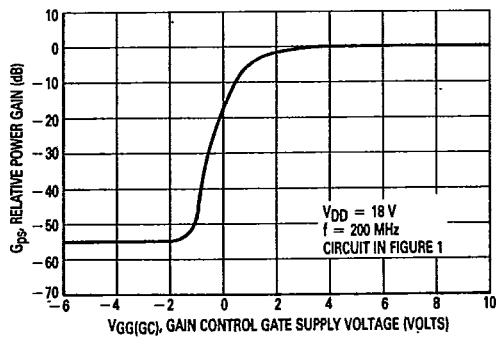


Figure 14. Relative Small-Signal Power Gain versus Gain Control Gate Supply Voltage
MFE211

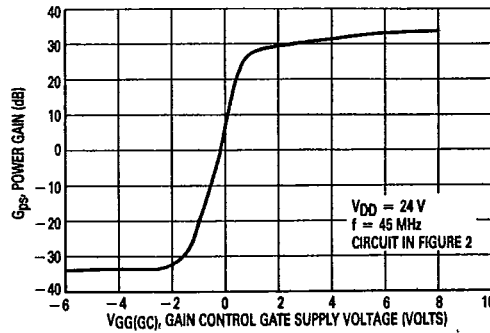


Figure 15. Small-Signal Common-Source Insertion Power Gain versus Gain Control Gate Supply Voltage

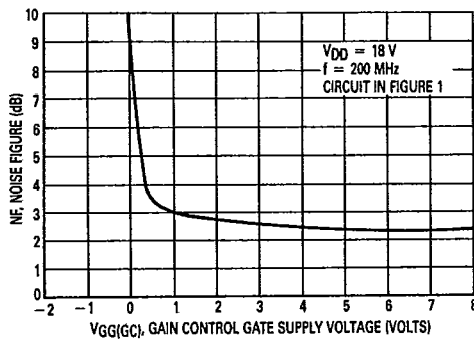


Figure 16. Common Source Spot Noise Figure versus Gain Control Gate Supply Voltage

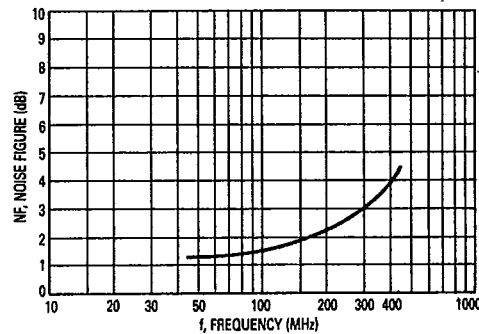


Figure 17. Optimum Spot Noise Figure versus Frequency