

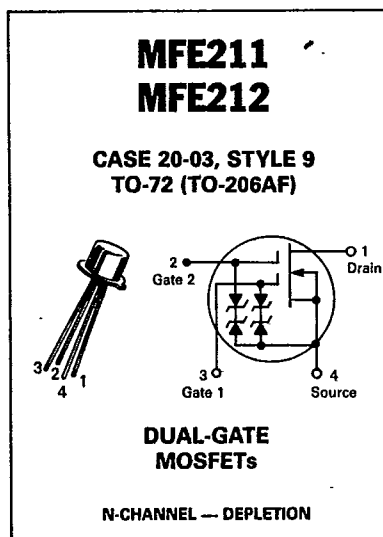
**N-CHANNEL DUAL-GATE  
SILICON-NITRIDE PASSIVATED  
MOS FIELD-EFFECT TRANSISTORS**

... 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                                                                    | $V_{DG1}$<br>$V_{DG2}$ | 35<br>35             | Vdc                          |
| Gate Current                                                                          | $I_{G1}$<br>$I_{G2}$   | $\pm 10$<br>$\pm 10$ | mAdc                         |
| Drain Current — Continuous                                                            | $I_D$                  | 50                   | mAdc                         |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$                  | 360<br>2.4           | mW<br>mW/ $^\circ\text{C}$   |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$                  | 1.2<br>8.0           | Watt<br>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<br>Surface for 10 Seconds                         | $T_L$                  | 300                  | $^\circ\text{C}$             |



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

| Characteristic                                                                                                                                                | Symbol                             | Min              | Max               | Unit                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------|-------------------|-------------------------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                                    |                                    |                  |                   |                         |
| Drain-Source Breakdown Voltage<br>( $I_D = 10$ $\mu\text{Adc}$ , $V_{G1S} = V_{G2S} = -4.0$ Vdc)                                                              | $V_{(BR)DSX}$                      | 20               | —                 | Vdc                     |
| Gate 1 — Source Breakdown Voltage(1)<br>( $I_{G1} = \pm 10$ mAdc, $V_{G2S} = V_{DS} = 0$ )                                                                    | $V_{(BR)G1SO}$                     | $\pm 6.0$        | —                 | Vdc                     |
| Gate 2 — Source Breakdown Voltage(1)<br>( $I_{G2} = \pm 10$ mAdc, $V_{G1S} = V_{DS} = 0$ )                                                                    | $V_{(BR)G2SO}$                     | $\pm 6.0$        | —                 | Vdc                     |
| Gate 1 to Source Cutoff Voltage<br>( $V_{DS} = 15$ Vdc, $V_{G2S} = 4.0$ Vdc, $I_D = 20$ $\mu\text{Adc}$ )                                                     | MFE211<br>MFE212<br>$V_{G1S(off)}$ | $-0.5$<br>$-0.5$ | $-5.5$<br>$-4.0$  | Vdc                     |
| Gate 2 to Source Cutoff Voltage<br>( $V_{DS} = 15$ Vdc, $V_{G1S} = 0$ , $I_D = 20$ $\mu\text{Adc}$ )                                                          | MFE211<br>MFE212<br>$V_{G2S(off)}$ | $-0.2$<br>$-0.2$ | $-2.5$<br>$-4.0$  | Vdc                     |
| Gate 1 Leakage Current<br>( $V_{G1S} = \pm 5.0$ Vdc, $V_{G2S} = V_{DS} = 0$ )<br>( $V_{G1S} = -5.0$ Vdc, $V_{G2S} = V_{DS} = 0$ , $T_A = 150^\circ\text{C}$ ) | $I_{G1SS}$                         | —                | $\pm 10$<br>$-10$ | mAdc<br>$\mu\text{Adc}$ |
| Gate 2 Leakage Current<br>( $V_{G2S} = \pm 5.0$ Vdc, $V_{G1S} = V_{DS} = 0$ )<br>( $V_{G2S} = -5.0$ Vdc, $V_{G1S} = V_{DS} = 0$ , $T_A = 150^\circ\text{C}$ ) | $I_{G2SS}$                         | —                | $\pm 10$<br>$-10$ | nAdc<br>$\mu\text{Adc}$ |
| <b>ON CHARACTERISTICS</b>                                                                                                                                     |                                    |                  |                   |                         |
| Zero-Gate Voltage Drain Current(2)<br>( $V_{DS} = 15$ Vdc, $V_{G1S} = 0$ , $V_{G2S} = 4.0$ Vdc)                                                               | $I_{DSS}$                          | 6.0              | 40                | mAdc                    |
| <b>SMALL-SIGNAL CHARACTERISTICS</b>                                                                                                                           |                                    |                  |                   |                         |
| Forward Transfer Admittance(3)<br>( $V_{DS} = 15$ Vdc, $V_{G2S} = 4.0$ Vdc, $V_{G1S} = 0$ , $f = 1.0$ kHz)                                                    | $ Y_{fs} $                         | 17               | 40                | mmhos                   |
| Reverse Transfer Capacitance<br>( $V_{DS} = 15$ Vdc, $V_{G2S} = 4.0$ Vdc, $I_D = 10$ mAdc, $f = 1.0$ MHz)                                                     | $C_{rss}$                          | 0.005            | 0.05              | pF                      |

(continued)

## MFE211, MFE212

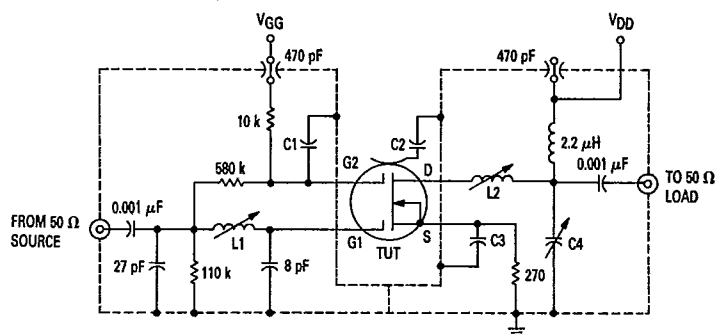
T-31-25

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

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

## Notes:

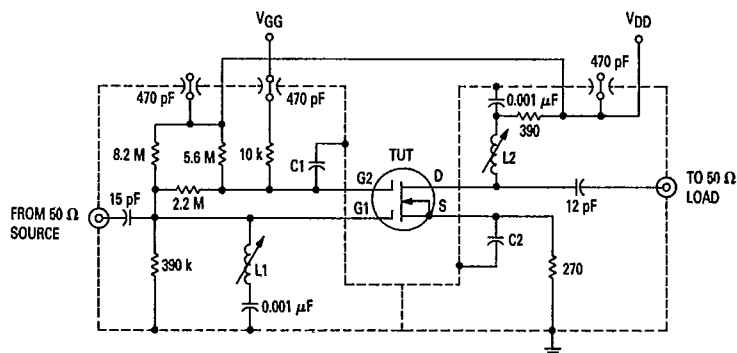
1. All gate breakdown voltages are measured while the device is conducting rated gate current. This ensures that the gate-voltage limiting network is functioning properly.
2. Pulse Test: Pulse Width =  $300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .
3. This parameter must be measured with bias voltages applied for less than 5 seconds to avoid overheating. The signal is applied to gate 1 with gate 2 at ac ground.
4.  $\Delta G_{ps}$  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

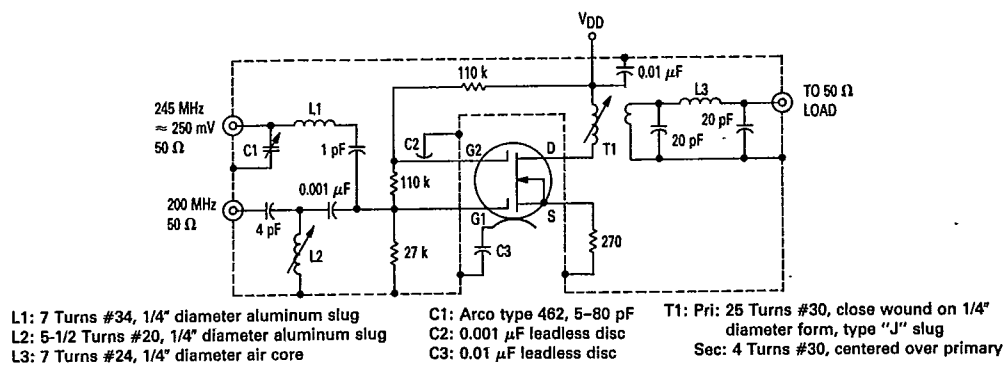


Figure 3. 200 MHz-to-45 MHz Circuit for Conversion Power Gain for MFE212

## TYPICAL CHARACTERISTICS

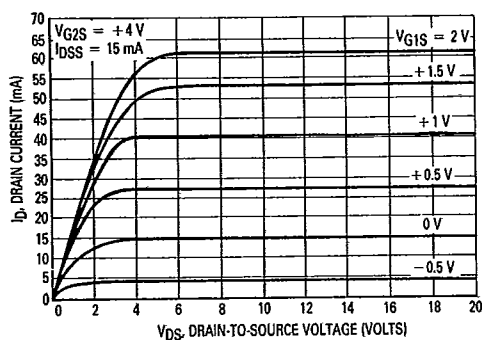


Figure 4. Drain Current versus Drain-to-Source Voltage

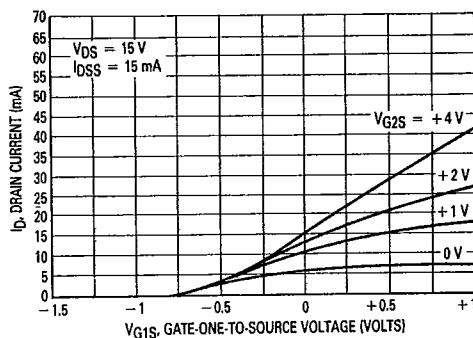


Figure 5. Drain Current versus Gate-One-to-Source Voltage

## SMALL-SIGNAL COMMON-SOURCE PARAMETER

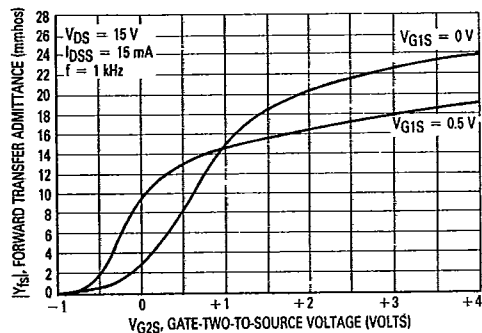


Figure 6. Forward Transfer Admittance versus Gate-Two-to-Source Voltage

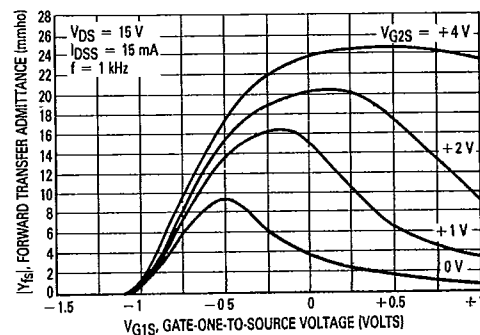


Figure 7. Forward Transfer Admittance versus Gate-One-to-Source Voltage

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# TYPICAL CHARACTERISTICS (continued)

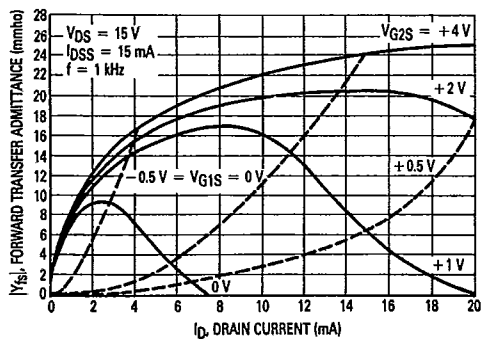


Figure 8. Forward Transfer Admittance versus Drain Current

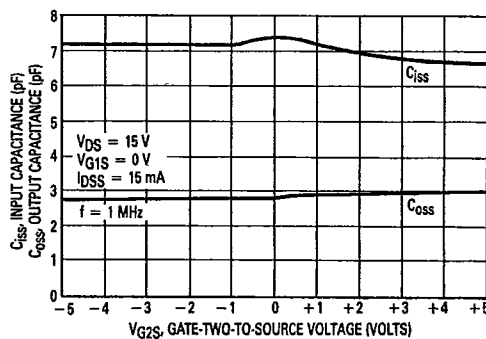


Figure 9. Input and Output Capacitance versus Gate-Two-to-Source Voltage

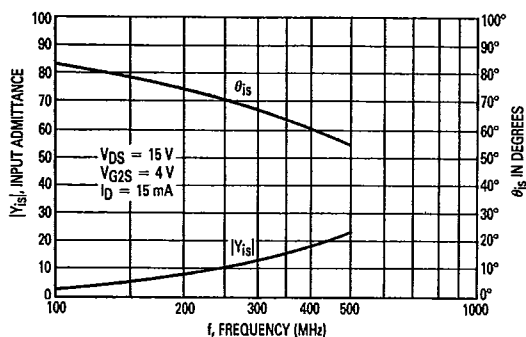


Figure 10. Small-Signal Gate-One Input Admittance versus Frequency

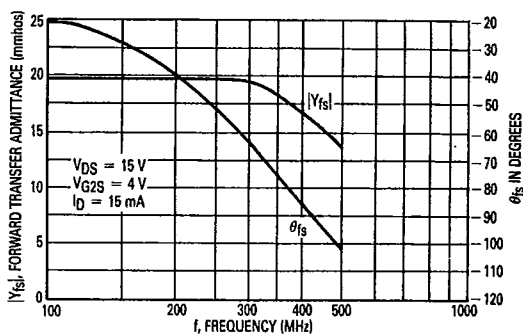


Figure 11. Small-Signal Forward Transfer Admittance versus Frequency

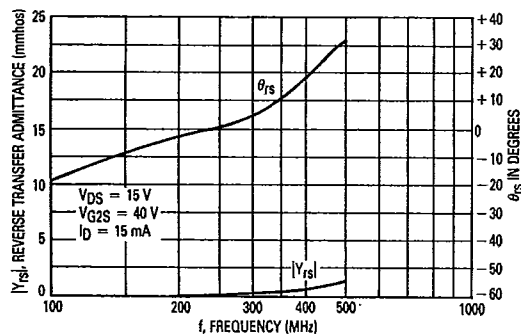


Figure 12. Small-Signal Gate-One Reverse Transfer Admittance versus Frequency

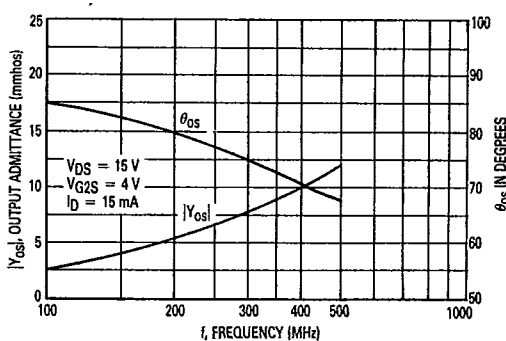


Figure 13. Small-Signal Gate-One Output Admittance versus Frequency

## TYPICAL CHARACTERISTICS (continued)

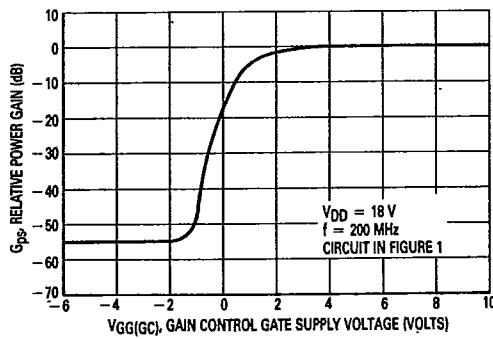


Figure 14. Relative Small-Signal Power Gain versus Gain Control Gate Supply Voltage  
MFE211

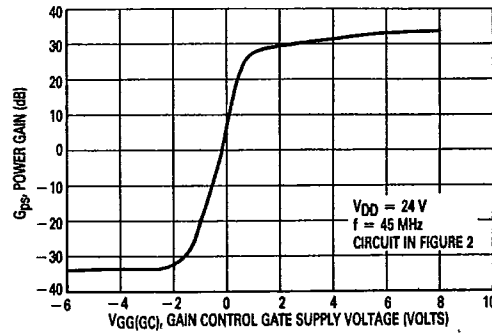


Figure 15. Small-Signal Common-Source Insertion Power Gain versus Gain Control Gate Supply Voltage

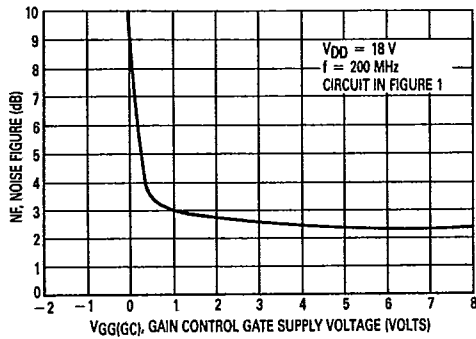


Figure 16. Common Source Spot Noise Figure versus Gain Control Gate Supply Voltage

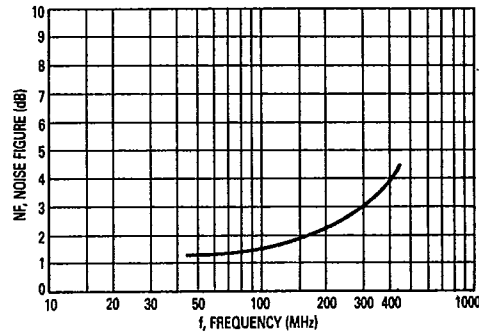


Figure 17. Optimum Spot Noise Figure versus Frequency