# RF Power FETs N-Channel Enhancement-Mode

Siliconix

**175 MHz 20W**
**20-30V 10dB**

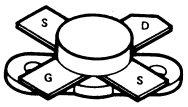
## FEATURES

- **Reduces Component Count and Design Time/Effort**
  - **Withstands Infinite VSWR**
  - **High Gain**
  - **High Two-Tone Intermodulation Intercept Point**
  - **Low Small Signal Noise Figure**
  - **Linear Transfer Characteristics**
- **Permits Broadband Designs**
  - **High Input Impedance**
  - **Low Noise Figure**
- **Permits Efficient Switching Amplifier Designs**
  - **High Input Impedance**
  - **No Storage Delay Time**
- **Improves Reliability**
  - **Free From Secondary Breakdown Failures and Voltage Derating**
  - **Output Current Decreases as Temperature Increases**

## APPLICATIONS

- **VHF Broadband Amplifiers**
- **Receiver Front Ends**
- **Class A, B, C, D, E Amplifiers**
- **Power Oscillators**

**S-Package**




**380 SOE**
**FLANGE**

## ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25°C unless otherwise noted)

| | | | |
|---|---|---|---|
| Gate-Source Voltage | 30 V | Total Device Dissipation | 25 W |
| Drain-Source Voltage | 60 V | Thermal Resistance, Junction to Case | 7°C/W |
| Drain-Gate Voltage | 60 V | Junction Temperature | 200°C |
| Drain Current (DC) | 2.0 A | Storage Temperature Range | -55 to 150°C |

## ELECTRICAL CHARACTERISTICS ($T_C$ = 25°C unless otherwise noted)

| Symbol | Characteristics | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | 60 | | | V | $V_{GS}$ = 0V, $I_D$ = 1.0 mA |
| $I_{DSS}$ | Drain-Source Leakage Current | | | 100 | μA | $V_{GS}$ = 0V, $V_{DS}$ = 25V |
| $I_{GSS}$ | Gate-Source Leakage Current | | | 100 | nA | $V_{GS}$ = 30V, $V_{DS}$ = 0V |
| $g_m$ | D. C. Forward Transconductance | 170 | 240 | | mℑ | $V_{DS}$ = 25V, $I_D$ = 0.5A, $\Delta V_{GS}$ = 1.0V |
| $I_D$ (on) | On-State Drain Current | 400 | | | mA | $V_{DS}$ = 25V, $V_{GS}$ = 5V |
| $V_{GS}$(th) | Gate Threshold Voltage | | 2.4 | | V | $V_{GS}$ = $V_{DS}$, $I_D$ = 100 mA |
| $C_{iss}$ | Common-Source Input Capacitance | | 32 | | pF | $V_{GS}$ = 0V, $V_{DS}$ = 25V, f = 1.0 MHz |
| $C_{oss}$ | Common-Source Output Capacitance | | 34 | | pF | $V_{GS}$ = 0V, $V_{DS}$ = 25V, f = 1.0 MHz |
| $C_{rss}$ | Reverse Transfer Capacitance | | 4.8 | | pF | $V_{GS}$ = 0V, $V_{DS}$ = 25V, f = 1.0 MHz |
| $G_{ps}$ | Common Source Power Gain | 10 | | | dB | $V_{DD}$ = 28V, Po = 20W, f = 175 MHz<br>$I_{DQ}$ = 100 mA |
| $\eta$ | Drain Efficiency | | 65 | | % | $V_{DD}$ = 28V, Po = 20W, f = 175 MHz<br>$I_{DQ}$ = 100 mA |
| $V_{SWR}$ | Load Mismatch Tolerance | 30:1 | | | | $V_{DD}$ = 28V, Po = 20W, f = 175 MHz<br>$I_{DQ}$ = 100 mA |
| N. F. | Noise Figure | | 2.5 | | dB | $V_{DS}$ = 24V, $I_D$ = 100 mA, f = 150 MHz |

VNAR-RF

## VMP4 PERFORMANCE CHARACTERISTICS (Cont'd)

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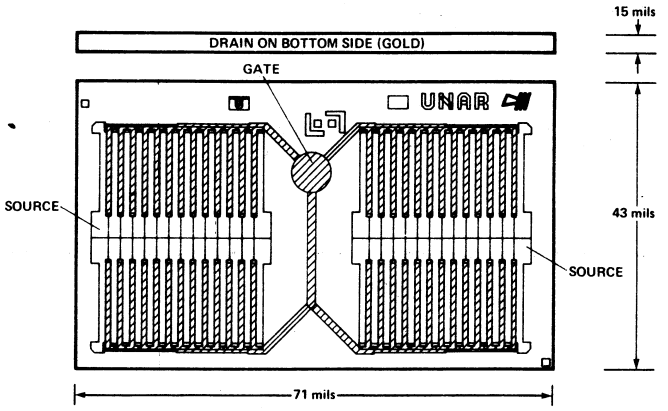
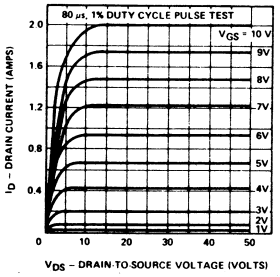
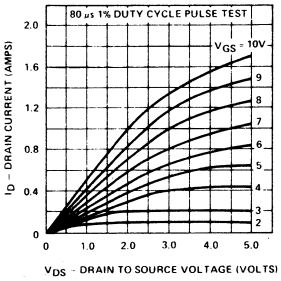



## TYPICAL PERFORMANCE CURVES (25°C unless otherwise noted)

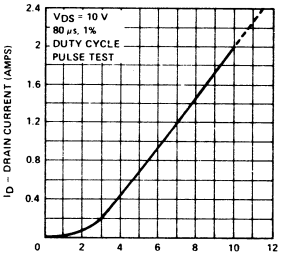
**Output Characteristics**



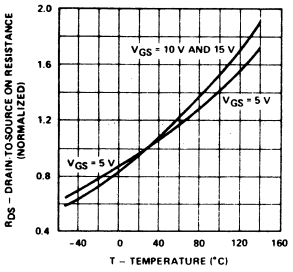

**Saturation Characteristics**



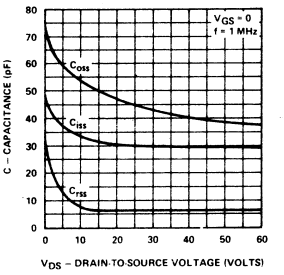

**Static Transfer Characteristic**



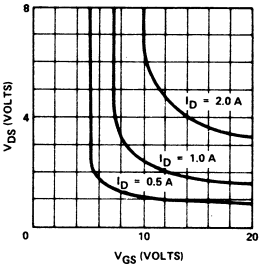

**Normalized Drain-to-Source ON Resistance vs Temperature**



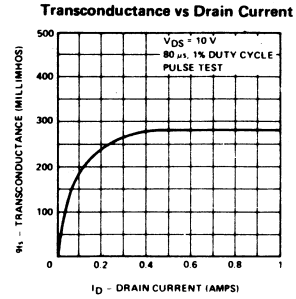

**Capacitance vs Drain-to-Source Voltage**



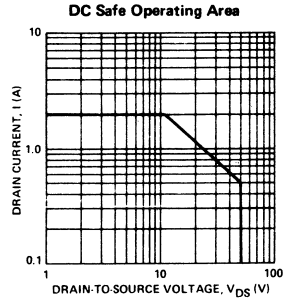

**Saturated Drain-Source Voltage vs Gate-Source Voltage**



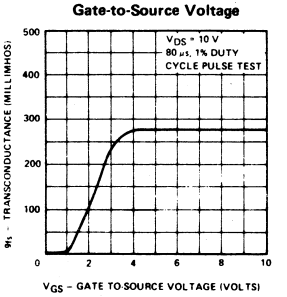

**Transconductance vs Drain Current**




**DC Safe Operating Area**




**Transconductance vs Gate-to-Source Voltage**

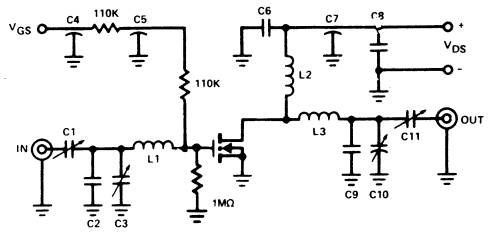


## VMP4 PERFORMANCE CHARACTERISTICS (Cont'd)

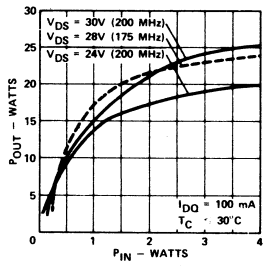
$C_1$ Arco 422 4-40 pf
$C_2$ 100 pf
$C_3$ Arco 422 4-40 pf
$C_4$ .001 μf
$C_5$ .001 μf
$C_6$ .1 μf Disk
$C_7$ .001 μf
$C_8$ .1 μf Disk
$C_9$ 8.2 pf
$C_{10}$ Arco 402 1.5-20 pf
$C_{11}$ Arco 422 4-40 pf

$L_1$ 2" Length #12 AWG
$L_2$ 6 Turns #18 AWG .4 Inner dia. close wound
$L_3$ 2" Length #12 AWG

**VMP4 175 MHz Test Fixture**

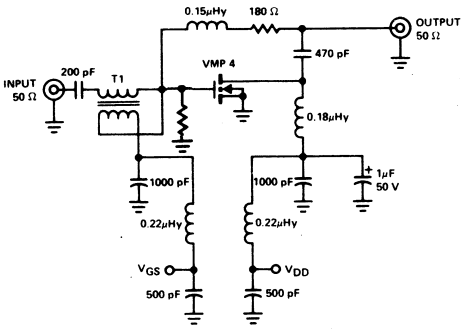



**Typical Output Power vs Input Power**

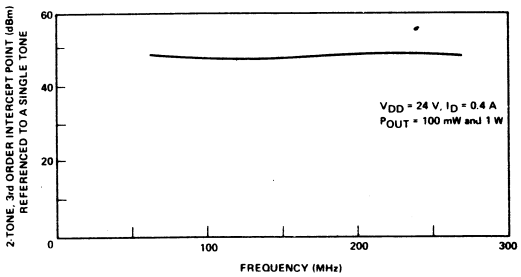



## APPLICATIONS

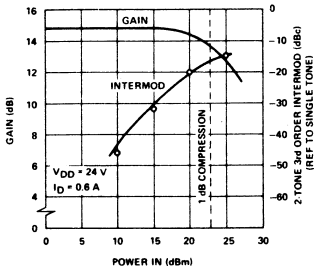
**Broadband Amplifier**



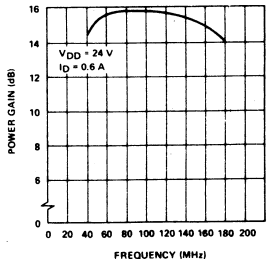

**Broadband Amplifier Performance**



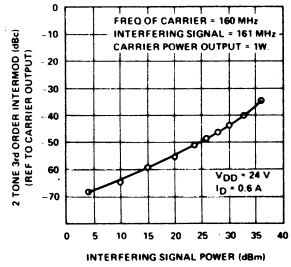

**Gain and 2-Tone 3rd Order Intermodulation Broadband Amplifier**




**Broadband Amplifier**




**Effects of Interference**



# VMP4 PERFORMANCE CHARACTERISTICS

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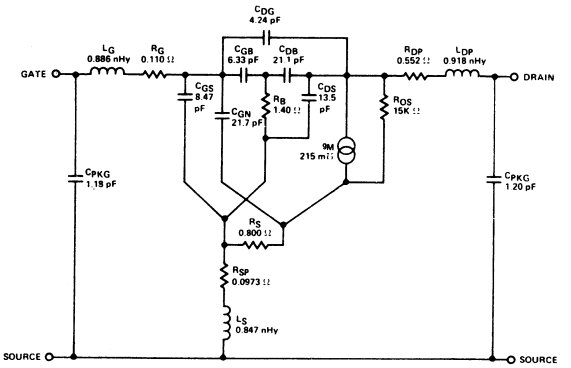
**VMP4 Equivalent Circuit**




## SMALL-SIGNAL POLAR S-PARAMETERS IN 50.0 OHM SYSTEM

| FREQ | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | | $S_{21}$ |
|---|---|---|---|---|---|---|---|---|---|
| MHz | (MAGN | ANGL) | (MAGN | ANGL) | (MAGN | ANGL) | (MAGN | ANGL) | dB |
| 1.00 | 1.00 | −3 | 20.98 | 177.7 | −50dB | 87.8 | 0.99 | −3 | 26.43 |
| 2.00 | 1.00 | −6 | 20.94 | 175.5 | 0.005 | 85.6 | 0.99 | −6 | 26.42 |
| 5.00 | 0.99 | −15 | 20.67 | 168.7 | 0.013 | 79.3 | 0.98 | −15 | 26.31 |
| 10.00 | 0.96 | −29 | 19.79 | 158.0 | 0.025 | 69.0 | 0.96 | −29 | 25.93 |
| 20.00 | 0.89 | −53 | 17.13 | 139.6 | 0.043 | 51.6 | 0.88 | −54 | 24.68 |
| 50.00 | 0.73 | −98 | 10.19 | 106.4 | 0.063 | 21.5 | 0.73 | −99 | 20.16 |
| 100.00 | 0.70 | −126 | 5.31 | 80.4 | 0.061 | 1.4 | 0.70 | −128 | 14.50 |
| 120.00 | 0.71 | −132 | 4.33 | 73.4 | 0.057 | −2.8 | 0.71 | −134 | 12.73 |
| 160.00 | 0.75 | −140 | 3.06 | 62.2 | 0.047 | −6.7 | 0.74 | −142 | 9.70 |
| 200.00 | 0.78 | −147 | 2.27 | 53.5 | 0.037 | −4.5 | 0.78 | −149 | 7.13 |
| 220.00 | 0.80 | −150 | 1.99 | 49.8 | 0.032 | 0.5 | 0.79 | −151 | 5.96 |
| 260.00 | 0.83 | −154 | 1.56 | 43.6 | 0.026 | 15.3 | 0.82 | −156 | 3.84 |
| 300.00 | 0.85 | −158 | 1.25 | 38.6 | 0.025 | 38.8 | 0.84 | −160 | 1.94 |
| 320.00 | 0.86 | −160 | 1.13 | 36.5 | 0.026 | 49.8 | 0.85 | −162 | 1.06 |
| 360.00 | 0.88 | −164 | 0.94 | 33.0 | 0.033 | 65.3 | 0.86 | −165 | −0.57 |
| 400.00 | 0.89 | −167 | 0.79 | 30.3 | 0.042 | 73.6 | 0.88 | −168 | −2.04 |

## SMALL-SIGNAL TWO-PORT Y-PARAMETER MATRIX IN MILLIMHOS

| FREQ | $Y_{11}$ | | $Y_{21}$ | | $Y_{12}$ | | $Y_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| MHz | (REAL | IMAG) | (REAL | IMAG) | (REAL | IMAG) | (REAL | IMAG) |
| 1.0 | 0.00 | 0.24 | 210.58 | −0.30 | 0.00 | −0.03 | 0.07 | 0.25 |
| 2.0 | −0.00 | 0.48 | 210.58 | −0.61 | 0.00 | −0.05 | 0.07 | 0.50 |
| 5.0 | 0.00 | 1.20 | 210.59 | −1.52 | 0.00 | −0.13 | 0.07 | 1.24 |
| 10.0 | 0.02 | 2.39 | 210.64 | −3.05 | 0.00 | −0.27 | 0.09 | 2.48 |
| 20.0 | 0.09 | 4.78 | 210.84 | −6.11 | 0.00 | −0.53 | 0.17 | 4.95 |
| 50.0 | 0.56 | 11.97 | 212.25 | −15.47 | 0.02 | −1.31 | 0.74 | 12.41 |
| 100.0 | 2.32 | 24.09 | 217.24 | −32.49 | 0.11 | −2.50 | 2.88 | 24.95 |
| 120.0 | 3.42 | 29.00 | 220.13 | −40.12 | 0.18 | −2.91 | 4.21 | 30.01 |
| 160.0 | 6.42 | 38.92 | 227.33 | −57.56 | 0.43 | −3.57 | 7.85 | 40.21 |
| 200.0 | 10.75 | 48.88 | 236.01 | −79.01 | 0.94 | −3.93 | 13.07 | 50.36 |
| 220.0 | 13.52 | 53.79 | 240.62 | −91.74 | 1.36 | −3.98 | 16.39 | 55.30 |
| 260.0 | 20.45 | 63.15 | 249.36 | −122.30 | 2.69 | −3.76 | 24.69 | 64.52 |
| 300.0 | 29.40 | 71.16 | 255.01 | −160.94 | 5.06 | −3.17 | 35.35 | 71.95 |
| 320.0 | 34.56 | 74.26 | 255.36 | −183.50 | 6.81 | −2.81 | 41.48 | 74.52 |
| 360.0 | 45.63 | 77.74 | 247.61 | −234.10 | 11.81 | −2.31 | 54.55 | 76.29 |
| 400.0 | 55.76 | 76.70 | 224.34 | −287.36 | 19.10 | −2.93 | 66.44 | 72.51 |