

The RF MOSFET Line 100W, 500MHz, 28V

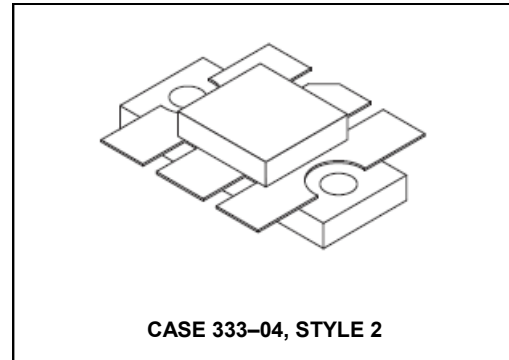
Rev. V1

Designed for broadband commercial and military applications using single ended circuits at frequencies to 500 MHz. The high power, high gain and broadband performance of this device makes possible solid state transmitters for FM broadcast or TV channel frequency bands.

N-Channel enhancement mode

- Guaranteed performance @ 500 MHz, 28 Vdc
Output power — 100 W
Power gain — 8.8 dB typ.
Efficiency — 55% typ.
- 100% ruggedness tested at rated output power
- Low thermal resistance
- Low Crss — 17 pF typ. @ VDS = 28 V

Product Image



MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|------------------|-------------|---------------|
| Drain-Source Voltage | V _{DSS} | 65 | Vdc |
| Gate-Source Voltage | V _{GS} | ±20 | Vdc |
| Drain Current — Continuous | I _D | 13 | Adc |
| Total Device Dissipation @ T _C = 25°C Derate above 25°C | P _D | 270 1.54 | Watts W/°C |
| Storage Temperature Range | T _{stg} | -65 to +150 | °C |
| Operating Junction Temperature | T _J | 200 | °C |

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|--------------------------------------|------------------|------|------|
| Thermal Resistance, Junction to Case | R _{θJC} | 0.65 | °C/W |

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|--|----------------------|----|---|-----|------|
| Drain-Source Breakdown Voltage (V _{GS} = 0, I _D = 50 mA) | V _{(BR)DSS} | 65 | — | — | Vdc |
| Zero Gate Voltage Drain Current (V _{DS} = 28 V, V _{GS} = 0) | I _{DSS} | — | — | 2.5 | mAdc |
| Gate-Body Leakage Current (V _{GS} = 20 V, V _{DS} = 0) | I _{GSS} | — | — | 1.0 | μAdc |

NOTE – CAUTION – MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

The RF MOSFET Line 100W, 500MHz, 28V

Rev. V1

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

ON CHARACTERISTICS

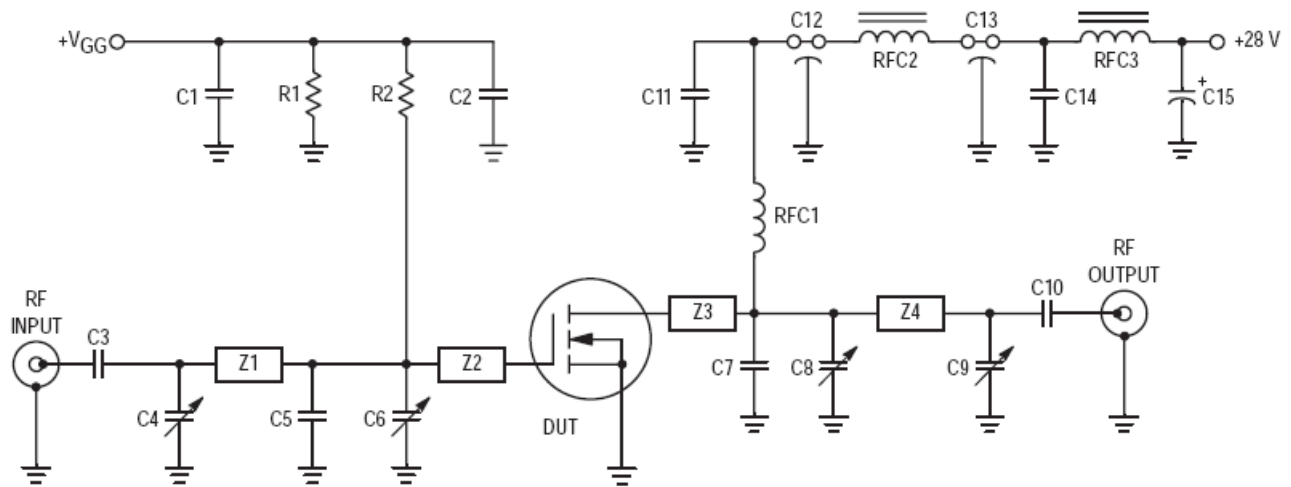
| | | | | | |
|--|--------------|-----|------|-----|------|
| Gate Threshold Voltage ($V_{DS} = 10\text{ V}$, $I_D = 100\text{ mA}$) | $V_{GS(th)}$ | 1.5 | 2.5 | 4.5 | Vdc |
| Drain–Source On–Voltage ($V_{GS} = 10\text{ V}$, $I_D = 5.0\text{ A}$) | $V_{DS(on)}$ | 0.5 | 0.9 | 1.5 | Vdc |
| Forward Transconductance ($V_{DS} = 10\text{ V}$, $I_D = 2.5\text{ A}$) | g_{fs} | 3.0 | 3.75 | — | mhos |

DYNAMIC CHARACTERISTICS

| | | | | | |
|---|-----------|---|-----|---|----|
| Input Capacitance ($V_{DS} = 28\text{ V}$, $V_{GS} = 0$, $f = 1.0\text{ MHz}$) | C_{iss} | — | 135 | — | pF |
| Output Capacitance ($V_{DS} = 28\text{ V}$, $V_{GS} = 0$, $f = 1.0\text{ MHz}$) | C_{oss} | — | 140 | — | pF |
| Reverse Transfer Capacitance ($V_{DS} = 28\text{ V}$, $V_{GS} = 0$, $f = 1.0\text{ MHz}$) | C_{rss} | — | 17 | — | pF |

FUNCTIONAL CHARACTERISTICS

| | | | | | |
|--|----------|--------------------------------|-----|---|----|
| Common Source Power Gain ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 100\text{ W}$, $f = 500\text{ MHz}$, $I_{DQ} = 100\text{ mA}$) | G_{ps} | 7.5 | 8.8 | — | dB |
| Drain Efficiency ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 100\text{ W}$, $f = 500\text{ MHz}$, $I_{DQ} = 100\text{ mA}$) | η | 50 | 55 | — | % |
| Electrical Ruggedness ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 100\text{ W}$, $f = 500\text{ MHz}$, $I_{DQ} = 100\text{ mA}$, VSWR 10:1 at all Phase Angles) | ψ | No Degradation in Output Power | | | |



| | | | |
|----------------|--|----------------|---------------------------------------|
| C1, C11, C14 | 0.1 μ F, Ceramic Capacitor | RFC1 | 8 Turns AWG #18, 0.25" I.D., Enameled |
| C2 | 240 pF, ATC Type Chip Capacitor | RFC2, RFC3 | Ferroxcube VK200 19/4B |
| C3, C10 | 270 pF, ATC Type Chip Capacitor | Z1, | 0.250" x 0.800", Microstrip Line |
| C4, C6, C8, C9 | 1–20 pF, Trimmer Capacitor, Johansen | Z2, Z3 | 0.250" x 0.400", Microstrip Line |
| C5 | 24 pF, Mini–Unelco Type Capacitor | Z4 | 0.250" x 1.25", Microstrip Line |
| C7 | 24 pF, Mini–Unelco Type Capacitor | Board Material | 0.062" Glass Teflon [®] , |
| C12, C13 | 680 pF, Feedthru Capacitors | | 2 oz. Copper, Double Clad Copper |
| C15 | 10 μ F, 50 V, Electrolytic Capacitor | | Board, $\epsilon_r = 2.55$ |

Figure 1. 500 MHz Test Circuit

TYPICAL CHARACTERISTICS

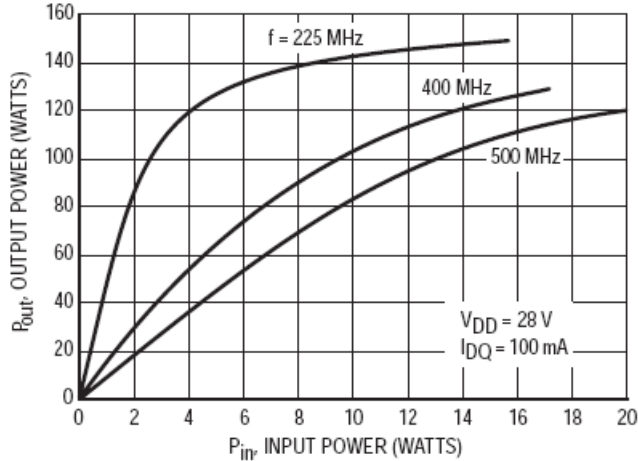


Figure 2. Output Power versus Input Power

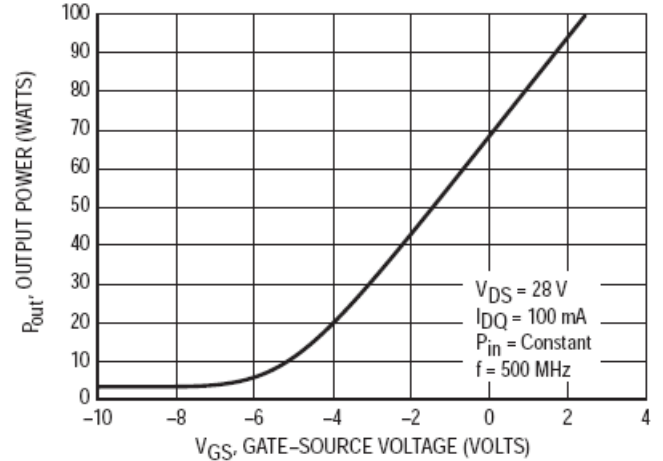


Figure 3. Output Power versus Gate Voltage

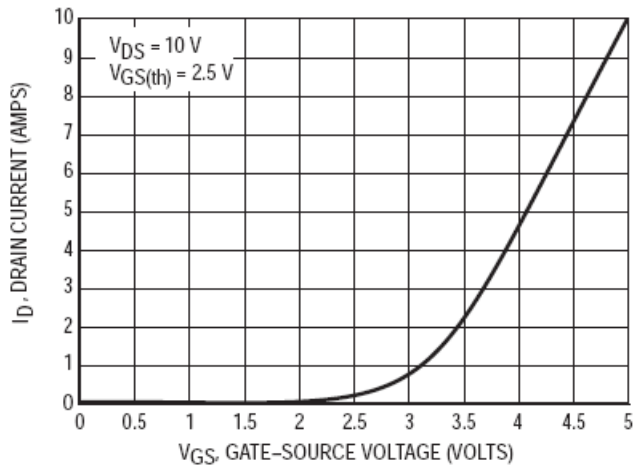


Figure 4. Drain Current versus Gate Voltage (Transfer Characteristics)

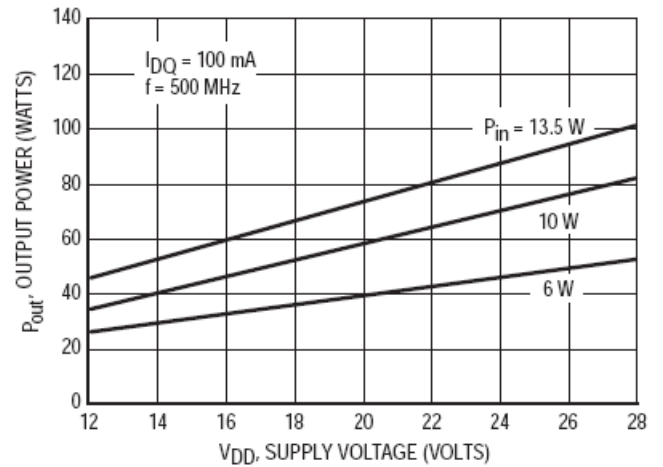


Figure 5. Output Power versus Supply Voltage

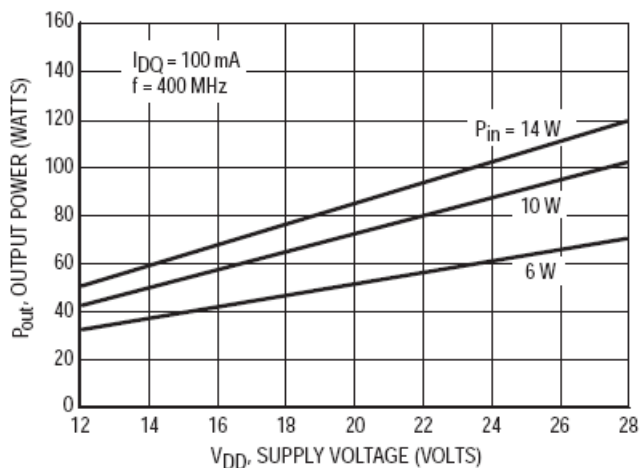


Figure 6. Output Power versus Supply Voltage

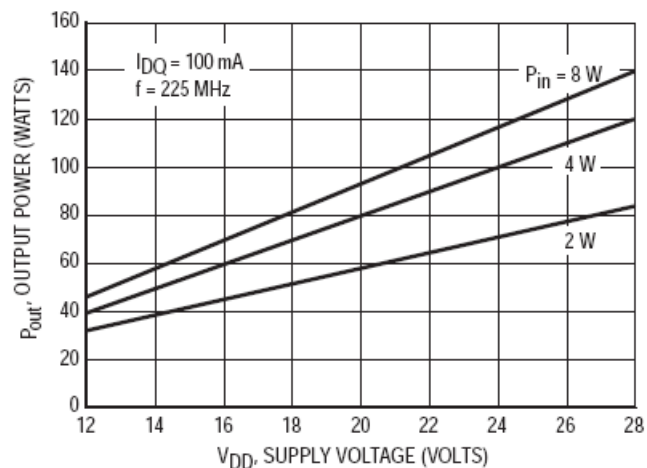


Figure 7. Output Power versus Supply Voltage

TYPICAL CHARACTERISTICS

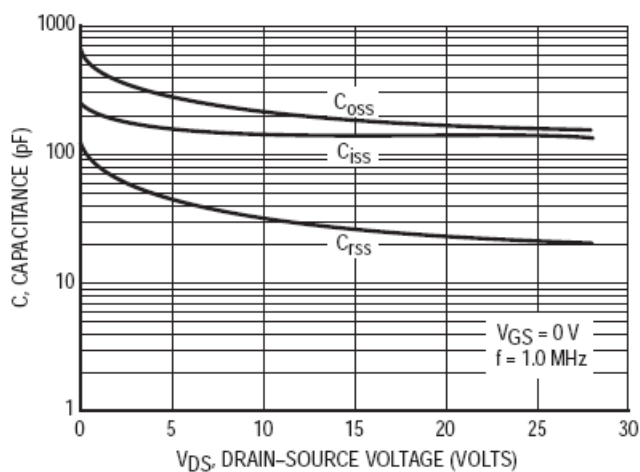


Figure 8. Capacitance versus Drain-Source Voltage

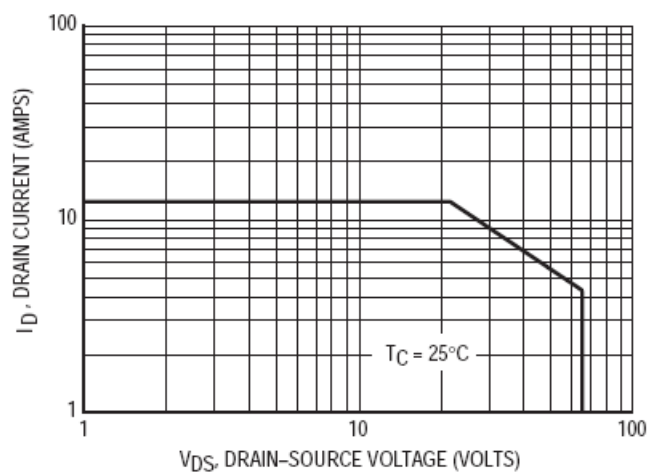
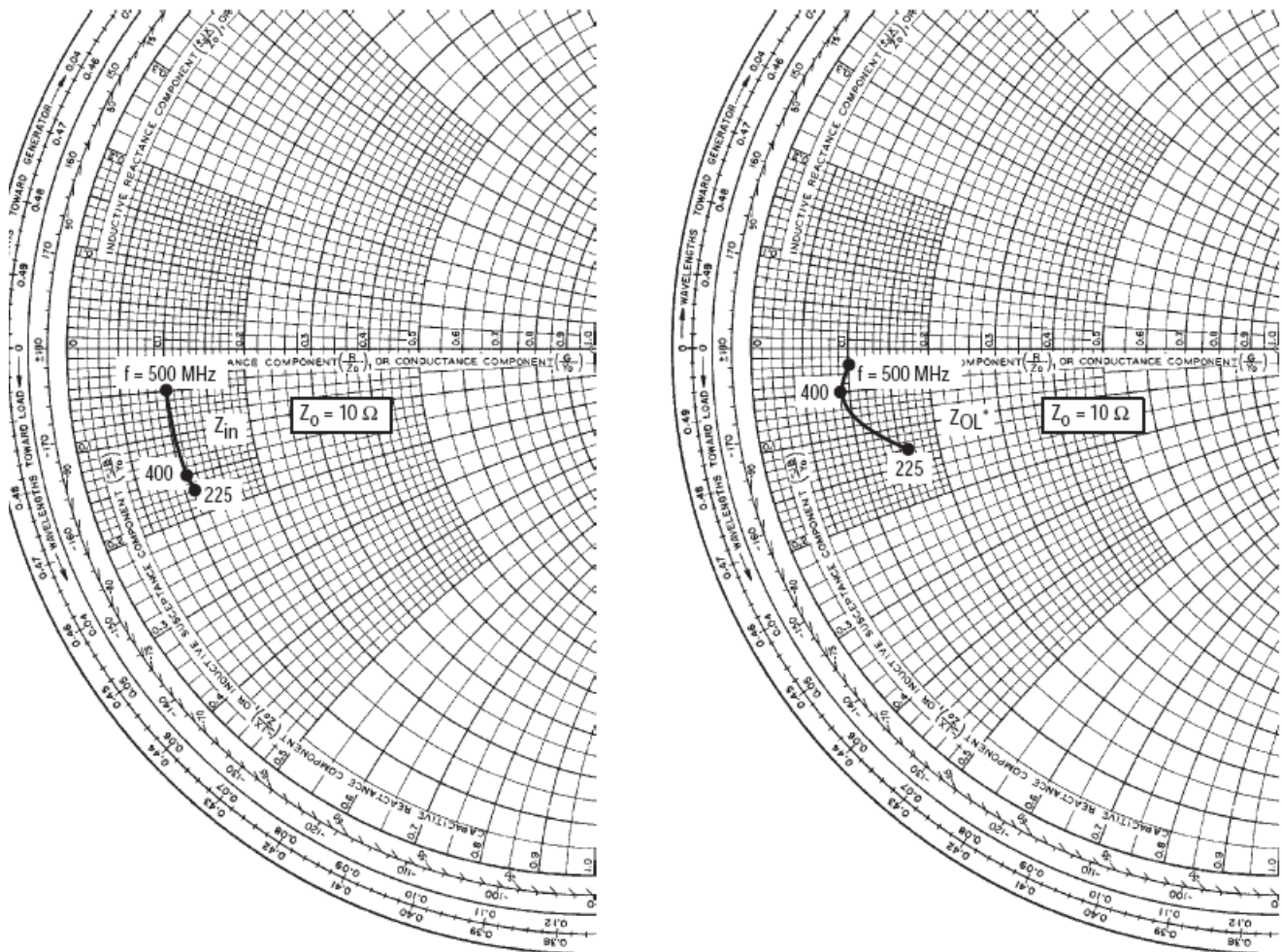


Figure 9. DC Safe Operating Area



$V_{DD} = 28\text{ V}$, $I_{DQ} = 100\text{ mA}$, $P_{out} = 100\text{ W}$

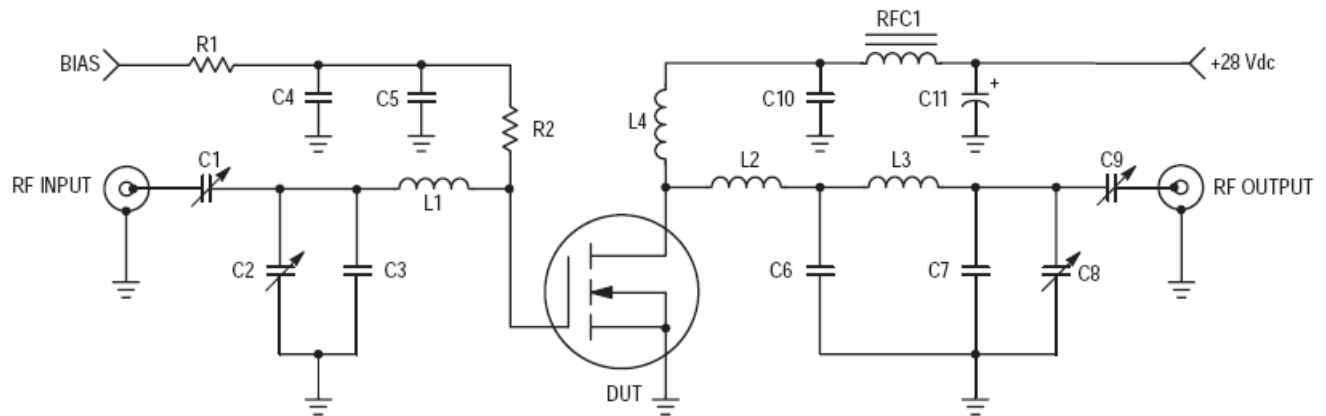
| f (MHz) | Z_{in} Ohms |
|---------|---------------|
| 225 | $1.1 - j1.7$ |
| 400 | $1.08 - j1.5$ |
| 500 | $1.0 - j0.5$ |

$V_{DD} = 28\text{ V}$, $I_{DQ} = 100\text{ mA}$, $P_{out} = 100\text{ W}$

| f (MHz) | Z_{OL}^* Ohms |
|---------|-----------------|
| 225 | $1.6 - j1.3$ |
| 400 | $0.9 - j0.5$ |
| 500 | $1.0 - j0.2$ |

Z_{OL}^* = Conjugate of the optimum load impedance into which the device operates at a given output power, voltage and frequency.

Figure 10. Series Equivalent Input/Output Impedance



| | | | | | |
|------------|---|----|------------------------------------|------|----------------------------|
| C1, C2, C8 | Arco 463 or Equivalent | L1 | Hairpin Inductor #18 Wire | L3 | Hairpin Inductor #16 Wire |
| C3, C7 | 25 pF, Unelco Capacitor | | | | |
| C4 | 1000 pF, Chip Capacitor | | | | |
| C5 | 0.01 μ F, Chip Capacitor | | | | |
| C6 | 250 pF, Unelco Capacitor | | | | |
| C9 | Arco 462 or Equivalent | | | | |
| C10 | 1000 pF, ATC Chip Capacitor | | | | |
| C11 | 10 μ F, 100 V, Electrolytic Capacitor | L2 | Stripline Inductor 0.200" x 0.500" | L4 | 2 Turns #16 Wire, 5/16" ID |
| | | | | RFC1 | VK200-4B |
| | | | | R1 | 1.0 k, 1/4 W Resistor |
| | | | | R2 | 100 Ω Resistor |

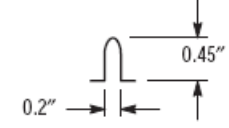
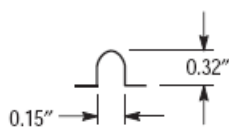
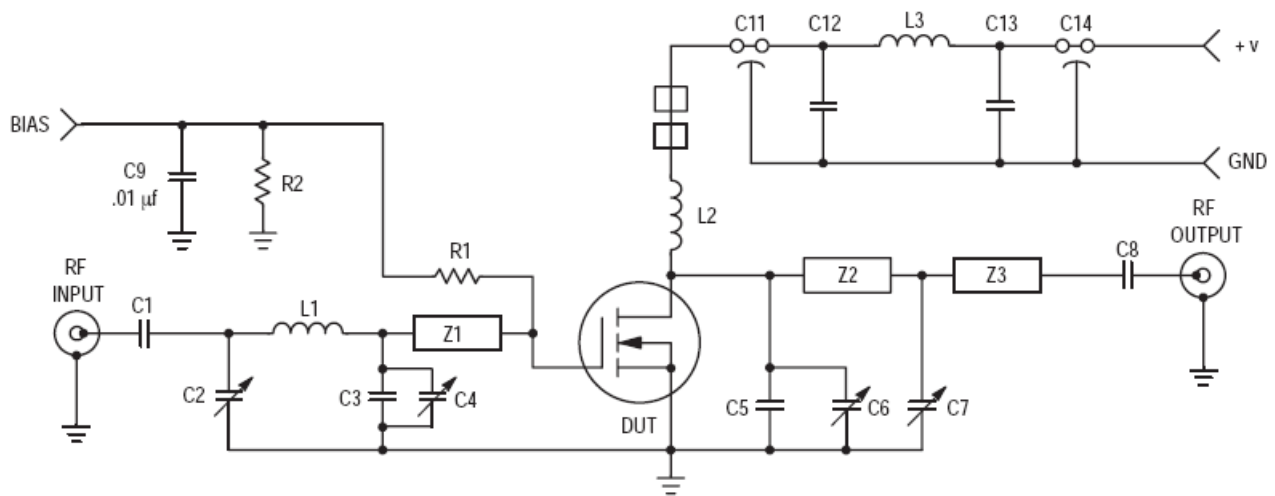


Figure 11. 225 MHz Test Circuit



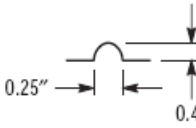
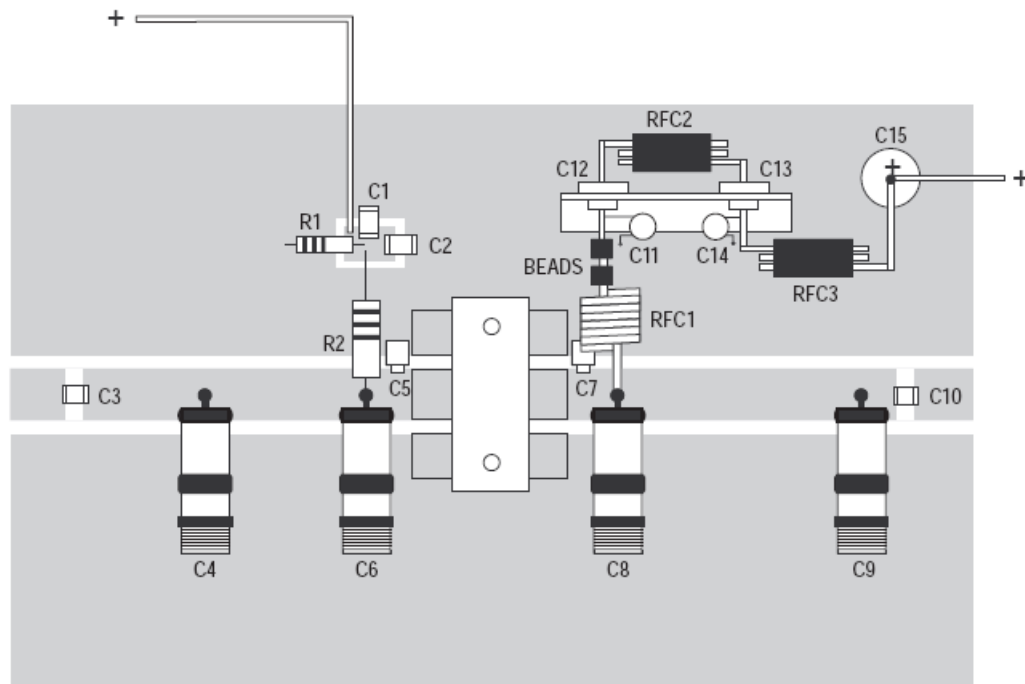
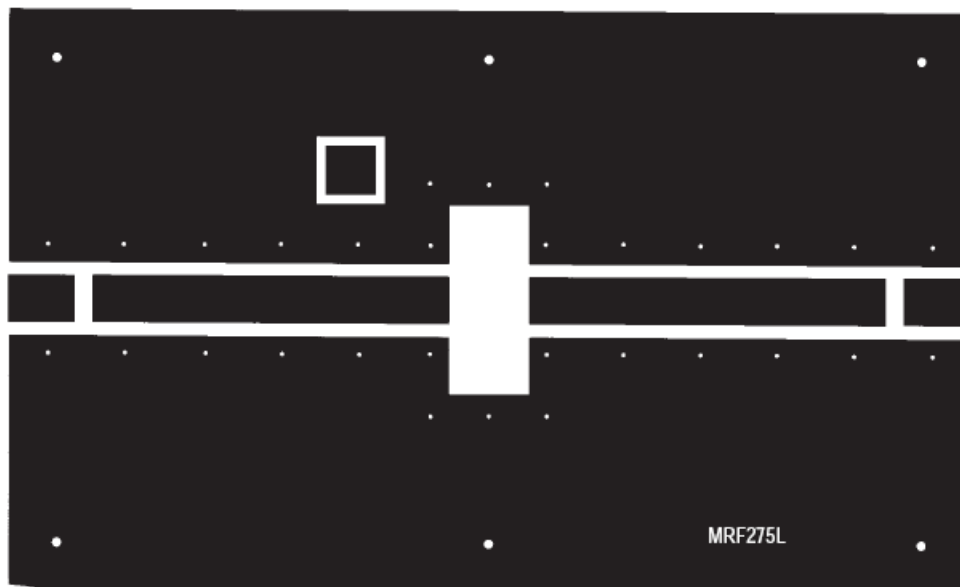
| | | | | | |
|----------------|------------------------------|----|---|----------------|--|
| C1, C8 | 270 pF, ATC Chip Capacitor | L1 | Hairpin Inductor #18 Wire | R1 | 10 k, 1/4 W Resistor |
| C2, C4, C6, C7 | 1.0–20 pF, Trimmer Capacitor | |  | R2 | 1 k, 1/4 W Resistor |
| C3 | 15 pF, Mini Unelco Capacitor | L2 | 12 Turns #18 Wire, 0.450" ID | R3 | 1.5 k, 1/4 W Resistor |
| C5 | 47 pF, Mini Unelco Capacitor | L3 | Ferroxcube VK200 20/4B | Z1 | 0.950" x 0.250", Microstrip Line |
| C9, C12 | 0.1 μF, Ceramic Capacitor | | | Z2 | 1.25" x 0.250", Microstrip Line |
| C11, C14 | 680 pF, Feed Thru Capacitor | | | Z3 | 0.300" x 0.250", Microstrip Line |
| C13 | 50 μF, Tantalum Capacitor | | | Board Material | 0.062" Teflon®, Fiberglass, 1 oz. Copper, Clad Both Sides, $\epsilon_r = 2.56$ |

Figure 12. 400 MHz Test Circuit



(Not to Scale)

Figure 13. MRF275L Component Location (500 MHz)



(Scale 1:1)

Figure 14. MRF275L Test Circuit Photomaster
(Reduced 18% in printed data book, DL110/D)

Table 1. Common Source S-Parameters ($V_{DS} = 12.5\text{ V}$, $I_D = 4.5\text{ A}$)

| f MHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|----------|-----------------|------|-----------------|----|-----------------|----|-----------------|------|
| | S ₁₁ | φ | S ₂₁ | φ | S ₁₂ | φ | S ₂₂ | φ |
| 30 | 0.936 | -176 | 6.22 | 87 | 0.010 | 21 | 0.944 | -179 |
| 40 | 0.938 | -178 | 4.28 | 87 | 0.010 | 24 | 0.930 | -177 |
| 50 | 0.937 | -178 | 3.65 | 83 | 0.010 | 29 | 0.922 | 179 |
| 60 | 0.937 | -179 | 2.99 | 83 | 0.011 | 34 | 0.920 | 179 |
| 70 | 0.938 | -179 | 2.54 | 81 | 0.011 | 39 | 0.917 | 179 |
| 80 | 0.938 | -179 | 2.18 | 80 | 0.012 | 42 | 0.913 | 179 |
| 90 | 0.939 | -180 | 1.94 | 78 | 0.012 | 44 | 0.909 | 180 |
| 100 | 0.939 | -180 | 1.77 | 77 | 0.013 | 47 | 0.913 | -180 |
| 110 | 0.939 | 180 | 1.57 | 77 | 0.015 | 50 | 0.916 | -179 |
| 120 | 0.940 | 180 | 1.45 | 74 | 0.015 | 54 | 0.914 | 179 |
| 130 | 0.940 | 179 | 1.34 | 75 | 0.016 | 57 | 0.935 | 180 |
| 140 | 0.940 | 179 | 1.26 | 72 | 0.016 | 58 | 0.943 | 180 |
| 150 | 0.940 | 179 | 1.19 | 71 | 0.017 | 57 | 0.951 | 178 |
| 160 | 0.941 | 179 | 1.09 | 70 | 0.019 | 58 | 0.943 | 179 |
| 170 | 0.941 | 179 | 1.01 | 69 | 0.019 | 62 | 0.940 | 180 |
| 180 | 0.941 | 179 | 0.956 | 68 | 0.021 | 64 | 0.948 | 179 |
| 190 | 0.941 | 178 | 0.912 | 67 | 0.022 | 65 | 0.957 | 180 |
| 200 | 0.942 | 178 | 0.860 | 65 | 0.022 | 65 | 0.941 | 178 |
| 210 | 0.942 | 178 | 0.816 | 64 | 0.023 | 65 | 0.931 | 178 |
| 220 | 0.943 | 178 | 0.779 | 63 | 0.025 | 66 | 0.922 | 178 |
| 230 | 0.943 | 177 | 0.717 | 60 | 0.027 | 67 | 0.965 | 177 |
| 240 | 0.943 | 177 | 0.709 | 61 | 0.026 | 68 | 0.927 | 176 |
| 250 | 0.944 | 177 | 0.674 | 60 | 0.026 | 70 | 0.924 | 178 |
| 260 | 0.944 | 177 | 0.645 | 58 | 0.028 | 69 | 0.930 | 179 |
| 270 | 0.944 | 177 | 0.627 | 57 | 0.030 | 70 | 0.933 | 178 |
| 280 | 0.945 | 176 | 0.608 | 58 | 0.032 | 70 | 0.940 | 177 |
| 290 | 0.946 | 176 | 0.580 | 54 | 0.031 | 71 | 0.941 | 175 |
| 300 | 0.946 | 176 | 0.569 | 56 | 0.033 | 71 | 0.945 | 176 |
| 310 | 0.946 | 176 | 0.539 | 55 | 0.033 | 72 | 0.953 | 178 |
| 320 | 0.947 | 175 | 0.512 | 54 | 0.035 | 71 | 0.952 | 177 |
| 330 | 0.948 | 175 | 0.483 | 51 | 0.037 | 72 | 0.927 | 176 |
| 340 | 0.947 | 175 | 0.477 | 52 | 0.038 | 72 | 0.921 | 176 |
| 350 | 0.947 | 175 | 0.466 | 51 | 0.039 | 75 | 0.929 | 178 |
| 360 | 0.947 | 175 | 0.459 | 51 | 0.040 | 73 | 0.963 | 177 |
| 370 | 0.948 | 174 | 0.441 | 50 | 0.043 | 71 | 0.968 | 175 |
| 380 | 0.949 | 174 | 0.428 | 49 | 0.044 | 72 | 0.937 | 175 |
| 390 | 0.949 | 174 | 0.417 | 49 | 0.045 | 74 | 0.907 | 176 |
| 400 | 0.949 | 174 | 0.409 | 47 | 0.044 | 77 | 0.912 | 177 |
| 410 | 0.950 | 173 | 0.390 | 46 | 0.046 | 74 | 0.962 | 175 |
| 420 | 0.950 | 173 | 0.377 | 45 | 0.047 | 71 | 0.971 | 174 |
| 430 | 0.950 | 173 | 0.369 | 45 | 0.050 | 72 | 0.948 | 176 |
| 440 | 0.951 | 173 | 0.368 | 47 | 0.052 | 74 | 0.953 | 176 |

Table 1. Common Source S-Parameters ($V_{DS} = 12.5\text{ V}$, $I_D = 4.5\text{ A}$) (continued)

| f MHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|----------|-----------------|-----|-----------------|----|-----------------|----|-----------------|-----|
| | S ₁₁ | φ | S ₂₁ | φ | S ₁₂ | φ | S ₂₂ | φ |
| 450 | 0.951 | 172 | 0.371 | 42 | 0.053 | 76 | 0.943 | 175 |
| 460 | 0.952 | 172 | 0.347 | 44 | 0.053 | 72 | 0.965 | 172 |
| 470 | 0.952 | 172 | 0.331 | 43 | 0.053 | 71 | 0.933 | 173 |
| 480 | 0.953 | 172 | 0.323 | 43 | 0.056 | 71 | 0.936 | 173 |
| 490 | 0.953 | 171 | 0.317 | 41 | 0.059 | 72 | 0.965 | 173 |
| 500 | 0.954 | 171 | 0.306 | 41 | 0.061 | 74 | 0.963 | 173 |
| 600 | 0.957 | 168 | 0.267 | 35 | 0.069 | 77 | 0.941 | 171 |
| 700 | 0.965 | 165 | 0.224 | 35 | 0.090 | 70 | 0.958 | 169 |
| 800 | 0.967 | 160 | 0.219 | 32 | 0.099 | 67 | 0.937 | 164 |
| 900 | 0.980 | 156 | 0.214 | 33 | 0.114 | 69 | 0.943 | 164 |
| 1000 | 0.986 | 151 | 0.218 | 34 | 0.146 | 67 | 0.955 | 162 |

Table 2. Common Source S-Parameters ($V_{DS} = 24\text{ V}$, $I_D = 4.5\text{ A}$)

| f MHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|----------|-----------------|------|-----------------|----|-----------------|----|-----------------|------|
| | S ₁₁ | φ | S ₂₁ | φ | S ₁₂ | φ | S ₂₂ | φ |
| 30 | 0.914 | -174 | 9.08 | 87 | 0.011 | 19 | 0.882 | -178 |
| 40 | 0.918 | -176 | 6.29 | 86 | 0.011 | 22 | 0.876 | -176 |
| 50 | 0.918 | -177 | 5.31 | 82 | 0.011 | 26 | 0.871 | 180 |
| 60 | 0.917 | -177 | 4.35 | 82 | 0.012 | 29 | 0.871 | -179 |
| 70 | 0.919 | -178 | 3.70 | 79 | 0.012 | 32 | 0.865 | -179 |
| 80 | 0.919 | -178 | 3.16 | 77 | 0.013 | 37 | 0.857 | -179 |
| 90 | 0.920 | -179 | 2.81 | 75 | 0.013 | 42 | 0.851 | -180 |
| 100 | 0.921 | -179 | 2.55 | 74 | 0.014 | 46 | 0.863 | -179 |
| 110 | 0.922 | -179 | 2.27 | 73 | 0.014 | 47 | 0.876 | -178 |
| 120 | 0.923 | -179 | 2.08 | 70 | 0.015 | 49 | 0.867 | -179 |
| 130 | 0.923 | -180 | 1.92 | 70 | 0.016 | 51 | 0.880 | -178 |
| 140 | 0.924 | -180 | 1.78 | 67 | 0.017 | 55 | 0.880 | -179 |
| 150 | 0.925 | -180 | 1.68 | 65 | 0.018 | 58 | 0.904 | 179 |
| 160 | 0.926 | 180 | 1.53 | 64 | 0.018 | 60 | 0.901 | -180 |
| 170 | 0.927 | 180 | 1.42 | 62 | 0.018 | 61 | 0.900 | -179 |
| 180 | 0.928 | 180 | 1.34 | 62 | 0.020 | 61 | 0.901 | -179 |
| 190 | 0.929 | 179 | 1.28 | 60 | 0.021 | 63 | 0.906 | -179 |
| 200 | 0.930 | 179 | 1.19 | 58 | 0.022 | 65 | 0.892 | 179 |
| 210 | 0.931 | 179 | 1.12 | 56 | 0.022 | 67 | 0.902 | 178 |
| 220 | 0.932 | 179 | 1.06 | 55 | 0.023 | 68 | 0.903 | 179 |
| 230 | 0.933 | 179 | 0.988 | 53 | 0.024 | 67 | 0.931 | 179 |
| 240 | 0.934 | 178 | 0.960 | 53 | 0.025 | 69 | 0.889 | 179 |
| 250 | 0.934 | 178 | 0.910 | 52 | 0.026 | 73 | 0.877 | 180 |
| 260 | 0.935 | 178 | 0.866 | 50 | 0.026 | 74 | 0.895 | 180 |
| 270 | 0.936 | 178 | 0.838 | 49 | 0.027 | 74 | 0.908 | 180 |
| 280 | 0.937 | 177 | 0.803 | 49 | 0.029 | 71 | 0.923 | 179 |
| 290 | 0.939 | 177 | 0.766 | 46 | 0.030 | 72 | 0.915 | 177 |

Table 2. Common Source S-Parameters ($V_{DS} = 24\text{ V}$, $I_D = 4.5\text{ A}$) (continued)

| f MHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|----------|-----------------|-----|-----------------|----|-----------------|----|-----------------|------|
| | S ₁₁ | φ | S ₂₁ | φ | S ₁₂ | φ | S ₂₂ | φ |
| 300 | 0.939 | 177 | 0.744 | 46 | 0.032 | 76 | 0.907 | 178 |
| 310 | 0.939 | 177 | 0.702 | 46 | 0.032 | 81 | 0.908 | 180 |
| 320 | 0.940 | 176 | 0.660 | 45 | 0.031 | 81 | 0.913 | 178 |
| 330 | 0.941 | 176 | 0.623 | 41 | 0.031 | 75 | 0.909 | 177 |
| 340 | 0.942 | 176 | 0.613 | 42 | 0.035 | 71 | 0.910 | 178 |
| 350 | 0.943 | 176 | 0.599 | 41 | 0.039 | 78 | 0.905 | -180 |
| 360 | 0.943 | 175 | 0.585 | 41 | 0.040 | 83 | 0.913 | 179 |
| 370 | 0.943 | 175 | 0.556 | 39 | 0.037 | 85 | 0.924 | 176 |
| 380 | 0.944 | 175 | 0.534 | 38 | 0.035 | 80 | 0.922 | 175 |
| 390 | 0.944 | 175 | 0.512 | 38 | 0.037 | 73 | 0.907 | 176 |
| 400 | 0.946 | 174 | 0.503 | 37 | 0.043 | 76 | 0.906 | 179 |
| 410 | 0.948 | 174 | 0.482 | 36 | 0.049 | 81 | 0.944 | 177 |
| 420 | 0.948 | 174 | 0.464 | 35 | 0.047 | 87 | 0.940 | 176 |
| 430 | 0.947 | 174 | 0.450 | 36 | 0.040 | 88 | 0.912 | 176 |
| 440 | 0.947 | 173 | 0.440 | 36 | 0.039 | 79 | 0.947 | 176 |
| 450 | 0.948 | 173 | 0.445 | 32 | 0.047 | 73 | 0.944 | 177 |
| 460 | 0.951 | 173 | 0.414 | 32 | 0.057 | 75 | 0.959 | 174 |
| 470 | 0.952 | 173 | 0.397 | 32 | 0.057 | 86 | 0.913 | 176 |
| 480 | 0.951 | 172 | 0.387 | 33 | 0.050 | 95 | 0.908 | 175 |
| 490 | 0.950 | 172 | 0.376 | 31 | 0.042 | 90 | 0.941 | 174 |
| 500 | 0.950 | 172 | 0.361 | 31 | 0.044 | 74 | 0.963 | 175 |
| 600 | 0.957 | 168 | 0.287 | 24 | 0.073 | 75 | 0.932 | 172 |
| 700 | 0.965 | 164 | 0.231 | 24 | 0.091 | 70 | 0.952 | 169 |
| 800 | 0.966 | 160 | 0.216 | 23 | 0.091 | 67 | 0.928 | 163 |
| 900 | 0.979 | 156 | 0.205 | 27 | 0.112 | 69 | 0.930 | 164 |
| 1000 | 0.981 | 150 | 0.206 | 29 | 0.146 | 58 | 0.947 | 162 |

Table 3. Common Source S-Parameters ($V_{DS} = 28\text{ V}$, $I_D = 4.5\text{ A}$)

| f MHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|----------|-----------------|------|-----------------|----|-----------------|----|-----------------|------|
| | S ₁₁ | φ | S ₂₁ | φ | S ₁₂ | φ | S ₂₂ | φ |
| 30 | 0.910 | -173 | 9.76 | 87 | 0.011 | 17 | 0.872 | -177 |
| 40 | 0.913 | -175 | 6.73 | 86 | 0.011 | 17 | 0.860 | -174 |
| 50 | 0.913 | -176 | 5.69 | 81 | 0.011 | 21 | 0.849 | -179 |
| 60 | 0.913 | -177 | 4.66 | 81 | 0.012 | 26 | 0.846 | -178 |
| 70 | 0.915 | -177 | 3.97 | 78 | 0.012 | 31 | 0.853 | -179 |
| 80 | 0.916 | -178 | 3.39 | 76 | 0.012 | 33 | 0.858 | -178 |
| 90 | 0.916 | -178 | 3.01 | 74 | 0.012 | 34 | 0.853 | -178 |
| 100 | 0.917 | -178 | 2.73 | 73 | 0.013 | 36 | 0.851 | -177 |
| 110 | 0.918 | -179 | 2.42 | 72 | 0.014 | 41 | 0.849 | -177 |
| 120 | 0.919 | -179 | 2.22 | 68 | 0.014 | 48 | 0.853 | -178 |
| 130 | 0.920 | -179 | 2.05 | 68 | 0.014 | 52 | 0.879 | -178 |
| 140 | 0.921 | -179 | 1.90 | 66 | 0.014 | 52 | 0.894 | -178 |
| 150 | 0.922 | -180 | 1.79 | 64 | 0.015 | 51 | 0.898 | -178 |

Table 3. Common Source S-Parameters ($V_{DS} = 28\text{ V}$, $I_D = 4.5\text{ A}$) (continued)

| f MHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|----------|-----------------|------|-----------------|----|-----------------|----|-----------------|------|
| | S ₁₁ | φ | S ₂₁ | φ | S ₁₂ | φ | S ₂₂ | φ |
| 160 | 0.923 | -180 | 1.63 | 63 | 0.016 | 53 | 0.880 | -177 |
| 170 | 0.924 | -180 | 1.50 | 61 | 0.017 | 58 | 0.890 | -178 |
| 180 | 0.925 | 180 | 1.42 | 60 | 0.019 | 62 | 0.904 | -178 |
| 190 | 0.926 | 180 | 1.35 | 58 | 0.019 | 64 | 0.922 | -179 |
| 200 | 0.928 | 179 | 1.26 | 56 | 0.019 | 63 | 0.914 | -179 |
| 210 | 0.929 | 179 | 1.19 | 54 | 0.020 | 62 | 0.897 | -179 |
| 220 | 0.930 | 179 | 1.12 | 53 | 0.022 | 64 | 0.881 | -179 |
| 230 | 0.932 | 179 | 1.04 | 51 | 0.024 | 67 | 0.907 | 180 |
| 240 | 0.932 | 179 | 1.01 | 51 | 0.024 | 69 | 0.892 | 179 |
| 250 | 0.933 | 178 | 0.955 | 49 | 0.024 | 70 | 0.910 | -180 |
| 260 | 0.934 | 178 | 0.912 | 47 | 0.025 | 70 | 0.912 | -178 |
| 270 | 0.936 | 178 | 0.882 | 46 | 0.027 | 71 | 0.904 | -178 |
| 280 | 0.936 | 178 | 0.842 | 46 | 0.029 | 72 | 0.901 | -180 |
| 290 | 0.938 | 177 | 0.798 | 43 | 0.028 | 71 | 0.920 | 177 |
| 300 | 0.939 | 177 | 0.770 | 44 | 0.030 | 71 | 0.930 | 178 |
| 310 | 0.939 | 177 | 0.731 | 43 | 0.032 | 72 | 0.934 | -179 |
| 320 | 0.941 | 177 | 0.690 | 42 | 0.035 | 74 | 0.939 | -180 |
| 330 | 0.942 | 176 | 0.655 | 39 | 0.036 | 76 | 0.895 | 180 |
| 340 | 0.942 | 176 | 0.639 | 40 | 0.035 | 75 | 0.892 | 179 |
| 350 | 0.942 | 176 | 0.613 | 39 | 0.036 | 75 | 0.906 | -180 |
| 360 | 0.943 | 175 | 0.601 | 38 | 0.040 | 71 | 0.945 | 179 |
| 370 | 0.945 | 175 | 0.577 | 36 | 0.045 | 71 | 0.960 | 178 |
| 380 | 0.946 | 175 | 0.555 | 35 | 0.047 | 74 | 0.928 | 178 |
| 390 | 0.947 | 175 | 0.531 | 35 | 0.045 | 79 | 0.893 | 178 |
| 400 | 0.946 | 174 | 0.518 | 34 | 0.042 | 80 | 0.892 | 179 |
| 410 | 0.947 | 174 | 0.492 | 33 | 0.044 | 72 | 0.948 | 176 |
| 420 | 0.948 | 174 | 0.472 | 32 | 0.049 | 67 | 0.960 | 176 |
| 430 | 0.950 | 173 | 0.462 | 32 | 0.056 | 71 | 0.936 | 179 |
| 440 | 0.951 | 173 | 0.455 | 32 | 0.058 | 78 | 0.945 | 179 |
| 450 | 0.951 | 173 | 0.460 | 30 | 0.054 | 82 | 0.920 | 177 |
| 460 | 0.950 | 173 | 0.424 | 30 | 0.050 | 73 | 0.951 | 173 |
| 470 | 0.950 | 172 | 0.400 | 29 | 0.053 | 65 | 0.937 | 174 |
| 480 | 0.952 | 172 | 0.389 | 29 | 0.063 | 65 | 0.941 | 175 |
| 490 | 0.954 | 172 | 0.382 | 27 | 0.071 | 72 | 0.960 | 175 |
| 500 | 0.955 | 172 | 0.367 | 27 | 0.069 | 80 | 0.954 | 176 |
| 600 | 0.958 | 168 | 0.284 | 22 | 0.071 | 80 | 0.935 | 172 |
| 700 | 0.967 | 164 | 0.226 | 22 | 0.088 | 71 | 0.950 | 169 |
| 800 | 0.967 | 160 | 0.211 | 22 | 0.096 | 67 | 0.929 | 164 |
| 900 | 0.979 | 156 | 0.197 | 26 | 0.116 | 69 | 0.929 | 165 |
| 1000 | 0.978 | 150 | 0.200 | 29 | 0.139 | 67 | 0.944 | 163 |

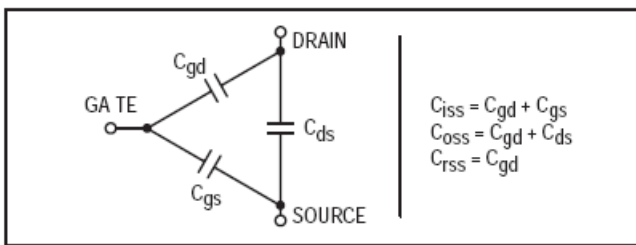
RF POWER MOSFET CONSIDERATIONS

MOSFET CAPACITANCES

The physical structure of a MOSFET results in capacitors between the terminals. The metal oxide gate structure determines the capacitors from gate-to-drain (C_{gd}), and gate-to-source (C_{gs}). The PN junction formed during the fabrication of the MOSFET results in a junction capacitance from drain-to-source (C_{ds}).

These capacitances are characterized as input (C_{iss}), output (C_{oss}) and reverse transfer (C_{rss}) capacitances on datasheets. The relationships between the inter-terminal capacitances and those given on data sheets are shown below. The C_{iss} can be specified in two ways:

1. Drain shorted to source and positive voltage at the gate.
2. Positive voltage of the drain in respect to source and zero volts at the gate. In the latter case the numbers are lower. However, neither method represents the actual operating conditions in RF applications.



DRAIN CHARACTERISTICS

One figure of merit for a FET is its static resistance in the full-on condition. This on-resistance, $V_{DS(on)}$, occurs in the linear region of the output characteristic and is specified under specific test conditions for gate-source voltage and drain current. For MOSFETs, $V_{DS(on)}$ has a positive temperature coefficient and constitutes an important design consideration at high temperatures, because it contributes to the power dissipation within the device.

GATE CHARACTERISTICS

The gate of the MOSFET is a polysilicon material, and is electrically isolated from the source by a layer of oxide. The input resistance is very high — on the order of 109 ohms — resulting in a leakage current of a few nanoamperes. Gate control is achieved by applying a positive voltage slightly in excess of the gate-to-source threshold voltage, $V_{GS(th)}$.

Gate Voltage Rating — Never exceed the gate voltage rating (or any of the maximum ratings on the front page). Exceeding the rated VGS can result in permanent damage to the oxide layer in the gate region.

Gate Termination — The gates of this device are essentially capacitors. Circuits that leave the gate open-circuited or floating should be avoided. These conditions can result in turn-on of the devices due to voltage build-up on the input capacitor due to leakage currents or pickup.

Gate Protection — These devices do not have an internal monolithic zener diode from gate-to-source. If gate protection is required, an external zener diode is recommended. Using a resistor to keep the gate-to-source impedance low also helps damp transients and serves another important function. Voltage transients on the drain can be coupled to the gate through the parasitic gate-drain capacitance. If the gate-to-source impedance and the rate of voltage change on the drain are both high, then the signal coupled to the gate may be large enough to exceed the gate-threshold voltage and turn the device on.

HANDLING CONSIDERATIONS

When shipping, the devices should be transported only in antistatic bags or conductive foam. Upon removal from the packaging, careful handling procedures should be adhered to. Those handling the devices should wear grounding straps and devices not in the antistatic packaging should be kept in metal tote bins. MOSFETs should be handled by the case and not by the leads, and when testing the device, all leads should make good electrical contact before voltage is applied. As a final note, when placing the FET into the system it is designed for, soldering should be done with grounded equipment.

DESIGN CONSIDERATIONS

The MRF275L is a RF power N-channel enhancement mode field-effect transistor (FETs) designed for HF, VHF and UHF power amplifier applications. M/A-COM RF MOSFETs feature a vertical structure with a planar design. M/A-COM Application Note AN211A, FETs in Theory and Practice, is suggested reading for those not familiar with the construction and characteristics of FETs. The major advantages of RF power FETs include high gain, low noise, simple bias systems, relative immunity from thermal runaway, and the ability to withstand severely mismatched loads without suffering damage. Power output can be varied over a wide range with a low power dc control signal.

DC BIAS

The MRF275L is an enhancement mode FET and, therefore, does not conduct when drain voltage is applied. Drain current flows when a positive voltage is applied to the gate. RF power FETs require forward bias for

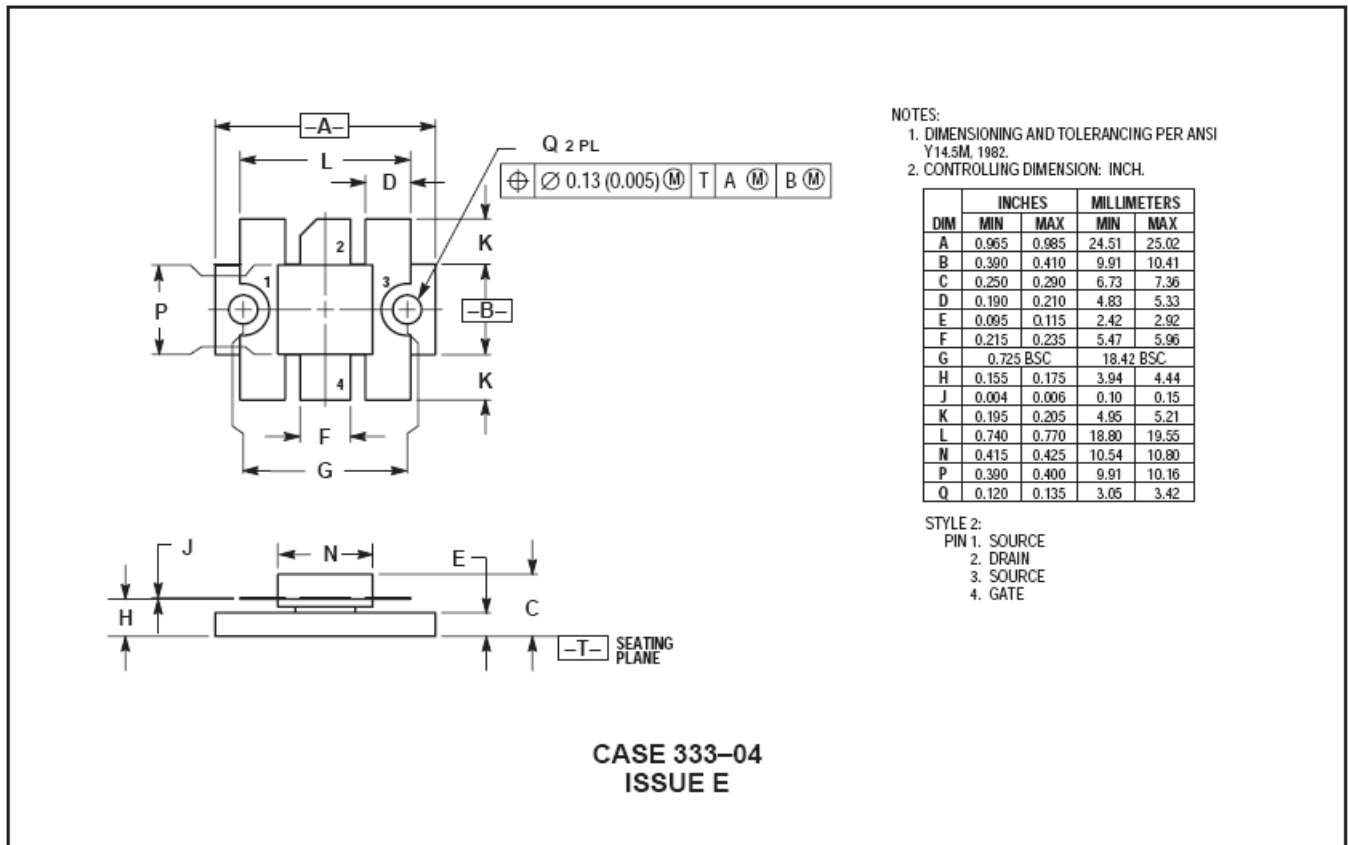
optimum performance. The value of quiescent drain current (I_{DQ}) is not critical for many applications. The MRF275L was characterized at $I_{DQ} = 100$ mA, each side, which is the suggested minimum value of I_{DQ} . For special applications such as linear amplification, I_{DQ} may have to be selected to optimize the critical parameters. The gate is a dc open circuit and draws no current. Therefore, the gate bias circuit may be just a simple resistive divider network. Some applications

may require a more elaborate bias system.

GAIN CONTROL

Power output of the MRF275L may be controlled from its rated value down to zero (negative gain) by varying the dc gate voltage. This feature facilitates the design of manual gain control, AGC/ALC and modulation systems.

PACKAGE DIMENSIONS



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