

## The RF MOSFET Line 100W, 400MHz, 28V

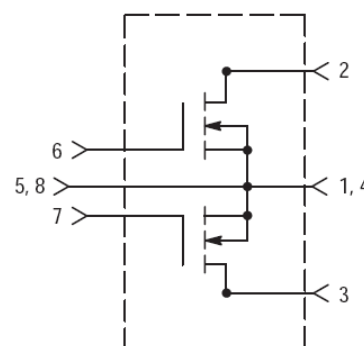
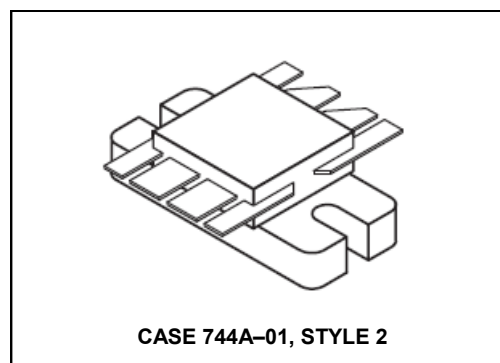
Rev. V1

Designed for broadband commercial and military applications up to 400 MHz frequency range. Primarily used as a driver or output amplifier in push-pull configurations. Can be used in manual gain control, ALC and modulation circuits.

N-Channel enhancement mode MOSFET

- Typical performance at 400 MHz, 28 V:  
Output power — 100 W  
Gain — 12 dB  
Efficiency — 60%
- Low thermal resistance
- Low Crss — 10 pF typ. @ VDS = 28 V
- Ruggedness tested at rated output power
- Nitride passivated die for enhanced reliability
- Excellent thermal stability; suited for Class A operation

### Product Image



### MAXIMUM RATINGS

| Rating   | Symbol    | Value           | Unit                         |
|--|-----------|-----------------|------------------------------|
| Drain-Source Voltage   | $V_{DS}$  | 65              | Vdc                          |
| Drain-Gate Voltage ( $R_{GS} = 1.0 \text{ M}\Omega$ )                                      | $V_{DGR}$ | 65              | Vdc                          |
| Gate-Source Voltage  | $V_{GS}$  | $\pm 40$        | Vdc                          |
| Drain Current — Continuous   | $I_D$     | 16              | Adc                          |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$ (1)<br>Derate above $25^\circ\text{C}$ | $P_D$     | 270<br>1.54     | Watts<br>W/ $^\circ\text{C}$ |
| Storage Temperature Range  | $T_{stg}$ | $-65$ to $+150$ | $^\circ\text{C}$             |
| Operating Temperature Range  | $T_J$     | 200             | $^\circ\text{C}$             |

### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max  | Unit               |
|--------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.65 | $^\circ\text{C/W}$ |

(1) Total device dissipation rating applies only when the device is operated as an RF push-pull amplifier.

**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, 400MHz, 28V**

Rev. V1

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

| Characteristic (1) | Symbol | Min | Typ | Max | Unit |
|--------------------|--------|-----|-----|-----|------|
|--------------------|--------|-----|-----|-----|------|

**OFF CHARACTERISTICS**

|  |               |    |   |     |                    |
|--|---------------|----|---|-----|--------------------|
| Drain-Source Breakdown Voltage<br>( $V_{GS} = 0$ , $I_D = 50$ mA)    | $V_{(BR)DSS}$ | 65 | — | —   | Vdc                |
| Zero Gate Voltage Drain Current<br>( $V_{DS} = 28$ V, $V_{GS} = 0$ ) | $I_{DSS}$     | —  | — | 2.0 | mA <sub>dc</sub>   |
| Gate-Source Leakage Current<br>( $V_{GS} = 20$ V, $V_{DS} = 0$ )     | $I_{GSS}$     | —  | — | 1.0 | $\mu\text{A}_{dc}$ |

**ON CHARACTERISTICS (1)**

|   |              |     |     |     |      |
|---|--------------|-----|-----|-----|------|
| Gate Threshold Voltage<br>( $V_{DS} = 10$ V, $I_D = 50$ mA)   | $V_{GS(th)}$ | 1.0 | 3.0 | 6.0 | Vdc  |
| Drain-Source On-Voltage<br>( $V_{GS} = 10$ V, $I_D = 3.0$ A)  | $V_{DS(on)}$ | —   | —   | 1.4 | Vdc  |
| Forward Transconductance<br>( $V_{DS} = 10$ V, $I_D = 2.0$ A) | $g_{fs}$     | 1.8 | 2.2 | —   | mhos |

**DYNAMIC CHARACTERISTICS (1)**

|  |           |   |     |   |    |
|--|-----------|---|-----|---|----|
| Input Capacitance<br>( $V_{DS} = 28$ V, $V_{GS} = 0$ , $f = 1.0$ MHz)            | $C_{iss}$ | — | 100 | — | pF |
| Output Capacitance<br>( $V_{DS} = 28$ V, $V_{GS} = 0$ , $f = 1.0$ MHz)           | $C_{oss}$ | — | 105 | — | pF |
| Reverse Transfer Capacitance<br>( $V_{DS} = 28$ V, $V_{GS} = 0$ , $f = 1.0$ MHz) | $C_{rss}$ | — | 10  | — | pF |

**FUNCTIONAL CHARACTERISTICS** (Figure 8) (2)

|   |          |  |    |   |    |
|---|----------|--|----|---|----|
| Common Source Power Gain<br>( $V_{DD} = 28$ Vdc, $P_{out} = 100$ W, $f = 400$ MHz, $I_{DQ} = 200$ mA)   | $G_{PS}$ | 10   | 12 | — | dB |
| Drain Efficiency<br>( $V_{DD} = 28$ Vdc, $P_{out} = 100$ W, $f = 400$ MHz, $I_{DQ} = 200$ mA)   | $\eta$   | 55   | 60 | — | %  |
| Electrical Ruggedness<br>( $V_{DD} = 28$ Vdc, $P_{out} = 100$ W, $f = 400$ MHz, $I_{DQ} = 200$ mA, Load VSWR = 30:1, All Phase Angles At Frequency of Test) | $\psi$   | No Degradation in Output Power Before & After Test |    |   |    |

(1) Note each transistor chip measured separately

(2) Both transistor chips operating in push-pull amplifier

## TYPICAL CHARACTERISTICS

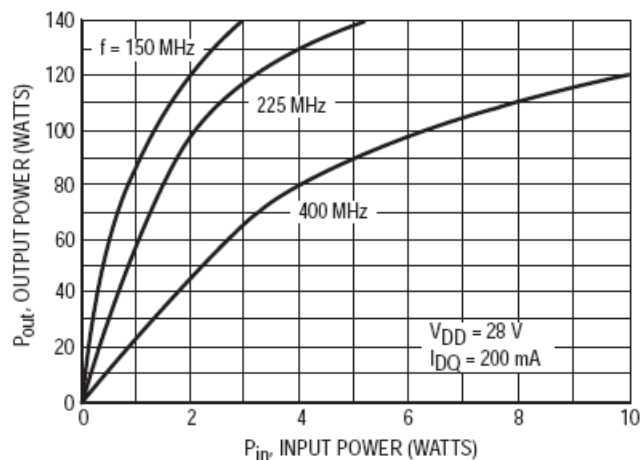


Figure 1. Output Power versus Input Power

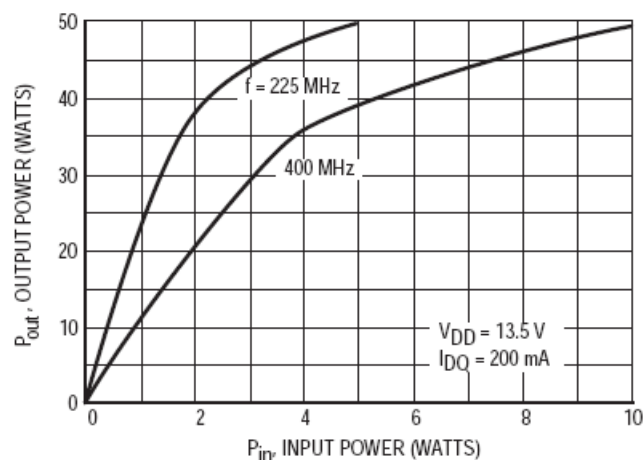


Figure 2. Output Power versus Input Power

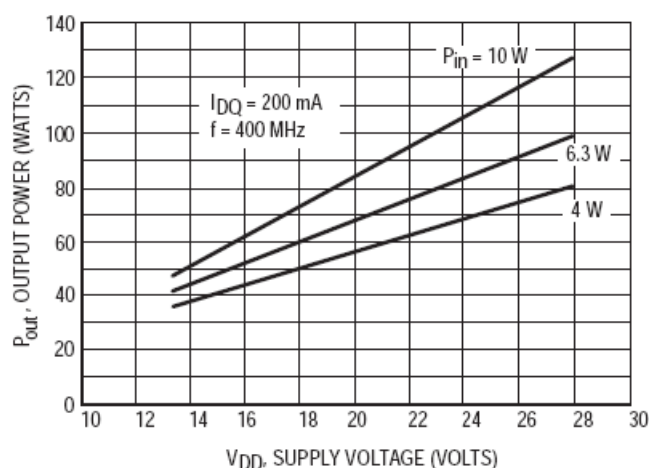


Figure 3. Output Power versus Supply Voltage

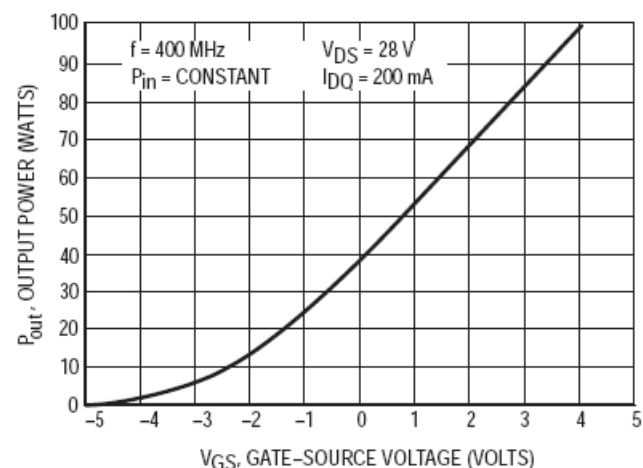


Figure 4. Output Power versus Gate Voltage

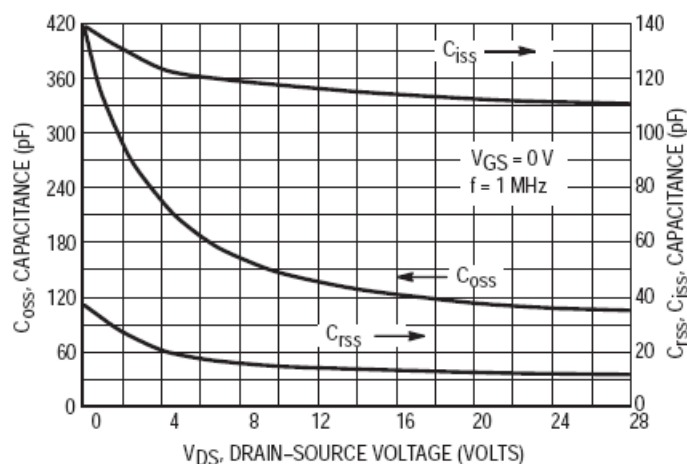


Figure 5. Capacitance versus Drain Voltage

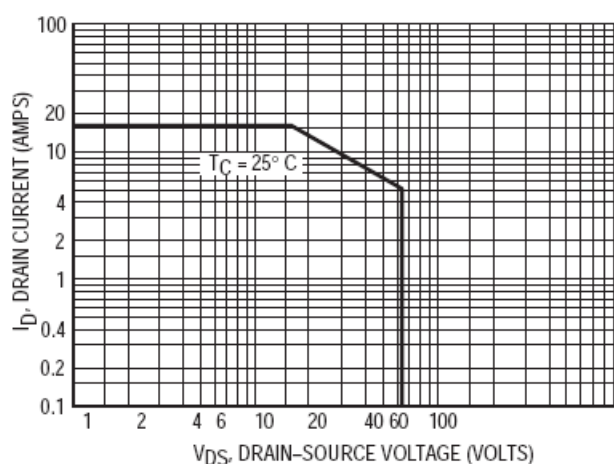
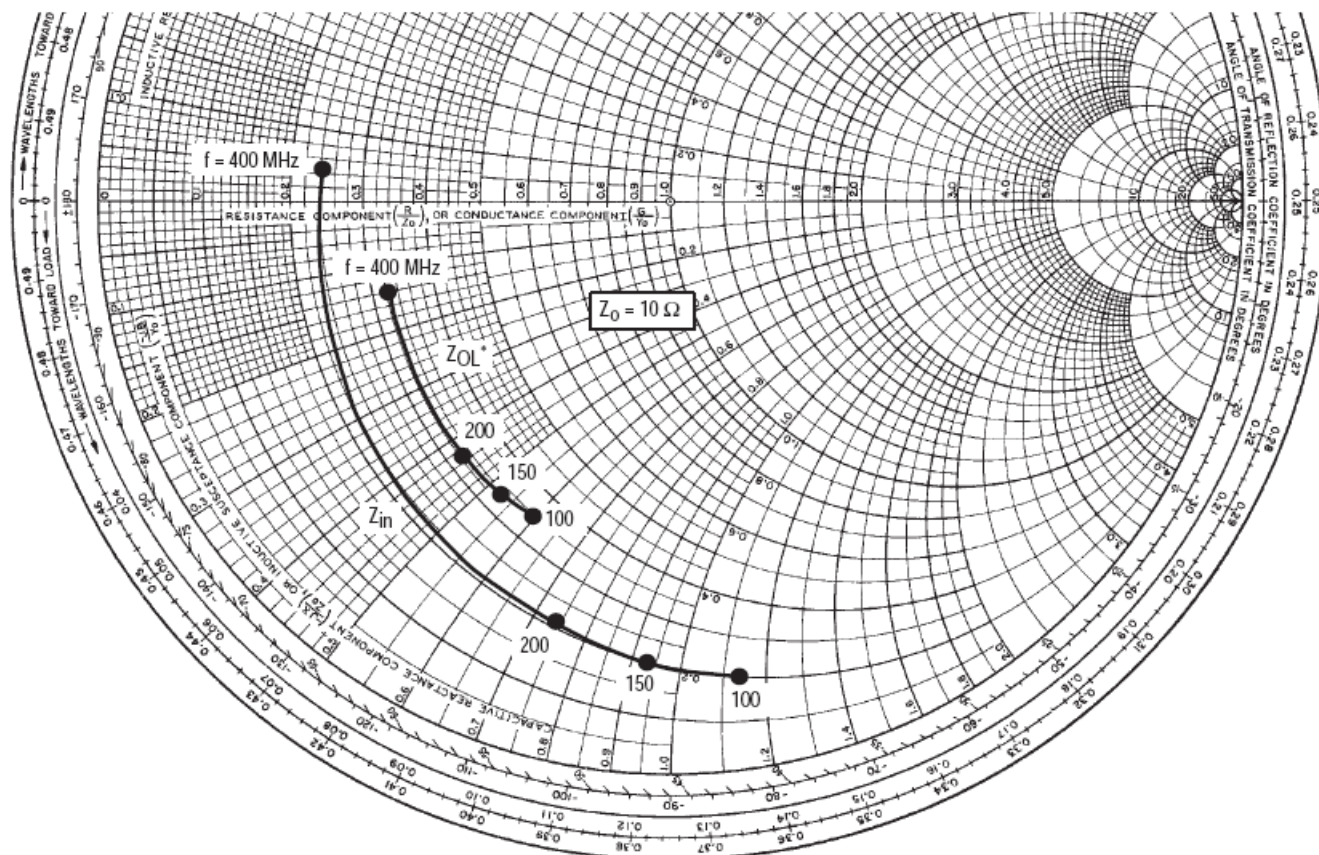


Figure 6. DC Safe Operating Area

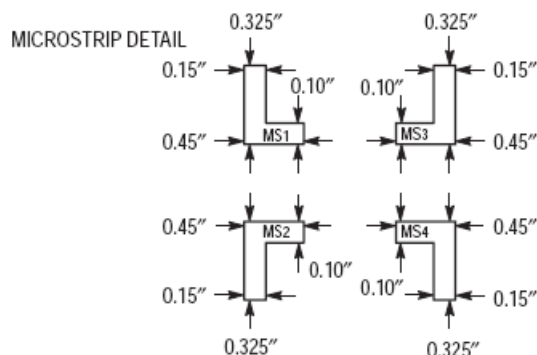
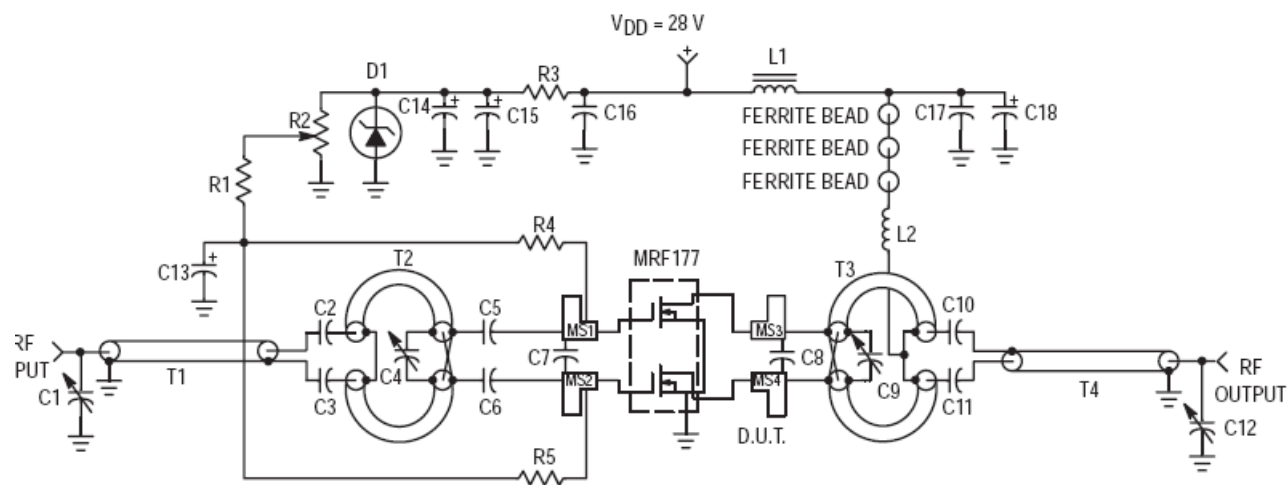


NOTE: Input and Output Impedance values given are measured gate-to-gate and drain-to-drain respectively.

| V <sub>DD</sub> = 28 V I <sub>DQ</sub> = 200 mA P <sub>out</sub> = 100 W |                      |                        |
|--|----------------------|------------------------|
| f (MHz)  | Z <sub>in</sub> Ohms | Z <sub>OL</sub> * Ohms |
| 100  | 2.0 - j11.5          | 3.5 - j6               |
| 150  | 2.05 - j9.45         | 3.35 - j5.34           |
| 200  | 2.1 - j7.5           | 3.3 - j4.4             |
| 400  | 2.35 + j0.4          | 3.2 - j1.38            |

Z<sub>OL</sub>\*: Conjugate of optimum load impedance into which the device operates at a given output power, voltage, current and frequency.

Figure 7. Impedance or Admittance Coordinates



|                          |                                |            |   |
|--------------------------|--------------------------------|------------|---|
| C1, C12                  | 1-10 pF JOHANSON OR EQUIVALENT | D1         | 1N5347B, 20 Vdc   |
| C2, C3, C5, C6, C10, C11 | 270 pF ATC 100 MIL CHIP CAP    | L1         | 1-TURN NO. 18, 0.25", 2-HOLE FERRITE BEAD   |
| C4, C9                   | 1-20 pF                        | L2         | 8-1/2 TURNS NO. 18, CLOSE WOUND .375" DIA.  |
| C7                       | 36 pF CHIP CAP                 | R1, R4, R5 | 10 k $\Omega$ @ 1/2 W RESISTOR  |
| C8                       | 10 pF CHIP CAP                 | R2         | 10 k $\Omega$ , 10 TURN RESISTOR  |
| C13, C14                 | 0.1 $\mu$ FD @ 50 Vdc          | R3         | 2.0 k $\Omega$ @ 1/2 W RESISTOR   |
| C15, C18                 | 10 $\mu$ FD @ 50 Vdc           | T1         | 1-1/2 T, 50 $\Omega$ COAX, .034" DIA. ON DUAL 0.5" FERRITE CORE                           |
| C16                      | 500 pF BUTTON                  | T2         | 2.0" 25 $\Omega$ COAX, .075" DIA.   |
| C17                      | 1000 pF UNCASSED MICA          | T3         | 2.1" 10 $\Omega$ COAX, .075" DIA.   |
|                          |                                | T4         | 4.0" 50 $\Omega$ COAX, .0865" DIA.  |
|                          |                                | BOARD      | Dielectric Thickness = 0.060" 2oz Copper, Cu-Clad, Teflon Fiberglass, $\epsilon_r = 2.55$ |

Figure 8. Test Circuit Electrical Schematic



# The RF MOSFET Line

## 100W, 400MHz, 28V

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NOTE: S-Parameter data represents measurements taken from one chip only.

Table 1. Common Source S-Parameters ( $V_{DS} = 24\text{ V}$ ,  $I_D = 0.4\text{ A}$ )

| f<br>MHz | S <sub>11</sub> |      | S <sub>21</sub> |    | S <sub>12</sub> |     | S <sub>22</sub> |      |
|----------|-----------------|------|-----------------|----|-----------------|-----|-----------------|------|
|          | S <sub>11</sub> | φ    | S <sub>21</sub> | φ  | S <sub>12</sub> | φ   | S <sub>22</sub> | φ    |
| 30       | 0.797           | -154 | 12.40           | 88 | 0.029           | 2   | 0.756           | -159 |
| 40       | 0.739           | -161 | 9.06            | 89 | 0.027           | 8   | 0.702           | -165 |
| 50       | 0.749           | -164 | 6.84            | 85 | 0.026           | 7   | 0.707           | -168 |
| 60       | 0.770           | -163 | 6.06            | 80 | 0.027           | 3   | 0.754           | -168 |
| 70       | 0.790           | -164 | 5.40            | 73 | 0.027           | -1  | 0.776           | -168 |
| 80       | 0.800           | -166 | 4.60            | 70 | 0.026           | -1  | 0.777           | -168 |
| 90       | 0.808           | -167 | 3.94            | 67 | 0.025           | -1  | 0.795           | -168 |
| 100      | 0.816           | -168 | 3.47            | 64 | 0.024           | -1  | 0.809           | -169 |
| 110      | 0.816           | -169 | 3.14            | 62 | 0.023           | 1   | 0.809           | -169 |
| 120      | 0.815           | -170 | 2.76            | 61 | 0.022           | 6   | 0.794           | -169 |
| 130      | 0.821           | -171 | 2.45            | 59 | 0.021           | 12  | 0.799           | -170 |
| 140      | 0.828           | -171 | 2.27            | 56 | 0.022           | 18  | 0.806           | -169 |
| 150      | 0.836           | -171 | 2.10            | 53 | 0.028           | 25  | 0.805           | -169 |
| 160      | 0.861           | -172 | 1.96            | 51 | 0.032           | -6  | 0.823           | -168 |
| 170      | 0.863           | -173 | 1.77            | 49 | 0.020           | -4  | 0.836           | -166 |
| 180      | 0.869           | -173 | 1.63            | 46 | 0.018           | 5   | 0.881           | -169 |
| 190      | 0.872           | -174 | 1.52            | 44 | 0.017           | 14  | 0.894           | -169 |
| 200      | 0.873           | -175 | 1.41            | 43 | 0.017           | 25  | 0.888           | -171 |
| 210      | 0.877           | -176 | 1.28            | 42 | 0.018           | 36  | 0.877           | -171 |
| 220      | 0.880           | -176 | 1.18            | 41 | 0.019           | 46  | 0.868           | -171 |
| 230      | 0.881           | -177 | 1.15            | 38 | 0.024           | 51  | 0.926           | -173 |
| 240      | 0.877           | -178 | 1.09            | 35 | 0.031           | 56  | 0.893           | -174 |
| 250      | 0.857           | -180 | 1.04            | 33 | 0.049           | 55  | 0.903           | -173 |
| 260      | 0.758           | -178 | 0.95            | 31 | 0.090           | 24  | 0.903           | -172 |
| 270      | 0.862           | -171 | 0.87            | 31 | 0.056           | -33 | 0.933           | -173 |
| 280      | 0.902           | -174 | 0.85            | 32 | 0.027           | -39 | 0.949           | -174 |
| 290      | 0.913           | -176 | 0.77            | 30 | 0.017           | -28 | 0.891           | -175 |
| 300      | 0.919           | -177 | 0.72            | 30 | 0.012           | -8  | 0.894           | -175 |
| 310      | 0.922           | -178 | 0.71            | 28 | 0.012           | 11  | 0.913           | -175 |
| 320      | 0.925           | -178 | 0.67            | 26 | 0.012           | 28  | 0.896           | -175 |
| 330      | 0.927           | -179 | 0.64            | 24 | 0.012           | 40  | 0.929           | -176 |
| 340      | 0.929           | -179 | 0.62            | 24 | 0.013           | 46  | 0.925           | -179 |
| 350      | 0.931           | -180 | 0.58            | 24 | 0.015           | 52  | 0.942           | -174 |
| 360      | 0.934           | 180  | 0.55            | 24 | 0.017           | 55  | 0.944           | -176 |
| 370      | 0.937           | 179  | 0.52            | 23 | 0.019           | 61  | 0.944           | -176 |
| 380      | 0.940           | 179  | 0.49            | 21 | 0.020           | 68  | 0.919           | -175 |
| 390      | 0.941           | 178  | 0.45            | 22 | 0.020           | 69  | 0.938           | -177 |
| 400      | 0.942           | 178  | 0.46            | 18 | 0.021           | 73  | 0.920           | -173 |
| 410      | 0.941           | 177  | 0.45            | 19 | 0.023           | 67  | 0.961           | -178 |
| 420      | 0.943           | 177  | 0.44            | 18 | 0.026           | 67  | 0.945           | -178 |
| 430      | 0.945           | 176  | 0.41            | 16 | 0.029           | 70  | 0.959           | -179 |

Table 1. Common Source S-Parameters ( $V_{DS} = 24\text{ V}$ ,  $I_D = 0.4\text{ A}$ ) (continued)

| f<br>MHz | S <sub>11</sub> |     | S <sub>21</sub> |    | S <sub>12</sub> |     | S <sub>22</sub> |      |
|----------|-----------------|-----|-----------------|----|-----------------|-----|-----------------|------|
|          | S <sub>11</sub> | ∠   | S <sub>21</sub> | ∠  | S <sub>12</sub> | ∠   | S <sub>22</sub> | ∠    |
| 440      | 0.947           | 176 | 0.38            | 16 | 0.029           | 75  | 0.962           | -179 |
| 450      | 0.949           | 176 | 0.38            | 19 | 0.030           | 78  | 0.984           | -178 |
| 460      | 0.952           | 175 | 0.36            | 17 | 0.029           | 72  | 0.987           | 178  |
| 470      | 0.953           | 175 | 0.34            | 18 | 0.030           | 70  | 0.976           | 179  |
| 480      | 0.952           | 174 | 0.34            | 14 | 0.035           | 69  | 0.968           | 179  |
| 490      | 0.952           | 174 | 0.34            | 14 | 0.039           | 72  | 0.987           | 178  |
| 500      | 0.952           | 174 | 0.32            | 13 | 0.040           | 76  | 1.002           | 179  |
| 600      | 0.938           | 170 | 0.22            | 9  | 0.047           | 117 | 1.013           | 172  |
| 700      | 0.962           | 166 | 0.19            | 13 | 0.060           | 73  | 0.993           | 171  |
| 800      | 0.953           | 162 | 0.17            | 18 | 0.097           | 68  | 0.981           | 171  |
| 900      | 0.953           | 159 | 0.14            | 21 | 0.097           | 65  | 0.949           | 166  |
| 1000     | 0.952           | 156 | 0.14            | 27 | 0.110           | 68  | 0.982           | 163  |



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Table 2. Common Source S-Parameters ( $V_{DS} = 28\text{ V}$ ,  $I_D = 0.435\text{ A}$ )

| f<br>MHz | S <sub>11</sub> |      | S <sub>21</sub> |    | S <sub>12</sub> |     | S <sub>22</sub> |      |
|----------|-----------------|------|-----------------|----|-----------------|-----|-----------------|------|
|          | S <sub>11</sub> | φ    | S <sub>21</sub> | φ  | S <sub>12</sub> | φ   | S <sub>22</sub> | φ    |
| 30       | 0.803           | -153 | 13.50           | 89 | 0.028           | 3   | 0.746           | -157 |
| 40       | 0.742           | -160 | 9.90            | 90 | 0.026           | 9   | 0.686           | -164 |
| 50       | 0.752           | -163 | 7.48            | 85 | 0.025           | 8   | 0.692           | -168 |
| 60       | 0.773           | -163 | 6.62            | 80 | 0.026           | 4   | 0.739           | -167 |
| 70       | 0.794           | -164 | 5.91            | 74 | 0.026           | 1   | 0.761           | -167 |
| 80       | 0.803           | -166 | 5.04            | 70 | 0.025           | 1   | 0.763           | -167 |
| 90       | 0.812           | -167 | 4.32            | 68 | 0.024           | 1   | 0.783           | -167 |
| 100      | 0.819           | -168 | 3.81            | 64 | 0.022           | 1   | 0.798           | -168 |
| 110      | 0.818           | -169 | 3.44            | 62 | 0.022           | 3   | 0.797           | -168 |
| 120      | 0.817           | -170 | 3.03            | 61 | 0.021           | 9   | 0.779           | -168 |
| 130      | 0.823           | -171 | 2.68            | 59 | 0.020           | 15  | 0.784           | -170 |
| 140      | 0.830           | -171 | 2.49            | 57 | 0.021           | 21  | 0.793           | -169 |
| 150      | 0.838           | -171 | 2.30            | 53 | 0.027           | 27  | 0.792           | -169 |
| 160      | 0.864           | -172 | 2.16            | 52 | 0.030           | -5  | 0.816           | -167 |
| 170      | 0.865           | -173 | 1.95            | 49 | 0.019           | -2  | 0.827           | -166 |
| 180      | 0.870           | -173 | 1.79            | 46 | 0.017           | 8   | 0.869           | -168 |
| 190      | 0.873           | -174 | 1.67            | 44 | 0.016           | 18  | 0.882           | -168 |
| 200      | 0.874           | -175 | 1.55            | 43 | 0.017           | 27  | 0.878           | -171 |
| 210      | 0.878           | -176 | 1.40            | 42 | 0.017           | 37  | 0.866           | -171 |
| 220      | 0.881           | -176 | 1.29            | 41 | 0.019           | 47  | 0.858           | -171 |
| 230      | 0.881           | -177 | 1.25            | 38 | 0.025           | 53  | 0.918           | -172 |
| 240      | 0.877           | -178 | 1.20            | 35 | 0.031           | 59  | 0.882           | -173 |
| 250      | 0.856           | -180 | 1.13            | 33 | 0.048           | 57  | 0.893           | -173 |
| 260      | 0.760           | -178 | 1.03            | 31 | 0.088           | 24  | 0.899           | -172 |
| 270      | 0.864           | -171 | 0.96            | 31 | 0.056           | -33 | 0.931           | -172 |
| 280      | 0.903           | -174 | 0.93            | 32 | 0.027           | -38 | 0.946           | -173 |
| 290      | 0.914           | -176 | 0.85            | 30 | 0.015           | -25 | 0.885           | -174 |

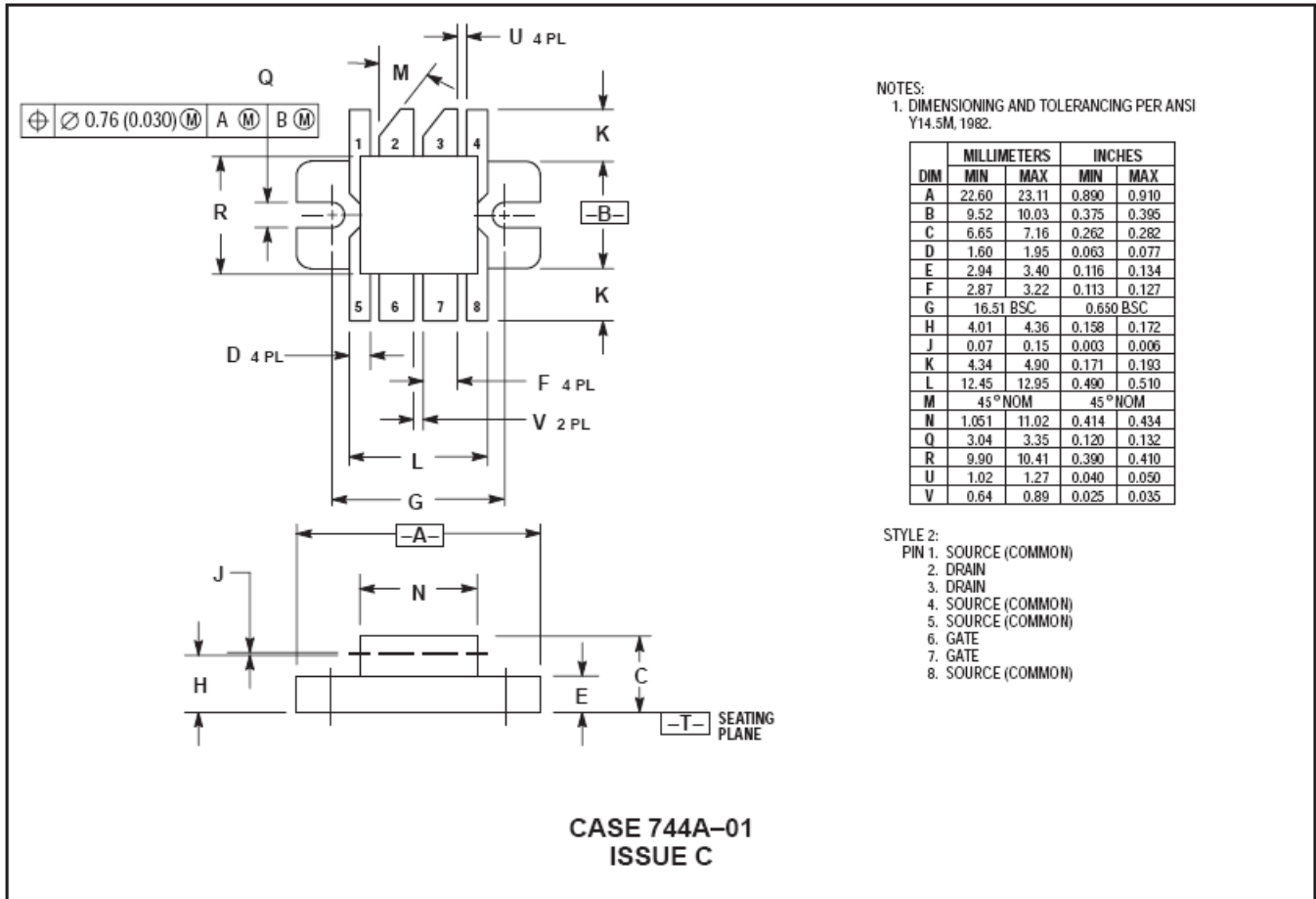
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Table 2. Common Source S-Parameters ( $V_{DS} = 28\text{ V}$ ,  $I_D = 0.435\text{ A}$ ) (continued)

| f<br>MHz | S <sub>11</sub> |      | S <sub>21</sub> |    | S <sub>12</sub> |     | S <sub>22</sub> |      |
|----------|-----------------|------|-----------------|----|-----------------|-----|-----------------|------|
|          | S <sub>11</sub> | ∠    | S <sub>21</sub> | ∠  | S <sub>12</sub> | ∠   | S <sub>22</sub> | ∠    |
| 300      | 0.919           | -177 | 0.79            | 30 | 0.010           | -7  | 0.881           | -175 |
| 310      | 0.922           | -178 | 0.78            | 28 | 0.009           | 6   | 0.903           | -175 |
| 320      | 0.925           | -178 | 0.75            | 26 | 0.010           | 18  | 0.900           | -175 |
| 330      | 0.927           | -179 | 0.70            | 24 | 0.012           | 31  | 0.925           | -176 |
| 340      | 0.929           | -180 | 0.68            | 24 | 0.014           | 45  | 0.920           | -178 |
| 350      | 0.931           | 180  | 0.63            | 25 | 0.015           | 63  | 0.932           | -173 |
| 360      | 0.934           | 179  | 0.61            | 23 | 0.014           | 70  | 0.931           | -176 |
| 370      | 0.936           | 179  | 0.57            | 23 | 0.013           | 68  | 0.929           | -176 |
| 380      | 0.939           | 178  | 0.53            | 21 | 0.015           | 61  | 0.909           | -176 |
| 390      | 0.941           | 178  | 0.50            | 22 | 0.018           | 61  | 0.940           | -178 |
| 400      | 0.941           | 178  | 0.50            | 18 | 0.022           | 74  | 0.917           | -173 |
| 410      | 0.940           | 177  | 0.49            | 19 | 0.024           | 80  | 0.955           | -178 |
| 420      | 0.941           | 177  | 0.48            | 18 | 0.022           | 83  | 0.942           | -178 |
| 430      | 0.943           | 176  | 0.46            | 16 | 0.020           | 77  | 0.957           | -179 |
| 440      | 0.946           | 176  | 0.42            | 16 | 0.022           | 69  | 0.960           | -178 |
| 450      | 0.948           | 175  | 0.41            | 18 | 0.029           | 71  | 0.982           | -177 |
| 460      | 0.951           | 175  | 0.39            | 17 | 0.032           | 76  | 0.983           | 178  |
| 470      | 0.951           | 175  | 0.37            | 17 | 0.031           | 88  | 0.968           | 179  |
| 480      | 0.950           | 174  | 0.37            | 13 | 0.027           | 93  | 0.965           | 179  |
| 490      | 0.950           | 174  | 0.37            | 13 | 0.025           | 81  | 0.994           | 179  |
| 500      | 0.950           | 173  | 0.36            | 12 | 0.031           | 69  | 1.012           | 180  |
| 600      | 0.936           | 170  | 0.24            | 7  | 0.063           | 127 | 1.005           | 171  |
| 700      | 0.960           | 166  | 0.20            | 11 | 0.064           | 72  | 0.989           | 171  |
| 800      | 0.953           | 162  | 0.17            | 15 | 0.092           | 66  | 1.017           | 169  |
| 900      | 0.954           | 159  | 0.15            | 19 | 0.092           | 65  | 0.952           | 167  |
| 1000     | 0.952           | 156  | 0.15            | 24 | 0.082           | 56  | 0.988           | 162  |

## PACKAGE DIMENSIONS



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