

MRFG35003N6T1 replaced by MRFG35003N6AT1.

## Gallium Arsenide PHEMT

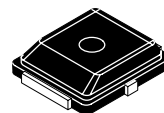
### RF Power Field Effect Transistor

Designed for 3.5 GHz WLL/MMDS/BWA or UMTS applications. Characterized from 0.5 to 5.0 GHz. Device is unmatched and is characterized for use in Class AB Customer Premise Equipment (CPE) applications.

- Typical W-CDMA Performance: -42 dBc ACPR, 3.55 GHz, 6 Volts,  
 $I_{DQ} = 180 \text{ mA}$   
 Output Power — 450 mWatts  
 Power Gain — 9 dB  
 Efficiency — 24%
- 3 Watts P1dB @ 3.55 GHz
- Excellent Phase Linearity and Group Delay Characteristics
- High Gain, High Efficiency and High Linearity
- N Suffix Indicates Lead-Free Terminations. RoHS Compliant.
- In Tape and Reel. T1 Suffix = 1000 Units per 12 mm, 7 inch Reel.

**MRFG35003N6T1**

**3.5 GHz, 3 W, 6 V**  
**POWER FET**  
**GaAs PHEMT**



**CASE 466-03, STYLE 1**  
**PLD-1.5**  
**PLASTIC**

**Table 1. Maximum Ratings**

| Rating                                                                                 | Symbol    | Value                | Unit                     |
|----------------------------------------------------------------------------------------|-----------|----------------------|--------------------------|
| Drain-Source Voltage                                                                   | $V_{DSS}$ | 8                    | Vdc                      |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$     | 22.7 (2)<br>0.15 (2) | W<br>W/ $^\circ\text{C}$ |
| Gate-Source Voltage                                                                    | $V_{GS}$  | -5                   | Vdc                      |
| RF Input Power                                                                         | $P_{in}$  | 24                   | dBm                      |
| Storage Temperature Range                                                              | $T_{stg}$ | -65 to +150          | $^\circ\text{C}$         |
| Channel Temperature (1)                                                                | $T_{ch}$  | 175                  | $^\circ\text{C}$         |
| Operating Case Temperature Range                                                       | $T_C$     | -20 to +85           | $^\circ\text{C}$         |

**Table 2. Thermal Characteristics**

| Characteristic                       | Symbol          | Value   | Unit               |
|--------------------------------------|-----------------|---------|--------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 6.6 (2) | $^\circ\text{C/W}$ |

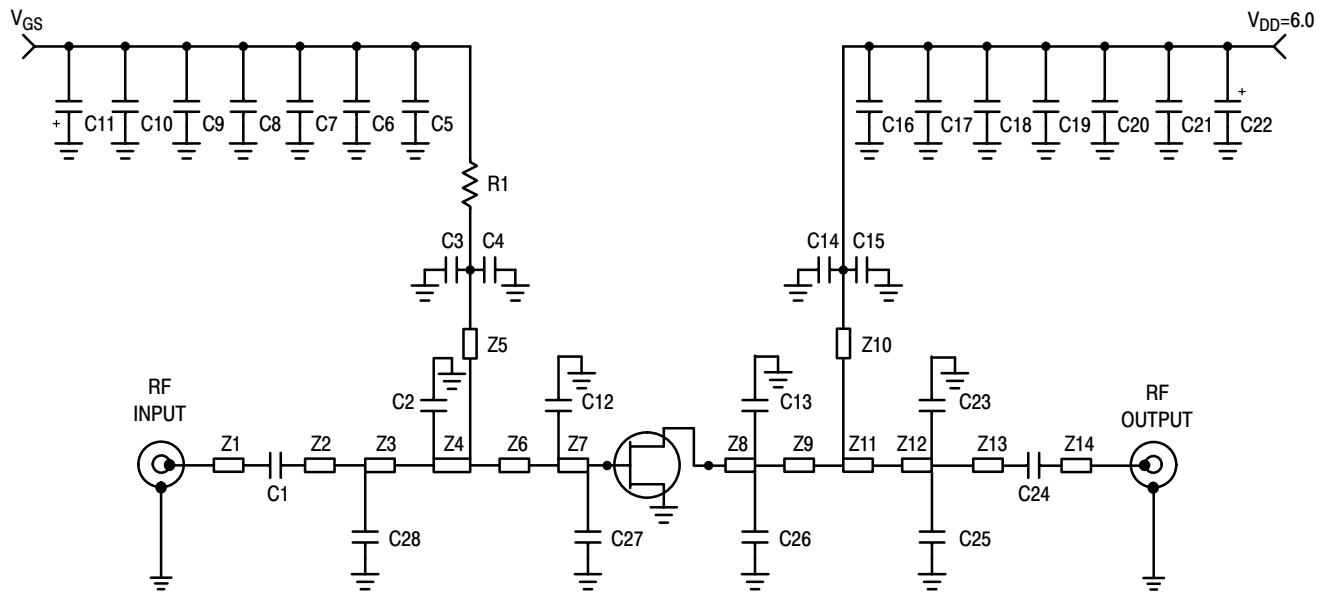
**Table 3. Moisture Sensitivity Level**

| Test Methodology                      | Rating | Package Peak Temperature | Unit             |
|---------------------------------------|--------|--------------------------|------------------|
| Per JESD 22-A113, IPC/JEDEC J-STD-020 | 1      | 260                      | $^\circ\text{C}$ |

1. For reliable operation, the operating channel temperature should not exceed  $150^\circ\text{C}$ .
2. Simulated.

**Table 4. Electrical Characteristics** ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

| Characteristic                                                                                                                                                                                                   | Symbol       | Min  | Typ   | Max  | Unit            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------|-------|------|-----------------|
| Saturated Drain Current<br>( $V_{DS} = 3.5 \text{ Vdc}$ , $V_{GS} = 0 \text{ Vdc}$ )                                                                                                                             | $I_{DSS}$    | —    | 2.9   | —    | Adc             |
| Off State Leakage Current<br>( $V_{GS} = -0.4 \text{ Vdc}$ , $V_{DS} = 0 \text{ Vdc}$ )                                                                                                                          | $I_{GSS}$    | —    | < 1.0 | 100  | $\mu\text{Adc}$ |
| Off State Drain Current<br>( $V_{DS} = 6 \text{ Vdc}$ , $V_{GS} = -1.9 \text{ Vdc}$ )                                                                                                                            | $I_{DSO}$    | —    | 0.02  | 1.0  | mAdc            |
| Off State Current<br>( $V_{DS} = 20 \text{ Vdc}$ , $V_{GS} = -2.5 \text{ Vdc}$ )                                                                                                                                 | $I_{DSX}$    | —    | 1.0   | 15   | mAdc            |
| Gate-Source Cut-off Voltage<br>( $V_{DS} = 3.5 \text{ Vdc}$ , $I_{DS} = 15 \text{ mA}$ )                                                                                                                         | $V_{GS(th)}$ | -1.2 | -1.0  | -0.7 | Vdc             |
| Quiescent Gate Voltage<br>( $V_{DS} = 6 \text{ Vdc}$ , $I_{DQ} = 180 \text{ mA}$ )                                                                                                                               | $V_{GS(Q)}$  | -1.1 | -0.9  | -0.7 | Vdc             |
| Power Gain<br>( $V_{DD} = 6 \text{ Vdc}$ , $I_{DQ} = 180 \text{ mA}$ , $f = 3.55 \text{ GHz}$ )                                                                                                                  | $G_{ps}$     | 8    | 9     | —    | dB              |
| Output Power, 1 dB Compression Point<br>( $V_{DD} = 6 \text{ Vdc}$ , $I_{DQ} = 180 \text{ mA}$ , $f = 3.55 \text{ GHz}$ )                                                                                        | $P_{1dB}$    | —    | 3     | —    | W               |
| Drain Efficiency<br>( $V_{DD} = 6 \text{ Vdc}$ , $I_{DQ} = 180 \text{ mA}$ , $P_{out} = 450 \text{ mW}$ , $f = 3.55 \text{ GHz}$ .<br>Tune for Maximum $P_{out}$ )                                               | $\eta_D$     | 22   | 24    | —    | %               |
| Adjacent Channel Power Ratio<br>( $V_{DD} = 6 \text{ Vdc}$ , $P_{out} = 450 \text{ mW Avg.}$ , $I_{DQ} = 180 \text{ mA}$ ,<br>$f = 3.55 \text{ GHz}$ , W-CDMA, 8.5 P/A @ 0.01% Probability,<br>64 CH, 3.84 MCPS) | ACPR         | —    | -42   | -38  | dBc             |

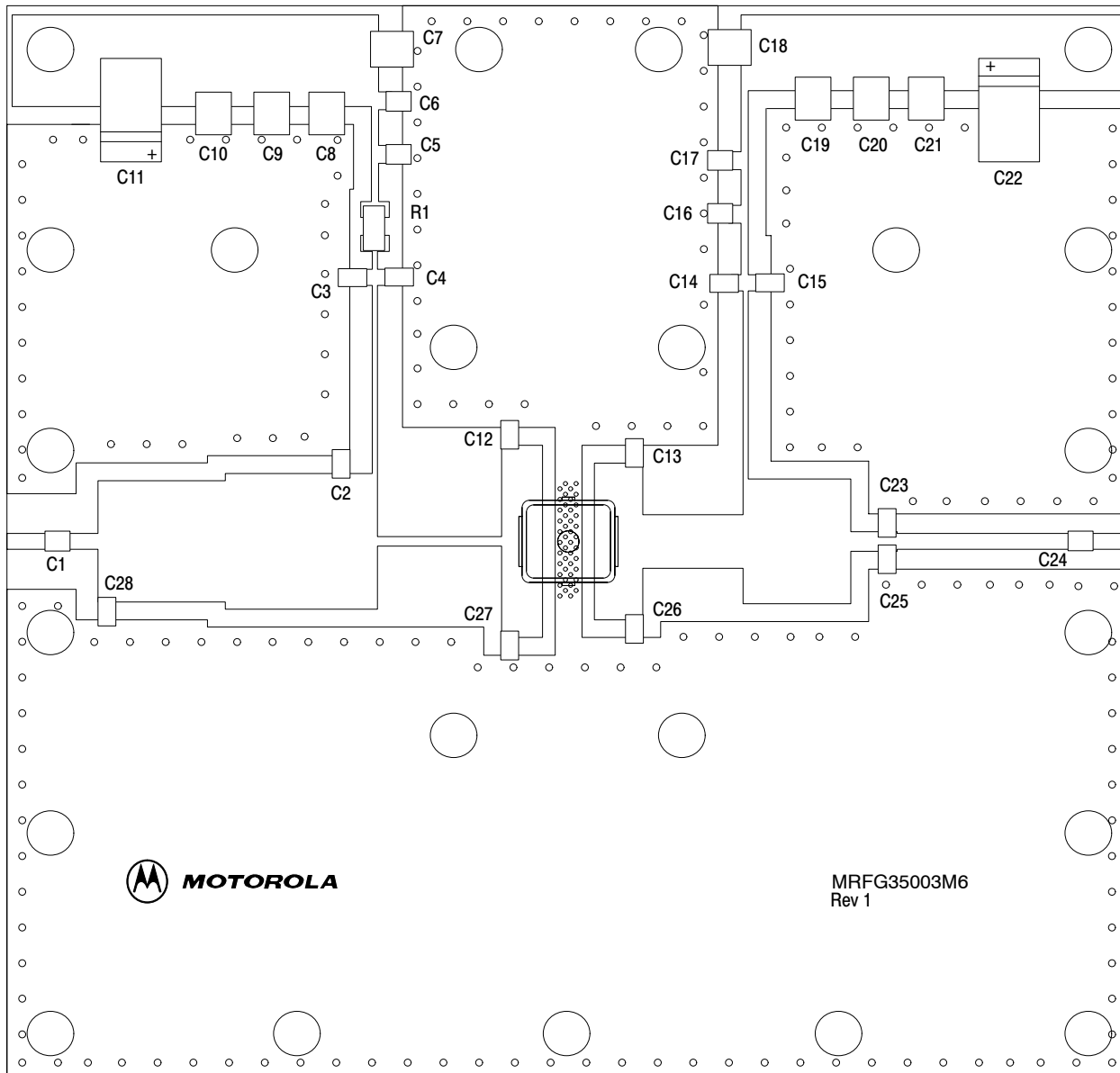


|         |                            |     |                                          |
|---------|----------------------------|-----|------------------------------------------|
| Z1, Z14 | 0.044" x 0.125" Microstrip | Z8  | 0.439" x 0.136" Microstrip               |
| Z2      | 0.440" x 0.105" Microstrip | Z9  | 0.062" x 0.280" Microstrip               |
| Z3      | 0.340" x 0.357" Microstrip | Z11 | 0.349" x 0.302" Microstrip               |
| Z4      | 0.380" x 0.426" Microstrip | Z12 | 0.055" x 0.130" Microstrip               |
| Z5, Z10 | 0.527" x 0.015" Microstrip | Z13 | 0.044" x 0.502" Microstrip               |
| Z6      | 0.027" x 0.347" Microstrip | PCB | Rogers 4350, 0.020", $\epsilon_r = 3.50$ |
| Z7      | 0.538" x 0.115" Microstrip |     |                                          |

Figure 1. 3.5 GHz Test Circuit Schematic

Table 5. 3.5 GHz Test Circuit Component Designations and Values

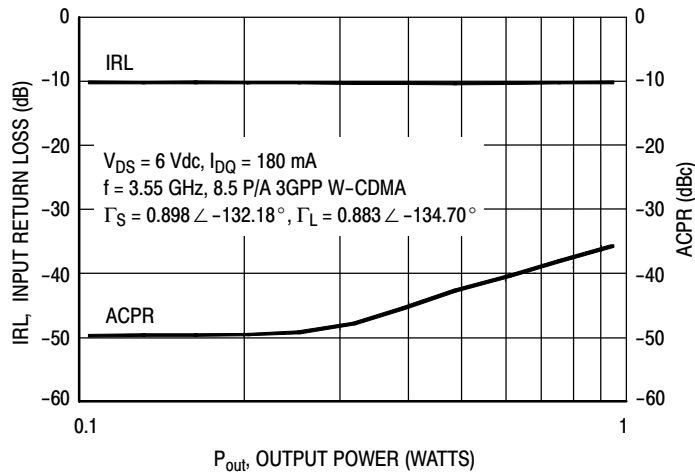
| Designation        | Description                                               |
|--------------------|-----------------------------------------------------------|
| C1                 | 12 pF Chip Capacitor, ATC                                 |
| C2                 | 0.1 pF Chip Capacitor (0805), AVX                         |
| C3, C4, C14, C15   | 3.9 pF Chip Capacitors (0805), AVX                        |
| C5, C16            | 10 pF Chip Capacitors, ATC                                |
| C6, C17            | 100 pF Chip Capacitors, ATC                               |
| C7, C18            | 100 pF Chip Capacitors, ATC                               |
| C8, C19            | 1000 pF Chip Capacitors, ATC                              |
| C9, C20            | 3.9 $\mu$ F Chip Capacitors, ATC                          |
| C10, C21           | 0.1 $\mu$ F Chip Capacitors, ATC                          |
| C11, C22           | 22 $\mu$ F, 35 V Tantalum Surface Mount Capacitor, Newark |
| C12, C13, C26, C27 | 0.3 pF Chip Capacitors (0805), AVX                        |
| C23, C25, C28      | 1.0 pF Chip Capacitors (0805), AVX                        |
| C24                | 7.5 pF Chip Capacitor, ATC                                |
| R1                 | 50 $\Omega$ Chip Resistor, Newark                         |



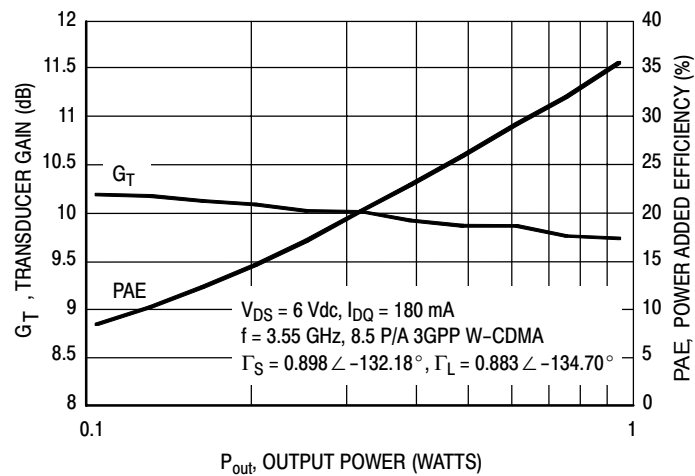
Freescall has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescall Semiconductor signature/logo. PCBs may have either Motorola or Freescall markings during the transition period. These changes will have no impact on form, fit or function of the current product.

**Figure 2. 3.5 GHz Test Circuit Component Layout**

# TYPICAL CHARACTERISTICS



**Figure 3. W-CDMA ACPR and Input Return Loss versus Output Power**



**Figure 4. Transducer Gain and Power Added Efficiency versus Output Power**

**NOTE:** All data is referenced to package lead interface.  $\Gamma_S$  and  $\Gamma_L$  are the impedances presented to the DUT. All data is generated from load pull, not from the test circuit shown.

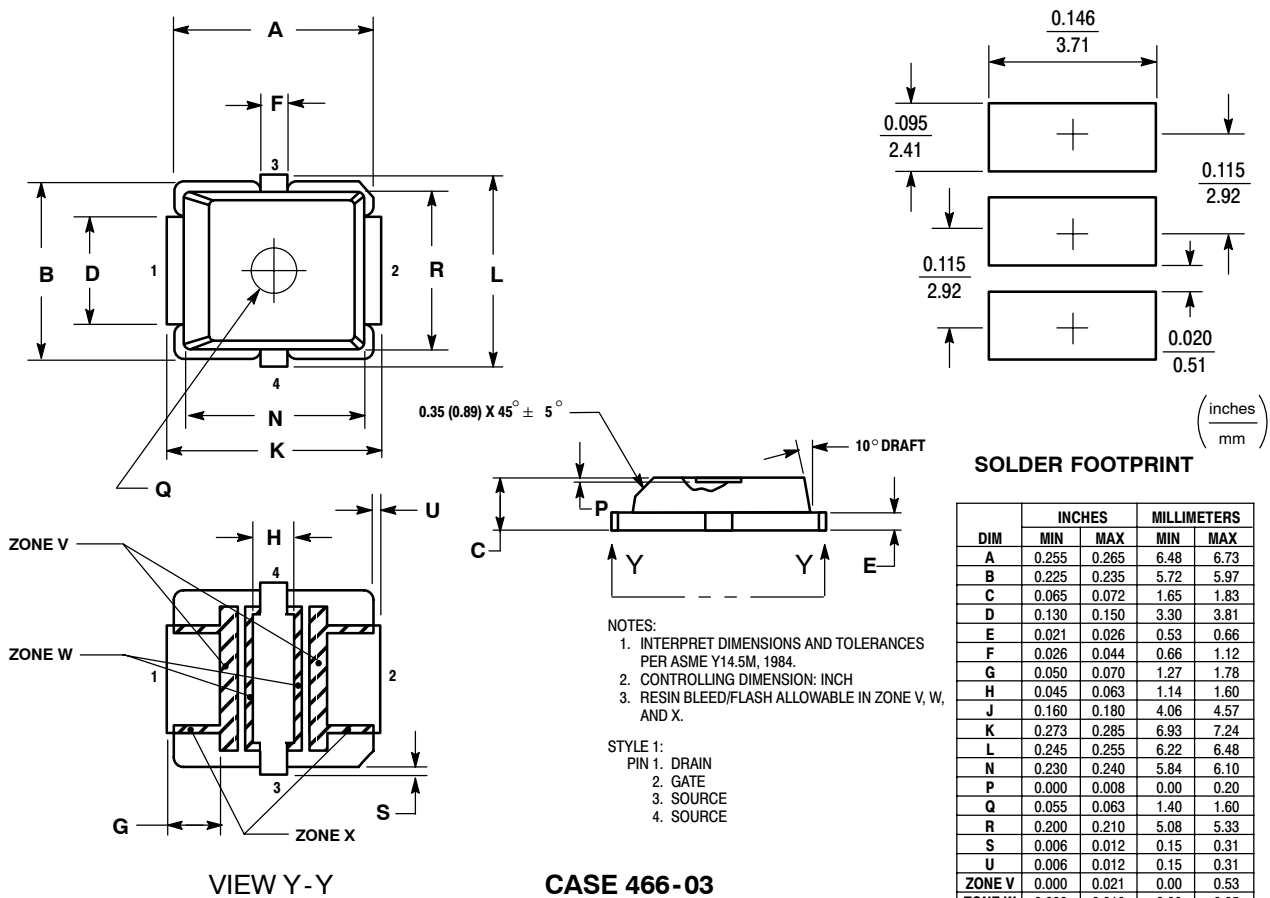
**Table 6. Class AB Common Source S-Parameters at  $V_{DS} = 6 \text{ Vdc}$ ,  $I_{DQ} = 180 \text{ mA}$** 

| f<br>GHz | 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    |
| 0.5      | 0.954           | -176.79 | 3.859           | 84.89 | 0.016           | 9.07 | 0.847           | 178.96 |
| 0.55     | 0.953           | -177.98 | 3.527           | 83.61 | 0.016           | 8.90 | 0.846           | 178.38 |
| 0.6      | 0.952           | -179.13 | 3.250           | 82.29 | 0.016           | 8.49 | 0.846           | 177.74 |
| 0.65     | 0.952           | 179.80  | 3.019           | 80.95 | 0.016           | 8.44 | 0.845           | 177.07 |
| 0.7      | 0.952           | 178.89  | 2.818           | 79.74 | 0.016           | 8.51 | 0.844           | 176.28 |
| 0.75     | 0.951           | 177.96  | 2.643           | 78.49 | 0.016           | 8.53 | 0.844           | 175.55 |
| 0.8      | 0.952           | 177.03  | 2.491           | 77.11 | 0.017           | 8.75 | 0.843           | 174.77 |
| 0.85     | 0.952           | 176.22  | 2.354           | 75.85 | 0.017           | 8.61 | 0.842           | 173.93 |
| 0.9      | 0.951           | 175.46  | 2.234           | 74.67 | 0.017           | 8.62 | 0.842           | 173.12 |
| 0.95     | 0.951           | 174.66  | 2.124           | 73.38 | 0.017           | 8.56 | 0.841           | 172.27 |
| 1        | 0.952           | 173.92  | 2.025           | 72.17 | 0.017           | 8.48 | 0.841           | 171.37 |
| 1.05     | 0.951           | 173.18  | 1.934           | 70.97 | 0.017           | 8.47 | 0.841           | 170.50 |
| 1.1      | 0.951           | 172.40  | 1.851           | 69.68 | 0.017           | 8.93 | 0.841           | 169.75 |
| 1.15     | 0.951           | 171.63  | 1.774           | 68.46 | 0.017           | 8.90 | 0.840           | 168.89 |
| 1.2      | 0.951           | 170.90  | 1.704           | 67.25 | 0.018           | 8.79 | 0.841           | 168.10 |
| 1.25     | 0.950           | 170.06  | 1.638           | 65.98 | 0.018           | 8.80 | 0.841           | 167.34 |
| 1.3      | 0.951           | 169.23  | 1.576           | 64.74 | 0.018           | 8.44 | 0.840           | 166.61 |
| 1.35     | 0.946           | 168.58  | 1.518           | 63.62 | 0.018           | 8.76 | 0.838           | 166.13 |
| 1.4      | 0.952           | 167.47  | 1.463           | 62.45 | 0.018           | 9.00 | 0.845           | 165.24 |
| 1.45     | 0.949           | 166.77  | 1.411           | 61.29 | 0.018           | 8.57 | 0.841           | 164.98 |
| 1.5      | 0.949           | 163.72  | 1.360           | 60.14 | 0.018           | 8.15 | 0.842           | 166.78 |
| 1.55     | 0.948           | 162.94  | 1.317           | 59.12 | 0.018           | 8.28 | 0.843           | 166.27 |
| 1.6      | 0.947           | 162.21  | 1.276           | 58.03 | 0.018           | 8.51 | 0.843           | 165.71 |
| 1.65     | 0.950           | 161.60  | 1.237           | 56.92 | 0.018           | 8.31 | 0.843           | 165.16 |
| 1.7      | 0.951           | 160.97  | 1.201           | 55.93 | 0.018           | 8.40 | 0.844           | 164.60 |
| 1.75     | 0.950           | 160.44  | 1.167           | 54.89 | 0.018           | 8.35 | 0.844           | 164.10 |
| 1.8      | 0.950           | 159.95  | 1.135           | 53.83 | 0.019           | 8.44 | 0.844           | 163.47 |
| 1.85     | 0.952           | 159.46  | 1.105           | 52.85 | 0.019           | 8.61 | 0.843           | 162.87 |
| 1.9      | 0.951           | 159.01  | 1.076           | 51.92 | 0.019           | 8.34 | 0.844           | 162.37 |
| 1.95     | 0.950           | 158.58  | 1.049           | 50.84 | 0.019           | 7.93 | 0.843           | 161.77 |
| 2        | 0.952           | 158.25  | 1.024           | 49.95 | 0.019           | 8.02 | 0.843           | 161.24 |
| 2.05     | 0.951           | 157.84  | 1.000           | 49.06 | 0.019           | 7.86 | 0.844           | 160.75 |
| 2.1      | 0.951           | 157.48  | 0.979           | 48.17 | 0.019           | 7.67 | 0.845           | 160.26 |
| 2.15     | 0.952           | 157.17  | 0.959           | 47.22 | 0.019           | 7.24 | 0.843           | 159.69 |
| 2.2      | 0.952           | 156.89  | 0.939           | 46.34 | 0.020           | 6.89 | 0.843           | 159.08 |
| 2.25     | 0.952           | 156.63  | 0.921           | 45.44 | 0.020           | 6.73 | 0.844           | 158.58 |
| 2.3      | 0.952           | 156.35  | 0.904           | 44.48 | 0.020           | 6.86 | 0.843           | 158.07 |
| 2.35     | 0.953           | 155.98  | 0.888           | 43.57 | 0.020           | 6.83 | 0.842           | 157.42 |
| 2.4      | 0.951           | 155.66  | 0.873           | 42.68 | 0.020           | 6.80 | 0.842           | 156.97 |
| 2.45     | 0.952           | 155.28  | 0.860           | 41.72 | 0.020           | 6.74 | 0.842           | 156.47 |
| 2.5      | 0.952           | 154.86  | 0.848           | 40.82 | 0.020           | 6.73 | 0.840           | 155.83 |
| 2.55     | 0.950           | 154.44  | 0.836           | 39.90 | 0.021           | 6.72 | 0.841           | 155.29 |
| 2.6      | 0.949           | 153.93  | 0.826           | 38.89 | 0.021           | 6.86 | 0.840           | 154.74 |
| 2.65     | 0.950           | 153.36  | 0.815           | 37.85 | 0.021           | 6.74 | 0.838           | 154.18 |
| 2.7      | 0.949           | 152.82  | 0.806           | 36.81 | 0.022           | 6.24 | 0.838           | 153.62 |
| 2.75     | 0.946           | 152.08  | 0.797           | 35.75 | 0.022           | 5.69 | 0.839           | 153.16 |

**Table 6. Class AB Common Source S-Parameters at  $V_{DS} = 6 \text{ Vdc}$ ,  $I_{DQ} = 180 \text{ mA}$  (continued)**

| f<br>GHz | 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    |
| 2.8      | 0.946           | 151.55 | 0.787           | 34.63  | 0.022           | 4.64   | 0.836           | 152.55 |
| 2.85     | 0.946           | 150.81 | 0.778           | 33.54  | 0.023           | 3.61   | 0.836           | 152.02 |
| 2.9      | 0.945           | 150.11 | 0.770           | 32.46  | 0.023           | 2.16   | 0.837           | 151.54 |
| 2.95     | 0.945           | 149.30 | 0.762           | 31.37  | 0.023           | 1.54   | 0.835           | 150.98 |
| 3        | 0.945           | 148.44 | 0.754           | 30.25  | 0.023           | 1.03   | 0.835           | 150.40 |
| 3.05     | 0.944           | 147.58 | 0.747           | 29.09  | 0.023           | 0.48   | 0.837           | 149.89 |
| 3.1      | 0.943           | 146.55 | 0.739           | 27.89  | 0.023           | 0.15   | 0.835           | 149.35 |
| 3.15     | 0.943           | 145.54 | 0.732           | 26.69  | 0.023           | -0.33  | 0.834           | 148.72 |
| 3.2      | 0.944           | 144.52 | 0.725           | 25.53  | 0.023           | -0.41  | 0.836           | 148.13 |
| 3.25     | 0.941           | 143.47 | 0.718           | 24.33  | 0.023           | -0.52  | 0.835           | 147.62 |
| 3.3      | 0.941           | 142.43 | 0.711           | 23.09  | 0.023           | -1.22  | 0.834           | 147.01 |
| 3.35     | 0.941           | 141.33 | 0.704           | 21.89  | 0.023           | -1.40  | 0.834           | 146.44 |
| 3.4      | 0.940           | 140.22 | 0.697           | 20.67  | 0.024           | -1.31  | 0.834           | 145.89 |
| 3.45     | 0.939           | 139.25 | 0.689           | 19.44  | 0.024           | -1.58  | 0.832           | 145.40 |
| 3.5      | 0.940           | 138.09 | 0.682           | 18.26  | 0.024           | -1.85  | 0.833           | 144.66 |
| 3.55     | 0.940           | 137.05 | 0.675           | 17.08  | 0.024           | -2.29  | 0.834           | 144.11 |
| 3.6      | 0.939           | 136.07 | 0.668           | 15.88  | 0.025           | -2.75  | 0.832           | 143.59 |
| 3.65     | 0.941           | 135.06 | 0.661           | 14.68  | 0.025           | -3.55  | 0.831           | 142.91 |
| 3.7      | 0.939           | 134.20 | 0.653           | 13.50  | 0.025           | -4.69  | 0.832           | 142.34 |
| 3.75     | 0.939           | 133.35 | 0.646           | 12.39  | 0.025           | -5.45  | 0.831           | 141.92 |
| 3.8      | 0.939           | 132.47 | 0.639           | 11.29  | 0.025           | -6.34  | 0.830           | 141.27 |
| 3.85     | 0.940           | 131.67 | 0.632           | 10.20  | 0.025           | -6.85  | 0.831           | 140.64 |
| 3.9      | 0.939           | 130.89 | 0.625           | 9.15   | 0.025           | -6.90  | 0.831           | 140.02 |
| 3.95     | 0.940           | 130.26 | 0.619           | 8.10   | 0.025           | -6.60  | 0.830           | 139.40 |
| 4        | 0.941           | 129.57 | 0.613           | 7.10   | 0.025           | -6.63  | 0.830           | 138.76 |
| 4.05     | 0.941           | 128.98 | 0.608           | 6.11   | 0.026           | -6.67  | 0.831           | 138.17 |
| 4.1      | 0.942           | 128.44 | 0.602           | 5.10   | 0.026           | -7.00  | 0.830           | 137.56 |
| 4.15     | 0.942           | 128.03 | 0.598           | 4.14   | 0.026           | -7.30  | 0.828           | 136.87 |
| 4.2      | 0.941           | 127.57 | 0.593           | 3.17   | 0.027           | -7.73  | 0.828           | 136.20 |
| 4.25     | 0.940           | 127.14 | 0.589           | 2.15   | 0.027           | -8.12  | 0.827           | 135.56 |
| 4.3      | 0.941           | 126.75 | 0.585           | 1.21   | 0.027           | -8.11  | 0.826           | 134.85 |
| 4.35     | 0.941           | 126.39 | 0.581           | 0.25   | 0.027           | -8.33  | 0.826           | 134.13 |
| 4.4      | 0.939           | 125.97 | 0.578           | -0.74  | 0.028           | -8.73  | 0.825           | 133.44 |
| 4.45     | 0.939           | 125.64 | 0.575           | -1.67  | 0.028           | -8.92  | 0.823           | 132.68 |
| 4.5      | 0.939           | 125.36 | 0.573           | -2.59  | 0.029           | -9.42  | 0.823           | 131.92 |
| 4.55     | 0.938           | 124.98 | 0.571           | -3.50  | 0.029           | -9.66  | 0.823           | 131.23 |
| 4.6      | 0.938           | 124.55 | 0.570           | -4.53  | 0.030           | -10.28 | 0.822           | 130.45 |
| 4.65     | 0.938           | 124.20 | 0.571           | -5.52  | 0.030           | -10.87 | 0.821           | 129.60 |
| 4.7      | 0.937           | 123.76 | 0.570           | -6.60  | 0.031           | -11.91 | 0.821           | 128.79 |
| 4.75     | 0.935           | 123.17 | 0.569           | -7.76  | 0.031           | -13.22 | 0.819           | 127.98 |
| 4.8      | 0.935           | 122.58 | 0.569           | -8.89  | 0.031           | -14.16 | 0.817           | 127.09 |
| 4.85     | 0.934           | 121.93 | 0.570           | -9.98  | 0.031           | -14.45 | 0.817           | 126.23 |
| 4.9      | 0.932           | 121.14 | 0.570           | -11.17 | 0.032           | -14.82 | 0.816           | 125.41 |
| 4.95     | 0.932           | 120.43 | 0.571           | -12.37 | 0.032           | -14.82 | 0.815           | 124.46 |
| 5        | 0.929           | 119.55 | 0.573           | -13.61 | 0.032           | -14.83 | 0.815           | 123.55 |

PACKAGE DIMENSIONS



CASE 466-03  
ISSUE D  
PLD-1.5  
PLASTIC



REVISION HISTORY

The following table summarizes revisions to this document.

| Revision | Date      | Description                                                                                                        |
|----------|-----------|--------------------------------------------------------------------------------------------------------------------|
| 6        | Jan. 2008 | <ul style="list-style-type: none"><li>Listed replacement part, p. 1</li><li>Added Revision History, p. 9</li></ul> |

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