



Heterojunction Bipolar Transistor Technology (InGaP HBT)

Broadband High Linearity Amplifier

The MMG3004NT1 is a General Purpose Amplifier that is internally prematched and designed for a broad range of Class A, small-signal, high linearity, general purpose applications. It is suitable for applications with frequencies from 400 to 2200 MHz such as Cellular, PCS, WLL, PHS, VHF, UHF, UMTS and general small-signal RF.

Features

- Frequency: 400-2200 MHz
- P1dB: 27 dBm @ 2140 MHz
- Small-Signal Gain: 16 dB @ 2140 MHz
- Third Order Output Intercept Point: 44 dBm @ 2140 MHz
- Single 5 Volt Supply
- Internally Prematched to 50 Ohms
- RoHS Compliant
- In Tape and Reel. T1 Suffix = 1000 Units per 16 mm, 13 inch Reel.

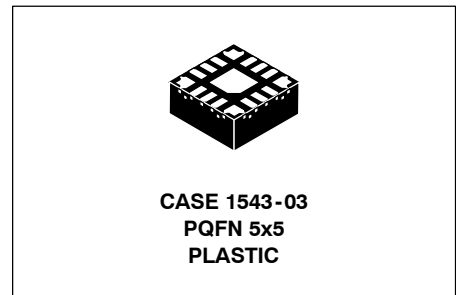
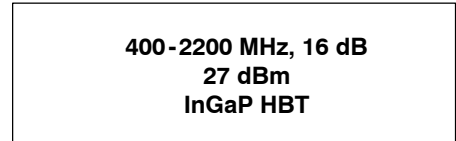


Table 1. Typical Performance (1)

| Characteristic | Symbol | 900 MHz | 1960 MHz | 2140 MHz | Unit |
|------------------------------------|----------------|---------|----------|----------|------|
| Small-Signal Gain (S21) | G _p | 19.5 | 16.5 | 16 | dB |
| Input Return Loss (S11) | IRL | -7.5 | -8 | -8 | dB |
| Output Return Loss (S22) | ORL | -10 | -12 | -12 | dB |
| Power Output @1dB Compression | P1db | 27 | 27 | 27 | dBm |
| Third Order Output Intercept Point | IP3 | 44 | 44 | 44 | dBm |

1. V_{DC} = 5 Vdc, T_C = 25°C, 50 ohm system

Table 2. Maximum Ratings

| Rating | Symbol | Value | Unit |
|---------------------------|------------------|-------------|------|
| Supply Voltage | V _{DC} | 6 | V |
| Supply Current | I _{DC} | 400 | mA |
| RF Input Power | P _{in} | 18 | dBm |
| Storage Temperature Range | T _{stg} | -65 to +150 | °C |
| Junction Temperature (2) | T _J | 150 | °C |

2. For reliable operation, the junction temperature should not exceed 150°C.

Table 3. Thermal Characteristics (V_{DC} = 5 Vdc, I_{DC} = 250 mA, T_C = 25°C)

| Characteristic | Symbol | Value (3) | Unit |
|--------------------------------------|------------------|-----------|------|
| Thermal Resistance, Junction to Case | R _{θJC} | 33 | °C/W |

3. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers*. Go to <http://www.freescale.com/rf>.
Select Documentation/Application Notes - AN1955.

Table 4. Electrical Characteristics ($V_{DC} = 5$ Vdc, 2140 MHz, $T_C = 25^\circ\text{C}$, 50 ohm system, in Freescale Application Circuit)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|------------------------------------|----------|-----|-----|-----|------|
| Small-Signal Gain (S21) | G_p | 15 | 16 | — | dB |
| Input Return Loss (S11) | IRL | — | -8 | — | dB |
| Output Return Loss (S22) | ORL | — | -12 | — | dB |
| Power Output @ 1dB Compression | P1dB | — | 27 | — | dBm |
| Third Order Output Intercept Point | IP3 | — | 44 | — | dBm |
| Noise Figure | NF | — | 3.4 | — | dB |
| Supply Current (1) | I_{DC} | 225 | 250 | 275 | mA |
| Supply Voltage (1) | V_{DC} | — | 5 | — | V |

1. For reliable operation, the junction temperature should not exceed 150°C .

Table 5. Functional Pin Description

| Name | Pin Number | Description |
|--|-----------------------|--|
| RF _{in} | 2, 3, 4 | RF input for the power amplifier. This pin is DC-coupled and requires a DC-blocking series capacitor. |
| RF _{out} / V _{CC} | 10, 11, 12 | RF output for the power amplifier. This pin is DC-coupled and requires a DC-blocking series capacitor. |
| V _{CC} | 14 | Collector voltage supply. |
| V _{BA} | 16 | Bias voltage supply. |
| GND | Backside Center Metal | The center metal base of the PQFN package provides both DC and RF ground as well as heat sink contact for the power amplifier. |

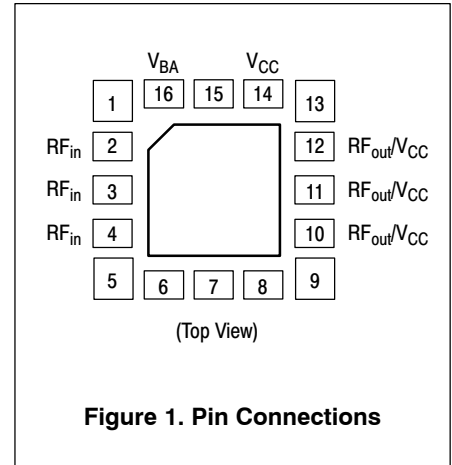


Table 6. ESD Protection Characteristics

| Test Methodology | Class |
|--|---------------|
| Human Body Model (per JESD 22-A114) | 1B (Minimum) |
| Machine Model (per EIA/JESD 22-A115) | A (Minimum) |
| Charge Device Model (per JESD 22-C101) | III (Minimum) |

Table 7. Moisture Sensitivity Level

| Test Methodology | Rating | Package Peak Temperature | Unit |
|---------------------------------------|--------|--------------------------|------|
| Per JESD 22-A113, IPC/JEDEC J-STD-020 | 3 | 260 | °C |

50 OHM TYPICAL CHARACTERISTICS

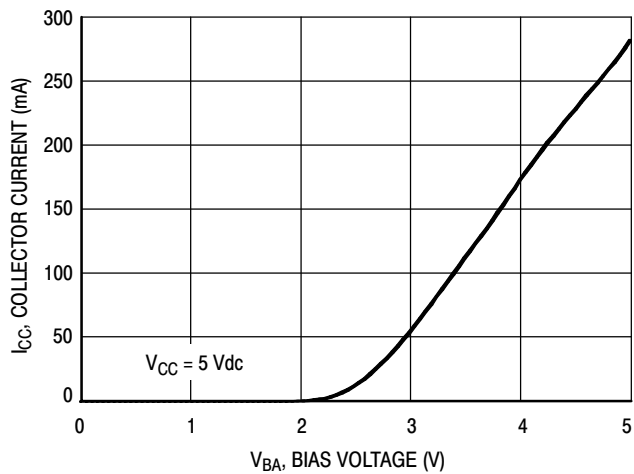
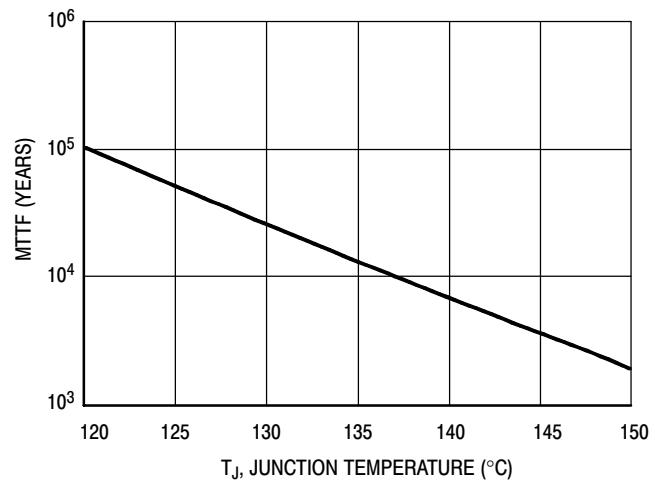


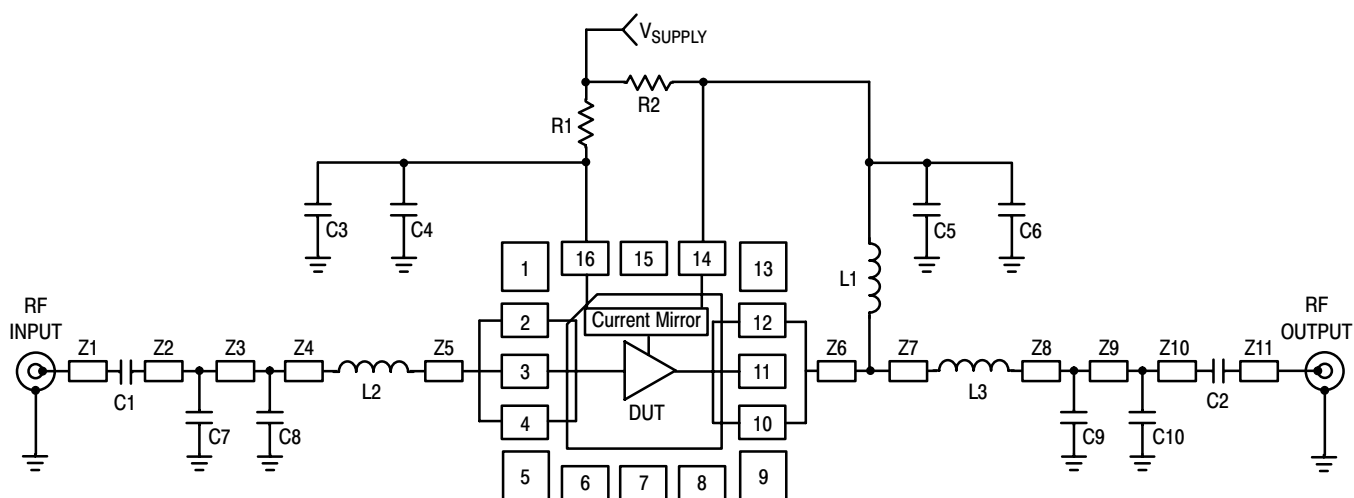
Figure 2. Collector Current versus Bias Voltage



NOTE: The MTTF is calculated with V_{DC} = 5 Vdc, I_{DC} = 250 mA

Figure 3. MTTF versus Junction Temperature

50 OHM APPLICATION CIRCUIT: 900 MHz



| | | | |
|---------|----------------------------|-----|---|
| Z1, Z11 | 0.140" x 0.028" Microstrip | Z6 | 0.089" x 0.028" Microstrip |
| Z2, Z10 | 0.060" x 0.028" Microstrip | Z7 | 0.051" x 0.028" Microstrip |
| Z3 | 0.192" x 0.028" Microstrip | Z8 | 0.055" x 0.028" Microstrip |
| Z4 | 0.055" x 0.028" Microstrip | Z9 | 0.112" x 0.028" Microstrip |
| Z5 | 0.084" x 0.028" Microstrip | PCB | Isola FR408, 0.014", $\epsilon_r = 3.7$ |

Figure 4. 50 Ohm Test Circuit Schematic

Table 8. 50 Ohm Test Circuit Component Designations and Values

| Part | Description | Part Number | Manufacturer |
|---------|------------------------------------|------------------|--------------|
| C1, C2 | 15 pF Chip Capacitors | ECUV1H150JCV | Panasonic |
| C3, C5 | 0.01 μ F Chip Capacitors | C0603C103J5RAC | Kemet |
| C4, C6 | 0.1 μ F Chip Capacitors | C0603C104J5RAC | Kemet |
| C7, C8 | 2.2 pF Chip Capacitors | 06035J2R2BS | AVX |
| C9, C10 | 1.8 pF Chip Capacitors | 06035J1R8BS | AVX |
| L1 | 33 nH Chip Inductor | LL1608-FSL33NJ | Toko |
| L2, L3 | 3.9 nH Chip Inductors | LL1608-FSL3N9S | Toko |
| R1 | 22 Ω , 1/10 W Chip Resistor | CRCW060322R0FKEA | Vishay |
| R2 | 0 Ω , 1/10 W Chip Resistor | CRCW06030000FKEA | Vishay |

50 OHM APPLICATION CIRCUIT: 900 MHz

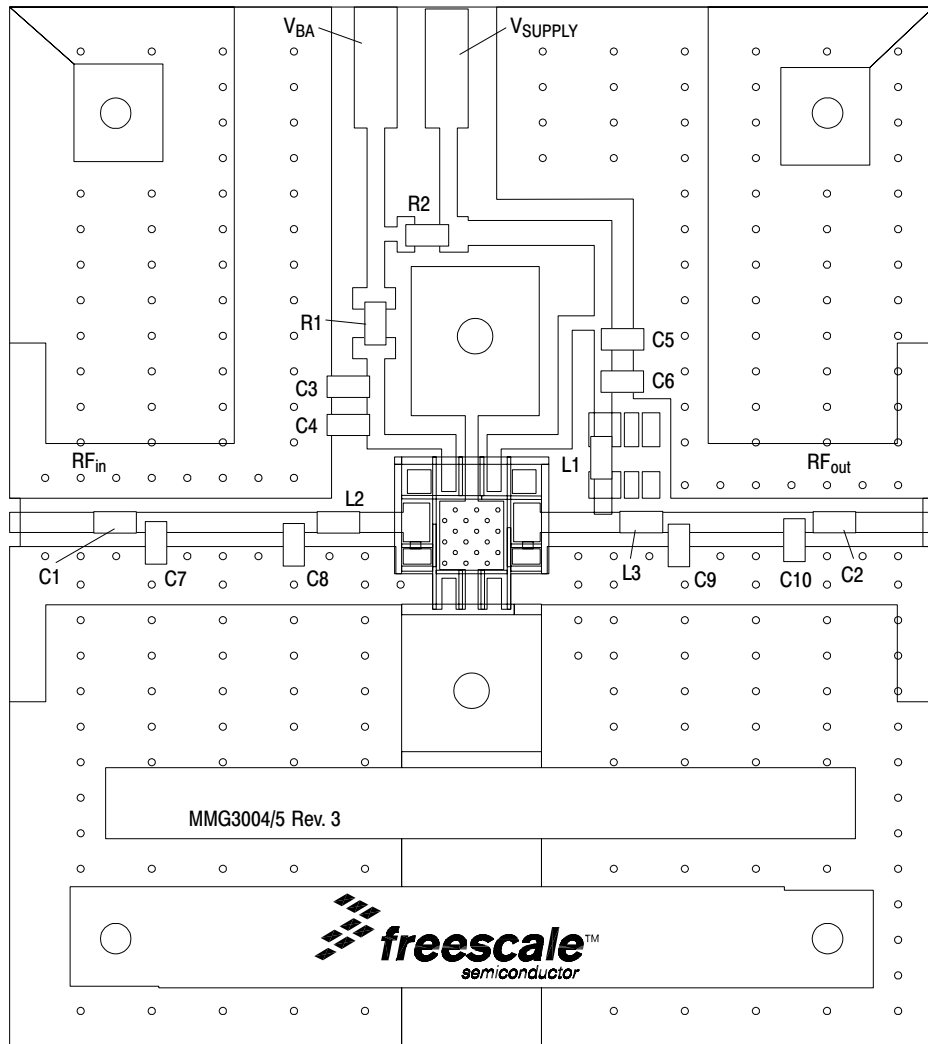


Figure 5. 50 Ohm Test Circuit Component Layout

50 OHM TYPICAL CHARACTERISTICS: 900 MHz

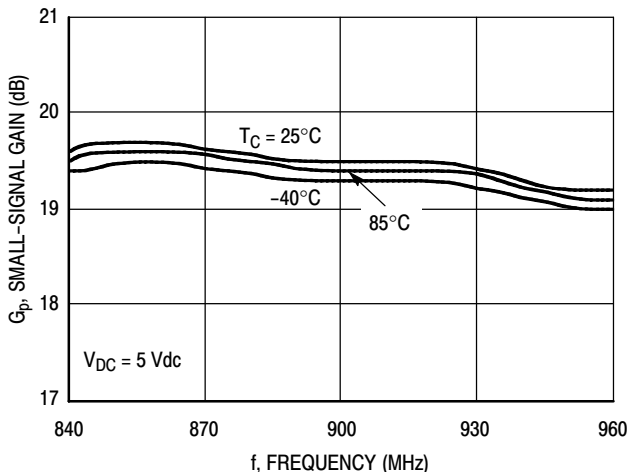


Figure 6. Small-Signal Gain (S21) versus Frequency

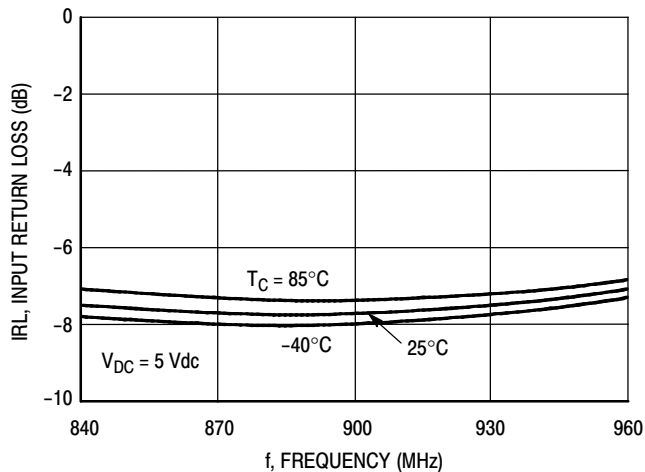


Figure 7. Input Return Loss (S11) versus Frequency

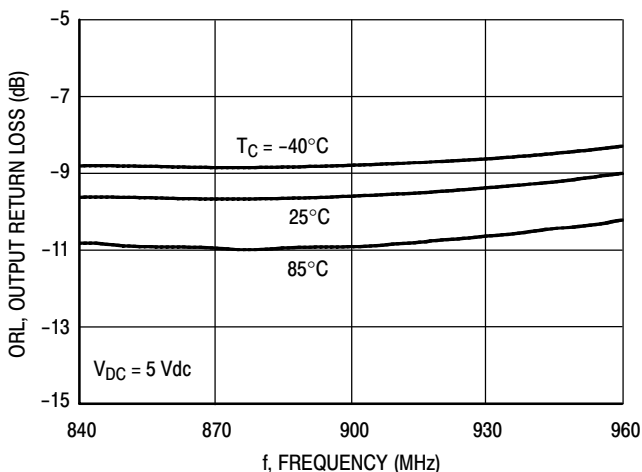


Figure 8. Output Return Loss (S22) versus Frequency

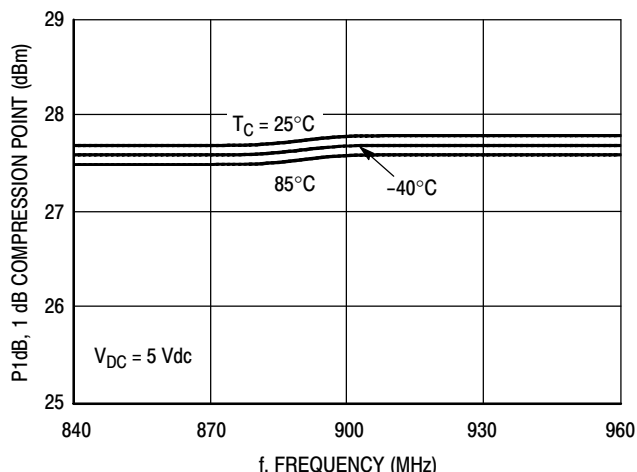


Figure 9. P1dB versus Frequency

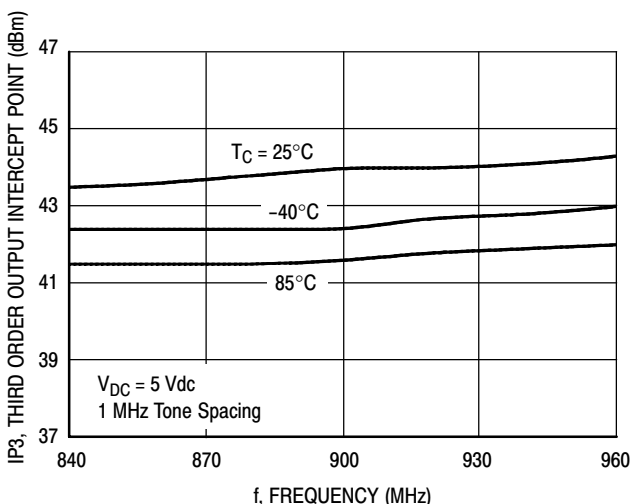


Figure 10. Third Order Output Intercept Point versus Frequency

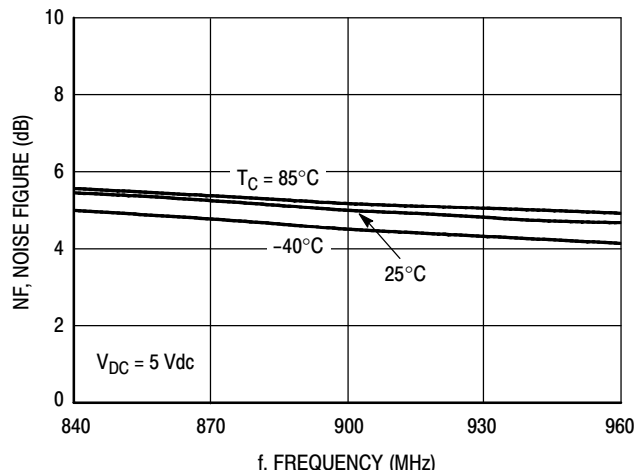


Figure 11. Noise Figure versus Frequency

50 OHM TYPICAL CHARACTERISTICS: 900 MHz

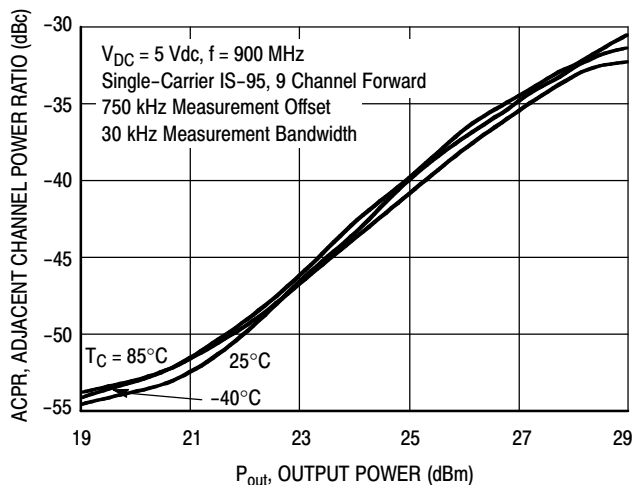


Figure 12. IS-95 Adjacent Channel Power Ratio versus Output Power

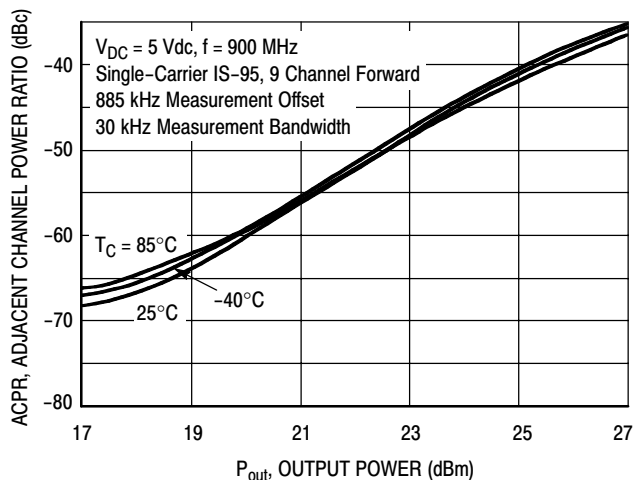


Figure 13. IS-95 Adjacent Channel Power Ratio versus Output Power

50 OHM APPLICATION CIRCUIT: 1900-2200 MHz

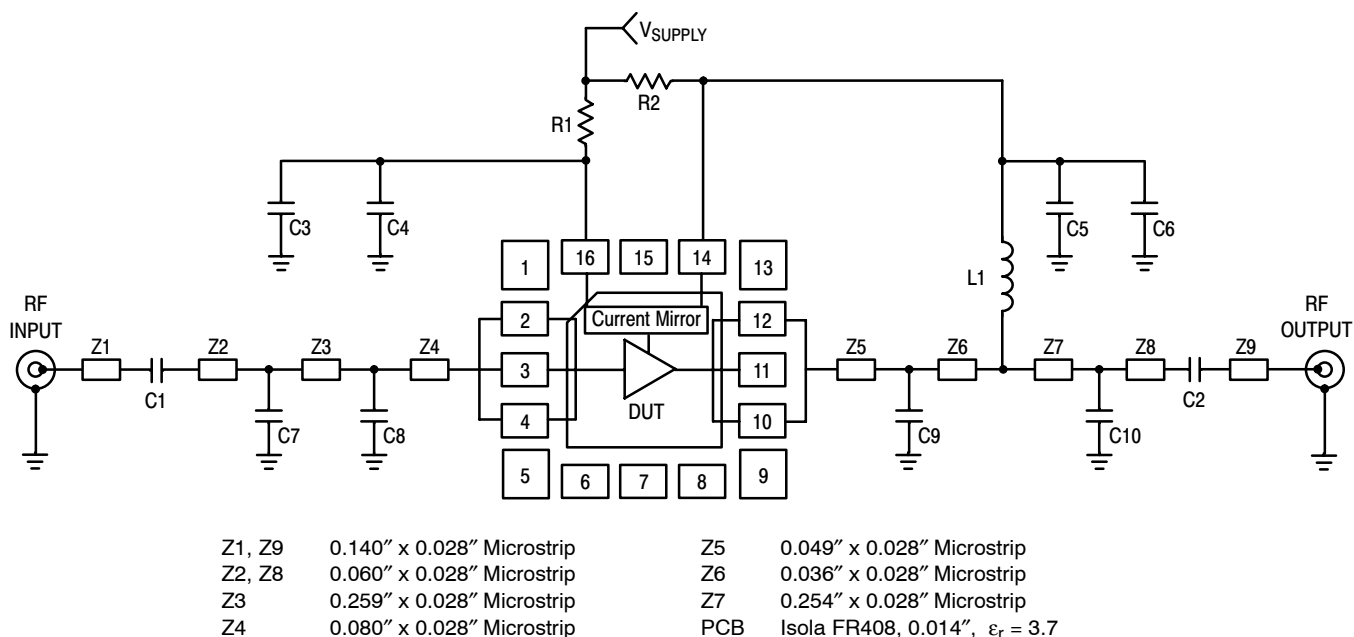


Figure 14. 50 Ohm Test Circuit Schematic

Table 9. 50 Ohm Test Circuit Component Designations and Values

| Part | Description | Part Number | Manufacturer |
|---------|------------------------------------|------------------|--------------|
| C1, C2 | 15 pF Chip Capacitors | ECUV1H150JCV | Panasonic |
| C3, C5 | 0.01 μ F Chip Capacitors | C0603C103J5RAC | Kemet |
| C4, C6 | 0.1 μ F Chip Capacitors | C0603C104J5RAC | Kemet |
| C7, C10 | 0.5 pF Chip Capacitors | 06035J0R5BS | AVX |
| C8 | 2.7 pF Chip Capacitor | 06035J2R7BS | AVX |
| C9 | 0.8 pF Chip Capacitor | 06035J0R8BS | AVX |
| L1 | 33 nH Chip Inductor | LL1608-FSL33NJ | Toko |
| R1 | 22 Ω , 1/10 W Chip Resistor | CRCW060322R0FKEA | Vishay |
| R2 | 0 Ω , 1/10 W Chip Resistor | CRCW06030000FKEA | Vishay |

50 OHM APPLICATION CIRCUIT: 1900-2200 MHz

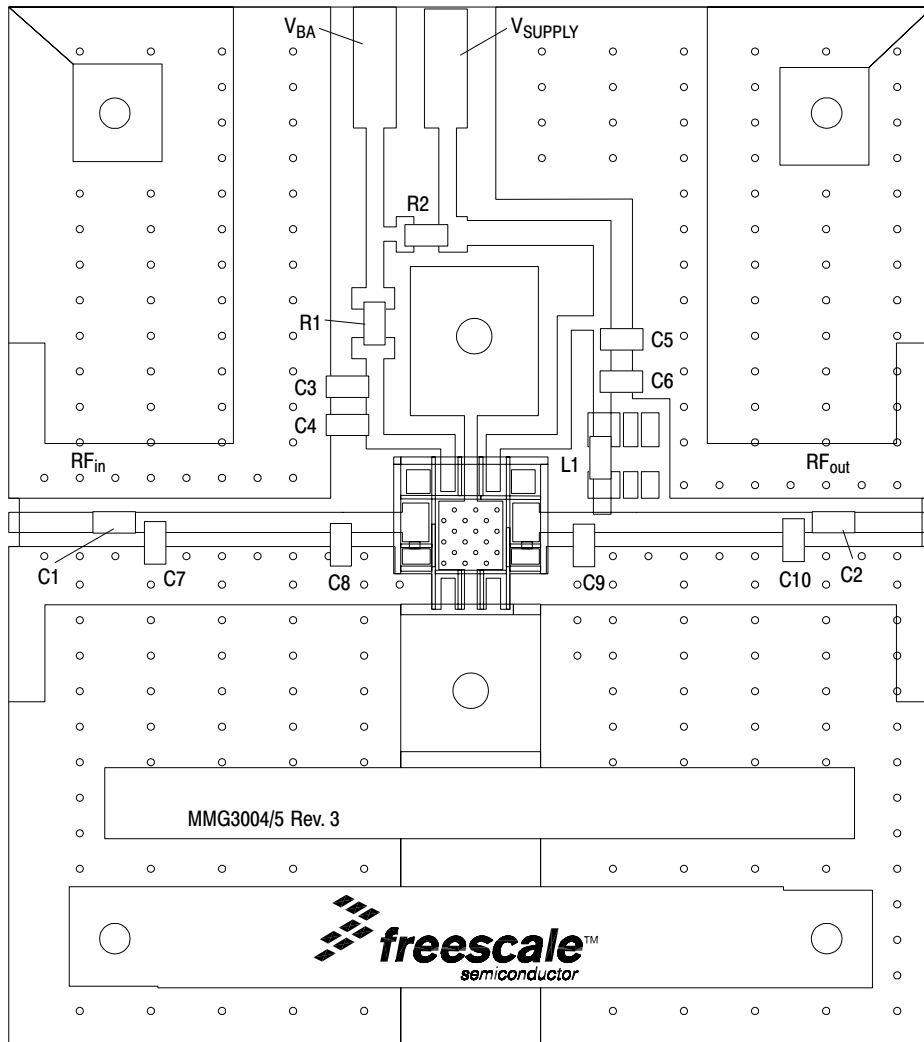


Figure 15. 50 Ohm Test Circuit Component Layout

50 OHM TYPICAL CHARACTERISTICS: 1900-2200 MHz

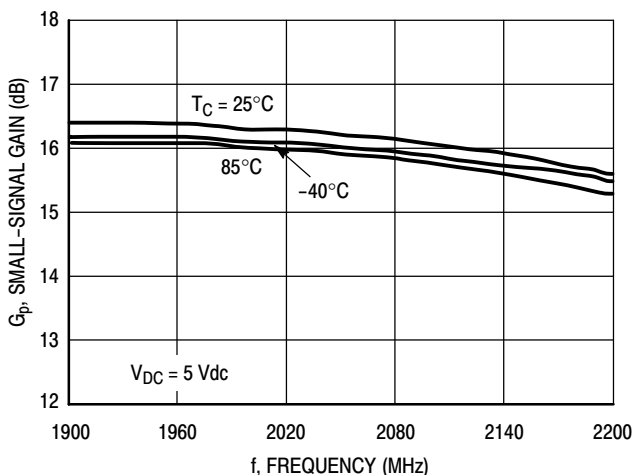


Figure 16. Small-Signal Gain (S21) versus Frequency

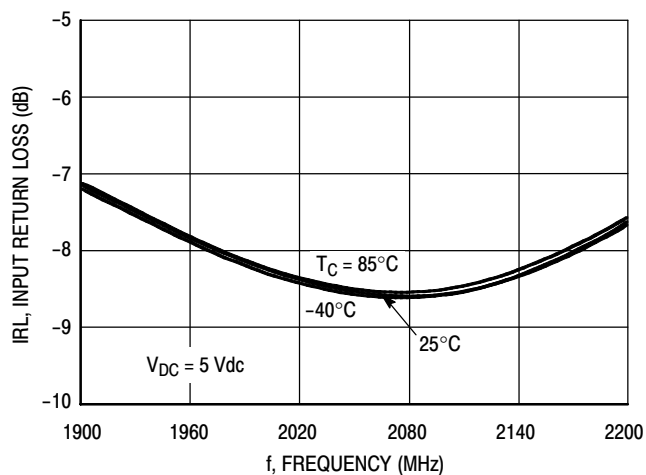


Figure 17. Input Return Loss (S11) versus Frequency

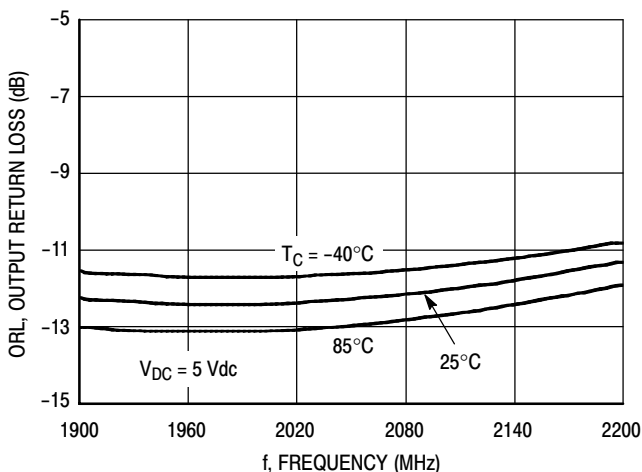


Figure 18. Output Return Loss (S22) versus Frequency

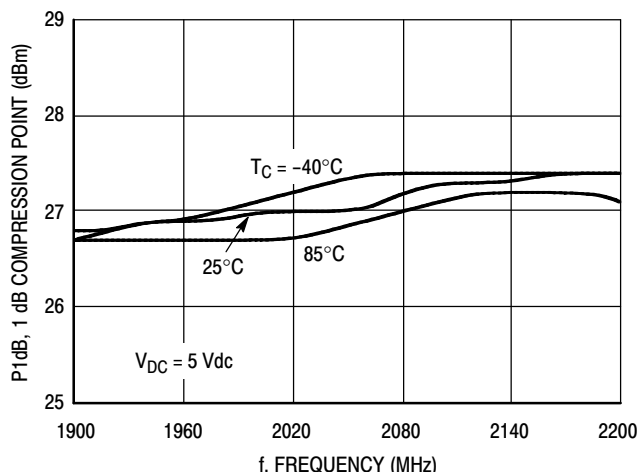


Figure 19. P1dB versus Frequency

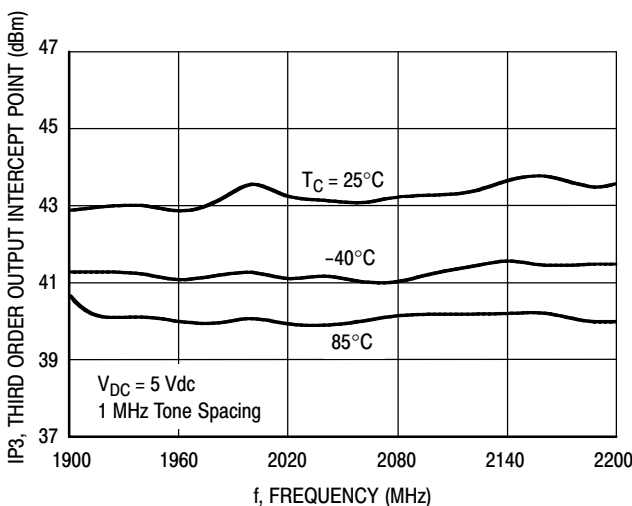


Figure 20. Third Order Output Intercept Point versus Frequency

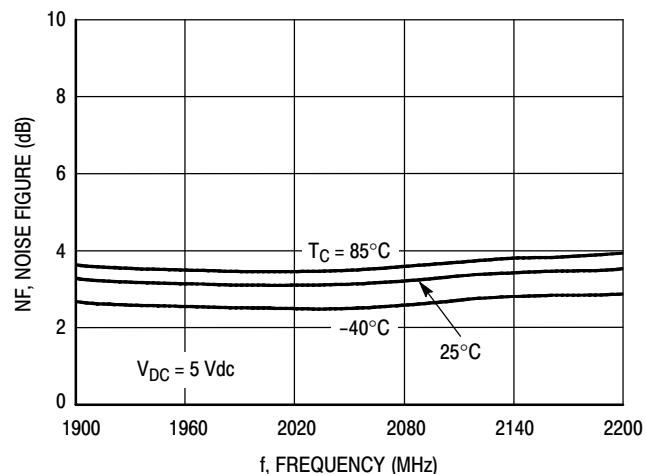


Figure 21. Noise Figure versus Frequency

50 OHM TYPICAL CHARACTERISTICS: 1900-2200 MHz

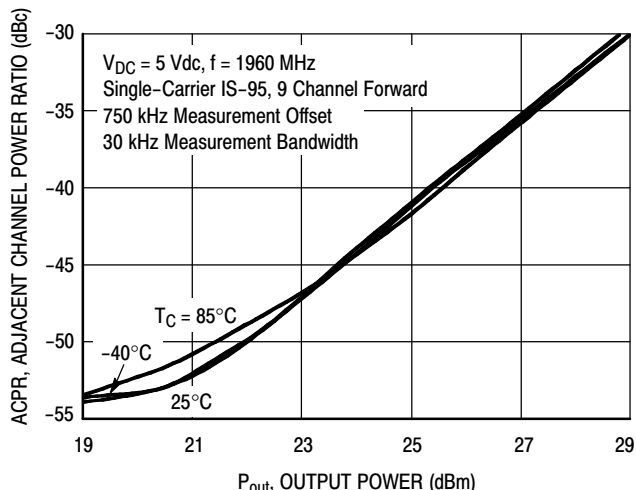


Figure 22. IS-95 Adjacent Channel Power Ratio versus Output Power

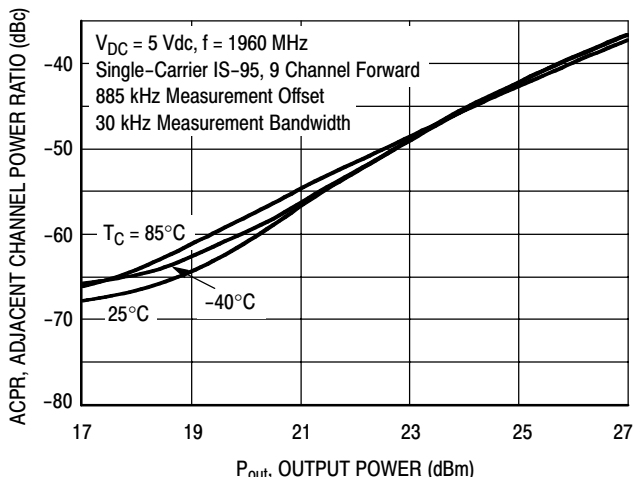


Figure 23. IS-95 Adjacent Channel Power Ratio versus Output Power

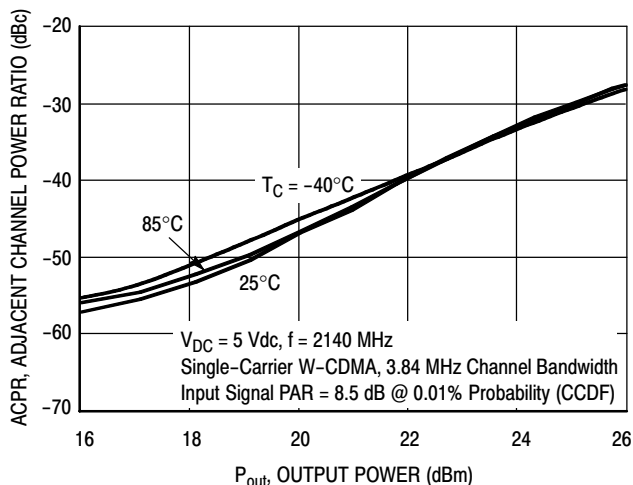


Figure 24. Single-Carrier W-CDMA Adjacent Channel Power Ratio versus Output Power

50 OHM TYPICAL CHARACTERISTICS

Table 10. Common Emitter S-Parameters ($V_{DC} = 5 \text{ Vdc}$, $I_{DC} = 250 \text{ mA}$, $T_C = 25^\circ\text{C}$, 50 Ohm System)

| f MHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|----------|-----------------|---------|-----------------|--------|-----------------|--------|-----------------|--------|
| | S ₁₁ | ∠ φ | S ₂₁ | ∠ φ | S ₁₂ | ∠ φ | S ₂₂ | ∠ φ |
| 400 | 0.62780 | -155.59 | 7.75028 | 138.19 | 0.01341 | -20.61 | 0.73308 | 177.59 |
| 425 | 0.64110 | -156.56 | 7.52200 | 135.93 | 0.01318 | -18.49 | 0.73263 | 177.05 |
| 450 | 0.65775 | -157.61 | 7.40177 | 133.81 | 0.01297 | -16.33 | 0.73058 | 176.51 |
| 475 | 0.67009 | -158.60 | 7.20037 | 131.68 | 0.01282 | -14.50 | 0.72961 | 176.03 |
| 500 | 0.68313 | -159.63 | 7.05567 | 129.69 | 0.01265 | -12.50 | 0.72804 | 175.54 |
| 525 | 0.69585 | -160.59 | 6.91538 | 127.76 | 0.01255 | -10.52 | 0.72718 | 175.02 |
| 550 | 0.70558 | -161.46 | 6.69940 | 125.72 | 0.01251 | -8.66 | 0.72650 | 174.46 |
| 575 | 0.71811 | -162.43 | 6.60437 | 123.98 | 0.01243 | -6.84 | 0.72500 | 173.90 |
| 600 | 0.72694 | -163.35 | 6.42427 | 122.18 | 0.01240 | -5.19 | 0.72458 | 173.43 |
| 625 | 0.73704 | -164.30 | 6.29327 | 120.47 | 0.01238 | -3.35 | 0.72338 | 172.92 |
| 650 | 0.74634 | -165.20 | 6.17990 | 118.78 | 0.01241 | -1.68 | 0.72241 | 172.43 |
| 675 | 0.75277 | -166.03 | 5.99028 | 117.13 | 0.01246 | -0.10 | 0.72250 | 171.98 |
| 700 | 0.76214 | -166.98 | 5.91391 | 115.54 | 0.01249 | 1.32 | 0.72135 | 171.44 |
| 725 | 0.76874 | -167.82 | 5.76815 | 114.00 | 0.01254 | 2.86 | 0.72103 | 170.97 |
| 750 | 0.77561 | -168.72 | 5.64770 | 112.56 | 0.01262 | 4.27 | 0.72003 | 170.51 |
| 775 | 0.78327 | -169.54 | 5.56291 | 111.09 | 0.01272 | 5.73 | 0.71950 | 170.03 |
| 800 | 0.78772 | -170.26 | 5.40401 | 109.64 | 0.01285 | 7.01 | 0.71888 | 169.54 |
| 825 | 0.79476 | -171.12 | 5.33575 | 108.25 | 0.01299 | 8.22 | 0.71803 | 169.01 |
| 850 | 0.79893 | -171.88 | 5.21557 | 106.88 | 0.01314 | 9.31 | 0.71838 | 168.59 |
| 875 | 0.80421 | -172.62 | 5.09417 | 105.61 | 0.01326 | 10.44 | 0.71707 | 168.13 |
| 900 | 0.80983 | -173.40 | 5.04484 | 104.35 | 0.01340 | 11.44 | 0.71668 | 167.64 |
| 925 | 0.81256 | -174.09 | 4.90083 | 102.95 | 0.01357 | 12.52 | 0.71611 | 167.14 |
| 950 | 0.81780 | -174.81 | 4.83208 | 101.78 | 0.01377 | 13.37 | 0.71547 | 166.62 |
| 975 | 0.82118 | -175.53 | 4.75850 | 100.63 | 0.01398 | 14.40 | 0.71514 | 166.17 |
| 1000 | 0.82354 | -176.19 | 4.64462 | 99.41 | 0.01421 | 15.20 | 0.71375 | 165.68 |
| 1025 | 0.82863 | -176.93 | 4.59813 | 98.27 | 0.01449 | 15.97 | 0.71292 | 165.18 |
| 1050 | 0.82994 | -177.51 | 4.47959 | 97.05 | 0.01482 | 16.45 | 0.71160 | 164.72 |
| 1075 | 0.83369 | -178.12 | 4.41800 | 96.02 | 0.01512 | 16.27 | 0.71100 | 164.34 |
| 1100 | 0.83728 | -178.76 | 4.36819 | 95.02 | 0.01522 | 16.04 | 0.71111 | 163.96 |
| 1125 | 0.83914 | -179.35 | 4.25589 | 93.92 | 0.01522 | 16.13 | 0.71104 | 163.46 |
| 1150 | 0.84333 | -179.99 | 4.21812 | 92.91 | 0.01532 | 16.71 | 0.71144 | 162.96 |
| 1175 | 0.84582 | 179.42 | 4.14782 | 91.86 | 0.01540 | 17.23 | 0.71102 | 162.41 |
| 1200 | 0.84730 | 178.80 | 4.07433 | 90.84 | 0.01549 | 17.85 | 0.71091 | 161.96 |
| 1225 | 0.85017 | 178.20 | 4.03089 | 89.88 | 0.01563 | 18.56 | 0.71058 | 161.46 |
| 1250 | 0.85104 | 177.63 | 3.94928 | 88.92 | 0.01581 | 19.15 | 0.70945 | 160.92 |
| 1275 | 0.85363 | 177.01 | 3.91182 | 87.97 | 0.01603 | 19.78 | 0.70911 | 160.44 |
| 1300 | 0.85515 | 176.48 | 3.84948 | 86.97 | 0.01623 | 20.21 | 0.70802 | 159.92 |
| 1325 | 0.85660 | 175.94 | 3.79124 | 86.09 | 0.01644 | 20.62 | 0.70758 | 159.44 |
| 1350 | 0.85919 | 175.39 | 3.75583 | 85.18 | 0.01665 | 21.10 | 0.70645 | 158.93 |
| 1375 | 0.85982 | 174.86 | 3.68725 | 84.24 | 0.01685 | 21.41 | 0.70534 | 158.44 |
| 1400 | 0.86102 | 174.26 | 3.65116 | 83.37 | 0.01708 | 21.83 | 0.70492 | 157.95 |
| 1425 | 0.86270 | 173.77 | 3.60736 | 82.44 | 0.01733 | 22.12 | 0.70407 | 157.43 |
| 1450 | 0.86382 | 173.26 | 3.55564 | 81.56 | 0.01754 | 22.31 | 0.70310 | 156.95 |
| 1475 | 0.86525 | 172.73 | 3.51922 | 80.69 | 0.01778 | 22.70 | 0.70185 | 156.45 |

(continued)

50 OHM TYPICAL CHARACTERISTICS

Table 10. Common Emitter S-Parameters ($V_{DC} = 5 \text{ Vdc}$, $I_{DC} = 250 \text{ mA}$, $T_C = 25^\circ\text{C}$, 50 Ohm System) (continued)

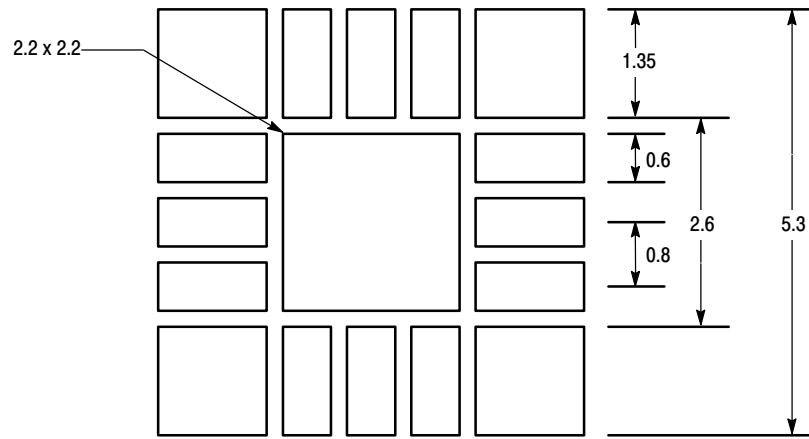
| f MHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|----------|-----------------|--------|-----------------|-------|-----------------|-------|-----------------|--------|
| | S ₁₁ | ∠ φ | S ₂₁ | ∠ φ | S ₁₂ | ∠ φ | S ₂₂ | ∠ φ |
| 1500 | 0.86447 | 171.75 | 3.49706 | 79.68 | 0.01815 | 22.78 | 0.69775 | 156.18 |
| 1525 | 0.86543 | 171.19 | 3.46774 | 78.76 | 0.01841 | 22.92 | 0.69678 | 155.64 |
| 1550 | 0.86646 | 170.67 | 3.42587 | 77.92 | 0.01868 | 23.04 | 0.69558 | 155.13 |
| 1575 | 0.86663 | 170.18 | 3.38624 | 77.08 | 0.01889 | 23.19 | 0.69453 | 154.61 |
| 1600 | 0.86864 | 169.65 | 3.35249 | 76.23 | 0.01916 | 23.38 | 0.69264 | 154.06 |
| 1625 | 0.86848 | 169.14 | 3.31471 | 75.38 | 0.01940 | 23.47 | 0.69185 | 153.54 |
| 1650 | 0.86907 | 168.58 | 3.28145 | 74.52 | 0.01966 | 23.55 | 0.69110 | 153.02 |
| 1675 | 0.86995 | 168.06 | 3.24680 | 73.68 | 0.01990 | 23.70 | 0.68960 | 152.47 |
| 1700 | 0.86908 | 167.55 | 3.21301 | 72.89 | 0.02016 | 23.85 | 0.68912 | 152.02 |
| 1725 | 0.87075 | 166.99 | 3.17917 | 72.07 | 0.02043 | 23.94 | 0.68700 | 151.51 |
| 1750 | 0.87075 | 166.48 | 3.14872 | 71.28 | 0.02072 | 23.94 | 0.68638 | 151.05 |
| 1775 | 0.87095 | 165.94 | 3.11816 | 70.46 | 0.02101 | 24.02 | 0.68533 | 150.57 |
| 1800 | 0.87210 | 165.38 | 3.08624 | 69.66 | 0.02127 | 24.02 | 0.68377 | 150.09 |
| 1825 | 0.87206 | 164.86 | 3.05732 | 68.88 | 0.02156 | 24.07 | 0.68284 | 149.66 |
| 1850 | 0.87291 | 164.26 | 3.02693 | 68.07 | 0.02183 | 24.07 | 0.68136 | 149.22 |
| 1875 | 0.87225 | 163.73 | 2.99956 | 67.29 | 0.02214 | 24.03 | 0.68073 | 148.79 |
| 1900 | 0.87269 | 163.18 | 2.97218 | 66.53 | 0.02241 | 24.07 | 0.67941 | 148.37 |
| 1925 | 0.87341 | 162.62 | 2.94317 | 65.76 | 0.02272 | 24.05 | 0.67817 | 147.93 |
| 1950 | 0.87288 | 162.11 | 2.91922 | 65.01 | 0.02300 | 24.10 | 0.67684 | 147.54 |
| 1975 | 0.87403 | 161.54 | 2.88985 | 64.24 | 0.02333 | 23.99 | 0.67500 | 147.15 |
| 2000 | 0.87359 | 160.98 | 2.86616 | 63.49 | 0.02366 | 23.91 | 0.67393 | 146.75 |
| 2025 | 0.87242 | 160.38 | 2.84227 | 62.70 | 0.02397 | 23.80 | 0.67298 | 146.42 |
| 2050 | 0.87347 | 159.78 | 2.81763 | 61.98 | 0.02429 | 23.70 | 0.67159 | 146.04 |
| 2075 | 0.87337 | 159.25 | 2.79570 | 61.26 | 0.02465 | 23.66 | 0.67018 | 145.69 |
| 2100 | 0.87327 | 158.66 | 2.77239 | 60.53 | 0.02498 | 23.49 | 0.66901 | 145.36 |
| 2125 | 0.87318 | 158.11 | 2.75232 | 59.81 | 0.02536 | 23.32 | 0.66790 | 145.01 |
| 2150 | 0.87233 | 157.55 | 2.73039 | 59.07 | 0.02571 | 23.11 | 0.66702 | 144.69 |
| 2175 | 0.87291 | 156.95 | 2.70958 | 58.40 | 0.02602 | 22.93 | 0.66610 | 144.37 |
| 2200 | 0.87284 | 156.41 | 2.69236 | 57.69 | 0.02636 | 22.73 | 0.66519 | 144.03 |
| 2225 | 0.87305 | 155.87 | 2.67297 | 57.01 | 0.02672 | 22.55 | 0.66417 | 143.67 |
| 2250 | 0.87252 | 155.28 | 2.65614 | 56.29 | 0.02709 | 22.23 | 0.66378 | 143.30 |
| 2275 | 0.87193 | 154.76 | 2.63741 | 55.58 | 0.02744 | 22.01 | 0.66344 | 142.95 |
| 2300 | 0.87178 | 154.15 | 2.62034 | 54.89 | 0.02777 | 21.74 | 0.66387 | 142.57 |
| 2325 | 0.87159 | 153.64 | 2.60593 | 54.19 | 0.02812 | 21.52 | 0.66363 | 142.19 |
| 2350 | 0.87191 | 153.13 | 2.59024 | 53.50 | 0.02850 | 21.34 | 0.66365 | 141.75 |
| 2375 | 0.87202 | 152.60 | 2.57507 | 52.78 | 0.02891 | 21.08 | 0.66346 | 141.32 |
| 2400 | 0.87117 | 152.09 | 2.55841 | 52.08 | 0.02926 | 20.77 | 0.66342 | 140.87 |
| 2425 | 0.87077 | 151.53 | 2.54515 | 51.37 | 0.02967 | 20.45 | 0.66386 | 140.39 |
| 2450 | 0.87026 | 151.02 | 2.53215 | 50.65 | 0.03007 | 20.15 | 0.66405 | 139.92 |
| 2475 | 0.87003 | 150.54 | 2.51806 | 49.95 | 0.03047 | 19.77 | 0.66432 | 139.41 |
| 2500 | 0.86985 | 150.02 | 2.50328 | 49.24 | 0.03087 | 19.40 | 0.66490 | 138.85 |
| 2525 | 0.86940 | 149.49 | 2.49003 | 48.49 | 0.03126 | 18.98 | 0.66538 | 138.34 |
| 2550 | 0.86918 | 148.98 | 2.47736 | 47.77 | 0.03167 | 18.61 | 0.66582 | 137.78 |
| 2575 | 0.86921 | 148.48 | 2.46415 | 47.02 | 0.03208 | 18.11 | 0.66531 | 137.21 |

(continued)

50 OHM TYPICAL CHARACTERISTICS

Table 10. Common Emitter S-Parameters ($V_{DC} = 5 \text{ Vdc}$, $I_{DC} = 250 \text{ mA}$, $T_C = 25^\circ\text{C}$, 50 Ohm System) (continued)

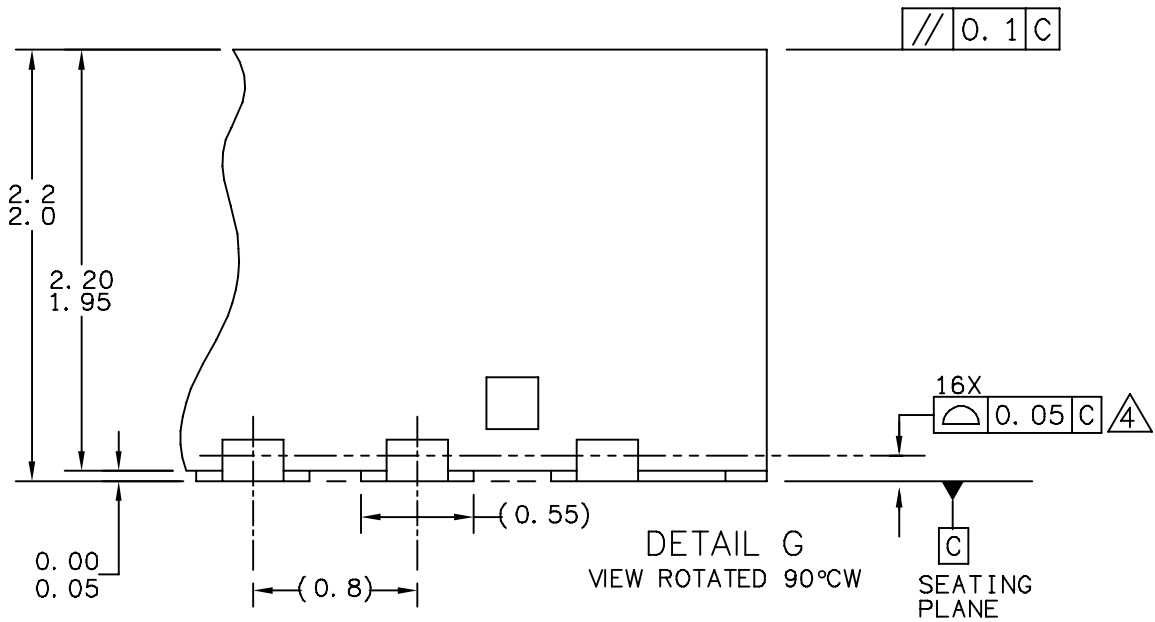
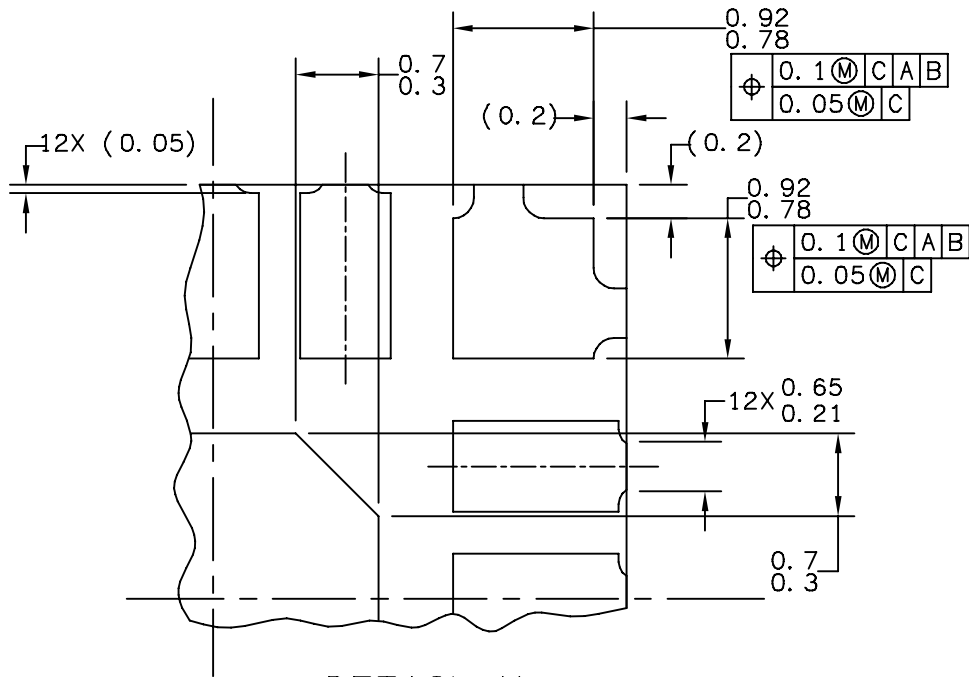
| f MHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|----------|-----------------|--------|-----------------|-------|-----------------|-------|-----------------|--------|
| | S ₁₁ | ∠ φ | S ₂₁ | ∠ φ | S ₁₂ | ∠ φ | S ₂₂ | ∠ φ |
| 2600 | 0.86804 | 147.97 | 2.45098 | 46.28 | 0.03246 | 17.66 | 0.66588 | 136.62 |
| 2625 | 0.86808 | 147.46 | 2.43657 | 45.54 | 0.03287 | 17.21 | 0.66553 | 136.01 |
| 2650 | 0.86755 | 146.99 | 2.42271 | 44.82 | 0.03328 | 16.67 | 0.66525 | 135.46 |
| 2675 | 0.86741 | 146.47 | 2.41111 | 44.06 | 0.03360 | 16.15 | 0.66520 | 134.87 |
| 2700 | 0.86769 | 145.97 | 2.39656 | 43.31 | 0.03402 | 15.56 | 0.66461 | 134.26 |
| 2725 | 0.86693 | 145.47 | 2.38409 | 42.57 | 0.03438 | 15.04 | 0.66448 | 133.68 |
| 2750 | 0.86730 | 144.92 | 2.37136 | 41.82 | 0.03473 | 14.40 | 0.66407 | 133.13 |
| 2775 | 0.86724 | 144.42 | 2.35811 | 41.07 | 0.03504 | 13.77 | 0.66312 | 132.57 |
| 2800 | 0.86702 | 143.87 | 2.34590 | 40.30 | 0.03530 | 13.25 | 0.66208 | 132.00 |
| 2825 | 0.86694 | 143.37 | 2.33197 | 39.55 | 0.03566 | 12.69 | 0.66088 | 131.39 |
| 2850 | 0.86602 | 142.83 | 2.32062 | 38.80 | 0.03594 | 12.05 | 0.66087 | 130.80 |
| 2875 | 0.86701 | 142.28 | 2.30727 | 38.05 | 0.03623 | 11.45 | 0.65952 | 130.25 |
| 2900 | 0.86649 | 141.70 | 2.29559 | 37.30 | 0.03650 | 10.82 | 0.65833 | 129.72 |
| 2925 | 0.86653 | 141.16 | 2.28517 | 36.51 | 0.03678 | 10.22 | 0.65713 | 129.15 |
| 2950 | 0.86661 | 140.59 | 2.27190 | 35.74 | 0.03700 | 9.61 | 0.65548 | 128.55 |
| 2975 | 0.86565 | 140.01 | 2.26115 | 34.97 | 0.03725 | 9.07 | 0.65458 | 127.97 |
| 3000 | 0.86627 | 139.42 | 2.24868 | 34.20 | 0.03747 | 8.51 | 0.65272 | 127.41 |



NOTES:


1. THERMAL AND RF GROUNDING CONSIDERATIONS SHOULD BE USED IN PCB LAYOUT DESIGN.
2. DEPENDING ON PCB DESIGN RULES, AS MANY VIAS AS POSSIBLE SHOULD BE PLACED ON THE BACKSIDE CENTER METAL GROUND LANDING PATTERN.
3. REFER TO FREESCALE APPLICATION NOTE AN2467 FOR ADDITIONAL PQFN PCB GUIDELINES.

Figure 25. Recommended Mounting Configuration



| | | | |
|---|---------------------------|----------------------------|--|
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| | CASE NUMBER: 1543-03 | 31 OCT 2006 | |
| | STANDARD: JEDEC MO-251 | | |

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
3. THE COMPLETE JEDEC DESIGNATOR FOR THIS PACKAGE IS: HF-PQFN.
4.  COPLANARITY APPLIES TO LEADS AND DIE ATTACH PAD.
5. MINIMUM METAL GAP SHOULD BE 0.25MM.

| | | | |
|---|---------------------------|----------------------------|--|
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| | CASE NUMBER: 1543-03 | 31 OCT 2006 | |
| | STANDARD: JEDEC M0-251 | | |

PRODUCT DOCUMENTATION

Refer to the following documents to aid your design process.

Application Notes

- AN1955: Thermal Measurement Methodology of RF Power Amplifiers
- AN3100: General Purpose Amplifier Biasing

REVISION HISTORY

The following table summarizes revisions to this document.

| Revision | Date | Description |
|----------|-----------|---|
| 2 | Mar. 2007 | <ul style="list-style-type: none"> • Replaced Case Outline 1543-02 with updated 1543-03, Issue C, p. 1, 16-18 • Added V_{CC} callout to Pin Connections 10, 11, and 12 in Fig. 1, Pin Connections, p. 3 • Updated Part Numbers in Table 8, Component Designations and Values, 900 MHz, to RoHS compliant part numbers, p. 5 • Corrected circuit board callouts, V_p to V_{BA} and V_{CC} to V_{SUPPLY}, Fig. 5, 50 Ohm Test Circuit Component Layout, 900 MHz, p. 6 • Removed I_{DC} value due to its variability over temperature, Figs. 12-13, IS-95 Adjacent Channel Power Ratio versus Output Power, 900 MHz, p. 8 • Updated Part Numbers in Table 9, Component Designations and Values, 1900-2200 MHz, to RoHS compliant part numbers, p. 9 • Corrected circuit board callouts, V_p to V_{BA} and V_{CC} to V_{SUPPLY}, Fig. 15, 50 Ohm Test Circuit Component Layout, 1900-2200 MHz, p. 10 • Removed I_{DC} value due to its variability over temperature, Figs. 22-23, IS-95 Adjacent Channel Power Ratio versus Output Power, 1900-2200 MHz, and Fig. 24, Single-Carrier W-CDMA Adjacent Channel Power Ratio versus Output Power, 1900-2200 MHz, p. 12 • Replaced Table 10, S-Parameters, p. 13-15 • Added Product Documentation and Revision History, p. 19 |
| 3 | Mar. 2008 | <ul style="list-style-type: none"> • Corrected Tape and Reel information from 12 mm, 7 inch Reel to 16 mm, 13 inch Reel, p. 1 • Removed Footnote 2, Continuous voltage and current applied to device, from Table 2, Maximum Ratings, p. 1 • Corrected Fig. 24, Single-Carrier W-CDMA Adjacent Channel Power Ratio versus Output Power y-axis (ACPR) unit of measure to dBc, p. 12 • Corrected S-Parameter table frequency column label to read "MHz" versus "GHz" and corrected frequency values from GHz to MHz, p. 13, 14, 15 |

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Japan:

Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064
Japan
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Asia/Pacific:

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