**Freescale Semiconductor**
Technical Data

Document Number: MRF6S20010N
Rev. 0, 12/2005

RoHS

# RF Power Field Effect Transistors

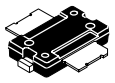
## N-Channel Enhancement-Mode Lateral MOSFETs

**MRF6S20010NR1**
**MRF6S20010GNR1**

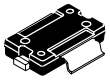
Designed for Class A or Class AB general purpose applications with frequencies from 1600 to 2200 MHz. Suitable for analog and digital modulation and multipurpose amplifier applications.

- Typical Two-Tone Performance @ 2170 MHz: $V_{DD}$ = 28 Volts, $I_{DQ}$ = 130 mA, $P_{out}$ = 10 Watts PEP
  - Power Gain — 15.5 dB
  - Drain Efficiency — 36%
  - IMD — -34 dBc
- Typical 2-Carrier W-CDMA Performance: $V_{DD}$ = 28 Volts, $I_{DQ}$ = 130 mA, $P_{out}$ = 1 Watt Avg., Full Frequency Band (2130-2170 MHz), Channel Bandwidth = 3.84 MHz. PAR = 8.5 dB @ 0.01% Probability
  - Power Gain — 15.5 dB
  - Drain Efficiency — 15%
  - IM3 @ 10 MHz Offset — -47 dBc in 3.84 MHz Channel Bandwidth
  - ACPR @ 5 MHz Offset — -49 dBc in 3.84 MHz Channel Bandwidth
- Typical Single-Carrier N-CDMA Performance: $V_{DD}$ = 28 Volts, $I_{DQ}$ = 130 mA, $P_{out}$ = 1 Watt Avg., Full Frequency Band (1930-1990 MHz), IS-95 (Pilot, Sync, Paging, Traffic Codes 8 through 13), Channel Bandwidth = 1.2288 MHz. PAR = 9.8 dB @ 0.01% Probability on CCDF.
  - Power Gain — 15.5 dB
  - Drain Efficiency— 16%
  - ACPR @ 885 kHz Offset = -60 dBc in 30 kHz Bandwidth
- Typical GSM EDGE Performance: $V_{DD}$ = 28 Volts, $I_{DQ}$ = 130 mA, $P_{out}$ = 4 Watts Avg., Full Frequency Band (1805-1880 MHz)
  - Power Gain — 16 dB
  - Drain Efficiency — 33%
  - EVM — 1.3% rms
- Capable of Handling 5:1 VSWR, @ 28 Vdc, 2000 MHz, 10 Watts CW Output Power
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Internally Matched for Ease of Use
- Qualified Up to a Maximum of 32 $V_{DD}$ Operation
- Integrated ESD Protection
- 200°C Capable Plastic Package
- N Suffix Indicates Lead-Free Terminations. RoHS Compliant.
- In Tape and Reel. R1 Suffix = 500 Units per 24 mm, 13 inch Reel.

**1600-2200 MHz, 10 W, 28 V**
**GSM/GSM EDGE**
**SINGLE N-CDMA**
**2 x W-CDMA**
**LATERAL N-CHANNEL**
**RF POWER MOSFETs**



**CASE 1265-08, STYLE 1**
**TO-270-2**
**PLASTIC**
**MRF6S20010NR1**



**CASE 1265A-02, STYLE 1**
**TO-270-2 GULL**
**PLASTIC**
**MRF6S20010GNR1**

**Table 1. Maximum Ratings**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DSS}$ | -0.5, +68 | Vdc |
| Gate-Source Voltage | $V_{GS}$ | -0.5, +12 | Vdc |
| Storage Temperature Range | $T_{stg}$ | -65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | 200 | °C |

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



freescale semiconductor

**Table 2. Thermal Characteristics**

| Characteristic | Symbol | Value (1,2) | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case<br>Case Temperature 78°C, 1 W CW<br>Case Temperature 79°C, 10 W PEP, Two-Tone Test | $R_{\theta JC}$ | <br>2.5<br>5.9 | °C/W |

**Table 3. ESD Protection Characteristics**

| Test Methodology | Class |
|---|---|
| Human Body Model (per JESD22-A114) | 1A (Minimum) |
| Machine Model (per EIA/JESD22-A115) | A (Minimum) |
| Charge Device Model (per JESD22-C101) | IV (Minimum) |

**Table 4. Moisture Sensitivity Level**

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

**Table 5. Electrical Characteristics** ($T_C$ = 25°C unless otherwise noted)

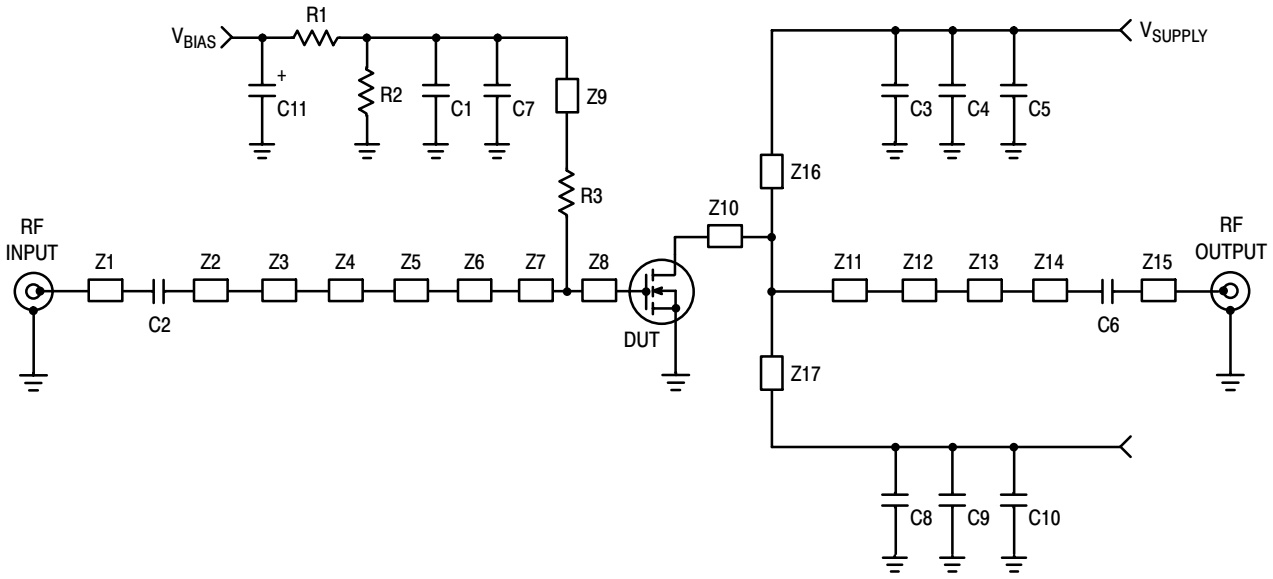
| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **Off Characteristics** | | | | | |
| Zero Gate Voltage Drain Leakage Current<br>($V_{DS}$ = 68 Vdc, $V_{GS}$ = 0 Vdc) | $I_{DSS}$ | — | — | 10 | μAdc |
| Zero Gate Voltage Drain Leakage Current<br>($V_{DS}$ = 28 Vdc, $V_{GS}$ = 0 Vdc) | $I_{DSS}$ | — | — | 1 | μAdc |
| Gate-Source Leakage Current<br>($V_{GS}$ = 5 Vdc, $V_{DS}$ = 0 Vdc) | $I_{GSS}$ | — | — | 500 | μAdc |
| **On Characteristics** | | | | | |
| Gate Threshold Voltage<br>($V_{DS}$ = 10 Vdc, $I_D$ = 40 μAdc) | $V_{GS(th)}$ | 1.5 | 2.2 | 3.5 | Vdc |
| Gate Quiescent Voltage<br>($V_{DS}$ = 28 Vdc, $I_D$ = 130 mAdc, Measured in Functional Test) | $V_{GS(Q)}$ | 2 | 2.8 | 4 | Vdc |
| Drain-Source On-Voltage<br>($V_{GS}$ = 10 Vdc, $I_D$ = 0.4 Adc) | $V_{DS(on)}$ | — | 0.33 | 0.4 | Vdc |
| **Dynamic Characteristics(3)** | | | | | |
| Input Capacitance<br>($V_{DS}$ = 28 Vdc ± 30 mV(rms)ac @ 1 MHz, $V_{GS}$ = 0 Vdc) | $C_{iss}$ | — | 0.12 | — | pF |
| Output Capacitance<br>($V_{DS}$ = 28 Vdc ± 30 mV(rms)ac @ 1 MHz, $V_{GS}$ = 0 Vdc) | $C_{oss}$ | — | 0.02 | — | pF |
| Reverse Transfer Capacitance<br>($V_{DS}$ = 28 Vdc ± 30 mV(rms)ac @ 1 MHz, $V_{GS}$ = 0 Vdc) | $C_{rss}$ | — | 11.6 | — | pF |
| **Functional Tests** (In Freescale Test Fixture, 50 ohm system) $V_{DD}$ = 28 Vdc, $I_{DQ}$ = 130 mA, $P_{out}$ = 10 W PEP, f1 = 2170 MHz, f2 = 2170.1 MHz, Two-Tone Test | | | | | |
| Power Gain | $G_{ps}$ | 14 | 15.5 | 17 | dB |
| Drain Efficiency | $\eta_D$ | 33 | 36 | — | % |
| Intermodulation Distortion | IMD | — | -34 | -28 | dBc |
| Input Return Loss | IRL | — | -15 | -9 | dB |

1. MTTF calculator available at http://www.freescale.com/rf. Select Tools/Software/Application Software/Calculators to access the MTTF calculators by product.
2. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.freescale.com/rf. Select Documentation/Application Notes - AN1955.
3. Part internally matched on input.

(continued)

**Table 5. Electrical Characteristics** ($T_C$ = 25°C unless otherwise noted) **(continued)**

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **Typical 2-Carrier W-CDMA Performances** (In Freescale CDMA Test Fixture, 50 ohm system) $V_{DD}$ = 28 Vdc, $I_{DQ}$ = 130 mA, $P_{out}$ = 1 W Avg., f1 = 2112.5 MHz, f2 = 2122.5 MHz and f1 = 2157.5 MHz, f2 = 2167.5 MHz, 2-Carrier W-CDMA, 3.84 MHz Channel Bandwidth Carriers. ACPR measured in 3.84 MHz Channel Bandwidth @ ±5 MHz Offset. IM3 measured in 3.84 MHz Bandwidth @ ±10 MHz Offset. PAR = 8.5 dB @ 0.01% Probability on CCDF. | | | | | |
| Power Gain | $G_{ps}$ | — | 15.5 | — | dB |
| Drain Efficiency | $\eta_D$ | — | 15 | — | % |
| Gain Flatness in 30 MHz Bandwidth @ $P_{out}$ = 1 W CW | $G_F$ | — | 0.3 | — | dB |
| Intermodulation Distortion | IM3 | — | -47 | — | dBc |
| Adjacent Channel Power Ratio | ACPR | — | -49 | — | dBc |
| **Typical N-CDMA Performances** (In Freescale Test Fixture, 50 ohm system) $V_{DD}$ = 28 Vdc, $I_{DQ}$ = 130 mA, $P_{out}$ = 1 W Avg., 1930 MHz<Frequency<1990 MHz, Single-Carrier N-CDMA, 1.2288 MHz Channel Bandwidth Carrier. ACPR measured in 30 kHz Channel Bandwidth @ ±885 kHz Offset. PAR = 9.8 dB @ 0.01% Probability on CCDF | | | | | |
| Power Gain | $G_{ps}$ | — | 15.5 | — | dB |
| Drain Efficiency | $\eta_D$ | — | 16 | — | % |
| Gain Flatness in 30 MHz Bandwidth @ $P_{out}$ = 1 W CW | $G_F$ | — | 0.3 | — | dB |
| Adjacent Channel Power Ratio | ACPR | — | -60 | — | dBc |
| **Typical GSM EDGE Performances** (In Freescale GSM EDGE Test Fixture, 50 ohm system) $V_{DD}$ = 28 Vdc, $I_{DQ}$ = 130 mA, $P_{out}$ = 4 W Avg., 1805 MHz<Frequency<1880 MHz | | | | | |
| Power Gain | $G_{ps}$ | — | 16 | — | dB |
| Drain Efficiency | $\eta_D$ | — | 33 | — | % |
| Gain Flatness in 30 MHz Bandwidth @ $P_{out}$ = 4 W CW | $G_F$ | — | 0.3 | — | dB |
| Error Vector Magnitude | EVM | — | 1.3 | — | % rms |
| Spectral Regrowth at 400 kHz Offset | SR1 | — | -60 | — | dBc |
| Spectral Regrowth at 600 kHz Offset | SR2 | — | -70 | — | dBc |




| | | | |
|---|---|---|---|
| Z1, Z15 | 0.066″ x 0.480″ Microstrip | Z10 | 0.930″ x 0.350″ Microstrip |
| Z2 | 0.066″ x 0.765″ Microstrip | Z11 | 0.930″ x 0.400″ Microstrip |
| Z3, Z5 | 0.066″ x 0.340″ x 0.050″ Taper | Z12 | 0.050″ x 0.105″ Microstrip |
| Z4 | 0.340″ x 0.295″ Microstrip | Z13 | 0.405″ x 0.242″ Microstrip |
| Z6 | 0.020″ x 0.060″ Microstrip | Z14 | 0.066″ x 0.740″ Microstrip |
| Z7 | 0.0905″ x 0.280″ Microstrip | Z16, Z17 | 0.050″ x 1.250″ Microstrip |
| Z8 | 0.0905″ x 0.330″ Microstrip | PCB | Taconic RF-35, 0.030″, $\varepsilon_r$ = 3.5 |
| Z9 | 0.050″ x 0.980″ Microstrip | | |

**Figure 1. MRF6S20010NR1(GNR1) Test Circuit Schematic — 2110-2170 MHz**

**Table 6. MRF6S20010NR1(GNR1) Test Circuit Component Designations and Values — 2110-2170 MHz**

| Part | Description | Part Number | Manufacturer |
|---|---|---|---|
| C1 | 100 nF Chip Capacitor (1206) | CDR33BX104AKWS | Kemet |
| C2, C6 | 4.7 pF 600B Chip Capacitors | 600B4R7CW | ATC |
| C3, C7, C8 | 9.1 pF 600B Chip Capacitors | 600B9R1CW | ATC |
| C4, C5, C9, C10 | 10 μF, 50 V Chip Capacitors | GRM55DR61H106KA88B | Murata |
| C11 | 10 μF, 35 V Tantalum Chip Capacitor | T490D106K035AS | Kemet |
| R1 | 1 kΩ Chip Resistor (1206) | | |
| R2 | 10 kΩ Chip Resistor (1206) | | |
| R3 | 10 Ω Chip Resistor (1206) | | |

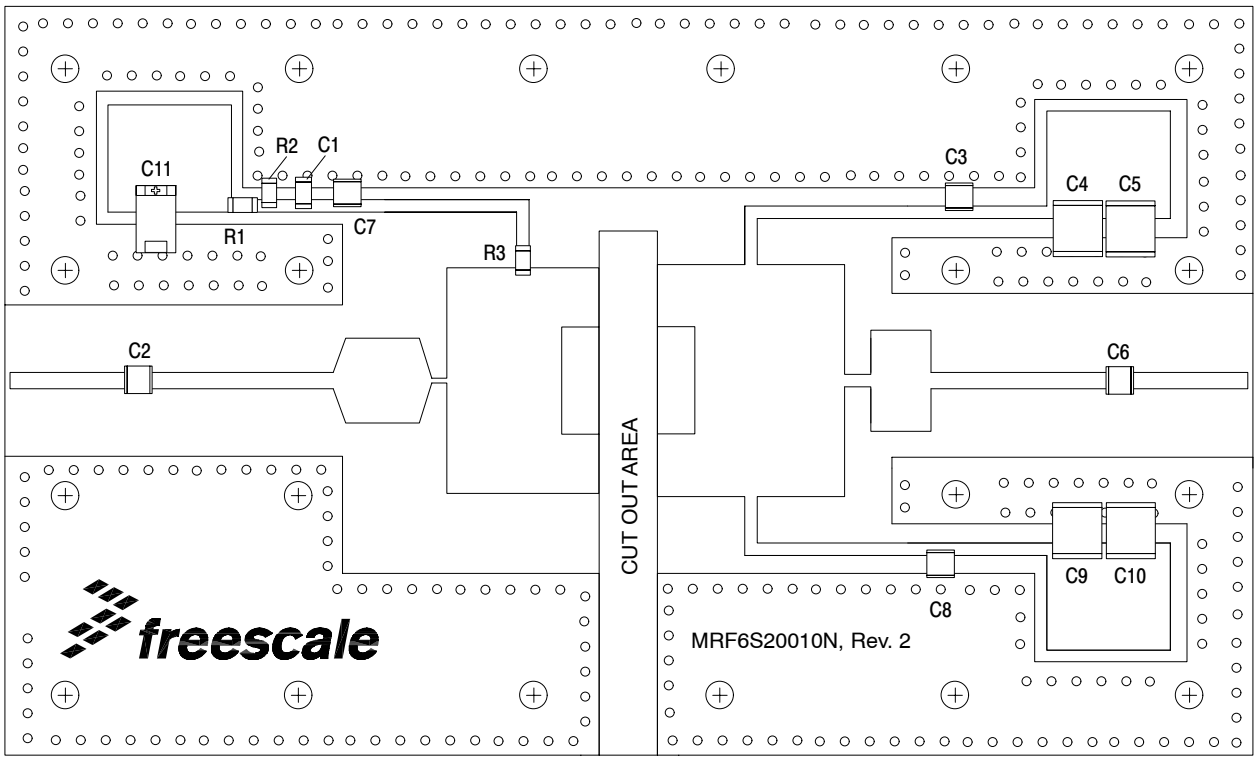



**Figure 2. MRF6S20010NR1(GNR1) Test Circuit Component Layout — 2110-2170 MHz**

## TYPICAL CHARACTERISTICS — 2110-2170 MHz

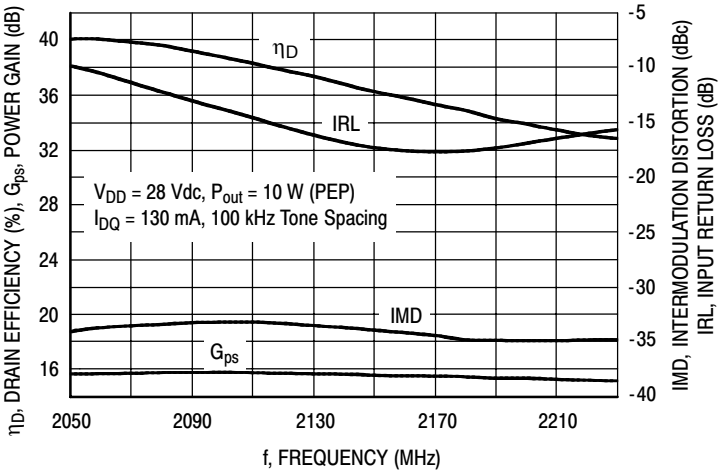



**Figure 3. Two-Tone Wideband Performance @ $P_{out}$ = 10 Watts (PEP)**

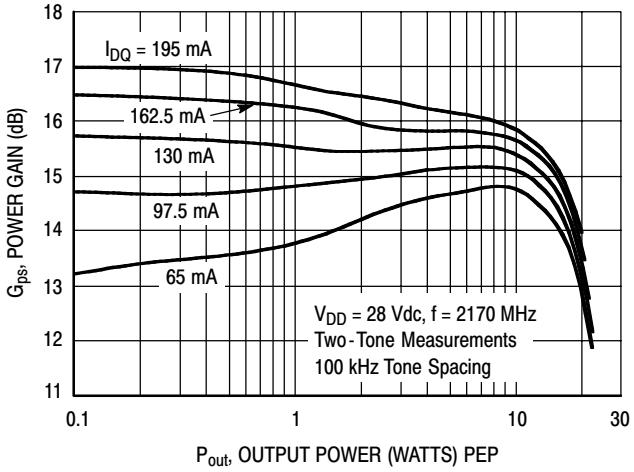



**Figure 4. Two-Tone Power Gain versus Output Power**

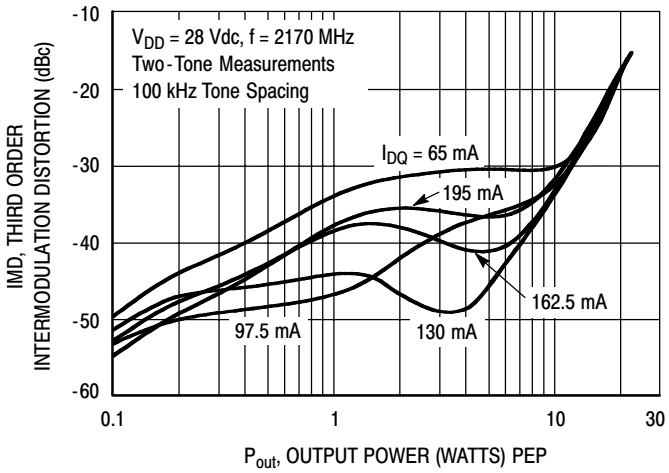



**Figure 5. Third Order Intermodulation Distortion versus Output Power**

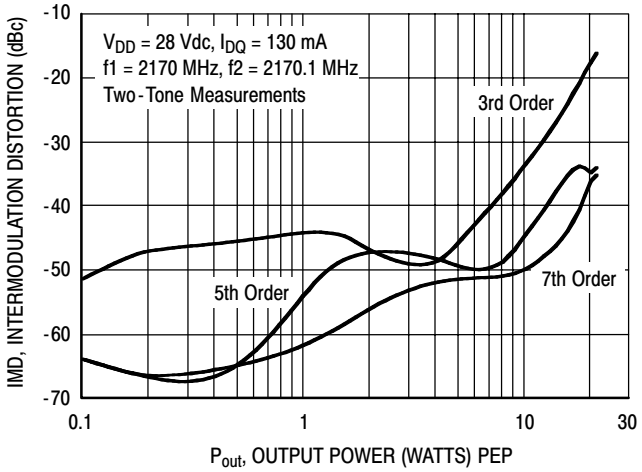



**Figure 6. Intermodulation Distortion Products versus Output Power**

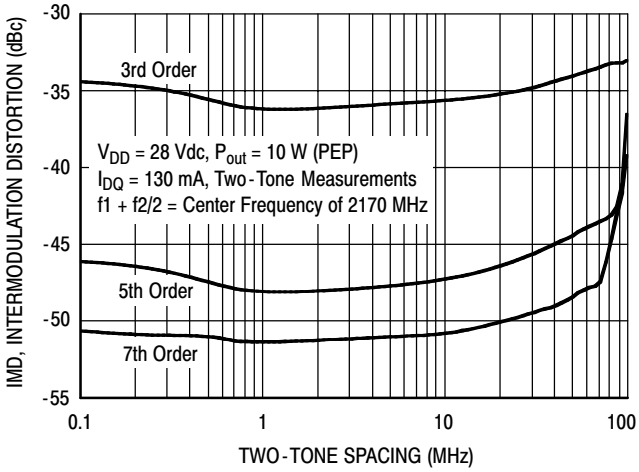



**Figure 7. Intermodulation Distortion Products versus Tone Spacing**

## TYPICAL CHARACTERISTICS — 2110-2170 MHz

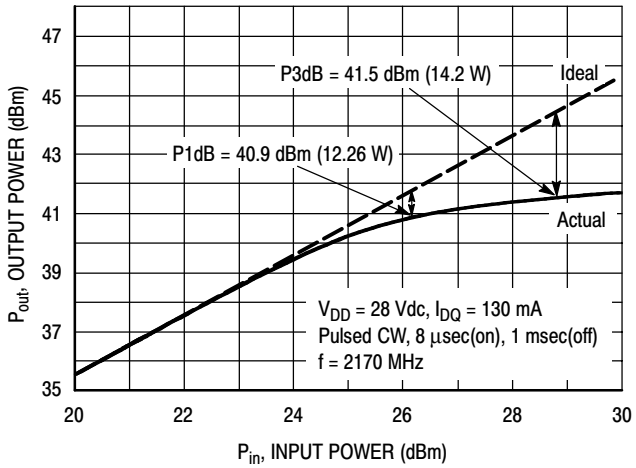



**Figure 8. Pulse CW Output Power versus Input Power**

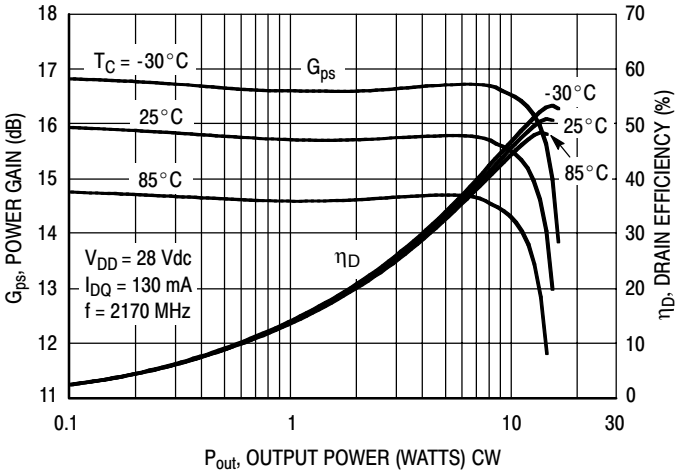



**Figure 9. Power Gain and Drain Efficiency versus CW Output Power**

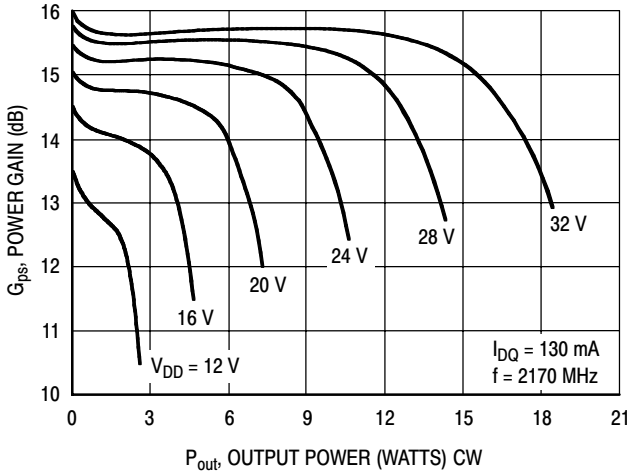



**Figure 10. Power Gain versus Output Power**

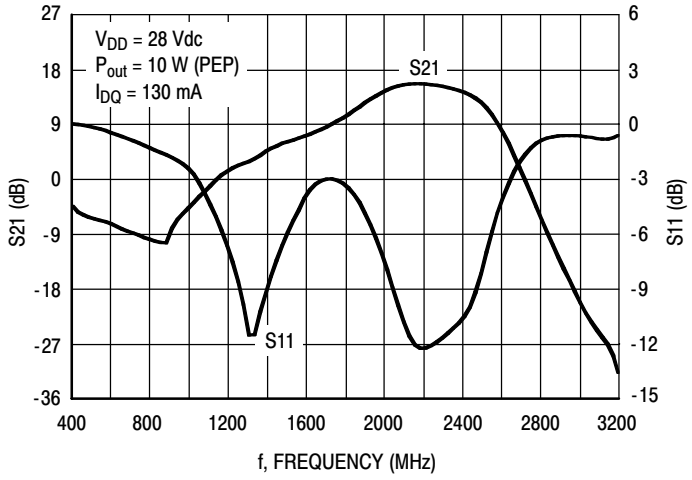
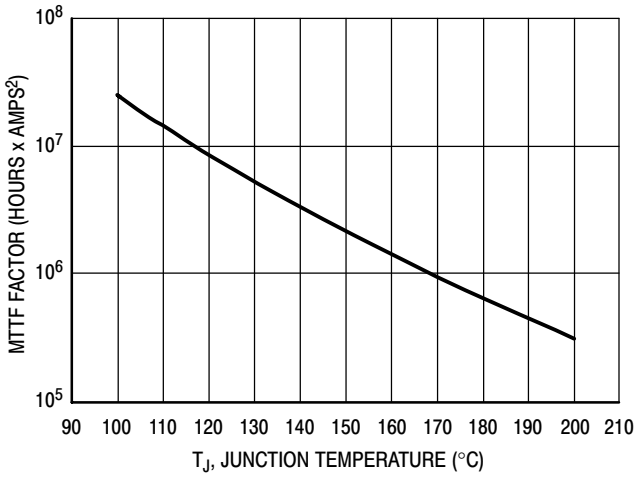



**Figure 11. Broadband Frequency Response**




This above graph displays calculated MTTF in hours x ampere$^2$ drain current. Life tests at elevated temperatures have correlated to better than ±10% of the theoretical prediction for metal failure. Divide MTTF factor by $I_D^2$ for MTTF in a particular application.

**Figure 12. MTTF Factor versus Junction Temperature**

## W-CDMA TYPICAL CHARACTERISTICS — 2110-2170 MHz

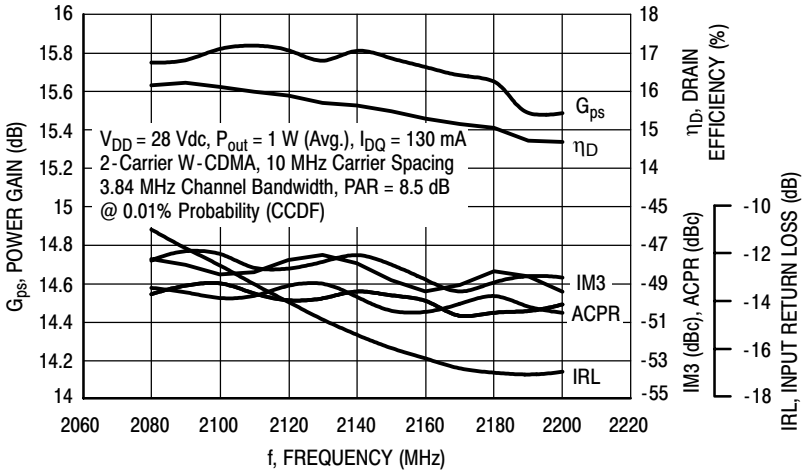



**Figure 13. 2-Carrier W-CDMA Broadband Performance @ $P_{out}$ = 1 Watt Avg.**

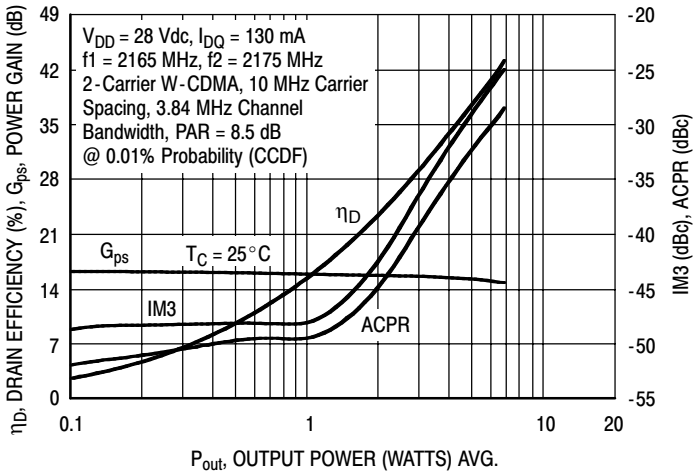



**Figure 14. 2-Carrier W-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power**

## W-CDMA TEST SIGNAL

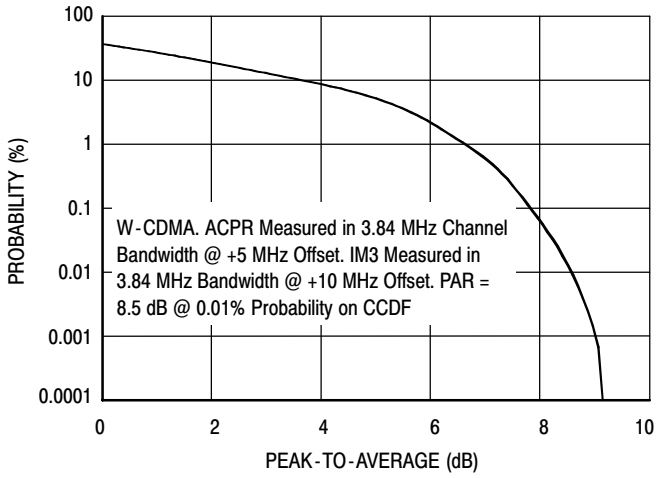



**Figure 15. CCDF W-CDMA 3GPP, Test Model 1, 64 DPCH, 67% Clipping, Single-Carrier Test Signal**

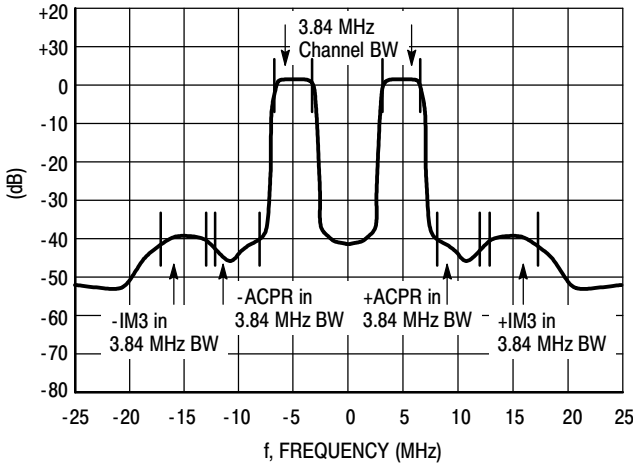
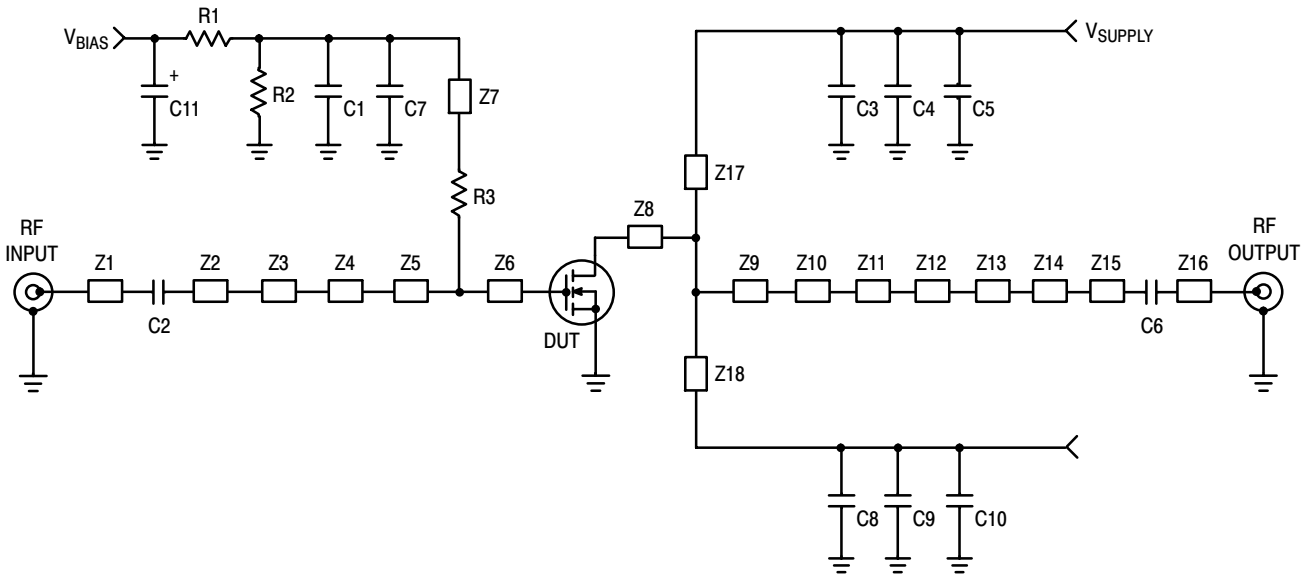



**Figure 16. 2-Carrier W-CDMA Spectrum**

## N-CDMA TYPICAL CHARACTERISTICS — 1930-1990 MHz




| | | | |
|---|---|---|---|
| Z1 | 0.066″ x 0.480″ Microstrip | Z11 | 0.244″ x 0.423″ Microstrip |
| Z2 | 0.066″ x 0.728″ Microstrip | Z12 | 0.244″ x 0.066″ x 0.089″ Taper |
| Z3 | 0.354″ x 0.512″ Microstrip | Z13 | 0.066″ x 0.182″ Microstrip |
| Z4 | 0.066″ x 0.079″ Microstrip | Z14 | 0.066″ x 0.263″ Microstrip |
| Z5, Z6 | 0.591″ x 0.335″ Microstrip | Z15 | 0.236″ x 0.118″ Microstrip |
| Z7 | 0.050″ x 0.980″ Microstrip | Z16 | 0.066″ x 0.099″ Microstrip |
| Z8 | 1.142″ x 0.350″ Microstrip | Z17, Z18 | 0.050″ x 1.250″ Microstrip |
| Z9 | 1.142″ x 0.516″ Microstrip | PCB | Taconic RF-35, 0.030″, $\varepsilon_r$ = 3.5 |
| Z10 | 0.433″ x 0.276″ Microstrip | | |

**Figure 17. MRF6S20010NR1(GNR1) Test Circuit Schematic — 1930-1990 MHz**

**Table 7. MRF6S20010NR1(GNR1) Test Circuit Component Designations and Values — 1930-1990 MHz**

| Part | Description | Part Number | Manufacturer |
|---|---|---|---|
| C1 | 100 nF Chip Capacitor (1206) | 1206C104KAT | AVX |
| C2, C6 | 4.7 pF 600B Chip Capacitors | 600B4R7BW | ATC |
| C3, C7, C8 | 9.1 pF 600B Chip Capacitors | 600B9R1BW | ATC |
| C4, C5, C9, C10 | 10 μF Chip Capacitors (2220) | C5750X5R1H106MT | TDK |
| C11 | 10 μF, 35 V Tantalum Chip Capacitor | TAJD106K035 | AVX |
| R1, R2 | 10 kΩ Chip Resistors (1206) | | |
| R3 | 10 Ω Chip Resistor (1206) | | |

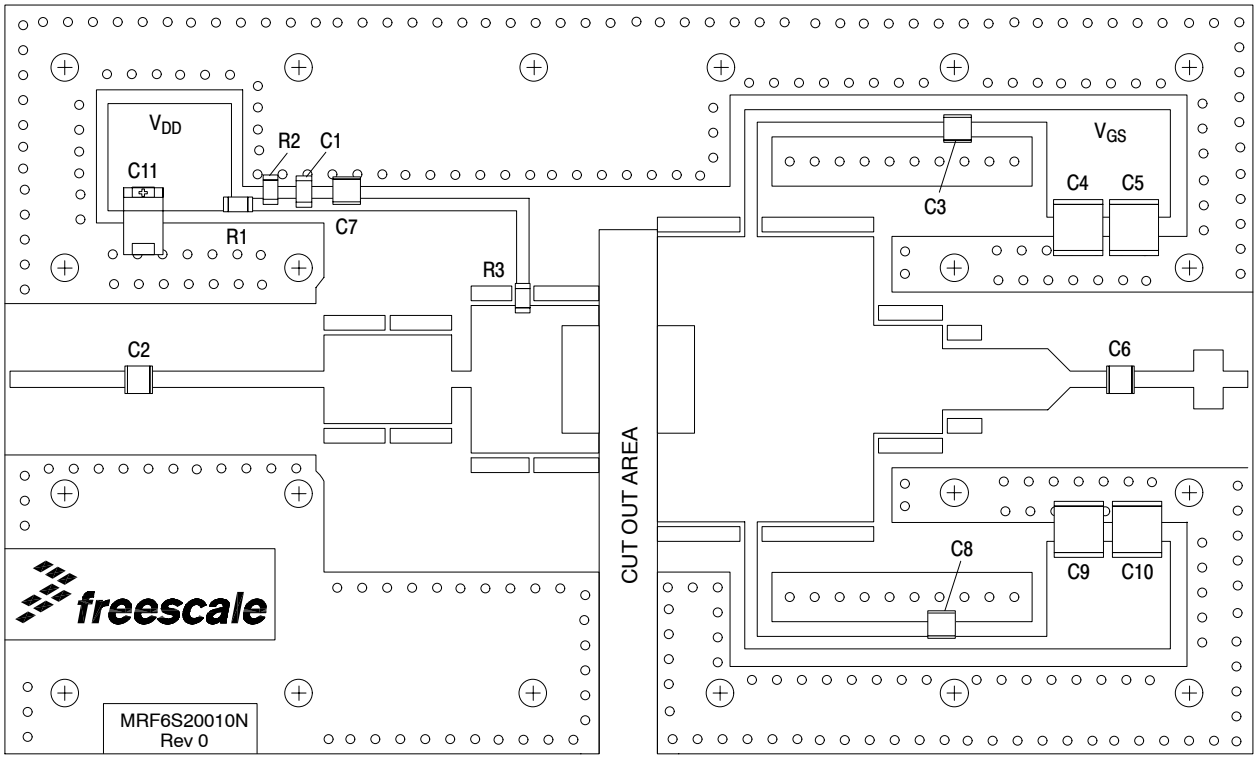



**Figure 18. MRF6S20010NR1(GNR1) Test Circuit Component Layout — 1930-1990 MHz**

## N-CDMA TYPICAL CHARACTERISTICS — 1930-1990 MHz

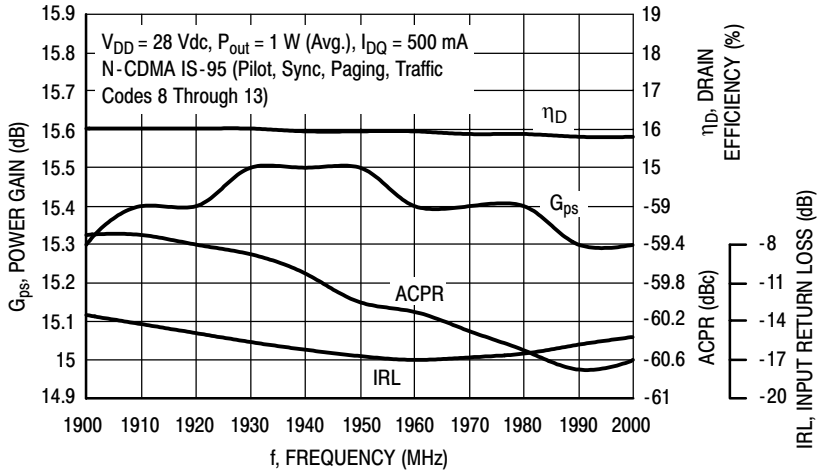



**Figure 19. Single-Carrier N-CDMA Broadband Performance @ $P_{out}$ = 1 Watt Avg.**

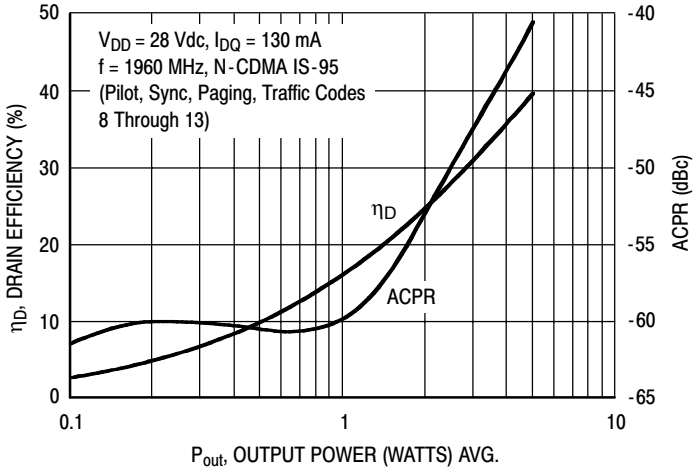



**Figure 20. Single-Carrier N-CDMA ACPR and Drain Efficiency versus Output Power**

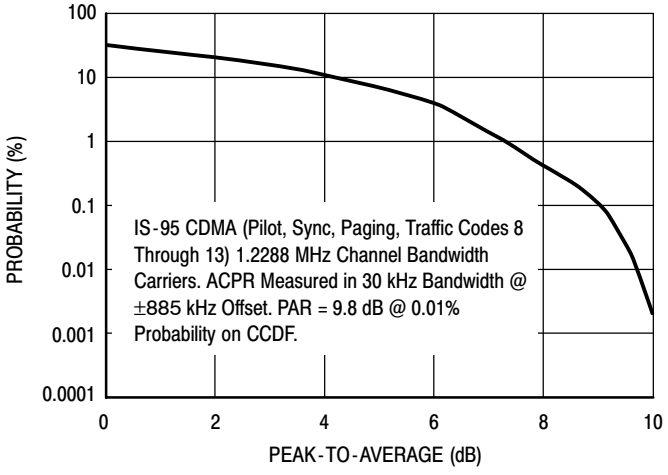



**Figure 21. Single-Carrier CCDF N-CDMA**

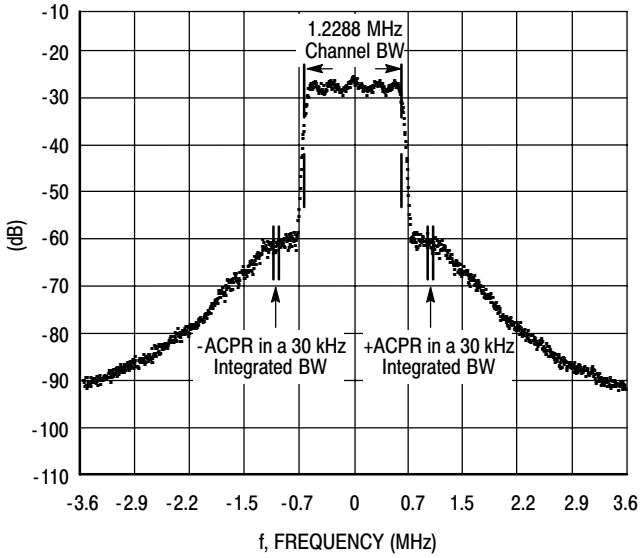
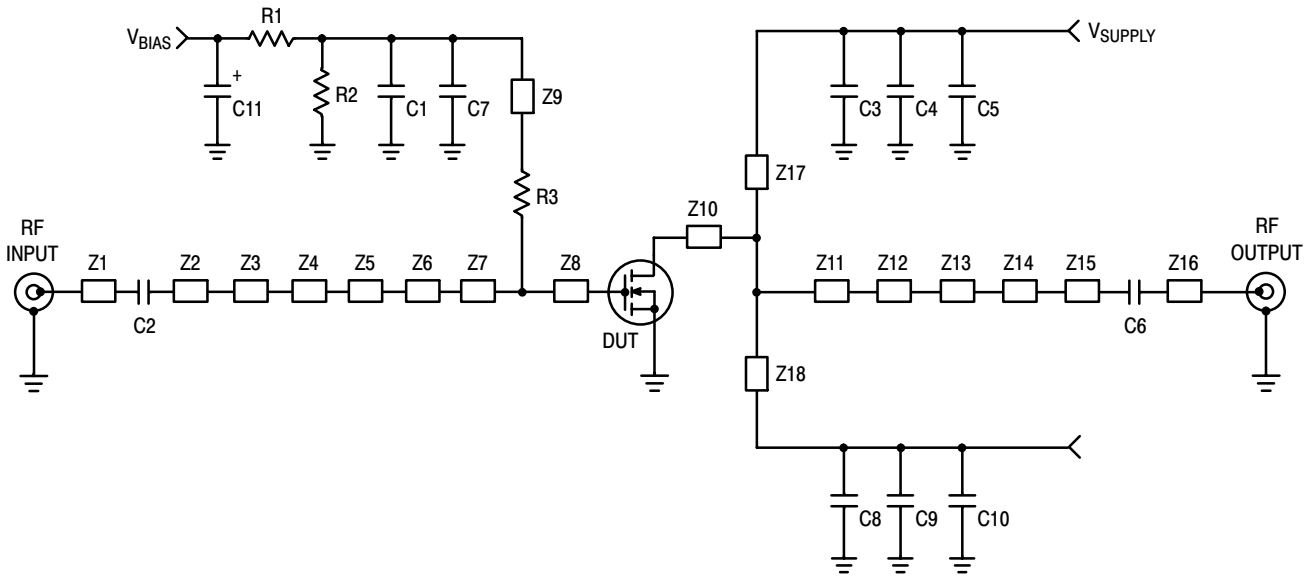



**Figure 22. Single-Carrier N-CDMA Spectrum**

## GSM EDGE TYPICAL CHARACTERISTICS — 1805-1880 MHz




| | | | |
|---|---|---|---|
| Z1, Z16 | 0.066″ x 0.480″ Microstrip | Z10 | 1.142″ x 0.350″ Microstrip |
| Z2 | 0.066″ x 0.137″ Microstrip | Z11 | 1.142″ x 0.516″ Microstrip |
| Z3 | 0.236″ x 0.236″ Microstrip | Z12 | 0.433″ x 0.276″ Microstrip |
| Z4 | 0.066″ x 0.354″ Microstrip | Z13 | 0.276″ x 0.157″ Microstrip |
| Z5 | 0.551″ x 0.512″ Microstrip | Z14 | 0.236″ x 0.433″ Microstrip |
| Z6 | 0.066″ x 0.079″ Microstrip | Z15 | 0.066″ x 0.104″ Microstrip |
| Z7 | 0.591″ x 0.189″ Microstrip | Z17, Z18 | 0.050″ x 1.250″ Microstrip |
| Z8 | 0.591″ x 0.334″ Microstrip | PCB | Taconic RF-35, 0.030″, $\varepsilon_r$ = 3.5 |
| Z9 | 0.050″ x 0.980″ Microstrip | | |

**Figure 23. MRF6S20010NR1(GNR1) Test Circuit Schematic — 1805-1880 MHz**

**Table 8. MRF6S20010NR1(GNR1) Test Circuit Component Designations and Values —1805-1880 MHz**

| Part | Description | Part Number | Manufacturer |
|---|---|---|---|
| C1 | 100 nF Chip Capacitor (1206) | 1206C104KAT | AVX |
| C2, C6 | 4.7 pF 600B Chip Capacitors | 600B4R7BW | ATC |
| C3, C7, C8 | 9.1 pF 600B Chip Capacitors | 600B9R1BW | ATC |
| C4, C5, C9, C10 | 10 μF Chip Capacitors (2220) | C5750X5R1H106MT | TDK |
| C11 | 10 μF, 35 V Tantalum Chip Capacitor | TAJD106K035 | AVX |
| R1, R2 | 10 kΩ Chip Resistors (1206) | | |
| R3 | 10 Ω Chip Resistor (1206) | | |

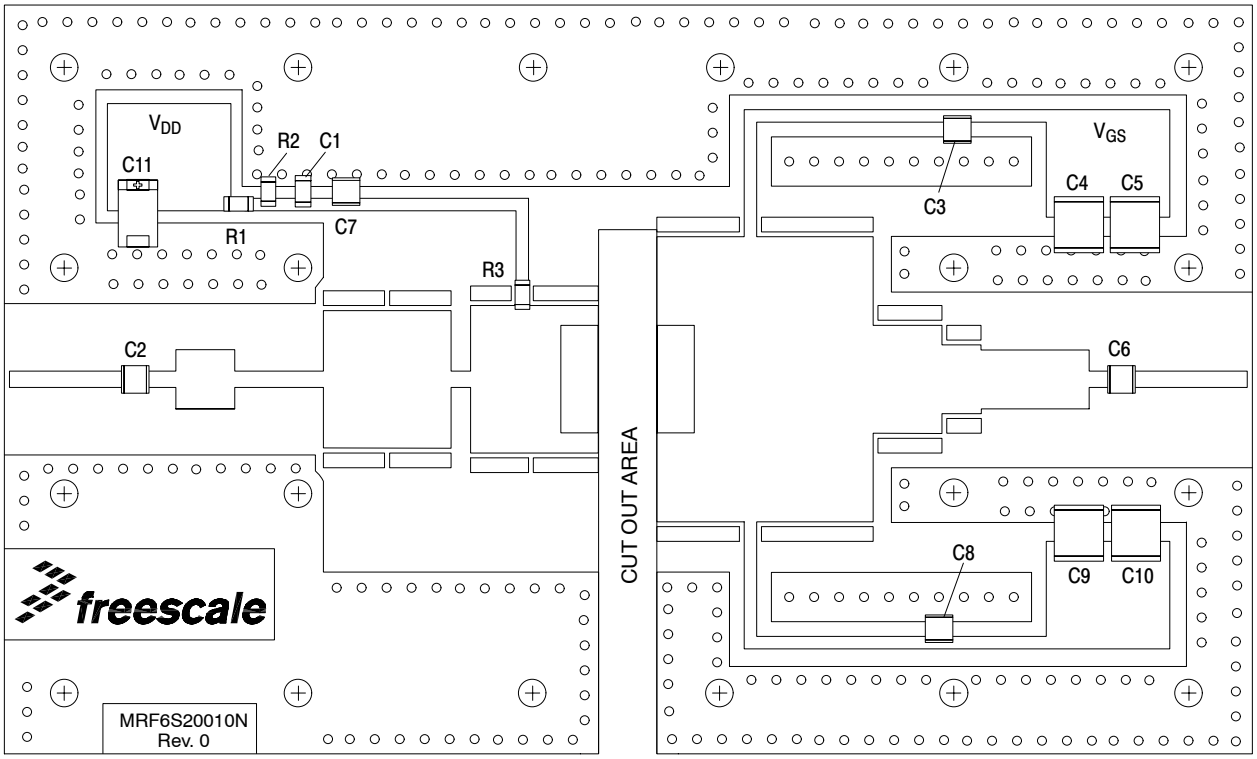



**Figure 24. MRF6S20010NR1(GNR1) Test Circuit Component Layout — 1805-1880 MHz**

## GSM EDGE TYPICAL CHARACTERISTICS — 1805-1880 MHz

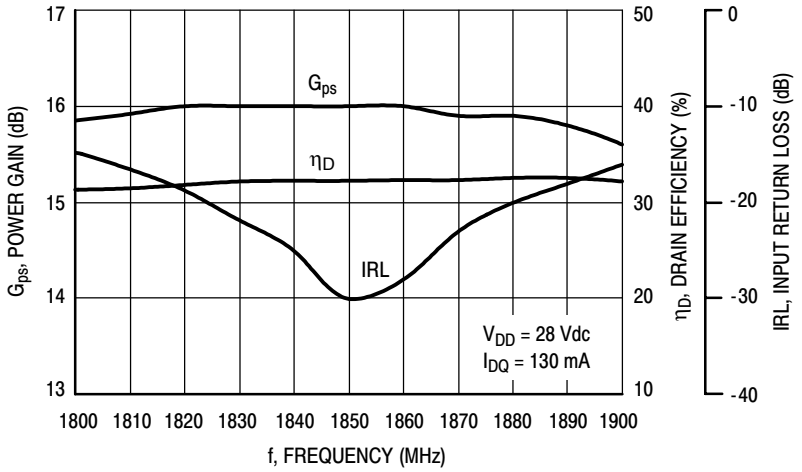



**Figure 25. Power Gain, Input Return Loss and Drain Efficiency versus Frequency @ $P_{out}$ = 4 Watts**

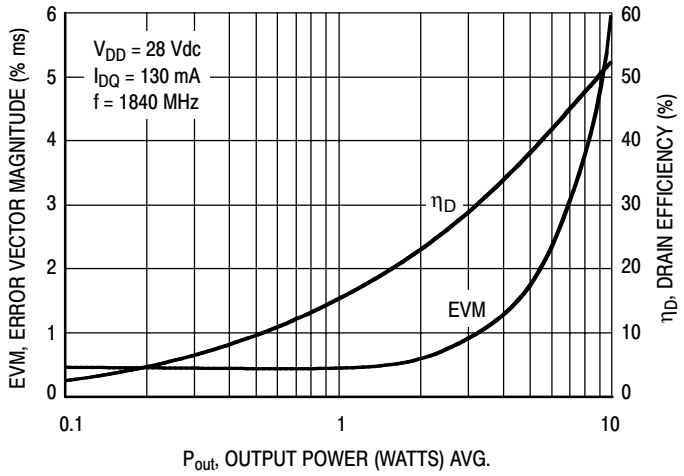



**Figure 26. Error Vector Magnitude and Drain Efficiency versus Output Power**

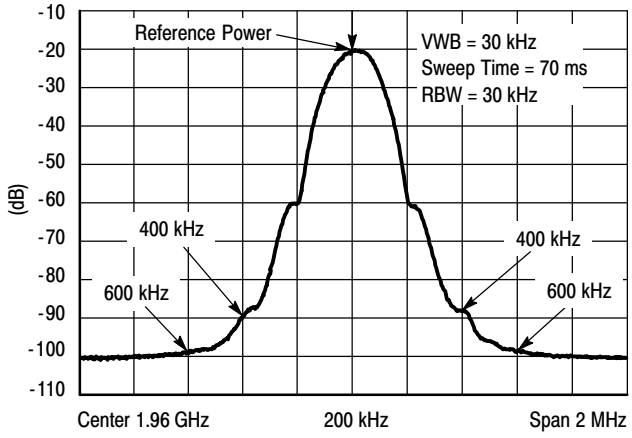



**Figure 27. EDGE Spectrum**

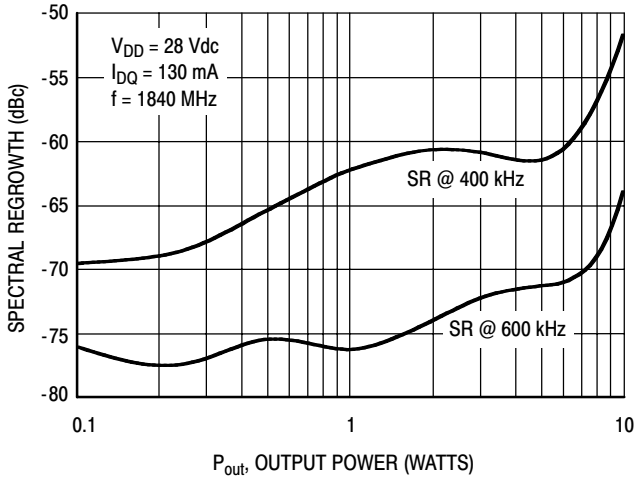
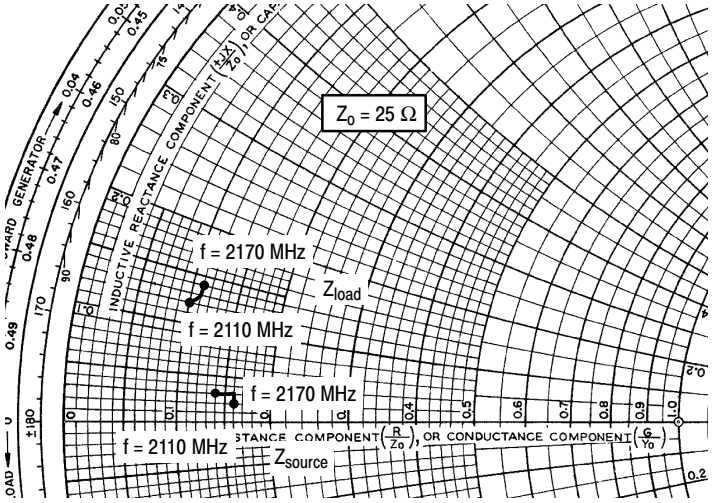


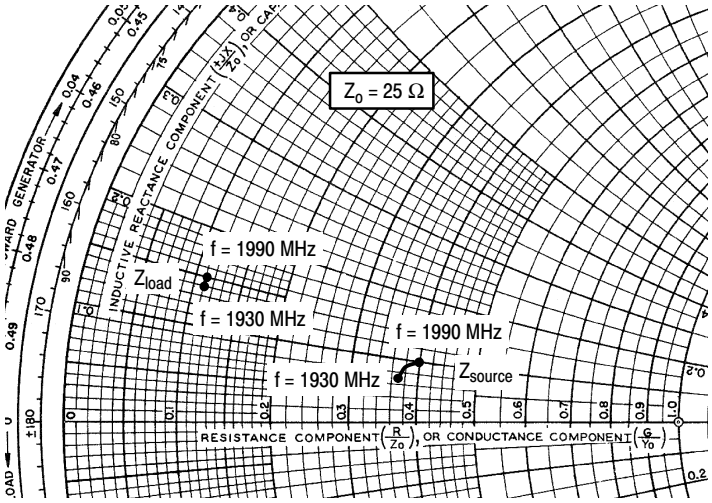

**Figure 28. Spectral Regrowth at 400 kHz and 600 kHz versus Output Power**




**2170 MHz**

$V_{DD}$ = 28 Vdc, $I_{DQ}$ = 130 mA, $P_{out}$ = 10 W PEP

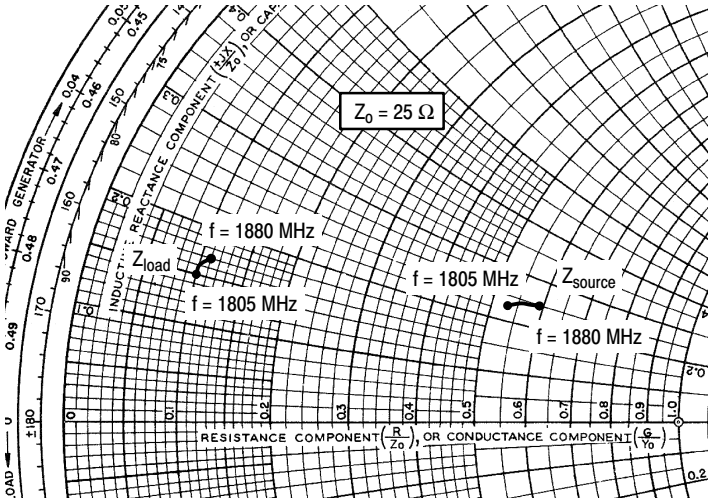
| f MHz | $Z_{source}$ Ω | $Z_{load}$ Ω |
|---|---|---|
| 2110 | 3.619 + j0.792 | 2.544 + j3.068 |
| 2140 | 3.918 + j0.797 | 2.673 + j3.291 |
| 2170 | 4.087 + j0.558 | 2.818 + j3.406 |




**1900 MHz**

$V_{DD}$ = 28 Vdc, $I_{DQ}$ = 130 mA, $P_{out}$ = 1 W Avg.

| f MHz | $Z_{source}$ Ω | $Z_{load}$ Ω |
|---|---|---|
| 1930 | 9.237 + j1.849 | 2.770 + j3.497 |
| 1960 | 9.521 + j2.144 | 2.754 + j3.668 |
| 1990 | 9.889 + j2.434 | 2.772 + j3.833 |




**1800 MHz**

$V_{DD}$ = 28 Vdc, $I_{DQ}$ = 130 mA, $P_{out}$ = 4 W Avg.

| f MHz | $Z_{source}$ Ω | $Z_{load}$ Ω |
|---|---|---|
| 1805 | 13.237 + j5.810 | 2.445 + j3.698 |
| 1840 | 13.953 + j6.084 | 2.542 + j3.942 |
| 1880 | 14.858 + j6.279 | 2.695 + j4.170 |

$Z_{source}$ = Test circuit impedance as measured from gate to ground.

$Z_{load}$ = Test circuit impedance as measured from drain to ground.

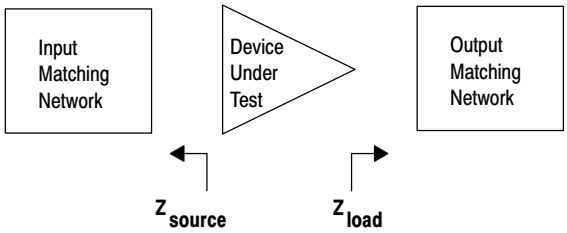



**Figure 29. Series Equivalent Source and Load Impedance**

**Table 9. Common Source Scattering Parameters ($V_{DD}$ = 28 V, 50 ohm system)**

$I_{DQ}$ = 126 mA

| f MHz | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| | $\|S_{11}\|$ | $\angle\phi$ | $\|S_{21}\|$ | $\angle\phi$ | $\|S_{12}\|$ | $\angle\phi$ | $\|S_{22}\|$ | $\angle\phi$ |
| 500 | 0.984 | -178.1 | 1.195 | 42.42 | 0.001 | -129.1 | 0.875 | -116.3 |
| 550 | 0.986 | -179.0 | 0.947 | 40.48 | 0.001 | -159.2 | 0.892 | -121.6 |
| 600 | 0.985 | 179.9 | 0.747 | 39.66 | 0.001 | 147.4 | 0.905 | -125.9 |
| 650 | 0.986 | 178.9 | 0.581 | 39.89 | 0.001 | 119.1 | 0.913 | -129.9 |
| 700 | 0.982 | 177.9 | 0.446 | 41.80 | 0.001 | 108.1 | 0.927 | -133.4 |
| 750 | 0.983 | 177.2 | 0.336 | 46.70 | 0.002 | 102.9 | 0.935 | -136.4 |
| 800 | 0.983 | 176.5 | 0.248 | 56.02 | 0.002 | 96.99 | 0.941 | -139.5 |
| 850 | 0.979 | 175.5 | 0.188 | 72.74 | 0.003 | 97.40 | 0.947 | -141.9 |
| 900 | 0.980 | 174.8 | 0.168 | 96.69 | 0.003 | 94.63 | 0.951 | -144.4 |
| 950 | 0.977 | 174.0 | 0.183 | 119.3 | 0.004 | 91.92 | 0.955 | -146.6 |
| 1000 | 0.978 | 173.2 | 0.223 | 134.3 | 0.004 | 92.80 | 0.960 | -148.6 |
| 1050 | 0.972 | 172.4 | 0.276 | 142.2 | 0.004 | 89.92 | 0.962 | -150.5 |
| 1100 | 0.972 | 171.4 | 0.335 | 146.4 | 0.005 | 89.90 | 0.966 | -152.2 |
| 1150 | 0.963 | 170.8 | 0.396 | 148.5 | 0.005 | 87.51 | 0.977 | -153.7 |
| 1200 | 0.964 | 169.9 | 0.461 | 148.8 | 0.006 | 89.25 | 0.971 | -155.2 |
| 1250 | 0.956 | 169.0 | 0.531 | 148.2 | 0.007 | 86.98 | 0.977 | -156.8 |
| 1300 | 0.948 | 167.8 | 0.604 | 146.9 | 0.007 | 85.08 | 0.982 | -157.9 |
| 1350 | 0.939 | 167.0 | 0.685 | 144.8 | 0.008 | 82.40 | 0.986 | -159.5 |
| 1400 | 0.927 | 165.7 | 0.772 | 142.2 | 0.008 | 79.69 | 0.988 | -160.7 |
| 1450 | 0.910 | 164.5 | 0.869 | 138.7 | 0.009 | 77.79 | 0.994 | -162.1 |
| 1500 | 0.889 | 163.2 | 0.975 | 134.7 | 0.010 | 75.79 | 0.991 | -163.4 |
| 1550 | 0.861 | 161.9 | 1.093 | 129.7 | 0.010 | 72.86 | 0.993 | -164.7 |
| 1600 | 0.821 | 160.9 | 1.221 | 123.8 | 0.011 | 69.89 | 0.996 | -166.0 |
| 1650 | 0.780 | 160.1 | 1.356 | 116.7 | 0.012 | 63.71 | 0.984 | -167.4 |
| 1700 | 0.722 | 160.6 | 1.491 | 108.3 | 0.013 | 57.70 | 0.985 | -168.5 |
| 1750 | 0.666 | 162.5 | 1.606 | 98.77 | 0.014 | 49.85 | 0.977 | -169.6 |
| 1800 | 0.618 | 167.0 | 1.687 | 88.09 | 0.014 | 41.19 | 0.970 | -170.8 |
| 1850 | 0.603 | 173.3 | 1.706 | 76.98 | 0.013 | 32.65 | 0.958 | -171.3 |
| 1900 | 0.614 | 179.7 | 1.673 | 66.08 | 0.012 | 25.40 | 0.954 | -171.9 |
| 1950 | 0.654 | -175.6 | 1.591 | 55.96 | 0.011 | 20.73 | 0.945 | -172.3 |
| 2000 | 0.701 | -173.5 | 1.484 | 47.04 | 0.010 | 15.11 | 0.947 | -172.6 |
| 2050 | 0.747 | -172.7 | 1.364 | 39.29 | 0.008 | 10.13 | 0.947 | -173.0 |
| 2100 | 0.783 | -172.6 | 1.242 | 32.87 | 0.006 | 6.333 | 0.945 | -173.6 |
| 2150 | 0.816 | -172.9 | 1.136 | 27.69 | 0.004 | 15.63 | 0.944 | -173.9 |
| 2200 | 0.842 | -173.6 | 1.042 | 23.26 | 0.004 | 42.20 | 0.944 | -174.2 |
| 2250 | 0.864 | -174.2 | 0.961 | 19.26 | 0.005 | 57.76 | 0.948 | -174.6 |
| 2300 | 0.882 | -175.0 | 0.888 | 15.75 | 0.006 | 62.56 | 0.948 | -175.2 |
| 2350 | 0.894 | -175.7 | 0.822 | 12.69 | 0.008 | 59.72 | 0.949 | -175.7 |
| 2400 | 0.906 | -176.4 | 0.764 | 9.857 | 0.009 | 49.09 | 0.951 | -176.1 |
| 2450 | 0.910 | -176.9 | 0.712 | 7.587 | 0.008 | 39.24 | 0.955 | -176.5 |

**Table 9. Common Source Scattering Parameters ($V_{DD}$ = 28 V, 50 ohm system) (continued)**

$I_{DQ}$ = 126 mA

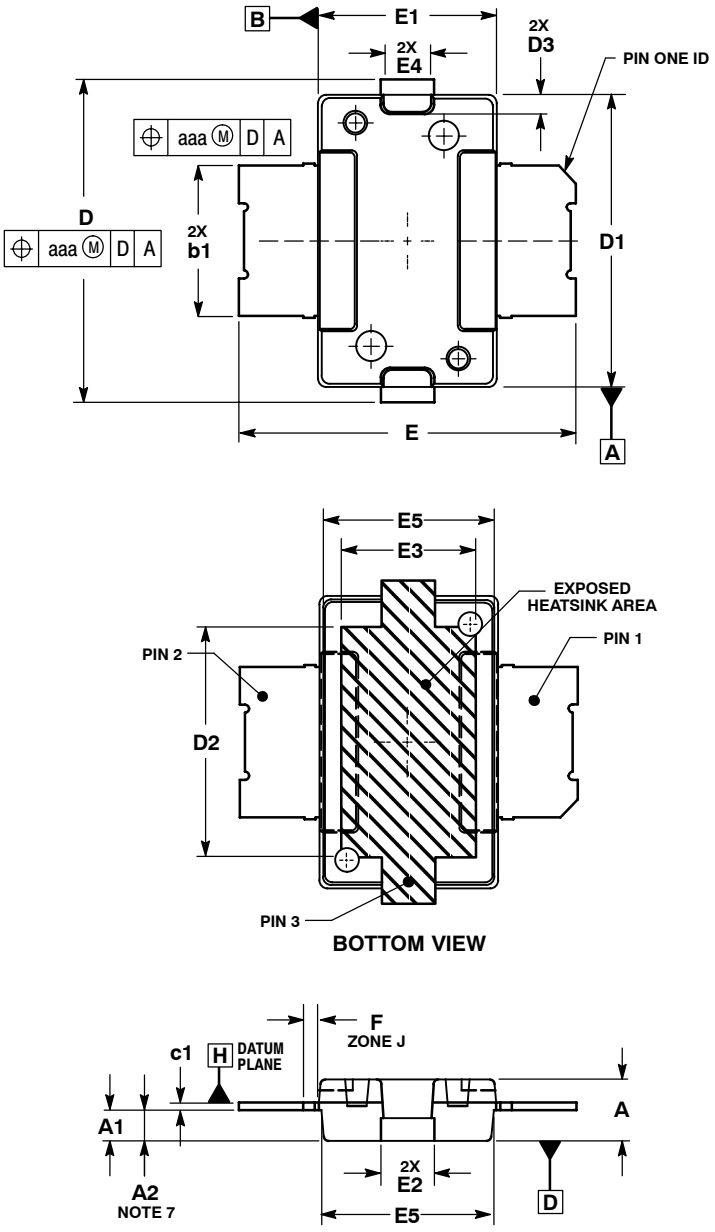
| f MHz | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| | $\|S_{11}\|$ | $\angle\phi$ | $\|S_{21}\|$ | $\angle\phi$ | $\|S_{12}\|$ | $\angle\phi$ | $\|S_{22}\|$ | $\angle\phi$ |
| 2500 | 0.923 | -177.5 | 0.666 | 5.462 | 0.006 | 42.56 | 0.957 | -177.2 |
| 2550 | 0.927 | -178.0 | 0.625 | 3.680 | 0.006 | 52.25 | 0.962 | -177.8 |
| 2600 | 0.937 | -178.8 | 0.591 | 1.864 | 0.006 | 60.26 | 0.961 | -178.4 |
| 2650 | 0.937 | -179.0 | 0.559 | 0.237 | 0.007 | 64.14 | 0.964 | -179.1 |
| 2700 | 0.942 | -179.8 | 0.529 | -1.378 | 0.007 | 65.62 | 0.964 | -179.6 |
| 2750 | 0.945 | -179.9 | 0.504 | -2.768 | 0.007 | 64.71 | 0.964 | 179.7 |
| 2800 | 0.946 | 179.5 | 0.479 | -4.088 | 0.007 | 67.58 | 0.966 | 179.4 |
| 2850 | 0.950 | 179.3 | 0.456 | -5.412 | 0.007 | 75.44 | 0.966 | 178.8 |
| 2900 | 0.949 | 178.8 | 0.436 | -6.305 | 0.008 | 82.04 | 0.964 | 178.3 |
| 2950 | 0.952 | 178.5 | 0.419 | -7.279 | 0.009 | 83.60 | 0.967 | 177.9 |
| 3000 | 0.950 | 178.4 | 0.402 | -8.087 | 0.011 | 83.41 | 0.968 | 177.4 |
| 3050 | 0.958 | 177.9 | 0.387 | -9.138 | 0.012 | 81.35 | 0.964 | 176.8 |
| 3100 | 0.953 | 177.7 | 0.373 | -9.904 | 0.013 | 77.45 | 0.969 | 176.4 |
| 3150 | 0.957 | 177.2 | 0.362 | -10.86 | 0.014 | 70.98 | 0.970 | 176.2 |
| 3200 | 0.960 | 177.4 | 0.350 | -11.79 | 0.013 | 67.00 | 0.970 | 175.5 |

# NOTES

# NOTES

# NOTES

## PACKAGE DIMENSIONS

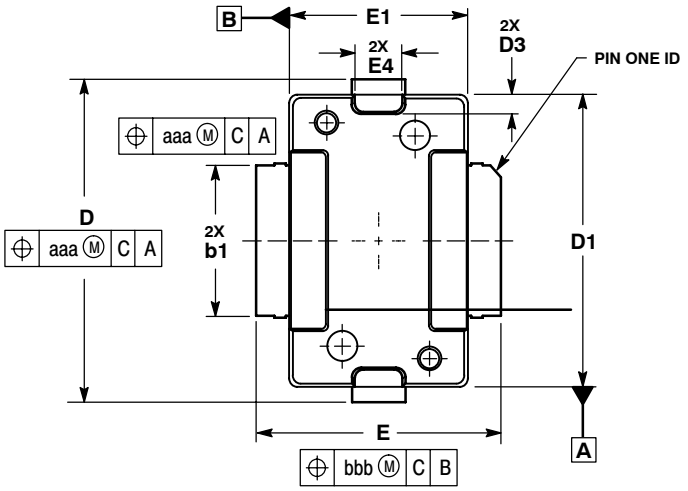


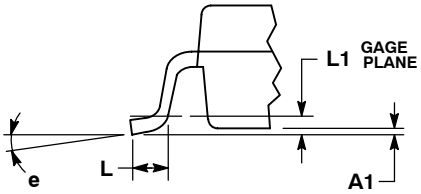

NOTES:
1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. DATUM PLANE -H- IS LOCATED AT TOP OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE TOP OF THE PARTING LINE.
4. DIMENSIONS "D1" AND "E1" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .006 PER SIDE. DIMENSIONS "D1" AND "E1" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -H-.
5. DIMENSION b1 DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 TOTAL IN EXCESS OF THE b1 DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. DATUMS -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-.
7. DIMENSION A2 APPLIES WITHIN ZONE "J" ONLY.
8. DIMENSIONS "D" AND "E2" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .003 PER SIDE. DIMENSIONS "D" AND "E2" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -D-.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | .078 | .082 | 1.98 | 2.08 |
| A1 | .039 | .043 | 0.99 | 1.09 |
| A2 | .040 | .042 | 1.02 | 1.07 |
| D | .416 | .424 | 10.57 | 10.77 |
| D1 | .378 | .382 | 9.60 | 9.70 |
| D2 | .290 | .320 | 7.37 | 8.13 |
| D3 | .016 | .024 | 0.41 | 0.61 |
| E | .436 | .444 | 11.07 | 11.28 |
| E1 | .238 | .242 | 6.04 | 6.15 |
| E2 | .066 | .074 | 1.68 | 1.88 |
| E3 | .150 | .180 | 3.81 | 4.57 |
| E4 | .058 | .066 | 1.47 | 1.68 |
| E5 | .231 | .235 | 5.87 | 5.97 |
| F | .025 BSC | | 0.64 BSC | |
| b1 | .193 | .199 | 4.90 | 5.06 |
| c1 | .007 | .011 | 0.18 | 0.28 |
| aaa | .004 | | 0.10 | |

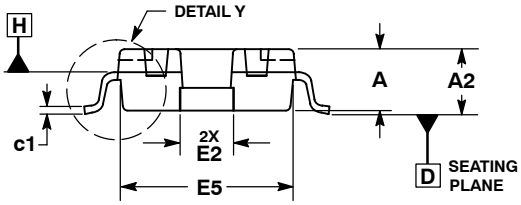
STYLE 1:
PIN 1. DRAIN
2. GATE
3. SOURCE

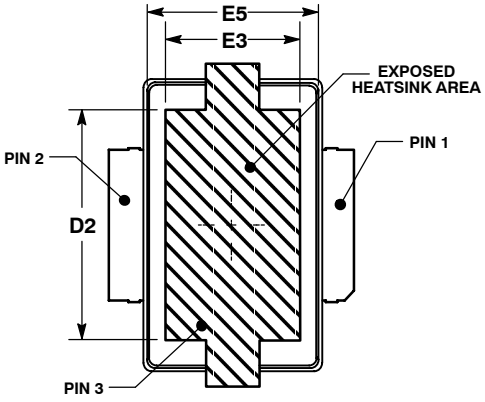
**CASE 1265-08**
**ISSUE H**
**TO-270-2**
**PLASTIC**
**MRF6S20010NR1**




DETAIL Y




BOTTOM VIEW

NOTES:
1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. DATUM PLANE -H- IS LOCATED AT TOP OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE TOP OF THE PARTING LINE.
4. DIMENSIONS "D1" AND "E1" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .006 PER SIDE. DIMENSIONS "D1" AND "E1" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -H-.
5. DIMENSION b1 DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 TOTAL IN EXCESS OF THE b1 DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. DATUMS -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-.
7. DIMENSIONS "D" AND "E2" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .003 PER SIDE. DIMENSIONS "D" AND "E2" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -D-.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | .078 | .082 | 1.98 | 2.08 |
| A1 | .001 | .004 | 0.02 | 0.10 |
| A2 | .077 | .088 | 1.96 | 2.24 |
| D | .416 | .424 | 10.57 | 10.77 |
| D1 | .378 | .382 | 9.60 | 9.70 |
| D2 | .290 | .320 | 7.37 | 8.13 |
| D3 | .016 | .024 | 0.41 | 0.61 |
| E | .316 | .324 | 8.03 | 8.23 |
| E1 | .238 | .242 | 6.04 | 6.15 |
| E2 | .066 | .074 | 1.68 | 1.88 |
| E3 | .150 | .180 | 3.81 | 4.57 |
| E4 | .058 | .066 | 1.47 | 1.68 |
| E5 | .231 | .235 | 5.87 | 5.97 |
| L | .018 | .024 | 4.90 | 5.06 |
| L1 | .01 BSC | | 0.25 BSC | |
| b1 | .193 | .199 | 4.90 | 5.06 |
| c1 | .007 | .011 | 0.18 | 0.28 |
| e | 2° | 8° | 2° | 8° |
| aaa | .004 | | 0.10 | |

STYLE 1:
PIN 1. DRAIN
2. GATE
3. SOURCE

**CASE 1265A-02**
**ISSUE B**
**TO-270-2 GULL**
**PLASTIC**
**MRF6S20010GNR1**

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