

# RF Power Field-Effect Transistors

## N-Channel Enhancement-Mode Lateral MOSFETs

Designed primarily for CW large-signal output and driver applications with frequencies up to 450 MHz. Devices are unmatched and are suitable for use in industrial, medical and scientific applications.

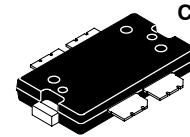
- Typical CW Performance at 220 MHz:  $V_{DD} = 50$  Volts,  $I_{DQ} = 450$  mA,  $P_{out} = 150$  Watts  
Power Gain — 25 dB  
Drain Efficiency — 68.3%
- Capable of Handling 10:1 VSWR, @ 50 Vdc, 220 MHz, 150 Watts CW Output Power

### Features

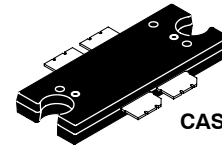
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Qualified Up to a Maximum of 50  $V_{DD}$  Operation
- Integrated ESD Protection
- 225°C Capable Plastic Package
- RoHS Compliant
- In Tape and Reel. R1 Suffix = 500 Units per 44 mm, 13 inch Reel.

**MRF6V2150NR1**  
**MRF6V2150NBR1**

**10-450 MHz, 150 W, 50 V**  
**LATERAL N-CHANNEL**  
**SINGLE-ENDED**  
**BROADBAND**  
**RF POWER MOSFETs**



**CASE 1486-03, STYLE 1**  
**TO-270 WB-4**  
**PLASTIC**  
**MRF6V2150NR1**



**CASE 1484-04, STYLE 1**  
**TO-272 WB-4**  
**PLASTIC**  
**MRF6V2150NBR1**

**PARTS ARE SINGLE-ENDED**

**Table 1. Maximum Ratings**

| Rating                               | Symbol    | Value        | Unit |
|--------------------------------------|-----------|--------------|------|
| Drain-Source Voltage                 | $V_{DSS}$ | - 0.5, +110  | Vdc  |
| Gate-Source Voltage                  | $V_{GS}$  | - 0.5, +12   | Vdc  |
| Storage Temperature Range            | $T_{stg}$ | - 65 to +150 | °C   |
| Case Operating Temperature           | $T_C$     | 150          | °C   |
| Operating Junction Temperature (1,2) | $T_J$     | 225          | °C   |

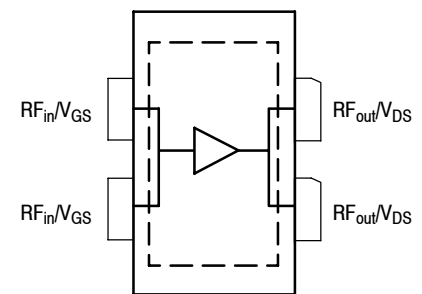
**Table 2. Thermal Characteristics**

| Characteristic                                                          | Symbol          | Value (2,3) | Unit |
|-------------------------------------------------------------------------|-----------------|-------------|------|
| Thermal Resistance, Junction to Case<br>Case Temperature 80°C, 150 W CW | $R_{\theta JC}$ | 0.24        | °C/W |

**Table 3. ESD Protection Characteristics**

| Test Methodology                      | Class        |
|---------------------------------------|--------------|
| Human Body Model (per JESD22-A114)    | 2 (Minimum)  |
| Machine Model (per EIA/JESD22-A115)   | A (Minimum)  |
| Charge Device Model (per JESD22-C101) | IV (Minimum) |

1. Continuous use at maximum temperature will affect MTTF.
2. MTTF calculator available at <http://www.freescale.com/rf>. Select Software & Tools/Development Tools/Calculators to access MTTF calculators by product.
3. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers*. Go to <http://www.freescale.com/rf>. Select Documentation/Application Notes - AN1955.



(Top View)

Note: Exposed backside of the package is the source terminal for the transistor.

**Figure 1. Pin Connections**

**Table 4. Moisture Sensitivity Level**

| Test Methodology                     | Rating | Package Peak Temperature | Unit |
|--------------------------------------|--------|--------------------------|------|
| Per JESD22-A113, IPC/JEDEC J-STD-020 | 3      | 260                      | °C   |

**Table 5. Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

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

**Off Characteristics**

|                                                                                                    |               |     |   |     |                 |
|----------------------------------------------------------------------------------------------------|---------------|-----|---|-----|-----------------|
| Zero Gate Voltage Drain Leakage Current<br>( $V_{DS} = 100\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ ) | $I_{DSS}$     | —   | — | 2.5 | mA              |
| Zero Gate Voltage Drain Leakage Current<br>( $V_{DS} = 50\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )  | $I_{DSS}$     | —   | — | 50  | $\mu\text{Adc}$ |
| Drain-Source Breakdown Voltage<br>( $I_D = 75\text{ mA}$ , $V_{GS} = 0\text{ Vdc}$ )               | $V_{(BR)DSS}$ | 110 | — | —   | Vdc             |
| Gate-Source Leakage Current<br>( $V_{GS} = 5\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )               | $I_{GSS}$     | —   | — | 10  | $\mu\text{Adc}$ |

**On Characteristics**

|                                                                                                               |              |     |      |     |     |
|---------------------------------------------------------------------------------------------------------------|--------------|-----|------|-----|-----|
| Gate Threshold Voltage<br>( $V_{DS} = 10\text{ Vdc}$ , $I_D = 400\text{ }\mu\text{Adc}$ )                     | $V_{GS(th)}$ | 1   | 1.62 | 3   | Vdc |
| Gate Quiescent Voltage<br>( $V_{DD} = 50\text{ Vdc}$ , $I_D = 450\text{ mAdc}$ , Measured in Functional Test) | $V_{GS(Q)}$  | 1.5 | 2.6  | 3.5 | Vdc |
| Drain-Source On-Voltage<br>( $V_{GS} = 10\text{ Vdc}$ , $I_D = 1\text{ Adc}$ )                                | $V_{DS(on)}$ | —   | 0.26 | —   | Vdc |

**Dynamic Characteristics**

|                                                                                                                       |           |   |     |   |    |
|-----------------------------------------------------------------------------------------------------------------------|-----------|---|-----|---|----|
| Reverse Transfer Capacitance<br>( $V_{DS} = 50\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ ) | $C_{rss}$ | — | 1.6 | — | pF |
| Output Capacitance<br>( $V_{DS} = 50\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )           | $C_{oss}$ | — | 93  | — | pF |
| Input Capacitance<br>( $V_{DS} = 50\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz)            | $C_{iss}$ | — | 163 | — | pF |

**Functional Tests** (In Freescale Test Fixture, 50 ohm system)  $V_{DD} = 50\text{ Vdc}$ ,  $I_{DQ} = 450\text{ mA}$ ,  $P_{out} = 150\text{ W}$ ,  $f = 220\text{ MHz}$ , CW

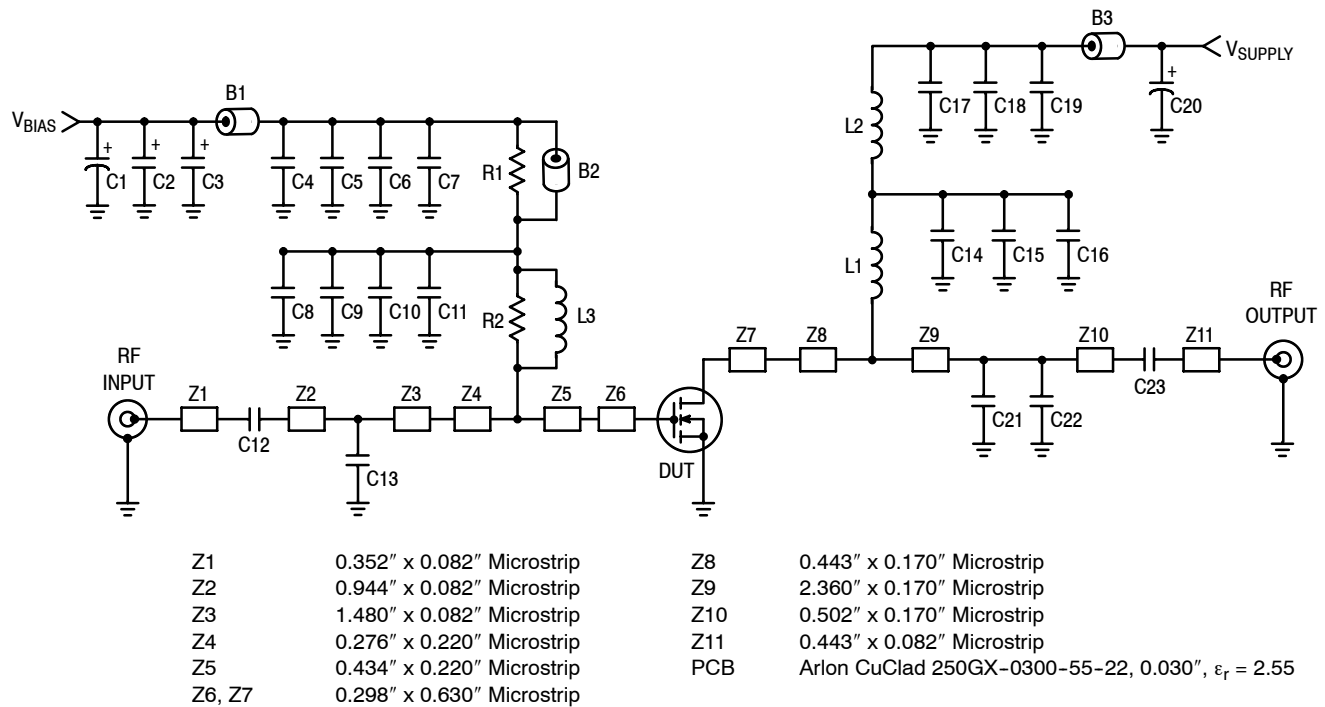
|                   |          |      |      |      |    |
|-------------------|----------|------|------|------|----|
| Power Gain        | $G_{ps}$ | 23.5 | 25   | 26.5 | dB |
| Drain Efficiency  | $\eta_D$ | 66   | 68.3 | —    | %  |
| Input Return Loss | IRL      | —    | -17  | -9   | dB |

**Typical Performances** (In Freescale 27 MHz and 450 MHz Test Fixtures, 50 ohm system)  $V_{DD} = 50\text{ Vdc}$ ,  $I_{DQ} = 450\text{ mA}$ ,  $P_{out} = 150\text{ W}$  CW

|                   |                      |          |   |       |   |    |
|-------------------|----------------------|----------|---|-------|---|----|
| Power Gain        | $f = 27\text{ MHz}$  | $G_{ps}$ | — | 32.3  | — | dB |
|                   | $f = 450\text{ MHz}$ |          | — | 22.9  | — |    |
| Drain Efficiency  | $f = 27\text{ MHz}$  | $\eta_D$ | — | 78.7  | — | %  |
|                   | $f = 450\text{ MHz}$ |          | — | 57.6  | — |    |
| Input Return Loss | $f = 27\text{ MHz}$  | IRL      | — | -10.6 | — | dB |
|                   | $f = 450\text{ MHz}$ |          | — | -17.6 | — |    |



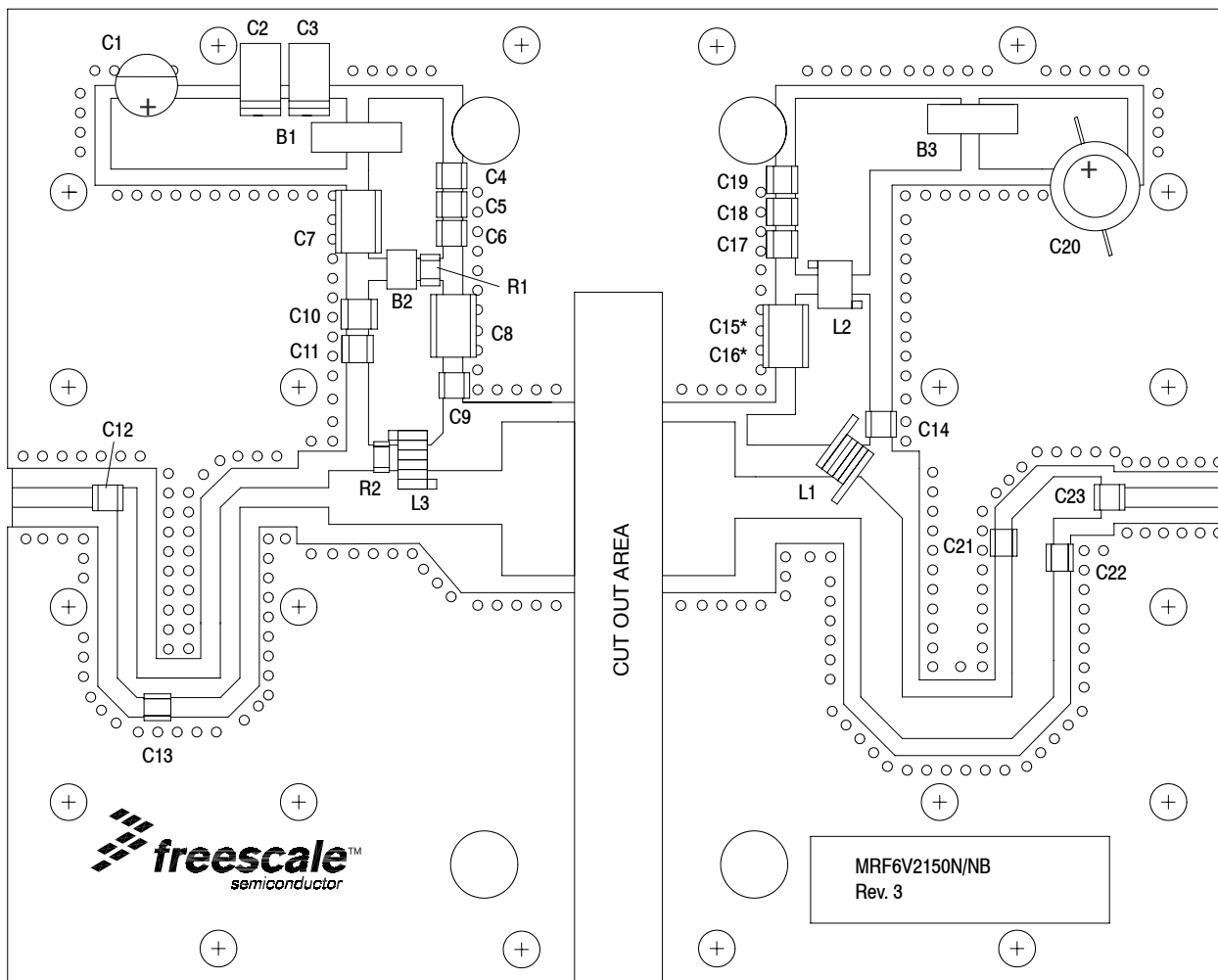
ATTENTION: The MRF6V2150N and MRF6V2150NB are high power devices and special considerations must be followed in board design and mounting. Incorrect mounting can lead to internal temperatures which exceed the maximum allowable operating junction temperature. Refer to Freescale Application Note AN3263 (for bolt down mounting) or AN1907 (for solder reflow mounting) **PRIOR TO STARTING SYSTEM DESIGN** to ensure proper mounting of these devices.



**Figure 2. MRF6V2150NR1(NBR1) Test Circuit Schematic — 220 MHz**

**Table 6. MRF6V2150NR1(NBR1) Test Circuit Component Designations and Values — 220 MHz**

| Part              | Description                                             | Part Number        | Manufacturer       |
|-------------------|---------------------------------------------------------|--------------------|--------------------|
| B1, B2            | 95 $\Omega$ , 100 MHz Long Ferrite Beads, Surface Mount | 2743021447         | Fair-Rite          |
| B3                | 47 $\Omega$ , 100 MHz Short Ferrite Bead, Surface Mount | 2743019447         | Fair-Rite          |
| C1                | 47 $\mu$ F, 50 V Electrolytic Capacitor                 | 476KXM063M         | Illinois Capacitor |
| C2                | 22 $\mu$ F, 35 V Tantalum Chip Capacitor                | T494X226K035AT     | Kemet              |
| C3                | 10 $\mu$ F, 35 V Tantalum Chip Capacitor                | T491D106K035AT     | Kemet              |
| C4, C17           | 39 K pF Chip Capacitors                                 | ATC200B393KT50XT   | ATC                |
| C5, C18           | 22 K pF Chip Capacitors                                 | ATC200B203KT50XT   | ATC                |
| C6, C11, C19      | 0.1 $\mu$ F, 50 V Chip Capacitors                       | CDR33BX104AKYS     | Kemet              |
| C7, C8, C15, C16  | 2.2 $\mu$ F, 50 V Chip Capacitors                       | C1825C225J5RAC     | Kemet              |
| C9, C12, C14, C23 | 1000 pF Chip Capacitors                                 | ATC100B102JT50XT   | ATC                |
| C10               | 220 nF Chip Capacitor                                   | C1812C224K5RAC     | Kemet              |
| C13               | 75 pF Chip Capacitor                                    | ATC100B750JT500XT  | ATC                |
| C20               | 470 $\mu$ F, 63 V Electrolytic Capacitor                | ESME630ELL471MK25S | United Chemi-Con   |
| C21               | 30 pF Chip Capacitor                                    | ATC100B300JT500XT  | ATC                |
| C22               | 33 pF Chip Capacitor                                    | ATC100B330JT500XT  | ATC                |
| L1                | 4 Turn #18 AWG, 0.18" ID                                | None               | None               |
| L2                | 82 nH Inductor                                          | 1812SMS-82NJL      | Coilcraft          |
| L3                | 17.5 nH Inductor                                        | B06TJL             | Coilcraft          |
| R1                | 270 $\Omega$ , 1/4 W Chip Resistor                      | CRCW12062700FKEA   | Vishay             |
| R2                | 27 $\Omega$ , 1/4 W Chip Resistor                       | CRCW12064R75FKEA   | Vishay             |



\* Stacked

**Figure 3. MRF6V2150NR1(NBR1) Test Circuit Component Layout — 220 MHz**

## TYPICAL CHARACTERISTICS

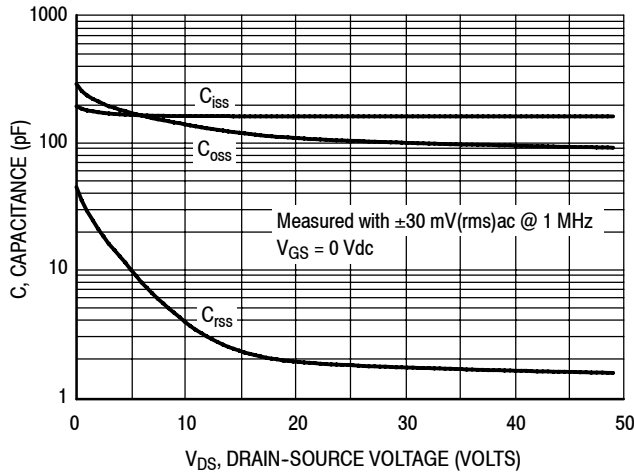


Figure 4. Capacitance versus Drain-Source Voltage

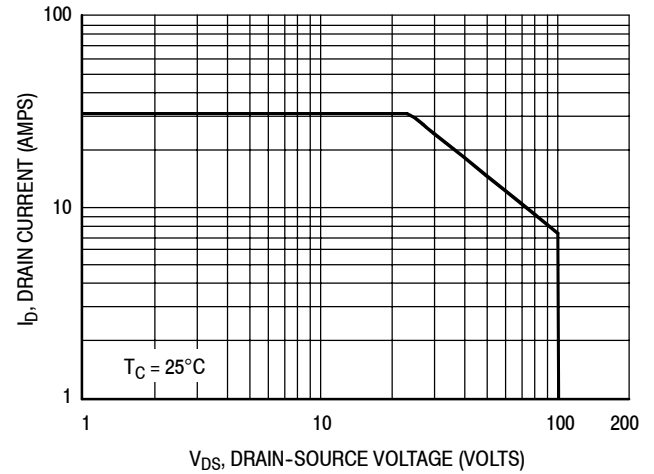


Figure 5. DC Safe Operating Area

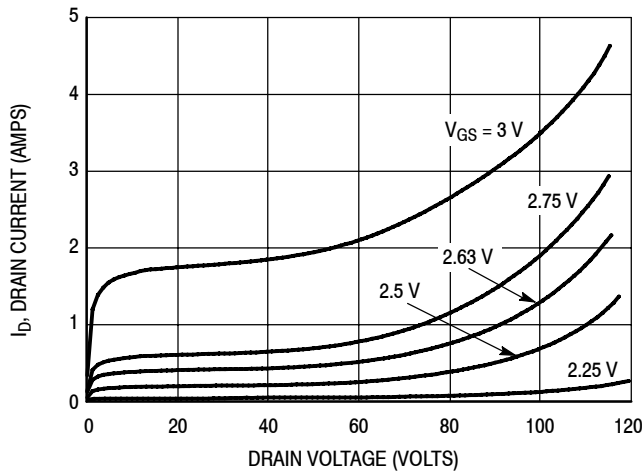


Figure 6. DC Drain Current versus Drain Voltage

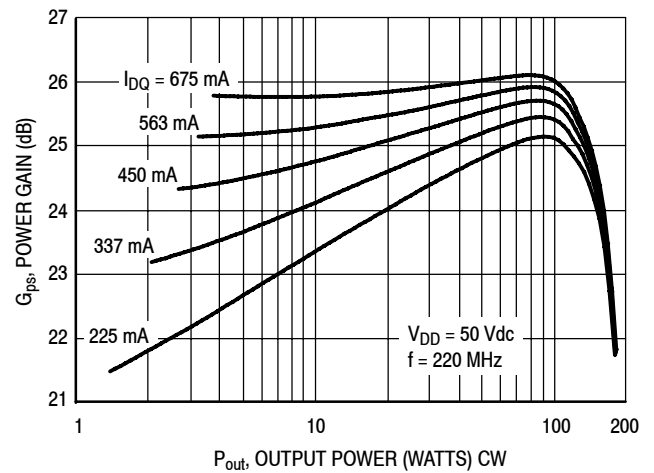


Figure 7. CW Power Gain versus Output Power

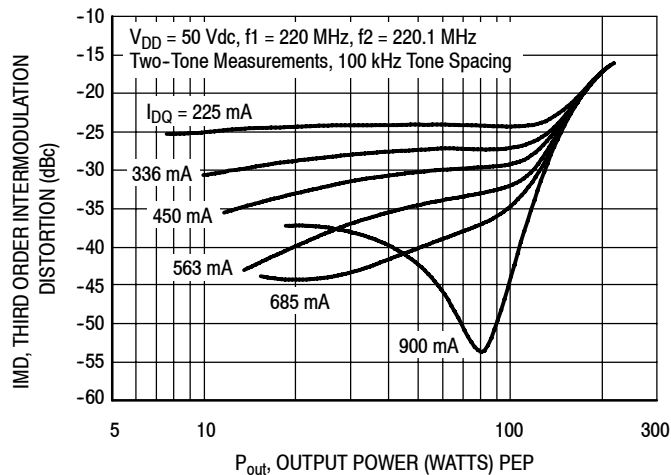


Figure 8. Third Order Intermodulation Distortion versus Output Power

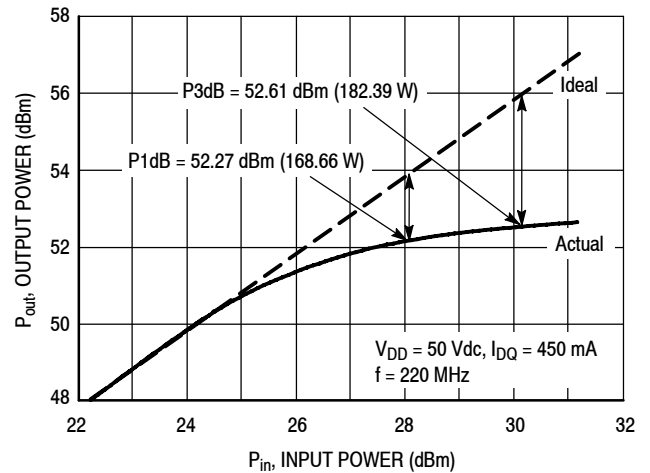


Figure 9. CW Output Power versus Input Power

## TYPICAL CHARACTERISTICS

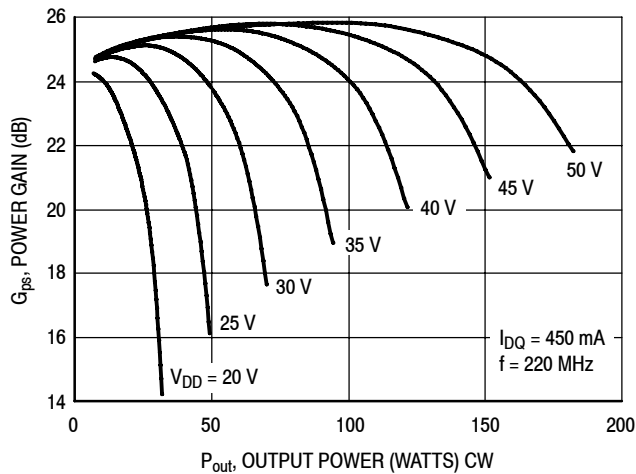


Figure 10. Power Gain versus Output Power

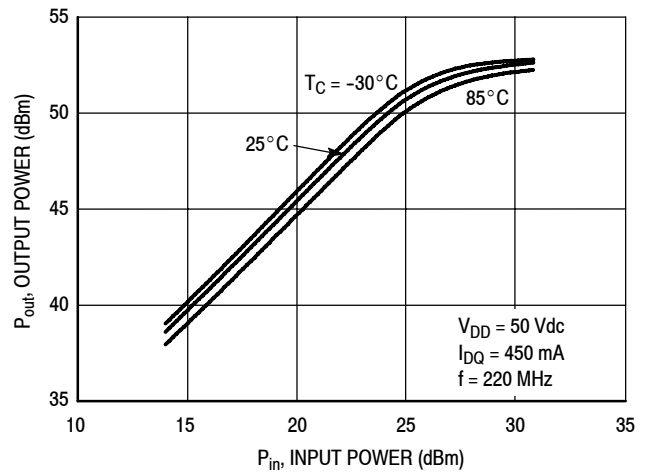


Figure 11. Power Output versus Power Input

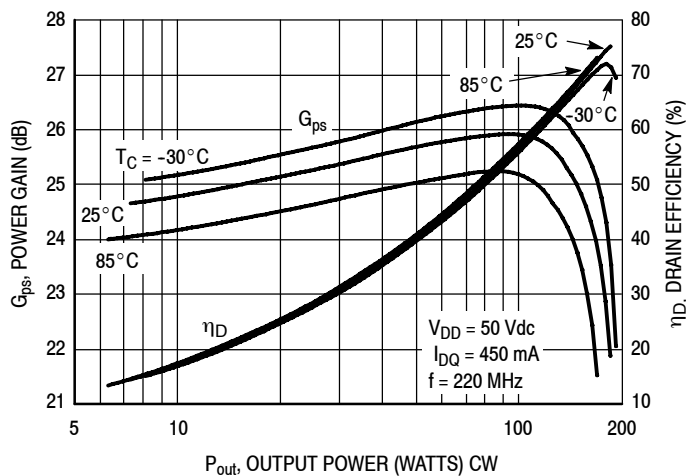
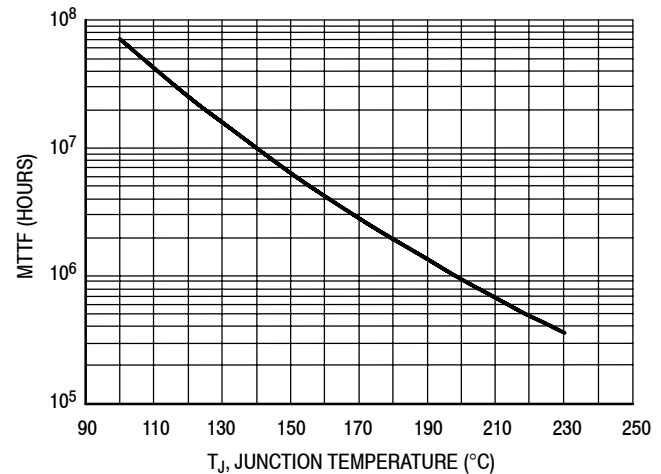


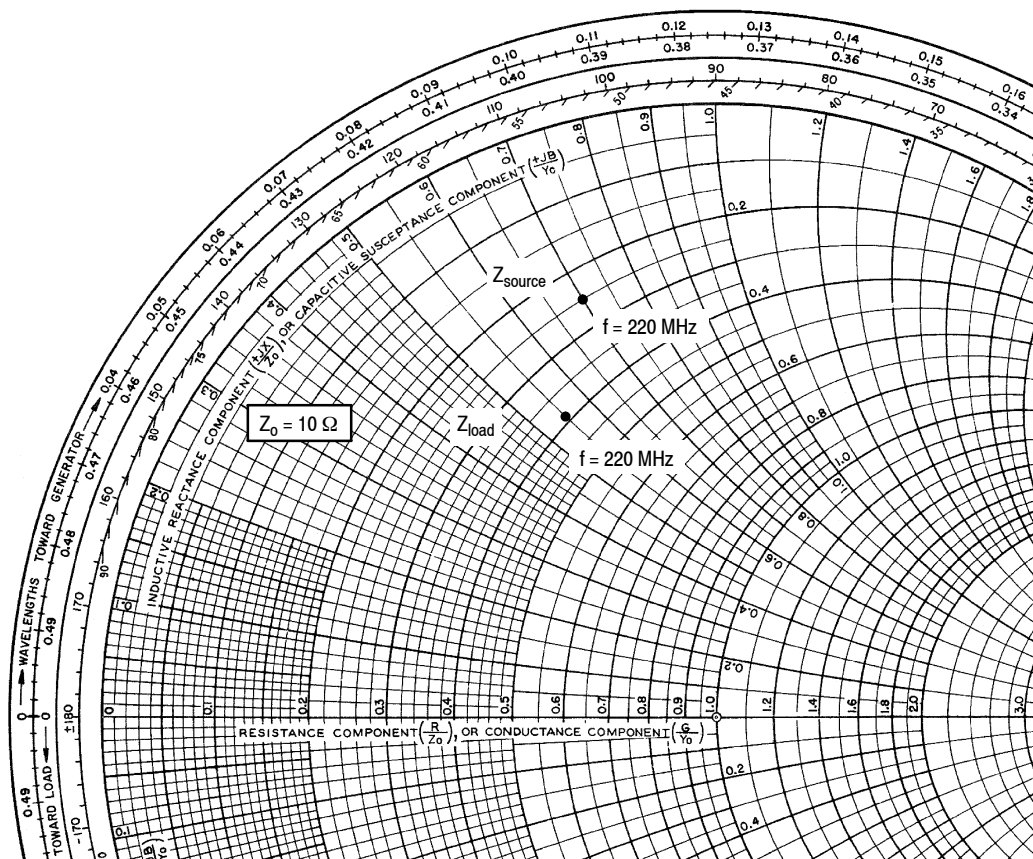
Figure 12. Power Gain and Drain Efficiency versus CW Output Power



This above graph displays calculated MTTF in hours when the device is operated at  $V_{DD} = 50$  Vdc,  $P_{out} = 150$  W CW, and  $\eta_D = 68.3\%$ .

MTTF calculator available at <http://www.freescale.com/rf>. Select Software & Tools/Development Tools/Calculators to access MTTF calculators by product.

Figure 13. MTTF versus Junction Temperature



$V_{DD} = 50 \text{ Vdc}$ ,  $I_{DQ} = 450 \text{ mA}$ ,  $P_{out} = 150 \text{ W CW}$

| f<br>MHz | $Z_{source}$<br>$\Omega$ | $Z_{load}$<br>$\Omega$ |
|----------|--------------------------|------------------------|
| 220      | $2.45 + j6.95$           | $3.90 + j5.50$         |

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

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

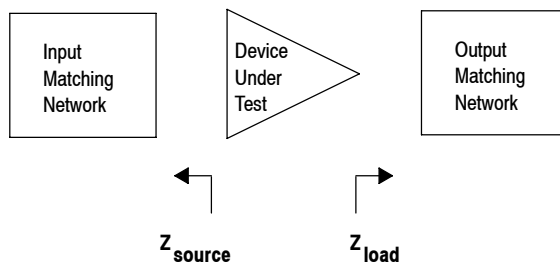


Figure 14. Series Equivalent Source and Load Impedance — 220 MHz

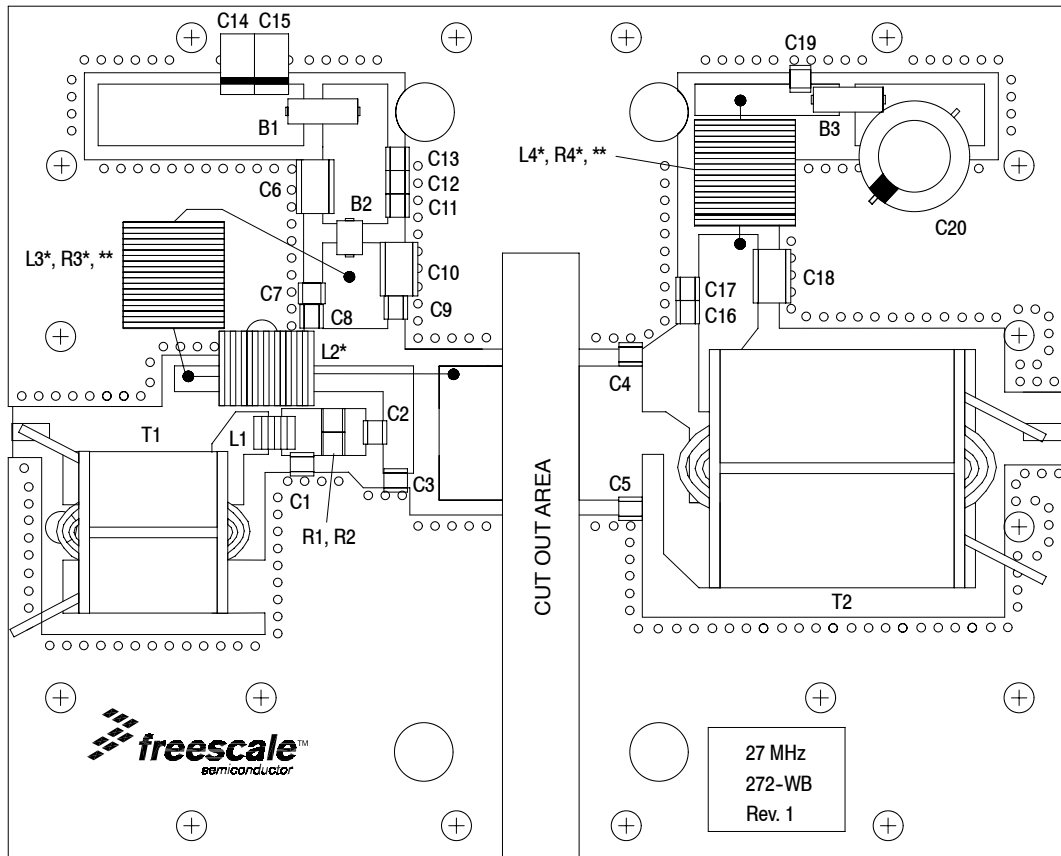


Figure 15. MRF6V2150NR1(NBR1) Test Circuit Component Layout — 27 MHz

Table 7. MRF6V2150NR1(NBR1) Test Circuit Component Designations and Values — 27 MHz

| Part            | Description                                       | Part Number          | Manufacturer  |
|-----------------|---------------------------------------------------|----------------------|---------------|
| B1, B3          | 95 $\Omega$ , 100 MHz Long Ferrite Beads          | 2743021447           | Fair-Rite     |
| B2              | 47 $\Omega$ , 100 MHz Short Ferrite Bead          | 2743019447           | Fair-Rite     |
| C1, C4, C5, C16 | 100 pF Chip Capacitors                            | ATC100B101JT500XT    | ATC           |
| C2              | 620 pF Chip Capacitor                             | ATC100B621JT200XT    | ATC           |
| C3              | 1000 pF Chip Capacitor                            | ATC100B102JT50XT     | ATC           |
| C6              | 2.2 $\mu$ F, 50 V Chip Capacitor                  | C1825C225J5RAC-TU    | Kemet         |
| C7              | 0.1 $\mu$ F Chip Capacitor                        | CDR33BX104AKYS       | Kemet         |
| C8              | 0.22 $\mu$ F, 50 V Chip Capacitor                 | C1812C224K5RAC-TU    | Kemet         |
| C9, C12         | 22K pF Chip Capacitors                            | ATC200B223KT50XT     | ATC           |
| C10, C18        | 0.01 $\mu$ F, 100 V Chip Capacitors               | C1825C103K1GAC-TU    | Kemet         |
| C11, C19        | 0.1 pF Chip Capacitors                            | ATC100B0R1BT500XT    | ATC           |
| C13, C17        | 39K pF Chip Capacitors                            | ATC200B393KT50XT     | ATC           |
| C14             | 22 $\mu$ F, 35 V Tantalum Capacitor               | T491X226K035AT       | Kemet         |
| C15             | 10 $\mu$ F, 35 V Tantalum Capacitor               | T491D106K035AT       | Kemet         |
| C20             | 470 $\mu$ F, 63 V Electrolytic Capacitor          | MCGPR63V477M13X26-RH | Multicomp     |
| L1              | 47 nH Inductor                                    | 1812SMS-47NJ         | Coilcraft     |
| L2*             | 9 Turn, #16 AWG, Inductor, Hand Wound, 0.250" ID  | Copper Wire          |               |
| L3*             | 10 Turn, #16 AWG, Inductor, Hand Wound, 0.375" ID | Copper Wire          |               |
| L4*             | 9 Turn, #16 AWG, Inductor, Hand Wound, 0.375" ID  | Copper Wire          |               |
| R1, R2          | 3.3 $\Omega$ , 1/2 W Chip Resistors               | RK73B2ETTD3R3J       | KOA           |
| R3*, **         | 1 K $\Omega$ , 1/4 W Resistor                     | MCCFR0W4J0102A50     | Multicomp     |
| R4*, **         | 510 $\Omega$ , 1/2 W Resistor                     | MCRC1/2G511JT-RH     | Multicomp     |
| T1              | RF600 Transformer 16:1 Impedance Ratio            | RF600LF-16           | Comm Concepts |
| T2              | RF1000 Transformer 9:1 Impedance Ratio            | RF1000LF-9           | Comm Concepts |

\* Loaded components mounted over traces.

\*\* Resistor is mounted at center of inductor coil.

## MRF6V2150NR1 MRF6V2150NBR1

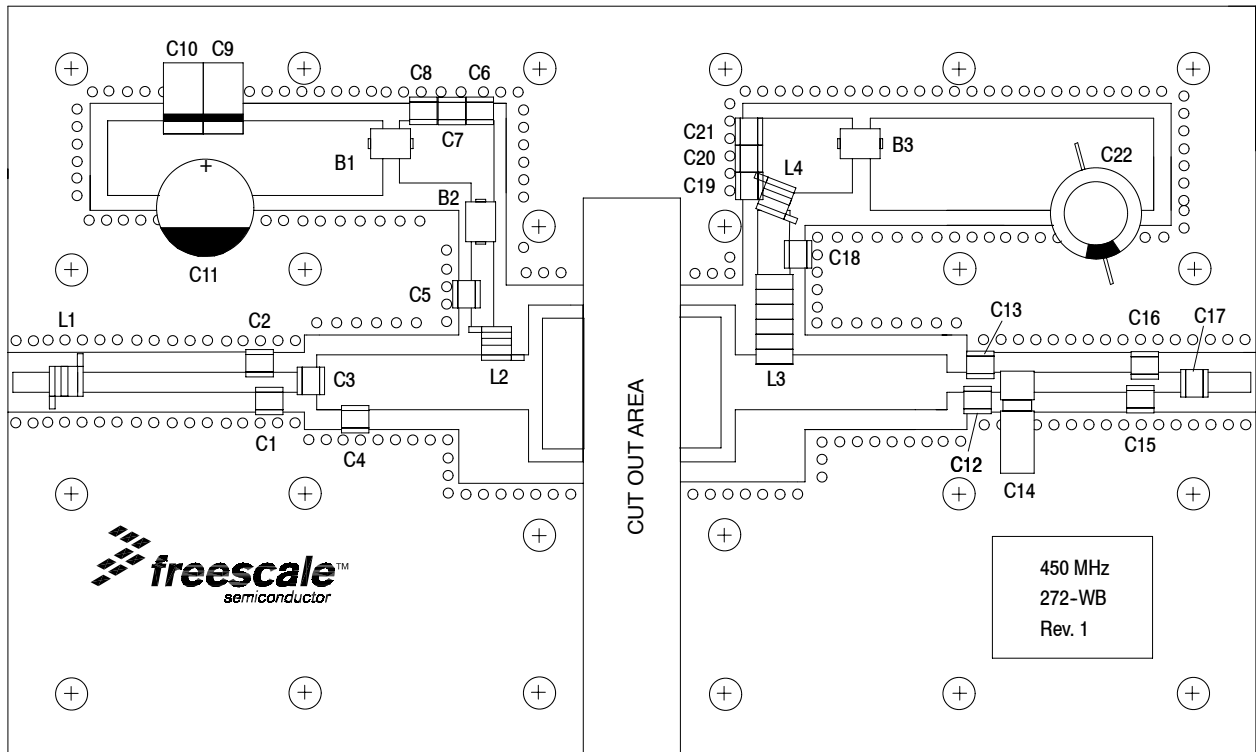
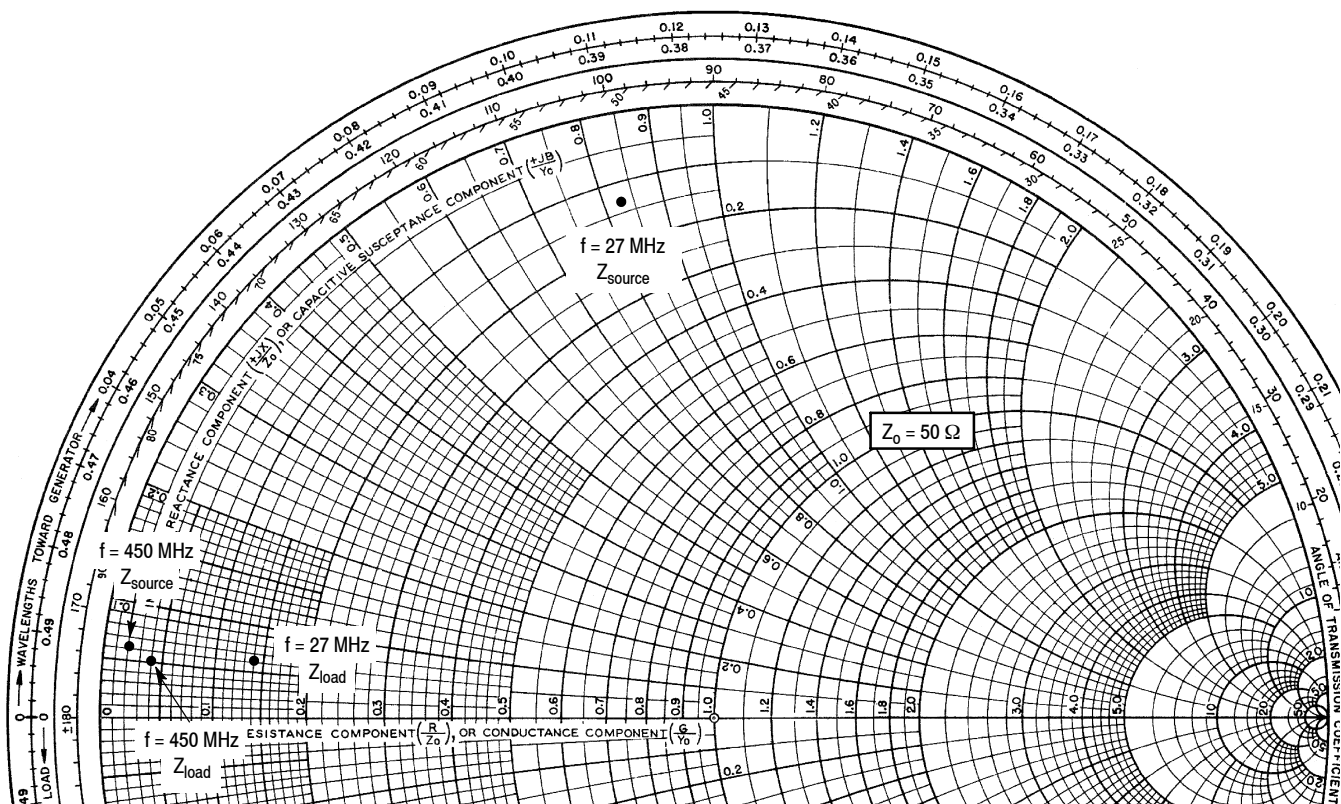


Figure 16. MRF6V2150NR1(NBR1) Test Circuit Component Layout — 450 MHz

Table 8. MRF6V2150NR1(NBR1) Test Circuit Component Designations and Values — 450 MHz

| Part             | Description                                                | Part Number          | Manufacturer       |
|------------------|------------------------------------------------------------|----------------------|--------------------|
| B1, B2, B3       | 47 $\Omega$ , 100 MHz Short Ferrite Beads                  | 2743019447           | Fair-Rite          |
| C1               | 6.8 pF Chip Capacitor                                      | ATC100B6R8CT500XT    | ATC                |
| C2               | 15 pF Chip Capacitor                                       | ATC100B150JT500XT    | ATC                |
| C3, C5, C17, C18 | 240 pF Chip Capacitors                                     | ATC100B241JT200XT    | ATC                |
| C4               | 36 pF Chip Capacitor                                       | ATC100B360JT500XT    | ATC                |
| C6, C21          | 0.1 $\mu$ F, 50 V Chip Capacitors                          | CDR33BX104AKYS       | Kemet              |
| C7, C20          | 10K pF Chip Capacitors                                     | ATC200B103KT50XT     | ATC                |
| C8, C19          | 22K pF Chip Capacitors                                     | ATC200B223KT50XT     | ATC                |
| C9               | 10 $\mu$ F, 35 V Tantalum Capacitor                        | T491D106K035AS       | Kemet              |
| C10              | 22 $\mu$ F, 35 V Tantalum Capacitor                        | T491X226K035AS       | Kemet              |
| C11              | 47 $\mu$ F, 50 V Electrolytic Capacitor                    | 476KXM050M           | Illinois Capacitor |
| C12              | 18 pF Chip Capacitor                                       | ATC100B180JT500XT    | ATC                |
| C13              | 10 pF Chip Capacitor                                       | ATC100B100JT500XT    | ATC                |
| C14              | 0.6 – 4.5 pF Variable Capacitor                            | 27271SL              | Johanson           |
| C15              | 3 pF Chip Capacitor                                        | ATC100B3R0CT500XT    | ATC                |
| C16              | 0.5 pF Chip Capacitor                                      | ATC100B0R5BT500XT    | ATC                |
| C22              | 470 $\mu$ F, 63 V Electrolytic Capacitor                   | MCGPR63V477M13X26-RH | Multicomp          |
| L1, L2           | 5 nH Mini Spring Air Core Inductors                        | A02TKLC              | Coilcraft          |
| L3               | 17.5 nH Mini Spring Air Core Inductor                      | B06TJLC              | Coilcraft          |
| L4               | 82 nH Midi Spring Air Core Inductor                        | 1812SMS-82NJLC       | Coilcraft          |
| PCB              | Arlon CuClad 250GX-0300-55-22, 0.030", $\epsilon_r = 2.55$ | DS2054               | DS                 |



$V_{DD} = 50 \text{ Vdc}$ ,  $I_{DQ} = 450 \text{ mA}$ ,  $P_{\text{out}} = 150 \text{ W CW}$

| f<br>MHz | $Z_{\text{source}}$<br>$\Omega$ | $Z_{\text{load}}$<br>$\Omega$ |
|----------|---------------------------------|-------------------------------|
| 27       | $6.57 + j41.4$                  | $7.16 + j3.02$                |
| 450      | $0.80 + j3.20$                  | $2.20 + j2.30$                |

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

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

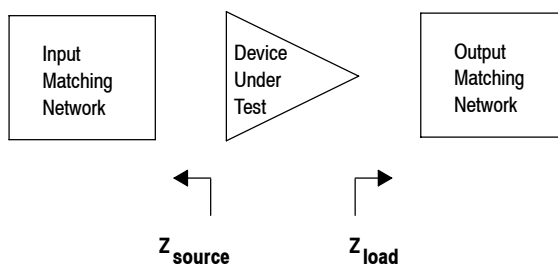
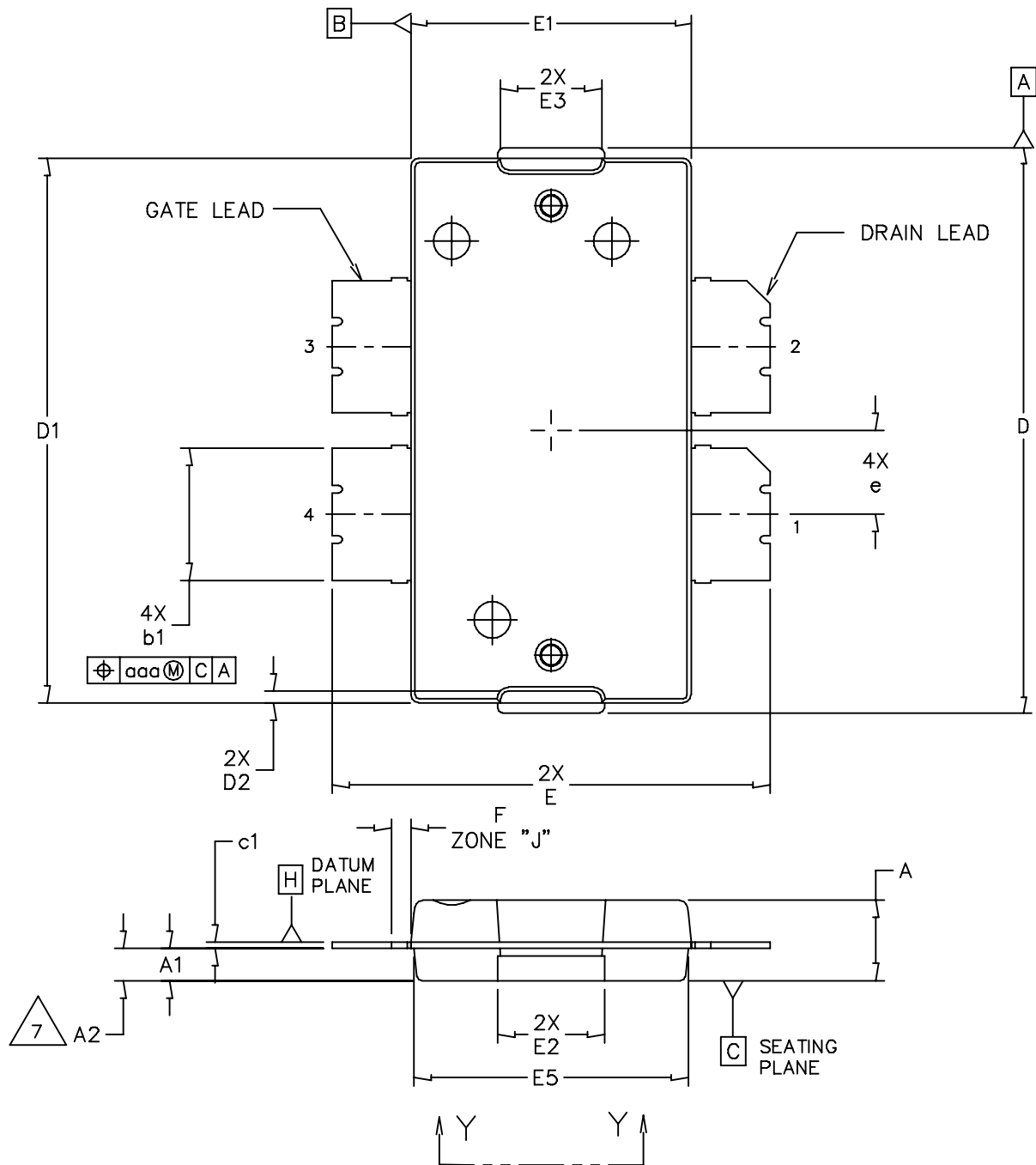


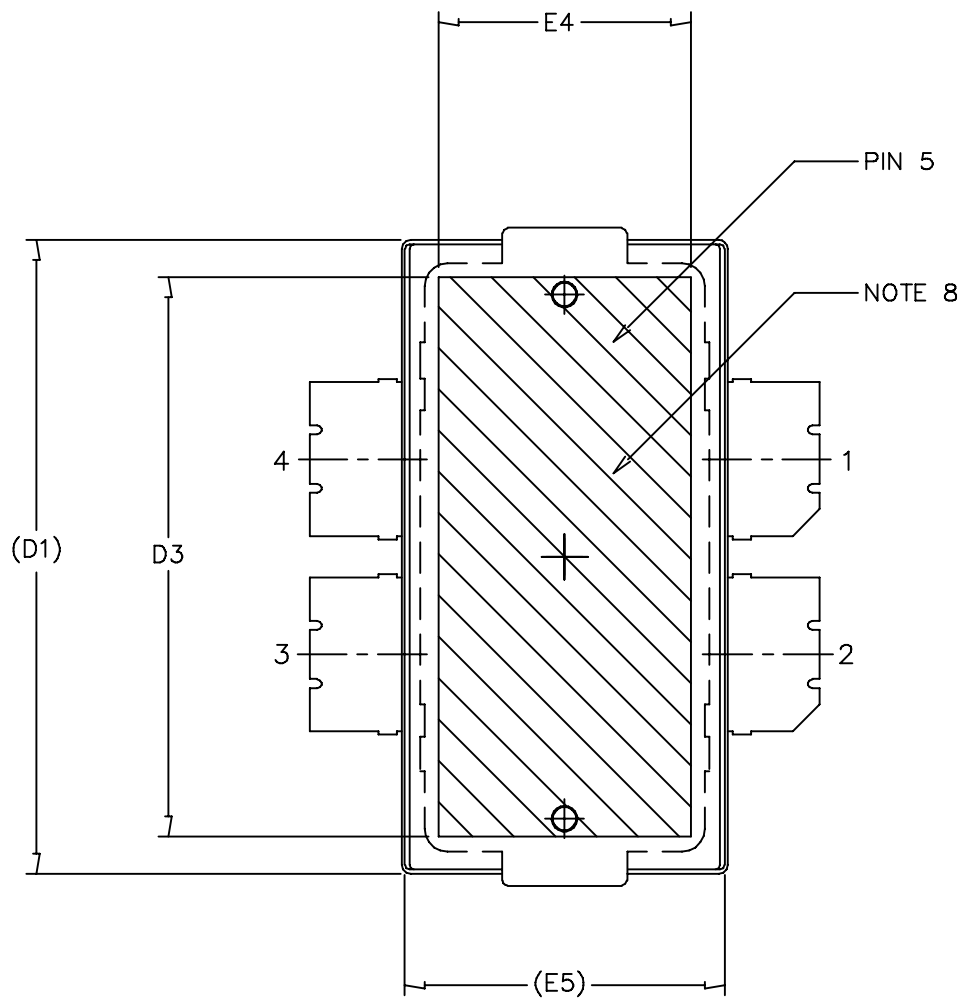
Figure 17. Series Equivalent Source and Load Impedance — 27, 450 MHz

# PACKAGE DIMENSIONS



|                                                         |  |                          |                            |
|---------------------------------------------------------|--|--------------------------|----------------------------|
| © FREESCALE SEMICONDUCTOR, INC.<br>ALL RIGHTS RESERVED. |  | MECHANICAL OUTLINE       | PRINT VERSION NOT TO SCALE |
| TITLE:<br>TO-270<br>4 LEAD, WIDE BODY                   |  | DOCUMENT NO: 98ASA10577D | REV: D                     |
|                                                         |  | CASE NUMBER: 1486-03     | 13 AUG 2007                |
|                                                         |  | STANDARD: NON-JEDEC      |                            |

MRF6V2150NR1 MRF6V2150NBR1



|                                                         |                    |                            |             |
|---------------------------------------------------------|--------------------|----------------------------|-------------|
| © FREESCALE SEMICONDUCTOR, INC.<br>ALL RIGHTS RESERVED. | MECHANICAL OUTLINE | PRINT VERSION NOT TO SCALE |             |
| TITLE:<br>TO-270<br>4 LEAD, WIDE BODY                   |                    | DOCUMENT NO: 98ASA10577D   | REV: D      |
|                                                         |                    | CASE NUMBER: 1486-03       | 13 AUG 2007 |
|                                                         |                    | STANDARD: NON-JEDEC        |             |

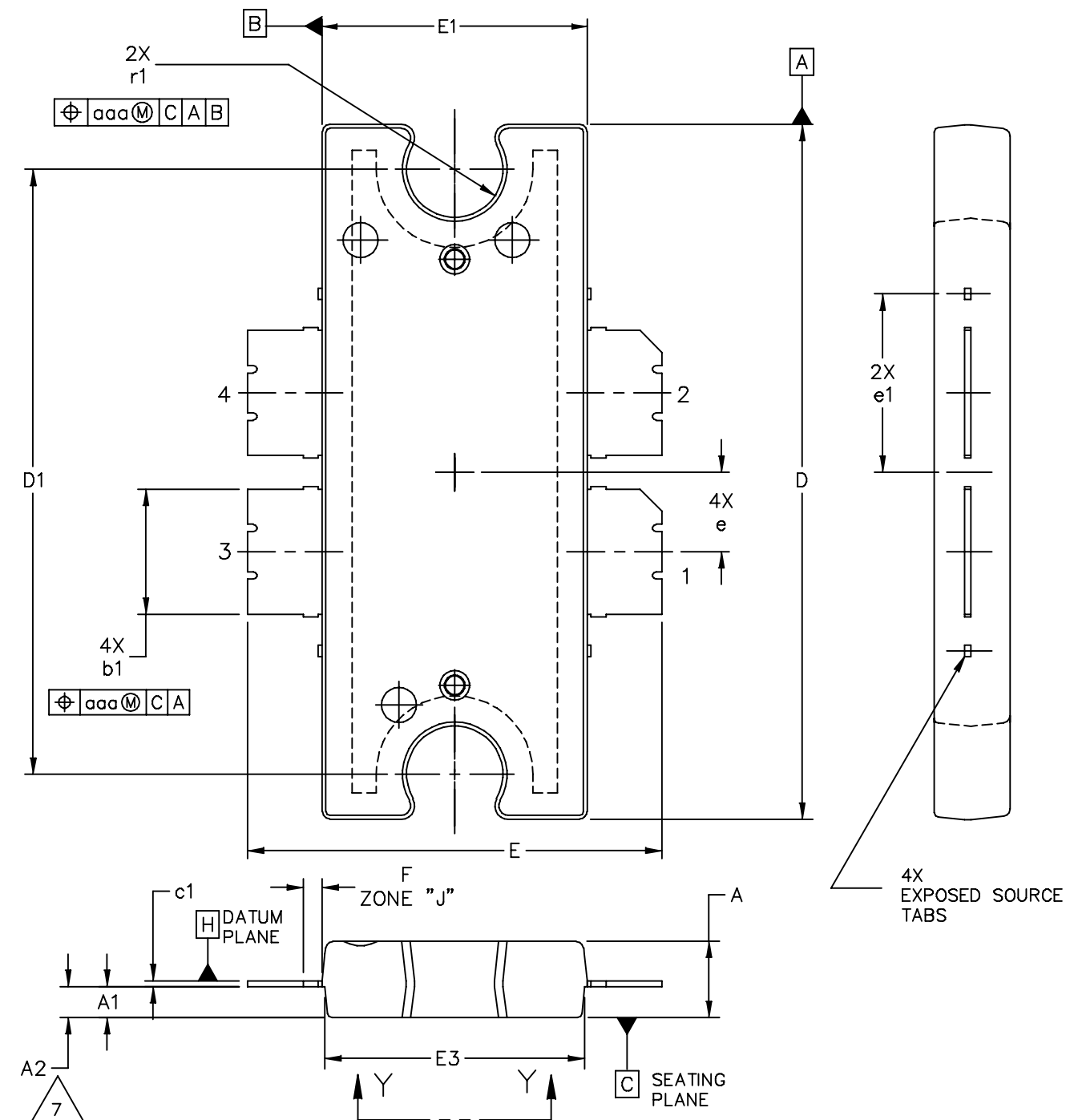
## NOTES:

1. CONTROLLING DIMENSION: INCH
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. DATUM PLANE -H- IS LOCATED AT THE 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 "D" AND "E1" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .006 PER SIDE. DIMENSIONS "D" AND "E1" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -H-.
5. DIMENSIONS "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. HATCHING REPRESENTS THE EXPOSED AREA OF THE HEAT SLUG.

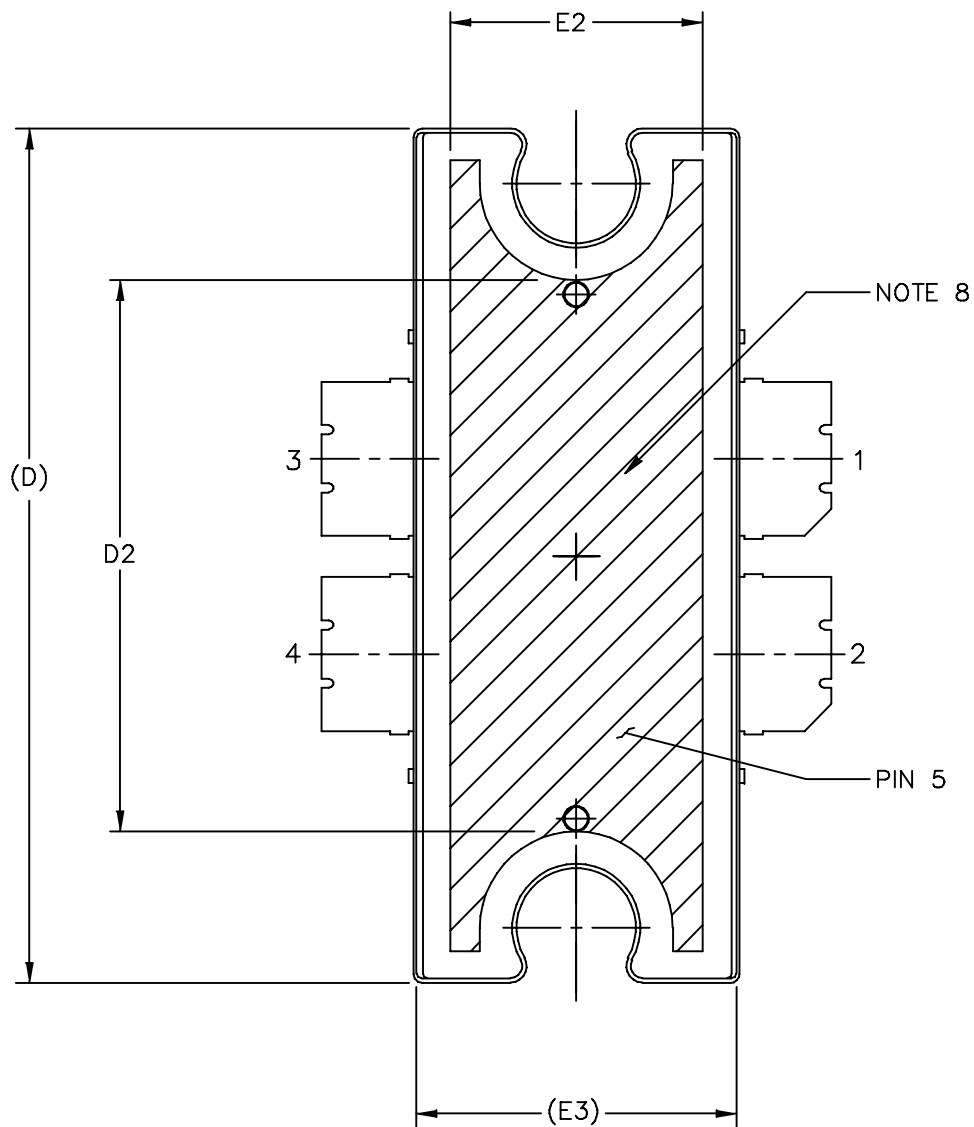
## STYLE 1:

PIN 1 - DRAIN      PIN 2 - DRAIN  
 PIN 3 - GATE      PIN 4 - GATE  
 PIN 5 - SOURCE

| INCH                                                    |      | MILLIMETER |                    | INCH  |                          | MILLIMETER                 |             |
|---------------------------------------------------------|------|------------|--------------------|-------|--------------------------|----------------------------|-------------|
| DIM                                                     | MIN  | MAX        | MIN                | MAX   | DIM                      | MIN                        | MAX         |
| A                                                       | .100 | .104       | 2.54               | 2.64  | F                        | .025 BSC                   | 0.64 BSC    |
| A1                                                      | .039 | .043       | 0.99               | 1.09  | b1                       | .164 .170                  | 4.17 4.32   |
| A2                                                      | .040 | .042       | 1.02               | 1.07  | c1                       | .007 .011                  | .18 .28     |
| D                                                       | .712 | .720       | 18.08              | 18.29 | e                        | .106 BSC                   | 2.69 BSC    |
| D1                                                      | .688 | .692       | 17.48              | 17.58 | aaa                      | .004                       | .10         |
| D2                                                      | .011 | .019       | 0.28               | 0.48  |                          |                            |             |
| D3                                                      | .600 | ---        | 15.24              | ---   |                          |                            |             |
| E                                                       | .551 | .559       | 14                 | 14.2  |                          |                            |             |
| E1                                                      | .353 | .357       | 8.97               | 9.07  |                          |                            |             |
| E2                                                      | .132 | .140       | 3.35               | 3.56  |                          |                            |             |
| E3                                                      | .124 | .132       | 3.15               | 3.35  |                          |                            |             |
| E4                                                      | .270 | ---        | 6.86               | ---   |                          |                            |             |
| E5                                                      | .346 | .350       | 8.79               | 8.89  |                          |                            |             |
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| TITLE:<br><br>TO-270<br>4 LEAD WIDE BODY                |      |            |                    |       | DOCUMENT NO: 98ASA10577D |                            | REV: D      |
|                                                         |      |            |                    |       | CASE NUMBER: 1486-03     |                            | 13 AUG 2007 |
|                                                         |      |            |                    |       | STANDARD: NON-JEDEC      |                            |             |



|                                                         |  |                          |                            |
|---------------------------------------------------------|--|--------------------------|----------------------------|
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| TITLE:<br>TO-272<br>4 LEAD, WIDE BODY                   |  | DOCUMENT NO: 98ASA10575D | REV: E                     |
|                                                         |  | CASE NUMBER: 1484-04     | 31 AUG 2007                |
|                                                         |  | STANDARD: NON-JEDEC      |                            |



|                                                         |                    |                            |             |
|---------------------------------------------------------|--------------------|----------------------------|-------------|
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| TITLE:<br>TO-272<br>4 LEAD, WIDE BODY                   |                    | DOCUMENT NO: 98ASA10575D   | REV: E      |
|                                                         |                    | CASE NUMBER: 1484-04       | 31 AUG 2007 |
|                                                         |                    | STANDARD: NON-JEDEC        |             |

NOTES:

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STYLE 1:  
 PIN 1 - DRAIN      PIN 2 - DRAIN  
 PIN 3 - GATE      PIN 4 - GATE  
 PIN 5 - SOURCE

| INCH                                                    |          |      | MILLIMETER         |       | INCH                     |                            |      | MILLIMETER     |      |
|---------------------------------------------------------|----------|------|--------------------|-------|--------------------------|----------------------------|------|----------------|------|
| DIM                                                     | MIN      | MAX  | MIN                | MAX   | DIM                      | MIN                        | MAX  | MIN            | MAX  |
| A                                                       | .100     | .104 | 2.54               | 2.64  | b1                       | .164                       | .170 | 4.17           | 4.32 |
| A1                                                      | .039     | .043 | 0.99               | 1.09  | c1                       | .007                       | .011 | .18            | .28  |
| A2                                                      | .040     | .042 | 1.02               | 1.07  | r1                       | .063                       | .068 | 1.60           | 1.73 |
| D                                                       | .928     | .932 | 23.57              | 23.67 | e                        | .106 BSC                   |      | 2.69 BSC       |      |
| D1                                                      | .810 BSC |      | 20.57 BSC          |       | e1                       | .239 INFO ONLY             |      | 6.07 INFO ONLY |      |
| D2                                                      | .600     | ---  | 15.24              | ---   | aaa                      | .004                       |      | .10            |      |
| E                                                       | .551     | .559 | 14                 | 14.2  |                          |                            |      |                |      |
| E1                                                      | .353     | .357 | 8.97               | 9.07  |                          |                            |      |                |      |
| E2                                                      | .270     | ---  | 6.86               | ---   |                          |                            |      |                |      |
| E3                                                      | .346     | .350 | 8.79               | 8.89  |                          |                            |      |                |      |
| F                                                       | .025 BSC |      | 0.64 BSC           |       |                          |                            |      |                |      |
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| TITLE:<br><br>TO-272<br>4 LEAD WIDE BODY                |          |      |                    |       | DOCUMENT NO: 98ASA10575D |                            |      | REV: E         |      |
|                                                         |          |      |                    |       | CASE NUMBER: 1484-04     |                            |      | 31 AUG 2007    |      |
|                                                         |          |      |                    |       | STANDARD: NON-JEDEC      |                            |      |                |      |

## PRODUCT DOCUMENTATION AND SOFTWARE

Refer to the following documents to aid your design process.

### Application Notes

- AN1907: Solder Reflow Attach Method for High Power RF Devices in Plastic Packages
- AN1955: Thermal Measurement Methodology of RF Power Amplifiers
- AN3263: Bolt Down Mounting Method for High Power RF Transistors and RFICs in Over-Molded Plastic Packages

### Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

### Software

- Electromigration MTTF Calculator
- RF High Power Model

For Software, do a Part Number search at <http://www.freescale.com>, and select the “Part Number” link. Go to the Software & Tools tab on the part’s Product Summary page to download the respective tool.

## REVISION HISTORY

The following table summarizes revisions to this document.

| Revision | Date      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0        | Feb. 2007 | <ul style="list-style-type: none"><li>• Initial Release of Data Sheet</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 1        | May 2007  | <ul style="list-style-type: none"><li>• Corrected Test Circuit Component part numbers in Table 6, Component Designations and Values for C4, C17, C5, C18, C9, C12, C14, C23, C13, C21, and C22, p. 3</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 2        | Apr. 2008 | <ul style="list-style-type: none"><li>• Added Case Operating Temperature limit to the Maximum Ratings table and set limit to 150°C, p. 1</li><li>• Corrected <math>C_{iss}</math> test condition to indicate AC stimulus on the <math>V_{GS}</math> connection versus the <math>V_{DS}</math> connection, Dynamic Characteristics table, p. 2</li><li>• Updated PCB information to show more specific material details, Fig. 2, Test Circuit Schematic, p. 3</li><li>• Updated Part Numbers in Table 6, Component Designations and Values, to latest RoHS compliant part numbers, p. 3</li><li>• Replaced Case Outline 1486-03, Issue C, with 1486-03, Issue D, p. 8-10. Added pin numbers 1 through 4 on Sheet 1.</li><li>• Replaced Case Outline 1484-04, Issue D, with 1484-04, Issue E, p. 11-13. Added pin numbers 1 through 4 on Sheet 1, replacing Gate and Drain notations with Pin 1 and Pin 2 designations.</li></ul> |
| 3        | Dec. 2008 | <ul style="list-style-type: none"><li>• Added Typical Performances table for 27 MHz, 450 MHz applications, p. 2</li><li>• Added Figs. 15 and 16, Test Circuit Component Layout – 27 MHz and 450 MHz, and Tables 7 and 8, Test Circuit Component Designations and Values – 27 MHz and 450 MHz, p. 8, 9</li><li>• Added Fig. 17, Series Equivalent Source and Load Impedance for 27 MHz, 450 MHz, p. 10</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 4        | Apr. 2010 | <ul style="list-style-type: none"><li>• Operating Junction Temperature increased from 200°C to 225°C in Maximum Ratings table, related “Continuous use at maximum temperature will affect MTTF” footnote added and changed 200°C to 225°C in Capable Plastic Package bullet, p. 1</li><li>• Added Electromigration MTTF Calculator and RF High Power Model availability to Product Software, p. 17</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

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