## The RF Line

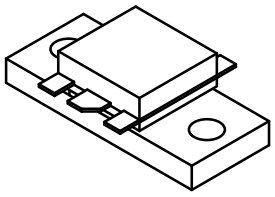
# NPN Silicon RF Power Transistor

# MRF6414

**50 W, 960 MHz**
**RF POWER TRANSISTOR**
**NPN SILICON**

The MRF6414 is designed for 26 volt UHF large signal, common emitter, class AB linear amplifier applications.

- Specified 26 Volt, 960 MHz Characteristics
  Output Power = 50 Watts
  Minimum Gain = 8.5 dB @ 960 MHz, Class AB
  Minimum Efficiency = 50% @ 960 MHz, 50 Watts
- Silicon Nitride Passivated
- Gold Metallized, Emitter Ballasted for Long Life and Resistance to Metal Migration
- Circuit Board Photomaster Available by Ordering Document MRF6414PHT/D from Motorola Literature Distribution.



**CASE 333A–02, STYLE 2**

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector–Emitter Voltage | $V_{CEO}$ | 28 | Vdc |
| Collector–Base Voltage | $V_{CBO}$ | 65 | Vdc |
| Emitter–Base Voltage | $V_{EBO}$ | 4 | Vdc |
| Collector–Current — Continuous | $I_C$ | 6 | Adc |
| Total Device Dissipation @ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 134<br>0.77 | Watts<br>W/°C |
| Storage Temperature Range | $T_{stg}$ | –65 to +150 | °C |

**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.3 | °C/W |

**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector–Emitter Breakdown Voltage ($I_C$ = 20 mAdc, $I_B$ = 0) | $V_{(BR)CEO}$ | 28 | — | — | Vdc |
| Collector–Base Breakdown Voltage ($I_C$ = 20 mAdc, $I_E$ = 0) | $V_{(BR)CBO}$ | 65 | — | — | Vdc |
| Emitter–Base Breakdown Voltage ($I_E$ = 10 mAdc, $I_C$ = 0) | $V_{(BR)EBO}$ | 4 | — | — | Vdc |
| Collector–Emitter Leakage Current ($V_{CE}$ = 30 Vdc, $R_{BE}$ = 75 Ω) | $I_{CER}$ | — | — | 10 | mAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain ($I_{CE}$ = 1 Adc, $V_{CE}$ = 5 Vdc) | $h_{FE}$ | 30 | — | 120 | — |



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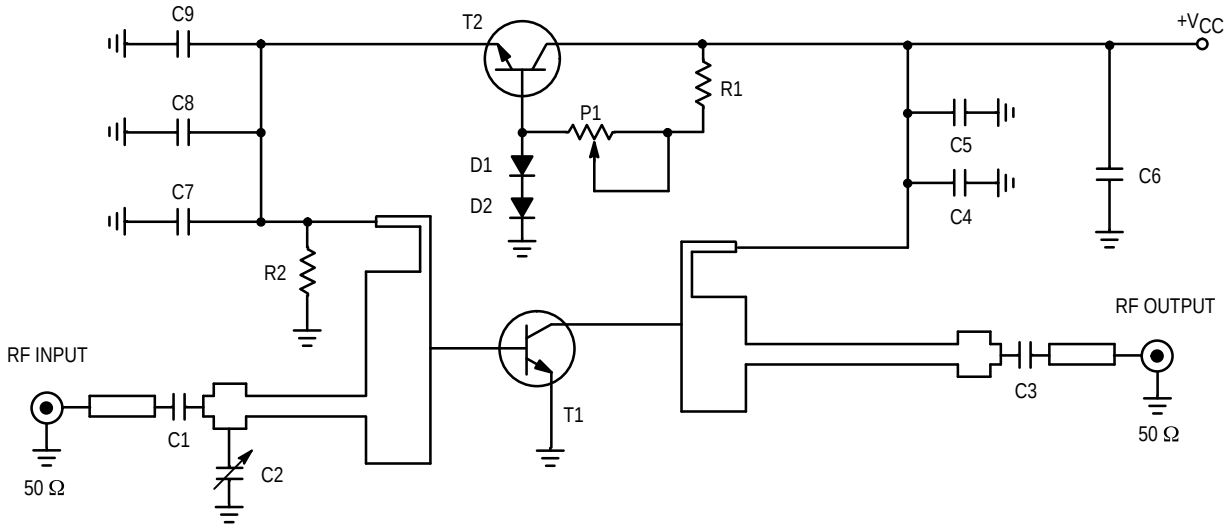
**ELECTRICAL CHARACTERISTICS — continued** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Output Capacitance ($V_{CB}$ = 26 Vdc, $I_E$ = 0, f = 1 MHz) (1) | $C_{ob}$ | — | 45 | — | pF |
| **FUNCTIONAL TESTS** | | | | | |
| Common–Emitter Amplifier Power Gain ($V_{CC}$ = 26 Vdc, $P_{out}$ = 50 W, $I_{CQ}$ = 200 mA, f = 960 MHz) | $G_{pe}$ | 8.5 | — | — | dB |
| Collector Efficiency ($V_{CC}$ = 26 Vdc, $P_{out}$ = 50 W, $I_{CQ}$ = 200 mA, f = 960 MHz) | η | 50 | 55 | — | % |
| Output Mismatch Stress ($V_{CC}$ = 26 Vdc, $P_{out}$ = 50 W, $I_{CQ}$ = 200 mA, f = 960 MHz) VSWR = 3:1; all phase angles at frequency of test | Ψ | No Degradation in Output Power | | | |

(1) For information only. It is not measurable in MRF6414 because of internal matching network.




| | | | |
|---|---|---|---|
| C1, C3 | 100 pF, Chip Capacitor, Hight Q | P1 | 1 kΩ, Trimmer |
| C2, C7 | 330 pF, Chip Capacitor, 0805 | R1 | 1 kΩ, Resistor |
| C5, C8 | 10 nF, Chip Capacitor, 0805 | R2 | 58 Ω, Resistor, 0805 |
| C6 | 15 μF, Capacitor, 63 V | T1 | MRF6414 |
| C9 | 100 μF, Capacitor, 16 V | T2 | Transistor NPN Type BD135 |
| D1, D2 | Diode 1N4007 | | |

**Figure 1. 960 MHz Test Circuit Schematic**

## TYPICAL CHARACTERISTICS

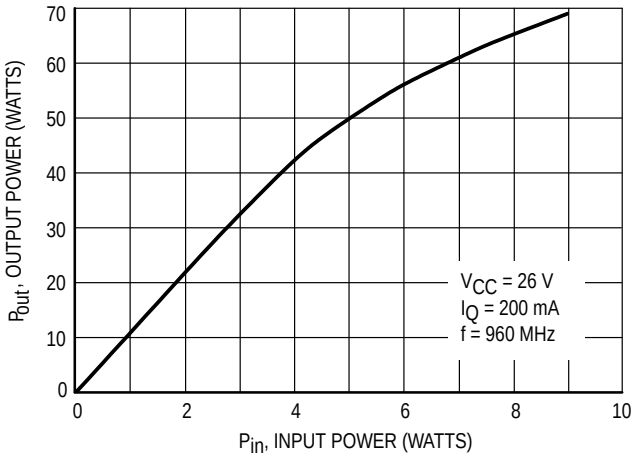



**Figure 2. Output Power versus Input Power (Typical)**

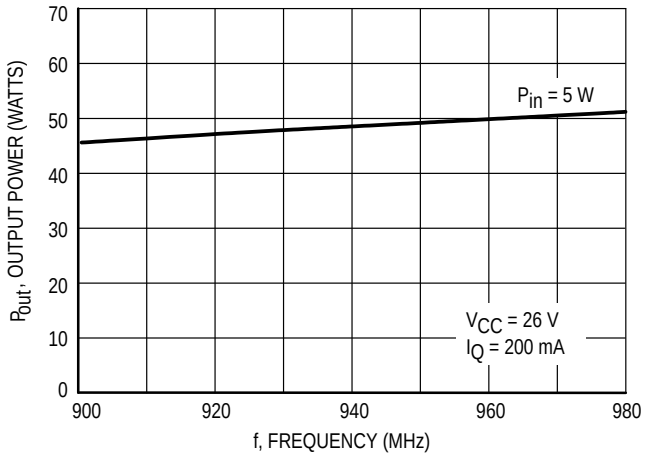



**Figure 3. Output Power versus Frequency**

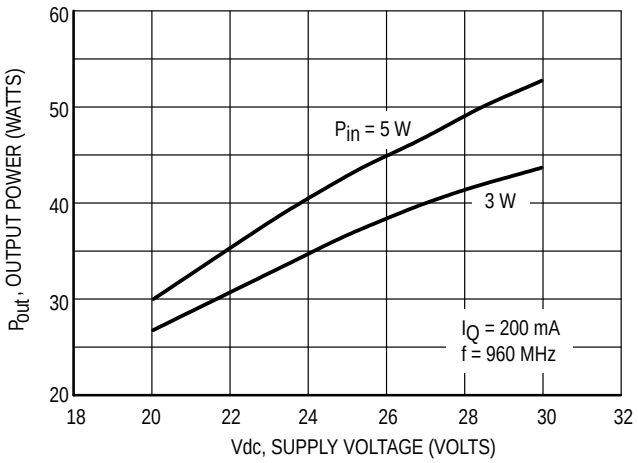



**Figure 4. Output Power versus Supply Voltage**

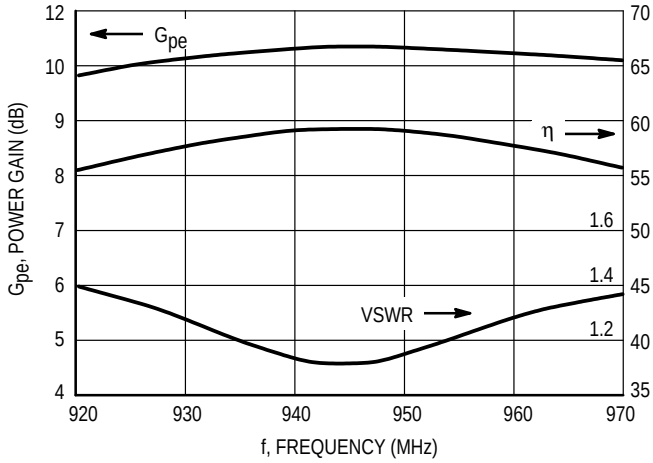



**Figure 5. Typical Broadband Amplifier**

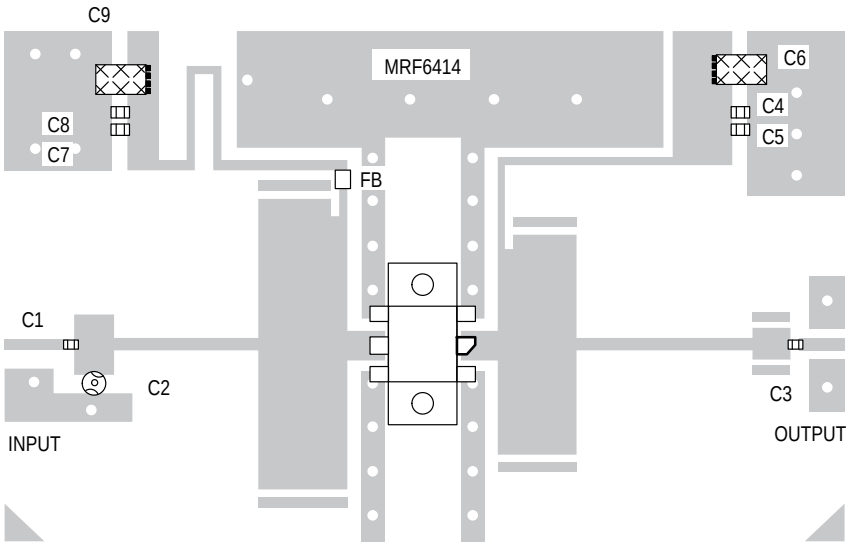
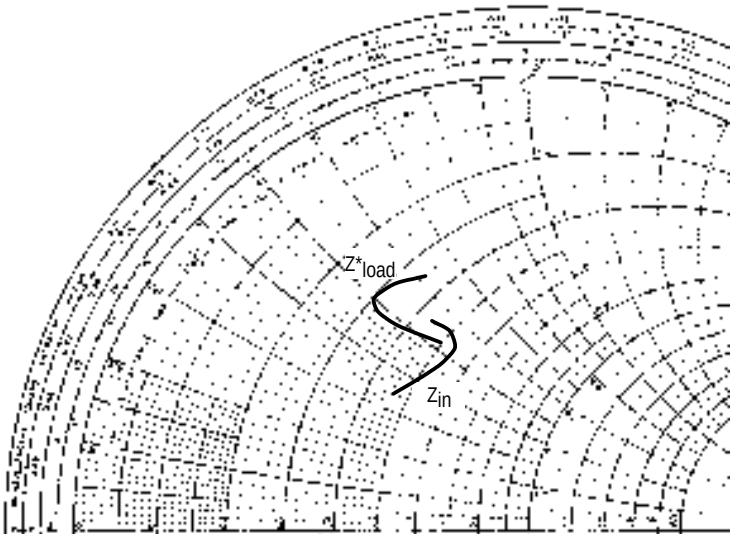



**Figure 6. 960 MHz Test Circuit Components Layout**



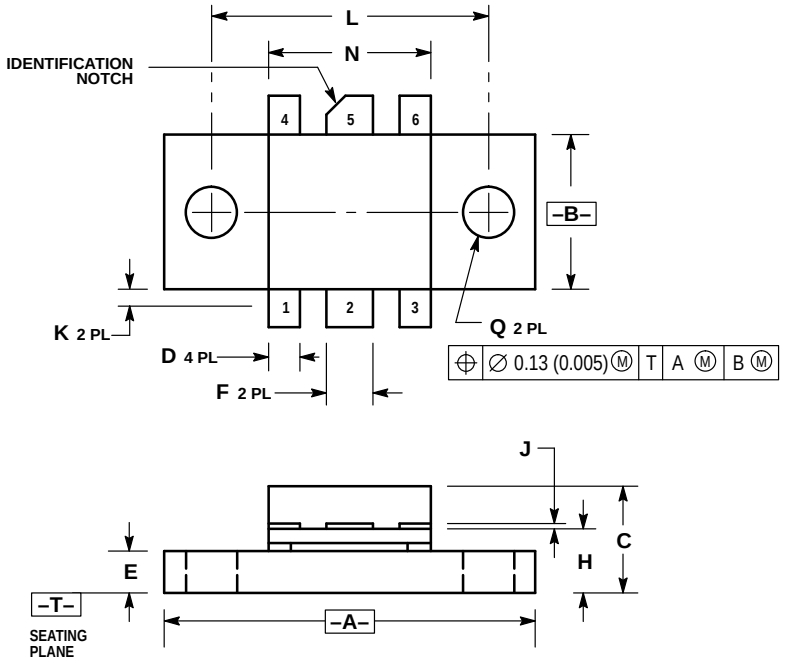

**Normalized to 10 Ω**

| f MHz | $Z_{in}$ Ohms | $Z_{OL}$* Ohms |
|---|---|---|
| 900 | 4.4 + j4.6 | 4.7 + j4.7 |
| 935 | 5.1 + j4.8 | 4.0 + j3.9 |
| 960 | 5.4 + j3.6 | 3.7 + j4.5 |
| 980 | 4.7 + j2.5 | 3.4 + j4.7 |

$Z_{OL}$*: Conjugate of optimum load impedance into which the device operates at a given output power, voltage, current and frequency.

**Figure 7. Input and Output Impedances with Circuit Tuned for Maximum Gain @ $V_{CC}$ = 26 V, $I_Q$ = 200 mA, $P_{out}$ = 50 W**

## PACKAGE DIMENSIONS




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.965 | 0.985 | 24.52 | 25.01 |
| B | 0.390 | 0.410 | 9.91 | 10.41 |
| C | 0.250 | 0.290 | 6.35 | 7.36 |
| D | 0.075 | 0.090 | 1.91 | 2.28 |
| E | 0.095 | 0.115 | 2.42 | 2.92 |
| F | 0.110 | 0.130 | 2.80 | 3.30 |
| H | 0.155 | 0.175 | 3.94 | 4.44 |
| J | 0.004 | 0.006 | 0.11 | 0.15 |
| K | 0.090 | 0.116 | 2.29 | 2.94 |
| L | 0.725 BSC | | 18.41 BSC | |
| N | 0.415 | 0.435 | 10.55 | 11.04 |
| Q | 0.120 | 0.135 | 3.05 | 3.42 |

STYLE 2:
PIN 1. EMITTER
2. BASE
3. EMITTER
4. EMITTER
5. COLLECTOR
6. EMITTER

**CASE 333A–02**
**ISSUE C**

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