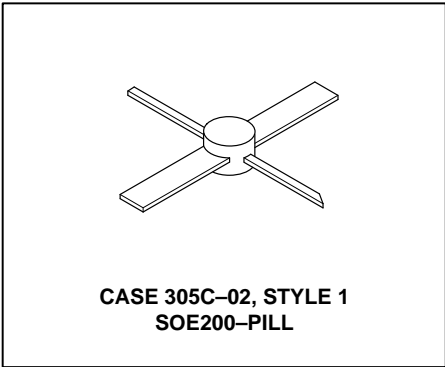
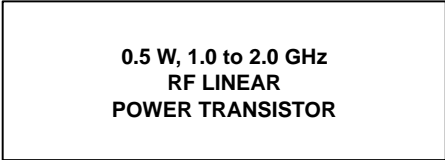


The RF Line NPN Silicon RF Power Transistor

The MRF6401 is designed for Class A common emitter, linear power amplifiers in the 1.0–2.0 GHz frequency range. It has been specifically designed for use in Personal Communications Network (PCN) base station and INMARSAT Standard M applications.

- Specified 20 Volts, 1.66 GHz Characteristics:
 - Output Power — 0.5 Watts
 - Gain — 10 dB Min
 - Class A Operation
- Specified 20 Volts, 1.88 GHz Characteristics:
 - Output Power — 0.5 Watts
 - Gain — 9.0 dB Min
 - Class A Operation
- Circuit Board Photomaster Available by Ordering Document MRF6401PHT/D from Motorola Literature Distribution.



MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|--|-----------|--------------|---------------|
| Collector–Emitter Voltage | V_{CEO} | 22 | Vdc |
| Collector–Base Voltage | V_{CB0} | 45 | Vdc |
| Emitter–Base Voltage | V_{EBO} | 3.5 | Vdc |
| Operating Junction Temperature | T_J | 200 | °C |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C | P_D | 5.8 0.033 | Watts W/°C |
| Storage Temperature Range | T_{stg} | –65 to +150 | °C |

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|--|-----------------|-----|------|
| Thermal Resistance, Junction to Case (1) | $R_{\theta JC}$ | 30 | °C/W |

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

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

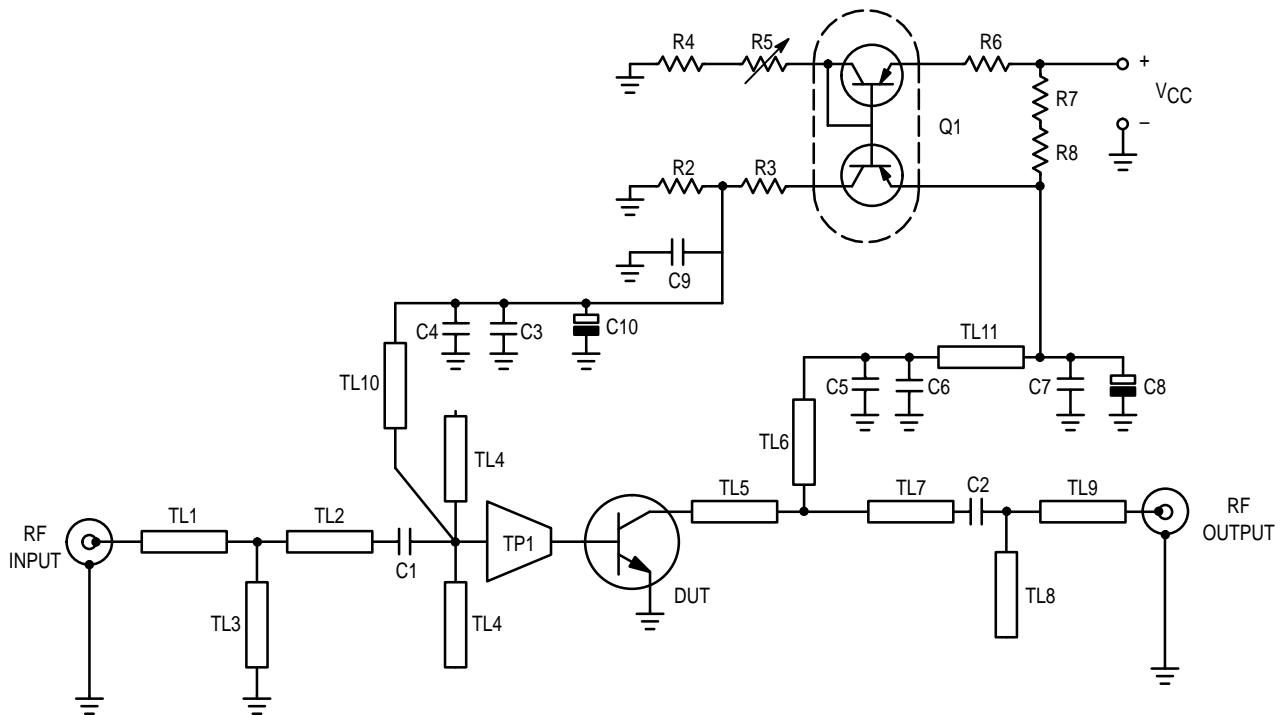
OFF CHARACTERISTICS

| | | | | | |
|--|---------------|-----|---|---|-----|
| Collector–Emitter Breakdown Voltage ($I_C = 10 \text{ mAdc}$, $R_B = 75 \Omega$) | $V_{(BR)CER}$ | 28 | — | — | Vdc |
| Emitter–Base Breakdown Voltage ($I_E = 0.25 \text{ mAdc}$) | $V_{(BR)EBO}$ | 3.5 | — | — | Vdc |
| Collector–Base Breakdown Voltage ($I_C = 1 \text{ mAdc}$) | $V_{(BR)CBO}$ | 45 | — | — | Vdc |

(1) Thermal resistance is determined under specified RF operating condition.

ELECTRICAL CHARACTERISTICS — continued ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|----------|--------------------------------|------------|--------|------|
| ON CHARACTERISTICS | | | | | |
| DC Current Gain ($I_C = 0.1 \text{ Adc}$, $V_{CE} = 5 \text{ Vdc}$) | h_{FE} | 20 | — | 120 | — |
| DYNAMIC CHARACTERISTICS | | | | | |
| Output Capacitance ($V_{CB} = 26 \text{ V}$, $I_E = 0$, $f = 1 \text{ MHz}$) | C_{ob} | — | 1.4 | — | pF |
| FUNCTIONAL TESTS ($V_{CC} = 20 \text{ V}$, $I_{CQ} = 80 \text{ mA}$) | | | | | |
| Common-Emitter Amplifier Power Gain ($f = 1660 \text{ MHz}$, $P_{Out} = 0.5 \text{ W}$) ($f = 1880 \text{ MHz}$, $P_{Out} = 0.5 \text{ W}$) | G_p | 10 9 | 11 10 | — — | dB |
| Load Mismatch ($f = 1660 \text{ MHz}$, $f = 1880 \text{ MHz}$, $P_{Out} = 0.5 \text{ W}$, Load VSWR = 20:1, all phase angles at frequency of test) | ψ | No Degradation in Output Power | | | |
| Intermodulation Distortion ($P_{Out} = 0.5 \text{ W PEP}$, $f_1 = 1659.2 \text{ MHz}$, $f_2 = 1660 \text{ MHz}$) ($P_{Out} = 0.5 \text{ W PEP}$, $f_1 = 1879.2 \text{ MHz}$, $f_2 = 1880 \text{ MHz}$) | IMD | -30 -30 | -35 -35 | — — | dBc |



| | | | |
|----------------|-------------------------------------|-------------|--|
| C1 | 1.5 pF, ATC Chip Capacitor 100A | R2 | 470 Ω , Chip Resistor 0805 |
| C2 | 3.9 pF, ATC Chip Capacitor 100A | R3 | 4.7 k Ω , Chip Resistor 0805 |
| C3 | 56 pF, ATC Chip Capacitor 100A | R4 | 8.2 k Ω , Chip Resistor 0805 |
| C4, C6, C7, C9 | 15 nF, Chip Capacitor 0805 | R5 | 5 k Ω , SMD Potentiometer |
| C5 | 47 pF, ATC Chip Capacitor 100A | R6 | 680 Ω , Chip Resistor 0805 |
| C8 | 4.7 μF , 35 V, Capacitor | R7, R8 | 7.5 Ω , Chip Resistor 0805 |
| C10 | 10 μF , 16 V, Capacitor | TL1 to TL11 | $\mu\text{Strip Lines}$; See Photomaster Document, MRF6401PHT/D |
| C11 | 100 pF, ATC Chip Capacitor 100A | TP1 | $\mu\text{Strip Taper}$; See Photomaster Document, MRF6401PHT/D |
| Q1 | Transistor, BCV62 | | |

Figure 1. 1600–2000 MHz Broadband Application Amplifier Schematic

TYPICAL CHARACTERISTICS

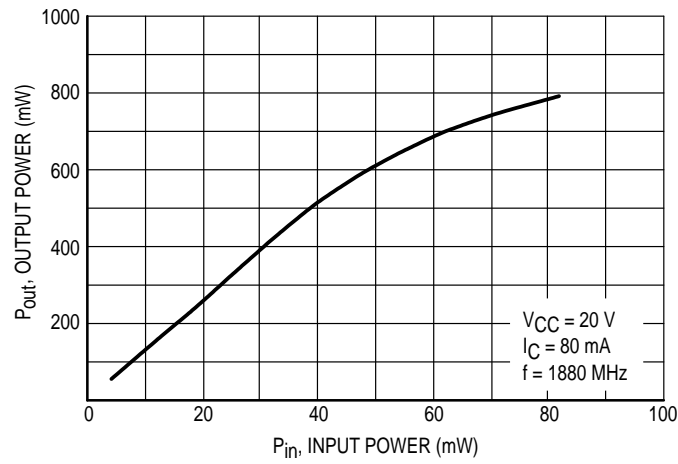


Figure 2. Output Power versus Input Power

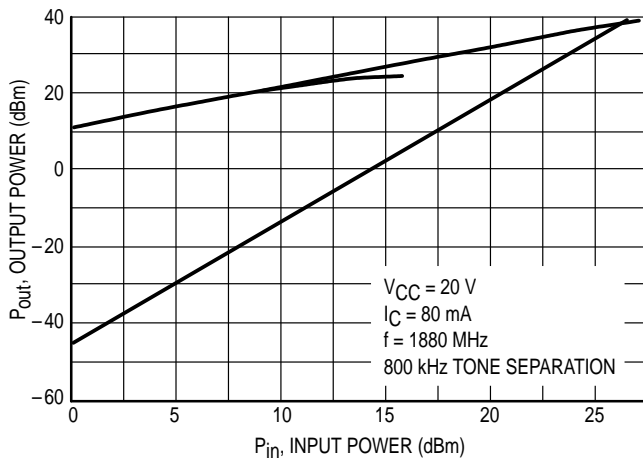


Figure 3. Third Order Intercept

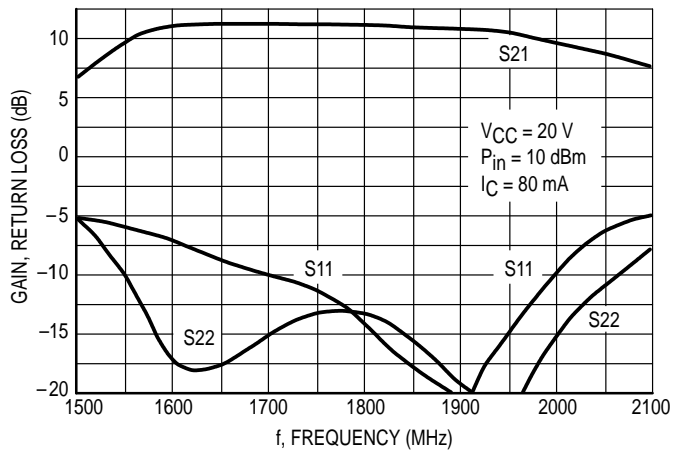


Figure 4. Performance in Broadband Test Fixture

Table 1. Common Emitter S-Parameters

$V_{CC} = 20\text{ V}$, $I_C = 80\text{ mA}$

| POLAR S-PARAMETERS IN 50 Ω SYSTEM | | | | | | | | |
|-----------------------------------|-----------------|------|-----------------|-----|-----------------|-----|-----------------|------|
| f MHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
| | S ₁₁ | ∠ φ | S ₂₁ | ∠ φ | S ₁₂ | ∠ φ | S ₂₂ | ∠ φ |
| 100 | 0.626 | -118 | 28.4 | 127 | 0.0186 | 45 | 0.649 | -40 |
| 200 | 0.718 | -149 | 17.1 | 106 | 0.0230 | 35 | 0.434 | -49 |
| 400 | 0.754 | -171 | 9.10 | 88 | 0.0271 | 35 | 0.303 | -53 |
| 600 | 0.761 | 179 | 6.15 | 77 | 0.0312 | 38 | 0.272 | -56 |
| 800 | 0.762 | 171 | 4.65 | 68 | 0.0359 | 42 | 0.266 | -62 |
| 1000 | 0.763 | 165 | 3.73 | 60 | 0.0409 | 44 | 0.271 | -68 |
| 1200 | 0.758 | 159 | 3.13 | 52 | 0.0469 | 44 | 0.286 | -75 |
| 1400 | 0.753 | 155 | 2.60 | 44 | 0.0490 | 46 | 0.291 | -87 |
| 1600 | 0.765 | 150 | 2.30 | 39 | 0.0574 | 50 | 0.288 | -93 |
| 1800 | 0.769 | 144 | 2.06 | 32 | 0.0665 | 49 | 0.303 | -97 |
| 1900 | 0.768 | 142 | 1.98 | 29 | 0.0714 | 48 | 0.312 | -100 |
| 2000 | 0.767 | 139 | 1.88 | 25 | 0.0756 | 48 | 0.322 | -103 |

$V_{CC} = 20\text{ V}$, $I_C = 50\text{ mA}$

| POLAR S-PARAMETERS IN 50 Ω SYSTEM | | | | | | | | |
|-----------------------------------|-----------------|------|-----------------|------|-----------------|-----|-----------------|------|
| f MHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
| | S ₁₁ | ∠ φ | S ₂₁ | ∠ φ | S ₁₂ | ∠ φ | S ₂₂ | ∠ φ |
| 100 | 0.618 | -113 | 26.2 | 130 | 0.0195 | 45 | 0.678 | -36 |
| 200 | 0.713 | -145 | 16.2 | 108 | 0.0251 | 34 | 0.465 | -47 |
| 400 | 0.758 | -168 | 8.78 | 89.2 | 0.0288 | 32 | 0.331 | -51 |
| 600 | 0.763 | 180 | 5.94 | 78 | 0.0323 | 35 | 0.297 | -55 |
| 800 | 0.761 | 169 | 4.49 | 68 | 0.0363 | 39 | 0.290 | -61 |
| 1000 | 0.764 | 166 | 3.61 | 60 | 0.0415 | 41 | 0.294 | -68 |
| 1200 | 0.758 | 160 | 3.02 | 52 | 0.0467 | 42 | 0.310 | -75 |
| 1400 | 0.757 | 155 | 2.52 | 44.5 | 0.0486 | 45 | 0.313 | -87 |
| 1600 | 0.768 | 150 | 2.22 | 39 | 0.0566 | 48 | 0.311 | -92 |
| 1800 | 0.772 | 145 | 2 | 32 | 0.0655 | 48 | 0.328 | -97 |
| 1900 | 0.770 | 142 | 1.91 | 28 | 0.0705 | 47 | 0.335 | -101 |
| 2000 | 0.772 | 140 | 1.81 | 25 | 0.0745 | 47 | 0.345 | -104 |

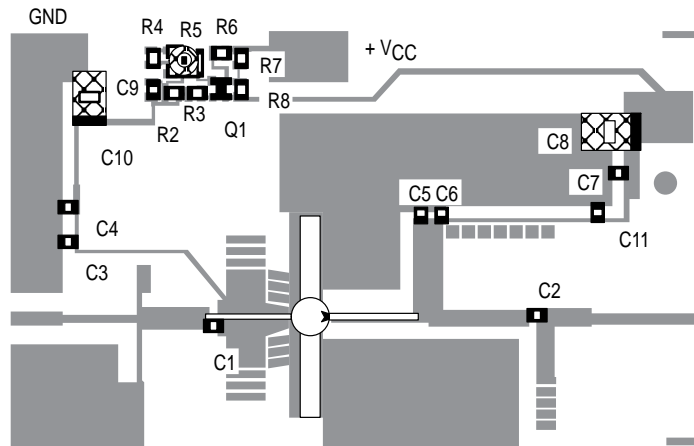
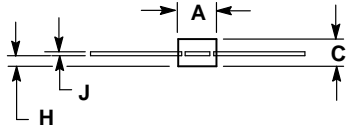
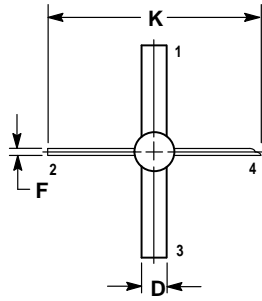


Figure 5. Test Circuit Components Layout

PACKAGE DIMENSIONS




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

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.200 | 0.210 | 5.08 | 5.33 |
| C | — | 0.125 | — | 3.17 |
| D | 0.120 | 0.130 | 3.05 | 3.30 |
| F | 0.025 | 0.035 | 0.64 | 0.88 |
| H | 0.035 | 0.045 | 0.88 | 1.14 |
| J | 0.004 | 0.006 | 0.11 | 0.15 |
| K | 0.970 | 1.030 | 24.64 | 26.16 |

- STYLE 1:
 PIN 1. EMITTER
 2. BASE
 3. EMITTER
 4. COLLECTOR

**CASE 305C-02
 ISSUE A**

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MRF6401/D

