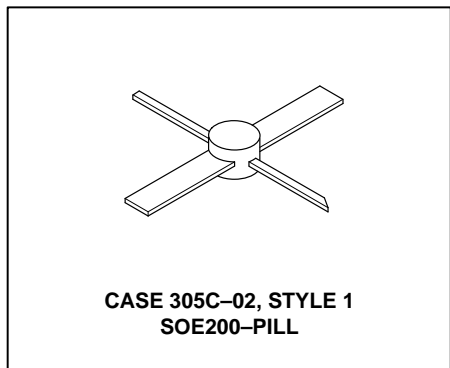
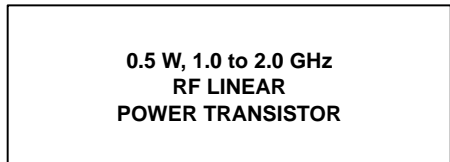


# The RF Line NPN Silicon RF Power Transistor

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
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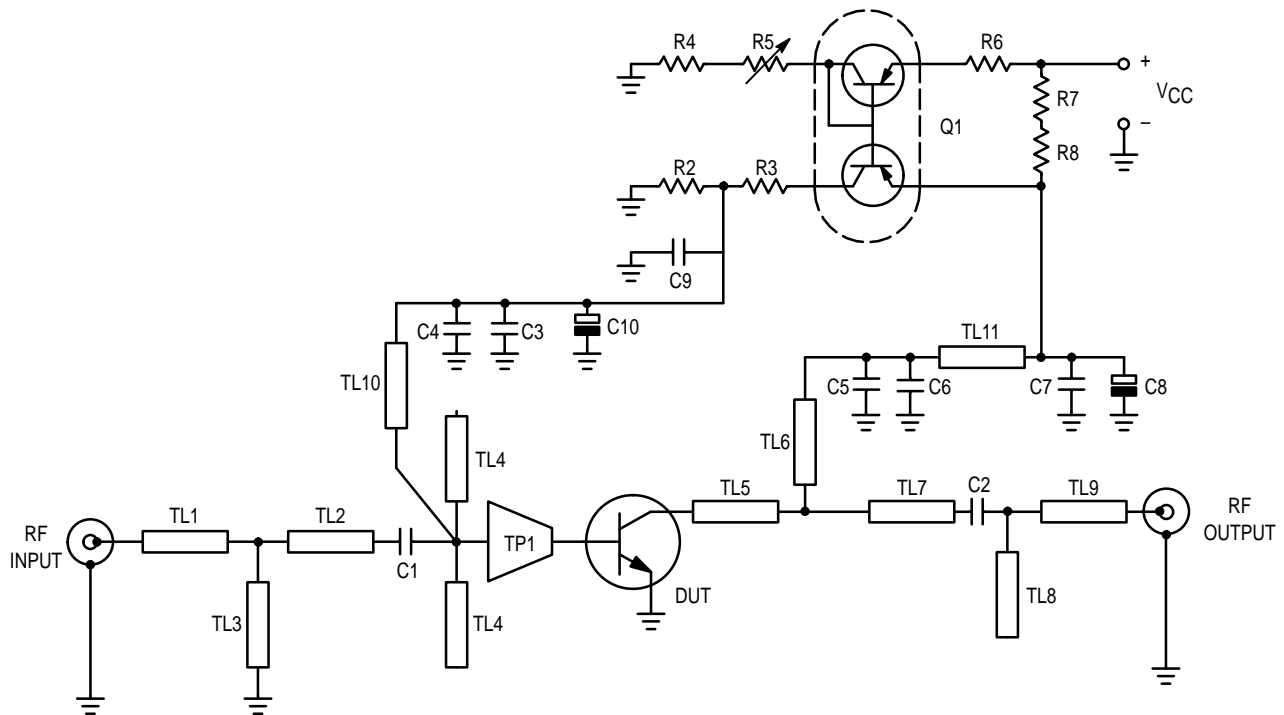
## OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage ( $I_C = 10\text{ mA}$ , $R_B = 75\ \Omega$ )	$V_{(BR)CER}$	28	—	—	Vdc
Emitter–Base Breakdown Voltage ( $I_E = 0.25\text{ mA}$ )	$V_{(BR)EBO}$	3.5	—	—	Vdc
Collector–Base Breakdown Voltage ( $I_C = 1\text{ mA}$ )	$V_{(BR)CBO}$	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
<b>ON CHARACTERISTICS</b>					
DC Current Gain ( $I_C = 0.1 \text{ Adc}$ , $V_{CE} = 5 \text{ Vdc}$ )	$h_{FE}$	20	—	120	—
<b>DYNAMIC CHARACTERISTICS</b>					
Output Capacitance ( $V_{CB} = 26 \text{ V}$ , $I_E = 0$ , $f = 1 \text{ MHz}$ )	$C_{ob}$	—	1.4	—	pF
<b>FUNCTIONAL TESTS</b> ( $V_{CC} = 20 \text{ V}$ , $I_{CQ} = 80 \text{ mA}$ )					
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)	$\psi$	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 $\Omega$ , Chip Resistor 0805
C2	3.9 pF, ATC Chip Capacitor 100A	R3	4.7 k $\Omega$ , Chip Resistor 0805
C3	56 pF, ATC Chip Capacitor 100A	R4	8.2 k $\Omega$ , Chip Resistor 0805
C4, C6, C7, C9	15 nF, Chip Capacitor 0805	R5	5 k $\Omega$ , SMD Potentiometer
C5	47 pF, ATC Chip Capacitor 100A	R6	680 $\Omega$ , Chip Resistor 0805
C8	4.7 $\mu\text{F}$ , 35 V, Capacitor	R7, R8	7.5 $\Omega$ , Chip Resistor 0805
C10	10 $\mu\text{F}$ , 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

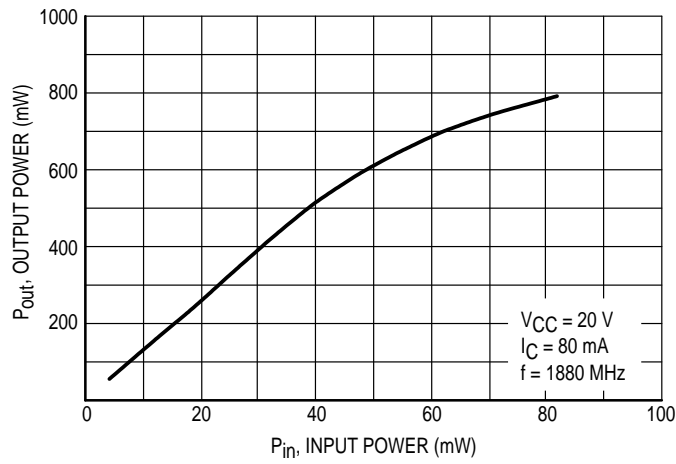


Figure 2. Output Power versus Input Power

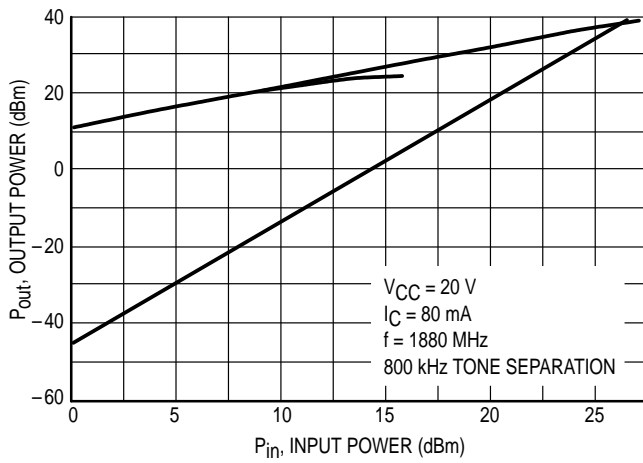


Figure 3. Third Order Intercept

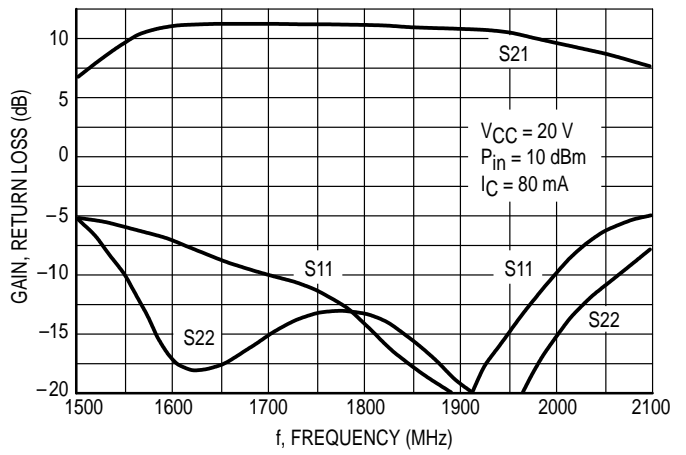


Figure 4. Performance in Broadband Test Fixture

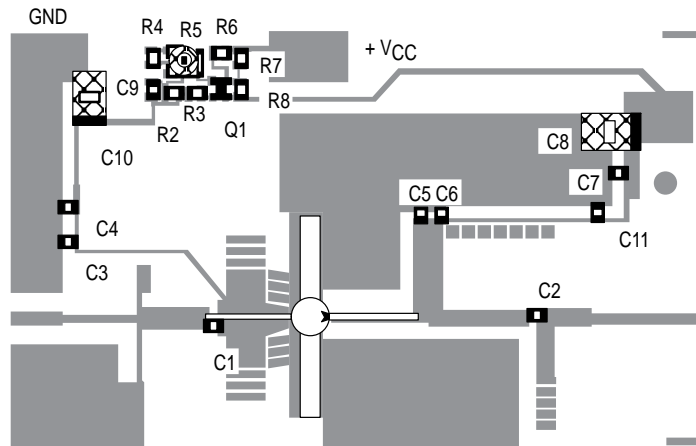
**Table 1. Common Emitter S-Parameters**

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

POLAR S-PARAMETERS IN 50 Ω SYSTEM								
f MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	S <sub>11</sub>	∠ φ	S <sub>21</sub>	∠ φ	S <sub>12</sub>	∠ φ	S <sub>22</sub>	∠ 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

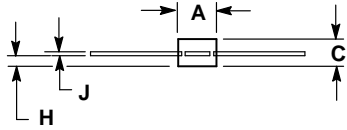
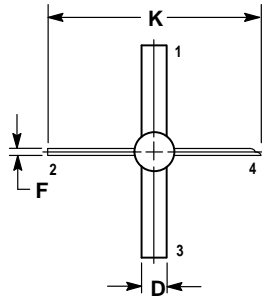
$V_{CC} = 20\text{ V}$ ,  $I_C = 50\text{ mA}$

POLAR S-PARAMETERS IN 50 Ω SYSTEM								
f MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	S <sub>11</sub>	∠ φ	S <sub>21</sub>	∠ φ	S <sub>12</sub>	∠ φ	S <sub>22</sub>	∠ 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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**How to reach us:**

**USA / EUROPE:** Motorola Literature Distribution;  
P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447

**JAPAN:** Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, Toshikatsu Otsuki,  
6F Seibu-Butsuryu-Center, 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-3521-8315

**MFAX:** RMFAX0@email.sps.mot.com – TOUCHTONE (602) 244-6609  
**INTERNET:** <http://Design-NET.com>

**HONG KONG:** Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,  
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298



MRF6401/D

