# MRF305 (SILICON)

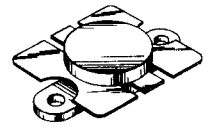
**The RF Line**

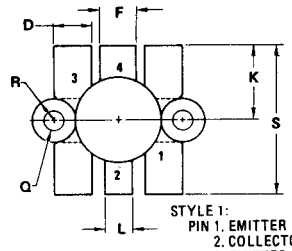
## NPN SILICON RF POWER TRANSISTOR

. . . designed primarily for wideband large-signal driver and output amplifier stages in the 225-400 MHz frequency range.

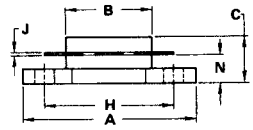
- Specified 28 Volt, 400 MHz Characteristics –
  Output Power = 30 Watt
  Minimum Gain = 8.0 dB
  Efficiency = 55% (Min)
- Built-In Matching Network for Broadband Operation
- 100% Tested for Load Mismatch at all Phase Angles with 30:1 VSWR

**30 W-400 MHz**
**CONTROLLED "Q" RF POWER TRANSISTOR**
**NPN SILICON**






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




| DIM | MILLIMETERS MIN | MILLIMETERS MAX | INCHES MIN | INCHES MAX |
|---|---|---|---|---|
| A | 24.38 | 25.15 | 0.960 | 0.990 |
| B | 12.45 | 12.95 | 0.490 | 0.510 |
| C | 5.97 | 7.62 | 0.235 | 0.300 |
| D | 5.46 TYP | | 0.215 TYP | |
| F | 5.08 | 5.33 | 0.200 | 0.210 |
| H | 18.29 | 18.54 | 0.720 | 0.730 |
| J | 0.10 | 0.15 | 0.004 | 0.006 |
| K | 10.67 | 10.92 | 0.420 | 0.430 |
| L | 3.81 | 4.06 | 0.150 | 0.160 |
| N | 3.81 | 4.32 | 0.150 | 0.170 |
| Q | 2.92 | 3.18 | 0.115 | 0.125 |
| R | 3.05 | 3.30 | 0.120 | 0.130 |
| S | 21.34 | 21.84 | 0.840 | 0.860 |

CASE 278-03

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Emitter Voltage | $V_{CEO}$ | 33 | Vdc |
| Collector-Base Voltage | $V_{CBO}$ | 60 | Vdc |
| Emitter-Base Voltage | $V_{EBO}$ | 4.0 | Vdc |
| Total Device Dissipation @ $T_C$ = 25°C (1)<br>Derate above 25°C | $P_D$ | 70<br>0.4 | Watts<br>W/°C |
| Storage Temperature Range | $T_{stg}$ | -65 to +200 | °C |

### THERMAL CHARACTERISTICS

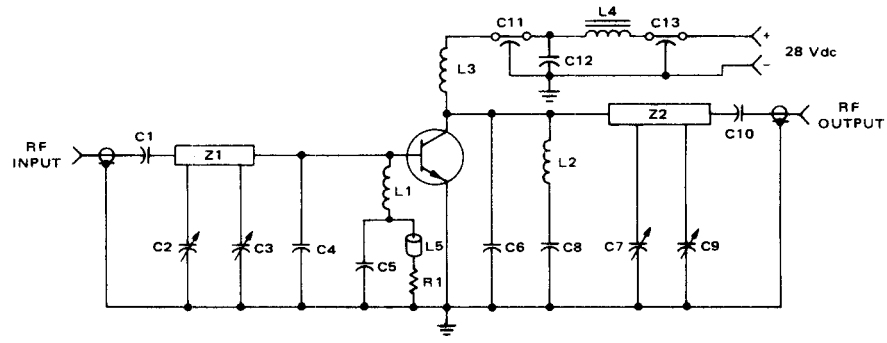
| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $\theta_{JC}$ | 2.5 | °C/W |

(1) These devices are designed for RF operation. The total device dissipation rating applies only when the devices are operated as RF amplifiers.

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector-Emitter Breakdown Voltage ($I_C$ = 50 mAdc, $I_B$ = 0) | $BV_{CEO}$ | 33 | – | – | Vdc |
| Collector-Emitter Breakdown Voltage ($I_C$ = 50 mAdc, $V_{BE}$ = 0) | $BV_{CES}$ | 60 | – | – | Vdc |
| Emitter-Base Breakdown Voltage ($I_E$ = 3.0 mAdc, $I_C$ = 0) | $BV_{EBO}$ | 4.0 | – | – | Vdc |
| Collector Cutoff Current ($V_{CB}$ = 30 Vdc, $I_E$ = 0) | $I_{CBO}$ | – | – | 2.0 | mAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain ($I_C$ = 500 mAdc, $V_{CE}$ = 5.0 Vdc) ($I_C$ = 3.0 Adc, $V_{CE}$ = 5.0 Vdc) | $h_{FE}$ | 10<br>10 | –<br>– | 100<br>– | – |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Output Capacitance ($V_{CB}$ = 28 Vdc, $I_E$ = 0, f = 1.0 MHz) | $C_{ob}$ | – | 40 | 45 | pF |
| **FUNCTIONAL TESTS** (Figure 1) | | | | | |
| Common-Emitter Amplifier Power Gain ($V_{CC}$ = 28 Vdc, $P_{out}$ = 30 W, f = 400 MHz) | $G_{PE}$ | 8.0 | – | – | dB |
| Collector Efficiency ($V_{CC}$ = 28 Vdc, $P_{out}$ = 30 W, f = 400 MHz) | $\eta$ | 55 | – | – | % |
| Electrical Ruggedness ($P_{out}$ = 30 W, $V_{CC}$ = 28 Vdc, f = 400 MHz, VSWR 30:1, all phase angles) | – | No Degradation in $P_{out}$ | | | – |

**FIGURE 1 – 400 MHz TEST CIRCUIT SCHEMATIC**




| | |
|---|---|
| C1,C10 | 0.018 μF VITRAMON Chip Capacitor |
| C2,C3,C7,C9 | 1.0-20 pF JOHANSON Type 3906 |
| C4 | 2, 10 pF UNDERWOOD (UNELCO) one each side of the Base Lead |
| C5 | 100 pF UNDERWOOD (UNELCO) |
| C6 | 2, 20 pF UNDERWOOD (UNELCO) one each side of the Collector Lead |
| C8 | 0.1 μF, 100 V Disc Ceramic |
| C11,13 | 680 pF ALLEN BRADLEY Feedthru |
| C12 | 1.0 μF, 35 V TANTALUM |
| R1 | 2.7 Ohm, 1/2 Watt, 10% |
| L1 | 3 Turns, #24 AWG, 1/8" ID |
| L2 | 2 Turns, Lead of C8, 1/8" ID |
| L3 | 5 Turns, #20 AWG, 1/4" ID |
| L4 | FERRITE Choke, FERROXCUBE VK200-20-4B |
| L5 | FERRITE Bead on Lead of R1, FERROXCUBE 56-590-65-3B |
| Z1 | Microstrip Line, 0.2" W x 1.7" L<br>C2 Mounted 0.3" from Start<br>C3 Mounted 0.9" from Start |
| Z2 | Microstrip Line, 0.3" W x 1.5" L<br>C7 Mounted 0.8" from End<br>C9 Mounted 0.2" from End |
| | Board – Glass Teflon $\epsilon_R$ = 2.56, t = 0.062 in. |
| | Input Output Connectors Type N |

FIGURE 2 – OUTPUT POWER versus FREQUENCY

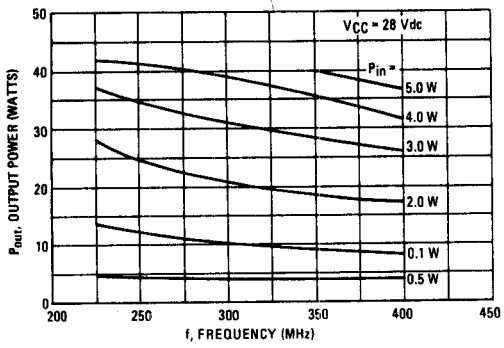



FIGURE 3 – OUTPUT POWER versus INPUT POWER

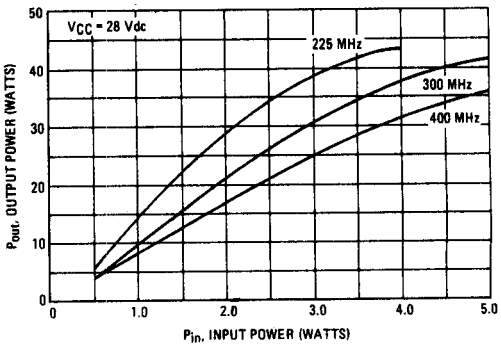



FIGURE 4 – POWER GAIN versus FREQUENCY

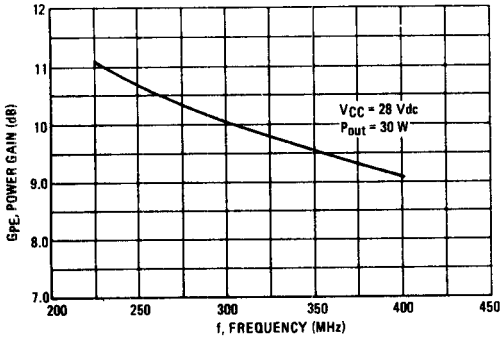



FIGURE 5 – OUTPUT POWER versus SUPPLY VOLTAGE – 400 MHz

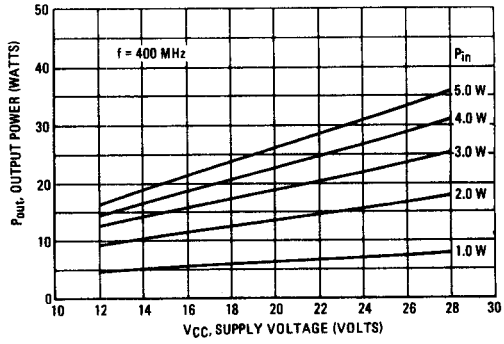



FIGURE 6 – OUTPUT POWER versus SUPPLY VOLTAGE – 225 MHz

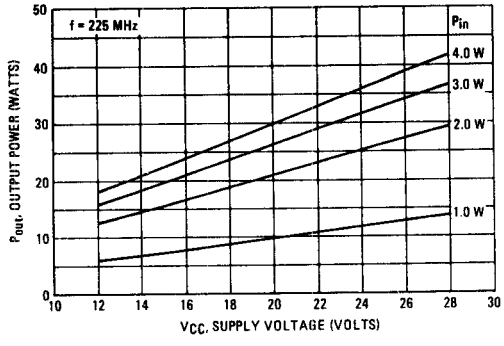



FIGURE 7 – SERIES EQUIVALENT IMPEDANCE

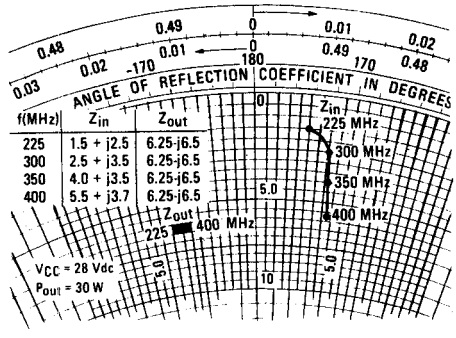


FIGURE 8 – INTERMODULATION DISTORTION versus OUTPUT POWER (PEP)

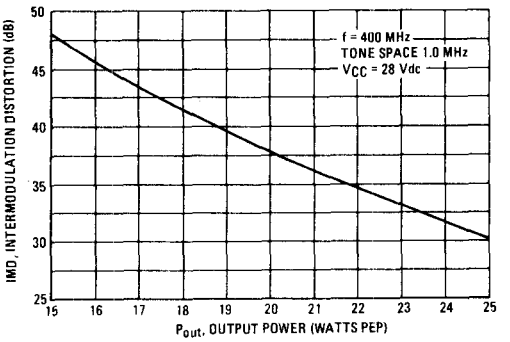



FIGURE 9 – 400 MHz TEST CIRCUIT