

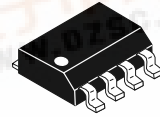
# The RF Line NPN Silicon RF Low Power Transistor

Designed for amplifier, frequency multiplier, or oscillator applications in industrial equipment constructed with surface mount components. Suitable for use as output driver or pre-driver stages in VHF and UHF equipment.

- Low Cost SORF Plastic Surface Mount Package
- Guaranteed RF Specification —  $|S_{21}|^2$
- S-Parameter Characterization
- Low Voltage Version of MRF3866
- Tape and Reel Packaging Available.  
 R2 suffix = 2,500 units per reel

## MRF4427R2

1.0 W, 175 MHz  
 HIGH-FREQUENCY  
 TRANSISTOR  
 NPN SILICON



CASE 751-05, STYLE 1  
 SORF  
 (SO-8)

### MAXIMUM RATINGS

| Rating                                                                                 | Symbol         | Value        | Unit                          |
|----------------------------------------------------------------------------------------|----------------|--------------|-------------------------------|
| Collector-Emitter Voltage                                                              | $V_{CEO}$      | 20           | Vdc                           |
| Collector-Base Voltage                                                                 | $V_{CB0}$      | 40           | Vdc                           |
| Emitter-Base Voltage                                                                   | $V_{EBO}$      | 2.0          | Vdc                           |
| Collector Current — Continuous                                                         | $I_C$          | 400          | mAdc                          |
| Total Device Dissipation @ $T_C = 75^\circ\text{C}$<br>Derate above $75^\circ\text{C}$ | $P_D$          | 1.67<br>22.2 | Watts<br>mW/ $^\circ\text{C}$ |
| Operating Junction and Storage Temperature Range                                       | $T_J, T_{stg}$ | -65 to +150  | $^\circ\text{C}$              |

### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max | Unit               |
|--------------------------------------|-----------------|-----|--------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 45  | $^\circ\text{C/W}$ |

### DEVICE MARKING

MRF4427 = 4427

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

| Characteristic                                                                                | Symbol        | Min | Typ | Max | Unit            |
|-----------------------------------------------------------------------------------------------|---------------|-----|-----|-----|-----------------|
| Collector-Emitter Sustaining Voltage<br>( $I_C = 5.0 \text{ mAdc}, I_B = 0$ )                 | $V_{(BR)CEO}$ | 20  | —   | —   | Vdc             |
| Collector-Emitter Breakdown Voltage<br>( $I_C = 5.0 \text{ mAdc}, R_{BE} = 10 \text{ ohms}$ ) | $V_{(BR)CER}$ | 40  | —   | —   | Vdc             |
| Emitter-Base Breakdown Voltage ( $I_E = 100 \mu\text{Adc}$ )                                  | $V_{(BR)EBO}$ | 2.0 | —   | —   | Vdc             |
| Collector Cutoff Current ( $V_{CE} = 12 \text{ Vdc}, I_B = 0$ )                               | $I_{CEO}$     | —   | —   | 20  | $\mu\text{Adc}$ |

NOTE:

1. Case temperature measured on collector lead immediately adjacent to body of package.

(continued)



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

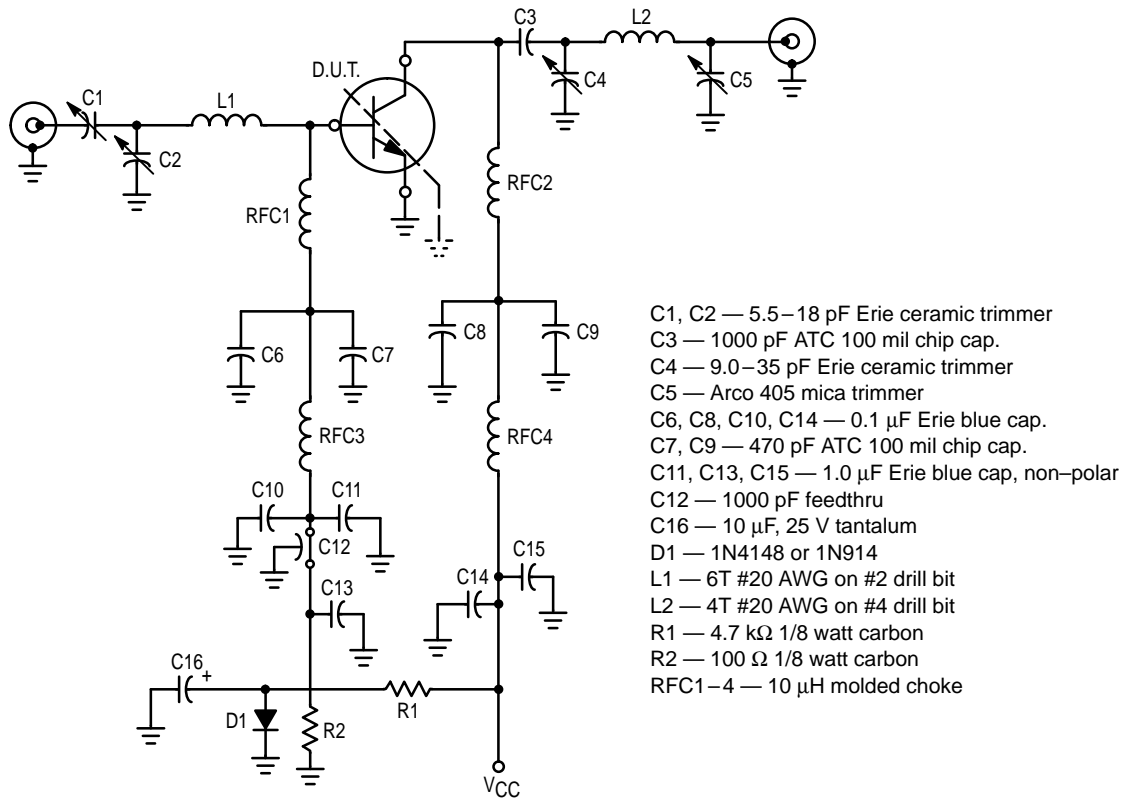
| Characteristic                                                                                                                    | Symbol        | Min       | Typ     | Max      | Unit |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------|-----------|---------|----------|------|
| <b>ON CHARACTERISTICS</b>                                                                                                         |               |           |         |          |      |
| DC Current Gain<br>( $I_C = 100\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ )<br>( $I_C = 360\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ ) | $h_{FE}$      | 10<br>5.0 | 50<br>— | 200<br>— | —    |
| Collector–Emitter Saturation Voltage<br>( $I_C = 100\text{ mA}$ , $I_B = 20\text{ mA}$ )                                          | $V_{CE(sat)}$ | —         | 60      | —        | mVdc |

**DYNAMIC CHARACTERISTICS**

|                                                                                                                |          |   |      |     |     |
|----------------------------------------------------------------------------------------------------------------|----------|---|------|-----|-----|
| Current–Gain — Bandwidth Product<br>( $I_C = 50\text{ mA}$ , $V_{CE} = 12\text{ Vdc}$ , $f = 200\text{ MHz}$ ) | $f_T$    | — | 1600 | —   | MHz |
| Output Capacitance<br>( $V_{CB} = 12\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )                          | $C_{ob}$ | — | —    | 3.0 | pF  |

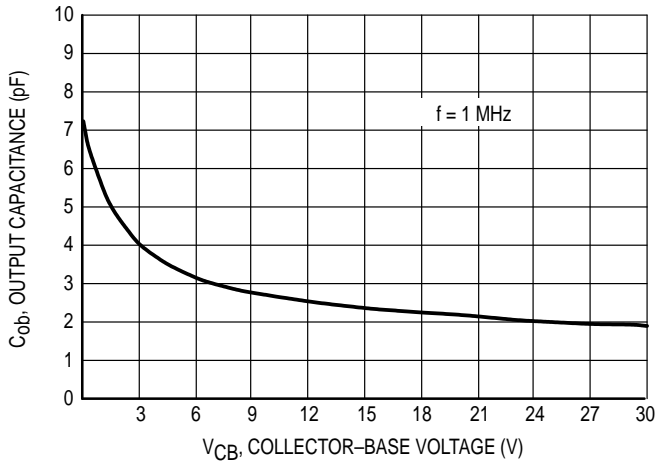
**FUNCTIONAL TESTS**

|                                                                                                                      |              |    |      |   |    |
|----------------------------------------------------------------------------------------------------------------------|--------------|----|------|---|----|
| Common–Emitter Amplifier Power Gain<br>( $P_{in} = 15\text{ mW}$ , $V_{CC} = 12\text{ Vdc}$ , $f = 175\text{ MHz}$ ) | $G_{pe}$     | —  | 18   | — | dB |
| Collector Efficiency (Figure 1)<br>( $P_{out} = 1.0\text{ W}$ , $V_{CC} = 12\text{ Vdc}$ , $f = 175\text{ MHz}$ )    | $\eta$       | —  | 60   | — | %  |
| Insertion Gain<br>( $V_{CE} = 12\text{ Vdc}$ , $I_C = 50\text{ mA}$ , $f = 200\text{ MHz}$ )                         | $ S_{21} ^2$ | 14 | 16.4 | — | dB |

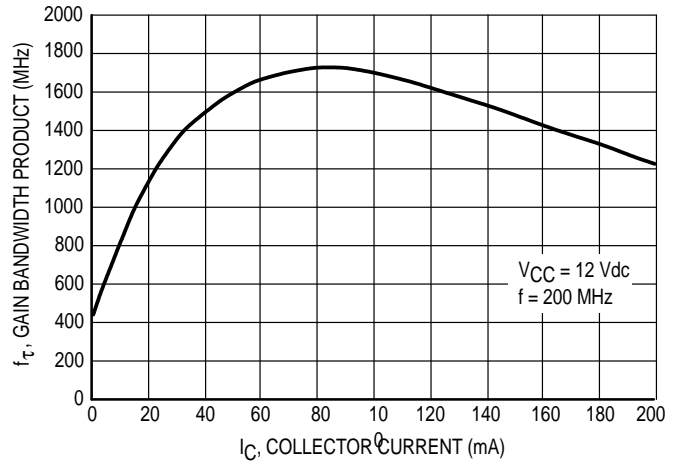


**Figure 1. 175 MHz RF Amplifier Circuit for Functional Tests**

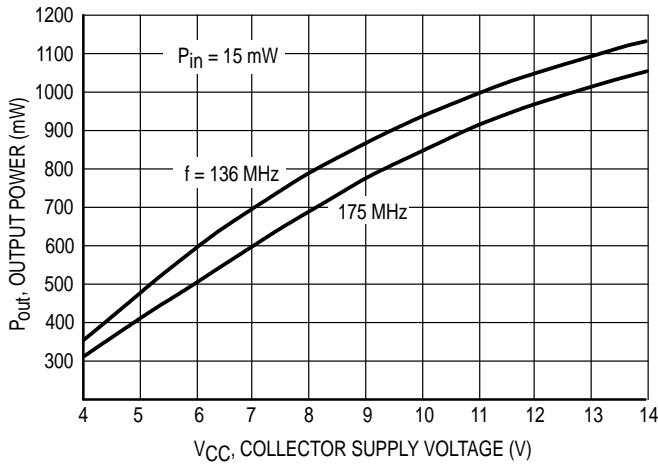
## TYPICAL CHARACTERISTICS



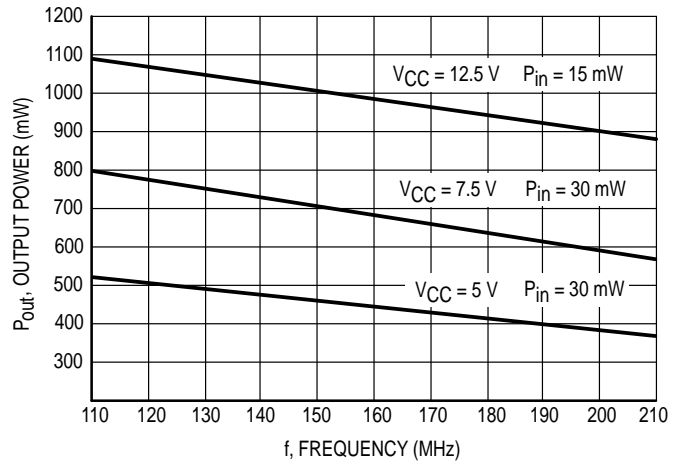
**Figure 2. Collector-Base Capacitance versus Voltage**



**Figure 3. Gain Bandwidth Product versus Collector Current**



**Figure 4. Output Power versus Voltage**



**Figure 5. Output Power versus Frequency**

| V <sub>CE</sub><br>(Volts) | I <sub>C</sub><br>(mA) | f<br>(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   |     |
| 5.0                        | 5.0                    | 50         | 0.82            | -104 | 10.3            | 125  | 0.05            | 38   | 0.68            | -34  |     |
|                            |                        | 100        | 0.83            | -141 | 6.1             | 103  | 0.06            | 26   | 0.51            | -40  |     |
|                            |                        | 200        | 0.81            | -165 | 3.2             | 85   | 0.07            | 21   | 0.44            | -46  |     |
|                            |                        | 500        | 0.80            | 169  | 1.3             | 57   | 0.07            | 32   | 0.49            | -73  |     |
|                            |                        | 750        | 0.79            | 156  | 0.8             | 42   | 0.08            | 49   | 0.58            | -94  |     |
|                            |                        | 1000       | 0.76            | 144  | 0.6             | 30   | 0.11            | 61   | 0.65            | -114 |     |
|                            |                        | 25         | 50              | 0.77 | -151            | 19   | 107             | 0.02 | 36              | 0.35 | -75 |
|                            | 100                    | 0.79       | -168            | 9.9  | 94              | 0.03 | 37              | 0.21 | -87             |      |     |
|                            | 200                    | 0.79       | -180            | 5.0  | 82              | 0.04 | 49              | 0.16 | -97             |      |     |
|                            | 500                    | 0.78       | 163             | 2.0  | 61              | 0.07 | 62              | 0.22 | -106            |      |     |
|                            | 750                    | 0.77       | 152             | 1.3  | 48              | 0.10 | 66              | 0.31 | -115            |      |     |
|                            | 1000                   | 0.74       | 141             | 0.9  | 36              | 0.13 | 66              | 0.37 | -127            |      |     |
|                            | 50                     | 50         | 0.77            | -163 | 21.1            | 103  | 0.02            | 37   | 0.29            | -98  |     |
|                            | 100                    | 0.79       | -174            | 10.7 | 92              | 0.02 | 50              | 0.19 | -119            |      |     |
|                            | 200                    | 0.79       | 177             | 5.4  | 82              | 0.03 | 62              | 0.16 | -134            |      |     |
|                            | 500                    | 0.78       | 162             | 2.2  | 62              | 0.07 | 67              | 0.20 | -131            |      |     |
|                            | 750                    | 0.77       | 151             | 1.4  | 50              | 0.10 | 69              | 0.26 | -130            |      |     |
|                            | 1000                   | 0.74       | 140             | 1.1  | 38              | 0.13 | 67              | 0.32 | -139            |      |     |
|                            | 12                     | 5.0        | 50              | 0.83 | -97             | 11   | 129             | 0.04 | 46              | 0.75 | -26 |
|                            |                        |            | 100             | 0.82 | -135            | 6.8  | 107             | 0.05 | 29              | 0.61 | -29 |
|                            |                        |            | 200             | 0.81 | -162            | 3.6  | 88              | 0.05 | 24              | 0.54 | -34 |
| 500                        |                        |            | 0.79            | 171  | 1.4             | 60   | 0.06            | 37   | 0.47            | -57  |     |
| 750                        |                        |            | 0.78            | 157  | 0.9             | 44   | 0.07            | 55   | 0.64            | -76  |     |
| 1000                       |                        |            | 0.75            | 145  | 0.7             | 32   | 0.09            | 68   | 0.70            | -95  |     |
| 25                         |                        |            | 50              | 0.73 | -143            | 22.1 | 111             | 0.02 | 38              | 0.43 | -52 |
| 100                        |                        | 0.76       | -164            | 11.7 | 96              | 0.02 | 39              | 0.29 | -52             |      |     |
| 200                        |                        | 0.77       | -177            | 6.0  | 84              | 0.03 | 48              | 0.22 | -53             |      |     |
| 500                        |                        | 0.76       | 165             | 2.4  | 63              | 0.06 | 64              | 0.27 | -69             |      |     |
| 750                        |                        | 0.75       | 154             | 1.6  | 49              | 0.08 | 67              | 0.35 | -84             |      |     |
| 1000                       |                        | 0.72       | 143             | 1.1  | 38              | 0.11 | 69              | 0.42 | -98             |      |     |
| 50                         |                        | 50         | 0.73            | -156 | 25.5            | 106  | 0.02            | 41   | 0.32            | -67  |     |
| 100                        |                        | 0.75       | -171            | 13.1 | 94              | 0.02 | 49              | 0.20 | -69             |      |     |
| 200                        |                        | 0.76       | 59              | 6.6  | 83              | 0.03 | 60              | 0.15 | -71             |      |     |
| 500                        |                        | 0.75       | 164             | 2.6  | 64              | 0.06 | 69              | 0.20 | -81             |      |     |
| 750                        |                        | 0.74       | 153             | 1.7  | 51              | 0.09 | 70              | 0.27 | -92             |      |     |
| 1000                       |                        | 0.71       | 142             | 1.2  | 38              | 0.12 | 70              | 0.34 | -104            |      |     |

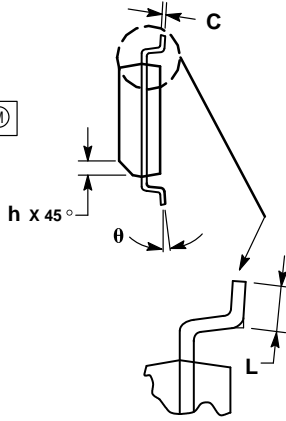
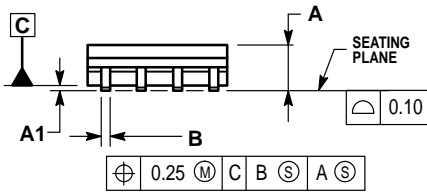
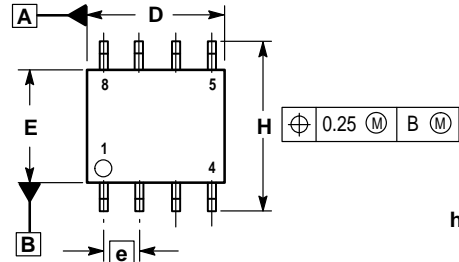
Table 1. Common Emitter S-Parameters

| Freq.<br>(MHz) | P <sub>in</sub><br>(mW) | P <sub>out</sub><br>(mW) | V <sub>CC</sub><br>(Volts) | Z <sub>in</sub><br>(Ohms) | Z <sub>OL</sub> *<br>(Ohms) |
|----------------|-------------------------|--------------------------|----------------------------|---------------------------|-----------------------------|
| 136            | 15                      | —                        | 12.5                       | 6.2 - j11.6               | —                           |
| 175            | 15                      | —                        | 12.5                       | 4.6 - j10.4               | —                           |
| 136            | —                       | 1000                     | 12.5                       | —                         | 47.7 + j41.7                |
| 175            | —                       | 1000                     | 12.5                       | —                         | 47.4 - j34.4                |
| 136            | 30                      | —                        | 7.5                        | 5.65 - j12.6              | —                           |
| 175            | 30                      | —                        | 7.5                        | 6.25 - j12.2              | —                           |
| 136            | —                       | 650                      | 7.5                        | —                         | 27.6 - j32.4                |
| 175            | —                       | 650                      | 7.5                        | —                         | 27.9 - j27.6                |
| 136            | 30                      | —                        | 5.0                        | 6.1 - j13.3               | —                           |
| 175            | 30                      | —                        | 5.0                        | 5.9 - j12.22              | —                           |
| 136            | —                       | 450                      | 5.0                        | —                         | 24.8 - j22.8                |
| 175            | —                       | 450                      | 5.0                        | —                         | 28.3 - j29.3                |

Z<sub>OL</sub>\* = Conjugate of the optimum load impedance into which the device output operates at a given output power, voltage and frequency.

Table 2. Series Input/Output Impedances

## PACKAGE DIMENSIONS



**NOTES:**


1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE MOLD PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 1.35        | 1.75 |
| A1  | 0.10        | 0.25 |
| B   | 0.35        | 0.49 |
| C   | 0.18        | 0.25 |
| D   | 4.80        | 5.00 |
| E   | 3.80        | 4.00 |
| e   | 1.27 BSC    |      |
| H   | 5.80        | 6.20 |
| h   | 0.25        | 0.50 |
| L   | 0.40        | 1.25 |
| θ   | 0°          | 7°   |

**STYLE 1:**

- PIN 1. EMITTER
2. COLLECTOR
3. COLLECTOR
4. EMITTER
5. EMITTER
6. BASE
7. BASE
8. EMITTER

**CASE 751-05  
ISSUE S**

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