

## UHF POWER TRANSISTOR

## DRF1402F

## NPN SiGe RF TRANSISTOR

The DRF1402F is a low cost, NPN medium power SiGe HBT(Hetero-Junction Bipolar Transistor) encapsulated in a plastic SOT-89 SMD package.

The DRF1402F can be used as a driver device or an output device, depending on the specific application

## FEATURES

- o 4.8 Volt operation
- o P1dB 28 dBm @f=465MHz
- o Power gain 10 dB @f=465MHz

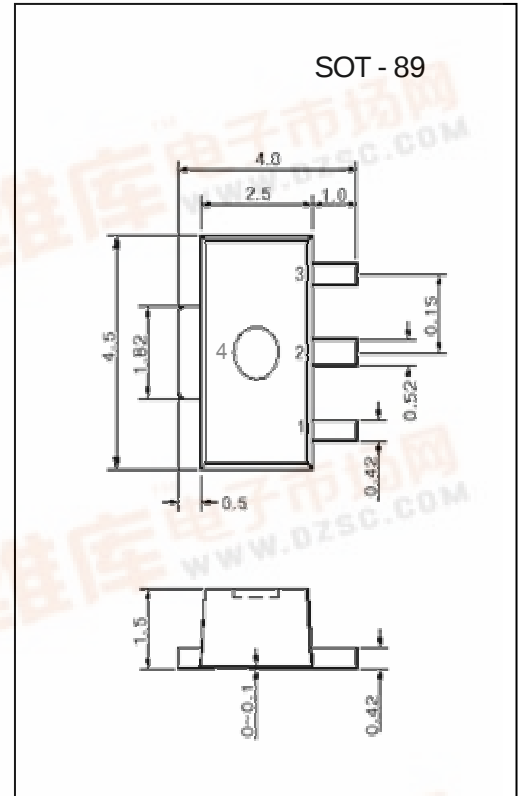
## APPLICATIONS

- o Hand-held radio equipment in common emitter class-AB operation in 450 MHz communication band.

## MAXIMUM RATINGS

| SYMBOL           | PARAMETER                      | CONDITION                    | VALUE     | Unit |
|------------------|--------------------------------|------------------------------|-----------|------|
| V <sub>CBO</sub> | Collector-Base Voltage         | Open Emitter                 | 20        | V    |
| V <sub>CEO</sub> | Collector-Emitter Voltage      | Open Base                    | 8         | V    |
| V <sub>EB0</sub> | Emitter-Base Voltage           | Open Collector               | 4         | V    |
| I <sub>c</sub>   | Collector Current (DC)         |                              | 350       | mA   |
| P <sub>T</sub>   | Total Power Dissipation        | T <sub>s</sub> = 60 ; note 1 | 1         | W    |
| T <sub>STG</sub> | Storage Temperature            |                              | -65 ~ 150 |      |
| T <sub>J</sub>   | Operating Junction Temperature |                              | 150       |      |

SOT - 89



PIN CONFIGURATION

| PIN NO | SYMBOL | DESCRIPTION |
|--------|--------|-------------|
| 1      | B      | base        |
| 2      | C      | collector   |
| 3      | E      | emitter     |
| 4      | C      | collector   |

## □ THERMAL CHARACTERISTICS

| SYMBOL              | PARAMETER                                           | CONDITION                                     | VALUE | Unit |
|---------------------|-----------------------------------------------------|-----------------------------------------------|-------|------|
| R <sub>th j-s</sub> | thermal resistance from junction to soldering point | P <sub>T</sub> =1W; T <sub>s</sub> =60 ;note1 | 55    | K/W  |

\* Note 1. T<sub>s</sub> is temperature at the soldering point of the collector pin.

## □ QUICK REFERENCE DATA

RF performance at T<sub>s</sub> ≤ 60 in common emitter test circuit (see Fig 8.)

| Mode of Operation | f [MHz] | V <sub>CE</sub> [V] | P <sub>L</sub> [mW] | G <sub>P</sub> [dB] | η <sub>c</sub> [%] |
|-------------------|---------|---------------------|---------------------|---------------------|--------------------|
| CW, class-AB      | 465     | 4.8                 | 630                 | ≥ 10                | ≥ 60               |

## □ DC CHARACTERISTICS

$T_j=25$  unless otherwise specified

| SYMBOL     | PARAMETER                           | CONDITION      | MIN. | MAX. | UNIT |
|------------|-------------------------------------|----------------|------|------|------|
| $BV_{CBO}$ | collector-base breakdown voltage    | open emitter   | 20   |      | V    |
| $BV_{CEO}$ | collector-emitter breakdown voltage | open base      | 8    |      | V    |
| $BV_{EBO}$ | emitter-base breakdown voltage      | open collector | 3    |      | V    |
| $I_s$      | Collector leakage current           |                | 0.1  |      | mA   |
| $h_{FE}$   | DC current gain                     |                | 60   |      |      |
| $C_c$      | Collector capacitance               |                |      | 4.5  | pF   |

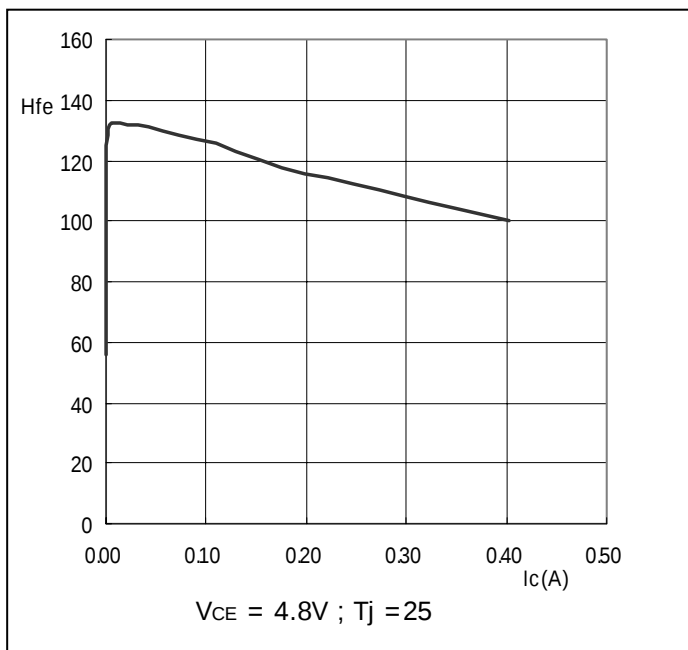


Fig 1. DC Current gain v.s Collector current

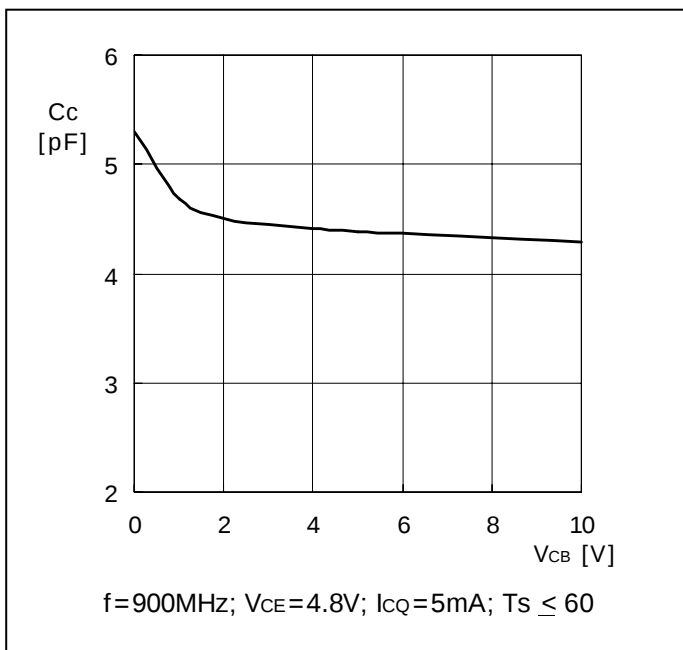


Fig 2. Collector-base capacitance v.s Collector-base voltage(DC)

## □ APPLICATION INFORMATION

RF performance at  $T_s \leq 60$  in common emitter configuration.

| Mode of Operation | f [MHz] | V <sub>CE</sub> [V] | P <sub>L</sub> [mW] | G <sub>P</sub> [dB] | $\eta_c$ [%] |
|-------------------|---------|---------------------|---------------------|---------------------|--------------|
| CW, class-AB      | 465     | 4.8                 | 630                 | $\geq 10$           | $\geq 60$    |

DRF1402F Source/Load Impedance as a frequency

V<sub>CE</sub> = 4.8V, I<sub>CQ</sub> = 5mA, P<sub>out</sub> = 28dBm

| Freq.<br>[MHz] | Z <sub>S</sub> [ $\Omega$ ] |                | Z <sub>L</sub> [ $\Omega$ ] |                |
|----------------|-----------------------------|----------------|-----------------------------|----------------|
|                | R <sub>s</sub>              | X <sub>s</sub> | R <sub>L</sub>              | X <sub>L</sub> |
| 440            | 17.34                       | 6.91           | 22.21                       | -0.59          |
| 450            | 17.21                       | 7.89           | 19.31                       | 2.58           |
| 460            | 17.12                       | 8.90           | 17.20                       | 7.07           |
| 470            | 17.09                       | 9.95           | 15.66                       | 19.00          |

DRF1402F Transister Impedance

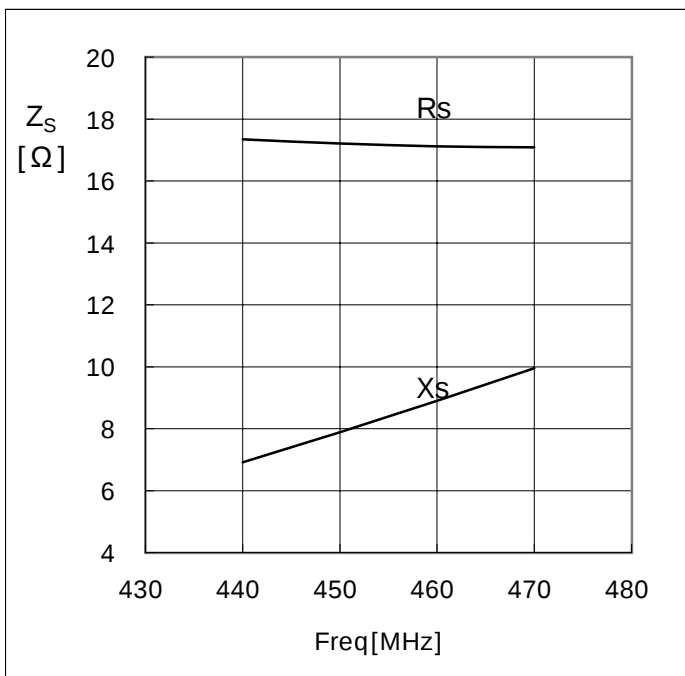
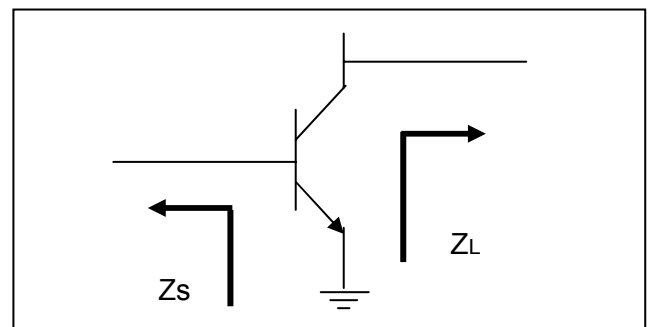


Fig 5. Source Impedance (series components) as a freq, typical values.

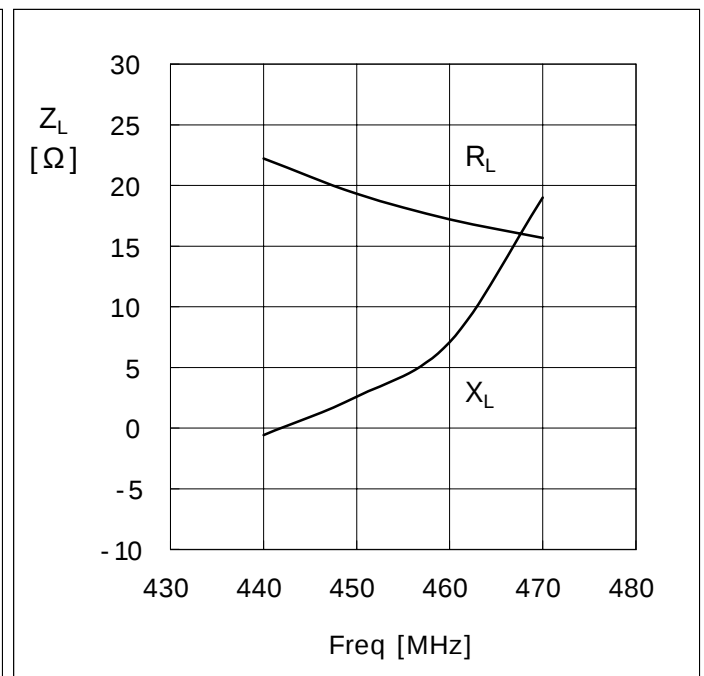
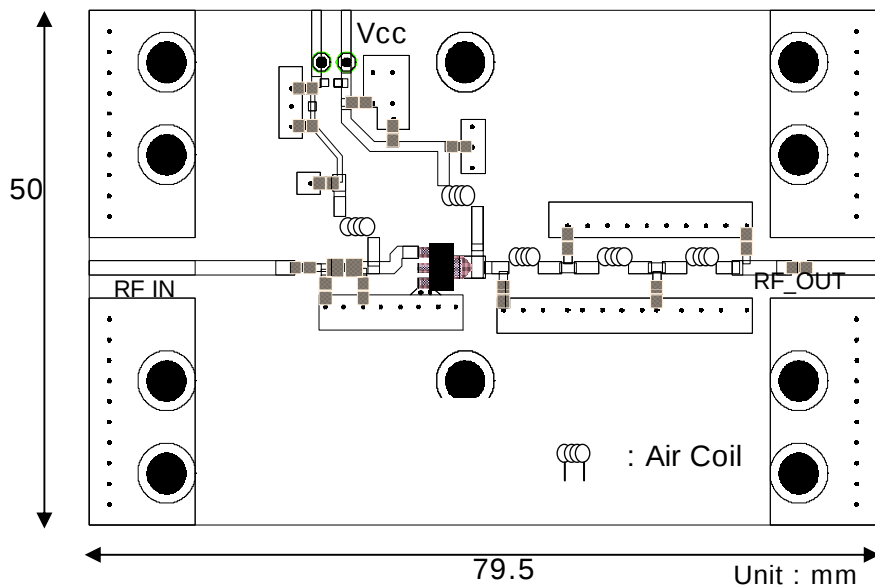


Fig 6. Load Impedance (series components) as a freq, typical values.



| Part List           |       |
|---------------------|-------|
| C1, C7,C10,C11      | 470pF |
| C3,C4               | 6pF   |
| C2                  | 8pF   |
| C5                  | 7pF   |
| C6                  | 12pF  |
| C9,C12              | 1nF   |
| C8,C13              | 100nF |
| L1(Chip L : 1608)   | 8.2nH |
| L2,L3,L4 (Air Coil) | 3turn |
| L5,L6 (Air Coil)    | 8turn |
| Air Coil Diameter   | 2 mm  |

Fig 7. DRF1402F Test Circuit Board Layout @ f = 465MHz

Test board : FR4 glass epoxy board, dielectric constant = 4.5, thickness = 0.8 mm

Test condition : CW test, Vcc = 4.8 V, Icq = 5 mA, frequency = 465 MHz.

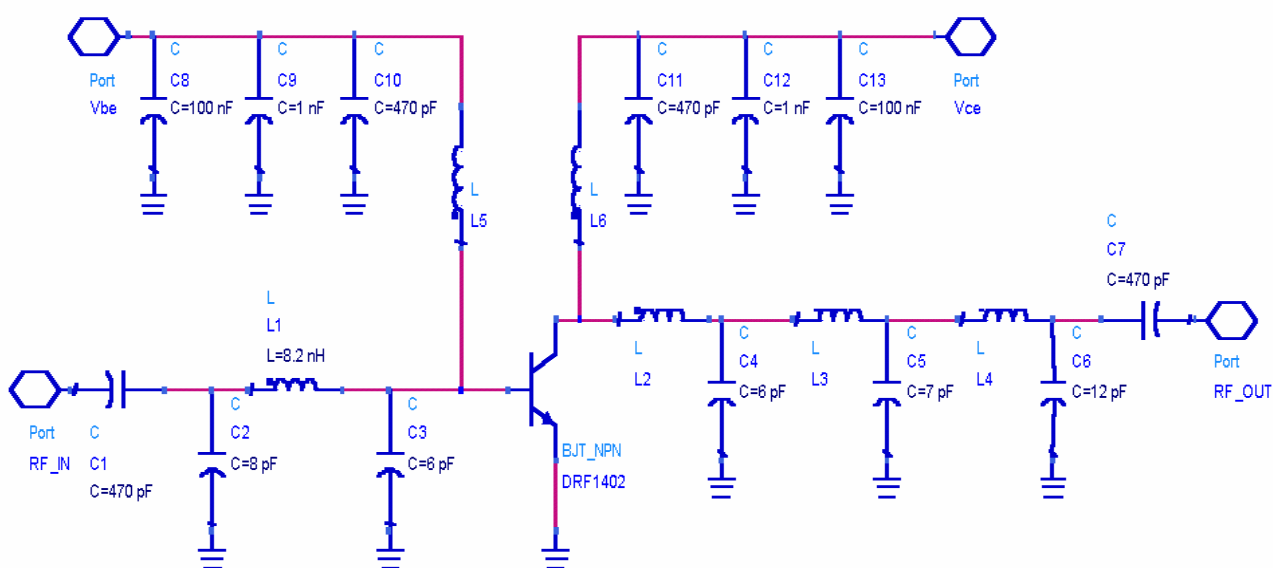
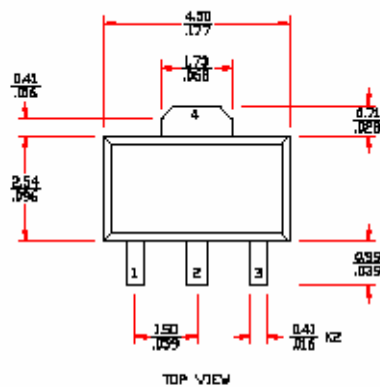
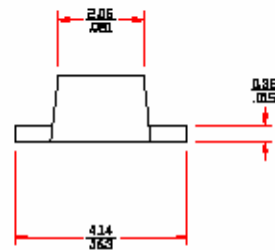
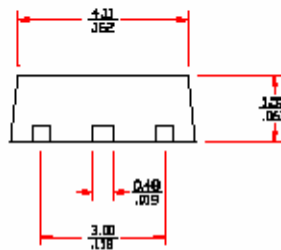
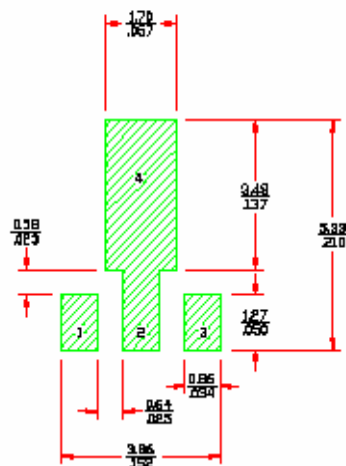


Fig 8. Test Circuit Schematic Diagram @f = 465MHz

☐ **PACKAGE DIMENSION**  
OUTLINE DRAWING


$$\frac{\text{mm}}{\text{inch}}$$


## LAND PATTERN



## MOUNTING CONFIGURATION

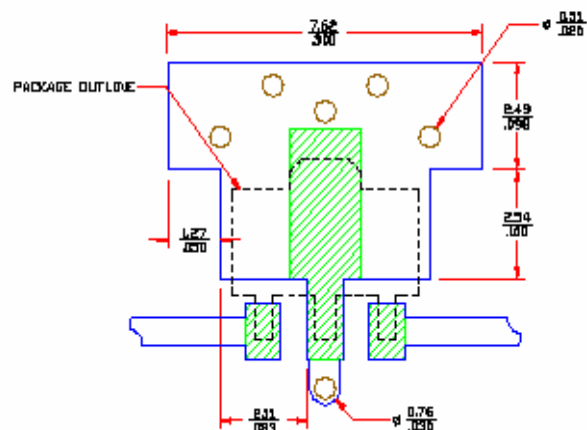


Fig 9. SOT-89 Package dimension