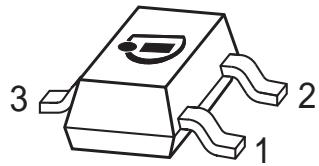


## NPN Silicon RF Transistor\*

- For low noise, high-gain broadband amplifiers at collector currents from 0.5 mA to 12 mA
- $f_T = 8$  GHz,  $F = 0.9$  dB at 900 MHz
- Pb-free (RoHS compliant) package<sup>1)</sup>
- Qualified according AEC Q101

\* Short term description



**ESD (Electrostatic discharge) sensitive device, observe handling precaution!**

| Type   | Marking | Pin Configuration |     |     | Package |
|--------|---------|-------------------|-----|-----|---------|
| BFR181 | RFs     | 1=B               | 2=E | 3=C | SOT23   |

### Maximum Ratings

| Parameter   | Symbol    | Value       | Unit |
|---|-----------|-------------|------|
| Collector-emitter voltage                                 | $V_{CEO}$ | 12          | V    |
| Collector-emitter voltage                                 | $V_{CES}$ | 20          |      |
| Collector-base voltage                                    | $V_{CBO}$ | 20          |      |
| Emitter-base voltage                                      | $V_{EBO}$ | 2           |      |
| Collector current   | $I_C$     | 20          | mA   |
| Base current  | $I_B$     | 2           |      |
| Total power dissipation <sup>2)</sup><br>$T_S \leq 91$ °C | $P_{tot}$ | 175         | mW   |
| Junction temperature                                      | $T_j$     | 150         | °C   |
| Ambient temperature                                       | $T_A$     | -65 ... 150 |      |
| Storage temperature                                       | $T_{stg}$ | -65 ... 150 |      |

### Thermal Resistance

| Parameter                                | Symbol     | Value      | Unit |
|--|------------|------------|------|
| Junction - soldering point <sup>3)</sup> | $R_{thJS}$ | $\leq 335$ | K/W  |

<sup>1</sup>Pb-containing package may be available upon special request

<sup>2</sup> $T_S$  is measured on the collector lead at the soldering point to the pcb

<sup>3</sup>For calculation of  $R_{thJA}$  please refer to Application Note Thermal Resistance

**Electrical Characteristics** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified

| <b>Parameter</b> | <b>Symbol</b> | <b>Values</b> |             |             | <b>Unit</b> |
|------------------|---------------|---------------|-------------|-------------|-------------|
|                  |               | <b>min.</b>   | <b>typ.</b> | <b>max.</b> |             |

### **DC Characteristics**

|  |                             |    |     |     |               |
|--|-----------------------------|----|-----|-----|---------------|
| Collector-emitter breakdown voltage<br>$I_C = 1 \text{ mA}, I_B = 0$                   | $V_{(\text{BR})\text{CEO}}$ | 12 | -   | -   | V             |
| Collector-emitter cutoff current<br>$V_{\text{CE}} = 20 \text{ V}, V_{\text{BE}} = 0$  | $I_{\text{CES}}$            | -  | -   | 100 | $\mu\text{A}$ |
| Collector-base cutoff current<br>$V_{\text{CB}} = 10 \text{ V}, I_E = 0$               | $I_{\text{CBO}}$            | -  | -   | 100 | nA            |
| Emitter-base cutoff current<br>$V_{\text{EB}} = 1 \text{ V}, I_C = 0$                  | $I_{\text{EBO}}$            | -  | -   | 1   | $\mu\text{A}$ |
| DC current gain-<br>$I_C = 5 \text{ mA}, V_{\text{CE}} = 8 \text{ V}$ , pulse measured | $h_{\text{FE}}$             | 70 | 100 | 140 | -             |

**Electrical Characteristics** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified

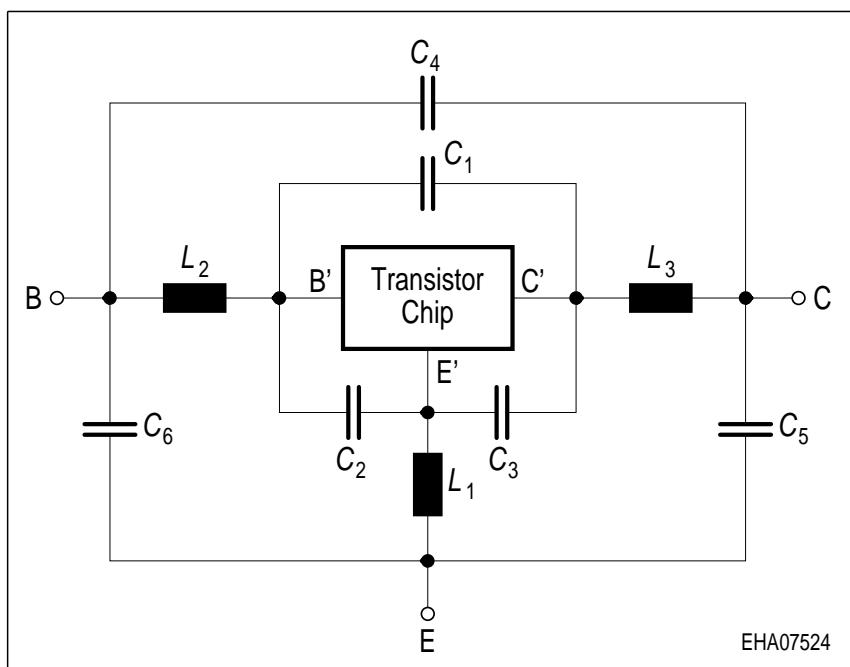
| Parameter   | Symbol        | Values |      |      | Unit |
|---|---------------|--------|------|------|------|
|   |               | min.   | typ. | max. |      |
| <b>AC Characteristics</b> (verified by random sampling)   |               |        |      |      |      |
| Transition frequency<br>$I_C = 10 \text{ mA}, V_{CE} = 8 \text{ V}, f = 500 \text{ MHz}$  | $f_T$         | 6      | 8    | -    | GHz  |
| Collector-base capacitance<br>$V_{CB} = 10 \text{ V}, f = 1 \text{ MHz}, V_{BE} = 0 \text{ V}$ ,<br>emitter grounded  | $C_{cb}$      | -      | 0.27 | 0.45 | pF   |
| Collector emitter capacitance<br>$V_{CE} = 10 \text{ V}, f = 1 \text{ MHz}, V_{BE} = 0 \text{ V}$ ,<br>base grounded  | $C_{ce}$      | -      | 0.2  | -    |      |
| Emitter-base capacitance<br>$V_{EB} = 0.5 \text{ V}, f = 1 \text{ MHz}, V_{CB} = 0 \text{ V}$ ,<br>collector grounded   | $C_{eb}$      | -      | 0.35 | -    |      |
| Noise figure<br>$I_C = 2 \text{ mA}, V_{CE} = 8 \text{ V}, Z_S = Z_{\text{Sopt}}$ ,<br>$f = 900 \text{ MHz}$<br>$I_C = 2 \text{ mA}, V_{CE} = 8 \text{ V}, Z_S = Z_{\text{Sopt}}$ ,<br>$f = 1.8 \text{ GHz}$    | $F$           | -      | 0.9  | -    | dB   |
| Power gain, maximum stable <sup>1)</sup><br>$I_C = 10 \text{ mA}, V_{CE} = 8 \text{ V}, Z_S = Z_{\text{Sopt}}, Z_L = Z_{\text{Lopt}}$ ,<br>$f = 900 \text{ MHz}$  | $G_{ms}$      | -      | 18.5 | -    | dB   |
| Power gain, maximum available <sup>2)</sup><br>$I_C = 5 \text{ mA}, V_{CE} = 8 \text{ V}, Z_S = Z_{\text{Sopt}}, Z_L = Z_{\text{Lopt}}$ ,<br>$f = 1.8 \text{ GHz}$  | $G_{ma}$      | -      | 12.5 | -    | dB   |
| Transducer gain<br>$I_C = 5 \text{ mA}, V_{CE} = 8 \text{ V}, Z_S = Z_L = 50 \Omega$ ,<br>$f = 900 \text{ MHz}$<br>$I_C = 5 \text{ mA}, V_{CE} = 8 \text{ V}, Z_S = Z_L = 50 \Omega$ ,<br>$f = 1.8 \text{ MHz}$ | $ S_{21e} ^2$ | -      | 14.5 | -    | dB   |

<sup>1</sup> $G_{ms} = |S_{21} / S_{12}|$ 
<sup>2</sup> $G_{ma} = |S_{21e} / S_{12e}| (k - (k^2 - 1)^{1/2})$

**SPICE Parameter (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax):**
**Transistor Chip Data:**

|       |           |          |       |         |          |        |          |          |
|-------|-----------|----------|-------|---------|----------|--------|----------|----------|
| IS =  | 0.0010519 | fA       | BF =  | 96.461  | -        | NF =   | 0.90617  | -        |
| VAF = | 22.403    | V        | IKF = | 0.12146 | A        | ISE =  | 12.603   | fA       |
| NE =  | 1.7631    | -        | BR =  | 16.504  | -        | NR =   | 0.87757  | -        |
| VAR = | 5.1127    | V        | IKR = | 0.24951 | A        | ISC =  | 0.01195  | fA       |
| NC =  | 1.6528    | -        | RB =  | 9.9037  | $\Omega$ | IRB =  | 0.69278  | mA       |
| RBM = | 6.6315    | $\Omega$ | RE =  | 2.1372  | -        | RC =   | 2.2171   | $\Omega$ |
| CJE = | 1.8168    | fF       | VJE = | 0.73155 | V        | MJE =  | 0.43619  | -        |
| TF =  | 17.028    | ps       | XTF = | 0.33814 | -        | VTF =  | 0.12571  | V        |
| ITF = | 1.0549    | mA       | PTF = | 0       | deg      | CJC =  | 319.69   | fF       |
| VJC = | 1.1633    | V        | MJC = | 0.30013 | -        | XCJC = | 0.082903 | -        |
| TR =  | 2.7449    | ns       | CJS = | 0       | fF       | VJS =  | 0.75     | V        |
| MJS = | 0         | -        | XTB = | 0       | -        | EG =   | 1.11     | eV       |
| XTI = | 3         | -        | FC =  | 0.99768 |          | TNOM   | 300      | K        |

All parameters are ready to use, no scaling is necessary. Extracted on behalf of Infineon Technologies AG by:  
Institut für Mobil- und Satellitentechnik (IMST)

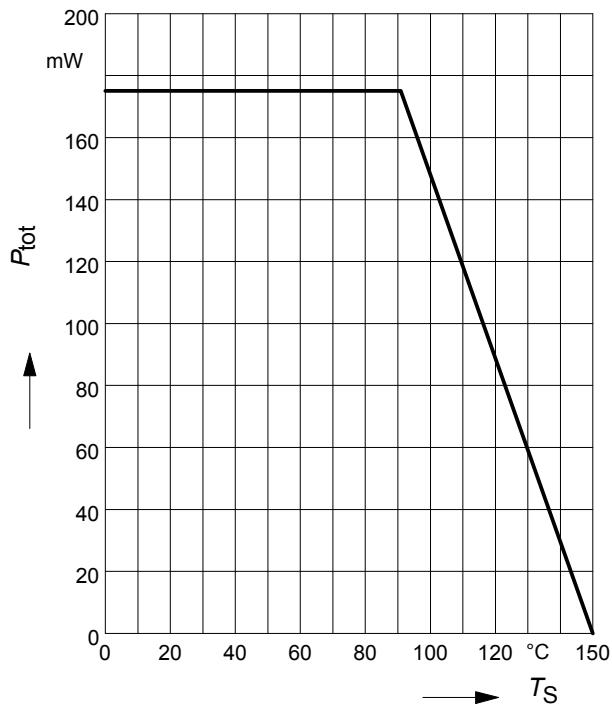
**Package Equivalent Circuit:**


|            |      |    |
|------------|------|----|
| $L_{BI} =$ | 0.85 | nH |
| $L_{BO} =$ | 0.51 | nH |
| $L_{EI} =$ | 0.69 | nH |
| $L_{EO} =$ | 0.61 | nH |
| $L_{CI} =$ | 0    | nH |
| $L_{CO} =$ | 0.49 | nH |
| $C_{BE} =$ | 73   | fF |
| $C_{CB} =$ | 84   | fF |
| $C_{CE} =$ | 165  | fF |

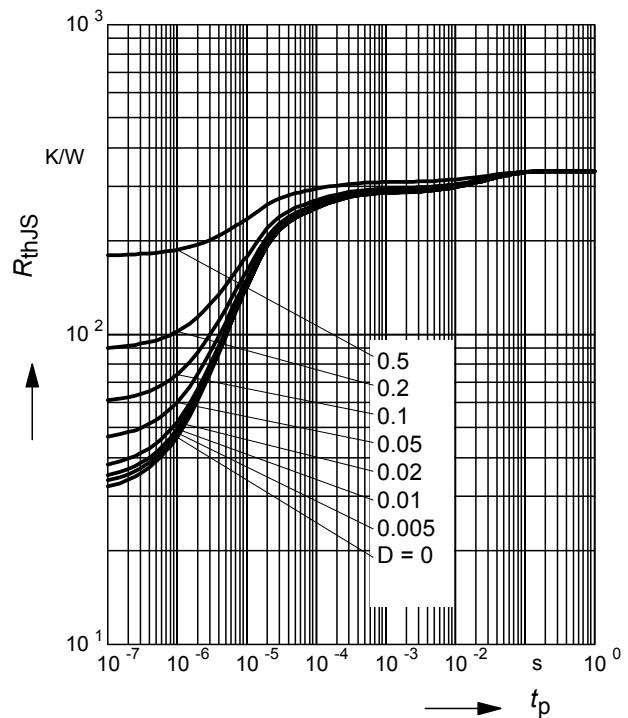
Valid up to 6GHz

For examples and ready to use parameters  
please contact your local Infineon Technologies  
distributor or sales office to obtain a Infineon  
Technologies CD-ROM or see Internet:  
<http://www.infineon.com>

**Total power dissipation**  $P_{\text{tot}} = f(T_S)$

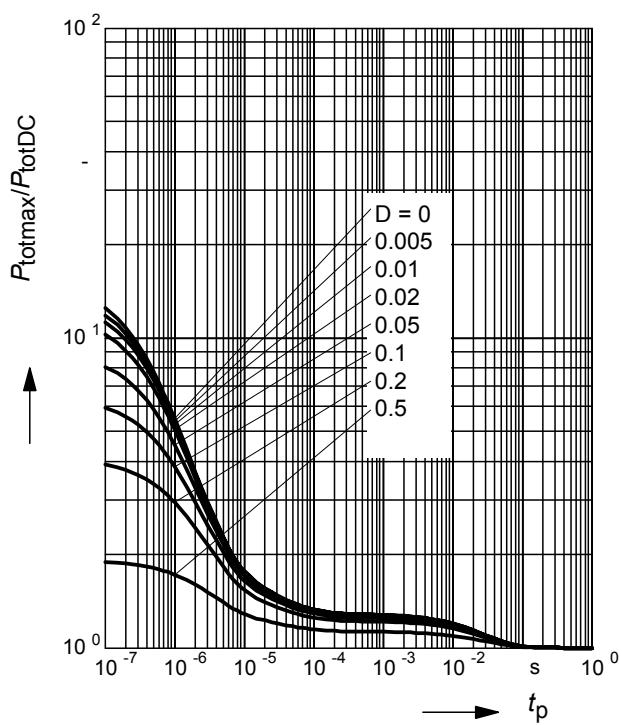


**Permissible Pulse Load**  $R_{\text{thJS}} = f(t_p)$

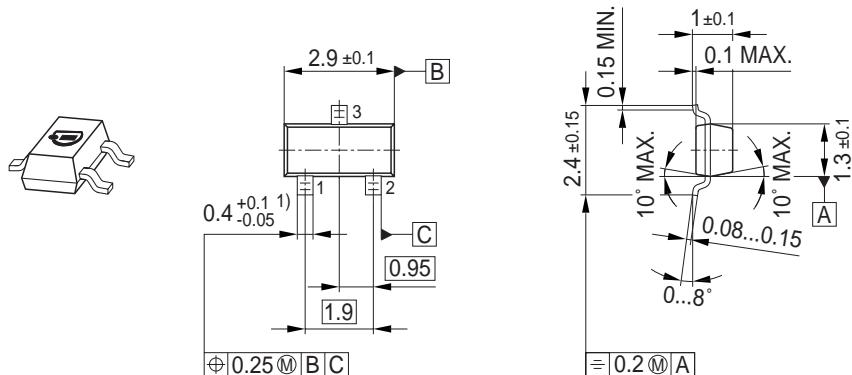


**Permissible Pulse Load**

$P_{\text{totmax}}/P_{\text{totDC}} = f(t_p)$

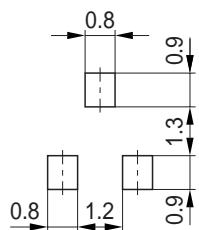


## Package Outline

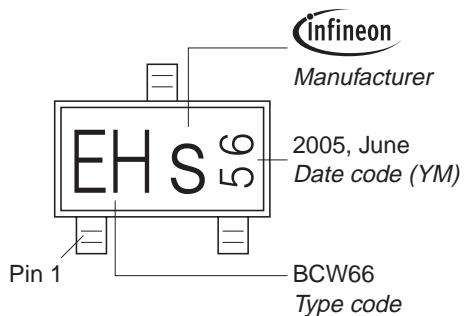


1) Lead width can be 0.6 max. in dambar area

## Foot Print

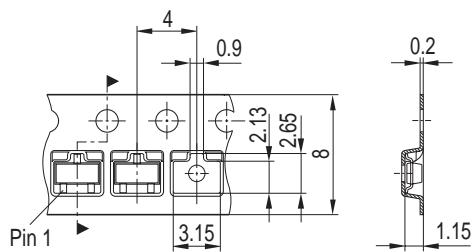


## Marking Layout (Example)



## Standard Packing

Reel ø180 mm = 3.000 Pieces/Reel  
 Reel ø330 mm = 10.000 Pieces/Reel



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