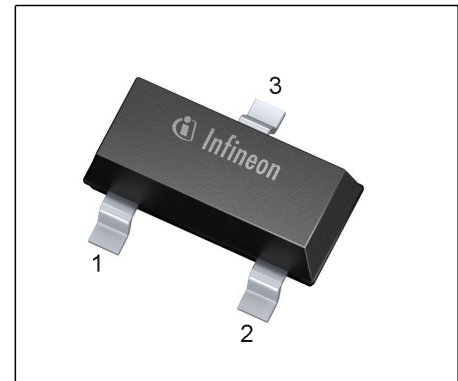


## Low Noise Silicon Bipolar RF Transistor

- For low noise, high-gain broadband amplifiers at collector currents from 0.5 mA to 12 mA
- $f_T = 8 \text{ GHz}$ ,  $NF_{\min} = 0.9 \text{ dB}$  at 900 MHz
- Pb-free (RoHS compliant) package
- Qualification report according to AEC-Q101 available



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

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

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

| 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>1)</sup><br>$T_S \leq 91 \text{ }^\circ\text{C}$ | $P_{\text{tot}}$ | 175         | mW               |
| Junction temperature                                                          | $T_J$            | 150         | $^\circ\text{C}$ |
| Ambient temperature                                                           | $T_A$            | -65 ... 150 |                  |
| Storage temperature                                                           | $T_{\text{Stg}}$ | -65 ... 150 |                  |

### Thermal Resistance

| Parameter                                | Symbol            | Value | Unit |
|------------------------------------------|-------------------|-------|------|
| Junction - soldering point <sup>2)</sup> | $R_{\text{thJS}}$ | 335   | K/W  |

<sup>1)</sup>  $T_S$  is measured on the collector lead at the soldering point of the pcb

<sup>2)</sup> For the definition of  $R_{\text{thJS}}$  please refer to Application Note AN077 (Thermal Resistance Calculation)

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

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

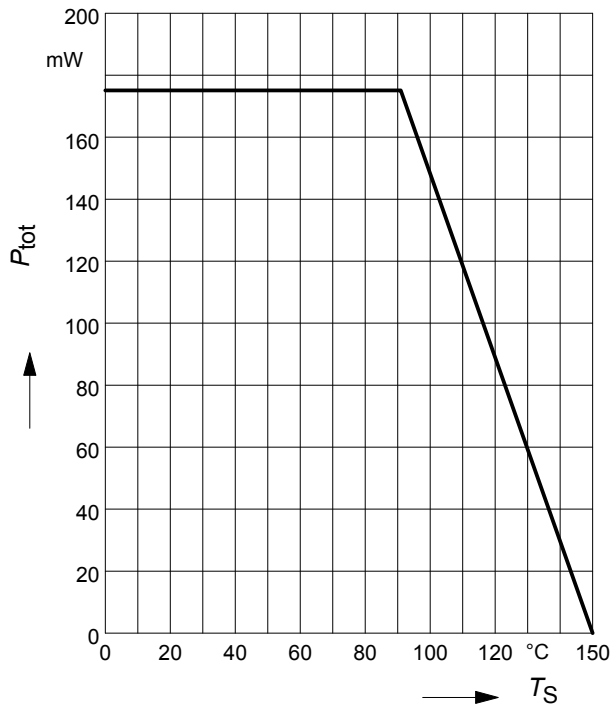
**Electrical Characteristics** at  $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified

| Parameter                                                                                                                                                                                                                           | Symbol        | Values     |                 |            | Unit |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------|-----------------|------------|------|
|                                                                                                                                                                                                                                     |               | min.       | typ.            | max.       |      |
| AC Characteristics (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>$V_{CB} = 10\text{ V}$ , $f = 1\text{ MHz}$ , $V_{BE} = 0$ ,<br>emitter grounded                                                                                                                      | $C_{cb}$      | -          | 0.27            | 0.45       | pF   |
| Collector emitter capacitance<br>$V_{CE} = 10\text{ V}$ , $f = 1\text{ MHz}$ , $V_{BE} = 0$ ,<br>base grounded                                                                                                                      | $C_{ce}$      | -          | 0.2             | -          |      |
| Emitter-base capacitance<br>$V_{EB} = 0.5\text{ V}$ , $f = 1\text{ MHz}$ , $V_{CB} = 0$ ,<br>collector grounded                                                                                                                     | $C_{eb}$      | -          | 0.35            | -          |      |
| Minimum noise figure<br>$I_C = 2\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_{Sopt}$ ,<br>$f = 900\text{ MHz}$<br>$I_C = 2\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_{Sopt}$ ,<br>$f = 1.8\text{ GHz}$                        | $NF_{min}$    | -<br><br>- | 0.9<br><br>1.2  | -<br><br>- | dB   |
| Power gain, maximum stable <sup>1)</sup><br>$I_C = 10\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_{Sopt}$ , $Z_L = Z_{Lopt}$ ,<br>$f = 900\text{ MHz}$                                                                            | $G_{ms}$      | -          | 18.5            | -          | dB   |
| Power gain, maximum available <sup>2)</sup><br>$I_C = 5\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_{Sopt}$ , $Z_L = Z_{Lopt}$ ,<br>$f = 1.8\text{ GHz}$                                                                          | $G_{ma}$      | -          | 12.5            | -          | dB   |
| Transducer gain<br>$I_C = 5\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_L = 50\text{ }\Omega$ ,<br>$f = 900\text{ MHz}$<br>$I_C = 5\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_L = 50\text{ }\Omega$ ,<br>$f = 1.8\text{ MHz}$ | $ S_{21e} ^2$ | -<br><br>- | 14.5<br><br>9.5 | -<br><br>- | dB   |

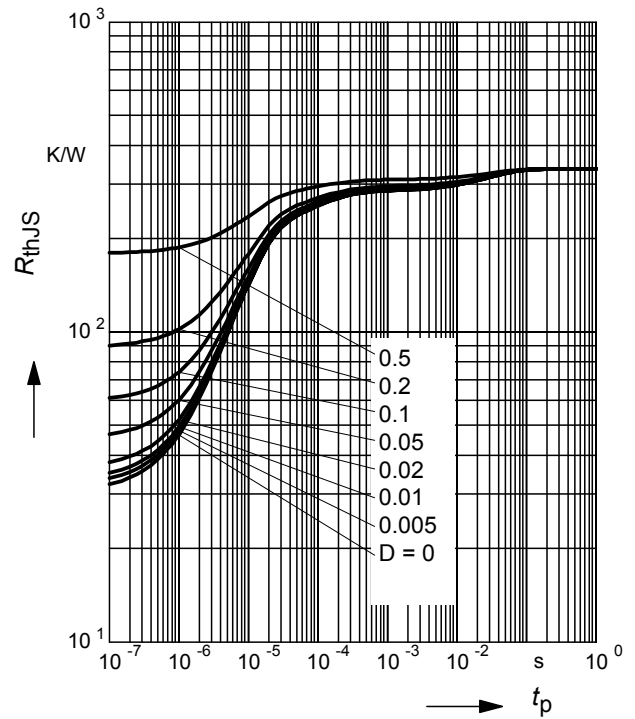
$$^1G_{ms} = |S_{21} / S_{12}|$$

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

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

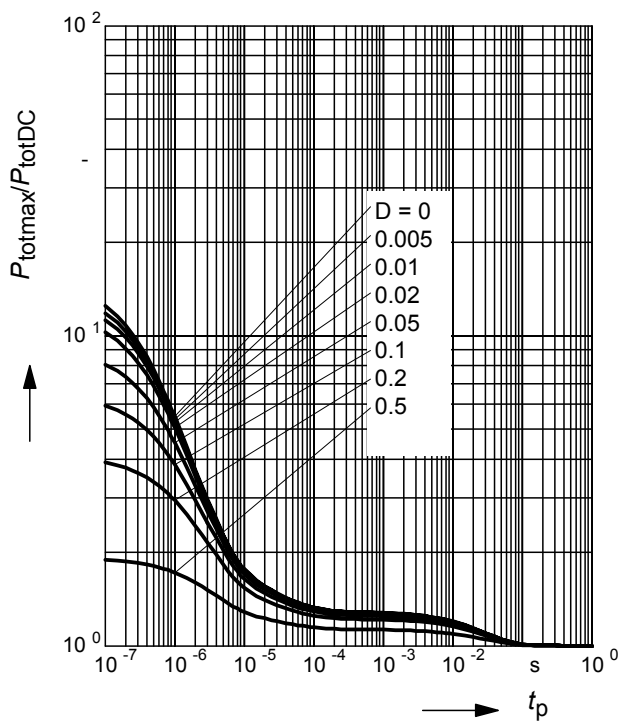


**Permissible Pulse Load**  $R_{\text{thJS}} = f(t_p)$

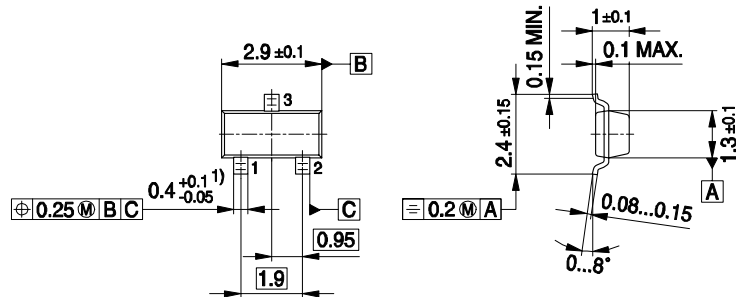
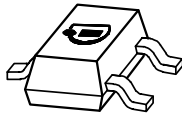


**Permissible Pulse Load**

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



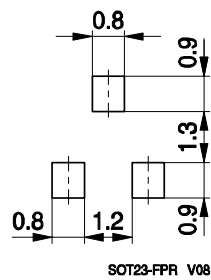
## Package Outline



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

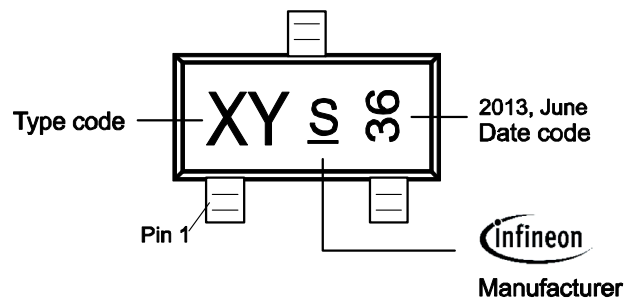
SOT23-PO V08

## Foot Print



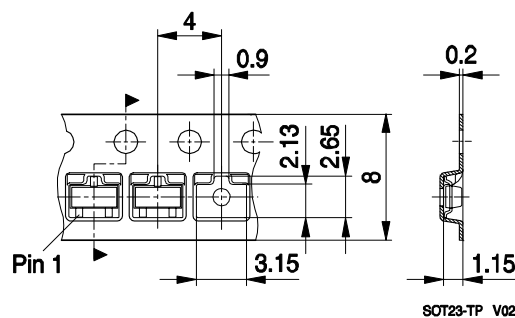
SOT23-FPR V08

## Marking Layout



## Standard Packing

Reel o 180 mm: 3.000 Pieces / Reel  
Reel o 330 mm = 10.000 Pieces / Reel



SOT23-TP V02

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