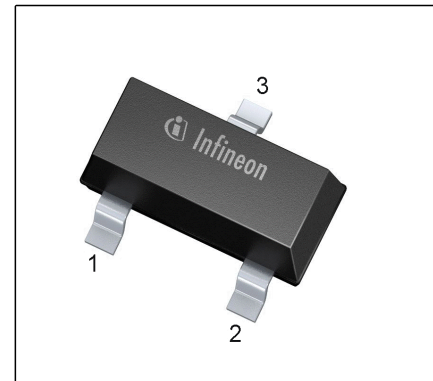


**Low Noise Silicon Bipolar RF Transistor**

- For low-noise, high gain broadband amplifiers at collector currents from 2 mA to 30 mA
- 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 |
|--------|---------|-------------------|-----|-----|---------|
| BFR93A | R2s     | 1=B               | 2=E | 3=C | SOT23   |

**Maximum Ratings** at  $T_A = 25\text{ °C}$ , 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                                                 | $I_C$     | 90          | mA   |
| Base current                                                      | $I_B$     | 9           |      |
| Total power dissipation <sup>1)</sup><br>$T_S \leq 111\text{ °C}$ | $P_{tot}$ | 300         | mW   |
| Junction temperature                                              | $T_J$     | 150         | °C   |
| Storage temperature                                               | $T_{Stg}$ | -55 ... 150 |      |

**Thermal Resistance**

| Parameter                                | Symbol     | Value | Unit |
|------------------------------------------|------------|-------|------|
| Junction - soldering point <sup>2)</sup> | $R_{thJS}$ | 130   | K/W  |

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

<sup>2)</sup> For the definition of  $R_{thJS}$  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. |               |
| <b>DC Characteristics</b>                                                            |               |        |      |      |               |
| 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>$V_{EB} = 2.5\text{ V}, I_C = 0$                      | $I_{EBO}$     | -      | -    | 10   | $\mu\text{A}$ |
| DC current gain<br>$I_C = 30\text{ mA}, V_{CE} = 8\text{ V}, \text{ pulse measured}$ | $h_{FE}$      | 70     | 100  | 140  | -             |

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

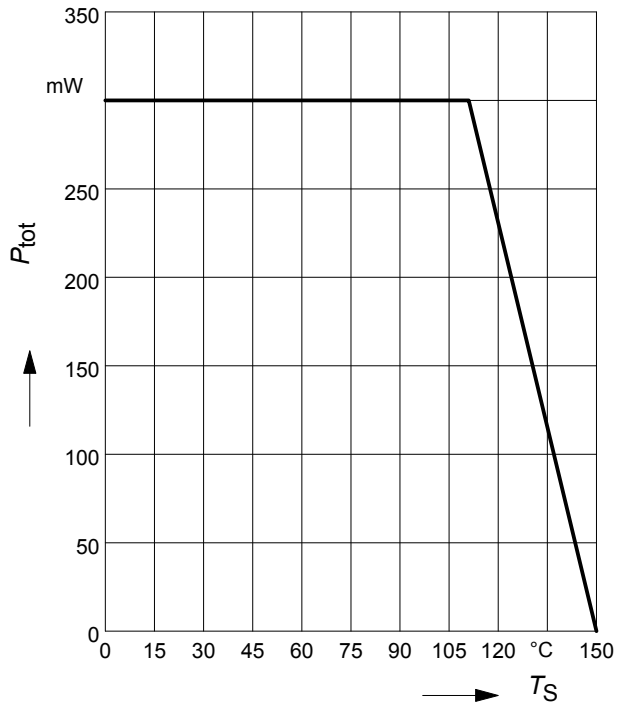
| Parameter                                                                                                                                                                           | Symbol        | Values |      |      | Unit |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|------|------|------|
|                                                                                                                                                                                     |               | min.   | typ. | max. |      |
| <b>AC Characteristics (verified by random sampling)</b>                                                                                                                             |               |        |      |      |      |
| Transition frequency<br>$I_C = 30\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $f = 500\text{ MHz}$                                                                                         | $f_T$         | 4.5    | 6    | -    | GHz  |
| Collector-base capacitance<br>$V_{CB} = 10\text{ V}$ , $f = 1\text{ MHz}$ , $V_{BE} = 0$ ,<br>emitter grounded                                                                      | $C_{cb}$      | -      | 0.54 | 0.8  | pF   |
| Collector emitter capacitance<br>$V_{CE} = 10\text{ V}$ , $f = 1\text{ MHz}$ , $V_{BE} = 0$ ,<br>base grounded                                                                      | $C_{ce}$      | -      | 0.25 | -    |      |
| Emitter-base capacitance<br>$V_{EB} = 0.5\text{ V}$ , $f = 1\text{ MHz}$ , $V_{CB} = 0$ ,<br>collector grounded                                                                     | $C_{eb}$      | -      | 1.9  | -    |      |
| Minimum noise figure<br>$I_C = 5\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_{Sopt}$ ,<br>$f = 900\text{ MHz}$<br>$f = 1.8\text{ GHz}$                                            | $NF_{min}$    | -      | 1.5  | -    | dB   |
| Power gain, maximum available <sup>1)</sup><br>$I_C = 30\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_{Sopt}$ , $Z_L = Z_{Lopt}$ ,<br>$f = 900\text{ MHz}$<br>$f = 1.8\text{ GHz}$ | $G_{ma}$      | -      | 14.5 | -    |      |
| Transducer gain<br>$I_C = 30\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_L = 50\ \Omega$ ,<br>$f = 900\text{ MHz}$<br>$f = 1.8\text{ MHz}$                                        | $ S_{21e} ^2$ | -      | 12.5 | -    | dB   |
| Third order intercept point at output <sup>2)</sup><br>$I_C = 30\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_L = 50\ \Omega$ ,<br>$f = 900\text{ MHz}$                            | $IP_3$        | -      | 15   | -    | dBm  |
| 1dB Compression point<br>$I_C = 30\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_L = 50\ \Omega$ ,<br>$f = 900\text{ MHz}$                                                          | $P_{-1dB}$    | -      | 6    | -    |      |

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

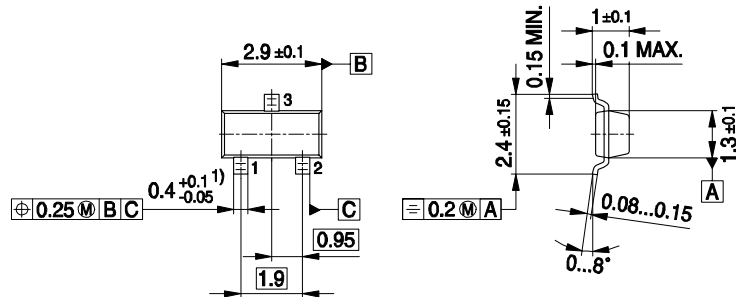
<sup>2</sup>IP3 value depends on termination of all intermodulation frequency components.

Termination used for this measurement is 50Ω from 0.2 MHz to 12 GHz

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



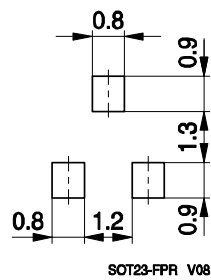
Package Outline



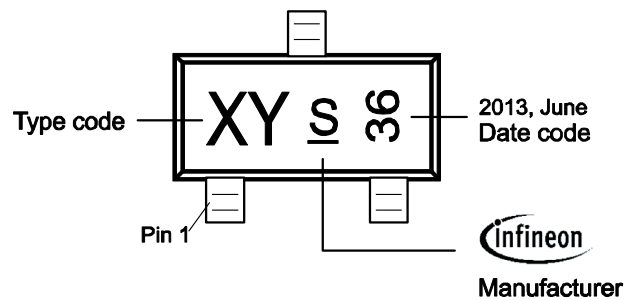
1) Lead width can be 0.6 max. in dambar area

SOT23-PO V08

Foot Print

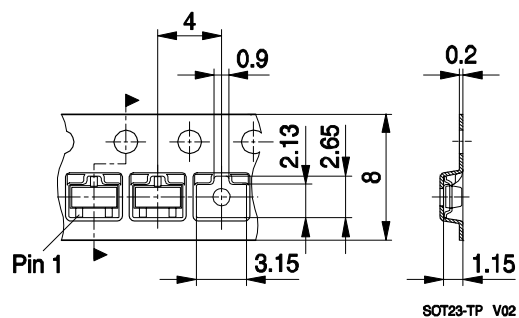


Marking Layout



Standard Packing

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



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