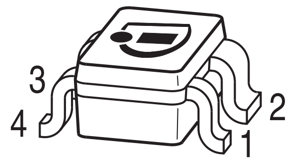
## Low Noise Silicon Bipolar RF Transistor




- For low current applications
- For oscillators up to 12 GHz
- Minimum noise figure $NF_{min}$ = 1.25 dB at 1.8 GHz
  Outstanding $G_{ms}$ = 23 dB at 1.8 GHz
- Pb-free (RoHS compliant) and halogen-free package
  with visible leads
- Qualification report according to AEC-Q101 available

RoHS

**ESD** (**E**lectro**s**tatic **d**ischarge) sensitive device, observe handling precaution!

| Type | Marking | Pin Configuration | | | | | | Package |
|---|---|---|---|---|---|---|---|---|
| BFP405 | ALs | 1=B | 2=E | 3=C | 4=E | - | - | SOT343 |

**Maximum Ratings** at $T_A$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Collector-emitter voltage<br>$T_A$ = 25 °C<br>$T_A$ = -55 °C | $V_{CEO}$ | <br>4.5<br>4.1 | V |
| Collector-emitter voltage | $V_{CES}$ | 15 | |
| Collector-base voltage | $V_{CBO}$ | 15 | |
| Emitter-base voltage | $V_{EBO}$ | 1.5 | |
| Collector current | $I_C$ | 25 | mA |
| Base current | $I_B$ | 3 | |
| Total power dissipation[1)]<br>$T_S \leq$ 110 °C | $P_{tot}$ | 75 | mW |
| Junction temperature | $T_J$ | 150 | °C |
| Ambient temperature | $T_A$ | -65 ... 150 | |
| Storage temperature | $T_{Stg}$ | -65 ... 150 | |

[1] $T_S$ is measured on the emitter lead at the soldering point to the pcb

**Thermal Resistance**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction - soldering point[1)] | $R_{thJS}$ | 530 | K/W |

**Electrical Characteristics** at $T_A$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| **DC Characteristics** | | | | | |
| Collector-emitter breakdown voltage<br>$I_C$ = 1 mA, $I_B$ = 0 | $V_{(BR)CEO}$ | 4.5 | 5 | - | V |
| Collector-emitter cutoff current<br>$V_{CE}$ = 15 V, $V_{BE}$ = 0 | $I_{CES}$ | - | - | 10 | µA |
| Collector-base cutoff current<br>$V_{CB}$ = 5 V, $I_E$ = 0 | $I_{CBO}$ | - | - | 100 | nA |
| Emitter-base cutoff current<br>$V_{EB}$ = 0.5 V, $I_C$ = 0 | $I_{EBO}$ | - | - | 1 | µA |
| DC current gain<br>$I_C$ = 5 mA, $V_{CE}$ = 4 V, pulse measured | $h_{FE}$ | 60 | 95 | 130 | - |

[1]For the definition of $R_{thJS}$ please refer to Application Note AN077 (Thermal Resistance Calculation)

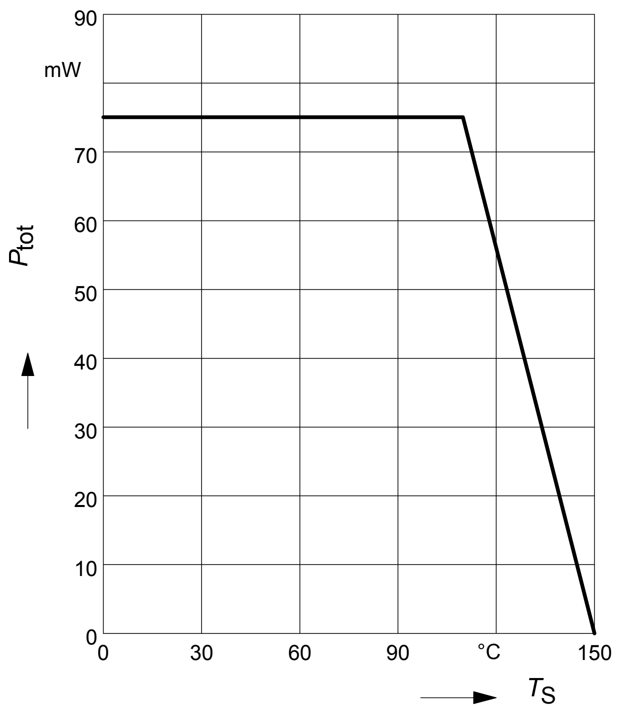
**Electrical Characteristics** at $T_A$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| **AC Characteristics** (verified by random sampling) | | | | | |
| Transition frequency<br>$I_C$ = 10 mA, $V_{CE}$ = 3 V, $f$ = 2 GHz | $f_T$ | 18 | 25 | - | GHz |
| Collector-base capacitance<br>$V_{CB}$ = 2 V, $f$ = 1 MHz, $V_{BE}$ = 0 ,<br>emitter grounded | $C_{cb}$ | - | 0.05 | 0.1 | pF |
| Collector emitter capacitance<br>$V_{CE}$ = 2 V, $f$ = 1 MHz, $V_{BE}$ = 0 ,<br>base grounded | $C_{ce}$ | - | 0.24 | - | |
| Emitter-base capacitance<br>$V_{EB}$ = 0.5 V, $f$ = 1 MHz, $V_{CB}$ = 0 ,<br>collector grounded | $C_{eb}$ | - | 0.29 | - | |
| Minimum noise figure<br>$I_C$ = 2 mA, $V_{CE}$ = 2 V, $f$ = 1.8 GHz, $Z_S = Z_{Sopt}$ | $NF_{min}$ | - | 1.25 | - | dB |
| Power gain, maximum stable[1)]<br>$I_C$ = 5 mA, $V_{CE}$ = 2 V, $Z_S = Z_{Sopt}$,<br>$Z_L = Z_{Lopt}$ , $f$ = 1.8 GHz | $G_{ms}$ | - | 23 | - | dB |
| Insertion power gain<br>$V_{CE}$ = 2 V, $I_C$ = 5 mA, $f$ = 1.8 GHz,<br>$Z_S = Z_L$ = 50 Ω | $\|S_{21}\|^2$ | 14 | 18.5 | - | |
| Third order intercept point at output[2)]<br>$V_{CE}$ = 2 V, $I_C$ = 5 mA, $f$ = 1.8 GHz,<br>$Z_S = Z_L$ = 50 Ω | $IP3$ | - | 15 | - | dBm |
| 1dB compression point at output<br>$I_C$ = 5 mA, $V_{CE}$ = 2 V, $Z_S = Z_L$ = 50 Ω,<br>$f$ = 1.8 GHz | $P_{-1dB}$ | - | 5 | - | |

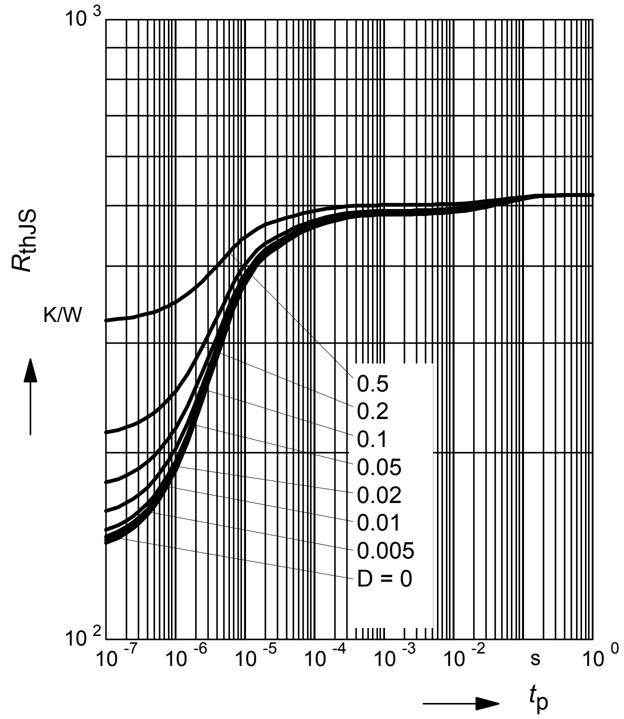
[1] $G_{ms} = |S_{21} / S_{12}|$

[2] IP3 value depends on termination of all intermodulation frequency components.
Termination used for this measurement is 50Ω from 0.1 MHz to 6 GHz

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

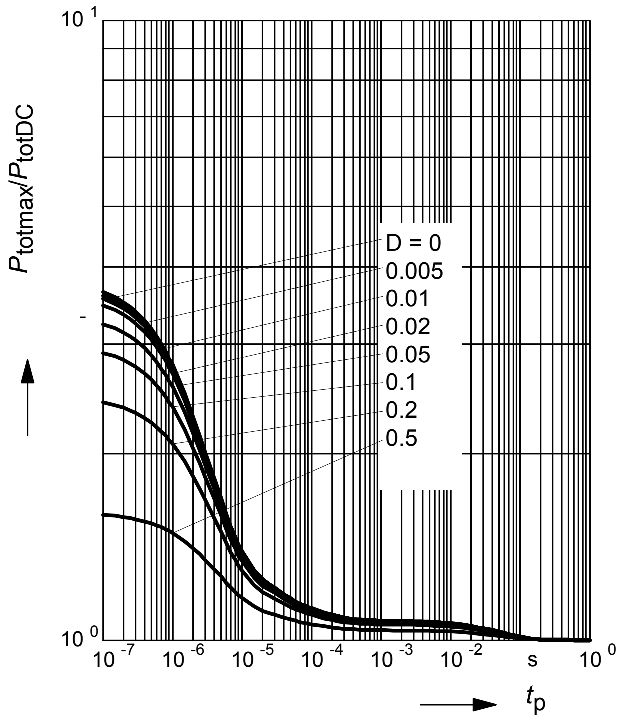



**Permissible Pulse Load** $R_{thJS} = f(t_p)$



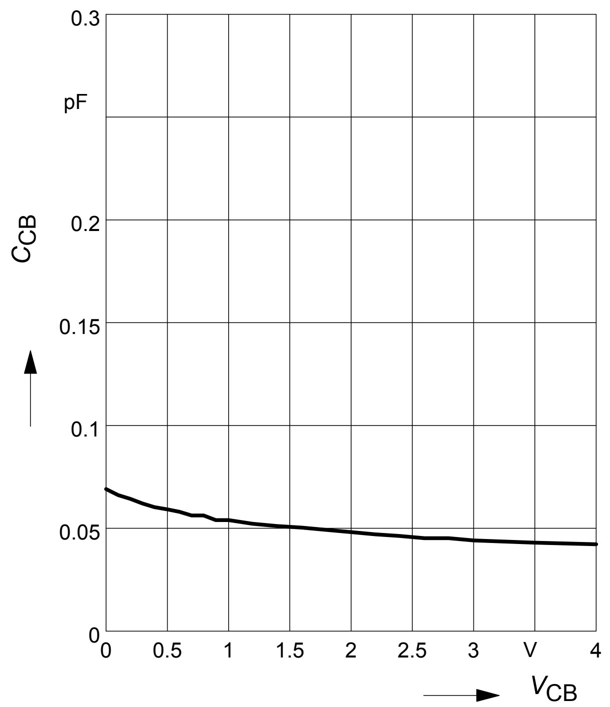

**Permissible Pulse Load**

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




**Collector-base capacitance** $C_{cb} = f(V_{CB})$

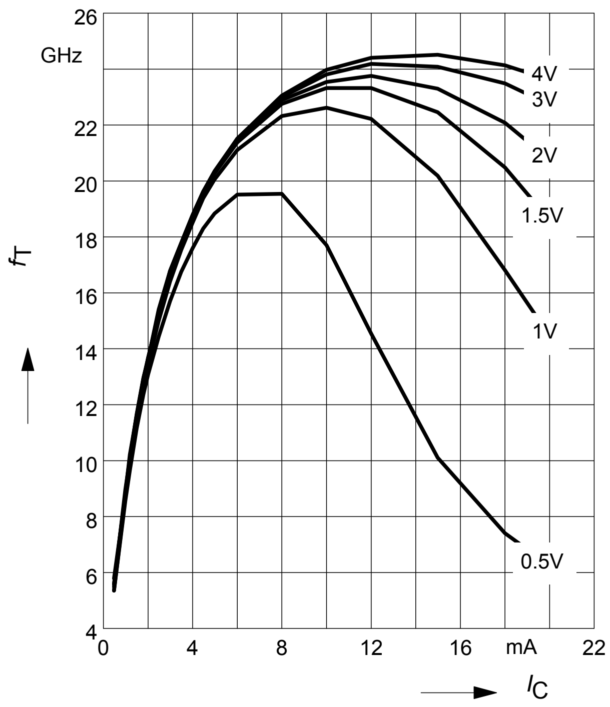
$f$ = 1MHz



**Transition frequency** $f_T = f(I_C)$

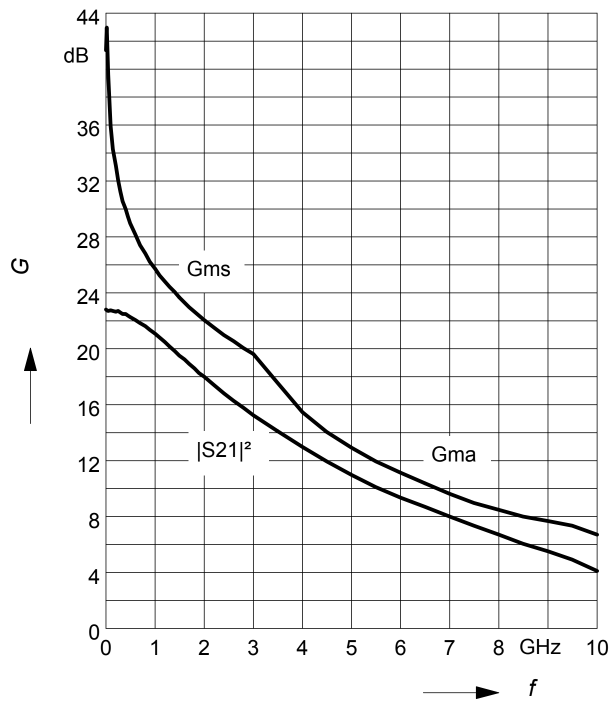
$f$ = 2 GHz

$V_{CE}$ = parameter in V




**Power gain** $G_{ma}$, $G_{ms}$, $|S_{21}|^2 = f(f)$

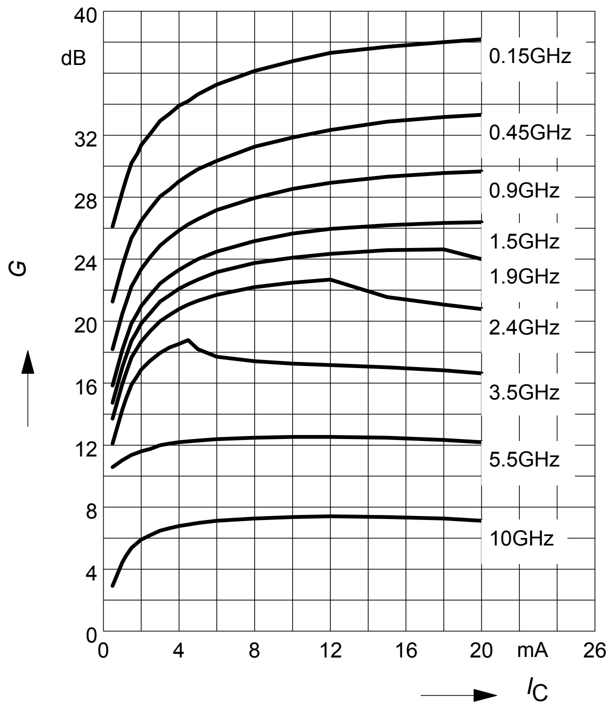
$V_{CE}$ = 3 V, $I_C$ = 5 mA




**Power gain** $G_{ma}$, $G_{ms}$ = $f(I_C)$

$V_{CE}$ = 3V

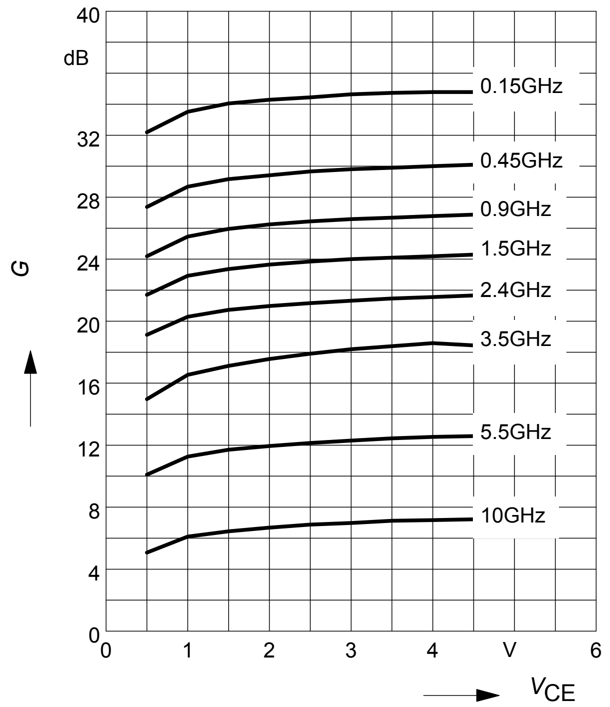
$f$ = parameter in GHz




**Power gain** $G_{ma}$, $G_{ms}$ = $f(V_{CE})$

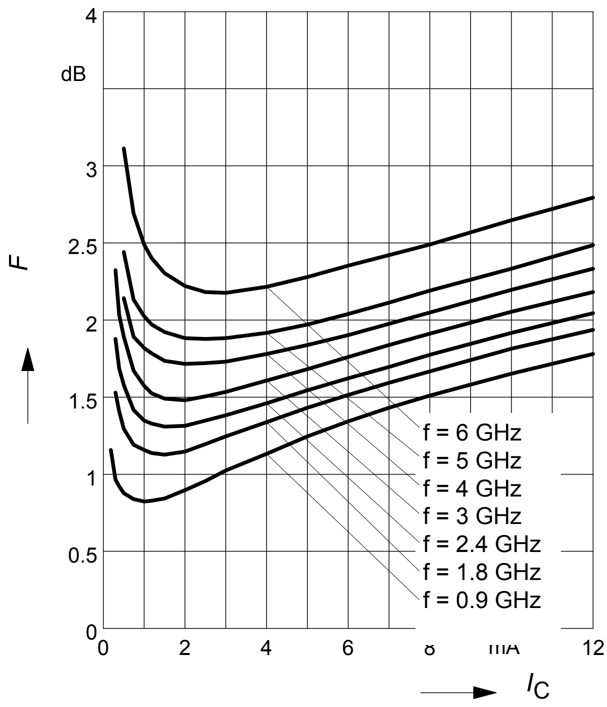
$I_C$ = 5 mA

$f$ = parameter in GHz



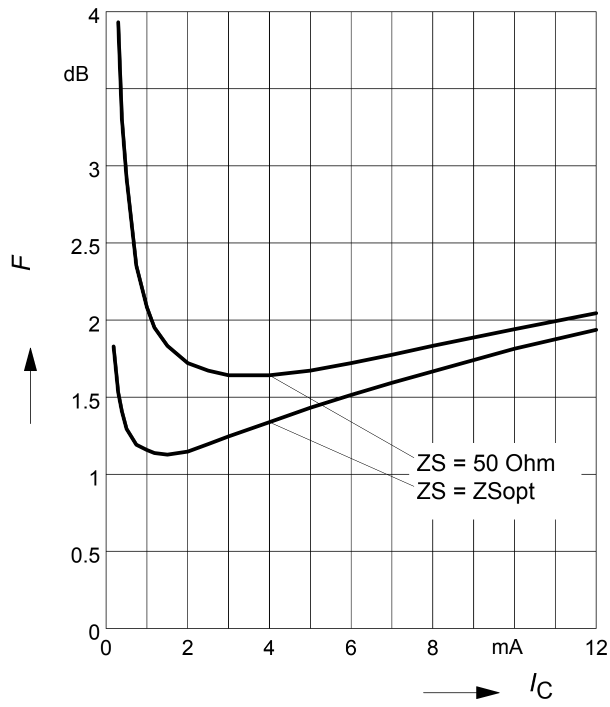
**Noise figure** $F = f(I_C)$

$V_{CE}$ = 2 V, $Z_S = Z_{Sopt}$



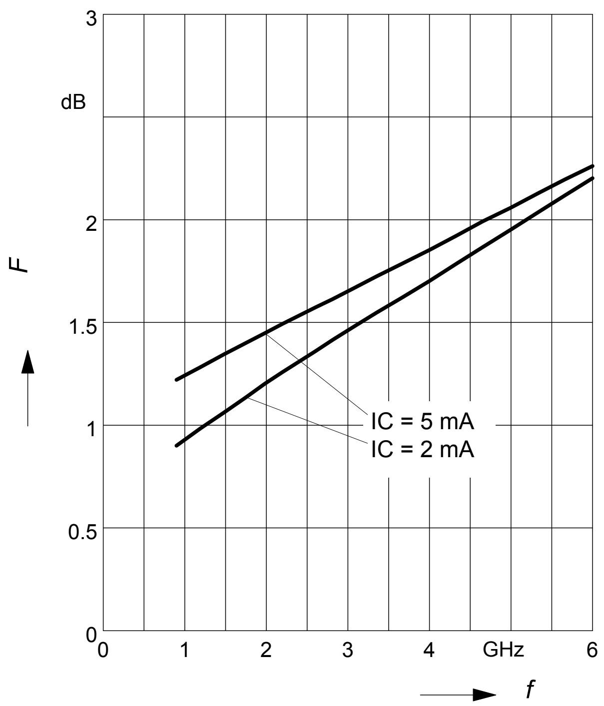

**Noise figure** $F = f(I_C)$

$V_{CE}$ = 2 V, $f$ = 1.8 GHz



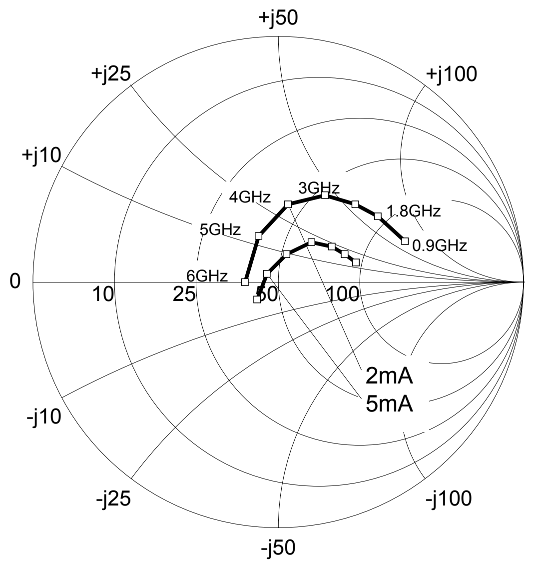

**Noise figure** $F = f(f)$

$V_{CE}$ = 1 V, $Z_S = Z_{Sopt}$




**Source impedance** for min. noise figure vs. frequency

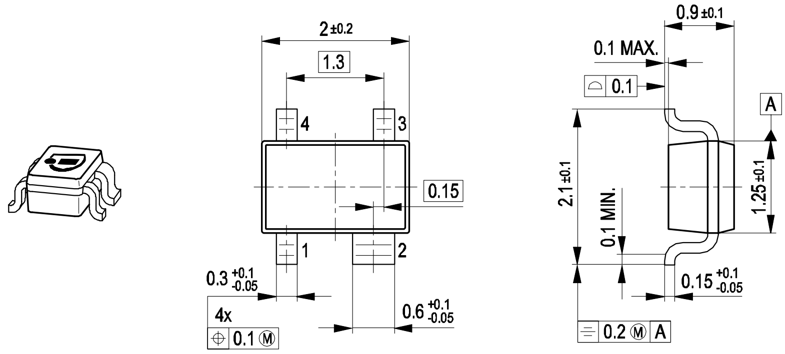
$V_{CE}$ = 3 V, $I_C$ = 2 mA / 5 mA



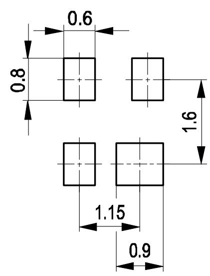
## SPICE GP Model

For the SPICE Gummel Poon (GP) model as well as for the S-parameters (including noise parameters) please refer to our internet website www.infineon.com/rf.models.
Please consult our website and download the latest versions before actually starting your design. You find the BFP405 SPICE GP model in the internet in MWO- and ADS-format, which you can import into these circuit simulation tools very quickly and conveniently. The model already contains the package parasitics and is ready to use for DC and high frequency simulations. The terminals of the model circuit correspond to the pin configuration of the device. The model parameters have been extracted and verified up to 6 GHz using typical devices. The BFP405 SPICE GP model reflects the typical DC- and RF-performance within the limitations which are given by the SPICE GP model itself. Besides the DC characteristics all S-parameters in magnitude and phase, as well as noise figure (including optimum source impedance, equivalent noise resistance and flicker noise) and intermodulation have been extracted.

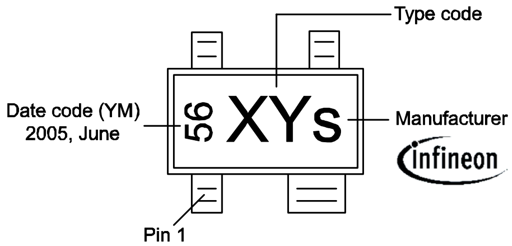
## Package Outline




## Foot Print

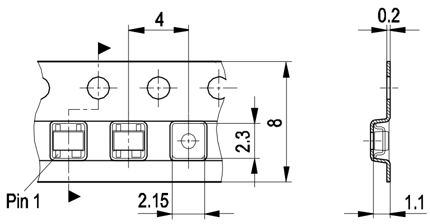



## Marking Layout (Example)




## Standard Packing

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



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