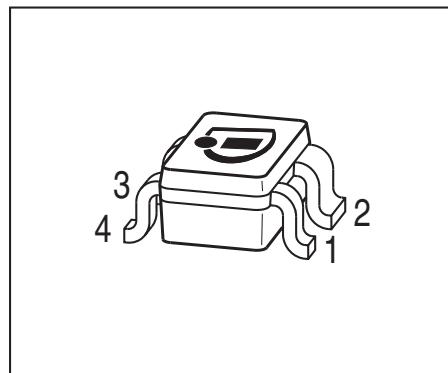


## Low Noise Silicon Bipolar RF Transistor

- General purpose low noise amplifier for low voltage, low current applications
- High ESD robustness, typical 1500 V (HBM)
- Low minimum noise figure 1.1 dB at 1.8 GHz
- High linearity: output compression point OP1dB = 13 dBm @ 3 V, 35 mA, 1.8 GHz
- Pb-free (RoHS compliant) and halogen-free package with visible leads
- Qualification report according to AEC-Q101 available



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

Type	Marking	Pin Configuration						Package
BFP460	ABs	1 = E	2 = C	3 = E	4=B	-	-	SOT343

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

Parameter	Symbol	Value	Unit
Collector-emitter voltage $T_A = 25^\circ\text{C}$	$V_{CEO}$	4.5	V
$T_A = -55^\circ\text{C}$		4.2	
Collector-emitter voltage	$V_{CES}$	15	
Collector-base voltage	$V_{CBO}$	15	
Emitter-base voltage	$V_{EBO}$	1.5	
Collector current	$I_C$	70	mA
Base current	$I_B$	7	
Total power dissipation <sup>1)</sup> $T_S \leq 92^\circ\text{C}$	$P_{tot}$	230	mW
Junction temperature	$T_J$	150	°C
Ambient temperature	$T_A$	-65 ... 150	
Storage temperature	$T_{Stg}$	-65 ... 150	

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

**Thermal Resistance**

Parameter	Symbol	Value	Unit
Junction - soldering point <sup>1)</sup>	$R_{thJS}$	250	K/W

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

**DC Characteristics**

Collector-emitter breakdown voltage $I_C = 1 \text{ mA}, I_B = 0$	$V_{(\text{BR})\text{CEO}}$	4.5	5.8	-	V
Collector-emitter cutoff current $V_{CE} = 15 \text{ V}, V_{BE} = 0$ $V_{CE} = 2 \text{ V}, V_{BE} = 0$ $V_{CE} = 5 \text{ V}, V_{BE} = 0, T_A = 85^\circ\text{C}$	$I_{CES}$	-	-	1000	nA
Verified by random sampling		-	1	30	
Collector-base cutoff current $V_{CB} = 2 \text{ V}, I_E = 0$ $V_{CB} = 5 \text{ V}, I_E = 0$	$I_{CBO}$	-	2	40	
Emitter-base cutoff current $V_{EB} = 0,5 \text{ V}, I_C = 0$	$I_{EBO}$	-	1	500	
DC current gain $V_{CE} = 3 \text{ V}, I_C = 20 \text{ mA}, \text{pulse measured}$	$h_{FE}$	90	120	160	-

<sup>1)</sup>For the definition of  $R_{thJS}$  please refer to Application Note AN077 (Thermal Resistance Calculation)

**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 $I_C = 30 \text{ mA}, V_{CE} = 3 \text{ V}, f = 1 \text{ GHz}$	$f_T$	16	22	-	GHz
Collector-base capacitance $V_{CB} = 3 \text{ V}, f = 1 \text{ MHz}, V_{BE} = 0 \text{ V}$ , emitter grounded	$C_{cb}$	-	0.32	0.45	pF
Collector emitter capacitance $V_{CE} = 3 \text{ V}, f = 1 \text{ MHz}, V_{BE} = 0 \text{ V}$ , base grounded	$C_{ce}$	-	0.28	-	
Emitter-base capacitance $V_{EB} = 0.5 \text{ V}, f = 1 \text{ MHz}, V_{CB} = 0 \text{ V}$ , collector grounded	$C_{eb}$	-	0.55	-	
Minimum noise figure $V_{CE} = 2 \text{ V}, I_C = 3 \text{ mA}, Z_S = Z_{\text{Sopt}}, f = 100 \text{ MHz}$ $V_{CE} = 3 \text{ V}, I_C = 5 \text{ mA}, Z_S = Z_{\text{Sopt}}, f = 1.8 \text{ GHz}$ $V_{CE} = 3 \text{ V}, I_C = 5 \text{ mA}, Z_S = Z_{\text{Sopt}}, f = 3 \text{ GHz}$	$NF_{\text{min}}$	-	0.7	-	dB

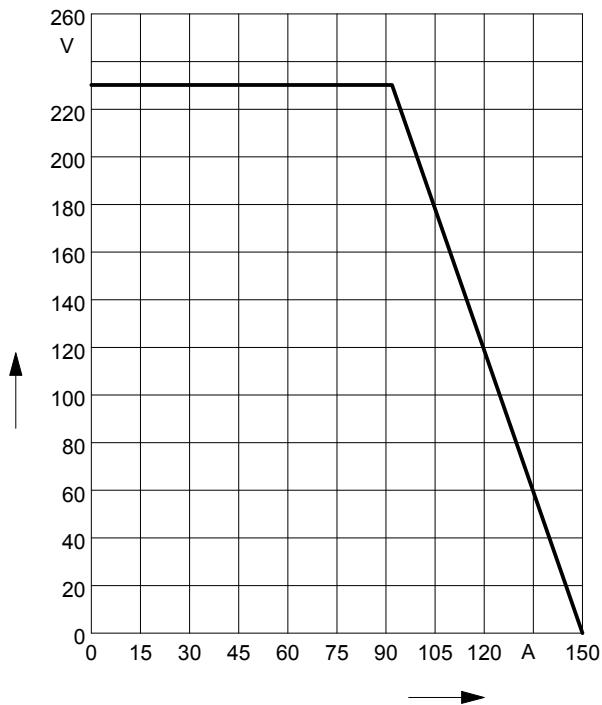
**Electrical Characteristics at  $T_A = 25^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>AC Characteristics (verified by random sampling)</b>					
Maximum power Gain <sup>1)</sup>  $I_C = 3 \text{ mA}$ , $V_{CE} = 1.5 \text{ V}$ , $Z_S = Z_{\text{Sopt}}$ , $Z_L = Z_{\text{Lopt}}$ , $f = 100 \text{ MHz}$	$G_{\text{max}}$	-	26.5	-	dB
$I_C = 20 \text{ mA}$ , $V_{CE} = 3 \text{ V}$ , $Z_S = Z_{\text{Sopt}}$ , $Z_L = Z_{\text{Lopt}}$ , $f = 1.8 \text{ GHz}$		-	17.5	-	
$f = 3 \text{ GHz}$		-	12.5	-	
Transducer gain  $I_C = 3 \text{ mA}$ , $V_{CE} = 1.5 \text{ V}$ , $Z_S = Z_L = 50\Omega$ , $f = 100 \text{ MHz}$	$ S_{21e} ^2$	-	20	-	dB
$I_C = 20 \text{ mA}$ , $V_{CE} = 3 \text{ V}$ , $Z_S = Z_L = 50\Omega$ , $f = 1.8 \text{ GHz}$		-	15	-	
$f = 3 \text{ GHz}$		-	10.5	-	
Third order intercept point at output <sup>2)</sup>  $V_{CE} = 3 \text{ V}$ , $I_C = 20 \text{ mA}$ , $f = 100 \text{ MHz}$	$IP3$	-	23.5	-	dBm
$V_{CE} = 3 \text{ V}$ , $I_C = 20 \text{ mA}$ , $f = 1.8 \text{ GHz}$		-	27.5	-	
1dB compression point at output  $V_{CE} = 3 \text{ V}$ , $I_C = 20 \text{ mA}$ , $Z_S = Z_L = 50\Omega$ , $f = 100 \text{ MHz}$	$P_{-1\text{dB}}$	-	9.5	-	
$V_{CE} = 3 \text{ V}$ , $I_C = 20 \text{ mA}$ , $Z_S = Z_L = 50\Omega$ , $f = 1.8 \text{ GHz}$		-	11.5	-	
$V_{CE} = 3 \text{ V}$ , $I_C = 35 \text{ mA}$ , $Z_S = Z_L = 50\Omega$ , $f = 1.8 \text{ GHz}$		-	13	-	

<sup>1)</sup> $G_{\text{ma}} = |S_{21} / S_{12}| (k - (k^2 - 1)^{1/2})$ ,  $G_{\text{ms}} = |S_{21} / S_{12}|$ 
<sup>2)</sup>IP3 value depends on termination of all intermodulation frequency components.

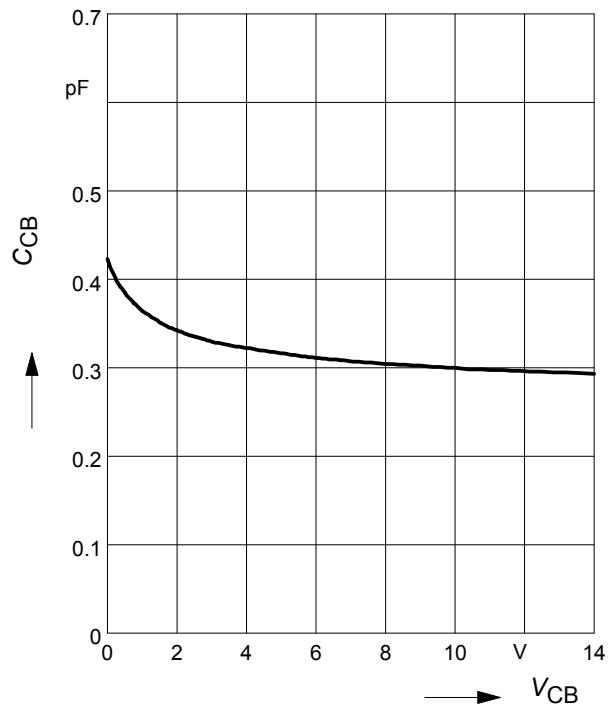
Termination used for this measurement is  $50\Omega$  from 0.1 MHz to 6 GHz

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



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

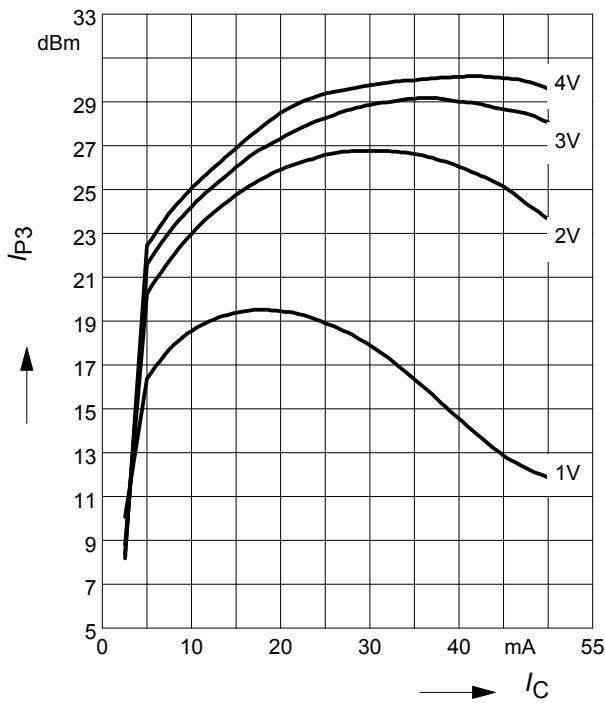
$f = 1\text{MHz}$



**Third order Intercept Point  $IP3 = f(I_C)$**

(Output,  $Z_S = Z_L = 50\Omega$ )

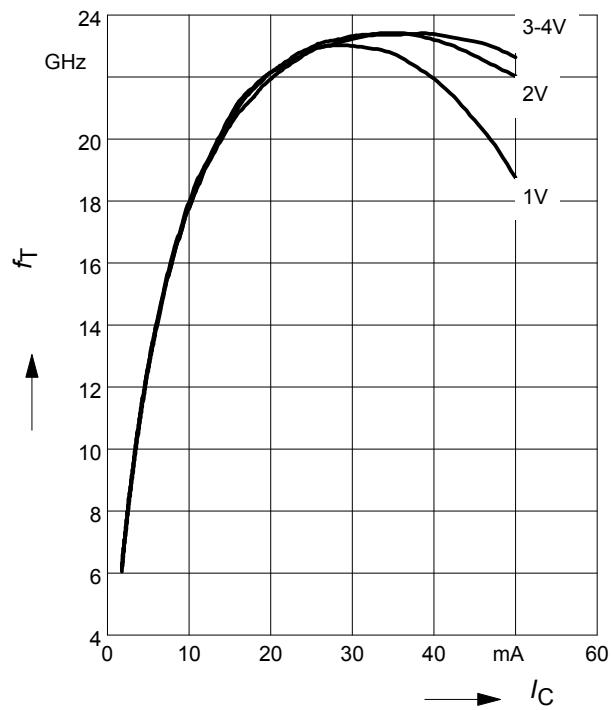
$V_{\text{CE}}$  = parameter,  $f = 1800\text{ MHz}$



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

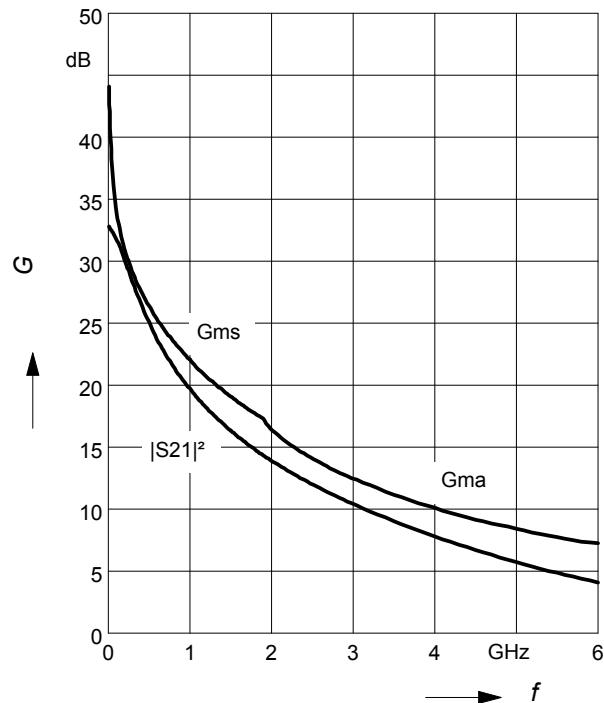
$f = 1\text{ GHz}$

$V_{\text{CE}}$  = parameter



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

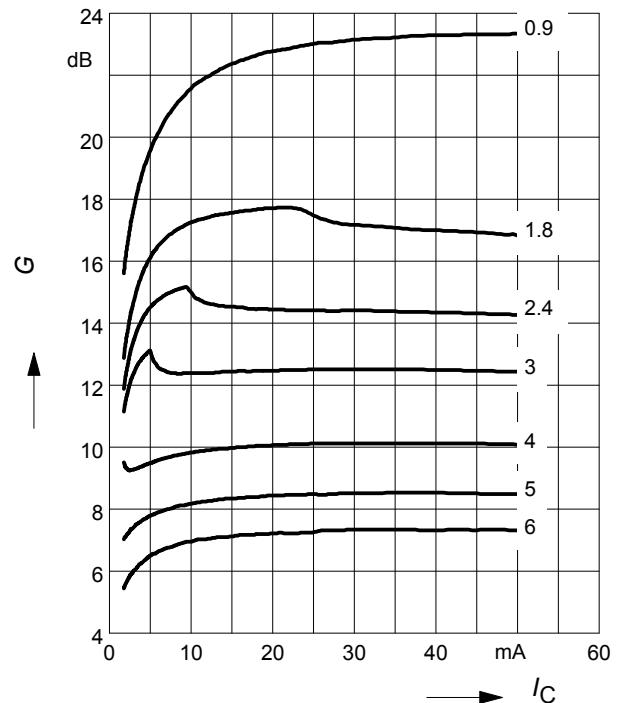
$V_{CE} = 3 \text{ V}$ ,  $I_C = 20 \text{ mA}$



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

$V_{CE} = 3 \text{ V}$

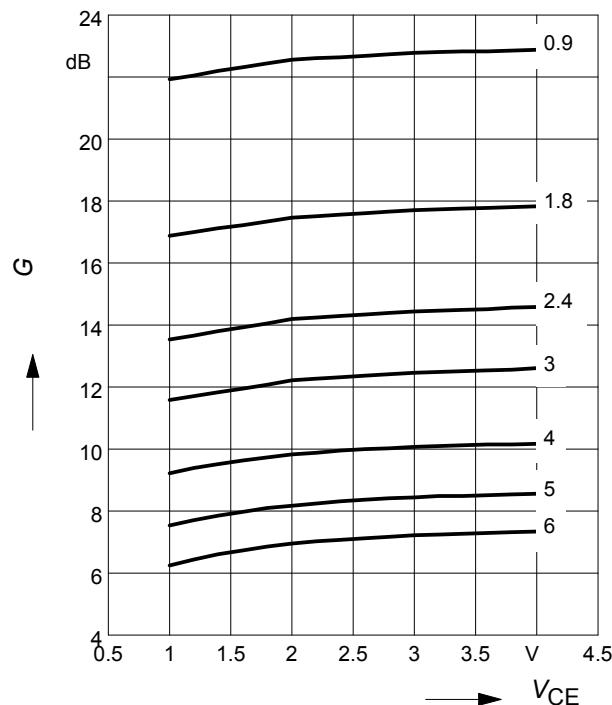
$f = \text{parameter in GHz}$



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

$I_C = 20 \text{ mA}$

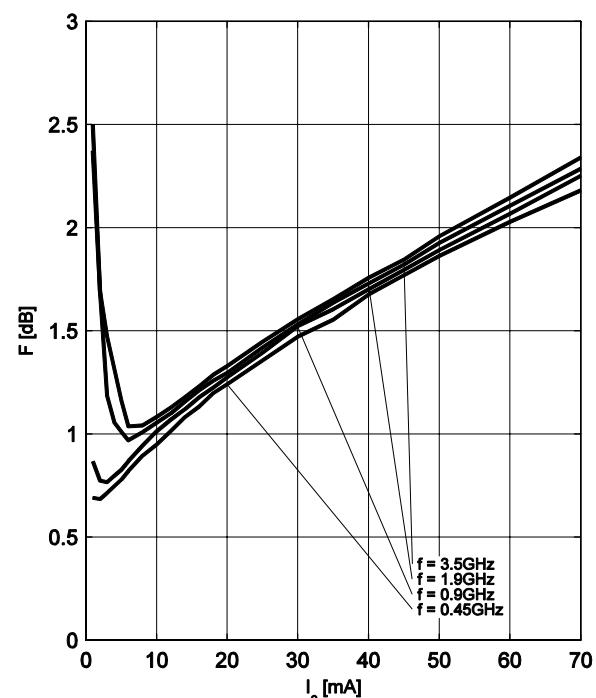
$f = \text{parameter in GHz}$



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

$V_{CE} = 2 \text{ V}$ ,  $f = \text{parameter}$

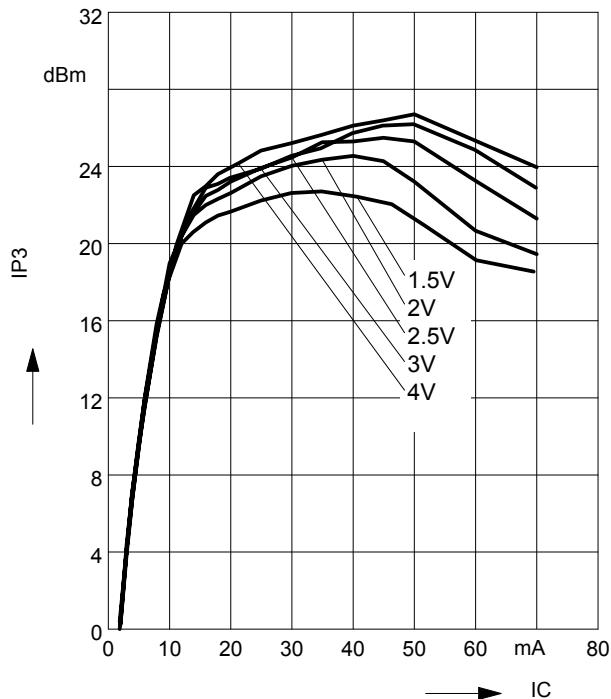
$Z_S = Z_{Sopt}$



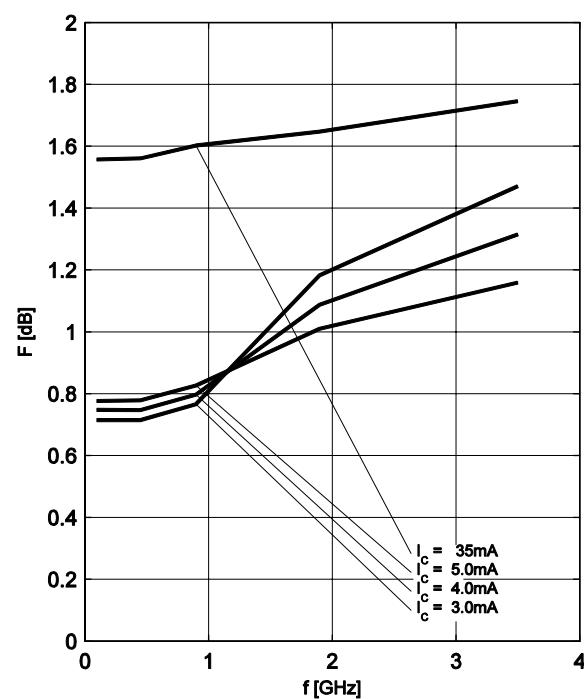
**Third order Intercept Point  $IP_3 = f(I_C)$** 

(Output,  $Z_S = Z_L = 50\Omega$ )

$V_{CE} = \text{parameter}$ ,  $f = 100\text{MHz}$

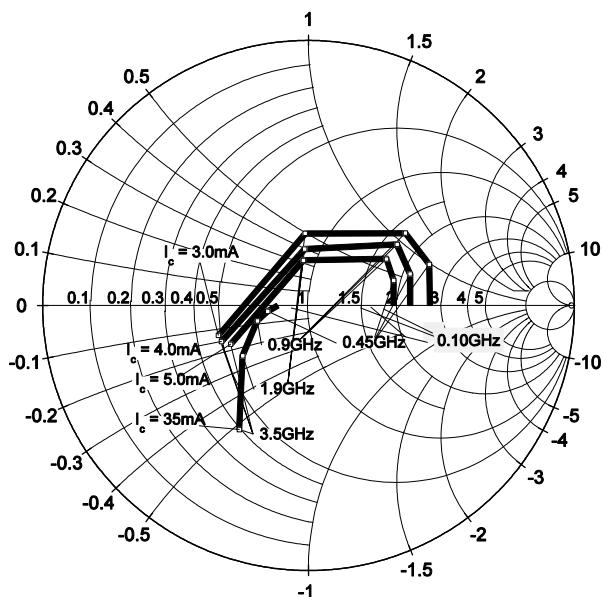

**Noise figure  $F = f(f)$** 

$V_{CE} = 2\text{V}$ ,  $Z_S = Z_{S\text{opt}}$ ,  $I_C = \text{parameter}$


**Source impedance for min.**

noise figure vs. frequency

$V_{CE} = 2\text{V}$ ,  $I_C = \text{parameter}$



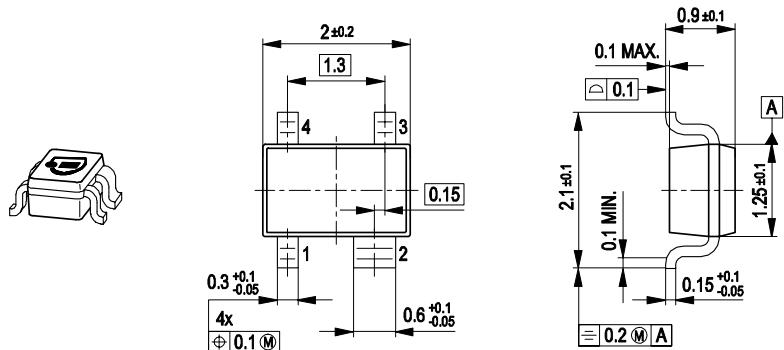
## SPICE GP Model

For the SPICE Gummel Poon (GP) model as well as for the S-parameters (including noise parameters) please refer to our internet website

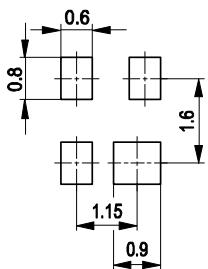
[www.infineon.com/rf.models](http://www.infineon.com/rf.models).

Please consult our website and download the latest versions before actually starting your design. You find the BFP460 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 BFP460 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.

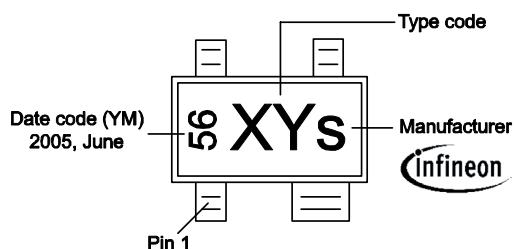
### Package Outline



### Foot Print

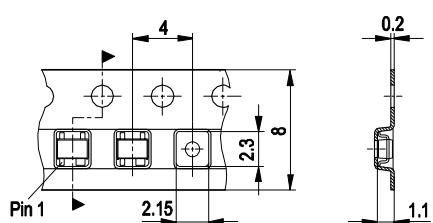


### Marking Layout (Example)



### Standard Packing

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



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