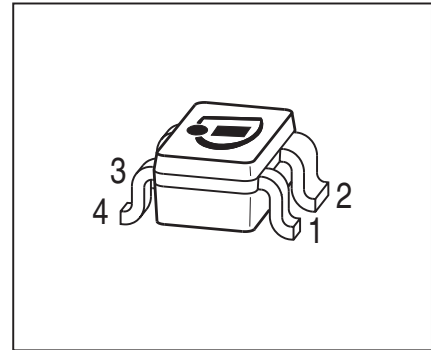


## NPN Silicon RF Transistor

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



**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

Parameter	Symbol	Value	Unit
Collector-emitter voltage $T_A > 0\text{ }^{\circ}\text{C}$ $T_A \leq 0\text{ }^{\circ}\text{C}$	$V_{CEO}$	4.5 4.2	V
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	$^{\circ}\text{C}$
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>	$R_{thJS}$	$\leq 250$	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 $I_C = 1\text{ mA}$ , $I_B = 0$	$V_{(BR)CEO}$	4.5	5.8	-	V
Collector-emitter cutoff current $V_{CE} = 15\text{ V}$ , $V_{BE} = 0$ $V_{CE} = 2\text{ V}$ , $V_{BE} = 0$ $V_{CE} = 5\text{ V}$ , $V_{BE} = 0$ , $T_A = 85^{\circ}\text{C}$ Verified by random sampling	$I_{CES}$	- - -	- 1 2	1000 30 40	nA
Collector-base cutoff current $V_{CB} = 2\text{ V}$ , $I_E = 0$ $V_{CB} = 5\text{ V}$ , $I_E = 0$	$I_{CBO}$	- -	1 -	30 30	
Emitter-base cutoff current $V_{EB} = 0,5\text{ V}$ , $I_C = 0$	$I_{EBO}$	-	1	500	
DC current gain $V_{CE} = 3\text{ V}$ , $I_C = 20\text{ mA}$ , pulse measured	$h_{FE}$	90	120	160	-

<sup>1)</sup>For calculation of  $R_{thJA}$  please refer to Application Note AN077 Thermal Resistance

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics (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 $V_{CB} = 3\text{ V}$ , $f = 1\text{ MHz}$ , $V_{BE} = 0$ , emitter grounded	$C_{cb}$	-	0.32	0.45	pF
Collector emitter capacitance $V_{CE} = 3\text{ V}$ , $f = 1\text{ MHz}$ , $V_{BE} = 0$ , base grounded	$C_{ce}$	-	0.28	-	
Emitter-base capacitance $V_{EB} = 0.5\text{ V}$ , $f = 1\text{ MHz}$ , $V_{CB} = 0$ , collector grounded	$C_{eb}$	-	0.55	-	
Minimum noise figure $V_{CE} = 2\text{V}$ , $I_C = 3\text{ mA}$ , $Z_S = Z_{Sopt}$ , $f = 100\text{ MHz}$ $V_{CE} = 3\text{V}$ , $I_C = 5\text{ mA}$ , $Z_S = Z_{Sopt}$ , $f = 1.8\text{ GHz}$ $V_{CE} = 3\text{V}$ , $I_C = 5\text{ mA}$ , $Z_S = Z_{Sopt}$ , $f = 3\text{ GHz}$	$NF_{min}$	- - -	0.7 1.1 1.2	- - -	dB

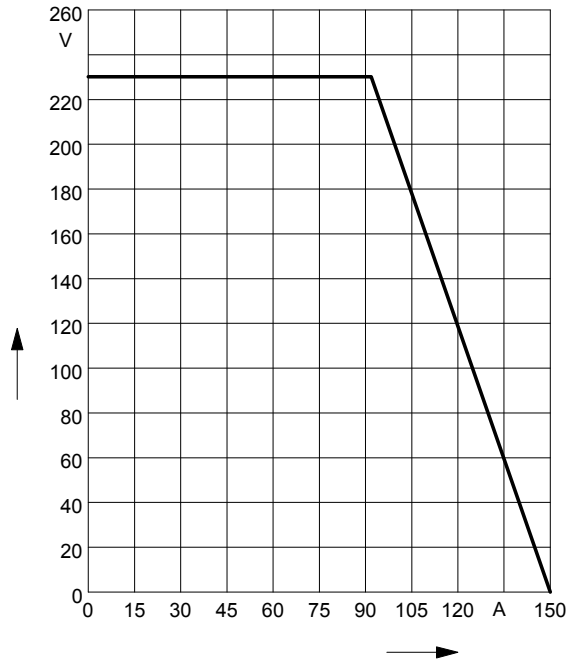
**Electrical Characteristics** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics (verified by random sampling)					
Maximum power Gain <sup>1)</sup> $I_C = 3 \text{ mA}$ , $V_{CE} = 1.5 \text{ V}$ , $Z_S = Z_{Sopt}$ , $Z_L = Z_{Lopt}$ , $f = 100 \text{ MHz}$ $I_C = 20 \text{ mA}$ , $V_{CE} = 3 \text{ V}$ , $Z_S = Z_{Sopt}$ , $Z_L = Z_{Lopt}$ , $f = 1,8 \text{ GHz}$ $f = 3 \text{ GHz}$	$G_{max}$	-	26.5	-	dB
Transducer gain $I_C = 3 \text{ mA}$ , $V_{CE} = 1.5 \text{ V}$ , $Z_S = Z_L = 50\Omega$ , $f = 100 \text{ MHz}$ $I_C = 20 \text{ mA}$ , $V_{CE} = 3 \text{ V}$ , $Z_S = Z_L = 50\Omega$ , $f = 1.8 \text{ GHz}$ $f = 3 \text{ GHz}$	$ S_{21e} ^2$	-	20	-	dB
Third order intercept point at output <sup>2)</sup> $V_{CE} = 3 \text{ V}$ , $I_C = 20 \text{ mA}$ , $f = 100 \text{ MHz}$ $V_{CE} = 3 \text{ V}$ , $I_C = 20 \text{ mA}$ , $f = 1.8 \text{ GHz}$	$IP_3$	-	23.5	-	dBm
1dB compression point at output $V_{CE} = 3\text{V}$ , $I_C = 20\text{mA}$ , $Z_S=Z_L = 50\Omega$ , $f = 100 \text{ MHz}$ $V_{CE} = 3\text{V}$ , $I_C = 20\text{mA}$ , $Z_S=Z_L = 50\Omega$ , $f = 1.8 \text{ GHz}$ $V_{CE} = 3\text{V}$ , $I_C = 35\text{mA}$ , $Z_S=Z_L = 50\Omega$ , $f = 1.8 \text{ GHz}$	$P_{-1dB}$	-	9.5	-	
		-	11.5	-	
		-	13	-	

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

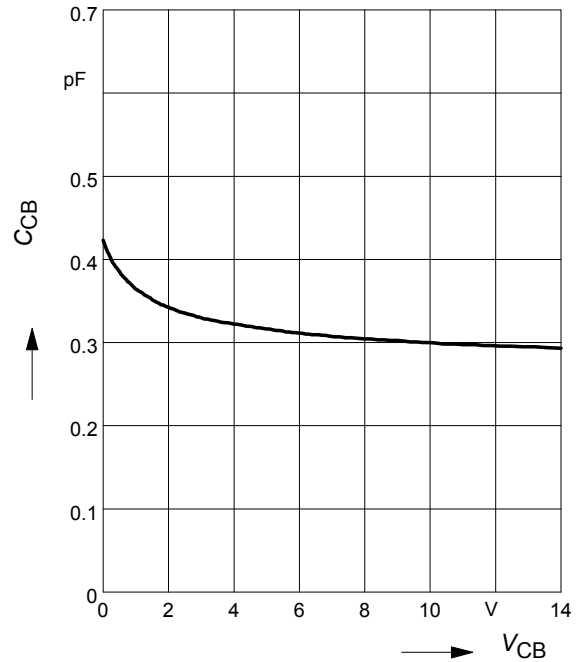
<sup>2)</sup>IP3 value depends on termination of all intermodulation frequency components.  
Termination used for this measurement is  $50\Omega$  from 0.1 MHz to 6 GHz

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



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

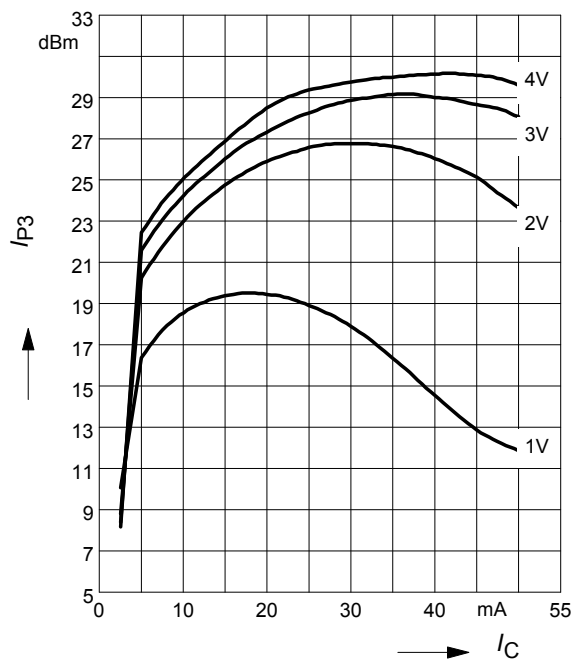
$f = 1\text{MHz}$



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

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

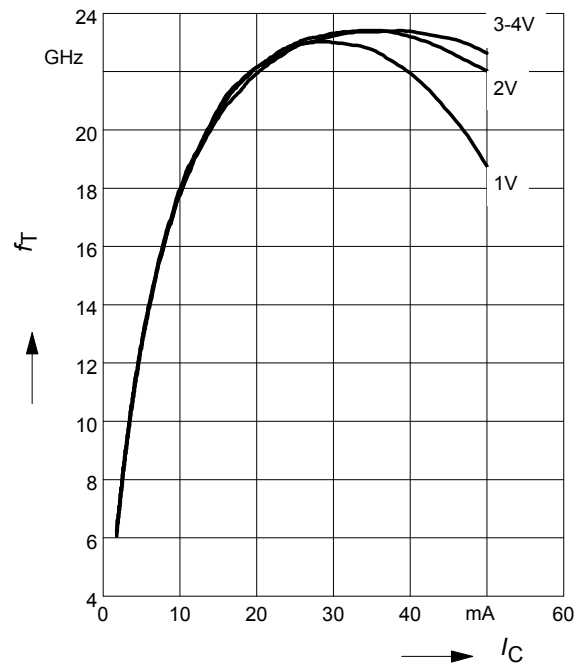
$V_{\text{CE}} = \text{parameter}$ ,  $f = 1800\text{MHz}$



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

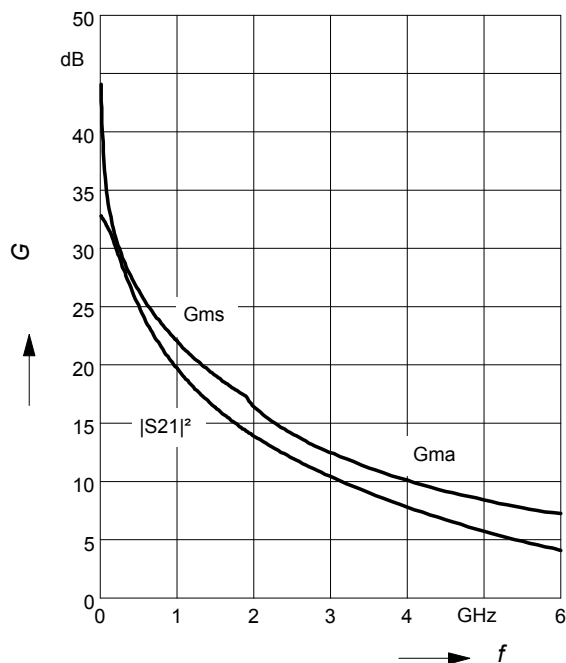
$f = 1\text{GHz}$

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



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

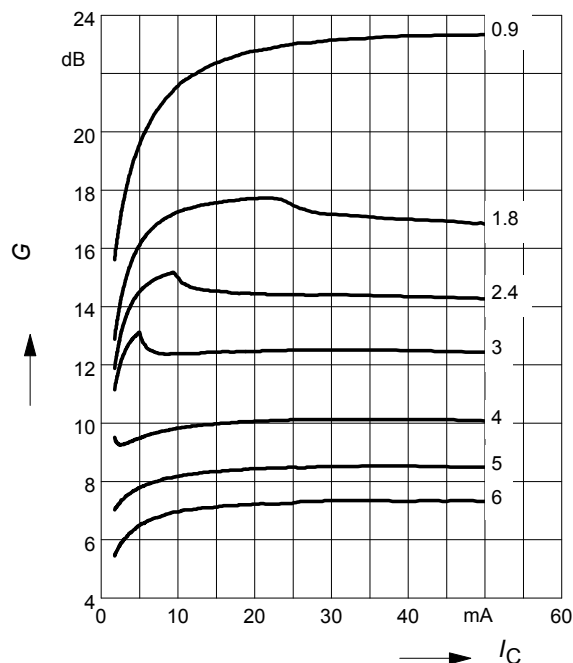
$V_{CE} = 3 \text{ V}$ ,  $I_C = 20 \text{ mA}$



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

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

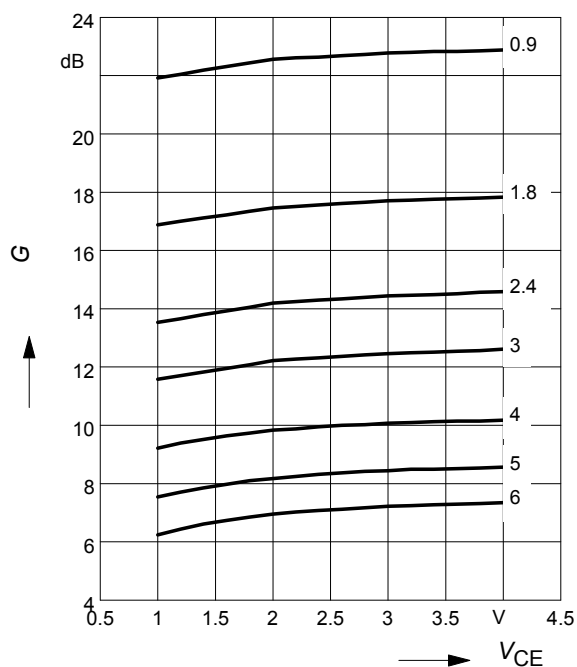
$f = \text{parameter in GHz}$



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

$I_C = 20 \text{ mA}$

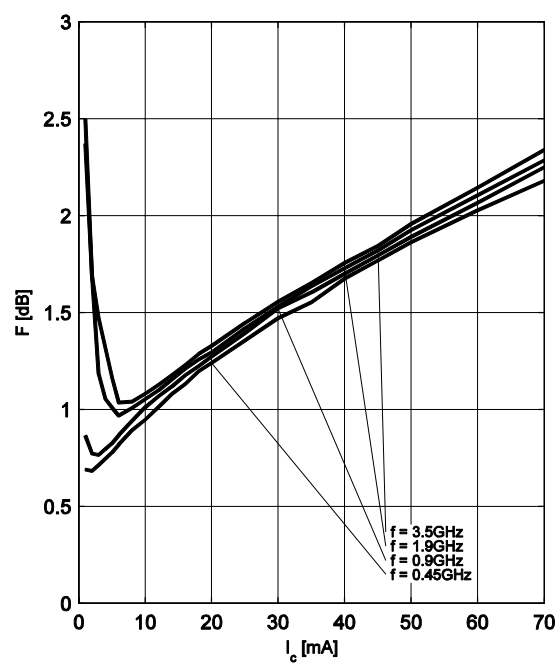
$f = \text{parameter in GHz}$



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

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

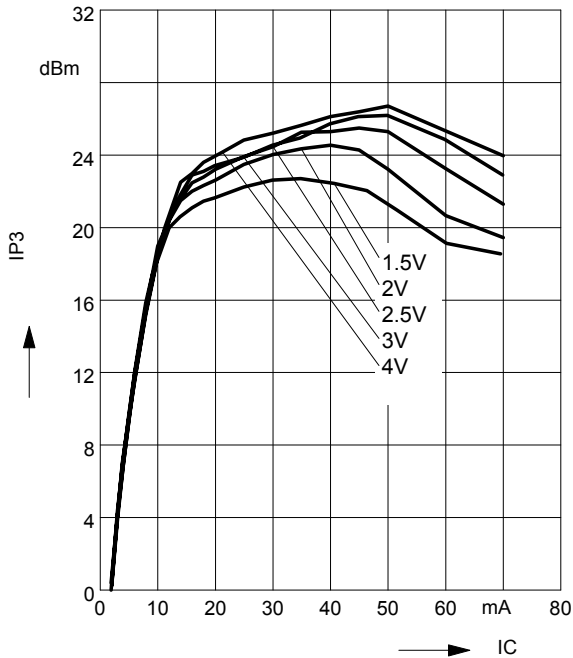
$Z_S = Z_{\text{Sopt}}$



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

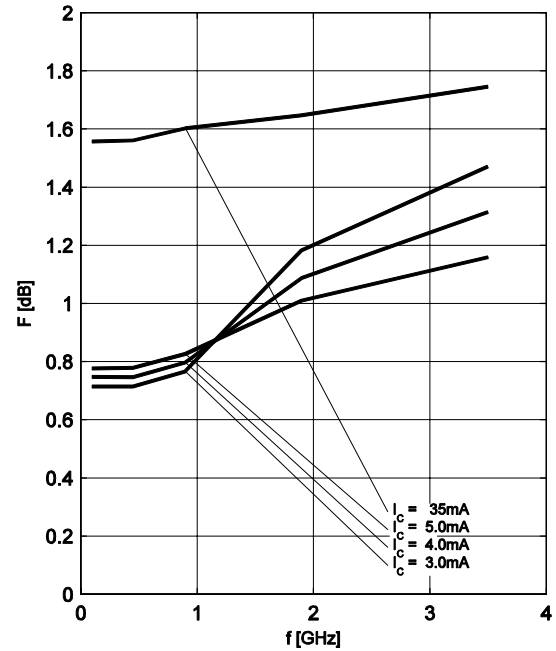
(Output,  $Z_S = Z_L = 50\Omega$ )

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



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

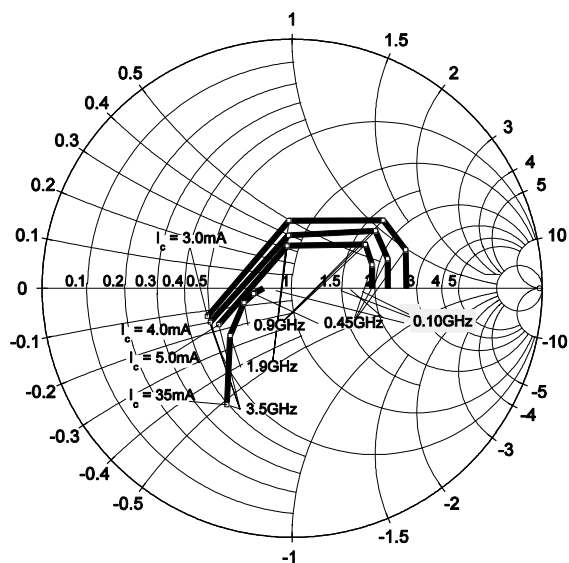
$V_{CE} = 2V$ ,  $Z_S = Z_{Sopt}$ ,  $I_C = \text{parameter}$



### Source impedance for min.

noise figure vs. frequency

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



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**SPICE Parameter**

For the SPICE 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.

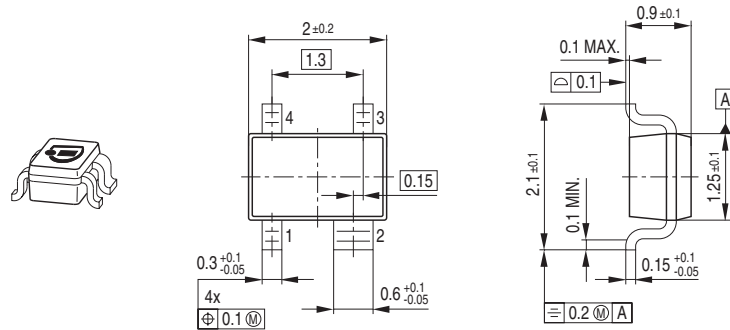
You find the BFP460 SPICE model in the internet in MWO- and ADS- format which you can import into these circuit simulation tools very quickly and conveniently.

The simulation data have been generated and verified using typical devices.

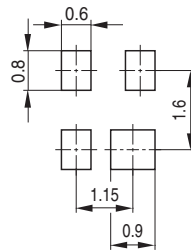
The BFP460 SPICE model reflects the typical DC- and RF-performance with high accuracy.



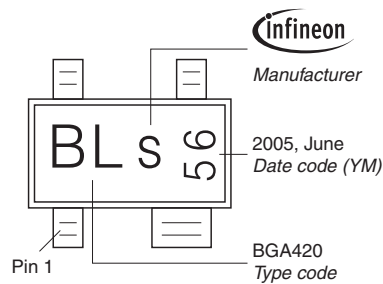
## Package Outline



## Foot Print

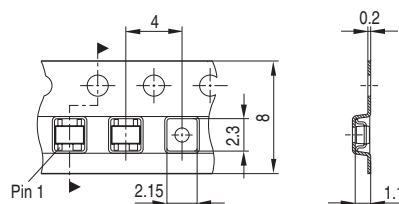


## Marking Layout (Example)



## Standard Packing

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



**Datasheet Revision History: 17 May 2010**

This datasheet replaces the revision from 14 August 2008.

The product itself has not been changed and the device characteristics remain unchanged. Only the product description and information available in the datasheet has been expanded and updated.

<b>Previous Revision: 14 August 2008</b>	
<b>Page</b>	<b>Subject (changes since last revision)</b>
1	Maximum ratings for collector current $I_{Cmax}$ , base current $I_{Bmax}$ and total power dissipation $P_{tot}$ increased
2	Typical values for leakage currents included, maximum leakage current values reduced
3	Noise description at 100 MHz added
4	Gain and linearity description at 100 MHz added
5 - 7	Curves for $IP_3$ and noise at 100 MHz added

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