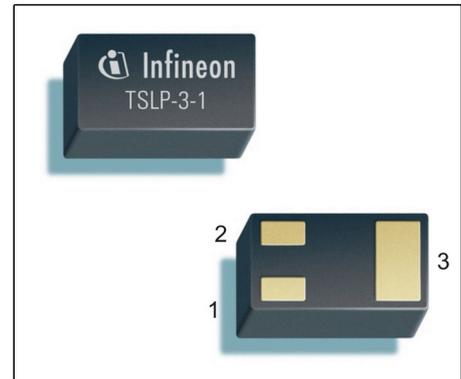


**Low Noise Silicon Bipolar RF Transistor**

- For low voltage / low current applications
- Ideal for VCO modules and low noise amplifiers
- Low noise figure: 1.1 dB at 1.8 GHz
- Excellent ESD performance  
typical value 1500V (HBM)
- High  $f_T$  of 22 GHz
- Pb-free (RoHS compliant) and halogen-free thin small leadless package
- Qualification report according to AEC-Q101 available



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

Type	Marking	Pin Configuration			Package
BFR460L3	AB	1 = B	2 = E	3 = C	TSLP-3-1

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

Parameter	Symbol	Value	Unit
Collector-emitter voltage	$V_{CEO}$		V
$T_A = 25\text{ °C}$		4.5	
$T_A = -55\text{ °C}$		4.2	
Collector-emitter voltage	$V_{CES}$	15	
Collector-base voltage	$V_{CBO}$	15	
Emitter-base voltage	$V_{EBO}$	1.5	
Collector current	$I_C$	50	mA
Base current	$I_B$	5	
Total power dissipation <sup>1)</sup>	$P_{tot}$	200	mW
$T_S \leq 108\text{ °C}$			
Junction temperature	$T_J$	150	°C
Storage temperature	$T_{Stg}$	-55 ... 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>	$R_{thJS}$	210	K/W

**Electrical Characteristics at  $T_A = 25\text{ °C}$ , 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 $V_{CE} = 15\text{ V}$ , $V_{BE} = 0$	$I_{CES}$	-	-	10	$\mu\text{A}$
Collector-base cutoff current $V_{CB} = 5\text{ V}$ , $I_E = 0$	$I_{CBO}$	-	-	100	nA
Emitter-base cutoff current $V_{EB} = 0,5\text{ V}$ , $I_C = 0$	$I_{EBO}$	-	-	1	$\mu\text{A}$
DC current gain $I_C = 20\text{ mA}$ , $V_{CE} = 3\text{ V}$ , pulse measured	$h_{FE}$	90	120	160	-

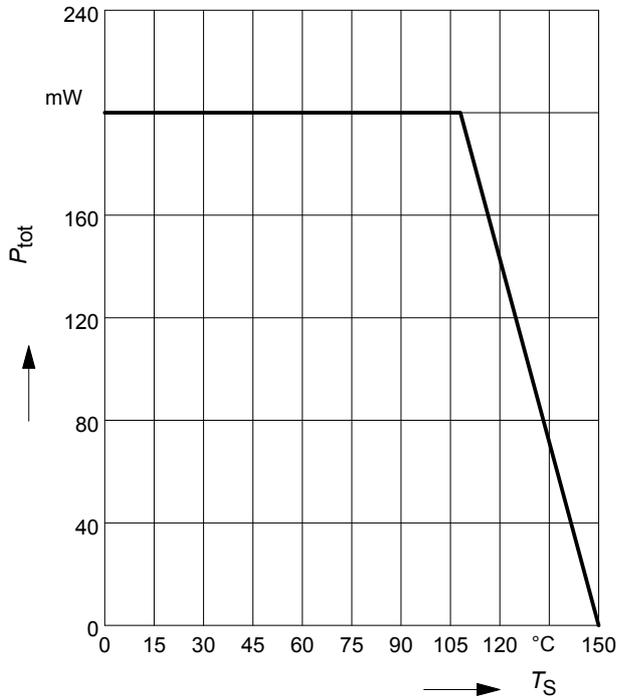
<sup>1)</sup>For the definition of  $R_{thJS}$  please refer to Application Note AN077 (Thermal Resistance Calculation)

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

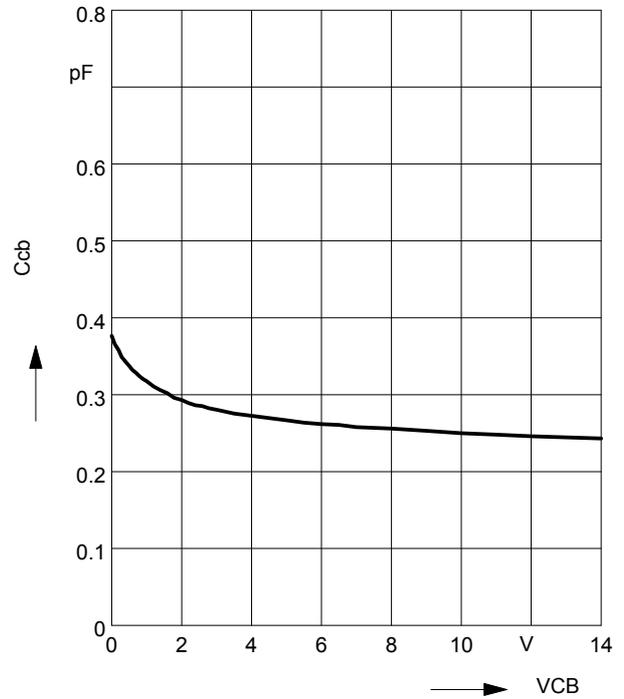
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>AC Characteristics (verified by random sampling)</b>					
Transition frequency $I_C = 30\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $f = 1\text{ GHz}$	$f_T$	16	22	-	GHz
Collector-base capacitance $V_{CB} = 3\text{ V}$ , $f = 1\text{ MHz}$ , $V_{BE} = 0$ , emitter grounded	$C_{cb}$	-	0.28	0.45	pF
Collector emitter capacitance $V_{CE} = 3\text{ V}$ , $f = 1\text{ MHz}$ , $V_{BE} = 0$ , base grounded	$C_{ce}$	-	0.14	-	
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 $I_C = 5\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $Z_S = Z_{Sopt}$ , $f = 1.8\text{ GHz}$ $f = 3\text{ GHz}$	$NF_{min}$	-	1.1 1.35	-	dB
Power gain, maximum stable <sup>1)</sup> $I_C = 20\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $Z_S = Z_{Sopt}$ , $Z_L = Z_{Lopt}$ , $f = 1.8\text{ GHz}$	$G_{ms}$	-	16.0	-	dB
Power gain, maximum available <sup>1)</sup> $I_C = 20\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $Z_S = Z_{Sopt}$ , $Z_L = Z_{Lopt}$ , $f = 3\text{ GHz}$	$G_{ma}$	-	11	-	dB
Transducer gain $I_C = 20\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $Z_S = Z_L = 50\Omega$ , $f = 1.8\text{ GHz}$ $f = 3\text{ GHz}$	$ S_{21e} ^2$	-	14 10	-	dB
Third order intercept point at output <sup>2)</sup> $V_{CE} = 3\text{ V}$ , $I_C = 20\text{ mA}$ , $f = 1.8\text{ GHz}$	$IP3$	-	27	-	dBm
1dB compression point at output $I_C = 20\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $f = 1.8\text{ GHz}$	$P_{-1dB}$	-	11.5	-	

<sup>1)</sup> $G_{ma} = |S_{21} / S_{12}| (k - (k^2 - 1)^{1/2})$ ,  $G_{ms} = |S_{21} / S_{12}|$ 
<sup>2)</sup>IP3 value depends on termination of all intermodulation frequency components.  
Termination used for this measurement is 50Ω from 0.1 MHz to 6 GHz

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



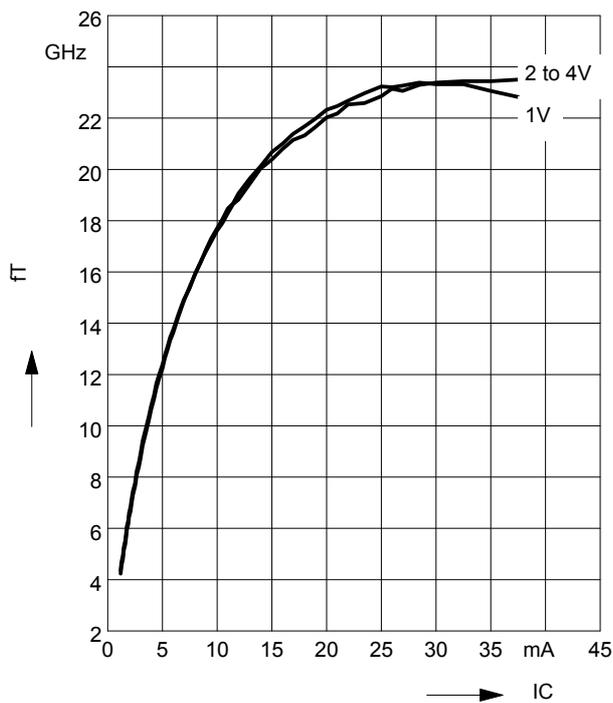
**Collector-base capacitance  $C_{cb} = f(V_{CB})$   
 $f = 1\text{ MHz}$**



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

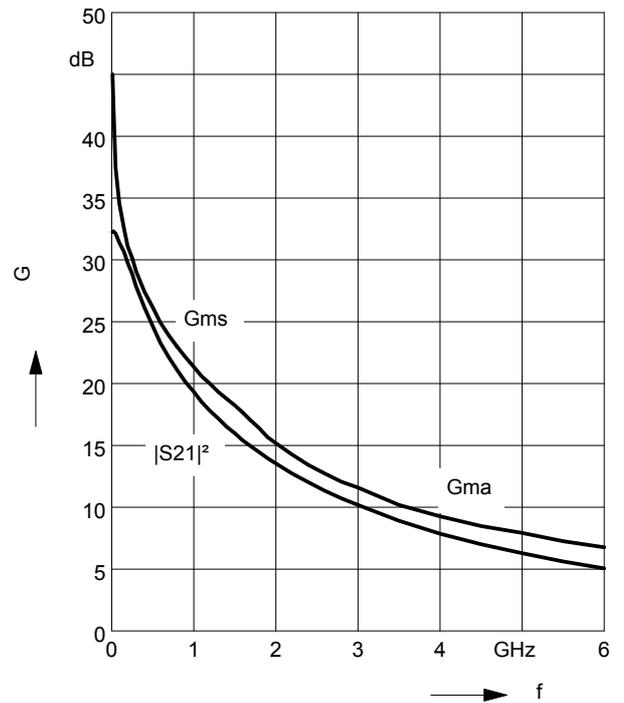
$f = 1\text{ GHz}$

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



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

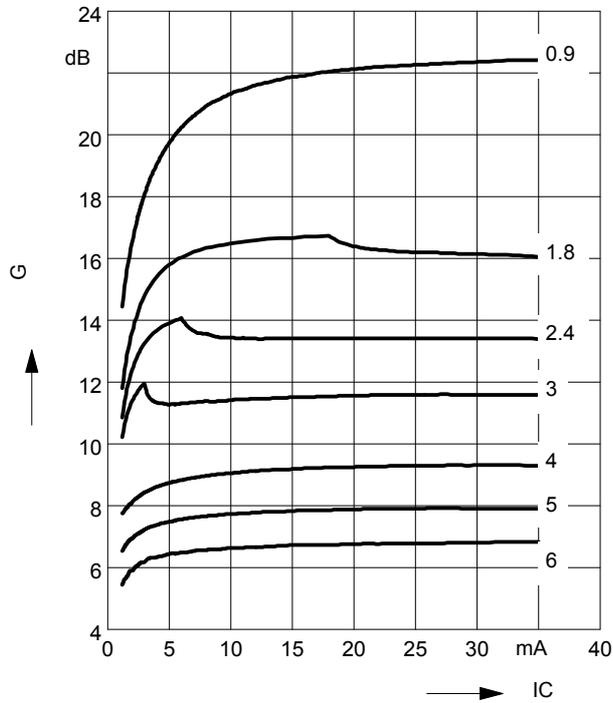
$V_{CE} = 3\text{ V}, I_C = 20\text{ mA}$



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

$V_{CE} = 3V$

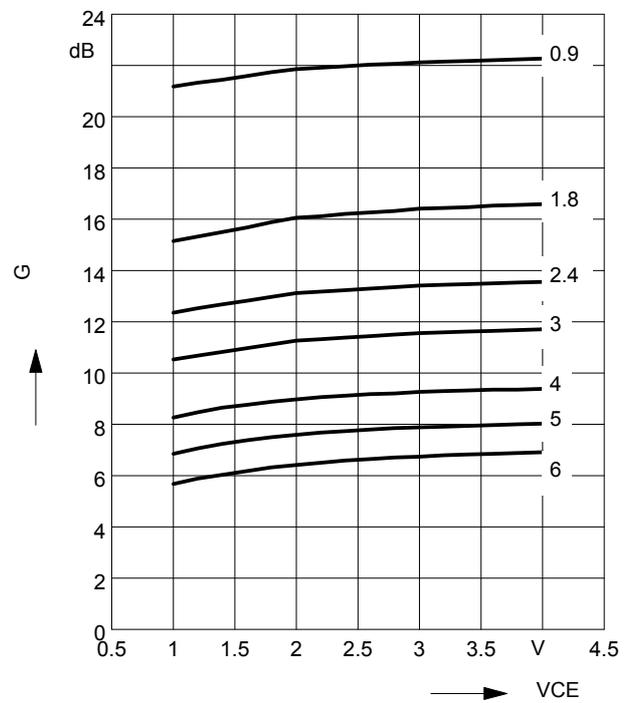
$f =$  parameter in GHz



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

$I_C = 20\text{ mA}$

$f =$  parameter in GHz

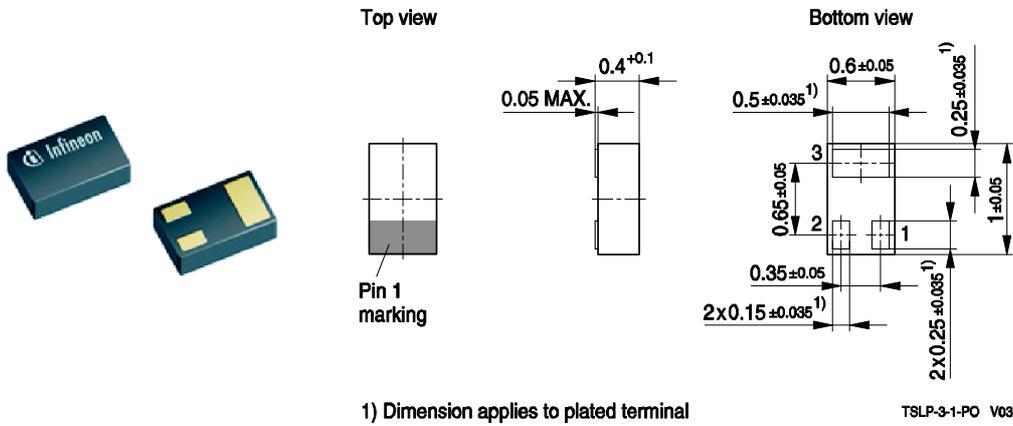


**SPICE GP Model**

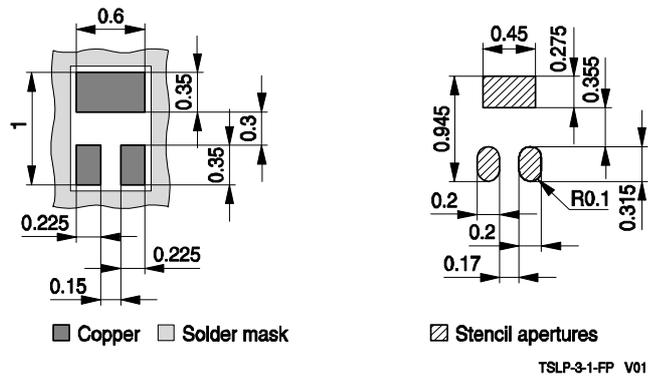
For the SPICE Gummel Poon (GP) model as well as for the S-parameters (including noise parameters) please refer to our internet website [www.infineon.com/rf.models](http://www.infineon.com/rf.models).

Please consult our website and download the latest versions before actually starting your design. You find the BFR460L3 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 BFR460L3 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.

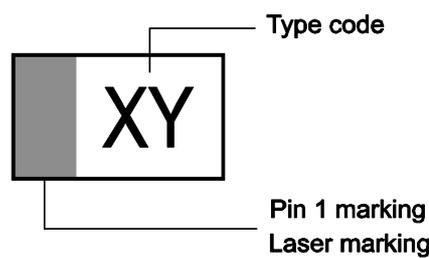
### Package Outline



### Foot Print

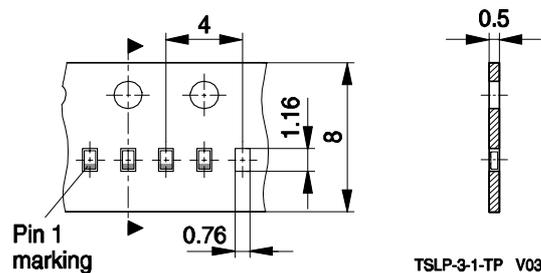


### Marking Layout (Example)



### Standard Packing

Reel Ø 330 mm: 15.000 Pieces/ Reel



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