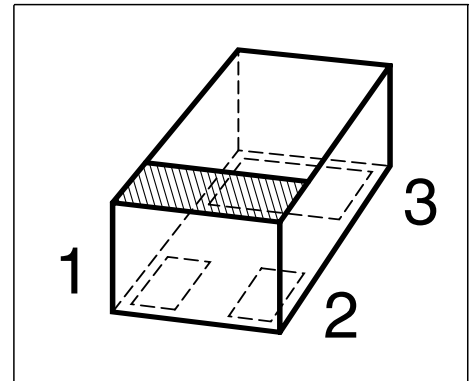


**NPN Silicon RF Transistor**

Preliminary data

- For low voltage / low current applications
- Ideal for VCO modules and low noise amplifiers
- Low noise figure: 1.1 dB at 1.8 GHz
- World's smallest SMD leadless package
- Excellent ESD performance  
typical value > 1500V (HBM)
- High  $f_T$  of 22 GHz


**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**

Parameter	Symbol	Value	Unit
Collector-emitter voltage	$V_{CEO}$	4.5	V
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)2)</sup> $T_S \leq 108^\circ\text{C}$	$P_{tot}$	200	mW
Junction temperature	$T_j$	150	°C
Ambient temperature	$T_A$	-65 ... 150	
Storage temperature	$T_{stg}$	-65 ... 150	

**Thermal Resistance**

Parameter	Symbol	Value	Unit
Junction - soldering point <sup>3)</sup>	$R_{thJS}$	$\leq 210$	K/W

<sup>1)</sup> $P_{tot}$  due to Maximum Ratings

<sup>2)</sup> $T_S$  is measured on the collector lead at the soldering point to the pcb

<sup>3)</sup>For calculation of  $R_{thJA}$  please refer to Application Note Thermal Resistance

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Characteristics</b>					
Collector-emitter breakdown voltage $I_C = 1 \text{ mA}, I_B = 0$	$V_{(BR)CEO}$	4.5	5	-	V
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 $I_C = 20 \text{ mA}, V_{CE} = 3 \text{ V}$	$h_{FE}$	50	130	200	-

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

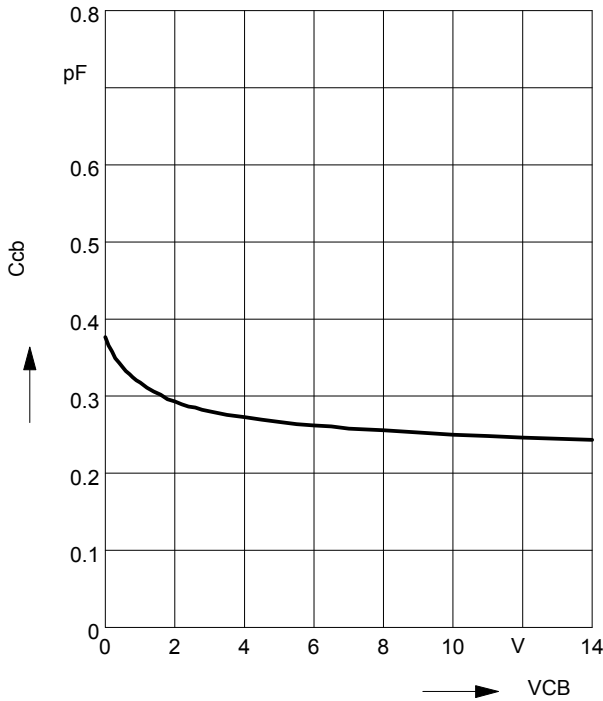
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>AC Characteristics (verified by random sampling)</b>					
Transition frequency $I_C = 30\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $f = 1\text{ GHz}$	$f_T$	16	22	-	GHz
Collector-base capacitance $V_{CB} = 3\text{ V}$ , $f = 1\text{ MHz}$ , emitter grounded	$C_{cb}$	-	0.3	0.45	pF
Collector emitter capacitance $V_{CE} = 3\text{ V}$ , $f = 1\text{ MHz}$ , base grounded	$C_{ce}$	-	0.14	-	
Emitter-base capacitance $V_{EB} = 0.5\text{ V}$ , $f = 1\text{ MHz}$ , collector grounded	$C_{eb}$	-	0.55	-	
Noise figure $I_C = 5\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $Z_S = Z_{Sopt}$ , $f = 1.8\text{ GHz}$ $I_C = 5\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $Z_S = Z_{Sopt}$ , $f = 3\text{ GHz}$	$F$	-	1.1	-	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 $I_C = 20\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $Z_S = Z_L = 50\Omega$ , $f = 1.8\text{ GHz}$ $I_C = 20\text{ mA}$ , $V_{CE} = 3\text{ V}$ , $Z_S = Z_L = 50\Omega$ , $f = 3\text{ GHz}$	$ S_{21e} ^2$	-	14	-	dB
Third order intercept point at output <sup>2)</sup> $V_{CE} = 3\text{ V}$ , $I_C = 20\text{ mA}$ , $f = 1.8\text{ GHz}$	$IP_3$	-	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	-	

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

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

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

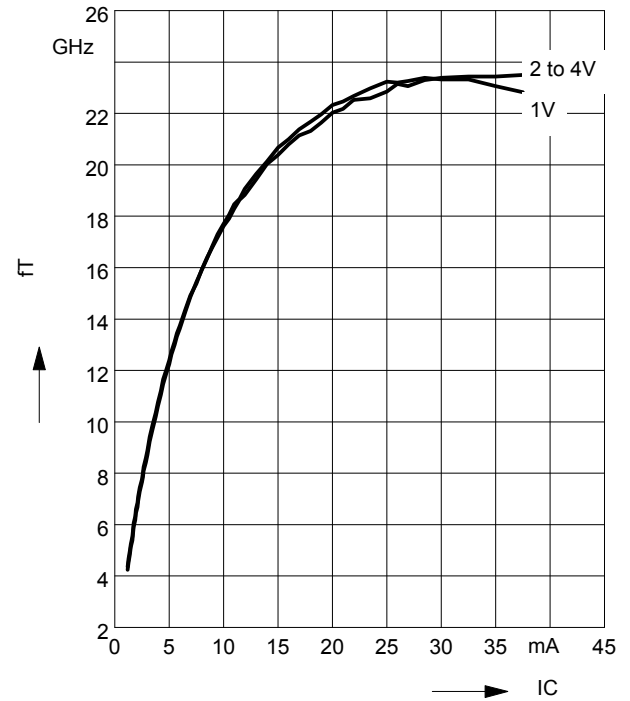
$f = 1\text{MHz}$



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

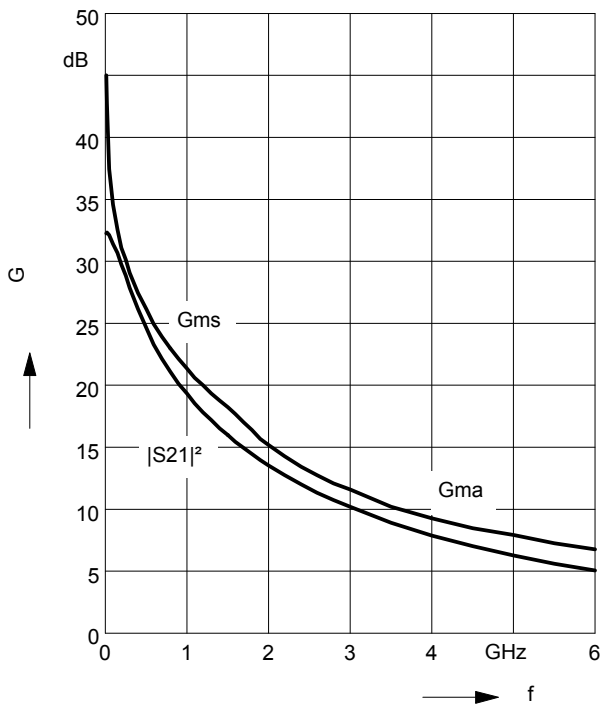
$f = 1\text{GHz}$

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



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

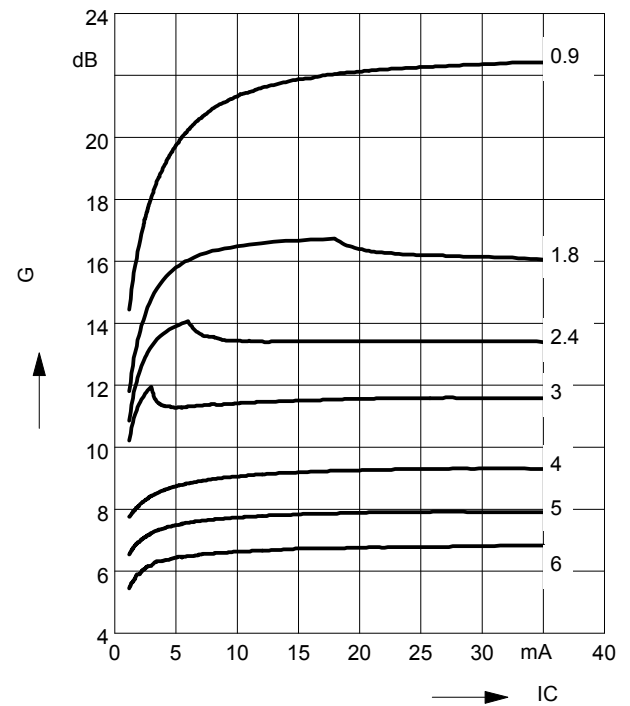
$V_{CE} = 3\text{V}, I_C = 20\text{mA}$



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

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

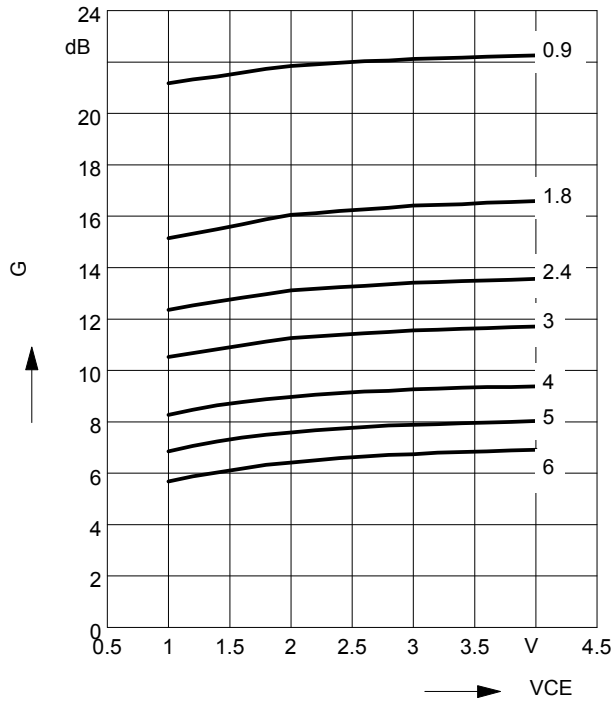
$f = \text{parameter in GHz}$



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

$I_C = 20 \text{ mA}$

$f = \text{parameter in GHz}$



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