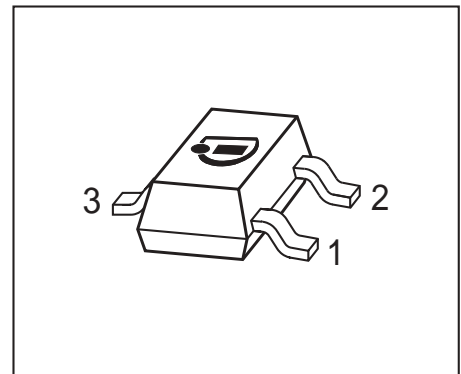


**NPN Silicon AF Transistors**

- For AF input stages and driver applications
- High current gain
- Low collector-emitter saturation voltage
- Low noise between 30 Hz and 15 kHz
- Complementary types: BCW61, BCX71 (PNP)
- Pb-free (RoHS compliant) package<sup>1)</sup>
- Qualified according AEC Q101



Type	Marking	Pin Configuration			Package
		1=B	2=E	3=C	
BCW60B	ABs	1=B	2=E	3=C	SOT23
BCW60C	ACs	1=B	2=E	3=C	SOT23
BCW60D	ADs	1=B	2=E	3=C	SOT23
BCW60FF	AFs	1=B	2=E	3=C	SOT23
BCX70G	AGs	1=B	2=E	3=C	SOT23
BCX70H	AHs	1=B	2=E	3=C	SOT23
BCX70J	AJs	1=B	2=E	3=C	SOT23
BCX70K	AKs	1=B	2=E	3=C	SOT23

<sup>1</sup>Pb-containing package may be available upon special request

**Maximum Ratings**

Parameter	Symbol	Value	Unit
Collector-emitter voltage BCW60, ...60FF BCX70	$V_{CEO}$	32 45	V
Collector-base voltage BCW60, ...60FF BCX70	$V_{CBO}$	32 45	
Emitter-base voltage	$V_{EBO}$	6	
Collector current	$I_C$	100	mA
Peak collector current	$I_{CM}$	200	
Peak base current	$I_{BM}$	200	
Total power dissipation $T_S \leq 71 \text{ }^\circ\text{C}$	$P_{tot}$	330	mW
Junction temperature	$T_j$	150	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-65 ... 150	

**Thermal Resistance**

Parameter	Symbol	Value	Unit
Junction - soldering point <sup>1)</sup>	$R_{thJS}$	$\leq 240$	K/W

<sup>1)</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>DC Characteristics</b>					
Collector-emitter breakdown voltage $I_C = 10\text{ mA}$ , $I_B = 0$ , BCW60, ...60FF $I_C = 10\text{ mA}$ , $I_B = 0$ , BCX70	$V_{(BR)CEO}$	32 45	- -	- -	V
Collector-base breakdown voltage $I_C = 10\text{ }\mu\text{A}$ , $I_E = 0$ , BCW60, ...60FF $I_C = 10\text{ }\mu\text{A}$ , $I_E = 0$ , BCX70	$V_{(BR)CBO}$	32 45	- -	- -	
Emitter-base breakdown voltage $I_E = 1\text{ }\mu\text{A}$ , $I_C = 0$	$V_{(BR)EBO}$	6	-	-	
Collector-base cutoff current $V_{CB} = 32\text{ V}$ , $I_E = 0$ , BCW60, ...60FF $V_{CB} = 45\text{ V}$ , $I_E = 0$ , BCX70 $V_{CB} = 32\text{ V}$ , $I_E = 0$ , $T_A = 150^\circ\text{C}$ , BCW60, ...60FF $V_{CB} = 45\text{ V}$ , $I_E = 0$ , $T_A = 150^\circ\text{C}$ , BCX70	$I_{CBO}$	- - - -	- - - -	0.02 0.02 20 20	$\mu\text{A}$
Emitter-base cutoff current $V_{EB} = 4\text{ V}$ , $I_C = 0$	$I_{EBO}$	-	-	20	nA
DC current gain- $I_C = 10\text{ }\mu\text{A}$ , $V_{CE} = 5\text{ V}$ , $h_{FE}$ -grp. G $I_C = 10\text{ }\mu\text{A}$ , $V_{CE} = 5\text{ V}$ , $h_{FE}$ -grp. B/ H $I_C = 10\text{ }\mu\text{A}$ , $V_{CE} = 5\text{ V}$ , $h_{FE}$ -grp. C/ J/ FF $I_C = 10\text{ }\mu\text{A}$ , $V_{CE} = 5\text{ V}$ , $h_{FE}$ -grp. D/ K $I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $h_{FE}$ -grp. G $I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $h_{FE}$ -grp. B/ H $I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $h_{FE}$ -grp. C/ J/ FF $I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $h_{FE}$ -grp. D/ K $I_C = 50\text{ mA}$ , $V_{CE} = 1\text{ V}$ , $h_{FE}$ -grp. G $I_C = 50\text{ mA}$ , $V_{CE} = 1\text{ V}$ , $h_{FE}$ -grp. B/ H $I_C = 50\text{ mA}$ , $V_{CE} = 1\text{ V}$ , $h_{FE}$ -grp. C/ J/ FF $I_C = 50\text{ mA}$ , $V_{CE} = 1\text{ V}$ , $h_{FE}$ -grp. D/ K	$h_{FE}$	20 20 40 100 120 180 <b>250</b> 380 50 <b>70</b> 90 100	140 200 300 460 170 250 350 500 -	- - - - 220 <b>310</b> 460 630 -	-

**DC Electrical Characteristics**

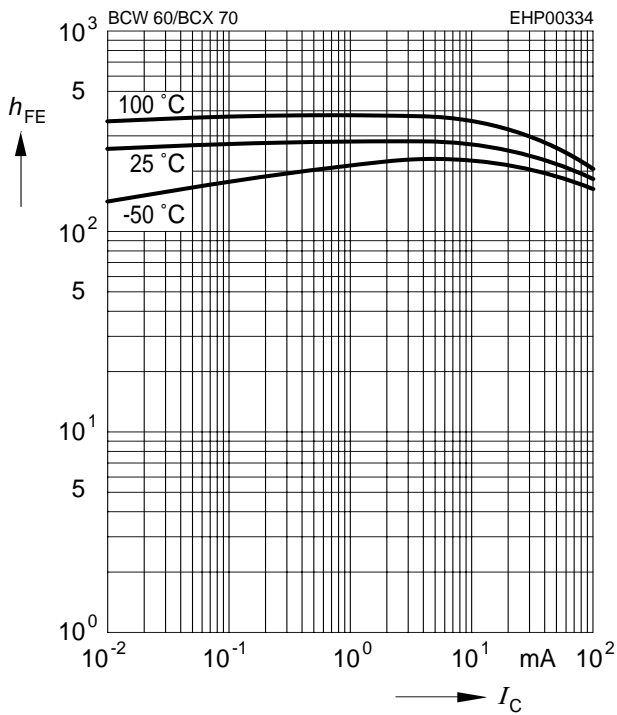
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Characteristics</b>					
Collector-emitter saturation voltage <sup>1)</sup> $I_C = 10 \text{ mA}, I_B = 0.25 \text{ mA}$ $I_C = 50 \text{ mA}, I_B = 1.25 \text{ mA}$	$V_{CEsat}$	- -	0.12 0.2	0.25 0.55	V
Base emitter saturation voltage <sup>1)</sup> $I_C = 10 \text{ mA}, I_B = 0.25 \text{ mA}$ $I_C = 50 \text{ mA}, I_B = 1.25 \text{ mA}$	$V_{BEsat}$	- -	0.7 0.83	0.85 1.05	
Base-emitter voltage <sup>1)</sup> $I_C = 10 \mu\text{A}, V_{CE} = 5 \text{ V}$ $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}$ $I_C = 50 \text{ mA}, V_{CE} = 1 \text{ V}$	$V_{BE(ON)}$	- 0.58 -	0.52 0.65 0.78	- 0.7 -	

<sup>1)</sup>Pulse test:  $t < 300\mu\text{s}$ ;  $D < 2\%$

<b>AC Characteristics</b>					
Transition frequency $I_C = 20 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 100 \text{ MHz}$	$f_T$	-	250	-	MHz
Collector-base capacitance $V_{CB} = 10 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{cb}$	-	0.95	-	pF
Emitter-base capacitance $V_{EB} = 0.5 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{eb}$	-	9	-	
Short-circuit input impedance $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. G $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. B/ H $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. C/ J /FF $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. D/ K	$h_{11e}$	-	2.7 3.6 4.5 7.5	-	k $\Omega$
Open-circuit reverse voltage transf. ratio $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. G $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. B /H $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. C/ J/ FF $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. D/ K	$h_{12e}$	-	1.5 2 2 3	-	10 <sup>-4</sup>
Short-circuit forward current transf. ratio $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. G $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. B/ H $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. C/ J/ FF $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. D/ K	$h_{21e}$	-	200 260 330 520	-	-
Open-circuit output admittance $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. G $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. B/ H $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. C/ J/ FF $I_C = 2 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $h_{FE}$ -grp. D/ K	$h_{22e}$	-	18 24 30 50	-	$\mu\text{S}$
Noise figure $I_C = 200 \mu\text{A}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , D $f = 200 \text{ Hz}$ , $R_S = 2 \text{ k}\Omega$ , $h_{FE}$ -grp. B - K $I_C = 200 \mu\text{A}$ , $V_{CE} = 5 \text{ V}$ , $f = 1 \text{ kHz}$ , $\Delta f = 200 \text{ Hz}$ , $R_S = 2 \text{ k}\Omega$ , $h_{FE}$ -grp. FF	$F$	-	2 1	- 2	dB
Equivalent noise voltage $I_C = 200 \mu\text{A}$ , $V_{CE} = 5 \text{ V}$ , $R_S = 2 \text{ k}\Omega$ , $f = 10 \dots 50 \text{ Hz}$ , $h_{FE}$ -grp. FF	$V_n$	-	-	0.135	$\mu\text{V}$

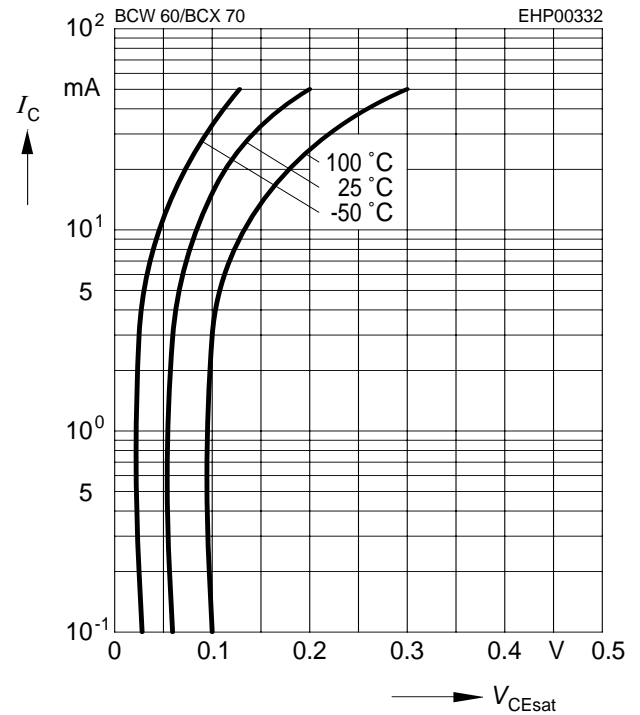
**DC current gain  $h_{FE} = f(I_C)$**

$V_{CE} = 5\text{ V}$



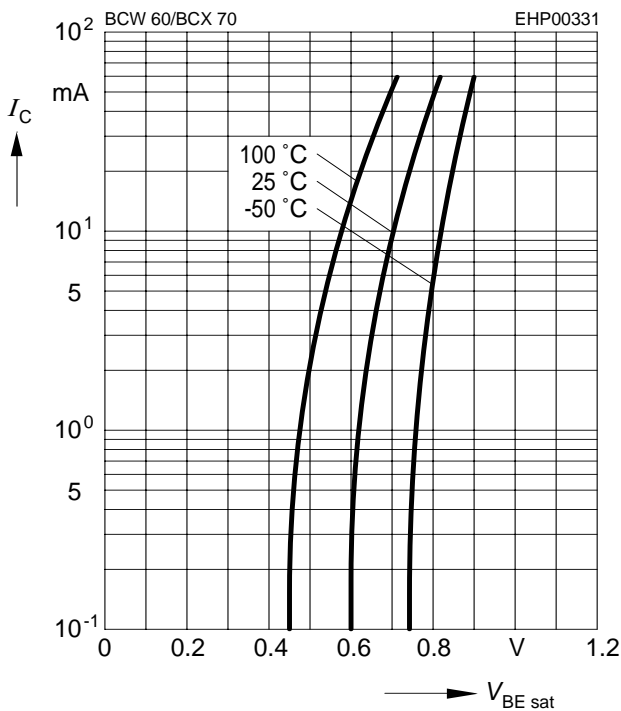
**Collector-emitter saturation voltage**

$I_C = f(V_{CEsat}), h_{FE} = 10$



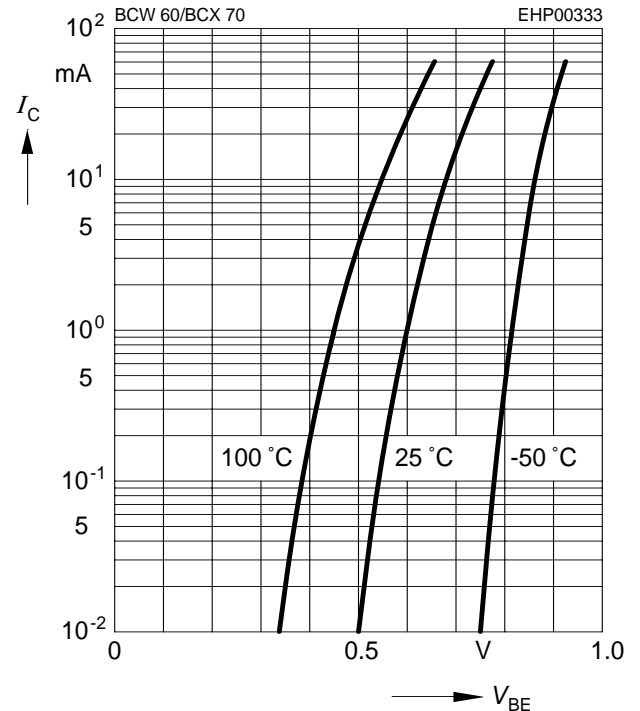
**Base-emitter saturation voltage**

$I_C = f(V_{BEsat}), h_{FE} = 40$



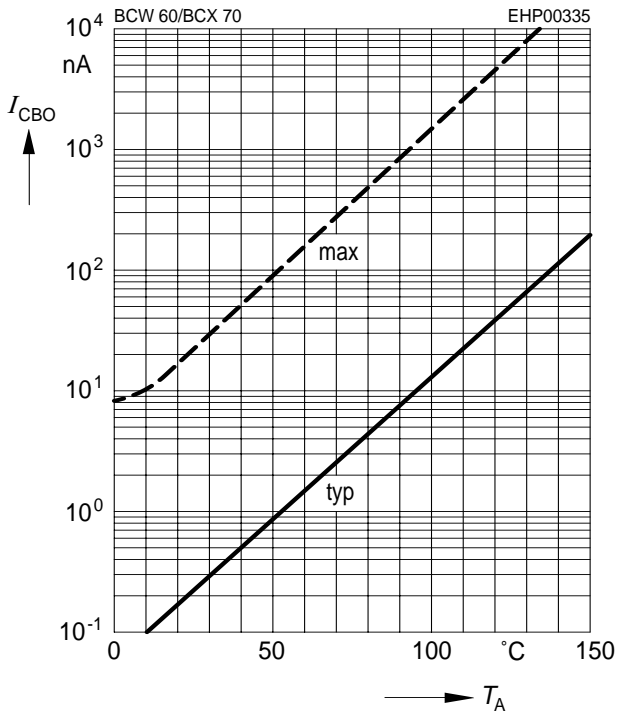
**Collector current  $I_C = f(V_{BE})$**

$V_{CE} = 5\text{ V}$



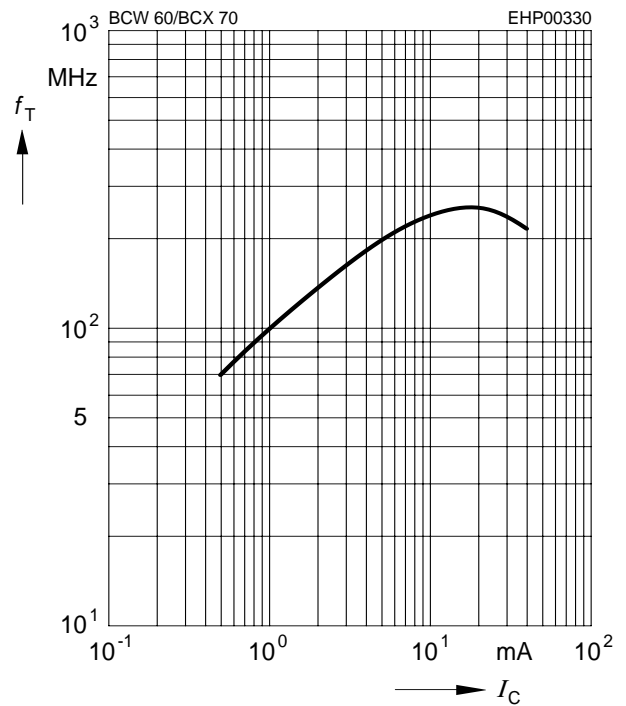
**Collector cutoff current  $I_{CBO} = f(T_A)$**

$V_{CB} = V_{CEmax}$



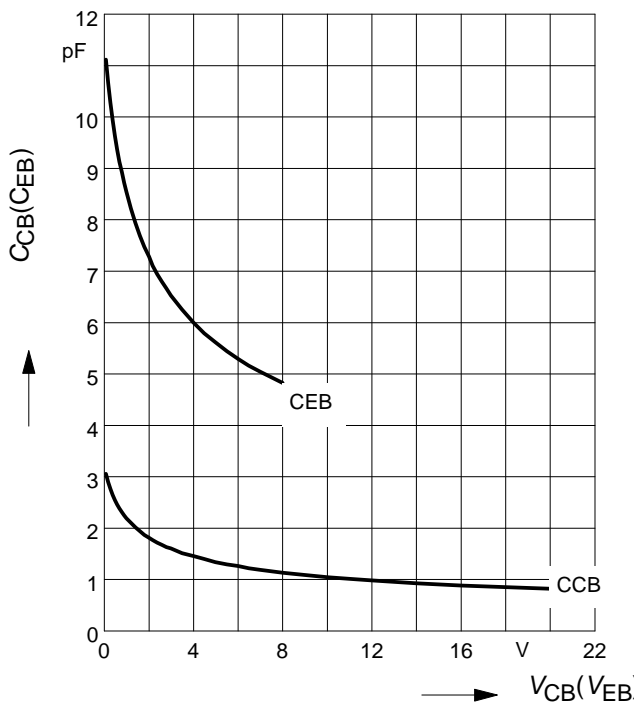
**Transition frequency  $f_T = f(I_C)$**

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

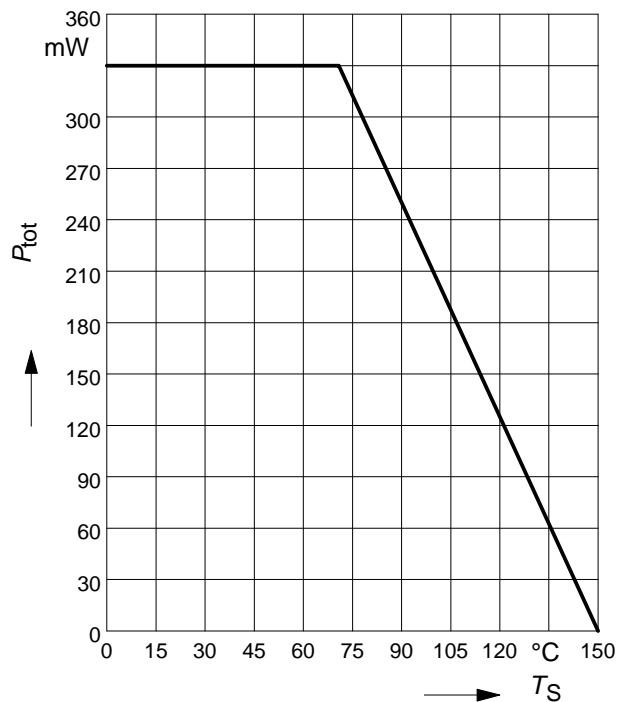


**Collector-base capacitance  $C_{cb} = f(V_{CB})$**

**Emitter-base capacitance  $C_{eb} = f(V_{EB})$**

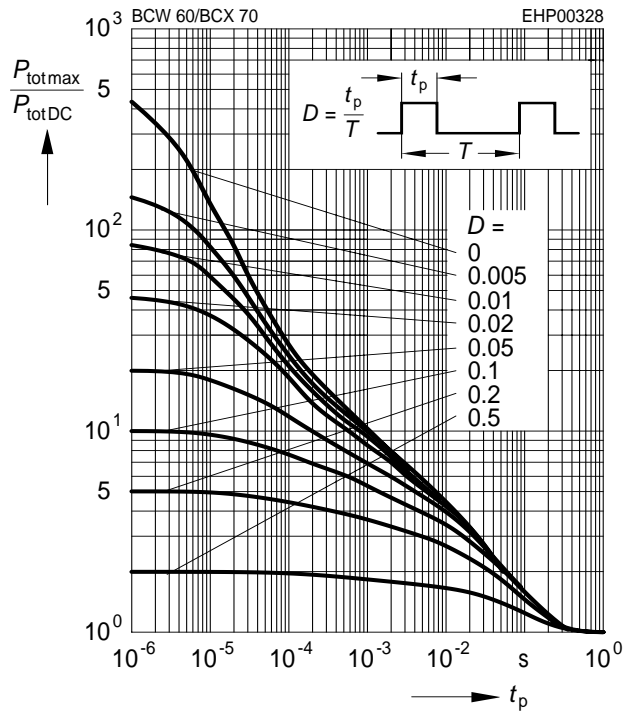


**Total power dissipation  $P_{tot} = f(T_S)$**

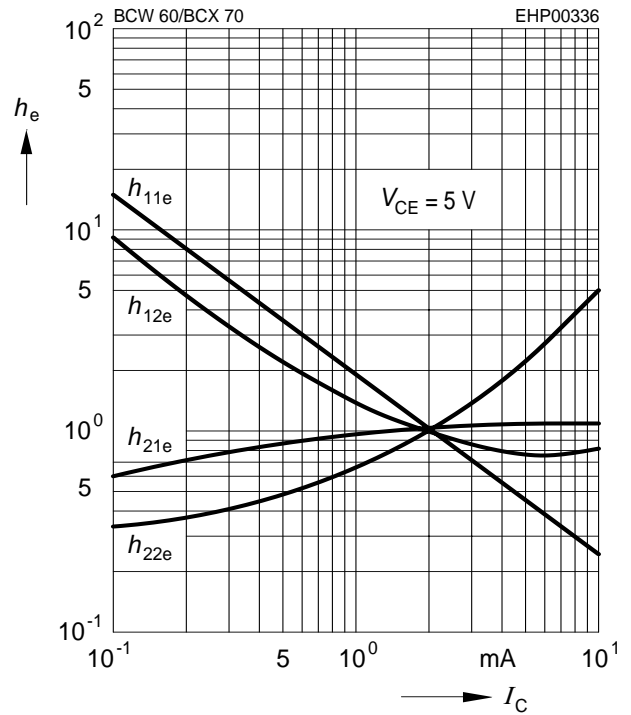


**Permissible Pulse Load**

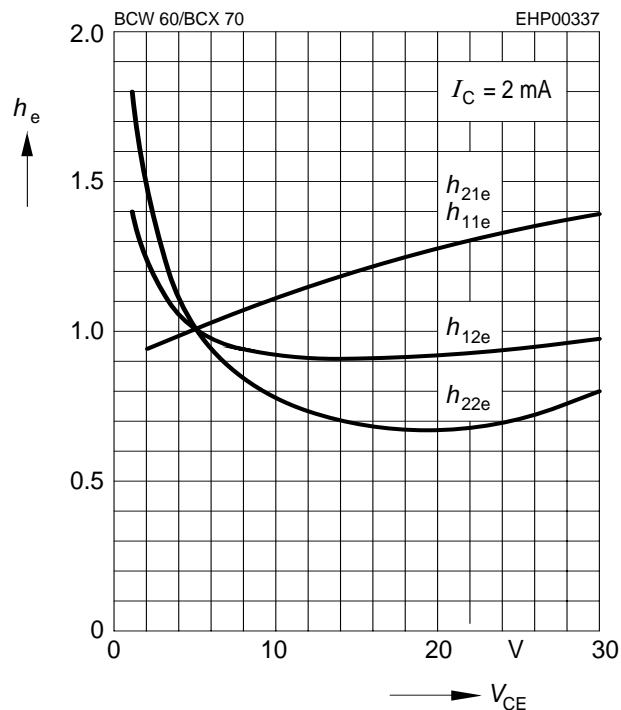
$$P_{\text{totmax}}/P_{\text{totDC}} = f(t_p)$$


**h parameter  $h_e = f(I_C)$  normalized**

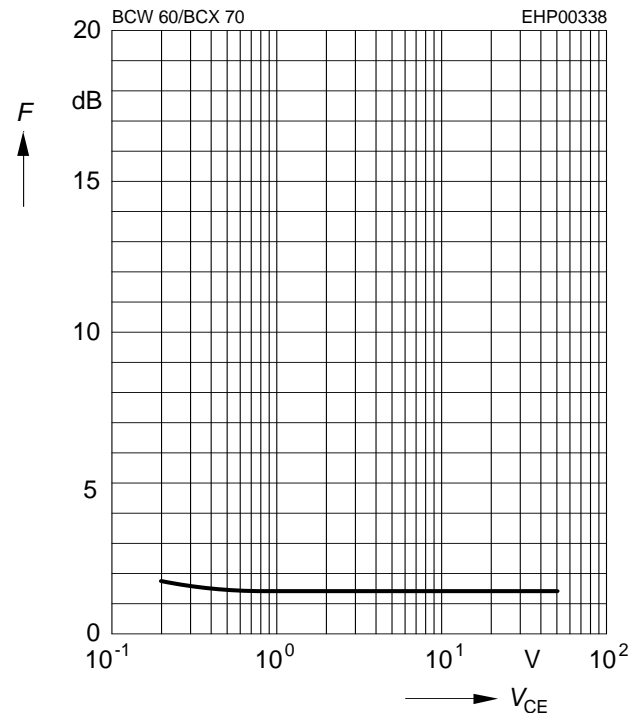
$$V_{CE} = 5V$$


**h parameter  $h_e = f(V_{CE})$  normalized**

$$I_C = 2\text{mA}$$


**Noise figure  $F = f(V_{CE})$** 

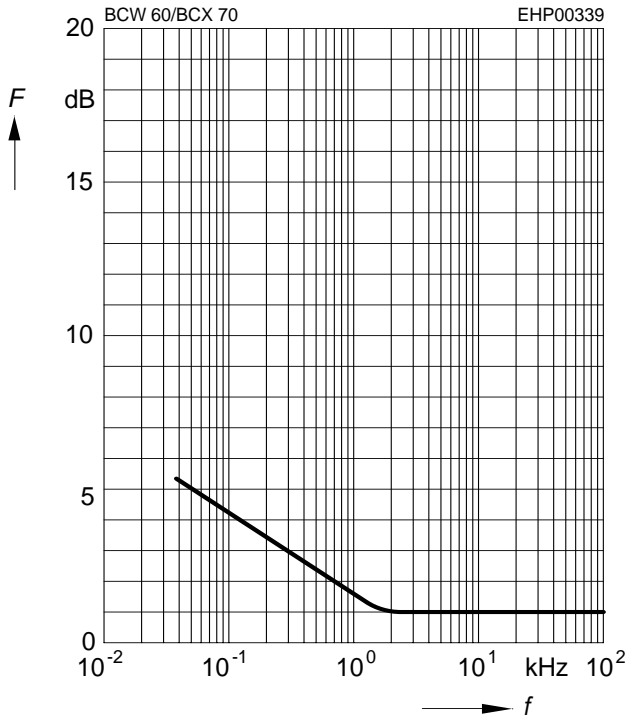
$$I_C = 0.2\text{mA}, R_S = 2\text{k}\Omega, f = 1\text{kHz}$$





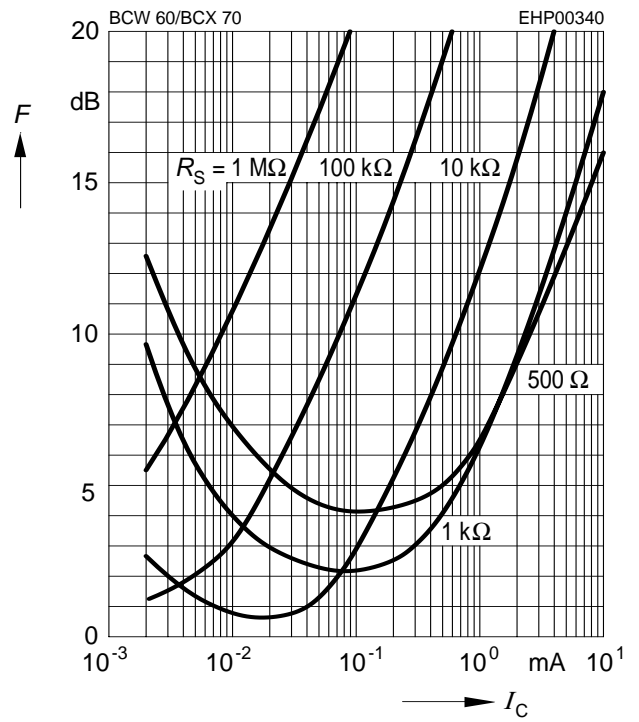
**Noise figure  $F = f(f)$**

$V_{CE} = 5V, Z_S = Z_{Sopt}$



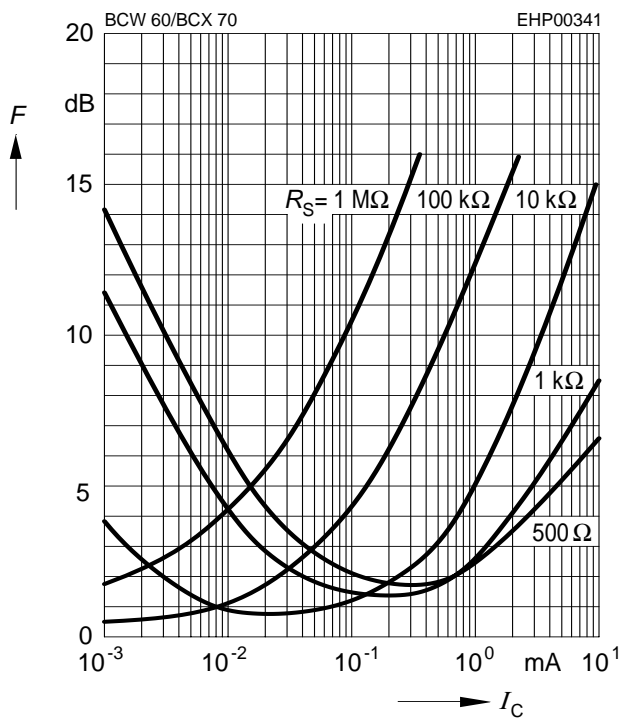
**Noise figure  $F = f(I_C)$**

$V_{CE} = 5V, f = 120Hz$



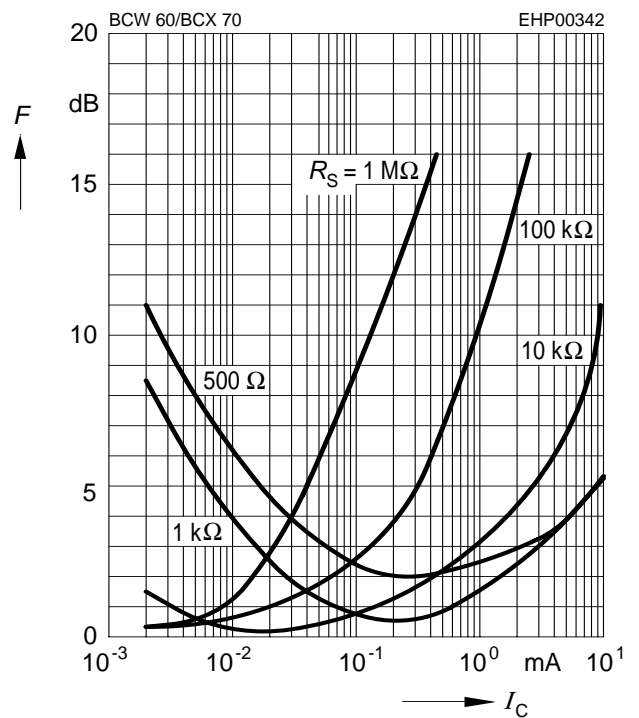
**Noise figure  $F = f(I_C)$**

$V_{CE} = 5V, f = 1kHz$

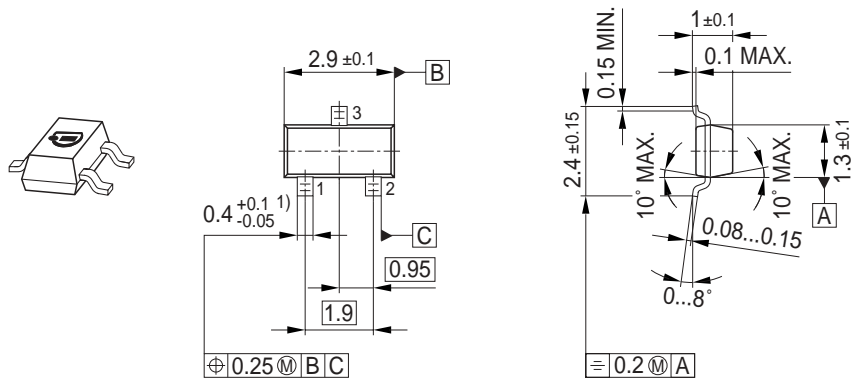


**Noise figure  $F = f(I_C)$**

$V_{CE} = 5V, f = 10kHz$

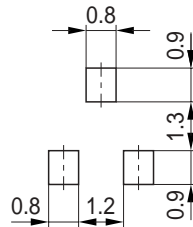


Package Outline

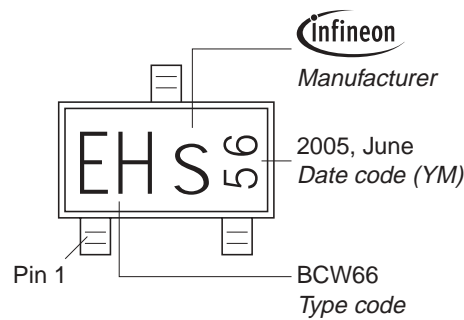


1) Lead width can be 0.6 max. in dambar area

Foot Print

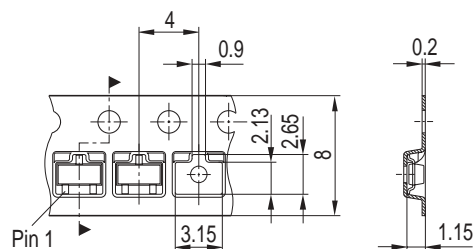


Marking Layout (Example)



Standard Packing

Reel  $\varnothing$ 180 mm = 3.000 Pieces/Reel  
 Reel  $\varnothing$ 330 mm = 10.000 Pieces/Reel



Edition 2006-02-01

Published by

Infineon Technologies AG

81726 München, Germany

© Infineon Technologies AG 2007.

All Rights Reserved.

### **Attention please!**

The information given in this dokument shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenhheitsgarantie"). With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

### **Information**

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office ([www.infineon.com](http://www.infineon.com)).

### **Warnings**

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies Office.

Infineon Technologies Components may only be used in life-support devices or systems with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system.

Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.