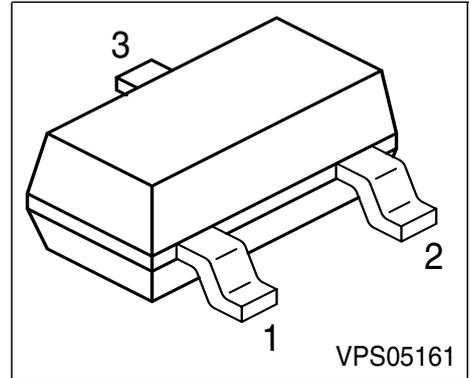**NPN Silicon AF Transistors**

- 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: BCW 61, BCX71 (PNP)

VPS05161

Type	Marking	Pin Configuration			Package
BCW 60A	AAs	1 = B	2 = E	3 = C	SOT-23
BCW 60B	ABs	1 = B	2 = E	3 = C	SOT-23
BCW 60C	ACs	1 = B	2 = E	3 = C	SOT-23
BCW 60D	ADs	1 = B	2 = E	3 = C	SOT-23
BCW 60FF	AFs	1 = B	2 = E	3 = C	SOT-23
BCW 60FN	ANs	1 = B	2 = E	3 = C	SOT-23
BCX 70G	AGs	1 = B	2 = E	3 = C	SOT-23
BCX 70H	AHs	1 = B	2 = E	3 = C	SOT-23
BCX 70J	AJs	1 = B	2 = E	3 = C	SOT-23
BCX 70K	AKs	1 = B	2 = E	3 = C	SOT-23

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Maximum Ratings

Parameter	Symbol	BCW 60	BCW60FF	BCX 70	Unit
Collector-emitter voltage	V_{CEO}	32	32	45	V
Collector-base voltage	V_{CBO}	32	32	45	
Emitter-base voltage	V_{EBO}	5	5	5	
DC collector current	I_C		100		mA
Peak collector current	I_{CM}		200		
Peak base current	I_{BM}		200		
Total power dissipation, T_S = 71 °C	P_{tot}		330		mW
Junction temperature	T_j		150		°C
Storage temperature	T_{stg}		-65 ... 150		

Thermal Resistance

Parameter	Symbol	Values	Unit
Junction ambient [1]	R_{thJA}	≤310	K/W
Junction - soldering point	R_{thJS}	≤240	

Electrical Characteristics at T_A = 25°C, unless otherwise specified.

Parameter	Symbol	min.	typ.	max.	Unit
DC Characteristics					
Collector-emitter breakdown voltage I_C = 10 mA, I_B = 0	$V_{(BR)CEO}$				V
BCW 60/60FF		32	-	-	
BCX 70		45	-	-	
Collector-base breakdown voltage I_C = 10 µA, I_B = 0	$V_{(BR)CBO}$				
BCW 60/60FF		32	-	-	
BCX 70		45	-	-	
Emitter-base breakdown voltage I_E = 1 µA, I_C = 0	$V_{(BR)EBO}$	5	-	-	

1) Package mounted on pcb 40mm x 40mm x 1.5mm / 6cm^2 Cu

Electrical Characteristics at T_A = 25°C, unless otherwise specified.

Parameter		Symbol	Values			Unit
			min.	typ.	max.	
AC Characteristics						
Collector cutoff current		I_{CBO}				nA
V_{CB} = 32 V, I_E = 0	**BCW 60 / 60FF**		-	-	20	
V_{CB} = 45 V, I_E = 0	**BCX 70**		-	-	20	
Collector cutoff current		I_{CBO}				µA
V_{CB} = 32 V, I_E = 0 , T_A = 150 °C **BCW 60 / 60FF**			-	-	20	
V_{CB} = 45 V, I_E = 0 , T_A = 150 °C **BCX 70**			-	-	20	
Emitter cutoff current		I_{EBO}	-	-	20	nA
V_{EB} = 4 V, I_C = 0						
DC current gain 1)		h_{FE}				-
I_C = 10 µA, V_{CE} = 5 V	h_{FE}-grp. **A/ G**		20	140	-	
	h_{FE}-grp. **B/ H**		20	200	-	
	h_{FE}-grp. **C/ J/ FF**		40	300	-	
	h_{FE}-grp. **D/ K/ FN**		100	460	-	
DC current gain 1)		h_{FE}				
I_C = 2 mA, V_{CE} = 5 V	h_{FE}-grp. **A/ G**		120	170	220	
	h_{FE}-grp. **B/ H**		180	250	310	
	h_{FE}-grp. **C/ J/ FF**		250	350	460	
	h_{FE}-grp. **D/ K/ FN**		380	500	630	
DC current gain 1)		h_{FE}				
I_C = 50 mA, V_{CE} = 1 V	h_{FE}-grp. **A/ G**		50	-	-	
	h_{FE}-grp. **B/ H**		70	-	-	
	h_{FE}-grp. **C/ J/ FF**		90	-	-	
	h_{FE}-grp. **D/ K/ FN**		100	-	-	

1) Pulse test: t ≤ 300µs, D = 2%

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Electrical Characteristics at T_A = 25°C, unless otherwise specified.

Parameter		Symbol	Values			Unit
			min.	typ.	max.	
DC Characteristics						
Collector-emitter saturation voltage1)		V_{CEsat}				V
I_C = 10 mA, I_B = 0.25 mA			-	0.12	0.25	
I_C = 50 mA, I_B = 1.25 mA			-	0.2	0.55	
Base-emitter saturation voltage 1)		V_{BEsat}				
I_C = 10 mA, I_B = 0.25 mA			-	0.7	0.85	
I_C = 50 mA, I_B = 1.25 mA			-	0.83	1.05	
Base-emitter voltage 1)		$V_{BE(ON)}$				
I_C = 10 μA, V_{CE} = 5 V			-	0.52	-	
I_C = 2 mA, V_{CE} = 5 V			0.55	0.65	0.75	
I_C = 50 mA, V_{CE} = 1 V			-	0.78	-	
AC Characteristics						
Transition frequency		f_T	-	250	-	MHz
I_C = 20 mA, V_{CE} = 5 V, f = 100 MHz						
Collector-base capacitance		C_{cb}	-	3	-	pF
V_{CB} = 10 V, f = 1 MHz						
Emitter-base capacitance		C_{eb}	-	8	-	
V_{EB} = 0.5 V, f = 1 MHz						
Short-circuit input impedance	h_{FE}-grp.	h_{11e}				kΩ
I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	**A / G**		-	2.7	-	
	B / H		-	3.6	-	
	C / J / FF		-	4.5	-	
	D / K / FN		-	7.5	-	
Open-circuit reverse voltage transf.ratio	h_{FE}-grp.	h_{12e}				10^{-4}
I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	**A / G**		-	1.5	-	
	B / H		-	2	-	
	C / J/FF		-	2	-	
	D / K / FN		-	3	-	

1) Pulse test: t ≤ 300μs, D = 2%

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Electrical Characteristics at T_A = 25°C, unless otherwise specified.

Parameter		Symbol	Values			Unit
			min.	typ.	max.	
AC Characteristics						
Short-circuit forward current transf.ratio | h_{FE}-grp.	h_{21e}					-
I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz **A / G**			-	200	-	
B / H			-	260	-	
C / J/ FF			-	330	-	
D / K / FN			-	520	-	
Open-circuit output admittance h_{FE}-grp.	h_{22e}					µS
I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz **A / G**			-	18	-	
B / H			-	24	-	
C / J / FF			-	30	-	
D / K / FN			-	50	-	
Noise figure h_{FE}-grp.	F					dB
I_C = 100 µA, V_{CE} = 5 V, R_S = 1 kΩ,						
f = 1 kHz, Δ f = 200 Hz **A - K**			-	2	-	
FF - FN			-	1	2	
Equivalent noise voltage h_{FE}-grp.	V_n	-	-	135	µV
I_C = 200 µA, V_{CE} = 5 V, R_S = 2 kΩ,						
f = 10 ... 50 Hz **FF / FN**						

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Total power dissipation $P_{tot} = f(T_A*; T_S)$
* Package mounted on epoxy
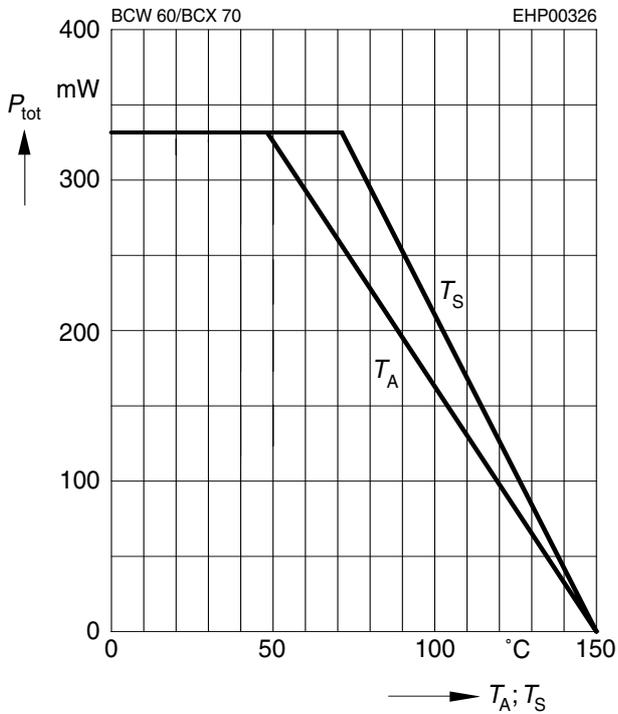
Collector-base capacitance $C_{CB} = f(V_{CBO})$
Emitter-base capacitance $C_{EB} = f(V_{EBO})$
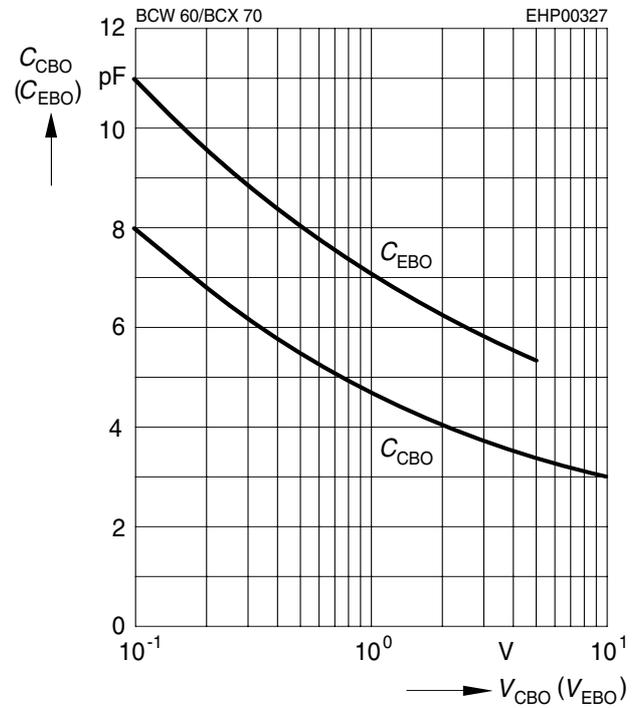
Permissible pulse load
$P_{totmax} / P_{totDC} = f(t_p)$
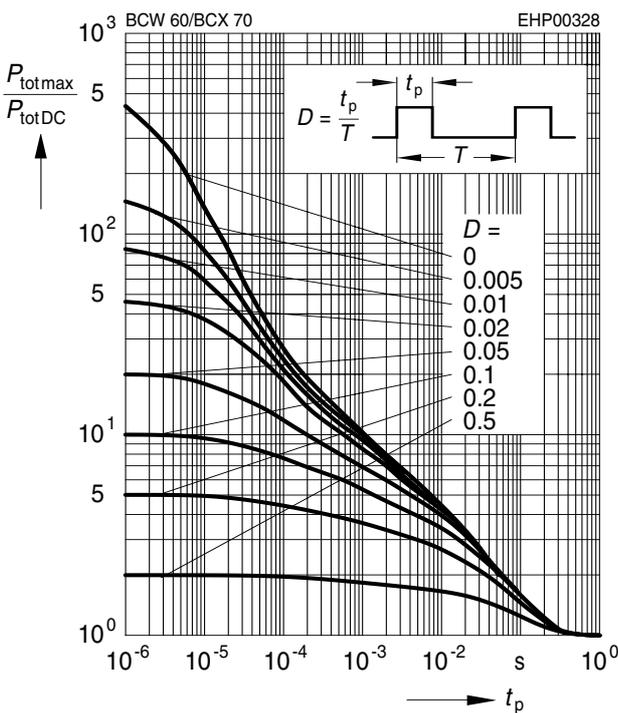
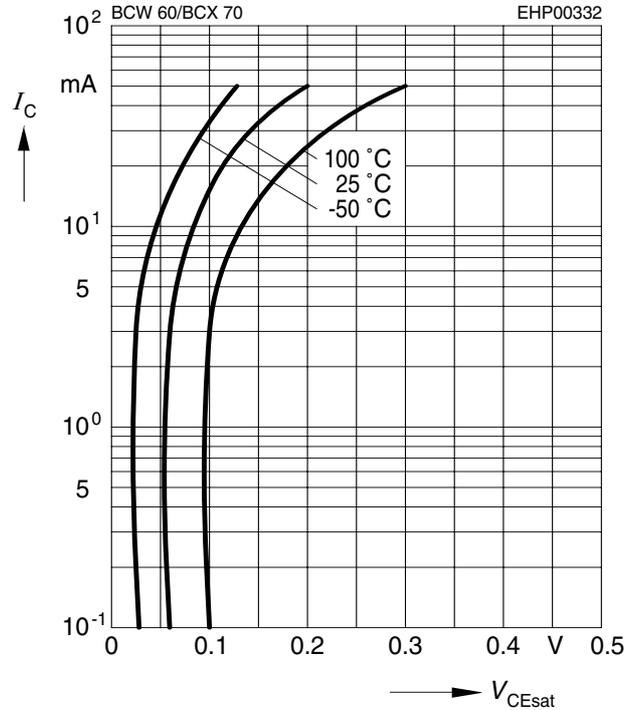

Transition frequency $f_T = f(I_C)$
$V_{CE} = 5V$

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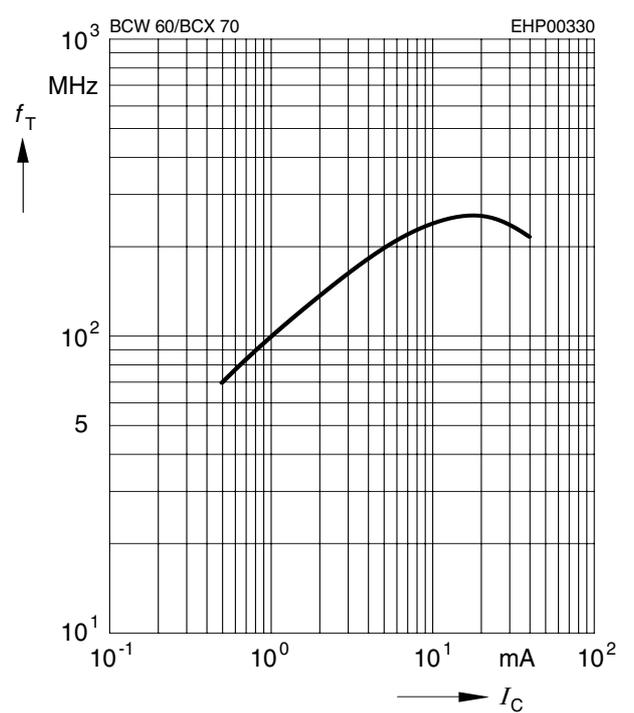
Base-emitter saturation voltage
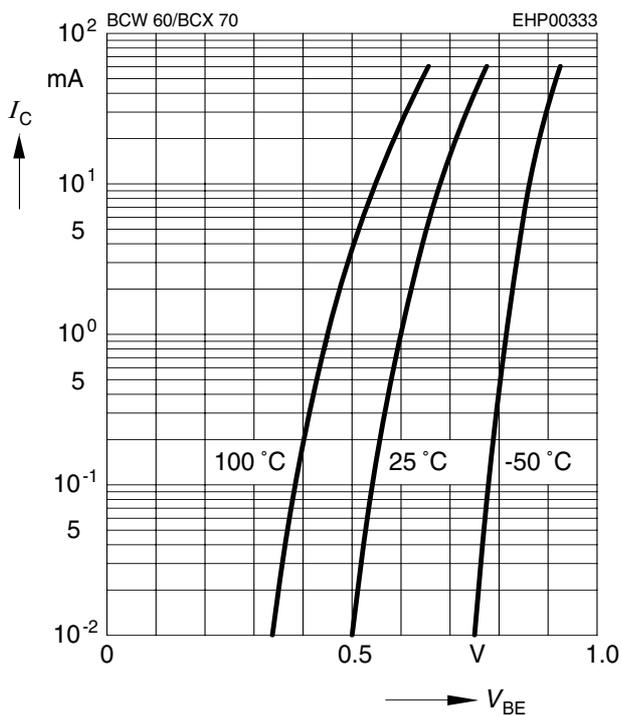
$I_C = f(V_{BEsat})$, $h_{FE} = 40$
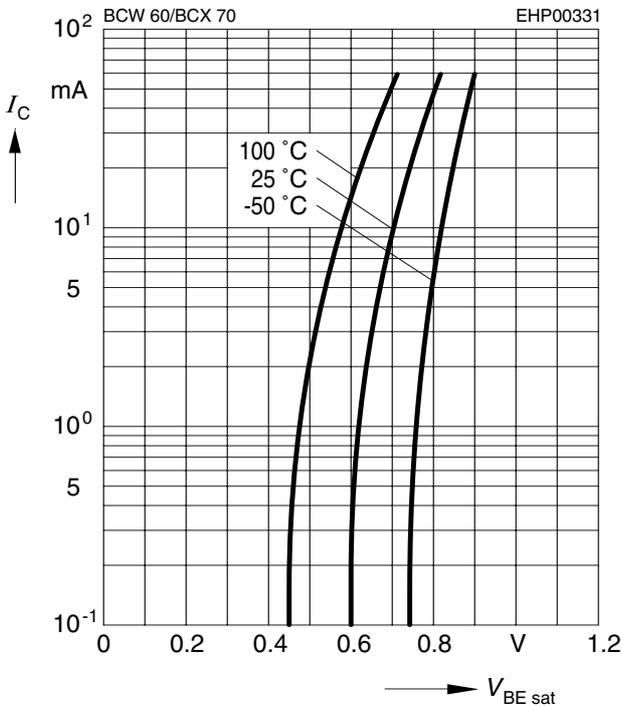
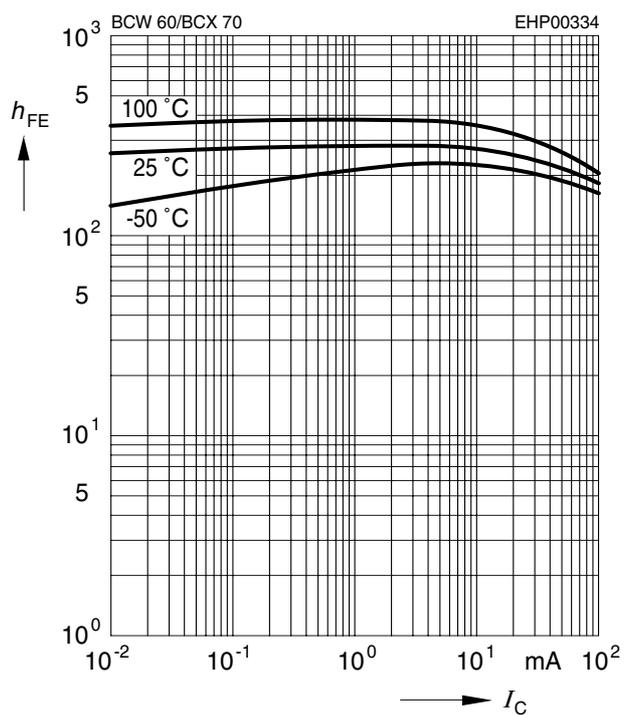## Collector-emitter saturation voltage

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

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

$V_{CE} = 5V$

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

$V_{CE} = 5V$

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

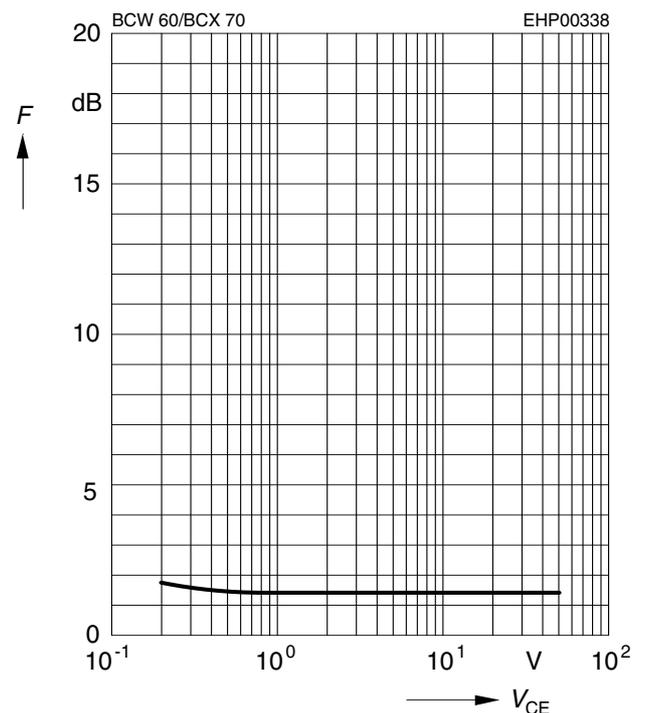$V_{CB} = V_{CEmax}$
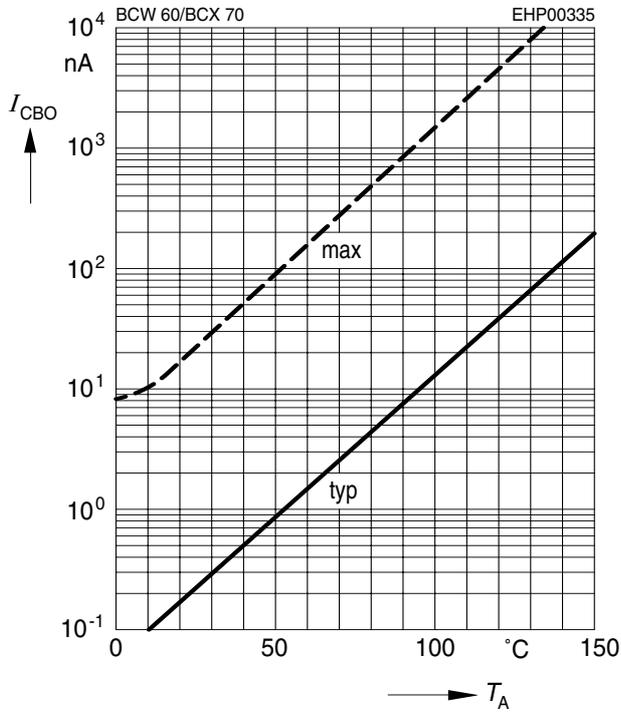
h parameter $h_e = f(I_C)$ **normalized**

$V_{CE} = 5V$
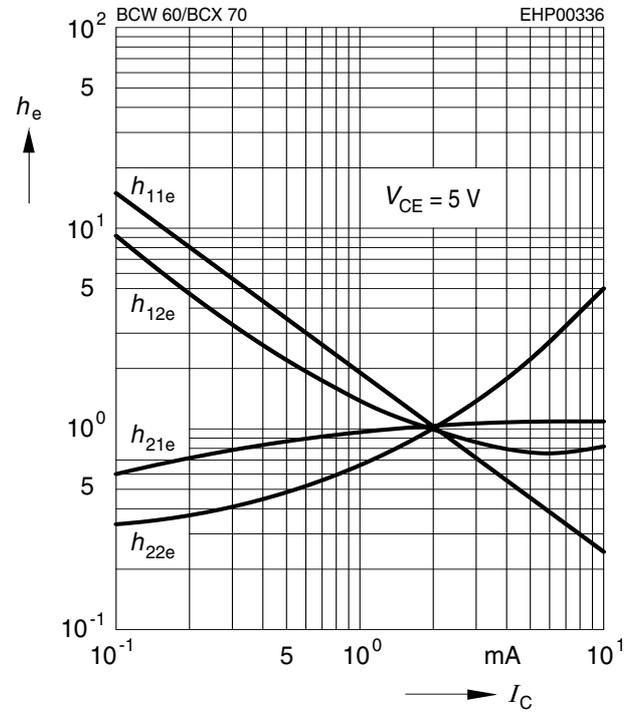
h parameter $h_e = f(V_{CE})$ **normalized**
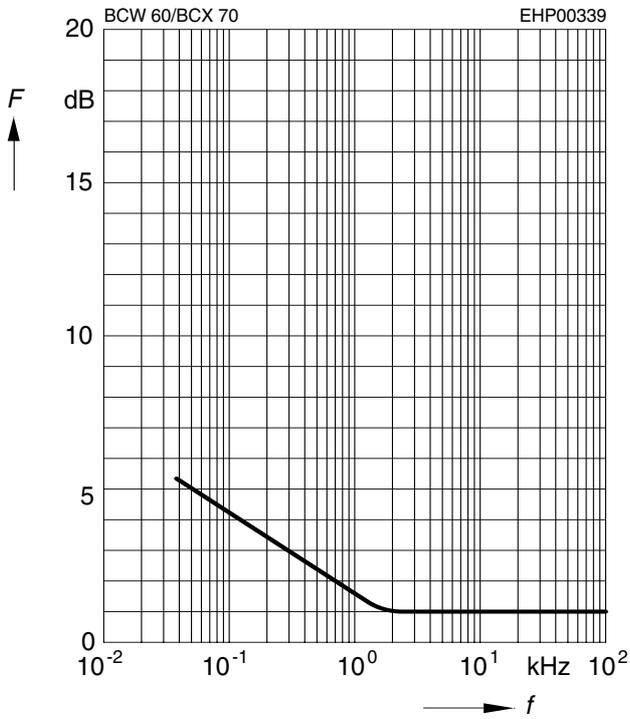
$I_C = 2mA$
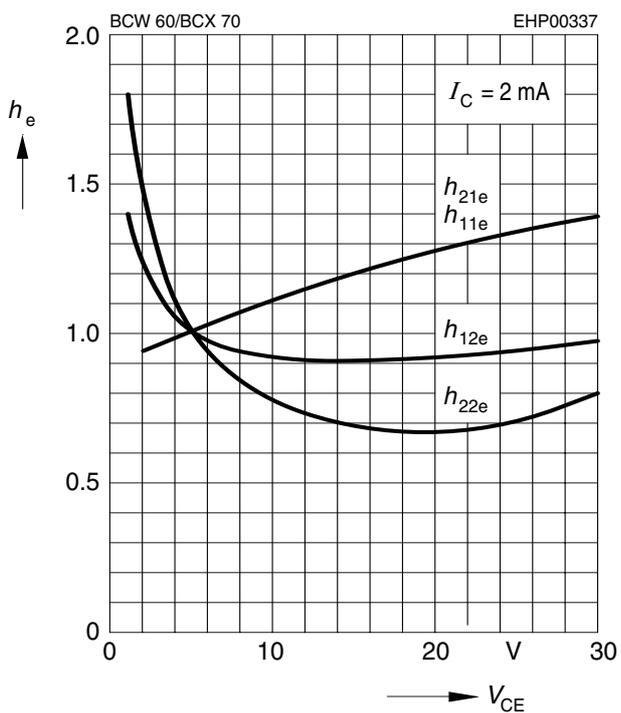
Noise figure $F = f(V_{CE})$

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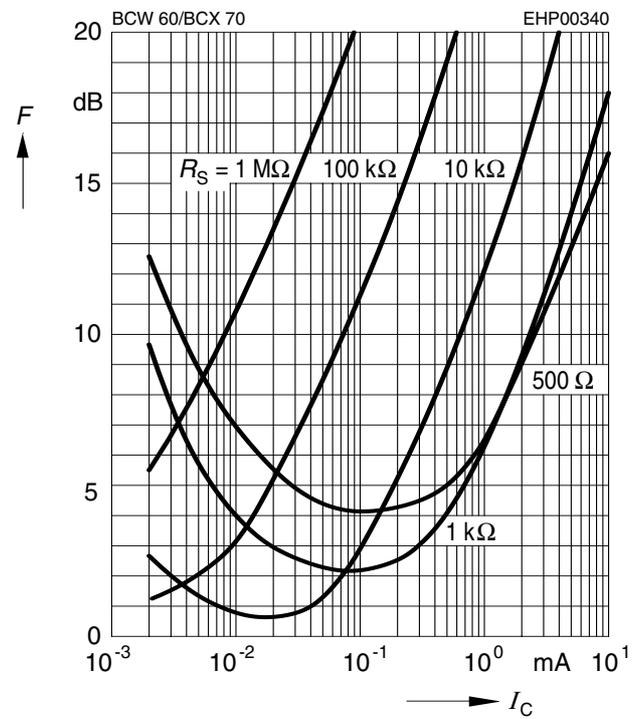

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Noise figure $F = f(f)$

$I_C = 0.2\text{mA},\ V_{CE} = 5\text{V},\ R_S = 2\text{k}\Omega$
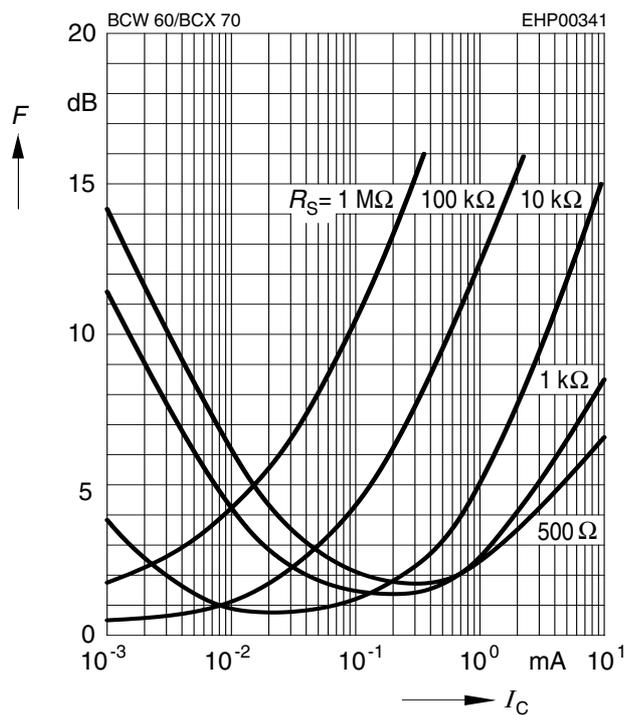

Noise figure $F = f(I_C)$

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

Noise figure $F = f(I_C)$

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

Noise figure $F = f(I_C)$

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

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