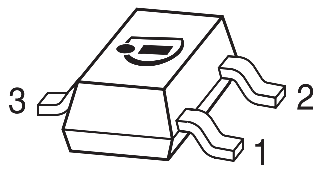
NPN Silicon AF Transistors



- 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
- Qualified according AEC Q101

Type	Marking	Pin Configuration			Package
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

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, $t_p \leq 10$ ms	I_{CM}	200	
Peak base current	I_{BM}	200	
Total power dissipation $T_S \leq 71$ °C	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature	T_{stg}	-65 ... 150	

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point[1)]	R_{thJS}	≤ 240	K/W

[1]For calculation of R_{thJA} please refer to Application Note AN077 (Thermal Resistance Calculation)

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

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

DC Electrical Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
Collector-emitter saturation voltage[1]	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		0.58	0.65	0.7	
I_C = 50 mA, V_{CE} = 1 V		-	0.78	-	

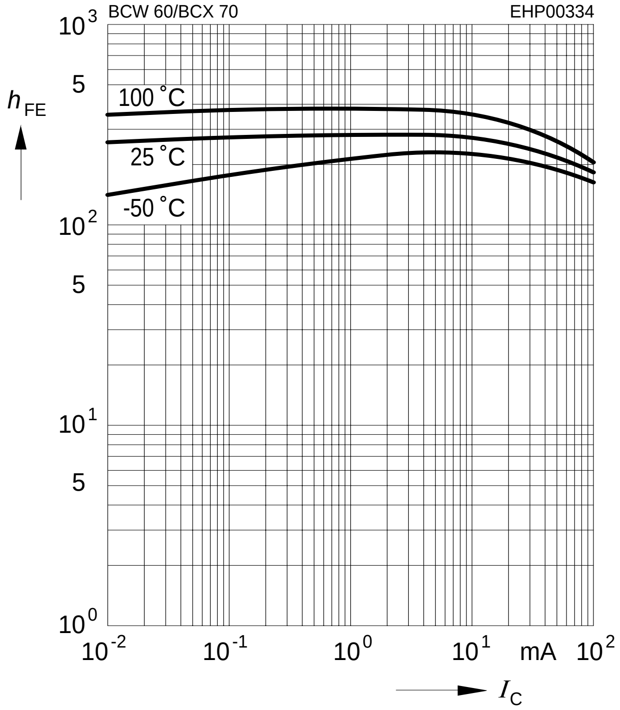
[1]Pulse test: t < 300µs; D < 2%

AC Characteristics

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

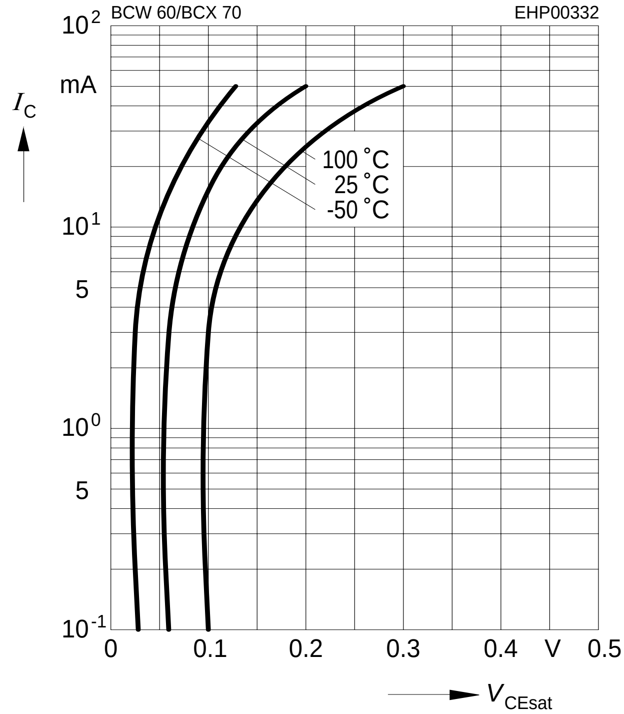
DC current gain $h_{FE} = f(I_C)$

$V_{CE} = 5$ V



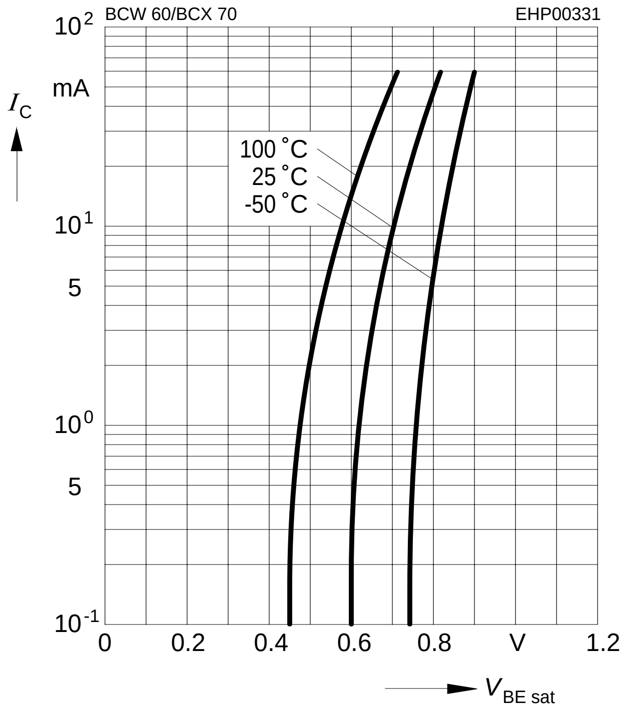
Collector-emitter saturation voltage

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



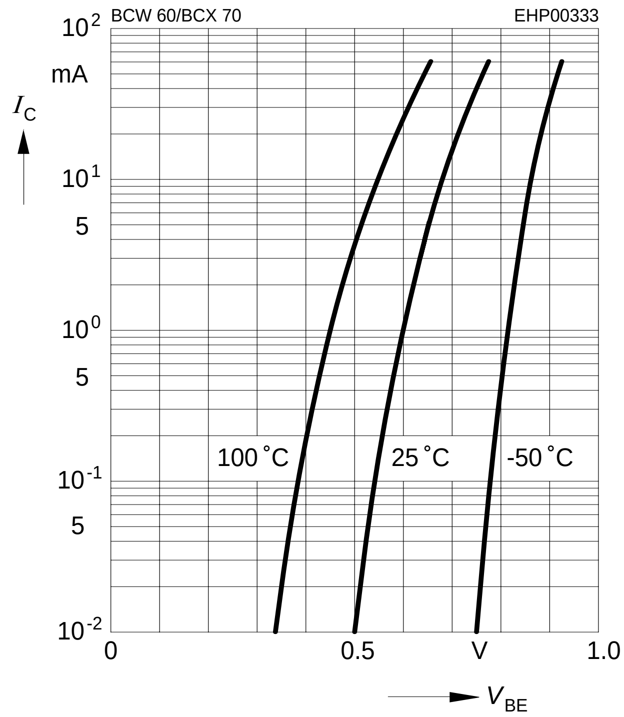
Base-emitter saturation voltage

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



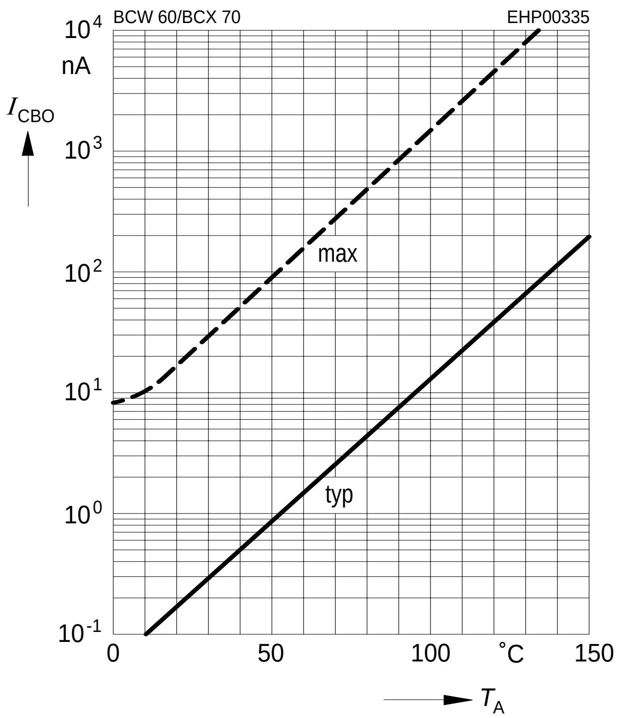
Collector current $I_C = f(V_{BE})$

$V_{CE} = 5$V



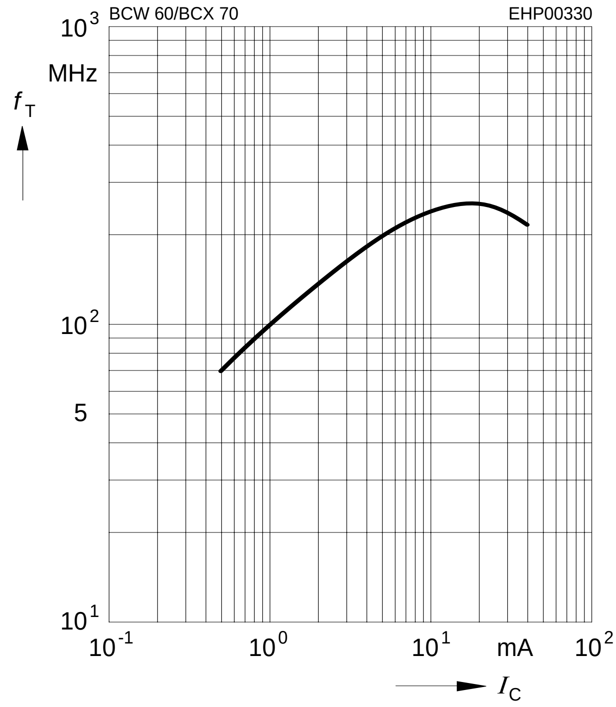
Collector cutoff current $I_{CBO} = f(T_A)$

$V_{CB} = V_{CEmax}$



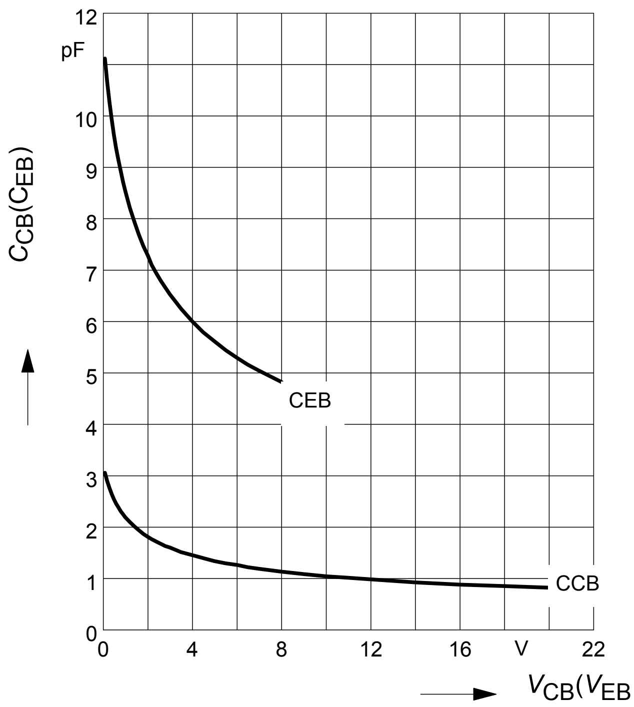
Transition frequency $f_T = f(I_C)$

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

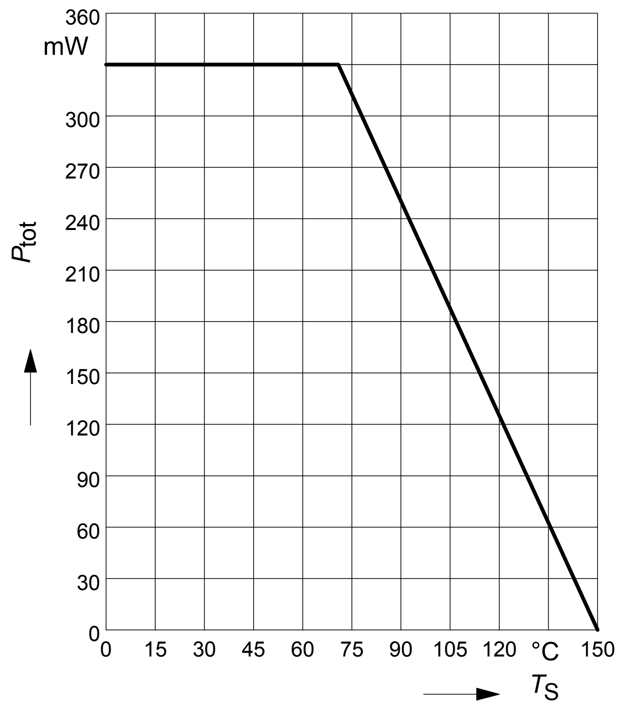


Collector-base capacitance $C_{cb} = f(V_{CB})$

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

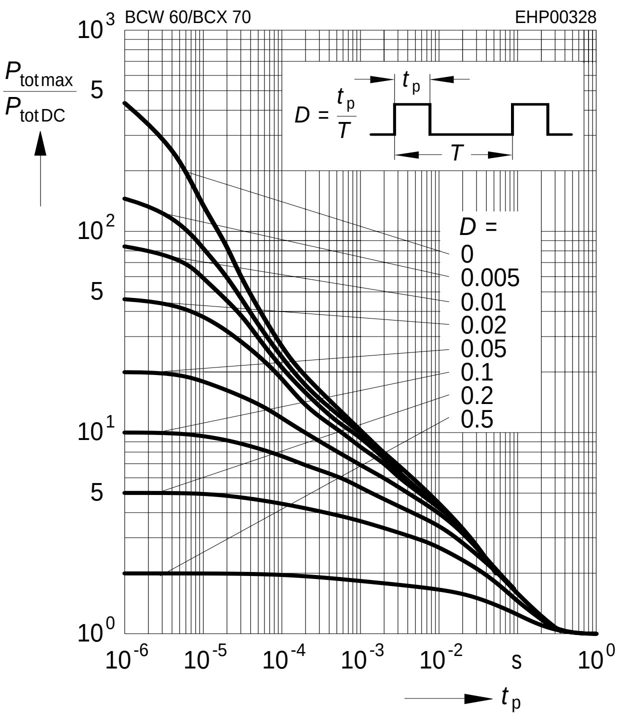


Total power dissipation $P_{tot} = f(T_S)$



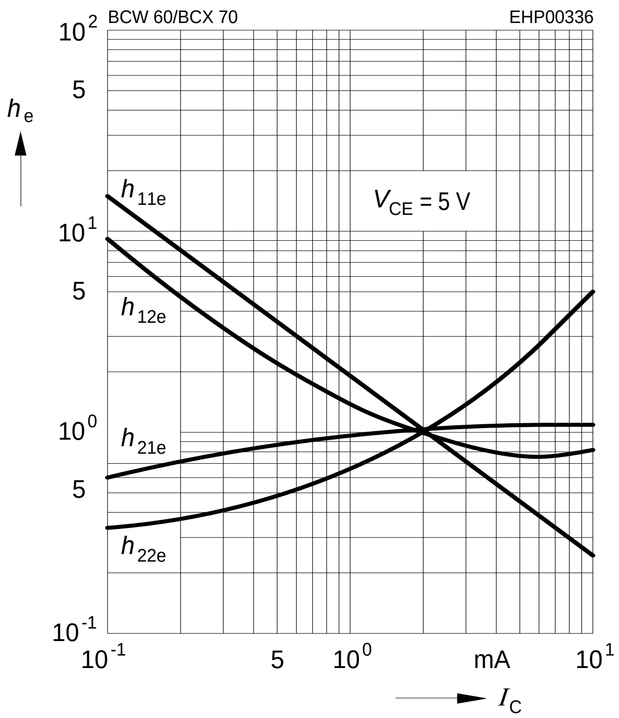
Permissible Pulse Load

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



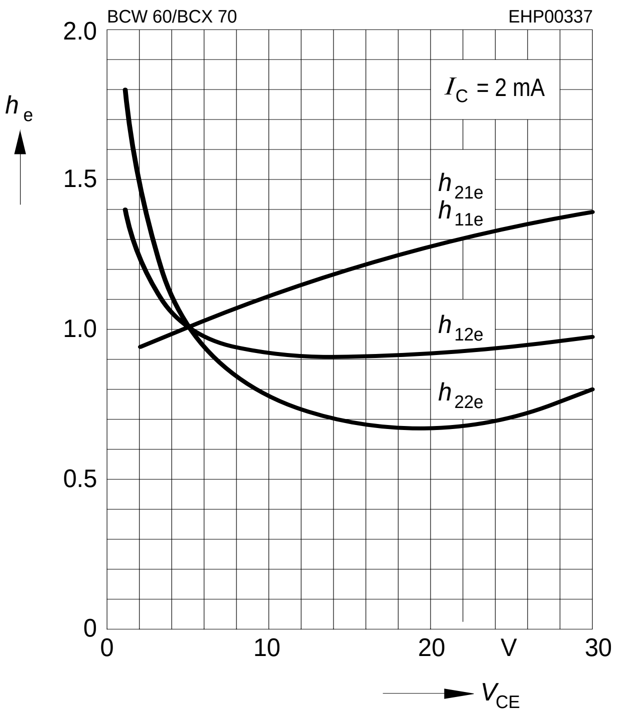
h parameter $h_e = f(I_C)$ normalized

V_{CE} = 5V



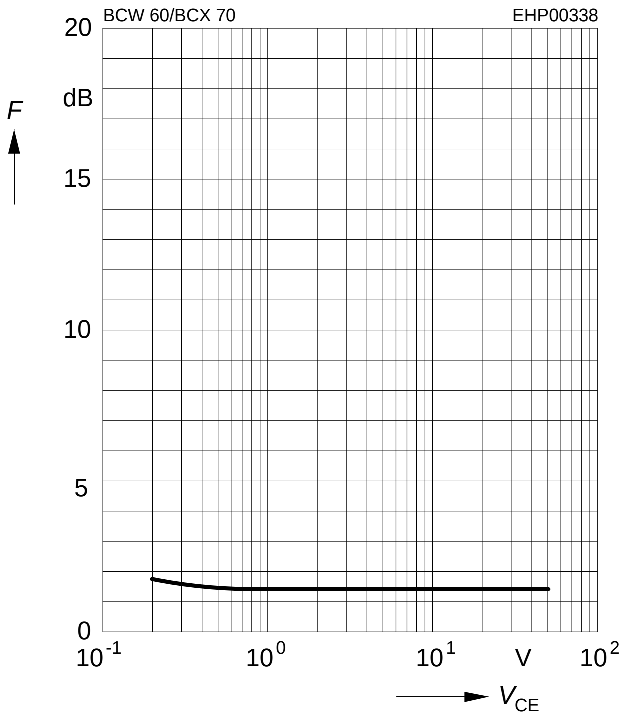
h parameter $h_e = f(V_{CE})$ normalized

I_C = 2mA



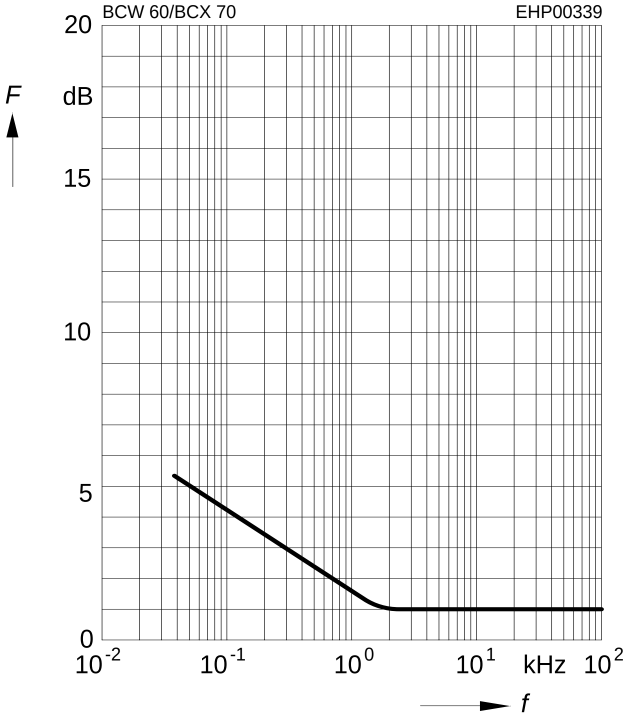
Noise figure $F = f(V_{CE})$

I_C = 0.2mA, R_S = 2kΩ , f = 1kHz



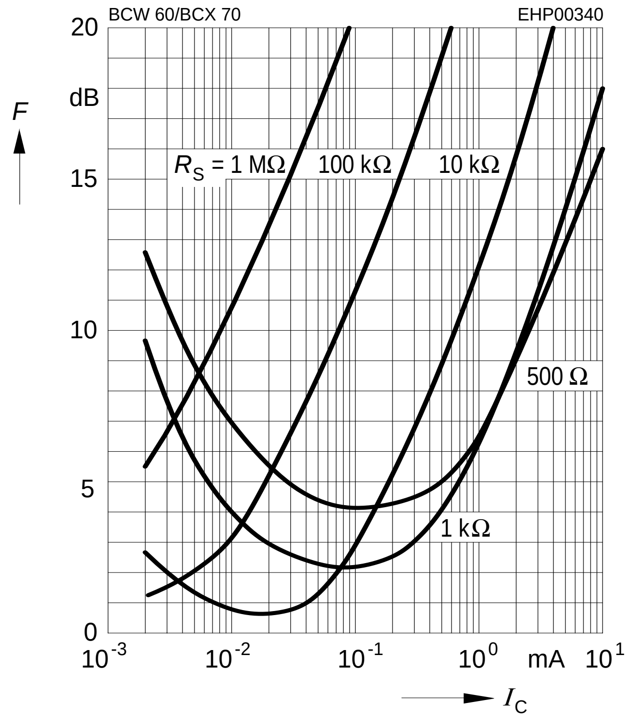
Noise figure $F = f(f)$

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



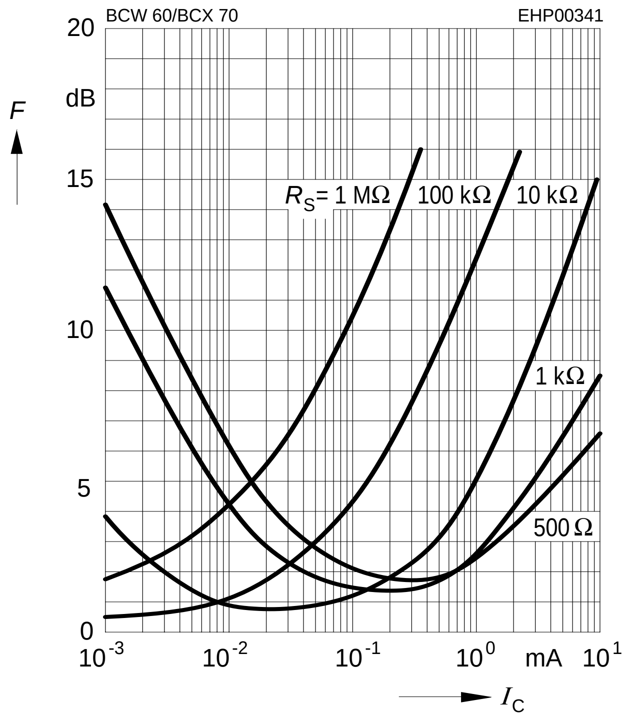
Noise figure $F = f(I_C)$

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



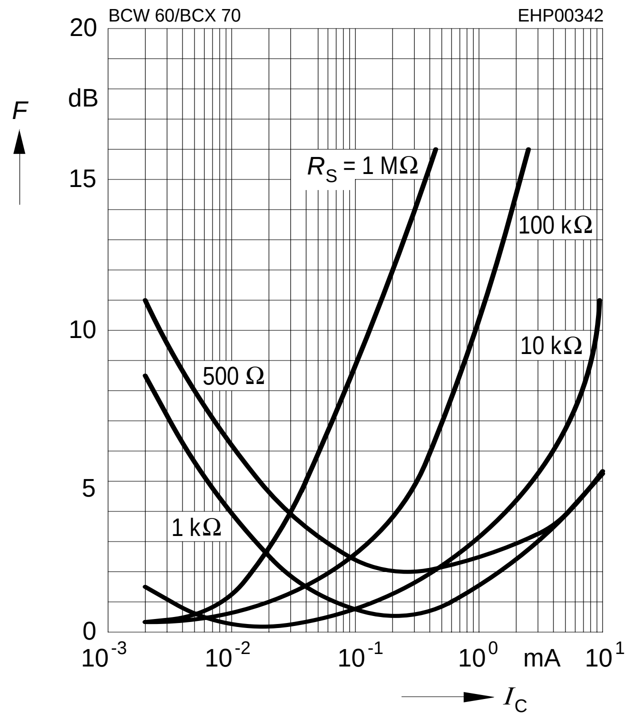
Noise figure $F = f(I_C)$

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

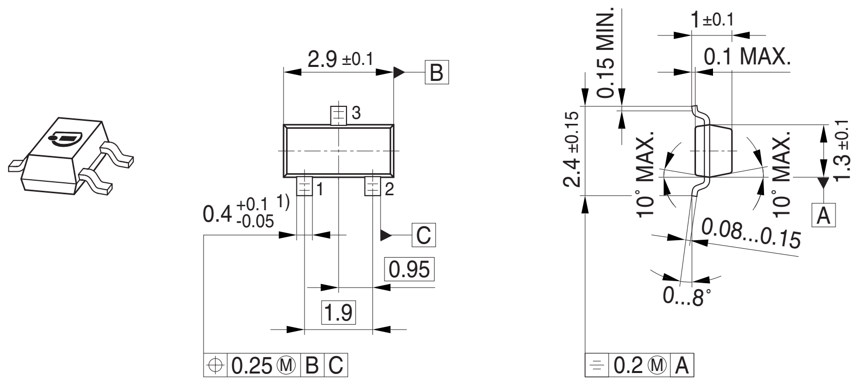


Noise figure $F = f(I_C)$

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

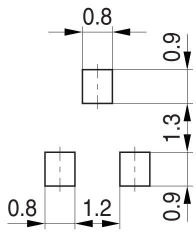


Package Outline

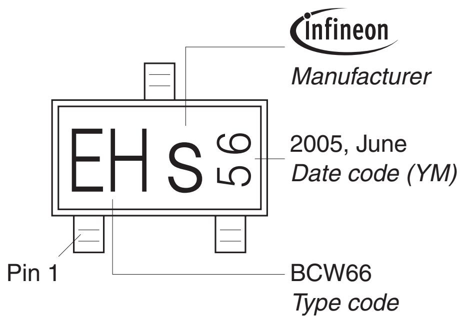


1) Lead width can be 0.6 max. in dambar area

Foot Print

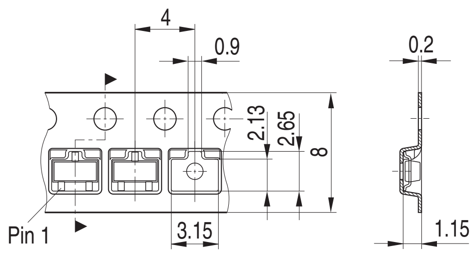


Marking Layout (Example)



Standard Packing

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



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