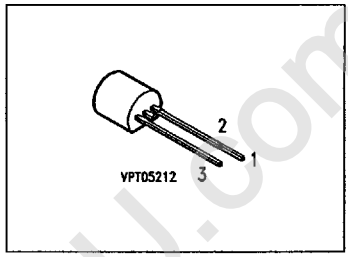
SIEMENS SIEMENS AKTIENGESELLSCHAF

T-29-21

PNP Silicon AF Transistors

BC 415
BC 416

- High current gain
- Low collector-emitter saturation voltage
- Low noise between 30 Hz and 15 kHz
- Complementary types: BC 413, BC 414 (NPN)



Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BC 415	–	Q62702-C377	C	B	E	TO-92
BC 415 A		Q62702-C377-V1				
BC 415 B		Q62702-C377-V2				
BC 415 C		Q62702-C377-V3				
BC 416		Q62702-C378				
BC 416 A		Q62702-C378-V1				
BC 416 B		Q62702-C378-V2				
BC 416 C		Q62702-C378-V3				

1) For detailed information see chapter Package Outlines.

Maximum Ratings

Parameter	Symbol	Values BC 415	BC 416	Unit
Collector-emitter voltage	V_{CE0}	35	45	V
Collector-base voltage	V_{CB0}	45	50	
Emitter-base voltage	V_{EB0}	5		
Collector current	I_C	100		mA
Peak collector current	I_{CM}	200		
Peak base current	I_{BM}	200		
Peak emitter current	I_{EM}	200		
Total power dissipation, $T_C = 70$ °C	P_{tot}	500		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	– 65 ... + 150		

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 250	K/W
Junction - case [1]	$R_{th\,JC}$	≤ 160	

[1] Mounted on Al heat sink 15 mm x 25 mm x 0.5 mm.

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

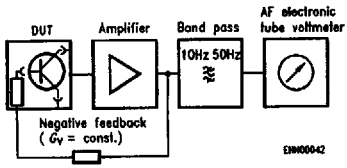
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC characteristics					
Collector-emitter breakdown voltage I_C = 2 mA	$V_{(BR)CE0}$				V
BC 415		35	–	–	
BC 416		45	–	–	
Collector-base breakdown voltage I_C = 10 µA	$V_{(BR)CB0}$				
BC 415		45	–	–	
BC 416		50	–	–	
Emitter-base breakdown voltage I_E = 1 µA	$V_{(BR)EB0}$	5	–	–	
Collector cutoff current	I_{CB0}				
V_{CB} = 30 V		–	–	15	nA
V_{CB} = 30 V, T_A = 150 °C		–	–	4	µA
DC current gain	h_{FE}				–
I_C = 10 µA; V_{CE} = 5 V					
BC 415 A, BC 416 A		40	90	–	
BC 415 B, BC 416 B		100	150	–	
BC 415 C, BC 416 C		100	270	–	
I_C = 2 mA; V_{CE} = 5 V					
BC 415 A, BC 416 A		125	180	250	
BC 415 B, BC 416 B		220	290	475	
BC 415 C, BC 416 C		420	520	800	
Collector-emitter saturation voltage[1]	V_{CEsat}				mV
I_C = 10 mA; I_B = 0.5 mA		–	75	300	
I_C = 100 mA; I_B = 5 mA		–	250	650	
Base-emitter saturation voltage[1]	V_{BEsat}				
I_C = 10 mA; I_B = 0.5 mA		–	700	–	
I_C = 100 mA; I_B = 5 mA		–	930	–	
Base-emitter voltage	$V_{BE\ (on)}$				
I_C = 2 mA; V_{CE} = 5 V		600	650	750	
I_C = 10 mA; V_{CE} = 5 V		–	–	820	

[1] Pulse test: $t \leq 300$ µs, $D \leq 2$ %.

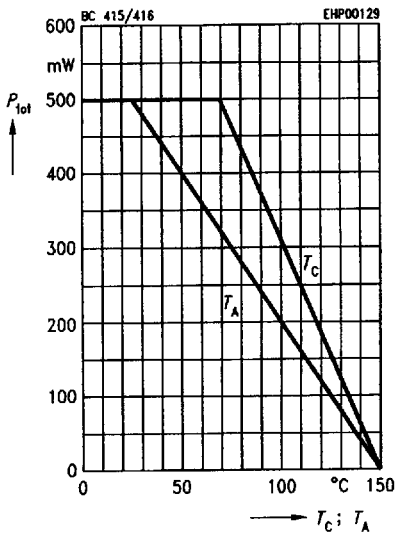
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC characteristics					
Transition frequency I_C = 20 mA, V_{CE} = 5 V, f = 100 MHz	f_T	–	250	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{obo}	–	4	–	pF
Input capacitance V_{EB} = 0.5 V, f = 1 MHz	C_{ibo}	–	8	–	
Short-circuit input impedance I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{11e}				kΩ
BC 415 A, BC 416 A		–	2.7	–	
BC 415 B, BC 416 B		–	4.5	–	
BC 415 C, BC 416 C		–	8.7	–	
Open-circuit reverse voltage transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{12e}				10^{-4}
BC 415 A, BC 416 A		–	1.5	–	
BC 415 B, BC 416 B		–	2	–	
BC 415 C, BC 416 C		–	3	–	
Short-circuit forward current transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{21e}				–
BC 415 A, BC 416 A		–	200	–	
BC 415 B, BC 416 B		–	330	–	
BC 415 C, BC 416 C		–	600	–	
Open-circuit output admittance I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{22e}				µS
BC 415 A, BC 416 A		–	18	–	
BC 415 B, BC 416 B		–	30	–	
BC 415 C, BC 416 C		–	60	–	
Noise figure I_C = 0.2 mA, V_{CE} = 5 V, R_S = 2 kΩ f = 1 kHz, Δf = 200 Hz	F	–	1	4	dB
Noise figure I_C = 0.2 mA, V_{CE} = 5 V, R_S = 2 kΩ f = 10 Hz ... 50 Hz	E_n	–	–	0.110	mV

Test circuit for noise voltage measurement

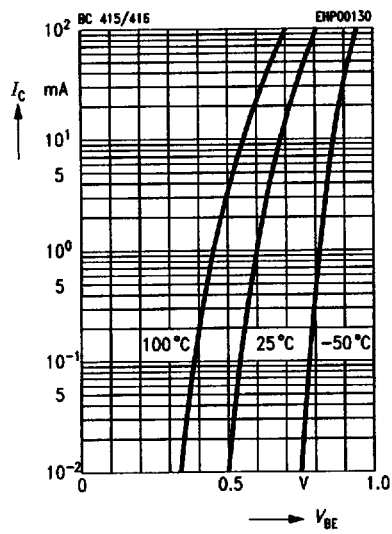


Total power dissipation $P_{tot} = f(T_A; T_C)$

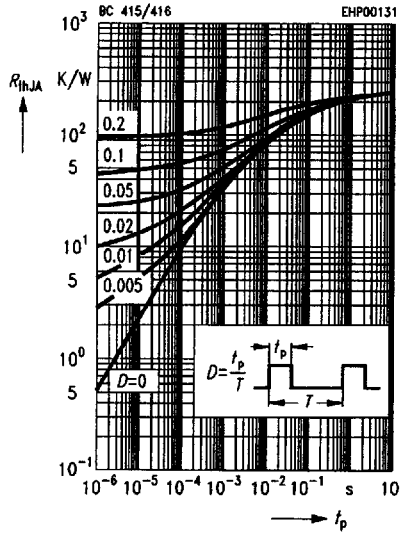


Collector current $I_C = f(V_{BE})$

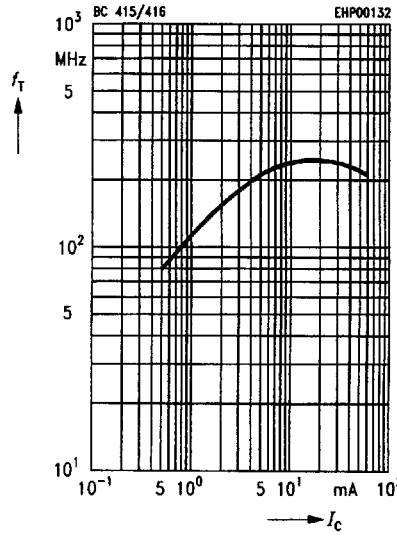
V_{CE} = 5 V



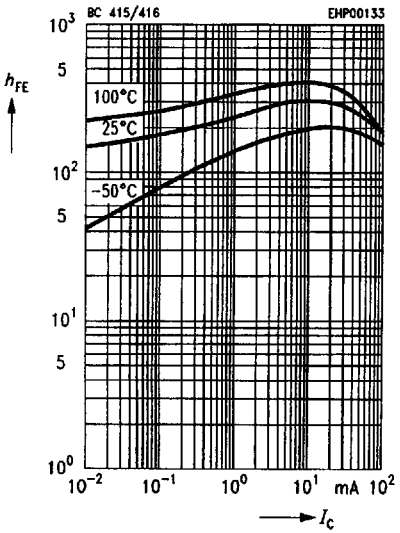
Permissible pulse load $R_{thJA} = f(t_p)$



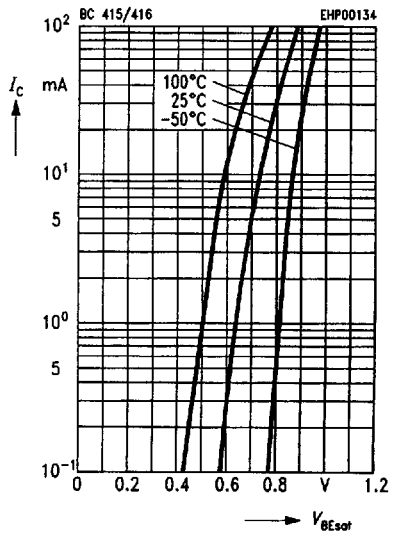
Transition frequency $f_T = f(I_C)$
V_{CE} = 5 V, f = 100 MHz



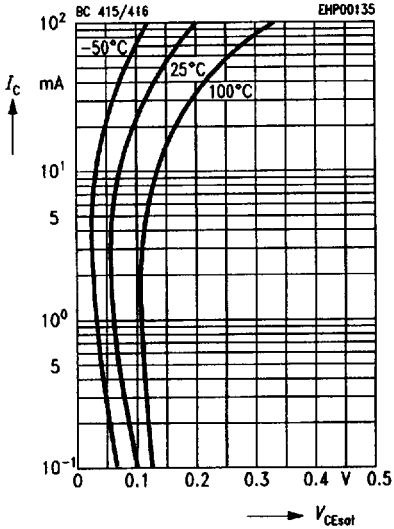
DC current gain $h_{FE} = f(I_C)$
V_{CE} = 5 V (common emitter configuration)



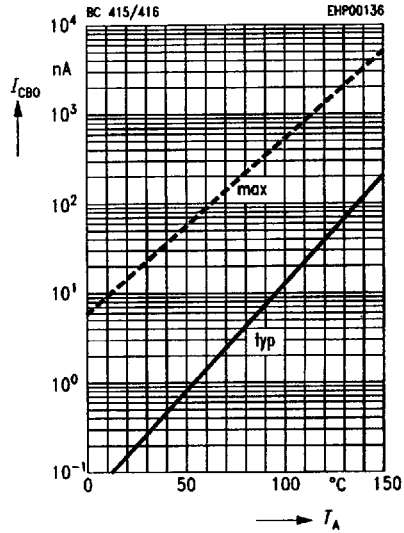
Base-emitter saturation voltage
$V_{BEsat} = f(I_C)$
h_{FE} = 20



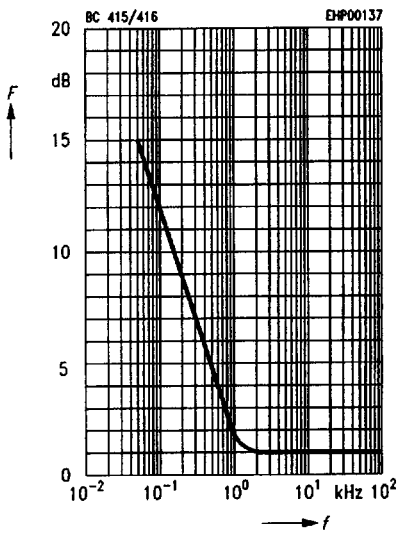
Collector-emitter saturation voltage
$V_{CEsat} = f(I_C)$
$h_{FE} = 20$



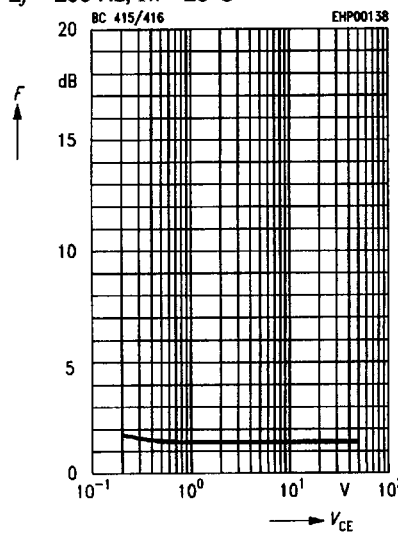
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 30$ V



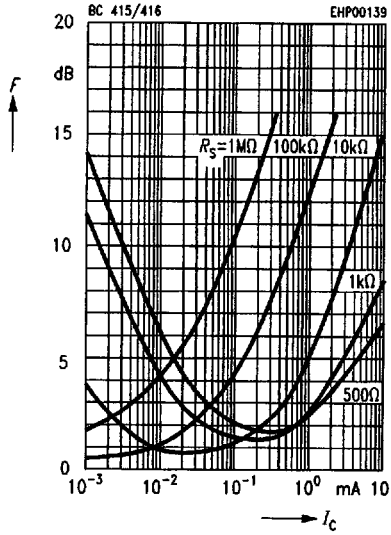
Noise figure $F = f(f)$
$I_C = 0.2$ mA, $f = 12$ kHz, $R_S = 2$ kΩ



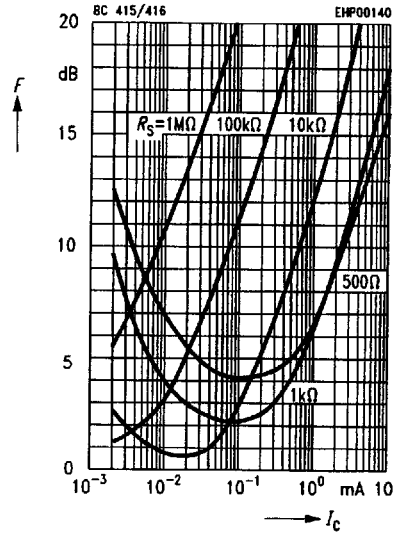
Noise figure $F = f(V_{CE})$
$I_C = 0.2$ mA, $R_S = 2$ kΩ, $f = 1$ kHz
$\Delta f = 200$ Hz, $T_A = 25$ °C



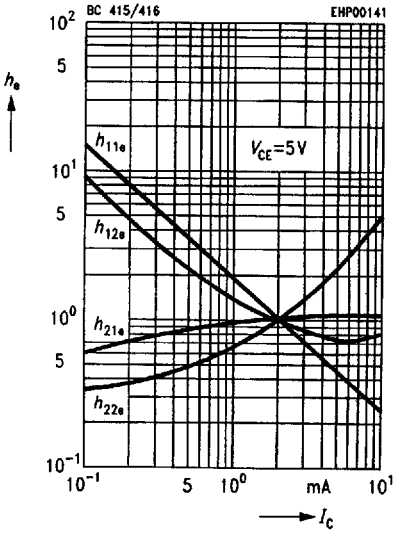
Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 120 kHz



Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 1 Hz



h parameter $h_e = f(I_C)$



Capacitance $C = f(V_{CB}, V_{EB})$