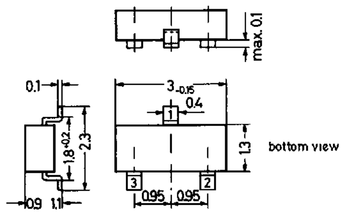
BCW60, BCX70

T-29-15

NPN Silicon Epitaxial Planar Transistors
for switching and AF amplifier applications.

Especially suited for automatic insertion in thick- and thin-film circuits.
The transistors BCW60 are subdivided into the groups A, B, C and D, the transistors BCX70 into the groups G, H, J and K according to their current gain. As complementary types the PNP transistors BCW61 and BCX71 are recommended.
Normally the pinconfiguration of these types is the following: 1 = Collector, 2 = Base, 3 = Emitter. All types are also available with the pinconfiguration 1 = Collector, 2 = Emitter, 3= Base. The type designation is then BCW60R resp. BCX70R.



Plastic package 23A3
according to DIN 41869 (≈ TO-236)
The case is impervious to light

Weight approximately 0.01 g
Dimensions in mm

Marking code

Type	Marking
BCW60A	AA
BCW60B	AB
BCW60C	AC
BCW60D	AD
BCW60RA	AO
BCW60RB	AP
BCW60RC	AR
BCW60RD	AS

Marking code

Type	Marking
BCX70G	AG
BCX70H	AH
BCX70J	AJ
BCX70K	AK
BCX70RG	AU
BCX70RH	AW
BCX70RJ	AX
BCX70RK	AY

Absolute Maximum Ratings

		Symbol	Value	Unit
Collector Emitter Voltage	**BCW60**	V_{CES}	32	V
	BCX70	V_{CES}	45	V
Collector Emitter Voltage	**BCW60**	V_{CEO}	32	V
	BCX70	V_{CEO}	45	V
Emitter Base Voltage		V_{EBO}	5	V
Collector Current		I_C	200	mA
Base Current		I_B	50	mA
Power Dissipation at T_{SB} = 50 °C		P_{tot}	310[1)]	mW
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_S	–65 to +150	°C

[1)] Ceramic Substrate 0.7 mm; 2.5 cm² area

Characteristics at T_{amb} = 25 °C

		Symbol	Min.	Typ.	Max.	Unit
h-Parameters at V_{CE} = 5 V, I_C = 2 mA, f = 1 kHz						
Small Signal Current Gain	**Group A, G**	h_{fe}	–	200	–	–
	B, H	h_{fe}	–	260	–	–
	C, J	h_{fe}	–	330	–	–
	D, K	h_{fe}	–	520	–	–
Input Impedance	**Group A, G**	h_{ie}	1.6	2.7	4.5	kΩ
	B, H	h_{ie}	2.5	3.6	6	kΩ
	C, J	h_{ie}	3.2	4.5	8.5	kΩ
	D, K	h_{ie}	4.5	7.5	12	kΩ
Output Admittance	**Group A, G**	h_{oe}	–	18	30	µS
	B, H	h_{oe}	–	24	50	µS
	C, J	h_{oe}	–	30	60	µS
	D, K	h_{oe}	–	50	100	µS
Reverse Voltage Transfer Ratio	**Group A, G**	h_{re}	–	$1.5\cdot10^{-4}$	–	–
	B, H	h_{re}	–	$2\cdot10^{-4}$	–	–
	C, J	h_{re}	–	$2\cdot10^{-4}$	–	–
	D, K	h_{re}	–	$3\cdot10^{-4}$	–	–
DC Current Gain						
at V_{CE} = 5 V, I_C = 10 µA	**Group A, G**	h_{FE}	–	78	–	–
	B, H	h_{FE}	20	145	–	–
	C, J	h_{FE}	40	220	–	–
	D, K	h_{FE}	100	300	–	–
at V_{CE} = 5 V, I_C = 2 mA	**Group A, G**	h_{FE}	120	170	220	–
	B, H	h_{FE}	180	250	310	–
	C, J	h_{FE}	250	350	460	–
	D, K	h_{FE}	380	500	630	–
at V_{CE} = 1 V, I_C = 50 mA	**Group A, G**	h_{FE}	50	–	–	–
	B, H	h_{FE}	70	–	–	–
	C, J	h_{FE}	90	–	–	–
	D, K	h_{FE}	100	–	–	–
Thermal Resistance Junction to Substrate Backside		R_{thSB}	–	–	320[1)]	K/W
Thermal Resistance Junction to Ambient		R_{thA}	–	–	450	K/W
Collector Saturation Voltage						
at I_C = 10 mA, I_B = 0.25 mA		V_{CEsat}	–	120	350	mV
at I_C = 50 mA, I_B = 1.25 mA		V_{CEsat}	–	200	550	mV
Base Saturation Voltage						
at I_C = 10 mA, I_B = 0.25 mA		V_{BEsat}	–	700	850	mV
at I_C = 50 mA, I_B = 1.25 mA		V_{BEsat}	–	830	1050	mV
Base Emitter Voltage						
at V_{CE} = 5 V, I_C = 10 µA		V_{BE}	–	520	–	mV
at V_{CE} = 5 V, I_C = 2 mA		V_{BE}	550	650	750	mV
at V_{CE} = 1 V, I_C = 50 mA		V_{BE}	–	780	–	mV
Collector Cutoff Current						
at V_{CE} = 32 V	**BCW60**	I_{CES}	–	–	20	nA
at V_{CE} = 32 V, T_{amb} = 150 °C		I_{CES}	–	–	20	µA
at V_{CE} = 45 V	**BCX70**	I_{CES}	–	–	20	nA
at V_{CE} = 45 V, T_{amb} = 150 °C		I_{CES}	–	–	20	µA
Emitter Cutoff Current at V_{EB} = 4 V		I_{EBO}	–	–	20	nA
Collector Emitter Breakdown Voltage						
at I_C = 2 mA	**BCW60**	$V_{(BR)CEO}$	32	–	–	V
	BCX70	$V_{(BR)CEO}$	45	–	–	V

1) Ceramic Substrate 0.7 mm; 2.5 cm^2 area

BCW60, BCX70

Characteristics, continuation

	Symbol	Min.	Typ.	Max.	Unit
Emitter Base Breakdown Voltage at $I_E = 1\ \mu A$	$V_{(BR)EBO}$	5	–	–	V
Gain Bandwidth Product at $V_{CE} = 5$ V, $I_C = 10$ mA, f = 100 MHz	f_T	125	250	–	MHz
Collector Base Capacitance at $V_{CEB} = 10$ V, f = 1 MHz	C_{CBO}	–	–	4.5	pF
Emitter Base Capacitance at $V_{EB} = 0.5$ V, f = 1 MHz	C_{EBO}	–	8	–	pF
Noise Figure at $V_{CE} = 5$ V, $I_C = 200\ \mu A$, $R_G = 2\ k\Omega$, f = 1 kHz, $\Delta f = 200$ Hz	F	–	2	6	dB
Switching Times (see Fig. 1) at $I_C = 10$ mA, $I_{B1} = -I_{B2} = 1$ mA, $R_1 = 5\ k\Omega$, $R_2 = 5\ k\Omega$, $-V_{BB} = 3.6$ V, $R_L = 990\ k\Omega$					
Delay Time	t_d	–	35	–	ns
Rise Time	t_r	–	50	–	ns
Turn-On Time	$t_d + t_r$	–	85	150	ns
Storage Time	t_s	–	400	–	ns
Fall Time	t_f	–	80	–	ns
Turn-Off Time	$t_s + t_f$	–	480	800	ns

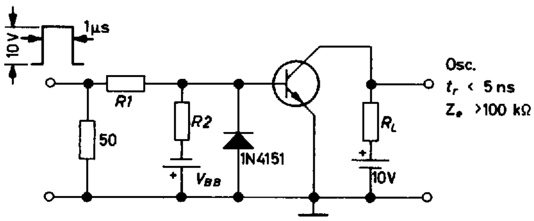
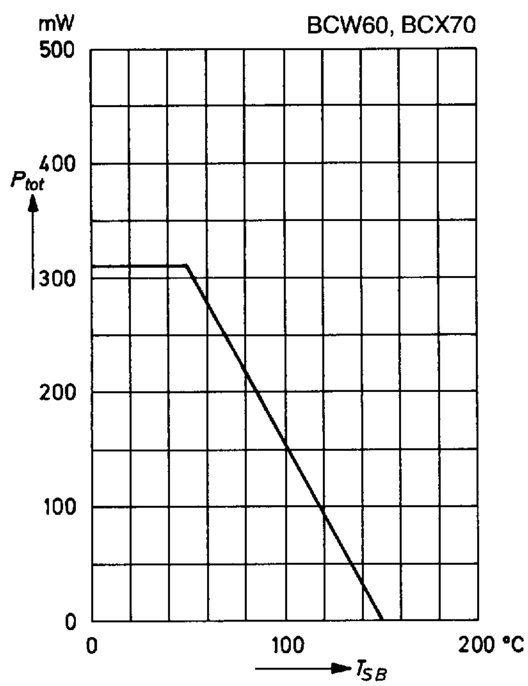


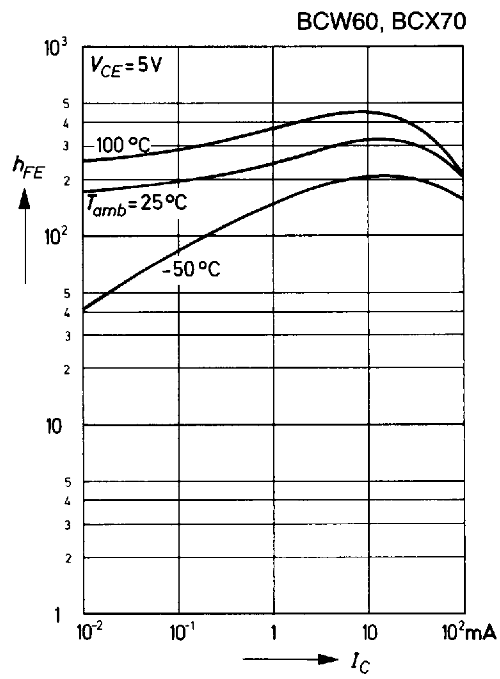
Fig. 1:
Test circuit for switching times

Admissible power dissipation versus temperature of substrate backside

Ceramic Substrate 0.7 mm; 2.5 cm² area.

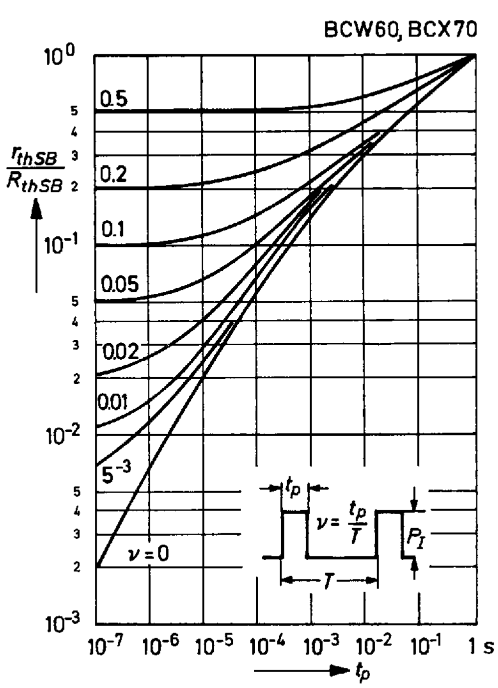


DC current gain versus collector current

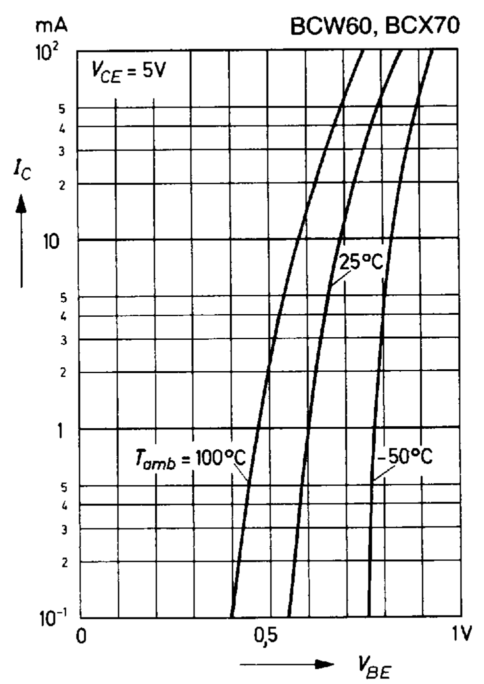


Pulse thermal resistance versus pulse duration (normalized)

Ceramic Substrate 0.7 mm; 2.5 cm² area.



Collector current versus base emitter voltage



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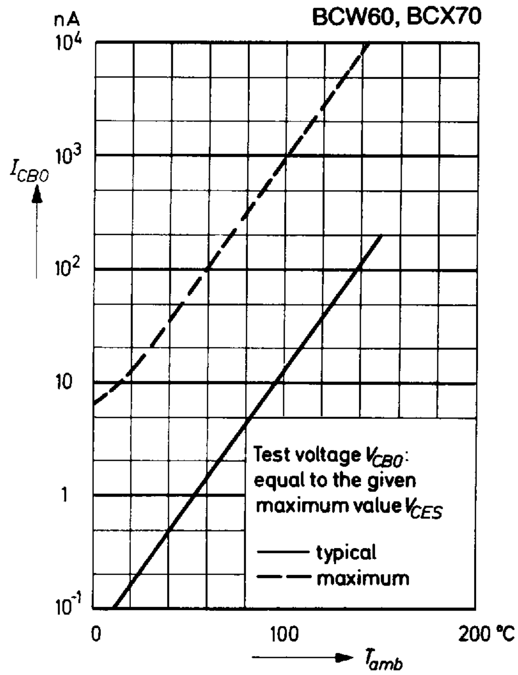
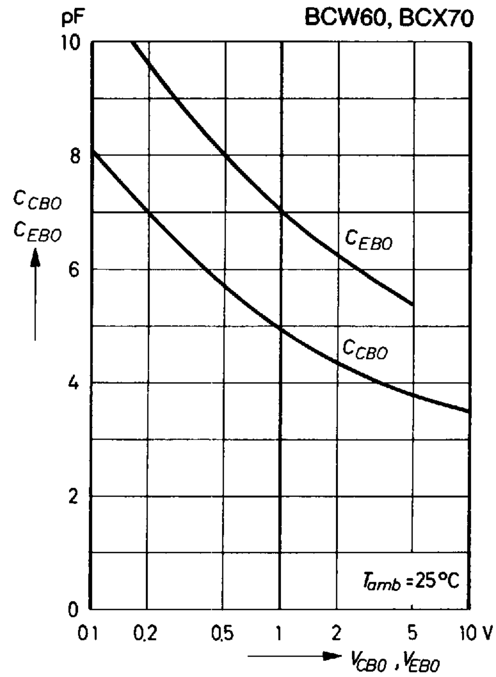
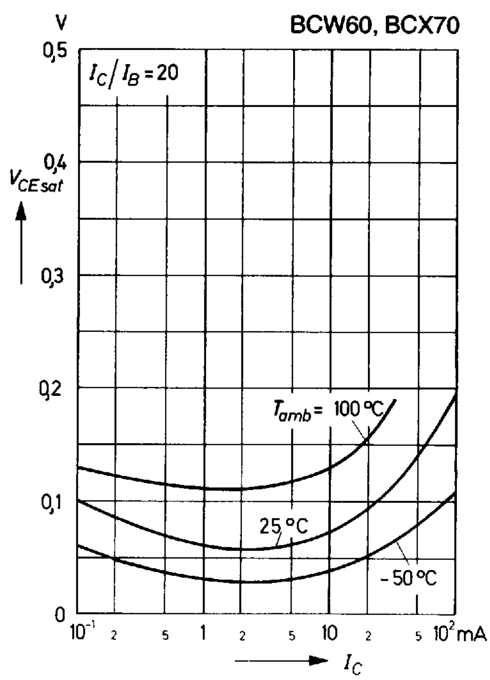
Collector cutoff current versus ambient temperature



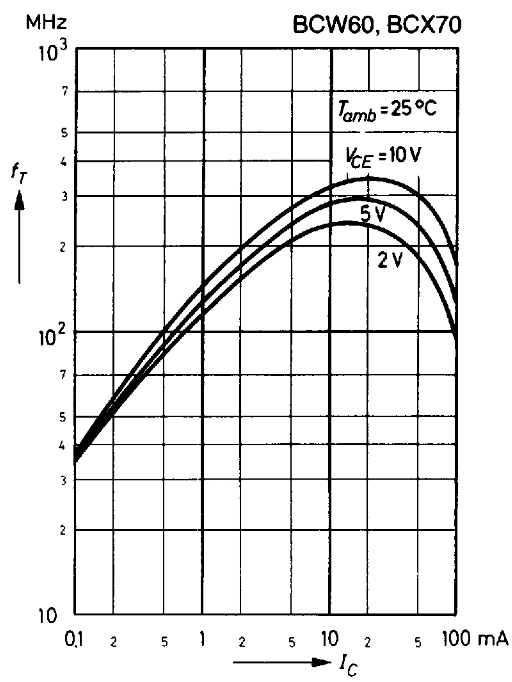
Collector base capacitance, Emitter base capacitance versus reverse bias voltage



Collector saturation voltage versus collector current



Gain bandwidth product versus collector current



Relative h-parameters versus collector current