SILICON PLANAR NPN

BC 107
BC 108
BC 109

LOW NOISE GENERAL PURPOSE AUDIO AMPLIFIERS

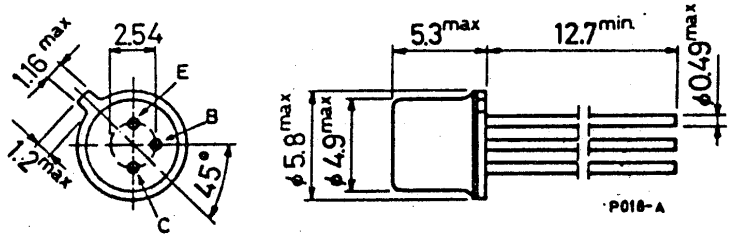
The BC 107, BC 108 and BC 109 are silicon planar epitaxial NPN transistors in TO-18 metal case. They are suitable for use in driver stages, low noise input stages and signal processing circuits of television receivers.
The complementary PNP types are respectively the BC 177, BC 178 and BC 179.

ABSOLUTE MAXIMUM RATINGS

		BC 107	BC 108	BC 109
V_{CBO}	Collector-base voltage ($I_E = 0$)	50 V	30 V	30 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45 V	20 V	20 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6 V	5 V	5 V
I_C	Collector current	100 mA		
P_{tot}	Total power dissipation at $T_{amb} \leq 25$ °C	0.3 W		
	at $T_{case} \leq 25$ °C	0.75 W		
T_{stg}	Storage temperature	-55 to 175 °C		
T_j	Junction temperature	175 °C		

MECHANICAL DATA

Dimensions in mm



(sim. to TO-18)

BC 107
BC 108
BC 109

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	200	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	500	°C/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for BC 107				
		V_{CB} = 40 V			15	nA
		V_{CB} = 40 V T_{amb} = 150 °C			15	µA
		for BC 108 - BC 109				
		V_{CB} = 20 V			15	nA
		V_{CB} = 20 V T_{amb} = 150 °C			15	µA
$V_{(BR)CBO}$	Collector-base breakdown voltage (I_E = 0)	I_C = 10 µA				
		for BC 107	50			V
		for BC 108	30			V
		for BC 109	30			V
$V_{(BR)CEO}$*	Collector-emitter breakdown voltage (I_B = 0)	I_C = 10 mA				
		for BC 107	45			V
		for BC 108	20			V
		for BC 109	20			V
$V_{(BR)EBO}$	Emitter-base breakdown voltage (I_C = 0)	I_E = 10 µA				
		for BC 107	6			V
		for BC 108	5			V
		for BC 109	5			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 10 mA I_B = 0.5 mA		70	250	mV
		I_C = 100 mA I_B = 5 mA		200	600	mV
V_{BE}*	Base-emitter voltage	I_C = 2 mA V_{CE} = 5 V	550	650	700	mV
		I_C = 10 mA V_{CE} = 5 V		700	770	mV
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 10 mA I_B = 0.5 mA		750		mV
		I_C = 100 mA I_B = 5 mA		900		mV

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C = 2 mA V_{CE} = 5 V				
		for BC 107	110	230	450	—
		for BC 107 Gr. A	110	180	220	—
		for BC 107 Gr. B	200	290	450	—
		for BC 108	110	350	800	—
		for BC 108 Gr. A	110	180	220	—
		for BC 108 Gr. B	200	290	450	—
		for BC 108 Gr. C	420	520	800	—
		for BC 109	200	350	800	—
		for BC 109 Gr. B	200	290	450	—
		for BC 109 Gr. C	420	520	800	—
		I_C = 10 µA V_{CE} = 5 V				
		for BC 107		120		—
		for BC 107 Gr. A		90		—
		for BC 107 Gr. B	40	150		—
		for BC 108		120		—
		for BC 108 Gr. A		90		—
		for BC 108 Gr. B	40	150		—
		for BC 108 Gr. C	100	270		—
		for BC 109	70	210		—
		for BC 109 Gr. B	40	150		—
		for BC 109 Gr. C	100	270		—
h_{fe}	Small signal current gain	I_C = 2 mA V_{CE} = 5 V f = 1 kHz				
		for BC 107		250		—
		for BC 107 Gr. A		190		—
		for BC 107 Gr. B		300		—
		for BC 108		370		—
		for BC 108 Gr. A		190		—
		for BC 108 Gr. B		300		—
		for BC 108 Gr. C		500		—
		for BC 109		370		—
		for BC 109 Gr. B		300		—
		for BC 109 Gr. C		550		—
		I_C = 10 mA V_{CE} = 10 V f = 100 MHz		2		—
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 10 V f = 1 MHz		4	6	pF

* Pulsed: pulse duration = 300 µs, duty factor = 1%.

ELECTRICAL CHARACTERISTICS (continued)

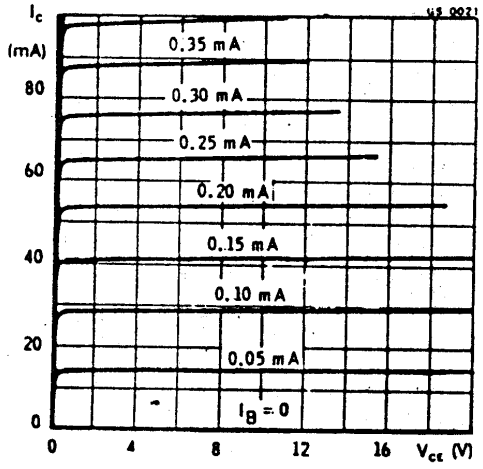
Parameter		Test conditions	Min.	Typ.	Max.	Unit
C_{EBO}	Emitter-base capacitance	$I_C = 0$ $V_{EB} = 0.5$ V $f = 1$ MHz		11.5		pF
NF	Noise figure	$I_C = 0.2$ mA $V_{CE} = 5$ V $R_g = 2$ kΩ $f = 1$ kHz $B = 200$ Hz				
		for BC 107		2	10	dB
		for BC 108		2	10	dB
		for BC 109		1.5	4	dB
		$I_C = 0.2$ mA $V_{CE} = 5$ V $R_g = 2$ kΩ $f = 10$ Hz to 10 kHz $B = 15.7$ kHz				
		for BC 109		1.5	4	dB
h_{ie}	Input impedance	$I_C = 2$ mA $V_{CE} = 5$ V $f = 1$ kHz				
		for BC 107		4		kΩ
		for BC 107 Gr. A		3		kΩ
		for BC 107 Gr. B		4.8		kΩ
		for BC 108		5.5		kΩ
		for BC 108 Gr. A		3		kΩ
		for BC 108 Gr. B		4.8		kΩ
		for BC 108 Gr. C		7		kΩ
		for BC 109		5.5		kΩ
		for BC 109 Gr. B		4.8		kΩ
		for BC 109 Gr. C		7		kΩ
h_{re}	Reverse voltage ratio	$I_C = 2$ mA $V_{CE} = 5$ V $f = 1$ kHz				
		for BC 107		2.2×10^{-4}		—
		for BC 107 Gr. A		1.7×10^{-4}		—
		for BC 107 Gr. B		2.7×10^{-4}		—
		for BC 108		3.1×10^{-4}		—
		for BC 108 Gr. A		1.7×10^{-4}		—
		for BC 108 Gr. B		2.7×10^{-4}		—
		for BC 108 Gr. C		3.8×10^{-4}		—
		for BC 109		3.1×10^{-4}		—
		for BC 109 Gr. B		2.7×10^{-4}		—
		for BC 109 Gr. C		3.8×10^{-4}		—

ELECTRICAL CHARACTERISTICS (continued)

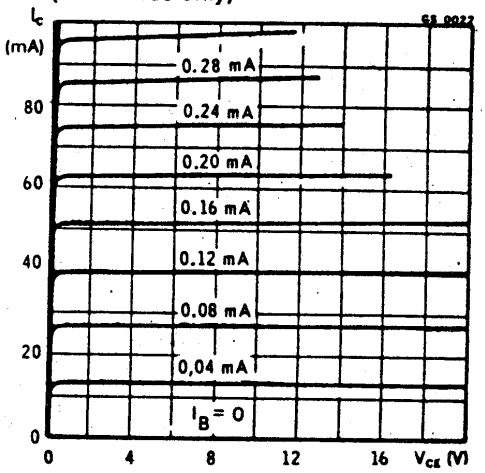
Parameter	Test conditions	Min.	Typ.	Max.	Unit
h_{oe} Output admittance	I_C = 2 mA V_{CE} = 5 V f = 1 kHz				
	for **BC 107**		20		µS
	for **BC 107** Gr. A		13		µS
	for **BC 107** Gr. B		26		µS
	for **BC 108**		30		µS
	for **BC 108** Gr. A		13		µS
	for **BC 108** Gr. B		26		µS
	for **BC 108** Gr. C		34		µS
	for **BC 109**		30		µS
	for **BC 109** Gr. B		26		µS
	for **BC 109** Gr. C		34		µS

32 K

Typical output characteristics
(for BC 107 only)

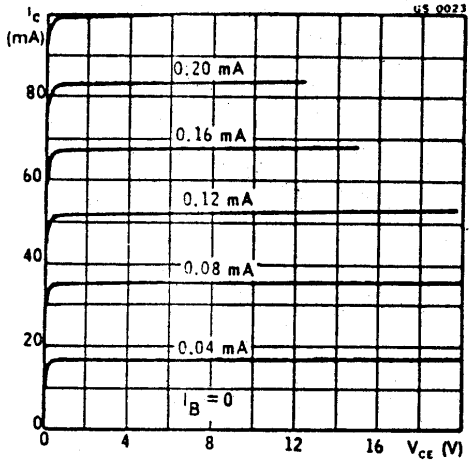


Typical output characteristics
(for BC 108 only)

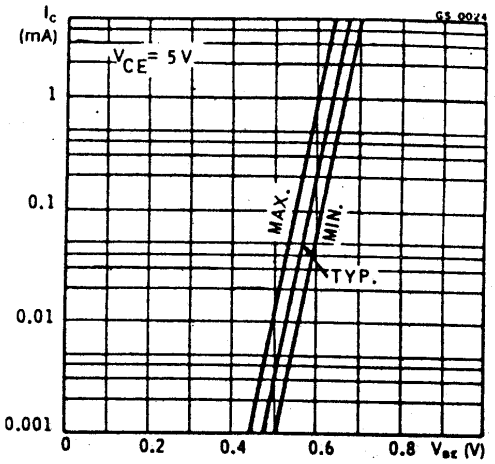


BC 107
BC 108
BC 109

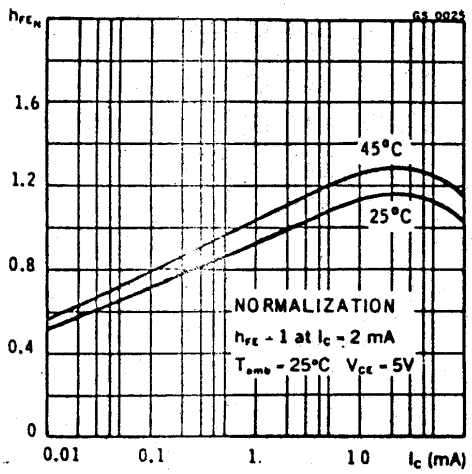
Typical output characteristics
(for BC 109 only)



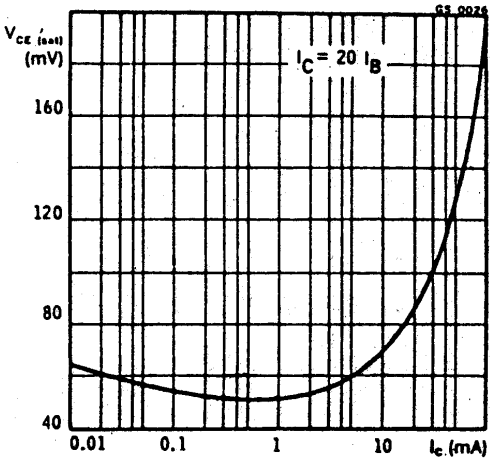
DC transconductance



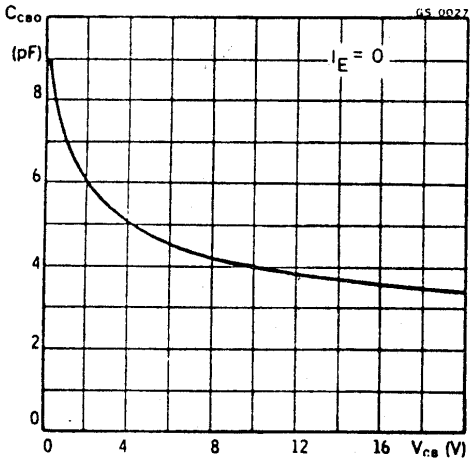
DC normalized current gain



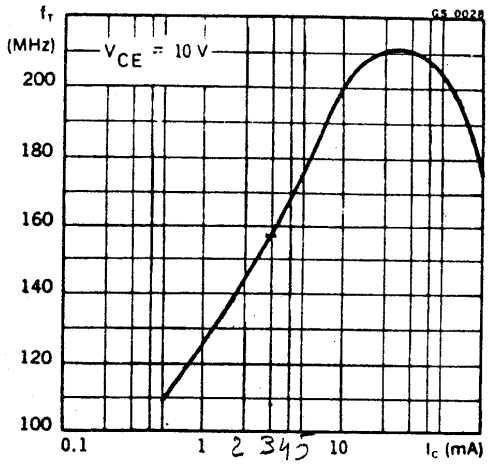
Collector-emitter saturation voltage



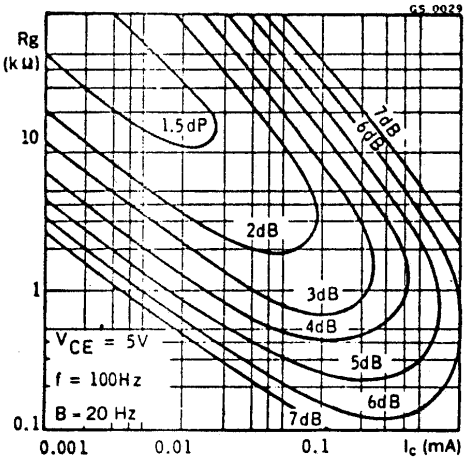
Collector-base capacitance



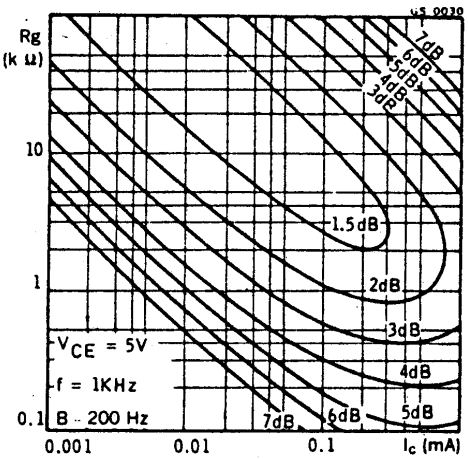
Transition frequency



Noise figure (for **BC 109** only)

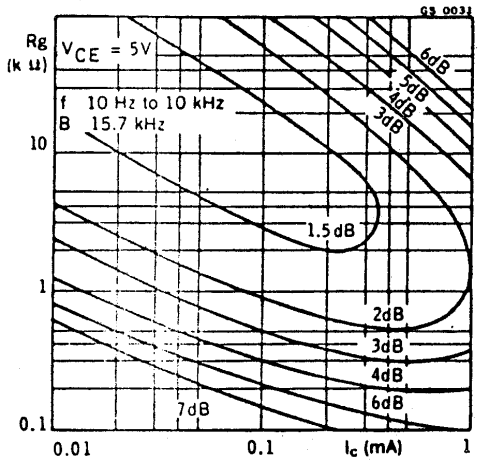


Noise figure (for **BC 109** only)

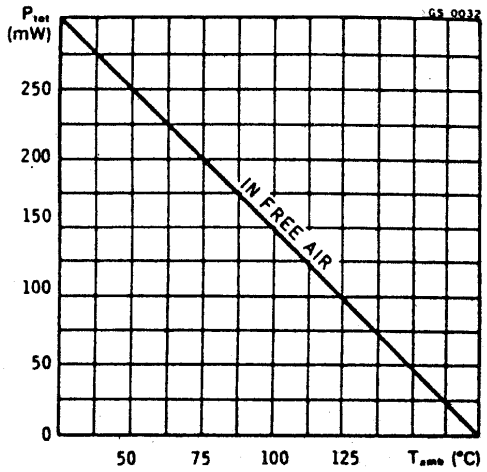


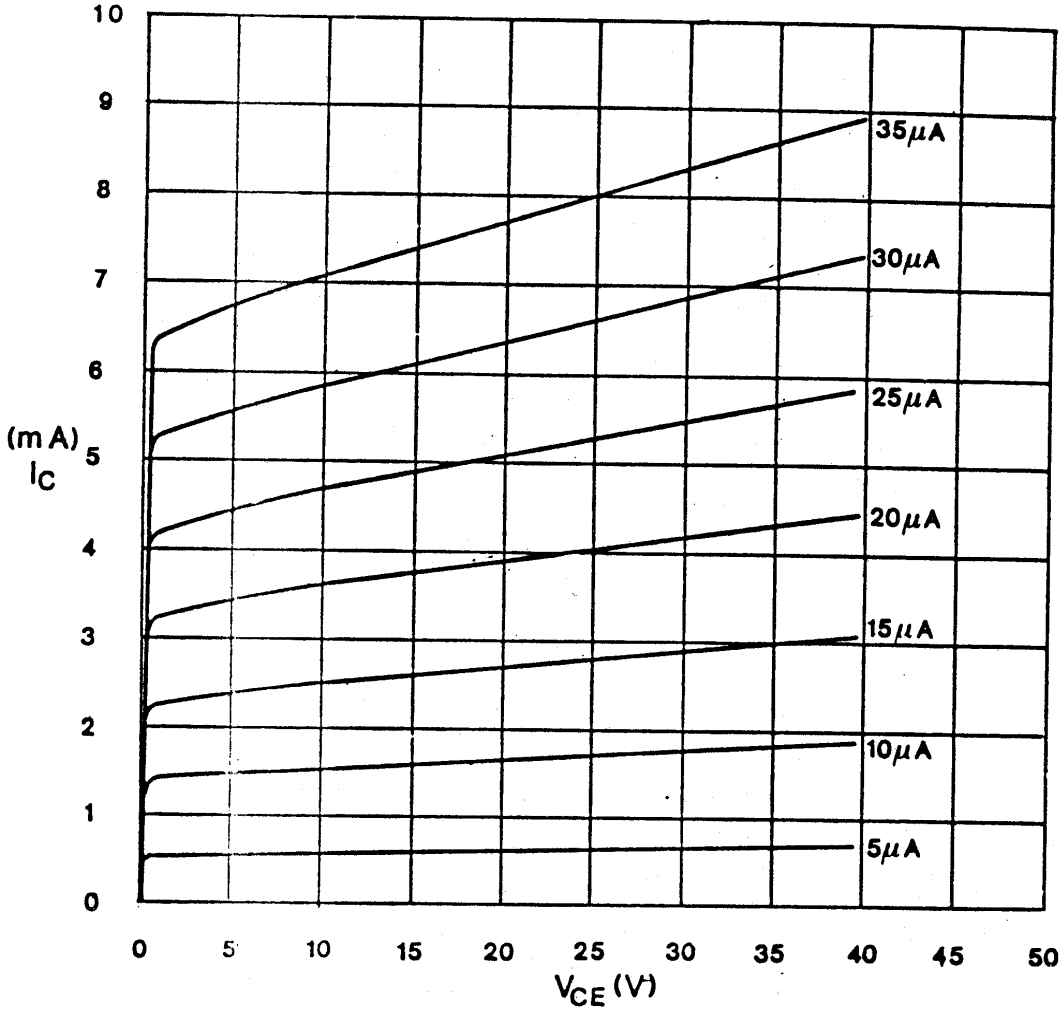
BC 107
BC 108
BC 109

Noise figure (for **BC 109** only)

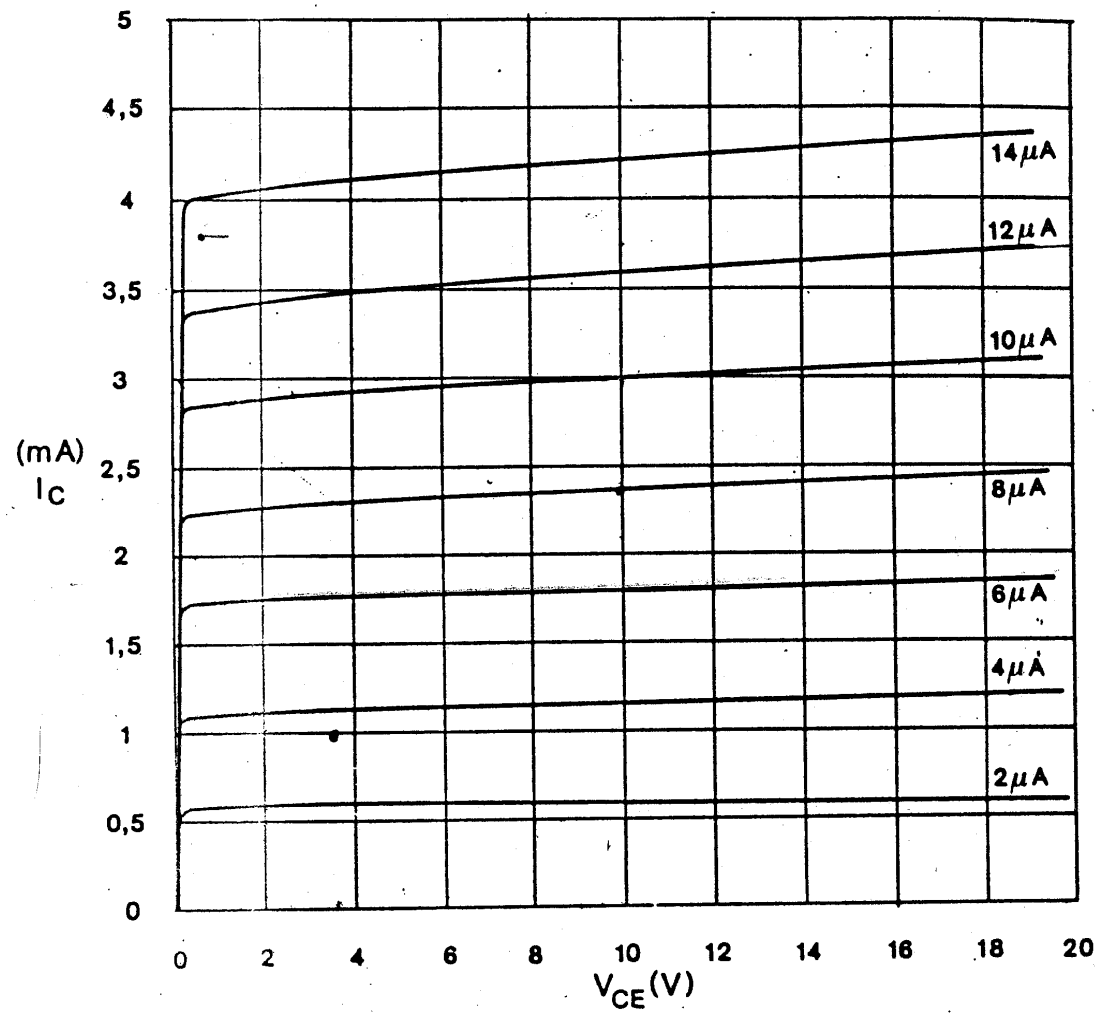


Power rating chart





BC 107 (Caratteristiche rilevate presso l'Istituto di Elettronica)



BC 109 (Caratteristiche rilevate presso l'Istituto di Elettronica) -

SILICON PLANAR PNP

BC 177
BC 178
BC 179

LOW NOISE GENERAL PURPOSE AUDIO AMPLIFIERS

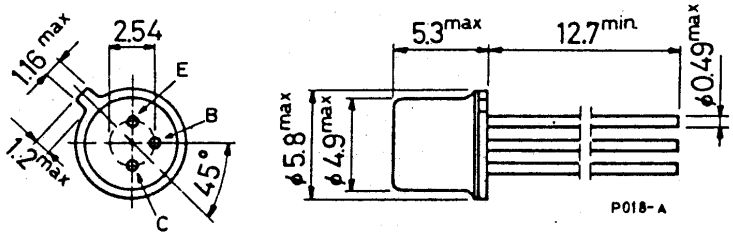
The BC 177, BC 178 and BC 179 are silicon planar epitaxial PNP transistors in TO-18 metal case. They are suitable for use in driver audio stages, low noise input audio stages and as low power, high gain general purpose transistors. The complementary NPN types are respectively the BC 107, BC 108, BC 109.

ABSOLUTE MAXIMUM RATINGS

		BC 177	BC 178	BC 179
V_{CBO}	Collector-base voltage ($I_E = 0$)	-50 V	-30 V	-25 V
→ V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-45 V	-25 V	-20 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45 V	-25 V	-20 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5 V		
→ I_{EM}	Emitter peak current	200 mA		
I_C	Collector current	-100 mA		
→ I_{CM}	Collector peak current	-200 mA		
P_{tot}	Total power dissipation at $T_{amb} \leq 25$ °C	300 mW		
	at $T_{case} \leq 115$ °C	300 mW		
T_{stg}	Storage temperature	-65 to 175 °C		
T_j	Junction temperature	175 °C		

MECHANICAL DATA

Dimensions in mm



(sim. to TO-18)

Supersedes issue dated 9/70

BC 177
BC 178
BC 179

THERMAL DATA

$R_{th\ j-case}$	Thermal resistance junction-case	max	200	°C/W
$R_{th\ j-amb}$	Thermal resistance junction-ambient	max	500	°C/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = -20 V		-1	-100	nA
$V_{(BR)\ CEO}$	Collector-emitter breakdown voltage (I_B = 0)	I_C = -2 mA for **BC 177** for **BC 178** for **BC 179**	 -45 -25 -20			 V V V
$V_{(BR)\ CES}$	Collector-emitter breakdown voltage (V_{BE} = 0)	I_C = -10 μA for **BC 177** for **BC 178** for **BC 179**	 -50 -30 -25			 V V V
$V_{(BR)\ EBO}$	Emitter-base breakdown voltage (I_C = 0)	I_E = -10 μA	-5			V
$V_{CE\ (sat)}$	Collector-emitter saturation voltage	I_C = -10 mA I_B = -0.5 mA I_C = -100 mA I_B = -5 mA		-75 -200	-250	mV mV
V_{BE}	Base-emitter voltage	I_C = -2 mA V_{CE} = -5 V	-600	-640	-750	mV
$V_{BE\ (sat)}$	Base-emitter saturation voltage	I_C = -10 mA I_B = -0.5 mA I_C = -100 mA I_B = -5 mA		-720 -860		mV mV
h_{FE}	DC current gain	I_C = -10 μA V_{CE} = -5 V	30			—

ELECTRICAL CHARACTERISTICS (continued)

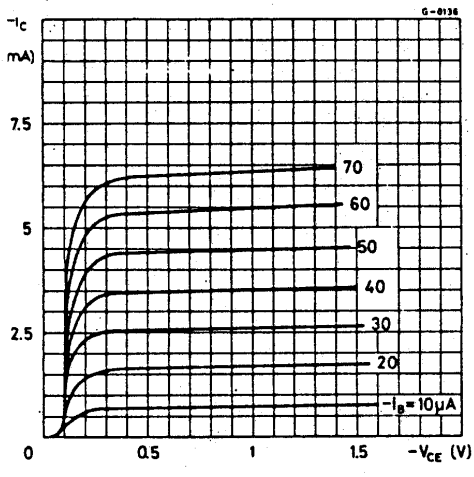
Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{fe}	Small signal current gain	I_C = -2 mA V_{CE} = -5 V f = 1 kHz				
		for **BC 177** Gr. 6	75		150	—
		for **BC 177** Gr. A	125		260	—
		for **BC 178** Gr. 6	75		150	—
		for **BC 178** Gr. A	125		260	—
		for **BC 178** Gr. B	240		500	—
		for **BC 179** Gr. A	125		260	—
		for **BC 179** Gr. B	240		500	—
f_T	Transition frequency	I_C = -10 mA V_{CE} = -5 V		200		MHz
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = -10 V		5.5		pF
NF	Noise figure	I_C = -0.2 mA V_{CE} = -5 V R_g = 2 kΩ f = 1 kHz B = 200 Hz				
		for **BC 177**		2	10	dB
		for **BC 178**		2	10	dB
		for **BC 179**		1.2	4	dB
h_{ie}	Input impedance	I_C = -2 mA V_{CE} = -5 V f = 1 kHz				
		for **BC 177** Gr. 6		1.5		kΩ
		for **BC 177** Gr. A		2.7		kΩ
		for **BC 178** Gr. 6		1.5		kΩ
		for **BC 178** Gr. A		2.7		kΩ
		for **BC 178** Gr. B		5.2		kΩ
		for **BC 179** Gr. A		2.7		kΩ
		for **BC 179** Gr. B		5.2		kΩ
h_{re}	Reverse voltage ratio	I_C = -2 mA V_{CE} = -5 V f = 1 kHz				
		for **BC 177** Gr. 6		1.8×10^{-4}		—
		for **BC 177** Gr. A		2.7×10^{-4}		—
		for **BC 178** Gr. 6		1.8×10^{-4}		—
		for **BC 178** Gr. A		2.7×10^{-4}		—
		for **BC 178** Gr. B		4.5×10^{-4}		—
		for **BC 179** Gr. A		2.7×10^{-4}		—
		for **BC 179** Gr. B		4.5×10^{-4}		—

BC 177
BC 178
BC 179

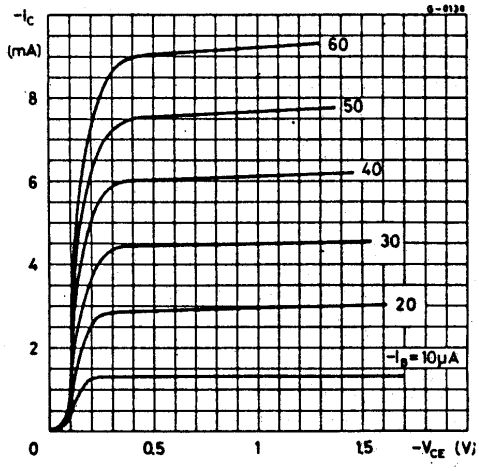
ELECTRICAL CHARACTERISTICS (continued)

Parameter	Test conditions	Min.	Typ.	Max.	Unit
h_{oe} Output admittance	I_C = -2 mA V_{CE} = -5 V f = 1 kHz				
	for BC 177 Gr. 6		20		µS
	for BC 177 Gr. A		25		µS
	for BC 178 Gr. 6		20		µS
	for BC 178 Gr. A		25		µS
	for BC 178 Gr. B		35		µS
	for BC 179 Gr. A		25		µS
	for BC 179 Gr. B		35		µS

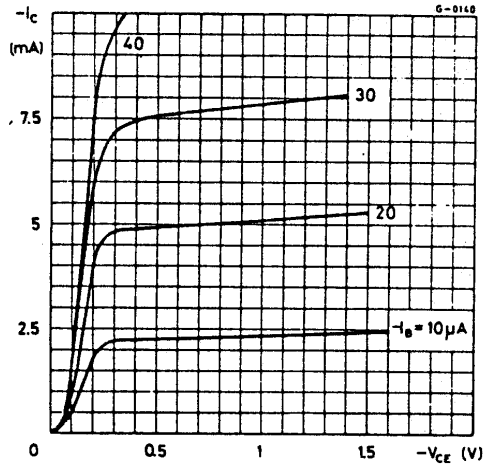
Typical output characteristics
(for BC 177 only)



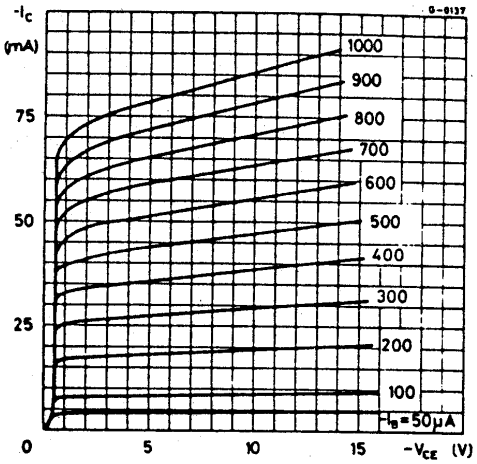
Typical output characteristics
(for BC 178 only)



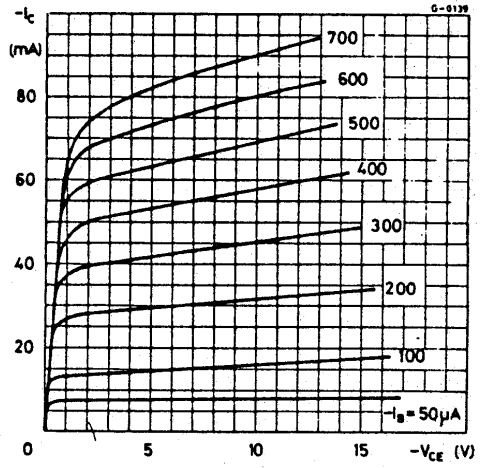
Typical output characteristics
(for **BC 179** only)



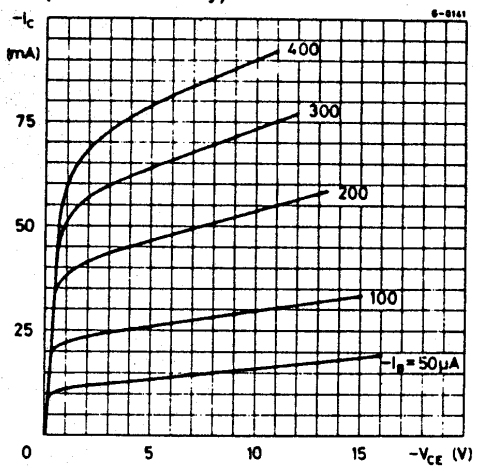
Typical output characteristics
(for **BC 177** only)



Typical output characteristics
(for **BC 178** only)

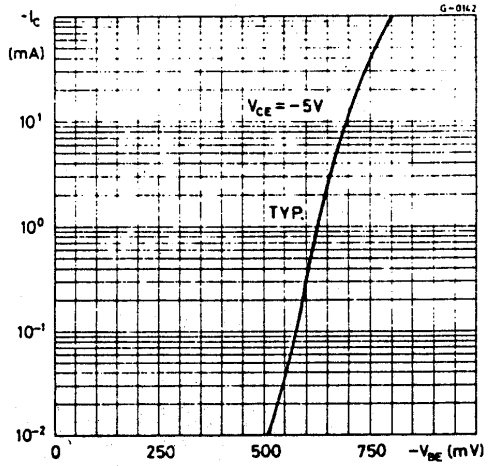


Typical output characteristics
(for **BC 179** only)

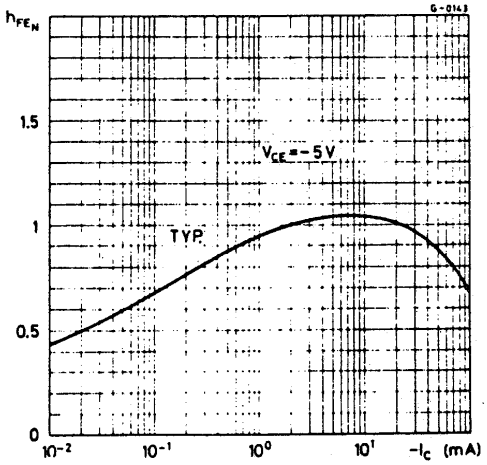


BC 177
BC 178
BC 179

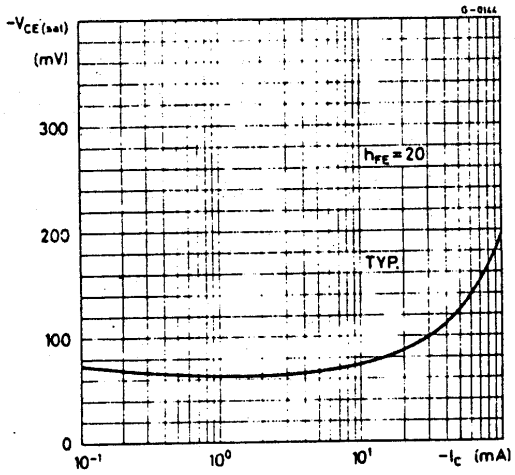
DC transconductance



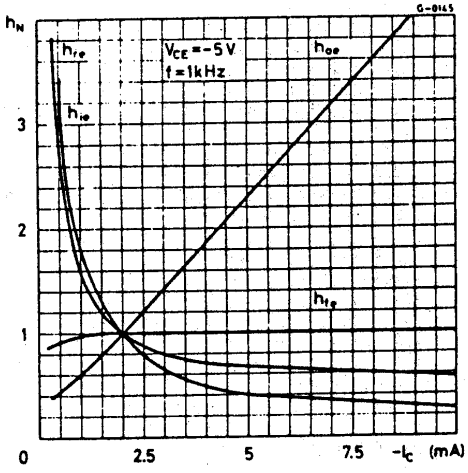
DC normalized current gain



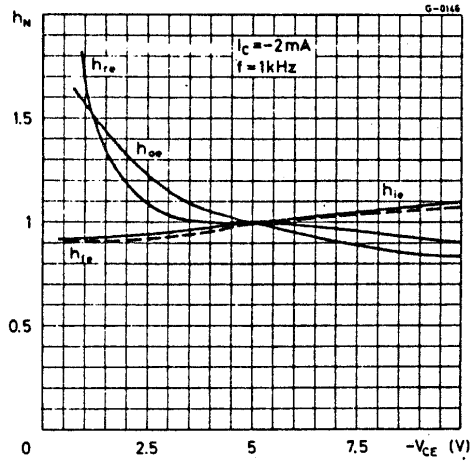
Collector-emitter saturation voltage



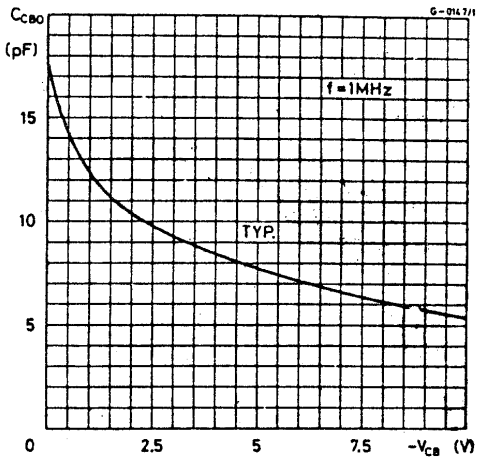
Typical normalized h parameters



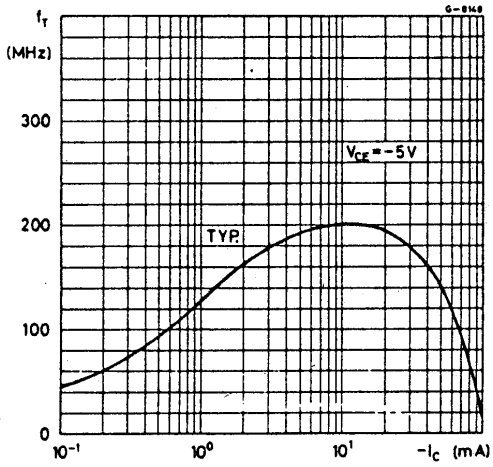
Typical normalized h parameters



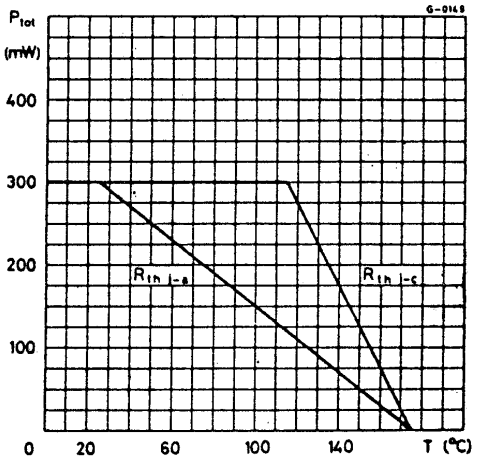
Collector-base capacitance

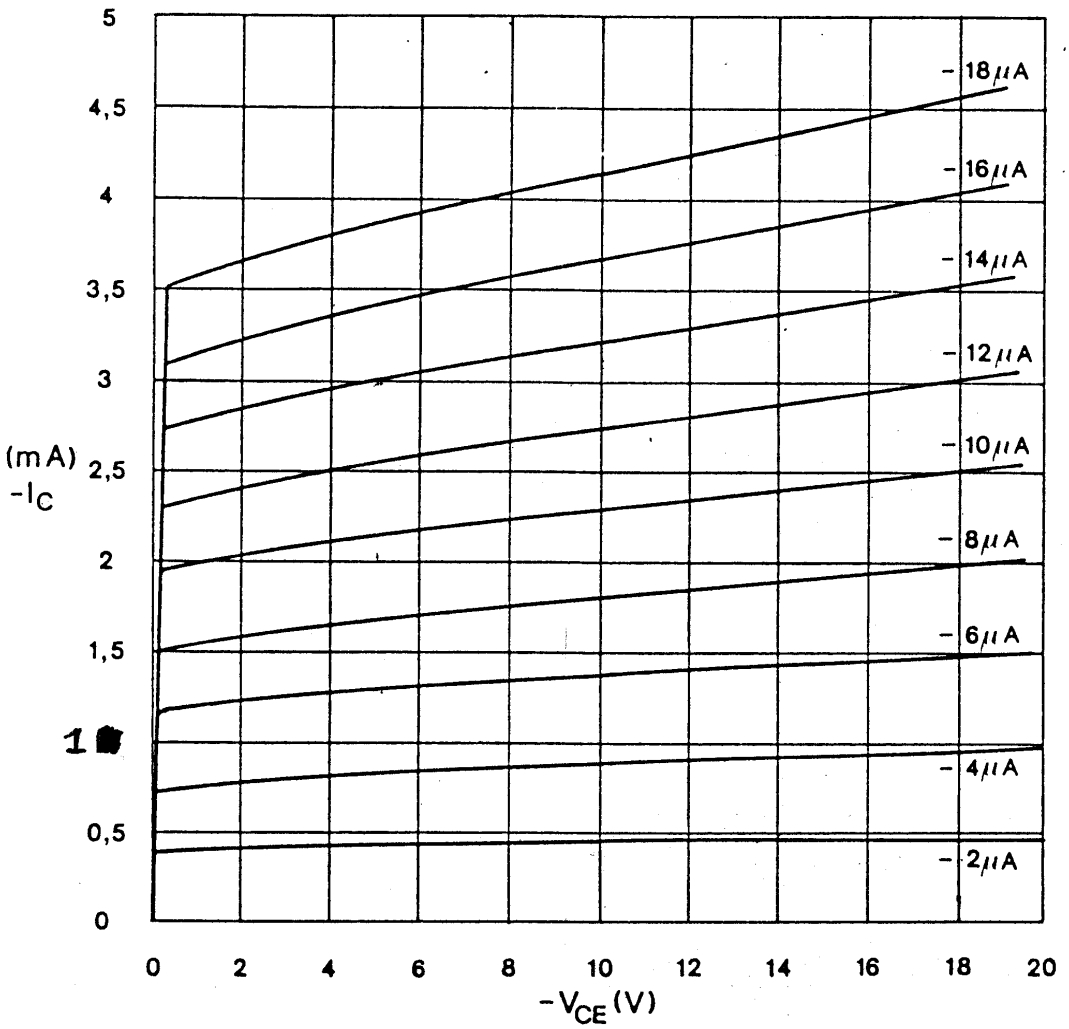


Transition frequency



Power rating chart

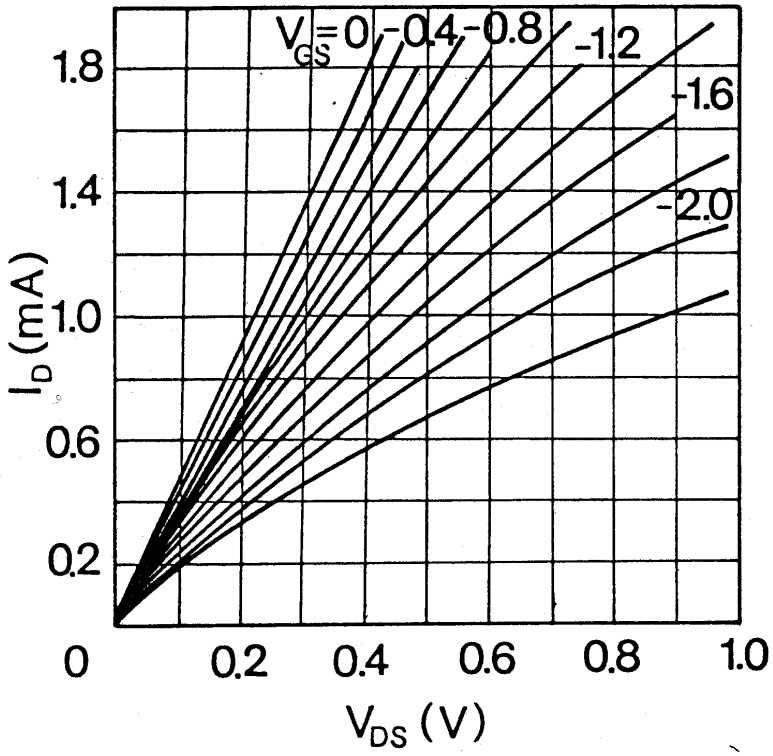


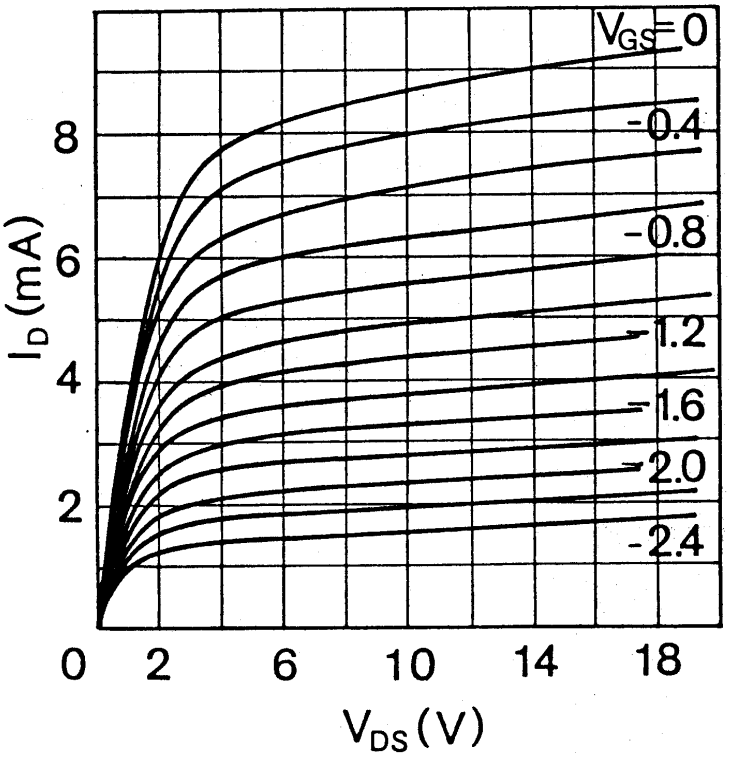


BC 179 (Caratteristiche rilevate presso l'Istituto di Elettronica) -

2.33μA

204.54


V_{GS}=0
-0.4
-0.8
-1.2
-1.6
-2.0
1.8
1.4
1.0
0.6
0.2
0
I_D(mA)
0.2
0.4
0.6
0.8
1.0
V_{DS} (V)


V_{GS}=0
-0.4
-0.8
-1.2
-1.6
-2.0
-2.4
8
6
4
2
0
I_D(mA)
2
6
10
14
18
V_{DS}(V)

N-CHANNEL SILICON FIELD EFFECT TRANSISTORS

N-channel silicon epitaxial planar junction field effect transistors in a TO-72 metal envelope with the shield lead connected to the case.
The transistors are designed for broad band amplifiers (0 to 300 MHz).
Their very low noise at low frequencies makes these devices very suitable for differential amplifiers, electro-medical and nuclear detector pre-amplifiers.

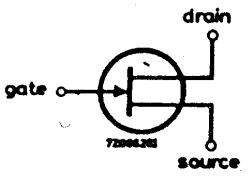
QUICK REFERENCE DATA

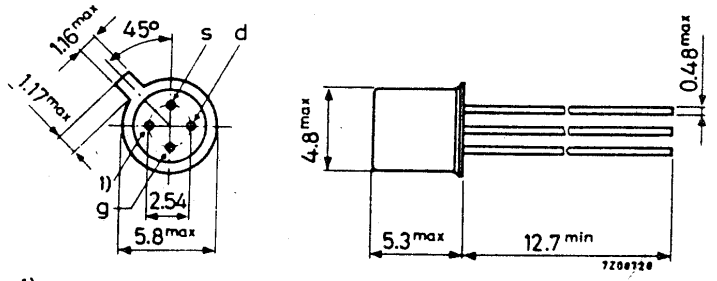
			BFW10	BFW11	
Drain-source voltage	$\pm V_{DS}$	max.	30	30	V
Gate-source voltage (open drain)	$-V_{GSO}$	max.	30	30	V
Total power dissipation up to $T_{amb} = 25\ ^{o}C$	P_{tot}	max.	300	300	mW
Drain current $V_{DS} = 15$ V; $V_{GS} = 0$	I_{DSS}	>	8	4	mA
		<	20	10	mA
Gate-source cut-off voltage $I_D = 0.5$ nA; $V_{DS} = 15$ V	$-V_{(P)GS}$	<	8	6	V
Feedback capacitance at f = 1 MHz $V_{DS} = 15$ V; $V_{GS} = 0$	$-C_{rs}$	<	0.75	0.75	pF
Transfer admittance (common source) $V_{DS} = 15$ V; $V_{GS} = 0$; f = 200 MHz	$\|y_{fs}\|$	>	3.2	3.2	$m\Omega^{-1}$
Noise figure at $V_{DS} = 15$ V; $V_{GS} = 0$ f = 100 MHz; $R_G = 1$ kΩ	F	<	2.5	2.5	dB
Equivalent noise voltage f = 10 Hz	$V_n/\sqrt{B}$	<	75	75	$nV/\sqrt{Hz}$

MECHANICAL DATA

Dimensions in mm

TO-72
Insulated electrodes





1) = shield lead (connected to case)

Accessories available: 56246, 56263.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages				
Drain-source voltage	$\pm V_{DS}$	max.	30	V
Drain-gate voltage (open source)	V_{DGO}	max.	30	V
Gate-source voltage (open drain)	$-V_{GSO}$	max.	30	V
Currents				
Drain current	I_D	max.	20	mA
Gate current	I_G	max.	10	mA
Power dissipation				
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Temperatures				
Storage temperature	T_{stg}	−65 to +200		°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

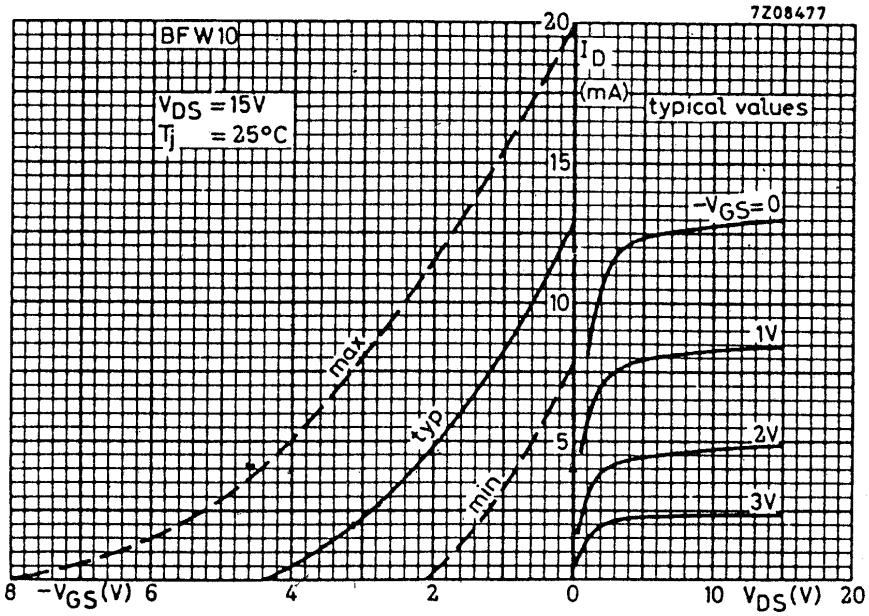
From junction to ambient	$R_{th\ j-a}$	=	0.59	°C/mW

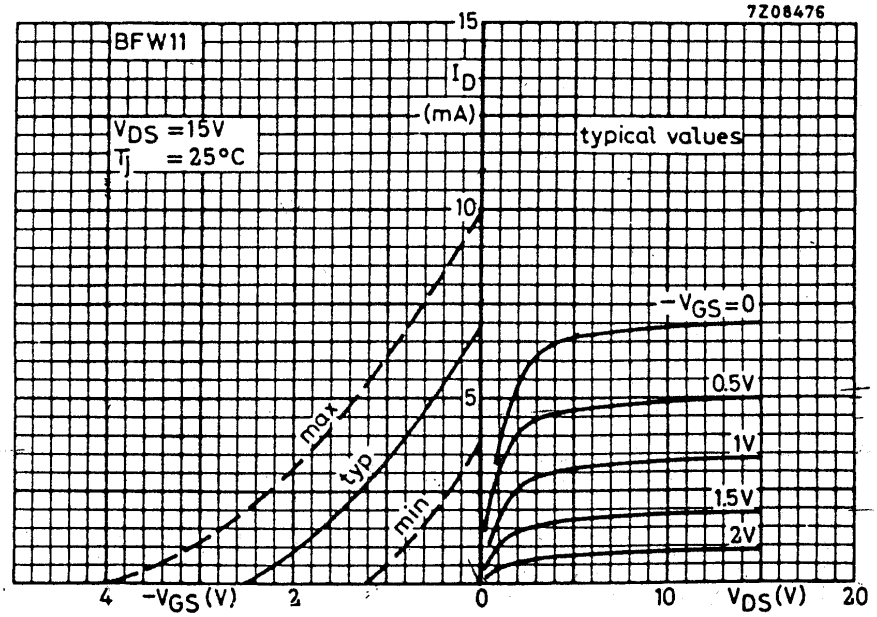
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BFW10	BFW11	
Gate cut-off current					
$-V_{GS}$ = 20 V; V_{DS} = 0	$-I_{GSS}$	<	0.5	0.5	nA
$-V_{GS}$ = 20 V; V_{DS} = 0; T_j = 150 °C	$-I_{GSS}$	<	0.5	0.5	μA
Drain current [1]					
V_{DS} = 15 V; V_{GS} = 0	I_{DSS}	>	8	4	mA
		<	20	10	mA
Gate-source voltage					
I_D = 400 μA; V_{DS} = 15 V	$-V_{GS}$	>	2.0		V
		<	7.5		V
I_D = 50 μA; V_{DS} = 15 V	$-V_{GS}$	>		1.25	V
		<		4.0	V
Gate-source cut-off voltage					
I_D = 0.5 nA; V_{DS} = 15 V	$-V_{(P)GS}$	<	8	6	V
y parameters					
V_{DS} = 15 V; V_{GS} = 0; T_{amb} = 25 °C					
f = 1 kHz Transfer admittance	$\|y_{fs}\|$	>	3.5	3.0	$m\Omega^{-1}$
		<	6.5	6.5	$m\Omega^{-1}$
Output admittance	$\|y_{os}\|$	<	85	50	$\mu\Omega^{-1}$
f = 1 MHz Input capacitance	C_{is}	typ.	4	4	pF
		<	5	5	pF
Feedback capacitance	$-C_{rs}$	typ.	0.6	0.6	pF
		<	0.75	0.75	pF
f = 200 MHz Transfer admittance	$\|y_{fs}\|$	>	3.2	3.2	$m\Omega^{-1}$
Input conductance	g_{is}	<	800	800	$\mu\Omega^{-1}$
Output conductance	g_{os}	<	200	100	$\mu\Omega^{-1}$
Noise figure at f = 100 MHz; R_G = 1 kΩ					
V_{DS} = 15 V; V_{GS} = 0; T_{amb} = 25 °C input tuned to minimum noise	F	<	2.5	2.5	dB
Equivalent noise voltage					
V_{DS} = 15 V; V_{GS} = 0; T_{amb} = 25 °C					
f = 10 Hz	$V_n/\sqrt{B}$	<	75	75	$nV/\sqrt{Hz}$

[1] Measured under pulsed conditions.


7Z08477
BFW10
V_{DS} = 15V
T_j = 25°C
I_D (mA)
typical values
$-V_{GS}$=0
1V
2V
3V
max
typ
min
20
15
10
5
8 $-V_{GS}$(V) 6
4
2
0
10 V_{DS}(V) 20


7Z08476
BFW11
V_{DS} = 15V
T_j = 25°C
I_D (mA)
typical values
$-V_{GS}$=0
0.5V
1V
1.5V
2V
max
typ
min
15
10
5
4 $-V_{GS}$(V) 2
0
10 V_{DS}(V) 20