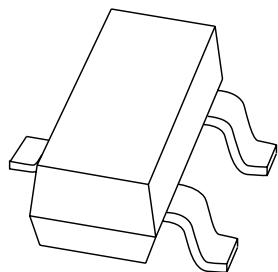


DATA SHEET



BC859; BC860 **PNP general purpose transistors**

Product data sheet
Supersedes data of 1999 May 28

2004 Jan 16

PNP general purpose transistors**BC859; BC860****FEATURES**

- Low current (max. 100 mA)
- Low voltage (max. 45 V).

APPLICATIONS

- Low noise input stages of audio frequency equipment.

DESCRIPTION

PNP transistor in a SOT23 plastic package.
NPN complements: BC849 and BC850.

MARKING

TYPE NUMBER	MARKING CODE ⁽¹⁾	TYPE NUMBER	MARKING CODE ⁽¹⁾
BC859B	4B*	BC860B	4F*
BC859C	4C*	BC860C	4G*

Note

1. * = p : Made in Hong Kong.
- * = t : Made in Malaysia.
- * = W : Made in China.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
BC859B	-	plastic surface mounted package; 3 leads	SOT23
BC859C			
BC860B			
BC860C			

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

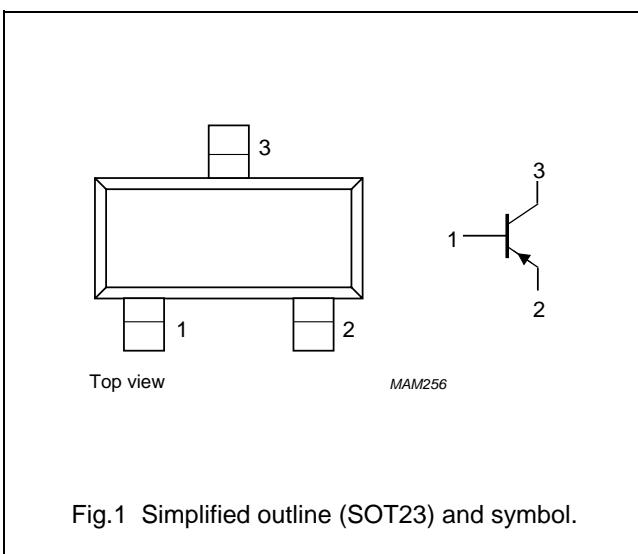


Fig.1 Simplified outline (SOT23) and symbol.

PNP general purpose transistors

BC859; BC860

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage BC859 BC860	open emitter	– –	–30 –50	V V
V_{CEO}	collector-emitter voltage BC859 BC860	open base	– –	–30 –45	V V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	collector current (DC)		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25^\circ\text{C}$; note 1	–	250	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature		–65	+150	°C

Note

- Transistor mounted on an FR4 printed-circuit board.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th(j-a)}$	thermal resistance from junction to ambient	note 1	500	K/W

Note

- Transistor mounted on an FR4 printed-circuit board.

PNP general purpose transistors

BC859; BC860

CHARACTERISTICS $T_j = 25^\circ\text{C}$ unless otherwise specified.

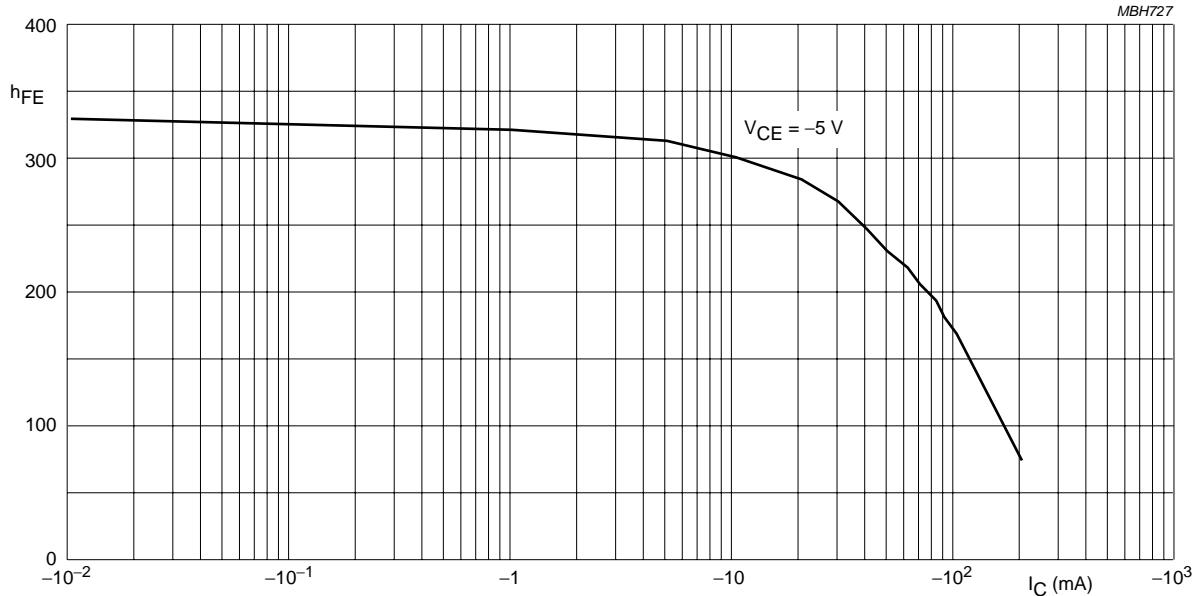
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0; V_{CB} = -30\text{ V}$	–	–1	–15	nA
		$I_E = 0; V_{CB} = -30\text{ V}; T_j = 150^\circ\text{C}$	–	–	–4	μA
I_{EBO}	emitter cut-off current	$I_C = 0; V_{EB} = -5\text{ V}$	–	–	–100	nA
h_{FE}	DC current gain BC859B; BC860B BC859C; BC860C	$I_C = -2\text{ mA}; V_{CE} = -5\text{ V};$ see Figs 2 and 3	220	–	475	
			420	–	800	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -10\text{ mA}; I_B = -0.5\text{ mA}$	–	–75	–300	mV
		$I_C = -100\text{ mA}; I_B = -5\text{ mA}$	–	–250	–650	mV
V_{BEsat}	base-emitter saturation voltage	$I_C = -10\text{ mA}; I_B = -0.5\text{ mA}; \text{note 1}$	–	–700	–	mV
		$I_C = -100\text{ mA}; I_B = -5\text{ mA}; \text{note 1}$	–	–850	–	mV
V_{BE}	base-emitter voltage	$I_C = -2\text{ mA}; V_{CE} = -5\text{ V}; \text{note 2}$	–600	–650	–750	mV
		$I_C = -10\text{ mA}; V_{CE} = -5\text{ V}; \text{note 2}$	–	–	–820	mV
C_c	collector capacitance	$I_E = I_e = 0; V_{CB} = -10\text{ V}; f = 1\text{ MHz}$	–	4.5	–	pF
C_e	emitter capacitance	$I_C = I_e = 0; V_{EB} = -500\text{ mV}; f = 1\text{ MHz}$	–	10	–	pF
f_T	transition frequency	$I_C = -10\text{ mA}; V_{CE} = -5\text{ V}; f = 100\text{ MHz}$	100	–	–	MHz
F	noise figure BC859B; BC860B; BC859C; BC860C	$I_C = -200\text{ }\mu\text{A}; V_{CE} = -5\text{ V}; R_S = 2\text{ k}\Omega;$ $f = 30\text{ Hz to }15\text{ kHz}$	–	–	4	dB
	noise figure BC859B; BC860B; BC859C; BC860C	$I_C = -200\text{ }\mu\text{A}; V_{CE} = -5\text{ V}; R_S = 2\text{ k}\Omega;$ $f = 1\text{ kHz}; B = 200\text{ Hz}$	–	–	4	dB

Notes

- V_{BEsat} decreases by about -1.7 mV/K with increasing temperature.
- V_{BE} decreases by about -2 mV/K with increasing temperature.

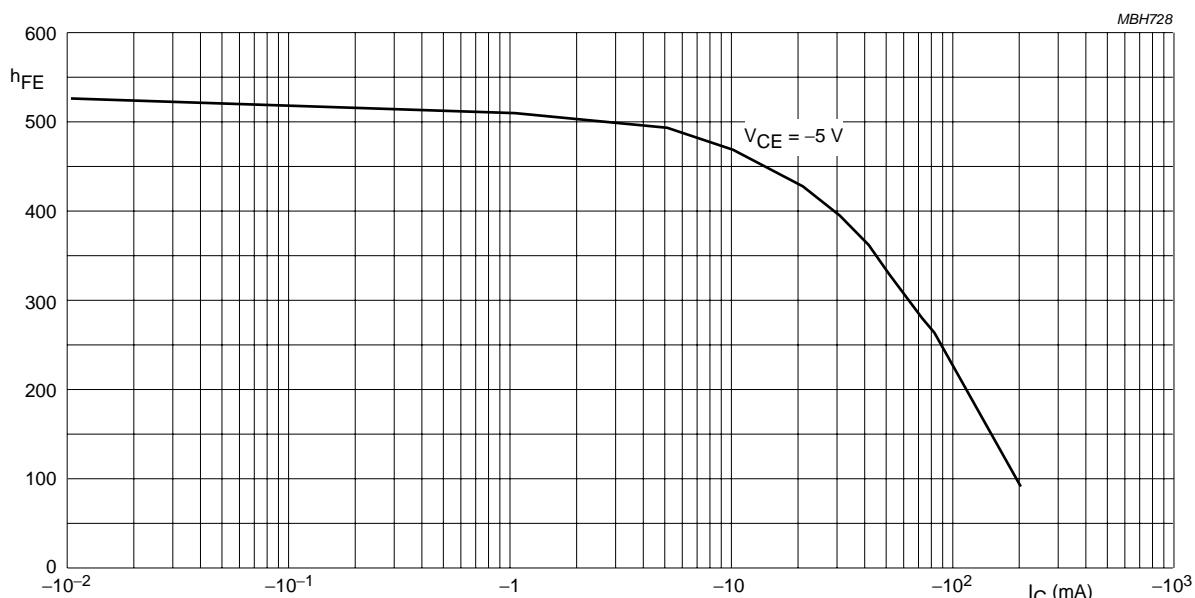
PNP general purpose transistors

BC859; BC860



BC859B; BC860B.

Fig.2 DC current gain; typical values.



BC859C; BC860C.

Fig.3 DC current gain; typical values.

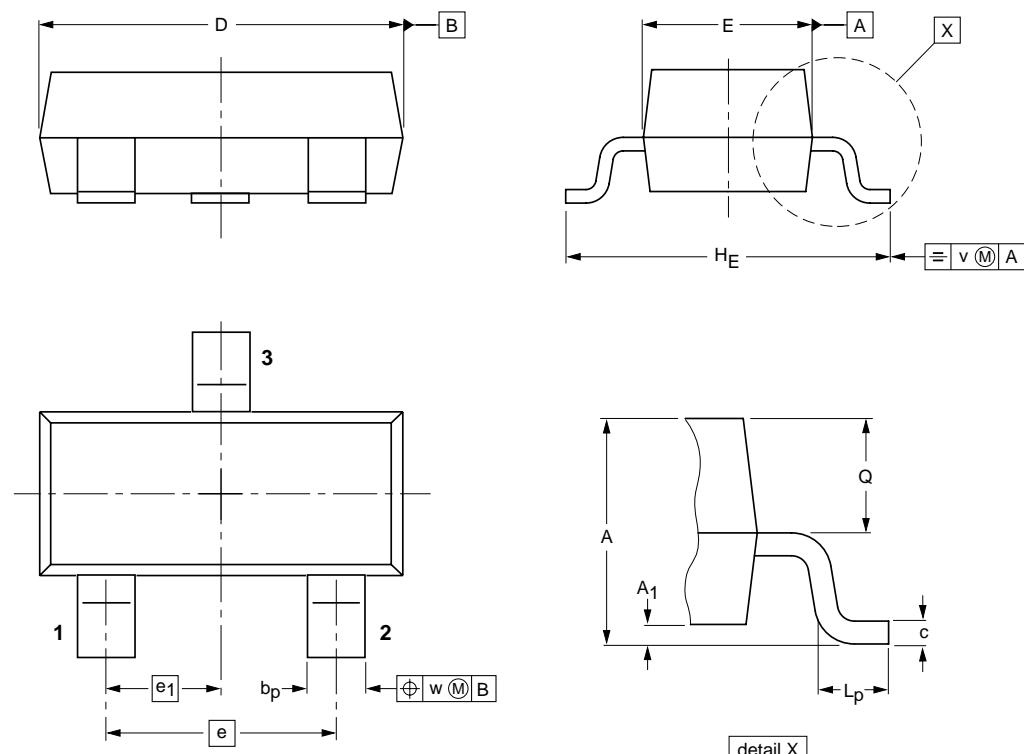
PNP general purpose transistors

BC859; BC860

PACKAGE OUTLINE

Plastic surface-mounted package; 3 leads

SOT23



0 1 2 mm
scale

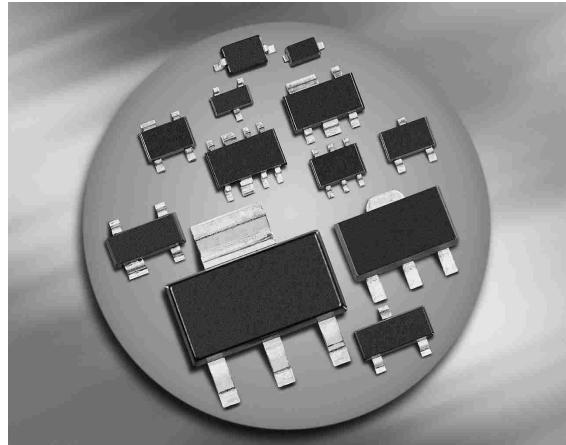
DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁ max.	b _p	c	D	E	e	e ₁	H _E	l _p	Q	v	w
mm	1.1 0.9	0.1	0.48 0.38	0.15 0.09	3.0 2.8	1.4 1.2	1.9	0.95	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT23		TO-236AB				-04-11-04- 06-03-16

PNP Silicon AF Transistor

- 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:
BC847...-BC850... (NPN)
- Pb-free (RoHS compliant) package
- Qualified according AEC Q101¹⁾



¹⁾BC857BL3 is not qualified according AEC Q101

Type	Marking	Pin Configuration						Package
BC857A	3Es	1=B	2=E	3=C	-	-	-	SOT23
BC857B	3Fs	1=B	2=E	3=C	-	-	-	SOT23
BC857BL3*	3F	1=B	2=E	3=C	-	-	-	TSLP-3-1
BC857BW	3Fs	1=B	2=E	3=C	-	-	-	SOT323
BC857C	3Gs	1=B	2=E	3=C	-	-	-	SOT23
BC857CW	3Gs	1=B	2=E	3=C	-	-	-	SOT323
BC858A	3Js	1=B	2=E	3=C	-	-	-	SOT23
BC858B	3Ks	1=B	2=E	3=C	-	-	-	SOT23
BC858BW	3Ks	1=B	2=E	3=C	-	-	-	SOT323
BC858C	3Ls	1=B	2=E	3=C	-	-	-	SOT23
BC858CW	3Ls	1=B	2=E	3=C	-	-	-	SOT323
BC859C	4Cs	1=B	2=E	3=C	-	-	-	SOT23
BC860B	4Fs	1=B	2=E	3=C	-	-	-	SOT23
BC860BW	4Fs	1=B	2=E	3=C	-	-	-	SOT323
BC860CW	4Gs	1=B	2=E	3=C	-	-	-	SOT323

* Not qualified according AEC Q101

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage BC857..., BC860...	V_{CEO}	45	V
BC858..., BC859...		30	
Collector-base voltage BC857..., BC860...	V_{CBO}	50	
BC858..., BC859...		30	
Emitter-base voltage	V_{EBO}	5	
Collector current	I_C	100	mA
Peak collector current, $t_p \leq 10$ ms	I_{CM}	200	
Total power dissipation $T_S \leq 71$ °C, BC857-BC860	P_{tot}	330	mW
$T_S \leq 135$ °C, BC857BL3		250	
$T_S \leq 124$ °C, BC857W-BC860W		250	
Junction temperature	T_j	150	°C
Storage temperature	T_{stg}	-65 ... 150	

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point ¹⁾ BC857-BC860	R_{thJS}	≤ 240	K/W
BC857BL3		≤ 60	
BC857W-BC860W		≤ 105	

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

Electrical Characteristics at $T_A = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 10 \text{ mA}, I_B = 0$, BC857..., BC860...	$V_{(\text{BR})\text{CEO}}$	45	-	-	V
$I_C = 10 \text{ mA}, I_B = 0$, BC858..., BC859...		30	-	-	
Collector-base breakdown voltage $I_C = 10 \mu\text{A}, I_E = 0$, BC857..., BC860...	$V_{(\text{BR})\text{CBO}}$	50	-	-	
$I_C = 10 \mu\text{A}, I_E = 0$, BC858..., BC859...		30	-	-	
Emitter-base breakdown voltage $I_E = 1 \mu\text{A}, I_C = 0$	$V_{(\text{BR})\text{EBO}}$	5	-	-	
Collector-base cutoff current $V_{CB} = 45 \text{ V}, I_E = 0$ $V_{CB} = 30 \text{ V}, I_E = 0, T_A = 150^\circ\text{C}$	I_{CBO}	-	-	0.015	μA
-		-	-	5	
DC current gain ¹⁾ $I_C = 10 \mu\text{A}, V_{CE} = 5 \text{ V}, h_{FE}\text{-grp.A}$ $I_C = 10 \mu\text{A}, V_{CE} = 5 \text{ V}, h_{FE}\text{-grp.B}$ $I_C = 10 \mu\text{A}, V_{CE} = 5 \text{ V}, h_{FE}\text{-grp.C}$ $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, h_{FE}\text{-grp.A}$ $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, h_{FE}\text{-grp.B}$ $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, h_{FE}\text{-grp.C}$	h_{FE}	-	140	-	-
-		-	250	-	
-		-	480	-	
-		125	180	250	
-		220	290	475	
-		420	520	800	
Collector-emitter saturation voltage ¹⁾ $I_C = 10 \text{ mA}, I_B = 0.5 \text{ mA}$ $I_C = 100 \text{ mA}, I_B = 5 \text{ mA}$	$V_{CE\text{sat}}$	-	75	300	mV
-		-	250	650	
Base emitter saturation voltage ¹⁾ $I_C = 10 \text{ mA}, I_B = 0.5 \text{ mA}$ $I_C = 100 \text{ mA}, I_B = 5 \text{ mA}$	$V_{BE\text{sat}}$	-	700	-	
-		-	850	-	
Base-emitter voltage ¹⁾ $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}$ $I_C = 10 \text{ mA}, V_{CE} = 5 \text{ V}$	$V_{BE(\text{ON})}$	600	650	750	
-		-	-	820	

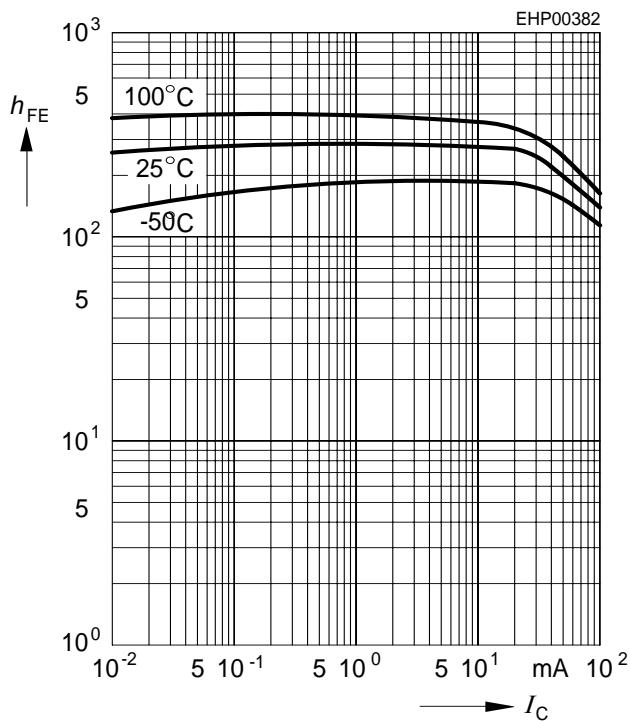
¹Pulse test: $t < 300\mu\text{s}$; $D < 2\%$

Electrical Characteristics at $T_A = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency $I_C = 20 \text{ mA}, V_{CE} = 5 \text{ V}, f = 100 \text{ MHz}$	f_T	-	250	-	MHz
Collector-base capacitance $V_{CB} = 10 \text{ V}, f = 1 \text{ MHz}$	C_{cb}	-	1.5	-	pF
Emitter-base capacitance $V_{EB} = 0.5 \text{ V}, f = 1 \text{ MHz}$	C_{eb}	-	8	-	
Short-circuit input impedance $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}, h_{FE}-\text{grp.A}$ $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}, h_{FE}-\text{grp.B}$ $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}, h_{FE}-\text{grp.C}$	h_{11e}	-	2.7	-	kΩ
Open-circuit reverse voltage transf. ratio $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}, h_{FE}-\text{grp.A}$ $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}, h_{FE}-\text{grp.B}$ $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}, h_{FE}-\text{grp.C}$	h_{12e}	-	1.5	-	10^{-4}
Short-circuit forward current transf. ratio $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}, h_{FE}-\text{grp.A}$ $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}, h_{FE}-\text{grp.B}$ $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}, h_{FE}-\text{grp.C}$	h_{21e}	-	200	-	-
Open-circuit output admittance $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}, h_{FE}-\text{grp.A}$ $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}, h_{FE}-\text{grp.B}$ $I_C = 2 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}, h_{FE}-\text{grp.C}$	h_{22e}	-	18	-	μS
Noise figure $I_C = 0.2 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz},$ $\Delta f = 200 \text{ Hz}, R_S = 2 \text{ kΩ}, \text{ BC859, BC850}$	F	-	1	4	dB
Equivalent noise voltage $I_C = 200 \text{ mA}, V_{CE} = 5 \text{ V}, R_S = 2 \text{ kΩ},$ $f = 10\dots50 \text{ Hz}, \text{ BC860}$	V_n	-	-	0.11	μV

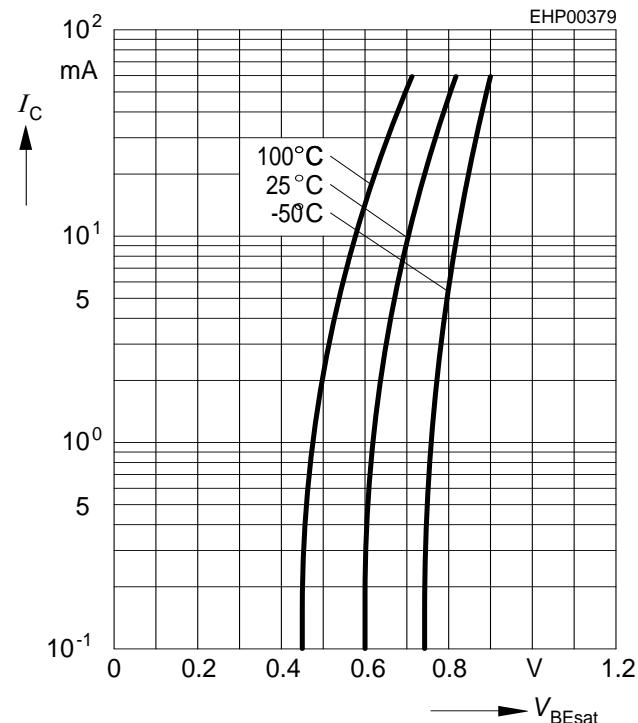
DC current gain $h_{FE} = f(I_C)$

$V_{CE} = 1 \text{ V}$



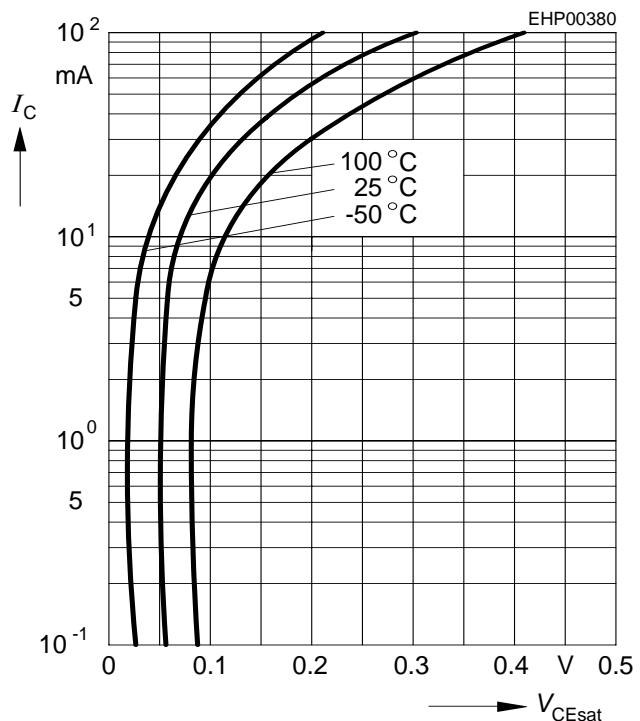
Base-emitter saturation voltage

$I_C = f(V_{BEsat}), h_{FE} = 20$



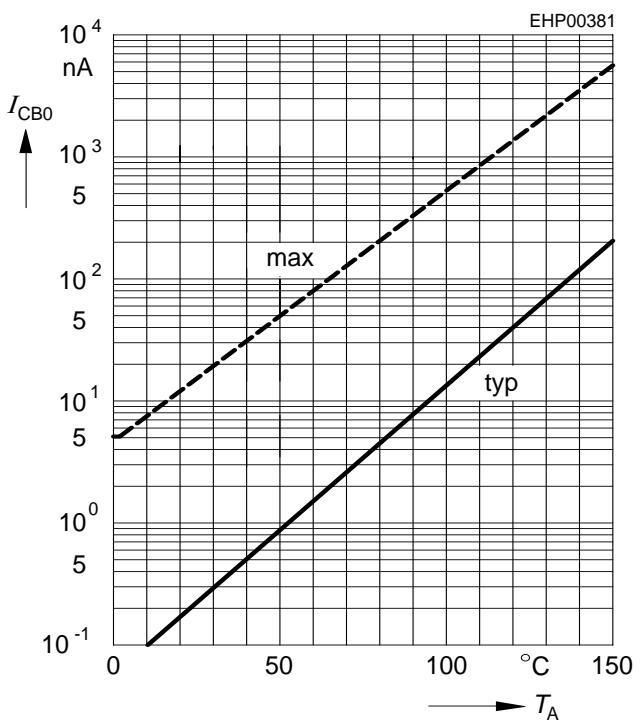
Collector-emitter saturation voltage

$I_C = f(V_{CEsat}), h_{FE} = 20$

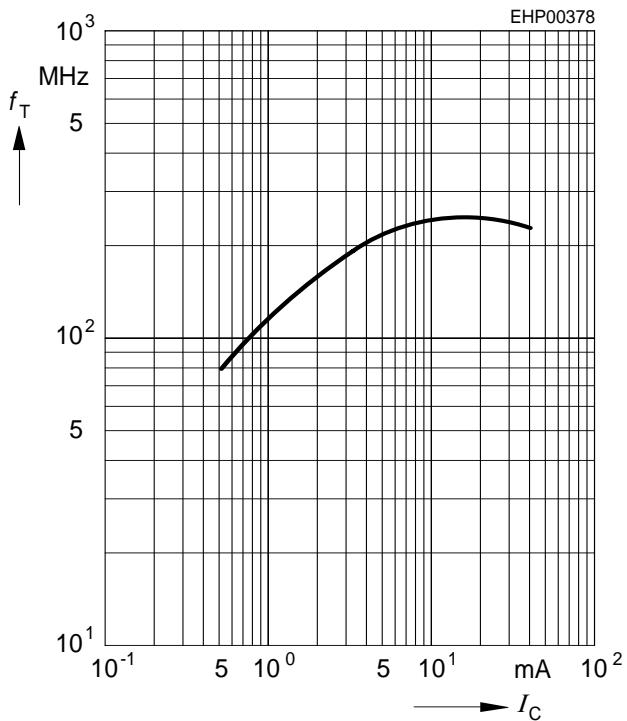


Collector cutoff current $I_{CBO} = f(T_A)$

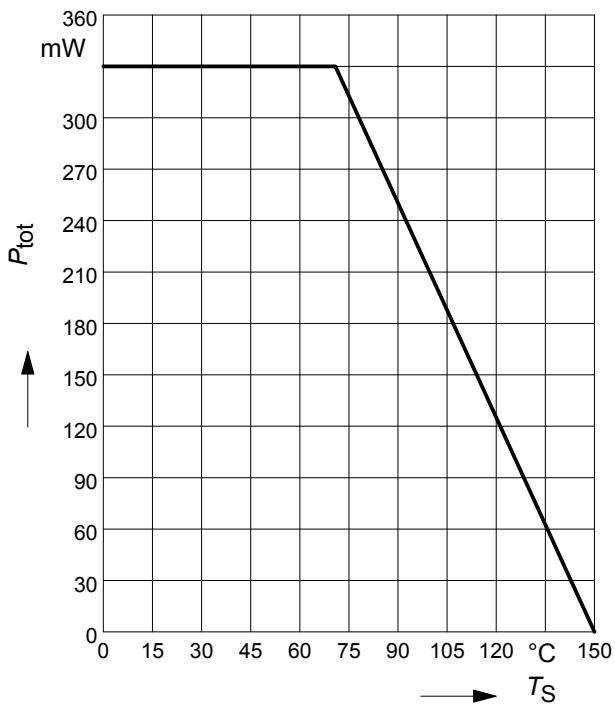
$V_{CBO} = 30 \text{ V}$



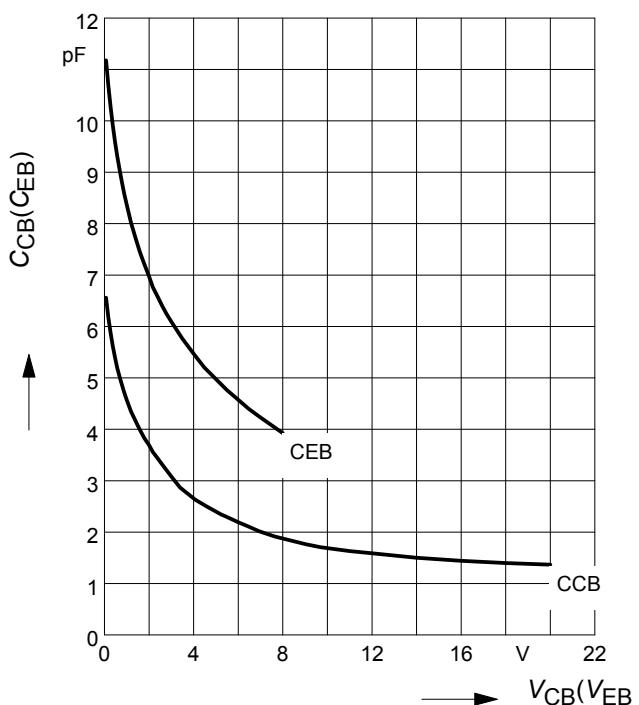
Transition frequency $f_T = f(I_C)$
 $V_{CE} = 5 \text{ V}$



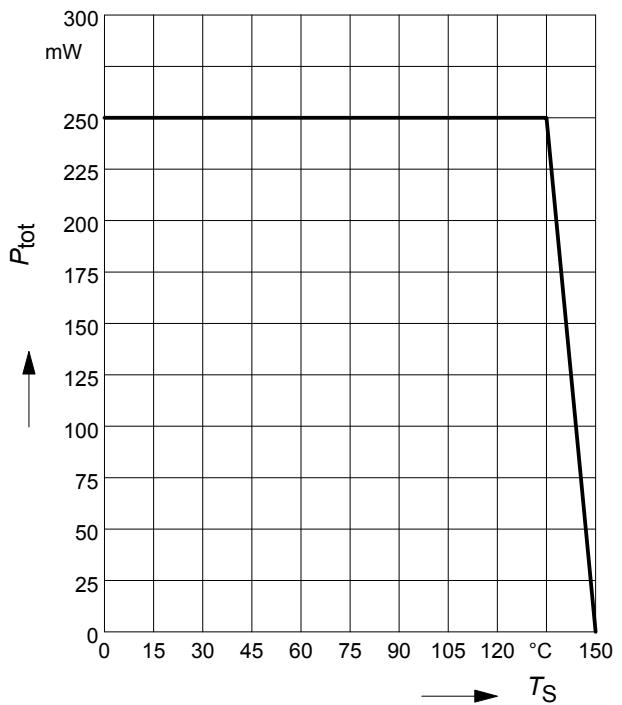
Total power dissipation $P_{\text{tot}} = f(T_S)$
BC856-BC860



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

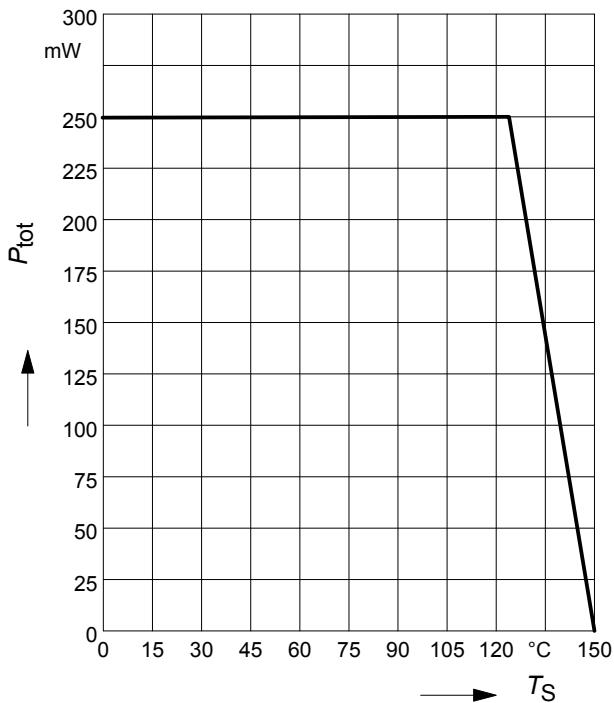


Total power dissipation $P_{\text{tot}} = f(T_S)$
BC857BL3



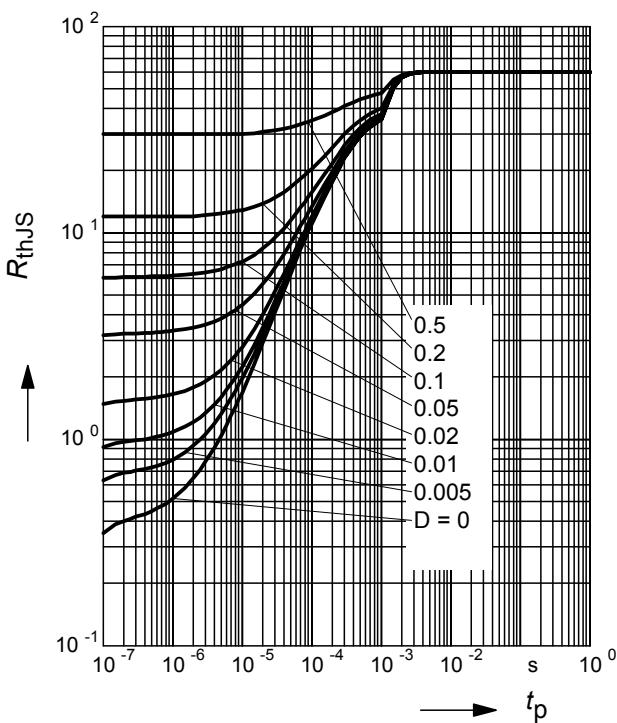
Total power dissipation $P_{\text{tot}} = f(T_S)$

BC857W-BC860W



Permissible Puls Load $R_{\text{thJS}} = f(t_p)$

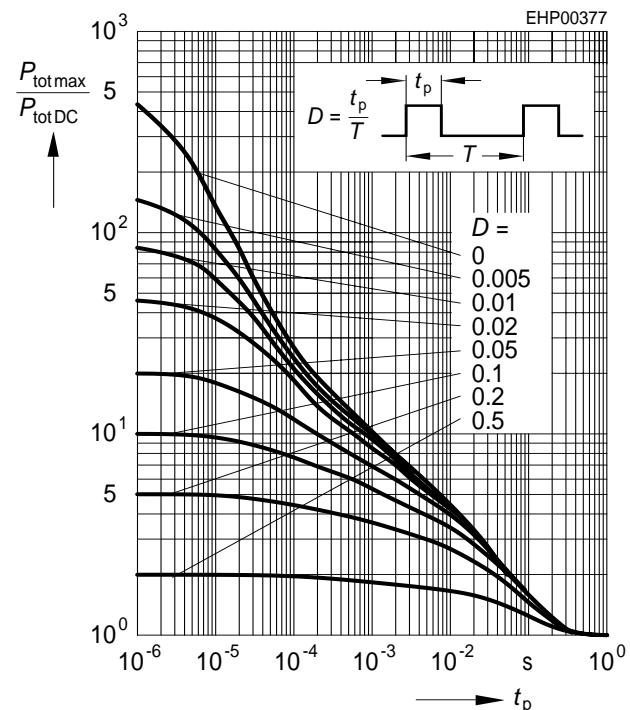
BC857BL3



Permissible Pulse Load

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

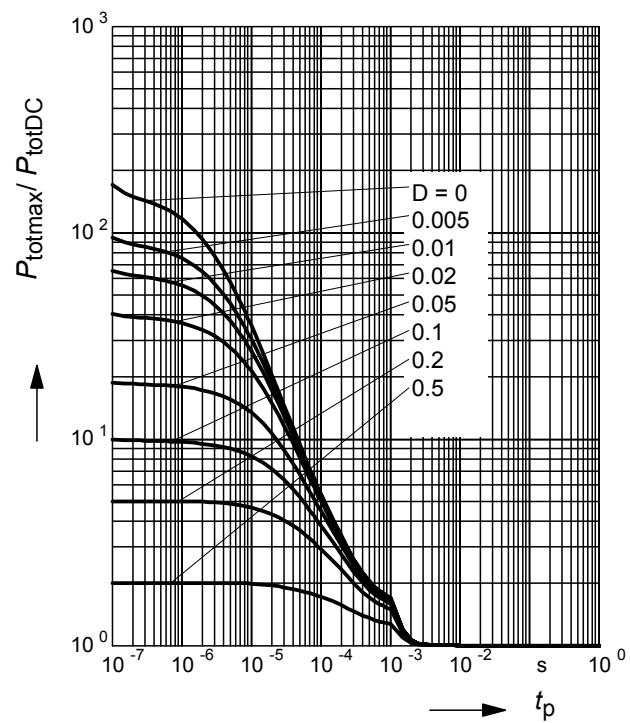
BC857/W-BC860/W



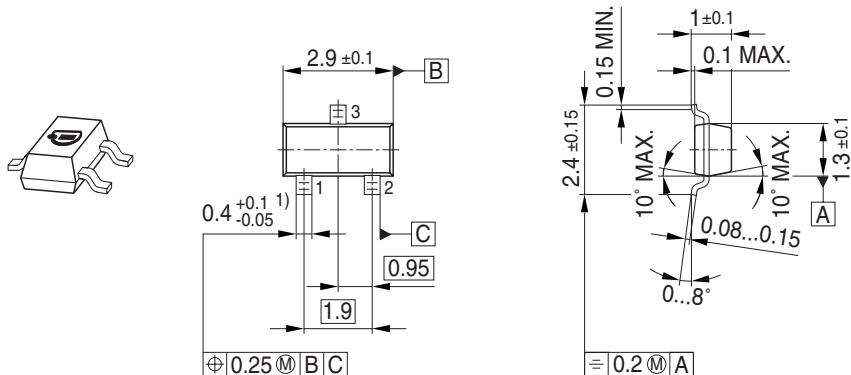
Permissible Pulse Load

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

BC857BL3

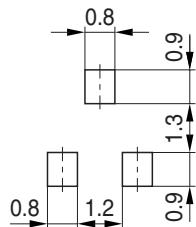


Package Outline

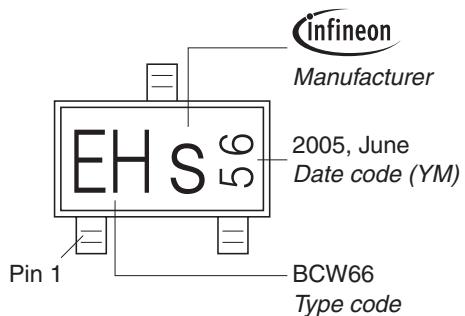


1) Lead width can be 0.6 max. in dambar area

Foot Print

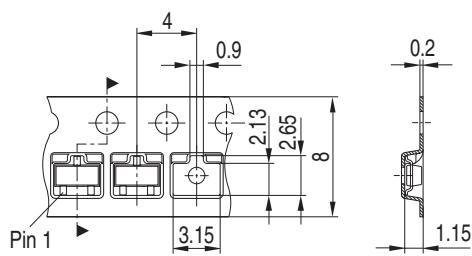


Marking Layout (Example)

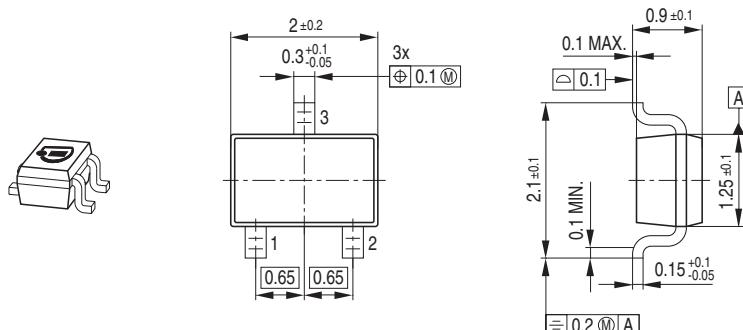


Standard Packing

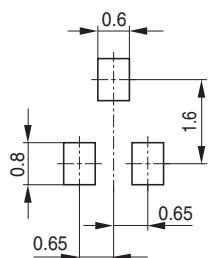
Reel ø180 mm = 3.000 Pieces/Reel
Reel ø330 mm = 10.000 Pieces/Reel



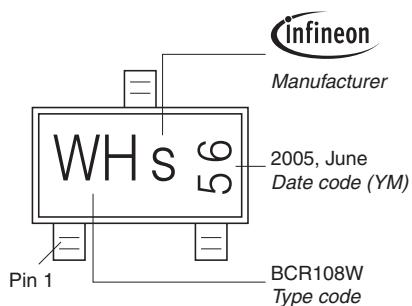
Package Outline



Foot Print



Marking Layout (Example)



Standard Packing

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

