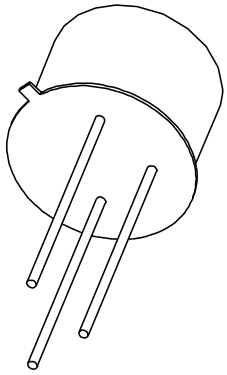
DATA SHEET



BC140; BC141
NPN medium power transistors

Product specification
Supersedes data of September 1994
File under Discrete Semiconductors, SC04

1997 May 12

Philips
Semiconductors

PHILIPS

NPN medium power transistors BC140; BC141

FEATURES

- High current (max. 1 A)
- Low voltage (max. 60 V).

APPLICATIONS

- General purpose switching and amplification.

DESCRIPTION

NPN medium power transistor in a TO-39 metal package.
PNP complements: BC160 and BC161.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector, connected to case

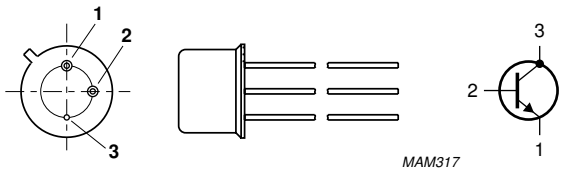


Fig.1 Simplified outline (TO-39) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter				
	BC140		–	–	80	V
	BC141		–	–	100	V
V_{CEO}	collector-emitter voltage	open base				
	BC140		–	–	40	V
	BC141		–	–	60	V
I_{CM}	peak collector current		–	–	1.5	A
P_{tot}	total power dissipation	$T_{case} \leq 45$ °C	–	–	3.7	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 1 V				
	BC140-10; BC141-10		63	100	160	
	BC140-16; BC141-16		100	160	250	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 100 MHz	50	–	–	MHz

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC140		–	80	V
	BC141		–	100	V
V_{CEO}	collector-emitter voltage	open base			
	BC140		–	40	V
	BC141		–	60	V
V_{EBO}	emitter-base voltage	open collector	–	7	V
I_C	collector current (DC)		–	1	A
I_{CM}	peak collector current		–	1.5	A
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	$T_{case} \leq 45$ °C	–	3.7	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	175	°C
T_{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	200	K/W
$R_{th\ j\text{-}c}$	thermal resistance from junction to case		35	K/W

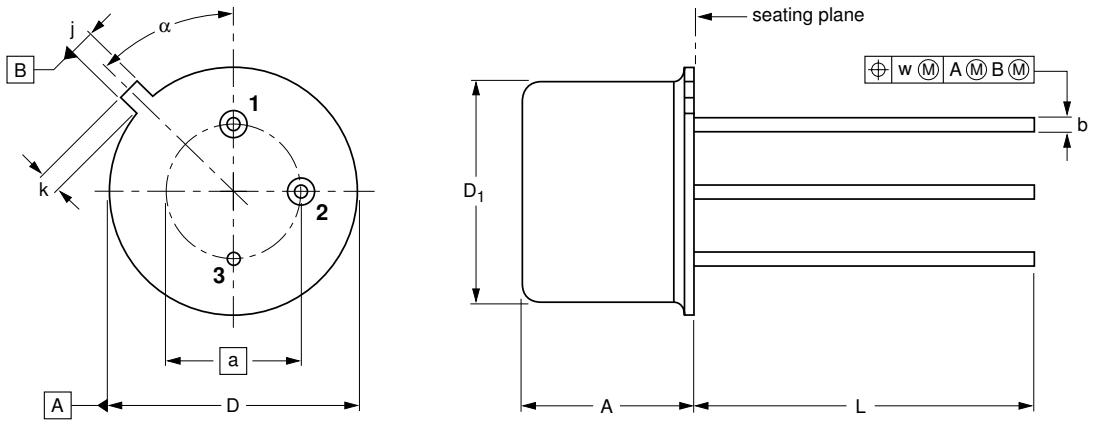
CHARACTERISTICS

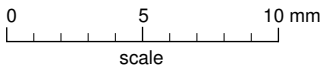
T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 60 V	–	10	100	nA
		I_E = 0; V_{CB} = 60 V; T_j = 150 °C	–	10	100	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 100 µA; V_{CE} = 1 V				
	BC140-10; BC141-10		–	40	–	
	BC140-16; BC141-16		–	90	–	
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 1 V				
	BC140-10; BC141-10		63	100	160	
	BC140-16; BC141-16		100	160	250	
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 1 V				
	BC140-10; BC141-10		–	20	–	
	BC140-16; BC141-16		–	30	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = 1 A; I_B = 100 mA	–	0.6	1	V
V_{BE}	base-emitter voltage	I_C = 1 A; V_{CE} = 1 V	–	1.2	1.8	V
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 10 V; f = 1 MHz	–	–	25	pF
C_e	emitter capacitance	I_C = i_c = 0; V_{EB} = 0.5 V; f = 1 MHz	–	–	80	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 100 MHz	50	–	–	MHz
Switching times (between 10% and 90% levels)						
t_{on}	turn-on time	I_{Con} = 100 mA; I_{Bon} = 5 mA; I_{Boff} = –5 mA	–	–	250	ns
t_{off}	turn-off time		–	–	850	ns

PACKAGE OUTLINE

Metal-can cylindrical single-ended package; 3 leads **SOT5/11**





DIMENSIONS (mm are the original dimensions)

UNIT	A	a	b	D	D_1	j	k	L	w	α
mm	6.60 6.35	5.08	0.48 0.41	9.39 9.08	8.33 8.18	0.85 0.75	0.95 0.75	14.2 12.7	0.2	45°

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT5/11		TO-39				97-04-11

DEFINITIONS

Data Sheet Status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

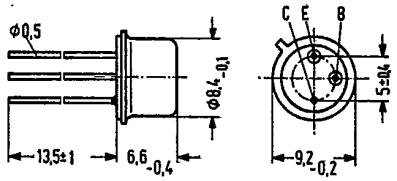
LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

NPN Silicon Transistors SIEMENS AKTIENGESELLSCHAF BC 140 BC 141

BC 140 and BC 141 are epitaxial NPN silicon transistors in TO 39 case (5 C 3 DIN 41873). The collector is electrically connected to the case. The transistors are intended for use in AF amplifiers and as complementary transistors to BC 160 and BC 161, as well as for AF switching applications up to 1 A. The transistors BC 140 and BC 141 are available upon request as matched pairs.

Type	Ordering code
BC 140[1)]	Q60203-X140
BC 140-6	Q60203-X140-V6
BC 140-10	Q60203-X140-V10
BC 140-16	Q60203-X140-V16
BC 140 paired	Q60203-X140-P
BC 140/BC 160 paired	Q62702-C228-S2
BC 141[1)]	Q62702-C719
BC 141-6	Q62702-C234
BC 141-10	Q62702-C235
BC 141-16	Q62702-C236
BC 141 paired	Q62702-C209
BC 141/BC 161 paired	Q62702-C230-S2



Approx. weight 1.5 g Dimensions in mm

Maximum ratings		BC 140	BC 141	
Collector-base voltage	V_{CBO}	80	100	V
Collector-emitter voltage	V_{CEO}	40	60	V
Emitter-base voltage	V_{EBO}	7	7	V
Collector current	I_C	1	1	A
Base current	I_B	0.1	0.1	A
Junction temperature	T_j	175	175	°C
Storage temperature range	T_{stg}	−55 to +175	−55 to +175	°C
Total power dissipation	P_{tot}	3.7	3.7	W
Thermal resistance				
Junction to ambient air	R_{thJA}	≤200	≤200	K/W
Junction to case	R_{thJC}	≤35	≤35	K/W

Static characteristics (T_{amb} = 25 °C)

The transistors BC 140 and BC 141 are grouped at I_C = 100 mA and V_{CE} = 1 V according to the DC current gain h_{FE} and are marked by numerals of the DIN standard series. For the operating points quoted below, the following values apply:

Type	BC 140, BC 141			
h_{FE}-group	6	10	16	
I_C mA	h_{FE} I_C/I_B	h_{FE} I_C/I_B	h_{FE} I_C/I_B	V_{BE} V
0.1	28	40	90	–
100	63 (40 to 100)	100 (63 to 160)	160 (100 to 250)	–
1000	15	20	30	1.2 (<1.8)

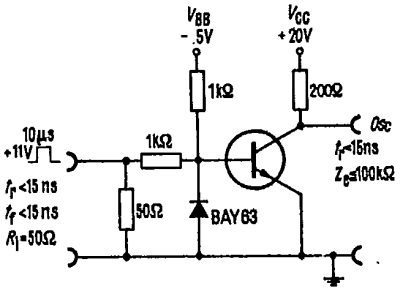
1) If the order does not include any exact indication of the current amplification group desired, a transistor of a current amplification group just available from stock will be delivered.

1580 A-07

Static characteristics (T_{amb} = 25 °C)		BC 140	BC 141	
Collector cutoff current (V_{CES} = 60 V)	I_{CES}	10 (<100)	10 (<100)	nA
Collector cutoff current (V_{CES} = 60 V; T_{amb} = 150 °C)	I_{CES}	10 (<100)	10 (<100)	µA
Collector-emitter breakdown voltage (I_{CEO} = 30 mA; pulse width = 200 µsec: duty cycle 1%)	$V_{(BR)CEO}$	>40	>60	V
Collector-emitter breakdown voltage (I_{CES} = 100 µA)	$V_{(BR)CES}$	>80	>100	V
Emitter-base breakdown voltage (I_{EBO} = 100 µA)	$V_{(BR)EBO}$	>7	>7	V
Collector emitter saturation voltage (I_C = 0.5 A; I_B = 25 mA)	V_{CEsat} [1]	0.6 (<1.0)	0.6 (<1.0)	V
Conditions for matching pairs: (I_C = 100 mA; V_{CE} = 1 V)	$\frac{h_{FE1}}{h_{FE2}}$	≤1.25	≤1.25	

Dynamic characteristics (T_{amb} = 25 °C)				
Transition frequency (I_C = 50 mA; V_{CE} = 10 V; f = 20 MHz)	f_T	>50	>50	MHz
Collector-base capacitance (V_{CB} = 10 V; f = 1 MHz)	C_{CBO}	<25	<25	pF
Emitter-base capacitance (V_{EB} = 0.5 V; f = 1 MHz)	C_{EBO}	<80	<80	pF

Test circuit

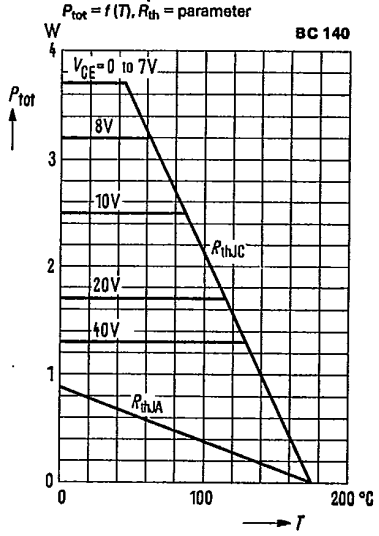


Switching times for transistors BC 140, BC 141:
(I_C = 100 mA; I_{B1} approx. $-I_{B2}$ approx. 5 mA)

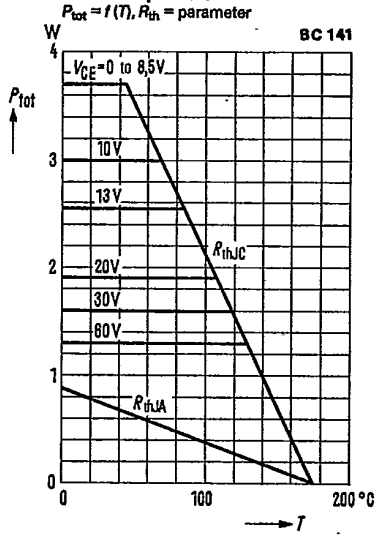
t_{on}	<250	ns
t_{off}	<850	ns

1) The transistor is overloaded to such an extent that the DC current gain decreases to h_{FE} = 20.

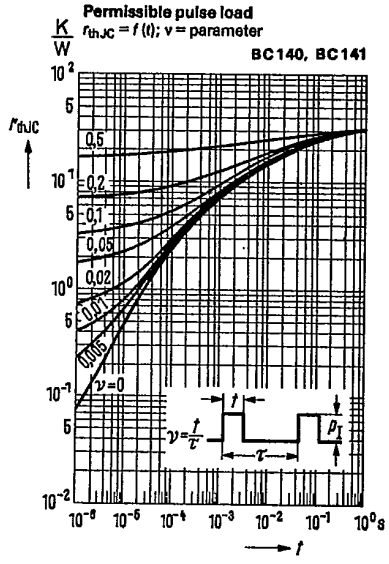
Total perm. power dissipation versus temperature
$P_{tot} = f(T)$, R_{th} = parameter



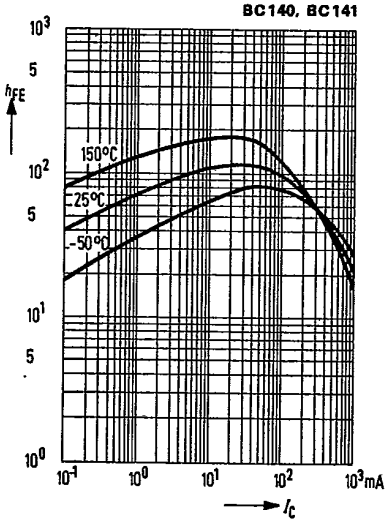
Total perm. power dissipation versus temperature
$P_{tot} = f(T)$, R_{th} = parameter



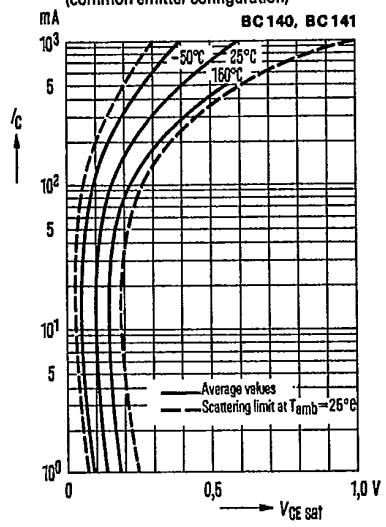
Permissible pulse load
$r_{thJC} = f(t)$; ν = parameter
BC140, BC141



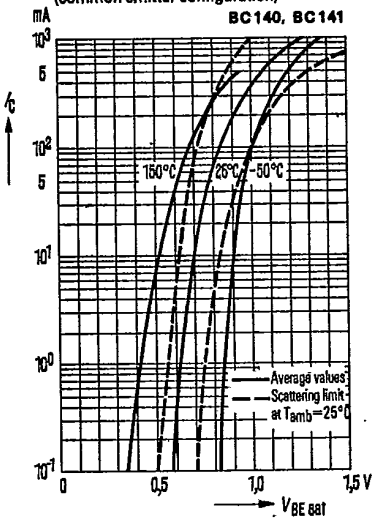
Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V
BC140, BC141



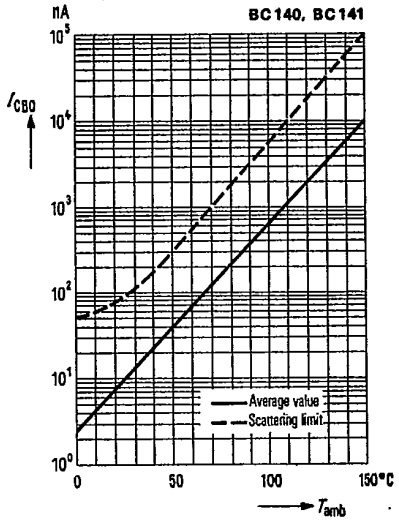
Collector-emitter saturation voltage
$V_{CEsat} = f(I_C)$
$h_{FE} = 10$; T_{amb} = parameter
(common emitter configuration)



Base-emitter saturation voltage
$V_{BEsat} = f(I_C)$
$h_{FE} = 10$; T_{amb} = parameter
(common emitter configuration)



Collector cutoff current versus temperature
$I_{CBO} = f(T_{amb})$; V_{CBO} = 60 V



Transition frequency $f_T = f(I_C)$
(V_{CE} = 10 V)