



# BC846BPN

65 V, 100 mA NPN/PNP general-purpose transistor

1 October 2022

Product data sheet

## 1. General description

NPN/PNP general-purpose transistor pair in a very small SOT363 (SC-88) Surface-Mounted Device (SMD) plastic package.

NPN/PNP complement: BC846BS

PNP/PNP complement: BC856BS

## 2. Features and benefits

- Low collector capacitance
- Low collector-emitter saturation voltage
- Closely matched current gain
- Reduces number of components and board space
- No mutual interference between the transistors

## 3. Applications

- General-purpose switching and amplification

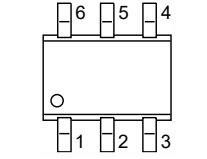
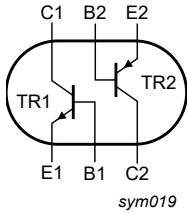
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor; for the PNP transistor with negative polarity</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	65	V
$I_C$	collector current		-	-	100	mA
<b>TR1 (NPN)</b>						
$h_{FE}$	DC current gain	$V_{CE} = 5 \text{ V}; I_C = 2 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	200	300	450	
<b>TR2 (PNP)</b>						
$h_{FE}$	DC current gain	$V_{CE} = -5 \text{ V}; I_C = -2 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	200	290	450	

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E1	emitter TR1	 <p>TSSOP6 (SOT363)</p>	 <p>sym019</p>
2	B1	base TR1		
3	C2	collector TR2		
4	E2	emitter TR2		
5	B2	base TR2		
6	C1	collector TR1		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
<a href="#">BC846BPN</a>	TSSOP6	plastic, surface-mounted package; 6 leads; 0.65 mm pitch; 2.1 mm x 1.25 mm x 0.95 mm body	<a href="#">SOT363</a>

## 7. Marking

Table 4. Marking codes

Type number	Marking code <sup>[1]</sup>
BC846BPN	PJ%

[1] % = placeholder for manufacturing site code

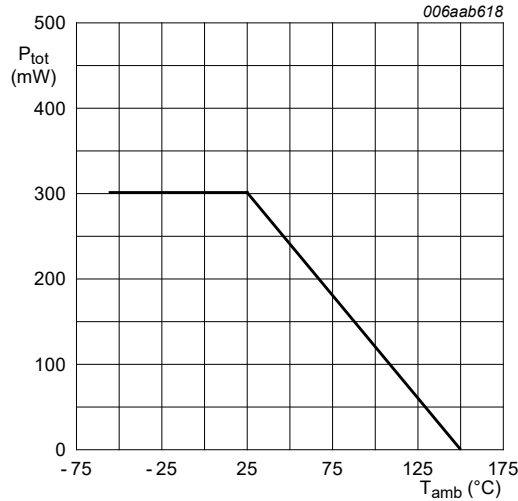
## 8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
<b>Per transistor; for the PNP transistor with negative polarity</b>					
$V_{CBO}$	collector-base voltage	open emitter	-	80	V
$V_{CEO}$	collector-emitter voltage	open base	-	65	V
$V_{EBO}$	emitter-base voltage	open collector	-	6	V
$I_C$	collector current		-	100	mA
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	200	mA
$I_{BM}$	peak base current		-	200	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	200	mW
<b>Per device</b>					
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	300	mW
$T_j$	junction temperature		-	150	°C
$T_{amb}$	ambient temperature		-55	150	°C
$T_{stg}$	storage temperature		-65	150	°C

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.



FR4 PCB, single-sided, 35 μm copper, tin-plated and standard footprint

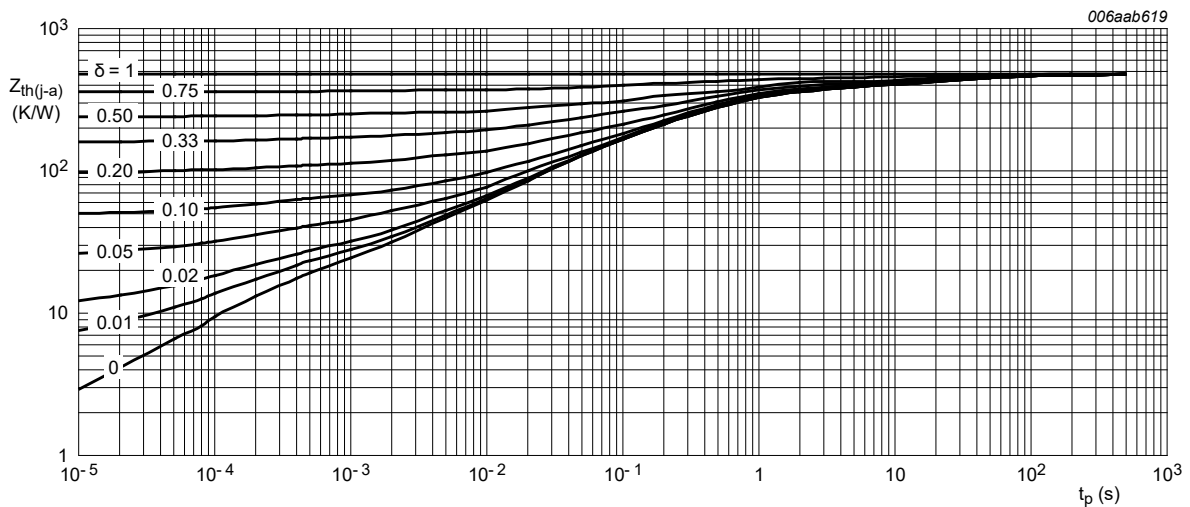
Fig. 1. Per device: Power derating curve

## 9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Per transistor</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	625	K/W
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point			-	-	230	K/W
<b>Per device</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	416	K/W

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.



FR4 PCB, single-sided, 35 μm copper, tin-plated and standard footprint

Fig. 2. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR1 (NPN)</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 50 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	15	nA
		$V_{CB} = 30 \text{ V}; I_E = 0 \text{ A}; T_j = 150 \text{ }^\circ\text{C}$	-	-	5	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 6 \text{ V}; I_C = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	100	nA
$h_{FE}$	DC current gain	$V_{CE} = 5 \text{ V}; I_C = 10 \text{ } \mu\text{A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	280	-	
		$V_{CE} = 5 \text{ V}; I_C = 2 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	200	300	450	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10 \text{ mA}; I_B = 0.5 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	55	100	mV
		$I_C = 100 \text{ mA}; I_B = 5 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	200	300	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 10 \text{ mA}; I_B = 0.5 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	755	850	mV
		$I_C = 100 \text{ mA}; I_B = 5 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	1000	-	mV
$V_{BE}$	base-emitter voltage	$V_{CE} = 5 \text{ V}; I_C = 2 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	580	650	700	mV
		$V_{CE} = 5 \text{ V}; I_C = 10 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	770	mV
$C_c$	collector capacitance	$V_{CB} = 10 \text{ V}; I_E = 0 \text{ A}; i_e = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	1.9	-	pF
$C_e$	emitter capacitance	$V_{EB} = 0.5 \text{ V}; I_C = 0 \text{ A}; i_c = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	11	-	pF
$f_T$	transition frequency	$V_{CE} = 5 \text{ V}; I_C = 10 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	100	-	-	MHz
NF	noise figure	$V_{CE} = 5 \text{ V}; I_C = 0.2 \text{ mA}; R_S = 2 \text{ k}\Omega; f = 15.7 \text{ kHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	1.9	-	dB
		$V_{CE} = 5 \text{ V}; I_C = 0.2 \text{ mA}; R_S = 2 \text{ k}\Omega; f = 1 \text{ kHz}; B = 200 \text{ Hz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	3.1	-	dB
<b>TR2 (PNP)</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -50 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-15	nA
		$V_{CB} = -30 \text{ V}; I_E = 0 \text{ A}; T_j = 150 \text{ }^\circ\text{C}$	-	-	-5	nA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -6 \text{ V}; I_C = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-100	nA
$h_{FE}$	DC current gain	$V_{CE} = -5 \text{ V}; I_C = -10 \text{ } \mu\text{A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	270	-	
		$V_{CE} = -5 \text{ V}; I_C = -2 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	200	290	450	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -10 \text{ mA}; I_B = -0.5 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-55	-100	mV
		$I_C = -100 \text{ mA}; I_B = -5 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-200	-300	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -10 \text{ mA}; I_B = -0.5 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-755	-850	mV
		$I_C = -100 \text{ mA}; I_B = -5 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-900	-	mV
$V_{BE}$	base-emitter voltage	$V_{CE} = -5 \text{ V}; I_C = -2 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-600	-650	-750	mV
		$V_{CE} = -5 \text{ V}; I_C = -10 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-820	mV
$C_c$	collector capacitance	$V_{CB} = -10 \text{ V}; I_E = 0 \text{ A}; i_e = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	2.3	-	pF
$C_e$	emitter capacitance	$V_{EB} = -0.5 \text{ V}; I_C = 0 \text{ A}; i_c = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	10	-	pF
$f_T$	transition frequency	$V_{CE} = -5 \text{ V}; I_C = -10 \text{ mA}; f = 100 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$	100	-	-	MHz

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
NF	noise figure	$V_{CE} = -5\text{ V}; I_C = -0.2\text{ mA}; R_S = 2\text{ k}\Omega;$ $f = 15.7\text{ kHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	1.6	-	dB
		$V_{CE} = -5\text{ V}; I_C = -0.2\text{ mA}; R_S = 2\text{ k}\Omega;$ $f = 1\text{ kHz}; B = 200\text{ Hz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	2.9	-	dB

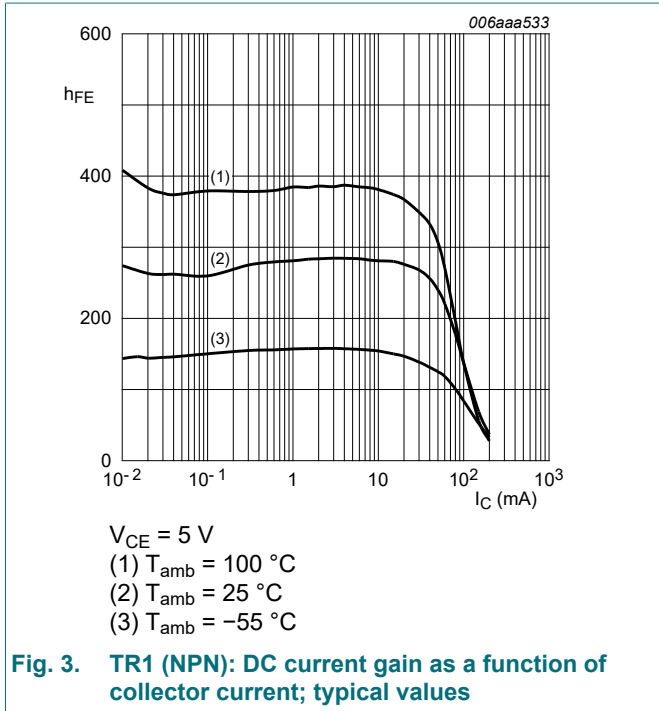


Fig. 3. TR1 (NPN): DC current gain as a function of collector current; typical values

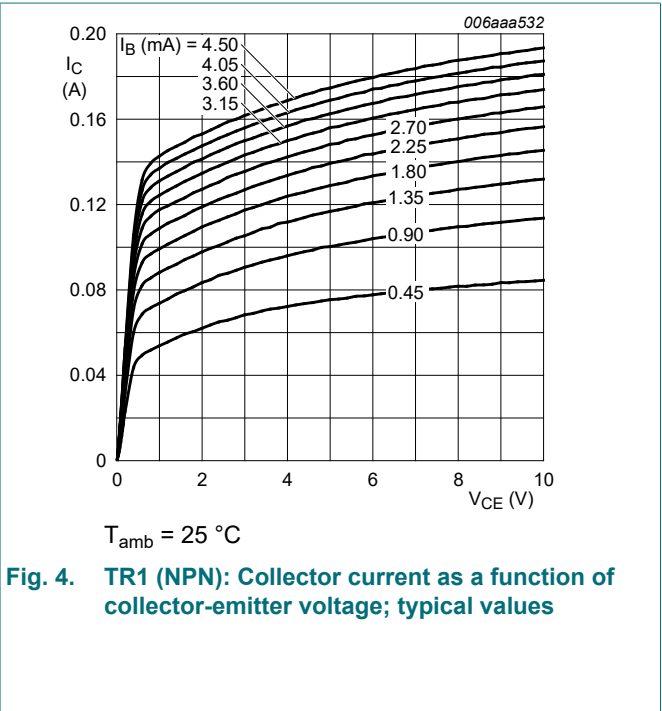


Fig. 4. TR1 (NPN): Collector current as a function of collector-emitter voltage; typical values

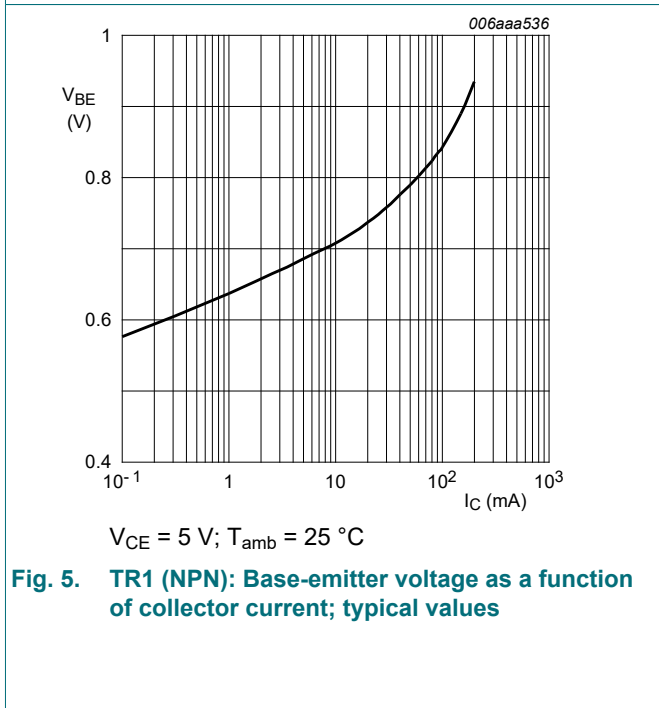


Fig. 5. TR1 (NPN): Base-emitter voltage as a function of collector current; typical values

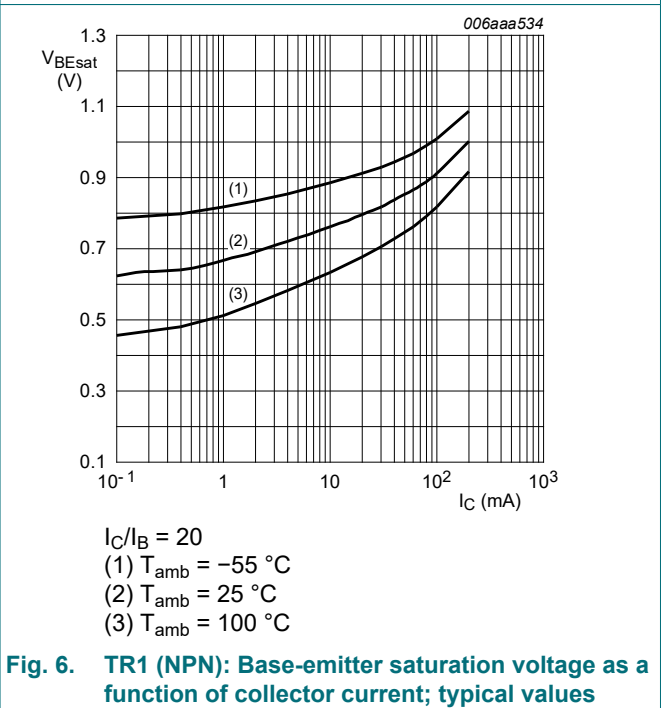
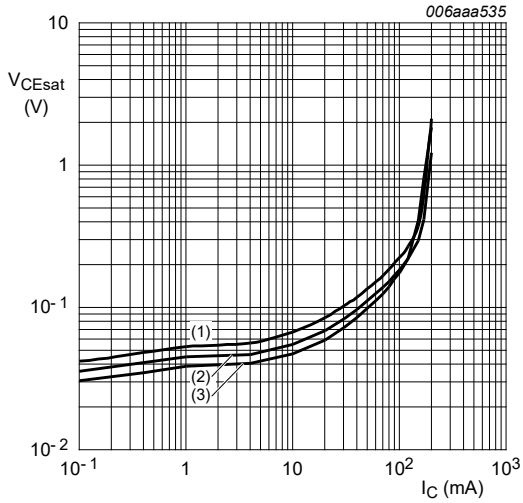
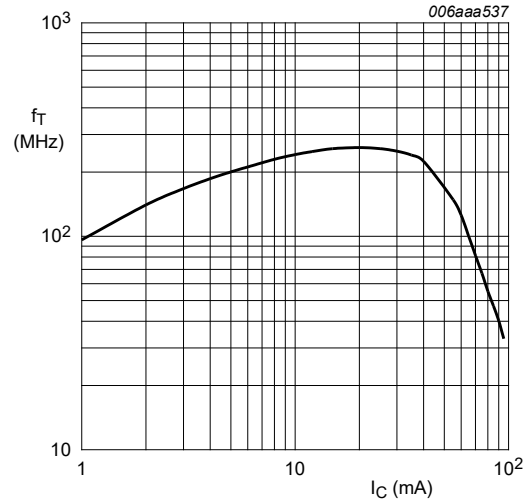


Fig. 6. TR1 (NPN): Base-emitter saturation voltage as a function of collector current; typical values



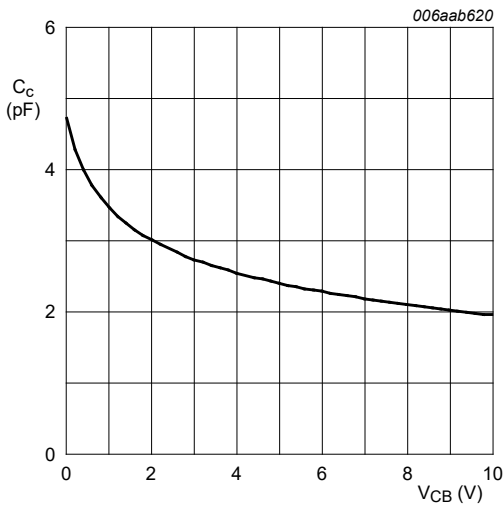
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

Fig. 7. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values



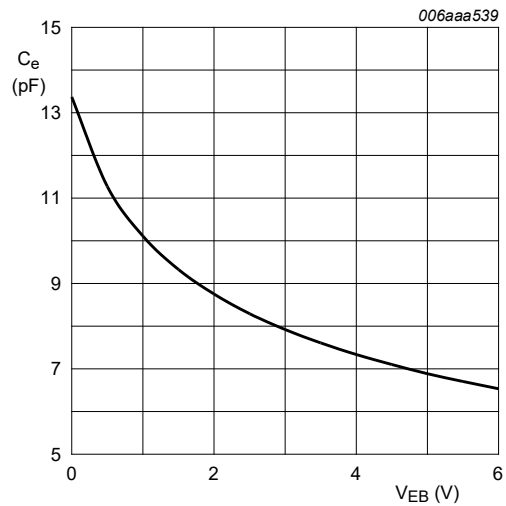
$V_{CE} = 5\text{ V}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$

Fig. 8. TR1 (NPN): Transition frequency as a function of collector current; typical values



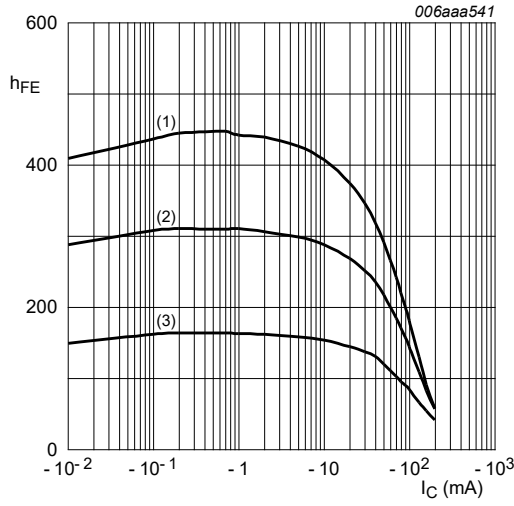
$f = 1\text{ MHz}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$

Fig. 9. TR1 (NPN): Collector capacitance as a function of collector-base voltage; typical values



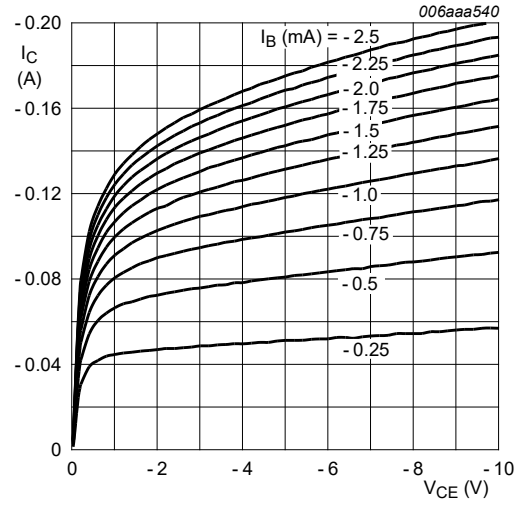
$f = 1\text{ MHz}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$

Fig. 10. TR1 (NPN): Emitter capacitance as a function of emitter-base voltage; typical values



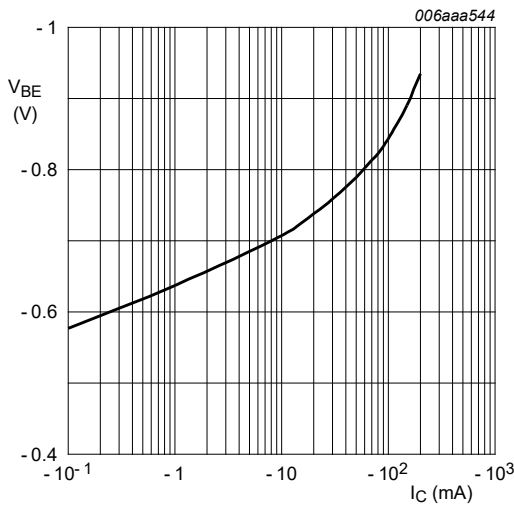
$V_{CE} = -5 \text{ V}$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55 \text{ }^\circ\text{C}$

**Fig. 11. TR2 (PNP): DC current gain as a function of collector current; typical values**



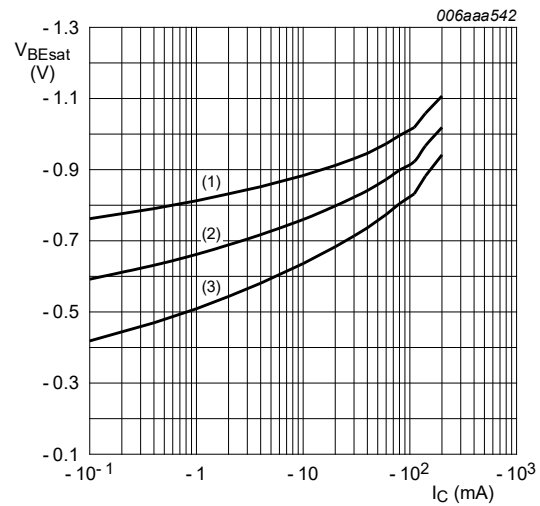
$T_{amb} = 25 \text{ }^\circ\text{C}$

**Fig. 12. TR2 (PNP): Collector current as a function of collector-emitter voltage; typical values**



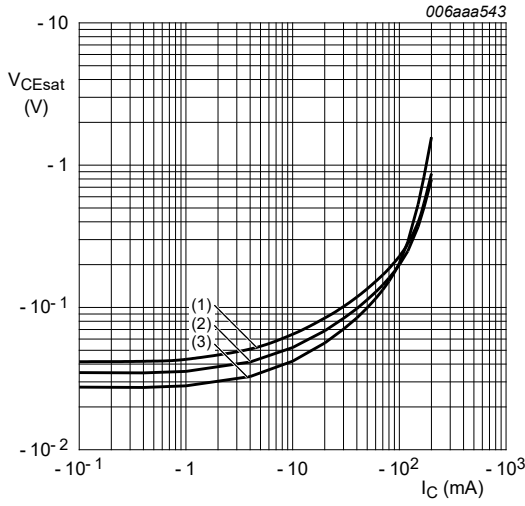
$V_{CE} = -5 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$

**Fig. 13. TR2 (PNP): Base-emitter voltage as a function of collector current; typical values**



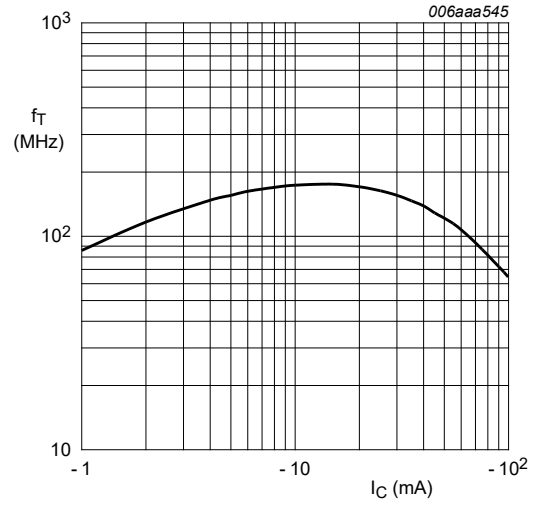
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**Fig. 14. TR2 (PNP): Base-emitter saturation voltage as a function of collector current; typical values**



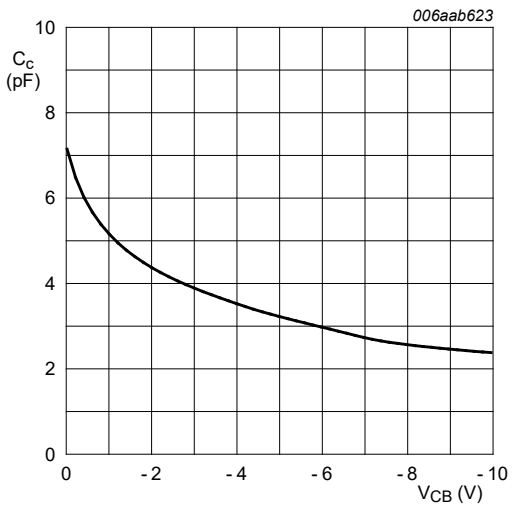
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

Fig. 15. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values



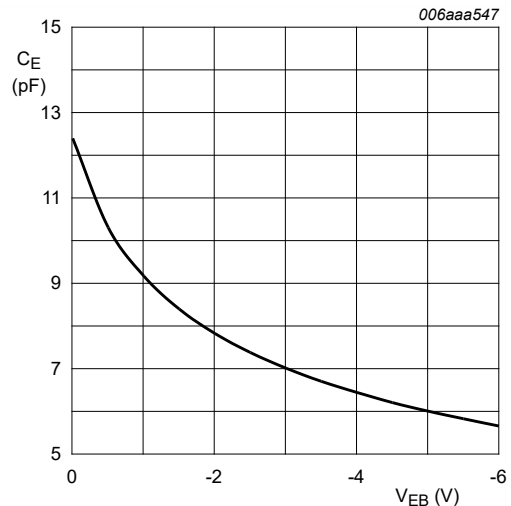
$V_{CE} = -5\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$

Fig. 16. TR2 (PNP): Transition frequency as a function of collector current; typical values



$f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$

Fig. 17. TR2 (PNP): Collector capacitance as a function of collector-base voltage; typical values



$f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$

Fig. 18. TR2 (PNP): Emitter capacitance as a function of emitter-base voltage; typical values



## 11. Package outline

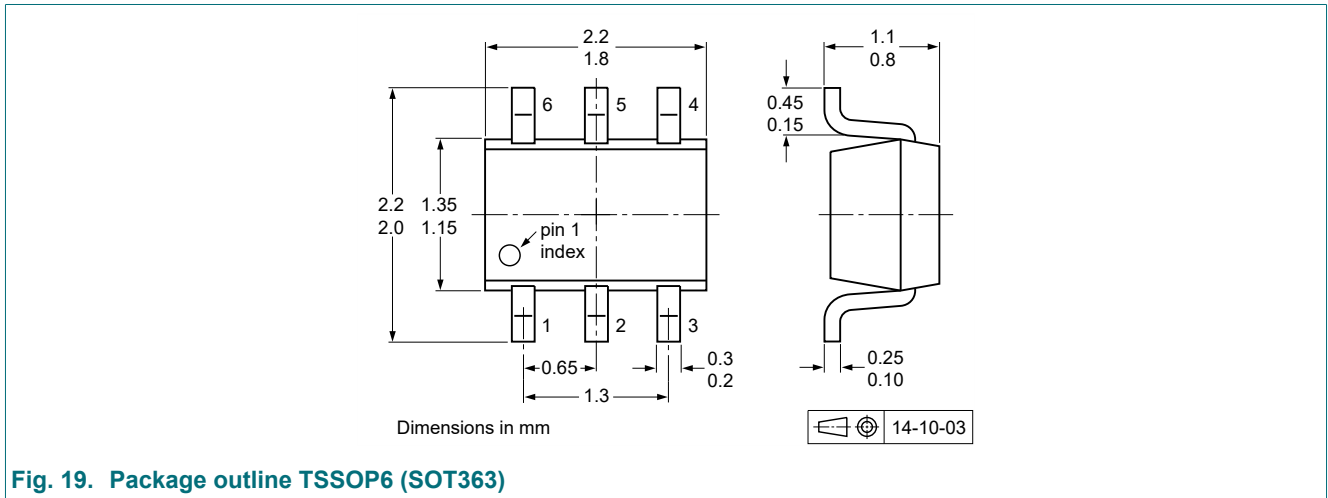


Fig. 19. Package outline TSSOP6 (SOT363)

## 12. Soldering

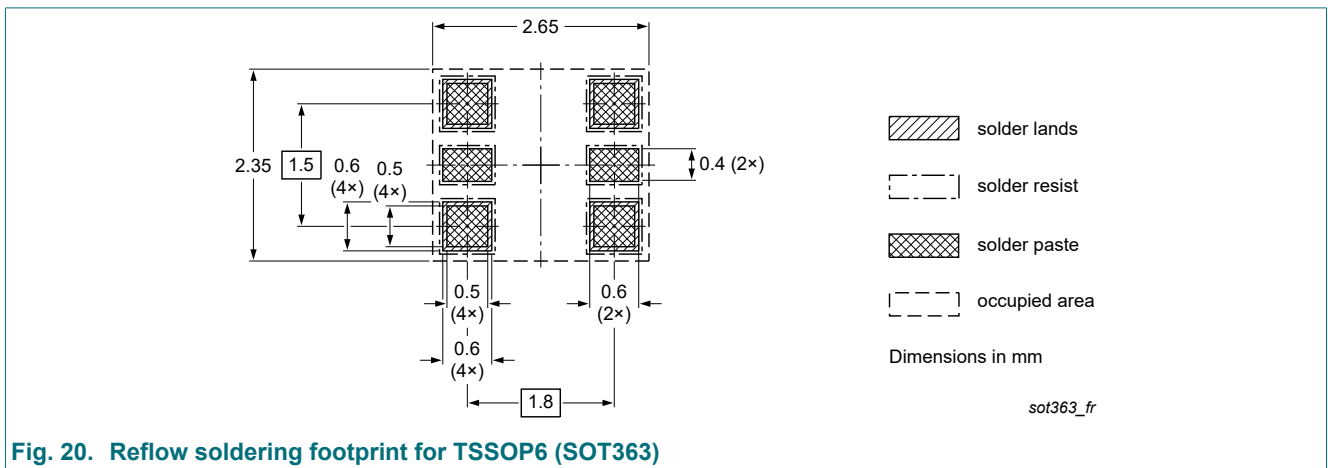


Fig. 20. Reflow soldering footprint for TSSOP6 (SOT363)

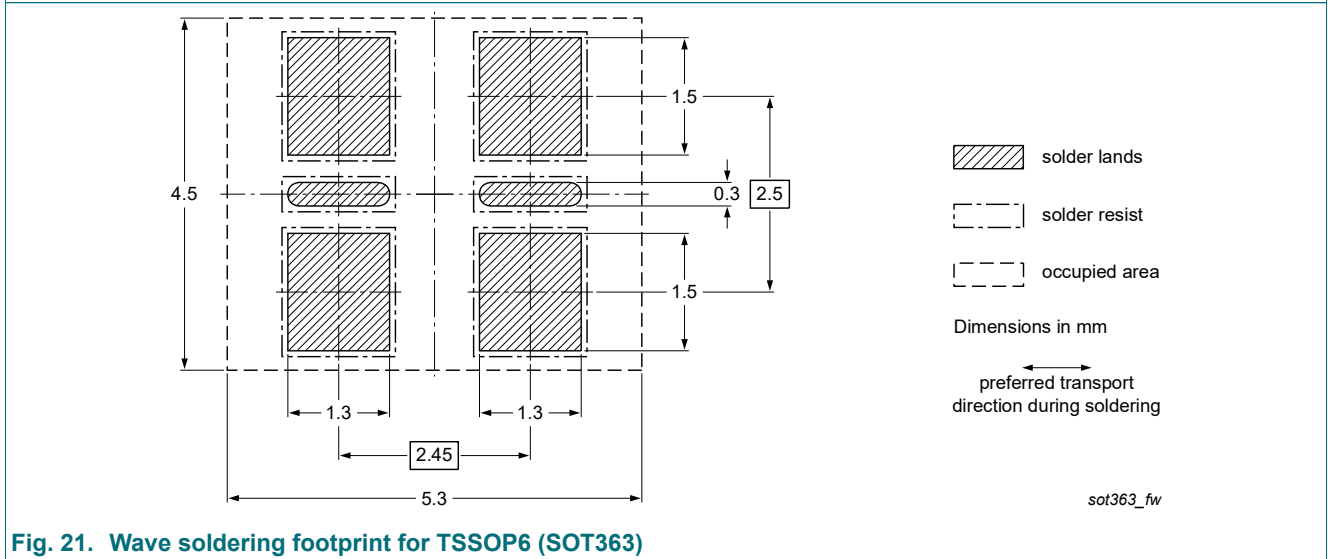


Fig. 21. Wave soldering footprint for TSSOP6 (SOT363)

## 13. Revision history

**Table 8. Revision history**

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
BC846BPN v.2	20221001	Product data sheet	-	BC846BPN v.1
Modifications:	<ul style="list-style-type: none"><li>• Product changed to non-automotive qualification. Please refer to <a href="http://nexperia.com">nexperia.com</a> for automotive (-Q) product alternative(s).</li><li>• Packing information is removed.</li></ul>			
BC846BPN v.1	20090717	Product data sheet	-	-

## 14. Legal information

### Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at <https://www.nexperia.com>.

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