



# BC846BPN

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

Rev. 01 — 17 July 2009

Product data sheet

## 1. Product profile

### 1.1 General description

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

Table 1. Product overview

Type number	Package		NPN/PNP complement	PNP/PNP complement
	NXP	JEITA		
BC846BPN	SOT363	SC-88	BC846BS	BC856BS

### 1.2 Features

- 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
- AEC-Q101 qualified

### 1.3 Applications

- General-purpose switching and amplification

### 1.4 Quick reference data

Table 2. 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	$V_{CE} = 5\text{ V}; I_C = 2\text{ mA}$	200	300	450	
<b>TR2 (PNP)</b>						
$h_{FE}$	DC current gain	$V_{CE} = -5\text{ V}; I_C = -2\text{ mA}$	200	290	450	

## 2. Pinning information

**Table 3. Pinning**

Pin	Description	Simplified outline	Graphic symbol
1	emitter TR1		
2	base TR1		
3	collector TR2		
4	emitter TR2		
5	base TR2		
6	collector TR1		

*sym019*

## 3. Ordering information

**Table 4. Ordering information**

Type number	Package		Version
	Name	Description	
BC846BPN	SC-88	plastic surface-mounted package; 6 leads	SOT363

## 4. Marking

**Table 5. Marking codes**

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

- [1] \* = -: made in Hong Kong  
 \* = p: made in Hong Kong  
 \* = t: made in Malaysia  
 \* = W: made in China

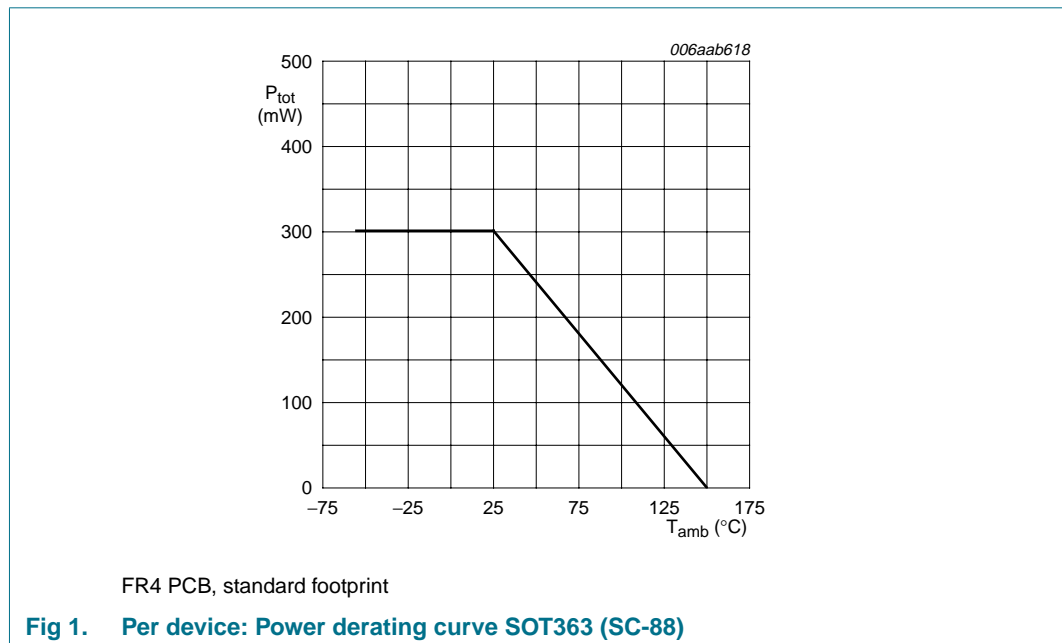
**5. Limiting values**

**Table 6. 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	single pulse; $t_p \leq 1$ ms	-	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.

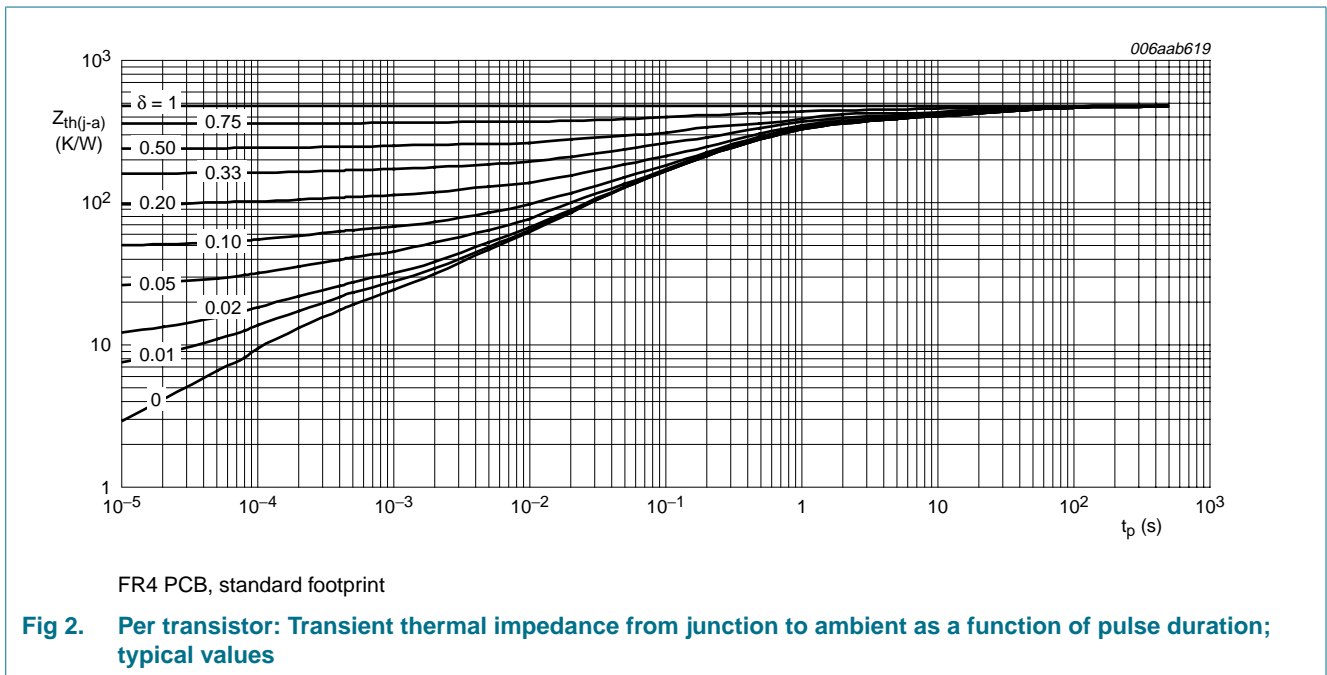


## 6. Thermal characteristics

Table 7. Thermal characteristics

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



## 7. Characteristics

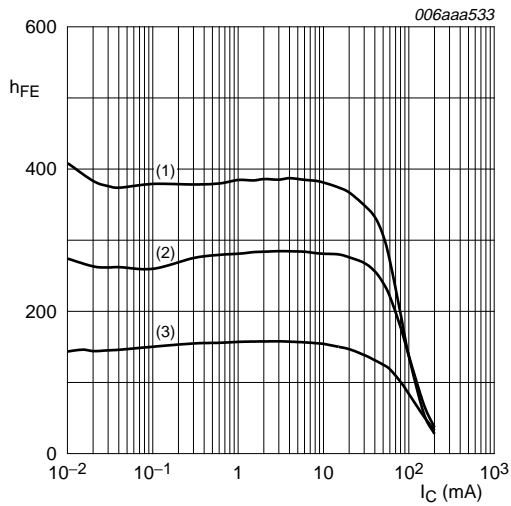
**Table 8. Characteristics**

$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

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

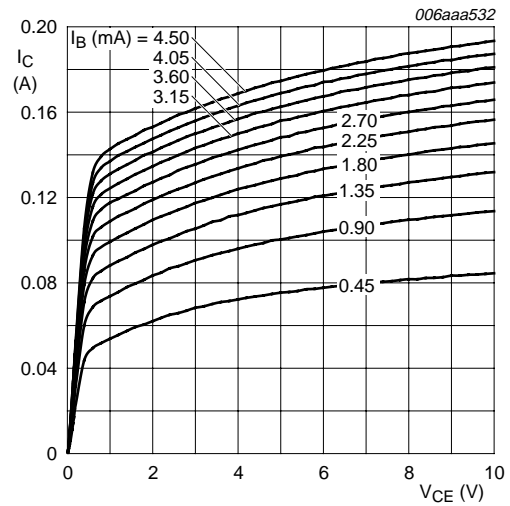
**Table 8. Characteristics ...continued**  
 $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -10\text{ mA}; I_B = -0.5\text{ mA}$	-	-755	-850	mV
		$I_C = -100\text{ mA}; I_B = -5\text{ mA}$	-	-900	-	mV
$V_{BE}$	base-emitter voltage	$V_{CE} = -5\text{ V}$	-	-	-	-
		$I_C = -2\text{ mA}$	-600	-650	-750	mV
		$I_C = -10\text{ mA}$	-	-	-820	mV
$C_c$	collector capacitance	$V_{CB} = -10\text{ V}; I_E = I_C = 0\text{ A}; f = 1\text{ MHz}$	-	2.3	-	pF
$C_e$	emitter capacitance	$V_{EB} = -0.5\text{ V}; I_C = I_E = 0\text{ A}; f = 1\text{ MHz}$	-	10	-	pF
$f_T$	transition frequency	$V_{CE} = -5\text{ V}; I_C = -10\text{ mA}; f = 100\text{ MHz}$	100	-	-	MHz
NF	noise figure	$V_{CE} = -5\text{ V}; I_C = -0.2\text{ mA}; R_S = 2\text{ k}\Omega; f = 10\text{ Hz to }15.7\text{ kHz}$	-	1.6	-	dB
		$V_{CE} = -5\text{ V}; I_C = -0.2\text{ mA}; R_S = 2\text{ k}\Omega; f = 1\text{ kHz}; B = 200\text{ Hz}$	-	2.9	-	dB



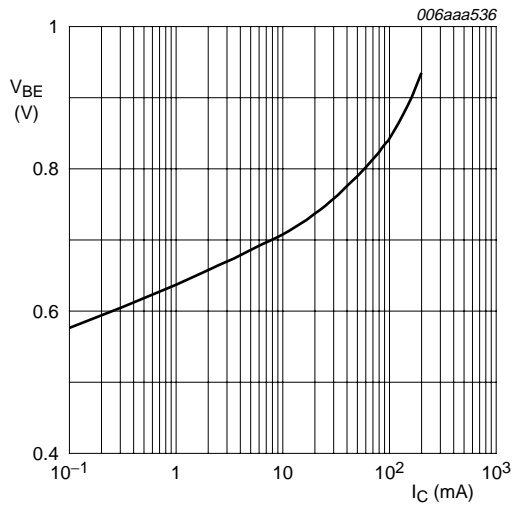
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



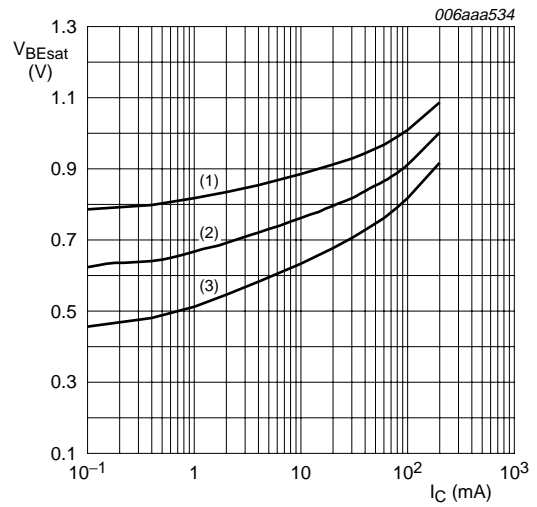
$T_{amb} = 25\text{ }^{\circ}\text{C}$

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



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

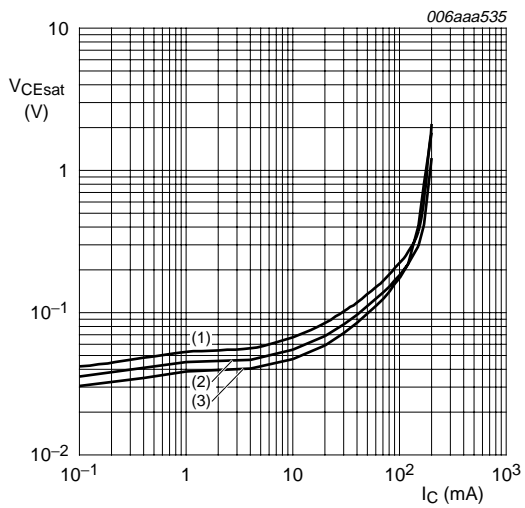
**Fig 5. TR1 (NPN): Base-emitter voltage as a function of collector current; typical values**



$I_C/I_B = 20$

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

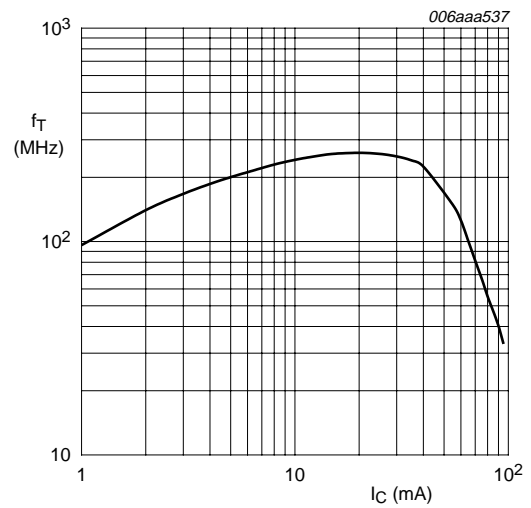
**Fig 6. TR1 (NPN): Base-emitter saturation voltage as a function of collector current; typical values**



$I_C/I_B = 20$

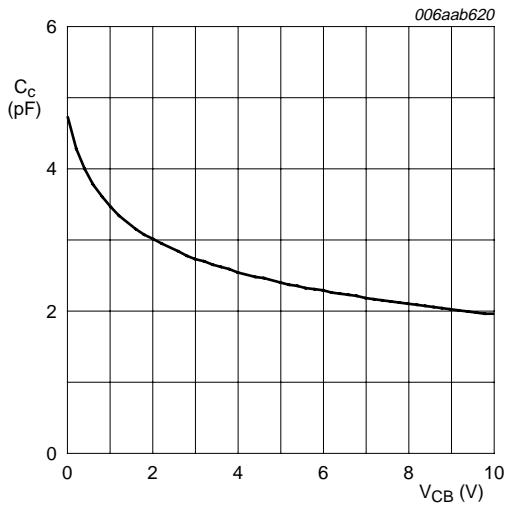
- (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$
- (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$
- (3)  $T_{amb} = -55 \text{ }^\circ\text{C}$

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



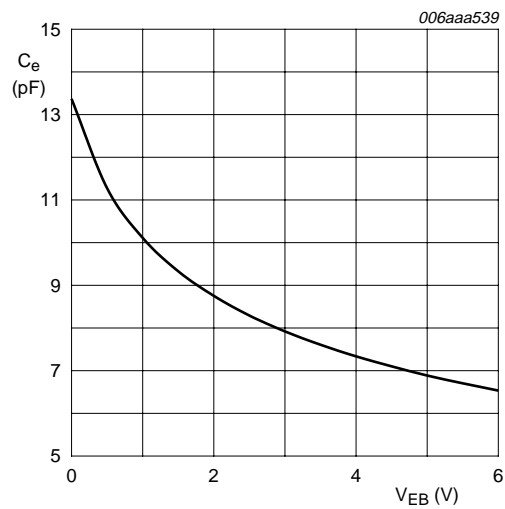
$V_{CE} = 5 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$

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



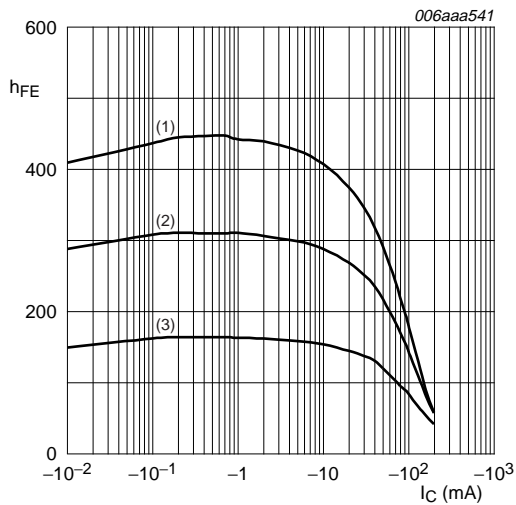
$f = 1 \text{ MHz}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$

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



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

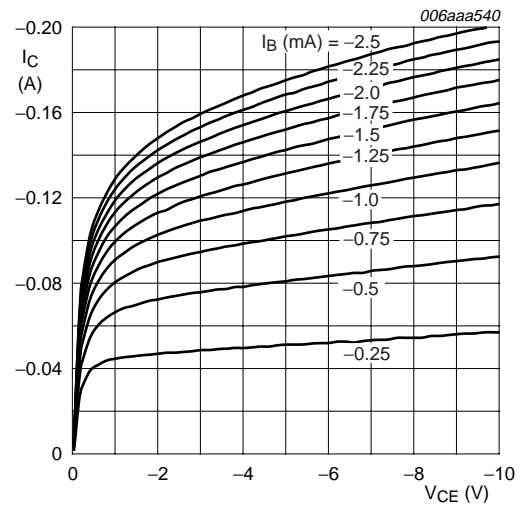
Fig 10. TR1 (NPN): Emitter capacitance as a function of emitter-base voltage; typical values



$V_{CE} = -5 \text{ V}$

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

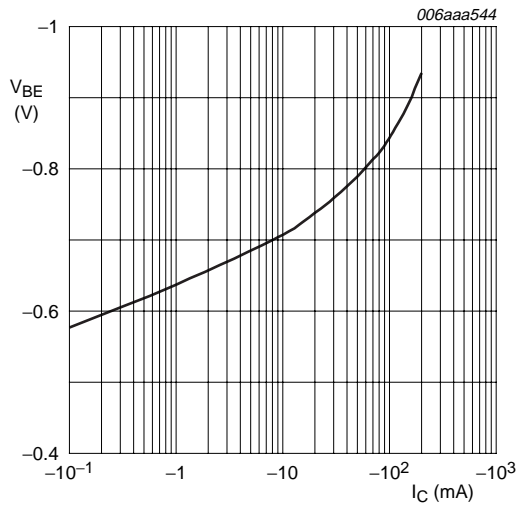
Fig 11. TR2 (PNP): DC current gain as a function of collector current; typical values



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

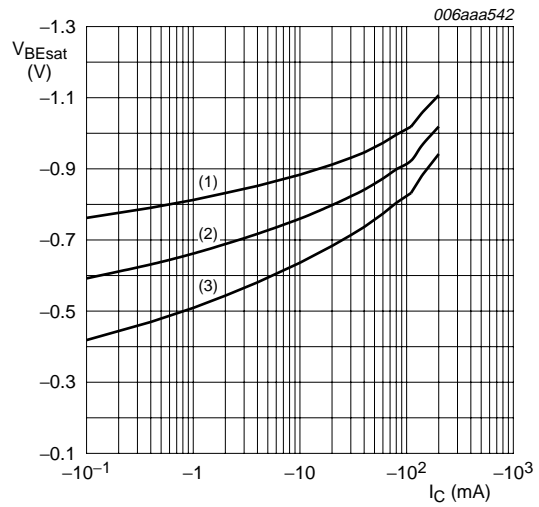
Fig 12. TR2 (PNP): Collector current as a function of collector-emitter voltage; typical values





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

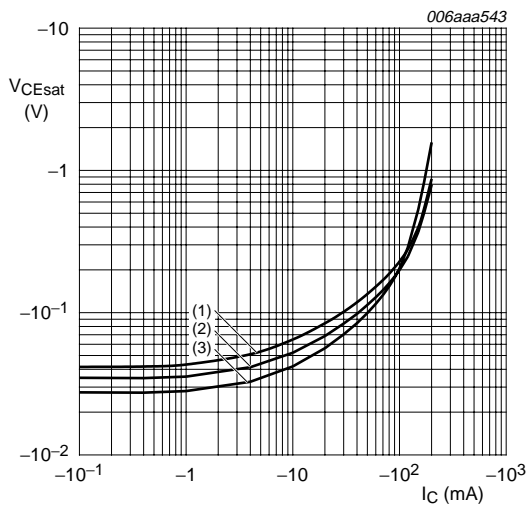
Fig 13. TR2 (PNP): Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 20$

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

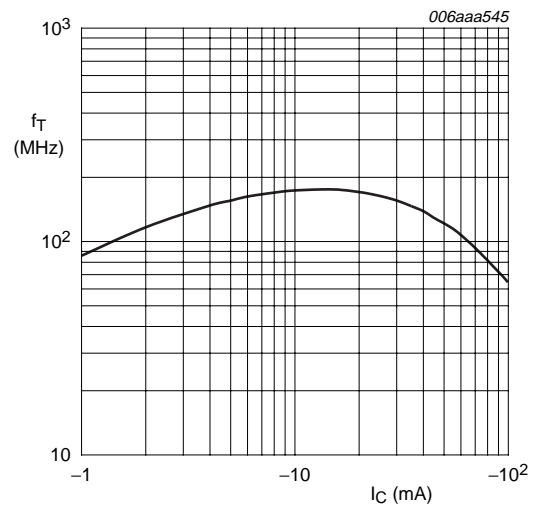
Fig 14. TR2 (PNP): Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$

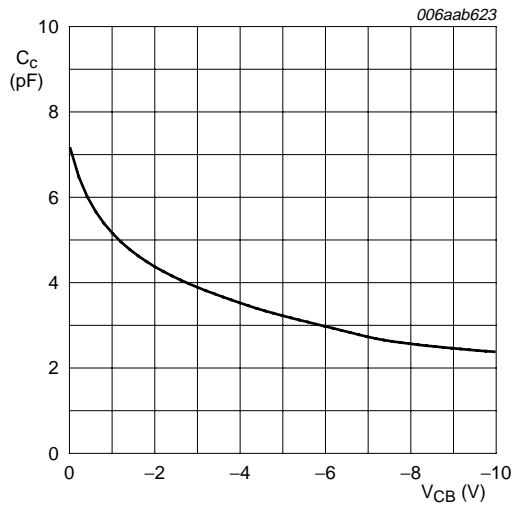
- (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$
- (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$
- (3)  $T_{amb} = -55 \text{ }^\circ\text{C}$

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



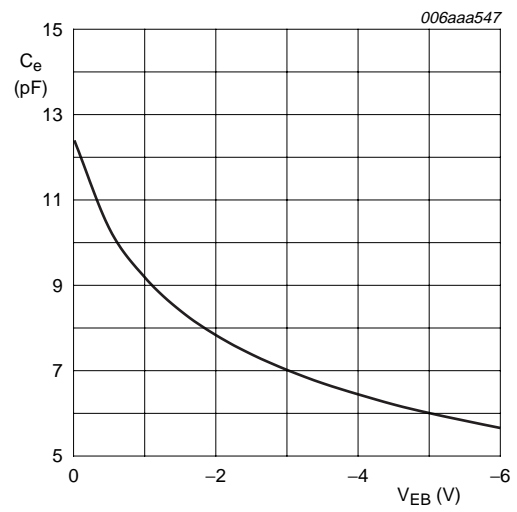
$V_{CE} = -5 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$

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



f = 1 MHz; T<sub>amb</sub> = 25 °C

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



f = 1 MHz; T<sub>amb</sub> = 25 °C

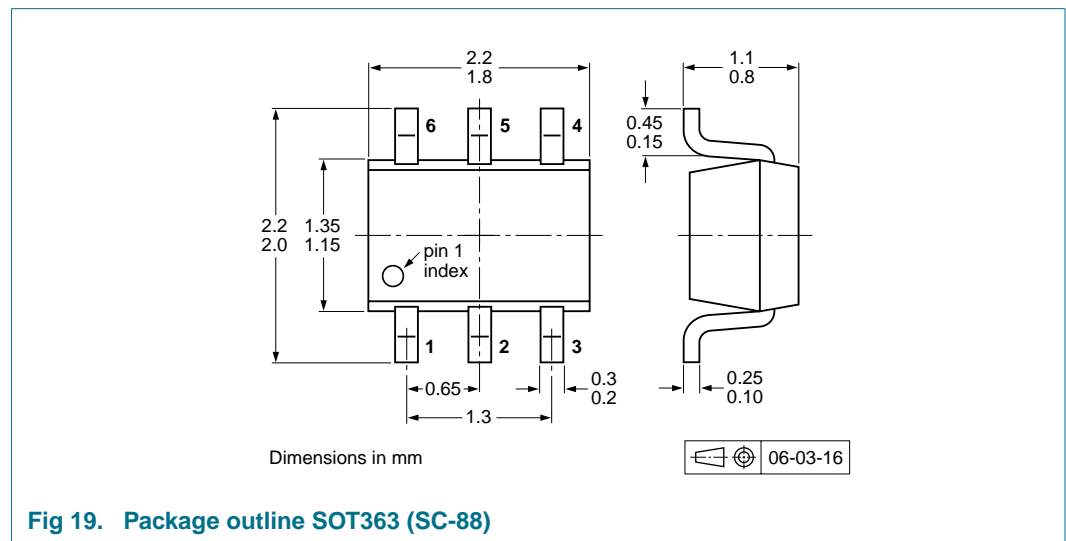
Fig 18. TR2 (PNP): Emitter capacitance as a function of emitter-base voltage; typical values

## 8. Test information

### 8.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

## 9. Package outline



## 10. Packing information

**Table 9. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

Type number	Package	Description	Packing quantity	
			3000	10000
BC846BPN	SOT363	4 mm pitch, 8 mm tape and reel; T1	<sup>[2]</sup> -115	-135
		4 mm pitch, 8 mm tape and reel; T2	<sup>[3]</sup> -125	-165

[1] For further information and the availability of packing methods, see [Section 14](#).

[2] T1: normal taping

[3] T2: reverse taping

11. Soldering

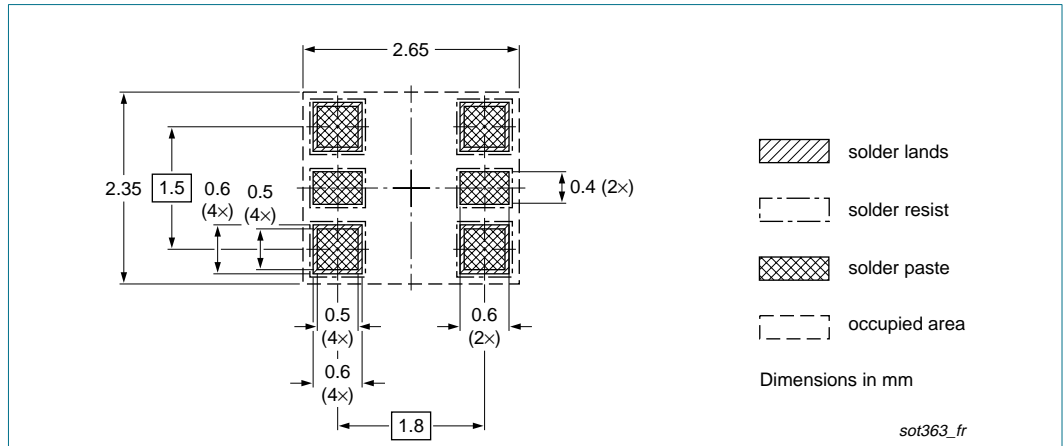


Fig 20. Reflow soldering footprint SOT363 (SC-88)

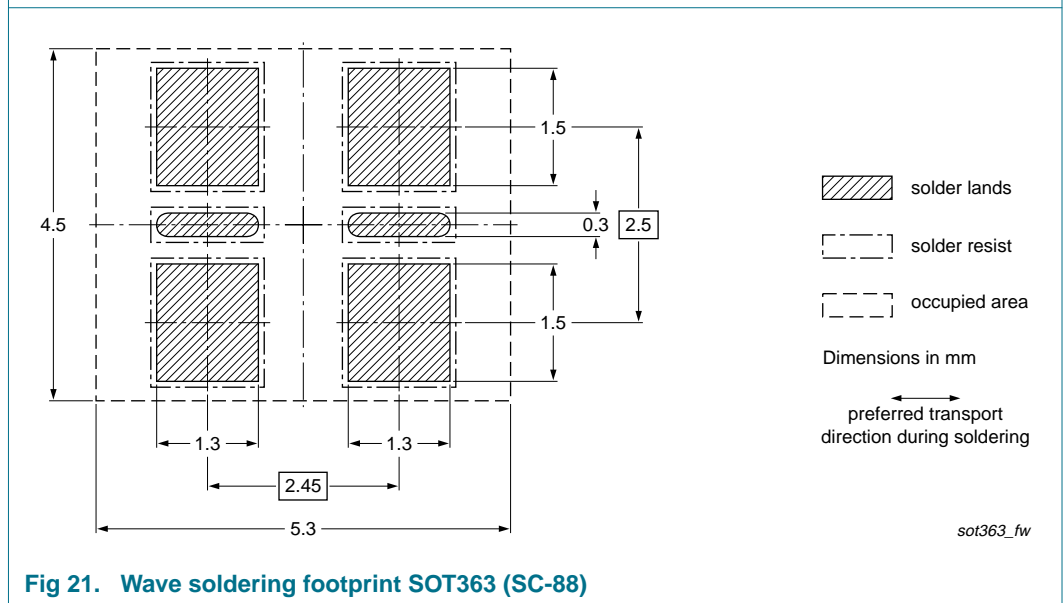


Fig 21. Wave soldering footprint SOT363 (SC-88)

## 12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BC846BPN_1	20090717	Product data sheet	-	-

## 13. Legal information

### 13.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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 URL <http://www.nxp.com>.

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