

# BC847 series

45 V, 100 mA NPN general-purpose transistors

Rev. 9 — 23 September 2014

Product data sheet

## 1. Product profile

### 1.1 General description

NPN general-purpose transistors in Surface-Mounted Device (SMD) plastic packages.

Table 1. Product overview

Type number <sup>[1]</sup>	Package			PNP complement
	Nexperia	JEITA	JEDEC	
BC847	SOT23	-	TO-236AB	BC857
BC847A				BC857A
BC847B				BC857B
BC847C				BC857C
BC847W	SOT323	SC-70	-	BC857W
BC847AW				BC857AW
BC847BW				BC857BW
BC847CW				BC857CW
BC847T	SOT416	SC-75	-	BC857T
BC847AT				BC857AT
BC847BT				BC857BT
BC847CT				BC857CT
BC847AM	SOT883	SC-101	-	BC857AM
BC847BM				BC857BM
BC847CM				BC857CM

[1] Valid for all available selection groups.

### 1.2 Features and benefits

- General-purpose transistors
- SMD plastic packages
- Three different gain selections
- AEC-Q101 qualified

### 1.3 Applications

- General-purpose switching and amplification

## 1.4 Quick reference data

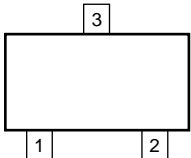
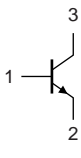
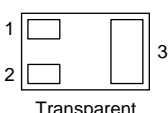
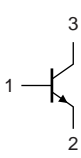
Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{CEO}$	collector-emitter voltage	open base	-	-	45	V	
$I_C$	collector current		-	-	100	mA	
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}; I_C = 2\text{ mA}$	[1]	110	-	800	
	$h_{FE}$ group A		110	180	220		
	$h_{FE}$ group B		200	290	450		
	$h_{FE}$ group C		420	520	800		

[1]  $T_{amb} = 25\text{ °C}$  unless otherwise specified

## 2. Pinning information

Table 3. Pinning

Pin	Description	Simplified outline	Graphic symbol
<b>SOT23, SOT323, SOT416</b>			
1	base	 006aaa144	 sym021
2	emitter		
3	collector		
<b>SOT883</b>			
1	base	 Transparent top view	 sym021
2	emitter		
3	collector		

### 3. Ordering information

Table 4. Ordering information

Type number <sup>[1]</sup>	Package		
	Name	Description	Version
BC847	-	plastic surface-mounted package; 3 leads	SOT23
BC847A			
BC847B			
BC847C			
BC847W	SC-70	plastic surface-mounted package; 3 leads	SOT323
BC847AW			
BC847BW			
BC847CW			
BC847T	SC-75	plastic surface-mounted package; 3 leads	SOT416
BC847AT			
BC847BT			
BC847CT			
BC847AM	SC-101	leadless ultra small plastic package; 3 solder lands; body 1.0 × 0.6 × 0.5 mm	SOT883
BC847BM			
BC847CM			

[1] Valid for all available selection groups.

### 4. Marking

Table 5. Marking codes

Type number	Marking code <sup>[1]</sup>	Type number	Marking code <sup>[1]</sup>
BC847	1H*	BC847T	1N
BC847A	1E*	BC847AT	1E
BC847B	1F*	BC847BT	1F
BC847C	1G*	BC847CT	1G
BC847W	1H*	BC847AM	D4
BC847AW	1E*	BC847BM	D5
BC847BW	1F*	BC847CM	D6
BC847CW	1G*		

[1] \* = placeholder for manufacturing site code

## 5. Limiting values

**Table 6. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CBO}$	collector-base voltage	open emitter	-	50	V
$V_{CEO}$	collector-emitter voltage	open base	-	45	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	-	100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]		
	SOT23		-	250	mW
	SOT323		-	200	mW
	SOT416		-	150	mW
	SOT883		[2]	250	mW
$T_j$	junction temperature		-	150	°C
$T_{amb}$	ambient temperature		-65	+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.

[2] Device mounted on an FR4 PCB with 60  $\mu$ m copper strip line, standard footprint.

## 6. Thermal characteristics

**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]			
	SOT23		-	-	500	K/W
	SOT323		-	-	625	K/W
	SOT416		-	-	833	K/W
	SOT883		[2]	-	-	500

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

[2] Device mounted on an FR4 PCB with 60  $\mu$ m copper strip line, standard footprint.

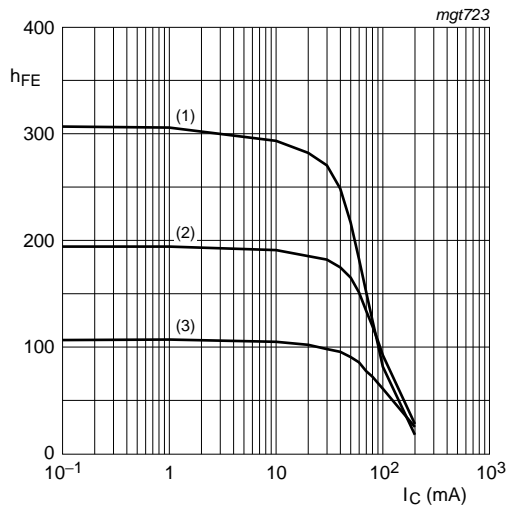
## 7. Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 30\text{ V}; I_E = 0\text{ A}$	-	-	15	nA	
		$V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ °C}$	-	-	5	$\mu\text{A}$	
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	100	nA	
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}; I_C = 10\text{ }\mu\text{A}$					
	$h_{FE}$ group A		-	170	-		
	$h_{FE}$ group B		-	280	-		
	$h_{FE}$ group C		-	420	-		
	DC current gain	$V_{CE} = 5\text{ V}; I_C = 2\text{ mA}$	110	-	800		
	$h_{FE}$ group A		110	180	220		
	$h_{FE}$ group B		200	290	450		
	$h_{FE}$ group C		420	520	800		
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$	-	90	200	mV	
		$I_C = 100\text{ mA}; I_B = 5\text{ mA}$	[1]	200	400	mV	
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$	[2]	700	-	mV	
		$I_C = 100\text{ mA}; I_B = 5\text{ mA}$	[2]	900	-	mV	
$V_{BE}$	base-emitter voltage	$I_C = 2\text{ mA}; V_{CE} = 5\text{ V}$	[2]	580	660	700	mV
		$I_C = 10\text{ mA}; V_{CE} = 5\text{ V}$	-	-	770	mV	
$f_T$	transition frequency	$V_{CE} = 5\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}$	100	-	-	MHz	
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	-	1.5	pF	
$C_e$	emitter capacitance	$V_{EB} = 0.5\text{ V}; I_C = i_c = 0\text{ A}; f = 1\text{ MHz}$	-	11	-	pF	
NF	noise figure	$I_C = 200\text{ }\mu\text{A}; V_{CE} = 5\text{ V}; R_S = 2\text{ k}\Omega; f = 1\text{ kHz}; B = 200\text{ Hz}$	-	2	10	dB	

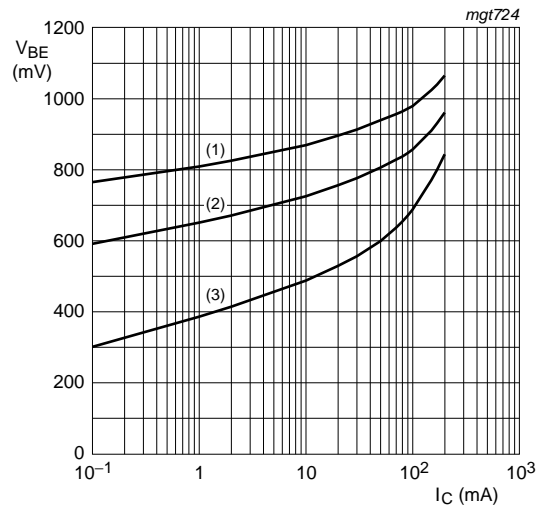
[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}; \delta = 0.02$ .

[2]  $V_{BE}$  decreases by approximately 2 mV/K with increasing temperature.



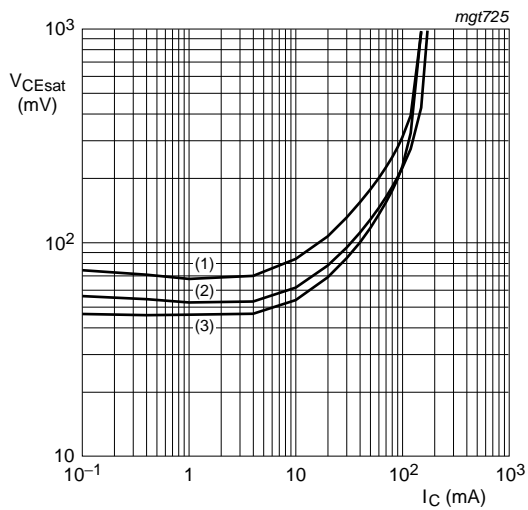
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 1. Group A: DC current gain as a function of collector current; typical values**



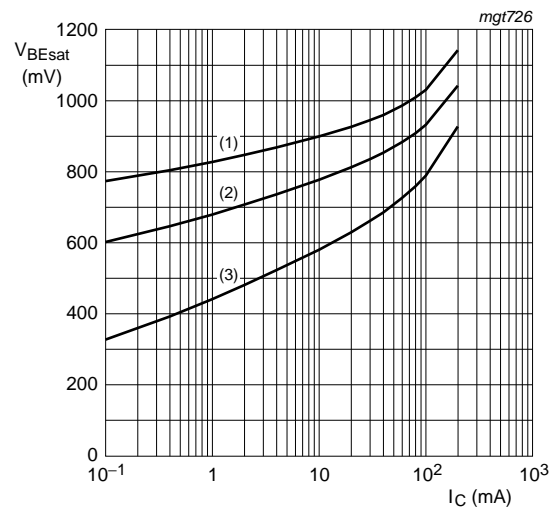
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 150\text{ °C}$

**Fig 2. Group A: Base-emitter voltage as a function of collector current; typical values**



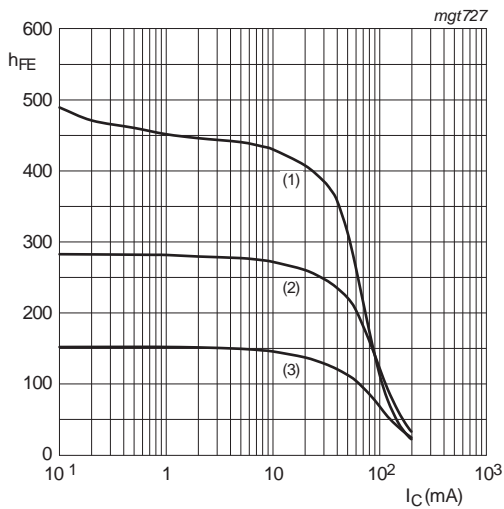
$I_C/I_B = 20$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 3. Group A: Collector-emitter saturation voltage as a function of collector current; typical values**



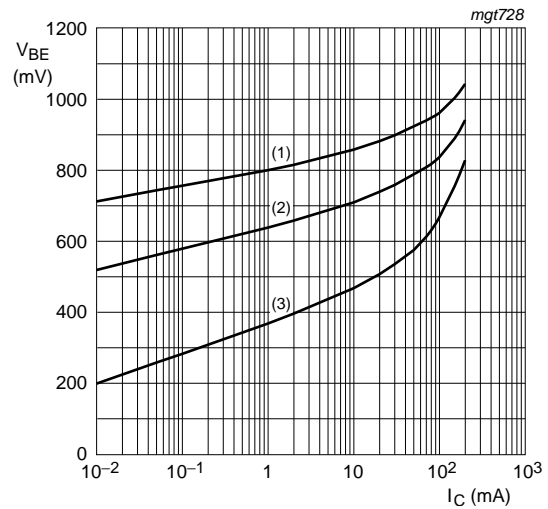
$I_C/I_B = 10$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 150\text{ °C}$

**Fig 4. Group A: Base-emitter saturation voltage as a function of collector current; typical values**



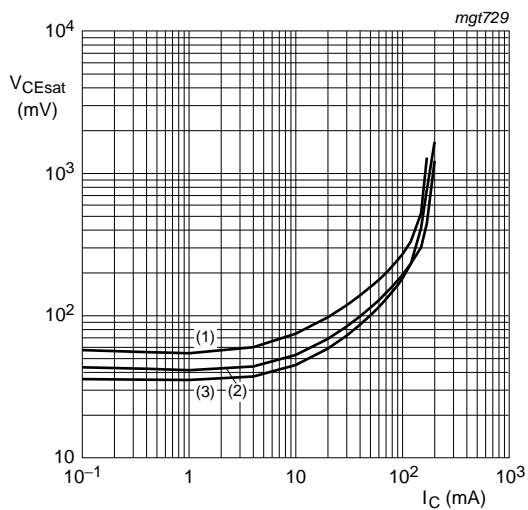
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = 150 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55 \text{ }^\circ\text{C}$

**Fig 5. Group B: DC current gain as a function of collector current; typical values**



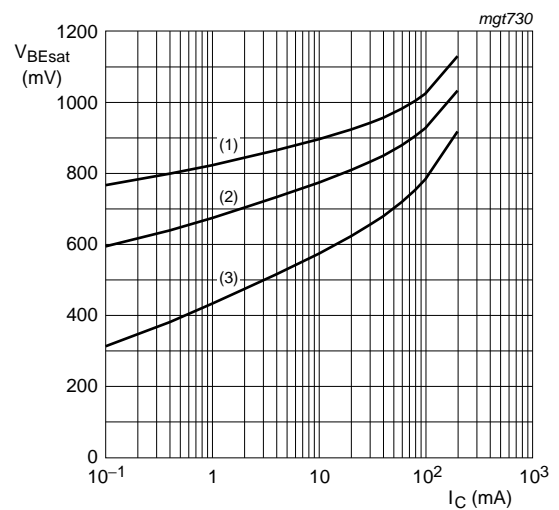
$V_{CE} = 5 \text{ V}$   
 (1)  $T_{amb} = -55 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 150 \text{ }^\circ\text{C}$

**Fig 6. Group B: Base-emitter voltage as a function of collector current; typical values**



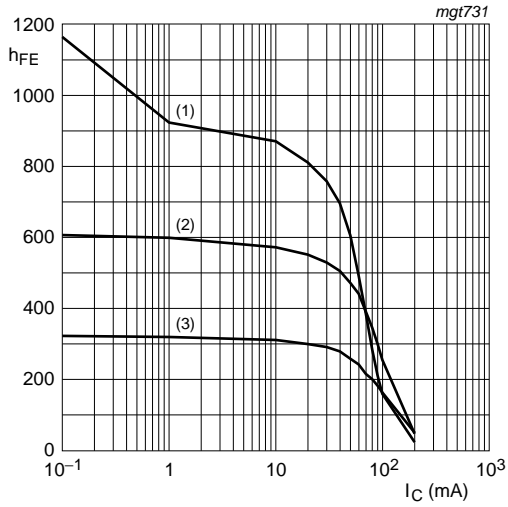
$I_C/I_B = 20$   
 (1)  $T_{amb} = 150 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55 \text{ }^\circ\text{C}$

**Fig 7. Group B: Collector-emitter saturation voltage as a function of collector current; typical values**



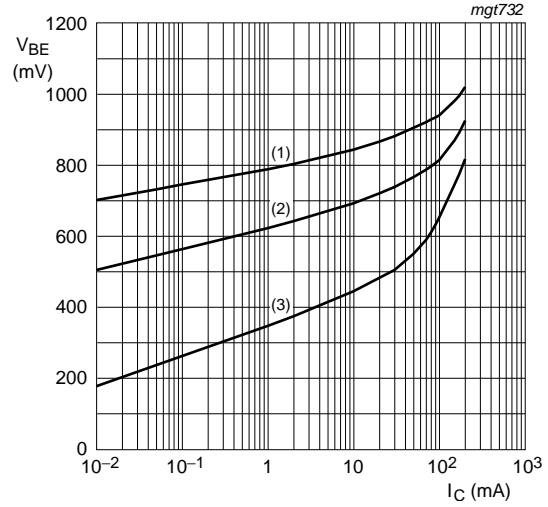
$I_C/I_B = 10$   
 (1)  $T_{amb} = -55 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 150 \text{ }^\circ\text{C}$

**Fig 8. Group B: Base-emitter saturation voltage as a function of collector current; typical values**



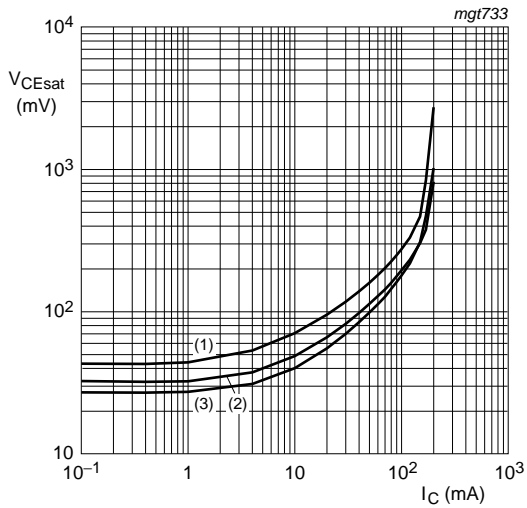
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 9. Group C: DC current gain as a function of collector current; typical values**



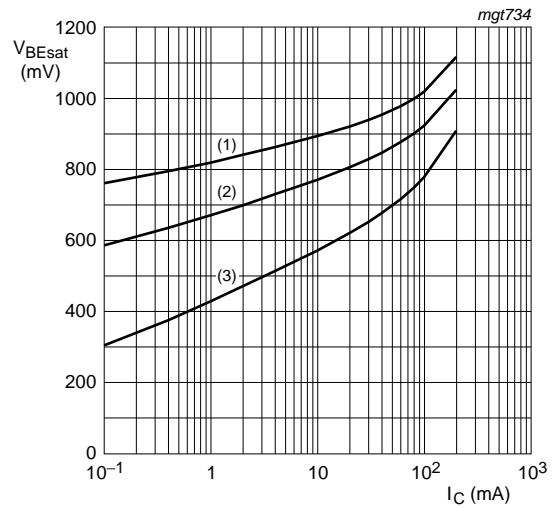
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 150\text{ °C}$

**Fig 10. Group C: Base-emitter voltage as a function of collector current; typical values**



$I_C/I_B = 20$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 11. Group C: Collector-emitter saturation voltage as a function of collector current; typical values**



$I_C/I_B = 10$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 150\text{ °C}$

**Fig 12. Group C: Base-emitter saturation voltage as a function of collector current; typical values**

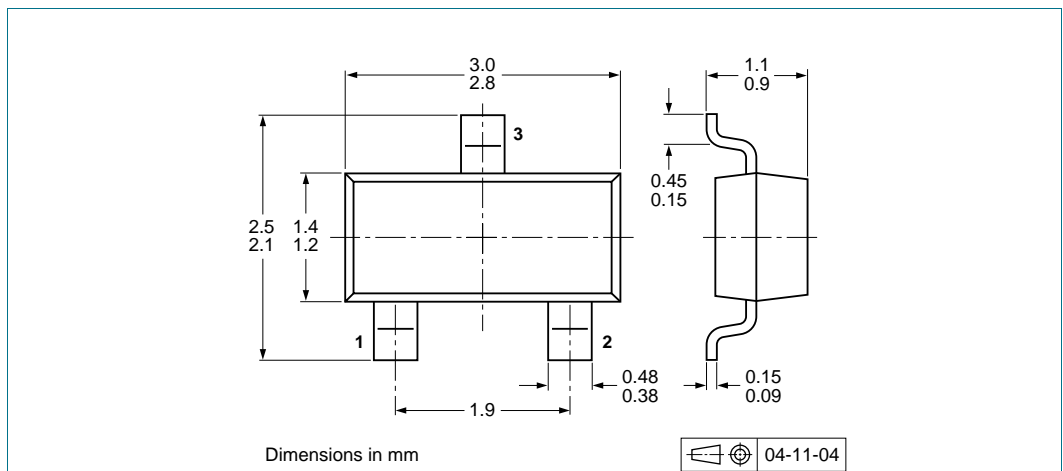


## 8. Test information

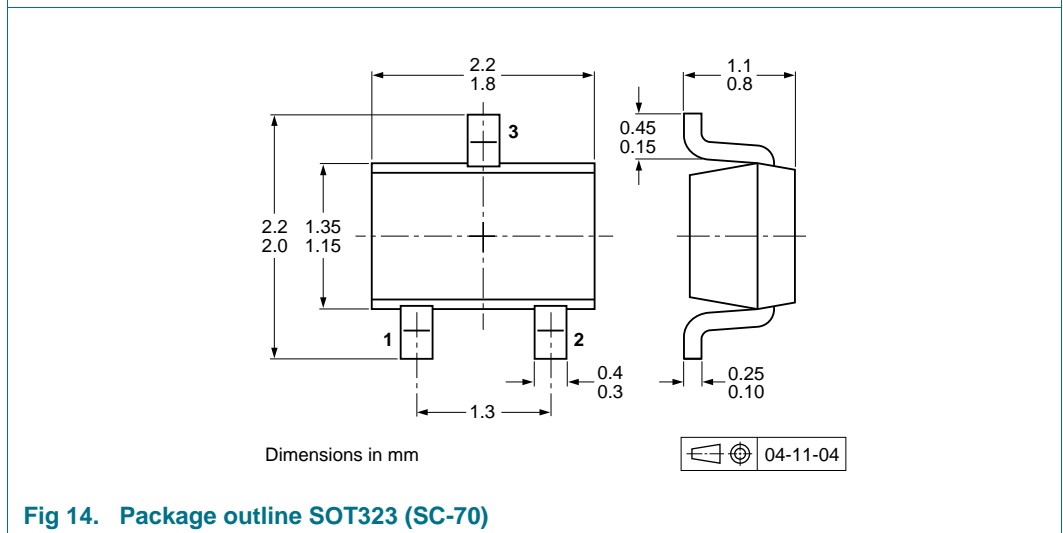
### 8.1 Quality information

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.

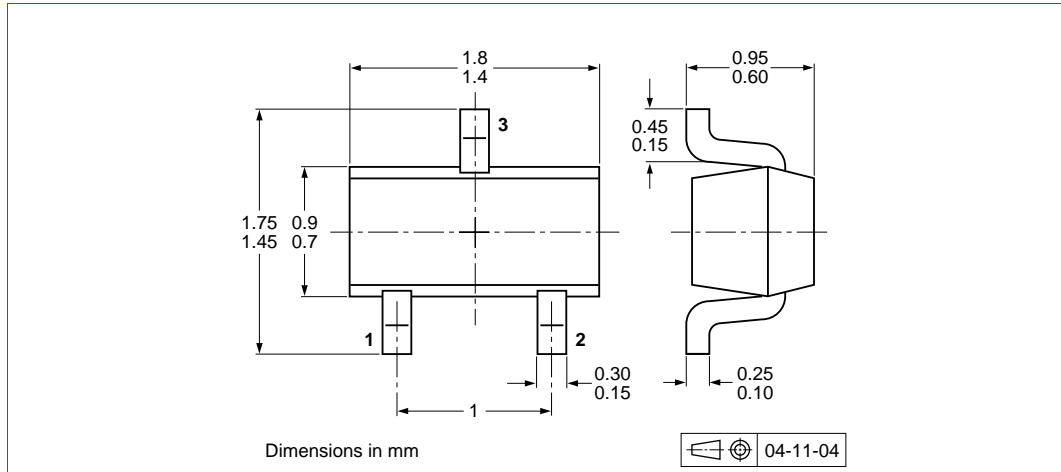
## 9. Package outline



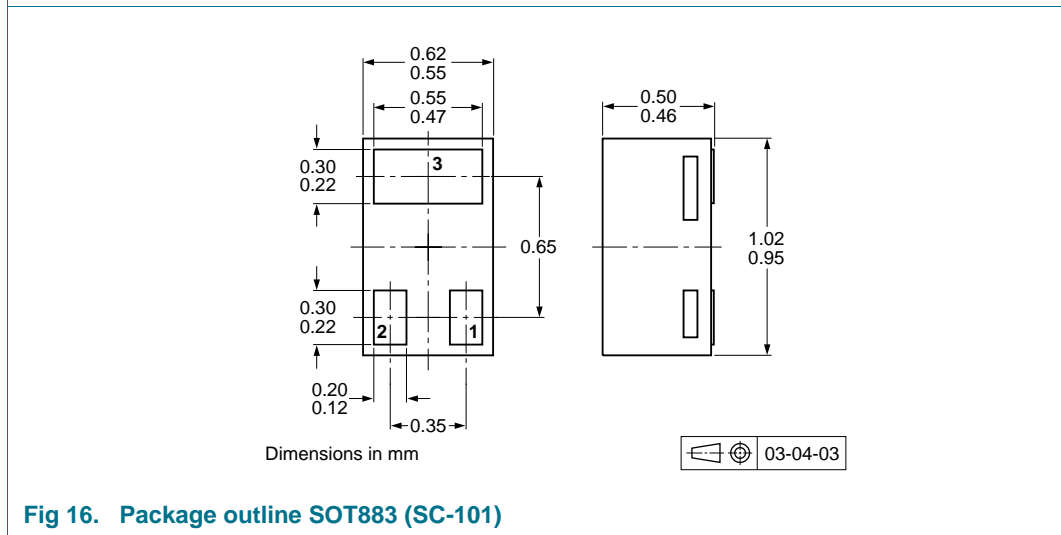
**Fig 13. Package outline SOT23 (TO-236AB)**



**Fig 14. Package outline SOT323 (SC-70)**

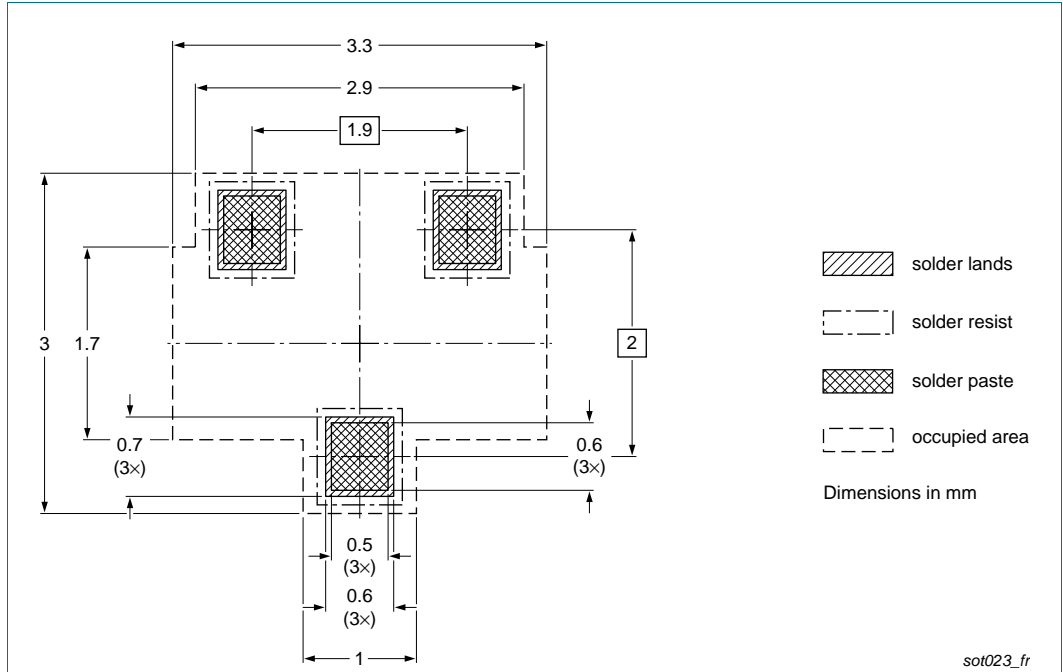


**Fig 15. Package outline SOT416 (SC-75)**

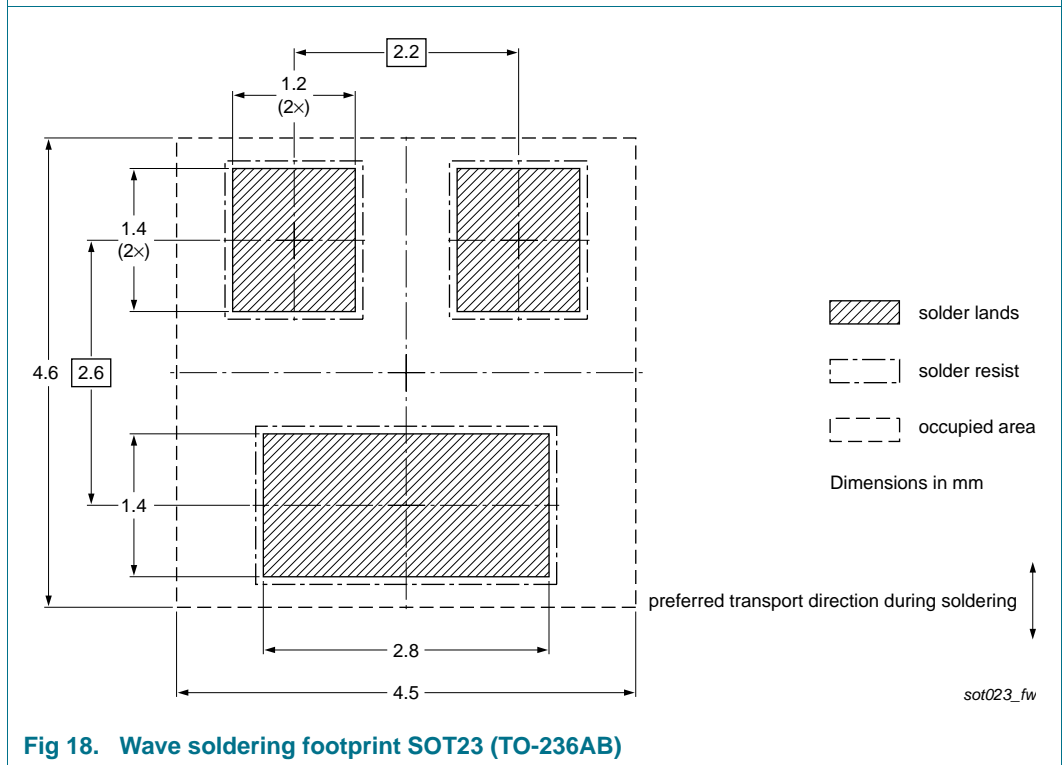


**Fig 16. Package outline SOT883 (SC-101)**

**10. Soldering**



**Fig 17. Reflow soldering footprint SOT23 (TO-236AB)**



**Fig 18. Wave soldering footprint SOT23 (TO-236AB)**

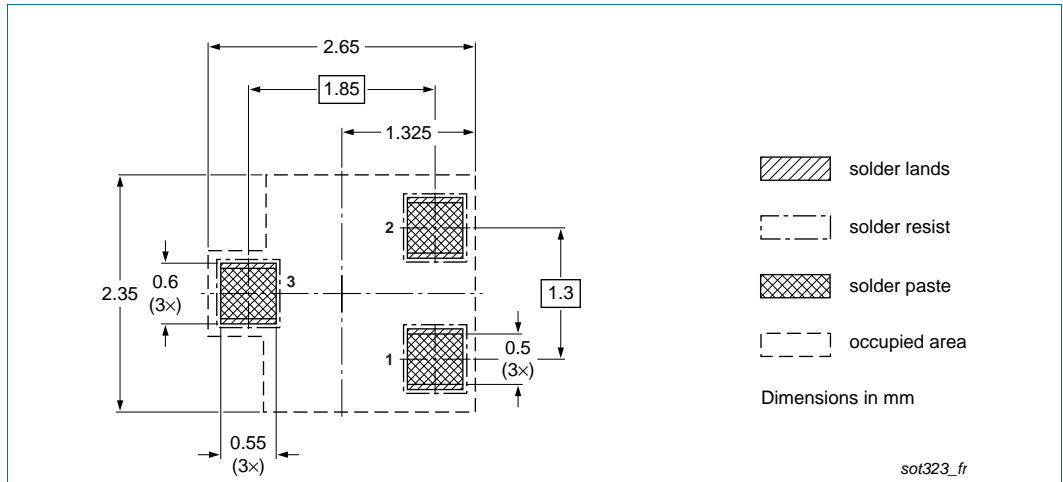


Fig 19. Reflow soldering footprint SOT323 (SC-70)

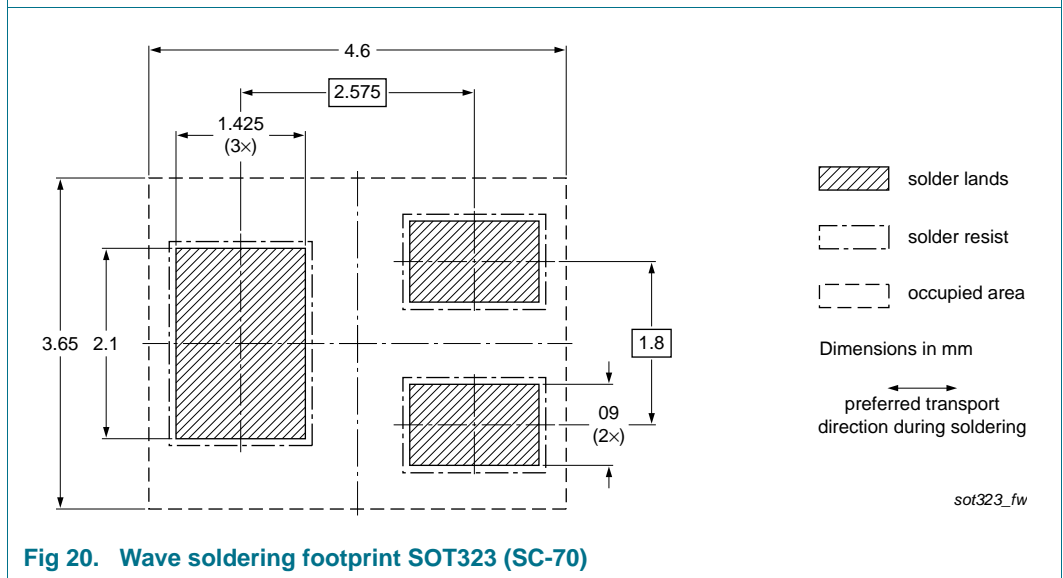
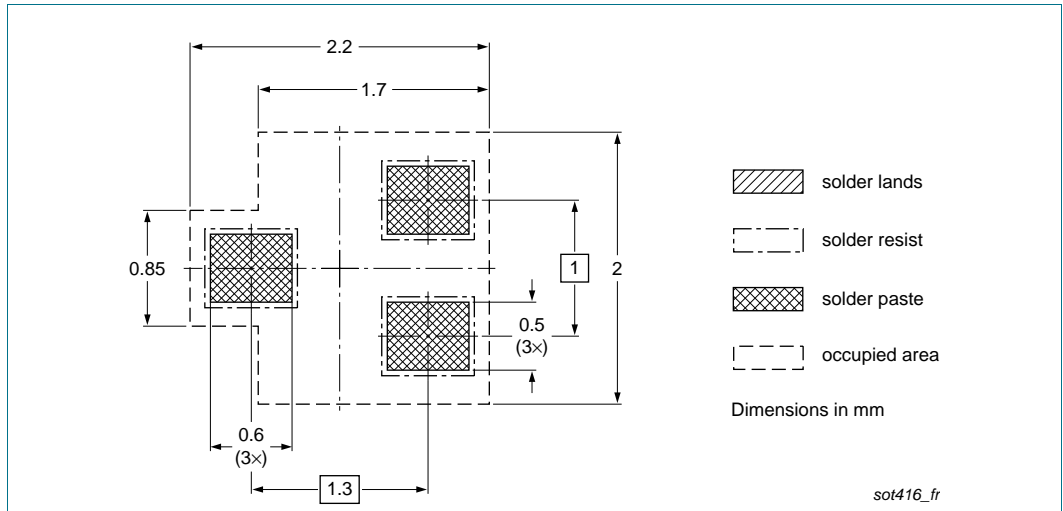
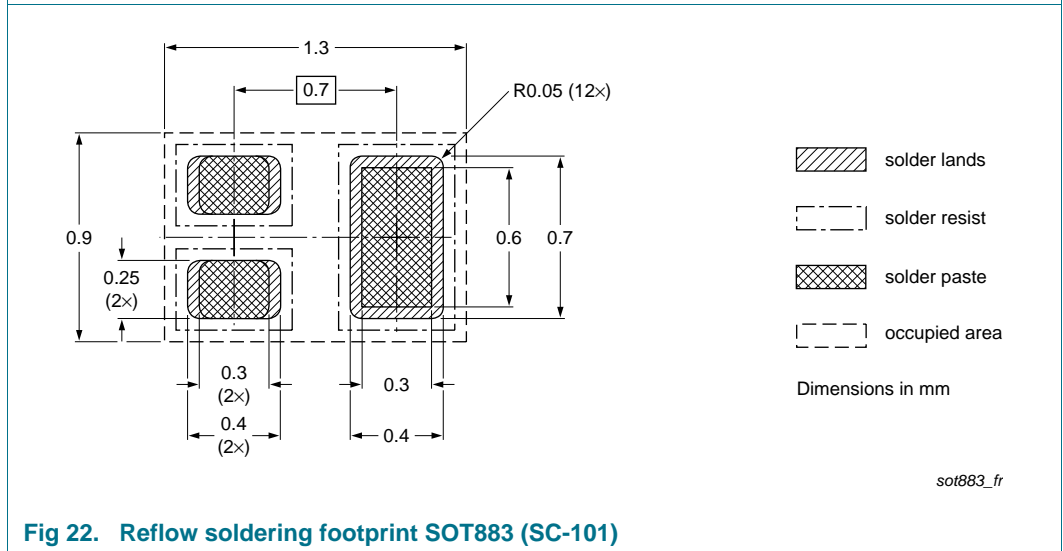


Fig 20. Wave soldering footprint SOT323 (SC-70)



**Fig 21. Reflow soldering footprint SOT416 (SC-75)**



**Fig 22. Reflow soldering footprint SOT883 (SC-101)**

## 11. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BC847_SER v.9	20140923	Product data sheet	-	BC847_SER v.8
Modifications:	<ul style="list-style-type: none"><li>• <a href="#">Section 1.2 "Features and benefits"</a>: updated</li><li>• <a href="#">Section 5 "Limiting values"</a>: updated</li><li>• <a href="#">Figure 5</a>: corrected</li><li>• <a href="#">Section 8 "Test information"</a>: added</li><li>• <a href="#">Section 12 "Legal information"</a>: updated</li></ul>			
BC847_SER v.8	20120820	Product data sheet	-	BC847_BC547_SER v.7
BC847_BC547_SER v.7	20081210	Product data sheet	-	BC847_BC547_SER v.6
BC847_BC547_SER v.6	20050519	Product data sheet	-	-

## 12. Legal information

### 12.1 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.nexperia.com>.

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**Translations** — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

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