

# BC846 series

65 V, 100 mA NPN general-purpose transistors

Rev. 9 — 25 September 2012

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
	NXP	JEITA	JEDEC	
BC846	SOT23	-	TO-236AB	BC856
BC846W	SOT323	SC-70	-	BC856W
BC846T	SOT416	SC-75	-	BC856T

[1] Valid for all available selection groups.

### 1.2 Features and benefits

- General-purpose transistors
- SMD plastic packages
- Two different gain selections

### 1.3 Applications

- General-purpose switching and amplification

### 1.4 Quick reference data

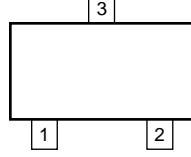
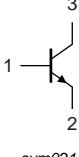
Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	65	V
$I_C$	collector current		-	-	100	mA
$h_{FE}$	DC current gain	$V_{CE} = 5$ V; $I_C = 2$ mA	110	-	450	
	$h_{FE}$ group A		110	180	220	
	$h_{FE}$ group B		200	290	450	



## 2. Pinning information

Table 3. Pinning

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

## 3. Ordering information

Table 4. Ordering information

Type number <sup>[1]</sup>	Package		
	Name	Description	Version
BC846	-	plastic surface-mounted package; 3 leads	SOT23
BC846W	SC-70	plastic surface-mounted package; 3 leads	SOT323
BC846T	SC-75	plastic surface-mounted package; 3 leads	SOT416

[1] Valid for all available selection groups.

## 4. Marking

Table 5. Marking codes

Type number	Marking code <sup>[1]</sup>
BC846	1D*
BC846A	1A*
BC846B	1B*
BC846W	1D*
BC846AW	1A*
BC846BW	1B*
BC846T	1M
BC846AT	1A
BC846BT	1B

[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	-	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; $t_p \leq 1 \text{ ms}$	-	200	mA
$I_{BM}$	peak base current	single pulse; $t_p \leq 1 \text{ ms}$	-	200	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25 \text{ }^{\circ}\text{C}$	[1]		
	SOT23		-	250	mW
	SOT323		-	200	mW
	SOT416		-	150	mW
$T_j$	junction temperature		-	150	$^{\circ}\text{C}$
$T_{amb}$	ambient temperature		-65	+150	$^{\circ}\text{C}$
$T_{stg}$	storage temperature		-65	+150	$^{\circ}\text{C}$

[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
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]			
	SOT23		-	-	500	K/W
	SOT323		-	-	625	K/W
	SOT416		-	-	833	K/W

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

## 7. Characteristics

**Table 8. Characteristics**

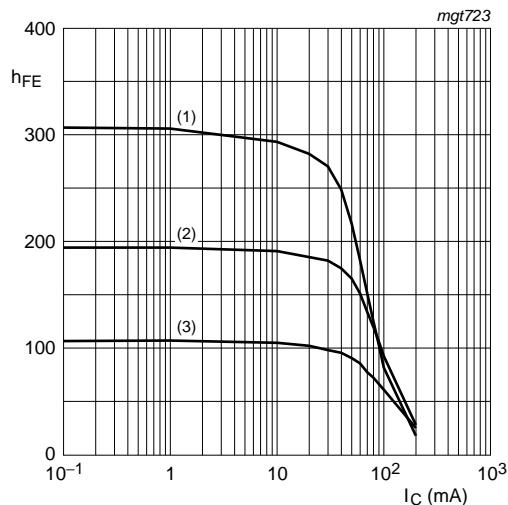
$T_{amb} = 25^\circ\text{C}$  unless otherwise specified.

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	
		$V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150^\circ\text{C}$	-	-	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		-	180	-		
	$h_{FE}$ group B		-	290	-		
	DC current gain	$V_{CE} = 5\text{ V}; I_C = 2\text{ mA}$	110	-	450		
	$h_{FE}$ group A		110	180	220		
	$h_{FE}$ group B		200	290	450		
$V_{CEsat}$	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]	-	760	-	mV
		$I_C = 100\text{ mA}; I_B = 5\text{ mA}$	[2]	-	900	-	mV
$V_{BE}$	base-emitter voltage	$I_C = 2\text{ mA}; V_{CE} = 5\text{ V}$	[3]	580	660	700	mV
		$I_C = 10\text{ mA}; V_{CE} = 5\text{ V}$	[3]	-	-	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	$V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	2	3	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:  $t_p \leq 300\text{ }\mu\text{s}; \delta = 0.02$ .

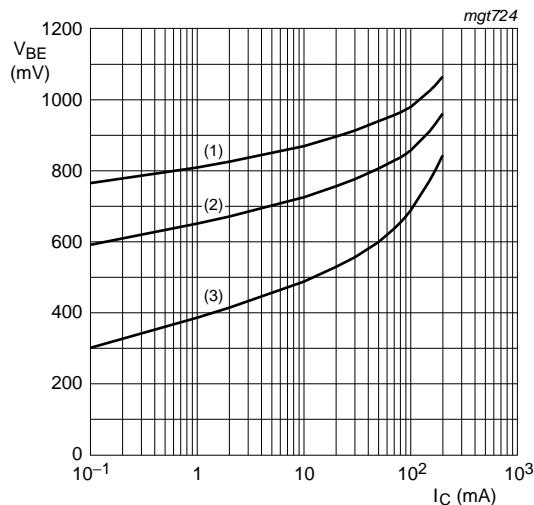
[2]  $V_{BESat}$  decreases by approximately 1.7 mV/K with increasing temperature.

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



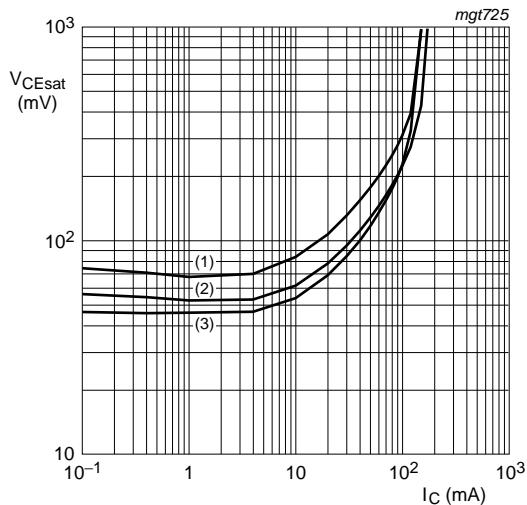
$V_{CE} = 5$  V  
 (1)  $T_{amb} = 150$  °C  
 (2)  $T_{amb} = 25$  °C  
 (3)  $T_{amb} = -55$  °C

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



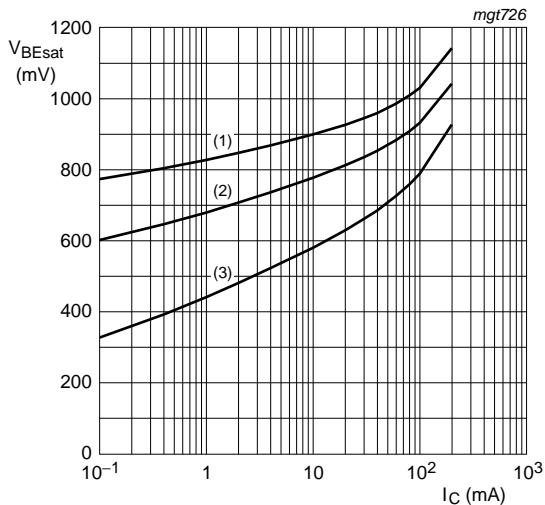
$V_{CE} = 5$  V  
 (1)  $T_{amb} = -55$  °C  
 (2)  $T_{amb} = 25$  °C  
 (3)  $T_{amb} = 150$  °C

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



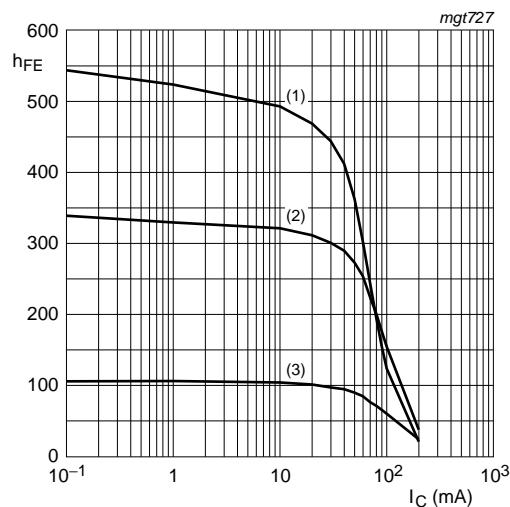
$I_C/I_B = 20$   
 (1)  $T_{amb} = 150$  °C  
 (2)  $T_{amb} = 25$  °C  
 (3)  $T_{amb} = -55$  °C

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



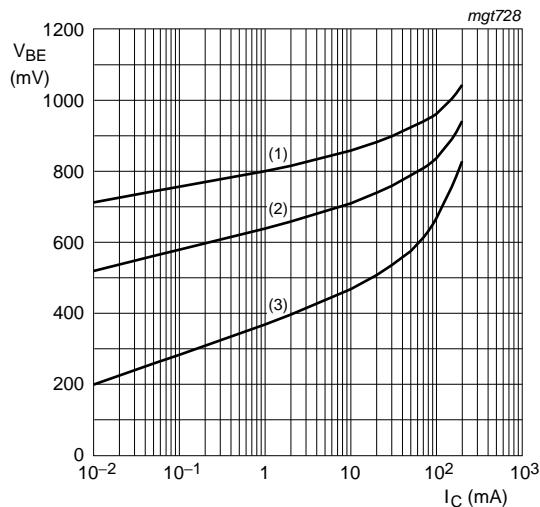
$I_C/I_B = 10$   
 (1)  $T_{amb} = -55$  °C  
 (2)  $T_{amb} = 25$  °C  
 (3)  $T_{amb} = 150$  °C

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



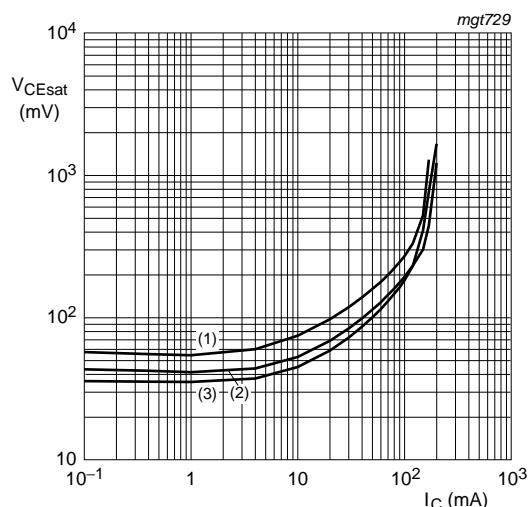
$V_{CE} = 5$  V  
 (1)  $T_{amb} = 150$  °C  
 (2)  $T_{amb} = 25$  °C  
 (3)  $T_{amb} = -55$  °C

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



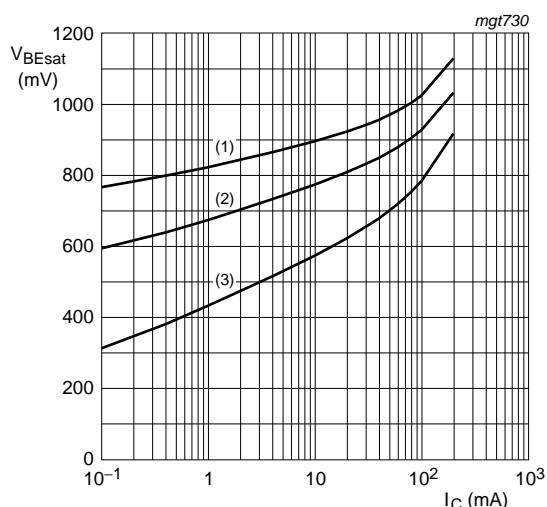
$V_{CE} = 5$  V  
 (1)  $T_{amb} = -55$  °C  
 (2)  $T_{amb} = 25$  °C  
 (3)  $T_{amb} = 150$  °C

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



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

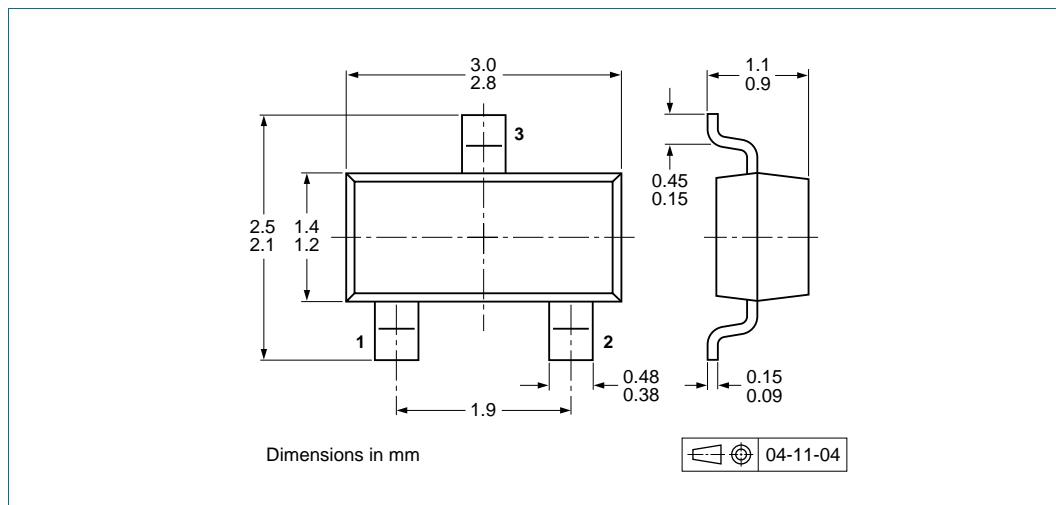
**Fig 7. Selection B: Collector-emitter saturation voltage as a function of collector current; typical values**



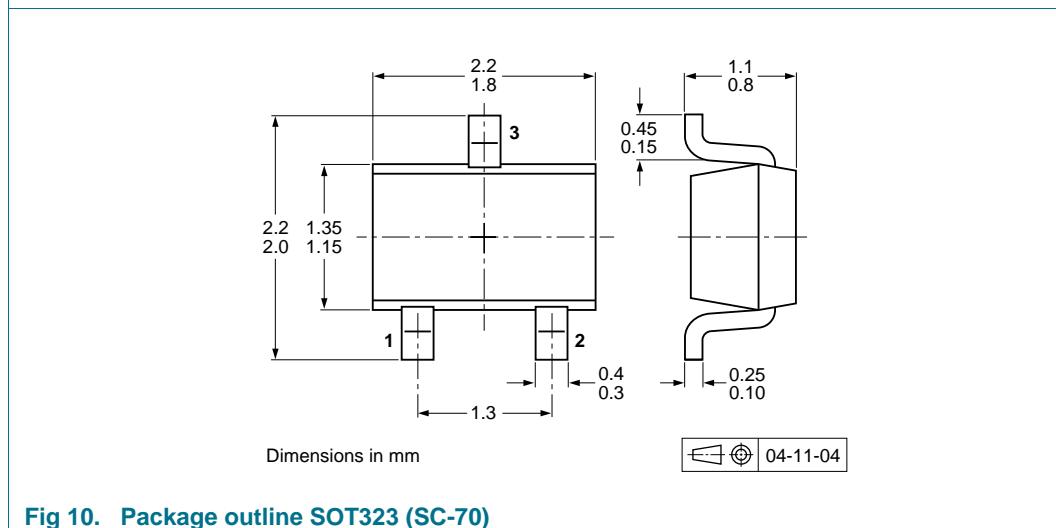
$I_C/I_B = 10$   
 (1)  $T_{amb} = -55$  °C  
 (2)  $T_{amb} = 25$  °C  
 (3)  $T_{amb} = 150$  °C

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

## 8. Package outline



**Fig 9. Package outline SOT23 (TO-236AB)**



**Fig 10. Package outline SOT323 (SC-70)**

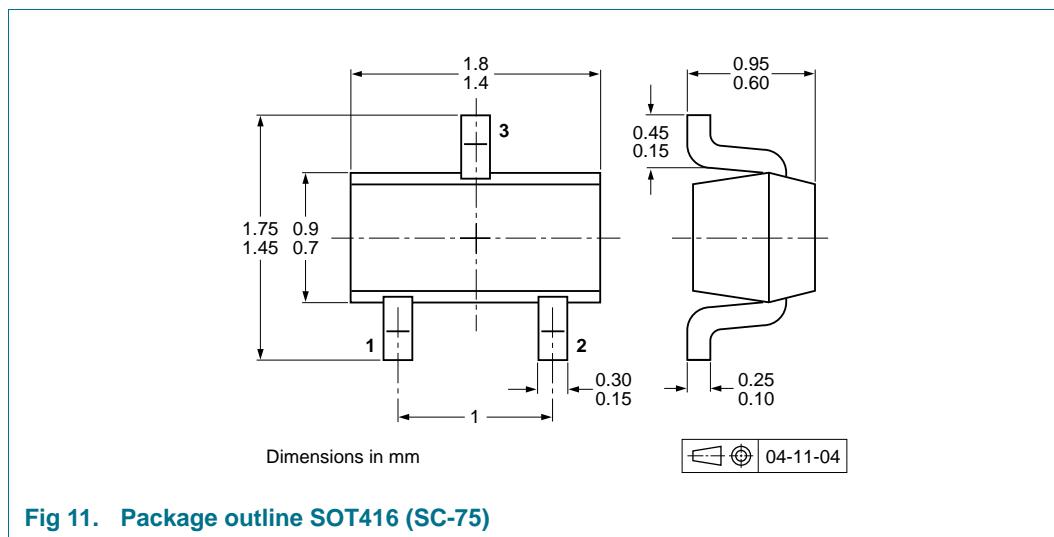


Fig 11. Package outline SOT416 (SC-75)

## 9. Packing information

Table 9. Packing methods

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

Type number <sup>[2]</sup>	Package	Description	Packing quantity		
			1000	3000	4000
BC846	SOT23	4 mm pitch, 8 mm tape and reel	-215	-	-235
BC846W	SOT323	4 mm pitch, 8 mm tape and reel	-115	-	-135
BC846T	SOT416	4 mm pitch, 8 mm tape and reel	-115	-	-135

[1] For further information and the availability of packing methods, see [Section 13](#).

[2] Valid for all available selection groups.

## 10. Soldering

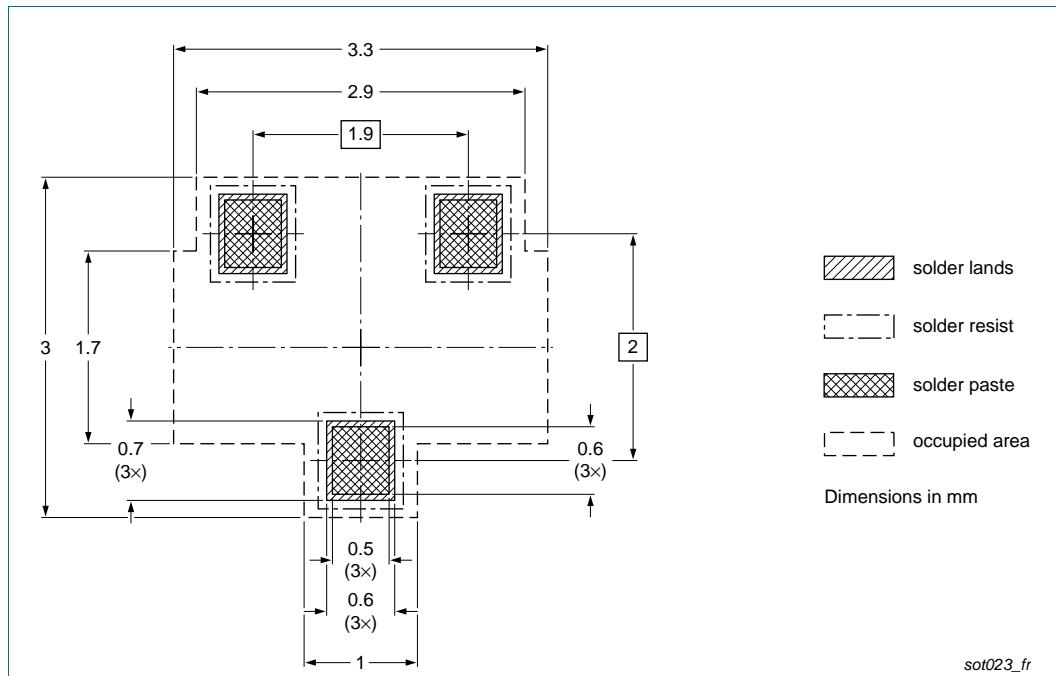


Fig 12. Reflow soldering footprint SOT23 (TO-236AB)

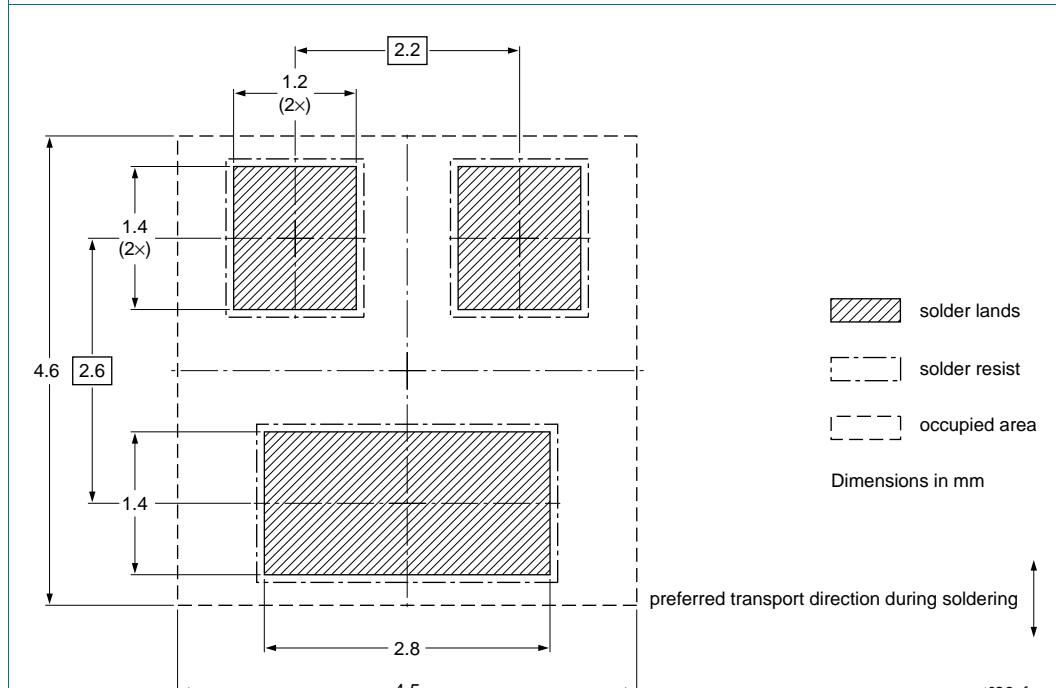
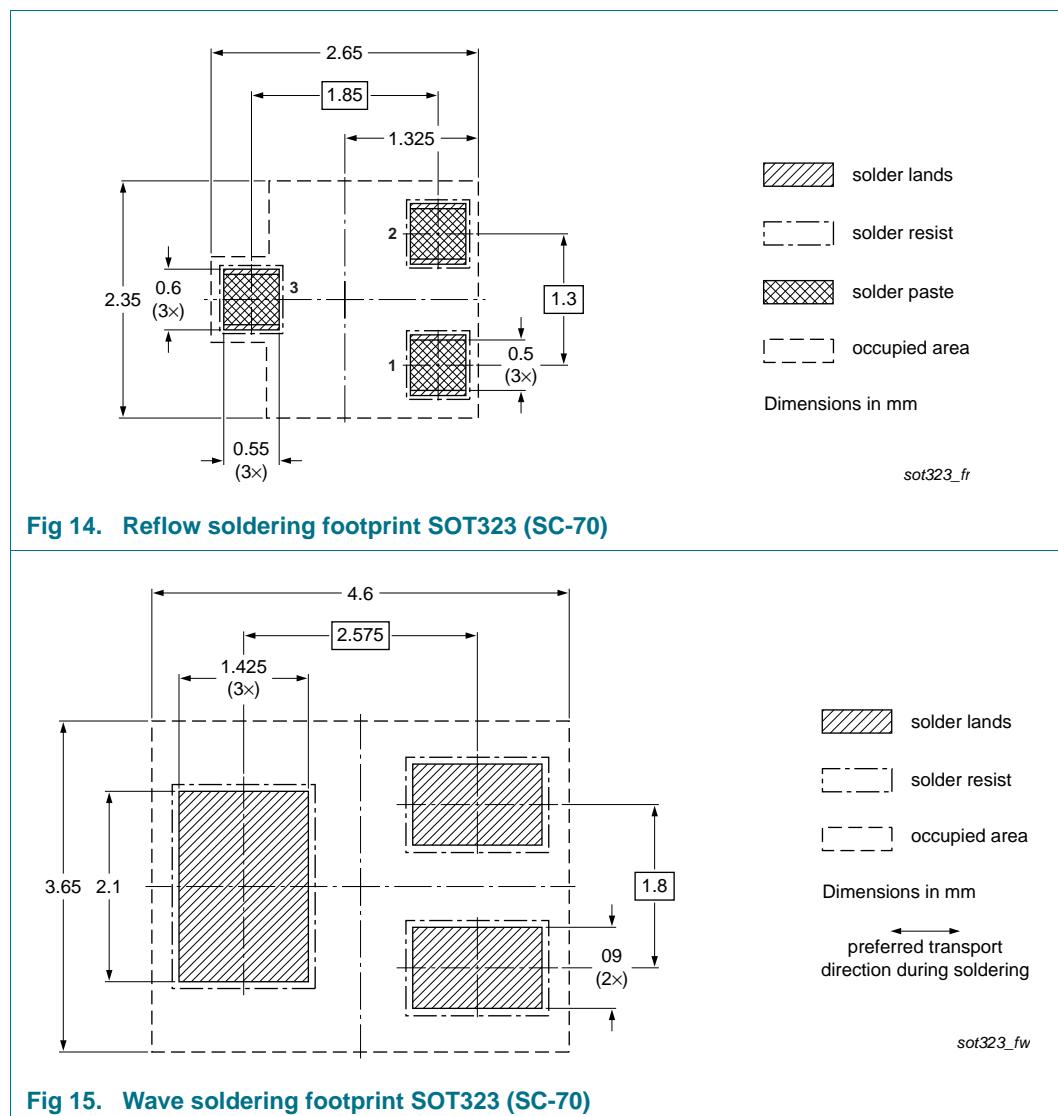
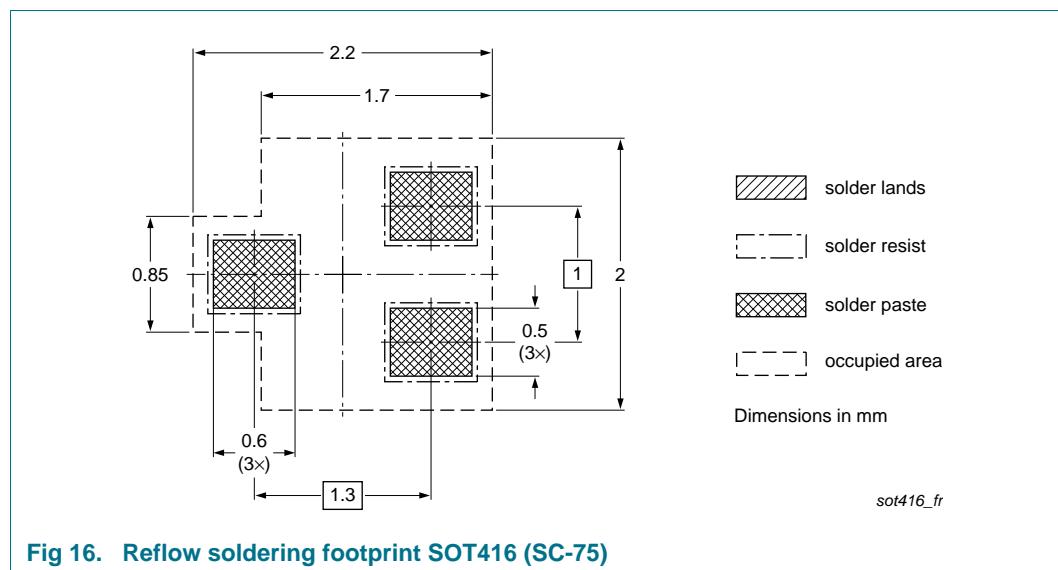


Fig 13. Wave soldering footprint SOT23 (TO-236AB)





## 11. Revision history

**Table 10. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
BC846_SER v.9	20120925	Product data sheet	-	BC846_SER v.8
Modifications:		• <a href="#">Table 6 "Limiting values": <math>P_{tot}</math> values corrected</a>		
BC846_SER v.8	20120424	Product data sheet		BC846_BC546_SER v.7
BC846_BC546_SER v.7	20091117	Product data sheet	-	BC846_BC546_SER v.6
BC846_BC546_SER v.6	20060207	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".

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