BC846/BC546 series

65 V, 100 mA NPN general-purpose transistors

1. Product profile

1.1 General description

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

Table 1.   Product overview

Type number[1]	Package			PNP complement
	NXP	**JEITA**	**JEDEC**	
BC846	SOT23	-	TO-236AB	BC856
BC846W	SOT323	SC-70	-	BC856W
BC846T	SOT416	SC-75	-	BC856T
BC546A[2]	SOT54	SC-43A	TO-92	BC556A
BC546B[2]	SOT54	SC-43A	TO-92	BC556B

[1]   Valid for all available selection groups.

[2]   Also available in SOT54A and SOT54 variant packages (see Section 2).

1.2 Features

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

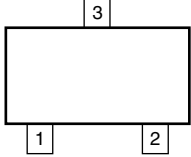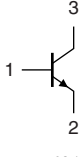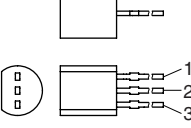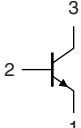### 1.3 Applications

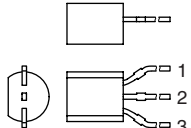- General-purpose switching and amplification
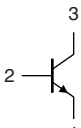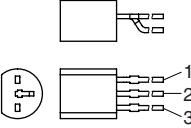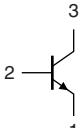
1.4 Quick reference data

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	Symbol
SOT23; SOT323; SOT416			
1	base		
2	emitter		
3	collector	006aaa144	sym021
SOT54			
1	emitter		
2	base		
3	collector	001aab347	sym026
SOT54A			
1	emitter		
2	base		
3	collector	001aab348	sym026
SOT54 variant			
1	emitter		
2	base		
3	collector	001aab447	sym026

3. Ordering information

Table 4.   Ordering information

Type number[1]	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
BC546A[2]	SC-43A	plastic single-ended leaded (through hole) package; 3 leads		SOT54
BC546B[2]	SC-43A	plastic single-ended leaded (through hole) package; 3 leads		SOT54

[1]   Valid for all available selection groups.

[2]   Also available in SOT54 and SOT54 variant packages (see Section 2 and Section 9).

4. Marking

Table 5.   Marking codes

Type number	Marking code[1]	Type number	Marking code[1]
BC846	1D*	BC846T	1M
BC846A	1A*	BC846AT	1A
BC846B	1B*	BC846BT	1B
BC846W	1D*	BC546A	C546A
BC846AW	1A*	BC546B	C546B
BC846BW	1B*	-	-

[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
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]			
	SOT23		-	250	mW
	SOT323		-	200	mW
	SOT416		-	150	mW
	SOT54		-	500	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.

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
	SOT54		-	-	250	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 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	V_{CB} = 30 V; I_E = 0 A		-	-	15	nA
		V_{CB} = 30 V; I_E = 0 A; T_j = 150 °C		-	-	5	μA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_E = 0 A		-	-	100	nA
h_{FE}	DC current gain						
	h_{FE} group A	V_{CE} = 5 V; I_C = 10 μA		-	180	-	
	h_{FE} group B	V_{CE} = 5 V; I_C = 10 μA		-	290	-	
	DC current gain	V_{CE} = 5 V; I_C = 2 mA		110	-	450	
	h_{FE} group A	V_{CE} = 5 V; I_C = 2 mA		110	180	220	
	h_{FE} group B	V_{CE} = 5 V; I_C = 2 mA		200	290	450	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA		-	90	200	mV
		I_C = 100 mA; I_B = 5 mA	[1]	-	200	400	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	[2]	-	760	-	mV
		I_C = 100 mA; I_B = 5 mA	[2]	-	900	-	mV
V_{BE}	base-emitter voltage	I_C = 2 mA; V_{CE} = 5 V	[3]	580	660	700	mV
		I_C = 10 mA; V_{CE} = 5 V	[3]	-	-	770	mV
f_T	transition frequency	V_{CE} = 5 V; I_C = 10 mA; f = 100 MHz		100	-	-	MHz
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz		-	2	3	pF
C_e	emitter capacitance	V_{EB} = 0.5 V; I_C = i_c = 0 A; f = 1 MHz		-	11	-	pF
NF	noise figure	I_C = 200 μA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz		-	2	10	dB

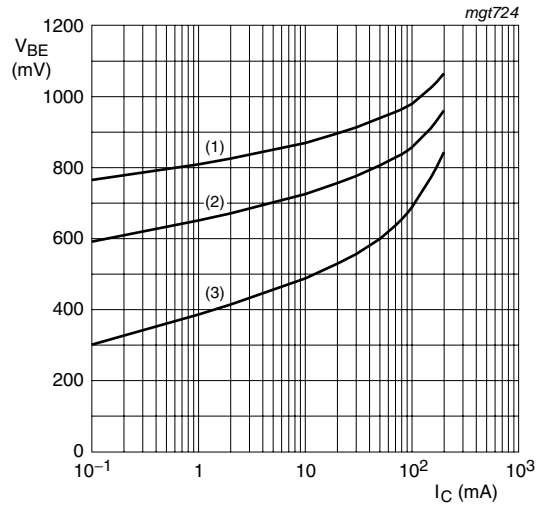[1]   Pulse test: $t_p \leq$ 300 μs; $\delta \leq$ 0.02.

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

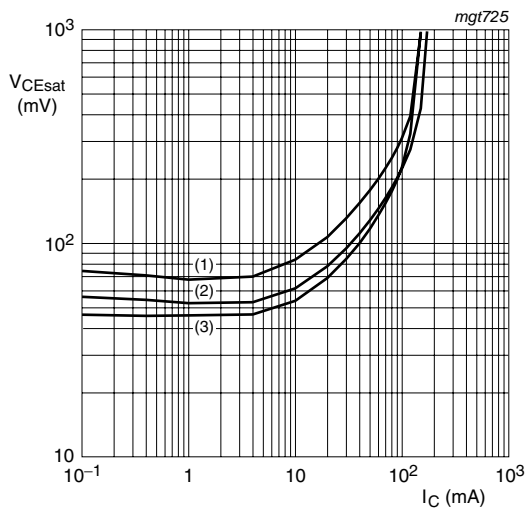[3] V_{BE} decreases by approximately 2 mV/K with increasing temperature.
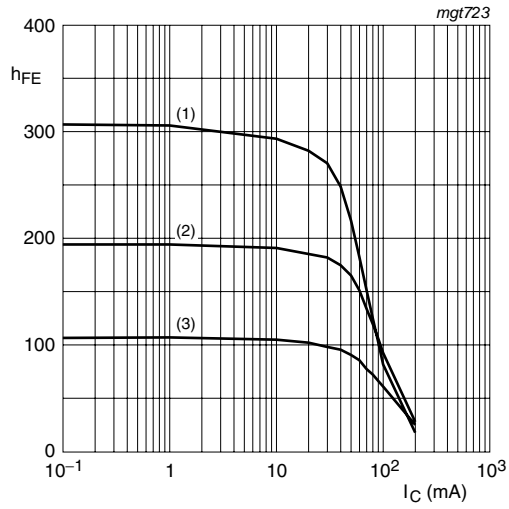
$V_{CE} = 5$ V
(1) $T_{amb} = 150$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = -55$ °C

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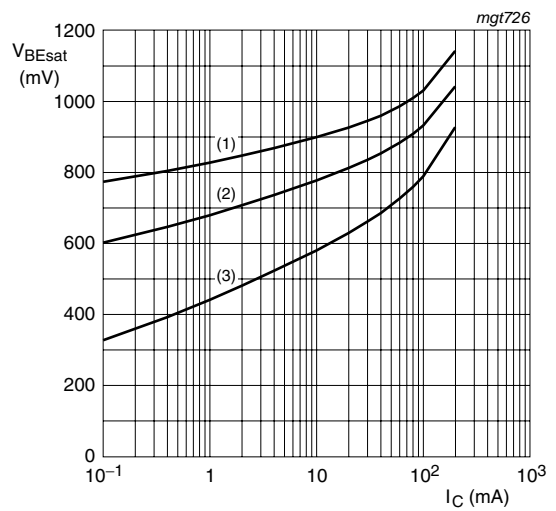
$I_C/I_B = 10$
(1) $T_{amb} = -55$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = 150$ °C

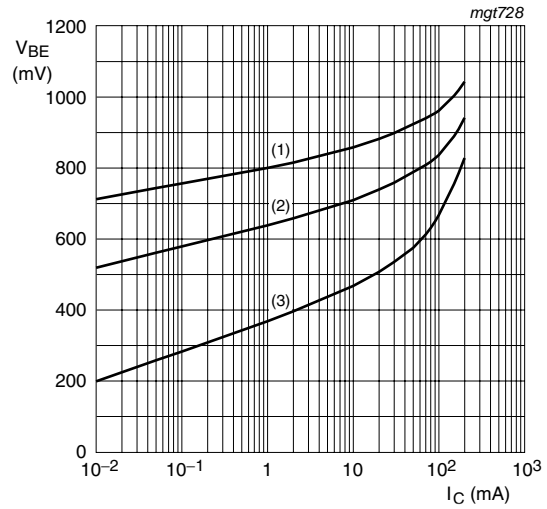**Fig 4.   Selection A: Base-emitter saturation voltage as a function of collector current; typical values**

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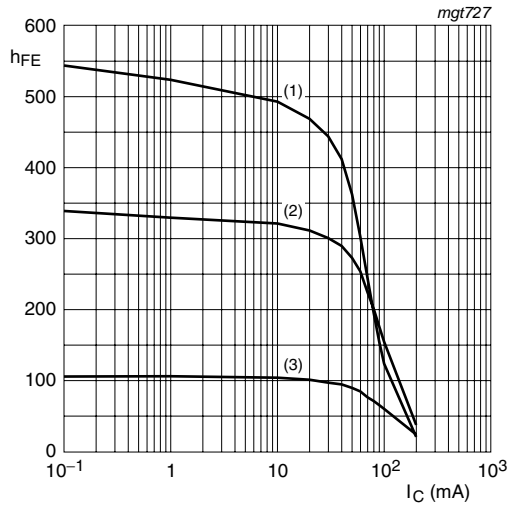
$V_{CE} = 5$ V

(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**

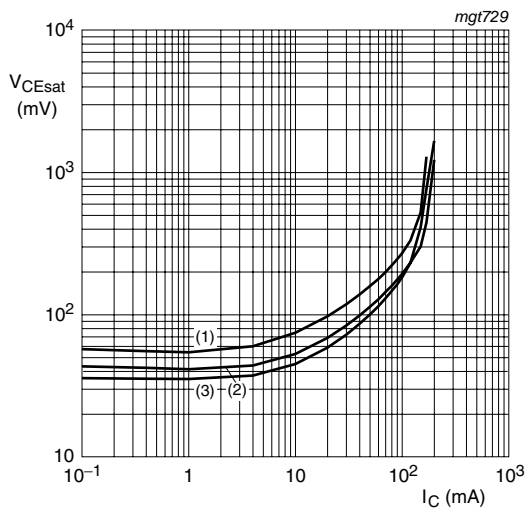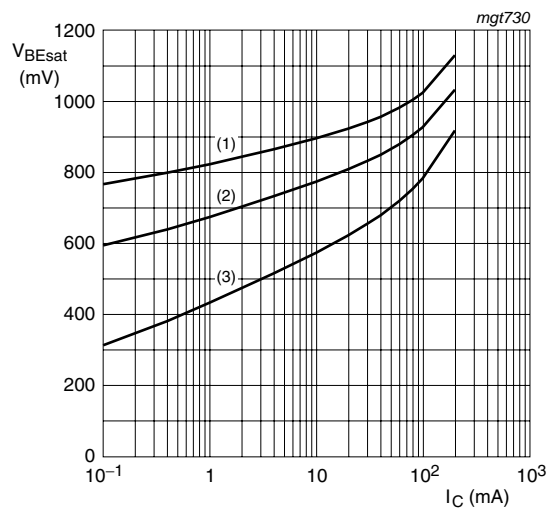BC846_BC546_SER_7

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8. Package outline

Dimensions in mm   04-11-04

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

Dimensions in mm   04-11-04

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

Dimensions in mm   04-11-04

Fig 11.   **Package outline SOT416 (SC-75)**

Dimensions in mm   04-11-16

Fig 12.   **Package outline SOT54 (SC-43A/TO-92)**

Dimensions in mm   04-06-28

Fig 13.   **Package outline SOT54A**

Dimensions in mm   05-01-10

Fig 14.   **Package outline SOT54 variant**

9. Packing information

Table 9. Packing methods

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

Type number[2]	Package	Description	Packing quantity		
			3 000	5 000	10 000
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
BC546A	SOT54	bulk, straight leads	-	-412	-
	SOT54A	tape and reel, wide pitch	-	-	-116
		tape ammopack, wide pitch	-	-	-126
	SOT54 variant	bulk, delta pinning	-	-112	-
BC546B	SOT54	bulk, straight leads	-	-412	-
	SOT54A	tape and reel, wide pitch	-	-	-116
		tape ammopack, wide pitch	-	-	-126
	SOT54 variant	bulk, delta pinning	-	-112	-

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

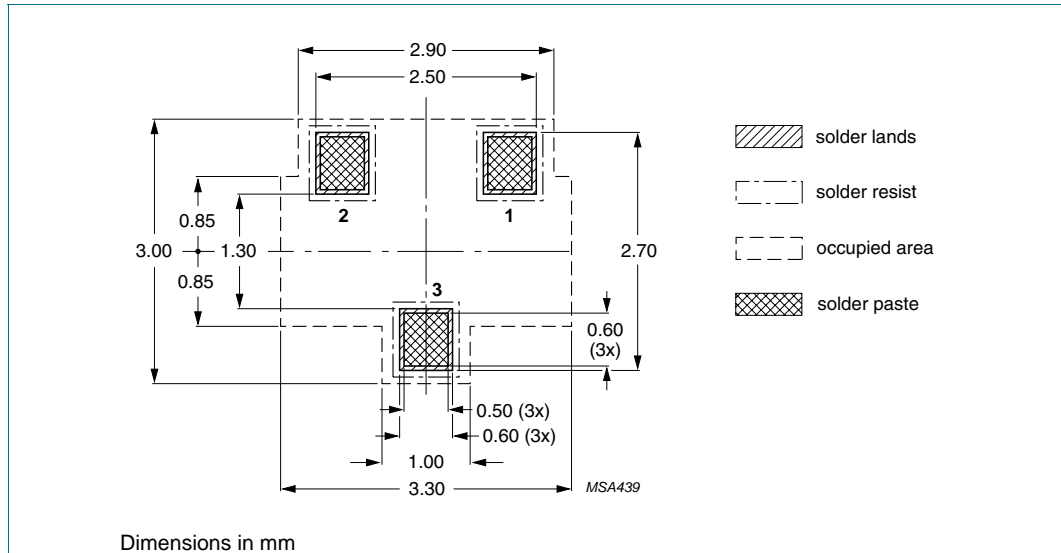[2] Valid for all available selection groups.

10. Soldering

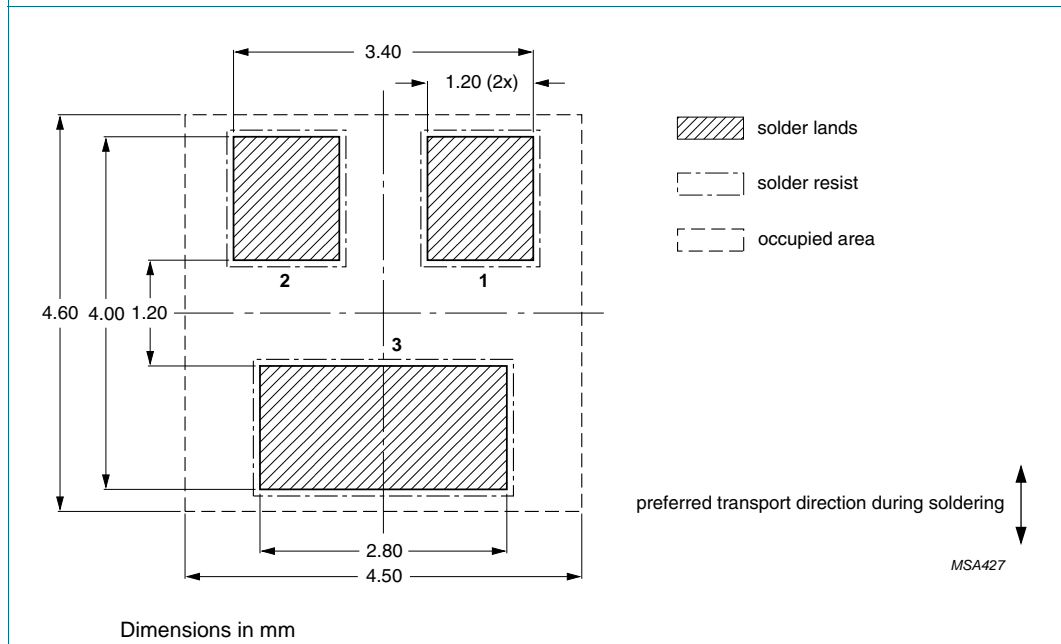Dimensions in mm

Fig 15. Reflow soldering footprint SOT23 (TO-236AB)

Dimensions in mm

Fig 16. Wave soldering footprint SOT23 (TO-236AB)

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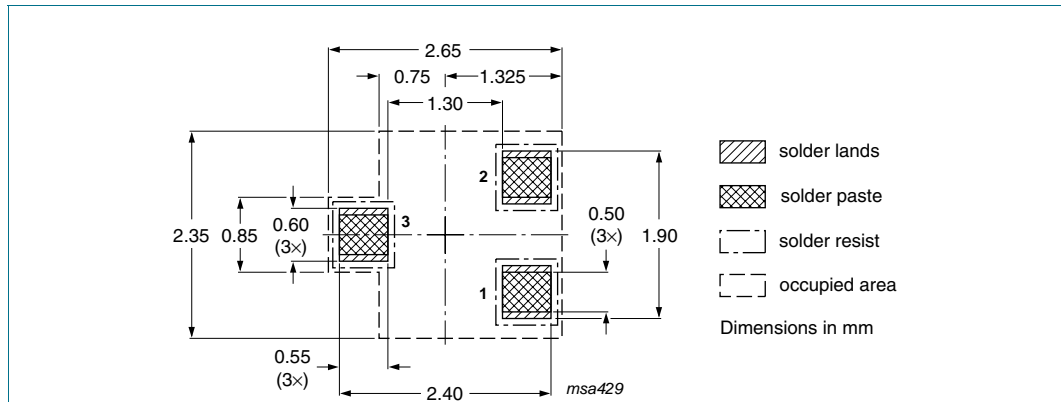
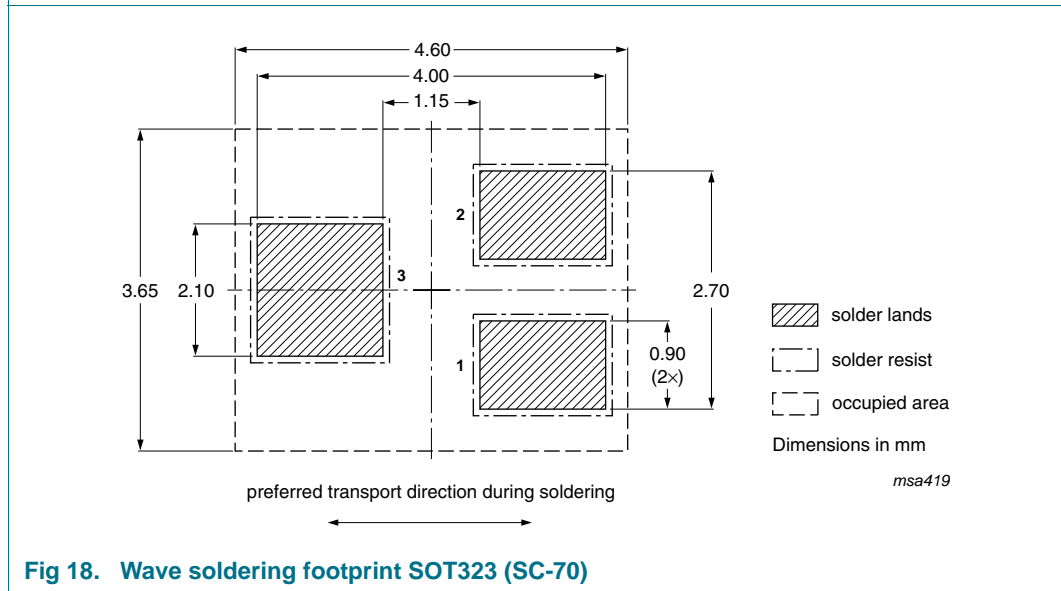**Fig 17. Reflow soldering footprint SOT323 (SC-70)**

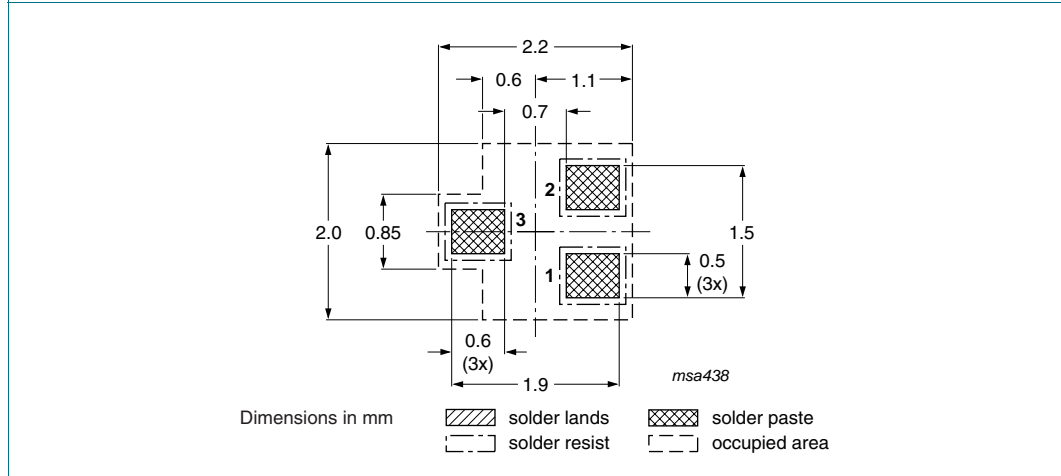**Fig 18. Wave soldering footprint SOT323 (SC-70)**

Fig 19. Reflow soldering footprint SOT416 (SC-75)

11. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BC846_BC546_SER_7	20091117	Product data sheet	-	BC846_BC546_SER_6
Modifications:	• This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content. • Table 3 "Pinning": updated • Figure 17 "Reflow soldering footprint SOT323 (SC-70)": updated • Figure 18 "Wave soldering footprint SOT323 (SC-70)": updated • Figure 19 "Reflow soldering footprint SOT416 (SC-75)": updated			
BC846_BC546_SER_6	20060207	Product data sheet	-	BC846_BC847_ BC848_5 BC846T_847T_ SERIES_3 BC846W_BC847W_ BC848W_4 BC546_547_4
BC846_BC847_BC848_5	20040206	Product specification	-	BC846_BC847_ BC848_4
BC846T_847T_SERIES_ 3	20001115	Product specification	-	BC846T_847T_2
BC846W_BC847W_ BC848W_4	20020204	Product specification	-	BC846W_847W_3
BC546_547_4	20041125	Product specification	-	BC546_547_3

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12. Legal information

12.1 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".

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