BC846/BC546 series

65 V, 100 mA NPN general-purpose transistors

Rev. 07 — 17 November 2009 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[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

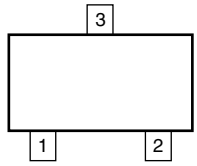
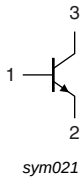
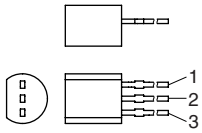
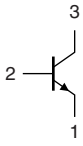
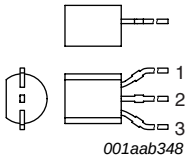
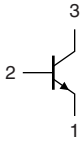
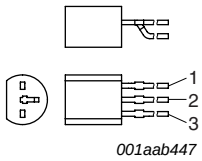
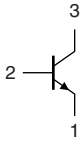
Table 2. Quick reference data

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	

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2. Pinning information

Table 3. Pinning

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

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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

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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.

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7. Characteristics

Table 8. Characteristics

T_{amb} = 25 °C unless otherwise specified.

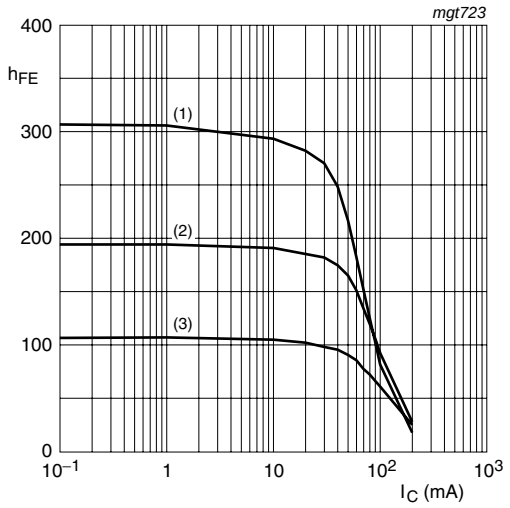
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	V_{CB} = 30 V; I_E = 0 A		-	-	15	nA
		V_{CB} = 30 V; I_E = 0 A; T_j = 150 °C		-	-	5	μA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_E = 0 A		-	-	100	nA
h_{FE}	DC current gain						
	h_{FE} group A	V_{CE} = 5 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.

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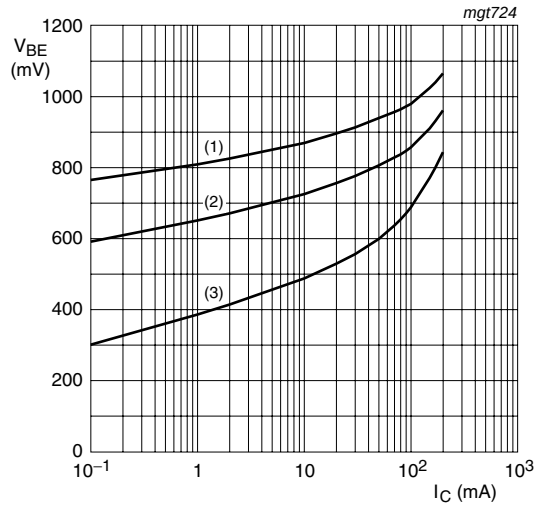
V_{CE} = 5 V

(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



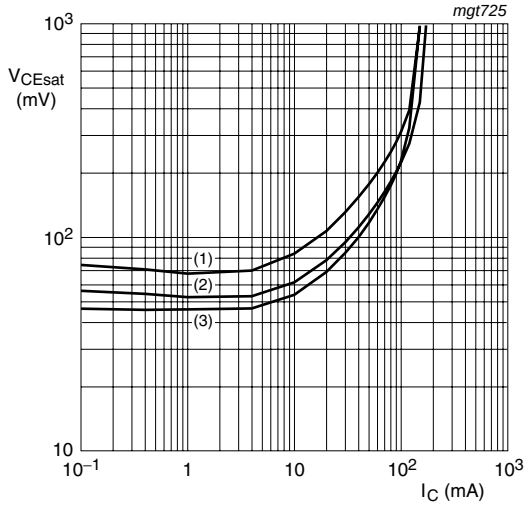
V_{CE} = 5 V

(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



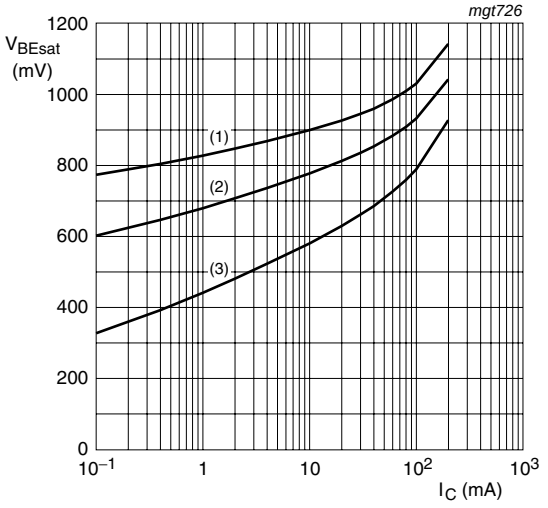
I_C/I_B = 20

(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

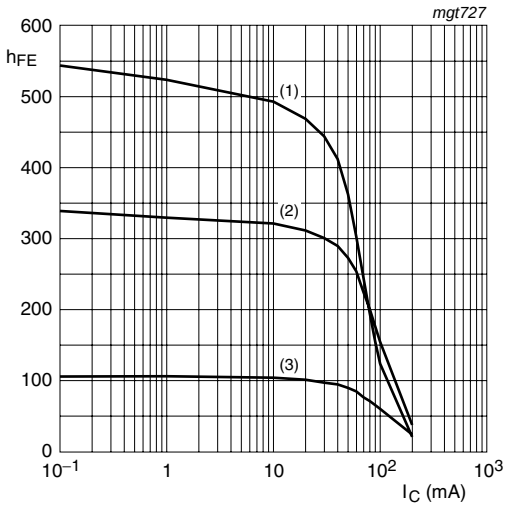
(1) T_{amb} = −55 °C

(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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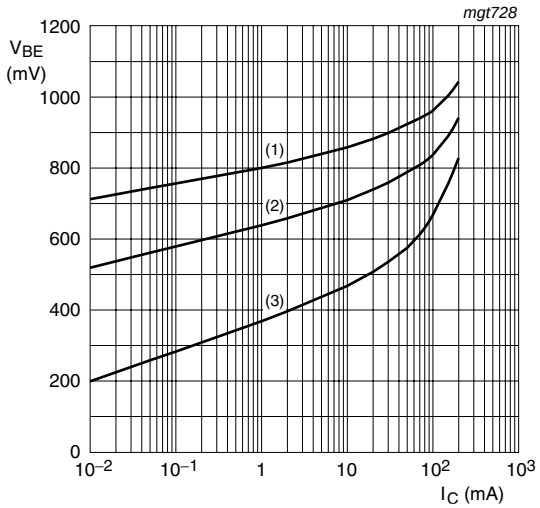
V_{CE} = 5 V

(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



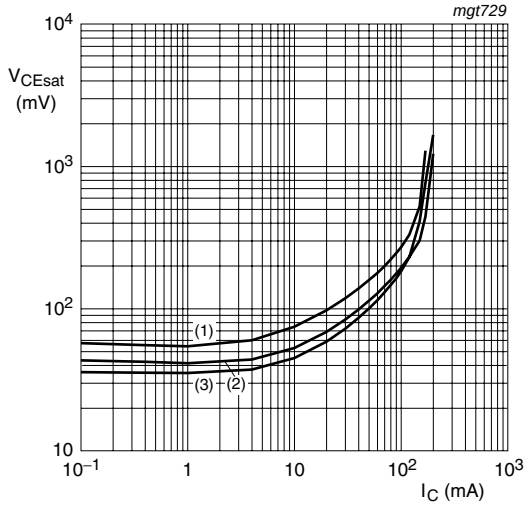
V_{CE} = 5 V

(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



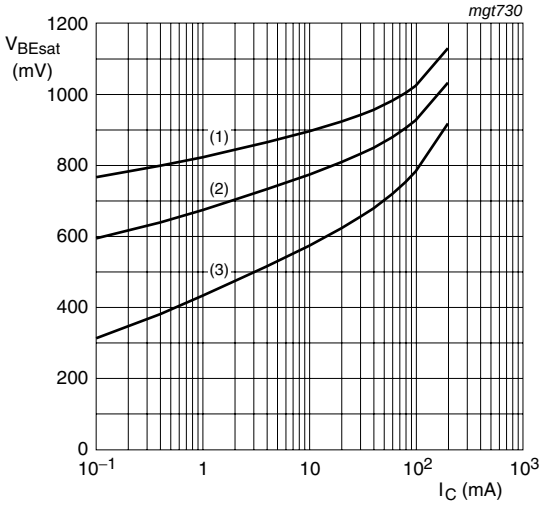
I_C/I_B = 20

(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

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8. Package outline

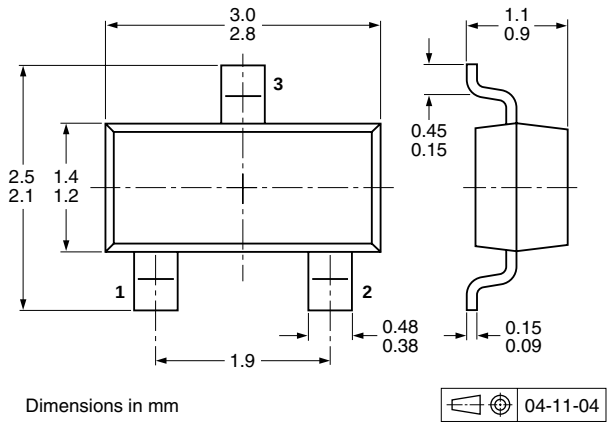


Fig 9. Package outline SOT23 (TO-236AB)

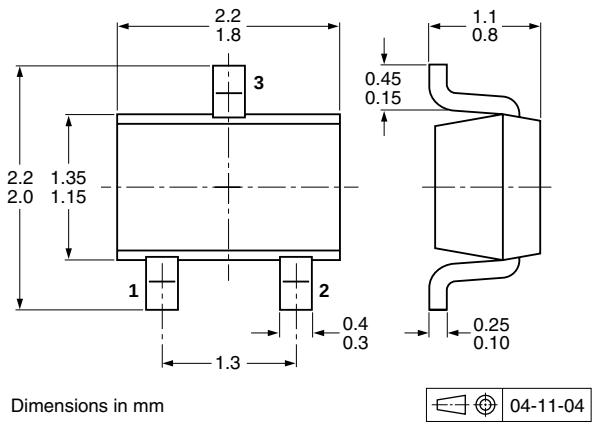


Fig 10. Package outline SOT323 (SC-70)

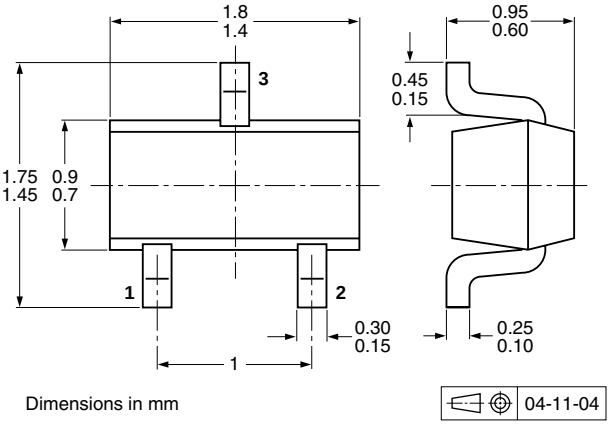


Fig 11. Package outline SOT416 (SC-75)

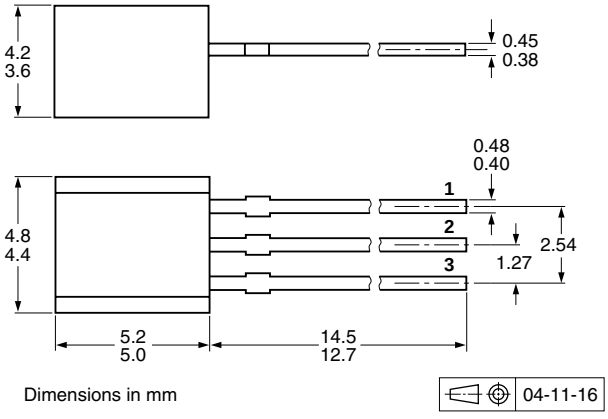


Fig 12. Package outline SOT54 (SC-43A/TO-92)

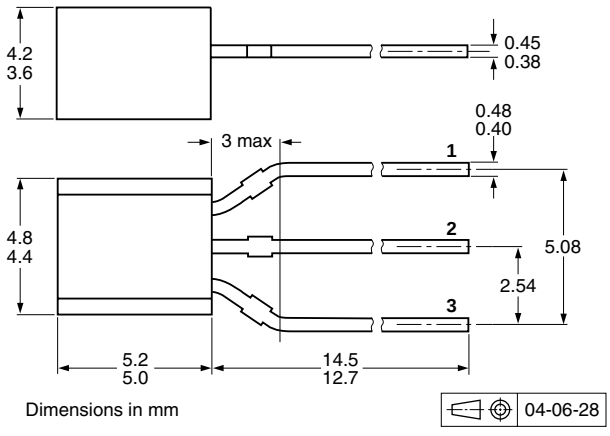


Fig 13. Package outline SOT54A

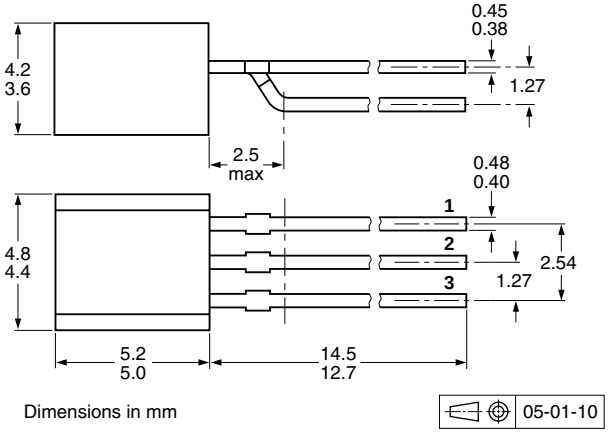


Fig 14. Package outline SOT54 variant

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9. Packing information

Table 9. Packing methods

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

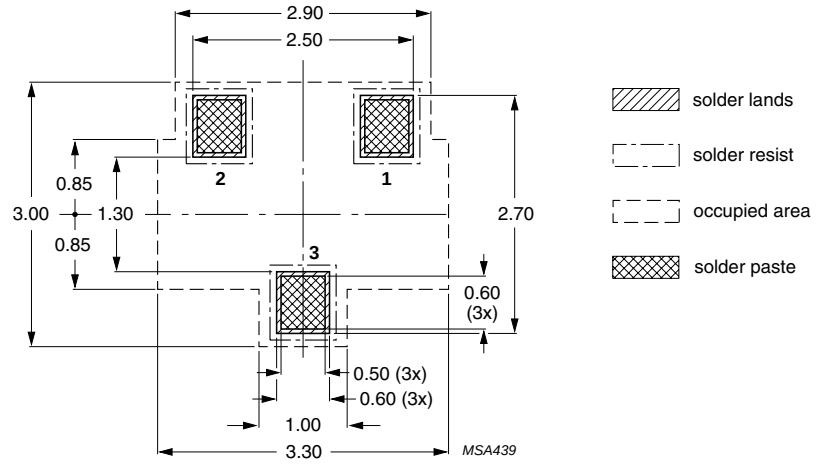
Type number[2]	Package	Description	Packing quantity		
			3000	5000	10000
BC846	SOT23	4 mm pitch, 8 mm tape and reel	-215	-	-235
BC846W	SOT323	4 mm pitch, 8 mm tape and reel	-115	-	-135
BC846T	SOT416	4 mm pitch, 8 mm tape and reel	-115	-	-135
BC546A	SOT54	bulk, straight leads	-	-412	-
	SOT54A	tape and 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.

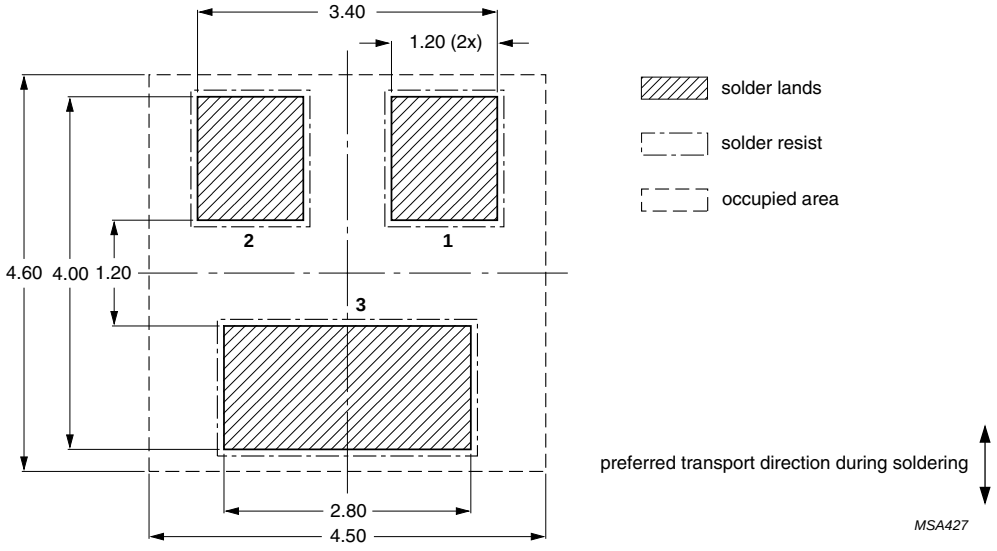
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10. Soldering



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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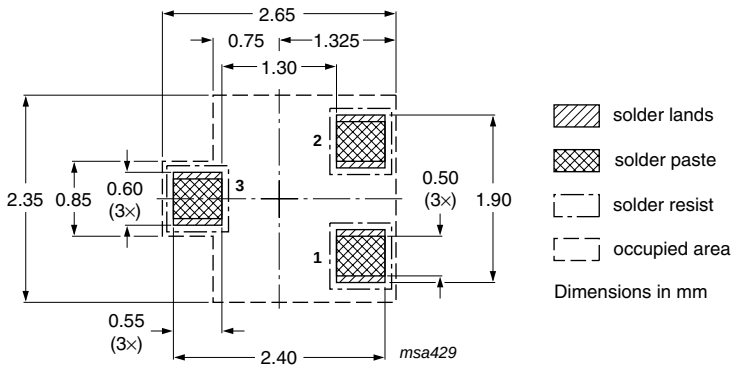


Fig 17. Reflow soldering footprint SOT323 (SC-70)

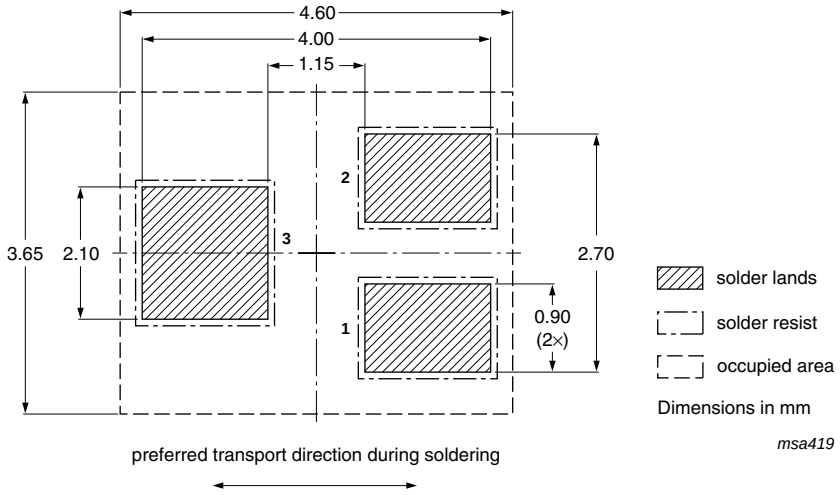


Fig 18. Wave soldering footprint SOT323 (SC-70)

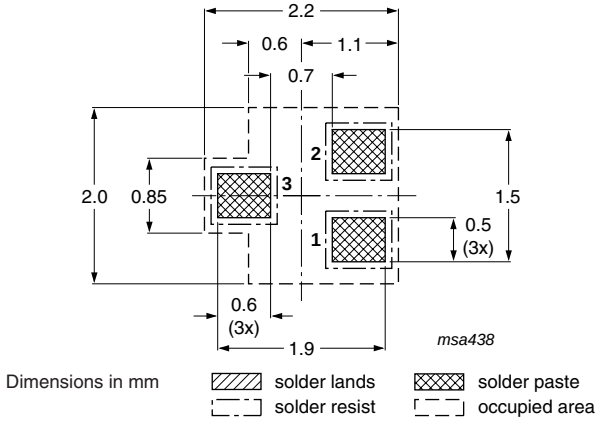


Fig 19. Reflow soldering footprint SOT416 (SC-75)

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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".

[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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