# 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[1] | Package | | | PNP complement |
|---|---|---|---|---|
| | Nexperia | 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

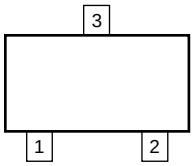
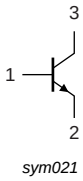
### 1.4 Quick reference data

**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 |
|---|---|---|---|
| **SOT23, SOT323, SOT416** | | | |
| 1 | base |  |  |
| 2 | emitter | | |
| 3 | collector | | |



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sym021

## 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 |

[1] Valid for all available selection groups.

## 4. Marking

**Table 5. Marking codes**

| Type number | Marking code[1] |
|---|---|
| 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; $t_p \leq 1$ 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 |
| $T_j$ | 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 |

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

# 7. Characteristics

**Table 8. Characteristics**

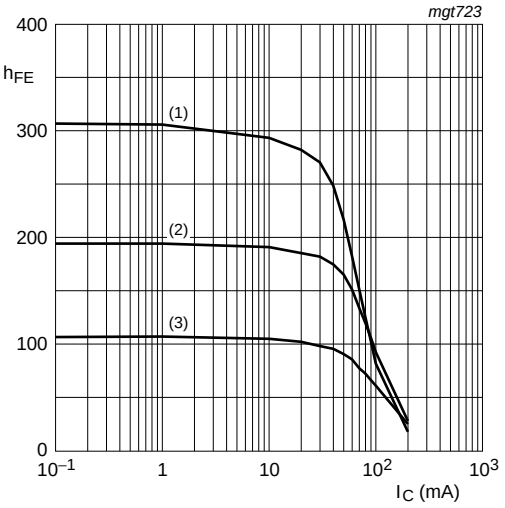
*$T_{amb}$ = 25 °C unless otherwise specified.*

| 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; $I_C$ = 0 A | | - | - | 100 | nA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 5 V; $I_C$ = 10 μA | | | | | |
| | $h_{FE}$ group A | | | - | 180 | - | |
| | $h_{FE}$ group B | | | - | 290 | - | |
| | 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 | |
| $V_{CEsat}$ | 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; $\delta = 0.02$.

[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.



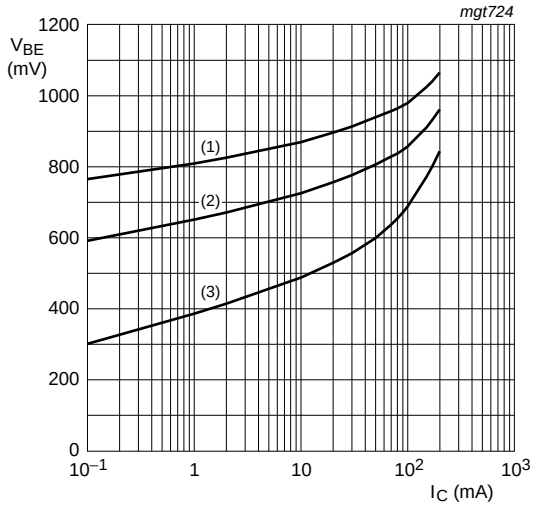

$V_{CE}$ = 5 V

(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**



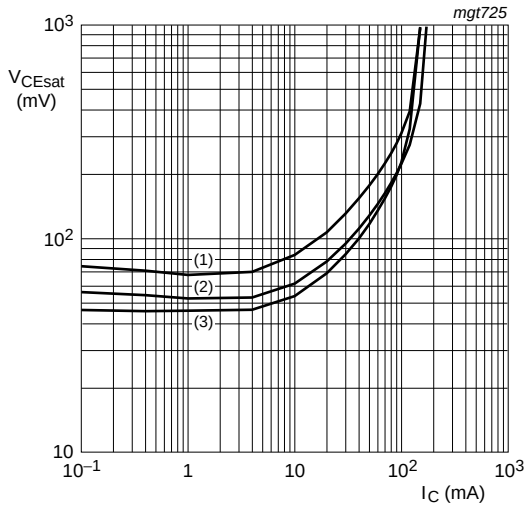

$V_{CE}$ = 5 V

(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**



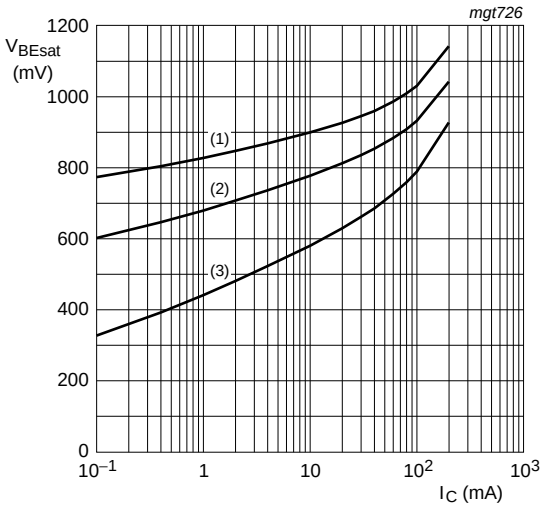

$I_C/I_B$ = 20

(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**



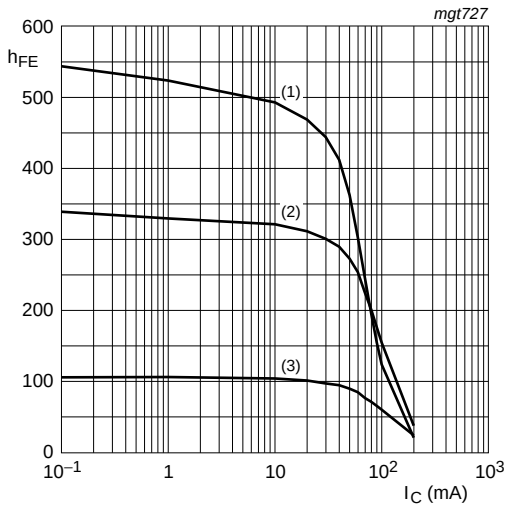

$I_C/I_B$ = 10

(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**



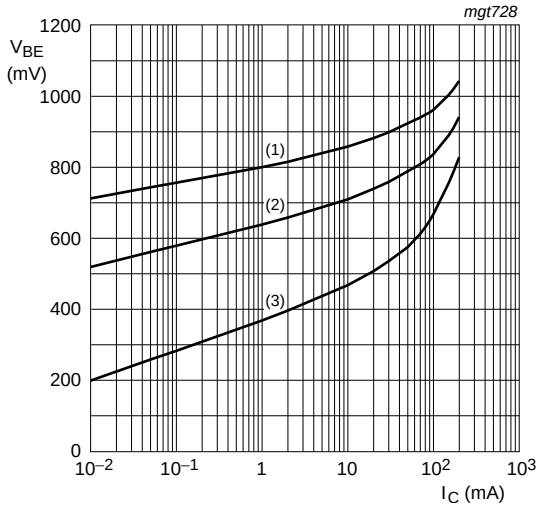

$V_{CE}$ = 5 V

(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**



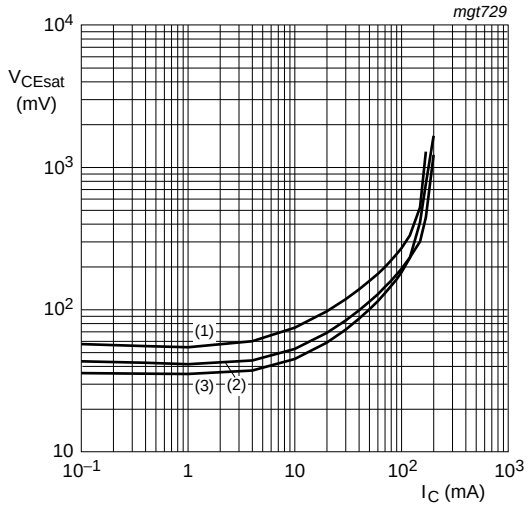

$V_{CE}$ = 5 V

(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**



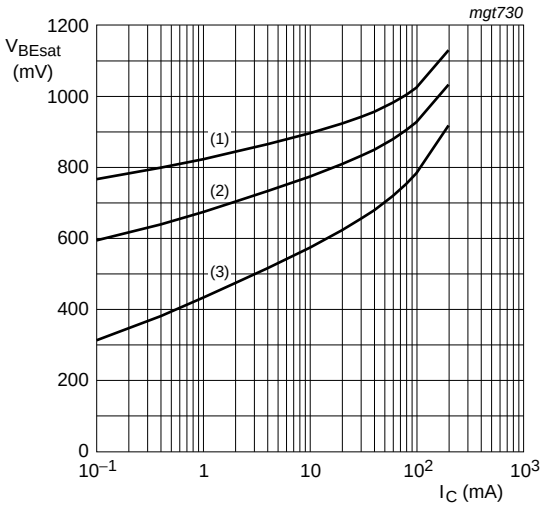

$I_C/I_B$ = 20

(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

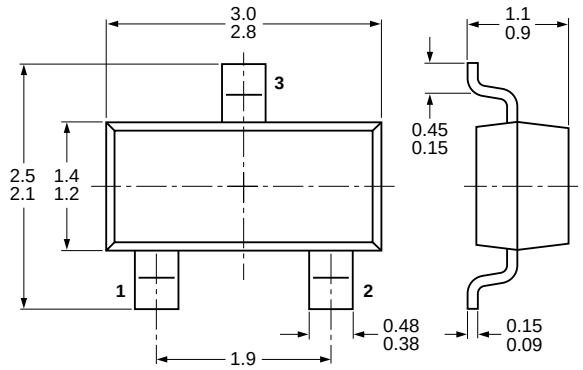



**Fig 9. Package outline SOT23 (TO-236AB)**

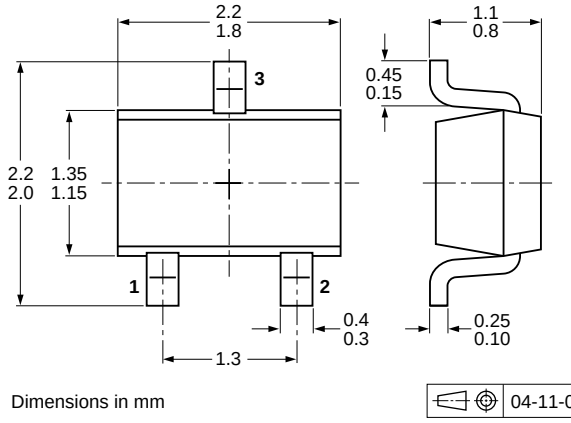



**Fig 10. Package outline SOT323 (SC-70)**

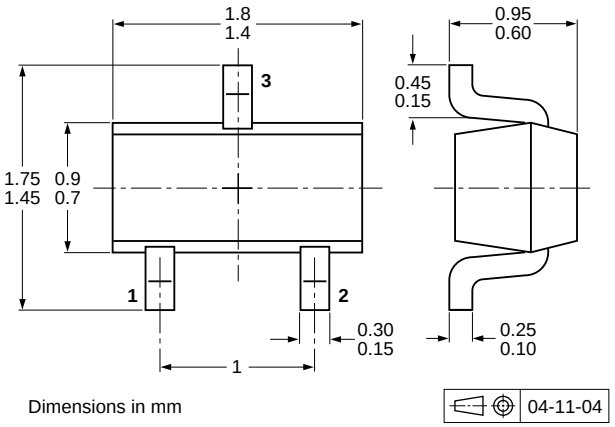



**Fig 11. Package outline SOT416 (SC-75)**

## 9. Packing information

**Table 9. Packing methods**

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

| Type number[2] | 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

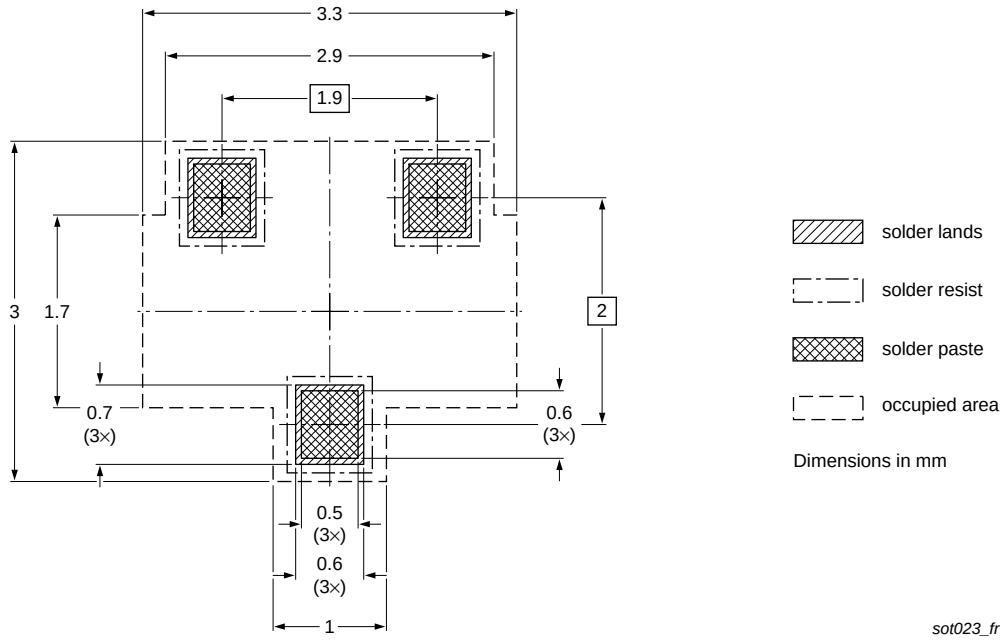



**Fig 12. Reflow soldering footprint SOT23 (TO-236AB)**

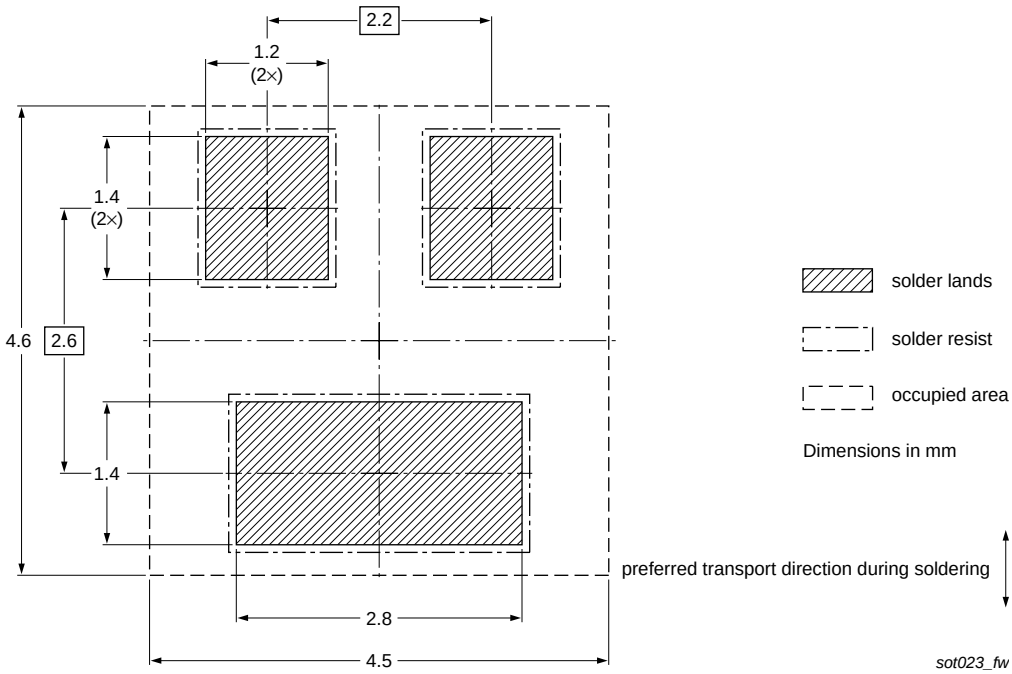



**Fig 13. Wave soldering footprint SOT23 (TO-236AB)**

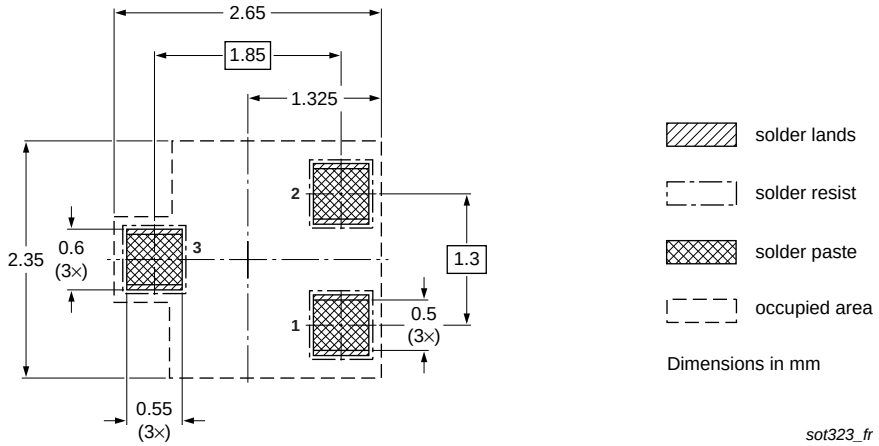



**Fig 14. Reflow soldering footprint SOT323 (SC-70)**

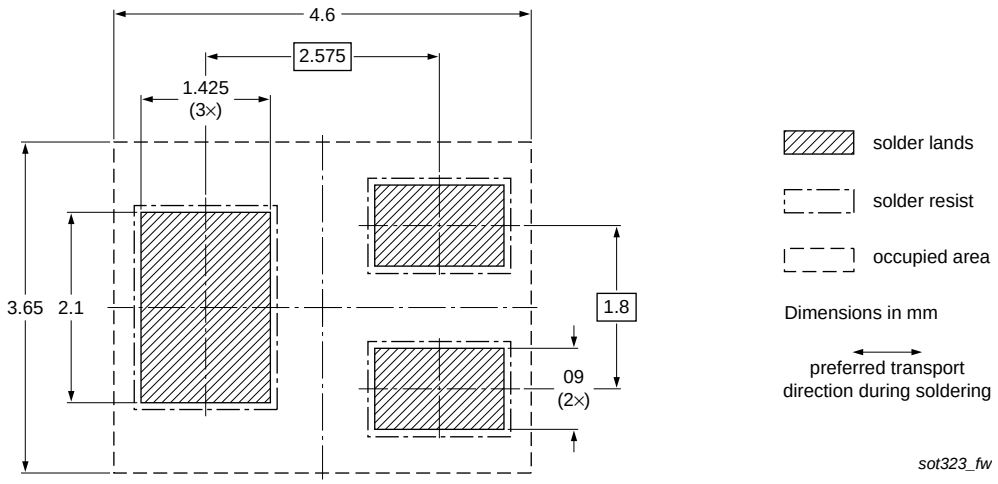



**Fig 15. Wave soldering footprint SOT323 (SC-70)**

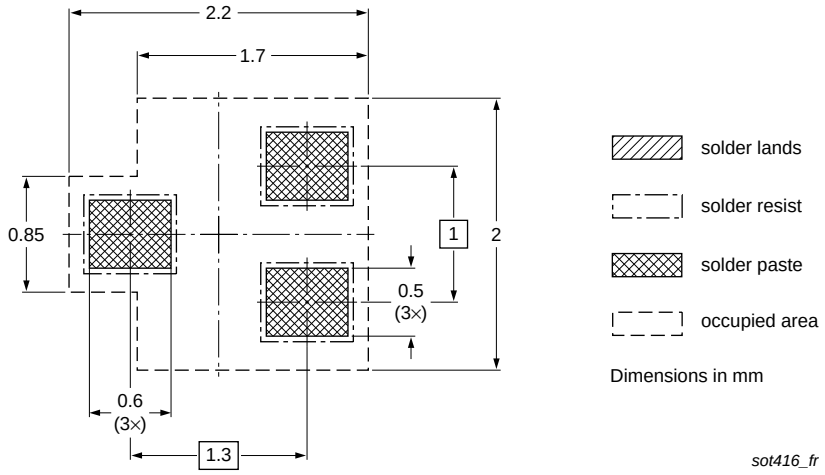



**Fig 16. Reflow soldering footprint SOT416 (SC-75)**

## 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: | • Table 6 “Limiting values”: $P_{tot}$ values corrected | | | |
| 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[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.nexperia.com.

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For sales office addresses, please send an email to: **salesaddresses@nexperia.com**

## 14. Contents





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**Date of release: 25 September 2012**