

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 |
|----------------------------|---------|-------|----------|----------------|
| | 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

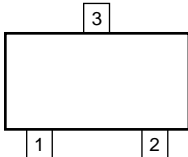
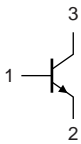
Table 2. Quick reference data

| 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 | $V_{CE} = 5\text{ V}; I_C = 2\text{ mA}$ | 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 |  <p>006aaa144</p> |  <p>sym021</p> |
| 2 | emitter | | |
| 3 | collector | | |

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

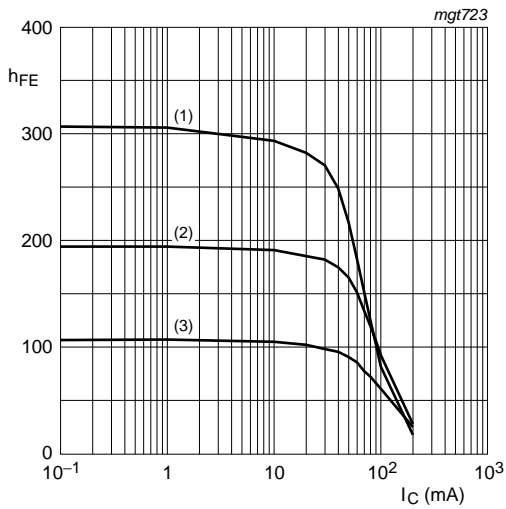
Table 8. Characteristics
 $T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

| 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 | |
| | | $V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | - | - | 5 | μA | |
| 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: $t_p \leq 300\text{ }\mu\text{s}; \delta = 0.02$.

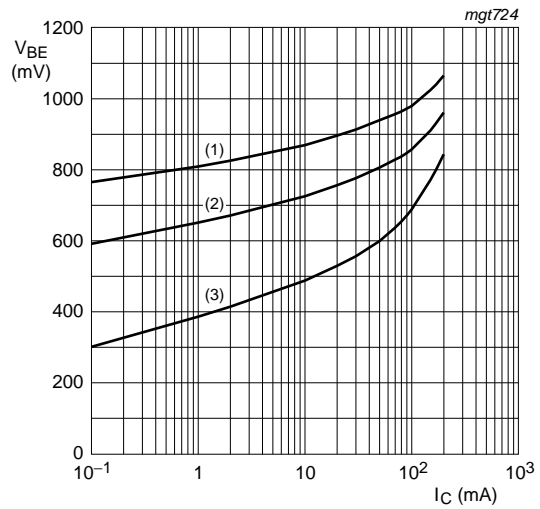
[2] V_{BEsat} decreases by approximately 1.7 mV/K with increasing temperature.

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



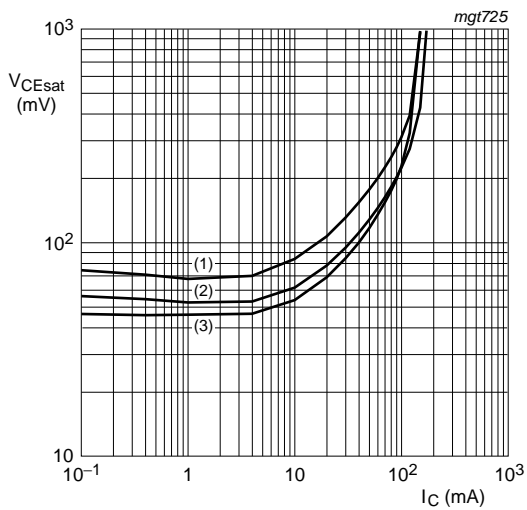
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = 150\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

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



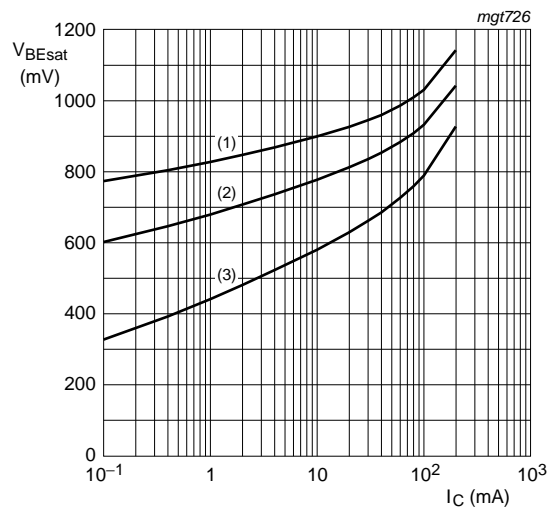
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 150\text{ °C}$

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



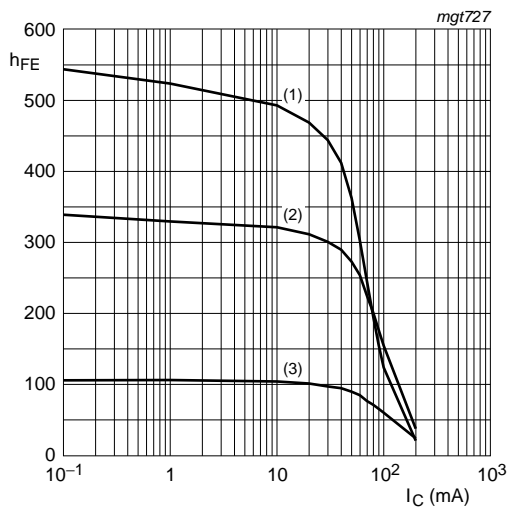
$I_C/I_B = 20$
 (1) $T_{amb} = 150\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

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



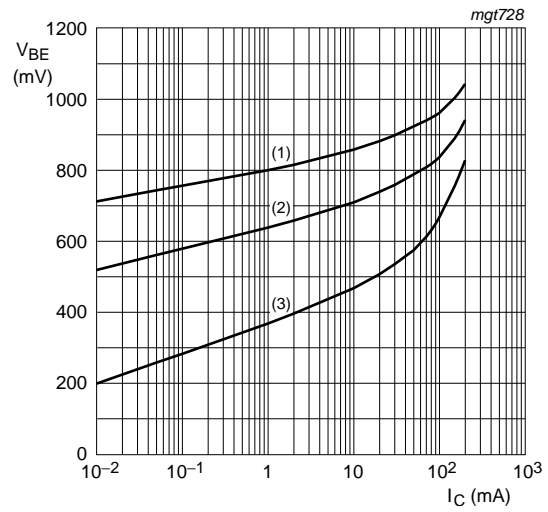
$I_C/I_B = 10$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 150\text{ °C}$

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



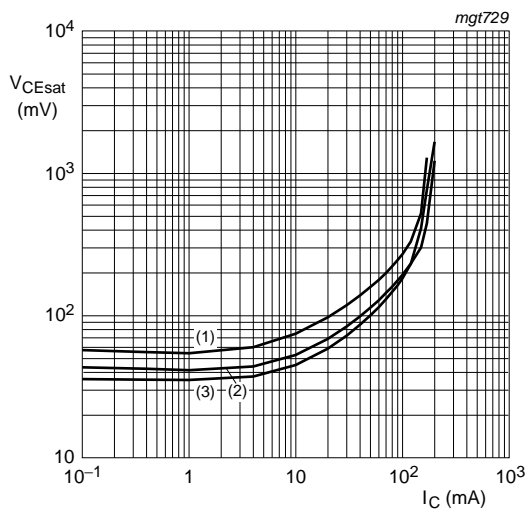
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = 150\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

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



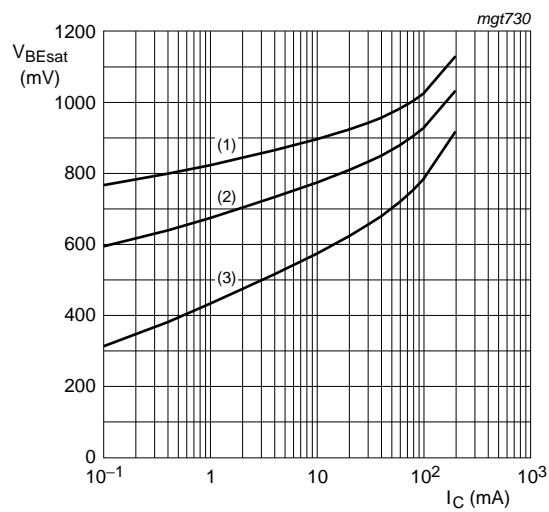
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 150\text{ °C}$

Fig 6. Selection B: 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 7. Selection B: 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 8. Selection B: Base-emitter saturation voltage as a function of collector current; typical values

8. Package outline

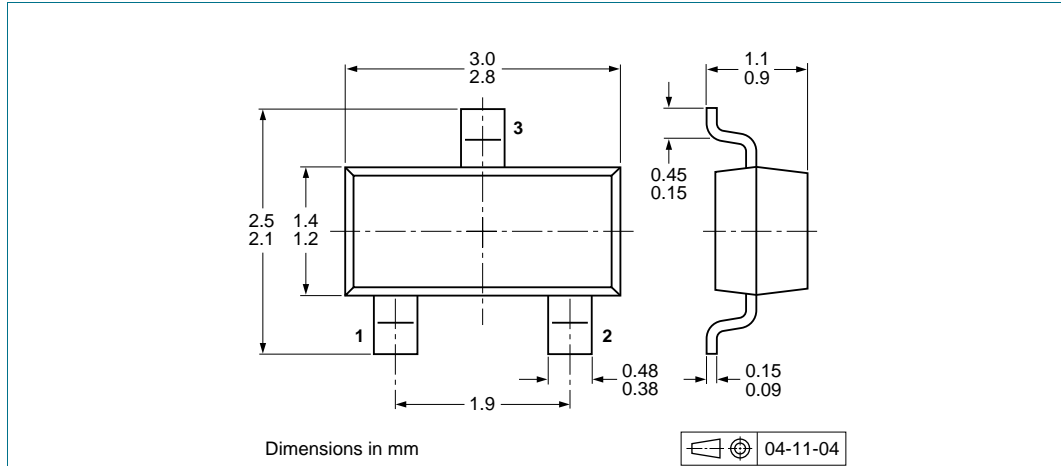


Fig 9. Package outline SOT23 (TO-236AB)

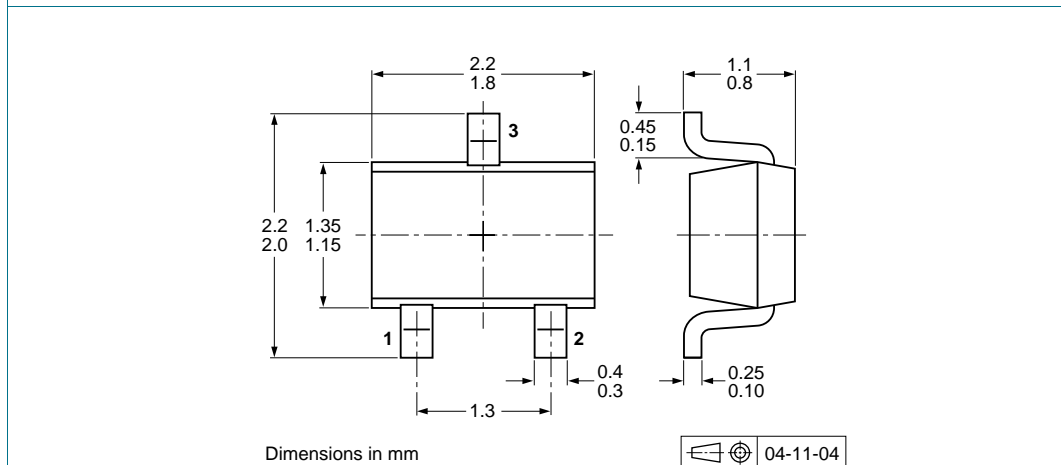
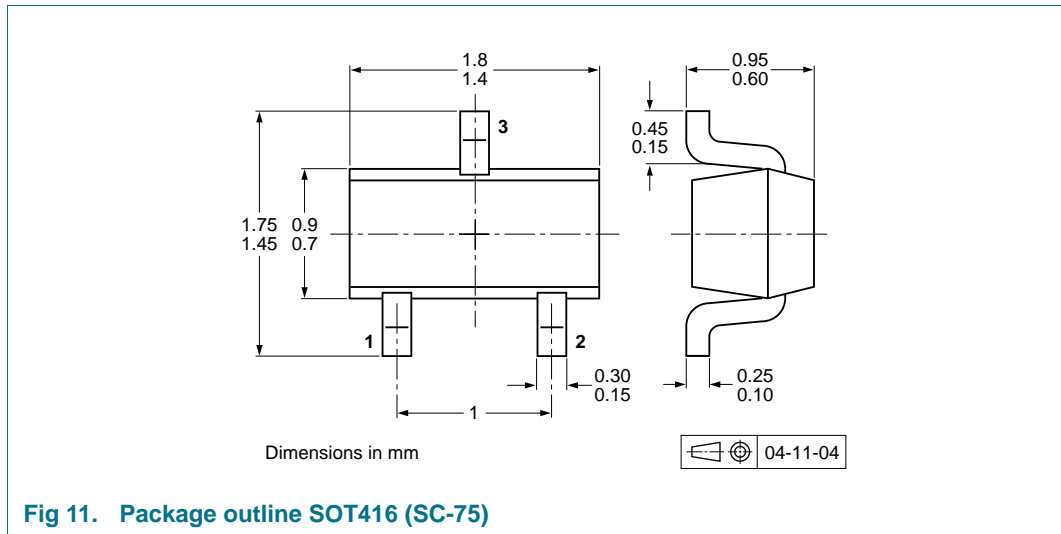


Fig 10. Package outline SOT323 (SC-70)



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

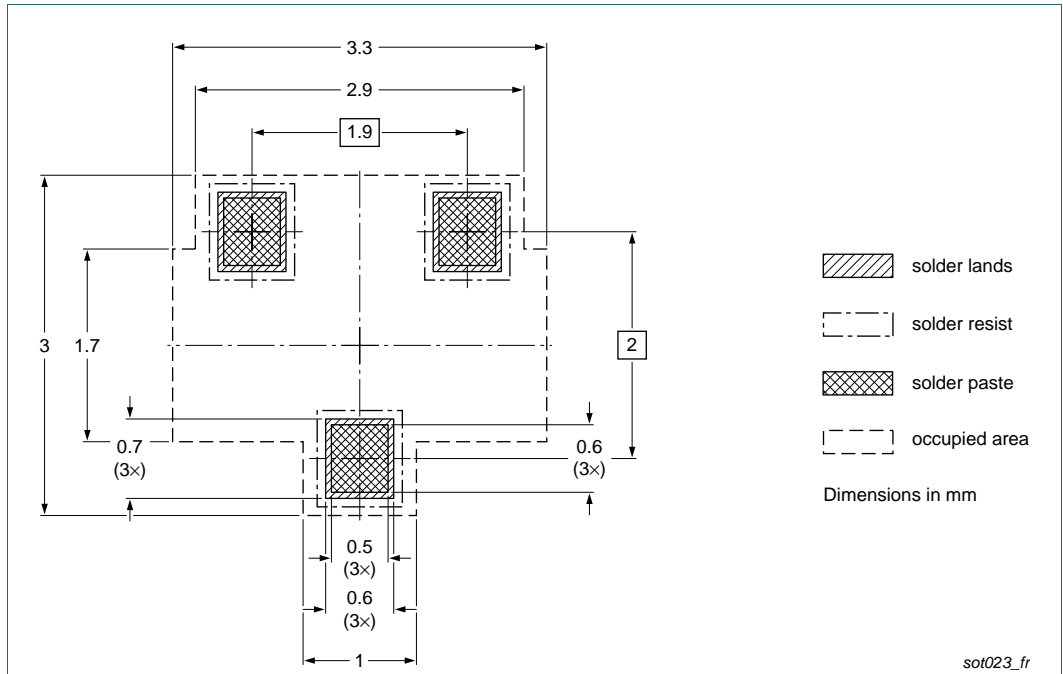


Fig 12. Reflow soldering footprint SOT23 (TO-236AB)

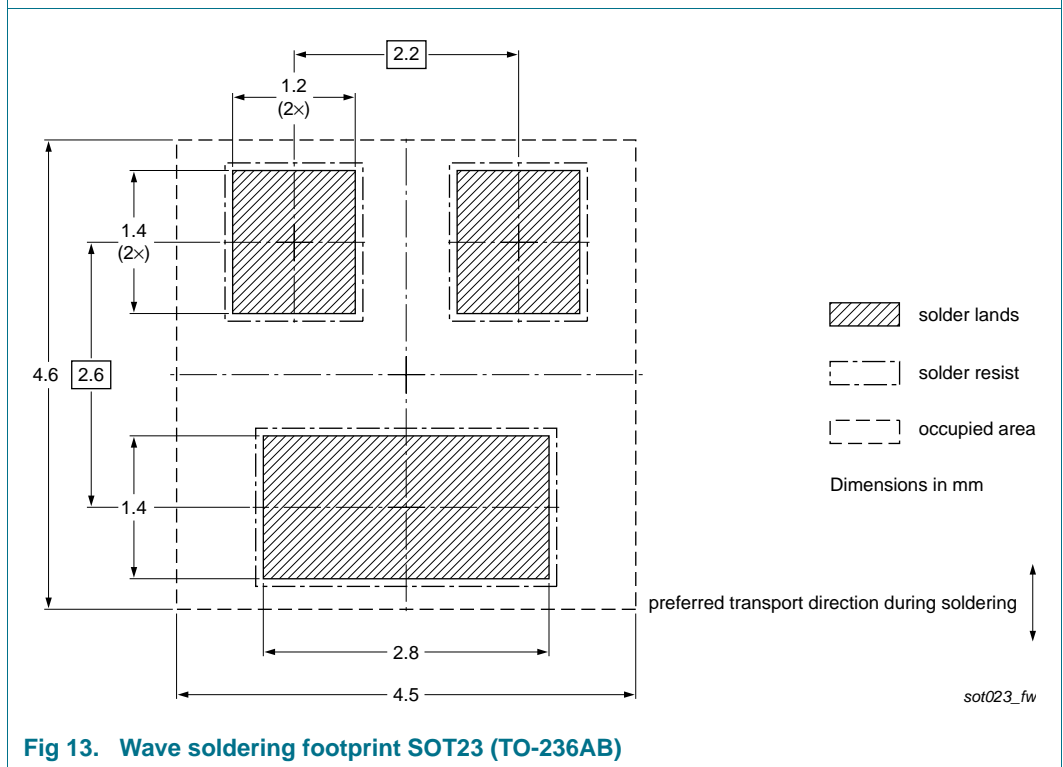


Fig 13. Wave soldering footprint SOT23 (TO-236AB)

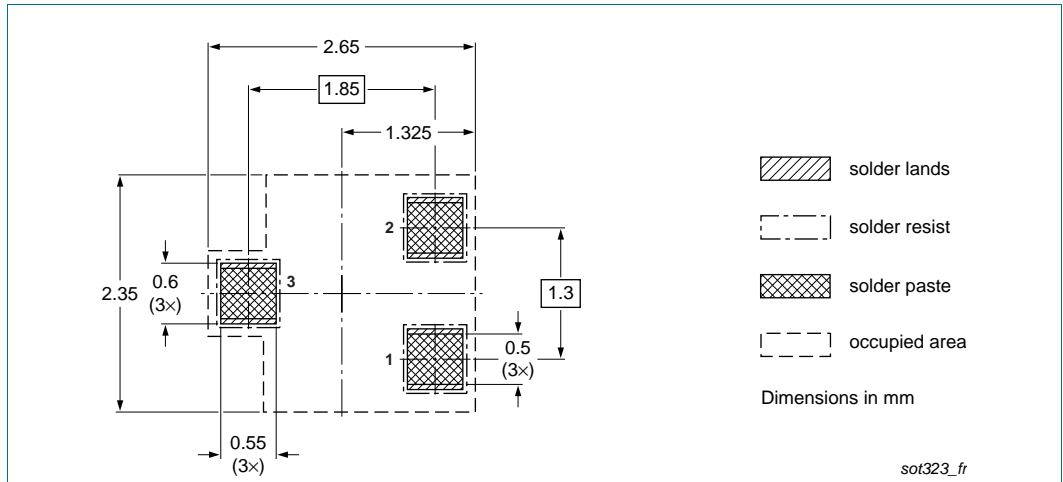


Fig 14. Reflow soldering footprint SOT323 (SC-70)

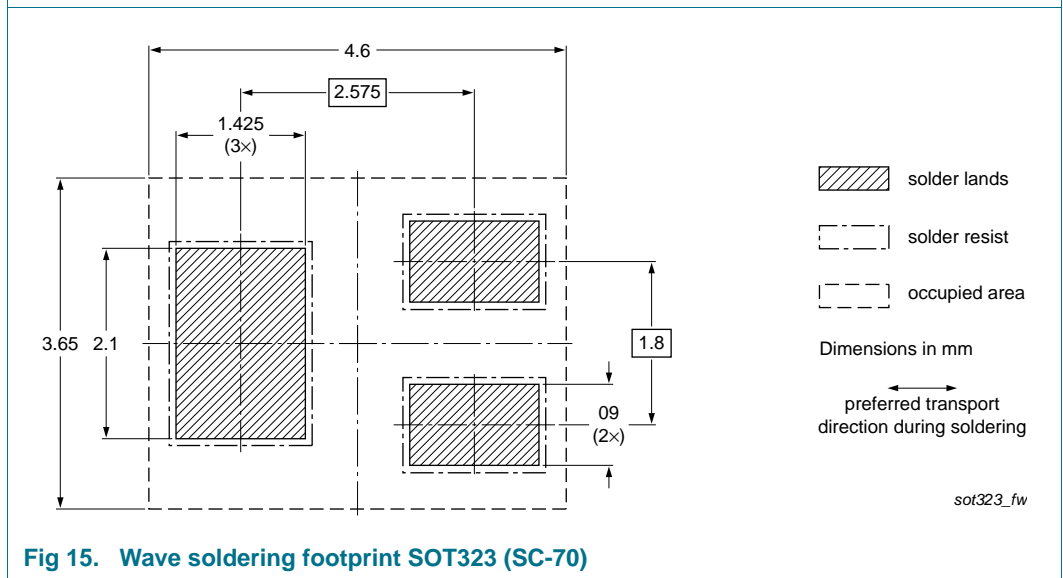
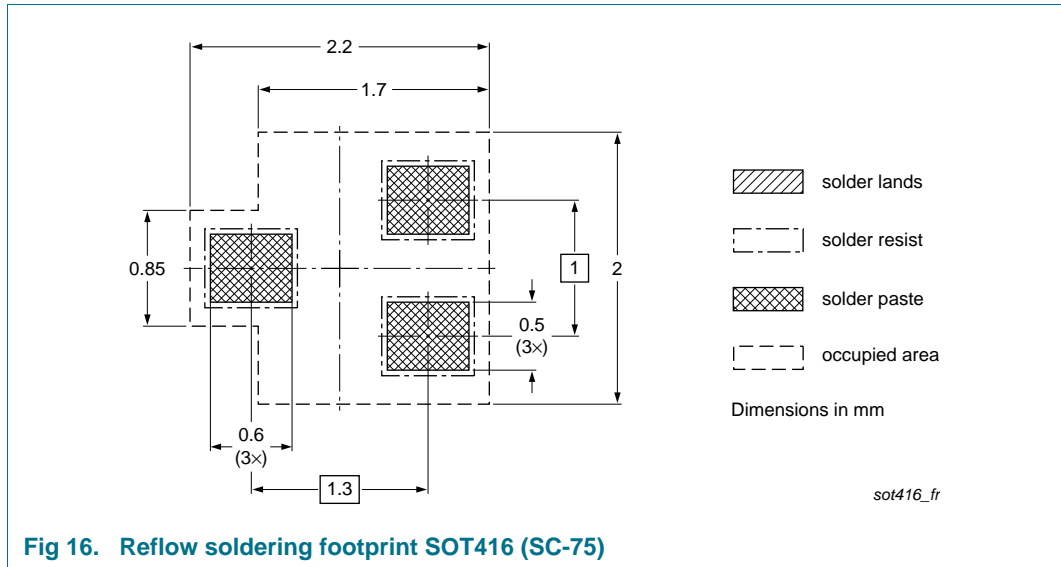


Fig 15. Wave soldering footprint SOT323 (SC-70)



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".

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