



# BC846DS

65 V, 100 mA NPN/NPN general-purpose transistor

Rev. 01 — 17 July 2009

Product data sheet

## 1. Product profile

### 1.1 General description

NPN/NPN general-purpose transistor pair in a small SOT457 (SC-74) Surface-Mounted Device (SMD) plastic package.

### 1.2 Features

- Low collector capacitance
- Low collector-emitter saturation voltage
- Closely matched current gain
- Reduces number of components and board space
- No mutual interference between the transistors
- AEC-Q101 qualified

### 1.3 Applications

- General-purpose switching and amplification

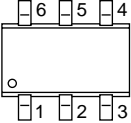
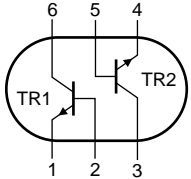
### 1.4 Quick reference data

Table 1. Quick reference data

| Symbol                | Parameter                 | Conditions                               | Min | Typ | Max | Unit |
|-----------------------|---------------------------|--|-----|-----|-----|------|
| <b>Per transistor</b> |                           |  |     |     |     |      |
| $V_{CE0}$             | collector-emitter voltage | open base                                | -   | -   | 65  | V    |
| $I_C$                 | collector current         |  | -   | -   | 100 | mA   |
| $h_{FE}$              | DC current gain           | $V_{CE} = 5\text{ V}; I_C = 2\text{ mA}$ | 200 | 300 | 450 |      |

## 2. Pinning information

Table 2. Pinning

| Pin | Description   | Simplified outline  | Graphic symbol  |
|-----|---------------|---|---|
| 1   | emitter TR1   |  |  |
| 2   | base TR1      |   |   |
| 3   | collector TR2 |   |   |
| 4   | emitter TR2   |   |   |
| 5   | base TR2      |   |   |
| 6   | collector TR1 |   |   |

*sym020*

## 3. Ordering information

Table 3. Ordering information

| Type number | Package |  |         |
|-------------|---------|--|---------|
|             | Name    | Description                                      | Version |
| BC846DS     | SC-74   | plastic surface-mounted package (TSOP6); 6 leads | SOT457  |

## 4. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| BC846DS     | ZK           |

## 5. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

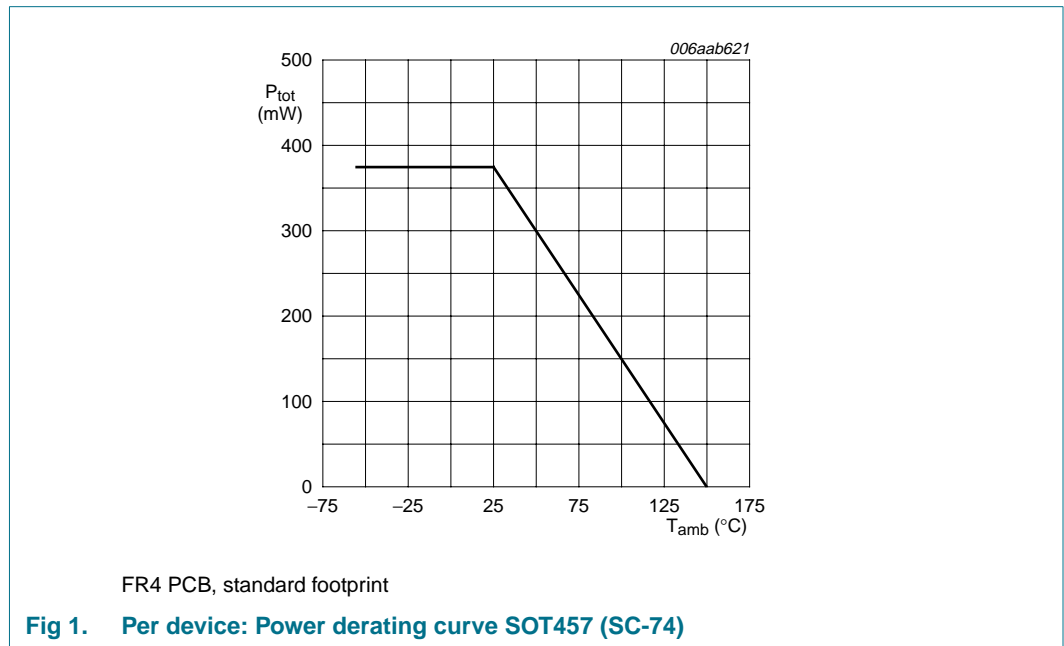
| Symbol                | Parameter                 | Conditions                       | Min | Max | Unit |
|-----------------------|---------------------------|----------------------------------|-----|-----|------|
| <b>Per transistor</b> |                           |                                  |     |     |      |
| $V_{CBO}$             | 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;<br>$t_p \leq 1$ ms | -   | 200 | mA   |
| $I_{BM}$              | peak base current         | single pulse;<br>$t_p \leq 1$ ms | -   | 200 | mA   |
| $P_{tot}$             | total power dissipation   | $T_{amb} \leq 25$ °C             | [1] | 250 | mW   |
| <b>Per device</b>     |                           |                                  |     |     |      |
| $P_{tot}$             | total power dissipation   | $T_{amb} \leq 25$ °C             | [1] | 380 | mW   |

**Table 5. Limiting values ...continued**

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol    | Parameter            | Conditions | Min | Max  | Unit |
|-----------|----------------------|------------|-----|------|------|
| $T_j$     | junction temperature |            | -   | 150  | °C   |
| $T_{amb}$ | ambient temperature  |            | -55 | +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.

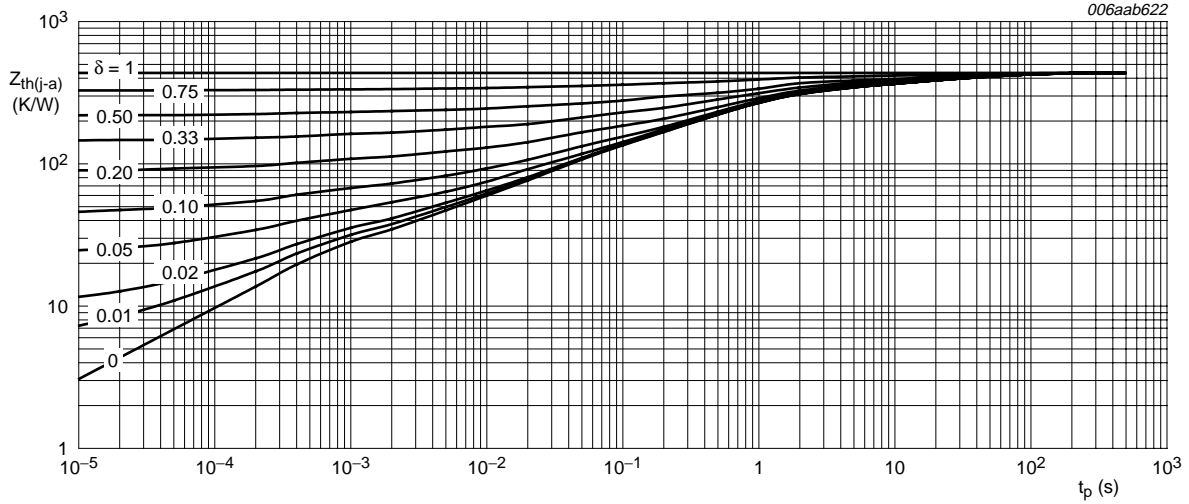


## 6. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol                | Parameter  | Conditions  | Min   | Typ | Max | Unit |
|-----------------------|--|-------------|-------|-----|-----|------|
| <b>Per transistor</b> |  |             |       |     |     |      |
| $R_{th(j-a)}$         | thermal resistance from junction to ambient      | in free air | [1] - | -   | 500 | K/W  |
| $R_{th(j-sp)}$        | thermal resistance from junction to solder point |             | -     | -   | 250 | K/W  |
| <b>Per device</b>     |  |             |       |     |     |      |
| $R_{th(j-a)}$         | thermal resistance from junction to ambient      | in free air | [1] - | -   | 328 | K/W  |

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



FR4 PCB, standard footprint

Fig 2. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 7. Characteristics

Table 7. Characteristics

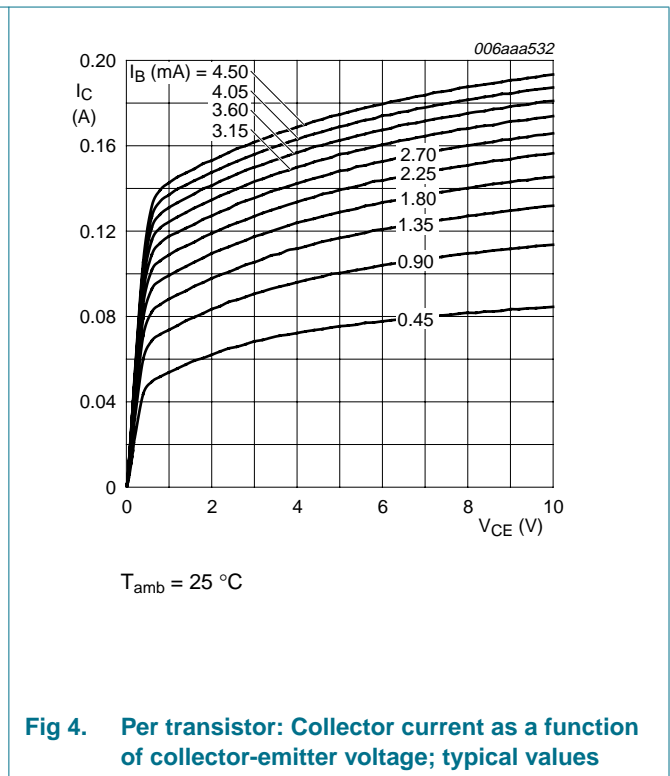
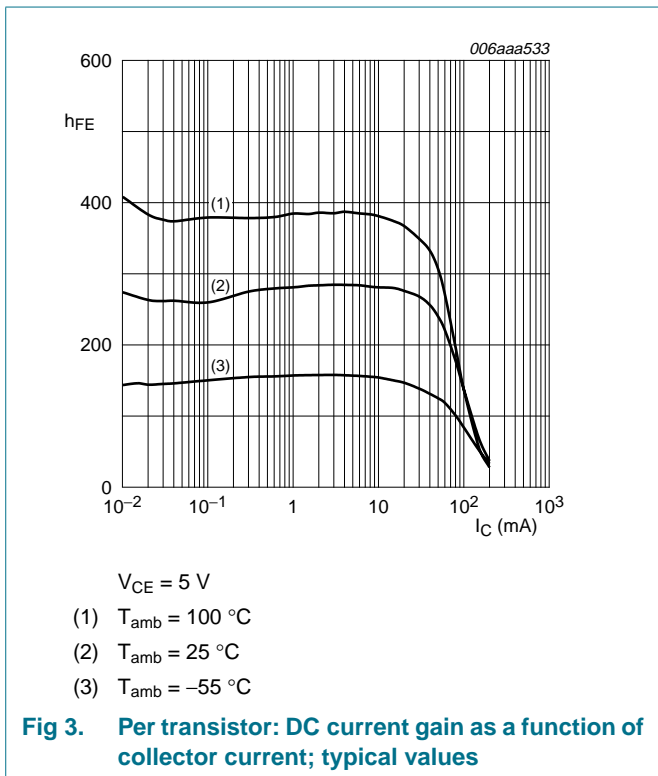
$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

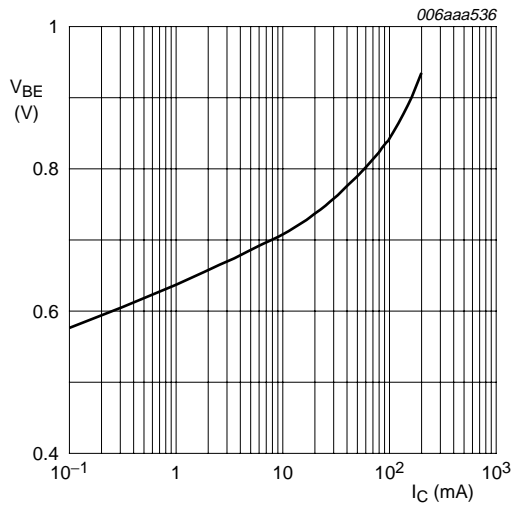
| Symbol                | Parameter                            | Conditions  | Min | Typ  | Max | Unit          |
|-----------------------|--------------------------------------|---|-----|------|-----|---------------|
| <b>Per transistor</b> |                                      |   |     |      |     |               |
| $I_{CBO}$             | collector-base cut-off current       | $V_{CB} = 50\text{ V}; I_E = 0\text{ A}$                                    | -   | -    | 15  | nA            |
|                       |                                      | $V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | -   | -    | 5   | $\mu\text{A}$ |
| $I_{EBO}$             | emitter-base cut-off current         | $V_{EB} = 6\text{ V}; I_C = 0\text{ A}$                                     | -   | -    | 100 | nA            |
| $h_{FE}$              | DC current gain                      | $V_{CE} = 5\text{ V}$   |     |      |     |               |
|                       |                                      | $I_C = 10\text{ }\mu\text{A}$   | -   | 280  | -   |               |
|                       |                                      | $I_C = 2\text{ mA}$   | 200 | 300  | 450 |               |
| $V_{CEsat}$           | collector-emitter saturation voltage | $I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$                                   | -   | 55   | 100 | mV            |
|                       |                                      | $I_C = 100\text{ mA}; I_B = 5\text{ mA}$                                    | -   | 200  | 300 | mV            |
| $V_{BEsat}$           | base-emitter saturation voltage      | $I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$                                   | -   | 755  | 850 | mV            |
|                       |                                      | $I_C = 100\text{ mA}; I_B = 5\text{ mA}$                                    | -   | 1000 | -   | mV            |
| $V_{BE}$              | base-emitter voltage                 | $V_{CE} = 5\text{ V}$   |     |      |     |               |
|                       |                                      | $I_C = 2\text{ mA}$   | 580 | 650  | 700 | mV            |
|                       |                                      | $I_C = 10\text{ mA}$  | -   | -    | 770 | mV            |

**Table 7. Characteristics ...continued**

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

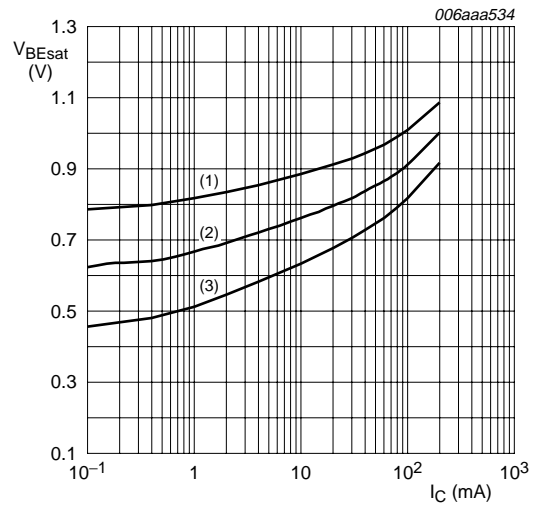
| Symbol | Parameter             | Conditions  | Min | Typ | Max | Unit |
|--------|-----------------------|---|-----|-----|-----|------|
| $C_c$  | collector capacitance | $V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$  | -   | 1.9 | -   | pF   |
| $C_e$  | emitter capacitance   | $V_{EB} = 0.5\text{ V}; I_C = i_c = 0\text{ A}; f = 1\text{ MHz}$                                       | -   | 11  | -   | pF   |
| $f_T$  | transition frequency  | $V_{CE} = 5\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}$   | 100 | -   | -   | MHz  |
| NF     | noise figure          | $V_{CE} = 5\text{ V}; I_C = 0.2\text{ mA}; R_S = 2\text{ k}\Omega; f = 10\text{ Hz to }15.7\text{ kHz}$ | -   | 1.9 | -   | dB   |
|        |                       | $V_{CE} = 5\text{ V}; I_C = 0.2\text{ mA}; R_S = 2\text{ k}\Omega; f = 1\text{ kHz}; B = 200\text{ Hz}$ | -   | 3.1 | -   | dB   |





$V_{CE} = 5$  V;  $T_{amb} = 25$  °C

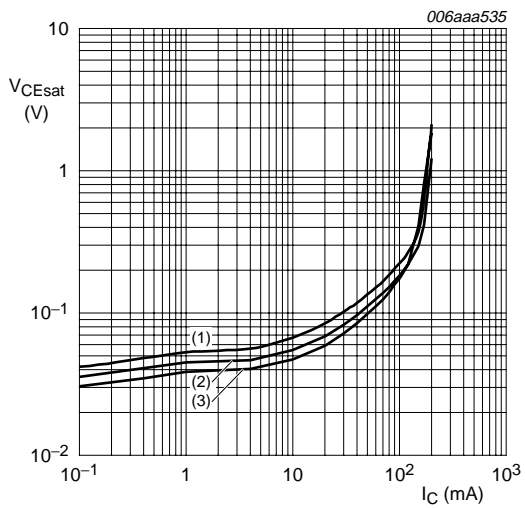
Fig 5. Per transistor: Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 20$

- (1)  $T_{amb} = -55$  °C
- (2)  $T_{amb} = 25$  °C
- (3)  $T_{amb} = 100$  °C

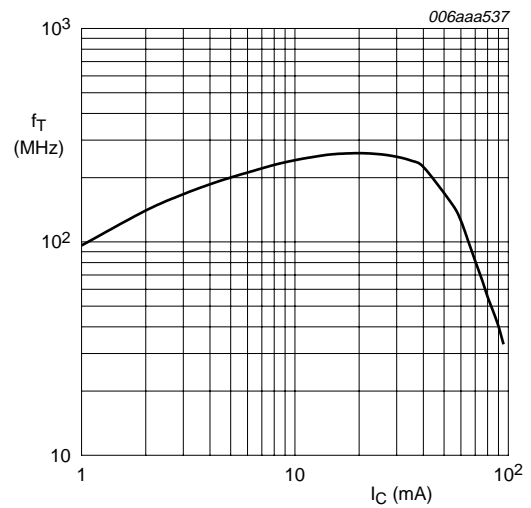
Fig 6. Per transistor: Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$

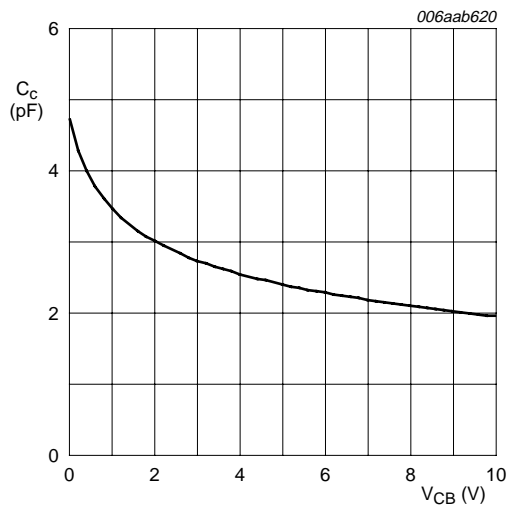
- (1)  $T_{amb} = 100$  °C
- (2)  $T_{amb} = 25$  °C
- (3)  $T_{amb} = -55$  °C

Fig 7. Per transistor: Collector-emitter saturation voltage as a function of collector current; typical values



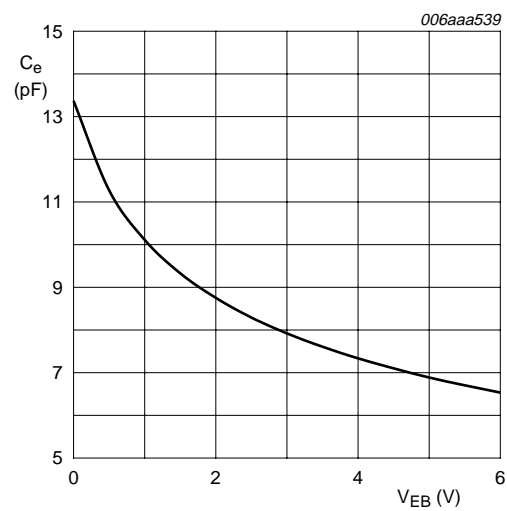
$V_{CE} = 5$  V;  $T_{amb} = 25$  °C

Fig 8. Per transistor: Transition frequency as a function of collector current; typical values



$f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$

**Fig 9. Per transistor: Collector capacitance as a function of collector-base voltage; typical values**



$f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$

**Fig 10. Per transistor: Emitter capacitance as a function of emitter-base voltage; typical values**

## 8. Test information

### 8.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

## 9. Package outline

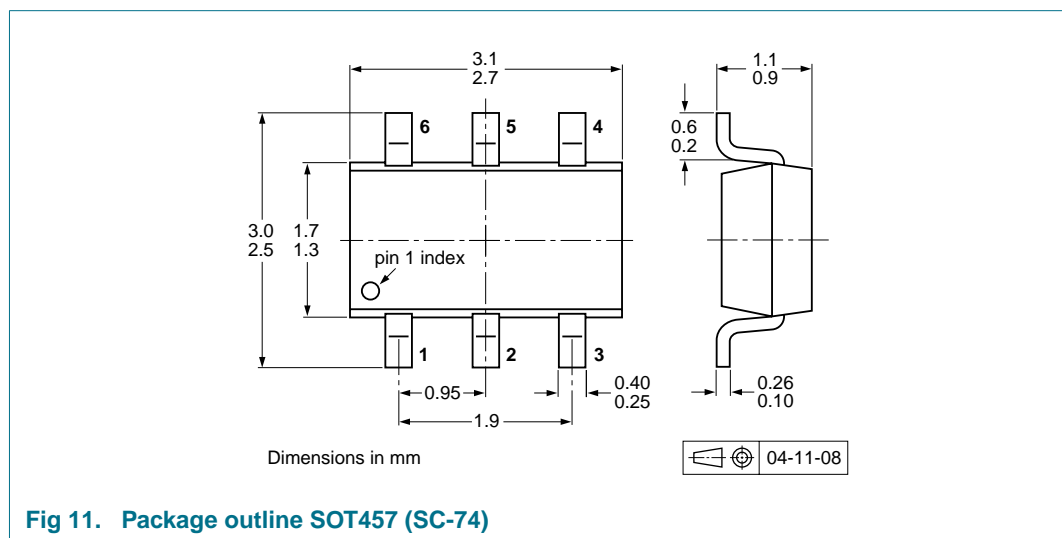


Fig 11. Package outline SOT457 (SC-74)

## 10. Packing information

Please refer to packing information on [www.nexperia.com](http://www.nexperia.com).



11. Soldering

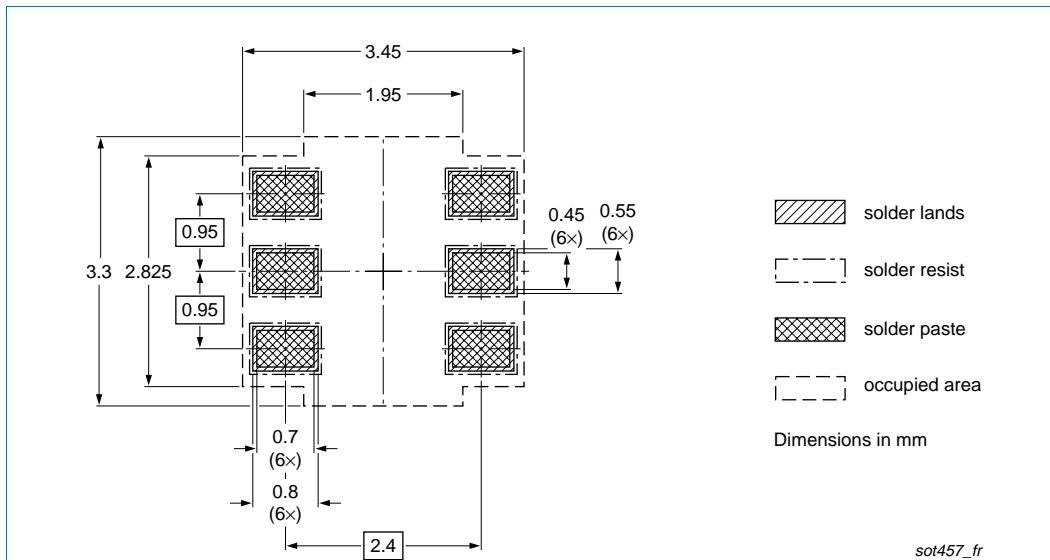


Fig 12. Reflow soldering footprint SOT457 (SC-74)

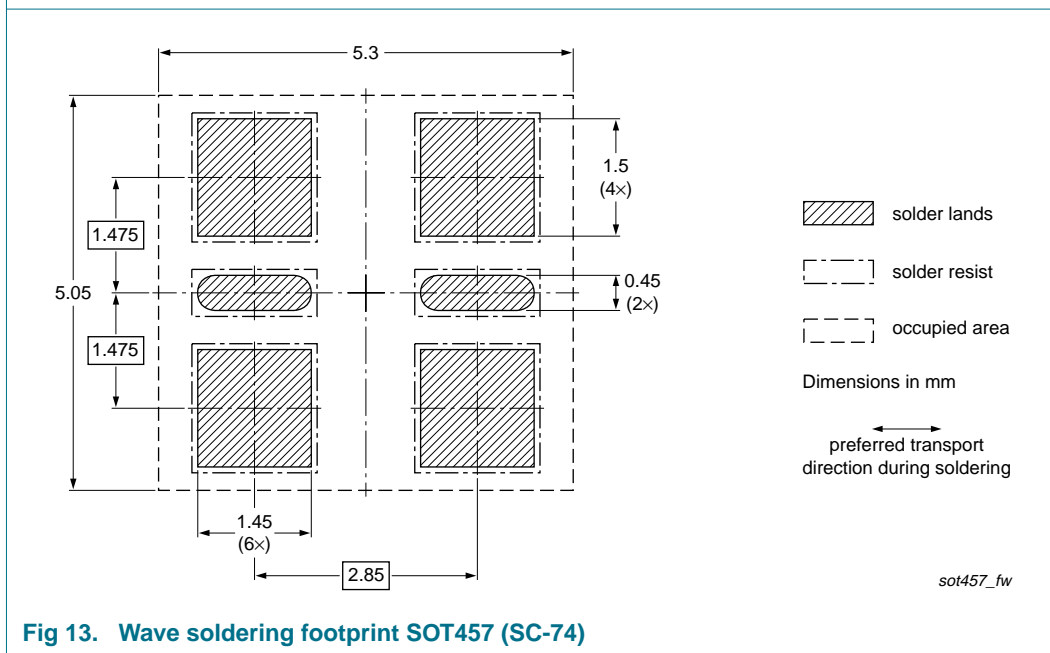


Fig 13. Wave soldering footprint SOT457 (SC-74)

## 12. Revision history

Table 9. Revision history

| Document ID | Release date | Data sheet status  | Change notice | Supersedes |
|-------------|--------------|--------------------|---------------|------------|
| BC846DS     | 20090717     | Product data sheet | -             | -          |

## 13. Legal information

### 13.1 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.                                     |

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[2] The term 'short data sheet' is explained in section "Definitions".

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Date of release: 17 July 2009  
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