



# THE DATASHEET OF BC846BS,115



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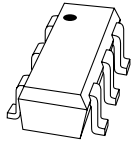
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Kind regards,

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# BC846BS

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

Rev. 01 — 24 August 2009

Product data sheet

## 1. Product profile

### 1.1 General description

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

Table 1. Product overview

| Type number | Package |       | PNP/PNP complement | NPN/PNP complement |
|-------------|---------|-------|--------------------|--------------------|
|             | NXP     | JEITA |                    |                    |
| BC846BS     | SOT363  | SC-88 | BC856BS            | BC846BPN           |

### 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 2. 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 3. 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 4. Ordering information**

| Type number | Package |  | Version |
|-------------|---------|--|---------|
|             | Name    | Description                              |         |
| BC846BS     | SC-88   | plastic surface-mounted package; 6 leads | SOT363  |

## 4. Marking

**Table 5. Marking codes**

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| BC846BS     | *E5                         |

- [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**

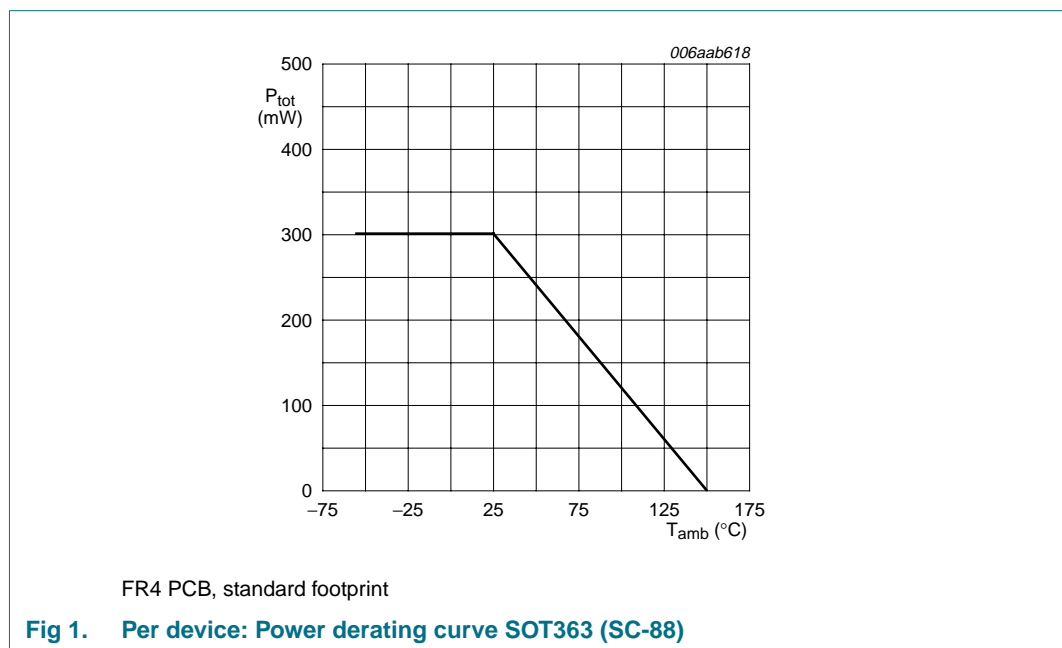
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol                | Parameter                 | Conditions                       | Min   | Max | Unit |
|-----------------------|---------------------------|----------------------------------|-------|-----|------|
| <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] - | 200 | mW   |

**Table 6. Limiting values ...continued**  
 In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol            | Parameter               | Conditions                  | Min   | Max  | Unit |
|-------------------|-------------------------|-----------------------------|-------|------|------|
| <b>Per device</b> |                         |                             |       |      |      |
| $P_{tot}$         | total power dissipation | $T_{amb} \leq 25\text{ °C}$ | [1] - | 300  | mW   |
| $T_j$             | 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.

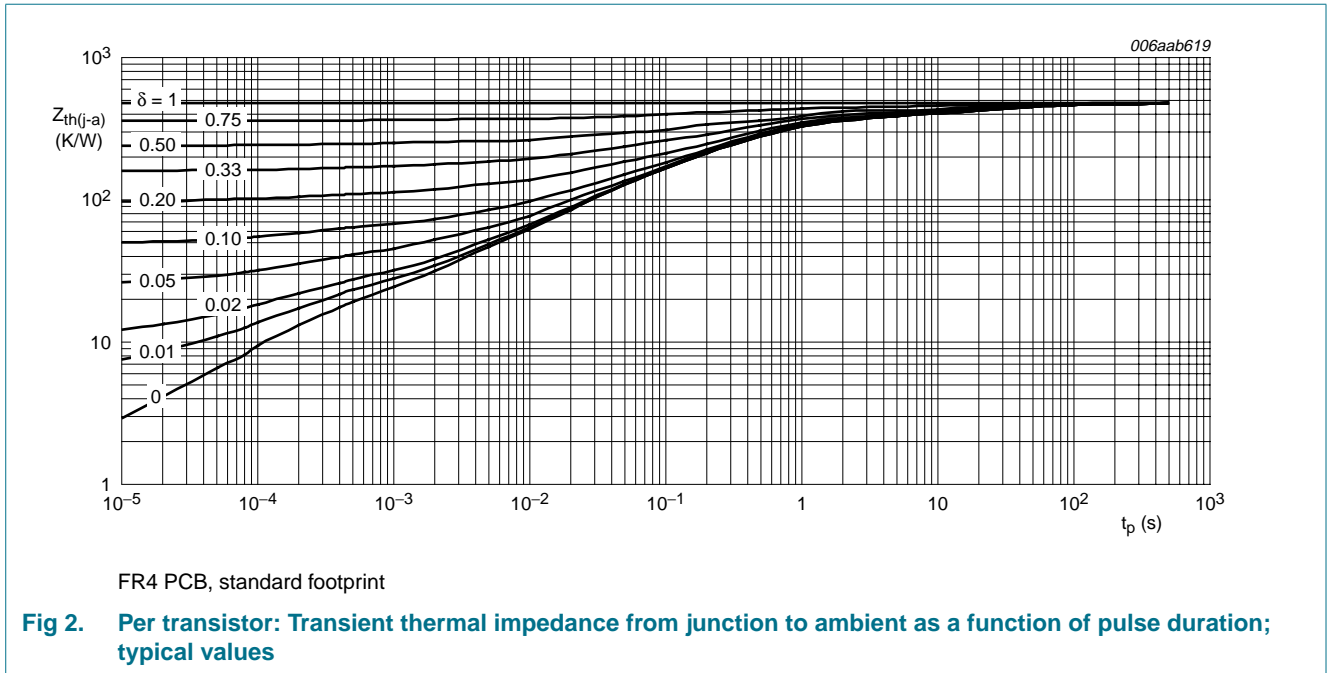


## 6. Thermal characteristics

**Table 7. 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] - | -   | 625 | K/W  |
| $R_{th(j-sp)}$        | thermal resistance from junction to solder point |             | -     | -   | 230 | K/W  |
| <b>Per device</b>     |  |             |       |     |     |      |
| $R_{th(j-a)}$         | thermal resistance from junction to ambient      | in free air | [1] - | -   | 416 | K/W  |

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



## 7. Characteristics

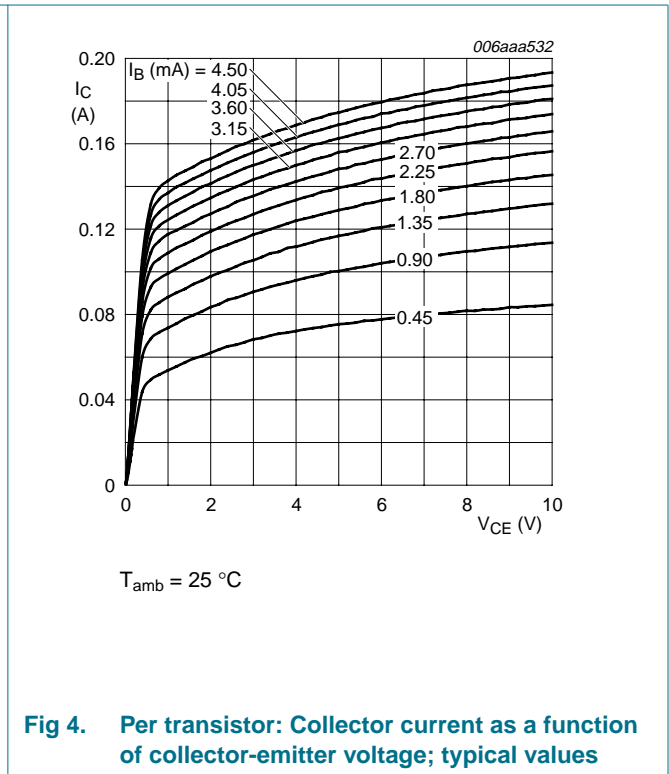
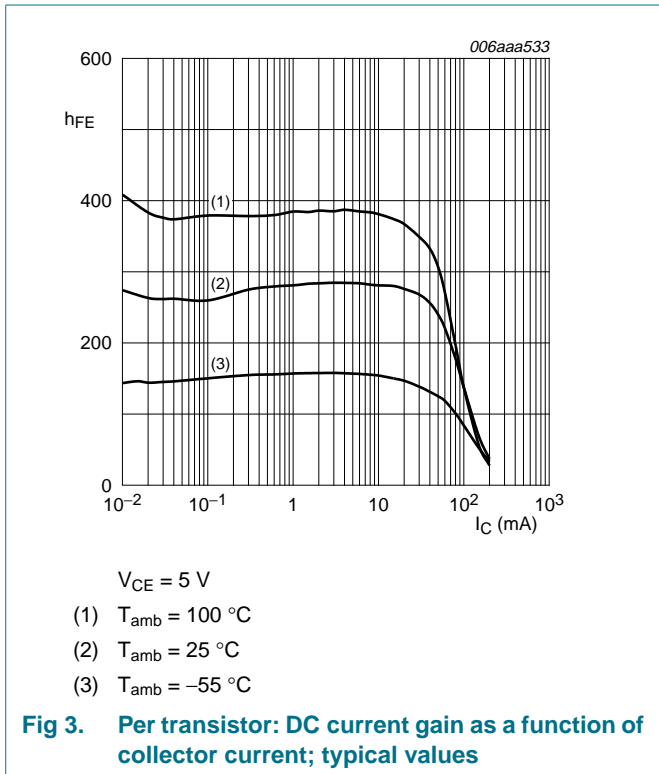
**Table 8. Characteristics**

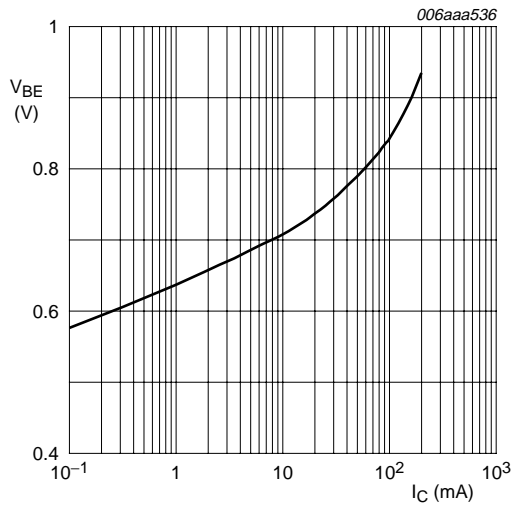
$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

| Symbol                | Parameter                            | Conditions  | Min | Typ  | Max | Unit          |
|-----------------------|--------------------------------------|---|-----|------|-----|---------------|
| <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 8. Characteristics ...continued**  
 $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

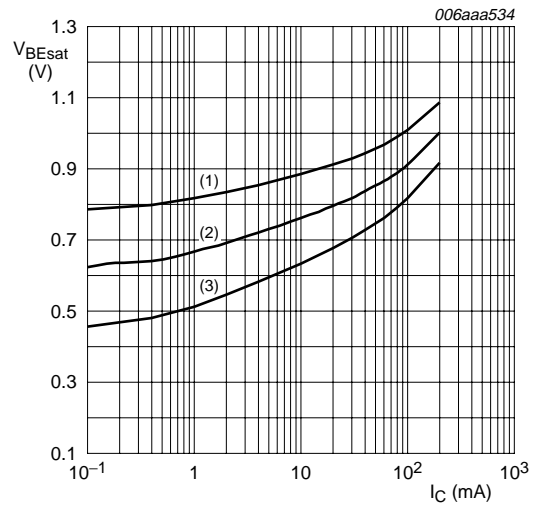
| Symbol | Parameter             | Conditions   | Min | Typ | Max | Unit |
|--------|-----------------------|--|-----|-----|-----|------|
| $C_c$  | collector capacitance | $V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A};$<br>$f = 1\text{ MHz}$  | -   | 1.9 | -   | pF   |
| $C_e$  | emitter capacitance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





$V_{CE} = 5$  V;  $T_{amb} = 25$  °C

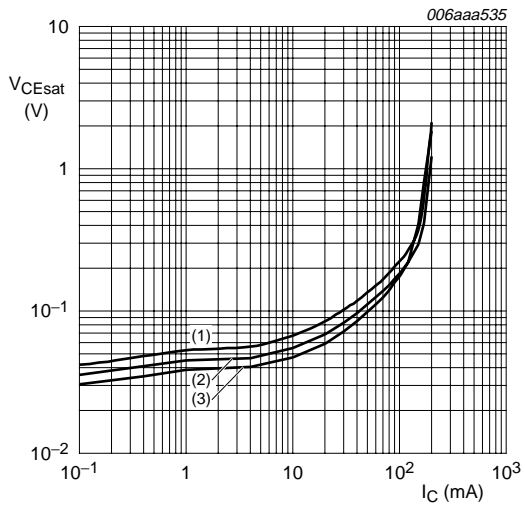
**Fig 5. Per transistor: Base-emitter voltage as a function of collector current; typical values**



$I_C/I_B = 20$

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

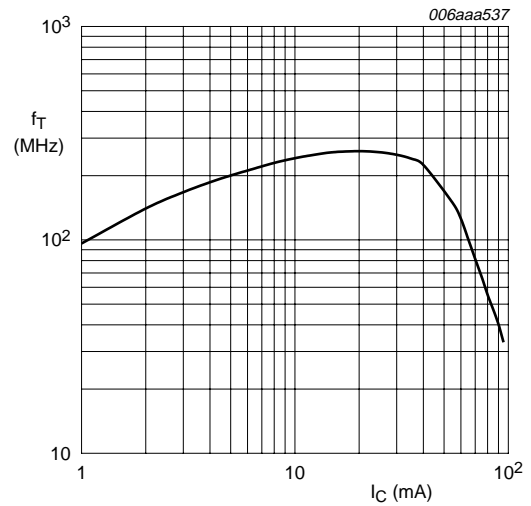
**Fig 6. Per transistor: Base-emitter saturation voltage as a function of collector current; typical values**



$I_C/I_B = 20$

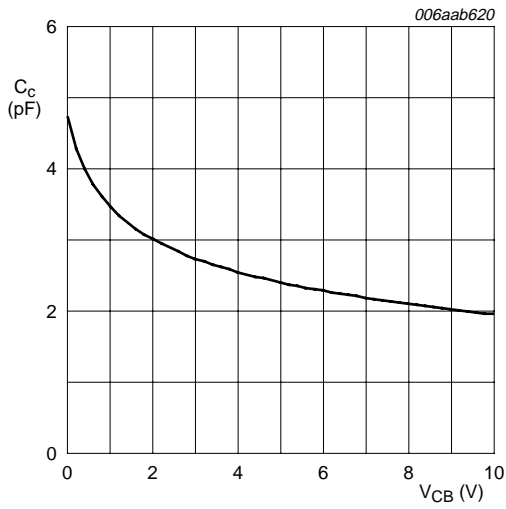
- (1)  $T_{amb} = 100$  °C
- (2)  $T_{amb} = 25$  °C
- (3)  $T_{amb} = -55$  °C

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



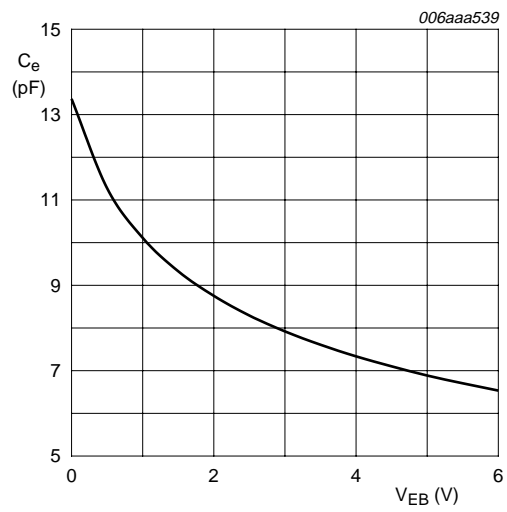
$V_{CE} = 5$  V;  $T_{amb} = 25$  °C

**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

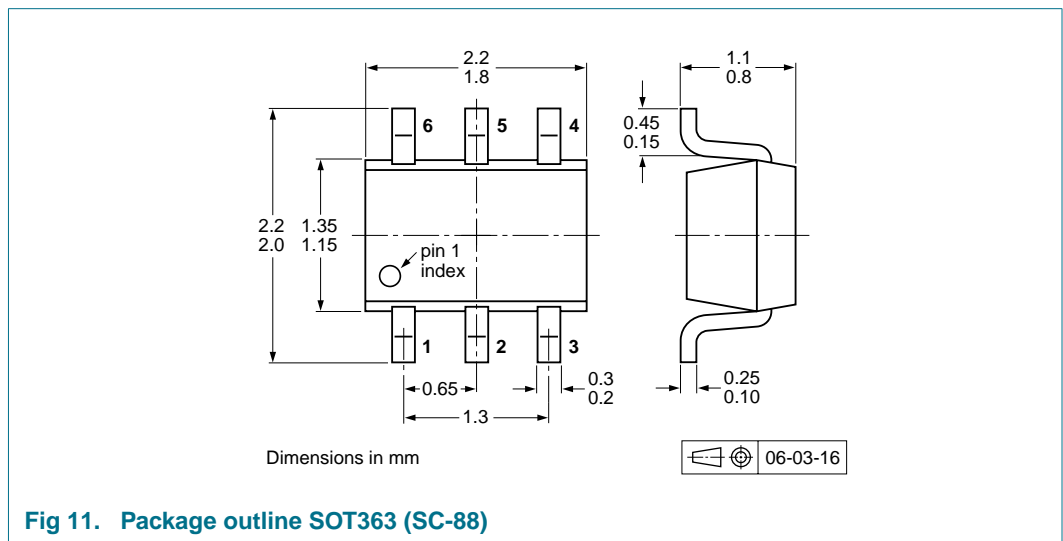


Fig 11. Package outline SOT363 (SC-88)

## 10. Packing information

**Table 9. Packing methods**

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

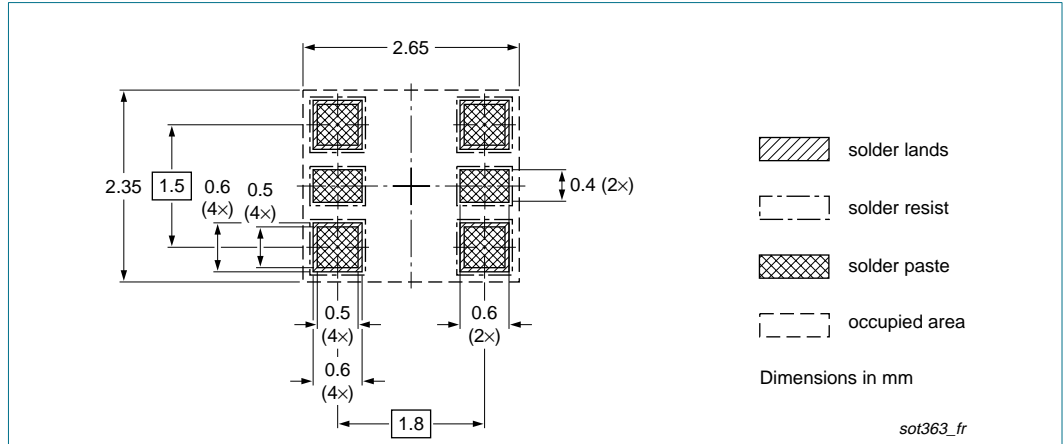
| Type number | Package | Description                        | Packing quantity |       |
|-------------|---------|------------------------------------|------------------|-------|
|             |         |                                    | 3000             | 10000 |
| BC846BS     | SOT363  | 4 mm pitch, 8 mm tape and reel; T1 | [2] -115         | -135  |
|             |         | 4 mm pitch, 8 mm tape and reel; T2 | [3] -125         | -165  |

[1] For further information and the availability of packing methods, see [Section 14](#).

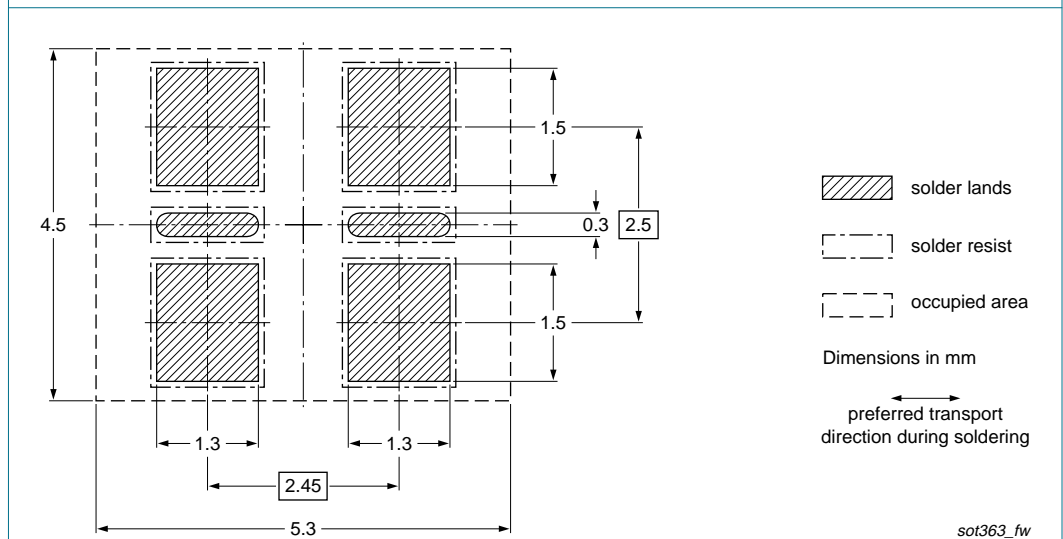
[2] T1: normal taping

[3] T2: reverse taping

**11. Soldering**



**Fig 12. Reflow soldering footprint SOT363 (SC-88)**



**Fig 13. Wave soldering footprint SOT363 (SC-88)**

## 12. Revision history

Table 10. Revision history

| Document ID | Release date | Data sheet status  | Change notice | Supersedes |
|-------------|--------------|--------------------|---------------|------------|
| BC846BS_1   | 20090824     | 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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