# BCM846BS

## NPN/NPN matched double transistor

26 June 2015 Product data sheet

## 1. General description

NPN/NPN matched double transistor in a very small SOT363 (TSSOP6) Surface-Mounted Device (SMD) plastic package. The transistors are fully isolated internally.

## 2. Features and benefits

- Current gain matching
- Base-emitter voltage matching
- Drop-in replacement for standard double transistors
- AEC-Q101 qualified

## 3. Applications

- Current mirror
- Differential amplifier

## 4. Quick reference data

**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Per transistor** | | | | | | | |
| $V_{CEO}$ | collector-emitter voltage | open base | | - | - | 65 | V |
| $I_C$ | collector current | | | - | - | 100 | mA |
| **Per transistor** | | | | | | | |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 5 V; $I_C$ = 2 mA; $T_{amb}$ = 25 °C | | 200 | 290 | 450 | |
| **Per device** | | | | | | | |
| $h_{FE1}/h_{FE2}$ | $h_{FE}$ matching | $V_{CE}$ = 5 V; $I_C$ = 2 mA; $T_{amb}$ = 25 °C | [1] | 0.9 | 1 | - | |
| $V_{BE1}-V_{BE2}$ | $V_{BE}$ matching | | [2] | - | - | 2 | mV |

[1] The smaller of the two values is taken as numerator.
[2] The smaller of the two values is subtracted from the larger value.

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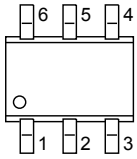
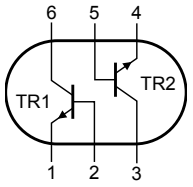
## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | E | emitter TR1 |  TSSOP6 (SOT363) |  sym020 |
| 2 | B | base TR1 | | |
| 3 | C | collector TR2 | | |
| 4 | E | emitter TR2 | | |
| 5 | B | base TR2 | | |
| 6 | C | collector TR1 | | |

## 6. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BCM846BS | TSSOP6 | plastic surface-mounted package; 6 leads | SOT363 |

## 7. Marking

**Table 4. Marking codes**

| Type number | Marking code [1] |
|---|---|
| BCM846BS | F2% |

[1] % = placeholder for manufacturing site code

# 8. Limiting values

**Table 5. Limiting values**

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| **Per transistor** | | | | | | |
| $V_{CBO}$ | 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 |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C | [1] | - | 200 | mW |
| **Per device** | | | | | | |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °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.

# 9. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Per transistor** | | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 625 | K/W |
| **Per device** | | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 416 | K/W |

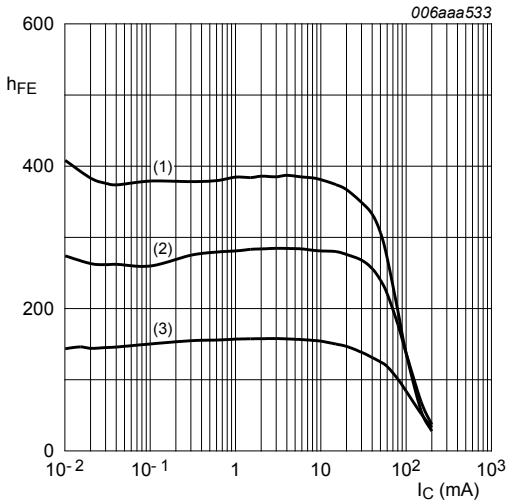
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

## 10. Characteristics

**Table 7. Characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Per transistor** | | | | | | | |
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = 30 V; $I_E$ = 0 A; $T_{amb}$ = 25 °C | | - | - | 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; $T_{amb}$ = 25 °C | | - | - | 100 | nA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 5 V; $I_C$ = 2 mA; $T_{amb}$ = 25 °C | | 200 | 290 | 450 | |
| | | $V_{CE}$ = 5 V; $I_C$ = 10 µA; $T_{amb}$ = 25 °C | | - | 250 | - | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 10 mA; $I_B$ = 0.5 mA; $T_{amb}$ = 25 °C | | - | 50 | 200 | mV |
| | | $I_C$ = 100 mA; $I_B$ = 5 mA; pulsed; $t_p \leq 300$ µs; $\delta \leq 0.02$; $T_{amb}$ = 25 °C | | - | 200 | 400 | mV |
| $V_{BEsat}$ | base-emitter saturation voltage | | [1] | - | 910 | - | mV |
| | | $I_C$ = 10 mA; $I_B$ = 0.5 mA; $T_{amb}$ = 25 °C | [1] | - | 760 | - | mV |
| $V_{BE}$ | base-emitter voltage | $V_{CE}$ = 5 V; $I_C$ = 10 mA; $T_{amb}$ = 25 °C | [2] | - | - | 770 | mV |
| $V_{BE}$ | base-emitter voltage | $V_{CE}$ = 5 V; $I_C$ = 2 mA; $T_{amb}$ = 25 °C | [2] | 610 | 660 | 710 | mV |
| $C_C$ | collector capacitance | $V_{CB}$ = 10 V; $I_E$ = 0 A; $i_e$ = 0 A; f = 1 MHz; $T_{amb}$ = 25 °C | | - | - | 1.5 | pF |
| $C_E$ | emitter capacitance | $V_{EB}$ = 0.5 V; $I_C$ = 0 A; $i_c$ = 0 A; f = 1 MHz; $T_{amb}$ = 25 °C | | - | 11 | - | pF |
| $f_T$ | transition frequency | $V_{CE}$ = 5 V; $I_C$ = 10 mA; f = 100 MHz; $T_{amb}$ = 25 °C | | 100 | 250 | - | MHz |
| NF | noise figure | $V_{CE}$ = 5 V; $I_C$ = 0.2 mA; $R_S$ = 2 kΩ; f = 1 kHz; B = 200 Hz; $T_{amb}$ = 25 °C | | - | 3.3 | - | dB |
| | | $V_{CE}$ = 5 V; $I_C$ = 0.2 mA; $R_S$ = 2 kΩ; $T_{amb}$ = 25 °C; f = 10 Hz to 15.7 kHz | | - | 2.8 | - | dB |
| **Per device** | | | | | | | |
| $h_{FE1}/h_{FE2}$ | $h_{FE}$ matching | $V_{CE}$ = 5 V; $I_C$ = 2 mA; $T_{amb}$ = 25 °C | [3] | 0.9 | 1 | - | |
| $V_{BE1}-V_{BE2}$ | $V_{BE}$ matching | | [4] | - | - | 2 | mV |

[1] $V_{BEsat}$ decreases by about 1.7 mV/K with increasing temperature.
[2] $V_{BE}$ decreases by about 2 mV/K with increasing temperature.
[3] The smaller of the two values is taken as numerator.
[4] The smaller of the two values is subtracted from the larger value.



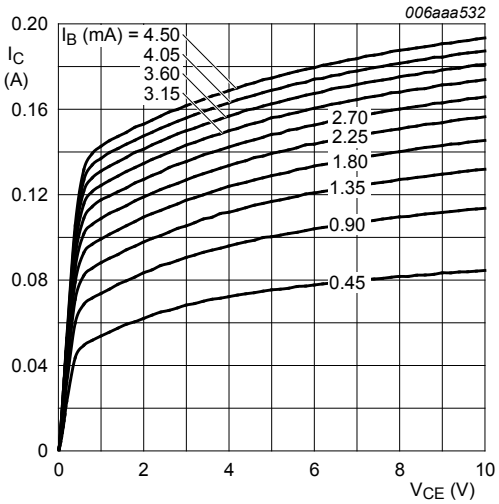

$V_{CE}$ = 5 V

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

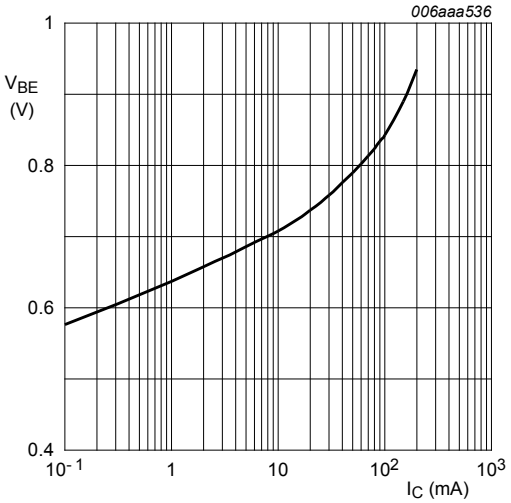
(3) $T_{amb}$ = −55 °C

**Fig. 1. DC current gain as a function of collector current; typical values**



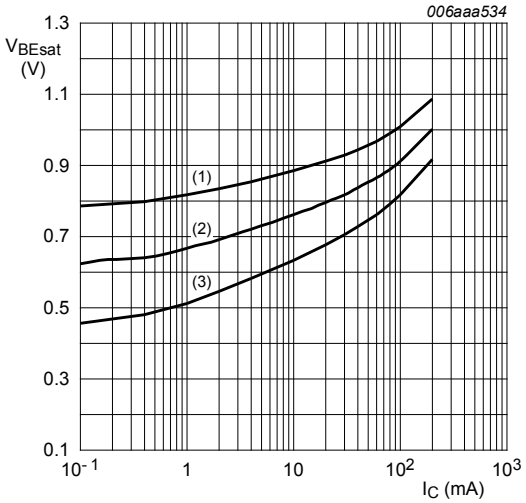

$T_{amb}$ = 25 °C

**Fig. 2. Collector current as a function of collector-emitter voltage; typical values**




$V_{CE}$ = 5 V; $T_{amb}$ = 25 °C

**Fig. 3. Base-emitter voltage as a function of collector current; typical values**



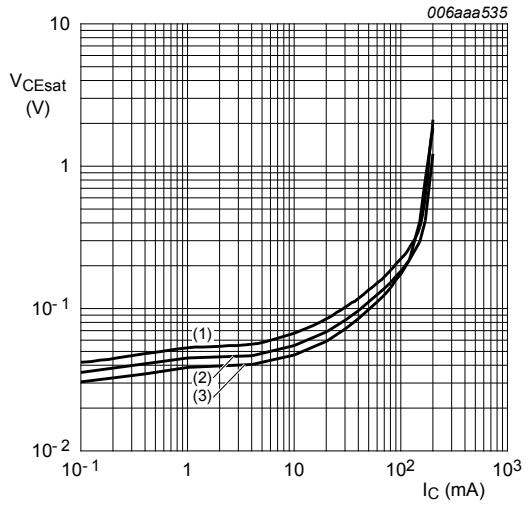

$I_C/I_B$ = 20

(1) $T_{amb}$ = −55 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

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



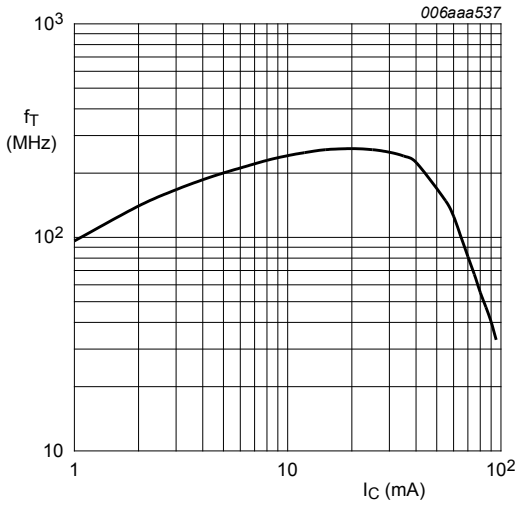

$I_C/I_B$ = 20

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

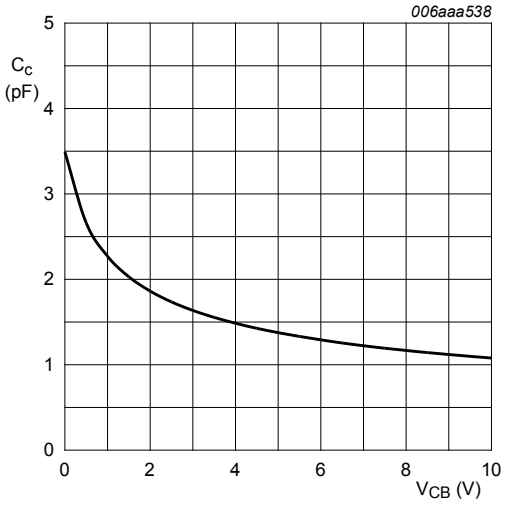
(3) $T_{amb}$ = −55 °C

**Fig. 5. Collector-emitter saturation voltage as a function of collector current; typical values**



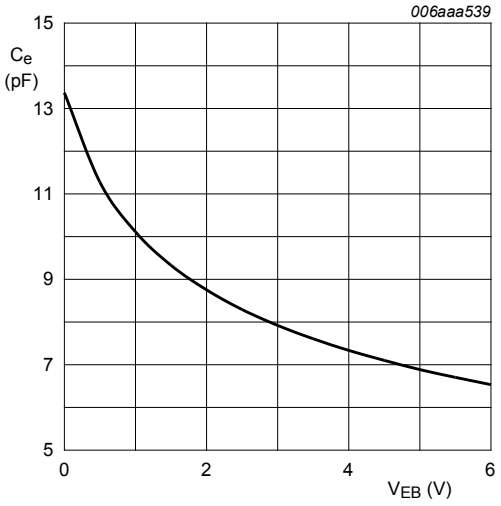

$V_{CE}$ = 5 V; $T_{amb}$ = 25 °C

**Fig. 6. Transition frequency as a function of collector current; typical values**




f = 1 MHz; $T_{amb}$ = 25 °C

**Fig. 7. Collector capacitance as a function of collector-base voltage; typical values**




f = 1 MHz; $T_{amb}$ = 25 °C

**Fig. 8. Emitter capacitance as a function of emitter-base voltage; typical values**

## 11. Package outline

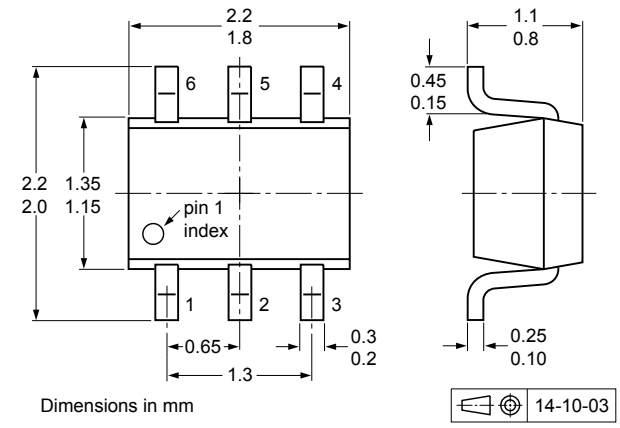



**Fig. 9. Package outline TSSOP6 (SOT363)**

## 12. Soldering

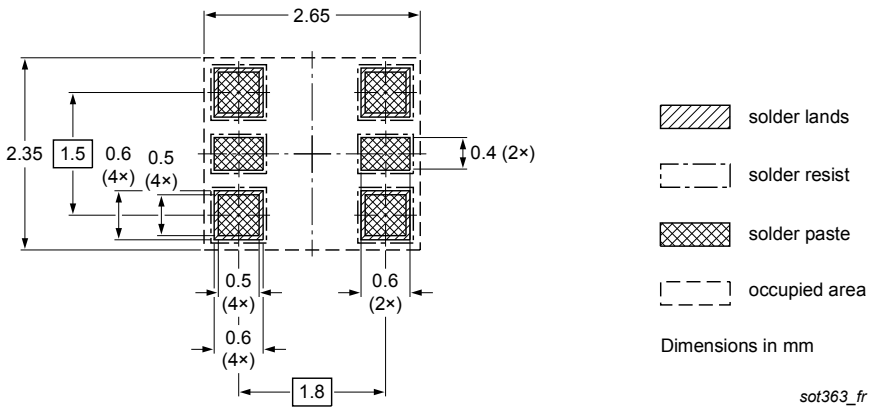



**Fig. 10. Reflow soldering footprint for TSSOP6 (SOT363)**

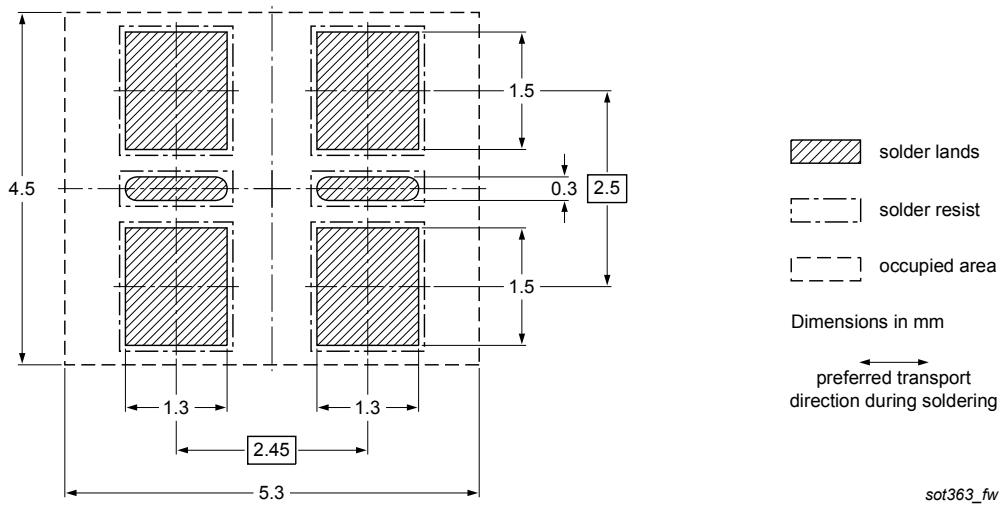



**Fig. 11. Wave soldering footprint for TSSOP6 (SOT363)**

## 13. Revision history

**Table 8. Revision history**

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BCM846BS v.2 | 20150626 | Product data sheet | - | BCM846BS v.1 |
| Modification: | • Product status changed | | | |
| BCM846BS v.1 | 20150424 | Objective data sheet | - | - |

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|---|---|---|
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| Product [short] data sheet | Production | This document contains the product specification. |

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