# BCM856BS; BCM856BS/DG
# BCM856DS; BCM856DS/DG

## PNP/PNP matched double transistors

Rev. 01 — 7 August 2008 Product data sheet

## 1. Product profile

### 1.1 General description

PNP/PNP matched double transistors in small Surface-Mounted Device (SMD) plastic packages. The transistors are fully isolated internally.

**Table 1. Product overview**

| Type number | Package | | Package configuration |
|---|---|---|---|
| | NXP | JEITA | |
| BCM856BS | SOT363 | SC-88 | very small |
| BCM856BS/DG | | | |
| BCM856DS | SOT457 | SC-74 | small |
| BCM856DS/DG | | | |

### 1.2 Features

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

### 1.3 Applications

- Current mirror
- Differential amplifier

### 1.4 Quick reference data

**Table 2. 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 |
| $h_{FE}$ | DC current gain | $V_{CE}$ = –5 V; $I_C$ = –2 mA | 200 | 290 | 450 | |

**Table 2. Quick reference data** *…continued*

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Per device** | | | | | | | |
| $h_{FE1}/h_{FE2}$ | $h_{FE}$ matching | $V_{CE}$ = –5 V; $I_C$ = –2 mA | [1] | 0.9 | 1 | - | |
| $V_{BE1}–V_{BE2}$ | $V_{BE}$ matching | $V_{CE}$ = –5 V; $I_C$ = –2 mA | [2] | - | - | 2 | mV |

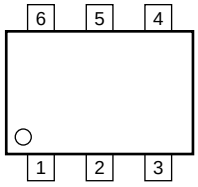
[1] The smaller of the two values is taken as the numerator.

[2] The smaller of the two values is subtracted from the larger value.

## 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 | | |

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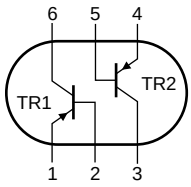


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## 3. Ordering information

**Table 4. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BCM856BS | SC-88 | plastic surface-mounted package; 6 leads | SOT363 |
| BCM856BS/DG | | | |
| BCM856DS | SC-74 | plastic surface-mounted package (TSOP6); 6 leads | SOT457 |
| BCM856DS/DG | | | |

## 4. Marking

**Table 5. Marking codes**

| Type number | Marking code[1] |
|---|---|
| BCM856BS | *BS |
| BCM856BS/DG | PB* |
| BCM856DS | DS |
| BCM856DS/DG | R9 |

[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 |
|---|---|---|---|---|---|---|
| **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 | | - | –5 | 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 | | | | |
| | BCM856BS (SOT363)<br>BCM856BS/DG (SOT363) | | [1] | - | 200 | mW |
| | BCM856DS (SOT457)<br>BCM856DS/DG (SOT457) | | [1] | - | 250 | mW |
| **Per device** | | | | | | |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C | | | | |
| | BCM856BS (SOT363)<br>BCM856BS/DG (SOT363) | | [1] | - | 300 | mW |
| | BCM856DS (SOT457)<br>BCM856DS/DG (SOT457) | | [1] | - | 380 | 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 |
|---|---|---|---|---|---|---|---|
| **Per transistor** | | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | | | | | |
| | BCM856BS (SOT363)<br>BCM856BS/DG (SOT363) | | [1] | - | - | 625 | K/W |
| | BCM856DS (SOT457)<br>BCM856DS/DG (SOT457) | | [1] | - | - | 500 | K/W |
| **Per device** | | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | | | | | |
| | BCM856BS (SOT363)<br>BCM856BS/DG (SOT363) | | [1] | - | - | 416 | K/W |
| | BCM856DS (SOT457)<br>BCM856DS/DG (SOT457) | | [1] | - | - | 328 | 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 |
|---|---|---|---|---|---|---|---|
| **Per transistor** | | | | | | | |
| $I_{CBO}$ | 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 | | - | 250 | - | |
| | | $V_{CE}$ = –5 V; $I_C$ = –2 mA | | 200 | 290 | 450 | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = –10 mA; $I_B$ = –0.5 mA | | - | –50 | –200 | mV |
| | | $I_C$ = –100 mA; $I_B$ = –5 mA | | - | –200 | –400 | mV |
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C$ = –10 mA; $I_B$ = –0.5 mA | [1] | - | –760 | - | mV |
| | | $I_C$ = –100 mA; $I_B$ = –5 mA | [1] | - | –920 | - | mV |

**Table 8. Characteristics** *...continued*

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

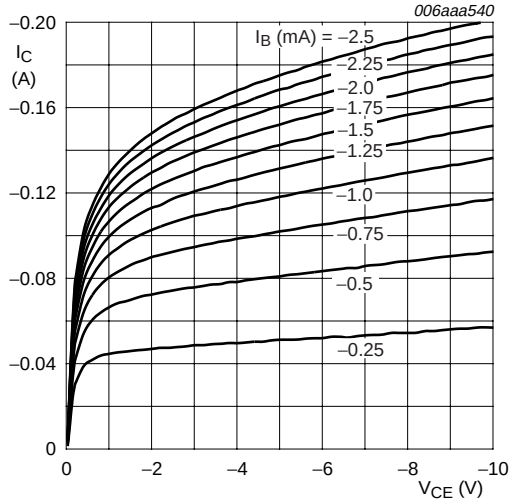
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{BE}$ | base-emitter voltage | $V_{CE}$ = –5 V; $I_C$ = –2 mA | [2] | –600 | –650 | –700 | mV |
| | | $V_{CE}$ = –5 V; $I_C$ = –10 mA | [2] | - | - | –760 | mV |
| $C_c$ | collector capacitance | $V_{CB}$ = –10 V; $I_E = i_e$ = 0 A; f = 1 MHz | | - | - | 2.2 | pF |
| $C_e$ | emitter capacitance | $V_{EB}$ = –0.5 V; $I_C = i_c$ = 0 A; f = 1 MHz | | - | 10 | - | pF |
| $f_T$ | transition frequency | $V_{CE}$ = –5 V; $I_C$ = –10 mA; f = 100 MHz | | 100 | 175 | - | MHz |
| NF | noise figure | $V_{CE}$ = –5 V; $I_C$ = –0.2 mA; $R_S$ = 2 kΩ; f = 10 Hz to 15.7 kHz | | - | 1.6 | - | dB |
| | | $V_{CE}$ = –5 V; $I_C$ = –0.2 mA; $R_S$ = 2 kΩ; f = 1 kHz; B = 200 Hz | | - | 3.1 | - | dB |
| **Per device** | | | | | | | |
| $h_{FE1}/h_{FE2}$ | $h_{FE}$ matching | $V_{CE}$ = –5 V; $I_C$ = –2 mA | [3] | 0.9 | 1 | - | |
| $V_{BE1}–V_{BE2}$ | $V_{BE}$ matching | $V_{CE}$ = –5 V; $I_C$ = –2 mA | [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.

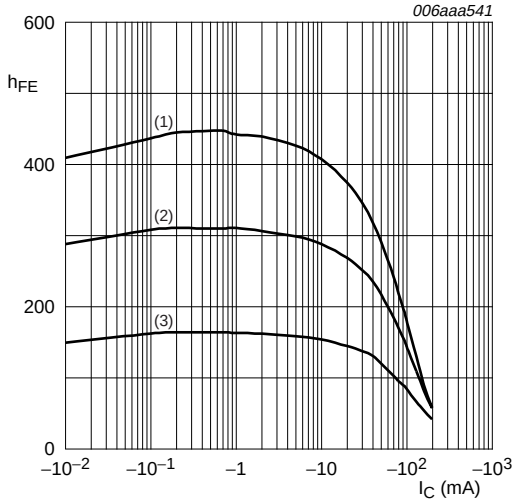
[3] The smaller of the two values is taken as the numerator.

[4] The smaller of the two values is subtracted from the larger value.




$T_{amb}$ = 25 °C

**Fig 1. Collector current as a function of collector-emitter voltage; typical values**



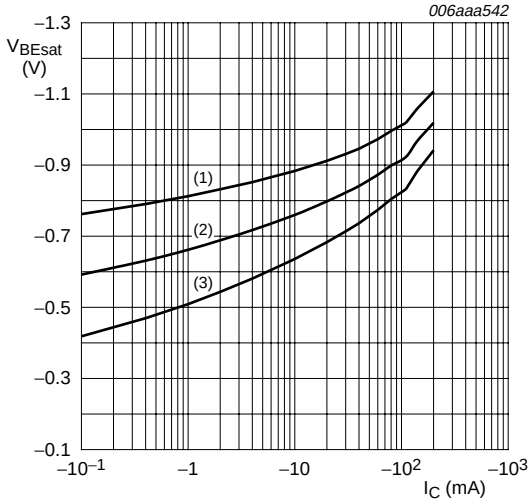

$V_{CE}$ = −5 V

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −55 °C

**Fig 2. DC current gain as a function of collector current; typical values**



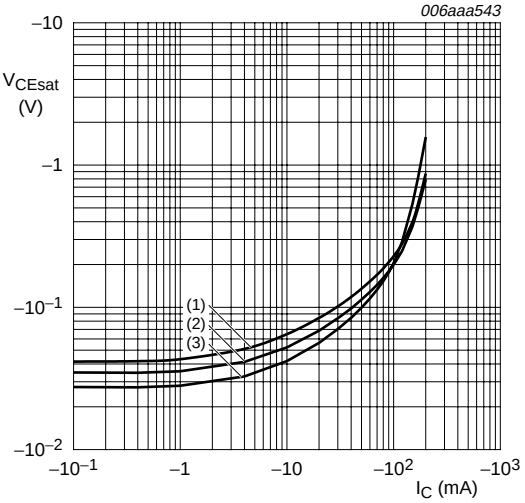

$I_C/I_B$ = 20

(1) $T_{amb}$ = −55 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

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



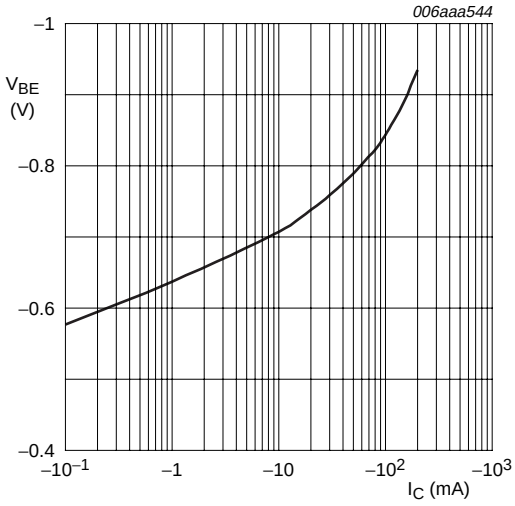

$I_C/I_B$ = 20

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

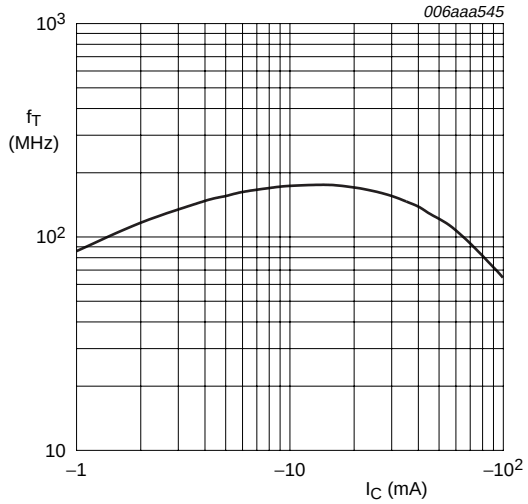
(3) $T_{amb}$ = −55 °C

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



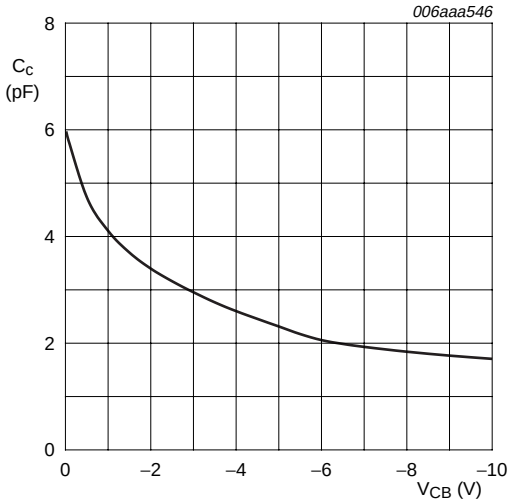

$V_{CE}$ = −5 V; $T_{amb}$ = 25 °C

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



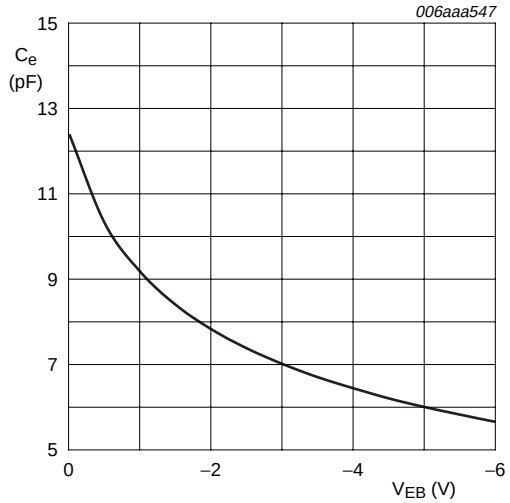

$V_{CE}$ = −5 V; $T_{amb}$ = 25 °C

**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**

# 8. Application information

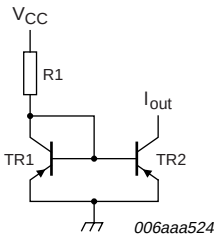



Fig 9. Current mirror

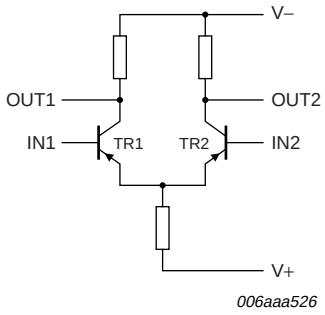



Fig 10. Differential amplifier

# 9. Test information

## 9.1 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.

# 10. Package outline

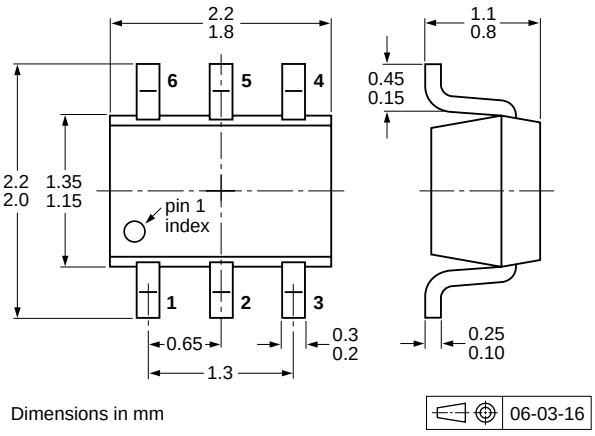



Fig 11. Package outline SOT363 (SC-88)

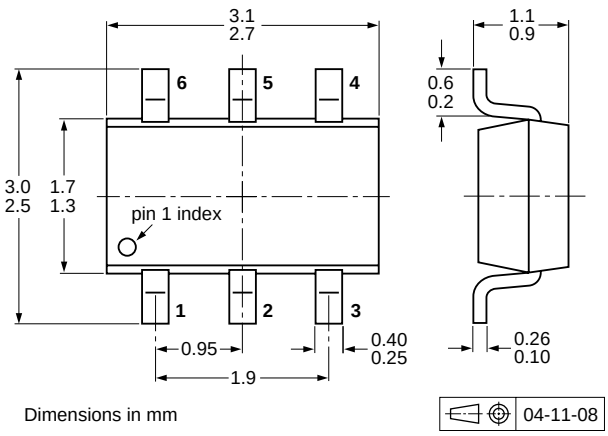



Fig 12. Package outline SOT457 (SC-74)

## 11. Packing information

**Table 9. Packing methods**

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

| Type number | Package | Description | | Packing quantity | |
|---|---|---|---|---|---|
| | | | | 3000 | 10000 |
| BCM856BS | 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 |
| BCM856BS/DG | 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 |
| BCM856DS | SOT457 | 4 mm pitch, 8 mm tape and reel; T1 | [2] | -115 | -135 |
| | | 4 mm pitch, 8 mm tape and reel; T2 | [3] | -125 | -165 |
| BCM856DS/DG | SOT457 | 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 15.

[2] T1: normal taping

[3] T2: reverse taping

## 12. Soldering

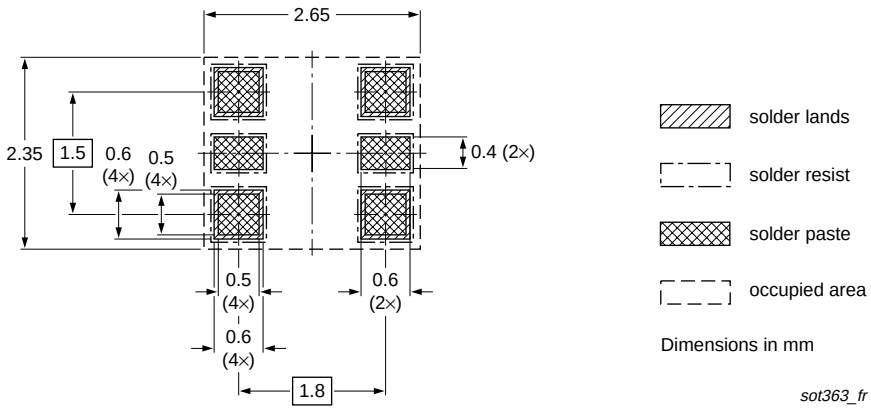



**Fig 13. Reflow soldering footprint SOT363 (SC-88)**

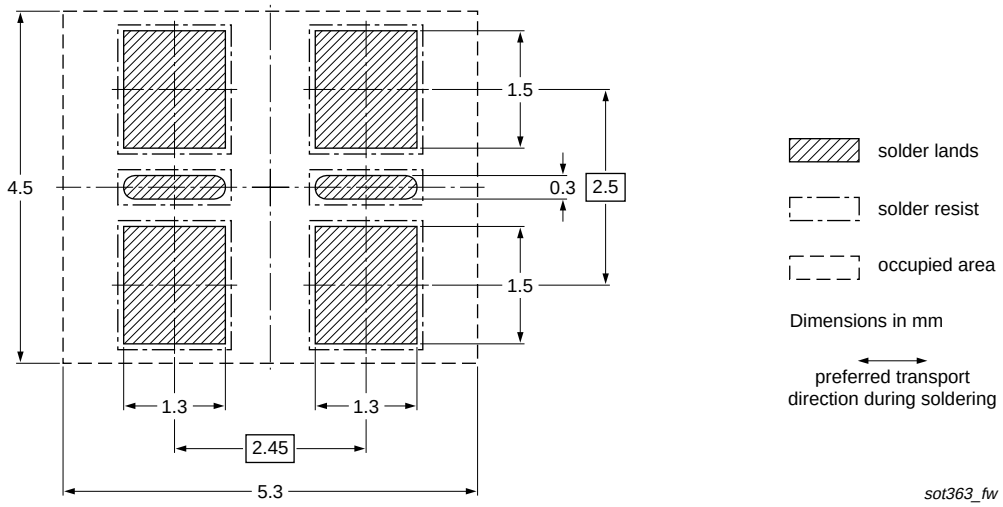



**Fig 14. Wave soldering footprint SOT363 (SC-88)**

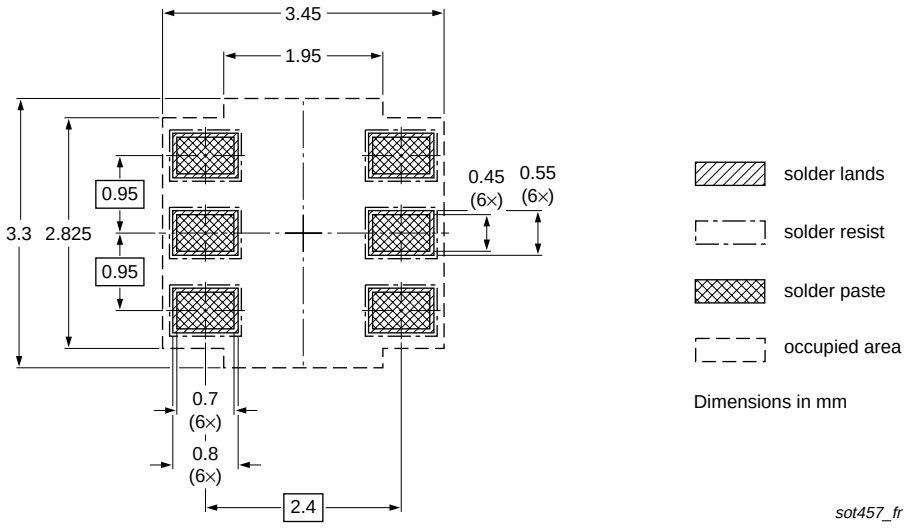



**Fig 15. Reflow soldering footprint SOT457 (SC-74)**

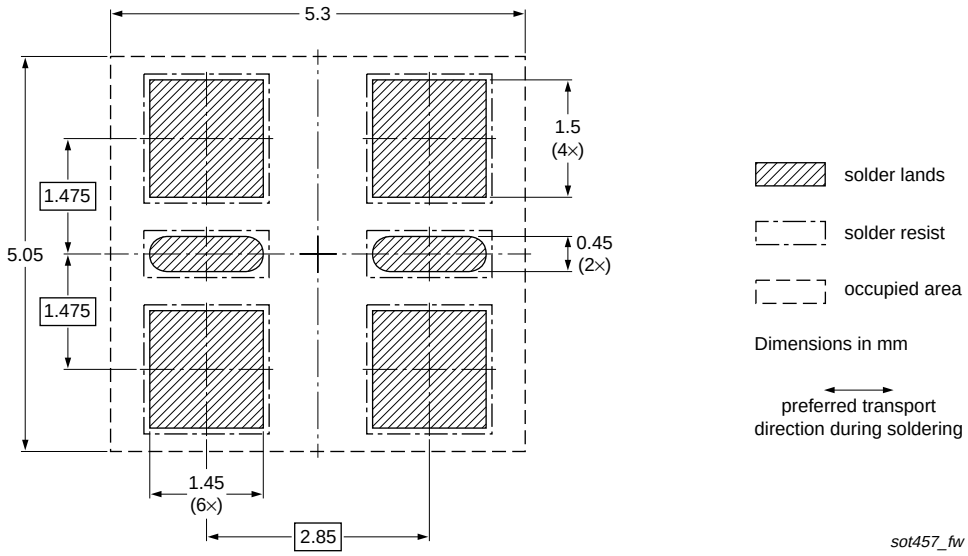



**Fig 16. Wave soldering footprint SOT457 (SC-74)**

## 13. Revision history

**Table 10. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BCM856BS_BCM856DS_1 | 20080807 | Product data sheet | - | - |

# 14. Legal information

## 14.1 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.nxp.com.

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## 16. Contents





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Date of release: 7 August 2008

Document identifier: BCM856BS_BCM856DS_1