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# BCM847BV; BCM847BS; BCM847DS

## NPN/NPN matched double transistors

Rev. 06 — 28 August 2009 Product data sheet

## 1. Product profile

### 1.1 General description

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

Table 1. Product overview

| Type number | Package | | PNP/PNP complement | Matched version of |
|---|---|---|---|---|
| | NXP | JEITA | | |
| BCM847BV | SOT666 | - | BCM857BV | BC847BV |
| BCM847BS | SOT363 | SC-88 | BCM857BS | BC847BS |
| BCM847DS | SOT457 | SC-74 | BCM857DS | - |

### 1.2 Features

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

### 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 | - | - | 45 | 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 |

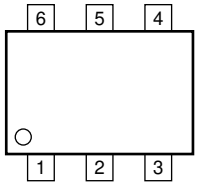
[1] The smaller of the two values is taken as the numerator.

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

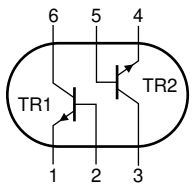
## 2. Pinning information

**Table 3. Pinning**

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




001aab555




sym020

## 3. Ordering information

**Table 4. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BCM847BV | - | plastic surface-mounted package; 6 leads | SOT666 |
| BCM847BS | SC-88 | plastic surface-mounted package; 6 leads | SOT363 |
| BCM847DS | SC-74 | plastic surface-mounted package (TSOP6); 6 leads | SOT457 |

## 4. Marking

**Table 5. Marking codes**

| Type number | Marking code[1] |
|---|---|
| BCM847BV | 3A |
| BCM847BS | M1* |
| BCM847DS | R6 |

[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 | | - | 50 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | | - | 45 | 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 | | | | |
| | SOT666 | | [1][2] | - | 200 | mW |
| | SOT363 | | [1] | - | 200 | mW |
| | SOT457 | | [1] | - | 250 | mW |
| **Per device** | | | | | | |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C | | | | |
| | SOT666 | | [1][2] | - | 300 | mW |
| | SOT363 | | [1] | - | 300 | mW |
| | SOT457 | | [1] | - | 380 | 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.

[2] Reflow soldering is the only recommended soldering method.

## 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 | | | | | |
| | SOT666 | | [1][2] | - | - | 625 | K/W |
| | SOT363 | | [1] | - | - | 625 | K/W |
| | SOT457 | | [1] | - | - | 500 | K/W |

**Table 7. Thermal characteristics** *...continued*

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Per device** | | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | | | | | |
| | SOT666 | | [1][2] | - | - | 416 | K/W |
| | SOT363 | | [1] | - | - | 416 | K/W |
| | SOT457 | | [1] | - | - | 328 | K/W |

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

[2] Reflow soldering is the only recommended soldering method.

# 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] | - | 910 | - | mV |
| $V_{BE}$ | base-emitter voltage | $V_{CE}$ = 5 V; $I_C$ = 2 mA | [2] | 610 | 660 | 710 | mV |
| | | $V_{CE}$ = 5 V; $I_C$ = 10 mA | [2] | - | - | 770 | mV |
| $C_c$ | collector capacitance | $V_{CB}$ = 10 V; $I_E = i_e$ = 0 A; f = 1 MHz | | - | - | 1.5 | pF |
| $C_e$ | emitter capacitance | $V_{EB}$ = 0.5 V; $I_C = i_c$ = 0 A; f = 1 MHz | | - | 11 | - | pF |

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

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

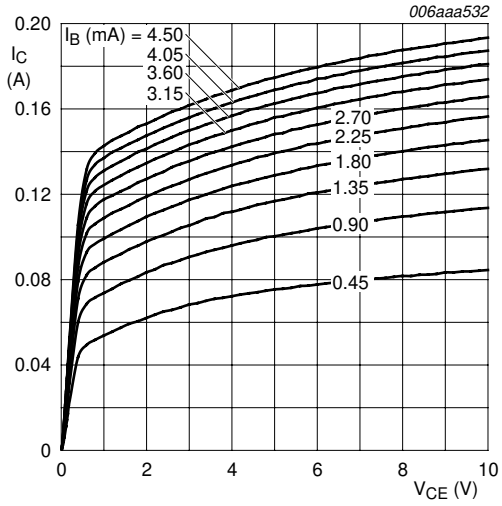
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $f_T$ | transition frequency | $V_{CE}$ = 5 V; $I_C$ = 10 mA; f = 100 MHz | | 100 | 250 | - | MHz |
| NF | noise figure | $V_{CE}$ = 5 V; $I_C$ = 0.2 mA; $R_S$ = 2 kΩ; f = 10 Hz to 15.7 kHz | | - | 2.8 | - | dB |
| | | $V_{CE}$ = 5 V; $I_C$ = 0.2 mA; $R_S$ = 2 kΩ; f = 1 kHz; B = 200 Hz | | - | 3.3 | - | 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.

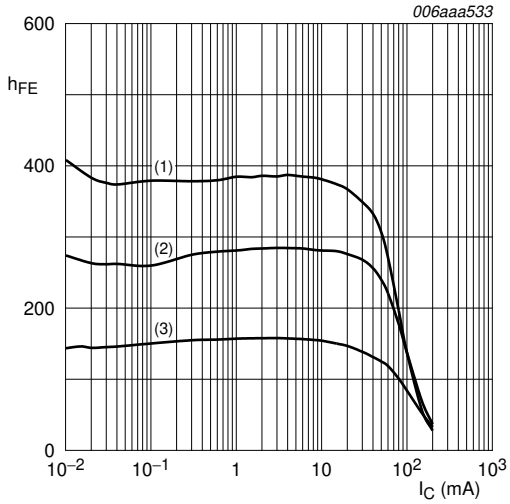
[3] The smaller of the two values is taken as the numerator.

[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**



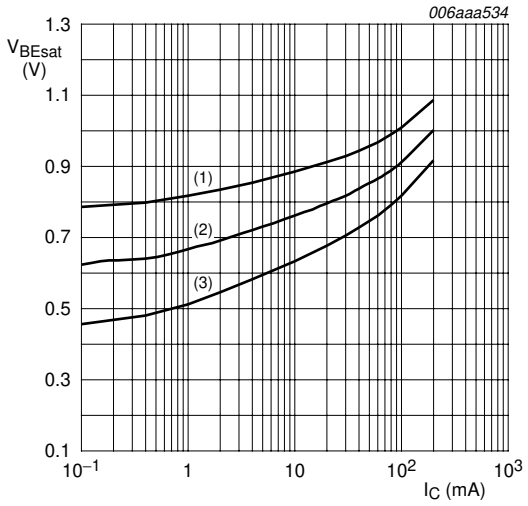

$V_{CE}$ = 5 V

(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**



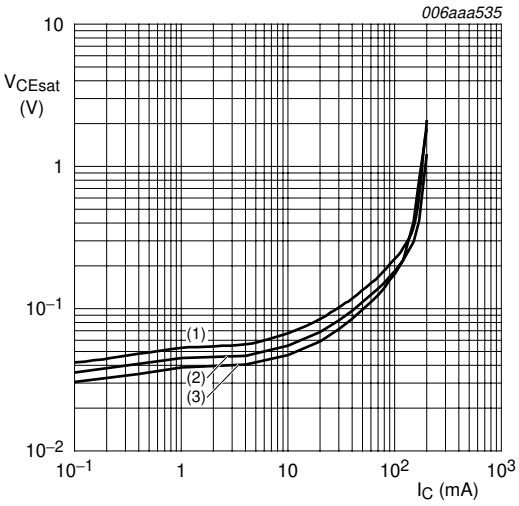

$I_C/I_B$ = 20

(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**



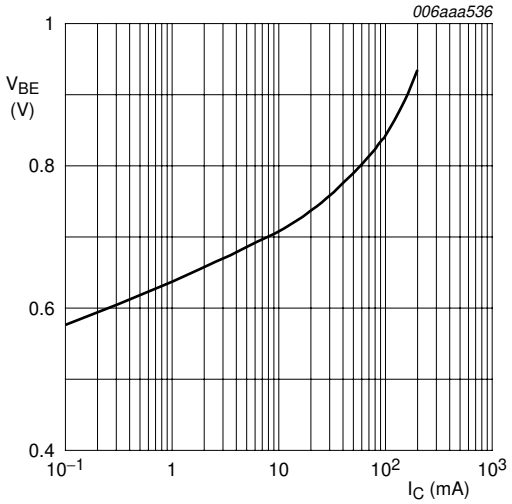

$I_C/I_B$ = 20

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

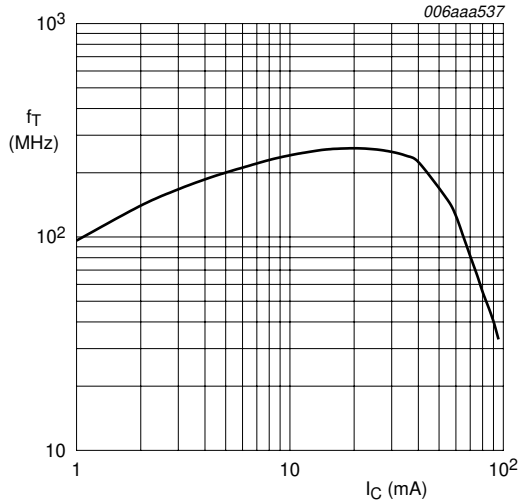
(3) $T_{amb}$ = −55 °C

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



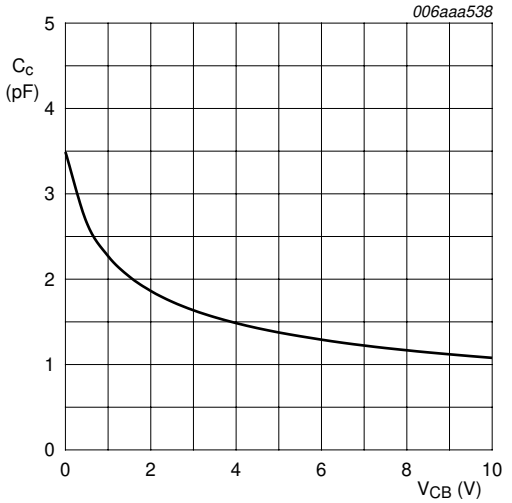

$V_{CE}$ = 5 V; $T_{amb}$ = 25 °C

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



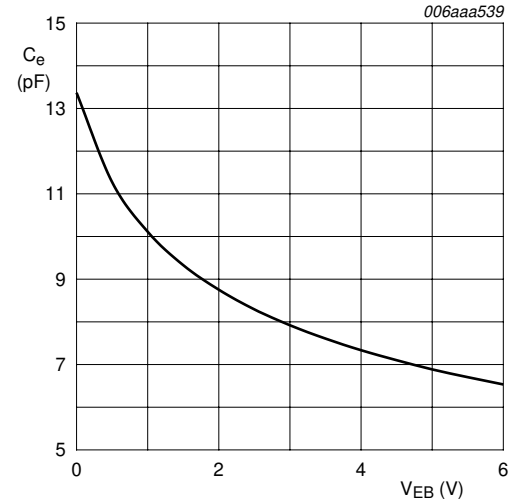

$V_{CE}$ = 5 V; $T_{amb}$ = 25 °C

**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

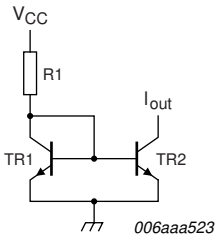



Fig 9. Current mirror

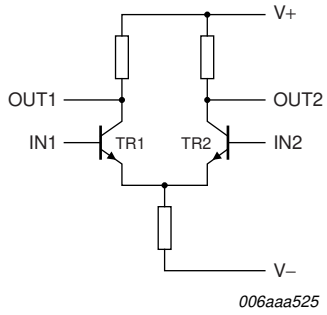



Fig 10. Differential amplifier

## 9. Package outline

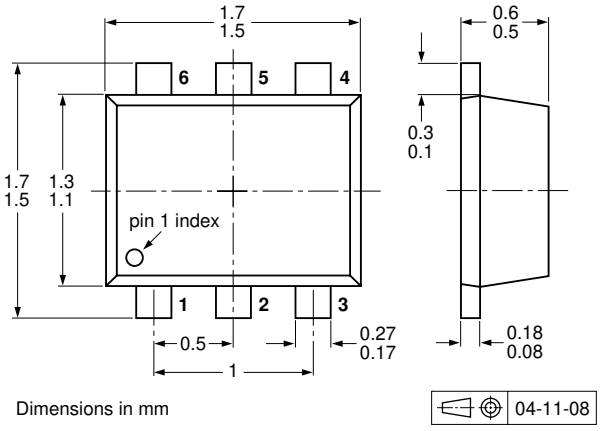



Fig 11. Package outline SOT666

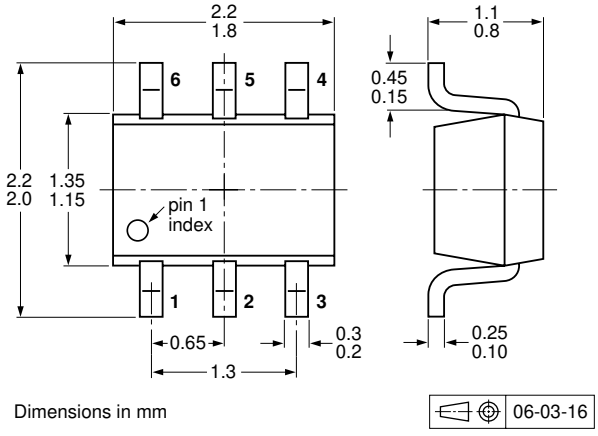



Fig 12. Package outline SOT363 (SC-88)

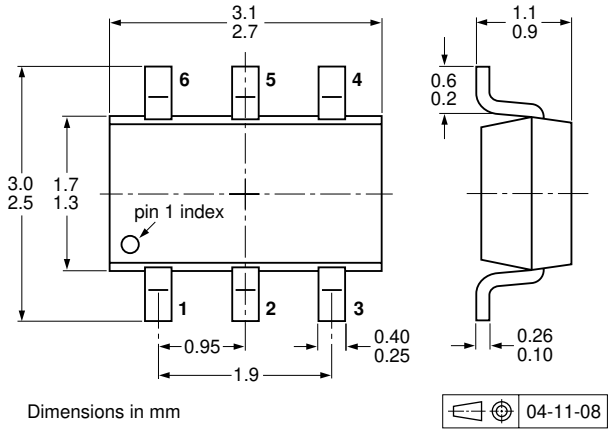



Fig 13. Package outline SOT457 (SC-74)

## 10. Packing information

**Table 9. Packing methods**

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

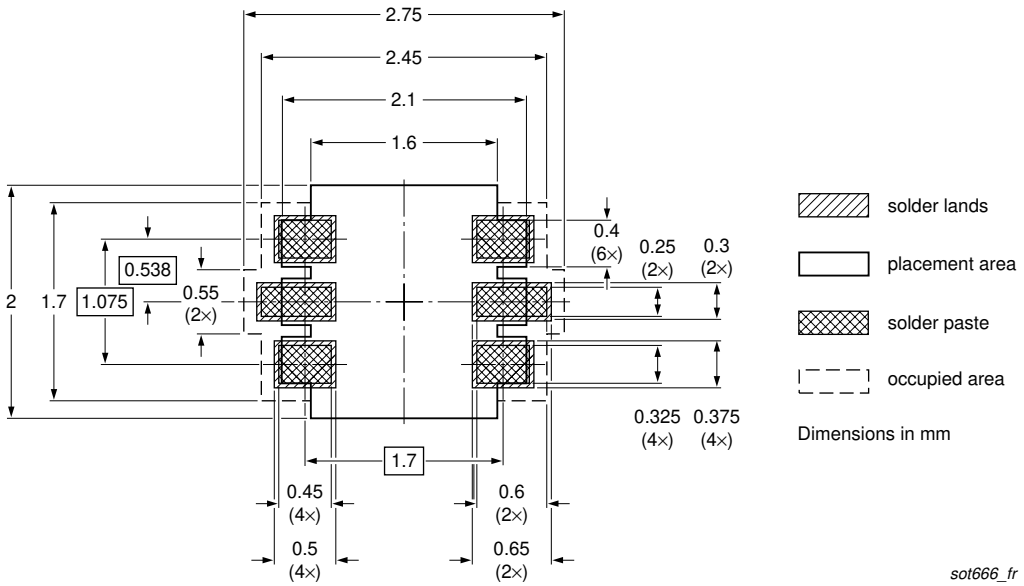
| Type number | Package | Description | Packing quantity | | | |
|---|---|---|---|---|---|---|
| | | | 3000 | 4000 | 8000 | 10000 |
| BCM847BV | SOT666 | 2 mm pitch, 8 mm tape and reel | - | - | -315 | - |
| | | 4 mm pitch, 8 mm tape and reel | - | -115 | - | - |
| BCM847BS | SOT363 | 4 mm pitch, 8 mm tape and reel; T1 [2] | -115 | - | - | -135 |
| | | 4 mm pitch, 8 mm tape and reel; T2 [3] | -125 | - | - | -165 |
| BCM847DS | 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 14.

[2] T1: normal taping

[3] T2: reverse taping

## 11. Soldering




Reflow soldering is the only recommended soldering method.

**Fig 14. Reflow soldering footprint SOT666**

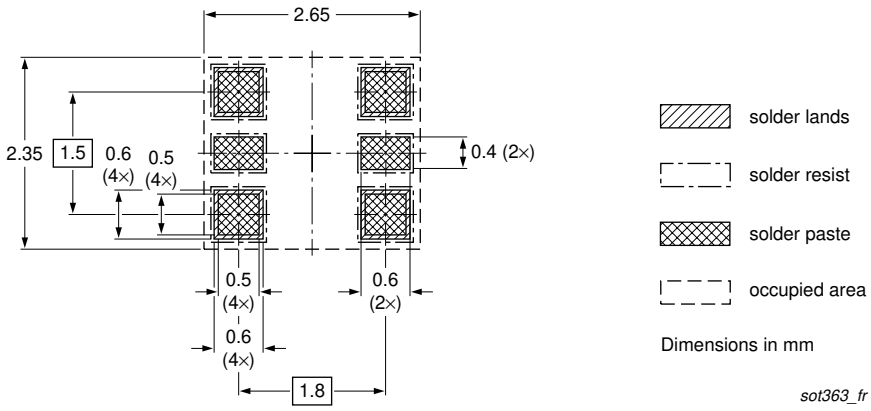



**Fig 15. Reflow soldering footprint SOT363 (SC-88)**

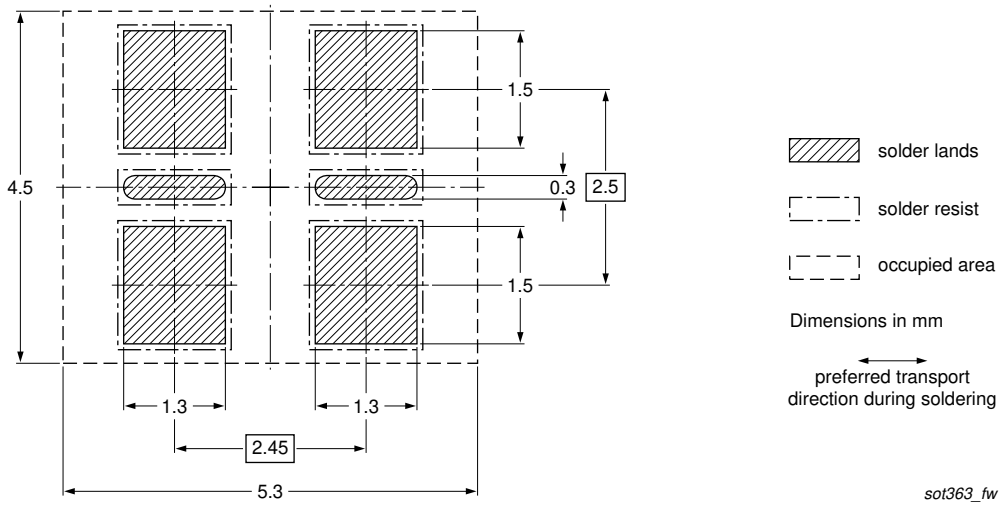
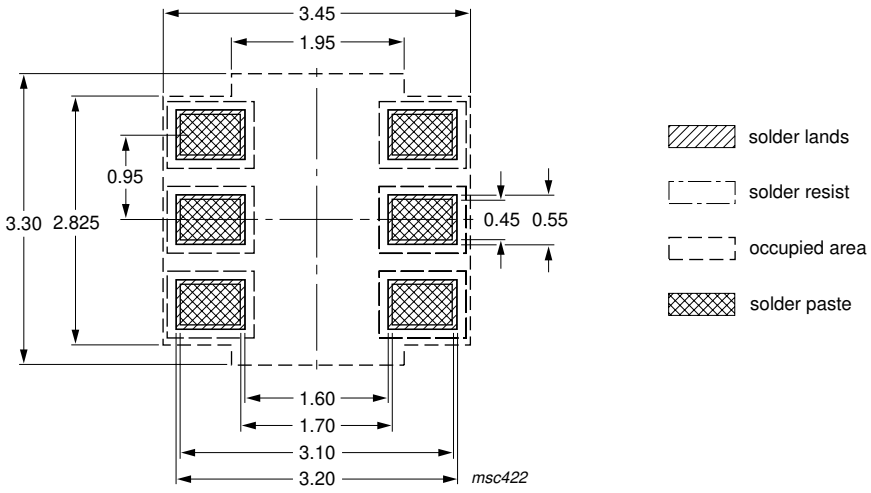
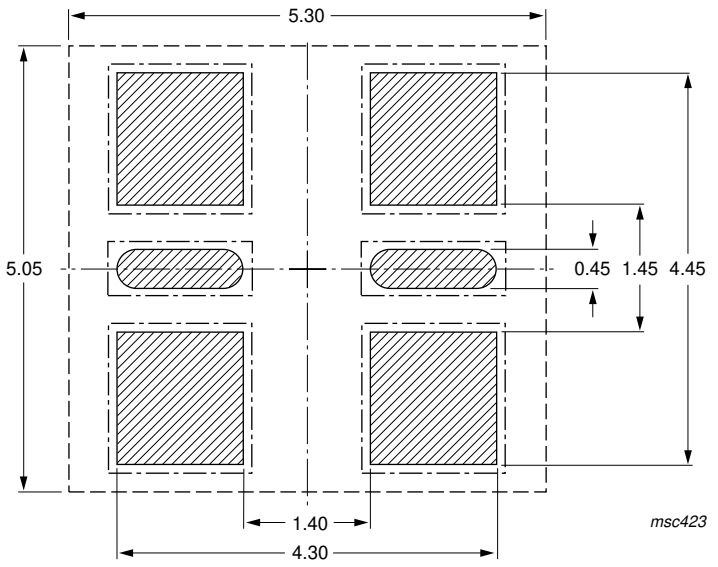



**Fig 16. Wave soldering footprint SOT363 (SC-88)**




Dimensions in mm

**Fig 17. Reflow soldering footprint SOT457 (SC-74)**




Dimensions in mm

**Fig 18. Wave soldering footprint SOT457 (SC-74)**

## 12. Revision history

**Table 10. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BCM847BV_BS_DS_6 | 20090828 | Product data sheet | - | BCM847BV_BS_DS_5 |
| Modifications: | • This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content.<br>• Figure 12 “Package outline SOT363 (SC-88)”: updated<br>• Figure 14 “Reflow soldering footprint SOT666”: updated<br>• Figure 15 “Reflow soldering footprint SOT363 (SC-88)”: updated<br>• Figure 16 “Wave soldering footprint SOT363 (SC-88)”: updated<br>• Figure 18 “Wave soldering footprint SOT457 (SC-74)”: updated | | | |
| BCM847BV_BS_DS_5 | 20060627 | Product data sheet | - | BCM847BS_DS_4 |
| BCM847BS_DS_4 | 20060216 | Product data sheet | - | BCM847BS_DS_3 |
| BCM847BS_DS_3 | 20060123 | Product data sheet | - | BCM847BS_2 |
| BCM847BS_2 | 20050406 | Product data sheet | - | BCM847BS_1 |
| BCM847BS_1 | 20040914 | Product data sheet | - | - |

# 13. Legal information

## 13.1 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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# 14. Contact information

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## 15. Contents





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