



# BCM56DS

80 V, 1 A NPN/NPN matched double transistors

10 April 2018

Product data sheet

## 1. General description

NPN/NPN matched double transistors in a small SOT457 (SC-74) Surface-Mounted Device (SMD) plastic package.

PNP/PNP complement: BCM53DS

## 2. Features and benefits

- High collector current capability  $I_C$  and  $I_{CM}$
- Reduces component count
- Reduces pick and place costs
- Current gain matching 5%
- Application-optimized pinout
- AEC-Q101 qualified

## 3. Applications

- Current mirror
- Differential amplifier
- Linear voltage regulators
- MOSFET drivers
- High-side switches
- Power management
- Amplifiers

## 4. Quick reference data

Table 1. Quick reference data

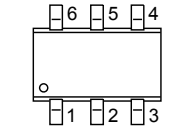
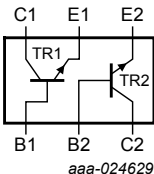
| Symbol                | Parameter                 | Conditions                                        | Min  | Typ | Max  | Unit |
|-----------------------|---------------------------|---------------------------------------------------|------|-----|------|------|
| <b>Per transistor</b> |                           |                                                   |      |     |      |      |
| $V_{CEO}$             | collector-emitter voltage | open base                                         | -    | -   | 80   | V    |
| $I_C$                 | collector current         |                                                   | -    | -   | 1    | A    |
| $I_{CM}$              | peak collector current    | single pulse; $t_p \leq 1$ ms                     | -    | -   | 2    | A    |
| $h_{FE}$              | DC current gain           | $V_{CE} = 2$ V; $I_C = 150$ mA; $T_{amb} = 25$ °C | [1]  | 63  | -    | 250  |
| <b>Per device</b>     |                           |                                                   |      |     |      |      |
| $h_{FE1}/h_{FE2}$     | DC current gain matching  | $V_{CE} = 5$ V; $I_C = 2$ mA; $T_{amb} = 25$ °C   | 0.95 | 1   | 1.05 |      |

| Symbol            | Parameter                     | Conditions |     | Min | Typ | Max | Unit |
|-------------------|-------------------------------|------------|-----|-----|-----|-----|------|
| $V_{BE1}-V_{BE2}$ | base-emitter voltage matching |            | [2] | -   | -   | 2   | mV   |

[1] Pulse test:  $t_p \leq 300 \mu s$ ;  $\delta \leq 0.02$   
[2] The smaller of the two values is subtracted from the larger value.

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description   | Simplified outline                                                                                  | Graphic symbol                                                                                    |
|-----|--------|---------------|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 1   | B1     | base TR1      | <br>TSOP6 (SOT457) | <br>aaa-024629 |
| 2   | B2     | base TR2      |                                                                                                     |                                                                                                   |
| 3   | C2     | collector TR2 |                                                                                                     |                                                                                                   |
| 4   | E2     | emitter TR2   |                                                                                                     |                                                                                                   |
| 5   | E1     | emitter TR1   |                                                                                                     |                                                                                                   |
| 6   | C1     | collector TR1 |                                                                                                     |                                                                                                   |

6. Ordering information

Table 3. Ordering information

| Type number | Package |                                          |         |
|-------------|---------|------------------------------------------|---------|
|             | Name    | Description                              | Version |
| BCM56DS     | TSOP6   | plastic, surface-mounted package (SC-74) | SOT457  |

7. Marking

Table 4. Marking codes

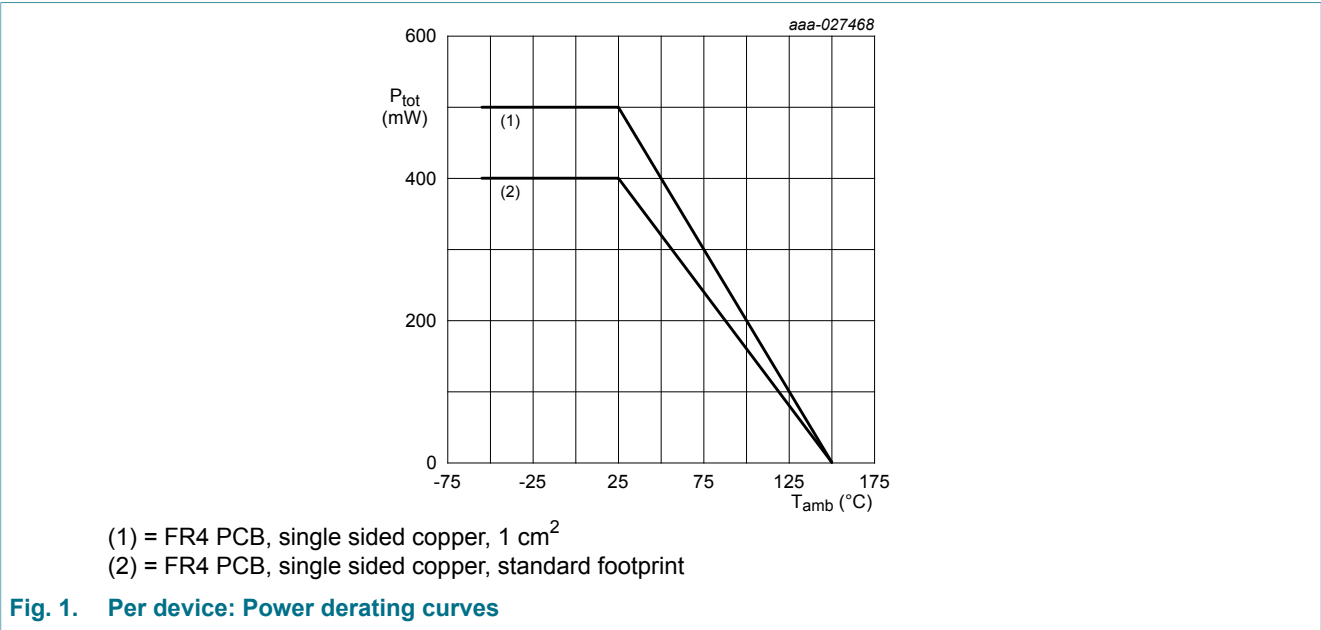
| Type number | Marking code |
|-------------|--------------|
| BCM56DS     | 3D           |

8. Limiting values

Table 5. Limiting values  
In accordance with the Absolute Maximum Rating System (IEC60134).

| Symbol            | Parameter                 | Conditions                          |     | Min | Max | Unit |
|-------------------|---------------------------|-------------------------------------|-----|-----|-----|------|
| Per transistor    |                           |                                     |     |     |     |      |
| V <sub>CBO</sub>  | collector-base voltage    | open emitter                        |     | -   | 100 | V    |
| V <sub>CEO</sub>  | collector-emitter voltage | open base                           |     | -   | 80  | V    |
| V <sub>EBO</sub>  | emitter-base voltage      | open collector                      |     | -   | 5   | V    |
| I <sub>C</sub>    | collector current         |                                     |     | -   | 1   | A    |
| I <sub>CM</sub>   | peak collector current    | single pulse; t <sub>p</sub> ≤ 1 ms |     | -   | 2   | A    |
| I <sub>Blim</sub> | limiting base current     |                                     |     | -   | 0.2 | A    |
| I <sub>BM</sub>   | peak base current         | single pulse; t <sub>p</sub> ≤ 1 ms |     | -   | 0.3 | A    |
| P <sub>tot</sub>  | total power dissipation   | T <sub>amb</sub> ≤ 25 °C            | [1] | -   | 270 | mW   |
|                   |                           |                                     | [2] | -   | 320 | mW   |
| Per device        |                           |                                     |     |     |     |      |
| P <sub>tot</sub>  | total power dissipation   | T <sub>amb</sub> ≤ 25 °C            | [1] | -   | 400 | mW   |
|                   |                           |                                     | [2] | -   | 500 | mW   |
| T <sub>j</sub>    | junction temperature      |                                     |     | -   | 150 | °C   |
| T <sub>amb</sub>  | ambient temperature       |                                     |     | -55 | 150 | °C   |
| T <sub>stg</sub>  | storage temperature       |                                     |     | -65 | 150 | °C   |

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.  
[2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.

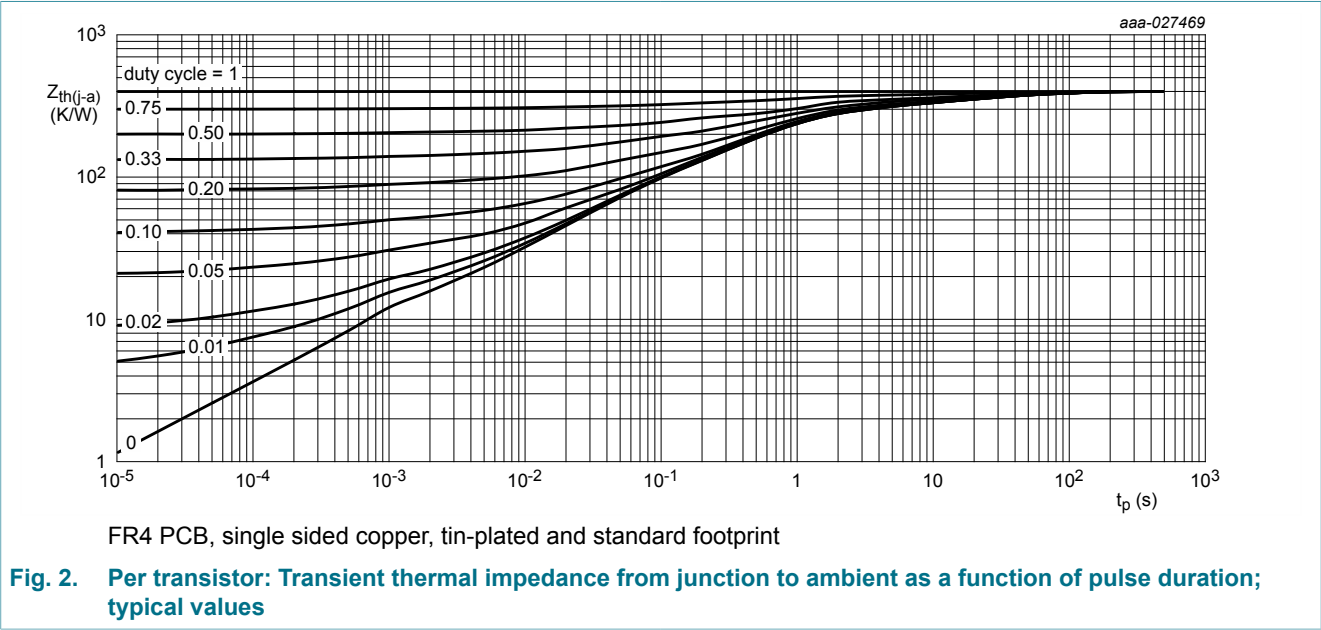


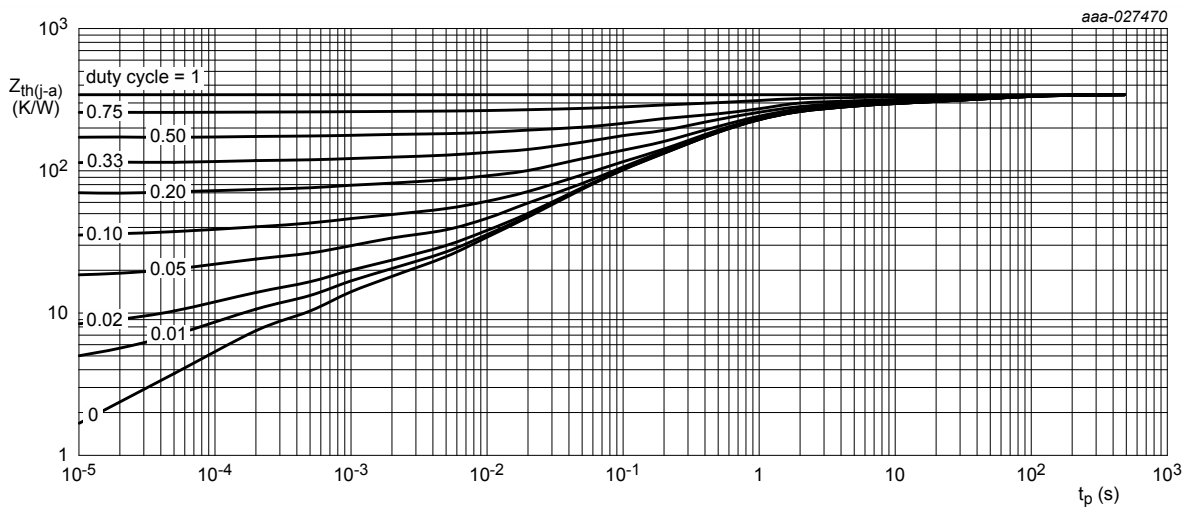
9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol                | Parameter                                        | Conditions  |     | Min | Typ | Max | Unit |
|-----------------------|--------------------------------------------------|-------------|-----|-----|-----|-----|------|
| Per transistor        |                                                  |             |     |     |     |     |      |
| R <sub>th(j-a)</sub>  | thermal resistance from junction to ambient      | in free air | [1] | -   | -   | 463 | K/W  |
|                       |                                                  |             | [2] | -   | -   | 391 | K/W  |
| R <sub>th(j-sp)</sub> | thermal resistance from junction to solder point |             |     | -   | -   | 150 | K/W  |
| Per device            |                                                  |             |     |     |     |     |      |
| R <sub>th(j-a)</sub>  | thermal resistance from junction to ambient      | in free air | [1] | -   | -   | 313 | K/W  |
|                       |                                                  |             | [2] | -   | -   | 250 | K/W  |

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.  
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.





**Fig. 3. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

## 10. Characteristics

Table 7. Characteristics

| Symbol                | Parameter                            | Conditions                                                                                                                        |     | Min  | Typ | Max  | Unit          |
|-----------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|------|---------------|
| <b>Per transistor</b> |                                      |                                                                                                                                   |     |      |     |      |               |
| $V_{(BR)CBO}$         | collector-base breakdown voltage     | $I_C = 100\ \mu\text{A}$ ; $I_E = 0\ \text{A}$                                                                                    |     | 100  | -   | -    | V             |
| $V_{(BR)CEO}$         | collector-emitter breakdown voltage  | $I_C = 2\ \text{mA}$ ; $I_B = 0\ \text{A}$                                                                                        |     | 80   | -   | -    | V             |
| $V_{(BR)EBO}$         | emitter-base breakdown voltage       | $I_C = 0\ \text{A}$ ; $I_E = 100\ \mu\text{A}$                                                                                    |     | 5    | -   | -    | V             |
| $I_{CBO}$             | collector-base cut-off current       | $V_{CB} = 30\ \text{V}$ ; $I_E = 0\ \text{A}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                             |     | -    | -   | 100  | nA            |
|                       |                                      | $V_{CB} = 30\ \text{V}$ ; $I_E = 0\ \text{A}$ ; $T_j = 150\ ^\circ\text{C}$                                                       |     | -    | -   | 10   | $\mu\text{A}$ |
| $I_{EBO}$             | emitter-base cut-off current         | $V_{EB} = 5\ \text{V}$ ; $I_C = 0\ \text{A}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                              |     | -    | -   | 100  | nA            |
| $h_{FE}$              | DC current gain                      | $V_{CE} = 5\ \text{V}$ ; $I_C = 2\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                             |     | 63   | -   | -    |               |
|                       |                                      | $V_{CE} = 2\ \text{V}$ ; $I_C = 150\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$ [1]                                       |     | 63   | -   | 250  |               |
|                       |                                      | $V_{CE} = 2\ \text{V}$ ; $I_C = 500\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$ [1]                                       |     | 40   | -   | -    |               |
| $V_{CEsat}$           | collector-emitter saturation voltage | $I_C = 500\ \text{mA}$ ; $I_B = 50\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$ [1]                                        |     | -    | -   | 500  | mV            |
| $V_{BE}$              | base-emitter voltage                 | $V_{CE} = 2\ \text{V}$ ; $I_C = 500\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$ [1]                                       |     | -    | -   | 1    | V             |
| $C_c$                 | collector capacitance                | $V_{CB} = 10\ \text{V}$ ; $I_E = 0\ \text{A}$ ; $i_e = 0\ \text{A}$ ; $f = 1\ \text{MHz}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$ |     | -    | 4.5 | -    | pF            |
| $f_T$                 | transition frequency                 | $V_{CE} = 5\ \text{V}$ ; $I_C = 50\ \text{mA}$ ; $f = 100\ \text{MHz}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                    |     | 100  | 155 | -    | MHz           |
| <b>Per device</b>     |                                      |                                                                                                                                   |     |      |     |      |               |
| $h_{FE1}/h_{FE2}$     | DC current gain matching             | $V_{CE} = 5\ \text{V}$ ; $I_C = 2\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                             |     | 0.95 | 1   | 1.05 |               |
| $V_{BE1}-V_{BE2}$     | base-emitter voltage matching        |                                                                                                                                   | [2] | -    | -   | 2    | mV            |

[1] Pulse test:  $t_p \leq 300\ \mu\text{s}$ ;  $\delta \leq 0.02$

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

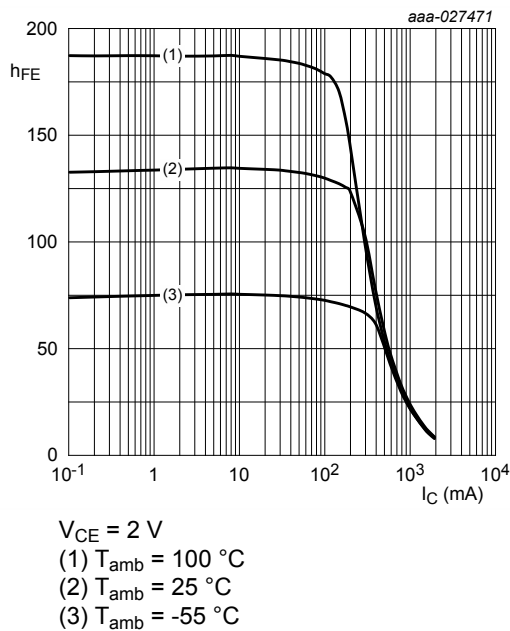


Fig. 4. DC current gain as a function of collector current; typical values

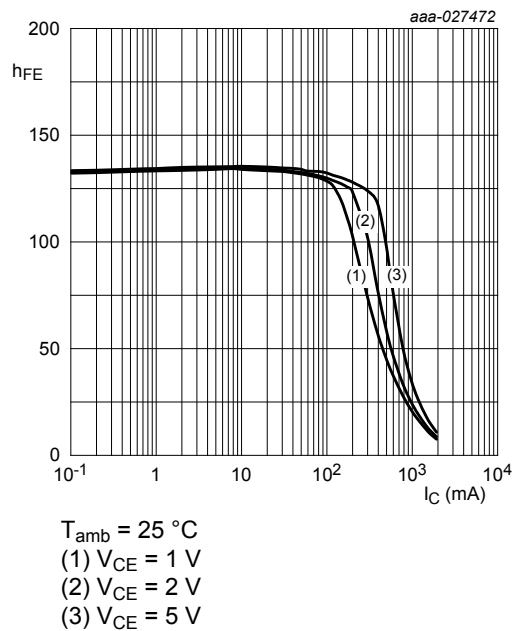


Fig. 5. DC current gain as a function of collector current; typical values

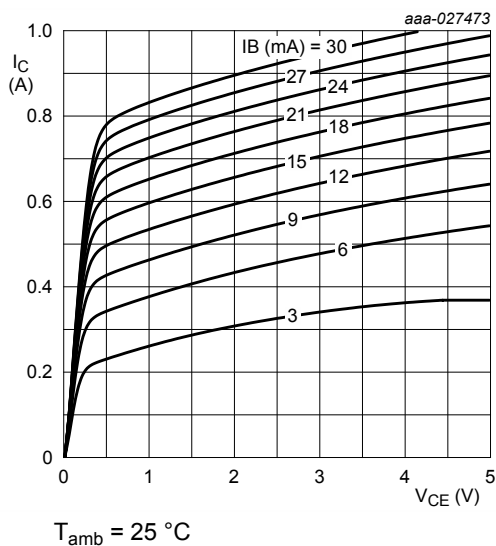


Fig. 6. Collector current as a function of collector-emitter voltage; typical values

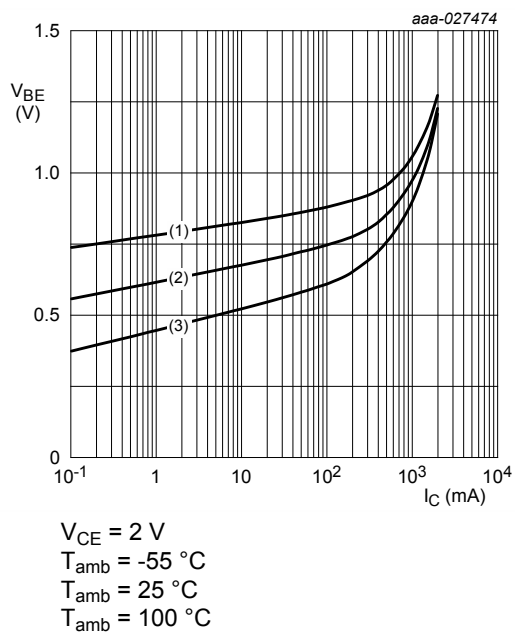
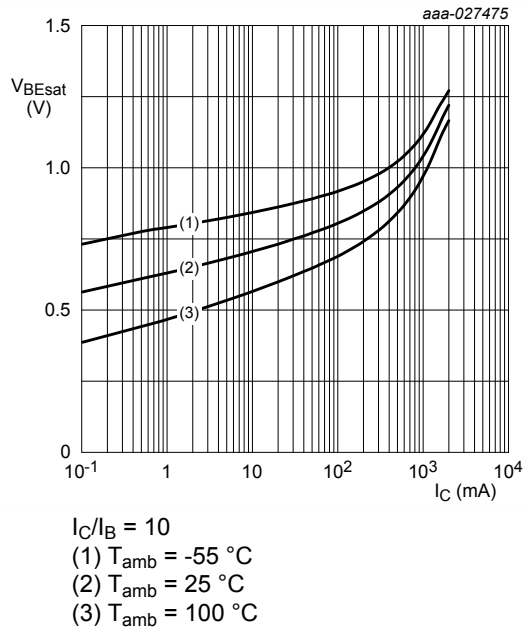
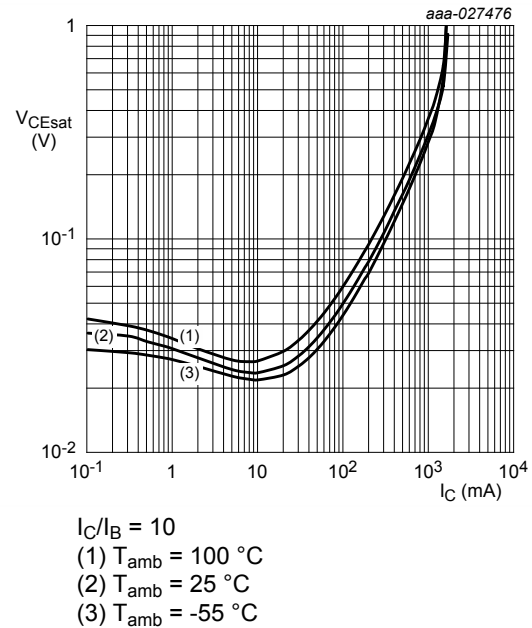


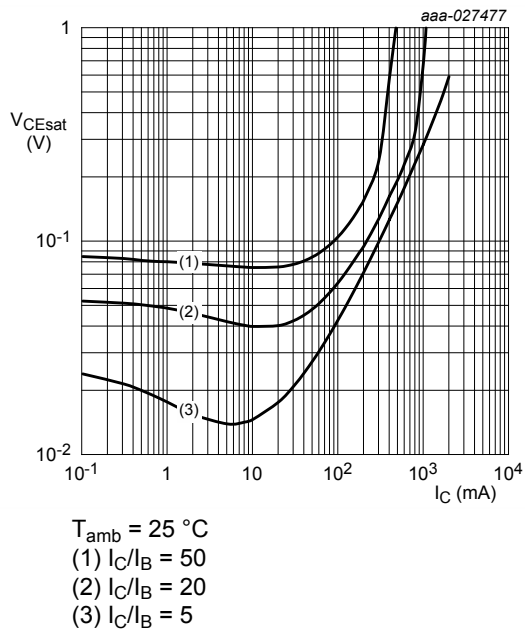
Fig. 7. Base-emitter voltage as a function of collector current; typical values



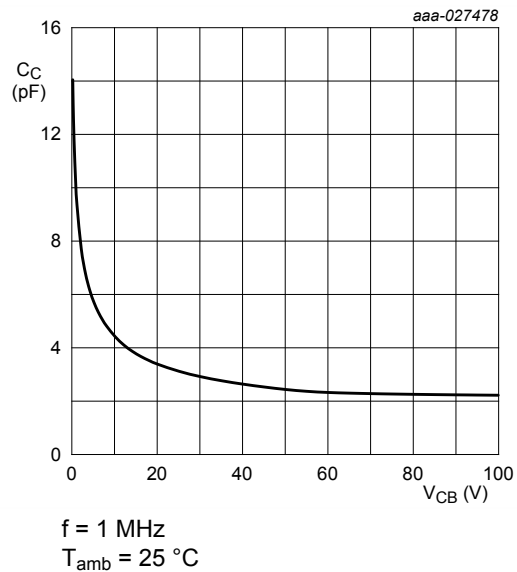
**Fig. 8. Base-emitter saturation voltage as a function of collector current; typical values**



**Fig. 9. Collector-emitter saturation voltage as a function of collector current; typical values**



**Fig. 10. Collector-emitter saturation voltage as a function of collector current; typical values**



**Fig. 11. Collector capacitance as a function of collector-base voltage; typical values**

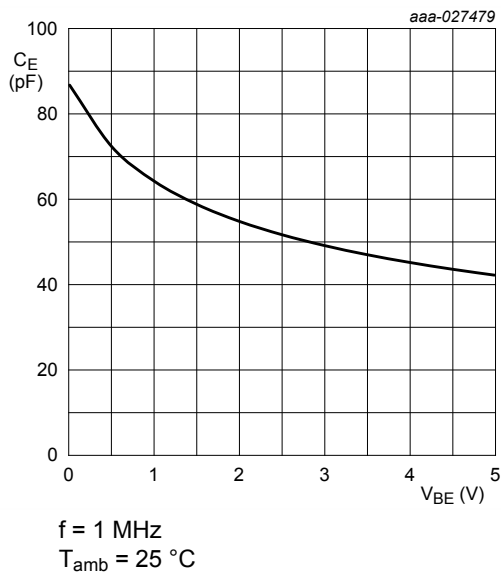


Fig. 12. Emitter capacitance as a function of emitter-base voltage; typical values

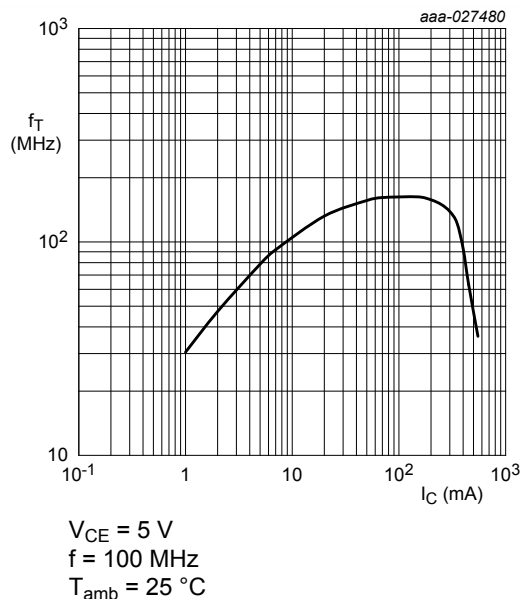


Fig. 13. Transition frequency as a function of collector current; typical values

11. Test information

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.

12. Package outline

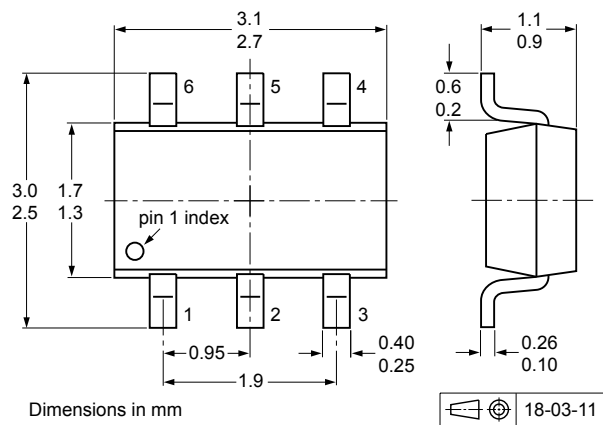


Fig. 14. Package outline TSOP6 (SOT457)

13. Soldering

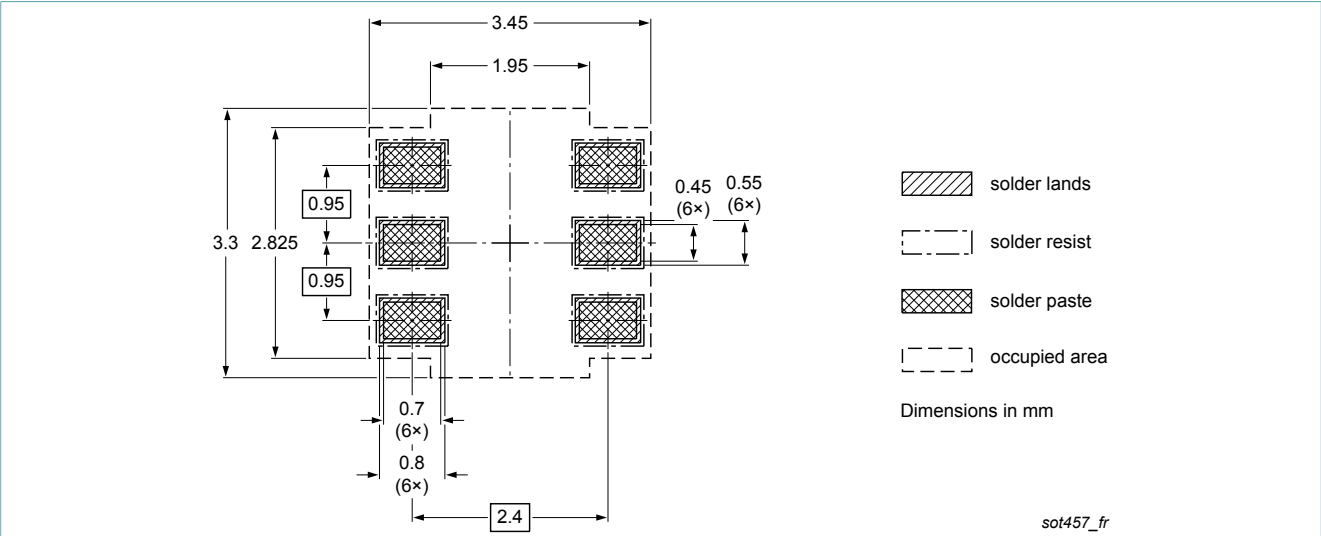


Fig. 15. Reflow soldering footprint for TSOP6 (SOT457)

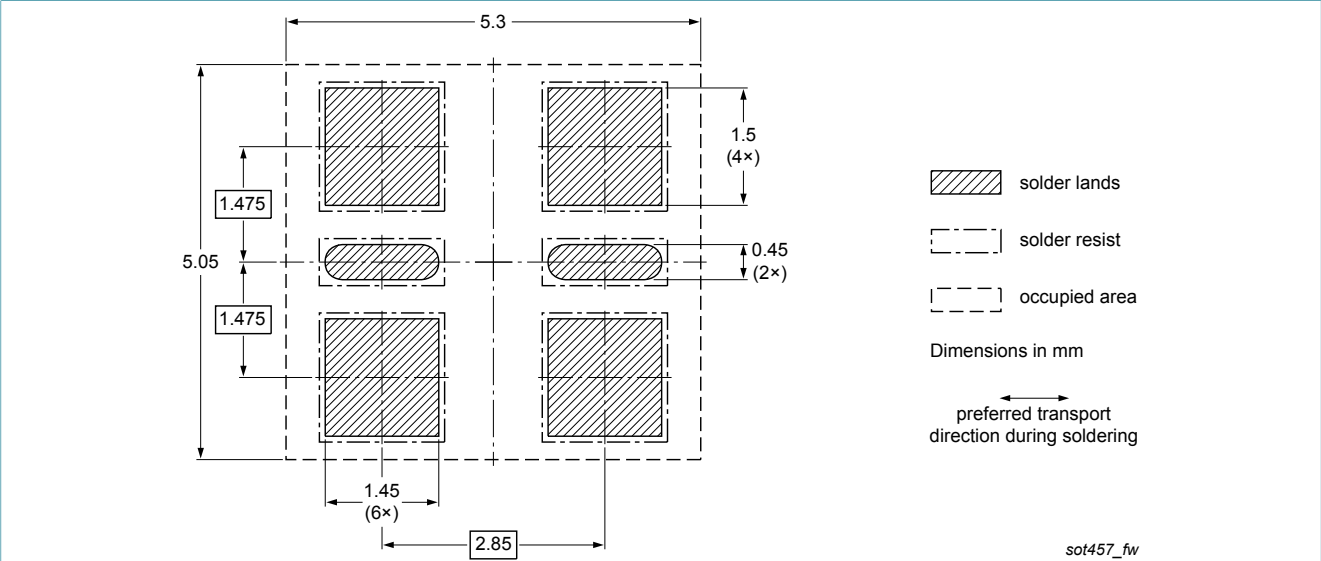


Fig. 16. Wave soldering footprint for TSOP6 (SOT457)

## 14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status  | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| BCM56DS v.1   | 20180410     | Product data sheet | -             | -          |

## 15. Legal information

### 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.                                     |

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