# BC847/BC547 series

## 45 V, 100 mA NPN general-purpose transistors

Rev. 06 — 19 May 2005 Product data sheet

## 1. Product profile

### 1.1 General description

NPN general-purpose transistors.

**Table 1: Product overview**

| Type number [1] | Package | | PNP complement |
|---|---|---|---|
| | Philips | JEITA | |
| BC847 | SOT23 | - | BC857 |
| BC847W | SOT323 | SC-70 | BC857W |
| BC847T | SOT416 | SC-75 | BC857T |
| BC847AM | SOT883 | SC-101 | BC857AM |
| BC847BM | SOT883 | SC-101 | BC857BM |
| BC847CM | SOT883 | SC-101 | BC857CM |
| BC547 [2] | SOT54 | SC-43A | BC557 |

[1] Valid for all available selection groups.

[2] Also available in SOT54A and SOT54 variant packages (see Section 2).

### 1.2 Features

- Low current
- Low voltage
- Three different gain selections

### 1.3 Applications

- General-purpose switching and amplification

### 1.4 Quick reference data

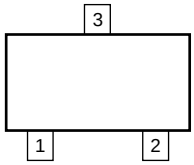
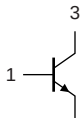
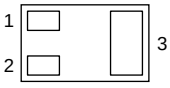
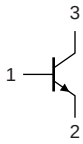
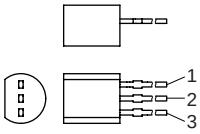
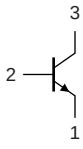
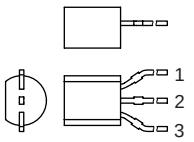
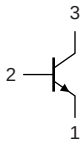
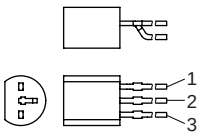
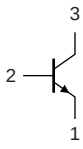
**Table 2: Quick reference data**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CEO}$ | collector-emitter voltage | open base | - | - | 45 | V |
| $I_C$ | collector current (DC) | | - | - | 100 | mA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 5 V; $I_C$ = 2 mA | 110 | - | 800 | |
| | $h_{FE}$ group A | | 110 | 180 | 220 | |
| | $h_{FE}$ group B | | 200 | 290 | 450 | |
| | $h_{FE}$ group C | | 420 | 520 | 800 | |

PHILIPS

## 2. Pinning information

**Table 3: Pinning**

| Pin | Description | Simplified outline | Symbol |
|---|---|---|---|
| **SOT23, SOT323, SOT416** | | | |
| 1 | base |   006aaa144 |   sym021 |
| 2 | emitter | | |
| 3 | collector | | |
| **SOT883** | | | |
| 1 | base |   Transparent top view |   sym021 |
| 2 | emitter | | |
| 3 | collector | | |
| **SOT54** | | | |
| 1 | emitter |   001aab347 |   sym026 |
| 2 | base | | |
| 3 | collector | | |
| **SOT54A** | | | |
| 1 | emitter |   001aab348 |   sym026 |
| 2 | base | | |
| 3 | collector | | |
| **SOT54 variant** | | | |
| 1 | emitter |   001aab447 |   sym026 |
| 2 | base | | |
| 3 | collector | | |

## 3. Ordering information

**Table 4: Ordering information**

| Type number [1] | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BC847 | - | plastic surface mounted package; 3 leads | SOT23 |
| BC847W | SC-70 | plastic surface mounted package; 3 leads | SOT323 |
| BC847T | SC-75 | plastic surface mounted package; 3 leads | SOT416 |
| BC847AM | SC-101 | leadless ultra small plastic package; 3 solder lands; body 1.0 × 0.6 × 0.5 mm | SOT883 |
| BC847BM | | | |
| BC847CM | | | |
| BC547 [2] | SC-43A | plastic single-ended leaded (through hole) package; 3 leads | SOT54 |

[1] Valid for all available selection groups.

[2] Also available in SOT54 and SOT54 variant packages (see Section 2 and Section 9).

## 4. Marking

**Table 5: Marking codes**

| Type number | Marking code [1] | Type number | Marking code [1] |
|---|---|---|---|
| BC847 | 1H* | BC847AT | 1E |
| BC847A | 1E* | BC847BT | 1F |
| BC847B | 1F* | BC847CT | 1G |
| BC847C | 1G* | BC847AM | D4 |
| BC847W | 1H* | BC847BM | D5 |
| BC847AW | 1E* | BC847CM | D6 |
| BC847BW | 1F* | BC547 | C547 |
| BC847CW | 1G* | BC547B | C547B |
| BC847T | 1N | BC547C | C547C |

[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 |
|---|---|---|---|---|---|---|
| $V_{CBO}$ | 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 (DC) | | | - | 100 | mA |
| $I_{CM}$ | peak collector current | single pulse; $t_p \leq 1$ ms | | - | 200 | mA |
| $I_{BM}$ | peak base current | single pulse; $t_p \leq 1$ ms | | - | 100 | mA |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C | | | | |
| | SOT23 | | [1] | - | 250 | mW |
| | SOT323 | | [1] | - | 200 | mW |
| | SOT416 | | [1] | - | 150 | mW |
| | SOT883 | | [2] [3] | - | 250 | mW |
| | SOT54 | | [1] | - | 500 | mW |
| $T_{stg}$ | storage temperature | | | –65 | +150 | °C |
| $T_j$ | junction temperature | | | - | 150 | °C |
| $T_{amb}$ | ambient 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.

[3] Device mounted on an FR4 PCB with 60 µm copper strip line, standard footprint.

## 6. Thermal characteristics

**Table 7: Thermal characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | | | | | |
| | SOT23 | | [1] | - | - | 500 | K/W |
| | SOT323 | | [1] | - | - | 625 | K/W |
| | SOT416 | | [1] | - | - | 833 | K/W |
| | SOT883 | | [2] [3] | - | - | 500 | K/W |
| | SOT54 | | [1] | - | - | 250 | 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.

[3] Device mounted on an FR4 PCB with 60 µm copper strip line, standard footprint.

## 7. Characteristics

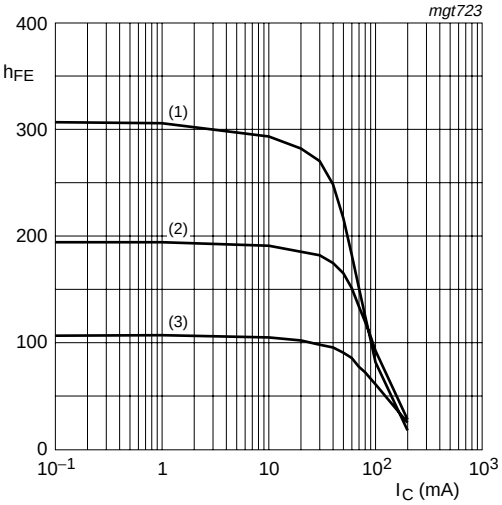
**Table 8: Characteristics**

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

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $I_{CBO}$ | 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; $I_E$ = 0 A | | - | - | 100 | nA |
| $h_{FE}$ | DC current gain | | | | | | |
| | $h_{FE}$ group A | $V_{CE}$ = 5 V; $I_C$ = 10 µA | | - | 90 | - | |
| | $h_{FE}$ group B | $V_{CE}$ = 5 V; $I_C$ = 10 µA | | - | 150 | - | |
| | $h_{FE}$ group C | $V_{CE}$ = 5 V; $I_C$ = 10 µA | | - | 270 | - | |
| | DC current gain | $V_{CE}$ = 5 V; $I_C$ = 2 mA | | 110 | - | 800 | |
| | $h_{FE}$ group A | $V_{CE}$ = 5 V; $I_C$ = 2 mA | | 110 | 180 | 220 | |
| | $h_{FE}$ group B | $V_{CE}$ = 5 V; $I_C$ = 2 mA | | 200 | 290 | 450 | |
| | $h_{FE}$ group C | $V_{CE}$ = 5 V; $I_C$ = 2 mA | | 420 | 520 | 800 | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 10 mA; $I_B$ = 0.5 mA | | - | 90 | 200 | mV |
| | | $I_C$ = 100 mA; $I_B$ = 5 mA | [1] | - | 200 | 400 | mV |
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C$ = 10 mA; $I_B$ = 0.5 mA | [2] | - | 700 | - | mV |
| | | $I_C$ = 100 mA; $I_B$ = 5 mA | [2] | - | 900 | - | mV |
| $V_{BE}$ | base-emitter voltage | $I_C$ = 2 mA; $V_{CE}$ = 5 V | [2] | 580 | 660 | 700 | mV |
| | | $I_C$ = 10 mA; $V_{CE}$ = 5 V | | - | - | 770 | mV |
| $C_c$ | collector capacitance | $I_E = i_e$ = 0 A; $V_{CB}$ = 10 V; f = 1 MHz | | - | - | 1.5 | pF |
| $C_e$ | emitter capacitance | $I_C = i_c$ = 0 A; $V_{EB}$ = 0.5 V; f = 1 MHz | | - | 11 | - | pF |
| $f_T$ | transition frequency | $I_C$ = 10 mA; $V_{CE}$ = 5 V; f = 100 MHz | | 100 | - | - | MHz |
| F | noise figure | $I_C$ = 200 µA; $V_{CE}$ = 5 V; $R_S$ = 2 kΩ; f = 1 kHz; B = 200 Hz | | - | 2 | 10 | dB |

[1] Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

[2] $V_{BE}$ decreases by approximately 2 mV/K with increasing temperature.



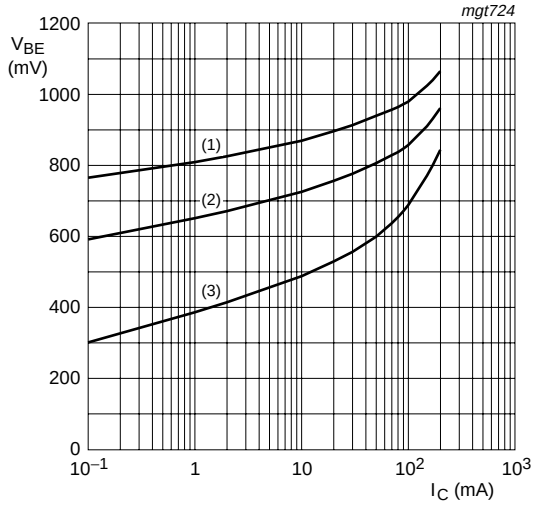

$V_{CE}$ = 5 V

(1) $T_{amb}$ = 150 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = –55 °C

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



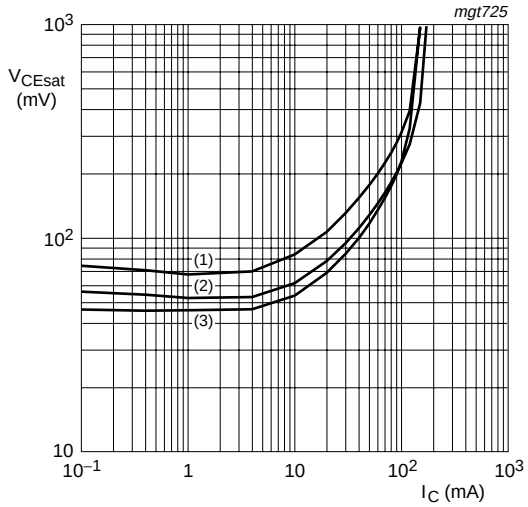

$V_{CE}$ = 5 V

(1) $T_{amb}$ = –55 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 150 °C

**Fig 2. Selection A: Base-emitter voltage as a function of collector current; typical values**



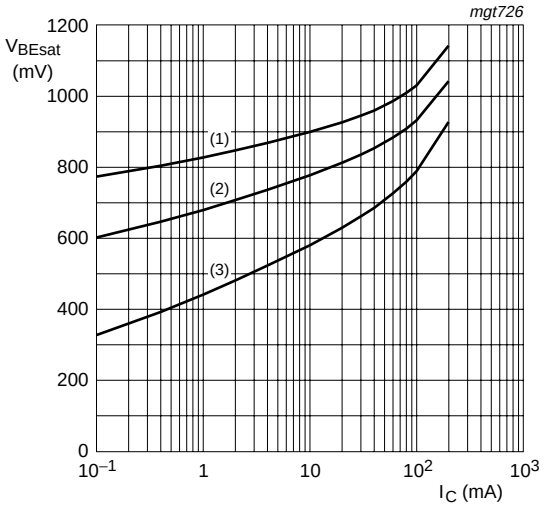

$I_C/I_B$ = 20

(1) $T_{amb}$ = 150 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = –55 °C

**Fig 3. Selection A: Collector-emitter saturation voltage as a function of collector current; typical values**



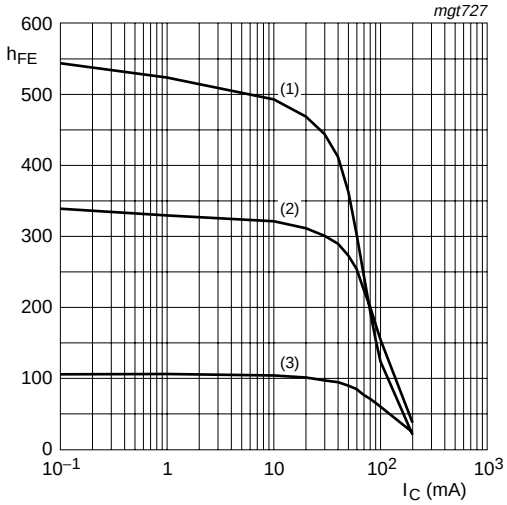

$I_C/I_B$ = 10

(1) $T_{amb}$ = –55 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 150 °C

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



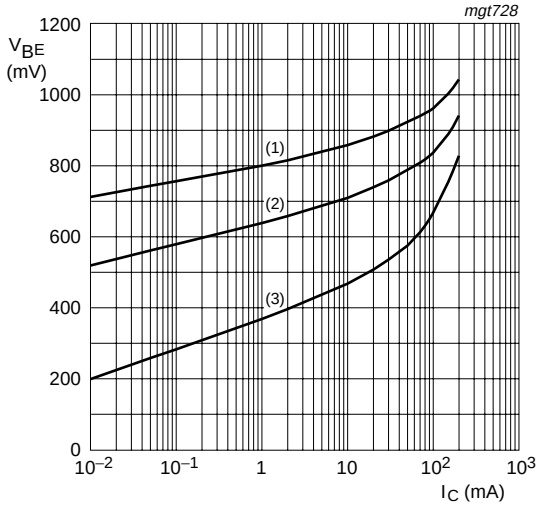

$V_{CE}$ = 5 V

(1) $T_{amb}$ = 150 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = –55 °C

**Fig 5. Selection B: DC current gain as a function of collector current; typical values**



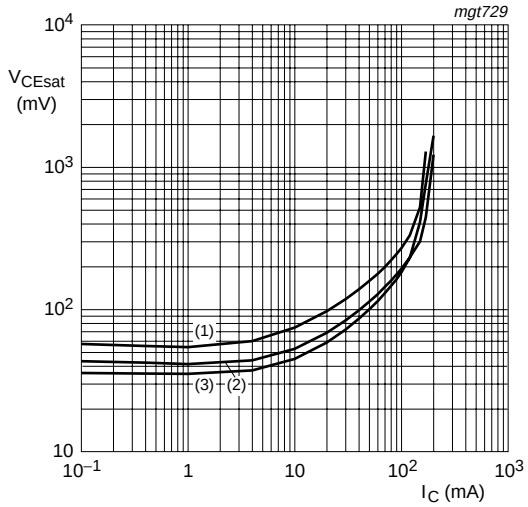

$V_{CE}$ = 5 V

(1) $T_{amb}$ = –55 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 150 °C

**Fig 6. Selection B: Base-emitter voltage as a function of collector current; typical values**



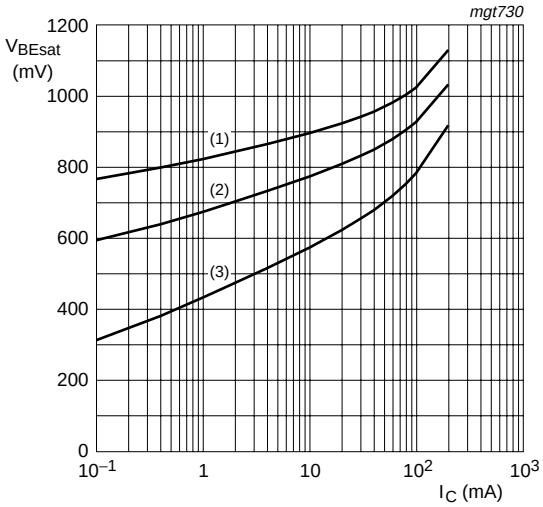

$I_C/I_B$ = 20

(1) $T_{amb}$ = 150 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = –55 °C

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



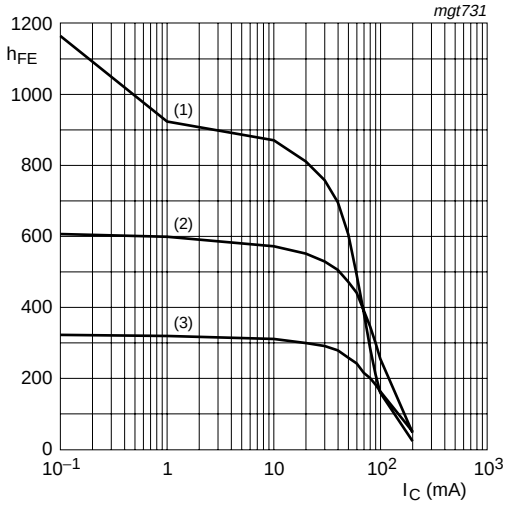

$I_C/I_B$ = 10

(1) $T_{amb}$ = –55 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 150 °C

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



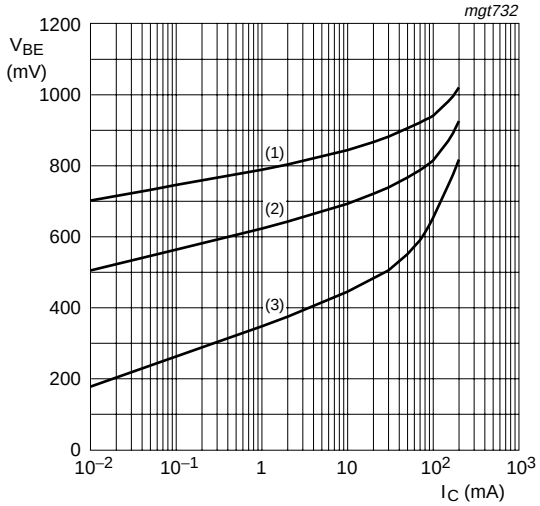

$V_{CE}$ = 5 V

(1) $T_{amb}$ = 150 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = –55 °C

**Fig 9. Selection C: DC current gain as a function of collector current; typical values**



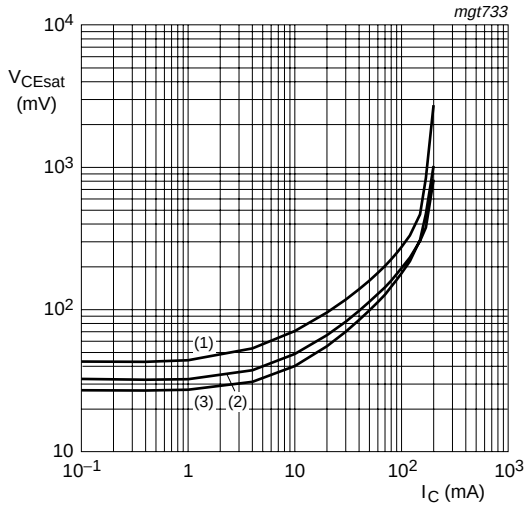

$V_{CE}$ = 5 V

(1) $T_{amb}$ = –55 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 150 °C

**Fig 10. Selection C: Base-emitter voltage as a function of collector current; typical values**



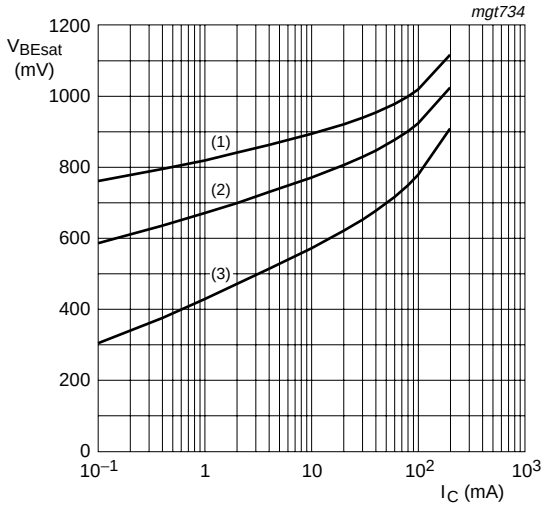

$I_C/I_B$ = 20

(1) $T_{amb}$ = 150 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = –55 °C

**Fig 11. Selection C: Collector-emitter saturation voltage as a function of collector current; typical values**




$I_C/I_B$ = 10

(1) $T_{amb}$ = –55 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 150 °C

**Fig 12. Selection C: Base-emitter saturation voltage as a function of collector current; typical values**

## 8. Package outline

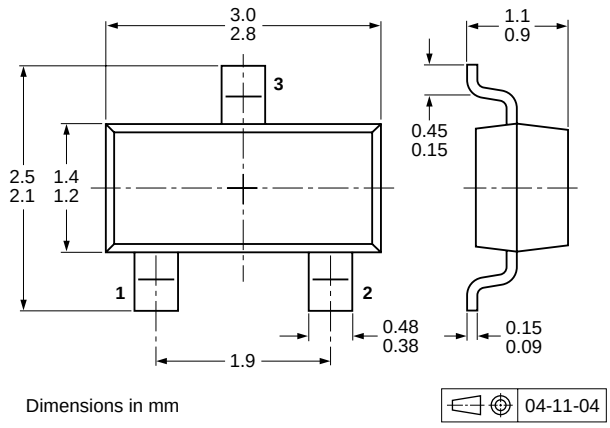



Fig 13. Package outline SOT23 (TO-236AB)

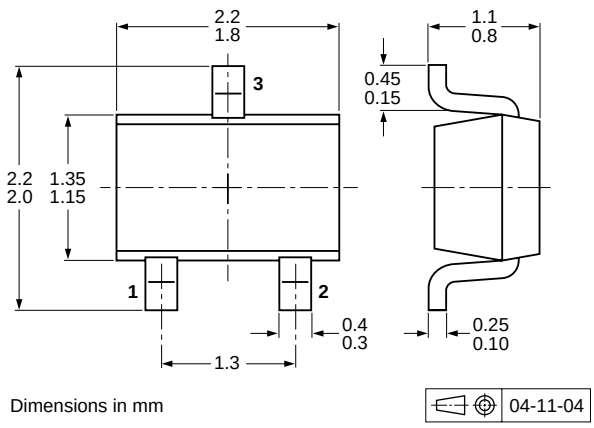



Fig 14. Package outline SOT323 (SC-70)

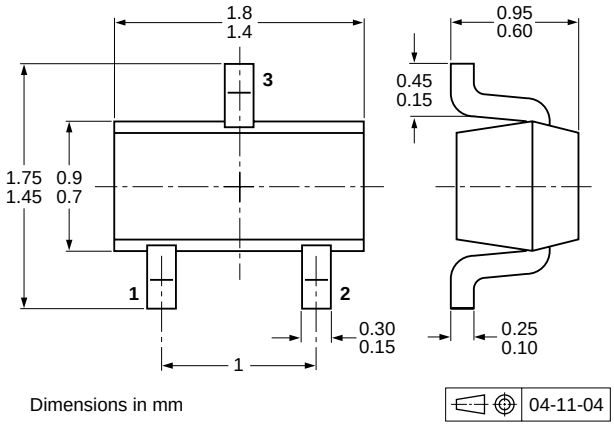



Fig 15. Package outline SOT416 (SC-75)

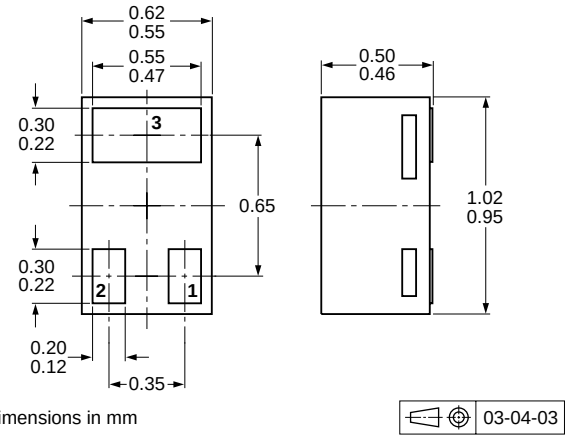



Fig 16. Package outline SOT883 (SC-101)

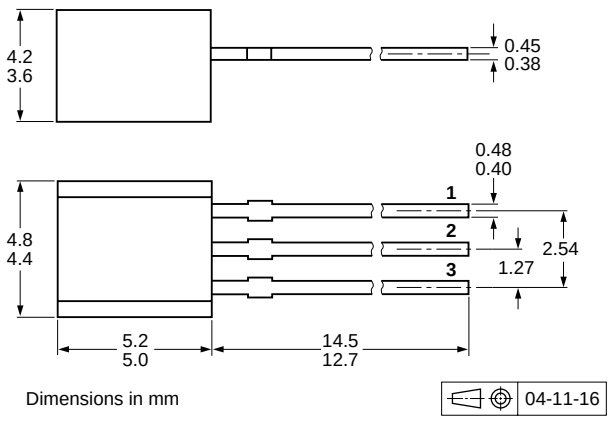



Fig 17. Package outline SOT54 (SC-43A/TO-92)

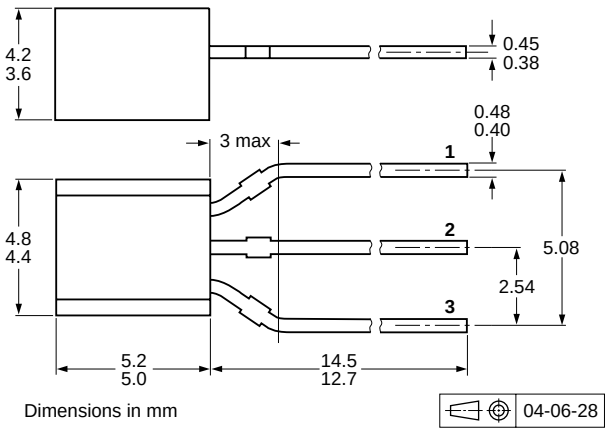



Fig 18. Package outline SOT54A

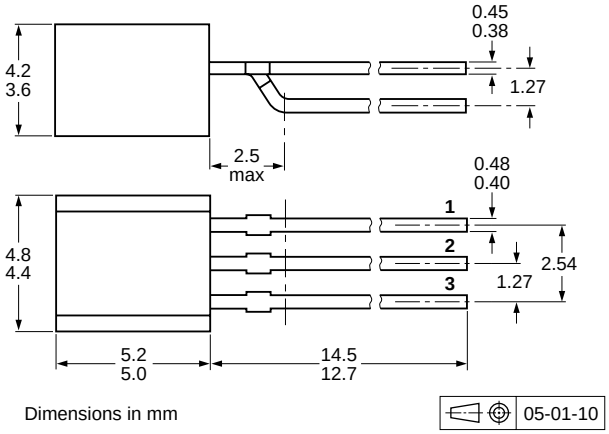



**Fig 19. Package outline SOT54 variant**

## 9. Packing information

**Table 9: Packing methods**

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

| Type number [2] | Package | Description | Packing quantity | | |
|---|---|---|---|---|---|
| | | | 3000 | 5000 | 10000 |
| BC847 | SOT23 | 4 mm pitch, 8 mm tape and reel | -215 | - | -235 |
| BC847W | SOT323 | 4 mm pitch, 8 mm tape and reel | -115 | - | -135 |
| BC847T | SOT416 | 4 mm pitch, 8 mm tape and reel | -115 | - | -135 |
| BC847AM | SOT883 | 2 mm pitch, 8 mm tape and reel | - | - | -315 |
| BC847BM | | | | | |
| BC847CM | | | | | |
| BC547 | SOT54 | bulk, straight leads | - | -412 | - |
| | SOT54A | tape and reel, wide pitch | - | - | -116 |
| | | tape ammopack, wide pitch | - | - | -126 |
| | SOT54 variant | bulk, delta pinning | - | -112 | - |

[1] For further information and the availability of packing methods, see Section 15.

[2] Valid for all available selection groups.

## 10. Revision history

**Table 10: Revision history**

| Document ID | Release date | Data sheet status | Change notice | Doc. number | Supersedes |
|---|---|---|---|---|---|
| BC847_BC547_SER_6 | 20050519 | Product data sheet | - | 9397 750 14609 | BC846_BC847_ BC848_5, BC847M_SERIES_2, BC846T_847T_ SERIES_3, BC846W_BC847W_ BC848W_4, BC546_547_4 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.<br>• This data sheet is a type combination out of the previous data sheets BC846_BC847_BC848_5, BC847M_SERIES_2, BC846T_847T_SERIES_3, BC846W_BC847W_BC848W_4 and BC546_547_4. | | | | |
| BC846_BC847_BC848_5 | 20040206 | Product specification | - | 9397 750 12395 | BC846_BC847_ BC848_4 |
| BC847M_SERIES_2 | 20040310 | Product specification | - | 9397 750 12838 | BC847M_SERIES_1 |
| BC846T_847T_SERIES_3 | 20001115 | Product specification | - | 9397 750 07524 | BC846T_847T_2 |
| BC846W_BC847W_ BC848W_4 | 20020204 | Product specification | - | 9397 750 09166 | BC846W_847W_3 |
| BC546_547_4 | 20041125 | Product specification | - | 9397 750 13568 | BC546_547_3 |

## 11. Data sheet status

| Level | Data sheet status [1] | Product status [2] [3] | Definition |
|---|---|---|---|
| I | Objective data | Development | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice. |
| II | Preliminary data | Qualification | This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product. |
| III | Product data | Production | This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). |

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

## 12. Definitions

**Short-form specification —** The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition —** Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

**Application information —** Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

## 13. Disclaimers

**Life support —** These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

**Right to make changes —** Philips Semiconductors reserves the right to make changes in the products - including circuits, standard cells, and/or software - described or contained herein in order to improve design and/or performance. When the product is in full production (status 'Production'), relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

## 14. Trademarks

**Notice —** All referenced brands, product names, service names and trademarks are the property of their respective owners.

## 15. Contact information

For additional information, please visit: **http://www.semiconductors.philips.com**

For sales office addresses, send an email to: **sales.addresses@www.semiconductors.philips.com**

## 16. Contents





**Date of release: 19 May 2005**
**Document number: 9397 750 14609**

**Published in The Netherlands**