# BC847/BC547 series

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

Rev. 07 — 10 December 2008 Product data sheet

## 1. Product profile

### 1.1 General description

NPN general-purpose transistors in small plastic packages.

**Table 1. Product overview**

| Type number[1] | Package | | | PNP complement |
|---|---|---|---|---|
| | NXP | JEITA | JEDEC | |
| BC847 | SOT23 | - | TO-236AB | BC857 |
| BC847A | | | | BC857A |
| BC847B | | | | BC857B |
| BC847B/DG | | | | - |
| BC847C | | | | BC857C |
| BC847W | SOT323 | SC-70 | - | BC857W |
| BC847AW | | | | BC857AW |
| BC847BW | | | | BC857BW |
| BC847BW/DG | | | | - |
| BC847CW | | | | BC857CW |
| BC847T | SOT416 | SC-75 | - | BC857T |
| BC847AT | | | | BC857AT |
| BC847AT/DG | | | | - |
| BC847BT | | | | BC857BT |
| BC847CT | | | | BC857CT |
| BC847AM | SOT883 | SC-101 | - | BC857AM |
| BC847BM | | | | BC857BM |
| BC847CM | | | | BC857CM |
| BC547[2] | SOT54 | SC-43A | TO-92 | BC557[2] |
| BC547B[2] | | | | BC557B[2] |
| BC547C[2] | | | | BC557C[2] |

[1] /DG: halogen-free

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

NXP founded by Philips

### 1.2 Features

- Low current
- Low voltage
- Three different gain selections

### 1.3 Applications

- General-purpose switching and amplification

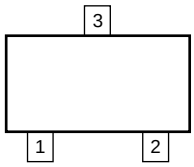
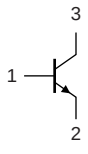
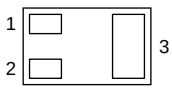
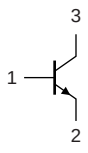
### 1.4 Quick reference data

**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 | | - | - | 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 | |

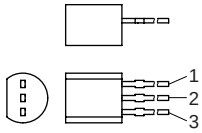
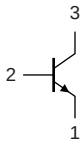
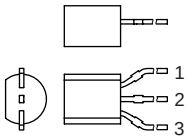
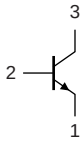
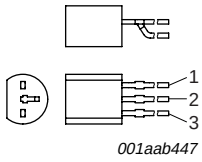
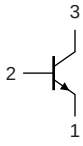
## 2. Pinning information

**Table 3. Pinning**

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| **SOT23, SOT323, SOT416** | | | |
| 1 | base |   006aaa144 |   sym021 |
| 2 | emitter | | |
| 3 | collector | | |
| **SOT883** | | | |
| 1 | base |   Transparent top view |   sym021 |
| 2 | emitter | | |
| 3 | collector | | |


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**Table 3. Pinning** *...continued*

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| **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 |
| BC847A | | | |
| BC847B | | | |
| BC847B/DG | | | |
| BC847C | | | |
| BC847W | SC-70 | plastic surface-mounted package; 3 leads | SOT323 |
| BC847AW | | | |
| BC847BW | | | |
| BC847BW/DG | | | |
| BC847CW | | | |



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**Table 4. Ordering information** *…continued*

| Type number[1] | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BC847T | SC-75 | plastic surface-mounted package; 3 leads | SOT416 |
| BC847AT | | | |
| BC847AT/DG | | | |
| BC847BT | | | |
| BC847CT | | | |
| 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 |
| BC547B[2] | | | |
| BC547C[2] | | | |

[1] /DG: halogen-free

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

## 4. Marking

**Table 5. Marking codes**

| Type number[1] | Marking code[2] | Type number[1] | Marking code[2] |
|---|---|---|---|
| BC847 | 1H* | BC847AT | 1E |
| BC847A | 1E* | BC847AT/DG | B5 |
| BC847B | 1F* | BC847BT | 1F |
| BC847B/DG | *BC | BC847CT | 1G |
| BC847C | 1G* | BC847AM | D4 |
| BC847W | 1H* | BC847BM | D5 |
| BC847AW | 1E* | BC847CM | D6 |
| BC847BW | 1F* | BC547 | C547 |
| BC847BW/DG | G9* | BC547B | C547B |
| BC847CW | 1G* | BC547C | C547C |
| BC847T | 1N | - | - |

[1] /DG: halogen-free

[2] * = -: made in Hong Kong
* = p: made in Hong Kong
* = t: made in Malaysia
* = W: made in China



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## 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 | | | - | 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 |
| $T_j$ | 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.

[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.



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## 7. Characteristics

**Table 8. Characteristics**

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

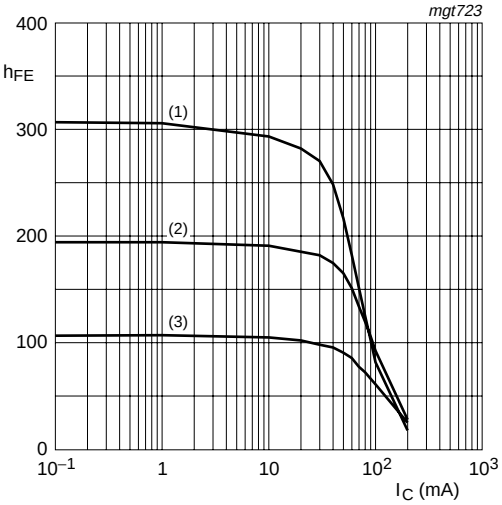
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = 30 V; $I_E$ = 0 A | | - | - | 15 | nA |
| | | $V_{CB}$ = 30 V; $I_E$ = 0 A; $T_j$ = 150 °C | | - | - | 5 | µA |
| $I_{EBO}$ | emitter-base cut-off current | $V_{EB}$ = 5 V; $I_C$ = 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 |
| NF | 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.



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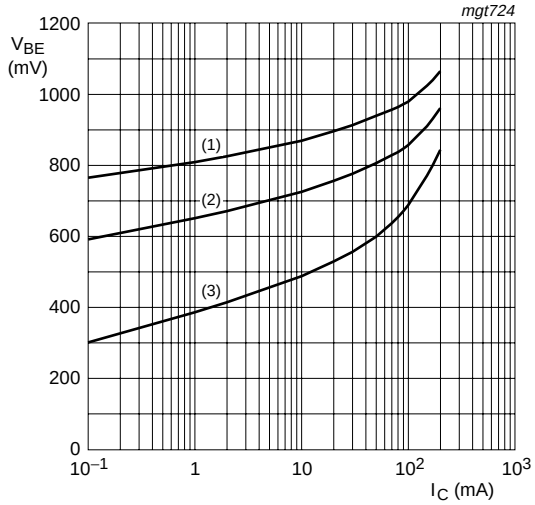

$V_{CE}$ = 5 V

(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**



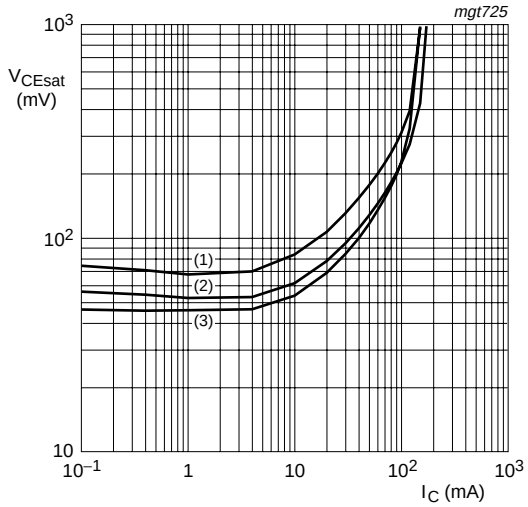

$V_{CE}$ = 5 V

(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**



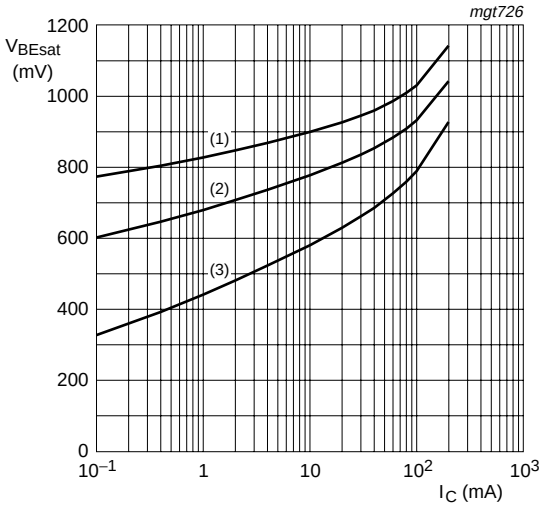

$I_C/I_B$ = 20

(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

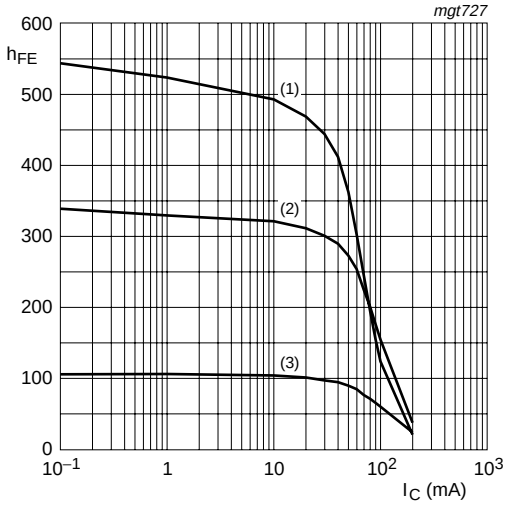
(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 150 °C

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



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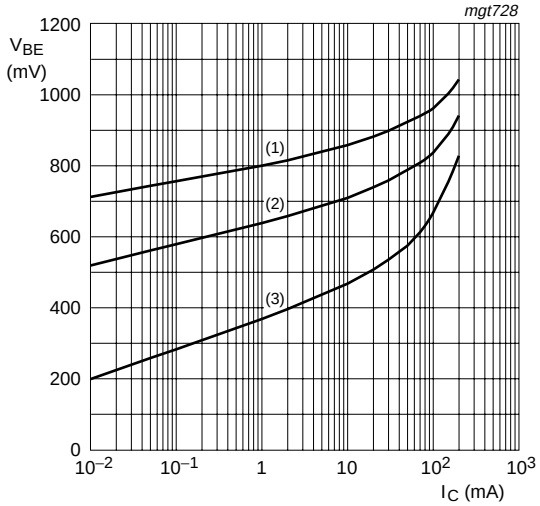

$V_{CE}$ = 5 V

(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**



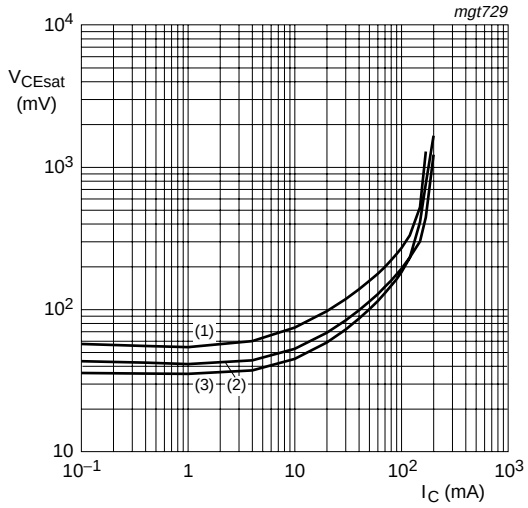

$V_{CE}$ = 5 V

(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**



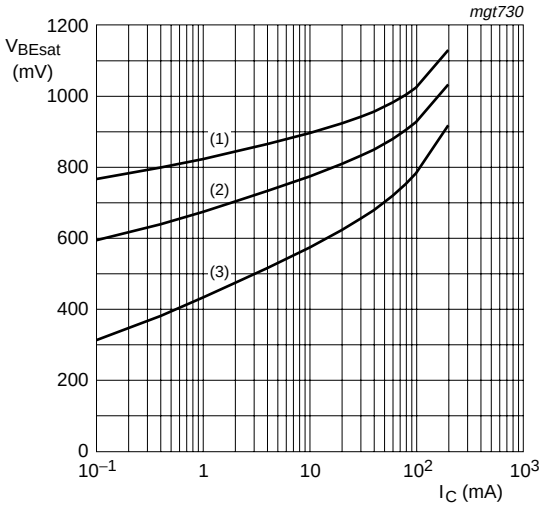

$I_C/I_B$ = 20

(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

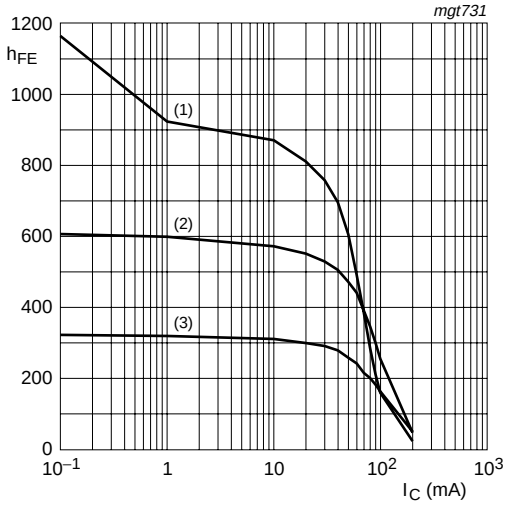
(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 150 °C

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



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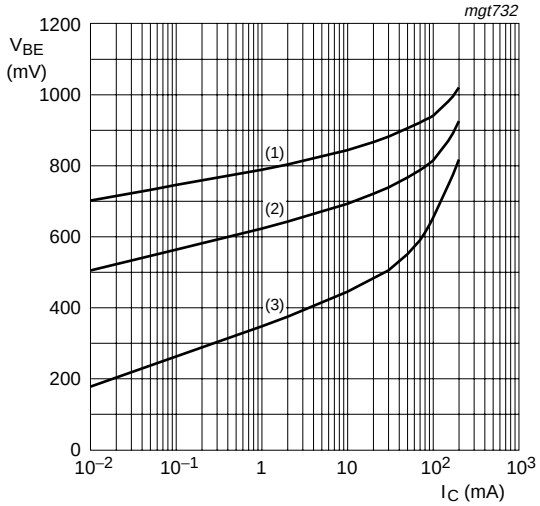

$V_{CE}$ = 5 V

(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**



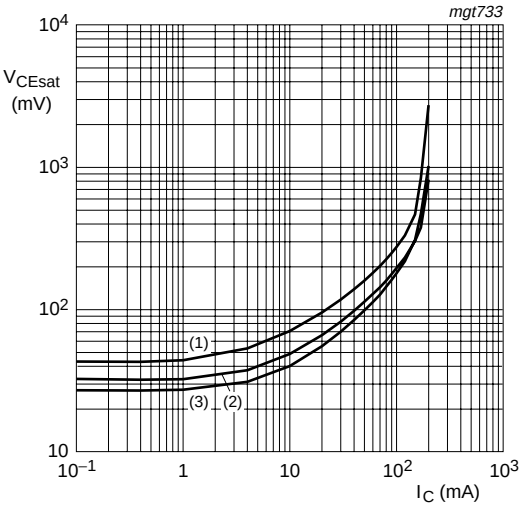

$V_{CE}$ = 5 V

(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**



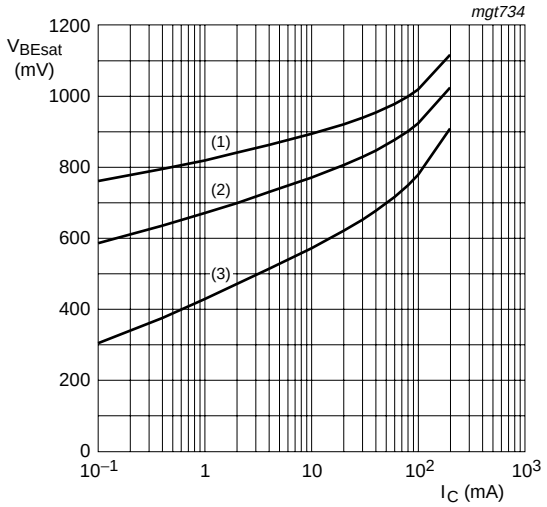

$I_C/I_B$ = 20

(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**



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## 8. Package outline

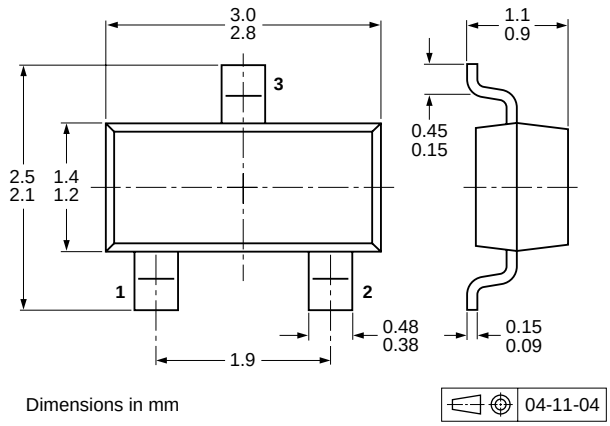



Fig 13. Package outline SOT23 (TO-236AB)

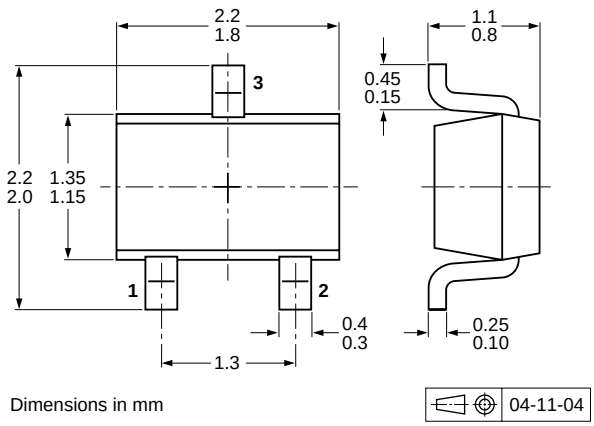



Fig 14. Package outline SOT323 (SC-70)

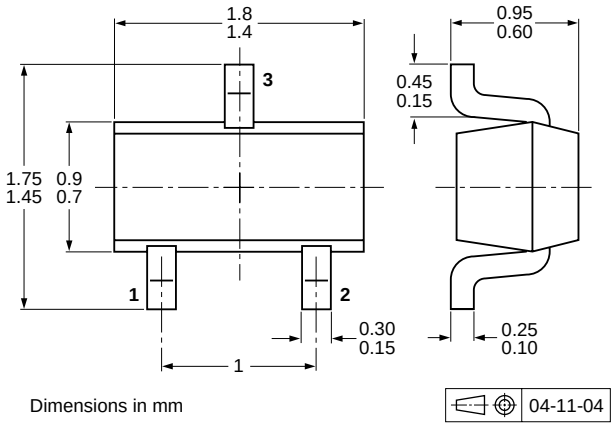



Fig 15. Package outline SOT416 (SC-75)

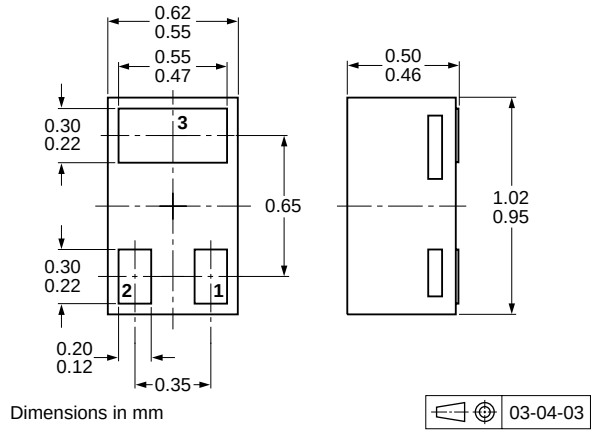



Fig 16. Package outline SOT883 (SC-101)

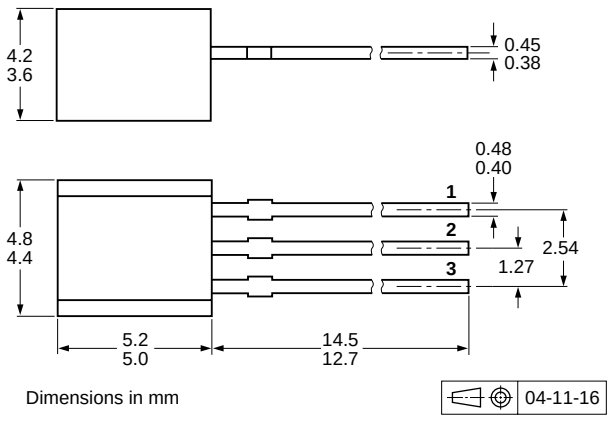



Fig 17. Package outline SOT54 (SC-43A/TO-92)

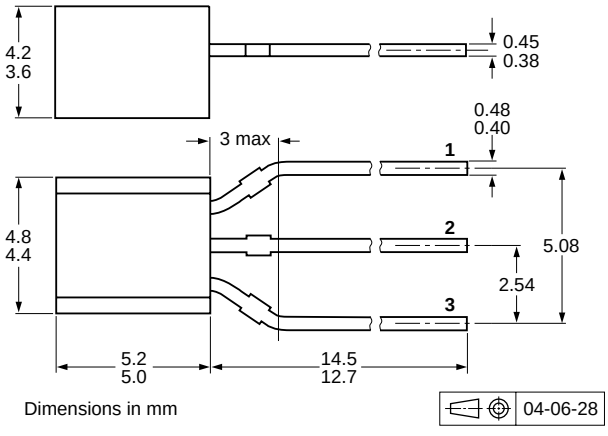



Fig 18. Package outline SOT54A



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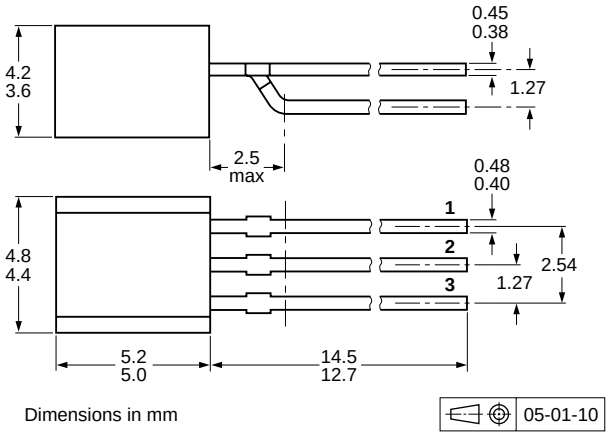



**Fig 19. Package outline SOT54 variant**

## 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 |
| BC847A | | | | | |
| BC847B | | | | | |
| BC847B/DG | | | | | |
| BC847C | | | | | |
| BC847W | SOT323 | 4 mm pitch, 8 mm tape and reel | -115 | - | -135 |
| BC847AW | | | | | |
| BC847BW | | | | | |
| BC847BW/DG | | | | | |
| BC847CW | | | | | |
| BC847T | SOT416 | 4 mm pitch, 8 mm tape and reel | -115 | - | -135 |
| BC847AT | | | | | |
| BC847AT/DG | | | | | |
| BC847BT | | | | | |
| BC847CT | | | | | |
| BC847AM | SOT883 | 2 mm pitch, 8 mm tape and reel | - | - | -315 |
| BC847BM | | | | | |
| BC847CM | | | | | |
| BC547 | SOT54 | bulk, straight leads | - | -412 | - |
| BC547B | | | | | |
| BC547C | | | | | |



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**Table 9. Packing methods** *...continued*

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

| Type number[2] | Package | Description | Packing quantity | | |
|---|---|---|---|---|---|
| | | | 3000 | 5000 | 10000 |
| BC547 | SOT54A | tape and reel, wide pitch | - | - | -116 |
| BC547B | | | | | |
| BC547C | | | | | |
| BC547 | SOT54A | tape ammopack, wide pitch | - | - | -126 |
| BC547B | | | | | |
| BC547C | | | | | |
| BC547 | SOT54 variant | bulk, delta pinning | - | -112 | - |
| BC547B | | | | | |
| BC547C | | | | | |

[1] For further information and the availability of packing methods, see Section 12.

[2] /DG: halogen-free



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## 10. Revision history

**Table 10. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BC847_BC547_SER_7 | 20081210 | Product data sheet | - | BC847_BC547_SER_6 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• Table 1 “Product overview”: enhanced<br>• Table 4 “Ordering information”: enhanced<br>• Table 5 “Marking codes”: enhanced<br>• Table 6 “Limiting values”: $I_{EBO}$ conditions amended<br>• Table 8 “Characteristics”: symbol N for parameter noise figure redefined to NF<br>• Table 9 “Packing methods”: enhanced<br>• Section 11 “Legal information”: updated | | | |
| BC847_BC547_SER_6 | 20050519 | Product data sheet | - | BC846_BC847_ BC848_5, BC847M_SERIES_2, BC846T_847T_ SERIES_3, BC846W_BC847W_BC848W_4, BC546_547_4 |
| BC846_BC847_BC848_5 | 20040206 | Product specification | - | BC846_BC847_ BC848_4 |
| BC847M_SERIES_2 | 20040310 | Product specification | - | BC847M_SERIES_1 |
| BC846T_847T_SERIES_3 | 20001115 | Product specification | - | BC846T_847T_2 |
| BC846W_BC847W_ BC848W_4 | 20020204 | Product specification | - | BC846W_847W_3 |
| BC546_547_4 | 20041125 | Product specification | - | BC546_547_3 |


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# 11. Legal information

## 11.1 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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