



# THE DATASHEET OF BC847W,135

# BC847 series

45 V, 100 mA NPN general-purpose transistors

Rev. 11 — 5 December 2018

Product data sheet

## 1 Product profile

### 1.1 General description

NPN general-purpose transistors in a small SOT23 (TO-236AB), very small SOT323 (SC-70) or ultra small SOT883 (DFN1006-3) Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

| Type number <sup>[1]</sup> | Package  |        |          | NPN complement |
|----------------------------|----------|--------|----------|----------------|
|                            | Nexperia | JEITA  | JEDEC    |                |
| BC847                      | SOT23    | -      | TO-236AB | BC857          |
| BC847A                     |          |        |          | BC857A         |
| BC847B                     |          |        |          | BC857B         |
| BC847C                     |          |        |          | BC857C         |
| BC847W                     | SOT323   | SC-70  | -        | BC857W         |
| BC847AW                    |          |        |          | BC857AW        |
| BC847BW                    |          |        |          | BC857BW        |
| BC847CW                    |          |        |          | BC857CW        |
| BC847AM                    | SOT883   | SC-101 | -        | BC857AM        |
| BC847BM                    |          |        |          | BC857BM        |
| BC847CM                    |          |        |          | BC857CM        |

[1] Valid for all available selection groups.

### 1.2 Features and benefits

- General-purpose transistors
- SMD plastic packages
- Three different gain selections
- AEC-Q101 qualified

### 1.3 Applications

- General-purpose switching and amplification

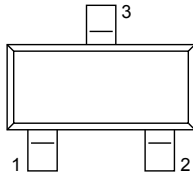
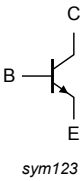
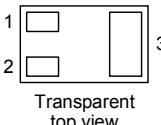
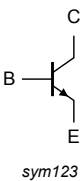
1.4 Quick reference data

Table 2. Quick reference data  
*T<sub>amb</sub> = 25 °C unless otherwise specified.*

| Symbol           | Parameter                 | Conditions                                   | Min | Typ | Max | Unit |
|------------------|---------------------------|----------------------------------------------|-----|-----|-----|------|
| V <sub>CEO</sub> | collector-emitter voltage | open base                                    | -   | -   | 45  | V    |
| I <sub>C</sub>   | collector current         |                                              | -   | -   | 100 | mA   |
| h <sub>FE</sub>  | DC current gain           | V <sub>CE</sub> = 5 V; I <sub>C</sub> = 2 mA | 110 | -   | 800 |      |
|                  | h <sub>FE</sub> group A   |                                              | 110 | 180 | 220 |      |
|                  | h <sub>FE</sub> group B   |                                              | 200 | 290 | 450 |      |
|                  | h <sub>FE</sub> group C   |                                              | 420 | 520 | 800 |      |

2 Pinning information

Table 3. Pinning information

| Pin           | Symbol | Description | Simplified outline                                                                    | Graphic symbol                                                                        |
|---------------|--------|-------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| SOT23; SOT323 |        |             |                                                                                       |                                                                                       |
| 1             | B      | base        |  |  |
| 2             | E      | emitter     |                                                                                       |                                                                                       |
| 3             | C      | collector   |                                                                                       |                                                                                       |
| SOT883        |        |             |                                                                                       |                                                                                       |
| 1             | B      | base        |  |  |
| 2             | E      | emitter     |                                                                                       |                                                                                       |
| 3             | C      | collector   |                                                                                       |                                                                                       |

### 3 Ordering information

Table 4. Ordering information

| Type number | Package  |                                                                               |         |
|-------------|----------|-------------------------------------------------------------------------------|---------|
|             | Name     | Description                                                                   | Version |
| BC847       | TO-236AB | plastic surface-mounted package; 3 leads                                      | SOT23   |
| BC847A      |          |                                                                               |         |
| BC847B      |          |                                                                               |         |
| BC847C      |          |                                                                               |         |
| BC847W      | SC-70    |                                                                               | SOT323  |
| BC847AW     |          |                                                                               |         |
| BC847BW     |          |                                                                               |         |
| BC847CW     |          |                                                                               |         |
| BC847AM     | SC-101   | leadless ultra small plastic package; 3 solder lands; body 1.0 x 0.6 x 0.5 mm | SOT 883 |
| BC847BM     |          |                                                                               |         |
| BC847CM     |          |                                                                               |         |

### 4 Marking

Table 5. Marking codes

| Type number | Marking code       |
|-------------|--------------------|
| BC847       | <sup>[1]</sup> 1H% |
| BC847A      | <sup>[1]</sup> 1E% |
| BC847B      | <sup>[1]</sup> 1F% |
| BC847C      | <sup>[1]</sup> 1G% |
| BC847W      | <sup>[1]</sup> 1H% |
| BC847AW     | <sup>[1]</sup> 1E% |
| BC847BW     | <sup>[1]</sup> 1F% |
| BC847CW     | <sup>[1]</sup> 1G% |
| BC847AM     | D4                 |
| BC847BM     | D5                 |
| BC847CM     | D6                 |

[1] % = placeholder for manufacturing site code

## 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; $t_p \leq 1 \text{ ms}$ |     | -   | 200 | mA               |
| $I_{BM}$  | peak base current         | single pulse; $t_p \leq 1 \text{ ms}$ |     | -   | 100 | mA               |
| $P_{tot}$ | total power dissipation   | $T_{amb} \leq 25^\circ\text{C}$       |     |     |     |                  |
|           | SOT23                     |                                       | [1] | -   | 250 | mW               |
|           | SOT323                    |                                       | [1] | -   | 200 | mW               |
|           | SOT883                    |                                       | [2] | -   | 250 | mW               |
| $T_j$     | junction temperature      |                                       |     | -   | 150 | $^\circ\text{C}$ |
| $T_{amb}$ | ambient temperature       |                                       |     | -65 | 150 | $^\circ\text{C}$ |
| $T_{stg}$ | storage temperature       |                                       |     | -65 | 150 | $^\circ\text{C}$ |

[1] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided copper; tin-plated and standard footprint.

[2] Device mounted on an PCB with 60  $\mu\text{m}$  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  |
|               | SOT883                                      |             | [2] | -   | -   | 500 | K/W  |

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

[2] Device mounted on an PCB with 60  $\mu\text{m}$  copper strip line, standard footprint.

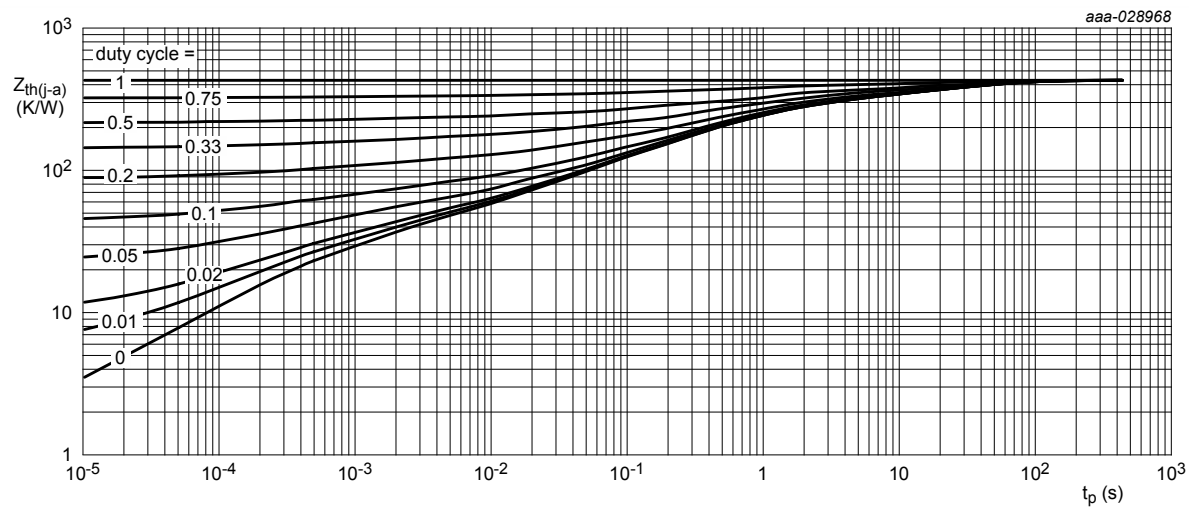


Figure 1. SOT23: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

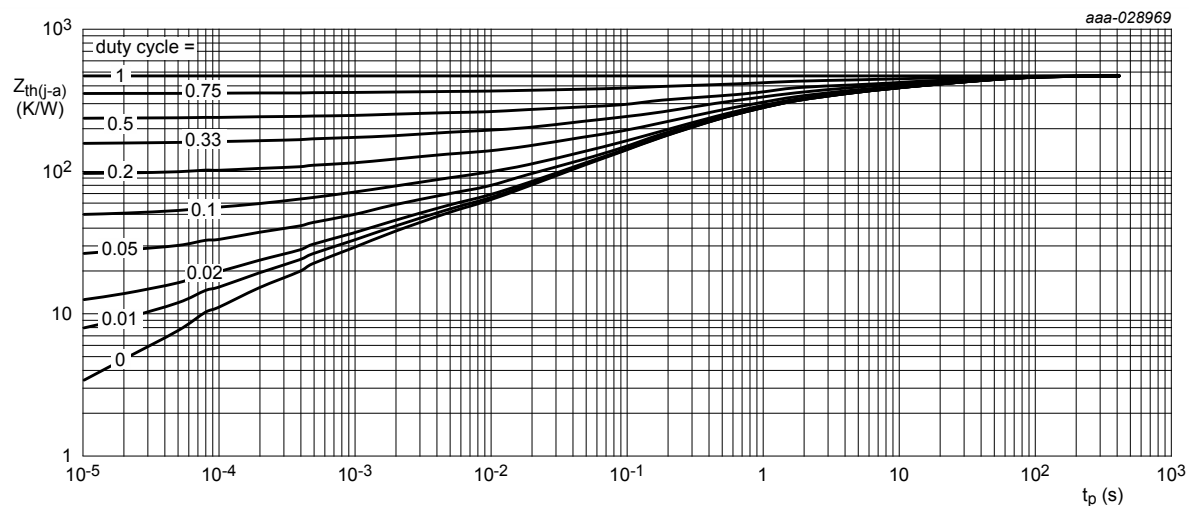
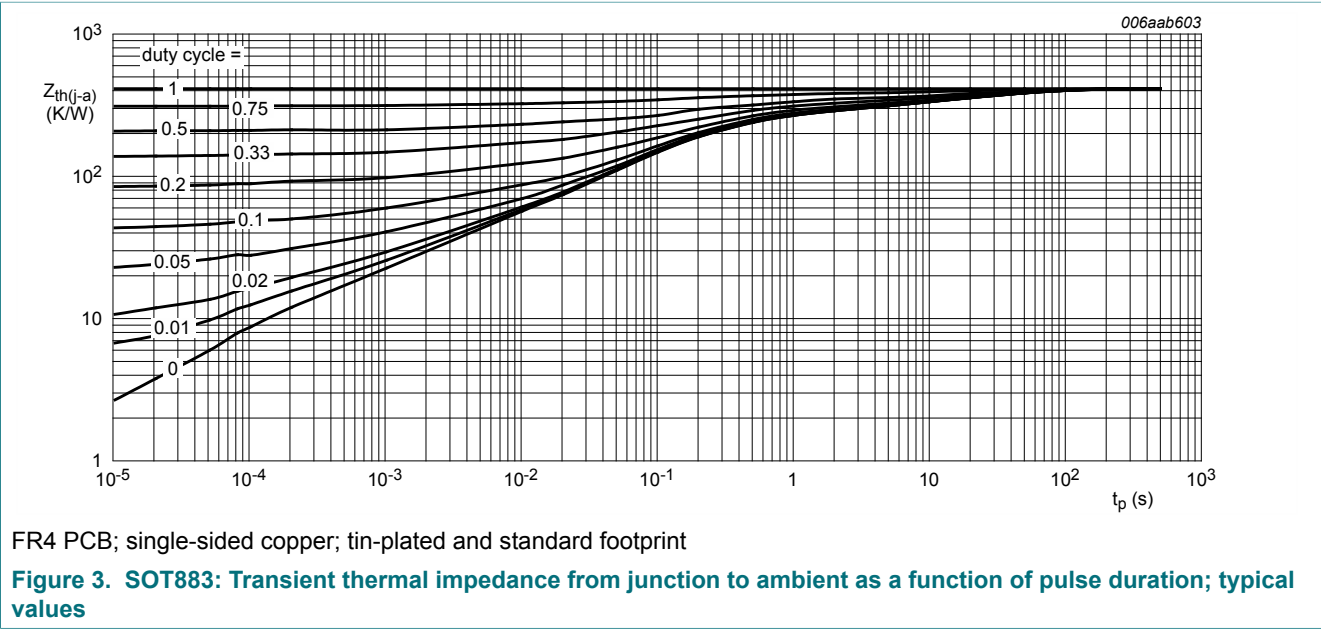


Figure 2. SOT323: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



## 7 Characteristics

**Table 8. Characteristics**

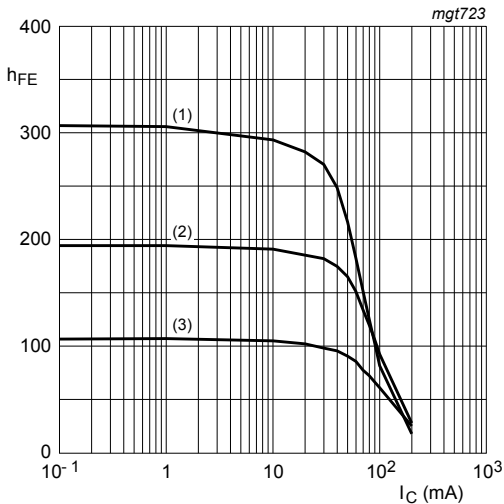
$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

| Symbol               | Parameter                            | Conditions                                                                                  |     | Min | Typ | Max | Unit |
|----------------------|--------------------------------------|---------------------------------------------------------------------------------------------|-----|-----|-----|-----|------|
| V <sub>(BR)CBO</sub> | collector-base breakdown voltage     | I <sub>C</sub> = 100 μA; I <sub>E</sub> = 0 A                                               |     | 50  | -   | -   | V    |
| V <sub>(BR)CES</sub> | collector-emitter breakdown voltage  | I <sub>C</sub> = 2 mA; V <sub>BE</sub> = 0 A                                                |     | 45  | -   | -   | V    |
| V <sub>(BR)EBO</sub> | emitter-base breakdown voltage       | I <sub>C</sub> = 0 A; I <sub>E</sub> = 100 μA                                               |     | 6   | -   | -   | V    |
| I <sub>CBO</sub>     | collector-base cut-off current       | V <sub>CB</sub> = 30 V; I <sub>E</sub> = 0 A                                                |     | -   | -   | 15  | nA   |
|                      |                                      | V <sub>CB</sub> = 30 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C                       |     | -   | -   | 5   | μA   |
| I <sub>EBO</sub>     | emitter-base cut-off current         | V <sub>EB</sub> = 5 V; I <sub>C</sub> = 0 A                                                 |     | -   | -   | 100 | nA   |
| h <sub>FE</sub>      | DC current gain                      | V <sub>CE</sub> = 5 V; I <sub>C</sub> = 10 μA                                               |     |     |     |     |      |
|                      | h <sub>FE</sub> group A              |                                                                                             |     | -   | 170 | -   |      |
|                      | h <sub>FE</sub> group B              |                                                                                             |     | -   | 280 | -   |      |
|                      | h <sub>FE</sub> group C              |                                                                                             |     | -   | 420 | -   |      |
|                      | DC current gain                      | V <sub>CE</sub> = 5 V; I <sub>C</sub> = 2 mA                                                |     | 110 | -   | 800 |      |
|                      | h <sub>FE</sub> group A              |                                                                                             |     | 110 | 180 | 220 |      |
|                      | h <sub>FE</sub> group B              |                                                                                             |     | 200 | 290 | 450 |      |
|                      | h <sub>FE</sub> group C              |                                                                                             |     | 420 | 520 | 800 |      |
| V <sub>CEsat</sub>   | collector-emitter saturation voltage | I <sub>C</sub> = 10 mA; I <sub>B</sub> = 0.5 mA                                             |     | -   | 90  | 200 | mV   |
|                      |                                      | I <sub>C</sub> = 100 mA; I <sub>B</sub> = 5 mA                                              | [1] | -   | 200 | 400 | mV   |
| V <sub>BEsat</sub>   | base-emitter saturation voltage      | I <sub>C</sub> = 10 mA; I <sub>B</sub> = 0.5 mA                                             | [2] | -   | 700 | -   | mV   |
|                      |                                      | I <sub>C</sub> = 100 mA; I <sub>B</sub> = 5 mA                                              | [2] | -   | 900 | -   | mV   |
| V <sub>BE</sub>      | base-emitter voltage                 | V <sub>CE</sub> = 5 V; I <sub>C</sub> = 2 mA                                                | [2] | 580 | 660 | 700 | mV   |
|                      |                                      | V <sub>CE</sub> = 5 V; I <sub>C</sub> = 10 mA                                               |     | -   | -   | 770 | mV   |
| f <sub>T</sub>       | transition frequency                 | V <sub>CE</sub> = 5 V; I <sub>C</sub> = 10 mA; f = 100 MHz                                  |     | 100 | -   | -   | MHz  |
| C <sub>c</sub>       | collector capacitance                | V <sub>CB</sub> = 10 V; I <sub>E</sub> = i <sub>e</sub> = 0 A; f = 1 MHz                    |     | -   | -   | 1.5 | pF   |
| C <sub>e</sub>       | emitter capacitance                  | V <sub>EB</sub> = 0.5 V; I <sub>C</sub> = i <sub>c</sub> = 0 A; f = 1 MHz                   |     | -   | 11  | -   | pF   |
| NF                   | noise figure                         | I <sub>C</sub> = 200 μA; V <sub>CE</sub> = 5 V; R <sub>S</sub> = 2 kΩ; f = 1 kHz; B = 200Hz |     | -   | 2   | 10  | dB   |

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

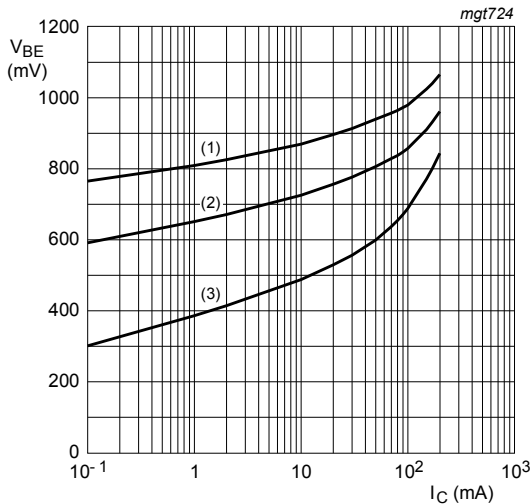
[2]  $V_{BE}$  decreases by approximately 2 mV/K with increasing temperature





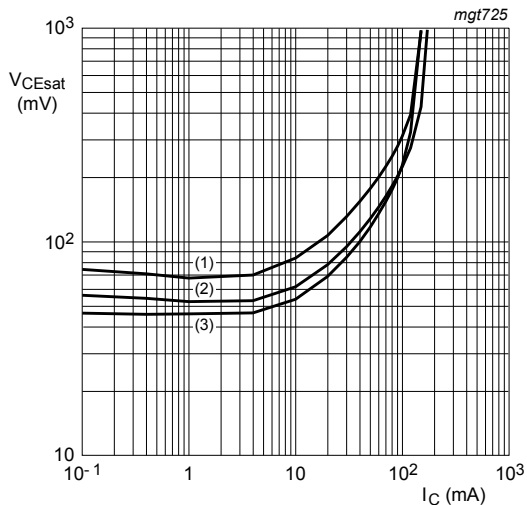
$V_{CE} = 5\text{ V}$   
(1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

Figure 4. Group A: DC current gain as a function of collector current; typical values



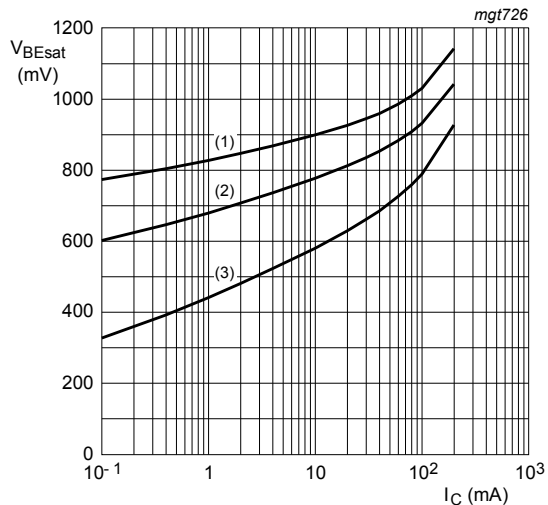
$V_{CE} = 5\text{ V}$   
(1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

Figure 5. Group A: Base-emitter voltage as a function of collector current; typical values



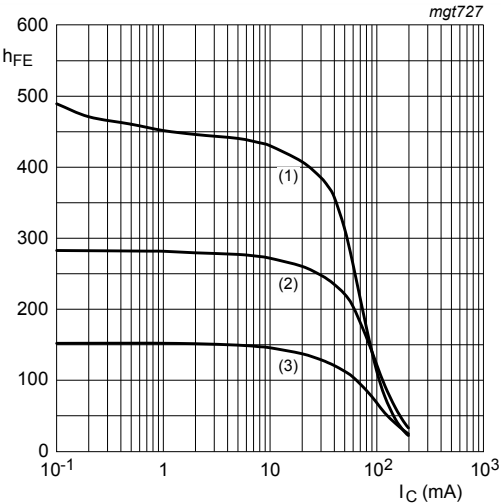
$I_C/I_B = 20$   
(1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

Figure 6. Group A: Collector-emitter saturation voltage as a function of collector current; typical values



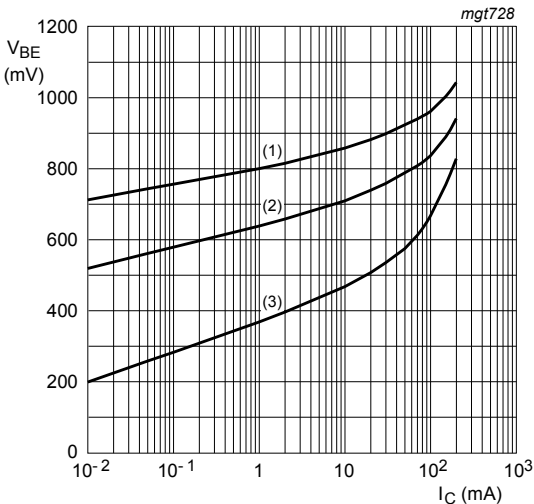
$I_C/I_B = 10$   
(1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

Figure 7. Group A: Base-emitter saturation voltage as a function of collector current; typical values



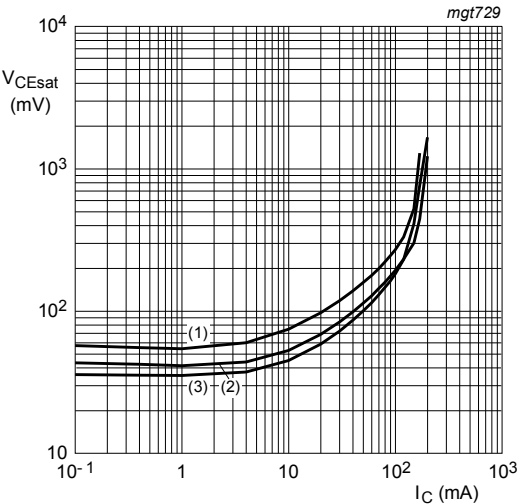
$V_{CE} = 5\text{ V}$   
(1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

Figure 8. Group B: DC current gain as a function of collector current; typical values



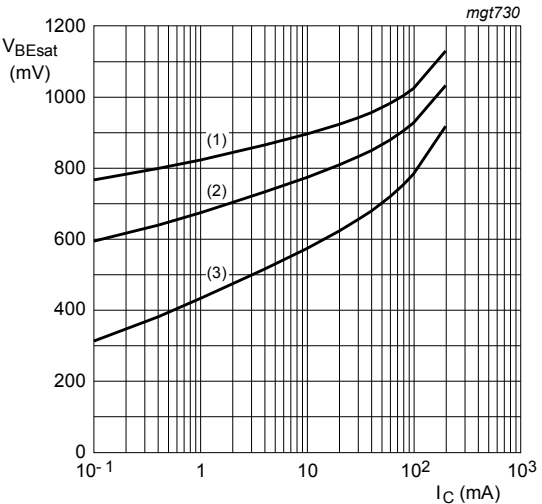
$V_{CE} = 5\text{ V}$   
(1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

Figure 9. Group B: Base-emitter voltage as a function of collector current; typical values



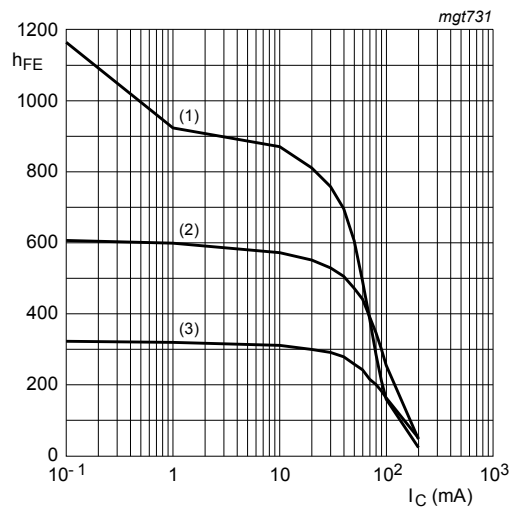
$I_C/I_B = 20$   
(1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

Figure 10. Group B: Collector-emitter saturation voltage as a function of collector current; typical values



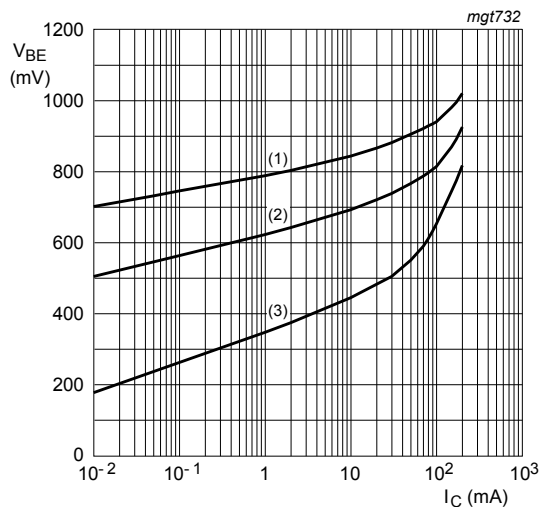
$I_C/I_B = 10$   
(1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

Figure 11. Group B: Base-emitter saturation voltage as a function of collector current; typical values



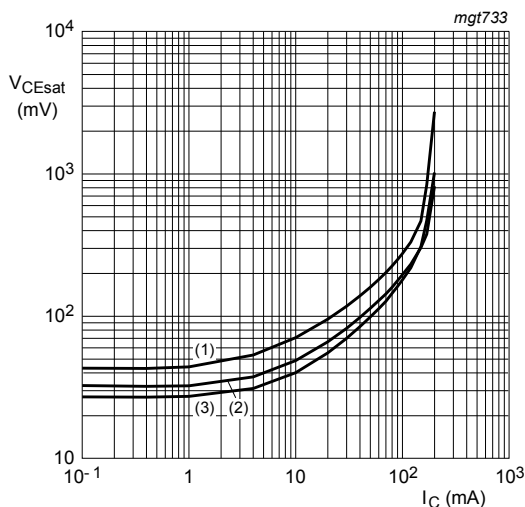
$V_{CE} = 5\text{ V}$   
(1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

Figure 12. Group C: DC current gain as a function of collector current; typical values



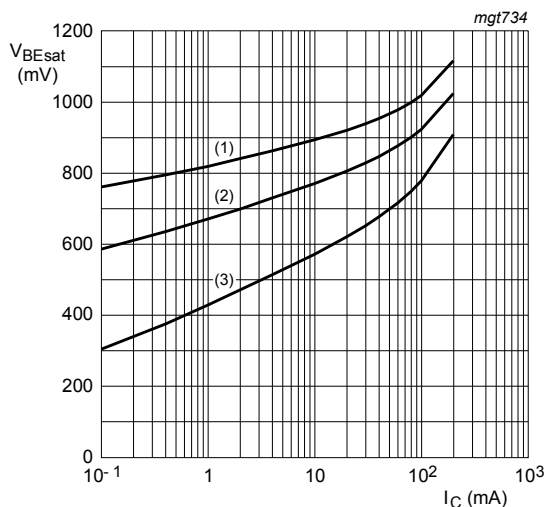
$V_{CE} = 5\text{ V}$   
(1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

Figure 13. Group C: Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 20$   
(1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

Figure 14. Group C: Collector-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 10$   
(1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

Figure 15. Group C: Base-emitter saturation voltage as a function of collector current; typical values

8 Test information

8.1 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.

9 Package outline

Table 9. Package outline

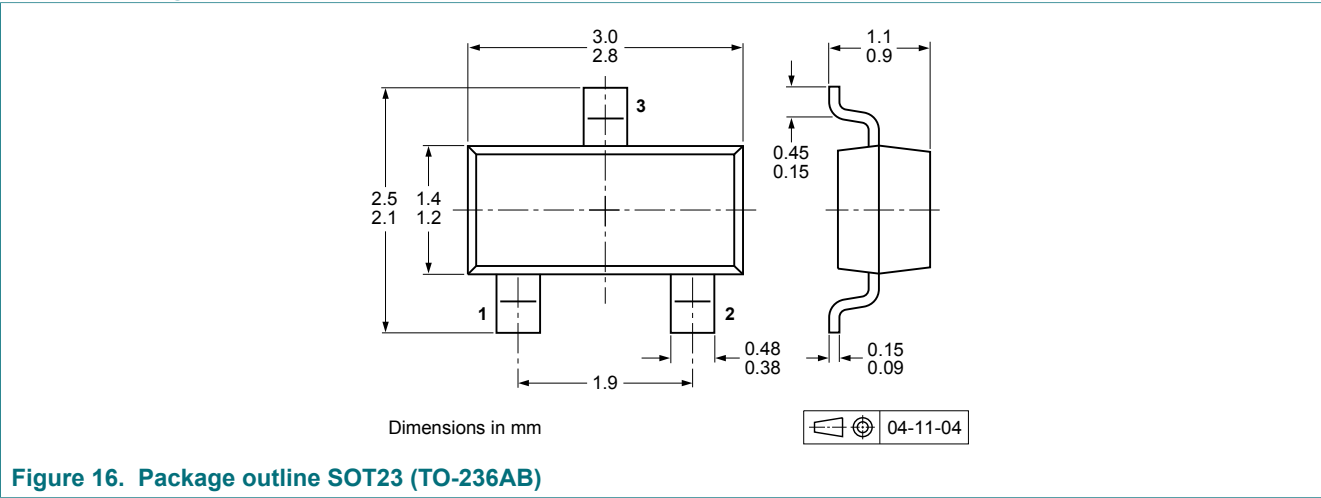


Figure 16. Package outline SOT23 (TO-236AB)

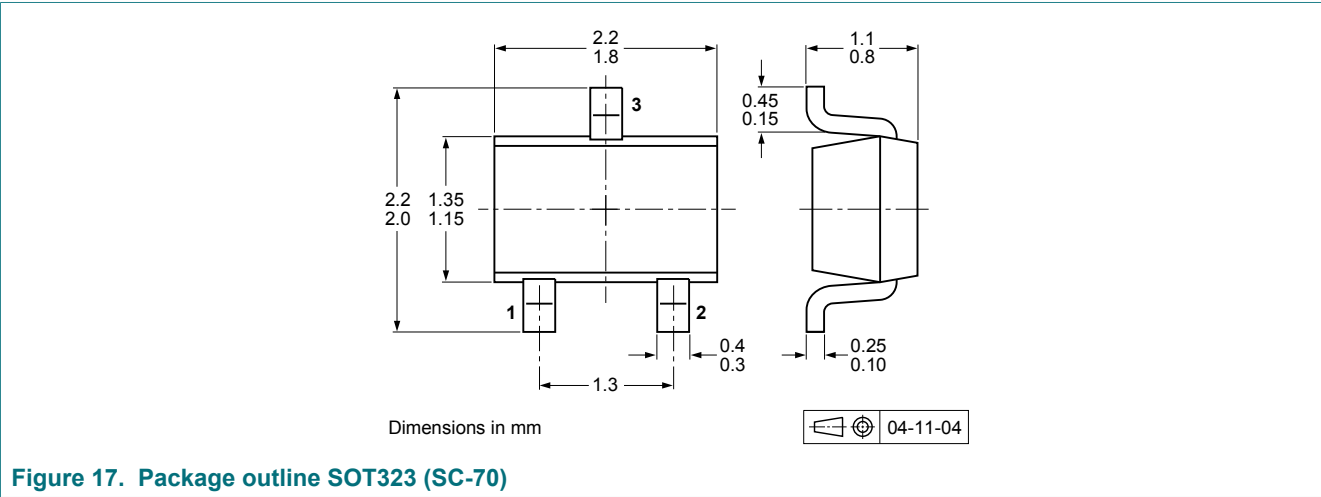


Figure 17. Package outline SOT323 (SC-70)

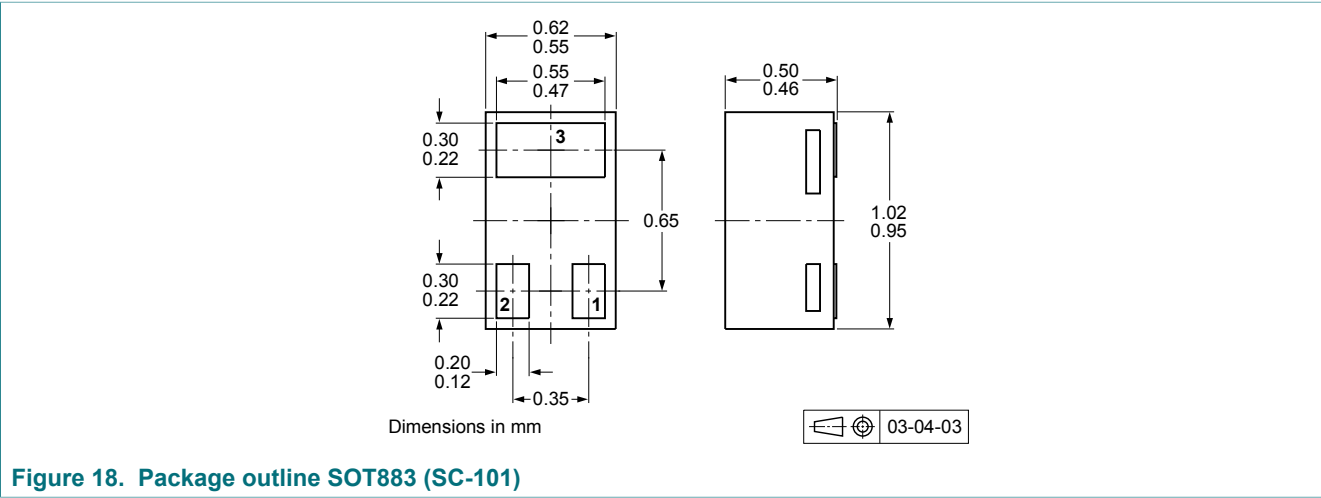


Figure 18. Package outline SOT883 (SC-101)

10 Soldering

Table 10. Soldering

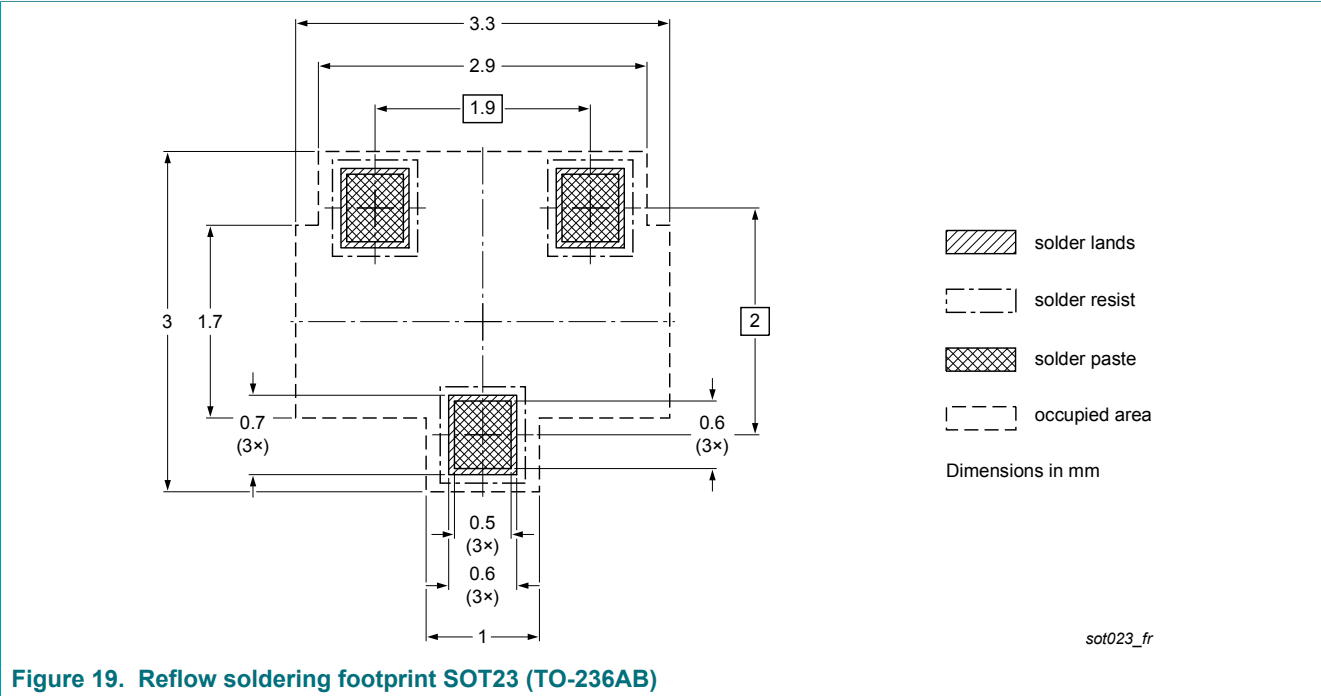


Figure 19. Reflow soldering footprint SOT23 (TO-236AB)

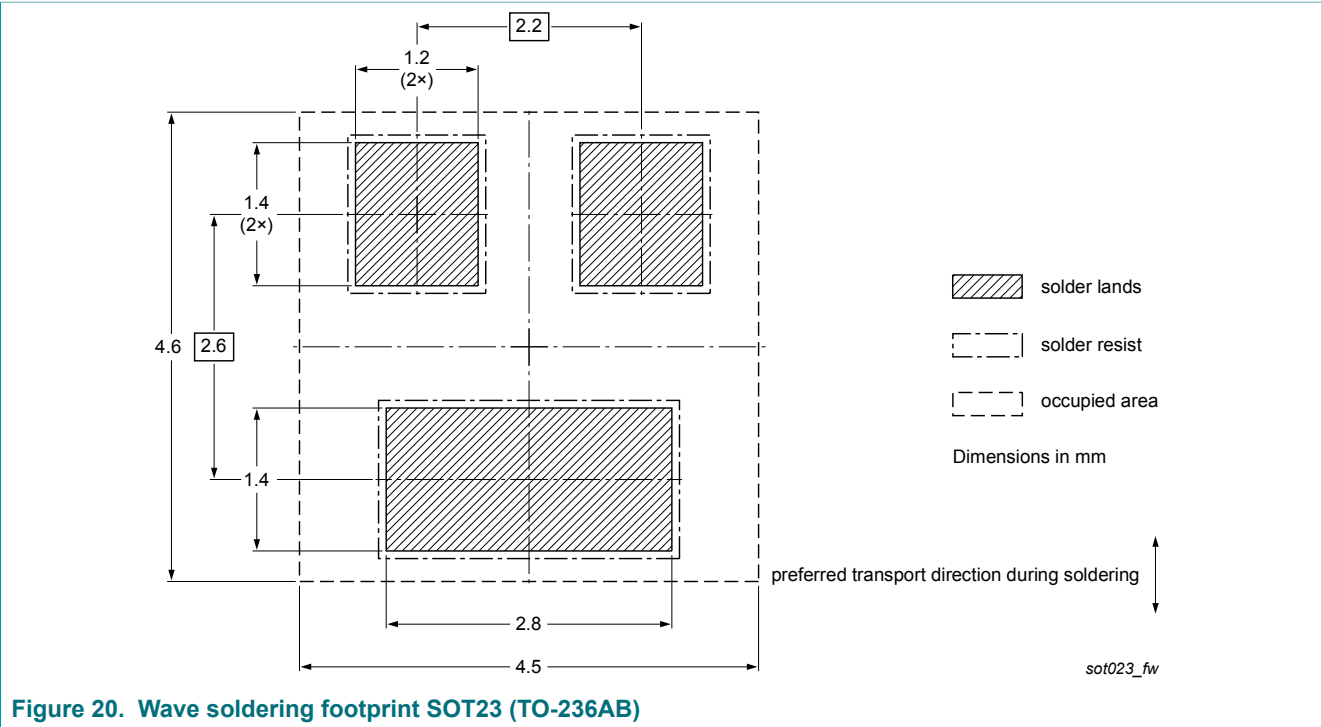
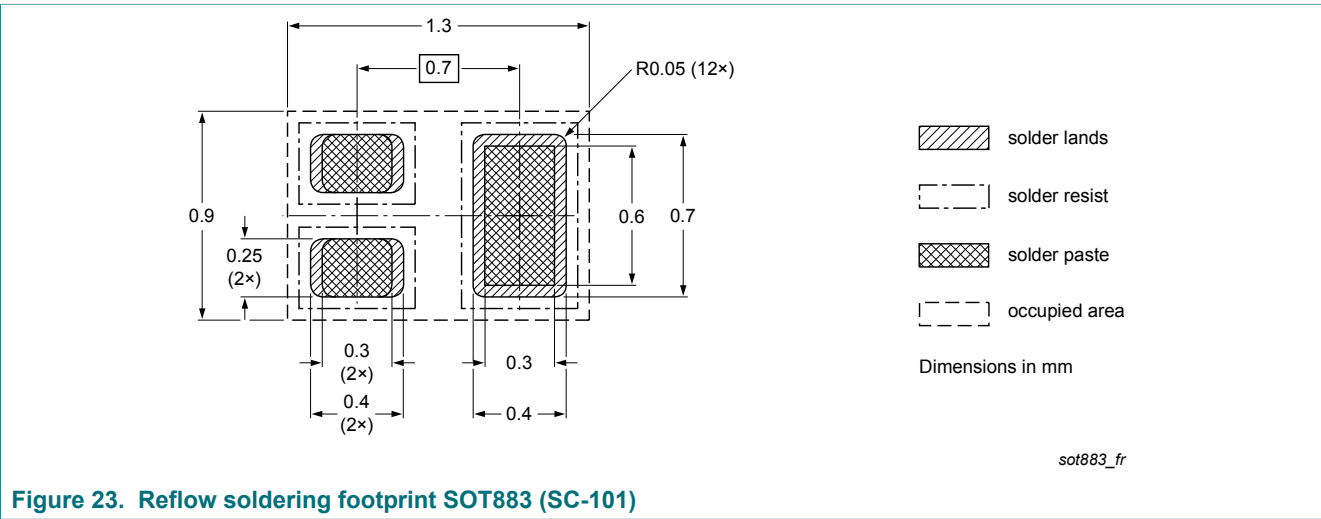
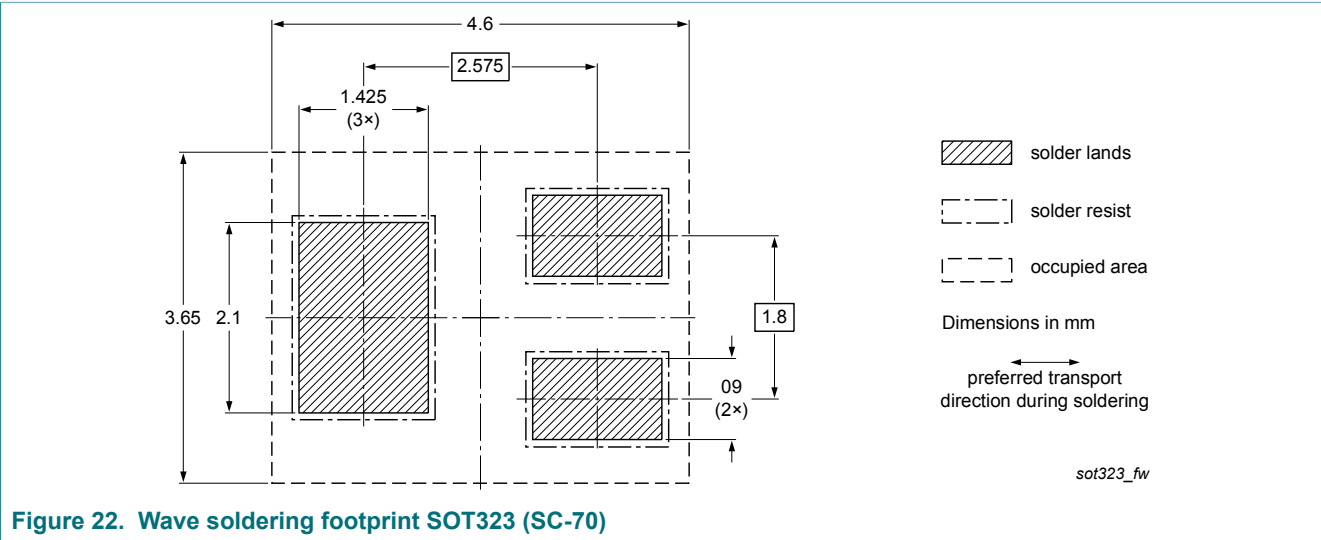
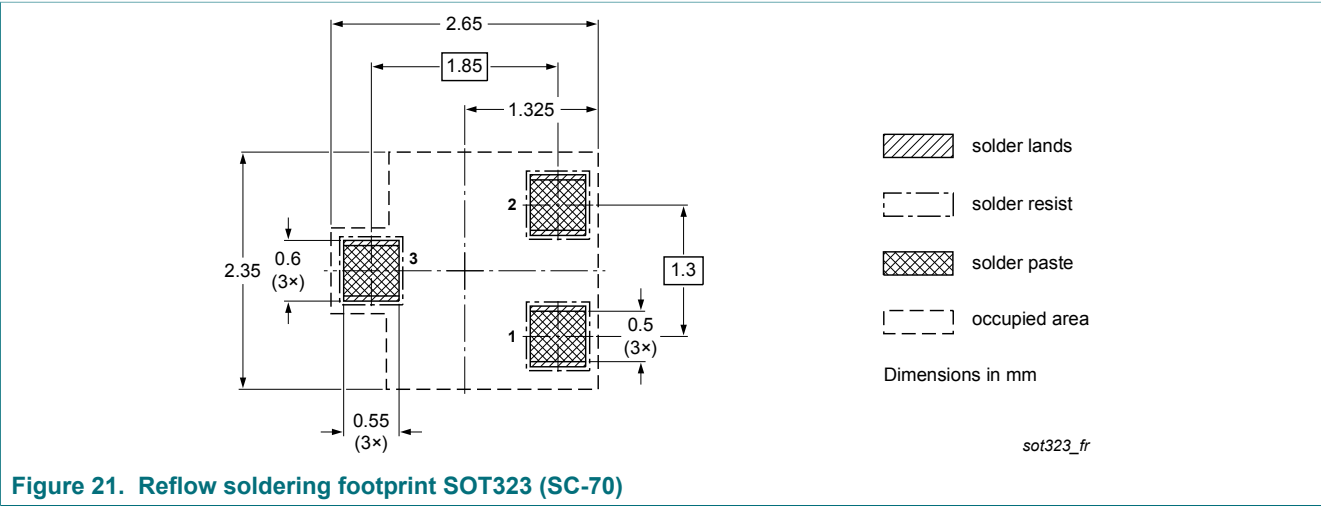


Figure 20. Wave soldering footprint SOT23 (TO-236AB)



## 11 Revision history

Table 11. Revision history

| Document ID         | Release date                                                                                                                                                                                         | Data sheet status  | Change notice | Supersedes          |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|---------------------|
| BC847_SER v.11      | 20181205                                                                                                                                                                                             | Product data sheet | -             | BC847_SER v.10      |
| Modifications:      | <ul style="list-style-type: none"><li>• General description: missing packages added</li><li>• Marking: Last type name BC847CW is changed to correct BC847CM</li><li>• Thermal graphs added</li></ul> |                    |               |                     |
| BC847_SER v.10      | 20180302                                                                                                                                                                                             | Product data sheet | -             | BC847_SER v.9       |
| BC847_SER v.9       | 20140923                                                                                                                                                                                             | Product data sheet | -             | BC847_SER v.8       |
| BC847_SER v.8       | 20120820                                                                                                                                                                                             | Product data sheet | -             | BC847_BC547_SER v.7 |
| BC847_BC547_SER v.7 | 20081210                                                                                                                                                                                             | Product data sheet | -             | BC847_BC547_SER v.6 |
| BC847_BC547_SER v.6 | 20050519                                                                                                                                                                                             | Product data sheet | -             | -                   |



## 12 Legal information

### 12.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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.nexperia.com>.

### 12.2 Definitions

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