



BC817QC series

45 V, 500 mA NPN general-purpose transistors

Rev. 2 — 28 October 2020

Product data sheet

1. General description

NPN general-purpose transistor in an ultra small DFN1412D-3 (SOT8009) leadless Surface-Mounted Device (SMD) plastic package with side-wettable flanks.

Table 1. Product overview

| Type number | Package | | | PNP complement |
|-------------|------------|----------|---------|----------------|
| | Name | JEDEC | Version | |
| BC817-16QC | DFN1412D-3 | MO-340CA | SOT8009 | BC807-16QC |
| BC817-25QC | | | | BC807-25QC |
| BC817-40QC | | | | BC807-40QC |

2. Features and benefits

- High power dissipation capability
- High current
- Three current gain selections
- Suitable for Automatic Optical Inspection (AOI) of solder joint
- Smaller footprint compared to conventional leaded SMD packages
- Low package height of 0.5 mm
- AEC-Q101 qualified

3. Applications

- General-purpose switching and amplification
- Space restricted applications

4. Quick reference data

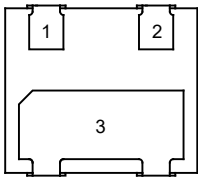
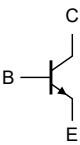
Table 2. Quick reference data

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|-----------|---------------------------|--|-----|-----|-----|-----|------|
| V_{CE0} | collector-emitter voltage | open base; $T_{amb} = 25\text{ °C}$ | | - | - | 45 | V |
| I_C | collector current | $T_{amb} = 25\text{ °C}$ | | - | - | 500 | mA |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1\text{ ms}$; $T_{amb} = 25\text{ °C}$ | | - | - | 1 | A |
| h_{FE} | DC current gain | | | | | | |
| | BC817-16QC | $V_{CE} = 1\text{ V}$; $I_C = 100\text{ mA}$ $T_{amb} = 25\text{ °C}$ | [1] | 100 | - | 250 | |
| | BC817-25QC | | [1] | 160 | - | 400 | |
| | BC817-40QC | | [1] | 250 | - | 600 | |

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

5. Pinning information

Table 3. Pinning

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|--|---|
| 1 | B | base |  <p>Bottom view DFN1412D-3 (SOT8009)</p> |  <p>sym021</p> |
| 2 | E | emitter | | |
| 3 | C | collector | | |

6. Ordering information

Table 4. Ordering information

| Type number | Package | | |
|-------------|------------|--|-----------------------|
| | Name | Description | Version |
| BC817-16QC | DFN1412D-3 | DFN1412D-3: plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body: 1.4 x 1.2 x 0.5 mm | SOT8009 (MO-340CA) |
| BC817-25QC | | | |
| BC817-40QC | | | |

7. Marking

Table 5. Marking

| Type number | Marking code |
|-------------|--------------|
| BC817-16QC | 9M |
| BC817-25QC | 9N |
| BC817-40QC | 9P |

8. Limiting values

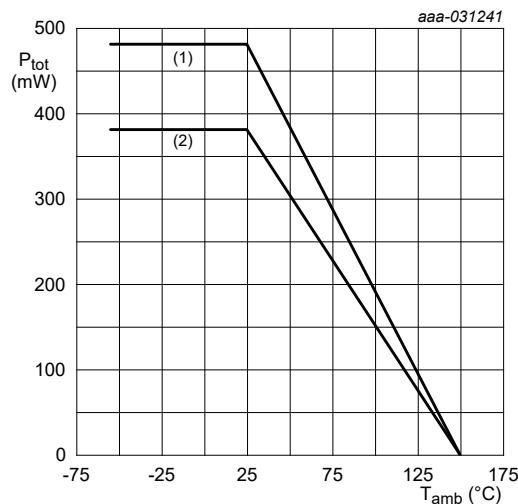
Table 6. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|---------------------------|---|-----|-----|------|
| V_{CBO} | collector-base voltage | open emitter; $T_{amb} = 25\text{ °C}$ | - | 50 | V |
| V_{CEO} | collector-emitter voltage | open base; $T_{amb} = 25\text{ °C}$ | - | 45 | V |
| V_{EBO} | emitter-base voltage | open collector; $T_{amb} = 25\text{ °C}$ | - | 5 | V |
| I_C | collector current | $T_{amb} = 25\text{ °C}$ | - | 500 | mA |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1\text{ ms}$; $T_{amb} = 25\text{ °C}$ | - | 1 | A |
| I_{BM} | peak base current | single pulse; $t_p \leq 1\text{ ms}$; $T_{amb} = 25\text{ °C}$ | - | 200 | mA |
| P_{tot} | total power dissipation | $T_{amb} \leq 25\text{ °C}$ | [1] | 380 | mW |
| | | | [2] | 480 | mW |
| T_j | junction temperature | | - | 150 | °C |
| T_{amb} | ambient temperature | | -55 | 150 | °C |
| T_{stg} | storage temperature | | -65 | 150 | °C |

[1] Device mounted on an FR4 PCB, single-sided 35 μm copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided 70 μm copper, tin-plated and standard footprint.



(1) FR4 PCB; single-sided 70 μm copper, tin-plated and standard footprint

(2) FR4 PCB; single-sided 35 μm copper, tin-plated and standard footprint

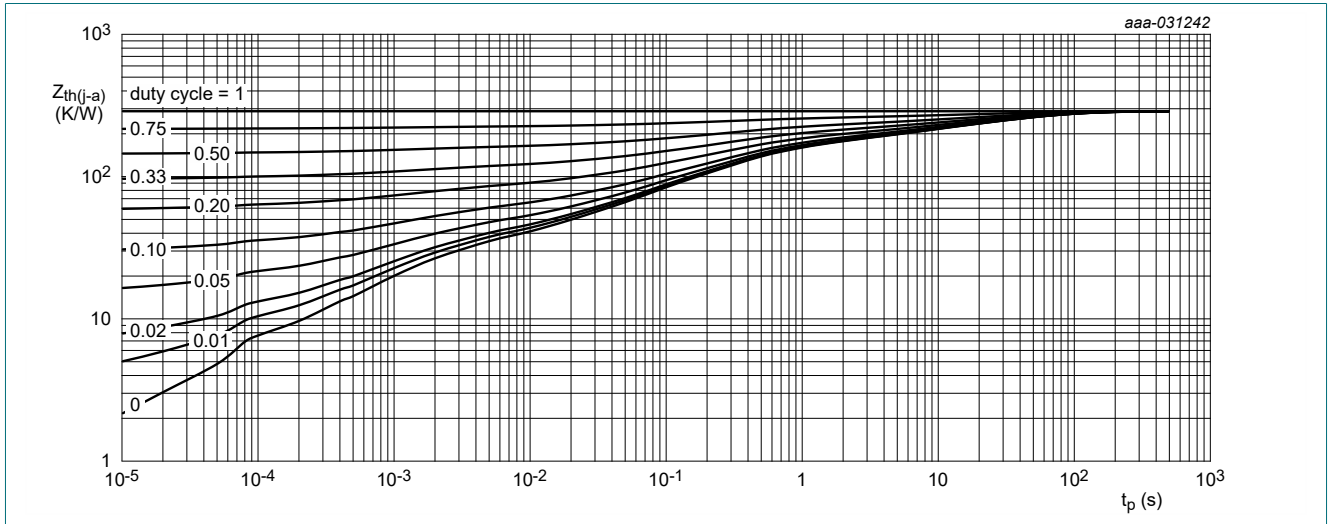
Fig. 1. Power derating curves for SOT8009

9. Thermal characteristics

Table 7. Thermal characteristics

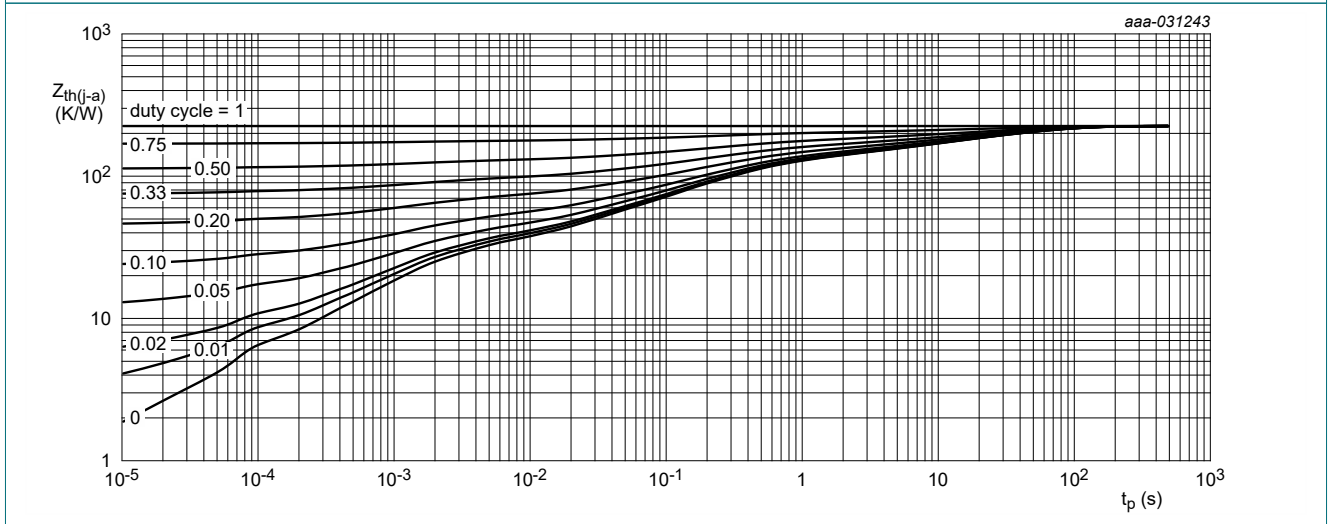
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|---------------|---|--|-----|-----|-----|------|-----|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air; $T_{amb} = 25\text{ °C}$ | [1] | - | - | 329 | K/W |
| | | | [2] | - | - | 261 | K/W |

- [1] Device mounted on an FR4 PCB, single-sided 35 μm copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided 70 μm copper, tin-plated and standard footprint.



FR4 PCB, single-sided 35 μm copper, tin-plated and standard footprint

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



FR4 PCB, single-sided 70 μm copper, tin-plated and standard footprint

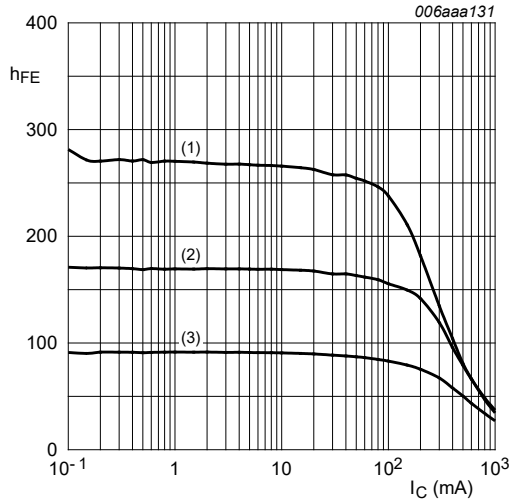
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 8. Characteristics

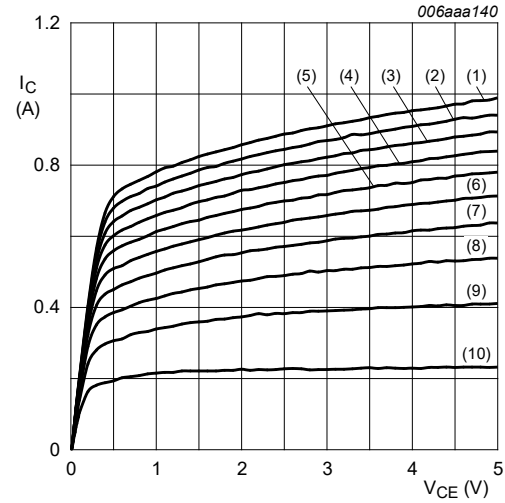
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------|--------------------------------------|---|-----|-----|-----|---------------|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C = 100 \mu\text{A}; I_E = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | 50 | - | | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $I_C = 10 \text{ mA}; I_E = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | 45 | - | | V |
| $V_{(BR)EBO}$ | emitter-base breakdown voltage | $I_E = 100 \mu\text{A}; I_C = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | 5 | - | | V |
| I_{CBO} | collector-base cut-off current | $V_{CB} = 20 \text{ V}; I_E = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | - | - | 100 | nA |
| | | $V_{CB} = 20 \text{ V}; I_E = 0 \text{ A}; T_j = 150 \text{ }^\circ\text{C}$ | - | - | 5 | μA |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5 \text{ V}; I_C = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | - | - | 100 | nA |
| h_{FE} | DC current gain | | | | | |
| | BC817-16QC | $V_{CE} = 1 \text{ V}; I_C = 100 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | [1] | 100 | - | 250 |
| | BC817-25QC | $V_{CE} = 1 \text{ V}; I_C = 100 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | [1] | 160 | - | 400 |
| | BC817-40QC | $V_{CE} = 1 \text{ V}; I_C = 100 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | [1] | 250 | - | 600 |
| | | $V_{CE} = 1 \text{ V}; I_C = 500 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | | 40 | - | - |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 500 \text{ mA}; I_B = 50 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | [1] | - | - | 700 mV |
| V_{BE} | base-emitter voltage | $V_{CE} = 1 \text{ V}; I_C = 500 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | [1] | - | - | 1.2 V |
| f_T | transition frequency | $V_{CE} = 5 \text{ V}; I_C = 10 \text{ mA}; f = 100 \text{ MHz}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | | 100 | - | MHz |
| C_C | collector capacitance | $V_{CB} = 10 \text{ V}; I_E = i_e = 0 \text{ A}; f = 1 \text{ MHz}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | | - | 3 | pF |

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



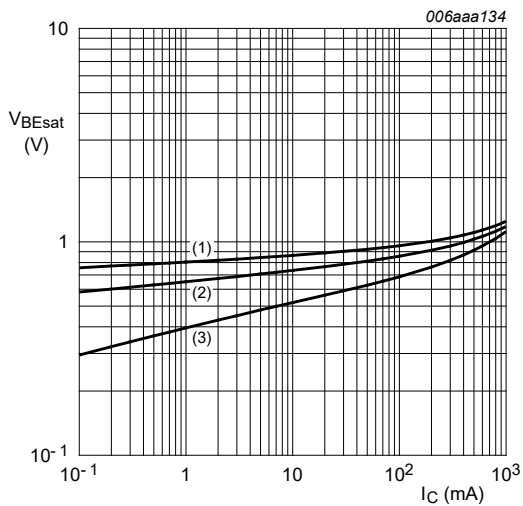
$V_{CE} = 1\text{ V}$
 (1) $T_{amb} = 150\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

Fig. 4. BC817-16QC: DC current gain as a function of collector current; typical values



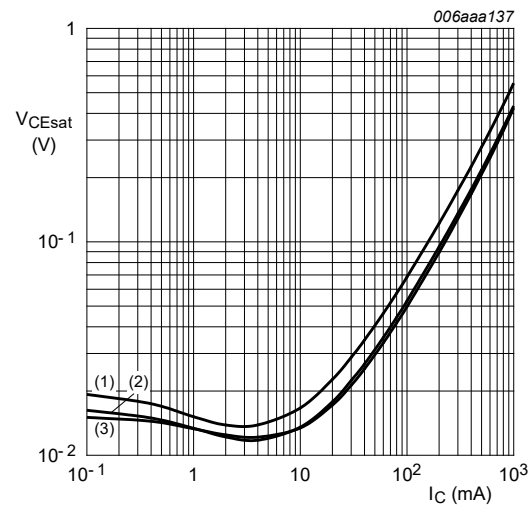
$T_{amb} = 25\text{ °C}$
 (1) $I_B = 16.0\text{ mA}$
 (2) $I_B = 14.4\text{ mA}$
 (3) $I_B = 12.8\text{ mA}$
 (4) $I_B = 11.2\text{ mA}$
 (5) $I_B = 9.6\text{ mA}$
 (6) $I_B = 8.0\text{ mA}$
 (7) $I_B = 6.4\text{ mA}$
 (8) $I_B = 4.8\text{ mA}$
 (9) $I_B = 3.2\text{ mA}$
 (10) $I_B = 1.6\text{ mA}$

Fig. 5. BC817-16QC: Collector current as a function of collector-emitter voltage; typical values



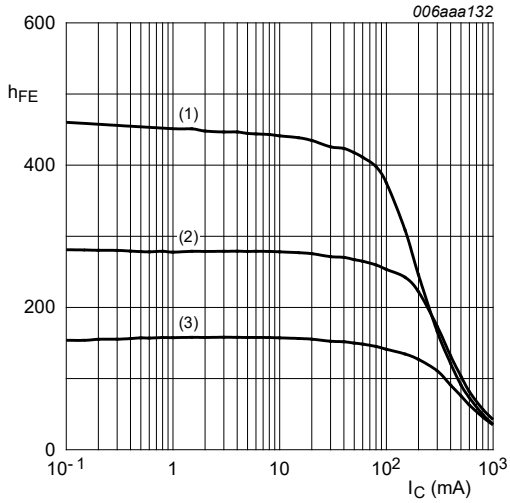
$I_C/I_B = 10$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 150\text{ °C}$

Fig. 6. BC817-16QC: Base-emitter saturation voltage as a function of collector current; typical values



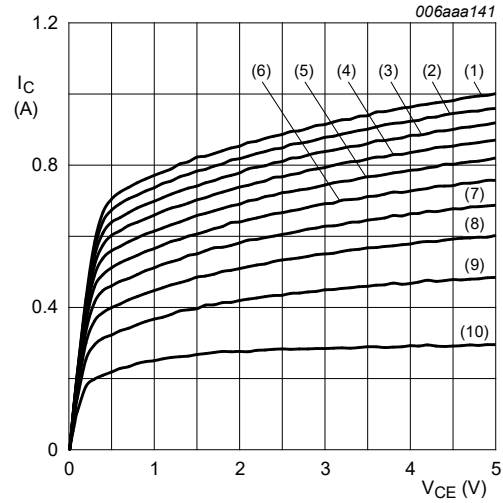
$I_C/I_B = 10$
 (1) $T_{amb} = 150\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

Fig. 7. BC817-16QC: Collector-emitter saturation voltage as a function of collector current; typical values



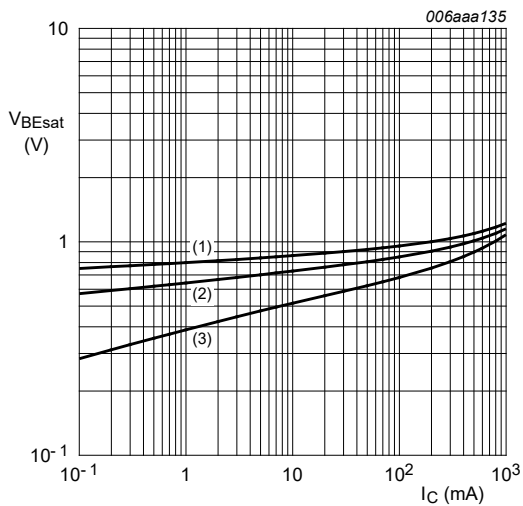
$V_{CE} = 1\text{ V}$
 (1) $T_{amb} = 150\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

Fig. 8. BC817-25QC: DC current gain as a function of collector current; typical values



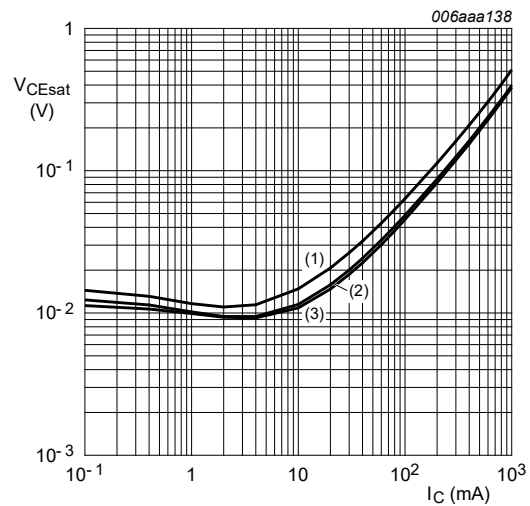
$T_{amb} = 25\text{ °C}$
 (1) $I_B = 13.0\text{ mA}$
 (2) $I_B = 11.7\text{ mA}$
 (3) $I_B = 10.4\text{ mA}$
 (4) $I_B = 9.1\text{ mA}$
 (5) $I_B = 7.8\text{ mA}$
 (6) $I_B = 6.5\text{ mA}$
 (7) $I_B = 5.2\text{ mA}$
 (8) $I_B = 3.9\text{ mA}$
 (9) $I_B = 2.6\text{ mA}$
 (10) $I_B = 1.3\text{ mA}$

Fig. 9. BC817-25QC: Collector current as a function of collector-emitter voltage; typical values



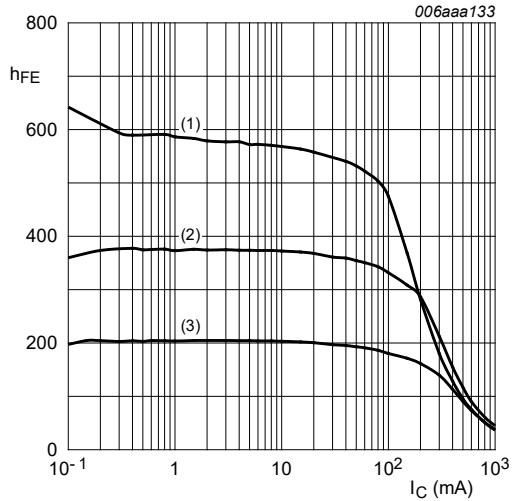
$I_C/I_B = 10$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 150\text{ °C}$

Fig. 10. BC817-25QC: Base-emitter saturation voltage as a function of collector current; typical values



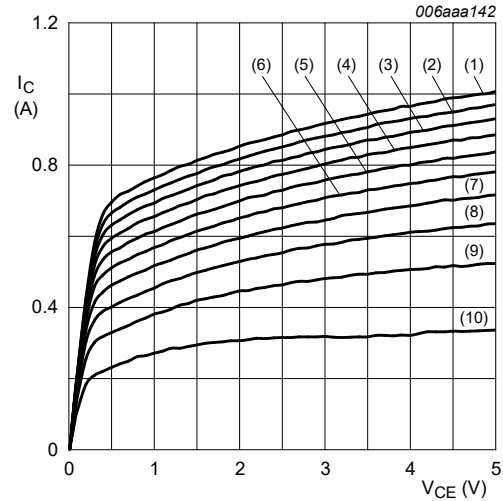
$I_C/I_B = 10$
 (1) $T_{amb} = 150\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

Fig. 11. BC817-25QC: Collector-emitter saturation voltage as a function of collector current; typical values



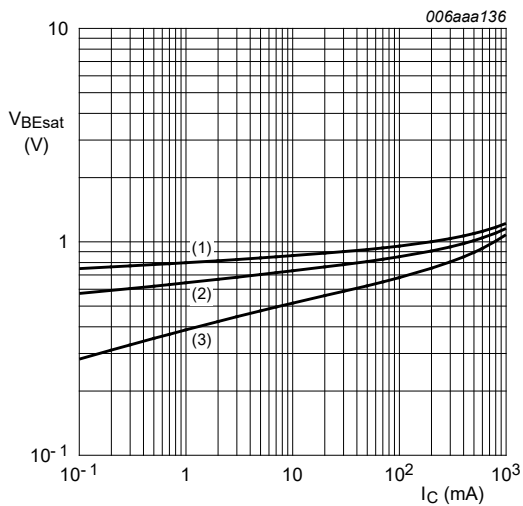
$V_{CE} = 1\text{ V}$
 (1) $T_{amb} = 150\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

Fig. 12. BC817-40QC: DC current gain as a function of collector current; typical values



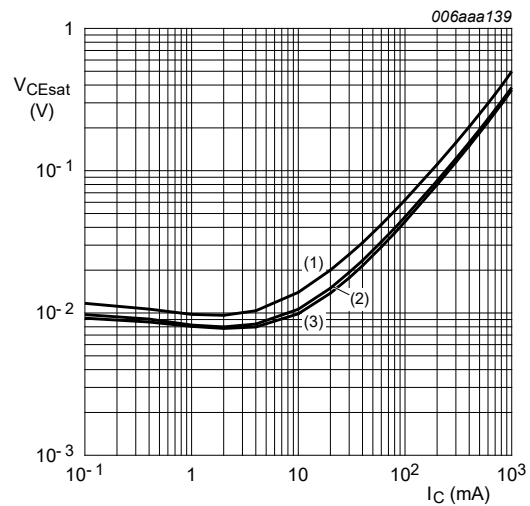
$T_{amb} = 25\text{ °C}$
 (1) $I_B = 12.0\text{ mA}$
 (2) $I_B = 10.8\text{ mA}$
 (3) $I_B = 9.6\text{ mA}$
 (4) $I_B = 8.4\text{ mA}$
 (5) $I_B = 7.2\text{ mA}$
 (6) $I_B = 6.0\text{ mA}$
 (7) $I_B = 4.8\text{ mA}$
 (8) $I_B = 3.6\text{ mA}$
 (9) $I_B = 2.4\text{ mA}$
 (10) $I_B = 1.2\text{ mA}$

Fig. 13. BC817-40QC: Transition frequency as a function of collector current; typical values



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

Fig. 14. BC817-40QC: Base-emitter saturation voltage as a function of collector current; typical values



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

Fig. 15. BC817-40QC: Collector-emitter saturation voltage as a function of collector current; typical values

11. Test information

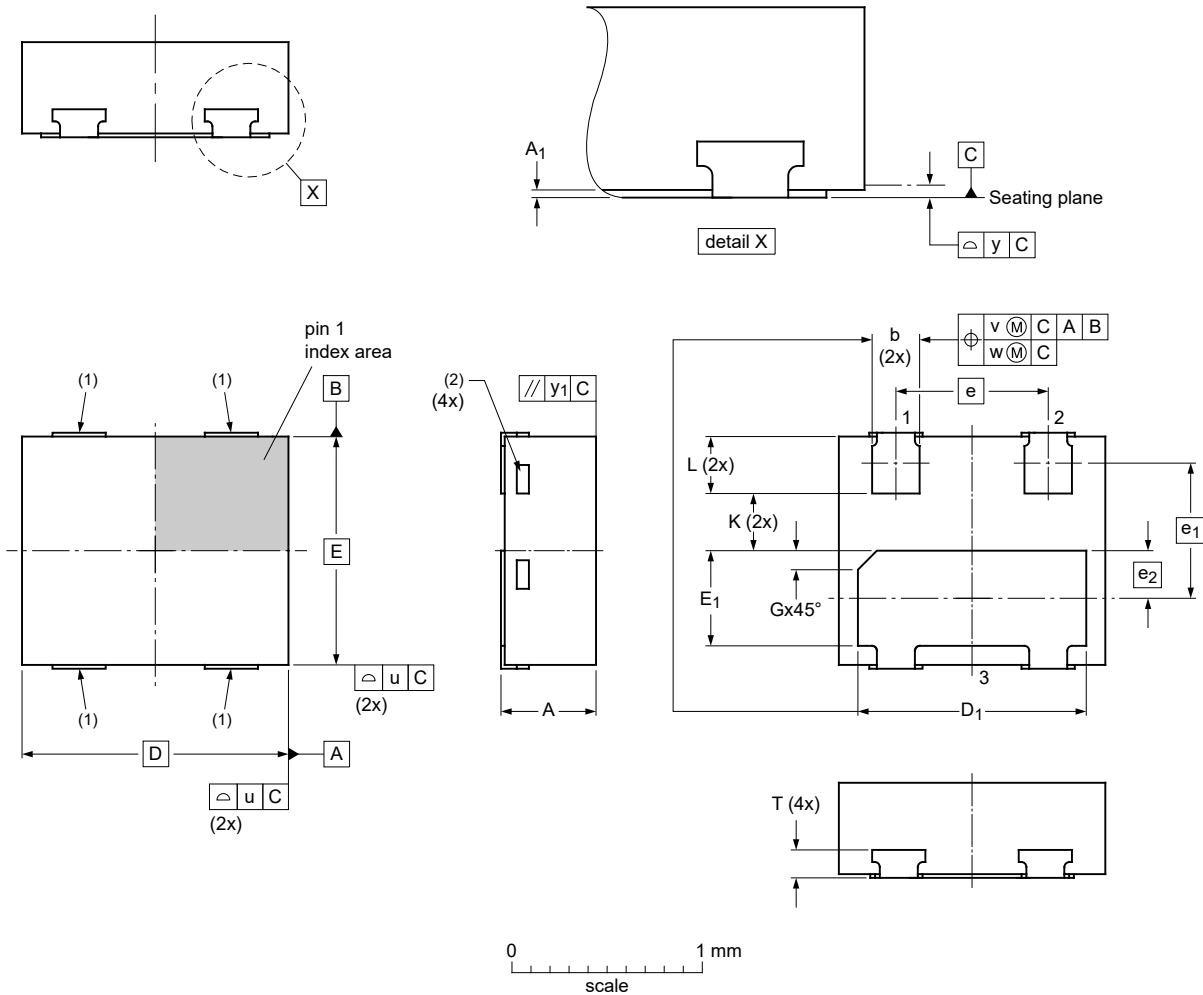
11.1. Quality information

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.

12. Package outline

DFN1412D-3: plastic, leadless extremely thin small outline package with side-wettable flanks (SWF); 3 terminals; 0.8 mm pitch; 1.4 mm x 1.2 mm x 0.48 mm body

SOT8009



Dimensions (mm are the original dimensions)

| Unit | A | A ₁ | b | D | D ₁ | E | E ₁ | e | e ₁ | e ₂ | G | K | L | T | u | v | w | y | y ₁ |
|------|------|----------------|------|------|----------------|-----|----------------|-----|----------------|----------------|-------|------|------|------|------|-----|------|------|----------------|
| max | 0.50 | 0.04 | 0.30 | 1.25 | 0.55 | | | | | | | | 0.35 | 0.22 | | | | | |
| nom | 0.47 | | 0.25 | 1.4 | 1.20 | 1.2 | 0.50 | 0.8 | 0.71 | 0.26 | 0.09 | | 0.30 | 0.16 | 0.05 | 0.1 | 0.05 | 0.05 | 0.05 |
| min | 0.44 | | 0.22 | 1.17 | 0.47 | | | | | | (ref) | 0.25 | 0.27 | 0.10 | | | | | |

Note

- Side Wettable Flank, protrusion max. 0.02 mm.
 - Visible depend upon used manufacturing technology.
- Dimension A and T are including plating thickness.

sot8009_po

| Outline version | References | | | | European projection | Issue date |
|-----------------|------------|----------|-------|--|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | | |
| SOT8009 | | MO-340CA | | | | 19-12-04 19-12-06 |

Fig. 16. Package outline SOT8009 (DFN1412D-3)

13. Soldering

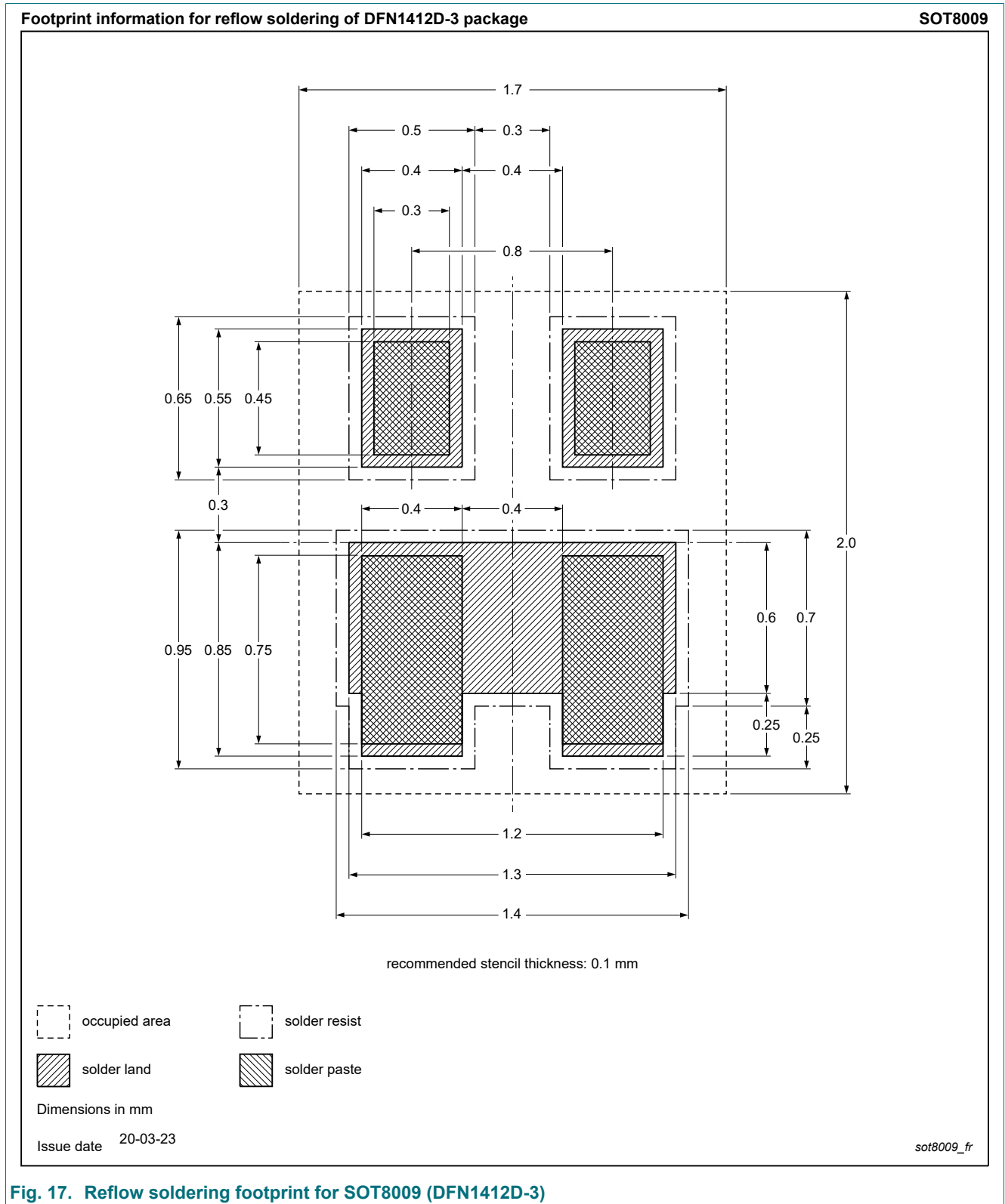


Fig. 17. Reflow soldering footprint for SOT8009 (DFN1412D-3)

14. Revision history

Table 9. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|---|--------------------|---------------|-----------------|
| BC817QC_SER v.2 | 20201028 | Product data sheet | - | BC817QC_SER v.1 |
| Modifications: | • Thermal characteristics: $R_{th(j-sp)}$ removed | | | |
| BC817QC_SER v.1 | 20200512 | 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. |

- [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 <https://www.nexperia.com>.

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For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: salesaddresses@nexperia.com

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