# BC847xQC-Q series

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

Rev. 2 — 21 May 2021 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: |
|---|---|---|---|
| | Nexperia | JEDEC | |
| BC847AQC-Q | SOT8009 | MO-340CA | BC857AQC-Q |
| BC847BQC-Q | | | BC857BQC-Q |
| BC847CQC-Q | | | BC857CQC-Q |

## 2. Features and benefits

- High power dissipation capability
- Suitable for Automatic Optical Inspection (AOI) of solder joint
- Smaller footprint compared to conventional leaded SMD packages
- Low package height of 0.5 mm
- Qualified according to AEC-Q101 and recommended for use in automotive applications

## 3. Applications

- General-purpose switching and amplification
- Space restricted applications

## 4. Quick reference data

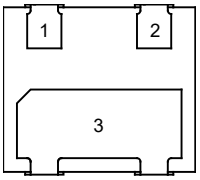
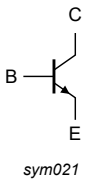
**Table 2. Quick reference data**

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CEO}$ | collector-emitter voltage | open base | - | - | 45 | V |
| $I_C$ | collector current | | - | - | 100 | mA |
| $I_{CM}$ | peak collector current | single pulse; $t_p \leq 1$ ms | - | - | 200 | mA |
| $h_{FE}$ | DC current gain | | | | | |
| | BC847AQC-Q | $V_{CE}$ = 5 V; $I_C$ = 2 mA | 110 | - | 220 | |
| | BC847BQC-Q | | 200 | - | 450 | |
| | BC847CQC-Q | | 420 | - | 800 | |

## 5. Pinning information

**Table 3. Pinning**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | B | base |   Bottom view |   sym021 |
| 2 | E | emitter | | |
| 3 | C | collector | | |

## 6. Ordering information

**Table 4. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BC847AQC-Q | DFN1412D-3 | plastic, leadless ultra small outline package with sidewettable flanks (SWF); 3 terminals; 0.8 mm pitch; 1.4 mm x 1.2 mm x 0.48 mm body | SOT8009 |
| BC847BQC-Q | | | |
| BC847CQC-Q | | | |

## 7. Marking

**Table 5. Marking**

| Type number | Marking code |
|---|---|
| BC847AQC-Q | 9C |
| BC847BQC-Q | 9D |
| BC847CQC-Q | 9E |

# 8. Limiting values

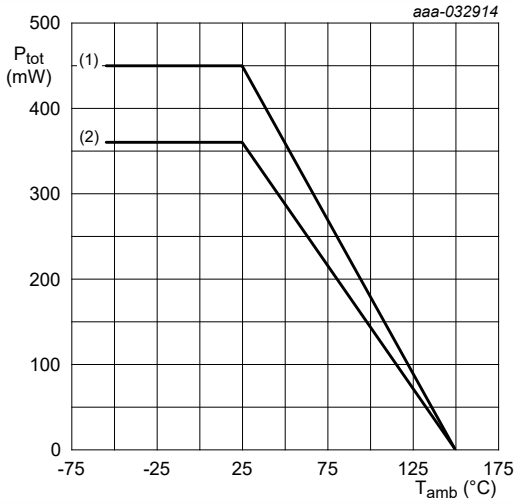
**Table 6. Limiting values**

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

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

| 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 | [1] | - | 360 | mW |
| | | | [2] | - | 450 | 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 Printed-Circuit-Board (PCB); single-sided 35 µm copper; tin-plated and standard footprint.
[2] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided 70 µm copper; tin-plated and standard footprint.




(1) FR4 PCB; single-sided 70 µm copper, standard footprint
(2) FR4 PCB; single-sided 35 µm copper, standard footprint

**Fig. 1. Power derating curves DFN1412D-3 (SOT8009)**

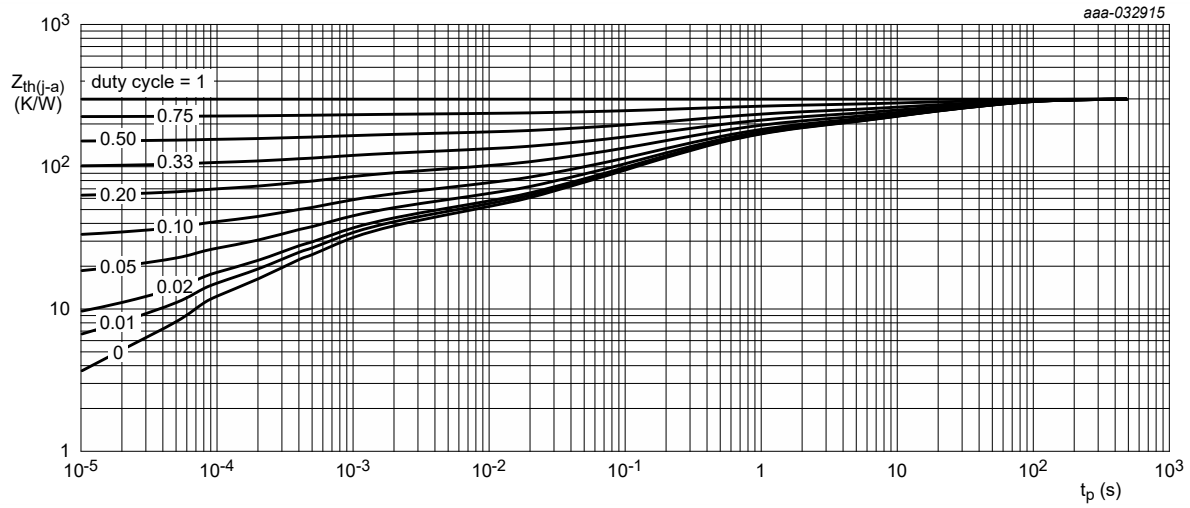
# 9. Thermal characteristics

**Table 7. Thermal characteristics**

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

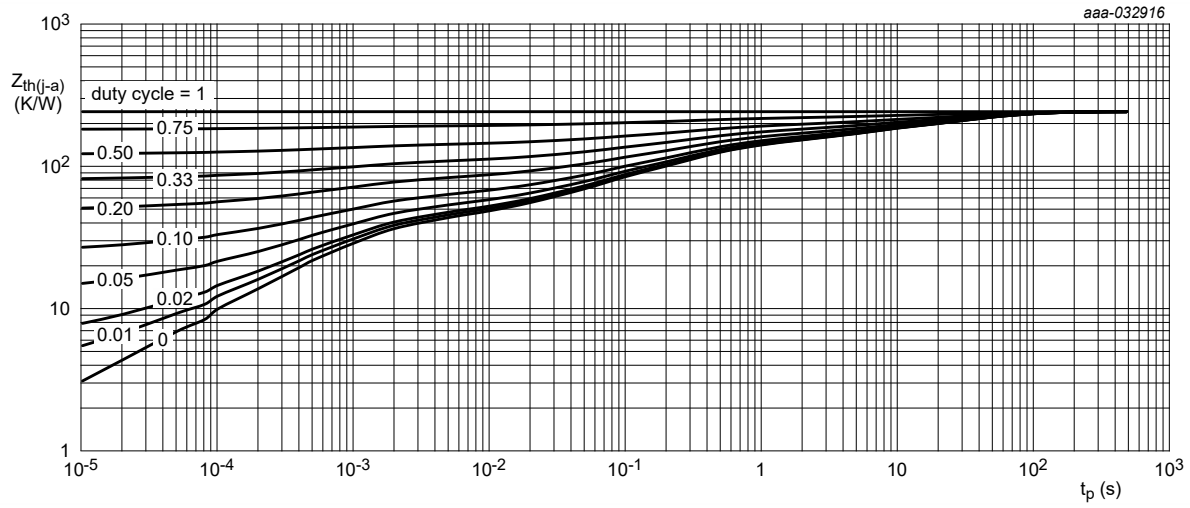
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 348 | K/W |
| | | | [2] | - | - | 278 | K/W |

[1] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided 35 µm copper; tin-plated and standard footprint.
[2] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided 70 µm copper; tin-plated and standard footprint.




FR4 PCB; single-sided 35 µm copper, 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, standard footprint

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

# 10. Characteristics

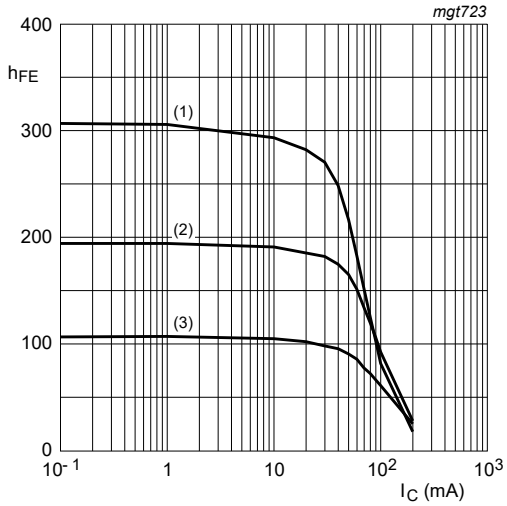
**Table 8. Characteristics**

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C$ = 100 µA; $I_E$ = 0 A | 50 | - | - | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $I_C$ = 2 mA; $I_B$ = 0 A | 45 | - | - | V |
| $V_{(BR)EBO}$ | emitter-base breakdown voltage | $I_E$ = 100 µA; $I_C$ = 0 A | 6 | - | - | V |
| $I_{CBO}$ | 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 | | | | | |
| | BC847AQC-Q | $V_{CE}$ = 5 V; $I_C$ = 2 mA | 110 | - | 220 | |
| | BC847BQC-Q | | 200 | - | 450 | |
| | BC847CQC-Q | | 420 | - | 800 | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 10 mA; $I_B$ = 0.5 mA | - | - | 200 | mV |
| | | $I_C$ = 100 mA; $I_B$ = 5 mA [1] | - | - | 400 | mV |
| $V_{BE}$ | base-emitter voltage | $V_{CE}$ = 5 V ; $I_C$ = 2 mA [2] | 580 | - | 700 | mV |
| | | $V_{CE}$ = 5 V ; $I_C$ = 10 mA [2] | - | - | 770 | mV |
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C$ = 10 mA ; $I_B$ = 0.5 mA | - | 760 | - | mV |
| | | $I_C$ = 100 mA ; $I_B$ = 5 mA [1] | - | 900 | - | mV |
| $f_T$ | transition frequency | $V_{CE}$ = 5 V; $I_C$ = 10 mA; f = 100 MHz | 100 | - | - | MHz |
| $C_c$ | collector capacitance | $V_{CB}$ = 10 V; $I_E$ = $i_e$ = 0 A; f = 1 MHz | - | - | 1.5 | pF |
| $C_e$ | emitter capacitance | $V_{EB}$ = 0.5 V; $I_E$ = $i_e$ = 0 A; f = 1 MHz | - | 11 | - | pF |
| NF | noise figure | $V_{CE}$ = 5 V; $I_C$ = 200µA; $R_S$ = 2 kΩ; f = 1 kHz; B = 200 Hz | - | - | 10 | dB |

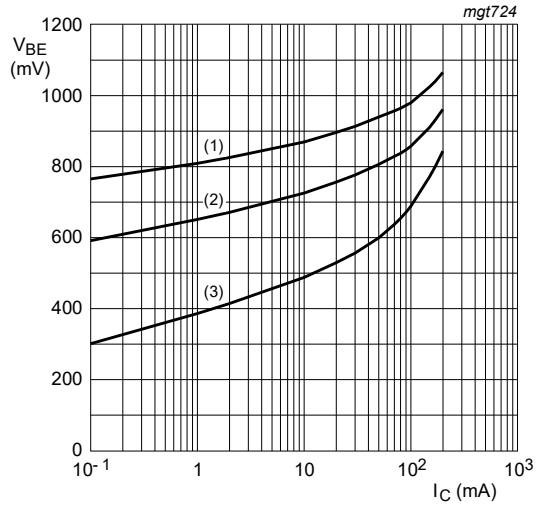
[1] pulsed; $t_p \leq 300$ µs; $\delta \leq 0.02$

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



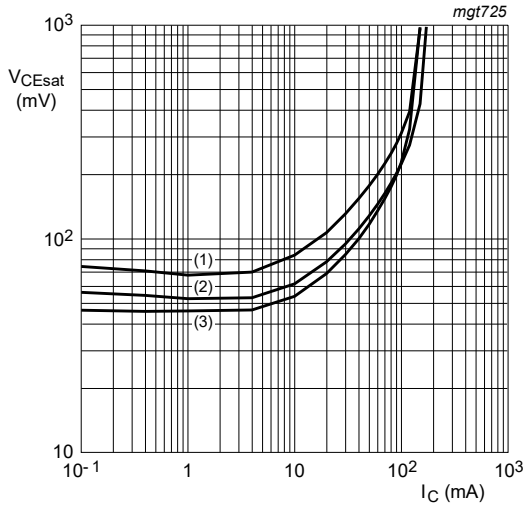

$V_{CE}$ = 5 V
(1) $T_{amb}$ = 150 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = -55 °C

**Fig. 4. BC847AQC-Q: DC current gain as a function of collector current; typical values**



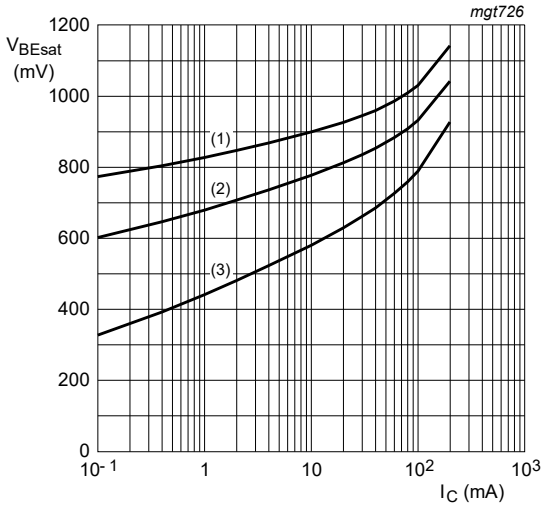

$V_{CE}$ = 5 V
(1) $T_{amb}$ = -55 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = 150 °C

**Fig. 5. BC847AQC-Q: Base-emitter voltage as a function of collector current; typical values**



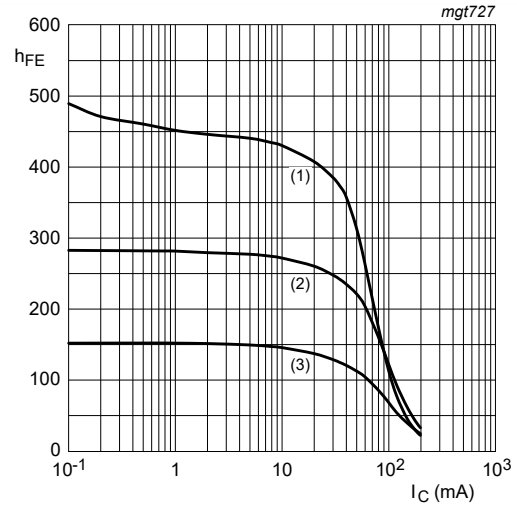

$I_C / I_B$ = 20
(1) $T_{amb}$ = 150 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = -55 °C

**Fig. 6. BC847AQC-Q: Collector-emitter saturation voltage as a function of collector current; typical values**



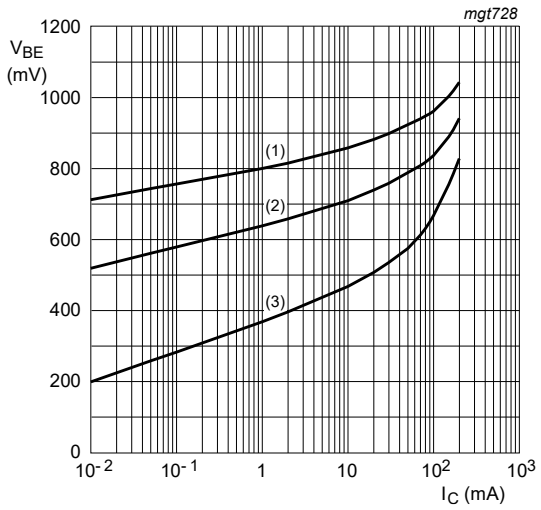

$I_C / I_B$ = 10
(1) $T_{amb}$ = -55 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = 150 °C

**Fig. 7. BC847AQC-Q: Base-emitter saturation voltage as a function of collector current; typical values**



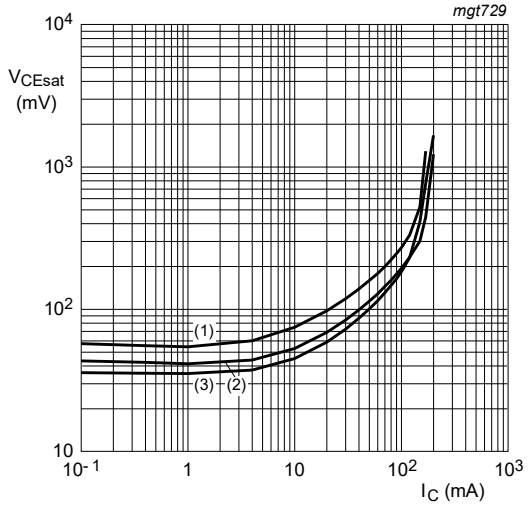

$V_{CE}$ = 5 V
(1) $T_{amb}$ = 150 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = -55 °C

**Fig. 8. BC847BQC-Q: DC current gain as a function of collector current; typical values**



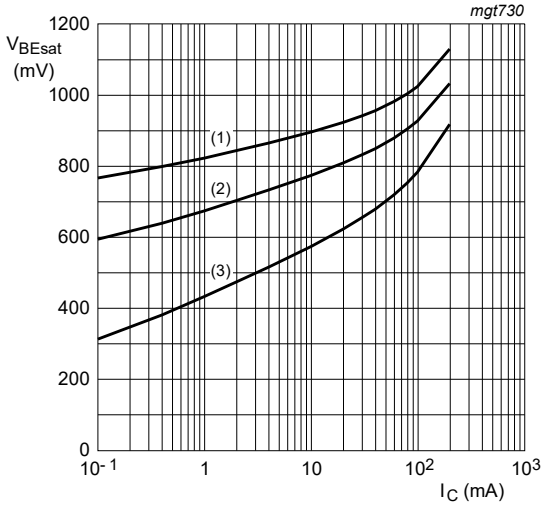

$V_{CE}$ = 5 V
(1) $T_{amb}$ = -55 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = 150 °C

**Fig. 9. BC847BQC-Q: Base-emitter voltage as a function of collector current; typical values**



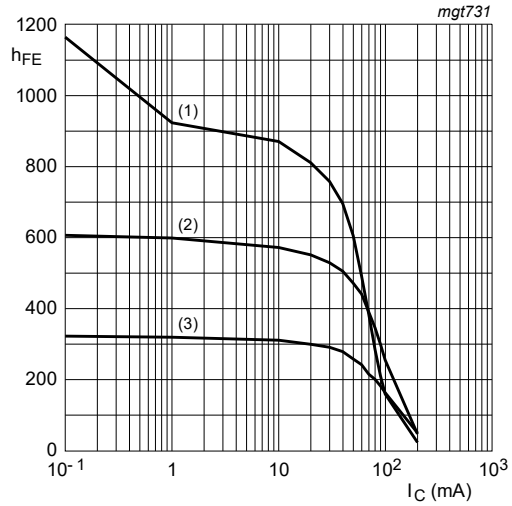

$I_C$/ $I_B$= 20
(1) $T_{amb}$ = 150 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = -55 °C

**Fig. 10. BC847BQC-Q: Collector-emitter saturation voltage as a function of collector current; typical values**



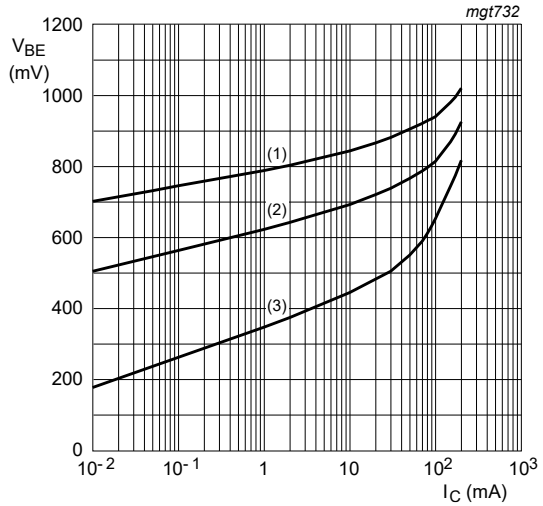

$I_C$/ $I_B$= 10
(1) $T_{amb}$ = -55 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = 150 °C

**Fig. 11. BC847BQC-Q: Base-emitter saturation voltage as a function of collector current; typical values**



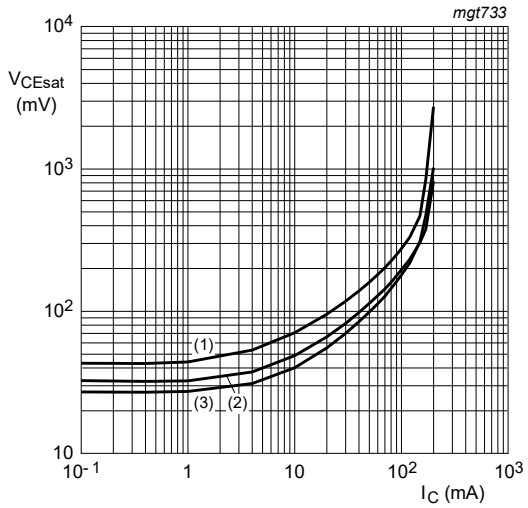

$V_{CE}$ = 5 V
(1) $T_{amb}$ = 150 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = -55 °C

**Fig. 12. BC847CQC-Q: DC current gain as a function of collector current; typical values**



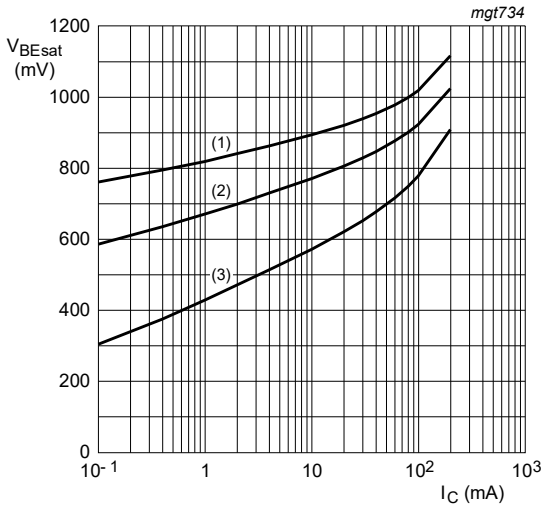

$V_{CE}$ = 5 V
(1) $T_{amb}$ = -55 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = 150 °C

**Fig. 13. BC847CQC-Q: 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. 14. BC847CQC-Q: 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. 15. BC847CQC-Q: Base-emitter saturation voltage as a function of collector current; typical values**

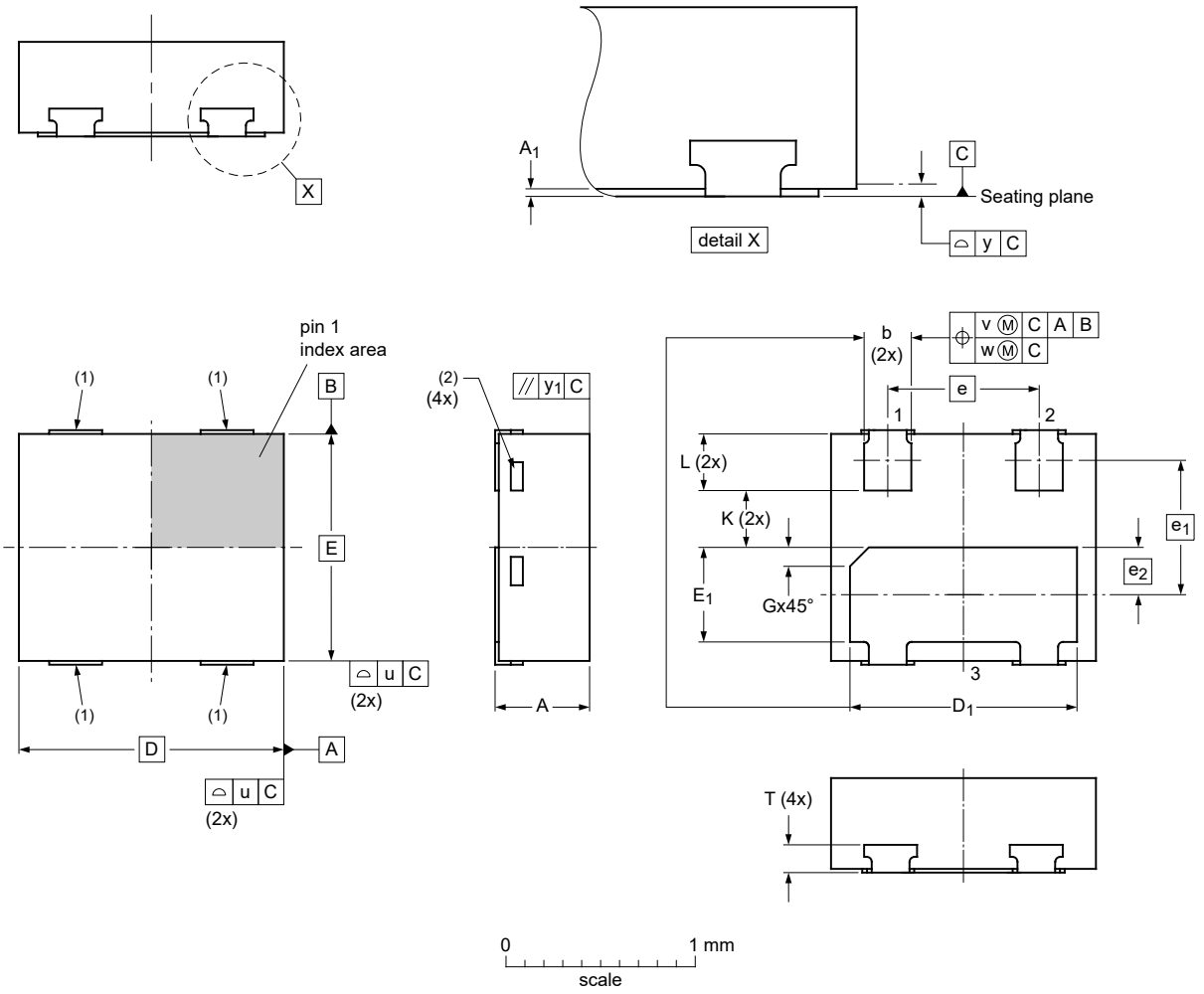
# 11. Test information

## Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.

## 12. Package outline

**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 | y1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| max | 0.50 | 0.04 | 0.30 | | 1.25 | | 0.55 | | | | | | 0.35 | 0.22 | | | | | |
| mm nom | 0.47 | | 0.25 | 1.4 | 1.20 | 1.2 | 0.50 | 0.8 | 0.71 | 0.26 | 0.09 (ref) | | 0.30 | 0.16 | 0.05 | 0.1 | 0.05 | 0.05 | 0.05 |
| min | 0.44 | | 0.22 | | 1.17 | | 0.47 | | | | | 0.25 | 0.27 | 0.10 | | | | | |

Note
1. Side Wettable Flank, protrusion max. 0.02 mm.
2. 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 DFN1412D-3 (SOT8009)**

## 13. Soldering

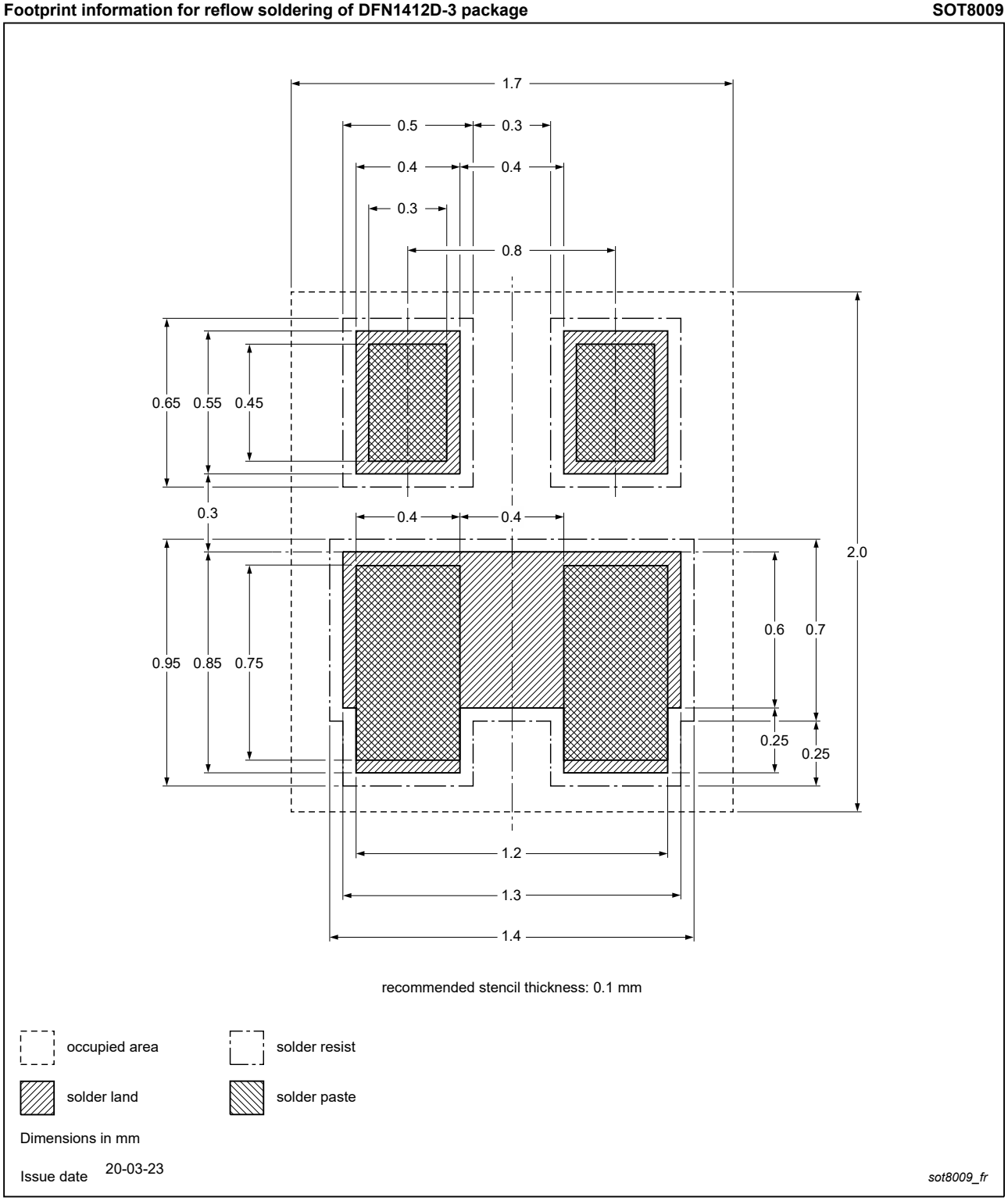



**Fig. 17. Reflow soldering footprint for DFN1412D-3 (SOT8009)**

## 14. Revision history

**Table 9. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BC847xQC-Q_SER v.2 | 20210521 | Product data sheet | - | BC847xQC-Q_SER v.1 |
| Modifications: | • Features and benefits: added recommendation for automotive applications | | | |
| BC847xQC-Q_SER v.1 | 20210304 | 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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# Contents





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