



BC816H series

80 V, 500 mA NPN general-purpose transistors

Rev. 1 — 26 March 2020

Product data sheet

1. General description

NPN general-purpose transistors in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

| Type number | Package | | NPN complement: |
|-------------|----------|----------|-----------------|
| | Nexperia | JEDEC | |
| BC816-16H | SOT23 | TO-236AB | BC806-16H |
| BC816-25H | SOT23 | TO-236AB | BC806-25H |

2. Features and benefits

- High current
- High voltage
- Two current gain selections
- High-temperature applications up to 175 °C
- AEC-Q101 qualified

3. Applications

- General-purpose switching and amplification
- 48 V automotive board net

4. Quick reference data

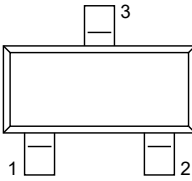
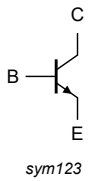
Table 2. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|-----------|---------------------------|--|-----|-----|-----|------|--|
| V_{CE0} | collector-emitter voltage | open base; $T_{amb} = 25\text{ °C}$ | - | - | 80 | 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 | | | | | | |
| | BC816-16H | $V_{CE} = 1\text{ V}$; $I_C = 100\text{ mA}$ $T_{amb} = 25\text{ °C}$ | [1] | 100 | - | 250 | |
| | BC816-25H | | [1] | 160 | - | 400 | |

[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 |  TO-236AB (SOT23) |  sym123 |
| 2 | E | emitter | | |
| 3 | C | collector | | |

6. Ordering information

Table 4. Ordering information

| Type number | Package | | |
|-------------|----------|---|---------|
| | Name | Description | Version |
| BC816-16H | TO-236AB | plastic, surface-mounted package; 3 leads | SOT23 |
| BC816-25H | | | |

7. Marking

Table 5. Marking

| Type number | Marking code [1] |
|-------------|------------------|
| BC816-16H | QQ% |
| BC816-25H | QR% |

[1] % = placeholder for manufacturing site code

8. Limiting values

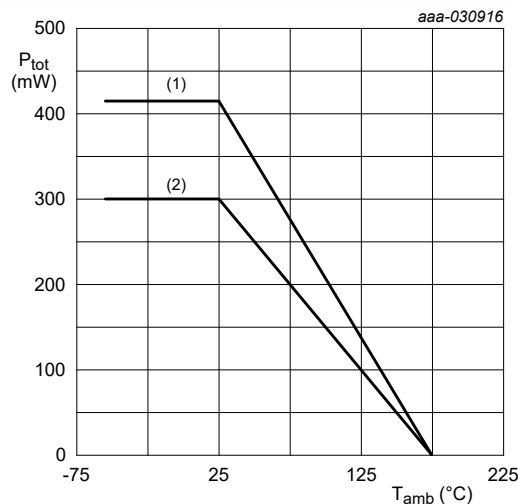
Table 6. Limiting values

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|---------------------------|---|-----|-----|------|
| V_{CBO} | collector-base voltage | open emitter; $T_{amb} = 25\text{ °C}$ | - | 80 | V |
| V_{CEO} | collector-emitter voltage | open base; $T_{amb} = 25\text{ °C}$ | - | 80 | V |
| V_{EBO} | emitter-base voltage | open collector; $T_{amb} = 25\text{ °C}$ | - | 7 | 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] | 300 | mW |
| | | | [2] | 415 | mW |
| T_j | junction temperature | | - | 175 | °C |
| T_{amb} | ambient temperature | | -55 | 175 | °C |
| T_{stg} | storage temperature | | -65 | 175 | °C |

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

[2] Device mounted on an FR4 PCB; single-sided copper; tin-plated; mounting pad for collector 1 cm^2 .



(1) FR4 PCB; 1 cm^2 mounting pad for collector

(2) FR4 PCB; standard footprint

Fig. 1. Power derating curves for SOT23

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] | - | - | 500 | K/W |
| | | | [2] | - | - | 363 | K/W |

- [1] Device mounted on an FR4 PCB; single-sided copper; tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB; single-sided copper; tin-plated; mounting pad for collector 1 cm².

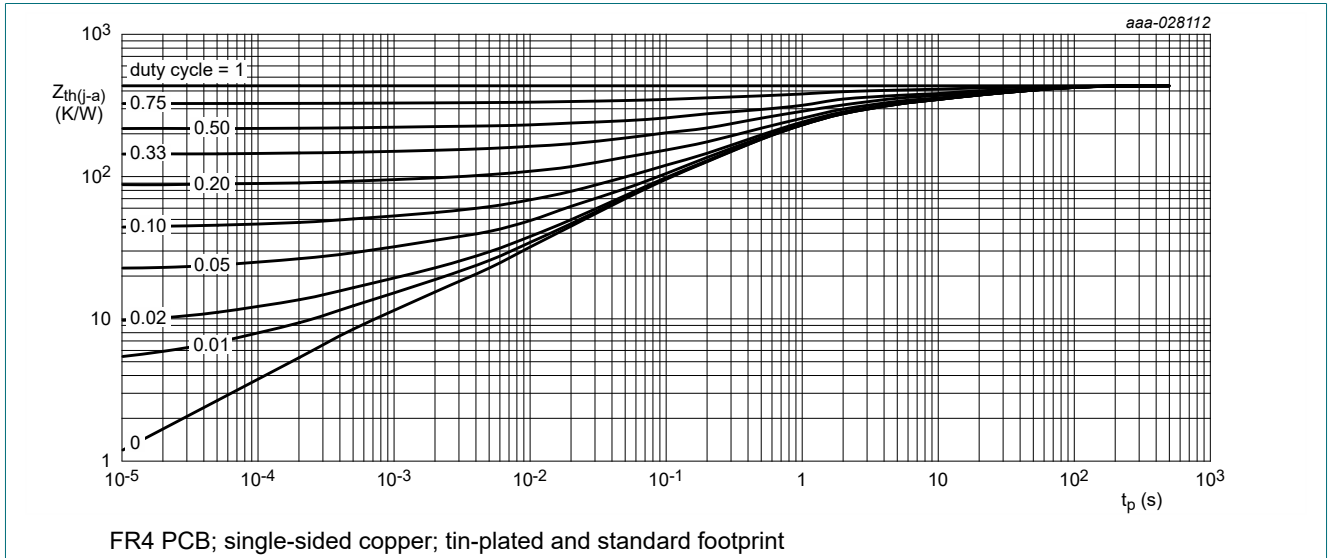


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

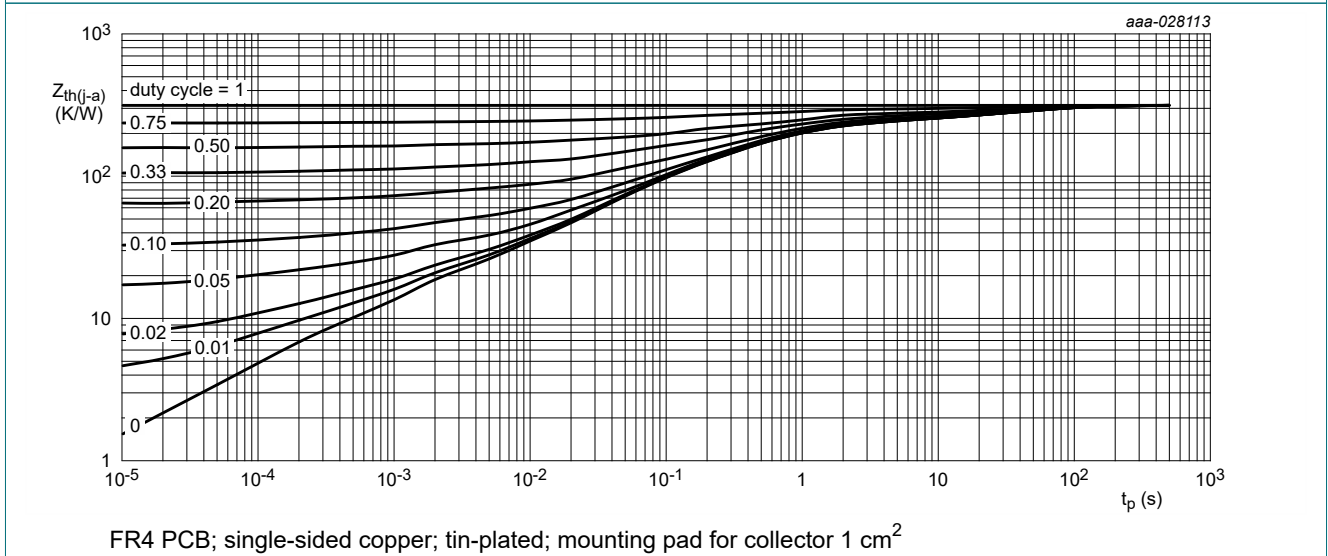


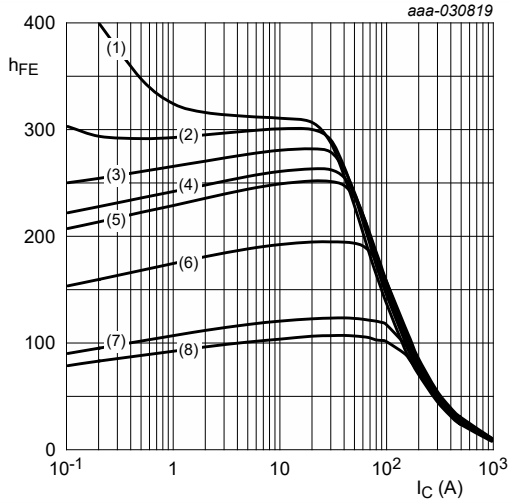
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 8. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|---------------|--------------------------------------|--|-----|-----|-----|---------------|-----|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C = 100 \mu\text{A}; I_E = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | 80 | - | | V | |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $I_C = 2 \text{ mA}; I_E = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | 80 | - | | V | |
| $V_{(BR)EBO}$ | emitter-base breakdown voltage | $I_E = 100 \mu\text{A}; I_C = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | 7 | - | | V | |
| I_{CBO} | collector-base cut-off current | $V_{CB} = 64 \text{ V}; I_E = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | - | - | 100 | nA | |
| | | $V_{CB} = 64 \text{ V}; I_E = 0 \text{ A}; T_j = 150 \text{ }^\circ\text{C}$ | - | - | 5 | μA | |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5.6 \text{ V}; I_C = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | - | - | 100 | nA | |
| h_{FE} | DC current gain | | | | | | |
| | BC816-16H | $V_{CE} = 1 \text{ V}; I_C = 100 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | [1] | 100 | - | 250 | |
| | BC816-25H | $V_{CE} = 1 \text{ V}; I_C = 100 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | [1] | 160 | - | 400 | |
| | | $V_{CE} = 2 \text{ V}; I_C = 500 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | [1] | 30 | - | - | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 100 \text{ mA}; I_B = 10 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | [1] | - | - | 150 | mV |
| | | $I_C = 500 \text{ mA}; I_B = 50 \text{ mA}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | [1] | - | - | 400 | 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 | $V_{CE} = 5 \text{ V}; I_C = 50 \text{ mA}; f = 100 \text{ MHz}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | | 100 | - | - | MHz |
| C_c | collector capacitance | $V_{CB} = 10 \text{ V}; I_E = i_c = 0 \text{ A}; f = 1 \text{ MHz}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | | - | 2 | - | pF |
| C_e | emitter capacitance | $V_{EB} = 0.5 \text{ V}; I_C = i_c = 0 \text{ A}; f = 1 \text{ MHz}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | | - | 42 | - | pF |

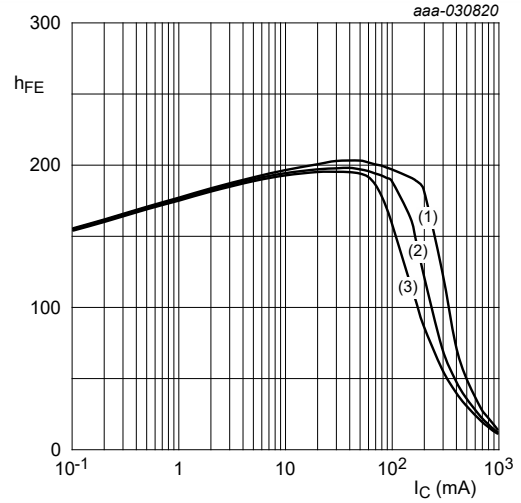
[1] pulsed; $t_p \leq 300 \mu\text{s}$; $\delta \leq 0.02$



$V_{CE} = 1 \text{ V}$

- (1) $T_{amb} = 175 \text{ }^\circ\text{C}$
- (2) $T_{amb} = 150 \text{ }^\circ\text{C}$
- (3) $T_{amb} = 125 \text{ }^\circ\text{C}$
- (4) $T_{amb} = 100 \text{ }^\circ\text{C}$
- (5) $T_{amb} = 85 \text{ }^\circ\text{C}$
- (6) $T_{amb} = 25 \text{ }^\circ\text{C}$
- (7) $T_{amb} = -40 \text{ }^\circ\text{C}$
- (8) $T_{amb} = -55 \text{ }^\circ\text{C}$

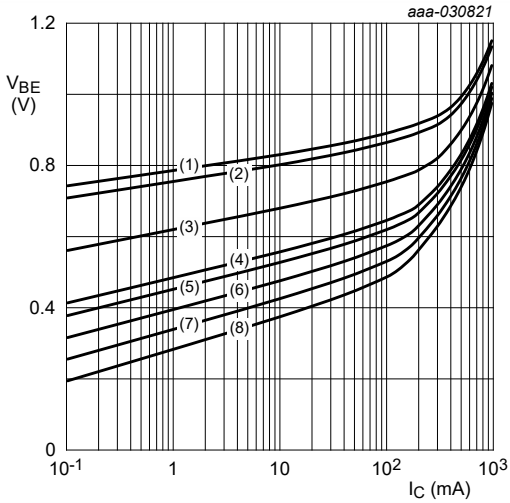
Fig. 4. BC816-16H: DC current gain as a function of collector current; typical values



$T_{amb} = 25 \text{ }^\circ\text{C}$

- (1) $V_{CE} = 5 \text{ V}$
- (2) $V_{CE} = 2 \text{ V}$
- (3) $V_{CE} = 1 \text{ V}$

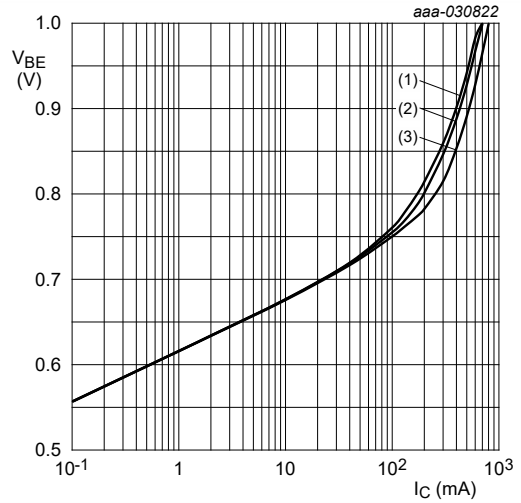
Fig. 5. BC816-16H: DC current gain as a function of collector current; typical values



$V_{CE} = 5 \text{ V}$

- (1) $T_{amb} = -55 \text{ }^\circ\text{C}$
- (2) $T_{amb} = -40 \text{ }^\circ\text{C}$
- (3) $T_{amb} = 25 \text{ }^\circ\text{C}$
- (4) $T_{amb} = 85 \text{ }^\circ\text{C}$
- (5) $T_{amb} = 100 \text{ }^\circ\text{C}$
- (6) $T_{amb} = 125 \text{ }^\circ\text{C}$
- (7) $T_{amb} = 150 \text{ }^\circ\text{C}$
- (8) $T_{amb} = 175 \text{ }^\circ\text{C}$

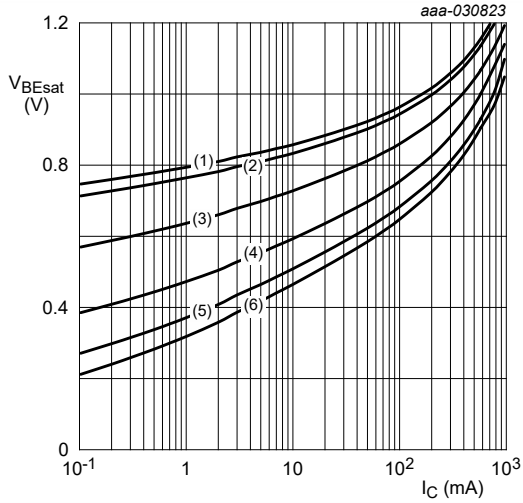
Fig. 6. BC816-16H: Base-emitter voltage as a function of collector current; typical values



$T_{amb} = 25 \text{ }^\circ\text{C}$

- (1) $V_{CE} = 1 \text{ V}$
- (2) $V_{CE} = 2 \text{ V}$
- (3) $V_{CE} = 5 \text{ V}$

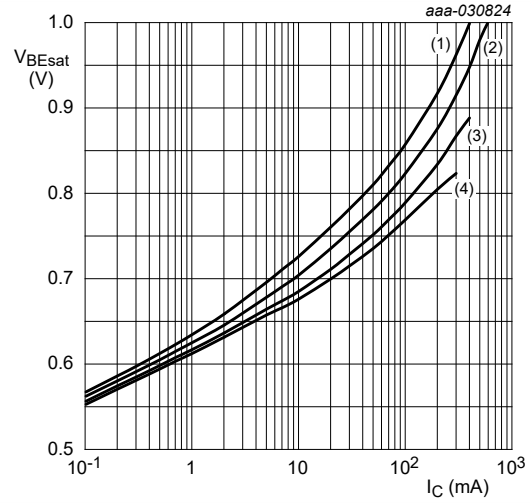
Fig. 7. BC816-16H: Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 10$

- (1) $T_{amb} = -55\text{ °C}$
- (2) $T_{amb} = -40\text{ °C}$
- (3) $T_{amb} = 25\text{ °C}$
- (4) $T_{amb} = 100\text{ °C}$
- (5) $T_{amb} = 150\text{ °C}$
- (6) $T_{amb} = 175\text{ °C}$

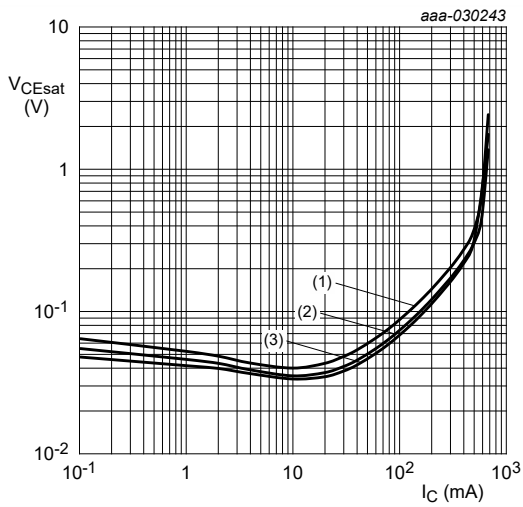
Fig. 8. BC816-16H: Base-emitter saturation voltage as a function of collector current; typical values



$T_{amb} = 25\text{ °C}$

- (1) $I_C/I_B = 10$
- (2) $I_C/I_B = 20$
- (3) $I_C/I_B = 50$
- (4) $I_C/I_B = 100$

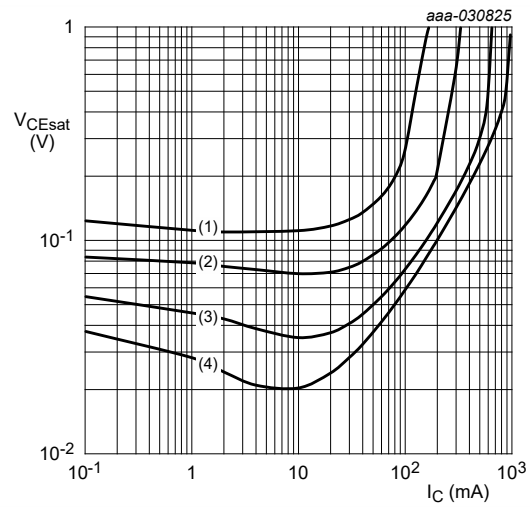
Fig. 9. BC816-16H: Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$

- (1) $T_{amb} = 100\text{ °C}$
- (2) $T_{amb} = 25\text{ °C}$
- (3) $T_{amb} = -40\text{ °C}$

Fig. 10. BC816-16H: Collector-emitter saturation voltage as a function of collector current; typical values



$T_{amb} = 25\text{ °C}$

- (1) $I_C/I_B = 100$
- (2) $I_C/I_B = 50$
- (3) $I_C/I_B = 20$
- (4) $I_C/I_B = 10$

Fig. 11. BC816-16H: Collector-emitter saturation voltage as a function of collector current; typical values

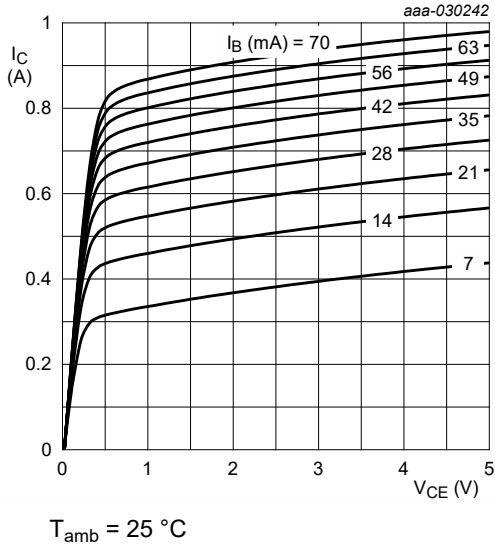


Fig. 12. BC816-16H: Collector current as a function of collector-emitter voltage; typical values

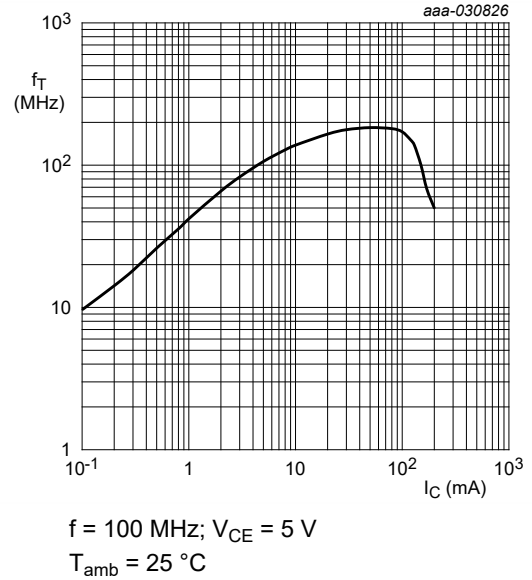


Fig. 13. BC816-16H: Transition frequency as a function of collector current; typical values

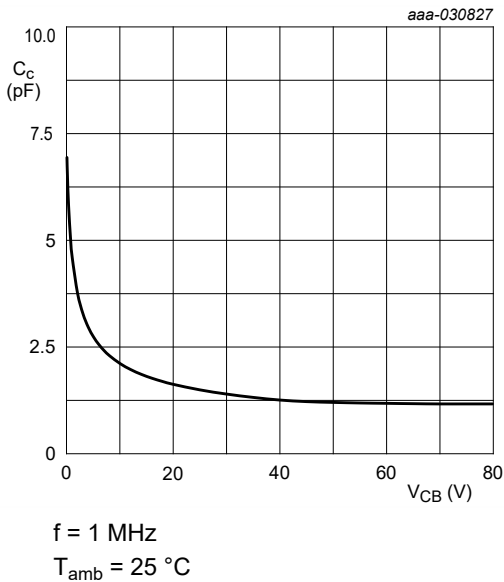


Fig. 14. BC816-16H: Collector capacitance as a function of collector-base voltage; typical values

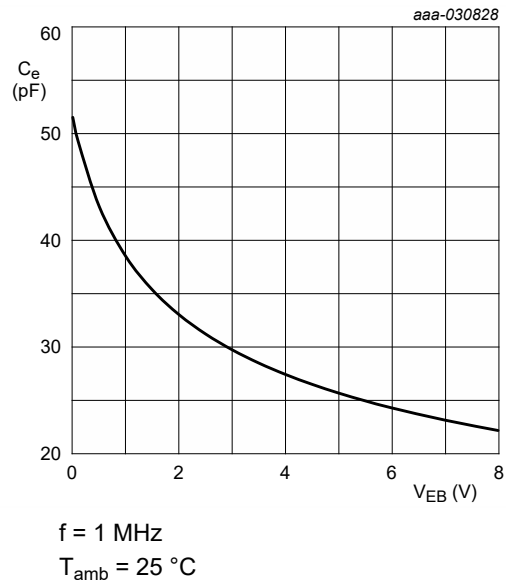
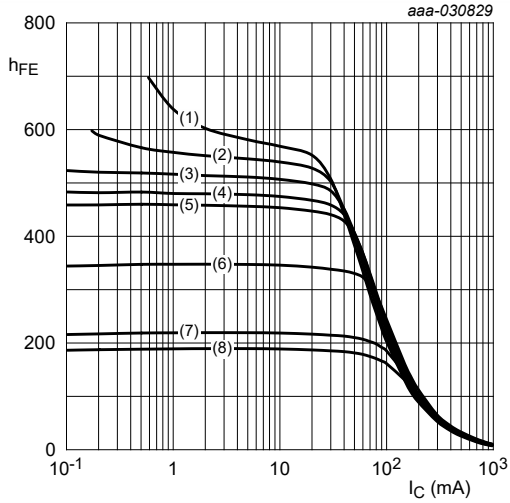


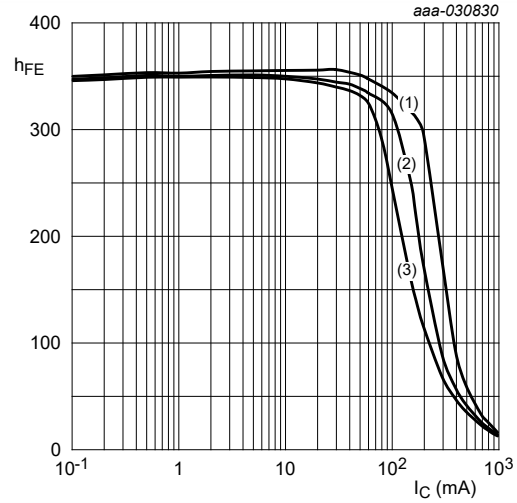
Fig. 15. BC816-16H: Emitter capacitance as a function of emitter-base voltage; typical values



$V_{CE} = 1\text{ V}$

- (1) $T_{amb} = 175\text{ °C}$
- (2) $T_{amb} = 150\text{ °C}$
- (3) $T_{amb} = 125\text{ °C}$
- (4) $T_{amb} = 100\text{ °C}$
- (5) $T_{amb} = 85\text{ °C}$
- (6) $T_{amb} = 25\text{ °C}$
- (7) $T_{amb} = -40\text{ °C}$
- (8) $T_{amb} = -55\text{ °C}$

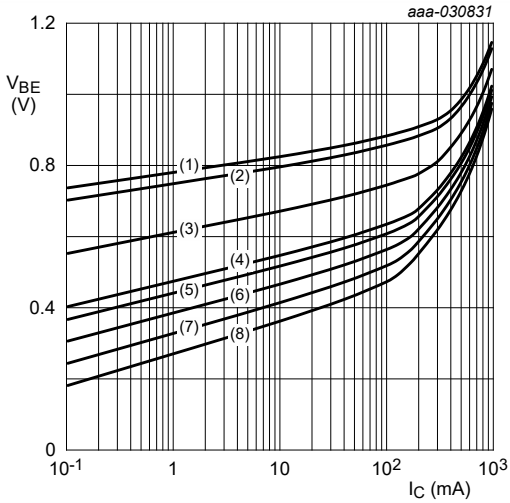
Fig. 16. BC816-25H: DC current gain as a function of collector current; typical values



$T_{amb} = 25\text{ °C}$

- (1) $V_{CE} = 5\text{ V}$
- (2) $V_{CE} = 2\text{ V}$
- (3) $V_{CE} = 1\text{ V}$

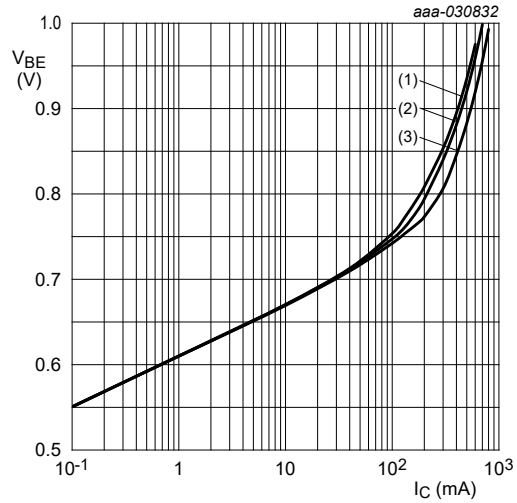
Fig. 17. BC816-25H: DC current gain as a function of collector current; typical values



$V_{CE} = 5\text{ V}$

- (1) $T_{amb} = -55\text{ °C}$
- (2) $T_{amb} = -40\text{ °C}$
- (3) $T_{amb} = 25\text{ °C}$
- (4) $T_{amb} = 85\text{ °C}$
- (5) $T_{amb} = 100\text{ °C}$
- (6) $T_{amb} = 125\text{ °C}$
- (7) $T_{amb} = 150\text{ °C}$
- (8) $T_{amb} = 175\text{ °C}$

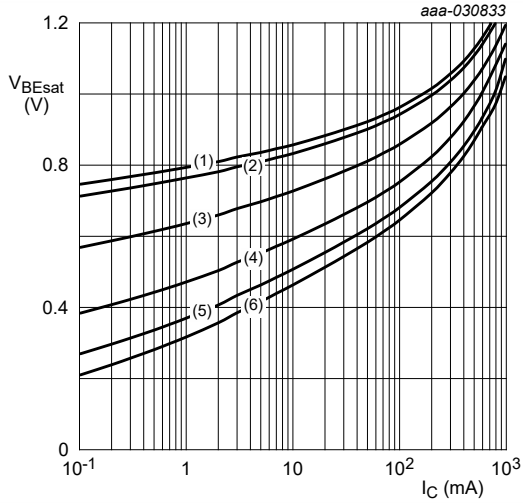
Fig. 18. BC816-25H: Base-emitter voltage as a function of collector current; typical values



$T_{amb} = 25\text{ °C}$

- (1) $V_{CE} = 1\text{ V}$
- (2) $V_{CE} = 2\text{ V}$
- (3) $V_{CE} = 5\text{ V}$

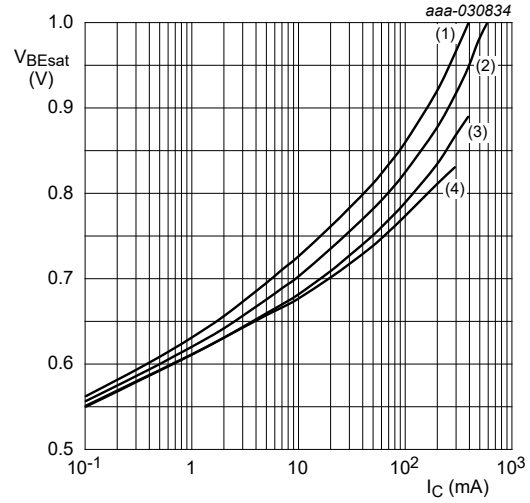
Fig. 19. BC816-25H: Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 10$

- (1) $T_{amb} = -55\text{ °C}$
- (2) $T_{amb} = -40\text{ °C}$
- (3) $T_{amb} = 25\text{ °C}$
- (4) $T_{amb} = 100\text{ °C}$
- (5) $T_{amb} = 150\text{ °C}$
- (6) $T_{amb} = 175\text{ °C}$

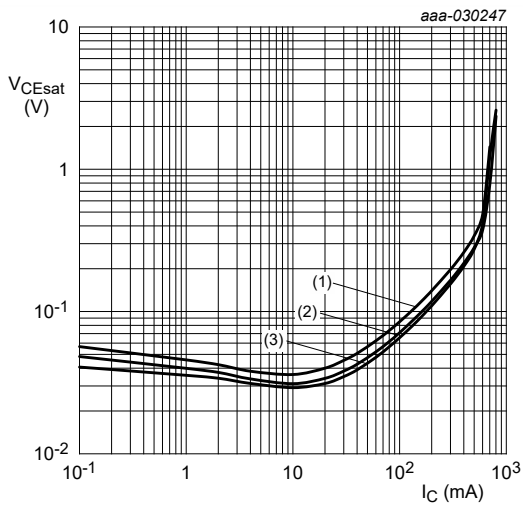
Fig. 20. BC816-25H: Base-emitter saturation voltage as a function of collector current; typical values



$T_{amb} = 25\text{ °C}$

- (1) $I_C/I_B = 10$
- (2) $I_C/I_B = 20$
- (3) $I_C/I_B = 50$
- (4) $I_C/I_B = 100$

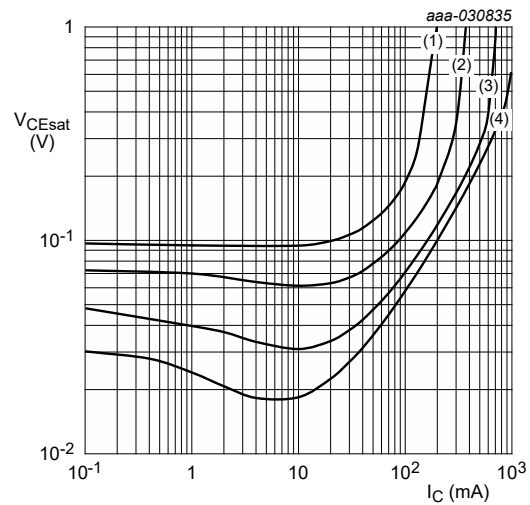
Fig. 21. BC816-25H: Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$

- (1) $T_{amb} = 100\text{ °C}$
- (2) $T_{amb} = 25\text{ °C}$
- (3) $T_{amb} = -40\text{ °C}$

Fig. 22. BC816-25H: Collector-emitter saturation voltage as a function of collector current; typical values



$T_{amb} = 25\text{ °C}$

- (1) $I_C/I_B = 100$
- (2) $I_C/I_B = 50$
- (3) $I_C/I_B = 20$
- (4) $I_C/I_B = 10$

Fig. 23. BC816-25H: Collector-emitter saturation voltage as a function of collector current; typical values

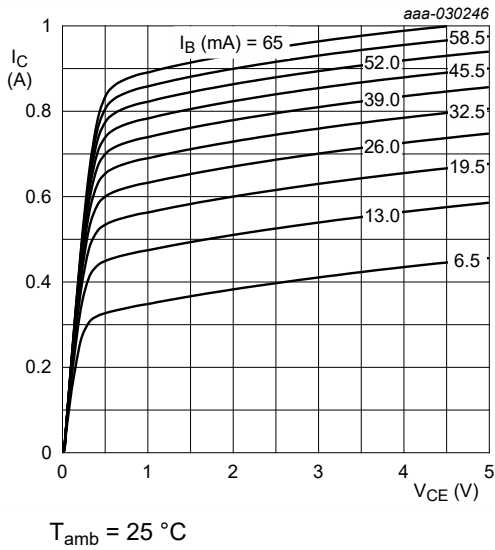


Fig. 24. BC816-25H: Collector current as a function of collector-emitter voltage; typical values

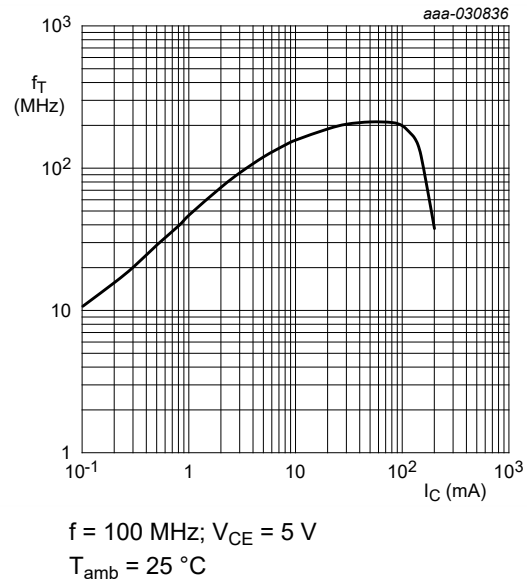


Fig. 25. BC816-25H: Transition frequency as a function of collector current; typical values

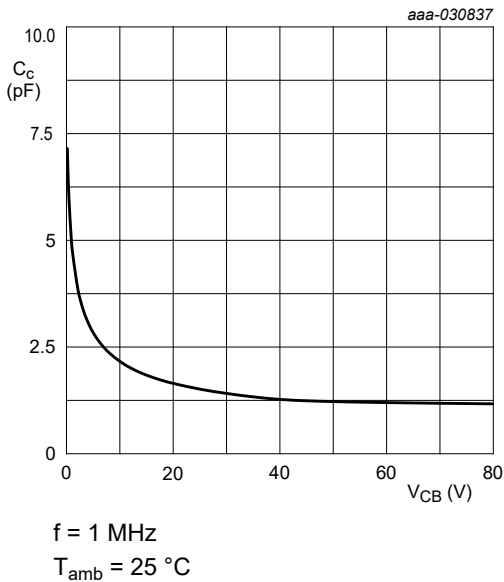


Fig. 26. BC816-25H: Collector capacitance as a function of collector-base voltage; typical values

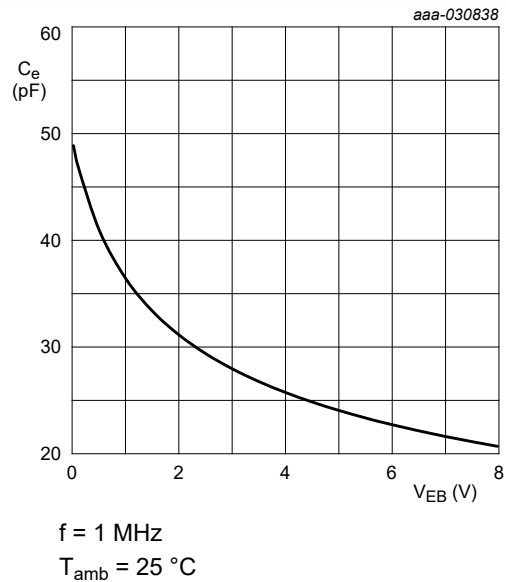


Fig. 27. BC816-25H: Emitter capacitance as a function of emitter-base voltage; typical values

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

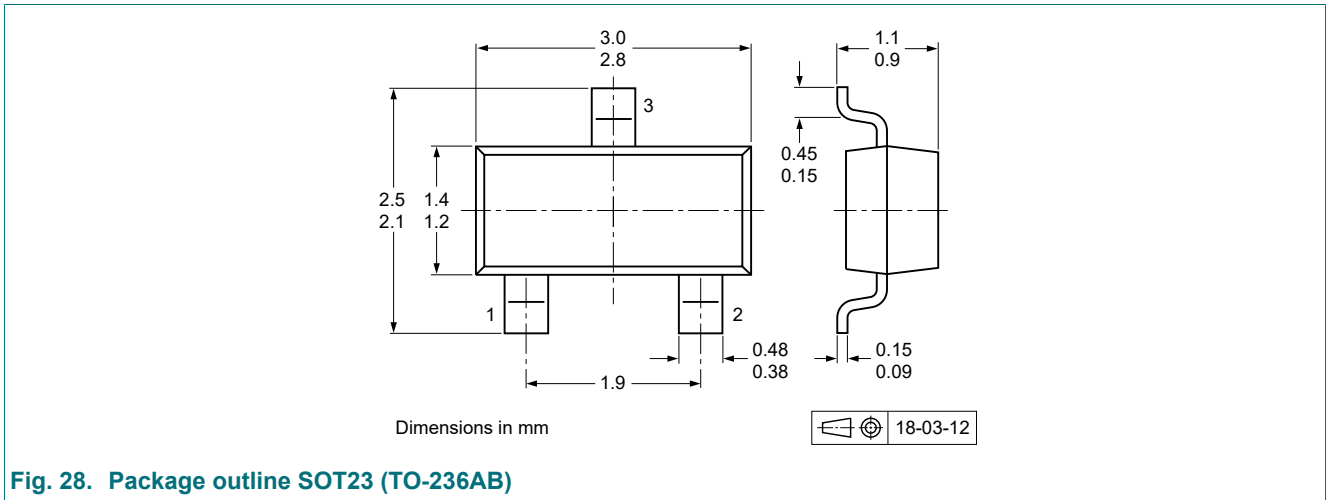


Fig. 28. Package outline SOT23 (TO-236AB)

13. Soldering

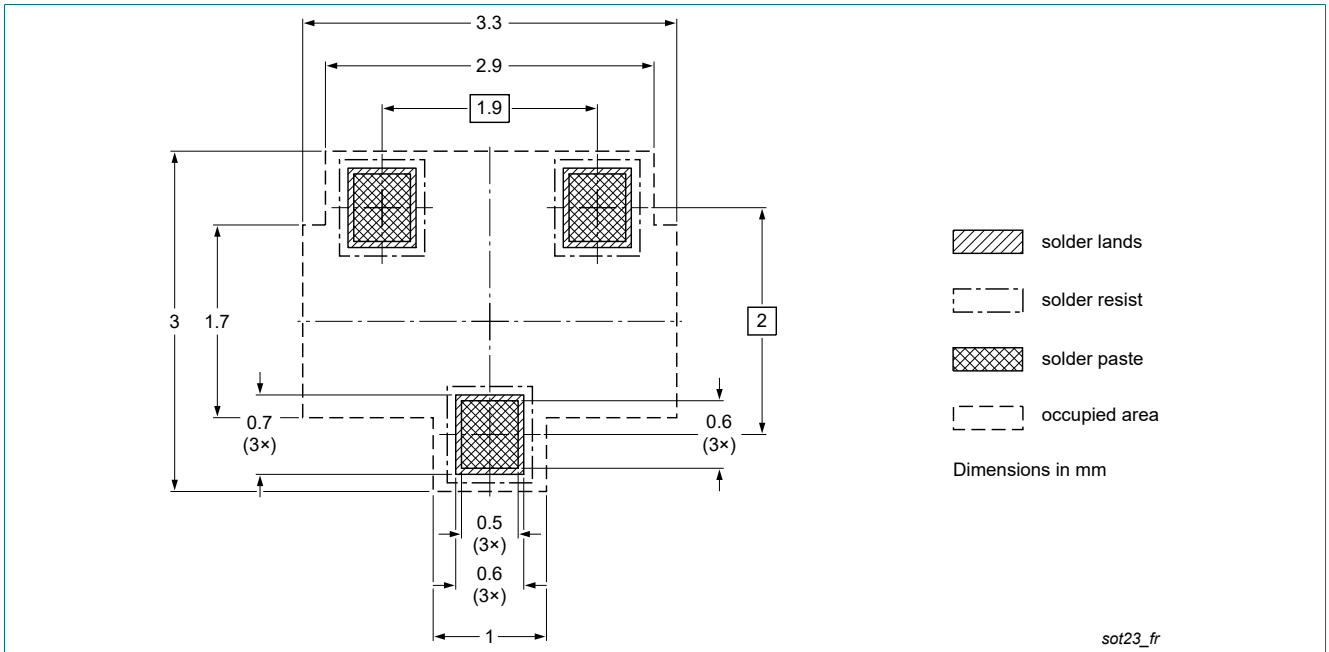


Fig. 29. Reflow soldering footprint for SOT23 (TO-236AB)

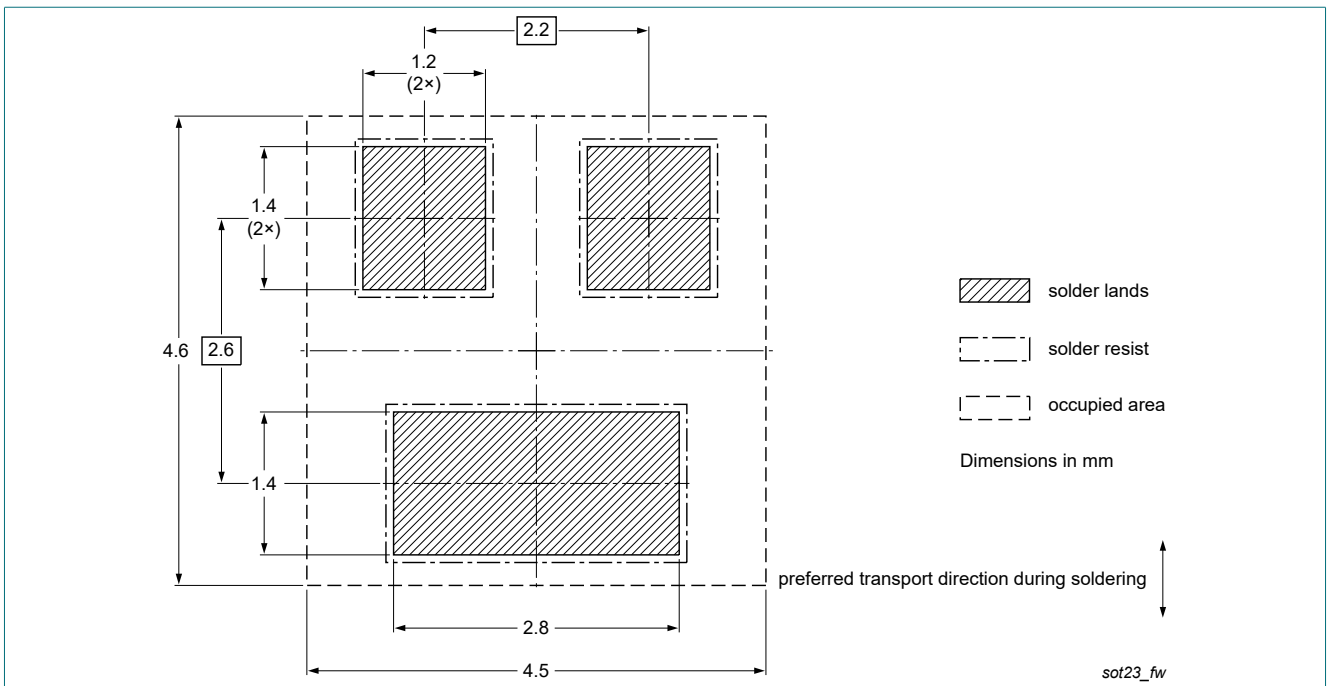


Fig. 30. Wave soldering footprint for SOT23 (TO-236AB)

14. Revision history

Table 9. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--------------|--------------------|---------------|------------|
| BC816H_SER v.1 | 20200326 | 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>.

Definitions

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Contents

| | |
|---------------------------------|----|
| 1. General description..... | 1 |
| 2. Features and benefits..... | 1 |
| 3. Applications..... | 1 |
| 4. Quick reference data..... | 1 |
| 5. Pinning information..... | 2 |
| 6. Ordering information..... | 2 |
| 7. Marking..... | 2 |
| 8. Limiting values..... | 3 |
| 9. Thermal characteristics..... | 4 |
| 10. Characteristics..... | 5 |
| 11. Test information..... | 11 |
| 11.1. Quality information..... | 11 |
| 12. Package outline..... | 12 |
| 13. Soldering..... | 13 |
| 14. Revision history..... | 14 |
| 15. Legal information..... | 15 |

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