



# 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

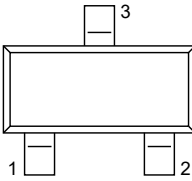
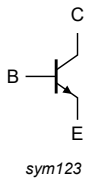
Table 2. Quick reference data

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

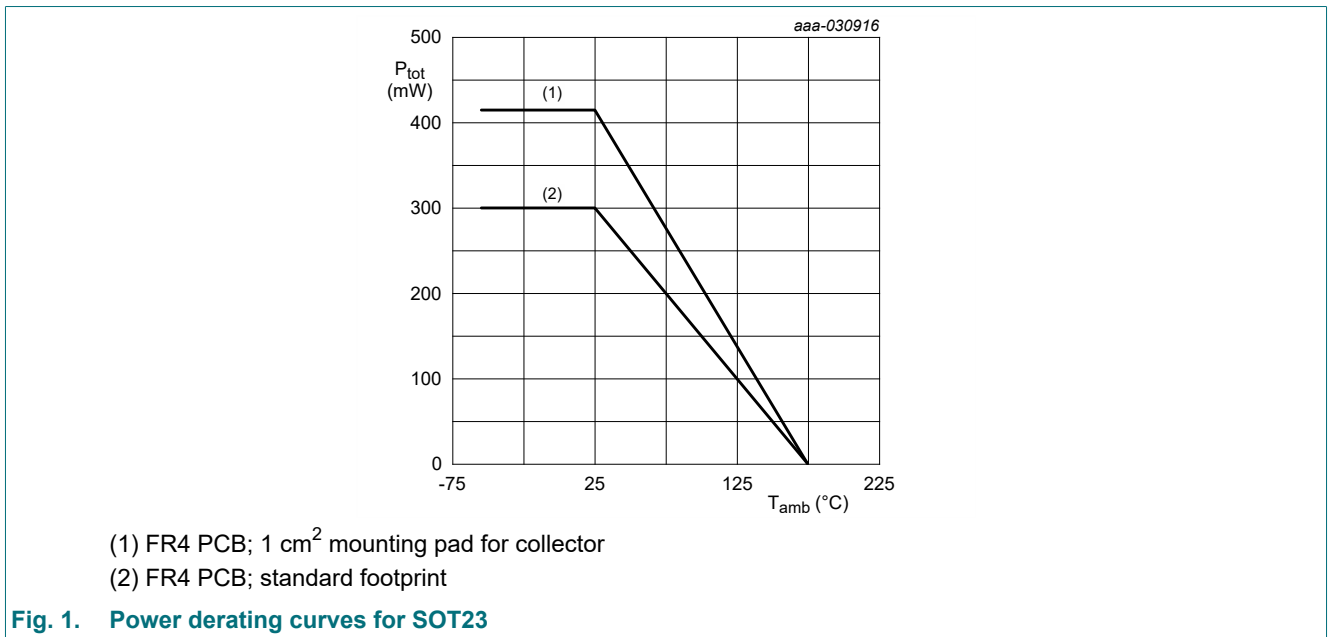
**Table 6. Limiting values**

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<sup>2</sup>.



## 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 cm<sup>2</sup>.

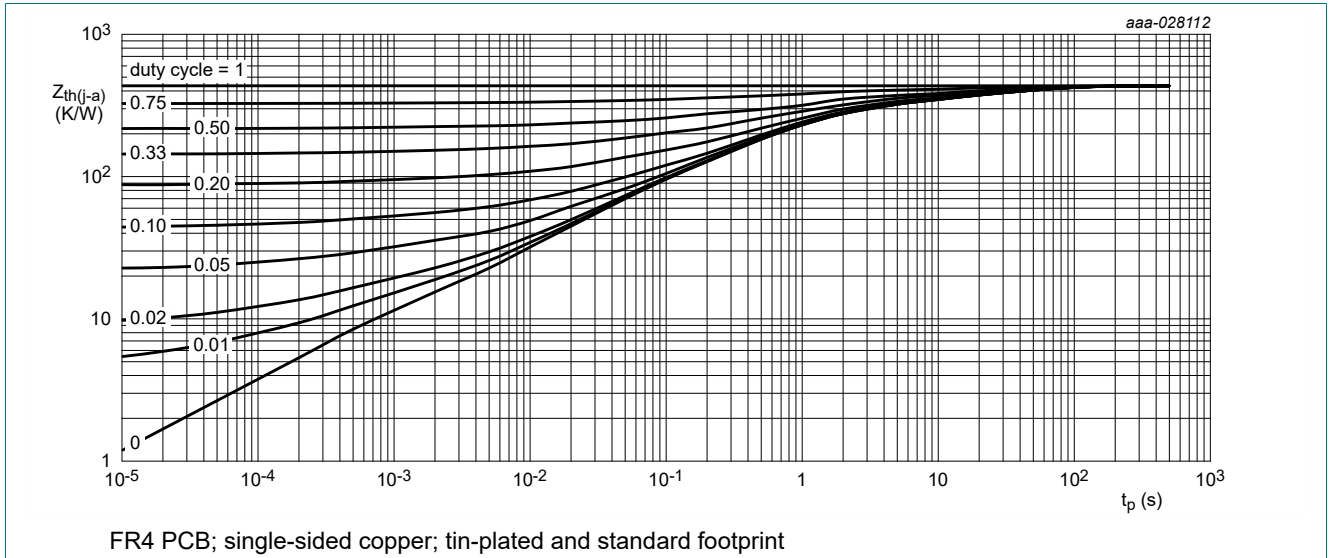


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

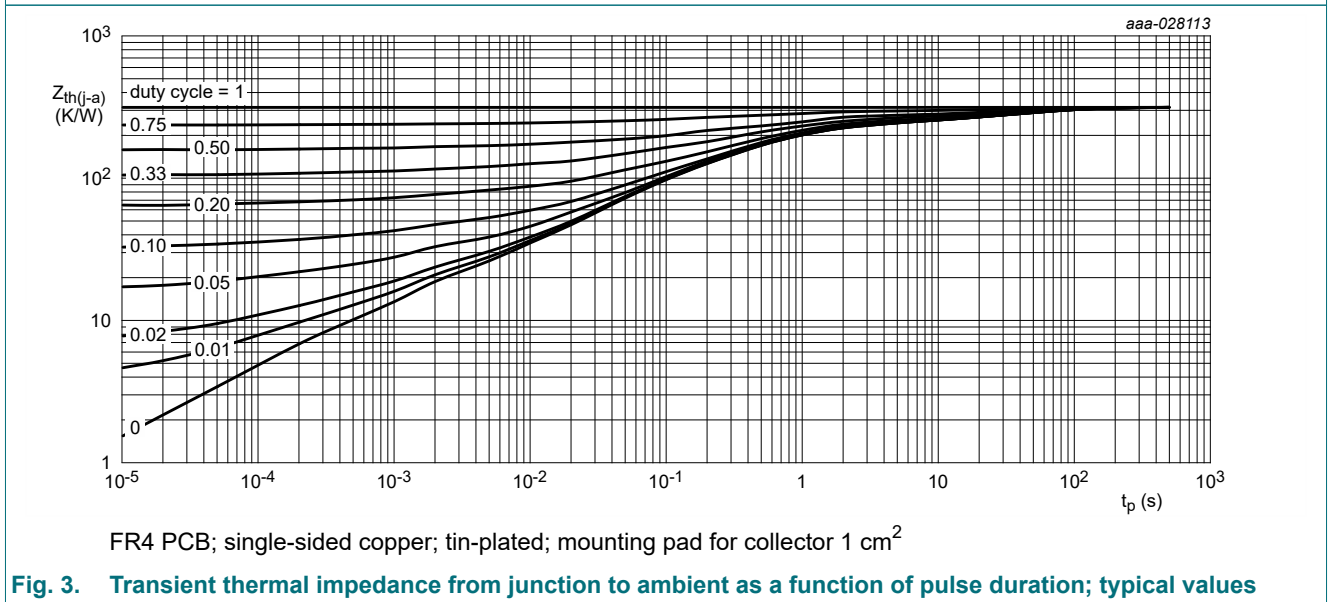


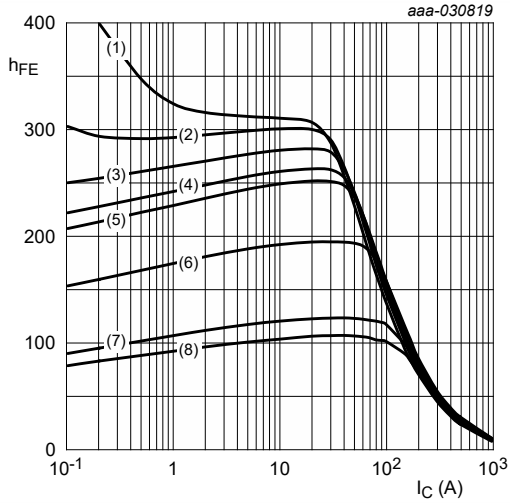
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 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	$\mu\text{A}$	
$I_{EBO}$	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

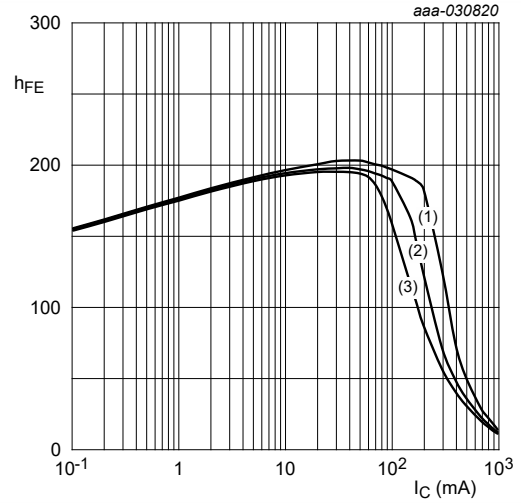
[1] pulsed;  $t_p \leq 300 \mu\text{s}; \delta \leq 0.02$



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

- (1)  $T_{amb} = 175\text{ °C}$
- (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)  $T_{amb} = -55\text{ °C}$

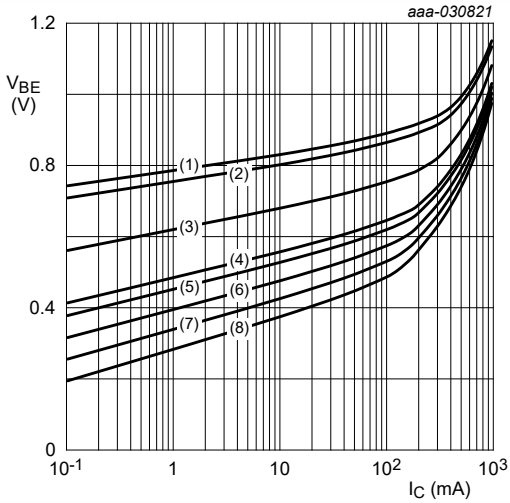
Fig. 4. BC816-16H: DC current gain as a function of collector current; typical values



$T_{amb} = 25\text{ °C}$

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

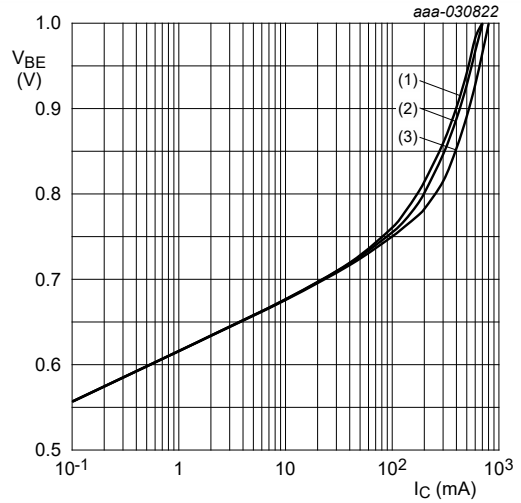
Fig. 5. BC816-16H: DC current gain as a function of collector current; typical values



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

- (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)  $T_{amb} = 175\text{ °C}$

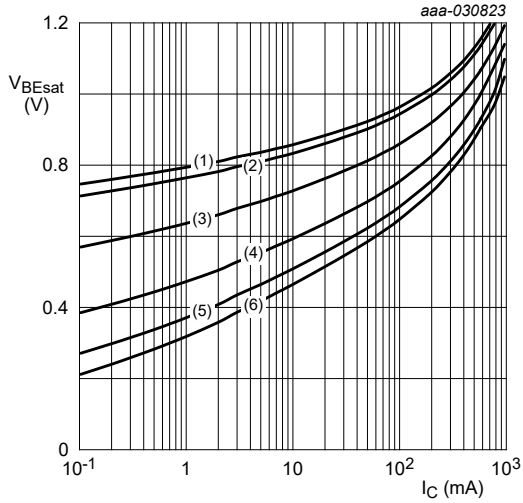
Fig. 6. BC816-16H: Base-emitter voltage as a function of collector current; typical values



$T_{amb} = 25\text{ °C}$

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

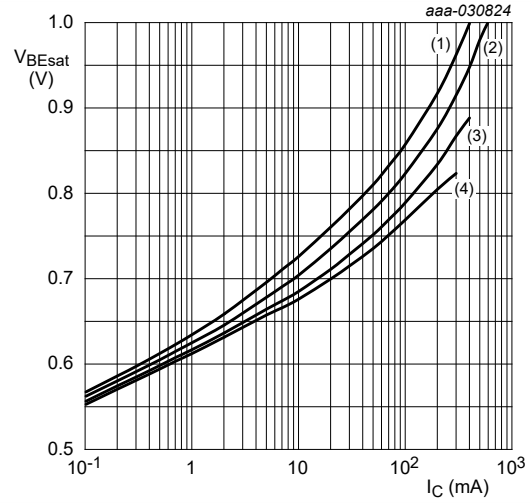
Fig. 7. BC816-16H: Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 10$

- (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)  $T_{amb} = 175\text{ °C}$

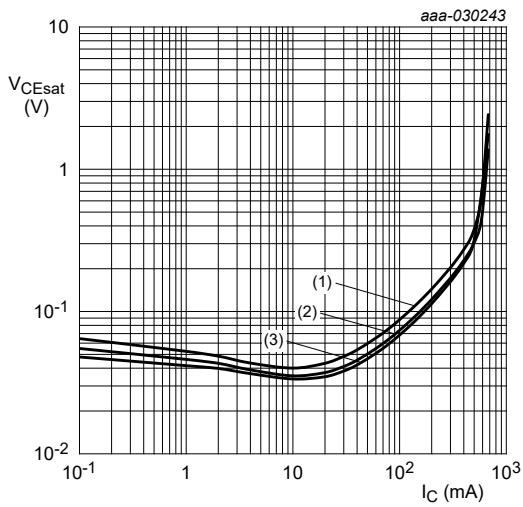
Fig. 8. BC816-16H: Base-emitter saturation voltage as a function of collector current; typical values



$T_{amb} = 25\text{ °C}$

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

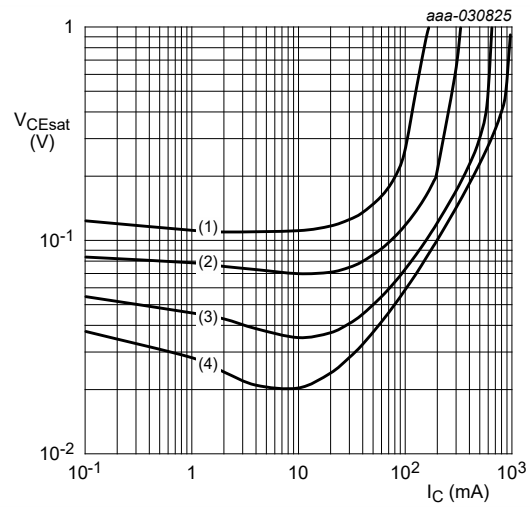
Fig. 9. BC816-16H: Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$

- (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

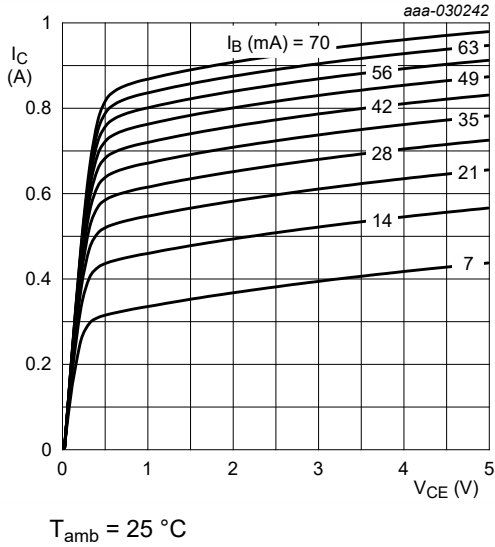


Fig. 12. BC816-16H: Collector current as a function of collector-emitter voltage; typical values

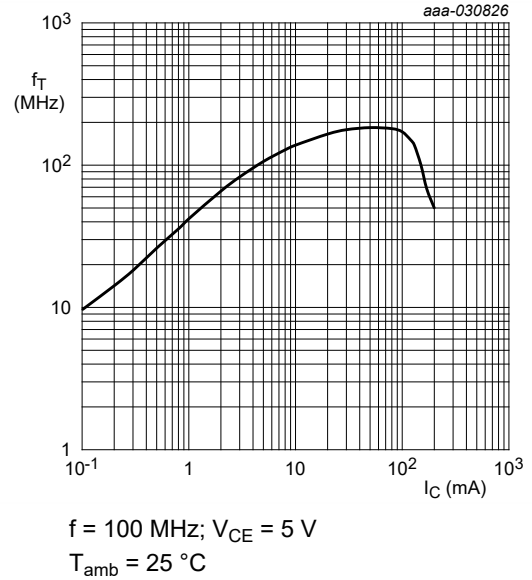


Fig. 13. BC816-16H: Transition frequency as a function of collector current; typical values

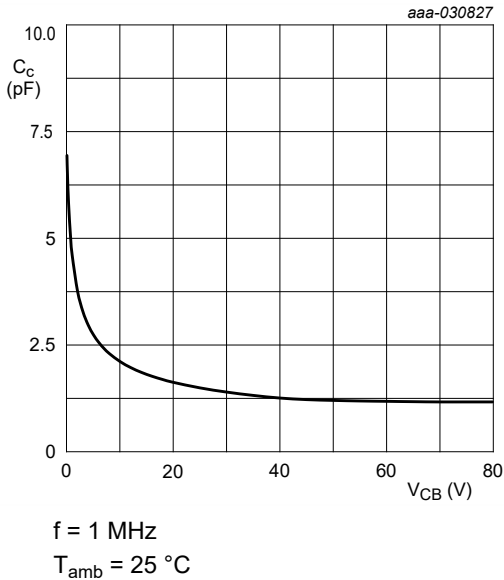


Fig. 14. BC816-16H: Collector capacitance as a function of collector-base voltage; typical values

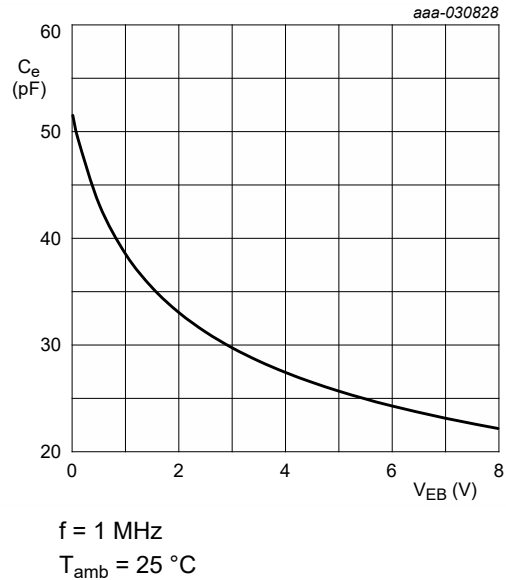
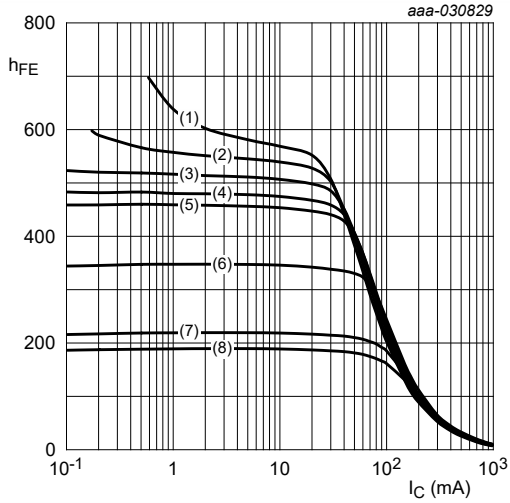


Fig. 15. BC816-16H: Emitter capacitance as a function of emitter-base voltage; typical values

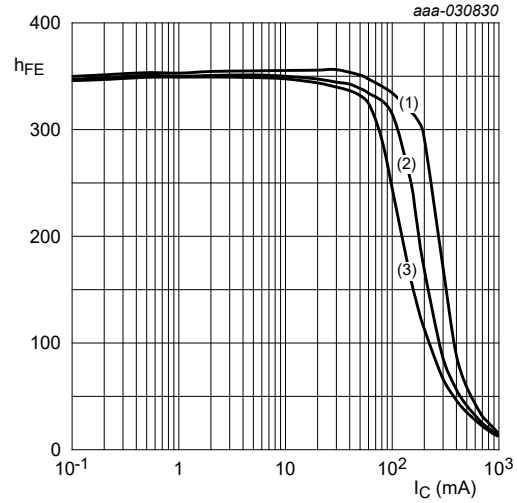




$V_{CE} = 1 \text{ V}$

- (1)  $T_{amb} = 175 \text{ }^\circ\text{C}$
- (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)  $T_{amb} = -55 \text{ }^\circ\text{C}$

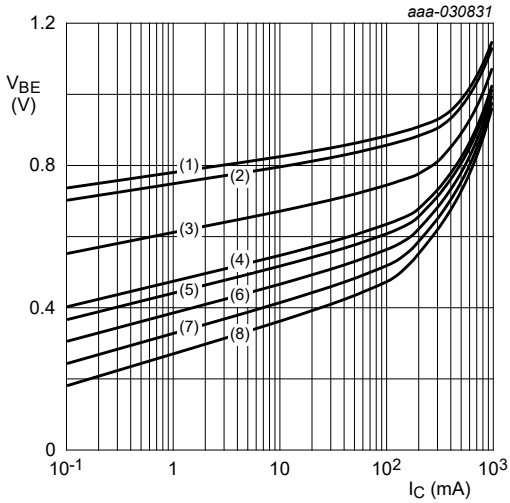
Fig. 16. BC816-25H: DC current gain as a function of collector current; typical values



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

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

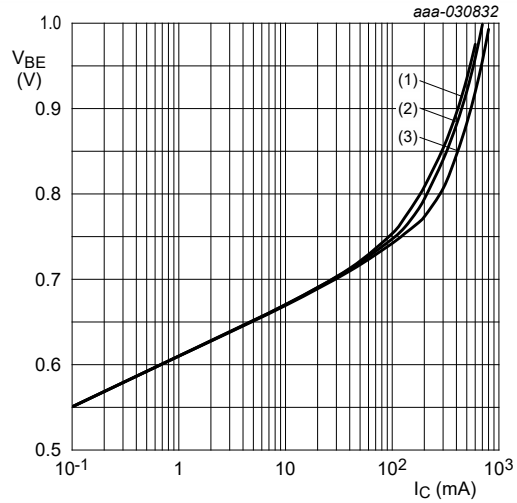
Fig. 17. BC816-25H: DC current gain as a function of collector current; typical values



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

- (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)  $T_{amb} = 175 \text{ }^\circ\text{C}$

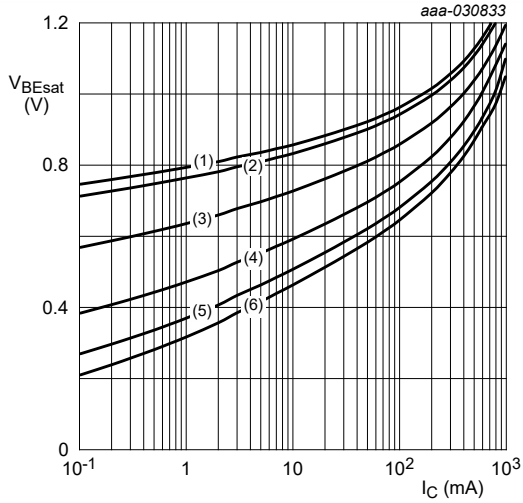
Fig. 18. BC816-25H: Base-emitter voltage as a function of collector current; typical values



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

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

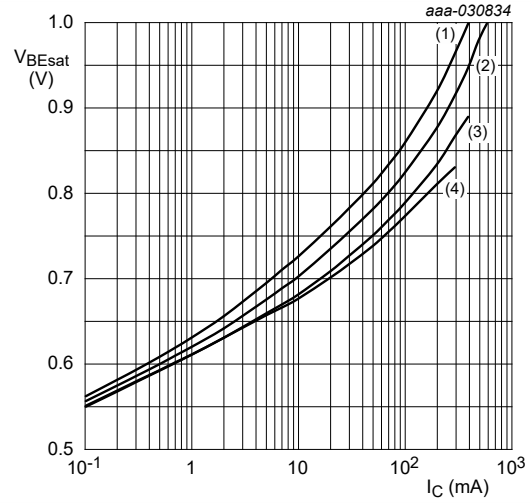
Fig. 19. BC816-25H: Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 10$

- (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)  $T_{amb} = 175\text{ °C}$

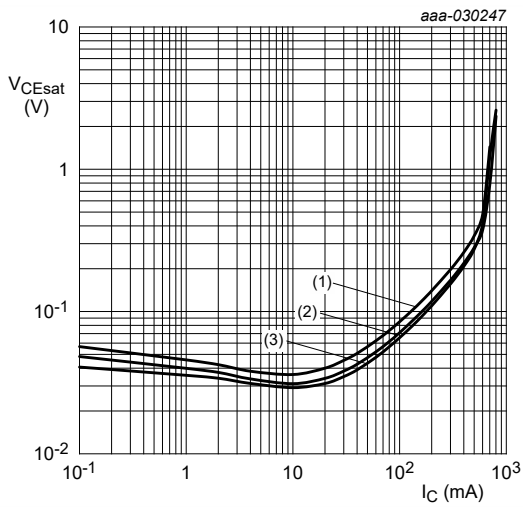
Fig. 20. BC816-25H: Base-emitter saturation voltage as a function of collector current; typical values



$T_{amb} = 25\text{ °C}$

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

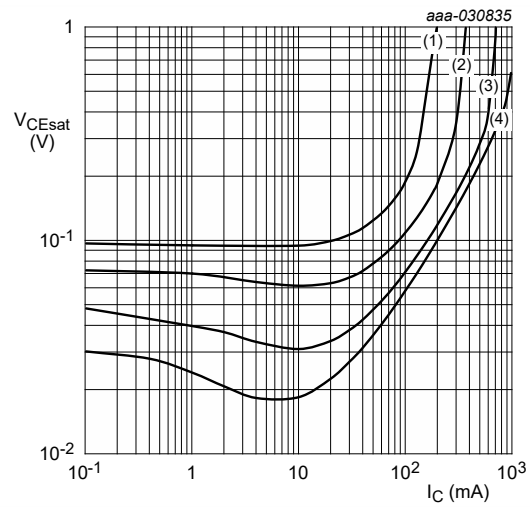
Fig. 21. BC816-25H: Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$

- (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

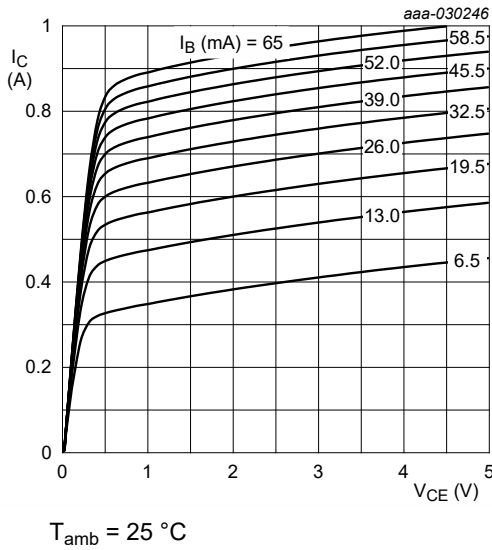


Fig. 24. BC816-25H: Collector current as a function of collector-emitter voltage; typical values

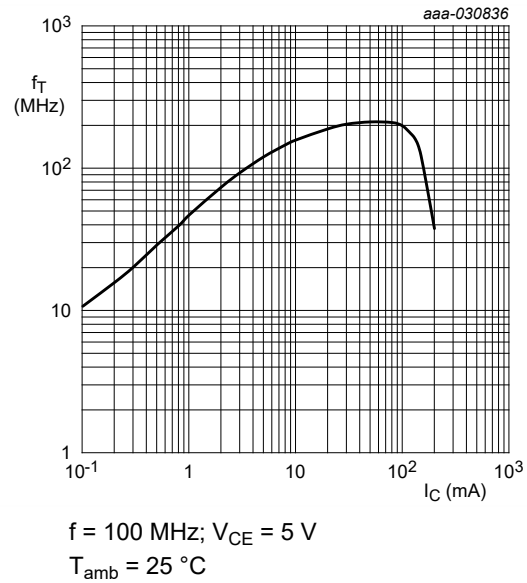


Fig. 25. BC816-25H: Transition frequency as a function of collector current; typical values

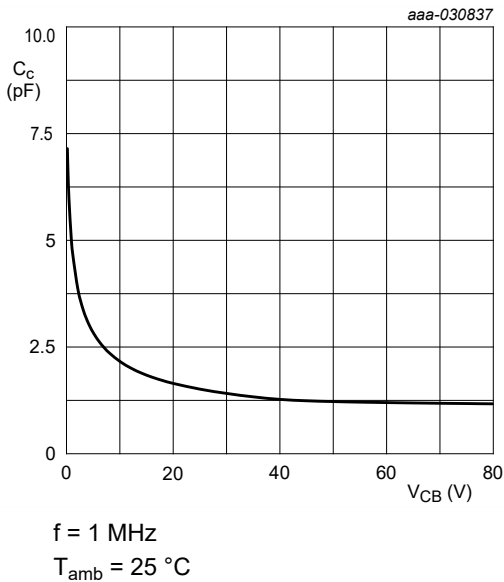


Fig. 26. BC816-25H: Collector capacitance as a function of collector-base voltage; typical values

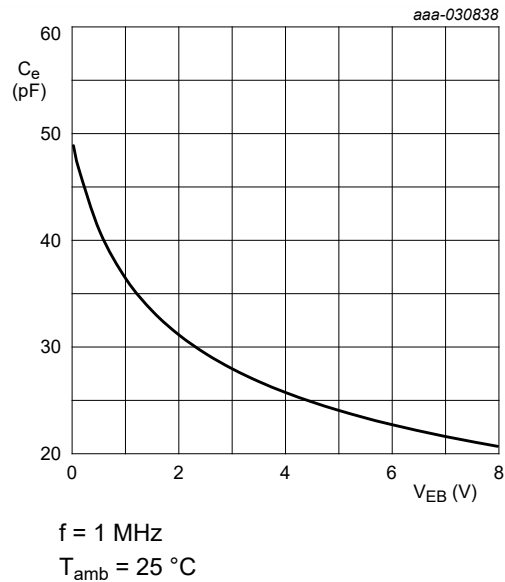


Fig. 27. BC816-25H: Emitter capacitance as a function of emitter-base voltage; typical values

## 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

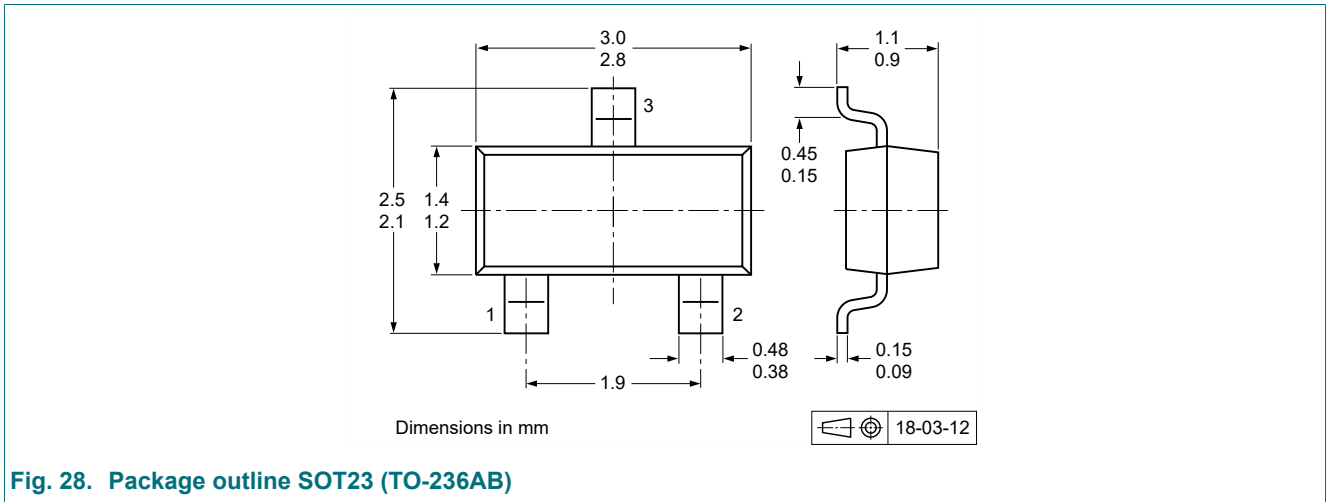


Fig. 28. Package outline SOT23 (TO-236AB)

### 13. Soldering

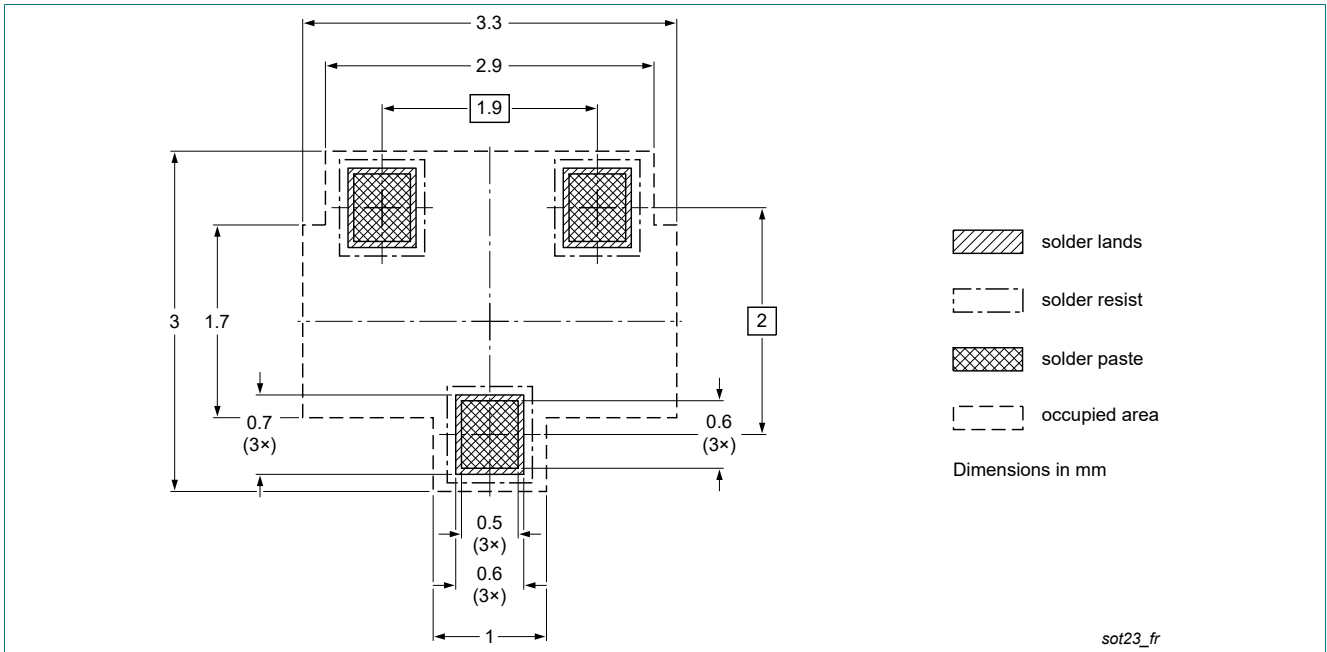


Fig. 29. Reflow soldering footprint for SOT23 (TO-236AB)

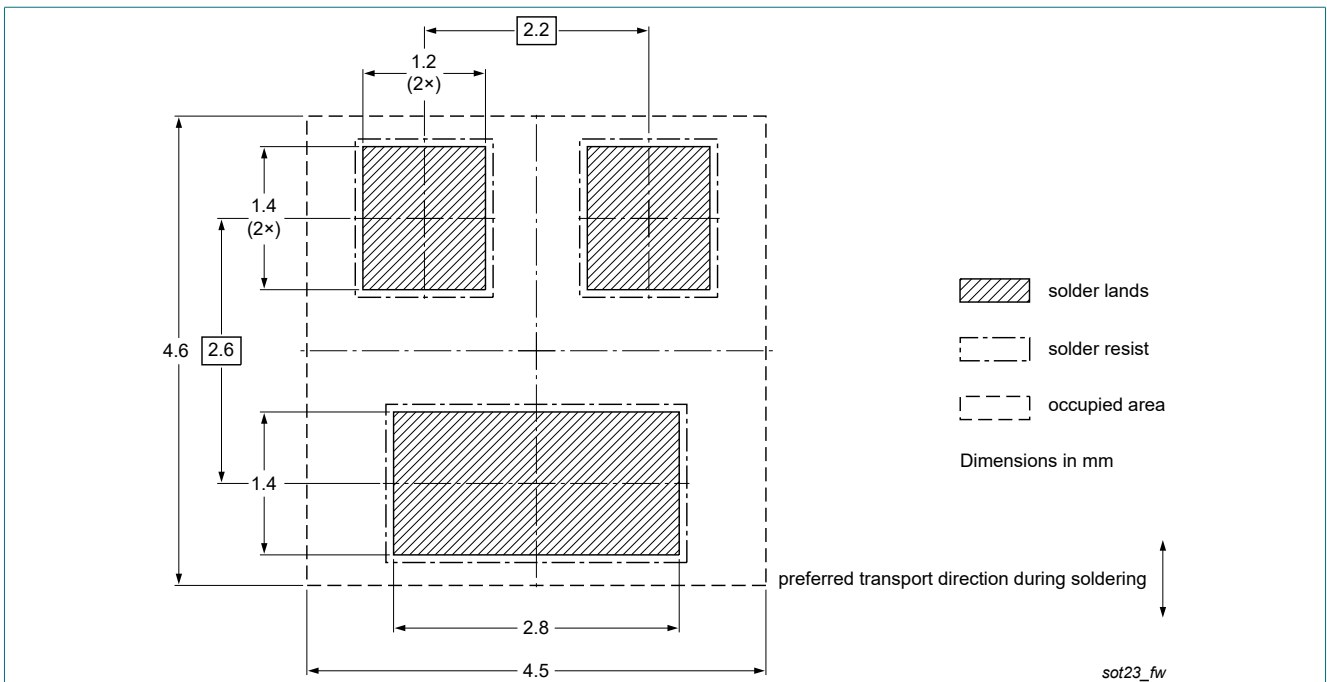


Fig. 30. Wave soldering footprint for SOT23 (TO-236AB)

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

For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)

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