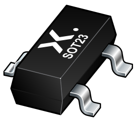


BC816H series

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

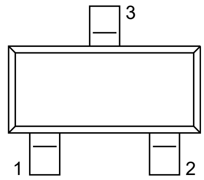
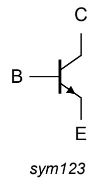
Table 2. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base; T_{amb} = 25 °C		-	-	80	V
I_C	collector current	T_{amb} = 25 °C		-	-	500	mA
I_{CM}	peak collector current	single pulse; t_p ≤ 1 ms; T_{amb} = 25 °C		-	-	1	A
h_{FE}	DC current gain						
	BC816-16H	V_{CE} = 1 V; I_C = 100 mA T_{amb} = 25 °C	[1]	100	-	250	
	BC816-25H		[1]	160	-	400	

[1] pulsed; t_p ≤ 300 µs; δ ≤ 0.02

5. Pinning information

Table 3. Pinning

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 TO-236AB (SOT23)	
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

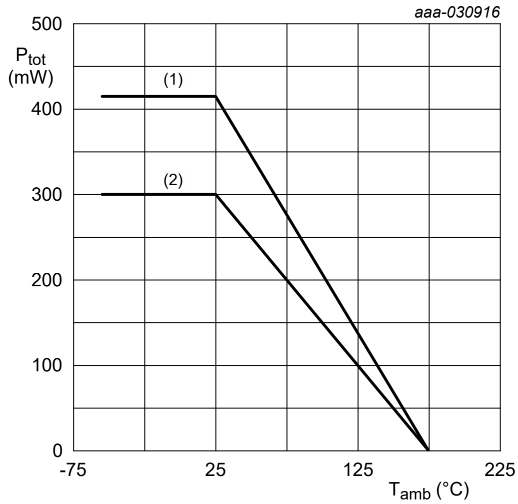
8. Limiting values

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 °C		-	80	V
V_{CEO}	collector-emitter voltage	open base; T_{amb} = 25 °C		-	80	V
V_{EBO}	emitter-base voltage	open collector; T_{amb} = 25 °C		-	7	V
I_C	collector current	T_{amb} = 25 °C		-	500	mA
I_{CM}	peak collector current	single pulse; t_p ≤ 1 ms; T_{amb} = 25 °C		-	1	A
I_{BM}	peak base current	single pulse; t_p ≤ 1 ms; T_{amb} = 25 °C		-	200	mA
P_{tot}	total power dissipation	T_{amb} ≤ 25 °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

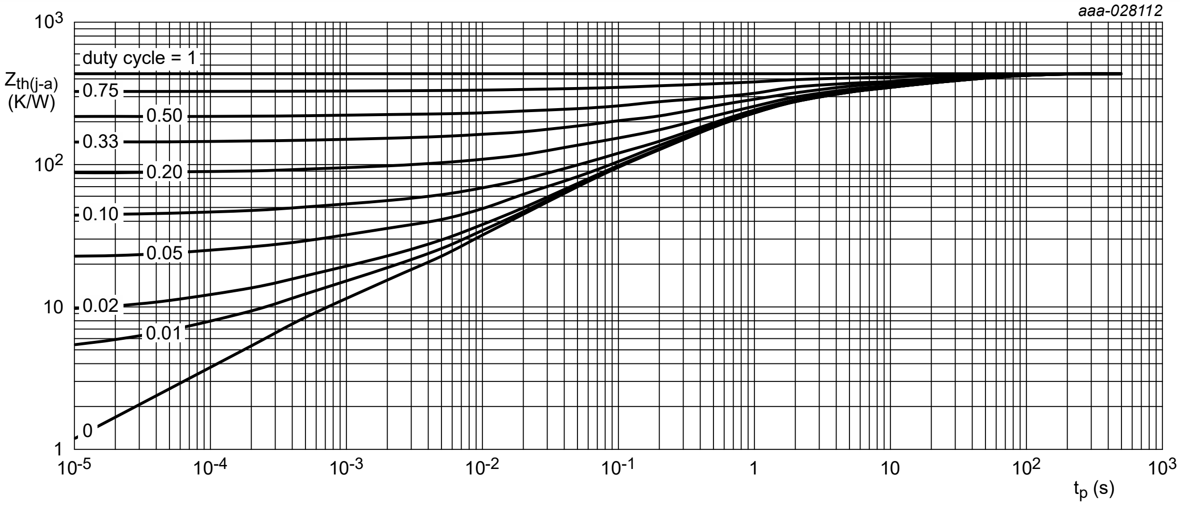
Fig. 1. Power derating curves for SOT23

9. Thermal characteristics

Table 7. Thermal characteristics

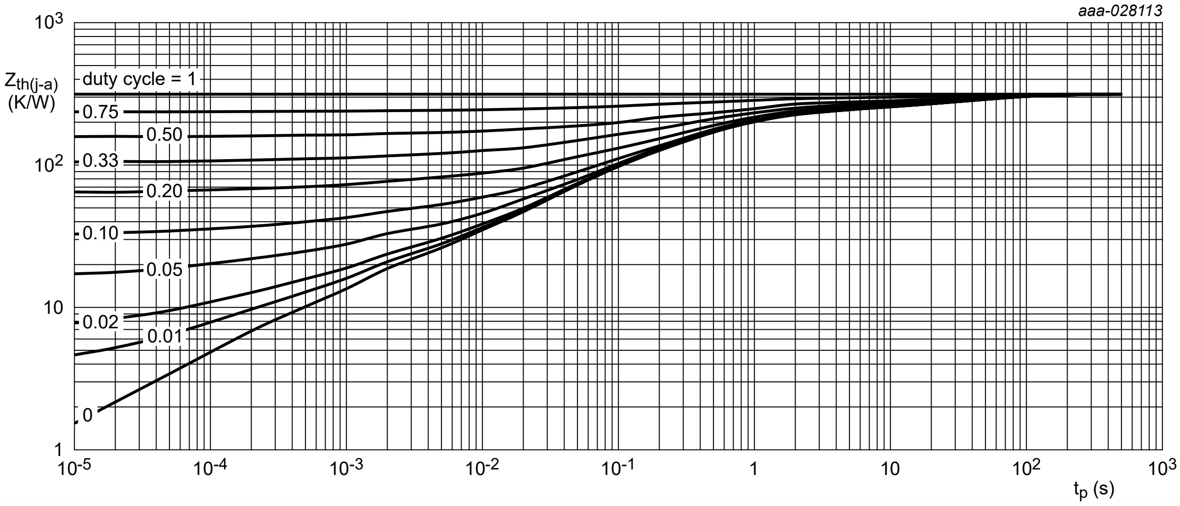
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air; T_{amb} = 25 °C	[1]	-	-	500	K/W
			[2]	-	-	363	K/W

[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^2.



FR4 PCB; single-sided 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 copper; tin-plated; mounting pad for collector 1 cm^2

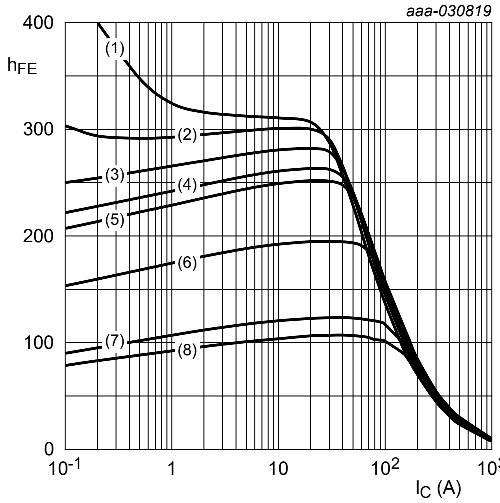
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 8. Characteristics

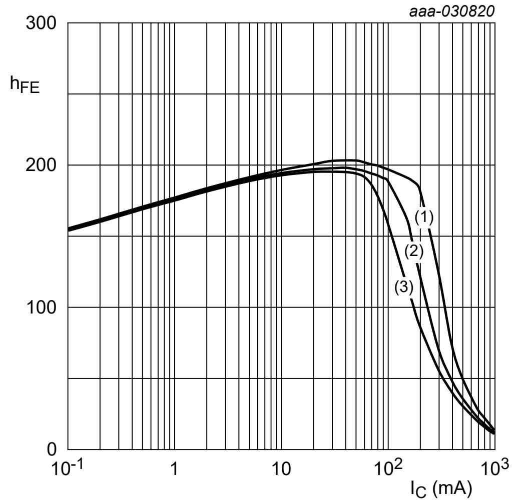
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 100 μA; I_E = 0 A; T_{amb} = 25 °C		80	-		V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 2 mA; I_E = 0 A; T_{amb} = 25 °C		80	-		V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 100 μA; I_C = 0 A; T_{amb} = 25 °C		7	-		V
I_{CBO}	collector-base cut-off current	V_{CB} = 64 V; I_E = 0 A; T_{amb} = 25 °C		-	-	100	nA
		V_{CB} = 64 V; I_E = 0 A; T_j = 150 °C		-	-	5	μA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5.6 V; I_C = 0 A; T_{amb} = 25 °C		-	-	100	nA
h_{FE}	DC current gain						
	BC816-16H	V_{CE} = 1 V; I_C = 100 mA; T_{amb} = 25 °C	[1]	100	-	250	
	BC816-25H	V_{CE} = 1 V; I_C = 100 mA; T_{amb} = 25 °C	[1]	160	-	400	
		V_{CE} = 2 V; I_C = 500 mA; T_{amb} = 25 °C	[1]	30	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 10 mA; T_{amb} = 25 °C	[1]	-	-	150	mV
		I_C = 500 mA; I_B = 50 mA; T_{amb} = 25 °C	[1]	-	-	400	mV
V_{BE}	base-emitter voltage	V_{CE} = 1 V; I_C = 500 mA; T_{amb} = 25 °C	[1]	-	-	1.2	V
f_T	transition frequency	V_{CE} = 5 V; I_C = 50 mA; f = 100 MHz; T_{amb} = 25 °C		100	-	-	MHz
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz; T_{amb} = 25 °C		-	2	-	pF
C_e	emitter capacitance	V_{EB} = 0.5 V; I_C = i_c = 0 A; f = 1 MHz; T_{amb} = 25 °C		-	42	-	pF

[1] pulsed; t_p ≤ 300 μs; δ ≤ 0.02



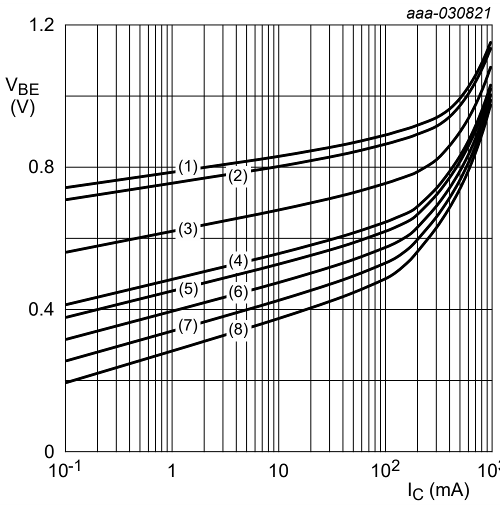
V_{CE} = 1 V
(1) T_{amb} = 175 °C
(2) T_{amb} = 150 °C
(3) T_{amb} = 125 °C
(4) T_{amb} = 100 °C
(5) T_{amb} = 85 °C
(6) T_{amb} = 25 °C
(7) T_{amb} = -40 °C
(8) T_{amb} = -55 °C

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



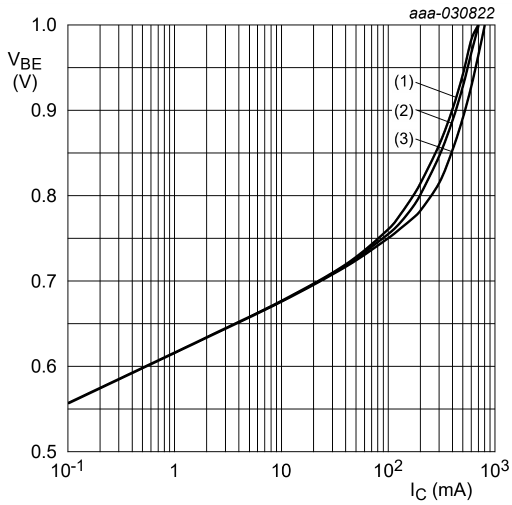
T_{amb} = 25 °C
(1) V_{CE} = 5 V
(2) V_{CE} = 2 V
(3) V_{CE} = 1 V

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



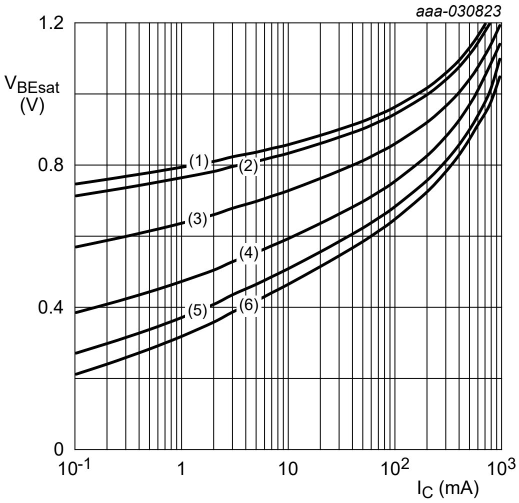
V_{CE} = 5 V
(1) T_{amb} = -55 °C
(2) T_{amb} = -40 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = 85 °C
(5) T_{amb} = 100 °C
(6) T_{amb} = 125 °C
(7) T_{amb} = 150 °C
(8) T_{amb} = 175 °C

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



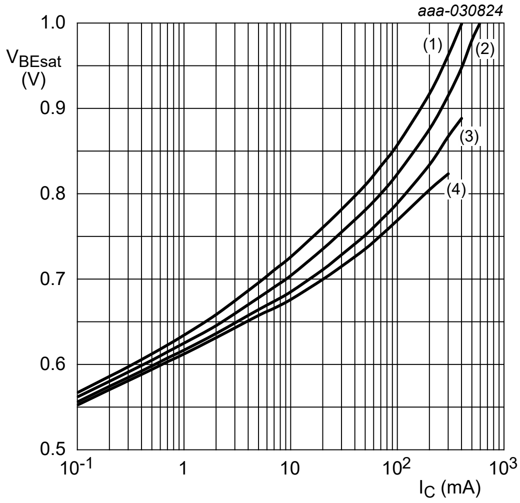
T_{amb} = 25 °C
(1) V_{CE} = 1 V
(2) V_{CE} = 2 V
(3) V_{CE} = 5 V

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



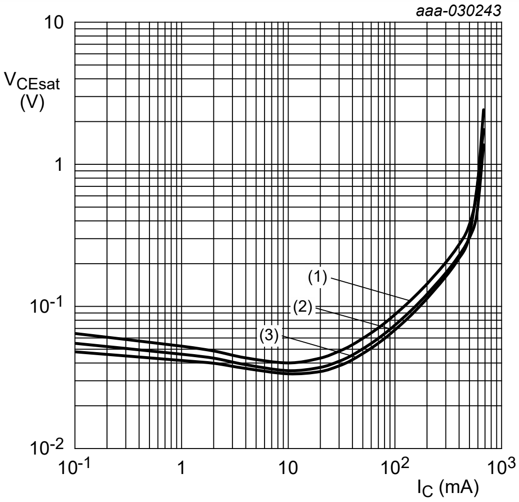
IC/IB = 10
(1) T_{amb} = -55 °C
(2) T_{amb} = -40 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = 100 °C
(5) T_{amb} = 150 °C
(6) T_{amb} = 175 °C

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



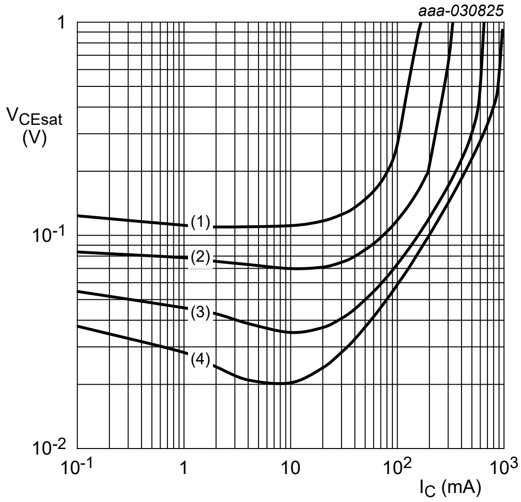
T_{amb} = 25 °C
(1) IC/IB = 10
(2) IC/IB = 20
(3) IC/IB = 50
(4) IC/IB = 100

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



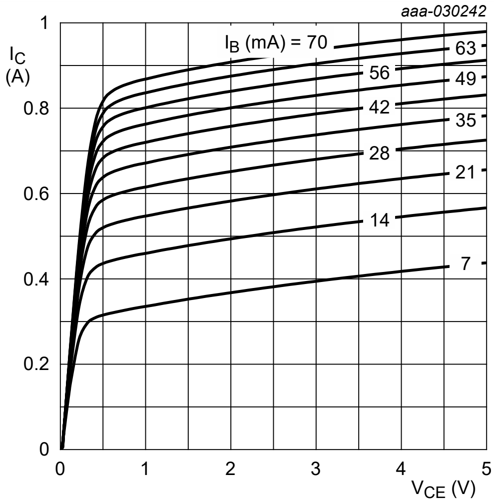
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

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



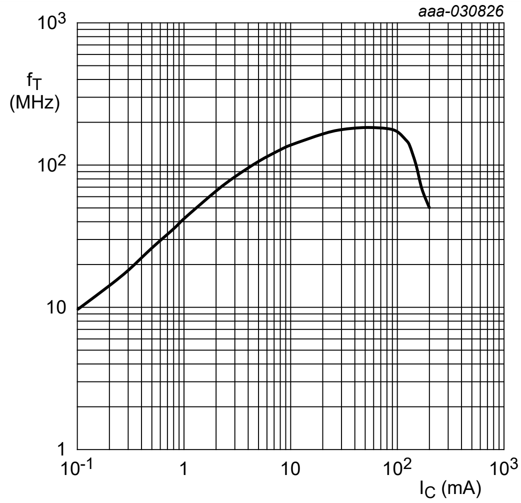
T_{amb} = 25 °C
(1) IC/IB = 100
(2) IC/IB = 50
(3) IC/IB = 20
(4) IC/IB = 10

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



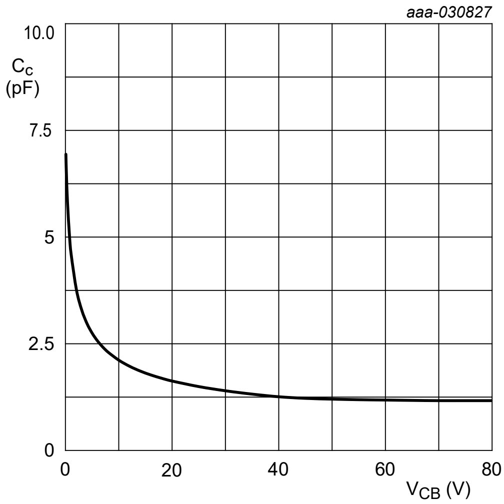
T_{amb} = 25 °C

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



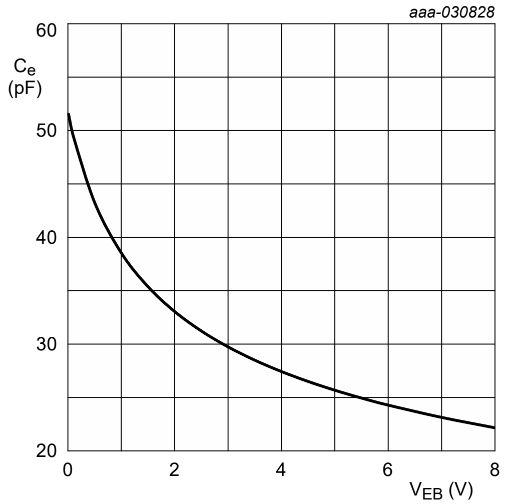
f = 100 MHz; V_{CE} = 5 V
T_{amb} = 25 °C

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



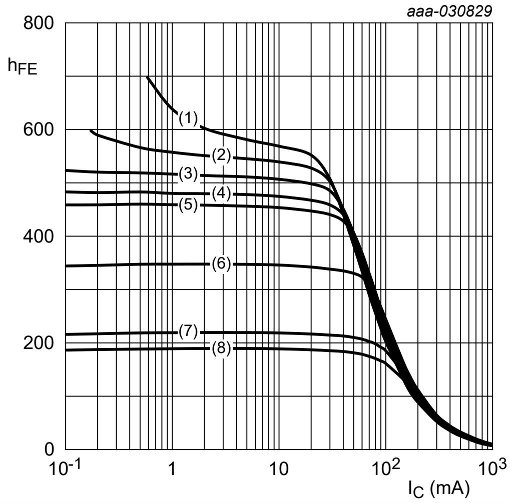
f = 1 MHz
T_{amb} = 25 °C

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



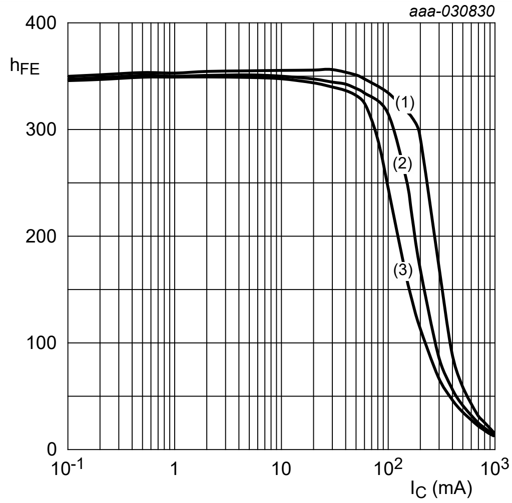
f = 1 MHz
T_{amb} = 25 °C

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



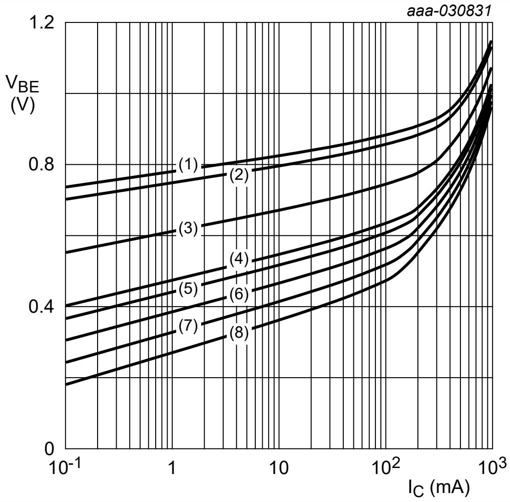
V_{CE} = 1 V
(1) T_{amb} = 175 °C
(2) T_{amb} = 150 °C
(3) T_{amb} = 125 °C
(4) T_{amb} = 100 °C
(5) T_{amb} = 85 °C
(6) T_{amb} = 25 °C
(7) T_{amb} = -40 °C
(8) T_{amb} = -55 °C

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



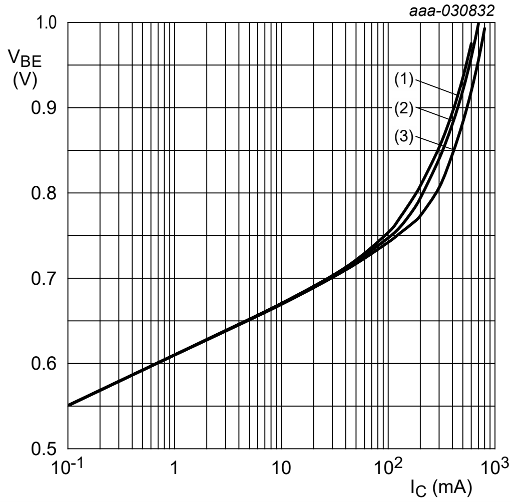
T_{amb} = 25 °C
(1) V_{CE} = 5 V
(2) V_{CE} = 2 V
(3) V_{CE} = 1 V

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



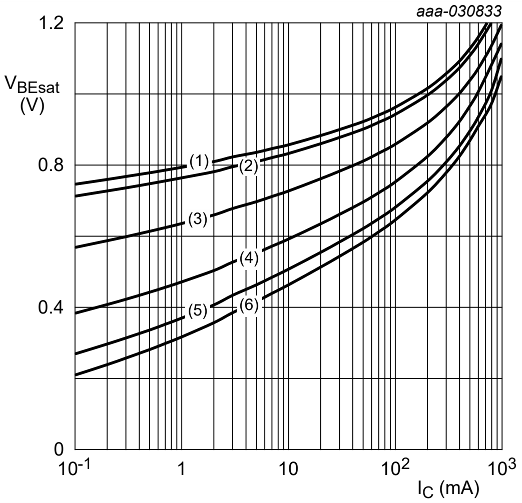
V_{CE} = 5 V
(1) T_{amb} = -55 °C
(2) T_{amb} = -40 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = 85 °C
(5) T_{amb} = 100 °C
(6) T_{amb} = 125 °C
(7) T_{amb} = 150 °C
(8) T_{amb} = 175 °C

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



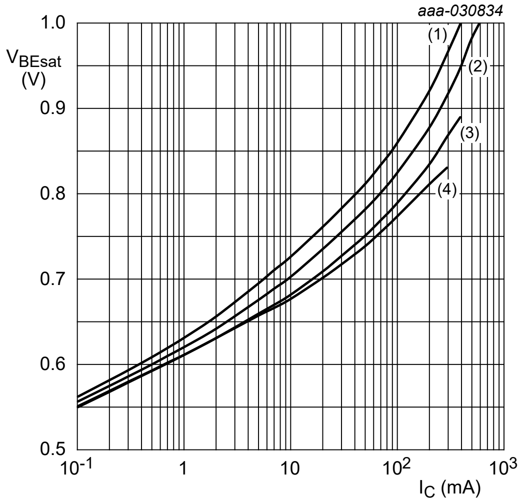
T_{amb} = 25 °C
(1) V_{CE} = 1 V
(2) V_{CE} = 2 V
(3) V_{CE} = 5 V

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



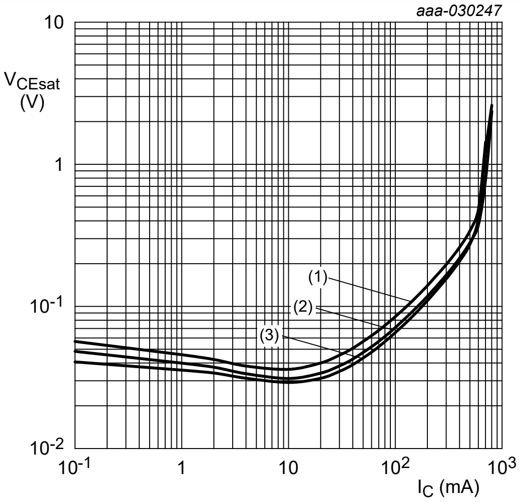
IC/IB = 10
(1) T_{amb} = -55 °C
(2) T_{amb} = -40 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = 100 °C
(5) T_{amb} = 150 °C
(6) T_{amb} = 175 °C

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



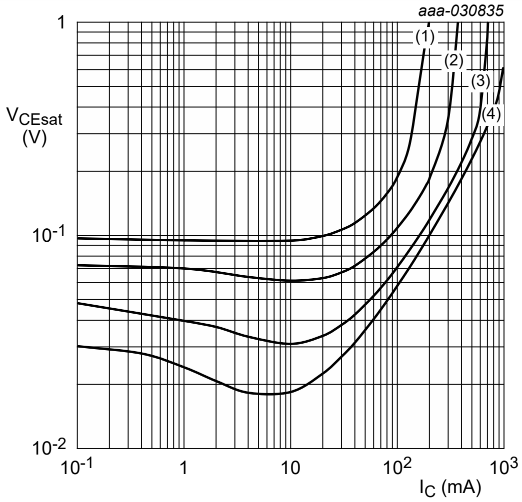
T_{amb} = 25 °C
(1) IC/IB = 10
(2) IC/IB = 20
(3) IC/IB = 50
(4) IC/IB = 100

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



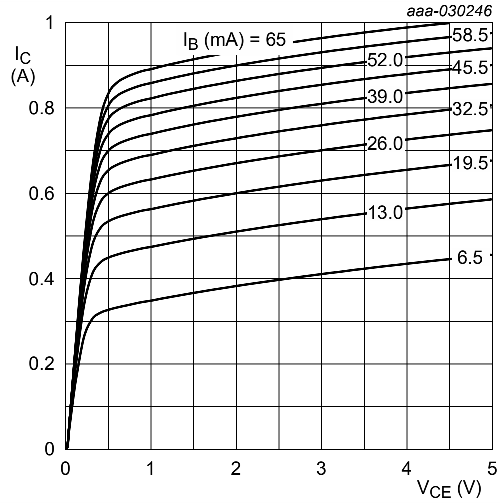
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

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



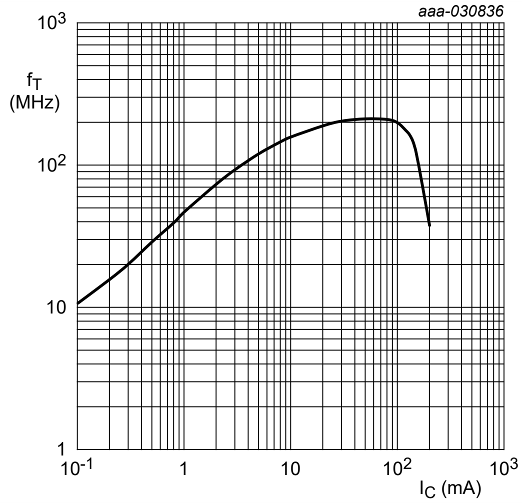
T_{amb} = 25 °C
(1) IC/IB = 100
(2) IC/IB = 50
(3) IC/IB = 20
(4) IC/IB = 10

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



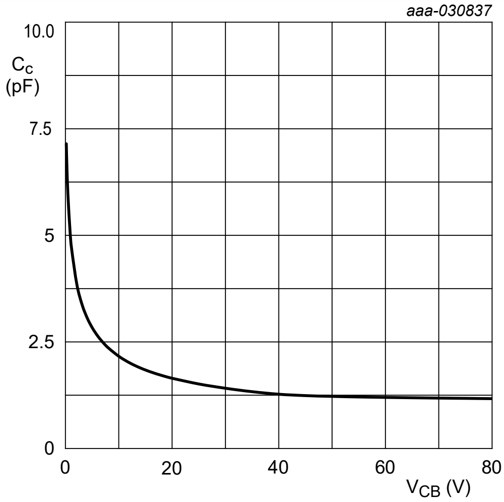
T_{amb} = 25 °C

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



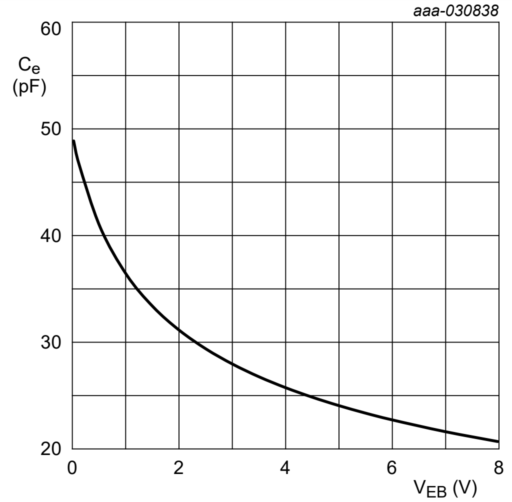
f = 100 MHz; V_{CE} = 5 V
T_{amb} = 25 °C

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



f = 1 MHz
T_{amb} = 25 °C

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



f = 1 MHz
T_{amb} = 25 °C

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

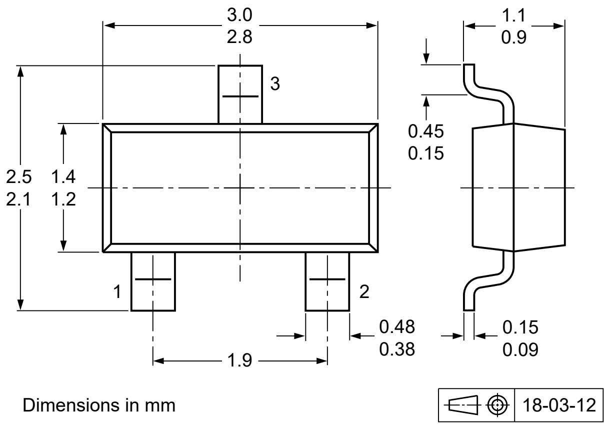


Fig. 28. Package outline SOT23 (TO-236AB)

13. Soldering

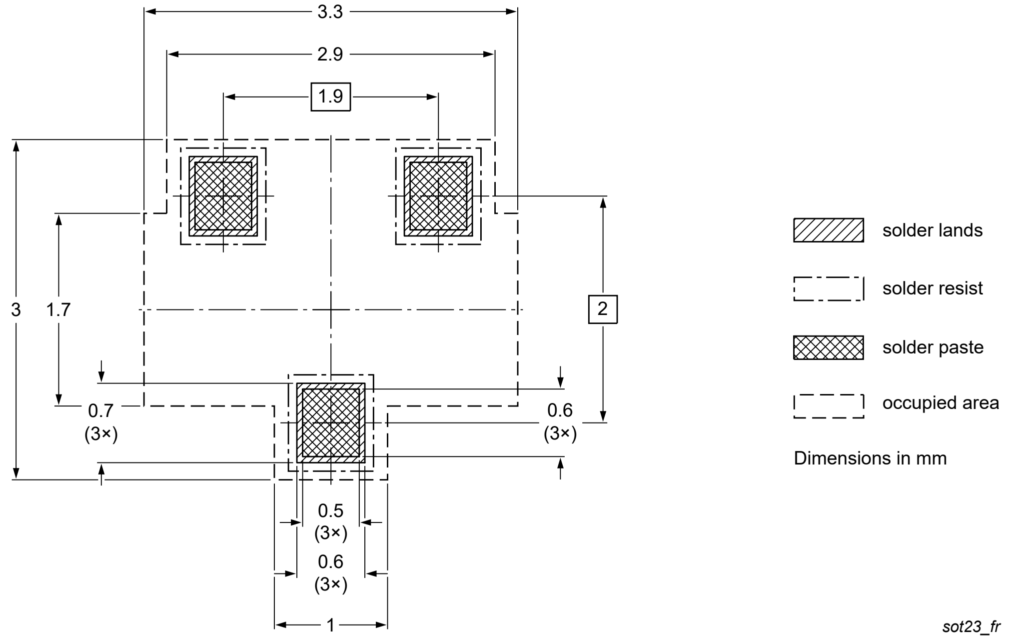


Fig. 29. Reflow soldering footprint for SOT23 (TO-236AB)

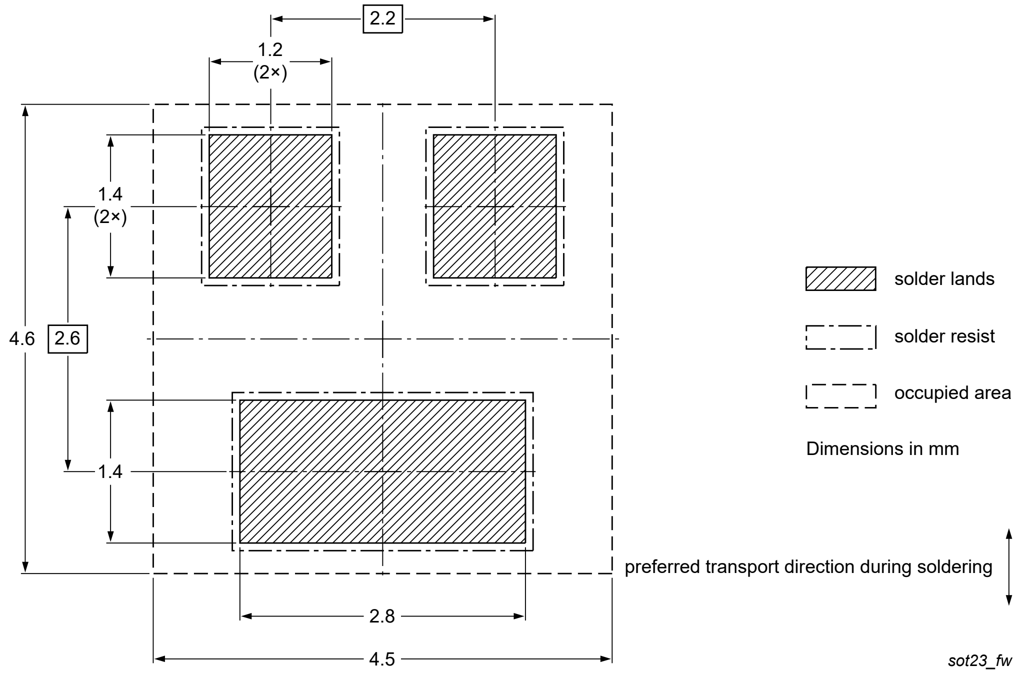


Fig. 30. Wave soldering footprint for SOT23 (TO-236AB)

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.

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Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

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