BC847 series

45 V, 100 mA NPN general-purpose transistors

Rev. 11 — 5 December 2018 Product data sheet

1 Product profile

1.1 General description

NPN general-purpose transistors in a small SOT23 (TO-236AB), very small SOT323 (SC-70) or ultra small SOT883 (DFN1006-3) Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

Type number[1]	Package			NPN complement
	Nexperia	JEITA	JEDEC	
BC847	SOT23	-	TO-236AB	BC857
BC847A				BC857A
BC847B				BC857B
BC847C				BC857C
BC847W	SOT323	SC-70	-	BC857W
BC847AW				BC857AW
BC847BW				BC857BW
BC847CW				BC857CW
BC847AM	SOT883	SC-101	-	BC857AM
BC847BM				BC857BM
BC847CM				BC857CM

[1] Valid for all available selection groups.

1.2 Features and benefits

- General-purpose transistors
- SMD plastic packages
- Three different gain selections
- AEC-Q101 qualified

1.3 Applications

- General-purpose switching and amplification

1.4 Quick reference data

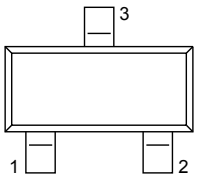
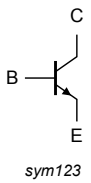
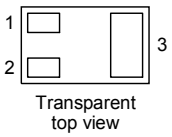
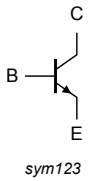
Table 2. Quick reference data

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
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 2 mA	110	-	800	
	h_{FE} group A		110	180	220	
	h_{FE} group B		200	290	450	
	h_{FE} group C		420	520	800	

2 Pinning information

Table 3. Pinning information

Pin	Symbol	Descrition	Simlified outline	Graphic symbol
SOT23; SOT323				
1	B	base		
2	E	emitter		
3	C	collector		
SOT883				
1	B	base		
2	E	emitter		
3	C	collector		

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3 Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
BC847	TO-236AB	plastic surface-mounted package; 3 leads	SOT23
BC847A			
BC847B			
BC847C			
BC847W	SC-70		SOT323
BC847AW			
BC847BW			
BC847CW			
BC847AM	SC-101	lesdless ultra small plastic package; 3 solder lands; body 1.0 x 0.6 x 0.5 mm	SOT 883
BC847BM			
BC847CM			

4 Marking

Table 5. Marking codes

Type number		Marking code
BC847	[1]	1H%
BC847A	[1]	1E%
BC847B	[1]	1F%
BC847C	[1]	1G%
BC847W	[1]	1H%
BC847AW	[1]	1E%
BC847BW	[1]	1F%
BC847CW	[1]	1G%
BC847AM		D4
BC847BM		D5
BC847CM		D6

[1] % = placeholder for manufacturing site code

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5 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		-	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; $t_{p \le 1\ ms}$		-	200	mA
I_{BM}	peak base current	single pulse; $t_{p \le 1\ ms}$		-	100	mA
P_{tot}	total power dissipation	$T_{amb} \le 25\ °C$				
	SOT23		[1]	-	250	mW
	SOT323		[1]	-	200	mW
	SOT883		[2]	-	250	mW
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			-65	150	°C
T_{stg}	storage temperature			-65	150	°C

[1] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided copper; tin-plated and standard footprint.
[2] Device mounted on an PCB with 60 µm copper strip line, standard footprint.

6 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					
	SOT23		[1]	-	-	500	K/W
	SOT323		[1]	-	-	625	K/W
	SOT883		[2]	-	-	500	K/W

[1] Device mounted on an FR4 PCB; single-sided copper; tin-plated and standard footprint.
[2] Device mounted on an PCB with 60 µm copper strip line, standard footprint.

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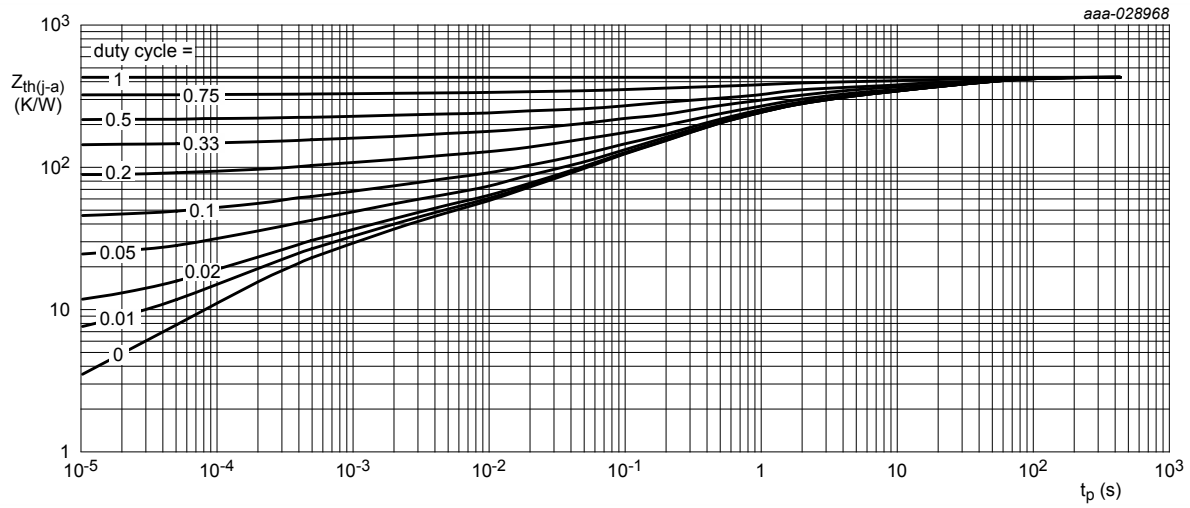
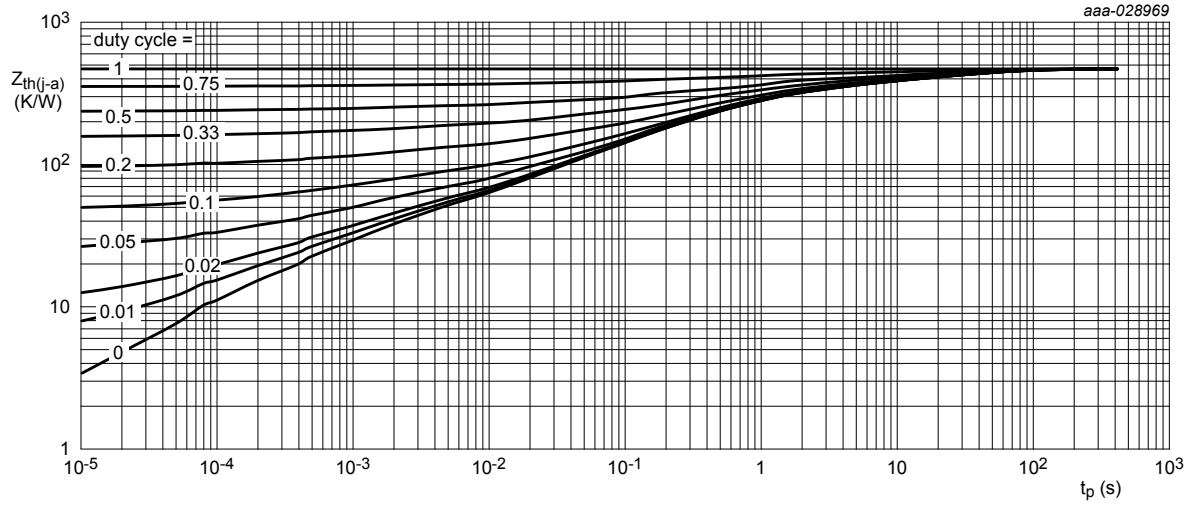


FR4 PCB; single-sided copper; tin-plated and standard footprint

Figure 1. SOT23: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB; single-sided copper; tin-plated and standard footprint

Figure 2. SOT323: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

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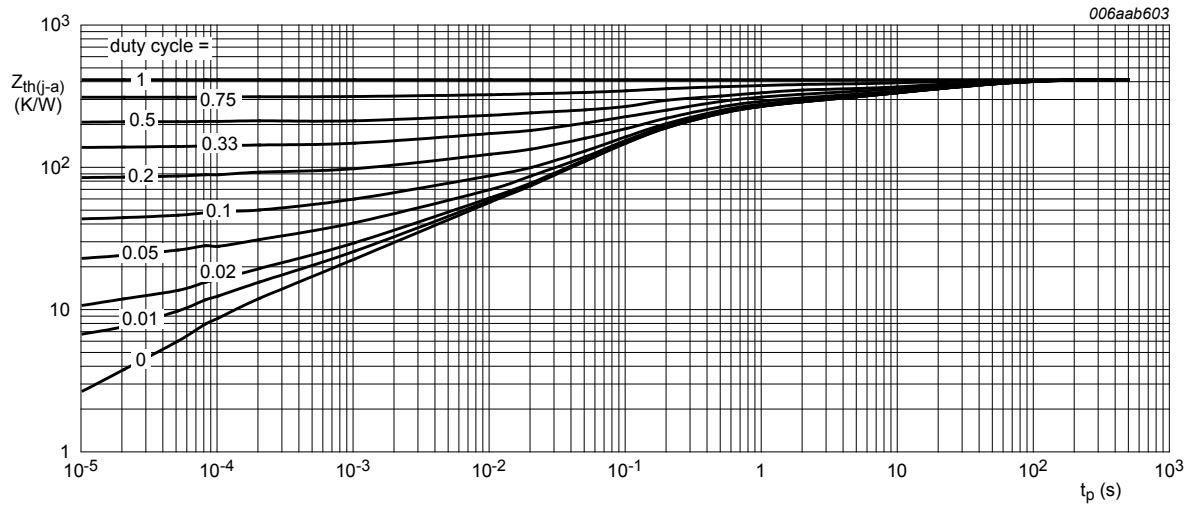

FR4 PCB; single-sided copper; tin-plated and standard footprint

Figure 3. SOT883: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

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7 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
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 2 mA; V_{BE} = 0 A		45	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_C = 0 A; I_E = 100 µA		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	V_{CE} = 5 V; I_C = 10 µA					
	h_{FE} group A			-	170	-	
	h_{FE} group B			-	280	-	
	h_{FE} group C			-	420	-	
	DC current gain	V_{CE} = 5 V; I_C = 2 mA		110	-	800	
	h_{FE} group A			110	180	220	
	h_{FE} group B			200	290	450	
	h_{FE} group C			420	520	800	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA		-	90	200	mV
		I_C = 100 mA; I_B = 5 mA	[1]	-	200	400	mV
V_{BEsat}	base-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	[2]	-	700	-	mV
		I_C = 100 mA; I_B = 5 mA	[2]	-	900	-	mV
V_{BE}	base-emitter voltage	V_{CE} = 5 V; I_C = 2 mA	[2]	580	660	700	mV
		V_{CE} = 5 V; I_C = 10 mA		-	-	770	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_C = i_c = 0 A; f = 1 MHz		-	11	-	pF
NF	noise figure	I_C = 200 µA; V_{CE} = 5 V; R_S = 2 kΩ; f = 1 kHz; B = 200Hz		-	2	10	dB

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

[2] V_{BE} decreases by approximately 2 mV/K with increasing temperature

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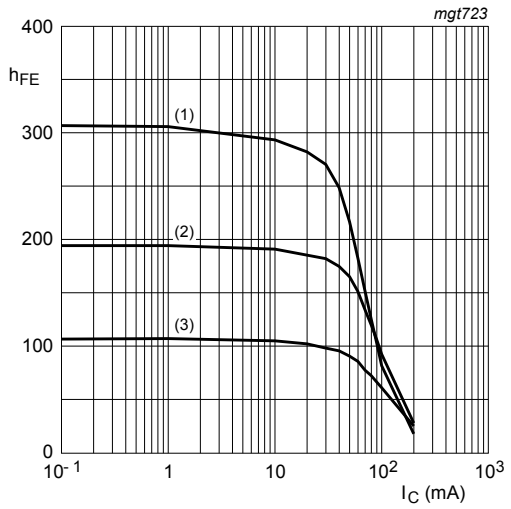
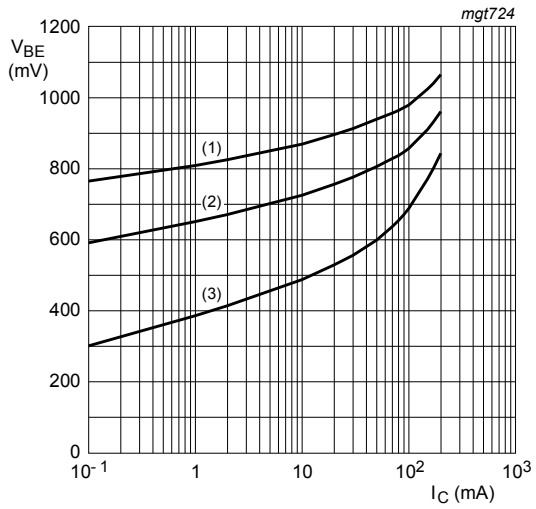


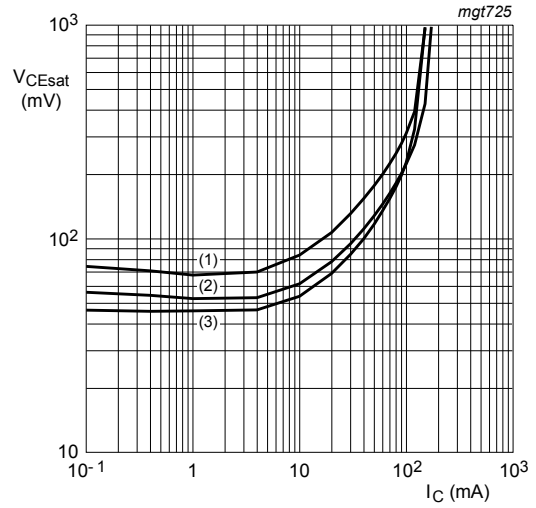
V_{CE} = 5 V
(1) T_{amb} = 150 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -55 °C

Figure 4. Group A: DC current gain as a function of collector current; typical values



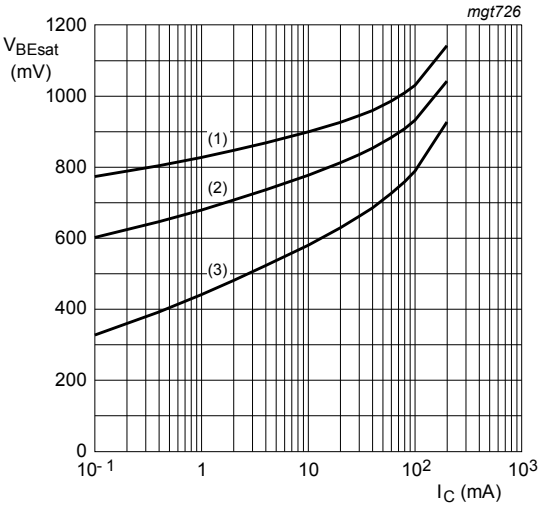
V_{CE} = 5 V
(1) T_{amb} = -55 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 150 °C

Figure 5. Group A: 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

Figure 6. Group A: 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

Figure 7. Group A: Base-emitter saturation voltage as a function of collector current; typical values

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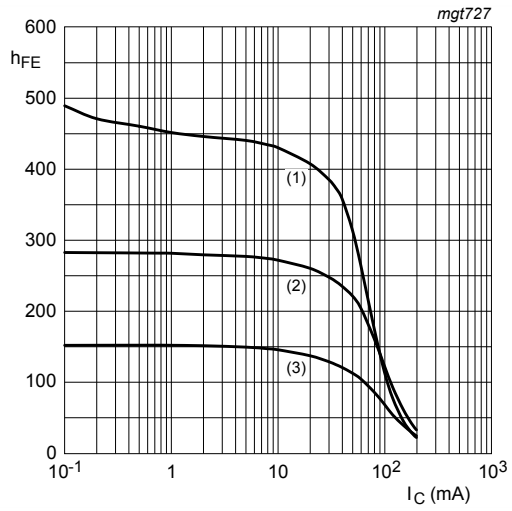
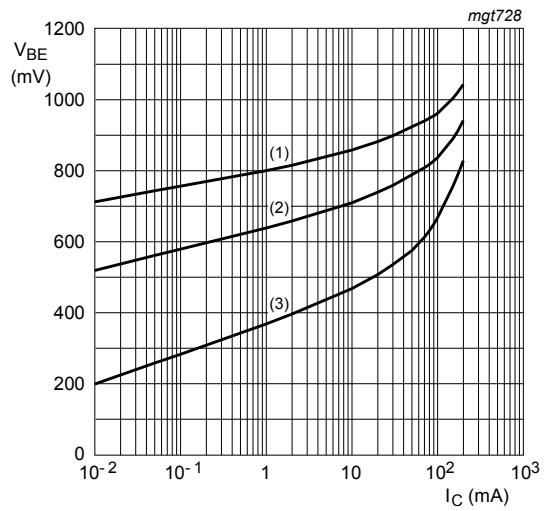


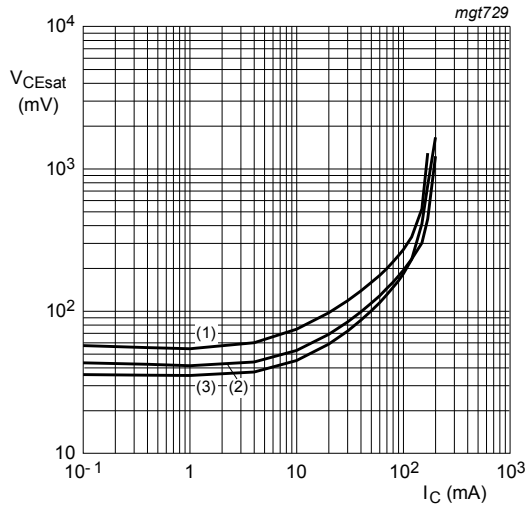
V_{CE} = 5 V
(1) T_{amb} = 150 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -55 °C

Figure 8. Group B: DC current gain as a function of collector current; typical values



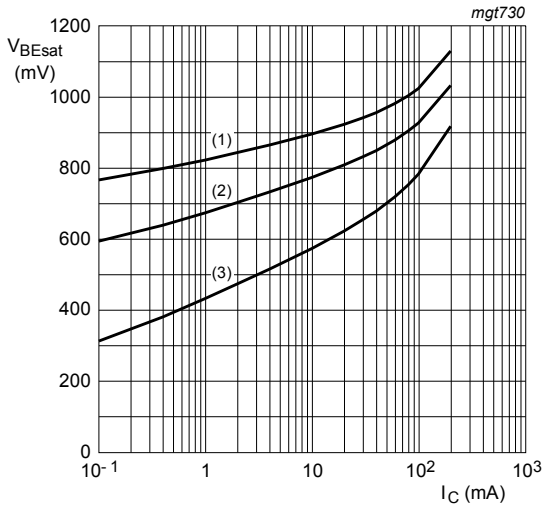
V_{CE} = 5 V
(1) T_{amb} = -55 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 150 °C

Figure 9. Group B: 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

Figure 10. Group B: 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

Figure 11. Group B: Base-emitter saturation voltage as a function of collector current; typical values

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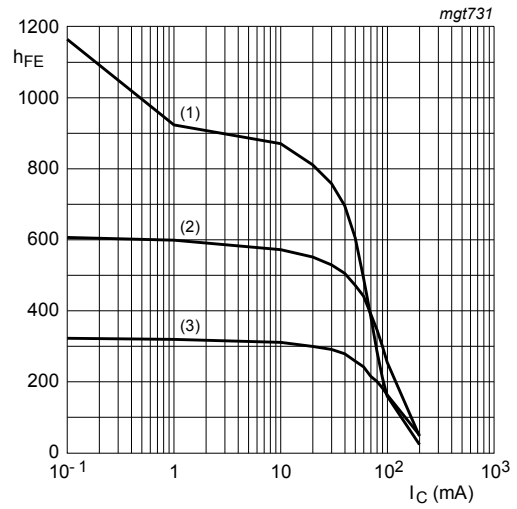
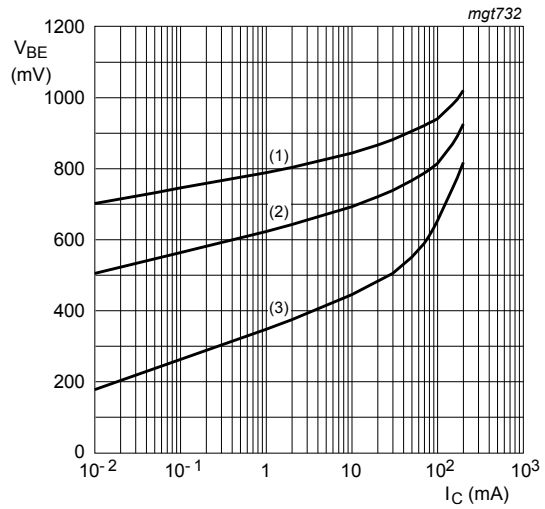


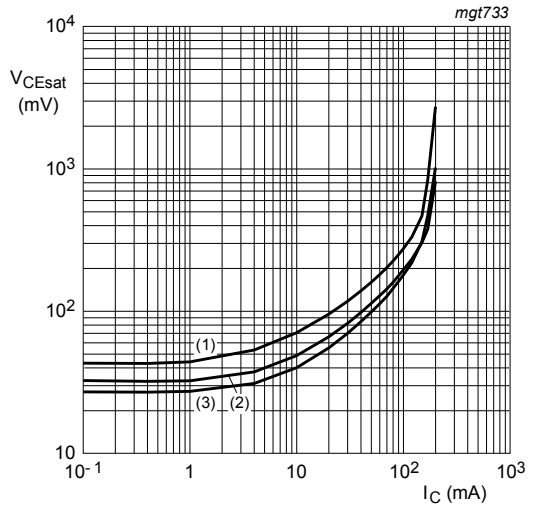
V_{CE} = 5 V
(1) T_{amb} = 150 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -55 °C

Figure 12. Group C: DC current gain as a function of collector current; typical values



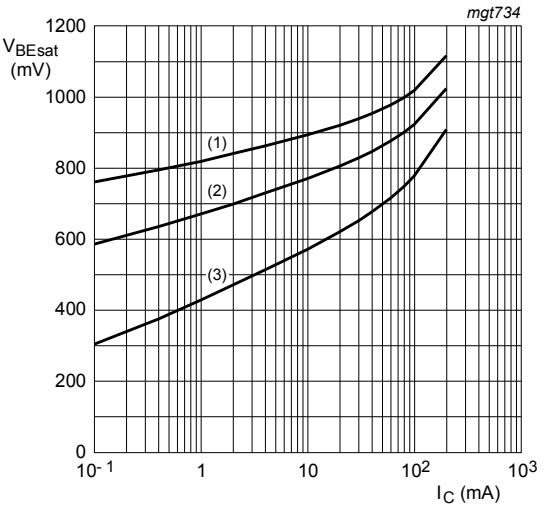
V_{CE} = 5 V
(1) T_{amb} = -55 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 150 °C

Figure 13. Group C: 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

Figure 14. Group C: 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

Figure 15. Group C: Base-emitter saturation voltage as a function of collector current; typical values

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8 Test information

8.1 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.

9 Package outline

Table 9. Package outline

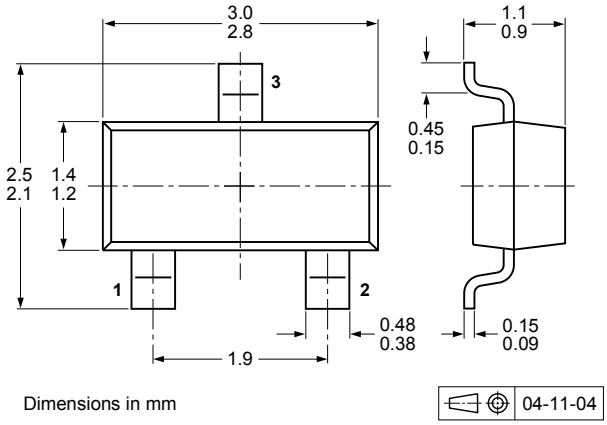

Figure 16. Package outline SOT23 (TO-236AB)

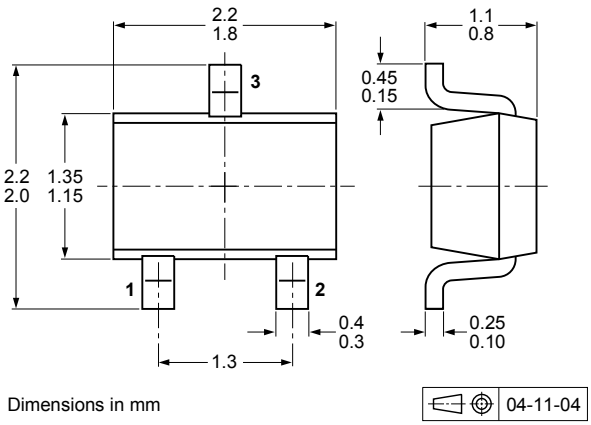

Figure 17. Package outline SOT323 (SC-70)

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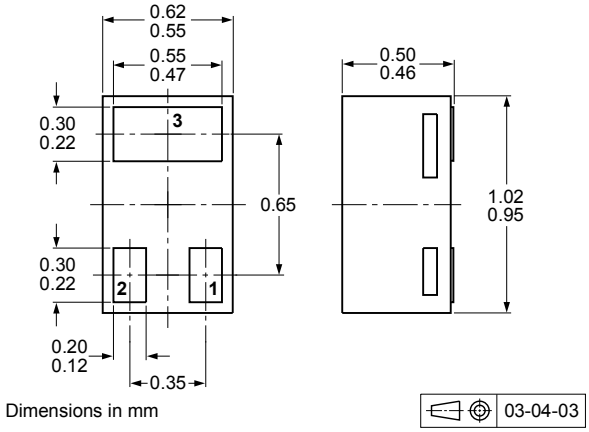

Figure 18. Package outline SOT883 (SC-101)

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10 Soldering

Table 10. Soldering

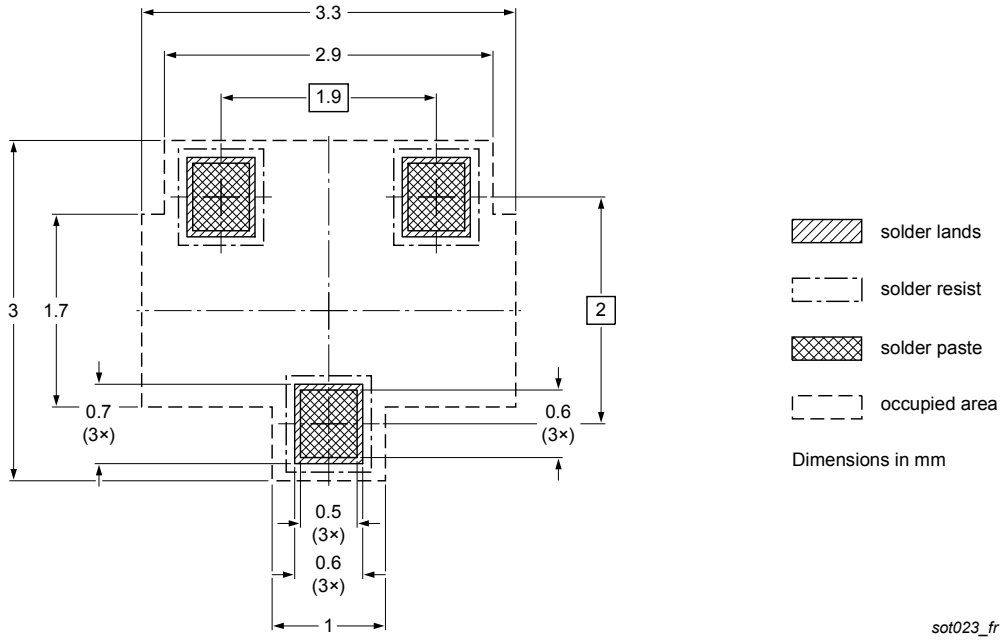

Figure 19. Reflow soldering footprint SOT23 (TO-236AB)

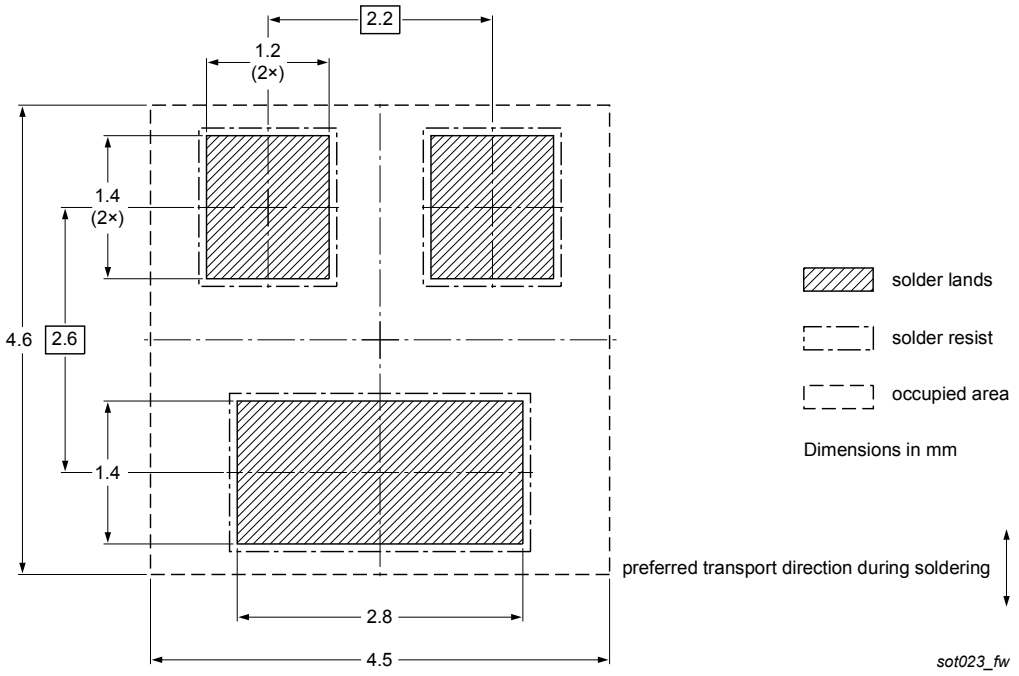

Figure 20. Wave soldering footprint SOT23 (TO-236AB)

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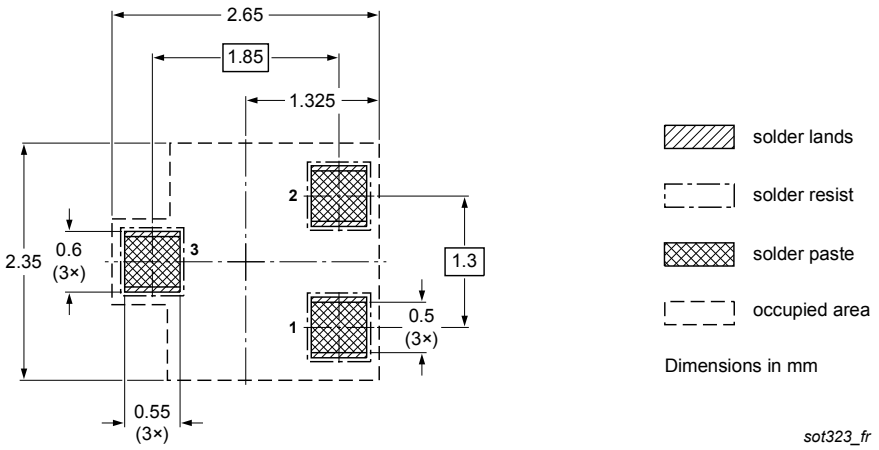

Figure 21. Reflow soldering footprint SOT323 (SC-70)

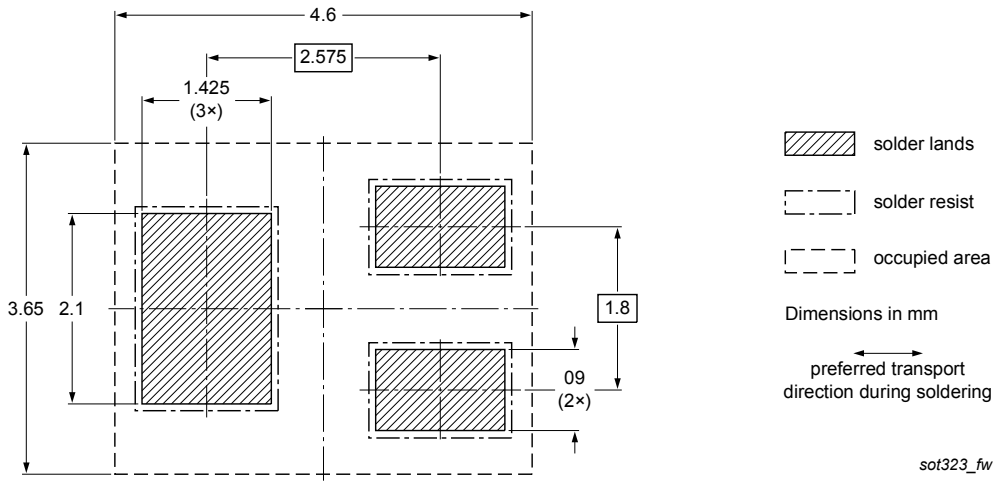

Figure 22. Wave soldering footprint SOT323 (SC-70)

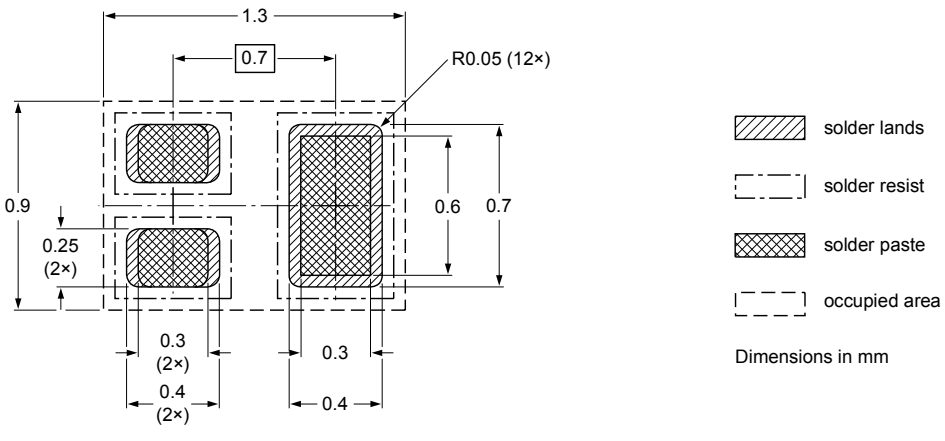

Figure 23. Reflow soldering footprint SOT883 (SC-101)

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11 Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BC847_SER v.11	20181205	Product data sheet	-	BC847_SER v.10
Modifications:	• General description: missing packages added • Marking: Last type name BC847CW is changed to correct BC847CM • Thermal graphs added			
BC847_SER v.10	20180302	Product data sheet	-	BC847_SER v.9
BC847_SER v.9	20140923	Product data sheet	-	BC847_SER v.8
BC847_SER v.8	20120820	Product data sheet	-	BC847_BC547_SER v.7
BC847_BC547_SER v.7	20081210	Product data sheet	-	BC847_BC547_SER v.6
BC847_BC547_SER v.6	20050519	Product data sheet	-	-

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12 Legal information

12.1 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 URL http://www.nexperia.com.

12.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

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Date of release: 5 December 2018
Document identifier: BC847_SER