



# PBSS5350TH

50 V, 3 A PNP low  $V_{CEsat}$  (BISS) transistor

21 June 2017

Product data sheet

## 1. General description

PNP low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) transistor in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package.

## 2. Features and benefits

- Low collector-emitter saturation voltage  $V_{CEsat}$
- High collector current capability:  $I_C$  and  $I_{CM}$
- High collector current gain ( $h_{FE}$ ) at high  $I_C$
- Higher efficiency leading to less heat generation
- High temperature applications up to 175 °C
- AEC-Q101 qualified

## 3. Applications

- Power management
- DC-to-DC conversion
- Supply line switches
- Battery charger switches
- Peripheral drivers
- Driver in low supply voltage applications (e.g. lamps and LEDs)
- Inductive load driver

## 4. Quick reference data

Table 1. Quick reference data

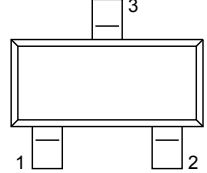
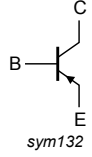
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	-50	V
$I_C$	collector current		-	-	-2	A
$I_{CM}$	peak collector current	pulsed [1]	-	-	-3	A
		single pulse; $t_p < 1$ ms	-	-	-5	A
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -2$ A; $I_B = -200$ mA; $T_{amb} = 25$ °C [2]	-	-	135	mΩ

[1] Pulse conditions: pulse width  $t_p \leq 100$  ms; duty cycle  $\delta \leq 0.25$

[2] Pulse test:  $t_p \leq 300$  μs;  $\delta \leq 0.02$

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p>TO-236AB (SOT23)</p>	 <p>sym132</p>
2	E	emitter		
3	C	collector		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS5350TH	TO-236AB	plastic surface-mounted package; 3 leads	SOT23

## 7. Marking

Table 4. Marking codes

Type number	Marking code <sup>[1]</sup>
PBSS5350TH	FJ%

[1] % = placeholder for manufacturing site code

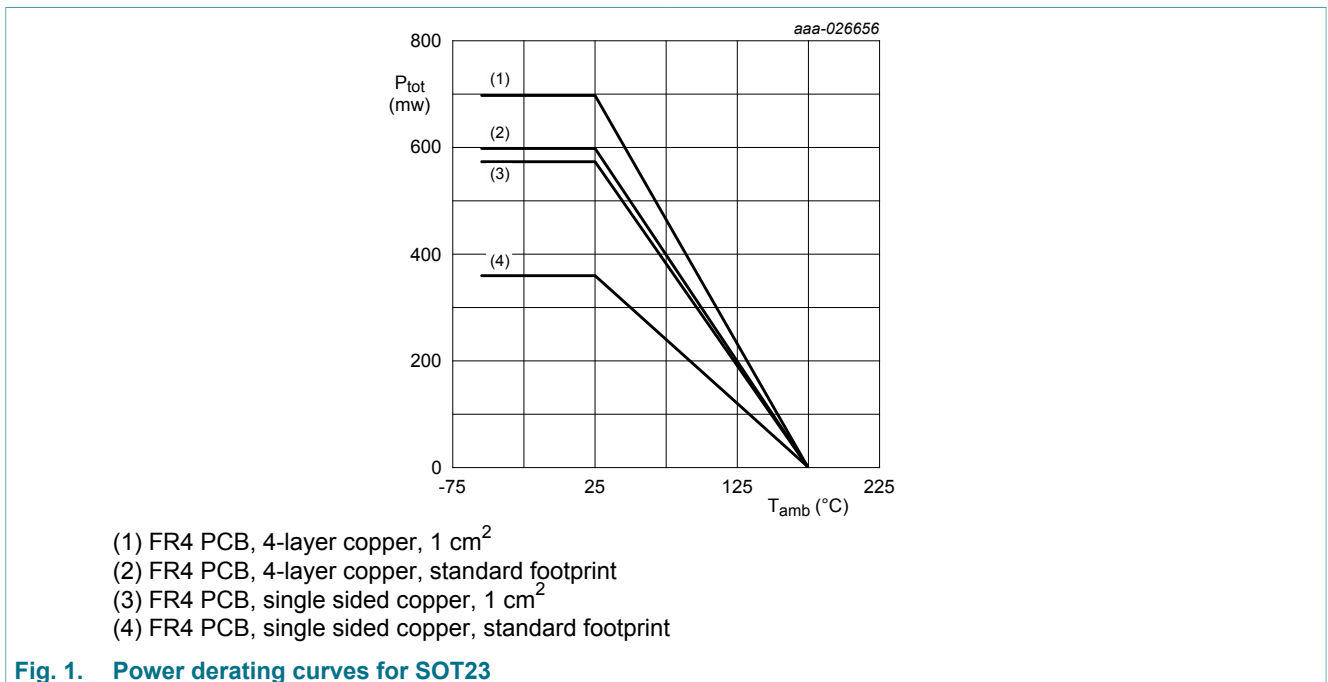
## 8. Limiting values

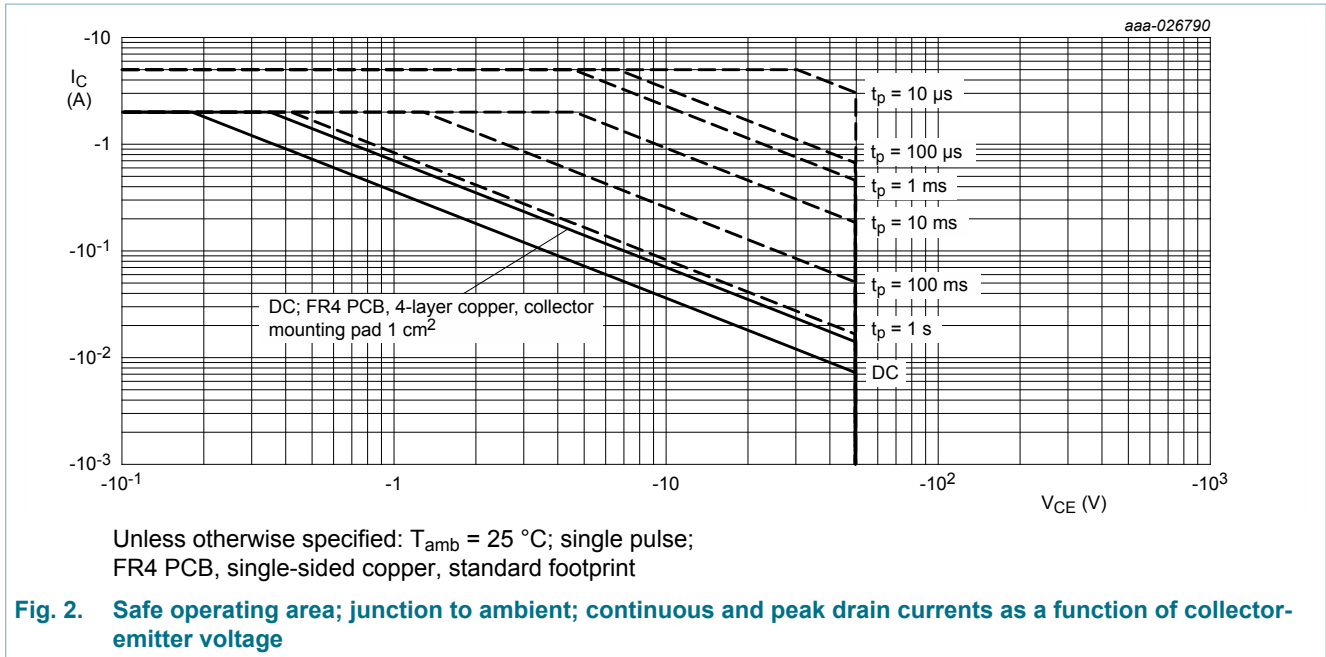
**Table 5. Limiting values**

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	-	-50	V	
$V_{EBO}$	emitter-base voltage	open collector	-	-7	V	
$I_C$	collector current		-	-2	A	
$I_{CM}$	peak collector current	pulsed [1]	-	-3	A	
		single pulse; $t_p < 1$ ms	-	-5	A	
$I_B$	base current		-	-500	mA	
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[2]	-	360	mW
			[3]	-	575	mW
			[4]	-	600	mW
			[5]	-	700	mW
			[1] [2]	-	1.44	W
$T_j$	junction temperature		-	175	°C	
$T_{amb}$	ambient temperature		-55	175	°C	
$T_{stg}$	storage temperature		-65	175	°C	

- [1] Pulse conditions: pulse width  $t_p \leq 100$  ms; duty cycle  $\delta \leq 0.25$
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.
- [5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.





## 9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	417	K/W
			[2]	-	-	261	K/W
			[3]	-	-	250	K/W
			[4]	-	-	215	K/W
			[1] [5]	-	-	104	K/W
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point			75	-	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>.
- [3] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.
- [4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [5] Operated under pulse conditions: pulse width t<sub>p</sub> ≤ 100 ms; duty cycle δ ≤ 0.25

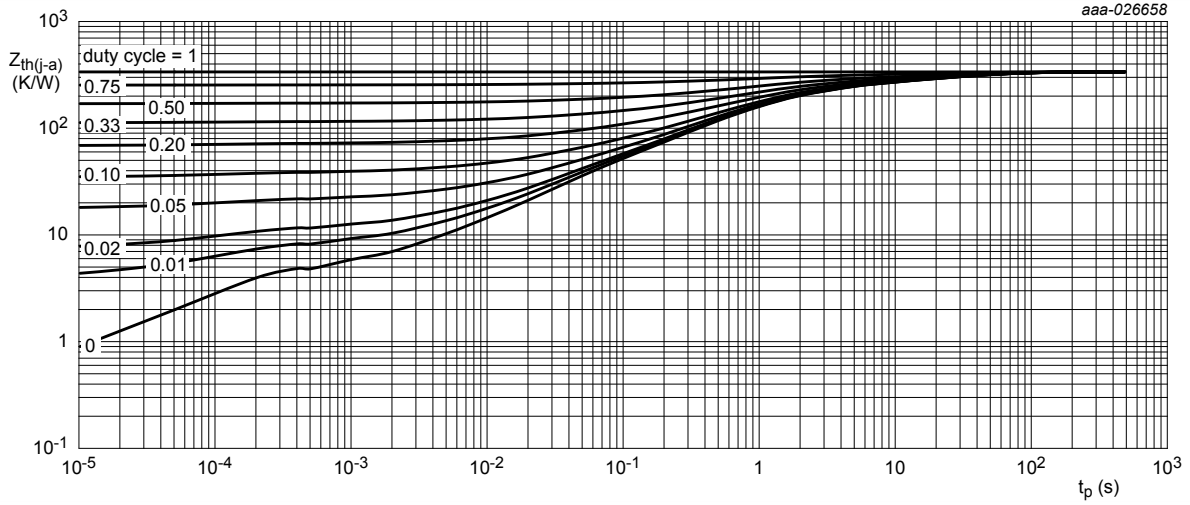


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

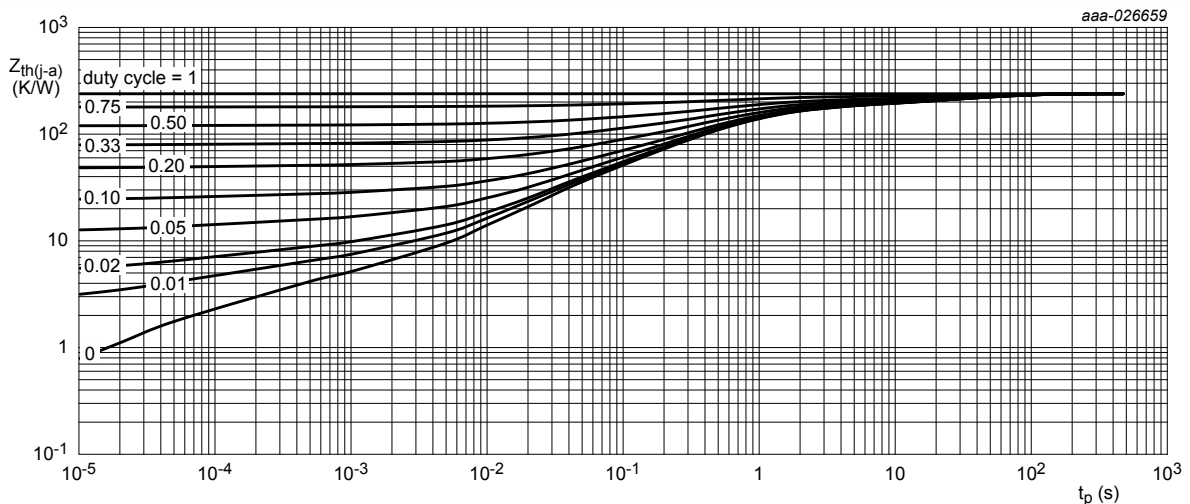
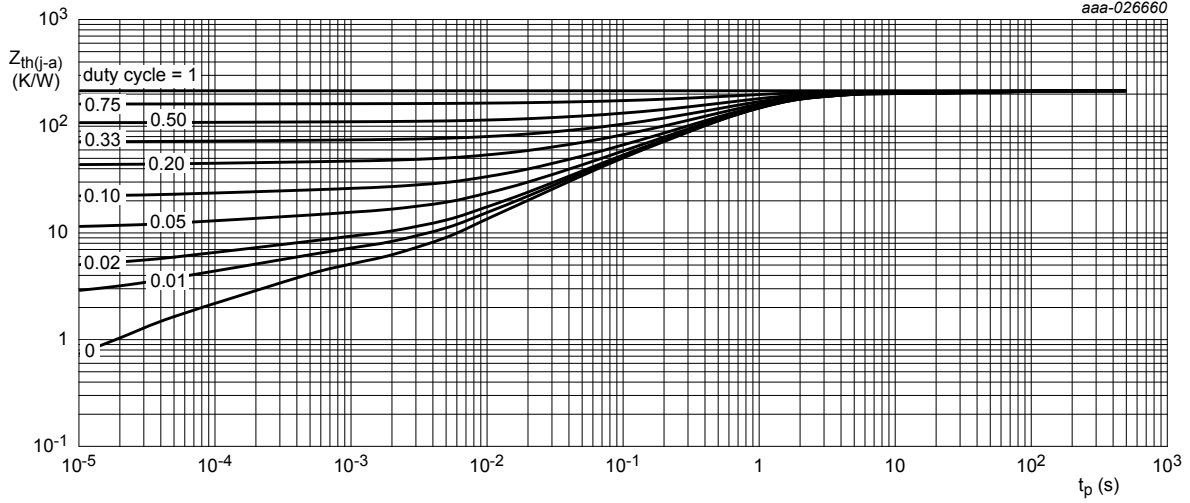
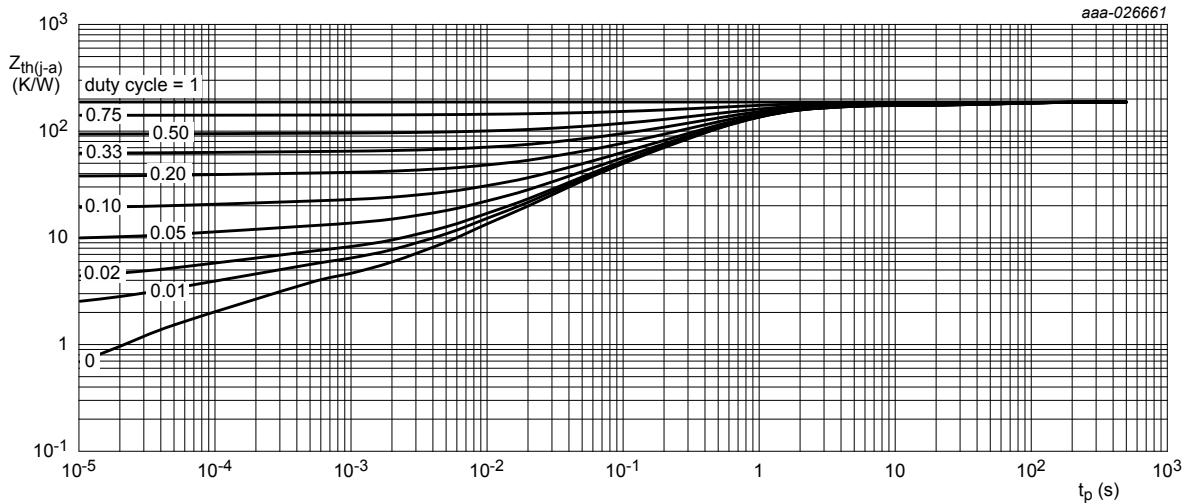


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, 4-layer copper, standard footprint

Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, 4-layer copper, mounting pad for collector 1 cm<sup>2</sup>

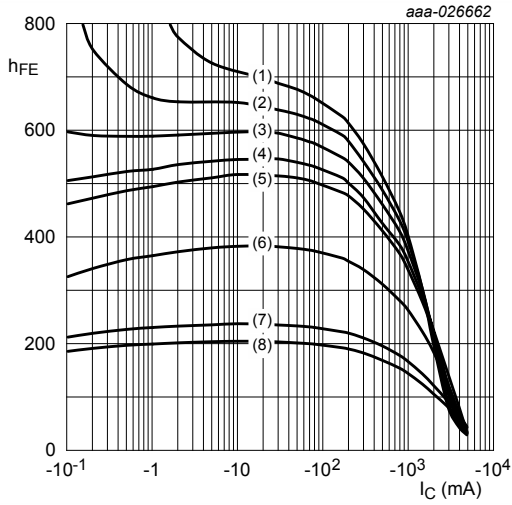
Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

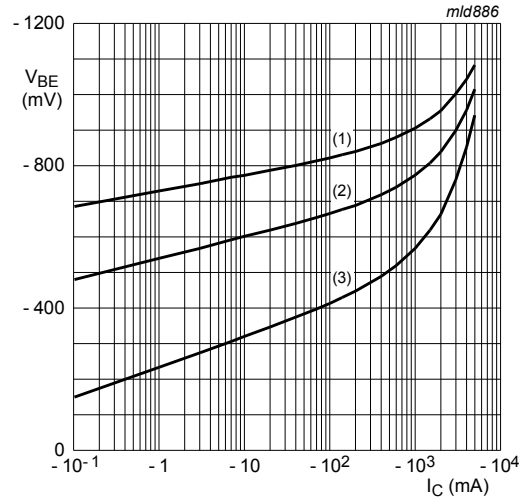
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = -100 \mu\text{A}$ ; $I_E = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$		-50	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = -10 \text{ mA}$ ; $I_B = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$		-50	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage (collector open)	$I_C = 0 \text{ A}$ ; $I_E = -100 \mu\text{A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$		-7	-	-	V
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -50 \text{ V}$ ; $I_E = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$		-	-	-100	nA
		$V_{CB} = -50 \text{ V}$ ; $I_E = 0 \text{ A}$ ; $T_j = 150 \text{ }^\circ\text{C}$		-	-	-5	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -5 \text{ V}$ ; $I_C = 0 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$		-	-	-100	nA
$h_{FE}$	DC current gain	$V_{CE} = -2 \text{ V}$ ; $I_C = -100 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	200	-	-	
		$V_{CE} = -2 \text{ V}$ ; $I_C = -500 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	200	-	-	
		$V_{CE} = -2 \text{ V}$ ; $I_C = -1 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	200	-	-	
		$V_{CE} = -2 \text{ V}$ ; $I_C = -2 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	130	-	-	
		$V_{CE} = -2 \text{ V}$ ; $I_C = -3 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	80	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -500 \text{ mA}$ ; $I_B = -50 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	-	-90	mV
		$I_C = -1 \text{ A}$ ; $I_B = -50 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	-	-180	mV
		$I_C = -2 \text{ A}$ ; $I_B = -100 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	-	-320	mV
		$I_C = -2 \text{ A}$ ; $I_B = -200 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	-	-270	mV
		$I_C = -3 \text{ A}$ ; $I_B = -300 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	-	-390	mV
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -2 \text{ A}$ ; $I_B = -200 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	-	135	m $\Omega$
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -2 \text{ A}$ ; $I_B = -100 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	-	-1.1	V
		$I_C = -3 \text{ A}$ ; $I_B = -300 \text{ mA}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	-	-1.2	V
$V_{BE}$	base-emitter voltage	$V_{CE} = -2 \text{ V}$ ; $I_C = -1 \text{ A}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	[1]	-	-	-1.2	V
$f_T$	transition frequency	$V_{CE} = -5 \text{ V}$ ; $I_C = -100 \text{ mA}$ ; $f = 100 \text{ MHz}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$		100	-	-	MHz
$C_c$	collector capacitance	$V_{CB} = -10 \text{ V}$ ; $I_E = 0 \text{ A}$ ; $i_e = 0 \text{ A}$ ; $f = 1 \text{ MHz}$ ; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$		-	-	35	pF

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



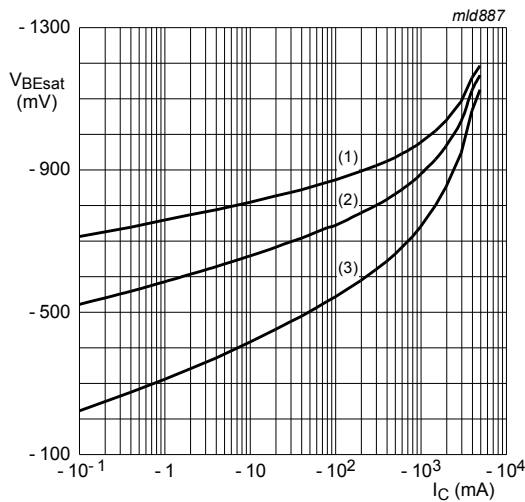
$V_{CE} = -2\text{ V}$   
 (1)  $T_{amb} = 175\text{ °C}$   
 (2)  $T_{amb} = 150\text{ °C}$   
 (3)  $T_{amb} = 125\text{ °C}$   
 (4)  $T_{amb} = 100\text{ °C}$   
 (5)  $T_{amb} = 85\text{ °C}$   
 (6)  $T_{amb} = 25\text{ °C}$   
 (7)  $T_{amb} = -40\text{ °C}$   
 (8)  $T_{amb} = -55\text{ °C}$

**Fig. 7. DC current gain as a function of collector current; typical values**



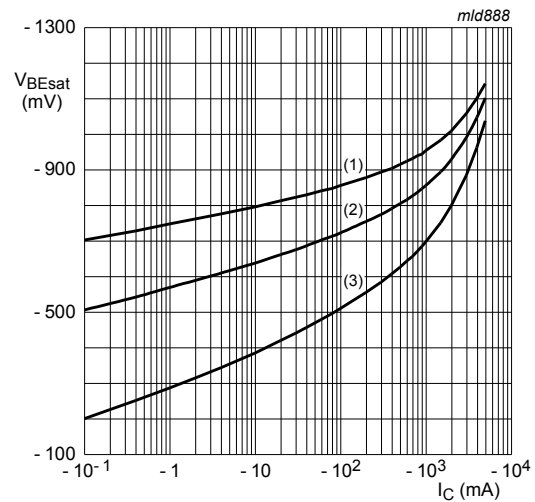
$V_{CE} = -2\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 150\text{ °C}$

**Fig. 8. Base-emitter voltage as a function of collector current; typical values**



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

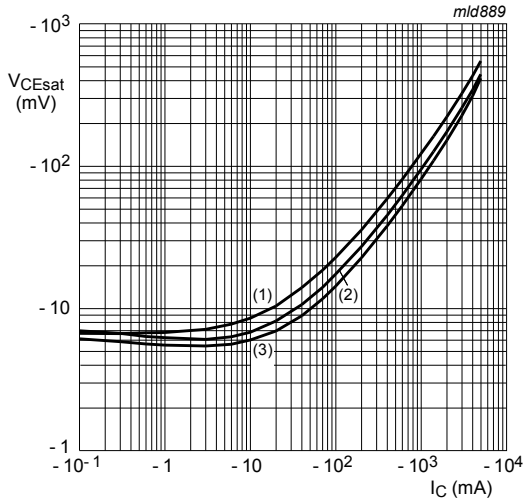
**Fig. 9. Base-emitter saturation voltage as a function of collector current; typical values**



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

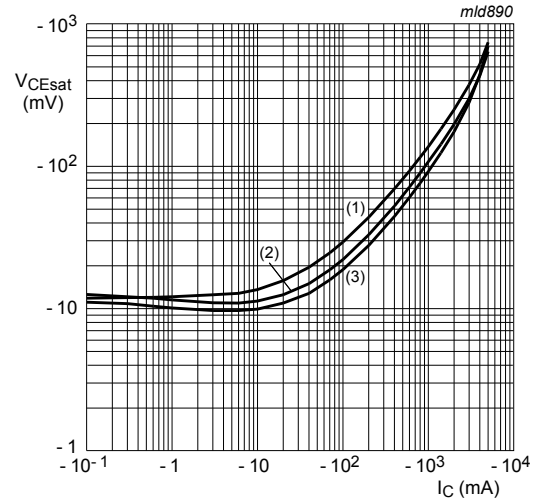
**Fig. 10. Base-emitter saturation voltage as a function of collector current; typical values**





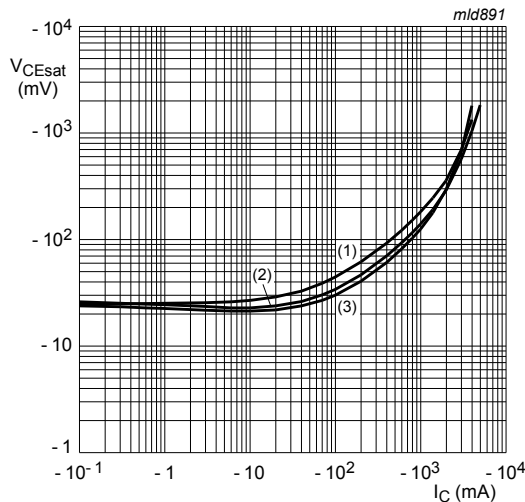
$I_C/I_B = 10$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig. 11. Collector-emitter saturation voltage as a function of collector current; typical values**



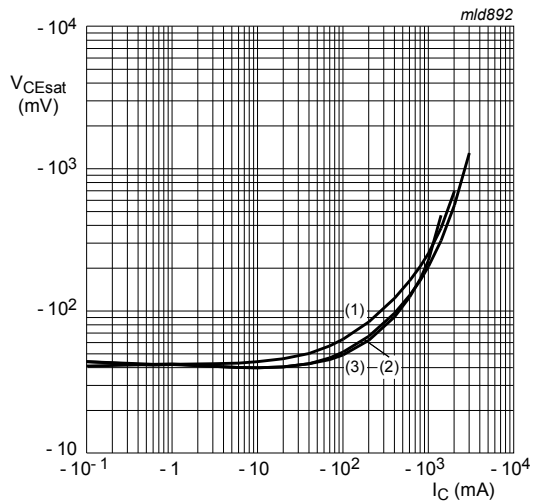
$I_C/I_B = 20$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig. 12. Collector-emitter saturation voltage as a function of collector current; typical values**



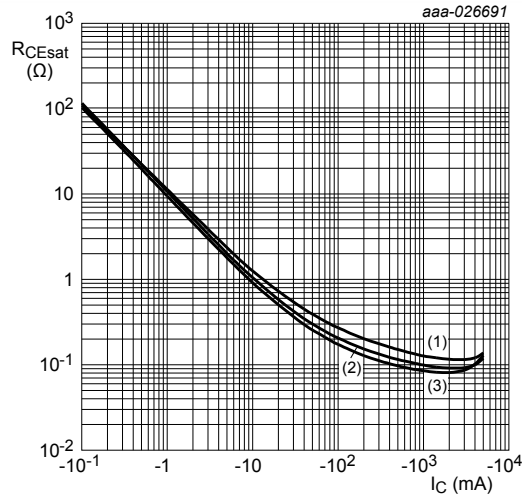
$I_C/I_B = 50$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig. 13. Collector-emitter saturation voltage as a function of collector current; typical values**



$I_C/I_B = 100$   
 (1)  $T_{amb} = 150\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig. 14. Collector-emitter saturation voltage as a function of collector current; typical values**



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

Fig. 15. Collector-emitter saturation resistance 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

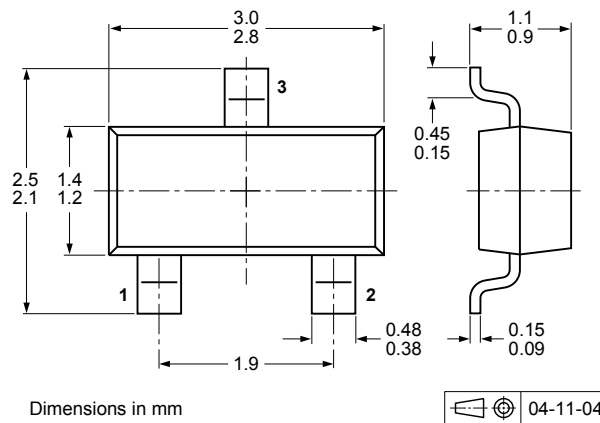


Fig. 16. Package outline TO-236AB (SOT23)

### 13. Soldering

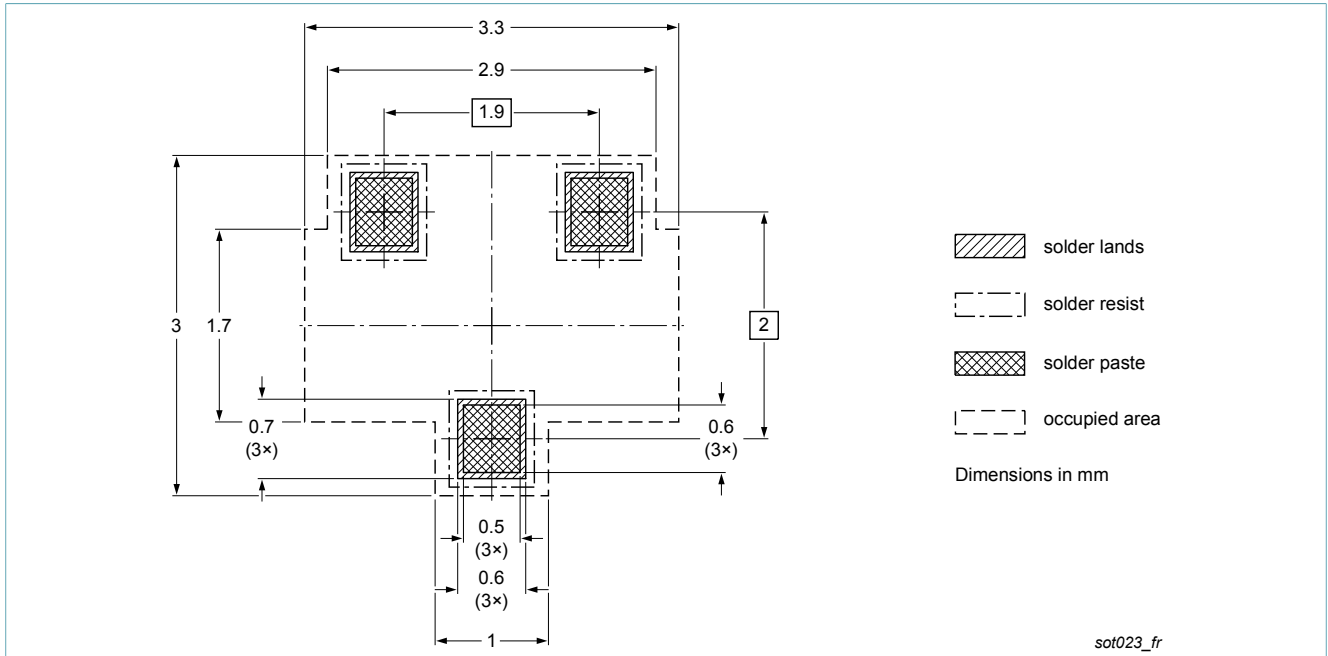


Fig. 17. Reflow soldering footprint for TO-236AB (SOT23)

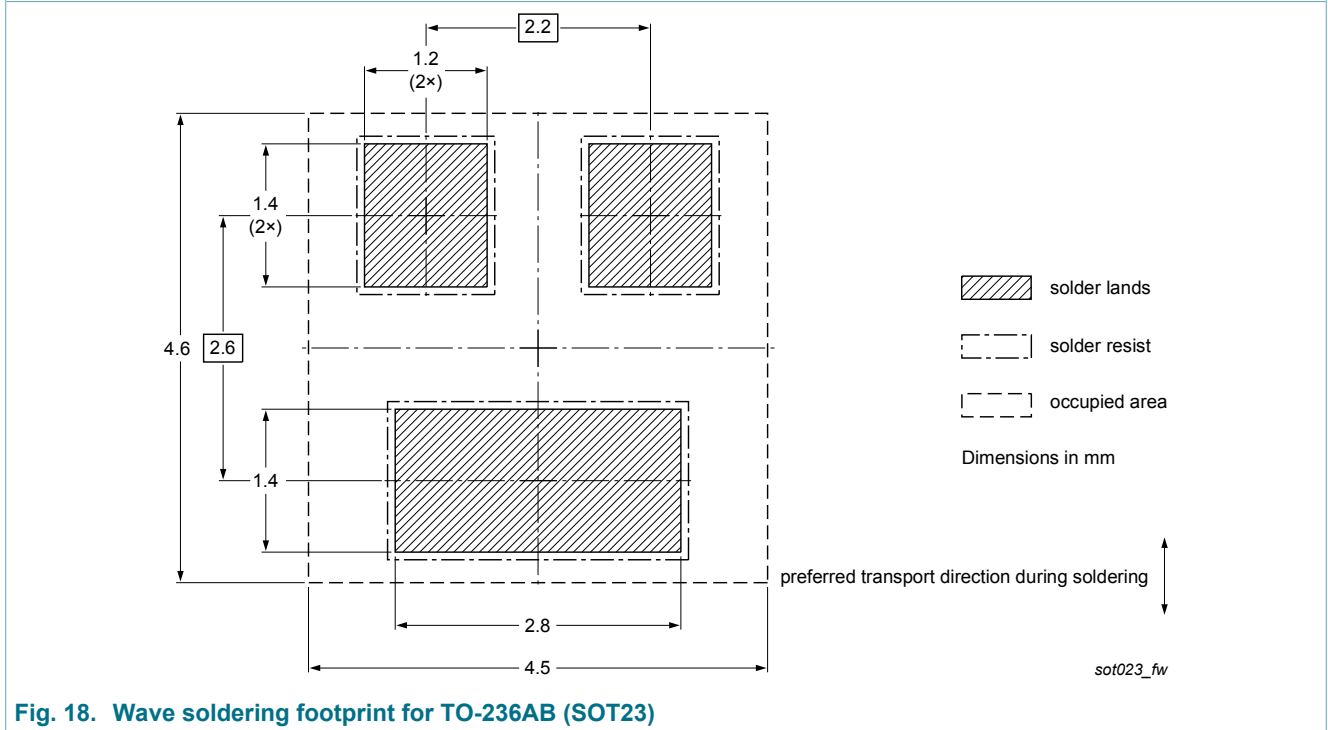


Fig. 18. Wave soldering footprint for TO-236AB (SOT23)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS5350TH v.1	20170621	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.

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