



# PBSS4041NZ

60 V, 7 A NPN low V<sub>CEsat</sub> transistor

20 September 2024

Product data sheet

## 1. General description

NPN low V<sub>CEsat</sub> transistor in a SOT223 (SC-73) medium power Surface-Mounted Device (SMD) plastic package.

PNP complement: PBSS4041PZ

## 2. Features and benefits

- Very low collector-emitter saturation voltage V<sub>CEsat</sub>
- High collector current capability I<sub>C</sub> and I<sub>CM</sub>
- High collector current gain (h<sub>FE</sub>) at high I<sub>C</sub>
- High energy efficiency due to less heat generation
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors
- AEC-Q101 qualified

## 3. Applications

- Loadswitch
- Battery-driven devices
- Power management
- Charging circuits
- Power switches (e.g. motors, fans)

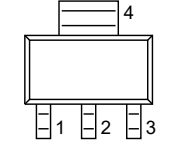
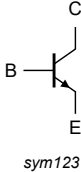
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	60	V
I <sub>C</sub>	collector current		-	-	7	A
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms	-	-	15	A
R <sub>CEsat</sub>	collector-emitter saturation resistance	I <sub>C</sub> = 6 A; I <sub>B</sub> = 600 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	17.5	25	mΩ

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 SC-73 (SOT223)	 sym123
2	C	collector		
3	E	emitter		
4	C	collector		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
<a href="#">PBSS4041NZ</a>	SC-73	plastic, surface-mounted package with increased heatsink; 4 leads; 2.3 mm pitch; 6.5 mm x 3.5 mm x 1.65 mm body	<a href="#">SOT223</a>

7. Marking

Table 4. Marking codes

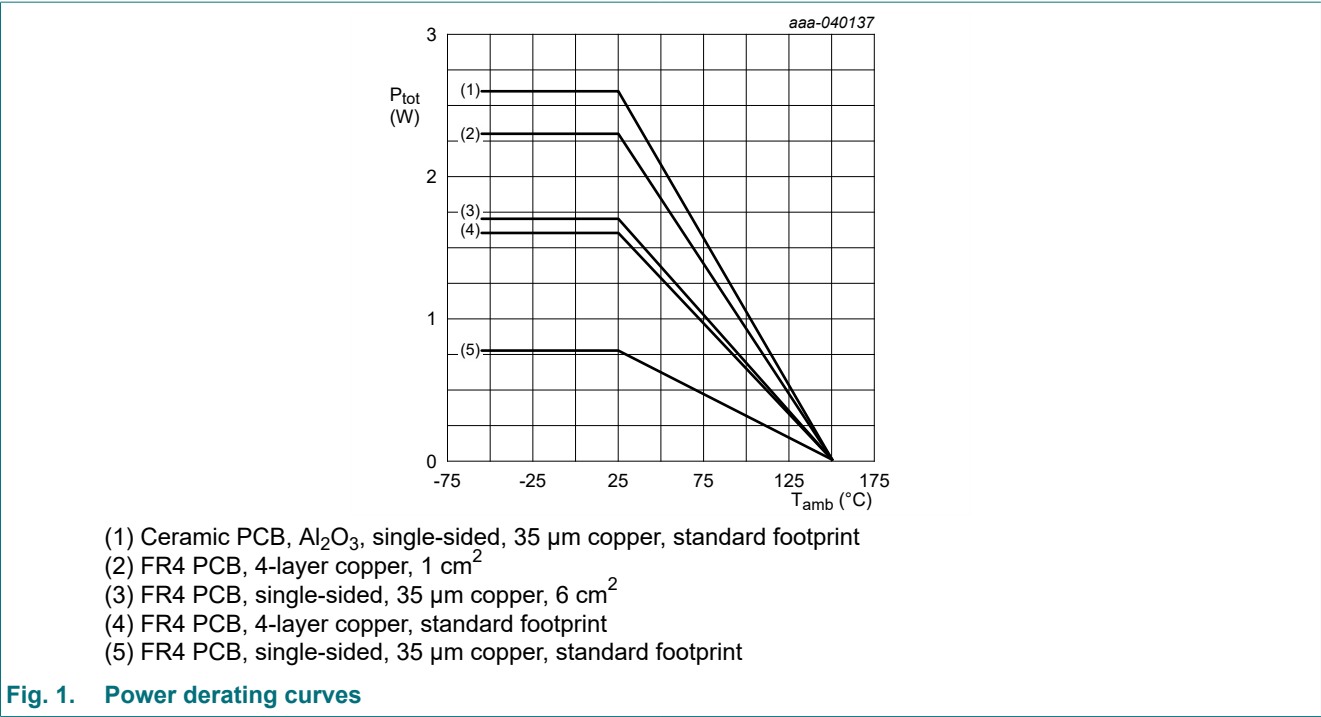
Type number	Marking code
PBSS4041NZ	PB4041 NZ

8. Limiting values

Table 5. Limiting values  
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V <sub>CBO</sub>	collector-base voltage	open emitter		-	60	V
V <sub>CEO</sub>	collector-emitter voltage	open base		-	60	V
V <sub>EBO</sub>	emitter-base voltage	open collector		-	5	V
I <sub>C</sub>	collector current			-	7	A
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms		-	15	A
I <sub>B</sub>	base current			-	1	A
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	0.77	W
			[2]	-	1.7	W
			[3]	-	1.6	W
			[4]	-	2.3	W
			[5]	-	2.6	W
T <sub>j</sub>	junction temperature			-	150	°C
T <sub>amb</sub>	ambient temperature			-55	150	°C
T <sub>stg</sub>	storage temperature			-65	150	°C

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided, 35 µm copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided, 35 µm copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, 4-layer, tin-plated and standard footprint.
- [4] Device mounted on an FR4 PCB, 4-layer, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [5] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, single-sided, 35 µm copper, tin-plated and standard footprint.



9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	160	K/W
			[2]	-	-	75	K/W
			[3]	-	-	80	K/W
			[4]	-	-	55	K/W
			[5]	-	-	50	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	11	K/W

- [1] Device mounted on an FR4 PCB, single-sided, 35 µm copper, tin-plated and standard footprint.  
[2] Device mounted on an FR4 PCB, single-sided, 35 µm copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.  
[3] Device mounted on an FR4 PCB, 4-layer, tin-plated and standard footprint.  
[4] Device mounted on an FR4 PCB, 4-layer, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.  
[5] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, single-sided, 35 µm copper, tin-plated and standard footprint.

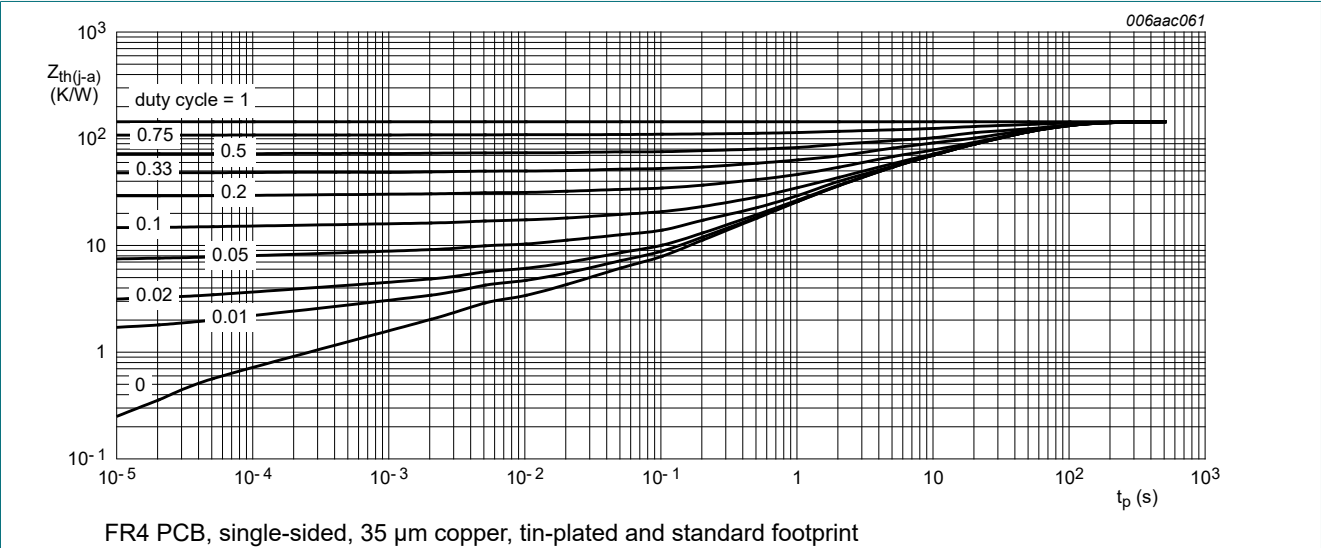


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

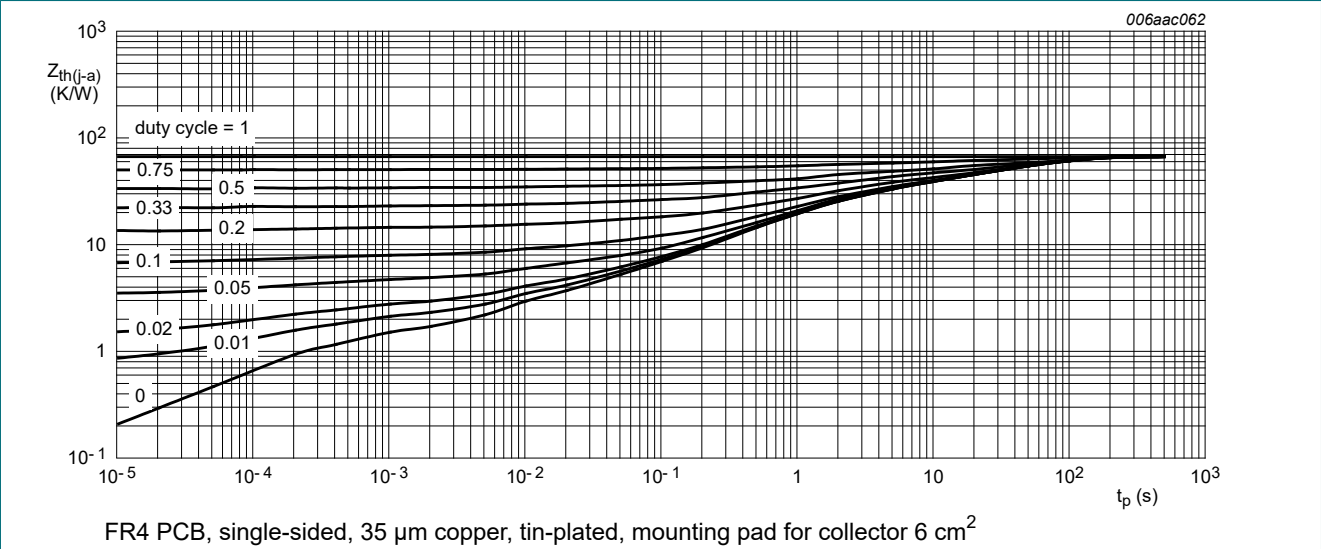
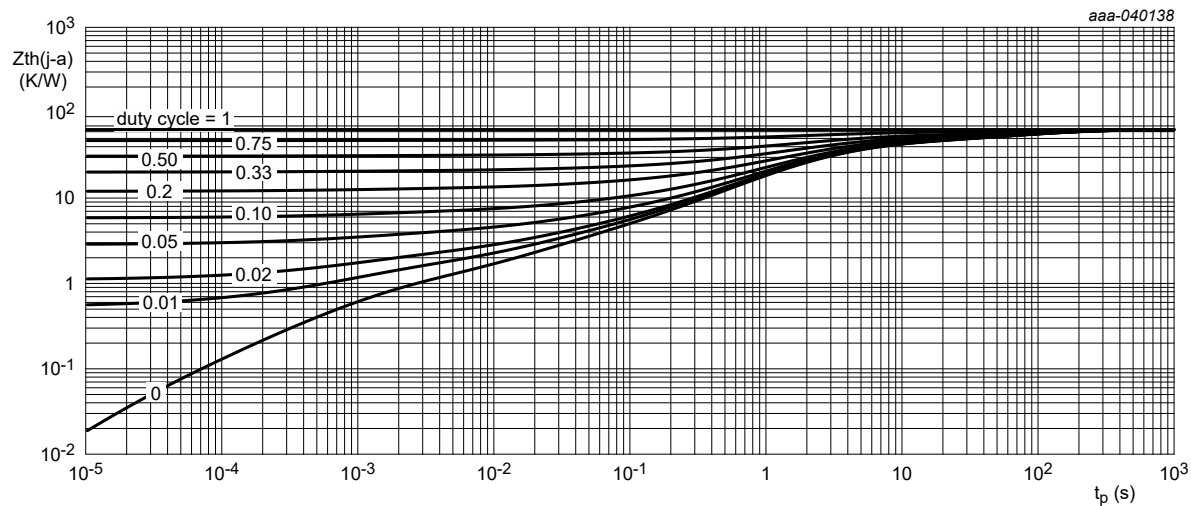
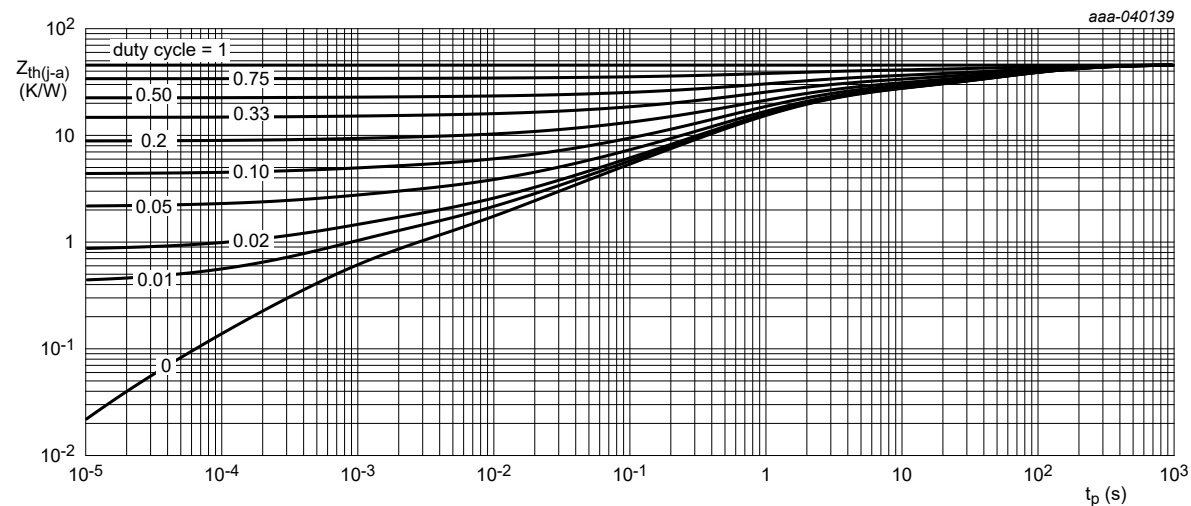


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



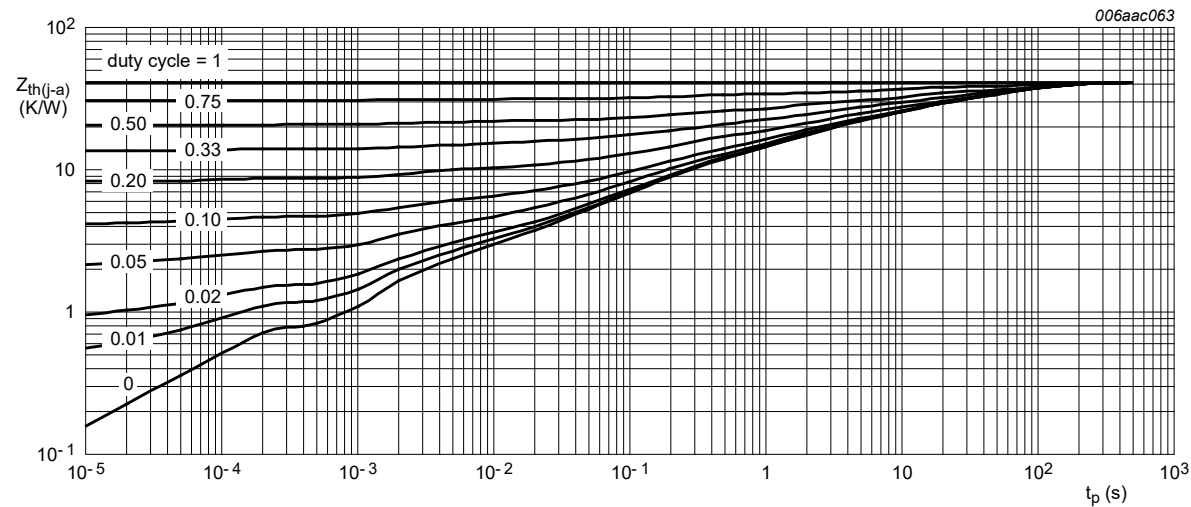
FR4 PCB, 4-layer, tin-plated and standard footprint

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



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

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



Ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint

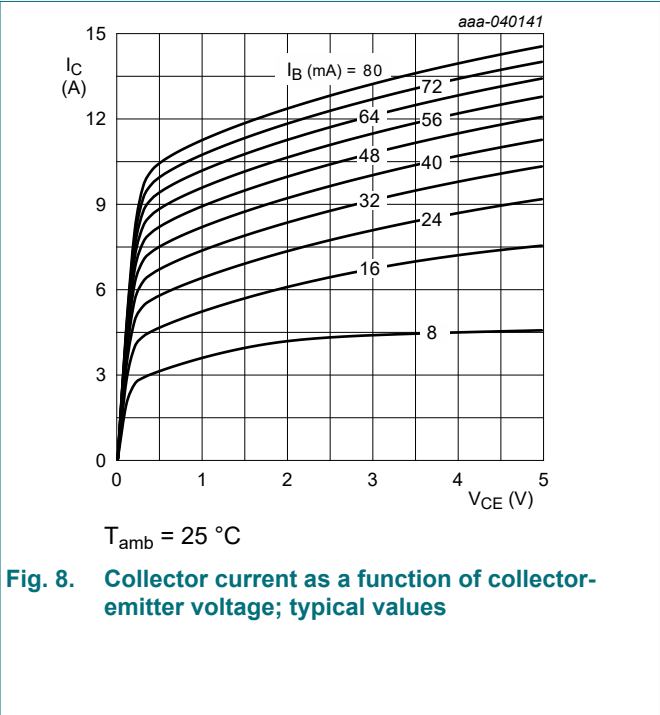
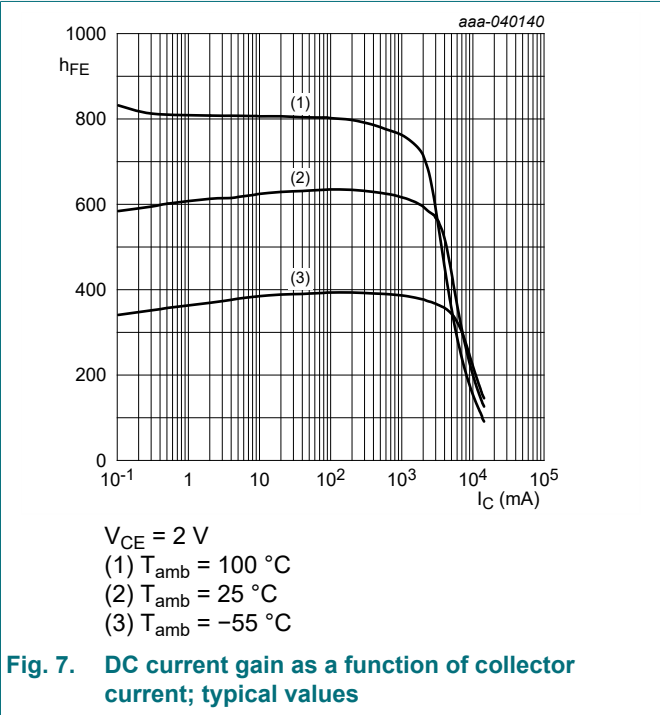
Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100\text{ }\mu\text{A}$ ; $I_E = 0\text{ A}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	60	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 10\text{ mA}$ ; $I_B = 0\text{ A}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	60	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_E = 100\text{ }\mu\text{A}$ ; $I_C = 0\text{ A}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	5	-	-	V
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 60\text{ V}$ ; $I_E = 0\text{ A}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	100	nA
		$V_{CB} = 60\text{ V}$ ; $I_E = 0\text{ A}$ ; $T_J = 150\text{ }^{\circ}\text{C}$	-	-	50	$\mu\text{A}$
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = 48\text{ V}$ ; $V_{BE} = 0\text{ V}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	100	nA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}$ ; $I_C = 0\text{ A}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	100	nA
$h_{FE}$	DC current gain	$V_{CE} = 2\text{ V}$ ; $I_C = 500\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	300	530	-	
		$V_{CE} = 2\text{ V}$ ; $I_C = 1\text{ A}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	300	520	-	
		$V_{CE} = 2\text{ V}$ ; $I_C = 2\text{ A}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	300	500	-	
		$V_{CE} = 2\text{ V}$ ; $I_C = 4\text{ A}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	250	430	-	
		$V_{CE} = 2\text{ V}$ ; $I_C = 6\text{ A}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	100	320	-	
		$V_{CE} = 2\text{ V}$ ; $I_C = 7\text{ A}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	50	240	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 1\text{ A}$ ; $I_B = 10\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	45	60	mV
		$I_C = 1\text{ A}$ ; $I_B = 50\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	25	35	mV
		$I_C = 2\text{ A}$ ; $I_B = 40\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	55	75	mV
		$I_C = 4\text{ A}$ ; $I_B = 40\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	115	160	mV
		$I_C = 4\text{ A}$ ; $I_B = 200\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	75	110	mV
		$I_C = 7\text{ A}$ ; $I_B = 350\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	125	195	mV
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = 6\text{ A}$ ; $I_B = 600\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	17.5	25	m $\Omega$
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 1\text{ A}$ ; $I_B = 100\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	0.82	0.9	V
		$I_C = 4\text{ A}$ ; $I_B = 400\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	0.97	1.05	V
$V_{BE}$	base-emitter voltage	$V_{CE} = 2\text{ V}$ ; $I_C = 2\text{ A}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	0.72	0.85	V

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_d$	delay time	$V_{CC} = 12.5\text{ V}; I_C = 1\text{ A}; I_{B(on)} = 50\text{ mA};$ $I_{B(off)} = -50\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}$	-	65	-	ns
$t_r$	rise time		-	40	-	ns
$t_{on}$	turn-on time		-	105	-	ns
$t_s$	storage time		-	1125	-	ns
$t_f$	fall time		-	95	-	ns
$t_{off}$	turn-off time		-	1220	-	ns
$f_T$	transition frequency	$V_{CE} = 10\text{ V}; I_C = 100\text{ mA}; f = 100\text{ MHz};$ $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	100	-	MHz
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A}; f = 1\text{ MHz};$ $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	50	-	pF



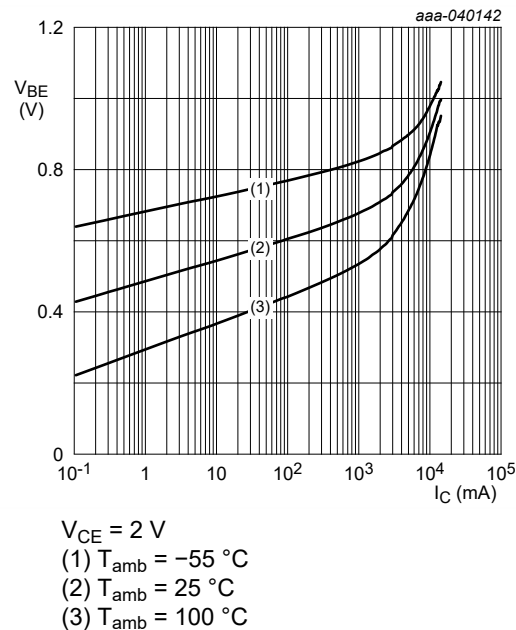


Fig. 9. Base-emitter voltage as a function of collector current; typical values

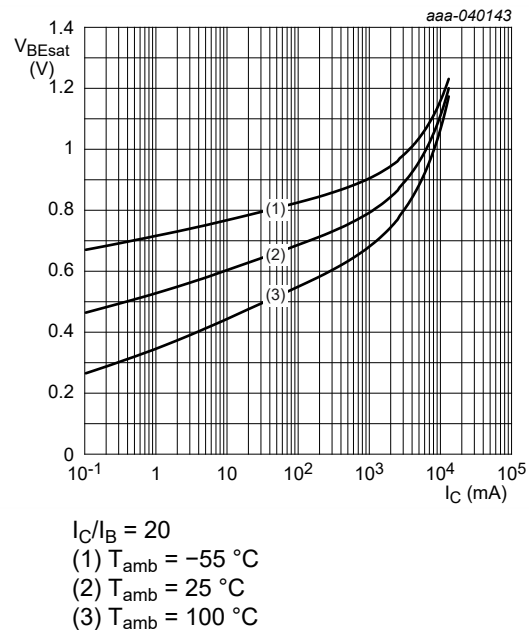


Fig. 10. Base-emitter saturation voltage as a function of collector current; typical values

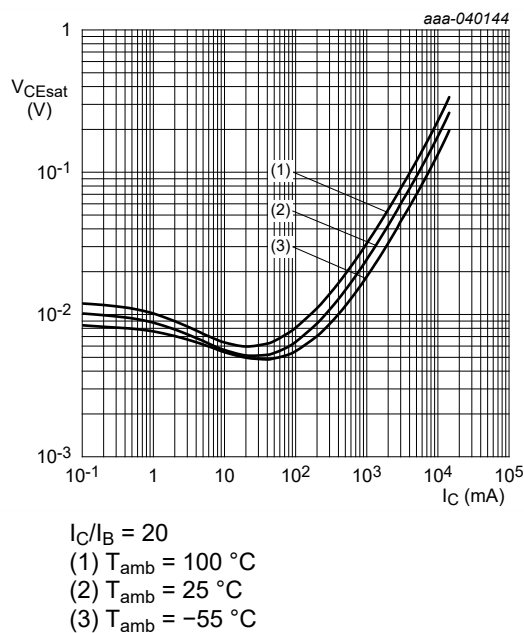


Fig. 11. Collector-emitter saturation voltage as a function of collector current; typical values

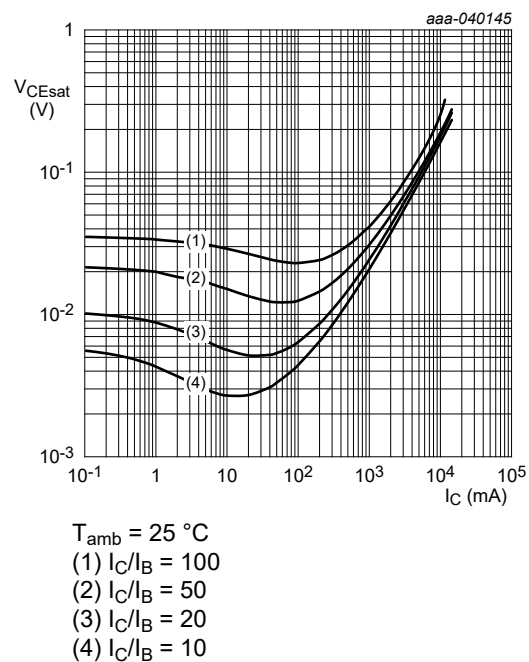


Fig. 12. Collector-emitter saturation voltage as a function of collector current; typical values



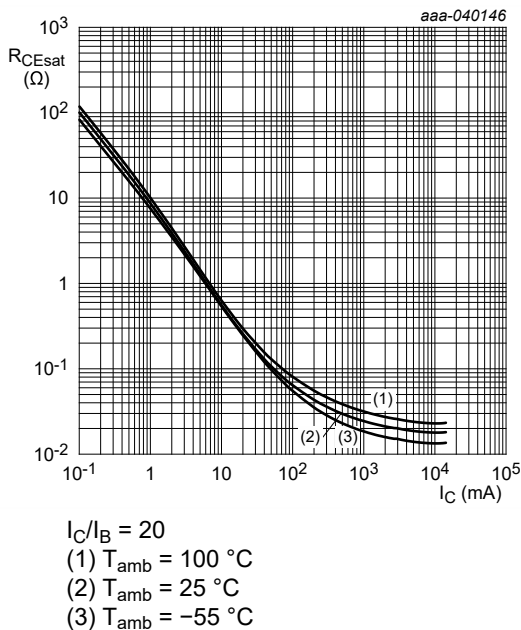


Fig. 13. Collector-emitter saturation resistance as a function of collector current; typical values

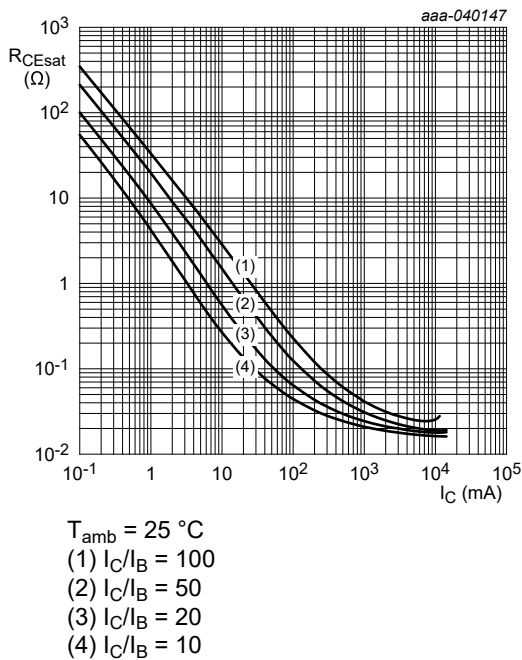


Fig. 14. Collector-emitter saturation resistance as a function of collector current; typical values

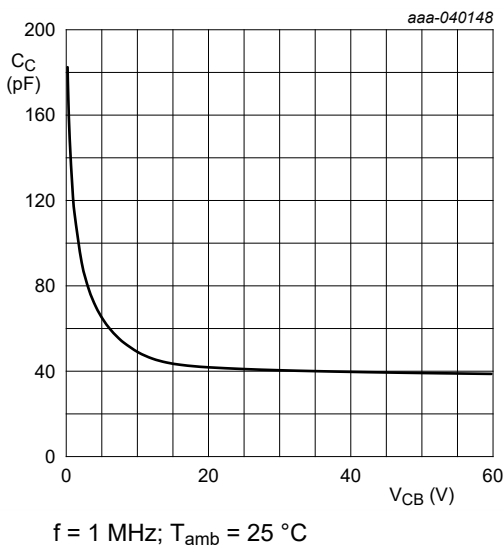


Fig. 15. Collector capacitance as a function of collector-base voltage; typical values

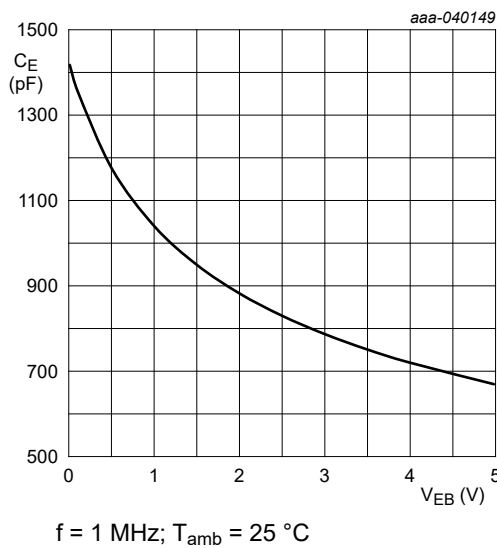


Fig. 16. Emitter capacitance as a function of emitter-base voltage; typical values

11. Test information

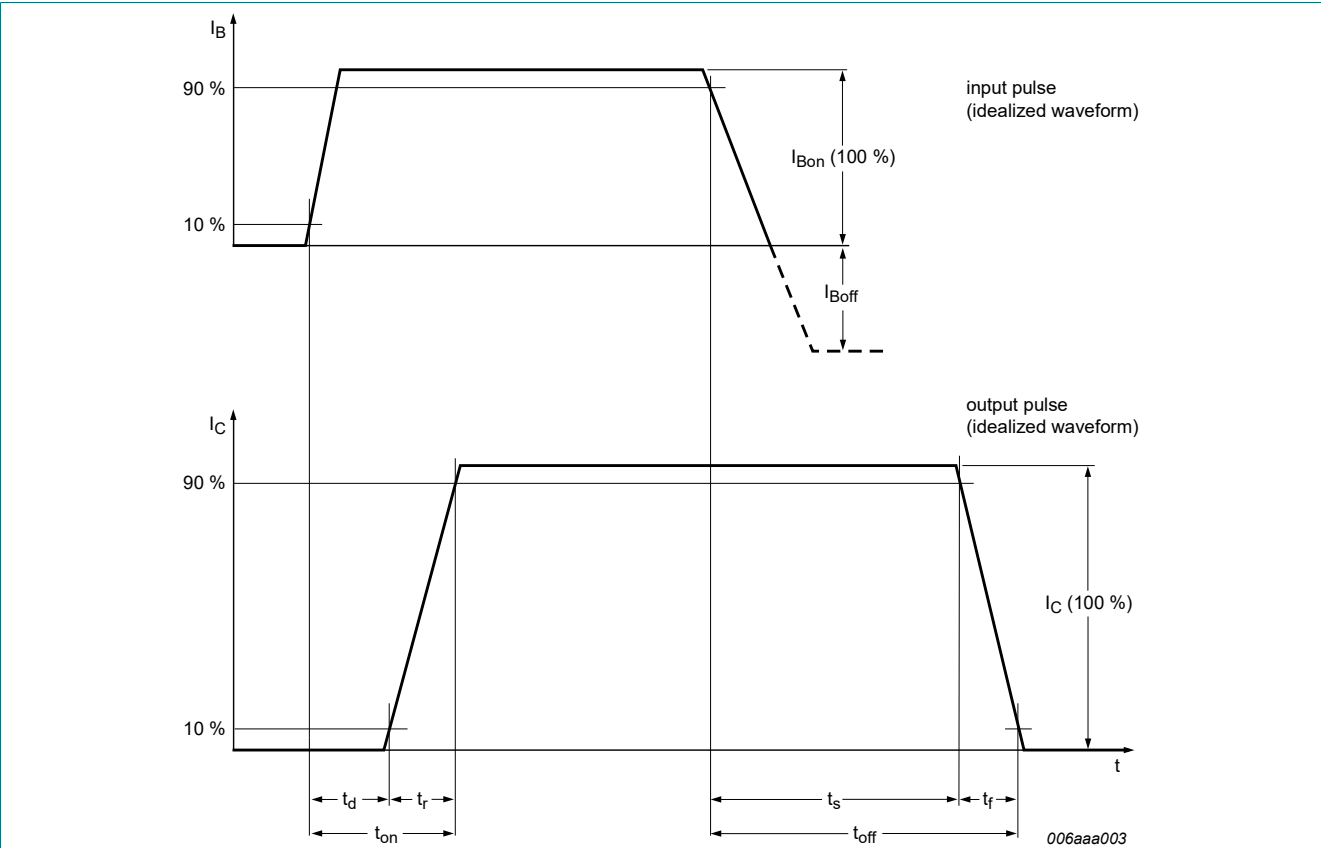


Fig. 17. Switching time definition

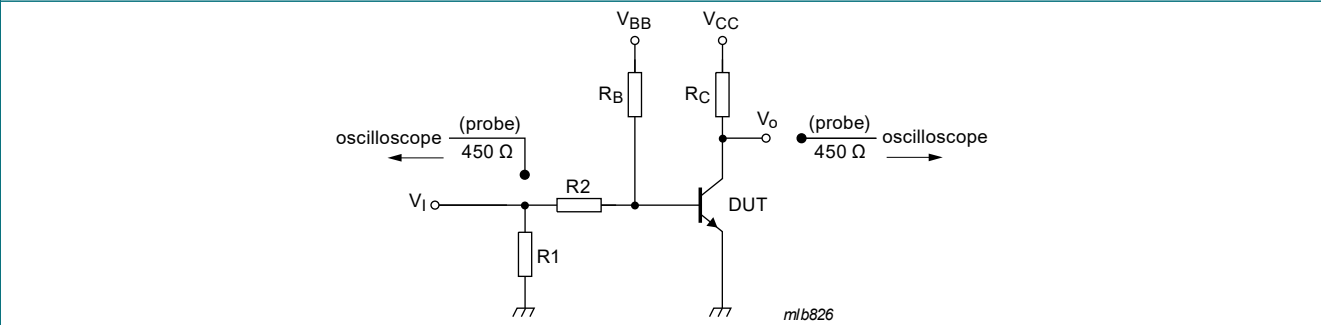
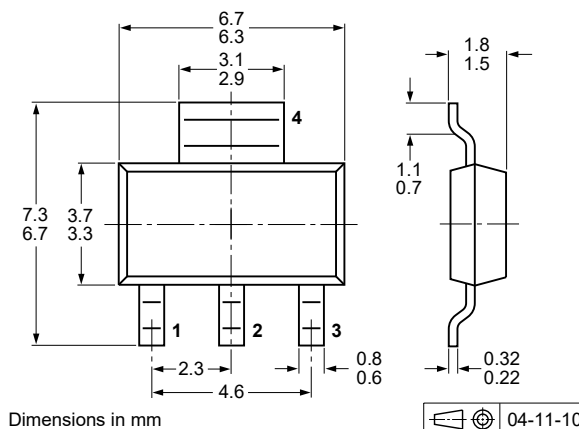


Fig. 18. Test circuit for switching times

Quality information

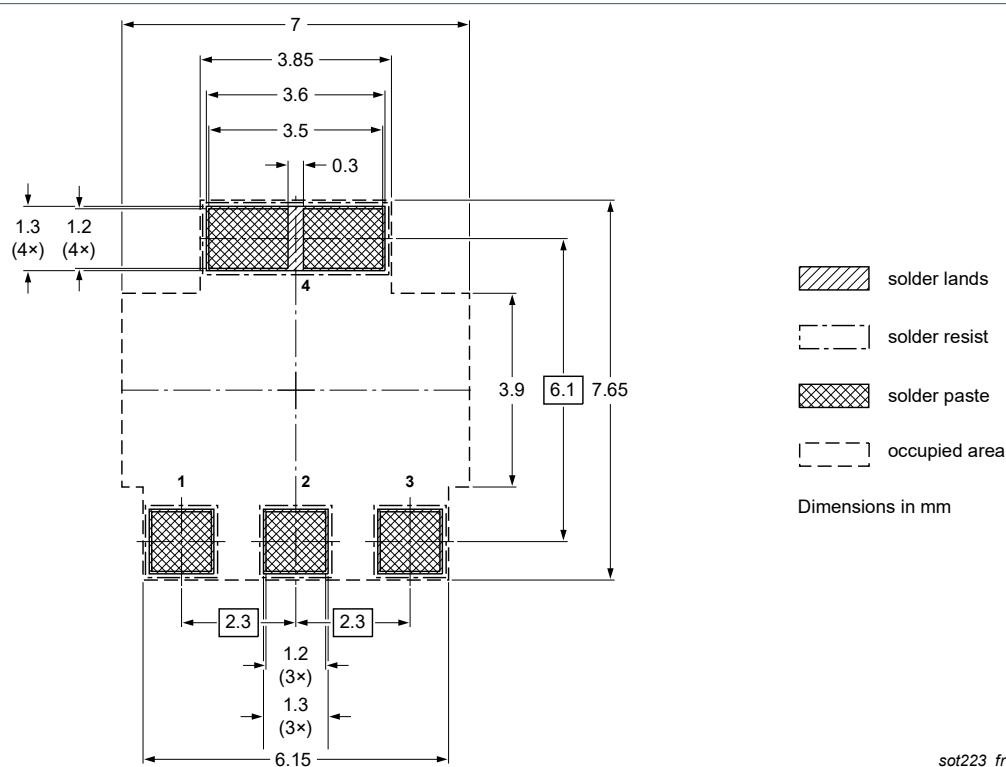
This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

## 12. Package outline

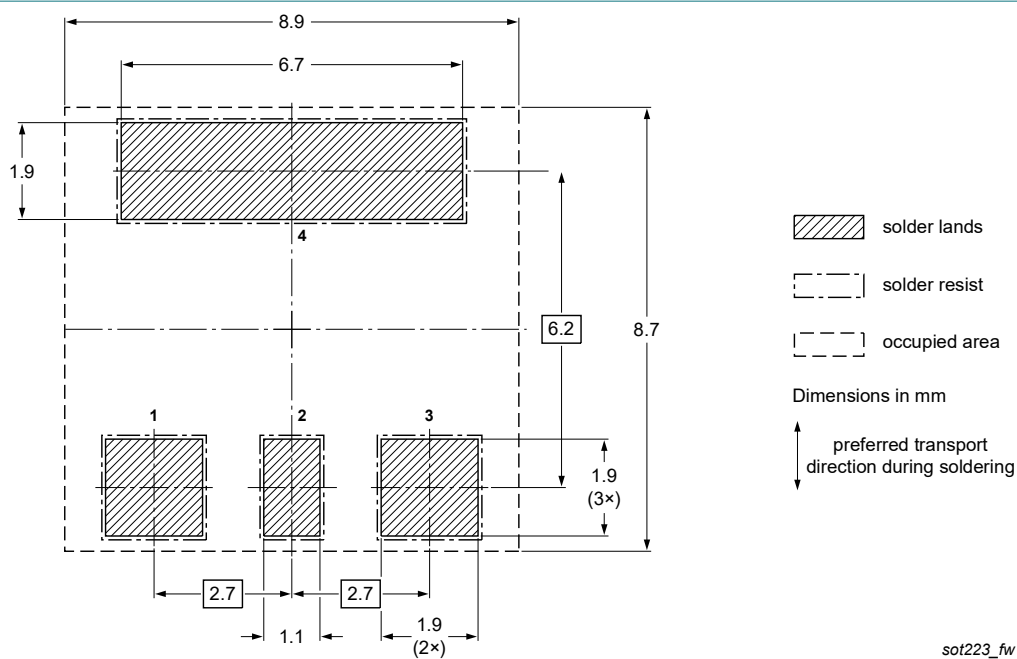


**Fig. 19. Package outline SC-73 (SOT223)**

## 13. Soldering



**Fig. 20. Reflow soldering footprint for SC-73 (SOT223)**



**Fig. 21. Wave soldering footprint for SC-73 (SOT223)**

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4041NZ v.3	20240920	Product data sheet	-	PBSS4041NZ v.2
Modifications:	• New graphics added, graphs updated and values changed.			
PBSS4041NZ v.2	0120808	Product data sheet	-	PBSS4041NZ v.1
PBSS4041NZ v.1	20100331	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".
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Date of release: 20 September 2024