



PBSS302NZ

20 V, 5.8 A NPN low VCEsat transistor

8 October 2024

Product data sheet

1. General description

NPN low V_{CEsat} transistor in a SOT223 (SC-73) small Surface-Mounted Device (SMD) plastic package.

PNP complement: PBSS302PZ

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
- High efficiency due to less heat generation
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors

3. Applications

- DC-to-DC conversion
- MOSFET gate driving
- Charging circuits
- Power switches (e.g. fans)

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	20	V
I_C	collector current		-	-	5.8	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	11.6	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 4$ A; $I_B = 200$ mA; pulsed; $t_p \leq 300$ μ s; $\delta \leq 0.02$; $T_{amb} = 25$ °C	-	30	43	m Ω

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
PBSS302NZ	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	SOT223

7. Marking

Table 4. Marking codes

Type number	Marking code
PBSS302NZ	S302NZ

8. Limiting values

Table 5. Limiting values

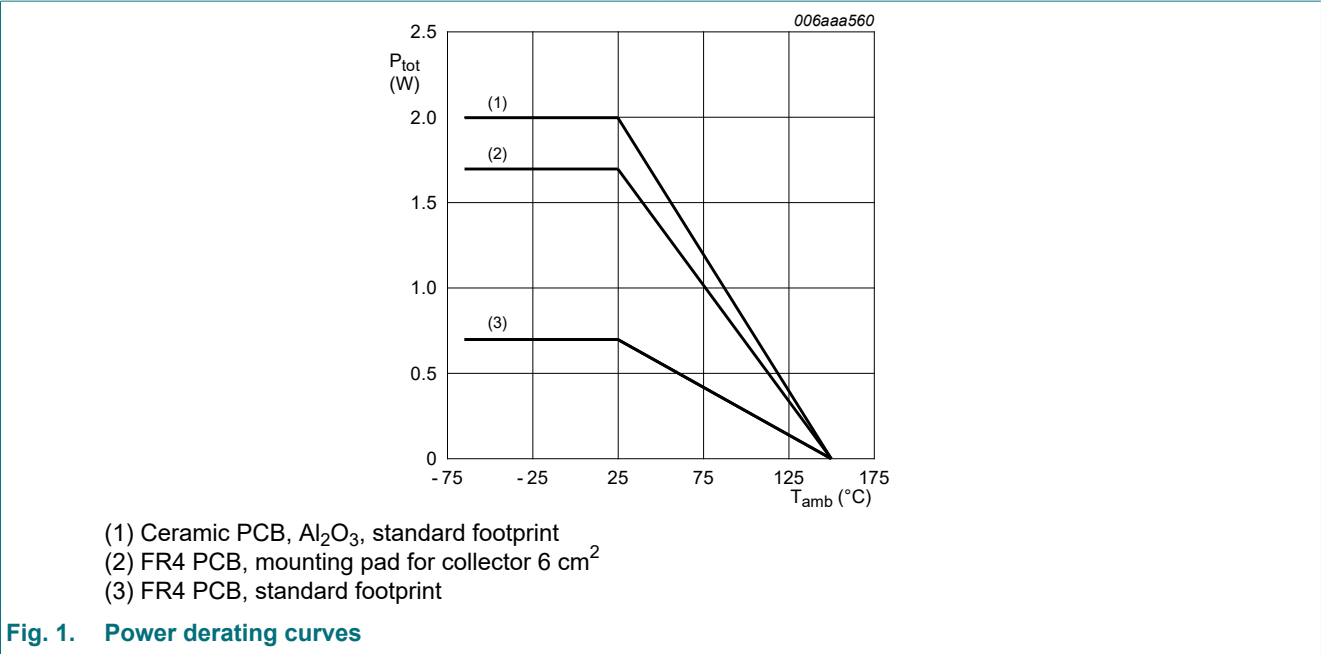
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V _{CBO}	collector-base voltage	open emitter		-	20	V
V _{CEO}	collector-emitter voltage	open base		-	20	V
V _{EBO}	emitter-base voltage	open collector		-	5	V
I _C	collector current			-	5.8	A
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms		-	11.6	A
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	0.7	W
			[2]	-	1.7	W
			[3]	-	2	W
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 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 6 cm².

[3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.

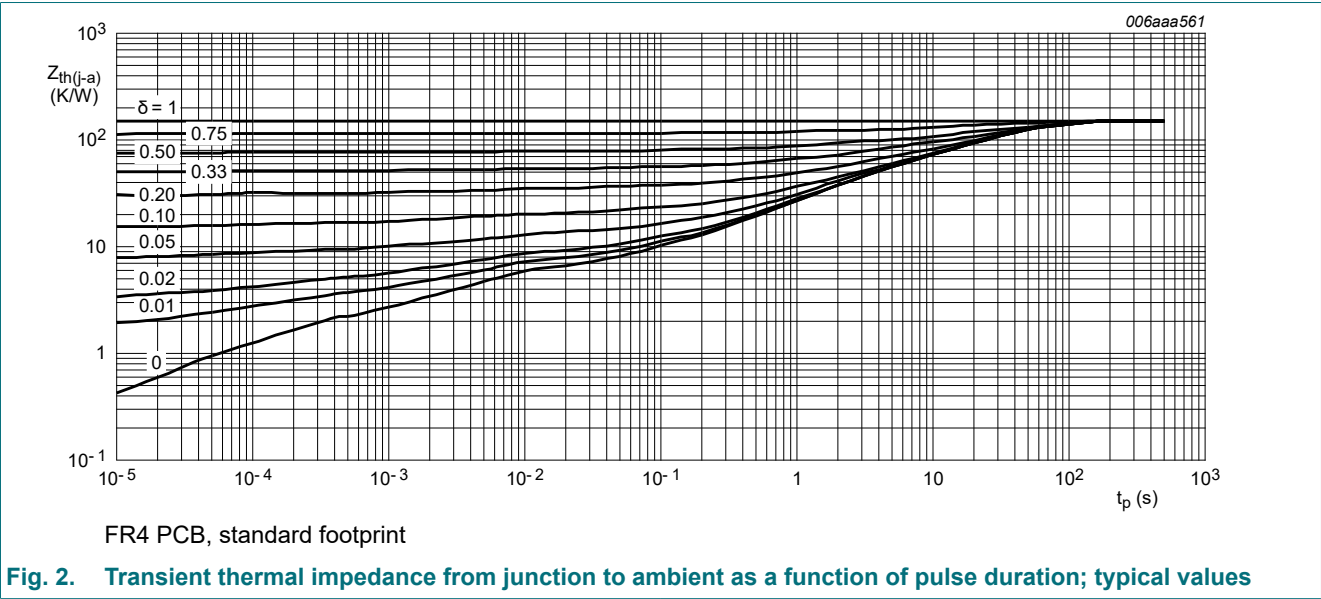


9. Thermal characteristics

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]	-	-	179	K/W
			[2]	-	-	74	K/W
			[3]	-	-	63	K/W
R _{th(j-sp)}	thermal resistance from junction to solder point			-	-	15	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 6 cm².
[3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.



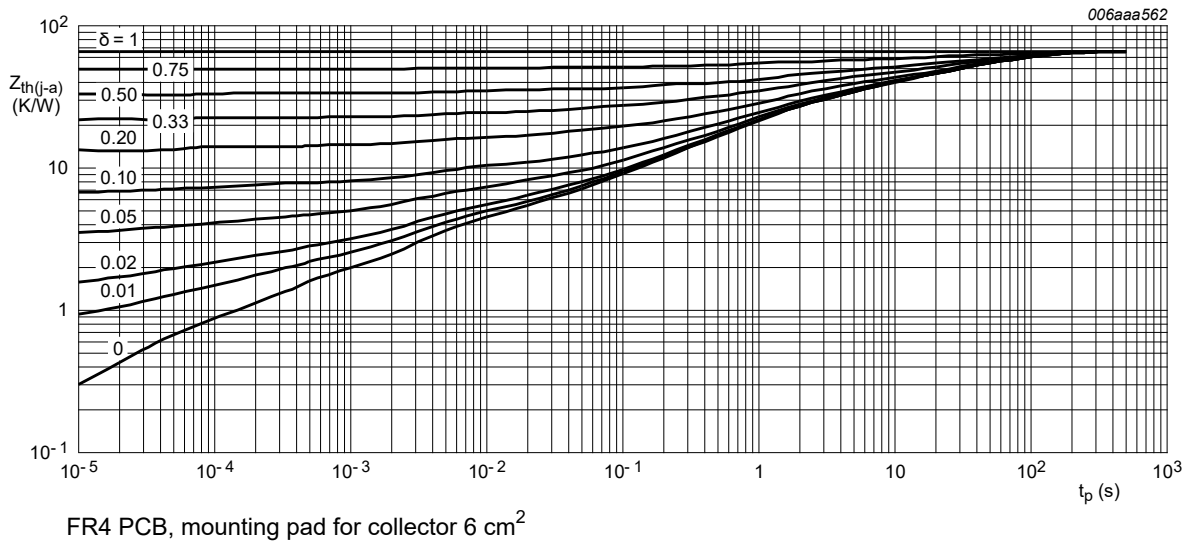


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

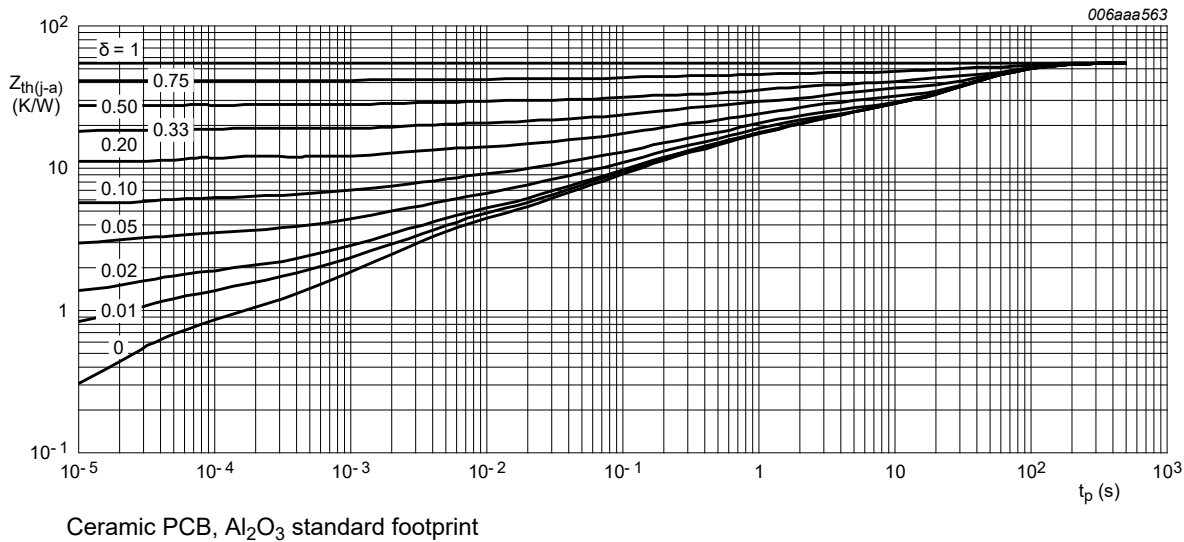


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I _{CBO}	collector-base cut-off current	V _{CB} = 20 V; I _E = 0 A; T _{amb} = 25 °C		-	-	100	nA
		V _{CB} = 20 V; I _E = 0 A; T _j = 150 °C		-	-	50	µA
I _{EBO}	emitter-base cut-off current	V _{EB} = 5 V; I _C = 0 A; T _{amb} = 25 °C		-	-	100	nA
h _{FE}	DC current gain	V _{CE} = 2 V; I _C = 0.5 A; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		300	570	-	
		V _{CE} = 2 V; I _C = 1 A; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		300	550	-	
		V _{CE} = 2 V; I _C = 2 A; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		250	520	-	
		V _{CE} = 2 V; I _C = 4 A; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		200	450	-	
		V _{CE} = 2 V; I _C = 7 A; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		200	350	-	
V _{CEsat}	collector-emitter saturation voltage	I _C = 0.5 A; I _B = 50 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	20	25	mV
		I _C = 1 A; I _B = 50 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	35	50	mV
		I _C = 1 A; I _B = 10 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	50	70	mV
		I _C = 2 A; I _B = 40 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	70	100	mV
		I _C = 4 A; I _B = 200 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	120	170	mV
		I _C = 4 A; I _B = 400 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	115	165	mV
		I _C = 4 A; I _B = 40 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	155	240	mV
		I _C = 5.8 A; I _B = 290 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	170	250	mV
R _{CEsat}	collector-emitter saturation resistance	I _C = 4 A; I _B = 200 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	30	43	mΩ
		I _C = 4 A; I _B = 40 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	38	60	mΩ
V _{BEsat}	base-emitter saturation voltage	I _C = 1 A; I _B = 100 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	0.82	0.9	V
		I _C = 4 A; I _B = 400 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	0.92	1.05	V
V _{BEon}	base-emitter turn-on voltage	V _{CE} = 2 V; I _C = 2 A; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	0.75	0.85	V
t _d	delay time	V _{CC} = 12.5 V; I _C = 3 A; I _{Bon} = 0.15 A; I _{Boff} = -0.15 A; T _{amb} = 25 °C		-	15	-	ns
t _r	rise time			-	40	-	ns
t _{on}	turn-on time			-	55	-	ns
t _s	storage time			-	270	-	ns
t _f	fall time			-	85	-	ns
t _{off}	turn-off time			-	335	-	ns

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
f_T	transition frequency	$V_{CE} = 10\text{ V}$; $I_C = 100\text{ mA}$; $f = 100\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	140	-	MHz
C_c	collector capacitance	$V_{CB} = 10\text{ V}$; $I_E = 0\text{ A}$; $i_e = 0\text{ A}$; $f = 1\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	95	150	pF

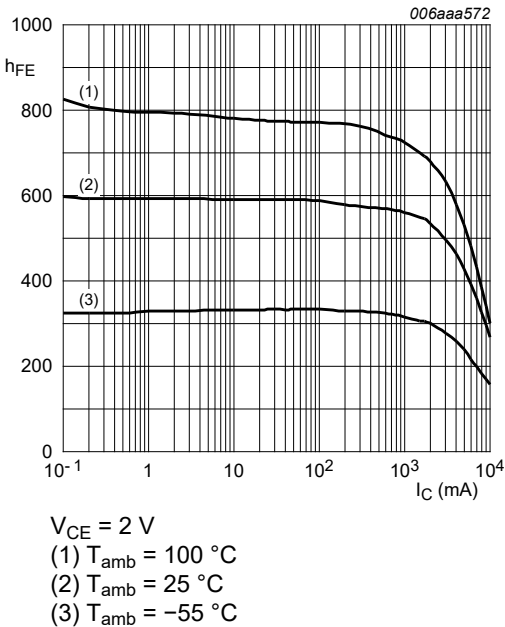


Fig. 5. DC current gain as a function of collector current; typical values

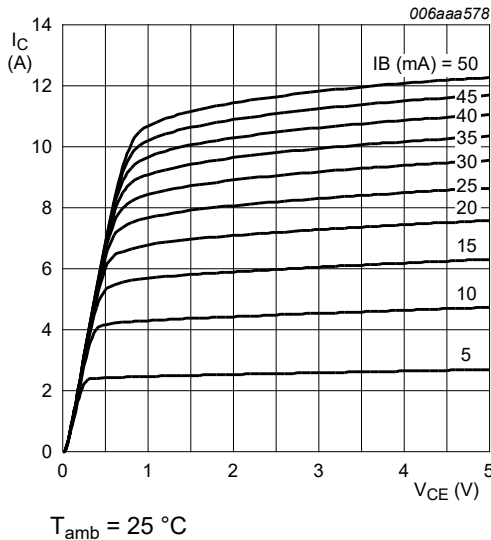


Fig. 6. Collector current as a function of collector-emitter voltage; typical values

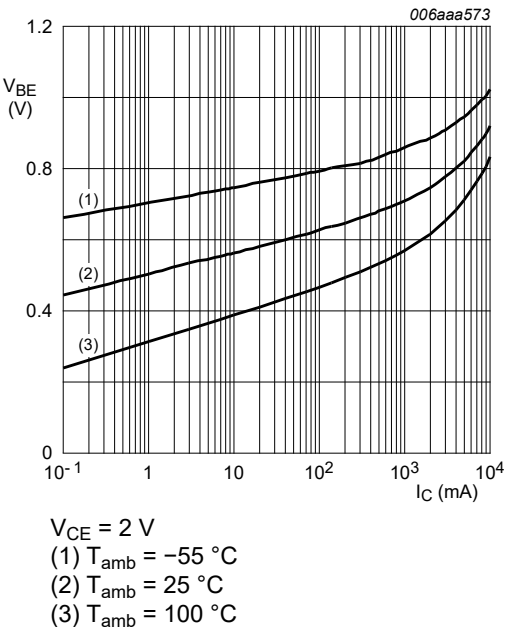


Fig. 7. Base-emitter voltage as a function of collector current; typical values

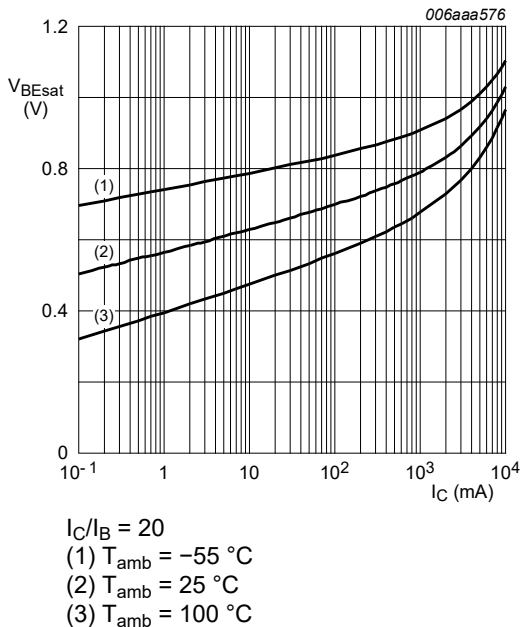


Fig. 8. Base-emitter saturation voltage as a function of collector current; typical values

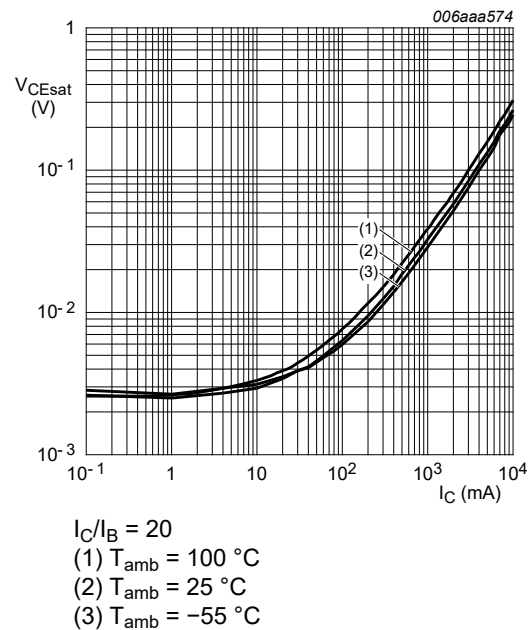


Fig. 9. Collector-emitter saturation voltage as a function of collector current; typical values

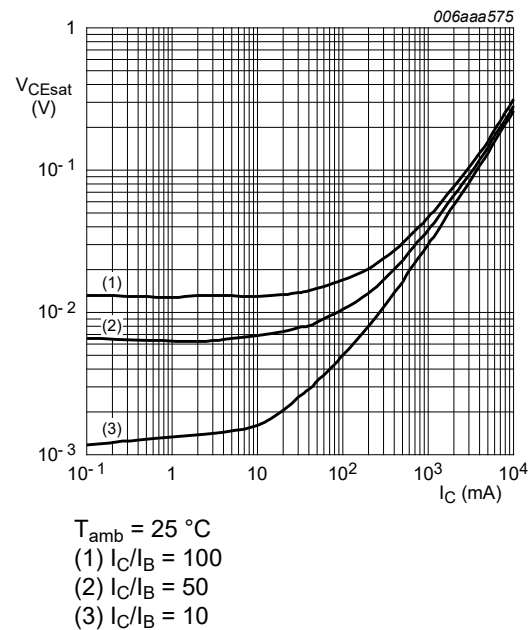


Fig. 10. Collector-emitter saturation voltage as a function of collector current; typical values

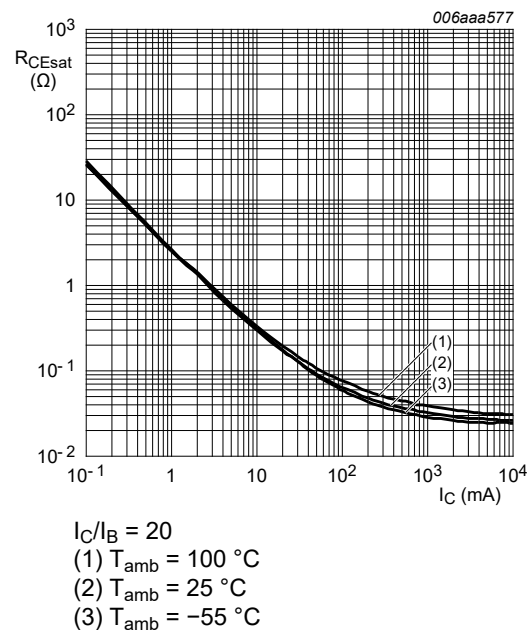


Fig. 11. Collector-emitter saturation resistance as a function of collector current; typical values

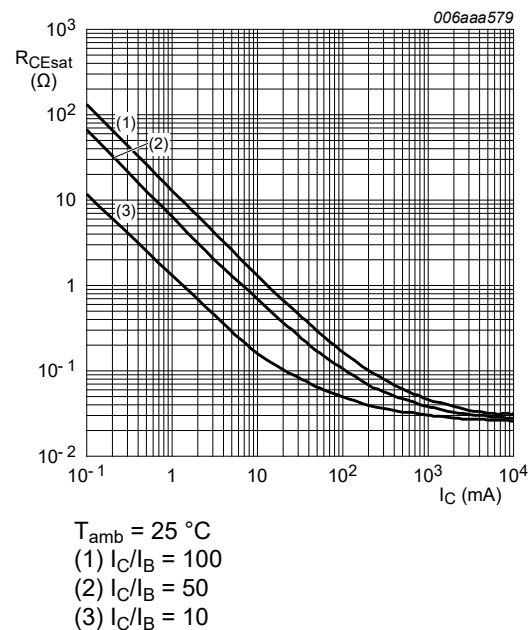


Fig. 12. Collector-emitter saturation resistance as a function of collector current; typical values

11. Test information

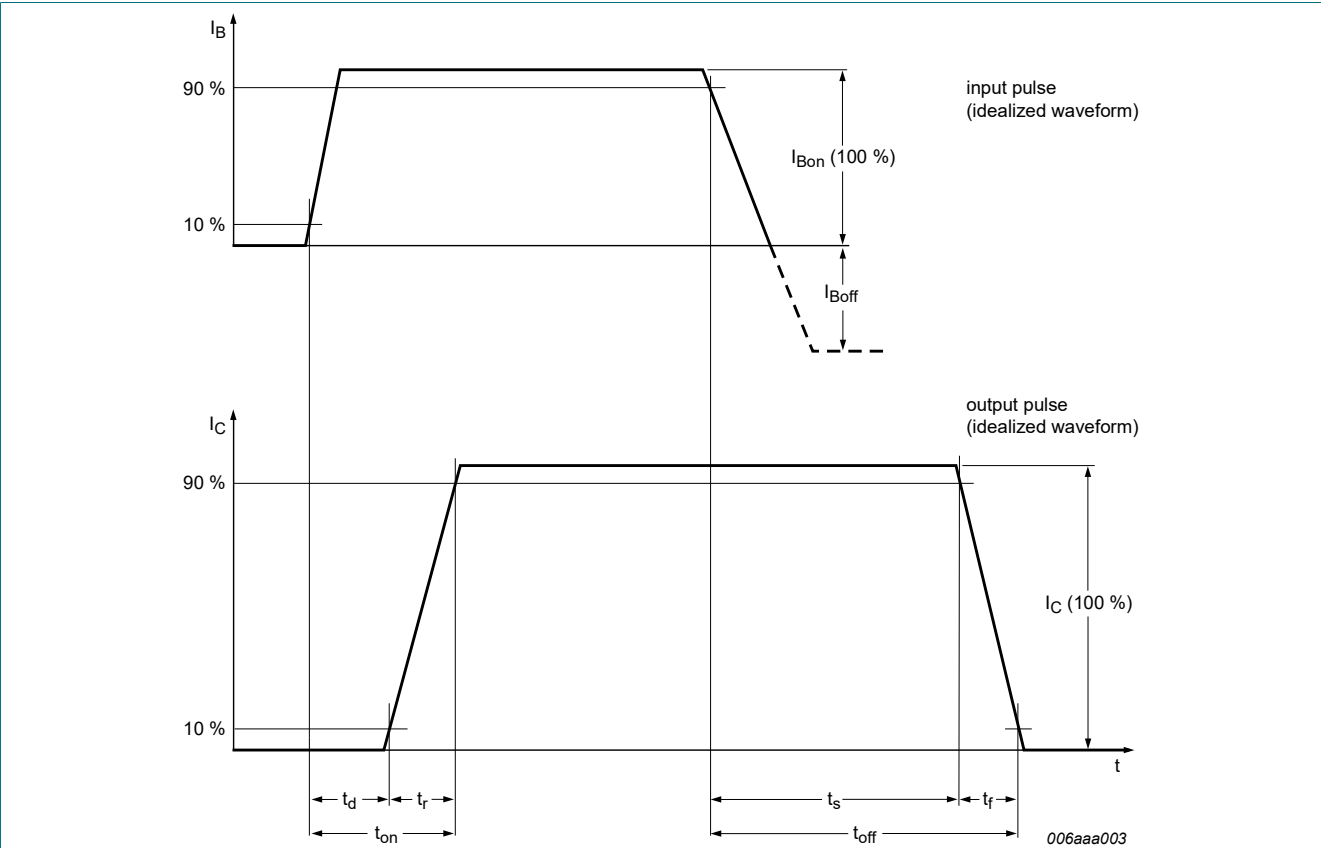


Fig. 13. Switching time definition

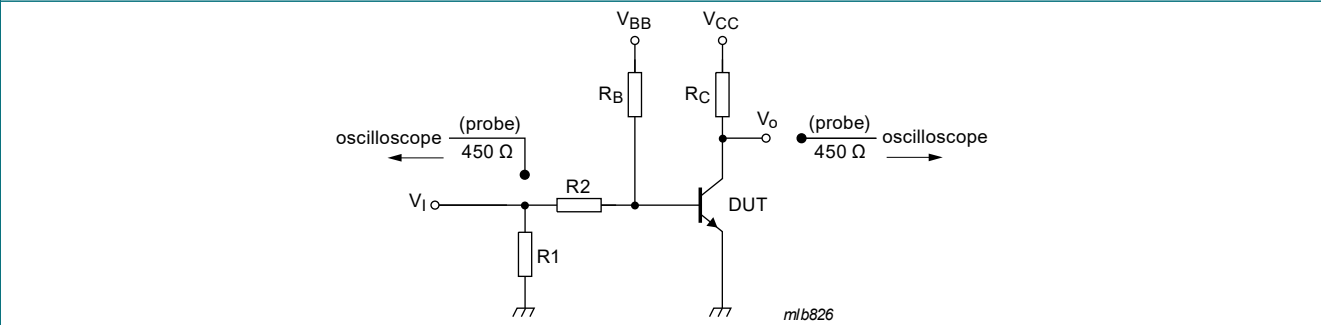
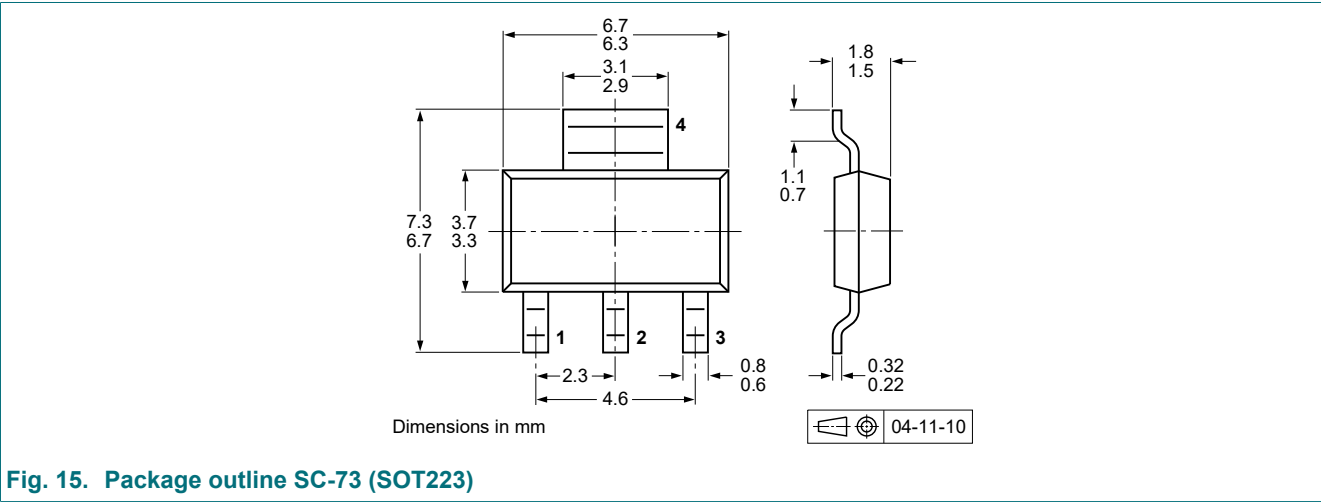
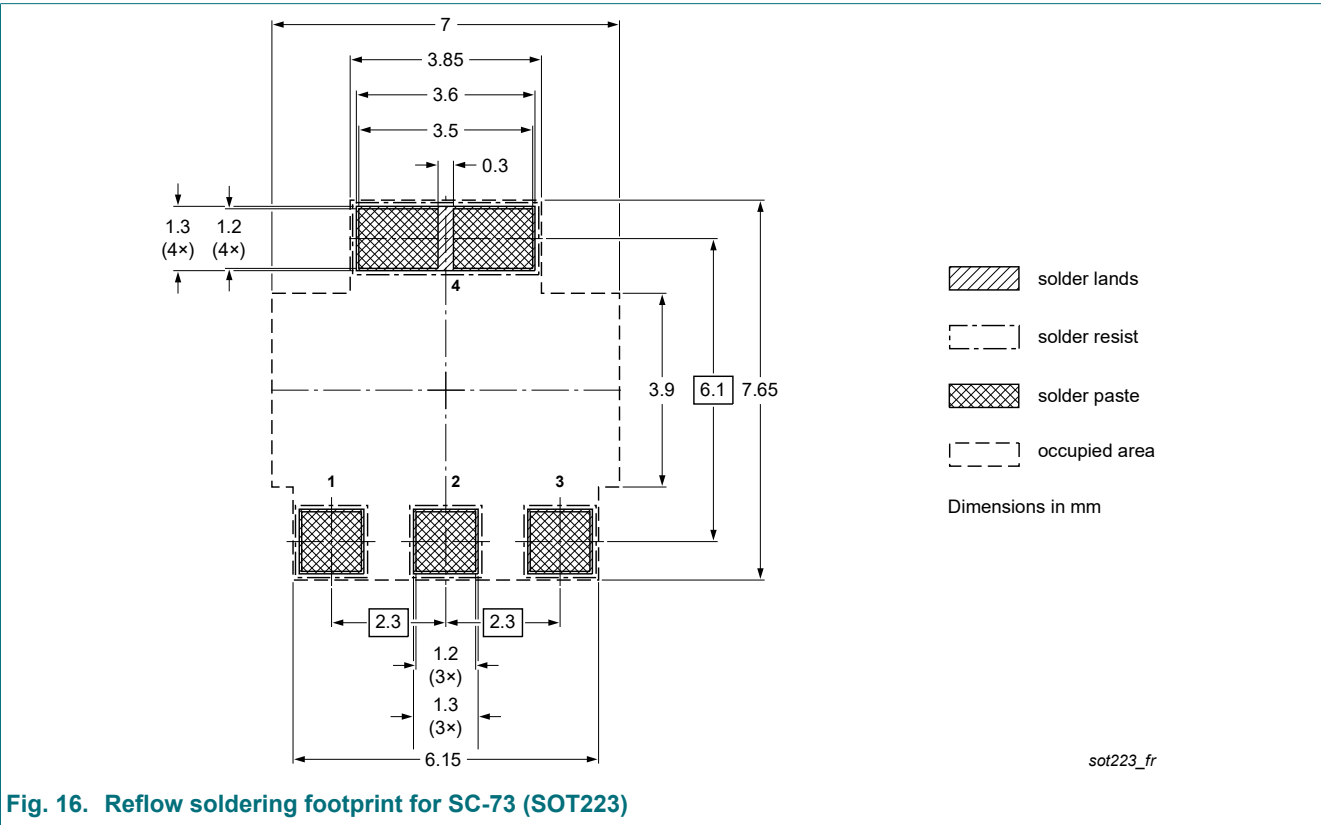


Fig. 14. Test circuit for switching times

12. Package outline



13. Soldering



14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS302NZ v.4	20241008	Product data sheet	-	PBSS302NZ v.3
Modifications:	<ul style="list-style-type: none">Product(s) changed to non-automotive qualification. Please refer to nexperia.com for automotive (-Q) product alternative(s).			
PBSS302NZ v.3	20230112	Product data sheet	-	PBSS302NZ_2
PBSS302NZ_2	20091120	Product data sheet	-	PBSS302NZ_1
PBSS302NZ_1	20060908	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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