

PBSS4021NZ-Q

20 V, 8 A NPN low V_{CEsat} transistor

5 January 2024

Product data sheet

1. General description

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

PNP complement: PBSS4021PZ-Q

2. Features and benefits

- Very 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 energy efficiency due to less heat generation
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

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

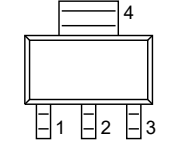
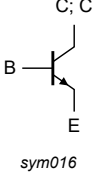
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CEO}	collector-emitter voltage	open base	-	-	20	V
I _C	collector current		-	-	8	A
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms	-	-	20	A
R _{CEsat}	collector-emitter saturation resistance	I _C = 6 A; I _B = 600 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C	-	14	20	mΩ

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 SC-73 (SOT223)	 sym016
2	C	collector		
3	E	emitter		
4	C	collector		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4021NZ-Q	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

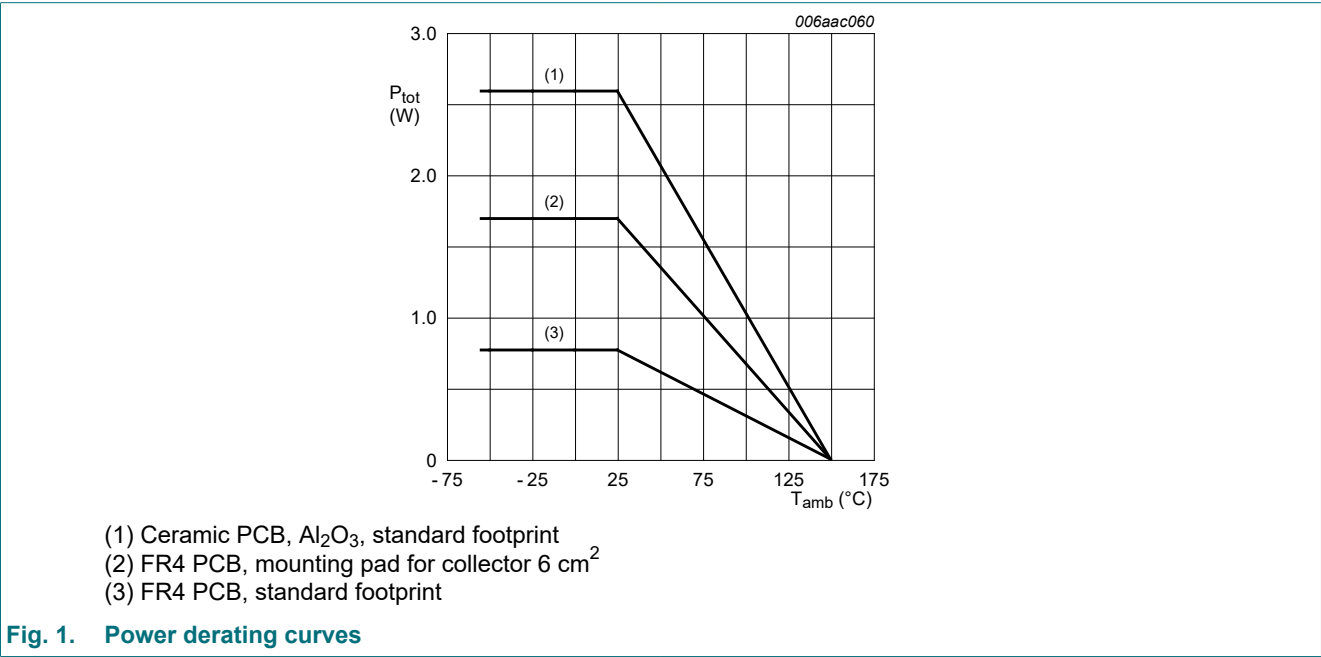
Type number	Marking code
PBSS4021NZ-Q	PB4021 NZ

8. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V _{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			-	8	A
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms		-	20	A
I _B	base current			-	1	A
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	770	mW
			[2]	-	1700	mW
			[3]	-	2600	mW
T _j	junction temperature			-	150	°C
T _{amb}	ambient temperature			-55	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]	-	-	160	K/W
			[2]	-	-	75	K/W
			[3]	-	-	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 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.

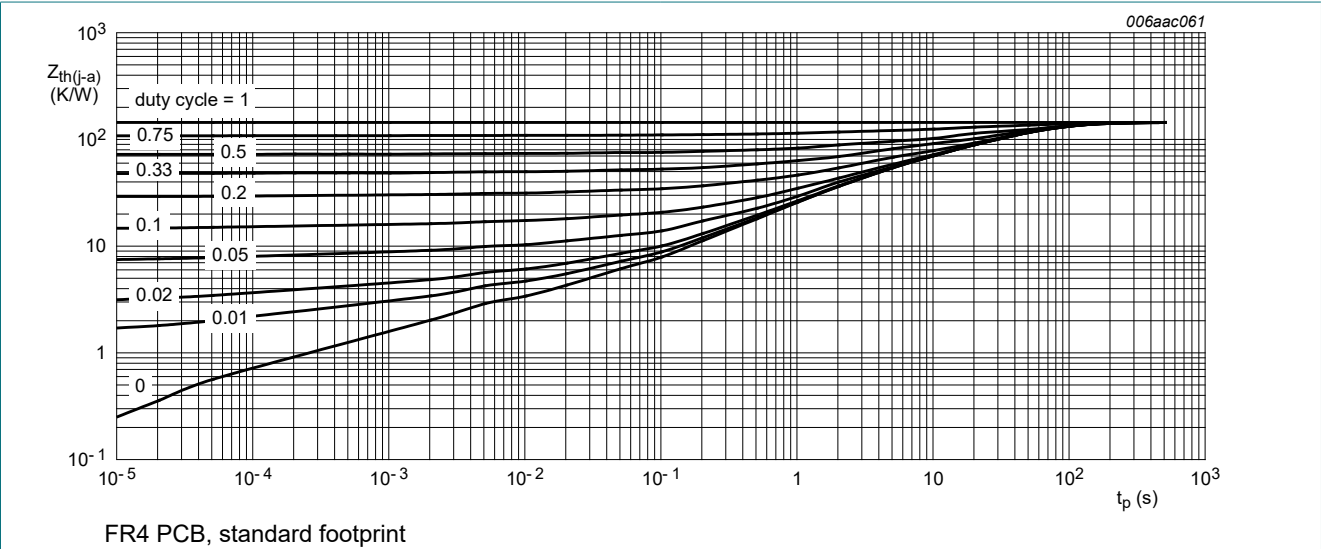


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

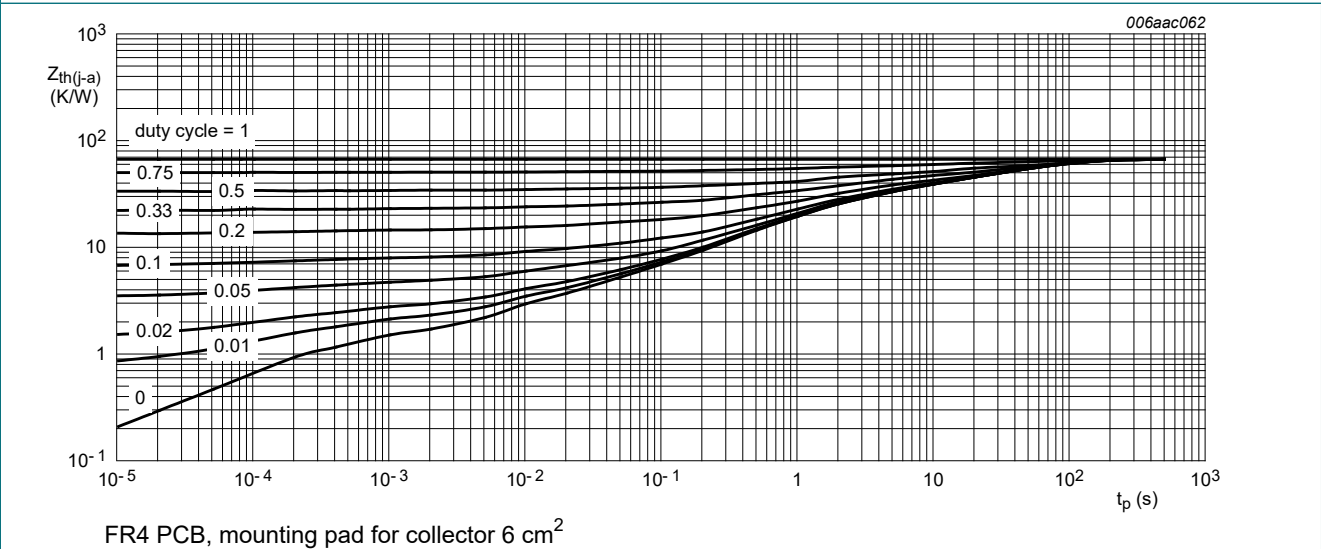
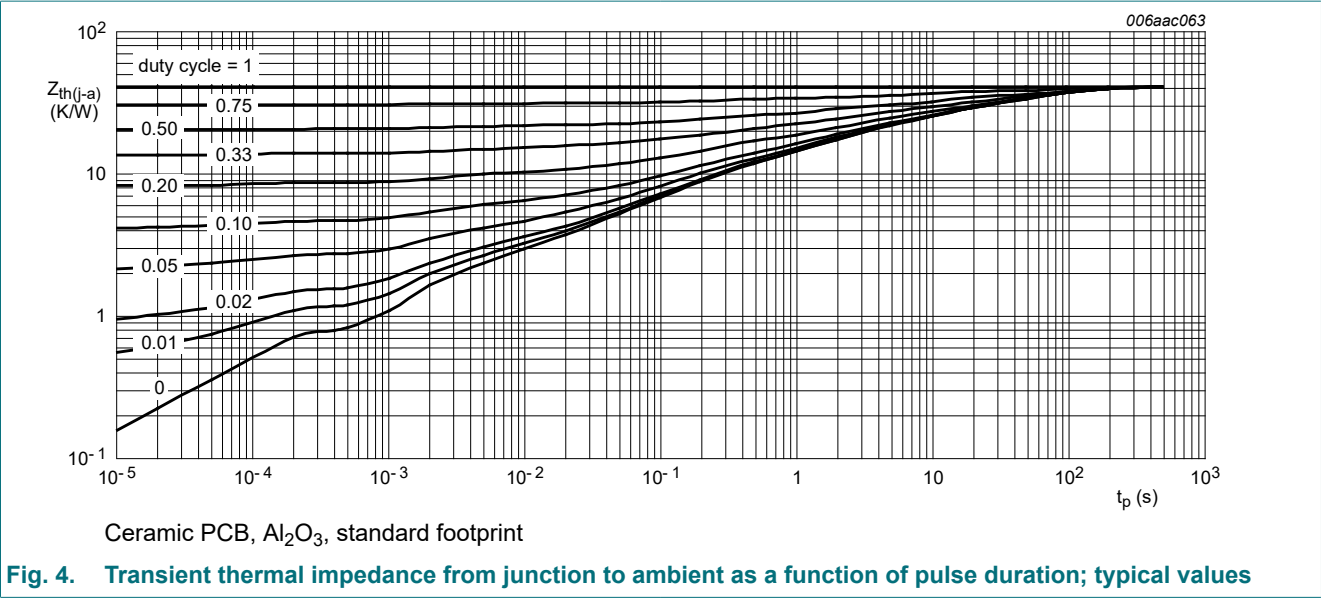


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



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
I _{CES}	collector-emitter cut-off current	V _{CE} = 16 V; V _{BE} = 0 V; T _{amb} = 25 °C		-	-	100	nA
h _{FE}	DC current gain	V _{CE} = 2 V; I _C = 500 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		300	550	-	
		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		300	500	-	
		V _{CE} = 2 V; I _C = 4 A; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		250	450	-	
		V _{CE} = 2 V; I _C = 8 A; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		250	400	-	
V _{CEsat}	collector-emitter saturation voltage	I _C = 1 A; I _B = 50 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	18	30	mV
		I _C = 1 A; I _B = 10 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	27	40	mV
		I _C = 2 A; I _B = 40 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	37	55	mV
		I _C = 4 A; I _B = 200 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	60	85	mV
		I _C = 4 A; I _B = 40 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	75	105	mV
		I _C = 8 A; I _B = 400 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	120	170	mV
R _{CEsat}	collector-emitter saturation resistance	I _C = 6 A; I _B = 600 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	14	20	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		-	0.84	0.9	V
		I _C = 4 A; I _B = 400 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	0.98	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		-	0.72	0.85	V
t _d	delay time	V _{CC} = 12.5 V; I _C = 1 A; I _{Bon} = 0.05 A; I _{Boff} = -0.05 A; T _{amb} = 25 °C		-	60	-	ns
t _r	rise time			-	40	-	ns
t _{on}	turn-on time			-	100	-	ns
t _s	storage time			-	780	-	ns
t _f	fall time			-	80	-	ns
t _{off}	turn-off time			-	860	-	ns
f _T	transition frequency	V _{CE} = 10 V; I _C = 100 mA; f = 100 MHz; T _{amb} = 25 °C		-	95	-	MHz
C _c	collector capacitance	V _{CB} = 10 V; I _E = 0 A; i _e = 0 A; f = 1 MHz; T _{amb} = 25 °C		-	110	-	pF

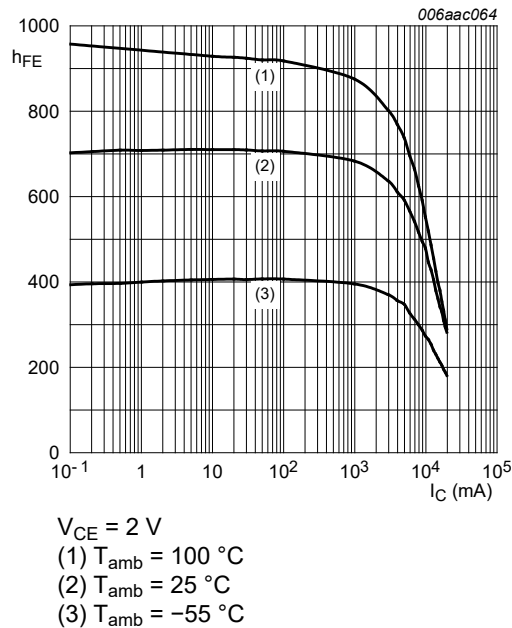


Fig. 5. DC current gain as a function of collector current; typical values

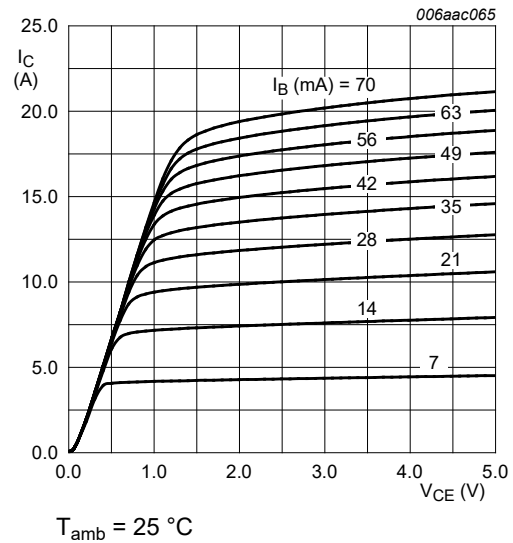


Fig. 6. Collector current as a function of collector-emitter voltage; typical values

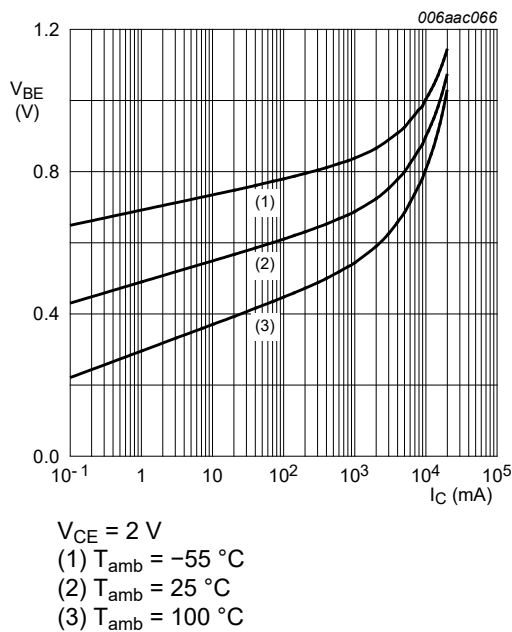


Fig. 7. Base-emitter voltage as a function of collector current; typical values

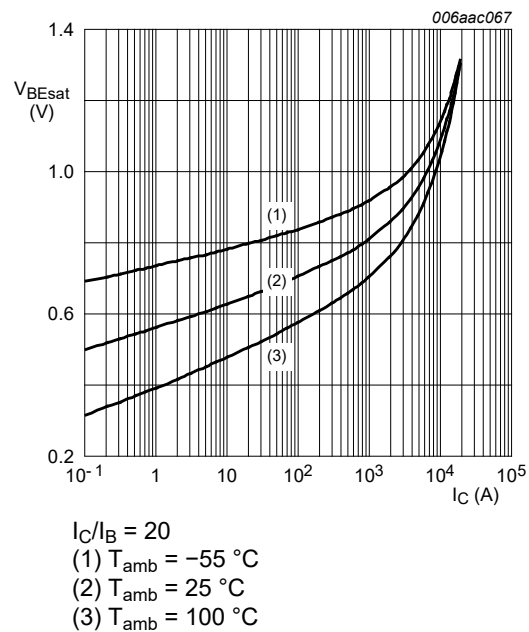


Fig. 8. Base-emitter saturation voltage as a function of collector current; typical values

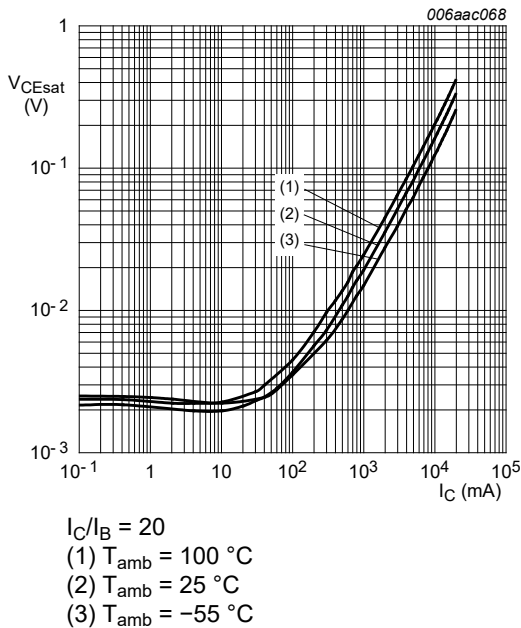


Fig. 9. Collector-emitter saturation voltage as a function of collector current; typical values

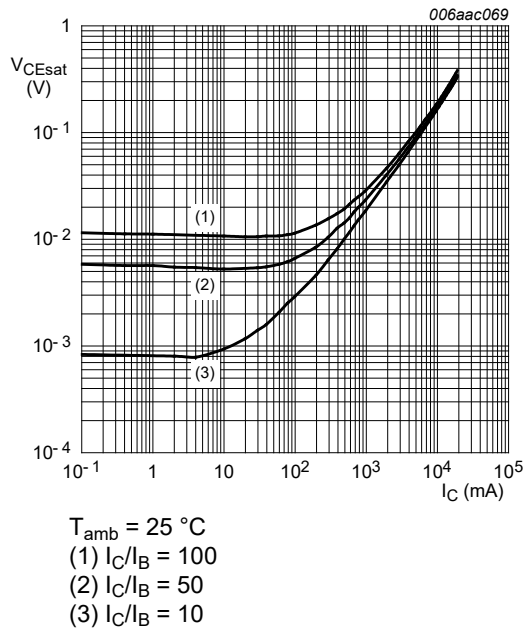


Fig. 10. Collector-emitter saturation voltage as a function of collector current; typical values

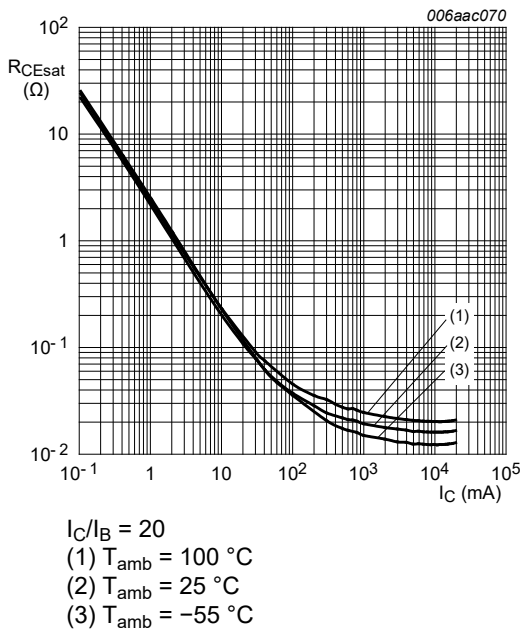


Fig. 11. Collector-emitter saturation resistance as a function of collector current; typical values

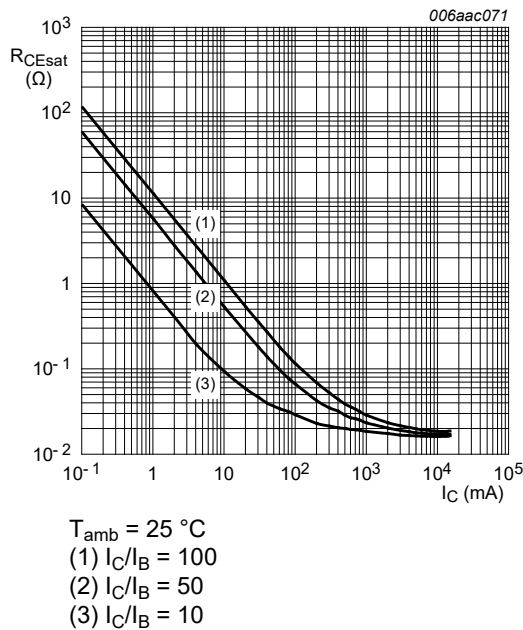


Fig. 12. Collector-emitter saturation resistance as a function of collector current; typical values

11. Test information

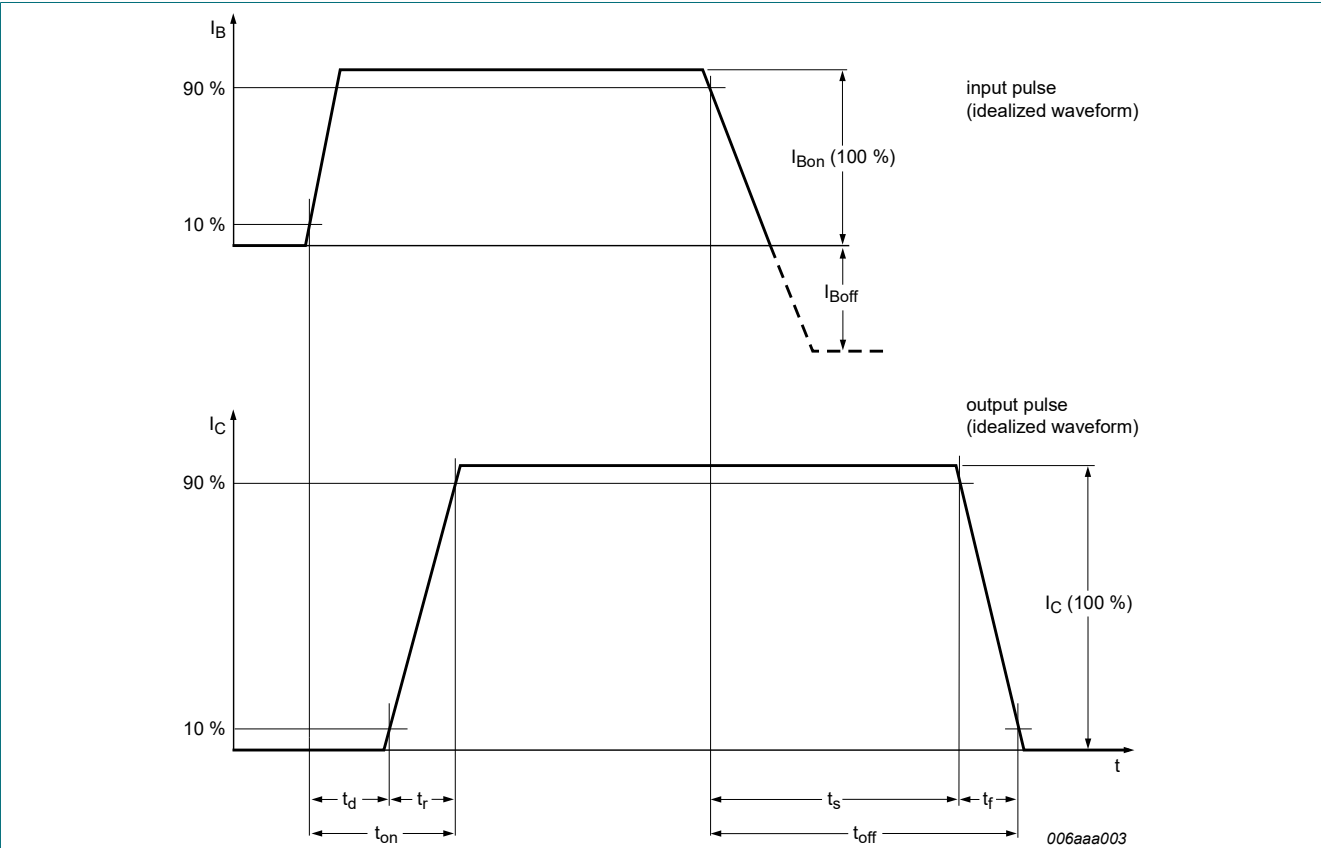


Fig. 13. Switching time definition

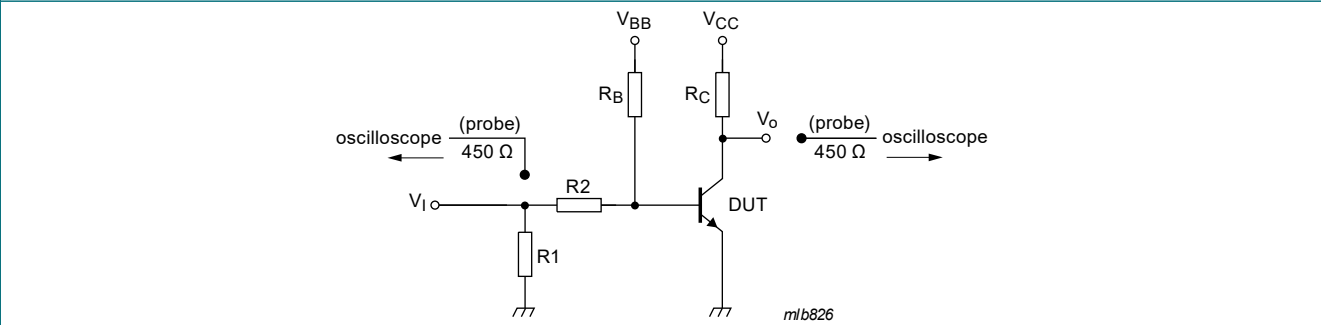
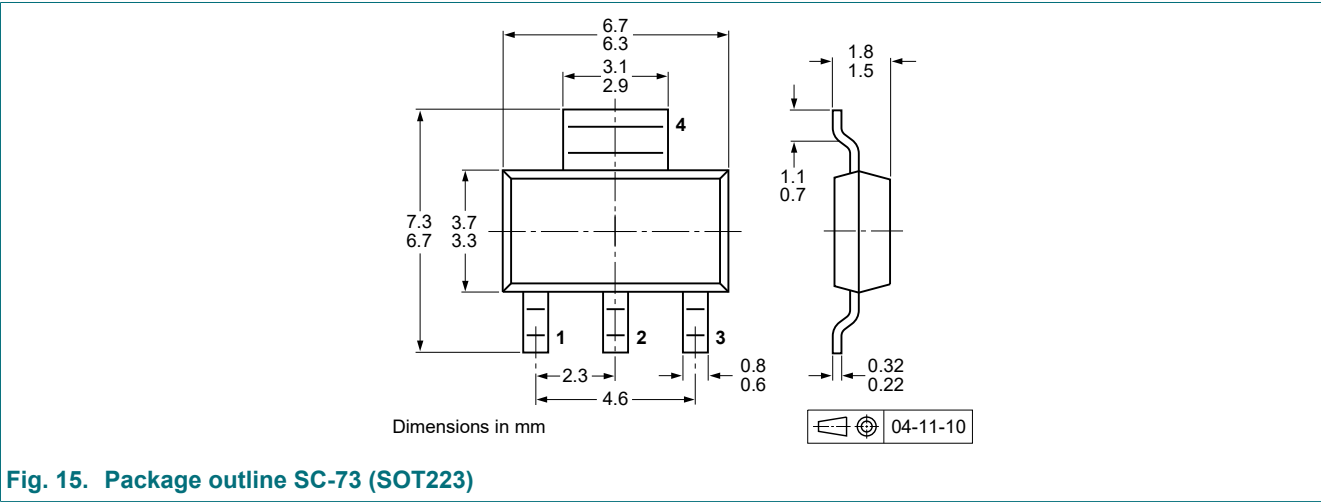


Fig. 14. Test circuit for switching times

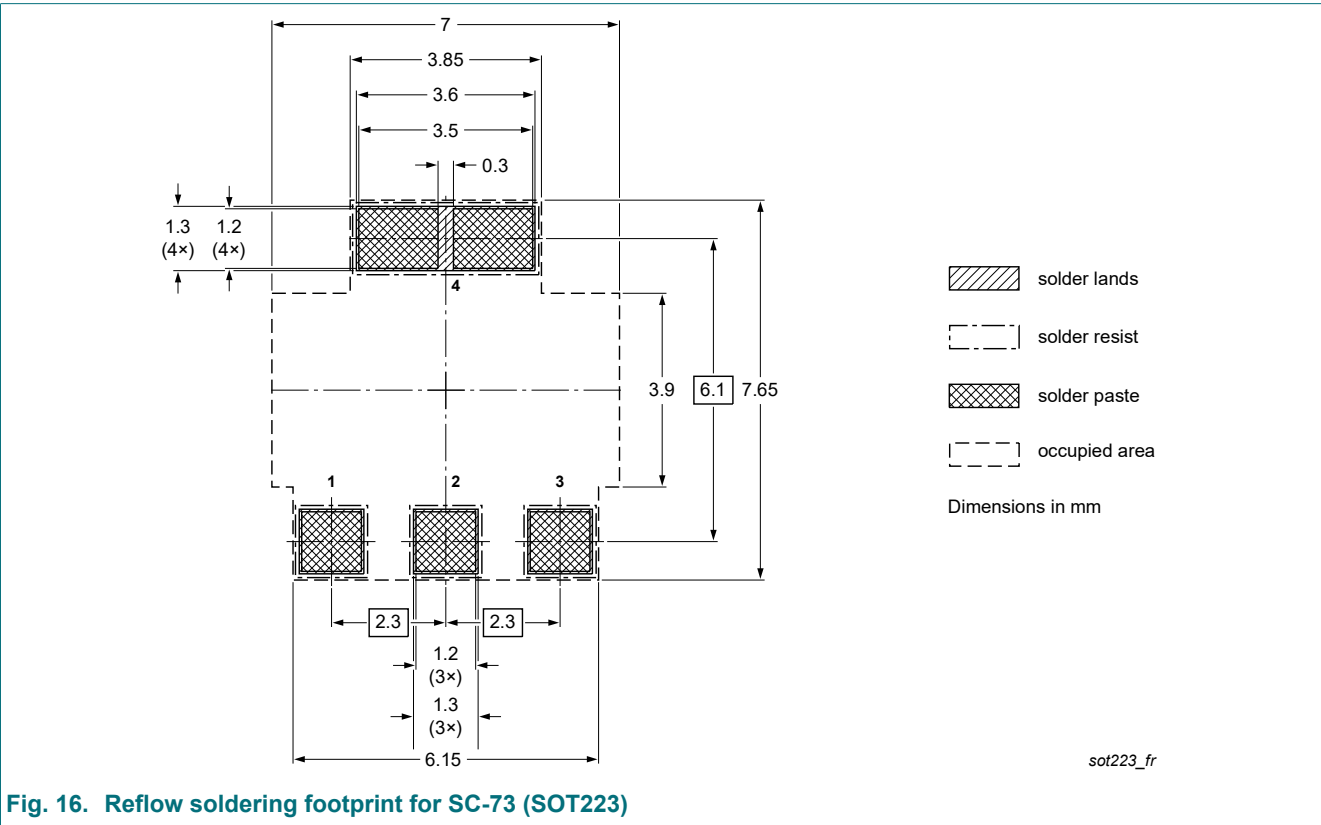
Quality information

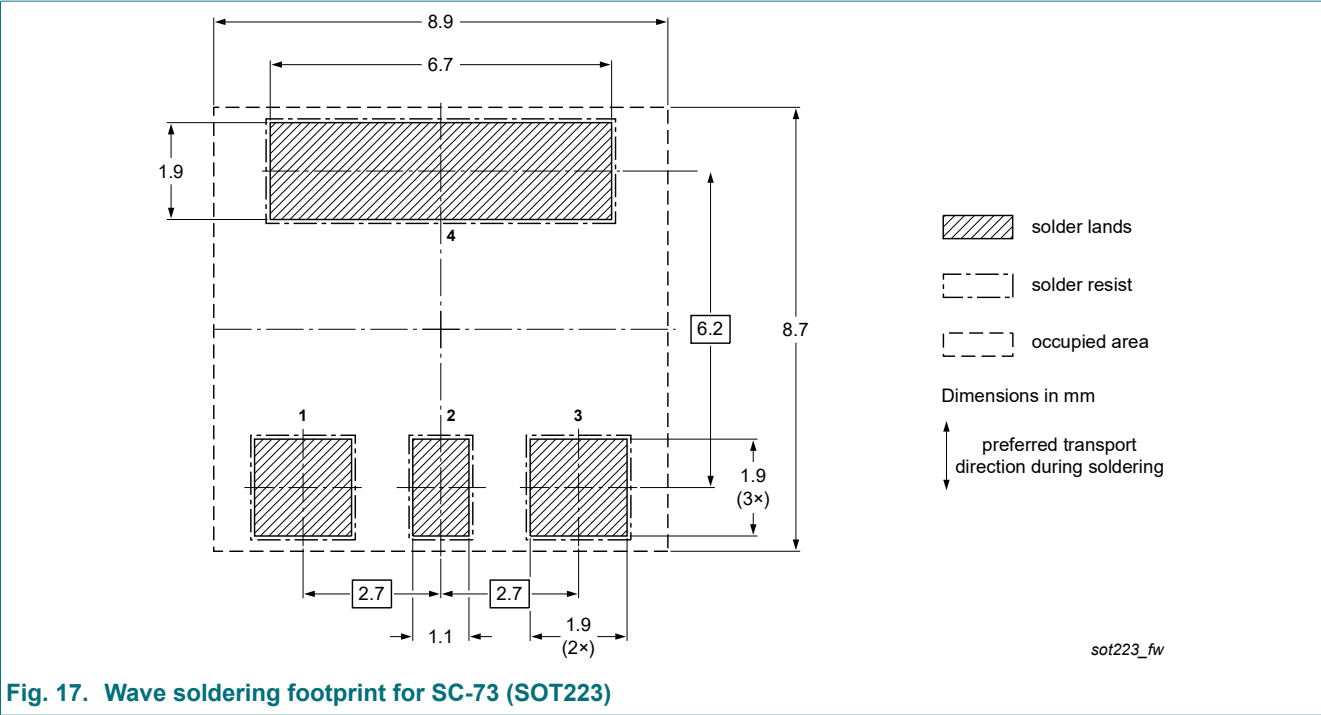
This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

12. Package outline



13. Soldering





14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4021NZ-Q v.1	20240105	Product data sheet	-	-

15. Legal information

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Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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- [2] The term 'short data sheet' is explained in section "Definitions".
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Contents

1. General description..... 1

2. Features and benefits..... 1

3. Applications..... 1

4. Quick reference data..... 1

5. Pinning information.....2

6. Ordering information.....2

7. Marking.....2

8. Limiting values..... 3

9. Thermal characteristics..... 4

10. Characteristics..... 6

11. Test information..... 9

12. Package outline..... 10

13. Soldering..... 10

14. Revision history.....12

15. Legal information.....13

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