



PBSS4021NT

20 V, 4.3 A NPN low V_{CEsat} transistor

20 September 2024

Product data sheet

1. General description

NPN low V_{CEsat} transistor in a SOT23 small Surface-Mounted Device (SMD) plastic package.

PNP complement: PBSS4021PT

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
- AEC-Q101 qualified

3. Applications

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

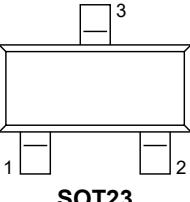
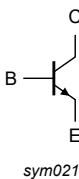
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CEO}	collector-emitter voltage	open base	-	-	20	V
I _C	collector current		-	-	4.3	A
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms	-	-	8	A
R _{CEsat}	collector-emitter saturation resistance	I _C = 4 A; I _B = 400 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C	-	32.5	50	mΩ

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 SOT23	 sym021
2	E	emitter		
3	C	collector		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4021NT	SOT23	plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body	SOT23

7. Marking

Table 4. Marking codes

Type number	Marking code ^[1]
PBSS4021NT	%BH

[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		-	20	V
V_{CEO}	collector-emitter voltage	open base		-	20	V
V_{EBO}	emitter-base voltage	open collector		-	5	V
I_C	collector current			-	4.3	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms		-	8	A
I_B	base current			-	1	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	0.39	W
			[2]	-	0.66	W
			[3]	-	0.7	W
			[4]	-	1	W
			[5]	-	1.1	W
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			-55	150	°C
T_{stg}	storage temperature			-65	150	°C

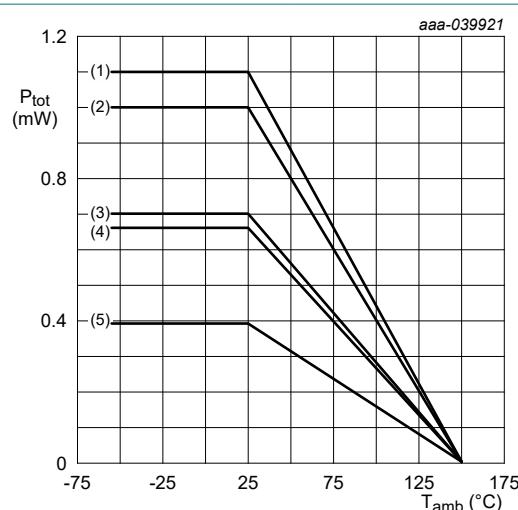
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided, 35 µm copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided, 35 µm copper, tin-plated, mounting pad for collector 1 cm².

[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 cm².

[5] Device mounted on a ceramic PCB, Al₂O₃, single-sided, 35 µm copper, tin-plated and standard footprint.



(1) Ceramic PCB, Al₂O₃, single-sided, 35 µm copper, standard footprint

(2) FR4 PCB, 4-layer copper, 1 cm²

(3) FR4 PCB, 4-layer copper, standard footprint

(4) FR4 PCB, single-sided, 35 µm copper, 1 cm²

(5) FR4 PCB, single-sided, 35 µm copper, standard footprint

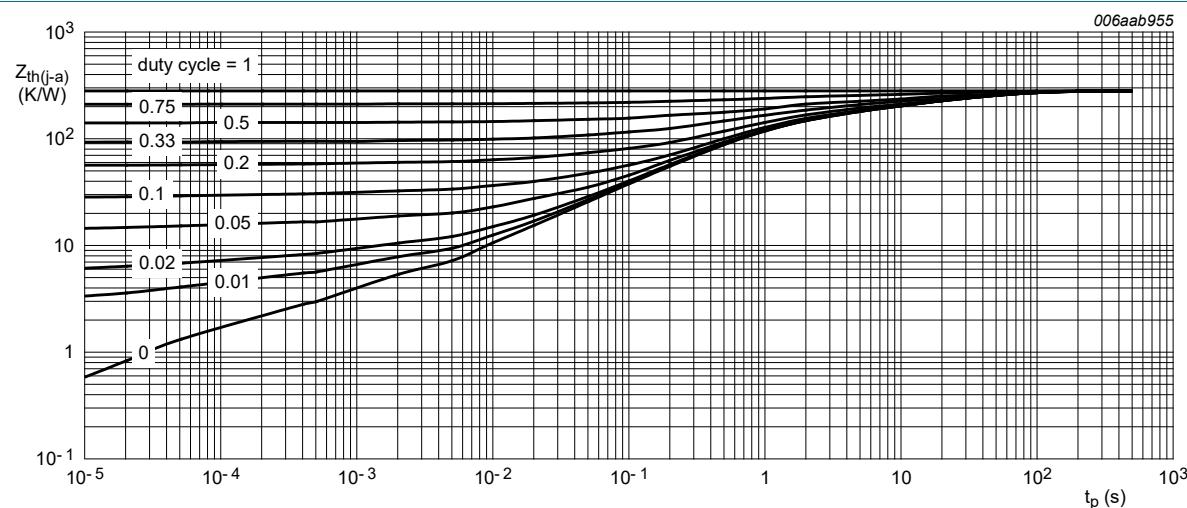
Fig. 1. Power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

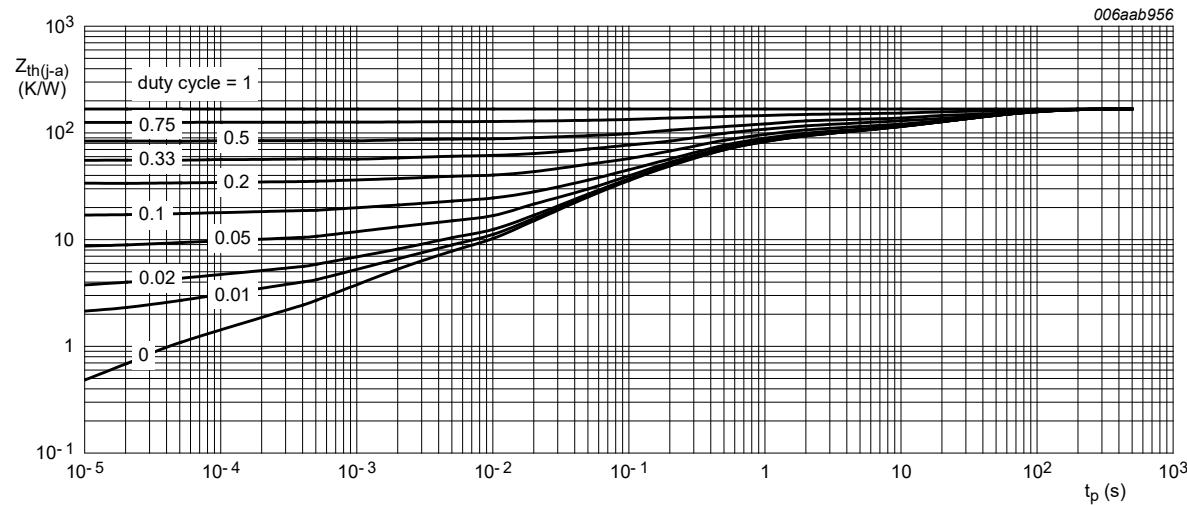
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	320	K/W
			[2]	-	-	190	K/W
			[3]	-	-	180	K/W
			[4]	-	-	125	K/W
			[5]	-	-	115	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	62	K/W

- [1] Device mounted on an FR4 PCB, single-sided, 35 μ m copper, tin-plated and standard footprint
- [2] Device mounted on an FR4 PCB, single-sided, 35 μ m copper, tin-plated, mounting pad for collector 1 cm^2
- [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^2
- [5] Device mounted on a ceramic PCB, Al_2O_3 , single-sided, 35 μ m copper, tin-plated and standard footprint



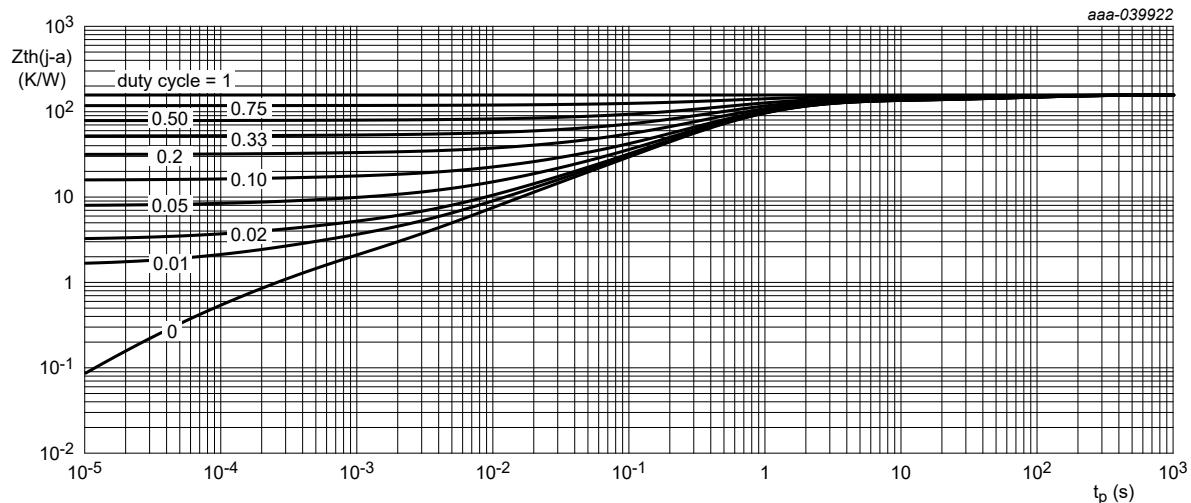
FR4 PCB, single-sided, 35 μ m copper, tin-plated and standard footprint

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



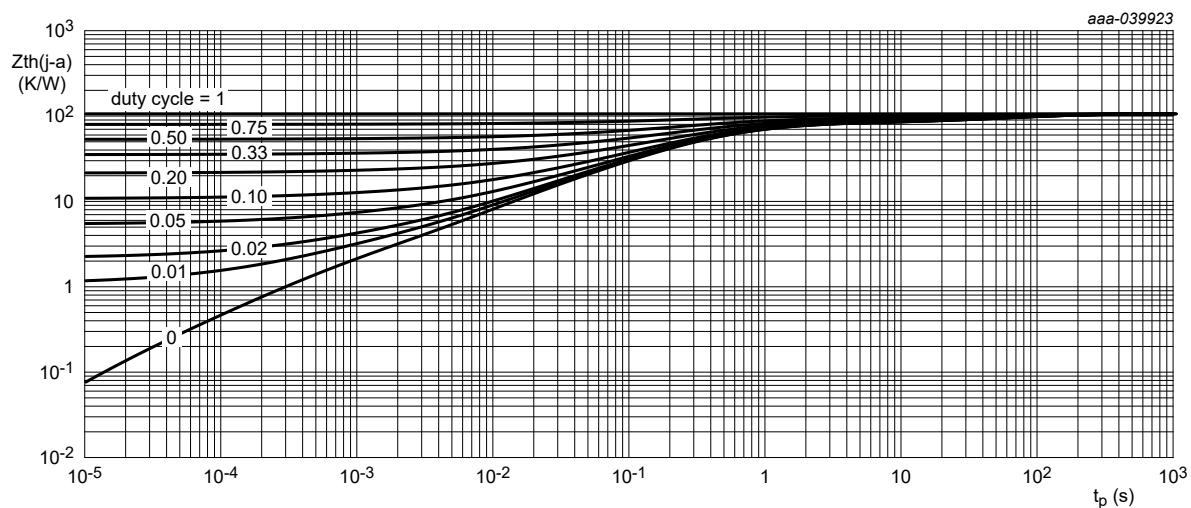
FR4 PCB, single-sided, 35 μ m copper, tin-plated, mounting pad for collector 1 cm^2

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



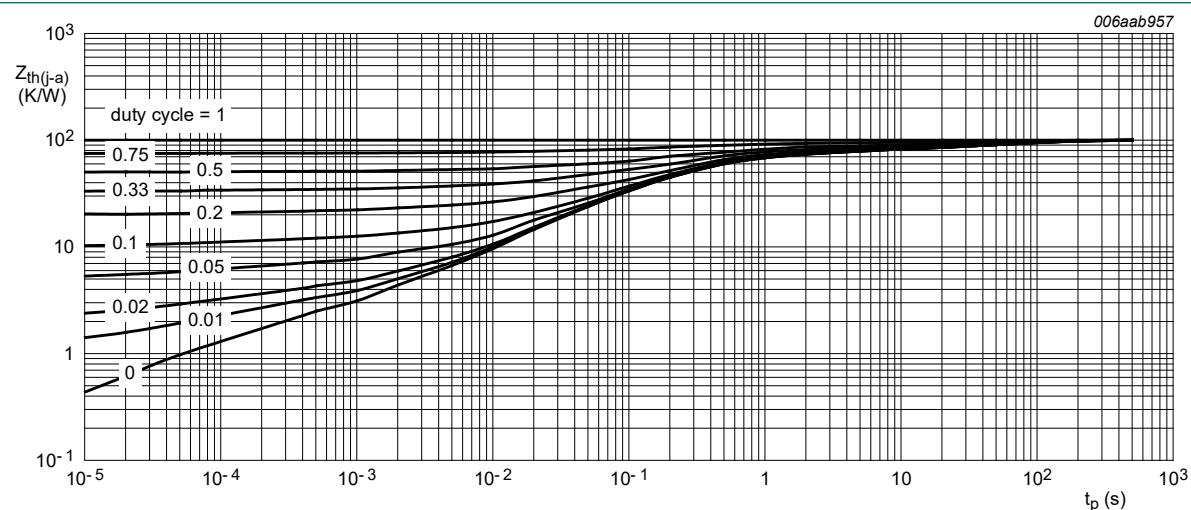
FR4 PCB, 4-layer, tin-plated and standard footprint

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 cm²

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



Ceramic PCB, Al₂O₃, single-sided, 35 μm copper, tin-plated and standard footprint

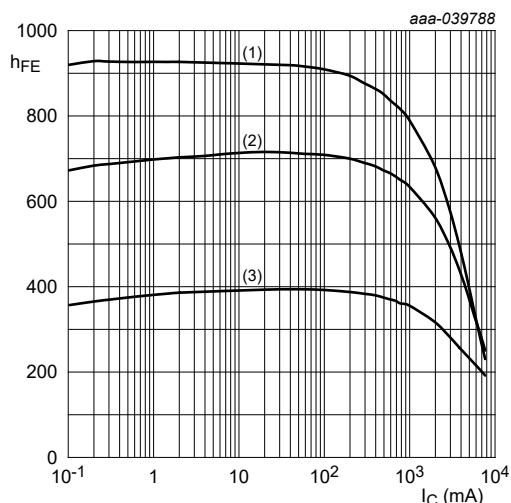
Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

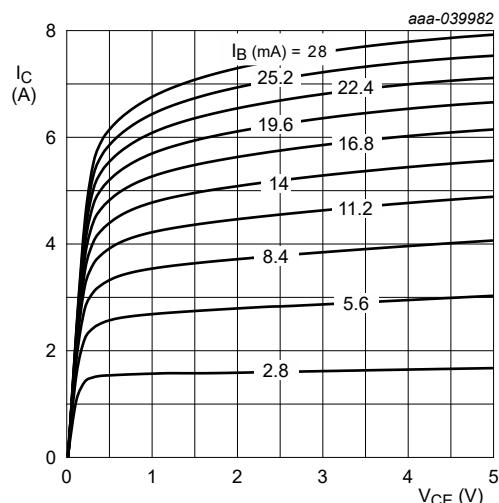
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100 \mu A; I_E = 0 A; T_{amb} = 25^\circ C$	20	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 10 mA; I_B = 0 A; T_{amb} = 25^\circ C$	20	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_E = 100 \mu A; I_C = 0 A; T_{amb} = 25^\circ C$	5	-	-	V
I_{CBO}	collector-base cut-off current	$V_{CB} = 20 V; I_E = 0 A; T_{amb} = 25^\circ C$	-	-	100	nA
		$V_{CB} = 20 V; I_E = 0 A; T_j = 150^\circ C$	-	-	50	μA
I_{CES}	collector-emitter cut-off current	$V_{CE} = 16 V; V_{BE} = 0 V; T_{amb} = 25^\circ C$	-	-	100	nA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5 V; I_C = 0 A; T_{amb} = 25^\circ C$	-	-	100	nA
h_{FE}	DC current gain	$V_{CE} = 2 V; I_C = 500 mA; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	300	600	-	
		$V_{CE} = 2 V; I_C = 1 A; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	300	550	-	
		$V_{CE} = 2 V; I_C = 2 A; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	300	500	-	
		$V_{CE} = 2 V; I_C = 4 A; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	150	400	-	
		$V_{CE} = 2 V; I_C = 6 A; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	100	300	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 1 A; I_B = 10 mA; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	-	55	75	mV
		$I_C = 1 A; I_B = 50 mA; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	-	40	60	mV
		$I_C = 2 A; I_B = 40 mA; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	-	80	120	mV
		$I_C = 4 A; I_B = 40 mA; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	-	160	265	mV
		$I_C = 4 A; I_B = 200 mA; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	-	135	220	mV
		$I_C = 4 A; I_B = 400 mA; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	-	130	200	mV
R_{CEsat}	collector-emitter saturation resistance		-	32.5	50	mΩ
V_{BEsat}	base-emitter saturation voltage	$I_C = 1 A; I_B = 100 mA; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	-	0.87	1.05	V
		$I_C = 4 A; I_B = 400 mA; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	-	1.08	1.25	V
V_{BE}	base-emitter voltage	$V_{CE} = 2 V; I_C = 2 A; \text{pulsed}; t_p \leq 300 \mu s; \delta \leq 0.02; T_{amb} = 25^\circ C$	-	0.76	0.9	V

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_d	delay time	$V_{CC} = 12.5 \text{ V}$; $I_C = 1 \text{ A}$; $I_{B\text{on}} = 50 \text{ mA}$; $I_{B\text{off}} = -50 \text{ mA}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	20	-	ns
t_r	rise time		-	30	-	ns
t_{on}	turn-on time		-	50	-	ns
t_s	storage time		-	355	-	ns
t_f	fall time		-	70	-	ns
t_{off}	turn-off time		-	425	-	ns
f_T	transition frequency	$V_{CE} = 10 \text{ V}$; $I_C = 100 \text{ mA}$; $f = 100 \text{ MHz}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	150	-	MHz
C_c	collector capacitance	$V_{CB} = 10 \text{ V}$; $I_E = 0 \text{ A}$; $i_e = 0 \text{ A}$; $f = 1 \text{ MHz}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	36	-	pF



$V_{CE} = 2 \text{ V}$
(1) $T_{\text{amb}} = 100 \text{ }^\circ\text{C}$
(2) $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$
(3) $T_{\text{amb}} = -55 \text{ }^\circ\text{C}$

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



$T_{\text{amb}} = 25 \text{ }^\circ\text{C}$
Fig. 8. Collector current as a function of collector-emitter voltage; typical values

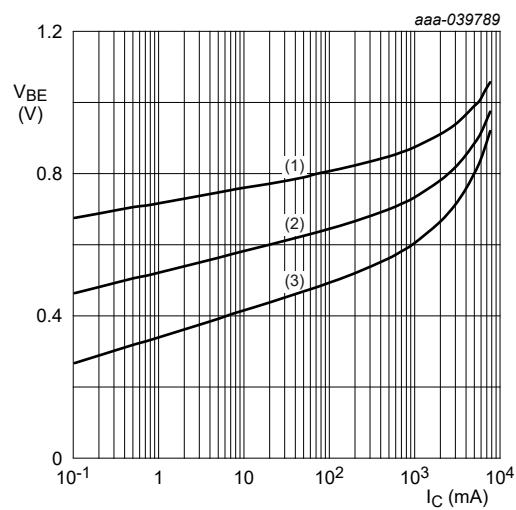


Fig. 9. Base-emitter voltage as a function of collector current; typical values

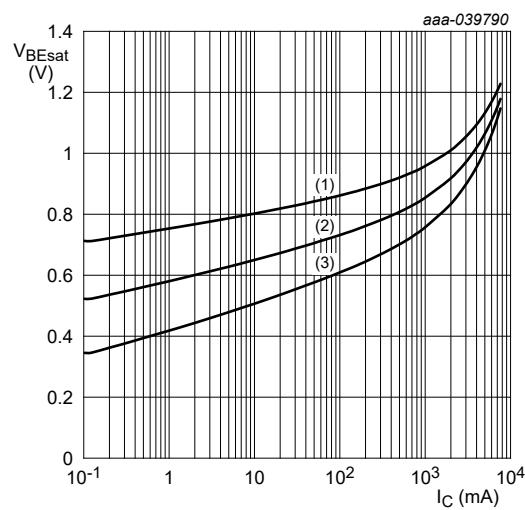


Fig. 10. Base-emitter saturation voltage as a function of collector current; typical values

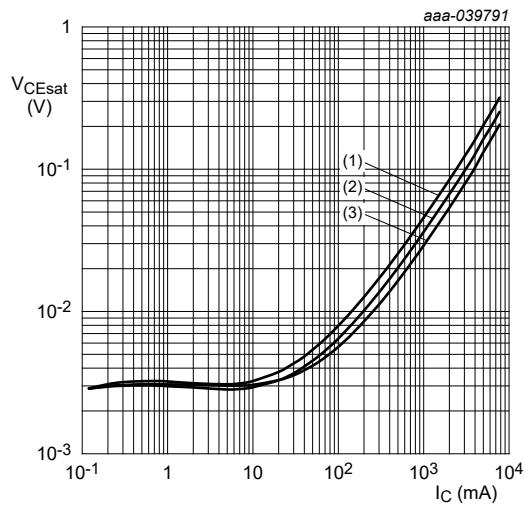


Fig. 11. Collector-emitter saturation voltage as a function of collector current; typical values

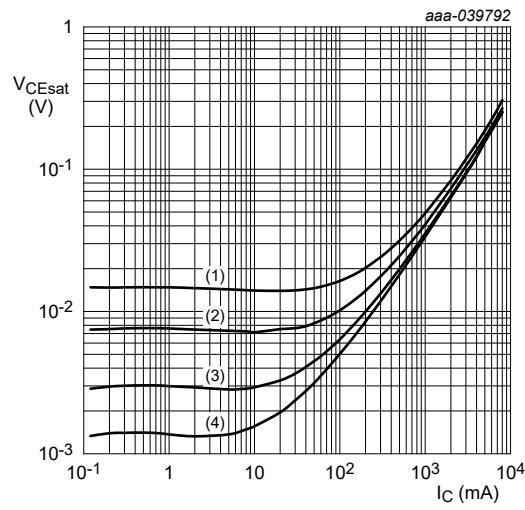
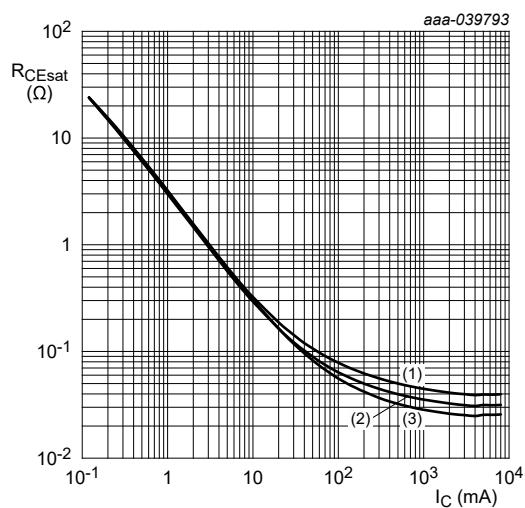
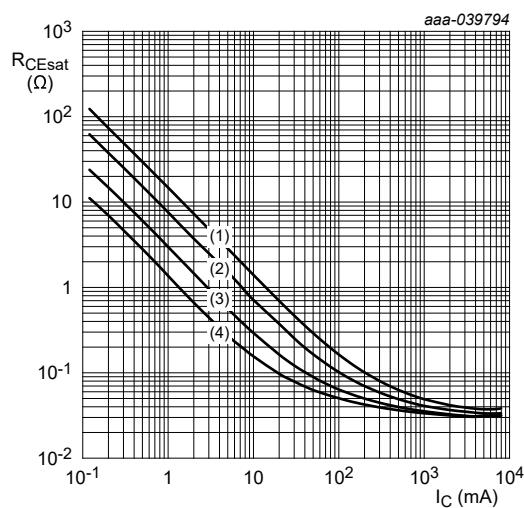


Fig. 12. Collector-emitter saturation voltage as a function of collector current; typical values



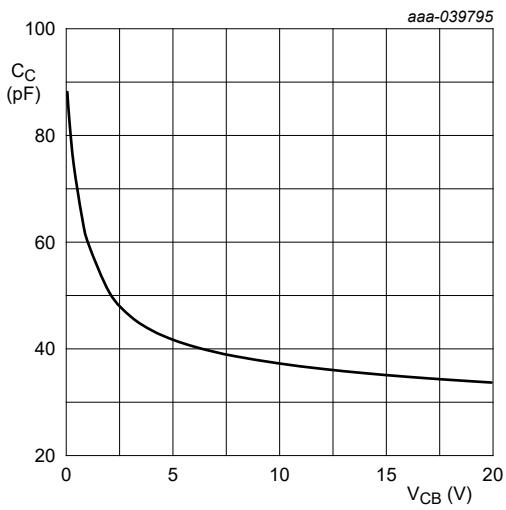
$I_C/I_B = 20$
 (1) $T_{amb} = 100 \text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25 \text{ }^{\circ}\text{C}$
 (3) $T_{amb} = -55 \text{ }^{\circ}\text{C}$

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



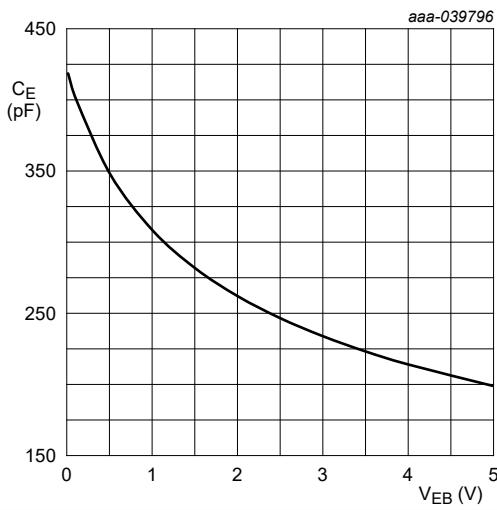
$T_{amb} = 25 \text{ }^{\circ}\text{C}$
 (1) $I_C/I_B = 100$
 (2) $I_C/I_B = 50$
 (3) $I_C/I_B = 20$
 (4) $I_C/I_B = 10$

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



$f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^{\circ}\text{C}$

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



$f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^{\circ}\text{C}$

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

11. Test information

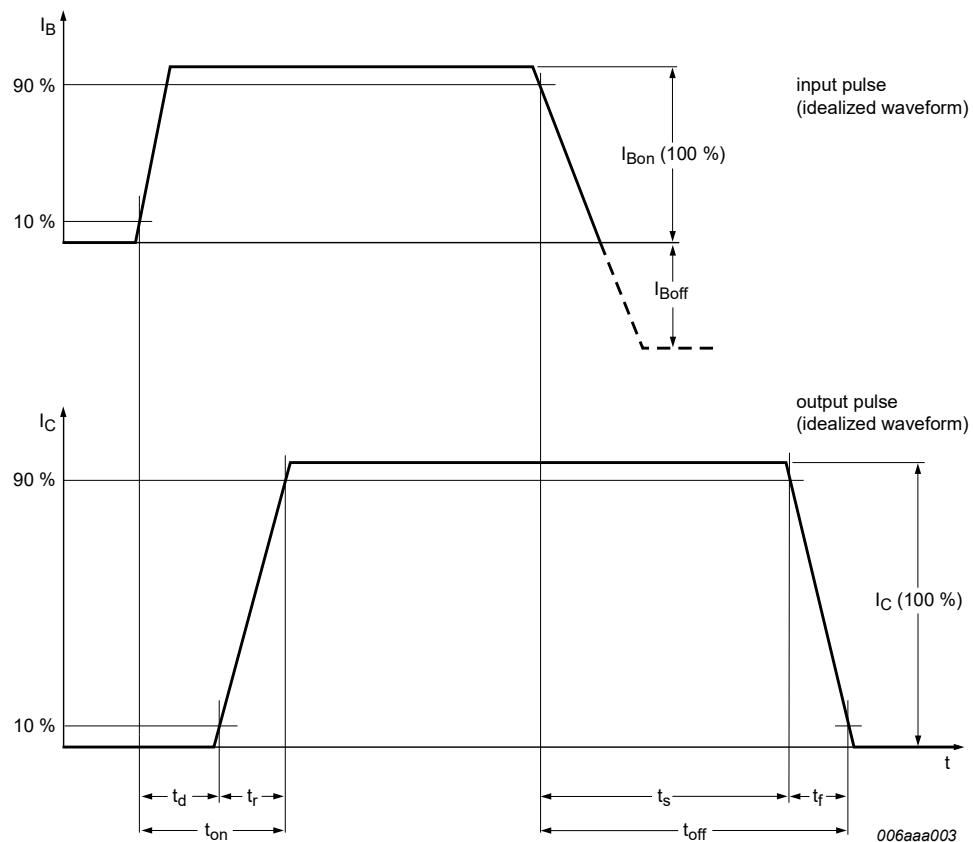


Fig. 17. Switching time definition

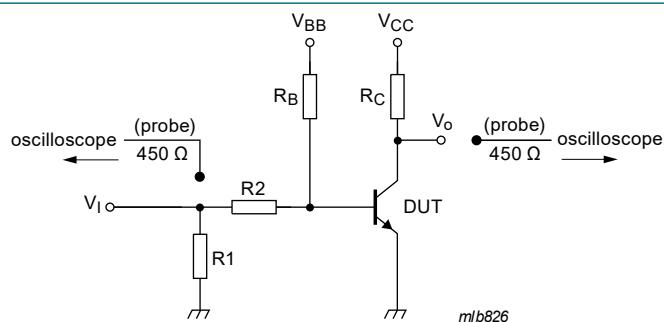


Fig. 18. Test circuit for switching times

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

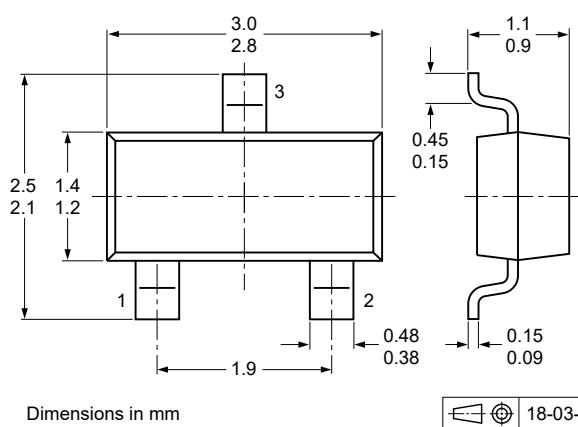


Fig. 19. Package outline SOT23

13. Soldering

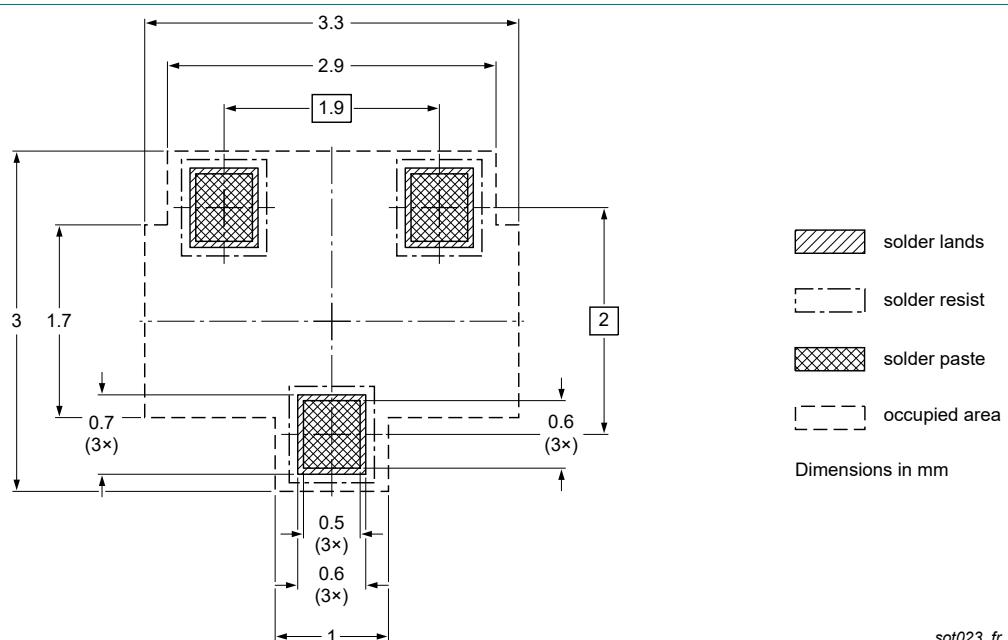


Fig. 20. Reflow soldering footprint for SOT23

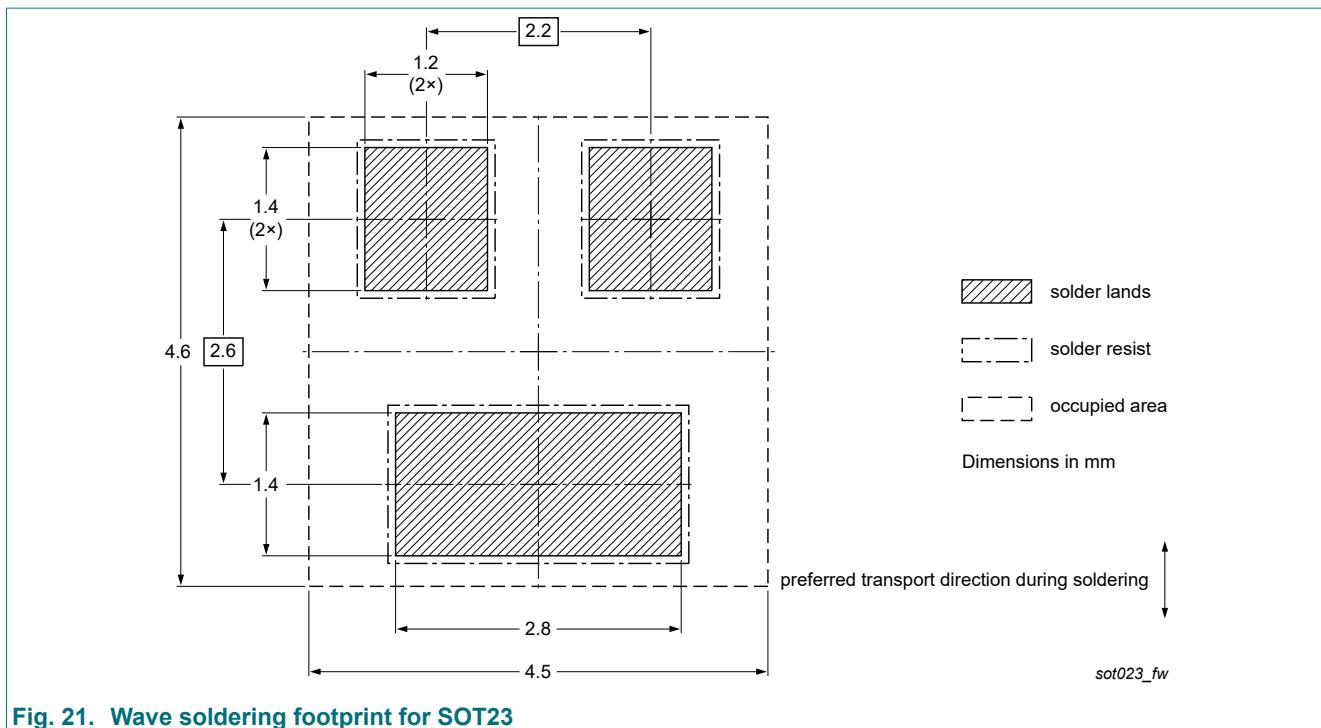


Fig. 21. Wave soldering footprint for SOT23

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4021NT v.3	20240920	Product data sheet	-	PBSS4021NT v.2
Modifications:	<ul style="list-style-type: none">• New graphics added, graphs updated and values changed.			
PBSS4021NT v.2	20240207	Product data sheet	-	PBSS4021NT v.1
PBSS4021NT v.1	20100131	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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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.....	10
12. Package outline.....	11
13. Soldering.....	11
14. Revision history.....	13
15. Legal information.....	14

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