



# PBSS4620PA-Q

20 V, 6 A NPN low V<sub>CEsat</sub> transistor

18 October 2024

Product data sheet

## 1. General description

NPN low V<sub>CEsat</sub> transistor, encapsulated in an ultra thin SOT1061 leadless small Surface-Mounted Device (SMD) plastic package with medium power capability.

PNP complement: PBSS5620PA

## 2. Features and benefits

- Low collector-emitter saturation voltage V<sub>CEsat</sub>
- High collector current capability I<sub>C</sub> and I<sub>CM</sub>
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors
- Exposed heat sink for excellent thermal and electrical conductivity
- Leadless small SMD plastic package with medium power capability
- 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)

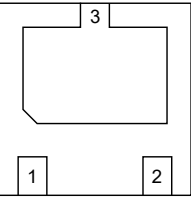
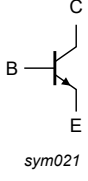
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	20	V
I <sub>C</sub>	collector current		-	-	6	A
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms	-	-	7	A
R <sub>CEsat</sub>	collector-emitter saturation resistance	I <sub>C</sub> = 6 A; I <sub>B</sub> = 300 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	33	46	mΩ

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p>Transparent top view DFN2020-3 (SOT1061)</p>	 <p>sym021</p>
2	E	emitter		
3	C	collector		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
<a href="#">PBSS4620PA-Q</a>	DFN2020-3	plastic, leadless thermal enhanced ultra thin small outline package; 3 terminals; 1.3 mm pitch; 2 mm x 2 mm x 0.65 mm body	<a href="#">SOT1061</a>

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4620PA-Q	A6

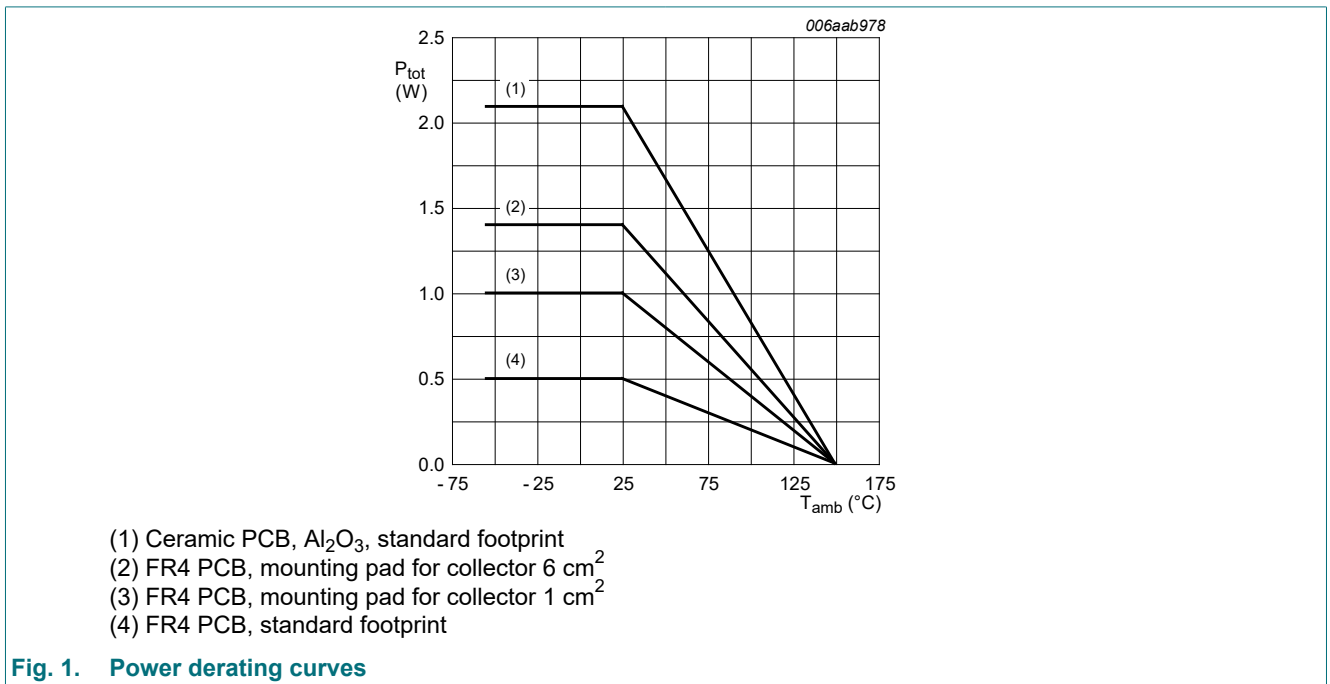
## 8. Limiting values

**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		-	20	V
V <sub>CEO</sub>	collector-emitter voltage	open base		-	20	V
V <sub>EBO</sub>	emitter-base voltage	open collector		-	6	V
I <sub>C</sub>	collector current			-	6	A
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms		-	7	A
I <sub>B</sub>	base current			-	600	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	500	mW
			[2]	-	1	W
			[3]	-	1.4	W
			[4]	-	2.1	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 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, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.
- [4] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, 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]	-	-	250	K/W
			[2]	-	-	125	K/W
			[3]	-	-	90	K/W
			[4]	-	-	60	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, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.
- [4] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.

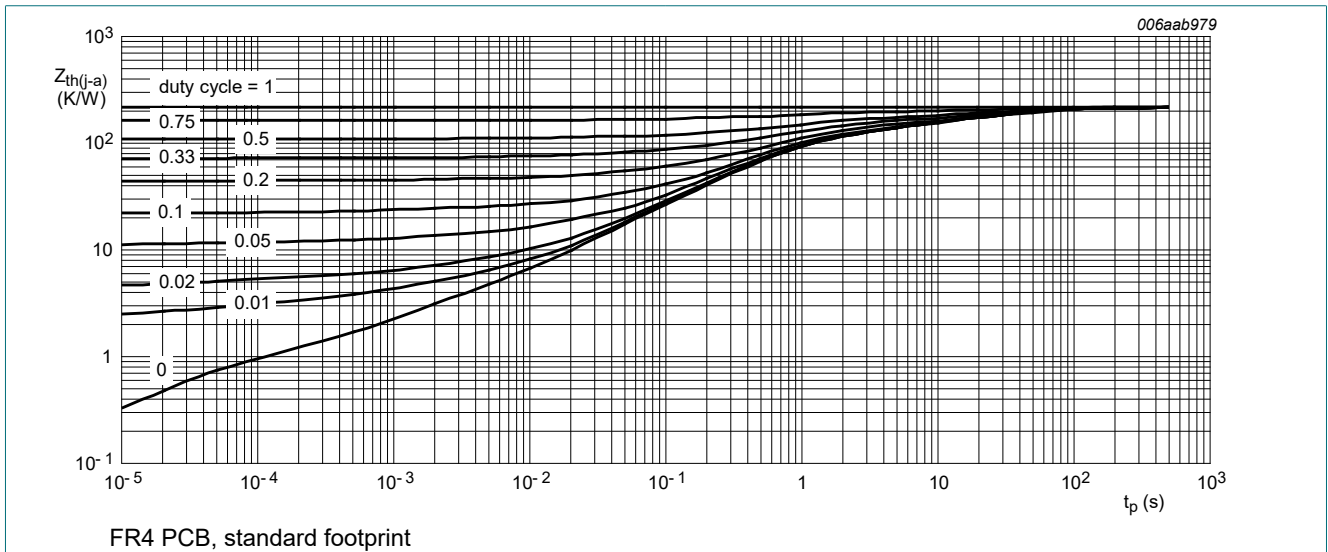


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

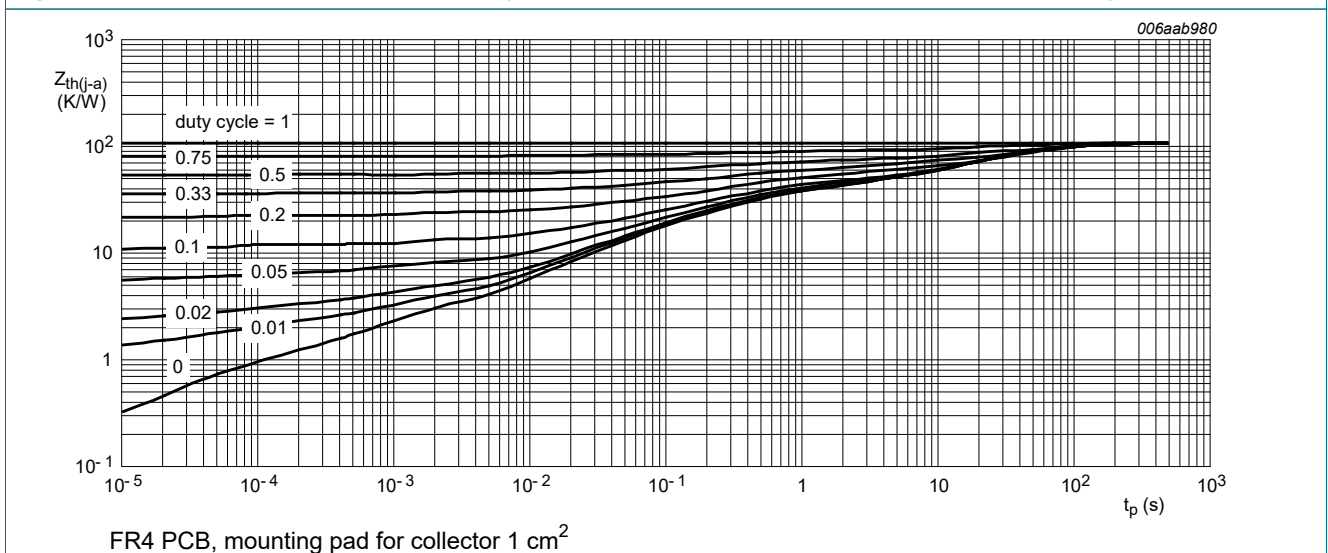


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

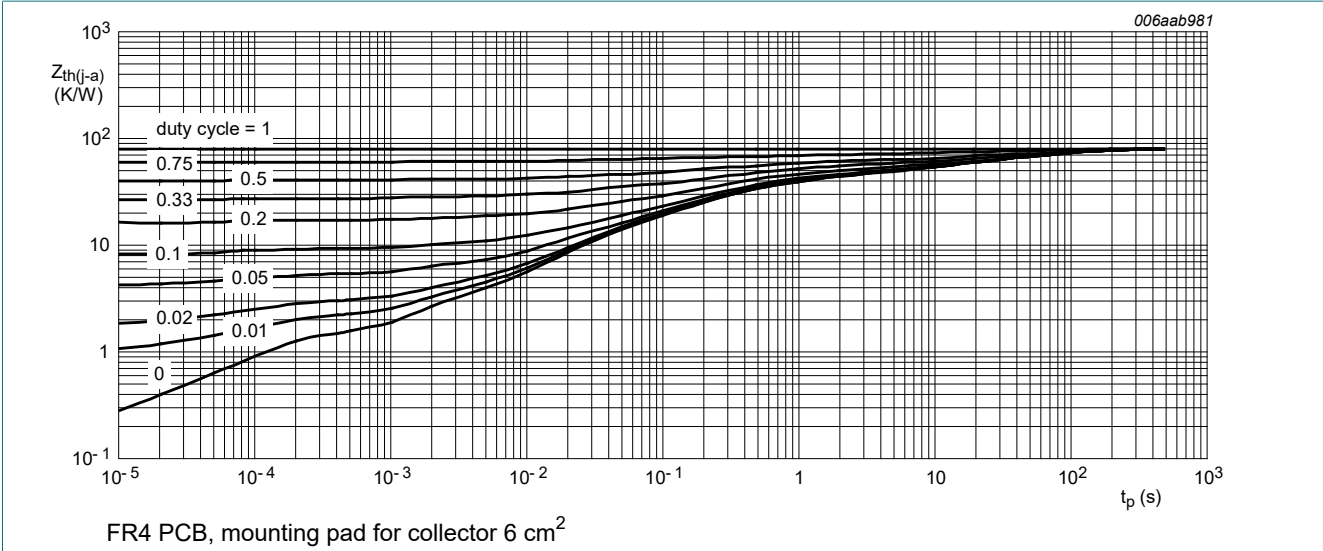


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

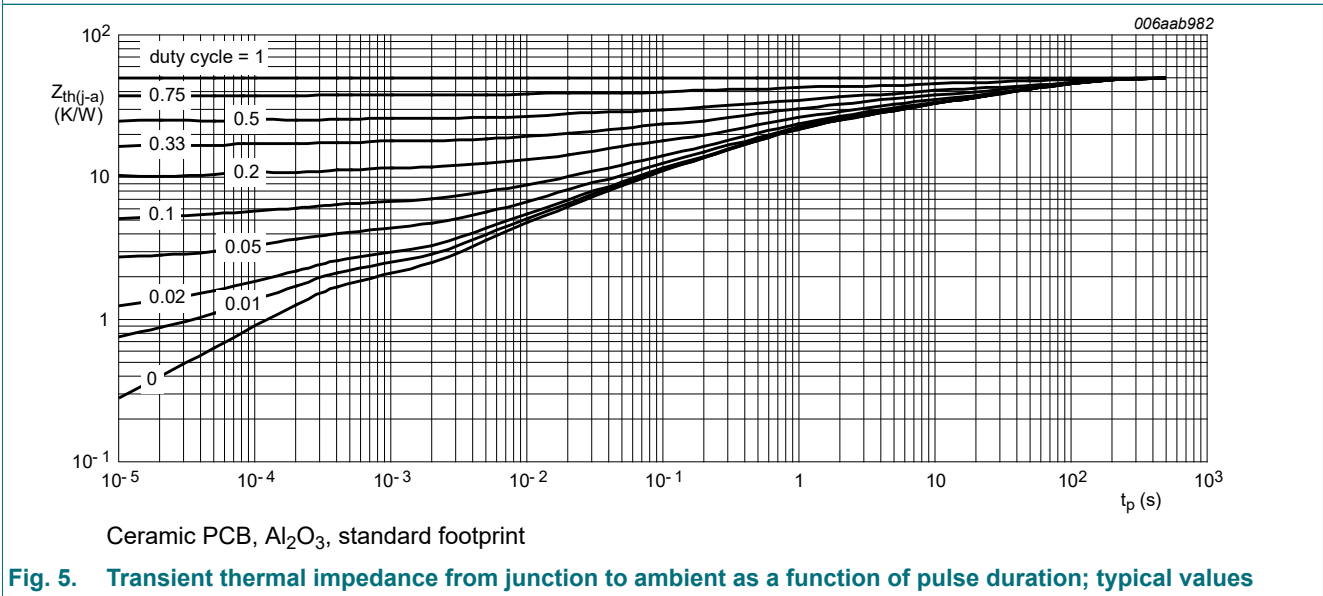
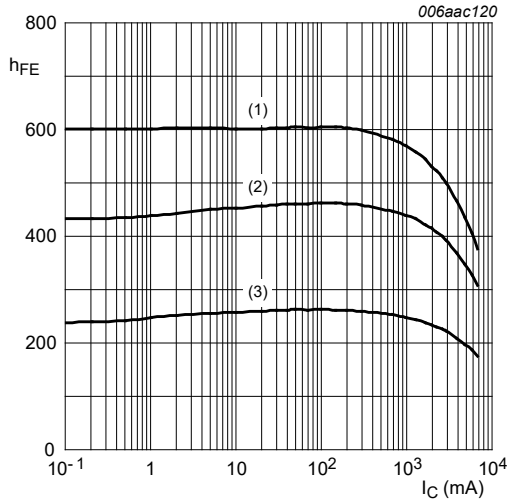


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

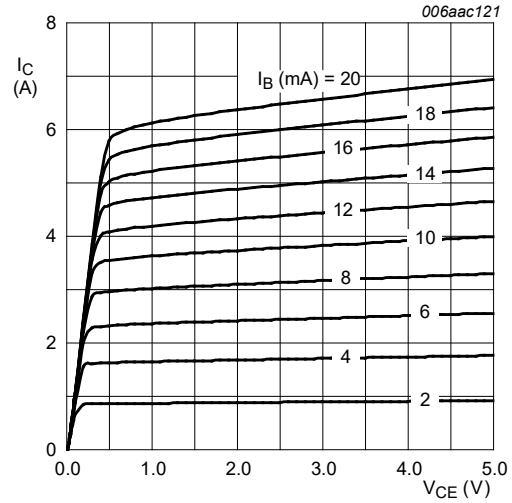
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 16\text{ V}; I_E = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	100	nA
		$V_{CB} = 16\text{ V}; I_E = 0\text{ A}; T_J = 150\text{ }^\circ\text{C}$	-	-	50	$\mu\text{A}$
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = 16\text{ V}; V_{BE} = 0\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	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	$V_{CE} = 2\text{ V}; I_C = 0.5\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	280	440	-	
		$V_{CE} = 2\text{ V}; I_C = 1\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	270	430	-	
		$V_{CE} = 2\text{ V}; I_C = 2\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	260	415	-	
		$V_{CE} = 2\text{ V}; I_C = 6\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	200	330	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 0.5\text{ A}; I_B = 50\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	20	30	mV
		$I_C = 1\text{ A}; I_B = 50\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	37	55	mV
		$I_C = 1\text{ A}; I_B = 10\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	50	70	mV
		$I_C = 2\text{ A}; I_B = 20\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	85	120	mV
		$I_C = 3\text{ A}; I_B = 30\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	120	170	mV
		$I_C = 4\text{ A}; I_B = 40\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	135	185	mV
		$I_C = 6\text{ A}; I_B = 300\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	200	275	mV
$R_{CEsat}$	collector-emitter saturation resistance		-	33	46	m $\Omega$
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 1\text{ A}; I_B = 10\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	0.75	0.9	V
		$I_C = 6\text{ A}; I_B = 300\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	0.97	1.1	V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = 2\text{ V}; I_C = 2\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	0.74	0.9	V
$t_d$	delay time	$V_{CC} = 9\text{ V}; I_C = 2\text{ A}; I_{B(on)} = 0.1\text{ A}; I_{B(off)} = -0.1\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	25	-	ns
$t_r$	rise time		-	55	-	ns
$t_{on}$	turn-on time		-	80	-	ns
$t_s$	storage time		-	285	-	ns
$t_f$	fall time		-	50	-	ns
$t_{off}$	turn-off time		-	335	-	ns
$f_T$	transition frequency		$V_{CE} = 10\text{ V}; I_C = 100\text{ mA}; f = 100\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	50	80	-
$C_C$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A}; f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	80	95	pF



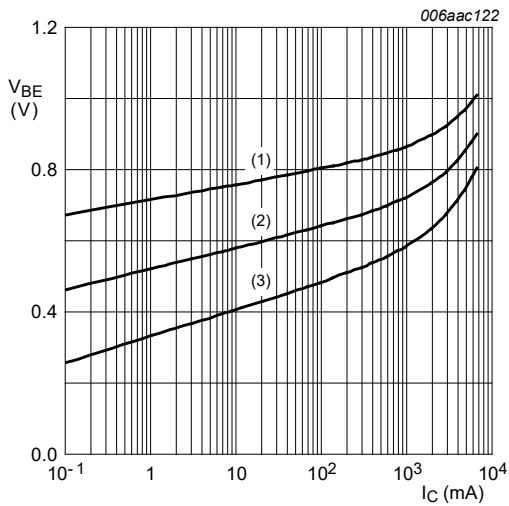
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = 100^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = -55^\circ\text{C}$

Fig. 6. DC current gain as a function of collector current; typical values



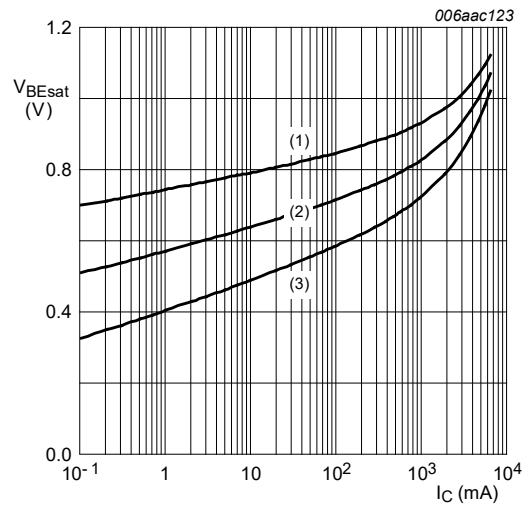
$T_{amb} = 25^\circ\text{C}$

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



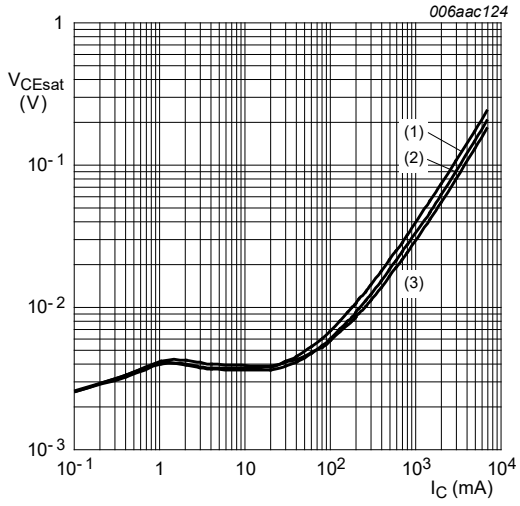
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = -55^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = 100^\circ\text{C}$

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



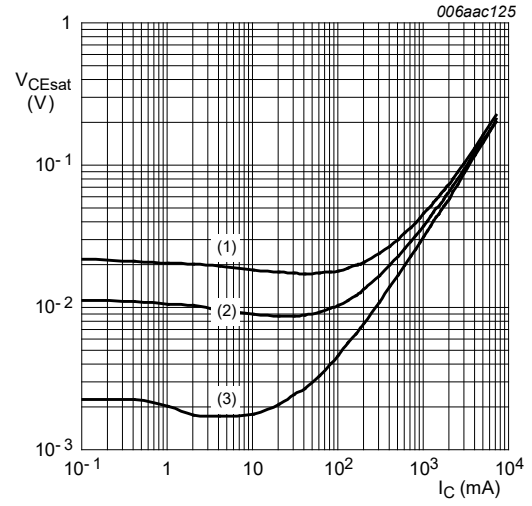
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = 100^\circ\text{C}$

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



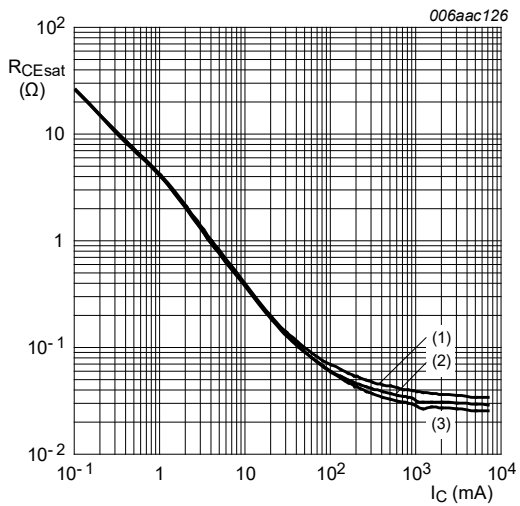
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



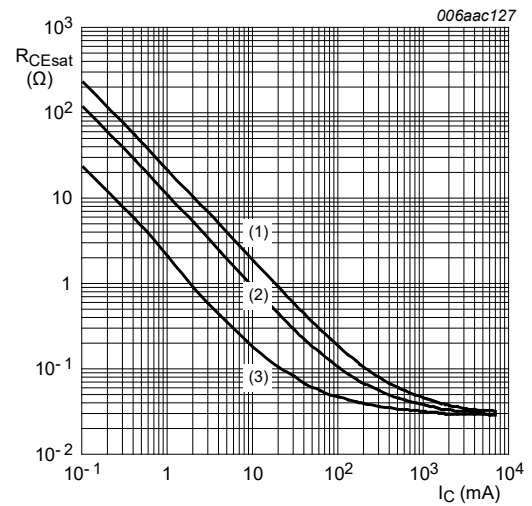
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

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



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

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



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

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

### 11. Test information

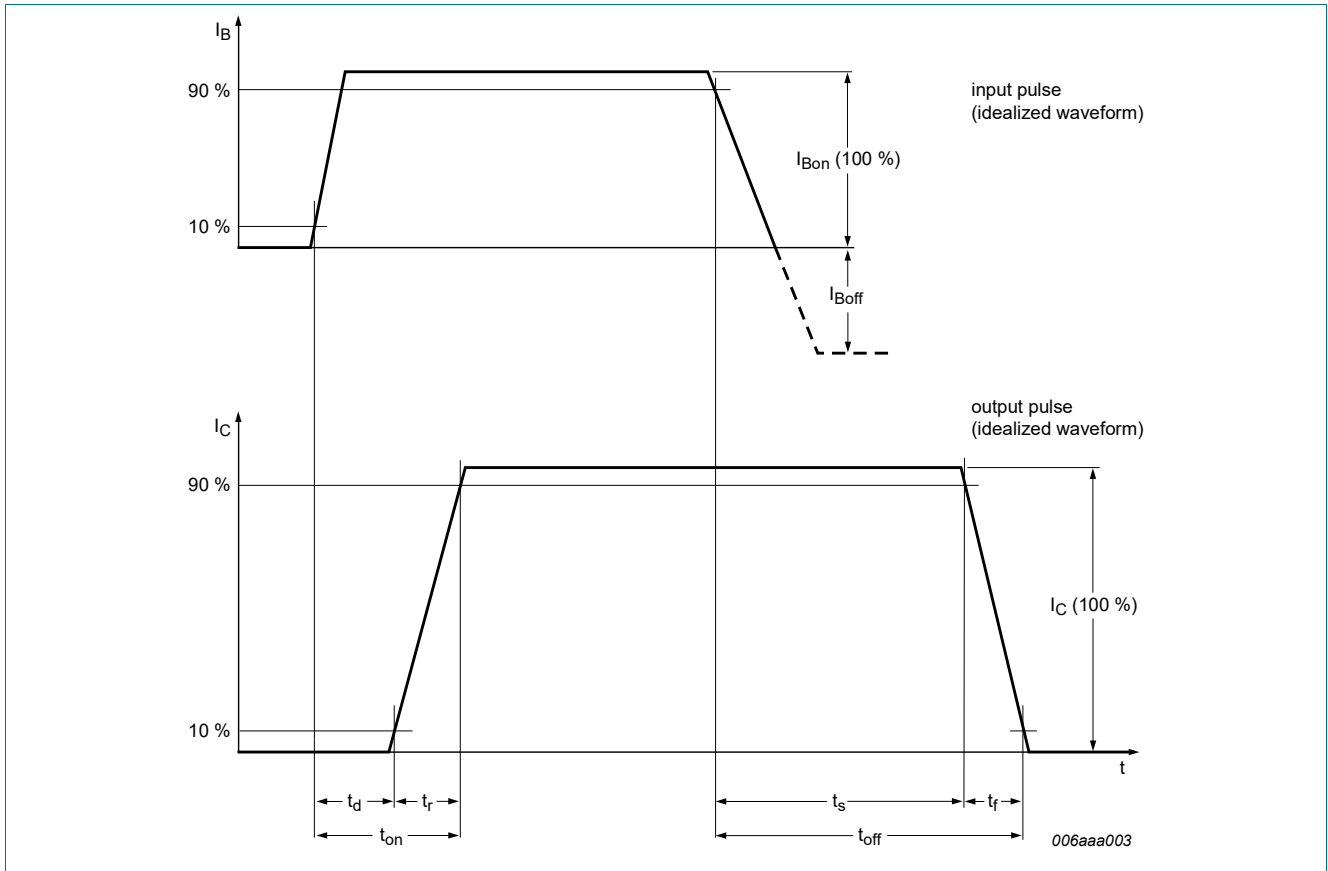


Fig. 14. Transistor switching time definition

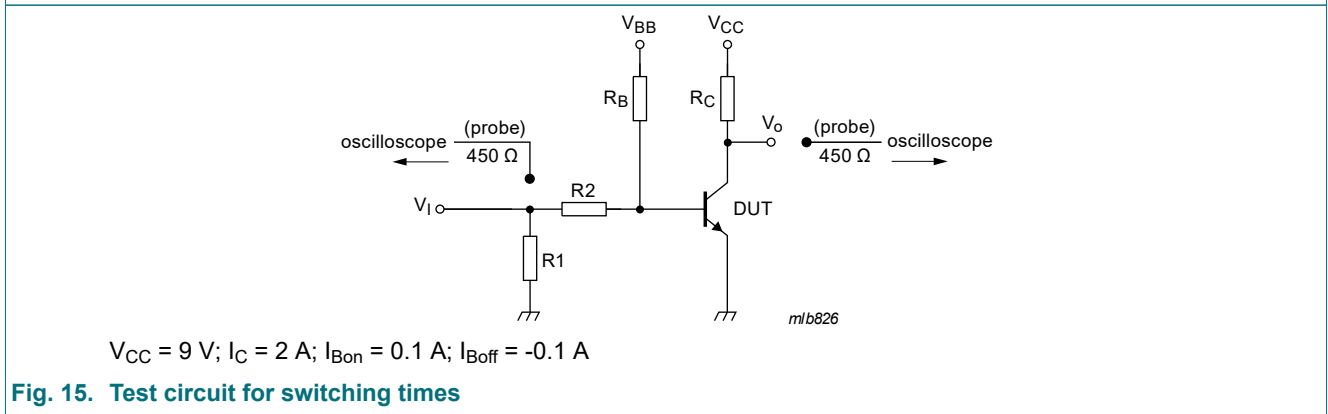


Fig. 15. Test circuit for switching times

### 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

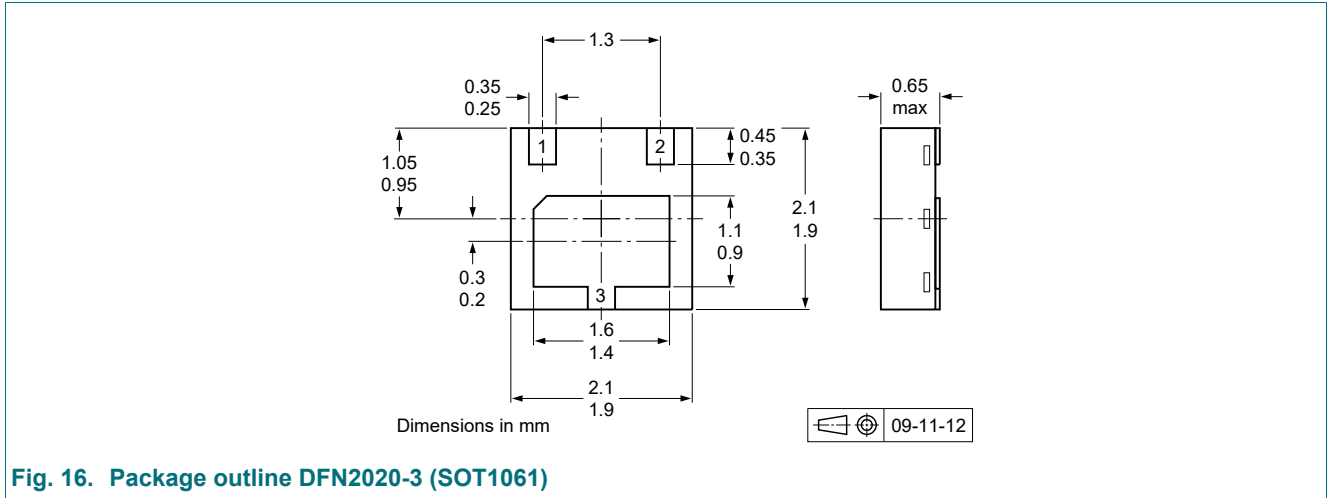


Fig. 16. Package outline DFN2020-3 (SOT1061)

## 13. Soldering

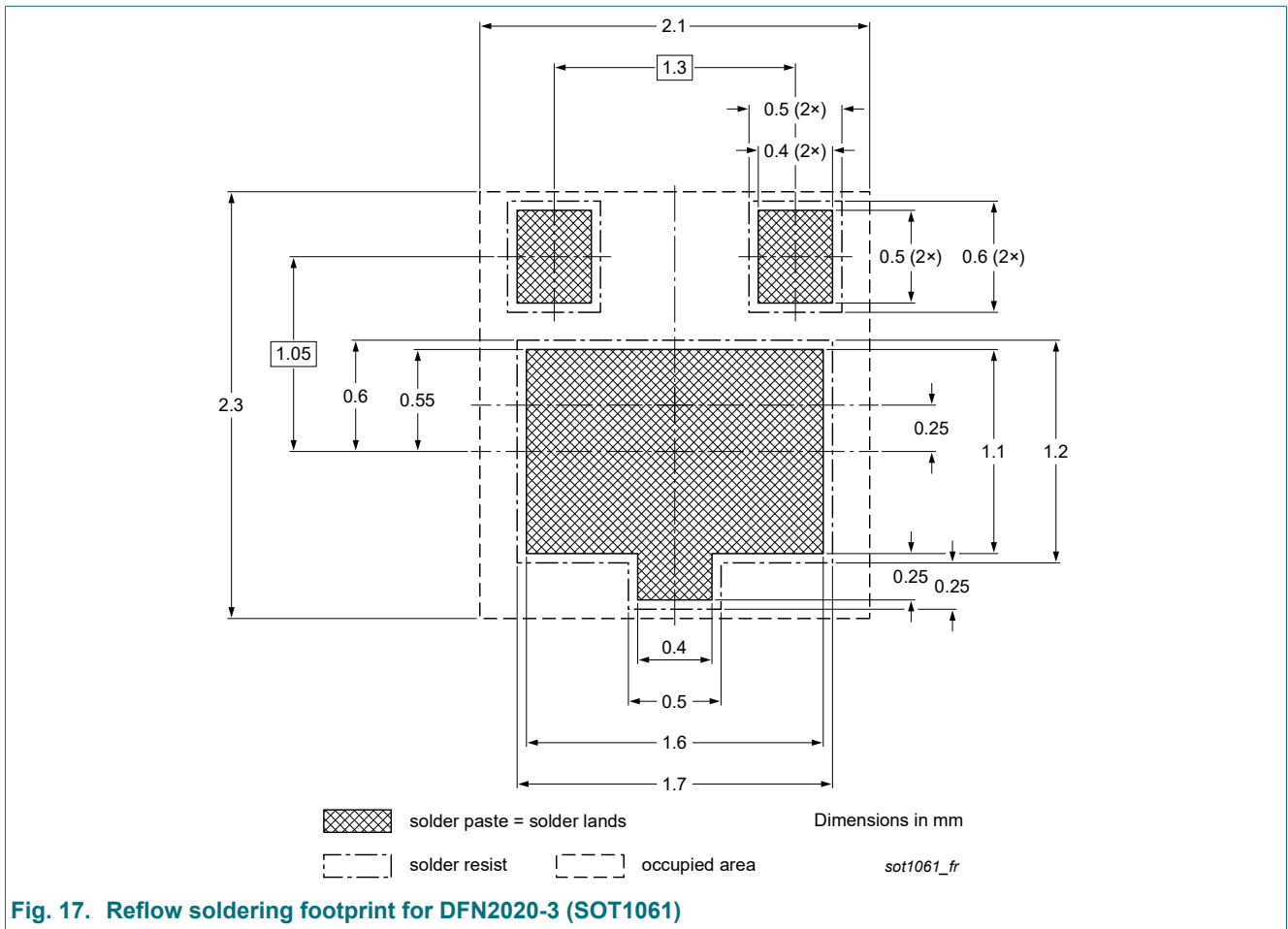


Fig. 17. Reflow soldering footprint for DFN2020-3 (SOT1061)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4620PA-Q v.1	20241018	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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- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 18 October 2024

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