



# PBSS4330PAS-Q

30 V, 3 A NPN low V<sub>CEsat</sub> transistor

29 July 2022

Product data sheet

## 1. General description

NPN low V<sub>CEsat</sub> transistor encapsulated in an ultra thin DFN2020D-3 (SOT1061D) leadless small Surface-Mounted Device (SMD) plastic package with medium power capability and visible and solderable side pads.

PNP complement: PBSS5330PAS

## 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>
- High collector current gain (h<sub>FE</sub>) at high I<sub>C</sub>
- High efficiency due to less heat generation
- High temperature applications up to 175 °C
- Reduced Printed-Circuit Board (PCB) area requirements
- Leadless small SMD plastic package with solderable side pads
- Exposed heat sink for excellent thermal and electrical conductivity
- Suitable for Automatic Optical Inspection (AOI) of solder joint
- 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)

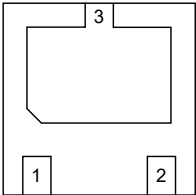
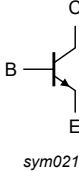
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	30	V
I <sub>C</sub>	collector current		-	-	3	A
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms	-	-	5	A
R <sub>CEsat</sub>	collector-emitter saturation resistance	I <sub>C</sub> = 3 A; I <sub>B</sub> = 300 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	75	100	mΩ

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p>Transparent top view DFN2020D-3 (SOT1061D)</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="#">PBSS4330PAS-Q</a>	DFN2020D-3	plastic, leadless thermal enhanced ultra thin small outline package with side-wettable flanks (SWF); no leads; 3 terminals; 1.3 mm pitch; 2 mm x 2 mm x 0.65 mm body	<a href="#">SOT1061D</a>

7. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4330PAS-Q	E1

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		-	50	V
V <sub>CEO</sub>	collector-emitter voltage	open base		-	30	V
V <sub>EBO</sub>	emitter-base voltage	open collector		-	6	V
I <sub>C</sub>	collector current			-	3	A
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms		-	5	A
I <sub>B</sub>	base current			-	500	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	600	mW
			[2] [3]	-	1.2	W
			[4]	-	1.5	W
			[5] [6]	-	2.5	W
T <sub>j</sub>	junction temperature			-	175	°C
T <sub>amb</sub>	ambient temperature			-55	175	°C
T <sub>stg</sub>	storage temperature			-65	175	°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, 4-layer copper, tin-plated and standard footprint.
- [4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.
- [5] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.
- [6] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm<sup>2</sup>.

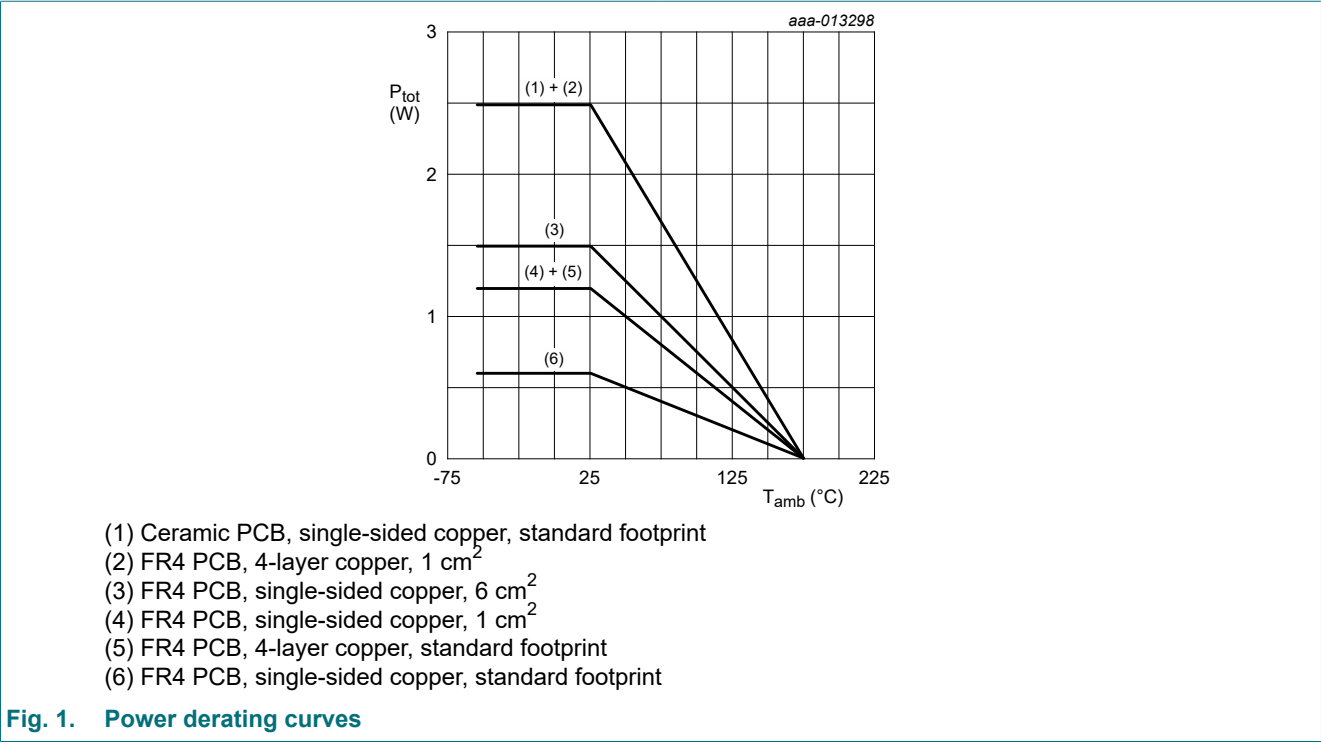


Fig. 1. Power derating curves

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] [3]	-	-	125	K/W
			[4]	-	-	100	K/W
			[5] [6]	-	-	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, 4-layer copper, tin-plated and standard footprint.
- [4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.
- [5] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.
- [6] Device mounted on a FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm<sup>2</sup>.

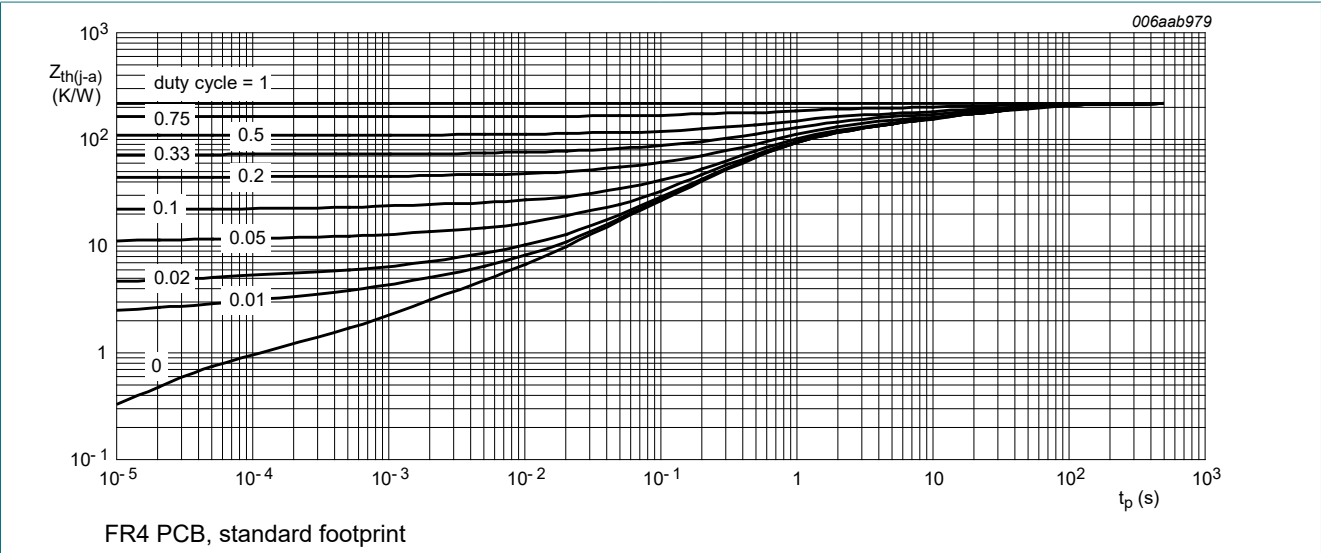


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

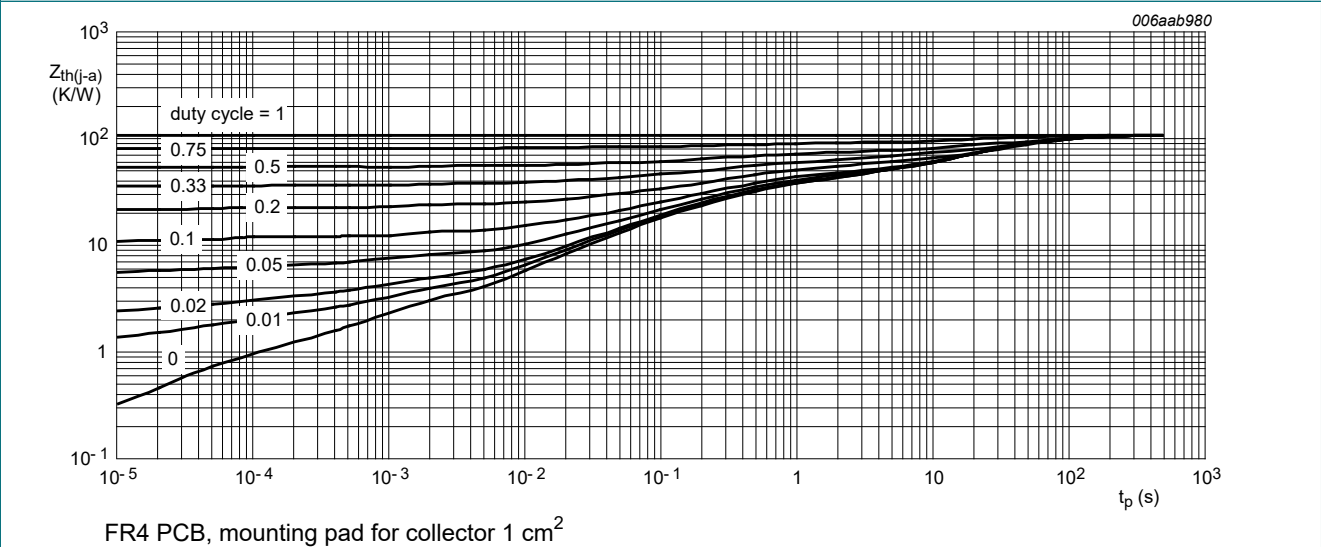
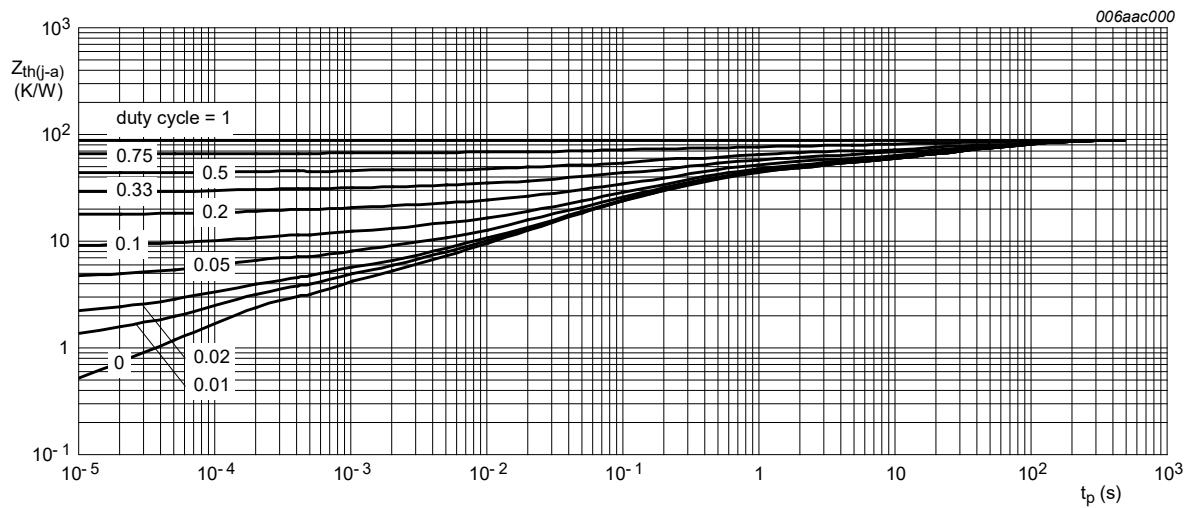
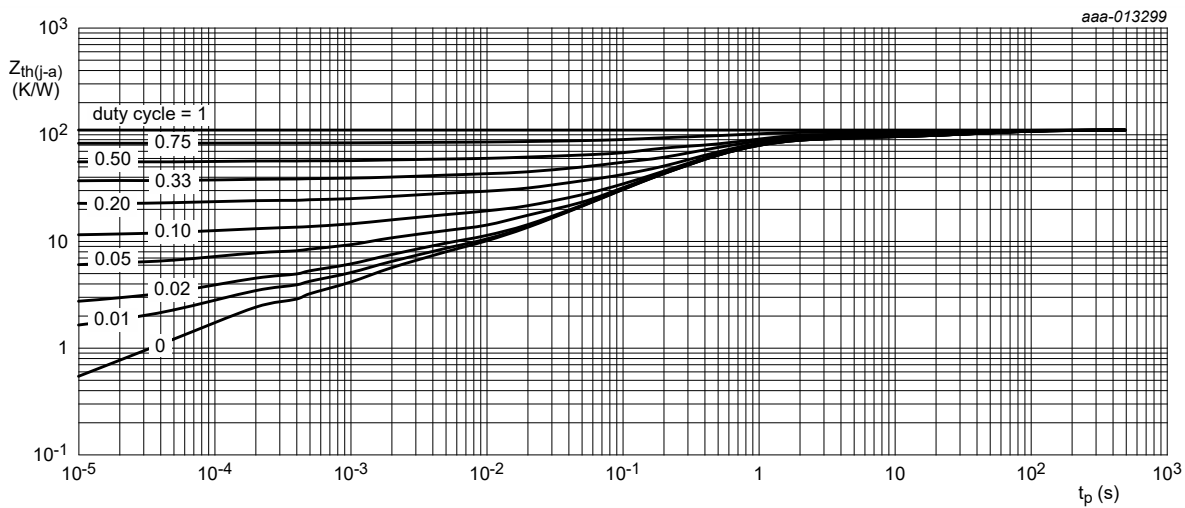


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



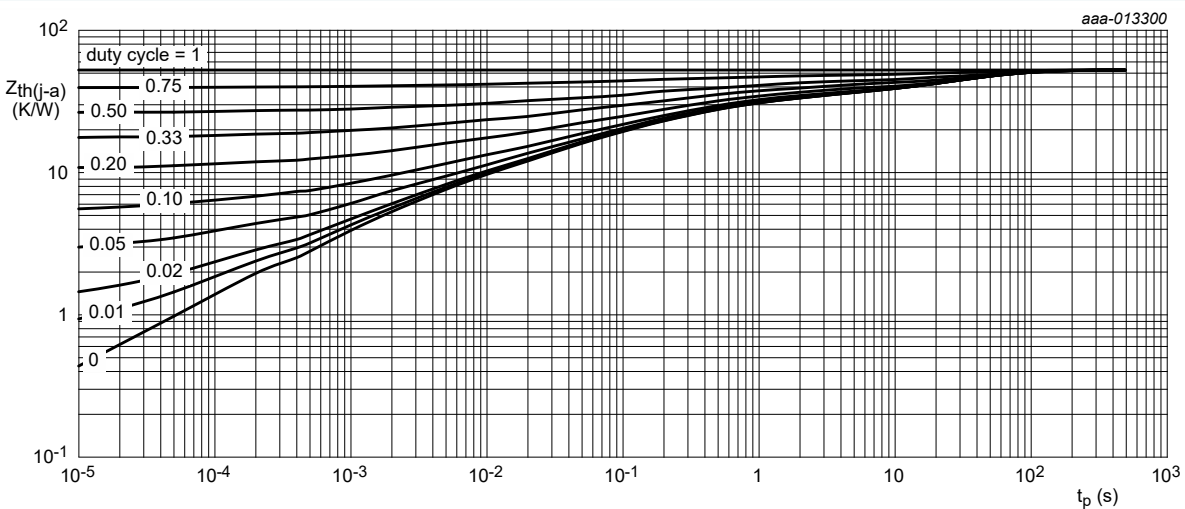
FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>

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



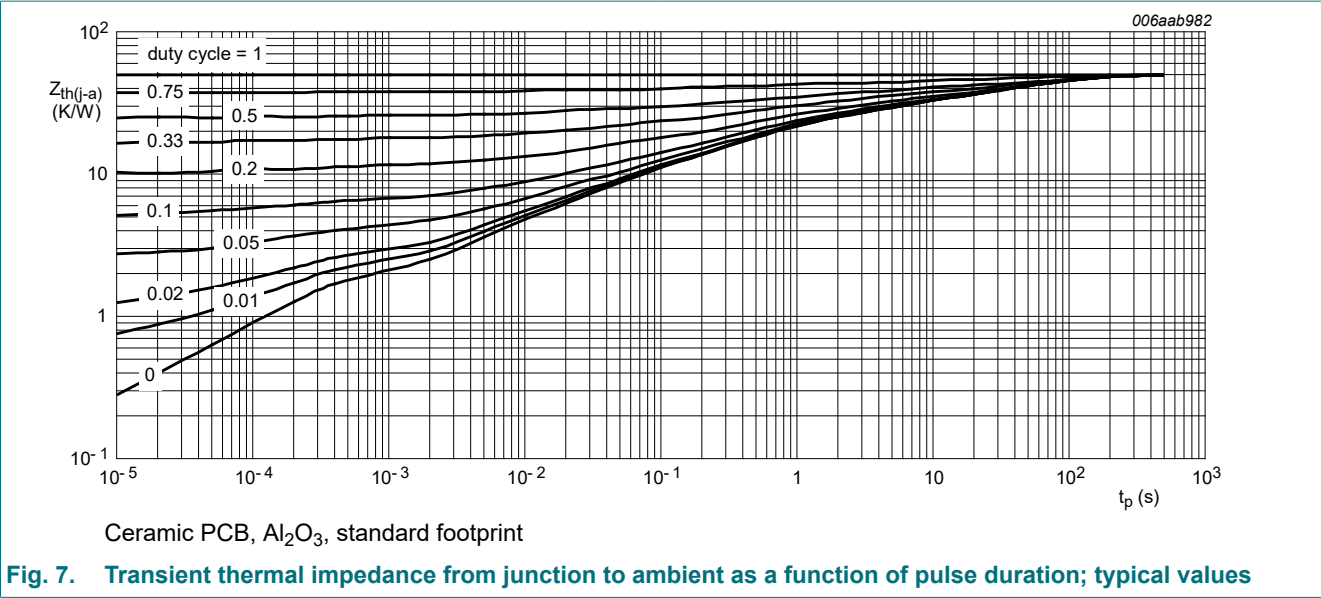
FR4 PCB, 4-layer copper, standard footprint

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



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

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
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 24 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 25 \text{ }^{\circ}\text{C}$	-	-	100	nA
		$V_{CB} = 24 \text{ V}; I_E = 0 \text{ A}; T_J = 150 \text{ }^{\circ}\text{C}$	-	-	50	$\mu\text{A}$
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = 24 \text{ V}; V_{BE} = 0 \text{ V}; T_{amb} = 25 \text{ }^{\circ}\text{C}$	-	-	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	$V_{CE} = 2 \text{ V}; I_C = 0.5 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$	300	465	-	
		$V_{CE} = 2 \text{ V}; I_C = 1 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$	270	435	700	
		$V_{CE} = 2 \text{ V}; I_C = 2 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$	230	370	-	
		$V_{CE} = 2 \text{ V}; I_C = 3 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$	180	310	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 0.5 \text{ A}; I_B = 50 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$	-	40	60	mV
		$I_C = 1 \text{ A}; I_B = 50 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$	-	80	110	mV
		$I_C = 2 \text{ A}; I_B = 100 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$	-	155	220	mV
		$I_C = 3 \text{ A}; I_B = 300 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$	-	220	300	mV
$R_{CEsat}$	collector-emitter saturation resistance		-	75	100	m $\Omega$
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 2 \text{ A}; I_B = 100 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$	-	0.95	1.1	V
		$I_C = 3 \text{ A}; I_B = 300 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$	-	1.07	1.2	V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = 2 \text{ V}; I_C = 1 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^{\circ}\text{C}$	-	0.76	1	V
$t_d$	delay time	$V_{CC} = 9 \text{ V}; I_C = 2 \text{ A}; I_{B(on)} = 0.1 \text{ A}; I_{B(off)} = -0.1 \text{ A}; T_{amb} = 25 \text{ }^{\circ}\text{C}$	-	11	-	ns
$t_r$	rise time		-	52	-	ns
$t_{on}$	turn-on time		-	63	-	ns
$t_s$	storage time		-	230	-	ns
$t_f$	fall time		-	40	-	ns
$t_{off}$	turn-off time		-	270	-	ns
$f_T$	transition frequency	$V_{CE} = 5 \text{ V}; I_C = 100 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^{\circ}\text{C}$	100	210	-	MHz
$C_c$	collector capacitance	$V_{CB} = 10 \text{ V}; I_E = 0 \text{ A}; i_e = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^{\circ}\text{C}$	-	21	30	pF

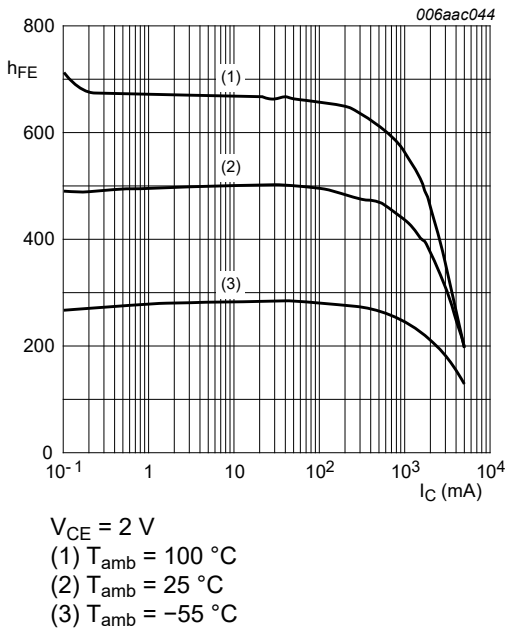


Fig. 8. DC current gain as a function of collector current; typical values

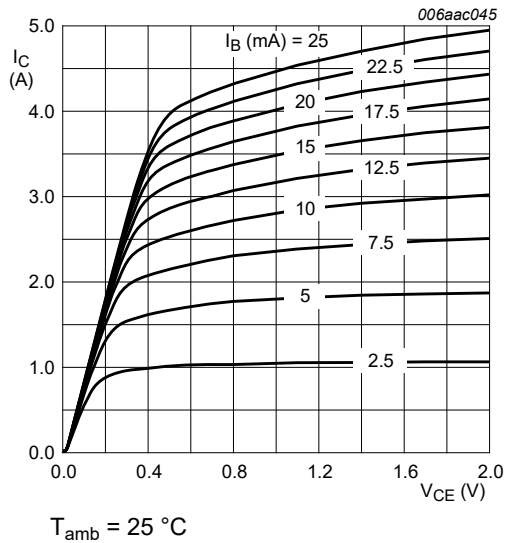


Fig. 9. Collector current as a function of collector-emitter voltage; typical values

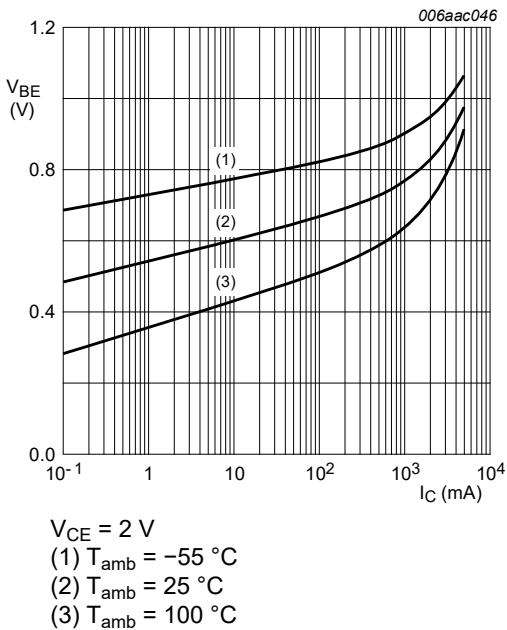


Fig. 10. Base-emitter voltage as a function of collector current; typical values

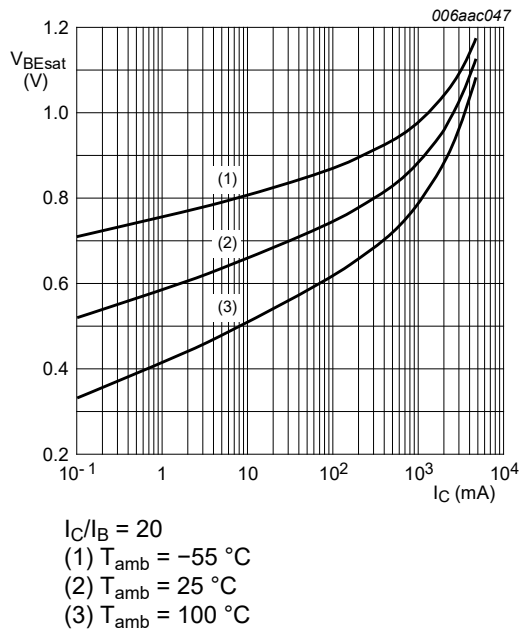


Fig. 11. Base-emitter saturation voltage as a function of collector current; typical values



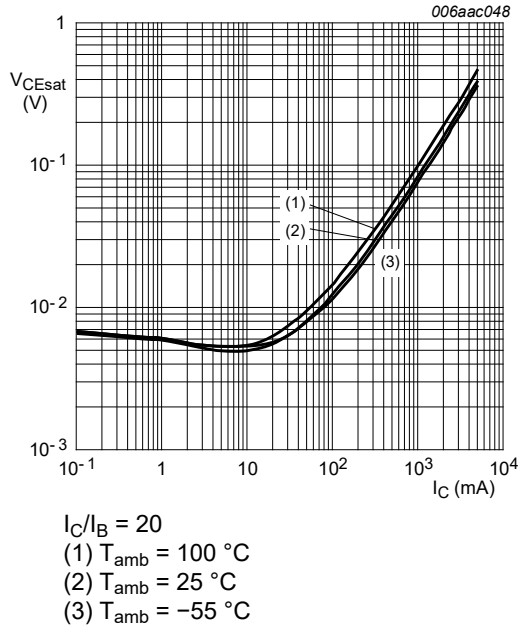


Fig. 12. Collector-emitter saturation voltage as a function of collector current; typical values

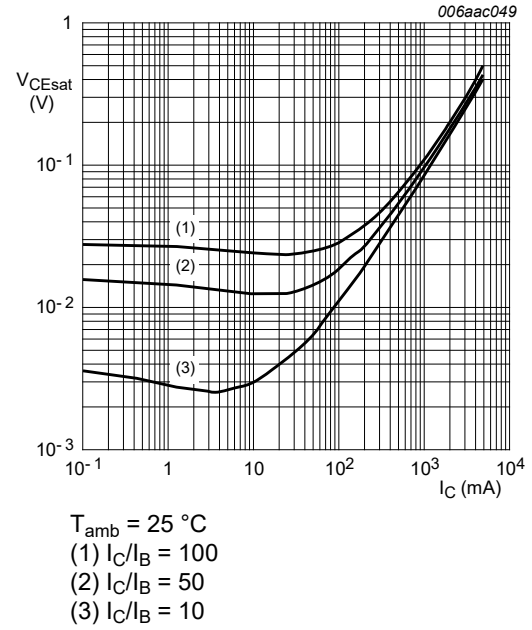


Fig. 13. Collector-emitter saturation voltage as a function of collector current; typical values

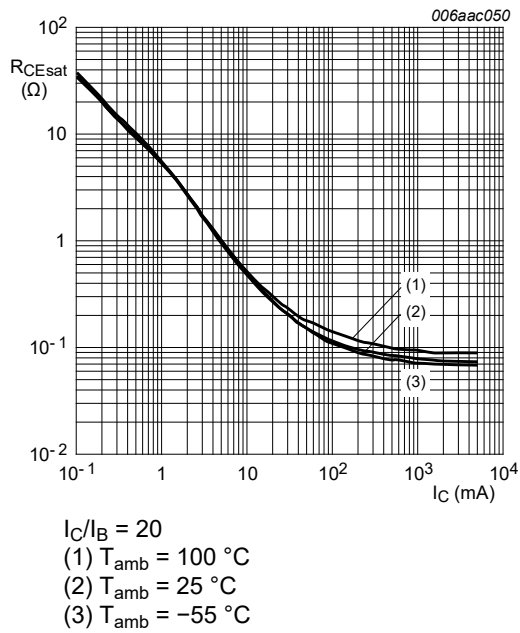


Fig. 14. Collector-emitter saturation resistance as a function of collector current; typical values

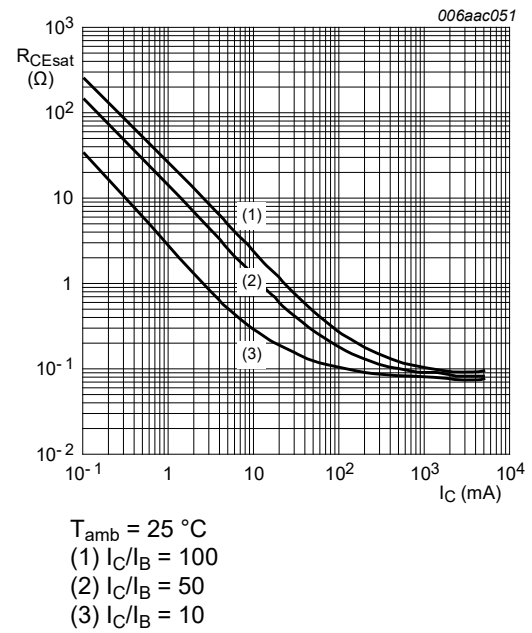


Fig. 15. Collector-emitter saturation resistance as a function of collector current; typical values

11. Test information

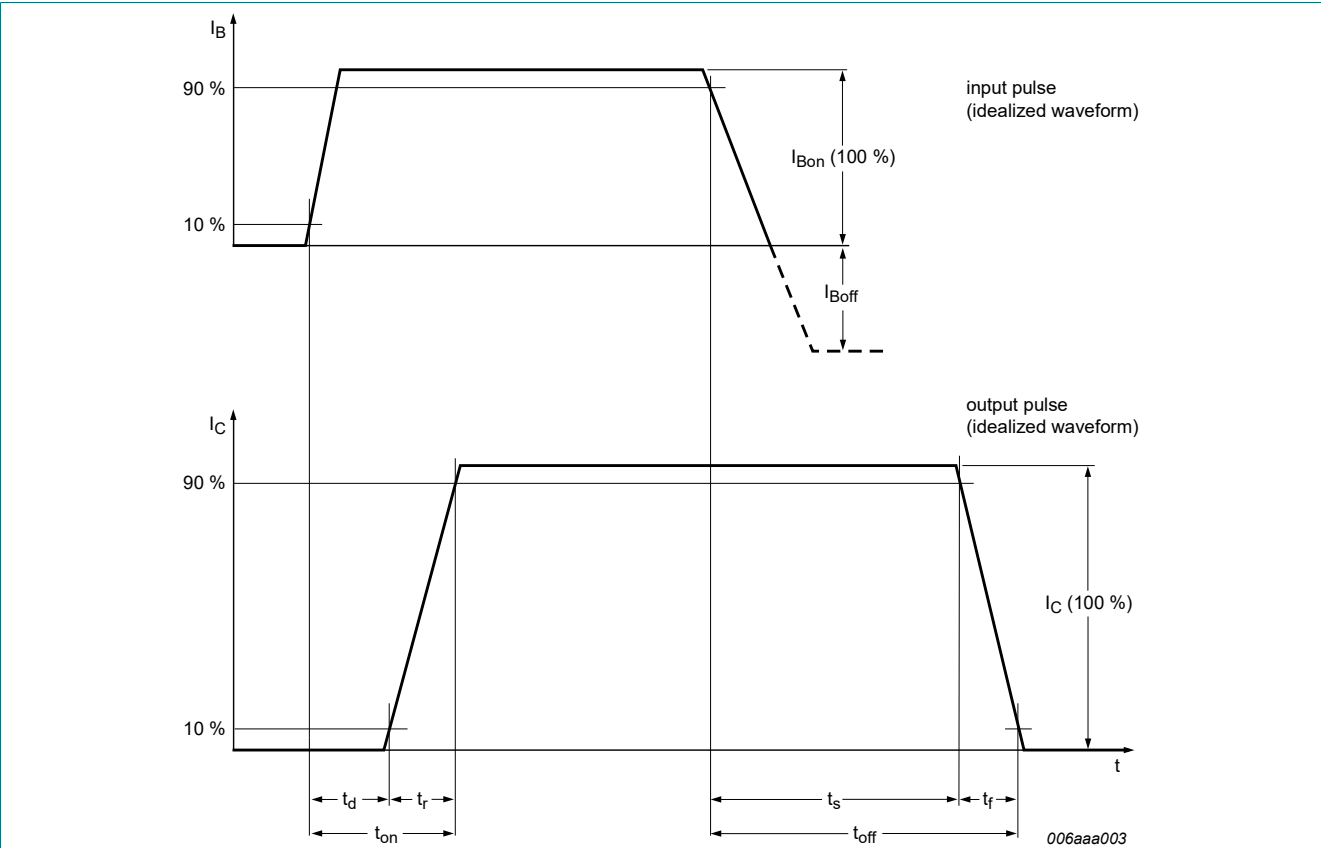


Fig. 16. Switching time definition

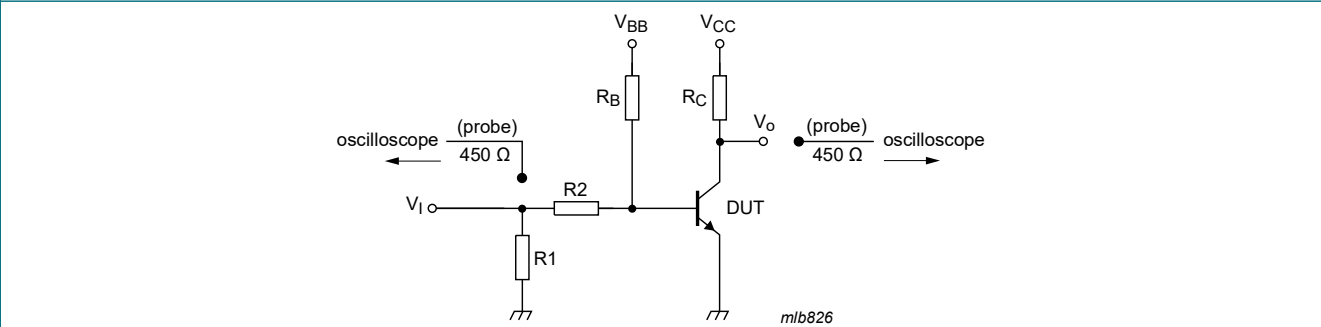


Fig. 17. Test circuit for switching times

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

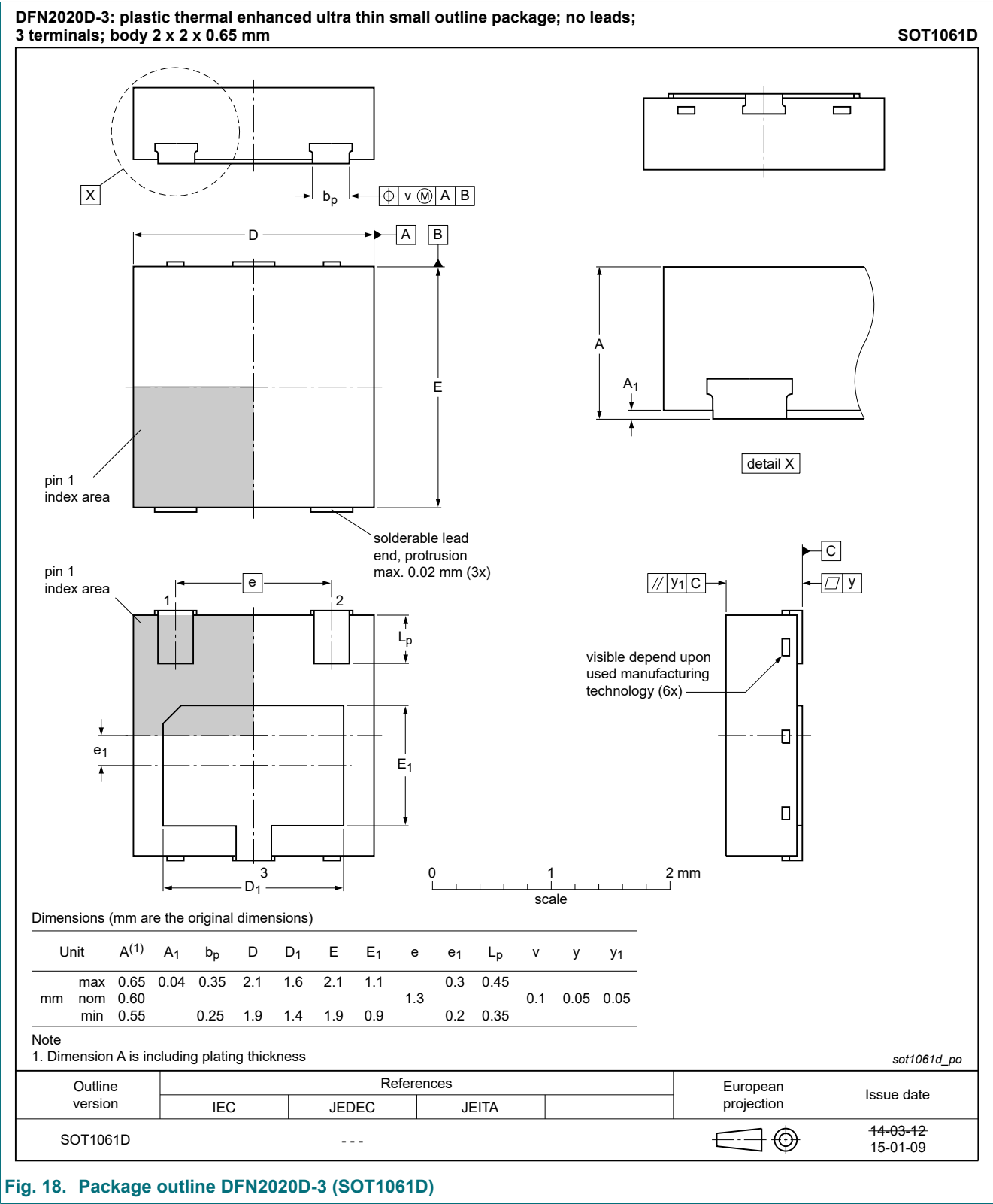
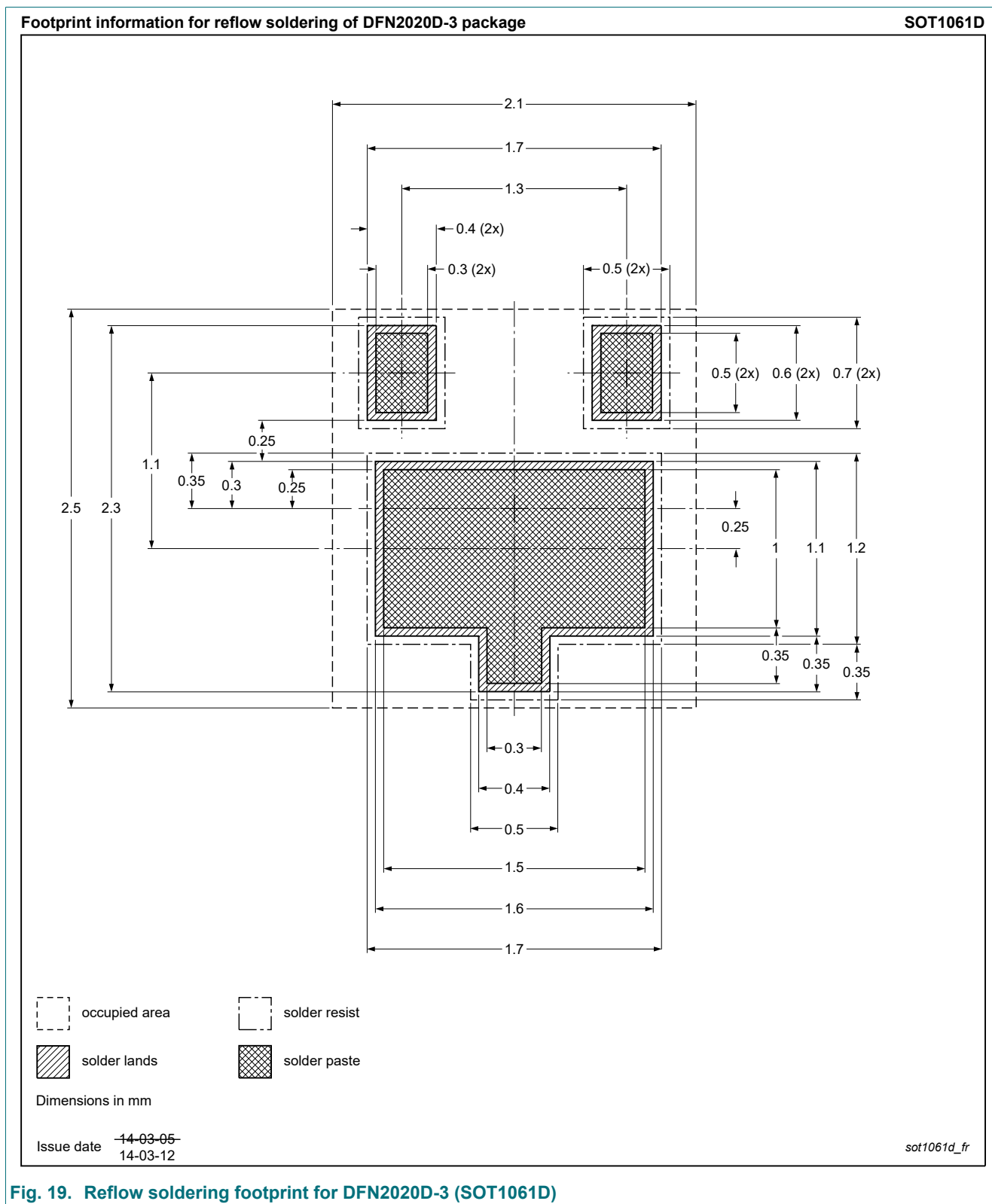


Fig. 18. Package outline DFN2020D-3 (SOT1061D)

## 13. Soldering



**Fig. 19. Reflow soldering footprint for DFN2020D-3 (SOT1061D)**

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4330PAS-Q v.1	20220729	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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Date of release: 29 July 2022

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