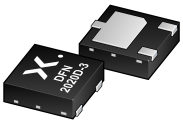

PBSS4360PAS

60 V, 3 A NPN low VCEsat transistor

1 July 2023 — Product data sheet

1. General description

NPN low V_{CEsat} transistor, encapsulated in an ultra thin DFN2020D-3 (SOT1061D) leadless small Surface-Mounted Device (SMD) plastic package with medium power capability and visible and soldarable side pads.

PNP complement: PBSS5360PAS

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
- High temperature applications up to 175 °C
- Reduced Printed-Circuit Board (PCB) area requirements
- Leadless small SMD plastic package with soldarable side pads
- Exposed heat sink for excellent thermal and electrical conductivity
- Suitable for Automatic Optical Inspection (AOI) of solder joint

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		-	-	60	V
I_C	collector current			-	-	3	A
I_{CM}	peak collector current	single pulse; $t_p \leq$ 1 ms		-	-	6	A
R_{CEsat}	collector-emitter saturation resistance	I_C = 3 A; I_B = 300 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	73	108	mΩ

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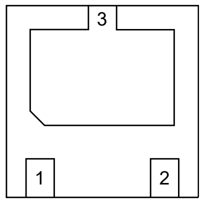
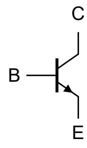
5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 Transparent top view **DFN2020D-3 (SOT1061D)**	 *sym021*
2	E	emitter		
3	C	collector		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4360PAS	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	SOT1061D

7. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4360PAS	E9

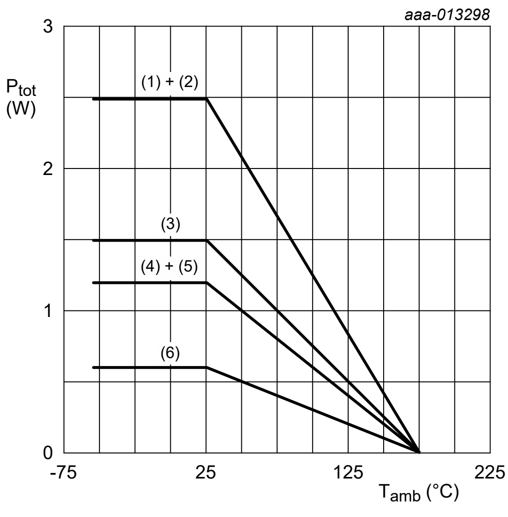
8. Limiting values

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		-	80	V
V_{CEO}	collector-emitter voltage	open base		-	60	V
V_{EBO}	emitter-base voltage	open collector		-	7	V
I_C	collector current			-	3	A
I_{CM}	peak collector current	single pulse; $t_p \leq$ 1 ms		-	6	A
I_B	base current			-	500	mA
I_{BM}	peak base current			-	1	A
P_{tot}	total power dissipation	$T_{amb} \leq$ 25 °C	[1]	-	0.6	W
			[2] [3]	-	1.2	W
			[4]	-	1.5	W
			[5] [6]	-	2.5	W
T_j	junction temperature			-	175	°C
T_{amb}	ambient temperature			-55	175	°C
T_{stg}	storage temperature			-65	175	°C

[1] Device mounted on an FR4 Printed-Circuit Board (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^2.
[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^2.
[5] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.
[6] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm^2.



(1) Ceramic PCB, single-sided copper, standard footprint
(2) FR4 PCB, 4-layer copper, 1 cm^2
(3) FR4 PCB, single-sided copper, 6 cm^2
(4) FR4 PCB, single-sided copper, 1 cm^2
(5) FR4 PCB, 4-layer copper, standard footprint
(6) FR4 PCB, single-sided copper, standard footprint

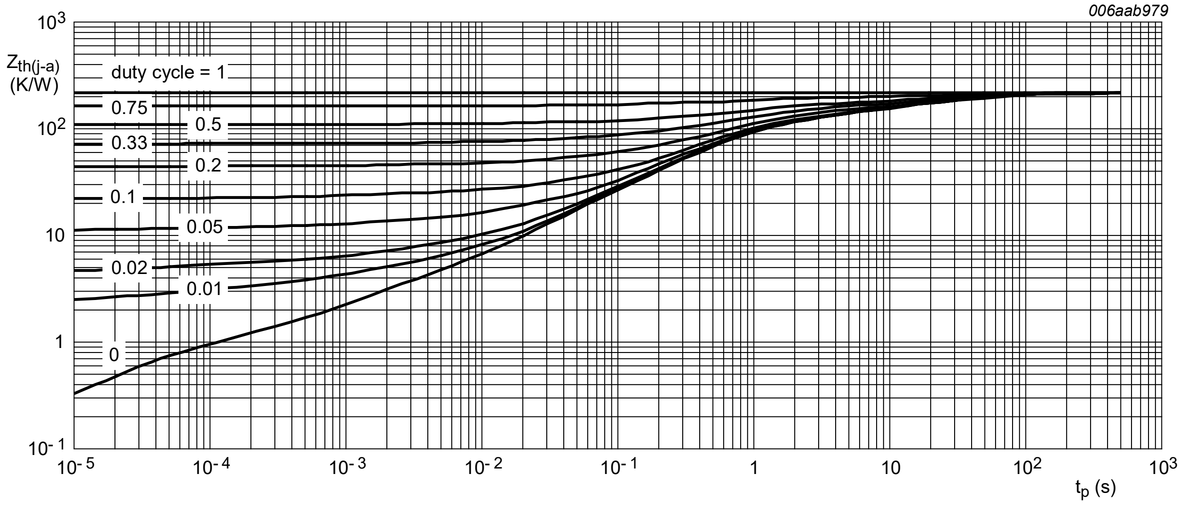
Fig. 1. Power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

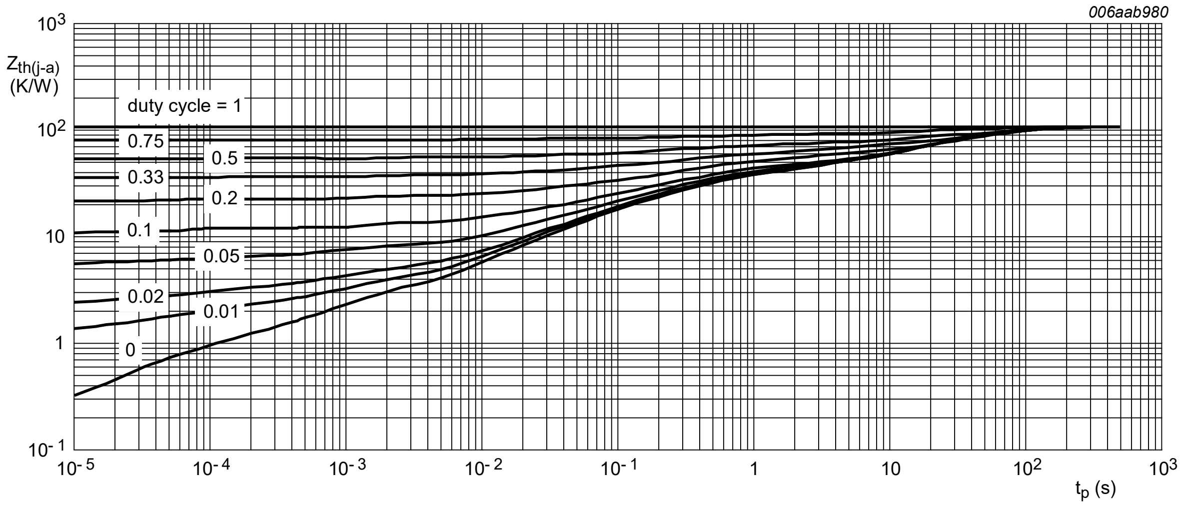
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	250	K/W
			[2] [3]	-	-	125	K/W
			[4]	-	-	100	K/W
			[5] [6]	-	-	60	K/W

[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^2.
[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^2.
[5] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.
[6] Device mounted on a FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm^2.



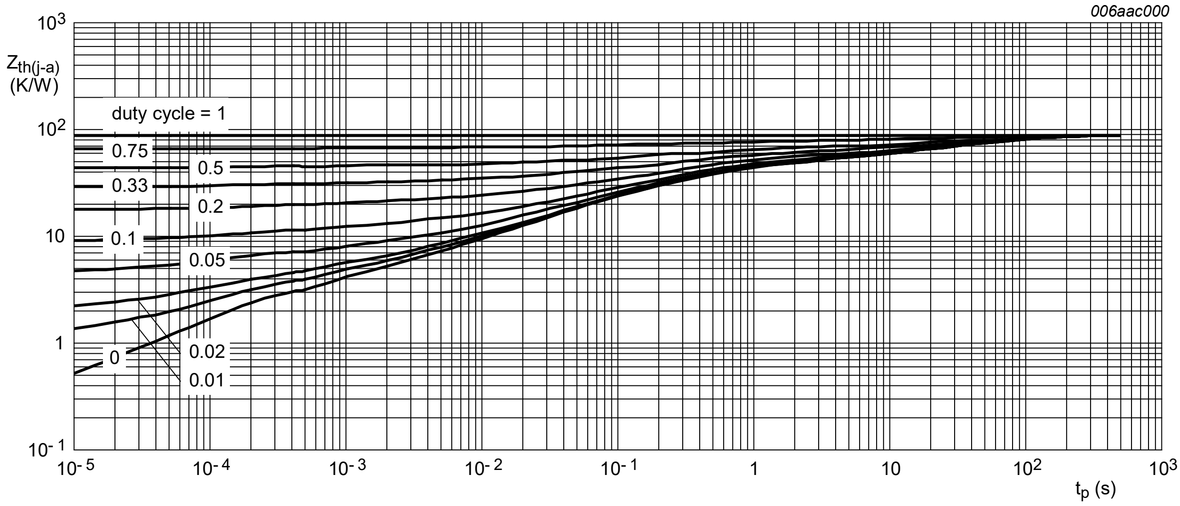
FR4 PCB, standard footprint

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



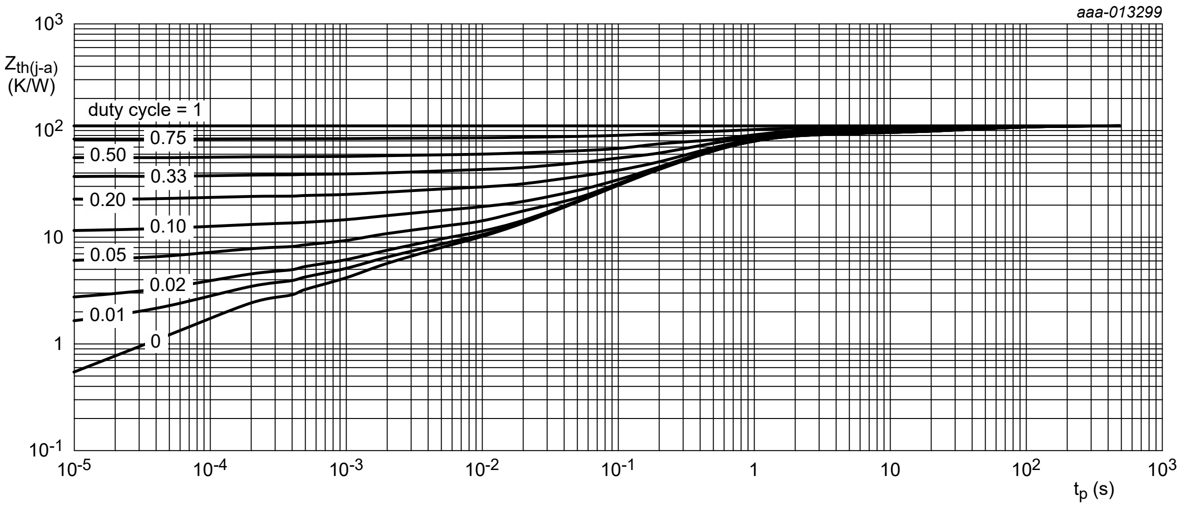
FR4 PCB, mounting pad for collector 1 cm^2

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



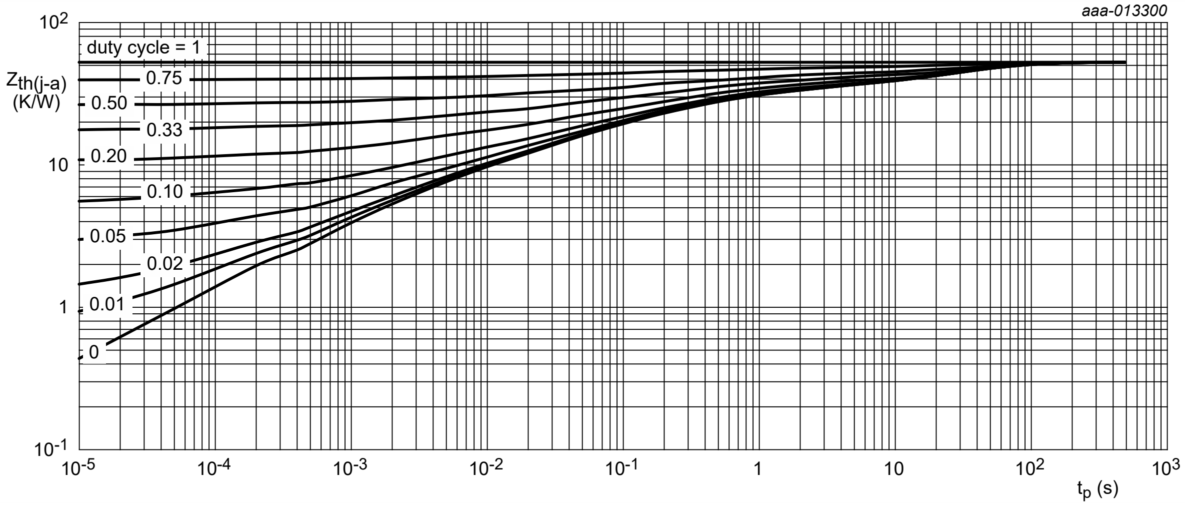
FR4 PCB, mounting pad for collector 6 cm^2

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



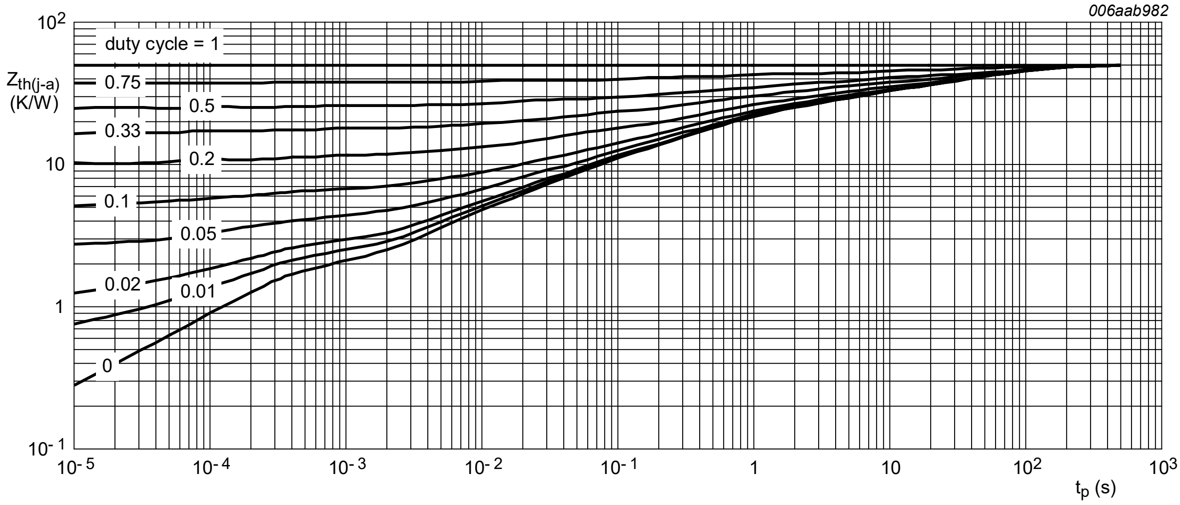
FR4 PCB, 4-layer copper, standard footprint

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^2

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



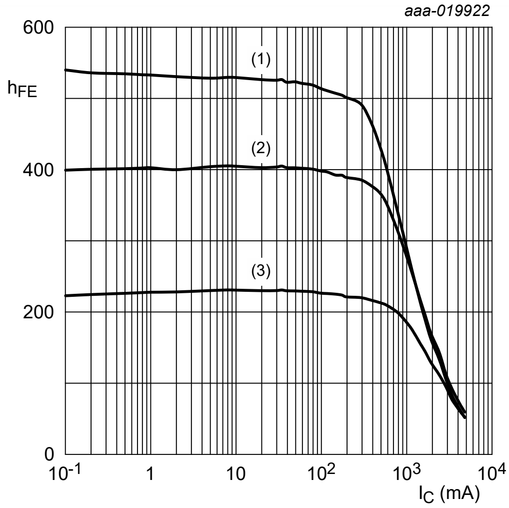
Ceramic PCB, Al_2O_3, standard footprint

Fig. 7. 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} = 64 V; I_E = 0 A; T_{amb} = 25 °C	-	-	100	nA
		V_{CB} = 64 V; I_E = 0 A; T_j = 150 °C	-	-	50	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5.6 V; I_C = 0 A; T_{amb} = 25 °C	-	-	100	nA
I_{CES}	collector-emitter cut-off current	V_{CE} = 48 V; V_{BE} = 0 V; T_{amb} = 25 °C	-	-	100	nA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 0.05 A; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C	200	380	-	
		V_{CE} = 5 V; I_C = 0.5 A; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C	200	360	-	
		V_{CE} = 5 V; I_C = 1 A; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C	200	330	-	
		V_{CE} = 5 V; I_C = 2 A; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C	125	220	-	
		V_{CE} = 5 V; I_C = 3 A; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C	75	140	-	
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	-	45	60	mV
		I_C = 1 A; I_B = 100 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C	-	80	110	mV
		I_C = 2 A; I_B = 200 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C	-	150	210	mV
		I_C = 3 A; I_B = 300 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C	-	220	325	mV
R_{CEsat}	collector-emitter saturation resistance		-	73	108	mΩ
V_{BEsat}	base-emitter saturation voltage	I_C = 2 A; I_B = 100 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C	-	0.9	1.1	V
V_{BEon}	base-emitter turn-on voltage	V_{CE} = 5 V; I_C = 1 A; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C	-	0.75	0.95	V
t_d	delay time	I_C = 2 A; I_{Bon} = 0.1 A; I_{Boff} = -0.1 A; T_{amb} = 25 °C	-	11	-	ns
t_r	rise time		-	130	-	ns
t_{on}	turn-on time		-	141	-	ns
t_s	storage time		-	200	-	ns
t_f	fall time		-	110	-	ns
t_{off}	turn-off time		-	310	-	ns
f_T	transition frequency	V_{CE} = 10 V; I_C = 100 mA; f = 100 MHz; T_{amb} = 25 °C	75	160	-	MHz
C_c	collector capacitance	V_{CB} = 10 V; I_E = 0 A; i_e = 0 A; f = 1 MHz; T_{amb} = 25 °C	-	11	14	pF



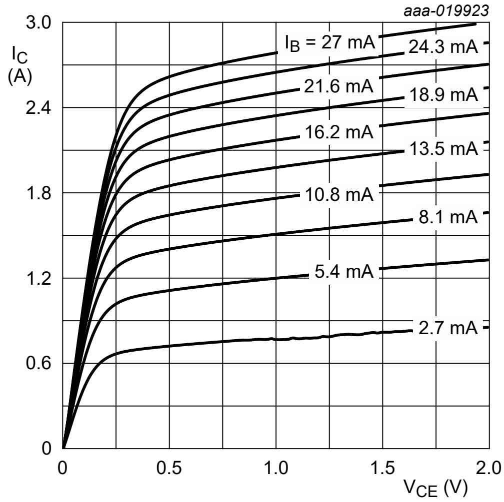
V_{CE} = 2 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

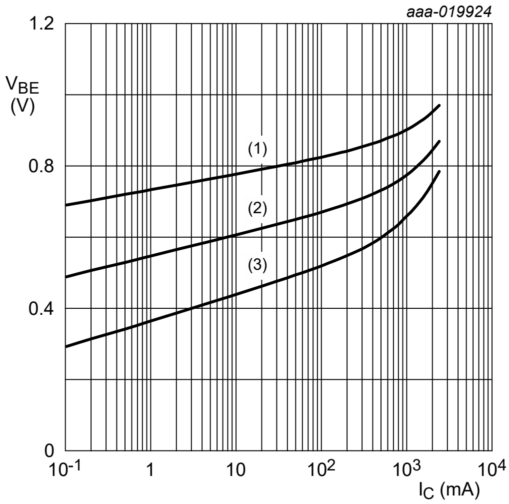
(3) T_{amb} = −55 °C

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



T_{amb} = 25 °C

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



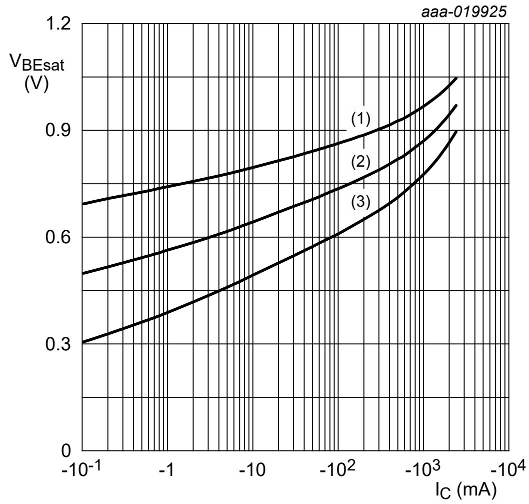
V_{CE} = 2 V

(1) T_{amb} = −55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



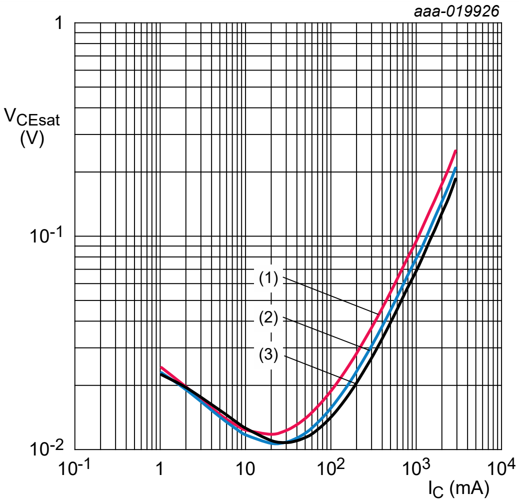
I_C/I_B = 20

(1) T_{amb} = −55 °C

(2) T_{amb} = 25 °C

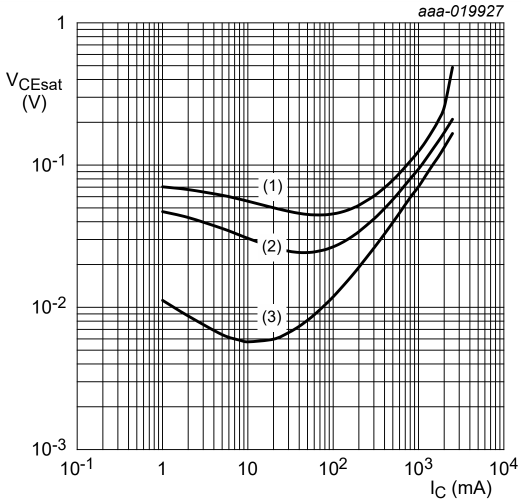
(3) T_{amb} = 100 °C

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



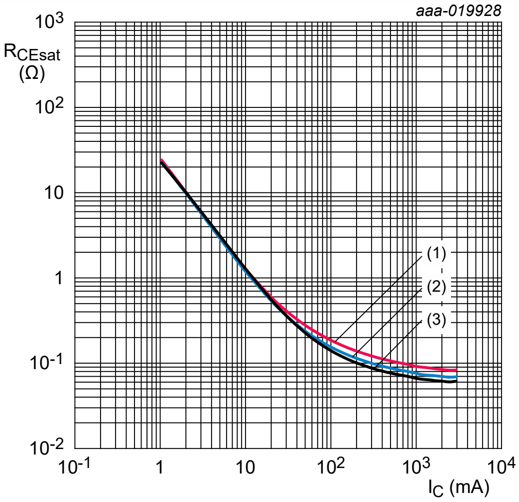
$I_C/I_B = 20$
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −55 °C

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



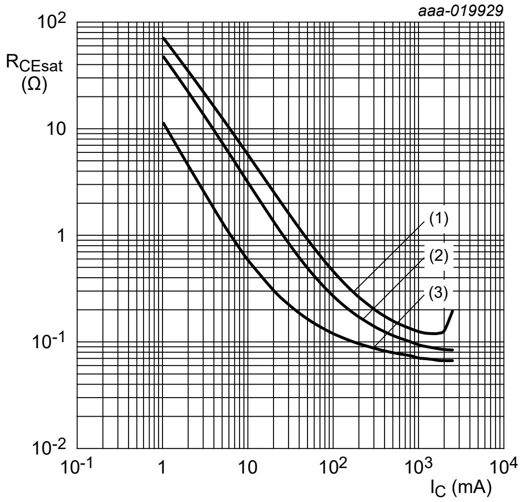
T_{amb} = 25 °C
(1) $I_C/I_B = 100$
(2) $I_C/I_B = 50$
(3) $I_C/I_B = 10$

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



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

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



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

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

11. Test information

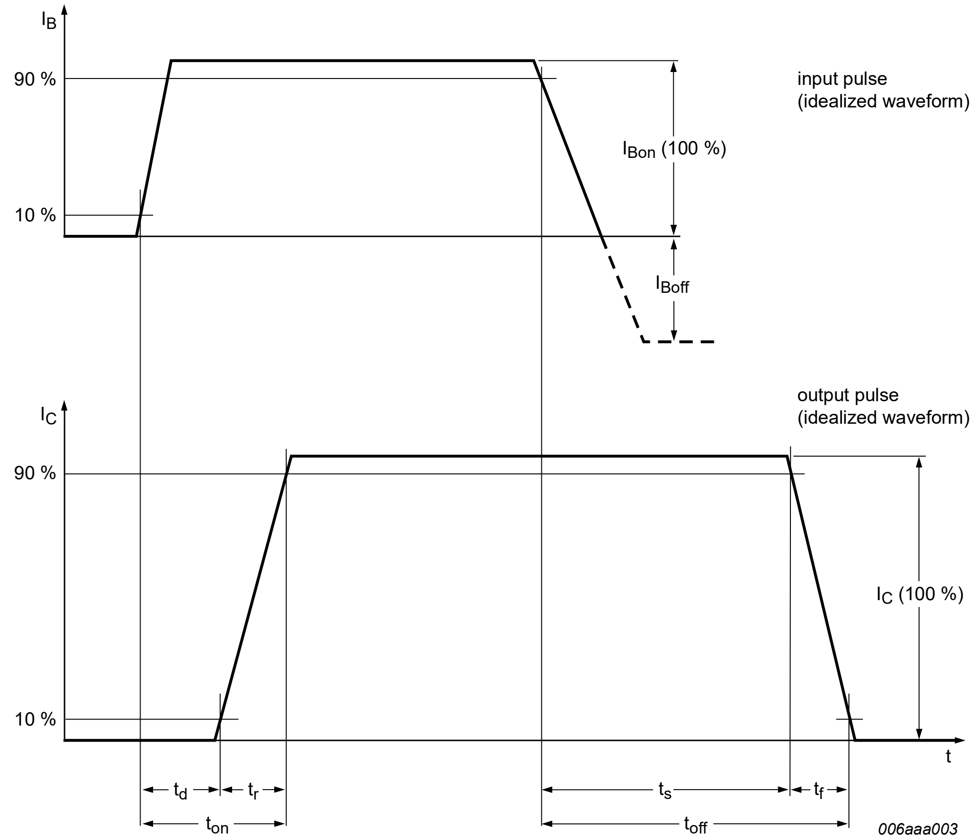


Fig. 16. Switching time definition

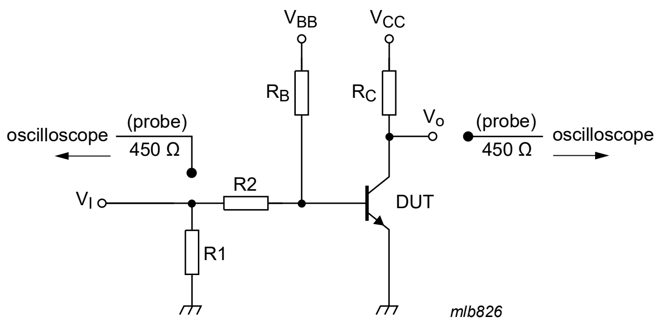


Fig. 17. Test circuit for switching times

12. Package outline

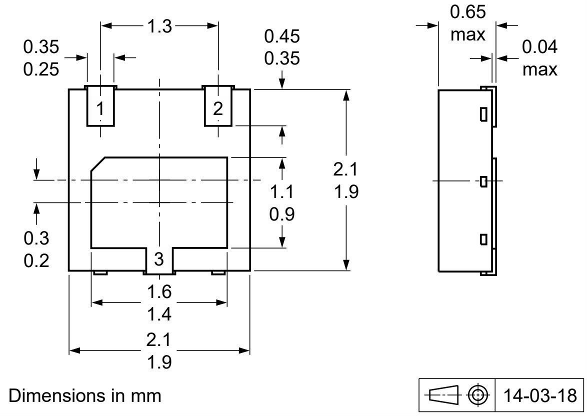


Fig. 18. Package outline DFN2020D-3 (SOT1061D)

13. Soldering

Footprint information for reflow soldering of DFN2020D-3 package **SOT1061D**

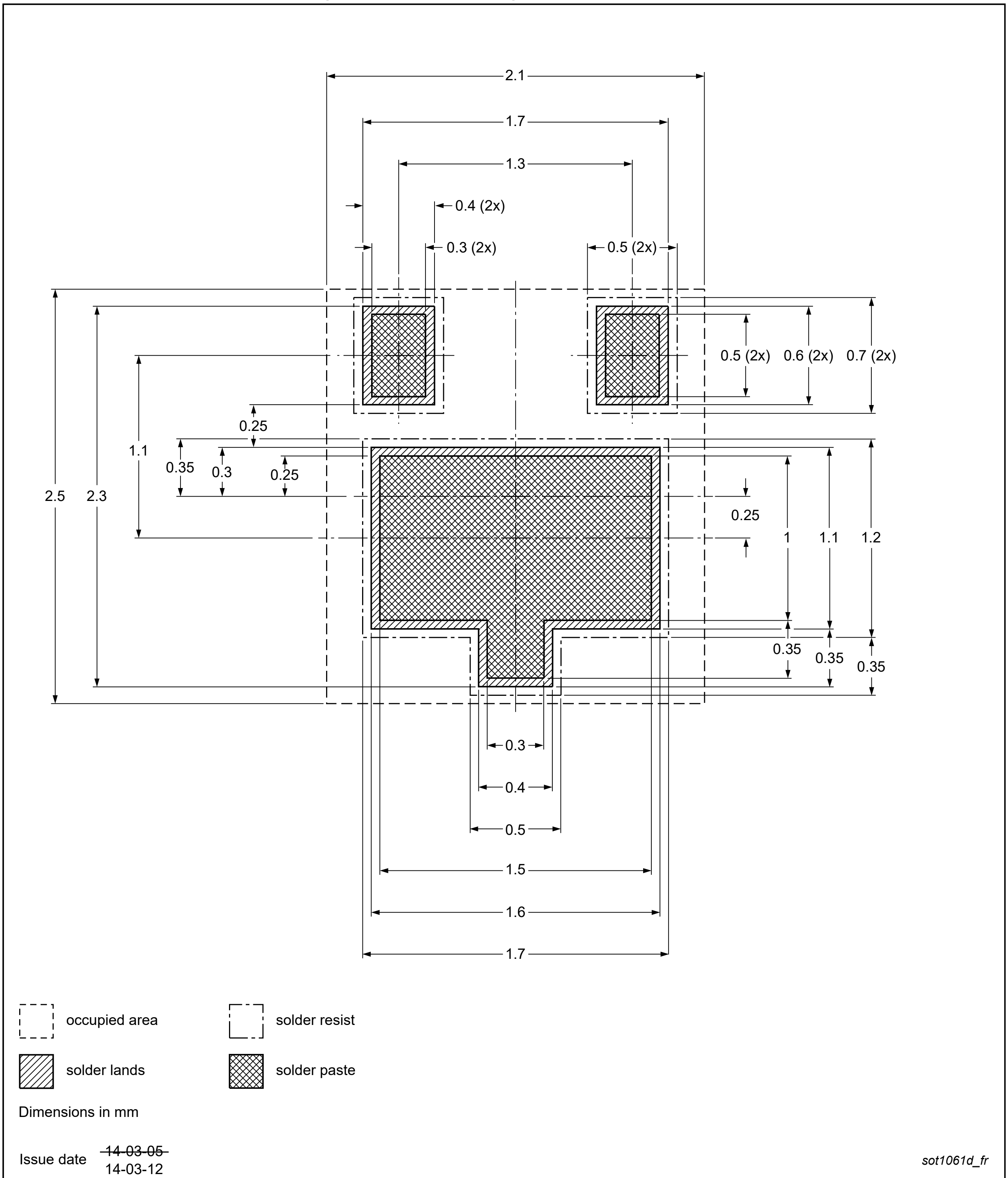


Fig. 19. Reflow soldering footprint for DFN2020D-3 (SOT1061D)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4360PAS v.3	20230701	Product data sheet	-	PBSS4360PAS v.2
Modifications:	• Product changed to non automotive. Please refer to the automotive product(s) with -Q.			
PBSS4360PAS v.2	20220318	Product data sheet	-	PBSS4360PAS v.1
PBSS4360PAS v.1	20151016	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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Date of release: 1 July 2023