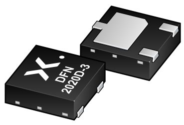
THE DATASHEET OF

MIMXRT1024DAG5B



PBSS4310PAS-Q

10 V, 3 A NPN low VCEsat transistor

20 December 2024 — Product data sheet

1. General description

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

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 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
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

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

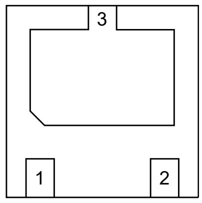
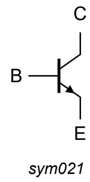
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base		-	-	10	V
I_C	collector current			-	-	3	A
h_{FE}	DC current gain	V_{CE} = 2 V; I_C = 100 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		325	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 1 A; I_B = 10 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		-	-	55	mV

5. Pinning information

Table 2. Pinning information

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

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4310PAS-Q	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
PBSS4310PAS-Q	F2

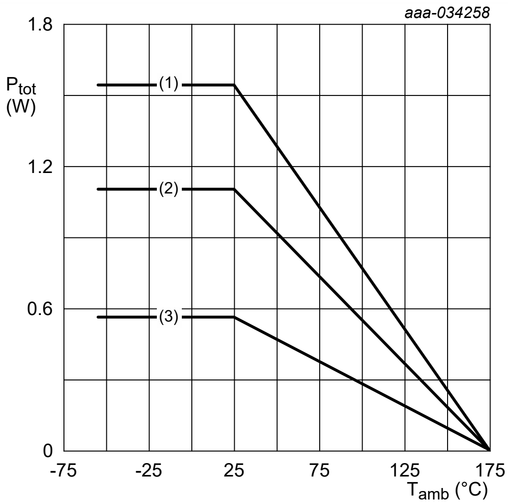
8. Limiting values

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		-	10	V
V_{CEO}	collector-emitter voltage	open base		-	10	V
V_{EBO}	emitter-base voltage	open collector		-	8	V
I_C	collector current			-	3	A
I_{CM}	peak collector current	single pulse; $t_p \leq$ 1 ms		-	5	A
I_B	base current			-	500	mA
P_{tot}	total power dissipation	$T_{amb} \leq$ 25 °C	[1]	-	560	mW
			[2]	-	1.1	W
			[3]	-	1.54	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, single-sided copper, tin-plated, mounting pad for collector 6 cm^2.



(1) FR4 PCB, single-sided copper, 6 cm^2
(2) FR4 PCB, single-sided copper, 1 cm^2
(3) 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]	-	-	268	K/W
			[2]	-	-	137	K/W
			[3]	-	-	98	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	7	K/W

[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, single-sided copper, tin-plated, mounting pad for collector 6 cm^2.

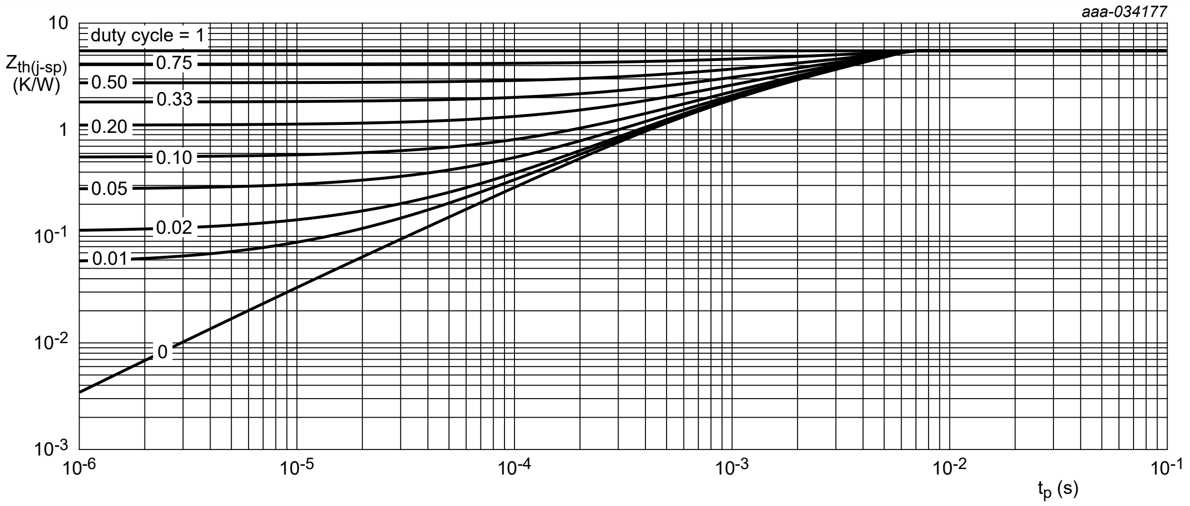


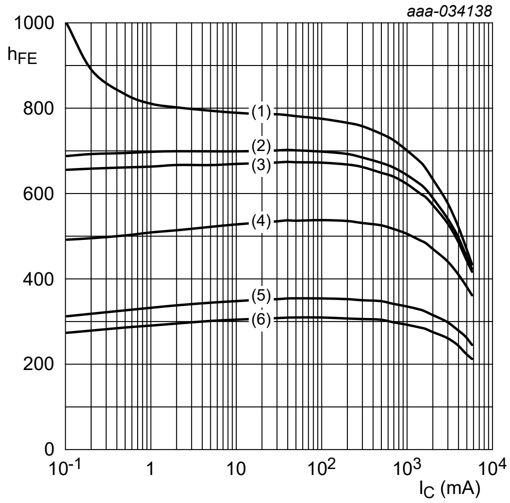
Fig. 2. Transient thermal impedance from junction to solderpoint as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

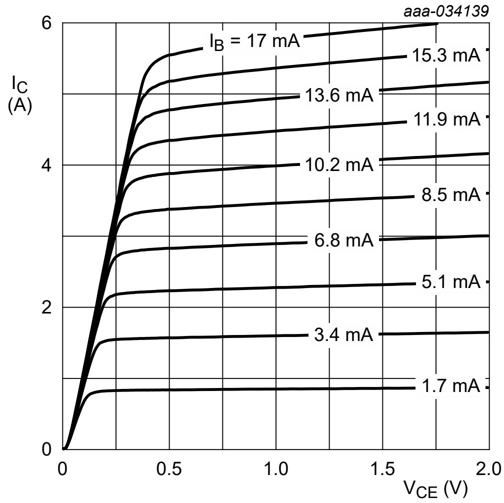
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 100 μA; I_E = 0 A		10	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 10 mA; I_B = 0 A		10	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 100 μA; I_C = 0 A		8	-	-	V
I_{CBO}	collector-base cut-off current	V_{CB} = 8 V; I_E = 0 A; T_{amb} = 25 °C		-	-	100	nA
		V_{CB} = 8 V; I_E = 0 A; T_j = 125 °C		-	-	50	μA
I_{CES}	collector-emitter cut-off current	V_{CE} = 8 V; V_{BE} = 0 V; T_{amb} = 25 °C		-	-	100	nA
I_{EBO}	emitter-base cut-off current	V_{EB} = 6.4 V; I_C = 0 A; T_{amb} = 25 °C		-	-	100	nA

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
h_{FE}	DC current gain	V_{CE} = 2 V; I_C = 100 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		325	-	-	
		V_{CE} = 2 V; I_C = 500 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		325	-	-	
		V_{CE} = 2 V; I_C = 1 A; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		300	-	-	
		V_{CE} = 2 V; I_C = 2 A; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		275	-	-	
		V_{CE} = 2 V; I_C = 3 A; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		250	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		-	-	25	mV
		I_C = 1 A; I_B = 50 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		-	-	35	mV
		I_C = 1 A; I_B = 10 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		-	-	55	mV
		I_C = 2 A; I_B = 20 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		-	-	85	mV
		I_C = 3 A; I_B = 150 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		-	-	90	mV
		I_C = 3 A; I_B = 30 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		-	-	110	mV
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		-	-	1	V
		I_C = 3 A; I_B = 300 mA; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		-	-	1.2	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		-	-	845	mV
t_d	delay time	I_C = 2 A; I_{Bon} = 100 mA; I_{Boff} = -100 mA; T_{amb} = 25 °C		-	16	-	ns
t_r	rise time			-	55	-	ns
t_s	storage time			-	190	-	ns
t_f	fall time			-	48	-	ns
f_T	transition frequency	V_{CE} = 5 V; I_C = 100 mA; f = 100 MHz; T_{amb} = 25 °C		-	80	-	MHz
C_c	collector capacitance	V_{CB} = 10 V; I_E = 0 A; i_e = 0 A; f = 1 MHz; T_{amb} = 25 °C		-	75	-	pF



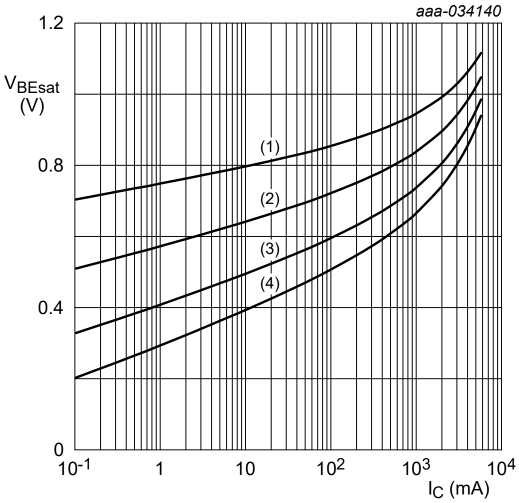
V_{CE} = 5 V
(1) T_{amb} = 150 °C
(2) T_{amb} = 100 °C
(3) T_{amb} = 85 °C
(4) T_{amb} = 25 °C
(5) T_{amb} = −40 °C
(6) T_{amb} = −55 °C

Fig. 3. DC current gain as a function of collector current; typical values



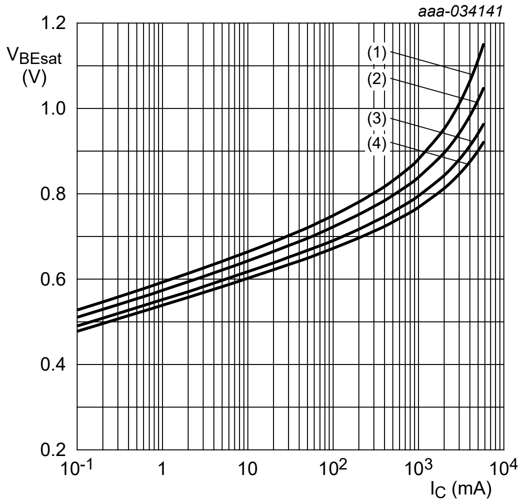
T_{amb} = 25 °C

Fig. 4. Collector current as a function of collector-emitter voltage; typical values



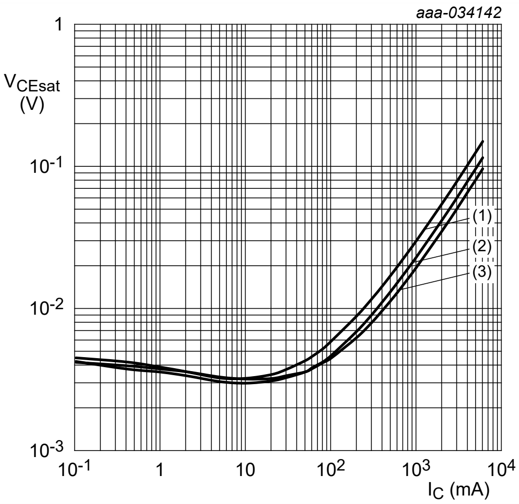
I_C/I_B = 20
(1) T_{amb} = −55 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C
(4) T_{amb} = 150 °C

Fig. 5. Base-emitter saturation voltage as a function of collector current; typical values



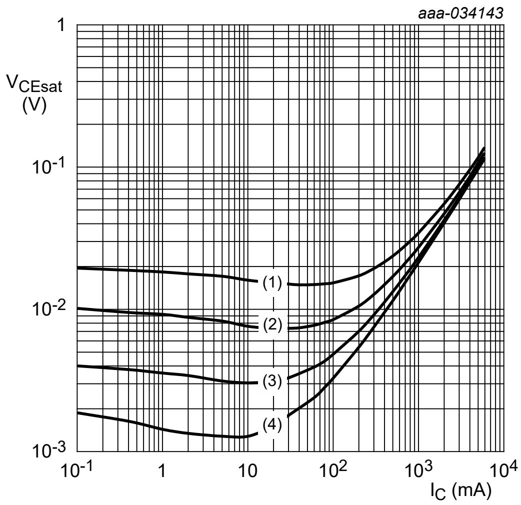
T_{amb} = 25 °C
(1) I_C/I_B = 10
(2) I_C/I_B = 20
(3) I_C/I_B = 50
(4) I_C/I_B = 100

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



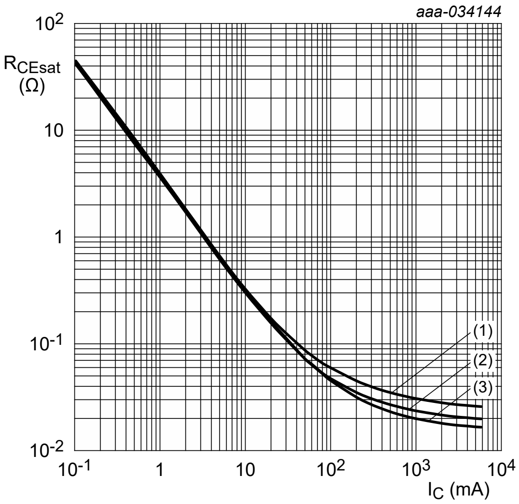
I_C/I_B = 20
(1) T_{amb} = 125 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −40 °C

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



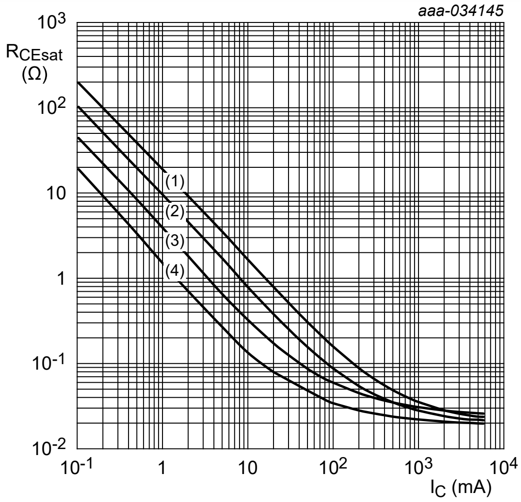
T_{amb} = 25 °C
(1) I_C/I_B = 100
(2) I_C/I_B = 50
(3) I_C/I_B = 20
(4) I_C/I_B = 10

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



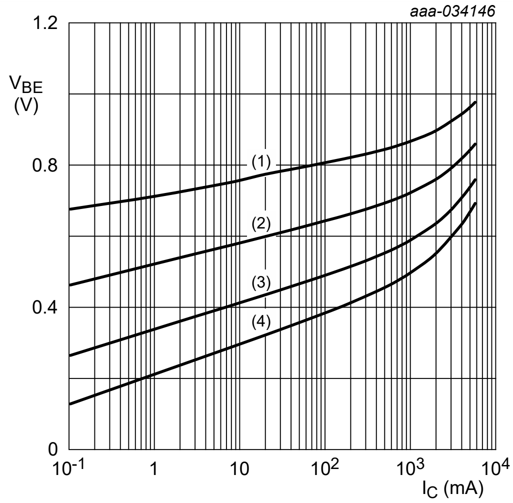
I_C/I_B = 20
(1) T_{amb} = 125 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −40 °C

Fig. 9. 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 = 20
(4) I_C/I_B = 10

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



V_{CE} = 2 V
(1) T_{amb} = −55 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C
(4) T_{amb} = 150 °C

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

11. Test information

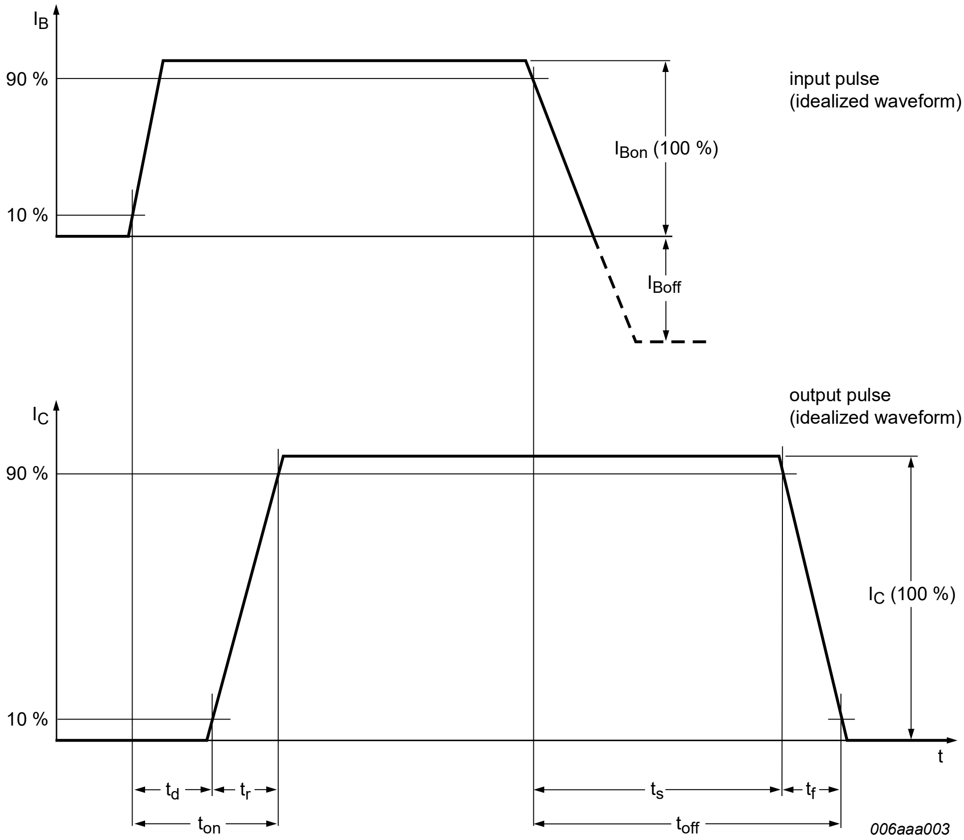


Fig. 12. Switching time definition

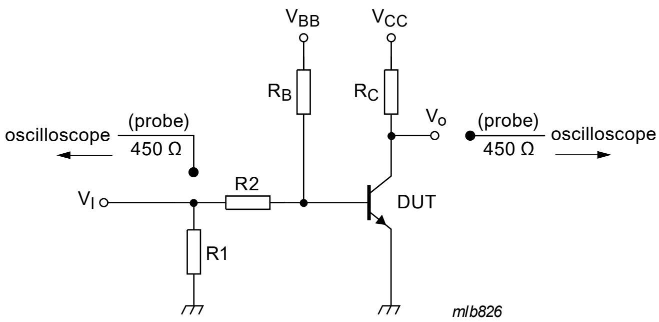


Fig. 13. Test circuit for switching times

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

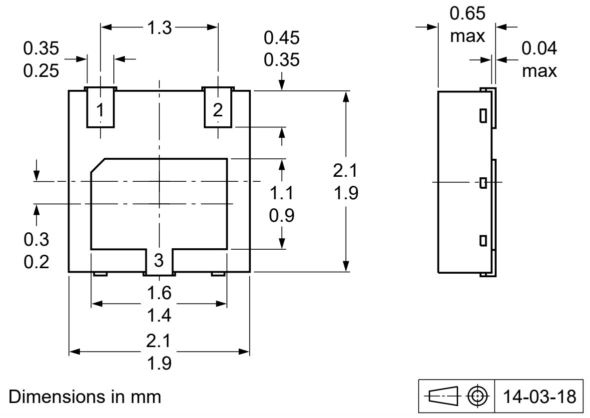


Fig. 14. Package outline DFN2020D-3 (SOT1061D)

13. Soldering

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

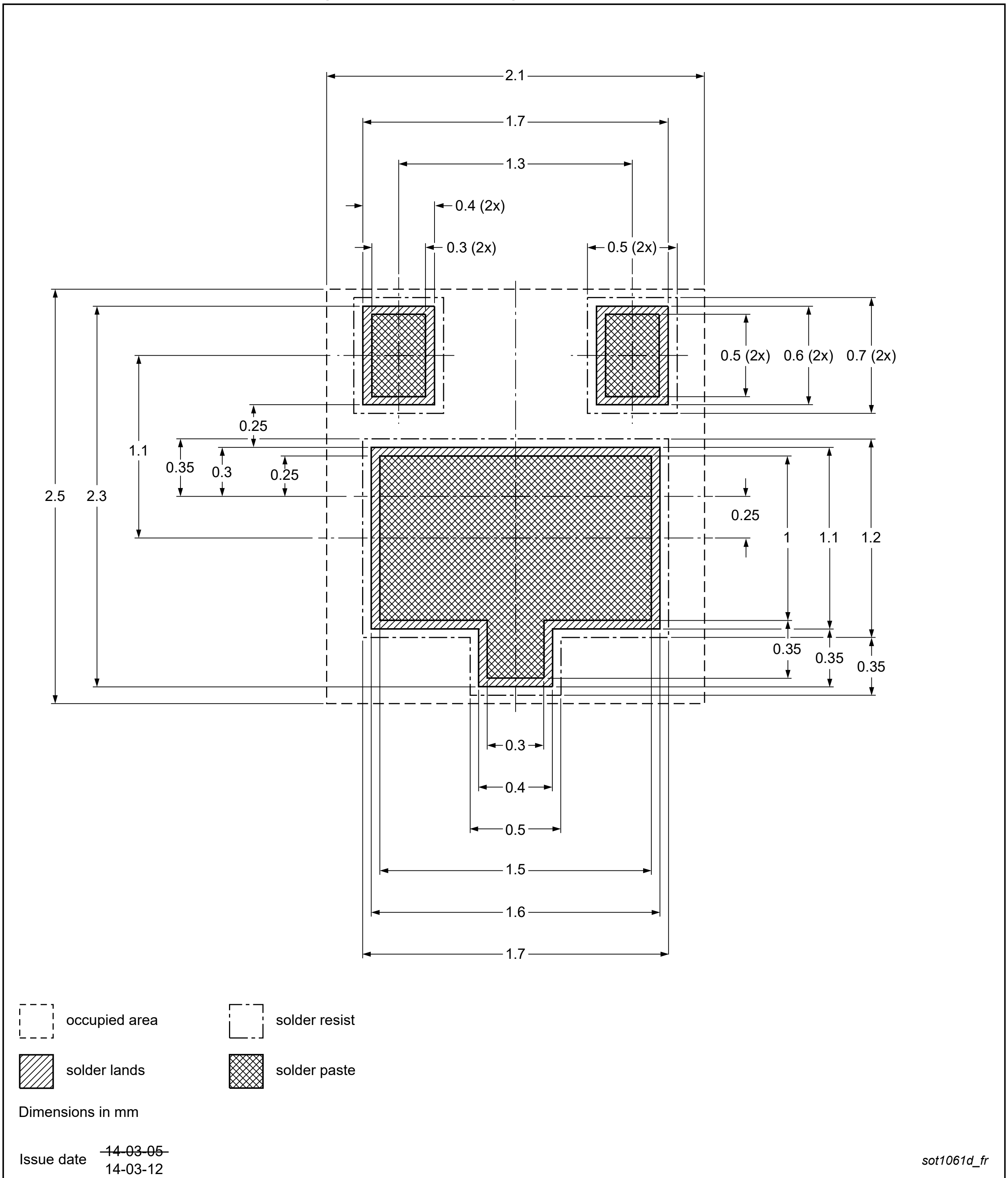


Fig. 15. Reflow soldering footprint for DFN2020D-3 (SOT1061D)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4310PAS-Q v.4	20241220	Product data sheet	-	PBSS4310PAS-Q v.3
Modifications:	• Characteristics: Graphs in figures 7 and 9 corrected			
PBSS4310PAS-Q v.3	20220121	Product data sheet	-	PBSS4310PAS-Q v.2
PBSS4310PAS-Q v.2	20211215	Product data sheet	-	PBSS4310PAS-Q v.1
PBSS4310PAS-Q v.1	20211203	Preliminary 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".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

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Date of release: 20 December 2024