



# PBSS4260PANPS

60 V, 2 A NPN/PNP low  $V_{CEsat}$  (BISS) double transistor

4 February 2016

Product data sheet

## 1. General description

NPN/PNP low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) double transistor in a leadless medium power DFN2020D-6 (SOT1118D) Surface-Mounted Device (SMD) plastic package with visible and solderable side pads.

NPN/NPN complement: PBSS4260PANS

PNP/PNP complement: PBSS5260PAPS

## 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  $I_C$
- Reduced Printed-Circuit Board (PCB) requirements
- Exposed heat sink for excellent thermal and electrical conductivity
- High energy efficiency due to less heat generation
- Suitable for Automatic Optical Inspection (AOI) of solder joints
- AEC-Q101 qualified

## 3. Applications

- Load switch
- Battery-driven devices
- Power management
- Charging circuits
- LED lighting
- Power switches (e.g. motors, fans)

## 4. Quick reference data

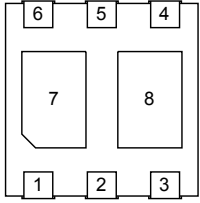
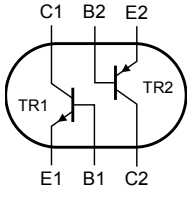
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor, for the PNP transistor with negative polarity</b>						
$V_{CEO}$	collector-emitter voltage	open base	-	-	60	V
$I_C$	collector current		-	-	2	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	3	A

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR1 (NPN)</b>						
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = 1\text{ A}$ ; $I_B = 50\text{ mA}$ ; pulsed; $t_p \leq 300\ \mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^\circ\text{C}$	-	-	200	m $\Omega$
<b>TR2 (PNP)</b>						
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -1\text{ A}$ ; $I_B = -50\text{ mA}$ ; pulsed; $t_p \leq 300\ \mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^\circ\text{C}$	-	-	310	m $\Omega$

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E1	emitter TR1	 <p>Transparent top view <b>DFN2020D-6 (SOT1118D)</b></p>	 <p><i>sym139</i></p>
2	B1	base TR1		
3	C2	collector TR2		
4	E2	emitter TR2		
5	B2	base TR2		
6	C1	collector TR1		
7	C1	collector TR1		
8	C2	collector TR2		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4260PANPS	DFN2020D-6	DFN2020D-6: plastic, thermally enhanced ultra thin and small outline package; no leads; 6 terminals; body 2 x 2 x 0.65 mm	SOT1118D

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4260PANPS	3D

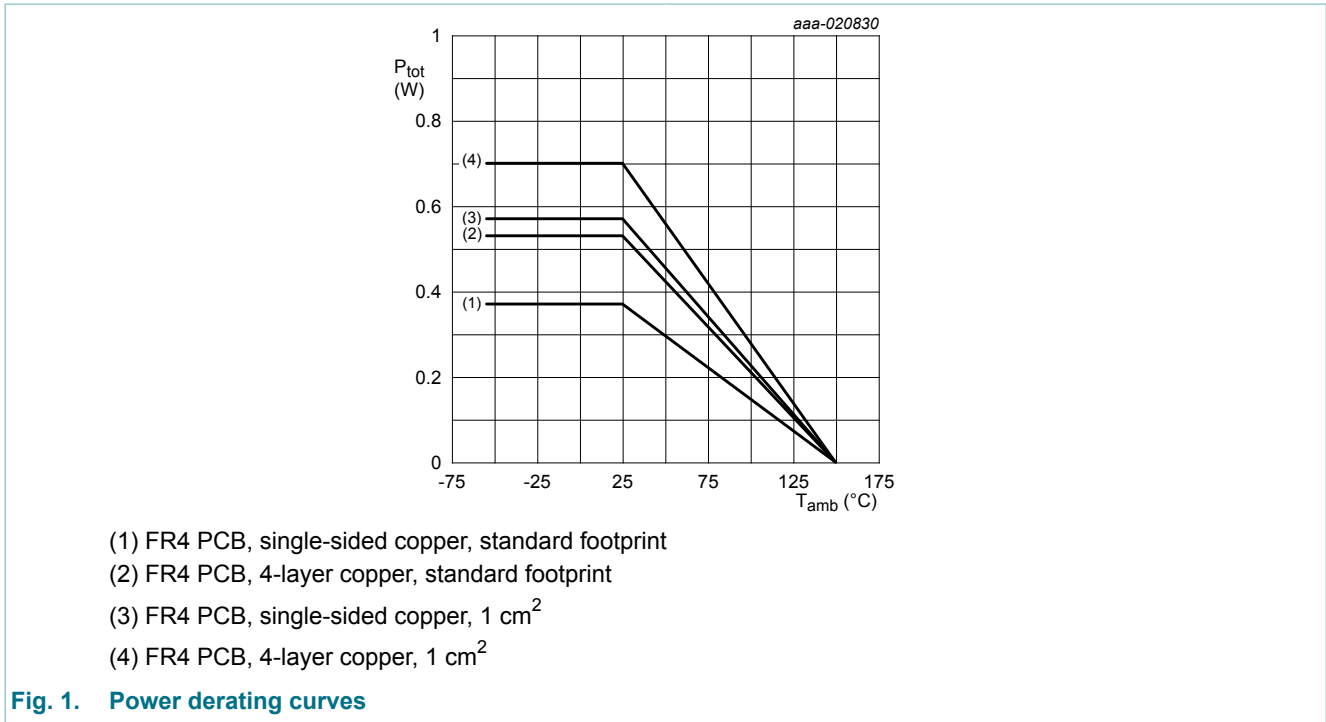
## 8. Limiting values

**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
<b>Per transistor, for the PNP transistor with negative polarity</b>						
V <sub>CB0</sub>	collector-base voltage	open emitter		-	60	V
V <sub>CEO</sub>	collector-emitter voltage	open base		-	60	V
V <sub>EBO</sub>	emitter-base voltage	open collector		-	7	V
I <sub>C</sub>	collector current			-	2	A
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms		-	3	A
I <sub>B</sub>	base current			-	0.3	A
I <sub>BM</sub>	peak base current	single pulse; t <sub>p</sub> ≤ 1 ms		-	1	A
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	370	mW
			[2]	-	570	mW
			[3]	-	530	mW
			[4]	-	700	mW
<b>Per device</b>						
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	510	mW
			[2]	-	780	mW
			[3]	-	730	mW
			[4]	-	960	mW
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 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 Printed-Circuit Board (PCB), single sided copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on an FR4 Printed-Circuit Board (PCB), 4-layer copper, tin-plated and standard footprint.
- [4] Device mounted on an FR4 Printed-Circuit Board (PCB), 4-layer copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.

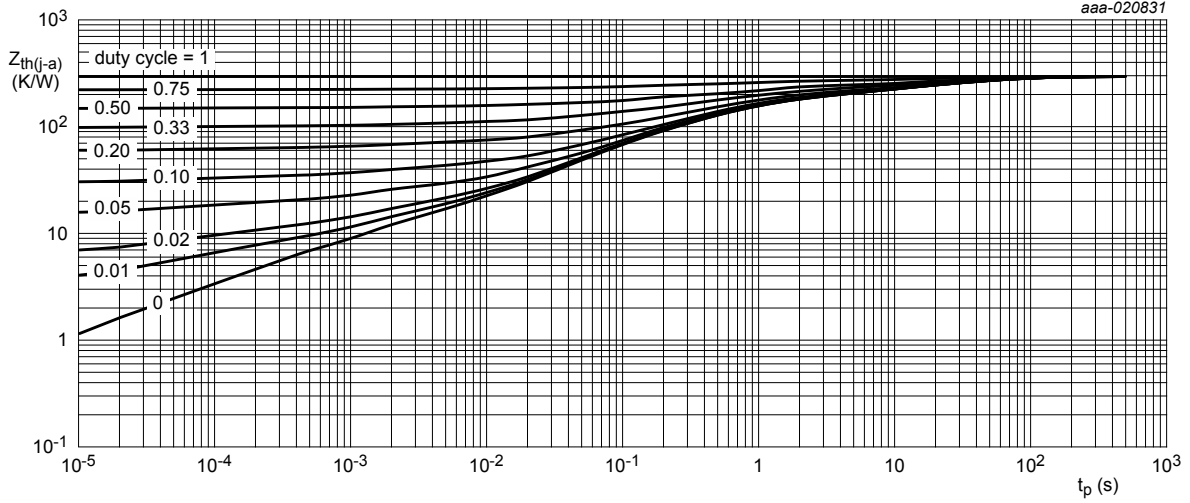


## 9. Thermal characteristics

**Table 6. Thermal characteristics**

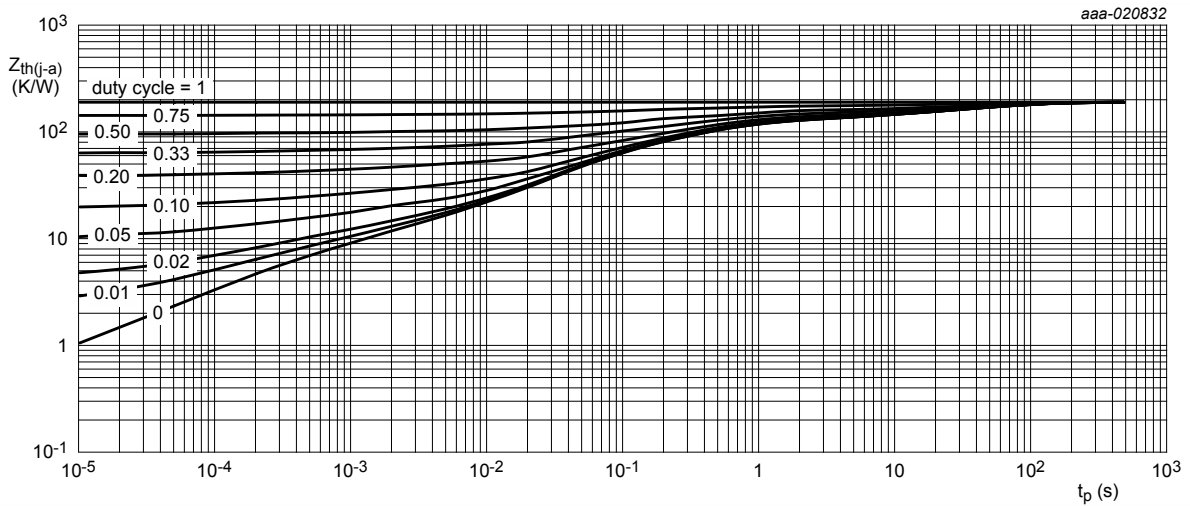
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Per transistor</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	338	K/W
			[2]	-	-	219	K/W
			[3]	-	-	236	K/W
			[4]	-	-	179	K/W
<b>Per device</b>							
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	246	K/W
			[2]	-	-	161	K/W
			[3]	-	-	172	K/W
			[4]	-	-	131	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 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on an FR4 Printed-Circuit Board (PCB), 4-layer copper, tin-plated and standard footprint.
- [4] Device mounted on an FR4 Printed-Circuit Board (PCB), 4-layer copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.



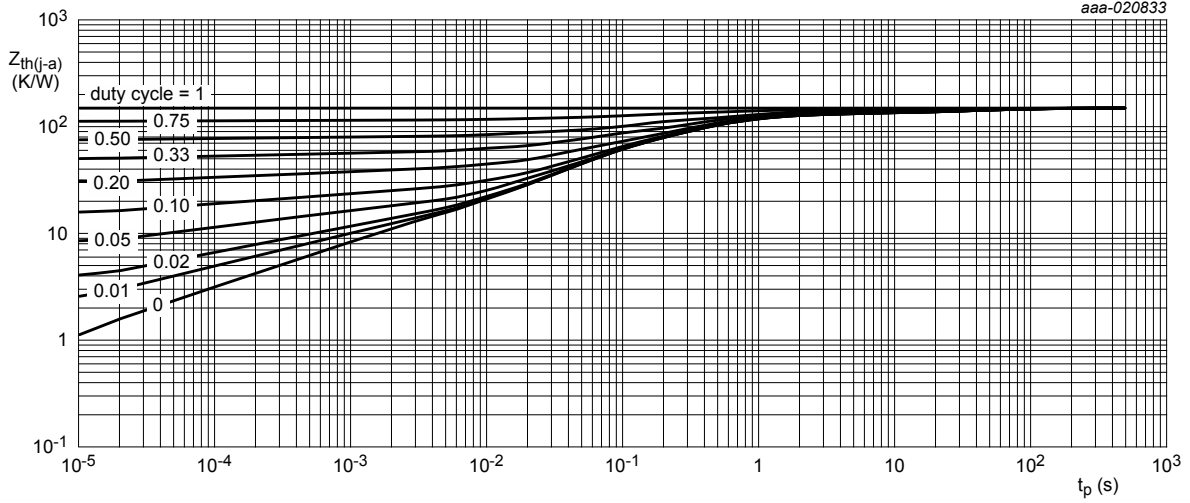
FR4 PCB, standard footprint

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



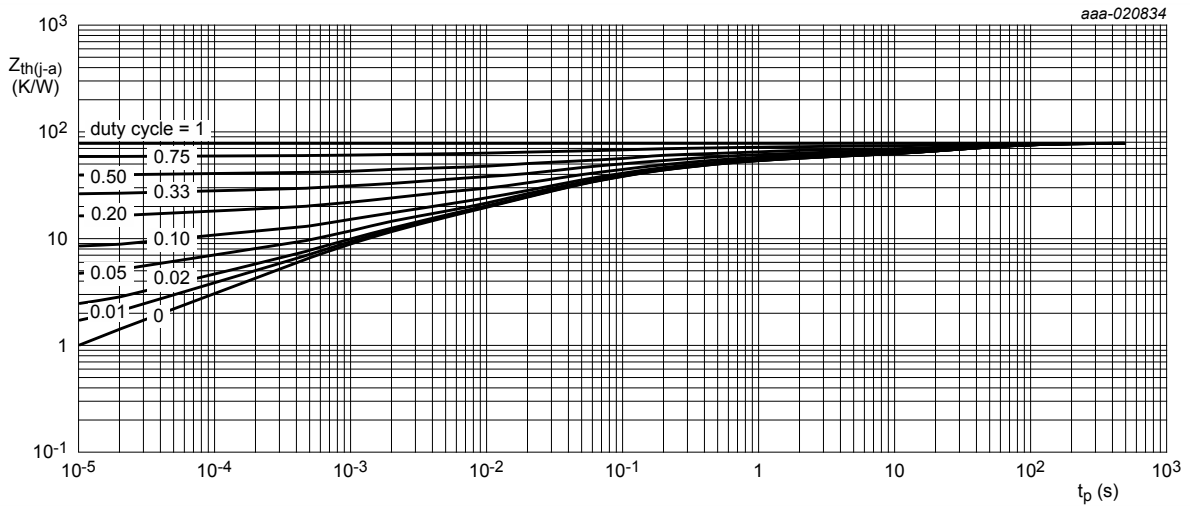
FR4 PCB, mounting pad for collector  $1 \text{ cm}^2$

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



FR4 PCB, 4-layer copper, standard footprint

Fig. 4. 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. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

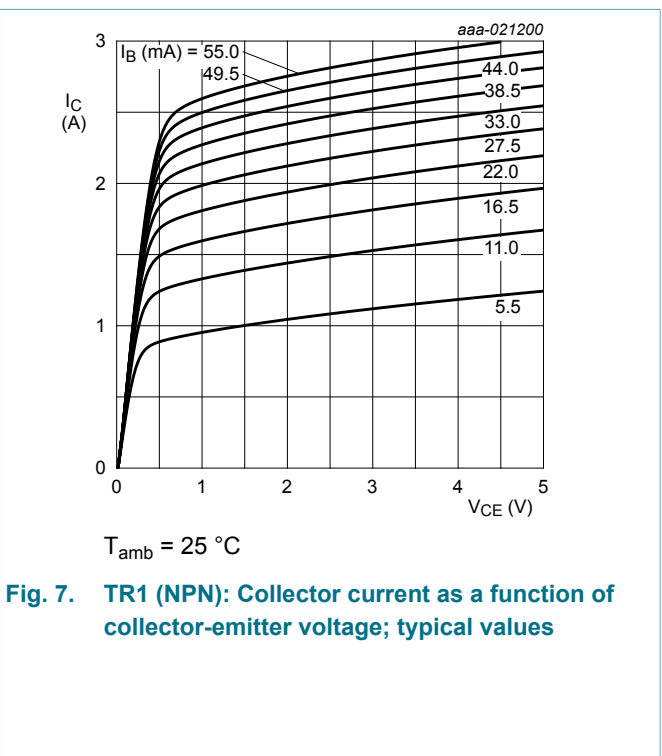
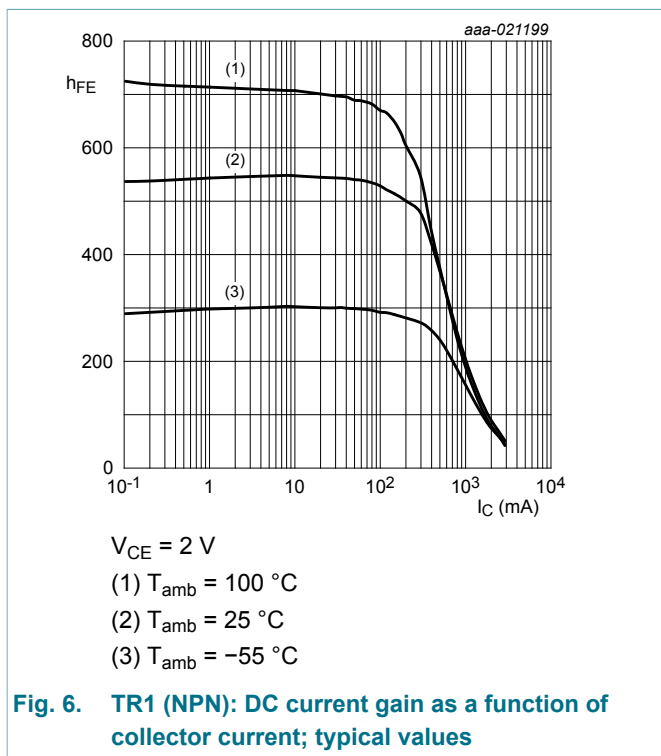
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TR1 (NPN)</b>						
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = 48 V; I <sub>E</sub> = 0 A; T <sub>amb</sub> = 25 °C	-	-	100	nA
		V <sub>CB</sub> = 48 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	50	μA
I <sub>CES</sub>	collector-emitter cut-off current	V <sub>CE</sub> = 48 V; V <sub>BE</sub> = 0 V; T <sub>amb</sub> = 25 °C	-	-	100	nA
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = 5 V; I <sub>C</sub> = 0 A; T <sub>amb</sub> = 25 °C	-	-	100	nA
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = 2 V; I <sub>C</sub> = 100 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	250	400	-	
		V <sub>CE</sub> = 2 V; I <sub>C</sub> = 500 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	210	330	-	
		V <sub>CE</sub> = 2 V; I <sub>C</sub> = 1 A; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	120	190	-	
		V <sub>CE</sub> = 2 V; I <sub>C</sub> = 2 A; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02	50	80	-	
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = 0.5 A; I <sub>B</sub> = 50 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	-	70	100	mV
		I <sub>C</sub> = 1 A; I <sub>B</sub> = 50 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	-	140	200	mV
		I <sub>C</sub> = 2 A; I <sub>B</sub> = 200 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	-	260	350	mV
R <sub>CEsat</sub>	collector-emitter saturation resistance	I <sub>C</sub> = 1 A; I <sub>B</sub> = 50 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	-	-	200	mΩ
V <sub>BEsat</sub>	base-emitter saturation voltage	I <sub>C</sub> = 0.5 A; I <sub>B</sub> = 50 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	-	0.92	1	V
		I <sub>C</sub> = 1 A; I <sub>B</sub> = 50 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	0.96	1.1	V
		I <sub>C</sub> = 2 A; I <sub>B</sub> = 200 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	1.18	1.3	V
V <sub>BE</sub>	base-emitter voltage	I <sub>C</sub> = 0.5 A; V <sub>CE</sub> = 2 V; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	0.77	0.9	V
t <sub>d</sub>	delay time	I <sub>C</sub> = 1 A; I <sub>Bon</sub> = 50 mA; I <sub>Boff</sub> = -50 mA; T <sub>amb</sub> = 25 °C	-	10	-	ns
t <sub>r</sub>	rise time		-	140	-	ns
t <sub>on</sub>	turn-on time		-	150	-	ns
t <sub>s</sub>	storage time		-	445	-	ns

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_f$	fall time		-	180	-	ns
$t_{off}$	turn-off time		-	625	-	ns
$f_T$	transition frequency	$V_{CE} = 10\text{ V}$ ; $I_C = 500\text{ mA}$ ; $f = 100\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	-	140	-	MHz
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}$ ; $I_E = 0\text{ A}$ ; $i_e = 0\text{ A}$ ; $f = 1\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	-	6.5	-	pF
<b>TR2 (PNP)</b>						
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -48\text{ V}$ ; $I_E = 0\text{ A}$ ; $T_{amb} = 25\text{ °C}$	-	-	-100	nA
			-	-	-50	$\mu\text{A}$
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = -48\text{ V}$ ; $V_{BE} = 0\text{ V}$ ; $T_{amb} = 25\text{ °C}$	-	-	-100	nA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -5\text{ V}$ ; $I_C = 0\text{ A}$ ; $T_{amb} = 25\text{ °C}$	-	-	-100	nA
$h_{FE}$	DC current gain	$V_{CE} = -2\text{ V}$ ; $I_C = -100\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	170	250	-	
		$V_{CE} = -2\text{ V}$ ; $I_C = -500\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	140	200	-	
		$V_{CE} = -2\text{ V}$ ; $I_C = -1\text{ A}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	110	150	-	
		$V_{CE} = -2\text{ V}$ ; $I_C = -2\text{ A}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	50	75	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -0.5\text{ A}$ ; $I_B = -50\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	-	-100	-140	mV
		$I_C = -1\text{ A}$ ; $I_B = -50\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	-	-200	-310	mV
		$I_C = -2\text{ A}$ ; $I_B = -200\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	-	-350	-500	mV
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -1\text{ A}$ ; $I_B = -50\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	-	-	310	$\text{m}\Omega$
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -0.5\text{ A}$ ; $I_B = -50\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	-	-0.89	-1	V
		$I_C = -1\text{ A}$ ; $I_B = -50\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	-	-0.93	-1.1	V
		$I_C = -2\text{ A}$ ; $I_B = -200\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	-	-1.14	-1.25	V
$V_{BE}$	base-emitter voltage	$I_C = -0.5\text{ A}$ ; $V_{CE} = -2\text{ V}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	-	-0.77	-0.9	V
$t_d$	delay time	$I_C = -1\text{ A}$ ; $I_{Bon} = -50\text{ mA}$ ; $I_{Boff} = 50\text{ mA}$ ; $T_{amb} = 25\text{ °C}$	-	10	-	ns
$t_r$	rise time		-	80	-	ns



Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{on}$	turn-on time		-	90	-	ns
$t_s$	storage time		-	195	-	ns
$t_f$	fall time		-	75	-	ns
$t_{off}$	turn-off time		-	270	-	ns
$f_T$	transition frequency	$V_{CE} = -10\text{ V}; I_C = -500\text{ mA};$ $f = 100\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	100	-	MHz
$C_c$	collector capacitance	$V_{CB} = -10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A};$ $f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	16	-	pF



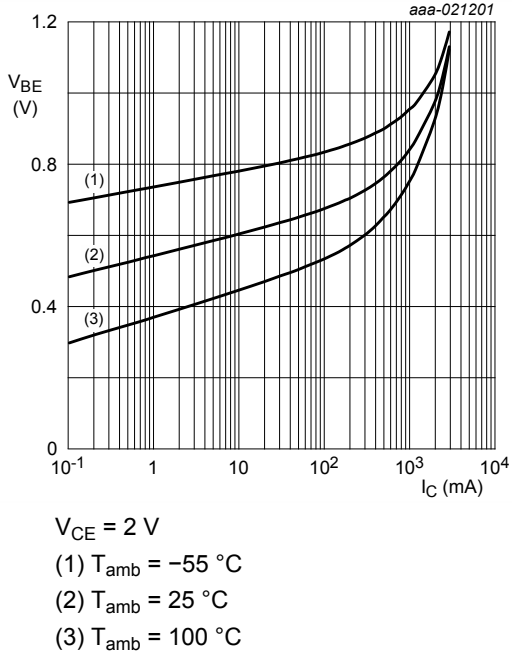


Fig. 8. TR1 (NPN): Base-emitter voltage as a function of collector current; typical values

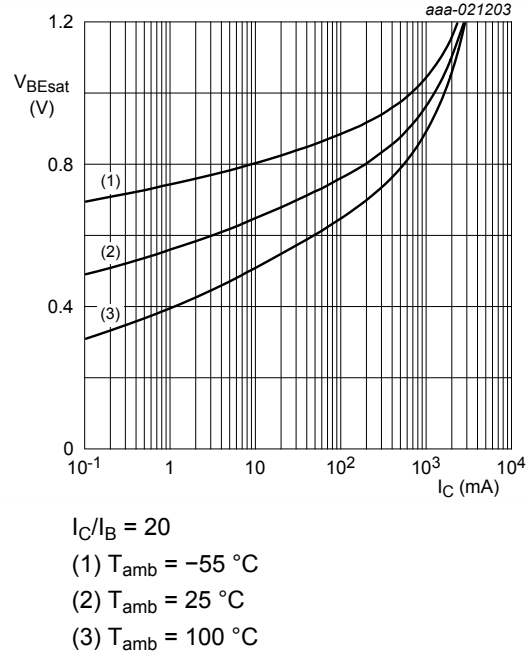


Fig. 9. TR1 (NPN): Base-emitter saturation voltage as a function of collector current; typical values

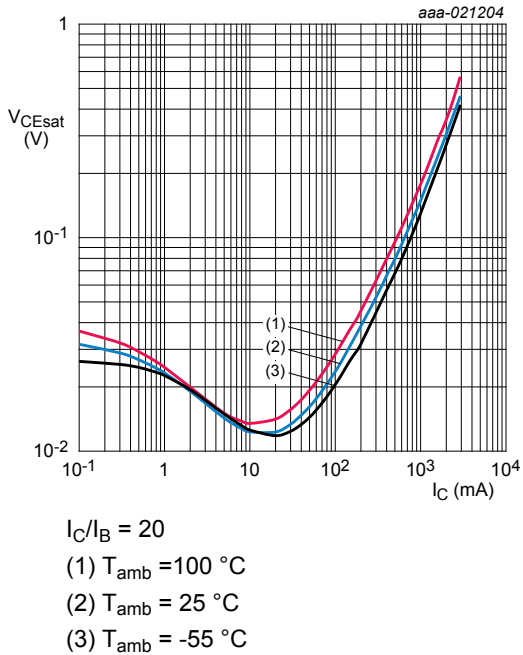


Fig. 10. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values

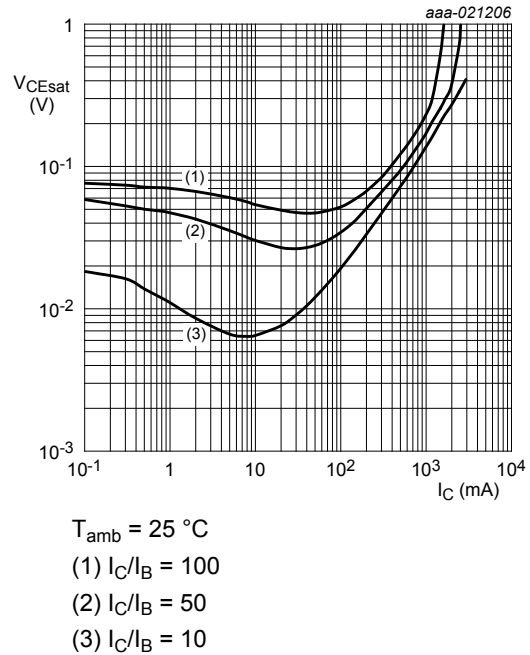
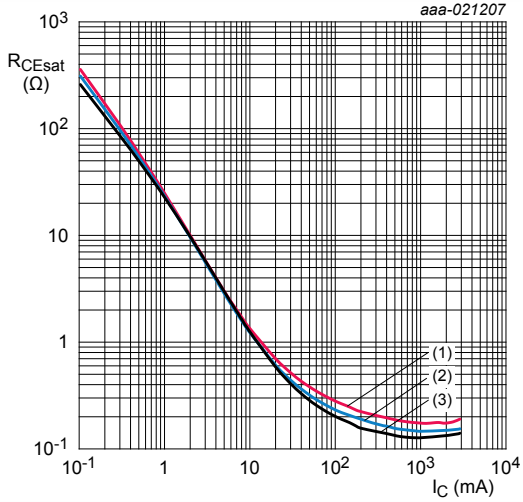
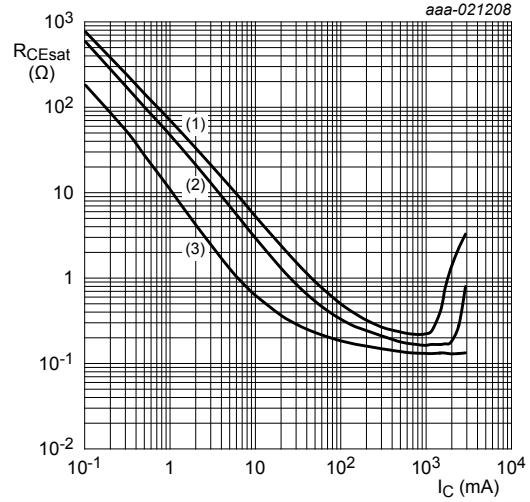


Fig. 11. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values



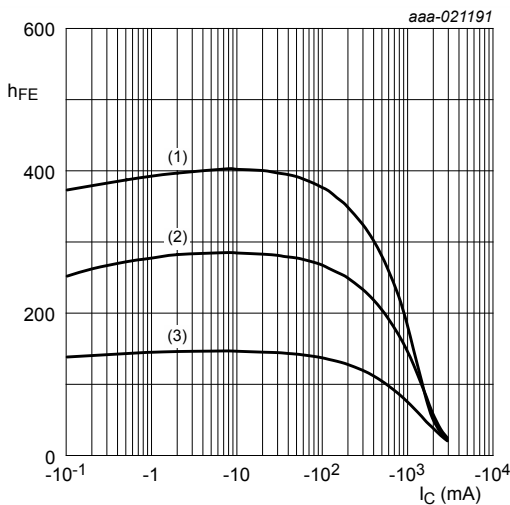
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig. 12. TR1 (NPN): Collector-emitter saturation resistance as a function of collector current; typical values**



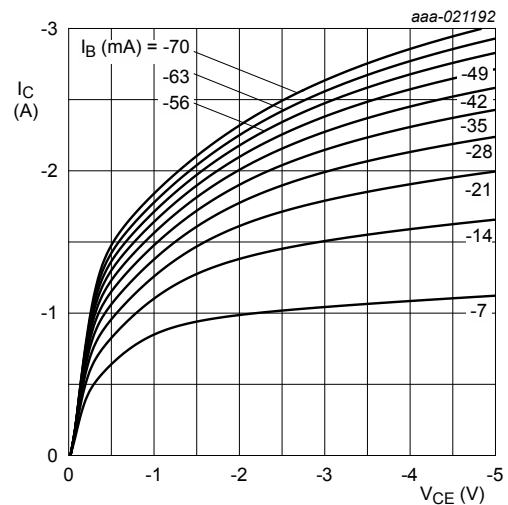
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

**Fig. 13. TR1 (NPN): Collector-emitter saturation resistance as a function of collector current; typical values**



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

**Fig. 14. TR2 (PNP): DC current gain as a function of collector current; typical values**



$T_{amb} = 25\text{ °C}$

**Fig. 15. TR2 (PNP): Collector current as a function of collector-emitter voltage; typical values**

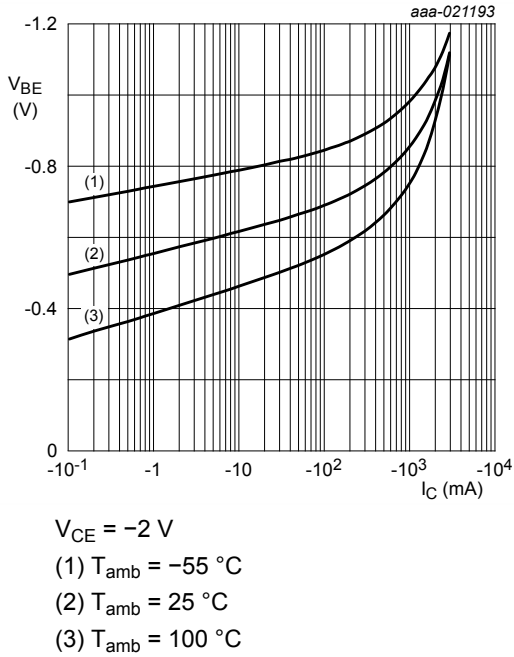


Fig. 16. TR2 (PNP): Base-emitter voltage as a function of collector current; typical values

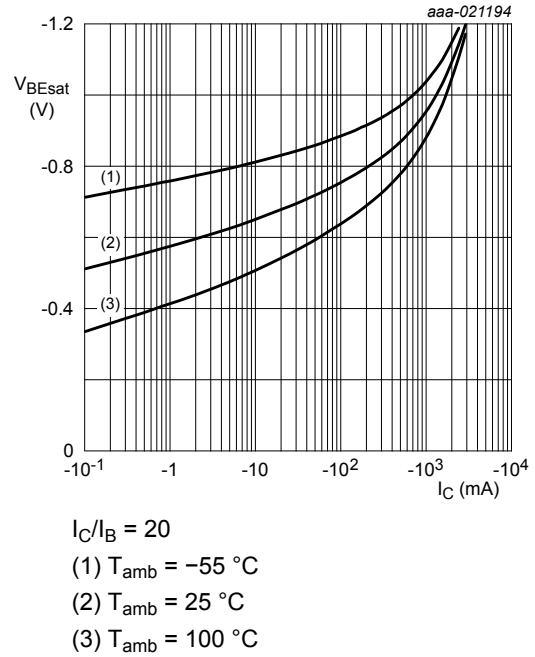


Fig. 17. TR2 (PNP): Base-emitter saturation voltage as a function of collector current; typical values

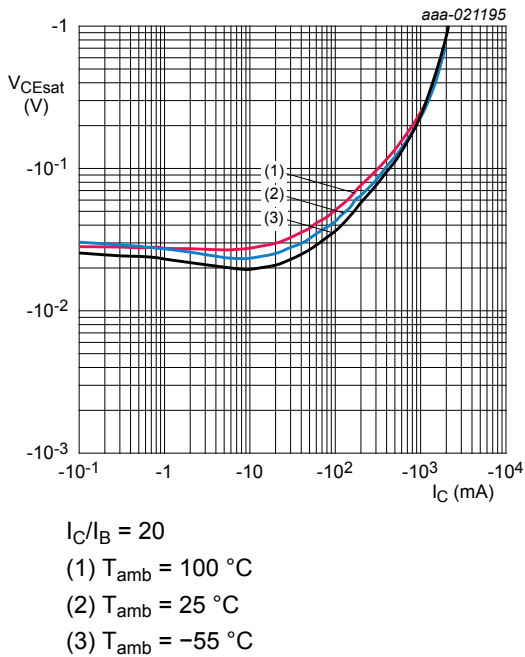


Fig. 18. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values

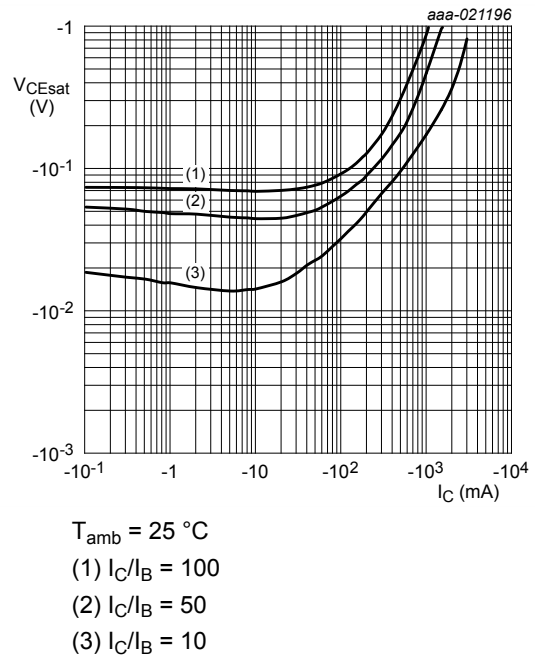
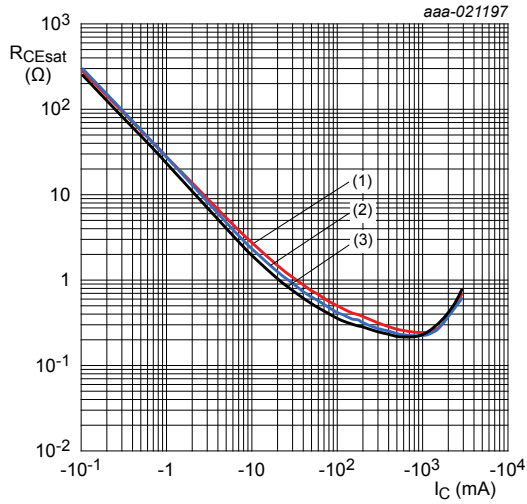


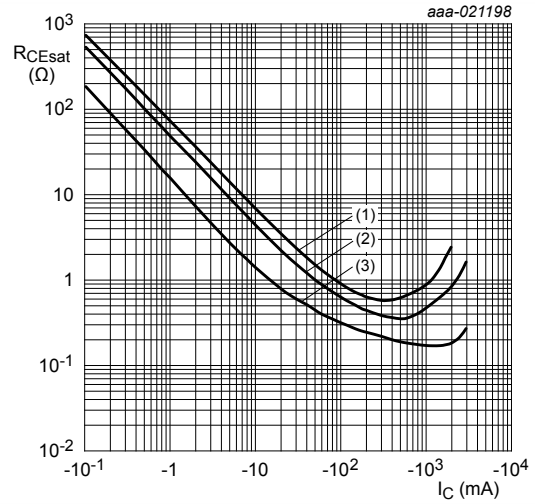
Fig. 19. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$

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

**Fig. 20. TR2 (PNP): 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. 21. TR2 (PNP): Collector-emitter saturation resistance as a function of collector current; typical values**

11. Test information

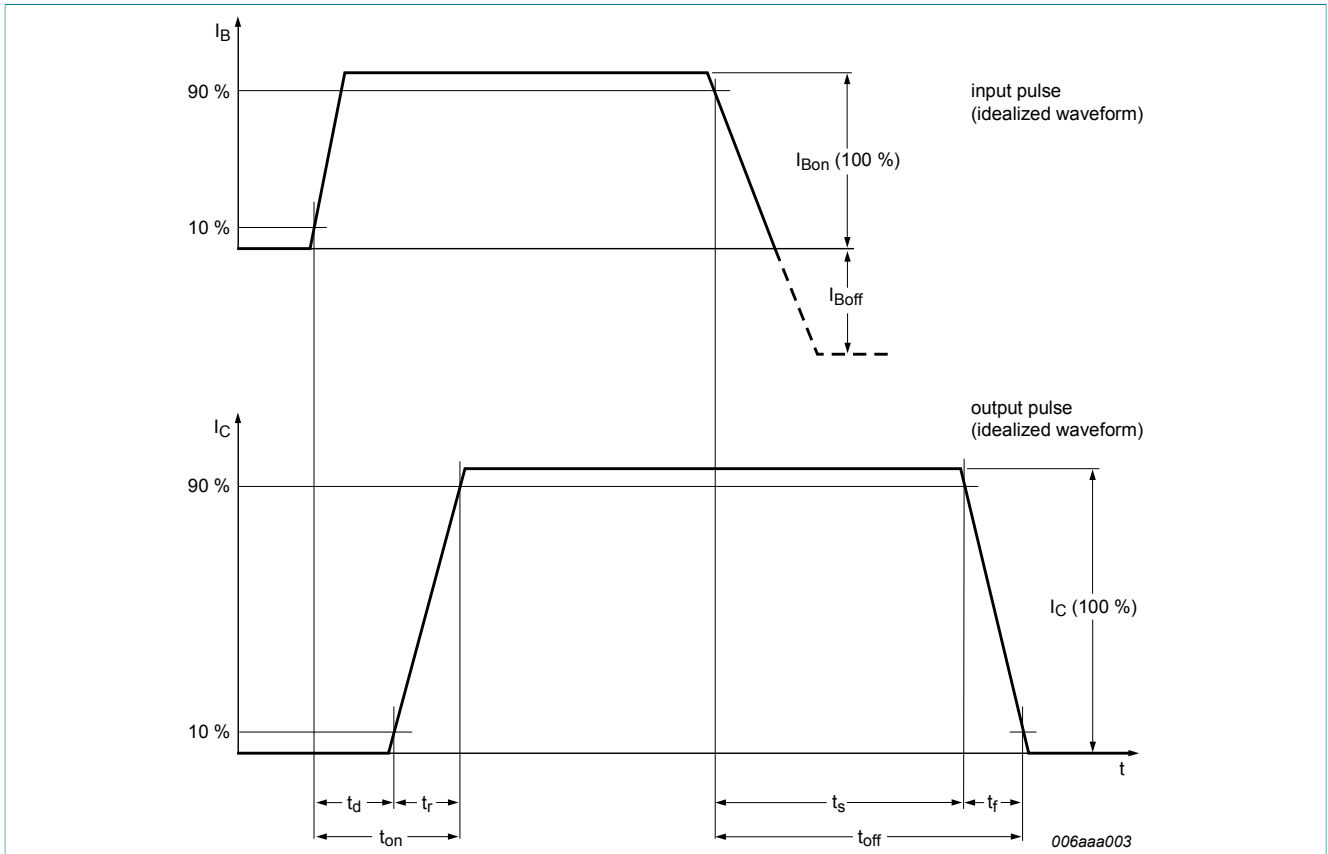


Fig. 22. TR1 (NPN): BISS transistor switching time definition

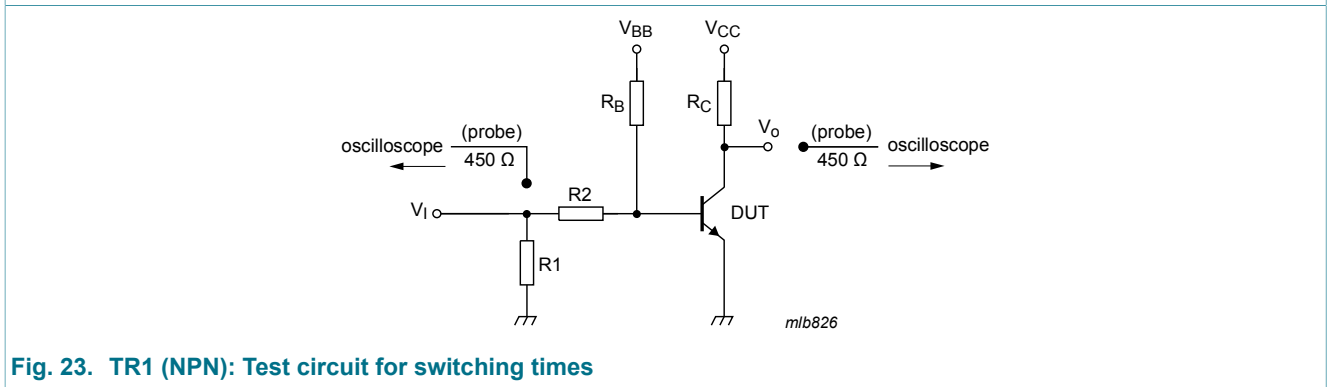


Fig. 23. TR1 (NPN): Test circuit for switching times

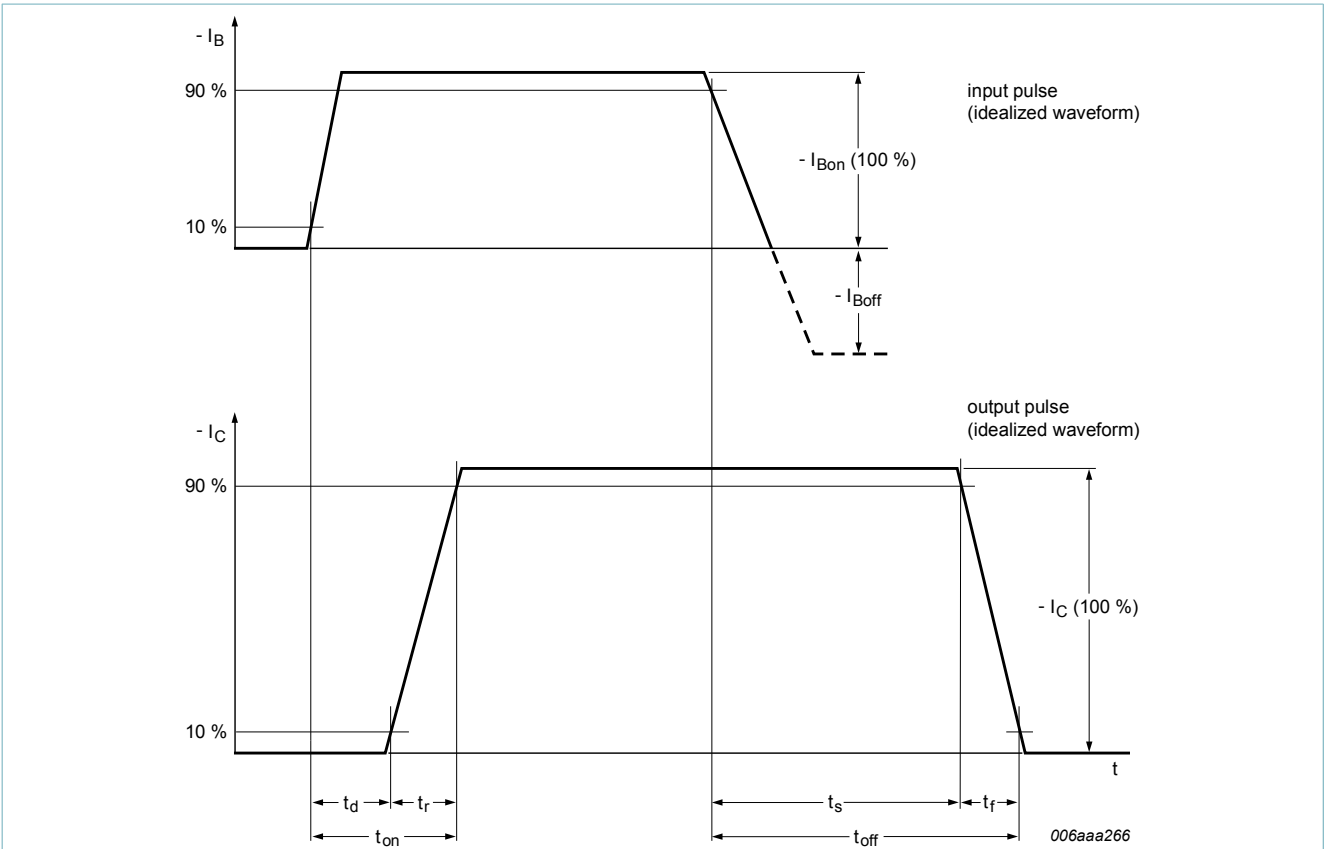


Fig. 24. TR2 (PNP): BISS transistor switching time definition

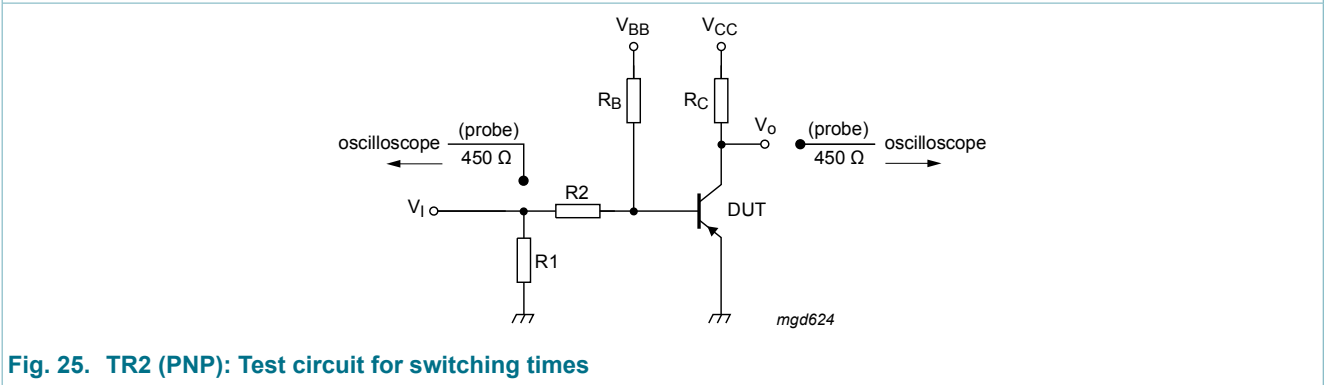


Fig. 25. TR2 (PNP): Test circuit for switching times

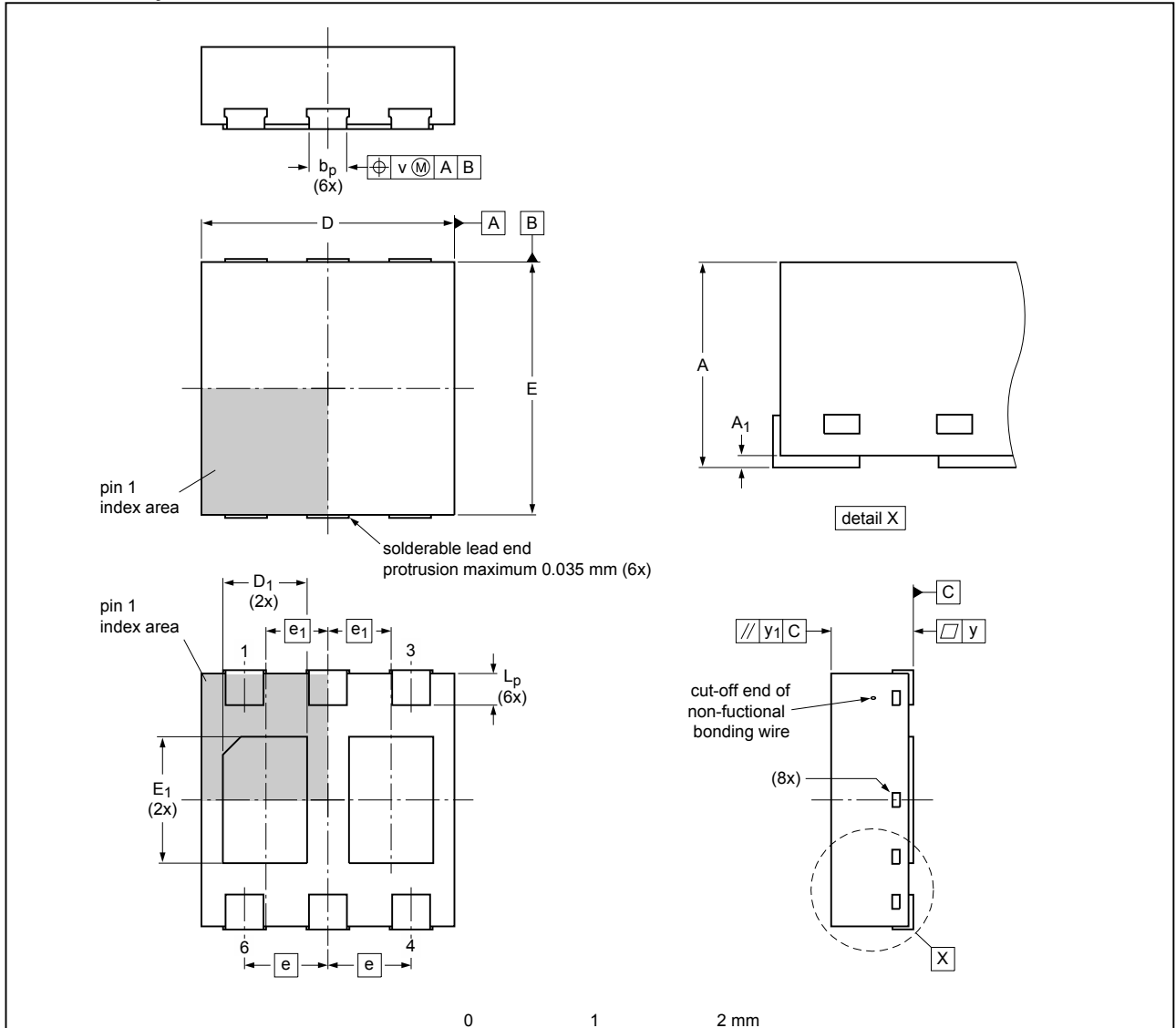
### 11.1 Quality information

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

DFN2020D-6: plastic, thermally enhanced ultra thin and small outline package; no leads; 6 terminals; body 2 x 2 x 0.65 mm

SOT1118D



Dimensions (mm are the original dimensions)

Unit	A	A <sub>1</sub>	b <sub>p</sub>	D	D <sub>1</sub>	E	E <sub>1</sub>	e	e <sub>1</sub>	L <sub>p</sub>	v	y	y <sub>1</sub>
max	0.65	0.04	0.35	2.1	0.77	2.1	1.0	0.54	0.30				
nom	0.62		0.30	2.0	0.67	2.0	0.9	0.65	0.49	0.25	0.1	0.05	0.05
min	0.59		0.25	1.9	0.57	1.9	0.8	0.44	0.20				

Note

1. Dimension A is including plating thickness.

sot1118d\_po

Outline version	References			European projection	Issue date
	IEC	JEDEC	JEITA		
SOT1118D		---			14-07-16 14-10-16

Fig. 26. Package outline DFN2020D-6 (SOT1118D)



### 13. Soldering

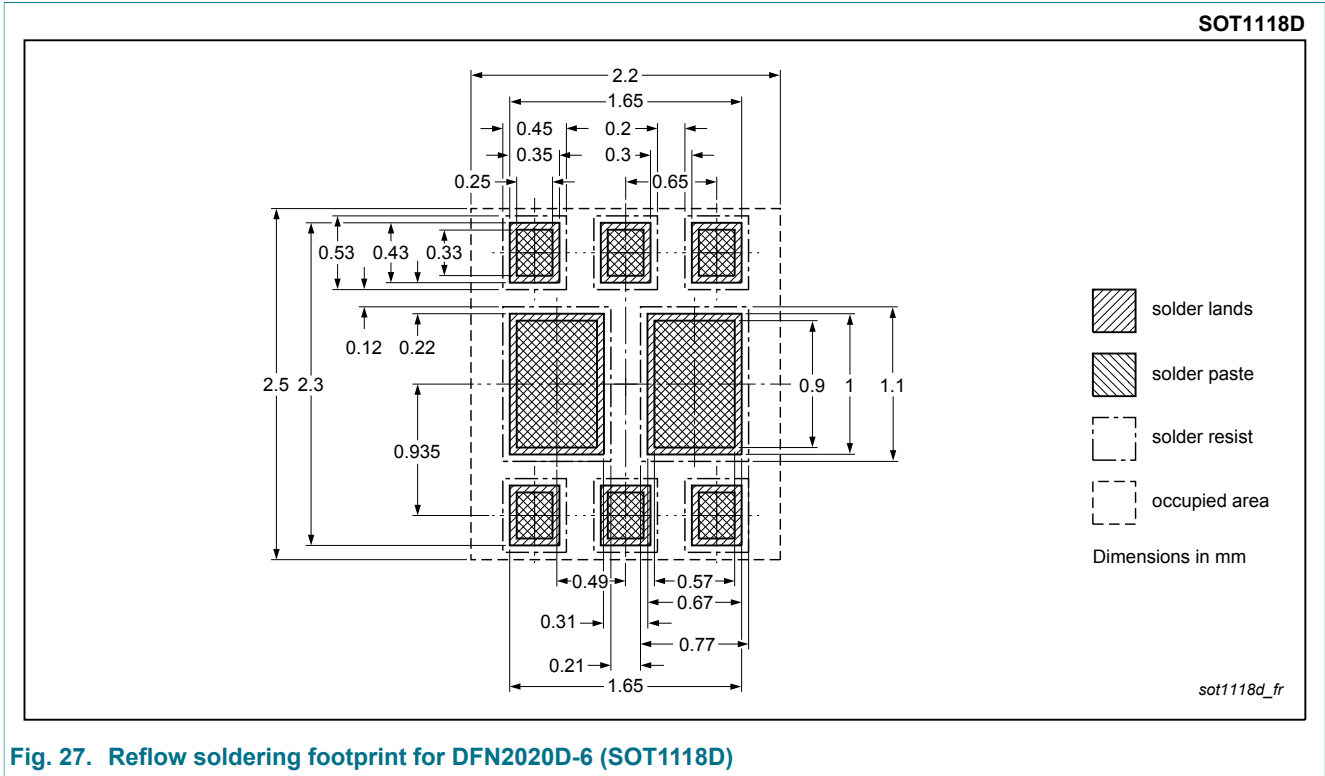


Fig. 27. Reflow soldering footprint for DFN2020D-6 (SOT1118D)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4260PANPS v.1	20160204	Product data sheet	-	-

## 15. Legal information

### 15.1 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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