PBSS4260PANP 60 V, 2 A NPN/PNP low VCEsat (BISS) transistor

12 December 2012

Product data sheet

## 1. General description

NPN/PNP low V<sub>CEsat</sub> Breakthrough In Small Signal (BISS) transistor in a leadless medium power DFN2020-6 (SOT1118) Surface-Mounted Device (SMD) plastic package.

NPN/NPN complement: PBSS4260PAN. PNP/PNP complement: PBSS5260PAP.

## 2. Features and benefits

- Very low collector-emitter saturation voltage V<sub>CEsat</sub>
- High collector current capability  $I_C$  and  $I_{CM}$
- High collector current gain h<sub>FE</sub> at high I<sub>C</sub>
- Reduced Printed-Circuit Board (PCB) requirements
- High efficiency due to less heat generation
- AEC-Q101 qualified

## 3. Applications

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

## 4. Quick reference data

Table 1. Quid	ck reference data								
Symbol	Parameter	Conditions		Min	Тур	Max	Unit		
Per transistor;	Per transistor; for the PNP transistor with negative polarity								
V <sub>CEO</sub>	collector-emitter voltage	open base		-	-	60	V		
I <sub>C</sub>	collector current			-	-	2	А		
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms		-	-	3	А		
TR1 (NPN)		·							
R <sub>CEsat</sub>	collector-emitter saturation resistance	$I_{C}$ = 1 A; $I_{B}$ = 100 mA; pulsed; $t_{p}$ ≤ 300 μs; δ ≤ 0.02 ; $T_{amb}$ = 25 °C		-	-	165	mΩ		





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Symbol	Parameter	Conditions	Min	Тур	Мах	Unit
TR2 (PNP)				-		
R <sub>CEsat</sub>	collector-emitter saturation resistance	$I_{C}$ = -1 A; $I_{B}$ = -100 mA; pulsed; $t_{p} \le 300$ μs; δ $\le 0.02$ ; $T_{amb}$ = 25 °C	-	-	250	mΩ

## 5. Pinning information

Table 2.	Pinning	information		
Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E1	emitter TR1	6 5 4	C1 B2 E2
2	B1	base TR1		
3	C2	collector TR2	7 8	
4	E2	emitter TR2		
5	B2	base TR2		E1 B1 C2
6	C1	collector TR1	Transparent top view DFN2020-6 (SOT1118)	sym139
7	C1	collector TR1	Britz020-0 (0011110)	
8	C2	collector TR2		

# 6. Ordering information

Table 3. Ordering in	formation		
Type number	Package		
	Name	Description	Version
PBSS4260PANP	DFN2020-6	plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals; body $2 \times 2 \times 0.65$ mm	SOT1118

## 7. Marking

Table 4. Marking codes	
Type number	Marking code
PBSS4260PANP	2Q

# 8. Limiting values

### Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit		
Per transistor	Per transistor; for the PNP transistor with negative polarity							
V <sub>CBO</sub>	collector-base voltage	open emitter		-	60	V		
V <sub>CEO</sub>	collector-emitter voltage	open base		-	60	V		
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Symbol	Parameter	Conditions	Mir	n Max	Unit
V <sub>EBO</sub>	emitter-base voltage	open collector	-	7	V
I <sub>C</sub>	collector current		-	2	А
I <sub>CM</sub>	peak collector current	single pulse; $t_p \le 1 \text{ ms}$	-	3	А
I <sub>B</sub>	base current		-	0.3	А
вм	peak base current	single pulse; t <sub>p</sub> ≤ 1 ms	-	1	А
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
			[5] -	450	mW
			[6] -	760	mW
			[7] -	700	mW
			[8] -	1450	mW
Per device					
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
			[5] -	620	mW
			<u>[6]</u> -	1040	mW
			[Z] -	960	mW
			[8] -	2000	mW
Tj	junction temperature		-	150	°C
T <sub>amb</sub>	ambient temperature		-55	5 150	°C
T <sub>stg</sub>	storage temperature		-65	5 150	°C

Device mounted on an FR4 PCB, single-sided 35 μm copper strip line, tin-plated and standard footprint.
 Device mounted on an FR4 PCB, single-sided 35 μm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

[3] Device mounted on 4-layer PCB 35 µm copper strip line, tin-plated and standard footprint.

[4] Device mounted on 4-layer PCB 35 µm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

[5] Device mounted on an FR4 PCB, single-sided 70 µm copper strip line, tin-plated and standard footprint.

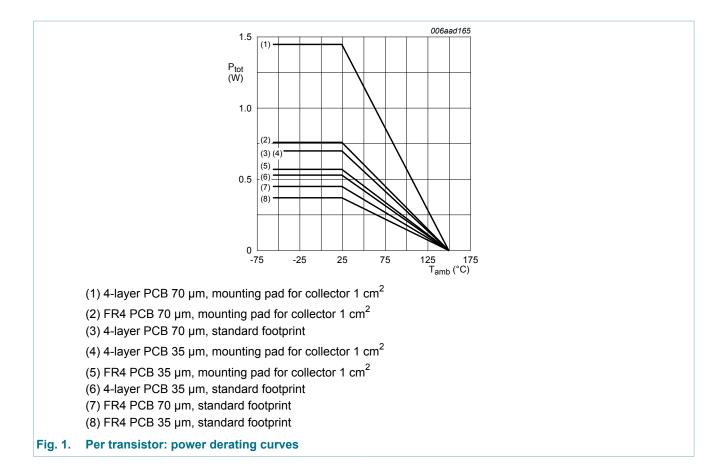
[6] Device mounted on an FR4 PCB, single-sided 70 μm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

[7] Device mounted on 4-layer PCB 70 µm copper strip line, tin-plated and standard footprint.

<sup>[8]</sup> Device mounted on 4-layer PCB 70 µm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

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## 9. Thermal characteristics

	Thermal characteristics	1					_
Symbol	Parameter	Conditions		Min	Тур	Max	Unit
Per transist	tor		· · ·				,
R <sub>th(j-a)</sub> thermal resistance	thermal resistance	in free air	[1]	-	-	338	K/W
	from junction to		[2]	-	-	219	K/W
ampient	ambient		[3]	-	-	236	K/W
			[4]	-	-	179	K/W
			[5]	-	-	278	K/W
			[6]	-	-	164	K/W
			[7]	-	-	179	K/W
			[8]	-	-	86	K/W
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point			-	-	30	K/W

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Symbol	Parameter	Conditions		Min	Тур	Мах	Unit
Per device			· ·				
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	245	K/W
		[2	[2]	-	-	160	K/W
ampient	-	[3]	-	-	171	K/W	
		[4	[4]	-	-	130	K/W
			[5]	-	-	202	K/W
			[6]	-	-	120	K/W
			[7]	-	-	130	K/W
			[8]	-	-	63	K/W

Device mounted on an FR4 PCB, single-sided 35 μm copper strip line, tin-plated and standard footprint.
 Device mounted on an FR4 PCB, single-sided 35 μm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

[3] Device mounted on 4-layer PCB 35 µm copper strip line, tin-plated and standard footprint.

[4] Device mounted on 4-layer PCB 35 µm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

[5] Device mounted on an FR4 PCB, single-sided 70 µm copper strip line, tin-plated and standard footprint.

[6] Device mounted on an FR4 PCB, single-sided 70 µm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

[7] Device mounted on 4-layer PCB 70 µm copper strip line, tin-plated and standard footprint.

[8] Device mounted on 4-layer PCB 70 µm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

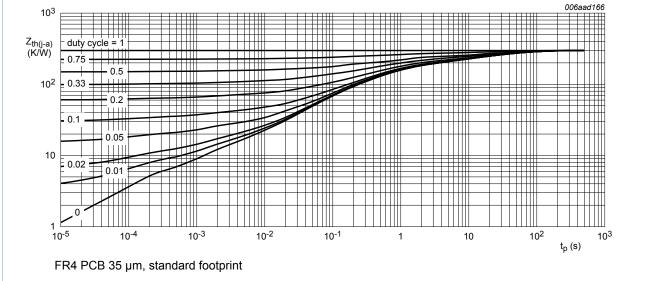
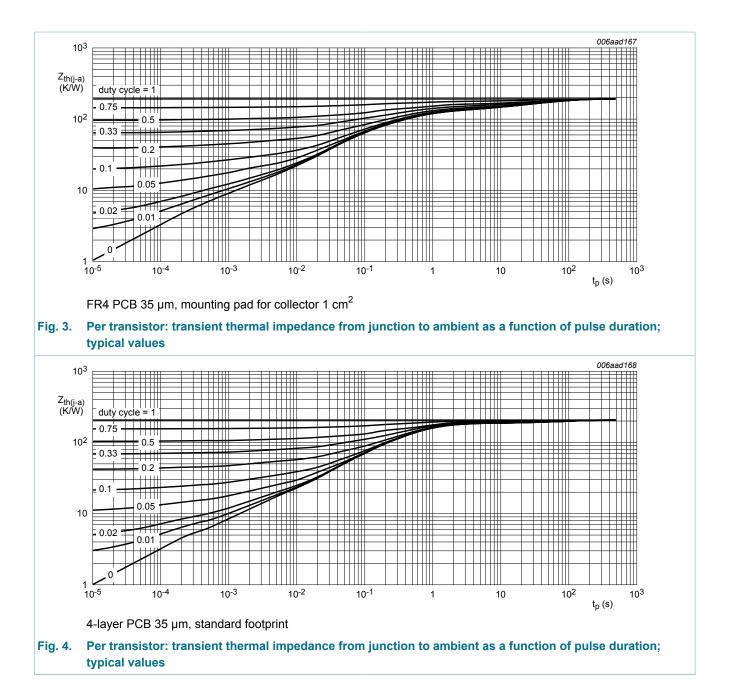


Fig. 2. Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration; typical values

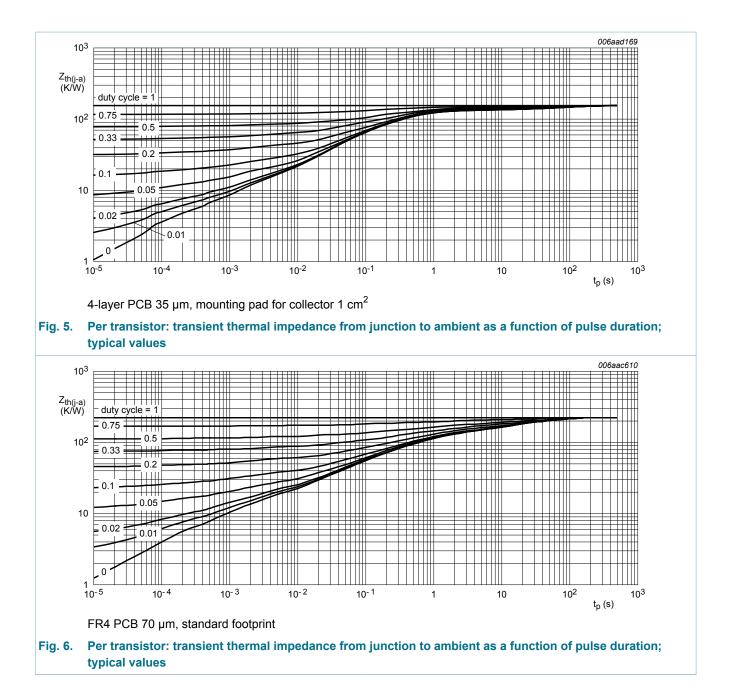
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### 60 V, 2 A NPN/PNP low VCEsat (BISS) transistor



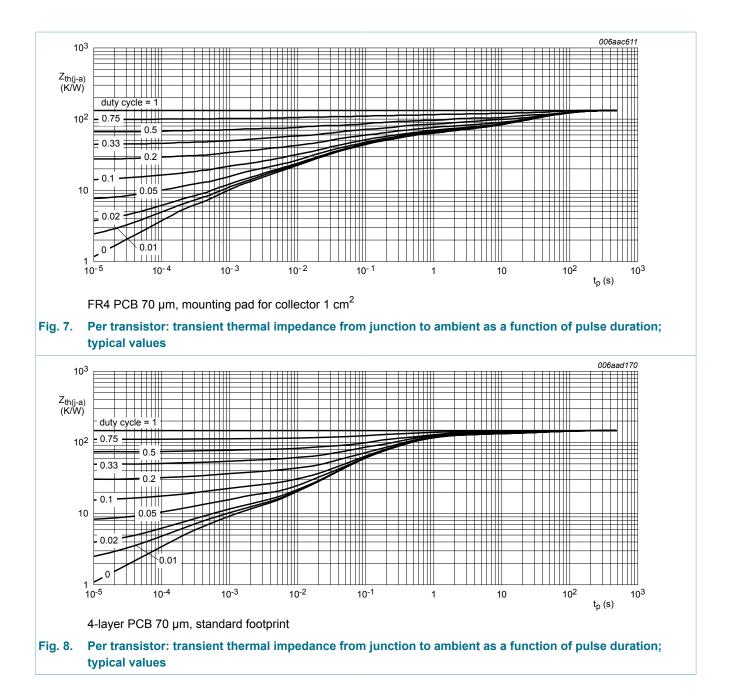
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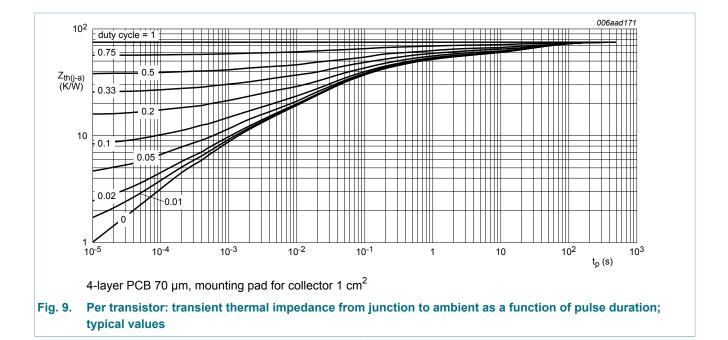
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### 60 V, 2 A NPN/PNP low VCEsat (BISS) transistor



## **10. Characteristics**

#### Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
TR1 (NPN)		· · · · · · · · · · · · · · · · · · ·				
I <sub>CBO</sub>	collector-base cut-off	V <sub>CB</sub> = 48 V; I <sub>E</sub> = 0 A; T <sub>amb</sub> = 25 °C	-	-	100	nA
	current	V <sub>CB</sub> = 48 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	50	μA
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	$V_{CE} = 2 \text{ V; } I_C = 100 \text{ mA; pulsed;}$ $t_p \le 300  \mu\text{s; } \delta \le 0.02 \text{ ; } T_{amb} = 25 ^\circ\text{C}$	290	430	-	
		$V_{CE} = 2 \text{ V; } I_C = 500 \text{ mA; pulsed;}$ $t_p \le 300  \mu\text{s; } \delta \le 0.02 \text{ ; } T_{amb} = 25 ^\circ\text{C}$	210	310	-	
		$V_{CE} = 2 \text{ V}; \text{ I}_{C} = 1 \text{ A}; \text{ pulsed};  \text{t}_{p} \leq 300  \mu\text{s}; \\ \delta \leq 0.02 \text{ ; } \text{ T}_{amb} = 25 ^{\circ}\text{C}$	120	185	-	
		$V_{CE} = 2 \text{ V; } I_C = 2 \text{ A; pulsed; } t_p \le 300  \mu\text{s;}$ $\delta \le 0.02 \text{ ; } T_{amb} = 25 ^\circ\text{C}$	50	85	-	
V <sub>CEsat</sub>	collector-emitter	$I_{C}$ = 500 mA; $I_{B}$ = 50 mA; $T_{amb}$ = 25 °C	-	70	90	mV
	saturation voltage	$I_{C}$ = 1 A; $I_{B}$ = 50 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	-	140	180	mV
		$I_{C}$ = 2 A; $I_{B}$ = 100 mA; pulsed; $t_{p} \le 300 \ \mu$ s; δ $\le 0.02$ ; $T_{amb}$ = 25 °C	-	270	350	mV
		$I_{C}$ = 2 A; $I_{B}$ = 200 mA; pulsed; $t_{p}$ ≤ 300 μs; δ ≤ 0.02 ; $T_{amb}$ = 25 °C	-	255	330	mV

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### 60 V, 2 A NPN/PNP low VCEsat (BISS) transistor

Symbol	Parameter	Conditions	Min	Тур	Мах	Unit
R <sub>CEsat</sub>	collector-emitter saturation resistance	$\begin{split} I_{C} &= 1 \text{ A};  I_{B} = 100 \text{ mA}; \text{ pulsed}; \\ t_{p} &\leq 300  \mu\text{s};  \delta \leq 0.02 \text{ ; }  T_{amb} = 25 ^{\circ}\text{C} \end{split}$	-	-	165	mΩ
V <sub>BEsat</sub>	base-emitter saturation	$I_{C}$ = 500 mA; $I_{B}$ = 50 mA; $T_{amb}$ = 25 °C	-	-	1	V
	voltage	$I_{C}$ = 1 A; $I_{B}$ = 50 mA; pulsed; $t_{p} \le 300 \ \mu$ s; δ $\le 0.02$ ; $T_{amb}$ = 25 °C	-	-	1	V
		$I_{C}$ = 2 A; $I_{B}$ = 100 mA; pulsed; $t_{p} \le 300 \ \mu$ s; δ $\le 0.02$ ; $T_{amb}$ = 25 °C	-	-	1.1	V
		$I_C$ = 2 A; $I_B$ = 200 mA; pulsed; $t_p \le 300 \ \mu$ s; δ $\le 0.02$ ; $T_{amb}$ = 25 °C	-	-	1.2	V
V <sub>BEon</sub>	base-emitter turn-on voltage	$V_{CE}$ = 2 V; I <sub>C</sub> = 0.5 A; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	-	-	0.9	V
t <sub>d</sub>	delay time	V <sub>CC</sub> = 12.5 V; I <sub>C</sub> = 1 A; I <sub>Bon</sub> = 50 mA;	-	10	-	ns
t <sub>r</sub>	rise time	I <sub>Boff</sub> = -50 mA; T <sub>amb</sub> = 25 °C	-	140	-	ns
t <sub>on</sub>	turn-on time		-	150	-	ns
t <sub>s</sub>	storage time		-	445	-	ns
t <sub>f</sub>	fall time		-	180	-	ns
t <sub>off</sub>	turn-off time		-	625	-	ns
f <sub>T</sub>	transition frequency	$V_{CE}$ = 10 V; I <sub>C</sub> = 50 mA; f = 100 MHz; T <sub>amb</sub> = 25 °C	70	140	-	MHz
C <sub>c</sub>	collector capacitance	V <sub>CB</sub> = 10 V; I <sub>E</sub> = 0 A; i <sub>e</sub> = 0 A; f = 1 MHz; T <sub>amb</sub> = 25 °C	-	6.5	9	pF
TR2 (PNP)						
I <sub>CBO</sub>	collector-base cut-off	$V_{CB}$ = -48 V; I <sub>E</sub> = 0 A; T <sub>amb</sub> = 25 °C	-	-	-100	nA
	current	V <sub>CB</sub> = -48 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	-50	μA
I <sub>EBO</sub>	emitter-base cut-off current	$V_{EB}$ = -5 V; I <sub>C</sub> = 0 A; T <sub>amb</sub> = 25 °C	-	-	-100	nA
h <sub>FE</sub>	DC current gain	$V_{CE} = -2 \text{ V; } I_C = -100 \text{ mA; pulsed;}$ $t_p \le 300  \mu\text{s; } \delta \le 0.02 \text{ ; } T_{amb} = 25 ^\circ\text{C}$	170	250	-	
		$\label{eq:VcE} \begin{array}{l} V_{CE} = -2 \ V; \ I_C = -500 \ m\text{A}; \ \text{pulsed}; \\ t_p \leq 300 \ \mu\text{s}; \ \delta \leq 0.02 \ ; \ T_{\text{amb}} = 25 \ ^\circ\text{C} \end{array}$	140	200	-	
		$V_{CE}$ = -2 V; I <sub>C</sub> = -1 A; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	110	155	-	
		$V_{CE}$ = -2 V; I <sub>C</sub> = -2 A; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	50	75	-	
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = -500 mA; I <sub>B</sub> = -50 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	-	-100	-140	mV
		$I_{C}$ = -1 A; $I_{B}$ = -50 mA; pulsed; $t_{p}$ ≤ 300 µs; δ ≤ 0.02 ; $T_{amb}$ = 25 °C	-	-220	-310	mV

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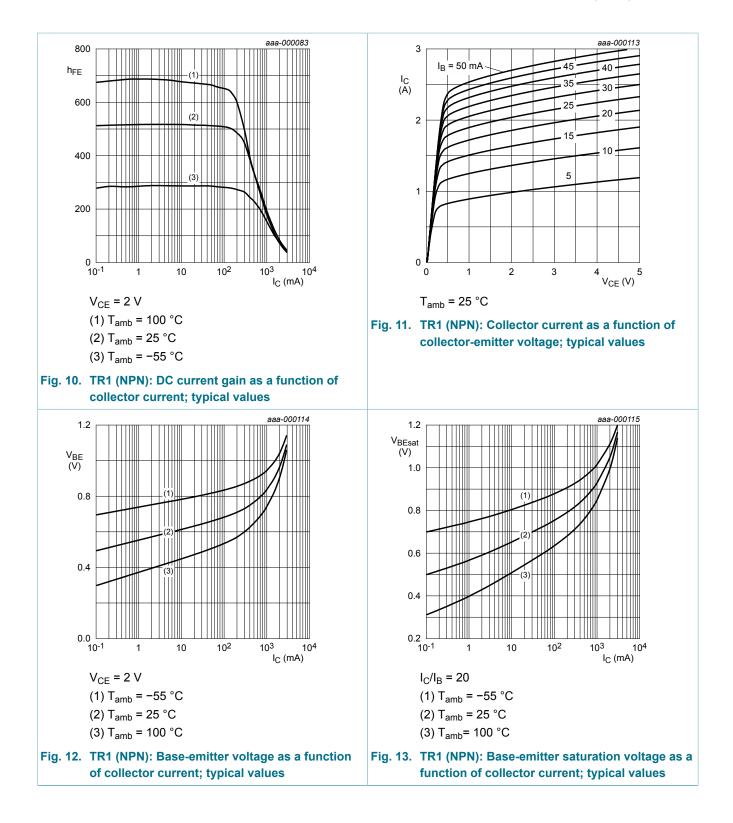
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### 60 V, 2 A NPN/PNP low VCEsat (BISS) transistor

Symbol	Parameter	Conditions	N	lin	Тур	Мах	Unit
		$I_C$ = -2 A; $I_B$ = -200 mA; pulsed; $t_p \le 300 \ \mu s; \delta \le 0.02$ ; $T_{amb}$ = 25 °C	-		-365	-500	mV
R <sub>CEsat</sub>	collector-emitter saturation resistance	$I_{C}$ = -1 A; $I_{B}$ = -100 mA; pulsed; $t_{p} \le 300 \ \mu$ s; δ $\le 0.02$ ; $T_{amb}$ = 25 °C	-		-	250	mΩ
V <sub>BEsat</sub>	base-emitter saturation voltage	$I_{C}$ = -500 mA; $I_{B}$ = -50 mA; $T_{amb}$ = 25 °C	-		-	-1	V
		$I_C$ = -1 A; $I_B$ = -50 mA; pulsed; $t_p$ ≤ 300 μs; δ ≤ 0.02 ; $T_{amb}$ = 25 °C	-		-	-1	V
		$I_C$ = -2 A; $I_B$ = -200 mA; pulsed; $t_p$ ≤ 300 μs; δ ≤ 0.02 ; $T_{amb}$ = 25 °C	-		-	-1.2	V
V <sub>BEon</sub>	base-emitter turn-on voltage	$\label{eq:VCE} \begin{array}{l} V_{CE} = \text{-2 V; } I_{C} = \text{-0.5 A; pulsed;} \\ t_{p} \leq 300 \; \mu s; \; \delta \leq 0.02 \; ; \; T_{amb} = 25 \; ^{\circ} C \end{array}$	-		-	-0.9	V
t <sub>d</sub>	delay time	$V_{CC}$ = -12.5 V; I <sub>C</sub> = -1 A; I <sub>Bon</sub> = -50 mA;	-		10	-	ns
t <sub>r</sub>	rise time	I <sub>Boff</sub> = 50 mA; T <sub>amb</sub> = 25 °C	-		80	-	ns
t <sub>on</sub>	turn-on time	-	-		90	-	ns
ts	storage time		-		195	-	ns
t <sub>f</sub>	fall time		-		75	-	ns
t <sub>off</sub>	turn-off time	1	-		270	-	ns
f <sub>T</sub>	transition frequency	$V_{CE}$ = -10 V; I <sub>C</sub> = -50 mA; f = 100 MHz; T <sub>amb</sub> = 25 °C	5	50	100	-	MHz
C <sub>c</sub>	collector capacitance	V <sub>CB</sub> = -10 V; I <sub>E</sub> = 0 A; i <sub>e</sub> = 0 A; f = 1 MHz; T <sub>amb</sub> = 25 °C	-		16	21	pF

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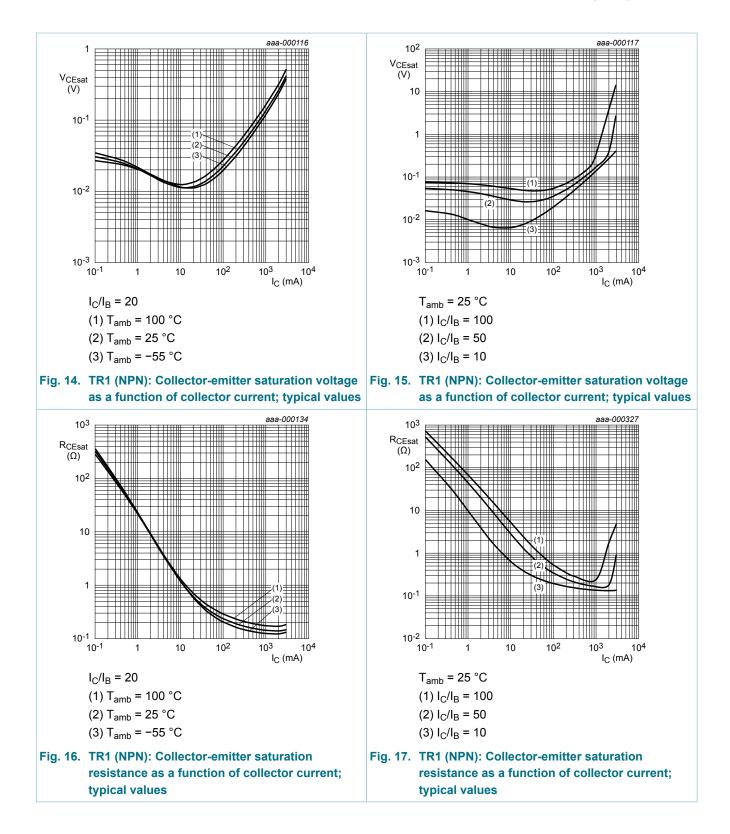
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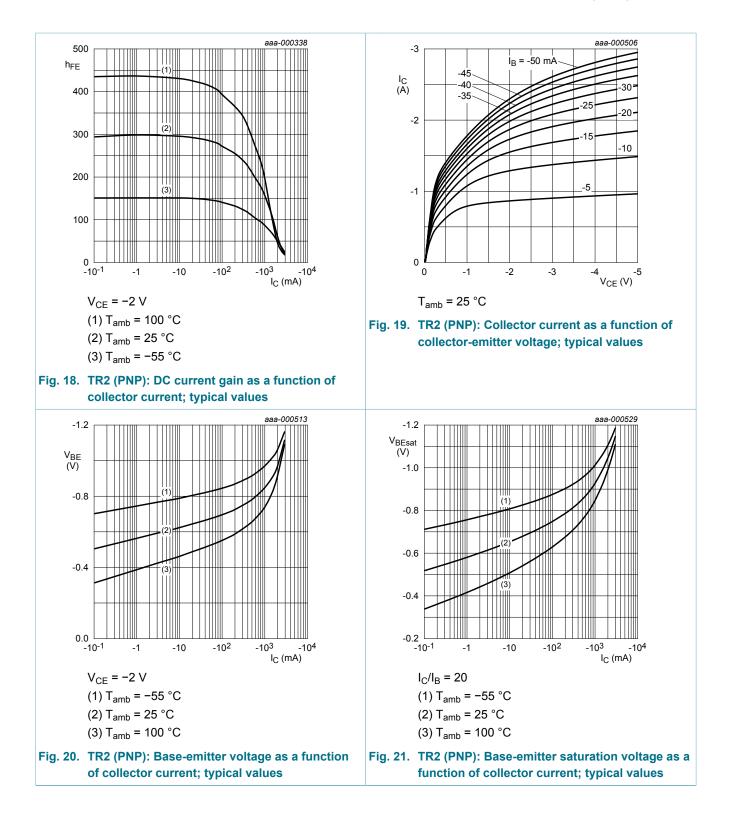
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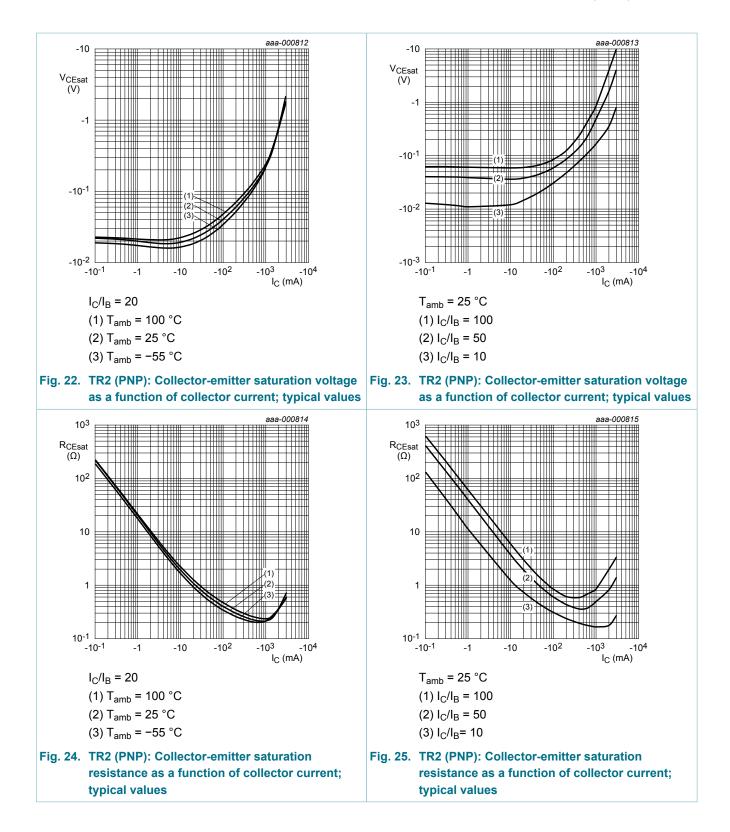
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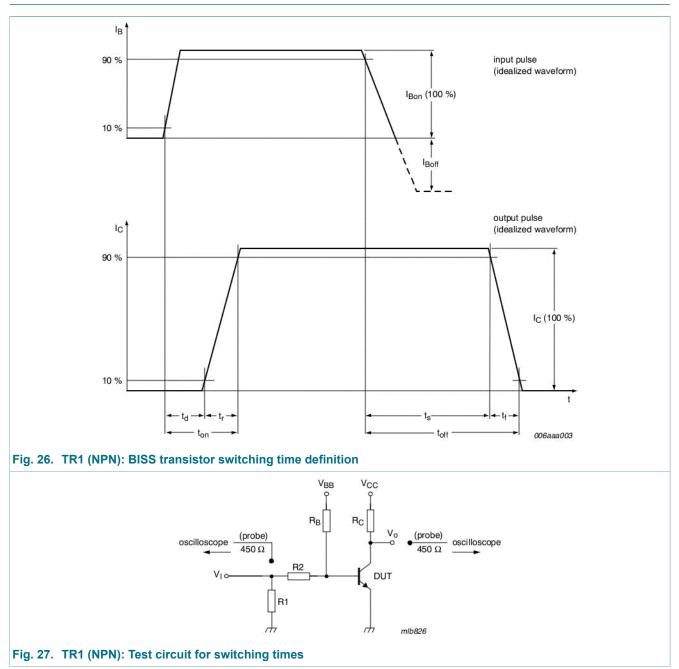
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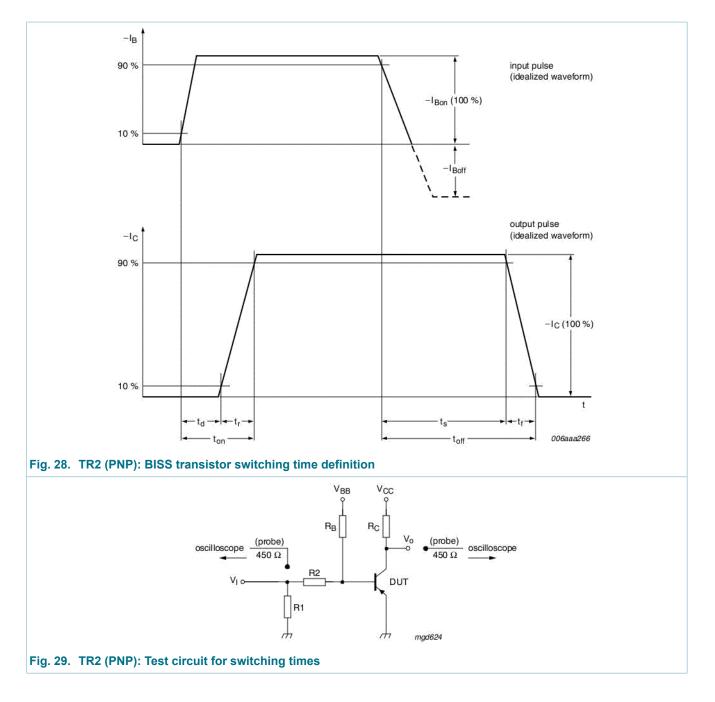
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# **11. Test information**

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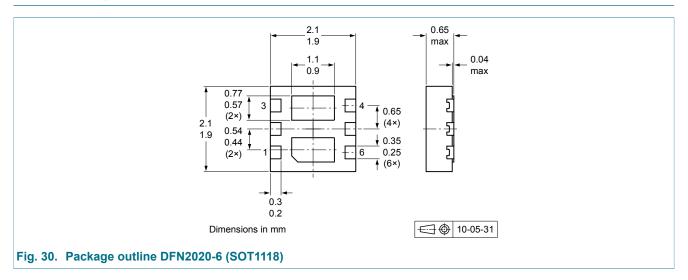


## **11.1 Quality information**

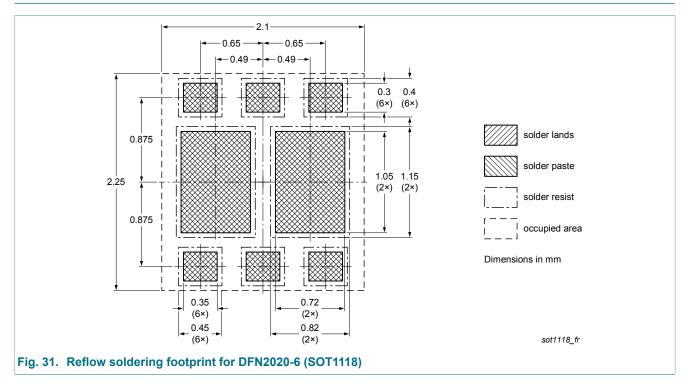
This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101* - *Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

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## 12. Package outline



## 13. Soldering



## 14. Revision history

Table 8. Revision h	istory			
Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4260PANP v.1	20121212	Product data sheet	-	-
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Product data sheet		12 December 2012		18 / 21

#### 60 V, 2 A NPN/PNP low VCEsat (BISS) transistor

### 15. Legal information

#### 15.1 Data sheet status

Document status [1][2]	Product status [ <u>3]</u>	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 URL <u>http://www.nxp.com</u>.

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