PBSS4260PANP

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

12 December 2012

Product data sheet

1. General description

NPN/PNP low V_{CEsat} 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_{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
- 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. Quick reference data

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
Per transis	tor; for the PNP transistor	with negative polarity					
V_{CEO}	collector-emitter voltage	open base		-	-	60	V
I _C	collector current			-	-	2	Α
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms		-	-	3	Α
TR1 (NPN)			,				
R _{CEsat}	collector-emitter saturation resistance	I_C = 1 A; I_B = 100 mA; pulsed; $t_p \le 300$ μs; $\delta \le 0.02$; T_{amb} = 25 °C		-	-	165	mΩ





Symbol	Parameter	Conditions	Min	Тур	Max	Unit
TR2 (PNP)						
R _{CEsat}	collector-emitter saturation resistance	I_{C} = -1 A; I_{B} = -100 mA; pulsed; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 \ ; T_{amb}$ = 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	(TR1)
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	DI 142020-0 (3011110)	
8	C2	collector TR2		

6. Ordering information

Table 3. Ordering information

	Package				
	Name	Description	Version		
PBSS4260PANP	DFN2020-6	plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals; body 2 x 2 x 0.65 mm	SOT1118		

7. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4260PANP	2Q

8. Limiting values

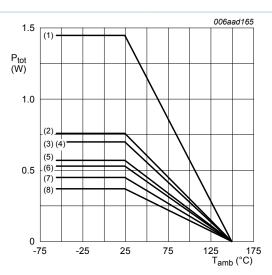
Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
Per transistor	; for the PNP transistor with neg	gative polarity			
V_{CBO}	collector-base voltage	open emitter	-	60	V
V _{CEO}	collector-emitter voltage	open base	-	60	V
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Symbol	Parameter	Conditions		Min	Max	Unit
V _{EBO}	emitter-base voltage	open collector		-	7	V
I _C	collector current			-	2	Α
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms		-	3	Α
I _B	base current			-	0.3	Α
I _{BM}	peak base current	single pulse; t _p ≤ 1 ms		-	1	Α
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	370	mW
			<u>[2]</u>	-	570	mW
			<u>[3]</u>	-	530	mW
			[4]	-	700	mW
			<u>[5]</u>	-	450	mW
			<u>[6]</u>	-	760	mW
			[7]	-	700	mW
			[8]	-	1450	mW
Per device						
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	510	mW
			<u>[2]</u>	-	780	mW
			[3]	-	730	mW
			<u>[4]</u>	-	960	mW
			<u>[5]</u>	-	620	mW
			[6]	-	1040	mW
			[7]	-	960	mW
			[8]	-	2000	mW
Tj	junction temperature			-	150	°C
T _{amb}	ambient temperature			-55	150	°C
T _{stg}	storage temperature			-65	150	°C

- [1] 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 cm².
- [3] Device mounted on 4-layer PCB 35 µm copper strip line, tin-plated and standard footprint.
- Device mounted on 4-layer PCB 35 µm copper strip line, tin-plated, mounting pad for collector 1 cm².
- [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 cm².
- [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 cm².



- (1) 4-layer PCB 70 μm, mounting pad for collector 1 cm²
- (2) FR4 PCB 70 µm, mounting pad for collector 1 cm²
- (3) 4-layer PCB 70 µm, standard footprint
- (4) 4-layer PCB 35 μm, mounting pad for collector 1 cm²
- (5) FR4 PCB 35 μm , mounting pad for collector 1 cm²
- (6) 4-layer PCB 35 µm, standard footprint
- (7) FR4 PCB 70 µm, standard footprint
- (8) FR4 PCB 35 µm, standard footprint

Fig. 1. Per transistor: power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
Per transist	tor						,
R _{th(j-a)}	thermal resistance	in free air	[1]	-	-	338	K/W
	from junction to ambient		[2]	-	-	219	K/W
	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 _{th(j-sp)}	thermal resistance from junction to solder point			-	-	30	K/W

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

- [1] Device mounted on an FR4 PCB, single-sided 35 µm copper strip line, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided 35 μm copper strip line, tin-plated, mounting pad for collector 1 cm².
- [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 cm².
- [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 cm².
- [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 cm².

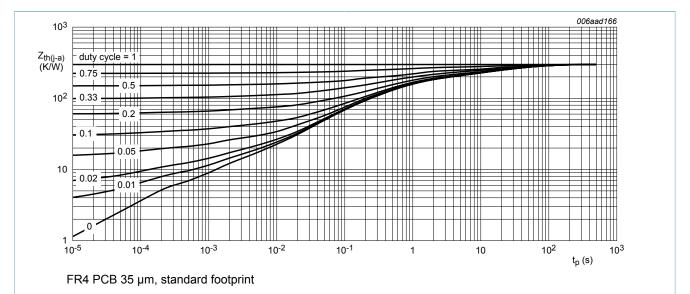


Fig. 2. Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration; typical values

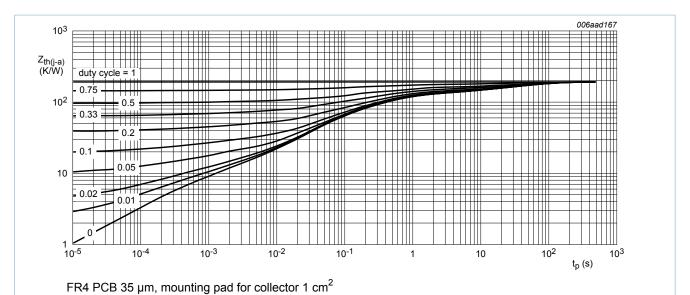


Fig. 3. Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration;

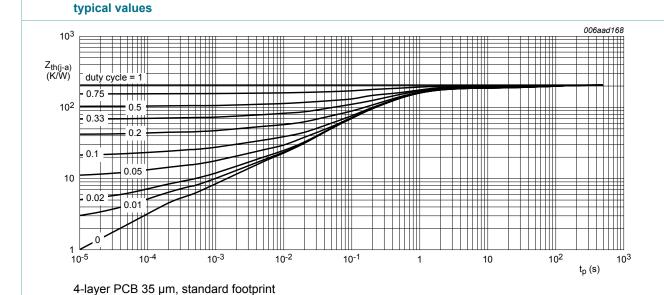


Fig. 4. Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration; typical values

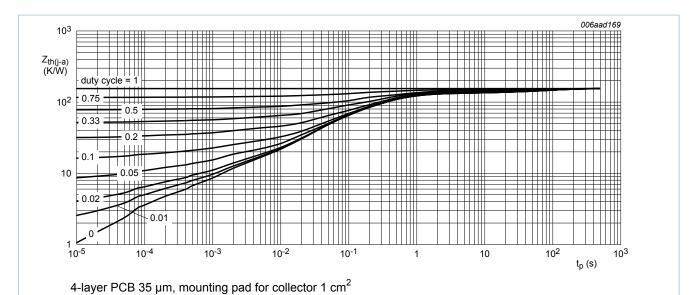


Fig. 5. Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration; typical values

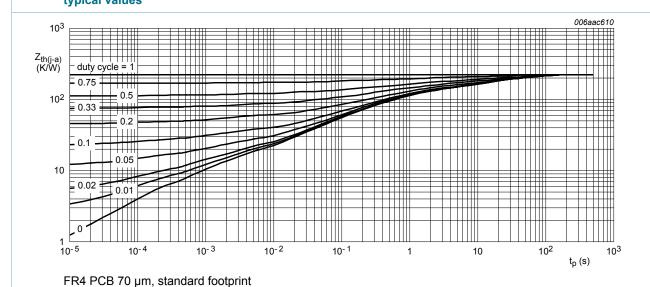


Fig. 6. Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration; typical values

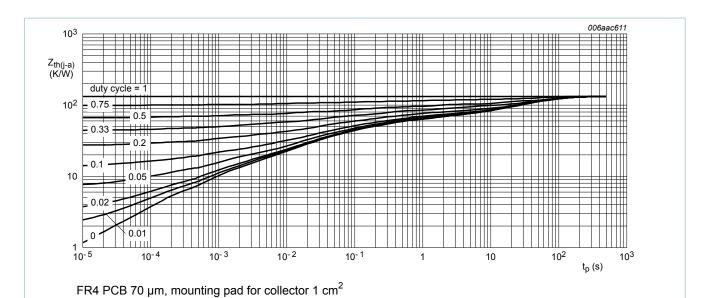


Fig. 7. Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration; typical values

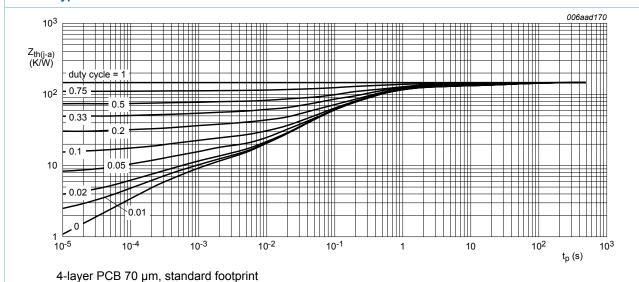
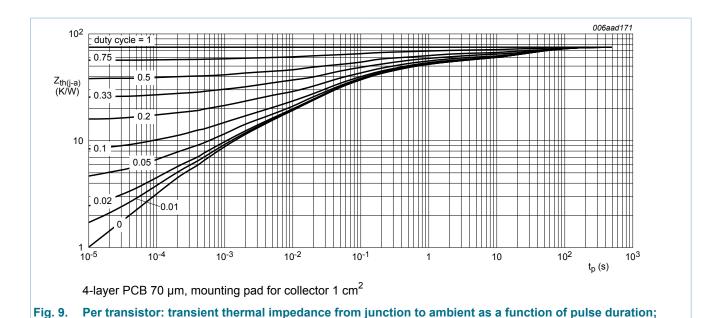


Fig. 8. Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration; typical values



10. Characteristics

typical values

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
TR1 (NPN)						
I _{CBO}	collector-base cut-off	V _{CB} = 48 V; I _E = 0 A; T _{amb} = 25 °C	-	-	100	nA
	current	V _{CB} = 48 V; I _E = 0 A; T _j = 150 °C	-	-	50	μΑ
I _{EBO}	emitter-base cut-off current	V _{EB} = 5 V; I _C = 0 A; T _{amb} = 25 °C	-	-	100	nA
h _{FE} DC current gain	V_{CE} = 2 V; I_{C} = 100 mA; pulsed; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 \ ; \ T_{amb}$ = 25 °C	290	430	-		
		V_{CE} = 2 V; I_{C} = 500 mA; pulsed; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 \ ; \ T_{amb}$ = 25 °C	210	310	-	
		V_{CE} = 2 V; I_{C} = 1 A; pulsed; t_{p} ≤ 300 μs; δ ≤ 0.02 ; T_{amb} = 25 °C	120	185	-	
		V_{CE} = 2 V; I_{C} = 2 A; pulsed; t_{p} ≤ 300 μs; δ ≤ 0.02 ; T_{amb} = 25 °C	50	85	-	
V _{CEsat}	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; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 ; T_{amb}$ = 25 °C	-	140	180	mV
		I_{C} = 2 A; I_{B} = 100 mA; pulsed; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 \ ; T_{amb}$ = 25 °C	-	270	350	mV
		I_C = 2 A; I_B = 200 mA; pulsed; $t_p \le 300 \ \mu s; \ \delta \le 0.02 ; T_{amb}$ = 25 °C	-	255	330	mV

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Symbol	Parameter	Conditions	Min	Тур	Max	Unit
R _{CEsat}	collector-emitter saturation resistance	I_{C} = 1 A; I_{B} = 100 mA; pulsed; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 \ ; T_{amb}$ = 25 °C	-	-	165	mΩ
V _{BEsat}	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; $t_p \le 300 \ \mu s; \ \delta \le 0.02 \ ; \ T_{amb}$ = 25 °C	-	-	1	V
		I_C = 2 A; I_B = 100 mA; pulsed; $t_p \le 300 \ \mu s; \ \delta \le 0.02 \ ; T_{amb}$ = 25 °C	-	-	1.1	V
		I_C = 2 A; I_B = 200 mA; pulsed; $t_p \le 300 \ \mu s; \ \delta \le 0.02 \ ; \ T_{amb}$ = 25 °C	-	-	1.2	V
V_{BEon}	base-emitter turn-on voltage	V_{CE} = 2 V; I_{C} = 0.5 A; pulsed; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 \ ; T_{amb}$ = 25 °C	-	-	0.9	V
t _d	delay time	V _{CC} = 12.5 V; I _C = 1 A; I _{Bon} = 50 mA;	-	250	-	ns
t _r	rise time	I_{Boff} = -50 mA; T_{amb} = 25 °C	-	140	-	ns
t _{on}	turn-on time		-	150	-	ns
t _s	storage time		-	445	-	ns
t _f	fall time		-	180	-	ns
t _{off}	turn-off time		-	625	-	ns
f _T	transition frequency	V_{CE} = 10 V; I_{C} = 50 mA; f = 100 MHz; T_{amb} = 25 °C	70	140	-	MHz
C _c	collector capacitance	V _{CB} = 10 V; I _E = 0 A; i _e = 0 A; f = 1 MHz; T _{amb} = 25 °C	-	6.5	9	pF
TR2 (PNP)						
I _{CBO}	collector-base cut-off	V_{CB} = -48 V; I_{E} = 0 A; T_{amb} = 25 °C	-	-	-100	nA
	current	V _{CB} = -48 V; I _E = 0 A; T _j = 150 °C	-	-	-50	μΑ
I _{EBO}	emitter-base cut-off current	V_{EB} = -5 V; I_{C} = 0 A; T_{amb} = 25 °C	-	-	-100	nA
h _{FE}	DC current gain	$V_{CE} = -2 \text{ V; } I_{C} = -100 \text{ mA; pulsed;}$ $t_{p} \le 300 \text{ µs; } \delta \le 0.02 \text{ ; } T_{amb} = 25 \text{ °C}$	170	250	-	
		V_{CE} = -2 V; I_{C} = -500 mA; pulsed; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 ; T_{amb}$ = 25 °C	140	200	-	
		V_{CE} = -2 V; I_{C} = -1 A; pulsed; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 \ ; T_{amb}$ = 25 °C	110	155	-	
		V_{CE} = -2 V; I_{C} = -2 A; pulsed; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 \ ; T_{amb}$ = 25 °C	50	75	-	
V _{CEsat}	collector-emitter saturation voltage	I_C = -500 mA; I_B = -50 mA; pulsed; $t_p \le 300$ μs; $\delta \le 0.02$; T_{amb} = 25 °C	-	-100	-140	mV
		I_C = -1 A; I_B = -50 mA; pulsed; $t_p \le 300 \ \mu s$; $\delta \le 0.02$; T_{amb} = 25 °C	-	-220	-310	mV

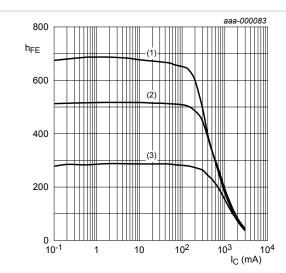
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Symbol	Parameter	Conditions	Min	Тур	Max	Unit	
		I_{C} = -2 A; I_{B} = -200 mA; pulsed; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 \ ; \ T_{amb}$ = 25 °C	-	-365	-500	mV	
R _{CEsat}	collector-emitter saturation resistance	I_{C} = -1 A; I_{B} = -100 mA; pulsed; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 \ ; \ T_{amb}$ = 25 °C	-	-	250	mΩ	
V_{BEsat}	base-emitter saturation voltage	I_{C} = -500 mA; I_{B} = -50 mA; I_{amb} = 25 °C	-	-	-1	V	
			I_C = -1 A; I_B = -50 mA; pulsed; $t_p \le 300 \ \mu s$; $\delta \le 0.02$; T_{amb} = 25 °C	-	-	-1	V
		I_{C} = -2 A; I_{B} = -200 mA; pulsed; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 \ ; \ T_{amb}$ = 25 °C	-	-	-1.2	V	
V_{BEon}	base-emitter turn-on voltage	V_{CE} = -2 V; I_{C} = -0.5 A; pulsed; $t_{p} \le 300 \ \mu s; \ \delta \le 0.02 \ ; T_{amb}$ = 25 °C	-	-	-0.9	V	
t _d	delay time	$V_{CE} = -2 \text{ V}; I_{C} = -0.5 \text{ A}; \text{ pulsed};$ $I_{CC} = -300 \text{ µs}; \delta \le 0.02; T_{amb} = 25 \text{ °C}$ $I_{CC} = -12.5 \text{ V}; I_{C} = -1 \text{ A}; I_{Bon} = -50 \text{ mA};$	-	10	-	ns	
t _r	rise time	I _{Boff} = 50 mA; T _{amb} = 25 °C	-	80	-	ns	
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 V; I_{C} = -50 mA; f = 100 MHz; T_{amb} = 25 °C	50	100	-	MHz	
C _c	collector capacitance	V _{CB} = -10 V; I _E = 0 A; i _e = 0 A; f = 1 MHz; T _{amb} = 25 °C	-	16	21	pF	

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$$V_{CE} = 2 V$$

(1)
$$T_{amb} = 100 \, ^{\circ}C$$

(2)
$$T_{amb} = 25 \, ^{\circ}C$$

(3)
$$T_{amb} = -55$$
 °C

Fig. 10. TR1 (NPN): DC current gain as a function of collector current; typical values

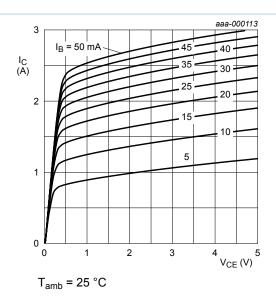
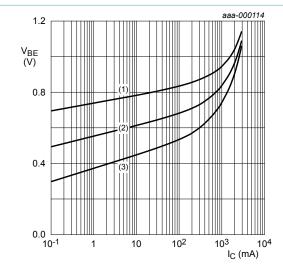


Fig. 11. TR1 (NPN): Collector current as a function of collector-emitter voltage; typical values



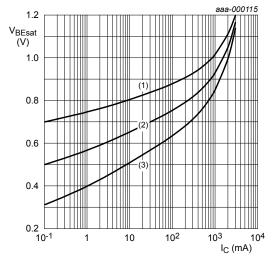
$$V_{CE} = 2 V$$

(1)
$$T_{amb} = -55 \,^{\circ}C$$

(2)
$$T_{amb}$$
 = 25 °C

(3)
$$T_{amb} = 100 \, ^{\circ}C$$

Fig. 12. TR1 (NPN): Base-emitter voltage as a function of collector current; typical values



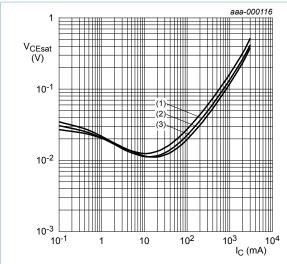
$$I_{\rm C}/I_{\rm B} = 20$$

(1)
$$T_{amb} = -55 \,^{\circ}C$$

(2)
$$T_{amb}$$
 = 25 °C

(3)
$$T_{amb} = 100 \, ^{\circ}C$$

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



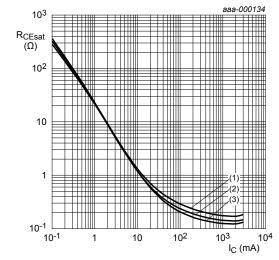
$$I_{\rm C}/I_{\rm B} = 20$$

(1)
$$T_{amb} = 100 \, ^{\circ}C$$

(2)
$$T_{amb}$$
 = 25 °C

(3)
$$T_{amb} = -55$$
 °C

Fig. 14. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values



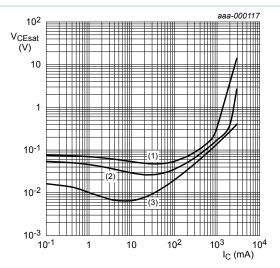
$$I_{\rm C}/I_{\rm B} = 20$$

(1)
$$T_{amb} = 100 \, ^{\circ}C$$

(2)
$$T_{amb}$$
 = 25 °C

(3)
$$T_{amb} = -55 \, ^{\circ}C$$

Fig. 16. TR1 (NPN): Collector-emitter saturation resistance as a function of collector current; typical values



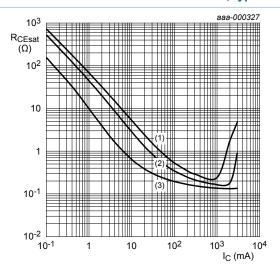
$$T_{amb} = 25 \, ^{\circ}C$$

(1)
$$I_C/I_B = 100$$

(2)
$$I_C/I_B = 50$$

(3)
$$I_C/I_B = 10$$

Fig. 15. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values



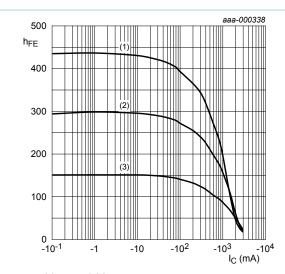
$$T_{amb}$$
 = 25 °C

(1)
$$I_C/I_B = 100$$

(2)
$$I_C/I_B = 50$$

(3)
$$I_C/I_B = 10$$

Fig. 17. TR1 (NPN): Collector-emitter saturation resistance as a function of collector current; typical values



$$V_{CE} = -2 V$$

(1)
$$T_{amb}$$
 = 100 °C

(2)
$$T_{amb} = 25 \, ^{\circ}C$$

(3)
$$T_{amb} = -55$$
 °C

Fig. 18. TR2 (PNP): DC current gain as a function of collector current; typical values

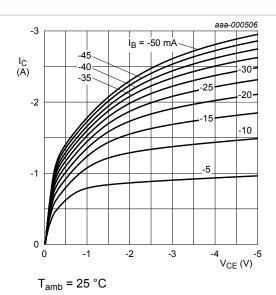
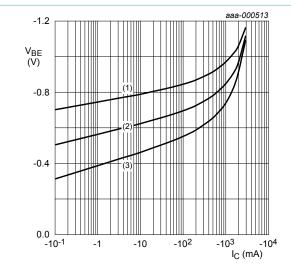


Fig. 19. TR2 (PNP): Collector current as a function of collector-emitter voltage; typical values



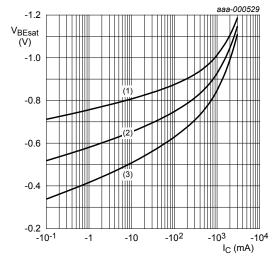
$$V_{CE} = -2 V$$

(1)
$$T_{amb} = -55 \, ^{\circ}C$$

(2)
$$T_{amb}$$
 = 25 °C

(3)
$$T_{amb} = 100 \, ^{\circ}C$$

Fig. 20. TR2 (PNP): Base-emitter voltage as a function of collector current; typical values



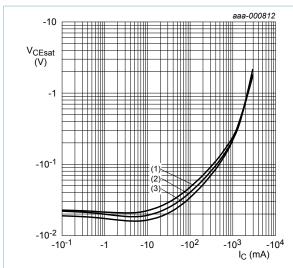
$$I_{\rm C}/I_{\rm B} = 20$$

(1)
$$T_{amb} = -55 \, ^{\circ}C$$

(2)
$$T_{amb}$$
 = 25 °C

(3)
$$T_{amb} = 100 \, ^{\circ}C$$

Fig. 21. TR2 (PNP): Base-emitter saturation voltage as a function of collector current; typical values



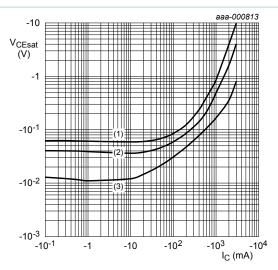
$$I_{\rm C}/I_{\rm B} = 20$$

(1)
$$T_{amb} = 100 \, ^{\circ}C$$

(2)
$$T_{amb} = 25 \, ^{\circ}C$$

(3)
$$T_{amb} = -55$$
 °C

Fig. 22. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values



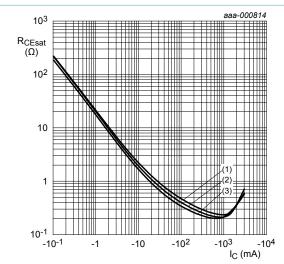
$$T_{amb}$$
 = 25 °C

(1)
$$I_C/I_B = 100$$

(2)
$$I_C/I_B = 50$$

(3)
$$I_C/I_B = 10$$

Fig. 23. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values



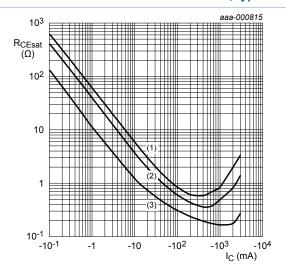
$$I_{\rm C}/I_{\rm B} = 20$$

(1)
$$T_{amb} = 100 \, ^{\circ}C$$

(2)
$$T_{amb}$$
 = 25 °C

(3)
$$T_{amb} = -55 \, ^{\circ}C$$

Fig. 24. TR2 (PNP): Collector-emitter saturation resistance as a function of collector current; typical values



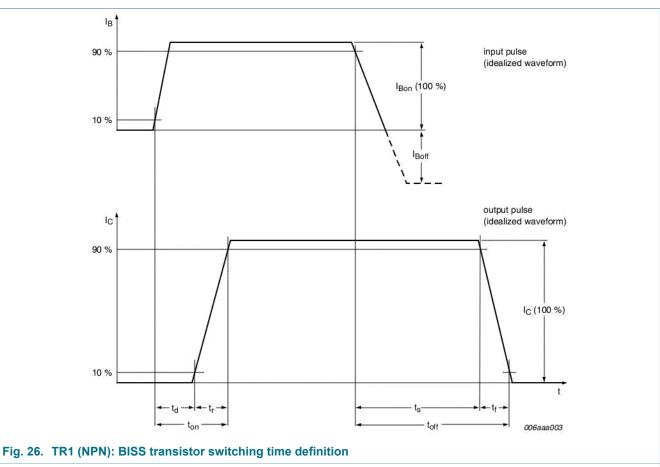
(1)
$$I_C/I_B = 100$$

(2)
$$I_C/I_B = 50$$

(3)
$$I_C/I_B = 10$$

Fig. 25. TR2 (PNP): Collector-emitter saturation resistance as a function of collector current; typical values

11. Test information



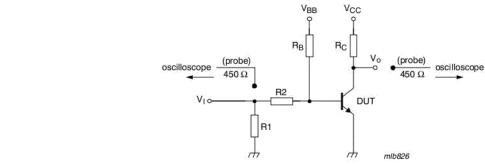
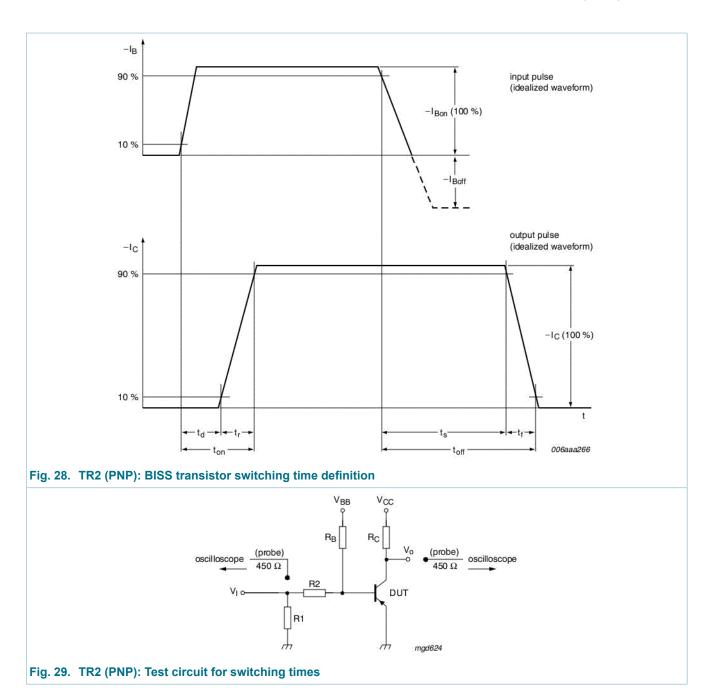


Fig. 27. TR1 (NPN): Test circuit for switching times

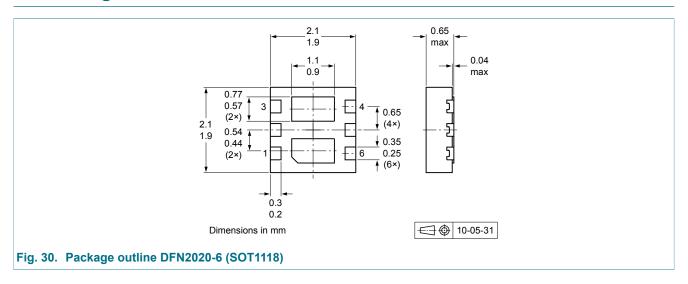


11.1 Quality information

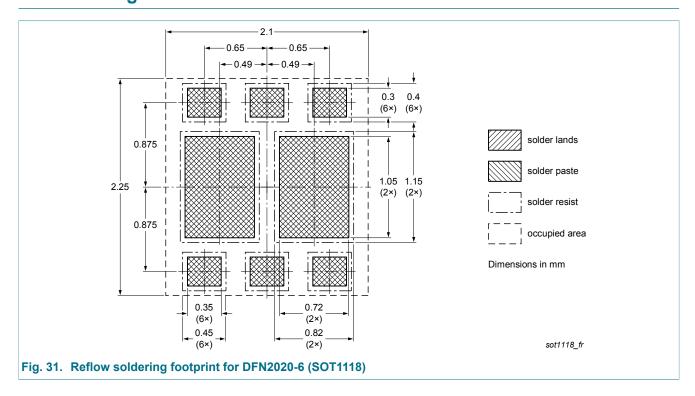
This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

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12. Package outline



13. Soldering



14. Revision history

Table 8. Revision history

- Italia or - Italia motor,						
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

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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.

- Please consult the most recently issued document before initiating or completing a design.
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