

PBSS4041NZ

60 V, 7 A NPN low V_{CEsat} (BISS) transistor

Rev. 2 — 8 August 2012

Product data sheet

1. Product profile

1.1 General description

NPN low V_{CEsat} Breakthrough In Small Signal (BISS) transistor in a SOT223 (SC-73) medium power Surface-Mounted Device (SMD) plastic package.

PNP complement: PBSS4041PZ.

1.2 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 energy efficiency due to less heat generation
- AEC-Q101 qualified
- Smaller required PCB area than for conventional transistors

1.3 Applications

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

1.4 Quick reference data

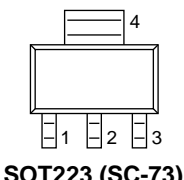
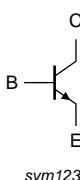
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	60	V
I_C	collector current		-	-	7	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	15	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 6$ A; $I_B = 600$ mA; pulsed; $t_p \leq 300$ μ s; $\delta \leq 0.02$; $T_{amb} = 25$ $^{\circ}$ C	-	17.5	25	m Ω



2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p>SOT223 (SC-73)</p>	 <p>sym123</p>
2	C	collector		
3	E	emitter		
4	C	collector		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4041NZ	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223

4. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4041NZ	PB4041NZ

5. 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	-	60	V	
V_{CEO}	collector-emitter voltage	open base	-	60	V	
V_{EBO}	emitter-base voltage	open collector	-	5	V	
I_C	collector current		-	7	A	
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	15	A	
I_B	base current		-	1	A	
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	770	mW
			[2]	-	1700	mW
			[3]	-	2600	mW

Table 5. Limiting values ...continued

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

Symbol	Parameter	Conditions	Min	Max	Unit
T_j	junction temperature		-	150	°C
T_{amb}	ambient temperature		-55	150	°C
T_{stg}	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 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
- [3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.

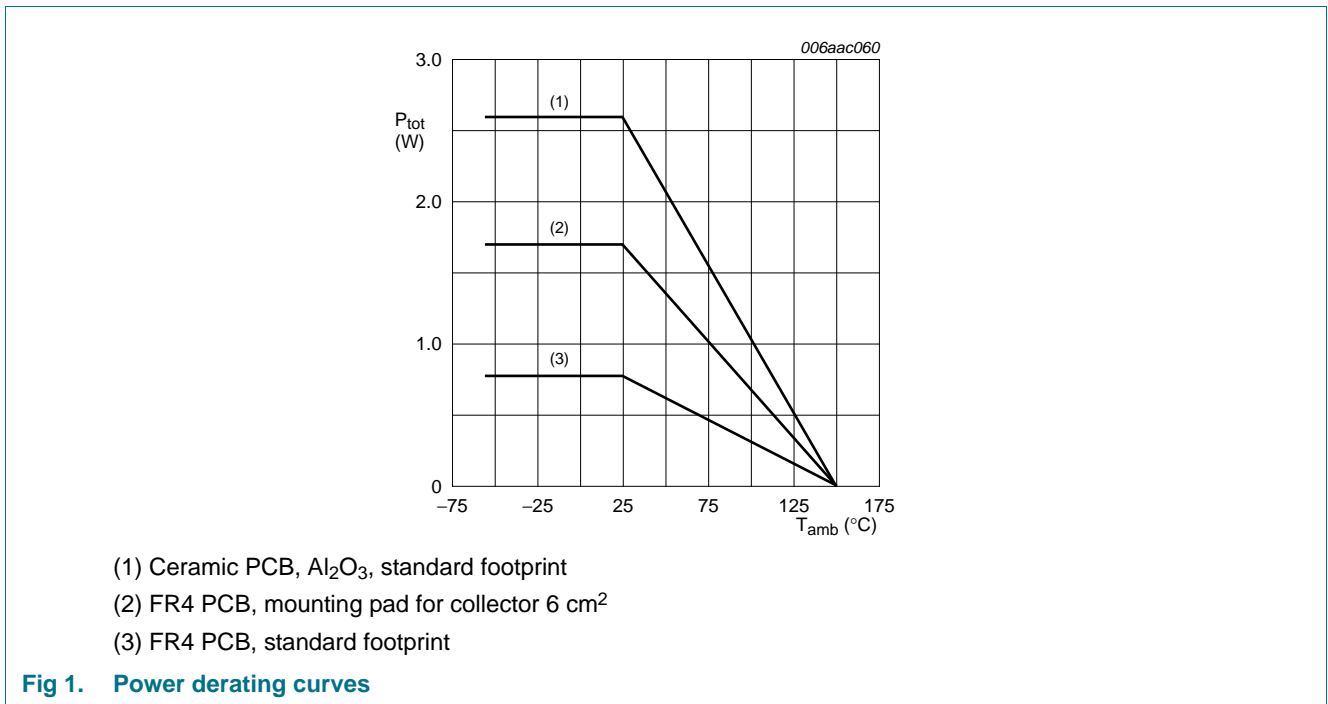


Fig 1. Power derating curves

6. 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]	-	-	160	K/W
			[2]	-	-	75	K/W
			[3]	-	-	50	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	11	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 6 cm².
- [3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.

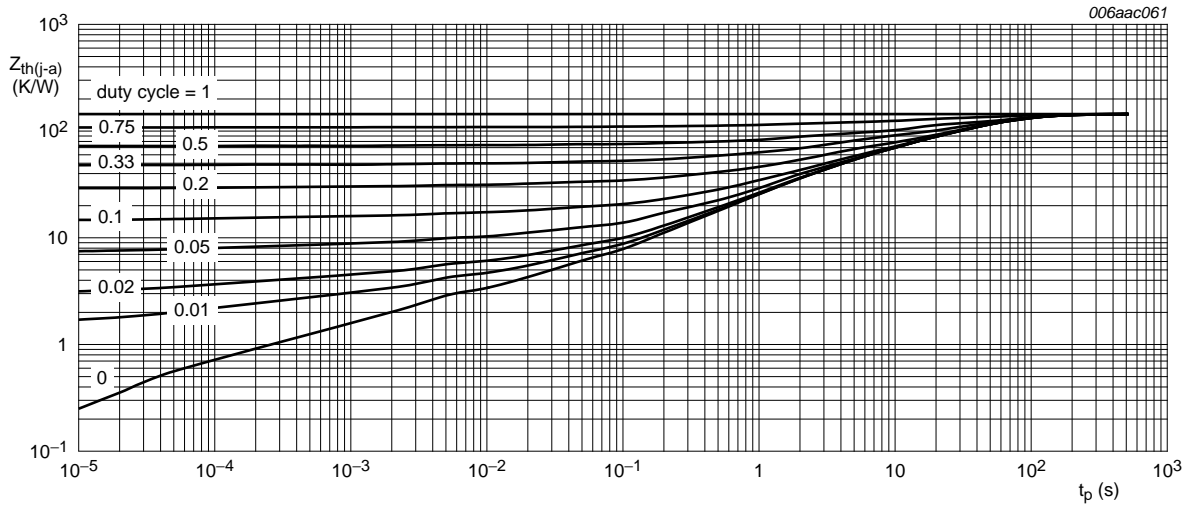


Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

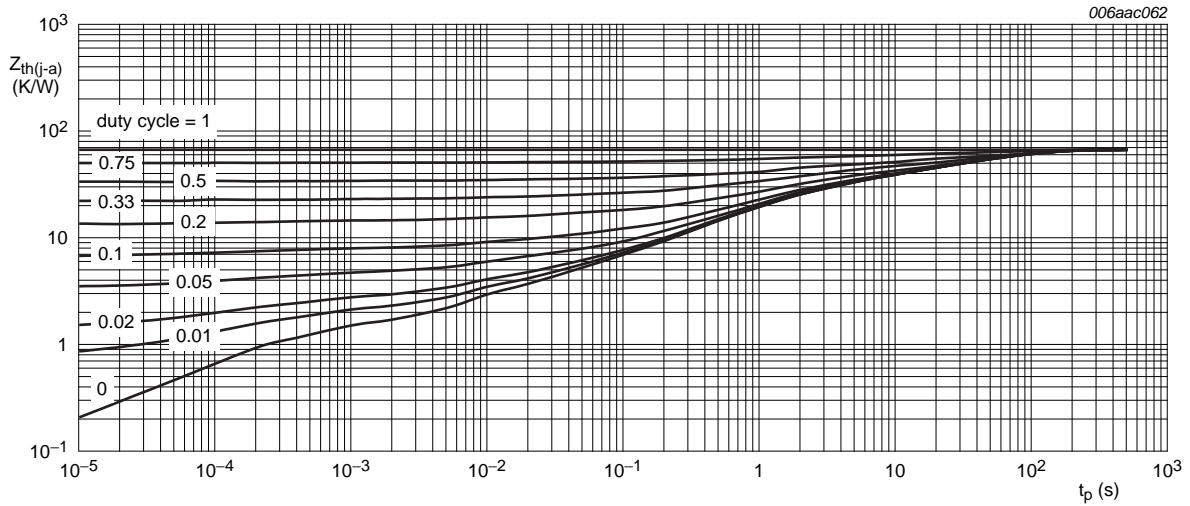
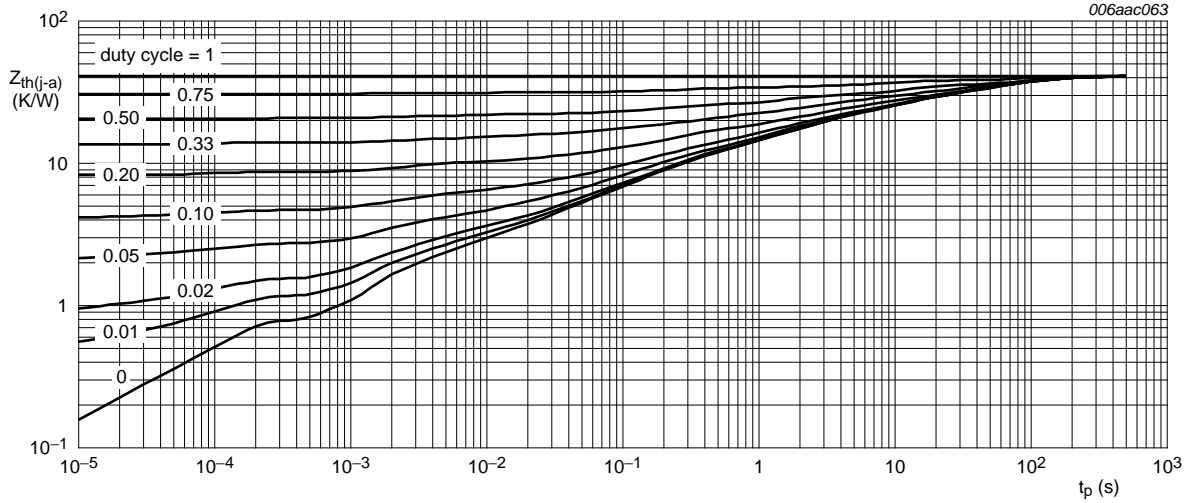


Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



Ceramic PCB, Al₂O₃, standard footprint

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

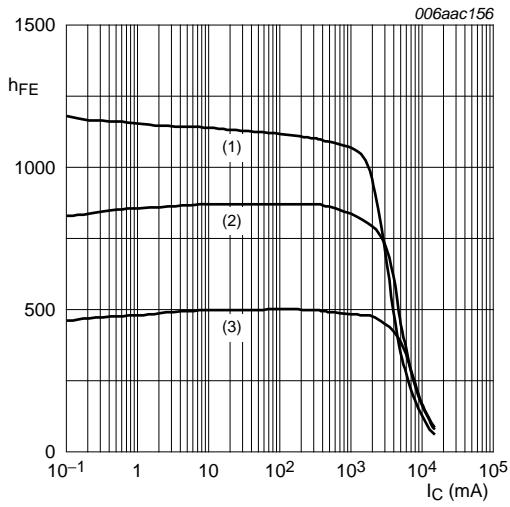
7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I _{CBO}	collector-base cut-off current	V _{CB} = 60 V; I _E = 0 A; T _{amb} = 25 °C	-	-	100	nA
		V _{CB} = 60 V; I _E = 0 A; T _j = 150 °C	-	-	50	µA
I _{CES}	collector-emitter cut-off current	V _{CE} = 48 V; V _{BE} = 0 V; T _{amb} = 25 °C	-	-	100	nA
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 = 500 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C	300	500	-	
		V _{CE} = 2 V; I _C = 1 A; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C	300	500	-	
		V _{CE} = 2 V; I _C = 2 A; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C	300	500	-	
		V _{CE} = 2 V; I _C = 4 A; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C	250	400	-	
		V _{CE} = 2 V; I _C = 6 A; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C	100	200	-	
		V _{CE} = 2 V; I _C = 7 A; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C	50	100	-	

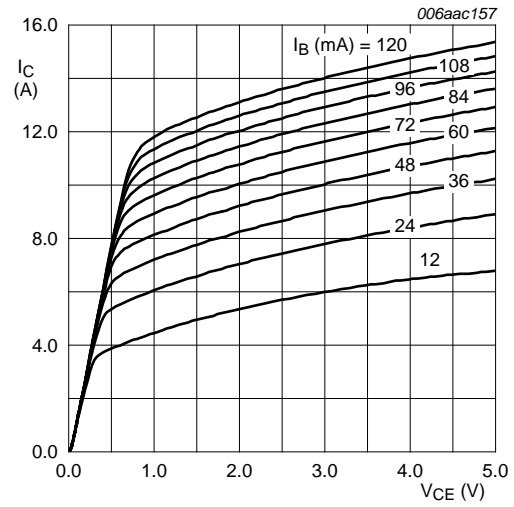
Table 7. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEsat}	collector-emitter saturation voltage	$I_C = 1\text{ A}; I_B = 50\text{ mA};$ pulsed; $t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	25	35	mV
		$I_C = 1\text{ A}; I_B = 10\text{ mA};$ pulsed; $t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	43	60	mV
		$I_C = 2\text{ A}; I_B = 40\text{ mA};$ pulsed; $t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	53	75	mV
		$I_C = 4\text{ A}; I_B = 200\text{ mA};$ pulsed; $t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	78	110	mV
		$I_C = 4\text{ A}; I_B = 40\text{ mA};$ pulsed; $t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	115	160	mV
		$I_C = 7\text{ A}; I_B = 350\text{ mA};$ pulsed; $t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	130	195	mV
R_{CEsat}	collector-emitter saturation resistance	$I_C = 6\text{ A}; I_B = 600\text{ mA};$ pulsed; $t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	17.5	25	m Ω
V_{BEsat}	base-emitter saturation voltage	$I_C = 1\text{ A}; I_B = 100\text{ mA};$ pulsed; $t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	0.83	0.9	V
		$I_C = 4\text{ A}; I_B = 400\text{ mA};$ pulsed; $t_p \leq 300\ \mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	0.98	1.05	V
V_{BEon}	base-emitter turn-on voltage	$V_{CE} = 2\text{ V}; I_C = 2\text{ A};$ pulsed; $t_p \leq 300\ \mu\text{s};$ $\delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	0.72	0.85	V
t_d	delay time	$V_{CC} = 12.5\text{ V}; I_C = 1\text{ A}; I_{Bon} = 0.05\text{ A};$ $I_{Boff} = -0.05\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	55	-	ns
t_r	rise time		-	55	-	ns
t_{on}	turn-on time		-	110	-	ns
t_s	storage time		-	1220	-	ns
t_f	fall time		-	230	-	ns
t_{off}	turn-off time		-	1450	-	ns
f_T	transition frequency	$V_{CE} = 10\text{ V}; I_C = 100\text{ mA}; f = 100\text{ MHz};$ $T_{amb} = 25\text{ }^\circ\text{C}$	-	105	-	MHz
C_c	collector capacitance	$V_{CB} = 10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A};$ $f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	50	-	pF



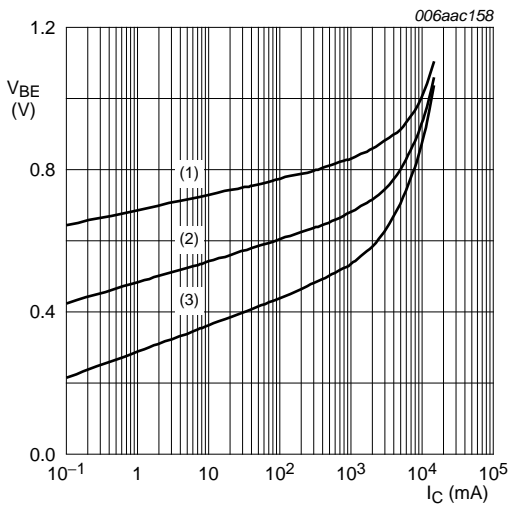
$V_{CE} = 2\text{ V}$
 (1) $T_{amb} = 100\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = -55\text{ }^\circ\text{C}$

Fig 5. DC current gain as a function of collector current; typical values



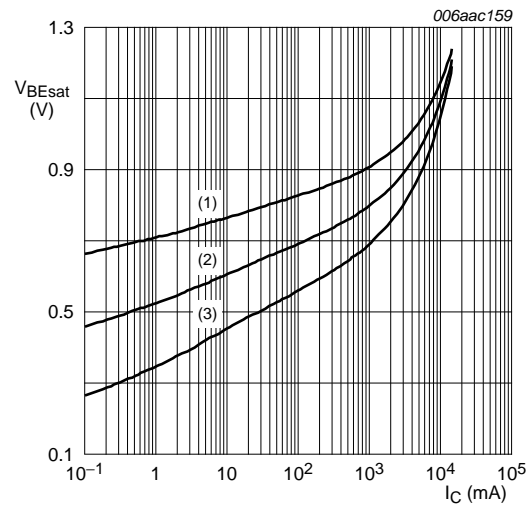
$T_{amb} = 25\text{ }^\circ\text{C}$

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



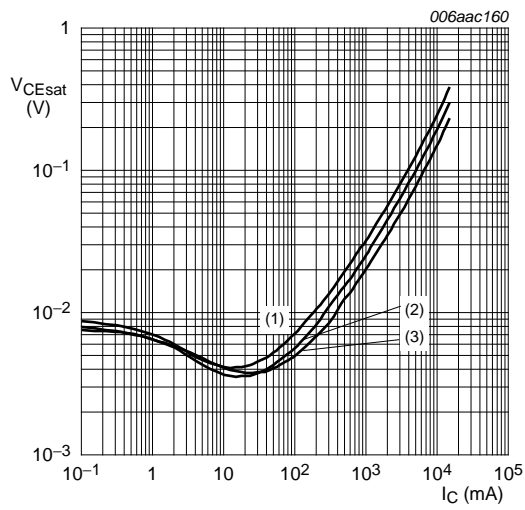
$V_{CE} = 2\text{ V}$
 (1) $T_{amb} = -55\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = 100\text{ }^\circ\text{C}$

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



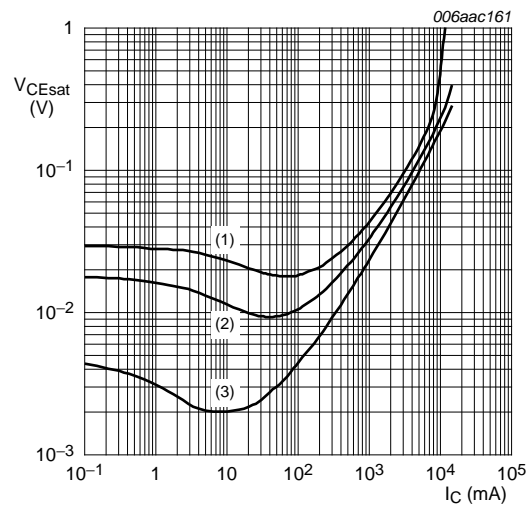
$I_C/I_B = 20$
 (1) $T_{amb} = -55\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = 100\text{ }^\circ\text{C}$

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



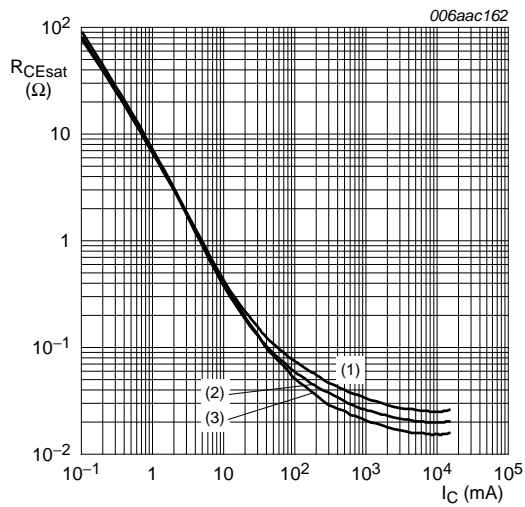
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = -55\text{ }^\circ\text{C}$

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



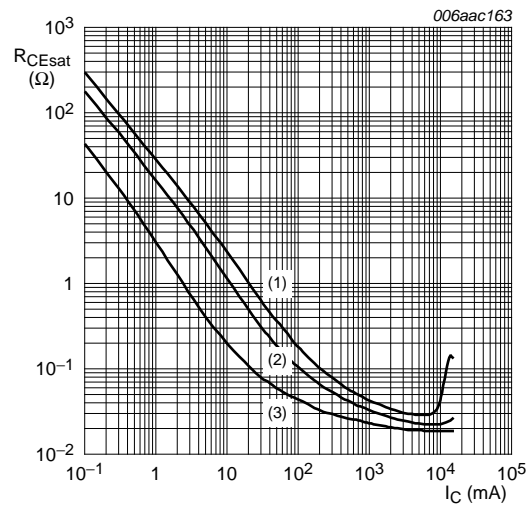
$T_{amb} = 25\text{ }^\circ\text{C}$
 (1) $I_C/I_B = 100$
 (2) $I_C/I_B = 50$
 (3) $I_C/I_B = 10$

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



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

Fig 11. Collector-emitter saturation resistance as a function of collector current; typical values



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

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

8. Test information

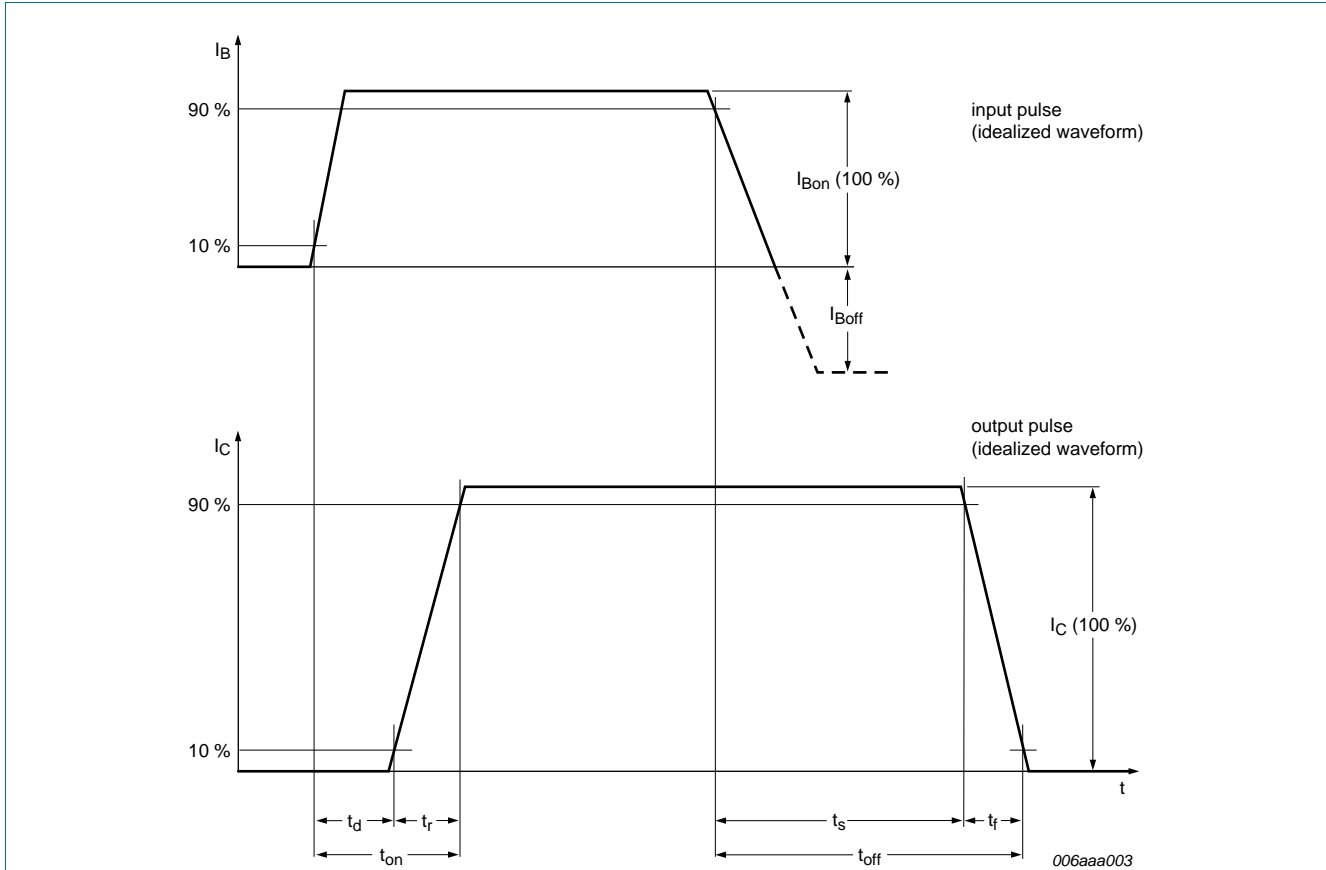


Fig 13. BISS transistor switching time definition

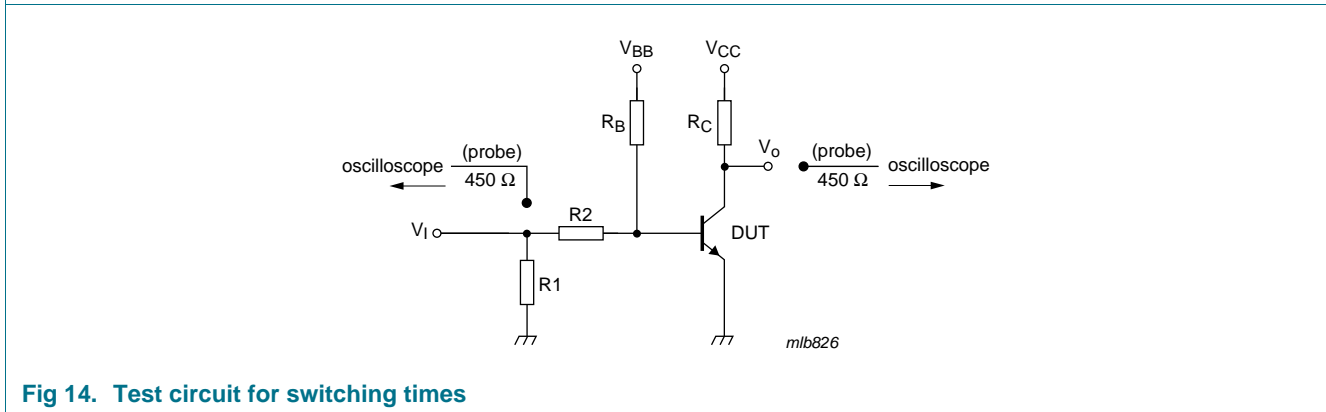


Fig 14. Test circuit for switching times

8.1 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.

9. Package outline

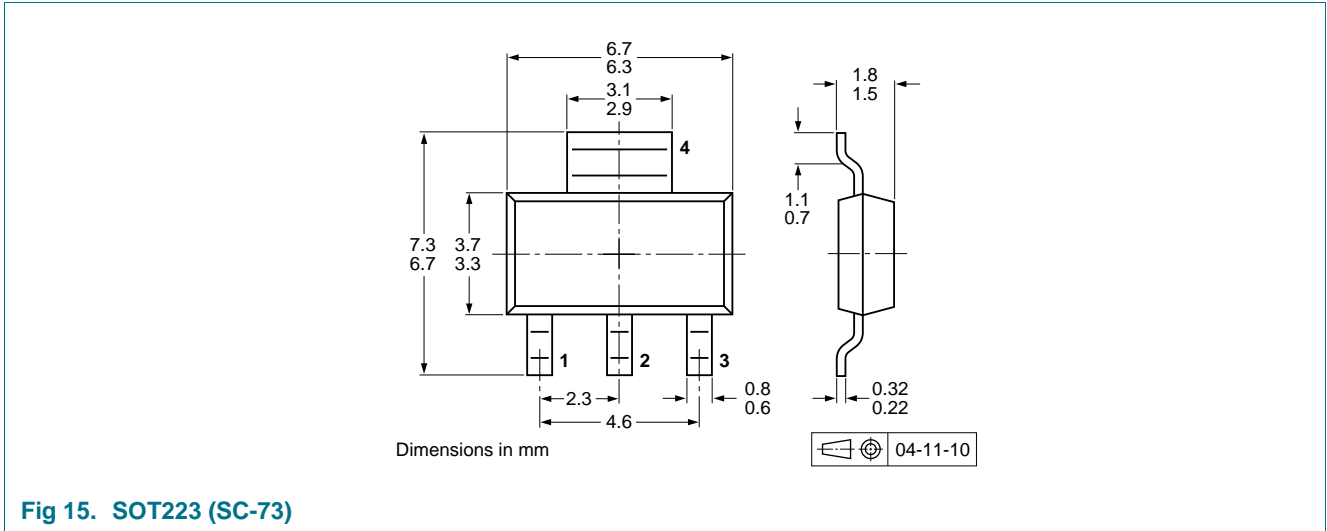


Fig 15. SOT223 (SC-73)

10. Soldering

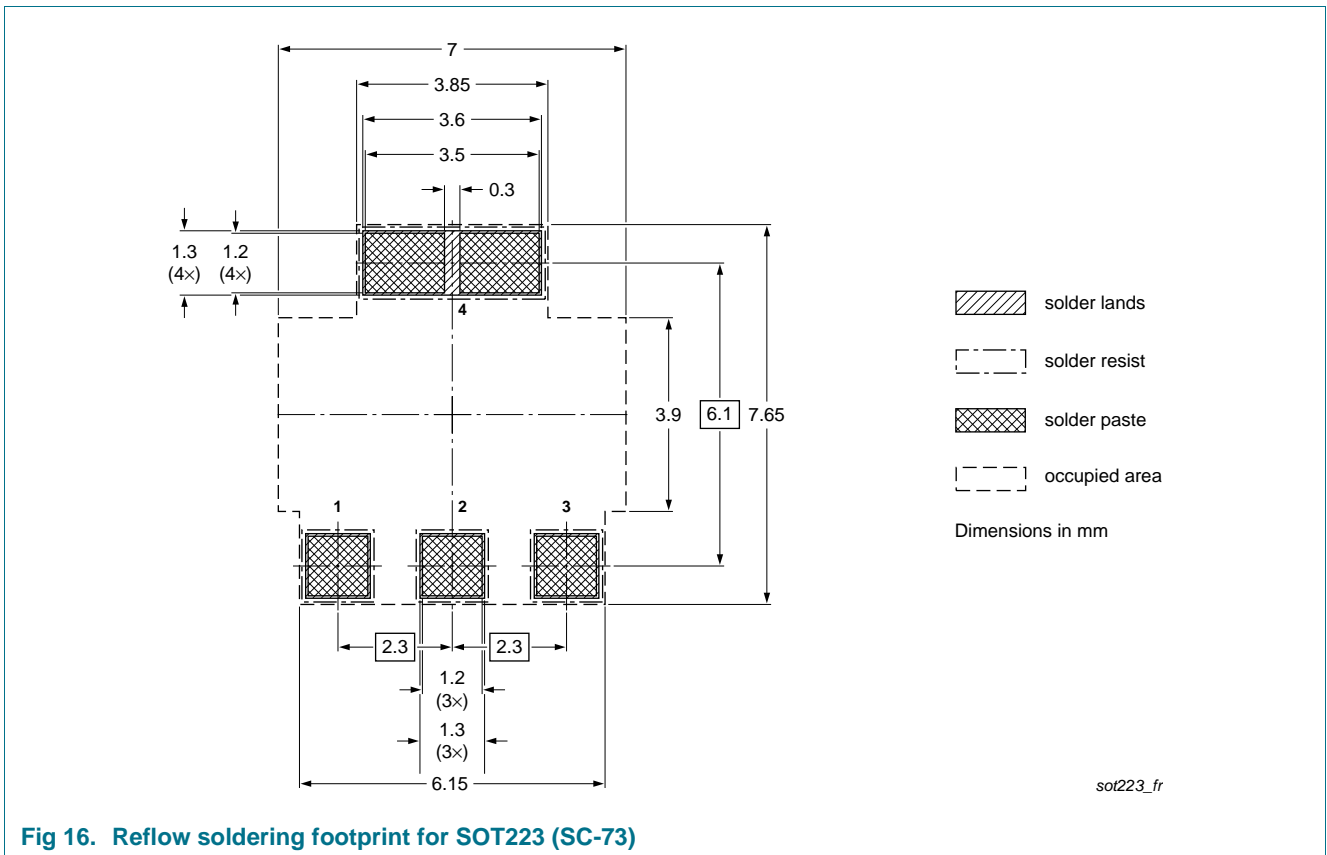


Fig 16. Reflow soldering footprint for SOT223 (SC-73)

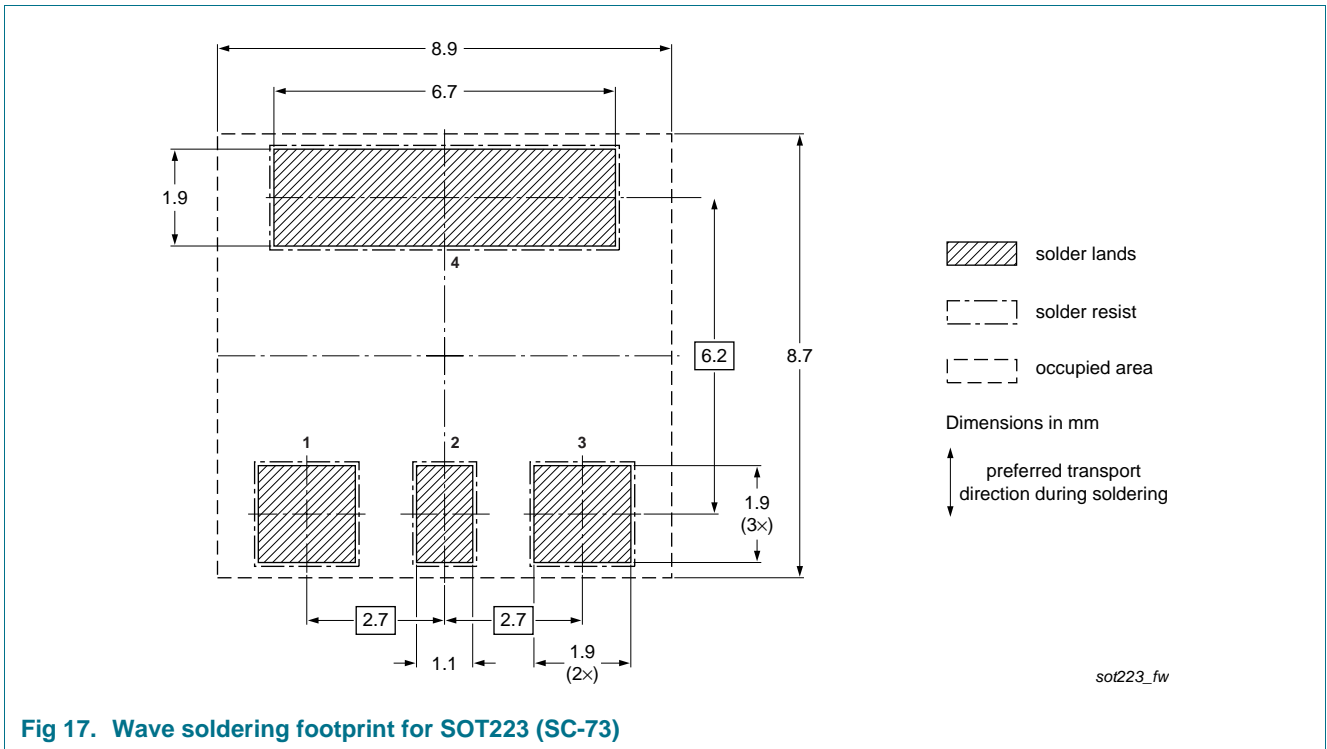


Fig 17. Wave soldering footprint for SOT223 (SC-73)

11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4041NZ v.2	20120808	Product data sheet	-	PBSS4041NZ v.1
Modifications:	<ul style="list-style-type: none">• 7 "Characteristics": V_{CEsat} corrected• 12 "Legal information": updated			
PBSS4041NZ v.1	20100331	Product data sheet	-	-

12. Legal information

12.1 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.

[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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For sales office addresses, please send an email to: salesaddresses@nxp.com

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