PBSS4021PZ

20 V, 6.6 A PNP low V_{CEsat} (BISS) transistor

Rev. 01 — 31 March 2010 Product data sheet

1. Product profile

1.1 General description

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

NPN complement: PBSS4021NZ.

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 Printed-Circuit Board (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

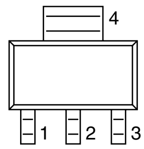
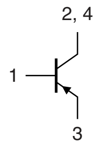
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	–20	V
I_C	collector current		-	-	–6.6	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	–20	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = –6$ A; $I_B = –600$ mA [1]	-	22	33	mΩ

[1] Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	base		 sym028
2	collector		
3	emitter		
4	collector		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4021PZ	SC-73	plastic surface-mounted package with increased heat sink; 4 leads	SOT223

4. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4021PZ	PB4021PZ

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	-	–20	V
V_{CEO}	collector-emitter voltage	open base	-	–20	V
V_{EBO}	emitter-base voltage	open collector	-	–5	V
I_C	collector current		-	–6.6	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	–20	A
I_B	base current		-	–1	A

Table 5. Limiting values *…continued*

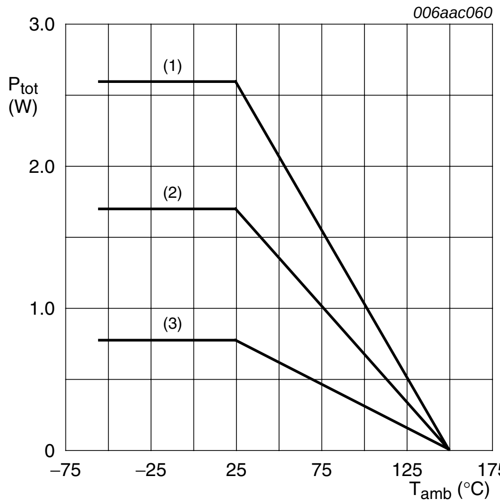
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	770	mW
			[2]	-	1700	mW
			[3]	-	2600	mW
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 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 cm^2.

[3] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.



(1) Ceramic PCB, Al_2O_3, standard footprint

(2) FR4 PCB, mounting pad for collector 6 cm^2

(3) FR4 PCB, standard footprint

Fig 1. Power derating curves

6. Thermal characteristics

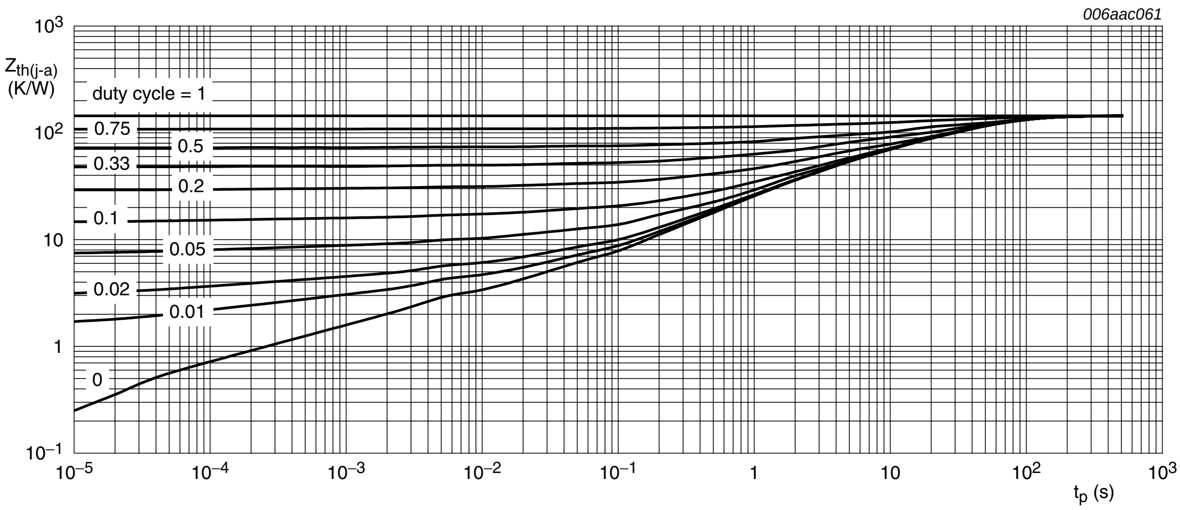
Table 6. Thermal characteristics

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.

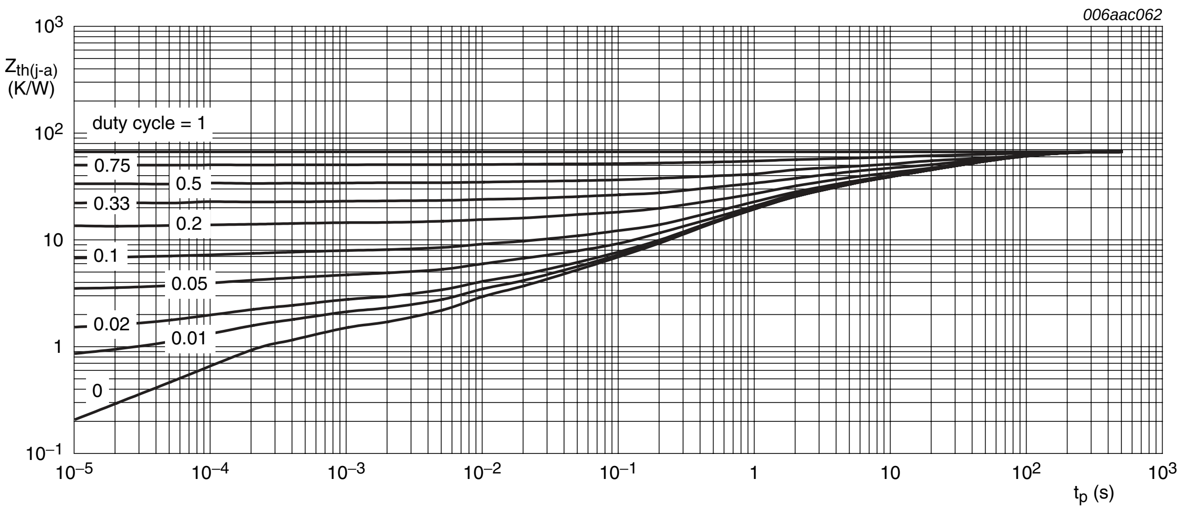
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm^2.

[3] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.



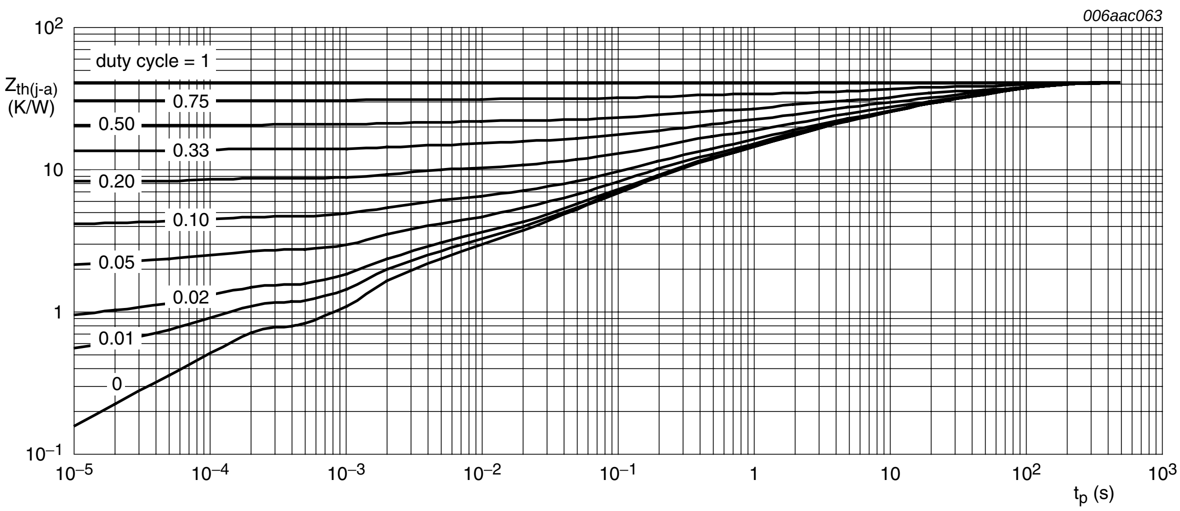
FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for collector 6 cm^2

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



Ceramic PCB, Al_2O_3, standard footprint

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

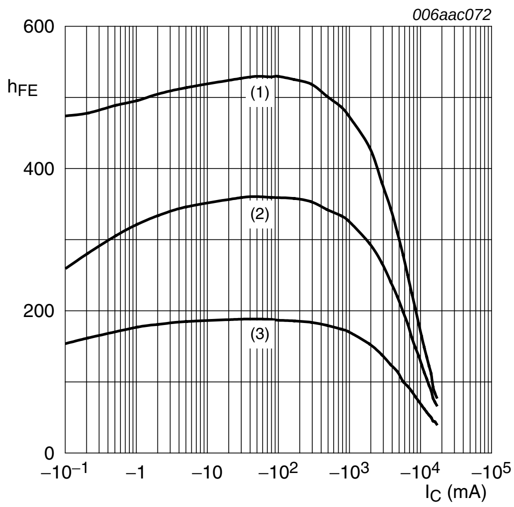
7. Characteristics

Table 7. Characteristics

T_{amb} = 25 °C unless otherwise specified.

<table>
<tr><th>Symbol</th><th>Parameter</th><th>Conditions</th><th></th><th>Min</th><th>Typ</th><th>Max</th><th>Unit</th></tr>
<tr><td rowspan="2">I_{CBO}</td><td rowspan="2">collector-base cut-off current</td><td>V_{CB} = –20 V; I_E = 0 A</td><td></td><td>-</td><td>-</td><td>–100</td><td>nA</td></tr>
<tr><td>V_{CB} = –20 V; I_E = 0 A; T_j = 150 °C</td><td></td><td>-</td><td>-</td><td>–55</td><td>μA</td></tr>
<tr><td>I_{CES}</td><td>collector-emitter cut-off current</td><td>V_{CE} = –16 V; V_{BE} = 0 V</td><td></td><td>-</td><td>-</td><td>–100</td><td>nA</td></tr>
<tr><td>I_{EBO}</td><td>emitter-base cut-off current</td><td>V_{EB} = –5 V; I_C = 0 A</td><td></td><td>-</td><td>-</td><td>–100</td><td>nA</td></tr>
<tr><td rowspan="6">h_{FE}</td><td rowspan="6">DC current gain</td><td></td><td>[1]</td><td></td><td></td><td></td><td></td></tr>
<tr><td>V_{CE} = –2 V; I_C = –500 mA</td><td></td><td>250</td><td>400</td><td>-</td><td></td></tr>
<tr><td>V_{CE} = –2 V; I_C = –1 A</td><td></td><td>250</td><td>400</td><td>-</td><td></td></tr>
<tr><td>V_{CE} = –2 V; I_C = –2 A</td><td></td><td>200</td><td>350</td><td>-</td><td></td></tr>
<tr><td>V_{CE} = –2 V; I_C = –4 A</td><td></td><td>150</td><td>250</td><td>-</td><td></td></tr>
<tr><td>V_{CE} = –2 V; I_C = –7 A</td><td></td><td>100</td><td>180</td><td>-</td><td></td></tr>
<tr><td rowspan="7">V_{CEsat}</td><td rowspan="7">collector-emitter saturation voltage</td><td></td><td>[1]</td><td></td><td></td><td></td><td></td></tr>
<tr><td>I_C = –1 A; I_B = –50 mA</td><td></td><td>-</td><td>–31</td><td>–50</td><td>mV</td></tr>
<tr><td>I_C = –1 A; I_B = –10 mA</td><td></td><td>-</td><td>–53</td><td>–80</td><td>mV</td></tr>
<tr><td>I_C = –2 A; I_B = –40 mA</td><td></td><td>-</td><td>–66</td><td>–100</td><td>mV</td></tr>
<tr><td>I_C = –4 A; I_B = –200 mA</td><td></td><td>-</td><td>–95</td><td>–140</td><td>mV</td></tr>
<tr><td>I_C = –4 A; I_B = –40 mA</td><td></td><td>-</td><td>–150</td><td>–225</td><td>mV</td></tr>
<tr><td>I_C = –7 A; I_B = –350 mA</td><td></td><td>-</td><td>–160</td><td>–240</td><td>mV</td></tr>
<tr><td>R_{CEsat}</td><td>collector-emitter saturation resistance</td><td>I_C = –6 A; I_B = –600 mA</td><td>[1]</td><td>-</td><td>22</td><td>33</td><td>mΩ</td></tr>
<tr><td rowspan="2">V_{BEsat}</td><td rowspan="2">base-emitter saturation voltage</td><td>I_C = –1 A; I_B = –50 mA</td><td>[1]</td><td>-</td><td>–0.79</td><td>–0.9</td><td>V</td></tr>
<tr><td>I_C = –4 A; I_B = –400 mA</td><td>[1]</td><td>-</td><td>–0.94</td><td>–1.05</td><td>V</td></tr>
<tr><td>V_{BEon}</td><td>base-emitter turn-on voltage</td><td>V_{CE} = –2 V; I_C = –2 A</td><td>[1]</td><td>-</td><td>–0.73</td><td>–0.85</td><td>V</td></tr>
<tr><td>t_d</td><td>delay time</td><td rowspan="6">V_{CC} = –12.5 V; I_C = –1 A; I_{Bon} = –0.05 A; I_{Boff} = 0.05 A</td><td></td><td>-</td><td>55</td><td>-</td><td>ns</td></tr>
<tr><td>t_r</td><td>rise time</td><td></td><td>-</td><td>60</td><td>-</td><td>ns</td></tr>
<tr><td>t_{on}</td><td>turn-on time</td><td></td><td>-</td><td>115</td><td>-</td><td>ns</td></tr>
<tr><td>t_s</td><td>storage time</td><td></td><td>-</td><td>400</td><td>-</td><td>ns</td></tr>
<tr><td>t_f</td><td>fall time</td><td></td><td>-</td><td>110</td><td>-</td><td>ns</td></tr>
<tr><td>t_{off}</td><td>turn-off time</td><td></td><td>-</td><td>510</td><td>-</td><td>ns</td></tr>
<tr><td>f_T</td><td>transition frequency</td><td>V_{CE} = –10 V; I_C = –100 mA; f = 100 MHz</td><td></td><td>-</td><td>85</td><td>-</td><td>MHz</td></tr>
<tr><td>C_c</td><td>collector capacitance</td><td>V_{CB} = –10 V; I_E = i_e = 0 A; f = 1 MHz</td><td></td><td>-</td><td>125</td><td>-</td><td>pF</td></tr>
</table>

[1] Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.



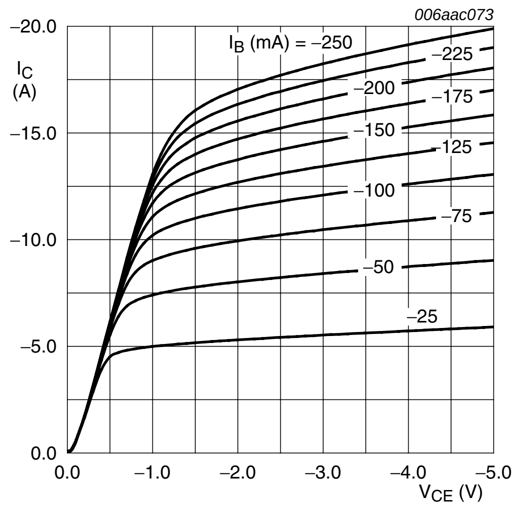
V_{CE} = −2 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

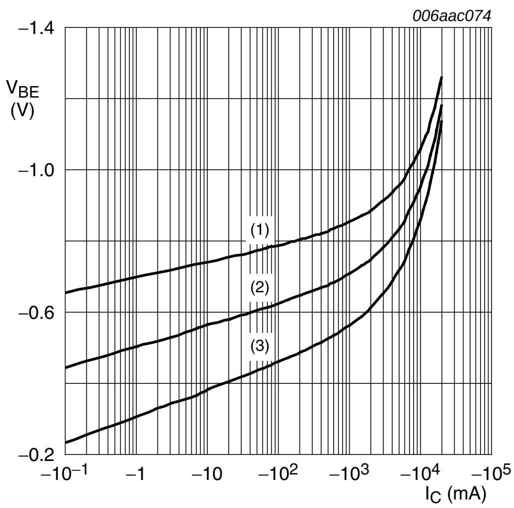
(3) T_{amb} = −55 °C

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



T_{amb} = 25 °C

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



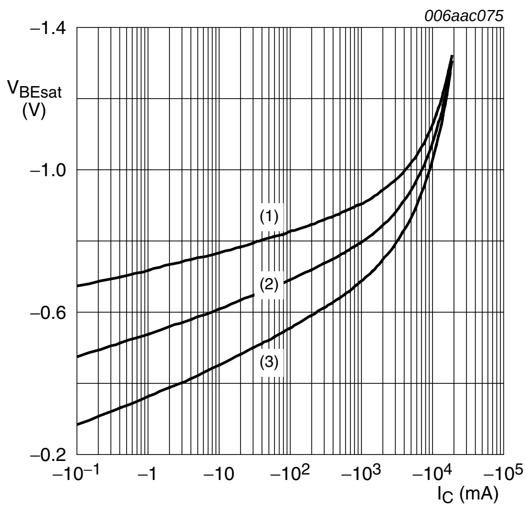
V_{CE} = −2 V

(1) T_{amb} = −55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



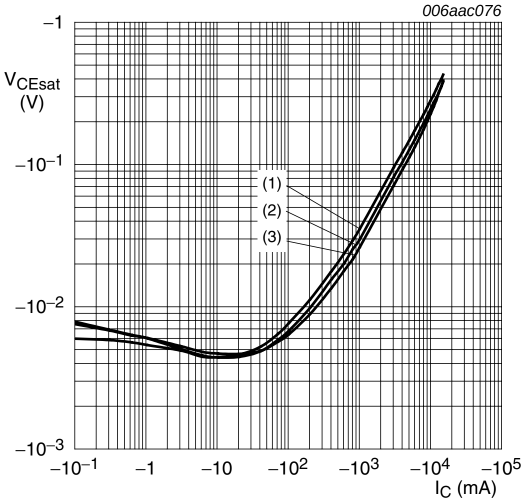
I_C/I_B = 20

(1) T_{amb} = −55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



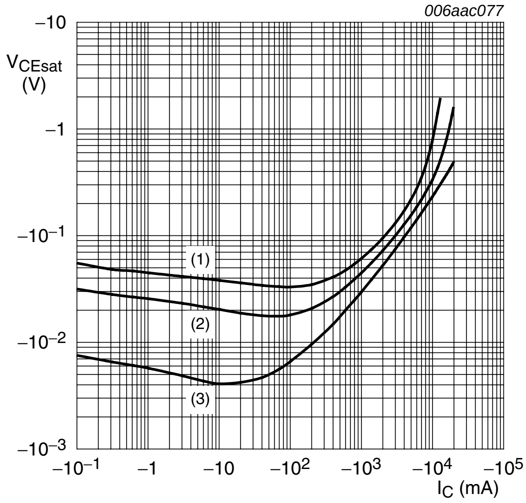
$I_C/I_B = 20$

(1) $T_{amb} = 100$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = -55$ °C

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



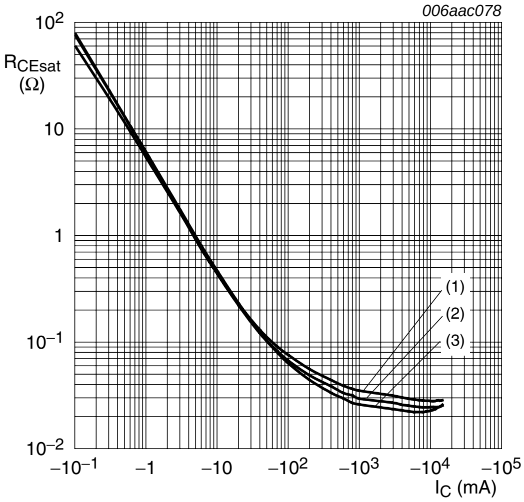
$T_{amb} = 25$ °C

(1) $I_C/I_B = 100$

(2) $I_C/I_B = 50$

(3) $I_C/I_B = 10$

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



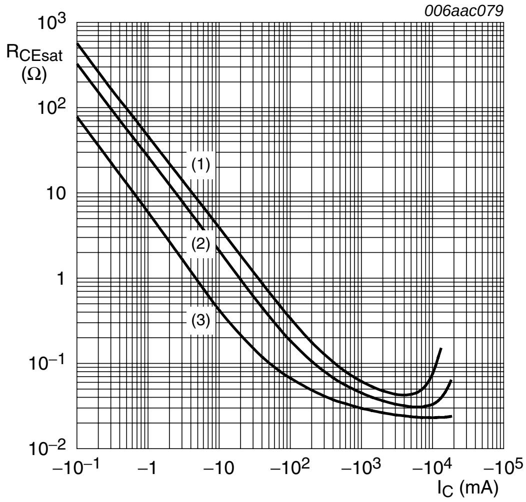
$I_C/I_B = 20$

(1) $T_{amb} = 100$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = -55$ °C

Fig 11. 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) $I_C/I_B = 10$

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

8. Test information

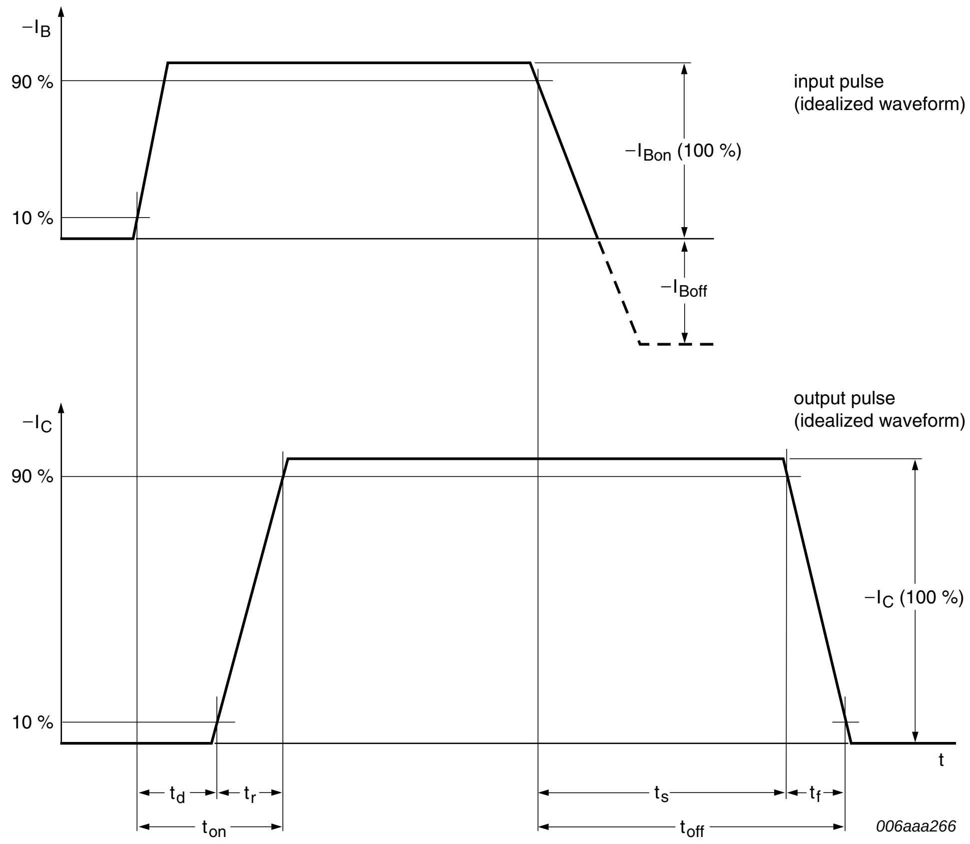


Fig 13. BISS transistor switching time definition

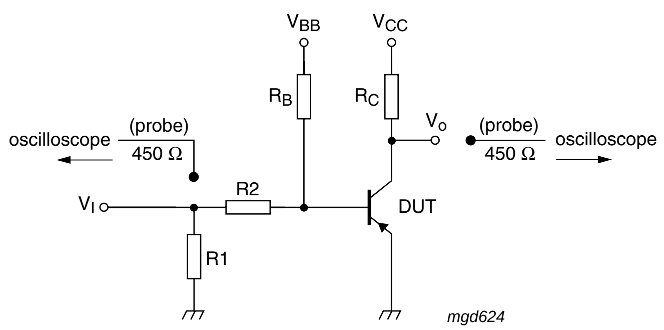


Fig 14. Test circuit for switching times

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

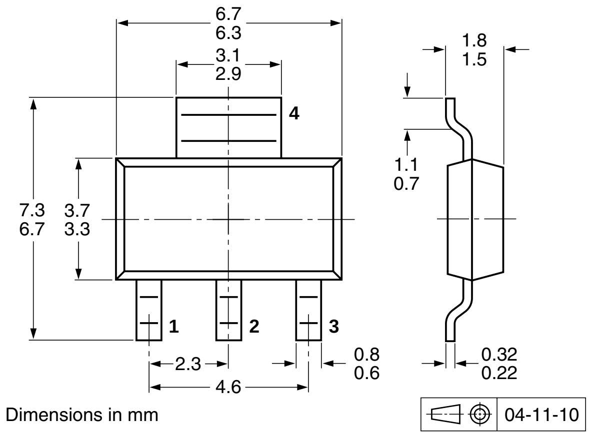


Fig 15. Package outline SOT223 (SC-73)

10. Packing information

Table 8. Packing methods

The indicated -xxx are the last three digits of the 12NC ordering code.[1]

Type number	Package	Description	Packing quantity	
			1000	4000
PBSS4021PZ	SOT223	8 mm pitch, 12 mm tape and reel	-115	-135

[1] For further information and the availability of packing methods, see Section 14.

11. Soldering

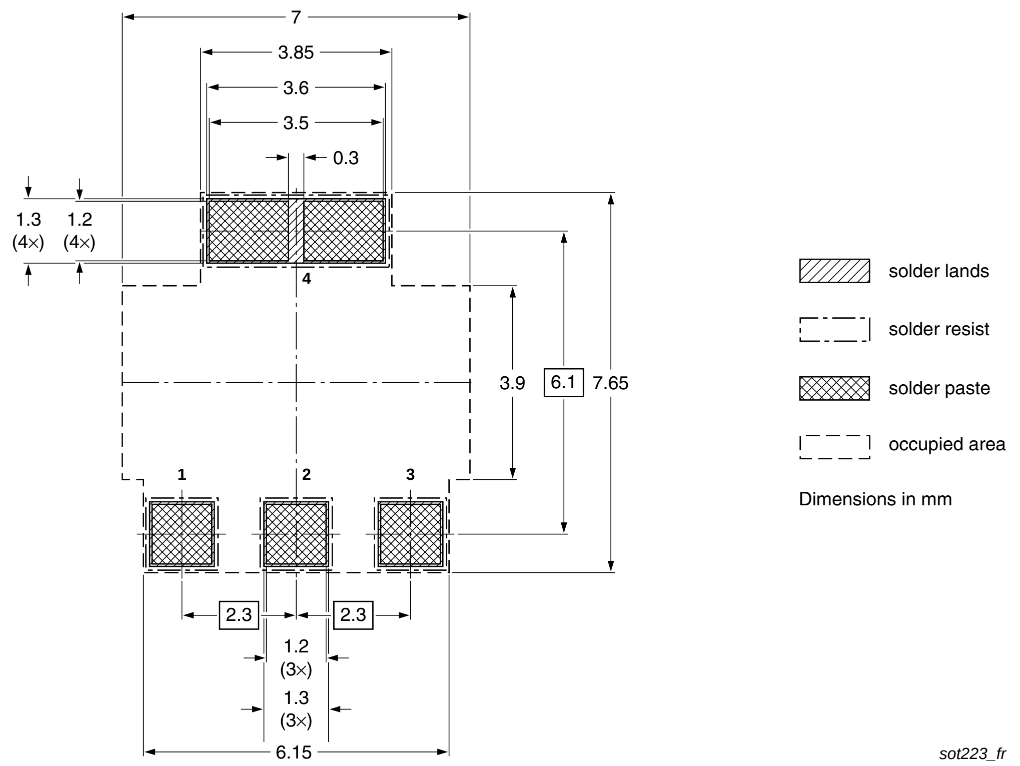


Fig 16. Reflow soldering footprint SOT223 (SC-73)

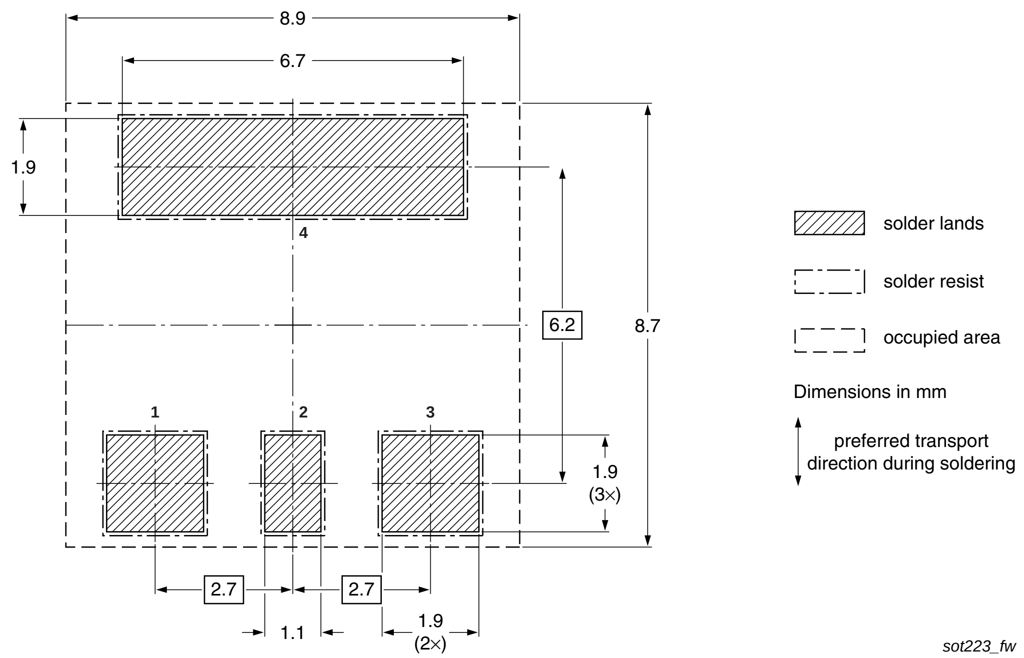


Fig 17. Wave soldering footprint SOT223 (SC-73)

12. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4021PZ_1	20100331	Product data sheet	-	-

13. Legal information

13.1 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".

[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 http://www.nexperia.com.

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14. Contact information

For more information, please visit: **http://www.nexperia.com**

For sales office addresses, please send an email to: **salesaddresses@nexperia.com**

15. Contents