



# PBSS5160U

60 V, 1 A PNP low V<sub>CEsat</sub> transistor

9 November 2023

Product data sheet

## 1. General description

PNP low V<sub>CEsat</sub> transistor in a very small SOT323 (SC-70) Surface-Mounted Device (SMD) plastic package.

NPN complement: PBSS4160U

## 2. Features and benefits

- Low collector-emitter saturation voltage V<sub>CEsat</sub>
- High collector current capability I<sub>C</sub> and I<sub>CM</sub>
- High collector current gain (h<sub>FE</sub>) at high I<sub>C</sub>
- High efficiency due to less heat generation
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors

## 3. Applications

- High voltage DC-to-DC conversion
- High voltage MOSFET gate driving
- High voltage motor control
- High voltage power switches (e.g. motors, fans)

## 4. Quick reference data

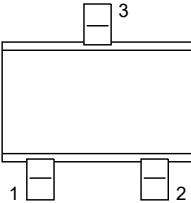
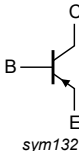
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	-60	V
I <sub>C</sub>	collector current	[1]	-	-	-1	A
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms	-	-	-2	A
R <sub>CEsat</sub>	collector-emitter saturation resistance	I <sub>C</sub> = -1 A; I <sub>B</sub> = -100 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	255	340	mΩ

[1] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 SC-70 (SOT323)	
2	E	emitter		
3	C	collector		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
<a href="#">PBSS5160U</a>	SC-70	plastic, surface-mounted package; 3 leads; 1.3 mm pitch; 2 mm x 1.25 mm x 0.95 mm body	<a href="#">SOT323</a>

7. Marking

Table 4. Marking codes

Type number	Marking code[1]
PBSS5160U	53 %

[1] % = placeholder for manufacturing site code

8. Limiting values

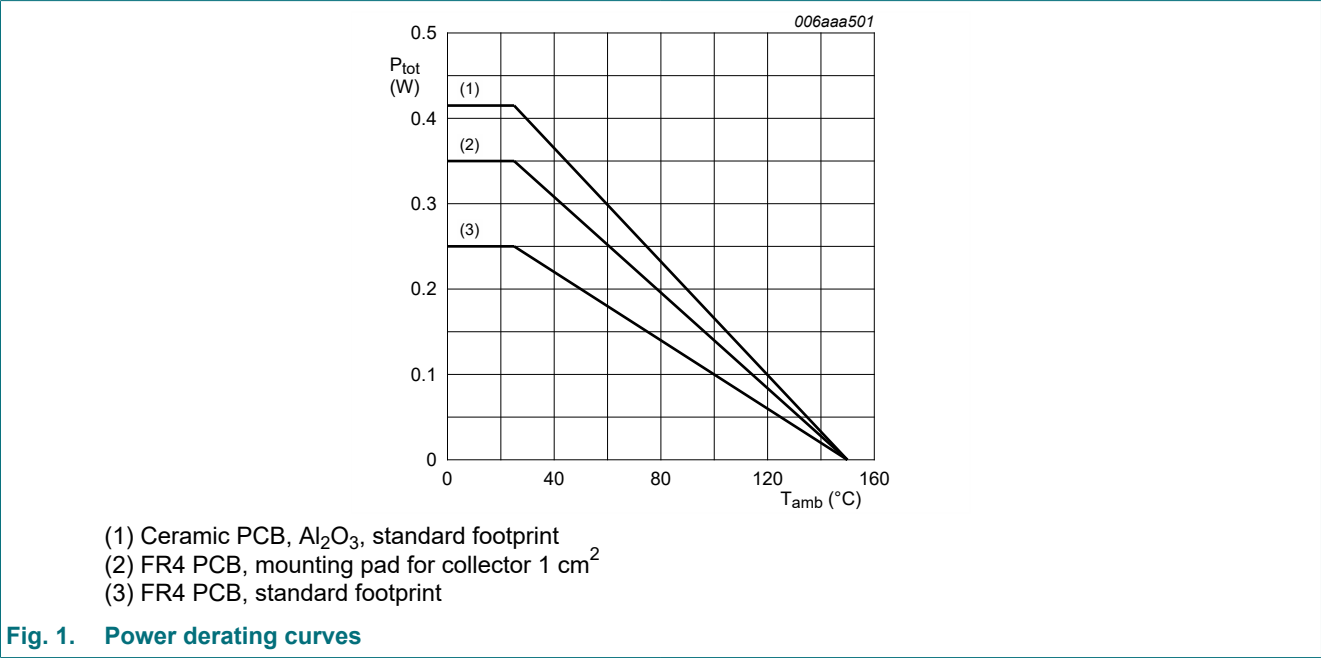
Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V <sub>CBO</sub>	collector-base voltage	open emitter		-	-80	V
V <sub>CEO</sub>	collector-emitter voltage	open base		-	-60	V
V <sub>EBO</sub>	emitter-base voltage	open collector		-	-5	V
I <sub>C</sub>	collector current		[1]	-	-0.7	A
			[2]	-	-0.86	A
			[3]	-	-1	A
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms		-	-2	A
I <sub>B</sub>	base current			-	-300	mA
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]	-	250	mW
			[2]	-	350	mW
			[3]	-	415	mW
T <sub>j</sub>	junction temperature			-	150	°C
T <sub>amb</sub>	ambient temperature			-65	150	°C

Symbol	Parameter	Conditions		Min	Max	Unit
T <sub>stg</sub>	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 1 cm<sup>2</sup>.
- [3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.

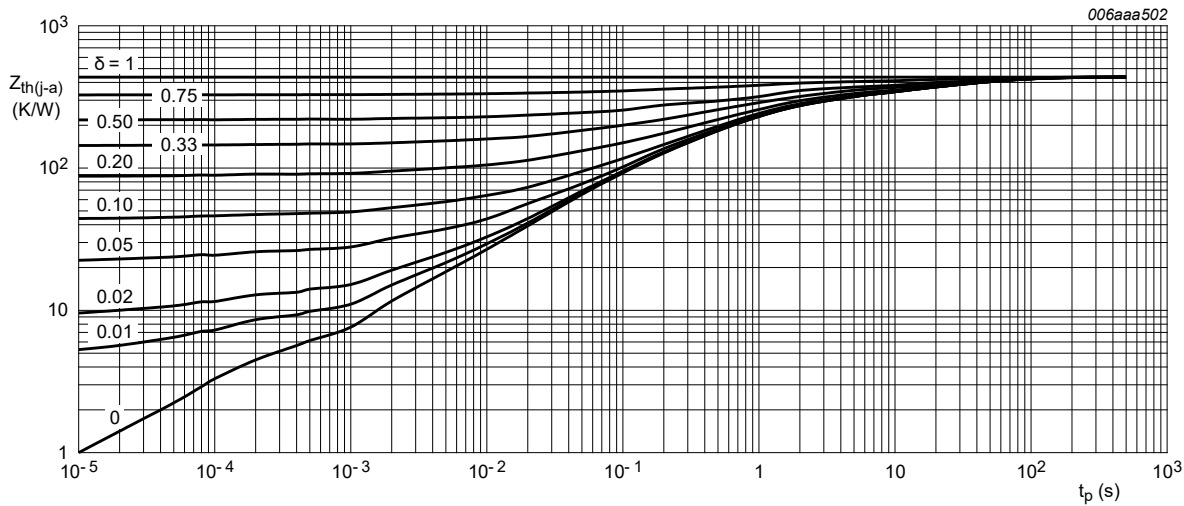


9. Thermal characteristics

Table 6. Thermal characteristics

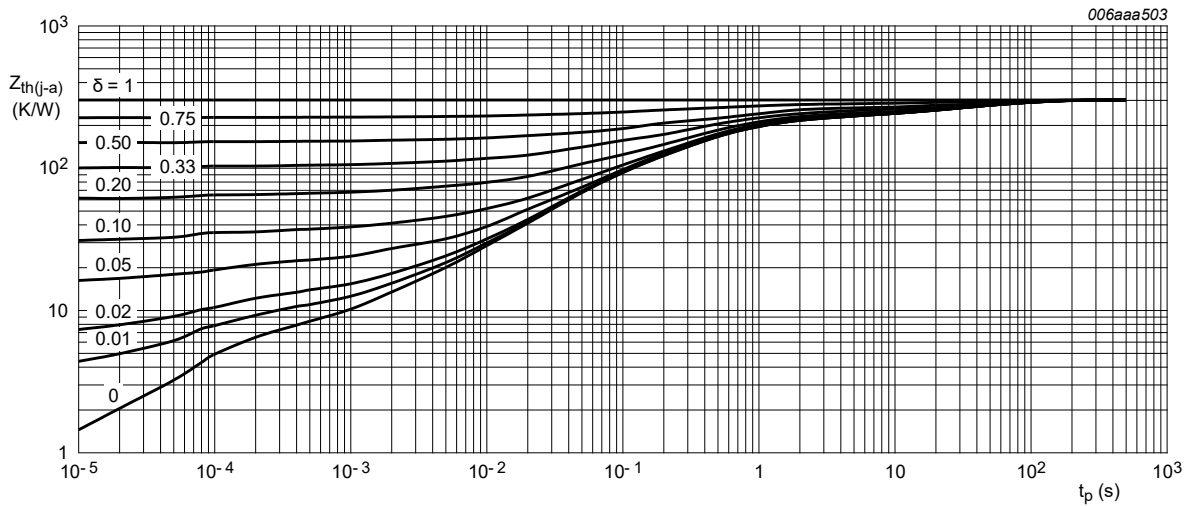
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	500	K/W
			[2]	-	-	357	K/W
			[3]	-	-	301	K/W
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point			-	-	150	K/W

- [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 1 cm<sup>2</sup>.
- [3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.



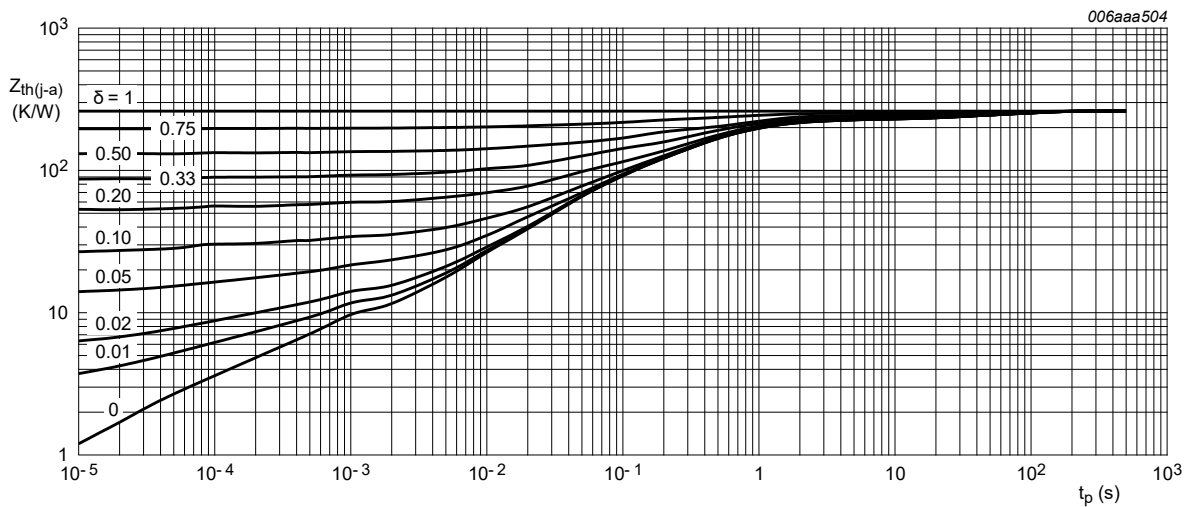
FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

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



Ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint

Fig. 4. 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
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -60\text{ V}$ ; $I_E = 0\text{ A}$ ; $T_{amb} = 25\text{ °C}$	-	-	-100	nA
		$V_{CB} = -60\text{ V}$ ; $I_E = 0\text{ A}$ ; $T_j = 150\text{ °C}$	-	-	-50	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -5\text{ V}$ ; $I_C = 0\text{ A}$ ; $T_{amb} = 25\text{ °C}$	-	-	-100	nA
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = -60\text{ V}$ ; $V_{BE} = 0\text{ V}$ ; $T_{amb} = 25\text{ °C}$	-	-	-100	nA
$h_{FE}$	DC current gain	$V_{CE} = -5\text{ V}$ ; $I_C = -1\text{ mA}$ ; $T_{amb} = 25\text{ °C}$	200	350	-	
		$V_{CE} = -5\text{ V}$ ; $I_C = -500\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	150	250	-	
		$V_{CE} = -5\text{ V}$ ; $I_C = -1\text{ A}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	100	160	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -100\text{ mA}$ ; $I_B = -1\text{ mA}$ ; $T_{amb} = 25\text{ °C}$	-	-110	-175	mV
		$I_C = -500\text{ mA}$ ; $I_B = -50\text{ mA}$ ; $T_{amb} = 25\text{ °C}$	-	-135	-180	mV
		$I_C = -1\text{ A}$ ; $I_B = -100\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	-	-255	-340	mV
$R_{CEsat}$	collector-emitter saturation resistance		-	255	340	m $\Omega$
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -1\text{ A}$ ; $I_B = -50\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	-	-0.95	-1.1	V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = -5\text{ V}$ ; $I_C = -1\text{ A}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ °C}$	-	-0.82	-0.9	V
$t_d$	delay time	$I_C = -0.5\text{ A}$ ; $I_{Bon} = -25\text{ mA}$ ; $I_{Boff} = 25\text{ mA}$ ; $T_{amb} = 25\text{ °C}$	-	11	-	ns
$t_r$	rise time		-	30	-	ns
$t_{on}$	turn-on time		-	41	-	ns
$t_s$	storage time		-	205	-	ns
$t_f$	fall time		-	55	-	ns
$t_{off}$	turn-off time		-	260	-	ns
$f_T$	transition frequency	$V_{CE} = -10\text{ V}$ ; $I_C = -50\text{ mA}$ ; $f = 100\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	150	185	-	MHz
$C_c$	collector capacitance	$V_{CB} = -10\text{ V}$ ; $I_E = 0\text{ A}$ ; $i_e = 0\text{ A}$ ; $f = 1\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	-	9	15	pF

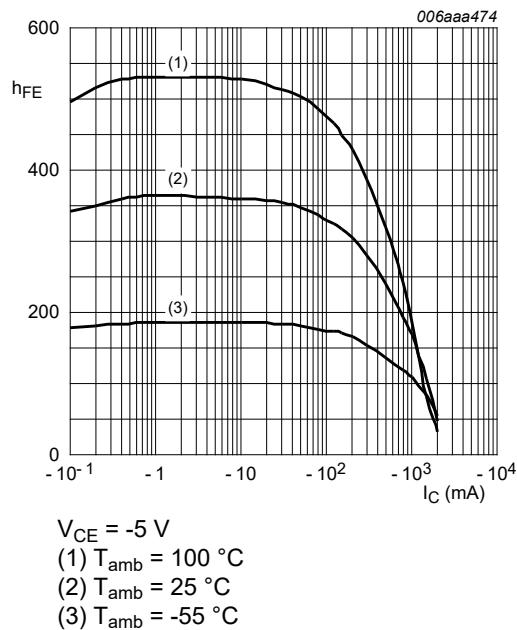


Fig. 5. DC current gain as a function of collector current; typical values

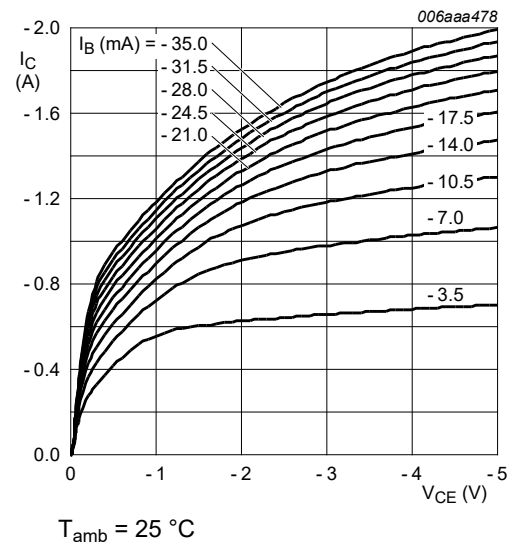


Fig. 6. Collector current as a function of collector-emitter voltage; typical values

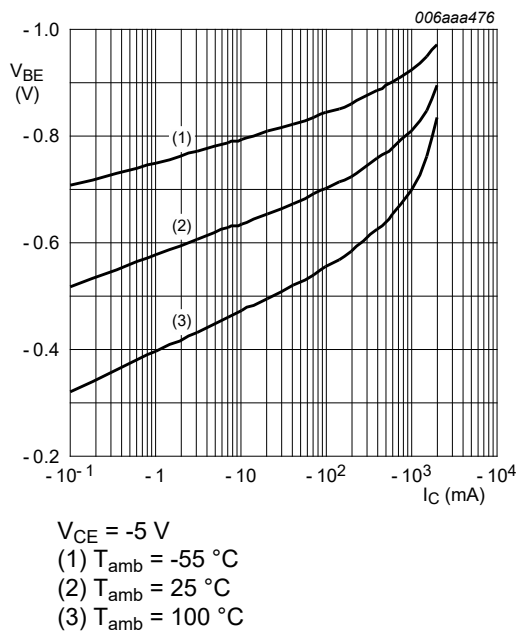


Fig. 7. Base-emitter voltage as a function of collector current; typical values

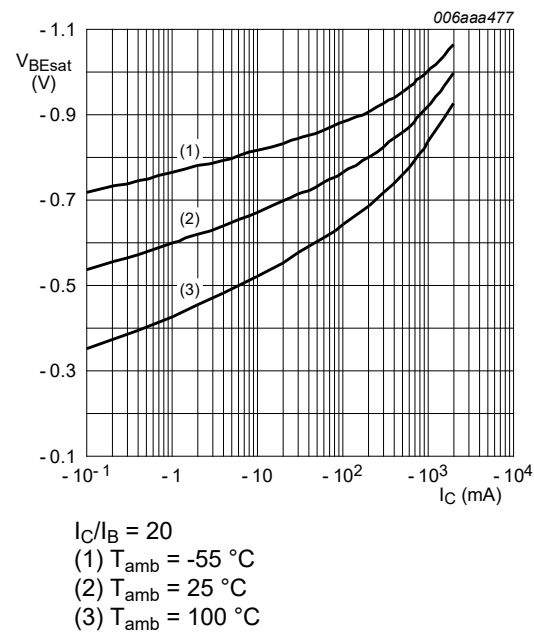


Fig. 8. Base-emitter saturation voltage as a function of collector current; typical values

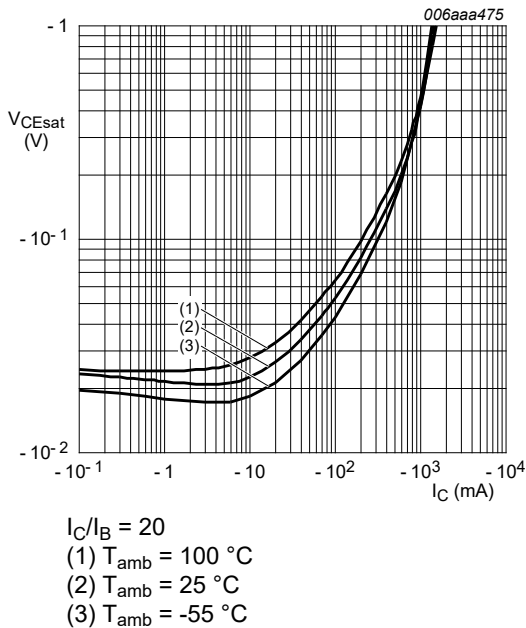


Fig. 9. Collector-emitter saturation voltage as a function of collector current; typical values

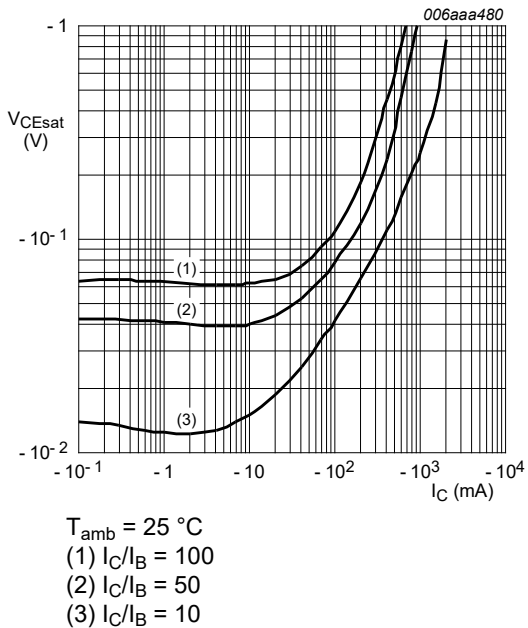


Fig. 10. Collector-emitter saturation voltage as a function of collector current; typical values

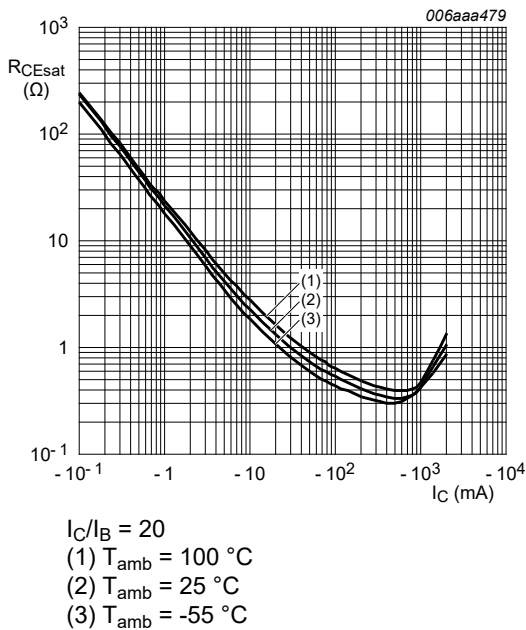


Fig. 11. Collector-emitter saturation resistance as a function of collector current; typical values

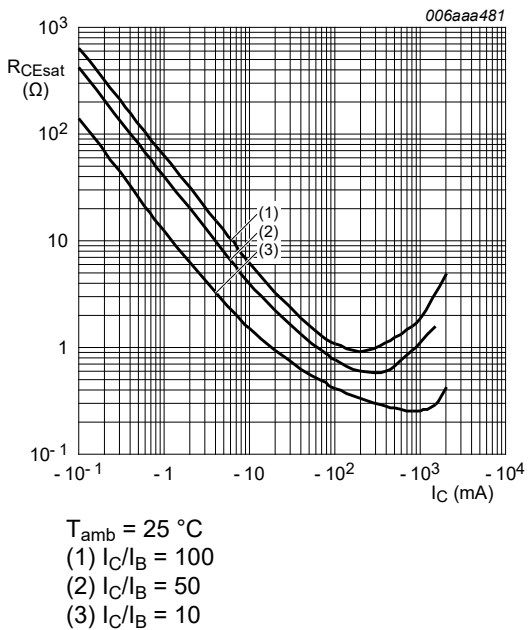


Fig. 12. Collector-emitter saturation resistance as a function of collector current; typical values

11. Test information

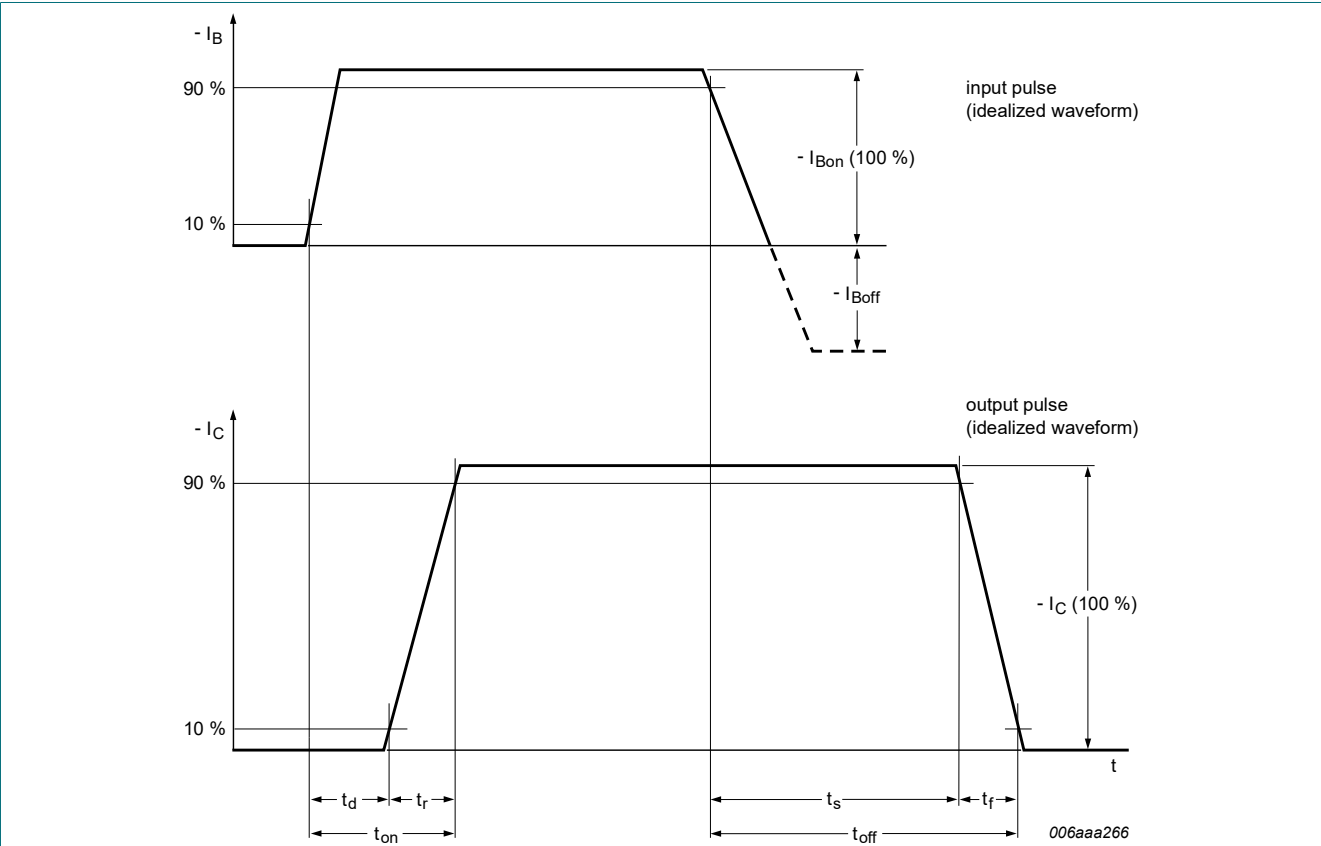


Fig. 13. Transistor switching time definition

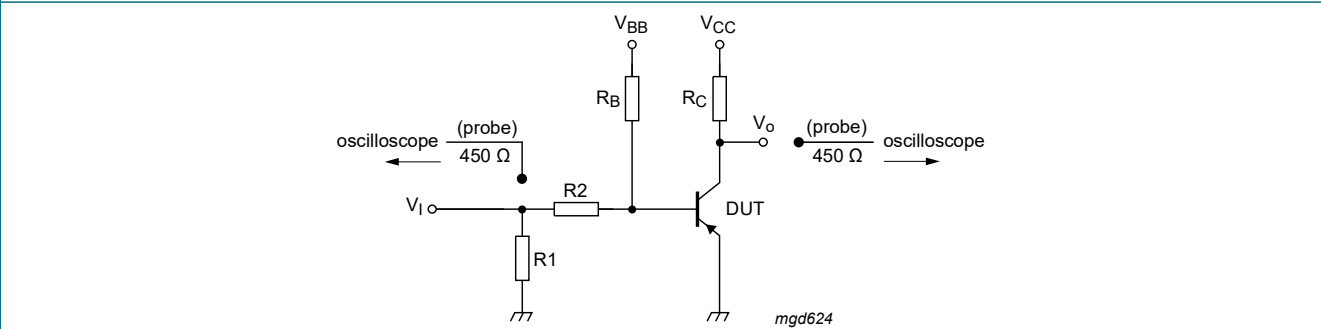


Fig. 14. Test circuit for switching times

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

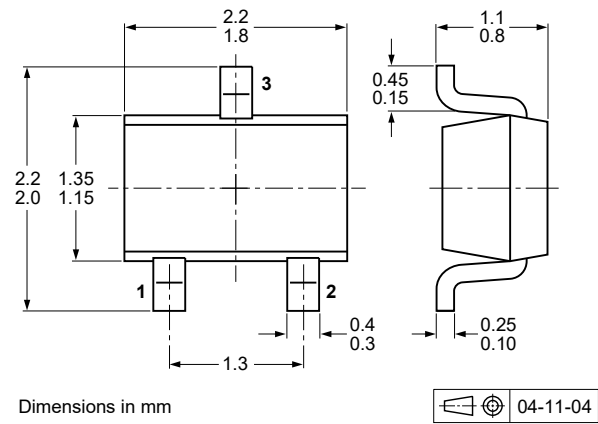


Fig. 15. Package outline SC-70 (SOT323)

13. Soldering

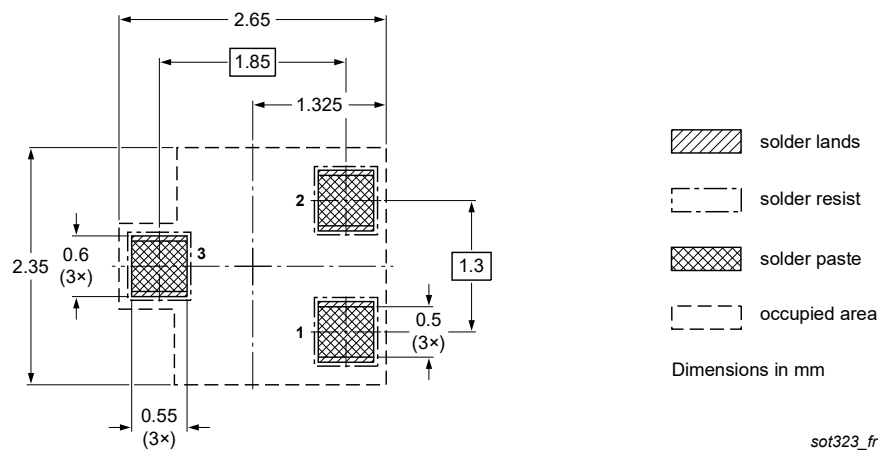


Fig. 16. Reflow soldering footprint for SC-70 (SOT323)

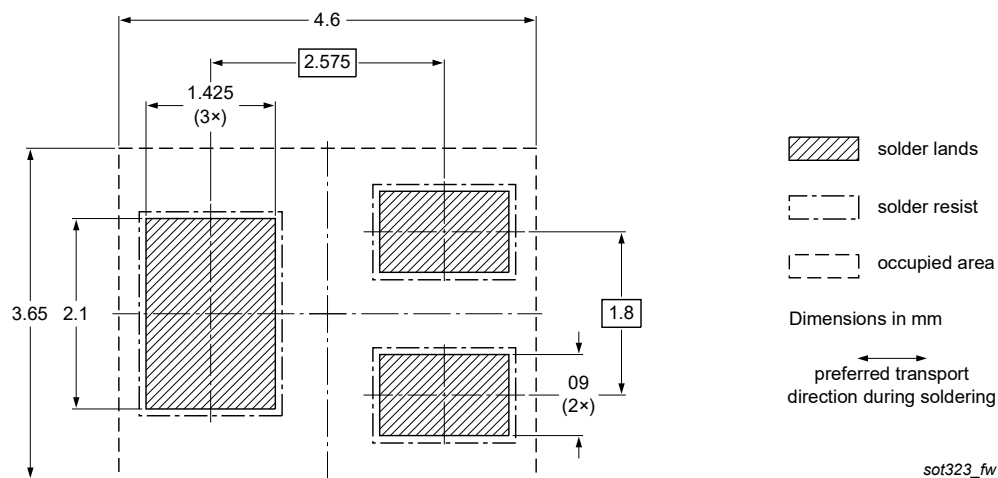


Fig. 17. Wave soldering footprint for SC-70 (SOT323)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS5160U v.5	20231109	Product data sheet	-	PBSS5160U v.4
Modifications:	<ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li>Packing information removed.</li></ul>			
PBSS5160U v.4	20081002	Product data sheet	-	PBSS5160U_3
PBSS5160U_3	20050811	Product data sheet	-	PBSS5160U_2
PBSS5160U_2	20040809	Objective data sheet	-	PBSS5160U_1
PBSS5160U_1	20040503	Objective data sheet	-	-

## 15. Legal information

### 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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