



PBSS303ND-Q

60 V, 3 A NPN low V_{CEsat} transistor

22 October 2024

Product data sheet

1. General description

NPN low V_{CEsat} transistor in a SOT457 (SC-74) small Surface-Mounted Device (SMD) plastic package.

PNP complement: PBSS303PD-Q

2. Features and benefits

- 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 efficiency due to less heat generation
- Qualified according to AEC-Q101 and recommended for use in automotive applications

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)
- Automotive applications

4. Quick reference data

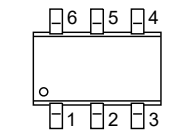
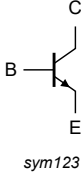
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V _{CEO}	collector-emitter voltage	open base		-	-	60	V
I _C	collector current		[1]	-	-	3	A
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms		-	-	6	A
R _{CEsat}	collector-emitter saturation resistance	I _C = 2 A; I _B = 200 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		-	68	90	mΩ

[1] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	C	collector	 TSOP6 (SOT457)	 sym123
2	C	collector		
3	B	base		
4	E	emitter		
5	C	collector		
6	C	collector		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS303ND-Q	TSOP6	plastic, surface-mounted package (SC-74; TSOP6); 6 leads	SOT457

7. Marking

Table 4. Marking codes

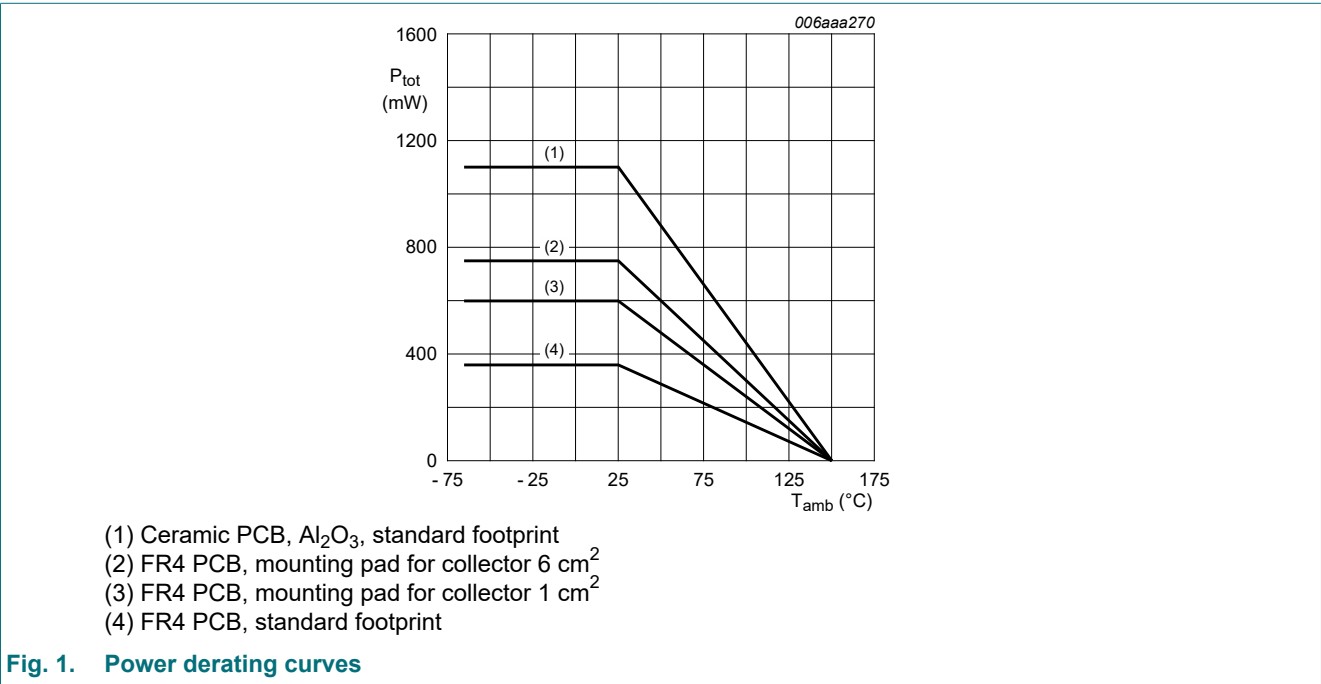
Type number	Marking code
PBSS303ND-Q	AE

8. 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		[1]	-	1	A
			[2]	-	3	A
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms		-	6	A
I _B	base current			-	0.8	A
I _{BM}	peak base current	single pulse; t _p ≤ 1 ms		-	2	A
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	360	mW
			[3]	-	600	mW
			[4]	-	750	mW
			[2]	-	1.1	W
			[1] [5]	-	2.5	W
T _j	junction temperature			-	150	°C
T _{amb}	ambient temperature			-65	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 a ceramic PCB, Al₂O₃, standard footprint.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².
- [4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
- [5] Pulse test: t_p ≤ 10 ms; δ ≤ 10 %.



9. 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]	-	-	350	K/W
			[2]	-	-	208	K/W
			[3]	-	-	167	K/W
			[4]	-	-	113	K/W
			[1] [5]	-	-	50	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	45	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 cm².
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
[4] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.
[5] Pulse test: t_p ≤ 10 ms; δ ≤ 10 %.

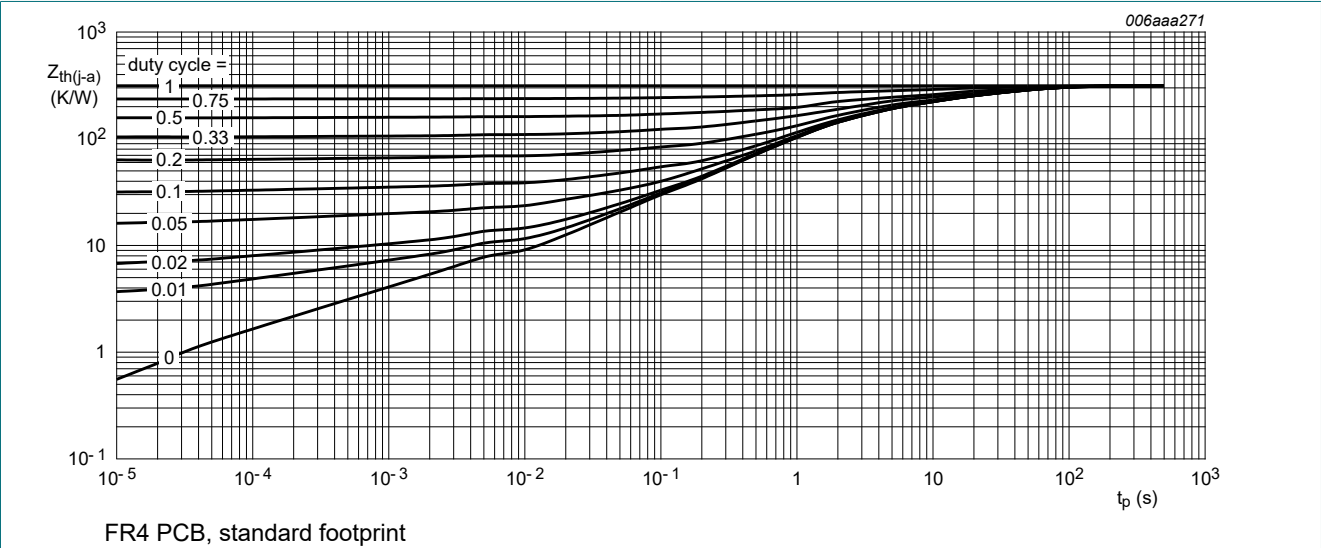


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

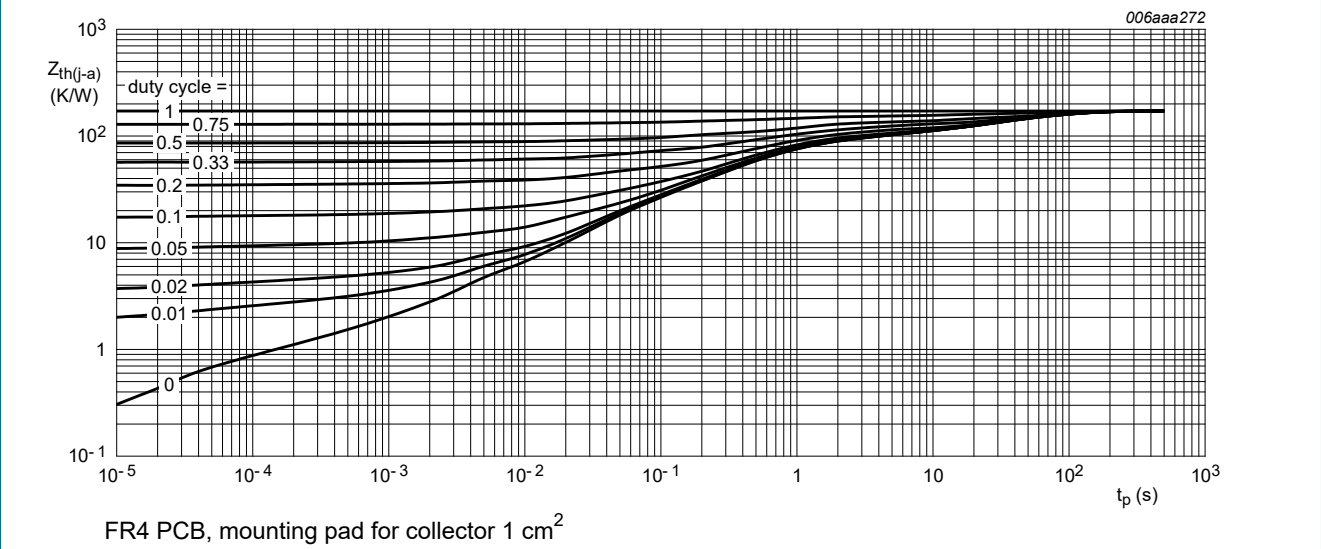


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

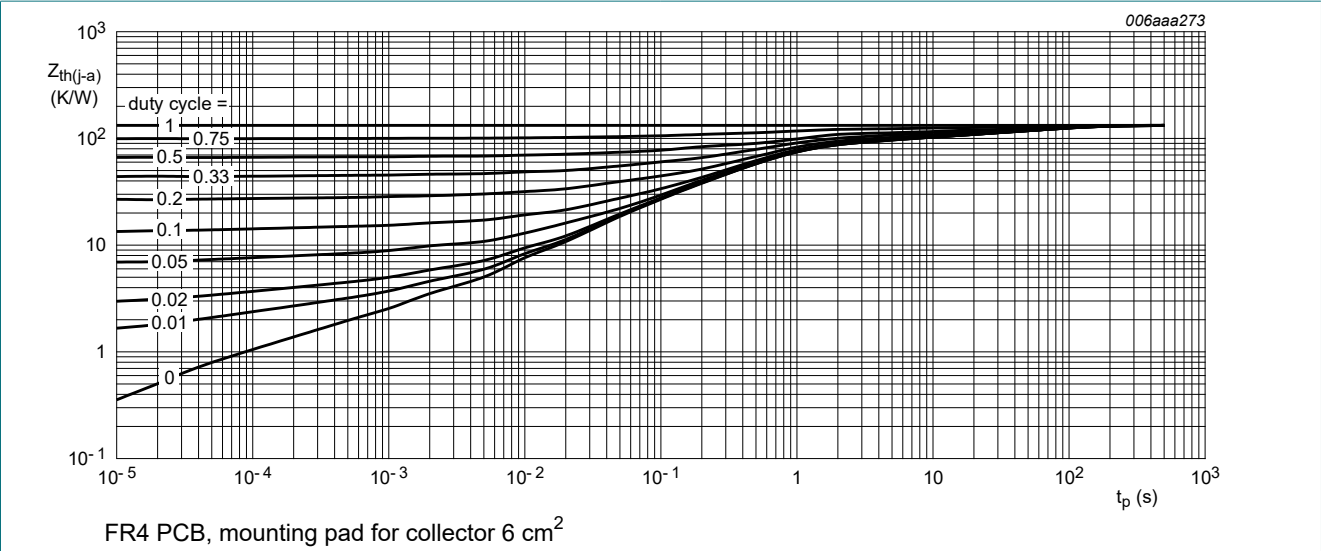


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

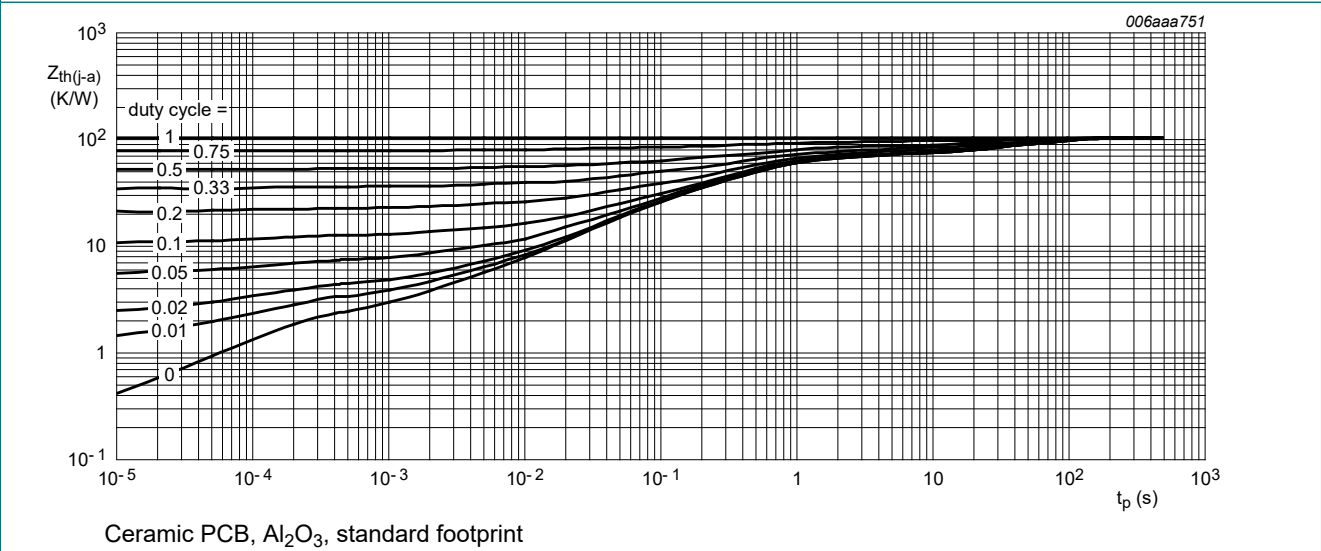


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 60\text{ V}; I_E = 0\text{ A}; T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	100	nA
		$V_{CB} = 60\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	50	μA
I_{CES}	collector-emitter cut-off current	$V_{CE} = 48\text{ V}; V_{BE} = 0\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	100	nA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}; T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	100	nA

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
h _{FE}	DC current gain	V _{CE} = 2 V; I _C = 0.5 A; T _{amb} = 25 °C		345	570	-	
		V _{CE} = 2 V; I _C = 1 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		315	530	-	
		V _{CE} = 2 V; I _C = 2 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		250	380	-	
		V _{CE} = 2 V; I _C = 3 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		120	185	-	
		V _{CE} = 2 V; I _C = 4 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		60	95	-	
		V _{CE} = 2 V; I _C = 5 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		35	60	-	
		V _{CE} = 2 V; I _C = 6 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		20	40	-	
V _{CEsat}	collector-emitter saturation voltage	I _C = 0.5 A; I _B = 50 mA; T _{amb} = 25 °C		-	40	55	mV
		I _C = 1 A; I _B = 50 mA; T _{amb} = 25 °C		-	80	105	mV
		I _C = 2 A; I _B = 200 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		-	135	180	mV
		I _C = 3 A; I _B = 150 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		-	210	280	mV
		I _C = 3 A; I _B = 300 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		-	195	260	mV
		I _C = 4 A; I _B = 400 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		-	255	340	mV
		I _C = 5 A; I _B = 0.5 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		-	320	425	mV
		I _C = 6 A; I _B = 0.6 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		-	385	515	mV
R _{CEsat}	collector-emitter saturation resistance	I _C = 2 A; I _B = 200 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		-	68	90	mΩ
V _{BEsat}	base-emitter saturation voltage	I _C = 0.5 A; I _B = 50 mA; T _{amb} = 25 °C		-	0.79	0.88	V
		I _C = 1 A; I _B = 50 mA; T _{amb} = 25 °C		-	0.81	0.89	V
		I _C = 1 A; I _B = 100 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		-	0.83	0.92	V
		I _C = 3 A; I _B = 150 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		-	0.92	0.99	V
		I _C = 3 A; I _B = 300 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C		-	0.95	1.02	V
V _{BEon}	base-emitter turn-on voltage	V _{CE} = 2 V; I _C = 2 A; T _{amb} = 25 °C		-	0.79	1	V
t _d	delay time	V _{CC} = 9.2 V; I _C = 2 A; I _{Bon} = 0.1 A; I _{Boff} = -0.1 A; T _{amb} = 25 °C		-	12	-	ns
t _r	rise time			-	103	-	ns
t _{on}	turn-on time			-	115	-	ns
t _s	storage time			-	401	-	ns
t _f	fall time			-	264	-	ns
t _{off}	turn-off time			-	665	-	ns
f _T	transition frequency	V _{CE} = 10 V; I _C = 0.1 A; f = 100 MHz; T _{amb} = 25 °C		-	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		-	33	-	pF

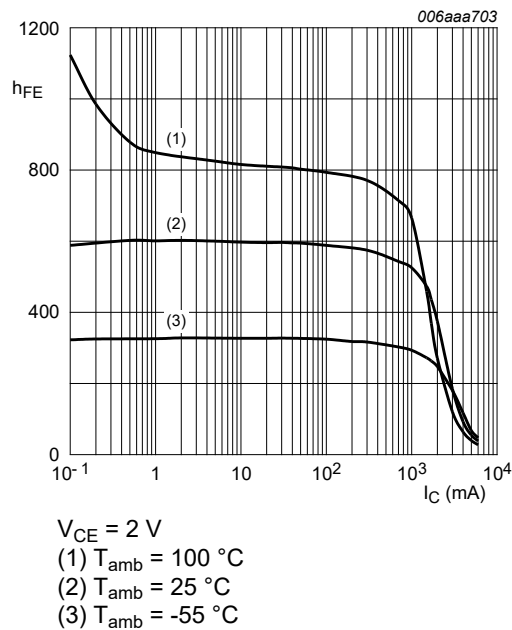


Fig. 6. DC current gain as a function of collector current; typical values

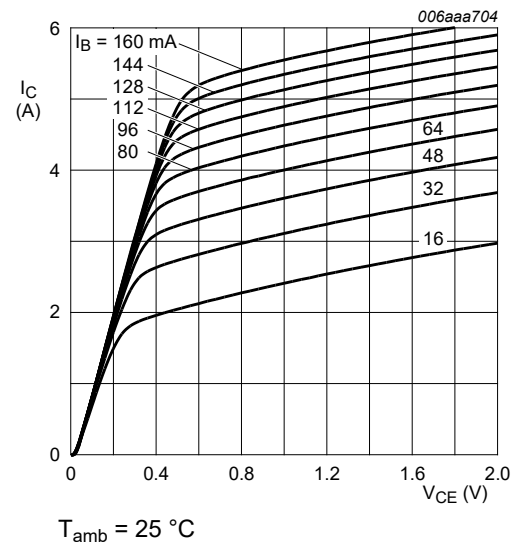


Fig. 7. Collector current as a function of collector-emitter voltage; typical values

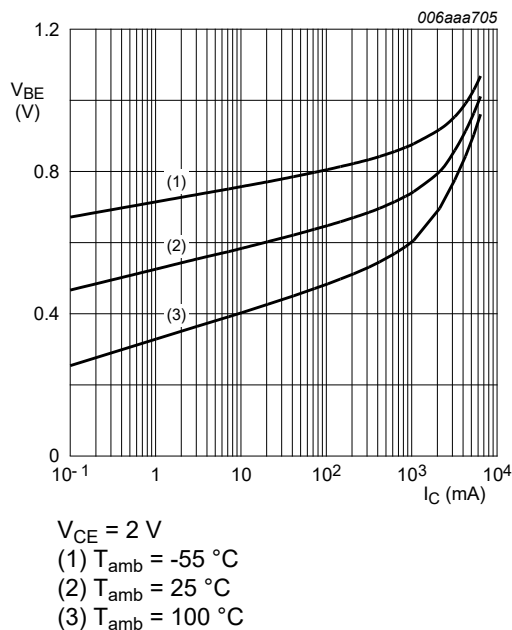


Fig. 8. Base-emitter voltage as a function of collector current; typical values

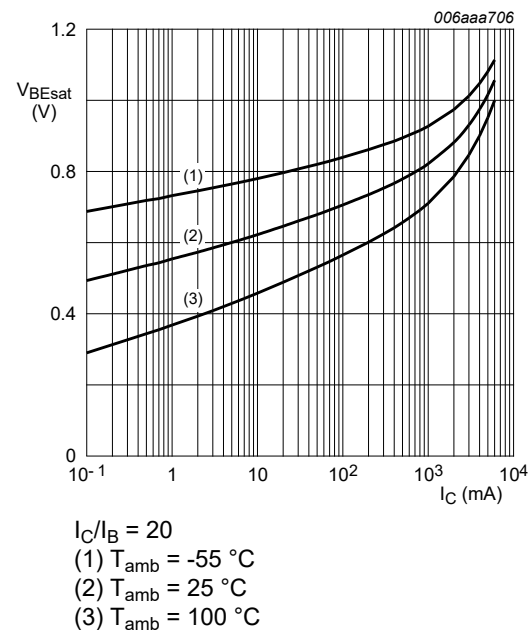


Fig. 9. Base-emitter saturation voltage as a function of collector current; typical values

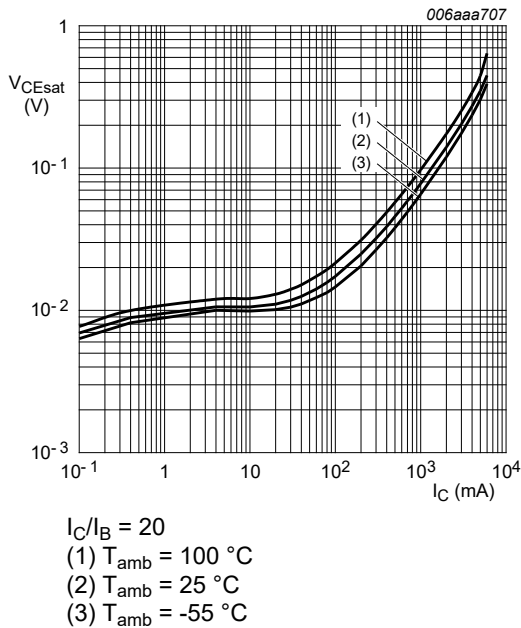


Fig. 10. Collector-emitter saturation voltage as a function of collector current; typical values

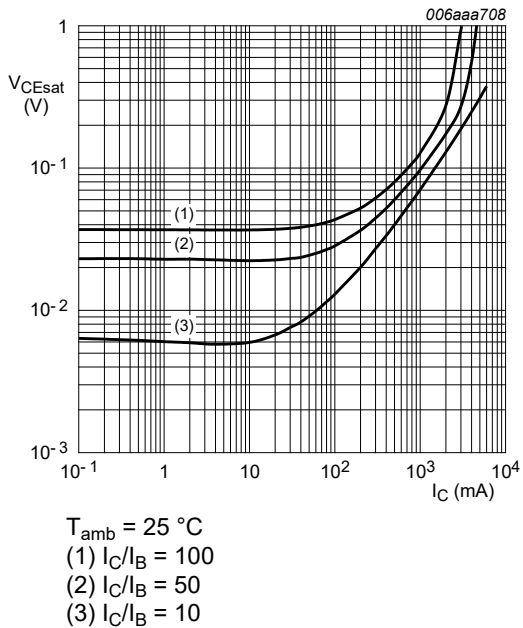


Fig. 11. Collector-emitter saturation voltage as a function of collector current; typical values

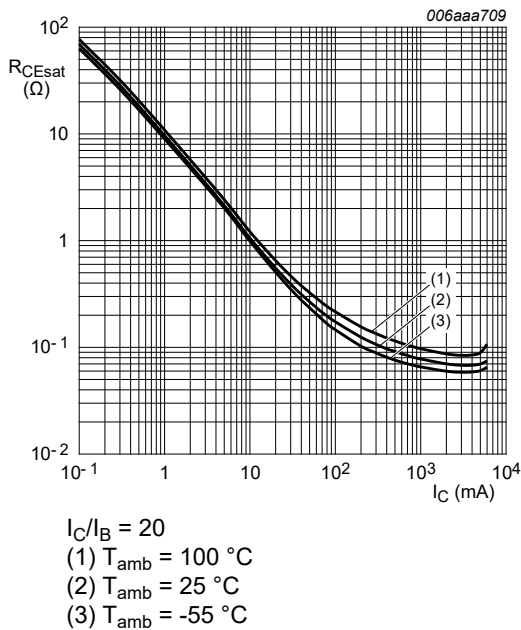


Fig. 12. Collector-emitter saturation resistance as a function of collector current; typical values

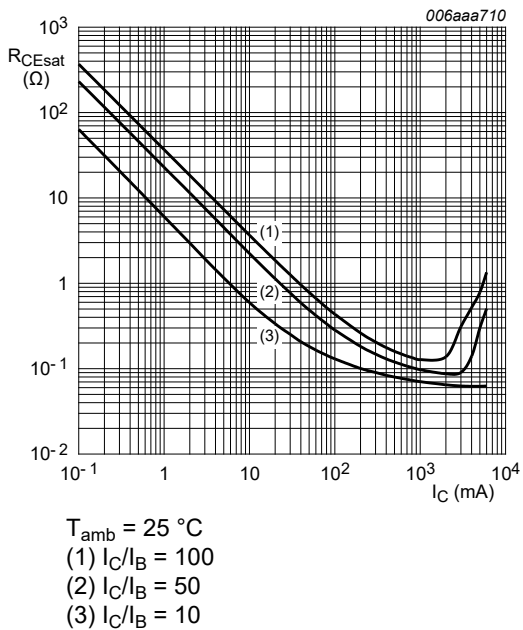


Fig. 13. Collector-emitter saturation resistance as a function of collector current; typical values

11. Test information



Fig. 14. Transistor switching time definition

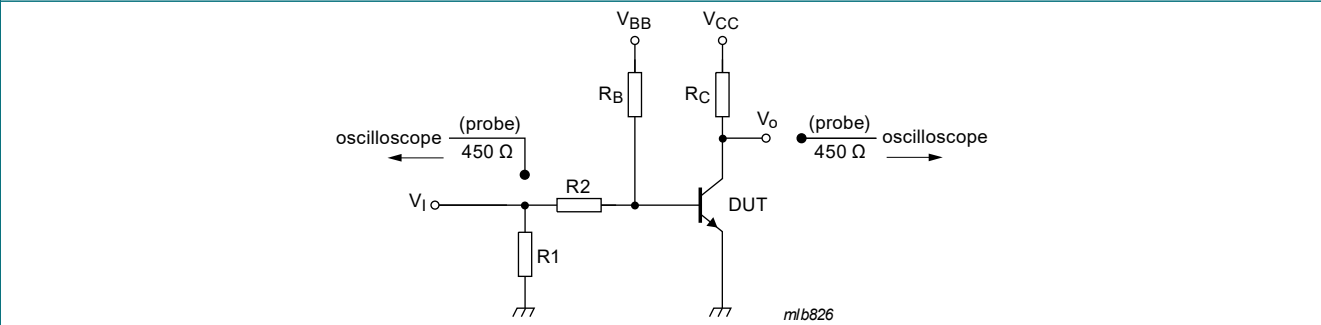
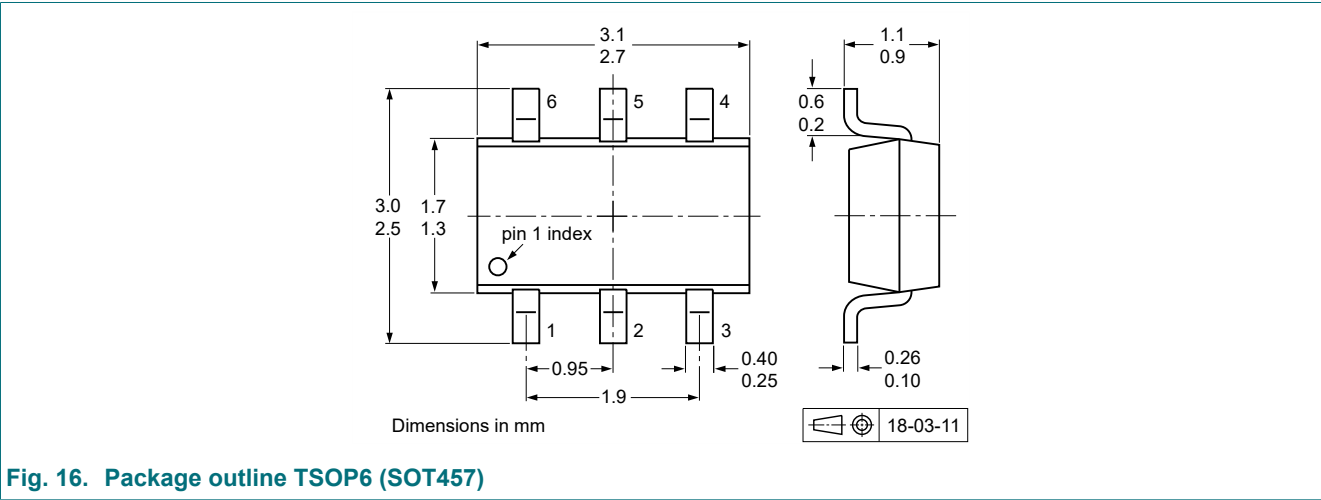


Fig. 15. Test circuit for switching times

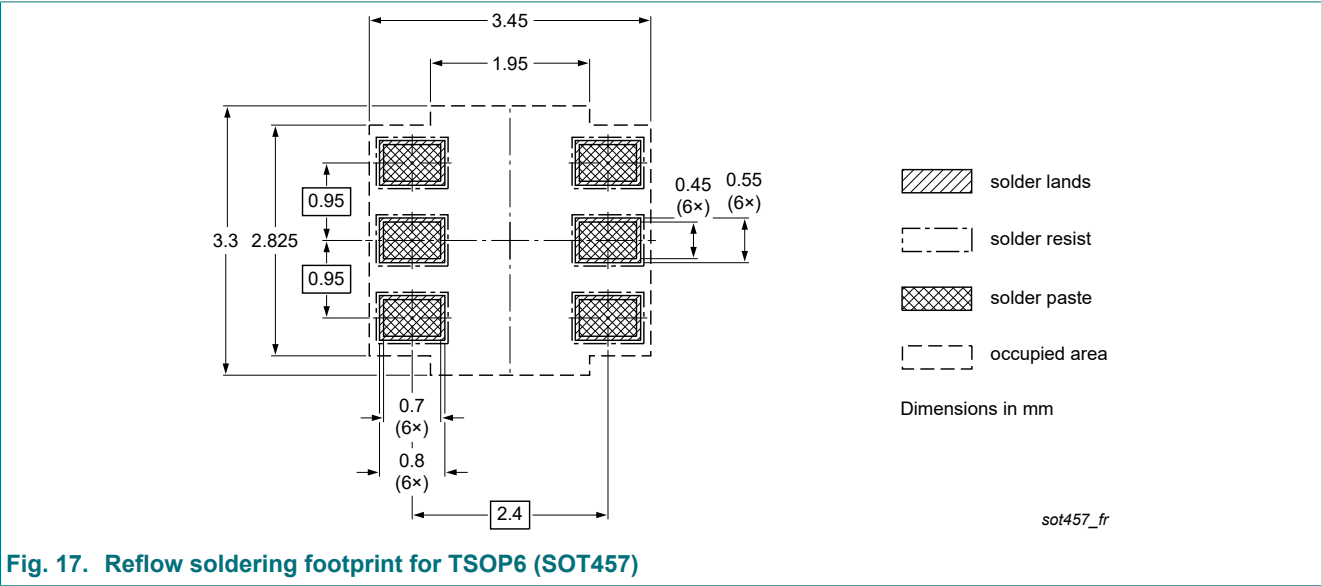
Quality information

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



13. Soldering



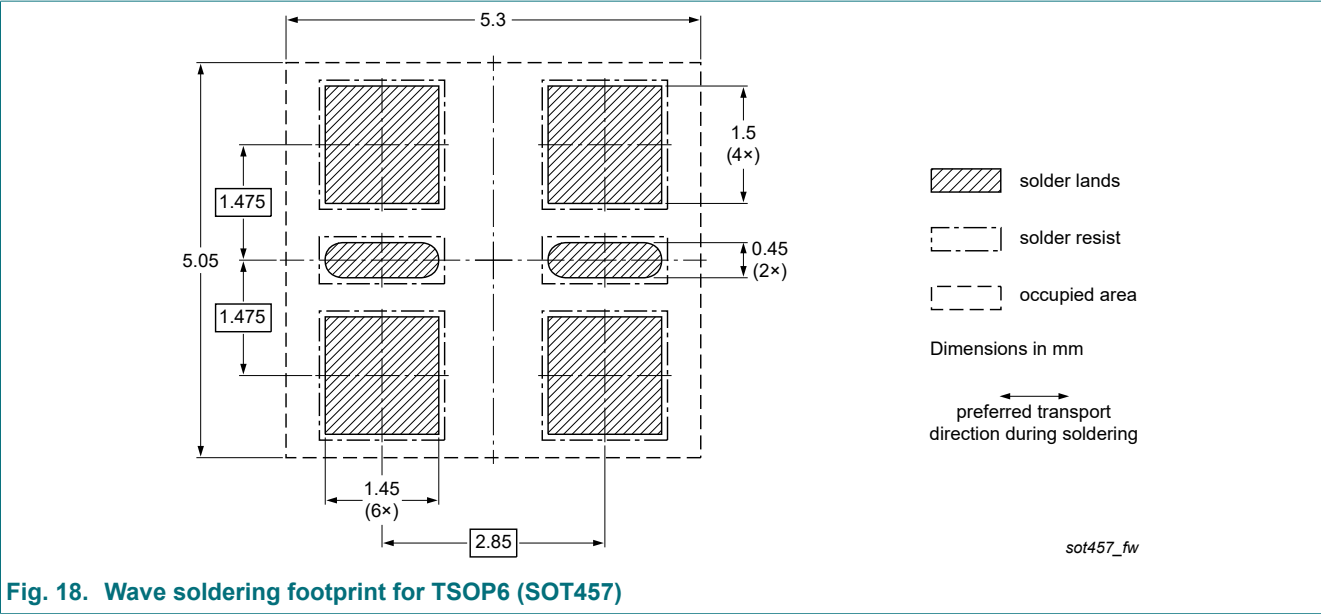


Fig. 18. Wave soldering footprint for TSOP6 (SOT457)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS303ND-Q v.1	20241022	Product 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.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 22 October 2024