



PBSS302PD-Q

40 V, 4 A PNP low V_{CEsat} transistor

30 August 2024

Product data sheet

1. General description

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

NPN complement: PBSS302ND-Q

2. Features and benefits

- Ultra low collector-emitter saturation voltage V_{CEsat}
- 4 A continuous collector current capability I_C
- Up to 15 A peak current
- Very low collector-emitter saturation resistance
- High efficiency due to less heat generation
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- Power management functions
- Charging circuits
- DC-to-DC conversion
- MOSFET gate driving
- Power switches (e.g. motors, fans)

4. Quick reference data

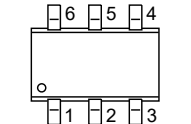
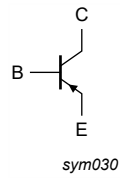
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CEO}	collector-emitter voltage	open base	-	-	-40	V
I _C	collector current		[1]	-	-4	A
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms	-	-	-15	A
R _{CEsat}	collector-emitter saturation resistance	I _C = -6 A; I _B = -600 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C	-	55	75	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	 <p>TSOP6 (SOT457)</p>	 <p>sym030</p>
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
PBSS302PD-Q	TSOP6	plastic, surface-mounted package (SC-74; TSOP6); 6 leads	SOT457

7. Marking

Table 4. Marking codes

Type number	Marking code
PBSS302PD-Q	C9

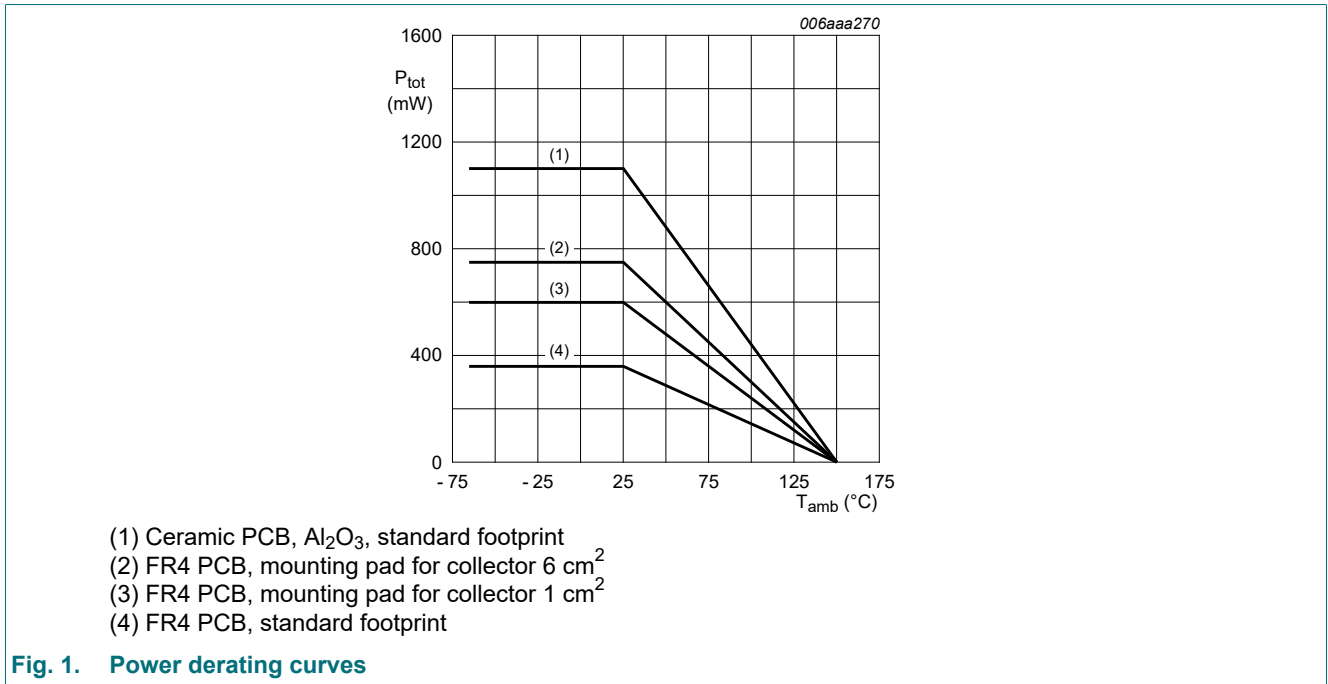
8. Limiting values

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		-	-40	V
V _{CEO}	collector-emitter voltage	open base		-	-40	V
V _{EBO}	emitter-base voltage	open collector		-	-5	V
I _C	collector current		[1]	-	-4	A
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms		-	-15	A
I _B	base current			-	-0.8	A
I _{BM}	peak base current	single pulse; t _p ≤ 1 ms		-	-2	mA
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[2]	-	360	mW
			[3]	-	600	mW
			[4]	-	750	mW
			[1]	-	1.1	W
			[2] [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 a ceramic PCB, Al₂O₃, standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and 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] Operated under pulsed conditions: duty cycle δ ≤ 10 % and pulse width t_p ≤ 10 ms.



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] Operated under pulsed conditions: duty cycle $\delta \leq 10\%$ and pulse width $t_p \leq 10\text{ ms}$.

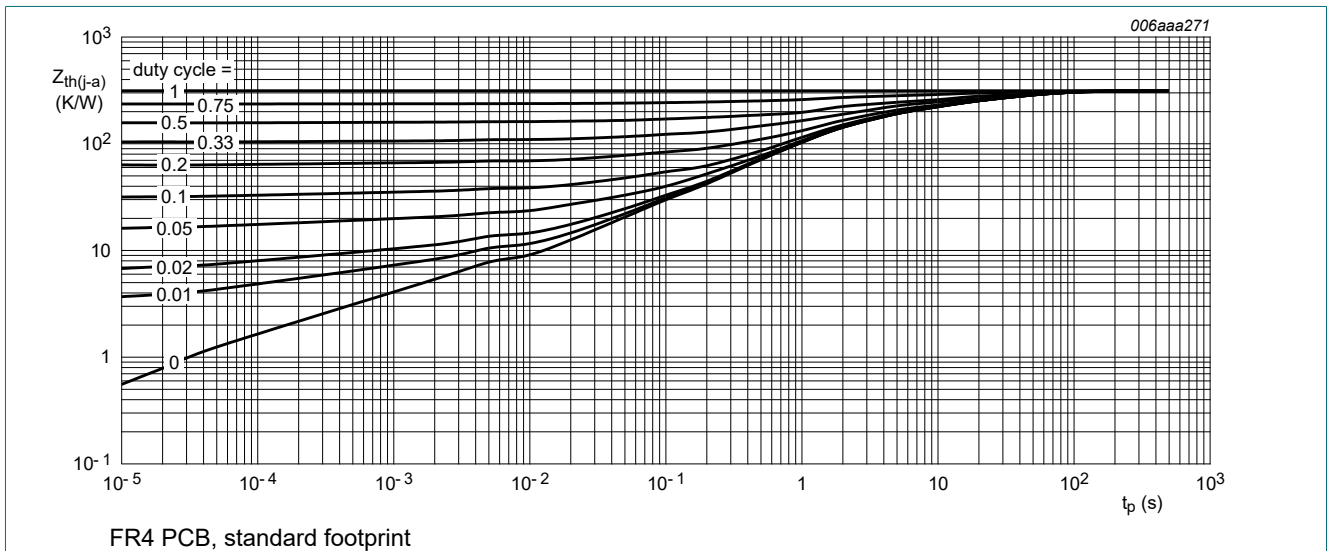


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

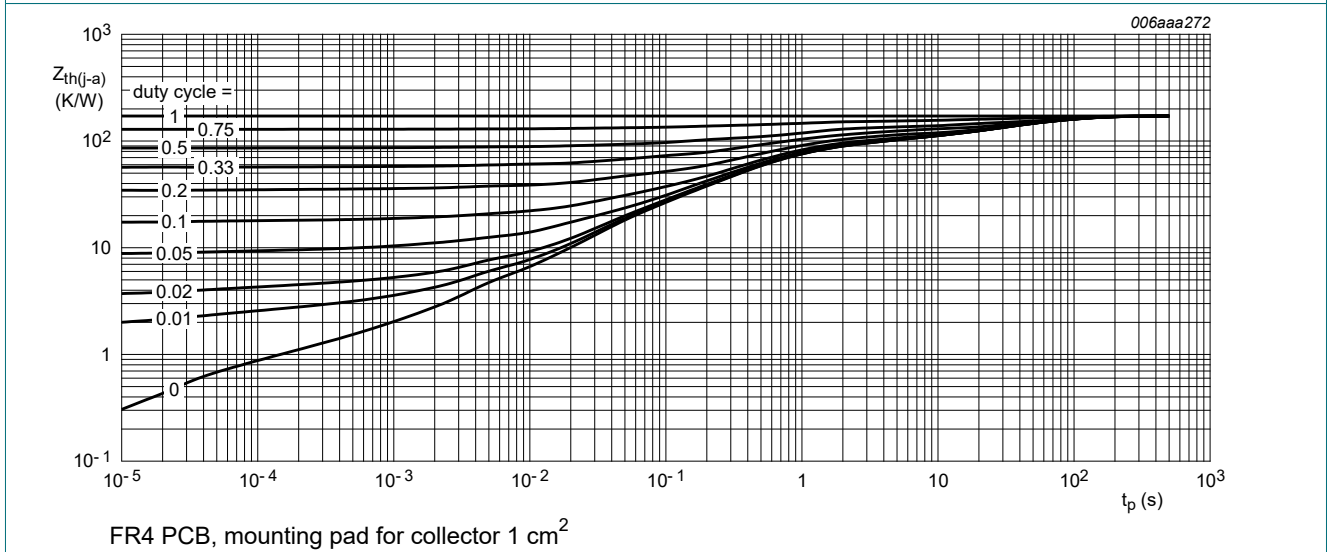
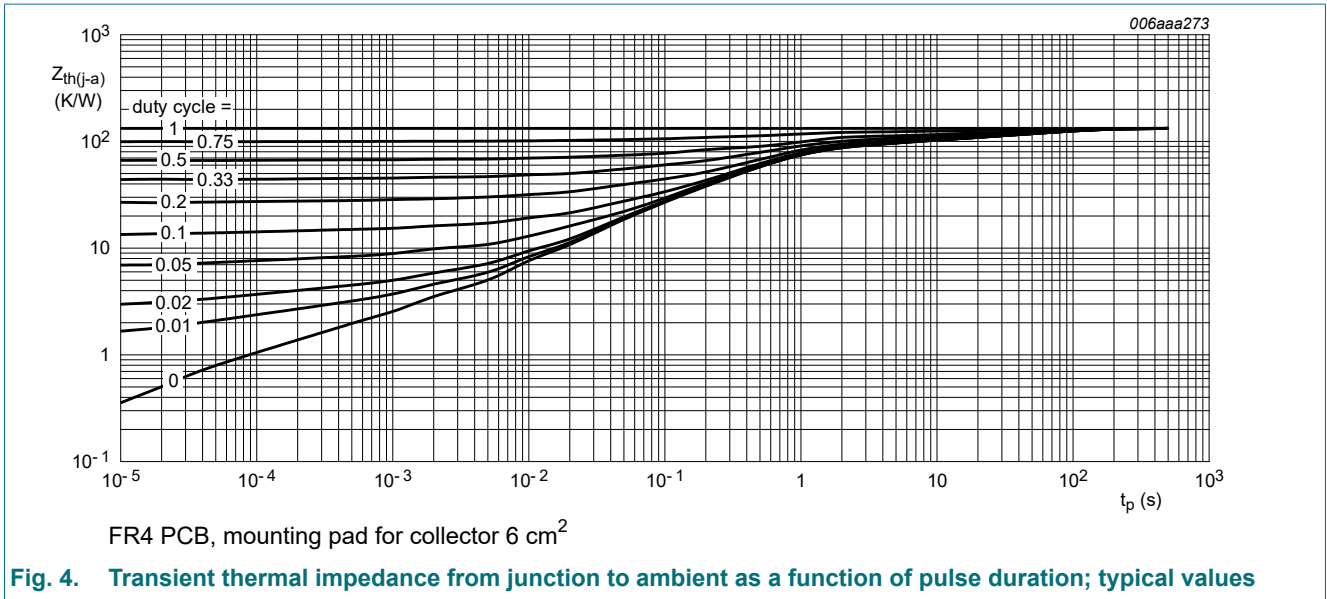


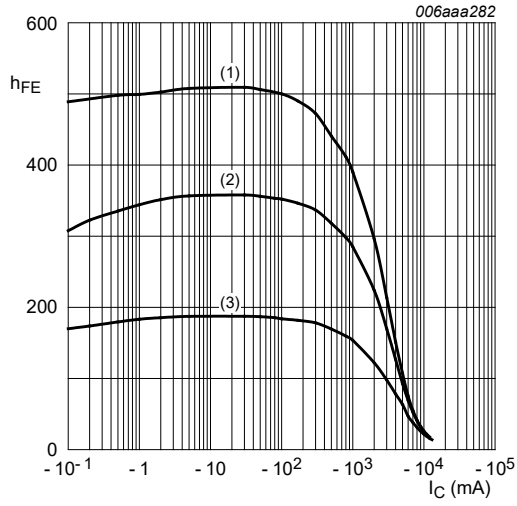
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



10. Characteristics

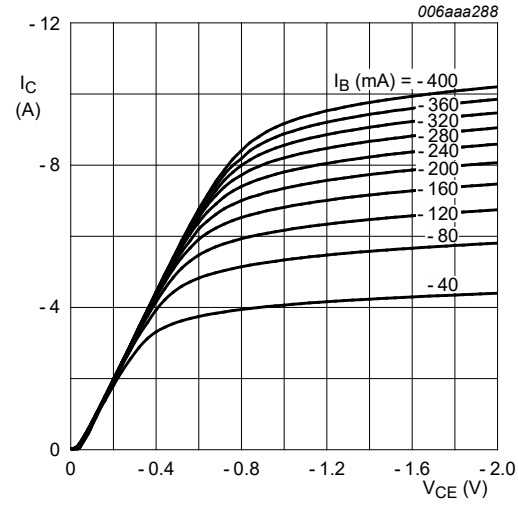
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = -30\text{ V}; I_E = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-100	nA
		$V_{CB} = -30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^\circ\text{C}$	-	-	-50	μA
I_{CES}	collector-emitter cut-off current	$V_{CE} = -30\text{ V}; V_{BE} = 0\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-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
h_{FE}	DC current gain	$V_{CE} = -2\text{ V}; I_C = -0.5\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	200	-	-	
		$V_{CE} = -2\text{ V}; I_C = -1\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	200	-	-	
		$V_{CE} = -2\text{ V}; I_C = -2\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	175	-	-	
		$V_{CE} = -2\text{ V}; I_C = -4\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	80	-	-	
		$V_{CE} = -2\text{ V}; I_C = -6\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	30	-	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -0.5\text{ A}; I_B = -50\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-46	-60	mV
		$I_C = -1\text{ A}; I_B = -50\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-70	-110	mV
		$I_C = -2\text{ A}; I_B = -200\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-120	-180	mV
		$I_C = -4\text{ A}; I_B = -400\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-220	-300	mV
		$I_C = -6\text{ A}; I_B = -600\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-320	-450	mV
R_{CEsat}	collector-emitter saturation resistance		-	55	75	m Ω
V_{BEsat}	base-emitter saturation voltage	$I_C = -0.5\text{ A}; I_B = -50\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-0.8	-0.85	V
		$I_C = -1\text{ A}; I_B = -50\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-0.84	-0.9	V
		$I_C = -1\text{ A}; I_B = -100\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-0.84	-1	V
		$I_C = -4\text{ A}; I_B = -400\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-1	-1.1	V
V_{BEon}	base-emitter turn-on voltage	$V_{CE} = -2\text{ V}; I_C = -2\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-0.8	-1	V
t_d	delay time	$V_{CC} = -10\text{ V}; I_C = -2\text{ A}; I_{B(on)} = -0.1\text{ A}; I_{B(off)} = 0.1\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	12	-	ns
t_r	rise time		-	43	-	ns
t_{on}	turn-on time		-	55	-	ns
t_s	storage time		-	241	-	ns
t_f	fall time		-	80	-	ns
t_{off}	turn-off time		-	321	-	ns
f_T	transition frequency		$V_{CE} = -10\text{ V}; I_C = -0.1\text{ A}; f = 100\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	110	-
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



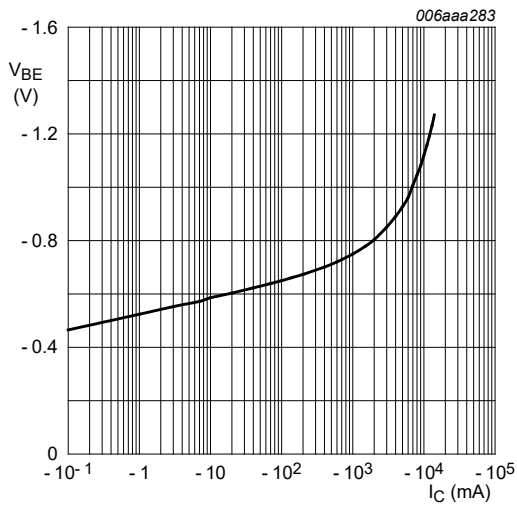
$V_{CE} = -2\text{ V}$
 (1) $T_{amb} = 100\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = -55\text{ }^\circ\text{C}$

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



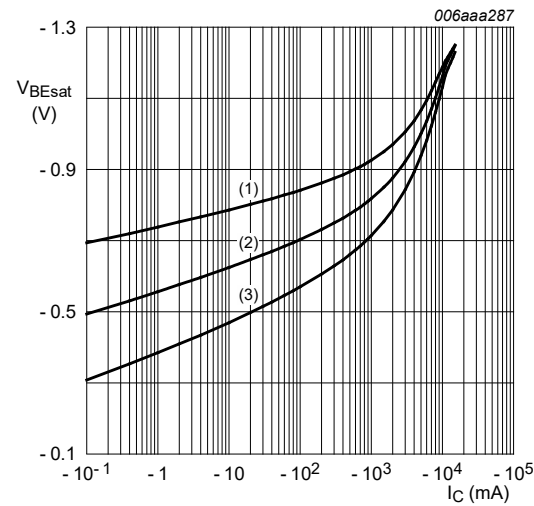
$T_{amb} = 25\text{ }^\circ\text{C}$

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



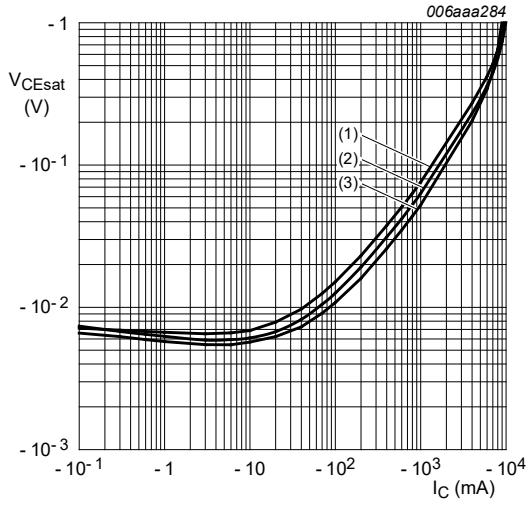
$V_{CE} = -2\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$

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



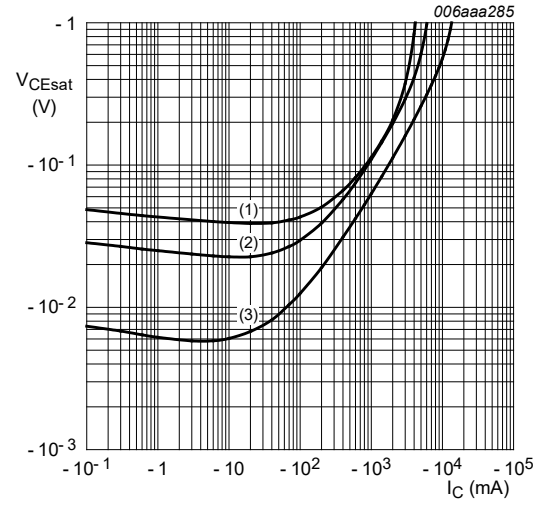
$I_C/I_B = 20$
 (1) $T_{amb} = -55\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = 100\text{ }^\circ\text{C}$

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



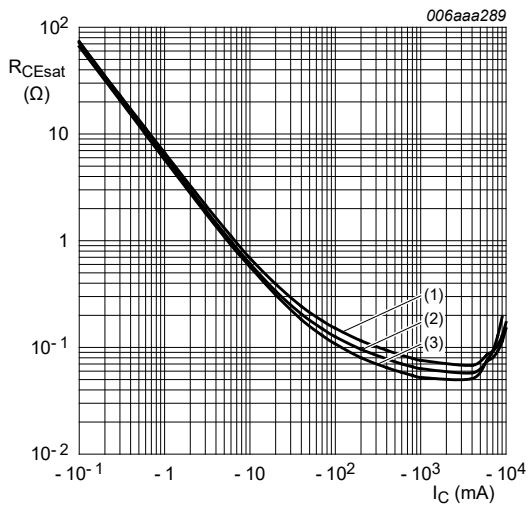
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

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



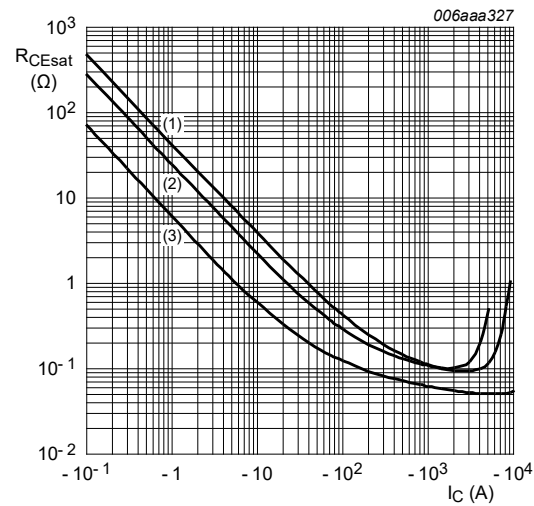
$T_{amb} = 25\text{ °C}$
 (1) $I_C/I_B = 100$
 (2) $I_C/I_B = 50$
 (3) $I_C/I_B = 10$

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



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

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



$T_{amb} = 25\text{ °C}$
 (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

11. Test information

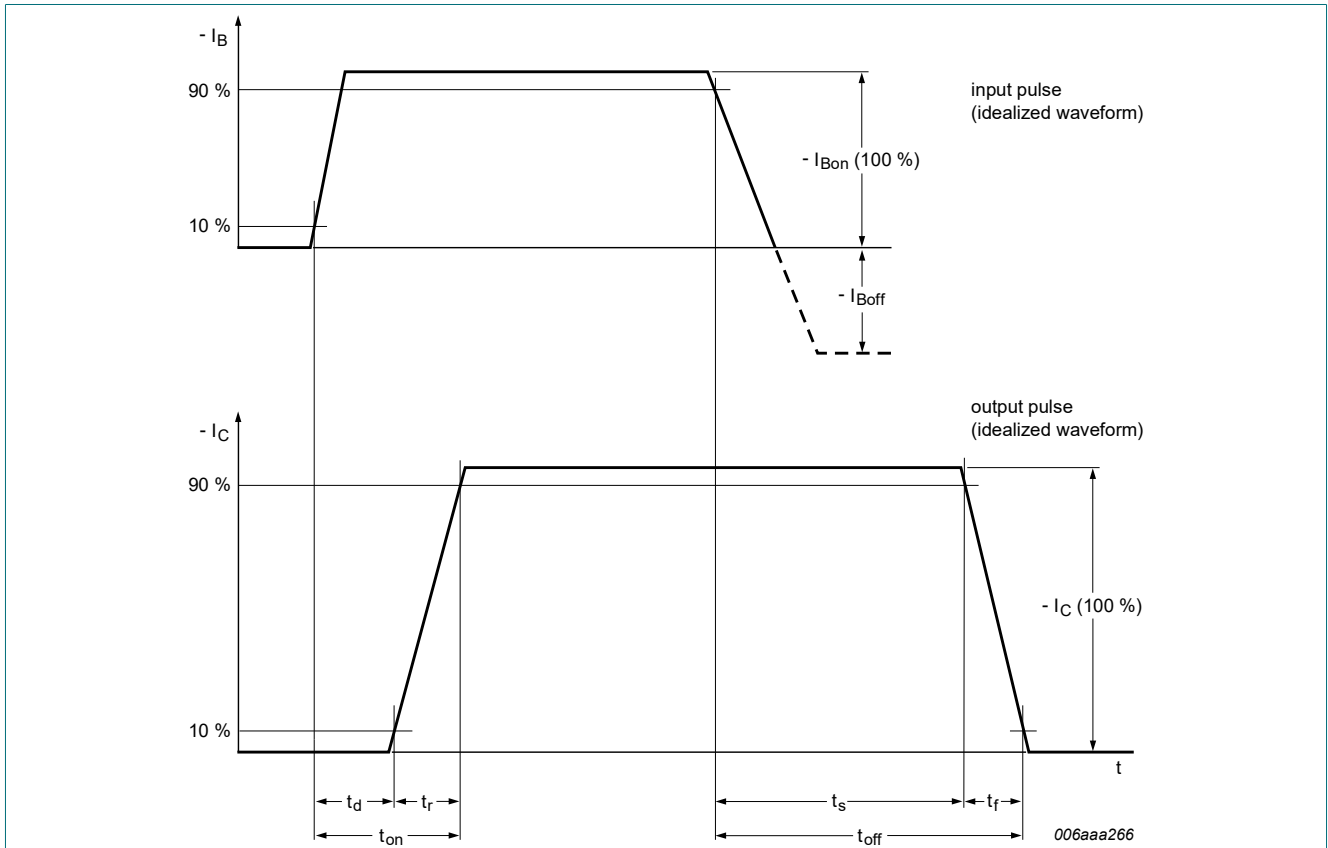


Fig. 13. Transistor switching time definition

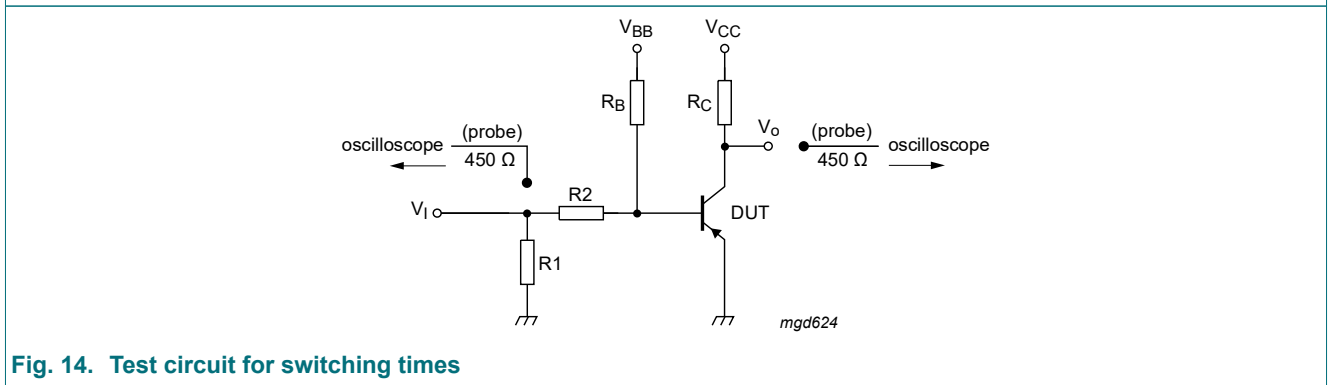


Fig. 14. Test circuit for switching times

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

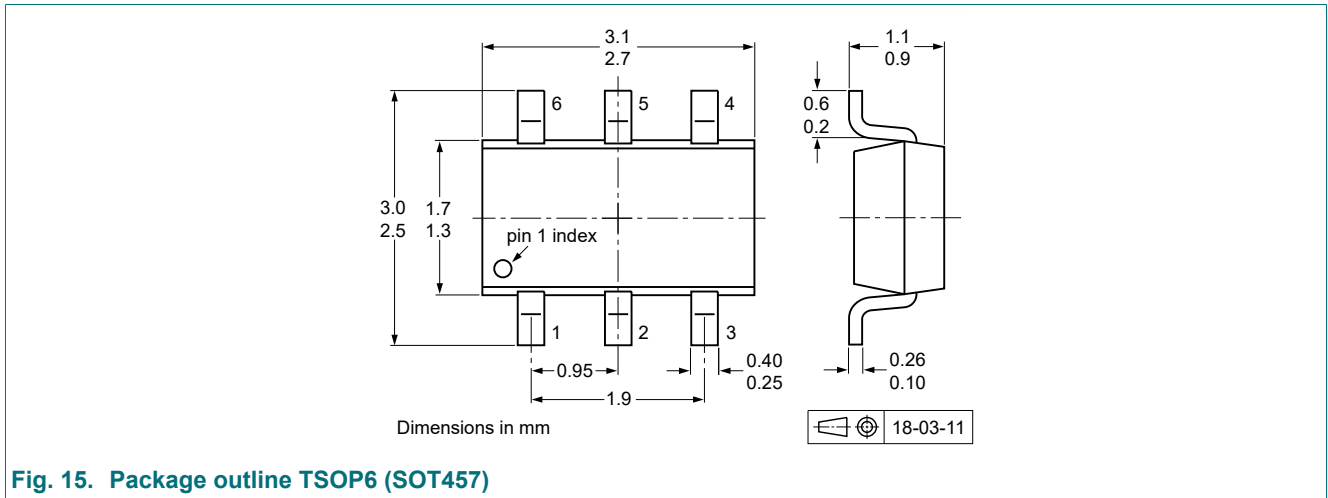


Fig. 15. Package outline TSOP6 (SOT457)

13. Soldering

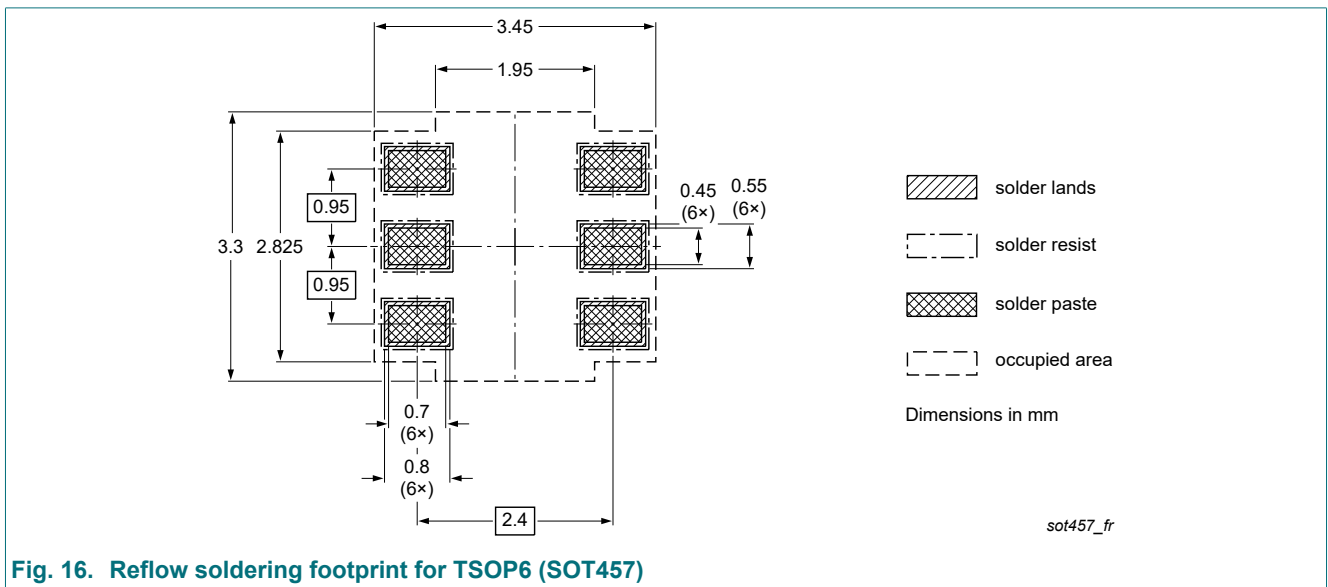


Fig. 16. Reflow soldering footprint for TSOP6 (SOT457)

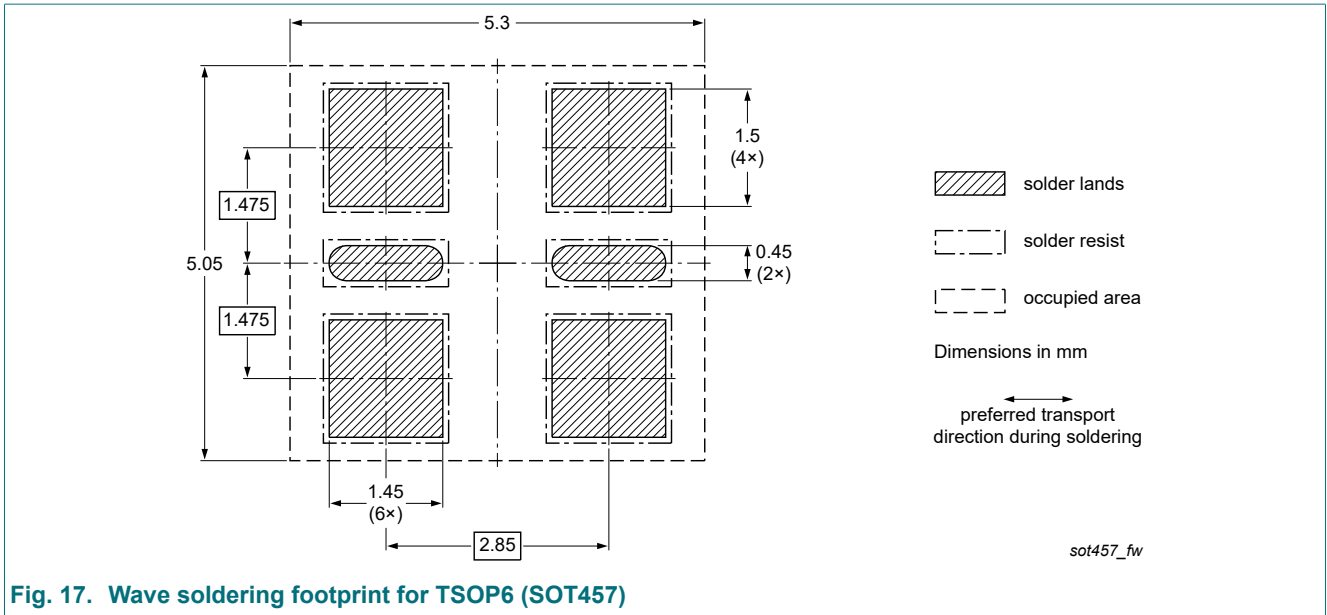


Fig. 17. Wave soldering footprint for TSOP6 (SOT457)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS302PD-Q v.1	20240830	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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