



PBSS4160DS-Q

60 V, 1 A NPN/NPN low V_{CEsat} transistor

21 September 2023

Product data sheet

1. General description

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

PNP/PNP complement: PBSS5160DS-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
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- Dual low power switches (e.g. motors, fans)
- Automotive applications

4. Quick reference data

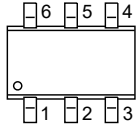
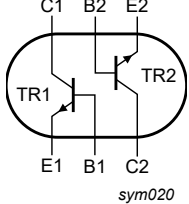
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per transistor						
V_{CEO}	collector-emitter voltage	open base	-	-	60	V
I_C	collector current		[1]	-	1	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	2	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 1$ A; $I_B = 100$ mA; pulsed; $t_p \leq 300$ μ s; $\delta \leq 0.02$; $T_{amb} = 25$ °C	-	200	250	m Ω

[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	E1	emitter TR1	 <p>TSOP6 (SOT457)</p>	 <p>sym020</p>
2	B1	base TR1		
3	C2	collector TR2		
4	E2	emitter TR2		
5	B2	base TR2		
6	C1	collector TR1		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4160DS-Q	TSOP6	plastic, surface-mounted package (SC-74; TSOP6); 6 leads	SOT457

7. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4160DS-Q	B8

8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
Per transistor						
V _{CBO}	collector-base voltage	open emitter		-	80	V
V _{CEO}	collector-emitter voltage	open base		-	60	V
V _{EBO}	emitter-base voltage	open collector		-	5	V
I _C	collector current		[1]	-	0.87	A
			[2]	-	1	A
			[3]	-	1	A
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms		-	2	A
I _B	base current			-	300	mA
I _{BM}	peak base current	single pulse; t _p ≤ 1 ms		-	1	A
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	290	mW
			[2]	-	370	mW
			[3]	-	450	mW
Per device						
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	420	mW
			[2]	-	560	mW
			[3]	-	700	mW
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 an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².
- [3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.

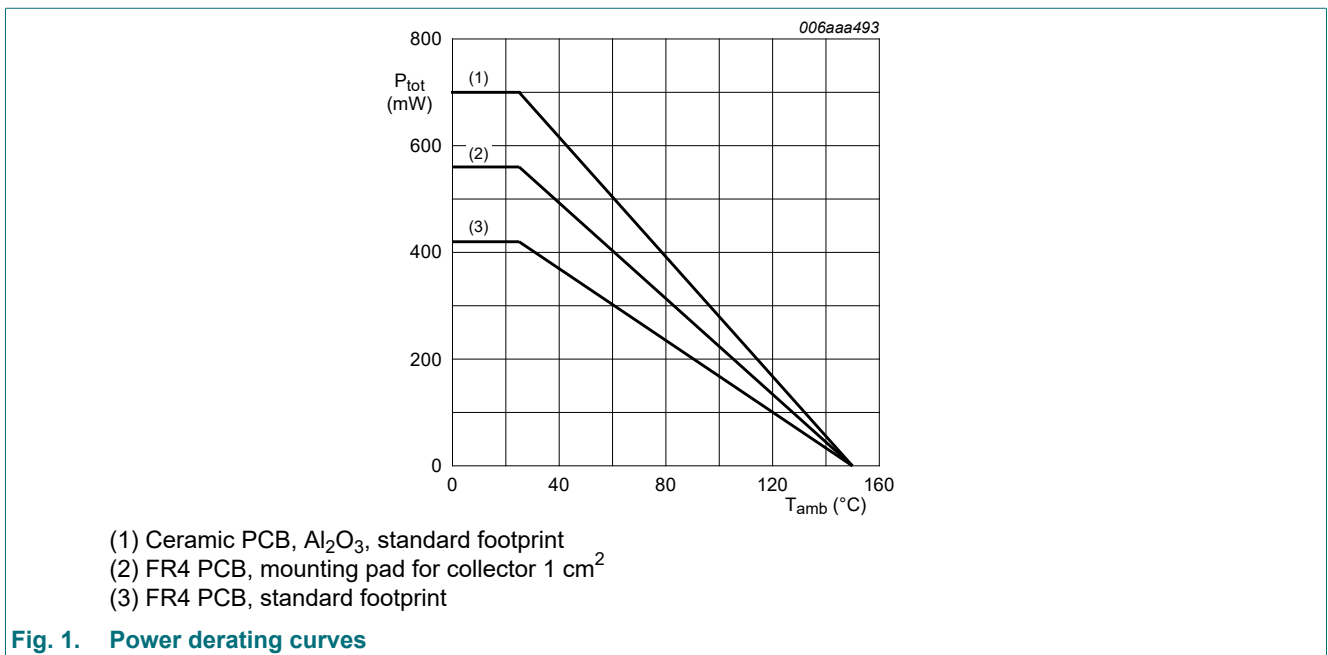


Fig. 1. Power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	431	K/W
			[2]	-	-	338	K/W
			[3]	-	-	278	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	105	K/W
Per device							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	298	K/W
			[2]	-	-	223	K/W
			[3]	-	-	179	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 a ceramic PCB, Al₂O₃, standard footprint.

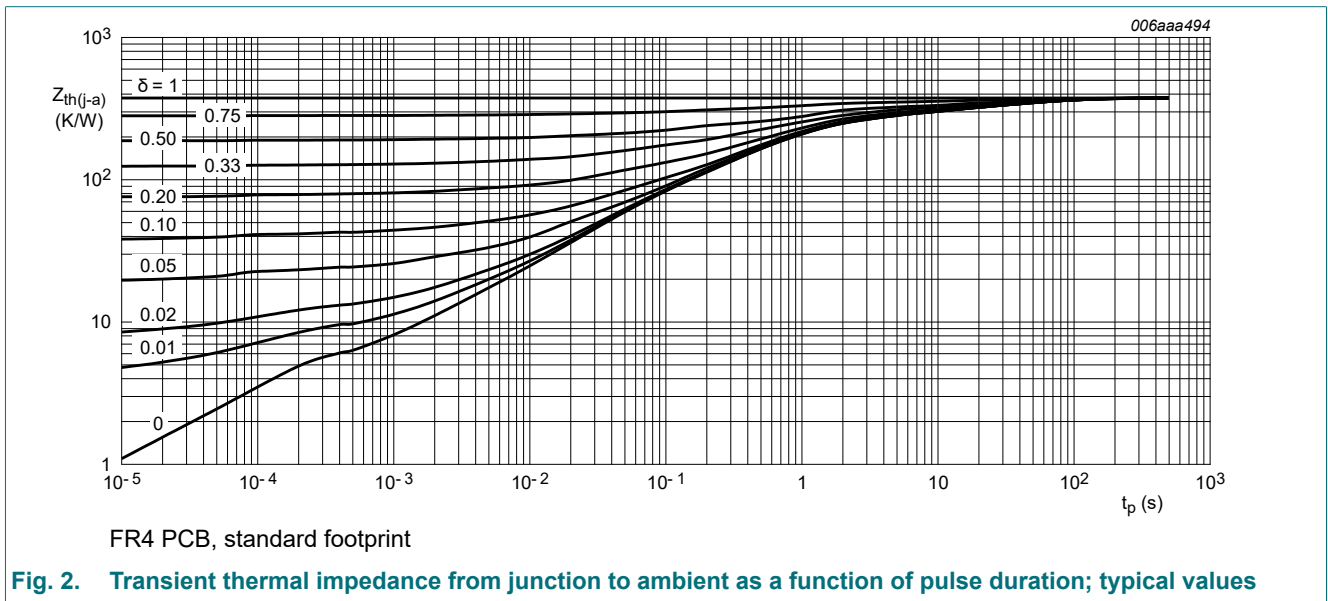


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

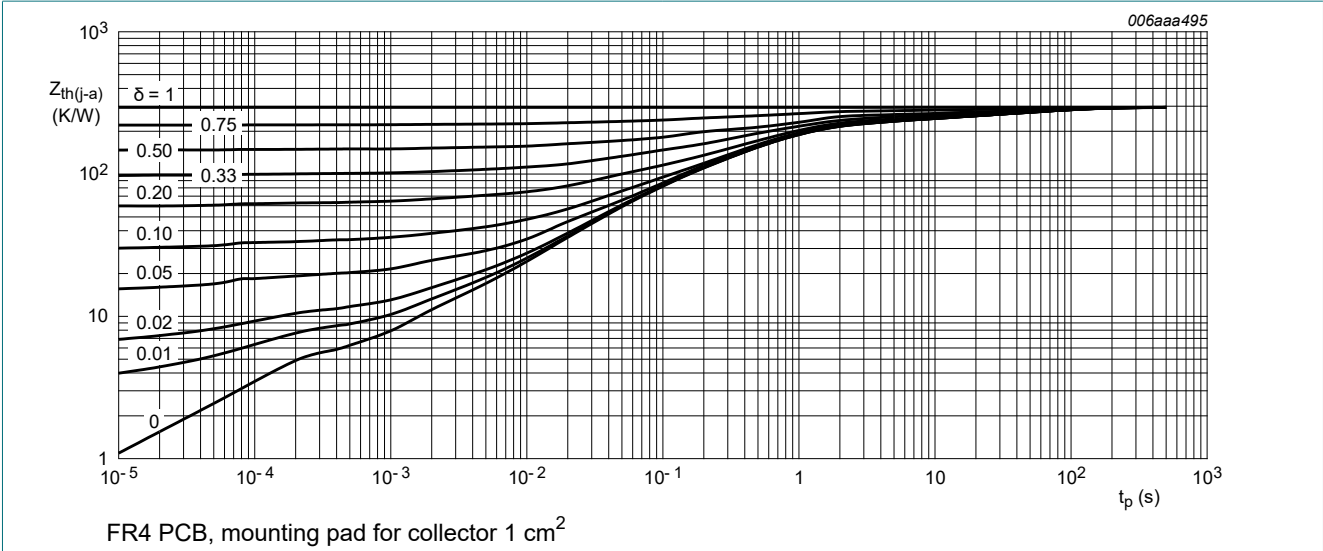


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

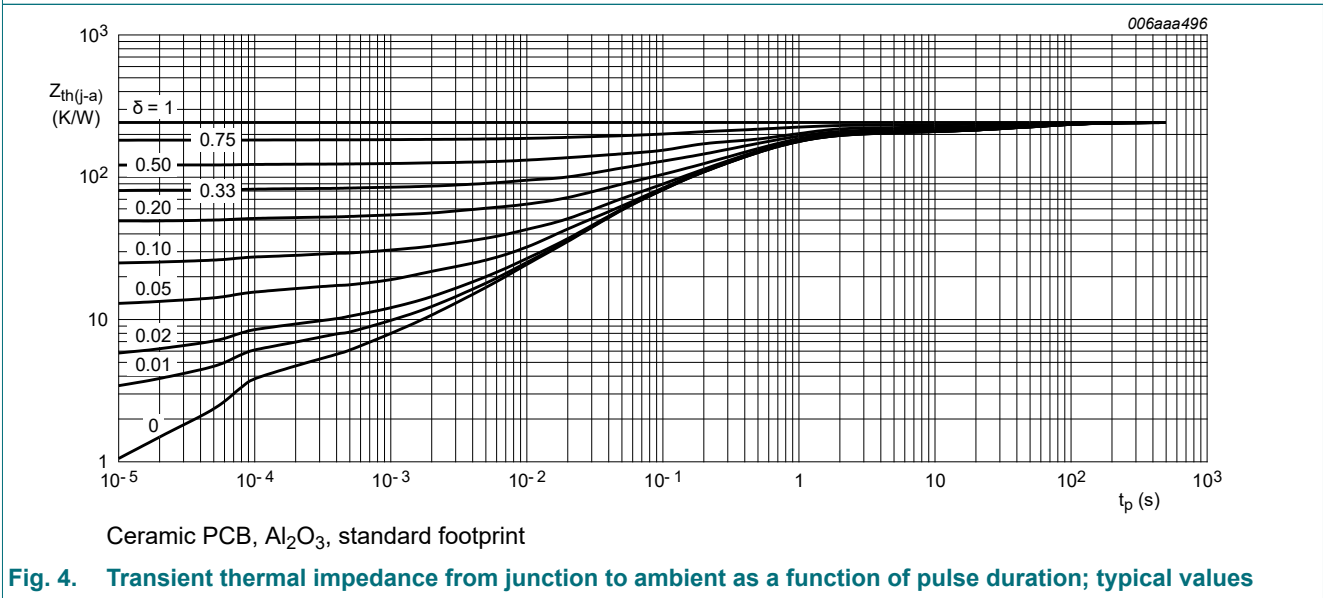
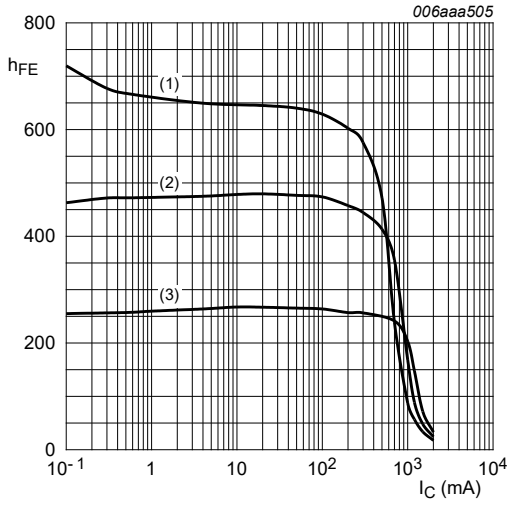


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

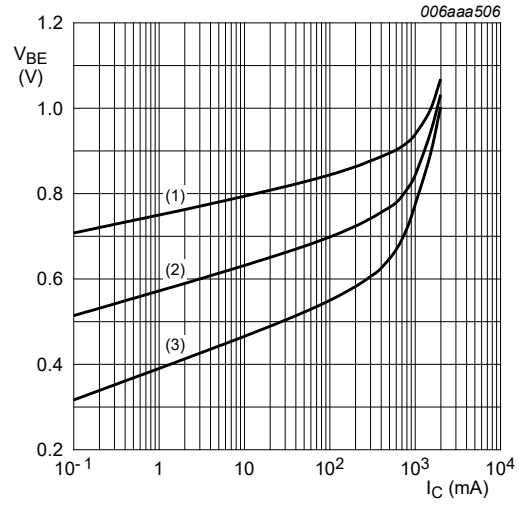
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per transistor						
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 _{EBO}	emitter-base cut-off current	V _{EB} = 5 V; I _C = 0 A; T _{amb} = 25 °C	-	-	100	nA
I _{CES}	collector-emitter cut-off current	V _{CE} = 60 V; V _{BE} = 0 V; T _{amb} = 25 °C	-	-	100	nA
h _{FE}	DC current gain	V _{CE} = 5 V; I _C = 1 mA; T _{amb} = 25 °C	250	500	-	
		V _{CE} = 5 V; I _C = 500 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C	200	420	-	
		V _{CE} = 5 V; I _C = 1 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C	100	180	-	
V _{CEsat}	collector-emitter saturation voltage	I _C = 100 mA; I _B = 1 mA; T _{amb} = 25 °C	-	90	110	mV
		I _C = 500 mA; I _B = 50 mA; T _{amb} = 25 °C	-	115	140	mV
		I _C = 1 A; I _B = 100 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C	-	200	250	mV
R _{CEsat}	collector-emitter saturation resistance	I _C = 1 A; I _B = 100 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C	-	200	250	mΩ
V _{BEsat}	base-emitter saturation voltage	I _C = 1 A; I _B = 50 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C	-	0.95	1.1	V
V _{BEon}	base-emitter turn-on voltage	V _{CE} = 5 V; I _C = 1 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C	-	0.82	0.9	V
t _d	delay time	I _C = 0.5 A; I _{Bon} = 25 mA; I _{Boff} = -25 mA; T _{amb} = 25 °C	-	11	-	ns
t _r	rise time		-	78	-	ns
t _{on}	turn-on time		-	90	-	ns
t _s	storage time		-	340	-	ns
t _f	fall time		-	160	-	ns
t _{off}	turn-off time		-	500	-	ns
f _T	transition frequency		V _{CE} = 10 V; I _C = 50 mA; f = 100 MHz; T _{amb} = 25 °C	150	220	-
C _c	collector capacitance	V _{CB} = 10 V; I _E = 0 A; i _e = 0 A; f = 1 MHz; T _{amb} = 25 °C	-	5.5	10	pF



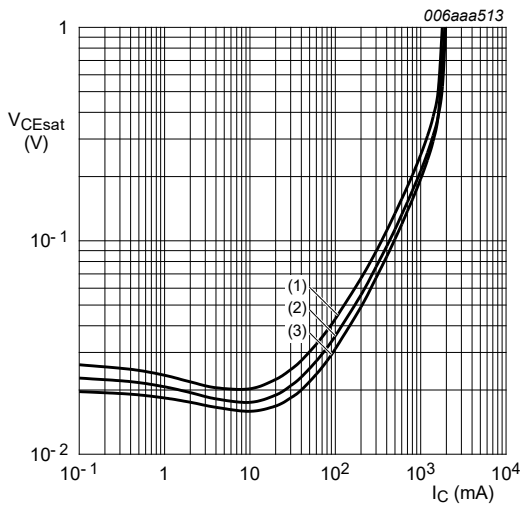
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = 100\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = -55\text{ }^\circ\text{C}$

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



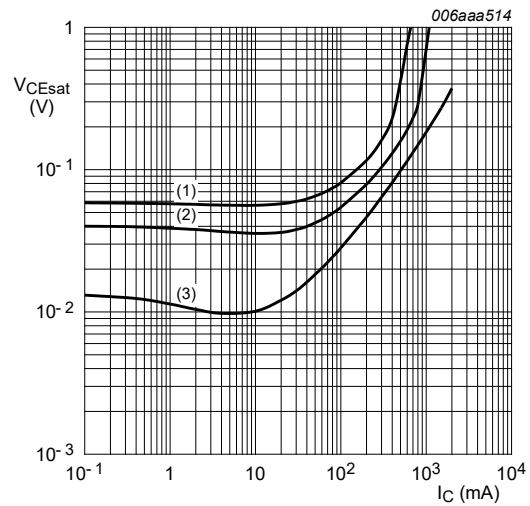
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = -55\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = 100\text{ }^\circ\text{C}$

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



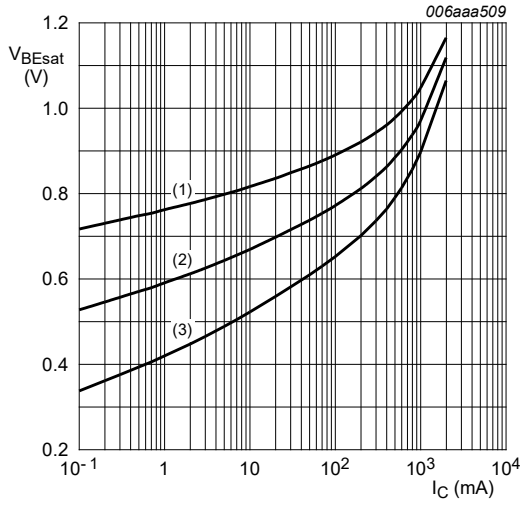
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = -55\text{ }^\circ\text{C}$

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



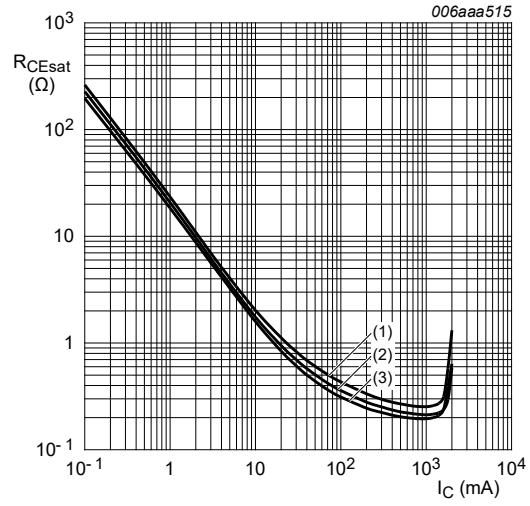
$T_{amb} = 25\text{ }^\circ\text{C}$
 (1) $I_C/I_B = 100$
 (2) $I_C/I_B = 50$
 (3) $I_C/I_B = 10$

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



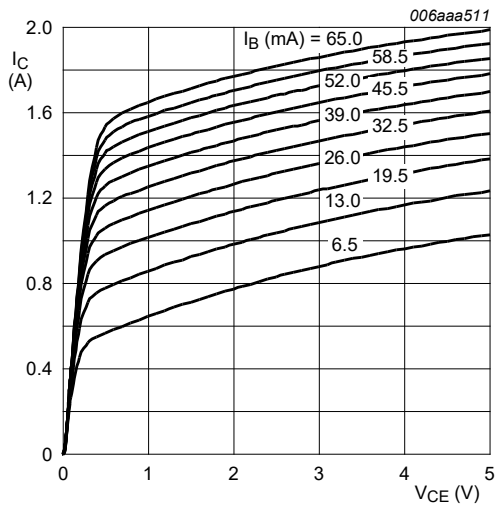
$I_C/I_B = 20$
 (1) $T_{amb} = -55^\circ\text{C}$
 (2) $T_{amb} = 25^\circ\text{C}$
 (3) $T_{amb} = 100^\circ\text{C}$

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



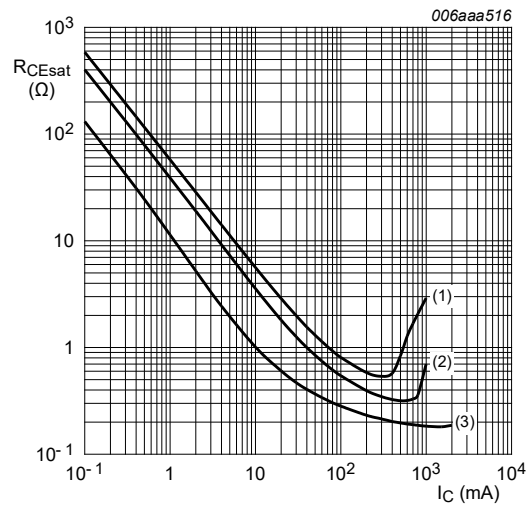
$I_C/I_B = 20$
 (1) $T_{amb} = 100^\circ\text{C}$
 (2) $T_{amb} = 25^\circ\text{C}$
 (3) $T_{amb} = -55^\circ\text{C}$

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



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

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



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

11. Test information

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.

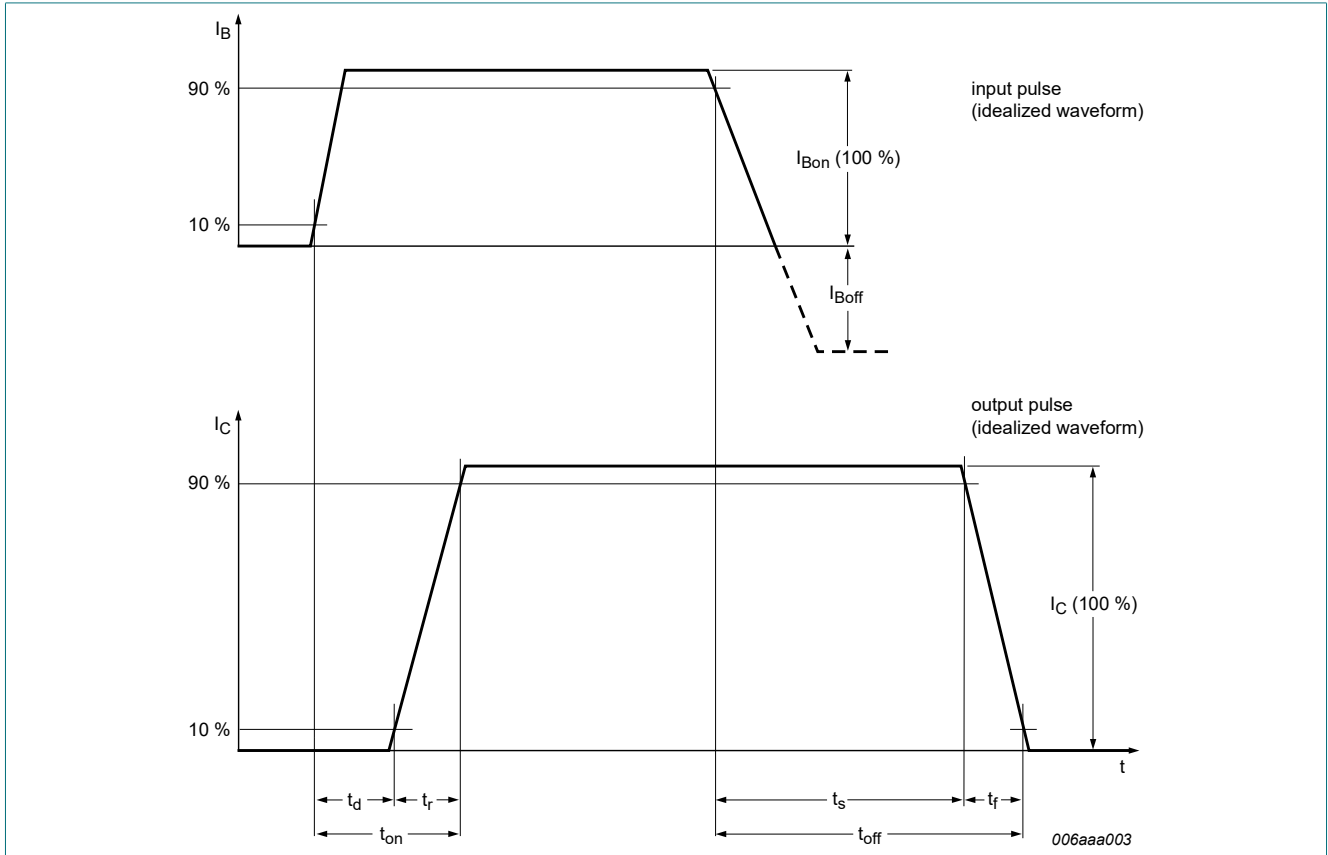


Fig. 13. Transistor switching time definition

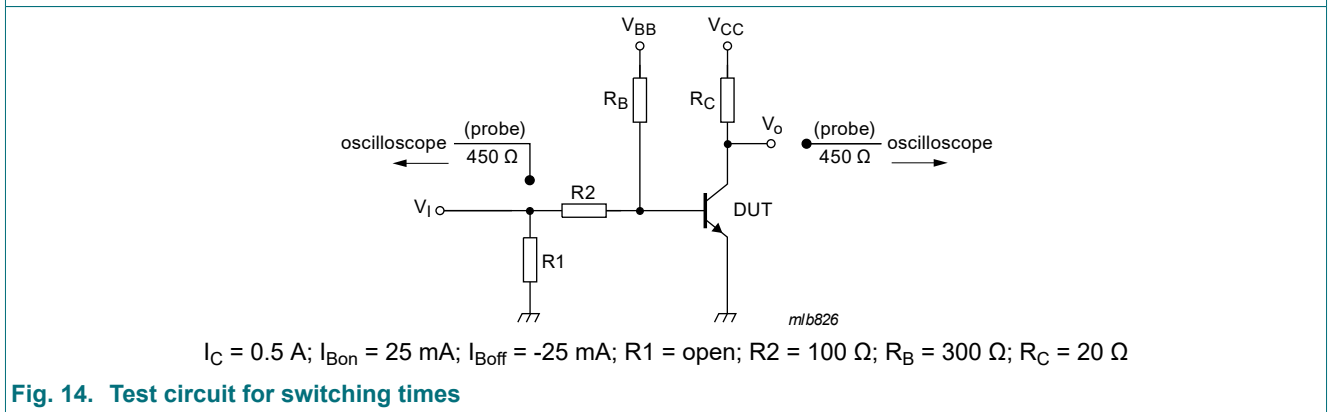


Fig. 14. Test circuit for switching times

12. Package outline

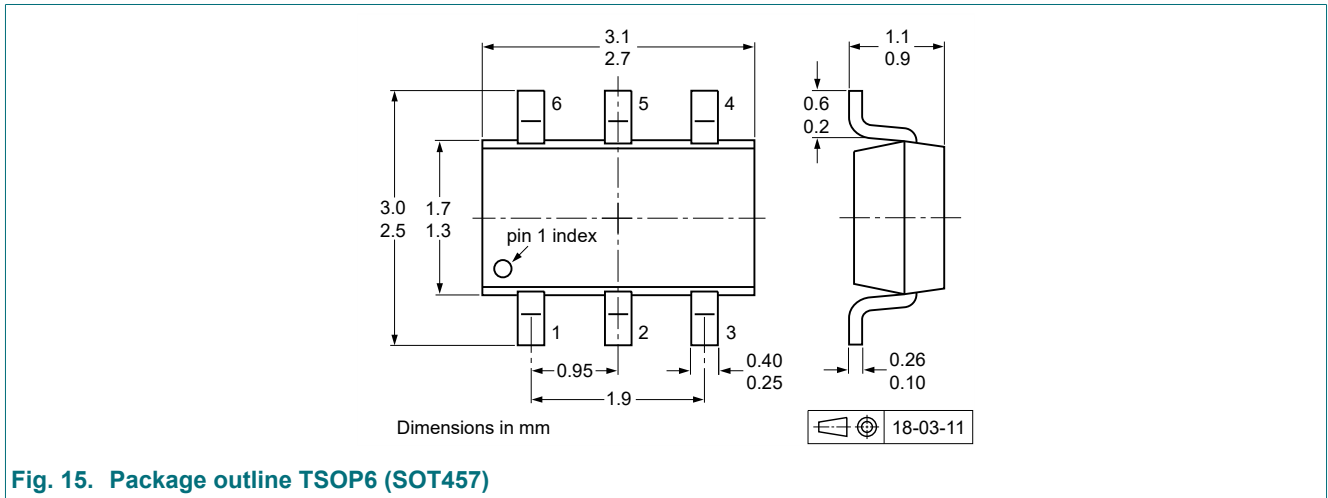


Fig. 15. Package outline TSOP6 (SOT457)

13. Soldering

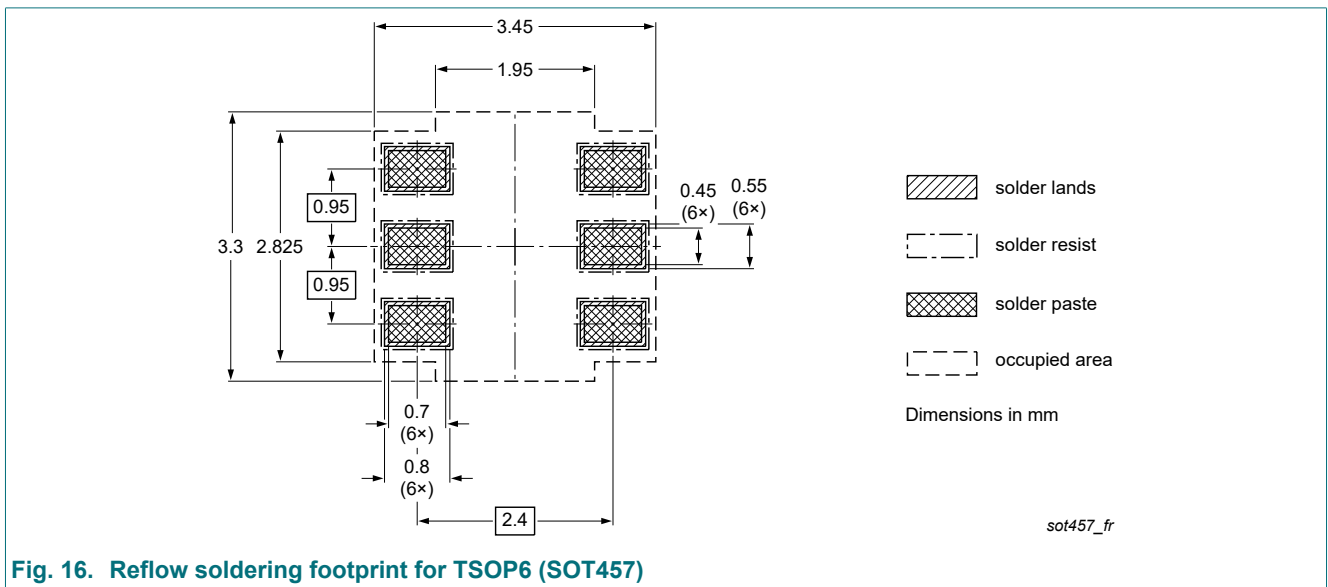


Fig. 16. Reflow soldering footprint for TSOP6 (SOT457)

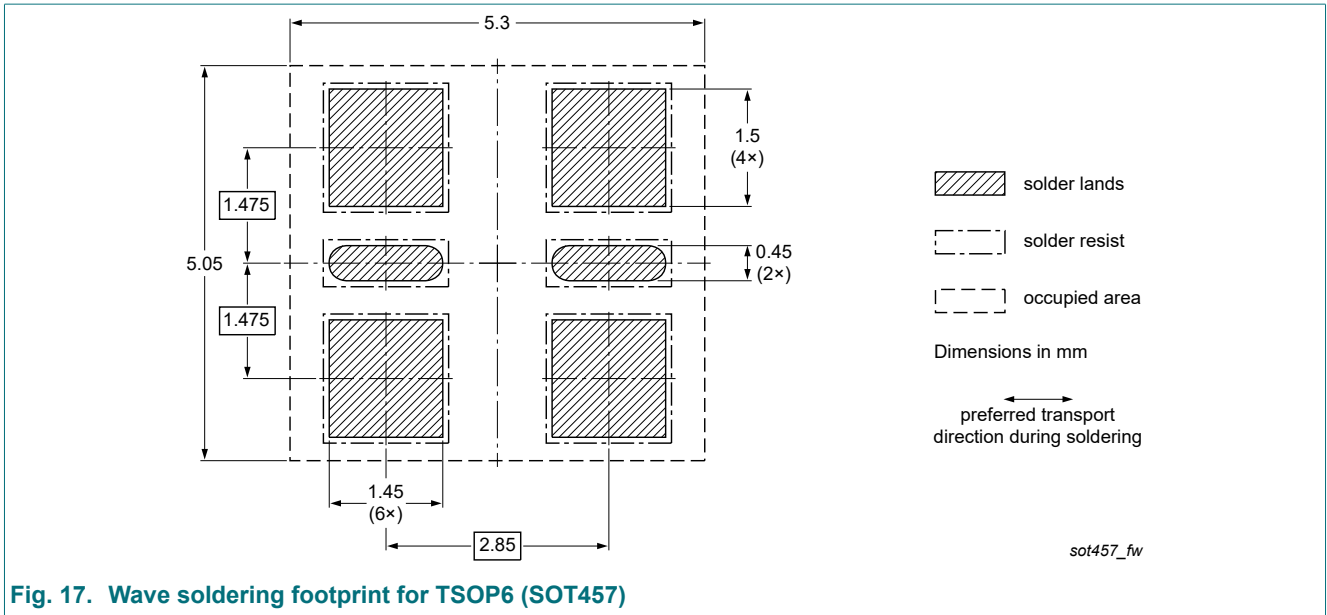


Fig. 17. Wave soldering footprint for TSOP6 (SOT457)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4160DS-Q v.1	20230921	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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