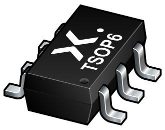


PBSS4160DS

60 V, 1 A NPN/NPN low VCEsat 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

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
- AEC-Q101 qualified

3. Applications

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

4. Quick reference data

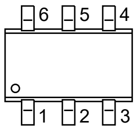
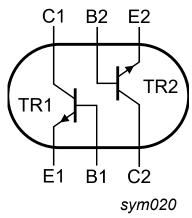
Table 1. Quick reference data

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 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	200	250	mΩ

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

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E1	emitter TR1	 TSOP6 (SOT457)	
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	TSOP6	plastic, surface-mounted package (SC-74; TSOP6); 6 leads	SOT457

7. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4160DS	B8

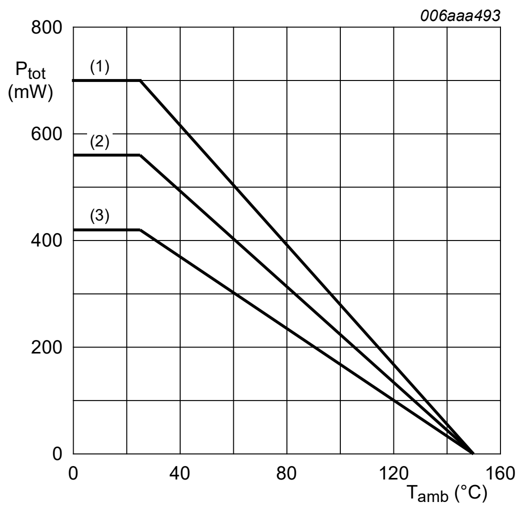
8. Limiting values

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; $t_p \leq$ 1 ms		-	2	A
I_B	base current			-	300	mA
I_{BM}	peak base current	single pulse; $t_p \leq$ 1 ms		-	1	A
P_{tot}	total power dissipation	$T_{amb} \leq$ 25 °C	[1]	-	290	mW
			[2]	-	370	mW
			[3]	-	450	mW
Per device						
P_{tot}	total power dissipation	$T_{amb} \leq$ 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 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 1 cm^2
(3) FR4 PCB, standard footprint

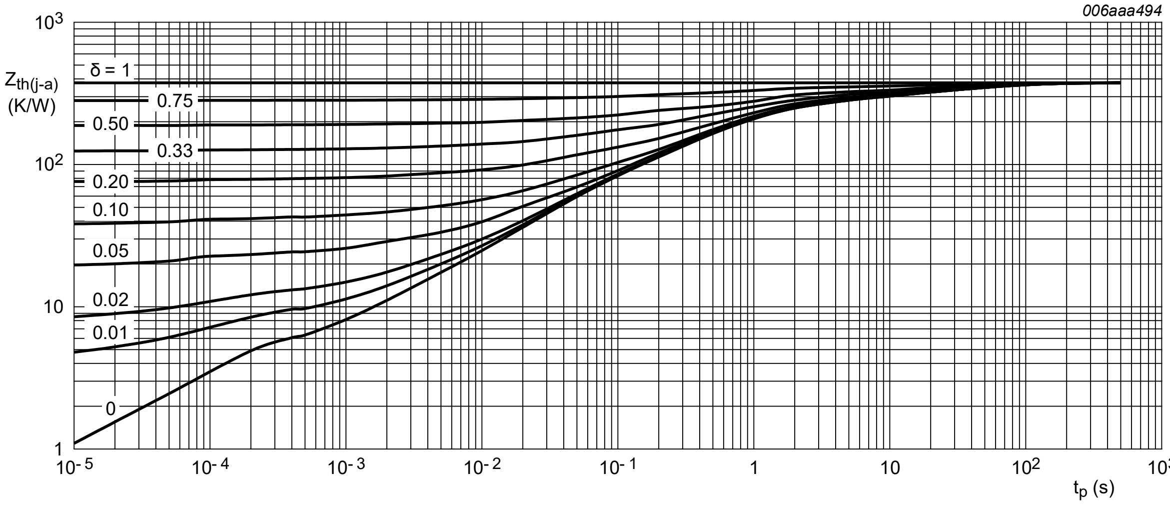
Fig. 1. Power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

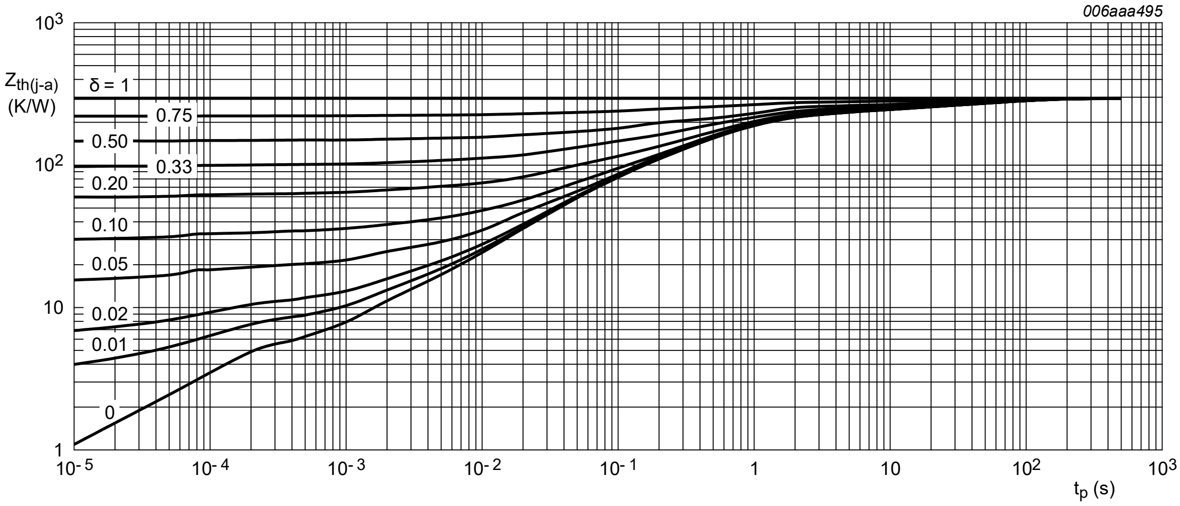
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	431	K/W
			[2]	-	-	338	K/W
			[3]	-	-	278	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	105	K/W
Per device							
$R_{th(j-a)}$	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 cm^2.
[3] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.



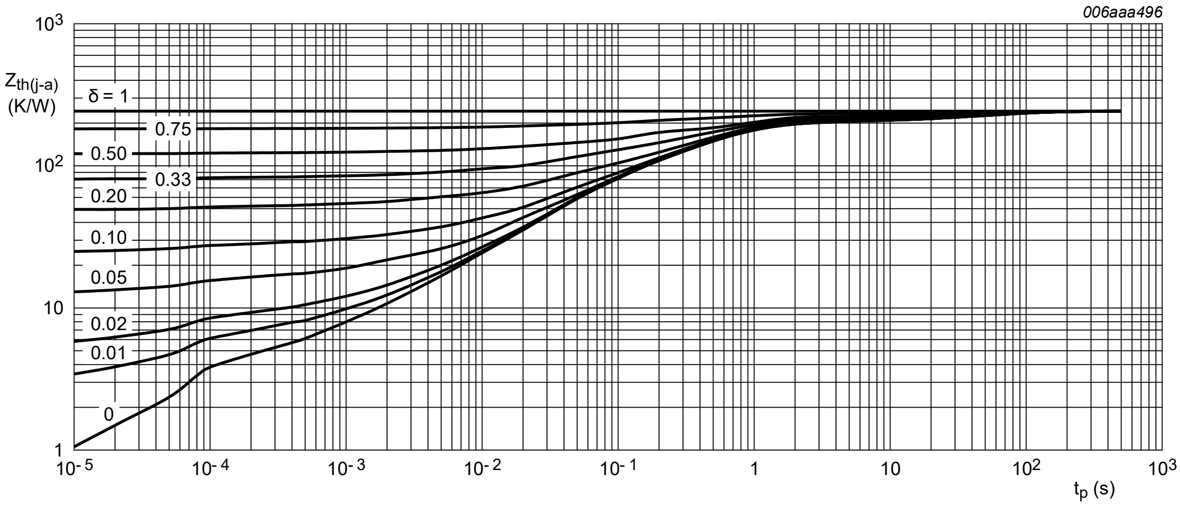
FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for collector 1 cm^2

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



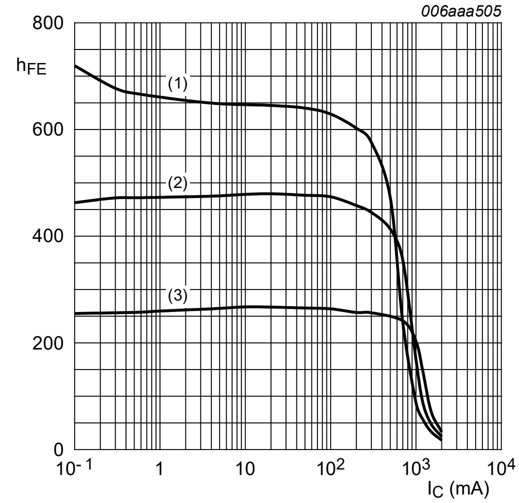
Ceramic PCB, Al_2O_3, standard footprint

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

10. Characteristics

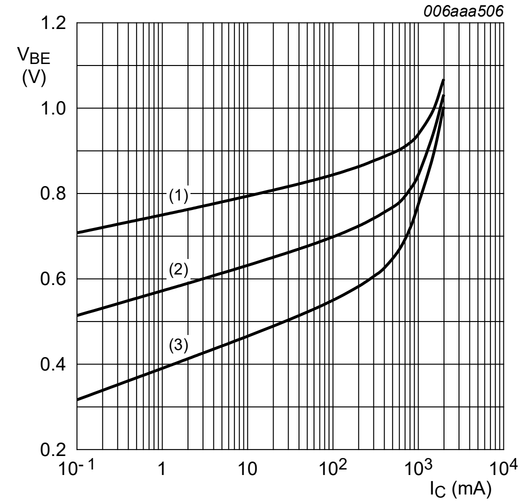
Table 7. Characteristics

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			-	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	-	MHz
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



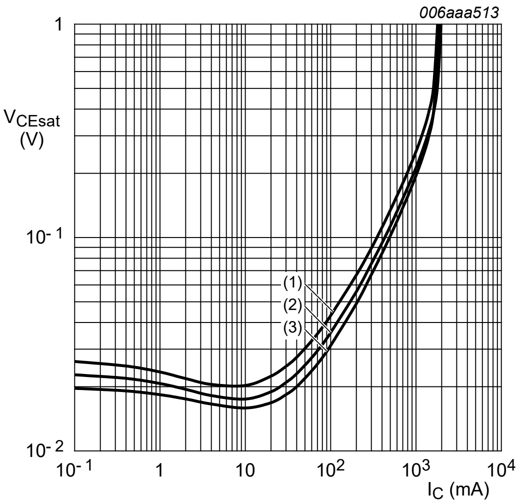
V_{CE} = 5 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −55 °C

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



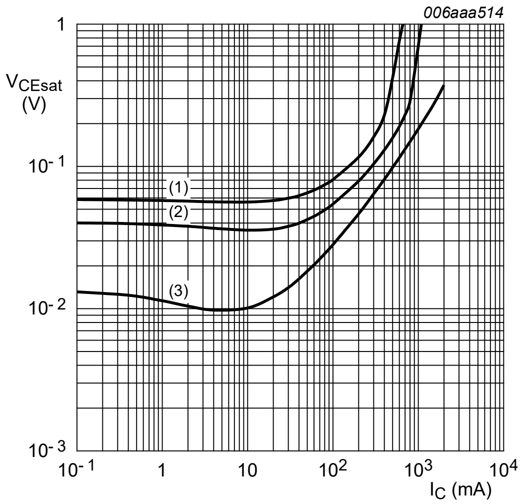
V_{CE} = 5 V
(1) T_{amb} = −55 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

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



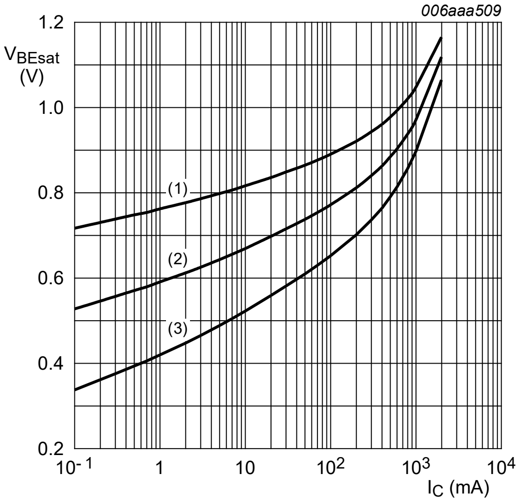
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −55 °C

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



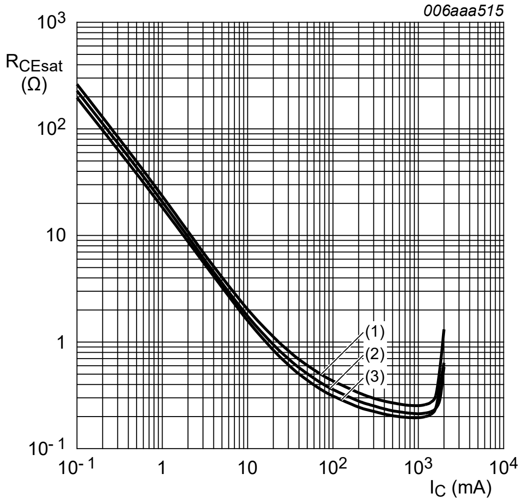
T_{amb} = 25 °C
(1) I_C/I_B = 100
(2) I_C/I_B = 50
(3) I_C/I_B = 10

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



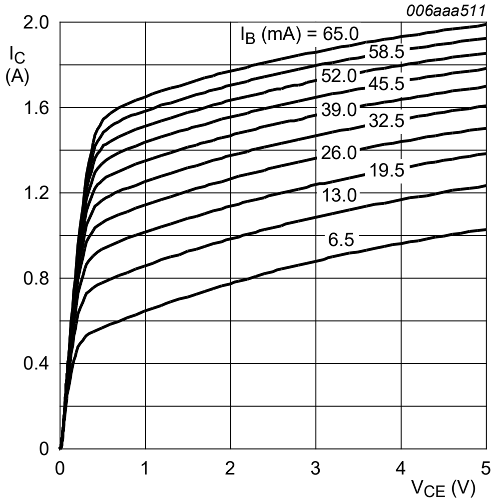
$I_C/I_B = 20$
(1) $T_{amb} = -55$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = 100$ °C

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



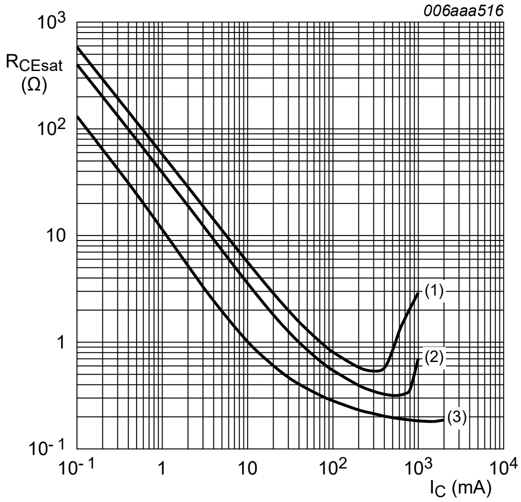
$I_C/I_B = 20$
(1) $T_{amb} = 100$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = -55$ °C

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



$T_{amb} = 25$ °C

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

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.

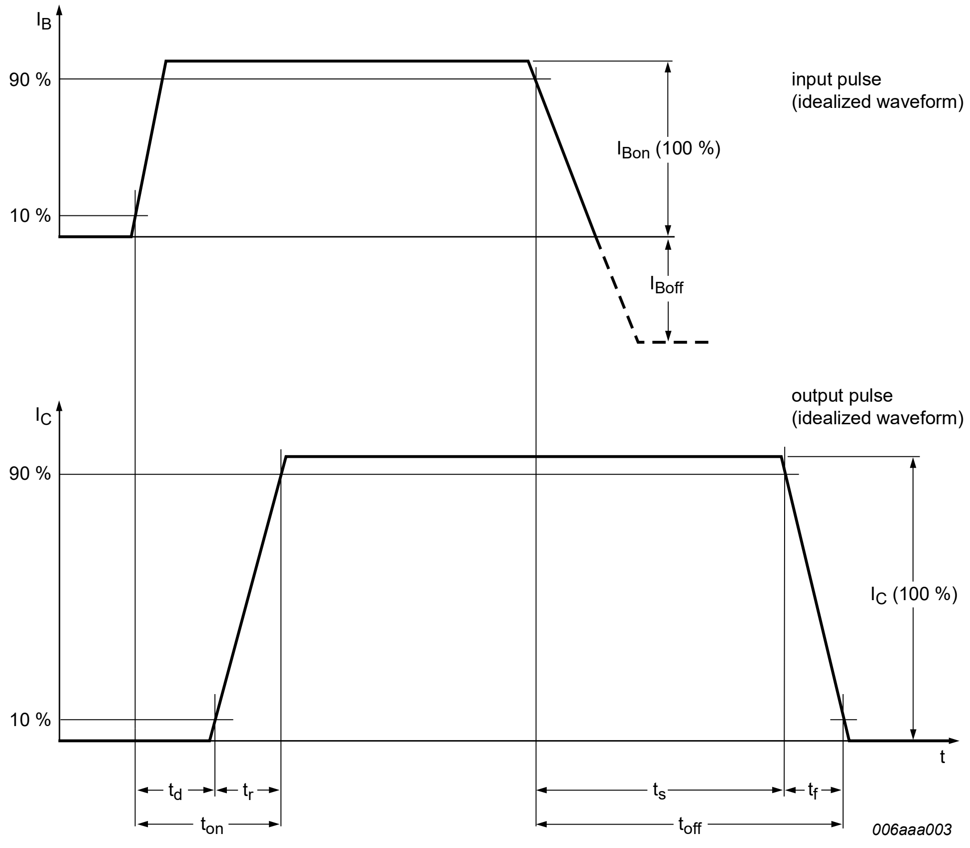
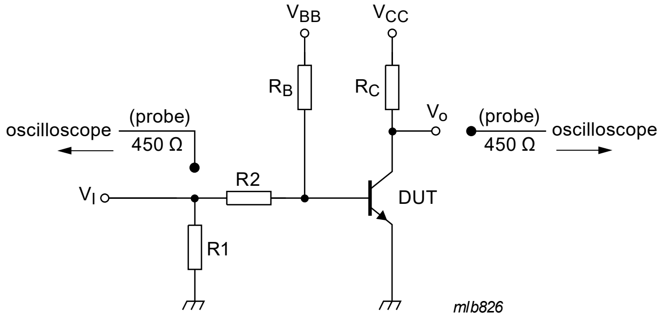


Fig. 13. Transistor switching time definition



I_C = 0.5 A; I_{Bon} = 25 mA; I_{Boff} = -25 mA; R1 = open; R2 = 100 Ω; R_B = 300 Ω; R_C = 20 Ω

Fig. 14. Test circuit for switching times

12. Package outline

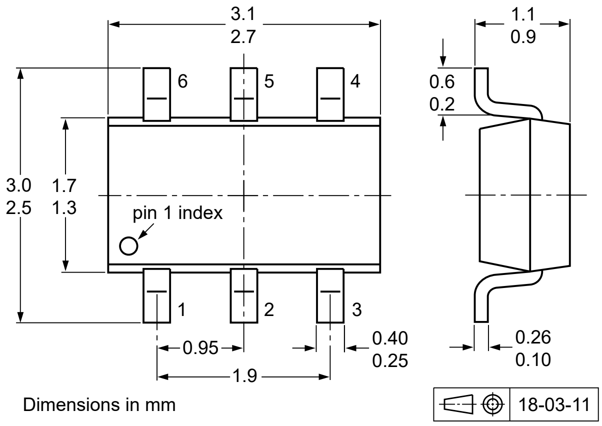


Fig. 15. Package outline TSOP6 (SOT457)

13. Soldering

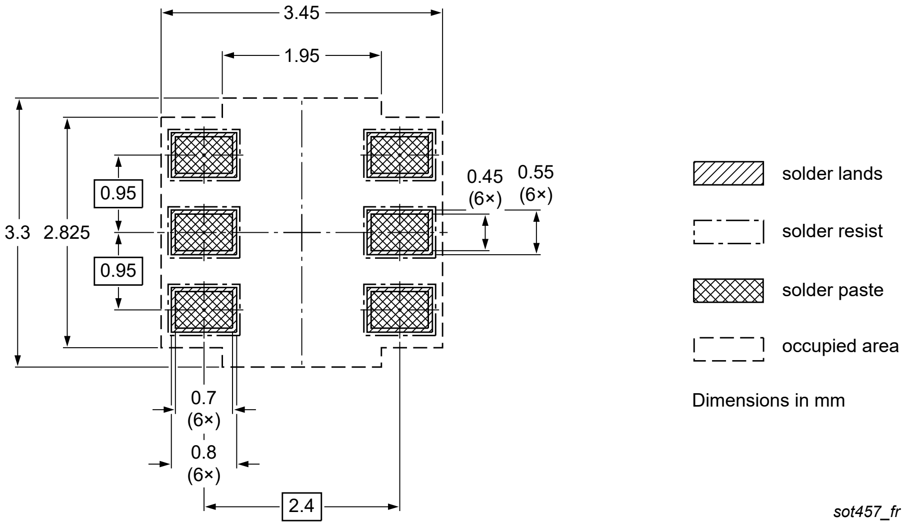


Fig. 16. Reflow soldering footprint for TSOP6 (SOT457)

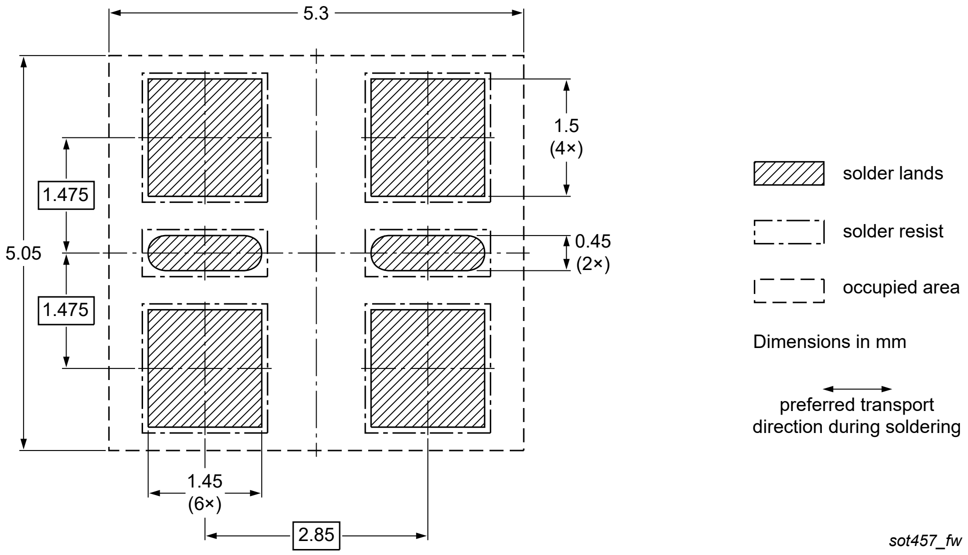


Fig. 17. Wave soldering footprint for TSOP6 (SOT457)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4160DS v.5	20230921	Product data sheet	-	PBSS4160DS_4
Modifications:	• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. • Legal texts have been adapted to the new company name where appropriate. • Section "Packing information" removed.			
PBSS4160DS_4	20091211	Product data sheet	-	PBSS4160DS_3
PBSS4160DS_3	20060209	Product data sheet	-	PBSS4160DS_2
PBSS4160DS_2	20050627	Product data sheet	-	PBSS4160DS_1
PBSS4160DS_1	20040426	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".
[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 https://www.nexperia.com.

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Contents

Date of release: 21 September 2023