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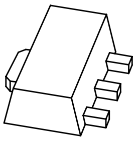
Team Nexperia



PBSS304NX

60 V, 4.7 A NPN low V_{CEsat} (BISS) transistor

Rev. 02 — 20 November 2009 Product data sheet

1. Product profile

1.1 General description

NPN low V_{CEsat} Breakthrough In Small Signal (BISS) transistor in a SOT89 (SC-62/TO-243) small and flat lead Surface-Mounted Device (SMD) plastic package.

PNP complement: PBSS304PX.

1.2 Features

- 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

1.3 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

1.4 Quick reference data

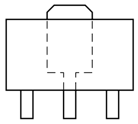
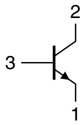
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base		-	-	60	V
I_C	collector current			-	-	4.7	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms		-	-	9.4	A
R_{CEsat}	collector-emitter saturation resistance	$I_C = 4$ A; $I_B = 200$ mA	[1]	-	37	53	mΩ

[1] Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Symbol
1	emitter		
2	collector		
3	base		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS304NX	SC-62	plastic surface-mounted package; collector pad for good heat transfer; 3 leads	SOT89

4. Marking

Table 4. Marking codes

Type number	Marking code[1]
PBSS304NX	*5E

[1] * = -: made in Hong Kong

* = p: made in Hong Kong

* = t: made in Malaysia

* = W: made in China

5. Limiting values

Table 5. Limiting values

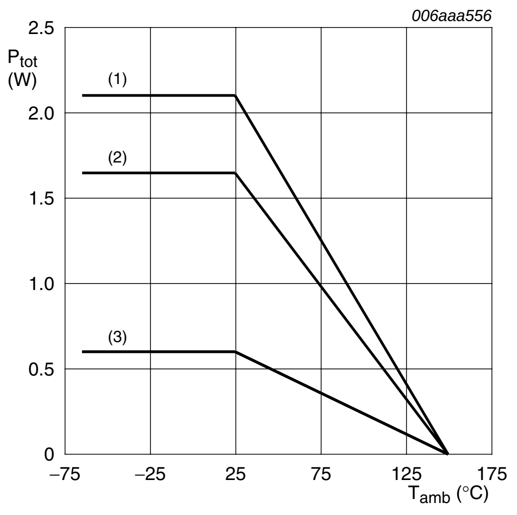
In accordance with the Absolute Maximum Rating System (IEC 60134).

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			-	4.7	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms		-	9.4	A
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	0.6	W
			[2]	-	1.65	W
			[3]	-	2.1	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 an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 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 6 cm^2

(3) FR4 PCB, standard footprint

Fig 1. Power derating curves

6. Thermal characteristics

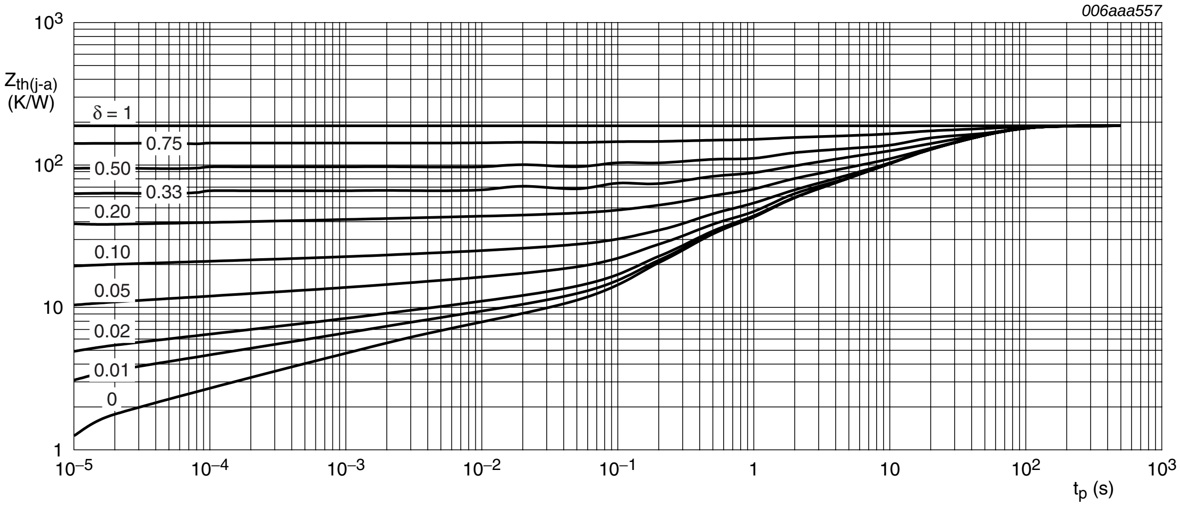
Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	208	K/W
			[2]	-	-	76	K/W
			[3]	-	-	60	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	20	K/W

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

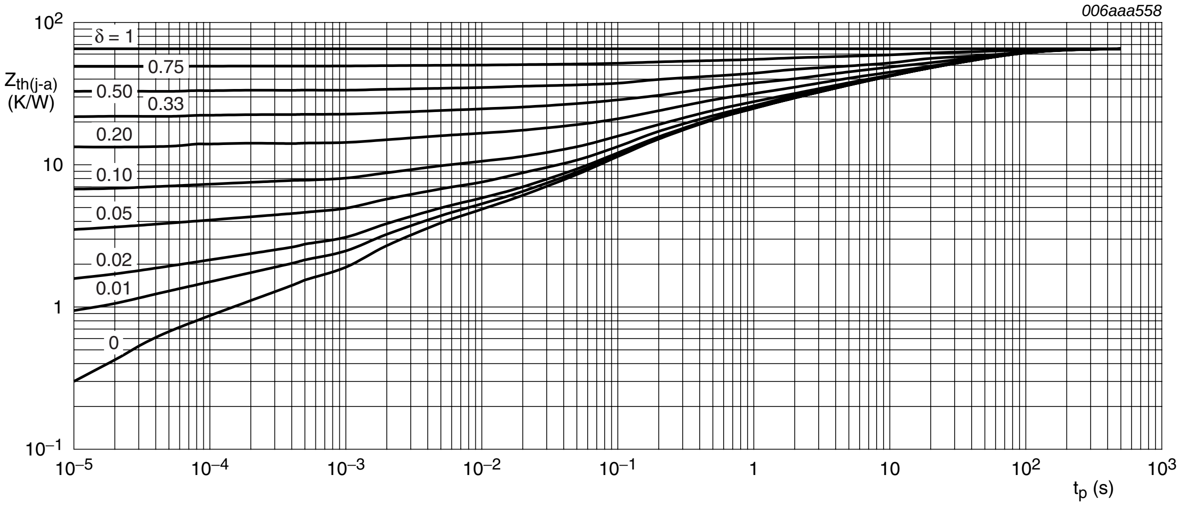
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm^2.

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



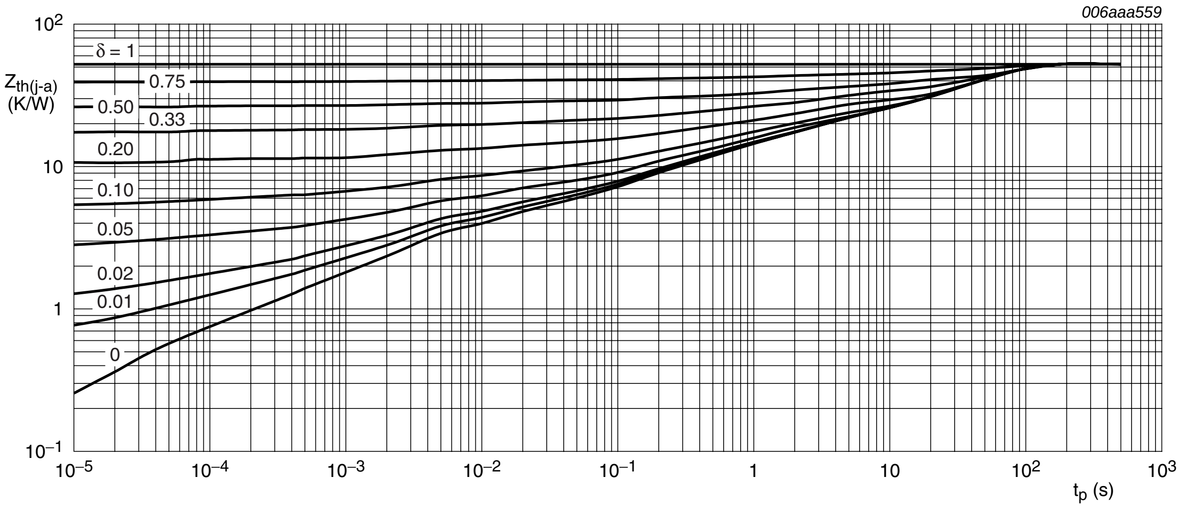
FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for collector 6 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

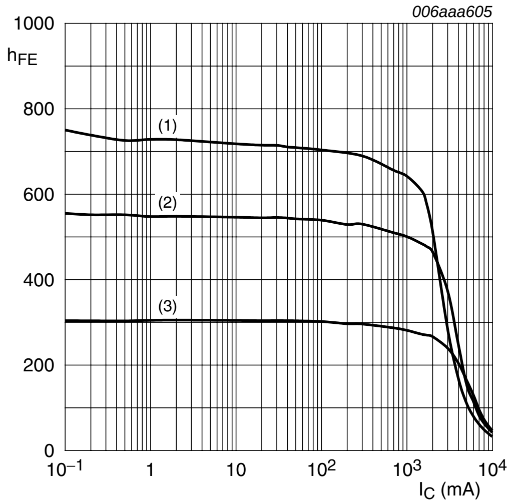
7. Characteristics

Table 7. Characteristics

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	V_{CB} = 60 V; I_E = 0 A		-	-	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		-	-	100	nA
h_{FE}	DC current gain	V_{CE} = 2 V; I_C = 0.5 A	[1]	300	520	-	
		V_{CE} = 2 V; I_C = 1 A	[1]	300	500	-	
		V_{CE} = 2 V; I_C = 2 A	[1]	250	470	-	
		V_{CE} = 2 V; I_C = 4 A	[1]	150	250	-	
		V_{CE} = 2 V; I_C = 6 A	[1]	75	115	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 0.5 A; I_B = 50 mA	[1]	-	25	35	mV
		I_C = 1 A; I_B = 50 mA	[1]	-	50	70	mV
		I_C = 1 A; I_B = 10 mA	[1]	-	85	120	mV
		I_C = 2 A; I_B = 40 mA	[1]	-	105	150	mV
		I_C = 4 A; I_B = 200 mA	[1]	-	145	210	mV
		I_C = 4 A; I_B = 400 mA	[1]	-	140	200	mV
		I_C = 4 A; I_B = 80 mA	[1]	-	190	290	mV
		I_C = 4.7 A; I_B = 235 mA	[1]	-	170	245	mV
R_{CEsat}	collector-emitter saturation resistance	I_C = 4 A; I_B = 200 mA	[1]	-	37	53	mΩ
		I_C = 4 A; I_B = 80 mA	[1]	-	48	73	mΩ
V_{BEsat}	base-emitter saturation voltage	I_C = 1 A; I_B = 100 mA	[1]	-	0.82	0.9	V
		I_C = 4 A; I_B = 400 mA	[1]	-	0.94	1.05	V
V_{BEon}	base-emitter turn-on voltage	V_{CE} = 2 V; I_C = 2 A	[1]	-	0.75	0.85	V
t_d	delay time	V_{CC} = 12.5 V; I_C = 3 A; I_{Bon} = 0.15 A; I_{Boff} = −0.15 A		-	15	-	ns
t_r	rise time			-	95	-	ns
t_{on}	turn-on time			-	110	-	ns
t_s	storage time			-	360	-	ns
t_f	fall time			-	195	-	ns
t_{off}	turn-off time			-	555	-	ns
f_T	transition frequency	V_{CE} = 10 V; I_C = 100 mA; f = 100 MHz		-	130	-	MHz
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz		-	48	70	pF

[1] Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.



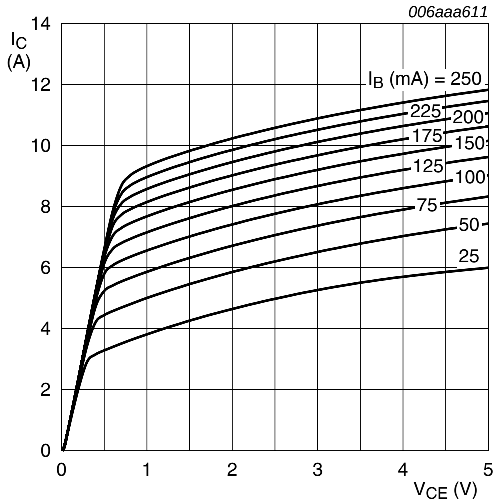
V_{CE} = 2 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

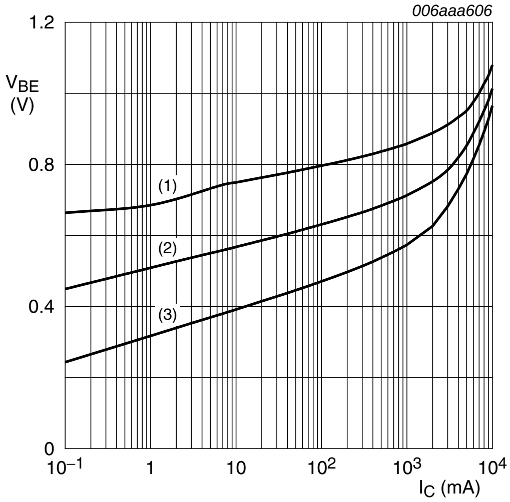
(3) T_{amb} = −55 °C

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



T_{amb} = 25 °C

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



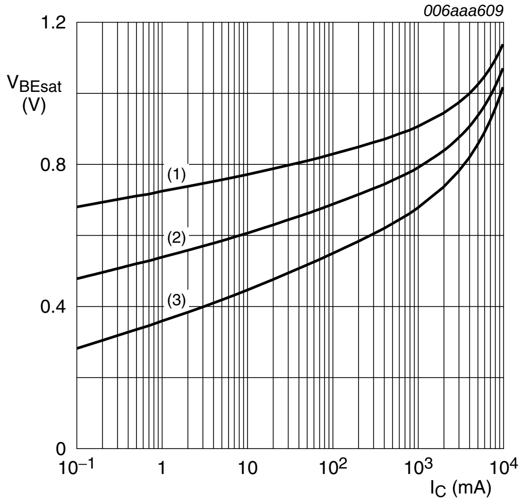
V_{CE} = 2 V

(1) T_{amb} = −55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



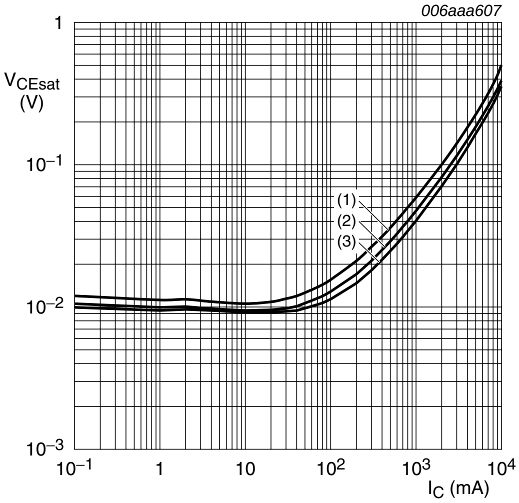
I_C/I_B = 20

(1) T_{amb} = −55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



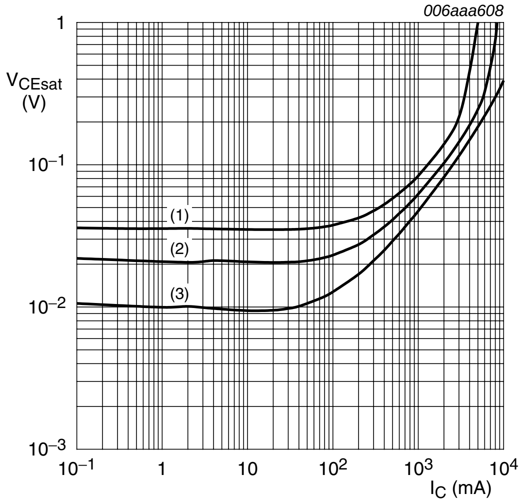
$I_C/I_B = 20$

(1) $T_{amb} = 100$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = -55$ °C

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



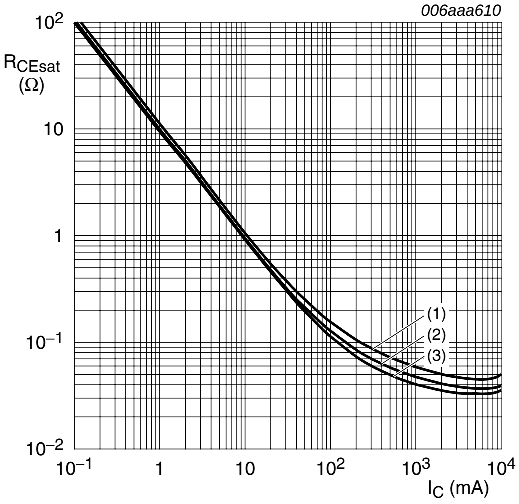
$T_{amb} = 25$ °C

(1) $I_C/I_B = 100$

(2) $I_C/I_B = 50$

(3) $I_C/I_B = 10$

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



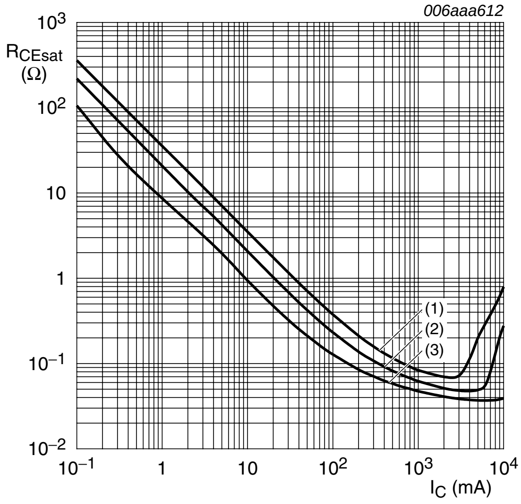
$I_C/I_B = 20$

(1) $T_{amb} = 100$ °C

(2) $T_{amb} = 25$ °C

(3) $T_{amb} = -55$ °C

Fig 11. Collector-emitter saturation resistance 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 12. Collector-emitter saturation resistance as a function of collector current; typical values

8. Test information

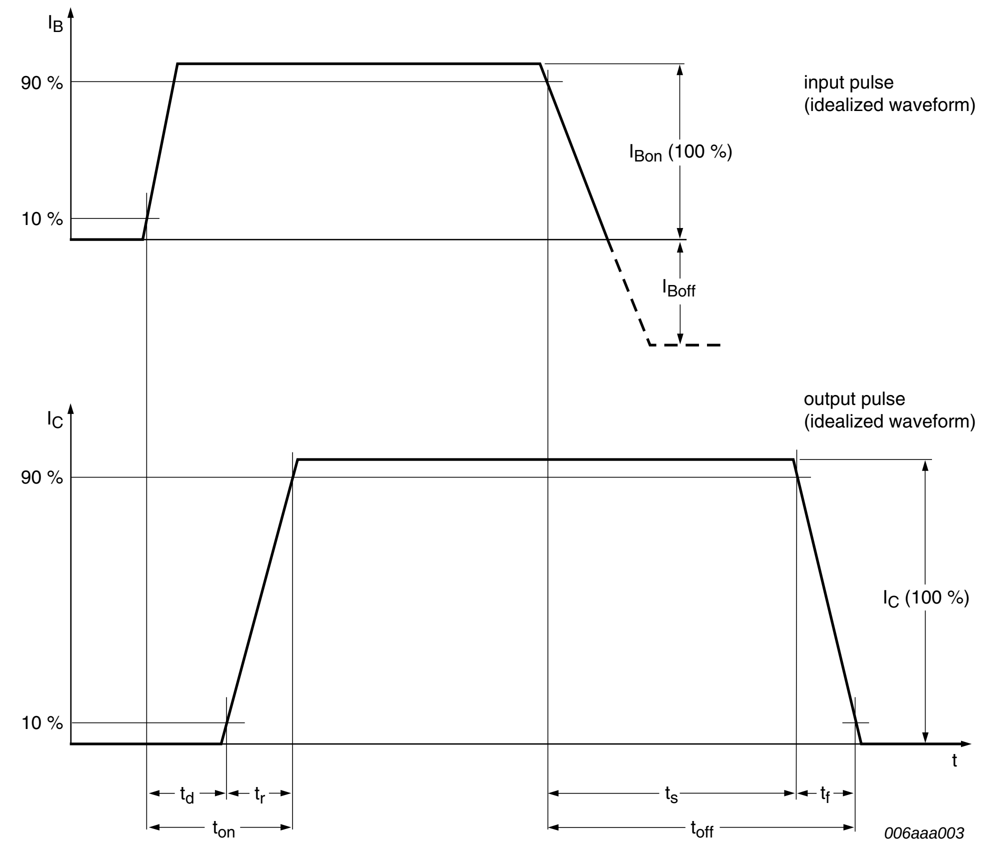
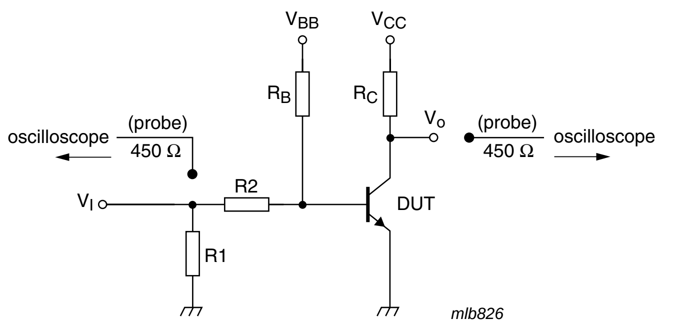


Fig 13. BISS transistor switching time definition



V_{CC} = 12.5 V; I_C = 3 A; I_{Bon} = 0.15 A; I_{Boff} = −0.15 A

Fig 14. Test circuit for switching times

9. Package outline

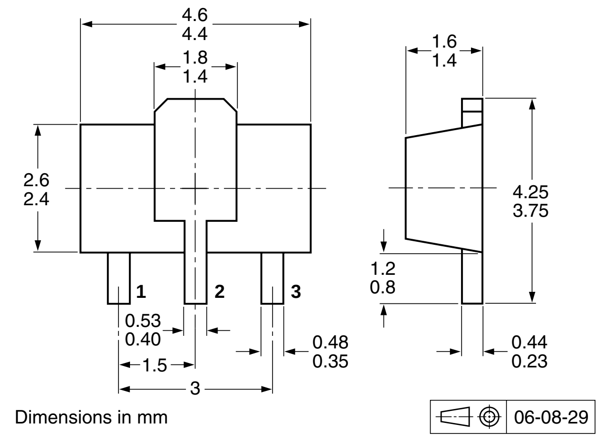


Fig 15. Package outline SOT89 (SC-62/TO-243)

10. Packing information

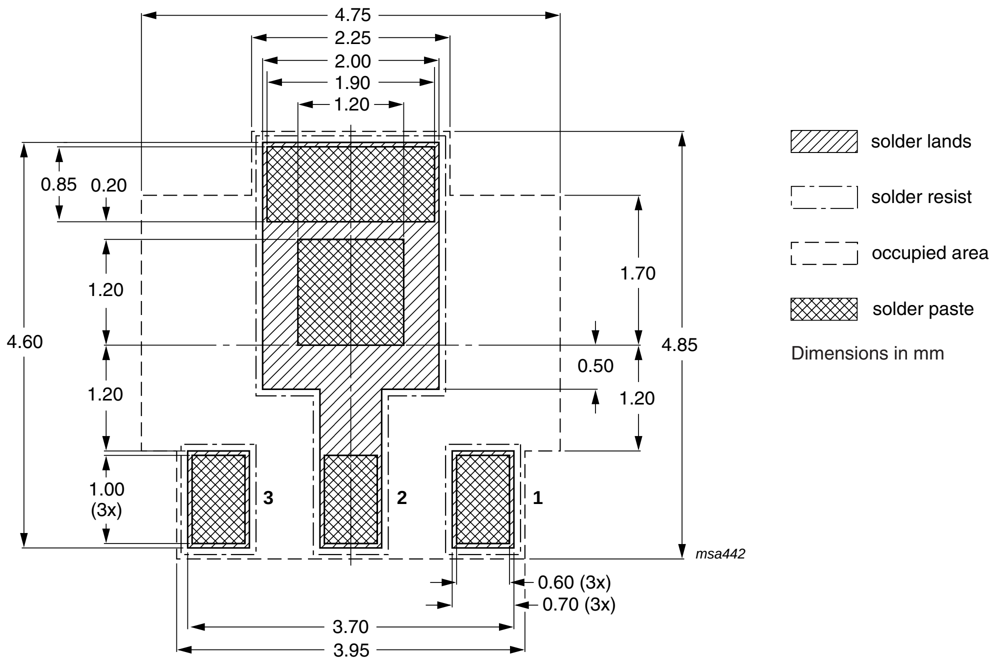
Table 8. Packing methods

The indicated -xxx are the last three digits of the 12NC ordering code.[1]

Type number	Package	Description	Packing quantity	
			1000	4000
PBSS304NX	SOT89	8 mm pitch, 12 mm tape and reel	-115	-135

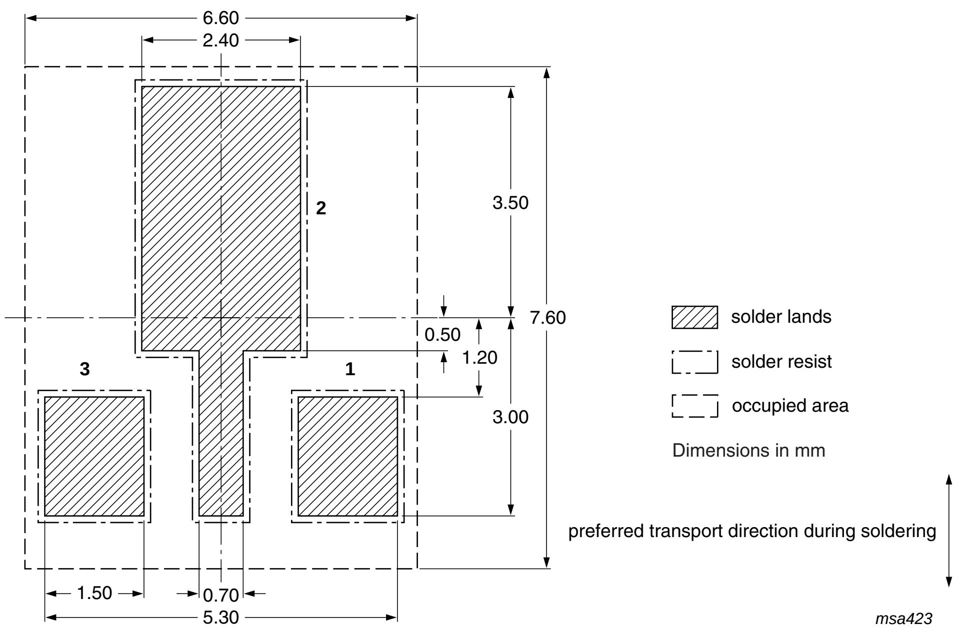
[1] For further information and the availability of packing methods, see Section 15.

11. Soldering



SOT89 standard mounting conditions for reflow soldering

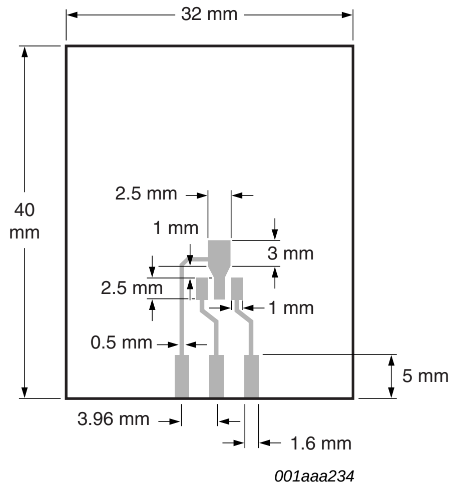
Fig 16. Reflow soldering footprint



Not recommended for wave soldering

Fig 17. Wave soldering footprint

12. Mounting

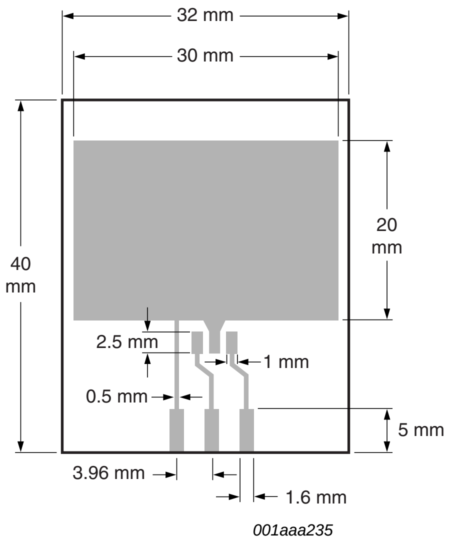


PCB thickness:

FR4 PCB = 1.6 mm

ceramic PCB = 0.635 mm

Fig 18. FR4 PCB, standard footprint; ceramic PCB, Al_2O_3, standard footprint



PCB thickness = 1.6 mm

Fig 19. FR4 PCB, mounting pad for collector 6 cm^2

13. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBSS304NX_2	20091120	Product data sheet	-	PBSS304NX_1
Modifications:	• This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content. • Figure 15 “Package outline SOT89 (SC-62/TO-243)”: updated • Figure 16 “Reflow soldering footprint”: updated • Figure 17 “Wave soldering footprint”: updated			
PBSS304NX_1	20060816	Product data sheet	-	-

14. Legal information

14.1 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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16. Contents

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