

# DATA SHEET



**PBSS4540X**

40 V, 5 A

NPN low  $V_{CEsat}$  (BISS) transistor

Product data sheet  
Supersedes data of 2004 Jun 11

2004 Nov 04

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**PBSS4540X**

**FEATURES**

- High  $h_{FE}$  and low  $V_{CEsat}$  at high current operation
- High collector current capability:  $I_C$  maximum 4 A
- High efficiency leading to less heat generation.

**APPLICATIONS**

- Medium power peripheral drivers (e.g. fan and motor)
- Strobe flash units for DSC and mobile phones
- Inverter applications (e.g. TFT displays)
- Power switch for LAN and ADSL systems
- Medium power DC-to-DC conversion
- Battery chargers.

**DESCRIPTION**

NPN low  $V_{CEsat}$  transistor in a medium power SOT89 (SC-62) package.  
 PNP complement: PBSS5540X.

**MARKING**

TYPE NUMBER	MARKING CODE <sup>(1)</sup>
PBSS4540X	*1B

**Note**

- \* = p: made in Hong Kong.  
 \* = t: made in Malaysia.  
 \* = W: made in China.

**QUICK REFERENCE DATA**

SYMBOL	PARAMETER	MAX.	UNIT
$V_{CEO}$	collector-emitter voltage	40	V
$I_C$	collector current (DC)	4	A
$I_{CM}$	peak collector current	10	A
$R_{CEsat}$	equivalent on-resistance	71	m $\Omega$

**PINNING**

PIN	DESCRIPTION
1	emitter
2	collector
3	base

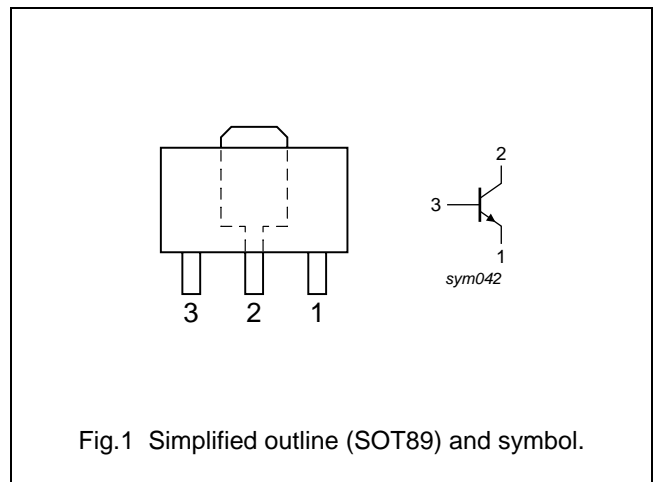


Fig.1 Simplified outline (SOT89) and symbol.

**ORDERING INFORMATION**

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
PBSS4540X	SC-62	plastic surface mounted package; collector pad for good heat transfer; 3 leads	SOT89

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**LIMITING VALUES**

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

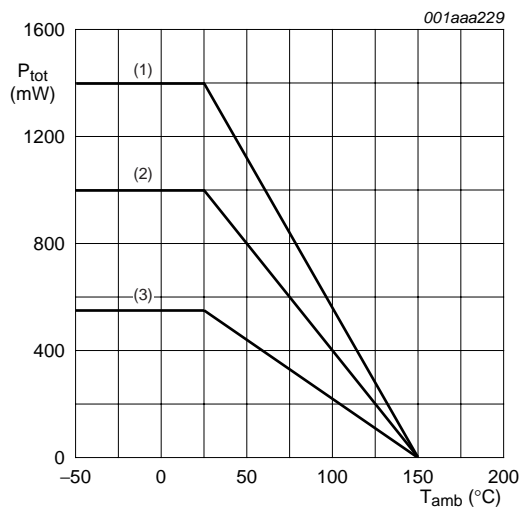
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{CBO}$	collector-base voltage	open emitter	–	40	V
$V_{CEO}$	collector-emitter voltage	open base	–	40	V
$V_{EBO}$	emitter-base voltage	open collector	–	6	V
$I_C$	collector current (DC)		–	4	A
$I_{CRM}$	maximum repetitive collector current	notes 1 and 2	–	5	A
$I_{CM}$	peak collector current	$t_p \leq 1$ ms	–	10	A
$I_B$	base current (DC)		–	1	A
$I_{BM}$	peak base current	$t_p \leq 1$ ms	–	2	A
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C notes 1 and 2 note 2 note 3 note 4 note 5	–	2.5 0.55 1 1.4 1.6	W W W W W
$T_{stg}$	storage temperature		–65	+150	°C
$T_j$	junction temperature		–	150	°C
$T_{amb}$	operating ambient temperature		–65	+150	°C

**Notes**

1. Operated under pulsed conditions; pulse width  $t_p \leq 10$  ms; duty cycle  $\delta \leq 0.2$ .
2. Device mounted on a printed-circuit board, single-sided copper, tin-plated and standard footprint.
3. Device mounted on a printed-circuit board, single-sided copper, tin-plated and mounting pad for collector 1 cm<sup>2</sup>.
4. Device mounted on a printed-circuit board, single-sided copper, tin-plated and mounting pad for collector 6 cm<sup>2</sup>.
5. Device mounted on a 7 cm<sup>2</sup> ceramic printed-circuit board, 1 cm<sup>2</sup> single-sided copper and tin-plated. For other mounting conditions, see “*Thermal considerations for SOT89 in the General Part of associated Handbook*”.

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- (1) FR4 PCB; 6 cm<sup>2</sup> mounting pad for collector.
- (2) FR4 PCB; 1 cm<sup>2</sup> mounting pad for collector.
- (3) FR4; standard footprint.

Fig.2 Power derating curves.

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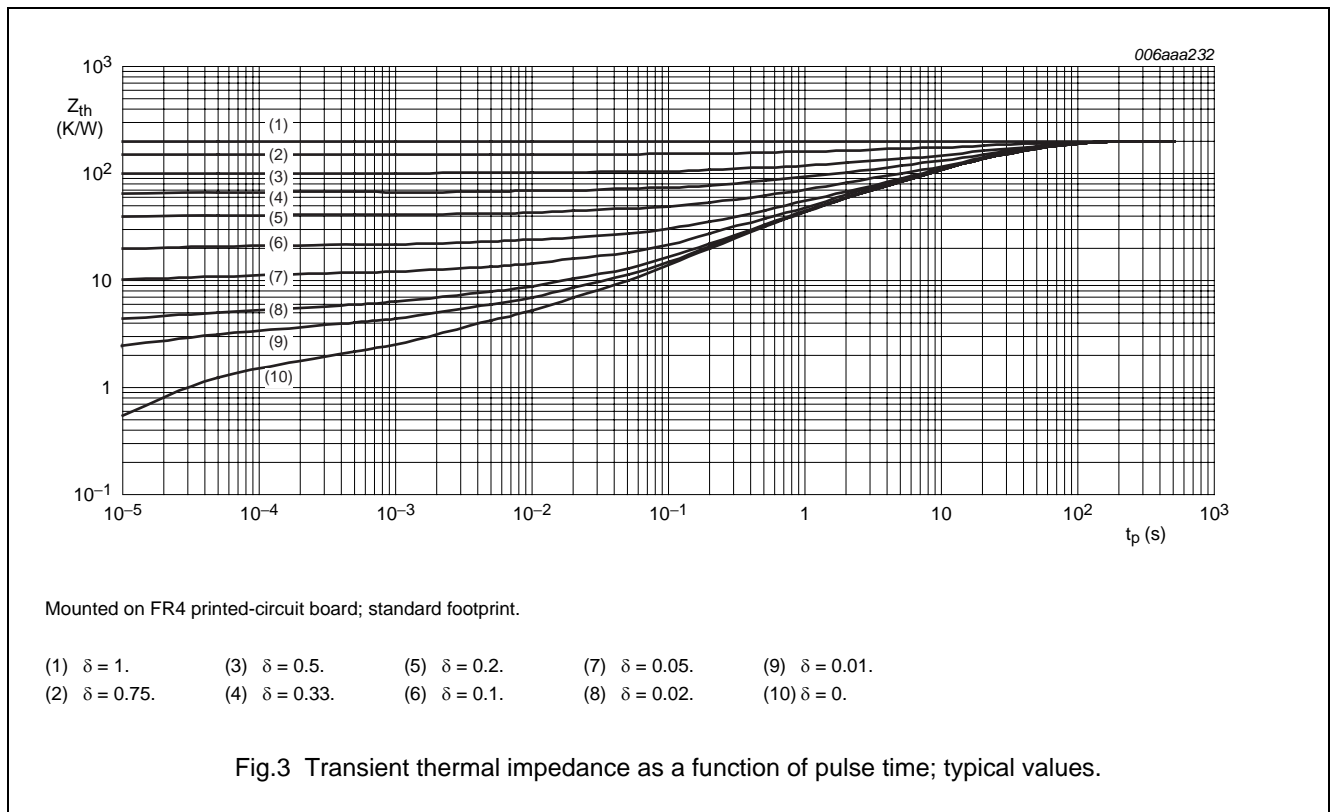
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**THERMAL CHARACTERISTICS**

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th(j-a)}$	from junction to ambient	in free air		
		notes 1 and 2	50	K/W
		note 2	225	K/W
		note 3	125	K/W
		note 4	90	K/W
		note 5	80	K/W
$R_{th(j-s)}$	from junction to soldering point		16	K/W

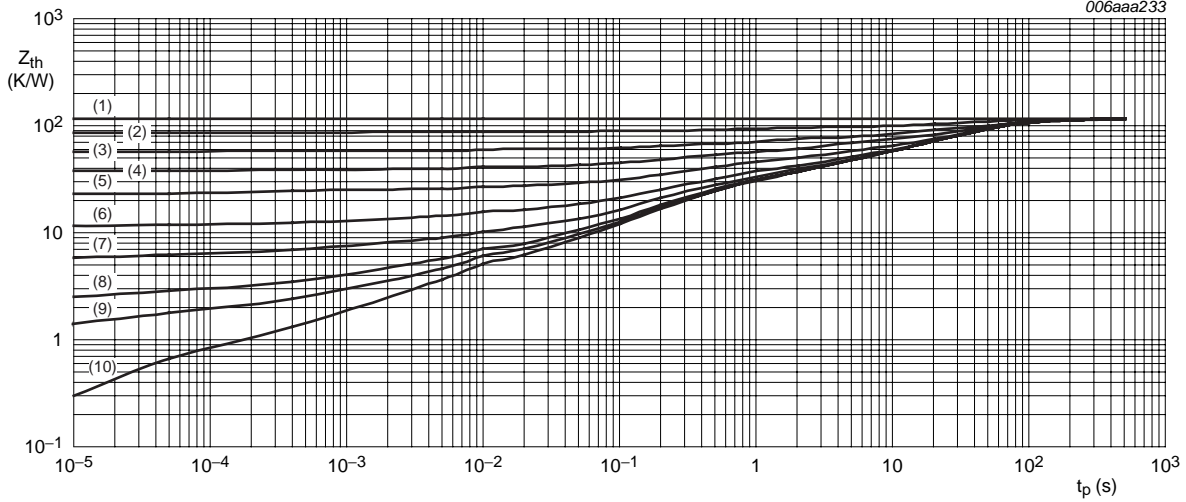
**Notes**

1. Operated under pulsed conditions; pulse width  $t_p \leq 10$  ms; duty cycle  $\delta \leq 0.2$ .
2. Device mounted on a printed-circuit board, single-sided copper, tin-plated and standard footprint.
3. Device mounted on a printed-circuit board, single-sided copper, tin-plated and mounting pad for collector 1 cm<sup>2</sup>.
4. Device mounted on a printed-circuit board, single-sided copper, tin-plated and mounting pad for collector 6 cm<sup>2</sup>.
5. Device mounted on a 7 cm<sup>2</sup> ceramic printed-circuit board, 1 cm<sup>2</sup> single-sided copper and tin-plated. For other mounting conditions, see "Thermal considerations for SOT89 in the General Part of associated Handbook".



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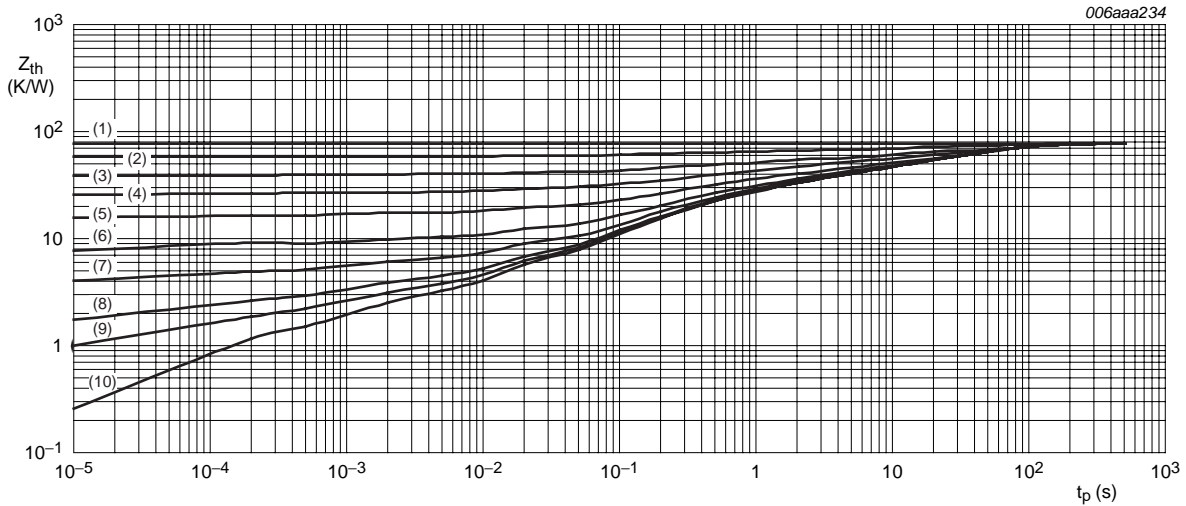
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Mounted on FR4 printed-circuit board; mounting pad for collector 1 cm<sup>2</sup>.

- |                      |                      |                     |                      |                      |
|----------------------|----------------------|---------------------|----------------------|----------------------|
| (1) $\delta = 1.$    | (3) $\delta = 0.5.$  | (5) $\delta = 0.2.$ | (7) $\delta = 0.05.$ | (9) $\delta = 0.01.$ |
| (2) $\delta = 0.75.$ | (4) $\delta = 0.33.$ | (6) $\delta = 0.1.$ | (8) $\delta = 0.02.$ | (10) $\delta = 0.$   |

Fig.4 Transient thermal impedance as a function of pulse time; typical values.



Mounted on FR4 printed-circuit board; mounting pad for collector 6 cm<sup>2</sup>.

- |                      |                      |                     |                      |                      |
|----------------------|----------------------|---------------------|----------------------|----------------------|
| (1) $\delta = 1.$    | (3) $\delta = 0.5.$  | (5) $\delta = 0.2.$ | (7) $\delta = 0.05.$ | (9) $\delta = 0.01.$ |
| (2) $\delta = 0.75.$ | (4) $\delta = 0.33.$ | (6) $\delta = 0.1.$ | (8) $\delta = 0.02.$ | (10) $\delta = 0.$   |

Fig.5 Transient thermal impedance as a function of pulse time; typical values.

# 40 V, 5 A NPN low $V_{CEsat}$ (BISS) transistor

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**CHARACTERISTICS** $T_{amb} = 25\text{ °C}$  unless otherwise specified.

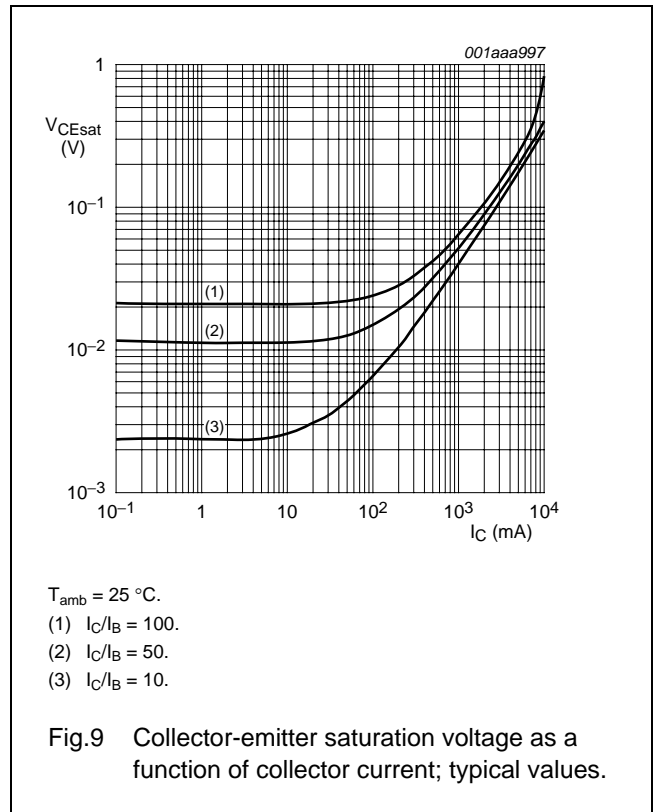
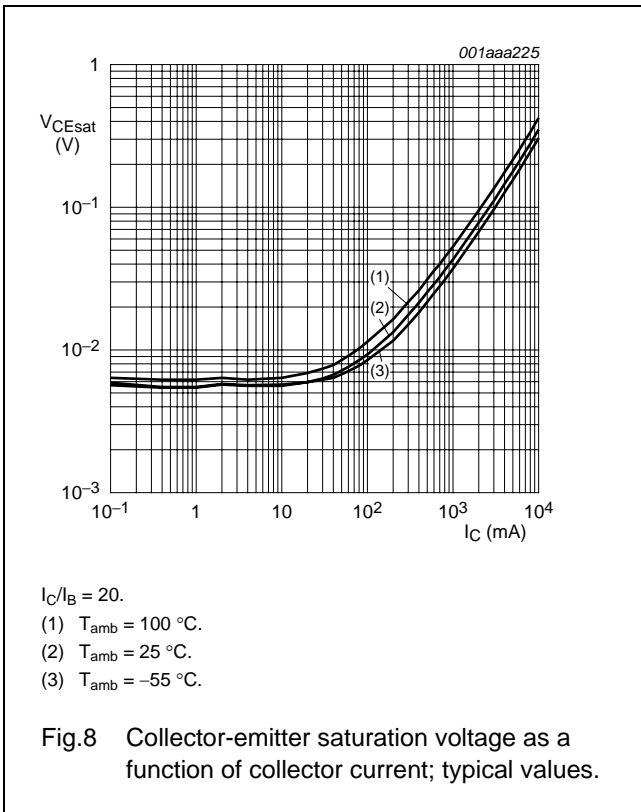
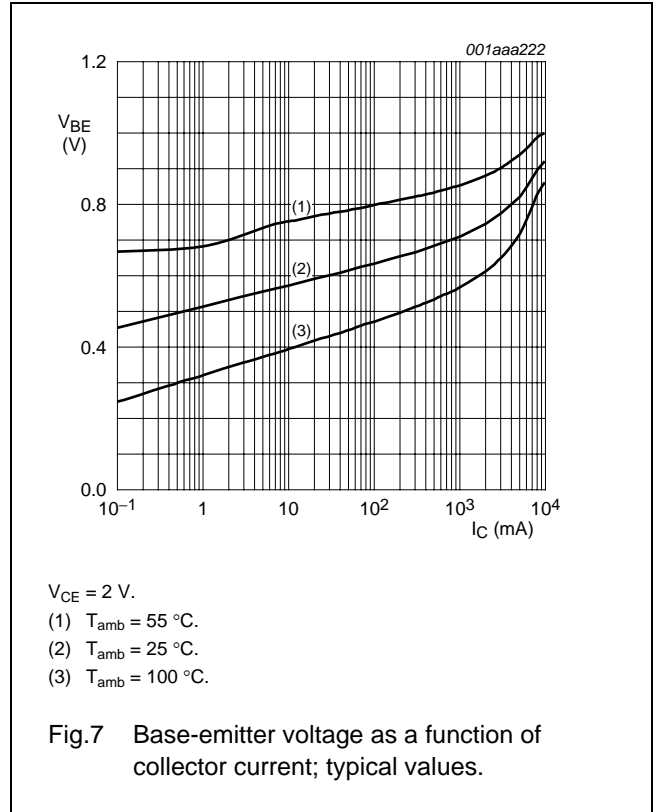
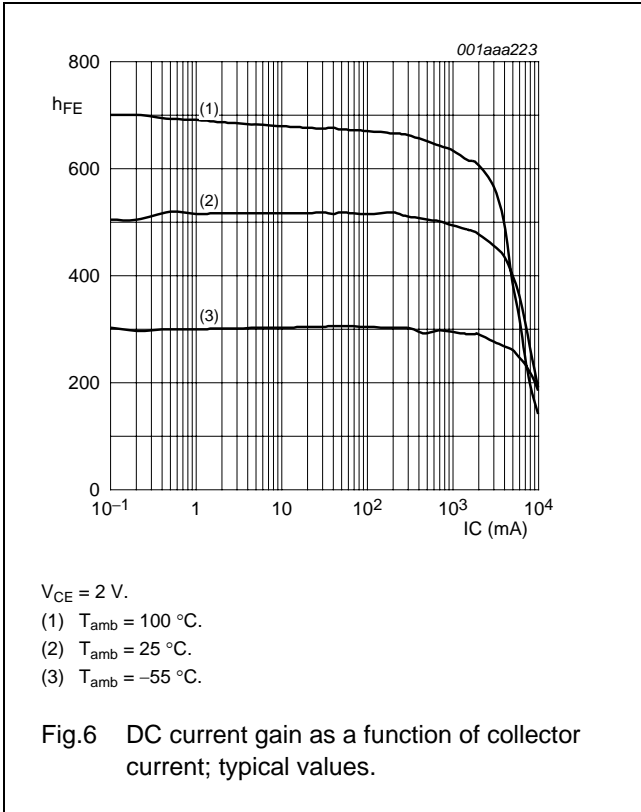
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 30\text{ V}; I_E = 0\text{ A}$	–	–	100	nA
		$V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ °C}$	–	–	50	$\mu\text{A}$
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = 30\text{ V}; V_{BE} = 0\text{ V}$	–	–	0.1	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	–	–	100	nA
$h_{FE}$	DC current gain	$V_{CE} = 2\text{ V}; I_C = 0.5\text{ A}$	300	–	–	
		$V_{CE} = 2\text{ V}; I_C = 1\text{ A};$ note 1	300	–	–	
		$V_{CE} = 2\text{ V}; I_C = 2\text{ A};$ note 1	250	–	–	
		$V_{CE} = 2\text{ V}; I_C = 5\text{ A};$ note 1	100	–	–	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 0.5\text{ A}; I_B = 5\text{ mA}$	–	–	90	mV
		$I_C = 1\text{ A}; I_B = 10\text{ mA}$	–	–	120	mV
		$I_C = 2\text{ A}; I_B = 200\text{ mA};$ note 1	–	–	150	mV
		$I_C = 4\text{ A}; I_B = 200\text{ mA};$ note 1	–	–	290	mV
		$I_C = 5\text{ A}; I_B = 500\text{ mA};$ note 1	–	–	355	mV
$R_{CEsat}$	equivalent on-resistance	$I_C = 5\text{ A}; I_B = 500\text{ mA};$ note 1	–	40	71	$\text{m}\Omega$
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 4\text{ A}; I_B = 200\text{ mA};$ note 1	–	–	1.1	V
		$I_C = 5\text{ A}; I_B = 500\text{ mA};$ note 1	–	–	1.2	V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = 2\text{ V}; I_C = 2\text{ A}$	–	–	1.1	V
$f_T$	transition frequency	$V_{CE} = 10\text{ V}; I_C = 0.1\text{ A};$ $f = 100\text{ MHz}$	70	–	–	MHz
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = I_C = 0\text{ A};$ $f = 1\text{ MHz}$	–	–	75	pF

**Note**

1. Pulse test:  $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$ .

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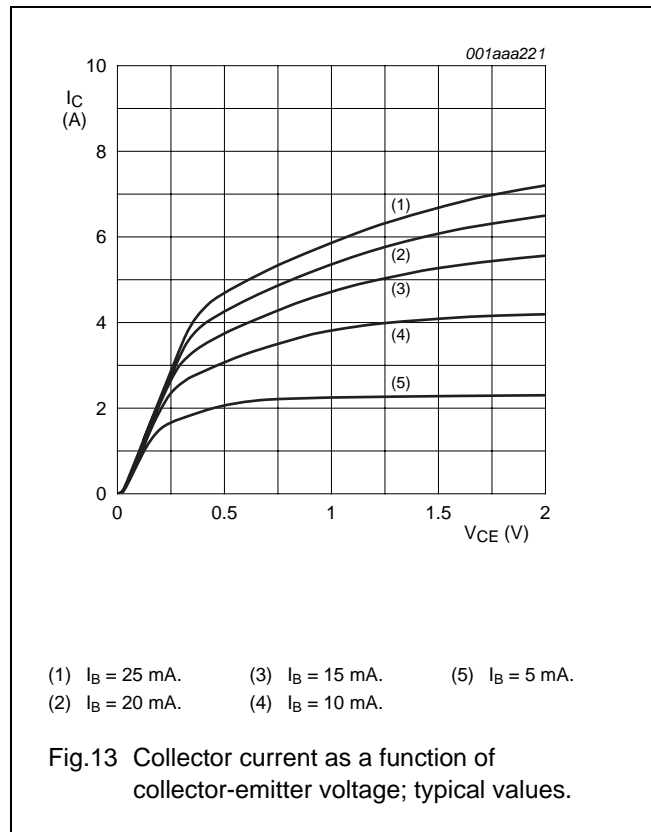
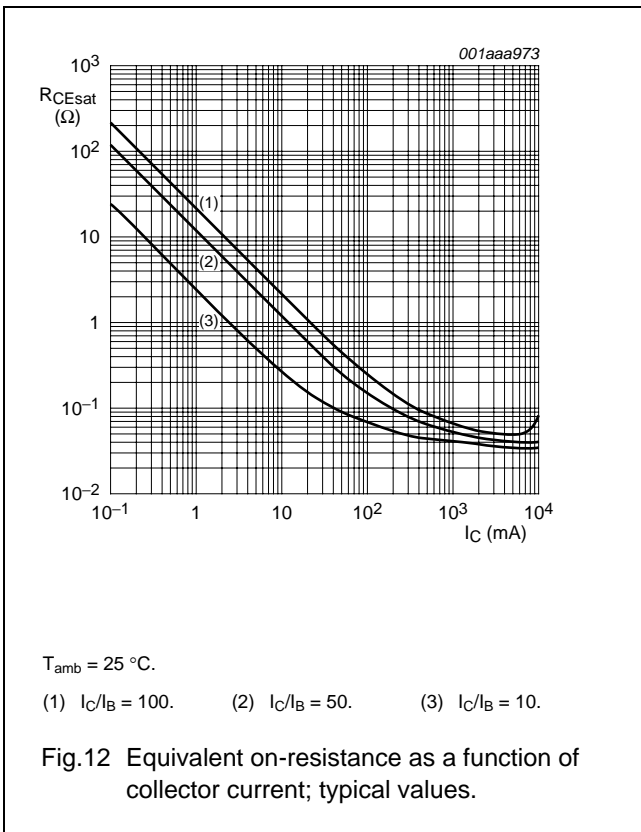
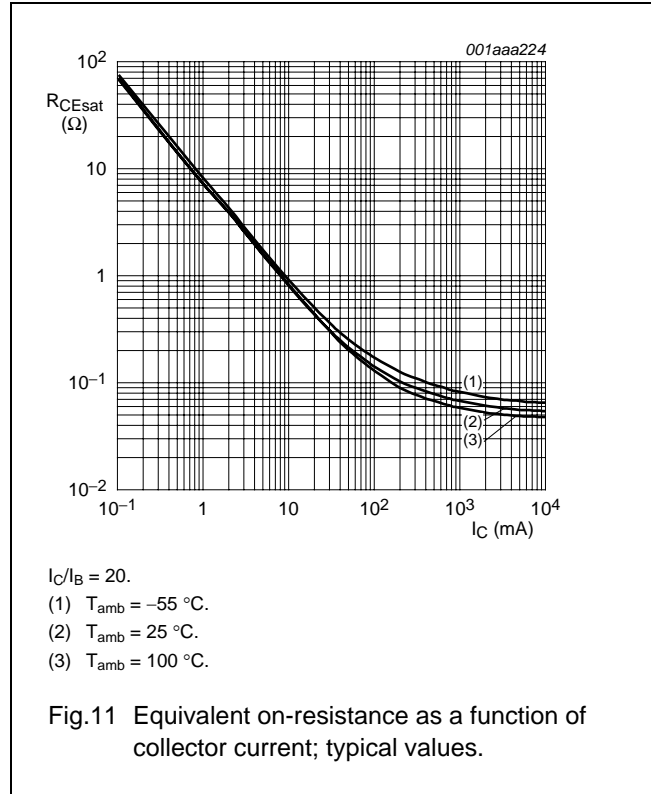
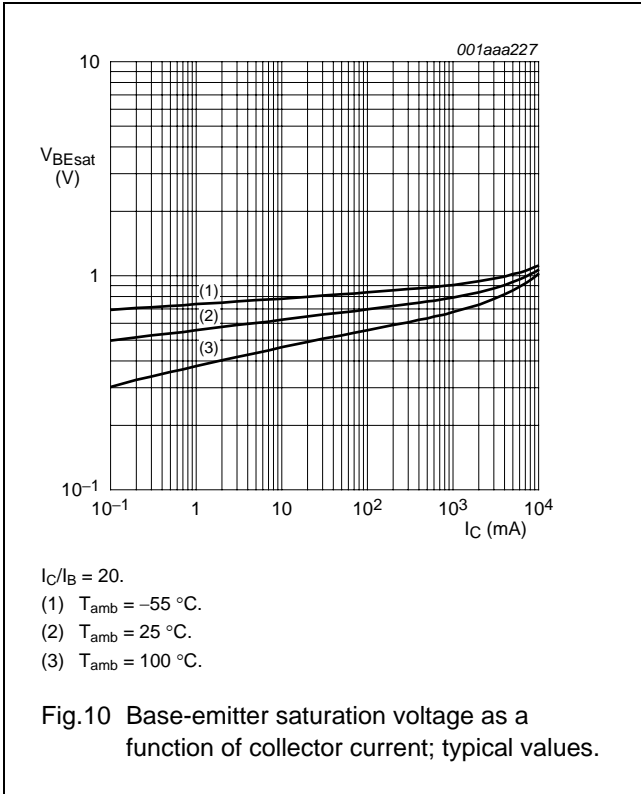
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Reference mounting conditions

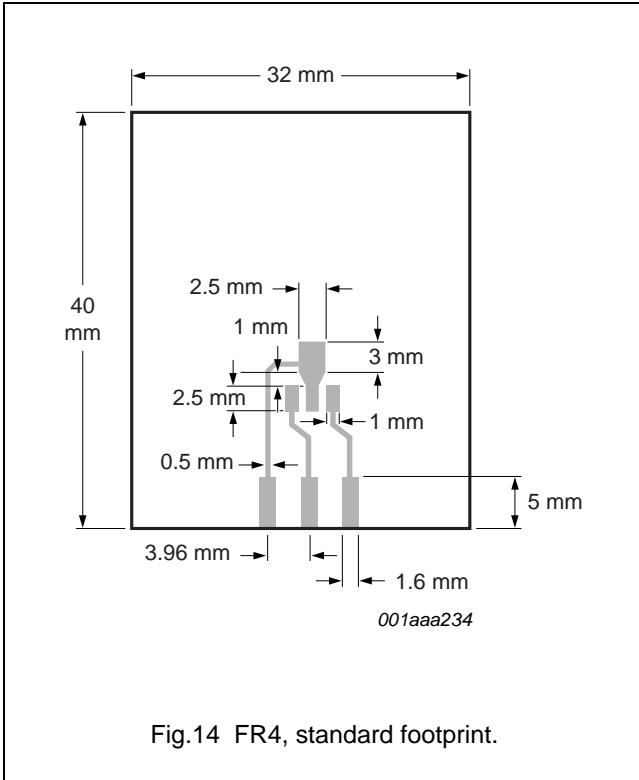


Fig.14 FR4, standard footprint.

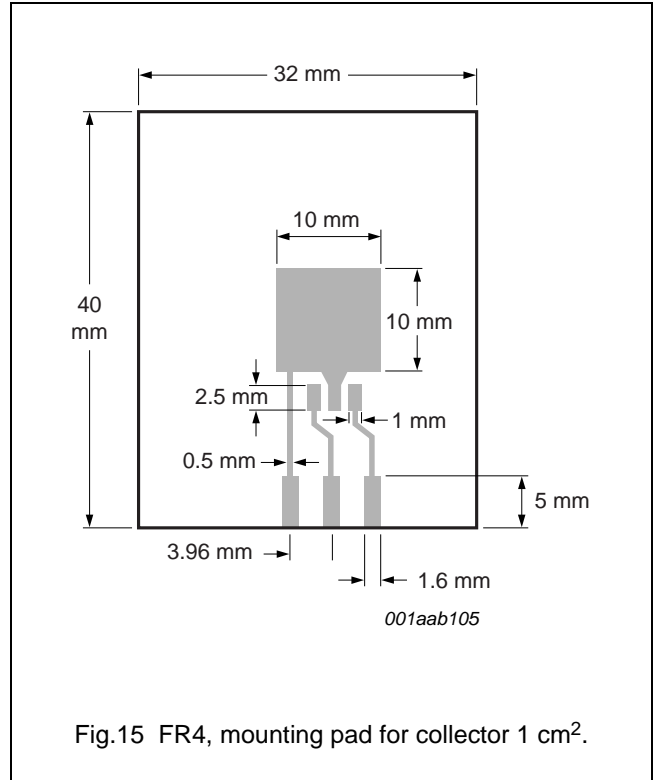


Fig.15 FR4, mounting pad for collector 1 cm<sup>2</sup>.

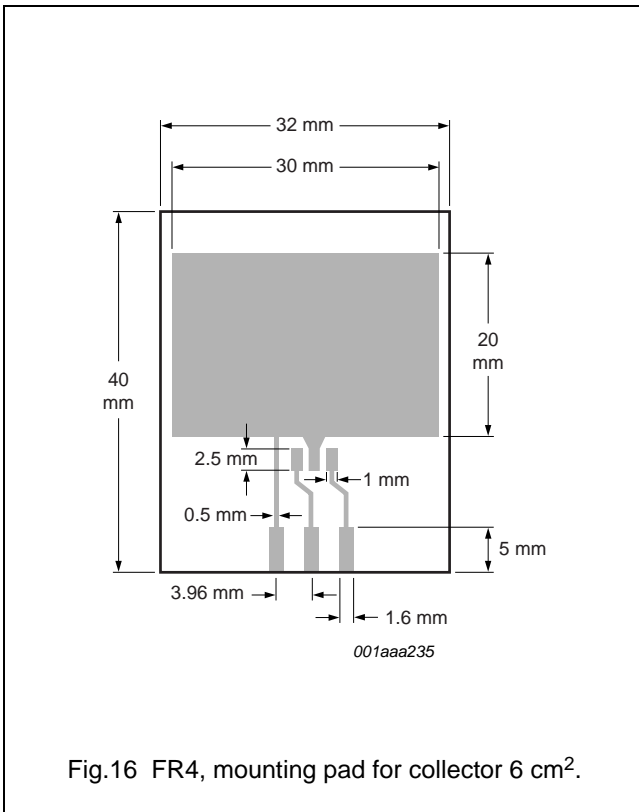


Fig.16 FR4, mounting pad for collector 6 cm<sup>2</sup>.

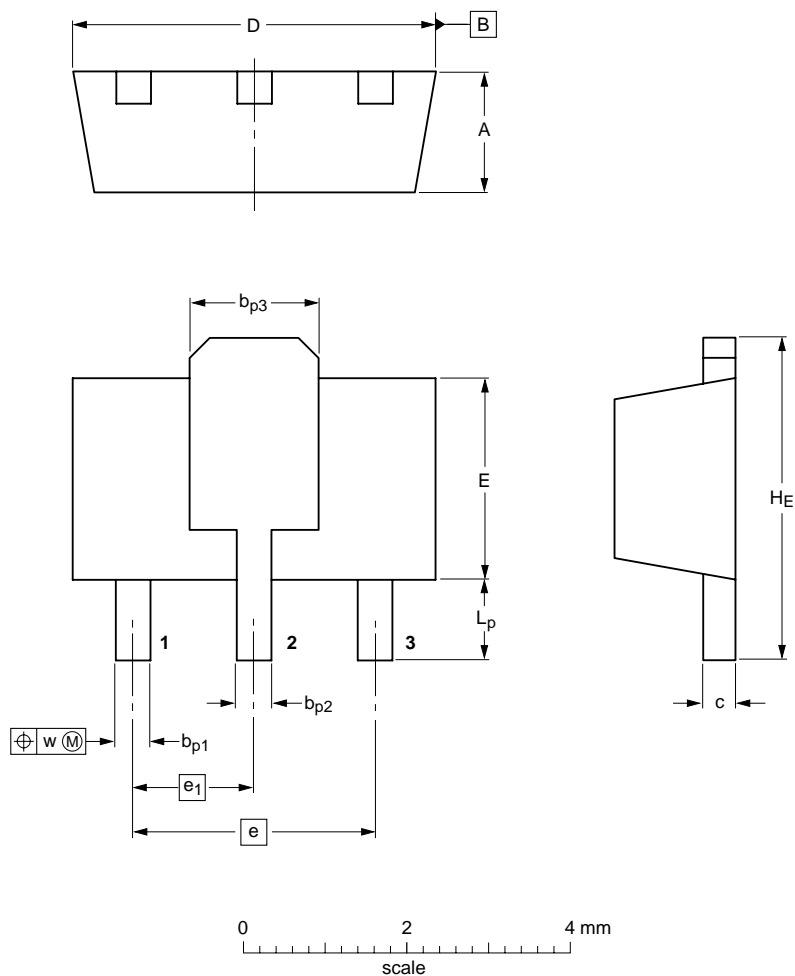
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PACKAGE OUTLINE

Plastic surface-mounted package; collector pad for good heat transfer; 3 leads

SOT89



DIMENSIONS (mm are the original dimensions)

UNIT	A	b <sub>p1</sub>	b <sub>p2</sub>	b <sub>p3</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L <sub>p</sub>	w
mm	1.6 1.4	0.48 0.35	0.53 0.40	1.8 1.4	0.44 0.23	4.6 4.4	2.6 2.4	3.0	1.5	4.25 3.75	1.2 0.8	0.13

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT89		TO-243	SC-62		04-08-03 06-03-16

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**DATA SHEET STATUS**

DOCUMENT STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)</sup>	DEFINITION
Objective data sheet	Development	This document contains data from the objective specification for product development.
Preliminary data sheet	Qualification	This document contains data from the preliminary specification.
Product data sheet	Production	This document contains the product specification.

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## **Contact information**

For additional information please visit: <http://www.nxp.com>

For sales offices addresses send e-mail to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

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