

DATA SHEET

2N7002

**N-channel vertical D-MOS
transistor**

Product specification
File under Discrete Semiconductors, SC13b

April 1995

N-channel vertical D-MOS transistor

2N7002

FEATURES

- Direct interface to C-MOS, TTL, etc.
- High-speed switching
- No secondary breakdown.

DESCRIPTION

N-channel enhancement mode vertical D-MOS transistor in a SOT23 envelope. It is designed for use as a Surface Mounted Device (SMD) in thin and thick-film circuits, with applications in relay, high-speed and line transformer drivers.

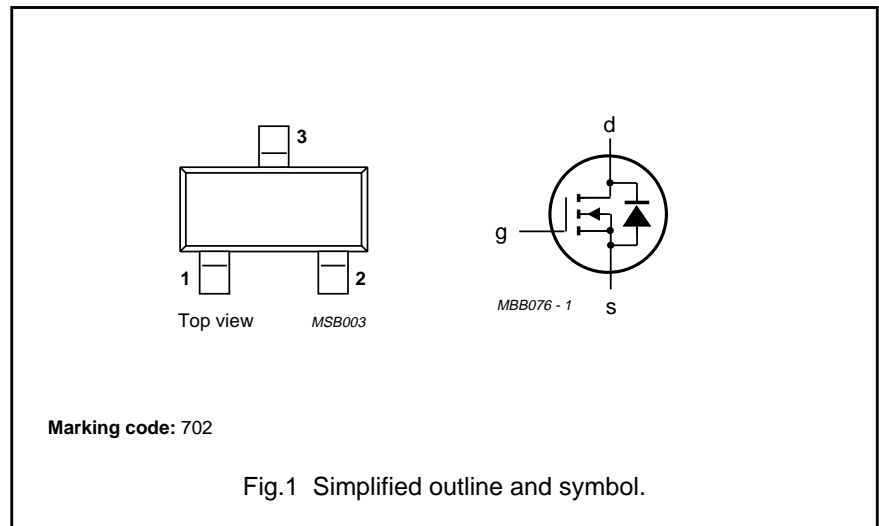
PINNING - SOT23

PIN	DESCRIPTION
1	gate
2	source
3	drain

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{DS}	drain-source voltage		60	V
I_D	drain current	DC value	180	mA
$R_{DS(on)}$	drain-source on-resistance	$I_D = 500\text{ mA}$ $V_{GS} = 10\text{ V}$	5	Ω
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}$ $V_{GS} = V_{DS}$	3	V

PIN CONFIGURATION



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LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	60	V
$\pm V_{GSO}$	gate-source voltage	open drain	–	40	V
I_D	drain current	DC value	–	180	mA
I_{DM}	drain current	peak value	–	800	mA
P_{tot}	total power dissipation	$T_{amb} = 25\text{ °C}$ (note 1) (note 2)	– –	300 250	mW mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

Notes

1. Mounted on a ceramic substrate measuring $10 \times 8 \times 0.7$ mm.
2. Mounted on a printed circuit board.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-a}$	from junction to ambient	note 1 note 2	430 500	K/W K/W

Notes

1. Mounted on a ceramic substrate measuring $10 \times 8 \times 0.7$ mm.
2. Mounted on a printed circuit board.

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CHARACTERISTICS $T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 10\ \mu\text{A}$ $V_{GS} = 0$	60	90	–	V
I_{DSS}	drain-source leakage current	$V_{DS} = 48\ \text{V}$ $V_{GS} = 0$	–	–	1	μA
$\pm I_{GSS}$	gate-source leakage current	$V_{DS} = 0$ $\pm V_{GS} = 15\ \text{V}$	–	–	10	nA
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ \text{mA}$ $V_{GS} = V_{DS}$	0.8	–	3	V
$R_{DS(on)}$	drain-source on-resistance	$I_D = 500\ \text{mA}$ $V_{GS} = 10\ \text{V}$	–	3.5	5	Ω
		$I_D = 75\ \text{mA}$ $V_{GS} = 4.5\ \text{V}$	–	–	5.3	Ω
$ Y_{fs} $	transfer admittance	$I_D = 200\ \text{mA}$ $V_{DS} = 10\ \text{V}$	100	200	–	mS
C_{iss}	input capacitance	$V_{DS} = 10\ \text{V}$ $V_{GS} = 0$ $f = 1\ \text{MHz}$	–	25	40	pF
C_{oss}	output capacitance	$V_{DS} = 10\ \text{V}$ $V_{GS} = 0$ $f = 1\ \text{MHz}$	–	22	30	pF
C_{rss}	feedback capacitance	$V_{DS} = 10\ \text{V}$ $V_{GS} = 0$ $f = 1\ \text{MHz}$	–	6	10	pF
Switching times (see Figs 2 and 3)						
t_{on}	turn-on time	$I_D = 200\ \text{mA}$ $V_{DD} = 50\ \text{V}$ $V_{GS} = 0\ \text{to}\ 10\ \text{V}$	–	–	10	ns
t_{off}	turn-off time	$I_D = 200\ \text{mA}$ $V_{DD} = 50\ \text{V}$ $V_{GS} = 0\ \text{to}\ 10\ \text{V}$	–	–	15	ns

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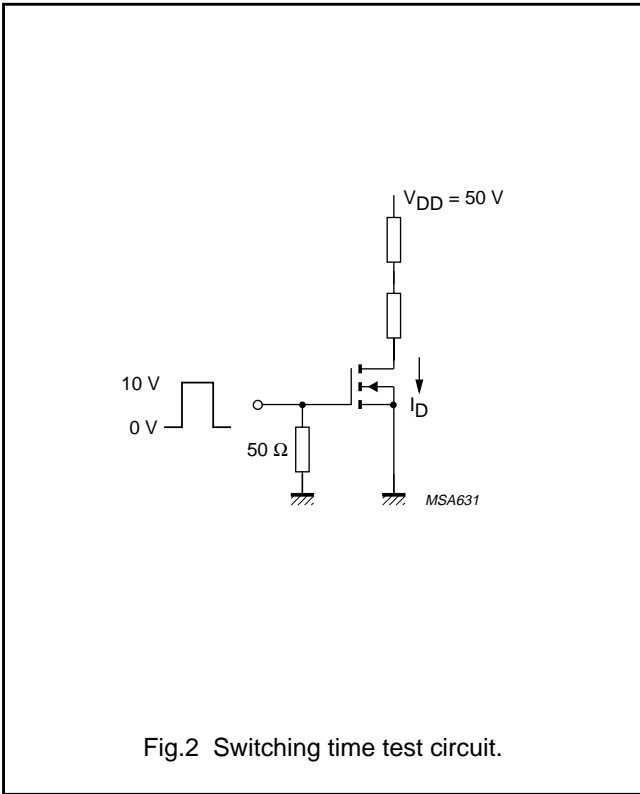


Fig.2 Switching time test circuit.

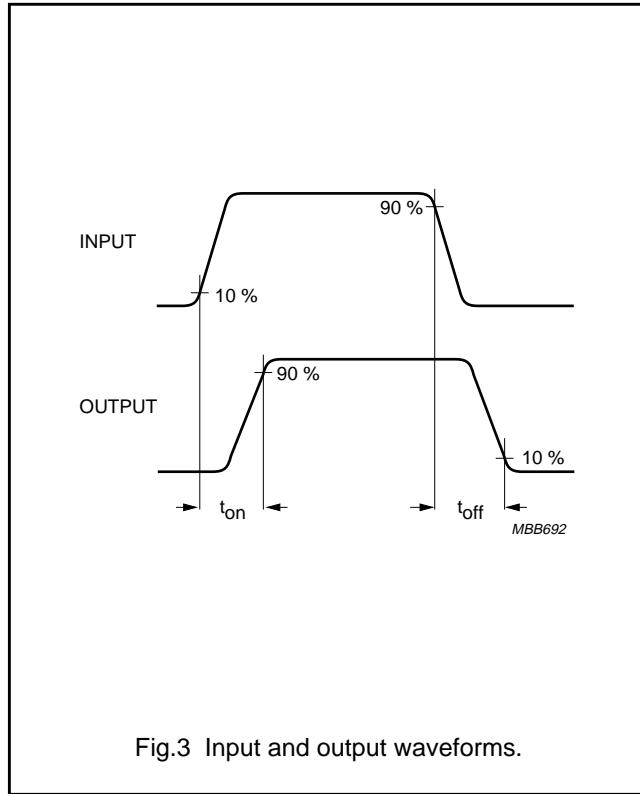
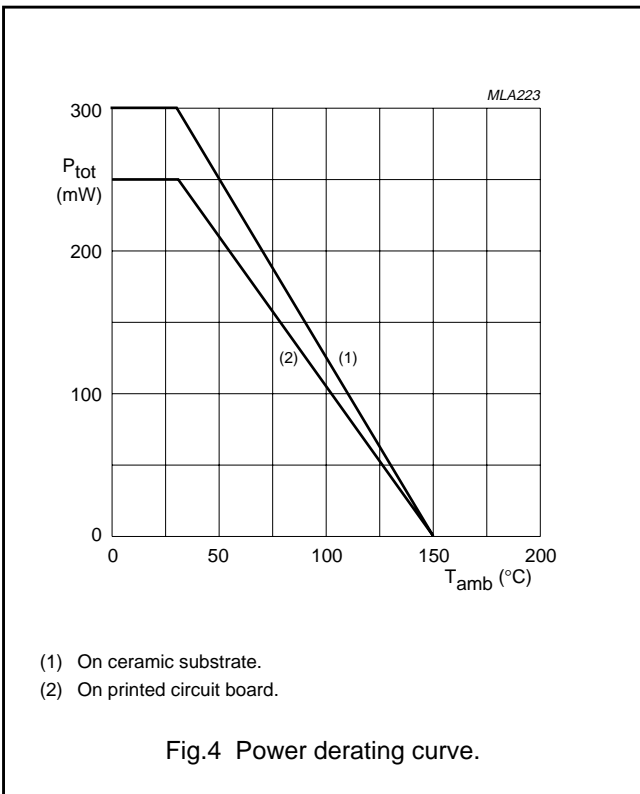


Fig.3 Input and output waveforms.



- (1) On ceramic substrate.
- (2) On printed circuit board.

Fig.4 Power derating curve.

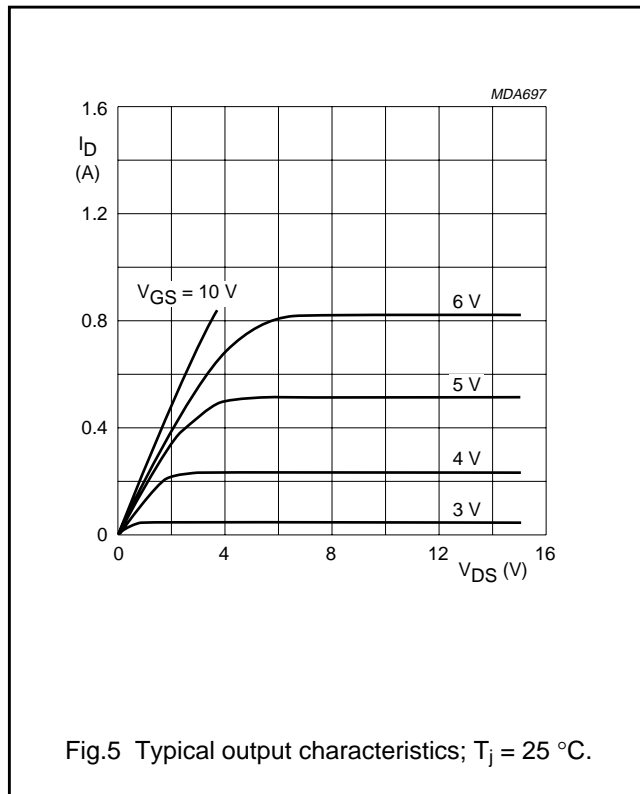
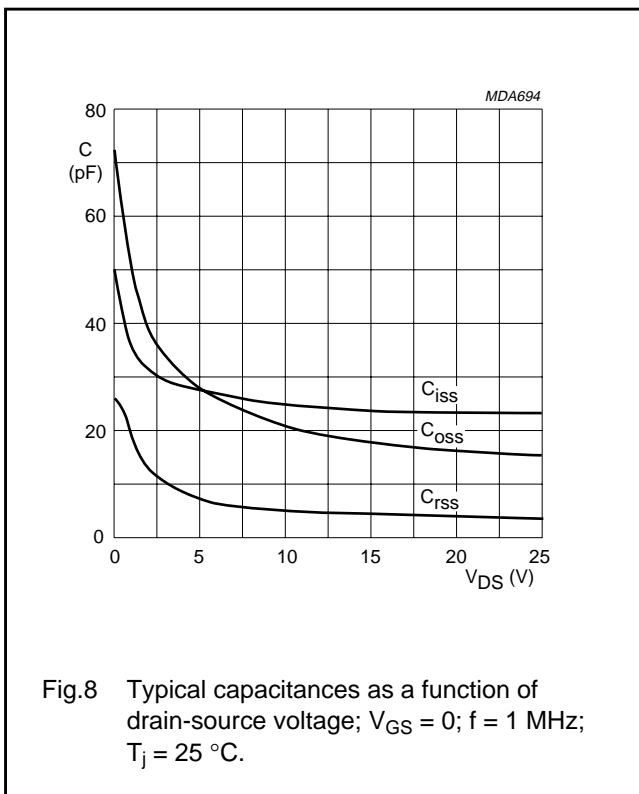
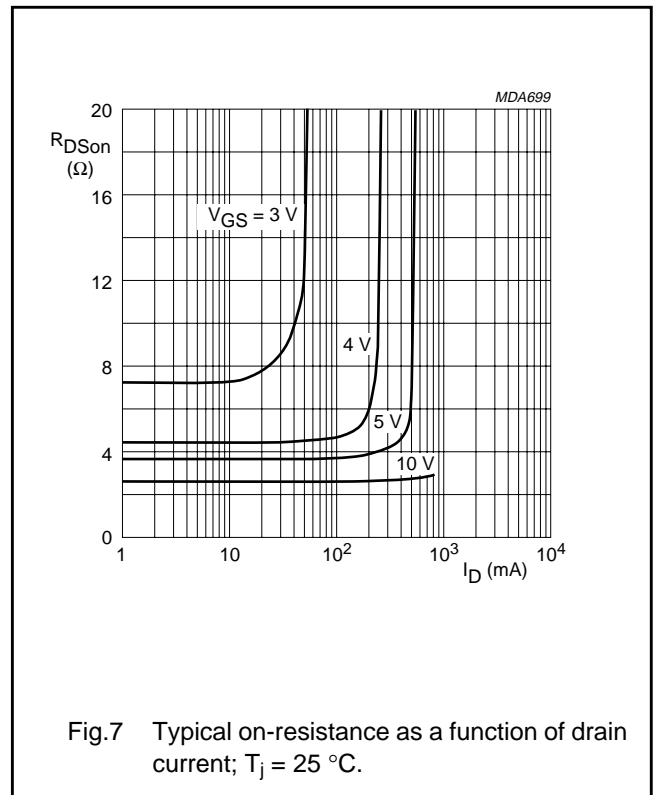
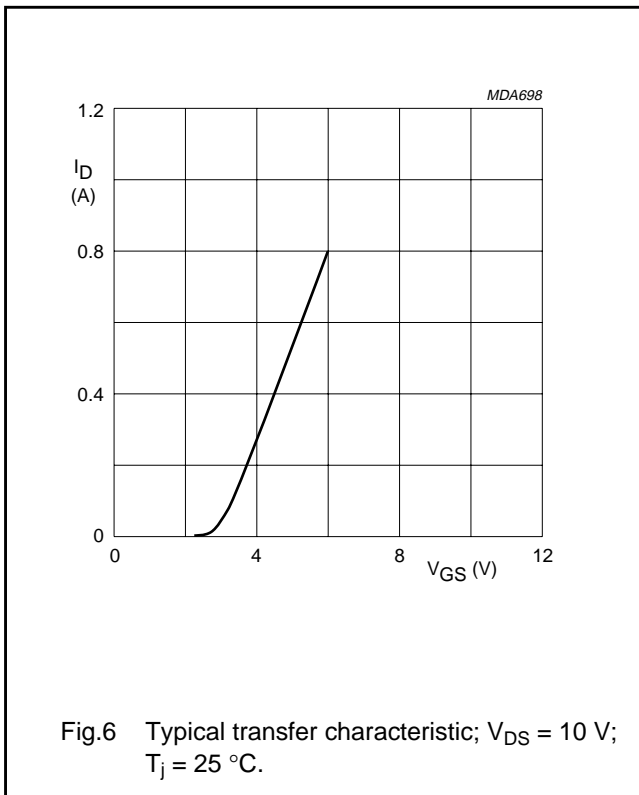


Fig.5 Typical output characteristics; T_j = 25 °C.

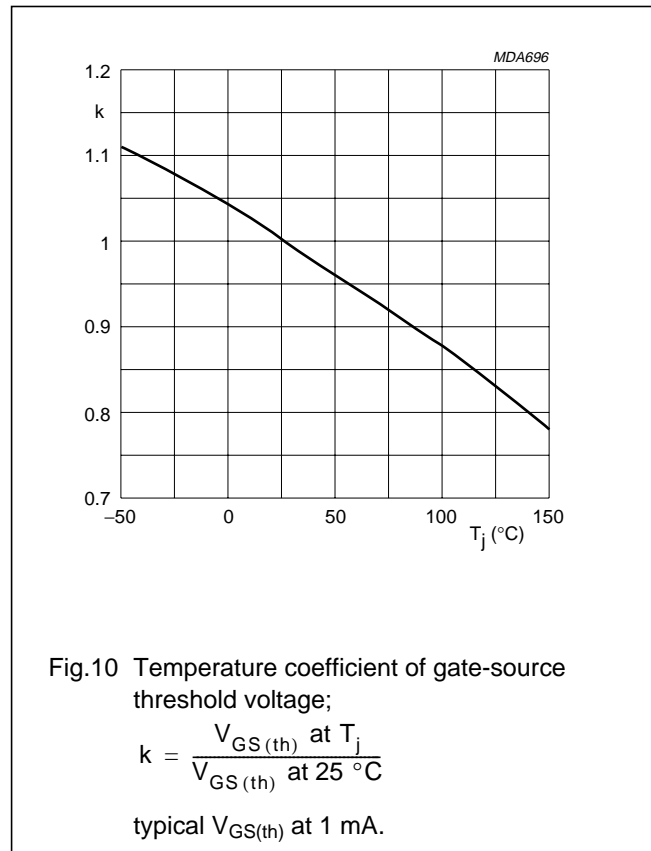
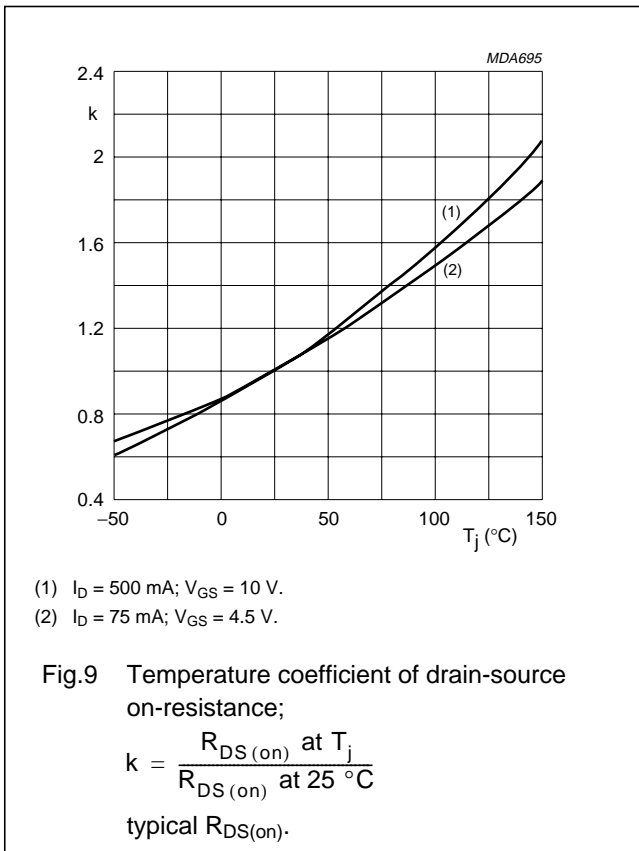
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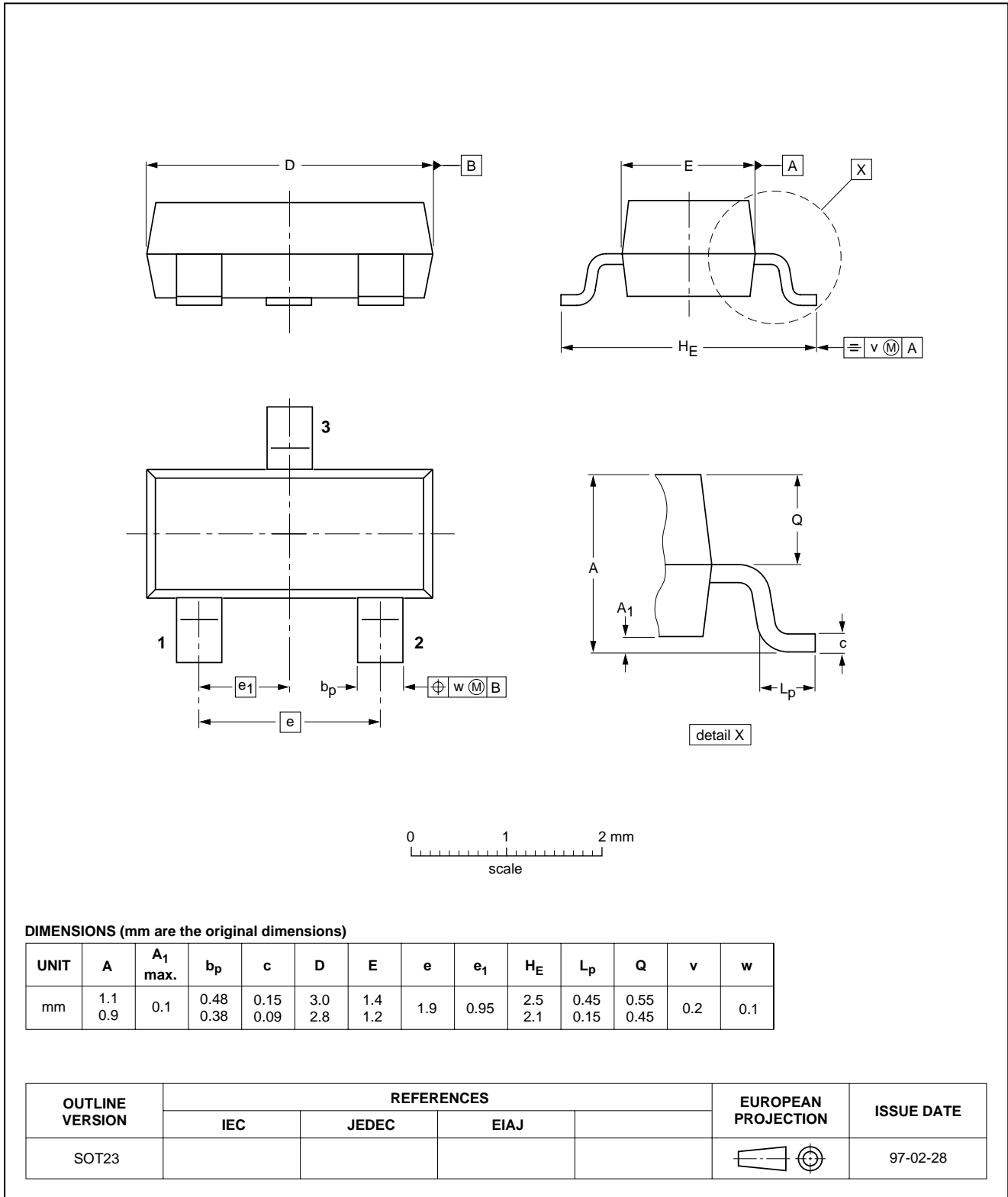
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PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT23



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DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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NOTES

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