

DATA SHEET

2N7000

N-channel enhancement mode
vertical D-MOS transistor

Product specification
File under Discrete Semiconductors, SC13b

April 1995

N-channel enhancement mode vertical
D-MOS transistor

2N7000

FEATURES

- Low $R_{DS(on)}$
- Direct interface to C-MOS, TTL, etc.
- High-speed switching
- No secondary breakdown.

DESCRIPTION

N-channel enhancement mode vertical D-MOS transistor in a TO-92 variant envelope, intended for use in relay, high-speed and line transformer drivers.

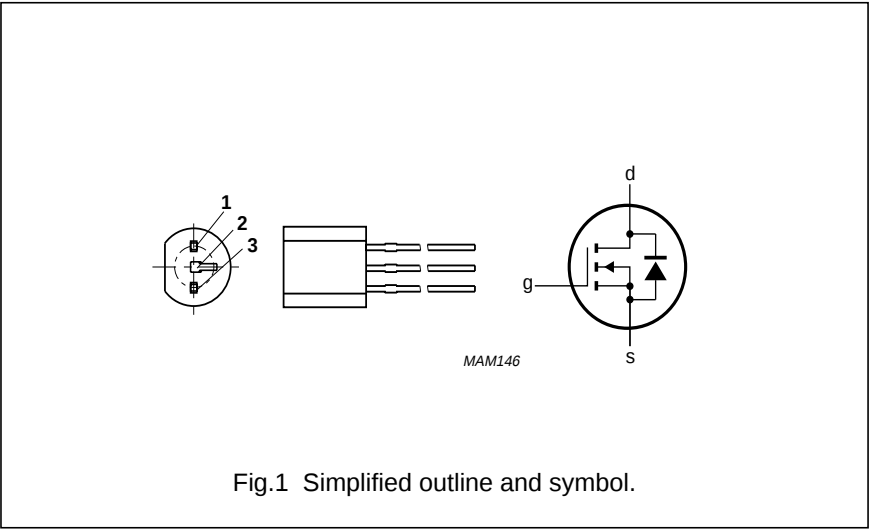
PINNING - TO-92 VARIANT

PIN	DESCRIPTION
1	drain
2	gate
3	source

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{DS}	drain-source voltage		60	V
I_D	drain current	DC value	280	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
V_{DG}	drain-gate voltage		–	60	V
$\pm V_{GSO}$	gate-source voltage	open drain	–	40	V
I_D	drain current	DC value	–	280	mA
I_{DM}	drain current	peak value	–	1.3	A
P_{tot}	total power dissipation	$T_{amb} = 25\text{ °C}$	–	830	mW
T_{stg}	storage temperature range		–55	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-a}$	from junction to ambient	150	K/W

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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	$I_D = 10\text{ }\mu\text{A}$ $V_{GS} = 0$	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	$\pm V_{GS} = 15\text{ V}$ $V_{DS} = 0$	–	–	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	$I_D = 200\text{ mA}$ $V_{DD} = 50\text{ V}$ $V_{GS} = 0\text{ to }10\text{ V}$	–	4	10	ns
t_{off}	turn-off time	$I_D = 200\text{ mA}$ $V_{DD} = 50\text{ V}$ $V_{GS} = 0\text{ to }10\text{ V}$	–	4	10	ns

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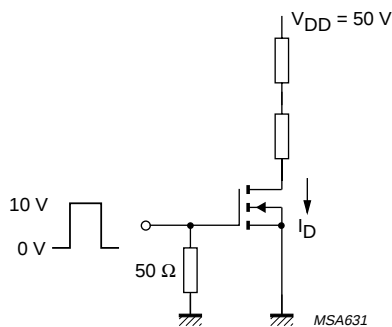


Fig.2 Switching time test circuit.

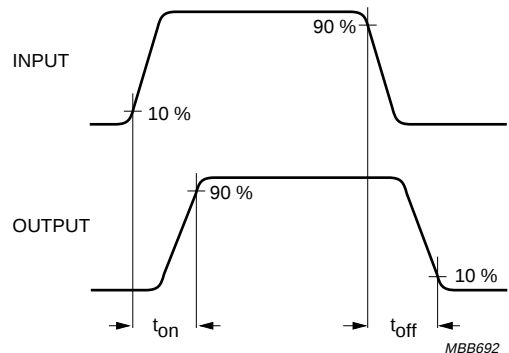


Fig.3 Input and output waveforms.

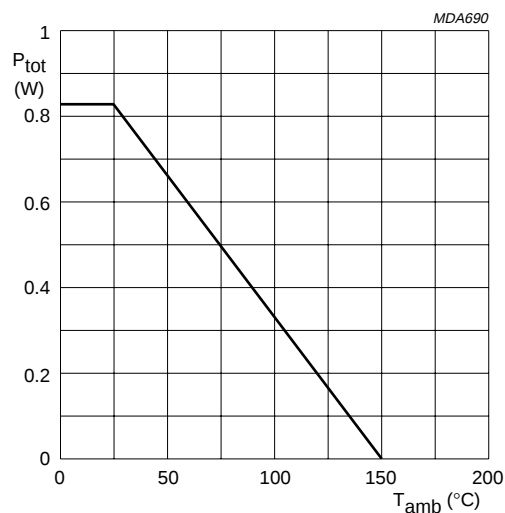


Fig.4 Power derating curve.

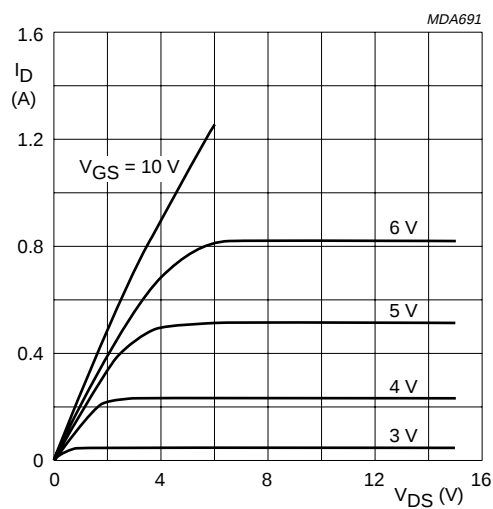


Fig.5 Typical output characteristics; $T_j = 25$ °C.

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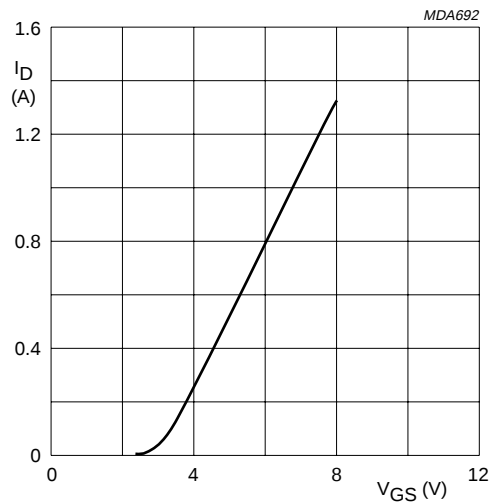


Fig.6 Typical transfer characteristic; $V_{DS} = 10$ V;
 $T_j = 25$ °C.

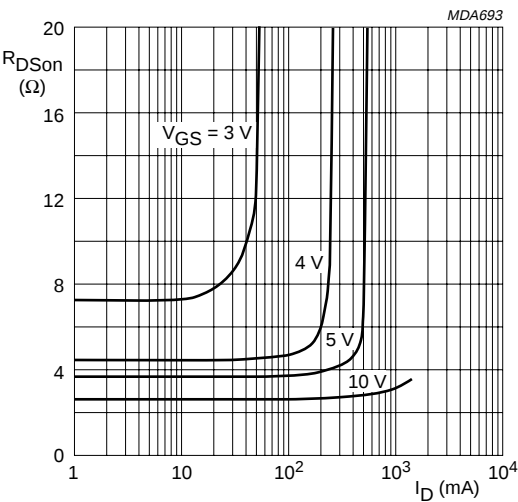


Fig.7 Typical on-resistance as a function of
drain current; $T_j = 25$ °C.

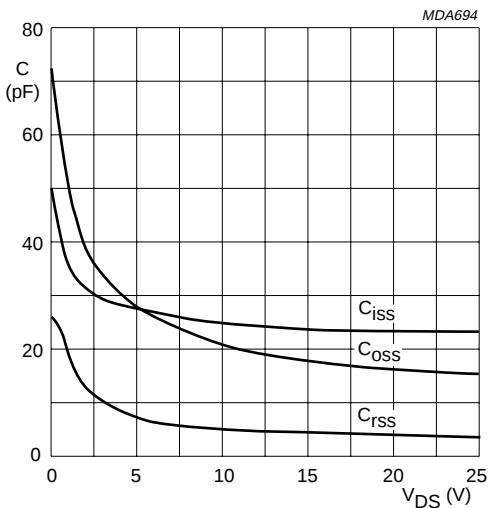
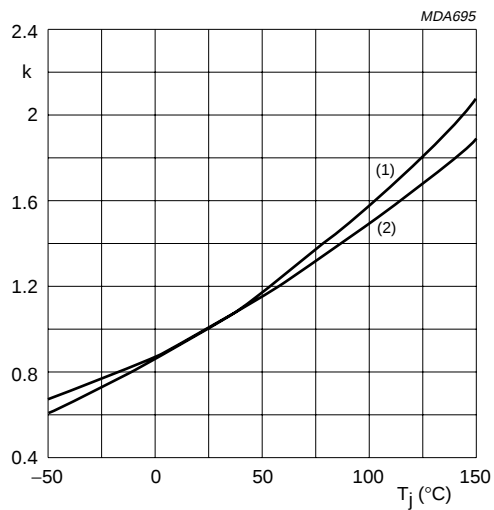


Fig.8 Typical capacitances as a function of
drain-source voltage; $V_{GS} = 0$;
 $f = 1$ MHz; $T_j = 25$ °C.

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- (1) $I_D = 500 \text{ mA}$; $V_{GS} = 10 \text{ V}$.
(2) $I_D = 75 \text{ mA}$; $V_{GS} = 4.5 \text{ V}$.

Fig.9 Temperature coefficient of drain-source on resistance;

$$k = \frac{R_{DS(on)} \text{ at } T_j}{R_{DS(on)} \text{ at } 25^\circ\text{C}} ; \text{ typical } R_{DS(on)}.$$

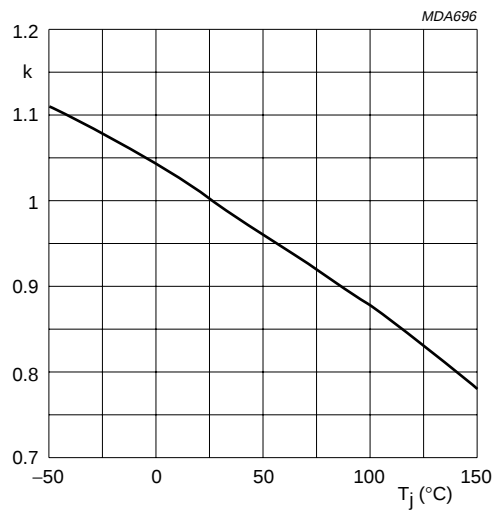


Fig.10 Temperature coefficient of gate-source threshold voltage;

$$k = \frac{V_{GS(th)} \text{ at } T_j}{V_{GS(th)} \text{ at } 25^\circ\text{C}} ; \text{ typical } V_{GS(th)} \text{ at } 1 \text{ mA}.$$

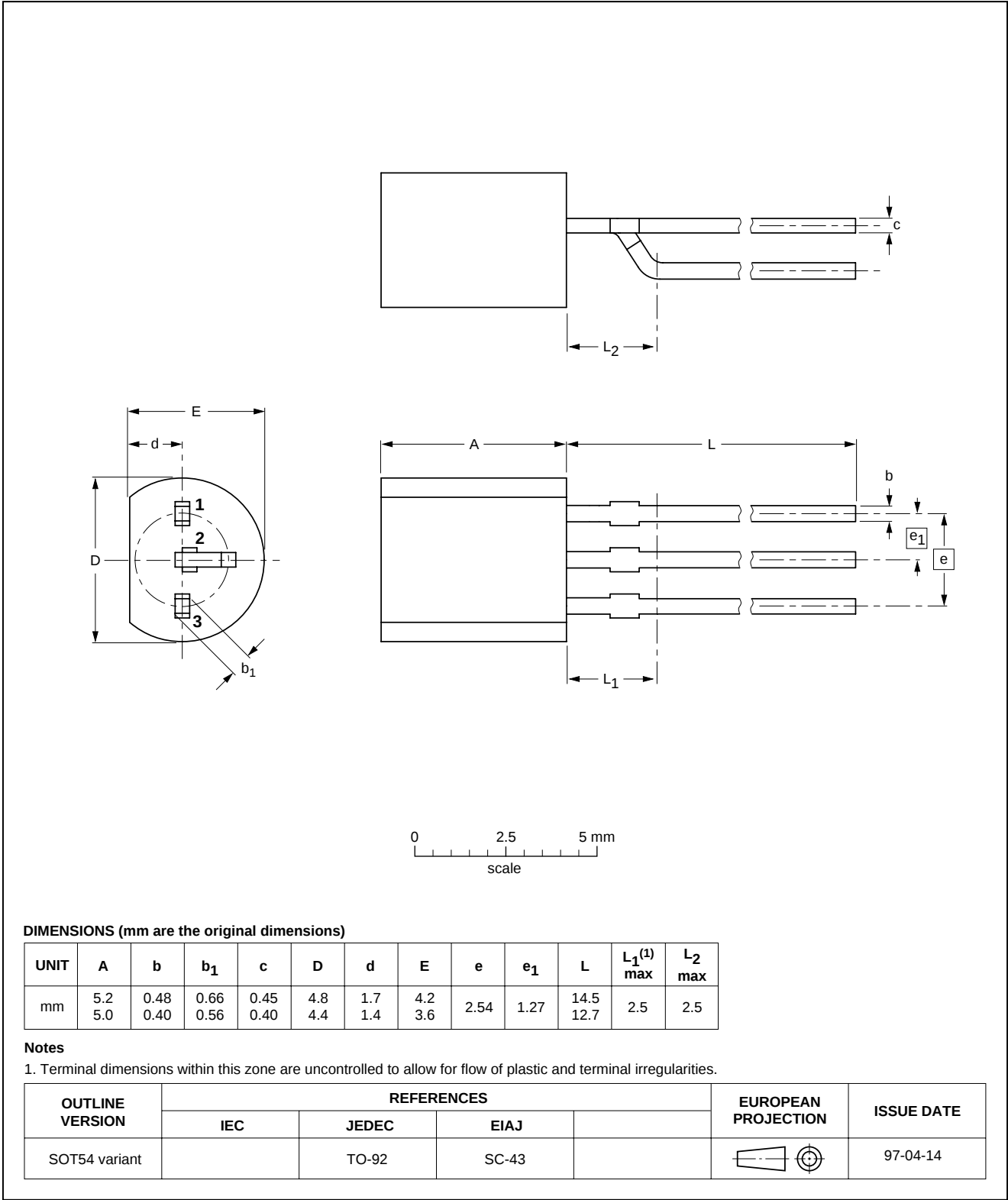
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PACKAGE OUTLINE

Plastic single-ended leaded (through hole) package; 3 leads (on-circle)

SOT54 variant



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2N7000**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.
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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