

# DATA SHEET

## **PHN110**

N-channel enhancement mode  
MOS transistor

Product specification  
Supersedes data of 1996 Jul 16  
File under Discrete Semiconductors, SC13b

1997 Jun 17

# N-channel enhancement mode MOS transistor

PHN110

## FEATURES

- High-speed switching
- No secondary breakdown
- Very low on-resistance.

## APPLICATIONS

- Motor and actuator driver
- Power management
- Synchronized rectification.

## PINNING - SOT96-1 (SO8)

PIN	SYMBOL	DESCRIPTION
1	n.c	not connected
2	s	source
3	s	source
4	g	gate
5	d	drain
6	d	drain
7	d	drain
8	d	drain

## DESCRIPTION

N-channel enhancement mode MOS transistor in an 8-pin plastic SOT96-1 (SO8) package.

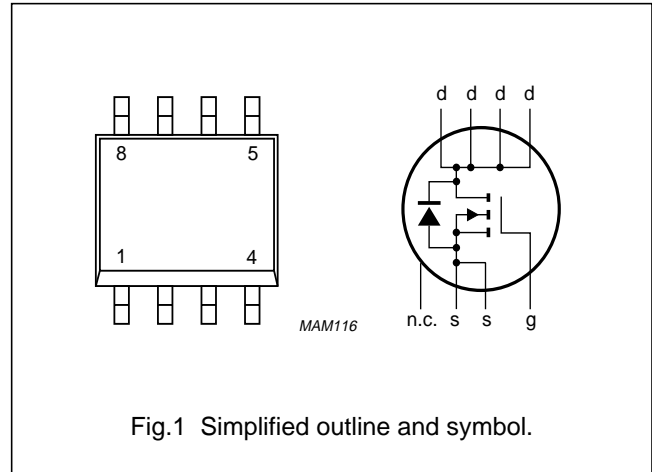


Fig.1 Simplified outline and symbol.

## CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static discharge during transport or handling.

## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{DS}$	drain-source voltage (DC)		–	30	V
$V_{SD}$	source-drain diode forward voltage	$I_S = 1.25 \text{ A}$	–	1.2	V
$V_{GS}$	gate-source voltage (DC)		–	$\pm 20$	V
$V_{GSth}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$	1	2.8	V
$I_D$	drain current (DC)	$T_s = 80 \text{ }^\circ\text{C}$	–	4	A
$R_{DSon}$	drain-source on-state resistance	$I_D = 2.2 \text{ A}; V_{GS} = 10 \text{ V}$	–	0.1	$\Omega$
$P_{tot}$	total power dissipation	$T_s = 80 \text{ }^\circ\text{C}$	–	2.8	W

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PHN110

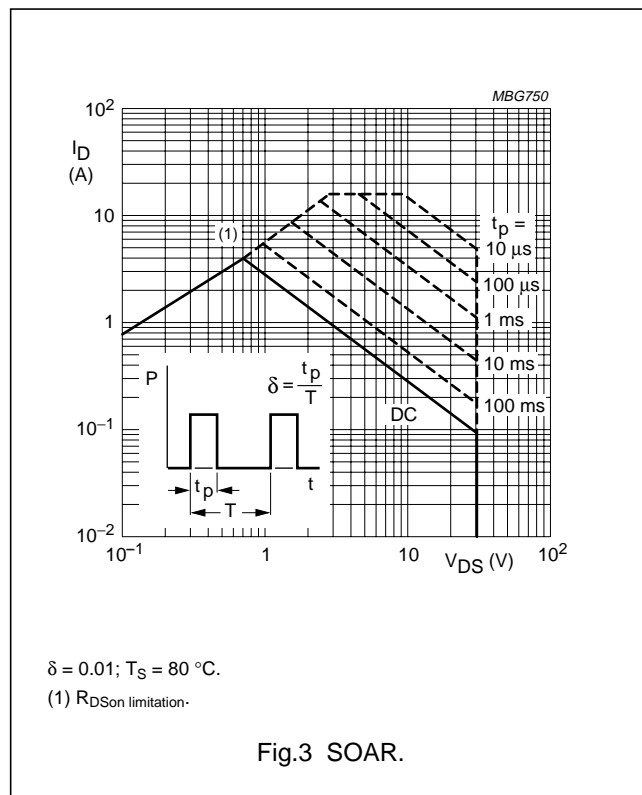
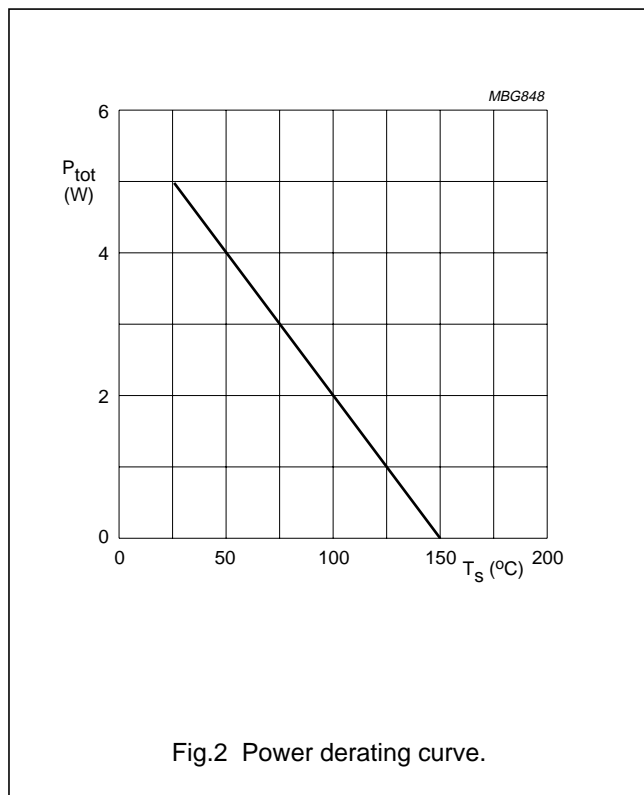
## LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{DS}$	drain-source voltage (DC)		–	30	V
$V_{GS}$	gate-source voltage (DC)		–	±20	V
$I_D$	drain current (DC)	$T_s = 80\text{ °C}$ ; note 1	–	4	A
$I_{DM}$	peak drain current	note 2	–	16	A
$P_{tot}$	total power dissipation	$T_s = 80\text{ °C}$	–	2.8	W
		$T_{amb} = 25\text{ °C}$ ; note 3	–	2.4	W
		$T_{amb} = 25\text{ °C}$ ; note 4	–	1.1	W
$T_{stg}$	storage temperature		–65	+150	°C
$T_j$	operating junction temperature		–65	+150	°C
<b>Source-drain diode</b>					
$I_S$	source current (DC)	$T_s = 80\text{ °C}$	–	3.5	A
$I_{SM}$	peak pulsed source current	note 2	–	14	A

### Notes

- $T_s$  is the temperature at the soldering point of the drain lead.
- Pulse width and duty cycle limited by maximum junction temperature.
- Value based on a printed-circuit board with a  $R_{th\ a-tp}$  (ambient to tie-point) of 27.5 K/W.
- Value based on a printed-circuit board with a  $R_{th\ a-tp}$  (ambient to tie-point) of 90 K/W.



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PHN110

**THERMAL CHARACTERISTICS**

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-s}$	thermal resistance from junction to soldering point	25	K/W

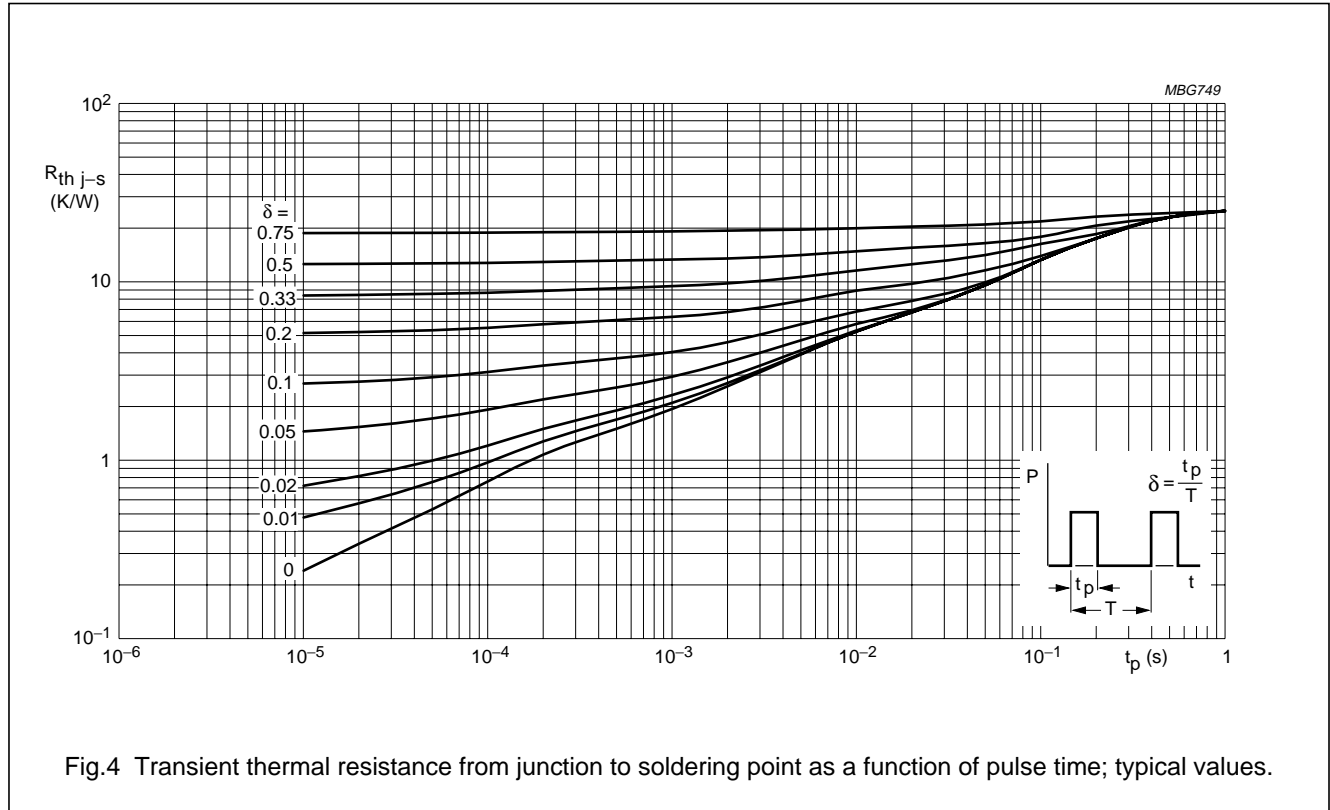


Fig.4 Transient thermal resistance from junction to soldering point as a function of pulse time; typical values.

# N-channel enhancement mode MOS transistor

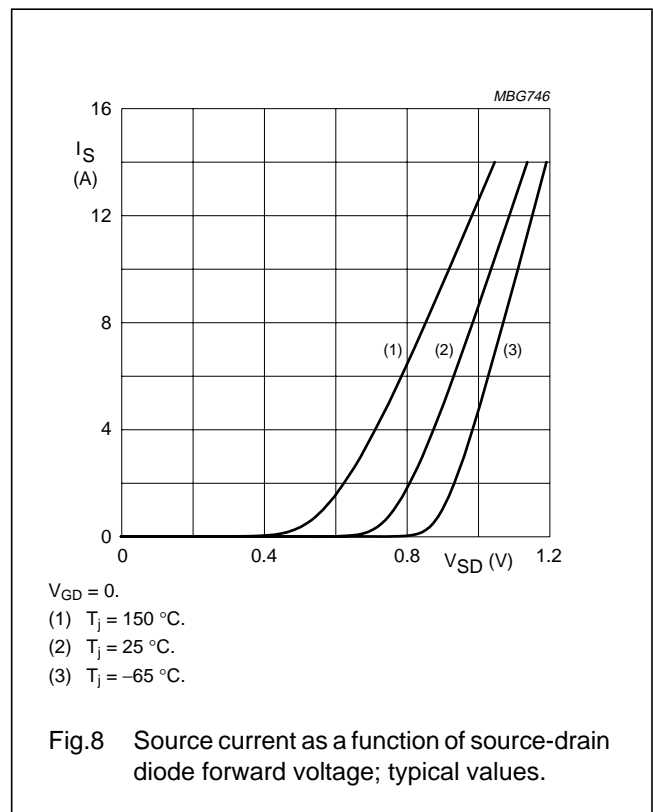
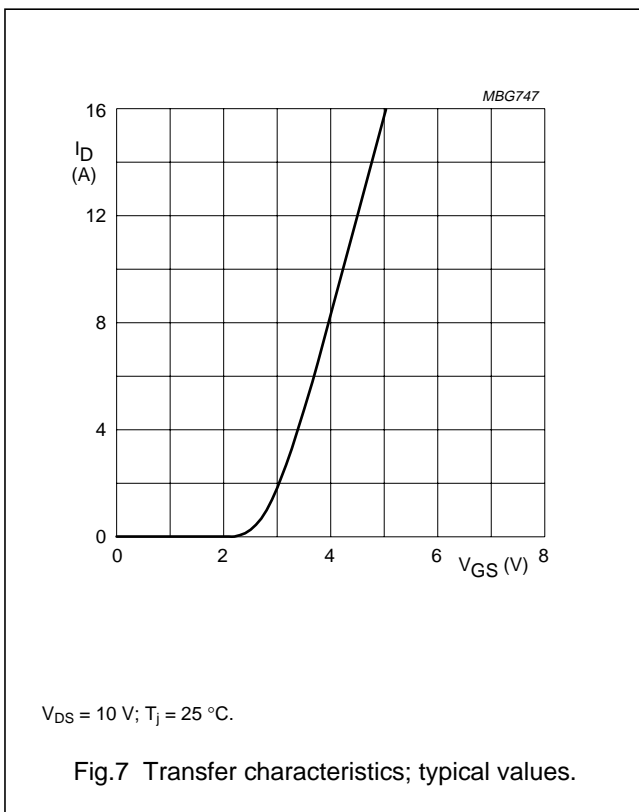
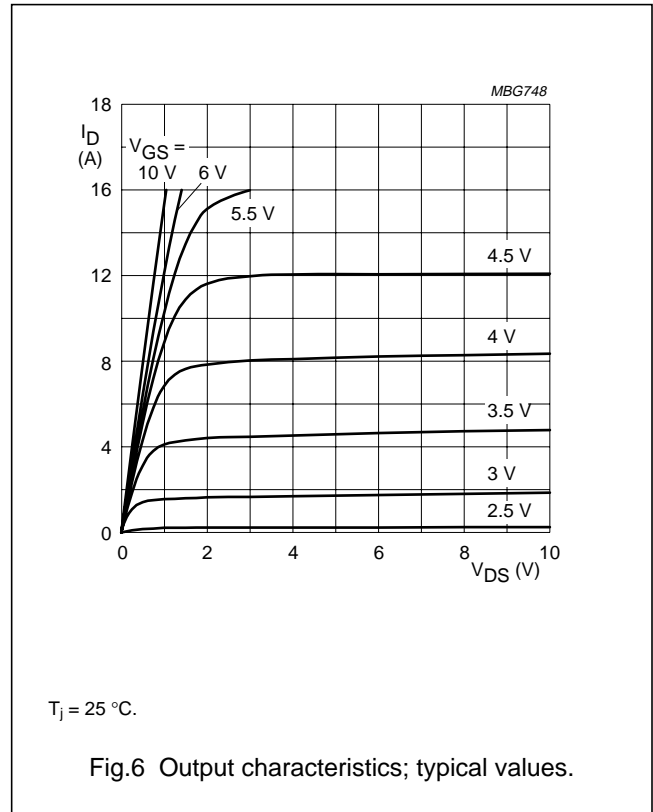
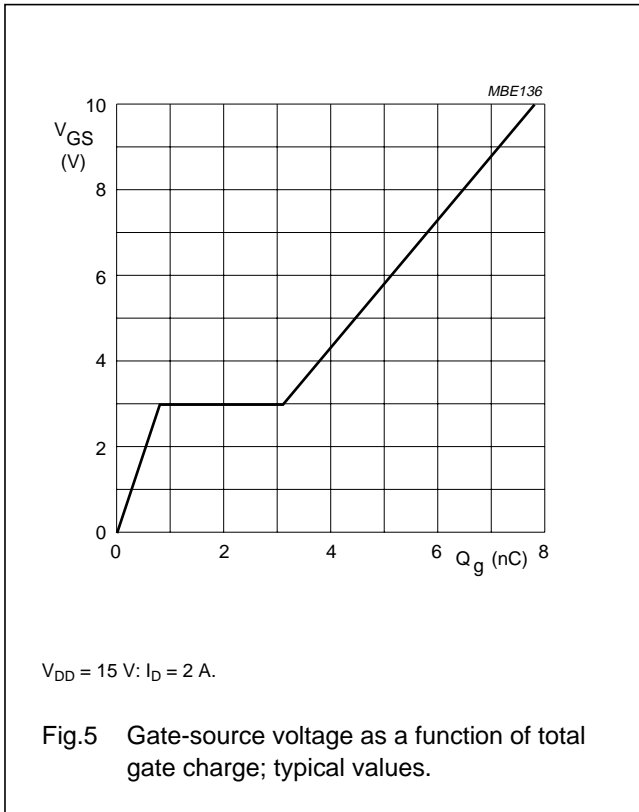
PHN110

**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	$V_{GS} = 0; I_D = 10\ \mu\text{A}$	30	–	–	V
$V_{GSth}$	gate-source threshold voltage	$V_{GS} = V_{DS}; I_D = 1\ \text{mA}$	1	–	2.8	V
$I_{DSS}$	drain-source leakage current	$V_{GS} = 0; V_{DS} = 24\ \text{V}$	–	–	100	nA
$I_{GSS}$	gate leakage current	$V_{GS} = \pm 20\ \text{V}; V_{DS} = 0$	–	–	$\pm 100$	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 4.5\ \text{V}; I_D = 1\ \text{A}$	–	0.11	0.2	$\Omega$
		$V_{GS} = 10\ \text{V}; I_D = 2\ \text{A}$	–	0.08	0.1	$\Omega$
$C_{iss}$	input capacitance	$V_{GS} = 0; V_{DS} = 24\ \text{V}; f = 1\ \text{MHz}$	–	250	–	pF
$C_{oss}$	output capacitance	$V_{GS} = 0; V_{DS} = 24\ \text{V}; f = 1\ \text{MHz}$	–	140	–	pF
$C_{rss}$	reverse transfer capacitance	$V_{GS} = 0; V_{DS} = 24\ \text{V}; f = 1\ \text{MHz}$	–	50	–	pF
$Q_g$	total gate charge	$V_{GS} = 10\ \text{V}; V_{DD} = 15\ \text{V}; I_D = 2\ \text{A}$	–	10	30	nC
$Q_{gs}$	gate-source charge	$V_{GS} = 10\ \text{V}; V_{DD} = 15\ \text{V}; I_D = 2\ \text{A}$	–	1	–	nC
$Q_{gd}$	gate-drain charge	$V_{GS} = 10\ \text{V}; V_{DD} = 15\ \text{V}; I_D = 2\ \text{A}$	–	2.5	–	nC
<b>Switching times</b> (see Fig.11)						
$t_{d(on)}$	turn-on delay time	$V_{GS} = 0\ \text{to}\ 10\ \text{V}; V_{DD} = 15\ \text{V};$ $I_D = 1\ \text{A}; R_L = 15\ \Omega; R_{gen} = 6\ \Omega$	–	4.5	–	ns
$t_f$	fall time		–	3.5	–	ns
$t_{on}$	turn-on switching time		–	8	16	ns
$t_{d(off)}$	turn-off delay time	$V_{GS} = 10\ \text{to}\ 0\ \text{V}; V_{DD} = 15\ \text{V};$ $I_D = 1\ \text{A}; R_L = 15\ \Omega; R_{gen} = 6\ \Omega$	–	15	–	ns
$t_r$	rise time		–	10	–	ns
$t_{off}$	turn-off switching time		–	25	50	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain diode forward voltage	$V_{GD} = 0; I_S = 1.25\ \text{A}$	–	–	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 1.25\ \text{A}; di/dt = -100\ \text{A}/\mu\text{s}$	–	35	100	ns

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PHN110



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PHN110

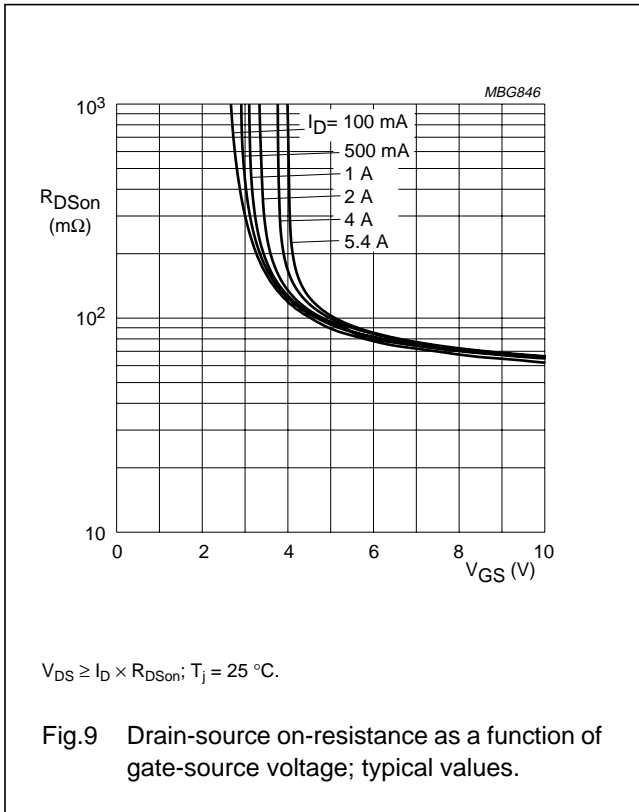


Fig.9 Drain-source on-resistance as a function of gate-source voltage; typical values.

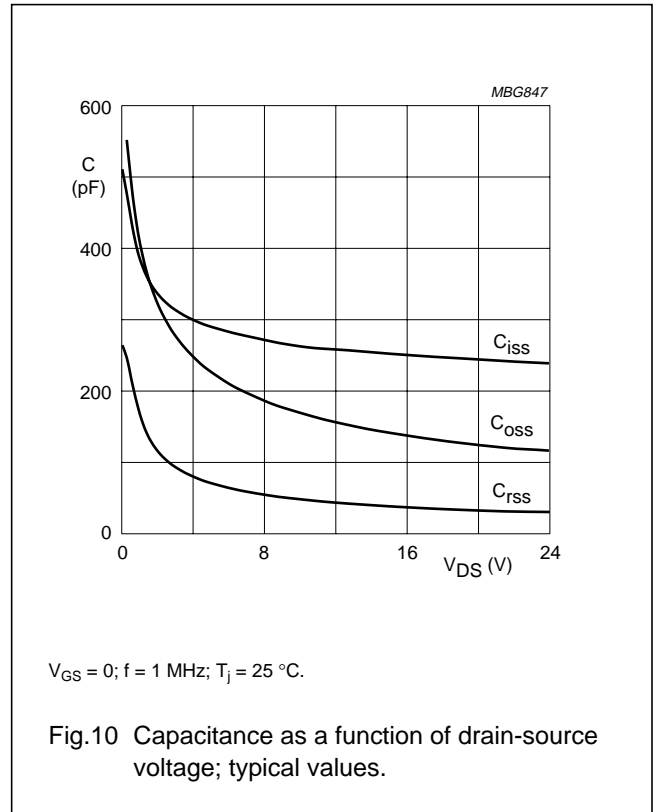


Fig.10 Capacitance as a function of drain-source voltage; typical values.

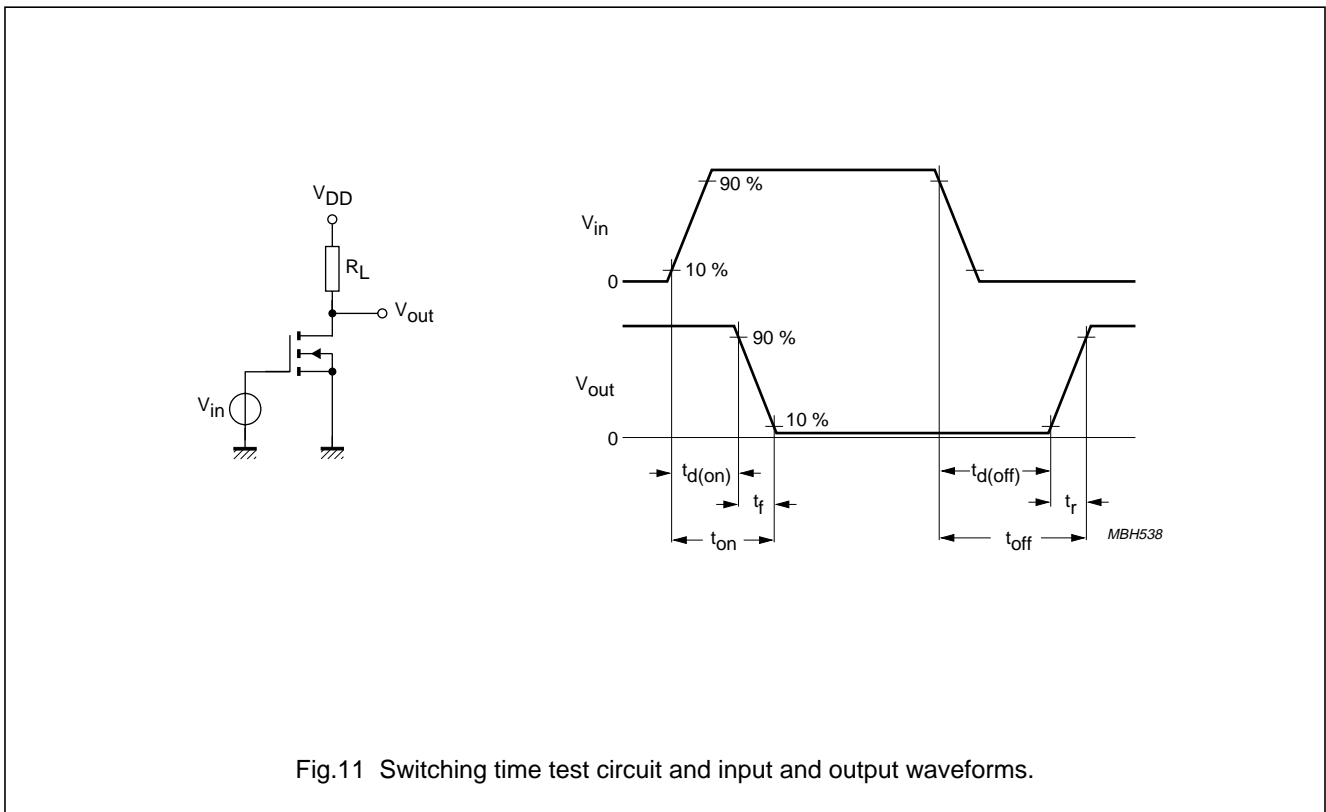
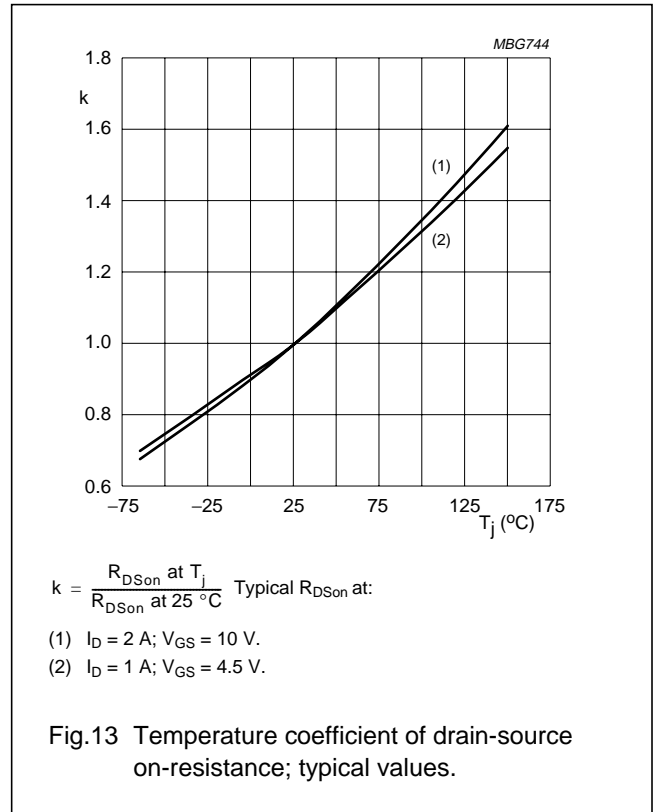
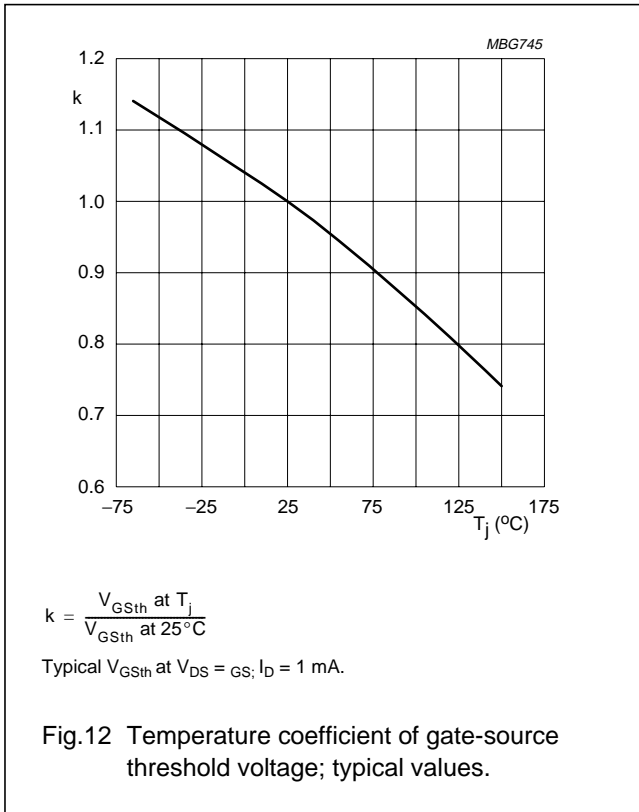


Fig.11 Switching time test circuit and input and output waveforms.

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MOS transistor

PHN110





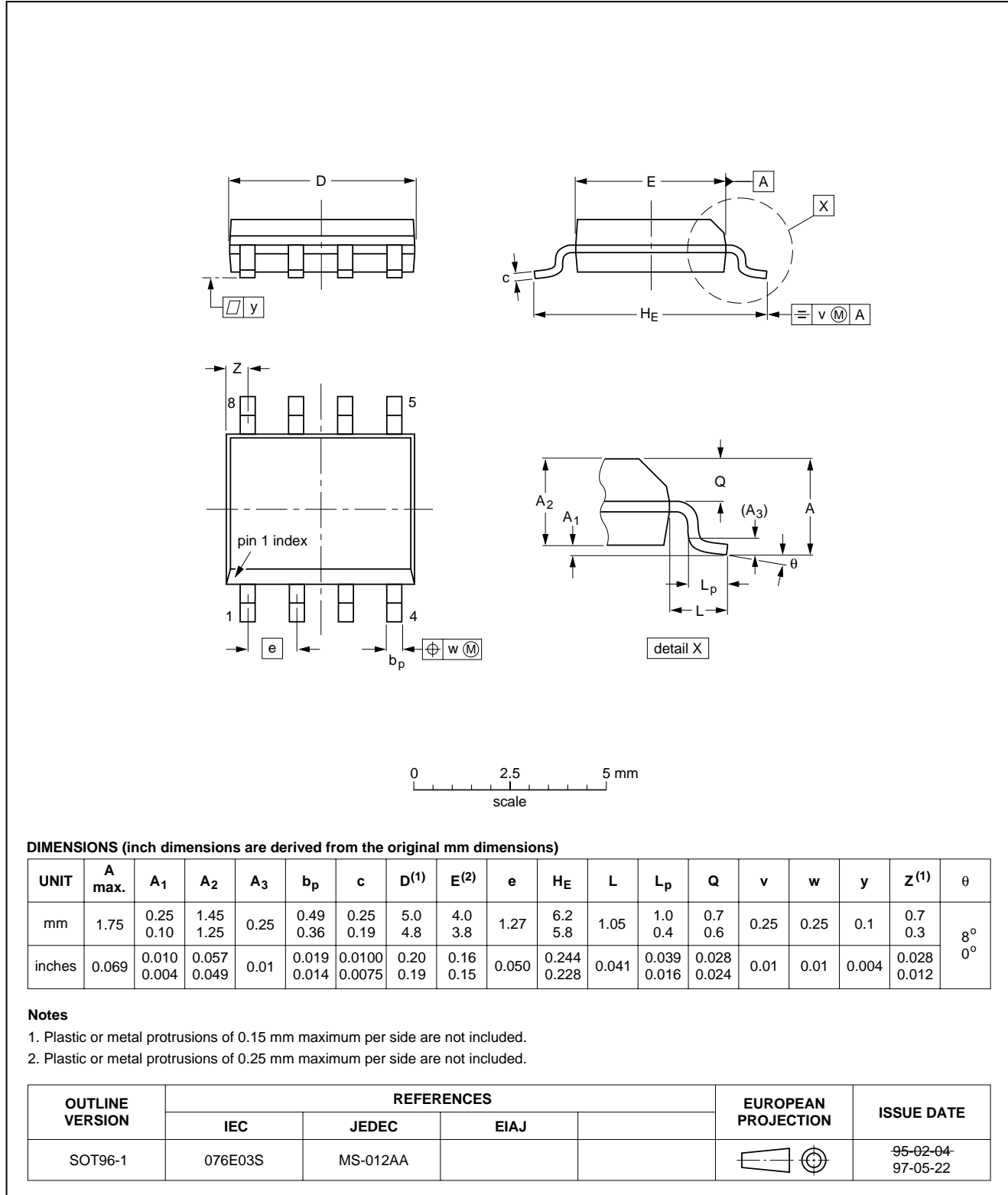
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PHN110

## PACKAGE OUTLINE

**SO8: plastic small outline package; 8 leads; body width 3.9 mm**

**SOT96-1**



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PHN110

## DEFINITIONS

<b>Data Sheet Status</b>	
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.
<b>Limiting values</b>	
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.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

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Printed in The Netherlands

137107/00/04/pp12

Date of release: 1997 Jun 17

Document order number: 9397 750 02385

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