

# DATA SHEET

## **PHN1013**

**N-channel enhancement mode  
MOS transistor**

Objective specification  
File under Discrete Semiconductors, SC13b

1997 Jun 20

# N-channel enhancement mode MOS transistor

PHN1013

## FEATURES

- Very low on-state resistance.

## APPLICATIONS

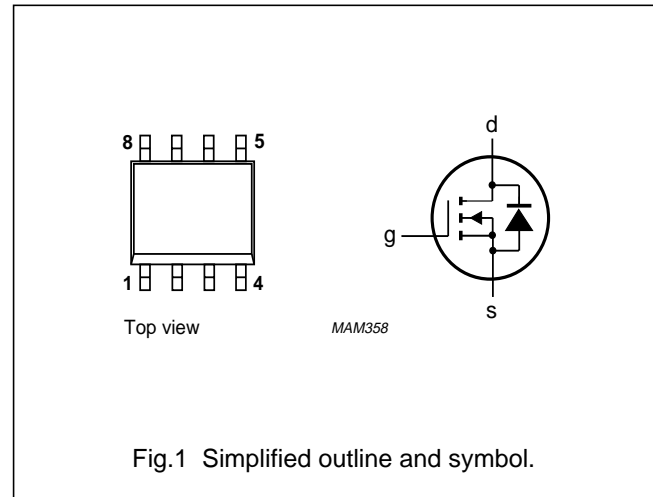
- DC to DC converters
- General purpose switching applications.

## PINNING - SOT96-1 (SO8)

PIN	SYMBOL	DESCRIPTION
1	s	source
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 logic level field-effect power transistor using 'trench' technology, in an 8-pin plastic SOT96-1 (SO8) package.



## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$V_{DS}$	drain-source voltage		30	V
$I_D$	drain current (DC)		10	A
$P_{tot}$	total power dissipation		2.5	W
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$	13.5	m $\Omega$
$T_j$	junction temperature		150	$^{\circ}\text{C}$

## LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{DS}$	drain-source voltage		-	30	V
$V_{DG}$	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	30	V
$V_{GS}$	gate-source voltage		-	$\pm 20$	V
$I_D$	drain current (DC)	$T_{amb} = 25\text{ }^{\circ}\text{C}; t_p \leq 10\text{ s}$	-	10	A
		$T_{amb} = 70\text{ }^{\circ}\text{C}; t_p \leq 10\text{ s}$	-	8	A
$I_{DM}$	peak drain current	$T_{amb} = 25\text{ }^{\circ}\text{C}$	-	50	A
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ }^{\circ}\text{C}$	-	2.5	W
		$T_{amb} = 70\text{ }^{\circ}\text{C}$	-	1.6	W
$T_{stg}$	storage temperature		-55	+150	$^{\circ}\text{C}$
$T_j$	operating junction temperature		-55	+150	$^{\circ}\text{C}$

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## THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j-a}$	thermal resistance from junction to ambient	minimum footprint; $t_p \leq 10$ s; note 1	50	K/W

### Note

1. Device mounted on an FR4 printed-circuit board.

## STATIC CHARACTERISTICS

$T_j = 25$  °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0$ ; $I_D = 250$ $\mu$ A	30	–	–	V
		$V_{GS} = 0$ ; $I_D = 250$ $\mu$ A; $T_j = -55$ °C	27	–	–	V
$V_{GSth}$	gate-source threshold voltage	$V_{DS} = V_{GS}$ ; $I_D = 250$ $\mu$ A	2.1	3	4	V
		$V_{DS} = V_{GS}$ ; $I_D = 250$ $\mu$ A; $T_j = 150$ °C	1.4	–	–	V
		$V_{DS} = V_{GS}$ ; $I_D = 250$ $\mu$ A; $T_j = -55$ °C	–	–	4.4	V
$I_{DSS}$	drain-source leakage current	$V_{DS} = 30$ V; $V_{GS} = 0$	–	0.05	10	$\mu$ A
		$V_{DS} = 30$ V; $V_{GS} = 0$ ; $T_j = 150$ °C	–	–	500	$\mu$ A
$I_{GSS}$	gate leakage current	$V_{GS} = \pm 10$ V; $V_{DS} = 0$	–	10	100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10$ V; $I_D = 10$ A	–	11	13.5	m $\Omega$
		$V_{GS} = 10$ V; $I_D = 10$ A; $T_j = 150$ °C	–	–	26	m $\Omega$

## DYNAMIC CHARACTERISTICS

$T_j = 25$  °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$g_{fs}$	forward transconductance	$V_{DS} = 25$ V; $I_D = 10$ A	4	8	–	S
$C_{iss}$	input capacitance	$V_{GS} = 0$ ; $V_{DS} = 25$ V; $f = 1$ MHz	–	1700	2200	pF
$C_{oss}$	output capacitance	$V_{GS} = 0$ ; $V_{DS} = 25$ V; $f = 1$ MHz	–	325	450	pF
$C_{rss}$	reverse transfer capacitance	$V_{GS} = 0$ ; $V_{DS} = 25$ V; $f = 1$ MHz	–	214	260	pF
$Q_G$	total gate charge	$V_{GS} = 5$ V; $V_{DD} = 24$ V; $I_D = 10$ A	–	27	–	nC
$Q_{GS}$	gate-source charge	$V_{GS} = 5$ V; $V_{DD} = 24$ V; $I_D = 10$ A	–	3.5	–	nC
$Q_{GD}$	gate-drain charge	$V_{GS} = 5$ V; $V_{DD} = 24$ V; $I_D = 10$ A	–	15	–	nC
<b>Switching times</b>						
$t_{d(on)}$	turn-on delay time	$V_{GS} = 5$ V; $V_{DD} = 25$ V; $I_D = 10$ A; $R_{gen} = 10$ $\Omega$ resistive load	–	25	40	ns
$t_{d(off)}$	turn-off delay time	$V_{GS} = 5$ V; $V_{DD} = 25$ V; $I_D = 10$ A; $R_{gen} = 10$ $\Omega$ resistive load	–	90	130	ns
$t_r$	rise time	$V_{GS} = 5$ V; $V_{DD} = 25$ V; $I_D = 10$ A; $R_{gen} = 10$ $\Omega$ resistive load	–	75	125	ns
$t_f$	fall time	$V_{GS} = 5$ V; $V_{DD} = 25$ V; $I_D = 10$ A; $R_{gen} = 10$ $\Omega$ resistive load	–	35	50	ns

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### REVERSE DIODE LIMITING VALUES AND CHARACTERISTICS

$T_j = 25\text{ °C}$  unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$I_{DR}$	continuous reverse drain current	$T_{amb} = 25\text{ °C}; t_p \leq 10\text{ s}$	–	10	A
$I_{DRM}$	pulsed reverse drain current		–	50	A
$V_{SD}$	source-drain diode forward voltage	$I_F = 10\text{ A}; V_{GS} = 0$	0.95	1.2	V
		$I_F = 50\text{ A}; V_{GS} = 0$	1	–	V
$t_{rr}$	reverse recovery time	$I_F = 10\text{ A}; di/dt = -100\text{ A}/\mu\text{s};$ $V_{GS} = -10\text{ V}; V_R = 25\text{ V}$	50	–	ns
$Q_{rr}$	reverse recovery charge	$I_F = 10\text{ A}; di/dt = -100\text{ A}/\mu\text{s};$ $V_{GS} = -10\text{ V}; V_R = 25\text{ V}$	0.1	–	$\mu\text{C}$

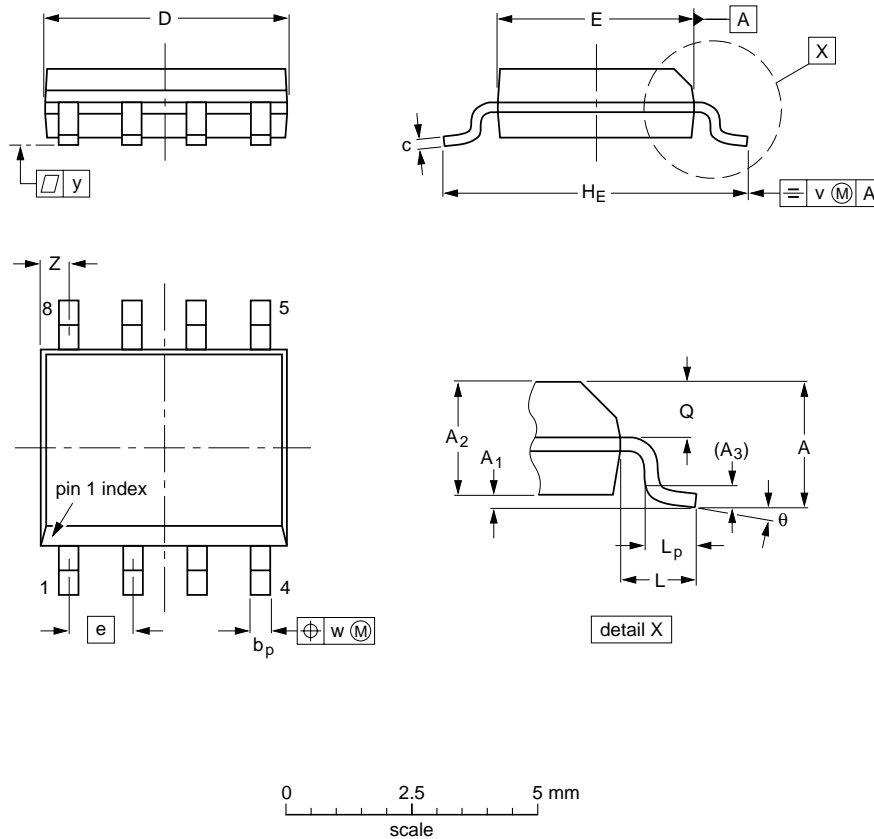
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PACKAGE OUTLINE

S08: plastic small outline package; 8 leads; body width 3.9 mm

SOT96-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A <sub>max.</sub>	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	5.0 4.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.20 0.19	0.16 0.15	0.050	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT96-1	076E03S	MS-012AA				95-02-04 97-05-22

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## 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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MOS transistor

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Printed in The Netherlands

137107/00/01/pp8

Date of release: 1997 Jun 20

Document order number: 9397 750 02452

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