

# PHK12NQ10T

TrenchMOS™ standard level FET

Rev. 01 — 15 September 2003

Product data

## 1. Product profile

### 1.1 Description

N-channel enhancement mode field-effect transistor in a plastic package using TrenchMOS™ technology.

### 1.2 Features

- Surface mounting package
- Low on-state resistance.

### 1.3 Applications

- DC-to-DC converter primary side
- Portable equipment applications.

### 1.4 Quick reference data

- $V_{DS} \leq 100 \text{ V}$
- $I_D \leq 11.6 \text{ A}$
- $P_{tot} \leq 8.9 \text{ W}$
- $R_{DSon} \leq 28 \text{ m}\Omega$

## 2. Pinning information

Table 1: Pinning - SOT96-1 (SO8), simplified outline and symbol

Pin	Description	Simplified outline	Symbol
1,2,3	source (s)	<p>Top view MBK187</p>	<p>MBB076</p>
4	gate (g)		
5,6,7,8	drain (d)		

SOT96-1 (SO8)



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### 3. Ordering information

**Table 2: Ordering information**

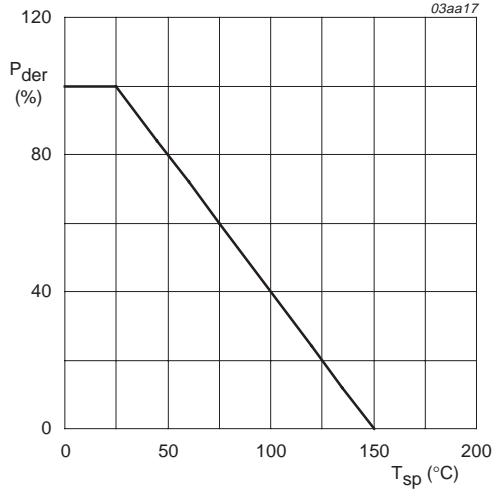
Type number	Package		Version
	Name	Description	
PHK12NQ10T	SO8	Plastic small outline package; 8 leads.	SOT96-1

### 4. Limiting values

**Table 3: Limiting values**

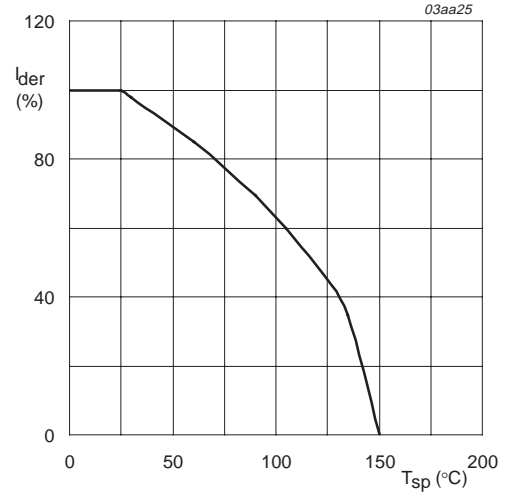
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage (DC)	$25\text{ °C} \leq T_j \leq 150\text{ °C}$	-	100	V
$V_{DGR}$	drain-gate voltage (DC)	$25\text{ °C} \leq T_j \leq 150\text{ °C}$ ; $R_{GS} = 20\text{ k}\Omega$	-	100	V
$V_{GS}$	gate-source voltage (DC)		-	$\pm 20$	V
$I_D$	drain current (DC)	$T_{sp} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; <b>Figure 2 and 3</b>	-	11.6	A
		$T_{sp} = 100\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; <b>Figure 2</b>	-	7.4	A
$I_{DM}$	peak drain current	$T_{sp} = 25\text{ °C}$ ; pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; <b>Figure 3</b>	-	48	A
$P_{tot}$	total power dissipation	$T_{sp} = 25\text{ °C}$ ; <b>Figure 1</b>	-	8.9	W
$T_{stg}$	storage temperature		-55	+150	°C
$T_j$	junction temperature		-55	+150	°C
<b>Source-drain diode</b>					
$I_S$	source (diode forward) current (DC)	$T_{sp} = 25\text{ °C}$	-	12	A
$I_{SM}$	peak source (diode forward) current	$T_{sp} = 25\text{ °C}$ ; pulsed; $t_p \leq 10\text{ }\mu\text{s}$	-	48	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; $I_D = 11.5\text{ A}$ ; $t_p = 0.1\text{ ms}$ ; $V_{DD} \leq 100\text{ V}$ ; $V_{GS} = 10\text{ V}$ ; starting $T_j = 25\text{ °C}$	-	65	mJ



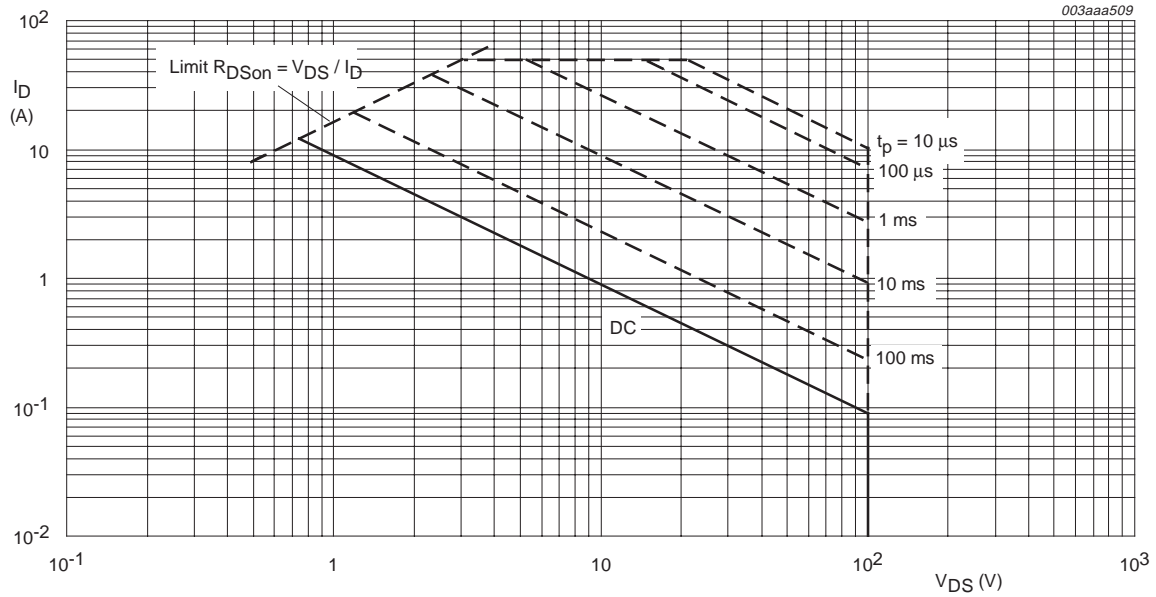
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

Fig 1. Normalized total power dissipation as a function of solder point temperature.



$$I_{der} = \frac{I_D}{I_{D(25^{\circ}C)}} \times 100\%$$

Fig 2. Normalized continuous drain current as a function of solder point temperature.



$T_{sp} = 25^{\circ}C$ ;  $I_{DM}$  is single pulse

Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage.

## 5. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	Figure 4	-	-	15	K/W

### 5.1 Transient thermal impedance

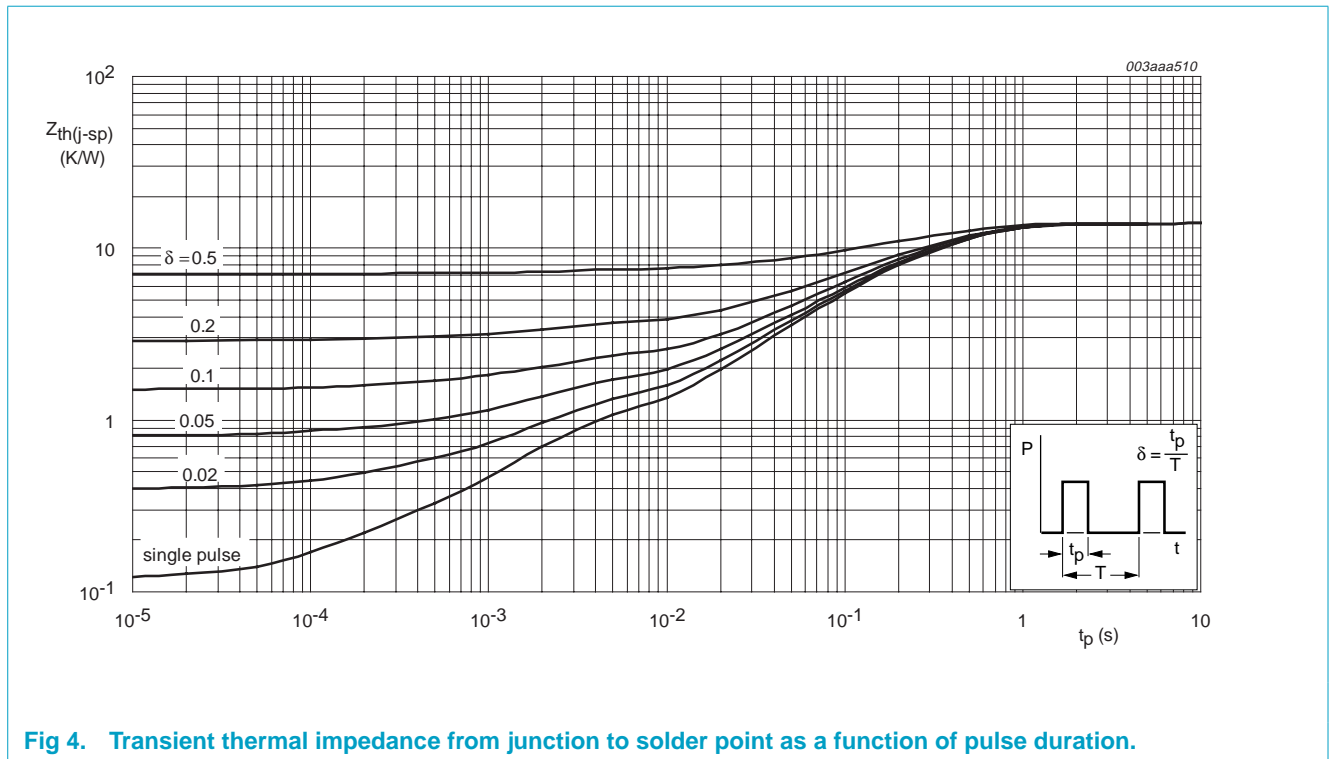
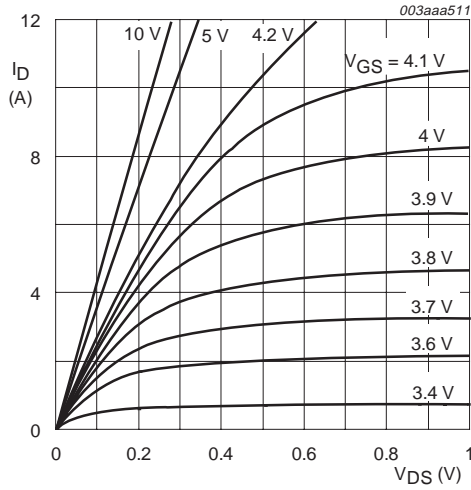


Fig 4. Transient thermal impedance from junction to solder point as a function of pulse duration.

## 6. Characteristics

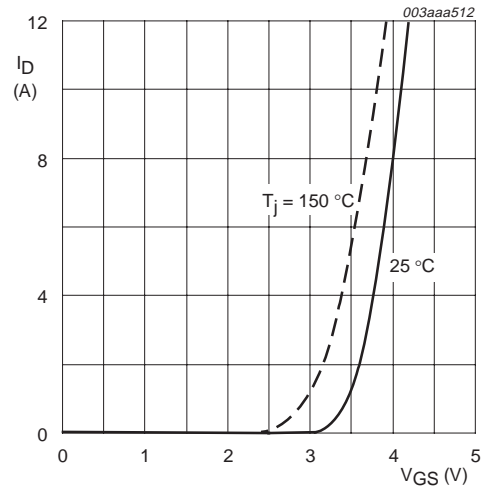
**Table 5: Characteristics**
 $T_j = 25\text{ °C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu\text{A}; V_{GS} = 0\ \text{V}$ $T_j = 25\text{ °C}$	100	-	-	V
		$T_j = -55\text{ °C}$	89	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ \text{mA}; V_{DS} = V_{GS}$ ; <b>Figure 9</b> $T_j = 25\text{ °C}$	2	3	4	V
		$T_j = 150\text{ °C}$	1.2	-	-	V
		$T_j = -55\text{ °C}$	-	-	4.4	V
$I_{DSS}$	drain-source leakage current	$V_{DS} = 100\ \text{V}; V_{GS} = 0\ \text{V}$ $T_j = 25\text{ °C}$	-	-	1	$\mu\text{A}$
		$T_j = 150\text{ °C}$	-	-	100	$\mu\text{A}$
$I_{GSS}$	gate-source leakage current	$V_{GS} = \pm 20\ \text{V}; V_{DS} = 0\ \text{V}$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\ \text{V}; I_D = 6\ \text{A}$ ; <b>Figure 7 and 8</b> $T_j = 25\text{ °C}$	-	23.7	28	m $\Omega$
		$T_j = 150\text{ °C}$	-	52.1	61.6	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{g(tot)}$	total gate charge	$I_D = 12\ \text{A}; V_{DD} = 50\ \text{V}; V_{GS} = 10\ \text{V}$ ; <b>Figure 13</b>	-	35	-	nC
$Q_{gs}$	gate-source charge		-	7.8	-	nC
$Q_{gd}$	gate-drain (Miller) charge		-	9	-	nC
$C_{iss}$	input capacitance	$V_{GS} = 0\ \text{V}; V_{DS} = 25\ \text{V}; f = 1\ \text{MHz}$ ; <b>Figure 11</b>	-	1965	-	pF
$C_{oss}$	output capacitance		-	260	-	pF
$C_{rss}$	reverse transfer capacitance		-	90	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DD} = 50\ \text{V}; I_D = 6\ \text{A}; V_{GS} = 10\ \text{V}; R_G = 6\ \Omega$	-	23	-	ns
$t_r$	rise time		-	21	-	ns
$t_{d(off)}$	turn-off delay time		-	52	-	ns
$t_f$	fall time		-	11	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain (diode forward) voltage	$I_S = 12\ \text{A}; V_{GS} = 0\ \text{V}$ ; <b>Figure 12</b>	-	0.83	1.0	V
$t_{rr}$	reverse recovery time	$I_S = 12\ \text{A}; dI_S/dt = -100\ \text{A}/\mu\text{s}; V_{GS} = 0\ \text{V}$	-	86	-	ns
$Q_r$	recovered charge		-	120	-	nC



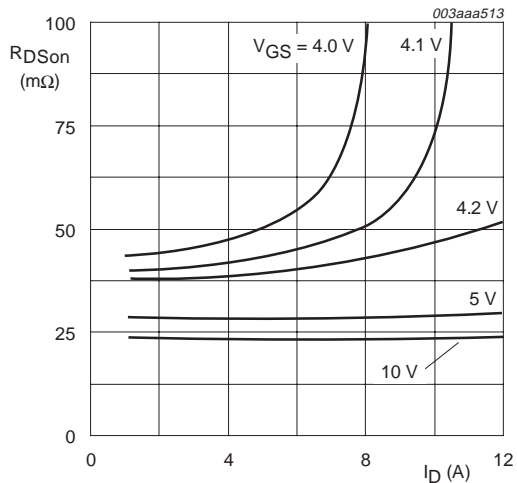
$T_j = 25\text{ }^\circ\text{C}$

**Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values.**



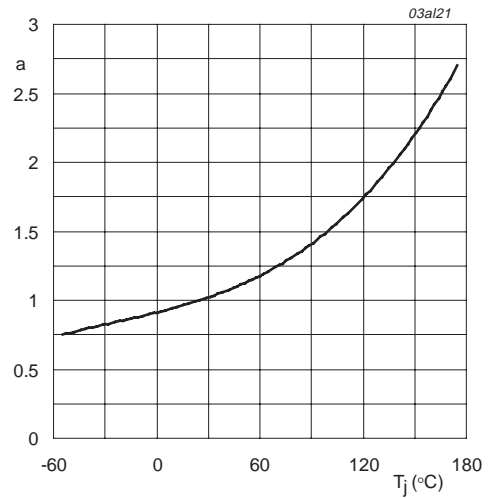
$T_j = 25\text{ }^\circ\text{C}$  and  $150\text{ }^\circ\text{C}$ ;  $V_{DS} > I_D \times R_{DSon}$

**Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values.**



$T_j = 25\text{ }^\circ\text{C}$

**Fig 7. Drain-source on-state resistance as a function of drain current; typical values.**



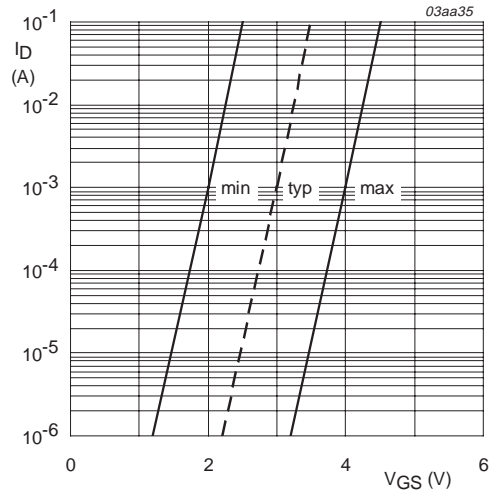
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

**Fig 8. Normalized drain source on-state resistance factor as a function of junction temperature.**



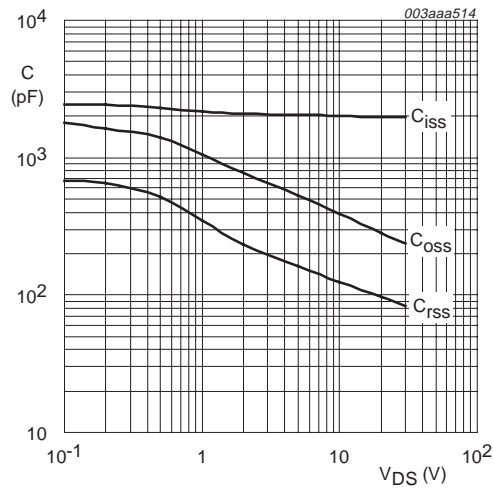
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

Fig 9. Gate-source threshold voltage as a function of junction temperature.



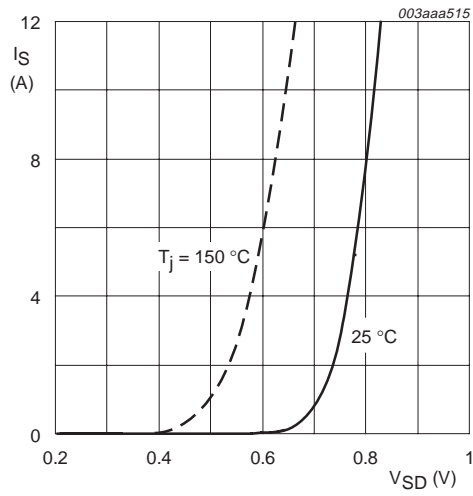
$T_j = 25 \text{ }^\circ\text{C}; V_{DS} = 5 \text{ V}$

Fig 10. Sub-threshold drain current as a function of gate-source voltage.



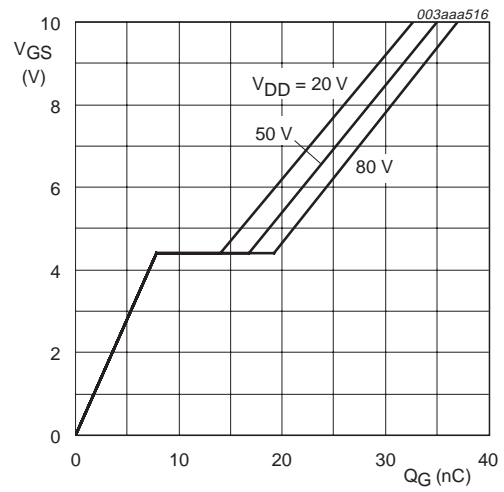
$V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

Fig 11. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values.



$T_j = 25^\circ\text{C}$  and  $150^\circ\text{C}$ ;  $V_{GS} = 0$  V

**Fig 12. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values.**



$I_D = 12$  A;  $V_{DD} = 20$  V,  $50$  V and  $80$  V

**Fig 13. Gate-source voltage as a function of gate charge; typical values.**



7. Package outline

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

SOT96-1

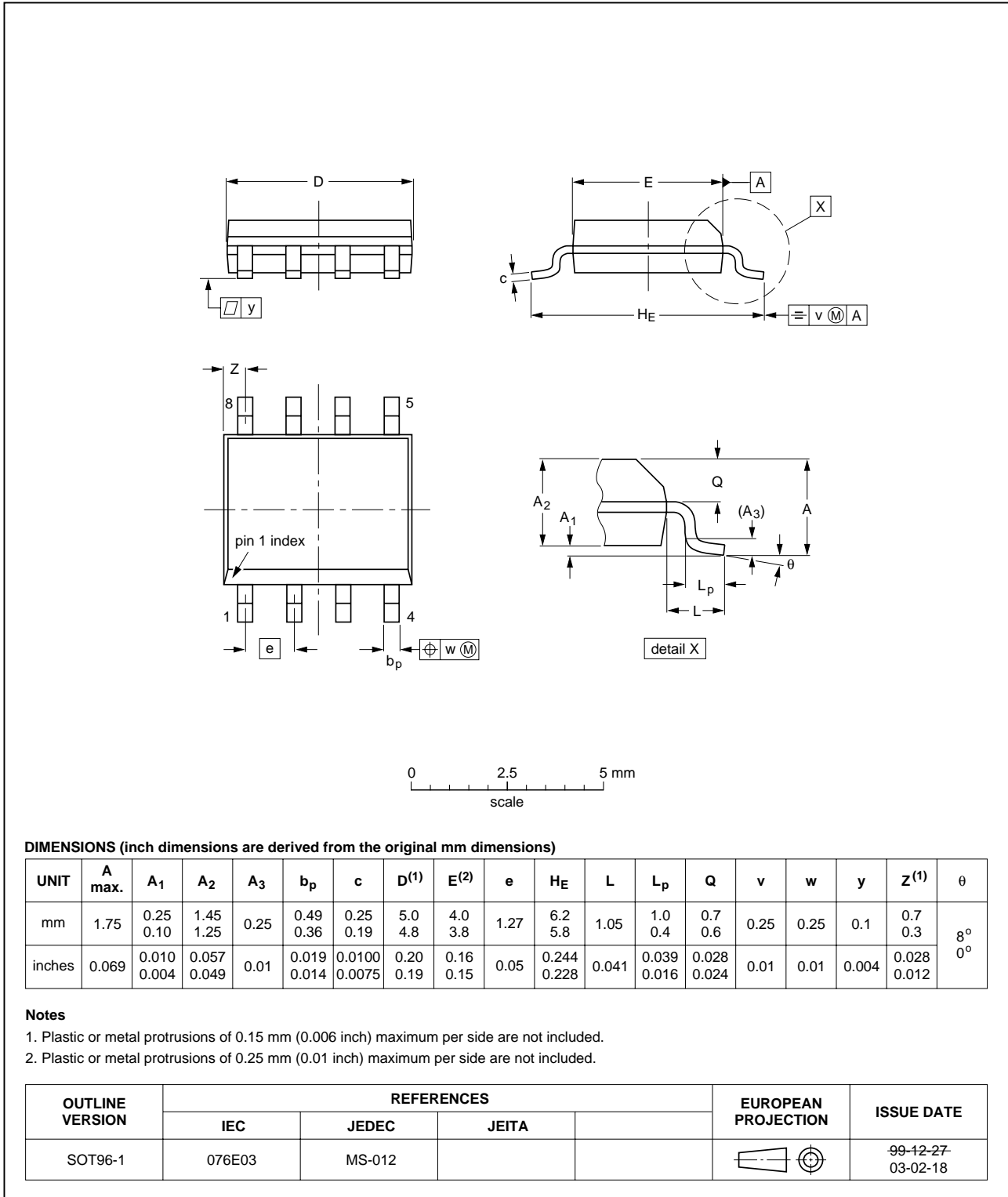


Fig 14. SOT96-1 (SO8).

## 8. Revision history

Table 6: Revision history

Rev	Date	CPCN	Description
01	20030915	-	Product data (9397 750 11949).

## 9. Data sheet status

Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2][3]</sup>	Definition
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