



**THE DATASHEET OF  
PHKD3NQ10T,518**



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Kind regards,

Team Nexperia

# PHKD3NQ10T

Dual N-channel TrenchMOS standard level FET

Rev. 02 — 16 December 2010

Product data sheet

## 1. Product profile

### 1.1 General description

Dual standard level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology. This product is designed and qualified for use in computing, communications, consumer and industrial applications only.

### 1.2 Features and benefits

- Low conduction losses due to low on-state resistance
- Suitable for high frequency applications due to fast switching characteristics
- Suitable for use in compact designs due to low profile

### 1.3 Applications

- DC-to-DC converters
- Motor and relay drivers

### 1.4 Quick reference data

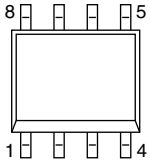
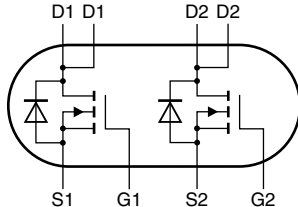
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 150\text{ °C}$	-	-	100	V
$I_D$	drain current	$T_{sp} = 25\text{ °C};$ One MOSFET conducting	-	-	3	A
$P_{tot}$	total power dissipation	$T_{sp} = 25\text{ °C}$	-	-	2	W
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 1.5\text{ A}; T_j = 25\text{ °C}$	-	70	90	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 3\text{ A}; V_{DS} = 80\text{ V}; T_j = 25\text{ °C}$	-	8	-	nC



## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source1	 <p>SOT96-1 (SO8)</p>	 <p>mbk725</p>
2	G1	gate1		
3	S2	source2		
4	G2	gate2		
5	D	drain2		
6	D	drain2		
7	D	drain1		
8	D	drain1		

## 3. Ordering information

Table 3. Ordering information

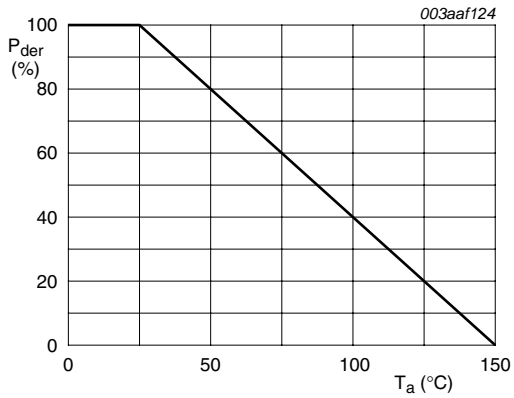
Type number	Package		
	Name	Description	Version
PHKD3NQ10T	SO8	plastic small outline package; 8 leads; body width 3.9 mm	SOT96-1

## 4. Limiting values

Table 4. Limiting values

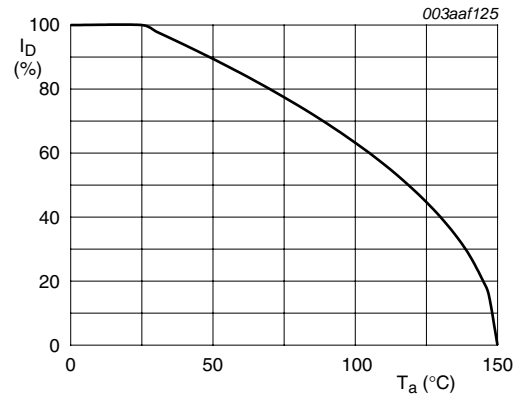
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 150\text{ °C}$	-	100	V
$V_{DGR}$	drain-gate voltage	$T_j \leq 150\text{ °C}$ ; $T_j \geq 25\text{ °C}$ ; $R_{GS} = 20\text{ k}\Omega$	-	100	V
$V_{GS}$	gate-source voltage		-20	20	V
$I_D$	drain current	$T_{sp} = 25\text{ °C}$ ; both MOSFETs conducting	-	2.2	A
		$T_{sp} = 70\text{ °C}$ ; one MOSFET conducting	-	2.4	A
		$T_{sp} = 70\text{ °C}$ ; both MOSFETs conducting	-	1.7	A
		$T_{sp} = 25\text{ °C}$ ; One MOSFET conducting	-	3	A
$I_{DM}$	peak drain current	$T_{sp} = 25\text{ °C}$ ; pulsed; One MOSFET conducting	-	12	A
$P_{tot}$	total power dissipation	$T_{sp} = 70\text{ °C}$	-	1.3	W
		$T_{sp} = 25\text{ °C}$	-	2	W
$T_{stg}$	storage temperature		-65	150	°C
$T_j$	junction temperature		-65	150	°C
<b>Source-drain diode</b>					
$I_S$	source current	$T_{sp} = 25\text{ °C}$	-	2	A
$I_{SM}$	peak source current	$T_{sp} = 25\text{ °C}$ ; pulsed; $t_p \leq 10\text{ s}$	-	12	A



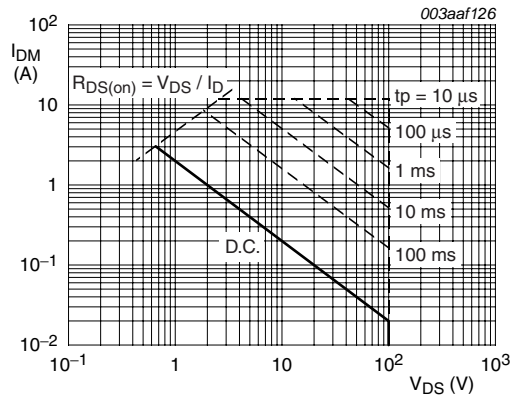
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100\%$$

**Fig 1. Normalized total power dissipation as a function of mounting base temperature**



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

**Fig 2. Normalized continuous drain current as a function of mounting base temperature**



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

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

### 5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	Surface mounted on FR4 board ; either or both MOSFETs conducting ; $t \leq 10$ sec	-	-	62.5	K/W
		Surface mounted on FR4 board ; either or both MOSFETs conducting	-	150	-	K/W

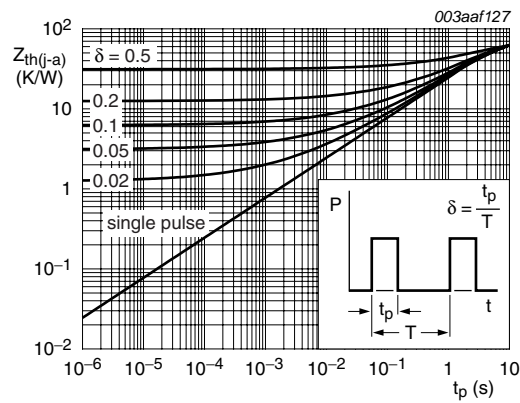


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	89	-	-	V
		$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	100	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C}$	-	-	6	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 150 \text{ }^\circ\text{C}$	1.1	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C}$	2	3	4	V
$I_{DSS}$	drain leakage current	$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.05	10	$\mu\text{A}$
		$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 150 \text{ }^\circ\text{C}$	-	-	100	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	10	100	nA
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 1.5 \text{ A}; T_j = 150 \text{ }^\circ\text{C}$	-	-	216	m $\Omega$
		$V_{GS} = 10 \text{ V}; I_D = 1.5 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	-	70	90	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 3 \text{ A}; V_{DS} = 80 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	21	-	nC
$Q_{GS}$	gate-source charge		-	2.5	-	nC
$Q_{GD}$	gate-drain charge		-	8	-	nC
$C_{iss}$	input capacitance	$V_{DS} = 20 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$	-	633	-	pF
$C_{oss}$	output capacitance		-	103	-	pF
$C_{rss}$	reverse transfer capacitance		-	61	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 50 \text{ V}; R_L = 15 \text{ } \Omega; V_{GS} = 10 \text{ V}; R_{G(ext)} = 5.6 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$	-	6	-	ns
$t_r$	rise time		-	12	-	ns
$t_{d(off)}$	turn-off delay time		-	20	-	ns
$t_f$	fall time		-	10	-	ns
$L_D$	internal drain inductance	measured from drain lead to centre of die ; $T_j = 25 \text{ }^\circ\text{C}$	-	2.5	-	nH
$L_S$	internal source inductance	measured from source lead to source bond pad ; $T_j = 25 \text{ }^\circ\text{C}$	-	5	-	nH
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 2 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.8	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 2 \text{ A}; di_S/dt = -100 \text{ A}/\mu\text{s}; V_{GS} = 0 \text{ V}; V_{DS} = 25 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	55	-	ns
$Q_r$	recovered charge		-	135	-	nC

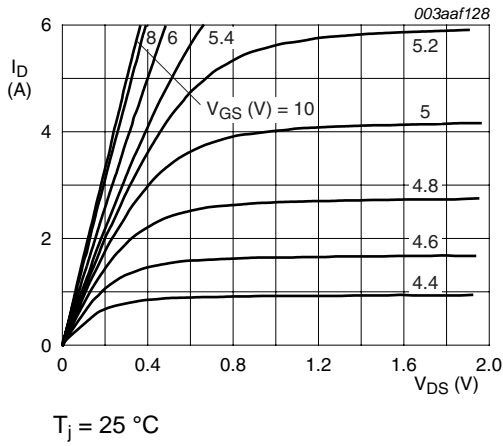


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

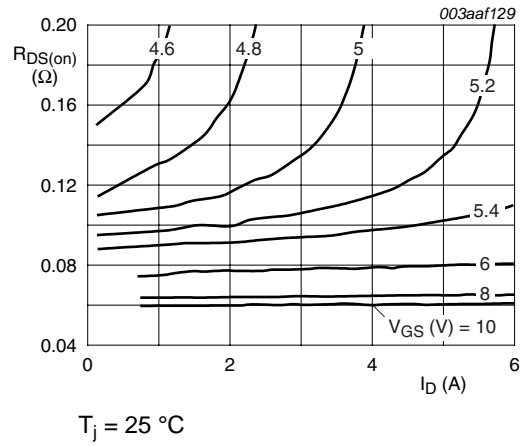


Fig 6. Drain-source on-state resistance as a function of drain current; typical values

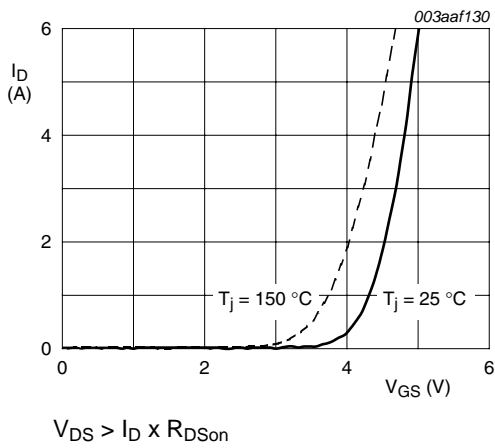


Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values

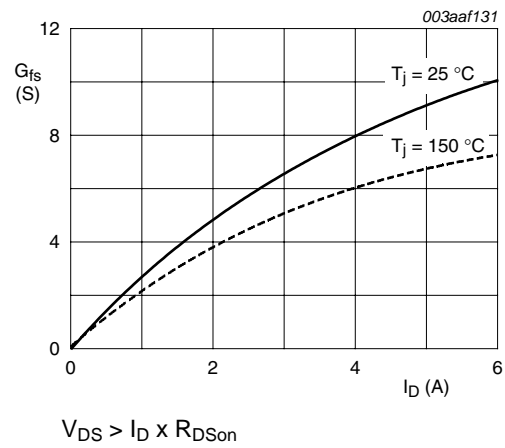
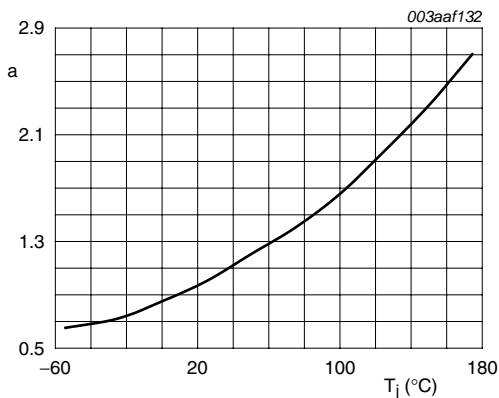
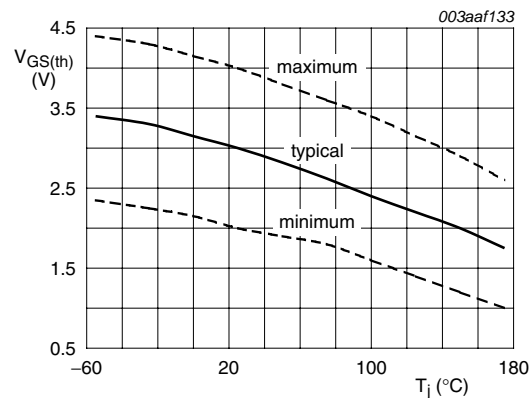


Fig 8. Forward transconductance as a function of drain current; typical values



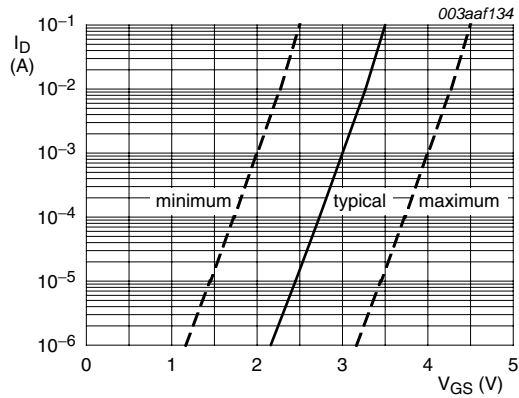
$$a = \frac{R_{DSon}}{R_{DSon(25^{\circ}C)}}$$

Fig 9. Normalized drain-source on-state resistance factor as a function of junction temperature



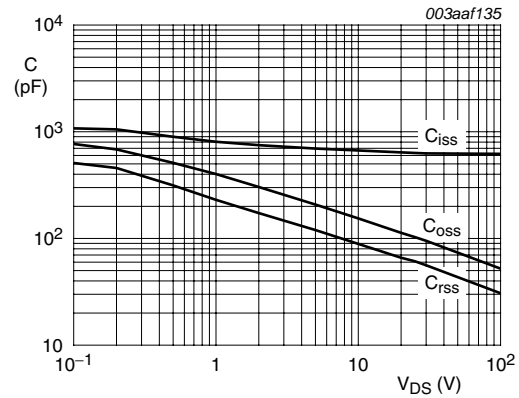
$$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$$

Fig 10. Gate-source threshold voltage as a function of junction temperature



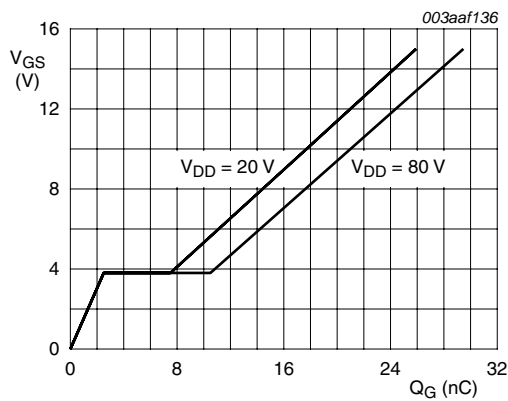
T<sub>j</sub> = 25 °C; V<sub>DS</sub> = V<sub>GS</sub>

Fig 11. Sub-threshold drain current as a function of gate-source voltage



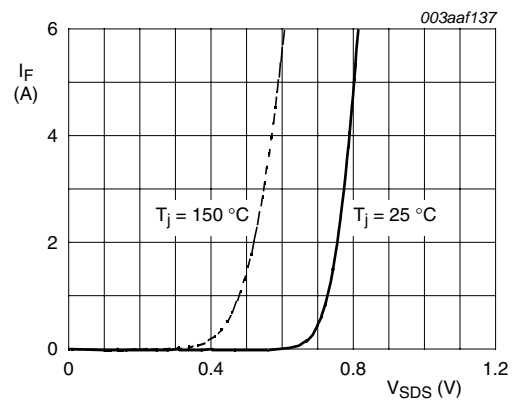
V<sub>GS</sub> = 0 V; f = 1 MHz

Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



T<sub>j</sub> = 25 °C; I<sub>D</sub> = 3 A

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



V<sub>GS</sub> = 0 V

Fig 14. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

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

SOT96-1

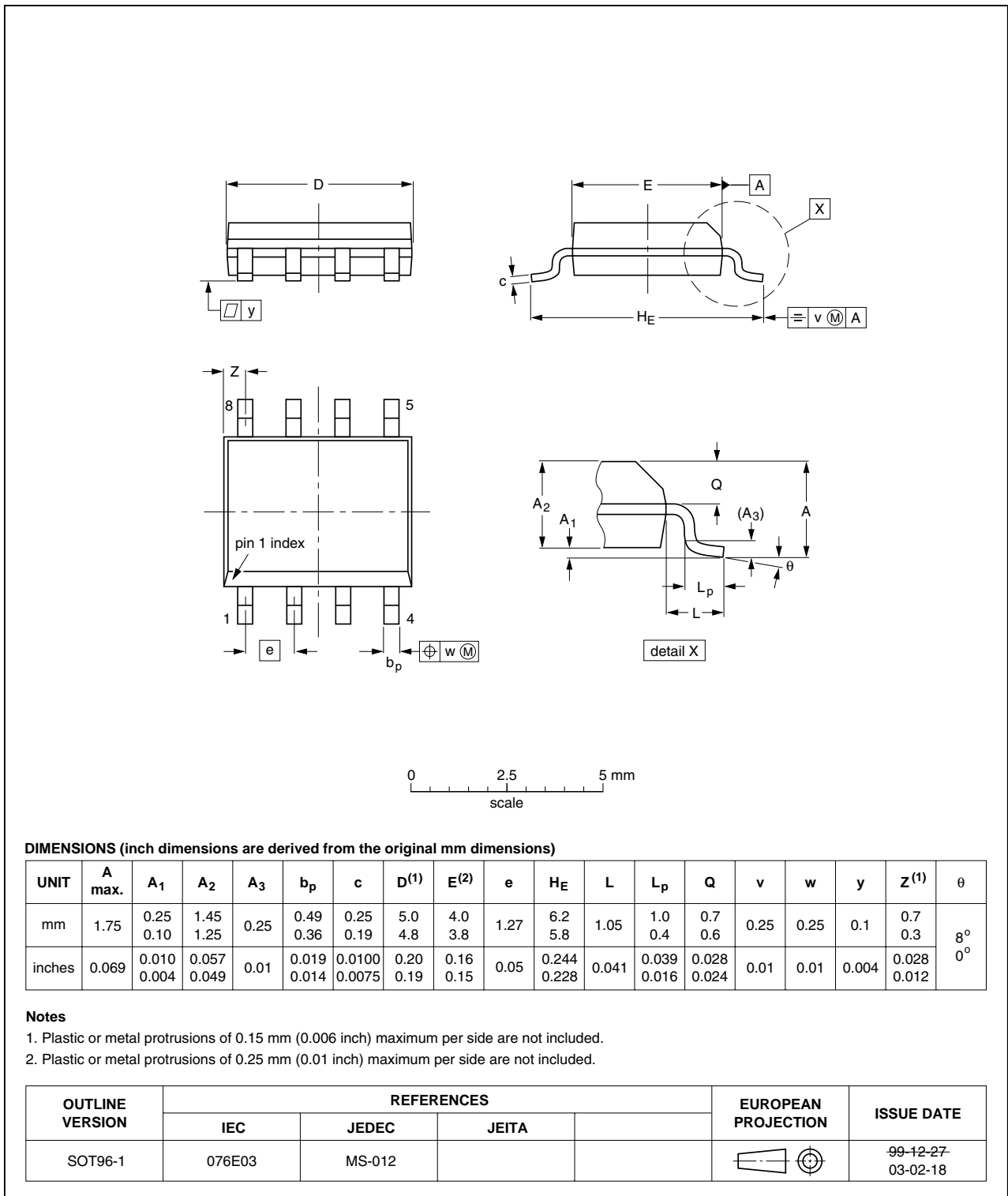


Fig 15. Package outline SOT96-1 (SO8)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHKD3NQ10T v.2	20101216	Product data sheet	-	PHKD3NQ10T v.1
Modifications:	<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li></ul>			
PHKD3NQ10T v.1	19990801	Product specification	-	-

## 9. Legal information

### 9.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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[2] The term 'short data sheet' is explained in section "Definitions".

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Date of release: 16 December 2010

Document identifier: PHKD3NQ10T

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