

# PHD71NQ03LT

## N-channel TrenchMOS logic level FET

Rev. 02 — 9 March 2010

Product data sheet

## 1. Product profile

### 1.1 General description

Logic 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

- Simple gate drive required due to low gate charge
- Suitable for logic level gate drive sources

### 1.3 Applications

- DC-to-DC convertors
- Switched-mode power supplies

### 1.4 Quick reference data

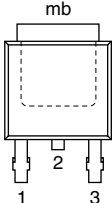
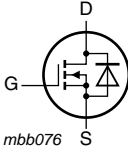
Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	-	30	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a> and <a href="#">3</a>	-	-	75	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	120	W
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 5\text{ V}$ ; $I_D = 50\text{ A}$ ; $V_{DS} = 15\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 11</a>	-	4.6	-	nC
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 9</a>	-	8	10	mΩ



## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	D	drain <a href="#">[1]</a>		
3	S	source		
mb	D	mounting base; connected to drain		

SOT428 (DPAK)

[1] It is not possible to make a connection to pin 2.

## 3. Ordering information

Table 3. Ordering information

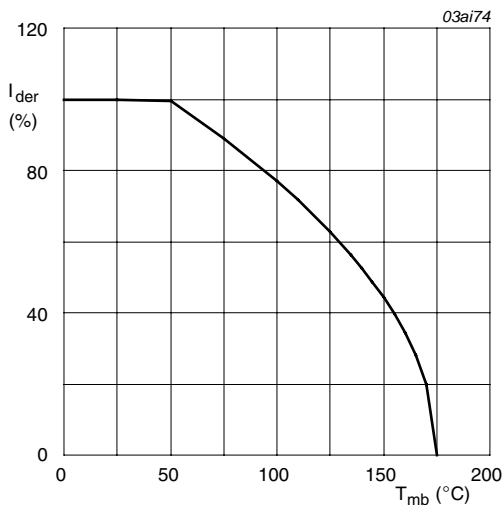
Type number	Package		Version
	Name	Description	
PHD71NQ03LT	DPAK	plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)	SOT428

## 4. Limiting values

Table 4. Limiting values

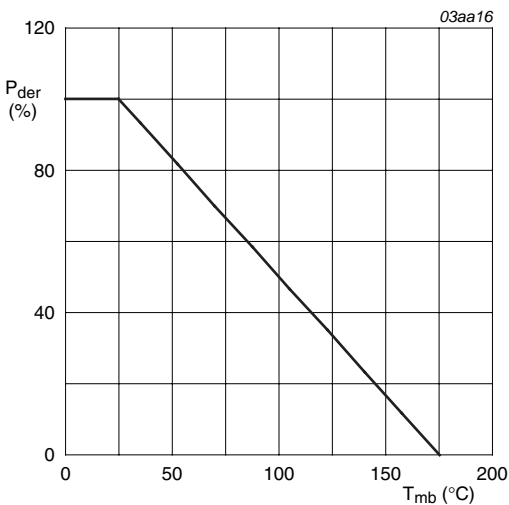
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	30	V
$V_{DGR}$	drain-gate voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$ ; $R_{GS} = 20\text{ k}\Omega$	-	30	V
$V_{GS}$	gate-source voltage		-20	20	V
$I_D$	drain current	$V_{GS} = 10\text{ V}$ ; $T_{mb} = 100\text{ °C}$ ; see <a href="#">Figure 1</a>	-	57.5	A
		$V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a> and <a href="#">3</a>	-	75	A
$I_{DM}$	peak drain current	$t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 3</a>	-	240	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	120	W
$T_{stg}$	storage temperature		-55	175	°C
$T_j$	junction temperature		-55	175	°C
$V_{GSM}$	peak gate-source voltage	pulsed; $\delta = 25\%$ ; $t_p \leq 50\text{ }\mu\text{s}$	-25	25	V
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	75	A
$I_{SM}$	peak source current	$t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; $T_{mb} = 25\text{ °C}$	-	57.7	A



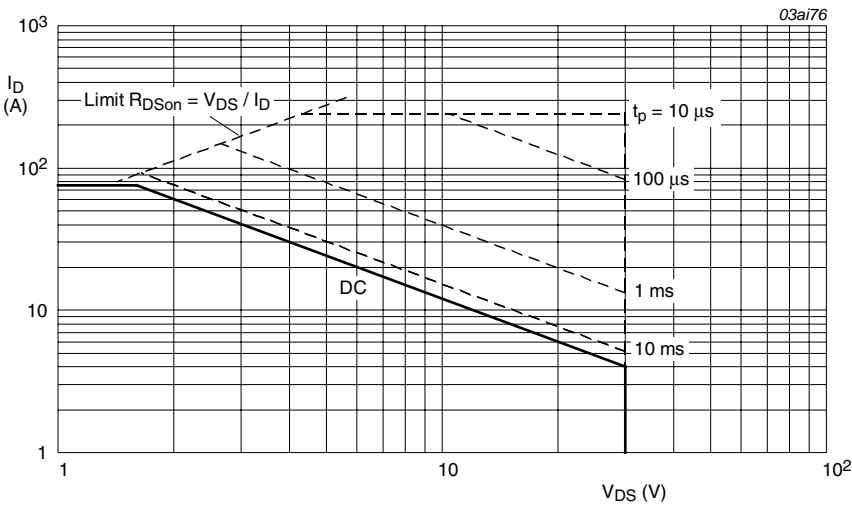
$$I_{der} = \frac{I_D}{I_{D(25^{\circ}\text{C})}} \times 100\%$$

Fig 1. Normalized continuous drain current as a function of mounting base temperature



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

Fig 2. Normalized total power dissipation as a function of mounting base temperature



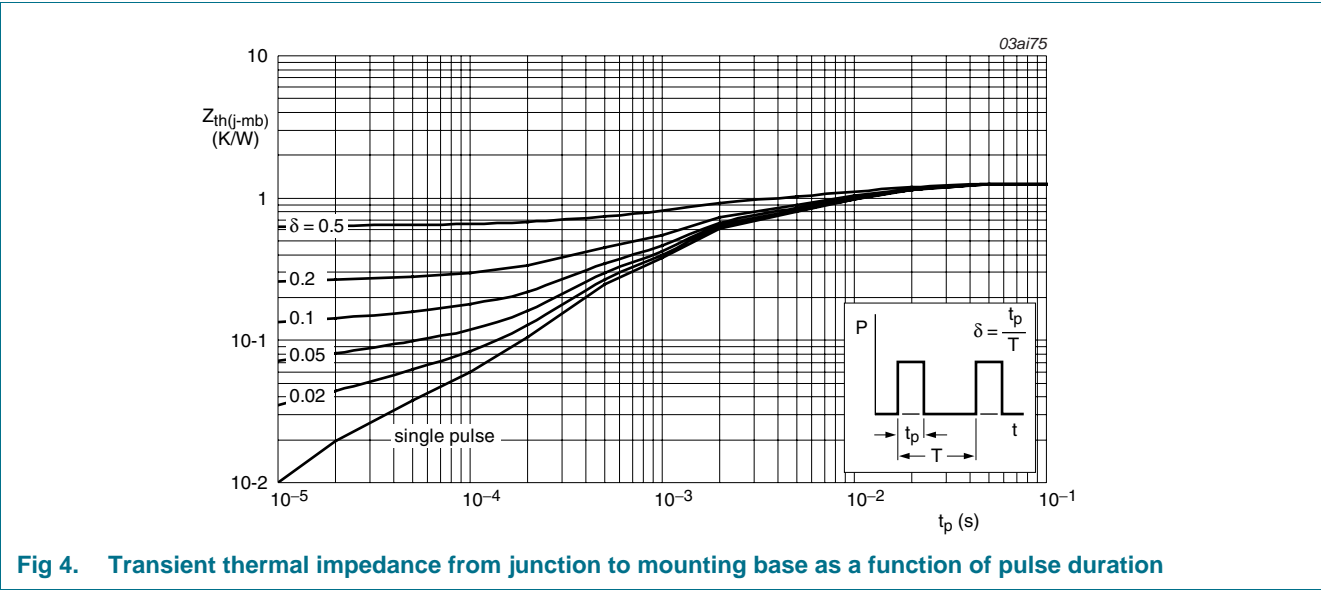
$$T_{mb} = 25^{\circ}\text{C}; I_{DM} \text{ is single pulse}; V_{GS} = 10\text{V}$$

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

5. Thermal characteristics

Table 5. Thermal characteristics

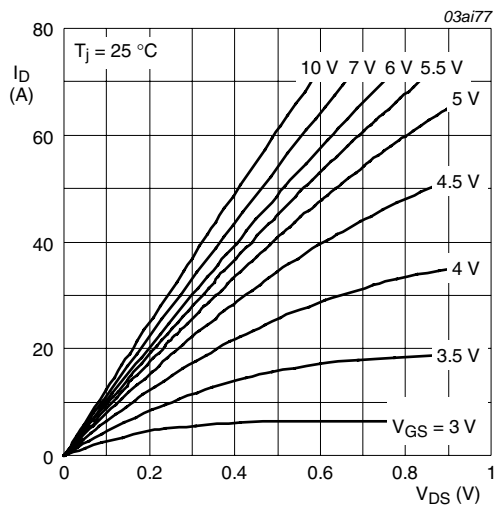
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 4</a>	-	-	1.25	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	mounted on a printed-circuit board; minimum footprint	-	75	-	K/W



## 6. Characteristics

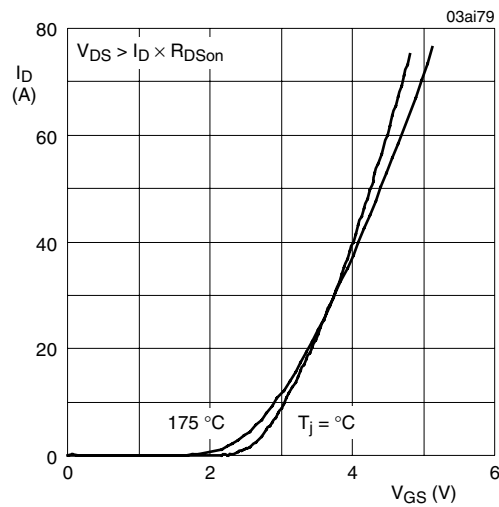
**Table 6. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V <sub>(BR)DSS</sub>	drain-source breakdown voltage	I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = -55 °C	27	-	-	V
		I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	30	-	-	V
V <sub>GS(th)</sub>	gate-source threshold voltage	I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 175 °C; see <a href="#">Figure 8</a>	0.6	-	-	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = -55 °C; see <a href="#">Figure 8</a>	-	-	2.9	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 25 °C; see <a href="#">Figure 8</a>	1	1.9	2.5	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 30 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	0.05	1	μA
		V <sub>DS</sub> = 30 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 175 °C	-	-	500	μA
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = 20 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	10	100	nA
		V <sub>GS</sub> = -20 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	10	100	nA
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 5 V; I <sub>D</sub> = 25 A; T <sub>j</sub> = 175 °C; see <a href="#">Figure 9</a> and <a href="#">10</a>	-	21.6	27.4	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 9</a>	-	8	10	mΩ
		V <sub>GS</sub> = 5 V; I <sub>D</sub> = 25 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 9</a> and <a href="#">10</a>	-	12	15.2	mΩ
Dynamic characteristics						
Q <sub>G(tot)</sub>	total gate charge	I <sub>D</sub> = 50 A; V <sub>DS</sub> = 15 V; V <sub>GS</sub> = 5 V; T <sub>j</sub> = 25 °C; see <a href="#">Figure 11</a>	-	13.2	-	nC
Q <sub>GS</sub>	gate-source charge		-	5.3	-	nC
Q <sub>GD</sub>	gate-drain charge		-	4.6	-	nC
C <sub>iss</sub>	input capacitance	V <sub>DS</sub> = 25 V; V <sub>GS</sub> = 0 V; f = 1 MHz; T <sub>j</sub> = 25 °C; see <a href="#">Figure 12</a>	-	1220	-	pF
C <sub>oss</sub>	output capacitance		-	330	-	pF
C <sub>rss</sub>	reverse transfer capacitance		-	140	-	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 15 V; R <sub>L</sub> = 0.6 Ω; V <sub>GS</sub> = 4.5 V; R <sub>G(ext)</sub> = 5.6 Ω; T <sub>j</sub> = 25 °C; I <sub>D</sub> = 25 A	-	15	-	ns
t <sub>r</sub>	rise time		-	150	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	13.5	-	ns
t <sub>f</sub>	fall time		-	18	-	ns
Source-drain diode						
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 25 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C; see <a href="#">Figure 13</a>	-	0.9	1.2	V
t <sub>rr</sub>	reverse recovery time	I <sub>S</sub> = 10 A; dI <sub>S</sub> /dt = -100 A/μs; V <sub>GS</sub> = 0 V;	-	29	-	ns
Q <sub>r</sub>	recovered charge	V <sub>DS</sub> = 25 V; T <sub>j</sub> = 25 °C	-	20	-	nC



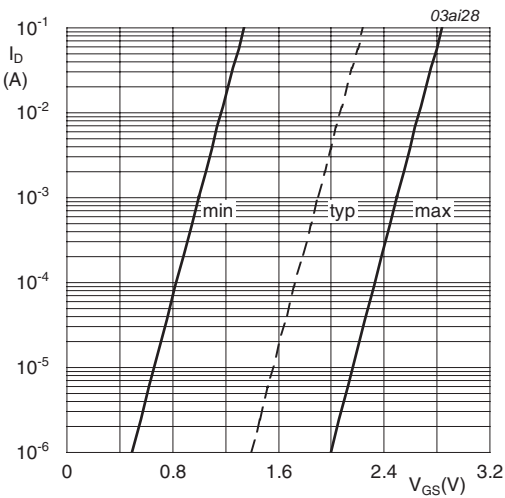
$T_j = 25\text{ }^{\circ}\text{C}$

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



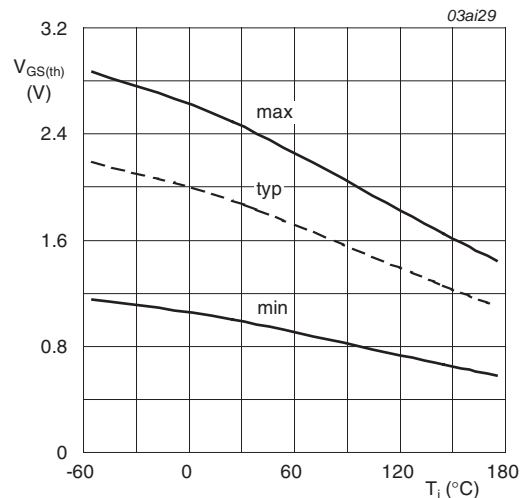
$T_j = 25\text{ }^{\circ}\text{C}$  and  $175\text{ }^{\circ}\text{C}; V_{DS} > I_D \times R_{DSon}$

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



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

Fig 7. Sub-threshold drain current as a function of gate-source voltage



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

Fig 8. Gate-source threshold voltage as a function of junction temperature

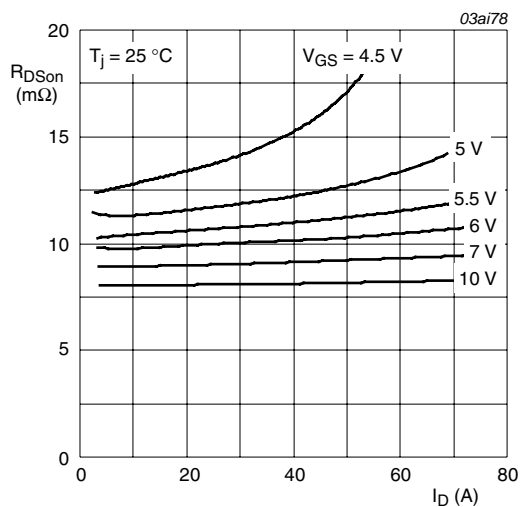


Fig 9. Drain-source on-state resistance as a function of drain current; typical values

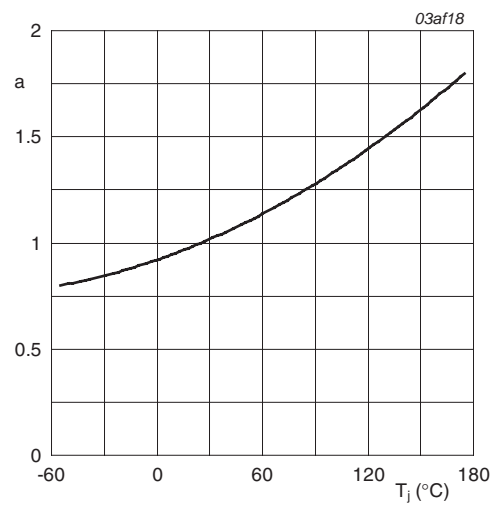


Fig 10. Normalized drain-source on-state resistance factor as a function of junction temperature

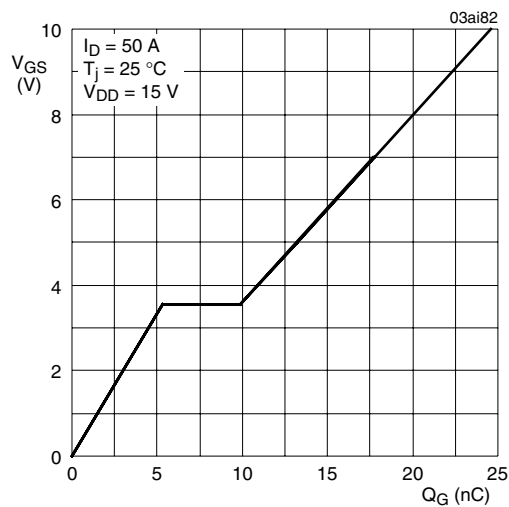


Fig 11. Gate-source voltage as a function of gate charge; typical values

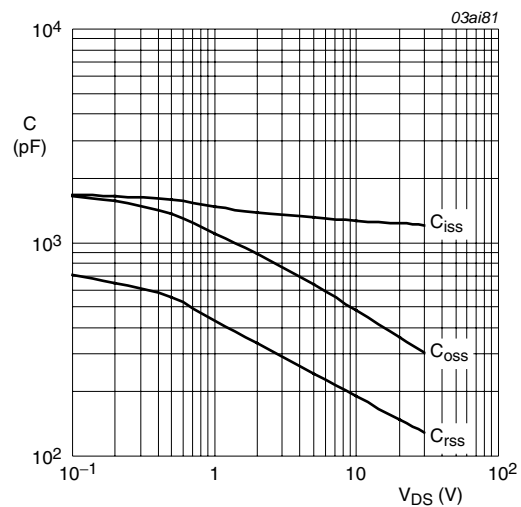
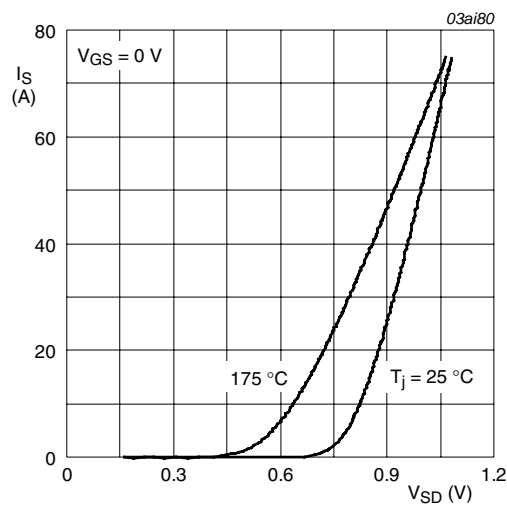


Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$T_J = 25^\circ\text{C}$  and  $175^\circ\text{C}$ ;  $V_{GS} = 0\text{ V}$

Fig 13. Source current as a function of source-drain voltage; typical values



7. Package outline

Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)

SOT428

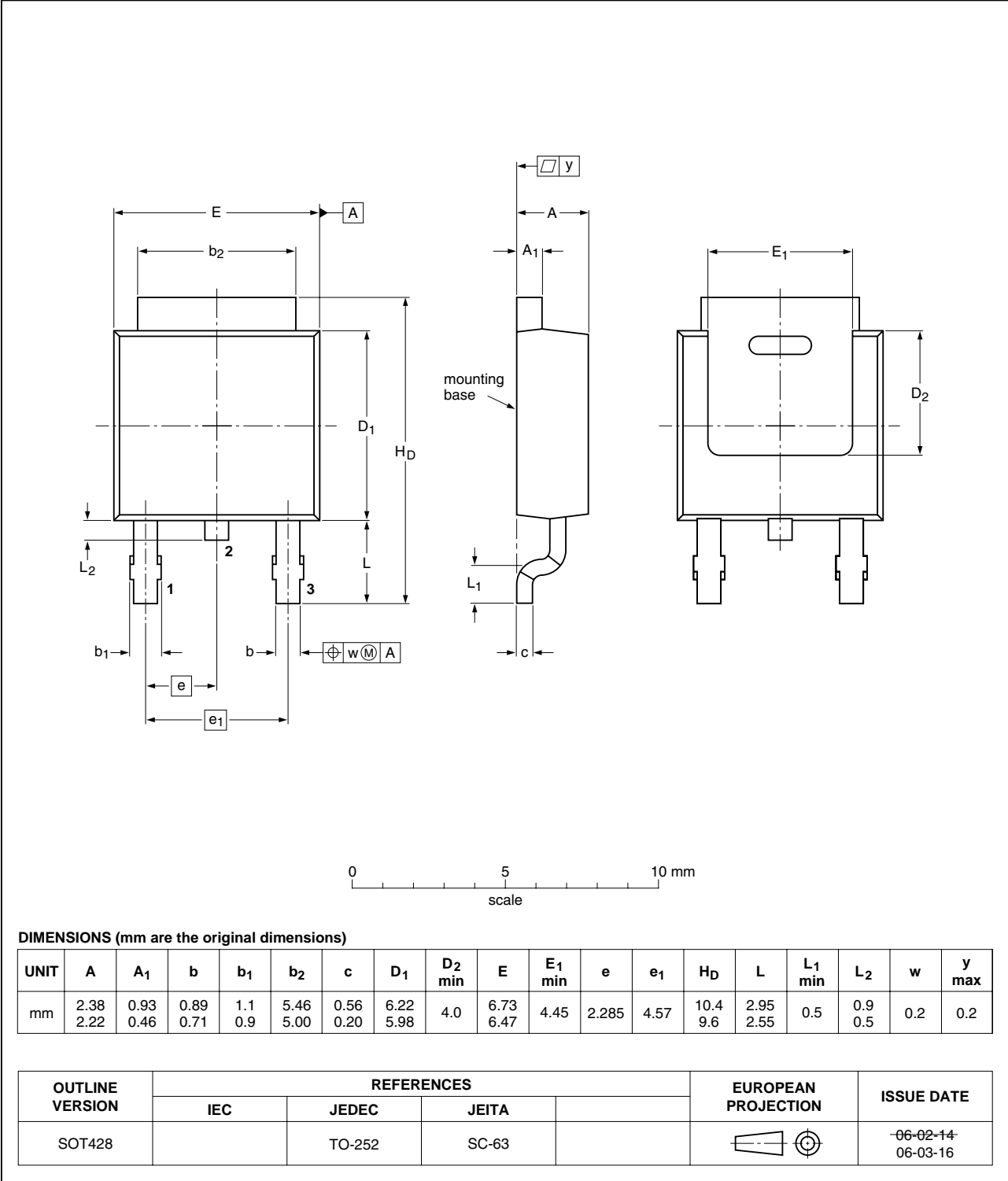


Fig 14. Package outline SOT428 (DPAK)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHD71NQ03LT_2	20100309	Product data sheet	-	PHP_PHB_PHD71NQ03LT-01
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><li>• Type number PHD71NQ03LT separated from data sheet PHP_PHB_PHD71NQ03LT-01.</li></ul>			
PHP_PHB_PHD71NQ03LT-01	20020625	Product data	-	-

## 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.

[1] Please consult the most recently issued document before initiating or completing a design.

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

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