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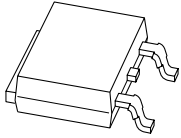
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Kind regards,

Team Nexperia



# PHD38N02LT

N-channel TrenchMOS logic level FET

Rev. 02 — 2 February 2007

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.

### 1.2 Features

- Low on-state resistance
- 2.5 V gate drive

### 1.3 Applications

- Linear regulator for Double-Data Rate (DDR) memory

### 1.4 Quick reference data

- $V_{DS} \leq 20$  V
- $I_D \leq 44.7$  A
- $R_{DSon} \leq 16$  m $\Omega$
- $P_{tot} \leq 57.6$  W

## 2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Symbol
1	gate (G)	<p>SOT428 (DPAK)</p>	
2	drain (D) <a href="#">[1]</a>		
3	source (S)		
mb	mounting base; connected to drain (D)		

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

### 3. Ordering information

**Table 2. Ordering information**

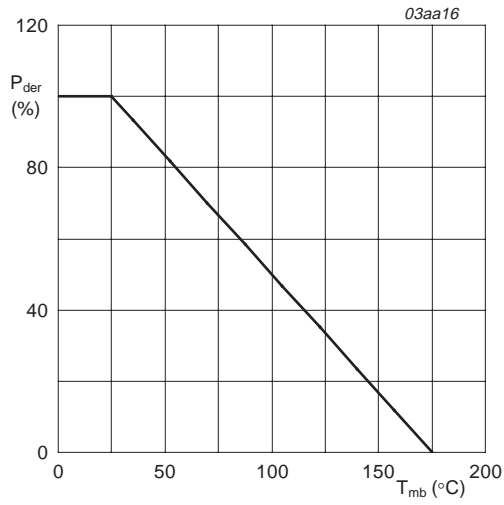
Type number	Package		Version
	Name	Description	
PHD38N02LT	DPAK	plastic single-ended surface-mounted package; 3 leads (one lead cropped)	SOT428

### 4. Limiting values

**Table 3. Limiting values**

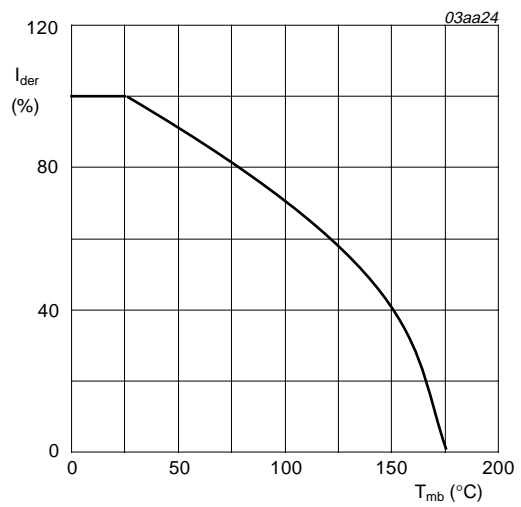
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$	-	20	V
$V_{DGR}$	drain-gate voltage (DC)	$25\text{ °C} \leq T_j \leq 175\text{ °C}$ ; $R_{GS} = 20\text{ k}\Omega$	-	20	V
$V_{GS}$	gate-source voltage		-	$\pm 12$	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}$ ; $V_{GS} = 5\text{ V}$ ; see <a href="#">Figure 2</a> and <a href="#">3</a>	-	44.7	A
		$T_{mb} = 100\text{ °C}$ ; $V_{GS} = 5\text{ V}$ ; see <a href="#">Figure 2</a>	-	31.6	A
$I_{DM}$	peak drain current	$T_{mb} = 25\text{ °C}$ ; pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; see <a href="#">Figure 3</a>	-	179	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a>	-	57.6	W
$T_{stg}$	storage temperature		-55	+175	°C
$T_j$	junction temperature		-55	+175	°C
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	44.7	A
$I_{SM}$	peak source current	$T_{mb} = 25\text{ °C}$ ; pulsed; $t_p \leq 10\text{ }\mu\text{s}$	-	179	A



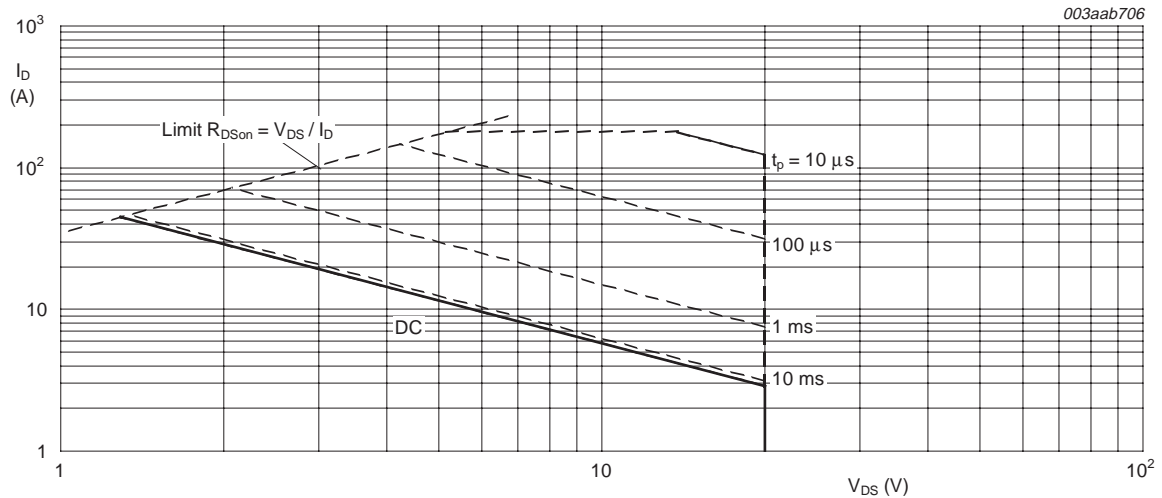
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

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



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

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



T<sub>mb</sub> = 25 °C; I<sub>DM</sub> is single pulse; V<sub>GS</sub> = 5 V

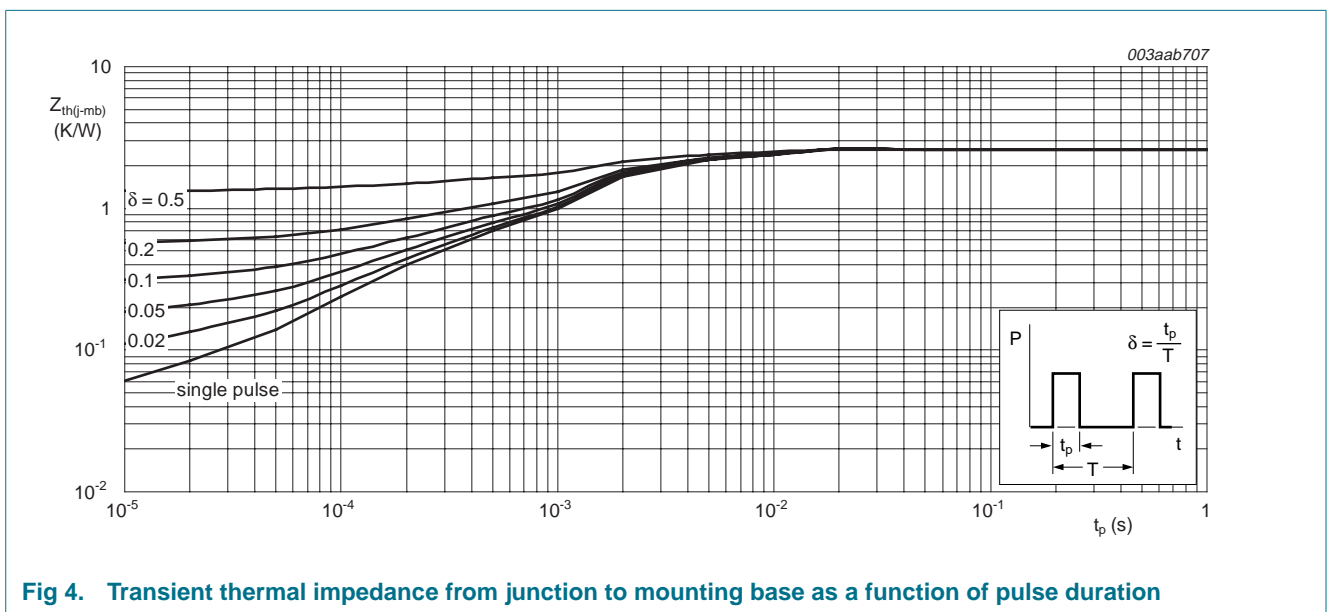
Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

### 5. Thermal characteristics

**Table 4. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 4</a>	-	-	2.6	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient					
	SOT428	minimum footprint	-	75	-	K/W
		SOT404 minimum footprint	[1]	50	-	K/W

[1] Mounted on a printed-circuit board; vertical in still air.



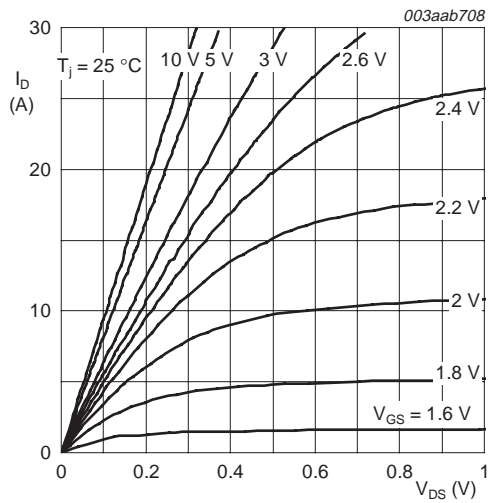
**Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration**

## 6. Characteristics

**Table 5. Characteristics**

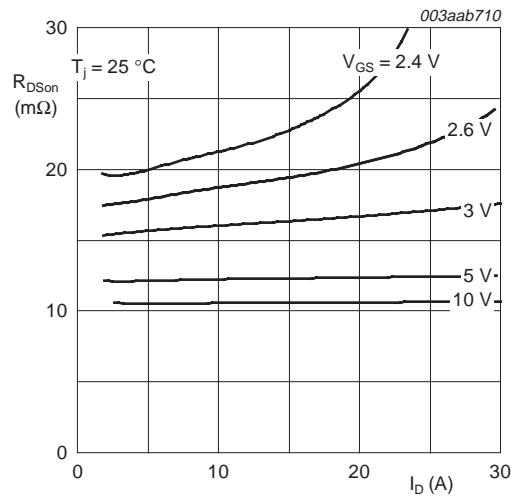
$T_j = 25\text{ }^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\text{ }\mu\text{A}; V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ }^\circ\text{C}$	20	-	-	V
		$T_j = -55\text{ }^\circ\text{C}$	18	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 250\text{ }\mu\text{A}; V_{DS} = V_{GS}$ ; see <a href="#">Figure 9</a> and <a href="#">10</a>				
		$T_j = 25\text{ }^\circ\text{C}$	0.5	1.0	1.5	V
		$T_j = 175\text{ }^\circ\text{C}$	0.3	-	-	V
		$T_j = -55\text{ }^\circ\text{C}$	-	-	1.8	V
$I_{DSS}$	drain leakage current	$V_{DS} = 20\text{ V}; V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ }^\circ\text{C}$	-	0.05	1.0	$\mu\text{A}$
		$T_j = 175\text{ }^\circ\text{C}$	-	-	500	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = \pm 12\text{ V}; V_{DS} = 0\text{ V}$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 5\text{ V}; I_D = 25\text{ A}$ ; see <a href="#">Figure 6</a> and <a href="#">8</a>				
		$T_j = 25\text{ }^\circ\text{C}$	-	13.5	16	m $\Omega$
		$T_j = 175\text{ }^\circ\text{C}$	-	24.3	28.8	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 25\text{ A}; V_{DS} = 10\text{ V}; V_{GS} = 5\text{ V}$ ; see <a href="#">Figure 11</a> and <a href="#">12</a>	-	15.1	-	nC
$Q_{GS}$	gate-source charge		-	4.5	-	nC
$Q_{GD}$	gate-drain charge		-	4.2	-	nC
$C_{iss}$	input capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 20\text{ V}; f = 1\text{ MHz}$ ; see <a href="#">Figure 14</a>	-	800	-	pF
$C_{oss}$	output capacitance		-	260	-	pF
$C_{rss}$	reverse transfer capacitance		-	190	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 10\text{ V}; I_D = 25\text{ A}; V_{GS} = 10\text{ V}$ ; $R_G = 5.6\text{ }\Omega$	-	4	-	ns
$t_r$	rise time		-	12.5	-	ns
$t_{d(off)}$	turn-off delay time		-	30	-	ns
$t_f$	fall time		-	23	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25\text{ A}; V_{GS} = 0\text{ V}$ ; see <a href="#">Figure 13</a>	-	0.98	1.2	V



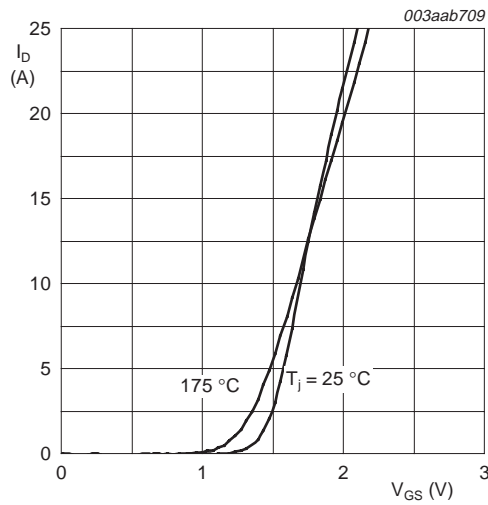
T<sub>j</sub> = 25 °C

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



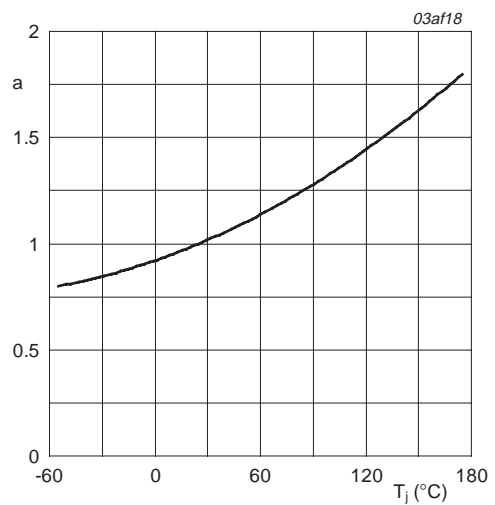
T<sub>j</sub> = 25 °C

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



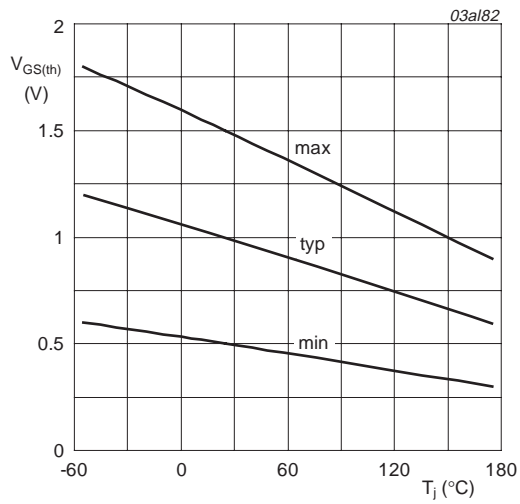
T<sub>j</sub> = 25 °C and 175 °C; V<sub>DS</sub> > I<sub>D</sub> × R<sub>DSon</sub>

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



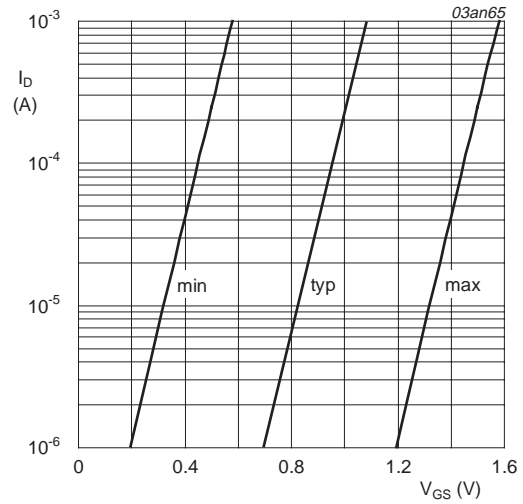
$$a = \frac{R_{DSon}}{R_{DSon(25^{\circ}C)}}$$

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



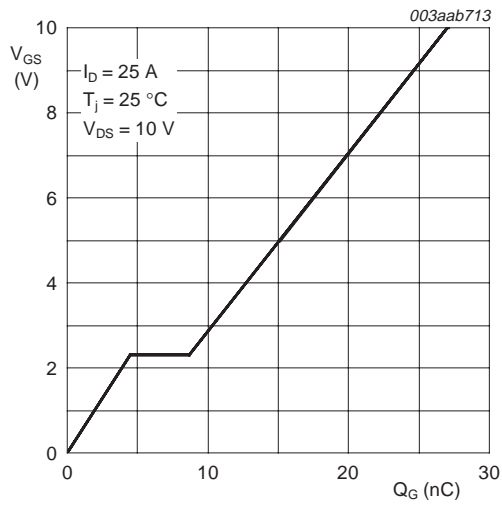
$I_D = 0.25 \text{ mA}; V_{DS} = V_{GS}$

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



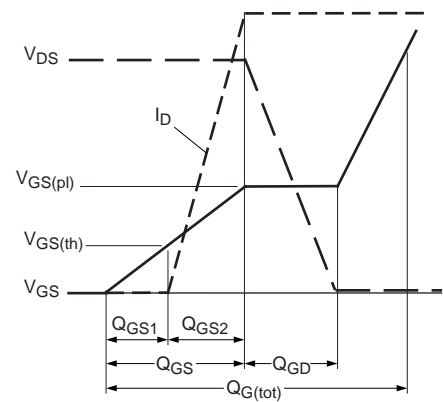
$T_j = 25 \text{ }^\circ\text{C}; V_{DS} = 5 \text{ V}$

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



$I_D = 25 \text{ A}; V_{DS} = 10 \text{ V}$

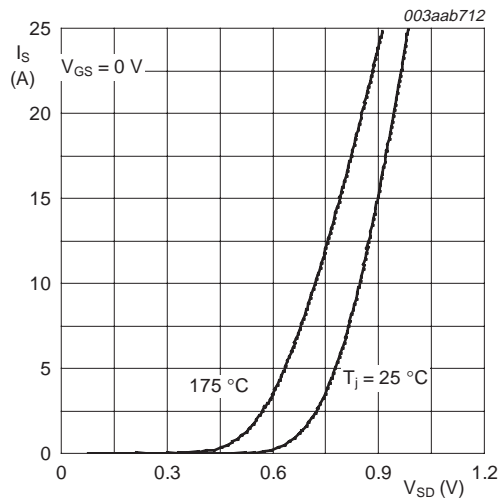
Fig 11. Gate-source voltage as a function of gate charge; typical values



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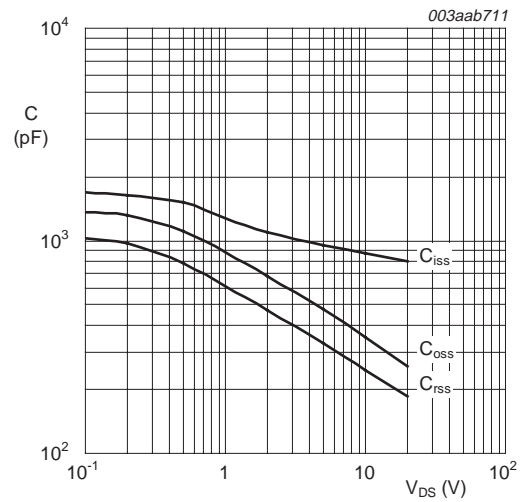
Fig 12. Gate charge waveform definitions





$T_j = 25\text{ °C}$  and  $175\text{ °C}$ ;  $V_{GS} = 0\text{ V}$

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



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

**Fig 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**

7. Package outline

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

SOT428

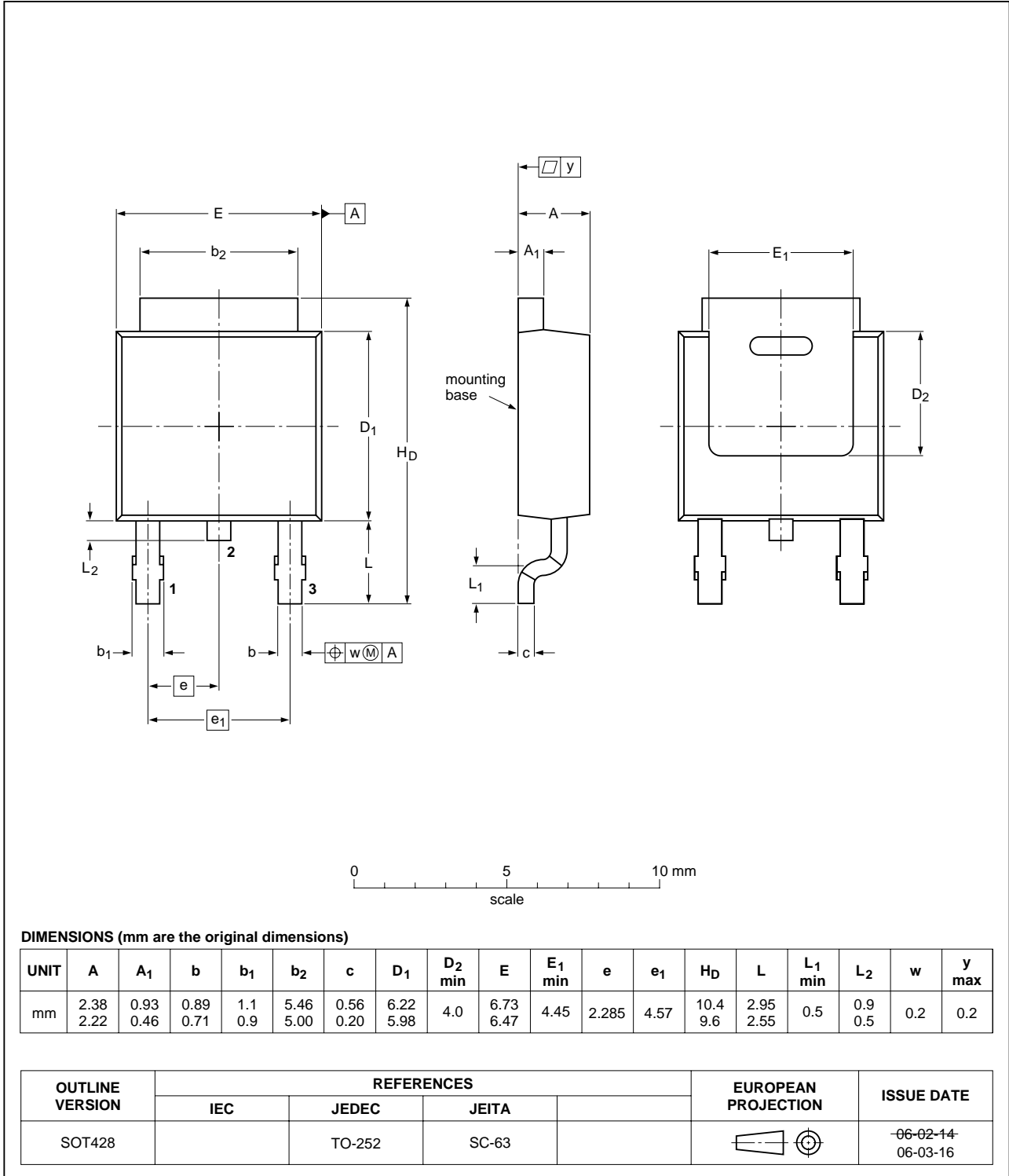


Fig 15. Package outline SOT428 (DPAK)

## 8. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHD38N02LT_2	20070202	Product data sheet	-	PHB_PHD38N02LT-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>• PHB38N02LT has been discontinued.</li></ul>			
PHB_PHD38N02LT-01 (9397 750 11614)	20030630	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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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