

# PHP191NQ06LT

## N-channel TrenchMOS logic level FET

Rev. 02 — 14 January 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

- Low conduction losses due to low on-state resistance
- Suitable for logic level gate drive sources

### 1.3 Applications

- DC-to-DC convertors
- Motors, lamps and solenoids
- General industrial applications
- Uninterruptible power supplies

### 1.4 Quick reference data

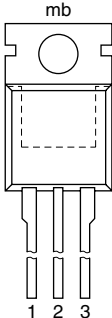
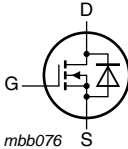
Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ }^{\circ}\text{C}$ ; $T_j \leq 175\text{ }^{\circ}\text{C}$	-	-	55	V
$I_D$	drain current	$T_{mb} = 25\text{ }^{\circ}\text{C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a> and <a href="#">3</a>	-	-	75	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 2</a>	-	-	300	W
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 5\text{ V}$ ; $I_D = 25\text{ A}$ ; $V_{DS} = 44\text{ V}$ ; $T_j = 25\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 11</a>	-	37.6	-	nC
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ; $T_j = 25\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 10</a> and <a href="#">9</a>	-	3.1	3.7	m $\Omega$



## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		
SOT78 (TO-220AB)				

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PHP191NQ06LT	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

## 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	$T_j \geq 25\text{ }^{\circ}\text{C}$ ; $T_j \leq 175\text{ }^{\circ}\text{C}$	-	55	V
$V_{DGR}$	drain-gate voltage	$T_j \geq 25\text{ }^{\circ}\text{C}$ ; $T_j \leq 175\text{ }^{\circ}\text{C}$ ; $R_{GS} = 20\text{ k}\Omega$	-	55	V
$V_{GS}$	gate-source voltage		-15	15	V
$I_D$	drain current	$V_{GS} = 10\text{ V}$ ; $T_{mb} = 100\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 1</a>	-	75	A
		$V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ }^{\circ}\text{C}$ ; 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; $T_{mb} = 25\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 3</a>	-	240	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 2</a>	-	300	W
$T_{stg}$	storage temperature		-55	175	$^{\circ}\text{C}$
$T_j$	junction temperature		-55	175	$^{\circ}\text{C}$
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25\text{ }^{\circ}\text{C}$	-	75	A
$I_{SM}$	peak source current	$t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; $T_{mb} = 25\text{ }^{\circ}\text{C}$	-	240	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; $I_D = 75\text{ A}$ ; $V_{sup} \leq 55\text{ V}$ ; unclamped; $R_{GS} = 50\text{ }\Omega$ ; $t_p \leq 0.21\text{ ms}$	-	560	mJ

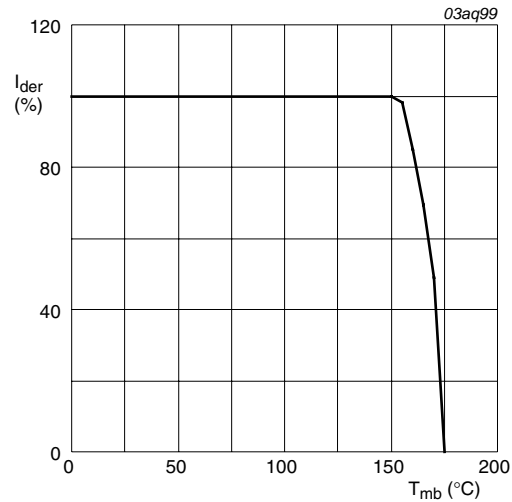


Fig 1. Normalized continuous drain current as a function of mounting base temperature

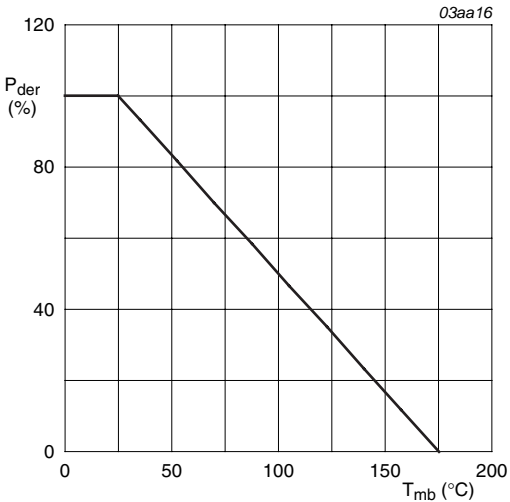


Fig 2. Normalized total power dissipation as a function of mounting base temperature

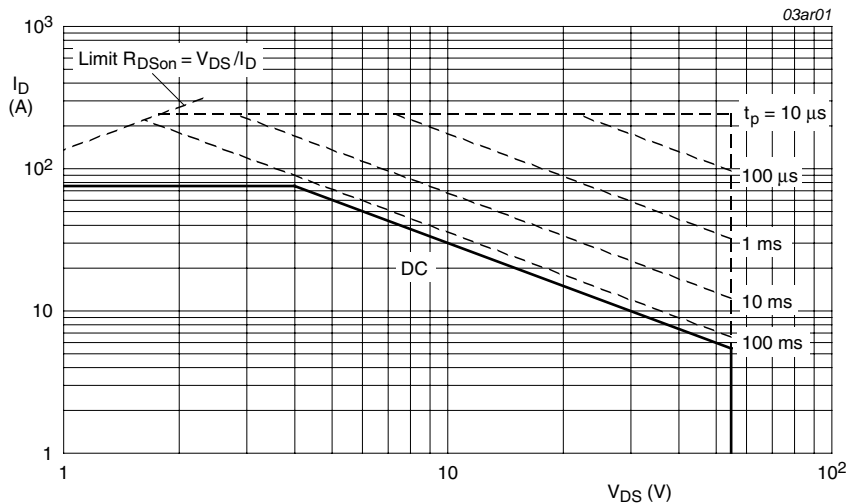


Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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>	-	-	0.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in still air	-	60	-	K/W

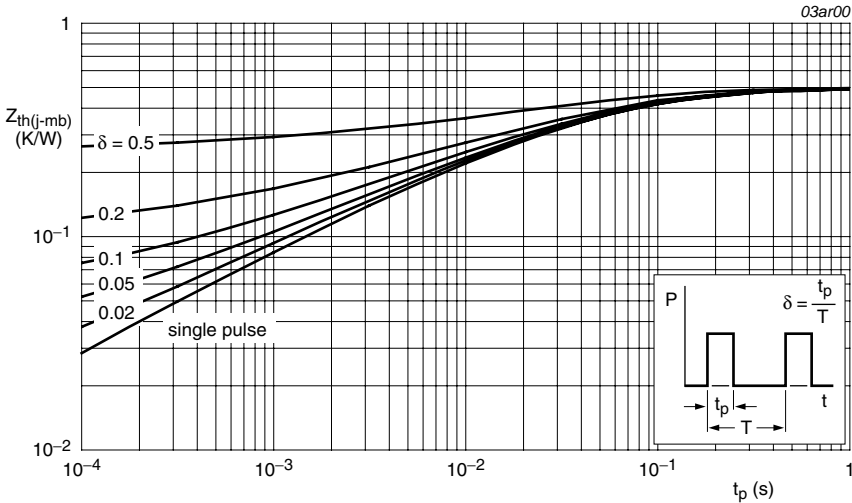


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

**Table 6. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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	50	-	-	V
		I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	55	-	-	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> = -55 °C; see <a href="#">Figure 7</a> and <a href="#">8</a>	-	-	2.2	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 175 °C; see <a href="#">Figure 7</a> and <a href="#">8</a>	0.5	-	-	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 7</a> and <a href="#">8</a>	1	1.5	2	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 55 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	-	1	μA
		V <sub>DS</sub> = 55 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> = 15 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	2	100	nA
		V <sub>GS</sub> = -15 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	2	100	nA
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 25 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 9</a>	-	-	4.4	mΩ
		V <sub>GS</sub> = 5 V; I <sub>D</sub> = 25 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 10</a> and <a href="#">9</a>	-	3.5	4.2	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; T <sub>j</sub> = 175 °C; see <a href="#">Figure 10</a> and <a href="#">9</a>	-	-	7.4	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 10</a> and <a href="#">9</a>	-	3.1	3.7	mΩ
Dynamic characteristics						
Q <sub>G(tot)</sub>	total gate charge	I <sub>D</sub> = 25 A; V <sub>DS</sub> = 44 V; V <sub>GS</sub> = 5 V; T <sub>j</sub> = 25 °C; see <a href="#">Figure 11</a>	-	95.6	-	nC
Q <sub>GS</sub>	gate-source charge		-	17.2	-	nC
Q <sub>GD</sub>	gate-drain charge		-	37.6	-	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>	-	7665	-	pF
C <sub>oss</sub>	output capacitance		-	1045	-	pF
C <sub>rss</sub>	reverse transfer capacitance		-	465	-	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 30 V; R <sub>L</sub> = 1.2 Ω; V <sub>GS</sub> = 5 V; R <sub>G(ext)</sub> = 10 Ω; T <sub>j</sub> = 25 °C	-	63	-	ns
t <sub>r</sub>	rise time		-	232	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	273	-	ns
t <sub>f</sub>	fall time		-	178	-	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>	-	0.79	1.2	V
t <sub>rr</sub>	reverse recovery time	I <sub>S</sub> = 20 A; dI <sub>S</sub> /dt = -100 A/μs; V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 25 V; T <sub>j</sub> = 25 °C	-	78	-	ns
Q <sub>r</sub>	recovered charge	V <sub>DS</sub> = 25 V; T <sub>j</sub> = 25 °C	-	171	-	nC

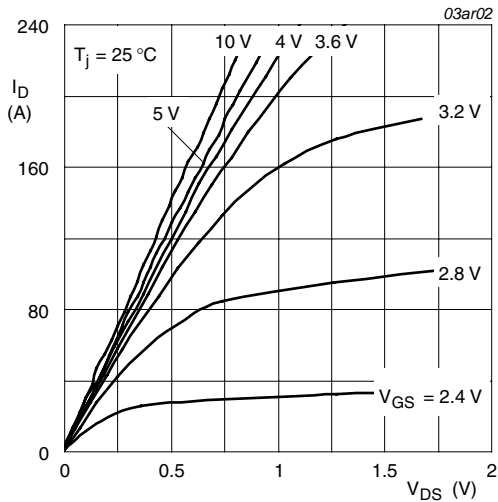


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

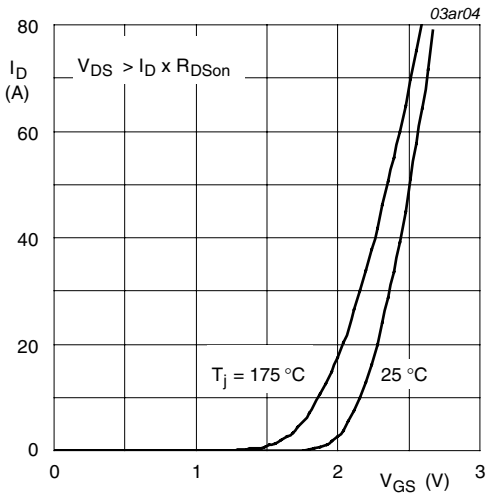


Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values

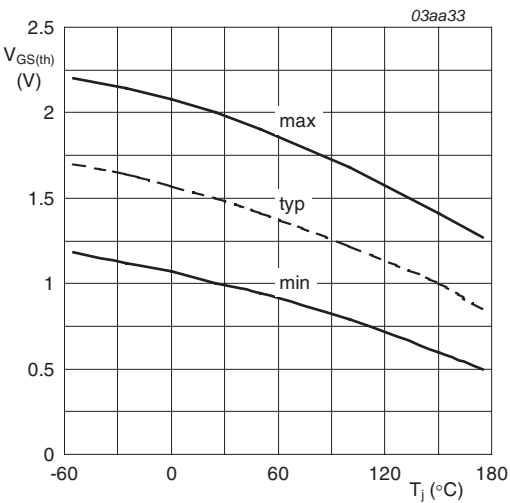


Fig 7. Gate-source threshold voltage as a function of junction temperature

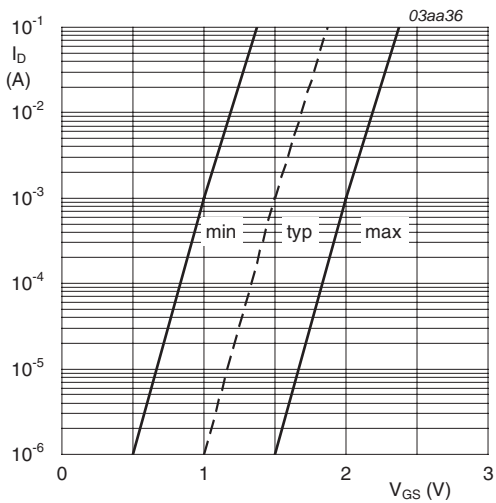
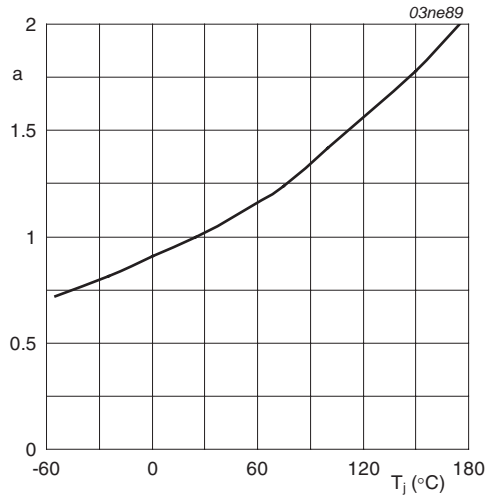
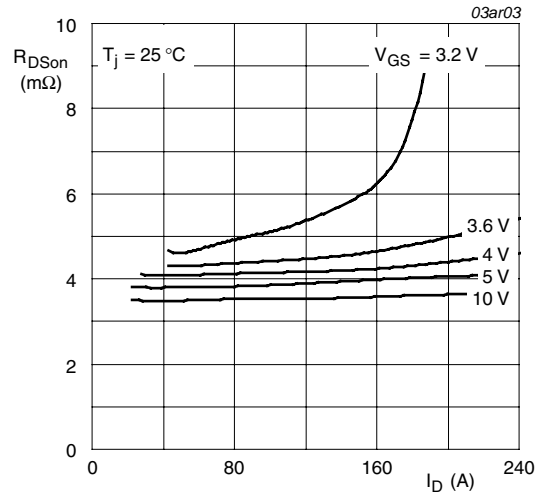


Fig 8. Sub-threshold drain current as a function of gate-source voltage



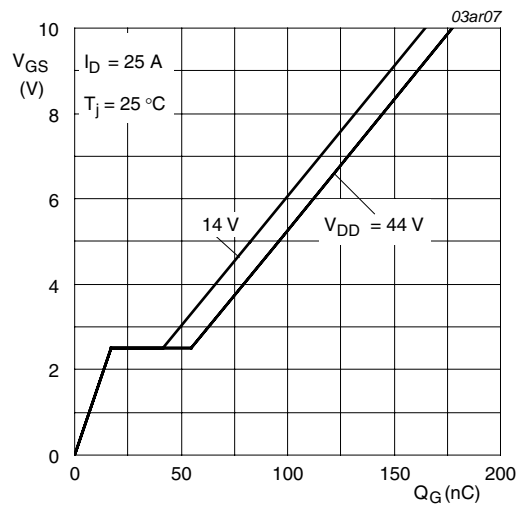
$$a = \frac{R_{DSon}}{R_{DSon(25^{\circ}\text{C})}}$$

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



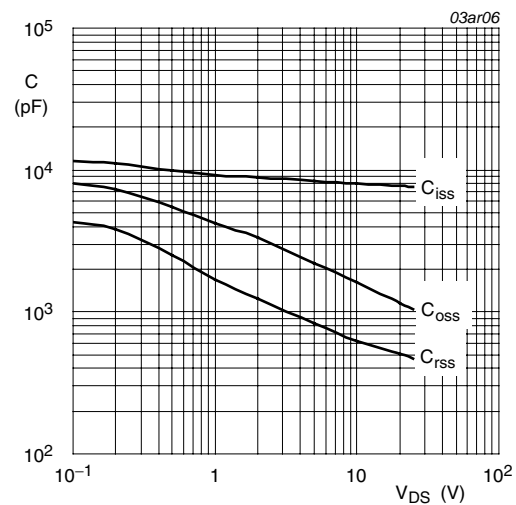
$$T_j = 25^{\circ}\text{C}$$

**Fig 10.** Drain-source on-state resistance as a function of drain current; typical values



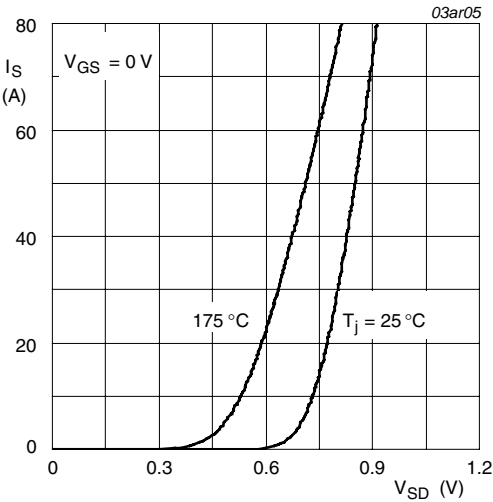
$$I_D = 25\text{ A}; V_{DS} = 14\text{ V and } 44\text{ V}$$

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



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

**Fig 12.** Sub-threshold drain current as a function of gate-source voltage



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

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



7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB SOT78

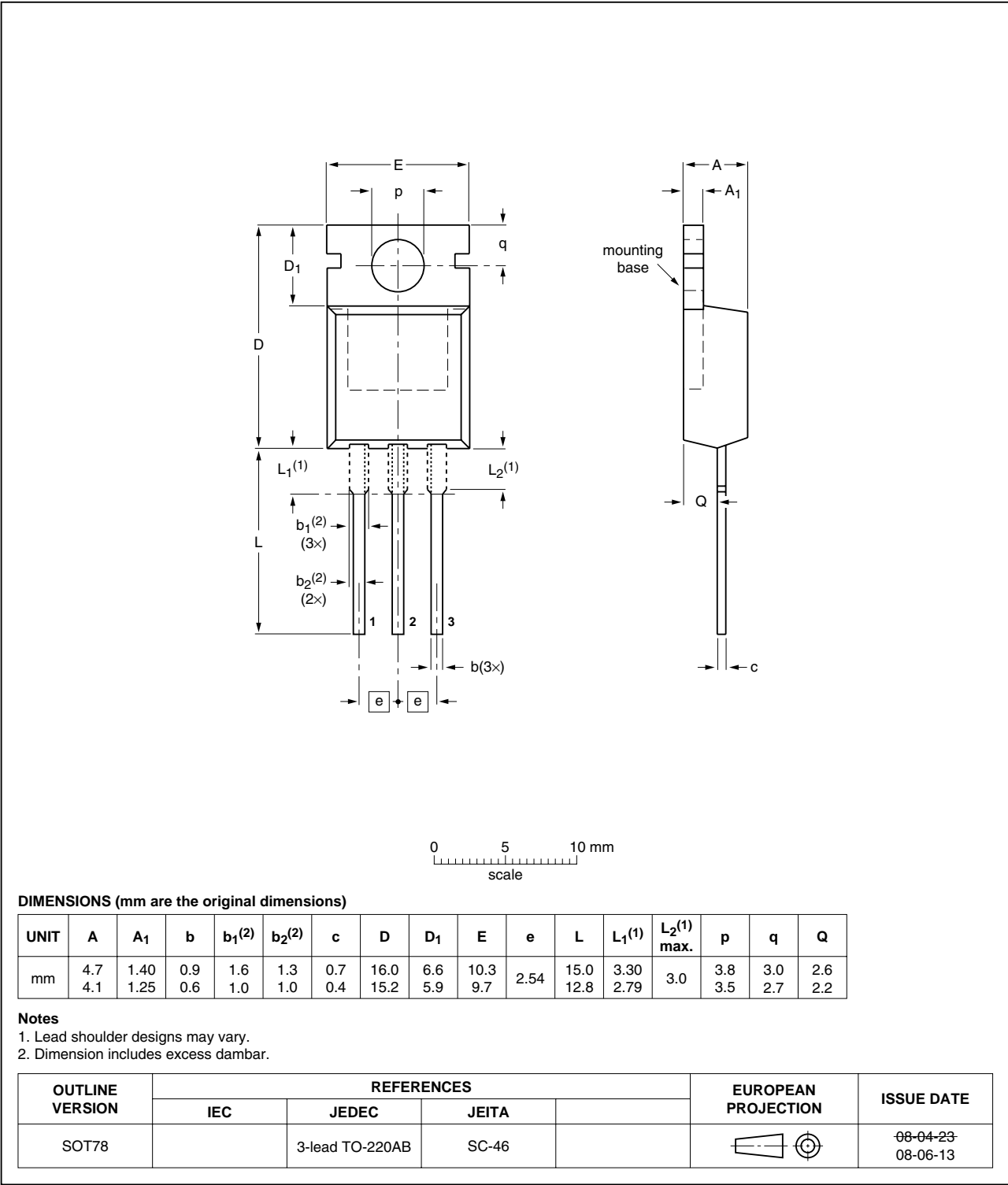


Fig 14. Package outline SOT78 (TO-220AB)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHP191NQ06LT_2	20100114	Product data sheet	-	PHP_PHB191NQ06LT-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 PHP191NQ06LT separated from data sheet PHP_PHB191NQ06LT-01.</li></ul>				
PHP_PHB191NQ06LT-01 (9397 750 13168)	20040505	Product data sheet	-	-

## 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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## 11. Contents

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<b>1</b>	<b>Product profile</b> . . . . .	<b>1</b>
1.1	General description . . . . .	1
1.2	Features and benefits . . . . .	1
1.3	Applications . . . . .	1
1.4	Quick reference data . . . . .	1
<b>2</b>	<b>Pinning information</b> . . . . .	<b>2</b>
<b>3</b>	<b>Ordering information</b> . . . . .	<b>2</b>
<b>4</b>	<b>Limiting values</b> . . . . .	<b>2</b>
<b>5</b>	<b>Thermal characteristics</b> . . . . .	<b>4</b>
<b>6</b>	<b>Characteristics</b> . . . . .	<b>5</b>
<b>7</b>	<b>Package outline</b> . . . . .	<b>9</b>
<b>8</b>	<b>Revision history</b> . . . . .	<b>10</b>
<b>9</b>	<b>Legal information</b> . . . . .	<b>11</b>
9.1	Data sheet status . . . . .	11
9.2	Definitions . . . . .	11
9.3	Disclaimers . . . . .	11
9.4	Trademarks . . . . .	12
<b>10</b>	<b>Contact information</b> . . . . .	<b>12</b>

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# AMEYA360

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➤ Sales :

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Email [amall@ameya360.com](mailto:amall@ameya360.com)

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