

# PHP30NQ15T

## N-channel TrenchMOS standard level FET

Rev. 03 — 3 March 2010

Product data sheet

## 1. Product profile

### 1.1 General description

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

### 1.3 Applications

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

### 1.4 Quick reference data

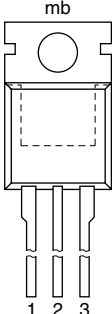
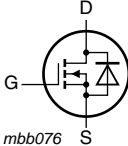
Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	150	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a> and <a href="#">2</a>	-	-	29	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C};$ see <a href="#">Figure 3</a>	-	-	150	W
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 30\text{ A};$ $V_{DS} = 120\text{ V}; T_j = 25\text{ °C};$ see <a href="#">Figure 13</a>	-	20	27	nC
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 15\text{ A};$ $T_j = 25\text{ °C};$ see <a href="#">Figure 11</a> and <a href="#">12</a>	-	60	63	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

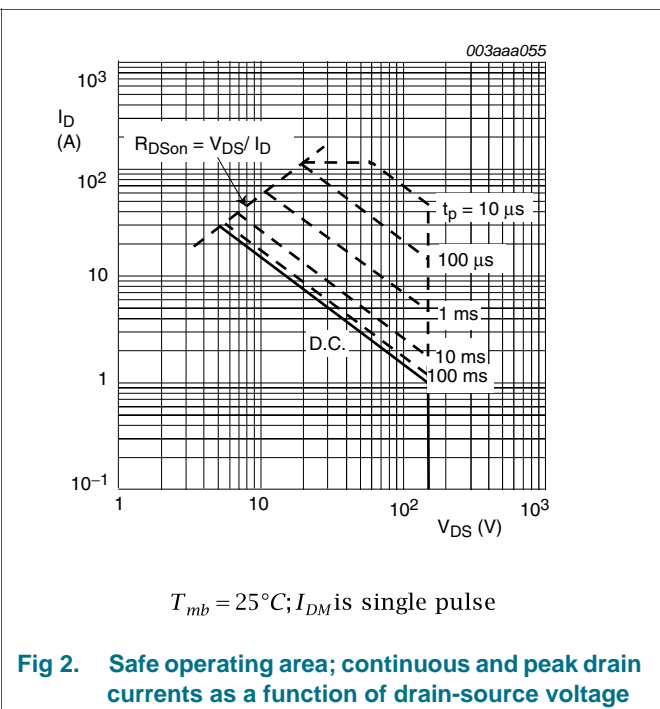
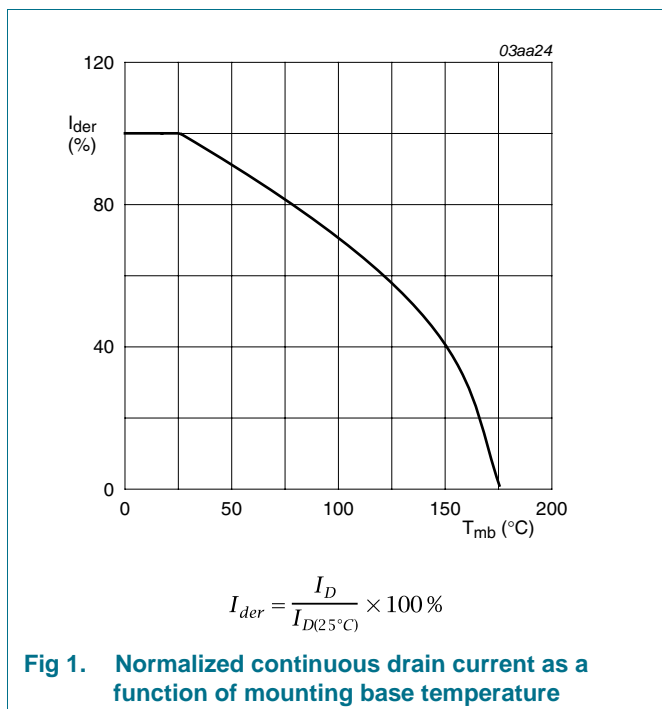
Type number	Package		Version
	Name	Description	
PHP30NQ15T	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

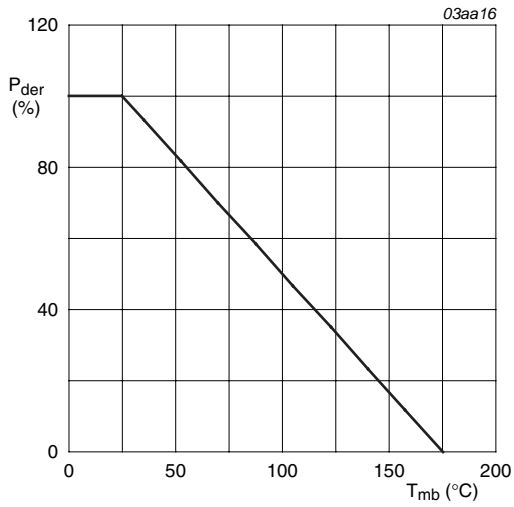
### 4. Limiting values

**Table 4. Limiting values**

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

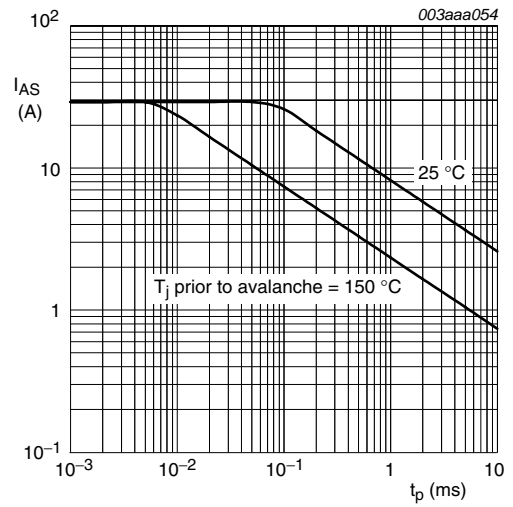
Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C	-	150	V
V <sub>DGR</sub>	drain-gate voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C; R <sub>GS</sub> = 20 kΩ	-	150	V
V <sub>GS</sub>	gate-source voltage		-20	20	V
I <sub>D</sub>	drain current	V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 25 °C; see <a href="#">Figure 1</a> and <a href="#">2</a>	-	29	A
		V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 100 °C; see <a href="#">Figure 1</a>	-	20	A
I <sub>DM</sub>	peak drain current	t <sub>p</sub> ≤ 10 μs; pulsed; T <sub>mb</sub> = 25 °C; see <a href="#">Figure 2</a>	-	116	A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; see <a href="#">Figure 3</a>	-	150	W
T <sub>stg</sub>	storage temperature		-55	175	°C
T <sub>j</sub>	junction temperature		-55	175	°C
<b>Source-drain diode</b>					
I <sub>S</sub>	source current	T <sub>mb</sub> = 25 °C	-	29	A
I <sub>SM</sub>	peak source current	t <sub>p</sub> ≤ 10 μs; pulsed; T <sub>mb</sub> = 25 °C	-	116	A
<b>Avalanche ruggedness</b>					
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	V <sub>GS</sub> = 10 V; T <sub>j(initial)</sub> = 25 °C; I <sub>D</sub> = 26 A; V <sub>sup</sub> ≤ 25 V; unclamped; R <sub>GS</sub> = 50 Ω; t <sub>p</sub> = 0.2 ms; see <a href="#">Figure 4</a>	-	502	mJ
I <sub>AS</sub>	non-repetitive avalanche current	V <sub>sup</sub> ≤ 25 V; V <sub>GS</sub> = 10 V; T <sub>j(initial)</sub> = 25 °C; R <sub>GS</sub> = 50 Ω; unclamped; see <a href="#">Figure 4</a>	-	29	A





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

Fig 3. Normalized total power dissipation as a function of mounting base temperature



Unclamped inductive load;  $V_{DS} \leq 25V$ ;  
 $R_{GS} = 50\Omega$ ;  $V_{GS} = 10V$ ; starting at  $T_j = 25^\circ C$  and  $150^\circ C$ .

Fig 4. Non-repetitive avalanche ruggedness current as a function of pulse duration

## 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 5</a>	-	-	1	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in still air	-	60	-	K/W

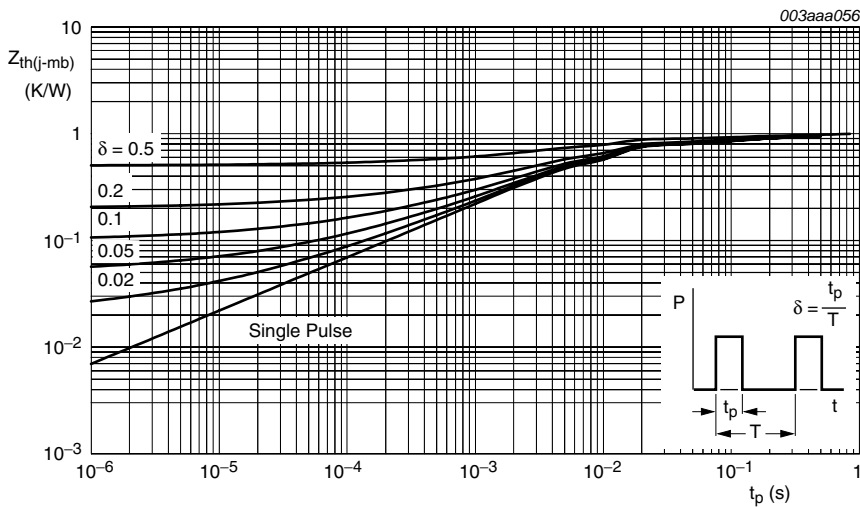


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

**Table 6. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	150	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 8</a>	2	3	4	V
		$I_D = 1 \text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 175 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 8</a>	1	-	-	V
$I_{DSS}$	drain leakage current	$V_{DS} = 150 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	0.05	10	$\mu\text{A}$
		$V_{DS} = 150 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 175 \text{ }^\circ\text{C}$	-	-	500	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = 10 \text{ V}$ ; $V_{DS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	0.02	100	nA
		$V_{GS} = -10 \text{ V}$ ; $V_{DS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	0.02	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}$ ; $I_D = 15 \text{ A}$ ; $T_j = 175 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 11</a> and <a href="#">12</a>	-	-	176	m $\Omega$
		$V_{GS} = 10 \text{ V}$ ; $I_D = 15 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 11</a> and <a href="#">12</a>	-	60	63	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 30 \text{ A}$ ; $V_{DS} = 120 \text{ V}$ ; $V_{GS} = 10 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 13</a>	-	55	-	nC
$Q_{GS}$	gate-source charge		-	10	-	nC
$Q_{GD}$	gate-drain charge		-	20	27	nC
$C_{iss}$	input capacitance	$V_{DS} = 25 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 14</a>	-	2390	-	pF
$C_{oss}$	output capacitance		-	240	-	pF
$C_{rSS}$	reverse transfer capacitance		-	98	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 75 \text{ V}$ ; $R_L = 2.7 \text{ } \Omega$ ; $V_{GS} = 10 \text{ V}$ ; $R_{G(ext)} = 5.6 \text{ } \Omega$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	14	-	ns
$t_r$	rise time		-	50	-	ns
$t_{d(off)}$	turn-off delay time		-	48	-	ns
$t_f$	fall time		-	38	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25 \text{ A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 15</a>	-	0.9	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 20 \text{ A}$ ; $di_S/dt = -100 \text{ A}/\mu\text{s}$ ; $V_{GS} = 0 \text{ V}$ ; $V_{DS} = 25 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	105	-	ns
$Q_r$	recovered charge		-	0.55	-	$\mu\text{C}$

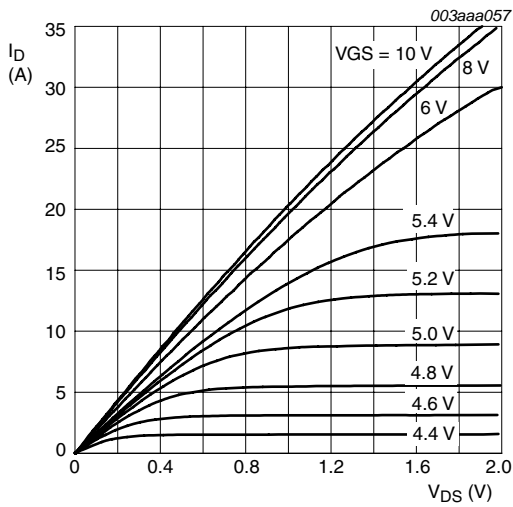


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values

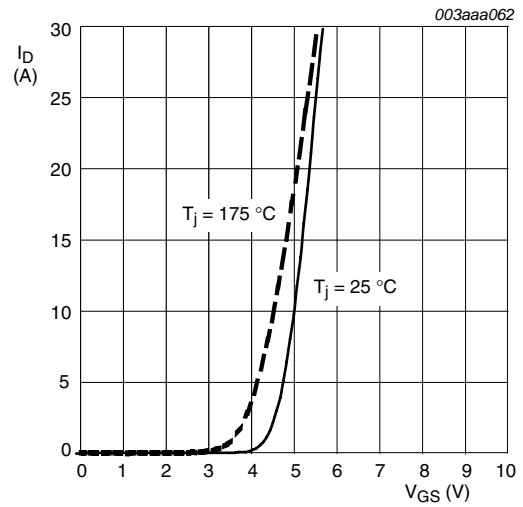


Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values

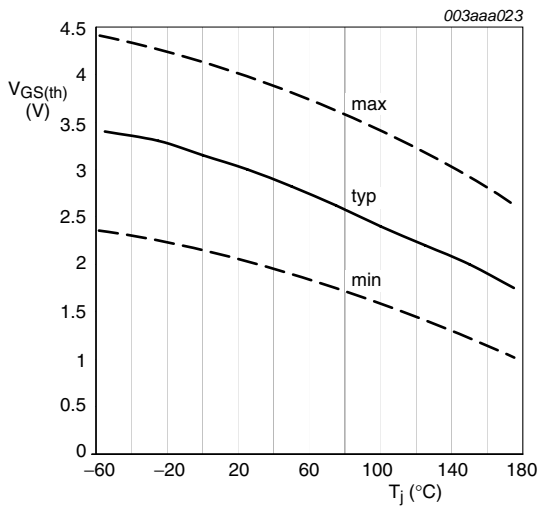


Fig 8. Gate-source threshold voltage as a function of junction temperature

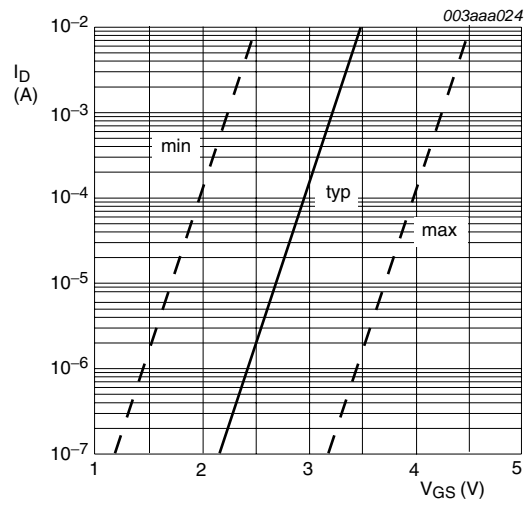
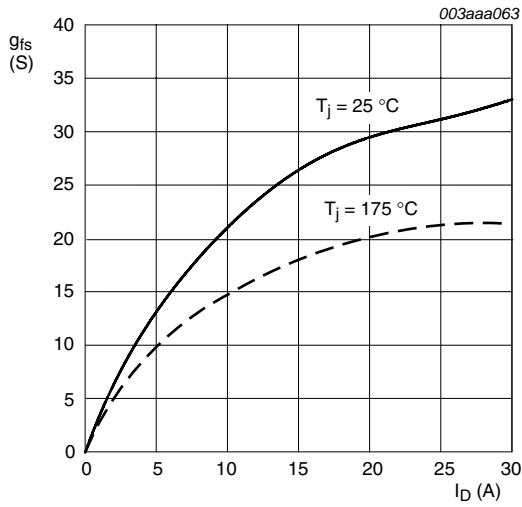
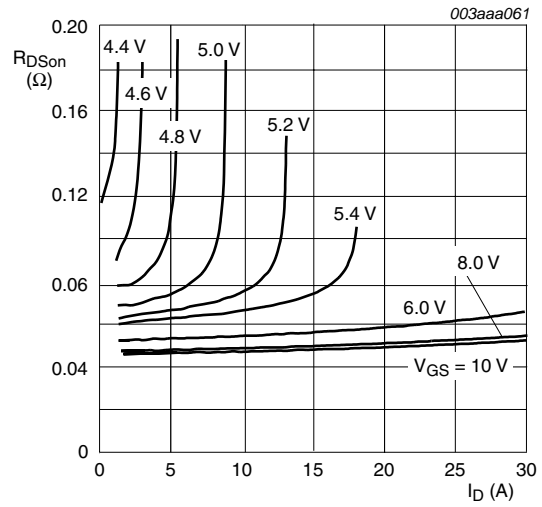


Fig 9. Sub-threshold drain current as a function of gate-source voltage



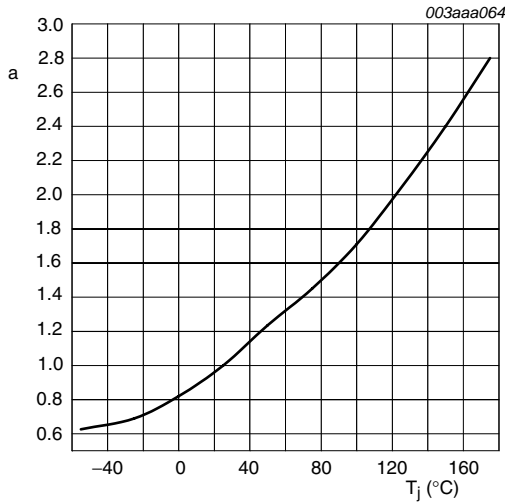
$T_j = 25^\circ\text{C}$  and  $175^\circ\text{C}; V_{DS} > I_D \times R_{DSon}$

Fig 10. Forward transconductance as a function of drain current; typical values



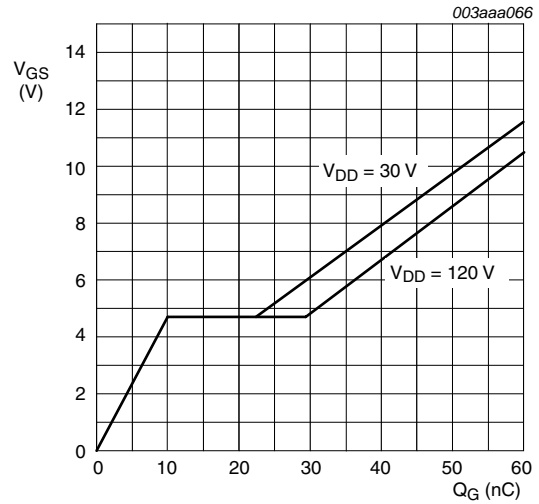
$T_j = 25^\circ\text{C}$

Fig 11. Drain-source on-state resistance as a function of drain current; typical values



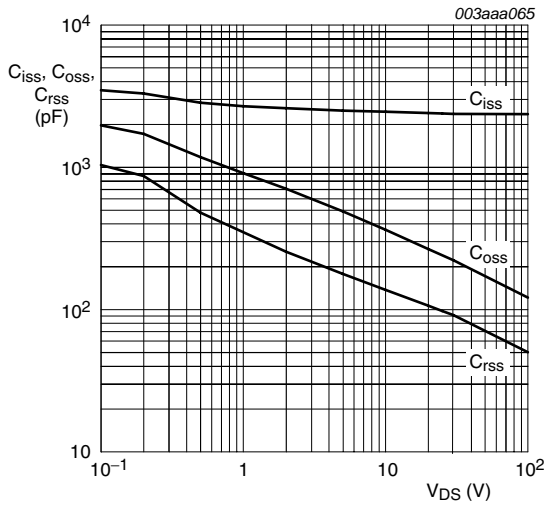
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature



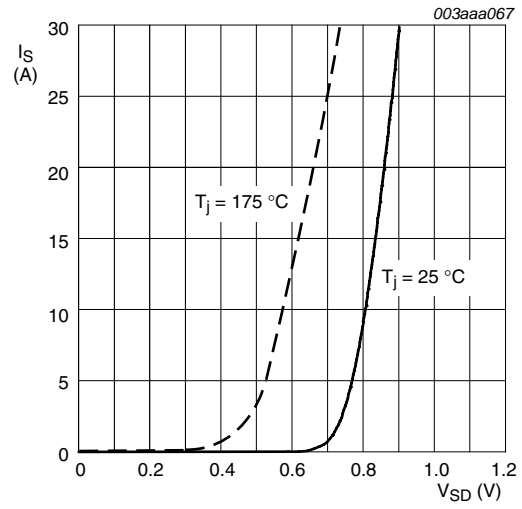
$I_D = 30\text{ A}; V_{DS} = 30\text{ V}$  and  $120\text{ V}$

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



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

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



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

**Fig 15. 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

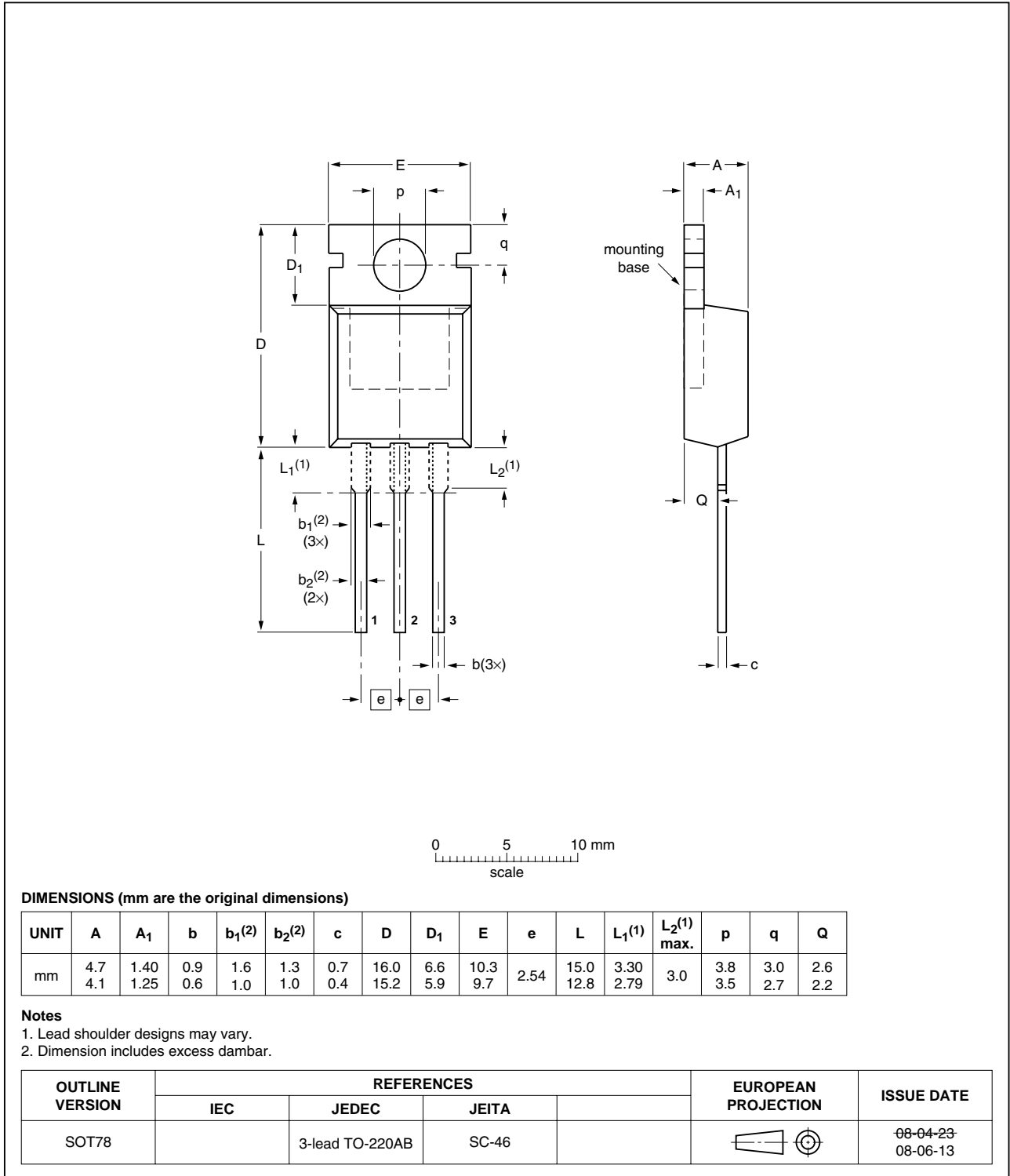


Fig 16. Package outline SOT78 (TO-220AB)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHP30NQ15T_3	20100303	Product data sheet	-	PHB_PHP30NQ15T-02
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>• Typenumber PHP30NQ15T separated from data sheet PHB_PHP30NQ15T-02.</li></ul>		
PHB_PHP30NQ15T-02 (9397 750 08037)	20010312	Product specification	-	PHB_PHP30NQ15T_1
PHB_PHP30NQ15T_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.

[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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