

# PHP79NQ08LT

## N-channel TrenchMOS logic level FET

Rev. 03 — 26 April 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 purpose power switching
- Uninterruptible power supplies

### 1.4 Quick reference data

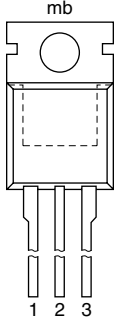
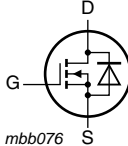
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	-	75	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$	-	-	73	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	157	W
<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> ; see <a href="#">Figure 10</a>	-	14	16	mΩ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 5\text{ V}$ ; $I_D = 25\text{ A}$ ; $V_{DS} = 60\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>	-	14	-	nC



## 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
PHP79NQ08LT	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	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	75	V
$V_{DGR}$	drain-gate voltage	$T_j \leq 175\text{ °C}; T_j \geq 25\text{ °C}; R_{GS} = 20\text{ k}\Omega$	-	-	75	V
$V_{GS}$	gate-source voltage		-15	-	15	V
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C}$	-	-	73	A
		$V_{GS} = 5\text{ V}; T_{mb} = 100\text{ °C}$ ; see <a href="#">Figure 1</a>	-	-	47	A
		$V_{GS} = 10\text{ V}; T_{mb} = 100\text{ °C}$	-	-	51	A
		$V_{GS} = 5\text{ V}; T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a>	-	-	67	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>	-	-	157	W
$T_{stg}$	storage temperature		-55	-	175	°C
$T_j$	junction temperature		-55	-	175	°C

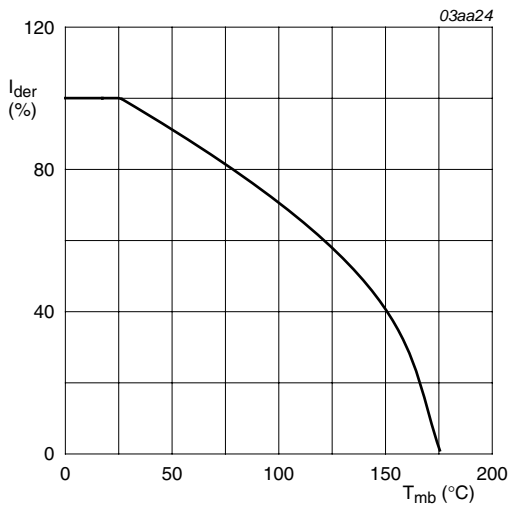
### Source-drain diode

$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	-	67	A
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**Table 4. Limiting values ...continued**

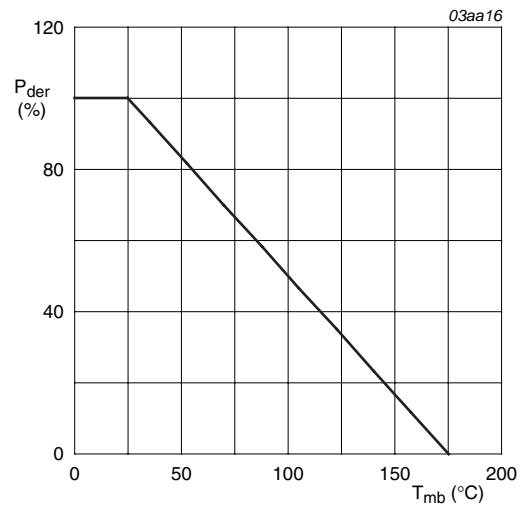
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{SM}$	peak source current	$t_p \leq 10 \mu s$ ; pulsed; $T_{mb} = 25^\circ C$	-	-	270	A
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10 V$ ; $T_{j(initial)} = 25^\circ C$ ; $I_D = 35 A$ ; $V_{sup} \leq 75 V$ ; $R_{GS} = 50 \Omega$ ; $t_p = 0.07 ms$ ; unclamped	-	-	120	mJ



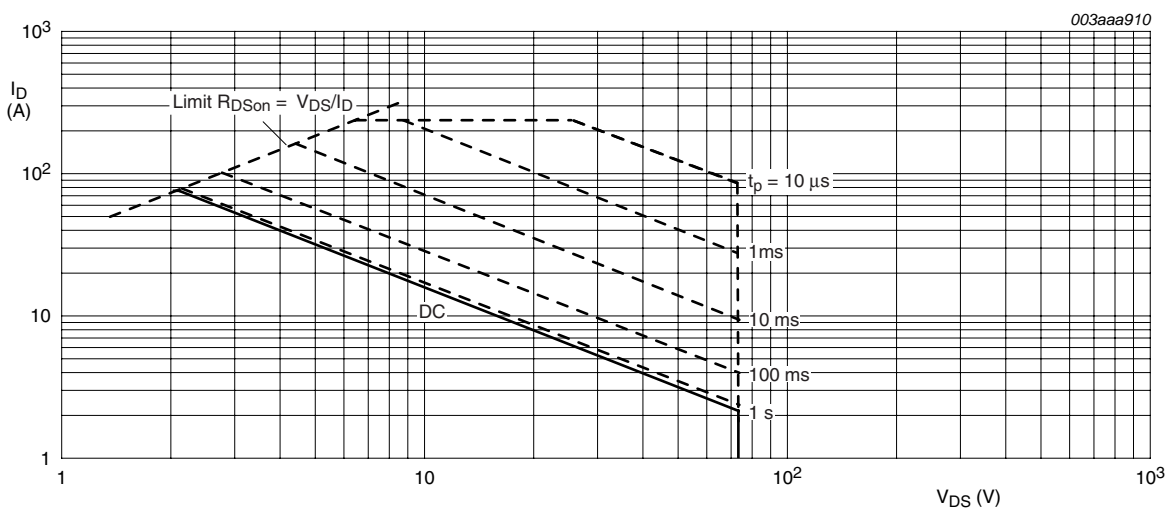
$$I_{der} = \frac{I_D}{I_{D(25^\circ C)}} \times 100\%$$

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



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

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



$T_{mb} = 25^\circ C$ ;  $I_{DM}$  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
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 4</a>	-	-	0.95	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in still air	-	60	-	K/W

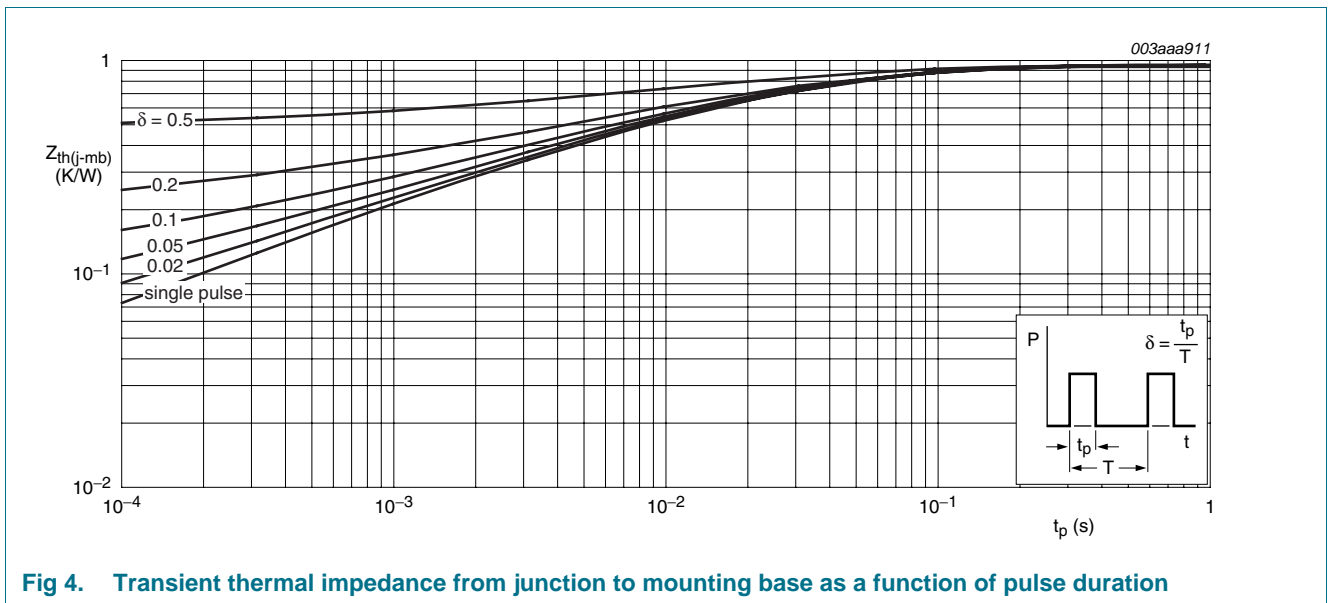
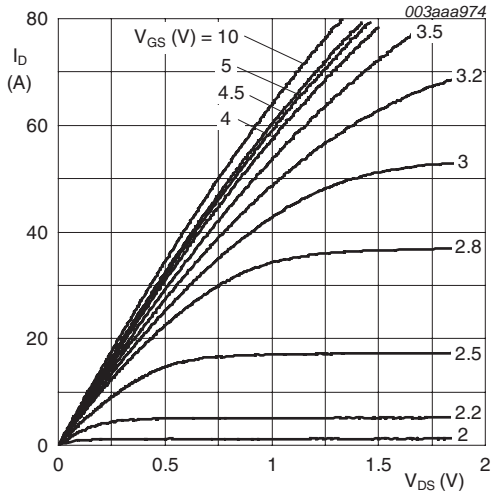


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

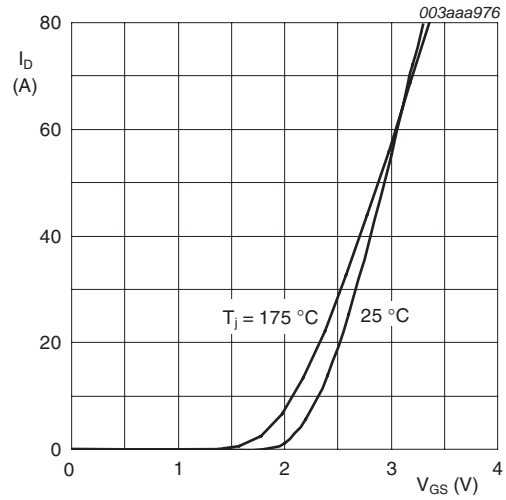
**Table 6. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	70	-	-	V
		$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	75	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see <a href="#">Figure 7</a> ; see <a href="#">Figure 8</a>	0.5	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see <a href="#">Figure 7</a> ; see <a href="#">Figure 8</a>	-	-	2.3	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 7</a> ; see <a href="#">Figure 8</a>	1.1	1.5	2	V
$I_{DSS}$	drain leakage current	$V_{DS} = 75 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.02	1	$\mu\text{A}$
		$V_{DS} = 75 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$	-	-	500	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = 15 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
		$V_{GS} = -15 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>	-	15.5	18	m $\Omega$
		$V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>	-	-	34	m $\Omega$
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>	-	14	16	m $\Omega$
		$V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>	-	15	16.4	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 60 \text{ V}; V_{GS} = 5 \text{ V};$ $T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>	-	30	-	nC
$Q_{GS}$	gate-source charge		-	6	-	nC
$Q_{GD}$	gate-drain charge		-	14	-	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 13</a>	-	3026	-	pF
$C_{oss}$	output capacitance		-	301	-	pF
$C_{rss}$	reverse transfer capacitance		-	140	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30 \text{ V}; R_L = 1.2 \text{ } \Omega; V_{GS} = 5 \text{ V};$ $R_{G(ext)} = 10 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$	-	30	-	ns
$t_r$	rise time		-	102	-	ns
$t_{d(off)}$	turn-off delay time		-	101	-	ns
$t_f$	fall time		-	57	-	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 14</a>	-	0.85	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 20 \text{ A}; di_S/dt = -100 \text{ A}/\mu\text{s};$ $V_{GS} = -10 \text{ V}; V_{DS} = 30 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	90	-	ns
$Q_r$	recovered charge		-	110	-	nC



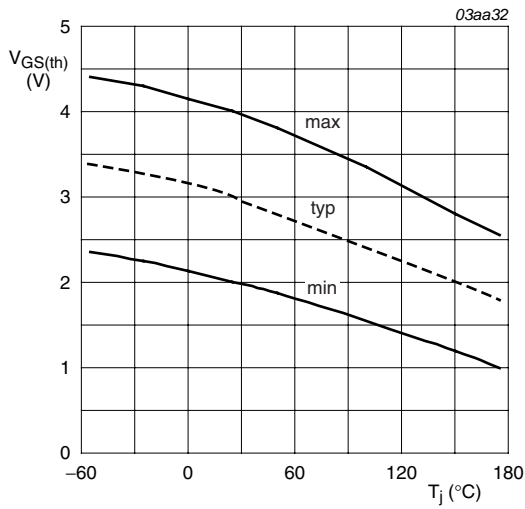
$T_j = 25^\circ\text{C}$

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



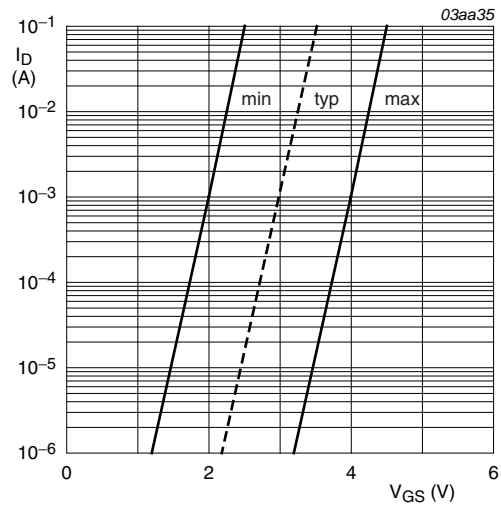
$T_j = 25^\circ\text{C}$  and  $175^\circ\text{C}; V_{DS} > I_D \times R_{DS(on)}$

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



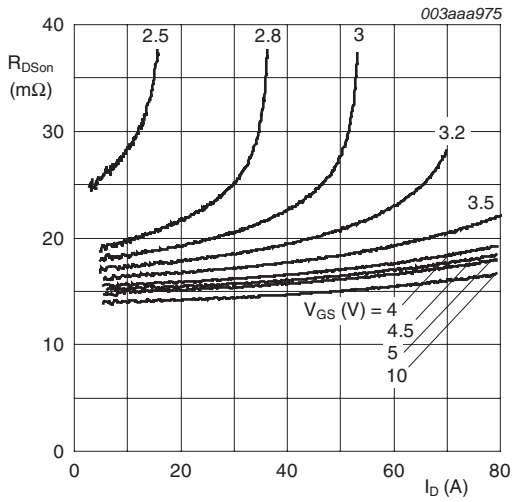
$I_D = 1\text{mA}; V_{DS} = V_{GS}$

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



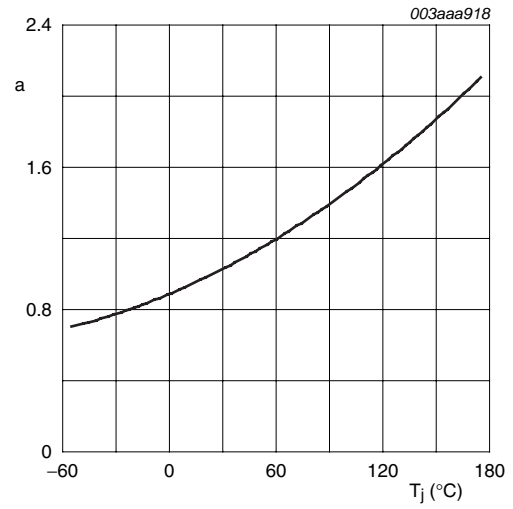
$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$

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



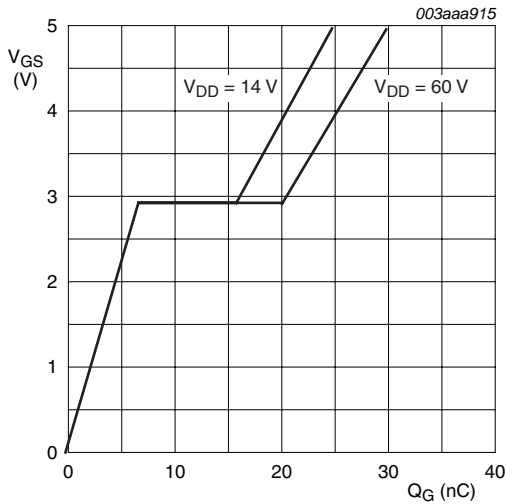
$T_j = 25^\circ\text{C}$

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



$$a = \frac{R_{DS(on)}}{R_{DS(on)@25^\circ\text{C}}}$$

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



$I_D = 25\text{A}; V_{DS} = 14\text{V}$  and  $60\text{V}$

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

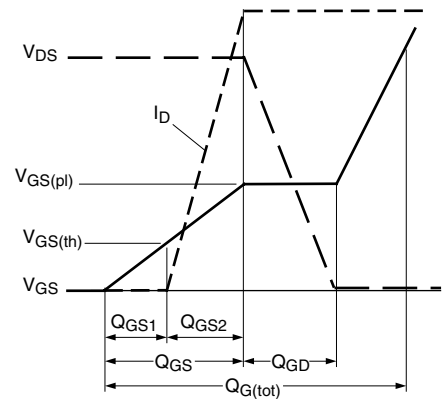
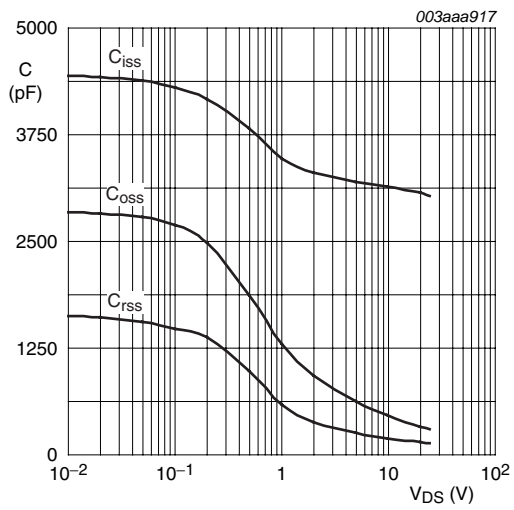
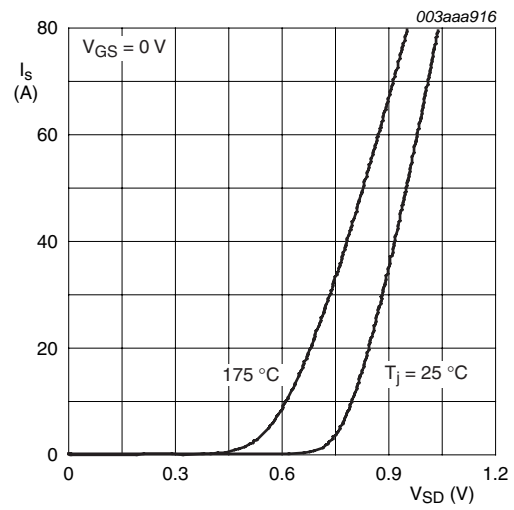


Fig 12. Gate charge waveform definitions



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

Fig 13. 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 14. 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

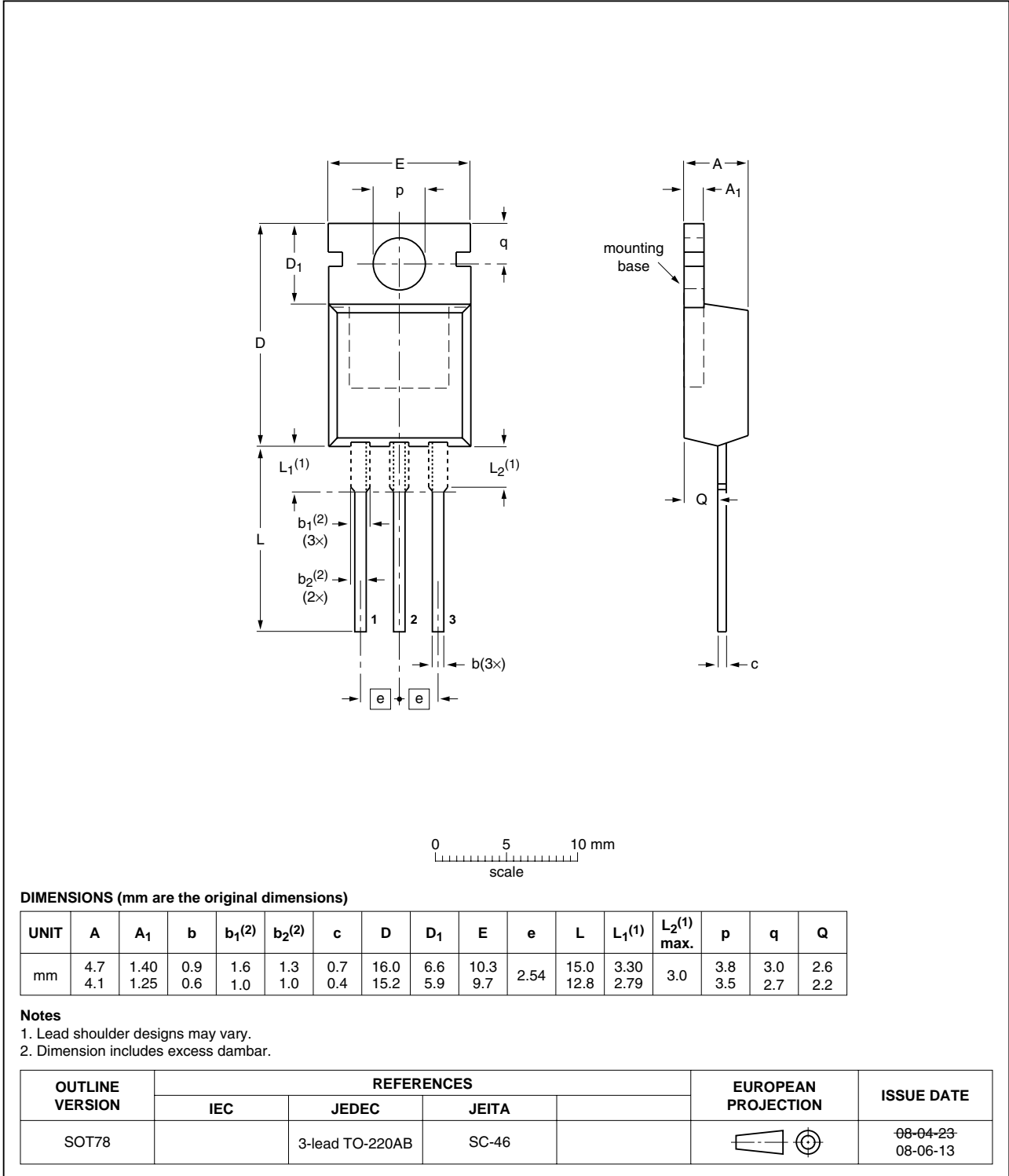


Fig 15. Package outline SOT78 (TO-220AB)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHP79NQ08LT_3	20100426	Product data sheet	-	PHP79NQ08LT_2
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>
PHP79NQ08LT_2	20100419	Product data sheet	-	PHP79NQ08LT_1

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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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