

PHP3055E

N-channel TrenchMOS standard level FET

Rev. 07 — 26 February 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

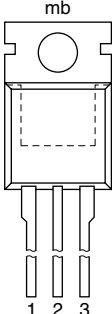
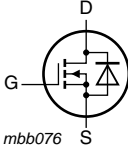
Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	-	60	V
I_D	drain current	$T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 1 and 3	-	-	10.3	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	33	W
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10\text{ V}$; $I_D = 10\text{ A}$; $V_{DS} = 44\text{ V}$; $T_j = 25\text{ °C}$; see Figure 12	-	3.2	-	nC
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 5.5\text{ A}$; $T_j = 25\text{ °C}$; see Figure 10 and 11	-	120	150	mΩ



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

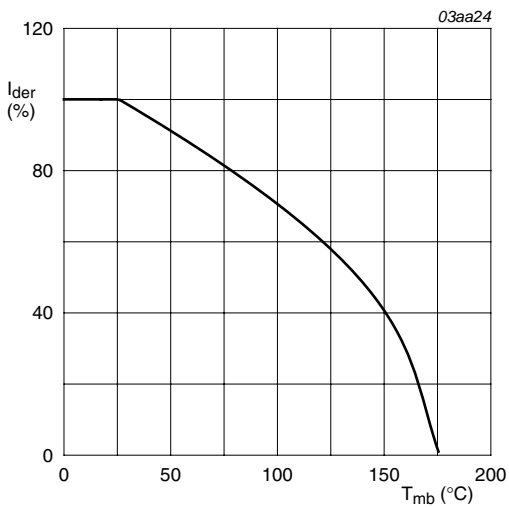
Type number	Package		Version
	Name	Description	
PHP3055E	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

4. Limiting values

Table 4. Limiting values

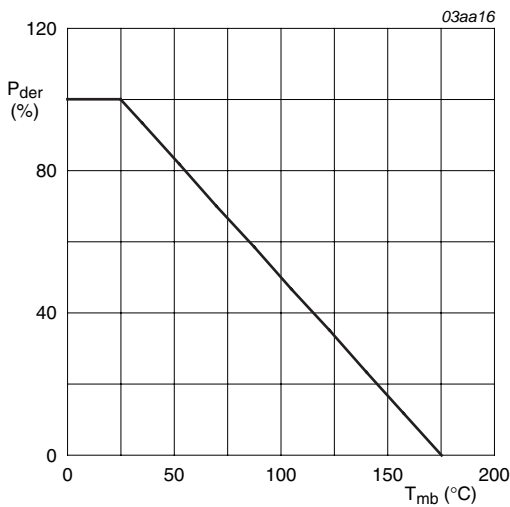
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	60	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	60	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; see Figure 1	-	7.3	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 1 and 3	-	10.3	A
I_{DM}	peak drain current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$; see Figure 3	-	41	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	33	W
T_{stg}	storage temperature		-55	175	°C
T_j	junction temperature		-55	175	°C
Source-drain diode					
I_S	source current	$T_{mb} = 25\text{ °C}$	-	10.3	A
I_{SM}	peak source current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$	-	41	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; $I_D = 3.3\text{ A}$; $V_{sup} \leq 25\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped; $t_p = 0.22\text{ ms}$	-	25	mJ
$I_{DS(AL)S}$	non-repetitive drain-source avalanche current	$V_{GS} = 10\text{ V}$; $V_{sup} \leq 25\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $T_{j(init)} = 25\text{ °C}$; unclamped; see Figure 4	-	10.3	A



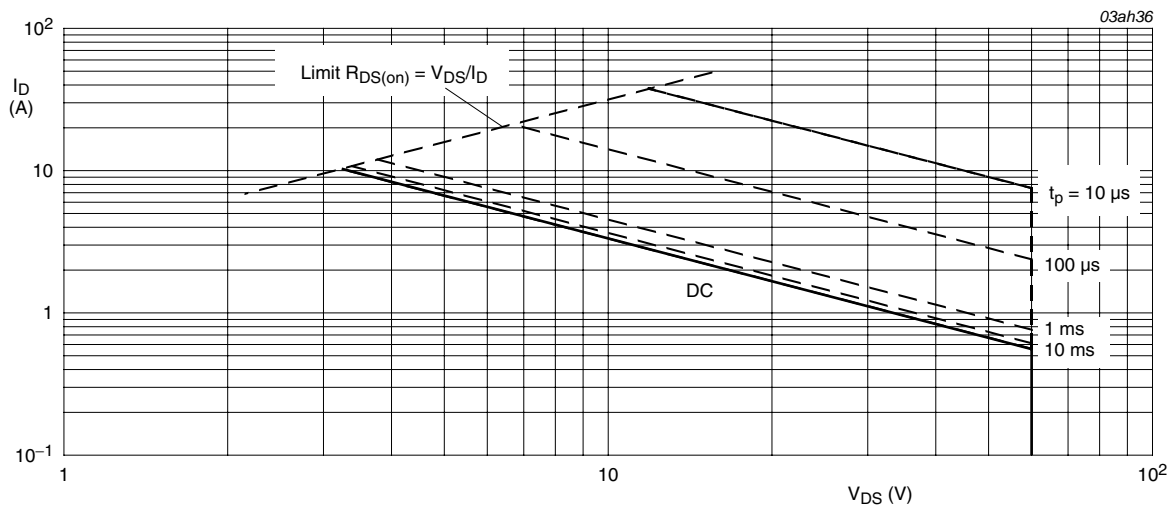
$$I_{der} = \frac{I_D}{I_{D(25^{\circ}C)}} \times 100\%$$

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



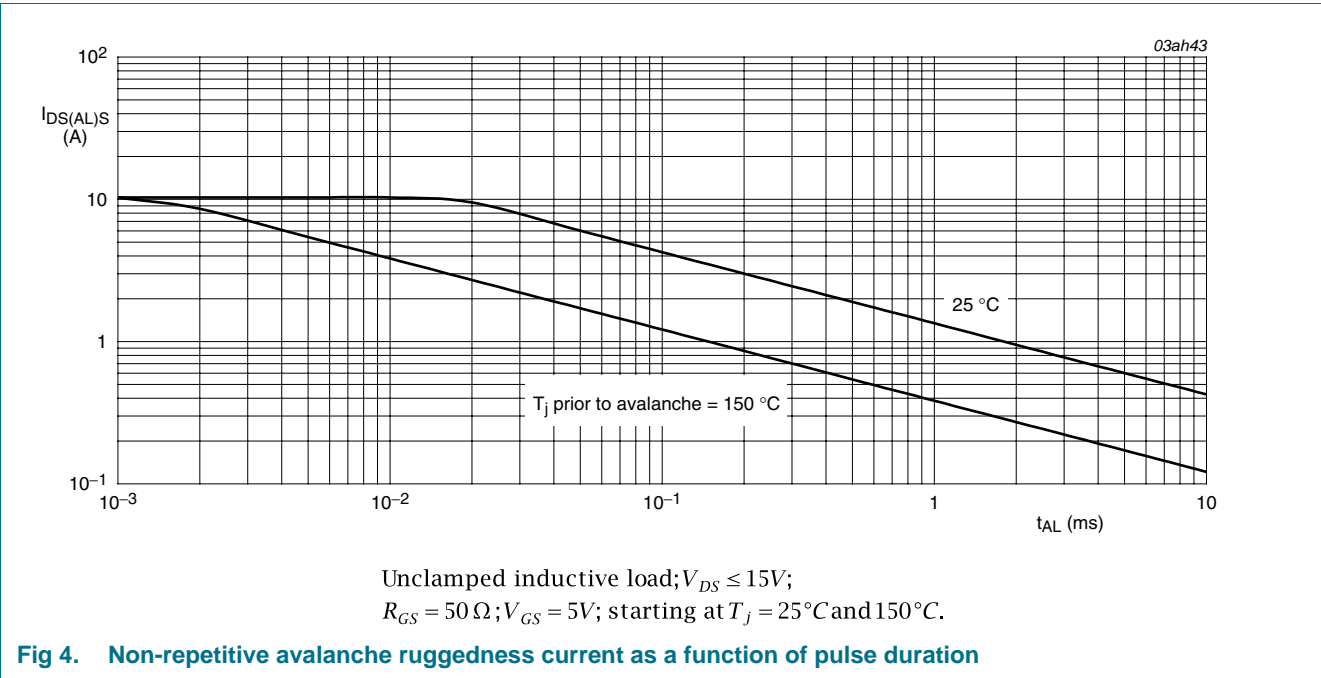
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

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



$T_{mb} = 25^{\circ}C$; I_{DM} is single pulse

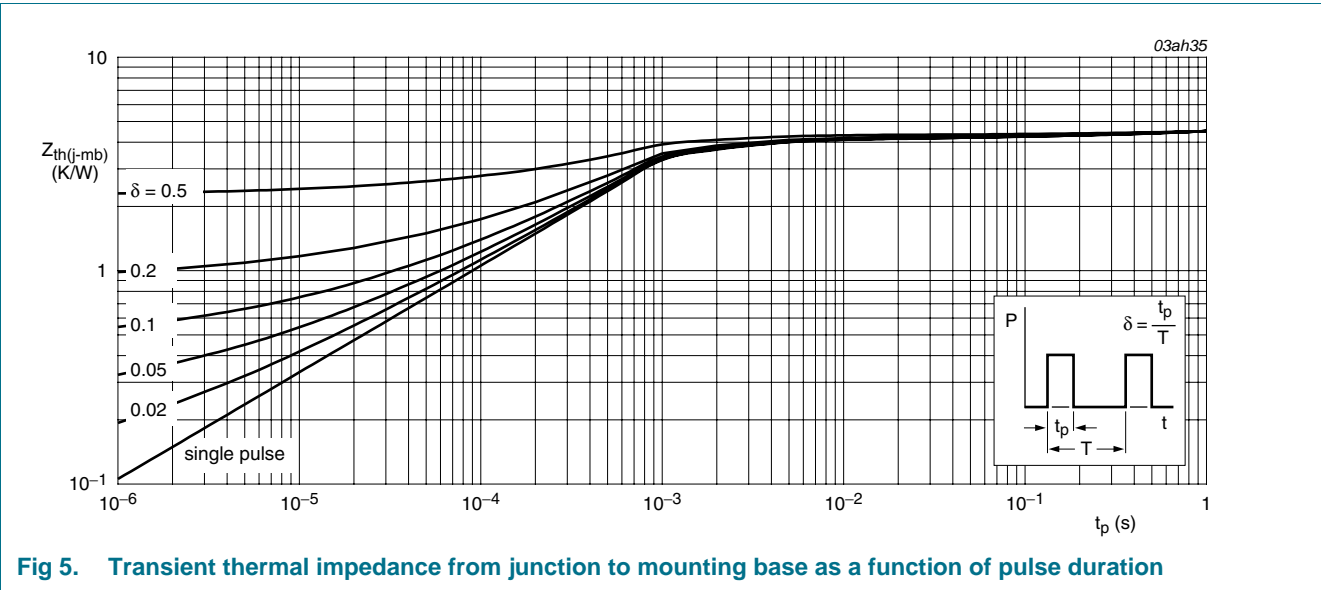
Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage



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 Figure 5	-	-	4.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in still air	-	60	-	K/W



6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 0.25 mA; V _{GS} = 0 V; T _j = -55 °C	55	-	-	V
		I _D = 0.25 mA; V _{GS} = 0 V; T _j = 25 °C	60	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} = V _{GS} ; T _j = 175 °C; see Figure 9	1	-	-	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _j = -55 °C; see Figure 9	-	-	6	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _j = 25 °C; see Figure 9	2	3	4	V
I _{DSS}	drain leakage current	V _{DS} = 55 V; V _{GS} = 0 V; T _j = 175 °C	-	-	500	μA
		V _{DS} = 55 V; V _{GS} = 0 V; T _j = 25 °C	-	0.05	10	μA
I _{GSS}	gate leakage current	V _{GS} = 10 V; V _{DS} = 0 V; T _j = 25 °C	-	10	100	nA
		V _{GS} = -10 V; V _{DS} = 0 V; T _j = 25 °C	-	10	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 5.5 A; T _j = 175 °C; see Figure 10 and 11	-	250	315	mΩ
		V _{GS} = 10 V; I _D = 5.5 A; T _j = 25 °C; see Figure 10 and 11	-	120	150	mΩ
Dynamic characteristics						
Q _{G(tot)}	total gate charge	I _D = 10 A; V _{DS} = 44 V; V _{GS} = 10 V; T _j = 25 °C; see Figure 12	-	5.8	-	nC
Q _{GS}	gate-source charge		-	1.5	-	nC
Q _{GD}	gate-drain charge		-	3.2	-	nC
C _{iss}	input capacitance	V _{DS} = 25 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; see Figure 13	-	190	250	pF
C _{oss}	output capacitance		-	55	80	pF
C _{rss}	reverse transfer capacitance		-	40	50	pF
t _{d(on)}	turn-on delay time	V _{DS} = 30 V; R _L = 2.7 Ω; V _{GS} = 10 V; R _{G(ext)} = 5.6 Ω; T _j = 25 °C	-	3	10	ns
t _r	rise time		-	26	35	ns
t _{d(off)}	turn-off delay time		-	8	15	ns
t _f	fall time		-	10	20	ns
Source-drain diode						
V _{SD}	source-drain voltage	I _S = 10 A; V _{GS} = 0 V; T _j = 25 °C; see Figure 14	-	1.1	1.5	V
t _{rr}	reverse recovery time	I _S = 10 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 25 V; T _j = 25 °C	-	32	-	ns
Q _r	recovered charge		-	50	-	nC

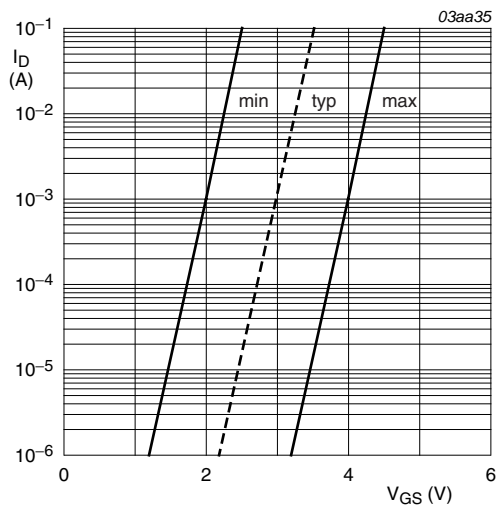


Fig 6. Sub-threshold drain current as a function of gate-source voltage

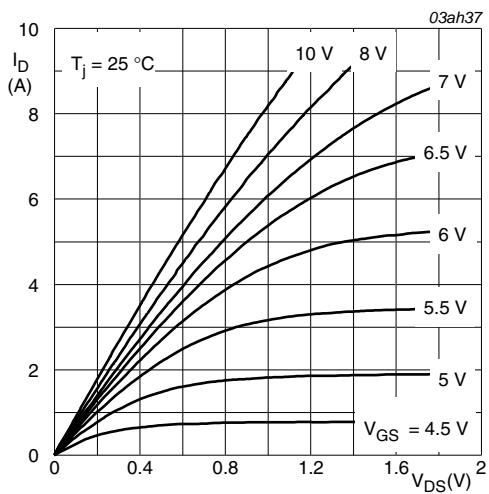


Fig 7. Output characteristics: drain current as a function of drain-source voltage; typical values

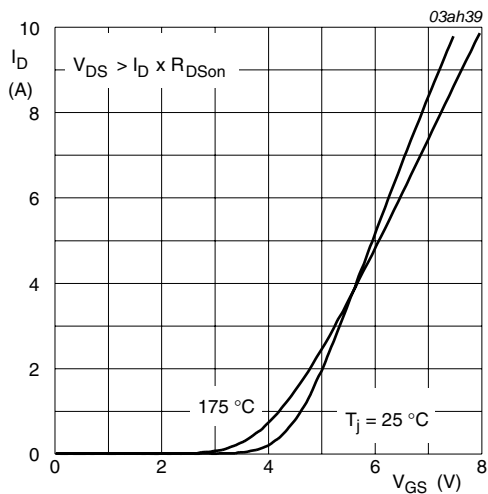


Fig 8. Transfer characteristics: drain current as a function of gate-source voltage; typical values

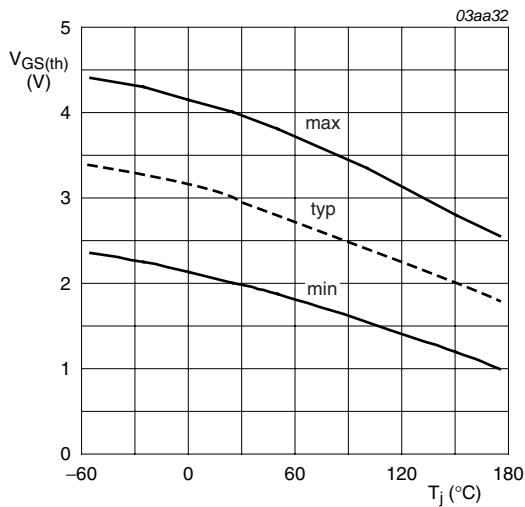
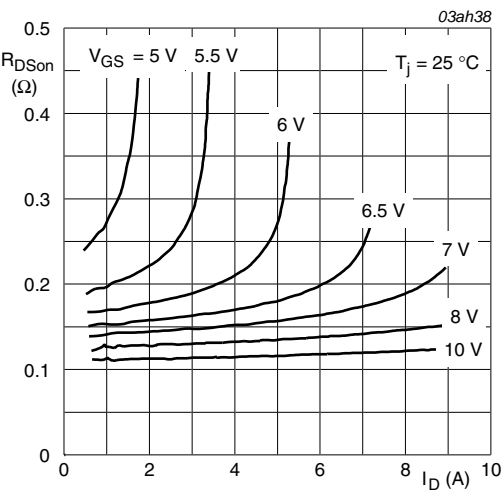
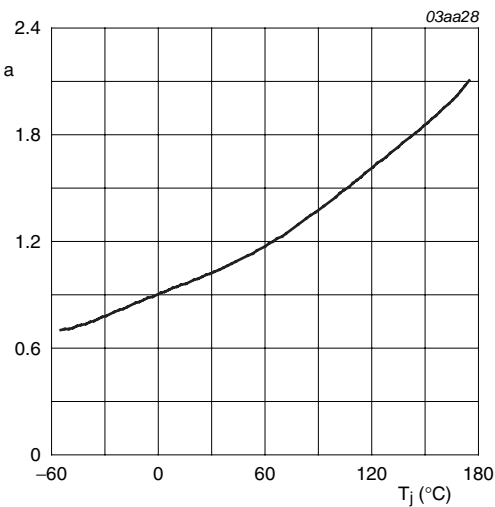


Fig 9. Gate-source threshold voltage as a function of junction temperature



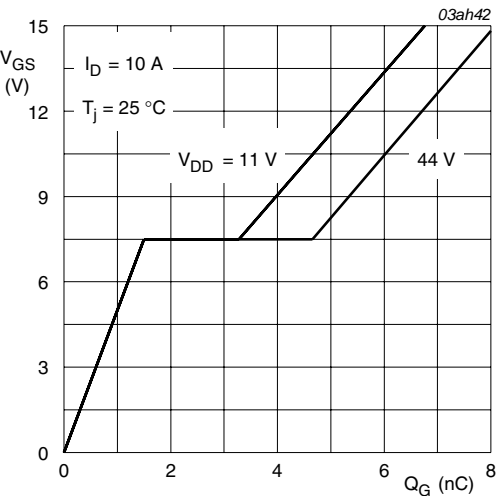
$T_J = 25\text{ }^\circ\text{C}$

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



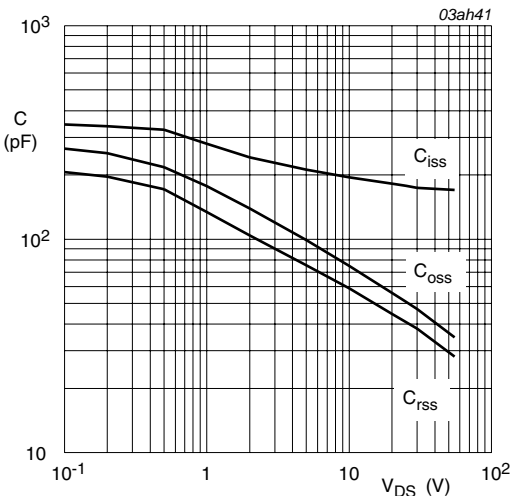
$$a = \frac{R_{DS(on)}}{R_{DS(on)(25\text{ }^\circ\text{C})}}$$

Fig 11. Normalized drain-source on-state resistance factor as a function of junction temperature



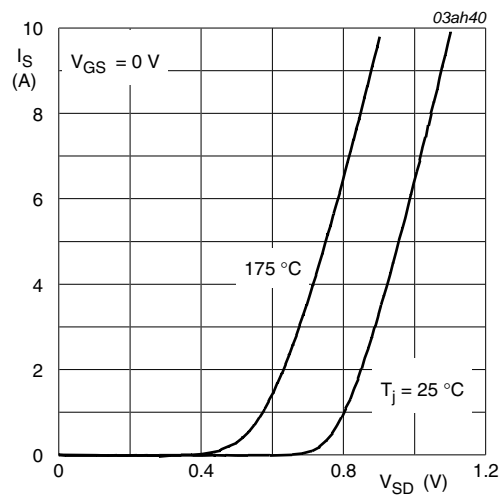
$I_D = 10\text{ A}; V_{DD} = 11\text{ V and } 44\text{ V}$

Fig 12. Gate-source voltage as a function of gate charge; typical values



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

Fig 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



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

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

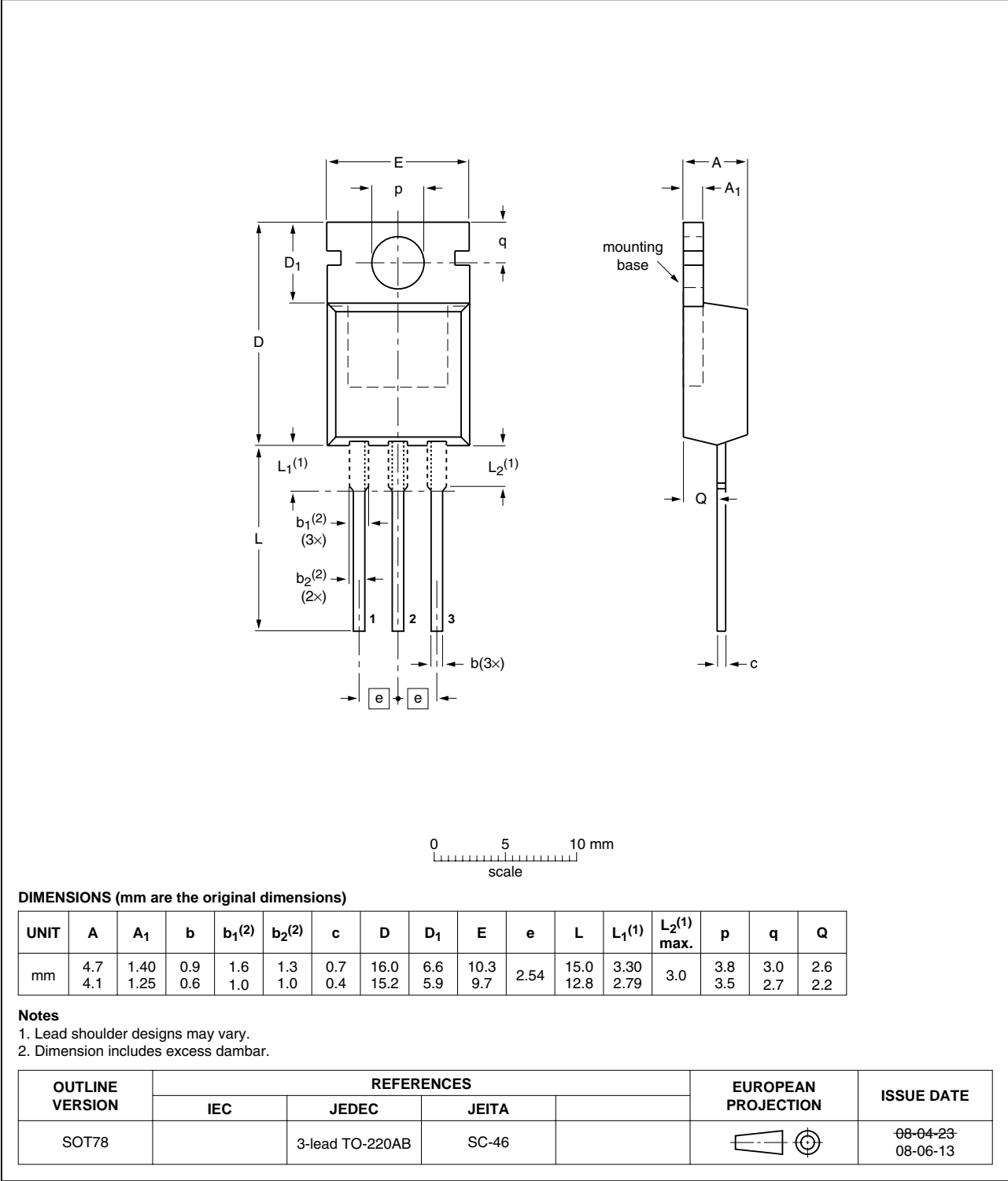


Fig 15. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHP3055E_7	20100226	Product data sheet	-	PHP_PHD3055E-06
Modifications:	<ul style="list-style-type: none">• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.• Legal texts have been adapted to the new company name where appropriate.• Typenumber PHP3055E separated from datasheet PHP_PHD3055E-06.			
PHP_PHD3055E-06 (9397 750 09354)	20020325	Product data	-	-

9. Legal information

9.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	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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Date of release: 26 February 2010

Document identifier: PHP3055E_7

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