

BUK7211-55B

TrenchMOS™ standard level FET

Rev. 01 — 12 December 2002

Objective data

1. Product profile

1.1 Description

N-channel enhancement mode field-effect power transistor in a plastic package using Philips High-Performance Automotive (HPA) TrenchMOS™ technology, featuring very low on-state resistance.

Product availability:

BUK7211-55B in SOT428 (D-PAK).

1.2 Features

- TrenchMOS™ technology
- 175 °C rated
- Q101 compliant
- Standard level compatible

1.3 Applications

- Automotive systems
- Motors, lamps and solenoids
- 12 V and 24 V loads
- General purpose power switching

1.4 Quick reference data

- $E_{DS(AL)S} \leq 172 \text{ mJ}$
- $I_D \leq 75 \text{ A}$
- $R_{DSon} = 9.3 \text{ m}\Omega$ (typ)
- $P_{tot} \leq 150 \text{ W}$

2. Pinning information

Table 1: Pinning - SOT428 (D-PAK), simplified outline and symbol

Pin	Description	Simplified outline	Symbol
1	gate (g)	<p>Top view MBK091</p>	<p>MBB076</p>
2	drain (d) [1]		
3	source (s)		
mb	mounting base; connected to drain (d)	<p>SOT428 (D-PAK)</p>	

[1] It is not possible to make connection to pin 2 of the SOT428 package.



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3. Limiting values

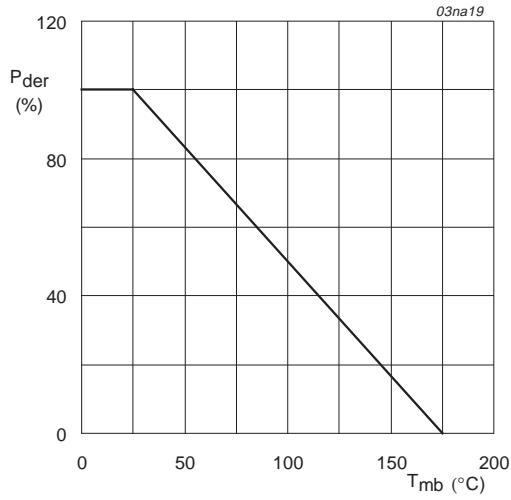
Table 2: Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage (DC)		-	55	V
V_{DGR}	drain-gate voltage (DC)	$R_{GS} = 20 \text{ k}\Omega$	-	55	V
V_{GS}	gate-source voltage (DC)		-	± 20	V
I_D	drain current (DC)	$T_{mb} = 25 \text{ }^\circ\text{C}; V_{GS} = 10 \text{ V};$ Figure 2 and 3	[1] -	82	A
			[2] -	75	A
		$T_{mb} = 100 \text{ }^\circ\text{C}; V_{GS} = 10 \text{ V};$ Figure 2	[1] -	58	A
I_{DM}	peak drain current	$T_{mb} = 25 \text{ }^\circ\text{C};$ pulsed; $t_p \leq 10 \text{ }\mu\text{s};$ Figure 3	-	330	A
P_{tot}	total power dissipation	$T_{mb} = 25 \text{ }^\circ\text{C};$ Figure 1	-	150	W
T_{stg}	storage temperature		-55	+175	$^\circ\text{C}$
T_j	junction temperature		-55	+175	$^\circ\text{C}$
Source-drain diode					
I_{DR}	reverse drain current (DC)	$T_{mb} = 25 \text{ }^\circ\text{C}$	[1] -	82	A
			[2] -	75	A
I_{DRM}	peak reverse drain current	$T_{mb} = 25 \text{ }^\circ\text{C};$ pulsed; $t_p \leq 10 \text{ }\mu\text{s}$	-	330	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive avalanche energy	unclamped inductive load; $I_D = 75 \text{ A};$ $V_{DS} \leq 55 \text{ V}; V_{GS} = 10 \text{ V};$ $R_{GS} = 50 \text{ }\Omega;$ starting $T_j = 25 \text{ }^\circ\text{C}$	-	172	mJ

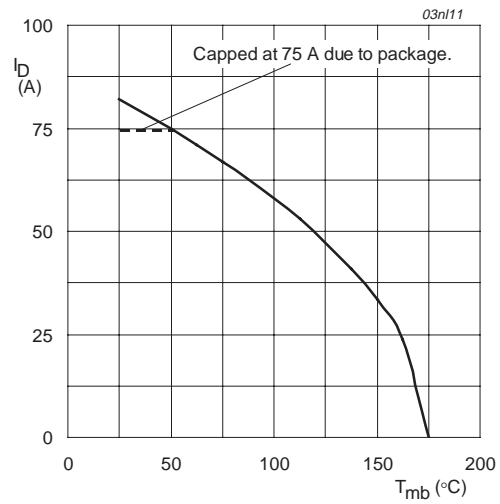
[1] Current is limited by power dissipation chip rating.

[2] Continuous current is limited by package.



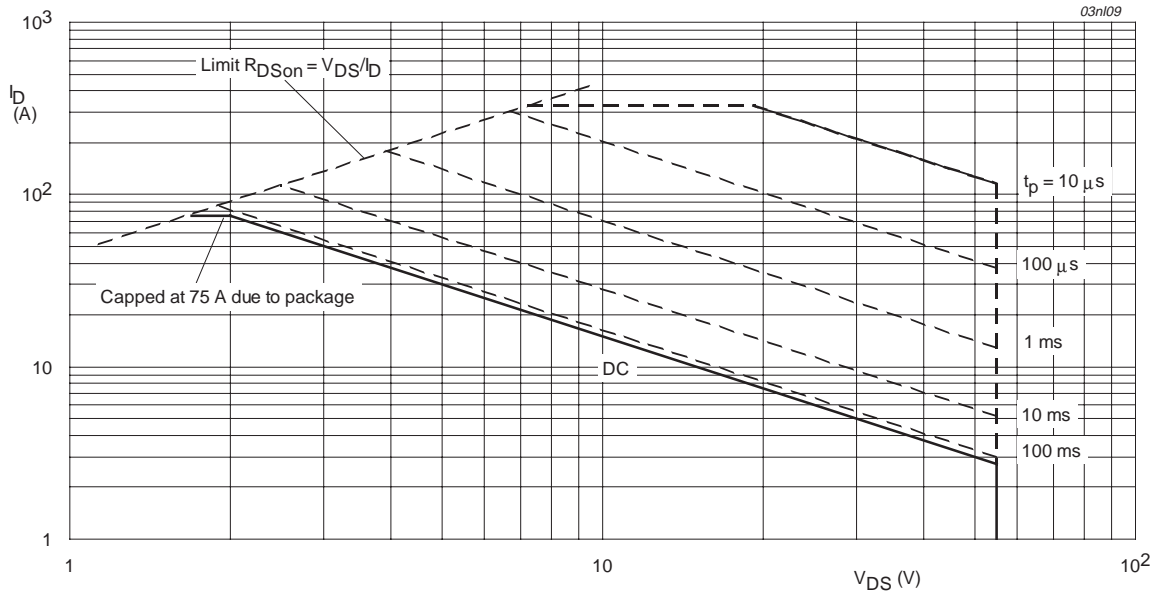
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

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



$V_{GS} \geq 10\text{ V}$

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



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

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

4. Thermal characteristics

Table 3: Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient		-	71.4	-	K/W
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Figure 4	-	0.45	1.0	K/W

4.1 Transient thermal impedance

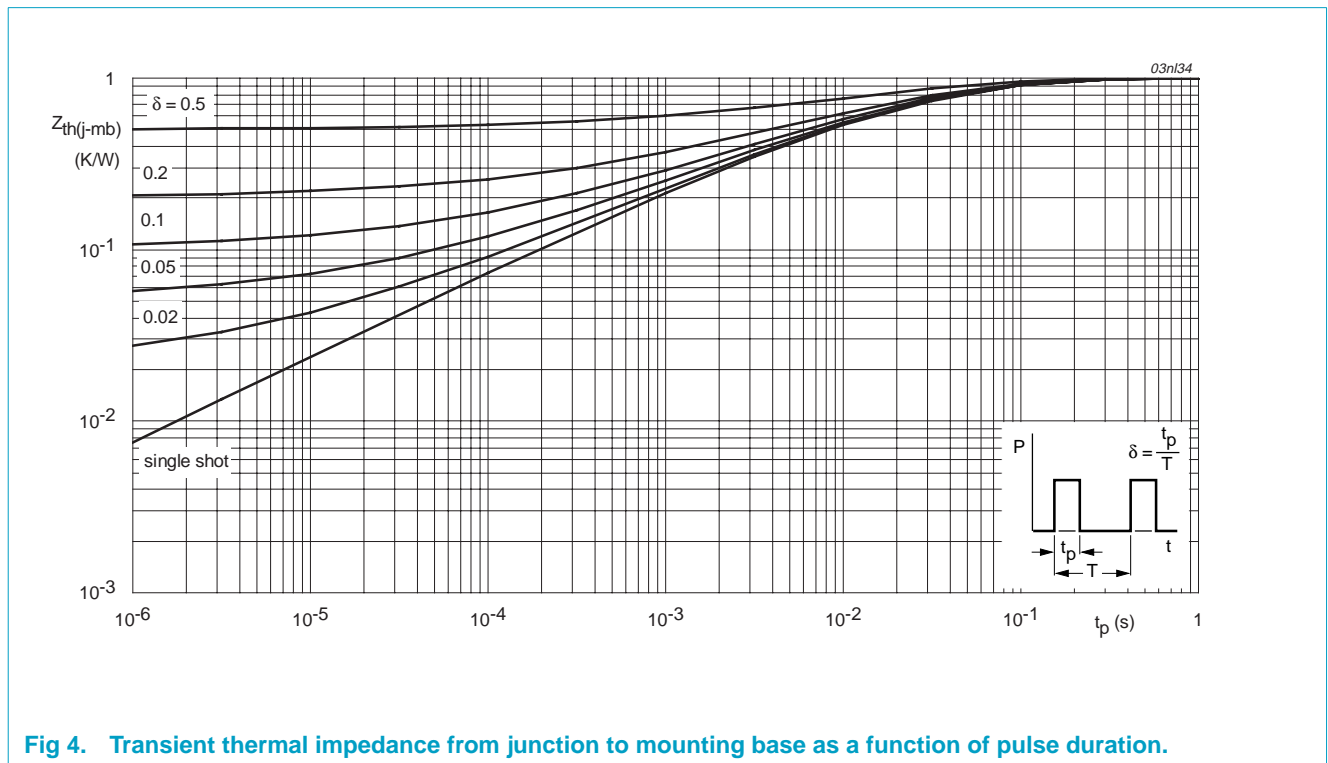


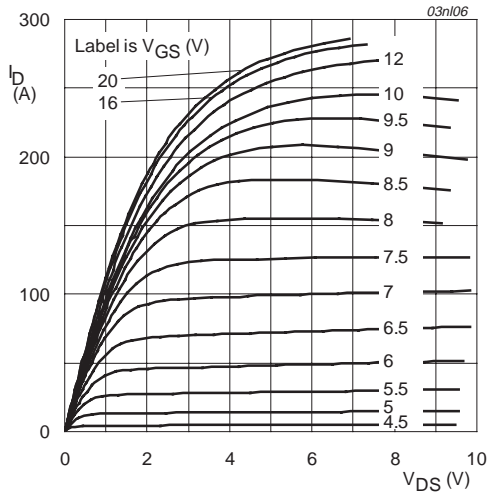
Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration.

5. Characteristics

Table 4: Characteristics

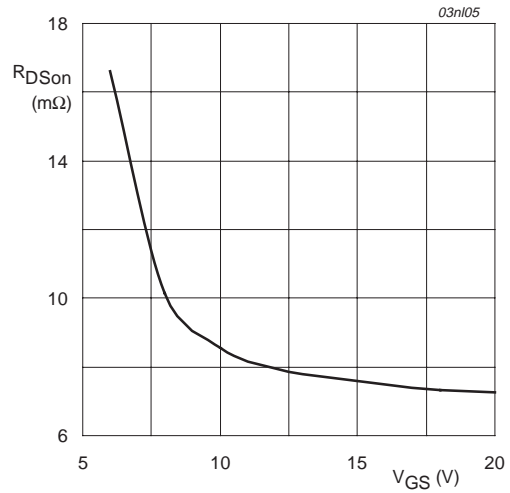
$T_j = 25\text{ °C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25\text{ mA}; V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ °C}$	55	-	-	V
		$T_j = -55\text{ °C}$	50	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}; V_{DS} = V_{GS};$ Figure 9				
		$T_j = 25\text{ °C}$	2	3	4	V
		$T_j = 175\text{ °C}$	1	-	-	V
		$T_j = -55\text{ °C}$	-	-	4.4	V
I_{DSS}	drain-source leakage current	$V_{DS} = 55\text{ V}; V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ °C}$	-	0.02	1	μA
		$T_j = 175\text{ °C}$	-	-	500	μA
I_{GSS}	gate-source leakage current	$V_{GS} = \pm 20\text{ V}; V_{DS} = 0\text{ V}$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A};$ Figure 7 and 8				
		$T_j = 25\text{ °C}$	-	9.3	11	m Ω
		$T_j = 175\text{ °C}$	-	-	22	m Ω
Dynamic characteristics						
$Q_{g(tot)}$	total gate charge	$V_{GS} = 10\text{ V}; V_{DS} = 44\text{ V};$ $I_D = 25\text{ A};$ Figure 14	-	35	-	nC
Q_{gs}	gate-source charge		-	9	-	nC
Q_{gd}	gate-drain (Miller) charge		-	12	-	nC
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 25\text{ V};$ $f = 1\text{ MHz};$ Figure 12	-	1840	2453	pF
C_{oss}	output capacitance		-	379	455	pF
C_{rss}	reverse transfer capacitance		-	165	226	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 25\text{ V}; R_L = 1.2\text{ }\Omega;$	-	18	-	nS
t_r	rise time	$V_{GS} = 10\text{ V}; R_G = 10\text{ }\Omega$	-	91	-	nS
$t_{d(off)}$	turn-off delay time		-	48	-	nS
t_f	fall time		-	45	-	nS
L_d	internal drain inductance	measured from drain to centre of die	-	2.5	-	nH
L_s	internal source inductance	measured from source lead to source bond pad	-	7.5	-	nH
Source-drain diode						
V_{SD}	source-drain (diode forward) voltage	$I_S = 18\text{ A}; V_{GS} = 0\text{ V};$ Figure 15	-	0.85	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}; dI_S/dt = -100\text{ A}/\mu\text{s}$	-	67	-	ns
Q_r	recovered charge	$V_{GS} = -10\text{ V}; V_{DS} = 30\text{ V}$	-	65	-	nC



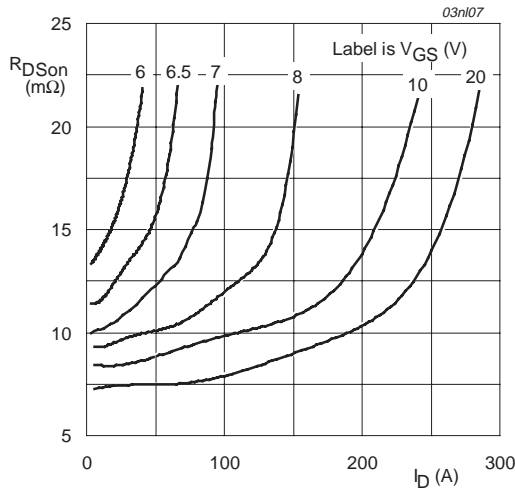
$T_j = 25\text{ }^\circ\text{C}; t_p = 300\text{ }\mu\text{s}$

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



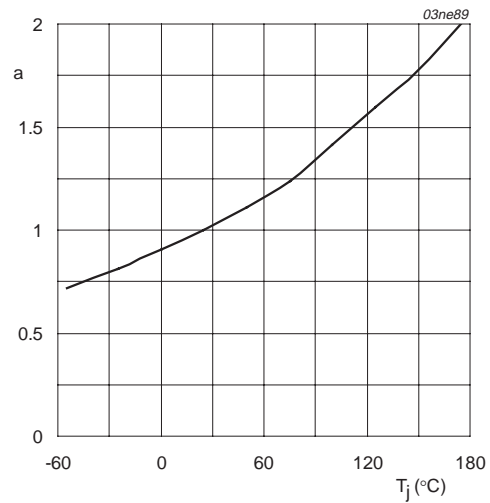
$T_j = 25\text{ }^\circ\text{C}; I_D = 25\text{ A}$

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



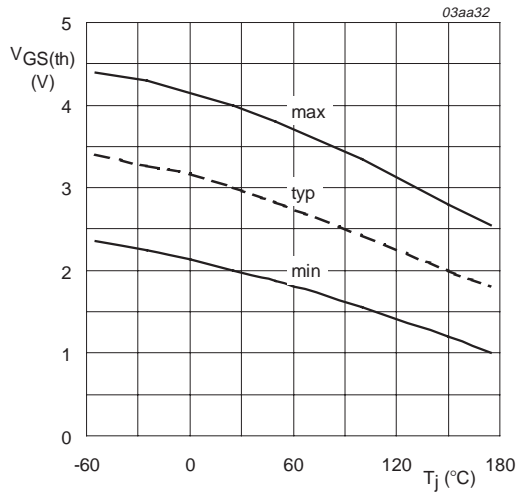
$T_j = 25\text{ }^\circ\text{C}; t_p = 300\text{ }\mu\text{s}$

Fig 7. Drain-source on-state resistance as a function of drain current; typical values.



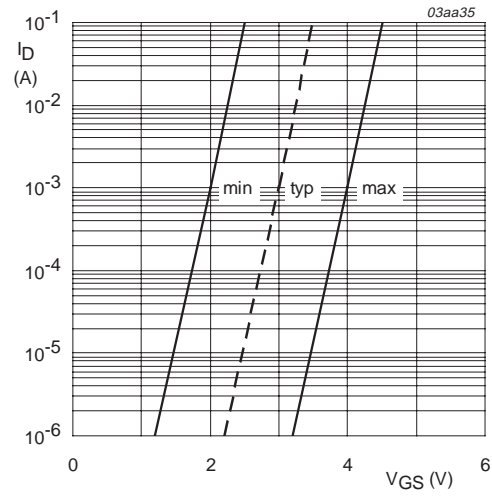
$$a = \frac{R_{DSon}}{R_{DSon}(25^\circ\text{C})}$$

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



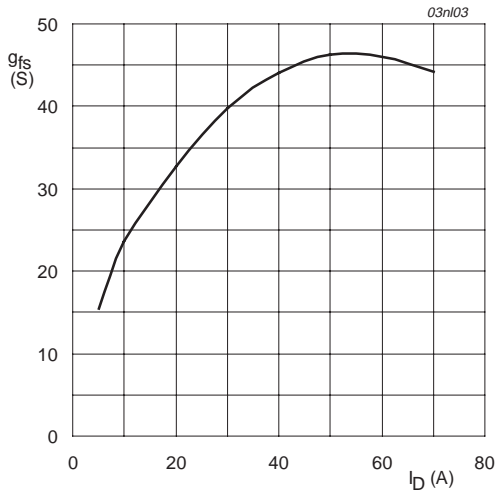
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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



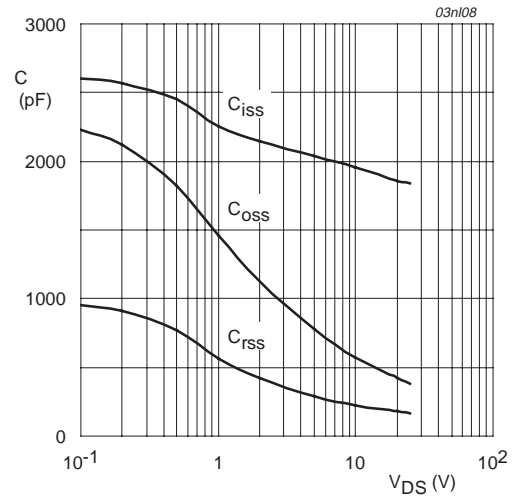
$T_j = 25 \text{ }^{\circ}C; V_{DS} = V_{GS}$

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



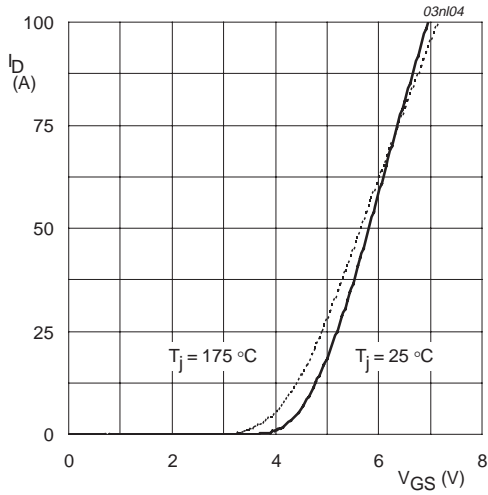
$T_j = 25 \text{ }^{\circ}C; V_{DS} = 25 \text{ V}$

Fig 11. Forward transconductance as a function of drain current; typical values.



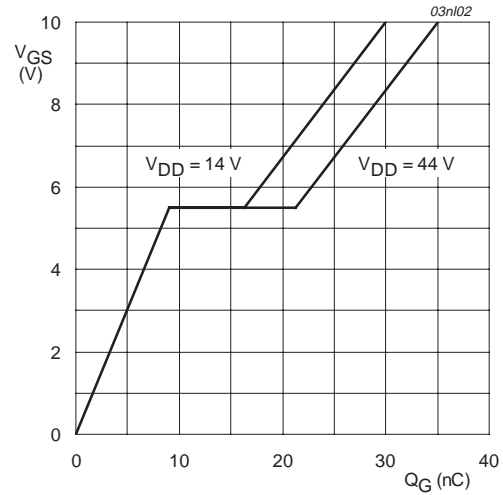
$V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values.



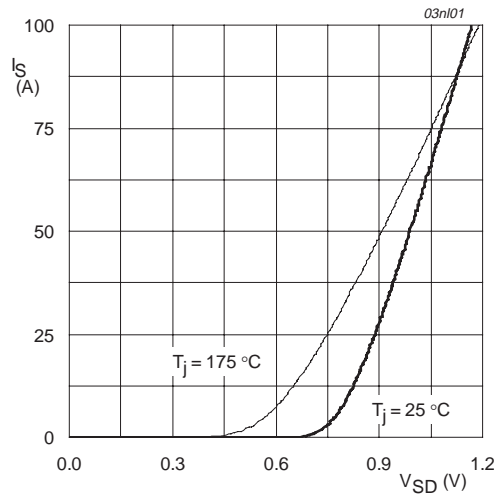
$V_{DS} = 25 \text{ V}$

Fig 13. Transfer characteristics: drain current as a function of gate-source voltage; typical values.



$T_j = 25 \text{ °C}; I_D = 25 \text{ A}$

Fig 14. Gate-source voltage as a function of turn-on gate charge; typical values.



$V_{GS} = 0 \text{ V}$

Fig 15. Reverse diode current as a function of reverse diode voltage; typical values.

6. Package outline

Plastic single-ended surface mounted package (Philips version of D-PAK); 3 leads (one lead cropped)

SOT428

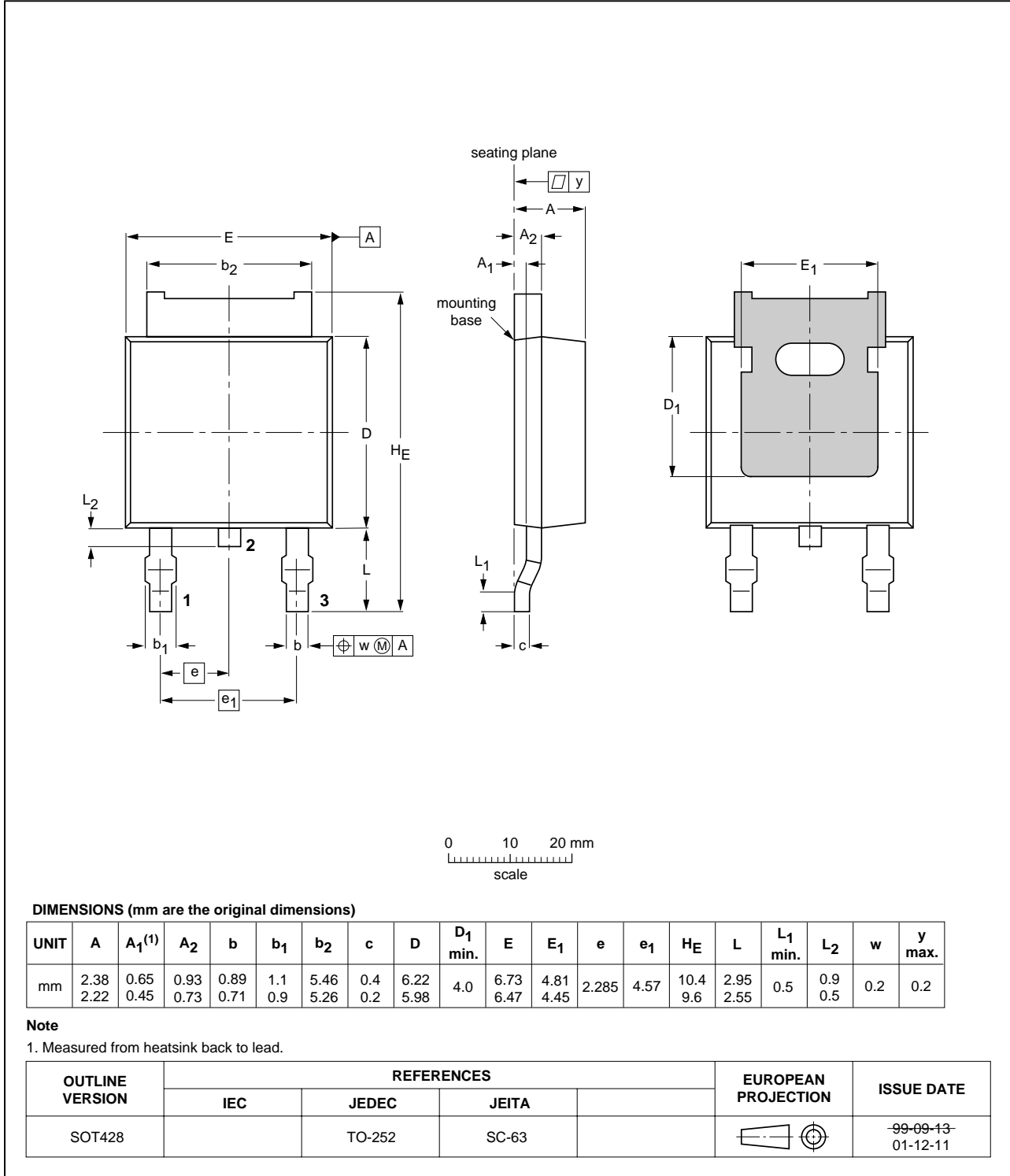


Fig 16. SOT428 (D-PAK).

7. Revision history

Table 5: Revision history

Rev	Date	CPCN	Description
01	20021212	-	Objective data (9397 750 10807)

8. Data sheet status

Level	Data sheet status ^[1]	Product status ^{[2][3]}	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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Contact information

For additional information, please visit <http://www.semiconductors.philips.com>.

For sales office addresses, send e-mail to: sales.addresses@www.semiconductors.philips.com.

Fax: +31 40 27 24825

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