

BUK9214-75B

TrenchMOS™ logic level FET

Rev. 01 — 10 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:

BUK9214-75B in SOT428 (D-PAK)

1.2 Features

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

1.3 Applications

- Automotive systems
- Motors, lamps and solenoids
- 12 V, 24 V, and 42 V loads
- General purpose power switching

1.4 Quick reference data

- $E_{DS(AL)S} \leq 131$ mJ
- $R_{DSon} = 11.9$ m Ω (typ)
- $I_D \leq 71$ A
- $P_{tot} \leq 150$ 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>SOT428 (D-PAK)</p>	<p>MBB076</p>
2	drain (d) [1]		
3	source (s)		
mb	mounting base; connected to drain (d)		

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



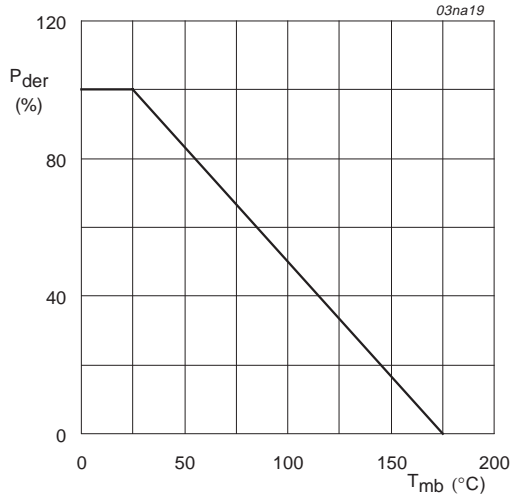
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3. Limiting values

Table 2: Limiting values

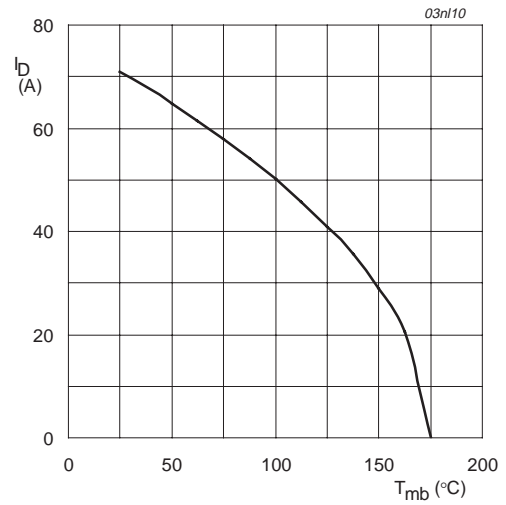
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage (DC)		-	75	V
V_{DGR}	drain-gate voltage (DC)	$R_{GS} = 20 \text{ k}\Omega$	-	75	V
V_{GS}	gate-source voltage (DC)		-	± 15	V
I_D	drain current (DC)	$T_{mb} = 25 \text{ }^\circ\text{C}$; $V_{GS} = 5 \text{ V}$; Figure 2 and 3	-	71	A
		$T_{mb} = 100 \text{ }^\circ\text{C}$; $V_{GS} = 5 \text{ V}$; Figure 2	-	50	A
I_{DM}	peak drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$; pulsed; $t_p \leq 10 \text{ }\mu\text{s}$; Figure 3	-	285	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)	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	71	A
I_{DRM}	peak reverse drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$; pulsed; $t_p \leq 10 \text{ }\mu\text{s}$	-	285	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive avalanche energy	unclamped inductive load; $I_D = 75 \text{ A}$; $V_{DS} \leq 75 \text{ V}$; $V_{GS} = 5 \text{ V}$; $R_{GS} = 50 \text{ }\Omega$; starting $T_j = 25 \text{ }^\circ\text{C}$	-	131	mJ



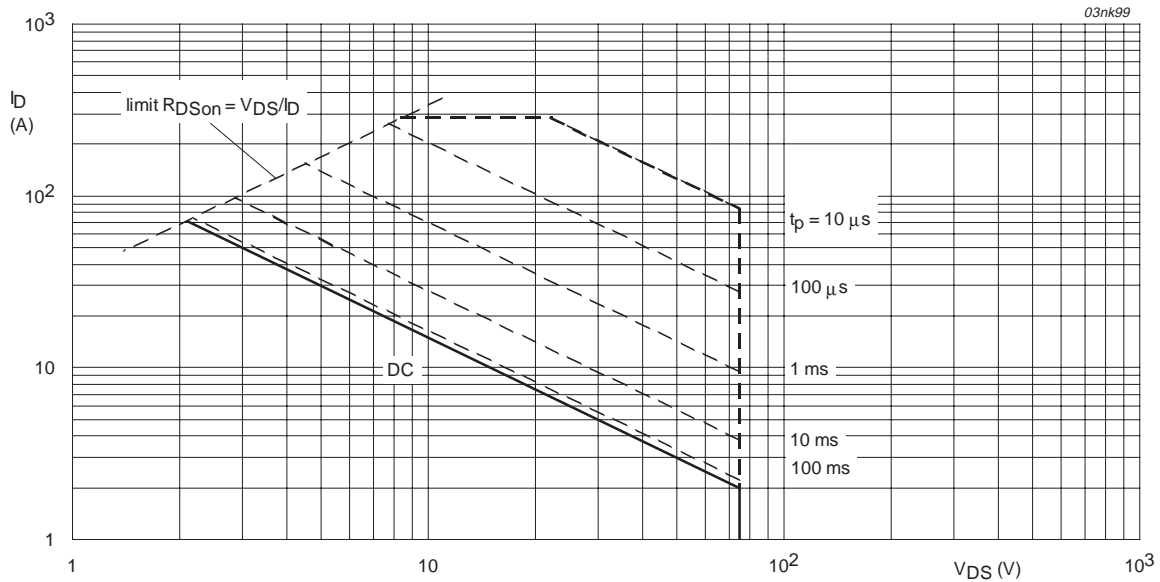
$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ C)}} \times 100\%$$

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



$V_{GS} \geq 5\text{ V}$

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



$T_{mb} = 25^\circ\text{C}$; 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

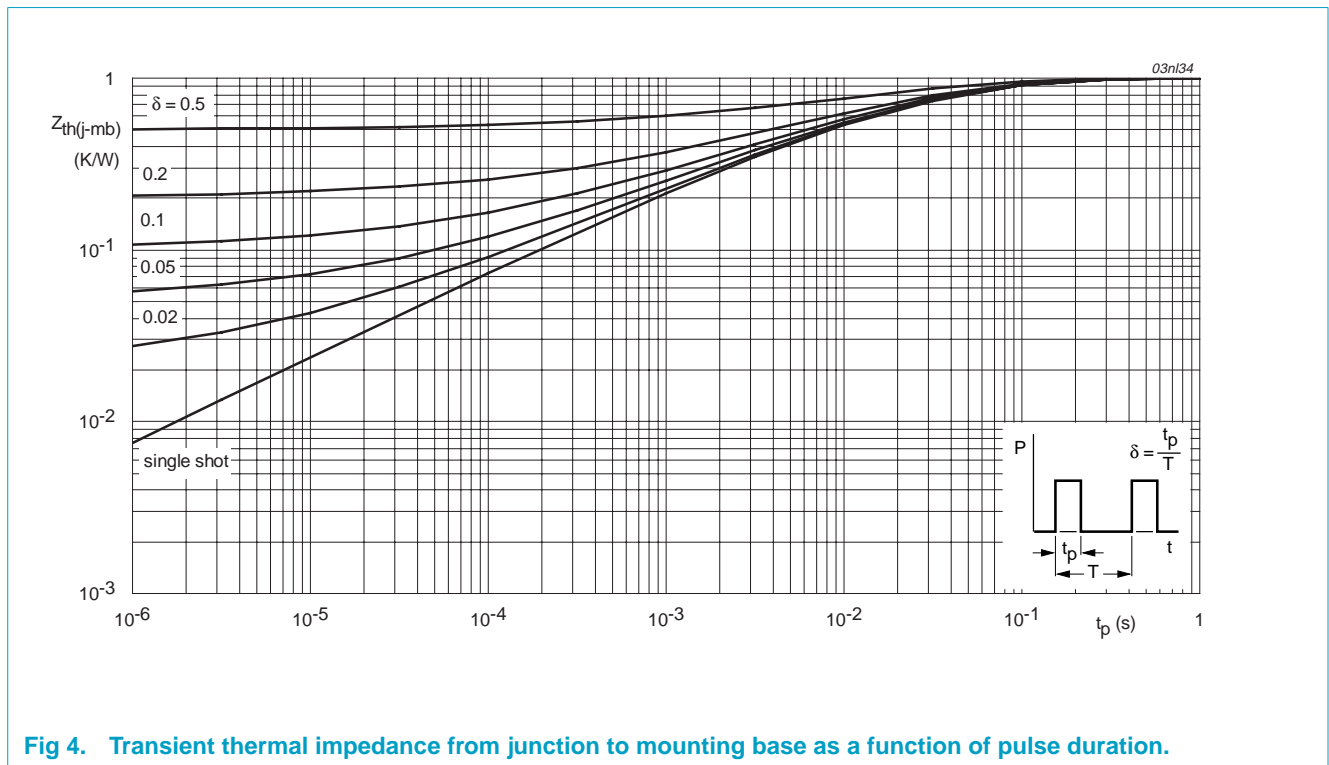
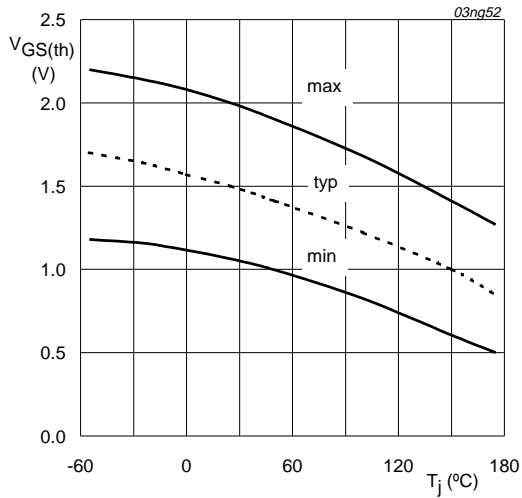


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration.

5. Characteristics

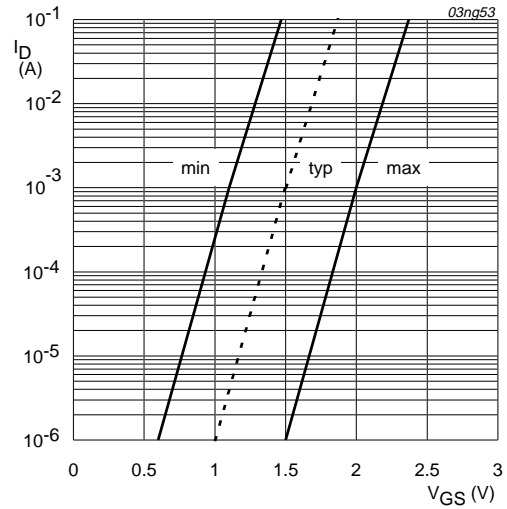
Table 4: Characteristics
 $T_j = 25\text{ °C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25\text{ mA}$; $V_{GS} = 0\text{ V}$ $T_j = 25\text{ °C}$	75	-	-	V
		$T_j = -55\text{ °C}$	70	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$; Figure 5 $T_j = 25\text{ °C}$	1.1	1.5	2	V
		$T_j = 175\text{ °C}$	0.5	-	-	V
		$T_j = -55\text{ °C}$	-	-	2.3	V
I_{DSS}	drain-source leakage current	$V_{DS} = 75\text{ V}$; $V_{GS} = 0\text{ V}$ $T_j = 25\text{ °C}$	-	0.02	1	μA
		$T_j = 175\text{ °C}$	-	-	500	μA
I_{GSS}	gate-source leakage current	$V_{GS} = \pm 15\text{ V}$; $V_{DS} = 0\text{ V}$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 5\text{ V}$; $I_D = 25\text{ A}$; Figure 7 $T_j = 25\text{ °C}$	-	11.9	14	m Ω
		$T_j = 175\text{ °C}$	-	-	29	m Ω
		$V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$	-	-	15.5	m Ω
		$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$	-	10.7	12	m Ω
Dynamic characteristics						
$Q_{g(tot)}$	total gate charge	$V_{GS} = 5\text{ V}$; $V_{DS} = 60\text{ V}$; $I_D = 25\text{ A}$;	-	32	-	nC
Q_{gs}	gate-source charge		-	6	-	nC
Q_{gd}	gate-drain (Miller) charge		-	13	-	nC
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 25\text{ V}$; $f = 1\text{ MHz}$;	-	3022	4029	pF
C_{oss}	output capacitance		-	290	348	pF
C_{rss}	reverse transfer capacitance		-	115	158	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30\text{ V}$; $R_L = 1.2\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $R_G = 10\text{ }\Omega$	-	tbf	-	nS
t_r	rise time		-	tbf	-	nS
$t_{d(off)}$	turn-off delay time		-	tbf	-	nS
t_f	fall time		-	tbf	-	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	$I_S = 10\text{ A}$; $V_{GS} = 0\text{ V}$; Figure 7	-	0.85	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}$; $dI_S/dt = -100\text{ A}/\mu\text{s}$	-	tbf	-	ns
Q_r	recovered charge	$V_{GS} = -10\text{ V}$; $V_{DS} = 30\text{ V}$	-	tbf	-	nC



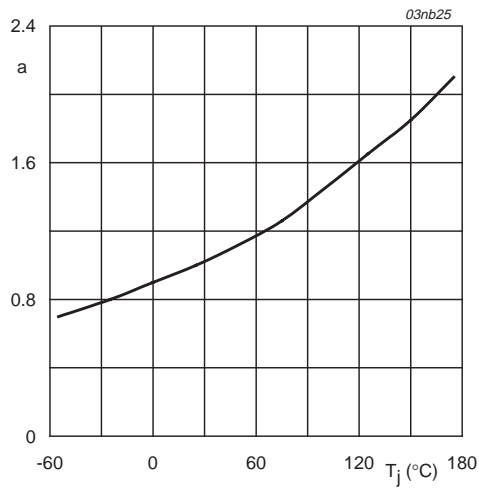
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

Fig 5. Gate-source threshold voltage as a function of junction temperature.



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

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



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

Fig 7. Normalized drain-source on-state resistance factor as a function of junction temperature.

6. Package outline

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

SOT428

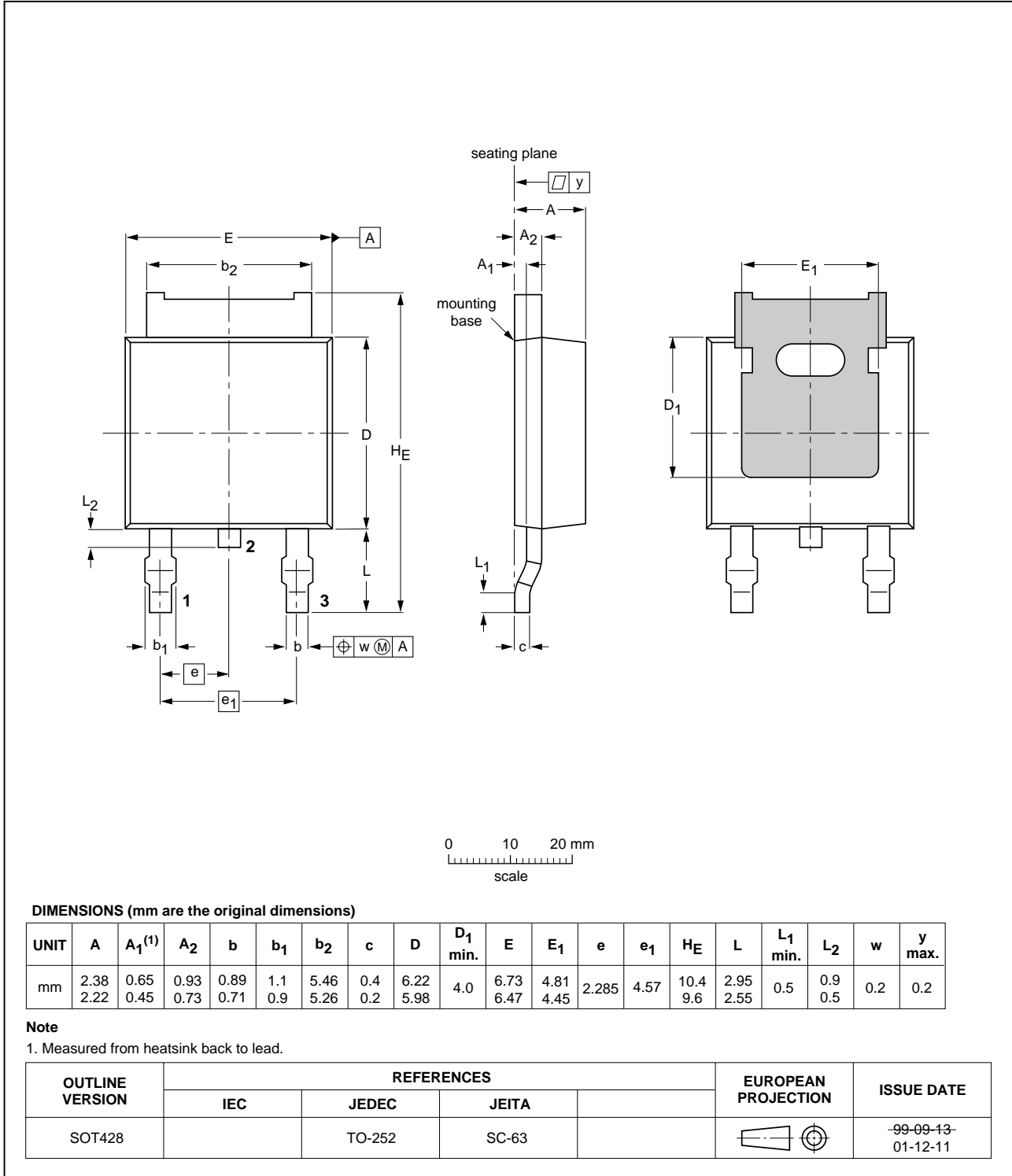


Fig 8. SOT428 (D-PAK)

7. Revision history

Table 5: Revision history

Rev	Date	CPCN	Description
01	20021210	-	Objective data (9397 750 10801)

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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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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