

# BUK9214-75B

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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

- $E_{DS(AL)S} \leq 131 \text{ mJ}$
- $I_D \leq 71 \text{ A}$
- $R_{DSon} = 11.9 \text{ m}\Omega \text{ (typ)}$
- $P_{tot} \leq 150 \text{ W}$

## 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><b>SOT428 (D-PAK)</b></p>	<p>MBB076</p>
2	drain (d) [1]		
3	source (s)		
mb	mounting base; connected to drain (d)		

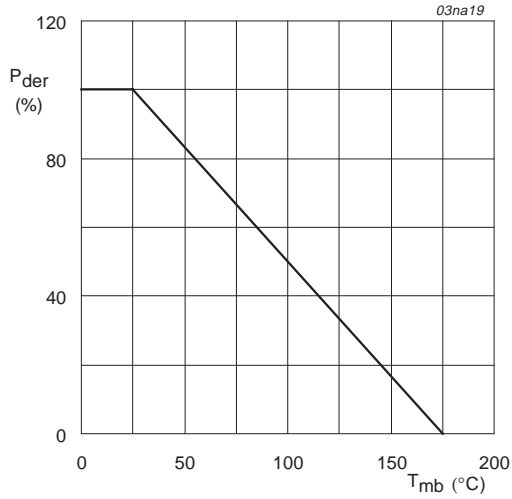
[1] It is not possible to make connection to pin 2 of the SOT428 package.

### 3. Limiting values

**Table 2: Limiting values**

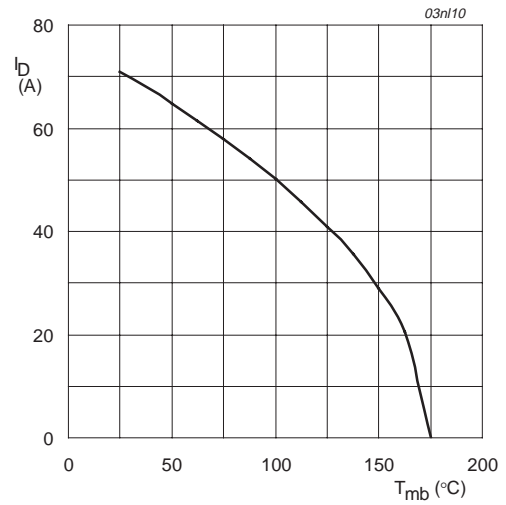
In accordance with the Absolute Maximum Rating System (IEC 60134).

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)		-	$\pm 15$	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	$^\circ\text{C}$
<b>Source-drain diode</b>					
$I_{DR}$	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
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	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



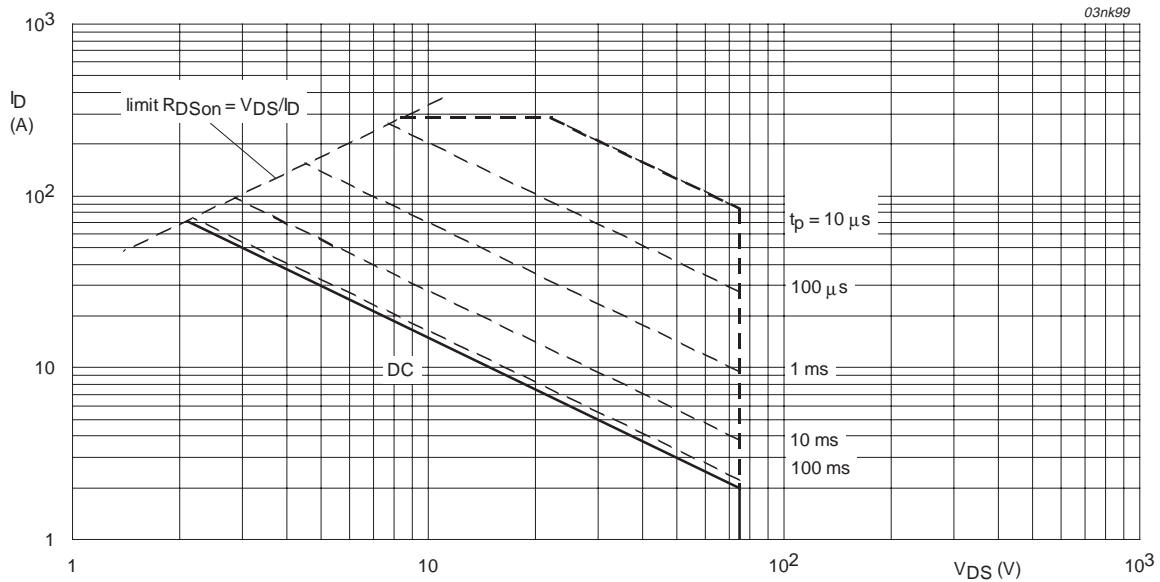
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

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



$V_{GS} \geq 5V$

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

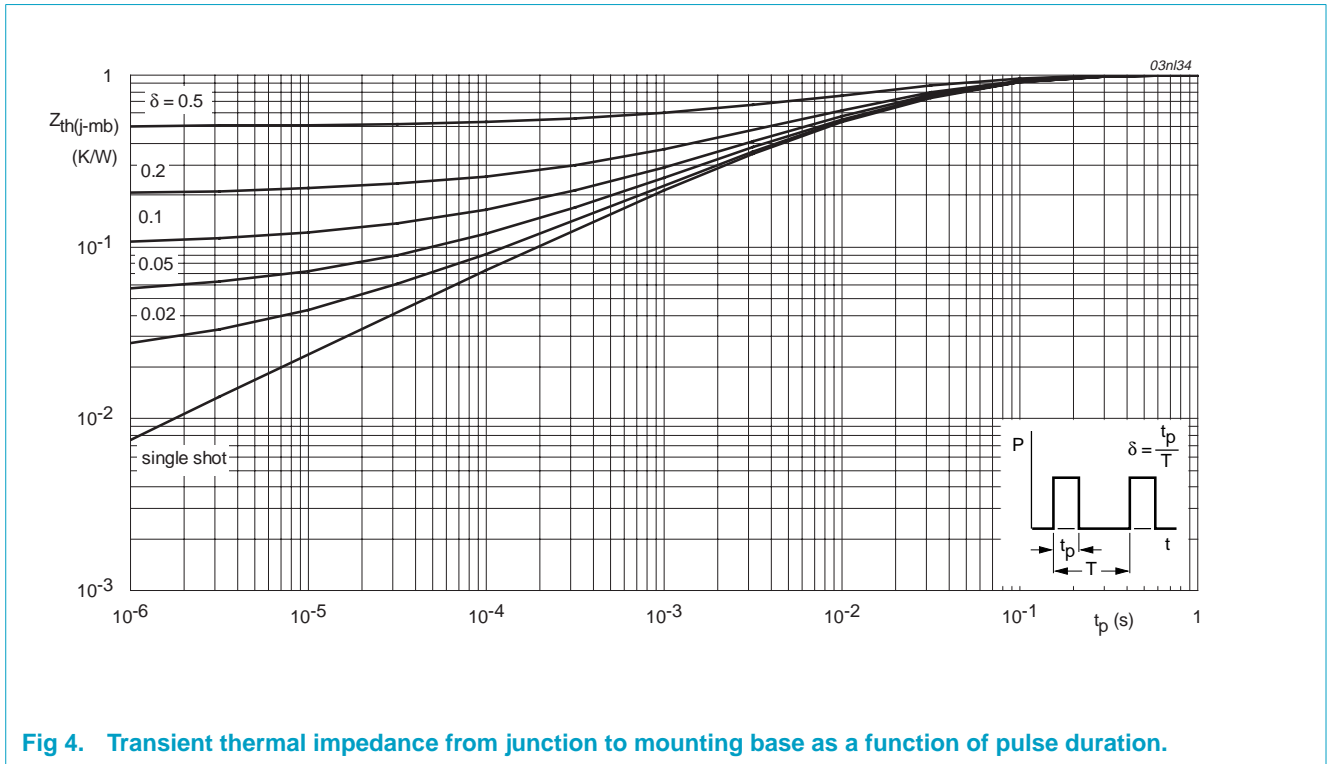
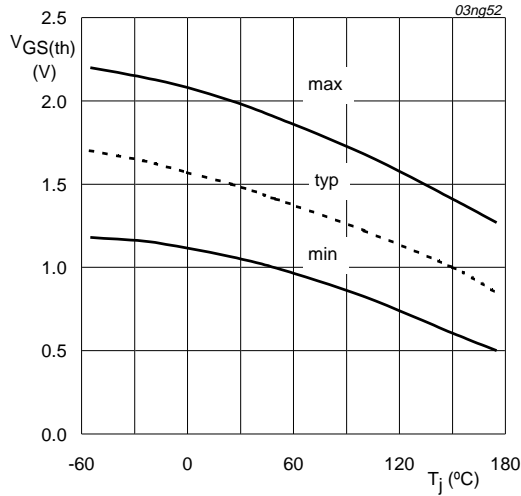


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration.

## 5. Characteristics

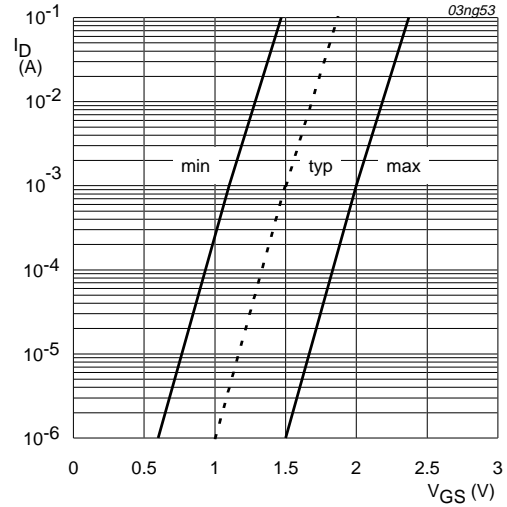
**Table 4: Characteristics**
 $T_j = 25\text{ °C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	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	$\mu\text{A}$
		$T_j = 175\text{ °C}$	-	-	500	$\mu\text{A}$
$I_{GSS}$	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 $\Omega$
		$T_j = 175\text{ °C}$	-	-	29	m $\Omega$
		$V_{GS} = 4.5\text{ V}; I_D = 25\text{ A}$	-	-	15.5	m $\Omega$
		$V_{GS} = 10\text{ V}; I_D = 25\text{ A}$	-	10.7	12	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{g(tot)}$	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
<b>Source-drain diode</b>						
$V_{SD}$	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



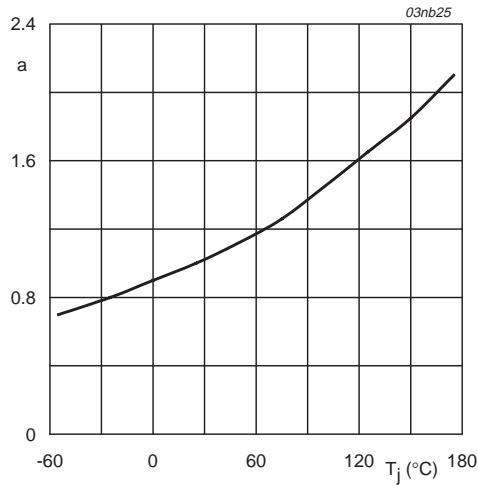
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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

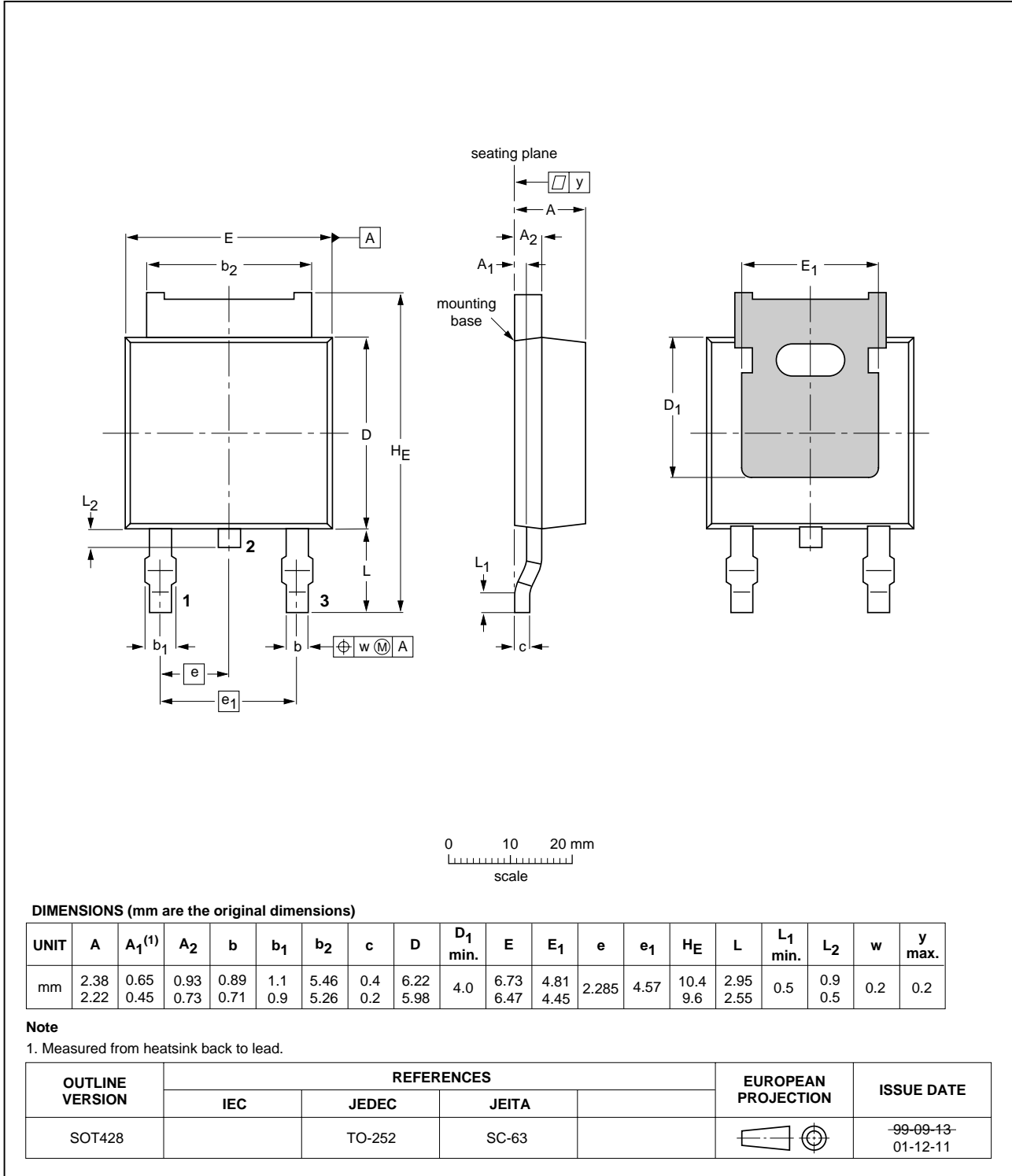


Fig 8. SOT428 (D-PAK)

## 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 <sup>[1]</sup>	Product status <sup>[2][3]</sup>	Definition
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