



# BUK9609-75A

N-channel TrenchMOS logic level FET

Rev. 4 — 30 August 2011

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 has been designed and qualified to the appropriate AEC standard for use in automotive critical applications.

### 1.2 Features and benefits

- Low conduction losses due to low on-state resistance
- Q101 compliant
- Suitable for logic level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

### 1.3 Applications

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

### 1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25^\circ\text{C}; T_j \leq 175^\circ\text{C}$	-	-	75	V
$I_D$	drain current	$V_{GS} = 5\text{ V}; T_{mb} = 25^\circ\text{C}$ ; see <a href="#">Figure 3</a> ; see <a href="#">Figure 1</a>	[1]	-	-	75 A
$P_{tot}$	total power dissipation	$T_{mb} = 25^\circ\text{C}$ ; see <a href="#">Figure 2</a>	-	-	230	W
Static characteristics						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}; I_D = 25\text{ A}; T_j = 25^\circ\text{C}$	-	-	9.95	$\text{m}\Omega$
		$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25^\circ\text{C}$	-	7.23	8.5	$\text{m}\Omega$
		$V_{GS} = 5\text{ V}; I_D = 25\text{ A}; T_j = 25^\circ\text{C}$ ; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	7.6	9	$\text{m}\Omega$
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}; V_{sup} \leq 75\text{ V}; R_{GS} = 50\text{ }\Omega; V_{GS} = 5\text{ V}; T_{j(init)} = 25^\circ\text{C}$ ; unclamped	-	-	562	$\text{mJ}$

[1] Continuous current is limited by package.

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## 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		
SOT404 (D2PAK)				

## 3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
BUK9609-75A	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	SOT404

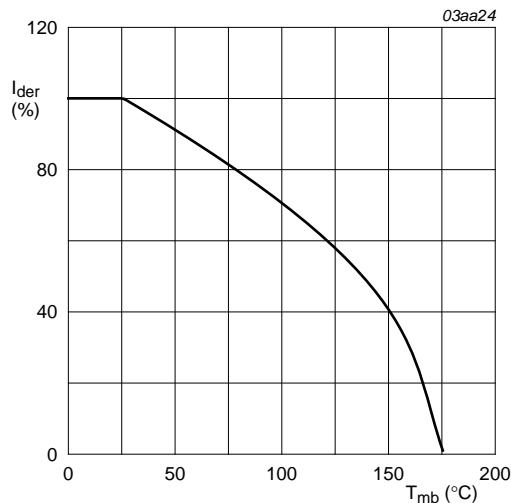
## 4. Limiting values

Table 4. Limiting values

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

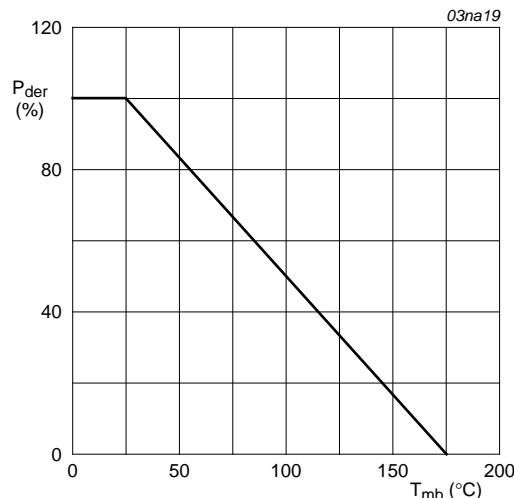
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25^\circ\text{C}; T_j \leq 175^\circ\text{C}$	-	75	V
$V_{DGR}$	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	75	V
$V_{GS}$	gate-source voltage		-10	10	V
$I_D$	drain current	$T_{mb} = 100^\circ\text{C}; V_{GS} = 5\text{ V}$ ; see <a href="#">Figure 1</a>	[1]	-	A
		$T_{mb} = 25^\circ\text{C}; V_{GS} = 5\text{ V}$ ; see <a href="#">Figure 3</a> ; see <a href="#">Figure 1</a>	[1]	-	A
$I_{DM}$	peak drain current	$T_{mb} = 25^\circ\text{C}$ ; pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; see <a href="#">Figure 3</a>	-	440	A
$P_{tot}$	total power dissipation	$T_{mb} = 25^\circ\text{C}$ ; see <a href="#">Figure 2</a>	-	230	W
$T_{stg}$	storage temperature		-55	175	°C
$T_j$	junction temperature		-55	175	°C
$V_{GSM}$	peak gate-source voltage	pulsed; $t_p \leq 50\text{ }\mu\text{s}$	-15	15	V
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25^\circ\text{C}$	[1]	-	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25^\circ\text{C}$	-	440	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}; V_{sup} \leq 75\text{ V}; R_{GS} = 50\text{ }\Omega$ ; $V_{GS} = 5\text{ V}$ ; $T_{j(init)} = 25^\circ\text{C}$ ; unclamped	-	562	mJ

[1] Continuous current is limited by package.



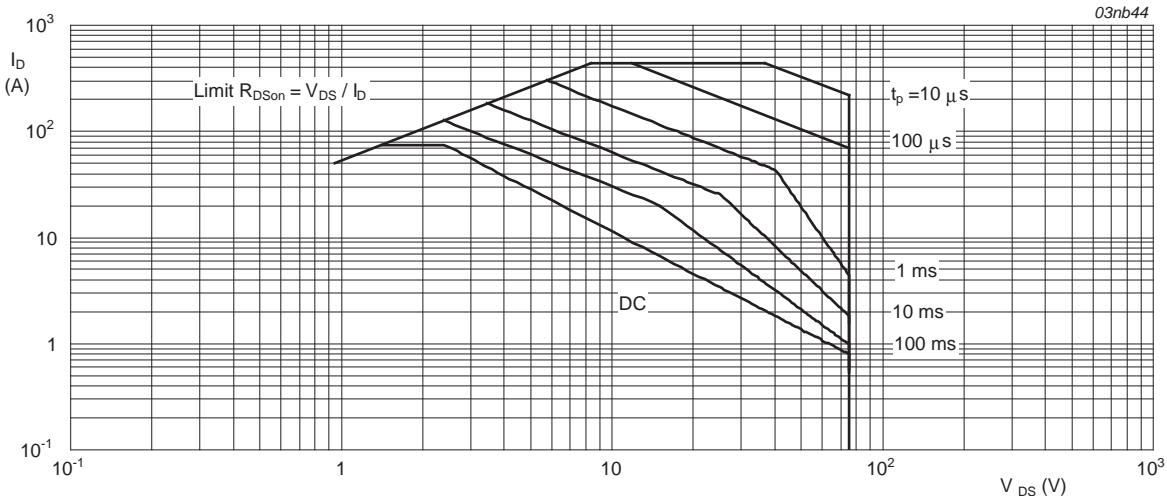
$$I_{der} = \frac{I_D}{I_{D(25^\circ C)}} \times 100\%$$

**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**



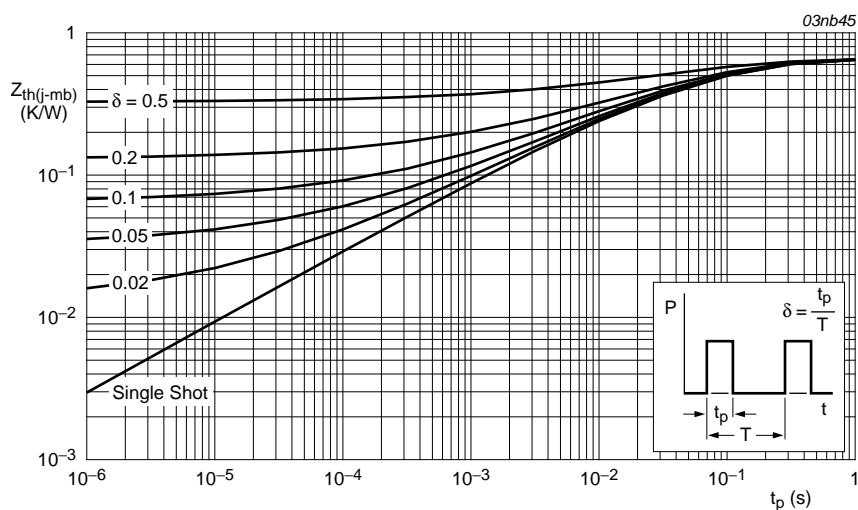
$$T_{mb} = 25^\circ C; I_{DM} \text{ is single pulse}$$

**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
$R_{th(j\text{-mb})}$	thermal resistance from junction to mounting base	see <a href="#">Figure 4</a>	-	-	0.65	K/W
$R_{th(j\text{-a})}$	thermal resistance from junction to ambient	minimum footprint ; mounted on a printed-circuit board	-	50	-	K/W

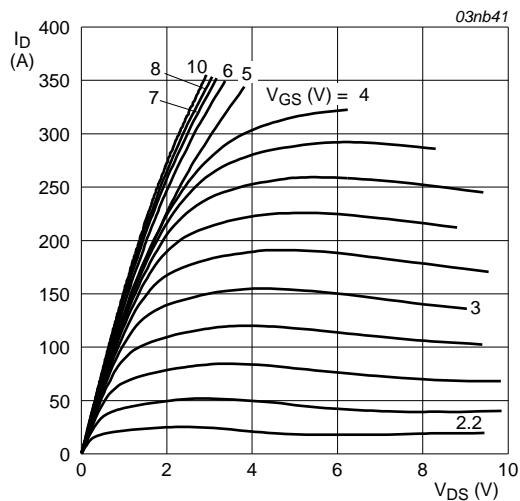


**Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration**

## 6. Characteristics

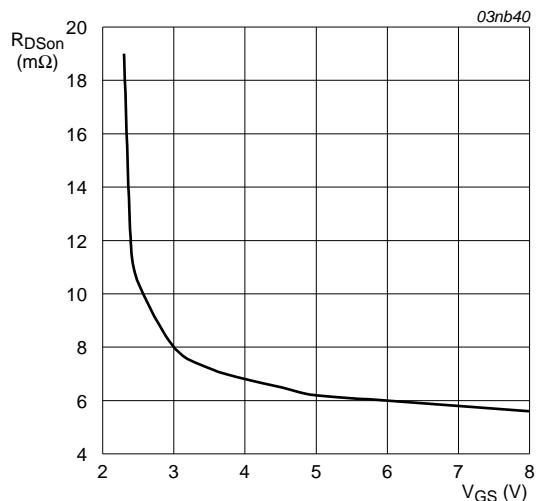
Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ $I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	75	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 12</a> $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see <a href="#">Figure 12</a> $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see <a href="#">Figure 12</a>	1	1.5	2	V
$I_{DSS}$	drain leakage current	$V_{DS} = 75 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$ $V_{DS} = 75 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	500	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = 10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ $V_{GS} = -10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ $V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a> $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ $V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	-	9.95	$\text{m}\Omega$
<b>Dynamic characteristics</b>						
$C_{iss}$	input capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 25 \text{ V}; f = 1 \text{ MHz};$	-	6631	8840	pF
$C_{oss}$	output capacitance	$T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 8</a>	-	905	1090	pF
$C_{rss}$	reverse transfer capacitance		-	610	840	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30 \text{ V}; R_L = 1.2 \text{ }\Omega; V_{GS} = 5 \text{ V};$	-	47	-	ns
$t_r$	rise time	$R_{G(ext)} = 10 \text{ }\Omega; T_j = 25 \text{ }^\circ\text{C}$	-	185	-	ns
$t_{d(off)}$	turn-off delay time		-	424	-	ns
$t_f$	fall time		-	226	-	ns
$L_D$	internal drain inductance	from upper edge of drain mounting base to centre of die ; $T_j = 25 \text{ }^\circ\text{C}$ from drain lead 6 mm from package to centre of die ; $T_j = 25 \text{ }^\circ\text{C}$	-	2.5	-	nH
$L_S$	internal source inductance	from source lead to source bond pad ; $T_j = 25 \text{ }^\circ\text{C}$	-	7.5	-	nH
<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 15</a>	-	0.85	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 20 \text{ A}; dI_S/dt = -100 \text{ A}/\mu\text{s};$	-	70.3	-	ns
$Q_r$	recovered charge	$V_{GS} = -10 \text{ V}; V_{DS} = 30 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	213	-	nC



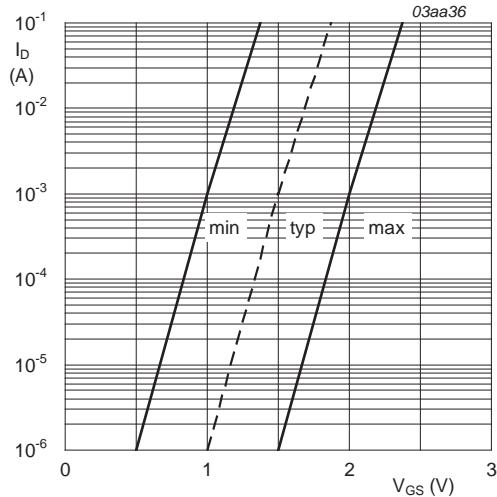
$T_j = 25^\circ C; t_p = 300\mu s$

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



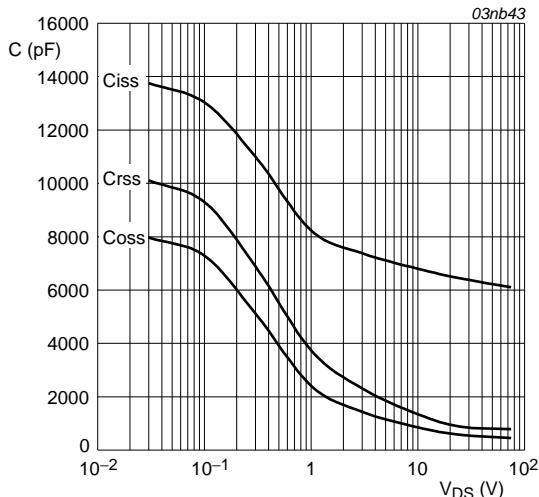
$T_j = 25^\circ C; I_D = 25A$

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



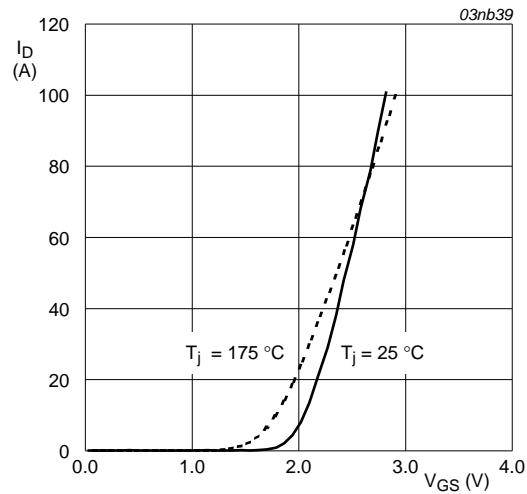
$T_j = 25^\circ C; V_{DS} = V_{GS}$

**Fig 7. Sub-threshold drain current as a function of gate-source voltage**



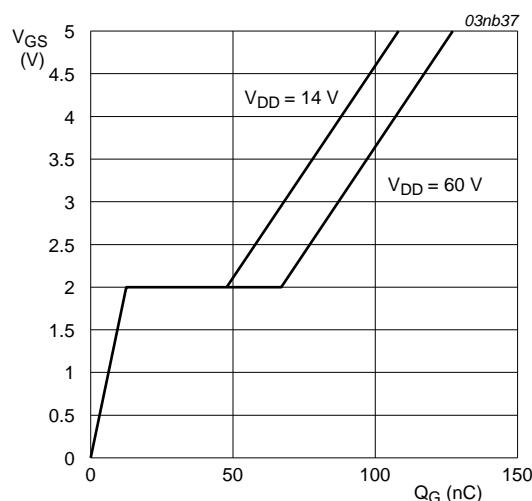
$V_{GS} = 0V; f = 1MHz$

**Fig 8. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**



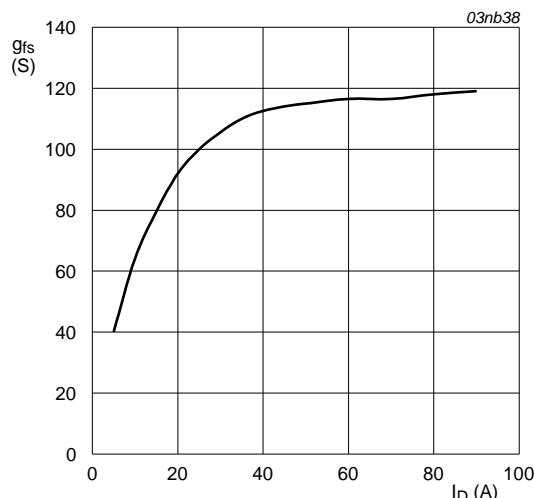
$V_{DS} = 25\text{V}$

**Fig 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values**



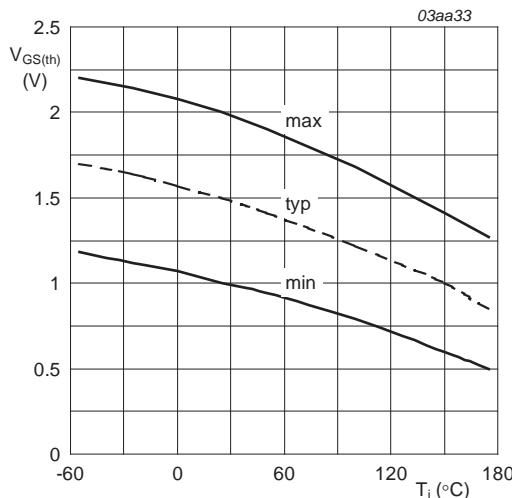
$T_j = 25^\circ\text{C}; I_D = 25\text{A}$

**Fig 10. Gate-source voltage as a function of gate charge; typical values**



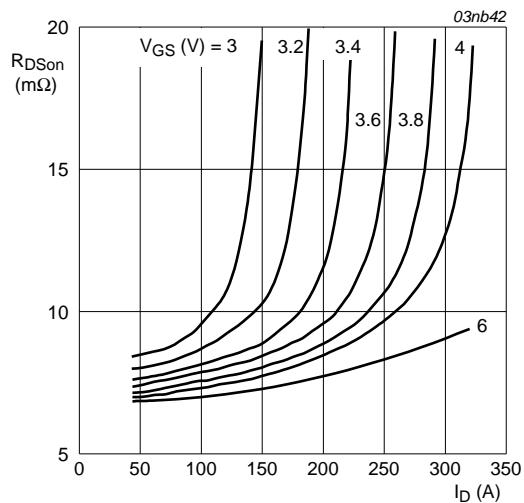
$T_j = 25^\circ\text{C}; V_{DS} = 25\text{V}$

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



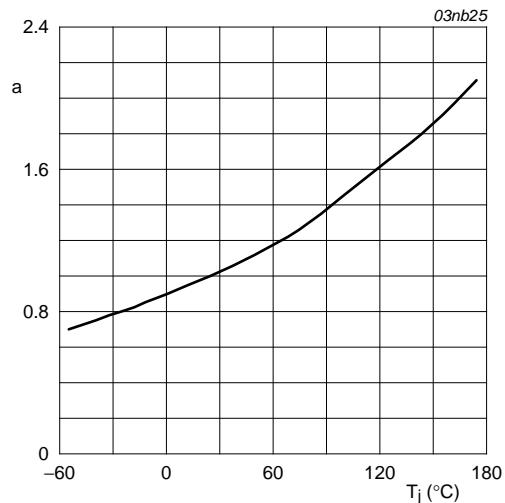
$I_D = 1\text{mA}; V_{DS} = V_{GS}$

**Fig 12. Gate-source threshold voltage as a function of junction temperature**



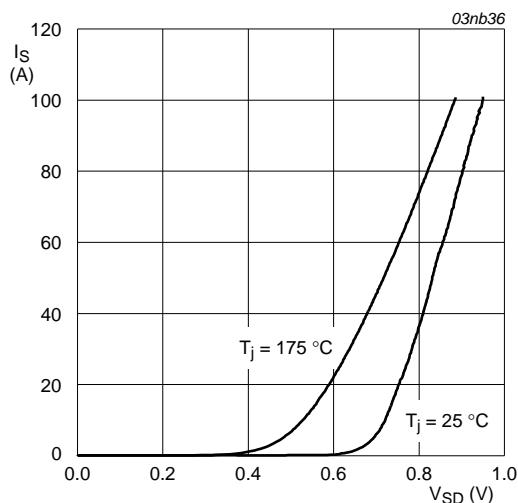
$T_j = 25^\circ C$

**Fig 13. Drain-source on-state resistance as a function of drain current; typical values**



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

**Fig 14. Normalized drain-source on-state resistance factor as a function of junction temperature**



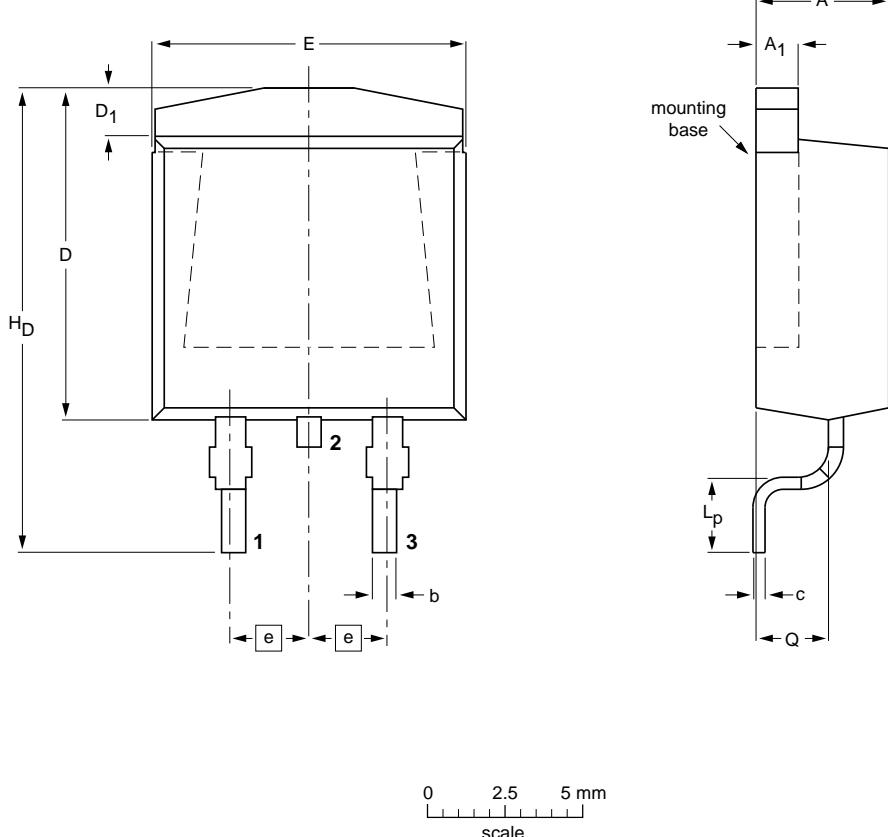
$V_{GS} = 0V$

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

## 7. Package outline

Plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)

SOT404



### DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b	c	D <sub>max.</sub>	D <sub>1</sub>	E	e	L <sub>p</sub>	H <sub>D</sub>	Q
mm	4.50 4.10	1.40 1.27	0.85 0.60	0.64 0.46	11	1.60 1.20	10.30 9.70	2.54	2.90 2.10	15.80 14.80	2.60 2.20

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT404						-05-02-11 06-03-16

Fig 16. Package outline SOT404 (D2PAK)

## 8. Revision history

**Table 7. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK9609-75A v.4	20110830	Product data sheet	-	BUK9609-75A v.3
Modifications:		• Various changes to content.		
BUK9609-75A v.3	20080922	Product data sheet	-	BUK9509_9609_75A v.2

## 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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