



**THE DATASHEET OF  
BUK9237-55A/C1,118**





# BUK9237-55A

N-channel TrenchMOS logic level FET

Rev. 3 — 9 November 2010

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

### 1.4 Quick reference data

Table 1. Quick reference data

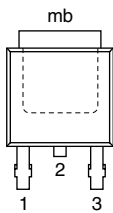
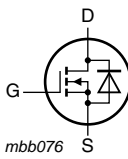
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	-	55	V
$I_D$	drain current	$V_{GS} = 5\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a>	-	-	32	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	77	W
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$ ; $I_D = 15\text{ A}$ ; $T_j = 25\text{ °C}$	-	28	33	mΩ
		$V_{GS} = 5\text{ V}$ ; $I_D = 15\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>	-	31	37	mΩ

Table 1. Quick reference data ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 32\text{ A}$ ; $V_{sup} \leq 30\text{ V}$ ; $R_{GS} = 50\ \Omega$ ; $V_{GS} = 5\text{ V}$ ; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$ ; unclamped	-	-	76	mJ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 5\text{ V}$ ; $I_D = 15\text{ A}$ ; $V_{DS} = 44\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 13</a>	-	9.2	-	nC

## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	D	drain <sup>[1]</sup>		
3	S	source		
mb	D	mounting base; connected to drain		

**SOT428 (DPAK)**

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

## 3. Ordering information

Table 3. Ordering information

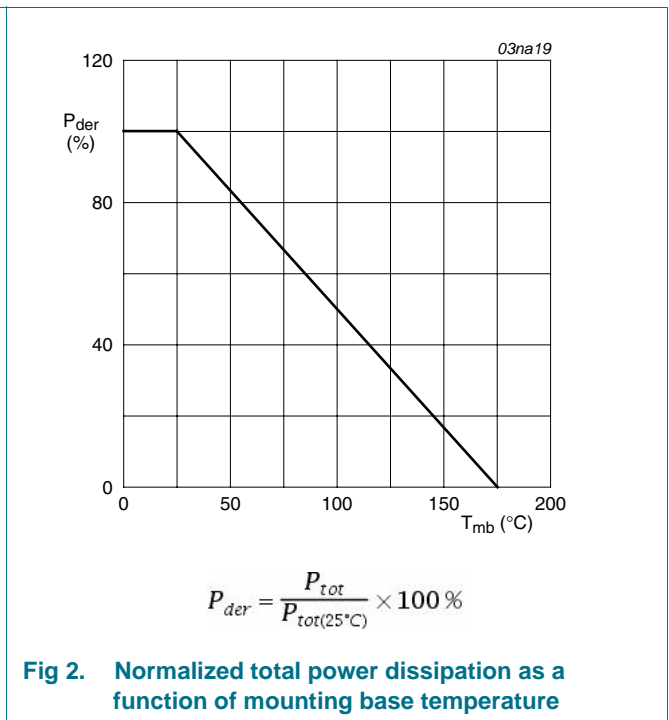
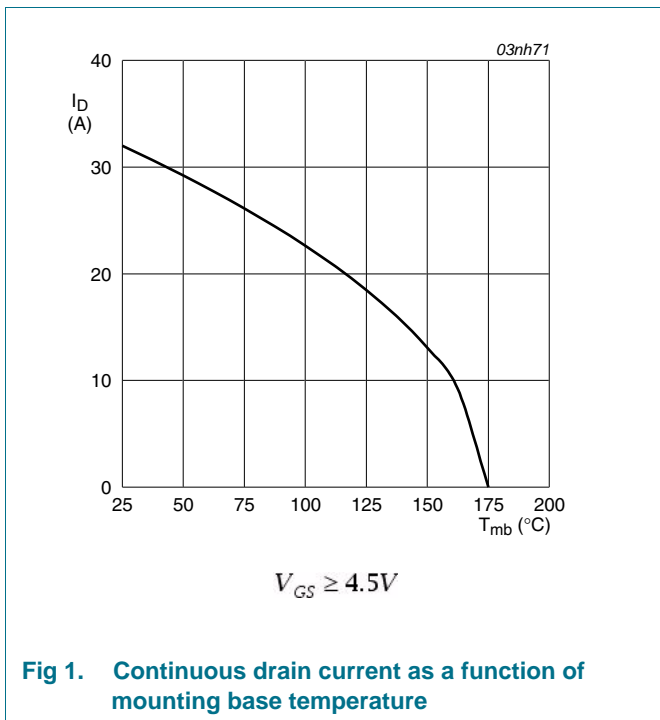
Type number	Package		Version
	Name	Description	
BUK9237-55A	DPAK	plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)	SOT428

**4. Limiting values**

**Table 4. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C	-	55	V
V <sub>DGR</sub>	drain-gate voltage	R <sub>GS</sub> = 20 kΩ	-	55	V
V <sub>GS</sub>	gate-source voltage		-15	15	V
I <sub>D</sub>	drain current	T <sub>mb</sub> = 25 °C; V <sub>GS</sub> = 5 V; see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a>	-	32	A
		T <sub>mb</sub> = 100 °C; V <sub>GS</sub> = 5 V; see <a href="#">Figure 1</a>	-	22	A
I <sub>DM</sub>	peak drain current	T <sub>mb</sub> = 25 °C; t <sub>p</sub> ≤ 10 μs; pulsed; see <a href="#">Figure 3</a>	-	129	A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; see <a href="#">Figure 2</a>	-	77	W
T <sub>stg</sub>	storage temperature		-55	175	°C
T <sub>j</sub>	junction temperature		-55	175	°C
<b>Source-drain diode</b>					
I <sub>S</sub>	source current	T <sub>mb</sub> = 25 °C	-	32	A
I <sub>SM</sub>	peak source current	t <sub>p</sub> ≤ 10 μs; pulsed; T <sub>mb</sub> = 25 °C	-	129	A
<b>Avalanche ruggedness</b>					
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	I <sub>D</sub> = 32 A; V <sub>sup</sub> ≤ 30 V; R <sub>GS</sub> = 50 Ω; V <sub>GS</sub> = 5 V; T <sub>j(init)</sub> = 25 °C; unclamped	-	76	mJ



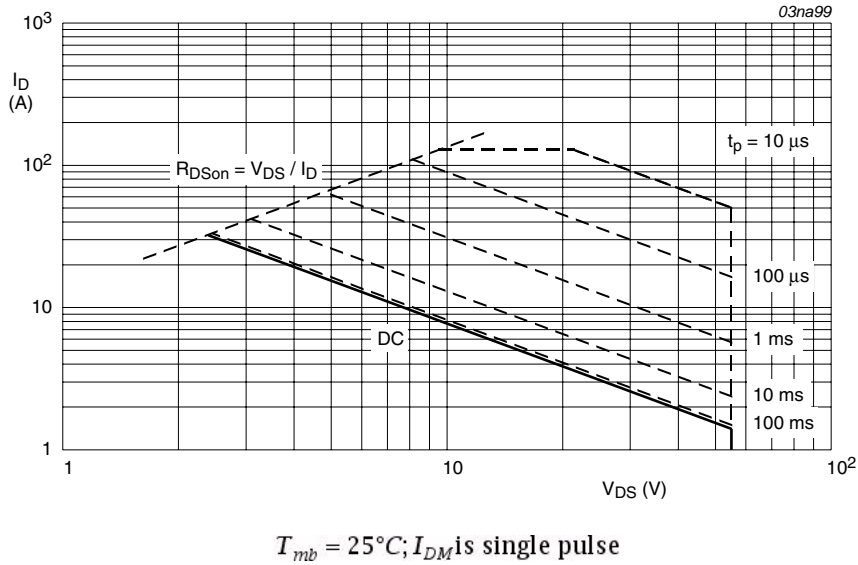


Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

### 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 <a href="#">Figure 4</a>	-	-	1.94	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient		-	71.4	-	K/W

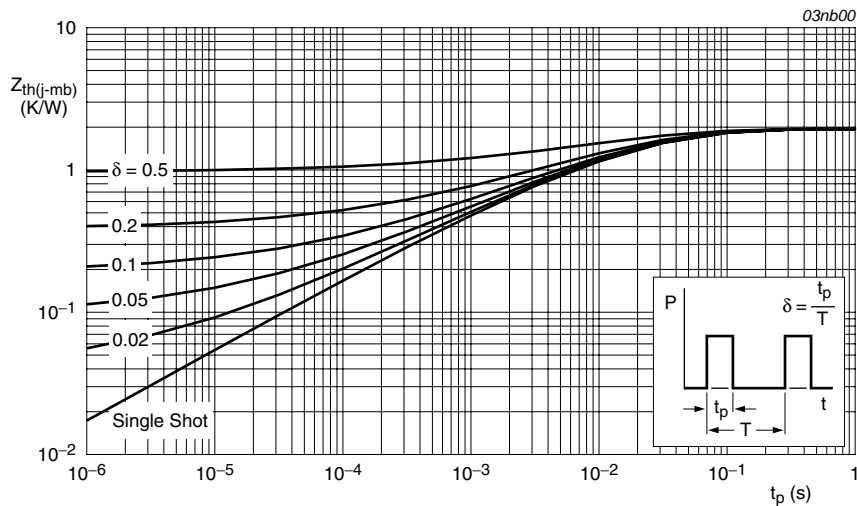
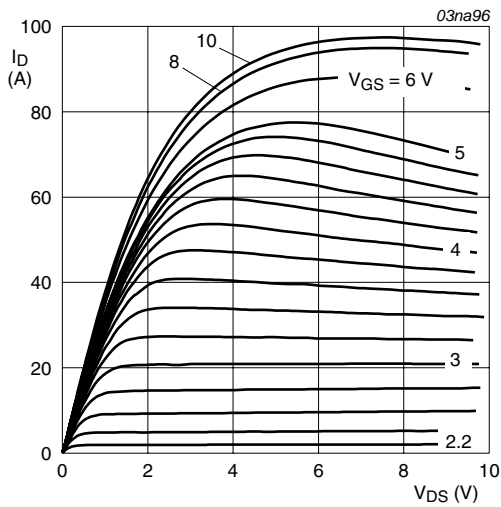


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

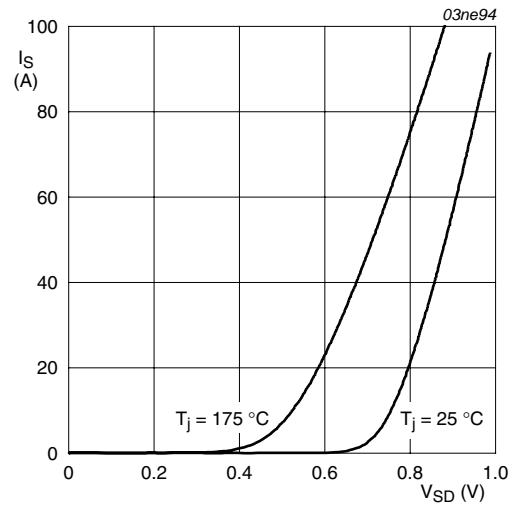
Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	55	-	-	V
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = -55 \text{ }^\circ\text{C}$	50	-	-	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 10</a>	1	1.5	2	V
		$I_D = 1 \text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = -55 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 10</a>	-	-	2.3	V
		$I_D = 1 \text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 175 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 10</a>	0.5	-	-	V
$I_{DSS}$	drain leakage current	$V_{DS} = 55 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	0.05	10	$\mu\text{A}$
		$V_{DS} = 55 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 175 \text{ }^\circ\text{C}$	-	-	500	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{DS} = 0 \text{ V}$ ; $V_{GS} = 10 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
		$V_{DS} = 0 \text{ V}$ ; $V_{GS} = -10 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}$ ; $I_D = 15 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	-	38	m $\Omega$
		$V_{GS} = 5 \text{ V}$ ; $I_D = 15 \text{ A}$ ; $T_j = 175 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>	-	-	74	m $\Omega$
		$V_{GS} = 10 \text{ V}$ ; $I_D = 15 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	28	33	m $\Omega$
		$V_{GS} = 5 \text{ V}$ ; $I_D = 15 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>	-	31	37	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 15 \text{ A}$ ; $V_{DS} = 44 \text{ V}$ ; $V_{GS} = 5 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 13</a>	-	17.6	-	nC
$Q_{GS}$	gate-source charge		-	2.9	-	nC
$Q_{GD}$	gate-drain charge		-	9.2	-	nC
$C_{iss}$	input capacitance	$V_{GS} = 0 \text{ V}$ ; $V_{DS} = 25 \text{ V}$ ; $f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 14</a>	-	927	1236	pF
$C_{oss}$	output capacitance		-	151	181	pF
$C_{rss}$	reverse transfer capacitance		-	96	131	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30 \text{ V}$ ; $R_L = 1.2 \text{ }^\circ\Omega$ ; $V_{GS} = 5 \text{ V}$ ; $R_{G(ext)} = 10 \text{ }^\circ\Omega$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	6	-	ns
$t_r$	rise time		-	36	-	ns
$t_{d(off)}$	turn-off delay time		-	95	-	ns
$t_f$	fall time		-	73	-	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 voltage	$I_S = 15 \text{ A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 15</a>	-	0.85	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 20 \text{ A}$ ; $dI_S/dt = -100 \text{ A}/\mu\text{s}$ ; $V_{GS} = -10 \text{ V}$ ; $V_{DS} = 30 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	42	-	ns
$Q_r$	recovered charge		-	83	-	nC



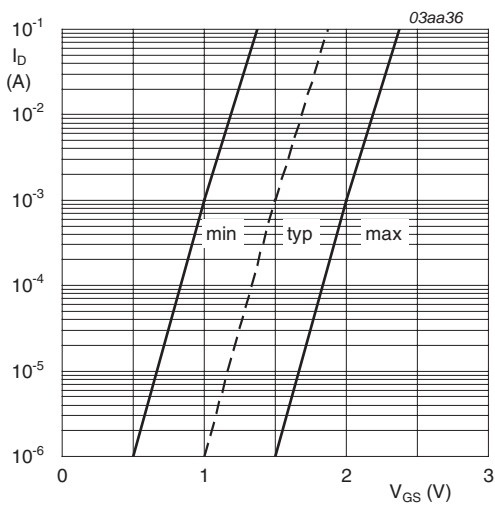
$T_j = 25^\circ\text{C}$

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



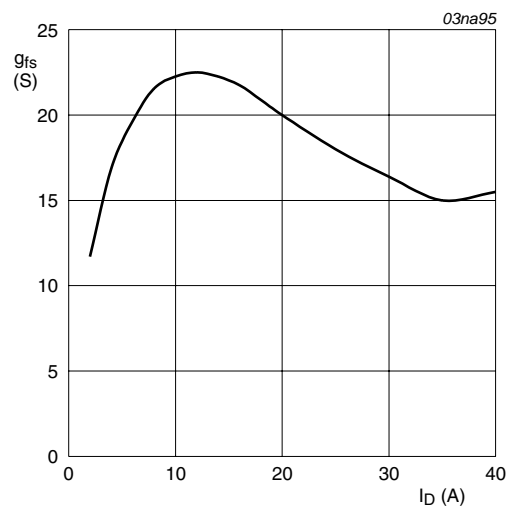
$V_{GS} = 0\text{V}$

**Fig 6. Reverse diode current as a function of reverse diode voltage; typical values**



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

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



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

**Fig 8. Forward transconductance as a function of drain current; typical values**

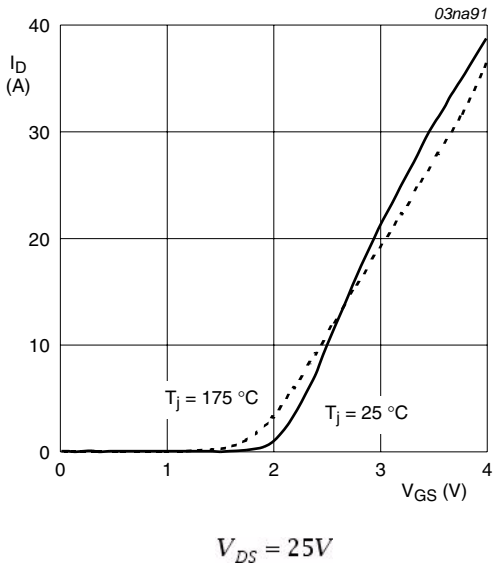


Fig 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

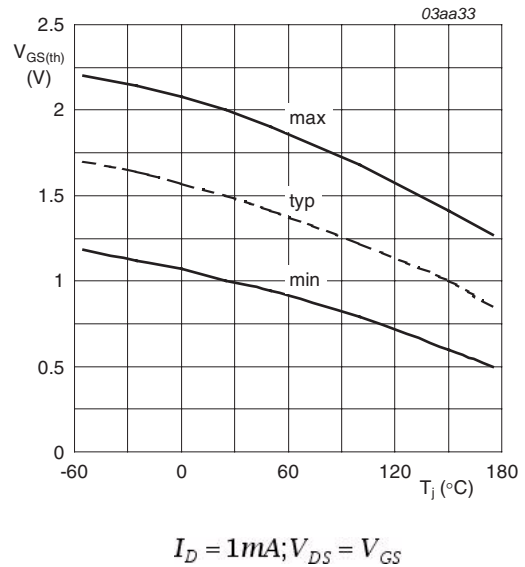


Fig 10. Gate-source threshold voltage as a function of junction temperature

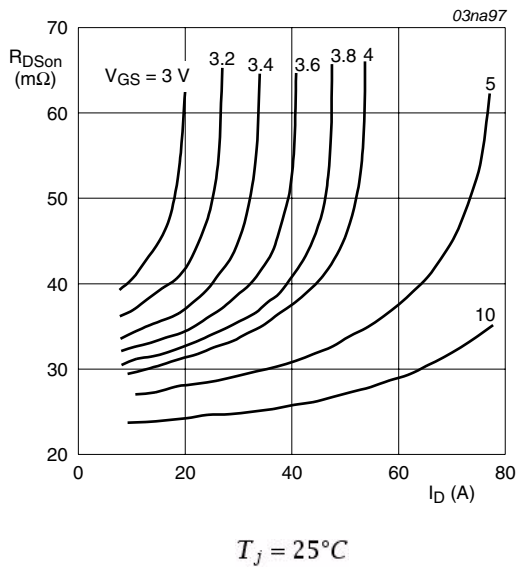


Fig 11. Drain-source on-state resistance as a function of drain current; typical values

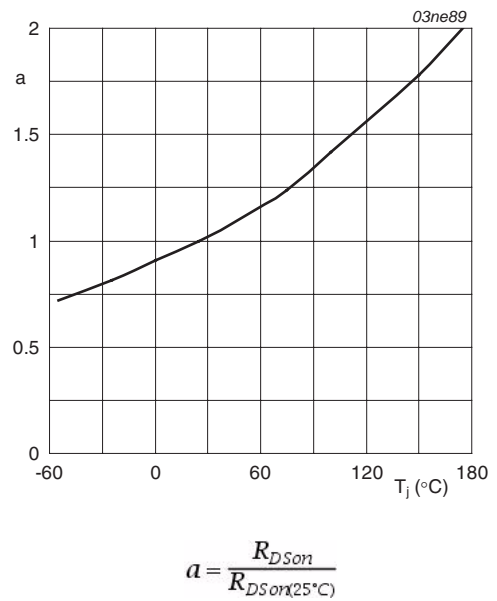
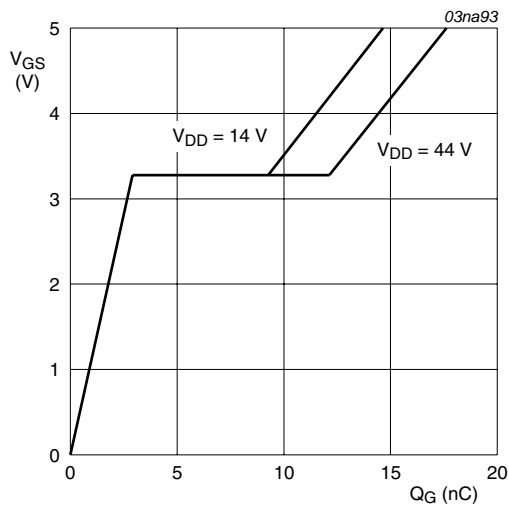
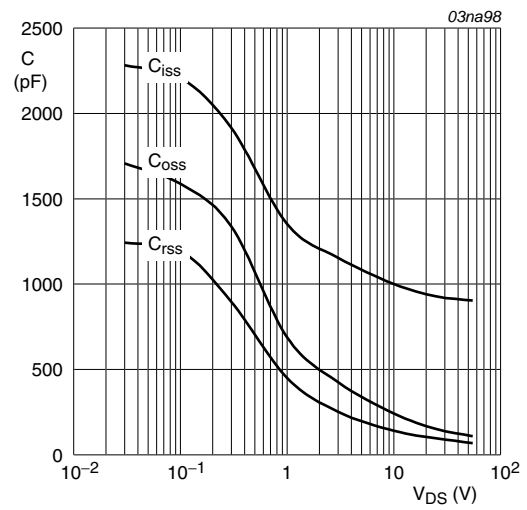


Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature



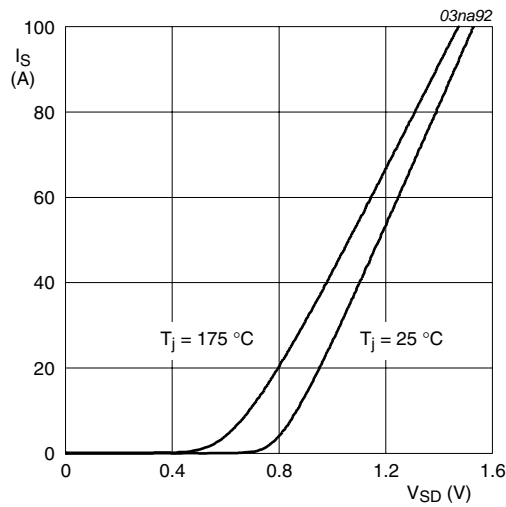
$T_j = 25^\circ\text{C}; I_D = 15\text{A}$

**Fig 13. Gate-source voltage as a function of turn-on gate charge; typical values**



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

**Fig 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**



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

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

**7. Package outline**

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

SOT428

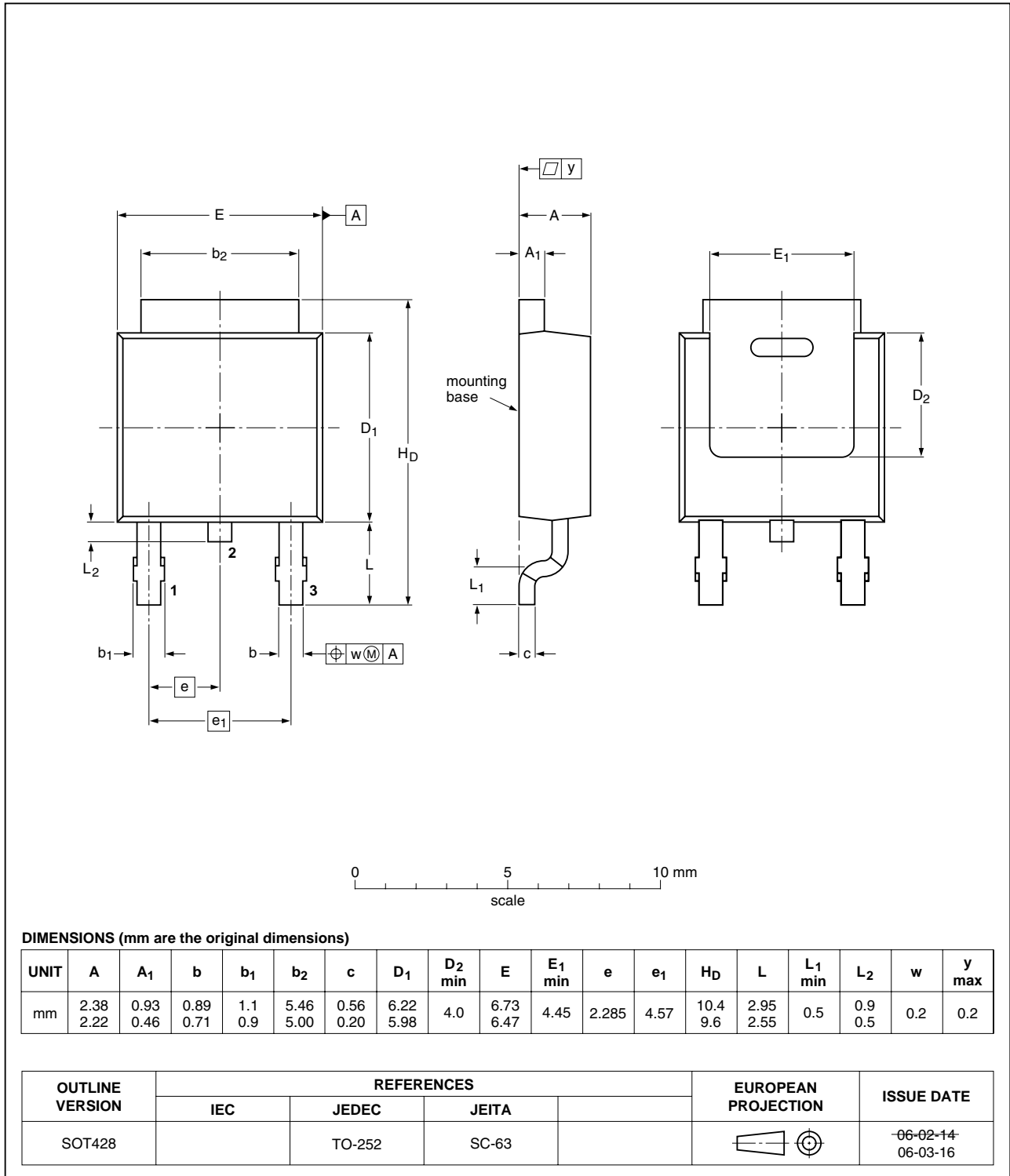


Fig 16. Package outline SOT428 (DPAK)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK9237-55A v.3	20101109	Product data sheet	-	BUK9237_55A-02
Modifications:	<ul style="list-style-type: none"><li>• Various changes to content.</li><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li></ul>			
BUK9237_55A-02	20020214	Product specification	-	BUK9237_55A-01

## 9. Legal information

### 9.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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