

# BUK9277-55A

N-channel TrenchMOS logic level FET

Rev. 02 — 24 October 2006

Product data sheet

## 1. Product profile

### 1.1 General description

N-channel enhancement mode power Field-Effect Transistor (FET) in a plastic package using NXP General Purpose Automotive (GPA) TrenchMOS technology.

### 1.2 Features

- Very low on-state resistance
- 175 °C rated
- Q101 compliant
- Logic level compatible

### 1.3 Applications

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

### 1.4 Quick reference data

- $E_{DS(AL)S} \leq 33$  mJ
- $I_D \leq 18$  A
- $R_{DSon} = 65$  m $\Omega$  (typ)
- $P_{tot} \leq 51$  W

## 2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Symbol
1	gate (G)	<p>SOT428 (D-PAK)</p>	
2	drain (D) <a href="#">[1]</a>		
3	source (S)		
mb	mounting base; connected to drain (D)		

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

### 3. Ordering information

**Table 2. Ordering information**

Type number	Package		Version
	Name	Description	
BUK9277-55A	DPAK	plastic single-ended surface-mounted package; 3 leads (one lead cropped)	SOT428

### 4. Limiting values

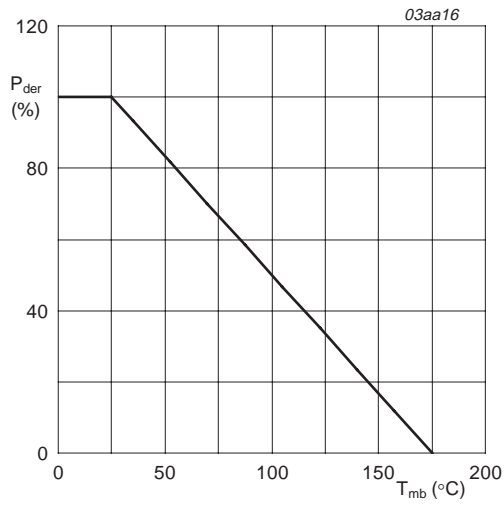
**Table 3. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage		-	55	V
$V_{DGR}$	drain-gate voltage (DC)	$R_{GS} = 20 \text{ k}\Omega$	-	55	V
$V_{GS}$	gate-source voltage		-	$\pm 15$	V
$I_D$	drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$ ; $V_{GS} = 5 \text{ V}$ ; see <a href="#">Figure 2</a> and <a href="#">3</a>	-	18	A
		$T_{mb} = 100 \text{ }^\circ\text{C}$ ; $V_{GS} = 5 \text{ V}$ ; see <a href="#">Figure 2</a>	-	13	A
$I_{DM}$	peak drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$ ; pulsed; $t_p \leq 10 \text{ }\mu\text{s}$ ; see <a href="#">Figure 3</a>	-	73	A
$P_{tot}$	total power dissipation	$T_{mb} = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 1</a>	-	51	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	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	18	A
$I_{DRM}$	peak reverse drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$ ; pulsed; $t_p \leq 10 \text{ }\mu\text{s}$	-	73	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; $I_D = 18 \text{ A}$ ; $V_{DS} \leq 55 \text{ V}$ ; $R_{GS} = 50 \text{ }\Omega$ ; $V_{GS} = 5 \text{ V}$ ; starting at $T_j = 25 \text{ }^\circ\text{C}$	-	33	mJ
$E_{DS(AL)R}$	repetitive drain-source avalanche energy		[1]	-	J

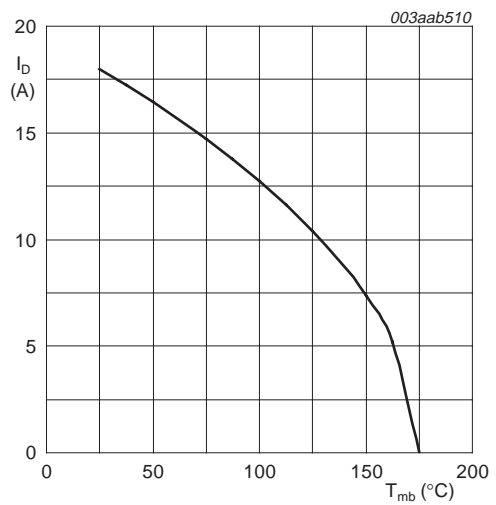
[1] Conditions:

- Maximum value not quoted. Repetitive rating defined in [Figure 16](#).
- Single-pulse avalanche rating limited by  $T_{j(max)}$  of 175  $^\circ\text{C}$ .
- Repetitive avalanche rating limited by an average junction temperature of 170  $^\circ\text{C}$ .
- Refer to application note [AN10273](#) for further information.



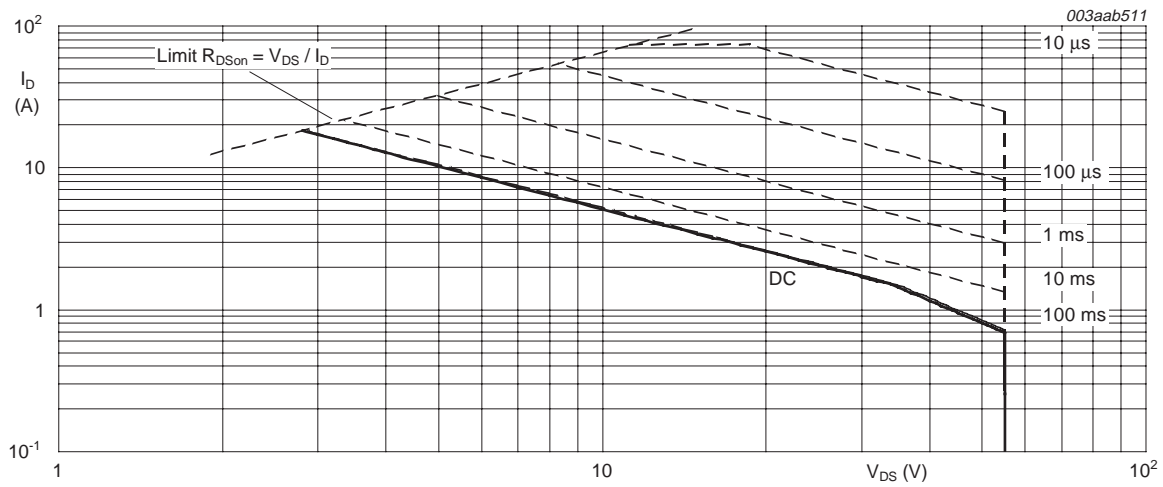
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

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



V<sub>GS</sub> ≥ 5 V

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



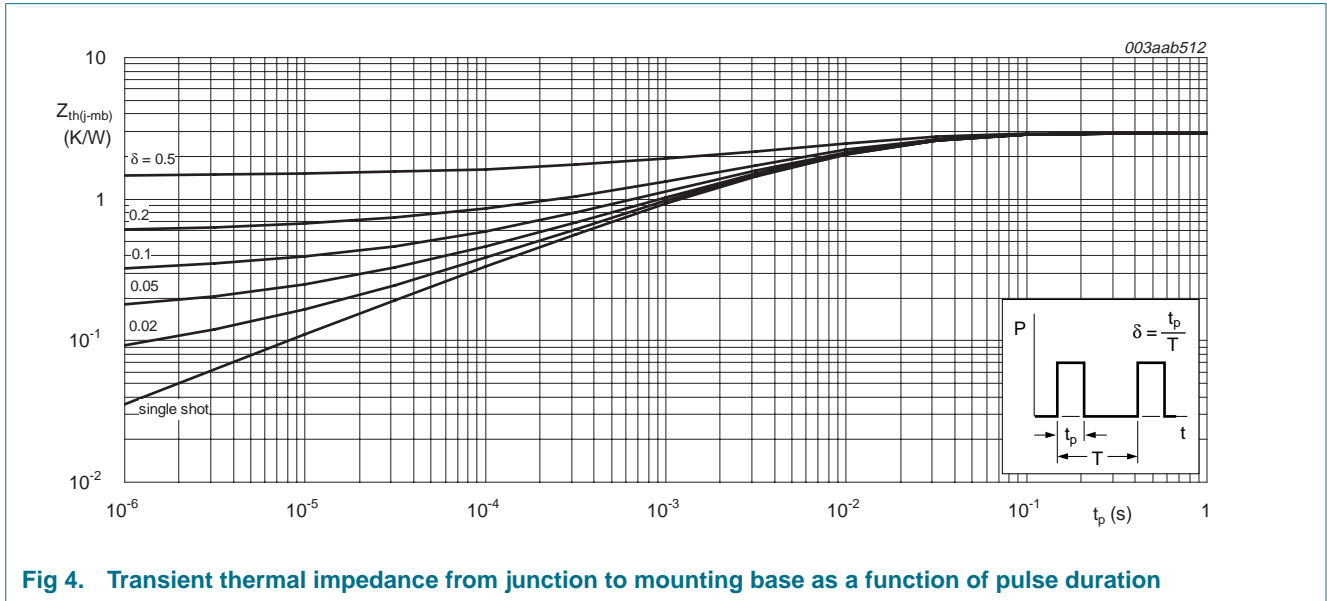
T<sub>mb</sub> = 25 °C; I<sub>DM</sub> is single pulse.

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

**5. Thermal characteristics**

**Table 4. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient		-	71	-	K/W
$R_{th(j-mb)}$	thermal resistance from junction to mounting base		-	-	3	K/W

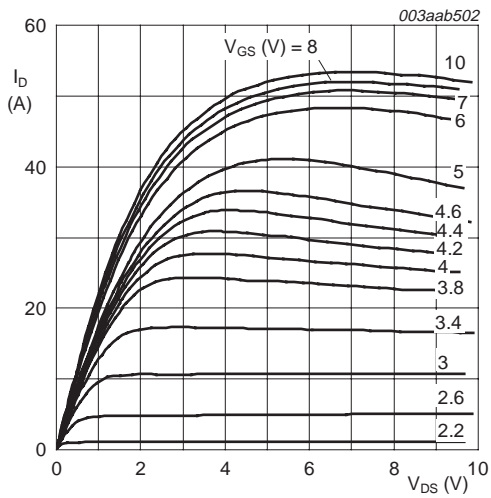


**Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration**

## 6. Characteristics

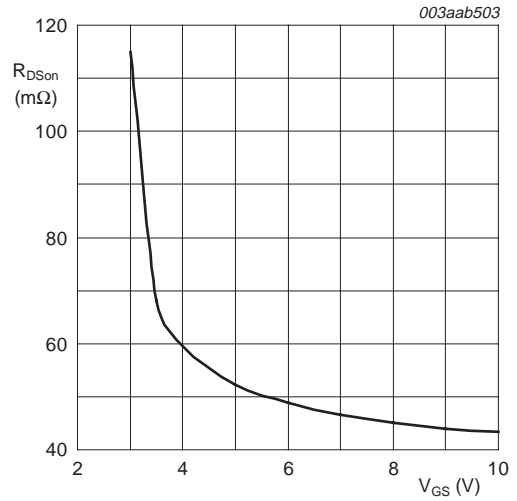
**Table 5. Characteristics**
*T<sub>j</sub> = 25 °C unless otherwise specified.*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
V <sub>(BR)DSS</sub>	drain-source breakdown voltage	I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V T <sub>j</sub> = 25 °C	55	-	-	V
		T <sub>j</sub> = -55 °C	50	-	-	V
V <sub>GS(th)</sub>	gate-source threshold voltage	I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; see <a href="#">Figure 9</a> T <sub>j</sub> = 25 °C	1	1.5	2	V
		T <sub>j</sub> = 175 °C	0.5	-	-	V
		T <sub>j</sub> = -55 °C	-	-	2.3	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 55 V; V <sub>GS</sub> = 0 V T <sub>j</sub> = 25 °C	-	0.05	10	μA
		T <sub>j</sub> = 175 °C	-	-	500	μA
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = ±15 V; V <sub>DS</sub> = 0 V	-	2	100	nA
R <sub>DS(on)</sub>	drain-source on-state resistance	V <sub>GS</sub> = 5 V; I <sub>D</sub> = 10 A; see <a href="#">Figure 7</a> and <a href="#">8</a> T <sub>j</sub> = 25 °C	-	65	77	mΩ
		T <sub>j</sub> = 175 °C	-	-	154	mΩ
		V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 10 A	-	-	86	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 10 A	-	59	69	mΩ
<b>Dynamic characteristics</b>						
Q <sub>G(tot)</sub>	total gate charge	I <sub>D</sub> = 10 A; V <sub>DD</sub> = 44 V; V <sub>GS</sub> = 5 V; see <a href="#">Figure 14</a>	-	11	-	nC
Q <sub>GS</sub>	gate-source charge		-	1.6	-	nC
Q <sub>GD</sub>	gate-drain charge		-	5	-	nC
C <sub>iss</sub>	input capacitance	V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 25 V; f = 1 MHz; see <a href="#">Figure 12</a>	-	440	643	pF
C <sub>oss</sub>	output capacitance		-	90	110	pF
C <sub>rss</sub>	reverse transfer capacitance		-	60	93	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 30 V; R <sub>L</sub> = 1.2 Ω; V <sub>GS</sub> = 5 V; R <sub>G</sub> = 10 Ω	-	10	-	ns
t <sub>r</sub>	rise time		-	47	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	28	-	ns
t <sub>f</sub>	fall time		-	33	-	ns
L <sub>D</sub>	internal drain inductance	from drain lead from package to center of die	-	2.5	-	nH
L <sub>S</sub>	internal source inductance	from source lead from package to source bond pad	-	7.5	-	nH
<b>Source-drain diode</b>						
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 15 A; V <sub>GS</sub> = 0 V; see <a href="#">Figure 15</a>	-	0.85	1.2	V
t <sub>rr</sub>	reverse recovery time	I <sub>S</sub> = 20 A; dI <sub>S</sub> /dt = -100 A/μs;	-	33	-	ns
Q <sub>r</sub>	recovered charge	V <sub>GS</sub> = -10 V; V <sub>R</sub> = 30 V	-	60	-	nC



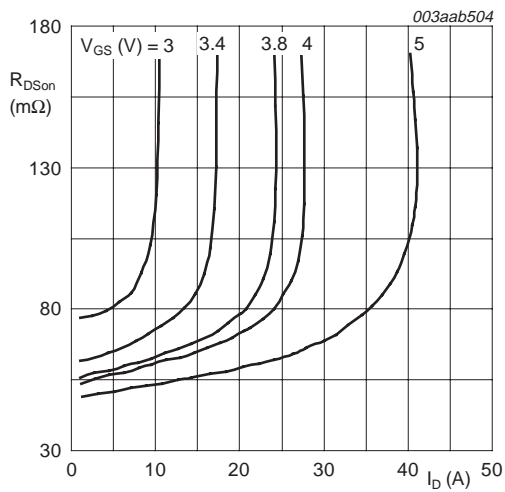
$T_j = 25^\circ\text{C}$

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



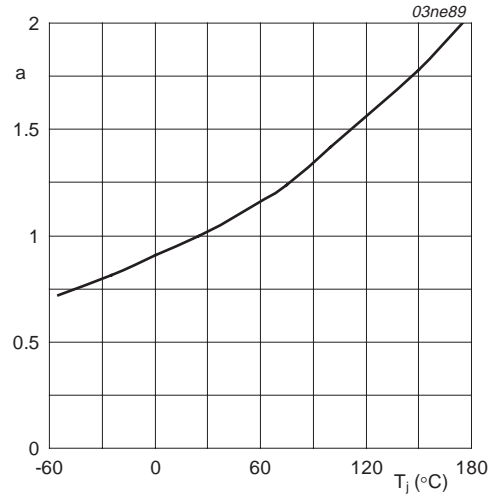
$T_j = 25^\circ\text{C}; I_D = 10\text{ A}$

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



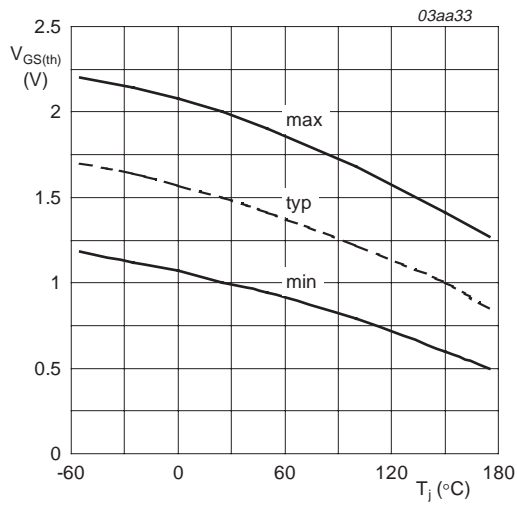
$T_j = 25^\circ\text{C}$

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



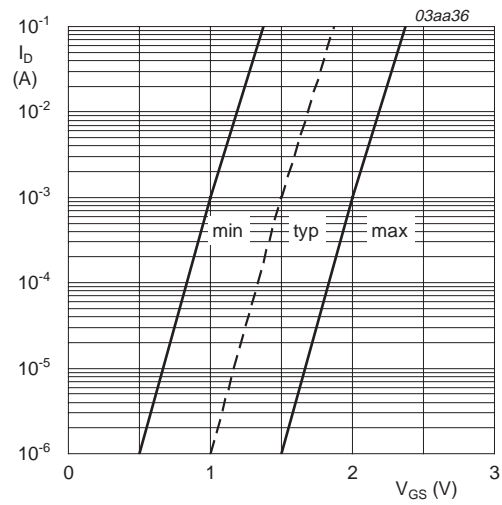
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

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



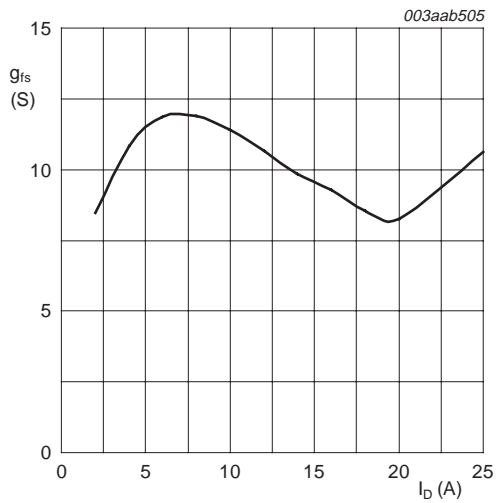
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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



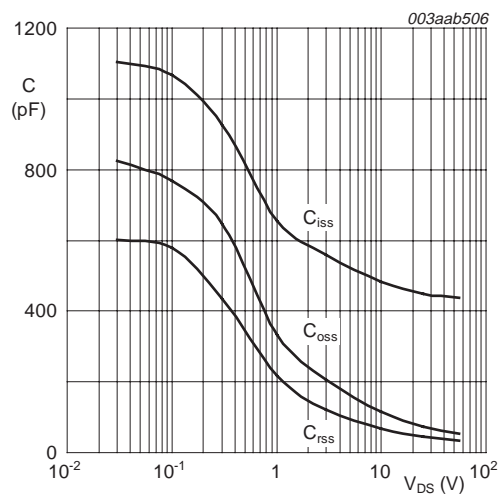
$T_j = 25 \text{ }^\circ\text{C}; V_{DS} = V_{GS}$

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



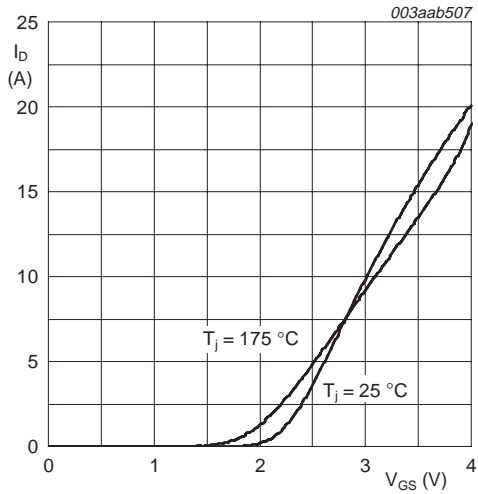
$T_j = 25 \text{ }^\circ\text{C}; V_{DS} = 25 \text{ V}$

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



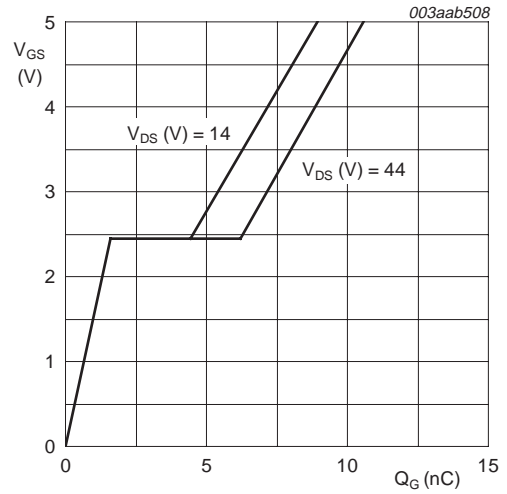
$V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

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



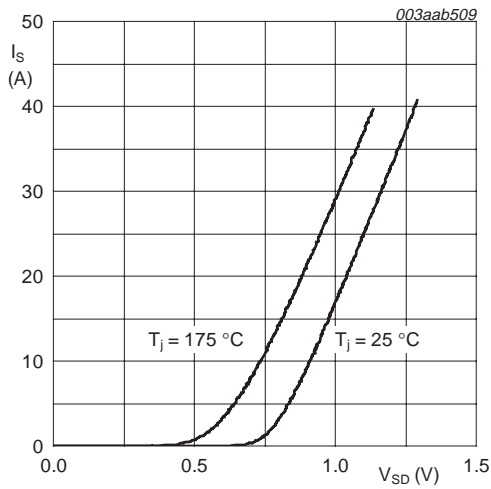
$V_{DS} = 25\text{ V}$

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



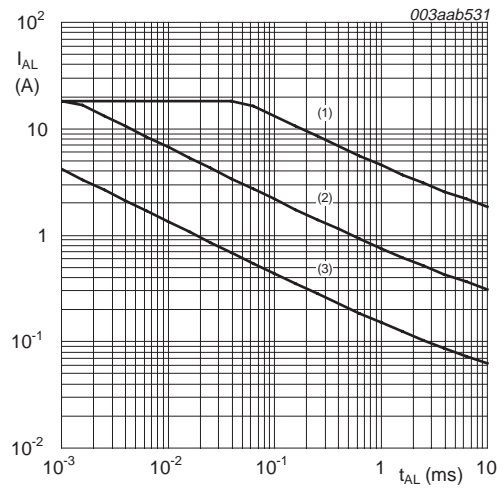
$T_j = 25\text{ °C}; I_D = 10\text{ A}$

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



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

**Fig 15. Source current as a function of source-drain voltage; typical values**



See [Table note 1](#) of [Table 3](#) Limiting values.

- (1) Single-pulse;  $T_j = 25\text{ °C}$ .
- (2) Single-pulse;  $T_j = 150\text{ °C}$ .
- (3) Repetitive.

**Fig 16. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time**



**7. Package outline**

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

SOT428

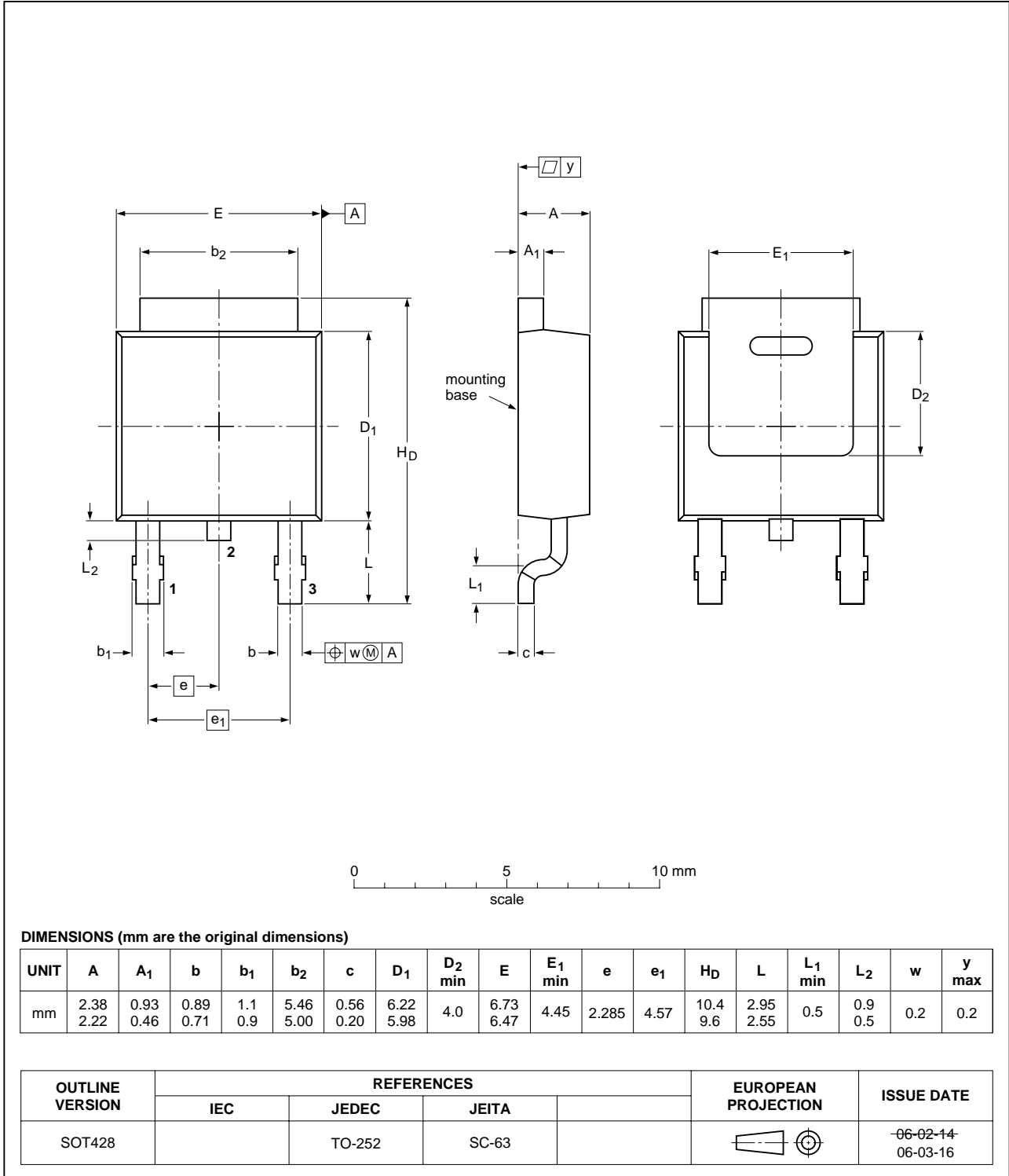


Fig 17. Package outline SOT428 (D-PAK)

## 8. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK9277-55A_2	20061024	Product data sheet	-	BUK9277_55A-1
Modifications:	<ul style="list-style-type: none"><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><li>• <a href="#">Section 4 "Limiting values"</a> Correction to <math>V_{GS}</math> value.</li></ul>			
BUK9277_55A-1	20010206	Product data sheet	-	-

## 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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