



# BUK9635-55A

N-channel TrenchMOS logic level FET

Rev. 2 — 21 April 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

- AEC Q101 compliant
- Low conduction losses due to low on-state resistance

### 1.3 Applications

- Automotive and general purpose power switching

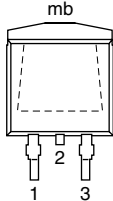
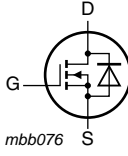
### 1.4 Quick reference data

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	$T_{mb} = 25\text{ °C}$	-	-	34	A
$P_{tot}$	total power dissipation		-	-	85	W
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C}$	-	24	32	m $\Omega$
		$V_{GS} = 5\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C}$	-	26	35	m $\Omega$
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 14\text{ A}; V_{sup} \leq 25\text{ V}; R_{GS} = 50\text{ }\Omega; V_{GS} = 5\text{ V}; T_{j(init)} = 25\text{ °C};$ unclamped	-	-	49	mJ

## 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

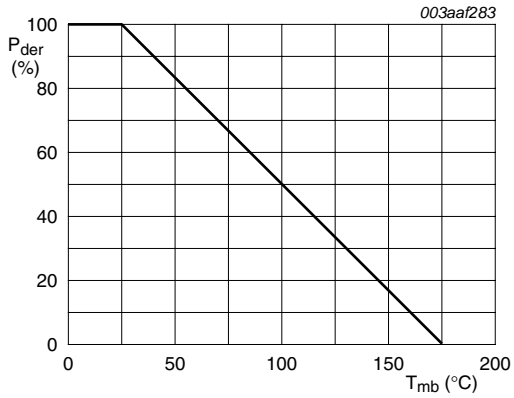
Type number	Package		
	Name	Description	Version
BUK9635-55A	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	SOT404

## 4. Limiting values

Table 4. Limiting values

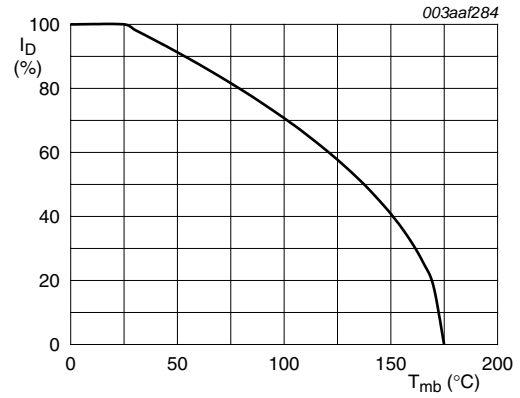
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	55	V
$V_{DGR}$	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	55	V
$V_{GS}$	gate-source voltage		-10	10	V
$I_D$	drain current	$T_{mb} = 100\text{ °C}$	-	24	A
		$T_{mb} = 25\text{ °C}$	-	34	A
$I_{DM}$	peak drain current	$T_{mb} = 25\text{ °C}$ ; pulsed	-	133	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$	-	85	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	$T_{mb} = 25\text{ °C}$	-	34	A
$I_{SM}$	peak source current	pulsed; $T_{mb} = 25\text{ °C}$	-	133	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 14\text{ A}$ ; $V_{sup} \leq 25\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; $V_{GS} = 5\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; unclamped	-	49	mJ



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

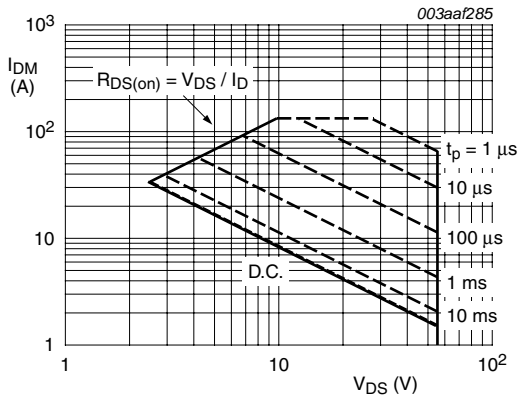
**Fig 1. Normalized total power dissipation as a function of mounting base temperature**



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

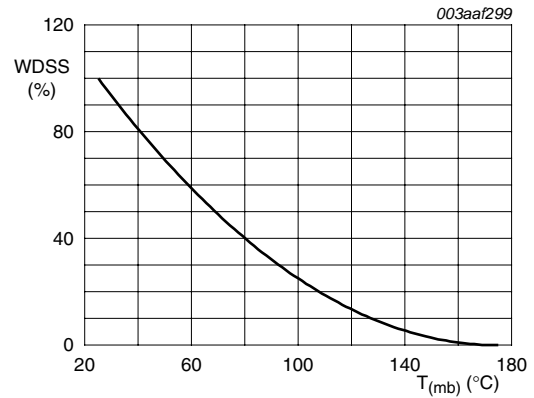
$V_{GS} \geq 5\text{ V}$

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



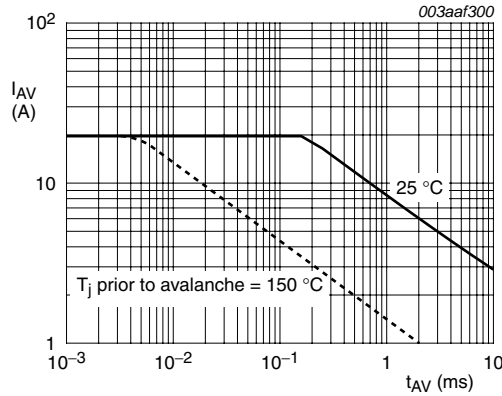
$T_{mb} = 25^{\circ}\text{C}$

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



$I_D = 75\text{ A}$

**Fig 4. Normalised drain-source non-repetitive avalanche energy as a function of mounting-base temperature**



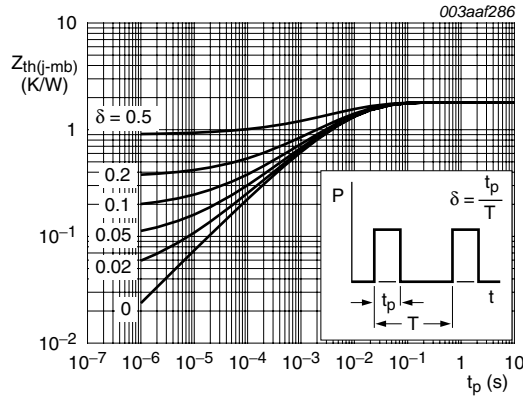
unclamped inductive load

**Fig 5. Single-shot avalanche rating; avalanche current as a function of avalanche period**

## 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		-	-	1.8	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	minimum footprint; FR4 board	-	50	-	K/W

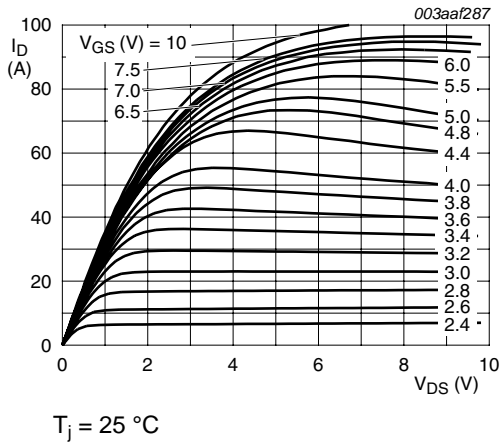


**Fig 6. Transient thermal impedance from junction to mounting base as a function of pulse duration**

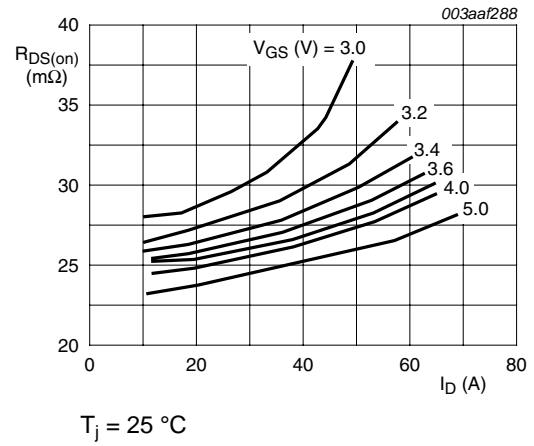
## 6. Characteristics

Table 6. Characteristics

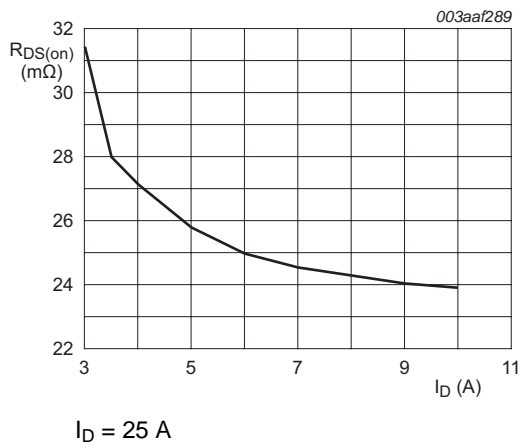
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ mV}; T_j = 25 \text{ }^\circ\text{C}$	55	-	-	V
		$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ mV}; T_j = -55 \text{ }^\circ\text{C}$	50	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C}$	-	-	2.3	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C}$	1	1.5	2	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C}$	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	$V_{GS} = 10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
		$V_{GS} = -10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	-	26.5	38	m $\Omega$
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	-	24	32	m $\Omega$
		$V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C}$	-	-	70	m $\Omega$
		$V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	-	26	35	m $\Omega$
<b>Dynamic characteristics</b>						
$C_{iss}$	input capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 25 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$	-	880	1173	pF
$C_{oss}$	output capacitance		-	165	198	pF
$C_{rss}$	reverse transfer capacitance		-	111	152	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	9	ns
$t_r$	rise time		-	36	55	ns
$t_{d(off)}$	turn-off delay time		-	96	134	ns
$t_f$	fall time		-	73	102	ns
$L_D$	internal drain inductance	from upper edge of drain mounting base to centre of die; $T_j = 25 \text{ }^\circ\text{C}$	-	2.5	-	nH
		from drain lead 6 mm from package to centre of die; $T_j = 25 \text{ }^\circ\text{C}$	-	4.5	-	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	$I_S = 25 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.85	1.2	V
		$I_S = 34 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	1.1	-	V
$t_{rr}$	reverse recovery time	$I_S = 34 \text{ A}; di_S/dt = -100 \text{ A}/\mu\text{s}; V_{GS} = -10 \text{ V}; V_{DS} = 30 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	36	-	ns
$Q_r$	recovered charge		-	0.07	-	$\mu\text{C}$



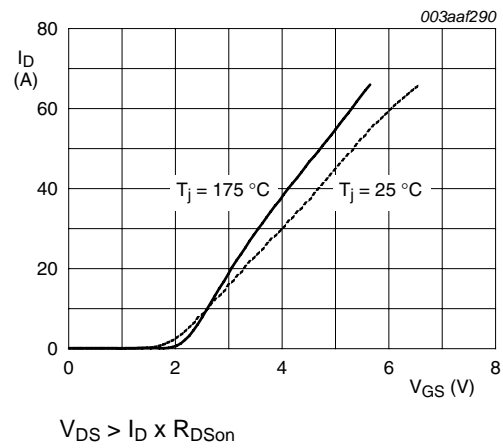
**Fig 7. Output characteristics: drain current as a function of drain-source voltage; typical values**



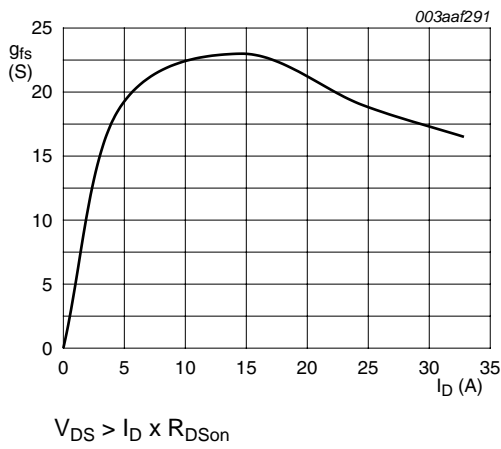
**Fig 8. Drain-source on-state resistance as a function of drain current; typical values**



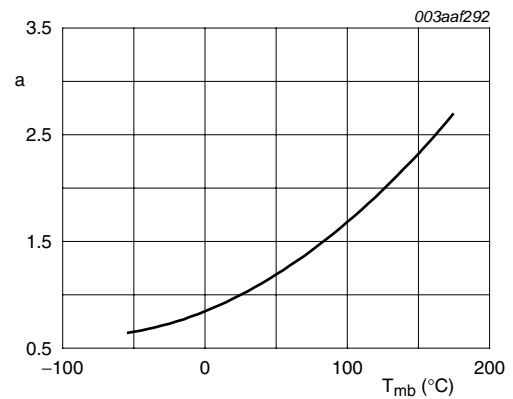
**Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values**



**Fig 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values**



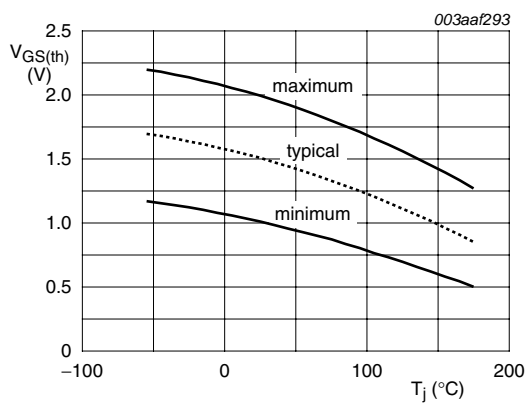
**Fig 11. Forward transconductance as a function of drain current; typical values**



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

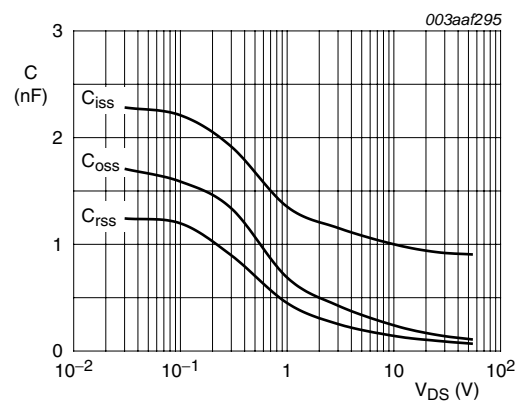
$I_D = 25 \text{ A}; V_{GS} = 5 \text{ V}$

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



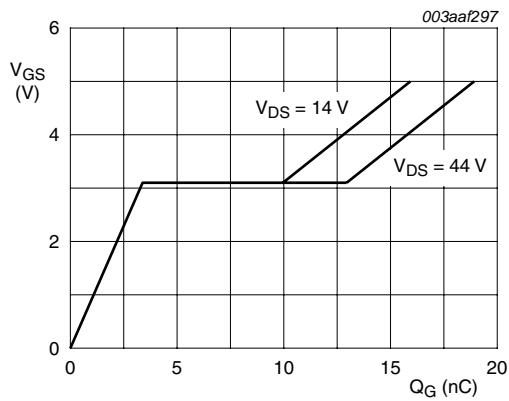
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

**Fig 13. Gate-source threshold voltage as a function of junction temperature**



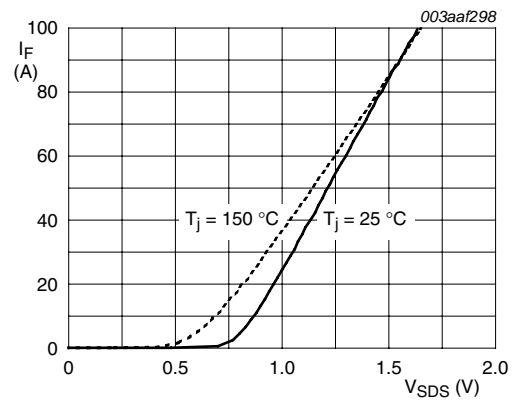
$V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

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



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

**Fig 15. Gate-source voltage as a function of gate charge; typical values**



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

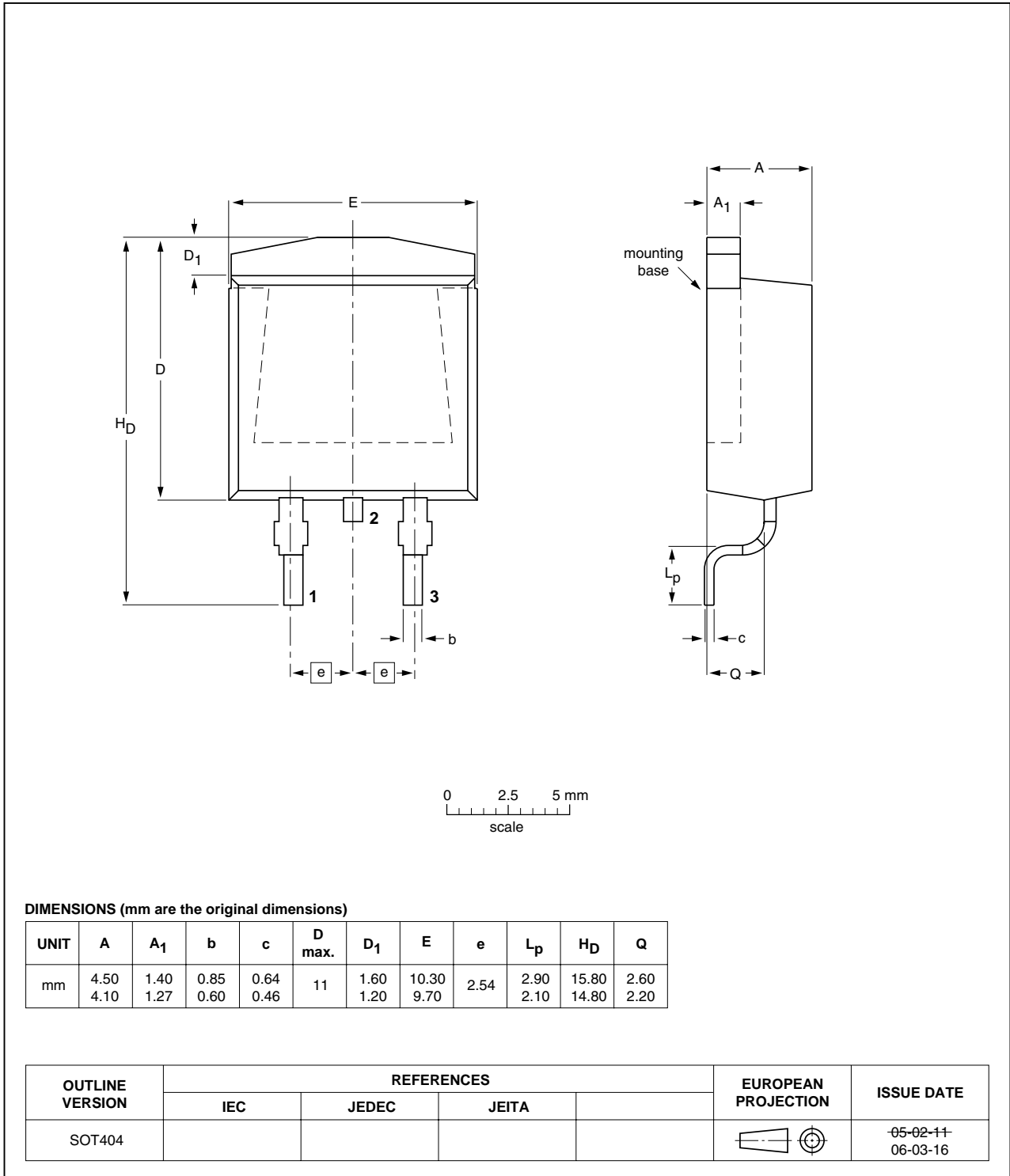
**Fig 16. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values**



**7. Package outline**

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

**SOT404**



**Fig 17. Package outline SOT404 (D2PAK)**

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK9635-55A v.2	20110421	Product data sheet	-	BUK9535_9635-55A_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>• Type number BUK9635-55A separated from data sheet BUK9535_9635-55A_1.</li></ul>			
BUK9535_9635-55A_1	20000201	Product specification	-	-

## 9. Legal information

### 9.1 Data sheet status

Document status <a href="#">[1]</a> <a href="#">[2]</a>	Product status <a href="#">[3]</a>	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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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## 11. Contents

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<b>1</b>	<b>Product profile</b> . . . . .	<b>1</b>
1.1	General description . . . . .	1
1.2	Features and benefits . . . . .	1
1.3	Applications . . . . .	1
1.4	Quick reference data . . . . .	1
<b>2</b>	<b>Pinning information</b> . . . . .	<b>2</b>
<b>3</b>	<b>Ordering information</b> . . . . .	<b>2</b>
<b>4</b>	<b>Limiting values</b> . . . . .	<b>2</b>
<b>5</b>	<b>Thermal characteristics</b> . . . . .	<b>4</b>
<b>6</b>	<b>Characteristics</b> . . . . .	<b>5</b>
<b>7</b>	<b>Package outline</b> . . . . .	<b>9</b>
<b>8</b>	<b>Revision history</b> . . . . .	<b>10</b>
<b>9</b>	<b>Legal information</b> . . . . .	<b>11</b>
9.1	Data sheet status . . . . .	11
9.2	Definitions . . . . .	11
9.3	Disclaimers . . . . .	11
9.4	Trademarks . . . . .	12
<b>10</b>	<b>Contact information</b> . . . . .	<b>12</b>