

# BUK7210-55B

## N-channel TrenchMOS standard level FET

Rev. 01 — 11 December 2008

Product data sheet

## 1. Product profile

### 1.1 General description

Standard level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using NXP High-Performance Automotive (HPA) 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

- 185 °C rated
- Q101 compliant
- Standard level compatible
- Very low on-state resistance

### 1.3 Applications

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

### 1.4 Quick reference data

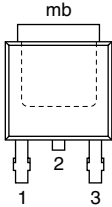
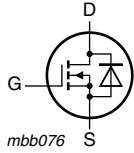
Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 185\text{ °C}$	-	-	55	V
$I_D$	drain current	$V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a> ;	[1]	-	75	A
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 10</a> ; see <a href="#">Figure 9</a>	-	8.5	10	m $\Omega$
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}$ ; $V_{sup} \leq 55\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; unclamped inductive load	-	-	173	mJ

[1] Continuous current is limited by package.

## 2. Pinning information

**Table 2. Pinning information**

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p style="text-align: center;"><b>SOT428</b> <b>(SC-63; DPAK)</b></p>	 <p style="text-align: center;"><i>mbb076</i></p>
2	D	drain <a href="#">[1]</a>		
3	S	source		
mb	D	mounting base; connected to drain		

[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	
BUK7210-55B	SC-63; DPAK	plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)	SOT428

## 4. Limiting values

**Table 4. Limiting values**

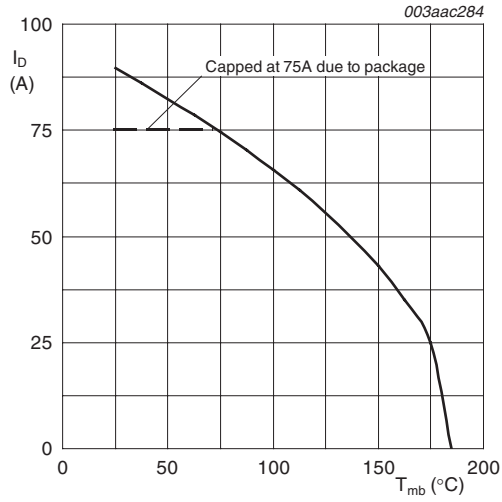
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 185\text{ °C}$	-	55	V	
$V_{DGR}$	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega; 25\text{ °C} \leq T_j \leq 185\text{ °C}$	-	55	V	
$V_{GS}$	gate-source voltage		-20	20	V	
$I_D$	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a> ;	[1]	-	89.6	A
		$T_{mb} = 100\text{ °C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a>	-	65.5	A	
		$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a> ;	[2]	-	75	A
$I_{DM}$	peak drain current	$T_{mb} = 25\text{ °C}; t_p \leq 10\text{ }\mu\text{s};$ pulsed	-	335	A	
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C};$ see <a href="#">Figure 2</a>	-	167	W	
$T_{stg}$	storage temperature		-55	185	°C	
$T_j$	junction temperature		-55	185	°C	
<b>Source-drain diode</b>						
$I_S$	source current	$T_{mb} = 25\text{ °C};$	[2]	-	75	A
		$T_{mb} = 25\text{ °C};$	[3]	-	89.6	A
$I_{SM}$	peak source current	$t_p \leq 10\text{ }\mu\text{s};$ pulsed; $T_{mb} = 25\text{ °C}$	-	335	A	
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}; V_{sup} \leq 55\text{ V}; R_{GS} = 50\text{ }\Omega; V_{GS} = 10\text{ V};$ $T_{j(init)} = 25\text{ °C};$ unclamped inductive load	-	173	mJ	

[1] Current is limited by power dissipation chip rating.

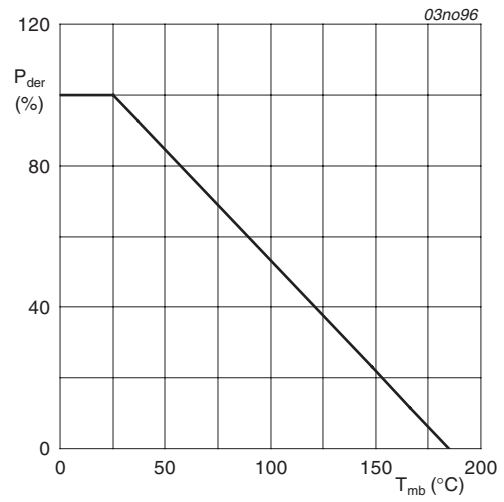
[2] Continuous current is limited by package.

[3] Current is limited by power dissipation chip rating.



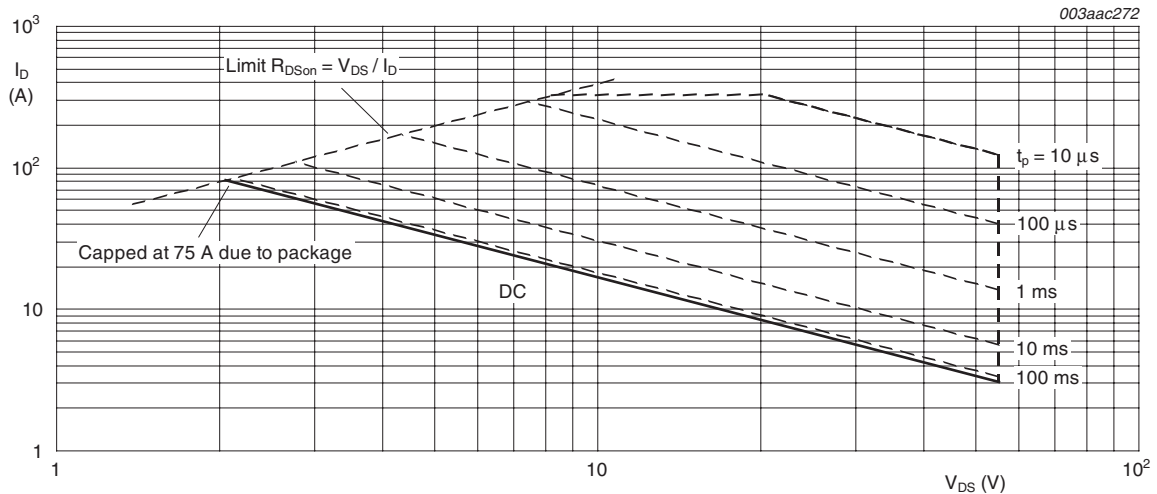
$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100\%$$

**Fig 1. Normalized continuous drain current as a function of mounting base temperature**



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

**Fig 2. Normalized total power dissipation as a function of mounting base temperature**



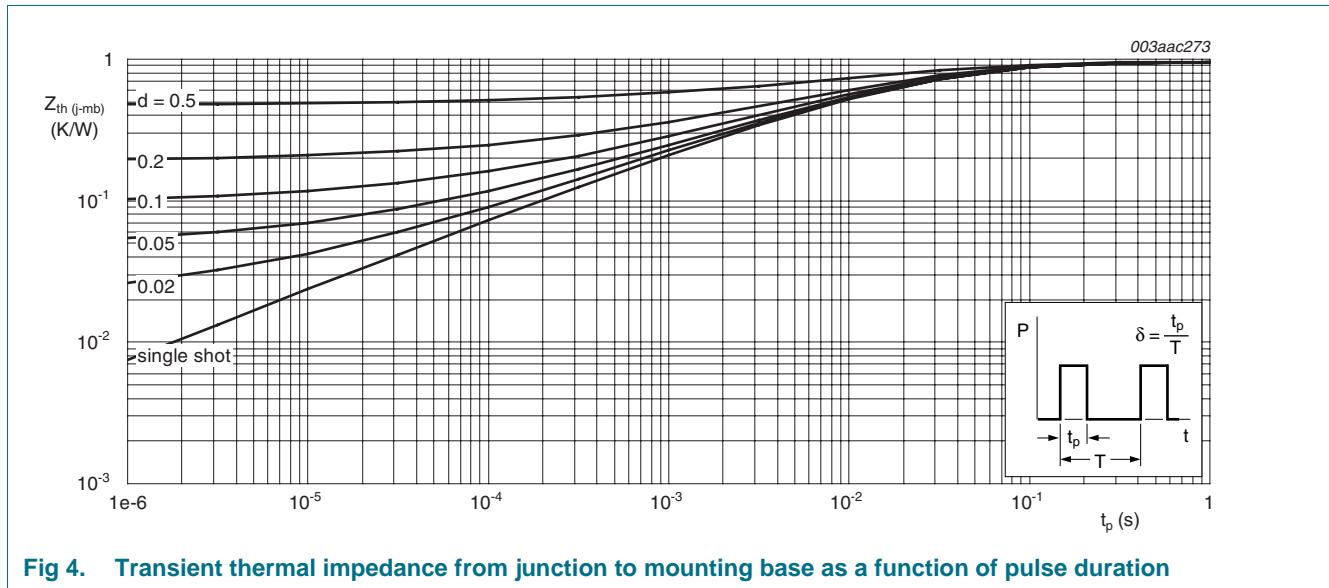
$T_{mb} = 25^\circ\text{C}; I_{DM}$  is single pulse

**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
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 4</a>	-	-	0.95	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Mounted on a printed circuit board; vertical in still air.; minimum footprint	-	75	-	K/W



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

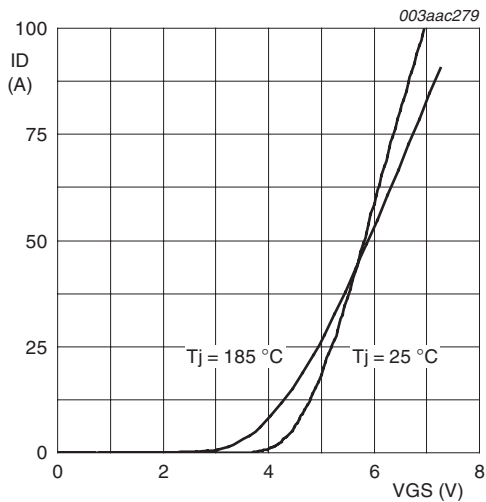
## 6. Characteristics

**Table 6. Characteristics**

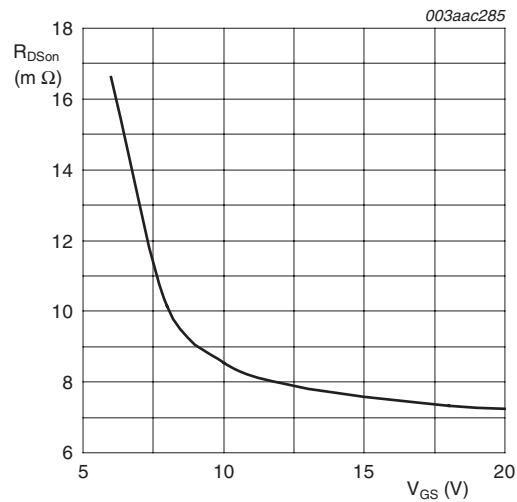
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	55	-	-	V
		$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	50	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 7</a>	-	1.75	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 7</a> ; see <a href="#">Figure 8</a>	2	3	4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 185 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 7</a>	0.9	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -40 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 7</a>	-	2.8	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 7</a>	-	-	4.4	V
$I_{DSS}$	drain leakage current	$V_{DS} = 55 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$	-	1.5	500	$\mu\text{A}$
		$V_{DS} = 55 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ\text{C}$	-	0.1	90	$\mu\text{A}$
		$V_{DS} = 55 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.02	1	$\mu\text{A}$
		$V_{DS} = 55 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 185 \text{ }^\circ\text{C}$	-	3	800	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{DS} = 0 \text{ V}; V_{GS} = 20 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
		$V_{DS} = 0 \text{ V}; V_{GS} = -20 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 185 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 9</a>	-	-	20.8	m $\Omega$
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 10</a> ; see <a href="#">Figure 9</a>	-	8.5	10	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 44 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	35	-	nC
$Q_{GS}$	gate-source charge		-	9	-	nC
$Q_{GD}$	gate-drain charge		-	12	-	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>	-	1840	2453	pF
$C_{oss}$	output capacitance		-	379	455	pF
$C_{rss}$	reverse transfer capacitance		-	165	226	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 25 \text{ V}; R_L = 1.2 \text{ } \Omega; V_{GS} = 10 \text{ V}; R_{G(ext)} = 10 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$	-	18	-	ns
$t_r$	rise time		-	91	-	ns
$t_{d(off)}$	turn-off delay time		-	48	-	ns
$t_f$	fall time		-	45	-	ns
$L_D$	internal drain inductance	measured from drain to center of die; $T_j = 25 \text{ }^\circ\text{C}$	-	2.5	-	nH
$L_S$	internal source inductance	measured from source lead to source bond pad; $T_j = 25 \text{ }^\circ\text{C}$	-	7.5	-	nH

**Table 6. Characteristics ...continued**

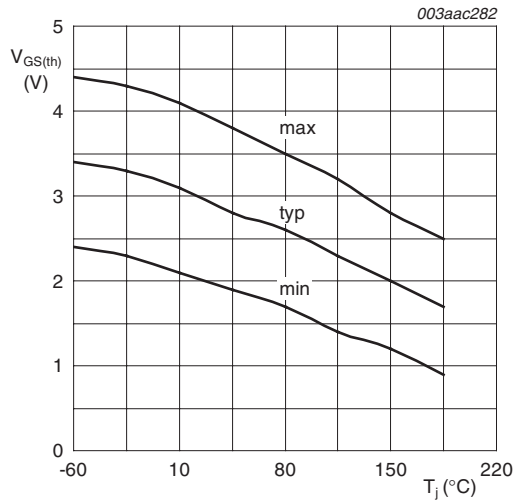
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 18\text{ A}; V_{GS} = 0\text{ V}; T_j = 150\text{ }^\circ\text{C}$	-	0.76	-	V
		$I_S = 18\text{ A}; V_{GS} = 0\text{ V}; T_j = 175\text{ }^\circ\text{C}$	-	0.74	-	V
		$I_S = 18\text{ A}; V_{GS} = 0\text{ V}; T_j = 100\text{ }^\circ\text{C}$	-	0.8	-	V
		$I_S = 18\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 11</a>	-	0.85	1.2	V
		$I_S = 18\text{ A}; V_{GS} = 0\text{ V}; T_j = 125\text{ }^\circ\text{C}$	-	0.78	-	V
		$I_S = 18\text{ A}; V_{GS} = 0\text{ V}; T_j = 185\text{ }^\circ\text{C}$ ; see <a href="#">Figure 11</a>	-	0.73	-	V
$t_{rr}$	reverse recovery time	$I_S = 20\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = -10\text{ V}$	-	67	-	ns
$Q_r$	recovered charge	$V_{DS} = 30\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	65	-	nC



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

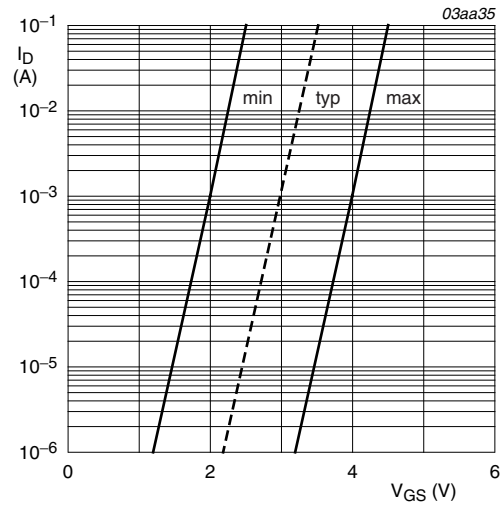


**Fig 6. Drain-source on-state resistance as a function of gate-source voltage; typical values.**



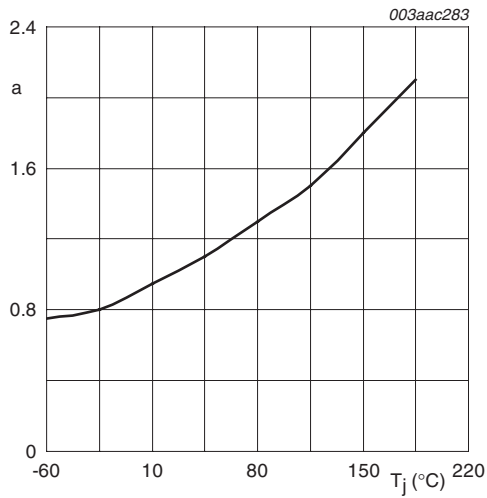
$$I_D = 1\text{ mA}; V_{DS} = V_{GS}$$

**Fig 7. Gate-source threshold voltage as a function of junction temperature**



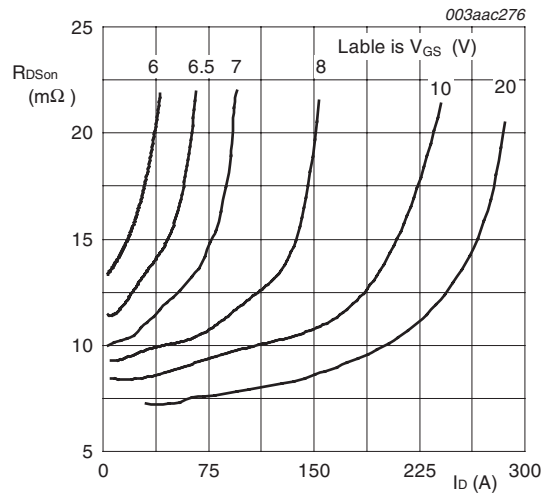
$$T_j = 25\text{ }^\circ\text{C}; V_{DS} = 5\text{ V}$$

**Fig 8. Sub-threshold drain current as a function of gate-source voltage**



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

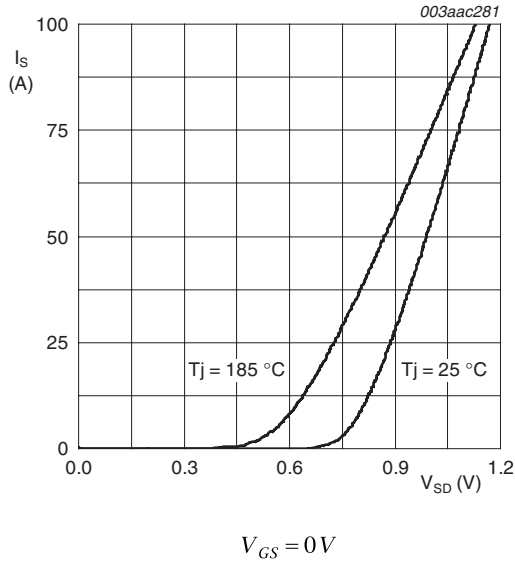
**Fig 9. Normalized drain-source on-state resistance factor as a function of junction temperature**



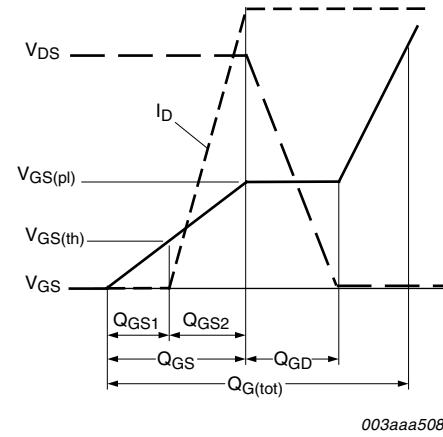
$$T_j = 25\text{ }^\circ\text{C}$$

**Fig 10. Drain-source on-state resistance as a function of drain current; typical values**

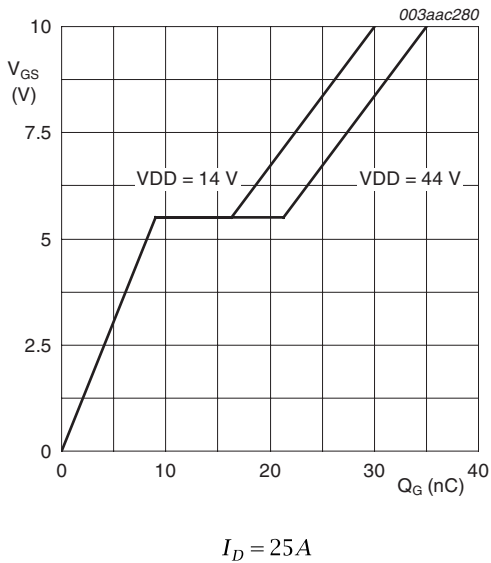




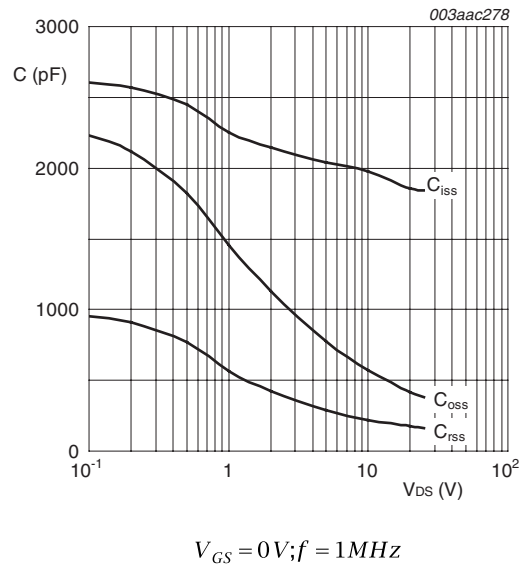
**Fig 11. Source current as a function of source-drain voltage; typical values**



**Fig 12. Gate charge waveform definitions**



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



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

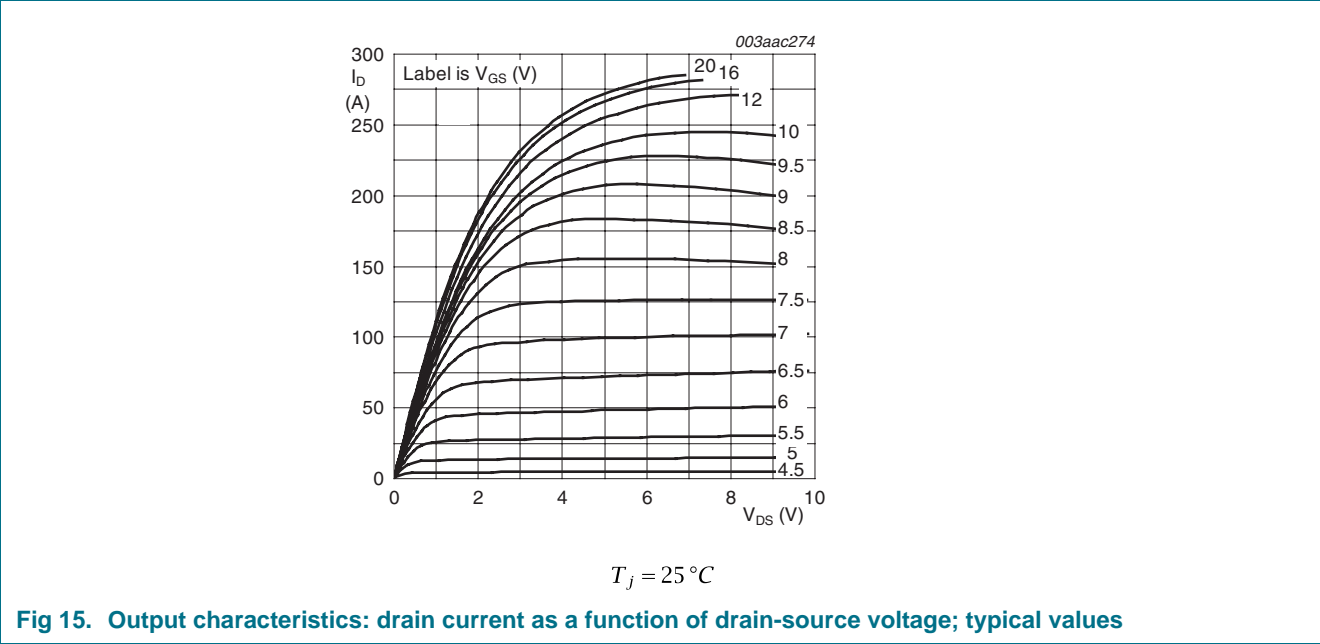


Fig 15. Output characteristics: drain current as a function of drain-source voltage; typical values

**7. Package outline**

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

SOT428

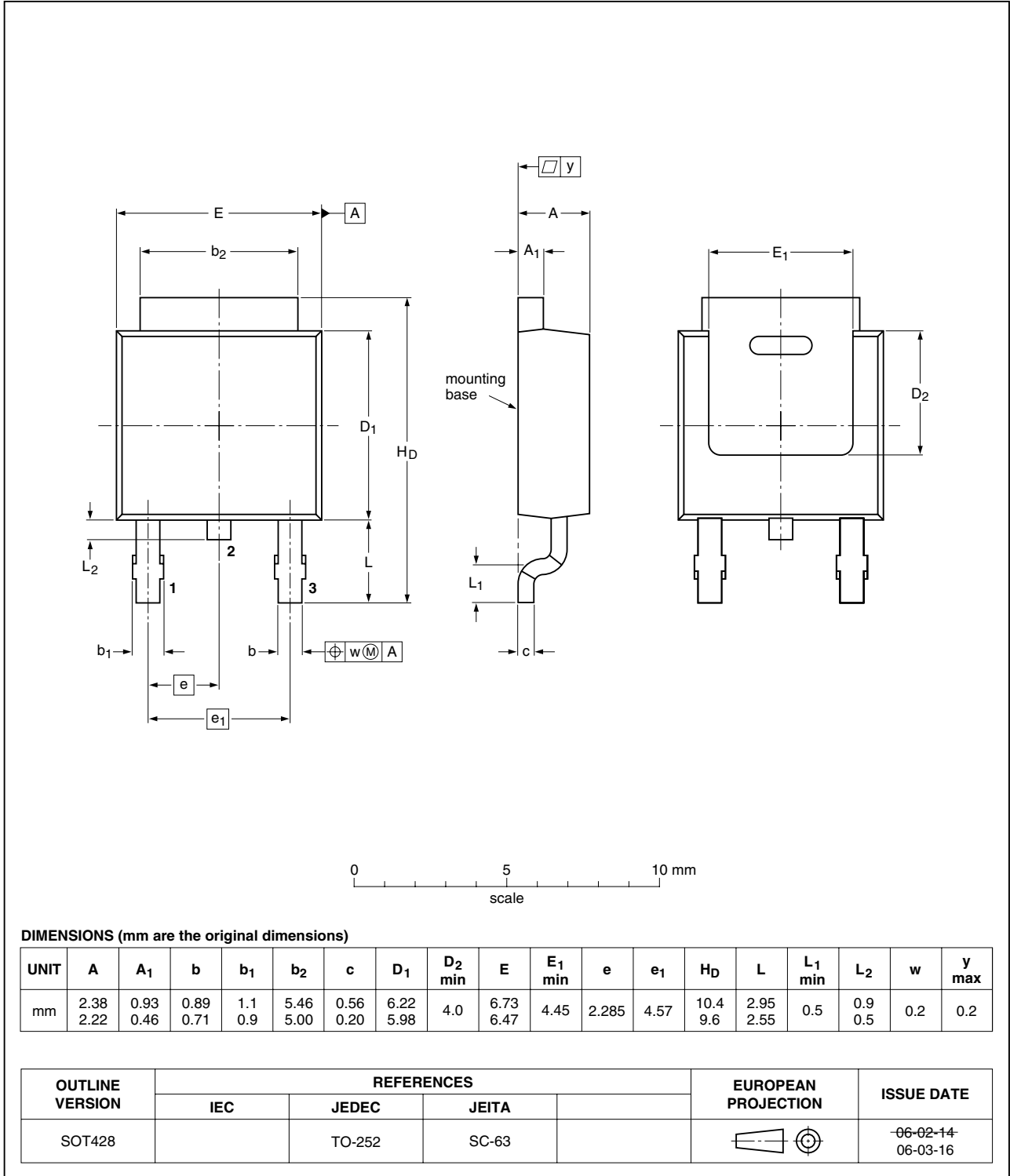


Fig 16. Package outline SOT428 (DPAK)

## 8. Revision history

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Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK7210-55B_1	20081211	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".

[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.nxp.com>.

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