

# BUK7208-40B

## N-channel TrenchMOS standard level FET

Rev. 03 — 7 June 2010

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 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 standard level gate drive sources
- Suitable for thermally demanding environments due to 185 °C rating

### 1.3 Applications

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

### 1.4 Quick reference data

Table 1. Quick reference data

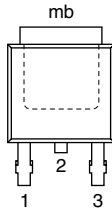
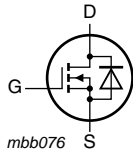
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 185\text{ °C}$	-	-	40	V
$I_D$	drain current	$V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a>	[1]	-	75	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	167	W
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>	-	6.6	8	mΩ
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}$ ; $V_{sup} \leq 40\text{ V}$ ; $R_{GS} = 50\text{ Ω}$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; unclamped	-	-	242	mJ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ; $V_{DS} = 32\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 13</a>	-	11.5	-	nC

[1] Continuous current is limited by package.



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.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK7208-40B	DPAK	plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)	SOT428

## 4. Limiting values

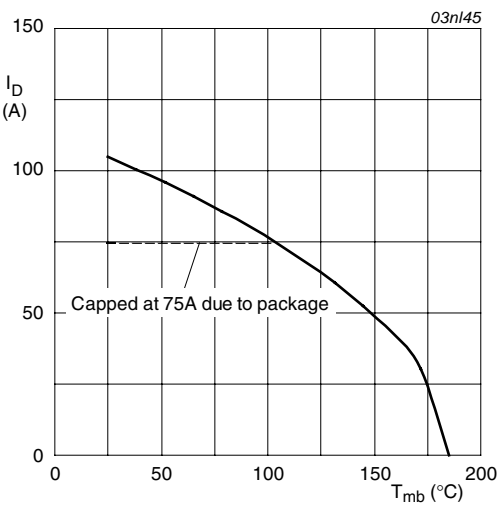
**Table 4. Limiting values**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ }^{\circ}\text{C}$ ; $T_j \leq 185\text{ }^{\circ}\text{C}$	-	-	40	V
$V_{DGR}$	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	-	40	V
$V_{GS}$	gate-source voltage		-20	-	20	V
$I_D$	drain current	$T_{mb} = 25\text{ }^{\circ}\text{C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a>	<a href="#">[1]</a> -	-	105	A
			<a href="#">[2]</a> -	-	75	A
		$T_{mb} = 100\text{ }^{\circ}\text{C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a>	<a href="#">[2]</a> -	-	75	A
$I_{DM}$	peak drain current	$T_{mb} = 25\text{ }^{\circ}\text{C}$ ; $t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; see <a href="#">Figure 3</a>	-	-	420	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 2</a>	-	-	167	W
$T_{stg}$	storage temperature		-55	-	185	$^{\circ}\text{C}$
$T_j$	junction temperature		-55	-	185	$^{\circ}\text{C}$
<b>Source-drain diode</b>						
$I_S$	source current	$T_{mb} = 25\text{ }^{\circ}\text{C}$	<a href="#">[2]</a> -	-	75	A
			<a href="#">[1]</a> -	-	105	A
$I_{SM}$	peak source current	$t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; $T_{mb} = 25\text{ }^{\circ}\text{C}$	-	-	420	A
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 75\text{ A}$ ; $V_{sup} \leq 40\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; unclamped	-	-	242	mJ

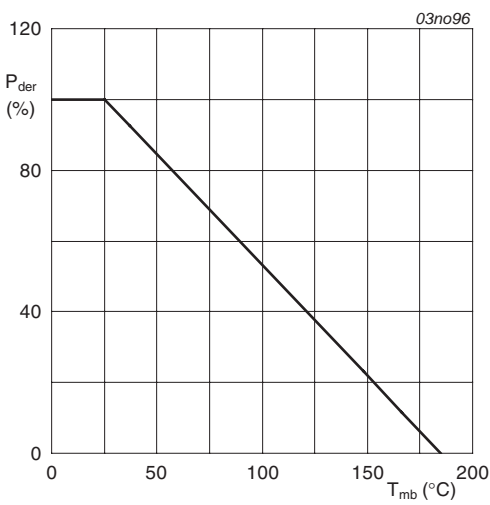
[1] Current is limited by power dissipation chip rating.

[2] Continuous current is limited by package.



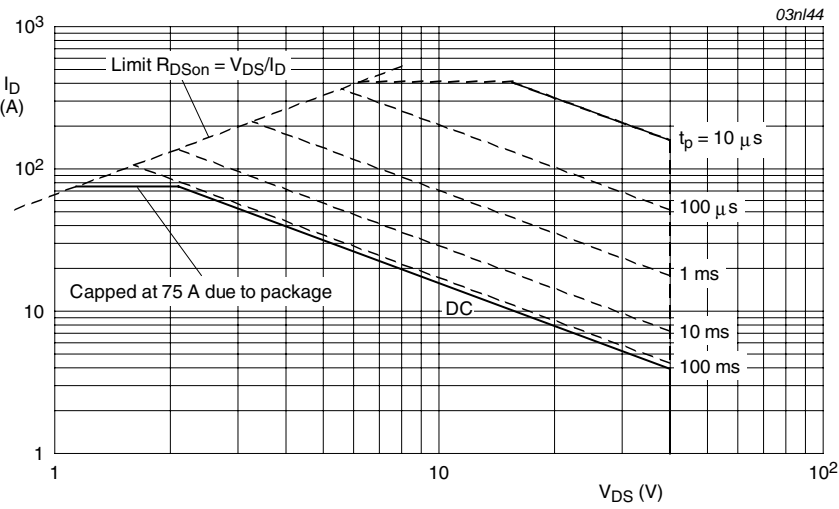
$$V_{GS} \geq 10V$$

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
$R_{th(j-mb)}$	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		-	71.4	-	K/W

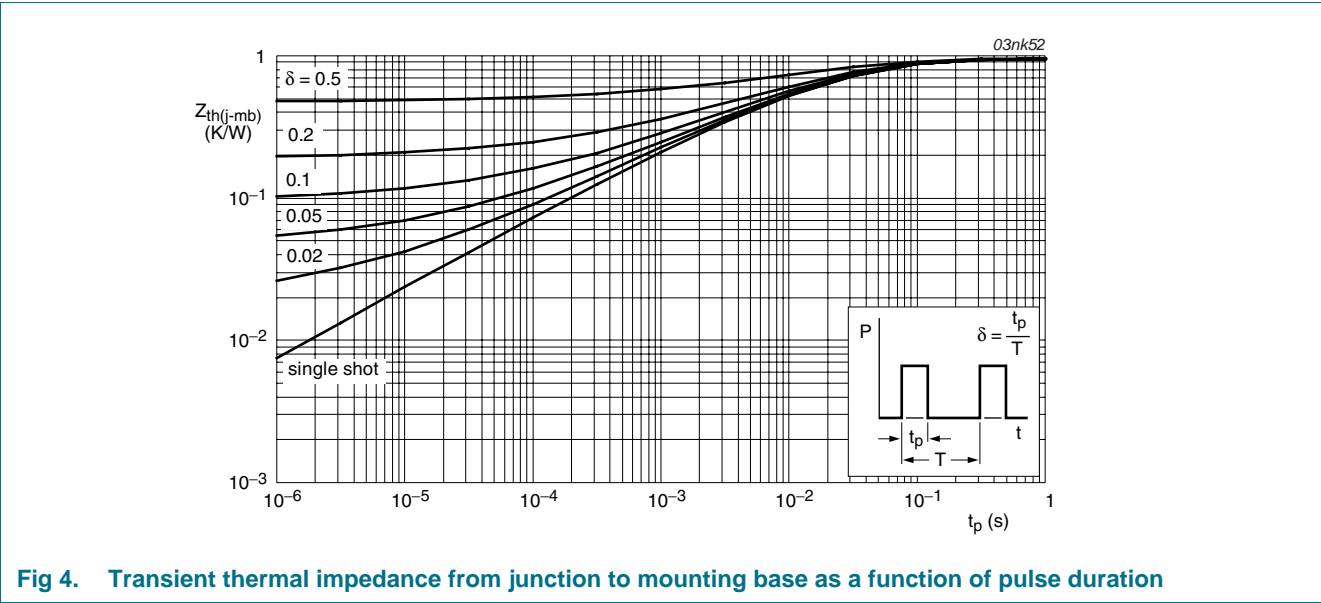


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V <sub>(BR)DSS</sub>	drain-source breakdown voltage	I <sub>D</sub> = 0.25 mA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	40	-	-	V
		I <sub>D</sub> = 0.25 mA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = -55 °C	36	-	-	V
V <sub>GS(th)</sub>	gate-source threshold voltage	I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 25 °C; see <a href="#">Figure 10</a>	2	3	4	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = -55 °C; see <a href="#">Figure 10</a>	-	-	4.4	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 185 °C; see <a href="#">Figure 10</a>	0.9	-	-	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 40 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 185 °C	-	-	500	μA
		V <sub>DS</sub> = 40 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	0.02	1	μA
I <sub>GSS</sub>	gate leakage current	V <sub>DS</sub> = 0 V; V <sub>GS</sub> = 20 V; T <sub>j</sub> = 25 °C	-	2	100	nA
		V <sub>DS</sub> = 0 V; V <sub>GS</sub> = -20 V; T <sub>j</sub> = 25 °C	-	2	100	nA
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; T <sub>j</sub> = 185 °C; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>	-	-	15.6	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>	-	6.6	8	mΩ
Dynamic characteristics						
Q <sub>G(tot)</sub>	total gate charge	I <sub>D</sub> = 25 A; V <sub>DS</sub> = 32 V; V <sub>GS</sub> = 10 V; T <sub>j</sub> = 25 °C; see <a href="#">Figure 13</a>	-	35	-	nC
Q <sub>GS</sub>	gate-source charge		-	9.8	-	nC
Q <sub>GD</sub>	gate-drain charge		-	11.5	-	nC
C <sub>iss</sub>	input capacitance	V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 25 V; f = 1 MHz; T <sub>j</sub> = 25 °C; see <a href="#">Figure 14</a>	-	1870	2493	pF
C <sub>oss</sub>	output capacitance		-	482	578	pF
C <sub>rss</sub>	reverse transfer capacitance		-	201	275	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> = 10 V; R <sub>G(ext)</sub> = 10 Ω; T <sub>j</sub> = 25 °C	-	16	-	ns
t <sub>r</sub>	rise time		-	104	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	47	-	ns
t <sub>f</sub>	fall time		-	51	-	ns
L <sub>D</sub>	internal drain inductance	measured from drain to centre of die ; T <sub>j</sub> = 25 °C	-	2.5	-	nH
L <sub>S</sub>	internal source inductance	measured form source lead to source bond pad ; T <sub>j</sub> = 25 °C	-	7.5	-	nH
Source-drain diode						
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 17 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C; 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; V <sub>GS</sub> = -10 V; V <sub>DS</sub> = 30 V; T <sub>j</sub> = 25 °C	-	50	-	ns
Q <sub>r</sub>	recovered charge		-	36	-	nC

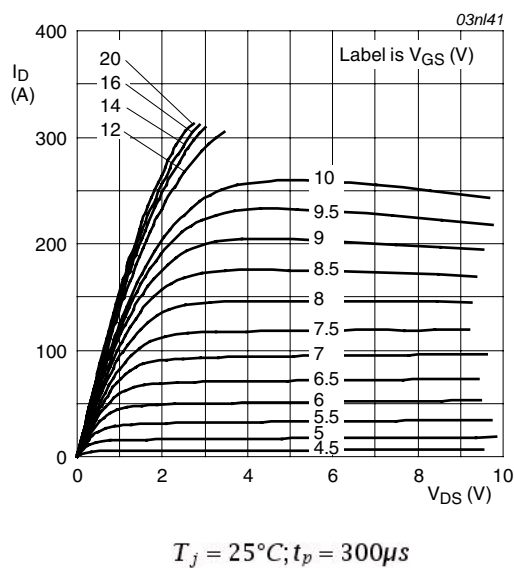


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

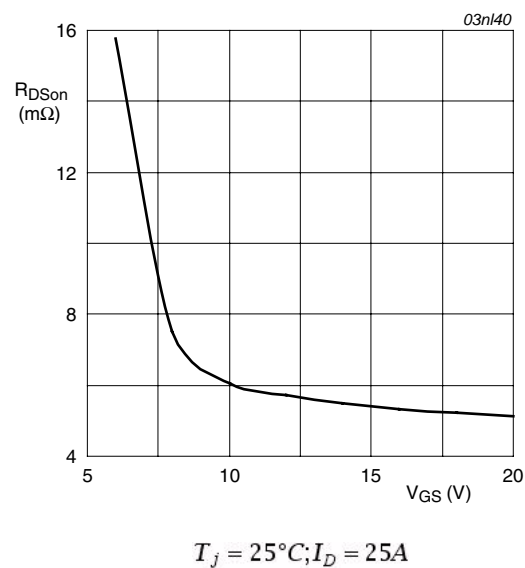


Fig 6. Drain-source on-state resistance as a function of gate-source voltage; typical values

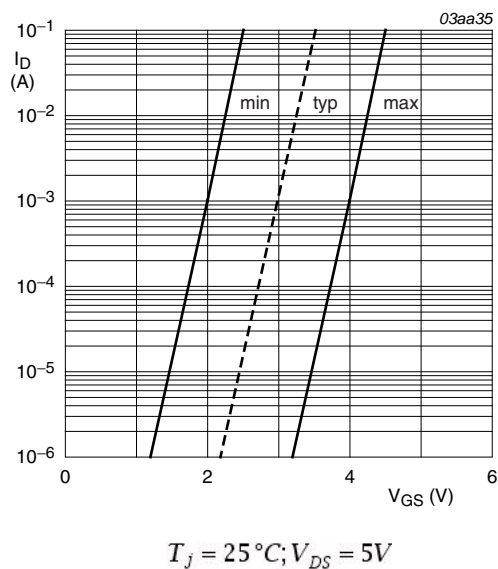


Fig 7. Sub-threshold drain current as a function of gate-source voltage

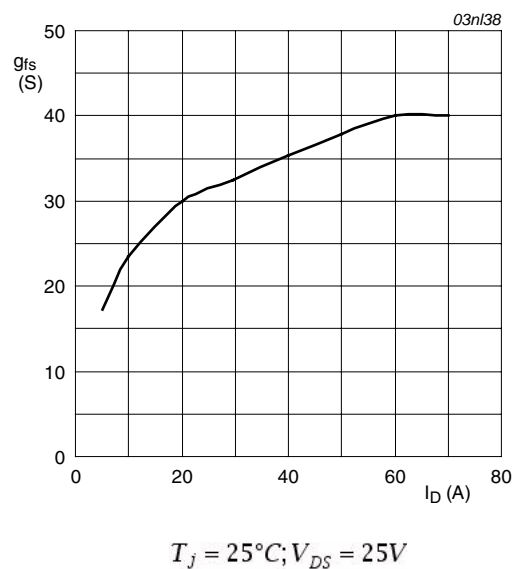


Fig 8. Forward transconductance as a function of drain current; typical values

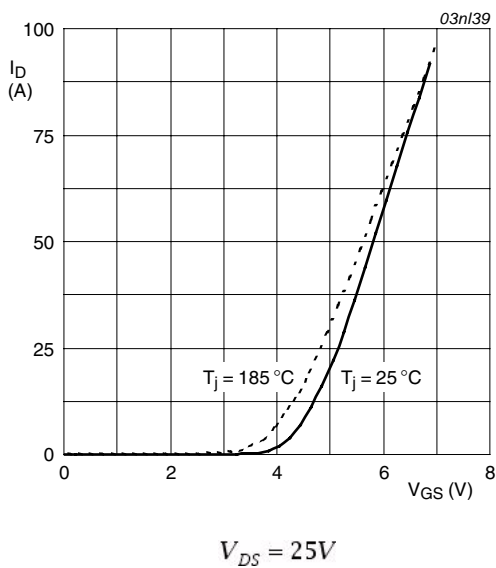


Fig 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

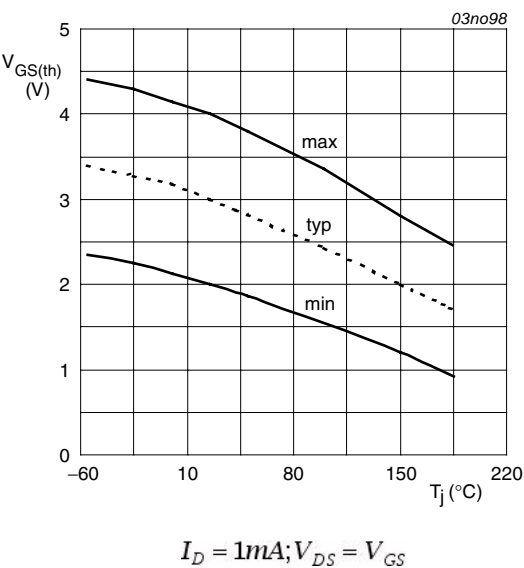


Fig 10. Gate-source threshold voltage as a function of junction temperature

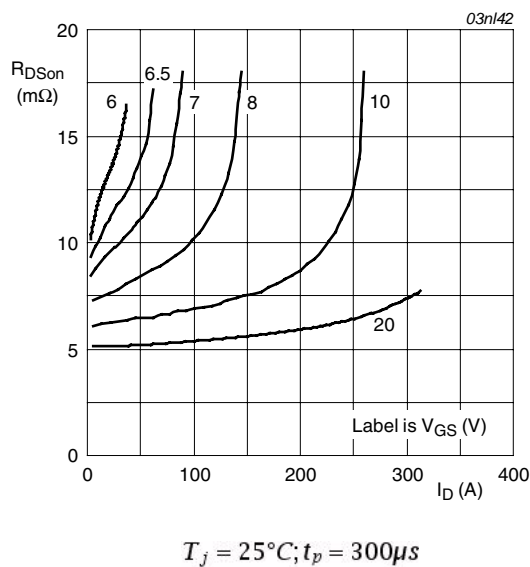


Fig 11. Drain-source on-state resistance as a function of drain current; typical values

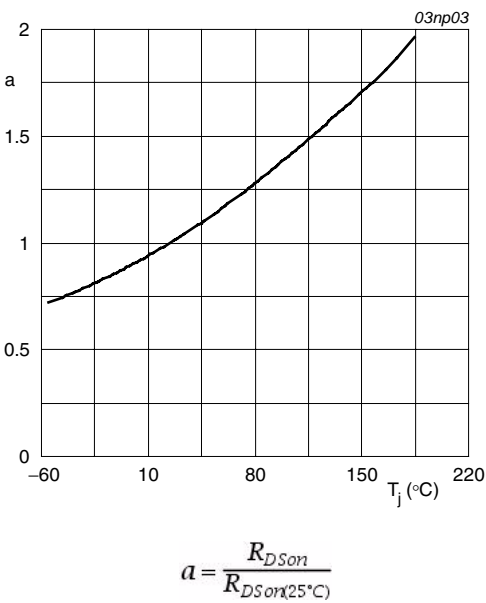
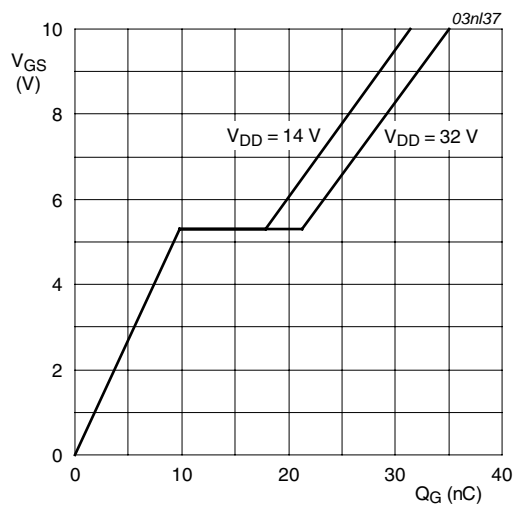


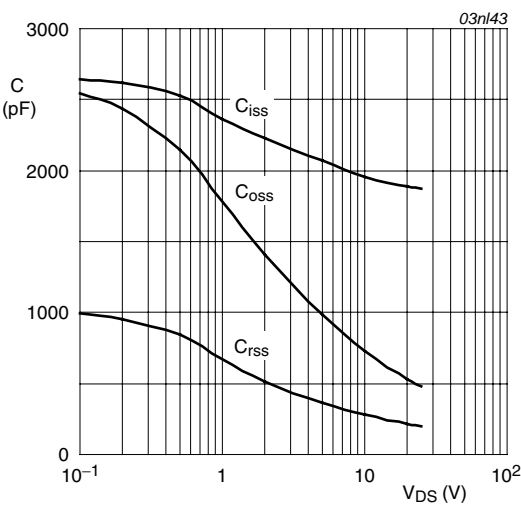
Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature





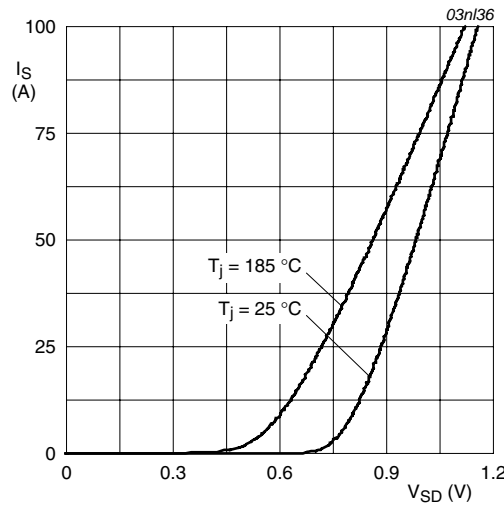
$T_j = 25^\circ\text{C}; I_D = 25\text{A}$

Fig 13. Gate-source voltage as a function of 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. Source current as a function of source-drain voltage; typical values

7. Package outline

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

SOT428

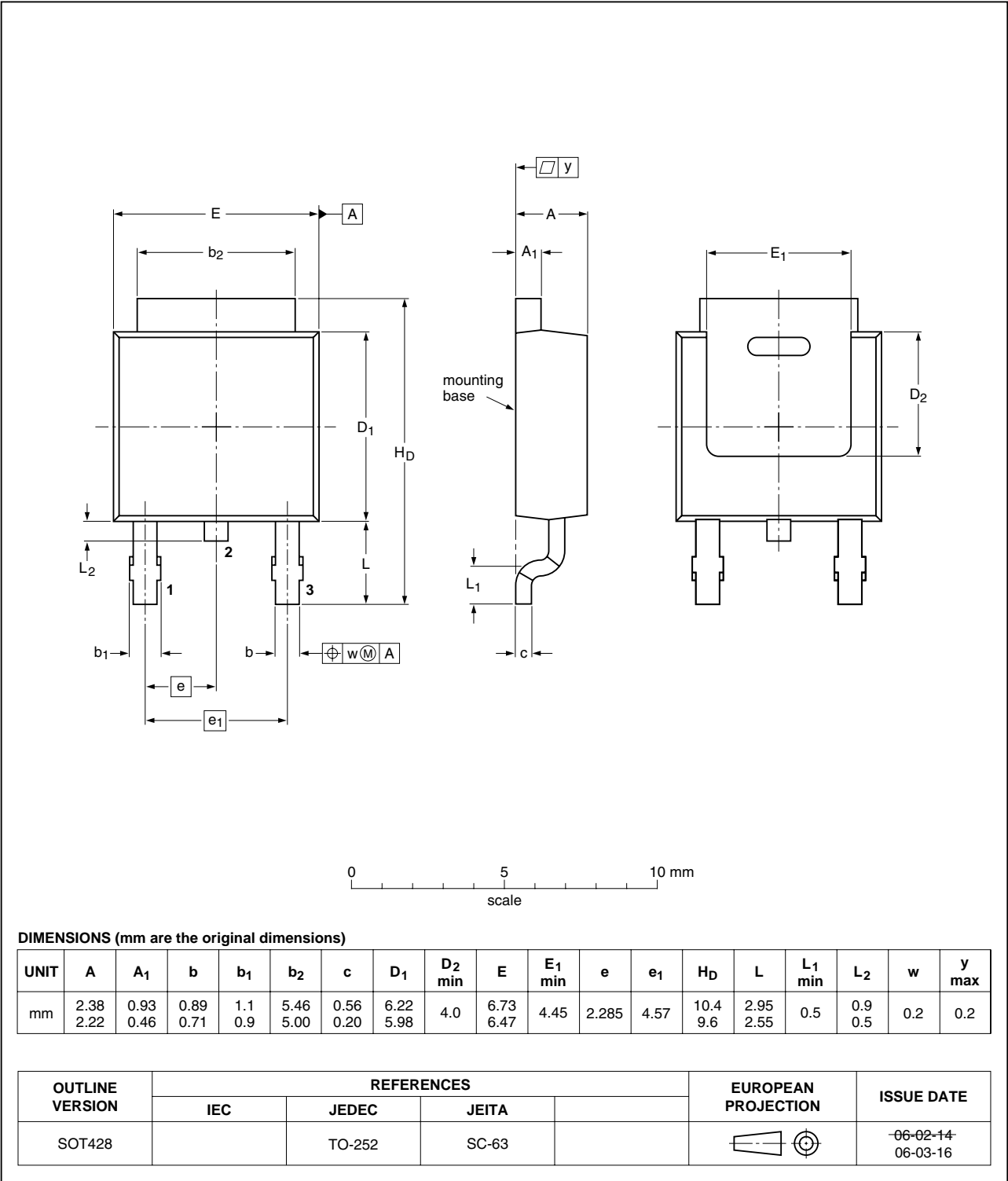


Fig 16. Package outline SOT428 (DPAK)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK7208-40B_3	20100607	Product data sheet	-	BUK7208-40B_2
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></ul>			
BUK7208-40B_2	20040122	Product data	-	BUK7208-40B_1
BUK7208-40B_1	20021212	Objective data	-	-

## 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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## 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>3</b>
<b>5</b>	<b>Thermal characteristics</b> . . . . .	<b>5</b>
<b>6</b>	<b>Characteristics</b> . . . . .	<b>6</b>
<b>7</b>	<b>Package outline</b> . . . . .	<b>10</b>
<b>8</b>	<b>Revision history</b> . . . . .	<b>11</b>
<b>9</b>	<b>Legal information</b> . . . . .	<b>12</b>
9.1	Data sheet status . . . . .	12
9.2	Definitions . . . . .	12
9.3	Disclaimers . . . . .	12
9.4	Trademarks . . . . .	13
<b>10</b>	<b>Contact information</b> . . . . .	<b>13</b>

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