



# BUK761R6-40E

N-channel TrenchMOS standard level FET

Rev. 1 — 30 March 2012

Objective data sheet

## 1. Product profile

### 1.1 General description

Standard level N-channel MOSFET in a SOT404 package using TrenchMOS technology. This product has been designed and qualified to AEC Q101 standard for use in high performance automotive applications.

### 1.2 Features and benefits

- AEC Q101 compliant
- Repetitive avalanche rated
- Suitable for thermally demanding environments due to 175 °C rating
- True standard level gate with VGS(th) rating of greater than 1V at 175 °C

### 1.3 Applications

- 12 V Automotive systems
- Electric and electro-hydraulic power steering
- Motors, lamps and solenoid control
- Start-Stop micro-hybrid applications
- Transmission control
- Ultra high performance power switching

### 1.4 Quick reference data

Table 1. Quick reference data

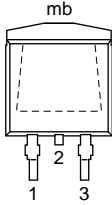
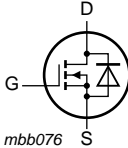
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C	-	-	40	V
I <sub>D</sub>	drain current	V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 100 °C; see <a href="#">Figure 1</a>	[1]	-	120	A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; see <a href="#">Figure 2</a>	-	-	357	W
<b>Static characteristics</b>						
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> = 25 °C; see <a href="#">Figure 11</a>	-	1.3	1.6	mΩ
<b>Dynamic characteristics</b>						
Q <sub>GD</sub>	gate-drain charge	V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; V <sub>DS</sub> = 32 V; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	48.2	-	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	 <p style="text-align: center;">SOT404 (D2PAK)</p>	 <p style="text-align: center;"><i>mbb076</i></p>
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		Version
	Name	Description	
BUK761R6-40E	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	SOT404

## 4. Marking

**Table 4. Marking codes**

Type number	Marking code
BUK761R6-40E	BUK761R6-40E

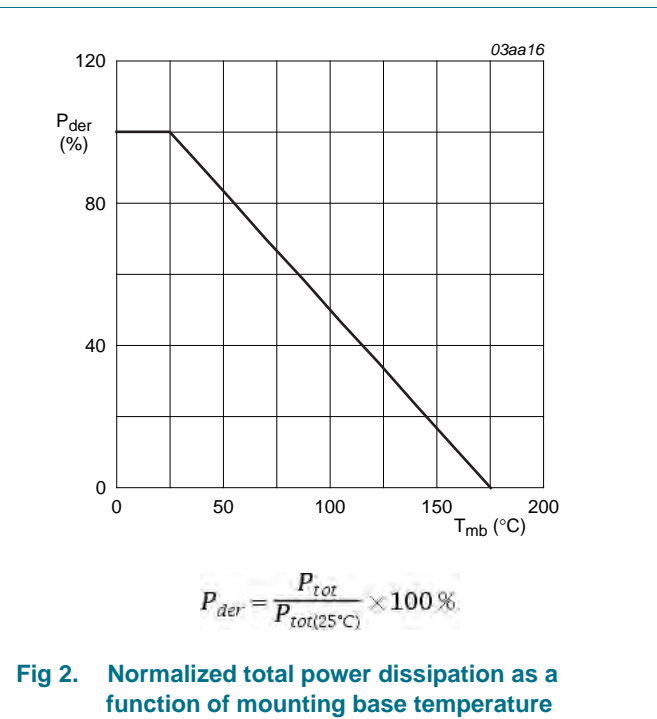
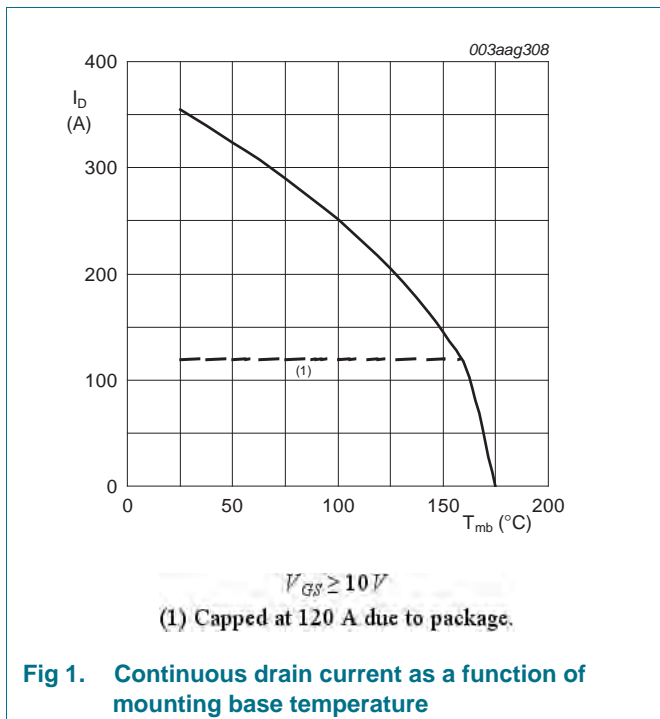
## 5. Limiting values

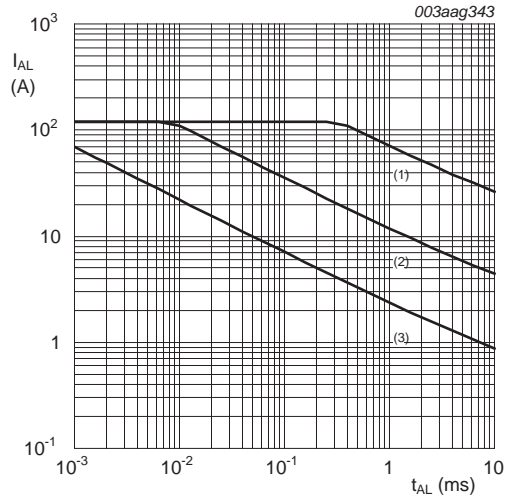
**Table 5. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	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	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a>	[1]	-	120	A
		$T_{mb} = 100\text{ °C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a>	[1]	-	120	A
$I_{DM}$	peak drain current	$T_{mb} = 25\text{ °C};$ pulsed; $t_p \leq 10\text{ }\mu\text{s};$ see <a href="#">Figure 4</a>	-	1418	A	
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C};$ see <a href="#">Figure 2</a>	-	357	W	
$T_{stg}$	storage temperature		-55	175	°C	
$T_j$	junction temperature		-55	175	°C	
<b>Source-drain diode</b>						
$I_S$	source current	$T_{mb} = 25\text{ °C}$	[1]	-	120	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C}$	-	1418	A	
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 120\text{ A}; V_{sup} \leq 40\text{ V}; R_{GS} = 50\text{ }\Omega; V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C};$ unclamped; see <a href="#">Figure 3</a>	[2][3][4]	-	1008	mJ

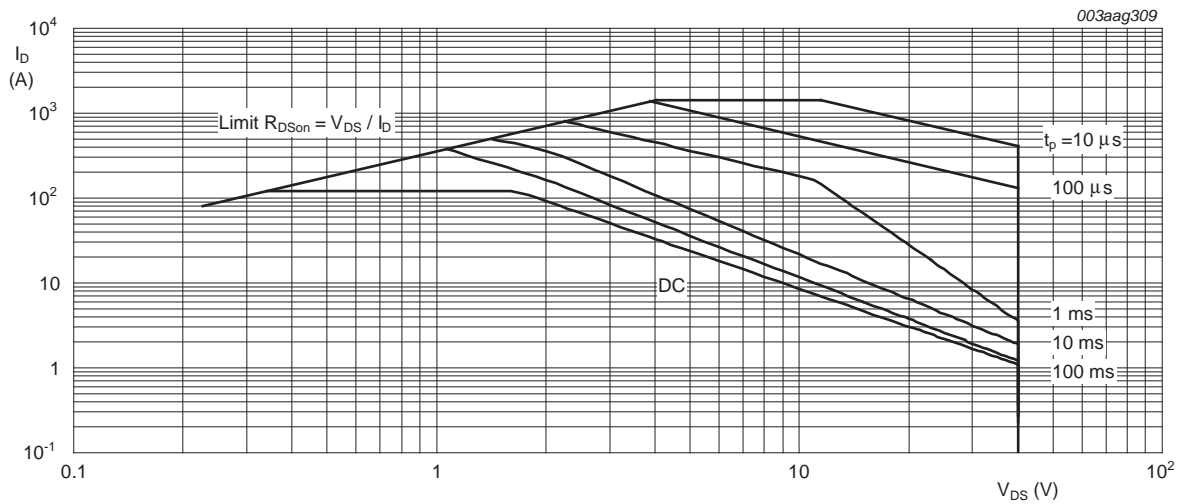
- [1] Continuous current is limited by package.
- [2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.
- [3] Repetitive avalanche rating limited by an average junction temperature of 170 °C.
- [4] Refer to application note AN10273 for further information.





(1)  $T_{j(amb)} = 25^{\circ}C$ ; (2)  $T_{j(amb)} = 150^{\circ}C$ ; (3) Repetitive Avalanche

**Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time**



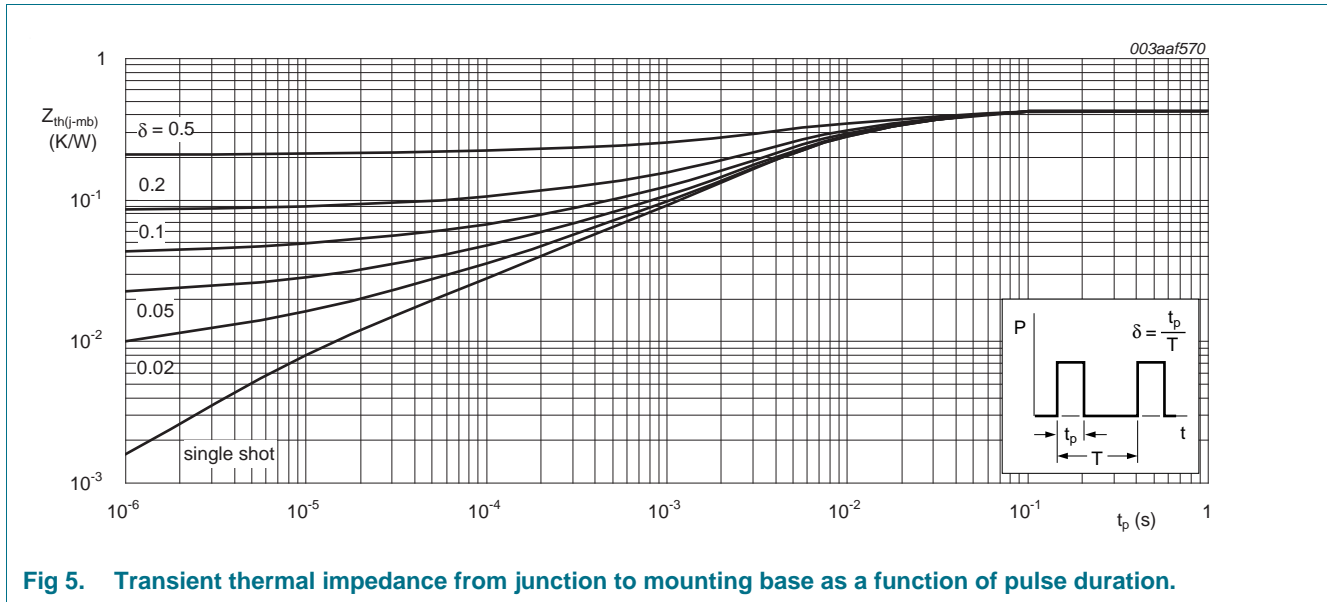
$T_{\eta b} = 25^{\circ}C$ ;  $I_{DM}$  is a single pulse

**Fig 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage**

**6. Thermal characteristics**

**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 5</a>	-	-	0.42	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	minimum footprint; mounted on a printed-circuit board	-	50	-	K/W

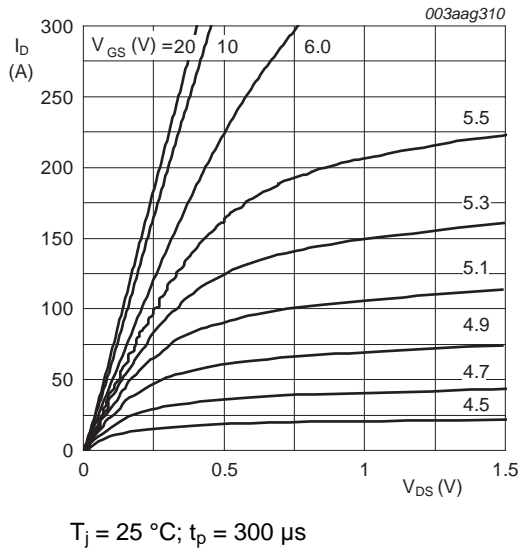


**Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration.**

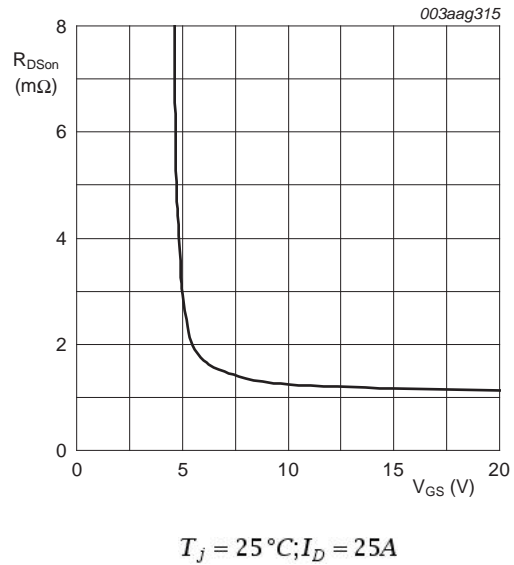
## 7. Characteristics

**Table 7. Characteristics**

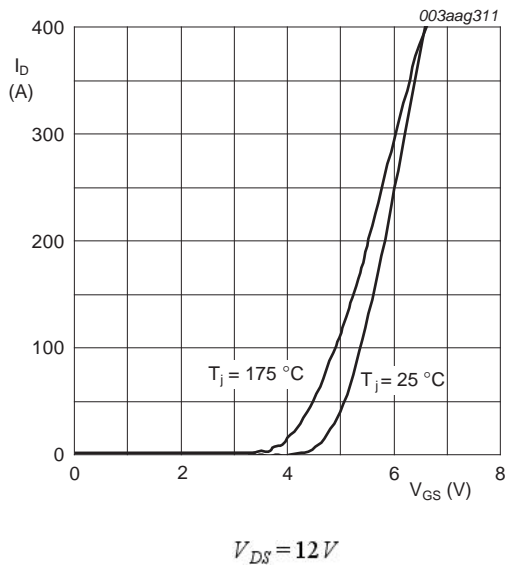
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	40	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	36	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$ ; see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>	2.4	3	4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C$ ; see <a href="#">Figure 10</a>	-	-	4.5	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ C$ ; see <a href="#">Figure 10</a>	1	-	-	V
$I_{DSS}$	drain leakage current	$V_{DS} = 40 V; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	-	0.25	3	$\mu A$
		$V_{DS} = 40 V; V_{GS} = 0 V; T_j = 175 \text{ }^\circ C$	-	-	500	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$	-	2	100	nA
		$V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 V; I_D = 25 A; T_j = 25 \text{ }^\circ C$ ; see <a href="#">Figure 11</a>	-	1.3	1.6	m $\Omega$
		$V_{GS} = 10 V; I_D = 25 A; T_j = 175 \text{ }^\circ C$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 11</a>	-	-	2.8	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 25 A; V_{DS} = 32 V; V_{GS} = 10 V$ ; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	145	-	nC
$Q_{GS}$	gate-source charge		-	35.7	-	nC
$Q_{GD}$	gate-drain charge		-	48.2	-	nC
$C_{iss}$	input capacitance	$V_{GS} = 0 V; V_{DS} = 25 V; f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ C$ ; see <a href="#">Figure 15</a>	-	8500	11340	pF
$C_{oss}$	output capacitance		-	1620	1950	pF
$C_{rss}$	reverse transfer capacitance		-	985	1350	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30 V; R_L = 1.2 \text{ } \Omega; V_{GS} = 10 V$ ; $R_{G(ext)} = 5 \text{ } \Omega$	-	42	-	ns
$t_r$	rise time		-	60	-	ns
$t_{d(off)}$	turn-off delay time		-	121	-	ns
$t_f$	fall time		-	83	-	ns
$L_D$	internal drain inductance	from upper edge of drain mounting base to center of die; $T_j = 25 \text{ }^\circ C$	-	2.5	-	nH
$L_S$	internal source inductance	from source lead to source bonding pad; $T_j = 25 \text{ }^\circ C$	-	7.5	-	nH
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25 A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$ ; see <a href="#">Figure 16</a>	-	0.77	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 20 A; di_S/dt = -100 \text{ A}/\mu s; V_{GS} = 0 V$ ; $V_{DS} = 25 V$	-	56	-	ns
$Q_r$	recovered charge		-	94	-	nC



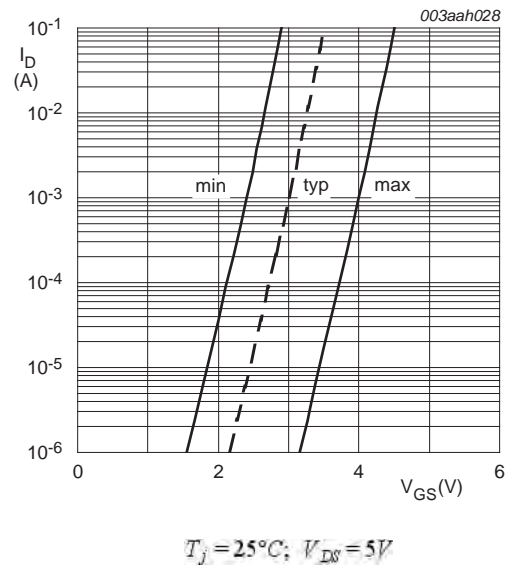
**Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values**



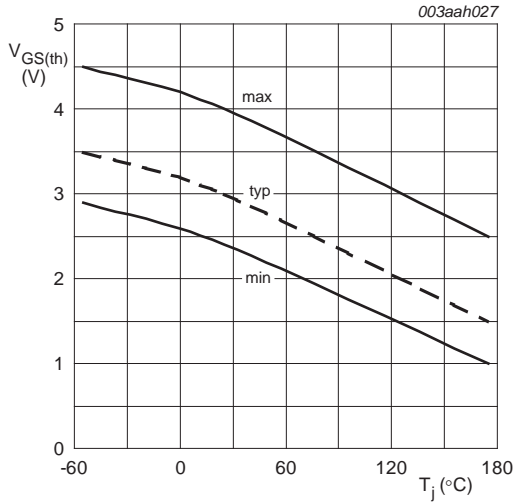
**Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values**



**Fig 8. Transfer characteristics: drain current as a function of gate-source voltage; typical values**

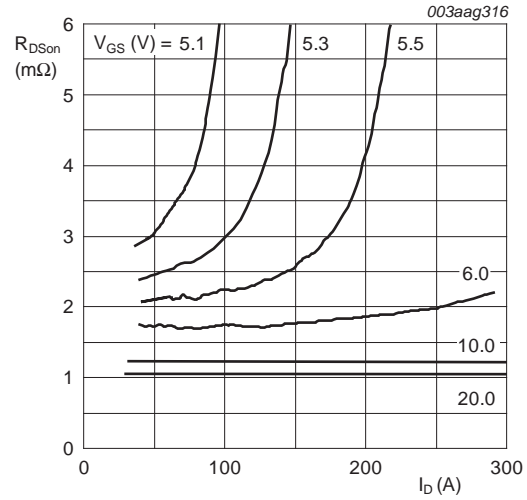


**Fig 9. Sub-threshold drain current as a function of gate-source voltage**



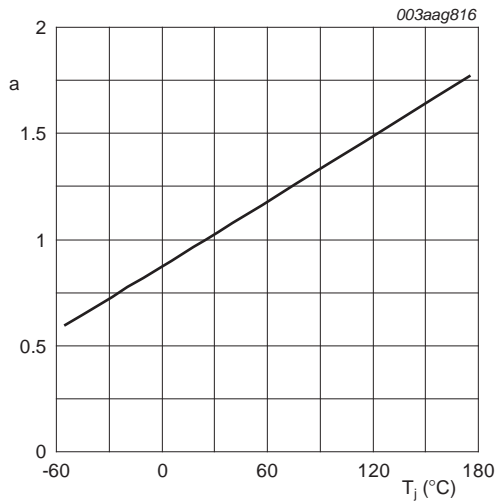
$$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$$

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



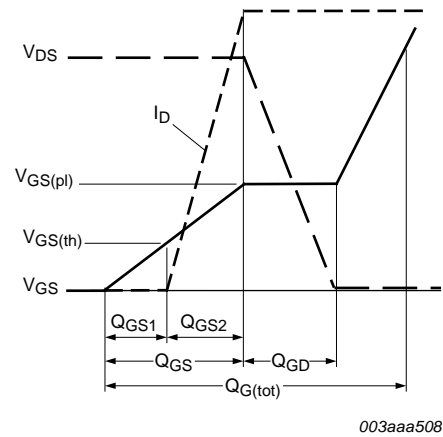
$$T_j = 25 \text{ °C}; t_p = 300 \text{ }\mu\text{s}$$

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



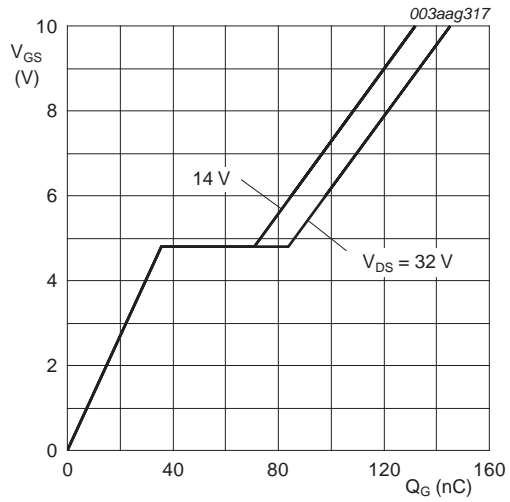
$$a = \frac{R_{Dson}}{R_{Dson}(25 \text{ °C})}$$

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



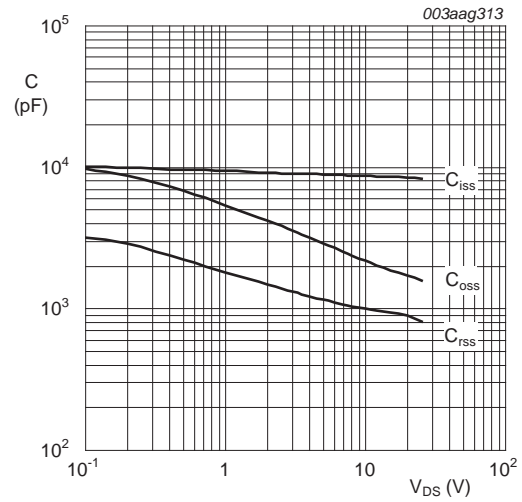
**Fig 13. Gate charge waveform definitions**





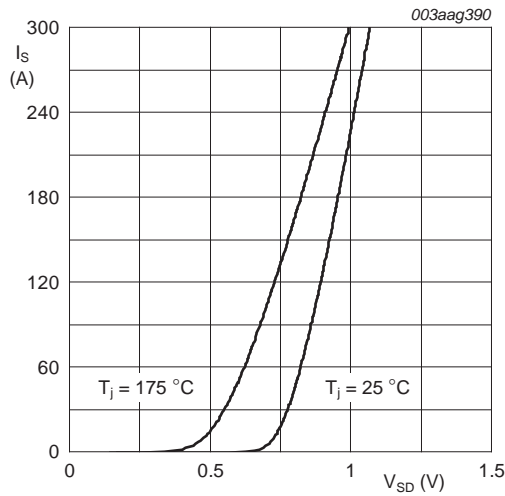
$T_j = 25\text{ }^\circ\text{C}$ ;  $I_D = 25$  A

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



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

**Fig 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**



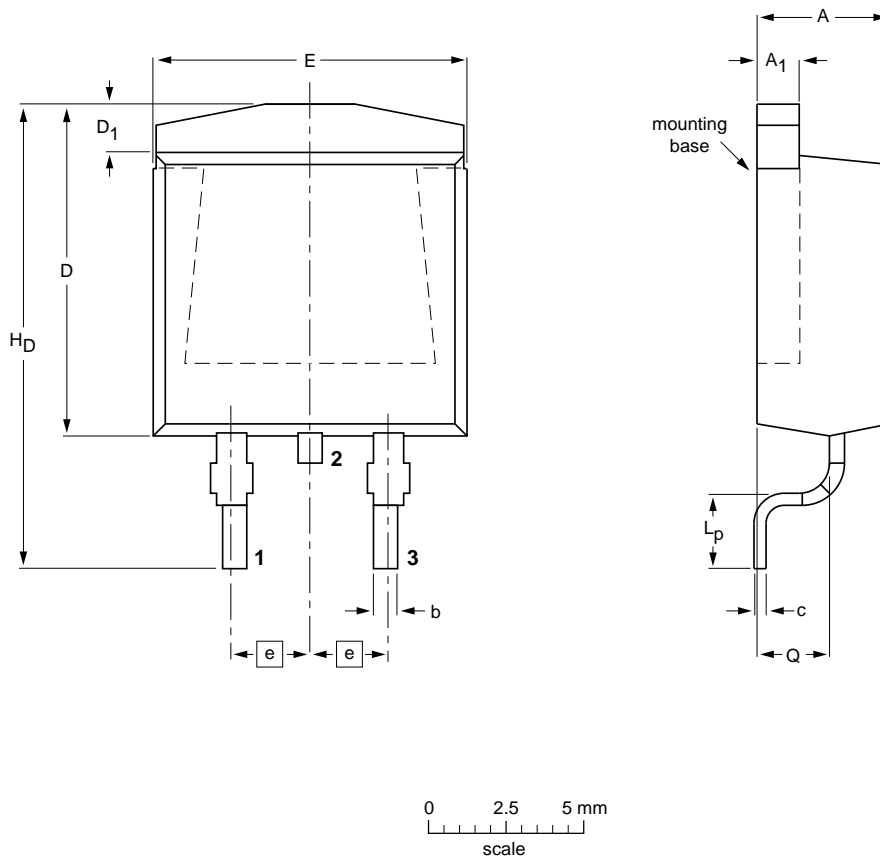
$V_{GS} = 0$  V

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

**8. Package outline**

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

**SOT404**



**DIMENSIONS** (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b	c	D max.	D <sub>1</sub>	E	e	L <sub>p</sub>	H <sub>D</sub>	Q
mm	4.50 4.10	1.40 1.27	0.85 0.60	0.64 0.46	11	1.60 1.20	10.30 9.70	2.54	2.90 2.10	15.80 14.80	2.60 2.20

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT404						05-02-11 06-03-16

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

## 9. Revision history

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**Table 8.** Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK761R6-40E v.1	20120330	Objective data sheet	-	-

## 10. Legal information

### 10.1 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.

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