



# BUK965R8-100E

N-channel TrenchMOS logic level FET

Rev. 2 — 16 May 2012

Product data sheet

## 1. Product profile

### 1.1 General description

Logic 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 logic level gate with  $V_{gst(th)}$  rating of greater than 0.5V at 175 °C

### 1.3 Applications

- 12V, 24V and 48V Automotive systems
- 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

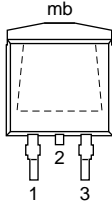
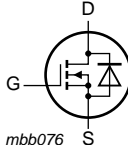
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	-	100	V
$I_D$	drain current	$V_{GS} = 5\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a>	[1]	-	120	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	357	W
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 5\text{ V}$ ; $I_D = 25\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 11</a>	-	4.62	5.8	mΩ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 5\text{ V}$ ; $I_D = 25\text{ A}$ ; $V_{DS} = 80\text{ V}$ ; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	51	-	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		
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
BUK965R8-100E	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	SOT404

## 4. Marking

Table 4. Marking codes

Type number	Marking code
BUK965R8-100E	BUK965R8-100E

## 5. Limiting values

**Table 5. Limiting values**

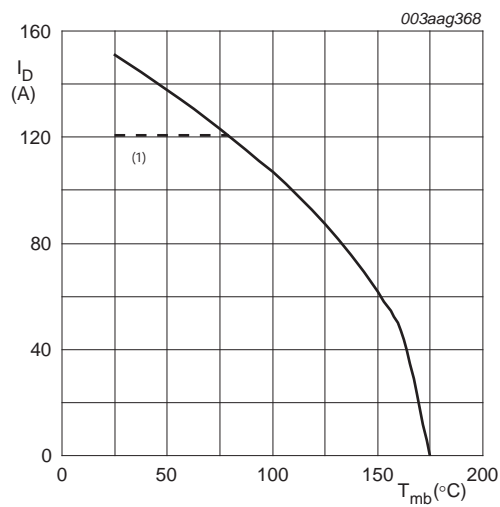
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ }^{\circ}\text{C}$ ; $T_j \leq 175\text{ }^{\circ}\text{C}$	-	100	V
$V_{DGR}$	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	100	V
$V_{GS}$	gate-source voltage	DC	-10	10	V
		Pulsed	-15	15	V
$I_D$	drain current	$T_{mb} = 25\text{ }^{\circ}\text{C}$ ; $V_{GS} = 5\text{ V}$ ; see <a href="#">Figure 1</a>	[1]	120	A
		$T_{mb} = 100\text{ }^{\circ}\text{C}$ ; $V_{GS} = 5\text{ V}$ ; see <a href="#">Figure 1</a>	-	105	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 4</a>	-	597	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 2</a>	-	357	W
$T_{stg}$	storage temperature		-55	175	$^{\circ}\text{C}$
$T_j$	junction temperature		-55	175	$^{\circ}\text{C}$
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25\text{ }^{\circ}\text{C}$	[1]	120	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ }^{\circ}\text{C}$	-	597	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 120\text{ A}$ ; $V_{sup} \leq 100\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; $V_{GS} = 5\text{ V}$ ; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; unclamped; see <a href="#">Figure 3</a>	[2][3]	385	mJ

[1] Continuous current is limited by package.

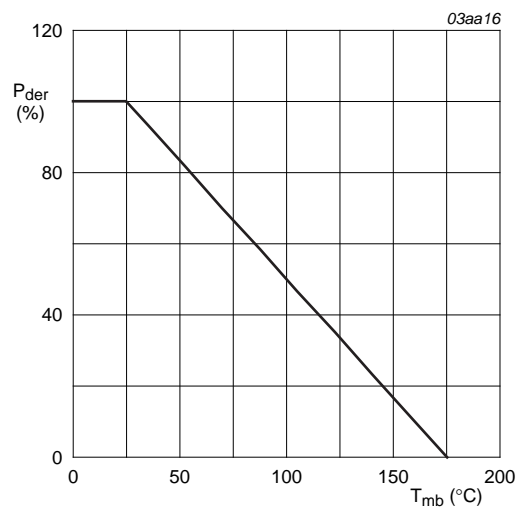
[2] Single-pulse avalanche rating limited by maximum junction temperature of 175  $^{\circ}\text{C}$ .

[3] Refer to application note AN10273 for further information.



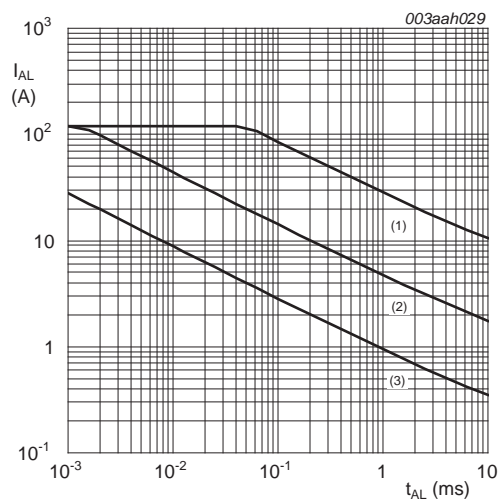
$V_{GS} \geq 5V$   
(1) Capped at 120 A due to package.

Fig 1. 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



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

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

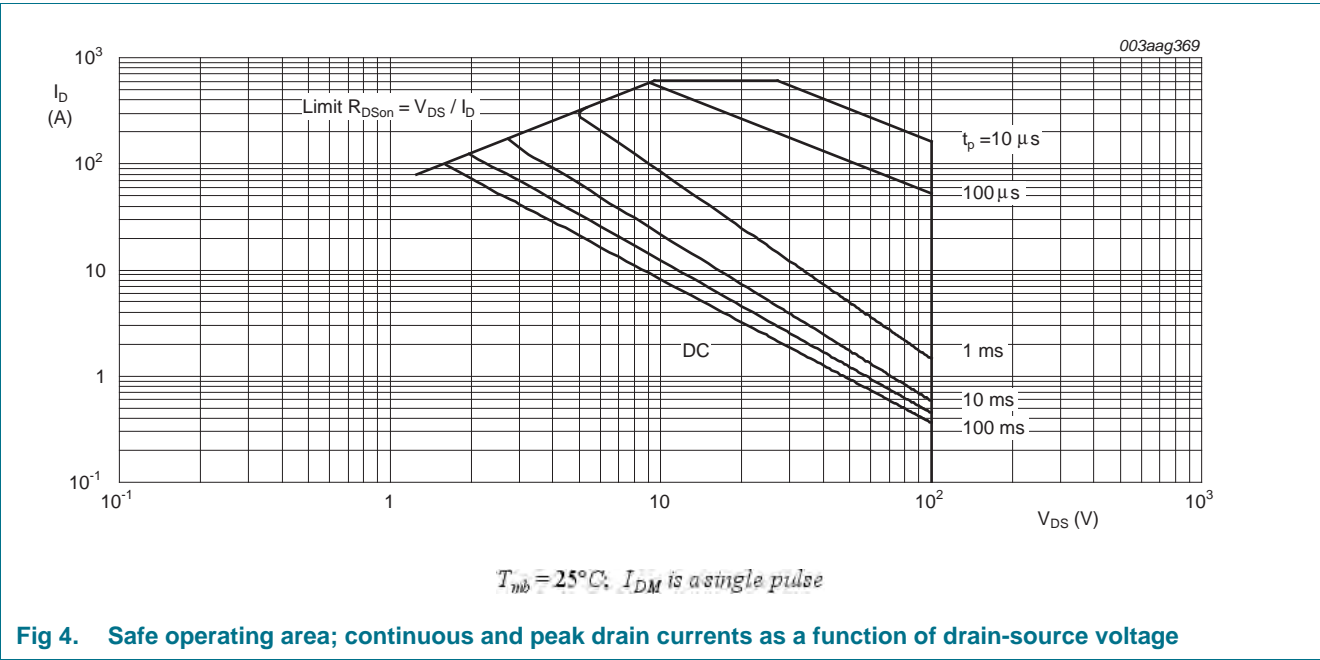


Fig 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

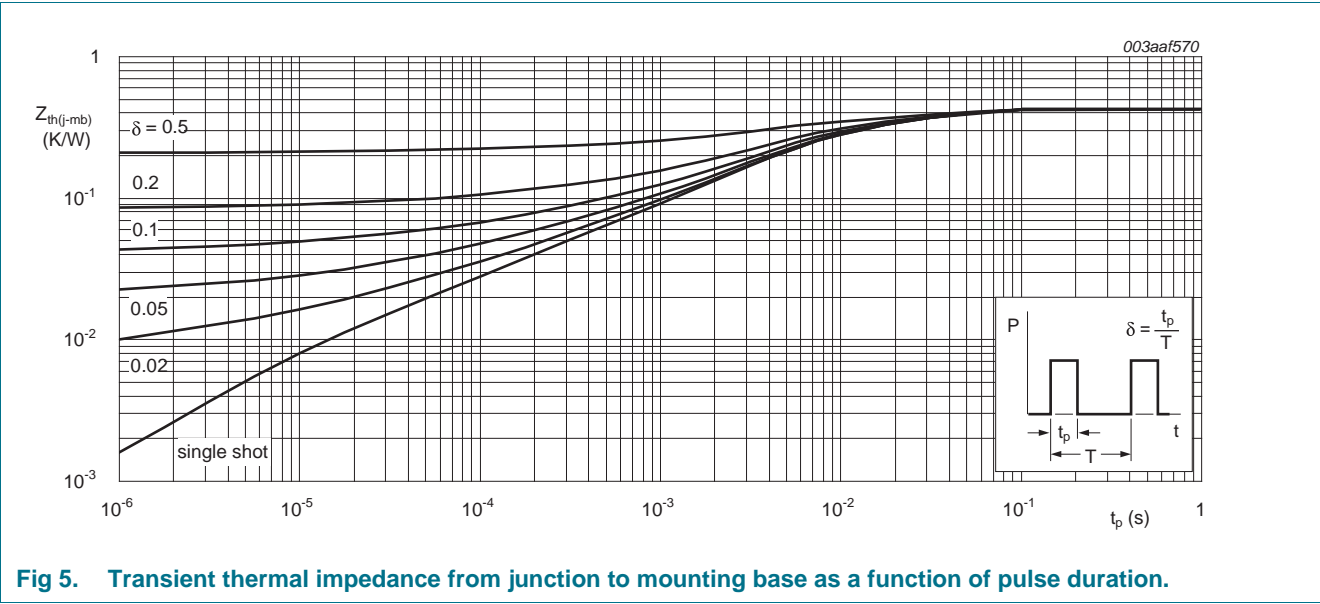


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration.

## 7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
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	100	-	-	V
		I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = -55 °C	90	-	-	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 9</a> ; see <a href="#">Figure 10</a>	1.4	1.7	2.1	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 9</a>	-	-	2.45	V
		I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 175 °C; see <a href="#">Figure 9</a>	0.5	-	-	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 100 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	0.05	1	μA
		V <sub>DS</sub> = 100 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 175 °C	-	-	500	μA
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = 10 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	2	100	nA
		V <sub>GS</sub> = -10 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	2	100	nA
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 5 V; I <sub>D</sub> = 25 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 11</a>	-	4.62	5.8	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>	-	4.45	5.6	mΩ
		V <sub>GS</sub> = 5 V; I <sub>D</sub> = 25 A; T <sub>j</sub> = 175 °C; see <a href="#">Figure 12</a> ; see <a href="#">Figure 11</a>	-	-	16	mΩ
Dynamic characteristics						
Q <sub>G(tot)</sub>	total gate charge	I <sub>D</sub> = 25 A; V <sub>DS</sub> = 80 V; V <sub>GS</sub> = 5 V; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	133	-	nC
Q <sub>GS</sub>	gate-source charge		-	23	-	nC
Q <sub>GD</sub>	gate-drain charge		-	51	-	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 15</a>	-	13100	17460	pF
C <sub>oss</sub>	output capacitance		-	725	870	pF
C <sub>rss</sub>	reverse transfer capacitance		-	450	620	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 80 V; R <sub>L</sub> = 3.2 Ω; V <sub>GS</sub> = 5 V; R <sub>G(ext)</sub> = 5 Ω	-	81	-	ns
t <sub>r</sub>	rise time		-	168	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	237	-	ns
t <sub>f</sub>	fall time		-	148	-	ns
L <sub>D</sub>	internal drain inductance	from upper edge of drain mounting base to center of die	-	2.5	-	nH
L <sub>S</sub>	internal source inductance	from source lead to source bonding pad	-	7.5	-	nH
Source-drain diode						
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 25 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C; see <a href="#">Figure 16</a>	-	0.77	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> = 0 V; V <sub>DS</sub> = 25 V	-	70	-	ns
Q <sub>r</sub>	recovered charge		-	202	-	nC

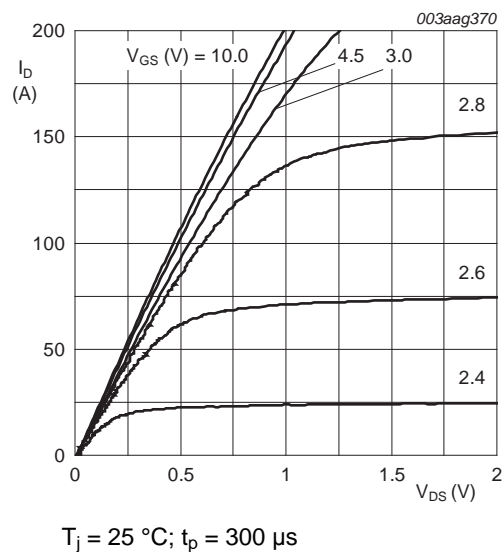


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values

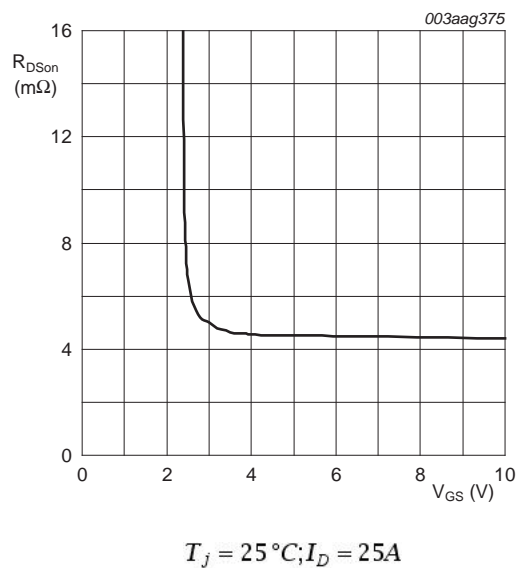


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

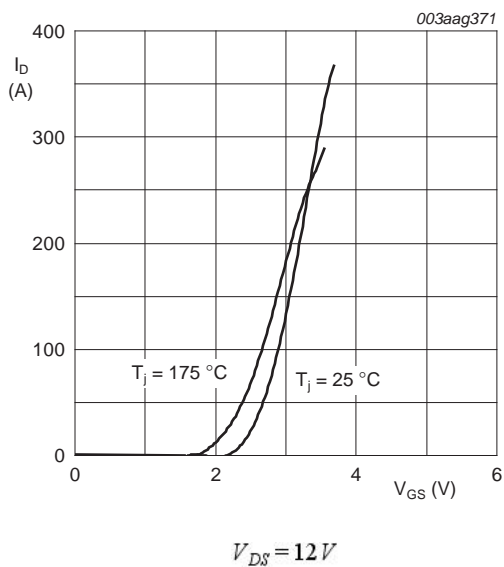


Fig 8. Transfer characteristics: drain current as a function of gate-source voltage; typical values

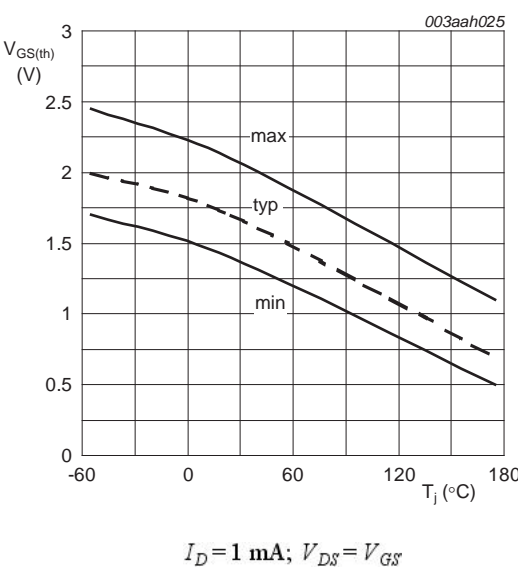


Fig 9. Gate-source threshold voltage as a function of junction temperature

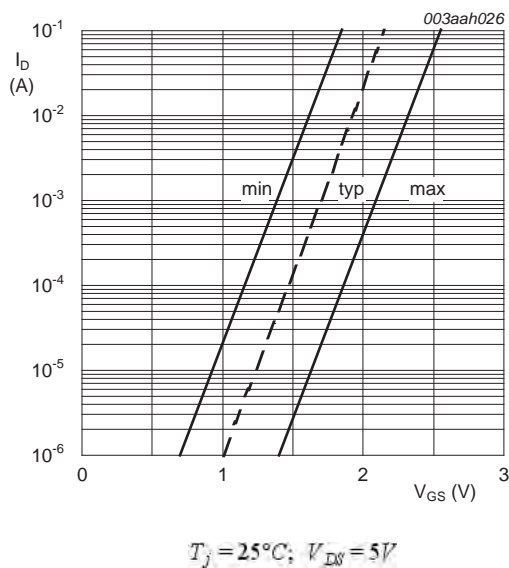


Fig 10. Sub-threshold drain current as a function of gate-source voltage

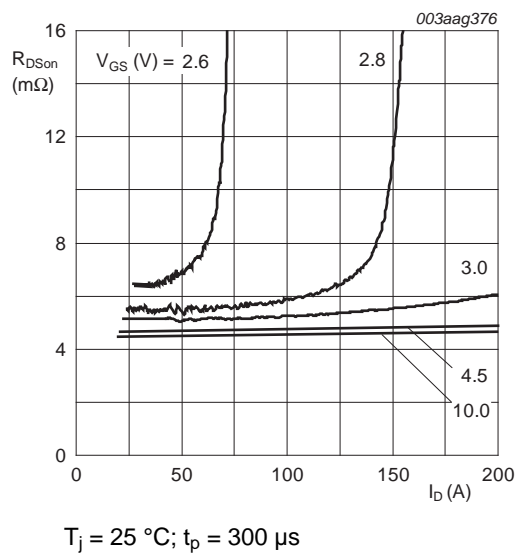


Fig 11. Drain-source on-state resistance as a function of drain current; typical values

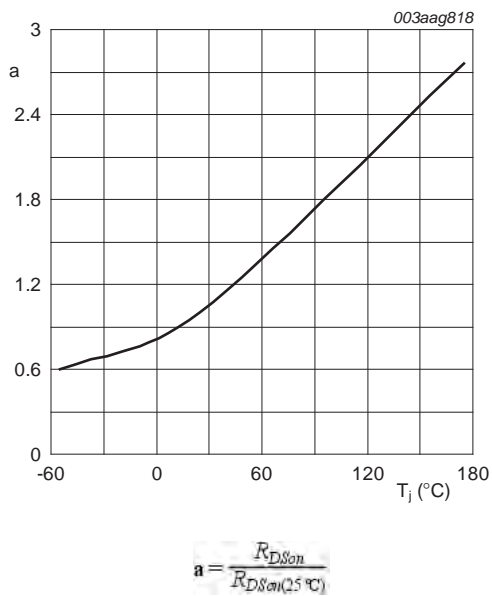


Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature

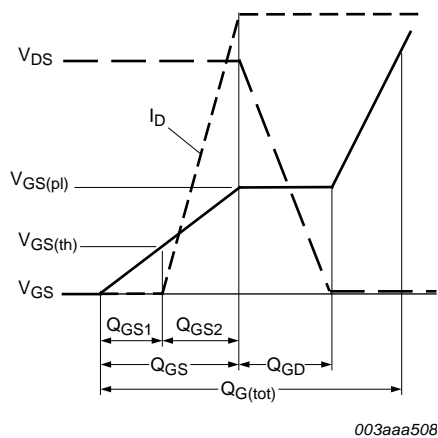
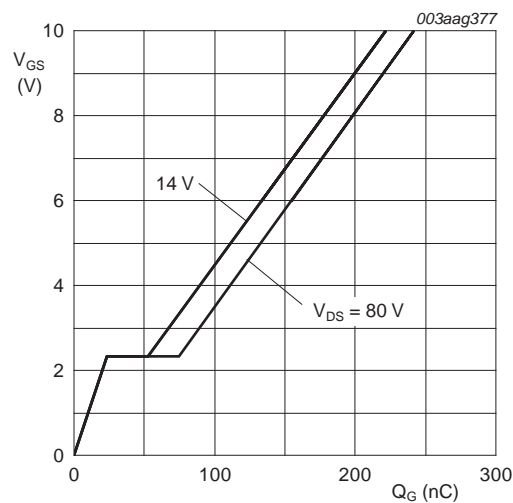


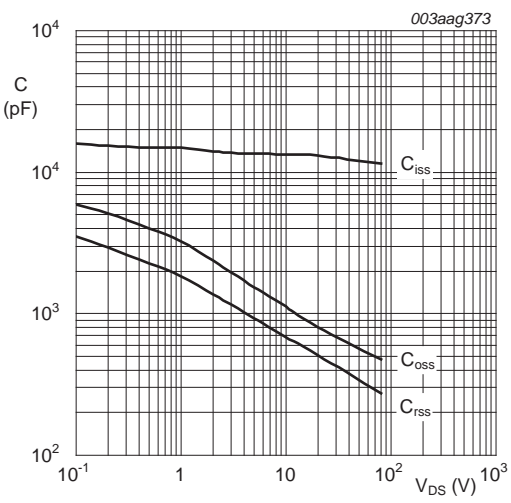
Fig 13. Gate charge waveform definitions





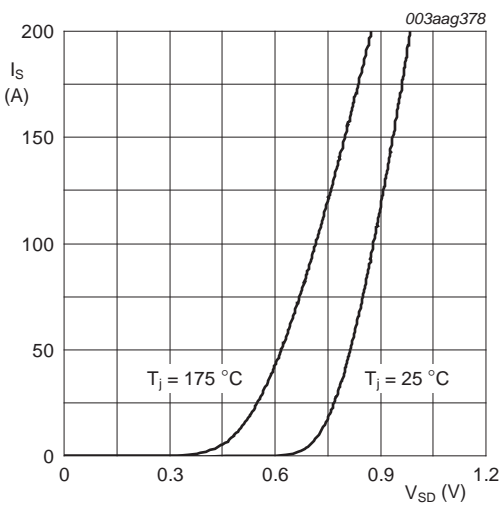
$T_j = 25\text{ °C}; I_D = 25\text{ A}$

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



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

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



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

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

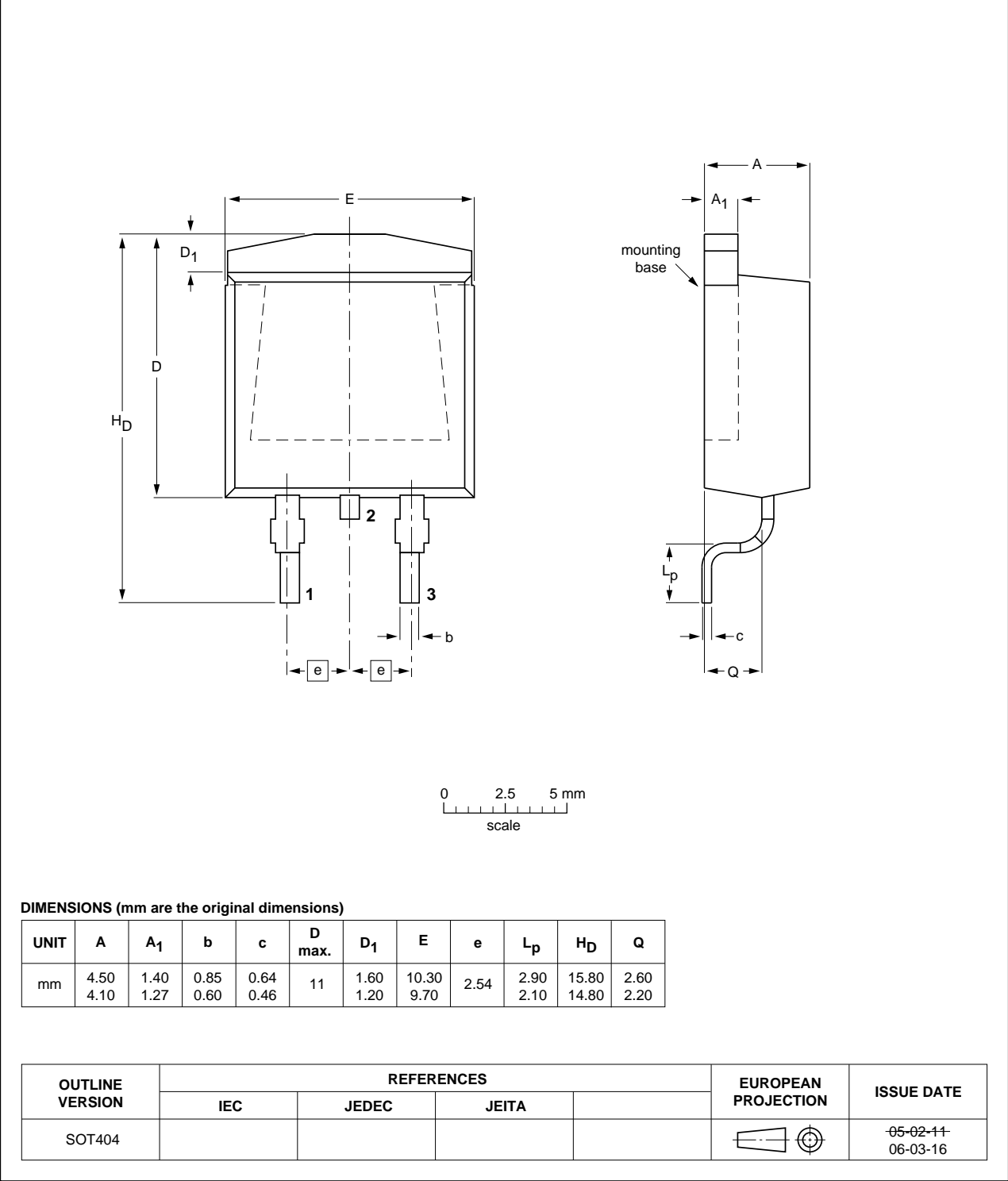


Fig 17. Package outline SOT404 (D2PAK)

## 9. Revision history

**Table 8.** Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK965R8-100E v.2	20120516	Product data sheet	-	BUK965R8-100E v.1
Modifications:	<ul style="list-style-type: none"><li>• Status changed from objective to product.</li><li>• Various changes to content.</li></ul>			
BUK965R8-100E v.1	20120404	Objective data sheet	-	-

## 10. Legal information

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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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