



BUK962R5-60E

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 VGS(th) rating of greater than 0.5V at 175 °C

1.3 Applications

- 12 V 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

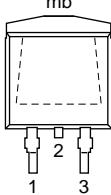
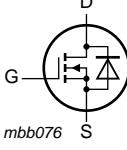
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25 \text{ }^\circ\text{C}; T_j \leq 175 \text{ }^\circ\text{C}$	-	-	60	V
I_D	drain current	$V_{GS} = 5 \text{ V}; T_{mb} = 25 \text{ }^\circ\text{C}$; see Figure 1	[1]	-	120	A
P_{tot}	total power dissipation	$T_{mb} = 25 \text{ }^\circ\text{C}$; see Figure 2	-	-	357	W
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$; see Figure 11	-	2	2.5	$\text{m}\Omega$
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 5 \text{ V}; I_D = 25 \text{ A}; V_{DS} = 48 \text{ V}$; see Figure 13 ; see Figure 14	-	41.2	-	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		
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
BUK962R5-60E	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	SOT404

4. Marking

Table 4. Marking codes

Type number	Marking code
BUK962R5-60E	BUK962R5-60E

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	$T_j \geq 25^\circ\text{C}$; $T_j \leq 175^\circ\text{C}$	-	60	V	
V_{DGR}	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	60	V	
V_{GS}	gate-source voltage	DC	-10	10	V	
		Pulsed	-15	15	V	
I_D	drain current	$T_{mb} = 25^\circ\text{C}$; $V_{GS} = 5\text{ V}$; see Figure 1	[1]	-	120	A
		$T_{mb} = 100^\circ\text{C}$; $V_{GS} = 5\text{ V}$; see Figure 1	[1]	-	120	A
I_{DM}	peak drain current	$T_{mb} = 25^\circ\text{C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; see Figure 4	-	1019	A	
P_{tot}	total power dissipation	$T_{mb} = 25^\circ\text{C}$; see Figure 2	-	357	W	
T_{stg}	storage temperature		-55	175	°C	
T_j	junction temperature		-55	175	°C	
Source-drain diode						
I_S	source current	$T_{mb} = 25^\circ\text{C}$	[1]	-	120	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25^\circ\text{C}$	-	1019	A	
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 120\text{ A}$; $V_{sup} \leq 60\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $T_{j(init)} = 25^\circ\text{C}$; unclamped; see Figure 3	[2][3]	-	655	mJ

[1] Continuous current is limited by package.

[2] Single-pulse avalanche rating limited by maximum junction temperature of 175°C .

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

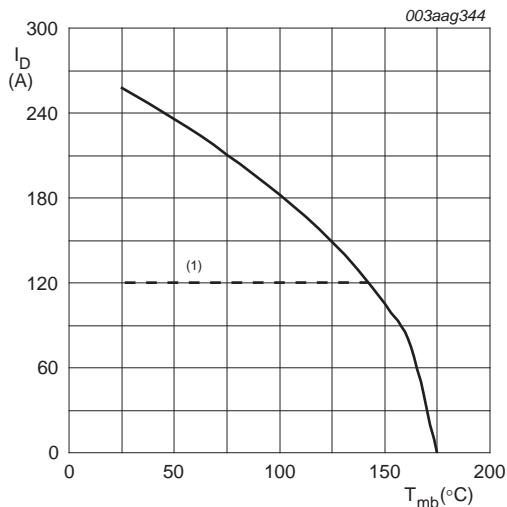


Fig 1. Continuous drain current as a function of mounting base temperature

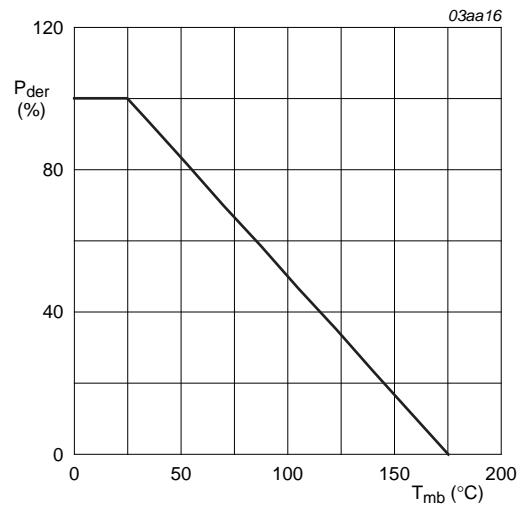


Fig 2. Normalized total power dissipation as a function of mounting base temperature

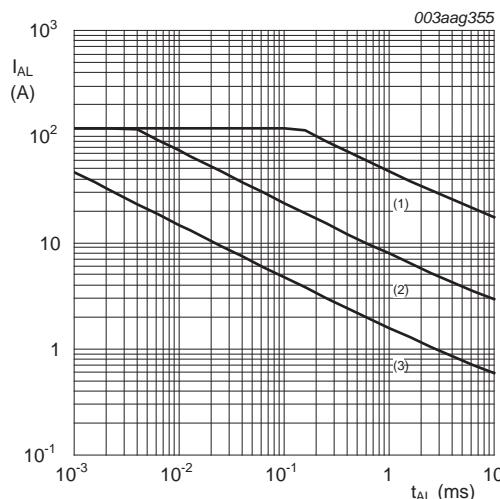
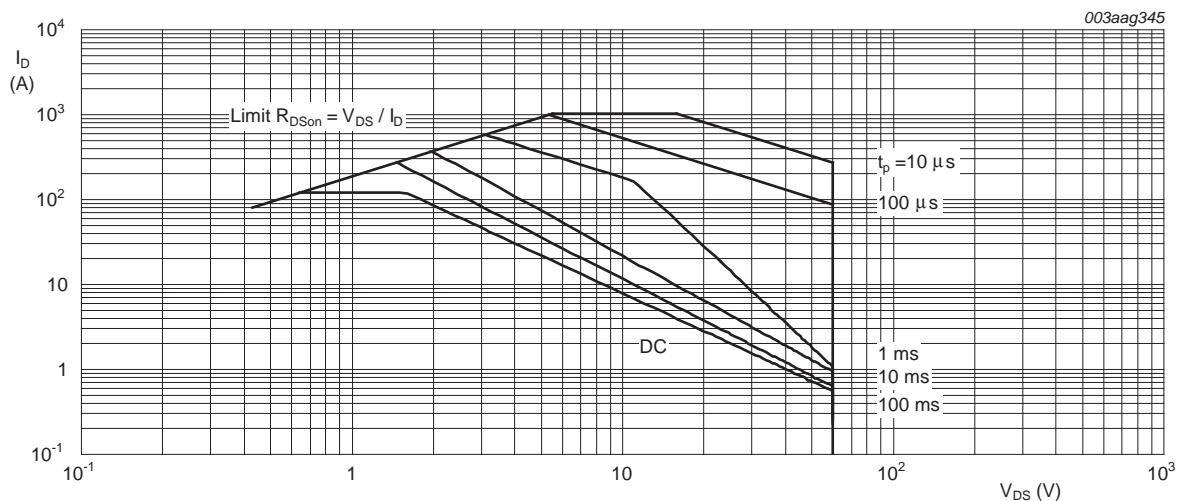


Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time



$T_{mb} = 25^\circ C$; 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 Figure 5	-	-	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

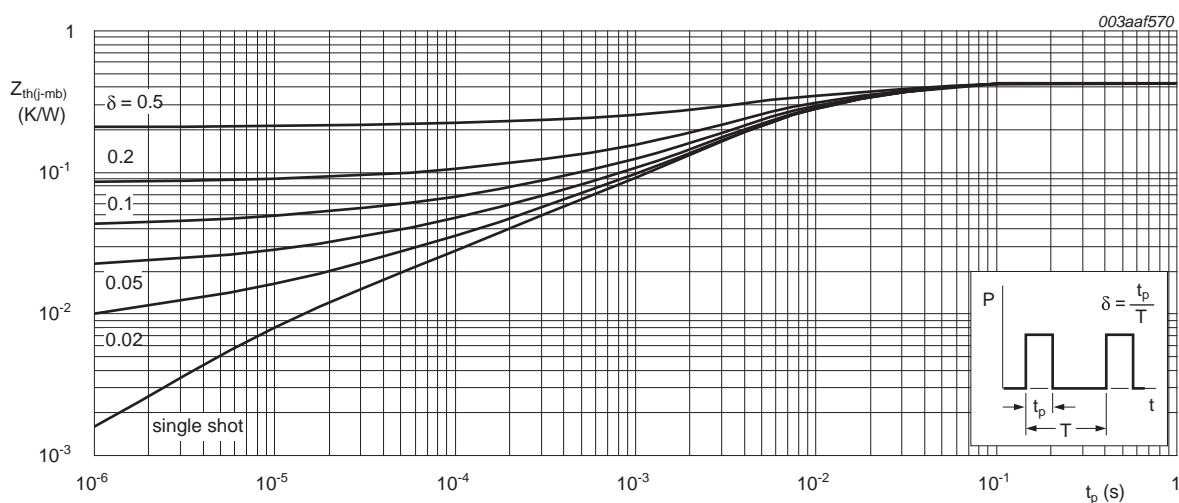
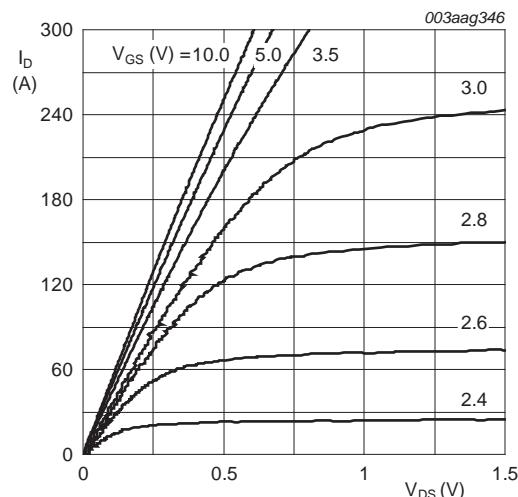


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration.

7. Characteristics

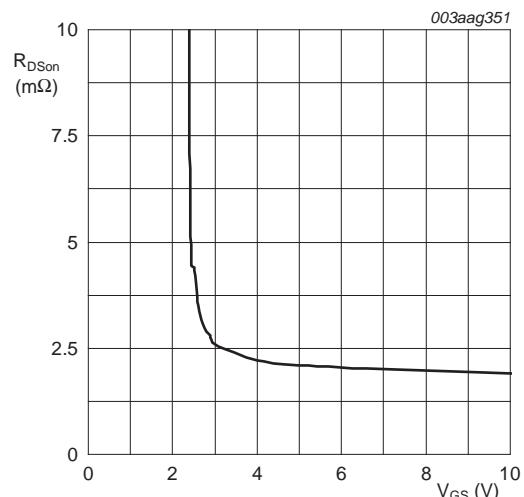
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25^\circ C$ $I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55^\circ C$	60	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25^\circ C$; see Figure 9 ; see Figure 10 $I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55^\circ C$; see Figure 9 $I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175^\circ C$; see Figure 9	1.4	1.7	2.1	V
I_{DSS}	drain leakage current	$V_{DS} = 60 V; V_{GS} = 0 V; T_j = 25^\circ C$ $V_{DS} = 60 V; V_{GS} = 0 V; T_j = 175^\circ C$	-	0.08	1	μA
I_{GSS}	gate leakage current	$V_{GS} = 10 V; V_{DS} = 0 V; T_j = 25^\circ C$ $V_{GS} = -10 V; V_{DS} = 0 V; T_j = 25^\circ C$	-	2	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 5 V; I_D = 25 A; T_j = 25^\circ C$; see Figure 11 $V_{GS} = 10 V; I_D = 25 A; T_j = 25^\circ C$; see Figure 11 $V_{GS} = 5 V; I_D = 25 A; T_j = 175^\circ C$; see Figure 12 ; see Figure 11	-	2	2.5	$m\Omega$
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 25 A; V_{DS} = 48 V; V_{GS} = 5 V$; see Figure 13 ; see Figure 14	-	120	-	nC
Q_{GS}	gate-source charge		-	25.6	-	nC
Q_{GD}	gate-drain charge		-	41.2	-	nC
C_{iss}	input capacitance	$V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz$	-	13070	17450	pF
C_{oss}	output capacitance	$T_j = 25^\circ C$; see Figure 15	-	1051	1260	pF
C_{rss}	reverse transfer capacitance		-	558	770	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 25 V; R_L = 1.8 \Omega; V_{GS} = 5 V$	-	71	-	ns
t_r	rise time	$R_{G(ext)} = 5 \Omega$	-	119	-	ns
$t_{d(off)}$	turn-off delay time		-	224	-	ns
t_f	fall time		-	128	-	ns
L_D	internal drain inductance	from upper edge of drain mounting base to center of die; $T_j = 25^\circ C$	-	2.5	-	nH
L_S	internal source inductance	from source lead to source bonding pad; $T_j = 25^\circ C$	-	7.5	-	nH
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25 A; V_{GS} = 0 V; T_j = 25^\circ C$; see Figure 16	-	0.77	1.2	V
t_{rr}	reverse recovery time	$I_S = 20 A; dI_S/dt = -100 A/\mu s; V_{GS} = 0 V; V_{DS} = 25 V$	-	53	-	ns
Q_r	recovered charge		-	98	-	nC



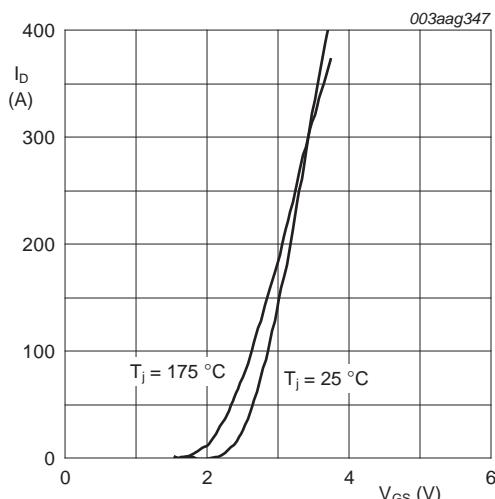
$T_j = 25^\circ\text{C}$; $t_p = 300 \mu\text{s}$

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



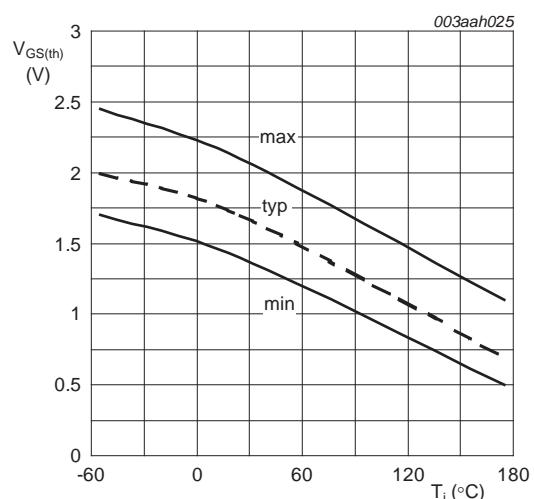
$T_j = 25^\circ\text{C}$; $I_D = 25\text{A}$

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



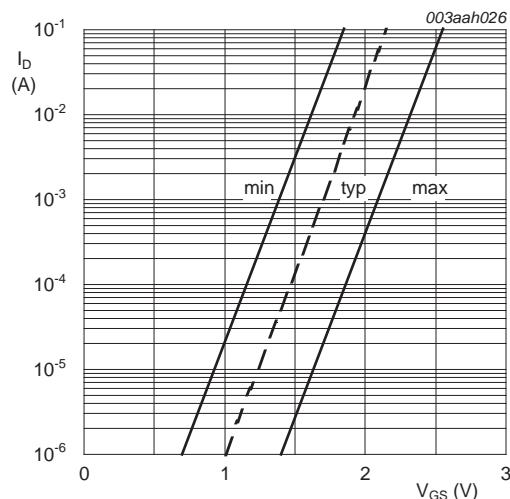
$V_{DS} = 12\text{V}$

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



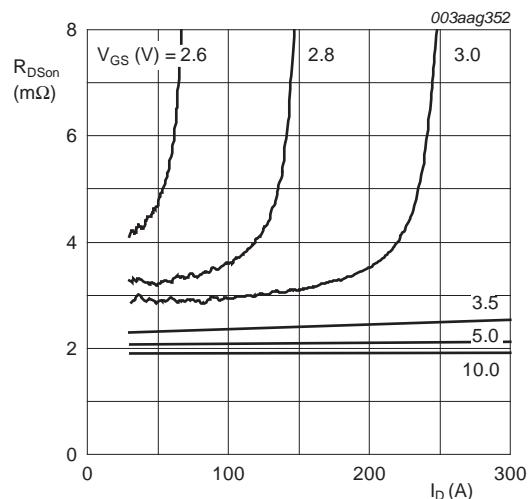
$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$

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



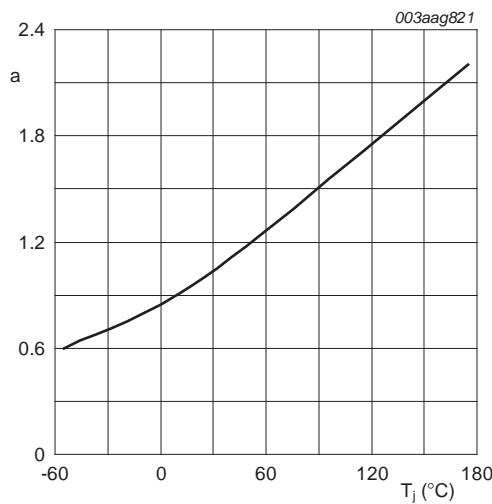
$T_j = 25^\circ\text{C}$; $V_{DS} = 5\text{V}$

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



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

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



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

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

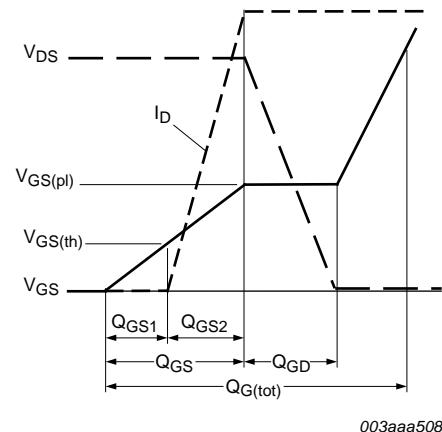
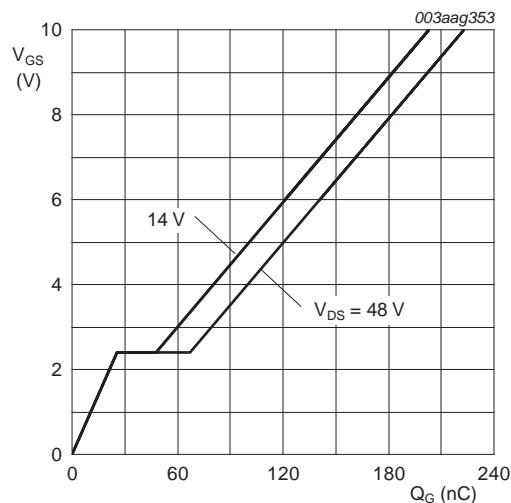
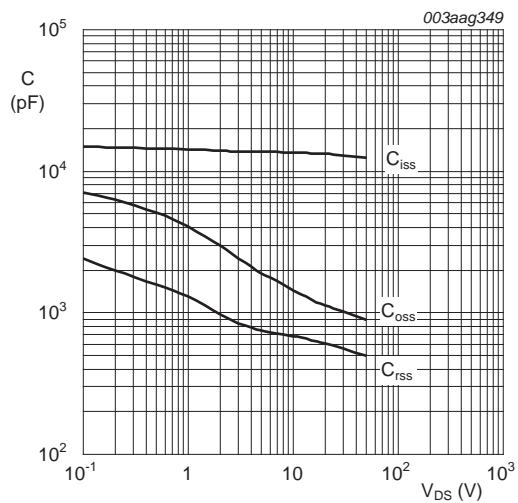


Fig 13. Gate charge waveform definitions



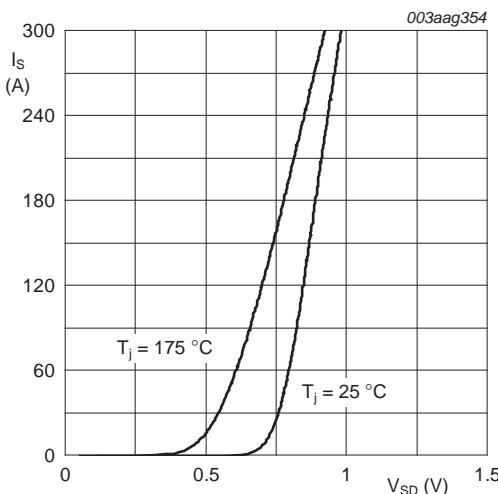
$T_j = 25$ °C; $I_D = 25$ A

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



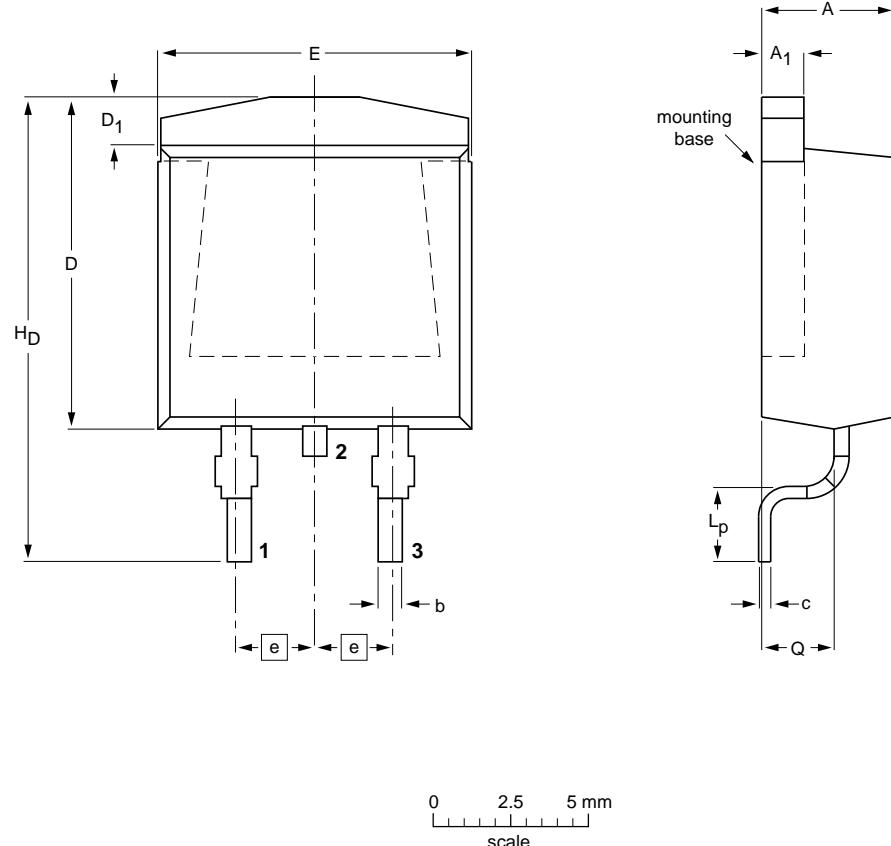
$V_{GS} = 0$ V

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 ₁	b	c	D _{max.}	D ₁	E	e	L _p	H _D	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

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK962R5-60E v.2	20120516	Product data sheet	-	BUK962R5-60E v.1
Modifications:		<ul style="list-style-type: none">• Status changed from objective to product.• Various changes to content.		
BUK962R5-60E v.1	20120404	Objective data sheet	-	-

10. Legal information

10.1 Data sheet status

Document status ^[1] [2]	Product status ^[3]	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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[2] The term 'short data sheet' is explained in section "Definitions".

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