



**THE DATASHEET OF  
BUK6C2R1-55C,118**





# BUK6C2R1-55C

N-channel TrenchMOS intermediate level FET

Rev. 3 — 18 January 2012

Product data sheet

## 1. Product profile

### 1.1 General description

Intermediate level gate drive 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 high-performance automotive applications.

### 1.2 Features and benefits

- AEC Q101 compliant
- High current handling capability, up to 320 A
- Low conduction losses due to very low on-state resistance
- Suitable for standard and logic level gate drive sources
- Suitable for thermally demanding environments due to 175 °C rating

### 1.3 Applications

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

### 1.4 Quick reference data

Table 1. Quick reference data

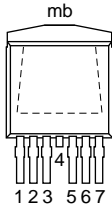
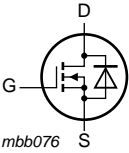
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	55	V
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C};$ see <a href="#">Figure 1</a>	-	-	228	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C};$ see <a href="#">Figure 2</a>	-	-	300	W
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 90\text{ A};$ $T_j = 25\text{ °C};$ see <a href="#">Figure 11</a>	-	1.9	2.3	mΩ

Table 1. Quick reference data ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$I_D = 180\text{ A}$ ; $V_{DS} = 44\text{ V}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	79	-	nC
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 120\text{ A}$ ; $V_{sup} \leq 55\text{ V}$ ; $R_{GS} = 50\ \Omega$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ }^\circ\text{C}$ ; unclamped	-	-	770	mJ

## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p style="text-align: center;"><b>SOT427 (D2PAK)</b></p>	
2	S	source		
3	S	source		
4	D	drain <sup>[1]</sup>		
5	S	source		
6	S	source		
7	S	source		
mb	D	mounting base; connected to drain		

[1] It is not possible to connect to pin 4 of the SOT427 package.

## 3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
BUK6C2R1-55C	D2PAK	plastic single-ended surface-mounted package (D2PAK); 7 leads (one lead cropped)	SOT427

## 4. Limiting values

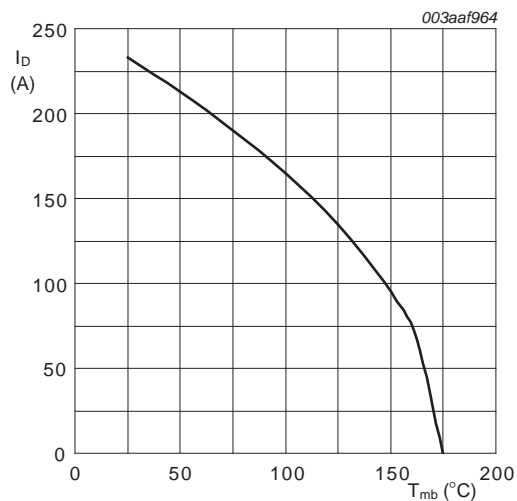
**Table 4. Limiting values**

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

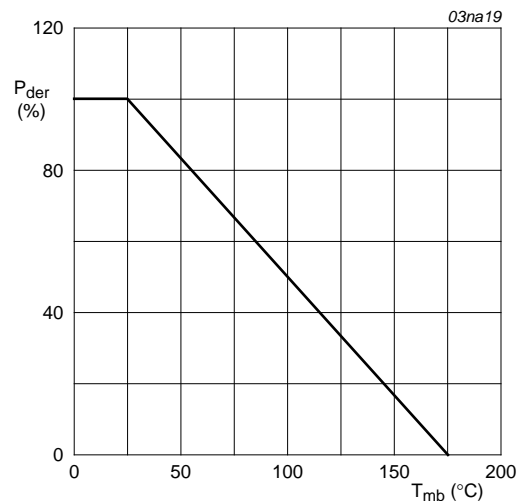
Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	55	V	
$V_{GS}$	gate-source voltage	Pulsed	[1]	-20	20	V
		DC	[2]	-16	16	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a>	-	228	A	
		$T_{amb} = 100\text{ °C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a>	-	162	A	
$I_{DM}$	peak drain current	$T_{mb} = 25\text{ °C};$ pulsed; $t_p \leq 10\text{ }\mu\text{s};$ see <a href="#">Figure 3</a>	-	914	A	
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C};$ see <a href="#">Figure 2</a>	-	300	W	
$T_{stg}$	storage temperature		-55	175	°C	
$T_j$	junction temperature		-55	175	°C	
<b>Source-drain diode</b>						
$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	228	A	
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C}$	-	914	A	
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 120\text{ A}; V_{sup} \leq 55\text{ V}; R_{GS} = 50\text{ }\Omega;$ $V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C};$ unclamped	-	770	mJ	

[1] Accumulated pulse duration not to exceed 5mins.

[2] -16V accumulated duration not to exceed 168 hrs.

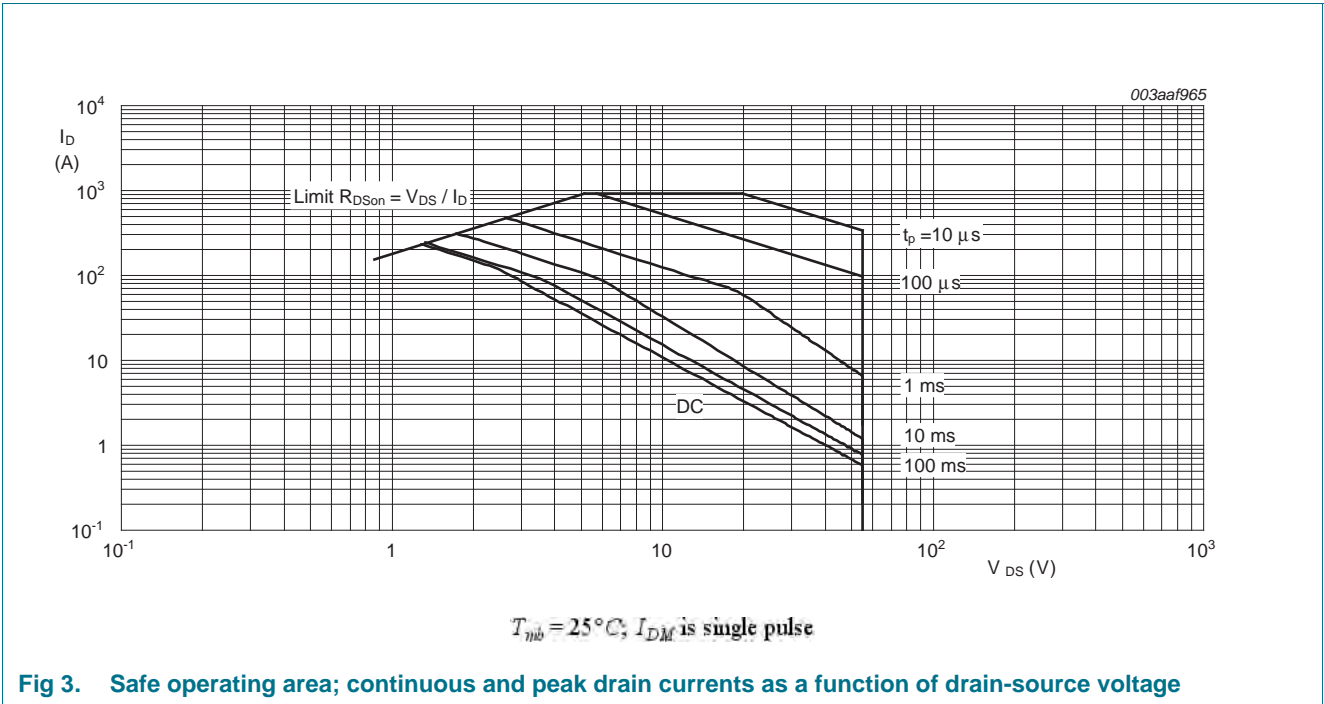


**Fig 1. Continuous drain current as a function of mounting base temperature**



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

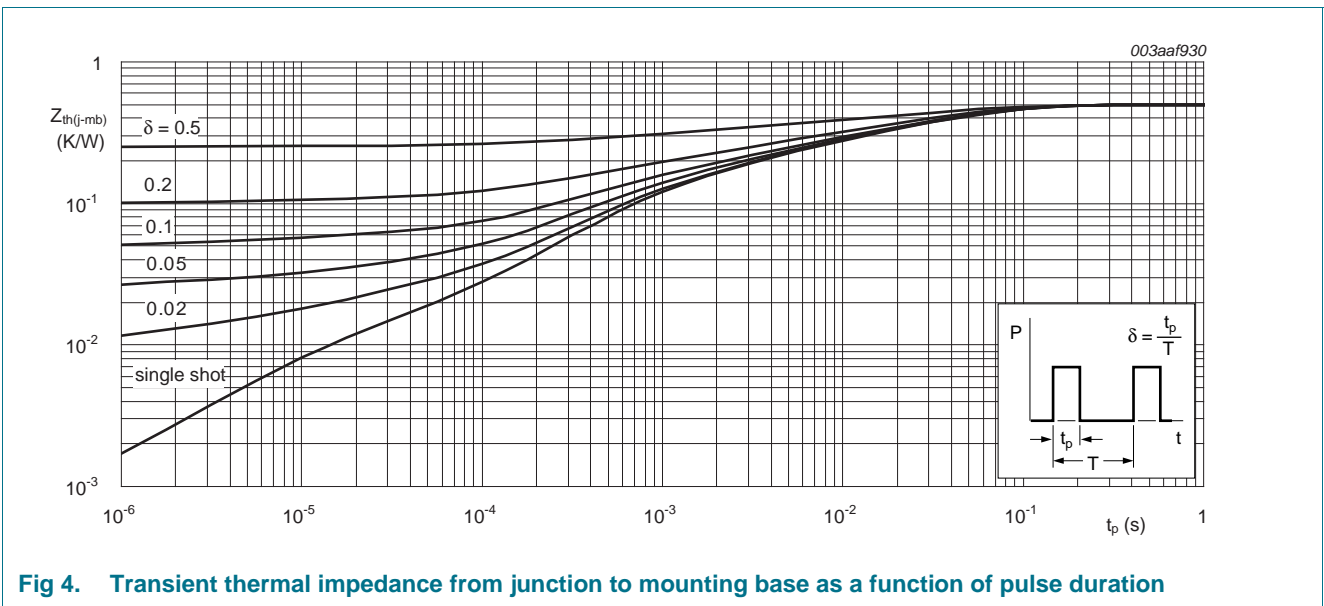
**Fig 2. Normalized total power dissipation as a function of mounting base temperature**



### 5. Thermal characteristics

Table 5. Thermal characteristics

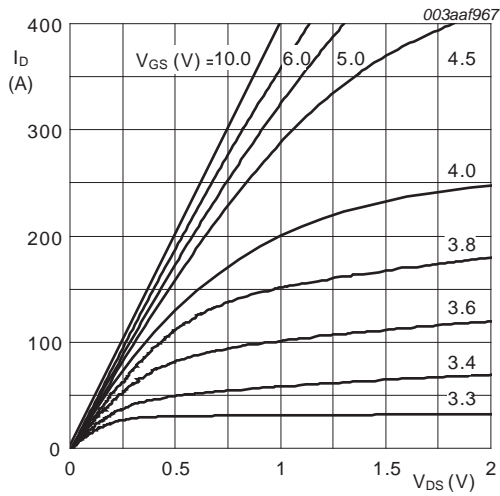
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 4</a>	-	-	0.5	K/W



## 6. Characteristics

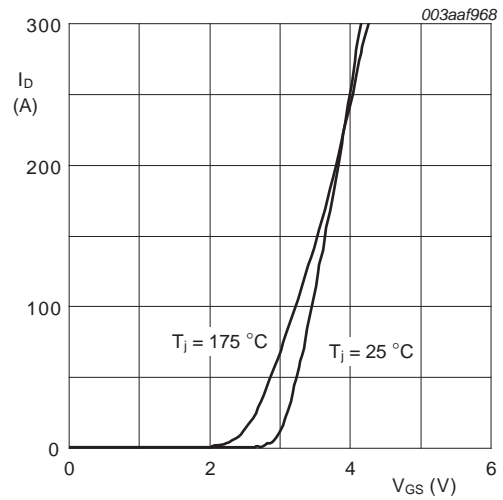
Table 6. Characteristics

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	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>	1.8	2.3	2.8	V
$V_{GSth}$	gate-source threshold voltage	$I_D = 2.5 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see <a href="#">Figure 10</a>	0.8	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see <a href="#">Figure 10</a>	-	-	3.3	V
$I_{DSS}$	drain leakage current	$V_{DS} = 55 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.04	1	$\mu\text{A}$
		$V_{DS} = 55 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$	-	-	500	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 90 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 11</a>	-	1.9	2.3	m $\Omega$
		$V_{GS} = 5 \text{ V}; I_D = 90 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 11</a>	-	2.4	3.1	m $\Omega$
		$V_{GS} = 4.5 \text{ V}; I_D = 90 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 11</a>	-	2.6	3.7	m $\Omega$
		$V_{GS} = 10 \text{ V}; I_D = 90 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>	-	-	5.7	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 180 \text{ A}; V_{DS} = 44 \text{ V}; V_{GS} = 10 \text{ V};$ see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	253	-	nC
		$I_D = 180 \text{ A}; V_{DS} = 44 \text{ V}; V_{GS} = 5 \text{ V};$ see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	140	-	nC
$Q_{GS}$	gate-source charge	$I_D = 180 \text{ A}; V_{DS} = 44 \text{ V}; V_{GS} = 10 \text{ V};$ see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	40	-	nC
$Q_{GD}$	gate-drain charge	see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	79	-	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 15</a>	-	12000	16000	pF
$C_{oss}$	output capacitance		-	1075	1290	pF
$C_{rSS}$	reverse transfer capacitance		-	730	1000	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30 \text{ V}; R_L = 0.3 \text{ } \Omega; V_{GS} = 10 \text{ V};$ $R_{G(ext)} = 10 \text{ } \Omega$	-	43	-	ns
$t_r$	rise time		-	206	-	ns
$t_{d(off)}$	turn-off delay time		-	412	-	ns
$t_f$	fall time		-	190	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 80 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 16</a>	-	0.8	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 50 \text{ A}; dI_S/dt = -100 \text{ A}/\mu\text{s}; V_{GS} = 0 \text{ V};$ $V_{DS} = 30 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	56	-	ns
$Q_r$	recovered charge		-	115	-	nC



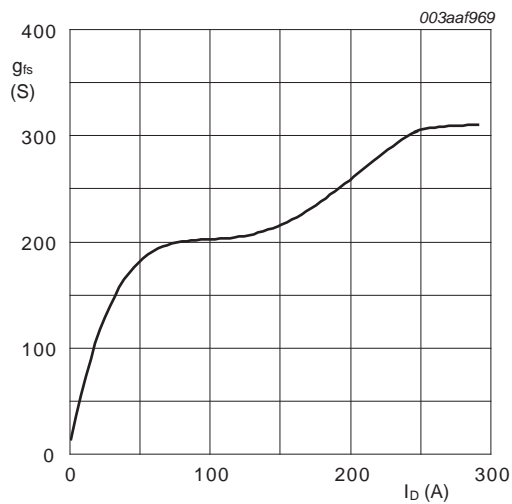
$T_j = 25\text{ }^\circ\text{C}; t_p = 300\text{ }\mu\text{s}$

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



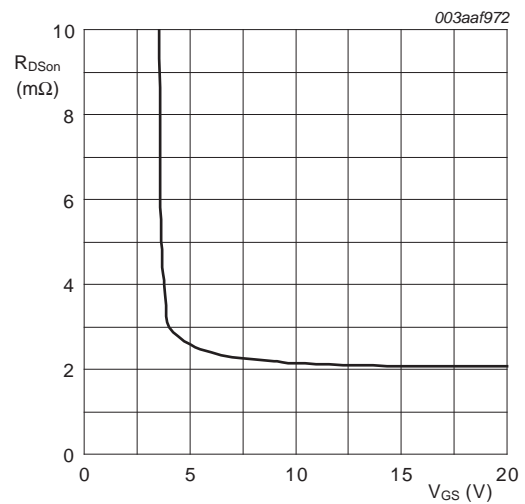
$$V_{DS} > I_D \times R_{DS(on)}$$

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



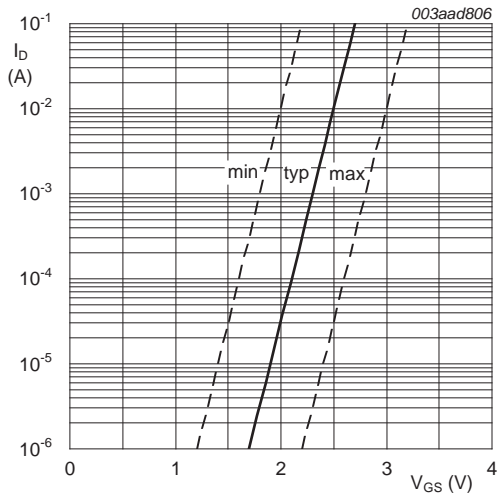
$T_j = 25\text{ }^\circ\text{C}; V_{DS} = 25\text{ V}$

**Fig 7. Forward transconductance as a function of drain current; typical values**



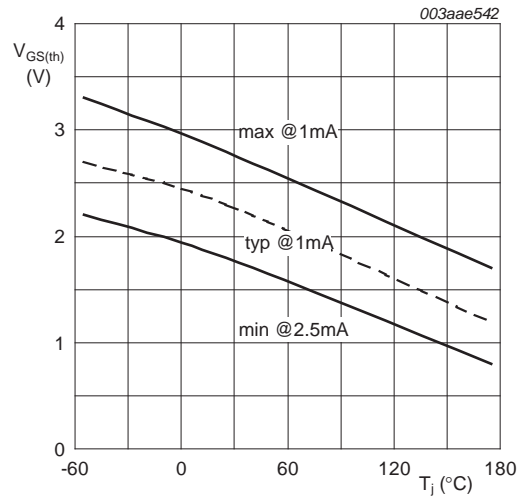
$T_j = 25\text{ }^\circ\text{C}; I_D = 90\text{ A}$

**Fig 8. Drain-source on-state resistance as a function of gate-source voltage; typical values**



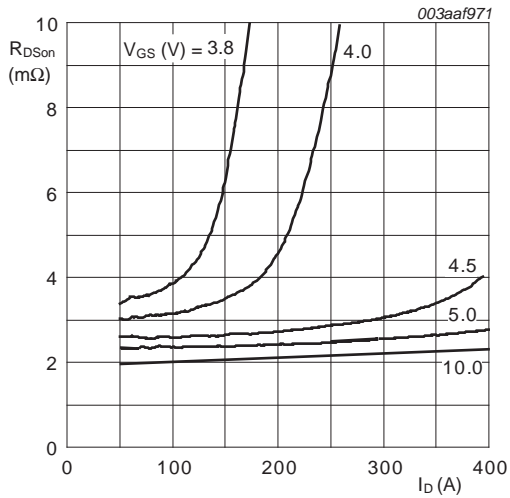
$T_j = 25\text{ }^\circ\text{C}; V_{DS} = 5\text{V}$

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



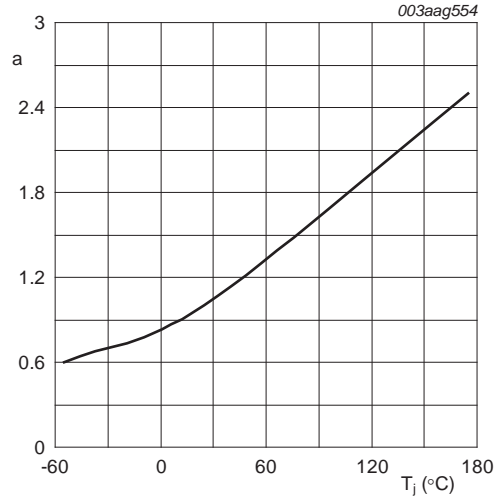
$I_D = 1\text{mA}; V_{DS} = V_{GS}$

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



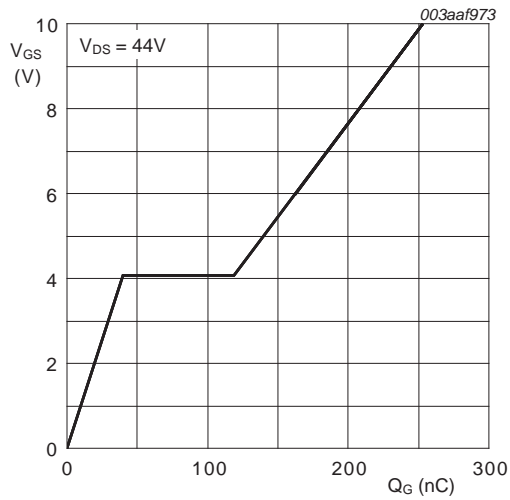
$T_j = 25\text{ }^\circ\text{C}; t_p = 300\text{ }\mu\text{s}$

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



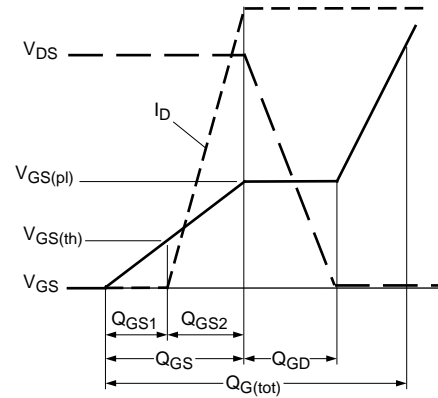
$$a = \frac{R_{DS(on)}}{R_{DS(on)25\text{ }^\circ\text{C}}}$$

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

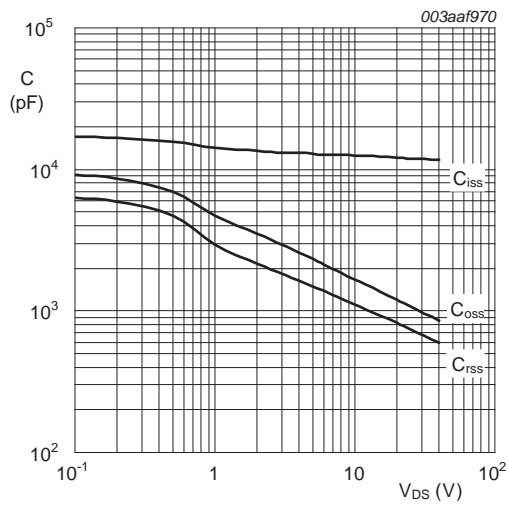


$T_j = 25\text{ }^\circ\text{C}; I_D = 180\text{ A}$

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

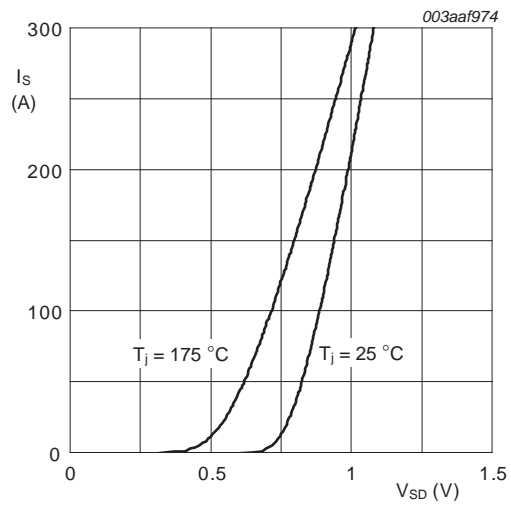


**Fig 14. Gate charge waveform definitions**



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

**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**

**7. Package outline**

Plastic single-ended surface-mounted package (D2PAK); 7 leads (one lead cropped)

SOT427

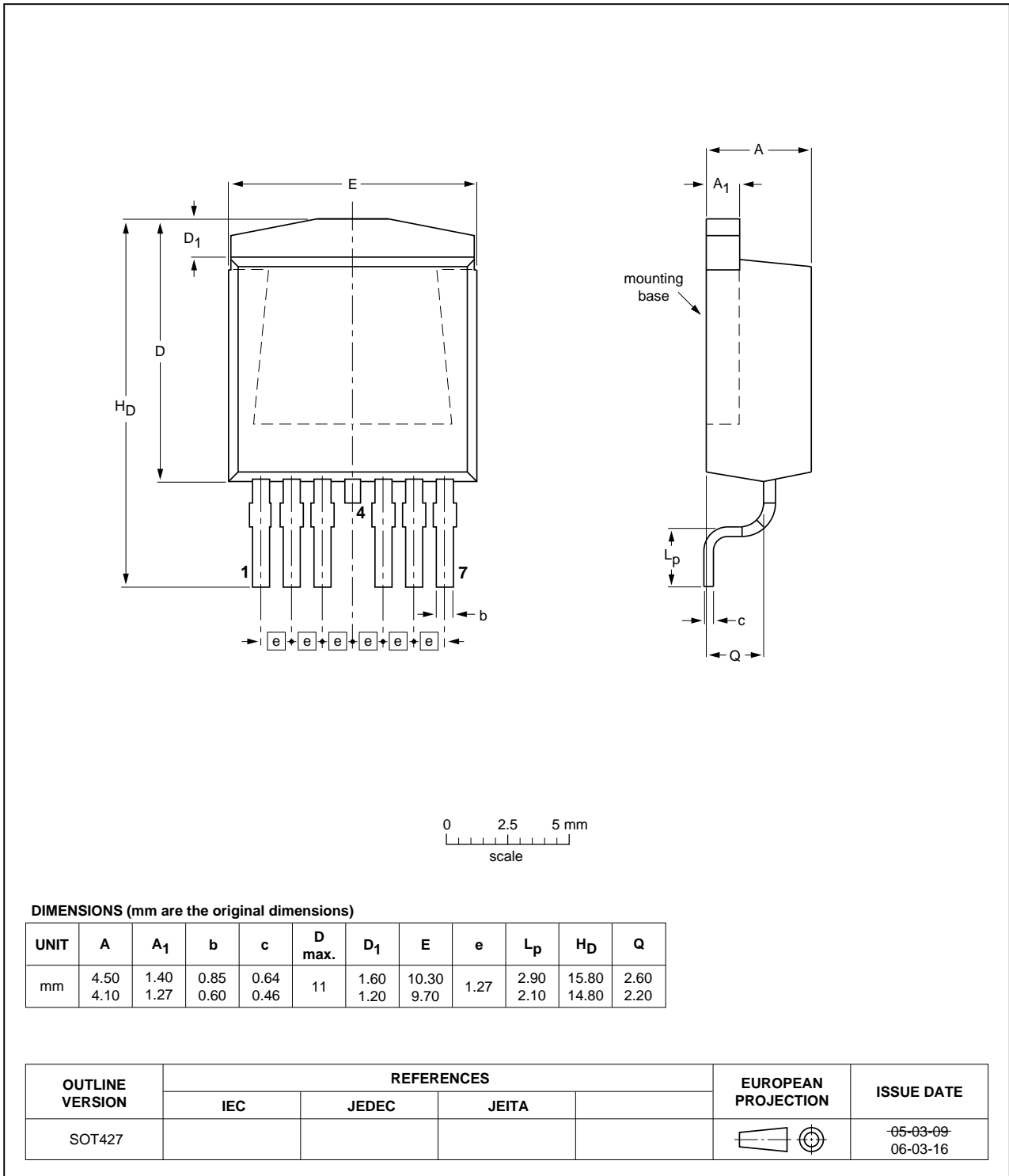


Fig 17. Package outline SOT427 (D2PAK)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUK6C2R1-55C v.3	20120118	Product data sheet	-	BUK6C2R1-55C v.2
Modifications:	• Status changed from preliminary to product.			
BUK6C2R1-55C v.2	20111221	Preliminary data sheet	-	BUK6C2R1-55C v.1

## 9. Legal information

### 9.1 Data sheet status

Document status <a href="#">[1]</a> <a href="#">[2]</a>	Product status <a href="#">[3]</a>	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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