



# 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

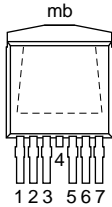
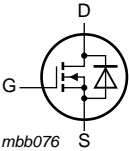


Table 1. Quick reference data ...continued

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><b>SOT427 (D2PAK)</b></p>	 <p>mbb076</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

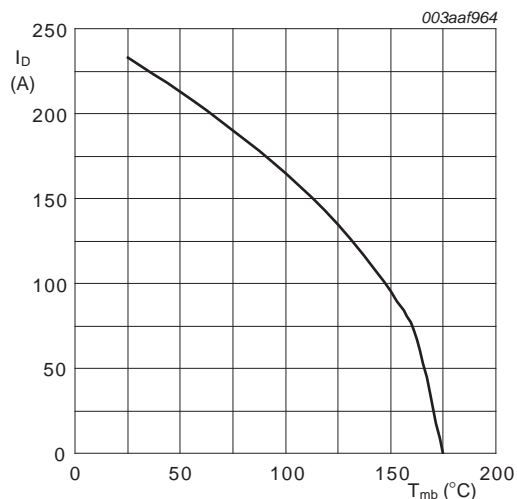
**Table 4. Limiting values**

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

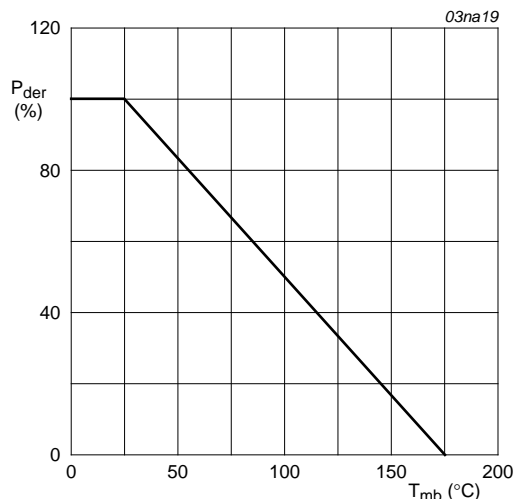
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	55	V
$V_{GS}$	gate-source voltage	Pulsed	[1] -20	20	V
		DC	[2] -16	16	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a>	-	228	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.

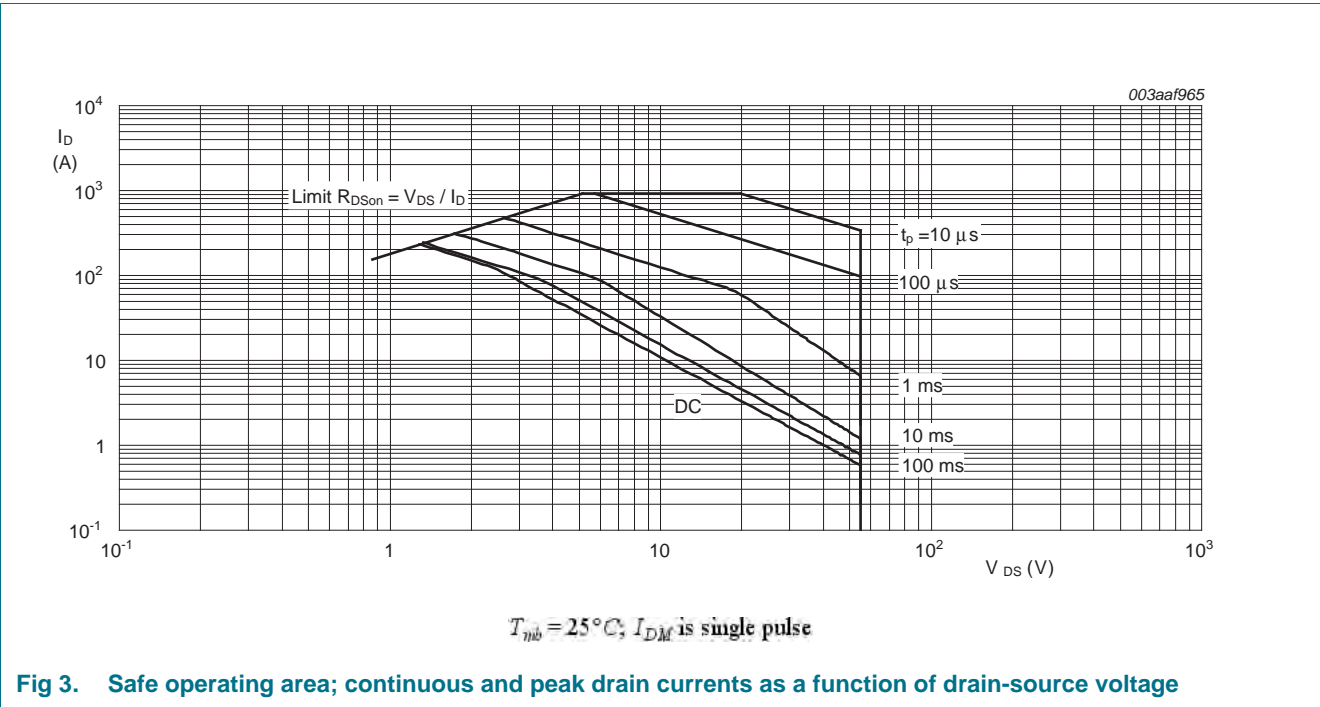


**Fig 1. Continuous drain current as a function of mounting base temperature**



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

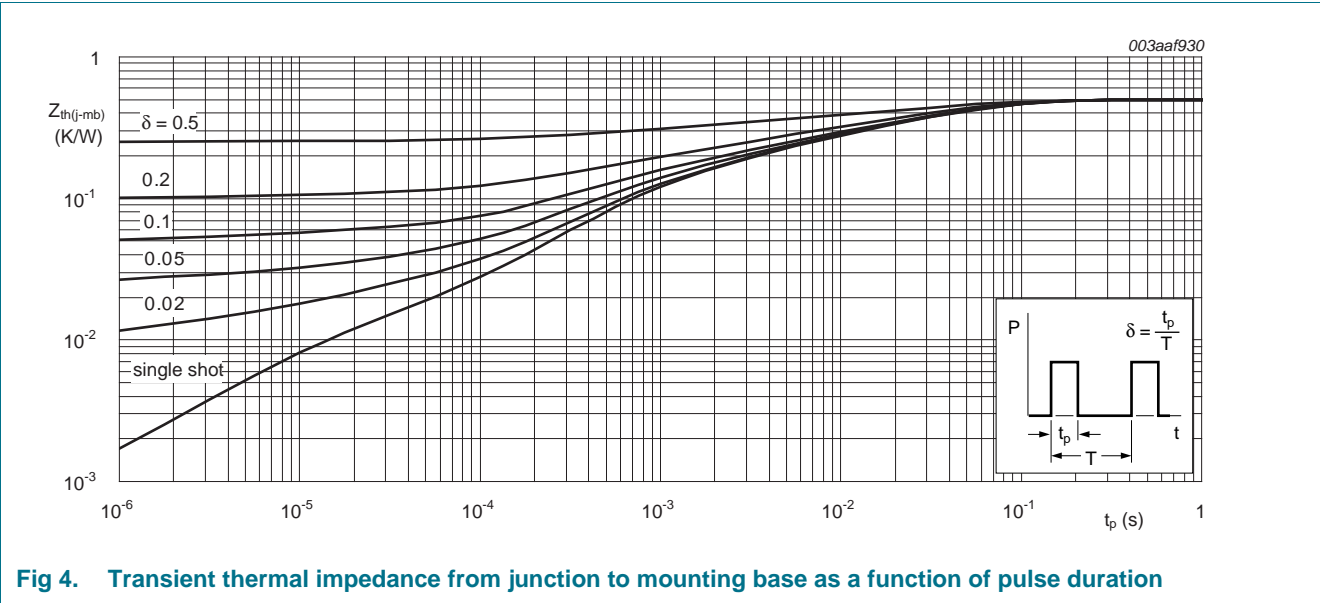
**Fig 2. Normalized total power dissipation as a function of mounting base temperature**



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
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	55	-	-	V
		I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = -55 °C	50	-	-	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>	1.8	2.3	2.8	V
V <sub>GSth</sub>	gate-source threshold voltage	I <sub>D</sub> = 2.5 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 175 °C; see <a href="#">Figure 10</a>	0.8	-	-	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>	-	-	3.3	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 55 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	0.04	1	μA
		V <sub>DS</sub> = 55 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> = 20 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C	-	2	100	nA
		V <sub>GS</sub> = -20 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> = 10 V; I <sub>D</sub> = 90 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 11</a>	-	1.9	2.3	mΩ
		V <sub>GS</sub> = 5 V; I <sub>D</sub> = 90 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 11</a>	-	2.4	3.1	mΩ
		V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 90 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 11</a>	-	2.6	3.7	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 90 A; T <sub>j</sub> = 175 °C; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>	-	-	5.7	mΩ
Dynamic characteristics						
Q <sub>G(tot)</sub>	total gate charge	I <sub>D</sub> = 180 A; V <sub>DS</sub> = 44 V; V <sub>GS</sub> = 10 V; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	253	-	nC
		I <sub>D</sub> = 180 A; V <sub>DS</sub> = 44 V; V <sub>GS</sub> = 5 V; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	140	-	nC
Q <sub>GS</sub>	gate-source charge	I <sub>D</sub> = 180 A; V <sub>DS</sub> = 44 V; V <sub>GS</sub> = 10 V; see <a href="#">Figure 13</a> ; see <a href="#">Figure 14</a>	-	40	-	nC
Q <sub>GD</sub>	gate-drain charge		-	79	-	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>	-	12000	16000	pF
C <sub>oss</sub>	output capacitance		-	1075	1290	pF
C <sub>rss</sub>	reverse transfer capacitance		-	730	1000	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 30 V; R <sub>L</sub> = 0.3 Ω; V <sub>GS</sub> = 10 V; R <sub>G(ext)</sub> = 10 Ω	-	43	-	ns
t <sub>r</sub>	rise time		-	206	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	412	-	ns
t <sub>f</sub>	fall time		-	190	-	ns
Source-drain diode						
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 80 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C; see <a href="#">Figure 16</a>	-	0.8	1.2	V
t <sub>rr</sub>	reverse recovery time	I <sub>S</sub> = 50 A; dI <sub>S</sub> /dt = -100 A/μs; V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 30 V; T <sub>j</sub> = 25 °C	-	56	-	ns
Q <sub>r</sub>	recovered charge		-	115	-	nC

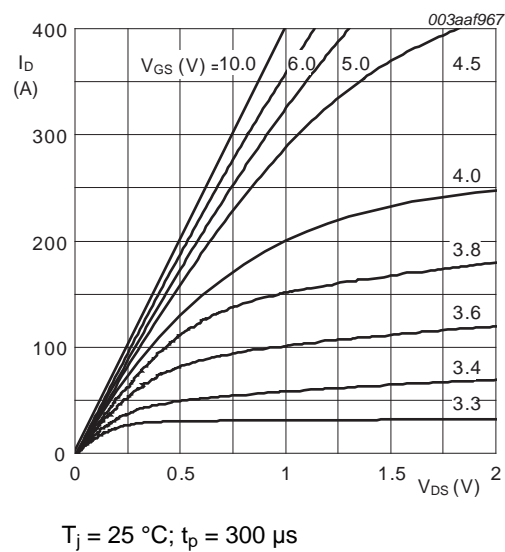


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

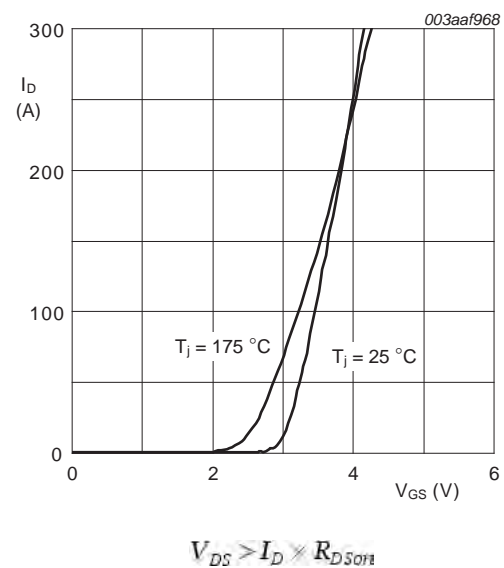


Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values

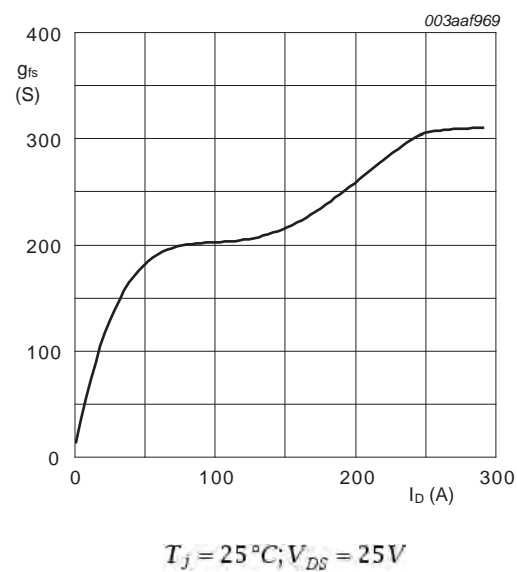


Fig 7. Forward transconductance as a function of drain current; typical values

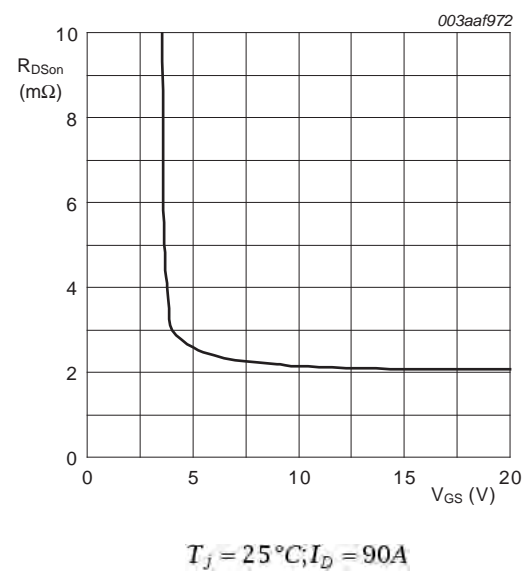
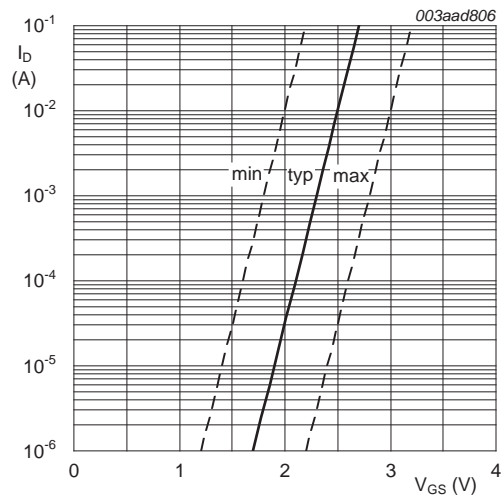
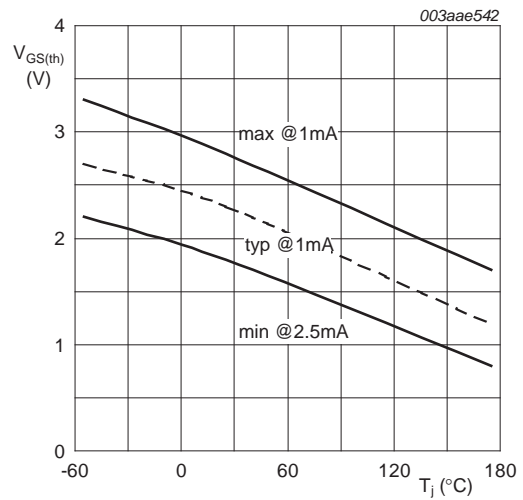


Fig 8. Drain-source on-state resistance as a function of gate-source voltage; typical values



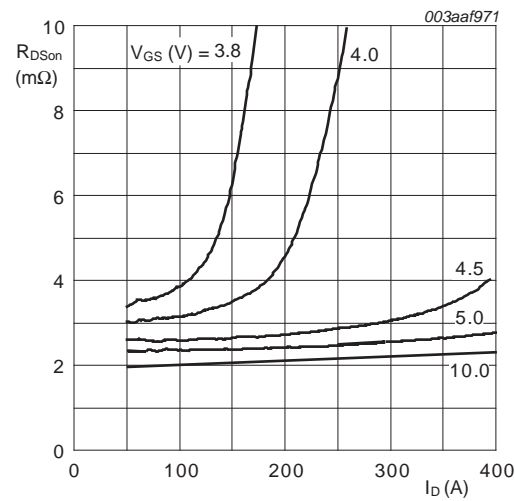
$$T_j = 25^\circ\text{C}; V_{DS} = 5V$$

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



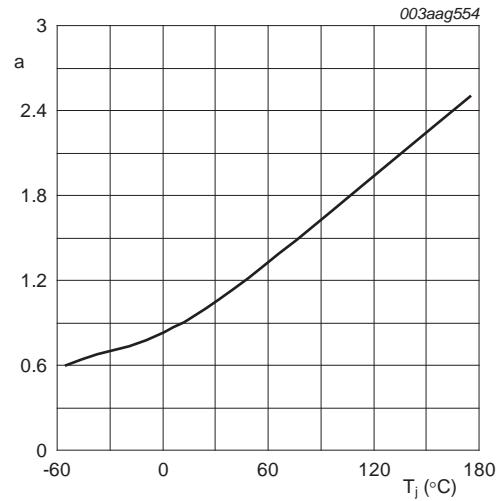
$$I_D = 1\text{mA}; V_{DS} = V_{GS}$$

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



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

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



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

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

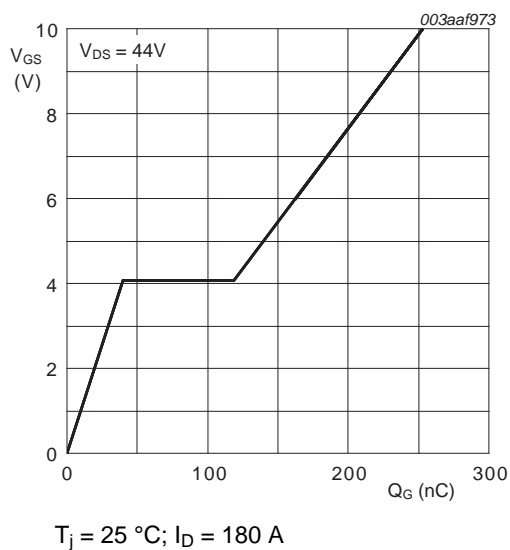


Fig 13. Gate-source voltage as a function of gate charge; typical values

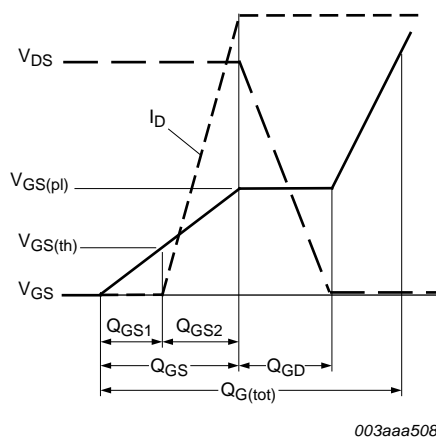


Fig 14. Gate charge waveform definitions

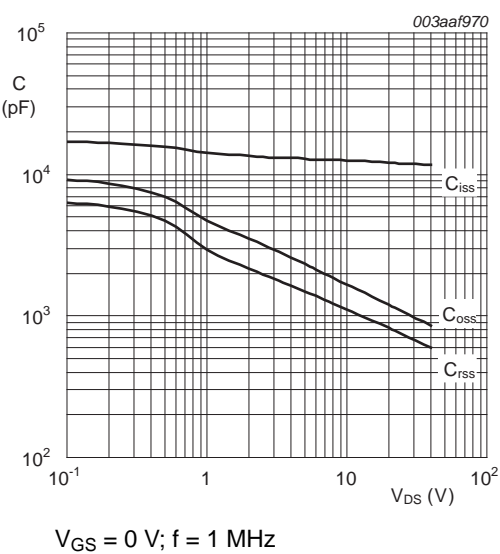


Fig 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

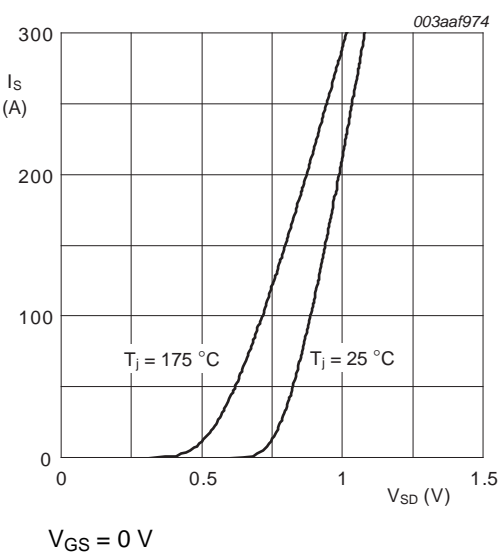


Fig 16. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values



7. Package outline

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

SOT427

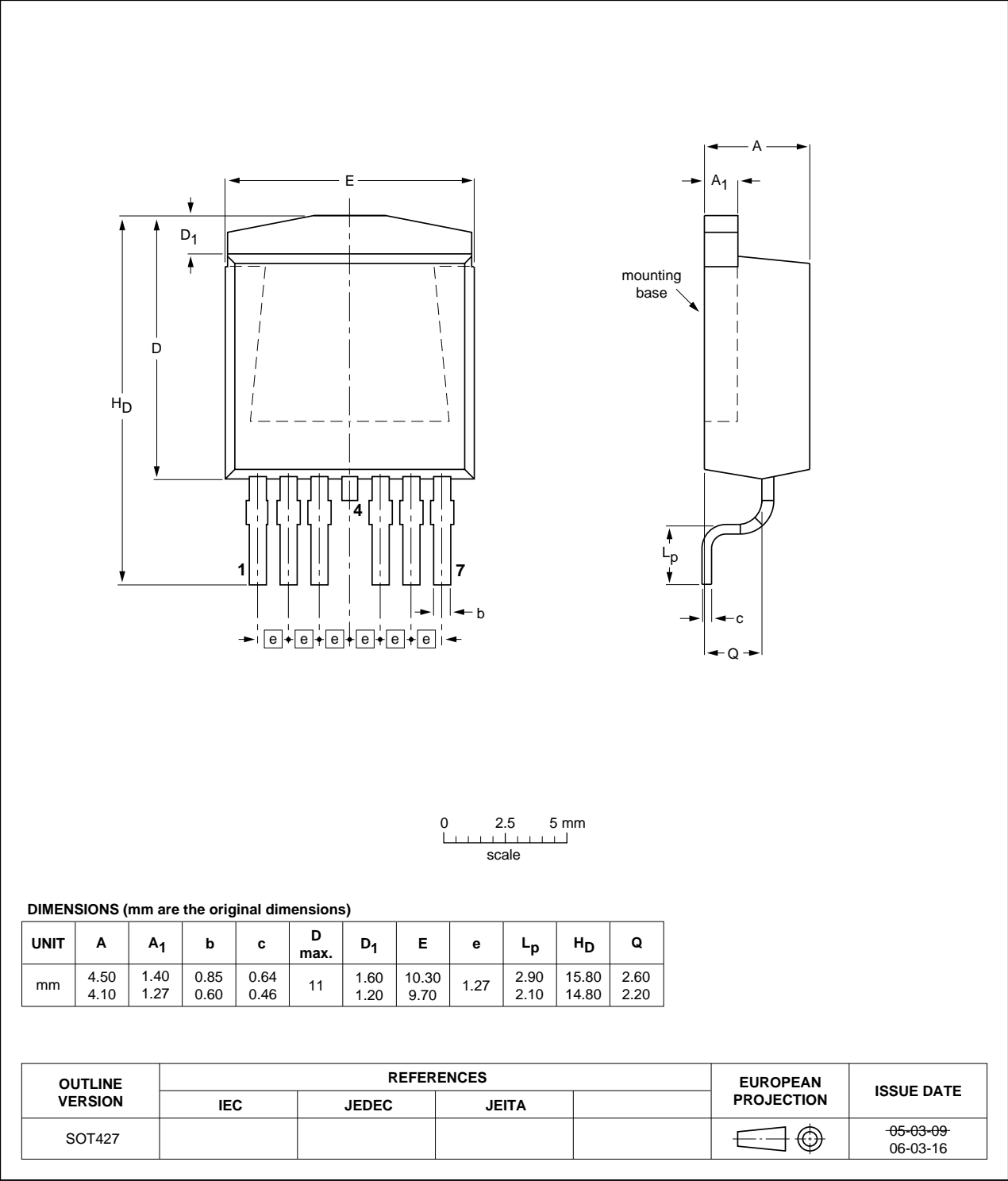


Fig 17. Package outline SOT427 (D2PAK)

## 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 <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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[2] The term 'short data sheet' is explained in section "Definitions".

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